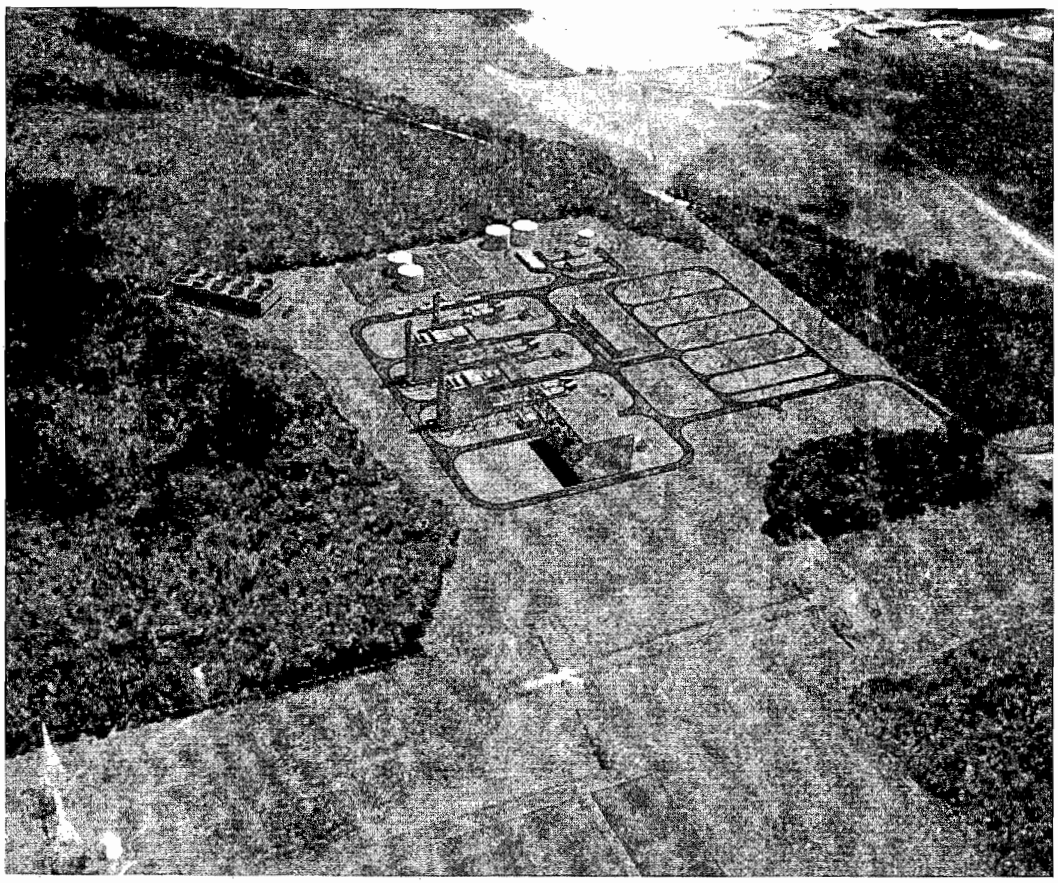
SITE CERTIFICATION APPLICATION

JEA Brandy Branch Combined Cycle Conversion

Building Community.

SITE CERTIFICATION APPLICATION



JEA Brandy Branch Combined Cycle Conversion

JEA

Building Community.

Received 12/8/00

#1

JEA Building Community

MEMORANDUM

JEA Brandy Branch
Combined Cycle Conversion 99262
Site Certification Application manuals/
Site Certification Application;
Appendix 10.7 – PSD Application;
Appendices

December 7, 2000

To: Holders of the JEA/BB Manuals

From: Controlled Documents Center

Project Management has placed these subject manuals under controlled distribution through the Controlled Documents Center.

This memo conveys your assigned copy of the manuals. They are serialized and your name is recorded as the holder. This office will distribute revisions to the manuals; however, keeping the manuals current shall be the responsibility of the individual holder.

Should your job status change and you no longer require these manuals, please return them to the Controlled Documents Center, PGF1 for reassignment.

jrw
Attachment

Name:	**Copy Number:**
~~Oven, Hamilton (Buck)~~	JEA/BB-001 thru 005
Fancy, Clair/App. 10.7 only	JEA/BB-006 thru 009
Hughes, Susan - JEA	JEA/BB-010
Perkins, Tim - JEA	JEA/BB-011
Mims, Eddie - JEA	JEA/BB-012
Gianazza, Bert - JEA	JEA/BB-013
Moser, Steve - JEA	JEA/BB-014
Starner, Lindsay - JEA	JEA/BB-015
Rollins, Myron	JEA/BB-016
Schutty, Chuck	JEA/BB-017
Serafin, Mike	JEA/BB-018
Weiss, Ken	JEA/BB-019
Hillman, Tim - JEA	JEA/BB-020
Gujjarapudi, Ebenezer	JEA/BB-021
Soltys, Mike	JEA/BB-022
Kight, Karen	JEA/BB-023
Project File - Graves, Carolyn	JEA/BB-024
Law Library - Langlois, Jennifer	JEA/BB-025
CDC - Hay, Karen	JEA/BB-026
Roberts, Douglas	JEA/BB-027 thru 028

JEA Brandy Branch
Combined Cycle Conversion

Site Certification Application

Manual Number JEA/BB - 01

Issued to Mr. Hamilton (Buck) Oven

Location Tallahassee, FL

21 West Church Street

Jacksonville, Florida 32202-3139

DEPARTMENT OF
ENVIRONMENTAL PROTECTIO

DEC 0 8 2000

NG COORDINAT

JEA

December 8, 2000

Mr. Hamilton S. Oven
Administrator
Siting Coordination Office
Department of Environmental Protection
2600 Blair Stone Road
Tallahassee, FL 32399-2400

Re: JEA
Site Certification Application
Brandy Branch Combined Cycle Conversion

Dear Mr. Oven:

JEA is pleased to submit this Site Certification Application under the Florida Electrical Power Plant Siting Act for conversion of the Brandy Branch Generating Station to combined cycle operation. Units 1-3 are simple cycle combustion turbine units currently under construction at the site, 15 miles west of Jacksonville in Duval County, near Baldwin. Units 2 and 3 are proposed for conversion to combined cycle operation. All units, whether operating in simple or combined cycle mode, will fire natural gas as the primary fuel. Certification is sought for all units and associated facilities onsite, and the access road corridor.

Five copies of the application and a $125,000 check for the filing fee are enclosed for the Department's initial completeness review, as requested by Steven Palmer of your office. Additional copies will be submitted to you and distributed to the other agencies after the application is determined to be complete.

In addition, by copy of this letter, we are also submitting one signed and sealed original and three copies of the Prevention of Significant Deterioration permit application to the Department's Bureau of Air Regulation. This PSD application comprises Volume 3 of the Site Certification Application. The appropriate application fee for that permit modification is to be covered by the site certification application fee.

A petition to determine the need for the combined cycle unit was filed with the Public Service Commission on November 15, 2000. A copy of the Need for Power petition is included in Section 1 of the application.

We look forward to working with you and your staff as this application progresses through the certification process. If you have any questions, please do not hesitate to call me at (904) 665-6247.

Sincerely,

N. Bert Gianazza, P.E.
Environmental Permitting
& Compliance Group

Enclosures

Cc: Clair Fancy, Chief , FDEP BAR (w/encls.)

Florida Electrical Power Plant Siting Act
Site Certification Application

JEA Brandy Branch
Generating Station
Conversion Project

December 2000

SITE CERTIFICATION APPLICATION

ENGINEERING CERTIFICATION STATEMENT

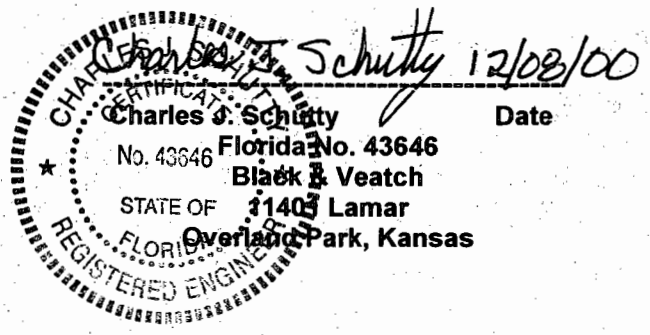
BRANDY BRANCH GENERATING STATION

I, the undersigned, hereby certify that:

The engineering features of Brandy Branch Generating Station combined cycle conversion project described in this application have been prepared, designed, or examined by me or individuals under my direct supervision and found to be in conformity with sound engineering principles; and,

To the best of my knowledge, the information submitted in support of the application is true, accurate, and complete and is based upon reasonable techniques, estimates, materials, and information gathered and evaluated by qualified personnel; and,

To the best of my knowledge, there is reasonable assurance that combined cycle conversion project described in this application, when properly operated and maintained, will comply with all applicable pollution control standards found in the Florida Statutes and rules of the Department of Environmental Protection.



Charles J. Schutty 12/08/00

Charles J. Schutty **Date**
Florida No. 43646
Black & Veatch
11401 Lamar
Overland Park, Kansas

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Preface

This Site Certification Application (SCA) is being submitted by JEA for certification of the Brandy Branch Generating Station ("Generating Station"). Currently, the Generating Station includes three simple cycle electric generating units that are under construction (Units 1-3). JEA proposes to convert two of the three units (Units 2 and 3) into a combined cycle unit by adding a steam turbine, electric generator, two heat recovery steam generators with new exhaust stacks, cooling tower, condenser, and associated plant equipment. The three simple cycle units hold permits issued by the individual governing agencies. However, the conversion to combined cycle, with the addition of the steam turbine generator, requires certification under the Florida Electrical Power Plant Siting Act. In order to have one set of conditions of certification governing the entire site, JEA is seeking certification under the Florida Electrical Power Plant Siting Act for the entire Brandy Branch Generating Station including the conversion of Units 2 and 3 to combined cycle, and Unit 1 which will remain as a simple cycle combustion turbine. The current permits would be replaced by the certification and surrendered at the appropriate time. JEA proposes that the substantive conditions of the current permits be incorporated into this certification.

This document is intended to serve as the SCA including all state and local permits for the construction of the conversion to combined cycle and operation of the Generating Station. Following are the major section headings:

1. Need for Power.
2. Site and Vicinity Characterization.
3. Plant and Directly Associated Facilities.
4. Effects of Site Preparation, and Plant and Associated Facility Construction.
5. Effects of Plant Operation.
6. Transmission Lines and Other Linear Facilities.
7. Economic and Social Effects of Plant Construction and Operation.
8. Site and Design Alternatives.
9. Coordination.
10. Appendices.

Project Information

The Brandy Branch Generating Station is located near the town of Baldwin in Duval County, Florida. The site is located approximately 1 mile north of US 90 and approximately 1 mile east of US 301. Currently, the site includes three 184 megawatt

(MW) simple cycle electric generating units that are under construction and were permitted by local and state governing agencies. Construction of the simple cycle facility is expected to be completed in December 2001. JEA is proposing to convert two of the three units into a combined cycle unit, which will add an additional 193 MW resulting in a maximum output of approximately 561 MW for the unit. Including the remaining 184 MW simple cycle combustion turbine, the resulting maximum capacity of all units will be 745 MW output for the Generating Station. Natural gas will serve as the primary fuel and low sulfur (0.05 percent) No. 2 fuel oil will serve as the backup fuel.

Project Impacts

Air

The three simple cycle units are currently permitted to operate under Florida Department of Environmental Protection Authority to Construct Permit 0310485-001-AC. The conversion to a combined cycle is classified as a major modification to an existing major stationary source under the New Source Review – Prevention of Significant Deterioration (NSR-PSD) program. However, air quality impacts resulting from the combined cycle conversion are less than the PSD significant impact levels.

Water Use

The three simple cycle units are currently supplied by two wells at the site; each well has a 900 gallon per minute (gpm) pump. Two additional 900 gpm well pumps are planned for the combined cycle unit. Process water demand, excluding cooling tower makeup, will be approximately 137 or 0.250 million gallons per day (gpd). Additional water for the unit cooling tower makeup will be approximately 1,733 gpm or 2.5 million gpd.

Land

The site is currently zoned as Planned Unit Development (PUD). A minor modification to the existing zoning permit will be required to incorporate the proposed facilities. An additional 2.5 acres on the site will be required for the proposed project.

Wastewater and Solid Waste

Process wastewater will be directed to the JEA wastewater treatment system via the Baldwin Force Main. A 1 mile process wastewater pipeline will be installed in the site access road corridor to connect the Brandy Branch facility with the Baldwin Force Main.

Trash and other solid waste generation will be minimal and will be disposed of at an approved facility by a licensed contractor.

Socioeconomic

Construction of Units 1, 2 and 3 have had positive socioeconomic impacts in Duval County, through tax revenues and employment. Construction and operation of the combined cycle unit will incrementally increase these benefits by creating approximately 385 temporary jobs. The net direct employment effect will be the creation of six additional full-time operations positions during simple cycle operation. During combined cycle operation, the plant will be staffed with 24 persons. The addition of the combined cycle unit at the Brandy Branch Generating Station is not anticipated to significantly impact the local or regional services or infrastructure.

Need for Power

In accordance with the Section 403.519 of the Florida Statues, JEA filed a Need for Power petition on November 15, 2000 with the Public Service Commission.

Schedule

The Brandy Branch Generating Station certification and major milestone schedule follows:

Need for Power Submittal	November 2000
Need for Power Approval	May 2001
Site Certification Application Submittal	December 2000
Site Certification Issued	February 2002
Start of Construction	July 2002
Construction Complete	April 2004
Commercial Operation	May 2004

Applicant Information

Applicants' Official Name

JEA

Address

21 W. Church Street
Jacksonville, Florida 32202

Address of Official Headquarters

Same as above

Business Entity

Municipality

Names, Owners, etc.

Not applicable

Name and Title of Chief Executive Officer

Walter P. Bussells, Managing Director & Chief Executive Officer

Name, Address, and Telephone Number of Official Representative Responsible for Obtaining Certification

N. Bert Gianazza
21 W. Church Street
Jacksonville, Florida 32202
904-665-6247

Site Location

Duval County. One mile north of US 90/SR 10; one mile east of Baldwin.

Nearest Incorporated City

Jacksonville

Latitude and Longitude

30° 17' 59" and 81° 57' 00"

UTM Coordinates

408774.1 North
3354530.8 East

Section, Township, and Range

Township 2 South, Range 23 and 24 East, Southeast quarter of Section 13 and Southwest quarter of Section 18.

Location of Any Directly Associated Transmission Facilities

Duval County

Maximum Generating Capacity

Unit 1: 204 MW
Unit 2: 204 MW
Unit 3: 204 MW

Capacity of Proposed Additions

200 MW

Total Capacity Required for Certification

812 MW

1.0 Need for Power and the Proposed Facilities

A Petition to Determine Need for Electrical Power Plant was submitted to the Florida Public Service Commission by JEA on November 15, 2000. A copy of the Petition follows this page. The Brandy Branch Generating Station currently under construction consists of three General Electric PG7241 FA (GE 7FA) combustion turbine units (Units 1, 2, 3) in simple cycle mode. Anticipated date of commercial operation for Units 1 and 2 is May 2001. Unit 3 is anticipated to be in commercial operation on December 15, 2001.

JEA proposes to convert two of the three GE 7FA simple cycle units into a combined cycle unit by adding a steam turbine (204 MW nameplate rating), electric generator, two heat recovery steam generators (HRSGs) with new exhaust stacks, cooling tower, condenser, and associated balance-of-plant equipment. The addition of the 200 MW steam turbine requires the unit to be certified under the Florida Electrical Power Plant Siting Act. The combined cycle unit will have a maximum rating of approximately 608 MW. Construction of the combined cycle conversion is proposed to start in July 2002. After the conversion, Brandy Branch Generating Station will have a maximum rating of approximately 812 MW, with the proposed commercial operation date of the combined cycle conversion on May 1, 2004.

BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

In Re: Petition of JEA to Determine Need For Proposed Electrical Power Plant in Duval County, Florida, Consisting of the Conversion of Two of the Brandy Branch Combustion Turbines Currently Under Construction to a Combined Cycle Unit	)	Docket No. _____
	)	Filed: November 15, 2000

PETITION TO DETERMINE NEED
FOR ELECTRICAL POWER PLANT

Comes now Petitioner JEA, by and through its undersigned attorneys, and petitions the FLORIDA PUBLIC SERVICE COMMISSION ("Commission"), pursuant to Section 403.519, Fla.Stat., and Rule 25-22.081, Florida Administrative Code, to determine that there is need for the proposed electrical power plant described herein and to file its report and order making that determination with the Department of Environmental Protection ("DEP") pursuant to Section 403.507 (2)(a), Fla.Stat. In support thereof, JEA states as follows:

1. JEA's full name and business address is:

   JEA
   21 West Church Street
   Jacksonville, Florida 32202

2. The name and address of JEA's representatives to receive communications regarding this docket are:

   Richard D. Melson
   Douglas S. Roberts
   Hopping Green Sams & Smith, P.A.
   P.O. Box 6526
   Tallahassee, FL 32314

with copies to:

Loree French
Assistant General Counsel
City of Jacksonville Office of General Counsel
117 W. Duval Street
Suite 480
Jacksonville, Florida 32202

and:

Charles Bond
Manager, Capacity Planning
JEA
21 West Church Street, T-11
Jacksonville, Florida 32202

3. JEA is a body corporate and politic created by the laws of the State of Florida and legally existing and engaged in the generation, transmission and distribution of electric power and is a valid applicant under the Florida Electrical Power Plant Siting Act, Sections 403.501-403.518, Fla.Stat.

4. JEA's Brandy Branch Generating Station is located near the City of Baldwin in Duval County, Florida. Baldwin is west of Jacksonville on Highway 301 a short distance north of Interstate 10. The plant site is a short distance north of Highway 90 east of Baldwin. The plant currently consists of three natural gas/oil simple cycle combustion turbine electric generating units which are currently under construction. These combustion turbines are General Electric's advanced class models, rated at 173 MW ISO each. The combustion turbines are dual fuel capable and will be operated with natural gas as the primary fuel and No. 2 as the backup fuel. These units were delivered to the Brandy Branch site in late 1999 and early 2000. Construction began in late 1999 and Units 1 and 2 should be in operation in May 2001, and Unit 3 in December 2001.

5. In order to increase its electric power generating capability, JEA is proposing to convert two of the Brandy Branch simple cycle units into a combined cycle unit. The Brandy Branch project was designed with future expansion in mind, namely adding a fourth combustion turbine or adding a steam turbine unit to the site. The expansion will occur in the northwest quadrant of the current plant, adjacent to the existing combustion turbines. Adequate space exists for the addition of this equipment.
6. This conversion will be accomplished by adding to two of the three combustion turbines, two heat recovery steam generators (HRSGs), and one steam turbine generator. This means one HRSG will be added to each of the two combustion turbines and the steam turbine generator will be shared by the two HRSGs. The conversion will create a 2 x 1 combined cycle with one simple cycle combustion turbine remaining. The ISO rating of the steam turbine is assumed to be 173 MW. The total capacity of the Brandy Branch power plant, including the simple cycle and the combined cycle unit after the conversion into combined cycle, will be 692 MW.
7. With conversion to combined cycle, Brandy Branch is subject to the Florida Electrical Power Plant Siting Act, Sections 403.501 to 403.518, Fla.Stat. Pursuant to the Act, and to Commission Rules 25-22.080 through 25-22.081, Florida Administrative Code, promulgated pursuant thereto, the Commission has jurisdiction to determine the need for the proposed electrical power plant, applying the standards set forth in Section 403.519, Florida Statutes.
8. As authorized by Rule 25-22.080(1), Florida Administrative Code, JEA has elected to commence this proceeding for determination of need prior to filing the Site

Certification Application with the DEP, for the conversion of two of the Brandy Branch combustion turbine units to a combined cycle unit.

9. Rule 25-22.081, Florida Administrative Code, establishes the information required by the Commission to support this Petition. This information is included in the Need for Power Application Brandy Branch Combined Cycle Conversion ("Need for Power Application") which is attached to this Petition.

10. As demonstrated in the Need for Power Application, the conversion to combined cycle is needed for JEA electric system reliability and integrity in 2004 when its reserves would dip below the 15 percent margin without the conversion of Brandy Branch to combined cycle.

11. As demonstrated in the Need for Power Application, the conversion of Brandy Branch to combined cycle is the most cost-effective alternative available to JEA. The combined cycle unit will provide adequate electricity at a reasonable cost to JEA and Peninsular Florida.

12. As demonstrated in the Need for Power Application, conservation measures were evaluated, but none were found to be cost-effective when compared to the low cost of the Brandy Branch conversion.

13. The foregoing information demonstrates that the Brandy Branch conversion to combined cycle merits an affirmative determination of need from the Commission pursuant to Section 403.519, Fla.Stat.

WHEREFORE, JEA respectfully requests that:

(1) Pursuant to Rule 25-22.080(2), Florida Administrative Code, the Commission set a date for a hearing on this Petition, not more than ninety (90) days after the date of the filing of this Petition;

(2) The Commission give notice of the commencement of the proceeding as required by Rule 25-22.080(3), Florida Adminstrative Code;

(3) The Commission submit a preliminary statement of issues to DEP pursuant to Section 403.507(1), Fla.Stat., within 60 days after distribution of the Site Certification Application; and

(4) The Commission determine that there is need for the conversion of Brandy Branch Units 1 and 2 to a combined cycle unit, and file its report, including an order making such determination, with the DEP pursuant to Section 403.507(2)(a)2., Fla.Stat.

RESPECTFULLY SUBMITTED this 15th day of November, 2000.

HOPPING GREEN SAMS & SMITH, P.A.

By: _____

Richard D. Melson
Florida Bar No. 201243
Douglas S. Roberts
Florida Bar No. 559466
P.O. Box 6526
Tallahassee, Florida 32314
(850) 222-7500

and

Loree French
Assistant General Counsel
City of Jacksonville Office of General Counsel
117 W. Duval Street, Suite 480
Jacksonville, Florida 32202

2.0 Site and Vicinity Characterization

2.1 Site and Associated Facilities

This section provides information concerning the physical, biological, and sociological characteristics of the existing site and Project area that might be affected by the modification of two of the simple cycle combustion turbines to combined cycle operation. The simple cycle facility currently has permits issued by various federal, state, and local authorities. Copies of the major permits are included in Appendices 10.1, 10.3, and 10.5.

2.1.1 Site Location

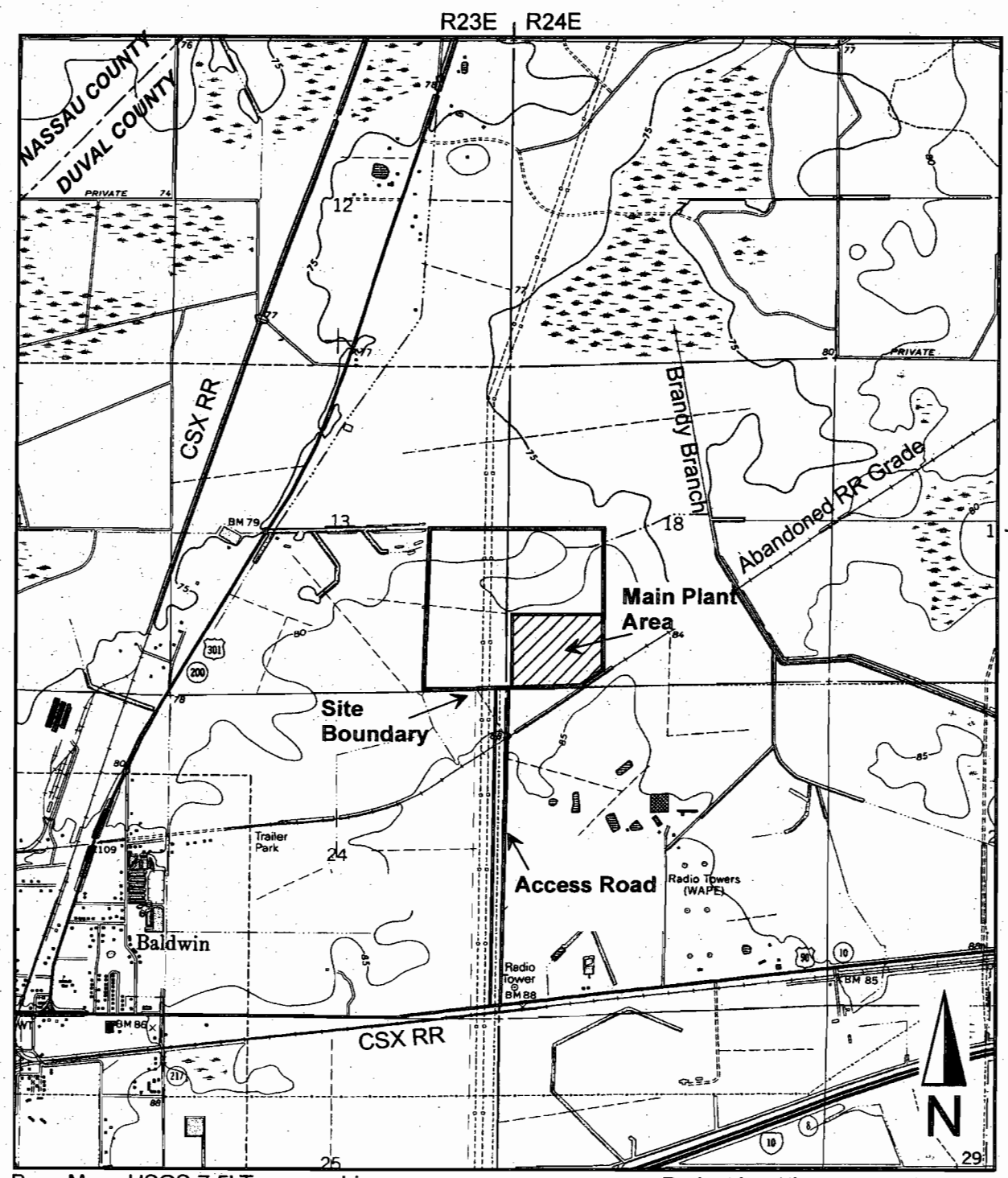
The Brandy Branch Generating Station ("Generating Station") is located at 15701 Beaver Street near the town of Baldwin, Duval County, Florida. Refer to Figure 2.1-1. The Generating Station facilities will occupy approximately 45 acres of the 153 acre site. Figure 2.1-2 shows the Generating Station boundaries and identifies adjacent property owners. Table 2.1-1 provides information on the adjacent property owners.

2.1.2 Site Modification

Proposed site modifications will consist of construction and operation of a 193 MW (maximum) steam turbine generating unit powered by two heat recovery steam generators recovering exhaust energy from the existing Units 2 and 3 combustion turbines. The steam turbine generator will be located next to, and west of, Unit 3. The heat recovery steam generators will be located behind the existing combustion turbine Units 2 and 3. The cooling tower used to cool the steam turbine condenser will be located north of the existing fuel oil storage tanks. No additional large tanks, water treatment facilities, fuel gas pipelines, transmission lines or large personnel facilities will be required for operation of the combined cycle unit. Two new wells will be used to supply additional process and cooling water. The site storm water system will be modified to accommodate the drainage from the power block area and the cooling tower area. Process wastewater will be directed to the JEA sewer system. A 1 mile process wastewater pipeline will be installed in the site access road corridor to connect to the JEA wastewater treatment system via the Baldwin Force Main. Refer to Figure 2.1-3, Site Arrangement to locate the new facilities.

IMAGE QUALITY

AS YOU REVIEW THE NEXT FEW PAGES, PLEASE NOTE THAT THE ORIGINAL DOCUMENT WAS OF POOR QUALITY.



Base Map: USGS 7.5' Topographic
Baldwin Quadrangle, Revised 1992

Project Location
Brandy Branch Generating Station

Mile
0 0.5 1

Figure 2.1-1
Project Location

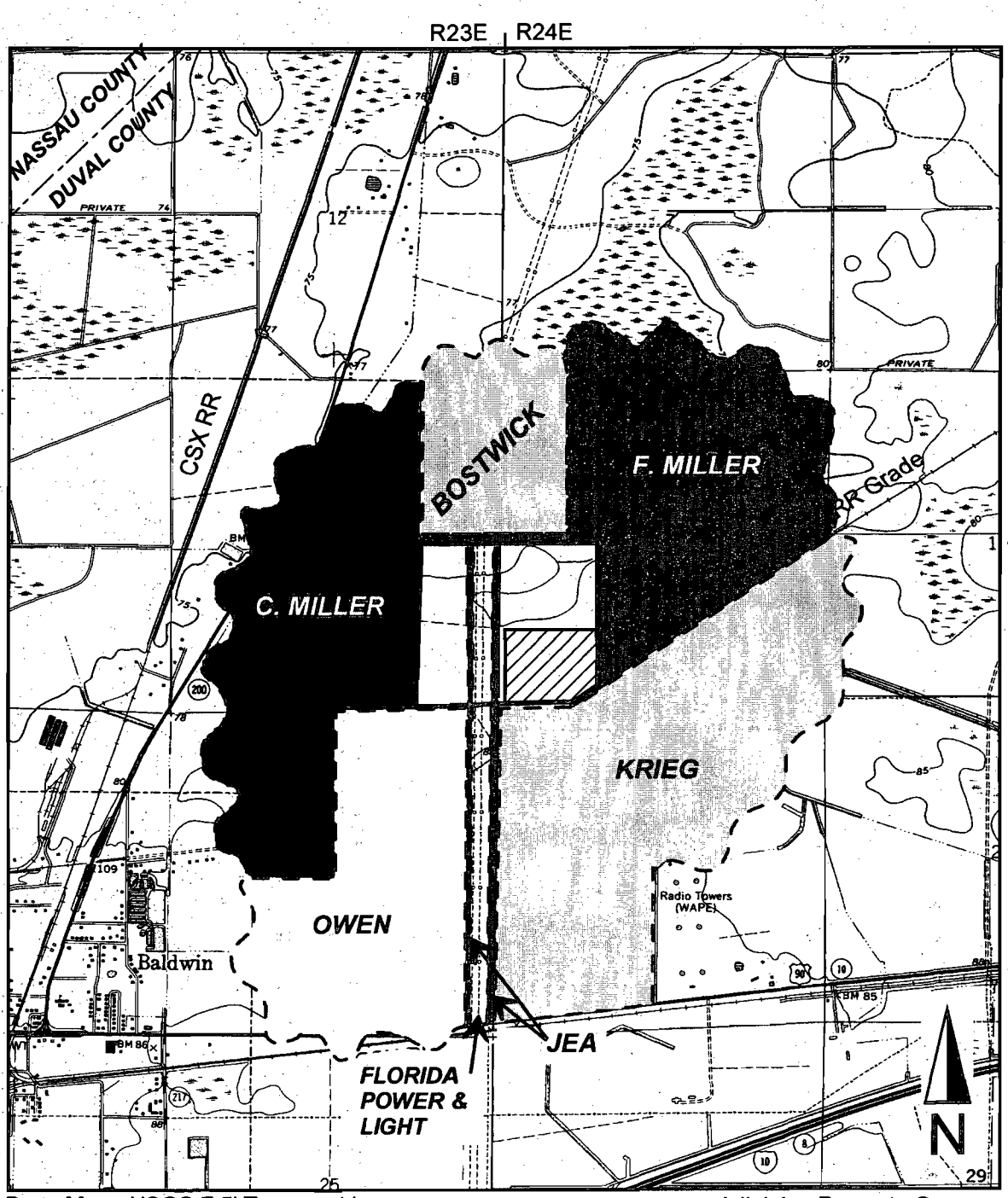
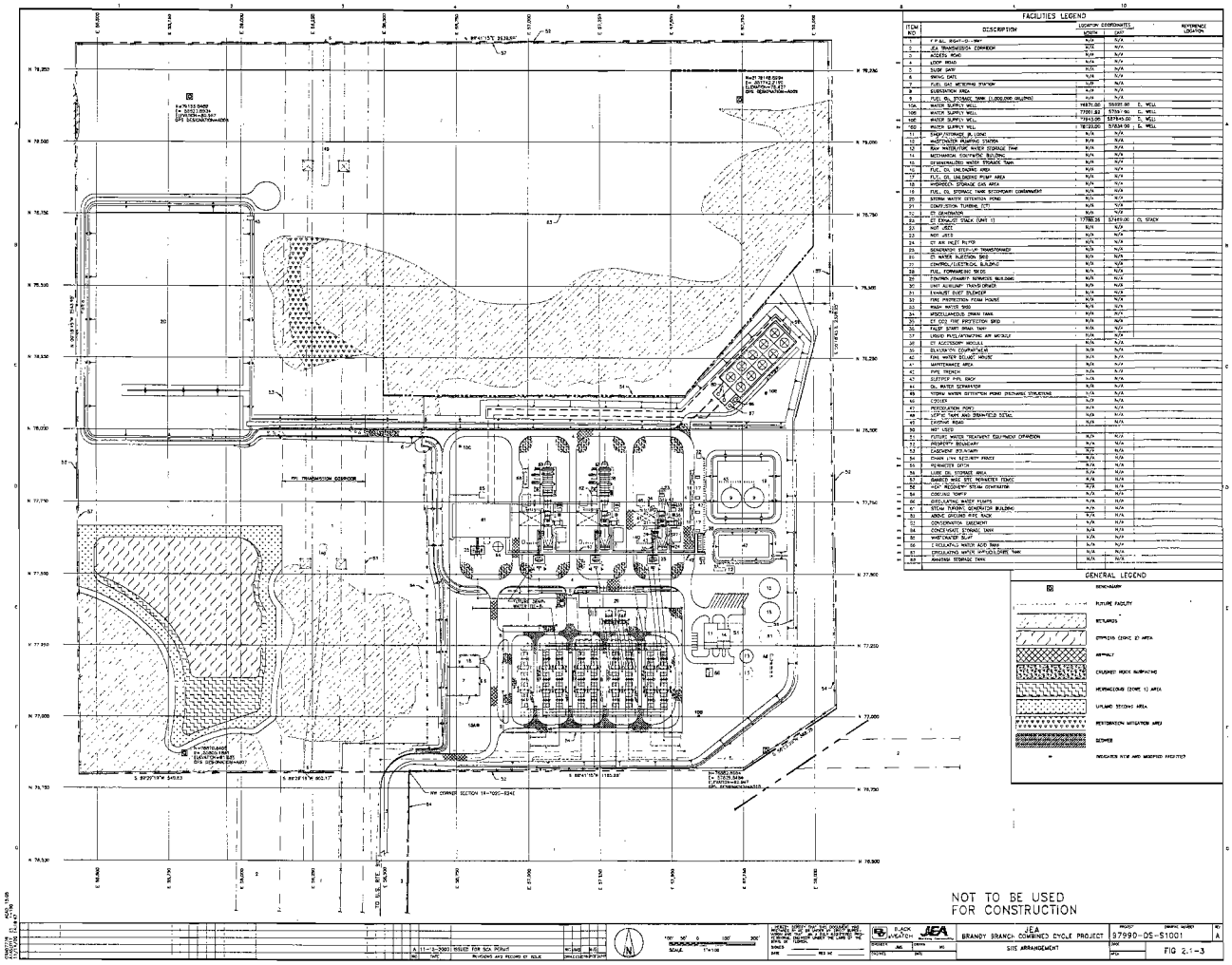


Figure 2.1-2
Adjoining Property Owners



FACILITIES LEGEND

ITEM NO.	DESCRIPTION	LOCATION COORDINATES NORTH	EAST	REFERENCE LOCATION
1	F.P.&L. RIGHT-OF-WAY	N/A	N/A	
2	JEA TRANSMISSION CORRIDOR	N/A	N/A	
3	ACOSTA ROAD	N/A	N/A	
4	LOOP ROAD	N/A	N/A	
5	SLUDGE DAM	N/A	N/A	
6	SWING GATE	N/A	N/A	
7	FUEL GAS METERING STATION	N/A	N/A	
8	SUBSTATION AREA	N/A	N/A	
9	FUEL OIL STORAGE TANK (1,000,000 GALLONS)	N/A	N/A	
10A	WATER SUPPLY WELL	76870.00	59200.00	E. WELL
10B	WATER SUPPLY WELL	77081.82	57761.96	E. WELL
10E	WATER SUPPLY WELL	77943.00	58945.00	E. WELL
10D	WATER SUPPLY WELL	78183.00	57834.00	E. WELL
11	SHOP/STORAGE BUILDING	N/A	N/A	
12	WASTEWATER PUMPING STATION	N/A	N/A	
13	50M DEMINERALIZED WATER STORAGE TANK	N/A	N/A	
14	MECHANICAL EQUIPMENT BUILDING	N/A	N/A	
15	DEMINERALIZED WATER STORAGE TANK	N/A	N/A	
16	FUEL OIL UNLOADING AREA	N/A	N/A	
17	FUEL OIL UNLOADING PUMP AREA	N/A	N/A	
18	HYDRAZINE STORAGE GAS AREA	N/A	N/A	
19	FUEL OIL STORAGE TANK SECONDARY CONTAINMENT	N/A	N/A	
20	STORM WATER DETENTION POND	N/A	N/A	
21	COMBUSTION TURBINE (CT)	N/A	N/A	
22	CT GENERATOR	N/A	N/A	
23	CT EXHAUST STACK (UNIT 1)	77985.35	57455.00	CL STACK
23	NOT USED	N/A	N/A	
23	NOT USED	N/A	N/A	
24	CT AIR INLET PLENUM	N/A	N/A	
25	GENERATOR STEP-UP TRANSFORMER	N/A	N/A	
26	CT WATER INJECTION SKID	N/A	N/A	
27	CONTROL/ELECTRICAL BUILDING	N/A	N/A	
28	FUEL FORWARDING SKIDS	N/A	N/A	
29	STARTER/AUXILIARY SERVICES BUILDING	N/A	N/A	
30	UNIT AUXILIARY TRANSFORMER	N/A	N/A	
31	EXHAUST DUCT SILENCER	N/A	N/A	
32	FIRE PROTECTION FOAM HOUSE	N/A	N/A	
33	WASH WATER SKID	N/A	N/A	
34	MISCELLANEOUS DRAIN TANK	N/A	N/A	
35	CT CO2 FIRE PROTECTION SKID	N/A	N/A	
36	FALSE START DRAIN TANK	N/A	N/A	
37	LIQUID POLLUTANTING AIR MODULE	N/A	N/A	
38	CT ACCESSORY MODULE	N/A	N/A	
39	ELEVATION COMPARTMENT	N/A	N/A	
40	FINAL WATER DELUGE HOUSE	N/A	N/A	
41	MAINTENANCE AREA	N/A	N/A	
42	PIPE TRENCH	N/A	N/A	
43	ELECTRIC PIPE DUCT	N/A	N/A	
44	OIL WATER SEPARATOR	N/A	N/A	
45	STORM WATER DETENTION POND DISCHARGE STRUCTURE	N/A	N/A	
46	COOLER	N/A	N/A	
47	PRETREATMENT POND	N/A	N/A	
48	LIFT-E TANK AND DEMINERALIZED TANK	N/A	N/A	
49	EXISTING ROAD	N/A	N/A	
50	NOT USED			
51	FUTURE WATER TREATMENT EQUIPMENT EXPANSION	N/A	N/A	
52	PROPERTY BOUNDARY	N/A	N/A	
53	EASEMENT BOUNDARY	N/A	N/A	
54	CHAIN LINK SECURITY FENCE	N/A	N/A	
55	PERIMETER DITCH	N/A	N/A	
56	LUBE OIL STORAGE AREA	N/A	N/A	
57	ARMORED MISC SITE PERIMETER FENCE	N/A	N/A	
58	HEAT RECOVERY STEAM GENERATOR	N/A	N/A	
59	COOLING TOWER	N/A	N/A	
60	CIRCULATING WATER PUMPS	N/A	N/A	
61	STEAM TURBINE GENERATOR BUILDING	N/A	N/A	
62	ABOVE GROUND PIPE RACK	N/A	N/A	
63	CONDENSATOR CASEMENT	N/A	N/A	
64	CONDENSATE STORAGE TANK	N/A	N/A	
65	WASTEWATER SUMP	N/A	N/A	
66	CHEMICAL WATER ADD TANK	N/A	N/A	
67	CIRCULATING WATER APPLICATION TANK	N/A	N/A	
68	AMMONIA STORAGE TANK	N/A	N/A	

GENERAL LEGEND

- BENCHMARK
- FUTURE FACILITY
- RETAINING
- STRUCTURES (EXCEPT BY AREA)
- ASPHALT
- CRUSHED ROCK SURFACING
- HYDRAULIC (ZONE 1) AREA
- UPLAND SECTIONS AREA
- RESTORATION MITIGATION AREA
- DITCHES
- EXISTING STRUCTURES AND MODIFIED FACILITIES

NOT TO BE USED FOR CONSTRUCTION

NO.	REVISIONS AND RECORD OF ISSUE	BY	DATE
A	11-6-2001 ISSUED FOR SCA PERMIT	MC	11/6/01

SCALE 1"=100'

JEA
BRANDY BRANCH COMBINED CYCLE PROJECT

SITE ARRANGEMENT

PROJECT NUMBER 97990-DS-S1001 REV A

FIG 2.1-3

Table 2.1-1
Adjacent Property Owners
Brandy Branch Generating Station

Parcel No.	Property Owner
1	W. C. Bostwick P.O. Box 12 Jacksonville, FL 32201-0012
2	I. Krieg 15551 W. Beaver Street Baldwin, FL 32234
3	F. B. Miller, Jr. 1840 Seminole Road Jacksonville, FL 32205-9130
4	C. U. Miller Trust 1840 Seminole Road Jacksonville, FL 32202-9130
5	Florida Power & Light Co. P.O. Box 14000 Juno Beach, FL 33408-0420
6	I. H. Owen, Jr. Trust 4076 McGirts Blvd. Jacksonville, FL 32210-4381

Note: Figure 2.1-2 illustrates the adjacent property ownership.

2.1.3 Existing and Proposed Uses

The Generating Station property includes approximately 153 acres. Existing use is for power production; the proposed use is for power production. JEA was issued a Planned Unit Development Permit by the Duval County Zoning Board for use of the site in an industrial capacity as an electrical power plant facility.

2.1.4 Flood Zones

The Brandy Branch Generating Station is not located in a 100 year flood zone.

2.2 Socio-Political Environment

2.2.1 Governmental Jurisdictions

The Project site is located within the Jacksonville incorporated area of Duval County. The Project is located at the Brandy Branch power generation facility in western Duval County in the vicinity of Baldwin, Florida. The site is located 1 mile north of US 90 and 1 mile east of US 301. The incorporated City of Baldwin is 1 mile west of the site and Jacksonville is about 18 miles east. The western boundary of Duval County is 2 miles west of the Project site. Figure 2.1-1 shows the area within a 1 mile radius of the site.

2.2.2 Zoning and Land Use Plans

Prior to the development and construction of the Brandy Branch Generating Station, this real property was zoned PBF-1. A decision to rezone this land to Planned Unit Development (PUD) status was issued on September 20, 1999 by the Jacksonville Office of the City Council. Council determined the rezoning to be consistent with the comprehensive plan adopted under the Comprehensive Planning Ordinance for future development of the City of Jacksonville.

The Generating Station is located in the Agriculture IV (AGR IV) functional land use category according to the Future Land Use Map series (FLUMs) portion of the 2010 Comprehensive Plan. This PUD facility is consistent with the FLUMs.

2.2.3 Demography and Ongoing Land Use

The population of Duval County in 1980 was approximately 571,000. By 1990, the population had increased 17.9 percent to 672,971. The population had increased 8.9 percent from 1990 to 732,622 by 1997. The 1999 estimated population was 738,483, a 9.7 percent increase since 1990. The average annual growth rate from 2000 to 2015 is projected at 1.09 percent with an average annual increase of 9,086 persons. The

population census data for Baldwin in 1990 and 1996 are 1,450 and 1,560 separately, with a increase rate of 7.6 percent.

The City of Jacksonville and Duval County merged in 1968. Jacksonville's government structure consists of a single entity covering all of Duval County with the exception of the beach communities and Baldwin. Jacksonville is the largest city in land area in the contiguous United States, covering 841 miles. From 1980 to 1990, the population of the city of Jacksonville increased by 101,968 or 17.86 percent. From 1990 to 1995, the population increased by 59,063 or 8.78 percent, compared to the Florida statewide average rate of growth of 8.95 percent and the national average of 5.41 percent. The projected population increase for Jacksonville from 1990 to 2020 is 232,190 or 34.5 percent, representing a projection of 905,161 residents by 2020.

Projected land use in the Project area is anticipated to continue as rural, residential and agricultural.

2.2.4 Easements, Title, Agency Works

There are no easements or titles to be obtained from public agencies for the conversion of the Generating Station. The entire site and access road corridor is owned by JEA.

2.2.5 Regional Scenic, Cultural, and Natural Landmarks

The Florida Department of State, Division of Historical Resources (DHR) has reviewed the site for possible impact to historic properties listed, or eligible for listing, in the National Register of Historic Places. In a letter dated March 24, 1999, the DHR indicated that a review found no significant archaeological or historical sites are recorded for or likely to be present within the Project area. Refer to Appendix 10.3.

2.2.6 Archeological and Historic Sites

No archeological or historical sites are known to exist on the Generating Station site.

2.2.7 Socioeconomics and Public Services

This section describes the current socioeconomic situation in the area that would be affected by the conversion of the Brandy Branch Generating Station.

2.2.7.1 Social and Economic Characteristics. The Generating Station is located in western Duval County, approximately 2 miles from the border of Duval County. Because the construction and operation of the Project will have socioeconomic impacts beyond the boundaries of Duval County, the Project impact area was defined to include

the counties of Duval, Baker, Clay, and Nassau. These counties were selected because of their proximity to the site and probable workforce contribution to the Project. Despite the large geographic area covered by this impact area, the impact area is not considered to be excessive due to the labor force and economic conditions described below.

Labor Force

The construction, installation, and operation of a combined cycle unit requires the combined efforts of many individuals from a wide range of professional and skilled disciplines. A large geographic area is necessary to gather such a large number of employees with such a wide array of skills. Statistics indicate that a large number of construction workers already reside in these counties. Since the highway system is well-developed, skilled workers will be able to commute to the Project site from relatively long distances. However, the effects of the construction Project may be diminished by distance, depending on the type of impact being analyzed.

Employment by Occupation

The latest breakdown in employment by occupation is found in the 1998 US Census data. This data was organized by county and indicates the distribution of population in the Project impact area.

Duval County contained a workforce of 381,829 workers--more than thirteen times the workforce of the second largest workforce area, Clay County. In fact, Duval County contained more than eight times the workforce of all the other three counties combined. The predominant employment category varied by county. In Baker County, most positions were described as Health and Support Services. Accommodation and Food Services was by far the most common job category in Nassau County. In Duval County, most positions were in the Finance and Insurance area. For Clay County, Retail Trade is the dominant position. Table 2.2-1 provides details on the employment in the primary impact areas.

Employment by Industrial Sector (SIC Code)

According to 1998 data, almost 13 percent of the workforce in the impact area is employed by the Retail Trade Industry. Health Care and Social Assistance and Finance and Insurance are the next two most populated categories followed by Administrative and Support Services. The data indicates that about 26,276 construction jobs were in existence in 1998 (Table 2.2-2).

Table 2.2-1
Employment by Industry
by County, 1998

	Duval County	Clay County	Baker County	Nassau County
Total Employed Persons	381,829	29,361	3,589	12,551
Farming, Forestry, and Fishing	201	105		469
Construction	22,652	2,710	252	662
Manufacturing	28,281	1,669	208	1,676
Wholesale Trade	22,535	574	50	279
Retail Trade	45,871	7,031	599	2,315
Transportation and Warehousing	22,352	687	71	270
Information	11,791	391		81
Finance and Insurance	47,730	594	76	270
Real Estate	6,699	559	25	101
Professional, Scientific, and Technical Services	20,284	1,091		376
Management	6,889	85		20
Administrative and Support Services	44,437	1,428		181
Educational Services	3,864	320		105
Health Care and Social Assistance	44,460	4,752	1,642	1,278
Arts, Entertainment and Recreation	3,601	619		129
Accommodation and Food Services	27,529	3,828	321	3,149
Other Services	18,319	1,931	146	1,023

Source: US Census Web Page. 1998 County Business Patterns at http://www.census.gov/epcd/cbp/map/98data/12/031.txt.

Table 2.2-2
Employment by Industry
by County, with Percentage of Workforce 1998

County:	Duval		Clay		Baker		Nassau	
Total Employed Persons	381,829		29,361		3,589		12,551	
Farming, Forestry, and Fishing	201	0%	105	0%		0%	469	4%
Construction	22,652	6%	2,710	9%	252	7%	662	5%
Manufacturing	28,281	7%	1,669	6%	208	6%	1,676	13%
Wholesale Trade	22,535	6%	574	2%	50	1%	279	2%
Retail Trade	45,871	12%	7,031	24%	599	17%	2,315	18%
Transportation and Warehousing	22,352	6%	687	2%	71	2%	270	2%
Information	11,791	3%	391	1%		0%	81	1%
Finance and Insurance	47,730	13%	594	2%	76	2%	270	2%
Real Estate	6,699	2%	559	2%	25	1%	101	1%
Professional, Scientific, and Technical Services	20,284	5%	1,091	4%		0%	376	3%
Management	6,889	2%	85	0%		0%	20	0%
Administrative and Support Services	44,437	12%	1,428	5%		0%	181	1%
Educational Services	3,864	1%	320	1%		0%	105	1%
Health Care and Social Assistance	44,460	12%	4,752	16%	1,642	46%	1,278	10%
Arts, Entertainment, and Recreation	3,601	1%	619	2%		0%	129	1%
Accommodation and Food Services	27,529	7%	3,828	13%	321	9%	3,149	25%
Other Services	18,319	5%	1,931	7%	146	4%	1,023	8%

Source: US Census Web Page. 1998 County Business Patterns at http://www.census.gov/epcd/cbp/map/98data/12/031.txt.

Baseline Employment Projections

The economic activity in and around the Jacksonville area has been growing rapidly and is expected to continue to grow at a similar pace. The number of jobs is expected to grow in the Jacksonville market by 28.8 percent between 1997 and 2007. Specifically, computer and technical related jobs are among the fastest growing in the region. For example, computer engineers are expected to grow at a rate of 124 percent over the next 10 years. During the same time frame, construction jobs are expected to grow at a rate of 4.4 percent while sales jobs are expected to grow at the rate of 22.1 percent. Service related jobs are predicted to grow at the fast rate of 54.1 percent during this time frame. Table 2.2-3 provides the Duval County employment growth projections for the twelve fastest growing occupations.

Statewide projections reflect the expectation that Florida's economy will continue to rapidly expand well into the 21st century. Table 2.2-4 provides the statewide employment growth projections for the thirteen fastest growing occupations.

Despite large population growth in the area, unemployment rates remain low. In Duval County, the unemployment rate was 3.1 percent in 1999 but has since grown to 3.9 percent as of June 2000. Unemployment rates have also grown slightly for the surrounding counties this year. In Clay County, unemployment is up to 3.2 percent, from just 2.6 percent in 1999. Baker County unemployment is up slightly at 3.6 percent from 3.3 percent in 1999 while Nassau County's unemployment rate is 4.1 percent, up from 3.4 percent in 1999. Overall, unemployment rates remain low compared to neighboring cities and counties in Florida.

General Income Characteristics

A Bureau of Labor Statistics survey for the Jacksonville area from July 1999 provides information on wages for several economic sectors. Professional, scientific, and technical occupations average $20.45 per hour. Executive, administrative, and managerial occupations average an hourly wage of $22.89. Sales occupations, both wholesale and retail, average $12.93 per hour.

In Duval County, the average annual wage is $28,085. Employees in the Management area have the highest incomes while workers in the Accommodation and Food Services industry receive the lowest incomes. The average annual wage for construction workers is $30,603. Table 2.2-5 shows gross employment figures for Duval County as well as annual wage figures.

Table 2.2-3
Occupational Forecasts - Duval County
Aggregate Ranking by Openings, Wage, and Growth

Rank	Occupational Title	Percent Growth 1997-2007	Average Annual Openings	Average Hourly Wage 1998($)
1	Computer Engineer	124.54	71	28.40
2	Computer Support Specialist	96.71	122	17.21
3	Home Health Aide	83.41	144	8.07
4	Technical Writer	78.09	33	16.71
5	Respiratory Therapist	74.73	25	16.82
6	Systems Analyst	74.70	198	25.73
7	Production Inspector, Grader	70.06	152	11.86
8	Demonstrator and Product Promoter	68.53	28	11.24
9	Database Administrator	64.62	23	23.51
10	Physical, Corrective Therapy Assistant	62.95	20	9.87
11	Residential Counselor	62.05	19	8.96
12	Usher, Lobby Attendant, Ticket Taker	60.36	22	5.72
13	Human Resources Assistant	60.00	105	10.96

Source: Florida Bureau of Labor Statistics
http://lmi.floridajobs.org/oes-proj/c97duval.xls

Table 2.2-4
Occupational Forecasts – Florida
Aggregate Ranking by Openings, Wage, and Growth

Rank Order	Occupational Title	Percent Growth 1997-2007	Average Annual Openings	Average Hourly Wage 1998($)
1	Computer Support Specialist	77.2	1410	17.85
2	System Analyst	70.07	1955	24.25
3	Computer Engineer	68.63	630	28.49
4	Home Health Aide	64.56	2297	8.04
5	Respiratory Therapist	62.06	391	17.00
6	Physical, Corrective Therapy Assistant	60.12	438	12.43
7	Producer, Director, Actor, Entertainer	57.68	401	15.93
8	Demonstrator and Product Promoter	56.45	348	9.96
9	Telemarketer, Door-to - Door Sales, Street Vendor	56.27	3864	9.98
10	Production Inspector, Grader	53.80	1664	10.17
11	Technical Writer	53.30	353	18.32
12	Medical Assistant	52.70	1481	10.21
13	Residential Counselor	51.86	337	9.10

Source: Florida Bureau of Labor Statistics
http://lmi.floridajobs.org/oes-proj/oes.htm

Table 2.2-5
Employment by Industry
Duval County (1998)

Industry	Establishments	Employment	Annual Payroll (in $000)	Annual Wage (in $)
Total All Industries	20,774	381,829	$10,723,590	$28,085
Farming, Forestry, and Fishing	29	201	$8,623	$42,900
Construction	1,740	22,652	$693,210	$30,603
Manufacturing	738	28,281	$986,384	$34,878
Wholesale Trade	1,398	22,535	$804,954	$35,720
Retail Trade	3,105	45,871	$828,259	$18,056
Transportation and Warehousing	772	22,352	$648,257	$29,002
Information	318	11,791	$505,619	$42,882
Finance and Insurance	1,819	47,730	$1,836,895	$38,485
Real Estate	899	6,699	$173,548	$25,907
Professional, Scientific, and Technical Services	2,212	20,284	$862,870	$42,539
Management	163	6,889	$328,000	$47,612
Administrative and Support Services	1,353	44,437	$813,408	$18,305
Educational Services	173	3,864	$83,941	$21,724
Health Care and Social Assistance	1,911	44,460	$1,309,235	$29,447
Arts, Entertainment, and Recreation	214	3,601	$124,024	$34,442
Accommodation and Food Services	1,396	27,529	$278,606	$10,120
Other Services	2,275	18,319	$332,693	$18,161

Source: US Census Web Page. 1998 County Business Patterns at http://www.census.gov/epcd/cbp/map/98data/12/031.txt.

Baseline Income Projections

Incomes have been growing sharply in the Project impact area for the last 10 years. The most updated median household income in Duval County is $34,575; this number has increased by 21.3 percent since 1989. In Clay County, the median household income is $43,507. The median household incomes are $31,802 for Baker County and $37,830 for Nassau County.

Existing Housing Stock

Existing housing stock features both renter and owner-occupier situations. As of June 2000, the estimated vacancy rate for the Duval County apartment market is 5.8 percent, which is about 3,502 vacant units. There are approximately 60,066 rental apartment units existing in the Jacksonville area. Over 371,090 housing units exist in Duval County, leaving 35,624 units vacant with a vacancy rate of 9.6 percent. There were 46,501 residential units in Clay County in 1998. According to 1990 Census of Population and Housing, there were 5,975 housing units in Baker County and 18,726 housing units in Nassau County.

Temporary housing is readily available in the Project impact area according to the Florida Statistical Abstract. This report indicated 43 registered hotels with a total of 6,411 units in the Jacksonville area. Also, 83 licensed motels total 6,644 units within the area.

Building Activity

The housing stock in the Project area continues to expand rapidly. In 1999, 4,215 new residential units were started in the City of Jacksonville. Also in the first half year of 2000, 2,040 new residential units were started in the City of Jacksonville. There were 1,289 single-family housings started in 1998 in Clay County.

Housing Costs

Compared to other major metropolitan areas in the United States, the Jacksonville area is one of the most affordable places to buy a home. In 1999, the median price of a purchased home in Jacksonville was $119,938; much less than the national average price of $167,900. Compared to other major cities around the nation, Jacksonville was significantly lower than such areas as Dallas/Ft. Worth ($128,600), Atlanta ($145,400), Los Angeles ($207,500), Seattle-Tacoma ($162,700) and Phoenix ($130,500). As of June 2000, in Duval County the average construction value of a single-family unit was approximately $113,841; average values range, by planning district, from $59,405 to $143,760. In 1998, the average house purchase price was $88,225 in Clay County. The

median house value was $53,400 in Baker County and $72,600 in Nassau County based on 1990 Census Population and Housing data. Rental units remain affordable. Average monthly rent for a two bedroom apartment unit in Duval County was around $692 as of June 2000. According to 1990 US Census of Housing, the median rent for a housing unit was $404 in Clay County, $327 in Nassau County, and $225 in Baker County.

2.2.7.2 Area Public Service and Utilities. This section of the application serves two purposes. First, it provides the base information that will be used in Section 7.0 to gauge the physical impacts caused by the construction of Generating Station. Second, it provides the information needed to gauge the extended impact of any influx of workers associated with the construction or operation of the Project.

Education

In Florida, each county comprises a school district. Despite the low need for schools in the immediate Project site area, there are dozens of public and private schools in Duval County. Duval County Public School System has 103 elementary schools, 24 middle schools, 19 high schools, 5 special schools, and 3 exceptional student education centers. There are also eight charter schools. The total enrollment for the school district is 125,612, and average class sizes are 25 for elementary schools, 27 for middle schools, and 28 for high schools. According to the statistics for the 1999-2000 school year for Clay County, there are 18 elementary schools, four junior high, and six high schools. The total enrollment for K-12 schools is 27,669 in Clay County. Nassau Public School District operates a total of 17 schools with the total of 9,128 students. Baker County School District has two elementary schools, two middle schools and one high school with the total 4,567 students.

Very few educational facilities exist within a 5 mile radius of the Brandy Branch Generating Station. There are two schools that exist within the City of Baldwin to the west of the Project site. Baldwin Middle/Senior High School (grades 7-12) has a total of 867 students and Mamie Agnes Jones Elementary School (pre-K – grades 6) has 451 students.

The Project impact area is also home to institutions of higher learning. Duval County is home to two fully-accredited, 4 year public institutions: the University of Florida at Jacksonville and University of North Florida (UNF). Duval County also hosts several community colleges and other schools with a wide variety of specialized curricula and services in the area. Those colleges and schools include Florida Community College at Jacksonville, Florida Coastal School of Law, Jones College, Edward Waters College, Jacksonville University and Webster University. Nassau County also hosts branches of

the Florida Community College at Jacksonville (Nassau Center), Edward Waters College, Jacksonville University and University of North Florida.

Transportation

The Project impact area has a very highly developed transportation system. Three public airports serve the area: Herlong Airport, Jacksonville International (which features more than 15 scheduled airlines serving more than 4 million passengers each year), and Craig Municipal Airport. There are two naval stations in the area that also have airfields, Jacksonville Naval Air Station and Mayport Naval Station, and one outlying landing field at Whitehouse; however, these are not for public use. Several major highways traverse the area including Interstates 95, 295, and 10, and US Highways 90, 1, and 17.

In and around Jacksonville, the Jacksonville Transit Authority (JTA) operates 63 routes, running 173 vehicles in their active fleet. JTA also runs a Skyway monorail system that serves both sides of the St. Johns River. There is no public mass transit serving all of Duval County although the Greyhound-Trailways Bus Service connects Jacksonville to many US destinations.

Area rail freight service is provided by CSX Transportation. Passenger rail service is provided by Amtrak to Lake City and Jacksonville.

Rental cars are plentiful and relatively inexpensive, compared to the rest of the United States.

Medical Facilities

Baptist Health System provides healthcare and education to the community. The system consists of four hospitals, Baptist Medical Center, Wolfson Children's Hospital, Baptist Medical Center Beaches, and Baptist Medical Center Nassau. Baptist Medical Center is a full service, 601 bed tertiary care medical center located on the south bank of the St. Johns River in Jacksonville, which is approximately 20 miles from the Brandy Branch Generating Station. Wolfson Children's Hospital is Northeast Florida's only pediatric hospital, which is co-located with Baptist Medical Center. This 160 bed facility provides services to more than 10,000 children a year. Baptist Medical Center Beaches, 40 miles from the Project site, is a full service center featuring emergency services and surgical services. Baptist Medical Center Nassau is a 54 bed acute care hospital, which is located over 50 miles away from the Project site.

St. Vincent's Health System includes two hospitals, St. Vincent's Medical Center and St. Catherine Laboure' Manor. St. Vincent's Medical Center is a 528 bed, full service tertiary care medical center located on the western bank of the St. Johns River.

This hospital is approximately 20 miles away from the Brandy Branch Generating Station. St. Catherine Laboure Manor is a 240 bed, short- and long-term care nursing home located in the Riverside area of Jacksonville, which is approximately 20 miles away from the Project site.

Shands HealthCare, the University of Florida and University & Methodist Medical Centers have joined forces to form Shands Jacksonville Medical Center. Featuring a 760-bed facility with 746 University of Florida faculty and community physicians, Shands Jacksonville provides specialty services including diabetes treatment center, women's breast health center, pain management center, etc. This medical center is located 21 miles away from Brandy Branch Generating Station.

Opened in 1986, Mayo Clinic provides medical diagnosis, treatment, surgery and programs in medical education and research. Mayo Clinic is approximately 37 miles from the Brandy Branch Generating Station.

Firefighting Facilities

The Generating Station is located in the City of Jacksonville. As such, the Fire and Rescue Department of the City of Jacksonville is responsible for fire/EMS protection for this location. The Jacksonville Fire and Rescue Department (JFRD) is a 1,000 member career department with an augmentation force of 50 reserve members. It staffs 50 stations using a three shift, 24/48 hour rotation.

The Generating Station is located in a predominately rural area of the community. The closest station to the Project is the City of Baldwin's Station which is located three miles from the Project site. It is dispatched to any incident in the area as part of an Automatic Aid agreement with their community. The Station houses a single Engine Company and Utility Vehicle which is staffed, 8 a.m. - 5 p.m., with a single firefighter, Monday through Friday, and is augmented with volunteers as their availability permits. The closest City of Jacksonville Station is located more than 10 miles from the site. That station houses an Engine/Tanker Company, staffed by four JFRD career members.

The Fire and Rescue Department of Clay County has 100 paid firefighters and 50 volunteers in ten stations across the County. The Baker County Fire and Rescue Department, which is around 10 miles away from the Project site, has 130 volunteer professionals but no paid professionals. In Nassau County, there are 82 paid personnel supplemented by more than 150 volunteers.

Police Protection

The Generating Station is located at 15701 Beaver Street west of Jacksonville proper. Police protection is provided by the Jacksonville Sheriff's Department, whose

headquarters are located at 501 E. Bay Street in Jacksonville. There are 1,600 police officers employed by the Jacksonville Sheriff's office. Jacksonville Sheriff's Office Zone 5, which is located at 210 South Mcduff Avenue, is responsible for the daily police protection of the Project site. This sub-office has 186 police officers. Elsewhere in the impact area, police protection responsibilities are shared by local municipal police forces, the Florida Highway Patrol, and county sheriff's departments.

Recreation Facilities

Rural area surrounds the Generating Station. Not many recreation facilities exist in the surrounding area. Jacksonville-Baldwin Rail Trail and Cecil Field Commerce Center are two major recreation facilities in Duval County.

Cecil Field Commerce Center, which is a closed Navy Air Base, is in the process of being converted to public use. The center is about 3 miles away from the Project site. The site includes an 18 hole golf course, a swimming pool, several playground areas, two lakes with boating and fishing facilities, and softball complex. Future improvements will include a national level equestrian center, additional sports fields, a wildlife corridor, and trails.

There are several smaller parks within the Duval County radius--most are single-sport complexes, either baseball or football league parks.

Electricity and Gas

JEA delivers power to more than 335,000 customers in Jacksonville and parts of three adjacent counties. The current electricity provider for the Generating Station is JEA. Orange Park, in Clay County is served by JEA while Baker County is served by Florida Power & Light.

Gas service is available in the Project impact area. The gas provider for the Jacksonville area is TECO-People's Gas.

2.3 Biophysical Environment

2.3.1 Geohydrology

A description of the site geology is presented in this section. Two types of geologic data were used to identify the subsurface conditions at the Brandy Branch Generating Station:

- Published literature providing regional geologic information for the Duval County geologic setting prepared by and for the State of Florida Bureau of Geology.

- Onsite subsurface investigations performed under the supervision of Black & Veatch in September 1999, for the three simple-cycle combustion turbine plant with associated facilities.

These data sources provided information on the Brandy Branch Generating Station stratigraphy, aquifers, and soil engineering properties. Subsurface conditions for the proposed heat recovery steam generators (HRSG) and steam turbine (ST) additions are anticipated to be the same as those encountered for the original Brandy Branch Generating Station power block area, since these HRSG and ST units will be immediately adjacent to the original combustion turbines.

2.3.1.1 Regional Geology. The Generating Station lies within the Northern or Proximal Physiographic Zone of the Florida Peninsula, in the southeastern Coastal Plain Province of the United States. The site is located on the western part of Duval County, within the physiographic boundary identified as the Duval Upland which is bounded on the northeast by the St. Mary's Meander Plain, on the southeast by the Eastern Valley, and on the west by the Trail Ridge (Figure 2.3-1). The Duval Upland consists predominantly of flatwoods with elevations ranging from 25 to 100 feet mean sea level (msl).

The topography of Duval County is mostly low and gentle to flat, controlled by a series of ancient marine terraces formed during the Pleistocene (Cooke, 1945). Seven terraces are recognized, namely the Coharie, Sunderland, Wicomico, Penholoway, Talbot, Pamlico, and Silver Bluff terraces (Leve, 1966). The terraces trend parallel to the present Atlantic shoreline and become progressively higher from east to west. The highest altitude is about 190 feet above msl along the eastern slope of the Trail Ridge, which is a remnant of the highest ancient marine terrace (Coharie) in Duval County (Fairchild, 1972). The Duval Upland in Duval County consists of the Wicomico terrace, 70 to 100 feet msl, and the Talbot and Penholoway terraces, 25 to 70 feet msl. The Generating Station is situated on the Wicomico terrace (Figure 2.3-2).

Drainage is primarily controlled by the ancient marine terraces (Fairchild, 1972). Each terrace is bounded along its eastern edge by remnants of a beach ridge parallel to the ancient shorelines, which direct runoff so that the streams flow parallel to the ancient shoreline (Fairchild, 1972). Much of the relatively flat Pamlico, Silver Bluff, and Wicomico terraces is marshland because drainage in these areas is poor (Leve, 1966).

Regional geology for this area consists of recent Holocene to Pleistocene Age undifferentiated surficial deposits underlain by the Miocene Age Hawthorn Formation underlain by Eocene Age limestone deposits, underlain by Paleocene deposits. Wells installed in northeastern Florida have only penetrated down to the Eocene age limestone deposits. In ascending order, the known stratigraphy in the region includes the Oldsmar Limestone of lower Eocene age, the Lake City, and the Avon Park Limestone of middle

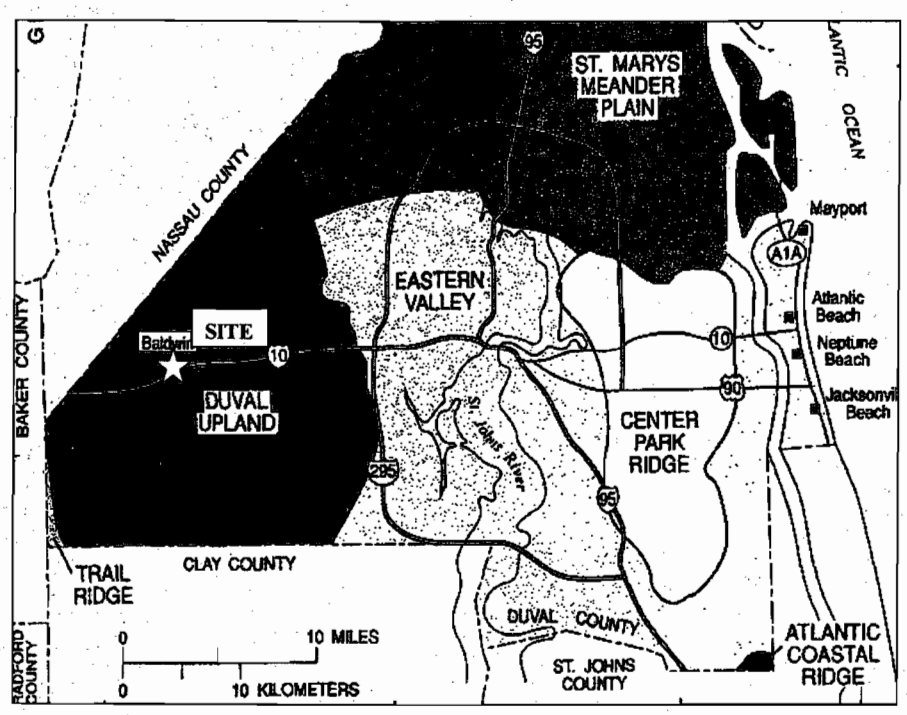


Figure 2.3-1
Regional Physiographic Subdivisions (Phelps, 1994)

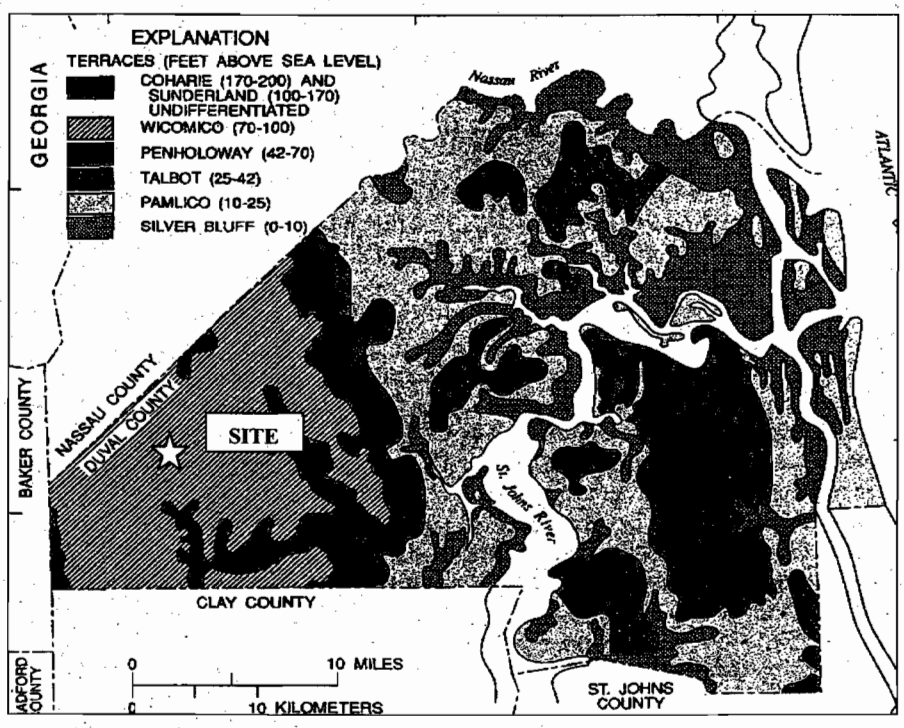


Figure 2.3-2
Terraces of Duval County (Phelps, 1994)

Eocene age, the Ocala Group of upper Eocene age, the Hawthorn Formation of Miocene age, and undifferentiated surficial deposits of Miocene to Holocene age. A generalized geologic column is shown in Table 2.3-1. Figure 2.3-3 shows a regional cross section west to east across Duval County south of Baldwin.

The Oldsmar limestone is the deepest and oldest formation used as a source of water in northeast Florida. The number of wells penetrating this formation are limited. Based on the available information, the elevation of the top of this formation ranges from Elevation –1,270 to Elevation –1,746 feet msl (Leve, 1966). The thickness of the formation is known to be greater than 340 feet, with one well indicating a thickness of 846 feet. The Oldsmar limestone in northeastern Florida consists of a cream to brown, soft, massive to chalky granular limestone, and cherty, glauconic, massive to finely crystalline dolomite. The formation is differentiated from the overlying Lake City limestone by its fossil content (Leve, 1966).

The Lake City limestone comformably overlies the Oldsmar limestone. Top of formation elevations in the region range from Elevation – 580 feet in south-central Duval County to Elevation – 1,260 feet msl in southeastern Nassau County, with a thickness ranging from 475 feet to greater than 490 feet. The Lake City limestone consists of alternating beds of white to brown, lignitic, chalky to granular limestone, and gray to tan, massive to finely crystalline dolomite (Leve, 1966). This formation contains abundant fossil foraminifers which are quite distinct from those fossils of overlying and underlying formations.

The Avon Park limestone varies both laterally and vertically in northeast Florida. It consists predominantly of tan to brown, hard, massive dolomite beds containing thin zones of tan granular fossiliferous limestone. It is believed that the Avon Park Limestone was a shallow marine deposit which received little clastic material. The formation is distinguished from overlying formations by the abundance of sand-sized, cone-shaped forams. The top of the formation usually can be detected during drilling because the hard dolomite beds in the upper part of the formation retard the drilling rate. In northeastern Florida, this formation has been thinned considerably by erosion, and varies in thickness from 50 to about 250 feet, generally thickening towards the coast (Leve, 1966).

Overlying the Avon Park limestone is the Ocala Group. The Ocala Group consists of three separate formations: the Inglis, the Williston, and the Crystal River formation, in ascending order. All three formations of the Ocala Group consist of fragmental, shallow marine limestones and are differentiated sometimes by slight changes in lithology (presence of dolomite) and on the basis of fossil content. The Ocala Group is easily recognizable by the abundance of flat and saddle shaped foraminifera. The top of the Ocala Group is an eroded surface which underlies the Hawthorn Formation. The total thickness of the Ocala Group formations ranges from 160 to about 570 feet.

Table 2.3-1
Generalized Regional Stratigraphic Section

System	Series		Stratigraphic Unit	Thickness (feet)	Lithology	Aquifer
Quaternary	Holocene		Unnamed Deposits	0 – 90	Sand, tan to yellow, loose, medium to fine quartz, sometimes with shells and/or minor clay content. Often has hardpan layer of iron oxide-cemented rusty red to dark brown medium to fine sand in the upper part of the section.	Shallow Aquifer System
	Pleistocene					
Tertiary	Pliocene			10-110	Tan to buff, fine to coarse sand and gray to light gray sandy clay, clayey sand, and shell beds. The lower part of this section consists of tan to yellow, sandy limestone.	
	Miocene		Hawthorn Formation	250 – 500	Gray to blue-green to olive-green clay, silty to sandy clay, clayey quartz sand and phosphatic sandy limestone; often contains phosphatic sands and clays.	Confining Unit
	Eocene	Upper	Ocala Limestone	160 – 570	Marine foraminiferal limestone, white to cream to tan, soft to hard, granular, highly porous, sometimes dolomitic.	Floridan Aquifer System
		Middle	Avon Park Limestone	50 – 250	Marine limestone, light brown to brown, poor to good porosity, highly fossiliferous, slightly carbonaceous, and dolomite, brown to dark brown, hard, massive, crystalline.	
			Lake City Limestone	450 - >490	Marine limestone, white to brown, lignitic, chalky to granular limestone, and gray to tan, massive to crystalline dolomite.	
		Lower	Oldsmar Formation	>340	Marine limestone, light brown to cream, chalky, porous, fossiliferous, with interbedded brown crystalline dolomite.	

Modified from Fairchild (1972) and Leve (1966)

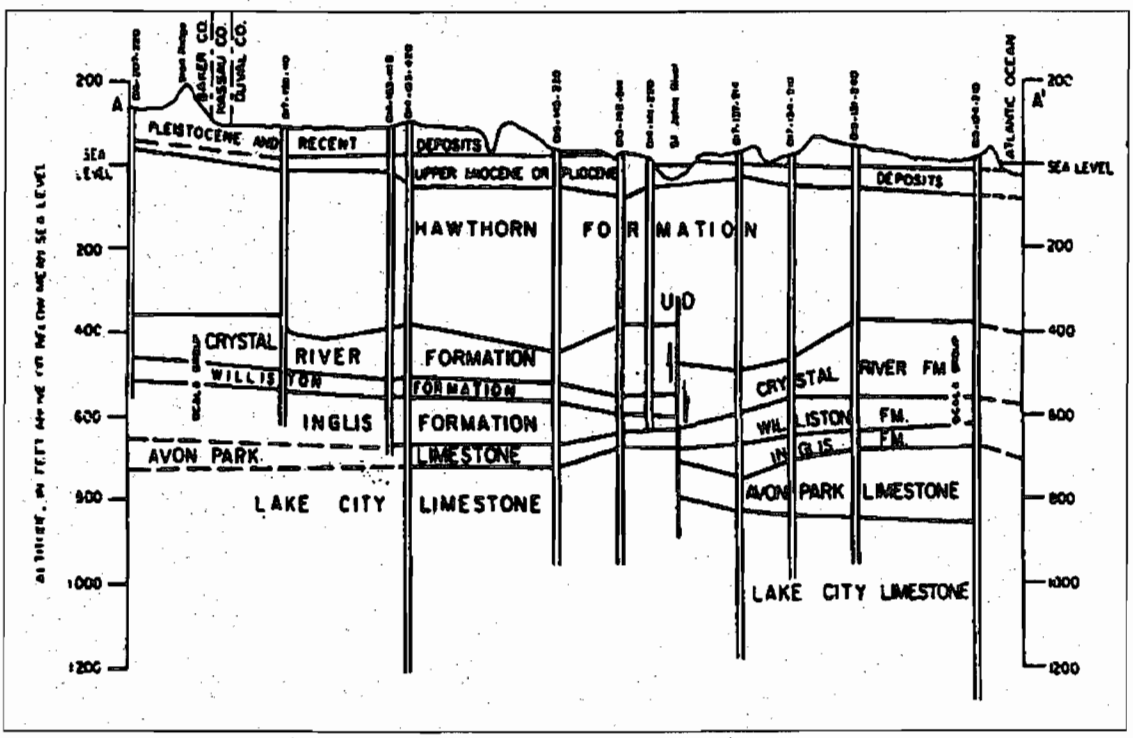


Figure 2.3-3
Regional Cross Section West to East across Duval County, South of Baldwin (Leve, 1966)

The Hawthorn Formation consists mainly of dark gray and olive-green, calcareous, phosphatic sandy to silty clays and clayey sands, interbedded with thin, discontinuous lenses of fine to medium phosphatic sand, phosphatic sandy limestone, and gray hard dolomite (Fairchild, 1972). In the western part of Duval county, the upper part of the Hawthorn consists mainly of coarse-grained sandy phosphatic limestone. The sediments in this formation are considered to be deltaic deposits subjected to subaerial erosion (Fairchild, 1972). The Hawthorn Formation ranges in thickness from about 250 feet to as much as 500 feet in Duval County (Leve 1966), generally thickening to the northeast.

The undifferentiated Upper Miocene or Pliocene age deposits consist of sand, shell, sandy clay and limestone. The sediments can generally be distinguished from the Hawthorn Formation by their lack of phosphate and by their lighter colors, generally tan, buff, or light gray. These deposits are thickest over the lows and thinnest over the highs on the Hawthorn Formation. Their thickness ranges from as little as 10 feet in the extreme southwest part of Duval County to as much as 130 feet in the west-central part of the county (Fairchild, 1972). Pleistocene and Holocene age sediments deposited during the formation of marine terraces and beach ridges blanket all of Duval County. These deposits consist primarily of tan to yellow, medium to fine grained loose quartz sand,

locally stained rusty brown and red from iron oxide. The deposits locally contain thin gray sandy clay beds, which in places contain mollusk shells (Fairchild, 1972). The thickness of these deposits ranges from less than 10 feet in the St. Johns River valley to about 100 feet in western Duval county. The deposits are thickest below the ridges and where they overlie depressions in the upper surface of the upper Miocene or Pliocene deposits.

Leve (1966) indicates that, structurally, the limestone formations of Eocene age dip northeastward in the western part of the county, and northwestward in the eastern part of the county, forming an irregular trough or basin. This trough or basin extends from south central Duval County, northeastward into northeastern Nassau County. A fault extends generally along the axis of the basin with the upthrown side to the west. Displacement of the Ocala group and Avon Park limestones by the fault in southern Duval County is about 125 feet. The displacement decreases northward and the fault probably does not extend farther than northern Duval County.

The Generating Station is located in Seismic Risk Zone 0, one of the most seismically stable areas of the United States. The potential for damage from a seismic event is minimal. All of the earthquakes that have occurred in Florida have had a Modified Mercalli Intensity of VI or less, and have caused very minor damage. The effective peak acceleration (Aa) and the effective peak-velocity-related acceleration (Av) were determined to be less than 0.05g, as determined from the National Earthquake Hazards Reduction Program (NEHRP) recommended Provisions for Seismic Regulations.

2.3.1.2 Site-Specific Geology. Detailed subsurface conditions have been determined from the results of a subsurface investigation completed for the Generating Station in September 1999. This investigation included soil borings, cone penetrometer soundings, shallow piezometers, slug tests, a double-ring infiltrometer test, soil resistivity tests, and laboratory tests on selected samples. Data collected from this investigation is included in the Geotechnical Design Report for The JEA Brandy Branch Generating Station, BV Project No. 60903, September 1999, by Black & Veatch Corporation (B&V), presented in Appendix 10.8.

Field Investigations

The soil borings, soil resistivity, cone penetrometer soundings, permeability tests, and laboratory testing were performed by Law Engineering and Environmental Services, Inc. (Law) of Jacksonville, Florida. Planning and field supervision were performed by a Black & Veatch (B&V) geotechnical engineer. Fieldwork was completed in June 1999.

Survey locations for the planned field testing were located and marked by Bowyer-Singleton & Associates. Test locations are presented in Figure 2.3-4.

The subsurface investigation consisted of the following:

- 21 rotary wash boreholes.
- Four cone penetrometer soundings.
- Seven piezometers.
- Eight soil resistivity tests.
- One double-ring infiltrometer test.
- Four rising and falling head slug tests.

The soil borings were advanced by rotary drilling with either a 2-7/8 inch or 3-7/8 inch tri-cone roller bit. Depths for the borings ranged from 12 to 100 feet below ground surface (bgs). Sampling while drilling consisted of standard penetration test (SPT) samples at 2.5 feet intervals within the upper 10 feet, with subsequent SPT samples obtained at 5 feet intervals. B&V performed borehole logging and field classification of samples in the field. All borings were backfilled with cement-bentonite grout. In addition to the soil borings, four cone penetrometer soundings were advanced to refusal within the main power block area.

Eight soil resistivity tests were performed at specific locations within the main plant area and the substation area. Resistances were measured using a Nilsson Model 400 4-pin soil resistance meter. The Wenner four point method was used with a pin spacing from 2.5 feet to 30.0 feet.

Four piezometers were installed using 6 inch internal diameter hollow stem augers. A series of rising and falling head slug tests performed in piezometers P-1, P-6, P-9, and P-18, as well as a double ring infiltrometer test performed near the location of Boring B-6, were used to determine the permeability of the near surface soils.

A series of laboratory tests were performed on samples obtained during the subsurface investigation. These tests included natural moisture content, Atterberg limits, organic content, and sieve analysis.

All boring logs, cone penetrometer soundings, and piezometer logs, as well as all results for the soil resistivity, double-ring infiltrometer, slug tests and laboratory tests, are presented in the geotechnical investigation report in Appendix 10.8.

Subsurface Conditions

The existing topography slopes from south to north from approximately elevation 84 feet to elevation 80 feet. The geological cross-section detailed in the following discussion presents the proposed fill for the Project site, and summarizes the subsurface conditions encountered during the soil investigation. A detailed discussion of each of the

layers and corresponding sublayers is presented in the geotechnical investigation report in Appendix 10.8. Based on the subsurface materials encountered, the proposed site consists in general of five main layers. The layers of subsurface materials at the site, in descending order from the surface, are as follows:

- Silty Sand and Sand (Fill) from elevation 88 feet to elevation 81 feet. This layer is an engineered fill compacted to 98 percent of maximum dry density as determined by ASTM D698, Standard Proctor Test. The fill was obtained from the excavation of the storm water run-off pond and a nearby borrow pit.
- Silty Sand and Sand from elevation 81 feet to elevation –2.0 feet. This layer consists of black, light brown, brown, and gray, fine-grained, silty sand to sand. The soil consistency varies greatly throughout its thickness, ranging from very loose to medium dense. Standard penetration blowcounts ranged from 0 to 32 blows per foot (bpf), with an overall average of 9 bpf. The average cone penetration tip resistance is 8 mPa and the average friction ratio is 1.2 percent. A trace of organic content was found within the top 6 feet of this layer.
- Sandy Silt from elevation –2.0 feet to elevation –12.0 feet. This layer consists of gray, soft, medium plasticity, sandy silt. The standard penetration test sampler advanced under its own weight within this layer. The average cone penetration tip resistance is 4 mPa and the average friction ratio is 5.5 percent.
- Highly Weathered Rock from elevation –12.0 feet to –19.0 feet. This layer consists of a combination of silt, sand, and rock fragments. The standard penetration blowcounts ranged from 17 to 44 bpf.
- Bedrock below elevation –19.0 feet. Standard penetration blowcounts exceeded 50 bpf for this layer. No rock coring was performed at the site.

2.3.1.3 Bearing Strength. The performance of the foundation systems for the proposed HRSG and ST unit additions must have an acceptable factor of safety against failure of the foundation element or bearing soils. Total and differential settlements should be limited to an acceptable level that will not result in damage to, or loss of service of, the supported facility.

Heavily loaded, settlement sensitive structures within the Generating Station, like the combustion turbines, are being supported on deep foundations consisting of augered cast-in-place piles. More lightly loaded structures are to be supported on shallow footings or mats. It is anticipated that deep foundations will be needed under the proposed HRSG and ST units.

2.3.2 Subsurface Hydrology

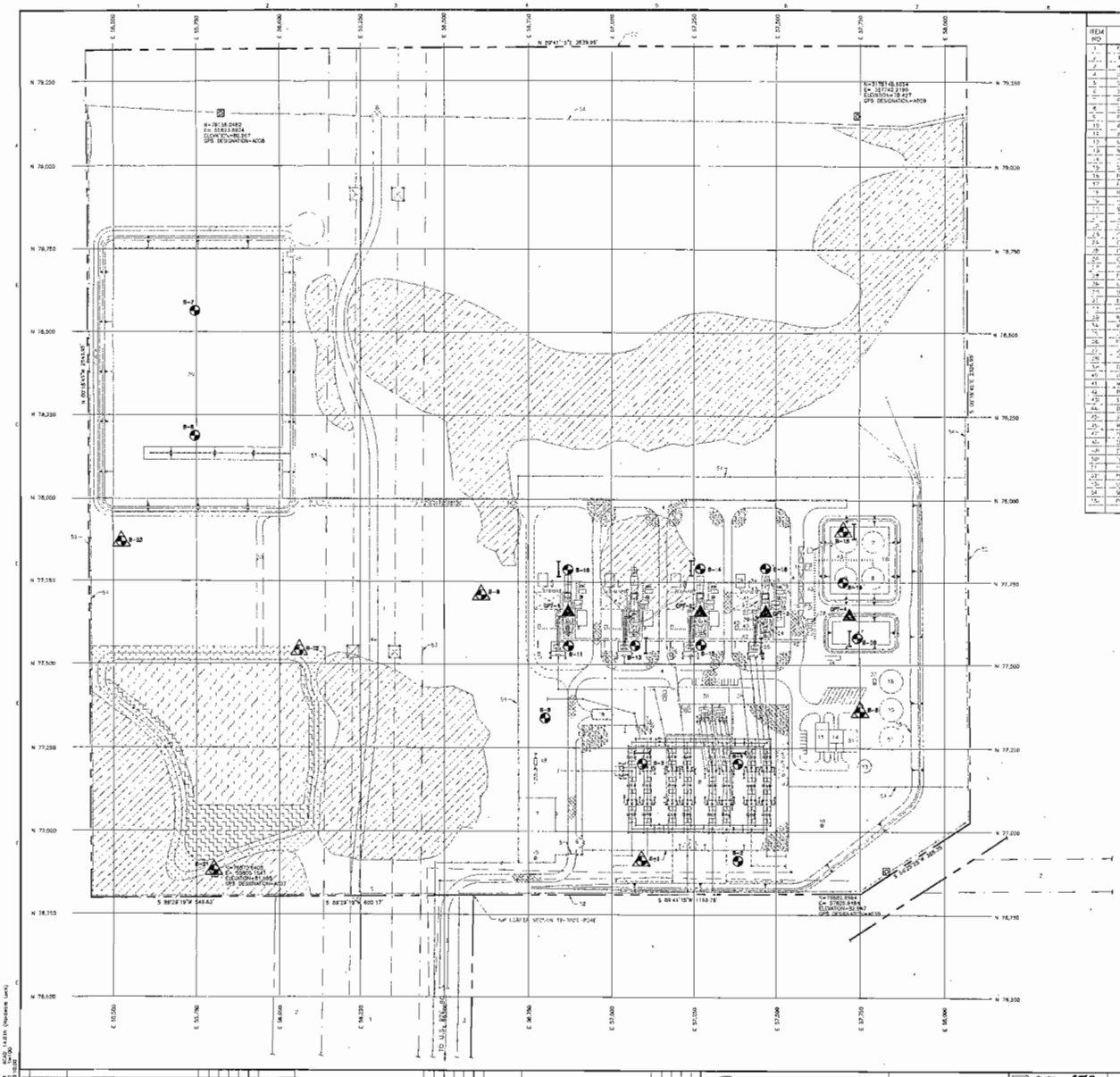
This section describes the ground water aquifers beneath the site. The description is based on published data, data from piezometers installed at various locations within the site, and the results of an aquifer testing program performed at the site, which consisted of two wells installed to a depth of 837 feet below ground surface (bgs) and pump testing. The location of the piezometers is shown on Figure 2.3-4. Pumping well locations are presented on Figure 2.3-5. A copy of the JEA Brandy Branch Hydrogeologic Report prepared by Black & Veatch in June, 2000 is presented in Appendix 10.9, including well installation logs and pump test results. Effects on the aquifers from construction and plant operations are discussed in Section 4.3 and Subsection 5.3.2 of this SCA, respectively; measurement and monitoring programs are discussed in Subsections 4.3.2 and 5.3.5.

In northeastern Florida, ground water occurs in two separate aquifer systems. These are the shallow aquifer system and the Floridan Aquifer system. The shallow aquifer system consists of permeable sand, shell, and limestone within the upper zone of the Hawthorn formation, and the surficial undifferentiated deposits of Pliocene to Holocene age. The Floridan Aquifer system is comprised of the Ocala group, Avon Park, Lake City, and Oldsmar limestone formations. These two aquifers are separated by the Hawthorn Formation which acts as an aquitard. A geotechnical cross section of the Generating Station is shown on Figure 2.3-6, based on the available soil borings and well logs.

2.3.2.1 Shallow Aquifer System. The shallow aquifer system is a surficial water table aquifer and consists primarily of permeable beds of sand, shell, and limestone, grading with depth into less permeable clayey or silty sands. This aquifer comprises the following stratigraphic units: the upper part of the Hawthorn Formation (middle Miocene Age), the upper Miocene or Pliocene deposits, and the Pleistocene and Holocene deposits (Fairchild, 1972). At the site, the bottom of the shallow aquifer was encountered at depths ranging from 92 feet to 98 feet bgs, with the top of the Hawthorn Formation, which regionally acts as an aquitard, separating the shallow aquifer system from the Floridan Aquifer system.

The limestone, sand and shell section at the base of the Miocene to Pliocene age deposits is the major water-yielding zone in the shallow aquifer system. This zone is about 10 to 40 feet thick, and is about 50 to 150 feet bgs throughout most of Duval County. Where the limestone is missing, lesser amounts of water are obtained from the upper sand and shell beds (Fairchild, 1972).

Poor Original



FACILITIES LEGEND

ITEM NO.	DESCRIPTION	LOCATION COORDINATES NORTH	LOCATION COORDINATES EAST	REFERENCE LOCATION
1	P.P. NO. 1 (EXISTING)			
2	EX. TRANSFORMER TO REMAIN			
3	ACCESS ROAD			
4	LOOP ROAD			
5	SIDE GATE			
6	MAIN GATE			
7	FUEL OIL VERTICAL STORAGE TANK			
8	SCREEN WALL			
9	FUEL OIL SECONDARY CONTAINMENT			
10	ANODE TARGET WELL			
11	EXPLOSIVE AREA			
12	GAS LOOP			
13	NON-POTABLE WATER STORAGE TANK			
14	AIR STRIPPER TOWER			
15	DEMINERALIZED WATER STORAGE TANK			
16	FUEL OIL UNLOADING AREA			
17	FUEL OIL UNLOAD AT PUMP AREA			
18	N. PERIMETER ACCESS ROAD			
19	HRSG 'A' STORAGE TANK SECONDARY CONTAINMENT			
20	POTABLE WATER DEMINERAL PLANT			
21	CHEMICAL TANK NO. 1			
22	CT DEMINERALIZER			
23	CT EVAPORATOR			
24	CT AIR INLET FILTER			
25	CT LIFT WATER TREATMENT SYSTEM			
26	CT WATER TREATMENT BUILDING			
27	CT ELECTRICAL BUILDING			
28	FUEL FORWARDING UNIT			
29	CHEMICAL FEED BUILDING			
30	CHEMICAL STORAGE BUILDING			
31	EVAPORATION SYSTEM			
32	CT INLET PIPE TRENCH			
33	MAIN PAPER SAC			
34	MISCELLANEOUS DRAIN TANK			
35	3 STEP FIRE INJECTION SYS			
36	CHEM. STEP TEMP. TANK			
37	WELD TYPE ATTACHING AIR NOZZLE			
38	CT ATTEMPERATOR NOZZLE			
39	CONDENSOR COMPARTMENT			
40	HRSG WATER DELUGE HOSES			
41	WATER HOSE LOOPS			
42	PIPE BRIDGE			
43	5 STEPPER FIRE RACK			
44	CT NATURAL DRAFT STACK			
45	JOHN MANSE RESIDENCE (P.C. CONCRETE STRUCTURE)			
46	WELL HOUSE			
47	NEW ENTRY ROAD			
48	CONC. DRIVE AND SIDEWALK (TYP.)			
49	FUTURE TANK			
50	CHEMICAL FEED BUILDING ADDITION			
51	FUTURE WATER TREATMENT EQUIPMENT EXPANSION			
52	PROPERTY BOUNDARY			
53	CURRENT BOUNDARY			
54	SECURITY FENCE			
55	CONCRETE BERM			

GENERAL LEGEND

- FUTURE FACILITY
- RETAINING WALL
- EXISTING VEGETATION AREA
- ASPHALT
- AGGREGATE SURFACING
- HERBACEOUS SEEDING AREA
- GRASS (SODDING)

SUBSURFACE INVESTIGATION LEGEND

- SUB. BORING (21 TOTAL)
- SUB. PIEZOMETER (3 TOTAL)
- SUB. BORING W/ PIEZOMETER
- CONE PENETROMETER SOUNDING (4 TOTAL)

BORING LOCATION

BORING NO.	NORTHING	EASTING	DEPTH
B-1	78912.39	57069.00	30'
B-2	78912.39	57365.80	30'
B-3	77208.81	57061.42	40'
B-4	77202.81	57365.48	40'
B-5	77338.78	58838.52	20'
B-6	77358.55	57730.50	20'
B-7	76504.00	58743.00	20'
B-8	78188.00	58748.00	20'
B-9	77710.40	58812.52	20'
B-10	77185.00	58688.00	100'
B-11	77253.34	58630.98	100'
B-12	77557.25	57578.68	100'
B-14	77741.42	57258.99	100'
B-15	77558.93	57278.87	100'
B-16	77705.00	57488.00	100'
B-18	77908.25	57791.48	80'
B-19	77700.41	57701.48	100'
B-20	77560.93	57743.70	100'
B-21	76881.77	58801.98	12'
B-22	77551.12	58019.28	12'
B-23	77570.87	55623.88	12'
CPT-1	77660.00	57610.00	88'
CPT-2	77850.00	57570.00	93'
CPT-3	77660.00	57470.00	93'
CPT-4	77850.00	57720.00	91'

NO	DATE	REVISION AND RECORD OF ISSUE	DRAWN	CHECKED
3	08-20-99	ISSUED FOR REPORT	JKS/MCE	RJM/PLM
1	06-08-99	REVISED BORING LOCATIONS	JKS/MCE	RJM/PLM
0	04-27-99	INITIAL ISSUE	JKS/MCE	RJM/PLM

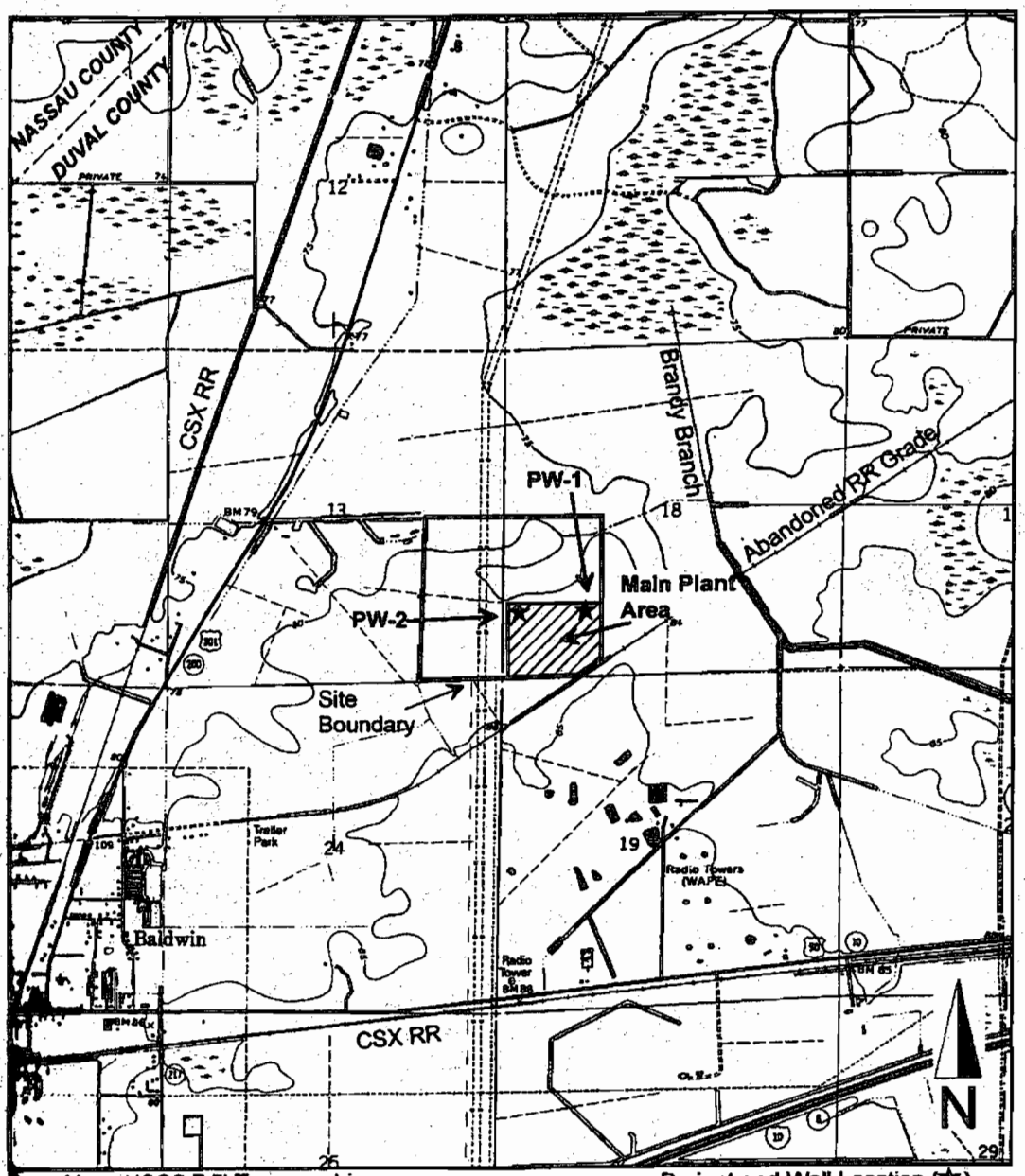
SCALE: 1"=100'

BLACK & VEATCH | JEA Electric Company

JEA
BRANDY BRANCH STATION
SUBSURFACE INVESTIGATION

PROJECT 60903-SS-0001 | DRAWING NUMBER 2 | REV

SCALE: AS SHOWN | Figure 2.3-4



WELL NUMBER	CASING DIA.	Lat./Long.
PW-1	12"	N 30 19' 16.5" W 81 56' 43.4"
PW-2	12"	N 30 19' 17.1" W 81 56' 58.6"

Figure 2.3-5
JEA Brandy Branch Site – Pumping Well Locations

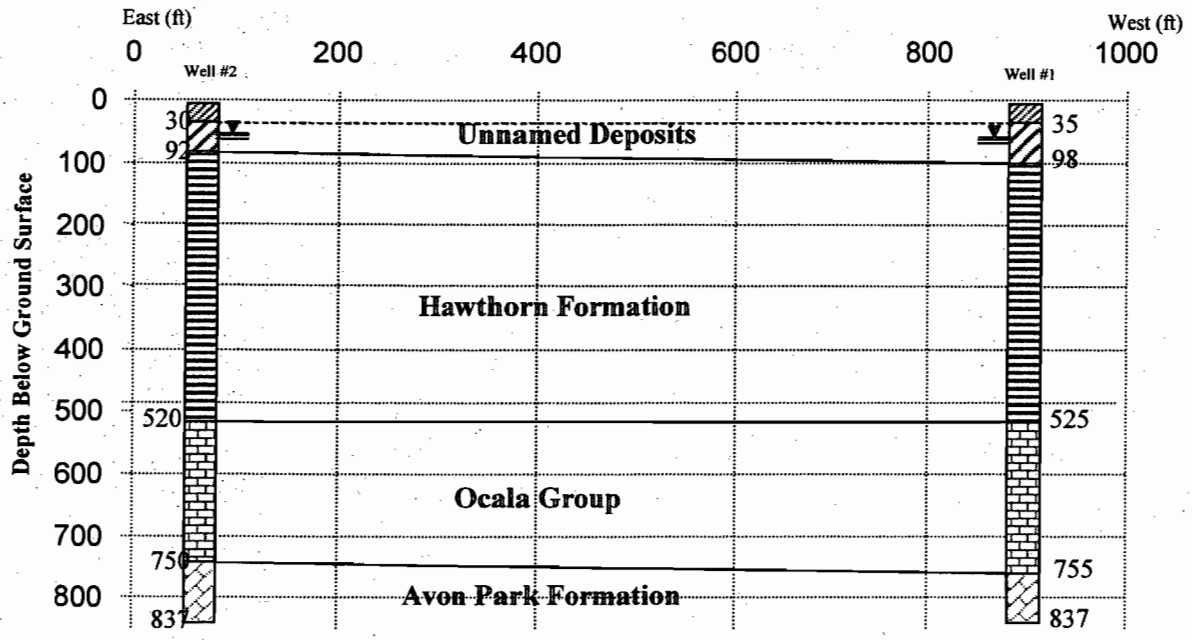


Figure 2.3-6
Geotechnical Cross Section at JEA Brandy Branch Site

The shallow aquifer is recharged from direct infiltration of precipitation, irrigation, and possibly by upward leakage from the deeper Floridan Aquifer (Fairchild, 1972). Upward leakage from the Floridan Aquifer is more likely in those areas where the thickness of the sediments overlying the Eocene limestones of the Floridan Aquifer are thinnest, and where the potentiometric surface of the Floridan Aquifer is above ground surface (eastern Duval County). Recharge from areas outside Duval County is likely to the west of Duval County in Baker County, and to the southwest in Clay County. Water is discharged from the aquifer by outflow to streams, by evapotranspiration, by pumpage, and by downward leakage to the Floridan Aquifer system.

Water levels in the shallow aquifer fluctuate in a seasonal pattern, responding mainly to local rainfall (Fairchild, 1972). During most years, low rainfall occurs from November through February, and high rainfall occurs from June through September. The water level surface of the shallow aquifer system tends to follow the contour of the land surface. As a result, the water level is highest where the terraces are highest and lowest where the terraces are lowest. The water level of the shallow aquifer system in most of Duval County is under nonartesian conditions, although the aquifer is locally confined in some low areas immediately adjacent to the St. Johns River and its tributaries, in eastern Duval County (Leve, 1966).

The ground water levels in the shallow aquifer during the site investigation were encountered about 6 feet bgs, at Elevation 75 feet. Piezometers were installed adjacent to soil borings BV-1, BV-6, BV-9, and BV-18, roughly in the power block area. Piezometers were also installed adjacent to soil borings BV-21, BV-22, and BV-23, within the vicinity of the wetlands creation area. Ground water elevations were recorded within the piezometers on a periodic basis from July 1999 through September 1999. A summary of the measured ground water conditions is presented on Figures 2.3-7 and 2.3-8.

The results of the double-ring infiltrometer test indicated a vertical permeability for the unsaturated, near surface soils of 8 feet per day. Rising and falling head slug tests performed in the saturated region of the upper soils resulted in horizontal permeability values ranging from 11 to 45 feet/day.

On a regional basis, with only a few exceptions, wells that penetrate the shallow aquifer system yield water of good quality. Fairchild (1972) indicated the hardness of the water in the regional shallow aquifer averages 187 mg/l (generally increasing with depth). Fairchild also indicated dissolved solids content ranges from about 50 to 2,560 mg/l; chloride content ranges from 6 to 30 mg/l; and iron content ranges from 0 to 2.8 mg/l. A table showing regional chemical analysis results of water from the shallow aquifer in Duval County, Florida, is presented in Appendix 10.10.

2.3.2.2 Floridan Aquifer. The Floridan Aquifer underlies all of Florida and, in the region, includes part or all of the Oldsmar, Lake City, Avon Park, and Ocala Group limestone formations, as well as some portions of the Hawthorn Formation that are in hydraulic contact with the underlying limestones. The Floridan Aquifer thickness in the region is about 1,700 feet. Beneath the Floridan Aquifer is the Cedar Keys Formation which acts as a confining unit. The top of the Floridan Aquifer at the site is at about 380 feet bgs, where the top of the Ocala Group was encountered during well drilling.

The Floridan Aquifer system is subdivided into the Upper Floridan Aquifer, the middle semiconfining unit, and the Lower Floridan Aquifer. The Upper Floridan Aquifer consists of the Ocala limestone and some of the dolomite and dolomitic limestones of the upper portion of the Avon Park Formation. The middle semiconfining unit consists of relatively less permeable, soft micritic limestone and dense dolomitic limestone in the middle portion of the Avon Park Formation. The Lower Floridan Aquifer includes the bottom portion of the Avon Park Formation, and the Lake City and Oldsmar formations. The latter two consist of alternating layers of relatively impermeable dolomite confining beds and soft, permeable limestone and dolomited water-bearing zones (Leve, 1966). A highly permeable zone known as the Fernandina permeable zone, is present in the deeper areas of the Lower Floridan Aquifer in parts of northeastern Florida and southeastern

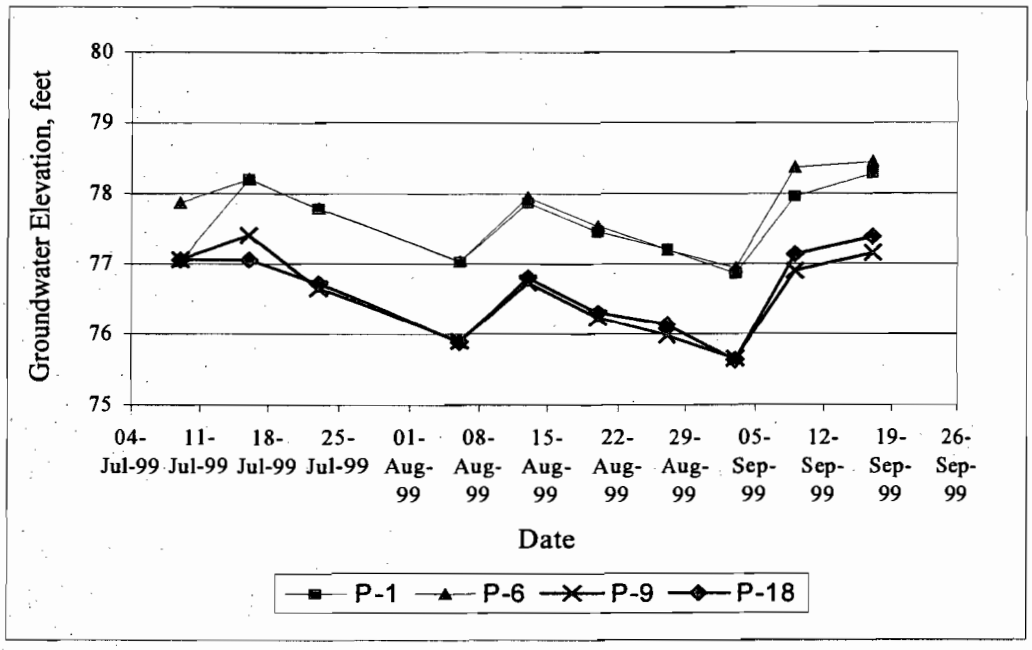


Figure 2.3-7
Ground Water Elevations in Main Plant Area Piezometers

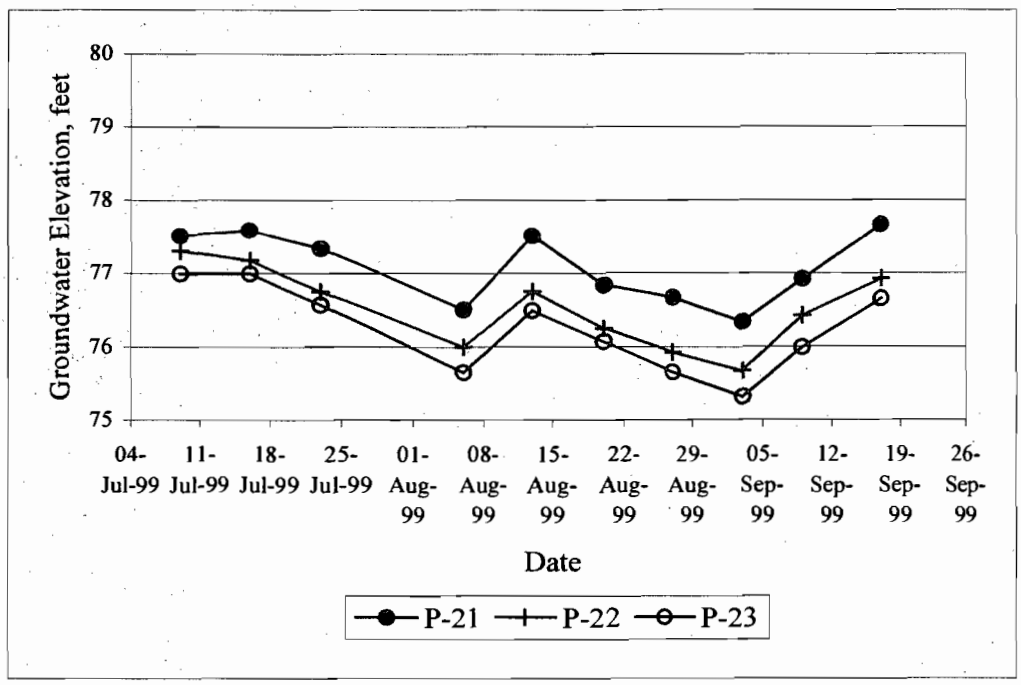


Figure 2.3-8
Ground Water Elevations in Wetlands Piezometers

coastal Georgia. This zone is of a partly cavernous nature due to the ground water circulation through the carbonate rocks in the geologic past and does not result from the present ground water flow system (Miller, 1986).

This aquifer is recharged primarily from infiltration of precipitation in its outcrop area. In northeastern Florida, the principal recharge area is in western Putnam and Clay counties and eastern Alachua and Bradford counties. These counties are located south and southwest of Duval County. Within this recharge area, water enters the Floridan Aquifer at its outcrop areas, through breaches in the Hawthorn Formation caused by sinkholes, and by downward leakage where the Hawthorn Formation is thin or absent. Discharge of ground water from the Floridan Aquifer in the region occurs primarily by pumping. Outflow to other areas and to the Atlantic Ocean also contributes to the discharge from this aquifer.

The artesian pressure in the Floridan Aquifer is created primarily by the presence of the confining layer above the Floridan Aquifer at the site. The potentiometric surface of the Floridan Aquifer in the region has been affected by heavy pumping around Jacksonville in Duval County and Fernandina Beach in Nassau County, as well as by the below normal precipitation in the region. In the September 2000 Hydrologic Report, the SJRWMD indicates that between May 1981 and September 2000, there has been a decrease of 4 to 8 feet in the potentiometric surface of the Floridan Aquifer in the Duval County region. The two well installation logs available for the Generating Station indicate that at present, the depth to the potentiometric surface of the Floridan Aquifer at the site is about 49 feet bgs (about Elevation 32 feet msl). Since both wells are open to the Ocala Group limestones and part of the upper portion of the Avon Park limestone, the potentiometric surface measured at the wells represents that of the Upper Floridan Aquifer. Leve (1966) reports that the potentiometric surface in wells cased to different lengths within the Floridan Aquifer in the region was lowest for those wells open to the Ocala Group limestones, and highest for those open to part of the Avon Park and Lake City limestones. The water pressure in the deeper wells was between 0.5 to 1.5 feet higher than that of the wells installed in the shallower zone. Leve (1966) proposed that as additional wells were installed into the deeper zones of the Floridan Aquifer, internal leakage within the well bores and pumping of water from the lower regions would probably equalize the pressures in the upper and lower zones of the aquifer.

The yield of wells installed within the Florida Aquifer in northeast Florida depends greatly on the depth of the wells. Wells drilled into the deeper zones of the aquifer generally yield more water than those in the shallower zones. Leve (1966) indicates that the average yield of wells between 8 and 12 inches in diameter is generally less than 2,000 gpm.

Based on the available literature, somewhat variable aquifer characteristics are present throughout the region. Pump tests at the Mandarin Utilities Community Hall wellfield in St. Johns County, indicate the Floridan Aquifer has a transmissivity of about 11,940 ft^2/day and a storage coefficient of from 2.4 x 10^{-3} (Leve, 1988). Another pump test reported by Franks and Phelps (1979) resulted in a transmissivity of 80,000 ft^2/day and a storage coefficient of 3.1 x 10^{-4}. The results of the pump tests performed on the two wells installed at the Generating Station indicated the Floridan Aquifer at the site has a transmissivity of 15,319 to 15,855 ft^2/day. Storage coefficients ranged from 2.94 x 10^{-4} to 3.23 x 10^{-4}.

Water in the Floridan Aquifer system generally is of a calcium and magnesium bicarbonate type because of the reaction between the limestone aquifer matrix and the weak carbonic acid characteristic of rainfall as a source of recharge (Leve, 1966). The chemical quality of the ground water in the Floridan Aquifer is better in the western than in the eastern part of Duval County. The concentration of dissolved solids near the St. Johns River is greater than 2,000 mg/l, while around the Generating Station dissolved solids are less than 250 mg/l. Chemical analyses on ground water samples taken from the two wells installed at the Generating Station are included in the Hydrogeologic Report presented in Appendix 10.9.

In the *SJRWMD Water Supply Needs and Sources Assessment 1994* (Vergara, 1994), the depth to the freshwater-saline water interface in the region was shown, based on a model simulation. Figure 2.3-9, obtained from the above mentioned report, indicates there is no freshwater-saline water interface near the Generating Station. The closest freshwater-saline water interface is about 4 miles east from the site, and is located below the Lower Floridan Aquifer, in what is known as the Fernandina permeable zone.

2.3.3 Site Water Budget and Area Users

Detailed climatological information for the site area is provided in Subsection 2.3.7 of this application. The general meteorological information presented herein was collected from the Jacksonville International Airport. This is the closest National Weather Service office to the Generating Station, being located approximately 20 miles northeast of the site. The Jacksonville International Airport data is considered to be representative of long-term, Generating Station conditions.

Duval County has, in general, a humid, subtropical climate, with relative humidity ranging from 50 to 95 percent. Winters are generally mild, with occasional cold weather fronts coming from the north. The closeness of the county to the Atlantic Ocean and the Gulf Stream results in rare occurrence of freezing temperatures during winter.

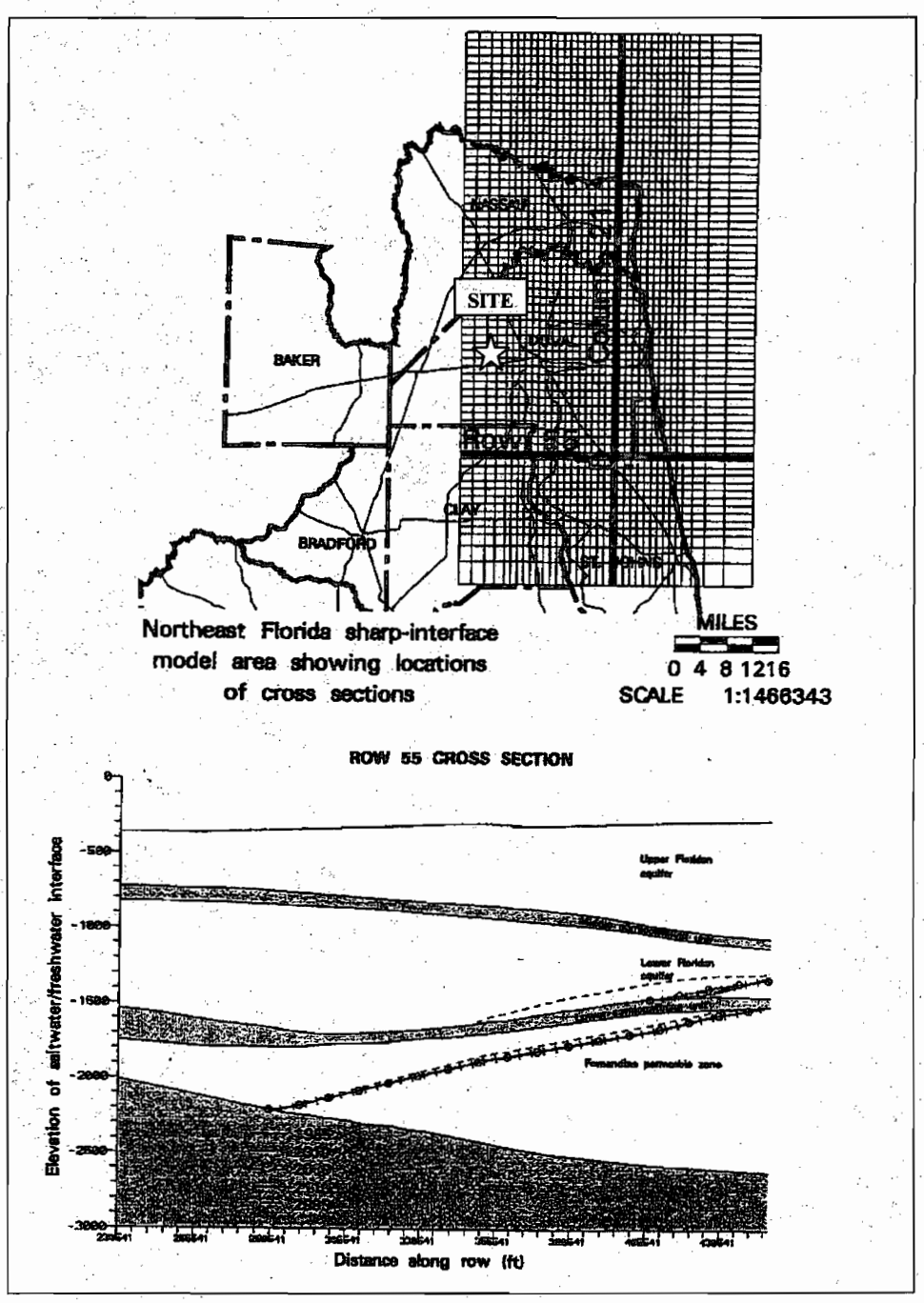


Figure 2.3-9
Freshwater-Saline Water Interface Near Baldwin (Vergara, 1998)

2.3.3.1 Temperature and Precipitation. Normal monthly and annual temperatures are presented in Table 2.3-5 (in Subsection 2.3.7). The annual average temperature for the period of record is 69° F near the coast and about 68° F inland. The warmest month is typically July, while the coldest month is typically January. Additional temperature information is included in Tables 2.3-6 (in Subsection 2.3.7) through 2.3-8 (in Subsection 2.3.7).

Normal monthly and annual rainfall totals are presented in Table 2.3-9 (in Subsection 2.3.7). The annual average for the period of record is approximately 52 inches. Rainfall is typically greatest in the summer months of June through September. November has the lowest average rainfall. Additional rainfall information is included in Tables 2.3-10 (in Subsection 2.3.7) through 2.3.12 (in Subsection 2.3.7).

Snow falls sparingly during the winter months of December through March. The greatest depth of snow on the ground has been 1.9 inches on February 13, 1899. The greatest number of consecutive days with snow in the region is 2 days.

2.3.3.2 Evapotranspiration and Runoff. Rainfall averages about 52 inches per year in the Jacksonville area. A portion of this rainfall is intercepted by vegetation or stored in small depressions on the surface, a portion infiltrates into the soil, and the remainder directly runs off during storm events. Evaporation occurs from shallow depressions on the surface, from soil surfaces and as transpiration from vegetation. The total evaporation and transpiration is known as evapotranspiration, which varies with surface conditions. The Natural Resource Conservation Service (NRCS) estimates evapotranspiration to be about 36 to 38 inches per year in this area. The average annual runoff from streams is about 20 inches. Base flow in the streams is sustained by ground water inflow from the shallow aquifer system and accounts for 10 to 12 inches of the annual runoff. The remainder of the annual runoff is direct runoff from overland flow.

2.3.3.3 Water Use. Water resources in the site vicinity include the shallow aquifer system and the Floridan Aquifer system. The lack of major surface water bodies in the area limits the use of surface water for water supply, although some streams, like the Brandy Branch of the St. Mary's River, have been channelized to provide limited amounts of water for irrigation and institutional purposes. The Floridan Aquifer will supply the plant with process, service, and reserve fire water, as well as cooling water makeup. A limited amount of water will be obtained from the City of Baldwin municipal water supply for potable water.

All the public water and most of the industrial and private water supplies in the region are obtained from wells developed in the Floridan Aquifer system. No industrial, municipal water supply or wastewater facilities are located onsite. Cecil Field Naval Air Station, about 3 miles southeast from the Generating Station, uses an average of

700,000 gallons per day (gpd) of water obtained from five wells in the Floridan Aquifer. The City of Baldwin municipal water supply wellfield is located about 2 miles southwest of the site. This well field is owned and operated by the City of Baldwin, and pumps water from three wells within the Floridan Aquifer.

No reservoirs or natural lakes are onsite, or within 5 miles of the site. No commercial transportation activities are known to occur on the limited surface waters in the vicinity of the site.

A list of the water supply wells installed within a 5 mile radius from the Generating Station, including well owners and specific well information, is presented in Appendix 10.11. The list was obtained from the SJRWMD-Palatka office. The nearest deep well to the site is approximately 1 mile southwest of the site, owned by Southern Wood Piedmont Company. The three City of Baldwin wells are approximately 2 miles southwest of the site.

Table 2.3-2 shows average ground water and surface water use in Duval County for the year 1995, along with projected 2020 conditions (Vergara, 1998). Projected changes in the elevation of the water table of the shallow aquifer system due to projected increases in ground water withdrawals between 1995 and 2020 are estimated to be less than 1 foot in the general region of the JEA Brandy Branch Generating Station. Likewise, projected changes in the elevation of the potentiometric surface of the Floridan Aquifer system due to projected increases in ground water withdrawals between 1995 and 2020 are estimated to be less than 3 feet in the site area (Vergara, 1998).

2.3.4 Surficial Hydrology

2.3.4.1 Regional Hydrology. The main rivers in Duval County include the St. Johns River, St. Mary's River and Nassau River. The Generating Station is located within the St. Mary's River Drainage Basin of the St. Johns River Water Management District, as shown on Figure 2.3-10. Numerous wetlands, small ponds and wet depressions, as well as several creeks and streams are located throughout this area.

The St. Mary's River drains the Florida counties of Baker and Nassau, as well as the northwestern and northern areas of Duval County. From its origin in the Okefenokee swamps in Georgia, the St. Mary's River follows the boundary between the states of Florida and Georgia, until it reaches the Atlantic Ocean. The channel of the St. Mary's River is well developed in its lower coastal reach. In this reach, the channel is incised into the water-table aquifer so that the river derives some base flow from the shallow aquifer during even the most severe droughts. The US Geological Survey (USGS) maintains several stream gauge stations along the St. Mary's River and some of its

Table 2.3-2
Total Water Demand for 1995 and 2020 in Duval County

Category	1995 Water Use (mgd)			Projected 2020 Water Use (mgd) Average Rainfall Year			
	Ground Water	Surface Water	Total	Ground Water	Surface Water	Total	Percent Change
Public Supply	98.94	0.00	98.94	135.26	0.00	135.26	37
Domestic and Other Small Public Supply	7.96	0.00	7.96	5.08	0.00	5.08	-36
Agricultural Irrigation	2.19	0.18	2.37	2.84	0.28	3.12	32
Recreational (Golf) Irrigation	3.76	0.88	4.64	4.93	1.16	6.09	31
Commercial/Industrial/ Institutional	24.75	0.00	24.75	29.03	0.00	29.03	17
Thermoelectric Power Generation	5.47	0.00	5.47	7.04	0.00	7.04	29
Total	143.07	1.06	144.13	184.18	1.44	185.62	29

Based on Tables from Vergara (1998).

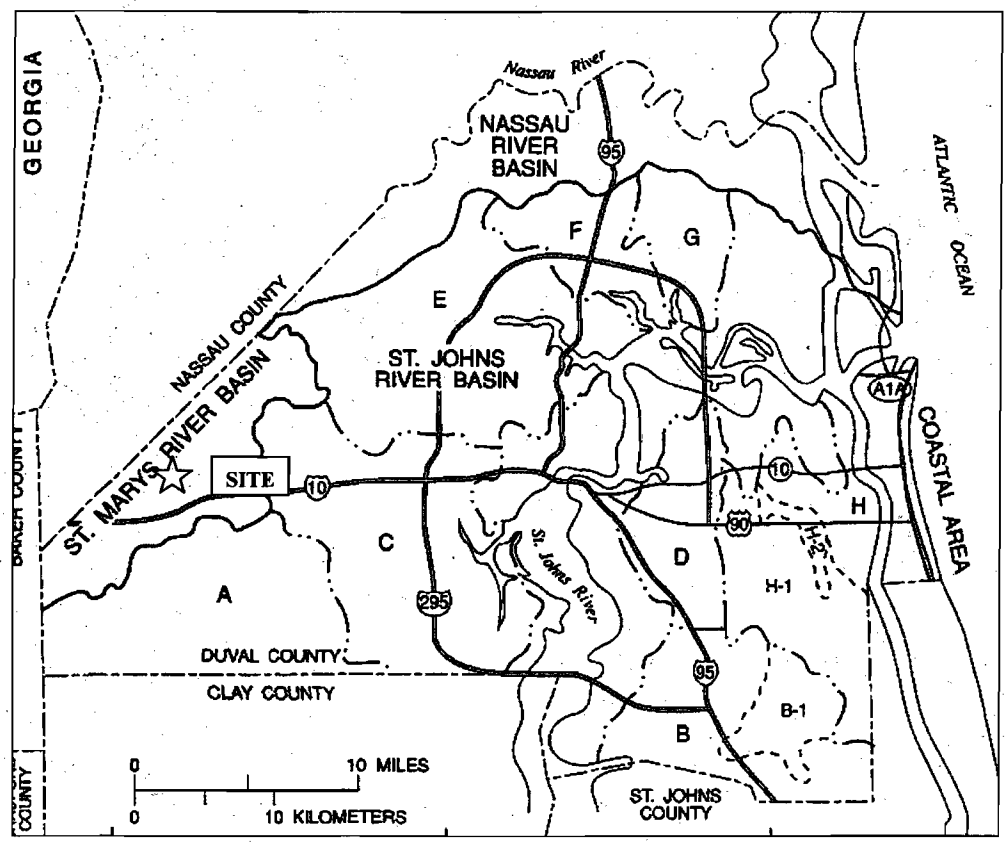


Figure 2.3-10
Drainage Basins in Duval County (Phelps, 1994)

tributaries. Table 2.3-3 summarizes the major characteristics of the gauged streams closest to the Generating Station. Monthly stream discharges generally reflect the seasonal distribution of annual rainfall. The highest average monthly discharges tend to occur in August, September, and October, when summer thunderstorms are common and tropical storms are most likely to occur. The high-flow period in March and April is more significant in the northern area. More important, the lowest average monthly discharges tend to occur during the late fall to early winter months (November and December) and the late spring to early summer months (May and June).

The predominant type of flooding that may occur at the Generating Station site is known as sheet flooding. USGS Flood-Prone Area Maps indicate inundated areas during a flood having a 100 year recurrence interval. These flood prone areas are shown for Duval County on Figure 2.3-11. The Generating Station is outside the 100 year flood areas.

Table 2.3-3
USGS Stream Gauging Stations around JEA Brandy Branch Generating Station

Station Name	Station Number	Latitude (ddmmss) (1)	Longitude (ddmmss) (1)	Drainage Area (miles^2)	Datum (feet above NGVD)	Period of Record	Peak Discharge Recorded, cfs (year)	Average Discharge (cfs)(2)
Turkey Creek at Macclenny, Fla.	2230000	301608	0820721	19.9	99.95	1956 - 1978	2,600 (1964)	30
South Prong St. Mary's River at Glen St. Mary, Fla.	2230500	301640	0820840	156	77.13	1950 - 1970	7,510 (1964)	150
St. Mary's River near Macclenny, Fla.	2231000	3012131	0820454	700	40	1926 – present	28,100 (1947)	900
St. Mary's River near St. George, Ga.	2231100	303128	0820107	890	--	1947 – 1973	28,500 (1947)	--

[1]dd = degrees, mm = minutes, and ss = seconds.
[2]Estimated value from available historical streamflow graphs.

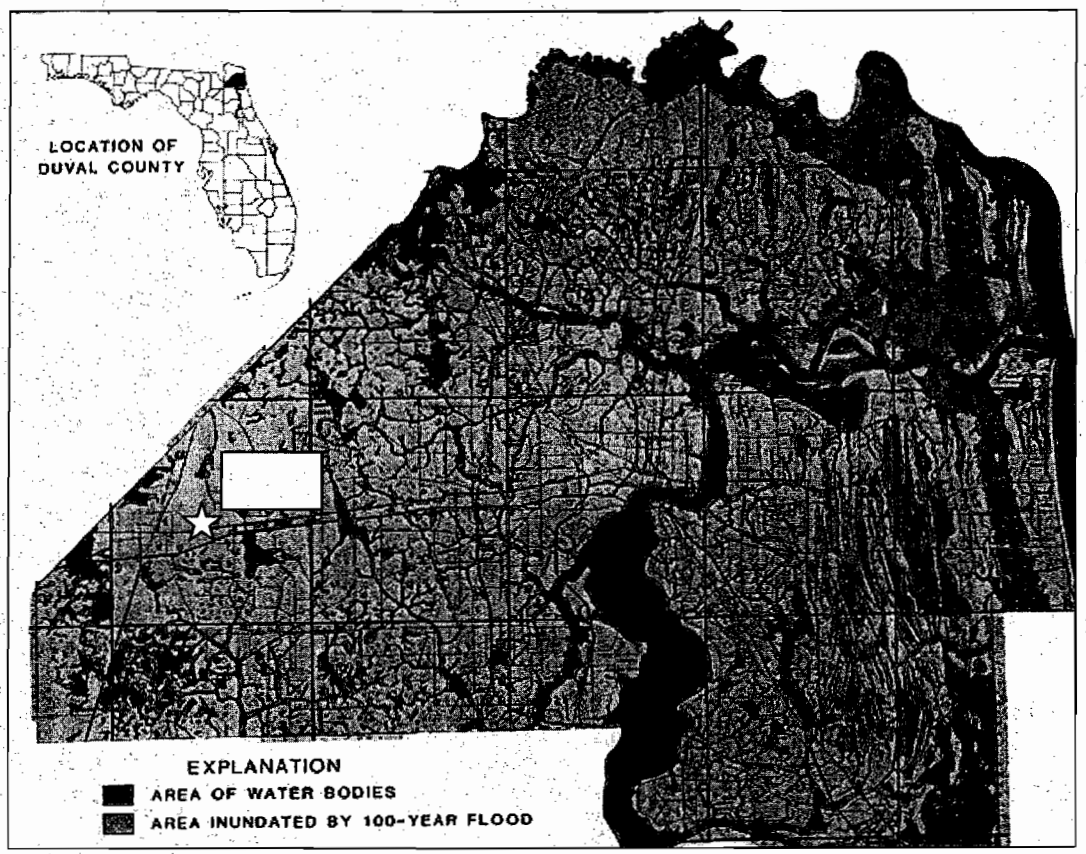


Figure 2.3-11
Flood-Prone Areas in Duval County (from Phelps, 1994)

2.3.4.2 Local Hydrology. Predominant surface hydrologic features in the vicinity of the Generating Station include unnamed emergent and cypress wetland areas, the Baldwin Bay wetlands area about 2 miles west of the site, Brandy Branch Creek about 2,000 feet to the east, McGirts Creek about 4 miles to the northeast, and Yellow Water Creek and Caldwell Branch Creek about 4 miles south of the site. McGirts Creek, Yellow Water Creek and Caldwell Branch Creek are all part of the St. Johns River Drainage Basin.

The predeveloped site area is fairly flat and gradually slopes from southwest to northeast across the site, into an existing wetland area. The elevation of the site has been built up and is now 5 to 7 feet higher than the surrounding wetlands. These wetlands have very little gradient and eventually drain into Brandy Branch Creek. The gradient of Brandy Branch Creek in the vicinity of the plant site is approximately 0.076 percent. Brandy Branch Creek eventually discharges into the St. Mary's River several miles north of the site. No discharge records are available for Brandy Branch Creek.

Periods of zero flow have been recorded at the stream gauging stations within the St. Mary's River drainage basin. This indicates that periods of zero flow can be expected during drought conditions within the Brandy Branch Creek, as well as within the other local creeks.

2.3.4.3 Surface Water Quality. The chemical character of the surface water throughout the region is highly variable, changing seasonally and daily in response to stream discharges, tides, and development. In the coastal rivers and the tidal reaches of the St. Johns, St. Mary's and Nassau rivers, the influx of seawater limits potential water use. Chloride concentrations generally decrease upstream from the mouths of these rivers as tidal influence diminishes. Chloride concentrations of all inland streams in Duval County not affected by tidal fluctuations are less than 250 mg/L (Phelps, 1994).

Within Duval County, the most frequently determined properties of surface water are specific conductance (indication of dissolved solids concentration), chloride contents and nutrient (nitrogen and phosphorus) contents (Phelps, 1994). Phelps (1994) indicates that the specific conductance in the inland sites not affected by tides, such as the Brandy Branch and Yellow Water Creeks, is very small in comparison with that observed in the coastal areas of St. Johns River, Nassau River and St. Mary's River. Chloride concentrations measured at McGirts Creek and Yellow Water Creek indicate a minimum of 5 mg/l, and a maximum of 18 mg/l of chloride ions. Nutrients contents measured at Yellow Water Creek indicate nitrate nitrogen contents ranging from 0 to 38 mg/l. Phosphorus contents ranging from 0.03 to 0.1 mg/l have been measured at McGirts Creek.

2.3.5 Vegetation/Land Use

The Generating Station site lies within the St. Mary's River drainage basin on the southern Coastal Plain in northern Florida. Historically, the area was covered by a mosaic of pine forested uplands and pine/cypress forested wetlands. Prior to development, the property was a combination of open pastureland and forest. Portions of those original land uses remain onsite. The site is divided by a 500 kV transmission line that runs north-south such that the area east of the transmission line (approximately two-thirds of the site) is forested and apparently not grazed at this time, while the area west of the transmission line is open pasture, although small areas of forest are present. Wetland areas are found in both the open and forested areas and while elevation changes between these habitats are subtle, the boundaries are well defined by changes in the vegetation. Cattle had grazed the western portion of the site where the vegetation is composed of numerous weedy and introduced plant species. The following paragraphs describe the vegetation at the Project site as it was observed in early December 1998 (pre-development). A list of the plant species encountered is provided in Table 2.3-4.

Table 2.3-4
Plants Observed at Brandy Branch Generating Station

Species[1]	Wetland Status[2]	Growth Form[3]	Wetland		Upland	
			Forest	Open	Forest	Open
Acer rubrum Red Maple	FAC	T	x		x	
Andropogon virginicus Broomsedge	FAC-	H				x
Aster sp. Aster		H				x
Baccharis halimifolia Eastern False-willow	FAC	S		x		
Bidens sp. Beggar's-tick	FACW-	H		x		
Boehmeria cylindrica Bog-nettle	FACW+	H	x	x		
Carex sp. Sedge	FAC	H	x	x		
Cenchrus insertus Coast Sandspur	NL	H				x
Cirsium horridulum Yellow Thistle	FAC+	H				x
Cnidoscolus stimulosus Tread Softly	NL	H				x
Commelina erecta Day-flower	NL	H		x		x
Cynodon dactylon Bermudagrass	FACU	H				x
Cyperus sp. Nutsedge	FAC	H		x		x
Dactyloctenium aegypticum Crowfoot	NL	H				x
Dichanthelium commutatum Variable Witchgrass	FAC	H	x			
Dichromena colorata Starbrush White-top-sedge	FACW	H	x	x		
Dichromena latifolia Giant White-top-sedge	FACW+	H	x			
Digitaria ciliaris Southern Crabgrass	NL	H				x
Echinochola crusgalli Barnyardgrass	FACW-	H		x		x
Eleusine indica India Goosegrass	FACU	H				x

Table 2.3-4 (Continued)
Plants Observed at Brandy Branch Generating Station

Species[1]	Wetland Status[2]	Growth Form[3]	Wetland		Upland	
			Forest	Open	Forest	Open
Eupatorium capillifolium Small Dog-fennel Thoroughwort	FACU	H				x
Euthamia minor Slender Fragrant Goldenrod	FAC	H				x
Hypericum sp. St. Johns-wort	FAC	H		x		x
Hypericum fasciculatum St. Johns-wort	FACW+	S		x		
Ilex cassine Dahoon Holly	FACW	S/T	x			
Juncus effusus Soft Rush	FACW+	H		x		
Lemna sp. Duckweed	OBL	H		x		
Liquidambar stryaciflua Sweetgum	FAC+	T	x			
Lobelia sp. Lobelia	FAC	H		x		x
Ludwigia palustris Marsh Seedbox	OBL	H		x		
Lycopus rubellus Taper-leaf Bugleweed	OBL	H		x		
Lycopodium alopecuroides Foxtail Clubmoss	OBL	H	x	x		
Medicago lupulina Black Medic	FACU	H				x
Mollugo verticillata Green Carpetweed	FAC	H				x
Nyssa sylvatica Black gum	OBL	T	x			
Osmunda cinnamomea Cinnamon Fern	FACW+	H	x	x		
Panicum rigidulum Red-top Panicgrass	FACW	H		x		x
Pennisetum purpureum Napiergrass	FACU+	H				x
Persea borbonia Red Bay	FACW	S	x		x	
Phytolacca americana Pokeweed	FACU	H				x

Table 2.3-4 (Continued)
Plants Observed at Brandy Branch Generating Station

Species[1]	Wetland Status[2]	Growth Form[3]	Wetland		Upland	
			Forest	Open	Forest	Open
Phyla nodiflora Common Frog-fruit	FACW	H		x		
Pinus elliotii Slash Pine	FACW	T	x		x	
Polygonum hydropiperoides Swamp Smartweed	OBL	H		x		
Pontederia cordata Pickeralweed	OBL	H		x		
Rhynchospora sp. Beaksedge	>FAC	H		x		
Sarracenia sp. Pitcherplant	OBL	H	x	x		
Saururus cernuus Lizard□s-tail	OBL	H	x	x		
Serenoa repens Saw Palmetto	FACU	S	x		x	
Setaria geniculata Knotroot Bristlegrass	FAC	H				x
Smilax bona-nox Saw Greenbriar	FAC	V	x		x	
Spirodela polyrhiza Giant Duckweed	OBL	H		x		
Sporobolus indicus West Indian Dropseed	FACU+	H				x
Taxodium adscendens Pond Cypress	OBL	T	x			
Thelypteris cf. kunthii Fern	FAC	H	x			
Toxicodendron radicans Poison Ivy	FAC	V	x		x	
Typha latifolia Broadleaf Cattail	OBL	H		x		
Verbena scabra Sandpaper Vervain	FACW+	H		x		
Wolffia brasiliensis Watermeal	OBL	H	x	x		
Woodwardia areolata Netted Chain Fern	OBL	H	x			

[1]Reed, P.B., Jr. 1988. *National List of Plant Species that Occur in Wetlands: Southeast (Region 2).* US Fish Wildl. Serv. Biol. Rep. 88 (26.2). 124 pp.
[2]From Reed (1988): OBL = Obligate; FACW = Facultative Wetland Plant; FAC = Facultative Wetland Plant; FACU = Facultative Upland Plant; UPL = Upland Plant; NL = Not Listed (and considered upland).
[3] = tree; S = shrub; V = Vine; H = Herb.

Slash pine woodlands (*Pinus elliottii*) and cypress dome/strands (*Taxodium ascendens*) occupy the forested areas of the Generating Station site. The quality of these with regard to species composition varies depending on whether or not the area is grazed. Based on the distribution of ground cover and water lines on the trees in the area, the wetlands may be inundated at times by as much as 20 inches of surface water. At the time these areas were observed, the ground was saturated but there was very little standing water.

The dry upland forest is dominated by slash pine. Where grazing occurred, the understory and ground cover is for practical purposes nonexistent. In the ungrazed areas the understory is composed of dense thickets of red bay (*Persea borbonia*), saw palmetto (*Serenoa repens*), and fetterbush (*Lyonia lucida*). Vines are common and include poison ivy (*Toxicodendron radicans*) and greenbrair (*Smilax bona-nox*). Ground cover is not especially prevalent, although there are small, shallow, scattered and open depressions where it is not uncommon to find white-top-sedges (*Dichromena colorata* and *D. latifolia*) or pitcherplant (*Sarracenia sp.*). Such depressions are especially common in a strip of land located in the east central portion of the property that was apparently plowed or cleared and planted with slash pine, probably less than 10 years ago.

Forested wetlands include two isolated cypress domes in the west half of the Generating Station site and a cypress strand and dome in the east half. The cypress domes are dominated by pond cypress with slash pine and red maple occurring toward the fringes. The understory and groundcover have been largely removed due to grazing, although a few ferns remain including netted chainfern (*Woodwardia areolata*) and *Thelypterissital*. The ungrazed cypress strand in the eastern portion of the site has more dense fern growth, understory shrubs such as dahoon holly (Ilex cassine), and various sedges and rushes present.

Open areas at the Generating Station site were historically grazed upland pasture with small areas of wetland dominated by herbaceous plants. The wetlands are located in the south-central portion of the site. A site perimeter fence will be installed prior to completion of the simple cycle facilities. At that time, the cattle will be removed from the site and future grazing prohibited.

The pastureland is dominated by Bermudagrass (*Cynodon dactlyon*), broomsedge (*Andropogon virginicus*), and southern crabgrass (*Digitaria ciliaris*). Herbaceous species are scattered in the area and include mostly introduced or otherwise weed species, such as slender fragrant goldenrod (*Euthamia minor*), small dog-fennnel thoroughwort (*Eupatorium capillifolium*), green carpetweed (*Mollugo verticillata*), and black medic (*Medicago lupulina*). The area is generally of low quality with regard to species composition as well as potential for providing habitat to wildlife.

The open wetland areas appear to have been created in the past by the clearing of the edge of a cypress dome for transmission line installation and maintenance. The open areas are nearly a monoculture of soft rush (*Juncus effusus*), except in areas of standing water where the surface is choked with duckweed *(Lemna* sp.), giant duckweed (*Spirodela polyrhiza*), and watermeal (*Wolffia brasiliensis*).

2.3.6 Ecology

This section identifies endangered, threatened, and other sensitive species that have the potential to occur within a 5 mile radius of the Generating Station which might reasonably be expected to be affected by the construction and operation of the facility. Sensitive species include plants and animals listed as endangered or threatened by the United States Fish and Wildlife Services (USFWS); species listed by the Florida Fish and Wildlife Conservation Commission (FFWCC) in FAC 39-27 as endangered, threatened, or of special concern; species listed as game, fur-bearers, or freshwater gamefish in FAC 39-1; and species which are indicators of, endemic to, or are unique to specific plant communities and habitat types.

Federal Listed Species

In a letter dated December 29, 1998, the US Fish and Wildlife Service indicated that the Brandy Branch simple cycle project is not likely to adversely affect resources protected by the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.).

During the onsite surveys conducted December 3, 1998, wood storks were observed resting in the herbaceous wetlands in the southwest portion of the site. The wood stork is an endangered species that is locally common in the swamps, marshes, and ponds of the southern US, including Florida. No nests were observed onsite. Conversion project plans do not include impacts to wetlands in the southwest portion, or any other portion of the Project site not previously impacted; thus, the Project will not affect these areas.

No federal listed plant species were observed or are expected onsite since no appropriate habitat is present.

State Listed Species

In a letter dated May 10, 1999, the Florida Game and Fresh Water Fish Commission (FGFWFC) indicated that potential habitat for Florida black bear (*Ursus americanus floridanus*), fox squirrel (*Sciurus niger shermani*), and indigo snake (*Drymarchon corais couperi*) may be present onsite or in the Project area. The FGFWFC indicated that the

black bear habitat was mostly in the northeast corner of the site and the fox squirrel and indigo snake habitat was scattered throughout the large parcel.

During the site visits in December 1998 and March 1999, a total of 20 wildlife species or their signs were observed onsite (Table 2). No state listed species were observed. The potential habitat for the black bear in the northeast corner of the site will remain undisturbed by the conversion project. The forested areas are too dense to be considered good fox squirrel habitat. No additional areas of potential indigo snake habitat will be impacted by the proposed conversion project. Therefore, the conversion project is not expected to impact any state listed species.

State listed plant species are not expected at the site since habitat appropriate to support the growth of these unique species is not present.

2.3.7 Meteorology and Ambient Air Quality

2.3.7.1 Regional Climatology/Meteorology. The prevailing subtropical marine climate of the northern Florida region results from the influence of the Atlantic Ocean and the Bermuda high-pressure system. Long, warm, humid summers and short, mild winters prevail. Because of the northern location and marine influences, this area has a climate characterized by small annual and diurnal temperature variations. Rainfall is moderate to heavy during the summer (rainy season) and light during the winter (dry season).

Winds are of moderate speed and blow from various directions ranging from the southwest to the southeast during the spring and summer (February through August). During the fall and winter months (September through January), the predominant direction is from the north to northwest. Along the coastal areas of northcentral Florida, local land-sea breeze circulations modify regional wind patterns by superimposing an easterly wind component during the daytime hours and a westerly component at night. Annual wind speed and prevailing direction for selected Florida locations are given on Figures 2.3-12 and 2.3-13, respectively. Hurricane force winds have a 1 in 7 chance of occurrence for any given year in Palm Beach and a 1 in 100 chance of occurring in Jacksonville (Bradley, 1972).

The average annual rainfall in this region is approximately 52 inches. Summer precipitation due to frequent afternoon thundershowers exceeds winter precipitation due to frontal systems, prefrontal squall lines, and wave disturbances along fronts stalled over the Florida peninsula. Summer precipitation is mostly of the convective type, resulting in frequent summertime afternoon thundershowers in this region. Tropical disturbances periodically cause significant precipitation during the summer and fall seasons.

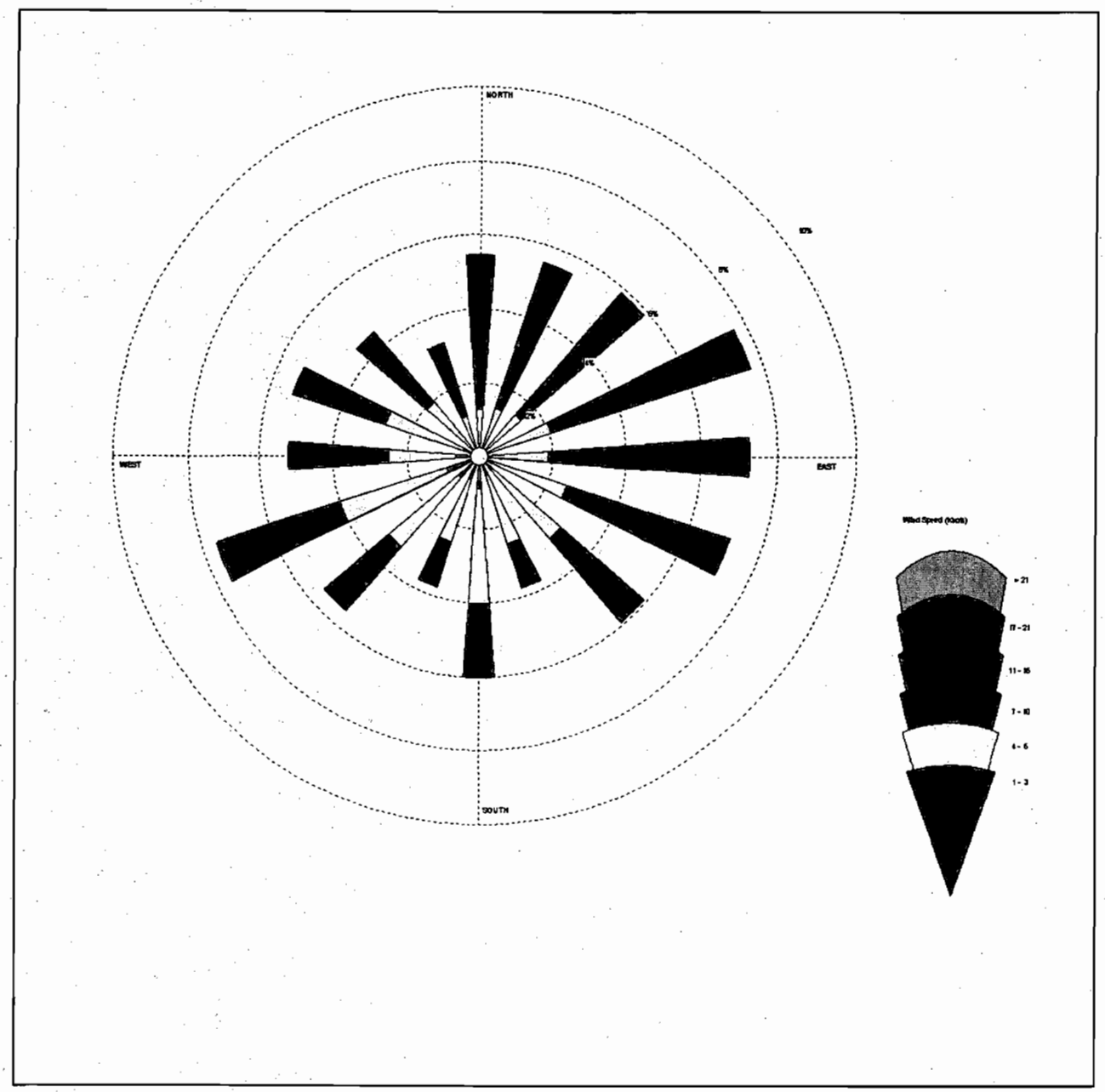


Figure 2.3-12
Annual Average Wind Speed and Prevailing
Direction for Daytona Beach

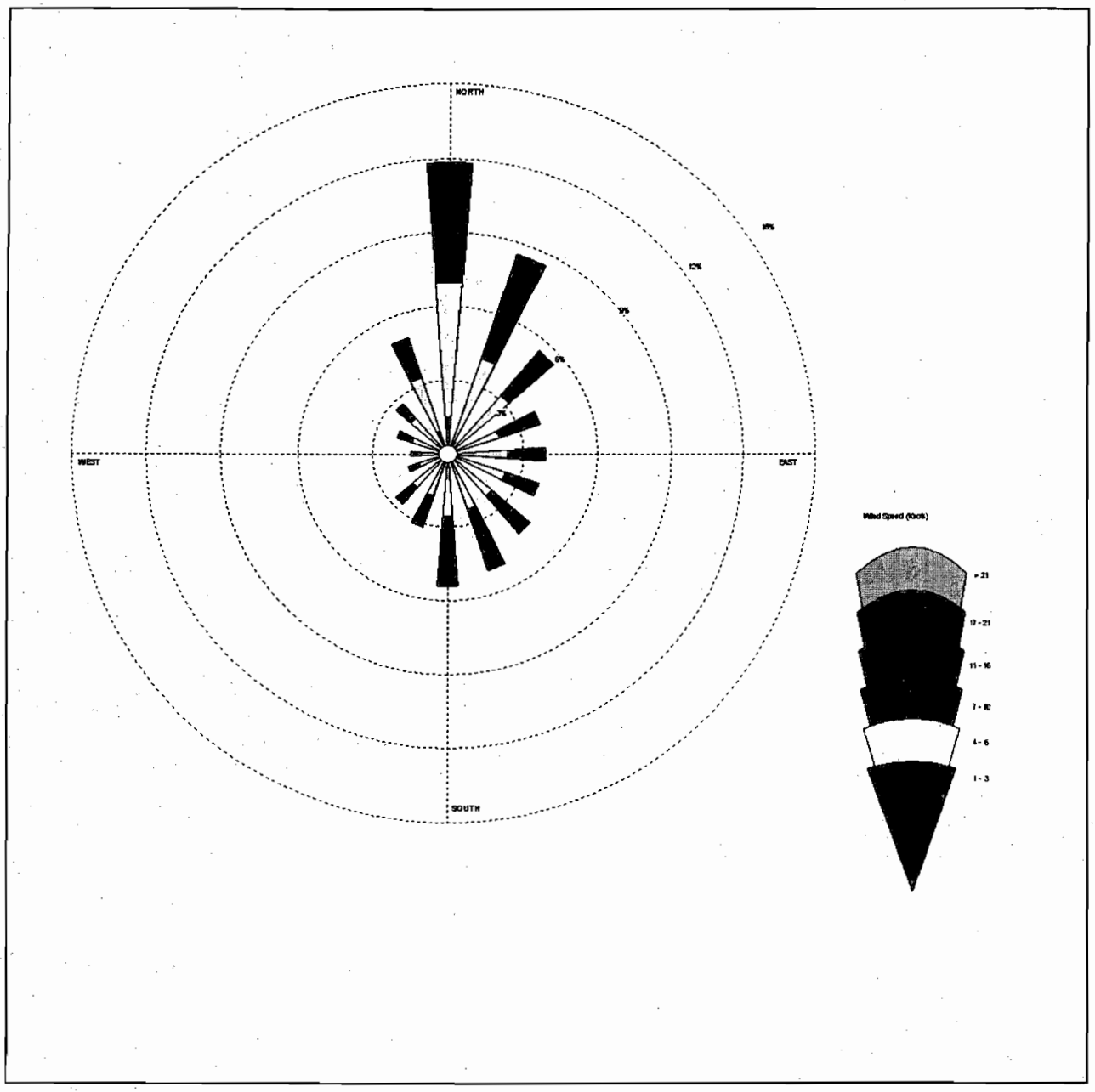


Figure 2.3-13
Annual Average Wind Speed and Prevailing
Direction for Tallahassee

Extremely hot weather is rare because of the ocean influence; maximum temperatures over a summer average near 90° F along the coast and low-90s in the proposed facility site region. Winter temperatures are mild, interrupted only a few times each season by northerly or northwesterly advection of polar air. In these cases, minimum temperatures may reach 32° F. Temperatures rarely fall below 32° F. There have been only 5 days in the past 72 years at Jacksonville where the maximum temperature has failed to climb above freezing. Inland locations generally display a greater range of temperatures because of the rapid heating and cooling of ground surfaces as compared with water bodies. Average annual humidities are high, ranging in percent from the mid-50s during the afternoon to the upper-80s at night.

The dispersion characteristics of the region are generally good because of land-sea breeze circulations, good ventilation, mixing due to convective instability, and flat terrain.

2.3.7.2 Site Climatology. The Generating Station is located in northern Florida about 32 miles inland from the Atlantic Ocean. This region of the United States is subject to a subtropical climate which is partly influenced by the Atlantic Ocean. This results in small to moderate variations in temperature and relative humidity throughout the year. Monthly precipitation is fairly consistent, with a peak in the summer months. The occurrence of severe weather is usually associated with midsummer thunderstorms. The summers are long and rather warm, with periods of hot and humid weather. The winters are mild with occasional cool mornings due to invasion of cool northern air.

There are no existing local meteorological data with long periods of record for the Generating Station. However, there is a location with meteorological data covering long periods of record which are considered representative of the facility site area. This location is the National Weather Service (NWS) office in Jacksonville, Florida. The NWS office is approximately 19 miles northeast of the facility site at an elevation of 26 feet above mean sea level.

Temperatures and Humidity

The temperature variation from season to season is slight, with warm, humid summers and mild winters. Table 2.3-5 presents a summary of the means and extremes of monthly and daily dry-bulb temperatures. Temperatures above 90° F occur during the summer months. The hottest month is July, with a mean monthly temperature of 82.5° F. The daily minimum and maximum temperature averages are 72.9° F and 92.1° F, respectively, for this month. Subfreezing temperatures rarely occur (i.e., about 18 days per year) and subzero temperatures have never been recorded. In some years, no freezing temperatures occur.

Table 2.3-5
Dry-Bulb Temperature Data for Jacksonville, Florida

Month	Mean Temperature*			Extreme Temperature**	
	Monthly (F)	Daily Minimum (F)	Daily Maximum (F)	Lowest (F)	Highest (F)
January	53.9	42.8	64.9	7	85
February	56.6	45.4	67.9	19	88
March	62.1	50.5	73.6	23	91
April	68.0	56.3	79.8	64	95
May	74.8	63.9	85.9	45	100
June	80.1	70.3	90.0	47	103
July	82.5	72.9	92.1	61	105
August	81.8	72.7	90.9	63	102
September	78.7	70.1	87.3	48	100
October	70.4	60.7	80.1	36	96
November	61.9	51.0	72.9	21	88
December	55.7	44.6	66.7	11	84
Annual	68.9	58.4	79.3	7	105
Season					
Summer	81.5	72.0	91.0	47	105
Fall	70.3	60.6	80.1	21	100
Winter	55.4	44.3	66.5	7	88
Spring	68.3	56.9	79.8	23	100

*Period of record: 1947-1998.
**Period of record: 1941-1998.

Source: United States Department of Commerce, Local Climatological Data--Annual Summary with Comparative Data—1998, Jacksonville, Florida, National Climatic Center, Asheville, North Carolina, 1999.

January is the coldest month with a mean monthly temperature of 53.9° F. Average January daily minimum and maximum temperatures are 42.8° F and 64.9° F, respectively. The absolute temperature range is from 105° F (July) to 7° F (January).

Table 2.3-6 presents a summary of the wet-bulb and dry-bulb design temperatures. The 1 and 2 percent wet-bulb temperatures for June through September are both 77° F, respectively. The 1 and 2 percent dry-bulb temperatures, based on historical data from June through September, are 93° F and 91° F, respectively (Department of Army, Navy, and Air Force, 1997). The 1 percent temperatures are exceeded only 1 percent of the time, and the 2 percent temperatures are exceeded 2 percent of the time. Table 2.3-6 also includes other design temperatures for cooling days of 0.4 percent, and heating days of 99 and 99.6 percent.

Average relative humidities are presented in Table 2.3-7 (US Department of Commerce, 1999). The table shows that the normal annual relative humidity is approximately 76 percent. Hourly normal minimum and maximum values are 48 percent and 93 percent and occur at 1,300 hours in April and 700 hours in September, respectively. The relative humidity does not vary significantly from season to season, with spring days being slightly drier. Heavy fog visibility (1/4 mile or less) averages only 39 days per year at Jacksonville (US Department of Commerce, 1999).

Heating and Cooling Degree-Days

Units of degree-days can be used as an indicator of heating or cooling requirements. One heating degree-day is accumulated for each degree that the daily mean temperature drops below the base temperature of 65° F. Cooling degree-days are accumulated when the daily mean temperature is above 65° F. Table 2.3-8 gives mean monthly and annual degree-day totals considered representative of the proposed facility site area.

Precipitation

Normal monthly and annual precipitation (rain) totals are shown in Table 2.3-9. As shown in the table, precipitation is highest during the summer months. Annually, thunderstorms occur about 67 days, mainly during the summer.

During the period 1969-1998, the annual precipitation has ranged from 31.20 inches to 79.63 inches. Measurable snows under 2 inches have been recorded only a few times in the last century. The highest amount of snowfall recorded during the period 1970 through 1998 was 0.8 inch. Extreme monthly precipitation totals are listed in Table 2.3-10. The highest recorded 24 hour rainfall and snowfall totals are 10.17 inches (September 1950) and 1.5 (February 1958), respectively. Maximum

Table 2.3-6
Wet-Bulb and Dry-Bulb Design Temperatures
for Jacksonville, Florida

Percent of Time	Temperatures (F)	
	Wet-Bulb	Dry-Bulb
0.4*	77	94
1*	77	93
2*	77	91
99**	--	32
99.6**	--	29

*Percentage of the time the temperature is exceeded during the months of June through September.
**Percentage of the time the temperature is exceeded during the months of December, January, and February.

Source: Departments of the Army, the Navy, and the Air Force, Army, Navy, and Air Force Manual-Engineering Weather Data, April, 1997. (Cecil Field US Naval Air Station).

Table 2.3-7
Normal Relative Humidity Data for Jacksonville, Florida*

Month	Hour (Local Standard Time) 0100 (percent)	0700 (percent)	1300 (percent)	1900 (percent)	Normal (percent)
January	84	86	58	74	75
February	83	86	54	69	72
March	84	88	51	66	71
April	84	88	48	63	70
May	86	88	52	67	73
June	88	89	58	73	77
July	89	90	60	74	78
August	91	92	62	79	80
September	91	93	63	81	81
October	89	91	59	80	79
November	88	90	57	80	78
December	86	88	58	78	77
Annual	87	89	57	74	76
Season					
Summer	89	90	60	75	78
Fall	89	91	60	80	79
Winter	84	87	57	74	75
Spring	85	88	50	65	71

*Period of record: 1961-1990.

Source: United States Department of Commerce, Local Climatological Data—Annual Summary with Comparative Data—1998, Jacksonville, Florida, National Climatic Center, Asheville, North Carolina, 1999.

Table 2.3-8
Heating and Cooling Degree-Day Data
for Jacksonville, Florida*

Month	Normal Degree-Day	
	Heating**	Cooling**
January	421	31
February	296	22
March	169	48
April	37	97
May	0	260
June	0	423
July	0	515
August	0	502
September	0	393
October	31	179
November	149	56
December	331	25
Annual	*1434*	*2551*

*Period of record: 1961-1990.
**Base 65° F.

Source: United States Department of Commerce, Local Climatological Data—Annual Summary with Comparative Data--1998, Jacksonville, Florida, National Climatic Data Center, Asheville, North Carolina, 1999.

Table 2.3-9
Total Precipitation Data for Jacksonville, Florida

Month	Normal Precipitation* (inches)
January	3.31
February	3.93
March	3.68
April	2.77
May	3.55
June	5.69
July	5.60
August	7.93
September	7.05
October	2.90
November	2.19
December	2.72
Annual	51.32

*Period of record: 1961-1990.

Source: United States Department of Commerce, Local Climatological Data—Annual Summary with Comparative Data—1998, Jacksonville, Florida, National Climatic Center, Asheville, North Carolina, 1999.

Table 2.3-10
Extreme Precipitation Data for Jacksonville, Florida*

Month	Extreme Precipitation			Extreme Snowfall	
	Maximum 24 Hour (inches)	Maximum Monthly (inches)	Minimum Monthly (inches)	Maximum 24 Hour (inches)	Maximum Monthly (inches)
January	3.02	10.20	0.06	Trace	Trace
February	6.22	11.12	0.52	1.5	1.5
March	7.12	10.18	0.18	0.5	0.5
April	8.25	11.61	0.14	Trace	Trace
May	5.40	10.43	0.18	--	--
June	5.93	13.96	1.59	Trace	Trace
July	10.09	16.21	1.97	Trace	Trace
August	7.93	16.24	1.92	--	--
September	10.17	19.36	1.02	--	--
October	7.90	13.44	0.16	--	--
November	5.44	7.85	--	--	--
December	3.75	9.77	0.04	0.8	0.8
Annual	10.17	19.36	--	1.5	1.5

*Period of record: 1943-1996.

Source: United States Department of Commerce, Local Climatological Data--Annual Summary with Comparative Data--1998, Jacksonville, Florida, National Climatic Center, Asheville, North Carolina, 1999.

recorded rainfall totals for various time periods are presented in Table 2.3-11. Precipitation maximums and intensities for various return periods and duration are shown in Table 2.3-12.

Wind Characteristics

Five years of wind data (1984-1988) were used to generate the annual and monthly wind roses from Jacksonville, as shown on Figures 2.3-14 through 2.3-26. These wind roses are considered appropriate in describing the general wind flow at the proposed facility site. Table 2.3-13 includes the annual percent frequency of occurrence of the wind speed categories for each of the 16 wind directions. The annual wind rose shows high variability in dominant wind direction. The annual winds tend to favor westerly components with a secondary preference for northeasterly and southeasterly flow. The winter months show a predominance of winds from the northwest at a maximum speed of greater than 21 knots. The spring and summer months show abundance of westerly and southeasterly winds, which could be a result of the easterly trade winds. Fall months show a predominance of winds from the north and northeast quadrants.

The design wind speed for wind loading is 105 miles per hour for the proposed facility site area (ANSI, 1982). The Jacksonville fastest observed 2 minute wind speed and peak gust on record are 57 and 77 miles per hour, respectively. The periods of record for the fastest 2 minute wind speed and peak gust are each 2 years, respectively.

2.3.7.3 Atmospheric Dispersion. Atmospheric dispersion depends primarily on four meteorological parameters:

- Height of the mixing layer (mixing height).
- Wind speed within the mixing layer.
- Frequency of low level temperature inversions.
- Atmospheric stability.

Holzworth (1972) has estimated mean mixing depths and average wind speed within the mixing layer for 62 National Weather Service radiosonde stations within the 48 contiguous states. The morning and afternoon mixing depths are calculated from the twice daily vertical temperature profiles and the morning and afternoon surface temperatures. Within the mixing depth, relatively vigorous mixing occurs. Diffusion within layers above this height is inhibited because of thermal buoyancy considerations (that is, neutral or slightly stable conditions). The worst dispersion conditions occur when both the mixing depth and wind speed are low. In general, Holzworth's data show that Florida's atmosphere has very favorable dispersion characteristics. Table 2.3-14 presents values of seasonal and annual morning and afternoon mixing depths and wind speed representative of the proposed facility site area.

Table 2.3-11
Maximum Recorded Rainfall Data for Jacksonville, Florida

Duration	Rainfall (inches)	Date
5 minutes*	0.78	August 16, 1901
10 minutes*	1.32	July 23, 1955
15 minutes*	1.75	July 23, 1955
30 minutes*	2.83	August 18, 1946
60 minutes**	3.32	July 8, 1946
2 hours**	4.19	October 22, 1933
3 hours**	4.97	October 18, 1950
6 hours**	6.75	October 19, 1944
12 hours**	8.65	October 19, 1944
24 hours**	10.17	September 9, 1950

*Period of record: 1896-1961.
**Period of record: 1891-1961.

Source: United States Weather Bureau, Maximum Recorded United States Point Rainfall for 5 Minutes to 24 Hours at 296 First-Order Stations, Technical Paper No. 2, Washington, D.C., 1963.

Table 2.3-12
Precipitation Amounts and Intensities for Selected Durations and Return Periods Expected in the Proposed Facility Site Area

PRECIPITATION AMOUNTS

Duration (hours)	Return Period						
	1 Year (inches)	2 Year (inches)	5 Year (inches)	10 Year (inches)	25 Year (inches)	50 Year (inches)	100 Year (inches)
1/2	1.51	1.70	2.10	2.35	2.70	3.00	3.10
1	1.90	2.20	2.65	3.00	3.37	3.70	4.05
2	2.30	2.70	3.20	3.70	4.30	4.70	5.10
3	2.50	2.90	3.70	4.05	4.90	5.30	6.00
6	3.00	3.50	4.50	5.10	6.00	6.50	7.05
12	3.50	4.25	5.40	6.20	7.05	8.00	9.00
24	4.00	5.00	6.40	7.30	8.50	9.80	11.00

PRECIPITATION INTENSITIES

Duration (hours)	Return Period						
	1 Year (inches/h)	2 Year (inches/h)	5 Year (inches/h)	10 Year (inches/h)	25 Year (inches/h)	50 Year (inches/h)	100 Year (inches/h)
1/2	3.02	3.40	4.20	4.70	5.40	6.00	6.20
1	1.90	2.20	2.65	3.00	3.37	3.70	4.05
2	1.15	1.35	1.60	1.85	2.15	2.35	2.55
3	0.83	0.97	1.23	1.35	1.63	1.77	2.00
6	0.50	0.58	0.75	0.85	1.00	1.08	1.18
12	0.29	0.35	0.45	0.52	0.59	0.67	0.75
24	0.17	0.21	0.27	0.30	0.35	0.41	0.46

Source: United States Weather Bureau, Rainfall Frequency Atlas of the United States for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years, Technical Paper No. 40, Washington, D.C., May 1961.

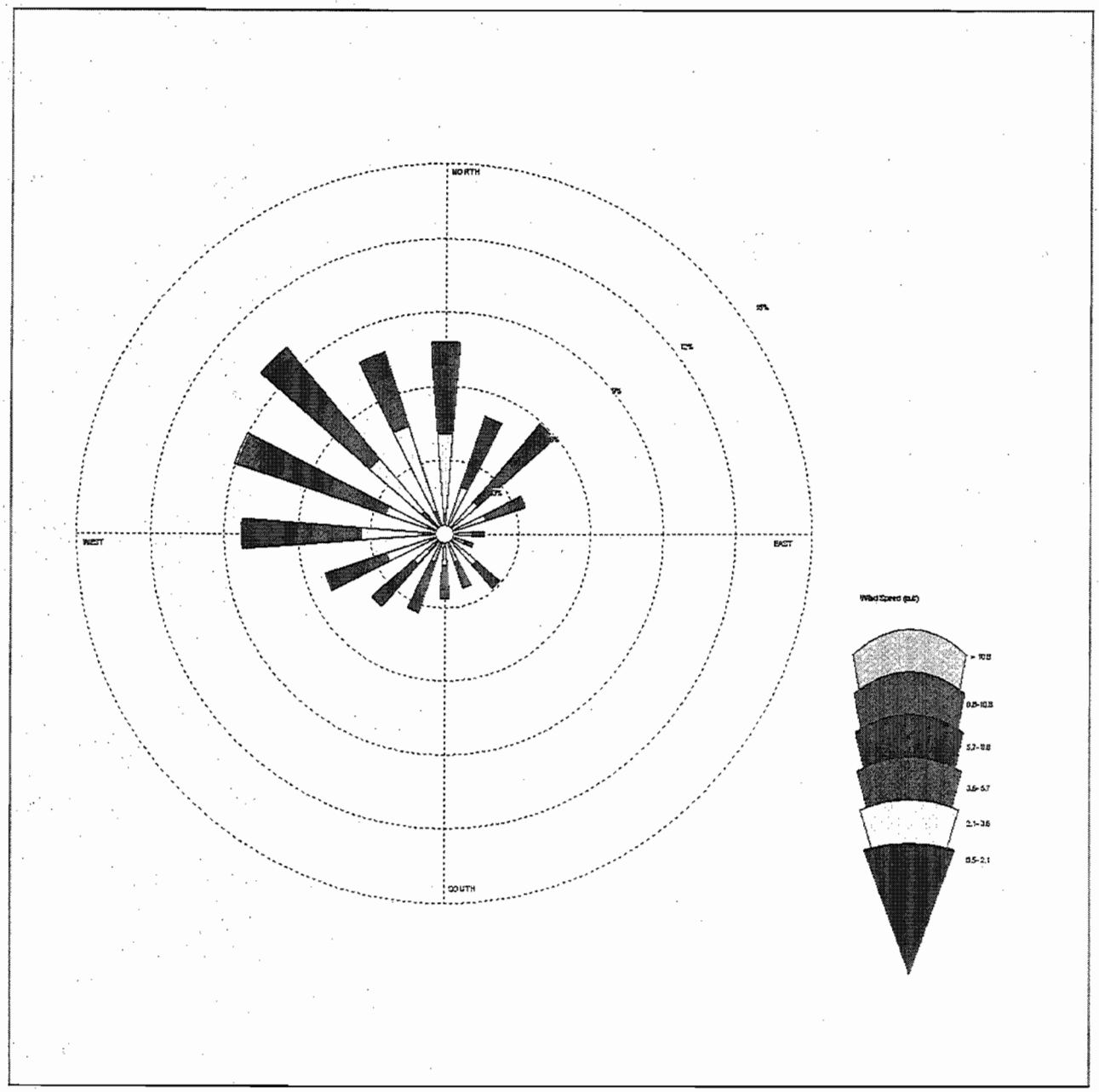


Figure 2.3-14
January Wind Rose for Jacksonville, Florida
Period of Record: 1984-1988

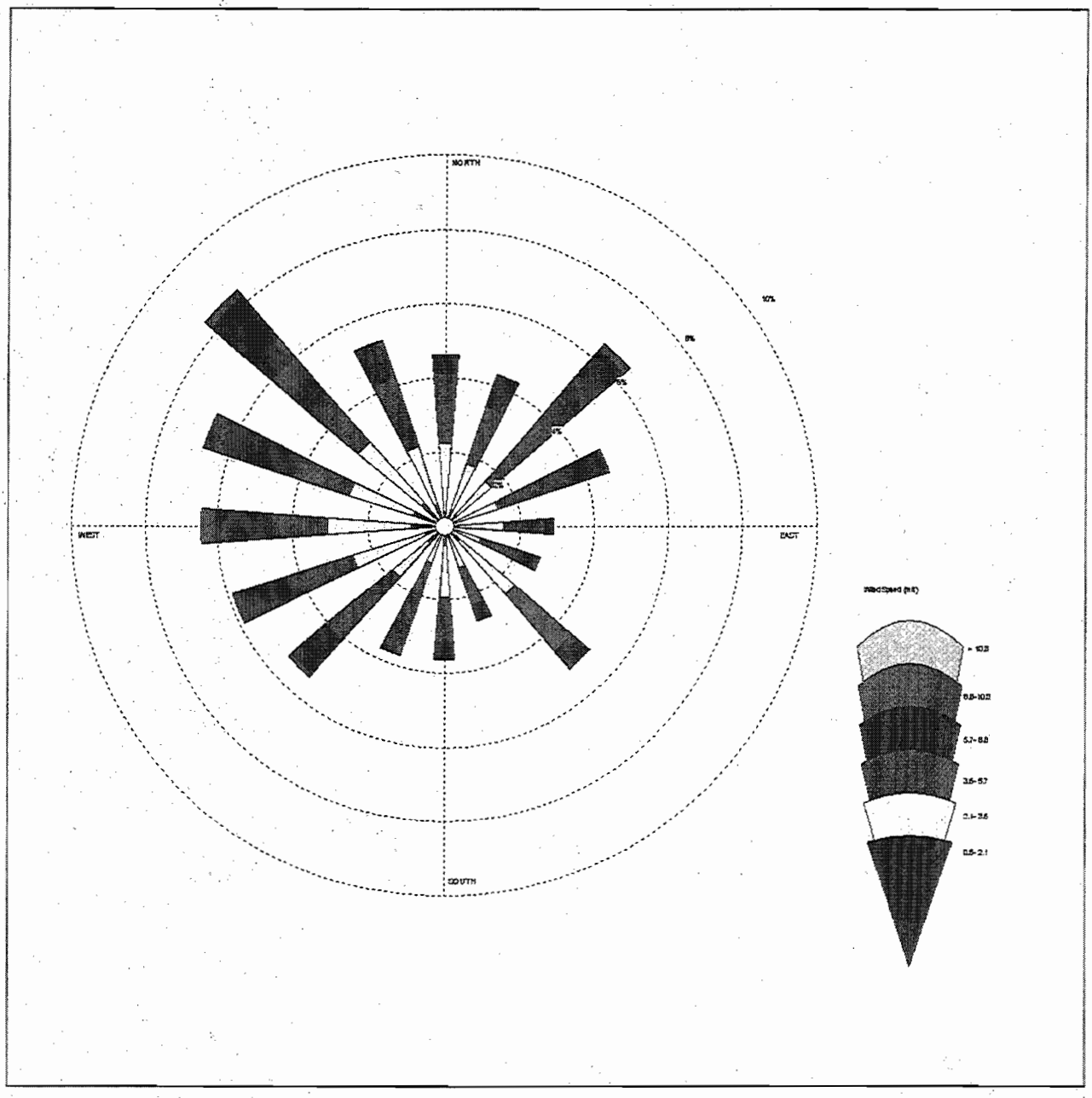


Figure 2.3-15
February Wind Rose for Jacksonville, Florida
Period of Record: 1984-1988

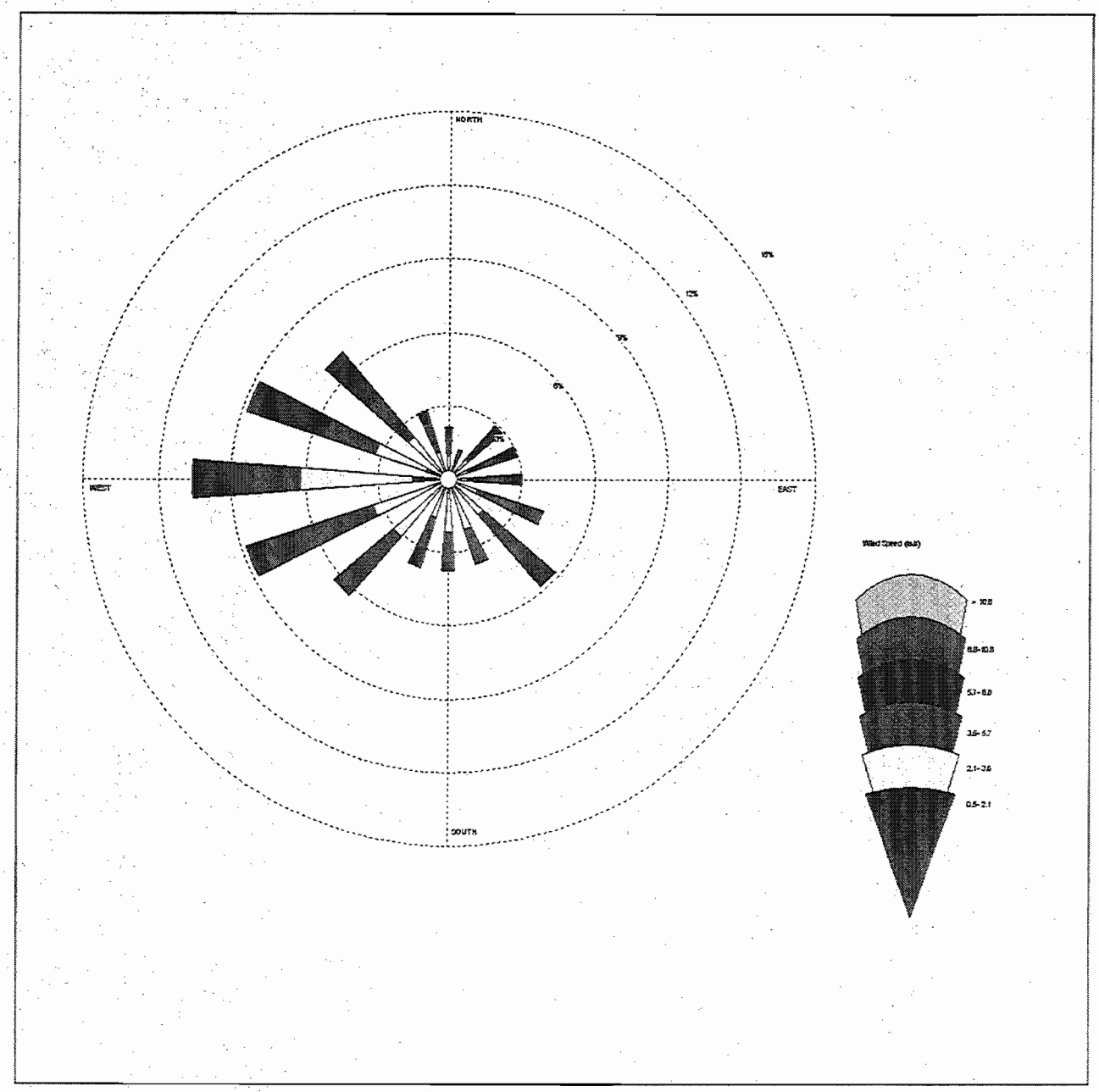


Figure 2.3-16
March Wind Rose for Jacksonville, Florida
Period of Record: 1984-1988

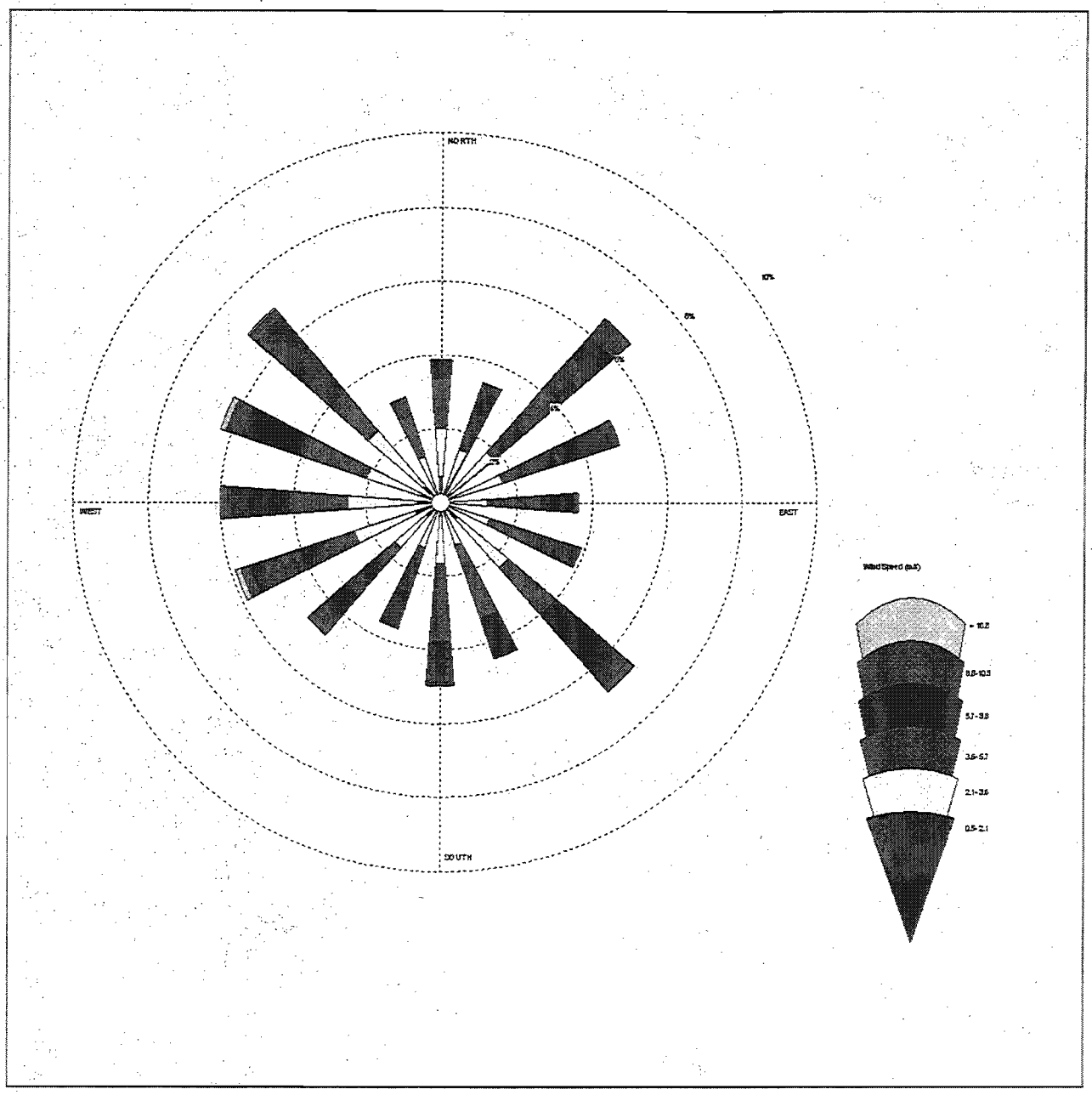


Figure 2.3-17
April Wind Rose for Jacksonville, Florida
Period of Record: 1984-1988

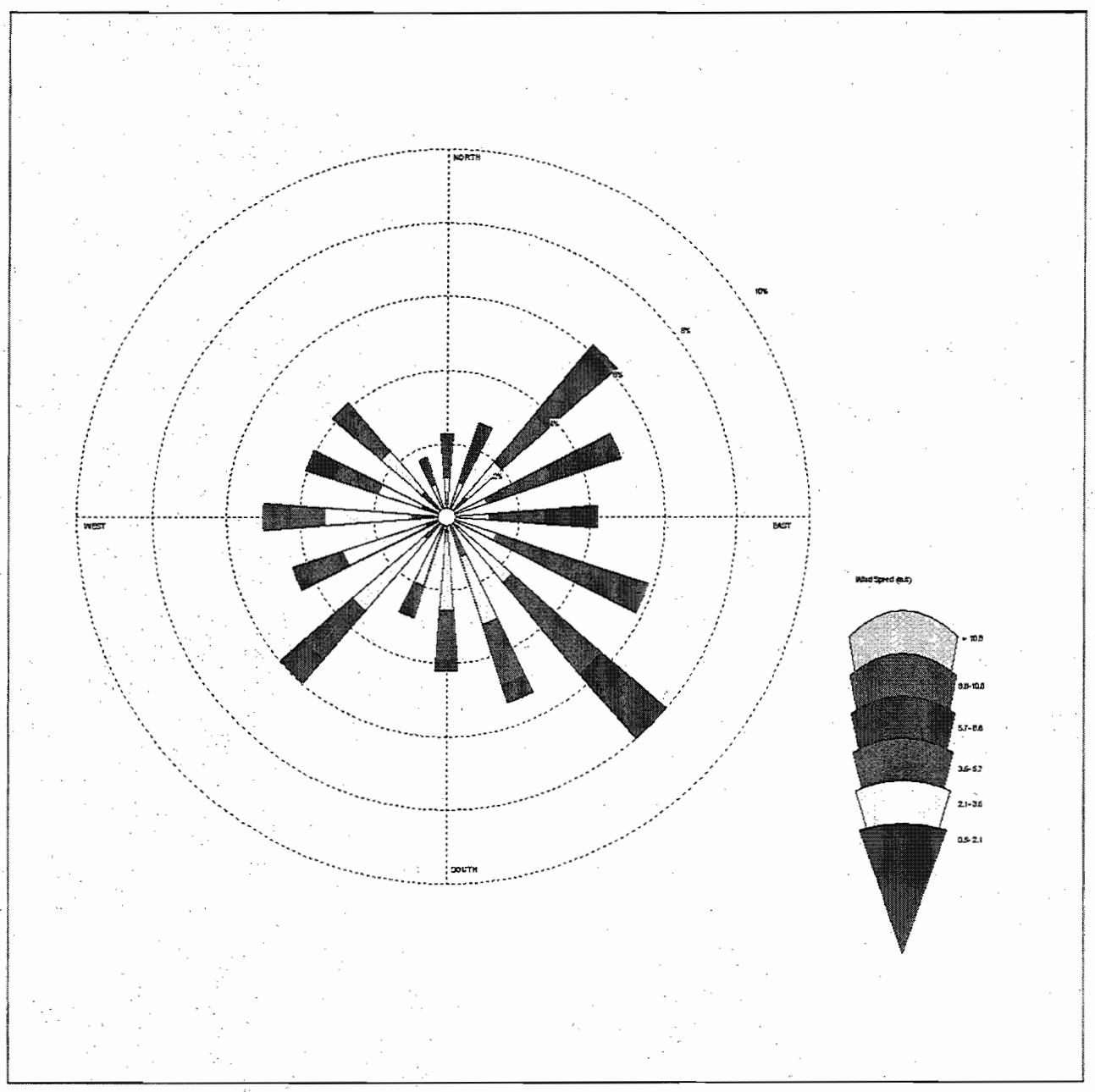


Figure 2.3-18
May Wind Rose for Jacksonville, Florida
Period: 1984-1988

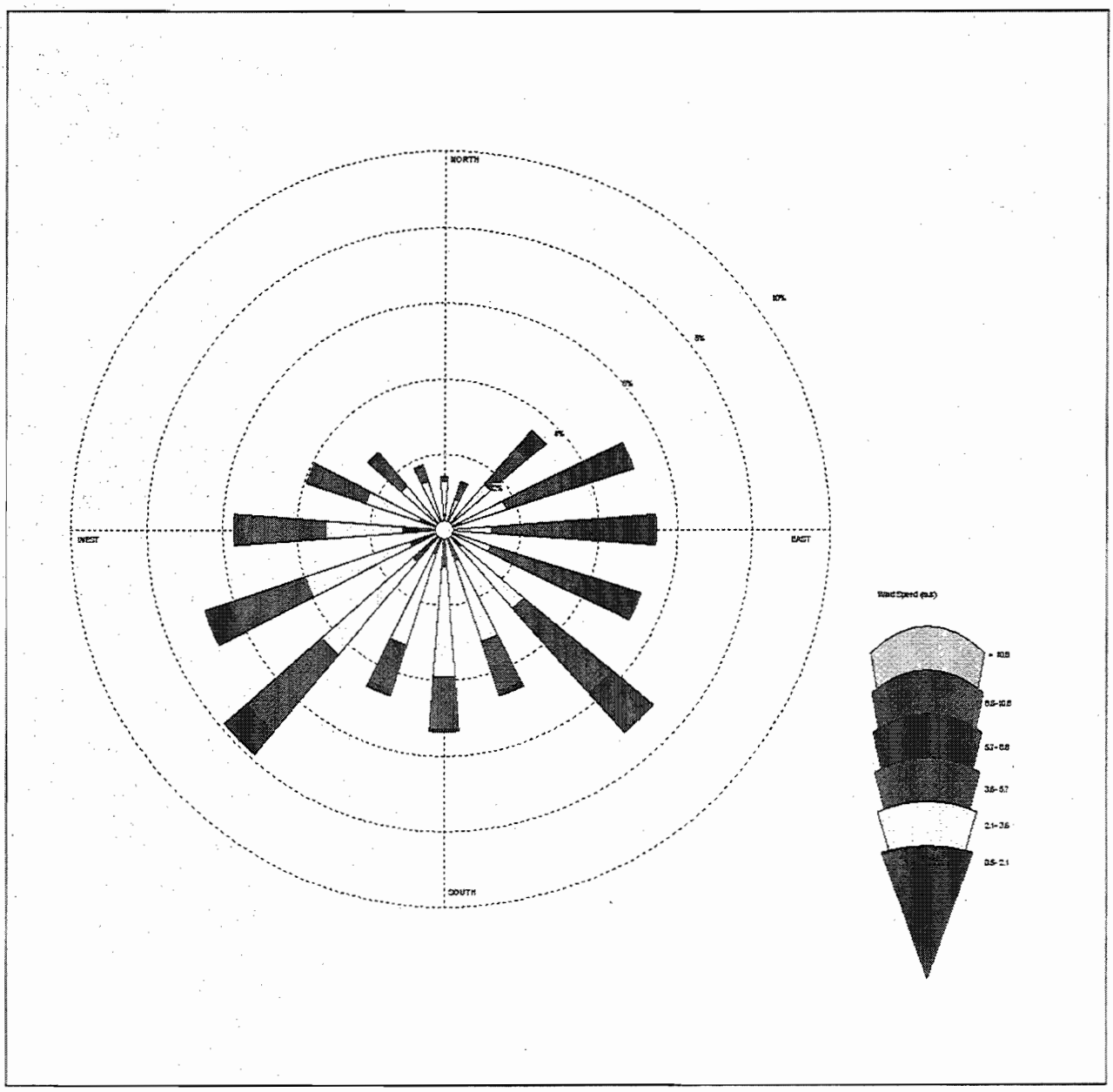


Figure 2.3-19
June Wind Rose for Jacksonville, Florida
Period: 1984-1988

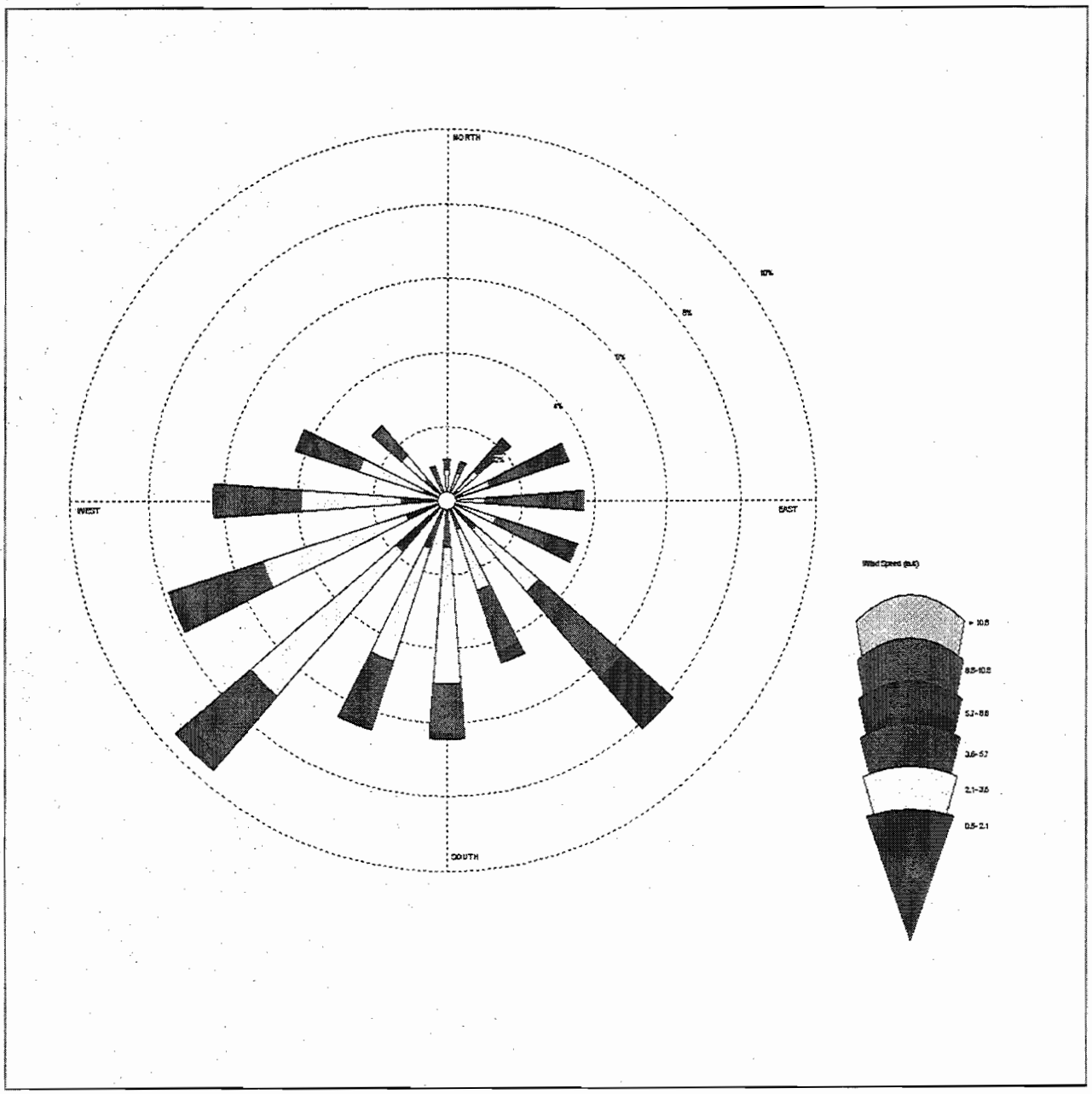


Figure 2.3-20
July Wind Rose for Jacksonville, Florida
Period: 1984-1988

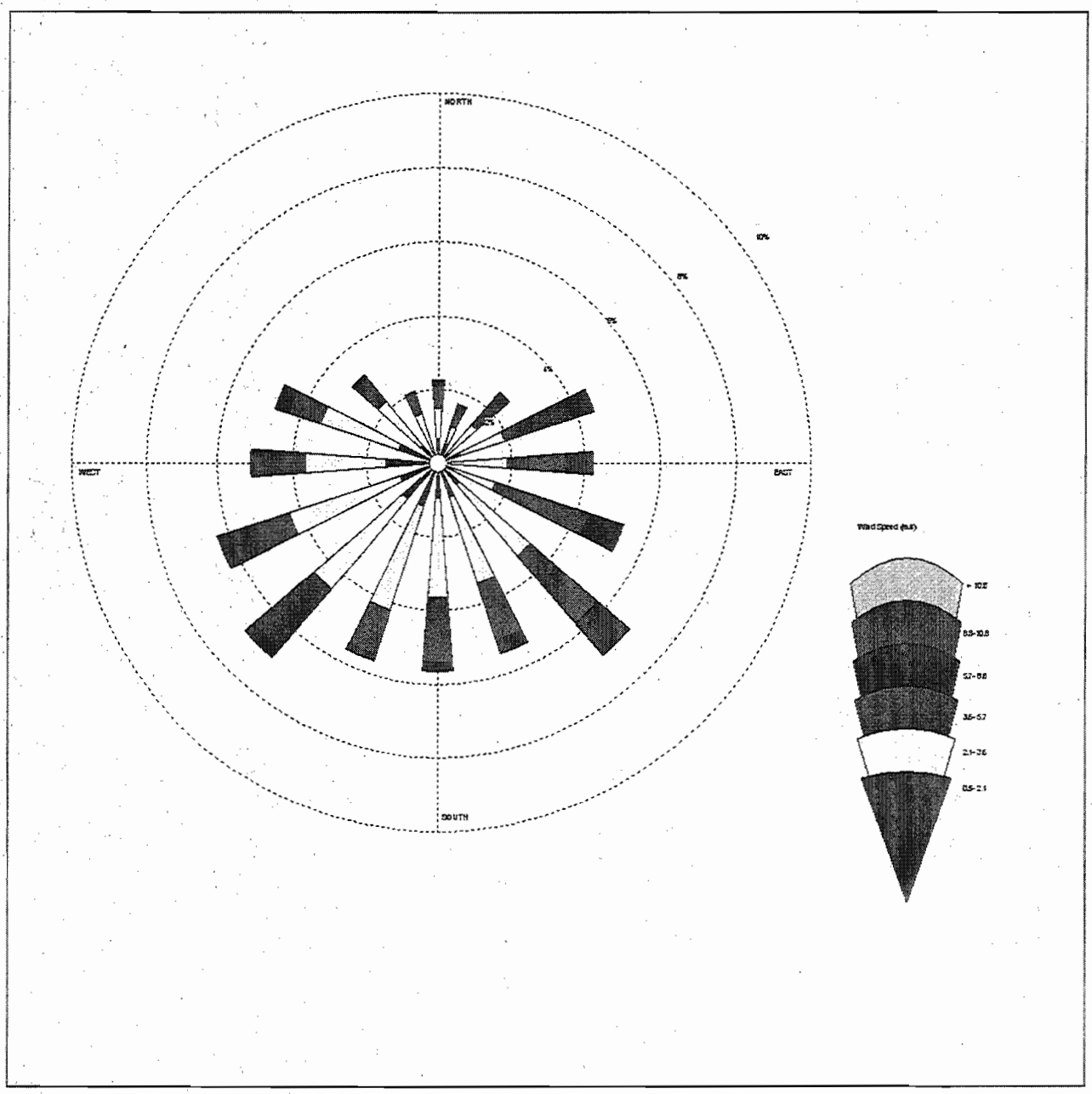


Figure 2.3-21
August Wind Rose for Jacksonville, Florida
Period: 1984-1988

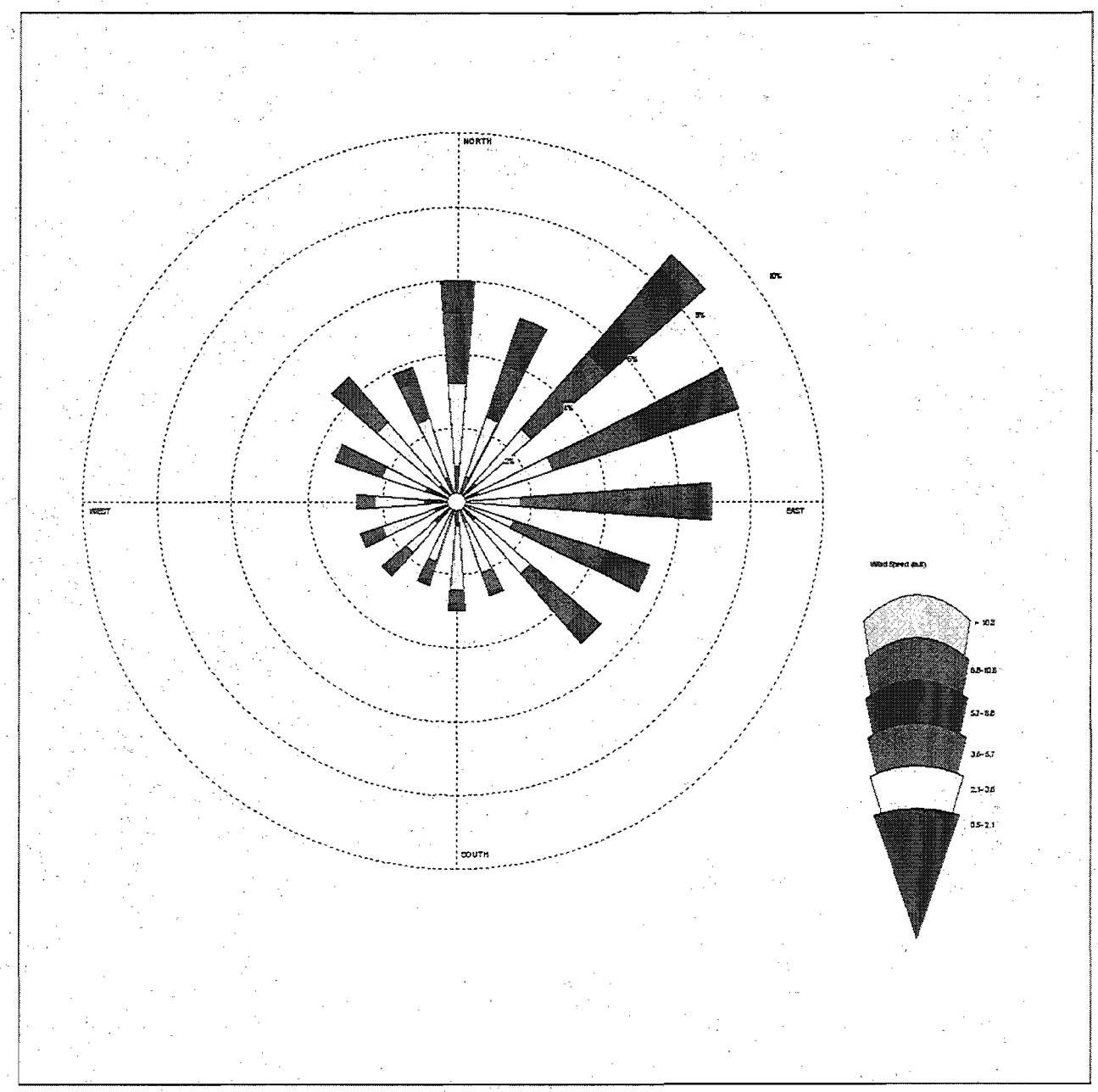


Figure 2.3-22
September Wind Rose for Jacksonville, Florida
Period: 1984-1988

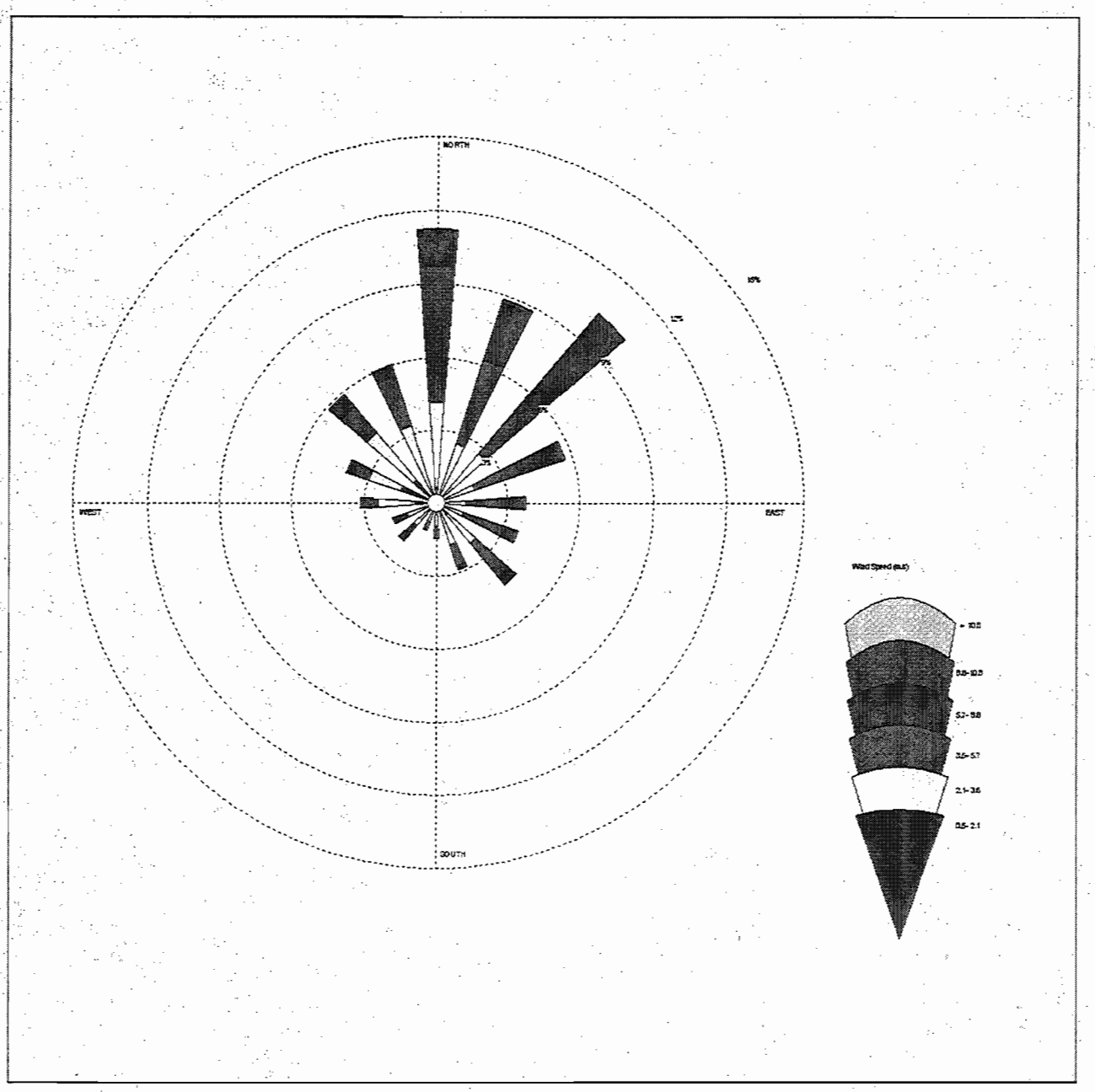


Figure 2.3-23
October Wind Rose for Jacksonville, Florida
Period: 1984-1988

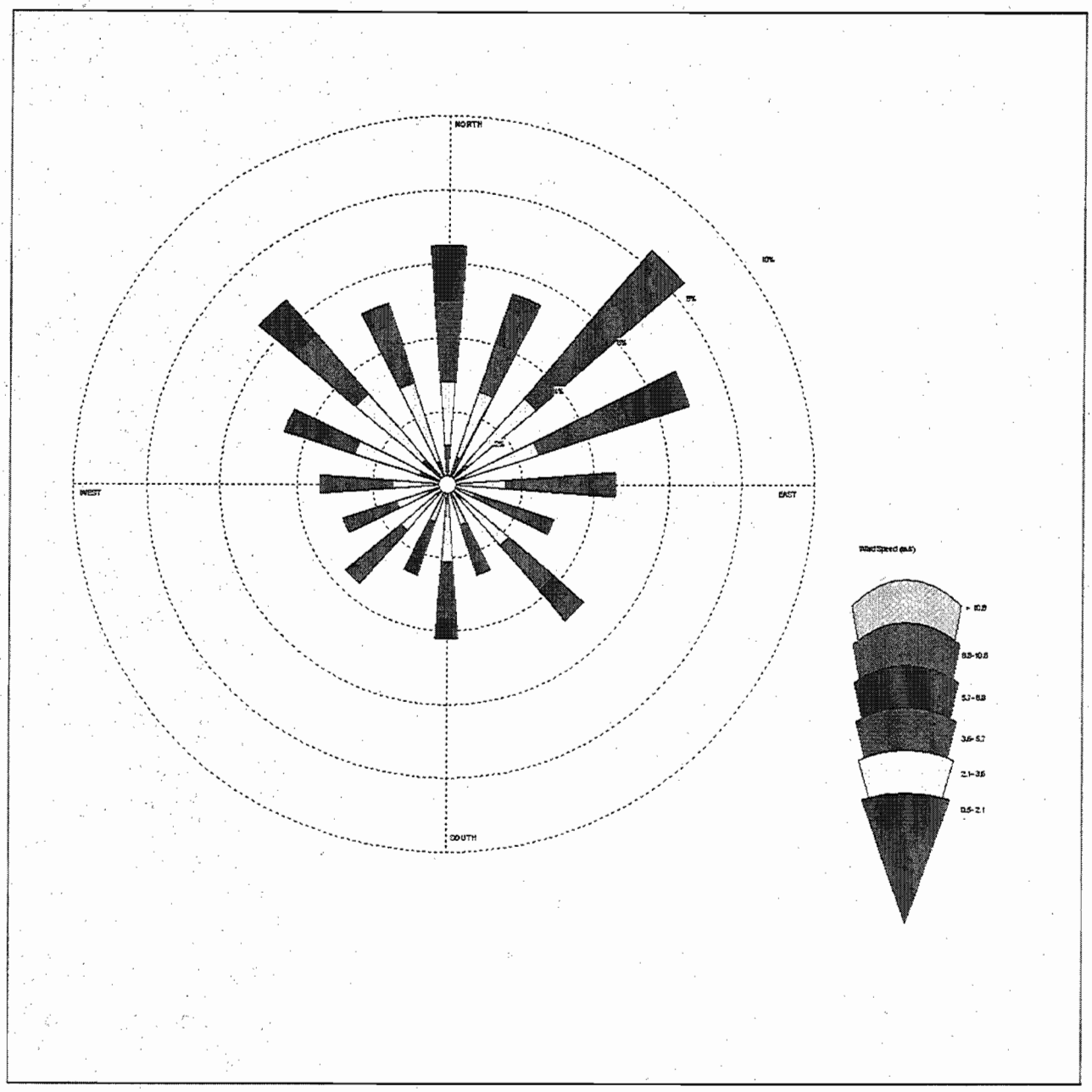


Figure 2.3-24
November Wind Rose for Jacksonville, Florida
Period: 1984-1988

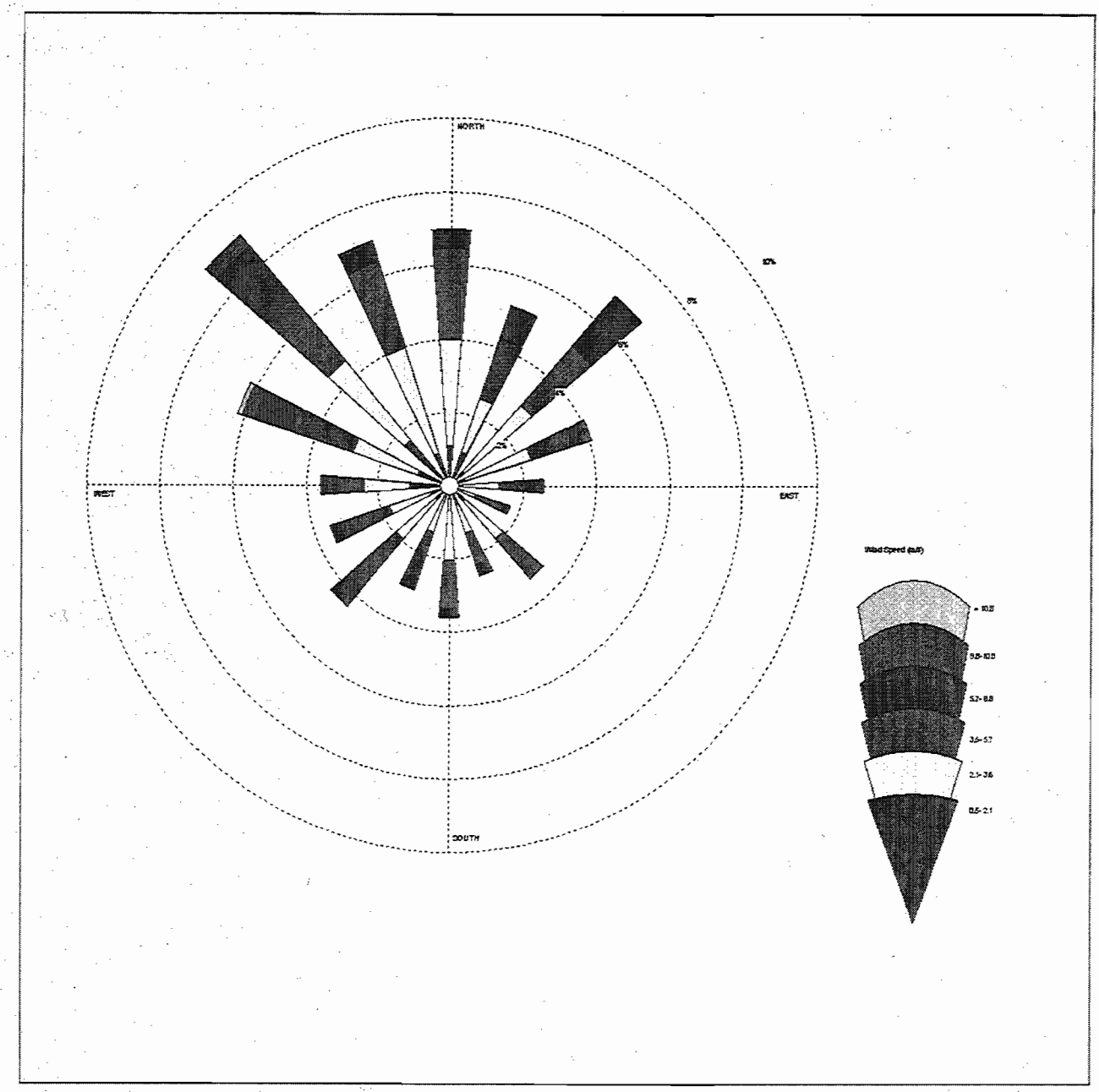


Figure 2.3-25
December Wind Rose for Jacksonville, Florida
Period: 1984-1988

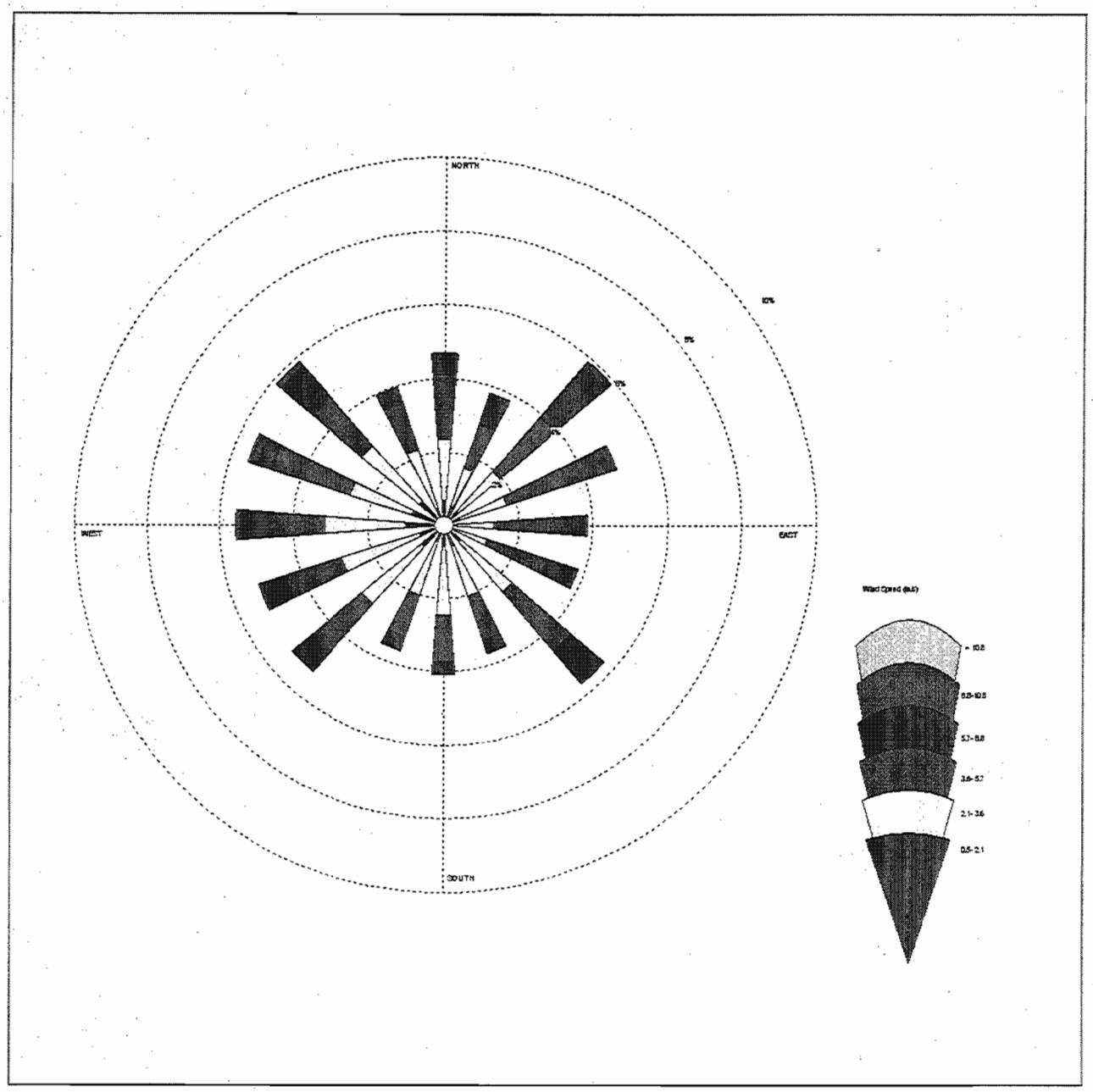


Figure 2.3-26
Annual Wind Rose for Jacksonville, Florida
Period: 1984-1988

Table 2.3-13
Annual Wind Rose
Percent Frequency Distribution

Direction Sector	Wind Speed Categories, knots*						Total (percent)
	0-3	4-6	7-10	11-16	17-21	>21	
N	0.673	1.688	1.756	0.593	0.011	0.000	4.721
NNE	0.547	1.102	1.284	0.830	0.078	0.002	3.843
NE	0.520	1.462	1.955	1.779	0.203	0.005	5.923
ENE	0.458	1.318	1.738	1.311	0.089	0.000	4.915
E	0.262	1.061	1.560	0.960	0.041	0.000	3.884
ESE	0.290	0.942	1.729	0.876	0.011	0.000	3.847
SE	0.604	1.806	2.105	1.179	0.039	0.000	5.733
SSE	0.625	1.421	1.261	0.385	0.014	0.002	3.708
S	0.591	1.879	1.257	0.349	0.027	0.000	4.103
SSW	0.500	1.523	1.195	0.406	0.016	0.000	3.640
SW	0.789	2.064	1.731	0.687	0.048	0.000	5.318
WSW	0.709	2.137	1.574	0.702	0.073	0.016	5.211
W	1.013	2.144	1.473	0.823	0.121	0.016	5.590
WNW	0.899	1.724	1.464	1.206	0.210	0.050	5.553
NW	0.880	1.975	1.758	1.127	0.157	0.018	5.916
NNW	0.525	1.676	1.316	0.454	0.021	0.002	3.993
Calm	24.10	--	--	--	--	--	24.10
Total	33.984	25.921	25.155	13.668	1.159	0.112	100.00

*1 knot = 1.15 mph.
Source: Derived from hourly Jacksonville, Florida, National Climatic Center meteorological data tapes (1984-1988).

Table 2.3-14
Estimated Average Mixing Heights and Average Wind Speeds
Through the Mixed Layer Representative
of the Proposed Facility Site Area

Season	Morning		Afternoon	
	Mixing Height (m)	Wind Speed (m/s)	Mixing Height (m)	Wind Speed (m/s)
Winter	400	6.0	1100	7.0
Spring	480	5.5	1650	7.2
Summer	540	4.6	1625	5.6
Fall	400	5.0	1400	6.5
Annual	485	5.5	1450	6.6

Source: Holzworth, 1972.

Atmospheric stability, in conjunction with general wind patterns, indicates the potential of the atmosphere to disperse airborne pollutants. Atmospheric conditions are typically categorized as unstable, neutral, or stable. An unstable atmosphere is one in which relatively rapid dispersion takes place in both the horizontal and vertical direction. Viewed in terms of changes in temperature with height, an unstable atmosphere is characterized by a sharp decrease in temperature with height. Neutral conditions are common in the atmosphere and are associated with moderate diffusion rates. Temperatures also decrease with height in a neutral atmosphere but not as rapidly as under unstable conditions (neutral conditions are associated with the adiabatic lapse rate). A stable atmosphere is characterized by slight decreases, or even increases of temperature with height, and greatly reduced dispersion rates in comparison with unstable or neutral atmospheres.

The stability classifications presented in this section are based on the well-known Pasquill, Gifford, Turner method, which assigns a stability on the basis of surface wind speed, cloud cover, and solar altitude (Turner, 1969). Stability classes range from Class A (most unstable) to Class F (most stable). Class D represents a neutral stability condition. The joint frequency distribution wind speed, wind direction, and stability at Jacksonville is summarized in Tables 2.3-15 through 2.3-20.

Table 2.3-15
Frequency Distribution of Wind Speed, Wind Direction, and Stability--A Stability
(Jacksonville, Florida, 1984-1988)

	Speed Categories (Knots)						
Direction	1-3	4-6	7-10	11-16	17-21	Greater Than 21	Total (hours)
N	7	12	0	0	0	0	19
NNE	7	5	0	0	0	0	12
NE	7	13	0	0	0	0	20
ENE	9	14	0	0	0	0	23
E	4	17	0	0	0	0	21
ESE	7	15	0	0	0	0	22
SE	11	12	0	0	0	0	23
SSE	9	13	0	0	0	0	22
S	11	25	0	0	0	0	36
SSW	10	13	0	0	0	0	23
SW	17	24	0	0	0	0	41
WSW	12	29	0	0	0	0	41
W	16	31	0	0	0	0	47
WNW	6	24	0	0	0	0	30
NW	10	17	0	0	0	0	27
NNW	4	19	0	0	0	0	23
Totals	147	283	0	0	0	0	430

Number of Occurrences of A Stability = 617
Number of Calms with A Stability = 187

Table 2.3-16
Frequency Distribution of Wind Speed, Wind Direction, and Stability--B Stability
(Jacksonville, Florida, 1984-1988)

	Speed Categories (Knots)						
Direction	1-3	4-6	7-10	11-16	17-21	Greater Than 21	Total (hours)
N	28	51	26	0	0	0	105
NNE	16	32	26	0	0	0	74
NE	23	46	36	0	0	0	105
ENE	13	36	59	2	0	0	110
E	9	33	49	3	0	0	94
ESE	12	51	71	5	0	0	139
SE	22	58	63	3	0	0	146
SSE	23	60	53	2	0	0	138
S	33	67	48	1	0	0	149
SSW	23	55	40	0	0	0	118
SW	32	75	66	1	0	0	174
WSW	31	94	69	0	0	0	194
W	43	103	81	0	0	0	227
WNW	34	86	80	2	0	0	202
NW	33	75	67	1	0	0	176
NNW	19	49	33	1	0	0	102
Totals	394	971	867	21	0	0	2,253

Number of Occurrences of B Stability = 2,461
Number of Calms with B Stability = 208

Table 2.3-17
Frequency Distribution of Wind Speed, Wind Direction, and Stability--C Stability
(Jacksonville, Florida, 1984-1988)

	Speed Categories (Knots)						
Direction	1-3	4-6	7-10	11-16	17-21	Greater Than 21	Total (hours)
N	38	52	116	21	0	0	227
NNE	21	39	102	22	0	0	184
NE	22	47	160	55	0	0	284
ENE	22	45	217	90	3	0	377
E	6	45	239	95	2	0	387
ESE	22	51	242	87	0	0	402
SE	25	69	273	74	0	0	441
SSE	22	40	102	18	0	0	182
S	31	73	116	17	1	0	238
SSW	25	68	114	23	2	0	232
SW	33	95	210	40	1	0	379
WSW	24	98	171	40	3	0	336
W	30	82	206	62	3	0	383
WNW	28	84	205	69	7	1	394
NW	43	74	199	50	6	0	372
NNW	19	53	79	16	0	0	167
Totals	411	1,015	2,751	779	28	1	4,985

Number of Occurrences of C Stability = 5,371
Number of Calms with C Stability = 386

Table 2.3-18
Frequency Distribution of Wind Speed, Wind Direction, and Stability--D Stability
(Jacksonville, Florida, 1984-1988)

	Speed Categories (Knots)						
Direction	1-3	4-6	7-10	11-16	17-21	Greater Than 21	Total (hours)
N	82	288	431	221	6	1	1029
NNE	54	203	346	317	30	1	951
NE	38	215	522	647	89	2	1513
ENE	29	155	396	438	36	0	1054
E	20	129	312	311	15	0	787
ESE	22	120	362	302	6	0	812
SE	31	167	435	425	17	0	1075
SSE	19	116	258	139	6	1	539
S	26	166	276	129	10	0	607
SSW	23	139	238	142	6	0	548
SW	36	189	316	253	20	0	814
WSW	41	170	261	262	27	7	768
W	42	164	200	283	48	7	744
WNW	33	144	210	443	85	19	934
NW	47	224	314	405	61	8	1059
NNW	60	260	285	163	9	0	777
Totals	603	2,849	5,162	4,880	471	46	14,011

Number of Occurrences of D Stability = 14,958
Number of Calms with D Stability = 947

Table 2.3-19
Frequency Distribution of Wind Speed, Wind Direction, and Stability--E Stability
(Jacksonville, Florida, 1984-1988)

	Speed Categories (mph)						
Direction	1-3	4-6	7-10	11-16	17-21	Greater Than 21	Total (hours)
N	29	108	100	0	0	0	237
NNE	21	92	36	3	0	0	152
NE	21	157	90	1	0	0	269
ENE	17	159	52	1	0	0	229
E	12	154	39	0	0	0	205
ESE	10	105	40	0	0	0	155
SE	26	249	121	0	0	0	396
SSE	17	157	119	1	0	0	294
S	25	188	85	1	0	0	299
SSW	22	145	92	3	0	0	262
SW	44	198	150	3	0	0	395
WSW	22	169	158	1	0	0	350
W	55	160	123	1	0	0	339
WNW	31	102	131	4	1	0	269
NW	47	145	142	2	0	0	336
NNW	28	129	107	2	0	0	266
Totals	427	2,417	1,585	23	1	0	4,453

Number of Occurrences of E Stability = 5,365
Number of Calms with D Stability = 912

Table 2.3-20
Frequency Distribution of Wind Speed, Wind Direction, and Stability--F Stability
(Jacksonville, Florida, 1984-1988)

	Speed Categories (Knots)						
Direction	1-3	4-6	7-10	11-16	17-21	Greater Than 21	Total (hours)
N	52	172	6	0	0	0	230
NNE	57	86	1	0	0	0	144
NE	50	106	2	0	0	0	158
ENE	60	134	2	0	0	0	196
E	34	74	0	0	0	0	108
ESE	22	55	0	0	0	0	77
SE	73	199	1	0	0	0	273
SSE	89	227	1	0	0	0	317
S	61	299	2	0	0	0	362
SSW	55	222	7	0	0	0	284
SW	59	308	6	0	0	0	373
WSW	71	343	3	1	0	0	418
W	81	378	3	0	0	0	462
WNW	65	277	4	0	0	0	346
NW	77	287	4	1	0	0	369
NNW	41	190	7	0	0	0	238
Totals	947	3,357	49	2	0	0	4,355

Number of Occurrences of F Stability = 6,853
Number of Calms with F Stability = 2,518

2.3.7.4 Ambient Air Quality. One requirement in obtaining site certification and applicable air quality permits is to demonstrate that the operation of the proposed facility will not cause or contribute to a violation of any federal or state ambient air quality standard or allowable air quality increment. This demonstration is included in Section 5.6, which also addresses many of the requirements of the Prevention of Significant Deterioration (PSD) permit application. One necessary part of the application is to establish representative values for background air quality for applicable pollutants. The existing air quality in the vicinity of the proposed facility site is described in this section including applicable standards and allowable incremental effects. The impact predictions resulting from the consideration of the proposed source emissions are also described in Appendix 10.7.

Air Quality Standards

Ambient air quality standards (AAQS) have been set to protect public health (primary standards) and public welfare (secondary standards). In addition, the State of Florida has adopted ambient air quality standards. The federal and state AAQS are given in Table 2.3-21.

In addition to ambient standards, the operation of the units must not cause air quality incremental impacts beyond those specified by Prevention of Significant Deterioration (PSD) criteria. The proposed facility site area is classified as PSD Class II. Class II PSD increments will be applicable for this analysis in all areas surrounding the proposed facility site.

Existing Air Quality

The State of Florida has been conducting air quality monitoring for criteria pollutants at locations throughout the state for many years. The FDEP document, *ALLSUM 1999,* accessed on the Internet, provides the most recent monitoring data for use in establishing background concentrations for applicable criteria pollutants (FDEP, 2000).

FDEP and EPA guidance would generally require the use of the highest or second highest monitored concentrations to establish conservative background concentrations for the Project area. For this analysis, 1999 data from all Duval County, Florida monitoring sites were reviewed for each pollutant. The monitoring location with the highest monitored concentration for the county was used to establish the background air quality levels. In all cases, the highest measured concentrations at the location considered were conservatively used as background values. Table 2.3-22 summarizes

Table 2.3-21
Ambient Air Quality Standards

Standard	Less Than 24-Hour Average	24-Hour Average	Annual Average
Sulfur Dioxide ($\mu g/m^3$)			
Federal primary	--	365*	80
Federal secondary	1,300 (3-hour)*	--	--
Florida	1,300 (3-hour)*	260*	60
Nitrogen Dioxide ($\mu g/m^3$)			
Federal primary and secondary	--	--	100
Florida	--	--	100
Carbon Monoxide ($\mu g/m^3$)			
Federal primary and secondary	40,000 (1-hour)*	--	--
Federal primary and secondary	10,000 (8-hour)*	--	--
Florida	Same as Federal**	--	--
Particulate Matter (PM_{10}) ($\mu g/m^3$)			
Federal primary and secondary	--	150*	50
Florida	--	150**	50
Lead (Pb) ($\mu g/m^3$)			
Federal primary and secondary	--	--	1.5 (3 mo)
Florida	--	--	1.5 (3 mo)
Ozone ($\mu g/m^3$)			
Federal primary and secondary	235 (1-hour)*	--	--
Federal primary and secondary	157 (8-hour)*	--	--
Florida	235 (1-hour)*	--	--

*Not to be exceeded more than once per year; averaging times given in parenthesis.

**Not to be exceeded an average of more than 1 day per year over a 3 year period.

NOTE: $\mu g/m^3$--micrograms per cubic meter at 25 C and 760 mm Hg.

Table 2.3-22
Background Ambient Air Quality

	Background Concentration[a]	NAAQS[c]	Location (County)	Site ID No.	Year
Sulfur Dioxide ($\mu g/m^3$)[b]					
Annual	10.7	80	Duval	12-031-0032	1999
24 hour	104.3	365	Duval	12-031-0080	1999
3 hour	267.8	1,300	Duval	12-031-0080	1999
Nitrogen Dioxide ($\mu g/m^3$)[b]					
Annual	30.2	100	Duval	12-031-0032	1999
PM_{10} ($\mu g/m^3$)[b]					
Annual	28	50	Duval	12-031-0053	1999
24 hour	56	150	Duval	12-031-0053	1999
Carbon Monoxide[b]					
1 hour	8.7	35	Duval	12-031-0083	1999
8 hour	4.6	9	Duval	12-031-0083	1999
Ozone ($\mu g/m^3$)[b]					
1 hour	207.6	235	Duval	12-031-0080	1999
Lead ($\mu g/m^3$)[b]					
Calendar quarter	0.02	1.5	Duval	12-031-0032	1999

[a]Represents maximum reported values for 1999 (FDEP sites in Duval County, FL).
[b]From 1999 ALLSUM, Florida Department of Environmental Protection.
[c]The values presented in the table represent the National Ambient Air Quality Standards established by the USEPA which are identical to the Florida ambient air quality standards, except for sulfur dioxide. A listing of the NAAQS and Florida standards is presented in Table 2.3-18.

the monitoring data used as background pollutant concentrations for the proposed facility site area. As the data indicates, the monitored concentrations are less than their respective ambient air quality standards.

2.3.8 Noise

A noise evaluation has been performed for the Generating Station. The noise evaluation involved a review of applicable noise regulations, calculations to predict facility noise emissions, and an assessment of necessary noise mitigation measures.

The City of Jacksonville has promulgated noise regulations based on land uses that include noise limits applicable to the proposed facility. The Jacksonville Noise Regulation requires the facility noise emissions to not exceed 65 dBA daytime and 60 dBA nighttime at the nearest residential land use or other land use which may be sensitive to noise emissions. The nearest residences are located approximately 3/4 of a mile from the facility. The facility is anticipated to operate during daytime and nighttime hours; therefore, the 60 dBA nighttime criteria at the residential locations is the governing regulation. Ambient noise levels currently in the Project area are anticipated to be within Noise Regulation standards.

2.3.9 Other Environmental Features

The environmental condition of the Generating Station's approximately 153 acre property has been evaluated. Based on the results of the evaluation, the site arrangement/ facility development area has been restricted to approximately 45 acres of the total land available. The remaining land is to be left in its current condition or, in some instances, enhanced to provide a natural environmental buffer surrounding the facility. JEA is committed to preserving the remaining land and to developing an environmentally safe and responsible project. For example, 24.75 acres of conservation easement were granted to FDEP and 5.8 acres of herbaceous/forested wetlands have been created as mitigation for FDEP and Corps of Engineers regulated impacts associated with the ERP and Section 404 permits.

2.4 References

Cooke, C.W., "*Geology of Florida,*" Florida Geological Survey Bulletin No. 29, Tallahassee, 1945.

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Franks, B.J. and Phelps, G.G., "Estimated Drawdowns in the Floridan Aquifer Due to Increased Withdrawals, Duval County, Florida," US Geological Survey Water Resources Investigations No. 79-84, 1979.

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3.0 The Plant and Directly Associated Facilities

3.1 Background

The Brandy Branch existing simple cycle plant facilities include three simple cycle generating units (Units 1, 2, and 3) and support facilities as shown on the site arrangement (Figure 2.1-3). The location and layout of major combined cycle conversion facilities are also shown.

Major conversion facilities will consist of a steam turbine generator with support facilities located west of Unit 3, a heat recovery steam generator behind Unit 2 combustion turbine, a heat recovery steam generator behind Unit 3 combustion turbine, and a cooling tower located north of the existing fuel oil storage tanks.

Flue gas is the only byproduct of the combustion process whether burning natural gas or No. 2 fuel oil. Both are low sulfur, low ash fuels. Existing combustion control measures, dry low NO_x combustors and temperature control by water injection, will continue to be used and selective catalytic reduction modules will be located in the HRSGs to further reduce NO_x emissions.

Cycle heat rejection will be accomplished using a rectangular, multicell, mechanical draft cooling tower. Well water from onsite wells will be used as cooling tower makeup water and service water. Potable water and service water backup will continue to be supplied from the City of Baldwin.

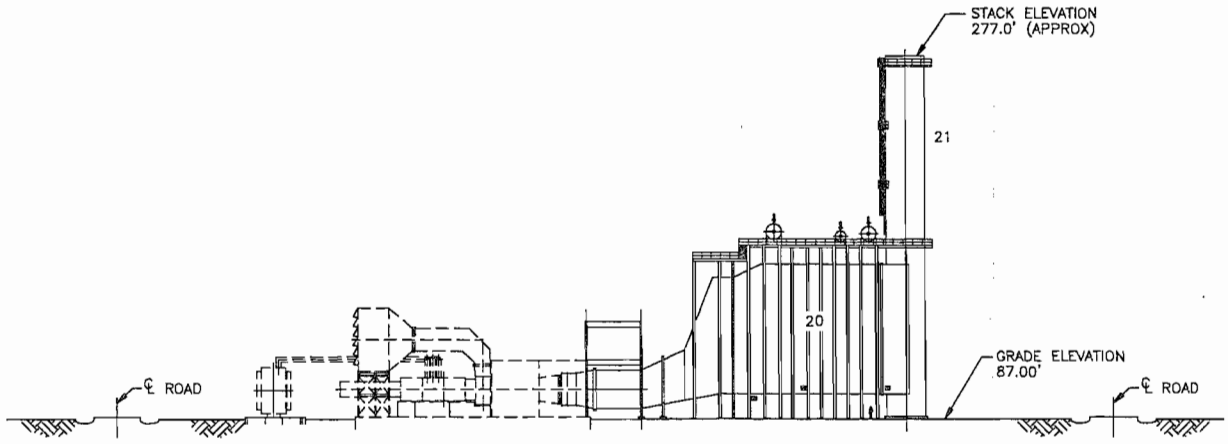
3.2 Site Layout

The site arrangement (Figure 2.1-3) depicts the proposed layout for expansion of the Generating Station due to the addition of the heat recovery steam generators on Units 2 and 3, the steam turbine generator, the cooling tower, and the required support facilities. The Site Arrangement also depicts the existing Units 1, 2, and 3 combustion turbines (GE Frame 7FA) and associated facilities. The general profile associated with Units 2 and 3 combustion turbine in combined cycle is depicted on Figure 3.2-1A. Figure 3.2-1B and Figure 3.2-1C show the general profile of the steam turbine generator and the cooling tower, respectively. These profiles are based on preliminary elevations and dimensions and may change during detailed design and equipment selection. Figure 3.2-2 depicts the proposed locations and elevations for gaseous and liquid release points associated with the expansion of Units 2 and 3.

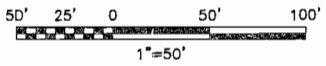
IMAGE QUALITY

AS YOU REVIEW THE NEXT FEW PAGES, PLEASE NOTE THAT THE ORIGINAL DOCUMENT WAS OF POOR QUALITY.

ITEM NO.	EQUIPMENT IDENTIFICATION LIST
20	HEAT RECOVER STEAM GENERATOR
21	HEAT RECOVERY STEAM GENERATOR EXHAUST STACK

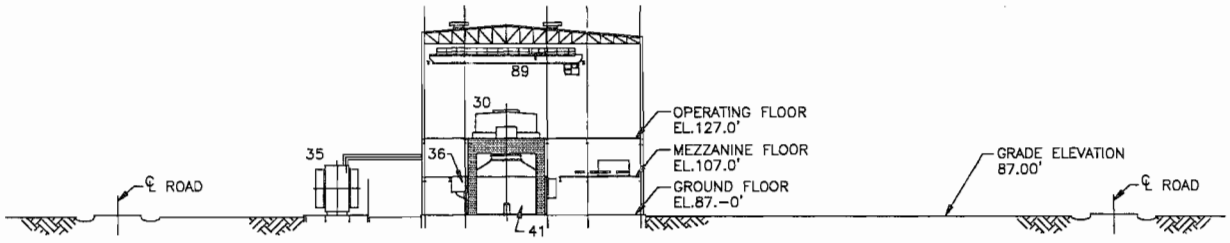


SECTIONAL ELEVATION–LOOKING WEST
COMBUSTION TURBINE/HEAT RECOVERY STEAM GENERATOR



BRANDY BRANCH COMBINED CYCLE
FIGURE 3.2–1A

ITEM NO.	EQUIPMENT IDENTIFICATION LIST
30	STEAM TURBINE
35	STEAM TURBINE GENERATOR STEPUP TRANSFORMER
36	STEAM TURBINE LUBE OIL PACKAGE
41	CONDENSER
89	TURBINE MAINTENANCE CRANE (ABOVE)



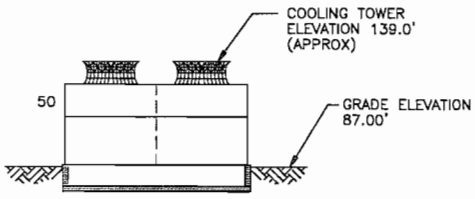
SECTIONAL ELEVATION–LOOKING WEST
STEAM TURBINE BUILDING

50' 25' 0 50' 100'

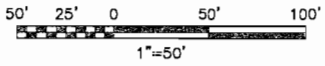
1"=50'

BRANDY BRANCH COMBINED CYCLE
FIGURE 3.2–1B

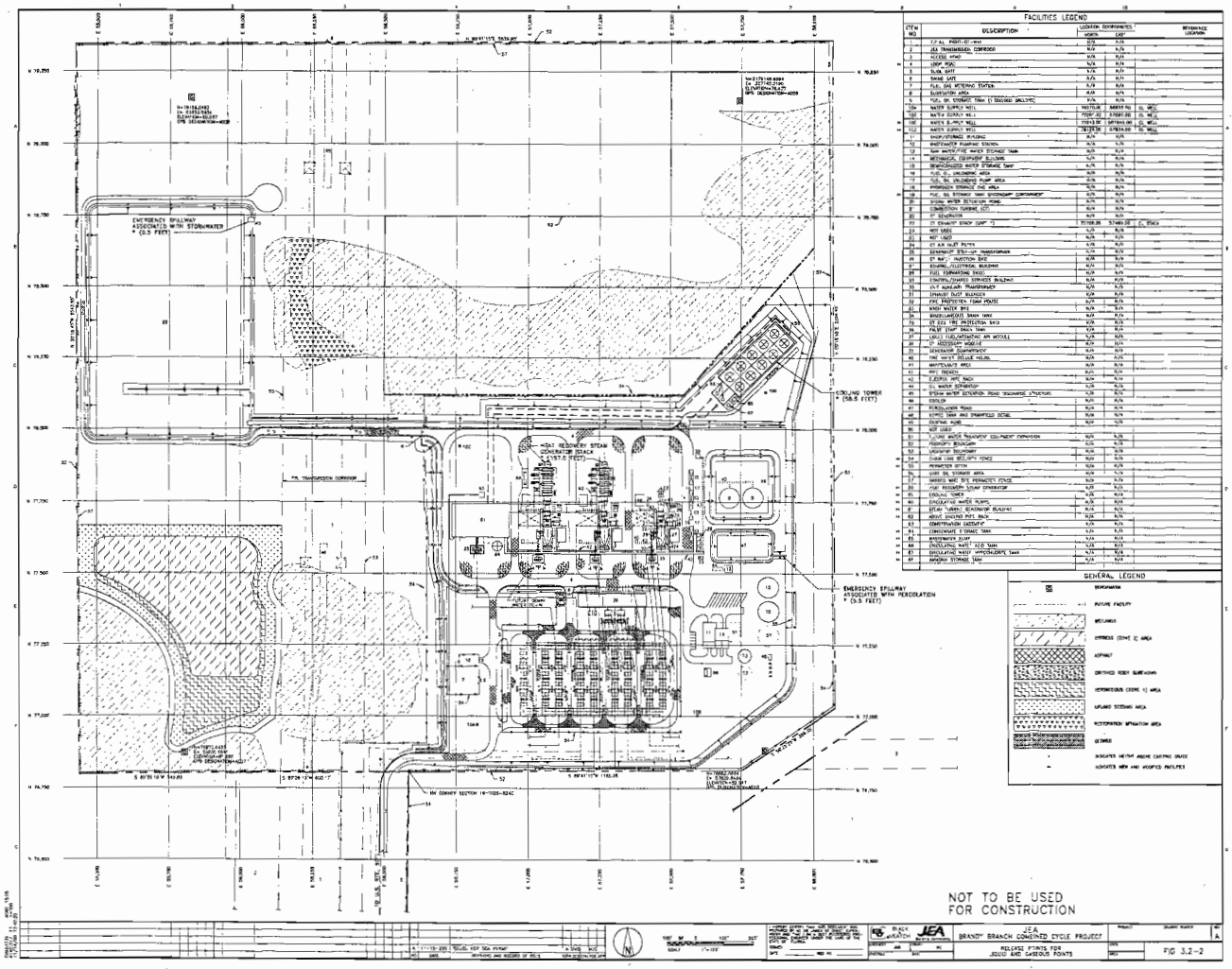
ITEM NO.	EQUIPMENT IDENTIFICATION LIST
50	COOLING TOWER



SECTIONAL ELEVATION–LOOKING NORTHEAST
COOLING TOWER



BRANDY BRANCH COMBINED CYCLE
FIGURE 3.2–1C


FACILITIES LEGEND
GENERAL LEGEND
EMERGENCY SPILLWAY ASSOCIATED WITH STORMWATER * (9.5 FEET)
COOLING TOWER * (58.5 FEET)
HEAT RECOVERY STEAM GENERATOR STACK * (197.5 FEET)
EMERGENCY SPILLWAY ASSOCIATED WITH PERCOLATION * (9.5 FEET)
NOT TO BE USED FOR CONSTRUCTION
JEA
BRANDY BRANCH COMBINED CYCLE PROJECT
RELEASE POINTS FOR LIQUID AND GASEOUS POINTS
FIG 3.2-2

3.3 Fuel

3.3.1 Fuel Types and Qualities

The primary fuel for the Generating Station is and will continue to be natural gas. Delivery contracts are in place for the simple cycle Units 1, 2, and 3 combustion turbines with the Tampa Electric Company (TECO). Table 3.3-1 presents typical property values for the primary fuel.

Table 3.3-1
Natural Gas Properties

Parameter	Mole, percent	Gal/Mcf **	Btu *	Rel Den *
C6 +	0.075	0.029	60.0	0.00015
Propane	0.665	0.182	342.0	0.00077
I-Butane	0.152	0.049	101.0	0.00023
N-Butane	0.130	0.041	87.0	0.00020
I-Pentane	0.040	0.015	33.0	0.00008
N-Pentane	0.020	0.007	16.0	0.00004
Nitrogen	0.309	0.000	0.00	0.00023
Methane	95.067	0.000	1,9202.0	0.04006
CO_2	0.881	0.000	0.00	0.00102
Ethane	2.661	0.708	957.0	0.00210
Totals	100.0	1.031	2,0798.0	0.04488

Notes:

*The component C6+ is assumed to be C6H6 only.

**The density for each component is evaluated under a pressure of 14.64 psia.

The backup fuel is and will continue to be low sulfur (0.05 percent) No. 2 fuel oil. Approximately 2 million gallons will be stored onsite. Operation on oil is proposed to be limited to 288 hours per year, per unit. Table 3.3-2 presents typical property values for the backup fuel.

Table 3.3-2
Typical No. 2 Fuel Oil Properties

Parameter	Value
Ash Content, percent wt	0.001
Sulfur Content by XRF, percent wt	<0.05
Water Content KF, percent wt	<0.50 percent
Density, kg/l at15° C	0.8422
Gross Heat Value, Btu/gal	138,000
Net Heat Value, Btu/gal	129,575
Gross Heat Value, Btu/lb	19,756
Net Heat Value, Btu/lb	18,550
Arsenic, ppm	<0.05
Beryllium, ppm	<0.05
Mercury, ppm	<0.05
Lead, ppm	0.07

3.3.2 Fuel Quantities

The natural gas consumption rate, at a 100 percent capacity factor for all three units, would be approximately 6.1 million cubic feet per hour.

The fuel oil consumption rate of all three units, operating at a 100 percent capacity factor, would be approximately 1.04 million gallons per day.

3.3.3 Fuel Transportation

Natural gas is the primary fuel at the Generating Station and is supplied via an underground 16 inch diameter natural gas line owned by JEA and operated by TECO/Peoples Gas. The natural gas line was installed with the construction of the simple cycle units. The onsite gas line to the combustion turbines connects with the natural gas main line on the west side of the switchyard at the gas metering station

No. 2 fuel oil is the secondary fuel for the Generating Station. Fuel oil is delivered to the Generating Station by tanker trucks. Once onsite, the fuel is transferred from the trucks to the onsite storage tanks. The 1 million gallon (each) storage tanks are within an earthen secondary containment berm used to contain the volume of one tank and a 10 year 1 hour storm event.

3.3.3.1 Natural Gas Delivery and Metering. Natural gas is delivered to the Generating Station as described in Subsection 3.3.3. The existing metering and pressure regulators station will continue to be used to control gas pressure and measure gas flow. No modifications to the existing delivery or metering facilities are required for the conversion project.

3.3.3.2 Fuel Oil Storage and Handling. No additional fuel oil facilities will be required for the conversion project. The existing simple cycle plant fuel oil storage and delivery systems will continue to be used to supply fuel oil to the existing combustion turbine units.

3.3.4 Alternate Fuel Types

JEA determined that combustion turbines, in either simple or combined cycle mode, firing primarily natural gas, would be the most efficient technology for power generation at the Brandy Branch Generating Station. Natural gas does not require delivery vehicles, storage facilities, secondary containment structures, or large dedicated acreages. Natural gas is also the cleanest burning fossil fuel, causing minimal air quality impacts. Incremental additions of natural gas fired combustion turbine capacity are also more flexible than additions of oil or coal fired capacity. The plant site is not suitable to accommodate coal fired generating units with coal storage and handling systems.

3.4 Air Emissions and Control

The anticipated air emissions and proposed control technologies are presented in Appendix 10.7 - PSD Application which is attached to this Site Certification Application under separate cover.

3.5 Plant Water Use

Potable water will continue to be supplied by the City of Baldwin. The existing deep wells to the Floridan Aquifer plus two new similar wells will supply added process water for the steam turbine steam cycle evaporative cooler makeup and cooling tower makeup. The two existing wells at the site, each with a 900 gallon per minute (gpm) pump, are used to supply Units 1 through 3 service fire water demands. Two additional 900 gpm well pumps are planned to support the cooling water and service water needs of the combined cycle unit.

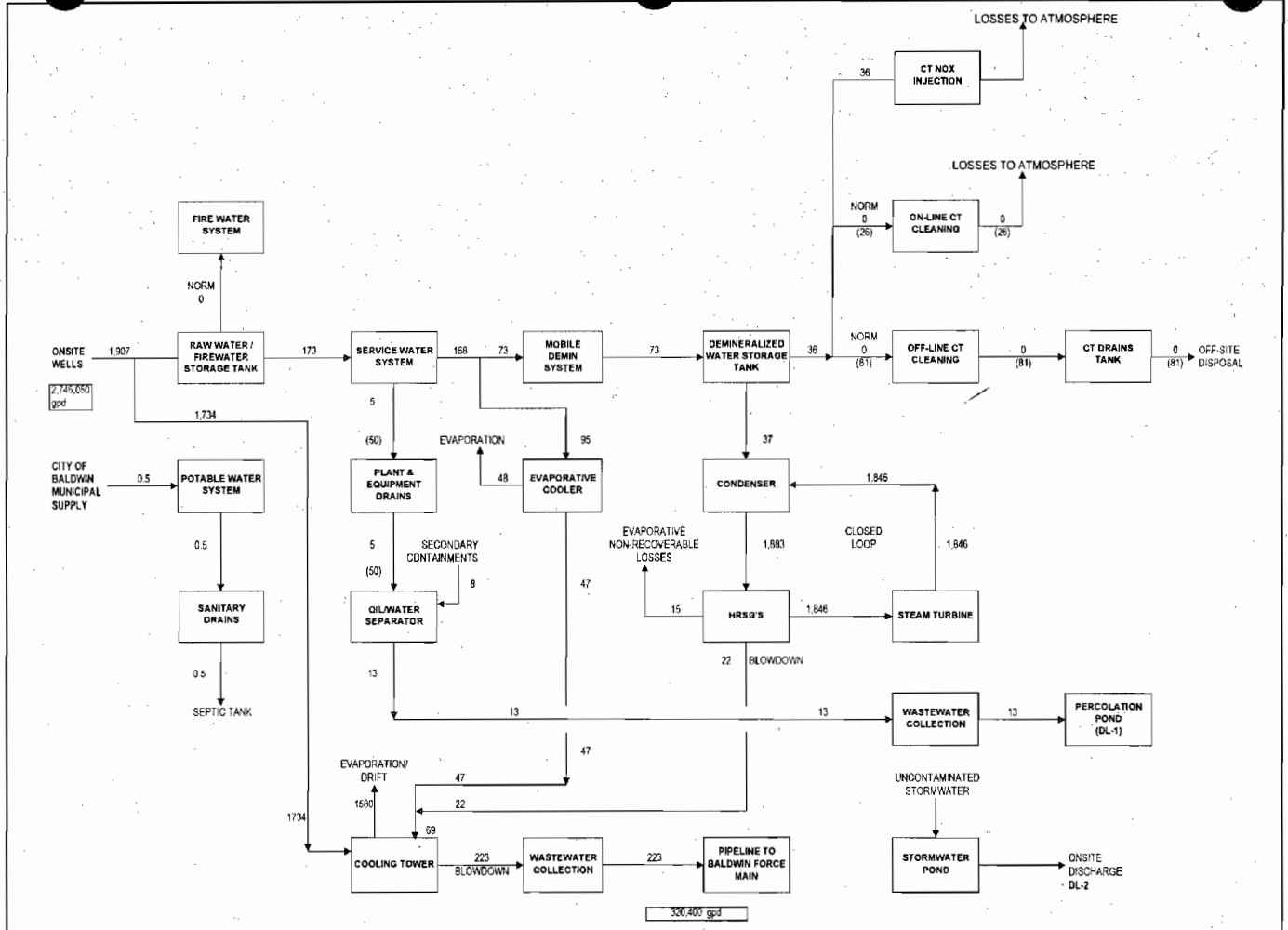
The average annual water mass balance is provided as Figure 3.5-1. This mass balance considers specific hours of operation on natural gas and fuel oil. The average daily process water demand is estimated to be 1,906 gpm, or 2.745 mgd. Cooling tower makeup demand is 90 percent of this water requirement.

Maximum process water demand requirements occur when the units burn fuel oil on hot days. The water mass balance estimating these conditions is provided as Figure 3.5-2. The demand increases when firing fuel oil due to the additional demineralized water requirement for injection into the turbines to control NO_x emissions. The usage rate under these conditions is 2,585 gpm, or 3.722 mgd. Cooling tower makeup demand is 75 percent of this requirement; injection water is 20 percent.

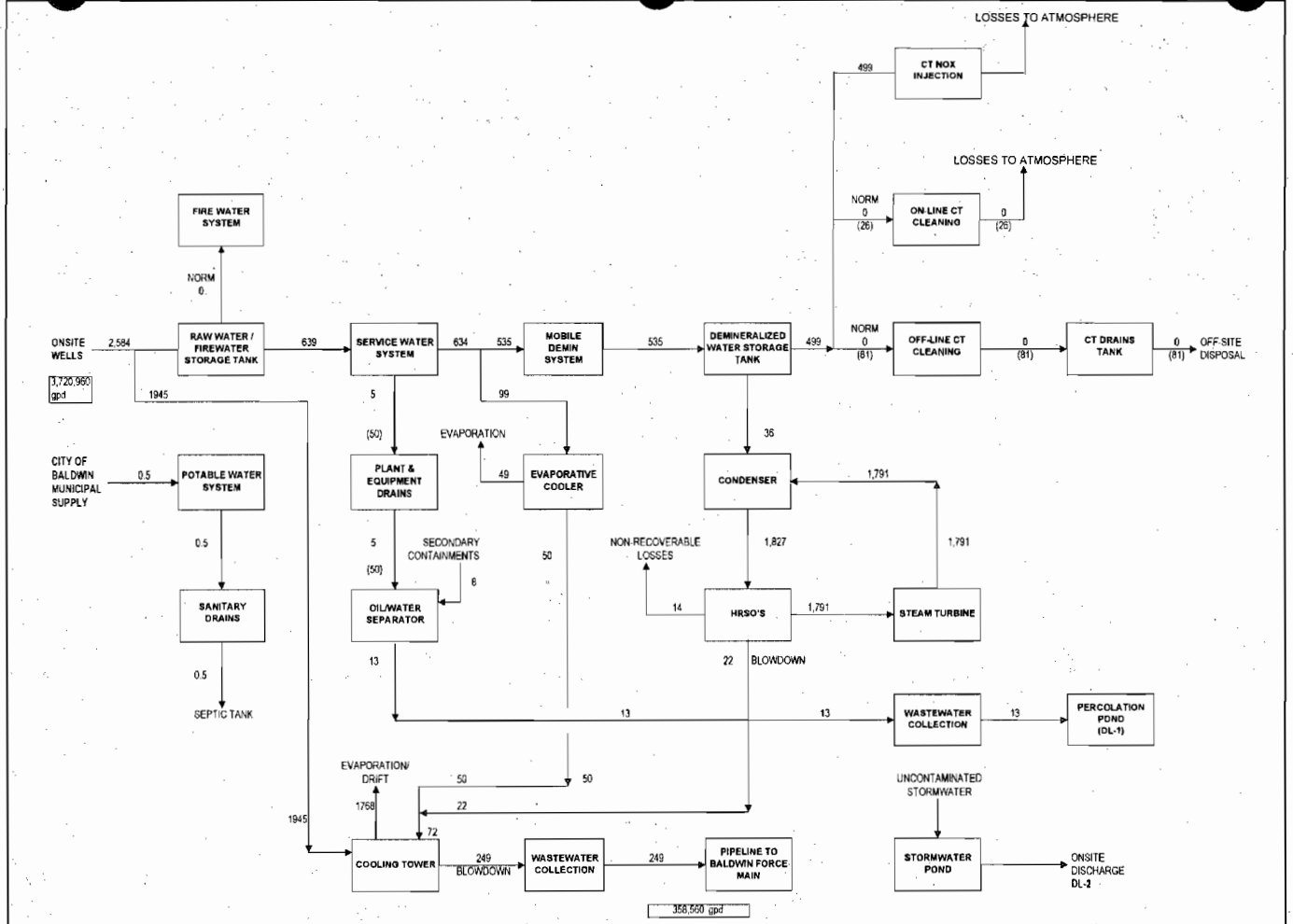
The water mass balances represent operation at 100 percent load conditions. Actual average annual flows will be less, dependent upon the electrical loading of the generators.

3.5.1 Heat Dissipation System (Cooling Tower)

Waste heat from the steam turbine condenser will be rejected to the atmosphere by a cooling cycle using a mechanical draft cooling tower. The source of cooling water makeup will be onsite wells. Cooling tower blowdown will be directed to a wastewater pump station that will pump plant wastewater to the Baldwin Force Main as described herein.



NOTES:							
1. FLOWS ARE IN GALLONS PER MINUTE (gpm).	COMBUSTION TURBINE FUEL	GAS/OIL	BLACK & VEATCH LLP	JACKSONVILLE ELECTRIC AUTHORITY	Project	Drawing	Rev
2. PEAK INSTANTANEOUS FLOWS ARE LISTED IN PARENTHESES.	TURBINE CONFIGURATION	GE 7FA, 2CC + 1SC		BRANDY BRANCH PROJECT	9T990.0040	WMB-7	H
3. NO INJECTION WATER OR STEAM FOR POWER AUGMENTATION.	OUTPUT (MW)	518		PRELIMINARY WATER MASS BALANCE			
4. COOLING TOWER WATER USE BASED ON 8 CYCLES OF CONCENTRATION.	LOAD FACTOR	100%	Eng: TSA Dwg: TSA	COMBINED CYCLE NATURAL GAS/OIL	Figure 3.5-1		
5. ANNUAL AVERAGE IS BASED ON 288 HOURS PER YEAR, PER TURBINE ON OIL.	NOx INJECTION, GPM PER TURBINE	187	Check Date: 10/25/2000	ANNUAL AVERAGE			



NOTES:
1. FLOWS ARE IN GALLONS PER MINUTE (gpm)
2. PEAK INSTANTANEOUS FLOWS ARE LISTED IN PARENTHESES
3. NO INJECTION WATER OR STEAM FOR POWER AUGMENTATION.
4. COOLING TOWER WATER USE BASED ON 8 CYCLES OF CONCENTRATION.

COMBUSTION TURBINE FUEL	OIL
TURBINE CONFIGURATION	GE 7FA, 2CC + 1SC
OUTPUT (MW)	476
LOAD FACTOR	100%
NOx INJECTION, GPM PER TURBINE	187

BLACK & VEATCH LLP
Eng: TSA Dwg: TSA
Check: Date: 10/18/2000

JACKSONVILLE ELECTRIC AUTHORITY
BRANDY BRANCH PROJECT
PRELIMINARY WATER MASS BALANCE
COMBINED CYCLE - OIL
SUMMER PEAK CONDITIONS

Project	Drawing	Rev
87990.0040	WMB-5	G

Figure 3.5-2

3.5.2 Domestic/Sanitary Wastewater

The existing septic disposal system, previously permitted and installed for the simple cycle units, will be used. Very little additional sanitary drainage and no additional facilities are required for the combined cycle facility.

3.5.3 Potable Water System

No new potable water uses are planned for this facility other than an extension of the existing hose bibb and safety shower system to the steam turbine building and cooling tower. The City of Baldwin will supply the incremental volume.

3.5.4 Process Water Systems

Service/process water will be provided for evaporative cooler makeup, washdown purposes, and for pump and equipment seal water and flushing as necessary. Hose stations will be located for washdown use as required.

Fire water is presently obtained from a dedicated supply of treated well water or City of Baldwin water available from the existing service/fire water storage tank. Existing fire water pumps will provide water by means of extending the existing underground piping loop which serves fire hydrants, hose racks and reels, and automatic suppression systems.

Demineralized water will be required for use as makeup to the steam-condensate-feedwater cycle associated with the HRSGs and steam turbine generators. This makeup is required to replace cycle losses and boiler blowdown. In addition, demineralized water will continue to be used to control combustion turbine NO_x emissions when firing fuel oil. Portable demineralizer facilities will be used to produce additional demineralized water for steam cycle makeup and inlet air evaporative cooling. These portable demineralizers are regenerated offsite. The existing demineralized water storage tanks and pumps will be used to supply the water to the new facilities.

3.6 Chemical and Biocide Waste

The Generating Station will have three major sources of wastewater: sanitary wastewaters, oil/water separator effluent, and cooling tower blowdown. Process wastewaters will be treated and discharged at three locations. Oil/water separator effluent is and will continue to be routed to an onsite percolation pond prior to ground water discharge. Cooling tower blowdown will be routed to the wastewater pump station that will pump plant wastewater to the Baldwin Force Main. Sanitary wastes will be

routed to the existing permitted onsite septic tank/tile field system. There is no source of leachate associated with the plant and, therefore, no basis for this process to occur.

3.6.1 Cooling Tower Blowdown

It is estimated that 322,000 gpd of combined cycle wastewater from cooling tower blowdown and other minor sources will be discharged to the Baldwin Force Main for treatment and disposal within the JEA Wastewater Treatment System.

3.6.2 Steam Cycle Water Treatment

The steam cycle water will be treated with an oxygen scavenger for dissolved oxygen control and with an amine, such as ammonia solution, for pH control. The oxygen scavenger will break down to ammonia at the system operating temperature. A phosphate solution will be fed to control scaling, corrosion, and boiling water pH in the steam generators. The phosphate will react with any calcium hardness in the steam generators to form a nonadherent precipitate. The cycle chemical feed systems will be located in curbed areas and any accidental spillage will be disposed of offsite.

Boiler blowdown will be relatively high purity water with small amounts of suspended solids and phosphate. Boiler blowdown will be routed to the cooling tower basin for use as makeup water.

3.6.3 Makeup Water Demineralization

The existing portable demineralizer facilities will be used to produce additional demineralized water for steam cycle makeup and NO_x injection. These portable demineralizers are regenerated offsite at the demineralizer contractor's facility.

3.6.4 Chemical Cleaning Wastes

The heat recovery steam generators and preboiler piping will be chemically cleaned during commissioning. The steam generators will also be cleaned periodically during the life of the unit. Chemicals used for these cleanings will not be stored onsite and will be administered utilizing a temporary system. The makeup of the chemical cleaning solutions to be used for acid and alkaline cleaning of the heat recovery steam generators will be dependent to a limited extent on the boiler manufacturer. Chemicals typically used in boiler and preboiler chemical cleaning include the following:

- Inhibited citric acid.
- Ammonia solution.
- Disodium phosphate.
- Trisodium phosphate.

- Nonfoaming wetting agents.
- Foam inhibitors.
- Chelates, such as EDTA.

Chemical cleaning wastewaters will consist of the cleaning solutions and material removed during the cleaning process. Since chemical cleaning is a maintenance operation, it will not contribute to the liquid wastes produced by the normal operation of the plant.

The acid and alkaline cleaning solutions will be neutralized onsite in temporary tanks and transported offsite by a licensed waste disposal contractor. Flush and rinse waters will be processed through the oil/water separator and routed to the wastewater percolation pond.

3.6.5 Miscellaneous Chemical Drains

Chemical wastewater can result from draining a chemical storage tank, overflowing a chemical tank during filling, or from maintenance operations such as hosing down chemical storage areas. Miscellaneous chemical drains will either be contained for disposal offsite or neutralized as required, and routed to the wastewater collection sump for discharge to the Baldwin Force Main. Flows from miscellaneous chemical drains will be intermittent and will not normally contribute to the wastewater flows.

3.7 Solid and Hazardous Waste

3.7.1 Solid Waste

The plant does not and will not generate any solid waste, such as combustion ash or FGD scrubber waste, from the generation process. The firing of natural gas, or fuel oil, does not create significant combustion byproducts. The site does not have any landfills or solid waste disposal areas.

3.7.2 Hazardous Waste

Waste oil is the only potentially hazardous substance generated by plant operation. Four processes generate waste oil: combustion turbine and other equipment oil changing, combustion turbine cleaning, false starts of the combustion turbines, and oil/water separator operation. The internal components of the combustion turbines are periodically cleaned using a solvent solution. This wash water may contain oily residues and metal particles. The wash water is collected in an underground combustion turbine drain tank and hauled offsite as needed by a licensed contractor for ultimate disposal. The residual oil resulting from any false starts is also collected in the combustion turbine

drain tank. Waste oil is collected in the drain tank and oil/water separator and will be hauled offsite as needed by a licensed contractor for ultimate disposal.

3.8 Onsite Drainage System

3.8.1 Uncontaminated Areas

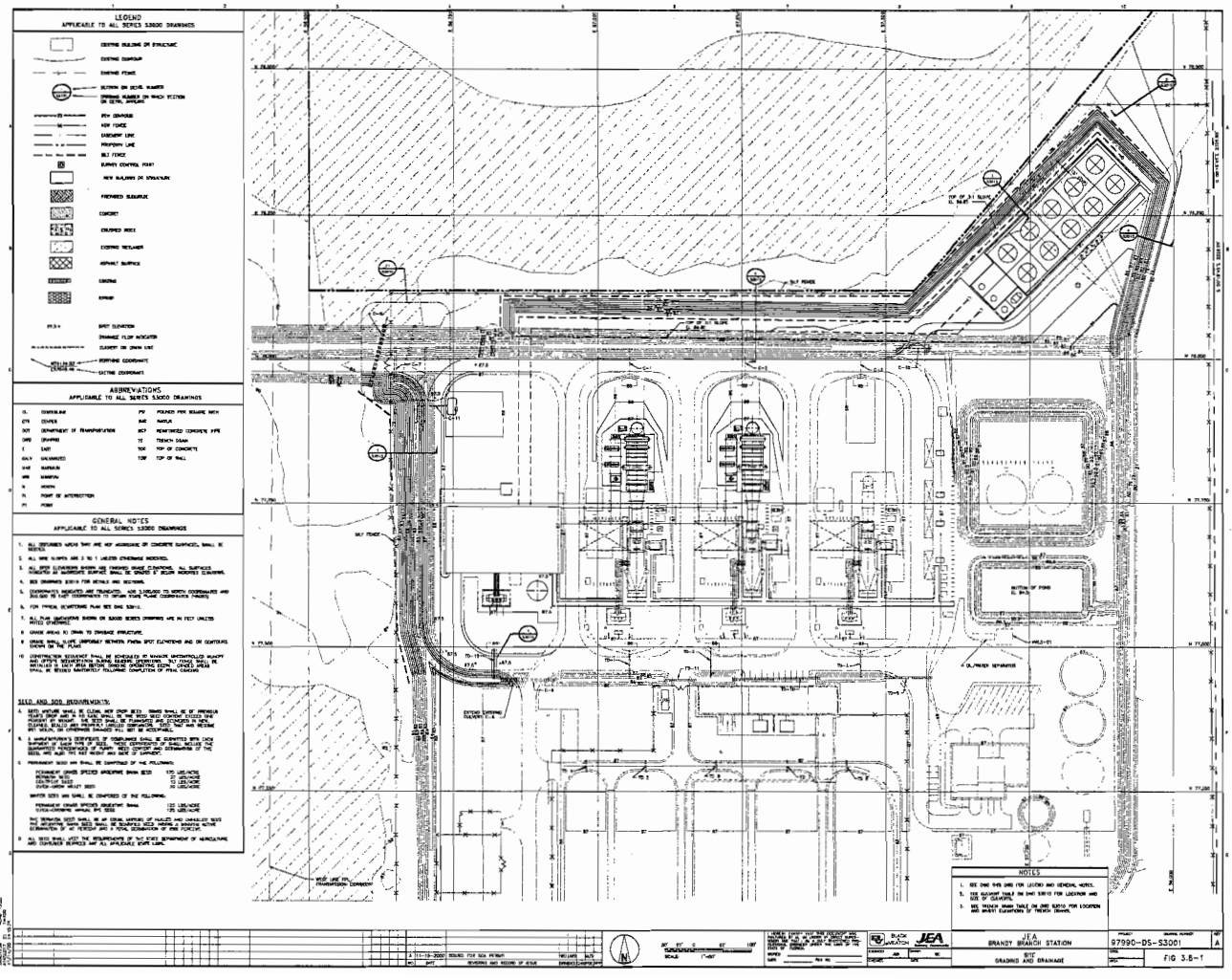
The predeveloped site area is fairly flat, gradually sloping from southwest to northeast. Generally, the existing site drainage is directed in northerly and westerly directions. Storm water runoff from the existing Units 1, 2, and 3 area is directed to the permitted storm water pond.

The onsite drainage facilities are designed in accordance with the requirements of the St. Johns River Water Management District (SJRWMD) and Florida Department of Environmental Protection (FDEP). These facilities were approved by FDEP. Refer to Appendix 10.3 for existing state permits. Figure 3.8-1 shows preliminary grading and drainage for the various facility areas. Open channels and drainage structures (culverts, piping systems, etc.) will be designed to collect and direct the runoff resulting from a 25 year, 24 hour storm event. Site runoff facilities (ditches, detention basin, etc.) provide storage to satisfy criteria for maintenance of water quality and quantity, and to provide storage to attenuate peak discharge rates (i.e., pre-post).

The requirements for quality treatment include retention of the greater of either 1 inch of runoff from the entire site drainage area or 2-1/2 inches times the total impervious area excluding any water bodies. The larger of these two volumes is provided in the onsite storm water detention pond as treatment volume. The requirements in SJRWMD are then met with no more than half of the treatment volume being discharged into the existing wetlands in 48 to 60 hours after the rainfall event.

The requirements for quantity treatment include the limitation that the post-development peak discharge not exceed the predevelopment peak discharge. The detention pond attenuates the peak discharge flows from the developed site to meet this requirement.

Runoff from areas of the site not disturbed by construction activities or plant operations will be maintained in the existing state to the greatest extent possible. When it is necessary to direct this flow around developed portions of the site, diversion ditches have been constructed. These diversion ditches collect runoff flow from the undisturbed areas and direct the flow to natural drainage patterns. Runoff from areas of the site disturbed by construction activities or plant operations are collected in a ditch system and directed to the onsite storm water pond as described below. Drainage systems are designed for gravity flow wherever site conditions allow. Generally, the drainage in the areas of the new facilities will be directed away from the structures and routed to the


LEGEND
APPLICABLE TO ALL SERIES 53000 DRAWINGS
ABBREVIATIONS
APPLICABLE TO ALL SERIES 53000 DRAWINGS
GENERAL NOTES
APPLICABLE TO ALL SERIES 53000 DRAWINGS
SEED AND SOD REQUIREMENTS:
NOTES
1. SEE DWG 5415 (M2) FOR LEGEND AND GENERAL NOTES.
2. SEE ELEVATION TABLE ON DWG 53610 FOR LOCATION AND INVERT ELEVATIONS.
3. SEE TRENCH DRAIN TABLE ON DWG 53610 FOR LOCATION AND INVERT ELEVATIONS @ TRENCH DRAINS.
JEA
BRANDY BRANCH STATION
SITE
GRADING AND DRAINAGE
97990-DS-53001
FIG 3.8-1

onsite storm water system. Figure 3.8-1 indicates the general storm water flow paths at the Generating Station site. Supporting calculations are included in Section 3.10.

3.8.2 Drainage Areas

Limited construction will be required in the existing Unit 1 area, fuel oil storage tank area, and water treatment area. In these areas, the existing drainage facilities will be used as much as possible; storm water runoff will continue to be directed to the existing storm water pond. The existing facilities were designed such that capacities are sufficient to handle any additional impact from the new construction.

Most of the construction will occur in the Unit 2 and 3 power block area as well as the area used for the addition of the steam turbine generator, cooling tower, and associated equipment. These areas will drain into the existing storm water pond during construction and operation. The existing storm water pond was originally designed to accommodate additional development. Drainage calculations provided in Section 3.10 confirm that the storm water system is adequately designed to accommodate the new development.

The storm water pond will serve as a wet detention basin to provide both quality and quantity treatment to the storm water. Detention and reduction of suspended solids load will accomplish the quality treatment. The basin will also provide quantity treatment by providing surge capacity to attenuate the maximum discharge rate into the existing wetlands. There will be no source of leachate associated with the proposed expansion of the Generating Station, thereby eliminating this potential pollution source.

3.8.3 Design Criteria

The management and storage of surface waters (MSSW) system has been designed in accordance with the regulations and requirements of the SJRWMD Applicant's Handbook, "Management and Storage of Surface Waters" and "Regulation of Stormwater Management Systems." The regulations and requirements of the Florida Department of Environmental Protection (FDEP), "The Florida Manual--A Guide to Sound Land and Water Management, Storm Water Management Practices" has also been followed in the design.

The MSSW system at the proposed combined cycle project is designed to maintain the existing drainage patterns wherever possible. The existing drainage patterns generally flow from the southern portion of the site in a northerly or westerly direction to a storm water pond that discharges to an existing wetland area.

The MSSW system for the developed areas of the Generating Station is designed to ensure that the postdevelopment peak discharge will not exceed that of the predevelopment peak discharge at the project site boundary.

The following design criteria are specified in the SJRWMD Permit Manual:

- Design Storm--25 year, 24 hour.

Rainfall frequencies obtained from the SJRWMD Permit Manual are as follows:

- Mean Annual - 24 hour--4.6 inches.
- 5 year - 24 hour--6.5 inches.
- 10 year - 24 hour--7.1 inches.
- 25 year 24 hour--8.75 inches.
- 100 year - 24 hour--11.0 inches.

Rainfall Distribution:

- NRCS Type II Florida Modified Hydrograph.

Outlet structures:

- Emergency spillways are designed to pass the 100 year recurrence interval storm event.

3.8.4 Runoff Analysis

The area associated with the combined cycle unit and the construction lay-down/staging area consists of approximately 7 acres of pervious area and 3 acres of impervious area. The entire area will drain into the existing storm water detention pond. The 25 year, 24 hour rainfall event was used to size the onsite runoff detention basin. The predevelopment curve number (CN) was estimated to be 77, with a predevelopment time of concentration of 3.26 hours. The postdevelopment CN and time of concentration were estimated to be 90.3 and 0.94 hours, respectively. The curve numbers and time of concentrations were determined using the methods outlined in the Soil Conservation Service TR-55 manual.

The proposed system will require minor modification of the site existing storm water management system. This system will continue to function as a storm water quality and quantity treatment facility. The quality treatment of runoff will be accomplished through percolation and detention in the site detention basin.

The discharge structure of the detention basin is designed for the 25 year, 24 hour event peak flow. The storm water detention pond and discharge structure are sized to meet the design criteria outlined in Subsection 3.8.3. Storm water enters the pond through direct precipitation and from ditches conveying runoff from the entire power block and the construction staging/lay-down areas.

The system predevelopment and postdevelopment peak flow discharges for the design event are both approximately 55 cubic feet per second (cfs). The discharges will enter the existing wetlands north of the power block. A spreader swale at the discharge location distributes the flow and prevents erosion.

3.8.5 Erosion and Sediment Control Measures

During construction, erosion and sediment control measures will be installed, as necessary, to control sediment disposition. The primary destination of construction runoff will be the storm water pond. The storm water pond will provide reduction of suspended solids load through detention.

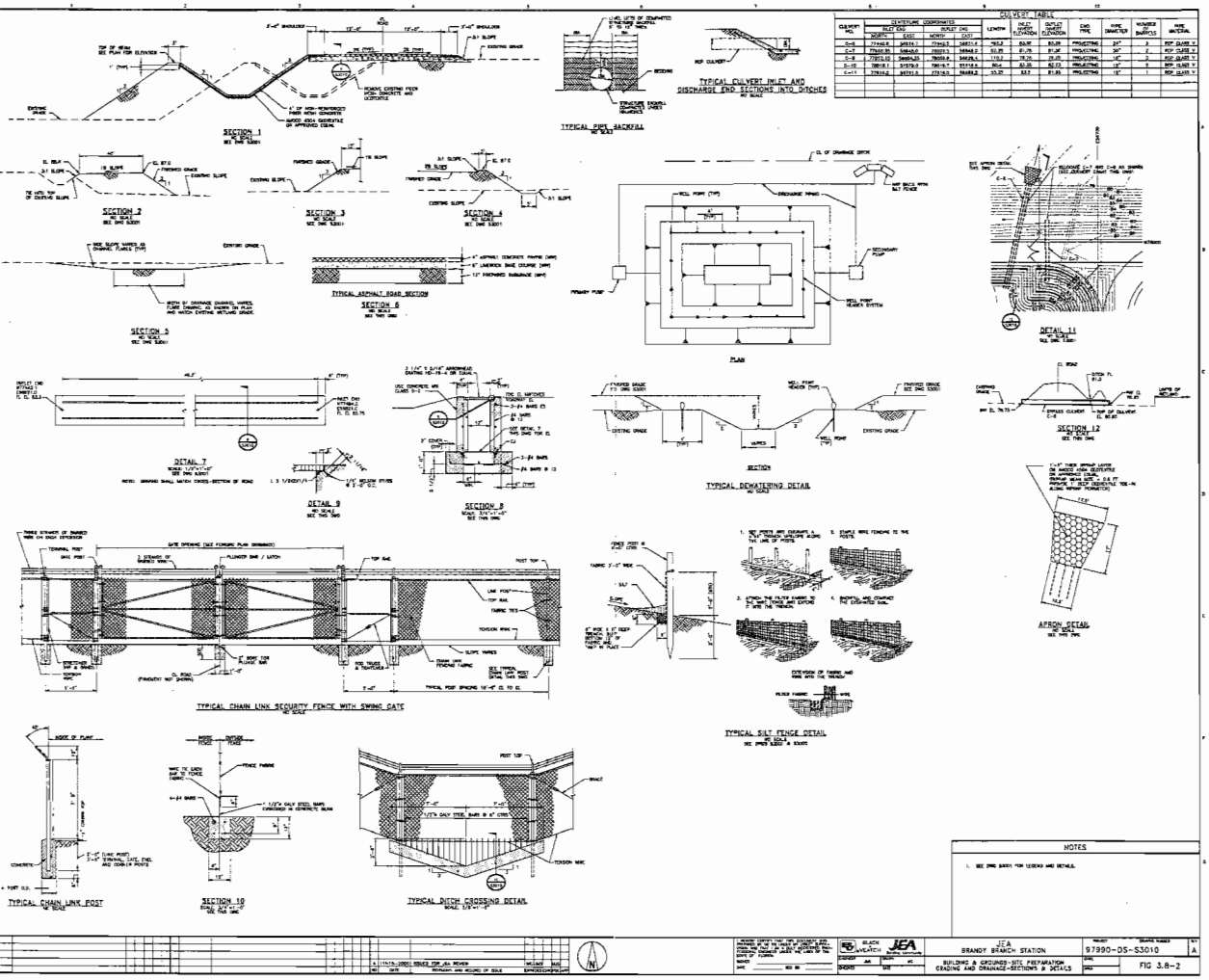
Prior to construction, silt fences or other appropriate control measures will be installed around the perimeter of the construction areas. Diversion ditches will be equipped with straw bale dikes to aid in minimizing the amount of sediments flowing into the onsite storm water pond and receiving wetland (refer to Figure 3.8-2 for typical detail). Construction accessways and parking areas will be surfaced with aggregate to provide a stabilized subgrade. Erosion control measures will also include minimizing fugitive dust through periodic spraying of water.

3.8.5.1 Staging of Earth Moving Activities. The only earth moving activities associated with the conversion project are in the new cooling tower area. Initial construction on the 2 acre cooling tower site will remove all significant vegetation (trees, brush, etc). If possible, some trees will be retained in the construction lay-down/staging area. Topsoil will be removed and stockpiled for finished grading and site restoration after construction is completed. Seeding and mulching activities will begin within 30 days of completion.

3.8.5.2 Construction Monitoring and Maintenance. In general, all erosion and sedimentation control measures will be checked weekly and after each significant rainfall event. Items, including the following, will be checked:

- Silt fences and straw bale dikes will be inspected after each significant rainfall and during prolonged periods of rainfall. Required repairs will be made immediately.
- Sediment deposits at barriers will be removed when the deposit depth reaches approximately one half the height of the barrier.

3.8.5.3 Permanent Control Measures. Permanent erosion and sedimentation control measures within the project plant site will include the runoff collection system (ditches, culverts, trenches), surfaced traffic and work areas, nonworking areas with established vegetation, and the site runoff detention pond. These measures will minimize erosion and potential sedimentation into the receiving wetland.



CULVERT TABLE

CULVERT NO.	CENTERLINE COORDINATES INLET END NORTH	INLET END EAST	OUTLET END NORTH	OUTLET END EAST	LENGTH	INLET ELEVATION	OUTLET ELEVATION	END TYPE	PIPE DIAMETER	NUMBER OF BARRELS	PIPE MATERIAL
C-15	77440.6	58931.1	77442.2	58831.4	100.2	83.97	83.39	PROJECTING	24"	3	RCP CLASS V
C-17	77650.95	58868.0	78031.1	58968.2	32.29	81.76	81.26	PROJECTING	24"	2	RCP CLASS V
C-8	77972.52	59080.25	78009.8	59428.4	113.2	78.26	78.26	PROJECTING	18"	3	RCP CLASS V
C-10	78018.1	57579.3	78018.7	57918.6	80.4	82.35	82.13	PROJECTING	24"	8	RCP CLASS V
C-11	77916.0	56743.5	77916.0	56688.2	55.29	83.1	81.85	PROJECTING	18"	1	RCP CLASS V

NOTES

1. SEE DWG SHEET FOR LEGEND AND DETAILS.

		JEA	JEA	BRANDY BRANCH STATION	97990-DS-S3010 A
				BUILDING & GROUNDS-SITE PREPARATION GRADING AND DRAINAGE-SECTIONS & DETAILS	FIG 3.8-2

The permanent erosion and sediment control system will be installed as early as possible during construction and will remain in service throughout the life of the project. The primary components of this system will be established vegetation, surfacing, grassed and concrete lined ditches, culverts, and trenches which will collect the site runoff and direct it to the site storm water pond. The system will be maintained and monitored during construction and operation. Surface water monitoring during construction and operation are described in Subsections 4.2.2 and 5.3.5, respectively.

The drainage system will require periodic inspection, maintenance, cleaning, and occasional repair work. Inspection will be completed on a seasonal basis and after any severe rainfall event. The condition of the ditches, culverts, and weirs will be noted. Cleaning or repair of the drainage structures will be completed as required.

3.8.6 Potentially Contaminated Areas

Flows originating from potentially contaminated areas, and any storm water runoff generated in these areas, are not collected in the MSSW system. These flows, which include miscellaneous plant drains and drainage from oil containment areas, are routed through an oil/water separator for treatment.

After passing through the separator, these flows are routed to an onsite percolation pond. Operation of the percolation pond is discussed in Section 5.3, Impacts on Water Supplies.

The following potentially contaminated areas will be added with the construction of the combined cycle unit:

- Steam Turbine Step-up Transformer Oil Catch Basin.
- Lube Oil Tanks.
- Circulating Water Acid Tank.
- Circulating Water Hypochlorite Tank.

The lube oil tanks, oil-filled transformers, and the associated piping will be constructed with a curbed secondary containment area sized to contain the volume of oil and fire water with a freeboard in accordance with EPA regulations. The discharge drain from the oil containment areas will be routed to the existing oil/water separator.

No new fuel oil storage tanks will be added at the Generating Station for the expansion.

The existing fuel oil storage tanks, lube oil secondary containment areas, and transformer secondary containment areas are designed such that all of the rainwater is collected and sent to the oil/water separator for treatment. The discharge pipe from each containment area and the fuel oil unloading area are tied together and routed to the oil/water separator by gravity.

The oil/water separator is provided for separation of any oil and grease from contaminated wastewaters. Treated separator effluent (water) will be discharged to an onsite percolation pond prior to ground water discharge. Collected oil will be periodically pumped from the separator and disposed offsite by a licensed waste management contractor. The discharge from the separator will be low in the structure to allow the water to underflow while the oil is retained for later removal. The separator is sized to contain the volume of oil produced by the total failure of the single largest source served by the separator, with the exception of the valved fuel oil storage tank containment area.

The valve on the fuel oil storage tank containment area will normally be in the closed position. After visual inspection of the runoff within the containment area, the valve will be opened to drain collected runoff to the oil/water separator.

Runoff collected in the circulating water acid and sodium hypochloride storage tank containment areas will be contained locally. If contaminated by leakage, the wastewater will be disposed offsite by a licensed contractor. Otherwise, containment drains will be pumped into the cooling tower basin.

3.9 Construction Materials and Equipment Handling

The major components associated with conversion of the Generating Station to combined cycle include the following:

- Two Heat Recovery Steam Generators (HRSGs).
- Generator Step-up Transformer.
- Cooling Tower.
- Steam Turbine and Generator.
- Steam Turbine Generator Building.
- Piperack Between the HRSGs and the Steam Turbine Generator Building.

The major components and all other required equipment and materials will be delivered to the Generating Station by truck. All deliveries associated with construction and operation will utilize the existing plant access road that connects the Generating Station to US Route 90/SR 10. All deliveries will be cleared through the Control Room or a temporary guardhouse located near the main gate. Once onsite, construction materials will be directed to the construction lay-down area or its permanent location for off-loading and transport by portable cranes, fork lifts, and trucks.

3.10 Drainage Calculations

The methods and calculations used to determine runoff rates, storm water detention and size, and site storm water drainage facilities are included in Appendix 10.12.

4.0 Effects of Site Preparation, and Plant and Associated Facilities Construction

4.1 Land Impact

The ultimate power block development area was delineated during the permitting of simple cycle Units 1, 2, and 3. The area for a future fourth combustion turbine was prepared during the initial site development. Construction of the Brandy Branch Generating Station expansion will occur almost entirely within the previously developed area. Approximately 2 additional acres will be impacted during construction of the conversion project for the cooling tower.

4.1.1 General Construction Impacts

The Brandy Branch Generating Stationsite includes a total of 153 acres of which 43 acres has already been permitted for power production. The expansion and associated facilities will impact an additional 2.5 acres not currently permitted. Construction due to the expansion will permanently alter additional lands on the site to an industrial use for the life of the facility.

The area proposed for development is, for the most part, the construction equipment/materials lay-down area that was used during construction of simple cycle Units 1, 2, and 3 (the fourth combustion turbine location) and the area required for the cooling tower. This 2.5 acre area being added for the cooling tower is wooded (pine forest). The construction equipment/materials lay-down area for the expansion will be identified by the contractor and will not alter additional areas within the Brandy Branch site proper. Facility locations are shown on Figure 2.1-3 in Section 2.0.

No paved roads will be required for construction access. Unimproved trails are available in the construction area such that new roads will not be needed for Generating Station construction area access. No railroad spur will be required. The CSX Railroad operates a track parallel to the US 90 that could potentially be used for heavy equipment deliveries.

Construction of the expansion facilities will modify the existing terrain to a minimal extent. The cooling tower area will be cleared and grubbed, and will be raised to a finished grade elevation of 87 feet National Geodetic Vertical Datum (NVGD). No explosives will be used during construction.

Construction materials, such as concrete, steel, and aggregate, will be delivered to the site by trucks.

Waste oils, grease, hydraulic fluids, construction wastes, and garbage will be collected, stored, and removed appropriately from the Generating Station for disposal at a

properly licensed landfill or resource recovery facility by the general services contractor or individual construction contractors. Such activities will be supervised and controlled by the construction manager.

Vegetative matter removed during site clearing will be burned onsite after receiving the proper authorizations from Duval County. Some trees may be removed from the proposed lay-down area, but this area will not require total clearing.

4.1.2 Roads

No new roads connecting to state roads will be required for the expansion of the Generating Station. Therefore, the "Utility Accommodation Guide" assessment is not required.

The existing paved plant loop road will be slightly changed by the conversion project. The plant loop road will now have an extension out to the cooling tower area for truck access to the chemical tanks and maintenance access for the cooling tower. The plant loop road layout is shown on Figure 2.1-3 in Section 2.0.

4.1.3 Flood Zones

The plant site is not located in a 100 year flood zone.

4.1.4 Topography and Soils

As described in Subsection 4.1.1 above, the proposed construction area is, for the most part, the construction lay-down area used during construction of simple cycle Units 1, 2, and 3 and the area to be added for the cooling tower. The area being added for the cooling tower is relatively flat and wooded. The soils in both of these areas are generally sandy.

The cooling tower area will be cleared, grubbed and raised to El. 87 feet. Clean fill material will be used to raise the cooling tower site elevation.

4.2 Impact on Surface Water Bodies and Uses

Brandy Branch Creek is offsite, approximately 2,000 feet east of the power block area at its nearest point. Onsite existing wetlands and site storm water management facilities buffer this surface water from the power block area. No impacts to Brandy Branch creek are expected.

4.2.1 Impact Assessment

Construction of the combined cycle unit will have no significant impact on the existing wetlands around the site. The erosion and sedimentation control measures and site storm water management facilities will control and minimize such impacts beyond

the construction zone. The storm water pond and drainage ditches used to drain the existing site will serve as the conversion project construction drainage system, providing both quality and quantity treatment of storm waters through detention. Treated water will discharge from the pond into the existing wetlands east of the storm water pond.

4.2.2 Measuring and Monitoring Programs

No additions or changes to the existing measuring and monitoring programs as required by Environmental Resource Permit No. 16-156348-003-ES. Refer to Appendix 10.3 for existing state permits.

4.3 Ground Water Impacts

4.3.1 Impact Assessment

During construction of the conversion project, a few new facilities will be constructed below the surface of the upper unconfined ground water system in the power block area. It will be necessary to dewater the excavation for construction of these new facilities. The location of these facilities is shown on Figure 2.1-3.

The majority of the underground utilities, miscellaneous pits, and sumps will be constructed above the ground water surface and will have no impact on the ground water at the site. However, the circulating water lines, the cooling tower pump pits, and the steam turbine generator foundation will be below the surface of the upper unconfined ground water system and will also need to be dewatered.

Dewatering for these facilities will be completed with a series of wellpoints installed around the perimeter of the excavation. The dewatering activity duration will be short term, less than 120 days, with total withdrawal volumes of less than 1 million gpd. Discharge from the dewatering activities will be directed to the storm water pond

The dewatering effects will be temporary and limited to the power block area. The ground water system will return to its original state after completion of the dewatering.

4.3.2 Measuring and Monitoring Program

Exemption from ground water monitoring was granted by the FDEP on October 6, 1999. Refer to Appendix 10.3, Industrial Wastewater Permit Exemption.

4.4 Ecological Impacts

Site preparation and construction of the combined cycle facilities will have a minimal impact on upland and wetland habitats, and resident wildlife. The location of the combined cycle facilities is where a fourth simple cycle combustion turbine would have been placed. This area was cleared and prepared for development during the

construction of the existing facilities. However, the 2.5 acre area required for the cooling tower will be cleared and prepared for cooling tower placement. Table 4.4-1 lists resource agencies involved in the ecological aspects of the Generating Station and permits issued by each for the existing facilities.

Table 4.4-1
Resource Agencies and Permits for Ecological Impacts

Agency	Permit Name	Permit Number
Duval County	PUD Zoning	1999-803-E
Florida Department of Environmental Protection	Environmental Resource Permits Access Road Main Site	ERP #16-156348-002-EI (main site) ERP #16-1563-348-001-EI (access road)
Florida Fish and Wildlife Conservation Commission	Protected Species Compliance	NA (issued through ERPs)
United States Army Corps of Engineers	Section 404 Dredge and Fill (Wetlands) Permit	199902804 (IP-MMS)
United States Fish and Wildlife Service	Endangered Species Act Compliance	NA (issued through 404 Permit)

4.4.1 Impact Assessment

Construction of the existing Brandy Branch facility resulted in the clearing and development of approximately 43 acres for the main site and access road. Only an additional 2.5 acres of upland forest clearing will be required for new facilities (cooling tower) associated with construction of the combined cycle facility. Wildlife species may be temporarily displaced from adjacent communities by the noise, fugitive dust, and other activities caused by the construction. No federal or state protected species are known or expected to occur in the immediate Project vicinity or the additional clearing area.

Construction activities for the simple cycle facility resulted in permanent impacts to 2.2 acres of forested wetlands, including 1.6 acre of cypress dome and 0.6 acre of disturbed cypress wetland. Mitigation for those impacts was approved under ERP No. 16-156348-002-EI and resulted in the creation of 5.8 acres of forested and herbaceous wetland. In addition, approximately 11,880 ft^2 (0.27 acre) of an existing elevated patrol road within the power line right-of-way was removed to restore herbaceous wetland areas. This activity reestablished an ecological connection to a larger wetland system to the east.

4.4.2 Measuring and Monitoring Programs

As part of the mitigation required for the simple cycle facility, created wetland monitoring and management is required by the United States Army Corps of Engineers and Florida agencies under the Section 404 Dredge and Fill Permit and Environmental Resource Permit, respectively, in compliance with the *Brandy Branch Generating Station Wetland Mitigation Plan* (refer to Appendix 10.3) prepared for these permits. Monitoring the development of the wetland construction and enhancement efforts to demonstrate the progress and success was initiated upon completion of the wetland construction. Monitoring activities will occur annually in late summer or early fall for a period of 5 years unless the wetland is determined to be successful earlier. Monitoring reports will be submitted annually in the fourth quarter to appropriate federal and state agencies and other interested parties.

The 5 year monitoring activities will examine the diversity and percent ground cover of herbaceous species present in the wetlands (annual), the survivorship and growth rates of tree plantings (annual), and track local surface water levels (monthly). Throughout the process, the presence of undesirable exotic vegetation will be monitored and, if necessary, controlled by agency approved methods. Photographic documentation will be made of sampling plots and area appearance throughout the monitoring study. The *Wetland Mitigation Plan* has established success goals based on the mentioned criteria that must be met in order for the agencies to declare the mitigation successful. No additional wetlands impact will occur from the construction of the combined cycle facility; therefore, no additional mitigation or monitoring programs or efforts are proposed.

4.5 Air Impacts

During the construction phase, atmospheric dust (particulate matter) will be generated from the mechanical disturbance of granular material that becomes exposed to the wind at the constructionsite. The particulate matter dust is often referred to as fugitive dust, as its source is particulate matter that cannot be reasonably discharged to the atmosphere in a confined flow stream. Fugitive dust generated during construction will be controlled in accordance with FDEP Rule 62-296.320(4)(c).

4.5.1 Sources of Construction Fugitive Dust

Construction activities, including material moving activities, site preparation, and vehicle traffic, if not properly monitored and controlled, have the potential to generate large amounts of fugitive dust. The construction activities at the Generating Stationsite may be generally broken down into three phases as related to generating fugitive dust.

Phase 1 - Debris Removal

Debris removal consists of removing any manmade or natural obstructions from the site. Only clearing and grubbing are anticipated in the new cooling tower area.

Phase 2 - Site Preparation

Site development includes the general site grading and soil stabilization techniques used to bring the site to a final or near final grade. These techniques will typically include cut and fill as well as aggregate surfacing operations. Typical fugitive dust emission sources of this phase include movement of large earth moving equipment (e.g., scrapers and dozers) over disturbed surfaces, material/aggregate loading and unloading, and vehicular travel on unpaved surfaces.

Phase 3 - General Construction

The construction phase is the final, but generally the longest, phase of the construction activities. This phase includes everything from foundation work, structural and reinforcing steel erection, exterior/interior operations, to piping/electrical work and final landscaping. In contrast to Phases 1 and 2, fugitive dust emissions during Phase 3 are somewhat sporadic in nature, depending on the delivery schedule of parts and materials, with many simultaneous operations throughout the constructionsite.

Within each of the major construction phases described above, there may be one or more specific construction activities occurring during that phase that can be a source(s) of fugitive dust. The fugitive dust emission sources resulting from these construction activities are typically assigned into one of four categories which include: disturbed surface areas, open storage piles, earth moving, and vehicular traffic. The following sections describe each of these fugitive dust emission sources.

4.5.1.1 Disturbed Surface Areas. Many of the construction activities will result in disturbed surface areas in the Generating Station area, which may be subject to wind erosion. A disturbed surface refers to a portion of the earth's surface which has been physically moved, uncovered, destabilized, or otherwise modified from its undisturbed natural soil condition, thereby increasing the potential for emissions of fugitive dust. Disturbed surfaces do not include those areas which have been restored to a natural state such that the vegetative ground cover is similar to any adjacent natural conditions, or which have been paved or covered by a permanent structure.

4.5.1.2 Storage Piles. A storage pile is any accumulation of bulk material, generally with a 5 percent or greater silt content, that is not fully enclosed or otherwise covered or chemically stabilized. The storage pile may be composed of soil, stored temporarily during cut and fill operations, or may be composed of aggregate used in foundation work

and construction materials. Storage piles of this nature are typically left uncovered because of the frequent need to transfer material into and out of storage.

Fugitive dust emissions may occur at several points in the storage pile cycle, including material loading or unloading (material handling), and dust entrainment in wind currents on the exposed slopes of the storage pile.

4.5.1.3 Earth Moving. Earth moving refers to a broad range of construction activities using heavy equipment to clear land, excavate, cut and fill, etc. The activities may directly expose material to wind erosion through excavation, scraping, hauling, loading, transferring, and other material moving activities.

4.5.1.4 Vehicular Traffic. Vehicular traffic associated with the construction activities will include worker vehicles, equipment deliveries, and heavy construction vehicle traffic over unpaved surfaces. When a vehicle travels on an unpaved surface, the force of the wheels on the surface causes the material on the road to become lifted, dropped, and then entrained into the turbulent air currents caused by the velocity of the vehicle. As such, the vehicle's speed and size, silt content of the road surface, and material moisture content all play a role in determining the magnitude of the fugitive dust emissions from unpaved roads.

4.5.2 Available Control Methods

Fugitive dust emissions may result from a variety of activities that may require a multitude of different emission control alternatives. Additionally, the relatively short-term nature of construction activities make some fugitive dust control methods more cost effective and practical than others. Tables 4.5-1 through 4.5-4 describe several available fugitive dust control methods and practices associated with disturbed surfaces, storage piles, earth moving, and vehicular traffic that may be employed to control fugitive dust during construction. The available control methods identified in each table are summarized in the following subsections. The control methods ultimately used will be agreed upon by the Contractor and Construction Manager.

4.5.2.1 Watering. Watering is an effective stabilizing tool that controls fugitive dust by using water (or water combined with a surfactant) as a binder by either maintaining soil moisture content or establishing a crust which prevents soil movement under windy conditions. The water can be applied by any suitable means such as trucks, hoses, and/or sprinklers appropriate for site characteristics and size. Watering is most effective when an area or road surface is prewatered, with frequent reapplication as necessary.

Table 4.5-1
Available Fugitive Dust Control Methods for Disturbed Surface Areas

Control Method	Description/Remarks
Work Practice Controls	Paving identified roads and access points early in the construction process, phasing of earth moving activities to reduce disturbed surface extent, compaction and/or stabilization of disturbed surfaces as quickly as practical. Onsite traffic control program to direct, control, and restrict unnecessary traffic.
Watering	Use of water or water plus a wetting agent to suppress fugitive dust over disturbed areas. Typically applied with spray nozzles attached to a special truck adapted for this purpose. Temporary in nature, but cost-effective even with frequent reapplication.
Graveling	Graveling of high volume traffic areas within the disturbed area of the constructionsite provides a physical stabilization of the exposed surface and covers the surface with a material having a lower silt content.
Wind Fencing	Wind fencing provides a sheltered region behind the fence line which reduces the mechanical turbulence generated by the ambient winds. The sheltered area of dust control is proportional to the physical height of the fence around the disturbed surface.
Physical Stabilization	Physical stabilization methods involve the application of materials such as rock, bark, wood chips, straw, or other suitable materials to cover the exposed surface, thus preventing the wind from disturbing the surface particles. Graveling is one example of physical stabilization.
Vegetative Stabilization	Vegetative cover provides a physical stabilization and wind shelter of the disturbed surface. However, it is effective only on inactive areas of the disturbed surfaces where frequent mechanical (i.e., earth moving) activities are not anticipated. As such, it is typically not implemented during short-term construction activities.
Chemical Stabilization	Chemical stabilization is a dust suppressant method that uses binding agents that, upon application, bind the surface particles to form a protective crust over the disturbed surface. Typically, the temporary nature of construction activities do not warrant their use as they are not cost-effective over such a small scale of application and reapplication.

Table 4.5-2
Available Fugitive Dust Control Methods for Storage Piles

Control Method	Description/Remarks
Work Practice Controls	Minimize temporary material storage pile(s) size and number by utilizing phased earth moving activities. Minimized drop height when adding material to the pile(s), and perform loading and unloading operations on the leeward (down wind) side of the pile. Cleanup spillage and maintain material to the confines of the pile.
Watering	Use of water or water plus a wetting agent to suppress fugitive dust from the storage pile. Temporary in nature, but cost-effective even with frequent reapplication.
Wind Fencing/ Barriers	Wind fencing or partial temporary barriers or enclosures provides a sheltered region in the vicinity of the storage pile which reduces the mechanical turbulence generated by the ambient winds. The sheltered area of dust control is proportional to the physical height of the fence or barrier.
Chemical Stabilization	Chemical stabilization is a dust suppressant method that uses binding agents that, upon application, bind the surface particles to form a protective crust over the disturbed surface. Typically, the temporary nature of construction activities do not warrant their use as they are not cost-effective over such a small scale of application and reapplication.

Table 4.5-3
Available Fugitive Dust Control Methods for Earth Moving

Control Method	Description/Remarks
Work Practice Controls	Onsite traffic control program to direct, control speed, and restrict unnecessary traffic. Reduce offsite hauling with balanced cut and fill operations and construction management. Cover truck beds during material hauling operations.
Watering	Preapplication of water or water plus a wetting agent to suppress fugitive dust prior to, and to the extent possible, during earth moving operations. Temporary in nature, but cost-effective even with frequent reapplication.
Wheel Washing	Water washing of heavy construction equipment wheels and undercarriages at constructionsite egress points to prevent material trackout and deposition outside of the constructionsite. System may include automatic or manual sprayers, and/or drive-through wheel washing basins.
Wind Fencing/ Barriers	Wind fencing or partial temporary barriers or enclosures provides a sheltered region in the vicinity of the storage pile which reduces the mechanical turbulence generated by the ambient winds. The sheltered area of dust control is proportional to the physical height of the fence or barrier.
Chemical Stabilization	Chemical stabilization is a dust suppressant method that uses binding agents that, upon application, bind the surface particles to form a protective crust over the disturbed surface. Typically, the temporary nature of construction activities do not warrant their use as they are not cost-effective over such a small scale of application and reapplication.

Table 4.5-4
Available Fugitive Dust Control Methods for Vehicular Traffic

Control Method	Description/Remarks
Work Practice Controls	Onsite traffic control program to direct, control speed, and restrict unnecessary traffic. Reduce offsite hauling with balanced cut and fill operations and construction management. Cover truck beds during material hauling operations.
Watering	UNPAVED ROADS Application of water or water plus a wetting agent to suppress fugitive dust prior to, and to the extent possible, during earth moving operations. Temporary in nature, but cost-effective even with frequent reapplication.
Graveling	Graveling of high volume unpaved traffic areas provides a physical stabilization of the exposed surface and covers the surface with a material having a lower silt content.
Chemical Stabilization	Chemical stabilization is a dust suppressant method that uses binding agents that, upon application, bind the surface particles to form a protective crust over the disturbed surface. Typically, the temporary nature of construction activities do not warrant their use as they are not cost-effective over such a small scale of application and reapplication.

4.5.2.2 Chemical Stabilizers. Chemical stabilizers are commercially available and contain approved chemical soil binding agents to artificially crust soil and prevent soil movement during windy conditions. Stabilizers are effective for temporary periods. Depending on the application rates and/or materials involved, stabilizer use may extend the durability and longevity of the artificial soil crust for longer periods. As such, stabilizers are best suited for areas not subject to daily disturbance.

4.5.2.3 Physical Barriers. Physical barriers provide a sheltered region behind the barrier to allow gravitational settling of larger fugitive dust particles, as well as a reduction in the wind's erosion potential. Physical barriers reduce the mechanical turbulence generated by the ambient winds for a downwind distance proportional to the height of the barrier and porosity. Physical barriers include portable wind screens and fences, partial enclosures, hay/straw bales, tree lines, and terraces for example. Wind screens and fences can be used to control a wide variety of fugitive dust sources at a constructionsite, including disturbed areas, storage piles, and providing shelter for material handing operations such as storage pile loading or unloading. Furthermore, fences and screens are portable and thus capable of being relocated around the constructionsite as necessary.

4.5.2.4 Vegetative Stabilization. Vegetative stabilization uses established cover or locally recommended varieties and seeding rates that approximate native cover to stabilize soil against wind erosion and emission of fugitive dust. Either temporary or permanent cover can be established using standard agricultural methods, hydroseeding, or hand seeding. Temporary cover for areas that will be disturbed again after a short period is best established by using rapidly emerging varieties of vegetation with rapid initial growth. Maintenance of the original vegetative cover and opportunistic vegetation such as weeds and native species are also options, but may require some watering to establish.

Vegetative stabilization as a fugitive dust control method is most effective only on inactive areas of the disturbed surfaces where frequent mechanical (i.e., earth moving) activities are not anticipated. As such, it is typically not implemented on a large scale for control of fugitive dust emissions during short-term construction activities.

4.5.2.5 Work Practice Controls. There are a number of work practice controls that can be applied to reduce the fugitive dust emissions during construction activities. These work practices include both active and preventive fugitive dust control methods which are typically integrated into a comprehensive construction management plan. The following list contains several common work practice activities that may be applied to reduce fugitive dust emissions during construction:

- Pave designated roads, construction parking areas, and site access points early on in the construction project.
- Compact or stabilize disturbed areas as quickly as practical.

- Phase earth moving activities to reduce disturbed surface extent.
- Maintain original vegetative ground cover as long as practical.
- Establish a traffic control plan to decrease disturbance of soil and fugitive dust generated from unnecessary vehicle traffic by posting speed limit signs (generally less than 10 mph), erecting fencing and/or placing barriers to direct traffic, designating specific haul and/or access roads, designating offsite or limited access onsite parking for construction workers, and limiting public vehicle access.
- Reduce offsite hauling via balanced cut and fill operations.

4.5.2.6 Physical Stabilization. Physical stabilization methods, which involve covering a disturbed surface with a material that prevents the wind from entraining the surface particles, may be used during many phases of the construction project. Common physical stabilizing materials include rock, gravel, crushed or granulated slag, bark, wood chips, straw, or hay that are harrowed into the top few inches of the disturbed surface.

4.6 Impact on Human Populations

4.6.1 Project Location and Description of Nearby Housing

The Brandy Branch Generating Station is near the City of Baldwin. Baldwin is west of Jacksonville on Highway 301, a short distance north of Interstate 10. The plant site is 1 mile north of Highway 90 and east of Baldwin. Only 45 acres of the 153 acres owned by JEA will be used for generating purposes. The site is accessed by a road leading north from US 90 to the south end of the property. Baldwin is a small town in a rural area of Jacksonville/Duval County and is about 1 mile west of the Project site. The town is 1 mile square and is located at the intersection of US 301 and US 90. Within the town limits, there are approximately 1,600 residents that reside in about 650 dwelling units. The majority of the dwelling units are single-family residential. There are approximately 90 mobile homes in the town. Half of the mobile homes are located in parks, and the remaining are on large lots in the town. There are 104 multi-family dwelling units in three apartment complexes in the town, all for low-income persons. There are four historically significant structures in the town. They are located south of US 90 and north and west of the railroad tracks, specifically at the following:

- 150 South Center Street
- 153 South Center Street
- 10 Chestnut Street
- 83 US Highway 90

The surrounding areas of the Project site are unpopulated rural areas with some commercial and industrial development. AmeriSteel is located southeast of the Project site. Winn-Dixie Warehouse and Distribution Center is on the south side of US 90, and commercial development related to the interstate is at the Interstate 10 and US 301 interchange.

4.6.2 Project Workforce

The construction project is anticipated to employ, at peak, approximately 385 construction workers. The entire construction phase is expected to last approximately 23 months.

JEA plans to staff the plant with six employees after the three simple cycle units are in operation. When converted to the combined cycle operation, JEA will staff the plant around the clock with a total of 24 operations staff. JEA has no plans to increase the total JEA production staffing levels. The additional people will come from within the existing JEA workforce.

4.6.3 Effects of Construction on Local Human Population

Large scale construction projects have the potential to affect many people over a wide geographic area. However, the proposed conversion of two Brandy Branch combustion turbines to a combined cycle project is not expected to produce any significant negative impacts on the local population due to the remote and isolated area in which the Project is located.

4.6.3.1 Impacts on Local Housing. The Generating Station is not expected to have any negative impacts on the availability of housing stock in the impact area. Due to the large number of construction workers in the Project impact area, and the multiple highway access routes to the Project site, it is anticipated that the vast majority of workers for the construction phase will commute daily from their established residences. These workers will, therefore, have no effect on housing patterns. Of the remaining workers, most are expected to commute weekly from more distant residences, traveling without their families and spending nights in temporary housing such as recreational vehicle campgrounds or hotel rooms. Studies have indicated that construction workers often commute in this fashion since the temporary nature of the positions do not make it economically feasible for complete relocation.

As previously mentioned, a large number of hotel rooms, apartments, and recreational vehicle campgrounds are available throughout the impact area.

It is possible that a few construction workers will decide to relocate into the Project impact area. However, the number of these workers is not expected to be large enough to overwhelm the existing available housing stock. Not only does sufficient housing stock already exist, but the high growth history of the Project impact area has already led builders and developers to plan for and begin new housing facilities.

4.6.3.2 Impacts on Educational Opportunities. Since the majority of workers are expected to either commute daily from their established residences within the impact area or commute weekly without their families, there are no anticipated impacts on opportunities for any level of education.

4.6.4 Noise

The nearest residences are located approximately 3/4 mile from the construction site. Based on the relatively distant proximity of the nearest residences and the anticipated construction noise emissions, noise impacts associated with construction activities of the Brandy Branch Generating Station are expected to comply with the criteria put forth in Rule 4 – Noise Pollution Control, of the Jacksonville Environmental Protection Board.

4.7 Impact on Landmarks and Sensitive Areas

According to the Historic Preservation Program section of the Planning and Development Department of Jacksonville, no known landmarks or scenic areas will be affected by the proposed Project.

4.8 Impact on Archaeological and Historic Sites

A Phase I cultural resources investigation was not required for development of the property. The Project received a letter dated March 24, 1999, from the Florida Department of State Division of Historical Resources indicating that no significant archaeological or historical sites are recorded for or likely to be present within the Project area. Therefore, construction of the combined cycle unit is not expected to impact any known or recorded archaeological or historic resources. If any such resources are discovered during construction, work in that area will stop, and the Division of Historical Resources will be contacted within 24 hours for an appropriate plan of action.

4.9 Special Features

Construction debris, trash, and garbage will be collected in appropriate containers and removed from the site by a contractor for disposal at an approved landfill or resource recovery facility.

4.10 Benefits from Construction

The benefits associated with the conversion of the Brandy Branch Generating Station will include increased employment for regional workers. Attendant to this employment will be the benefits of increased sales tax revenue for Duval County and the City of Jacksonville.

Increased income due to economic activity will also accrue to the region. Among these benefits are the increased revenue that will be enjoyed by the owners/operators of temporary housing facilities in the area. Although most of the construction employees are expected to commute daily from their established, permanent residences within the impact areas, some workers will be traveling into the impact areas from more distant residences. Even though Electric Power Research Institute (EPRI) studies have indicated that these workers travel without their families, their individual housing needs will have to be satisfied. They will predictably patronize the hotels and recreational vehicle campgrounds that already exist in the area. Although this theoretically could cause a shortage of short-term housing, this situation is more optimistically interpreted as meaning that the owners of short-term housing will enjoy an increase in business. Realistically, a shortage of short-term housing is not anticipated since the area has a large amount of short-term housing capacity.

A detailed and comprehensive analysis of the benefits created by the site preparation, plant construction, and operation of the proposed Brandy Branch conversion is contained in Section 7.0 of this application.

4.11 Variances

No variances from applicable codes or standards are requested for or during construction of the Generating Station conversion project.

5.0 Effects of Plant Operation

5.1 Effects of the Operation of the Heat Dissipation System

The Brandy Branch Generating Station will use a mechanical draft cooling tower as the major heat dissipation/cooling method. Well water from onsite wells will be used as cooling tower makeup water. Cooling tower blowdown and appropriate process wastewater will be directed to the wastewater pumps that pump plant wastewater to the Baldwin Force Main, as described herein.

5.1.1 Temperature Effect on Receiving Body of Water

Cooling towers are used to dissipate heat produced during power generation. There will be no discharge of cooling waters from the heat dissipation system to surface waters. Blowdown from the heat dissipation system is discharged to the Baldwin Force Main. Temperature of effluent from the Brandy Branch plant is not anticipated to affect the JEA sewage treatment system.

5.1.2 Effect on Aquatic Life

There will be no discharge of effluent from the site into surface waters; therefore, no impacts to aquatic life are expected.

5.1.3 Biological Effects of Modified Circulation

The combined cycle unit will use ground water for cooling and service water. Since modified circulation of a water body will not occur, there will be no biological effects.

5.1.4 Effects of Offstream Cooling

The purpose of this section is to assess the potential environmental impacts associated with the operation of the cooling tower at the Generating Station. Potential impacts from the cooling tower include plume induced fogging and icing, deposition from circulating water drift, and visible plume formation. The following subsections describe the cooling tower at the Generating Station, explain the methodology and assumptions used to quantify the magnitude and extent of the impacts, present the results of the modeling, and discuss the potential environmental effects.

5.1.4.1 Cooling Tower Description. The conversion project at the Generating Station will necessitate the construction and operation of a new cooling tower. The proposed new cooling tower will be a linear mechanical draft (LMDCT), cross flow, wet

design cooling tower, incorporating plume abatement features. The current design consists of 10 cells in one housing arranged along a northeast-southwest axis.

5.1.4.2 Technical Approach. A computer modeling analysis was performed to evaluate the magnitude and extent of the potential environmental impacts resulting from the operation of the cooling tower at the Generating Station. The Electric Power Research Institute (EPRI)-sponsored Seasonal/Annual Cooling Tower Plume Impact (SACTI, Version 1.0 12/93) model was used to quantify the cooling tower impacts. This computer code is an outgrowth of an earlier model evaluation study carried out by A. J. Policastro of the Argonne National Laboratory (ANL). Improved plume and drift models in the code have been calibrated with existing field and laboratory data and then subsequently verified with new data not included in the calibration process. The SACTI model has been widely used by electric utilities and their consultants to assess cooling tower plume impacts for incorporation into various types of environmental impact studies.

The methodology used in the SACTI model is based on the assumption that up to 35 distinct plume categories, based on the local ambient meteorological conditions and cooling tower design characteristics, can be identified at any given site. For mechanical draft cooling tower designs, the SACTI code assumes that 10 additional distinct plume categories may exist which are characteristic of plume induced ground level fogging and icing. In other words, depending on the type of cooling tower and the specific site conditions, a cooling tower plume may exhibit up to 45 distinctly different sets of plume characteristics (e.g., plume height, plume spread, plume downwash, and plume dispersion). In the case of mechanical draft cooling tower arrangements, the effects of the orientation of the tower with respect to merging cell plumes and structure induced downwash are simulated through the use of representative wind directions and the specific tower configuration.

The cooling tower plume in each of the aforementioned categories is produced by a different set of ambient meteorological conditions. Hourly meteorological data are used by the SACTI model to compute frequency distributions of the meteorological conditions responsible for each plume type within the assumed plume category. The SACTI model performs the following computational functions in a sequential manner to determine the representative plume categories and plume impacts.

Meteorological Data Preprocessor

The meteorological data preprocessor performs three subtasks to delineate plume categories and calculate representative parameters for each category. In the first subtask, hourly surface meteorological data are read, and invalid or missing parameters and hours

are discarded. For each valid record, the model uses cooling tower parameters such as tower height, tower effective exit diameter, tower effective heat rejection, and tower effective air flow to calculate additional exit parameters, including temperature and velocity, and some nondimensional parameters which characterize the buoyancy of the plume and the stability and saturation of the ambient air.

The second subtask generates frequency distribution tables for ranges of tower, meteorological, and nondimensional parameters as a function of the standard 16 wind directions. These meteorological variables represent the full range of atmospheric conditions affecting plume dispersion and drift deposition. For example, the SACTI model selects temperature ranges from -49° F to 113° F in 9° F intervals. The frequency of actual dry-bulb temperatures occurring in each of those ranges for each of the standard 16 wind directions is tabulated. Likewise, the model tabulates relative humidity values falling between 0 and 100 percent in intervals of 10 percent.

Subtask 3 uses the frequency distributions from Subtask 2 to delineate the distinctly different plume categories that could occur from cooling tower operation. Categories are selected so that all categories are roughly equally populated. A single set of representative tower and ambient conditions is then calculated from the range of conditions in each category, and then reassigned to each category.

Plume Calculations

Using the preprocessor's representative conditions and cooling tower design data (e.g., tower orientation, number of cells, drift droplet spectrum, and salt concentrations), the plume code calculates fogging/icing and the plume's dimensions and depositional characteristics for each plume category and each representative wind direction. For example, assuming 45 total drift and fogging categories and 4 representative wind directions, a total of 180 plume cases are simulated.

As previously stated, the representative wind directions are used to simulate tower-induced downwash. Therefore, specific output showing the nature and extent of the downwash is not generated by the program. Rather, output is generated for each representative wind direction, and the downwash effects can be inferred from the deposition/fogging/icing gradients.

Impact Calculations

The various plume code prediction results are used in conjunction with the meteorological data preprocessor's frequency distribution of plume categories and actual wind directions to calculate impacts. The resulting cumulative impacts from all plume

categories are tabularized and plotted in the SACTI model output as a function of wind direction and distance from the cooling tower.

5.1.4.2.1 Cooling tower plume model input. The SACTI cooling tower model requires as input certain site-specific, tower-specific, and circulating water-specific data. Input data used in the SACTI cooling tower model are discussed below and summarized in Table 5.1-1 with the documented source of the data:

- Site-specific data includes the site's latitude and longitude, time zone, surface roughness height, monthly clearness indices, daily solar isolation values, representative hourly recorded surface meteorological data, and average morning and afternoon mixing heights.
- Tower-specific data includes information pertaining to the type of cooling tower, dimensions of the tower housing, cell exhaust diameter, heat load, drift rate, design air flow rate, and orientation of the cooling tower cells with respect to the 16 representative wind directions.
- Water-specific data includes the circulating water salt concentration, salt density, and the size distribution of the water droplets in the cooling tower drift.

The Generating Station latitude, longitude, time zone, and surface roughness height were either directly measured or estimated. The monthly clearness indices and solar isolation values were obtained from Appendix B of the User's Manual for the SACTI Computer Code for a representative location at approximately the same latitude (EPRI 1984).

Six years (1990-1995) of surface meteorological data from Jacksonville, Florida, collected by the National Weather Service (NWS) and compiled by the National Climatic Data Center (NCDC) into a database of hourly United States weather observations were used in the SACTI modeling analysis. These data were converted into the appropriate format (TD-1440 format) and contained the required set of surface meteorological parameters necessary to conduct the cooling tower modeling analysis, and are considered representative of the Generating Station site.

The type of cooling tower, dimensions of the tower housing, cell exhaust diameter, heat load, drift rate, design air flow rate, and orientation of the cooling tower cells for the Generating Station were all based on data representative of a typical tower sized to reject waste heat from the proposed Generating Station's heat cycle.

The size distribution of drift droplets from the cooling tower is required as input to the SACTI model. The size distribution of drift droplets depends on the details of the interior construction, air and water flow through the fill, and the efficiency of the drift eliminators. The cooling tower drift droplet size spectrum data used in this study are

Table 5.1-1
SACTI Cooling Tower Modeling Input Parameters

Site-Specific Data		**Data Source/Notes**
Site Latitude	30.32 N	Measured
Site Longitude	81.95 E	Measured
Time Zone	-5	Measured
Surface Roughness Height	100 cm	Estimated
Monthly Clearness Indices (K_T)	0.53, 0.57, 0.57, 0.59, 0.59, 0.54, 0.55, 0.53, 0.49, 0.51, 0.52, 0.49	SACTI User's Manual
Monthly Average Daily Total Solar Flux (MJ/m^2)	11.18, 14.49, 17.71, 21.52, 23.28, 21.98, 21.86, 19.93, 16.03, 13.86, 11.47, 9.63	SACTI User's Manual
Meteorological Data (surface data)	Jacksonville, FL (90-95)	HUWSO-NCDC
Average Annual Mixing Height	444 m (morning) 1,424 m (afternoon)	SACTI User's Manual
Wind Instrument Reference Height	6.1 m (anemometer height)	NWS
Tower-Specific Data		
Tower Type	Linear Mechanical Draft	Preliminary Design
Number of Towers	1	Preliminary Design
Effective Exhaust Diameter	31.8 m	Preliminary Design
Tower Height	15.2 m	Preliminary Design
Tower Width	32.0 m	Preliminary Design
Tower Length	83.8 m	Preliminary Design
Total Heat Dissipation Rate	1,110 MBtu/h	Preliminary Design
Total Circulating Water	140,761 gpm	Preliminary Design
Total Drift Loss Rate	177 g/s	Preliminary Design, based on 0.002% drift rate.
Total Airflow Rate	4,930 kg/s	Preliminary Design
Water-Specific Data		
Cooling Tower Salt Concentration	0.00149 g Salt/g Soln	Preliminary Design
Salt Density	2.17 g/cm^3	Estimated
Drift Droplet Spectrum	Drop Size (μm) / Mass Fraction: 0-20 0.0061 20-40 0.0508 40-60 0.1077 60-80 0.1423 80-100 0.1382 100-120 0.1280 120-140 0.0976 140-160 0.0772 160-180 0.0732 180-200 0.0569 200-220 0.0447 220-240 0.0264 240-260 0.0163 260-280 0.0142 280-300 0.0102 300-320 0.0061 320-340 0.0041	Estimated, based on Hamon cooling tower drift data.

based on representative vendor data. These drift droplet size data are representative of best available technology (BAT) currently utilized in cooling tower drift eliminator design. The concentration of total dissolved solids (TDS) in the cooling tower circulating water was based on the Project area's water quality.

5.1.4.3 Cooling Tower Impact Modeling Results. The SACTI cooling tower model was used to predict the magnitude of the cooling tower induced fogging and icing, deposition, and plume length frequency of occurrence while conservatively assuming the cooling tower is operating the entire year under peak conditions. The cooling tower systems will dissipate waste heat by evaporating water and releasing the water vapor into the atmosphere. If the ambient air is cold and/or moist, a portion of the emitted water vapor will condense to form small water droplets. This condition is seen as a visible white plume emanating from the cooling tower.

Potential environmental impacts such as fogging, icing, and deposition associated with the cooling tower plumes may arise depending on the meteorological conditions and the environmental setting. The following subsections address the potential impacts mentioned above.

5.1.4.3.1 Plume fogging modeling results. Ground level fogging occurs when the visible plume from a cooling tower contacts the ground. Meteorological conditions favorable for ground level fogging from a LMDCT are generally associated with strong winds (generally greater than 20 mph) which bend the plume to intercept the ground, and high relative humidity (small dew point depression) for easy plume saturation. The cooling tower fogging results are calculated by the SACTI cooling tower model as the maximum number of hours plume induced fogging from a cooling tower could occur for each wind direction. Table 5.1-2 presents the total hours (based on the 6 year Jacksonville meteorological database) of predicted plume fogging associated with the cooling tower. The 16 wind direction labels in the columns of the table represent the direction from the cooling tower that the plume is headed. The data represent the total hours (over the 6 year data base) that the cooling tower plume could induce fogging conditions for a particular direction and distance from the cooling tower.

As the data in Table 5.1-2 indicate, the SACTI model predicts that a maximum of 14.2 hours (over the 6 year database) of plume fogging occur approximately 200 m (656 ft) southwest of the cooling tower.

5.1.4.3.2 Plume icing modeling results. Ground level plume icing (fog ice) is a semi-opaque coating of small granules of ice formed when small water droplets in the visible cooling tower fog freeze rapidly on the ground during conditions of high relative humidity and below freezing temperatures. The SACTI cooling tower model predicted no occurrences of cooling tower plume induced icing based on the 6 year Jacksonville

IMAGE QUALITY

AS YOU REVIEW THE NEXT FEW PAGES, PLEASE NOTE THAT THE ORIGINAL DOCUMENT WAS OF POOR QUALITY.

meteorological database. This is consistent with the climate of the area, as records indicate that freezing temperatures occur less than 1 percent of the year on average.

5.1.4.3.3 Water deposition modeling results. Water deposition from a cooling tower occurs when the airborne water droplets coalesce and precipitate downwind of the cooling tower. The pattern of water deposition and the distance of maximum water deposition from the cooling tower are a function of the physical size of the water droplets in the drift, prevailing wind direction, orientation of the cooling tower cells, and the airflow rate.

Table 5.1-2
Total Hours of Predicted Plume Induced Fogging

Distance From Tower (m)	Fogging in the direction Plume is Headed (Hours)																
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	Total
100	4.2	4.6	12.3	2.7	1.3	0.2	0.4	0.8	0.4	0.2	1.9	1.9	1.9	4.0	2.3	2.8	41.8
200	2.9	2.9	14.2	1.9	1.7	0.1	0.0	0.8	2.0	0.1	1.8	1.9	1.8	1.7	1.9	1.1	37.0
300	0.8	1.0	3.0	0.0	0.2	0.0	0.0	0.1	2.0	0.0	0.0	0.0	0.2	0.1	1.1	0.1	8.7
400	0.1	0.9	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	4.2
500	0.0	0.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	2.5
600	0.0	0.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	2.5
700	0.0	0.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	2.5
800	0.0	0.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	2.5
900	0.0	0.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	2.5
1000	0.0	0.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	2.5
1100	0.0	0.2	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	1.2
1200	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1300	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1400	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1500	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1600	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

*Total hours of fogging over 6 years. Average annual hours of cooling tower induced fogging is obtained by dividing the table value by 6.

Source: SACTI cooling tower model.

Table 5.1-3 presents the SACTI model predicted average monthly (based on the 6 year Jacksonville meteorological database) water deposition rate in scientific notation in units of kg/km^2/month associated with the proposed cooling tower at the Generating Station. The 16 wind direction labels in the columns of the table represent the direction from the cooling tower that the water deposition is predicted to occur.

The SACTI model predicted that the maximum cooling tower water deposition would occur approximately 300 m (984 feet) northwest of the cooling tower at a rate of 4,500 kg/km^2/month. The average water deposition at a 300 m (984 feet) radius from the cooling tower (considering all directions of plume travel) is predicted to be 1,100 kg/ km^2/month.

Table 5.1-3
Average Monthly Predicted Cooling Tower Water Deposition

Water Deposition in the Direction Plume is Headed (kg/km^2-month)

Distance From Tower (m)	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
100	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
200	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.49E+03	.41E+03	.13E+03	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.25E+03	.24E+03	.62E+02	.99E+02
300	.00E+00	.50E+02	.76E+02	.76E+02	.00E+00	.39E+04	.45E+04	.17E+04	.00E+00	.25E+02	.18E+03	.10E+03	.00E+00	.32E+04	.28E+04	.94E+03	.11E+04
400	.00E+00	.11E+03	.69E+02	.69E+02	.41E+02	.35E+04	.41E+04	.18E+04	.23E+03	.90E+02	.49E+03	.56E+03	.81E+02	.29E+04	.25E+04	.93E+03	.11E+04
500	.12E+02	.13E+03	.79E+02	.76E+02	.14E+03	.34E+04	.37E+04	.20E+04	.46E+03	.15E+03	.61E+03	.73E+03	.26E+03	.29E+04	.28E+04	.12E+04	.12E+04
600	.23E+03	.41E+03	.10E+04	.90E+03	.99E+03	.19E+04	.22E+04	.14E+04	.25E+03	.41E+03	.72E+03	.89E+03	.86E+03	.19E+04	.19E+04	.10E+04	.11E+04
700	.60E+03	.54E+03	.11E+04	.81E+03	.69E+03	.18E+04	.21E+04	.16E+04	.53E+03	.46E+03	.64E+03	.81E+03	.70E+03	.20E+04	.21E+04	.12E+04	.11E+04
800	.99E+03	.74E+03	.13E+04	.10E+04	.82E+03	.17E+04	.21E+04	.16E+04	.10E+04	.65E+03	.86E+03	.10E+04	.85E+03	.22E+04	.23E+04	.14E+04	.13E+04
900	.11E+04	.85E+03	.14E+04	.10E+04	.11E+04	.10E+04	.14E+04	.12E+04	.94E+03	.71E+03	.91E+03	.11E+04	.13E+04	.16E+04	.18E+04	.12E+04	.12E+04
1000	.12E+04	.87E+03	.13E+04	.95E+03	.94E+03	.99E+03	.13E+04	.11E+04	.94E+03	.70E+03	.87E+03	.10E+04	.13E+04	.16E+04	.17E+04	.11E+04	.11E+04
1100	.12E+04	.85E+03	.13E+04	.88E+03	.77E+03	.72E+03	.10E+04	.92E+03	.85E+03	.63E+03	.78E+03	.92E+03	.11E+04	.13E+04	.14E+04	.97E+03	.98E+03
1200	.12E+04	.87E+03	.13E+04	.87E+03	.74E+03	.60E+03	.84E+03	.75E+03	.79E+03	.60E+03	.75E+03	.89E+03	.11E+04	.11E+04	.12E+04	.83E+03	.91E+03
1300	.11E+04	.79E+03	.11E+04	.74E+03	.70E+03	.55E+03	.77E+03	.67E+03	.71E+03	.53E+03	.66E+03	.77E+03	.10E+04	.10E+04	.11E+04	.76E+03	.81E+03
1400	.10E+04	.73E+03	.99E+03	.62E+03	.54E+03	.50E+03	.67E+03	.57E+03	.61E+03	.48E+03	.58E+03	.68E+03	.81E+03	.85E+03	.91E+03	.62E+03	.70E+03
1500	.73E+03	.59E+03	.82E+03	.54E+03	.47E+03	.46E+03	.62E+03	.52E+03	.44E+03	.38E+03	.47E+03	.55E+03	.72E+03	.80E+03	.86E+03	.58E+03	.60E+03
1600	.68E+03	.50E+03	.72E+03	.47E+03	.44E+03	.31E+03	.45E+03	.38E+03	.38E+03	.32E+03	.40E+03	.47E+03	.69E+03	.66E+03	.70E+03	.48E+03	.50E+03
1700	.64E+03	.48E+03	.68E+03	.45E+03	.40E+03	.21E+03	.33E+03	.30E+03	.36E+03	.30E+03	.37E+03	.45E+03	.59E+03	.53E+03	.57E+03	.40E+03	.44E+03
1800	.48E+03	.40E+03	.58E+03	.38E+03	.36E+03	.18E+03	.26E+03	.23E+03	.24E+03	.25E+03	.32E+03	.38E+03	.53E+03	.40E+03	.43E+03	.31E+03	.36E+03
1900	.42E+03	.32E+03	.44E+03	.28E+03	.29E+03	.16E+03	.22E+03	.19E+03	.21E+03	.20E+03	.24E+03	.29E+03	.45E+03	.36E+03	.38E+03	.26E+03	.29E+03
2000	.40E+03	.30E+03	.41E+03	.26E+03	.19E+03	.15E+03	.22E+03	.18E+03	.20E+03	.18E+03	.22E+03	.27E+03	.36E+03	.34E+03	.36E+03	.25E+03	.27E+03
2100	.38E+03	.29E+03	.40E+03	.26E+03	.18E+03	.14E+03	.20E+03	.17E+03	.19E+03	.18E+03	.22E+03	.26E+03	.33E+03	.32E+03	.33E+03	.23E+03	.26E+03
2200	.36E+03	.27E+03	.38E+03	.24E+03	.16E+03	.13E+03	.19E+03	.15E+03	.16E+03	.16E+03	.20E+03	.24E+03	.27E+03	.30E+03	.31E+03	.21E+03	.23E+03
2300	.29E+03	.24E+03	.32E+03	.19E+03	.16E+03	.12E+03	.18E+03	.14E+03	.13E+03	.14E+03	.17E+03	.20E+03	.26E+03	.28E+03	.29E+03	.20E+03	.21E+03
2400	.22E+03	.15E+03	.16E+03	.88E+02	.13E+03	.11E+03	.16E+03	.12E+03	.98E+02	.72E+02	.85E+02	.10E+03	.23E+03	.24E+03	.25E+03	.17E+03	.15E+03
2500	.21E+03	.14E+03	.15E+03	.79E+02	.70E+02	.10E+03	.13E+03	.97E+02	.86E+02	.64E+02	.77E+02	.91E+02	.19E+03	.18E+03	.19E+03	.14E+03	.12E+03
2600	.20E+03	.13E+03	.15E+03	.76E+02	.63E+02	.91E+02	.12E+03	.79E+02	.82E+02	.61E+02	.74E+02	.87E+02	.17E+03	.16E+03	.17E+03	.11E+03	.11E+03
2700	.17E+03	.12E+03	.14E+03	.71E+02	.52E+02	.78E+02	.95E+02	.61E+02	.69E+02	.56E+02	.67E+02	.79E+02	.15E+03	.12E+03	.12E+03	.77E+02	.95E+02
2800	.15E+03	.97E+02	.11E+03	.56E+02	.43E+02	.57E+02	.70E+02	.48E+02	.63E+02	.48E+02	.60E+02	.70E+02	.12E+03	.95E+02	.97E+02	.62E+02	.78E+02
2900	.12E+03	.77E+02	.88E+02	.44E+02	.31E+02	.12E+02	.21E+02	.20E+02	.52E+02	.39E+02	.48E+02	.56E+02	.93E+02	.52E+02	.53E+02	.39E+02	.53E+02
3000	.88E+02	.76E+02	.87E+02	.43E+02	.27E+02	.12E+02	.20E+02	.20E+02	.41E+02	.39E+02	.47E+02	.55E+02	.81E+02	.51E+02	.52E+02	.38E+02	.49E+02
3100	.88E+02	.71E+02	.81E+02	.38E+02	.23E+02	.12E+02	.20E+02	.20E+02	.41E+02	.37E+02	.43E+02	.52E+02	.63E+02	.51E+02	.52E+02	.38E+02	.46E+02
3200	.88E+02	.65E+02	.74E+02	.34E+02	.18E+02	.12E+02	.20E+02	.20E+02	.41E+02	.35E+02	.40E+02	.49E+02	.46E+02	.51E+02	.52E+02	.38E+02	.43E+02
3300	.75E+02	.60E+02	.69E+02	.31E+02	.12E+02	.12E+02	.20E+02	.19E+02	.34E+02	.33E+02	.38E+02	.47E+02	.30E+02	.51E+02	.51E+02	.37E+02	.39E+02
3400	.30E+02	.44E+02	.51E+02	.24E+02	.95E+01	.89E+01	.16E+02	.15E+02	.15E+02	.25E+02	.29E+02	.35E+02	.26E+02	.40E+02	.41E+02	.29E+02	.27E+02
3500	.28E+02	.23E+02	.27E+02	.15E+02	.94E+01	.73E+01	.14E+02	.13E+02	.13E+02	.13E+02	.16E+02	.19E+02	.26E+02	.35E+02	.34E+02	.24E+02	.20E+02
3600	.28E+02	.23E+02	.26E+02	.15E+02	.90E+01	.57E+01	.11E+02	.11E+02	.13E+02	.12E+02	.15E+02	.18E+02	.25E+02	.28E+02	.28E+02	.19E+02	.18E+02
3700	.26E+02	.21E+02	.23E+02	.13E+02	.69E+01	.45E+01	.92E+01	.89E+01	.12E+02	.11E+02	.13E+02	.15E+02	.18E+02	.20E+02	.21E+02	.14E+02	.15E+02
3800	.25E+02	.16E+02	.19E+02	.10E+02	.62E+01	.43E+01	.90E+01	.86E+01	.12E+02	.85E+01	.10E+02	.12E+02	.17E+02	.19E+02	.20E+02	.13E+02	.13E+02
3900	.24E+02	.14E+02	.17E+02	.93E+01	.59E+01	.43E+01	.90E+01	.86E+01	.11E+02	.76E+01	.94E+01	.11E+02	.16E+02	.19E+02	.20E+02	.13E+02	.12E+02
4000	.17E+02	.14E+02	.17E+02	.93E+01	.59E+01	.43E+01	.90E+01	.86E+01	.80E+01	.76E+01	.94E+01	.11E+02	.16E+02	.19E+02	.20E+02	.13E+02	.12E+02
4100	.16E+02	.14E+02	.16E+02	.90E+01	.59E+01	.43E+01	.90E+01	.86E+01	.72E+01	.74E+01	.91E+01	.11E+02	.16E+02	.19E+02	.20E+02	.13E+02	.12E+02
4200	.16E+02	.13E+02	.16E+02	.85E+01	.55E+01	.43E+01	.90E+01	.86E+01	.72E+01	.68E+01	.86E+01	.10E+02	.15E+02	.19E+02	.20E+02	.13E+02	.11E+02
4300	.15E+02	.13E+02	.16E+02	.84E+01	.53E+01	.37E+01	.61E+01	.56E+01	.68E+01	.67E+01	.85E+01	.10E+02	.15E+02	.11E+02	.11E+02	.83E+01	.94E+01
4400	.15E+02	.13E+02	.15E+02	.83E+01	.53E+01	.36E+01	.58E+01	.52E+01	.68E+01	.66E+01	.84E+01	.10E+02	.15E+02	.97E+01	.11E+02	.78E+01	.91E+01
4500	.15E+02	.13E+02	.15E+02	.82E+01	.53E+01	.31E+01	.48E+01	.44E+01	.68E+01	.66E+01	.84E+01	.10E+02	.15E+02	.79E+01	.86E+01	.64E+01	.86E+01
4600	.15E+02	.13E+02	.15E+02	.81E+01	.52E+01	.29E+01	.43E+01	.40E+01	.68E+01	.65E+01	.83E+01	.99E+01	.15E+02	.74E+01	.80E+01	.60E+01	.84E+01
4700	.15E+02	.13E+02	.15E+02	.80E+01	.43E+01	.27E+01	.40E+01	.37E+01	.68E+01	.64E+01	.81E+01	.98E+01	.12E+02	.71E+01	.76E+01	.56E+01	.81E+01
4800	.15E+02	.13E+02	.15E+02	.80E+01	.38E+01	.23E+01	.33E+01	.31E+01	.66E+01	.64E+01	.81E+01	.98E+01	.10E+02	.64E+01	.67E+01	.48E+01	.76E+01
4900	.13E+02	.12E+02	.14E+02	.75E+01	.38E+01	.22E+01	.32E+01	.29E+01	.60E+01	.60E+01	.76E+01	.89E+01	.10E+02	.63E+01	.65E+01	.47E+01	.72E+01
5000	.13E+02	.11E+02	.13E+02	.70E+01	.38E+01	.21E+01	.31E+01	.28E+01	.58E+01	.55E+01	.70E+01	.81E+01	.10E+02	.62E+01	.64E+01	.47E+01	.68E+01

Source: SACTI cooling tower model.

5.1.4.3.4 Salt deposition modeling results. Salt deposition is primarily a function of the salt concentration in the circulating cooling water and the water deposition rate. Table 5.1-4 presents the SACTI model predicted average monthly (based on the 6 year Jacksonville meteorological database) salt deposition rate in units of kg/km^2/month associated with the proposed cooling tower at the Generating Station. The 16 wind direction labels in the columns of the table represent the direction from the proposed cooling tower that the salt deposition is predicted to occur.

The maximum salt deposition occurs approximately 400 m (1,312 feet) northwest of the cooling tower at a rate of 8.5 kg/km^2/month. The average salt deposition at a radius of 400 m (1,312 feet) from the cooling tower (considering all directions of plume travel) is predicted to be 2.1 kg/km^2/month. Beyond 800 m (2,625 feet) from the cooling tower, the salt deposition continually decreases. In fact, the average salt deposition beyond 1,800 m (5,906 feet) from the cooling tower in all directions is less than 1 kg/km^2/month.

5.1.4.3.5 Plume length modeling results. The cooling tower plume lengths are calculated by the SACTI model as the frequency of occurrence of a given plume length from the cooling tower for each wind direction. Table 5.1-5 presents the average annual (based on the 6 year Jacksonville meteorological database) predicted plume length frequency of occurrence associated with the cooling tower. The 16 wind direction labels in the columns of the table represent the direction from the cooling tower that the plume is headed. The data represent the probability (by percent of the year) that the cooling tower plume will be as long or longer than the length defined in the table for a particular direction and distance from the cooling tower.

As the data in Table 5.1-5 indicates, the SACTI model predicts the plume length to be less than 200 m (656 ft) 90 percent of the year considering all directions of plume travel. The median plume length, or that length which the plume is predicted to be longer or shorter than for 50 percent of the year considering all directions of plume travel, is less than 300 m (984 feet).

As indicated in Table 5.1-5, the percent frequency of occurrence of long cooling tower plumes in any particular direction is very small. The highest probability of a visible plume over a particular location is approximately 9 percent of the year in an area 100 m (328 feet) east of the cooling tower.

5.1.4.4 Environmental Impact. The following sections discuss the potential environmental impacts associated with the operation of the cooling tower at the Generating Station. The relative magnitude of the impacts are based on the results of the numerical modeling studies presented in Subsection 5.1.4.3. The environmental impacts are assessed with respect to the transportation arteries, vegetation, aesthetics, and land use.

Table 5.1-4
Average Monthly Predicted Cooling Tower Salt Deposition

Salt Deposition in the Direction Plume is Headed (kg/km^2-month)

Distance From Tower (m)	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
200	0.00	0.00	0.00	0.00	0.00	0.73	0.60	0.20	0.00	0.00	0.00	0.00	0.00	0.38	0.35	0.09	0.15
300	0.00	0.08	0.11	0.11	0.00	6.19	7.60	2.52	0.00	0.04	0.26	0.15	0.00	5.38	4.46	1.41	1.77
400	0.00	0.27	0.10	0.10	0.13	6.01	8.47	2.93	0.72	0.23	1.24	1.54	0.26	5.95	4.63	1.45	2.13
500	0.04	0.51	0.14	0.13	0.51	5.39	6.25	3.18	2.15	0.60	2.58	3.40	1.07	4.81	4.41	1.90	2.32
600	0.38	0.77	1.60	1.38	1.67	3.17	4.06	2.22	1.35	0.94	1.98	2.53	1.81	3.41	3.19	1.58	2.00
700	1.05	0.93	1.70	1.31	1.10	3.04	3.80	2.71	1.57	1.00	1.64	2.05	1.19	3.45	3.50	2.00	2.00
800	1.89	1.39	2.18	1.87	1.79	2.99	3.85	2.92	2.54	1.36	2.11	2.53	1.82	3.77	3.93	2.38	2.46
900	2.14	1.63	2.43	2.02	2.35	2.06	2.78	2.32	2.50	1.53	2.25	2.66	2.68	3.00	3.19	2.07	2.35
1000	2.41	1.63	2.42	1.94	2.18	2.05	2.75	2.30	2.42	1.48	1.92	2.21	2.75	2.97	3.15	2.08	2.29
1100	2.53	1.58	2.32	1.69	1.57	1.52	2.18	1.95	2.26	1.30	1.68	1.92	2.21	2.53	2.69	1.83	1.98
1200	2.56	1.63	2.34	1.69	1.50	1.33	1.91	1.63	2.21	1.27	1.64	1.88	2.19	2.22	2.38	1.63	1.87
1300	2.36	1.55	2.18	1.55	1.38	1.26	1.82	1.53	2.10	1.19	1.55	1.76	2.07	2.09	2.23	1.52	1.76
1400	2.25	1.48	2.02	1.39	1.22	1.19	1.66	1.37	1.96	1.09	1.41	1.61	1.77	1.82	1.94	1.32	1.59
1500	1.70	1.24	1.72	1.20	1.16	1.04	1.45	1.19	1.43	0.89	1.14	1.33	1.68	1.69	1.81	1.22	1.37
1600	1.61	1.10	1.56	1.10	1.10	0.75	1.09	0.91	1.31	0.79	1.03	1.21	1.62	1.43	1.53	1.05	1.20
1700	1.54	1.06	1.50	1.04	1.01	0.62	0.93	0.79	1.26	0.74	0.98	1.16	1.44	1.25	1.35	0.94	1.10
1800	1.25	0.95	1.37	0.97	0.90	0.57	0.81	0.67	0.90	0.68	0.91	1.08	1.31	1.05	1.13	0.78	0.96
1900	1.15	0.86	1.26	0.92	0.83	0.52	0.75	0.61	0.86	0.62	0.84	0.99	1.20	0.97	1.03	0.70	0.88
2000	1.12	0.79	1.18	0.86	0.78	0.51	0.74	0.59	0.83	0.57	0.75	0.88	1.13	0.94	1.00	0.68	0.83
2100	1.03	0.77	1.16	0.84	0.76	0.49	0.71	0.57	0.71	0.55	0.74	0.87	1.08	0.90	0.96	0.65	0.80
2200	0.90	0.70	1.07	0.76	0.74	0.43	0.65	0.49	0.54	0.49	0.66	0.79	0.99	0.85	0.89	0.59	0.72
2300	0.80	0.62	0.87	0.59	0.72	0.40	0.61	0.44	0.49	0.41	0.55	0.66	0.96	0.80	0.83	0.55	0.64
2400	0.66	0.43	0.51	0.32	0.63	0.37	0.57	0.39	0.41	0.27	0.36	0.42	0.87	0.72	0.74	0.49	0.51
2500	0.61	0.41	0.48	0.30	0.34	0.35	0.51	0.34	0.37	0.25	0.34	0.40	0.69	0.60	0.62	0.42	0.44
2600	0.59	0.40	0.47	0.29	0.30	0.32	0.46	0.29	0.36	0.24	0.33	0.39	0.62	0.55	0.55	0.35	0.41
2700	0.53	0.39	0.46	0.28	0.25	0.30	0.42	0.25	0.33	0.23	0.32	0.37	0.53	0.46	0.47	0.29	0.37
2800	0.51	0.34	0.41	0.25	0.21	0.24	0.36	0.22	0.32	0.22	0.31	0.36	0.47	0.40	0.40	0.25	0.33
2900	0.43	0.30	0.36	0.23	0.18	0.11	0.19	0.14	0.29	0.20	0.28	0.33	0.40	0.26	0.27	0.19	0.26
3000	0.37	0.30	0.36	0.23	0.17	0.11	0.18	0.14	0.27	0.20	0.28	0.33	0.36	0.25	0.26	0.18	0.25
3100	0.37	0.28	0.34	0.21	0.16	0.11	0.18	0.14	0.27	0.19	0.27	0.32	0.32	0.25	0.26	0.18	0.24
3200	0.37	0.27	0.32	0.20	0.13	0.11	0.18	0.14	0.27	0.18	0.26	0.31	0.26	0.25	0.26	0.18	0.23
3300	0.33	0.26	0.31	0.20	0.12	0.10	0.17	0.13	0.24	0.18	0.26	0.30	0.21	0.24	0.25	0.17	0.22
3400	0.23	0.22	0.28	0.18	0.10	0.09	0.16	0.12	0.20	0.16	0.23	0.26	0.19	0.22	0.22	0.15	0.19
3500	0.19	0.16	0.20	0.14	0.09	0.09	0.16	0.11	0.16	0.12	0.18	0.21	0.19	0.20	0.20	0.14	0.16
3600	0.19	0.15	0.19	0.13	0.09	0.08	0.15	0.11	0.16	0.11	0.17	0.20	0.18	0.19	0.19	0.13	0.15
3700	0.17	0.14	0.17	0.12	0.08	0.08	0.15	0.10	0.16	0.10	0.15	0.19	0.15	0.18	0.18	0.12	0.14
3800	0.16	0.11	0.15	0.11	0.07	0.08	0.14	0.10	0.15	0.09	0.14	0.17	0.14	0.17	0.18	0.12	0.13
3900	0.16	0.11	0.14	0.10	0.07	0.08	0.14	0.10	0.15	0.09	0.14	0.17	0.13	0.17	0.18	0.12	0.13
4000	0.14	0.11	0.14	0.10	0.07	0.08	0.14	0.10	0.14	0.09	0.14	0.17	0.13	0.17	0.18	0.12	0.13
4100	0.12	0.10	0.14	0.10	0.07	0.08	0.14	0.10	0.13	0.08	0.13	0.16	0.13	0.17	0.18	0.12	0.12
4200	0.12	0.09	0.12	0.09	0.06	0.08	0.14	0.10	0.13	0.07	0.12	0.15	0.12	0.17	0.18	0.12	0.12
4300	0.11	0.09	0.12	0.09	0.06	0.08	0.14	0.09	0.12	0.07	0.12	0.15	0.11	0.15	0.15	0.10	0.11
4400	0.11	0.09	0.11	0.08	0.06	0.08	0.13	0.09	0.12	0.07	0.12	0.14	0.11	0.14	0.15	0.10	0.11
4500	0.11	0.09	0.11	0.08	0.06	0.07	0.12	0.08	0.12	0.07	0.12	0.14	0.11	0.12	0.12	0.08	0.10
4600	0.11	0.08	0.11	0.08	0.06	0.07	0.11	0.07	0.12	0.06	0.11	0.14	0.11	0.11	0.11	0.08	0.10
4700	0.11	0.08	0.11	0.07	0.06	0.06	0.11	0.07	0.12	0.06	0.11	0.14	0.11	0.11	0.11	0.07	0.09
4800	0.11	0.08	0.11	0.07	0.06	0.05	0.08	0.05	0.12	0.06	0.11	0.14	0.10	0.08	0.08	0.06	0.08
4900	0.09	0.08	0.10	0.07	0.06	0.05	0.08	0.05	0.11	0.06	0.11	0.13	0.10	0.08	0.08	0.05	0.08
5000	0.09	0.08	0.10	0.07	0.06	0.05	0.07	0.05	0.11	0.06	0.11	0.13	0.10	0.08	0.08	0.05	0.08

Source: SACTI cooling tower model.

Table 5.1-5
Average Annual Predicted Plume Length Frequency of Occurrence

Probability the Plume is Longer in a Given Direction Than the Distance Indicated (percent)

Distance From Tower (m)	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	SUM
100	7.83	5.16	7.03	6.26	7.37	4.93	5.91	4.31	7.35	4.46	6.09	6.80	9.04	6.20	6.71	4.56	100.00
200	6.40	3.49	3.96	2.69	2.15	1.66	2.31	2.43	4.60	2.07	2.36	2.48	4.74	3.64	4.11	3.13	52.22
300	5.64	3.15	3.51	2.23	1.44	1.17	1.86	1.81	3.16	1.71	1.95	2.09	3.69	3.25	3.61	2.77	43.04
400	4.18	2.58	2.71	1.63	1.11	0.86	1.37	1.33	1.75	1.12	1.35	1.46	2.92	2.69	2.94	2.29	32.29
500	3.67	2.30	2.38	1.36	0.91	0.66	1.03	1.01	1.50	0.95	1.16	1.29	2.52	2.36	2.50	1.89	27.47
600	3.34	1.93	1.97	1.10	0.82	0.66	1.03	1.01	1.31	0.76	0.89	1.01	2.30	2.36	2.50	1.89	24.88
700	3.00	1.93	1.97	1.10	0.82	0.57	0.91	0.87	1.14	0.76	0.89	1.01	2.30	2.19	2.27	1.71	23.44
800	3.00	1.93	1.97	1.10	0.74	0.57	0.91	0.87	1.14	0.76	0.89	1.01	2.04	2.19	2.27	1.71	23.10
900	3.00	1.73	1.73	0.96	0.74	0.51	0.83	0.78	1.14	0.70	0.80	0.91	2.04	2.02	2.08	1.56	21.52
1000	3.00	1.73	1.73	0.96	0.74	0.51	0.83	0.78	1.14	0.70	0.80	0.91	2.04	2.02	2.08	1.56	21.52
1100	3.00	1.73	1.73	0.96	0.74	0.51	0.83	0.78	1.14	0.70	0.80	0.91	2.04	2.02	2.08	1.56	21.52
1200	3.00	1.73	1.73	0.96	0.74	0.51	0.83	0.78	1.14	0.70	0.80	0.91	2.04	2.02	2.08	1.56	21.52
1300	3.00	1.73	1.73	0.96	0.74	0.51	0.83	0.78	1.14	0.70	0.80	0.91	2.04	2.02	2.08	1.56	21.52
1400	3.00	1.73	1.73	0.96	0.74	0.51	0.83	0.78	1.14	0.70	0.80	0.91	2.04	2.02	2.08	1.56	21.52
1500	3.00	1.73	1.73	0.96	0.74	0.51	0.83	0.78	1.14	0.70	0.80	0.91	2.04	2.02	2.08	1.56	21.52
1600	3.00	1.73	1.73	0.96	0.74	0.51	0.83	0.78	1.14	0.70	0.80	0.91	2.04	2.02	2.08	1.56	21.52
1700	3.00	1.73	1.73	0.96	0.74	0.51	0.83	0.78	1.14	0.70	0.80	0.91	2.04	2.02	2.08	1.56	21.52
1800	3.00	1.73	1.73	0.96	0.74	0.51	0.83	0.78	1.14	0.70	0.80	0.91	2.04	2.02	2.08	1.56	21.52
1900	3.00	1.73	1.73	0.96	0.74	0.51	0.83	0.78	1.14	0.70	0.80	0.91	2.04	2.02	2.08	1.56	21.52
2000	3.00	1.73	1.73	0.96	0.74	0.51	0.83	0.78	1.14	0.70	0.80	0.91	2.04	2.02	2.08	1.56	21.52
2100	3.00	1.73	1.73	0.96	0.74	0.51	0.83	0.78	1.14	0.70	0.80	0.91	2.04	2.02	2.08	1.56	21.52
2200	3.00	1.73	1.73	0.96	0.74	0.51	0.83	0.78	1.14	0.70	0.80	0.91	2.04	2.02	2.08	1.56	21.52
2300	3.00	1.73	1.73	0.96	0.74	0.51	0.83	0.78	1.14	0.70	0.80	0.91	2.04	2.02	2.08	1.56	21.52
2400	3.00	1.73	1.73	0.96	0.74	0.51	0.83	0.78	1.14	0.70	0.80	0.91	2.04	2.02	2.08	1.56	21.52
2500	3.00	1.73	1.73	0.96	0.74	0.51	0.83	0.78	1.14	0.70	0.80	0.91	2.04	2.02	2.08	1.56	21.52
2600	3.00	1.73	1.73	0.96	0.74	0.51	0.83	0.78	1.14	0.70	0.80	0.91	2.04	2.02	2.08	1.56	21.52
2700	3.00	1.73	1.73	0.96	0.74	0.51	0.83	0.78	1.14	0.70	0.80	0.91	2.04	2.02	2.08	1.56	21.52
2800	3.00	1.73	1.73	0.96	0.72	0.51	0.83	0.78	1.14	0.70	0.80	0.91	1.96	2.02	2.08	1.56	21.42
2900	2.86	1.73	1.73	0.96	0.72	0.50	0.80	0.75	1.08	0.70	0.80	0.91	1.96	1.93	2.00	1.52	20.95
3000	2.86	1.62	1.60	0.91	0.72	0.50	0.80	0.75	1.08	0.64	0.73	0.82	1.96	1.93	2.00	1.52	20.45
3100	2.86	1.62	1.60	0.91	0.72	0.50	0.80	0.75	1.08	0.64	0.73	0.82	1.96	1.93	2.00	1.52	20.45
3200	2.86	1.62	1.60	0.91	0.72	0.50	0.80	0.75	1.08	0.64	0.73	0.82	1.96	1.93	2.00	1.52	20.45
3300	2.86	1.62	1.60	0.91	0.72	0.50	0.80	0.75	1.08	0.64	0.73	0.82	1.96	1.93	2.00	1.52	20.45
3400	2.86	1.62	1.60	0.91	0.72	0.50	0.80	0.75	1.08	0.64	0.73	0.82	1.96	1.93	2.00	1.52	20.45
3500	2.86	1.62	1.60	0.91	0.72	0.50	0.80	0.75	1.08	0.64	0.73	0.82	1.96	1.93	2.00	1.52	20.45
3600	2.86	1.62	1.60	0.91	0.72	0.50	0.80	0.75	1.08	0.64	0.73	0.82	1.96	1.93	2.00	1.52	20.45
3700	2.86	1.62	1.60	0.91	0.72	0.50	0.80	0.75	1.08	0.64	0.73	0.82	1.96	1.93	2.00	1.52	20.45
3800	2.86	1.62	1.60	0.91	0.72	0.50	0.80	0.75	1.08	0.64	0.73	0.82	1.96	1.93	2.00	1.52	20.45
3900	2.86	1.62	1.60	0.91	0.72	0.50	0.80	0.75	1.08	0.64	0.73	0.82	1.96	1.93	2.00	1.52	20.45
4000	2.86	1.62	1.60	0.91	0.72	0.50	0.80	0.75	1.08	0.64	0.73	0.82	1.96	1.93	2.00	1.52	20.45
4100	2.86	1.62	1.60	0.91	0.72	0.50	0.80	0.75	1.08	0.64	0.73	0.82	1.96	1.93	2.00	1.52	20.45
4200	2.86	1.62	1.60	0.91	0.72	0.50	0.80	0.75	1.08	0.64	0.73	0.82	1.96	1.93	2.00	1.52	20.45
4300	2.86	1.62	1.60	0.91	0.72	0.50	0.80	0.75	1.08	0.64	0.73	0.82	1.96	1.93	2.00	1.52	20.45
4400	2.86	1.62	1.60	0.91	0.72	0.50	0.80	0.75	1.08	0.64	0.73	0.82	1.96	1.93	2.00	1.52	20.45
4500	2.86	1.62	1.60	0.91	0.72	0.50	0.80	0.75	1.08	0.64	0.73	0.82	1.96	1.93	2.00	1.52	20.45
4600	2.86	1.62	1.60	0.91	0.72	0.50	0.80	0.75	1.08	0.64	0.73	0.82	1.96	1.93	2.00	1.52	20.45
4700	2.86	1.62	1.60	0.91	0.72	0.50	0.80	0.75	1.08	0.64	0.73	0.82	1.96	1.93	2.00	1.52	20.45
4800	2.45	1.38	1.39	0.76	0.72	0.42	0.70	0.62	0.86	0.50	0.59	0.68	1.96	1.67	1.71	1.35	17.78
4900	2.08	1.15	1.17	0.64	0.53	0.42	0.70	0.62	0.75	0.42	0.51	0.57	1.46	1.67	1.71	1.35	15.77
5000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Source: SACTI cooling tower model.

In addition to assessing the environmental impacts associated with each of the aforementioned categories, this section also discusses many naturally occurring meteorological and atmospheric phenomena such as fog, cloud cover, and precipitation that may tend to mitigate the actual or perceived environmental impacts resulting from the operation of the cooling tower.

5.1.4.4.1 Impact on transportation arteries. Cooling towers may at times produce plume induced fogging and icing in the vicinity of the cooling tower structures which may have an effect on nearby transportation arteries such as roads, highways, bridges, airports, or navigable waters. Several factors influence the cooling tower plume as it leaves the tower which, to varying degrees, determine the location and magnitude of these phenomena.

The cooling tower plume will have thermal buoyancy and momentum as it is exhausted from the cooling tower. Under calm conditions, the plume will ascend vertically due to these forces. Brief periods of calm conditions do occasionally occur in the atmosphere, and are somewhat normal along the northeastern Florida peninsula. In fact, winds in the vicinity of the Generating Station are calm about 24 percent of the year. However, the subtropical humid climate is frequently unstable. As such, the cooling tower plume's trajectory becomes modified almost immediately as it leaves the cooling tower by moderately persistent winds and atmospheric instability.

As the wind speed increases, the cooling tower plume begins to assume a trajectory that is sloped in the direction of the wind vector, bringing the plume closer to the ground. The plume will likely undergo further trajectory modification as the result of turbulent airflow over and around terrain features, buildings, or the cooling tower structure itself. This effect, known as structure or building downwash, occurs when the trajectory modification is such that the plume is forced to the ground in the vicinity of the cooling tower. If the plume becomes supersaturated during this process (i.e., becomes visible), then the result is a phenomenon known as cooling tower induced ground level fogging (Ovard and Reisman).

Cooling tower induced fogging can occur at any time during the year, but it is most commonplace during periods of moderate wind speeds (which bend the plume to intercept the ground), high relative humidity, and cool temperatures. These meteorological conditions frequently occur during the late evening and early morning periods of the day.

A land use map of the area, illustrated on Figure 2.3-3, was reviewed to determine the major transportation arteries in the vicinity of the site. Apart from the Generating Station entrance road, which is restricted from public access, the nearest transportation

arteries include Highway 301 to the west and Highways 10 and 90 to the south of the site. The CSX rail line just west and south of Baldwin is approximately 1 mile from the power block.

As discussed in Subsection 5.1.4.3.1, the maximum cooling tower plume induced fogging is predicted to occur approximately 14.2 hours (over the 6 year database) within 200 m (656 feet), and no amount of fogging is predicted to extend beyond a radius of 1,200 m (3,937 m) from the cooling tower.

Figure 5.1-1 illustrates the minimal extent and duration of the predicted cooling tower induced fogging. The outermost contour represents 0.4 hour per year of possible plume fogging, with increasing contours of fogging at 0.4 hour per year intervals. Based on the results of the modeling, the cooling tower plume induced fogging is not predicted to extend significantly beyond the power block limits, and will not significantly impact nearby transportation arteries.

Many of the meteorological conditions that are favorable for the occurrence of cooling tower plume induced fogging are conducive to natural fog. As such, the two events may occur simultaneously and thereby mitigate the relative impact potentially caused by cooling tower plume induced events. Climatologically, natural fog (that which restricts visibility to less than 1/4 mile) occurs an average of 179 days a year based on meteorological data from Jacksonville. This means that there are at least 179 hours of naturally occurring fog in the vicinity of the Generating Station (conservatively assuming that reported fogging events last for only 1 hour per day), which is approximately 13 times greater than the maximum annual fogging hours predicted by the SACTI model in the vicinity of the Generating Station.

A secondary effect of cooling tower fogging is the formation of cooling tower induced ground level icing. However, as temperatures rarely fall below freezing in the area, no cooling tower plume induced icing is predicted to occur.

5.1.4.4.2 Impact on vegetation. The plume exhaust from cooling tower may affect the vegetation in the vicinity as the result of drift deposition. Drift deposition from a cooling tower occurs when airborne water droplets, caused by cooling tower drift, coalesce and precipitate in the vicinity of the cooling tower. The pattern of drift deposition and the distance from the cooling tower to the areas of maximum deposition concentrations are a function of many variables, which include cooling tower type, prevailing wind direction and speed, orientation of the cooling tower, airflow rate, drift rate, water chemistry, and the physical size of the water droplets (drift droplet size spectrum) in the cooling tower drift. The potential effects associated with cooling tower drift deposition are primarily associated with salt and water deposition. The response of the vegetation to salt and water deposition will vary from year to year depending on the rate of deposit and precipitation patterns during the growing season.

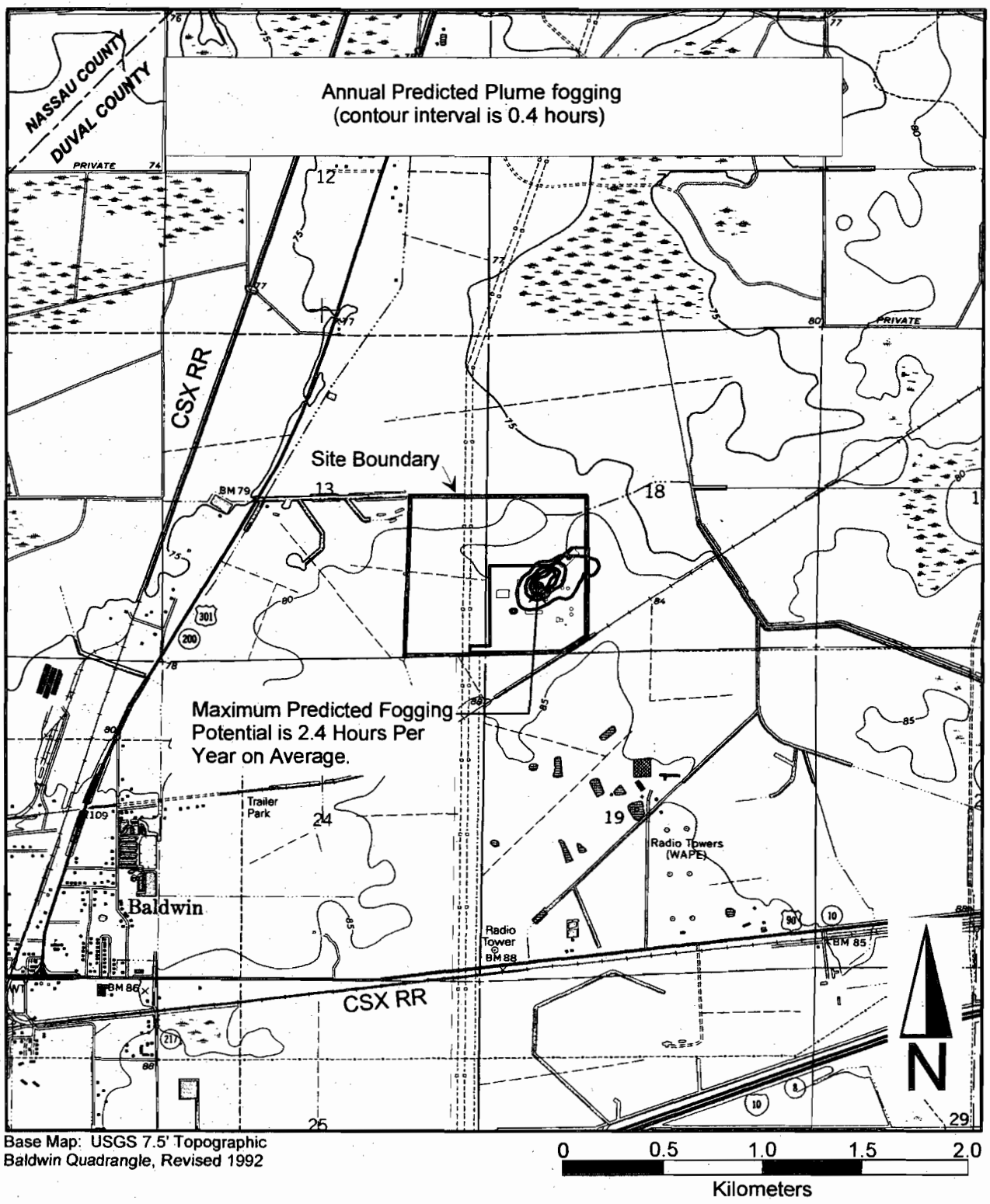


Figure 5.1-1
Brandy Branch Cooling Tower
Effects of Offstream Cooling

An area map depicting the Generating Station location and surrounding vegetation and land use overlaid with an isopleth analysis of the SACTI predicted average monthly water deposition rate is presented on Figure 5.1-2. The predicted location of the maximum water deposition rate occurs approximately 300 m (948 feet) northwest of the power block at a deposition rate of 4,500 kg/km^2/month. Vegetation and land use in this area are characterized as unimproved pastures and coniferous plantations as illustrated on Figure 2.3-3. Predicted water deposition rates in this area, as well as the upland natural area of the Generating Station, range from 1,000 to 4,500 kg/km^2/month.

A second predicted location of maximum of water deposition occurs southeast of the power block, approximately 300 m (984 ft) from the cooling tower as illustrated on Figure 5.1-2. Predicted water deposition rates in this area range from 1,000 to 2,800 kg/km^2/month. Vegetation and land use in this area are primarily characterized as unimproved pastures and coniferous plantations. A potential effect of water deposition on vegetation species is the increased threat of plant fungal diseases associated with the increased precipitation.

Based on historical meteorological data for Jacksonville, the average monthly rainfalls for the driest month (November) and the wettest month (September) are 51 and 196 mm, respectively. If one conservatively assumes no evaporation of the falling cooling tower drift droplets, then the precipitation rate equivalent of the maximum SACTI model predicted water deposition rate (4,500 kg/km^2/month) is approximately less than 0.01 mm per month. By comparison, this precipitation rate is significantly less than 1/10 percent of the average monthly rainfall of the driest month.

Dr. Walter Stephenson, a crop pathologist at the University of Wisconsin has experience with plant disease prediction models that consider precipitation and leaf wetness. Dr. Stephenson's research shows that a slight increase in disease occurrence is sometimes observed by US midwestern potato growers when irrigation at a rate of approximately 50 mm per week is applied. A 50 mm per week irrigation rate is equivalent to a water deposition rate of approximately 2 x 10^8 kg/km^2/month, which is more than 40,000 times greater than the maximum Generating Station water deposition rate predicted by the SACTI model. This suggests that the water deposition from the cooling tower on vegetation and crop species is insignificant when compared to normal wetting associated with dew, precipitation, and irrigation.

An area map depicting the site, surrounding vegetation, and land use overlaid with an isopleth analysis of the SACTI predicted average monthly salt deposition rate is presented on Figure 5.1-3. The predicted location of the maximum salt deposition rate occurs just northwest of the power block at a deposition rate of 8.5 kg/km^2/month.

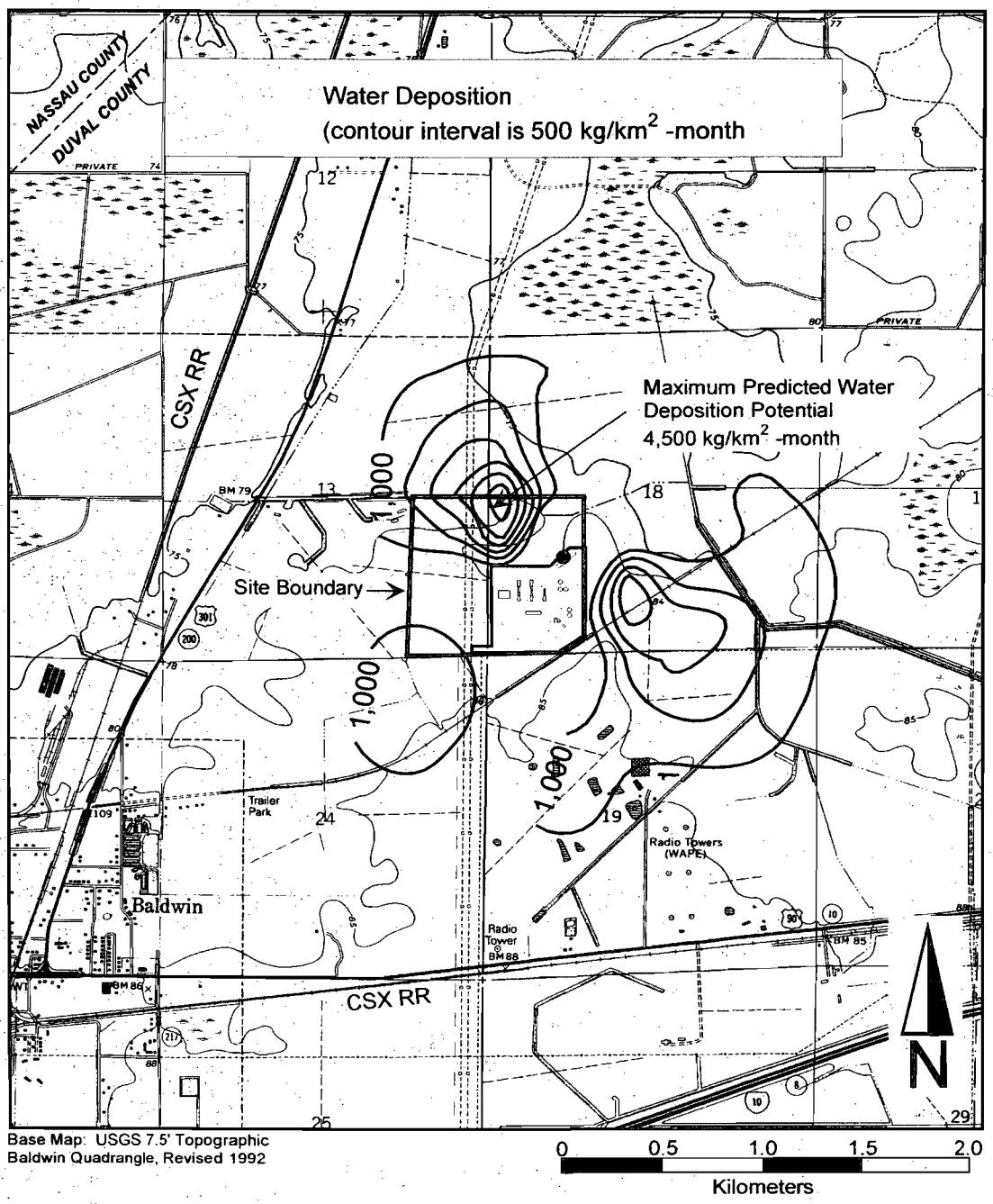


Figure 5.1-2
Brandy Branch Cooling Tower
Effects of Offstream Cooling

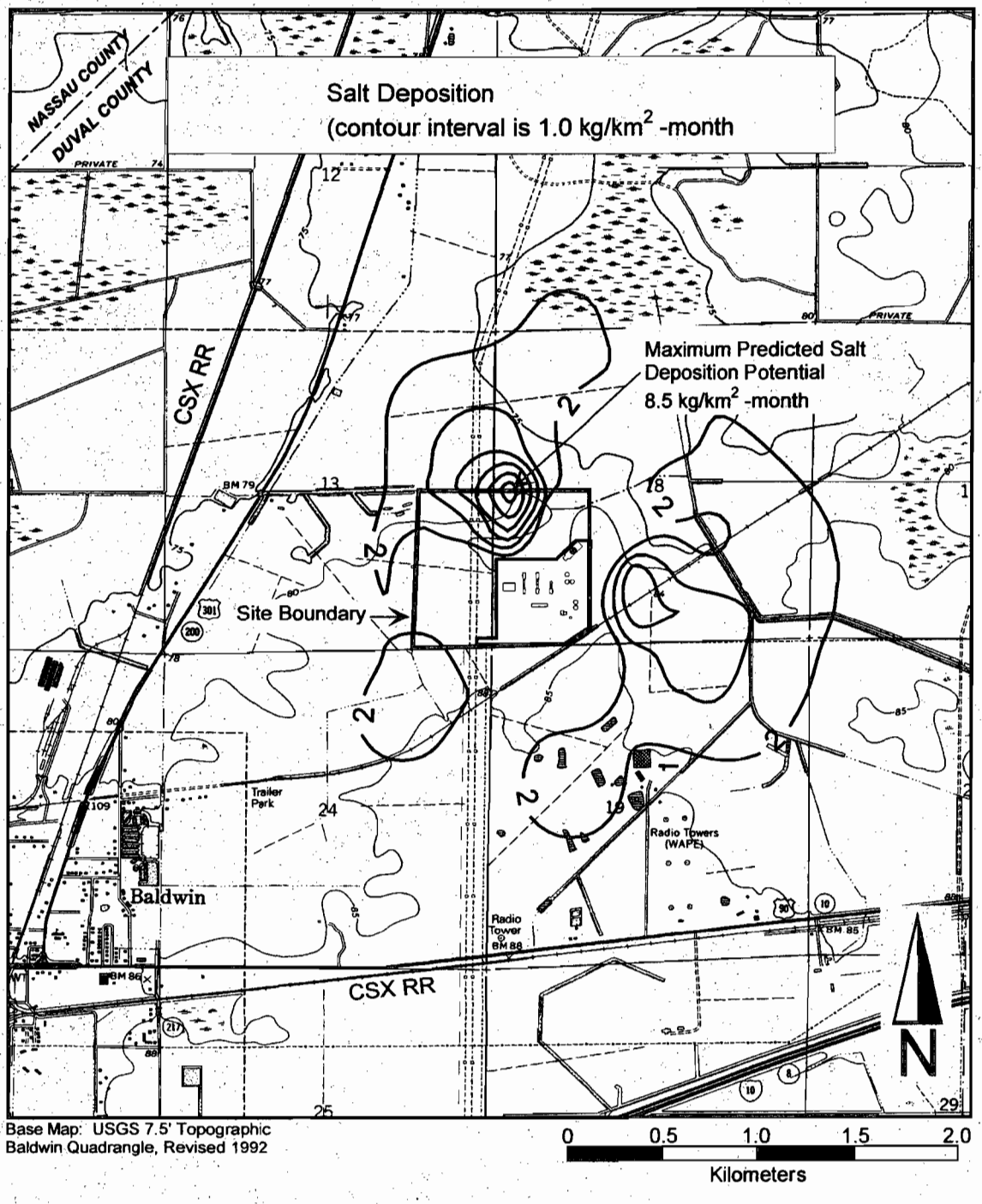


Figure 5.1-3
Brandy Branch Cooling Tower
Effects of Offstream Cooling

Vegetation and land use in this area are classified as unimproved pastures and coniferous plantations. Predicted salt deposition rates in this area, including the upland natural area of the Generating Station, range from 2 to 8.5 kg/km^2/month.

A second predicted location of maximum of salt deposition occurs just southeast of the site, approximately 400 m (1,312 feet) from the proposed location of the cooling tower. Predicted salt deposition rates in this area generally range from 2 to 4 kg/km^2/ month. Vegetation and land use in this area are characterized primarily as unimproved pastures and coniferous plantations.

Research studies on salt deposition effects have been conducted in response to known or observed cases of vegetation damage. From these studies, it is known that the local climate plays a significant role in increasing or reducing the stress that such deposition can have on vegetation. For example, a species growing in an area with high rainfall during the growing season tends to be less stressed from salt deposition than the same species growing in an area with less rainfall due to the dilution of the deposited salt on the leaf surface. Additionally, vegetation species growing along coastal regions have a higher tolerance for salt deposition because of the relatively high ambient airborne concentration of sea salts in the marine environment.

As salinity levels increase, growth of intolerant plants declines, and yields are reduced. Some plant families tend to show either high or low limits of salt survival. The limit is low in legumes, (pea, beans), medium in cereal grasses (rye, oats, wheat barley), and high in some forage and other crop plants (alfalfa, sunflower, sugar beet, forage beet) (Maianu et al., 1965). Growth suppression is sometimes accompanied by leaf injury. Leaves become smaller and deeper blue-green than normal, and leaf tips or margins become bleached, tan, or brownish in proportion to the degree of salt deposition. Bronzing and early defoliation may also be prominent. Leaf injury may be the most prominent symptom of salt deposition, but is not nearly important to yield reductions as the growth suppression (Treshow 1970).

Dr. Charles Mulchi of the University of Maryland at College Park has conducted extensive research on cooling tower salt deposition effects and toxicity levels in several vegetation species. According to Dr. Mulchi (1991), a salt deposition rate of 400 kg/km^2/month or greater is sufficient to cause damage to vegetation. The amount and type of damage is dependent on the species involved. For example, one species of pine may show signs of damage while another species may show no signs of damage. The 400 kg/km^2/month salt deposition rate is the threshold level for most vegetation species and has been used in many environmental assessments as a screening or trigger level of potentially significant salt deposition rates. Salt deposition rates less than 400 kg/km^2/month are generally not considered to have a significant impact on

vegetation. The maximum predicted salt deposition rate from the cooling tower is 8.5 kg/km^2/month. Therefore, salt deposition from the cooling tower is expected to have a negligible impact on vegetation and land use.

5.1.4.4.3 Impact on aesthetics and land use. A cooling tower contributes to the impacts on the aesthetics of an area by forming a visible, at times completely opaque, vapor condensate plume emanating from the cooling tower exhaust. The presence of a visible plume and cooling tower are often perceived as a distraction or debasement to the otherwise scenic quality or functional use of an area. This is particularly true if the cooling tower plume and tower structure are in the background or foreground of a view with a particular scenic quality or land use type. The potential impacts on aesthetics and land use as the result of visible plume formation and the cooling tower structure are discussed below.

Perhaps the most obvious environmental impact from a cooling tower is the formation of a visible plume extending out from the cooling tower cell exhaust ports. The visible plume may extend several hundred yards downwind, potentially obstructing visibility on the site and at nearby residences. The factors that affect visible cooling tower plume formation are discussed in the following paragraphs.

Cooling towers are simple fluid heat exchange systems that dissipate waste heat to the atmosphere through mass and convective heat transfer of water vapor. The exhaust from a cooling tower is essentially a saturated air-water vapor mixture which is warmer than the ambient air as it leaves the tower. Depending on the ambient air temperature and the wet-bulb temperature, a portion of the saturated air-water vapor mixture will become supersaturated and begin to condense into small water droplets as heat transfer with the atmosphere begins to cool the plume. With time, more small water droplets continue to form and grow through condensation and coalescence until the cooling tower exhaust becomes visible as a white plume emanating from the tower. The cooling tower plume will continue to be visible until it is dispersed and evaporated, or until meteorological conditions are no longer favorable for its formation. In the former case, the visible cooling tower plume is transported downwind until turbulent mixing in the atmosphere with the abundant and relatively drier ambient air causes the small water droplets to disperse and evaporate. As the visible plume becomes thoroughly mixed with the ambient air, the small water droplets completely disperse and evaporate until the plume is no longer visible and becomes transparent.

The frequency, persistence, and size of the visible cooling tower plume depends primarily on the cooling tower type, heat load, orientation of the cooling tower, and the prevailing meteorological conditions. Mechanical draft towers typically present less of a visual distraction because of the relatively low plume exhaust height and profile.

Visible plume formation from cooling tower is more frequent during the cooler seasons when ambient air conditions are capable of rapidly condensing the cooling tower exhaust and allowing only minimal evaporation of the condensed water droplets. Similar conditions exist on a diurnal scale that are also more suitable for visible plume formation. These periods occur during the early morning hours, shortly before and after sunrise, when relatively low ambient air temperatures and high relative humidity make the environment particularly conducive to visible plume formation.

Figure 5.1-4 illustrates the site location overlaid with an isopleth analysis of the average annual predicted plume length frequency of occurrence. The highest probability of a visible plume is predicted to occur in the power block area just east of the cooling tower for approximately 9 percent of the year on average. Over the remaining portions of the Generating Station and the immediate vicinity, the frequency of occurrence of a visible plume for a particular location generally ranges from about 2 to 5 percent of the year. Based on these results, it is concluded that the presence of a visible plume from the cooling tower will only minimally contribute to the visible and aesthetic impacts in the area.

The visible plume from the cooling tower is also predicted to periodically extend offsite. However, as shown on Figure 5.1-4, this is predicted to occur only about 2 percent of the year on average, and therefore will have little or no impact on nearby residences or the unimproved pastures and coniferous plantations that surround the power block and Generating Station.

It should be noted that the probability of visible plume lengths predicted by the SACTI model are conservative overestimates of actual plume lengths. This is primarily because the SACTI model does not distinguish prevailing meteorological conditions such as haze, overcast skies, fog, and precipitation, which may render the cooling tower plume indiscernible. In certain cases, especially as the distance from the cooling tower increases, the model may predict saturation (thus a visible plume by modeling standards), but due to spreading of the plume, it may only be visible as a slight haze. If this is the case, then from an aesthetic perspective, the plume may not be discernible against the background haze that may already exist due to the high humidity, smog, or suspended particulate matter. In other cases, the plume may be dense, but it would not be discernable against the existing cloud deck.

5.1.5 Measurement Program

Blowdown from the cooling towers will be collected for pH control and pumped into the Baldwin Force Main. Flow volumes to the Baldwin Force Main will be monitored.

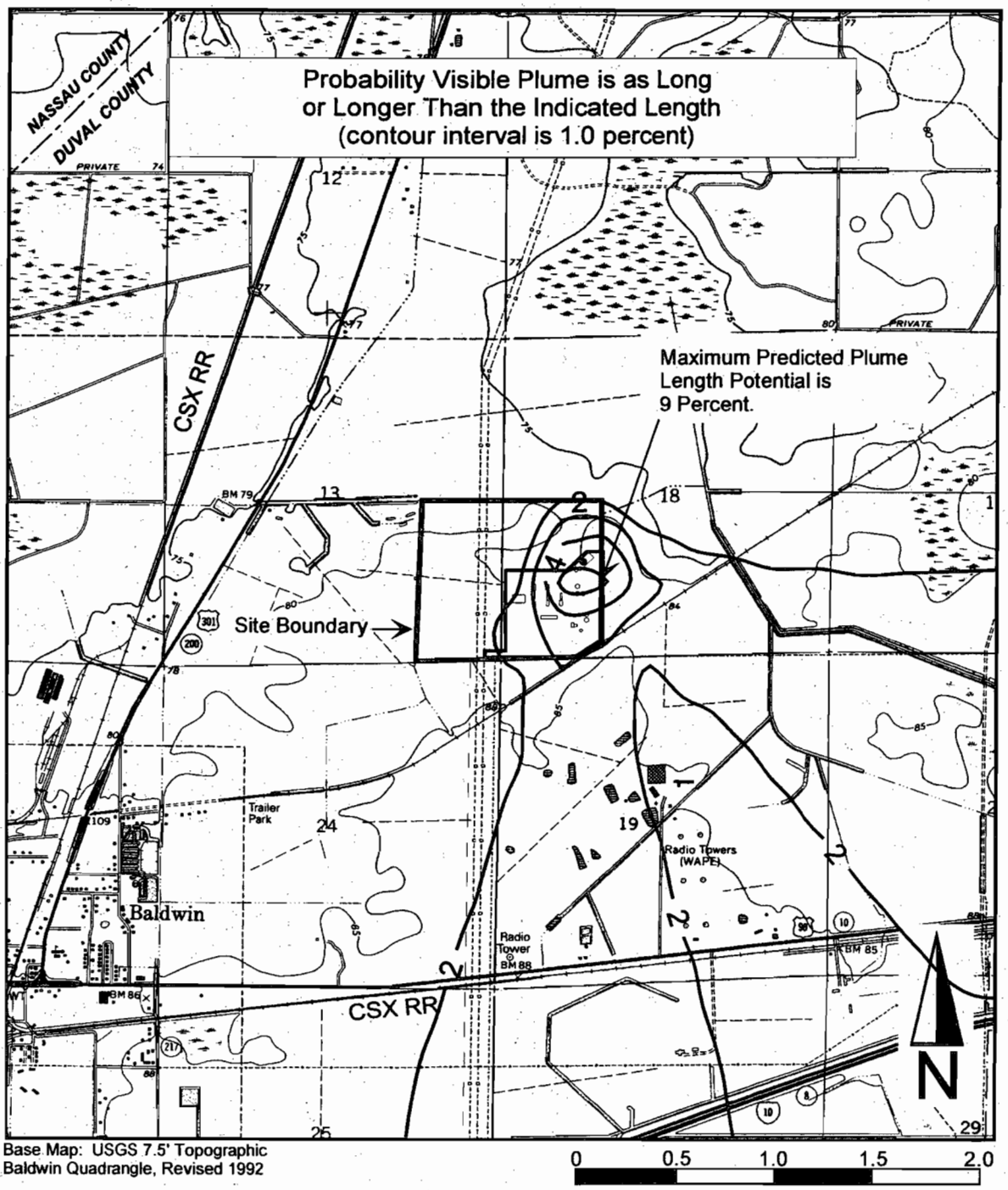


Figure 5.1-4
Brandy Branch Cooling Tower
Effects of Offstream Cooling

5.2 Effects of Chemical and Biocide Discharges

As shown on the water mass balances (Figures 3.5-1 and 3.5-2) in Section 3, and as described below, there is one industrial wastewater discharge from operations at the plant: discharge to the Baldwin Force Main. There are no industrial wastewater discharges to wetlands or surface waters under normal operating conditions. The conditions in the Industrial Wastewater Facility Permit issued to JEA for operation of the Units 1, 2, and 3 wastewater treatment and disposal system will be modified and transferred to the Conditions of Certification ultimately issued for the conversion project to incorporate the new wastewater station and treatment disposal facilities. A copy of the Units 1, 2, and 3 permit is included in Appendix 10.3; a permit modification request is included in Appendix 10.4.

5.2.1 Industrial Wastewater Discharges

Wastewaters potentially contaminated with grease or oil from the plant floor drain system and oil containment areas are, and will continue to be, treated by an oil/water separator and an onsite dry pretreatment (percolation) pond prior to onsite discharge to ground water. Effluent from the oil/water separators will contain no more than 15 ppm oil/grease.

5.2.2 Cooling Tower Blowdown

Cooling tower blowdown will be collected in a sump and discharged to the Baldwin Force Main. Water quantity estimates are provided on the water mass balances (Figures 3.5-1 and 3.5-2).

An estimated analysis of this wastewater is indicated in Table 5.2-1. The wastewater will meet the general and categorical pretreatment regulations of the Florida Department of Environmental Protection and the United States Environmental Protection Agency.

Table 5.2-1
Estimated Cooling Tower Blowdown Analysis

Calcium	85	0	0	659	mg/l as $CaCO_3$
Magnesium	53	0	0	414	mg/l as $CaCO_3$
Sodium	24	0	0	185	mg/l as $CaCO_3$
Potassium	3	0	0	20	mg/l as $CaCO_3$
Total Alkalinity	124	0	0	961	mg/l as $CaCO_3$
Sulfate	28	0	0	218	mg/l as $CaCO_3$
Chloride	13	0	0	98	mg/l as $CaCO_3$
Nitrate	0.01	0	0	0	mg/l as $CaCO_3$
Silica	9	0	0	70	mg/l as SiO_2
Total Dissolved Solids	186	0	0	1,442	mg/l
Total Suspended Solids	3	0	0	<50	mg/l
Total Phosphate				<1	mg/l as P

5.2.3 Measurement Program

Exemption from ground water monitoring was granted by the FDEP on October 6, 1999. Refer to Appendix 10.3, Industrial Wastewater Permit Exemption.

5.3 Impacts on Water Supplies

5.3.1 Surface Water

Brandy Branch operations will not withdraw or discharge to surface waters; therefore, no impacts to surface waters are expected as a result of plant operations.

The plant drainage system will be designed to comply with all applicable federal, state, and local regulations regarding discharge into surface waters. Runoff from areas not disturbed by construction or operations will be directed to natural drainage systems within the area. Runoff from disturbed areas will be collected and directed into a drainage system consisting of ditches, swales, and runoff basins for treatment. The runoff from uncontaminated areas will be directed through a detention basin for reduction of the suspended solids load and equalization of peak flows. At the property boundary, the postdevelopment peak flow rate will not exceed the predevelopment peak discharge rate during the applicable design storm event. A detailed description of the onsite drainage system is provided in Section 3.8.

Brandy Branch operations are not expected to affect surface water quality within the area. Undisturbed areas will remain in their existing state. Runoff water quality should at least remain unchanged and is expected to be improved as a result of detention in the storm water pond.

5.3.2 Ground Water

A modular three-dimensional finite difference ground water flow model using Visual MODFLOW 2.8.2 was used to investigate the impact of withdrawals associated with proposed plant operations on the Floridan Aquifer. The objective of the model was to determine the drawdown with distance from the pumping wells at the site.

5.3.2.1 Ground Water Model. The model was defined by a series of grids increasing in size from 1 foot to 400 feet, extending outward from the wells. Total model dimensions were approximately 4 miles per side; therefore, the model boundaries were about 2 miles from the center of the site. The piezometric head was fixed at the boundaries and allowed to fluctuate at all other locations. Table 5.3-1 summarizes the model description and aquifer parameters used as input for the model.

Table 5.3-1
Ground Water Model Input Parameters [1]

Layer	Unit	Thickness (feet)	Piezometric Head (feet, msl)	Hydraulic Conductivity (feet/day) [2]	Transmissivity (ft^2/day)	Storage Coefficient
1	Surficial Aquifer	95	78	10	--	0.00001
2	Hawthorn Formation	425	78	0.0001	--	0.00001
3	Floridan Aquifer	550	36	-	14,850	0.00033

(1) Recharge from rainfall, surface water, and other sources was assumed negligible, adding a conservancy factor to the model.

(2) Vertical and horizontal hydraulic conductivity assumed the same.

The model consisted of three layers with a total thickness of 1,070 feet. The thickness of the first two layers was established based on the well installation logs for the existing production wells (refer to Figure 2.3-6). The Floridan Aquifer layer thickness was based on thickness values for the Upper Floridan section of the aquifer, as determined by Franks and Phelps (1979).

The surficial aquifer parameters were based on the results of the double-ring infiltrometer test and slug tests performed during the site investigation (JEA Brandy Branch Generating Station Geotechnical Design Report, Appendix 10.8). Parameters for the confining unit (Hawthorn Formation) between the surficial aquifer system and the Floridan Aquifer system were based on values presented by Franks and Phelps (1979).

Aquifer parameters for the Floridan Aquifer layer were based on the results of the constant rate pump test performed at the site (JEA Brandy Branch Hydrogeologic Report, Appendix 10.9). The pump test was performed at 900 gpm for 48 hours. Drawdown measurements were recorded during this period, as well as recovery measurements for more than 24 hours after the termination of the test. Approximately 34 feet of drawdown occurred in the pumped well and less than 5 feet occurred in the monitoring well 770 feet from the pumping well. Based on the drawdown versus time curves, calculated aquifer transmissivity values ranged from 15,300 to 15,900 ft^2/day, and storage coefficient values ranged from 2.9×10^{-4} to 3.2×10^{-4}. For the model, an initial transmissivity value of 15,000 ft^2/day and an initial storage coefficient value of 3.1×10^{-4} were used. The ground water model was then calibrated by varying the initial transmissivity and storage coefficient values until the model simulated drawdowns matched the actual pump test results. The final transmissivity and storage coefficient values based on this iterative procedure were 14,850 ft^2/day and 3.3×10^{-4}, respectively.

The calibration curve is shown in Figure 5.3-1. The model values correlate well with the calculated values from the pump test results.

5.3.2.2 Projected Plant Water Usage. Operation of the simple cycle units under construction at the Brandy Branch Generating Station requires withdrawal of water from two existing wells installed in the Floridan Aquifer. These wells consist of 12 inch diameter casing installed to a depth of 536 feet bgs and 12-inch diameter open boreholes extending to a depth of 837 feet bgs, resulting in 301 feet of open borehole within the limestone bedrock for ground water production. Each well has a pump with a capacity of 900 gpm, and each well is capable of supplying 100 percent of the required water for the simple cycle plant capacity. The existing wells were permitted by SJRWMD, which issued Consumptive Use Permit No. 51629. The maximum annual allocation is 43.29 million gallons; the maximum daily allocation is 2.6 million gallons. The SJRWMD Consumptive Use Permit is presented in Appendix 10.5.

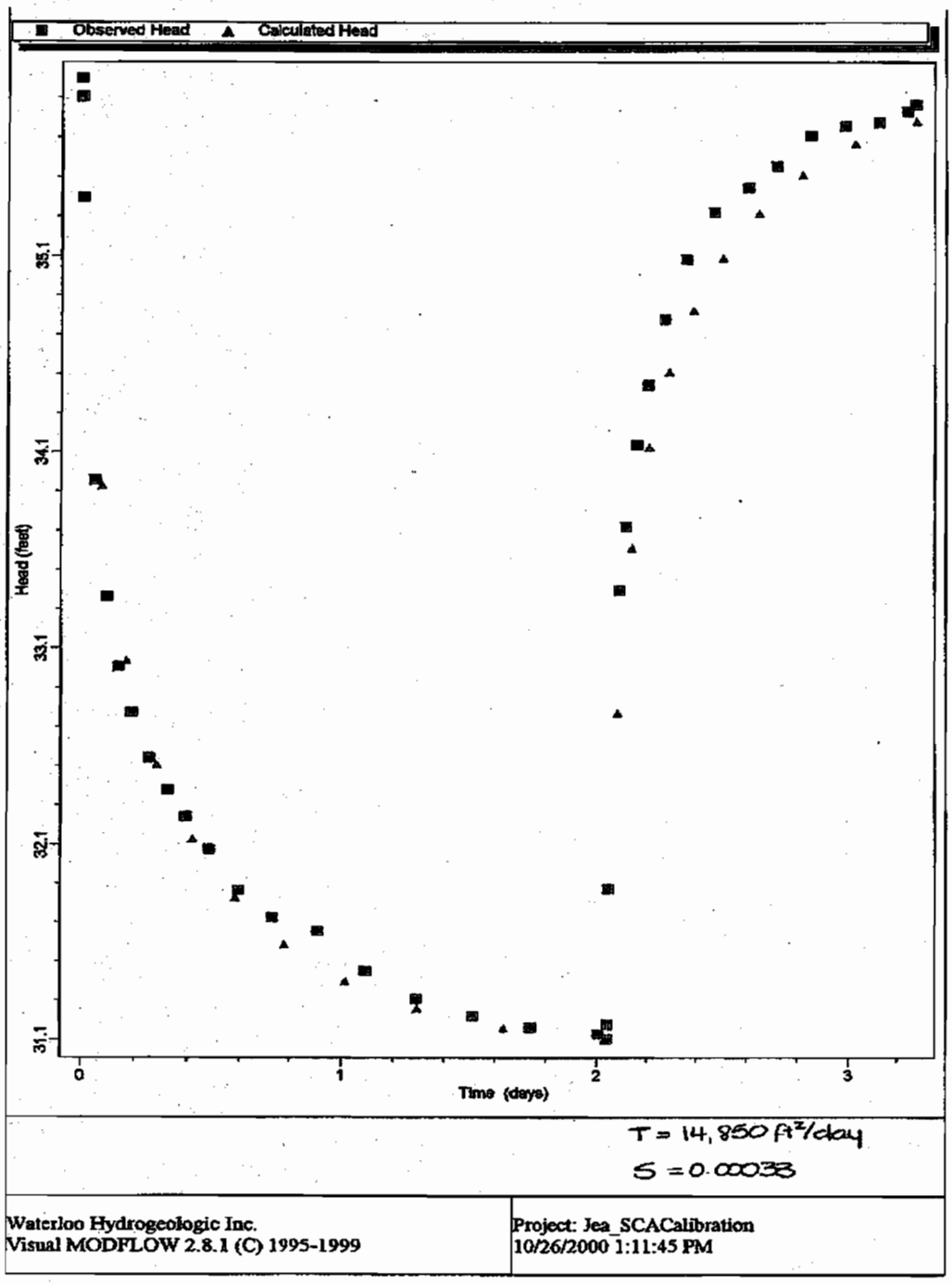


Figure 5.3-1
MODFLOW Model Calibration Curve

Conversion of the plant from simple cycle to combined cycle will require an additional withdrawal of ground water. It is estimated that the total average daily ground water usage of the upgraded power station, running on oil and natural gas, will be 2,744,330 gpd. Daily ground water usage for the average, peak summer and peak winter ambient conditions has been determined for turbines fueled by oil or by natural gas. Table 5.3-2 shows the estimated daily ground water withdrawals for each case. Maximum daily ground water usage is expected to occur for the peak summer ambient conditions with the power plant running fully on oil, with a required ground water pumpage of 3,722,162 gpd.

Table 5.3-2
Daily Ground Water Usage Requirements
for Brandy Branch Conversion Project

Ambient Conditions	Fuel	Load Factor	Required Daily Ground Water Usage
Average	Gas/Oil	100%	2,744,330 gpd
Average	Gas	100%	2,710,903 gpd
Peak Summer	Gas	100%	3,209,261 gpd
Peak Winter	Gas	100%	2,583,438 gpd
Average	Oil	100%	3,438,198 gpd
Peak Summer	Oil	100%	3,722,162 gpd
Peak Winter	Oil	100%	3,399,098 gpd

Based on the anticipated average and maximum daily ground water usage, installation of a minimum of two additional wells withdrawing water from the Floridan Aquifer will be required. One of the wells will act as a backup in case of an individual well outage. The remaining three wells will each pump approximately 1,240,720 gpd during the peak summer season. The operating and backup wells will be restarted on a regular basis to minimize potential impacts.

5.3.2.3 Impact Assessment. Once the model was calibrated, the following two plant ground water usage conditions were simulated:

- Average Daily Flow--Three onsite wells were modeled to pump at a capacity of 635 gpm each, equivalent to a total average daily ground water usage of 1,907 gpm. The model was set to simulate steady-state conditions. Figure 5.3-2 presents the estimated drawdowns associated with this pumpage.

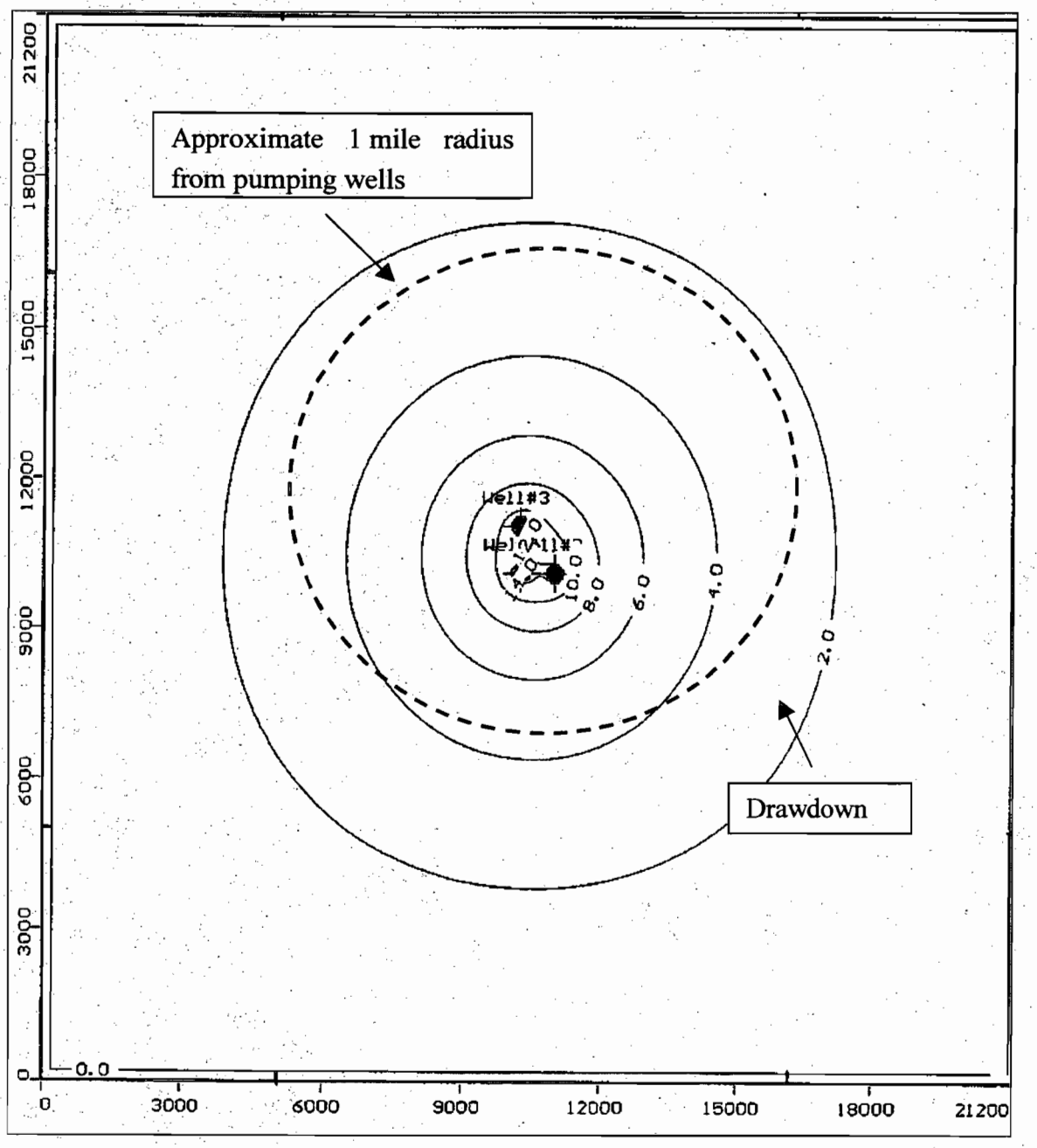


Figure 5.3-2
Drawdown with Distance from Pumping Wells – Average Daily Ground Water Usage

- Maximum Daily Flow--The maximum daily ground water usage model used 3 wells pumping at 861 gpm each, for a total capacity of 2,584 gpm. This model used transient conditions, and was run for 90 days, the assumed time for the maximum ground water usage condition. Figure 5.3-3 presents the estimated drawdowns associated with this pumpage.

Shallow Aquifer

The results of the two simulations described above indicate that plant operations will have negligible effect on the shallow aquifer water levels and no impact on its ground water quality. No additional facilities that would affect the water table zone will be constructed at the Generating Station. No water for plant use will be withdrawn from the shallow aquifer.

Floridan Aquifer

The model indicates the average daily ground water flow will result in a drawdown at the pumping wells of 20 feet, and a drawdown of about 3 feet at a radius of 1 mile from the pumping wells (Figure 5.3-2). For the maximum daily ground water flow simulation, the model indicates that at the end of the 90 days, the drawdown in each of the pumping wells will be 28 feet. Drawdown at a radius of 1 mile away from the well field is estimated to be about 4 feet for this same condition (Figure 5.3-3). The predicted drawdown at a one mile radius from the pumping wells indicates that there will be minimal affects to existing domestic, irrigation, or other public water supply wells installed into the Floridan aquifer due to average or maximum ground water withdrawals at the Generating Station.

The proposed ground water use will not cause any saltwater intrusion. As mentioned previously in Section 2.3.2, literature search indicated there is no brackish ground water within the Floridan Aquifer at the site. Figure 2.3-9 shows the freshwater-saline water interface about 4 miles east from the site, at about Elevation –2,400 feet, in what is known as the Fernandina permeable zone located below the Lower Floridan Aquifer.

Average and maximum ground water usage at the plant is not considered to be sufficient to cause the head changes to induce vertical or lateral saltwater intrusion into the Floridan Aquifer.

In summary, ground water withdrawal from the Floridan Aquifer at the Generating Station will not affect unconfined ground water elevations, will not adversely impact other well users, and will not result in saline water intrusion.

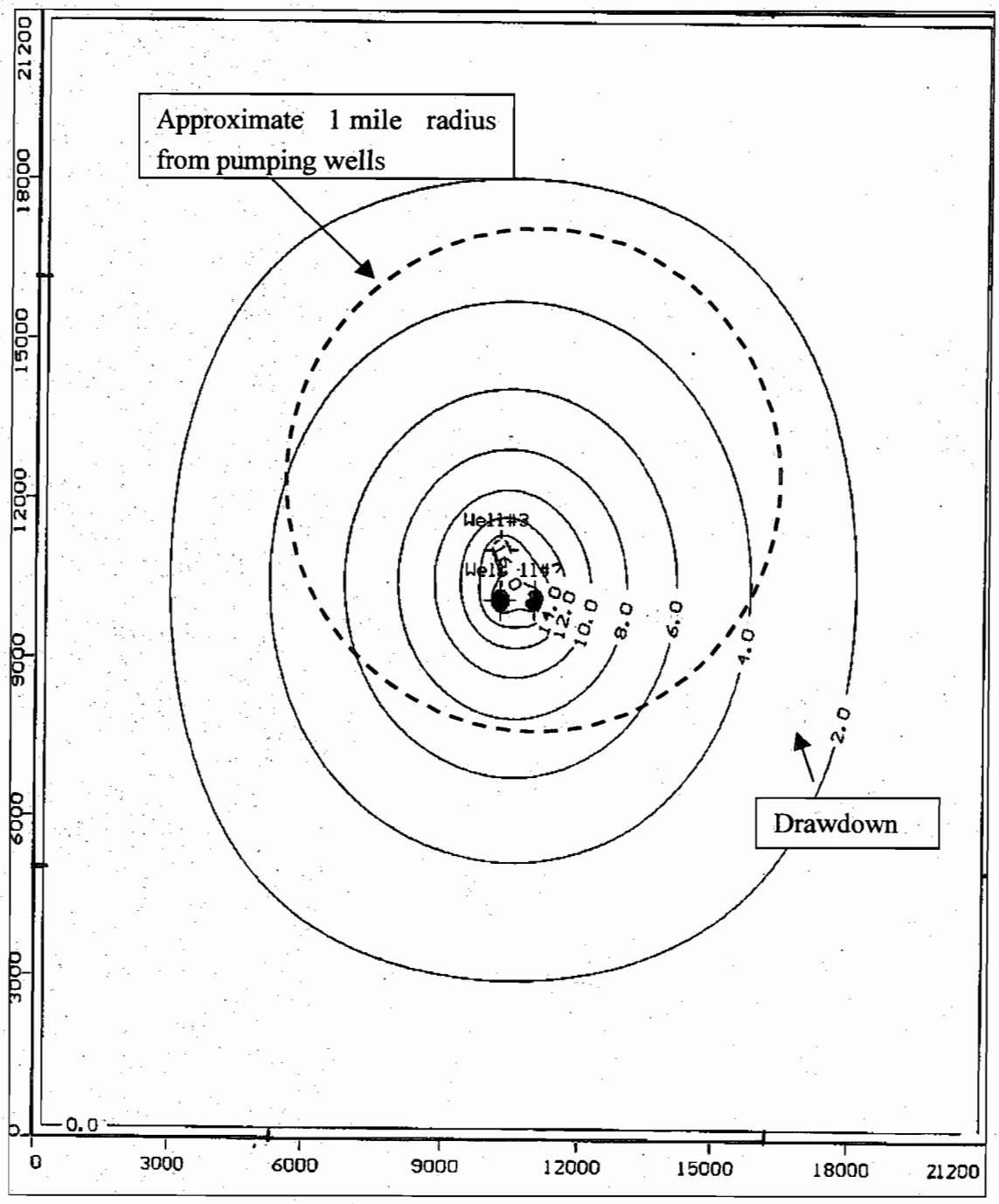


Figure 5.3-3
Drawdown with Distance from Pumping Wells – Maximum Daily Ground Water Usage (for 90 days)

5.3.3 Drinking Water

The effects of ground water withdrawals during operation on drinking water supplies are discussed in Section 5.3.2. The effects of leachate and runoff are discussed in Section 5.3.4. The locations and descriptions of existing wells are provided in Section 2.3.3. There will be no harm to any existing legal users or to the resource by any of the activities associated with the Generating Station.

5.3.4 Leachate and Runoff

There is no new source of leachate associated with the plant and there will be no impact on the underlying aquifers due to leachate. The impacts from plant operations on the surficial ground water system are monitored as described in Section 5.3.5. Effluent from the oil/water separators is routed to the existing percolation pond for discharge to the surficial aquifer.

5.3.5 Measuring and Monitoring Program

A surface water monitoring system has been provided for at the Generating Station to measure the seasonal water level fluctuations in the created wetlands. This monitoring system consists of a permanent staff gauge to monitor water levels. Water levels at this gauge are measured on a monthly basis. Monitoring of the gauge will be performed during construction and operation of the proposed additions at the plant site. The surface water in the wetlands should match the level of the ground water adjacent to the wetlands. Therefore, monitoring the water level in the wetlands area essentially monitors the surrounding ground water levels. Additionally, one temporary piezometer will be installed between the construction area and the wetlands to monitor ground water levels in the shallow aquifer during construction.

Following completion of the conversion project, the ground water in the Floridan Aquifer will be monitored to measure fluctuation in the potentiometric surface and water quality. Water level readings of the potentiometric surface in the Floridan Aquifer will be made on a monthly basis at the backup well. Water quality analyses of samples of the ground water in the well production pipeline will be obtained on a yearly basis, as required by the Consumptive Use Permit. Water samples for chemical analyses will be collected and analyzed using standard methods required by the Florida Department of Environmental Protection.

5.3.5.1 Surface Water Monitoring. The general site runoff will be monitored during a rainfall event which causes discharge from the site runoff collection system at the site runoff detention overflow weir. A grab sample will be collected during the event in the

vicinity of the basin overflow. The sample will be tested in accordance with applicable local, state, and federal requirements.

5.3.5.2 Ground Water Monitoring. Exemption from ground water monitoring was granted by the FDEP on October 6, 1999. Refer to Appendix 10.3, Industrial Wastewater Permit Exemption.

Ground Water Monitoring Plan Requirements

The ground water monitoring plan consists of a natural background well and two downgradient monitoring wells. The natural background well is used to determine natural background quality and used for assessment of water quality measurements from sampling of the downgradient wells.

Two monitoring wells have been located downgradient from the percolation pond. Well placement was optimized by inspection of gradients generated from the existing units Percolation Pond Mounding Study. The study indicated that the infiltration through the percolation pond would extend radially away from the pond. These wells should provide adequate coverage of the downgradient flow from the percolation pond at the intermediate distance intended by the FDEP.

A natural background well was placed at the southernmost portion of site development, and north of the percolation pond where the ground water elevation established in the calibration model was equal to the ground water elevation determined in the predictive model.

Well screens were placed at such a depth as to adequately monitor the upper zone of the surficial aquifer. All of the wells are placed within the fenced enclosure of the developed site for maximum security. The well locations are protected by concrete pads and provided with lockable enclosures to limit access to authorized personnel only.

Reporting requirements for ground water monitoring include the following parameters. Results are submitted quarterly:

- Ground water level.
- pH.
- TDS (Total Dissolved Solids).
- Turbidity.
- Nitrate.
- Sulfate.
- Sodium.
- Chloride.
- TRPH (Total Residual Petroleum Hydrocarbon).

FDEP Fax:850-921-7250

** Transmit Conf. Report **

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Department of Environmental Protection

Jeb Bush
Governor

Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

David B. Struhs
Secretary

SITING COORDINATION OFFICE
FAX COVER SHEET

OFFICE TELEPHONE NO: 850-487-0472
FAX NO: 850-921-7250

19668

DATE: 9/11/01

TO: Scott Goorland and Gita Buzick FAX NO. 487-2339

FROM: Landa Korokows

COMMENTS: 8.7AW notice for Calpine Blue Heron

5.4 Solid/Hazardous Waste Disposal Impacts

Operation as a combustion turbine facility burning primarily natural gas will not generate solid or hazardous wastes through the combustion process. Consequently, there are no onsite landfills or disposal areas.

5.4.1 Solid Waste

Miscellaneous office trash and maintenance wastes will be collected in dumpsters and removed from the site by a licensed contractor.

5.4.2 Hazardous Waste

A licensed contractor will provide for the disposal of cleaning wastes collected in the combustion turbine drain tanks, and for oil collected in the oil/water separator.

5.5 Sanitary and Other Waste Discharges

5.5.1 Impacts

The operation of the combined cycle unit will have a very small impact on the sanitary waste discharge of the plant, as discussed in Section 3.5.2 and Section 3.5.3. The existing system was sized to accommodate incremental staff additions.

5.6 Air Quality Impacts

The air quality impacts associated with the addition of the proposed units are addressed in the PSD Air Permit Application attached to this Site Certification Application as Appendix 10.7 under separate cover.

5.7 Noise Impacts

The facility noise emissions have been projected through the application of a computer modeling program. The modeling calculates facility noise propagation by considering the natural reduction of noise with distance, the absorption of noise by the atmosphere, and the blockage of noise by onsite barriers and equipment. The model does not consider the effects of interceding terrain. The modeling did include a conservative estimate of the absorption of sound by the ground and vegetation. The noise modeling results are shown on Figure 5.7-1.

The results indicate facility noise emissions, with standard supplied mitigation equipment, will result in sound emissions that are well below the criteria level of 60 dBA at all neighboring residential locations. The mitigation includes the following:

- The combustion turbine generator located within an acoustically insulated enclosure.

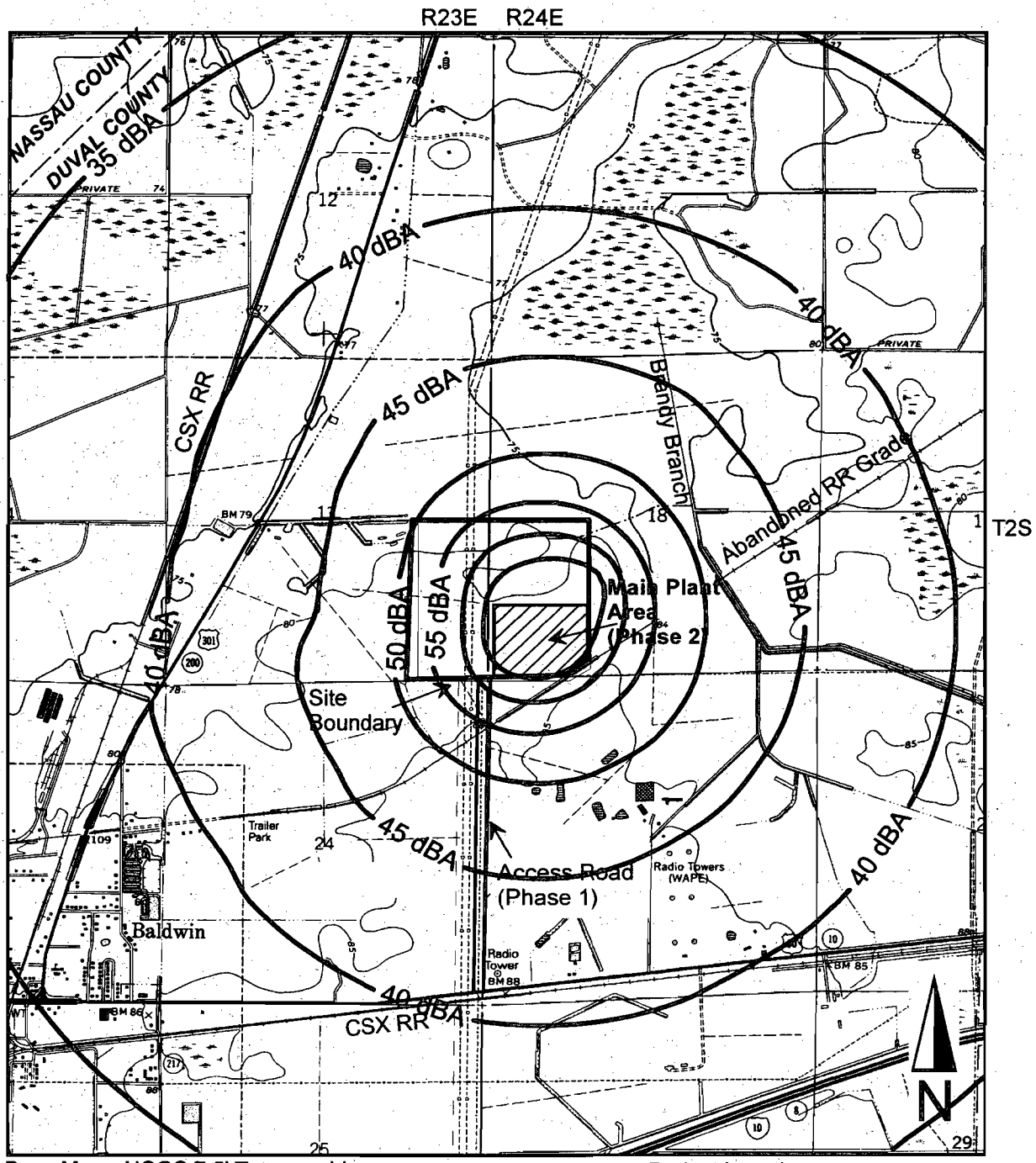


Figure 5.7-1
Projected Facility Noise Emissions during Baseload Facility Operation

- The steam turbines and associated equipment will be located in an acoustically insulated building.
- Combustion Turbine Inlet Silencer
- Silencers on the combustion turbine vents.
- Thermal/acoustic insulation and jacketing of steam and gas piping.

5.8 Changes in Nonaquatic Species Populations

5.8.1 Impacts

Operation of the Generating Station is not expected to decrease the relative abundance of nonaquatic species in the vicinity of the facility. The location of the combined cycle unit will not remove any natural wildlife habitat; however, the cooling tower area will result in a loss of 2.5 acres of upland pine forest. This loss is not expected to cause any changes in species diversity or composition.

5.8.2 Monitoring

No new monitoring efforts are proposed. There will be no changes to the existing monitoring plan for the wetlands creation site.

5.9 Other Plant Operation Effects

The operating staff number will increase from the current level of 6 to 24. No significant impacts on traffic in the Baldwin area are expected. Most employees are expected to use I-10 or US 90 to access the site area. No new offsite roads or road improvements will be required.

5.10 Archaeological Sites

No landmark, sensitive area, or archaeological site will be impacted by operation of the Generating Station.

The Project received a letter dated March 24, 1999, from the Florida Department of State Division of Historical Resources indicating that no significant archaeological or historical sites are recorded for or likely to be present within the Project area.

5.11 Resources Committed

The plant site includes 153 total acres. Of this area, 32 acres are either existing or mitigated wetland areas. Plant and associated onsite facilities include 45 acres permitted for power development. The developed lands may be mostly returned to their original use after the plant ceases operations.

The materials used to construct Brandy Branch Units 1, 2, and 3 simple cycles and the expansion are and will be dedicated resources. It is possible that some of the materials may be reclaimed after plant closure.

The natural gas and oil burned as fuel will be a permanent commitment of resources. It is estimated that approximately 53 billion cubic feet of natural gas and 19 million gallons of No. 2 fuel oil (288 hours/year) will be consumed annually over the 30 year operating period.

5.12 Variances

No variances from applicable codes or standards will be required for the operation of the Generating Station.

5.13 References

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6.0 Transmission Lines and Other Linear Facilities

Existing transmission lines will be used to serve the Brandy Branch Generating Station. No new offsite transmission lines or linear facilities will be required for construction or operation of the Generating Station.

7.0 Economic and Social Effects of Plant Construction and Operation

7.1 Socioeconomic Benefits

The Generating Station will provide benefits to Duval County, the region, and the State of Florida primarily by providing jobs that will increase the buying power of individuals and also generate tax revenues. The project also productively uses a site with limited development potential.

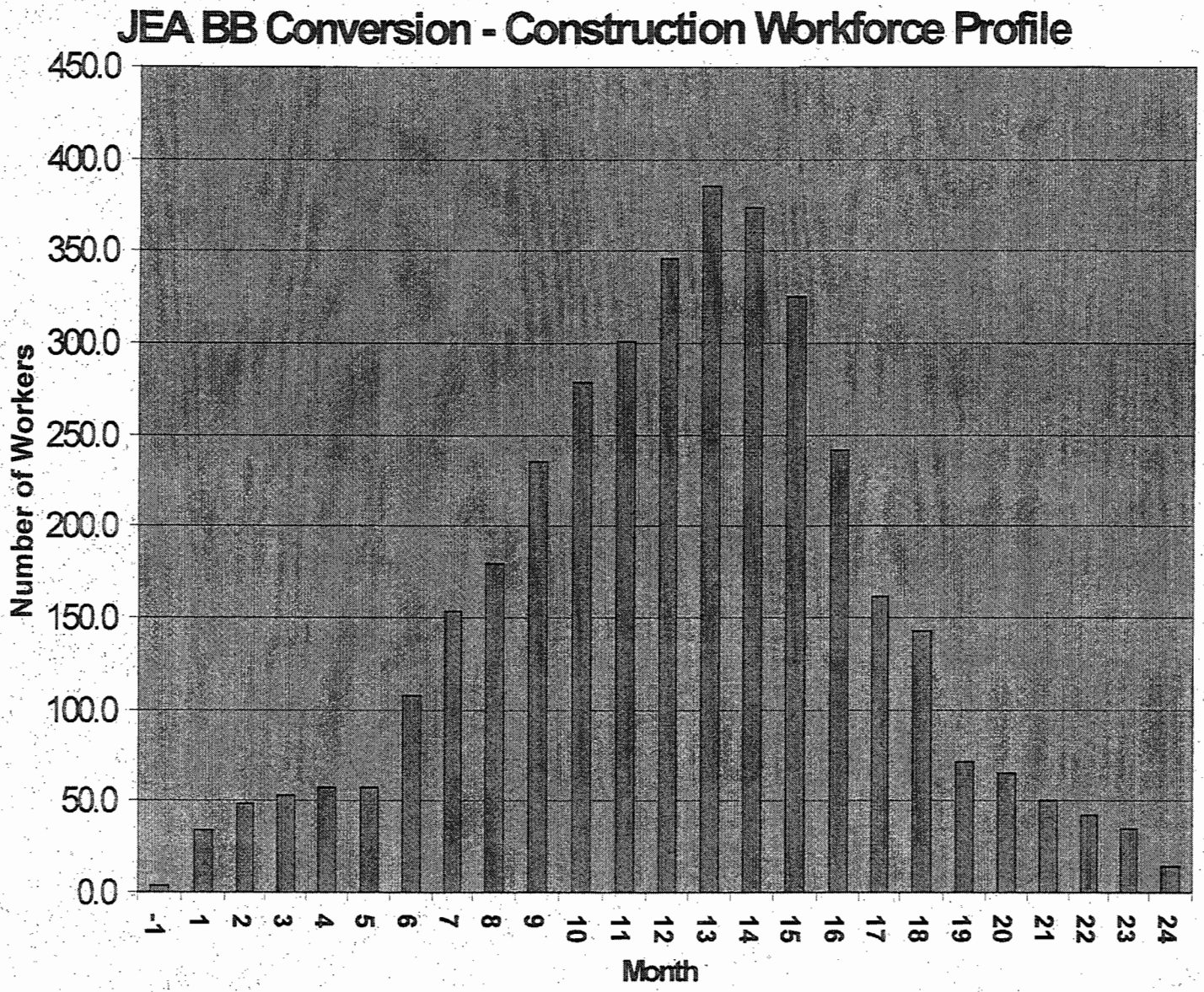
7.1.1 Creation of Temporary and Permanent Jobs

7.1.1.1 Temporary Jobs. The conversion of the Generating Station is expected to create approximately 385 temporary construction jobs. As with all major construction projects, the labor force will change as the project progresses. Early in the project, laborers, carpenters, concrete workers, and operating engineers will be needed. Later, electricians, pipe fitters, boilermakers, and ironworkers will be hired. The anticipated workforce evolution for Brandy Branch conversion is shown on Figure 7.1-1.

The construction workforce is expected to be primarily drawn from the impact area of Duval, Nassau, Clay, and Baker Counties. As discussed above, it is anticipated that most of the workforce will commute daily from permanent residences within the impact area. However, workers who commute weekly to similar construction jobs have been known to travel up to 200 miles (EPRI 1982).

The estimated payroll for the construction project is $19.7 million (in 2002 dollars). Distribution of this payroll would follow the workforce curve presented on Figure 7.1-1.

7.1.1.2 Permanent Jobs. JEA plans to staff the simple cycle plant with six employees, each working 40 hours per week. The total payroll for those six individuals is $350,000. When the units are converted to combined cycle operation, JEA plans to staff the plant 24 hours a day with a total of 24 people over three shifts in a 7 day workweek. The annual payroll would then increase to 1.4 million in 2000 dollars, which will be 1.6 million in 2004 with an annual escalation rate of 3.5 percent. The additional people will come from within the existing JEA workforce. However, studies indicate that operational staff tends to live within 30 miles of the worksite (EPRI IV-2). Therefore, the benefits of these permanent positions will still remain in the impact area.



Poor Original

Figure 7.1-1

7.1.2 Additional Job Creation/Stimulation of Local Economies

While a great deal of local purchasing is not expected to be generated by the power plant construction (EPRI VI-5), the influx of workers into an area tends to stimulate job creation in the service industry. EPRI has studied this indirect economic benefit in power plant construction situations. EPRI concluded from case studies that 0.7 full-time local service jobs are created for every one power plant construction job (EPRI 1982). Therefore, the construction workforce during peak employment could be expected to stimulate the creation of 270 service positions (385x0.7=270). For operational employees, the multiplier has been found to be 0.8 (EPRI 1982). Therefore, it is anticipated that possibly 14 service positions will still remain as a result of the 18 additional operational personnel transferred to the project site with the operation of combined cycle units (18x0.8=14.4).

7.1.3 Revenue Generation for State and Local Governments

Each of the temporary and permanent jobs directly or indirectly created will contribute revenue to the State of Florida and local jurisdictions through sales and use taxes and, potentially, property taxes generated by purchases.

7.1.4 Creation or Improvement of Local Roads, Waterways, or Other Local Transportation Facilities

No improvement to local transportation systems was required by Florida Department of Transportation for development of the existing facilities. It is not anticipated that operation of the facility will have a significant impact on local transportation systems.

7.1.5 Increased Knowledge of the Environment

Surveys conducted during simple cycle permitting revealed no new information, but added to the general scientific knowledge of species type and distribution, the importance of habitat, and the ability of the wide variety of plant and animal species located at or near the Generating Station to co-exist with a human population. Species inventories, mapping, and delineation of habitats were all conducted and have subsequently become part of the general body of scientific knowledge of area ecosystems and the overall environment.

7.1.6 Increased Land Use Efficiency

The Generating Station increases the efficiency of land use in the area. Increased productivity from a given parcel of land is especially beneficial in areas of high economic

growth, such as the impact area, since this allows other parcels to remain available for other beneficial uses.

7.2 Socioeconomic Costs

Major construction projects can potentially affect area residences and businesses; school and library systems; parks and recreation facilities; and public infrastructure such as streets, bridges, and highways, as well as police and fire departments, sewer and water service providers, and local government administration. However, the Generating Station and 18 additional operators will not have any significant negative long-term impacts on these resources and services.

7.2.1 Temporary External Costs

Temporary external costs may include shortages of housing; inflationary rentals or prices; congestion of local streets and highways; noise; temporary aesthetic disturbances; overloading of water supply and sewage treatment facilities; crowding of local schools, hospitals, or other public facilities; burdening of community services; and the disruption of people's lives or the local community caused by the acquisition of land for the proposed site. However, JEA has owned the Generating Station site since 1973 with the intent of developing the property as an electrical power plant station. As described in other sections, there are no major construction impacts expected from the Generating Station. JEA believes that the Generating Station is an environmentally and socially responsible development.

7.2.1.1 Traffic Congestion. Some form of construction-related transportation impact is unavoidable in a project of any significant size due to the movement of workers, machines, and supplies to and from the worksite. During construction, the most significant negative impact is expected to take the form of traffic congestion. However, this impact will only be temporary and will not have any significant adverse impact on the roadways and intersections in the vicinity of the project site.

Construction will occur during daylight hours, with the majority of workers onsite between 7:00 a.m. and 4:00 p.m. A late shift is anticipated, but this shift will have fewer workers.

The access point for the construction workforce and deliveries is the Brandy Branch Generating Station entrance off Highway 90. The entrance is gated and access will continue to be controlled. Designed and constructed during the initial construction of the Brandy Branch Generating Station, this entrance was designed with appropriate geometric improvements, deceleration, acceleration, and turn lanes, all based on Florida

Department of Transportation (FDOT) standards, so that the construction and operational traffic could be appropriately accommodated.

During the early construction phase, vehicles such as road graders, bulldozers, and dump trucks will also require access. However, the majority of these heavy construction vehicles are anticipated to remain onsite for the duration of the initial construction activities, entering at initiation and exiting upon completion. Since the majority of these vehicles will not be making daily trips to and from the worksite, traffic impacts are expected to be minimal. Routine multiple trips by dump trucks and cement mixer vehicles are expected but volumes are not anticipated to be problematic. For example, a majority of the concrete pouring activity will occur in a single day. While cement truck volume on that single day will be significant, the inconvenience will be of short duration.

7.2.1.2 Noise. As indicated in Subsection 2.3.8, the noise from the current Brandy Branch Generating Station configuration does not have a significant negative impact on nearby residences. Furthermore, the additional noise generated by the operation of the new combined cycle unit is expected to be imperceptible.

The construction noise associated with the conversion project is not anticipated to be significant. The majority of construction will be located southeast of the property site. The vegetative buffer and physical distance to the nearest residences (approximately 1 mile) will all mitigate the intermittent disturbance. The project is expected to comply with the Noise Control Regulations.

7.2.1.3 Housing Impacts. No negative housing impacts will occur due to the construction of the Generating Station. As mentioned previously, most of the construction workforce is expected to commute daily from established residences within the impact area. This expectation is based on studies of electric generator construction projects which found that in the project impact area "where a trained labor force exists, there is likely to be less relocation of workers and more commuting from existing places of residence" (III-11, Socioeconomic Impacts of Power Plants, EPRI, Report EA-2228, February 1982). Since the impact area has been experiencing tremendous economic growth for an extended period of time, a seasoned labor force of construction tradesmen is well established in the impact area.

Construction workers relocating to the area temporarily will not affect the availability of short-term housing. If even half of the expected workforce seeks temporary housing, this is only an increased demand of 193 individuals. As mentioned in Section 2.2.7.1 under the heading Existing Housing Stock, Duval County alone had over 3,502 vacant rental apartments and 35,624 vacant housing units, and over 6,411 hotel

rooms and 6,644 motel rooms. This large amount of available temporary housing will easily absorb the additional individuals.

Creation of single-family housing or apartment complexes that will later stand vacant is not expected to be a result of the influx of migratory construction workers. Such workers will not be in the area long enough for it to make financial sense for them to make single-family home purchases.

JEA is not planning on providing housing for construction workers nor offering incentives to local developers or subsidies to local housing suppliers, a fact that supports the conclusion that no significant problems with housing supply are anticipated.

7.2.1.4 General Municipal or Utility Services Impacts. As with potential housing impacts, construction-related impacts to public services and facilities will not be significant. The majority of the construction workforce is anticipated to commute from current residences, with minimal relocation. Since the current workforce is already provided with services, no significant changes in the patterns of use or demands upon public services will occur.

Water Service Impacts

Service and fire water for use at the Generating Station is normally supplied from onsite wells. Service water will be used to supply all general water requirements. Potable water, construction water, and a backup supply for service water will be provided from the City of Baldwin. Potable water is currently supplied to the plant site by the City of Baldwin.

Wastewater Impact

Plant and equipment drains and any site runoff from areas where oil contamination is anticipated will be routed through an oil/water separator prior to disposal into a percolation pond. Other site runoff will be collected and routed to a storm water detention pond which will discharge to an existing onsite wetland.

Solid Waste Collection and Disposal Impacts

Residential and commercial trash collection is provided by a private company. Solid wastes generated during operation will be sent to Trailridge landfill which is owned by City of Jacksonville. Sufficient capacity exists at Trailridge landfill to handle the solid waste disposal needs of the Brandy Branch Generating conversion project; the haulers will directly transfer the waste to the landfill without involving any transfer station. There is no known impact from the proposed new unit conversion on the current solid waste facilities.

Sewer Service Impacts

The Generating Station currently uses and will continue to use a permitted septic tank/tile field system for sanitary wastewater treatment and disposal. Construction contractors will be required to provide temporary sanitary services for their employees.

Police Protection Impacts

Fencing and security will continue to provide for the physical enclosure of secured areas and allow for the monitoring of incoming and outgoing traffic. The security fence will continue to enclose the main plant area and construction areas and allow only limited access. Therefore, police protection demand will not increase.

The combination of the size of the construction work force and the duration of the construction phase will not cause any deterioration in the ability of the Duval County Sheriff's Department to provide routine patrol and protection services in the project area.

Fire Protection Impacts

The Generating Station will have a minimal impact on the demand for fire protection services and facilities. Because the Generating Station's design includes extensive fire detection and firefighting equipment, no additional local firefighting staff and equipment are anticipated to be required. Fire equipment at the plant will include deluge water spray systems, fire hydrants and hose houses, portable fire extinguishers and detection system, and CO_2 systems. According to the Fire and Rescue Department in Jacksonville, current facilities, equipment, and workforce are more than ample to handle any potential situation at the Generating Station.

7.2.2 Long-Term External Costs

There may be long-term external costs resulting from operation of the Generating Station as described in the following paragraphs. However, due to the remote location, self-reliant operation, relatively small staff, use of modern pollution control devices, and compliance with all applicable federal, state, and local regulatory requirements, the potential negative impacts will not be significant.

Negative Impacts on Water Service

The additional potable water usage required during the construction phase will not impact the provision of potable water for the surrounding communities. The wells for the Brandy Branch Generating Station tap a deeper aquifer than that utilized locally for potable water provision.

The incremental use of potable water at the Generating Station due to unit conversion will not have significant impacts during the operational phase.

Negative Impacts on Potential Use of Contiguous Parcels

Since the Brandy Branch Generating Station is already developed as an electric generating facility, the conversion project will not negatively affect any land usage for the balance of Brandy Branch property or the surrounding area. Since the Brandy Branch Generating Station already operates as an electric generating facility, the combined cycle conversion construction project at issue will not affect the utility of this area.

Negative Impacts on Local Recreational Activities

No access to local recreational activities is available through or near the Generating Station site; therefore, the conversion project described herein will not affect these activities.

Negative Impacts on Local Native Species

No negative impacts on local native species is anticipated.

Negative Impacts on Archaeological Sites

No significant archaeological sites existed on the Brandy Branch Generating Station property prior to its development; no eligible sites have been subsequently identified. The project poses no threat to any other areas, whether of recreational, scenic, historic, cultural, natural, or archeological value.

Negative Impacts on Alternative Land Uses

No alternative uses for the site have been proposed. The project site has been designated for industrial use, such as electricity generation, by the City of Jacksonville.

Negative Impacts on Local Meteorological Conditions

Neither the construction of the combined cycle conversion or operation of the Generating Station will have significant meteorological impacts. Fogging due to operation of the cooling tower is projected to be minimal. Air pollutant emissions from the combustion units will be within acceptable permitted limits.

Noise

The Generating Station will not generate sufficient noise to negatively affect any local residents. There are currently no residential units within 1 mile of the power block, and none are currently planned. The vegetation will act to absorb or deflect sounds that otherwise may travel to the populated area. Equipment traveling to and from the Generating Station will unavoidably generate noise during transit through populated areas, but this noise will not be significant in either level of intensity or duration.

Displacement of Persons for Construction Purposes

Since the Generating Station was uninhabited prior to the construction of simple cycle units and has continued to be uninhabited, no displacement of persons will result from the expansion. No lost income will result from any reduction of regional products

or productivity whether due to displacement of persons from the land proposed for the site or otherwise.

Negative Impacts on Neighboring Property Values

Since the site has been zoned and developed as an electric generating facility, the proposed conversion will not decrease the property values of the surrounding real estate. There are no current or proposed public recreation, tourist, or commercial fishing developments in the area immediately surrounding the site. Since the area is zoned for industrial use, it is not anticipated that such proposals will be forthcoming.

Negative Impacts on Local Municipal or Utility Services

As discussed above, the majority of workers hired during the construction phase of combined cycle unit conversion are expected to commute locally to the project site from established, permanent residences. The majority of the remaining workers are expected to travel alone into the impact area on a weekly basis, staying in temporary housing facilities such as hotels or recreational vehicle campgrounds. In either case, these workers will not generate any increased costs to local government for services. While such workers will benefit from police, fire, ambulance, sewer, water, and recreational services provided by local governments, they will help defray the costs of providing such services through property taxes, sales taxes, or costs built into rent payments. In any event, the number of workers hired for peak construction activity is expected to be about 385, a figure considered too low to adversely affect the ability of local governments to adequately provide any necessary services. Furthermore, the number of permanently employed workers associated with the combined cycle units is only expected to be 18, which is too low to adversely impact the ability of a local government from providing services. It is also expected that these permanent employees will simply continue to commute from their current, existing, permanent residences which will, therefore, further reduce any negative impacts of service provisions by government.

Negative Impacts on Aesthetic or Scenic Values

Due to vegetative buffers and extensive setbacks, incremental Generating Station development will not result in the deterioration of any local scenic or aesthetic values. Some tree removal will be required for installation of the cooling tower. However, these removals will not cause a deterioration of the local or regional aesthetics.

7.3 References

Florida Department of Labor and Employment Security, Florida Industry and Occupational Employment Projections to 2008.

Gierman, Kristen, Jacksonville Housing Department, in personal communication to Tammy Wang, Black & Veatch, October 2000.

Gueterman, David, Zone Commander, Jacksonville Sheriff's Department Zone 5, in personal communication to Tammy Wang, Black & Veatch, October 2000.

Lashley, James, Duval County Public Schools, in personal communication to Tammy Wang, Black & Veatch, October 2000.

Mock, Lorin L., Division Chief Operations, Jacksonville Fire and Rescue Department (Tel: 904-1-798-1146), in personal communication to Tammy Wang, Black & Veatch, October 2000.

Socioeconomic Impacts of Power Plants, Electric Power Research Institute (EPRI), Report EA-2228, February, 1982.

US Census Bureau, http://www.census.gov/, US Counties General Profile, 1998.

http://www.educationcentral.org/Schools_Info/SchoolsA_Z/schools_high.htm, Education/school information.

http://www.expandinjax.com/index.asp, Median Housing Price for a New Home in Jacksonville MSA.

http://lmi.floridajobs.org/Press/trends.pdf, http://lmi.floridajobs.org/laus/avg99.prn, for County unemployment rate.

http://www.floridabusiness.com/infocenter/CountyProfiles/floridacounties.htm, for general income information.

http://www.expandinjax.com/com_overview/, for county household income information.

8.0 Site and Design Alternatives

8.1 Alternative Sites

Due to the availability and resources of the existing site, no alternative sites are being considered.

8.2 Proposed Site Design Alternatives

8.2.1 Alternative Heat Rejection Systems

No alternative heat rejection systems were evaluated due to the lack of surface water in the area and availability of well water at the site. A mechanical draft cooling tower is the proposed heat rejection system.

8.2.2 Biological Fouling Control

Periodic biocide treatment of recirculating cooling water is necessary to control biological fouling of condensers, associated piping, and related equipment. Potential biofouling control alternatives include the following:

- Chlorination
- Sodium bromination
- Ozonation
- Ultraviolet radiation
- Mechanical cleaning

8.2.2.1 Alternative Biofouling Control Methods. Nonchlorine biofouling control alternatives are considered less favorable than the chlorination method, primarily due to cost and operational effectiveness. Sodium bromide and ozone as biocides were considered but involve significantly higher operational costs than chlorine, especially in the treatment of such large water volumes as recirculating cooling water for power plants. Ultraviolet radiation also involves much higher operational cost and has operation deficiencies since this alternative is relatively ineffective in treating water with suspended particles. Mechanical cleaning is ineffective in cleaning remote portions of the cooling system equipment and destroying microorganisms suspended in the water. Based on these considerations, these potential alternatives offer no environmental, operational, or cost-effectiveness advantages relative to the chlorination method for biofouling control.

8.2.2.2 Proposed Biofouling Control Method. Chlorination using liquid sodium hypochlorite is the proposed method of biocide treatment for the cooling tower. The sodium hypochlorite solution will be contained in a storage tank. Pumps will transfer the solution through diffusers at the cooling tower basin. Biological growth will be

controlled by shock chlorination. Provisions will also be included for periodic feed of a nonoxidizing biocide should operation indicate the need.

8.2.3 Cooling Water Makeup/Process Water Source Alternatives

8.2.3.1 Potential Alternative Water Sources. The City of Baldwin currently provides potable water to the Brandy Branch site at a rate of approximately 400 gallons per day (gpd). Conversion of the facility from simple cycle to combined cycle will only require an increase in potable water demand to approximately 700 gpd. Baldwin has the capacity to supply this incremental demand; therefore, Baldwin Municipal Water is the most desirable source of practical, reliable, sanitized water to supply the Brandy Branch potable water system. Alternative potable water options include the construction of an onsite potable water system. Given the low potable water use requirement, the expense of constructing and operating a potable water system, and the additional ground water withdrawal requirement, this option is undesirable. The use of municipal potable water is the preferred alternative.

The project proposes to use approximately 2.7 million gallons per day (mgd) (annual average) of nonpotable ground water for cooling, steam production, and related process systems. To help reduce the volume of water required, the water will be cycled through the cooling tower until the amount of dissolved solids and minerals are concentrated eight times. Recycling of water through the cooling tower greatly reduces the total amount of water required on a daily basis.

Process Water Option 1 would use reclaimed water as a potential alternative source of cooling water makeup and process water for the project. Reclaimed water can be produced at JEA's Southwest Wastewater Treatment Facility (WWTF) and supplied to the site. The Southwest WWTF is located over 22 miles from the project site. The construction of a pumping station and over 22 miles of new pipeline would be required to supply the water to the site.

In addition to the construction of the pump station and pipeline to the project site, the use of reclaimed water would require the installation of treatment devices prior to demineralization. Such pretreatment includes methods such as clarification, filtration, and reverse osmosis. High-level UV disinfection would also be required.

It is estimated that the use of reclaimed water from the Southwest WWTF would cost approximately $21.2 million. This estimate does not include easement acquisition costs nor does it reflect any potential environmental remediation or permitting costs.

Process Water Option 2 is the use of ground water withdrawn from the Floridan Aquifer through the onsite wells as a source of cooling water makeup and process water for the project. The use of ground water would include using two existing onsite wells

and installing two new onsite wells. Only three of the four wells would be used at any one time. Withdrawal from the wells would be rotated so that all four wells receive periodic use.

In conjunction with utilizing the Brandy Branch wells, water use offsets are available from the JEA Northside Station. To utilize the available offsets, the Northside Station will use effluent from the JEA District II WWTF as a source of cooling and process water and reduce dependence on ground water. This will save the use of approximately 1 million gallons of well water per day at the Northside Station. Additionally, JEA is pursuing numerous future reuse options, including a tree farm demonstration project at the District II WWTF.

The estimated cost is $1.5 million for the use of ground water from wells at Brandy Branch. This cost includes the installation of two new onsite wells. The installation of two new onsite wells would greatly reduce environmental impact, as compared to the construction of 22 miles of pipeline as required in Option 1.

Process Water Option 3 would use a combination of reclaimed water from the Southwest WWTF and onsite well water. While this option may be potentially feasible, it would carry with it the full cost and engineering burden of building approximately 22 miles of influent piping. Interconnections allowing the use of both well water and reclaimed water would also have to be engineered and constructed. The full environmental impact of the installation of 22 miles of pipeline would also be present in this option.

In conclusion, the use of ground water from onsite wells is the preferred option. The cost of installation and operation is significantly lower than that of using reclaimed water. The immediate environmental impacts of installing two new wells would be significantly lower than installing 22 miles of pipeline. Also, the effect of using ground water from the deep Floridan Aquifer can be mitigated through the potential use of reuse offsets available at the JEA Kennedy and Northside Stations. The Kennedy and Northside Stations would reduce their use of ground water and increase their dependence on the use of reclaimed water.

8.2.3.2 Proposed Water Sources. The two proposed sources of water for the Generating Station are well water and the City of Baldwin municipal supply. Site wells will supply plant service water requirements and cooling tower makeup. City of Baldwin municipal water will also be used as an emergency source of service water cooling tower makeup should well water be temporarily unavailable. Two additional onsite wells will be required to meet this increased demand in well water.

8.2.4 Sanitary Waste System Alternatives

No sanitary waste system alternatives were considered due to the small amount of additional sanitary waste produced at the Generating Station.

8.2.5 Plant Drainage System Alternatives

8.2.5.1 Potential Alternative Systems. Presently, oil/water separator effluent is routed to an onsite percolation pond. One potential alternative would be to discharge treated oil/water separator effluent to the Baldwin Force Main; however, this option was not considered desirable in discussions with the FDEP. It is preferable to maintain the current concept which will continue to allow ground water recharge in the site area.

8.2.5.2 Proposed Plant Drainage System. Site drainage from oil containment areas and other potentially oil contaminated areas will be routed through an oil/water separator to the onsite percolation pond prior to ground water discharge. The existing percolation pond will be expanded as required to accommodate the additional wastewaters from the combined cycle unit.

As required by the FDEP, the Generating Station storm water management system directs all storm waters from developed areas to an onsite detention pond. Minor modifications to the system will be required to incorporate the conversion project facilities.

8.2.6 Process Wastewater Treatment Alternatives

8.2.6.1 Potential Alternative Wastewater Systems. Several wastewater disposal options are presented below. Several of these options are severely constrained by capital costs and time to construct.

Potential Wastewater Option 1 is to pump the flow of wastewater to the City of Baldwin WWTF. The permitted capacity of the Baldwin WWTF is 0.4 mgd; average daily flow (ADF) is 0.2 mgd. The estimated peak daily wastewater flow from the project is 0.36 mgd (249 gpm). The addition of 0.36 mgd would exceed the permitted capacity of the City of Baldwin WWTF.

The cost of expanding the City of Baldwin WWTF is estimated to be $8 per capital gallon, or $3.7 million. Also, since the project wastewater is relatively "clean," it would dilute the wastewater at the WWTF and could potentially cause a degradation or upset in the treatment process. In addition, the elevated concentration of total dissolved solids (TDS) would pass through the WWTF with minimal treatment and could negatively impact the UV disinfection system by significantly reducing the transmissivity of the water. Given the lack of permitted capacity and the cost of upgrading the Baldwin facility, Option 1 is not desired.

Potential Wastewater Option 2 is the use of an onsite percolation pond. A percolation pond is an impoundment into which the effluent is pumped and allowed to seep or "percolate" into the ground. Approximately 40,000 square feet of percolation area would be required to accommodate the effluent flow from the project.

The concentration of three parameters would likely exceed secondary ground water standards (identified in parentheses). These parameters include: sulfates (SO_4) – 1,343 mg/L (250 mg/L); fluoride (F) – 8 mg/L (2.0 mg/L); and total dissolved solids (TDS) – 2,190 mg/L (500 mg/L). The concentrations identified above could be reduced by decreasing the cycles of cooling tower blowdown. However, since a new percolation pond would likely have to be constructed at the northwest corner of the property, the zone of discharge and the property line would be essentially the same. It is likely that the resultant concentration reduction would be insufficient to meet the ground water standards.

Additionally, decreasing the cycles of concentration would require an increase in ground water withdrawal above the proposed 1,906 gpm (annual average). It may be difficult to permit the additional ground water withdrawal requirements.

Potential Wastewater Option 3 is to pump the wastewater effluent approximately 9 miles to a connection point located at Cecil Field (CF). CF ultimately pumps to the Southwest WWTF.

Construction of this line would encounter minimal obstructions for much of the route. A disadvantage would be that the main on CF would have to be sized to accommodate future flows pumped to the Buckman WWTF. Determining this main size would be heavily dependent on the potential future developments to be located at CF. Additionally, the main would need to be authorized, designed, permitted, and constructed by late 2002 to support a Brandy Branch startup in early 2003. As such, this option presents serious time constraints.

Potential Wastewater Option 4 is to construct a WWTF on the western edge of the existing JEA wastewater service area. Such a WWTF could be used to provide reclaimed water for cooling purposes at Brandy Branch, as well as for a proposed tree farm which could potentially be located on CF property.

The estimated cost for a 5 mgd WWTF is approximately $30 million. The potential quantity and quality of water from this potential WWTF is unknown. The time required for design and construction may also present serious delays. As such, given the uncertainty as to the quantity and quality of water potentially available, the time required for construction, and the extremely high capital cost, this is not a viable option.

Potential Wastewater Option 5 would be to pump the project effluent approximately 8 miles to a connection point located along Beaver Street which ultimately pumps to the Buckman WWTF. An advantage of this option would be its long-term use to accommodate additional flows in the growing Westside area.

Disadvantages include a congested construction route which potentially makes construction difficult and expensive. Another disadvantage would be getting the main authorized, designed, permitted, and constructed by late 2002 to support a Brandy Branch startup in early 2003. The estimated cost of this option is approximately $7 million.

In conclusion, it is recommended that Wastewater Option 5 be pursued given the low initial capital cost and its potential long-term use in the growing Westside area.

8.2.6.2 Proposed Wastewater Treatment System. Appropriate plant wastewater, including cooling tower blowdown, will be discharged to the Baldwin Force Main for disposal.

8.2.7 Solid Waste Disposal System

There are no solid process wastes generated at the plant. Trash and other non-process solid waste will be disposed of at an approved facility. No alternatives were evaluated.

9.0 Coordination

The following is a list of individuals within state, regional, and local government agencies who were contacted to provide information for this project:

State

- **Public Service Commission**
  Tallahassee
  Mr. Tom Ballinger
  Mr. Michael Huff
- **Department of Environmental Protection**
  Power Plant Siting Coordination
  Tallahassee
  Mr. Buck Oven
  Mr. Scott Goorland
  Mr. Steve Palmer
  Air Resources Management Division, Bureau of Air Regulation
  Tallahassee
  Mr. Mike Halpin
  Mr. Chris Carlson
  Environmental Resource Permit Section
  Jacksonville
  Mr. David Apple
  Industrial Wastewater Permit Section
  Jacksonville
  Mr. Ken Kohn
- **St. Johns River Water Management District**
  Jacksonville
  Ms. Caroline Silvers
  Mr. Jay Lawrence

Local

- **Jacksonville Regulatory and Environmental Services Department (RESD)**
  Jacksonville
  Mr. Steve Pace

- **Jacksonville Planning and Development Department (PDD)**
  Jacksonville
  Mr. Steve Smith
- **Jacksonville Building Department**
  Jacksonville
  Mr. Jim Schock

JEA Brandy Branch
Combined Cycle Conversion

Site Certification Application

Appendices

Manual Number JEA/BB - 02

Issued to Mr. Hamilton (Buck) Over

Location _____

10.0 Appendices

This section identifies the existing Brandy Branch Generating Stations permits for the simple cycle units and includes the major permit applications and approvals required to construct and operate the combined cycle unit.

10.1 Existing Federal Permits

10.1.1 NPDES Permit

The NPDES storm water construction permit for the Brandy Branch site is in place at the Federal level. Minor modifications are required in the Storm Water Pollution Prevention Plan, as discussed in Appendix 10.2, to bring the permit in line with the most current project information.

10.1.2 COE – 404 Permit

A Corps of Engineers 404 permit was issued on November 5, 1999 for wetlands impacts.

National Pollutant Discharge Elimination System Permit

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)
STORM WATER CONSTRUCTION GENERAL PERMIT COVERAGE NOTICE

October 26, 1999

Dear Operator:

Your Notice of Intent (NOI) for the facility noted below has been processed by the U.S. Environmental Protection Agency. This facility is authorized to discharge storm water associated with construction activity under the terms and conditions imposed by EPA's NPDES storm water construction general permit issued for use in the state of Florida. Your facility's NPDES construction storm water general permit number is FLR10G281.

EPA's storm water construction general permit requires certain storm water pollution prevention and control measures. Among the conditions and requirements of this permit, you must prepare and implement a pollution prevention plan (PPP) that is tailored to your construction site. Enclosed is an insert explaining how you may obtain a summary guidance document designed to assist you in the development and implementation of your PPP. The summary is organized according to the phases of the pollution prevention planning process and contains a set of worksheets and an example of a pollution prevention plan. As a facility authorized to discharge under this storm water construction general permit, all terms and conditions must be complied with to maintain coverage and avoid possible penalties.

FACILITY:
Brandy Branch Generating Stat
1 Mi N/us 90 Sr 10 1 Mi Ne
Baldwin, FL -
301910, 0815645,
, ,

OPERATOR:
Jea
21 W Church St
Jacksonville
FL 32202-

To obtain a copy of the construction general permit terms and conditions to which you are now held accountable, please call the EPA Office of Water Resource Center at (202)260-7786. If you have general questions concerning the storm water program, please call the EPA Region 04 contact: Floyd Wellborn, (404) 562-9296.

United States Army Corps of Engineers
404 Permit

IMAGE QUALITY

AS YOU REVIEW THE NEXT FEW PAGES, PLEASE NOTE THAT THE ORIGINAL DOCUMENT WAS OF POOR QUALITY.

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

REPLY TO
ATTENTION OF

Regulatory Division
Atlantic Permits Branch
199902804(IP-MMS)

NOV 0 5 1999

Mr. Walt Bussells
Managing Director, JEA
21 West Church Street
Jacksonville, Florida 32202.

Dear Mr. Bussells:

We are pleased to enclose the Department of the Army permit for the access road and a power generation plant near Baldwin, Florida. Work may begin in accordance with the terms and conditions of the issued permit.

The Enforcement Branch Chief is responsible for inspections to determine that permit conditions are strictly adhered to. A copy of the permit and drawings must be available at the site of work. **Please reference the permit number, 199902804, in all correspondence sent to this office that is related to the work.**

If, in the future, you choose to modify your permitted work, this must be requested in writing and drawings showing the proposed changes must also be submitted. Any requests for extensions beyond the 5 year time limit must be requested, in writing, at least 1 month prior to the expiration date of the permit.

IT IS NOT LAWFUL TO DEVIATE FROM THE APPROVED PLANS ENCLOSED.

Sincerely,

John R. Hall
Chief, Regulatory Division

Enclosure

DEPARTMENT OF THE ARMY PERMIT
(ORIGINAL)

RECEIVED
NOV 1 1999
BY:

Permittee: JEA

Permit Number: 199902840(IP-MMS)

U.S. Army Engineer District, Jacksonville

NOTE: The term "you" and its derivatives, as used in this permit, means the permittee or any future transferee. The term "this office" refers to the appropriate district or division office of the Corps of Engineers, Corps, having jurisdiction over the permitted activity or the appropriate official of that office acting under the authority of the commanding officer.

You are authorized to perform work in accordance with the terms and conditions specified below.

Project Location: The project is located one mile east of Baldwin and one mile north of U.S. 90 / S.R. 10, in Sections 13 and 18, Township 2 South, Ranges 23 East and 24 East, Baldwin, Duval County, Florida.

Project Description: To fill 2.2 acres of forested cypress wetlands for a new power generation facility and to fill 1.4 acres of herbaceous wetlands for a site access road. All work is to be completed in accordance with the attached plans numbered 199902840(IP-MMS) in 9 sheets dated 26 October 1999.

Permit Conditions:

General Conditions:

1. The time limit for completing the work authorized ends on OCT 27 2004. If you find that you need more time to complete the authorized activity, submit your request for a time extension to this office for consideration at least one month before the above date is reached.

2. You must maintain the activity authorized by this permit in good condition and in conformance with the terms and conditions of this permit. You are not relieved of this requirement if you abandon the permitted activity, although you may make a good faith transfer to a third party in compliance with General

Condition 4 below. Should you wish to cease to maintain the authorized activity or should you desire to abandon it without a good faith transfer, you must obtain a modification of this permit from this office, which may require restoration of the area.

3. If you discover any previously unknown historic or archeological remains while accomplishing the activity authorized by this permit, you must immediately notify this office of what you have found. We will initiate the Federal and state coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

4. If you sell the property associated with this permit, you must obtain the signature of the new owner in the space provided and forward a copy of the permit to this office to validate the transfer of this authorization.

5. If a conditioned water certification has been issued for your project, you must comply with the conditions specified in the certification as special conditions to this permit. For your convenience, a copy of the certification is attached if it contains such conditions.

6. You must allow representatives from this office to inspect the authorized activity at any time deemed necessary to ensure that it is being or has been accomplished in accordance with the terms and conditions of your permit.

Special Conditions:

1. At least 48 hours prior to commencement of work authorized by this permit, the permittee shall notify the Corps in writing at the following address. All information regarding this permit and reports shall be submitted to the U.S. Army Corps of Engineers, Regulatory Branch, Enforcement Branch, P.O. Box 4970, Jacksonville, Florida 32232-0019 and **shall reference the permit number.**

2. Within 12 months of the commencement of the fill authorized herein, the permittee shall create 4.4 acres of cypress wetlands and 1.4 acres of herbaceous wetlands as shown on sheets 8 and 9 of 9.

3. The created cypress wetlands will be planted with cypress trees at a minimum density of 400 trees per acre. The cypress

will be planted on 10-foot centers. The cypress will comprise of 3-gallon containerized trees from a registered nursery. As-built surveys of the completed creation cypress wetlands will be submitted to the Corps.

4. The field sampling and monitoring to determine the success of the created cypress wetlands shall be conducted as follows:

(a) A baseline report will include a drawing depicting the plantings of the mitigation site, the methodology for the monitoring of the site, the location of the transects and a hydrological report. The report shall be submitted within 60 days of the completion of the monitoring event.

(b) Monitoring shall be conducted once a year in the fall for five years. The monitoring shall include: a count of live stems of established or survived trees, assessment of growth (height) using a random sub-sample of plantings, relative health of plantings, percentage of exotic or nuisance species present, wildlife utilization (qualitative), recruitment of wetland species, and a recording of all additional plant species observed in the vicinity of the belt transect that were not present in the previous sample.

(c) The reports shall be submitted within 60 days of the completion of the monitoring event. The report shall include the quantitative or qualitative data, narrative description, monthly monitoring of water level elevations (if available), and one page summary. The one page summary shall highlight any potential problems. Some examples of potential problems are concerns with the hydrological conditions i.e. to much or to little water, a decline in wetland species (less than 85% obligate wetland and/or facultative wetland species in each area), an increase of nuisance species (more than 10% in each mitigation area), and any other potential problem that may cause the mitigation area to fail. If there are any problems at the site then the monitoring shall be conducted quarterly until the problem has been resolved.

(d) If at the end of the five year monitoring period, the created cypress wetlands have achieved the proper hydrological and soils conditions, have sustained at a minimum 85% obligate wetland and/or facultative wetland species as defined by the Corps 1987 Jurisdictional Delineation Manual, and do not contain more than 10% nuisance species in each mitigation site then they can be considered successful and monitoring may

end. If the mitigation areas are considered unsuccessful then the monitoring continues until it is successful.

5. If the mitigation efforts within the created cypress wetlands fail to indicate a reasonable degree of success by the third year of monitoring, the permittee shall submit a contingency plan for review and approval. A reasonable degree of success will be that the wetland species have grown at least 12 inches on average and there is less than 10% nuisance species on site. The Corps reserves the right to review and approve this contingency plan.

6. Within 12 months of the commencement of the fill authorized herein, the created herbaceous wetlands shall be excavated and seeded as shown on drawing 8 and 9 of 9. After the construction of the creation herbaceous wetland areas is complete, as-built surveys shall be prepared and submitted to the Regulatory Division, Enforcement Branch, Post Office Box 4970, Jacksonville, Florida 32232-0019 for final approval.

7. The herbaceous wetland creation area shall be monitored annually for three years. Natural recruitment by herbaceous groundcover and woody species shall be visual assessed and documented in each annual report. Other field observations shall include hydrology, wildlife utilization, and presence of nuisance species.

8. If at the end of the three year monitoring period, the created herbaceous wetlands have achieved the proper hydrological and soils conditions, have achieved a minimum coverage area of 80% obligate wetland and/or facultative wetland species as defined by the Corps 1987 Jurisdictional Delineation Manual, and do not contain more than a 10% coverage area of nuisance species (primrose willow, dog fennel, chinese tallow, cattail, climbing hemp vine, air potato, etc, but are not limited to these species), then they can be considered successful and monitoring may end.

9. If the creation herbaceous area is considered unsuccessful after one year of monitoring then the permittee shall submit a contingency plan for review and approval. The Corps reserves the right to review and approve this contingency plan. Upon approval, the permittee will implement the plan.

10. On Sheet 7 of 9 there is an existing isolated wetland labeled "EXISTING WETLAND 1" in which a power line access road runs through it in a north-south direction. As added

mitigation, the applicant shall enhance the existing wetland by scraping approximately 30-feet of the road down to the elevation of the wetlands to the side of the road, to restore hydrology to the site.

11. The permittee agrees to preserve the created and existing wetlands within the property boundary of the generating station. The preserved wetlands shall remain in their natural state in perpetuity. The permittee agrees that the following uses and/or activities will be prohibited on the preserved lands.

- Construction or placing buildings, roads, signs, billboards or other advertising, utilities or other structures on or above the ground need to be reviewed on a case by case basis and may require a modification or a permit.
- Dumping or placing soil or other substance or material as landfill or dumping or placing of trash, waste or hazardous material.
- Removing or destroying trees, shrubs, or other vegetation, except for exotic species.
- Excavating, dredging or removing loam, peat, gravel, soil, rocks, or other material substances in such a manner as to affect the surface.
- Surface use, except for purposes that permit the land or water area to remain predominantly in its natural condition.
- Activities detrimental to drainage, flood control, water conservation, erosion control, soil conservation, or fish and wildlife habitat preservation.
- Acts or uses detrimental to such retention of land or water areas.
- Acts or uses detrimental to the preservation of the structural integrity or the physical appearance of sites or properties of historical, architectural, or cultural significance.

12. The only exception to special condition 11 is that trees near the power line may be trimmed.

13. Within 60 days of completion of the work authorized and mitigation the attached Self-Certification Statement of Compliance must be completed and submitted to the U.S. Army Corps of Engineers. Mail the completed form to the Regulatory Division, Enforcement Branch, Post Office Box 4970, Jacksonville, Florida 32232-0019.

14. Work shall not start on the generation plant until a copy of the State permit containing water quality for the generation

plant is furnished to Regulatory Division, Atlantic Permits Branch, Post Office Box 4970, Jacksonville, Florida 32232-0019.

15. If the State permit is not issued within one year of issuance of this permit, a modification shall be made to this permit requesting a time extension on the required mitigation at the generation plant.

Further Information:

1. Congressional Authorities: You have been authorized to undertake the activity described above pursuant to:

( ) Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403).

(X) Section 404 of the Clean Water Act (33 U.S.C. 1344).

( ) Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. 1413).

2. Limits of this authorization:

a. This permit does not obviate the need to obtain other Federal, state, or local authorizations required by law.

b. This permit does not grant any property rights or exclusive privileges.

c. This permit does not authorize any injury to the property or rights of others.

d. This permit does not authorize interference with any existing or proposed Federal projects.

3. Limits of Federal Liability: In issuing this permit, the Federal Government does not assume any liability for the following:

a. Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes.

b. Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest.

c. Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.

d. Design or construction deficiencies associated with the permitted work.

e. Damage claims associated with any future modification, suspension, or revocation of this permit.

4. Reliance on Applicant's Data: The determination of this office that issuance of this permit is not contrary to the public interest was made in reliance on the information you provided.

5. Reevaluation of Permit Decision: This office may reevaluate its decision on this permit at any time the circumstances warrant. Circumstances that could require a reevaluation include, but are not limited to, the following:

a. You fail to comply with the terms and conditions of this permit.

b. The information provided by you in support of your permit application proves to have been false, incomplete, or inaccurate (see 4 above).

c. Significant new information surfaces which this office did not consider in reaching the original public interest decision.

Such a reevaluation may result in a determination that it is appropriate to use the suspension, modification, and revocation procedures contained in 33 CFR 325.7 or enforcement procedures such as those contained in 33 CFR 326.4 and 326.5. The referenced enforcement procedures provide for the issuance of an administrative order requiring you comply with the terms and conditions of your permit and for the initiation of legal action where appropriate. You will be required to pay for any corrective measures ordered by this office, and if you fail to comply with such directive, this office may in certain situations (such as those specified in 33 CFR 209.170) accomplish the corrective measures by contract or otherwise and bill you for the cost.

6. Extensions: General condition 1 establishes a time limit for the completion of the activity authorized by this permit.

Unless there are circumstances requiring either a prompt completion of the authorized activity or a reevaluation of the public interest decision, the Corps will normally give favorable consideration to a request for an extension of this time limit.

Your signature below, as permittee, indicates that you accept and agree to comply with the terms and conditions of this permit.

(PERMITTEE) 11/3/99 (DATE)

This permit becomes effective when the Federal official, designated to act for the Secretary of the Army, has signed below.

(DISTRICT ENGINEER) 5 Nov 99 (DATE)

for Joe R. Miller
Colonel, U.S. Army

SELF-CERTIFICATION STATEMENT OF COMPLIANCE

Permit Number: 199902840(IP-MMS)

Permittee's Name & Address (please print or type):_____

_____

_____

Telephone Number:_____

Location of the Work:_____

_____

Date Work Started:_____ Date Work Completed:_____

Description of the Work (e.g. bank stabilization, residential or commercial filling, docks, dredging, etc.):_____

_____

_____

Acreage or Square Feet of Impacts to Waters of the United States:

_____

Describe Mitigation completed (if applicable):_____

_____

_____

Describe any Deviations from Permit (attach drawing(s) depicting the deviations):

_____

_____

_____

****

I certify that all work, and mitigation (if applicable) was done in accordance with the limitations and conditions as described in the permit. Any deviations as described above are depicted on the attached drawing(s).

_____

Signature of Permittee

_____

Date

DEPARTMENT OF THE ARMY PERMIT TRANSFER REQUEST

PERMIT NUMBER: 199902840(IP-MMS)

When the structures or work authorized by this permit are still in existence at the time the property is transferred, the terms and conditions of this permit will continue to be binding on the new owner(s) of the property. Although the construction period for works authorized by Department of the Army permits is finite, the permit itself, with its limitations, does not expire.

To validate the transfer of this permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below. Mail to: U.S. Army Corps of Engineers, Regulatory Division, Post Office Box 4970, Jacksonville, Florida, 32232-0019. The Transferee acknowledges receipt of a copy of the above-referenced permit.

_____ _____

TRANSFEREE SIGNATURE DATE

_____

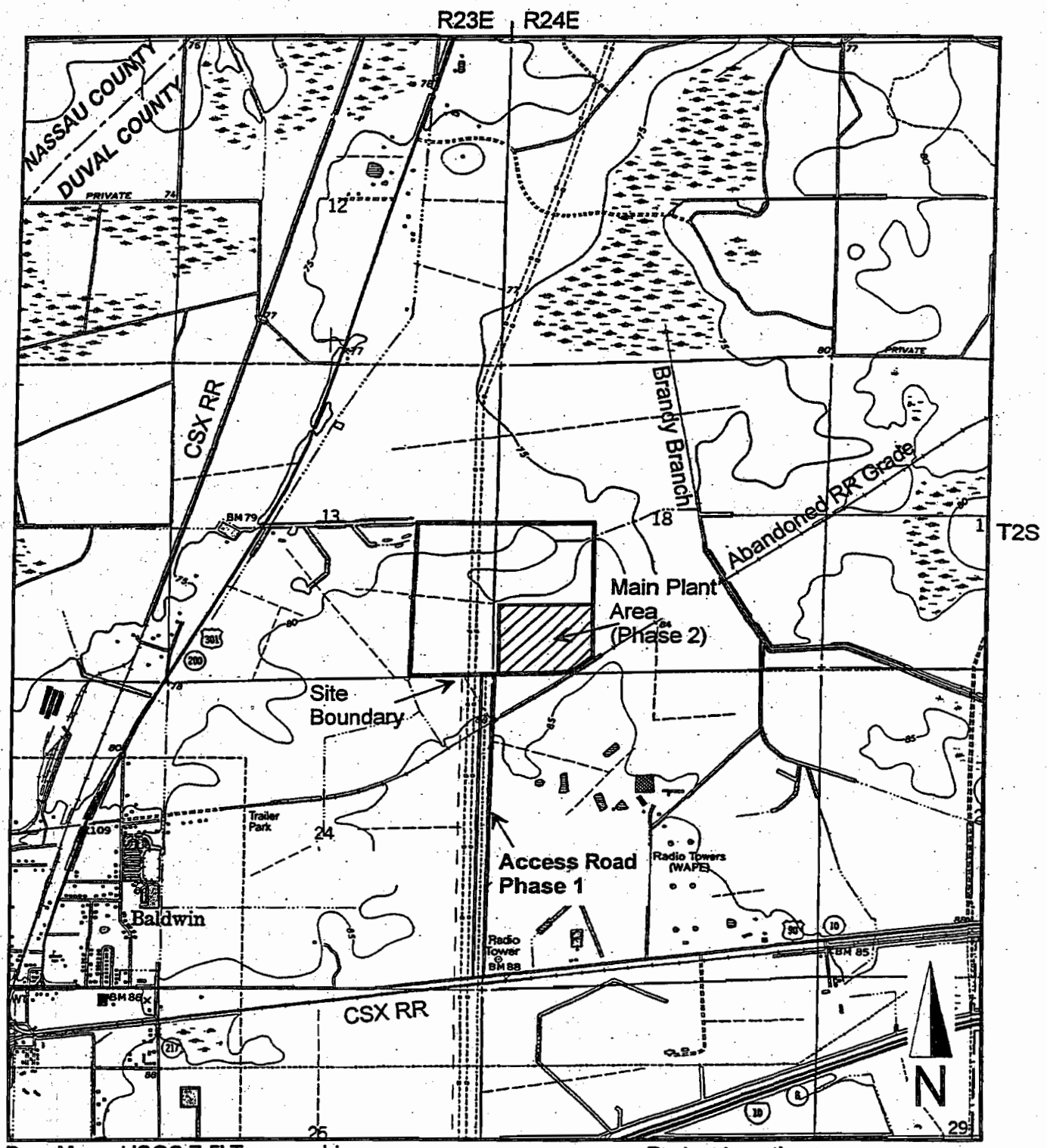
NAME--PRINTED

_____

MAILING ADDRESS

_____

CITY, STATE, AND ZIP CODE



Base Map: USGS 7.5' Topographic
Baldwin Quadrangle, Revised 1992

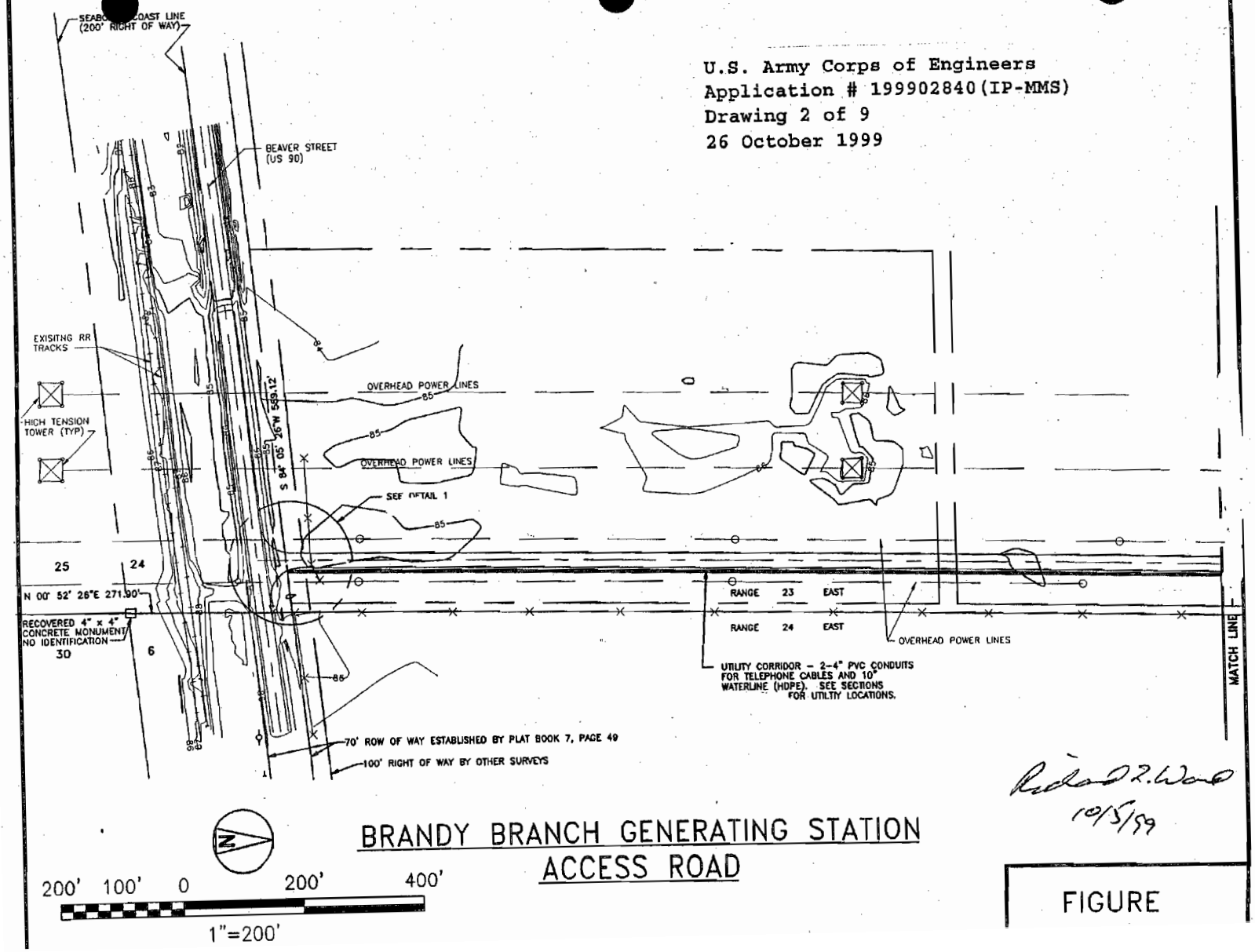
Project Location
Brandy Branch Generating Station

Mile
0 0.5 1

U.S. Army Corps of Engineers
Application # 199902840(IP-MMS)
Drawing 1 of 9
26 October 1999

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U.S. Army Corps of Engineers
Application # 199902840(IP-MMS)
Drawing 2 of 9
26 October 1999



Richard R. Ward
10/5/99

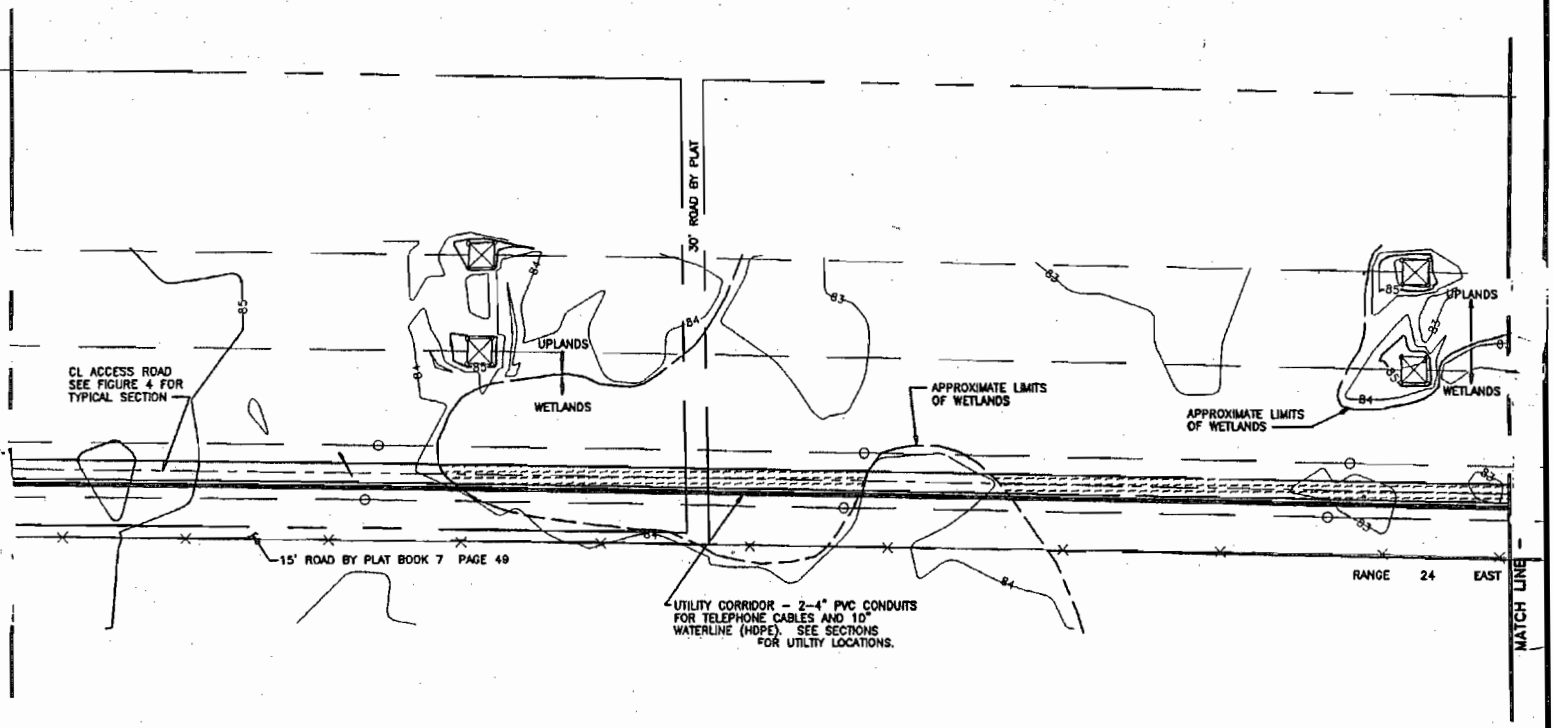
BRANDY BRANCH GENERATING STATION
ACCESS ROAD

FIGURE

LEGEND

WETLAND IMPACTS

U.S. Army Corps of Engineers
Application # 199902840(IP-MMS)
Drawing 3 of 9
26 October 1999



BRANDY BRANCH GENERATING STATION
ACCESS ROAD

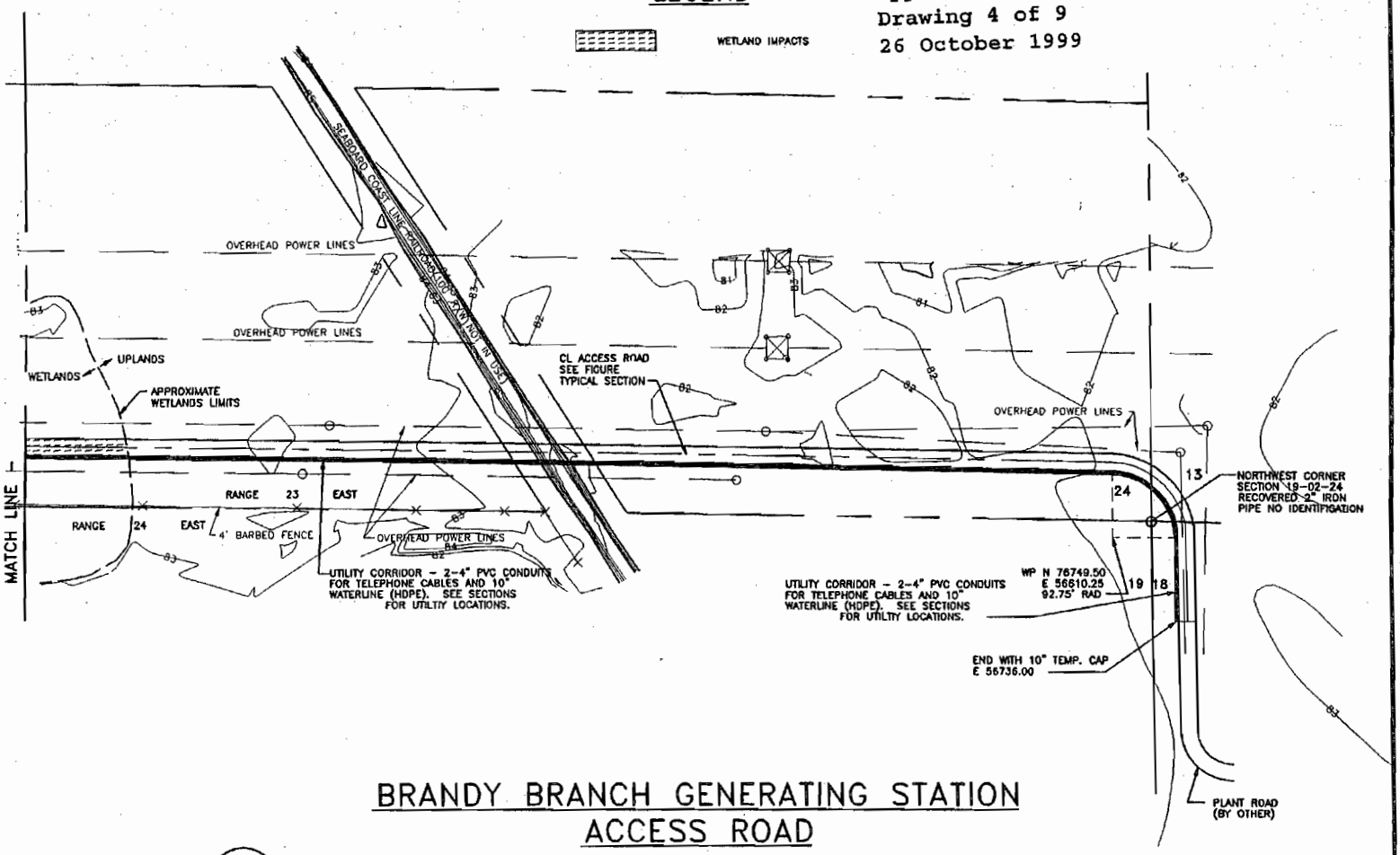
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200' 100' 0 200' 400'

1"=200'

FIGURE

U.S. Army Corps of Engineers
Application # 199902840(IP-MMS)
Drawing 4 of 9
26 October 1999



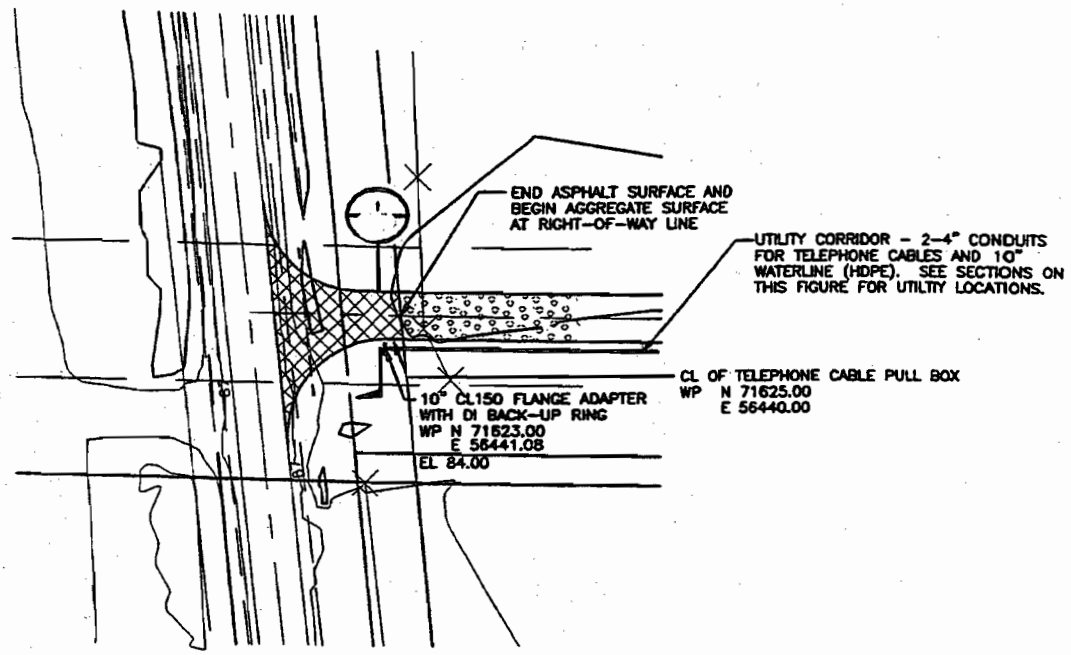
BRANDY BRANCH GENERATING STATION
ACCESS ROAD

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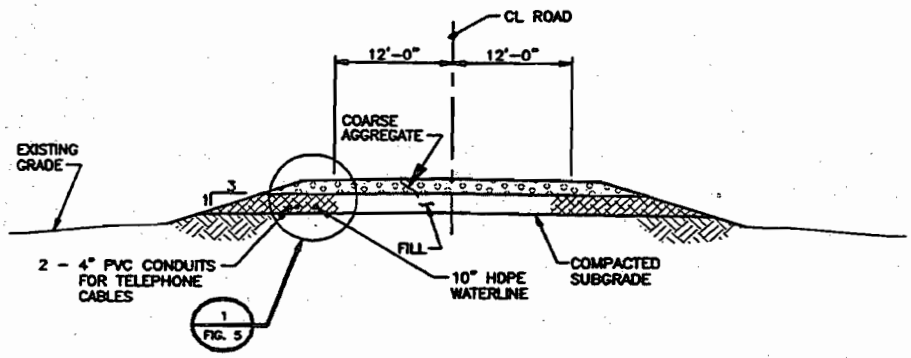
200' 100' 0 200' 400'

1"=200'

FIGURE

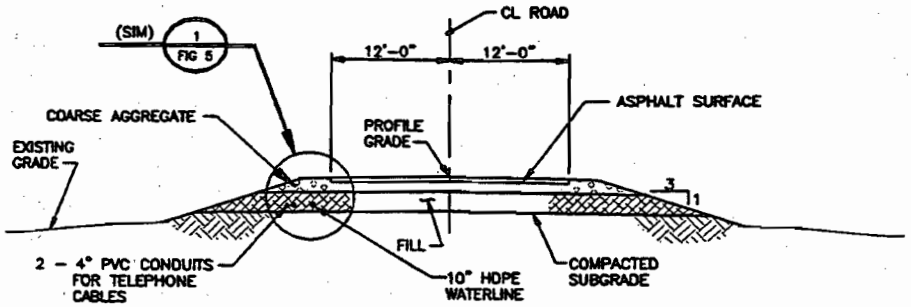


DETAIL 1
NOT TO SCALE
SEE FIGURE 1



NOTE 1: CLEAR AND GRUB ALL ORGANIC MATERIAL AS REQUIRED (APPROX. 6" TO 8")
2: SEE TYPICAL PULL BOX DETAIL, FIGURE 5.

TYPICAL ACCESS ROAD SECTION
NOT TO SCALE



NOTE 1: CLEAR AND GRUB ALL ORGANIC MATERIAL AS REQUIRED (APPROX. 6" TO 8")
2: SEE TYPICAL PULL BOX DETAIL.

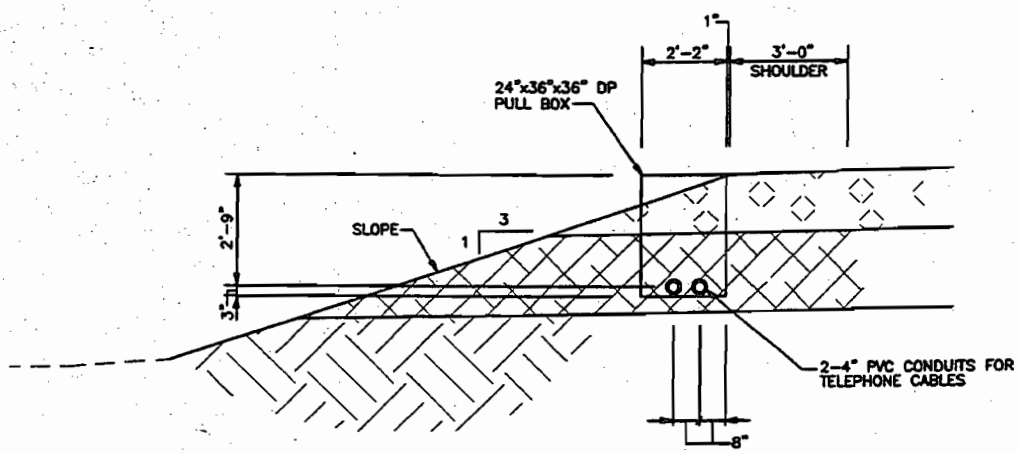
SECTION 1
NOT TO SCALE

Richard J. Ward
10/5/99

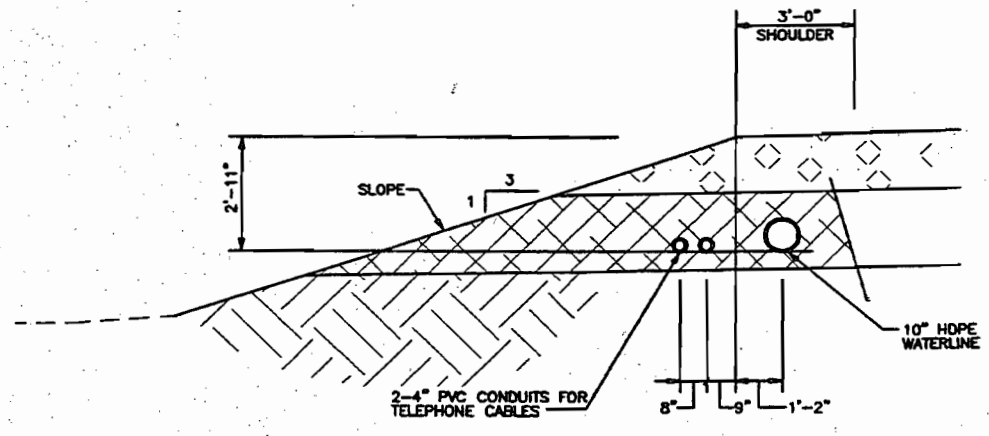
U.S. Army Corps of Engineers
Application # 19902840(IP-MMS)
Drawing 5 of 9
26 October 1999

BRANDY BRANCH GENERATING STATION ACCESS ROAD

FIGURE



TYPICAL PULL BOX DETAIL
NOT TO SCALE



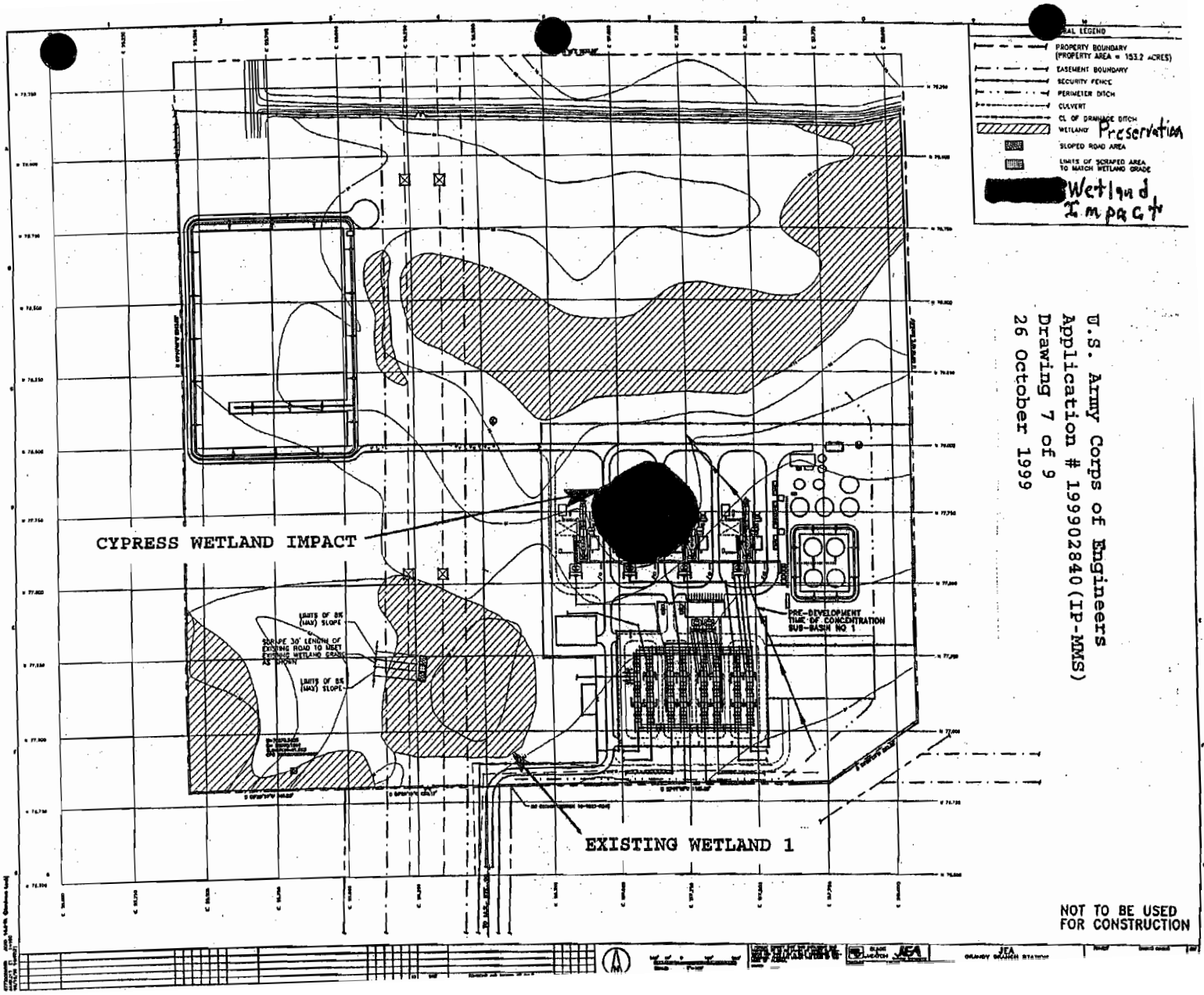
SECTION 1
NOT TO SCALE

U.S. Army Corps of Engineers
Application # 199902840(IP-MMS)
Drawing 6 of 9
26 October 1999

Richard R. Ward
10/5/99

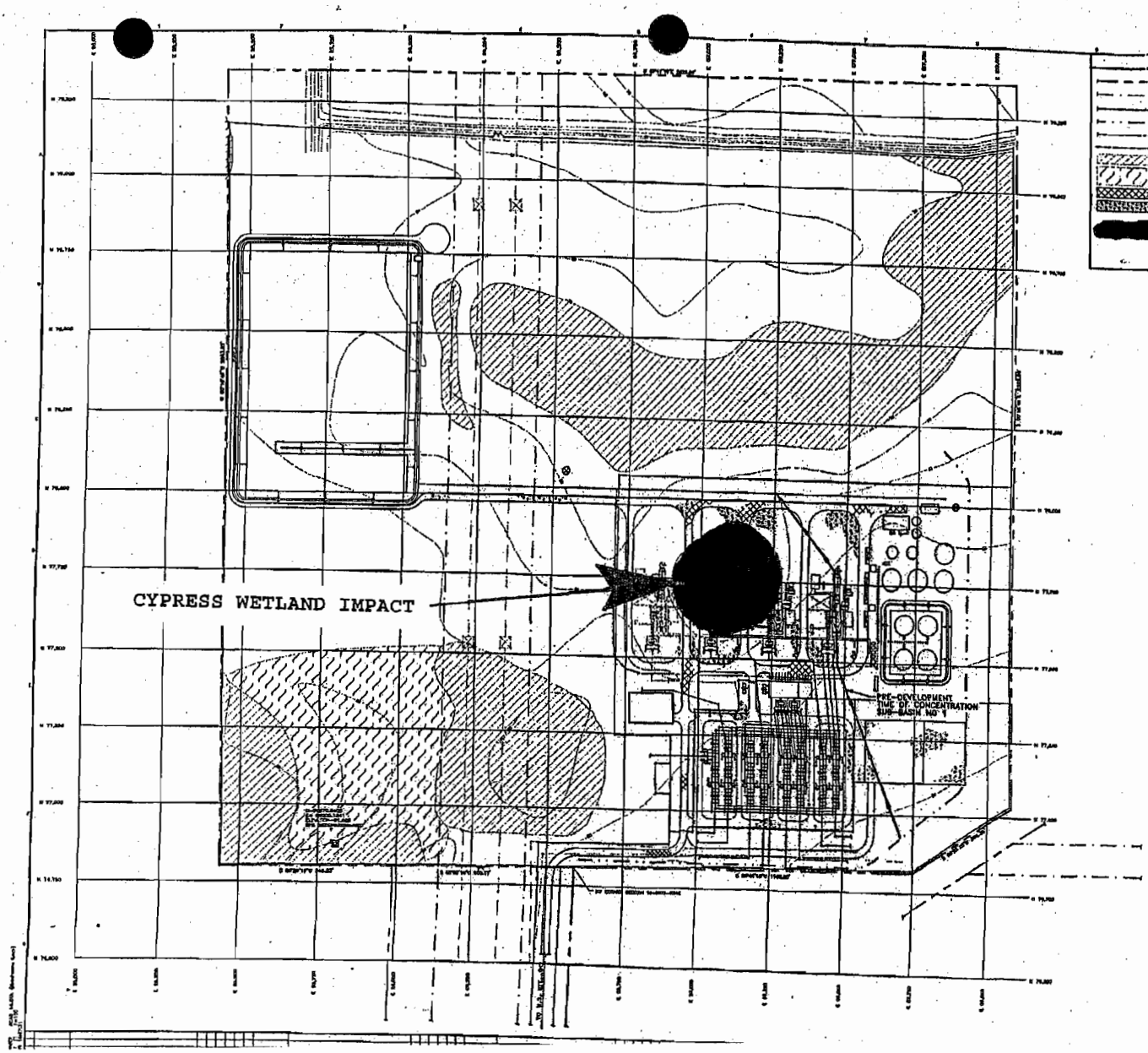
BRANDY BRANCH GENERATING STATION
ACCESS ROAD

FIGURE



U.S. Army Corps of Engineers
Application # 199902840(IP-MMS)
Drawing 7 of 9
26 October 1999

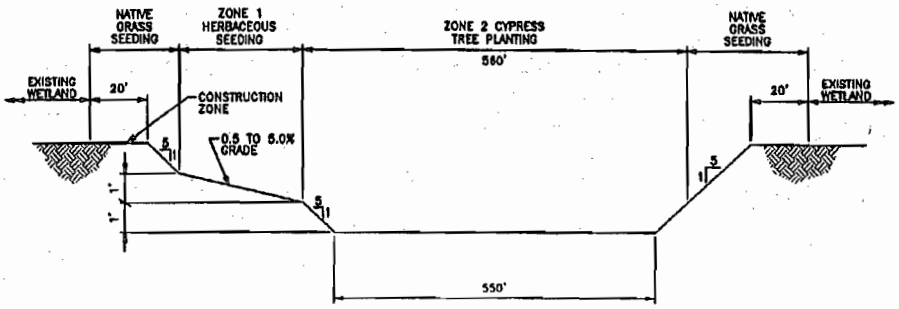
NOT TO BE USED FOR CONSTRUCTION



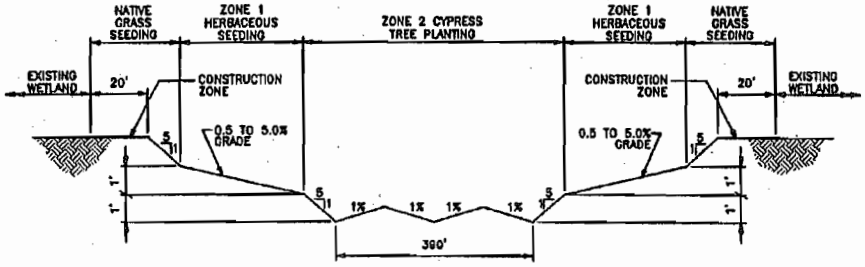
U.S. Army Corps of Engineers
Application # 199902840(IP-MMS)
Drawing 8 of 9
26 October 1999

NOT TO BE USED
FOR CONSTRUCTION

28297WAGGONE ACAD 10.c7
OUTLINE 1=1
06/23/99



SECTION 5
NO SCALE



SECTION 6
NO SCALE

BRANDY BRANCH GENERATING STATION
WETLAND CONSTRUCTION DETAILS

U.S. Army Corps of Engineers
Application # 199902840(IP-MMS)
Drawing 9 of 9
26 October 1999

(r) Upon reasonable notice to the permittee, Department authorized staff with proper identification shall have permission to enter, inspect, sample and test the system to insure conformity with the plans and specifications approved by the permit.

(s) If historical or archaeological artifacts are discovered at any time on the project site, the permittee shall immediately notify the Department.

(t) The permittee shall immediately notify the Department in writing of any previously submitted information that is later discovered to be inaccurate.

SPECIFIC CONDITIONS:

1. Prior to commencement of work authorized by this permit, the permittee shall provide written notification of the date of commencement and proposed schedule of construction on Form No. 62-343.900(3), F.A.C. to the Department of Environmental Protection, Submerged Lands and Environmental Resources Program, 7825 Baymeadows Way, Suite B-200, Jacksonville, FL 32256-7590.

2. The project shall comply with applicable State Water Quality Standards, namely:
   a) Surface Waters, Minimum Criteria, General Criteria - **62-302.500,**
   b) Class III Waters - Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife. - **62-302.400**

3. All structures shall be constructed in accordance with the attached drawings.

4. Appropriate turbidity controls shall be utilized throughout the project to contain any turbidity generated that exceeds state water quality standards.

5. All wetland areas and surface waters which are outside the specific limits of construction authorized by this permit shall be protected from erosion, siltation, scouring or excess turbidity or dewatering.

6. The work shall be done during periods of average or low water.

7. The structures authorized by this permit shall not be placed on any property, other than that owned by the permittee, without the prior written approval of that property owner.

PERMITTEE:
JEA - Brandy Branch Access Road
c/o J. M. Connolly

PERMIT NUMBER: 16-156348-001-EI
DATE OF ISSUE: August 19, 1999
EXPIRATION DATE: August 19, 2004

8. To mitigate for the wetland elimination, the permittee shall create 1.4 acres of herbaceous wetlands in conjunction with the forested wetland creation activity associated with the Phase II Generating Station construction.

Executed in Jacksonville, Florida.

Issued this 18th day of August, 1999.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

Ernest E. Frey, P.E.
Director of District Management
Submerged Lands and
Environmental Resources Program

Copy to: Francine Ffolkes, DEP Attorney
US Army Corps of Engineers, Jacksonville District
Susan Hughes, P.E., JEA

CERTIFICATE OF SERVICE

The undersigned duly designated deputy clerk hereby certifies that this NOTICE OF PERMIT and all copies were mailed before the close of business on 8/19/99 to the listed persons.

FILING AND ACKNOWLEDGEMENT
FILED on this date, pursuant to S120.52, Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.
Linda Bratton 8/19/99
Clerk Date

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

REPLY TO
ATTENTION OF

23 May 2000

Regulatory Division
Atlantic Permits Branch
199902804(IP-MMS)

Mr. William L. Cox
U.S. Environmental Protection Agency
Wetlands Regulatory Section
61 Forsyth Street
Atlanta, Georgia 30303

Dear Mr. Cox:

The JEA has applied for a modification to a Department of the Army permit. The original permit was to fill 2.2 acres of forested cypress wetlands and fill 1.4 acres of herbaceous wetlands. The applicant is to create 4.4 acres of cypress wetlands and 1.4 acres of herbaceous wetlands for mitigation. The mitigation is on-site. The project is located one mile east of Baldwin and one mile north of U.S. 90 / S.R. 10, in Sections 13 & 18, Township 02 South, Ranges 23 East and 24 East, Baldwin, Duval County, Florida.

JEA requests to modify its original permit. The modification would consist of filling the same amount of wetlands, but one of the original areas to be filled is smaller in area and there is an other area to be filled that is 0.6 acre of fill. The additional impacts are needed for an access road within the power generation facility. The 0.6 acre area was missed on the original survey and is considered minor. As for the mitigation, the applicant proposes to preserve 14 acres of wetlands in addition to its previous mitigation. Enclosed are the drawings of the modification. The proposed modification is considered to be minor work and we plan to issue the modification without a public notice 14 days from the date of this letter.

If you have any objections to the issuance of the modification, please contact Matt Smith at the letterhead address. If you have questions you may call Mr. Smith at 904-232-1677.

Sincerely,

Bertil Heimer
Chief, Atlantic Permits Branch

Enclosures

Copy Furnished (w/encl):

(x) Mr. David Hankla
Field Supervisor
U.S. Fish and Wildlife Service
6620 Southpoint Drive South
Suite #310
Jacksonville, Florida 32216-0912

(x) Mr. Bradley H. Hartman
Florida Fish & Wildlife Conservation Commission
620 South Meridian Street
Tallahassee, Florida 32399-0250

( ) Mr. Mark Thompson
Fishery Biologist
National Marine Fisheries Service
Habitat Conservation Division
3500 Delwood Beach
Panama City, Florida 32408

(x) Mr. George Percy
Secretary of State
Florida Department of State
Division of Historic Resources
ATTN: Compliance Review Section
R.A. Gray Building
5000 South Bronough
Tallahassee, Florida 32399-0250

Copy Finished (w/o enclosures):

(x) JEA
21 West Church Street
Jacksonville, Florida 32202

(x) Mr. J. Michael Soltys
Black & Veatch Corp.
8400 Ward Parkway
Kansas City, Missouri 64114

BLACK & VEATCH

8400 Ward Parkway
P.O. Box 8405
Kansas City, Missouri 64114 USA

Tel: (913) 458-2000

Black & Veatch Corporation

JEA
Brandy Branch Project

B&V Project 60903
B&V File 32.0202
April 21, 2000

Mr. Matt Smith
Jacksonville District Corps of Engineers
Regulatory Division/Atlantic Permits Branch
400 West Bay Street
Jacksonville, Florida 32232-0019

Subject: Requested Drawing

Dear Mr. Smith:

As requested, enclosed is a Site Arrangement drawing of the Brandy Branch Generating Station site indicating the revised wetland impact area, the new 1.6 acre wetland impact area, and the proposed conservation easement area. This drawing is provided in support of the minor modification request of Department of the Army Permit No. 199902804 (IP-MMS) for additional fill activities in wetlands at the site.

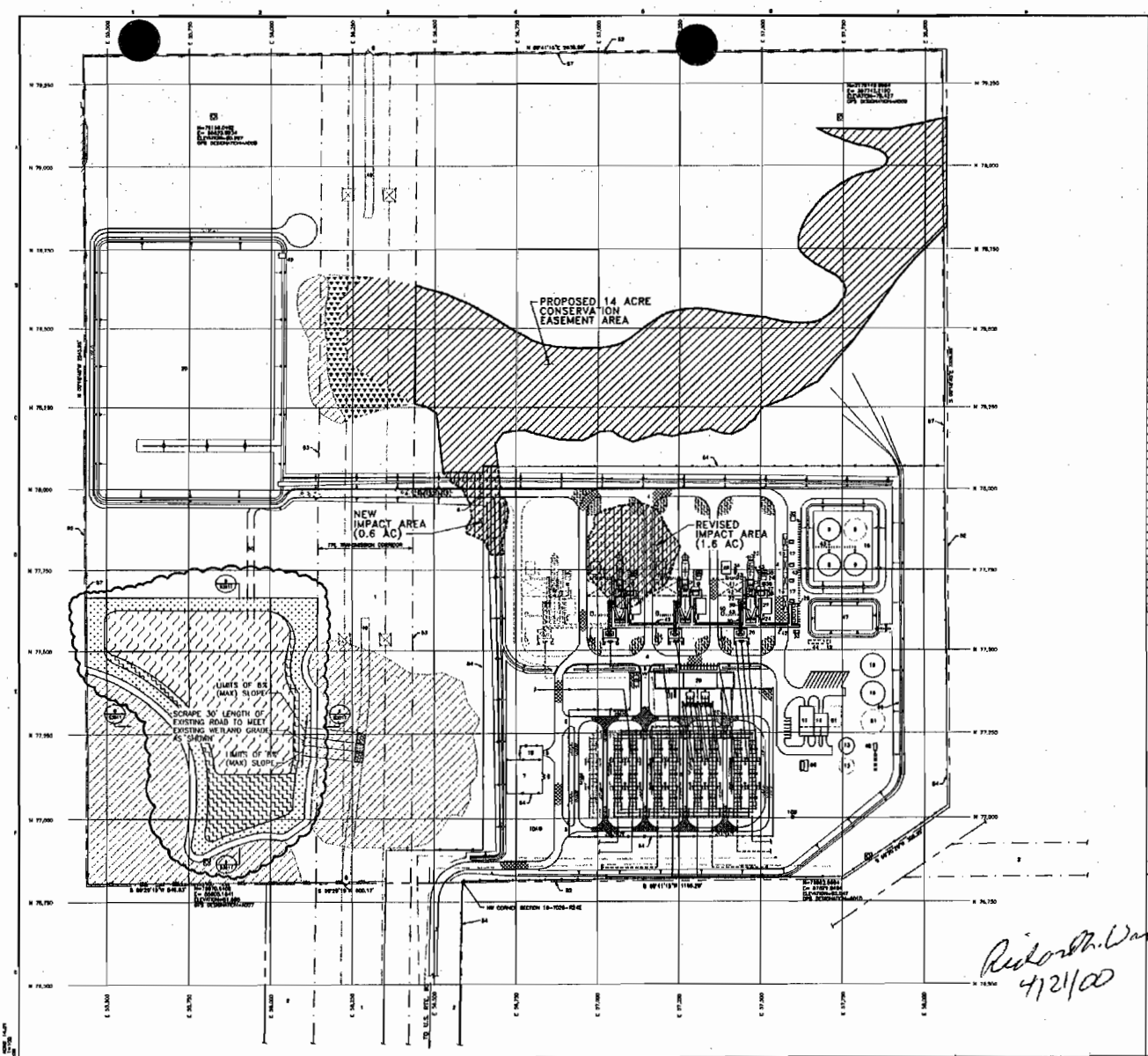
Please feel free to call me at (913) 458-7563 if you have questions regarding the project, the modification request, or this drawing.

Very truly yours,

BLACK & VEATCH CORPORATION

J. Michael Soltys
Permitting Manager

Enclosure
cc: Lindsey Starner, JEA



FACILITIES LEGEND

ITEM NO.	DESCRIPTION
1	F.P.&L. ECM-SY-1
2	JEA TRANSMISSION C
3	ACCESS ROAD
4	LOOP ROAD
5	SLIDE GATE
6	SWING GATE
7	FUEL GAS METERING STATION
8	SUBSTATION AREA
9	FUEL OIL STORAGE TANK (1,000,000 GALLONS)
10A	WATER SUPPLY WELL
10B	WATER SUPPLY WELL
11	SHOP/STORAGE BUILDING
12	WASTEWATER PUMPING STATION
13	RAW WATER/FIRE WATER STORAGE TANK
14	MECHANICAL EQUIPMENT BUILDING
15	DEMINERALIZED WATER STORAGE TANK
16	FUEL OIL UNLOADING AREA
17	FUEL OIL UNLOADING PUMP AREA
18	HYDROGEN STORAGE GAS AREA
19	FUEL OIL STORAGE TANK SECONDARY CONTAINMENT
20	STORM WATER DETENTION POND
21	COMBUSTION TURBINE (CT)
22	CT GENERATOR
23	CT 1 EXHAUST STACK (UNIT 1)
24	CT 1 EXHAUST STACK (UNIT 2)
25	CT 1 EXHAUST STACK (UNIT 3)
26	CT 1 AIR INLET FILTER
27	CT 1 GENERATOR STEP-UP TRANSFORMER
28	CT WATER INJECTION SKID
29	CONTROL/ELECTRICAL BUILDING
30	FUEL FORWARDING SKIDS
31	CONTROL/GARAGE SERVICES BUILDING
32	UNIT AUXILIARY TRANSFORMER
33	EXHAUST DUCT SILENCER
34	FIRE PROTECTION PUMP HOUSE
35	RAW WATER SKID
36	MISCELLANEOUS DRAIN TANK
37	CT 1&2 FIRE PROTECTION SKID
38	FALSE START DRAIN TANK
39	LIQUID FUEL/ATOMIZING AIR MODULE
40	CT ACCESSORY MODULE
41	GENERATOR COMPARTMENT
42	FIRE WATER DELUGE HOUSE
43	MAINTENANCE AREA
44	PIPE TRENCH
45	BLEEDER PIPE RACK
46	OIL WATER SEPARATOR
47	STORM WATER DETENTION POND DISCHARGE STRUCTURE
48	COOLER
49	PERCOLATION POND
50	SEPTIC TANK AND DRAINFIELD DETAIL
51	EXISTING ROAD
52	TEMPORARY CONSTRUCTION ACCESS ROAD
53	FUTURE WATER TREATMENT EQUIPMENT EXPANSION
54	PROPERTY BOUNDARY
55	EASEMENT BOUNDARY
56	CHAIN LINK SECURITY FENCE
57	PERIMETER DITCH
58	TURBINE OIL STORAGE AREA
59	BARBED WIRE SITE PERIMETER FENCE

GENERAL LEGEND

- BENCHMARK
- FUTURE FACILITY
- EXISTING WETLANDS
- CYPRESS AREA (ZONE II)
- ASPHALT
- CRUSHED ROCK SURFACING
- HERBACEOUS AREA (ZONE II)
- UPLAND BORING AREA
- IMPACTED, DELINEATED WETLANDS
- RESTORATION MITIGATION AREA
- DEBRIS

NOTES

1. WATER SUPPLY WELL 10A HAS LATITUDE/LONGITUDINAL COORDINATES OF N 30° 19' 6.7" AND W 81° 38' 53.3".
2. WATER SUPPLY WELL 10B HAS LATITUDE/LONGITUDINAL COORDINATES OF N 30° 19' 6.8" AND W 81° 38' 48.8".

Richard L. Ward 4/21/00

NO.	DATE	REVISION	BY	CHK	APP
3	07-01-2000	GENERAL REVISIONS	FG	SJ K	KJR/LW
2	11-12-99	GENERAL REVISIONS	FG	SJ K	KJR/LW
1	06-11-99	GENERAL REVISIONS	FG	SJ K	KJR/LW
0	04-26-99	INITIAL ISSUE	FG	SJ K	KJR/LW
	04-21-1999	REVISED FOR CORPS OF ENGINEERS	ARMENTA	KJR/LW	KJR/LW

SCALE: 1"=100'

BLACK & VEATCH — JEA

DESIGNED BGF PROJ. MGR. FG
DRAWN BGF CHKD.
DATE 04-26-99 REF. NO. 35384

RICHARD L. WARD
11401 LAMAR AVENUE
OVERLAND PARK, KANSAS 66211
P.E. NO. 33384

JEA
BRANDY BRANCH STATION
SITE ARRANGEMENT

PROJECT 80903-DS-S1001
DRWG NO.
REV. 5

10.2 Federal Permit Applications or Approvals

10.2.1 PSD Permit Application

The US EPA will review the PSD application in coordination with the Florida Department of Environmental Protection. This application is included under separate cover as Appendix 10.7.

10.2.2 Certification of Compliance Statement

In accordance with the Power Plant and Industrial Use Act, JEA must certify that the Brandy Branch Generating Station would be capable of firing coal (including gasified coal) or another alternate fuel as the primary energy source. A copy of the Certification of Compliance is attached.

10.2.3 Corps of Engineers Notification Letter

A copy of the letter that will be provided to the Corps of Engineers advising of the project conversion is included herein.

Certification of Compliance Statement

Mr. Anthony J. Como
Manager, Electric Power Regulation
Office of Coal & Power Im/Ex
Office of Fossil Energy
Room 3H-087, FE-27
1000 Independence Avenue, S.W.
Washington, D.C. 20585

Re: Brandy Branch Generating Station

Dear Mr. Como:

On behalf of JEA, we hereby submit a Self-Certification of Coal Capability for a new baseload electric generation plant, pursuant to Section 201(d) of the Powerplant and Industrial Fuel Use Act of 1978 (FUA), as amended.

If you have any questions or need further assistance, please contact me at_____.

Very truly yours,

_____

CERTIFICATION OF COMPLIANCE UNDER THE PROVISIONS OF THE POWER PLANT AND INDUSTRIAL FUEL USE ACT AS AMENDED

JEA hereby submits to the U.S. Department of Energy (DOE) a Self-Certification of Coal Capability for a new baseload electric generating plant, the Brandy Branch Generating Station, pursuant to Section 201(d) of the Powerplant and Industrial Fuel Use Act of 1978 (FUA), as amended, and Section 501.60(a)(2) of DOE's regulations (10 CFR 501.60(a)(2)).

1. Name and Address of Owner of the Proposed Facility:

   JEA
   21 West Church Street
   Jacksonville, FL 32202

2. Correspondence Should be Addressed to:

   JEA
   21 West Church Street
   Jacksonville, FL 32202

3. Operator's Name and Address:

   JEA
   21 West Church Street
   Jacksonville, FL 32202

4. Location and Address of Facility:

   The Facility is located in Duval County, FL, 1 mile north of U.S. 90/S.R. 10, 1 mile east of Baldwin.

   Township 2 South, Range 23 and 24 East, South East quarter of section 13 and South West quarter of section 18.

5. Configuration of the Facility:

   The Facility will be a combined cycle cogeneration facility producing electric power and steam.

6. Design Electric Capacity of Facility:

   686 MW

7. Fuel to be used:

The design fuel for this Facility is natural gas.

8. Name of Utility Purchasing Electricity from the Facility:

The Facility will be operated as a "merchant power plant." As such, it will sell power on the wholesale electricity market, and customers will purchase the power on a voluntary, wholesale basis.

9. Date Facility is Expected to be Placed in Service:

Commercial operation of the Facility is set for May 2004.

10. Certification:

I, _____, as _____ for JEA, do hereby certify that the proposed Facility:

(a) Has sufficient inherent design characteristics to permit the addition of equipment (including all necessary pollution devices) necessary to render the Facility capable of using coal or another alternative fuel as its primary energy source; and

(b) Is not physically, structurally, or technologically precluded from using coal or another alternate fuel as its primary energy source.

Certified this ____ day of _____, 2000.

JEA

By: JEA

_____

_____

Date

Corps of Engineers Notification Letter

November 30, 2000

Mr. Matt Smith
U.S. Army Corps of Engineers
Regulatory Branch
P.O. Box 4970
Jacksonville, FL 32232-0019

Dear Mr. Smith:

Re: Brandy Branch Generating Station
Permit Number 199902804(IP-MMS)

JEA intends to modify the Brandy Branch Generating Station (currently under construction) by converting two of the three simple cycle units into a combined cycle unit by adding two heat recovery steam generators, a steam turbine, an electric generator, and associated plant equipment. The only impact outside of the area under construction will be the clearing of 2 acres of pine flatwoods for the installation of a cooling tower. No wetland areas will be disturbed.

JEA has recently filed a Site Certification Application to the Florida Department of Environmental Protection for this proposed project. Modifications to the above referenced federal permit should not be required, but we want to make you aware of our intention. If you have any questions about this project, please call me at (904) 665-6223.

Sincerely,

Steven L. Moser, P.E.
Environmental Permitting and Compliance

10.3 Existing State Permits

10.3.1 Prevention of Significant Deterioration

The simple cycle units operate under FDEP issued Authority to Construct Permit 0310485-001-AC until a Title V operating permit is issued. A copy of the current PSD permit is included herein.

10.3.2 Environmental Resource Permits

On August 19, 1999, Permit Number 16-156348-001-E1 to construct as access road was issued by the FDEP for construction of the Brandy Branch Simple Cycle Units. On June 9, 2000, Permit Number 16-156348-003-ES to construct and operate a proposed stormwater management system for the Brandy Branch Simple Cycle Units was issued by the FDEP.

10.3.3 Consumptive Use Permit

Consumptive Use Permit Number 51629 was issued by the St. Johns River Water Management District on October 3, 2000. The permit authorizes the use of 73.58 million gallons per year of ground water from the Floridan Aquifer for power production. The permit is attached.

10.3.4 Industrial Wastewater Permit Exemption

The Brandy Branch Generating Station received an Industrial Wastewater Permit Exemption dated October 6, 1999. The exemption letter from the Florida Department of Environmental Protection is attached.

10.3.5 Historical Review

Attached is the letter of no impact dated March 24, 1999 from the Division of Historical Resources.

Prevention of Significant Deterioration

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
NOTICE OF FINAL PERMIT

In the Matter of an
Application for Permit by:

Walter P. Bussells, Chief Executive Officer
Jacksonville Electric Authority
21 West Church Street
Jacksonville, Florida 32202-3139

DEP File No. 0310485-001-AC, PSD-FL-267
Brandy Branch Facility
Duval County

Enclosed is Final Permit Number 0310485-001-AC. This permit authorizes Jacksonville Electric Authority to construct the Brandy Branch facility. This permit is issued pursuant to Chapter 403, Florida Statutes.

Any party to this order has the right to seek judicial review of it under section 120.68 of the Florida Statutes, by filing a notice of appeal under rule 9.110 of the Florida Rules of Appellate Procedure with the clerk of the Department of Environmental Protection in the Office of General Counsel, Mail Station #35, 3900 Commonwealth Boulevard, Tallahassee, Florida, 32399-3000, and by filing a copy of the notice of appeal accompanied by the applicable filing fees with the appropriate District Court of Appeal. The notice must be filed within thirty days after this order is filed with the clerk of the Department.

Executed in Tallahassee, Florida.

C. H. Fancy, P.E., Chief
Bureau of Air Regulation

CERTIFICATE OF SERVICE

The undersigned duly designated deputy agency clerk hereby certifies that this Notice of Final Permit (including the Final permit) was sent by certified mail (*) and copies were mailed by U.S. Mail before the close of business on 10-14-99 to the person(s) listed:

Walter P. Bussells, JEA *
N. Bert Gianazza, P.E., JEA
Gregg Worley, EPA
John Bunyak, NPS
Chris Kirts, NED
James L. Manning, P.E. RESD
Anthony L. Compaan, Black & Veatch

Clerk Stamp

FILING AND ACKNOWLEDGMENT FILED, on this date, pursuant to §120.52, Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

Kyni Joker (Clerk) 10-14-99 (Date)

FINAL DETERMINATION

JEA
Brandy Branch/Baldwin City
DEP File No.0310485, PSD-FL-267

The Department distributed a public notice package on August 12, 1999 to allow the applicant to construct a new plant known as the Brandy Branch Facility located at Baldwin City, Duval County. The Public Notice of Intent to Issue was published in The Florida Times-Union on August 23, 1999.

COMMENTS/CHANGES

Comments were received from EPA by letter and facsimile correspondence dated September 10, 1999.

Comments were received from the Fish and Wildlife Service by letter dated August 30, 1999.

Comments were received from the applicant by electronic correspondences dated August 27 and September 24, 1999. Additionally, the Department received comments from the applicant requesting that the wording on the Public Notice be revised to reflect a maximum number of operating hours of 4750 of which 750 could be on oil. The Department agreed to the Public Notice change and will address the substantive issue herein.

EPA and the applicant commented on the Technical Evaluation and Preliminary Determination (TEPD), the BACT and the DRAFT Permit. The comments related to the BACT and permit are summarized below and the Department's responses are included following each comment. Comments related to the TEPD are noted and maintained in the file.

The Fish and Wildlife Service as well as the EPA commented on the need for CALPUFF modeling for visibility and regional haze in the (Class I) Okefenokee area. The applicant submitted this modeling on September 10, 1999 and (as indicated by FWS) the shutting down of the applicant's Southside Station along with the permitting of this new facility will cause a net benefit to visibility. A cumulative analysis, modeling all increment-consuming sources in the area, predicted SO_2 exceedances, which were not significantly contributed to by this facility. FDEP will investigate the matter to determine which sources are contributing significantly to the exceedances and develop possible remedies for further consideration..

DRAFT Permit Administrative Requirements:

The applicant requested that the requirements listed as Conditions 6. and 7. ("Expiration" and "BACT Determination") be removed due to the inapplicability of 40 CFR 52.21 in the State of Florida.

RESPONSE: These conditions will remain, with changes to the referenced citations associated with these conditions.

DRAFT Permit Specific Conditions:

1. *Specific Condition 4*: The applicant requested that the permit reflect the applicant's ability to install (optional) evaporative inlet cooling.

RESPONSE: The requested change will be accommodated, as this option was referenced in the Technical evaluation.

2. *Specific Condition 7*: The applicant requested that parenthesis be placed around the words "No. 2 or superior grade of distillate oil".

RESPONSE: The requested change will not be accommodated due to the possible inference that the adjective "superior" applies only to the grade of oil (No. 2) and not the sulfur content.

3. *Specific Condition 8*: The applicant requested that a permitting note be placed at the end of the condition, clarifying the Department's position on the purpose of heat input values.

RESPONSE: The following language is added to the end of the condition, as has been done in other permitting actions: {Permitting note: The heat input limitations have been placed in the permit to identify the capacity of each emissions unit for purposes of confirming that emissions testing is conducted within 95-100 percent of the emissions unit's rated capacity (or to limit future operation to 105 percent of the test load), to establish appropriate limits and to aid in determining future rule applicability.....}

4. *Specific Condition 13*: The applicant requested that the condition be reworded to clearly indicate total hours of permitted use and to be consistent with all modeling. Additionally, the EPA indicated a lack of clarity in hours of operation per combustion turbine and recommended that the use of the words "a calendar year" be replaced so as to be consistent with other permit conditions.

RESPONSE: The permit condition is reworded as follows: 13. Maximum allowable hours: Each stationary gas turbine shall only operate up to 4750 hours during any consecutive twelve month period, of which 750 hours of operation per combustion turbine may be while firing oil. Additionally, each turbine shall be limited to 16 hours per day of oil firing. [Applicant Request, Rule 62-210.200, F.A.C. (Definitions - Potential Emissions)]

5. *Specific Conditions 14 and 15*: The applicant requested that these conditions be deleted. The EPA commented that limits should be on an individual combustion turbine basis. These conditions had required facility-wide fuel usage monitoring and reporting on a monthly basis.

RESPONSE: The aforementioned permit conditions are deleted as the newly worded Specific Condition 13 dictates a precise (and different) method of compliance per combustion turbine.

6. *Specific Condition 17*: The applicant requested that this condition be deleted. The EPA commented that the related NOx limits should be lower and have shorter compliance times.

RESPONSE: This condition requires that the units be constructed so as to be easily capable of accommodating an SCR should one be required in order to meet the NOx limits. Given that the applicant initially requested a NOx limit of 12 ppm and that the Department has imposed a more stringent limit of 10.5 ppm, this condition will not be deleted.

7. *Specific Condition 20*: The applicant requested language changes to accurately reflect the purpose and basis of the chart, noting that a BACT analysis was not required for VOC.

RESPONSE: A note will be added below the chart indicating that the VOC limit was not determined by BACT.

8. *Specific Condition 21*: The EPA suggested that the limits imposed by the second "bullet" be more stringent. The EPA additionally commented on the applicability of SCR (as discussed in the BACT) questioning several of the applicant's assumptions (through its comments 4., 5. and 6.). The applicant requested that the condition imposed by the fourth "bullet" (requirement to evaluate lower NOx emissions while firing oil) be deleted or reworded.

RESPONSE: The limits imposed by the second bullet are related to NOx emissions while firing natural gas. The Department appreciates the concerns raised by the EPA, but believes that extenuating circumstances are involved. Namely, these are:

1) The applicant has proposed to shutdown an existing facility (Southside) in an effort to offset most air emission-related issues. The result should yield a net reduction of regulated pollutants emitted on an annual basis.

2) By imposing a limit of 10.5 ppm (versus 12 ppm as proposed by the applicant), the Department estimates that the net NOx emissions of the combined actions noted above are approximately zero TPY. Further mandated NOx reductions may be viewed as punitive.

3) In order to accommodate the applicant's concern about their ability to routinely achieve this lower imposed limit as well as the applicant's action noted in 1) above, the Department believes that a compliance method which is more flexible than is normally required can be allowed.

Therefore, the limits imposed by the second bullet will not be changed. However, the BACT will incorporate these extenuating circumstances as a part of the Department's justification. Concerning the applicant's request on the fourth "bullet", the wording will be revised in a fashion similar to that proposed by the applicant.

9. *Specific Condition 22*: The applicant requested that EPA method 10 be clearly indicated as the method of compliance for both the concentration and lb/hr limit of CO emissions. The applicant additionally noted that vendor guarantees for CO have only been obtained at the 15 ppm level, versus the 12 ppm level identified in the draft BACT. The applicant indicated that reasonable assurance for a 12 ppm emission rate cannot be provided and requested the ability to evaluate a lower limit (via testing and analysis) after the initial (15 ppm) acceptance test and subsequent testing is completed.

RESPONSE: Language similar to that proposed by the applicant for EPA Method 10 will be added. Concerning the CO limit, permit language will be included (similar to what is shown in Specific Condition 21 (fourth bullet)) including an "initial" 15 ppm limit with a requirement to submit an evaluation to FDEP concerning a lower limitation.

10. *Specific Condition 24*: The EPA requested that the permit conditions should list the corresponding particulate matter emissions rate limit even though opacity will be used as the method of compliance. Additionally, the EPA questioned the allowance of 20% opacity during startup and shutdown, noting that FDEP routinely permits combustion turbines without this "automatic" allowance.

RESPONSE: The Department agrees with EPA and will revise this condition accordingly.

11. *Specific Condition 26*: The applicant requested that an assumed typographical error be corrected in this condition.

RESPONSE: The typographical error will be corrected.

12. *Specific Condition 27*: The applicant requested that compliance-related notifications should be made to RESD and not duplicated to the Department. Additionally, the applicant requested that the condition be revised to accurately reflect Rule 62-210.700(6), F.A.C.

RESPONSE: Administrative Requirement number 13 as well as Specific Conditions 6, 27, 35, 37 and 41 will be re-worded to accurately reflect the Department's intent regarding compliance-related notifications. Specific Condition 27 will be revised to accurately reflect Rule 62-210.700(6), F.A.C.

13. *Specific Condition 29*: The applicant requested a revision to this condition clarifying the Department's intent concerning initial testing on oil as well as shake-down testing.

RESPONSE: Language similar to that proposed by the applicant will be added for initial testing on oil. However, the condition will not be revised in such a manner to allow routine or repetitive shakedown periods after the initial 100 days of operation.

14. *Specific Condition 30*: The applicant requested a revision to this condition eliminating reference to SCR controls and clarifying the Department's intent concerning 3-hr and 24-hr averaging times for NOx compliance.

RESPONSE: The Department will clarify its intent. However, the Department intends to allow for the possibility of SCR controls to be installed as indicated in prior discussion above.

15. *Specific Condition 31*: The applicant requested a revision to this condition so as to have similar language to other permits regarding the sulfur content of natural gas.

RESPONSE: The Department will modify the language so as to replicate other permits.

16. *Specific Condition 33*: The applicant requested a revision to this condition so as to eliminate the reference to the VOC limit having been determined by BACT.

RESPONSE: The Department will eliminate this reference in this condition.

17. *Specific Condition 40*: The applicant requested a revision to this condition to be consistent with its request in item 4. above.

RESPONSE: The Department will revise this condition so as to provide a means of compliance with the newly worded permit conditions (concerning hours of operation per CT).

18. *Specific Condition 41*: The applicant requested that this condition be revised so as to eliminate the last sentence or (at a minimum) to eliminate the words "and fuel switching".

RESPONSE: The Department will eliminate the words "and fuel switching".

19. *Specific Condition 43*: The applicant requested that this condition be revised so as to be consistent with other similar permitting actions.

RESPONSE: The Department will comply with this request.

20. *Specific Condition 45*: The applicant requested that this condition be revised for clarity so as to indicate when an Acid Rain permit should be applied for.

RESPONSE: The Department will comply with this request.

CONCLUSION

The final action of the Department is to issue the permit with the changes described above.

Department of Environmental Protection

Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Jeb Bush
Governor

David B. Struhs
Secretary

PERMITTEE:

Jacksonville Electric Authority
Brandy Branch Facility
21 West Church Street
Jacksonville, Florida 32202-3139
Authorized Representative:

Walter P. Bussells, Chief Executive Officer

File No.	PSD-FL-267
FID No.	0310485
SIC No.	4911
Expires:	12/31/02

PROJECT AND LOCATION:

Permit pursuant to the requirements for the Prevention of Significant Deterioration of Air Quality (PSD Permit) for the construction of: three dual-fuel nominal 170 megawatt (MW) General Electric PG7241FA combustion turbine-electrical generators and three 90-foot stacks. The units will operate in simple cycle mode and intermittent duty. The units will be equipped with Dry Low NO_x (DLN-2.6) combustors and wet injection capability. They are designated by JEA as Combustion Turbine Generators 1, 2 and 3 and by the Department as ARMS Emissions Units 001, 002 and 003.

The project will be located approximately 1 mile N.E. of Baldwin City, Duval County. UTM coordinates are: Zone 17; 408.81 km E; 3354.38 km N.

STATEMENT OF BASIS:

This PSD permit is issued under the provisions of Chapter 403 of the Florida Statutes (F.S.), and Chapters 62-4, 62-204, 62-210, 62-212, 62-296, and 62-297 of the Florida Administrative Code (F.A.C.) and 40CFR51.166. The above named permittee is authorized to modify the facility in accordance with the conditions of this permit and as described in the application, approved drawings, plans, and other documents on file with the Department of Environmental Protection (Department).

Attached Appendices and Tables made a part of this permit:

Appendix BD	BACT Determination
Appendix GC	Construction Permit General Conditions

for Howard L. Rhodes, Director
Division of Air Resources Management

SECTION I. FACILITY INFORMATION

FACILITY DESCRIPTION

This facility is a new site. This permitting action is to install three dual-fuel nominal 170 megawatt (MW) General Electric PG7241FA combustion turbine-electrical generators with three 90-foot stacks and three fuel oil storage tanks.

Emissions from the new units will be controlled by Dry Low NO_X (DLN-2.6) combustors when operating on natural gas and wet injection when firing fuel oil. Inherently clean fuels and good combustion practices will be employed to control all pollutants.

EMISSION UNITS

This permit addresses the following emission units:

ARMS Emissions Unit	System	Emission Unit Description
001	Power Generation	One nominal 170 Megawatt Gas Simple Cycle Combustion Turbine-Electrical Generator
002	Power Generation	One nominal 170 Megawatt Simple Cycle Gas Combustion Turbine-Electrical Generator
003	Power Generation	One nominal 170 Megawatt Simple Cycle Gas Combustion Turbine-Electrical Generator
004	Fuel Storage	1 Million Gallon Fuel Oil Storage Tank
005	Fuel Storage	1 Million Gallon Fuel Oil Storage Tank
006	Fuel Storage	1 Million Gallon Fuel Oil Storage Tank

REGULATORY CLASSIFICATION

The facility is classified as a Major or Title V Source of air pollution because emissions of at least one regulated air pollutant, such as particulate matter (PM/PM_{10}), sulfur dioxide (SO_2), nitrogen oxides (NO_X), carbon monoxide (CO), or volatile organic compounds (VOC) exceeds 100 tons per year (TPY).

This facility is not within an industry included in the list of the 28 Major Facility Categories per Table 212.400-1, F.A.C. Because emissions are greater than 100 TPY for at least one criteria pollutant, the facility is also a Major Facility with respect to Rule 62-212.400, Prevention of Significant Deterioration (PSD). Pursuant to Table 62-212.400-2, modifications at this facility resulting in emissions increases greater than any of the following values require review per the PSD rules as well as a determination of Best Available Control Technology (BACT): 40 TPY of NO_X, SO_2, or VOC; 25/15 TPY of PM/PM_{10}; 100 TPY of CO; or 7 TPY of sulfuric acid mist (SAM). This facility and the project are also subject to applicable provisions of Title IV, Acid Rain, of the Clean Air Act.

SECTION I. FACILITY INFORMATION

PERMIT SCHEDULE

- 08/23/99 Notice of Intent published in The Florida Times-Union
- 08/12/99 Distributed Intent to Issue Permit
- 08/06/99 Application deemed complete
- 05/18/99 Received Application

RELEVANT DOCUMENTS:

The documents listed below are the basis of the permit. They are specifically related to this permitting action, but not all are incorporated into this permit. These documents are on file with the Department.

- Application received on May 18, 1999
- Department letters dated May 26 and July 21, 1999
- Comments from the Fish and Wildlife Service dated July 20, August 12 and August 30, 1999
- Letter from JEA dated June 21, 1999
- Letter (e-mail) from JEA dated August 4, 1999 and related submittals
- Department's Intent to Issue and Public Notice Package dated August 12, 1999
- Letters (e-mail) from JEA dated August 27 and September 24, 1999
- Letter (facsimile) from EPA dated September 10, 1999
- Letter from Golder Associates Inc. dated September 10, 1999 and regional haze analysis
- Department's Final Determination and Best Available Control Technology Determination issued concurrently with this permit.

SECTION II. ADMINISTRATIVE REQUIREMENTS

1. Regulating Agencies: All documents related to applications for permits to construct, operate or modify an emissions unit should be submitted to the Bureau of Air Regulation (BAR), Florida Department of Environmental Protection (FDEP), at 2600 Blair Stone Road, Tallahassee, Florida 32399-2400 and phone number (850) 488-1344. All documents related to reports, tests, and notifications should be submitted to the DEP Northeast District office, 7825 Baymeadows Way, Suite 200B, Jacksonville, Florida 32256 and phone number 904/448-4300; additionally, such documents shall be submitted to RESD, Suite 225, 117 W. Duval St., Jacksonville, Florida 32202 and phone number 904/630-3484.
2. General Conditions: The owner and operator is subject to and shall operate under the attached General Permit Conditions G.1 through G.15 listed in Appendix GC of this permit. General Permit Conditions are binding and enforceable pursuant to Chapter 403 of the Florida Statutes. [Rule 62-4.160, F.A.C.]
3. Terminology: The terms used in this permit have specific meanings as defined in the corresponding chapters of the Florida Administrative Code.
4. Forms and Application Procedures: The permittee shall use the applicable forms listed in Rule 62-210.900, F.A.C. and follow the application procedures in Chapter 62-4, F.A.C. [Rule 62-210.900, F.A.C.]
5. Modifications: The permittee shall give written notification to the Department when there is any modification to this facility. This notice shall be submitted sufficiently in advance of any critical date involved to allow sufficient time for review, discussion, and revision of plans, if necessary. Such notice shall include, but not be limited to, information describing the precise nature of the change; modifications to any emission control system; production capacity of the facility before and after the change; and the anticipated completion date of the change. [Chapters 62-210 and 62-212]
6. Expiration: Approval to construct shall become invalid if construction is not commenced within 18 months after receipt of such approval, or if construction is discontinued for a period of 18 months or more, or if construction is not completed within a reasonable time. The Department may extend the 18-month period upon a satisfactory showing that an extension is justified. [62-4.070(4), 62-4.210(2)&(3), 62-210.300(1)(a)].
7. BACT Determination: In accordance with paragraph (4) of 40 CFR 51.166(j) the Best Available Control Technology (BACT) determination shall be reviewed and modified as appropriate in the event of a plant conversion. This paragraph states: "For phased construction projects, the determination of best available control technology shall be reviewed and modified as appropriate at the latest reasonable time which occurs no later than 18 months prior to commencement of construction of each independent phase of the project. At such time, the owner or operator of the applicable stationary source may be required to demonstrate the adequacy of any previous determination of best available control technology for the source." This reassessment will also be conducted for this project if there are any increases in heat input limits, hours of operation, oil firing, low or baseload operation (e.g. conversion to combined-

cycle operation) short-term or annual emission limits, annual fuel heat input limits or similar changes. [40 CFR 51.166, Rule 62-4.070 F.A.C.]

8. Application for Title V Permit: An application for a Title V operating permit, pursuant to Chapter 62-213, F.A.C., must be submitted to the DEP's Bureau of Air Regulation, and a copy to the Department Northeast District office as well as RESD. [Chapter 62-213, F.A.C.]

9. New or Additional Conditions: Pursuant to Rule 62-4.080, F.A.C., for good cause shown and after notice and an administrative hearing, if requested, the Department may require the permittee to conform to new or additional conditions. The Department shall allow the permittee a reasonable time to conform to the new or additional conditions, and on application of the permittee, the Department may grant additional time. [Rule 62-4.080, F.A.C.]

10. Annual Reports: Pursuant to Rule 62-210.370(2), F.A.C., Annual Operation Reports, the permittee is required to submit annual reports on the actual operating rates and emissions from this facility. Annual operating reports shall be sent to the DEP's Northeast District office as well as RESD by March 1st of each year. [Rule 62-210.370(2), F.A.C.]

11. Stack Testing Facilities: Stack sampling facilities shall be installed in accordance with Rule 62-297.310(6), F.A.C.

12. Permit Extension: The permittee, for good cause, may request that this construction permit be extended. Such a request shall be submitted to the Bureau of Air Regulation prior to 60 days before the expiration of the permit [Rule 62-4.080, F.A.C.]

13. Quarterly Reports: Quarterly excess emission reports, in accordance with 40 CFR 60.7 (a)(7) (c) (1997 version), shall be submitted to RESD. Each excess emission report shall include the information required in 40 CFR 60.7(c) and 60.334.

14. Retirement of existing facility: In accordance with JEA's analyses of regional haze in the nearby Class I areas, the Brandy Branch facility may cause or contribute to haze values greater than 5%. In order to mitigate this possibility, JEA will limit the operation of the combustion turbines permitted herein to a maximum of 16 hours per day of oil operation. Additionally, so as to cause a net benefit to the nearby Class I areas, JEA shall retire the existing Southside Facility (AIRS ID 0310046) located at 801 Colorado Avenue, Jacksonville, Florida upon JEA's application for a Title V permit for the Brandy Branch facility (including certification that the facility is in compliance with applicable requirements and permit conditions). JEA shall concurrently submit a letter from the designated representative of the Southside facility certifying that the facility has been shutdown and that related permits are being surrendered. This shall occur on or before October 31, 2002.

SECTION III. EMISSION UNITS SPECIFIC CONDITIONS

APPLICABLE STANDARDS AND REGULATIONS:

1. Unless otherwise indicated in this permit, the construction and operation of the subject emission unit(s) shall be in accordance with the capacities and specifications stated in the application. The facility is subject to all applicable provisions of Chapter 403, F.S. and Florida Administrative Code Chapters 62-4, 62-103, 62-204, 62-210, 62-212, 62-213, 62-214, 62-296, 62-297; and the applicable requirements of the Code of Federal Regulations Section 40, Parts 60, 72, 73, and 75.
2. Issuance of this permit does not relieve the facility owner or operator from compliance with any applicable federal, state, or local permitting requirements or regulations. [Rule 62-210.300, F.A.C.]
3. These emission units shall comply with all applicable requirements of 40CFR60, Subpart A, General Provisions including:

- 40CFR60.7, Notification and Recordkeeping
- 40CFR60.8, Performance Tests
- 40CFR60.11, Compliance with Standards and Maintenance Requirements
- 40CFR60.12, Circumvention
- 40CFR60.13, Monitoring Requirements
- 40CFR60.19, General Notification and Reporting requirements

4. ARMS Emission Units 001-003, Power Generation, consisting of three 170 megawatt combustion turbines (with optional evaporative inlet cooling) shall comply with all applicable provisions of 40CFR60, Subpart GG, Standards of performance for Stationary Gas Turbines, adopted by reference in Rule 62-204.800(7)(b), F.A.C. The Subpart GG requirement to correct test data to ISO conditions applies. However, such correction is not used for compliance determinations with the BACT standard(s). [Rule 62-204.800(7)(b), F.A.C.]
5. ARMS Emission Units 004-006, Fuel Storage, consisting of three 1 million gallon distillate fuel oil storage tanks shall comply with all applicable provisions of 40CFR60, Subpart Kb, Standards of Performance for Volatile Organic Liquid Storage Vessels, adopted by reference in Rule 62-204.800, F.A.C. [Rule 62-204.800(7)(b), F.A.C.]
6. All notifications and reports required by the above specific conditions shall be submitted to RESD.

GENERAL OPERATION REQUIREMENTS

7. Fuels: Only pipeline natural gas or maximum 0.05 percent sulfur fuel oil No. 2 or superior grade of distillate fuel oil shall be fired in this unit. [Applicant Request, Rule 62-210.200, F.A.C. (Definitions - Potential Emissions)] {Note: The limitation of this specific condition is more stringent than the NSPS sulfur dioxide limitation and thus assures compliance with 40 CFR 60.333 and 60.334}

8. Capacity: The maximum heat input rates, based on the lower heating value (LHV) of each fuel to each Unit (1-3) at ambient conditions of 59°F temperature, 60% relative humidity, 100% load, and 14.7 psi pressure shall not exceed 1,623 million Btu per hour (MMBtu/hr) when firing natural gas, nor 1,822 MMBtu/hr when firing No. 2 or superior grade of distillate fuel oil. These maximum heat input rates will vary depending upon ambient conditions and the combustion turbine characteristics. Manufacturer's curves corrected for site conditions or equations for correction to other ambient conditions shall be provided to the Department of Environmental Protection (DEP) within 45 days of completing the initial compliance testing. {Permitting note: The heat input limitations have been placed in the permit to identify the capacity of each emissions unit for purposes of confirming that emissions testing is conducted within 90-100 percent of the emissions unit's rated capacity (or to limit future operation to 110 percent of the test load), to establish appropriate limits and to aid in determining future rule applicability. Regular record keeping is not required for heat input. Instead, the owner or operator is expected to determine heat input whenever emission testing is required, to demonstrate at what percentage of the rated capacity that the unit was tested. Rule 62-297.310(5), F.A.C., included in this permit requires measurement of the process variables for emission tests. Such heat input determination may be based on measurements of fuel consumption by various methods (including but not limited to) fuel flow metering or tank drop measurements, using the heat value of the fuel determined by the fuel vendor or the operator to calculate average hourly heat input during the test.} [Design, Rule 62-210.200, F.A.C. (Definitions - Potential Emissions)]

9. Unconfined Particulate Emissions: During the construction period, unconfined particulate matter emissions shall be minimized by dust suppressing techniques such as covering and/or application of water or chemicals to the affected areas, as necessary. [Rule 62-296.320(4)(c)., F.A.C.]

10. Plant Operation - Problems: If temporarily unable to comply with any of the conditions of the permit due to breakdown of equipment or destruction by fire, wind or other cause, the owner or operator shall notify the DEP Northeast District office and RESD as soon as possible, but at least within (1) working day, excluding weekends and holidays. The notification shall include: pertinent information as to the cause of the problem; the steps being taken to correct the problem and prevent future recurrence; and where applicable, the owner's intent toward reconstruction of destroyed facilities. Such notification does not release the permittee from any liability for failure to comply with the conditions of this permit and the regulations. [Rule 62-4.130, F.A.C.]

11. Operating Procedures: Operating procedures shall include good operating practices and proper training of all operators and supervisors. The good operating practices shall meet the guidelines and procedures as established by the equipment manufacturers. All operators (including supervisors) of air pollution control devices shall be properly trained in plant specific equipment. [Rule 62-4.070(3), F.A.C.]

12. Circumvention: The owner or operator shall not circumvent the air pollution control equipment or allow the emission of air pollutants without this equipment operating properly. [Rules 62-210.650, F.A.C.]

13. Maximum allowable hours: Each stationary gas turbine shall only operate up to 4750 hours during any consecutive twelve month period, of which 750 hours of operation per combustion turbine may be while firing oil. Additionally, each turbine shall be limited to 16 hours per day of oil firing. [Applicant Request, Rule 62-210.200, F.A.C. (Definitions - Potential Emissions)]

14. [DELETED]

15. [DELETED]

Control Technology

16. Dry Low NO_X (DLN) combustors shall be installed on each stationary combustion turbine to control NO_X emissions while firing natural gas. [BACT, Rule 62-4.070, F.A.C.]

17. The permittee shall design each stationary combustion turbine, ducting, and stack(s) so as to not preclude installation of SCR equipment and/or oxidation catalyst in the event of a failure to achieve the NO_X limits given in Specific Condition No. 20 and 21 or the carbon monoxide (CO) limits given in Specific Condition 22. [Rule 62-4.070, F.A.C.]

18. A water injection (WI) system shall be installed for use when firing No. 2 or superior grade distillate fuel oil for control of NO_X emissions. [Design, Rules 62-4.070, 62-212.400, F.A.C.]

19. Consistent with best operation and maintenance practices, the DLN systems shall each be tuned upon initial operation to optimize emissions reductions and shall be maintained to minimize NO_X emissions and CO emissions. Operation of the DLN systems in the diffusion-firing mode shall be minimized when firing natural gas. [Rules 62-4.070, 62-210.650 F.A.C.]

EMISSION LIMITS AND STANDARDS

20. The following table is a summary of the BACT determination and is followed by the applicable specific conditions. Values for NO_X are corrected to 15% O_2 on a dry basis. [Rule 62-212.400, F.A.C.]

Operational Mode (Fuel)	NO_X (15%O2)	CO	VOC***	PM/Visibility (% Opacity)	SO_2/SAM	*Technology and Comments*
Natural Gas	10.5 ppm	15** ppm	2 ppm	10	2 grain S per 100 CF	Dry Low NOx Burners. Clean fuels, good combustion
Fuel Oil	42 ppm*	20 ppm	3.5 ppm	10	0.05% sulfur oil	Water Injection. Units limited to 750 hrs equivalent full load oil operation (per CT) annually. Clean fuels, good combustion

NOTES: * See Condition 21. ** See Condition 22. *** The VOC limit imposed herein was not determined by BACT.

21. Nitrogen Oxides (NO_X) Emissions:

- When NO_X monitoring data is not available, substitution for missing data shall be handled as required by Title IV (40 CFR 75) to calculate any specified average time.
- While firing Natural Gas: The emission rate of NO_X in the exhaust gas shall not exceed 69.3 lb/hr (at ISO conditions) on a 24 hr block average as measured by the continuous emission monitoring system (CEMS). In addition, NO_X emissions calculated as NO_2 (at ISO conditions) shall not exceed 10.5 ppm @15% O_2 to be demonstrated by annual stack test nor 9 ppm @15% O_2 to be demonstrated by the initial "new and clean" GE performance stack test. Note: Basis for lb/hr limit is 10.5 ppm @ 15% O_2, full load. [Rule 62-212.400, F.A.C.]
- While firing Fuel oil: The concentration of NO_X in the exhaust gas shall not exceed 42 ppmvd at 15% O_2 on the basis of a 3 hr average as measured by the continuous emission monitoring system (CEMS). In addition, NO_X emissions calculated as NO_2 (at ISO conditions) shall not exceed 42 ppm @15% O_2 to be demonstrated by stack test. [Rule 62-212.400, F.A.C.]
- After combusting fuel oil for at least 400 hours on any individual CT, the permittee shall prepare and submit for the Department's review and acceptance an engineering report regarding the lowest NO_X emission rate that can consistently be achieved when firing distillate oil. This lowest recommended rate shall include a reasonable operating margin, taking into account long-term performance expectations and good operating and maintenance practices. The Department may revise the NO_X emission rate based upon this report. [BACT determination]

22. Carbon Monoxide (CO) emissions: The concentration of CO in the exhaust gas when firing natural gas shall not exceed 15 ppmvd when firing natural gas and 20 ppmvd when firing fuel oil as measured by EPA Method 10. CO emissions (at ISO conditions) shall not exceed 48.0 lb/hr (when firing natural gas) and 65.0 lb/hr (when firing fuel oil) as indicated by EPA Method 10. [Rule 62-212.400, F.A.C.]

- Within 18 months after the initial compliance test on any individual CT, the permittee shall prepare and submit for the Department's review and acceptance an engineering report regarding the lowest CO emission rate that can consistently be achieved firing natural gas. This lowest recommended rate shall include a reasonable operating margin, taking into account long-term performance expectations and good operating and maintenance practices. The Department may revise the CO emission rate based upon this report. [BACT determination]

23. Sulfur Dioxide (SO_2) emissions: SO_2 emissions (at ISO conditions) shall not exceed 1.1 pounds per hour when firing pipeline natural gas and 98.2 pounds per hour when firing maximum 0.05 percent sulfur No. 2 or superior grade distillate fuel oil as measured by applicable compliance methods described below. [Rule 62-212.400, F.A.C.]

24. Visible emissions (VE): VE emissions shall not exceed 10 percent opacity when firing natural gas or No. 2 or superior grade of fuel oil. Particulate matter emissions shall not exceed 9.0

lb/hr (front catch) while firing natural gas and 17.0 lb/hr (front catch) while firing fuel oil as indicated by opacity. [Rule 62-296.320(4)(b), F.A.C.]

25. Volatile Organic Compounds (VOC) Emissions: The concentration of VOC in the exhaust gas when firing natural gas shall not exceed 2 ppmvd when firing natural gas and 3.5 ppmvd when firing fuel oil as assured by EPA Methods 18 and/or 25 A. VOC emissions (at ISO conditions) shall not exceed 4.0 lb/hr (when firing natural gas) and 7.5 lb/hr (when firing fuel oil) as indicated by EPA Methods 18 and/or 25A. [Rule 62-212.400, F.A.C.]

EXCESS EMISSIONS

26. Excess emissions resulting from startup, shutdown or malfunction shall be permitted provided that best operational practices are adhered to and the duration of excess emissions shall be minimized. Excess emissions occurrences shall in no case exceed two hours in any 24-hour period for other reasons unless specifically authorized by DEP for longer duration. Operation below 50% output shall be limited to 2 hours per unit cycle (breaker closed to breaker open). Excess emissions caused entirely or in part by poor maintenance, poor operation, or any other equipment or process failure that may reasonably be prevented during startup, shutdown or malfunction, shall be prohibited pursuant to Rule 62-210.700, F.A.C.

27. Excess Emissions Report: If excess emissions occur due to malfunction, the owner or operator shall notify RESD within (1) working day of: the nature, extent, and duration of the excess emissions; the cause of the excess emissions; and the actions taken to correct the problem. In addition, the Department may request a written summary report of the incident. Pursuant to the New Source Performance Standards, excess emissions shall also be reported in accordance with 40 CFR 60.7, Subpart A. [Rules 62-4.130 and 62-210.700(6), F.A.C.]

COMPLIANCE DETERMINATION

28. Compliance with the allowable emission limiting standards shall be determined within 60 days after achieving the maximum production rate, for each fuel, at which this unit will be operated, but not later than 180 days of initial operation of the unit for that fuel, and annually thereafter as indicated in this permit, by using the following reference methods as described in 40 CFR 60, Appendix A (1997 version), and adopted by reference in Chapter 62-204.800, F.A.C.

29. Initial (I) performance tests shall be performed on each unit while firing natural gas as well as while firing fuel oil, in accordance with Specific Condition 28. Initial tests shall also be conducted after any modifications (and shake down period not to exceed 100 days after starting the CT) to air pollution control equipment, including low NO_x burners or SCR. Annual (A) compliance tests shall be performed during every federal fiscal year (October 1 - September 30) pursuant to Rule 62-297.310(7), F.A.C., on each unit as indicated. The following reference methods shall be used. No other test methods may be used for compliance testing unless prior DEP approval is received in writing.

- EPA Reference Method 9, "Visual Determination of the Opacity of Emissions from Stationary Sources" (I, A).
- EPA Reference Method 10, "Determination of Carbon Monoxide Emissions from Stationary Sources" (I, A).
- EPA Reference Method 20, "Determination of Oxides of Nitrogen Oxide, Sulfur Dioxide and Diluent Emissions from Stationary Gas Turbines." Initial test only for compliance with 40CFR60 Subpart GG and (I, A) short-term NO_X BACT limits (EPA reference Method 7E, "Determination of Nitrogen Oxides Emissions from Stationary Sources" or RATA test data may be used to demonstrate compliance for annual test requirement).
- EPA Reference Method 18, and/or 25A, "Determination of Volatile Organic Concentrations." Initial test only.

30. Continuous compliance with the NO_X emission limits: Continuous compliance with the NO_X emission limits shall be demonstrated with the CEM system based on the applicable averaging time of 24-hr block average (DLN technology while burning gas) or a 3-hr average (SCR technology or while burning oil). For the 24-hr block average (lb/hr) emissions may be determined via EPA Method 19 or equivalent EPA approved methods. Based on CEMS data, a separate compliance determination is conducted at the end of each operating day (or 3-hr period when applicable) and a new average emission rate is calculated from the arithmetic average of all valid hourly emission rates from the previous operating day (or 3-hr period when applicable). Valid hourly emission rates shall not include periods of startup, shutdown, or malfunction as defined in Rule 62-210.200 F.A.C., where emissions exceed the applicable NO_X standard. These excess emissions periods shall be reported as required in Conditions 26 and 27. A valid hourly emission rate shall be calculated for each hour in which at least two NO_X concentrations are obtained at least 15 minutes apart. [Rules 62-4.070 F.A.C., 62-210.700, F.A.C., and 40 CFR 75]

31. Compliance with the SO_2 and PM/PM_{10} emission limits: Notwithstanding the requirements of Rule 62-297.310(7), F.A.C., the use of pipeline natural gas and maximum 0.05 percent sulfur (by weight) No. 2 or superior grade distillate fuel oil, is the method for determining compliance for SO_2 and PM_{10}. For the purposes of demonstrating compliance with the 40 CFR 60.333 SO_2 standard and the 0.05% S limit, fuel oil analysis using ASTM D2880-941 or D4294-90 (or equivalent latest version) for the sulfur content of liquid fuels and D1072-80, D3031-81, D4084-82 or D3246-81 (or equivalent latest version) for sulfur content of gaseous fuel shall be utilized in accordance with the EPA-approved custom fuel monitoring schedule or natural gas supplier data may be submitted or the natural gas sulfur content referenced in 40 CFR 75 Appendix D may be utilized. The applicant is responsible for ensuring that the procedures above are used for determination of fuel sulfur content. Analysis may be performed by the owner or operator, a service contractor retained by the owner or operator, the fuel vendor, or any other qualified agency pursuant to 40 CFR 60.335(e) (1997 version).

32. Compliance with CO emission limit: An initial test for CO shall be conducted concurrently with the initial NO_X test, as required. The initial NO_X and CO test results shall be the average of three valid one-hour runs. Annual compliance testing for CO may be conducted concurrent with the annual RATA testing for NO_X required pursuant to 40 CFR 75 (required for gas only).

33. Compliance with the VOC emission limit: An initial test is required to demonstrate compliance with the VOC emission limit. Thereafter, CO emission limit will be employed as surrogate and no annual testing is required.

34. Testing procedures: Testing of emissions shall be conducted with the combustion turbine operating at permitted capacity. Permitted capacity is defined as 90-100 percent of the maximum heat input rate allowed by the permit, corrected for the average ambient air temperature during the test (with 100 percent represented by a curve depicting heat input vs. ambient temperature). If it is impracticable to test at permitted capacity, the source may be tested at less than permitted capacity. In this case, subsequent operation is limited by adjusting the entire heat input vs. ambient temperature curve downward by an increment equal to the difference between the maximum permitted heat input (corrected for ambient temperature) and 110 percent of the value reached during the test until a new test is conducted. Once the unit is so limited, operation at higher capacities is allowed for no more than 15 consecutive days for the purposes of additional compliance testing to regain the permitted capacity. Test procedures shall meet all applicable requirements (i.e., testing time frequency, minimum compliance duration, etc.) of Chapter 62-204.800 F.A.C.

35. Test Notification: The DEP's Northeast District office and RESD shall be notified, in writing, at least 30 days prior to the initial performance tests and RESD notified at least 15 days before annual compliance test(s). [40 CFR 60.11]

36. Special Compliance Tests: The DEP or RESD may request a special compliance test pursuant to Rule 62-297.310(7), F.A.C., when, after investigation (such as complaints, increased visible emissions, or questionable maintenance of control equipment), there is reason to believe that any applicable emission standard is being violated.

37. Test Results: Compliance test results shall be submitted to RESD no later than 45 days after completion of the last test run. [Rule 62-297.310(8), F.A.C.]

NOTIFICATION, REPORTING, AND RECORDKEEPING

38. Records: All measurements, records, and other data required to be maintained by JEA shall be recorded in a permanent form and retained for at least five (5) years following the date on which such measurements, records, or data are recorded. These records shall be made available to DEP and RESD representatives upon request.

39. Emission Compliance Stack Test Reports: A test report indicating the results of the required compliance tests shall be filed as per Condition 37. above. The test report shall provide sufficient detail on the tested emission unit and the procedures used to allow the Department to

determine if the test was properly conducted and if the test results were properly computed. At a minimum, the test report shall provide the applicable information listed in Rule 62-297.310(8), F.A.C.

40. Special Record Keeping Requirements: The owner or operator shall obtain, make, and keep the following records related to fuel usage:

    (1) Hours of operation for each combustion turbine by fuel type shall be submitted with the Annual Operation Report (AOR) for the prior year.

    (2) Hours of operation for each combustion turbine shall kept for each consecutive 12-month period by fuel type.

    (3) Daily hours of fuel oil operation shall be kept for each combustion turbine during any day in which fuel oil is fired.

MONITORING REQUIREMENTS

41. Continuous Monitoring System: The permittee shall install, calibrate, maintain, and operate a continuous emission monitor in the stack to measure and record the nitrogen oxides emissions from each (CT) unit. Periods when NO_X emissions are above the standards as listed in Specific Condition No 21, shall be reported to RESD pursuant to Rule 62-4.160(8), F.A.C. Following the format of 40 CFR 60.7, periods of startup, shutdown and malfunction shall be monitored, recorded, and reported as excess emissions when emission levels exceed the standards listed in Specific Condition No. 21 except as noted in Specific Condition No. 30. [Rule 62-204.800 and 40 CFR 60.7 (1997 version)]

42. CEMS in lieu of Water to Fuel Ratio: The NO_X CEMS shall be used in lieu of the water/fuel monitoring system for reporting excess emissions in accordance with 40 CFR 60.334(c)(1), Subpart GG (1997 version). The calibration of the water/fuel-monitoring device required in 40 CFR 60.335 (c)(2) (1997 version) will be replaced by the 40 CFR 75 certification tests of the NO_X CEMS. Upon request from DEP, the CEMS emission rates for NO_X shall be corrected to ISO conditions to demonstrate compliance with the NO_X standard established in 40 CFR 60.332.

43. Continuous Monitoring System Reports: The monitoring devices shall comply with the certification and quality assurance, and any other applicable requirements of Rule 62-297.520, F.A.C., 40 CFR 60.13, including certification of each device in accordance with 40 CFR 60, Appendix B, Performance Specifications and 40 CFR 60.7(a)(5) or 40 CFR Part 75. Quality assurance procedures must conform to all applicable sections of 40 CFR 60, Appendix F or 40CFR75. Data on CEM equipment specifications, manufacturer, type, calibration and maintenance needs, and its proposed location shall be provided to the Department's Northeast District Office as well as RESD no later than 45 days prior to the first scheduled certification test pursuant to 40 CFR 75.62.

SECTION III. EMISSION UNITS SPECIFIC CONDITIONS

44. Fuel Oil Monitoring Schedule: The following monitoring schedule for No. 2 or superior grade fuel oil shall be followed: For all bulk shipments of No. 2 or superior grade fuel oil received at the Brandy Branch Power Plant, an analysis which reports the sulfur content and nitrogen content of the fuel shall be provided by the fuel vendor. The analysis shall also specify the methods by which the analyses were conducted and shall comply with the requirements of 40 CFR 60.335(d).

45. Natural Gas Monitoring Schedule: The following custom monitoring schedule for natural gas is approved (pending EPA concurrence) in lieu of the daily sampling requirements of 40 CFR 60.334 (b)(2):

- The permittee shall apply for an Acid Rain permit in compliance with the deadlines specified in 40 CFR 72.30.
- The permittee shall submit a monitoring plan, certified by signature of the Designated Representative that commits to using a primary fuel of pipeline supplied natural gas (sulfur content less than 20 gr/100 scf pursuant of 40 CFR 75.11(d)(2)).
- Each unit shall be monitored for SO_2 emissions using methods consistent with the requirements of 40 CFR 75 and certified by the USEPA.
- JEA shall notify DEP of any change in natural gas supply for reexamination of this monitoring schedule. A substantial change in natural gas quality (i.e., sulfur content variation of greater than 1 grain per 100 cubic foot of natural gas) shall be considered as a change in the natural gas supply. Sulfur content of the natural gas will be monitored weekly by the natural gas supplier during the interim period when this monitoring schedule is being reexamined.

46. Determination of Process Variables:

- The permittee shall operate and maintain equipment and/or instruments necessary to determine process variables, such as process weight input or heat input, when such data is needed in conjunction with emissions data to determine the compliance of the emissions unit with applicable emission limiting standards.
- Equipment and/or instruments used to directly or indirectly determine such process variables, including devices such as belt scales, weigh hoppers, flow meters, and tank scales, shall be calibrated and adjusted to indicate the true value of the parameter being measured with sufficient accuracy to allow the applicable process variable to be determined within 10% of its true value [Rule 62-297.310(5), F.A.C]

APPENDIX BD
BEST AVAILABLE CONTROL TECHNOLOGY DETERMINATION (BACT)

JEA Brandy Branch Facility
PSD-FL-267 and 0310485-001-AC
Duval County, Florida

BACKGROUND

The applicant, JEA (formerly Jacksonville Electric Authority) proposes to install three nominal 170 megawatt (MW) General Electric PG 7241 FA combustion turbine-electrical generators at the planned Brandy Branch Facility near Baldwin City, Duval County. The proposed project will result in "significant increases" with respect to Table 62-212.400-2, Florida Administrative Code (F.A.C.) of emissions of particulate matter (PM and PM_{10}), carbon monoxide (CO), nitrogen oxides (NO_X), sulfur dioxide (SO_2), and sulfuric acid mist (SAM). The project is therefore subject to review for the Prevention of Significant Deterioration (PSD) and a determination of Best Available Control Technology (BACT) in accordance with Rules 62-212.400, F.A.C.

The new units will operate in simple cycle mode and intermittent duty and exhaust through separate 90-foot stacks. JEA proposes to operate these units up to 4000 hours on natural gas and 800 hours on maximum 0.05 percent sulfur distillate fuel oil. Descriptions of the process, project, air quality effects, and rule applicability are given in the Technical Evaluation and Preliminary Determination dated August 11, 1999, accompanying the Department's Intent to Issue.

DATE OF RECEIPT OF A BACT APPLICATION:

The application was received on May 18, 1999 and included a proposed BACT proposal prepared by the applicant's consultant. Black & Veatch.

REVIEW GROUP MEMBERS:

Michael P. Halpin, P.E. and A. A. Linero, P.E.

BACT DETERMINATION REQUESTED BY THE APPLICANT:

POLLUTANT	CONTROL TECHNOLOGY	PROPOSED BACT LIMIT
Nitrogen Oxides	Dry Low NO_X Combustors Water Injection (Oil)	12 ppmvd @ 15% O_2 (gas) 42 ppmvd @ 15% O_2 (oil)
Particulate Matter	Pipeline Natural Gas No. 2 Distillate Oil (800 hr/yr) Combustion Controls	10% Opacity
Carbon Monoxide	As Above	15 ppm (gas, baseload) 20 ppm (oil baseload)
Sulfur Dioxide	As Above	0.05% S in fuel oil
Sulfuric Acid Mist	As Above	0.05% S in fuel oil

According to the application, the maximum emissions from the facility will be approximately 858 tons per year (TPY) of NO_X, 366 TPY of CO, 75 TPY of PM/PM_{10}, 124 TPY of SO_2, 15 TPY of SAM, and 21 TPY of VOC.

BACT DETERMINATION PROCEDURE:

In accordance with Chapter 62-212.400, F.A.C., this BACT determination is based on the maximum degree of reduction of each pollutant emitted which the Department of Environmental Protection (Department), on a case by case basis, taking into account energy, environmental and economic impacts, and other costs, determines is achievable through application of production processes and available methods, systems, and techniques. In addition, the regulations state that, in making the BACT determination, the Department shall give consideration to:

- Any Environmental Protection Agency determination of BACT pursuant to Section 169, and any emission limitation contained in 40 CFR Part 60 - Standards of Performance for New Stationary Sources or 40 CFR Part 61 - National Emission Standards for Hazardous Air Pollutants.
- All scientific, engineering, and technical material and other information available to the Department.
- The emission limiting standards or BACT determination of any other state.
- The social and economic impact of the application of such technology.

The EPA currently stresses that BACT should be determined using the "top-down" approach. The first step in this approach is to determine, for the emission unit in question, the most stringent control available for a similar or identical emission unit or emission unit category. If it is shown that this level of control is technically or economically unfeasible for the emission unit in question, then the next most stringent level of control is determined and similarly evaluated. This process continues until the BACT level under consideration cannot be eliminated by any substantial or unique technical, environmental, or economic objections.

STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES:

The minimum basis for a BACT determination is 40 CFR 60, Subpart GG, Standards of Performance for Stationary Gas Turbines (NSPS). The Department adopted subpart GG by reference in Rule 62-204.800, F.A.C. The key emission limits required by Subpart GG are 75 ppmvd NO_X @ 15% O_2 (assuming 25 percent efficiency) and 150 ppmvd SO_2 @ 15% O_2 (or <0.8% sulfur in fuel). The BACT proposed by JEA is within the NSPS limit, which allows NO_X emissions, over 110 ppmvd for the high efficiency units to be purchased for the Brandy Branch Facility.

No National Emission Standard for Hazardous Air Pollutants exists for stationary gas turbines.

DETERMINATIONS BY EPA AND STATES:

The following table is based primarily on "F" Class intermittent-duty simple cycle turbines recently permitted or still under review. One project (PREPA) based on smaller units but permitted to operate continuously is included as an example of a simple cycle unit with add-on control equipment. Another continuous-duty project (Lakeland) based on the larger "G" Class is also included. The proposed JEA Brandy Branch project is included to facilitate comparison.

APPENDIX BD
BEST AVAILABLE CONTROL TECHNOLOGY DETERMINATION (BACT)

Project Location	Power Output and Duty	NO_X Limit ppmvd @ 15% O_2 and Fuel	Technology	Comments
Lakeland, FL	250 MW SC CON	9/9 – NG (by 2002) 42/15 - No. 2 FO	DLN/HSCR WI/HSCR	250 MW WH 501G CT Initially 25 ppm NO_X limit on gas Issued 7/98. 250 hrs on oil.
Oleander Cocoa, FL	850 MW SC INT	9 - NG 42 - No. 2 FO	DLN WI	5x170 MW GE PG7241FA CTs Draft 4/99. 1000 hrs on oil
JEA Brandy, FL	510 MW SC INT	12 - NG 42 - No. 2 FO	DLN WI	3x170 MW GE MS7241FA CTs Application 5/99. 800 hrs on oil
JEA Kennedy, FL	170 MW SC INT	15 - NG 42 - No. 2 FO	DLN WI	170 MW GE MS7241FA CT Issued 2/99. Not PSD/BACT
TEC Polk Power, FL	330 MW SC INT	10.5 – NG 42 – No. 2 F.O.	DLN WI	2x165 MW GE MS7241FA CTs Application 2/99. 876 hrs on oil
Dynegy Heard, GA	510 MW SC INT	15 – NG	DLN	3x170 MW WH 501F CTs Application. Gas only
Tenaska Heard, GA	960 MW SC INT	15 - NG 42 - No. 2 FO	DLN WI	6x170 MW GE PG7241FA CTs Issued 12/98. 720 hrs on oil
Thomaston, GA	680 MW SC INT	15 - NG 42 - No. 2 FO	DLN WI	4x170 MW GE PG7241FA CTs Application. 1687 hrs on oil
Dynegy Reidsville, NC	900 MW SC INT	15 – NG (by 2002) 42 – No. 2 FO	DLN WI	5x180 MW WH 501F CTs Initially 25 ppm NO_X limit on gas Draft 5/98. 1000 hrs on oil.
RockGen Cristiana, WI	525 MW SC INT	15/12 – NG 42 - No. 2 FO	DLN WI	3x175 MW GE PG7241FA CTs 15/12 ppm are on 1/24 hr basis Issued 1/99. 800 hrs on oil
SEI Neenah, WI	330 MW SC INT	15/12 - NG 42 - No. 2 FO	DLN WI	2x165 MW GE PG7241FA CTs 15/12 ppm are on 1/24 hr basis Issued 1/99. 8760/699 hrs gas/oil
PREPA, PR	248 MW SC CON	10 - No. 2 FO	WI & HSCR	3x83 MW ABB GT11N CTs Issued 12/95.

CON = Continuous
SC = Simple Cycle
INT = Intermittent
DLN = Dry Low NO_X Combustion
SCR = Selective Catalytic Reduction
HSCR = Hot SCR
FO = Fuel Oil
NG = Natural Gas
WI = Water or Steam Injection
GE = General Electric
WH = Westinghouse
ABB = Asea Brown Bovari

Project Location	CO - ppm (or as indicated)	VOC - ppm (or as indicated)	PM - lb/hr (or as indicated)	Technology and Comments
Lakeland, FL	25 - NG or 10 by Ox Cat 75 - FO @ 15% O_2	4 – NG 10 – FO	10% Opacity	Clean Fuels Good Combustion
Oleander Cocoa, FL	12 - NG 20 - FO	3 – NG 6 – FO	10% Opacity	Clean Fuels Good Combustion
JEA Brandy, FL	15 - NG 20/26 (full/part load) - FO	1.4 – NG 1.4 – FO	9 lb/hr - NG 17 lb/hr - FO	Clean Fuels Good Combustion
JEA Kennedy, FL	15 - NG 20 - FO	1.4 – NG 3.5 – FO	9 lb/hr - NG 17 lb/hr - FO	Clean Fuels Good Combustion
TEC Polk Power, FL	15 - NG 33 - FO	7 – NG 7 – FO	10% Opacity	Clean Fuels Good Combustion
Dynegy Heard Co., GA	25 - NG	? – NG	? - NG	Clean Fuels Good Combustion
Tenaska Heard Co., GA	15 - NG 20 - FO	? – NG ? – FO	? - NG ? lb/hr - FO	Clean Fuels Good Combustion
Dynegy Reidsville, NC	25 - NG 50 - FO	6 lb/hr – NG 8 lb/hr – FO	6 lb/hr - NG 23 lb/hr - FO	Clean Fuels Good Combustion
RockGen Cristiana, WI	12@>50% load – NG 15@>75% 24@<75% - FO	2 - NG 5 - FO	18 lb/hr – NG 44 lb/hr - FO	Clean Fuels Good Combustion
SEI Neenah, WI	12@>50% load – NG 15@>75% 24@<75% - FO	2 - NG 5 - FO	18 lb/hr - NG 41 lb/hr - FO	Clean Fuels Good Combustion
PREPA, PR	9 – FO @15% O_2	11 – FO @15% O_2	0.0171 gr/dscf	Clean Fuels Good Combustion

OTHER INFORMATION AVAILABLE TO THE DEPARTMENT:

Besides the information submitted by the applicant and that mentioned above, other information available to the Department consists of:

- Comments from EPA dated September 10, 1999
- Comments from the Fish and Wildlife Service dated July 20, August 12 and August 30, 1999
- DOE website information on Advanced Turbine Systems Project
- Alternative Control Techniques Document - NO_X Emissions from Stationary Gas Turbines
- General Electric 39th Turbine State-of-the-Art Technology Seminar Proceedings
- GE Guarantee for Jacksonville Electric Authority Brandy Branch Station Project
- GE Power Generation - Speedtronic™ Mark V Gas Turbine Control System
- GE Combustion Turbine Startup Curves
- JEA Website – www.jea.com
- Goal Line Environmental Technologies Website – www.glet.com
- Catalytica Website – www.catalytica-inc.com

REVIEW OF NITROGEN OXIDES CONTROL TECHNOLOGIES:

Some of the discussion in this section is based on a 1993 EPA document on Alternative Control Techniques for NO_X Emissions from Stationary Gas Turbines. Project-specific information is included where applicable.

Nitrogen Oxides Formation

Nitrogen oxides form in the gas turbine combustion process as a result of the dissociation of molecular nitrogen and oxygen to their atomic forms and subsequent recombination into seven different oxides of nitrogen. Thermal NO_X forms in the high temperature area of the gas turbine combustor. Thermal NO_X increases exponentially with increases in flame temperature and linearly with increases in residence time. Flame temperature is dependent upon the ratio of fuel burned in a flame to the amount of fuel that consumes all of the available oxygen.

By maintaining a low fuel ratio (lean combustion), the flame temperature will be lower, thus reducing the potential for NO_X formation. Prompt NO_X is formed in the proximity of the flame front as intermediate combustion products. The contribution of Prompt to overall NO_X is relatively small in near-stoichiometric combustors and increases for leaner fuel mixtures. This provides a practical limit for NO_X control by lean combustion.

Fuel NO_X is formed when fuels containing bound nitrogen are burned. This phenomenon is not important when combusting natural gas. It is not a significant issue for the JEA project because these units will not be continuously operated, but rather will be "peakers". Also, low sulfur fuel oil (which has more fuel-bound nitrogen than natural gas) is proposed to be used for no more than 800 hours per year (per CT). Uncontrolled emissions range from about 100 to over 600 parts per million by volume, dry, corrected to 15 percent oxygen (ppmvd @15% O_2). The Department

estimates uncontrolled emissions at approximately 200 ppmvd @15% O_2 for each turbine of the JEA Project. The proposed NO_X controls will reduce these emissions significantly.

NO_X Control Techniques

Wet Injection

Injection of either water or steam directly into the combustor lowers the flame temperature and thereby reduces thermal NO_X formation. Typical emissions achieved by wet injection are in the range of 15–25 ppmvd when firing gas and 42 ppmvd when firing fuel oil in large combustion turbines. These values often form the basis, particularly in combined cycle turbines, for further reduction to BACT limits by other techniques. Carbon monoxide (CO) and hydrocarbon (HC) emissions are relatively low for most gas turbines. However steam and (more so) water injection increase emissions of both of these pollutants.

Combustion Controls

The excess air in lean combustion cools the flame and reduces the rate of thermal NO_X formation. Lean premixing of fuel and air prior to combustion can further reduce NO_X emissions. This is accomplished by minimizing localized fuel-rich pockets (and high temperatures) that can occur when trying to achieve lean mixing within the combustion zones.

The above principle is depicted in Figure 1 for a General Electric DLN-1 can-annular combustor operating on gas. For ignition, warm-up, and acceleration to approximately 20 percent load, the first stage serves as the complete combustor. Flame is present only in the first stage, which is operated as lean stable combustion will permit. With increasing load, fuel is introduced into the secondary stage, and combustion takes place in both stages. When the load reaches approximately 40 percent, fuel is cut off to the first stage and the flame in this stage is extinguished. The venturi ensures the flame in the second stage cannot propagate upstream to the first stage. When the fuel in the first-stage flame is extinguished (as verified by internal flame detectors), fuel is again introduced into the first stage, which becomes a premixing zone to deliver a lean, unburned, uniform mixture to the second stage. The second stage acts as the complete combustor in this configuration.

To further reduce NO_X emissions, GE developed the DLN-2.0 (cross section shown in Figure 1) wherein air usage (other than for premixing) was minimized. The venturi and the centerbody assembly were eliminated and each combustor has a single burning zone. So-called "quaternary fuel" is introduced through pegs located on the circumference of the outward combustion casing.

GE has made further improvements in the DLN design. The most recent version is the DLN-2.6 (proposed for the JEA project). The combustor is similar to the DLN-2 with the addition of a sixth (center) fuel nozzle. The emission characteristics of the DLN-2.6 combustor while firing natural gas are given in Figure 2 for a unit tuned to meet a 15 ppmvd NO_X limit (by volume, dry corrected to at 15 percent oxygen) at Jacksonville Electric Authority's Kennedy Station.

NO_X concentrations are higher in the exhaust at lower loads because the combustor does not operate in the lean pre-mix mode. Therefore such a combustor emits NO_X at concentrations of 15 ppmvd at loads between 50 and 100 percent of capacity, but concentrations as high as 100 ppmvd at less than 50 percent of capacity. Note that VOC comprises a very small amount of the "unburned hydrocarbons" which in turn is mostly non-VOC methane.

The combustor can be tuned differently to achieve emissions as low as 9 ppm of NO_x and 9 ppm of CO. Emissions characteristics while firing oil are expected to be similar for the DLN-2.6 as they are for those of the DLN-2.0 shown in Figure 3. Simplified cross sectional views of the totally premixed DLN-2.6 combustor to be installed at the JEA project are shown in Figure 4.

In all but the most recent gas turbine combustor designs, the high temperature combustion gases are cooled to an acceptable temperature with dilution air prior to entering the turbine (expansion) section. The sooner this cooling occurs, the lower the thermal NO_x formation. Cooling is also required to protect the first stage nozzle. When this is accomplished by air cooling, the air is injected into the component and is ejected into the combustion gas stream, causing a further drop in combustion gas temperature. This, in turn, lowers achievable thermal efficiency for the unit.

Larger units, such as the Westinghouse 501 G or the planned General Electric 7H, use steam in a closed loop system to provide much of the cooling. The fluid is circulated through the internal portion of the nozzle component or around the transition piece between the combustor and the nozzle and does not enter the exhaust stream. Instead it is normally sent back to a steam generator. The difference between flame temperature and firing temperature into the first stage is minimized and higher efficiency is attained.

Another important result of steam cooling is that a higher firing temperature can be attained with no increase in flame temperature. Flame temperatures and NO_x emissions can therefore be maintained at comparatively low levels even at high firing temperatures. At the same time, thermal efficiency should be greater when employing steam cooling. A similar analysis applies to steam cooling around the transition piece between the combustor and first stage nozzle.

The relationship between flame temperature, firing temperature, unit efficiency, and NO_x formation can be appreciated from Figure 5 which is from a General Electric discussion on these principles. In addition to employing pre-mixing and steam cooling, further reductions are accomplished through design optimization of the burners, testing, further evaluation, etc.

At the present time, emissions achieved by combustion controls are as low as 9 ppmvd from gas turbines smaller than 200 MW (simple cycle), such as GE "F Class" units. Even lower NO_x emissions are achieved from certain units smaller than 100 MW, such as the GE 7EA line.

Selective Catalytic Combustion

Selective catalytic reduction (SCR) is an add-on NO_x control technology that is employed in the exhaust stream following the gas turbine. SCR reduces NO_x emissions by injecting ammonia into the flue gas in the presence of a catalyst. Ammonia reacts with NO_x in the presence of a catalyst and excess oxygen yielding molecular nitrogen and water. The catalysts used in combined cycle, low temperature applications (conventional SCR), are usually vanadium or titanium oxide and account for almost all installations. For high temperature applications (Hot SCR up to 1125 °F), such as simple cycle turbines, zeolite catalysts are available but used in few applications to-date. SCR units are typically used in combination with wet injection or DLN combustion controls.

In the past, sulfur was found to poison the catalyst material. Sulfur-resistant catalyst materials are now becoming more available. Catalyst formulation improvements have proven effective in resisting sulfur-induced performance degradation with fuel oil in Europe and Japan, where conventional SCR catalyst life in excess of 4 to 6 years has been achieved, while 8 to 10 years catalyst life has been reported with natural gas.

Excessive ammonia use tends to increase emissions of CO, ammonia (slip) and particulate matter (when sulfur-bearing fuels are used).

As of early 1992, over 100 gas turbine installations already used SCR in the United States. Per the above table, only one combustion turbine project in Florida (FPC Hines Power Block 1) employs SCR. The equipment was installed on a temporary basis because Westinghouse had not yet demonstrated emissions as low as 12 ppmvd by DLN technology at the time the units were to start up in 1998. SCR is also proposed on a permanent basis for the expansion of the FPC Hines Facility (Power Block II). Seminole Electric will install SCR on a previously-permitted 501F unit at the Hardee Unit 3 project. The reasons are similar to those for the FPC Hines Power Block I.

Permit limits as low as 2.25 to 3.5 ppmvd NO_x have been specified using SCR on combined cycle F Class projects throughout the country.

Selective Non-Catalytic Combustion

Selective non-catalytic reduction (SNCR) reduction works on the same principle as SCR. The differences are that it is applicable to hotter streams than conventional or hot SCR, no catalyst is required, and urea can be used as a source of ammonia. No applications have been identified wherein SNCR was applied to a gas turbine because the exhaust temperature of 1100 °F is too low to support the NO_x removal mechanism.

The Department did, however, specify SNCR as one of the available options for the combined cycle Santa Rosa Energy Center. The project will incorporate a large 600 MMBtu/hr duct burner in the heat recovery steam generator (HRSG) and can provide the acceptable temperatures (between 1400 and 2000 °F) and residence times to support the reactions.

Emerging Technologies: SCONOX™ and XONON™

There are at last two technologies on the horizon that will influence BACT determinations. These, as usual, are prompted by the needs specific to non-attainment areas such as Southern California.

The first technology is called $SCONO_x$™ and is a catalytic technology that achieves NO_x control by oxidizing and then absorbing the pollutant onto a honeycomb structure coated with potassium carbonate. The pollutant is then released as harmless molecular nitrogen during a regeneration cycle that requires a dilute hydrogen reducing gas. The technology has been demonstrated on small units in California and has been purchased for a small source in Massachusetts.[1] California regulators and industry sources have stated that the first 250 MW block to install SCONOx ™ will be at U.S. Generating's La Paloma Plant near Bakersfield.[2] The overall project includes several more 250 MW blocks with SCR for control.[3] USEPA has identified an "achieved in practice" BACT value of 2.0 ppmvd over a three-hour rolling average based upon the recent performance of a Vernon, California natural gas-fired 32 MW combined cycle turbine (without duct burners) equipped with the patented SCONOx™ system

SCONOx™ technology (at 2.0 ppmvd) is considered to represent LAER in non-attainment areas where cost is not a factor in setting an emission limit. It competes with less-expensive SCR in those areas, but has the advantages that it does not cause ammonia emissions in exchange for NO_x reduction. Advantages of the SCONOx ™ process include in addition to the reduction of NO_x, the elimination of ammonia and the control of some CO emissions. SCONOx™ has not been applied on any major sources in ozone attainment areas.

In a letter dated March 23, 1998 to Goal Line Environmental Technologies, the SCONOx™ process was deemed as technically feasible for maintaining NO_x emissions at 2 ppmvd on a combined cycle unit. ABB Environmental was announced on September 10, 1998 as the exclusive licensee for SCONOx™ for United States turbine applications larger than 100 MW. ABB Power Generation has stated that scale up and engineering work will be required before SCONOx™ can be offered with commercial guarantees for large turbines (based upon letter from Kreminski/Broemmelsiek of ABB Power Generation to the Massachusetts Department of Environmental Protection dated November 4, 1998). SCONOx requires a much lower temperature regime that is not available in simple cycle units and is therefore not feasible for this project. Therefore the SCONOx system cannot be considered as achievable or demonstrated in practice for this application.

The second technology is XONON™, which works by partially burning fuel in a low temperature pre-combustor and completing the combustion in a catalytic combustor. The overall result is low temperature partial combustion (and thus lower NO_x combustion) followed by flameless catalytic combustion to further attenuate NO_x formation. The technology has been demonstrated on combustors on the same order of size as $SCONO_x$ ™ has. However GE has teamed with Catalytica to develop a combustor for gas turbines in the 80-90 MW range before continuing with development on a combustor for a larger unit. XONON™ avoids the emissions of ammonia and the need to generate hydrogen. It is also extremely attractive from a mechanical point of view.

Catalytica Combustion Systems, Inc. develops, manufactures and markets the XONON™ Combustion System. In a press release on October 8, 1998 Catalytica announced the first installation of a gas turbine equipped with the XONON™ Combustion System in a municipally owned utility for the production of electricity. The turbine was started up on that day at the Gianera Generating Station of Silicon Valley Power, a municipally owned utility serving the City of Santa Clara, Calif. The XONON™ Combustion System, deployed for the first time in a commercial setting, is designed to enable turbines to produce environmentally sound power without the need for expensive cleanup solutions. Previously, this XONON™ system had successfully completed over 1,200 hours of extensive full-scale tests which documented its ability to limit emissions of nitrogen oxides, a primary air pollutant, to less than 3 parts per million.

Catalytica's XONON™ system is represented as a powerful technology that essentially eliminates the formation of nitrogen oxides air emissions in gas turbines without impacting the turbine's operating performance. In a definitive agreement signed on November 19, 1998, GE Power Systems and Catalytica agreed to cooperate in the design, application, and commercialization of XONON™ systems for both new and installed GE E-class and F-class turbines used in power generation and mechanical drive applications. This appears to be an up-and-coming technology, the development of which will be watched closely by the Department for future applications. It is not yet available for fuel oil and cycling operation.

REVIEW OF SULFUR DIOXIDE (SO_2) AND SULFURIC ACID MIST (SAM)

SO_2 control processes can be classified into five categories: fuel/material sulfur content limitation, absorption by a solution, adsorption on a solid bed, direct conversion to sulfur, or direct conversion to sulfuric acid. A review of the BACT determinations for combustion turbines

contained in the BACT Clearinghouse shows that the exclusive use of low sulfur fuels constitutes the top control option for SO_2.

For this project, the applicant has proposed as BACT the use of 0.05% sulfur oil for up to 800 hours per CT as well as pipeline natural gas. The applicant estimated total emissions for the project at 124 TPY of SO_2 and 15 TPY of SAM. The Department expects the emissions to be lower because of the limited oil consumption and the typical natural gas in Florida that contains less than 1 grain of sulfur per 100 standard cubic feet (gr S/100ft^3). This value is well below the "default" maximum value of 20 gr. S/100 ft^3, but high enough to require a BACT determination.

REVIEW OF PARTICULATE MATTER (PM/PM_{10}) CONTROL TECHNOLOGIES:

Particulate matter is generated by various physical and chemical processes during combustion and will be affected by the design and operation of the NO_X controls. The particulate matter emitted from this unit will mainly be less than 10 microns in diameter (PM_{10}).

Natural gas and 0.05 percent sulfur No. 2 (or superior grade) distillate fuel oil will be the only fuels fired and are efficiently combusted in gas turbines. Such fuels are necessary to avoid damaging turbine blades and other components already exposed to very high temperature and pressure. Natural gas is an inherently clean fuel and contains no ash. The fuel oil to be combusted contains a minimal amount of ash and its use is proposed for only 800 hours per year making any conceivable add-on control technique for PM/PM_{10} either unnecessary or impractical.

A technology review indicated that the top control option for PM/PM_{10} is a combination of good combustion practices, fuel quality, and filtration of inlet air. Total annual emissions of PM_{10} for the project are expected to be approximately 75 tons per year.

REVIEW OF CARBON MONOXIDE (CO) CONTROL TECHNOLOGIES

CO is emitted from combustion turbines due to incomplete fuel combustion. Combustion design and catalytic oxidation are the control alternatives that are viable for the project. The most stringent control technology for CO emissions is the use of an oxidation catalyst.

All combustion turbines using catalytic oxidation appear to be combined cycle units. Among the most recently permitted ones are the 500 MW Wyandotte Energy project in Michigan, the El Dorado project in Nevada, Ironwood in Pennsylvania, Millenium in Massachusetts, and Sutter Calpine in California. The permitted CO values of these units are between 3 and 5 ppm. Catalytic oxidation was recently installed at a cogeneration plant at Reedy Creek (Walt Disney World), Florida to avoid PSD review which would have been required due to increased operation at low load. Seminole Electric recently proposed catalytic oxidation in order to meet the permitted CO limit at its planned 244 MW Westinghouse 501FD combined cycle unit in Hardee County, Florida.[4]

Most combustion turbines incorporate good combustion to minimize emissions of CO. So far this appears to be the only technology proposed at simple cycle turbine projects. These installations typically achieve emissions between 10 and 25 ppm at full load while firing gas. The values of 15 and 20 ppm for gas and oil respectively at baseload proposed in JEA's original application are within the range of recent determinations for simple cycle CO BACT determinations. By comparison, values of 12 and 20 ppm for gas and oil respectively (at baseload) were proposed for

the Oleander's project using identical equipment. Values given in GE-based applications are representative of operations between 50 and 100 percent of full load.

REVIEW OF VOLATILE ORGANIC COMPOUND (VOC) CONTROL TECHNOLOGIES

Volatile organic compound (VOC) emissions, like CO emissions, are formed due to incomplete combustion of fuel. There are no viable add-on control techniques as the combustion turbine itself is very efficient at destroying VOC. The applicant has proposed good combustion practices to control VOC. The limits proposed by JEA for this project are 1.4 ppm for both gas and oil firing at baseload. According to GE, however, VOC emissions less than 1.4 ppm were achieved during recent tests of the DLN-2.6 technology when firing natural gas.[5] By comparison, limits of 3 and 6 ppm were proposed for gas and oil firing respectively in the Oleander application. The limits proposed by JEA are sufficiently low to exempt the Brandy Branch project from BACT for VOC.

BACKGROUND ON PROPOSED GAS TURBINE

JEA plans the purchase of three 170 MW (nominal) General Electric PG 7241FA simple cycle gas turbines. This is the most recent designation of GE's line of "F" Class units.

The first commercial GE 7F Class unit was installed in a combined cycle project at the Virginia Power Chesterfield Station in 1990.[6] The initial units had a firing temperature of 2300 °F and a combined cycle efficiency exceeding 50 percent. By the mid-90s, the line was improved by higher combustor pressure, a firing temperature of 2400 °F, and a combined cycle efficiency of approximately 56 percent based on a 167 MW combustion turbine. The line was redesignated as the 7FA Class.

The first GE 7F/FA project in Florida was at the FPL Martin Plant in 1993 and entered commercial service in 1994.[7] The units were equipped with DLN-2 combustors with a permitted NO_X limit of 25 ppmvd. These actually achieved emissions of 13-25 ppmvd of NO_X, 0-3 ppm of CO, and 0-0.17 ppm of VOC.[8] The City of Tallahassee recently received approval to install a GE 7FA Class unit at its Purdom Plant.[9] Although permitted emissions are 12 ppmvd of NO_X, the City obtained a performance guarantee from GE of 9 ppmvd.[10] FPL also obtained a guarantee and permit limit of 9 ppmvd NO_X for six GE 7241FA turbines to be installed at the Fort Myers Repowering project.[11] The Santa Rosa Energy Center in Pace, Florida, also received a permit with a 9 ppmvd NO_X limit for a GE 7241 turbine with DLN-2.6 burners.[12]

Most recently, the Department issued draft BACT determinations for the simple cycle Oleander project in Brevard County and the combined cycle projects in Volusia (Duke Energy) and Osceola County (Kissimmee Utilities). These three draft permits also include NO_X limits of 9 ppmvd based on the DLN-2.6 technology installed on F Class units.

General Electric has primarily relied on further advancement and refinement of DLN technology to provide sufficient NO_X control for their combined cycle turbines in Florida. Where required by BACT determinations of certain states, General Electric incorporates SCR in combined cycle projects.[13] In its recent permits, Florida has included separate and lower limits in the event that DLN emissions limits are not attainable or the applicant selects a manufacturer that does not provide combustors capable of meeting 9 ppmvd.

GE's approach of progressively refining such technology is a proven one, even on some relatively large units. Recently GE Frame 7FA units met performance guarantees of 9 ppmvd with "DLN-2.6" burners at Fort St. Vrain, Colorado and Clark County, Washington.[14] Although the permitted limit is 15 ppmvd, GE has already achieved emission levels of approximately 6-7 ppmvd on gas at a dual-fuel 7EA (120 MW combined cycle) KUA Cane Island Unit 2.[15] Unit 2 is equipped with DLN-2 combustors. According to GE, similar performance is expected soon on the 7FA line such as the one that will be installed for the JEA Brandy Branch Project. Performance guarantees less than 9 ppmvd can be expected for DLN-2.6 combustors on units delivered in a couple of years.[16]

The 12 ppmvd NO_X limit on natural gas proposed by JEA is a fairly stringent BACT determination for simple cycle F Class, though it is becoming less so. The company has obtained a guarantee from GE to achieve 9 ppmvd, which is for a performance test on a "new and clean unit." The test must be conducted at a steady-state load of 50 to 100 percent and completed within the first 100 fired hours of operation as specified in the GE protocols.

With the frequent start-ups and shutdowns of the unit, JEA is concerned about the ability to maintain the low (9 ppmvd) NO_X values for long periods of time following the performance tests. Presumably, this concern would be lessened should these units be converted to a more continuous duty (i.e combined cycle). Although the Department is not fully aware of the details of the GE guarantee for Oleander (proposed 9 ppmvd on a simple cycle unit), the Department is aware from discussions with other applicants that a continuing guarantee is available at a substantial cost.[17]

The GE Speedtronic™ Mark V Gas Control System will be used. This control system is designed to fulfill all gas turbine control requirements. These include control of liquid, gas, or both fuels in accordance with the requirements of the speed, load control under part-load conditions, temperature control under maximum capability conditions, or during start-up conditions. Since emissions are controlled utilizing dry low NO_X techniques, fuel staging and combustion mode are also controlled by the Mark V, which also monitors the process. Sequencing of the auxiliaries to allow fully automated start-up, shutdown and cool-down are also handled by the Mark V.[18]

DEPARTMENT BACT DETERMINATION

Following are the BACT limits determined for the JEA project assuming full load. Values for NO_X are corrected to 15% O_2 on a dry volume basis. The emission limits or their equivalents in terms of pounds per hour and NSPS units, as well as the applicable averaging times, are given in the permit Specific Conditions No. 20 through 25.

POLLUTANT	CONTROL TECHNOLOGY	PROPOSED BACT LIMIT
PM/PM_{10}	Pipeline Natural Gas Good Combustion	10 Percent Opacity 9 lb/hr – Gas 17 lb/hr – Fuel Oil
CO	As Above	12* ppm – Gas 20 ppm – Fuel Oil
SO_2/SAM	As Above	2 grains of sulfur per 100 ft^3 gas 0.05 percent sulfur in fuel oil
NO_X	Dry Low NO_X, WI for F.O., limited oil use	10.5 ppmvd – Gas 42* ppmvd – F.O. for 750 of 4750hours

* See discussion below.

RATIONALE FOR DEPARTMENT'S DETERMINATION

- JEA has agreed to shutdown its Southside facility, also located in Duval County. This will result in a net decrease of regulated pollutants which are emitted.
- General Electric has provided a "clean and new" one-time guarantee of 9 ppmvd NO_X.
- Typical "continuous" permit limits nation-wide for these GE 7FA units while operating on natural gas and in simple cycle mode and intermittent duty are 12-15 ppmvd even though GE provides the same "new and clean" guarantees for them. Limits as high as 25 ppmvd have been recently proposed by some for similar units produced by other manufacturers.
- A level of 9 ppmvd NO_X by DLN has been demonstrated on GE 7FA combustion turbines at Fort St. Vrain, Colorado and Clark County, Washington. However the permitted limits are actually higher at these two facilities providing some level of operating margin.
- A limit of 9 ppmvd was proposed by Oleander for five GE7 FA units and is reflected in the Department's recent Draft BACT Determination for that facility. A BACT level of 9 ppmvd has been proposed by Virginia Power for a GE 7FA unit to avoid non-attainment New Source Review.
- The proposed 9 ppmvd limit at Oleander and Virginia Power while firing natural gas is the lowest known Draft BACT value for an "F" frame combustion turbine operating in simple cycle mode and intermittent duty. The 42 ppmvd limit while firing fuel oil is typical.
- The Department prepared a Draft permit for the TEC Polk Power Station Project adopting TEC's proposed 10.5 ppmvd limit for two GE 7FA units, but limited the hours of operation on fuel to less than the hours allowed at Oleander. The TEC Draft BACT is being issued concurrently with the Draft BACT for the JEA project.
- JEA's proposed 12 ppmvd limit for the Brandy Branch Facility while firing natural gas is relatively low for a GE 7FA Class simple cycle, intermittent duty unit.
- The Department however, proposes a BACT limit of 10.5 ppmvd, which is the same as proposed for the TEC project. The Department also proposes to limit oil firing to the same number of hours as TEC (750) and less than the number of hours at Oleander (1000). Considering the applicant's shutdown of its Southside facility in conjunction with the Department's BACT limits, net annual NO_X emissions (TPY) will be approximately zero.
- The Department will still require JEA to meet to meet the "clean and new" limit of 9 ppmvd during initial testing as well as requiring a continuous 9 ppmvd guarantee (or better) in the event that JEA converts the units to continuous duty (i.e. combined cycle).
- The proposed BACT limit of 10.5 ppmvd is about one-tenth of the applicable NSPS limit per 40 CFR 60, Subpart GG for units as efficient as the 7FA.
- The units will be operated in simple cycle mode. Therefore control options, which are feasible for combined cycle units, are not applicable. This rules out Low Temperature (conventional) SCR, which achieves 4.5 ppmvd NO_X or lower. It also rules out the possibility of SCONOx. XONON is not available for F Class dual fuel projects.
- The simple cycle "F Class" turbines have very high exhaust temperatures of up to 1200 °F. Without additional cooling, this is at the higher limit of the present operational temperature of

- Hot SCR zeolite catalyst (around 1125 °F). The PREPA simple cycle turbines, which use Hot SCR, have exhaust temperatures ranging from 824 to 1024°F and burn exclusively #2 oil.

- The levelized costs of NO_X removal by Hot SCR for the JEA project were estimated by Black & Veatch at $13,380 per ton assuming 4000 hours of operation on natural gas and a reduction from 12 to 5 ppmvd. The Department estimates that this figure is reduced by including oil operation (up to 750 hours per year) and other criteria, but still exceeds $7,000 per ton.

- TEC estimated the cost of Hot SCR at $9,717 per ton of NO_X removed assuming 4,380 and 876 hours per year of operation on gas and oil respectively.

- The Department previously concluded that Hot SCR is cost-effective for continuous duty simple cycle service (Lakeland). EPA also concluded Hot SCR is cost-effective on continuous duty simple cycle projects (PREPA).

- Although the Department does not have a "bright line" cost-effectiveness figure and does not necessarily adopt the precise cost calculations for the JEA and TEC projects, the values projected by JEA and TEC indicate that Hot SCR is not cost-effective for their respective projects.

- Comments from the National Park Service on the Oleander project suggested that a reduction in the applicant's proposed NO_X emissions on oil from 42 ppmvd to 25 ppmvd is possible based on reported oil-fired units listed in the BACT Clearinghouse. GE has advised that it only offers a 42 ppmvd NO_X guarantee on F Class units when firing oil.

- The Department is aware that ABB offers a DLN technology for fuel oil firing applicable to at least certain smaller combustion turbines (ABB-GTX). It is noted, however that ABB does not offer a guarantee of 9 ppmvd on the same unit when firing natural gas.

- It is possible that the NO_X emissions while firing oil from may be reduced from 42*ppmvd by increasing the water injection rate. In order to address this possibility, a specific condition will be added to conduct appropriate testing and prepare an engineering report. The report will be submitted for the Department's review to ensure that the lowest reliable NO_X emission rates while firing oil have been achieved.

- The Department's overall BACT determination is equivalent to approximately 0.5 lb./MW-hr NO_X emissions for combined gas and oil operation. For reference, the new NSPS promulgated on September 3, 1998 requires that new conventional power plants (based on boilers, etc.) meet a limit of 1.6 lb/MW-hr. FDEP BACT analyses typically target values less than 1.0 lb./MW-hr for simple cycle CT's and less than 0.5 lb./MW-hr for combined cycle units.

- VOC emissions of 1.4 ppm while firing gas or oil proposed by the applicant clearly reflect BACT and, in fact, exempt the project from a BACT determination for VOC. The Department will set VOC limits at 2 ppm (gas) and 3.5 ppm (oil). These values are still sufficient to maintain VOC emissions to less than 40 tons per year.

- The Department will set CO limits achievable by good combustion at full load as 12* ppm (gas) and 20 ppm (oil). These values are equal to the lowest values from permitted or proposed simple cycle units and are equal to those proposed by the Department for Oleander and TEC project. Due to the applicant's (higher) guarantee while firing gas of 15 ppm, the specific permit condition will be worded so as to allow for initial 15 ppm operation with a requirement

- to conduct appropriate testing and prepare an engineering report. The report will be submitted for the Department's review to ensure that the lowest reliable CO emission rates while firing gas have been achieved.

- Black & Veatch evaluated the use of an oxidation catalyst for the JEA project with an 88 percent control efficiency and having a three-year catalyst life. The oxidation catalyst control system was estimated to increase the capital cost of the project by $1,905,000 with an annualized cost of $509,000 per year. Levelized costs for CO catalyst control were calculated at $4,700 per ton. This figure does not appear to be cost-effective for removal of CO.

- BACT for PM_{10} was determined to be good combustion practices consisting of: inlet air filtering; use of pipeline natural gas; use of clean, low ash, low sulfur fuels for limited hours, and operation of the unit in accordance with the manufacturer-provided manuals.

- PM_{10} emissions will be very low and difficult to measure. Additionally, the higher emission mode will involve fuel oil firing which will occur only approximately 750 hours per year. It is not practical to require running the turbine on oil, simply to conduct tests. Therefore, the Department will set a Visible Emission standard of 10 percent opacity as BACT for both natural gas and fuel oil firing, consistent with the definition of BACT. Examples of installations with similar VE limits include the City of Lakeland, the City of Tallahassee, Santa Rosa Energy Center, FPL Fort Myers, and the Southern Company Barry projects.

Compliance Procedures

POLLUTANT	COMPLIANCE PROCEDURE
Particulate Matter	Method 9
Carbon Monoxide	Annual Method 10 (can use RATA if at capacity)
NO_X (performance)	Annual Method 20 (can use RATA if at capacity)
NO_X (24-hr block average)	NO_X CEMS, O_2 or CO_2 diluent monitor, and flow device as needed
SO_2 and SAM	Custom Fuel Monitoring Schedule

DETAILS OF THE ANALYSIS MAY BE OBTAINED BY CONTACTING:

Michael P. Halpin, P.E., Review Engineer, New Source Review Section MPHalpin PE
A. A. Linero, P.E. Administrator, New Source Review Section AALinero PE
Department of Environmental Protection / Bureau of Air Regulation
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Recommended By:

C. H. Fancy, P.E., Chief
Bureau of Air Regulation

10/13/99
Date:

Approved By:

for Howard L. Rhodes, Director
Division of Air Resources Management

10/13/99
Date:

REFERENCES

[1] News Release. Goaline Environmental. Genetics Institute Buys SCONOx Clean Air System. August 20, 1999.

[2] "Control Maker Strives to Sway Utility Skeptics." Air Daily. Volume 5, No. 199. October 14, 1998.

[3] Telecom. Linero, A.A., FDEP, and Beckham, D., U.S. Generating. Circa November 1998.

[4] Letter from Opalinski, M.P., SECI to Linero, A.A., FDEP. Turbines and Related Equipment at Hardee unit 3. December 9, 1998.

[5] Telecon. Vandervort, C., GE, and Linero, A.A., DEP. "VOC Emissions from FA Gas Turbines with DLN-2.6 Combustors."

[6] Brochure. General Electric. "GE Gas Turbines - MS7001FA." Circa 1993.

[7] Davis, L.B., GE. "Dry Low NO_X Combustion Systems for GE Heavy Duty Gas Turbines." 1994.

[8] Report. Florida Power & Light. "Final Dry Low NO_X Verification Testing at Martin Combine Cycle Plant." August 7, 1995.

[9] Florida DEP. PSD Permit, City of Tallahassee Purdom Unit 8. May, 1998.

[10] City of Tallahassee. PSD/Site Certification Application. April, 1997.

[11] Florida DEP. Intent to Issue Permit. FPL Fort Myers Repowering Project. September, 1998.

[12] Florida DEP. Final Permit. Santa Rosa Energy Center. December, 1998.

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[14] Telecon. Schorr, M., GE, and Costello, M., Florida DEP. March 31, 1998. Status of DLN-2.6 Program

[15] Florida DEP. Bureau of Air Regulation Monthly Report. June, 1998.

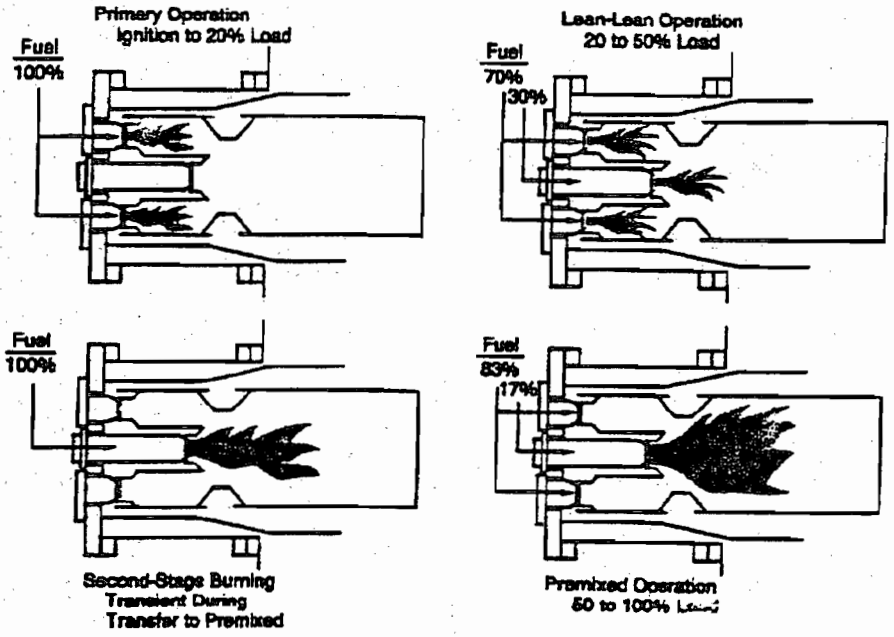
[16] Telecon. Schorr, M., GE, and Linero, A.A., Florida DEP. August, 1998. Cost effectiveness of DLN versus SCR.

[17] Telecon. Gianazza, N.B., JEA, and Linero, A.A., Florida DEP. Proposed NO_X limits at Brandy Branch Project.

[18] Rowen, W.I. "General Electric Speedtronic™ Mark V Gas Turbine Control System. 1994."

IMAGE QUALITY

AS YOU REVIEW THE NEXT FEW PAGES, PLEASE NOTE THAT THE ORIGINAL DOCUMENT WAS OF POOR QUALITY.



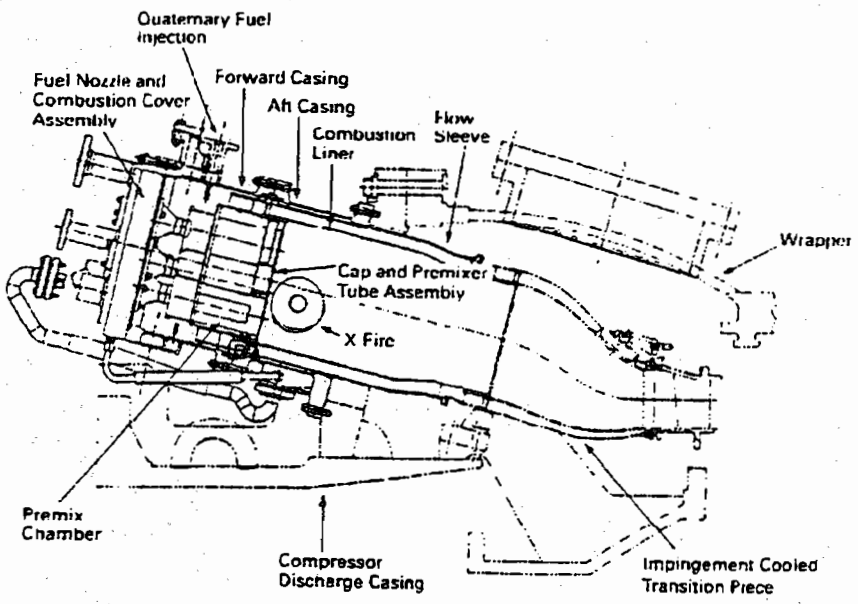


Figure 1 - Dry Low NOx Operating Modes - DLN-1

Cross Section of GE DLN-2

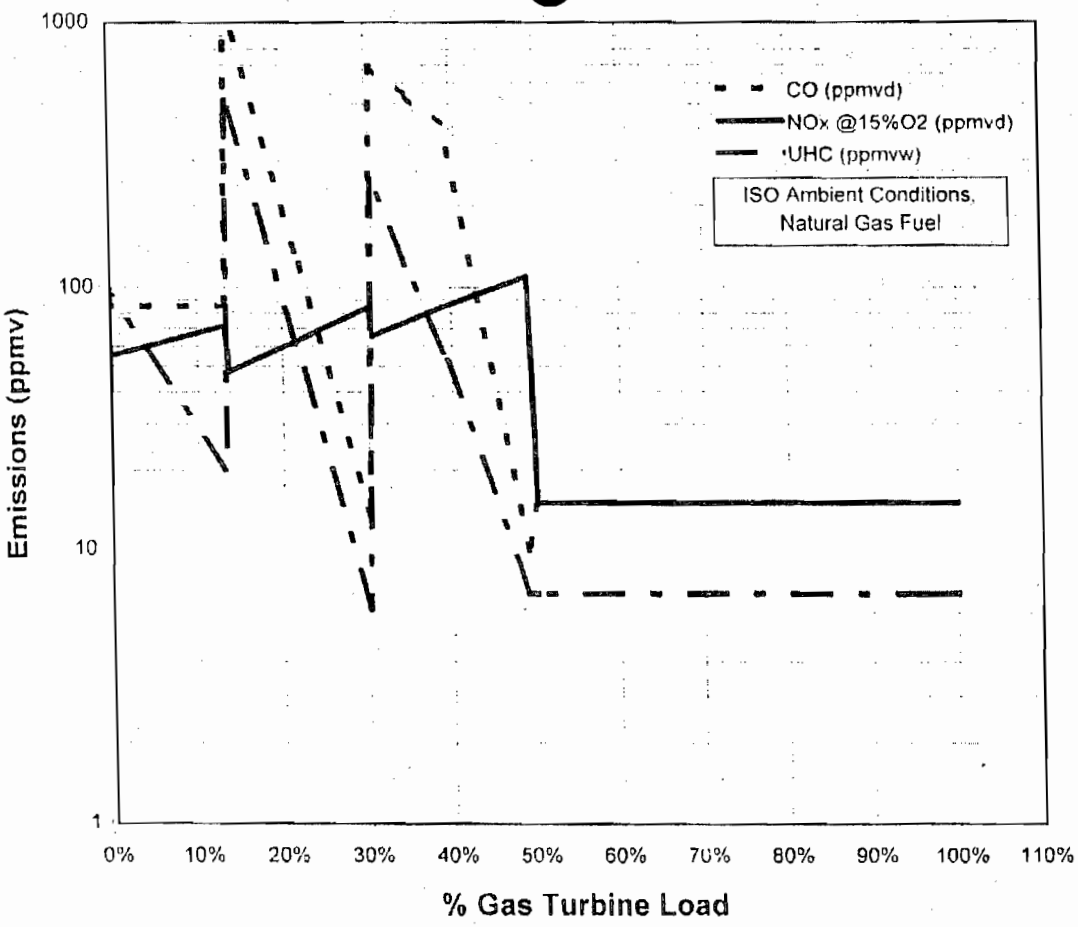


Figure 2 – Emissions Performance Curves for GE DLN-2.6 Combustor Firing Natural Gas in a Dual Fuel GE 7FA Combustion Turbine

(Simple Cycle Intermittent Duty – If Tuned to 15 ppmvd NO_X)

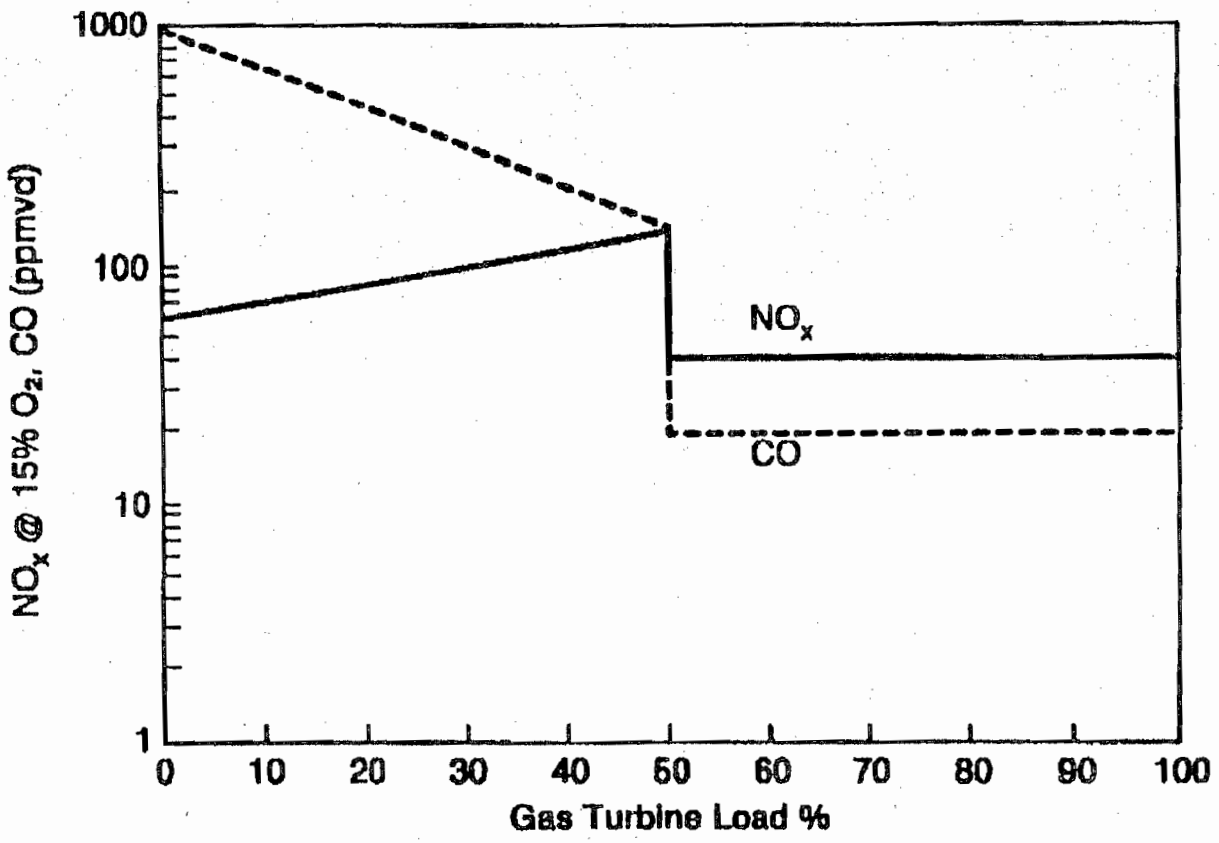


Figure 3 – Emissions Performance for DLN-2 Combustors Firing Fuel Oil in Dual Fuel GE 7FA Turbine

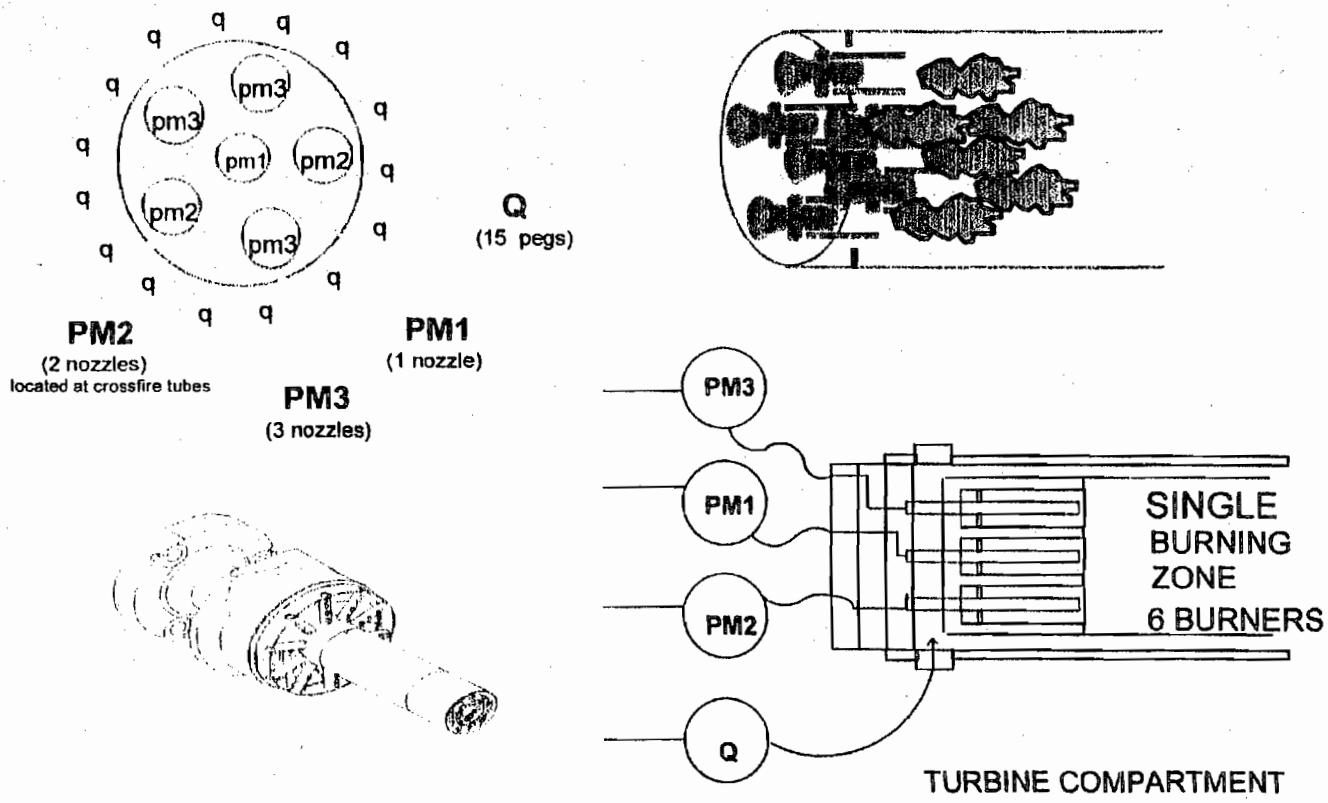


Figure 4 - DLN-2.6 Nozzle and Burner Arrangement

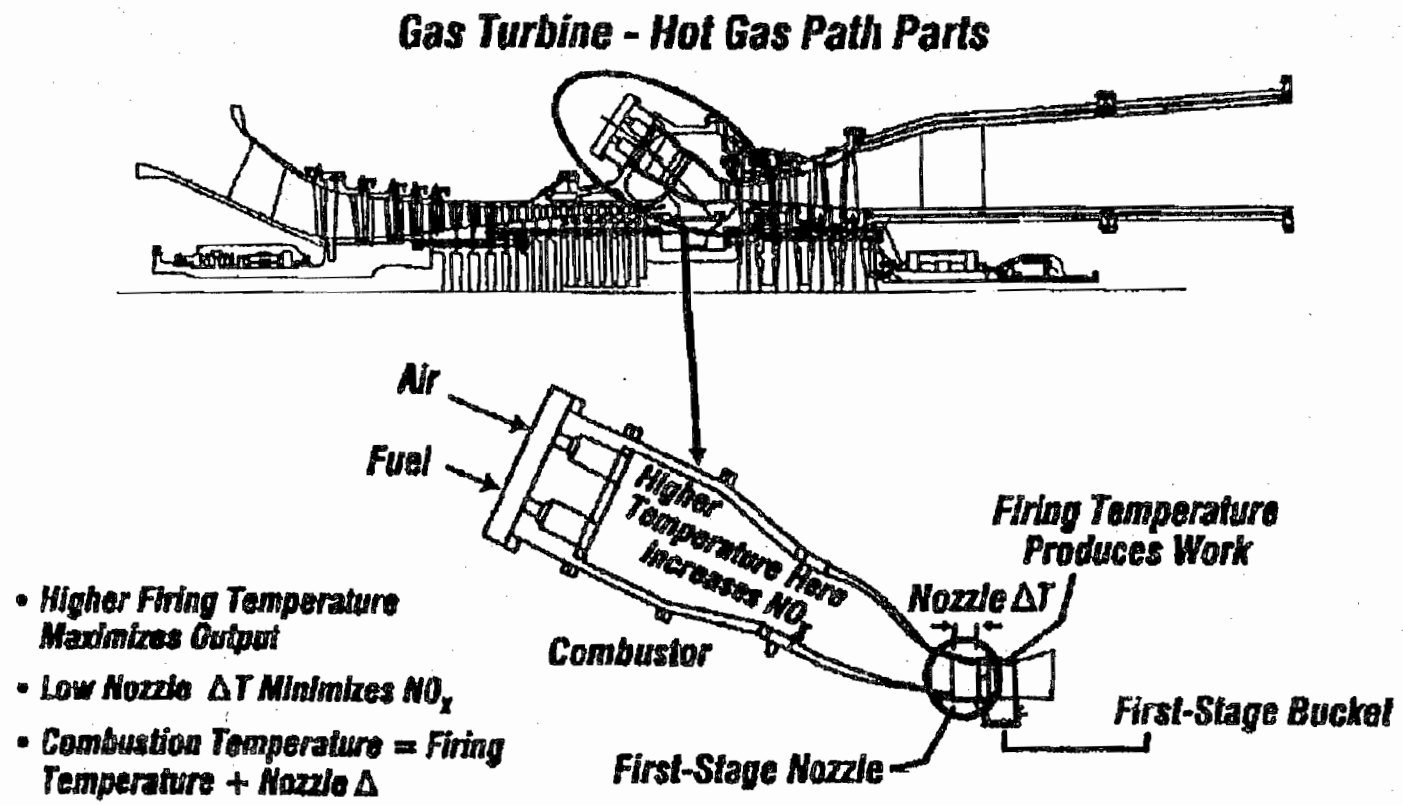


Figure 5 - Relation Between Flame Temperature and Firing Temperature

G.1 The terms, conditions, requirements, limitations, and restrictions set forth in this permit are "Permit Conditions" and are binding and enforceable pursuant to Sections 403.161, 403.727, or 403.859 through 403.861, Florida Statutes. The permittee is placed on notice that the Department will review this permit periodically and may initiate enforcement action for any violation of these conditions.

G.2 This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviation from the approved drawings or exhibits, specifications, or conditions of this permit may constitute grounds for revocation and enforcement action by the Department.

G.3 As provided in Subsections 403.087(6) and 403.722(5), Florida Statutes, the issuance of this permit does not convey any vested rights or any exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations. This permit is not a waiver or approval of any other Department permit that may be required for other aspects of the total project which are not addressed in the permit.

G.4 This permit conveys no title to land or water, does not constitute State recognition or acknowledgment of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the State. Only the Trustees of the Internal Improvement Trust Fund may express State opinion as to title.

G.5 This permit does not relieve the permittee from liability for harm or injury to human health or welfare, animal, or plant life, or property caused by the construction or operation of this permitted source, or from penalties therefore; nor does it allow the permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department.

G.6 The permittee shall properly operate and maintain the facility and systems of treatment and control (and related appurtenances) that are installed or used by the permittee to achieve compliance with the conditions of this permit, as required by Department rules. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to achieve compliance with the conditions of the permit and when required by Department rules.

G.7 The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, upon presentation of credentials or other documents as may be required by law and at a reasonable time, access to the premises, where the permitted activity is located or conducted to:

a) Have access to and copy and records that must be kept under the conditions of the permit;
b) Inspect the facility, equipment, practices, or operations regulated or required under this permit, and,
c) Sample or monitor any substances or parameters at any location reasonably necessary to assure compliance with this permit or Department rules.

Reasonable time may depend on the nature of the concern being investigated.

G.8 If, for any reason, the permittee does not comply with or will be unable to comply with any condition or limitation specified in this permit, the permittee shall immediately provide the Department with the following information:

a) A description of and cause of non-compliance; and
b) The period of noncompliance, including dates and times; or, if not corrected, the anticipated time the non-compliance is expected to continue, and steps being taken to reduce, eliminate, and prevent recurrence of the non-compliance.

The permittee shall be responsible for any and all damages which may result and may be subject to enforcement action by the Department for penalties or for revocation of this permit.

G.9 In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data and other information relating to the construction or operation of this permitted source which are submitted to the Department may be used by the Department as evidence in any enforcement case involving the permitted source arising under the Florida Statutes or Department rules, except where such use is prescribed by Sections 403.73 and 403.111, Florida Statutes. Such evidence shall only be used to the extent it is consistent with the Florida Rules of Civil Procedure and appropriate evidentiary rules.

G.10 The permittee agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance, provided, however, the permittee does not waive any other rights granted by Florida Statutes or Department rules.

G.11 This permit is transferable only upon Department approval in accordance with Florida Administrative Code Rules 62-4.120 and 62-730.300, F.A.C., as applicable. The permittee shall be liable for any non-compliance of the permitted activity until the transfer is approved by the Department.

G.12 This permit or a copy thereof shall be kept at the work site of the permitted activity.

G.13 This permit also constitutes:

a) Determination of Best Available Control Technology ( )
b) Determination of Prevention of Significant Deterioration ( ); and
c) Compliance with New Source Performance Standards (X).

G.14 The permittee shall comply with the following:

a) Upon request, the permittee shall furnish all records and plans required under Department rules. During enforcement actions, the retention period for all records will be extended automatically unless otherwise stipulated by the Department.

b) The permittee shall hold at the facility or other location designated by this permit records of all monitoring information (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation) required by the permit, copies of all reports required by this permit, and records of all data used to complete the application or this permit. These materials shall be retained at least three years from the date of the sample, measurement, report, or application unless otherwise specified by Department rule.

c) Records of monitoring information shall include:

1. The date, exact place, and time of sampling or measurements;
2. The person responsible for performing the sampling or measurements;
3. The dates analyses were performed;
4. The person responsible for performing the analyses;
5. The analytical techniques or methods used; and
6. The results of such analyses.

G.15 When requested by the Department, the permittee shall within a reasonable time furnish any information required by law which is needed to determine compliance with the permit. If the permittee becomes aware that relevant facts were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be corrected promptly.

Environmental Resource Permits

Department of Environmental Protection

Jeb Bush
Governor

Northeast District
7825 Baymeadows Way, Suite B200
Jacksonville, Florida 32256-7590

David B. Struhs
Secretary

ENVIRONMENTAL RESOURCE PERMIT

Permit Number: 16-156348-001-EI
Date of Issue: August 19, 1999
Expiration Date of Construction Phase: August 19, 2004
County: Duval
Project: construct access road

PERMITTEE/AUTHORIZED ENTITY:
JEA - Brandy Branch Access Road
c/o J. M. Connolly
21 W. Church Street
Jacksonville, FL 32202

AGENT:
Black & Vetch Corporation
c/o Mike Soltys
11401 Lamar
Overland Park, KS 66211

This permit is issued under the authority of Part IV of Chapter 373, F.S., and Title 62, Florida Administrative Code (F.A.C.). The activity is not exempt from the requirement to obtain an environmental resource permit. Pursuant to Operating Agreements executed between the Department and the water management districts, as referenced in Chapter 62-113, F.A.C., the Department is responsible for reviewing and taking final agency action on this activity.

ACTIVITY DESCRIPTION:

Construct an access road as Phase I for the construction of a 500-megawatt Generating Station near the Town of Baldwin, Duval County. The road is to extend from US 90 a distance of approximately 4,324 linear feet to the power plant site. The road is to have a 30 foot top width with side slopes of 3:1 and is to have a pervious gravel surface. The road is to be constructed within an existing cleared and regularly mowed power line corridor. The road is to cross approximately 1.4 acres of low quality, isolated herbaceous wetlands within the cleared power line corridor. The permittee is to mitigate for the elimination of the low quality wetlands in Phase II by creating 1.4 acres of herbaceous wetlands as part of a 4.4 acre forested creation area and fencing the 150 acre power plant site to eliminate existing cattle grazing and access within existing wetlands on the site.

The road is to have 2,679 square feet of impervious surface with the remaining portion to be a pervious gravel surface. Pursuant to rule 40C-42.022(1)(a), F.A.C., the 2,679 square feet of impervious surface is exempt from the need to provide a stormwater treatment system since it is less than 4,000 square feet of impervious area.

The access road is **not** located on sovereignty submerged lands owned by the state and therefore does not require state proprietary authorization.

ACTIVITY LOCATION:

The activity is located within isolated wetlands, Class III Waters, Sections 13 & 18, Township 02 South, Range 23 & 24 East, not within a Shellfish Harvesting Area, not within an Outstanding Florida Waters.

This permit also constitutes a finding of consistency with Florida's Coastal Zone Management Program, as required by Section 307 of the Coastal Management Act.

This permit also constitutes certification compliance with water quality standards under Section 401 of the Clean Water Act, 33 U.S.C. 1341.

SPGP - REVIEW:

Your project has been reviewed for compliance with a State Programmatic General Permit (SPGP). Your proposed activity as outlined on the attached drawings is **not** in compliance with the SPGP program. A copy of this authorization has been sent to the U.S. Army Corps of Engineers (USACOE) for review. The USACOE may require a separate permit. Failure to obtain this authorization prior to construction could subject you to enforcement action by that agency. You are hereby advised that authorizations also may be required by other federal, state, and local entities. This authorization does not relieve you from the requirements to obtain all other required permits and authorizations.

Authority for review; an agreement with the U.S. Army Corps of Engineers entitled Coordination Between the U.S. Army Corps of Engineers (Jacksonville, District) and the Florida Department of Environmental Protection State Programmatic General Permit, Section 10 of the Rivers and Harbor Act of 1899 and Section 404 of the Clean Water Act.

PERMITTEE:
JEA - Brandy Branch Access Road
c/o J. M. Connolly

PERMIT NUMBER: 16-156348-001-EI
DATE OF ISSUE: August 19, 1999
EXPIRATION DATE: August 19, 2004

The above named permittee is hereby authorized to construct the work shown on the application and approved drawing(s), plans, and other documents attached hereto or on file with the Department and made a part hereof. **This permit is subject to the limits, conditions, and locations of work shown in the attached drawings, and is also subject to the General Conditions and Specific Conditions, which are a binding part of this permit.** You are advised to read and understand these drawings and conditions prior to commencing the authorized activities, and to ensure the work is conducted in conformance with all the terms, conditions, and drawings. If you are utilizing a contractor, the contractor also should read and understand these drawings and conditions prior to commencing the authorized activities. Failure to comply with all drawings and conditions shall constitute grounds for revocation of the permit and appropriate enforcement action.

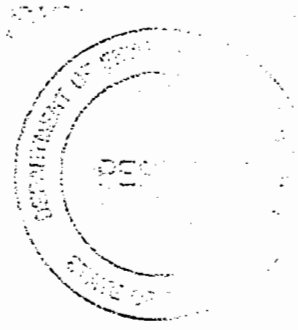
Operation of the facility is not authorized except when determined to be in conformance with all applicable rules and with the general and specific conditions of this permit/certification/ authorization, as specifically described below.

GENERAL CONDITIONS:

(a) All activities shall be implemented as set forth in the plans, specifications and performance criteria as approved by this permit. Any deviation from the permitted activity and the conditions for undertaking that activity shall constitute a violation of this permit.

(b) This permit or a copy thereof, complete with all conditions, attachments, exhibits, and modifications, shall be kept at the work site of the permitted activity. The complete permit shall be available for review at the work site upon request by Department staff. The permittee shall require the contractor to review the complete permit prior to commencement of the activity authorized by this permit.

(c) Activities approved by this permit shall be conducted in a manner which do not cause violations of state water quality standards.



(d) Prior to and during construction, the permittee shall implement and maintain all erosion and sediment control measures (best management practices) required to retain sediment on-site and to prevent violations of state water quality standards. All practices must be in accordance with the guidelines and specifications in chapter 6 of the Florida Land Development Manual: A Guide to Sound Land and Water Management (Florida Department of Environmental Regulation 1988), which are incorporated by reference, unless a project specific erosion and sediment control plan is approved as part of the permit, in which case the practices must be in accordance with the plan. If site specific conditions require additional measures during any phase of construction or operation to prevent erosion or control sediment, beyond those specified in the erosion and sediment control plan, the permittee shall implement additional best management practices as necessary, in accordance with the specifications in chapter 6 of the Florida Land Development Manual: A Guide to Sound Land and Water Management (Florida Department of Environmental Regulation 1988). The permittee shall correct any erosion or shoaling that causes adverse impacts to the water resources.

(e) Stabilization measures shall be initiated for erosion and sediment control on disturbed areas as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 7 days after the construction activity in that portion of the site has temporarily or permanently ceased.

(f) At least 48 hours prior to commencement of activity authorized by this permit, the permittee shall submit to the Department an "Environmental Resource Permit Construction Commencement" notice (Form No. 62-343.900(3), F.A.C.) indicating the actual start date and the expected completion date.

(g) When the duration of construction will exceed one year, the permittee shall submit construction status reports to the Department on an annual basis utilizing an "Annual Status Report Form" (Form No. 62-343.900(4), F.A.C.). These forms shall be submitted during June of each year.



(h) For those systems which will be operated or maintained by an entity which will require an easement or deed restriction in order to provide that entity with the authority necessary to operate or maintain the system, such easement or deed restriction, together with any other final operation or maintenance documents as are required by subsections 7.1.1 through 7.1.4 of the Applicant's Handbook: Management and Storage of Surface Waters, must be submitted to the Department for approval. Documents meeting the requirements set forth in these subsections of the Applicant's Handbook will be approved. Deed restrictions, easements and other operation and maintenance documents which require recordation either with the Secretary of State or the Clerk of the Circuit Court must be so recorded prior to lot or unit sales within the project served by the system, or upon completion of construction of the system, whichever occurs first. For those systems which are proposed to be maintained by county or municipal entities, final operation and maintenance documents must be received by the Department when maintenance and operation of the system is accepted by the local governmental entity. Failure to submit the appropriate final documents referenced in this paragraph will result in the permittee remaining liable for carrying out maintenance and operation of the permitted system.

(i) Each phase or independent portion of the permitted system must be completed in accordance with the permitted plans and permit conditions prior to the initiation of the permitted use of site infrastructure located within the area served by that portion or phase of the system. Each phase or independent portion of the system must be completed in accordance with the permitted plans and permit conditions prior to transfer of responsibility for operation and maintenance of that phase or portion of the system to a local government or other responsible entity.

(j) Within 30 days after completion of construction of the permitted system, or independent portion of the system, the permittee shall submit a written statement of completion and certification by a registered professional engineer or other appropriate individual as authorized by law, utilizing "Environmental Resource Permit As-Built Certification by a Registered Professional" (Form 62-343.900(5), F.A.C.) supplied with this permit. When the completed system differs substantially from the permitted plans, any substantial deviations shall be noted and explained and two copies of as-built drawings submitted to the Department. Submittal of the completed form shall serve to notify the Department that the system is ready for inspection. The statement of completion and certification shall be based on on-site observation of construction (conducted by the registered professional engineer, or other appropriate individual as authorized by law, or under his or her direct supervision) or review of as-built drawings for the purpose of determining if the work was completed in compliance with approved

j. (con't):
plans and specifications. As-built drawings shall be the permitted drawings revised to reflect any changes made during construction. Both the original and any revised specifications must be clearly shown. The plans must be clearly labeled as "as-built" or "record" drawing. All surveyed dimensions and elevations shall be certified by a registered surveyor. The following information, at a minimum, shall be verified on the as-built drawings:

1. Dimensions and elevations of all discharge structures including all weirs, slots, gates, pumps, pipes, and oil and grease skimmers;
2. Locations, dimensions, and elevations of all filter, exfiltration, or underdrain systems including cleanouts, pipes, connections to control structures, and points of discharge to the receiving waters;
3. Dimensions, elevations, contours, or cross-sections of all treatment storage areas sufficient to determine stage-storage relationships of the storage area and the permanent pool depth and volume below the control elevation for normally wet systems, when appropriate;
4. Dimensions, elevations, contours, final grades, or cross-sections of the system to determine flow directions and conveyance of runoff to the treatment system;
5. Dimensions, elevations, contours, final grades, or cross-sections of all conveyance systems utilized to convey off-site runoff around the system;
6. Existing water elevation(s) and the date determined; and
7. Elevation and location of benchmark(s) for the survey.

(k) The operation phase of this permit shall not become effective until the permittee has complied with the requirements of the condition in paragraphs (i and j) above, the Department determines the system to be in compliance with the permitted plans, and the entity approved by the Department in accordance with subsections 7.1.1 through 7.1.4 of the Applicant's Handbook: Management and Storage of Surface Waters, accepts responsibility for operation and maintenance of the system. The permit may not be transferred to such an approved operation and maintenance entity until the operation phase of the permit becomes effective. Following inspection and approval of the permitted system by the Department, the permittee shall request transfer of the permit to the responsible approved operation and maintenance entity, if different from the permittee. Until the permit is transferred pursuant to section 7.1 of the Applicant's Handbook: Management and Storage of Surface Waters, the permittee shall be liable for compliance with the terms of the permit.

DEPARTMENT OF ENVIRONMENTAL
PERMIT
STATE OF FL

(l) Should any other regulatory agency require changes to the permitted system, the permittee shall provide written notification to the Department of the changes prior to implementation so that a determination can be made whether a permit modification is required.

(m) This permit does not eliminate the necessity to obtain any required federal, state, local and special district authorizations prior to the start of any activity approved by this permit. This permit does not convey to the permittee or create in the permittee any property right, or any interest in real property, nor does it authorize any entrance upon or activities on property which is not owned or controlled by the permittee, or convey any rights or privileges other than those specified in the permit and chapter 40C-4 or chapter 40C-40, F.A.C.

(n) The permittee is hereby advised that section 253.77, F.S., states that a person may not commence any excavation, construction, or other activity involving the use of sovereign or other lands of the state, the title to which is vested in the Board of Trustees of the Internal Improvement Trust Fund without obtaining the required lease, license, easement, or other form of consent authorizing the proposed use. Therefore, the permittee is responsible for obtaining any necessary authorizations from the Board of Trustees prior to commencing activity on sovereignty lands or other state-owned lands.

(o) The permittee shall hold and save the Department harmless from any and all damages, claims, or liabilities which may arise by reason of the activities authorized by the permit or any use of the permitted system.

(p) Any delineation of the extent of a wetland or other surface water submitted as part of the permit application, including plans or other supporting documentation, shall not be considered specifically approved unless a specific condition of this permit or a formal determination under section 373.421(2), F.S., provides otherwise.

(q) The permittee shall notify the Department in writing within 30 days of any sale, conveyance, or other transfer of ownership or control of the permitted system or the real property at which the permitted system is located. All transfers of ownership or transfers of a permit are subject to the requirements of section 62-343.130, F.A.C. The permittee transferring the permit shall remain liable for any corrective actions that may be required as a result of any permit violations prior to such sale, conveyance or other transfer.

(r) Upon reasonable notice to the permittee, Department authorized staff with proper identification shall have permission to enter, inspect, sample and test the system to insure conformity with the plans and specifications approved by the permit.

(s) If historical or archaeological artifacts are discovered at any time on the project site, the permittee shall immediately notify the Department.

(t) The permittee shall immediately notify the Department in writing of any previously submitted information that is later discovered to be inaccurate.

SPECIFIC CONDITIONS:

1. Prior to commencement of work authorized by this permit, the permittee shall provide written notification of the date of commencement and proposed schedule of construction on Form No. 62-343.900(3), F.A.C. to the Department of Environmental Protection, Submerged Lands and Environmental Resources Program, 7825 Baymeadows Way, Suite B-200, Jacksonville, FL 32256-7590.

2. The project shall comply with applicable State Water Quality Standards, namely:
   a) Surface Waters, Minimum Criteria, General Criteria - **62-302.500**,
   b) Class III Waters - Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife. - **62-302.400**

3. All structures shall be constructed in accordance with the attached drawings.

4. Appropriate turbidity controls shall be utilized throughout the project to contain any turbidity generated that exceeds state water quality standards.

5. All wetland areas and surface waters which are outside the specific limits of construction authorized by this permit shall be protected from erosion, siltation, scouring or excess turbidity or dewatering.

6. The work shall be done during periods of average or low water.

7. The structures authorized by this permit shall not be placed on any property, other than that owned by the permittee, without the prior written approval of that property owner.

8. To mitigate for the wetland elimination, the permittee shall create 1.4 acres of herbaceous wetlands in conjunction with the forested wetland creation activity associated with the Phase II Generating Station construction.

Executed in Jacksonville, Florida.

Issued this 18th day of August, 1999.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

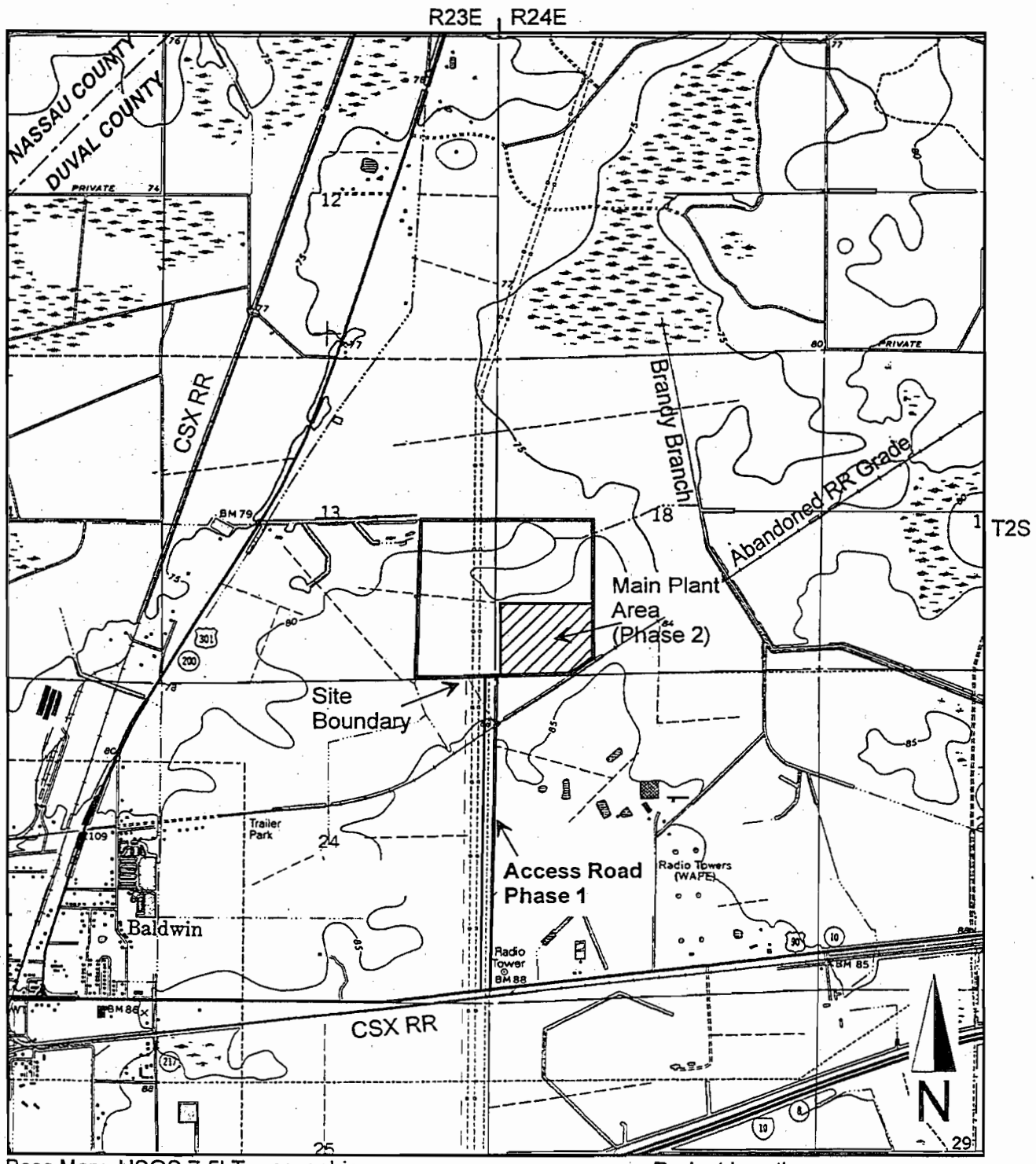
Ernest E. Frey, P.E.
Director of District Management
Submerged Lands and
Environmental Resources Program

Copy to: Francine Ffolkes, DEP Attorney
US Army Corps of Engineers, Jacksonville District
Susan Hughes, P.E., JEA

CERTIFICATE OF SERVICE

The undersigned duly designated deputy clerk hereby certifies that this NOTICE OF PERMIT and all copies were mailed before the close of business on 8/19/99 to the listed persons.

FILING AND ACKNOWLEDGEMENT
FILED on this date, pursuant to S120.52 , Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.
Linda Bratton 8/19/99
Clerk Date



Base Map: USGS 7.5' Topographic
Baldwin Quadrangle, Revised 1992

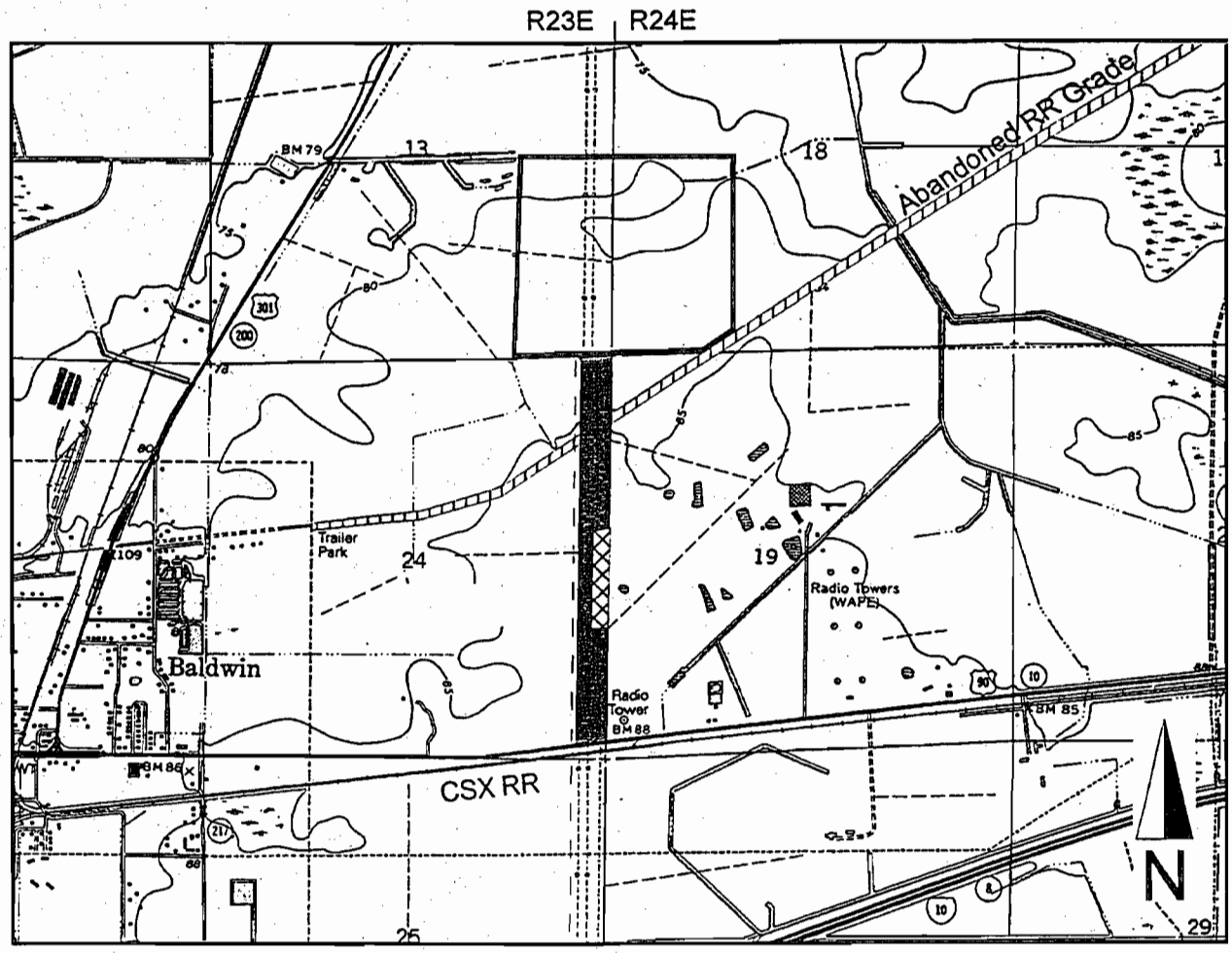
Project Location
Brandy Branch Generating Station

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Figure 2

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Base Map: USGS 7.5' Topographic
Baldwin Quadrangle, Revised 1992

Existing Land Use and Land Cover
Brandy Branch Generating Station

Florida Land Use, Cover, and Forms Classification System

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644

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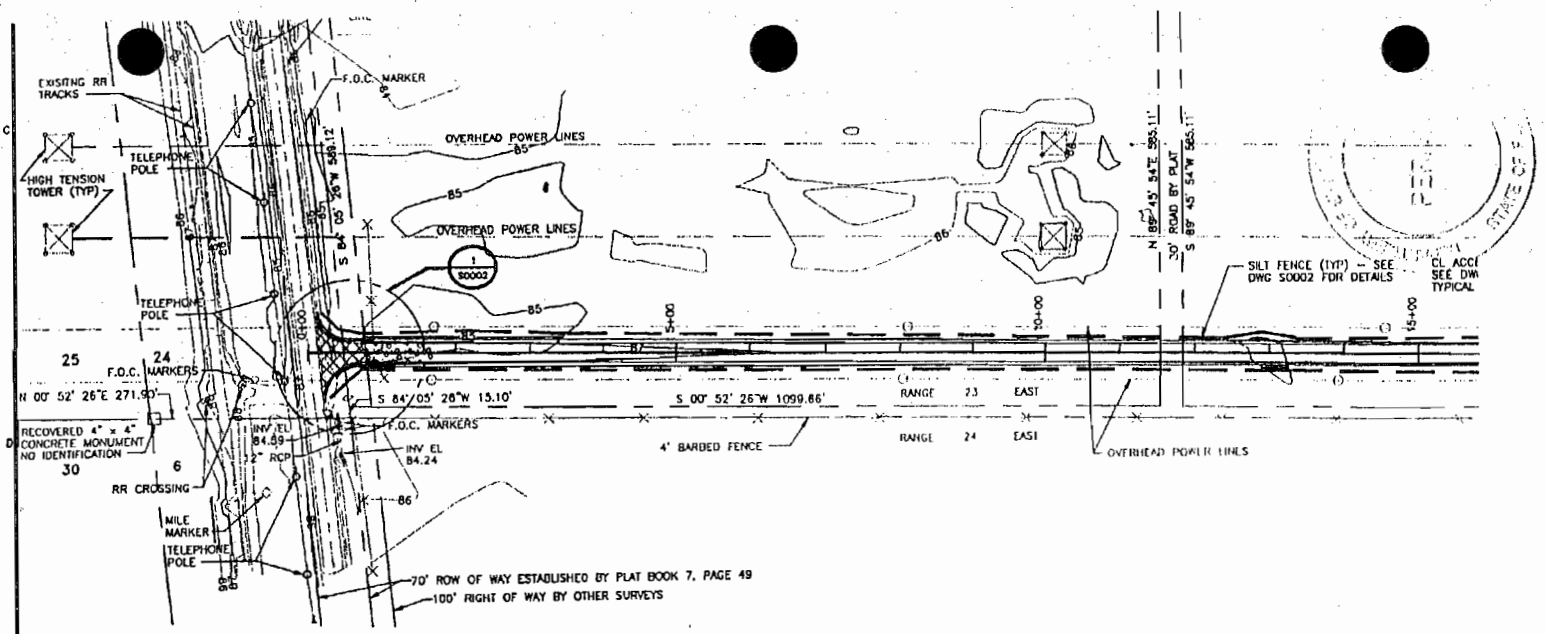
Existing Land Use and Cover
Brandy Branch Access Road

FLUCFCS* Code	Description	Acres	Percent of Project Area
189	Other Recreational	0.1	<1%
644	Emergent Aquatic Vegetation	3.57	25%
832	Electric Power Transmission Lines	19.95	100%

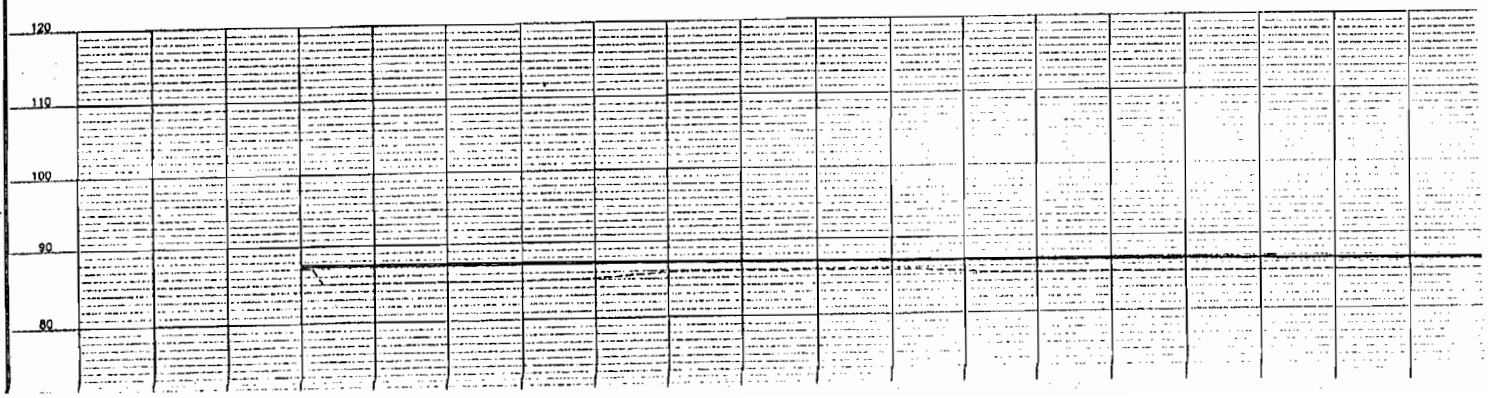
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DEPT OF ENVIRONMENTAL REGULATION
NORTHEAST DISTRICT
PERMIT
STATE OF FLORIDA

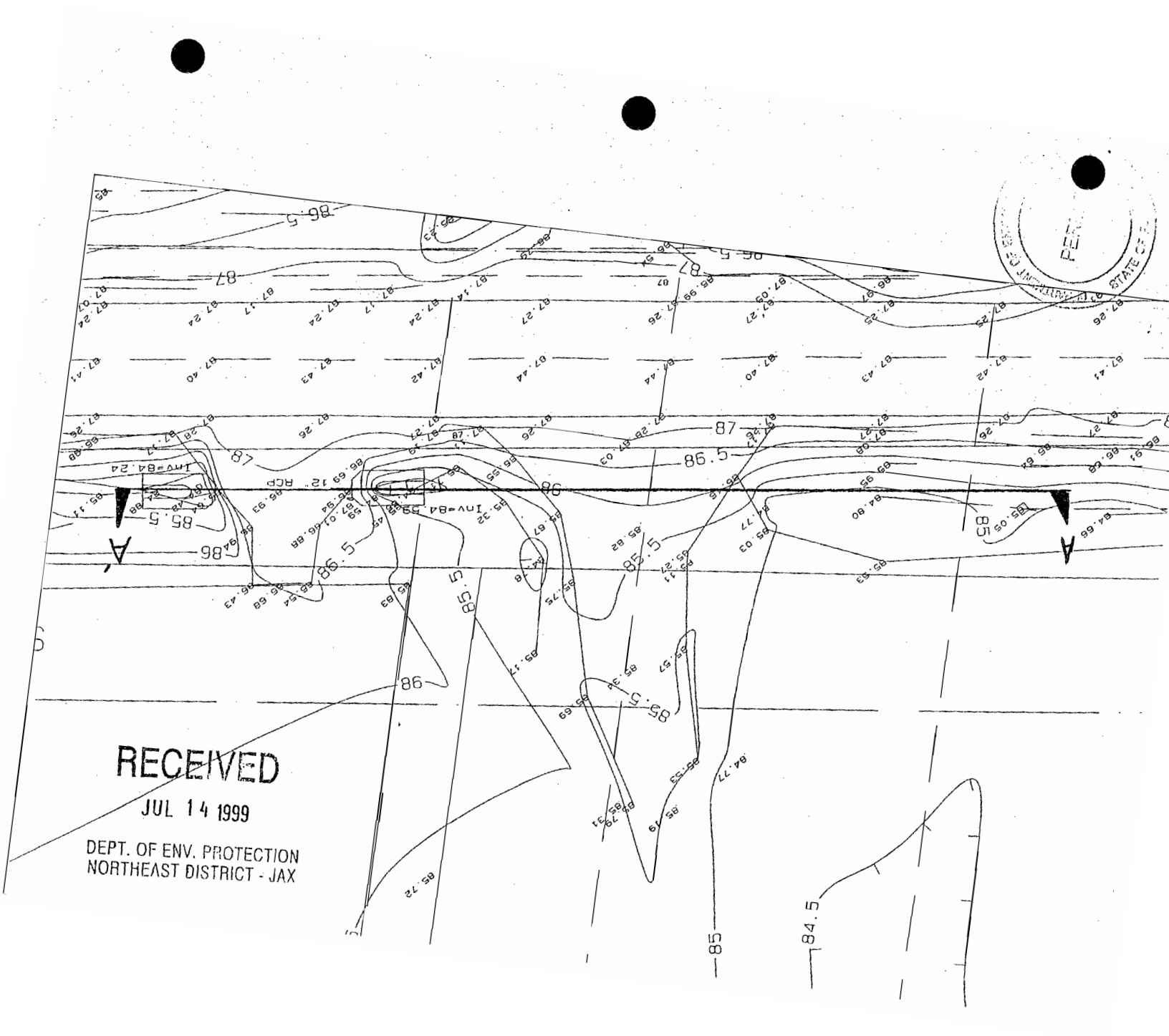
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Figure 4

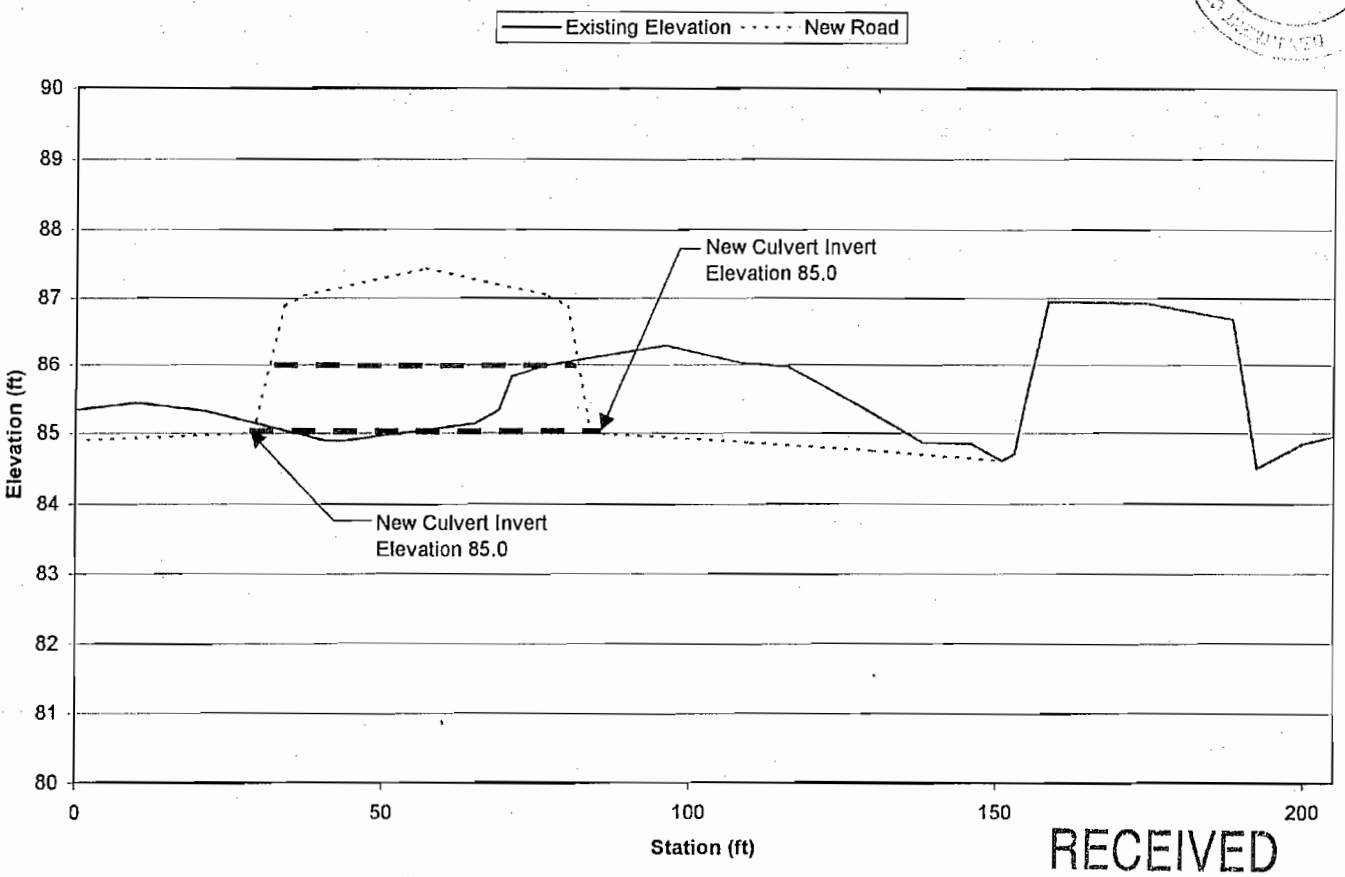


ACCESS
STA 0+00

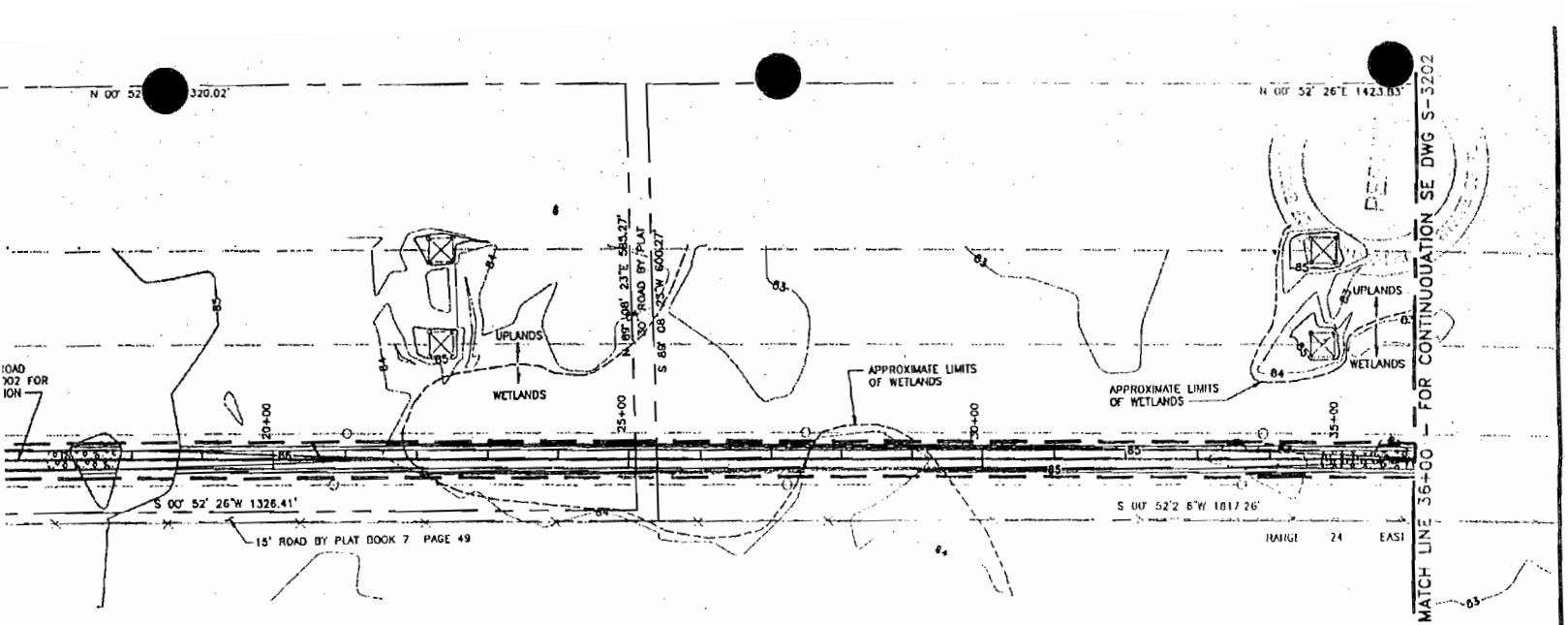



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NORTHEAST DISTRICT - JAX

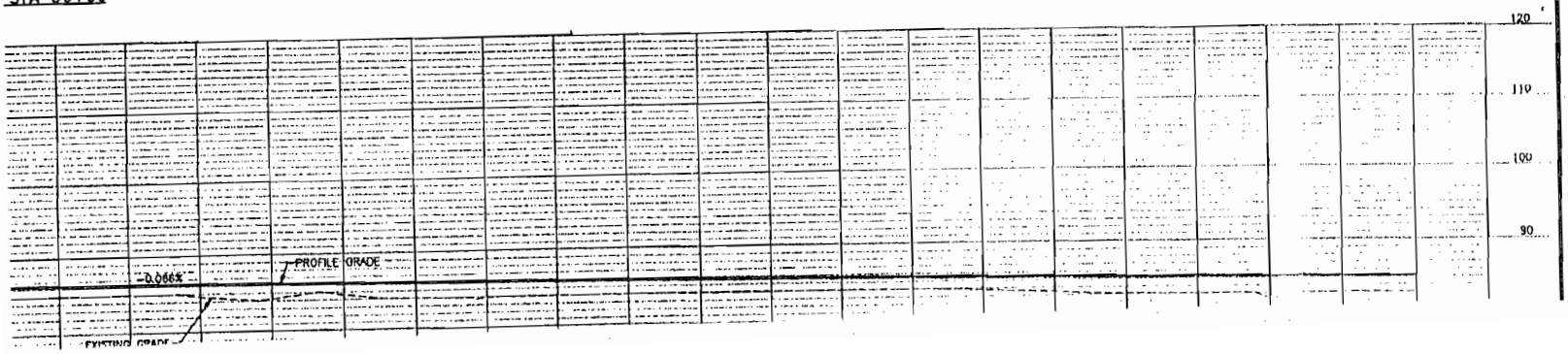
Access Road Section Cut

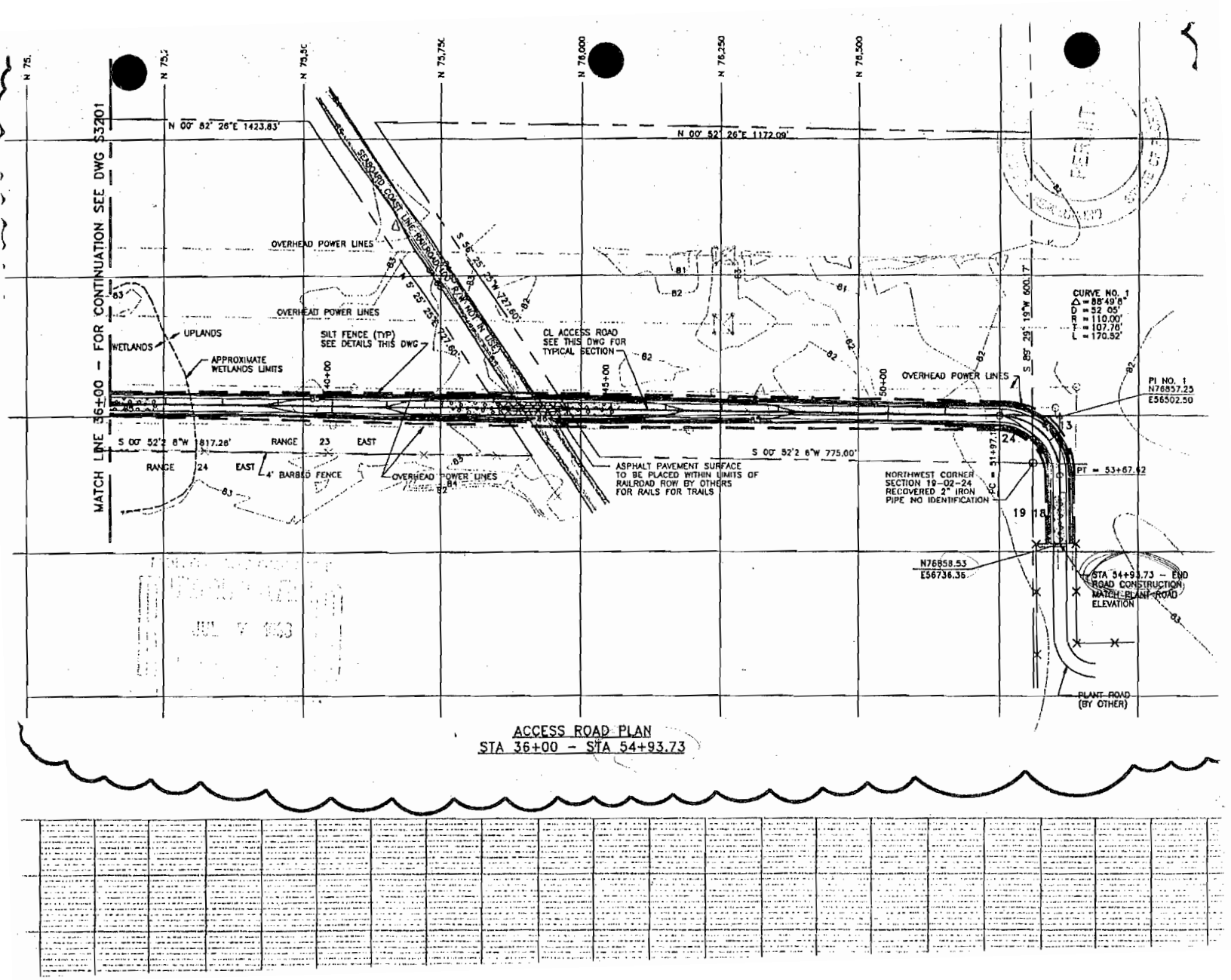


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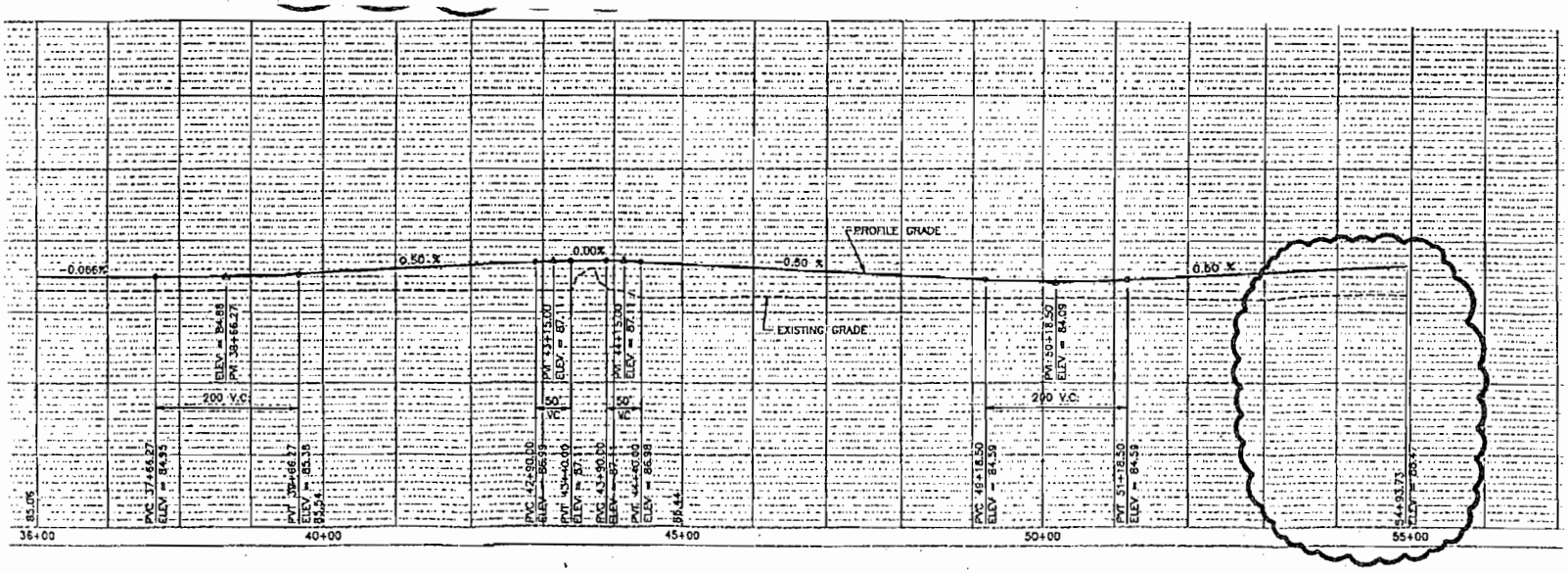


)AD PLAN
STA 36+00





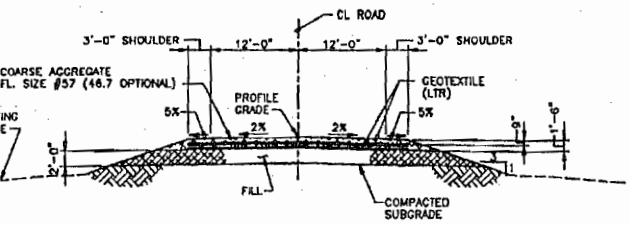
ACCESS ROAD PLAN
STA 36+00 - STA 54+93.73



ACCESS ROAD PROFILE
STA 36+00 – STA 52+54.55

NO	DATE	REVISIONS AND RECORD OF ISSUE	DRN	DES	CHK	PDE	APP
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0	05-18-99	INITIAL ISSUE	FC	MJF		MJSRLW	

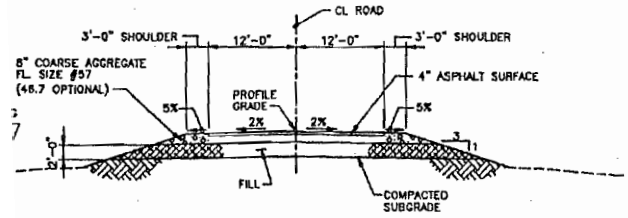
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SCALE:



NOTE 1: CLEAR AND GRUB ALL ORGANIC MATERIAL AS REQUIRED (APPROX. 6" TO 8")

TYPICAL ACCESS ROAD SECTION

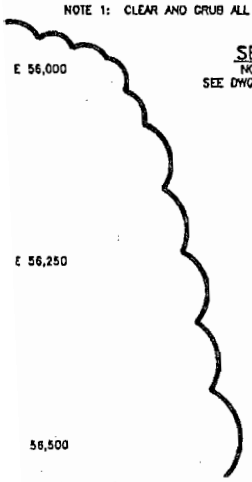
NOT TO SCALE
SEE DWGS S0001 & S0002

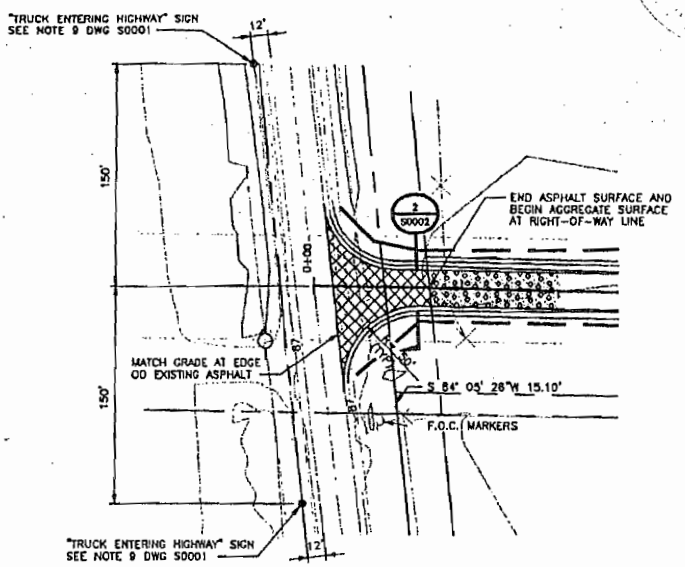


NOTE 1: CLEAR AND GRUB ALL ORGANIC MATERIAL AS REQUIRED (APPROX. 6" TO 8")

SECTION 2

NOT TO SCALE
SEE DWGS S0001 & S0002





DETAIL 1

SCALE: 1"=50'
SEE DWG S0001

Department of Environmental Protection

Jeb Bush
Governor

Northeast District
7825 Baymeadows Way, Suite B200
Jacksonville, Florida 32256-7590

David B. Struhs
Secretary

12/6

December 2, 1999

In the Matter of an
Application for a Permit by:

Mr. Walter P. Bussells
JEA
21 W. Church Street
Jacksonville, Florida 32202

File No.: 16-156348-002-EI
Duval County

Enclosed is Permit Number 16-156348-002-EI, issued pursuant to Part IV of Chapter 373, Florida Statutes, Title 62, Florida Administrative Code, and Public Law 92-500. This permit includes regulatory authorization to construct and operate the system as described. In addition, the application has been reviewed under a Coordination Agreement Between the U.S. Army Corps of Engineers, Jacksonville District, and the Department for a State Programmatic General Permit pursuant to Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act and may contain Federal authorization to construct and operate the facility as described.

When the Order (Permit) is final, any party to the Order has the right to seek judicial review of the Order pursuant to Section 120.68, Florida Statutes, by the filing of a Notice of Appeal pursuant to Rule 9.110, Florida Rules of Appellate procedure, with the Clerk of the Department in the Office of General Counsel, 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000; and by filing a copy of the Notice of Appeal accompanied by the applicable filing fees with the appropriate District Court of Appeal. The Notice of Appeal must be filed within 30 days from the date the Final Order is filed with the Clerk of the Department.

Executed in Jacksonville, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

Jeremy Tyler
Environmental Administrator

Copies furnished to: Mike Soltys, Black & Vetch Corporation
Francine Ffolkes, OGC

Department of Environmental Protection

Jeb Bush
Governor

Northeast District
7825 Baymeadows Way, Suite B200
Jacksonville, Florida 32256-7590

David B. Struhs
Secretary

ENVIRONMENTAL RESOURCE PERMIT

PERMITTEE/AUTHORIZED ENTITY:
Mr. Walter P. Bussells
JEA
21 W. Church Street
Jacksonville, Florida 32202

AGENT:
Black & Vetch Corporation
c/o Mike Soltys
11401 Lamar
Overland Park, KS 66211

Permit Number: 16-156348-002-EI
Date of Issue: December 2, 1999
Expiration Date of Construction Phase: December 2, 2004
County: Duval
Project: To construct and operate a Stormwater Management System for a new nominal 500 megawatt simple cycle combustion turbine generating facility.

This permit is issued under the authority of Part IV of Chapter 373, F.S., and Title 62, Florida Administrative Code (F.A.C.). The activity is not exempt from the requirement to obtain an environmental resource permit. Pursuant to Operating Agreements executed between the Department and the water management districts, as referenced in Chapter 62-113, F.A.C., the Department is responsible for reviewing and taking final agency action on this activity.

ACTIVITY DESCRIPTION:

The proposed stormwater system is to consist of a wet detention pond with a surface water discharge to Brandy Branch Creek through existing wetlands located in the northeast quadrant of the site. The wet detention pond is to have a discharge (control) structure to regulate stormwater flows during major and minor storm events. The pond's control structure is to have an overflow weir with an oil skimmer, and an orifice to regulate the rate of discharge of stormwater to meet water quality requirements. The overflow weir in the control structure is to regulate the discharge of excess stormwater during a storm event. The control structure's orifice is to recover one half of the pond's treatment volume within 48 to 60 hours following a storm event. Runoff from the generating site is to be conveyed to the stormwater pond through a series of perimeter ditches. These perimeter ditches are to be interconnected by culverts.

Rooted in Conservation, Growing Florida's Economy and Protecting Natural Resources"

Printed on recycled paper.

Located in the southwest portion of the site is approximately 13.03 acres of off-site drainage that historically drains to the north to the existing wetland on-site.

To continue this connection, three (3) 18-inch culverts are to be installed under the stormwater pond's access roadway to continue the conveyance of this flow to the wetland.

Located to the southeast of the site, is an off-site area of approximately 14.46 acres that historically drain to the wetland located on the northern portion of the site. A concrete lined by-pass ditch is to be installed around the eastern perimeter of the generator site to continue to convey this flow to the wetland. At the point of discharge to the wetland, the end of the Bypass channel section is to be graded to match existing elevations. This is to reduce the velocity of stormwater discharging to the wetland to prevent erosion from occurring resulting for the discharge of stormwater.

To minimize erosion and sedimentation during construction activities, temporary erosion and sedimentation control measures (silt fencing, floating turbidity barriers, hay bales, etc.) are to be installed and maintained on site. Erosion control mats are to be installed on the discharge end of the control structure pipe, spillways, and at the end of all culverts. Once final grades are achieved, all disturbed earthen surface areas are to have establish a permanent grassed vegetative cover to prevent erosion of the surface areas from occurring

Wetland Impacts:

Fill 2.2 acres of isolated forested wetlands for the construction of the generating station. The wetland to be filled is a forested cypress (Taxodium spp.) dome. To mitigate for the wetlands eliminated, the permittee is to create a 4.4 acre isolated cypress dome within an existing grassed pasture. An additional 1.4 acres of herbaceous wetlands are to be created around the outside edge of the cypress area to mitigate for the previously permitted access road (DEP File No: 16-156348-001-EI). The access road eliminated 1.4 acres of a mixed upland/wetland herbaceous wetland within an existing cleared power line right-of-way. Remove an existing elevated patrol road to restore approximately 11,880 square feet of Juncus effusus wetlands and reestablish a vegetative connection to the larger wetland system to the east.

PERMITTEE:
Mr. Walter P. Bussells
JEA

PERMIT NUMBER: 16-156348-002-EI
DATE OF ISSUE: December 2, 1999
EXPIRATION DATE: December 2, 2004

ACTIVITY LOCATION:

The activity is located within isolated wetlands, Class III Waters, Sections 13 & 18, Township 02 South, Range 23 East.

This permit also constitutes a finding of consistency with Florida's Coastal Zone Management Program, as required by Section 307 of the Coastal Management Act.

This permit also constitutes certification compliance with water quality standards und Section 401 of the Clean Water Act, 33 U.S.C. 1341.

SPGP - REVIEW:

Your project has been reviewed for compliance with a State Programmatic General Permit (SPGP). Your proposed activity as outlined on the attached drawings is **not** in compliance with the SPGP program. A copy of this authorization has been sent to the U.S. Army Corps of Engineers (USACOE) for review. The USACOE may require a separate permit. Failure to obtain this authorization prior to construction could subject you to enforcement action by that agency. You are hereby advised that authorizations also may be required by other federal, state, and local entities. This authorization does not relieve you from the requirements to obtain all other required permits and authorizations.

Authority for review; an agreement with the U.S. Army Corps of Engineers entitled Coordination Between the U.S. Army Corps of Engineers (Jacksonville, District) and the Florida Department of Environmental Protection State Programmatic General Permit, Section 10 of the Rivers and Harbor Act of 1899 and Section 404 of the Clean Water Act.

PERMITTEE:
Mr. Walter P. Bussells
JEA

PERMIT NUMBER: 16-156348-002-EI
DATE OF ISSUE: December 2, 1999
EXPIRATION DATE: December 2, 2004

The above named permittee is hereby authorized to construct the work shown on the application and approved drawing(s), plans, and other documents attached hereto or on file with the Department and made a part hereof. **This permit is subject to the limits, conditions, and locations of work shown in the attached drawings, and is also subject to the General Conditions and Specific Conditions, which are a binding part of this permit.** You are advised to read and understand these drawings and conditions prior to commencing the authorized activities, and to ensure the work is conducted in conformance with all the terms, conditions, and drawings. If you are utilizing a contractor, the contractor also should read and understand these drawings and conditions prior to commencing the authorized activities. Failure to comply with all drawings and conditions shall constitute grounds for revocation of the permit and appropriate enforcement action.

Operation of the facility is not authorized except when determined to be in conformance with all applicable rules and with the general and specific conditions of this permit/certification/ authorization, as specifically described below.

GENERAL CONDITIONS:

(a) All activities shall be implemented as set forth in the plans, specifications and performance criteria as approved by this permit. Any deviation from the permitted activity and the conditions for undertaking that activity shall constitute a violation of this permit.

(b) This permit or a copy thereof, complete with all conditions, attachments, exhibits, and modifications, shall be kept at the work site of the permitted activity. The complete permit shall be available for review at the work site upon request by Department staff. The permittee shall require the contractor to review the complete permit prior to commencement of the activity authorized by this permit.

(c) Activities approved by this permit shall be conducted in a manner which do not cause violations of state water quality standards.

(d) Prior to and during construction, the permittee shall implement and maintain all erosion and sediment control measures (best management practices) required to retain sediment on-site and to prevent violations of state water quality standards. All practices must be in accordance with the guidelines and specifications in chapter 6 of the Florida Land Development Manual: A Guide to Sound Land and Water Management (Florida Department of Environmental Regulation 1988), which are incorporated by reference, unless a project specific erosion and sediment control plan is approved as part of the permit, in which case the practices must be in accordance with the plan. If site specific conditions require additional measures during any phase of construction or operation to prevent erosion or control sediment, beyond those specified in the erosion and sediment control plan, the permittee shall implement additional best management practices as necessary, in accordance with the specifications in chapter 6 of the Florida Land Development Manual: A Guide to Sound Land and Water Management (Florida Department of Environmental Regulation 1988). The permittee shall correct any erosion or shoaling that causes adverse impacts to the water resources.

(e) Stabilization measures shall be initiated for erosion and sediment control on disturbed areas as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 7 days after the construction activity in that portion of the site has temporarily or permanently ceased.

(f) At least 48 hours prior to commencement of activity authorized by this permit, the permittee shall submit to the Department an "Environmental Resource Permit Construction Commencement" notice (Form No. 62-343.900(3), F.A.C.) indicating the actual start date and the expected completion date.

(g) When the duration of construction will exceed one year, the permittee shall submit construction status reports to the Department on an annual basis utilizing an "Annual Status Report Form" (Form No. 62-343.900(4), F.A.C.). These forms shall be submitted during June of each year.

(h) For those systems which will be operated or maintained by an entity which will require an easement or deed restriction in order to provide that entity with the authority necessary to operate or maintain the system, such easement or deed restriction, together with any other final operation or maintenance documents as are required by subsections 7.1.1 through 7.1.4 of the Applicant's Handbook: Management and Storage of Surface Waters, must be submitted to the Department for approval. Documents meeting the requirements set forth in these subsections of the Applicant's Handbook will be approved. Deed restrictions, easements and other operation and maintenance documents which require recordation either with the Secretary of State or the Clerk of the Circuit Court must be so recorded prior to lot or unit sales within the project served by the system, or upon completion of construction of the system, whichever occurs first. For those systems which are proposed to be maintained by county or municipal entities, final operation and maintenance documents must be received by the Department when maintenance and operation of the system is accepted by the local governmental entity. Failure to submit the appropriate final documents referenced in this paragraph will result in the permittee remaining liable for carrying out maintenance and operation of the permitted system.

(i) Each phase or independent portion of the permitted system must be completed in accordance with the permitted plans and permit conditions prior to the initiation of the permitted use of site infrastructure located within the area served by that portion or phase of the system. Each phase or independent portion of the system must be completed in accordance with the permitted plans and permit conditions prior to transfer of responsibility for operation and maintenance of that phase or portion of the system to a local government or other responsible entity.

(j) Within 30 days after completion of construction of the permitted system, or independent portion of the system, the permittee shall submit a written statement of completion and certification by a registered professional engineer or other appropriate individual as authorized by law, utilizing "Environmental Resource Permit As-Built Certification by a Registered Professional" (Form 62-343.900(5), F.A.C.) supplied with this permit. When the completed system differs substantially from the permitted plans, any substantial deviations shall be noted and explained and two copies of as-built drawings submitted to the Department. Submittal of the completed form shall serve to notify the Department that the system is ready for inspection. The statement of completion and certification shall be based on on-site observation of construction (conducted by the registered professional engineer, or other appropriate individual as authorized by law, or under his or her direct supervision) or review of as-built drawings for the purpose of determining if the work was completed in compliance with approved

j. (con't):
plans and specifications. As-built drawings shall be the permitted drawings revised to reflect any changes made during construction. Both the original and any revised specifications must be clearly shown. The plans must be clearly labeled as "as-built" or "record" drawing. All surveyed dimensions and elevations shall be certified by a registered surveyor. The following information, at a minimum, shall be verified on the as-built drawings:

1. Dimensions and elevations of all discharge structures including all weirs, slots, gates, pumps, pipes, and oil and grease skimmers;
2. Locations, dimensions, and elevations of all filter, exfiltration, or underdrain systems including cleanouts, pipes, connections to control structures, and points of discharge to the receiving waters;
3. Dimensions, elevations, contours, or cross-sections of all treatment storage areas sufficient to determine stage-storage relationships of the storage area and the permanent pool depth and volume below the control elevation for normally wet systems, when appropriate;
4. Dimensions, elevations, contours, final grades, or cross-sections of the system to determine flow directions and conveyance of runoff to the treatment system;
5. Dimensions, elevations, contours, final grades, or cross-sections of all conveyance systems utilized to convey off-site runoff around the system;
6. Existing water elevation(s) and the date determined; and
7. Elevation and location of benchmark(s) for the survey.

(k) The operation phase of this permit shall not become effective until the permittee has complied with the requirements of the condition in paragraphs (i and j) above, the Department determines the system to be in compliance with the permitted plans, and the entity approved by the Department in accordance with subsections 7.1.1 through 7.1.4 of the Applicant's Handbook: Management and Storage of Surface Waters, accepts responsibility for operation and maintenance of the system. The permit may not be transferred to such an approved operation and maintenance entity until the operation phase of the permit becomes effective. Following inspection and approval of the permitted system by the Department, the permittee shall request transfer of the permit to the responsible approved operation and maintenance entity, if different from the permittee. Until the permit is transferred pursuant to section 7.1 of the Applicant's Handbook: Management and Storage of Surface Waters, the permittee shall be liable for compliance with the terms of the permit.

(l) Should any other regulatory agency require changes to the permitted system, the permittee shall provide written notification to the Department of the changes prior to implementation so that a determination can be made whether a permit modification is required.

(m) This permit does not eliminate the necessity to obtain any required federal, state, local and special district authorizations prior to the start of any activity approved by this permit. This permit does not convey to the permittee or create in the permittee any property right, or any interest in real property, nor does it authorize any entrance upon or activities on property which is not owned or controlled by the permittee, or convey any rights or privileges other than those specified in the permit and chapter 40C-4 or chapter 40C-40, F.A.C.

(n) The permittee is hereby advised that section 253.77, F.S., states that a person may not commence any excavation, construction, or other activity involving the use of sovereign or other lands of the state, the title to which is vested in the Board of Trustees of the Internal Improvement Trust Fund without obtaining the required lease, license, easement, or other form of consent authorizing the proposed use. Therefore, the permittee is responsible for obtaining any necessary authorizations from the Board of Trustees prior to commencing activity on sovereignty lands or other state-owned lands.

(o) The permittee shall hold and save the Department harmless from any and all damages, claims, or liabilities which may arise by reason of the activities authorized by the permit or any use of the permitted system.

(p) Any delineation of the extent of a wetland or other surface water submitted as part of the permit application, including plans or other supporting documentation, shall not be considered specifically approved unless a specific condition of this permit or a formal determination under section 373.421(2), F.S., provides otherwise.

(q) The permittee shall notify the Department in writing within 30 days of any sale, conveyance, or other transfer of ownership or control of the permitted system or the real property at which the permitted system is located. All transfers of ownership or transfers of a permit are subject to the requirements of section 62-343.130, F.A.C. The permittee transferring the permit shall remain liable for any corrective actions that may be required as a result of any permit violations prior to such sale, conveyance or other transfer.

(r) Upon reasonable notice to the permittee, Department authorized staff with proper identification shall have permission to enter, inspect, sample and test the system to insure conformity with the plans and specifications approved by the permit.

(s) If historical or archaeological artifacts are discovered at any time on the project site, the permittee shall immediately notify the Department.

(t) The permittee shall immediately notify the Department in writing of any previously submitted information that is later discovered to be inaccurate.

SPECIFIC CONDITIONS:

1. NOTICE: If any of the specific conditions listed below are in conflict with any of the general conditions listed in this permit, the specific conditions shall take precedence over the general condition(s).

2. All construction, operation, and maintenance of the stormwater system shall be as set forth in the plans, specifications, and performance criteria contained in the Department file and approved by this permit. Any deviation from the permitted plans are to be addressed by the department prior to their implementation to determine if a modification to the permit is required.

3. Turbidity barriers shall be installed at all locations where the possibility of transferring suspended solids into the receiving water body exists due to the proposed work. Turbidity barriers shall remain in place at all locations until construction is completed and soils are stabilized and vegetation has been established. The Permittee shall be responsible for the removal of the barriers.

4. At a minimum, all retention and detention storage areas must be excavated to rough grade prior to or concurrent with building construction or placement of impervious surface within the area served by those facilities. To prevent reduction in storage volume and percolation rates, all accumulated sediment must be removed from the storage area prior to final grading and stabilization.

Specific Conditions (con't):

5. If historical or archaeological artifacts, such as, but not limited to, Indian canoes, arrow heads, pottery or physical remains, are discovered at any time within the project site the permittee shall immediately stop all activities which disturb the soil and contact the Northeast District Office of the Department of Environmental Protection and the Bureau of Historic Preservation, Division of Historical Resources, R.A. Gray Building, 500 South Bronough, Tallahassee, Florida, 32399-0250. Any activity which causes the disturbance of the soil may not resume without the written authorization from the Division of Historic Resources.

6. All disturbed areas, swales, retention/detention basin side slopes, and roadside slopes must be sodded or seeded and mulched within 30 days following their completion and a substantial vegetation cover must be established within 60 days of seeding. Erosion preventive measures must be taken to ensure establishment of vegetative cover. All critical slopes immediately above the detention/retention basin must be seeded, mulched, or sodded as required for preventing sedimentation or clogging of the detention/retention basin.

7. The Permittee must obtain an individual permit pursuant to 40C-4 F.A.C. prior to beginning construction of any work not authorized by this permit.

8. The Permittee shall provide the Northeast District Office of DEP with prior written notice within 30 days of the date the work authorized by this permit is to commence.

9. Department of Environmental Protection staff, upon proper identification, shall have permission to enter, inspect, and observe the system to insure conformity with the plans and specifications approved by this permit.

10. This permit for construction will expire five (5) years from the date of issuance.

11. All wetland areas or water bodies which are outside of the specific limits of construction authorized by this permit must be protected from erosion, siltation, scouring, or excess turbidity and dewatering.

Specific Conditions (con't):

12. The Department must be notified, in writing, within 30 days of any sale, conveyance, or other transfer of a permitted system or facility or within 30 days of any transfer of ownership or control of the real property at which the permitted system or facility is located. Transfer of this permit shall be in accordance with the provisions of Chapter 373 F.S. and Chapter 40C-4, 40C-40, and 40C-41 F.A.C. All terms and conditions of this permit shall be binding upon the transferee.

13. If any other regulatory agency should require revisions or modification to the permitted project, the Department is to be notified of the revisions prior to any implementation of such revisions so that a determination can be made whether a permit modification is required.

14. The Permittee is responsible for the selection, implementation, and operation of all erosion and sediment controls on-site and to prevent violations of water quality standards in Chapters 62-3 and 62-4, F.A.C. The Permittee is encouraged to use the appropriate Best Management Practices described in the Florida Land Development Manual: A guide to Sound Land and Water Management (DER, 1988).

15. Within thirty (30) days after sale or conveyance of the permitted surface water management system or the land on which the system is located, the owner in whose name the permit was granted shall notify the Department of such change of ownership. Transfer of this permit shall be in accordance with the provisions of Chapter 373, Florida Statutes, and Chapters 40C-4, and 40C-41, Florida Administrative Code. All terms and conditions of this permit shall be binding upon the transferee.

16. The following operational maintenance activities shall be performed on all permitted systems on a regular basis or as needed:

    (a) Removal of trash and debris.

    (b) Inspection of inlets and outlets.

Specific Conditions (con't):

(c) Removal of sediments when the storage volume or conveyance capacity of the system is below design level or when the system is rendered ineffective on account of clogging/sedimentation of the pond bottoms.

(d) Stabilization and restoration of eroded areas.

(e) Mowing and removal of grass clippings.

(f) Aeration, tilling or replacement of topsoil as needed to restore percolation capability of the system.

(g) Replanting if vegetative cover in littoral zones falls below 80% coverage.

The stormwater management system shall be inspected after each heavy rain, but at a minimum once per quarter.

17. The permittee is required to provide for periodic inspections of the stormwater management system. The permittee shall submit reports to the Department certifying that the stormwater management system is operating as designed. The reports shall be submitted to the Department as follows:

(a) Inspection reports for retention, underdrain, wet detention (with/without littoral shelf), and swales shall be submitted one year after completion of construction and every year thereafter. A registered Florida Professional Engineer must sign and seal the report certifying the system is functioning as designed.

(b) Inspection reports for filtration treatment systems and pumped systems shall be submitted one year after completion of construction and every year thereafter. A registered Florida Professional Engineer must sign and seal the report certifying the filtration treatment system and/or pumped system is operating as designed.

(c) Each inspection shall be documented and kept on file at the facility office. Each inspection report shall contain, as a minimum; date, name of inspector, as found condition of major system features, and nature and extent of maintenance/repair performed.

Specific Conditions (con't):

(d) The Reports shall be submitted to the Department's Stormwater Engineer at 7825 Baymeadows Way, Suite B-200, Jacksonville, FL 32256-7590.

18. If stormwater management system is not functioning as designed and permitted, operational maintenance must be performed immediately to restore the system. If operational maintenance measures are insufficient to enable the system to meet the design standards, the permittee must either replace the system or construct an alternative design. In this connections, the permittee must submit a permit modification application within sixty (60) days of the date the system was determined to be design deficient.

19. The Permittee shall immediately notify the Department by telephone whenever a serious problem occurs at this facility. During regular business hours notification shall be made to the Northeast District Office at (904) 448-4300. If an emergency occurs outside regular business hours, the Permittee shall telephone the 24-hour emergency phone number (904) 488-1320. This number is for emergencies only. Within 7 days of telephone notification, the Permittee shall submit to the Department a written report explaining the extent of the problem, its cause, and what actions have been or will be taken to correct the problem.

20. Pursuant to F.A.C. Rule 62-4.090, sixty (60) days prior to the expiration date of this permit, the Permittee shall apply for a renewal of the permit on forms and in a manner prescribed by the Department.

21. Outfall ditches must be inspected monthly, with the removal of trash, debris, silt and vegetation when necessary to insure proper drainage of stormwater ponds. A copy of these inspections are to be submitted to the Department as part of the yearly inspection report. The Inspection Report is to be signed and sealed by a registered Florida Professional Engineer.

Specific Conditions (con't):

22. Construction of the stormwater management system must be complete and all disturbed areas stabilized in accordance with permitted plans and conditions prior to any of the following: issuance of the first certificate of occupancy; initiation of intended use of the infrastructure; or transfer of responsibility of maintenance of the system to a local government or other responsible entity.

23. The project shall comply with applicable State Water Quality Standards, namely:
    a) Surface Waters, Minimum Criteria, General Criteria - **62-302.500**,
    b) Class III Waters - Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife. - **62-302.400**

24. The structure authorized by this permit shall not be placed on any property, other than that owned by the permittee, without the prior written approval of that property owner.

25. During construction, all wetland areas and surface waters which are outside the specific limits of construction authorized by this permit shall be protected from erosion, siltation, scouring or excess turbidity or dewatering. Within 14 days after the areas have stabilized the controls shall be removed.

26. The existing patrol road located within the area labeled as "Area of Additional Mitigation Area = 50,887 SF on Figure 1 shall be excavated down to an elevation that matches the adjacent wetland areas.

27. Equipment used to excavate the existing patrol road shall be confined to upland areas and shall not enter the existing wetland areas.

28. The material excavated from the existing patrol road shall be disposed at an appropriate upland disposal site.

WETLAND CREATION

29. All written notifications and reports required in the following conditions shall be submitted to the Submerged Lands and Environmental Resources Program, 7825 Baymeadows Way, Suite B-200, Jacksonville, FL 32256-7590, phone number (904)448-4340. All written notifications shall include the permittee name and permit number.

Specific Conditions (con't):

30. The attached "Wetlands Mitigation Plan Brandy Branch Generating Station" shall be appended as a Specific Condition of this permit. Specific Condition requirements listed herein shall supersede or modify any requirements contained in the appended mitigation and monitoring plan.

31. Prior to placement of fill material in the 2.2 acre isolated wetland, the existing topsoil shall be excavated and stockpiled. The excavated material shall be used as the topsoil in the wetland creation area.

32. Excavation to design grade of the wetland creation area indicated on Drawing Number 60903-DS-S1001, Site Arrangement, shall commence within 90 days following the placement of fill in the 2.2 acre isolated wetland and shall be completed within 60 days of excavation commencement. Written notification shall be submitted within 14 days of the commencement date for the excavation.

33. Equipment used to excavate the creation area shall be confined to existing upland areas and shall not enter any of the existing wetlands on site.

34. The material excavated from the creation site shall be disposed at an appropriate upland disposal site.

35. Within 30 days of completion of grading to design elevations, an 'as built' survey of the wetland creation area shall be completed. The 'as built' survey shall indicate the dimensions and square footage of the wetland creation area, 0.5 foot contour intervals, and an appropriate scale. The dimensions and square footage shall only include the areas that are designed to be wetlands. The 'as built' surveys shall be submitted within 7 days after completion of the survey.

36. The 'as built' survey shall be signed and sealed by a surveyor registered in the State of Florida.

37. Cross sections shall be taken in the creation area at the locations indicated on Drawing Number 60903-DS-S1001, Site Arrangement and shall be submitted with the 'as built' surveys. The cross sections shall include elevations and dimensions. The location of the cross sections shall be indicated on the 'as built' surveys or on a plan view drawing. The cross sections do not need to be signed and sealed by the surveyor.

Specific Conditions (con't):

38. All species planted in the creation area shall be Obligate and Facultative Wet species as listed in Rule 62-340.450(1) & (2), Florida Administrative Code and shall be appropriate species for the planned elevations and hydroperiod. The forested species planted shall be predominately Taxodium spp. The permittee shall provide written notification of the date planting is to start and estimated completion date.

39. Following completion of the excavation and planting of the creation area and annually during the late summer thereafter, the permittee shall submit a monitoring report of the area. The monitoring report shall at a minimum contain the following information:

a. Identity of the species planted and naturally recruited in the area and wetland indicator status pursuant to Chapter 62-340, Florida Administrative Code (F.A.C.);

b. Percent coverage of the planted and any naturally recruited wetland species and percent coverage of any upland species and nuisance species, if any, using established sampling methods such as Daubenmire (1968), Green (1979), Grieg-Smith (1983) and Mueller-Dombois and Ellenberg (1974). Nuisance species shall be defined as those species of flora which are not listed as obligate or facultative wet species in 62-340, F.A.C. or are listed species but whose characteristics or presence in sufficient number, biomass, or areal extent may reasonably be expected to prevent or unreasonably interfere with the successful establishment of the forested/herbaceous wetland;

c. Wildlife utilization of the area, if any;

d. Any problems noted and proposed remedial measures to achieve the success criteria;

e. Color photographs from fixed photographic stations of the creation area with the location indicated on a plan view drawing; and

f. Any other information the permittee deems pertinent to demonstrate trends toward the successful establishment of the wetland system.

The monitoring report shall be submitted to the Department within 14 days following the required due date and shall continue to be submitted until the success criteria have been met.

Specific Conditions (con't):

40. The wetland creation area shall be determined to be successful when all of the success criteria below have been continuously met for a period of at least one growing season, without intervention in the form of but not limited to irrigation, dewatering, removal of undesirable vegetation, or replanting of desirable vegetation. The procedures for requesting a success determination and guidelines for the Department's response are provided herein:

a. Not less than 5.8 acres of the created wetland is determined by the Department to be a wetland pursuant to Section 373.421, Florida Statutes and Chapter 62-340, F.A.C.;

b. The created wetland is inundated or periodically inundated as indicated by staff gauges monitoring surface water levels in the creation area;

c. An average of at least 400 desirable trees per acre within the 4.4 acre portion of the creation site shall be growing above the herbaceous and shrub stratum;

d. On an annual basis at least 80 percent of the planted trees have survived and are showing signs of normal annual growth based on but not limited to such standard parameters as increase in height and base diameter, canopy circumference and seed production;

e. Percent cover of desirable herbaceous and/or shrub species shall be $\geq$75 percent within the 1.4 acre herbaceous portion of the creation site and the plants are reproducing naturally, either by normal, healthy vegetative spread or through seedling establishment, growth and survival;

f. Non-native and exotic/nuisance is limited to $\leq$5% of the total vegetative coverage. Nuisance vegetation shall be defined as any plant species that threatens the survivorship of the desired wetland species;

41. The creation area shall be determined to be successful when the all of the success criteria have been met. The procedures for requesting a success determination and guidelines for the Department's response are provided herein:

a. The permittee may notify the Department whenever the permittee believes the creation area has met all of the success criteria. The notice shall be sent by certified mail addressed to the Department.

b. The notice shall include a copy of the most recent monitoring report and a narrative describing how the reported data support the contention that each of the success criteria have been met. The permittee shall afford Department personnel the opportunity to schedule and conduct sufficient on-site inspections of the creation area to determine whether the success criteria are met. Creation sites may be successful at different times.

PERMITTEE:
Mr. Walter P. Bussells
JEA

PERMIT NUMBER: 16-156348-002-EI
DATE OF ISSUE: December 2, 1999
EXPIRATION DATE: December 2, 2004

Specific Conditions (con't):

c. Within 120 days of receipt of this notice, the Department shall notify the permittee by certified mail that the Department determined that the creation area has been successfully completed, has not been successfully completed, or can not be determined at this time. The notification shall identify those elements of the success criteria that have not been met.

d. When the Department notifies the permittee that the creation is successful or if the Department fails to notify the permittee within the time period prescribed by this condition, then the permittee's creation obligation under the terms of the permit shall be deemed satisfied for that particular area.

Executed in Jacksonville, Florida.

Issued this 2nd day of December, 1999.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

Jeremy Tyler
Environmental Administrator
Submerged Lands and
Environmental Resources Program

Copy to: Francine Ffolkes, DEP Attorney
US Army Corps of Engineers, Jacksonville District
Mike Soltys, Black & Veatch Corp.

CERTIFICATE OF SERVICE

The undersigned duly designated deputy clerk hereby certifies that this NOTICE OF PERMIT and all copies were mailed before the close of business on 12/2/99 to the listed persons.

FILING AND ACKNOWLEDGEMENT
FILED, on this date, pursuant to §120.52, Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

Linda Hatton 12/2/99
Clerk Date

Wetlands Mitigation Plan
Brandy Branch Generating Station

Introduction

JEA has applied for an Environmental Resource Permit (ERP) for wetlands impacts and construction of a storm water management system associated with development of the Brandy Branch Generating Station (Station). The Station is a nominal 500 megawatt simple cycle combustion turbine facility located on 153 acres, 1 mile northeast of Baldwin, in Duval County. Project construction will require the clearing and filling of 1.4 acres of herbaceous wetlands in the site access road corridor (an existing, maintained transmission line right-of-way) and 2.2 acres of an isolated, good quality, pond cypress (*Taxodium ascendens*) dome on the main site. JEA proposes compensatory mitigation for these wetlands impacts in two phases. Phase I mitigation will fence the main site and access road corridor north of the hiking/biking trail to prohibit further grazing and enhance existing onsite wetlands. Phase II mitigation will construct a 6.8 acre forested and herbaceous wetland on the Station site.

JEA proposes wetland creation at a 2:1 ratio (mitigation: impact) to mitigate the loss of the 2.2 acre cypress dome for a total of 4.4 acres. Emergent/herbaceous wetlands creation are proposed at a 1:1 replacement ratio for a total of 1.4 acres.

Avoidance and Minimization of Impacts

JEA has made significant efforts to avoid and minimize wetlands impacts by using previously disturbed areas and existing corridors for project development. The access road will be constructed in an existing transmission line right-of-way (ROW), impacting only 1.4 acres of regularly disturbed (mowed) isolated herbaceous wetlands. The power block and associated facilities were located on the main site to avoid wetlands to the extent practical, impacting only 2.2 acres of isolated wetlands.

In addition to being located within a maintained 50 foot wide ROW, the access road will be a 35 foot wide, permeable, rock surfaced road. Two additional transmission line ROW's are adjacent west of the access road ROW. This ROW includes 5 acres of emergent wetlands; road construction will impact only 1.4 acres of these wetlands.

The main site includes 27 acres of forested wetlands; power block construction will only impact an isolated 2.2 acres of these wetlands. JEA decided to minimize wetlands impacts by taking the 2.2 acre cypress wetland in the south-central portion of the site for construction, thereby avoiding 25 acres of emergent and cypress areas to the north and west of the power block. The storm water pond was located in the pasture northwest of the main site to avoid impacts to the emergent and forested wetlands in the southwest corner of the site.

Mitigation Area

The area proposed for wetland construction is an upland pasture area in the southwest corner of the site located between areas of existing forested (cypress) and emergent (softrush) wetlands. The mitigation area is shown on the Site Arrangement drawing, Drawing No. DS-S1001. Soils in the mitigation area are Ridgeland fine sand, a nearly level, poorly drained sandy soil. The water table may range from 1 to 6 feet below the surface, depending on seasonal conditions. Natural fertility is moderate; organic matter content is high; and, available water capacity is low.

Disturbed herbaceous wetlands dominated by softrush (*Juncus effusus*) occur east and south of the proposed mitigation area. The area to the west is a moderate quality pond cypress dome. The area to the north is open pasture. All of these areas have been disturbed by cattle; however, the entire site will be fenced and the cattle removed (Phase I mitigation) prior to Station construction.

Mitigation Plan

Design and construction of the wetland will follow good engineering practices in an attempt to mimic the wetland ecology of the adjacent cypress and softrush areas. The

design will be based on site soil boring, piezometer, and topographic survey data, onsite plant community investigations, local hydrology, and climatic patterns, and scientific literature on wetlands ecology and creation.

The source of water to the wetland will be groundwater, precipitation, and surface water runoff. Information from the Duval County Soil Survey (1978) indicates that groundwater in the Ridgeland fine sand may be at a depth of less than 10 inches for brief periods of 2-4 weeks, at 10-20 inches for 2-4 months, and at 20-40 inches most of the remainder of the year. However, onsite testing has indicated that groundwater may be as low as 6 feet below surface during the current dry period. Average annual precipitation in the Jacksonville area is 47.5 inches.

Construction of the wetland should not significantly affect the hydrology of the adjacent existing wetlands. Impacts on groundwater due to the created wetland will be dependent on seasonal conditions. During periods of high precipitation, the created wetland will collect surface runoff from the adjacent areas and function as a groundwater recharge area. During low rainfall periods, the water elevation in the wetland will equalize with surrounding groundwater elevations. The evapotranspiration rate in the wetland during periods of low rainfall is expected to be similar to the adjacent softrush wetlands until the cypress trees mature. The annual mass balance of the regional groundwater system is expected to be similar to existing conditions following wetland creation.

Wetland Construction

Wetland construction will be scheduled early in the overall project construction sequence to use the removed topsoil for fill and landscaping in the power block area. The wetland construction sequence and techniques to be used at the Station are as follow.

- Install sediment control fence around mitigation site.
- Clear, grub, and stockpile the soil from the 2.2 acre cypress wetland to be filled. This soil will be used in the new wetland.

- Construct/excavate depression to create the wetland. The bottom elevation of the created wetland will be excavated to match or nearly match the bottom elevation of the adjacent cypress wetlands. Sides will be sloped to meet existing adjacent pasture grade.
- Use St. Johns River Water Management District/Corps of Engineers approved weed control chemicals to eliminate noxious vegetation in and near the planned wetland.
- Rough grade the wetland site.
- Scarify subsoil (rip the construction area to loosen the top 12 to 30 inches to enhance water infiltration and root growth).
- Test soil to ensure proper chemical balance to promote wetland growth.
- Finish grading.
- Spread topsoil from impact wetland.
- Prepare planting area/seed bed (disking of soils).
- Seed native grasses in area around wetland where appropriate, such as upland areas disturbed by construction.
- Apply mulch to areas above water.
- Install biodegradable erosion control mat, where necessary, as determined by the water management district.
- Seed and plant wetland.

Section details of wetland construction are shown on the Wetland Construction drawing, Figure 1. The anticipated cost the proposed wetland is $400,000.

Wetland Planting

As previously stated, JEA proposes to create 6 acres of forested and herbaceous wetlands in an excavated area. Species proposed for planting are pond cypress, softrush (seeded and transplanted from adjacent areas), uptight sedge (*Carex stricta),* and wool-grass (*Scirpus cyperinus).* Planting of the softrush, sedge, and wool-grass will be per the suppliers recommendations.

Two wetland zones will be planted. Zone 1 will be planted on the upper perimeter of the wetland and will consist of herbaceous vegetation. This area will be designed to experience periodic inundation. Zone 1 will have a 5 percent slope. Zone 2 will be the cypress area in the deeper portion of the wetland. This area will be designed to maintain temporary to significant periods of inundation. Trees will be planted on 10-foot centers.

Wetland Monitoring

The progress and success of the created wetland will be monitored beginning immediately after completion of the wetland construction. Monitoring will be performed annually during the late summer and will continue for a period of five years unless the wetland is determined successful prior to the five year period.

Survivorship of the herbaceous species, and presence of exotic vegetation (see Wetland Success below), will be assessed by abundance determinations. Abundance will be determined from 1 meter square plots placed at regular intervals (10, 50 and 90 foot) on three (3), 100 foot belt transects located throughout Zone 1. Percent canopy cover for all species either rooted in or extending into each plot will be visually estimated using the modified cover class scale (Bailey and Poulton, 1968) shown below. Percent non-vegetated area will also be determined. Data will be calculated to determine the mean percent canopy coverage for each transect and for all transects.

Tree survivorship and density in Wetland Zone 2 will be determined by counting the number of living saplings within six (6), 100-foot long, permanent belt transects. The Zone 2 transects will be 33 feet wide. A tree will be considered living by an increase in growth (height or diameter) and/or the appearance of fruit or green leaves. Tree heights will be measured from the ground surface (bottom of wetland) to the tallest part of the living tree (branch or apical meristem). Diameters will be measured at breast height (dbh: 4.5 feet above ground surface). The mean tree height and dbh will be determined from these data.

Cover Class Scale

Cover Class	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Range (%)	0-1	1-5	5-25	25-50	50-75	75-95	95-100
Midpoint (%)	0.5	3.0	15.0	37.5	62.5	85.0	97.5

Surface water levels in the wetland will be monitored using a staff gauge. A permanent gauge will be installed in the deepest portion of the wetland to monitor surface water levels. The staff gauge will be read on a monthly basis.

Panoramic color photographs of the wetland and photographs of each transect will be taken during each monitoring event.

Annual monitoring reports will be submitted to interested parties. The reports will include the raw and summarized data, and the wetland photographs. The first monitoring report will also include the wetland as-built information. The annual reports will describe the measured progress and any problems encountered, survivorship, growth and abundance assessments, and an evaluation against the success criteria. A final report will be submitted within 6 months once the mitigation project has been determined successful. The final report will summarize the development, monitoring, and success of the created wetland.

Wetland Success

The created wetland will be considered successful when the success criteria have been met for three consecutive years. The success criteria are defined below.

- Percent cover of exotic/nuisance species must be maintained at or below 10% of the total wetland vegetative cover. These species are Australian pine, malaleuca, hydrilla, Brazialian pepper, cogon grass, Chinese tallow, torpedo grass, kudzu, tropical soda apple, waterhyacinth, and catclaw mimosa.
- Percent cover of herbaceous species must be 75% at the end of the monitoring period.

- Survivorship must be maintained at 80% for planted trees. Trees must be living and naturally reproducing as indicated by the appearance of fruit, leaves, or an increase in height or diameter.

References

Soil Survey of City of Jacksonville, Duval County, Florida. U.S. Dept. of Agriculture Soil Conservation Service. May 1978.

Bailey, A.W. and C.E. Poulton, 1968. Plant Communities and Environmental Relationships in a Portion of the Tilamook Burn, Northwest Oregon. Ecology 49: 1-13.

Wetlands Mitigation Plan - Supplement
Brandy Branch Generating Station

Introduction

JEA was issued Environmental Resource Permit (ERP) No. 16-156348-002-EI on December 1, 1999, for wetlands impacts and construction of a storm water management system associated with development of the Brandy Branch Generating Station (Station). Project construction is underway; however, it has been determined that an additional 0.6 acre of disturbed cypress (*Taxodium ascendens*) strand forest will be impacted by construction of the storm water pond access road. JEA proposes compensatory mitigation for these wetlands impacts in the form of a conservation easement granted to the FDEP over approximately 14 acres of undisturbed cypress strand forest.

Mitigation Area

The area proposed for conservation easement is located north of the main site area and east of the 500 kV transmission line right-of-way. The area is largely undisturbed cypress strand. The area is shown on the Site Arrangement drawing, Drawing No. DS-S1001.

Mitigation Schedule

Upon approval of this modification request, JEA will initiate efforts to survey the boundaries of the proposed wetland easement. The first step will be to confirm that the wetland delineation line flagging is still in-place. If flagging is missing, new flagging will be placed. The surveyor will then be instructed to prepare a survey of the proposed easement and develop a legal description. As the survey information is being prepared, JEA will develop a draft conservation easement agreement, similar to previous agreements between JEA and the FDEP.

JEA will submit the draft easement survey and agreement to FDEP for review within 180 days of approval of this modification request.

Department of Environmental Protection

Jeb Bush
Governor

Northeast District
7825 Baymeadows Way, Suite B200
Jacksonville, Florida 32256-7590

David B. Struhs
Secretary

ENVIRONMENTAL RESOURCE PERMIT

PERMITTEE/AUTHORIZED ENTITY:
Mr. Walter P. Bussells
JEA
21 W. Church Street
Jacksonville, Florida 32202

AGENT:
Black & Vetch Corporation
c/o Mike Soltys
11401 Lamar
Overland Park, KS 66211

Permit Number: 16-156348-003-ES
Date of Issue: June 9, 2000
Expiration Date of Construction Phase: June 9, 2005
County: Duval
Project: To construct and operate a proposed Stormwater Management System for a new nominal 500-megawatt simple cycle combustion turbine generating facility.

This permit is issued under the authority of Part IV of Chapter 373, F.S., and Title 62, Florida Administrative Code (F.A.C.). The activity is not exempt from the requirement to obtain an environmental resource permit. Pursuant to Operating Agreements executed between the Department and the water management districts, as referenced in Chapter 62-113, F.A.C., the Department is responsible for reviewing and taking final agency action on this activity.

ACTIVITY DESCRIPTION:

This is a major modification of the stormwater system permitted by DEP Permit 16-156348-002-EI. The modifications to the stormwater system are to consist of adding an additional 1.428 acres which is to include a fuel gas metering station and hydrogen gas storage area. Additional changes to the power plant are to include paving of additional roadways within the plant area and the addition of storage and mechanical buildings with associated parking lot. A section of perimeter ditch is to be relocated to accommodate the fuel metering station and hydrogen gas storage area.

To minimize erosion and sedimentation during construction activities, temporary erosion and sedimentation control measures (silt fencing, floating turbidity barriers, hay bales, etc) are to be installed and maintained on site. Once final grades are achieved, all disturbed earthen surface areas are to have established a permanent grassed vegetative cover to prevent erosion of the surface areas from occurring.

Wetland Impacts:

To mitigate for the 0.6 acre of wetlands eliminated by the stormwater pond access road, the permittee is to place approximately 30± acres of wetlands and upland buffer into a Conservation Easement. The Conservation Easement area is indicated on Drawing Number S1000 received on and dated May 5, 2000 and labeled as 'Cons. Easement'. The permittee is to provide a survey and legal description of the Conservation Easement area certified by a registered land surveyor in the State of Florida.

More Protection, Less Process

Printed on recycled paper.

PERMITTEE:
Mr. Walter P. Bussells
JEA

PERMIT NUMBER: 16-156348-003-ES
DATE OF ISSUE: June 9, 2000
EXPIRATION DATE: June 9, 2005

ACTIVITY LOCATION:

The activity is located within isolated wetlands, Sections 13 & 18, Township 02 South, Range 23 East.

This permit also constitutes a finding of consistency with Florida's Coastal Zone Management Program, as required by Section 307 of the Coastal Management Act.

This permit also constitutes certification compliance with water quality standards under Section 401 of the Clean Water Act, 33 U.S.C. 1341.

SPGP - REVIEW:

Your project has been reviewed for compliance with a State Programmatic General Permit (SPGP). Your proposed activity as outlined on the attached drawings is **not** in compliance with the SPGP program. A copy of this authorization has been sent to the U.S. Army Corps of Engineers (USACOE) for review. The USACOE may require a separate permit. Failure to obtain this authorization prior to construction could subject you to enforcement action by that agency. You are hereby advised that authorizations also may be required by other federal, state, and local entities. This authorization does not relieve you from the requirements to obtain all other required permits and authorizations.

Authority for review; an agreement with the U.S. Army Corps of Engineers entitled Coordination Between the U.S. Army Corps of Engineers (Jacksonville, District) and the Florida Department of Environmental Protection State Programmatic General Permit, Section 10 of the Rivers and Harbor Act of 1899 and Section 404 of the Clean Water Act.

The above named permittee is hereby authorized to construct the work shown on the application and approved drawing(s), plans, and other documents attached hereto or on file with the Department and made a part hereof. **This permit is subject to the limits, conditions, and locations of work shown in the attached drawings, and is also subject to the General Conditions and Specific Conditions, which are a binding part of this permit.** You are advised to read and understand these drawings and conditions prior to commencing the authorized activities, and to ensure the work is conducted in conformance with all the terms, conditions, and drawings. If you are utilizing a contractor, the contractor also should read and understand these drawings and conditions prior to commencing the authorized activities. Failure to comply with all drawings and conditions shall constitute grounds for revocation of the permit and appropriate enforcement action.

Operation of the facility is not authorized except when determined to be in conformance with all applicable rules and with the general and specific conditions of this permit/certification/ authorization, as specifically described below.

GENERAL CONDITIONS:

(a) All activities shall be implemented as set forth in the plans, specifications and performance criteria as approved by this permit. Any deviation from the permitted activity and the conditions for undertaking that activity shall constitute a violation of this permit.

(b) This permit or a copy thereof, complete with all conditions, attachments, exhibits, and modifications, shall be kept at the work site of the permitted activity. The complete permit shall be available for review at the work site upon request by Department staff. The permittee shall require the contractor to review the complete permit prior to commencement of the activity authorized by this permit.

(c) Activities approved by this permit shall be conducted in a manner which do not cause violations of state water quality standards.

(d) Prior to and during construction, the permittee shall implement and maintain all erosion and sediment control measures (best management practices) required to retain sediment on-site and to prevent violations of state water quality standards. All practices must be in accordance with the guidelines and specifications in chapter 6 of the Florida Land Development Manual: A Guide to Sound Land and Water Management (Florida Department of Environmental Regulation 1988), which are incorporated by reference, unless a project specific erosion and sediment control plan is approved as part of the permit, in which case the practices must be in accordance with the plan. If site specific conditions require additional measures during any phase of construction or operation to prevent erosion or control sediment, beyond those specified in the erosion and sediment control plan, the permittee shall implement additional best management practices as necessary, in accordance with the specifications in chapter 6 of the Florida Land Development Manual: A Guide to Sound Land and Water Management (Florida Department of Environmental Regulation 1988). The permittee shall correct any erosion or shoaling that causes adverse impacts to the water resources.

(e) Stabilization measures shall be initiated for erosion and sediment control on disturbed areas as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 7 days after the construction activity in that portion of the site has temporarily or permanently ceased.

(f) At least 48 hours prior to commencement of activity authorized by this permit, the permittee shall submit to the Department an "Environmental Resource Permit Construction Commencement" notice (Form No. 62-343.900(3), F.A.C.) indicating the actual start date and the expected completion date.

(g) When the duration of construction will exceed one year, the permittee shall submit construction status reports to the Department on an annual basis utilizing an "Annual Status Report Form" (Form No. 62-343.900(4), F.A.C.). These forms shall be submitted during June of each year.

(h) For those systems which will be operated or maintained by an entity which will require an easement or deed restriction in order to provide that entity with the authority necessary to operate or maintain the system, such easement or deed restriction, together with any other final operation or maintenance documents as are required by subsections 7.1.1 through 7.1.4 of the Applicant's Handbook: Management and Storage of Surface Waters, must be submitted to the Department for approval. Documents meeting the requirements set forth in these subsections of the Applicant's Handbook will be approved. Deed restrictions, easements and other operation and maintenance documents which require recordation either with the Secretary of State or the Clerk of the Circuit Court must be so recorded prior to lot or unit sales within the project served by the system, or upon completion of construction of the system, whichever occurs first. For those systems which are proposed to be maintained by county or municipal entities, final operation and maintenance documents must be received by the Department when maintenance and operation of the system is accepted by the local governmental entity. Failure to submit the appropriate final documents referenced in this paragraph will result in the permittee remaining liable for carrying out maintenance and operation of the permitted system.

(i) Each phase or independent portion of the permitted system must be completed in accordance with the permitted plans and permit conditions prior to the initiation of the permitted use of site infrastructure located within the area served by that portion or phase of the system. Each phase or independent portion of the system must be completed in accordance with the permitted plans and permit conditions prior to transfer of responsibility for operation and maintenance of that phase or portion of the system to a local government or other responsible entity.

(j) Within 30 days after completion of construction of the permitted system, or independent portion of the system, the permittee shall submit a written statement of completion and certification by a registered professional engineer or other appropriate individual as authorized by law, utilizing "Environmental Resource Permit As-Built Certification by a Registered Professional" (Form 62-343.900(5), F.A.C.) supplied with this permit. When the completed system differs substantially from the permitted plans, any substantial deviations shall be noted and explained and two copies of as-built drawings submitted to the Department. Submittal of the completed form shall serve to notify the Department that the system is ready for inspection. The statement of completion and certification shall be based on on-site observation of construction (conducted by the registered professional engineer, or other appropriate individual as authorized by law, or under his or her direct supervision) or review of as-built drawings for the purpose of determining if the work was completed in compliance with approved plans and specifications. As-built drawings shall be the permitted drawings revised to reflect any changes made during construction. Both the original and any revised specifications must be clearly shown. The plans must be clearly labeled as "as-built" or "record" drawing. All surveyed dimensions and elevations shall be certified by a registered surveyor. The following information, at a minimum, shall be verified on the as-built drawings:

1. Dimensions and elevations of all discharge structures including all weirs, slots, gates, pumps, pipes, and oil and grease skimmers;
2. Locations, dimensions, and elevations of all filter, exfiltration, or underdrain systems including cleanouts, pipes, connections to control structures, and points of discharge to the receiving waters;

3. Dimensions, elevations, contours, or cross-sections of all treatment storage areas sufficient to determine stage-storage relationships of the storage area and the permanent pool depth and volume below the control elevation for normally wet systems, when appropriate;

4. Dimensions, elevations, contours, final grades, or cross-sections of the system to determine flow directions and conveyance of runoff to the treatment system;

5. Dimensions, elevations, contours, final grades, or cross-sections of all conveyance systems utilized to convey off-site runoff around the system;

6. Existing water elevation(s) and the date determined; and

7. Elevation and location of benchmark(s) for the survey.

(k) The operation phase of this permit shall not become effective until the permittee has complied with the requirements of the condition in paragraphs (i and j) above, the Department determines the system to be in compliance with the permitted plans, and the entity approved by the Department in accordance with subsections 7.1.1 through 7.1.4 of the Applicant's Handbook: Management and Storage of Surface Waters, accepts responsibility for operation and maintenance of the system. The permit may not be transferred to such an approved operation and maintenance entity until the operation phase of the permit becomes effective. Following inspection and approval of the permitted system by the Department, the permittee shall request transfer of the permit to the responsible approved operation and maintenance entity, if different from the permittee. Until the permit is transferred pursuant to section 7.1 of the Applicant's Handbook: Management and Storage of Surface Waters, the permittee shall be liable for compliance with the terms of the permit.

(l) Should any other regulatory agency require changes to the permitted system, the permittee shall provide written notification to the Department of the changes prior to implementation so that a determination can be made whether a permit modification is required.

(m) This permit does not eliminate the necessity to obtain any required federal, state, local and special district authorizations prior to the start of any activity approved by this permit. This permit does not convey to the permittee or create in the permittee any property right, or any interest in real property, nor does it authorize any entrance upon or activities on property which is not owned or controlled by the permittee, or convey any rights or privileges other than those specified in the permit and chapter 40C-4 or chapter 40C-40, F.A.C.

(n) The permittee is hereby advised that section 253.77, F.S., states that a person may not commence any excavation, construction, or other activity involving the use of sovereign or other lands of the state, the title to which is vested in the Board of Trustees of the Internal Improvement Trust Fund without obtaining the required lease, license, easement, or other form of consent authorizing the proposed use. Therefore, the permittee is responsible for obtaining any necessary authorizations from the Board of Trustees prior to commencing activity on sovereignty lands or other state-owned lands.

(o) The permittee shall hold and save the Department harmless from any and all damages, claims, or liabilities which may arise by reason of the activities authorized by the permit or any use of the permitted system.

(p) Any delineation of the extent of a wetland or other surface water submitted as part of the permit application, including plans or other supporting documentation, shall not be considered specifically approved unless a specific condition of this permit or a formal determination under section 373.421(2), F.S., provides otherwise.

(q) The permittee shall notify the Department in writing within 30 days of any sale, conveyance, or other transfer of ownership or control of the permitted system or the real property at which the permitted system is located. All transfers of ownership or transfers of a permit are subject to the requirements of section 62-343.130, F.A.C. The permittee transferring the permit shall remain liable for any corrective actions that may be required as a result of any permit violations prior to such sale, conveyance or other transfer.

(r) Upon reasonable notice to the permittee, Department authorized staff with proper identification shall have permission to enter, inspect, sample and test the system to insure conformity with the plans and specifications approved by the permit.

(s) If historical or archaeological artifacts are discovered at any time on the project site, the permittee shall immediately notify the Department.

(t) The permittee shall immediately notify the Department in writing of any previously submitted information that is later discovered to be inaccurate.

SPECIFIC CONDITIONS:

1. NOTICE: If any of the specific conditions listed below are in conflict with any of the general conditions listed in this permit, the specific conditions shall take precedence over the general condition(s).
2. This permit does not supercede any conditions of DEP Permit No. 16-156348-002-EI. The permittee shall comply with all conditions for the stormwater treatment system authorized in permit No. 16-156348-002-EI.

3. All construction, operation, and maintenance of the stormwater system shall be as set forth in the plans, specifications, and performance criteria contained in the Department file and approved by this permit. Any deviation from the permitted plans are to be addressed by the department prior to their implementation to determine if a modification to the permit is required.

4. Turbidity barriers shall be installed at all locations where the possibility of transferring suspended solids into the receiving water body exists due to the proposed work. Turbidity barriers shall remain in place at all locations until construction is completed and soils are stabilized and vegetation has been established. The Permittee shall be responsible for the removal of the barriers.

5. At a minimum, all retention and detention storage areas must be excavated to rough grade prior to or concurrent with building construction or placement of impervious surface within the area served by those facilities. To prevent reduction in storage volume and percolation rates, all accumulated sediment must be removed from the storage area prior to final grading and stabilization.

6. If historical or archaeological artifacts, such as, but not limited to, Indian canoes, arrow heads, pottery or physical remains, are discovered at any time within the project site the permittee shall immediately stop all activities which disturb the soil and contact the Northeast District Office of the Department of Environmental Protection and the Bureau of Historic Preservation, Division of Historical Resources, R.A. Gray Building, 500 South Bronough, Tallahassee, Florida, 32399-0250. Any activity which causes the disturbance of the soil may not resume without the written authorization from the Division of Historic Resources.

7. All disturbed areas, swales, retention/detention basin side slopes, and roadside slopes must be sodded or seeded and mulched within 30 days following their completion and a substantial vegetation cover must be established within 60 days of seeding. Erosion preventive measures must be taken to ensure establishment of vegetative cover. All critical slopes immediately above the detention/retention basin must be seeded, mulched, or sodded as required for preventing sedimentation or clogging of the detention/retention basin.

8. The Permittee must obtain an individual permit pursuant to 40C-4 F.A.C. prior to beginning construction of any work not authorized by this permit.

9. The Permittee shall provide the Northeast District Office of DEP with prior written notice within 30 days of the date the work authorized by this permit is to commence.

10. Department of Environmental Protection staff, upon proper identification, shall have permission to enter, inspect, and observe the system to insure conformity with the plans and specifications approved by this permit.

11. This permit for construction will expire five (5) years from the date of issuance.

12. All wetland areas or water bodies which are outside of the specific limits of construction authorized by this permit must be protected from erosion, siltation, scouring, or excess turbidity and dewatering.

13. The Department must be notified, in writing, within 30 days of any sale, conveyance, or other transfer of a permitted system or facility or within 30 days of any transfer of ownership or control of the real property at which the permitted system or facility is located. Transfer of this permit shall be in accordance with the provisions of Chapter 373 F.S. and Chapter 40C-4, 40C-40, and 40C-41 F.A.C. All terms and conditions of this permit shall be binding upon the transferee.

14. If any other regulatory agency should require revisions or modification to the permitted project, the Department is to be notified of the revisions prior to any implementation of such revisions so that a determination can be made whether a permit modification is required.

15. The Permittee is responsible for the selection, implementation, and operation of all erosion and sediment controls on-site and to prevent violations of water quality standards in Chapters 62-3 and 62-4, F.A.C. The Permittee is encouraged to use the appropriate Best Management Practices described in the Florida Land Development Manual: A guide to Sound Land and Water Management (DER, 1988).

16. Within thirty (30) days after sale or conveyance of the permitted surface water management system or the land on which the system is located, the owner in whose name the permit was granted shall notify the Department of such change of ownership. Transfer of this permit shall be in accordance with the provisions of Chapter 373, Florida Statutes, and Chapters 40C-4, and 40C-41, Florida Administrative Code. All terms and conditions of this permit shall be binding upon the transferee.

17. The following operational maintenance activities shall be performed on all permitted systems on a regular basis or as needed:

    (a) Removal of trash and debris.

    (b) Inspection of inlets and outlets.

    (c) Removal of sediments when the storage volume or conveyance capacity of the system is below design level or when the system is rendered ineffective on account of clogging/sedimentation of the pond bottoms.

    (d) Stabilization and restoration of eroded areas.

    (e) Mowing and removal of grass clippings.

    (f) Aeration, tilling or replacement of topsoil as needed to restore percolation capability of the system.

    (g) Replanting if vegetative cover in littoral zones falls below 80% coverage.

    The stormwater management system shall be inspected after each heavy rain, but at a minimum once per quarter.

18. The permittee is required to provide for periodic inspections of the stormwater management system. The permittee shall submit reports to the Department certifying that the stormwater management system is operating as designed. The reports shall be submitted to the Department as follows:

    (a) Inspection reports for retention, underdrain, wet detention (with/without littoral shelf), and swales shall be submitted one year after completion of construction and every year thereafter. A registered Florida Professional Engineer must sign and seal the report certifying the system is functioning as designed.

(b) Inspection reports for filtration treatment systems and pumped systems shall be submitted one year after completion of construction and every year thereafter. A registered Florida Professional Engineer must sign and seal the report certifying the filtration treatment system and/or pumped system is operating as designed.

(c) Each inspection shall be documented and kept on file at the facility office. Each inspection report shall contain, as a minimum; date, name of inspector, as found condition of major system features, and nature and extent of maintenance/repair performed.

(d) The Reports shall be submitted to the Department's Stormwater Engineer at 7825 Baymeadows Way, Suite B-200, Jacksonville, FL 32256-7590.

19. If stormwater management system is not functioning as designed and permitted, operational maintenance must be performed immediately to restore the system. If operational maintenance measures are insufficient to enable the system to meet the design standards, the permittee must either replace the system or construct an alternative design. In this connections, the permittee must submit a permit modification application within sixty (60) days of the date the system was determined to be design deficient.

20. The Permittee shall immediately notify the Department by telephone whenever a serious problem occurs at this facility. During regular business hours notification shall be made to the Northeast District Office at (904) 448-4300. If an emergency occurs outside regular business hours, the Permittee shall telephone the 24-hour emergency phone number (904) 488-1320. This number is for emergencies only. Within 7 days of telephone notification, the Permittee shall submit to the Department a written report explaining the extent of the problem, its cause, and what actions have been or will be taken to correct the problem.

21. Pursuant to F.A.C. Rule 62-4.090, sixty (60) days prior to the expiration date of this permit, the Permittee shall apply for a renewal of the permit on forms and in a manner prescribed by the Department.

22. Outfall ditches must be inspected monthly, with the removal of trash, debris, silt and vegetation when necessary to insure proper drainage of stormwater ponds. A copy of these inspections are to be submitted to the Department as part of the yearly inspection report. The Inspection Report is to be signed and sealed by a registered Florida Professional Engineer.

23. Construction of the stormwater management system must be complete and all disturbed areas stabilized in accordance with permitted plans and conditions prior to any of the following: issuance of the first certificate of occupancy; initiation of intended use of the infrastructure; or transfer of responsibility of maintenance of the system to a local government or other responsible entity.

24. The project shall comply with applicable State Water Quality Standards, namely:
    a) Surface Waters, Minimum Criteria, General Criteria - **62-302.500,**
    b) Class III Waters - Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife. - **62-302.400**

25. The structure authorized by this permit shall not be placed on any property, other than that owned by the permittee, without the prior written approval of that property owner.

26. During construction, all wetland areas and surface waters which are outside the specific limits of construction authorized by this permit shall be protected from erosion, siltation, scouring or excess turbidity or dewatering. Within 14 days after the areas have stabilized the controls shall be removed.

27. The existing patrol road located within the area labeled as "Area of Additional Mitigation Area=50,887 SF on Figure 1 shall be excavated down to an elevation that matches the adjacent wetland areas.

28. Equipment used to excavate the existing patrol road shall be confined to upland areas and shall not enter the existing wetland areas.

29. The material excavated from the existing patrol road shall be disposed at an appropriate upland disposal site.

CONSERVATION EASEMENT

30. All written notifications and reports required in the following conditions shall be submitted to the Submerged Lands and Environmental Resources Program, 7825 Baymeadows Way, Suite B-200, Jacksonville, FL 32256-7590, phone number (904)448-4340. All written notifications shall include the permittee name and permit number.

31. The permit does not supercede or modify any conditions of DEP Permit No. 16-156348-002-EI. The permittee shall comply with all conditions and success criteria for the wetland creation authorized in permit No. 16-156348-002-EI.

32. The permittee shall record a Conservation Easement over the 30± acres (approximate) wetland and upland buffer indicated on Drawing Number S1000 received on and dated May 5, 2000 and labeled as 'Cons. Easement'. The Conservation Easement shall be recorded within 90 days of the issuance date of this permit. The Conservation Easement shall be in accordance with Section 704.06, Florida Statutes (F.S.) prohibiting all construction including clearing, dredging or filling, except that which is authorized by this permit. The Conservation Easement shall contain provisions as set forth in subsections 1(a)-(h) of Section 704.06, F.S. as well as provisions indicating that they may be enforced by the Department and may not be amended without the Department's approval. Prior to recording, the conservation Easement shall be submitted to the Department for review and approval. Following Department approval and within 14 days after recording the Conservation Easement, the permittee shall submit a certified copy of the recorded easement showing the date recorded and the official records and page number.

33. The Conservation Easement submitted to the Department for review and approval prior to recording shall include the following information:

I. TITLE INFORMATION

1. Proof of ownership as a deed or updated title certificate.
2. Affidavit of lien status.
3. If lien on the property exists, subordination/release/joinder agreement.

II. BOUNDARY INFORMATION

1. Legal description of the proposed Conservation Easement.
2. A survey of the proposed Conservation Easement.

PERMITTEE:
Mr. Walter P. Bussells
JEA

PERMIT NUMBER: 16-156348-003-ES
DATE OF ISSUE: June 9, 2000
EXPIRATION DATE: June 9, 2005

Both documents shall be certified by a registered land surveyor and should reference each other if on separate pages.

Executed in Jacksonville, Florida.

Issued this 9th day of June, 2000.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

Jeremy Tyler
Environmental Administrator
Submerged Lands and
Environmental Resources Program

Copy to: Francine Ffolkes, DEP Attorney
US Army Corps of Engineers, Jacksonville District
Mike Soltys, Black & Veatch Corp.

CERTIFICATE OF SERVICE

The undersigned duly designated deputy clerk hereby certifies that this NOTICE OF PERMIT and all copies were mailed before the close of business on 6/12/00 to the listed persons.

Poor Original

FILING AND ACKNOWLEDGEMENT
FILED, on this date, pursuant to §120.52, Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.
Linda Platton 6/12/00
Clerk Date

Consumptive Use Permit

IMAGE QUALITY

AS YOU REVIEW THE NEXT FEW PAGES, PLEASE NOTE THAT THE ORIGINAL DOCUMENT WAS OF POOR QUALITY.

Susan Hughes Henry Dean, Executive Director
John R. Wehle, Assistant Executive Director

ST. JOHNS RIVER WATER MANAGEMENT DISTRICT

POST OFFICE BOX 1429 PALATKA, FLORIDA 32178-1429
TELEPHONE 904-329-4500 SUNCOM 904-860-4500
TDD 904-329-4450 TDD SUNCOM 860-4450
FAX (Executive) 329-4125 (Legal) 329-4485 (Permitting) 329-4315 (Administration/Finance) 329-4508

SERVICE CENTERS

618 E. South Street
Orlando, Florida 32801
407-897-4300
TDD 407-897-5960

7775 Baymeadows Way
Suite 102
Jacksonville, Florida 32256
904-730-6270
TDD 904-448-7900

PERMITTING:
305 East Drive
Melbourne, Florida 32904
407-984-4940
TDD 407-722-5368

OPERATIONS:
2133 N. Wickham Road
Melbourne, Florida 32935-8109
407-752-3100
TDD 407-752-3102

October 3, 2000

rec'd 10/9/00 $100.

Jacksonville Electrical Authority
21 W Church St F16
Jacksonville, FL 32202

SUBJECT: Consumptive Use Permit Number 51629
Brandy Branch Generating Station
Dear Sir/Madam:

Enclosed is your permit and the forms necessary for submitting information to comply with conditions of the permit as authorized by the St. Johns River Water Management District on October 03, 2000.

Permit issuance does not relieve you from the responsibility of obtaining permits from any federal, state and/or local agencies asserting concurrent jurisdiction over this work.

The enclosed permit is a legal document and should be kept with your other important records. Please read the permit and conditions carefully since the referenced conditions may require submittal of additional information. All information submitted as compliance with permit conditions must be submitted to the nearest District Service Center and should include the above referenced permit number.

Please be advised that the period of time within which a third party may request an administrative hearing on this permit may not have expired by the date of issuance. A potential petitioner has twenty-six (26) days from the date on which the actual notice is deposited in the mail, or twenty-one (21) days from publication of this notice when actual notice is not provided, within which to file a petition for an administrative hearing pursuant to Sections 120.569 and 120.57, Florida Statutes. Receipt of such a petition by the District may result in this permit becoming null and void.

Sincerely,

Gloria Lewis

Gloria Lewis, Director
Permit Data Services Division

Enclosures: Permit, Conditions for Issuance, Compliance Forms, Map,Well Tags

cc: District Permit File

Agent: Black & Veatch
11401 Lamar
Overland Park, KS 66221

William Kerr, CHAIRMAN MELBOURNE BEACH
Ometrias D. Long, VICE CHAIRMAN APOPKA
Jeff K. Jennings, SECRETARY MAITLAND
Duane Ottenstroer, TREASURER SWITZERLAND
Dan Roach FERNANDINA BEACH
William M. Segal MAITLAND
Otis Mason ST. AUGUSTINE
Clay Albright EAST LAKE WEIR
Reid Hughes DAYTONA BEACH

PERMIT NO. 51629 **DATE ISSUED:** October 3, 2000

PROJECT NAME: Brandy Branch Generating Station

A PERMIT AUTHORIZING:

The District authorizes the use of 73.58 million gallons per year of groundwater from the Floridan aquifer for power production, essential and potable uses in 2010.

LOCATION:

Site: Brandy Branch Generating Station
Duval County

Section(s): 13, 18 Township(s): 2S Range(s): 23E

ISSUED TO:

Jacksonville Electrical Authority
21 W Church St F16
Jacksonville, FL 32202

Permittee agrees to hold and save the St. Johns River Water Management District and its successors harmless from any and all damages, claims, or liabilities which may arise from permit issuance. Said application, including all maps and specifications attached thereto, is by reference made a part hereof.

This permit does not convey to permittee any property rights nor any rights of privileges other than those specified herein, nor relieve the permittee from complying with any law, regulation or requirement affecting the rights of other bodies or agencies. All structures and works installed by permittee hereunder shall remain the property of the permittee.

This permit may be revoked, modified or transferred at any time pursuant to the appropriate provisions of Chapter 373, Florida Statutes and 40C-1, Florida Administrative Code.

PERMIT IS CONDITIONED UPON:

See conditions on attached "Exhibit A", dated October 3, 2000

AUTHORIZED BY: St. Johns River Water Management District
Department of Resource Management

By: _____
Dwight T Jenkins
Division Director

"EXHIBIT A"
CONDITIONS FOR ISSUANCE OF PERMIT NUMBER 51629
JACKSONVILLE ELECTRICAL AUTHORITY
DATED OCTOBER 3, 2000

1. District Authorized staff, upon proper identification, will have permission to enter, inspect and observe permitted and related facilities in order to determine compliance with the approved plans, specifications and conditions of this permit.

2. Nothing in this permit should be construed to limit the authority of the St. Johns River Water Management District to declare a water shortage and issue orders pursuant to Section 373.175, Florida Statutes, or to formulate a plan for implementation during periods of water shortage, pursuant to Section 373.246, Florida Statutes. In the event a water shortage, is declared by the District Governing Board, the permittee must adhere to the water shortage restriction as specified by the District, even though the specified water shortage restrictions may be inconsistent with the terms and conditions of this permit.

3. Prior to the construction, modification, or abandonment of a well, the permittee must obtain a Water Well Construction Permit from the St. Johns River Water Management District, or the appropriate local government pursuant to Chapter 40C-3, Florida Administrative Code. Construction, modification, or abandonment of a well will require modification of the consumptive use permit when such construction, modification or abandonment is other than that specified and described on the consumptive use permit application form.

4. Leaking or inoperative well casings, valves, or controls must be repaired or replaced as required to eliminate the leak or make the system fully operational.

5. Off-site land uses existing at the time of permit application may not be significantly adversely impacted as a result of the consumptive use. If unanticipated significant adverse impacts occur, the District shall revoke the permit in whole or in part to curtail or abate the adverse impacts, unless the impacts can be mitigated by the permittee.

6. The District must be notified, in writing, within 30 days of any sale, conveyance, or other transfer of a well or facility from which the permitted consumptive use is made or within 30 days of any transfer of ownership or control of the real property at which the permitted consumptive use is located. All transfers of ownership or transfers of permits are subject to the provisions of section 40C-1.612, Florida Administrative Code.

7. Landscape irrigation is prohibited between the hours of 10:00 a.m. and 4:00 p.m., except

as follows:

a) Irrigation using a micro-irrigation system is allowed anytime.

(b) The use of reclaimed water for irrigation is allowed anytime, provided appropriate signs are placed on the property to inform the general public and District enforcement personnel of such use. Such signs must be in accordance with local restrictions.

(c) Irrigation of, or in preparation for planting, new landscape is allowed any time of day for one 30 day period provided irrigation is limited to the amount necessary for plant establishment.

(d) Watering in of chemicals, including insecticides, pesticides, fertilizers, fungicides, and herbicides when required by law, the manufacturer, or best management practices is allowed anytime within 24 hours of application.

(e) Irrigation systems may be operated anytime for maintenance and repair purposes not to exceed ten minutes per hour per zone.

8. All submittals made to demonstrate compliance with this permit must include the permit number 51629 plainly labeled on the submittal.

9. This permit will expire on October 3, 2010.

10. Legal uses of water existing at the time of the permit application may not be interfered with by the consumptive use. If unanticipated interference occurs, the District may revoke the permit in whole or in part to curtail or abate the interfer-ence unless the permittee mitigates for the interference. The permittee must submit a mitigation plan to the District for approval prior to implementing any mitigation.

11. Maximum annual groundwater withdrawals from the Floridan aquifer for power production use must not exceed:
,43.290 million gallons in 2000 through 2002,
,53.385 million gallons in 2003 through 2005,
,63.479 million gallons in 2006 through 2008,
,73.574 million gallons in 2009 through 2010.

12. Maximum daily groundwater withdrawals from the Floridan aquifer for essential (fire protection) use must not exceed 2.592 million gallons (mgals).

13. Maximum annual groundwater withdrawals from the Floridan aquifer for household use must not exceed .010 million gallons (mgals).

14. Groundwater wells No. PW-1 (GRS ID 22278) and PW-2 (GRS ID 22279), as listed on the application, must be equipped with totalizing meters prior to use. These flow meters must remain for the duration of this permit. These meters must maintain 95% accuracy, be verifiable, and be installed to the manufacturer's specifications.

15. Total withdrawals from wells No. PW-1 (GRS ID 22278) and PW-2 (GRS ID 22279), as listed on the application, must be recorded continuously, totaled monthly, and reported to the District at least every six months for the duration of this permit using Form #EN-50. The reporting dates each year will be as follows for the duration of the permit:

Reporting Period	Report Due Date
January - June	July 31
July - December	January 31

16. Permittee must maintain all flow meters for the duration of this permit. In case of failure or breakdown of any meter, the District must be notified in writing within 5 days of its discovery. A defective meter must be repaired or replaced within 30 days of its discovery.

17. Permittee must have all flow meters checked for accuracy at least once every 3 years, and recalibrated if the difference between the actual flow and the meter reading is greater than 5% or if the difference between the actual flow and the alternative method measurement is greater than 10%. District Form #EN-51 must be submitted to the District within 10 days of the inspection/calibration.

18. The permittee must implement the Water Conservation Plan received by the District on July 8, 1999, and subsequently approved by District staff. A report detailing the progress of plan implementation must be submitted to the District by November 30, 2005.

19. The permittee must accept and use reclaimed water from the Town of Baldwin within 6 months of it becoming available to the site, if it has been determined by the District that the use of reclaimed water at this site, from the Town of Baldwin, is technically and economically feasible, and permissible under State and Federal statutes or regulations promulgated thereunder.

20. The Permittee must collect a water quality sample from the Floridan aquifer well wells No. PW-1 (GRS ID 22278) in May of each year and have the sample analyzed for the following:

Chlorides	Total Iron
Sulfates	Total Hardness
Calcium,	Magnesium
Field Temperature	Sodium
Specific Conductance	Potassium

Field pH, Carbonate - field & lab
Bi-carbonate - total alkalinity if pH is 6.9 or lower

otal dissolved solids

Quality Assurance
Prior to sample collection, a minimum of 3-5 casing volumes must be removed from each well. All major ion analyses must be checked for anion-cation balance and must balance within 5%. It is recommended that duplicates be taken to al-low for laboratory errors or data loss.

All sampling and water quality analysis shall be performed by organizations with District approved comprehensive or generic quality assurance plans (COMQAPS) on file with the Department of Environmental Protection or a labo-ratory having DHRS certification.

A report including all sample analysis and an evaluation of the data must be submitted to the District within 30 days of receipt from the laboratory. If the Dis-trict determines that unacceptable water quality degradation is occurring as a re-sult of the withdrawals authorized by this permit, the District shall revoke the permit in whole or in part to curtail or abate the water quality degradation.

21. Prior to the construction, modification or abandonment of a well, the permittee must obtain a Water Well Construction Permit from the Department of Health, Welfare & Bio-environmental Services, pursuant to an Inter-agency Agreement with the St. Johns River Water Management District and Duval County signed November 29, 1978. Construction, modification or abandonment of a water well will require modification of the Consumptive Use Permit when such construction, modification or abandonment is other than that specified and described on the Consumptive Use Permit Application Form.

Notice Of Rights

1. A person whose substantial interests are or may be determined has the right to request an administrative hearing by filing a written petition with the St. Johns River Water Management District (District), or may choose to pursue mediation as an alternative remedy under Sections 120.569 and 120.573, Florida Statutes, before the deadline for filing a petition. Choosing mediation will not adversely affect the rights to a hearing if mediation does not result in a settlement. The procedures for pursuing mediation are set forth in Sections120.569 and 120.57, Florida Statutes, and Rules 28-106.111 and 28-106.401-.405, Florida Administrative Code. Pursuant to Chapter 28-106 and Rule 40C-1.1007, Florida Administrative Code, the petition must be filed at the office of the District Clerk at District Headquarters, P. O. Box 1429, Palatka, Florida 32178-1429 (4049 Reid St., Palatka, FL 32177) within twenty-six (26) days of the District depositing notice of District decision in the mail (for those persons to whom the District mails actual notice) or within twenty-one (21) days of newspaper publication of the notice of District decision (for those persons to whom the District does not mail actual notice). A petition must comply with Chapter 28-106, Florida Administrative Code.

2. If the Governing Board takes action which substantially differs from the notice of District decision, a person whose substantial interests are or may be determined has the right to request an administrative hearing or may choose to pursue mediation as an alternative remedy as described above. Pursuant to District Rule 40C-1.1007, Florida Administrative Code,the petition must be filed at the office of the District Clerk at the address described above, within twenty-six (26) days of the District depositing notice of final District decision in the mail (for those persons to whom the District mails actual notice) or within twenty-one (21) days of newspaper publication of the notice of its final agency action (for those persons to whom the District does not mail actual notice).
   Such a petition must comply with Rule Chapter 28-106, Florida Administrative Code.

3. A substantially interested person has the right to a formal administrative hearing pursuant to Section 120.569 and 120.57(1), Florida Statutes, where there is a dispute between the District and the party regarding an issue of material fact. A petition for formal hearing must comply with the requirements set forth in Rule 28-106.201, Florida Administrative Code.

4. A substantially interested person has the right to an informal hearing pursuant to Sections 120.569 and 120.57(2), Florida Statutes, where no material facts are in dispute. A petition for an informal hearing must comply with the requirements set forth in Rule 28-106.301, Florida Administrative Code.

5. A petition for an administrative hearing is deemed filed upon delivery of the petition to the District Clerk at the District headquarters in Palatka, Florida.

6. Failure to file a petition for an administrative hearing, within the requisite time frame shall constitute a waiver of the right to an administrative hearing (Section 28-106.111, Florida Administrative Code).

7. The right to an administrative hearing and the relevant procedures to be followed are governed by Chapter 120, Florida Statutes, and Chapter 28-106, Florida Administrative Code and Section 40C-1.1007, Florida Administrative Code.

Notice Of Rights

8. An applicant with a legal or equitable interest in real property who believes that a District permitting action is unreasonable or will unfairly burden the use of his property, has the right to, within 30 days of receipt of notice of the District's written desision regarding a permit application, apply for a special master proceeding under Section 70.51, Florida Statutes, by filing a written request for relief at the office of the District Clerk located at District headquarters, P. O. Box 1429, Palatka, FL 32178-1429 (4049 Reid St., Palatka, Florida 32177). A request for relief must contain the information listed in Subsection 70.51(6), Florida Statutes.

9. A timely filed request for relief under Section 70.51, Florida Statutes, tolls the time to request an administrative hearing under paragraph no. 1 or 2 above (Paragraph 70.51(10)(b), Florida Statutes). However, the filing of a request for an administrative hearing under paragraph no. 1 or 2 above waives the right to a special master proceeding (Subsection 70.51(10)(b), Florida Statutes).

10. Failure to file a request for relief within the requisite time frame shall constitute a waiver of the right to a special master proceeding (Subsection 70.51(3), Florida Statutes).

11. Any substantially affected person who claims that final action of the District constitutes an unconstitutional taking of property without just compensation may seek review of the action in circuit court pursuant to Section 373.617, Florida Statutes, and the Florida Rules of Civil Procedures, by filing an action in circuit court within 90 days of the rendering of the final District action, (Section 373.617, Florida Statutes).

12. Pursuant to Section 120.68, Florida Statutes, a person who is adversely affected by final District action may seek review of the action in the District Court of Appeal by filing a notice of appeal pursuant to the Florida Rules of Appellate Procedure within 30 days of the rendering of the final District action.

13. A party to the proceeding before the District who claims that a District order is inconsistent with the provisions and purposes of Chapter 373, Florida Statutes, may seek review of the order pursuant to Section 373.114, Florida Statutes, by the Florida Land and Water Adjudicatory Commission, by filing a request for review with the Commission and serving a copy on the Department of Environmental Protection and any person named in the order within 20 days of adoption of a rule or the rendering of the District order.

14. For appeals to the District Court of Appeal, a District action is considered rendered after it is signed on behalf of the District, and is filed by the District Clerk.

15. Failure to observe the relevant time frames for filing a petition for judicial review described in paragraphs #11 and #12, or for Commission review as described in paragraph #13, will result in waiver of that right to review.

Notice Of Rights

Certificate of Service

I HEREBY CERTIFY that a copy of the foregoing Notice of Rights has been sent by U.S. Mail to:

Jacksonville Electrical Authority
21 W Church St F16
Jacksonville, FL 32202

at 4:00 p.m. this ~~3rd~~ 5th day of October, 2000.

Gloria Lewis

Division of Permit Data Services
Gloria Lewis, Director

St. Johns River Water Management District
Post Office Box 1429
Palatka, FL 32178-1429
(904) 329-4152

Permit Number: 51629

Industrial Wastewater Permit Exemption

Department of Environmental Protection

Jeb Bush
Governor

Northeast District
7825 Baymeadows Way, Suite B200
Jacksonville, Florida 32256-7590

David B. Struhs
Secretary

October 6, 1999

CERTIFIED - RETURN RECEIPT

Ms. Susan N. Hughes, P.E.
Manager
Environmental Permitting & Compliance
Jacksonville Electric Authority
21 West Church Street
Jacksonville, Florida 32256-7590

Dear Ms. Hughes:

Duval County - Industrial Wastewater
JEA Brandy Branch Generating Station
Groundwater Monitoring Exemption
Industrial Wastewater Permit Exemption

Reference is made to your September 20, 1999, letter requesting the withdrawal of your application for industrial wastewater permit, and request for industrial wastewater permit and ground water monitoring exemptions for the subject facility. Prior to your September 20, letter the Department had already completed review of your application and made the determination that neither an industrial wastewater permit or ground water monitoring would be required.

JEA Brandy Branch is a proposed simple cycle 500 MW combustion turbine power plant owned and to be operated by the JEA. Bulk electricity will be generated by firing natural gas as the primary fuel. The permitting exemption applies to the disposal of industrial wastewater generated from pretreatment filter backwash water, fuel oil unloading and forwarding areas, miscellaneous plant and equipment drains, and secondary containment areas. All potential sources of industrial wastewater and contaminated storm water will be collected and routed to a 30,000 gallon oil/water separator and then to a percolation/evaporation pond. The percolation/evaporation pond is sized to contain the process/non process related wastewater and contaminated storm water from the 100 year 24 hour storm event with no discharge to surface waters of the state. Industrial sludge/solids, oily wastes and/or petroleum contact water generated at this facility shall be disposed of in accordance with the applicable requirements of FAC Chapter 62-701 and FAC Chapter 62-740. The facility will be located 1 mile North of US-90, approximately 1 mile to the Northeast of the Town of Baldwin, Duval County, Florida.

The Department considers the disposal of the above-described industrial wastewater to the percolation/evaporation pond to be exempt from the permitting requirements of Florida Administrative Code (FAC) Rule 62-4.040(1)(b).

The exemption of ground water monitoring requirements is also allowed, pursuant to Rule 62-522.600 (9)(b) FAC. This is supported by the consultant's calculations of specific parameter concentrations in the proposed final discharge meeting the applicable ground water standards of Rule 62-550.310, 62-550.320, FAC, and the minimum criteria of 62-520.400, FAC.

This exemption has one stipulation, pursuant to Rule 62-522.600 (9)(b), FAC. **Within 30 days of the subject facility's initial effluent discharge, a one-time wastewater characterization of the final effluent must be conducted.** This effluent sampling shall include the following parameters: total dissolved solids, polycyclic aromatic hydrocarbons, and sodium. Samples shall be collected after final treatment and prior to discharge to the percolation/evaporation pond. The analytical results shall be submitted to the Ground Water Section at the letter head address.

Use of chemical additives or treatment that was not proposed or evaluated for operations at the installation is not authorized under this exemption. Should the discharge be subsequently found to pose a threat to the environment or public health, this exemption shall be terminated and the discharge re-evaluated under the applicable portions of Chapters 62-4, 62-520, 62-522, and 62-620 or 62-660, FAC.

This permitting exemption only relates to industrial wastewater and ground water permitting requirements from the Department and does not relieve you from the responsibility of obtaining any required permits from other state, federal, or local agencies.

A person whose substantial interests are affected by the Department's proposed permitting decision may petition for an administrative proceeding (hearing) under sections 120.569 and 120.57 of the Florida Statutes. Please see Attachment 1, "Notice of Rights" for additional information. If you have any questions regarding this matter, please call Ken Kohn at (904) 448-4330, extension 310.

Sincerely,

Jeremy Tyler

for Jerry M. Owen, P.E.
Water Facilities Administrator

KK

Attachment

cc: J. Michael Soltys

n:iw/kohn/letters/exempt/jeabrandy/exempt

Division of Historical Resources Letter

DIVISIONS OF FLORIDA DEPARTMENT OF STATE
Office of the Secretary
Office of International Relations
Division of Elections
Division of Corporations
Division of Cultural Affairs
Division of Historical Resources
Division of Library and Information Services
Division of Licensing
Division of Administrative Services

MEMBER OF THE FLORIDA CABINET
State Board of Education
Trustees of the Internal Improvement Trust Fund
Administration Commission
Florida Land and Water Adjudicatory Commission
Siting Board
Division of Bond Finance
Department of Revenue
Department of Law Enforcement
Department of Highway Safety and Motor Vehicles
Department of Veterans' Affairs

FLORIDA DEPARTMENT OF STATE
Katherine Harris
Secretary of State
DIVISION OF HISTORICAL RESOURCES

March 24, 1999

Mr. J. Michael Soltys
Black & Veatch
P. O. Box 8405
Kansas City, Missouri 64114

RE: DHR Project File No. 988681
Cultural Resource Assessment Request
Construction and Operation of New Power Generation Facility and Associated Linear Facilities (Transmission Lines)
Duval County, Florida

Dear Mr. Soltys:

In accordance with the procedures contained in 36 C.F.R., Part 800 ("Protection of Historic Properties"), we have reviewed the referenced project(s) for possible impact to historic properties listed, or eligible for listing, in the National Register of Historic Places. The authority for this procedure is the National Historic Preservation Act of 1966 (Public Law 89-665), as amended.

A review of the Florida Site File indicates that no significant archaeological or historical sites are recorded for or likely to be present within the project area. Furthermore, because of the project location and/or nature it is unlikely that any such sites will be affected. Therefore, it is the opinion of this office that the proposed project will have no effect on historic properties listed, or eligible for listing, in the *National Register of Historic Places.*

If you have any questions concerning our comments, please contact Ms. Robin Jackson, Historic Sites Specialist at (850) 487-2333 or 1-(800) 847-7278. Your interest in protecting Florida's historic properties is appreciated.

Sincerely,

Laura A. Kammerer

for George W. Percy, Director
Division of Historical Resources
and
State Historic Preservation Officer

GWP/Jrj

R.A. Gray Building • 500 South Bronough Street • Tallahassee, Florida 32399-0250 • http://www.flheritage.com

☐ Director's Office (850) 488-1480 • FAX: 488-3355
☐ Archaeological Research (850) 487-2299 • FAX: 414-2207
☑ Historic Preservation (850) 487-2333 • FAX: 922-0496
☐ Historical Museums (850) 488-1484 • FAX: 921-2503
☐ Historic Pensacola Preservation Board (850) 595-5985 • FAX: 595-5989
☐ Palm Beach Regional Office (561) 279-1475 • FAX: 279-1476
☐ St. Augustine Regional Office (904) 825-5045 • FAX: 825-5044
☐ Tampa Regional Office (813) 272-3843 • FAX: 272-2340

10.4 State Permit Applications

10.4.1 Prevention of Significant Deterioration (PSD) Application

The construction and operation of the combined cycle unit will require a PSD permit. The PSD Air Permit Application is attached to this Site Certification Application as Appendix 10.7.

10.4.2 Consumptive Use Permit Application

An application for the additional project water use is included herein.

10.4.3 Public Drinking Water System Extension Permit Application

An application for extension of the potable water system to the new project facilities is included herein.

10.4.4 Industrial Wastewater Exemption Request

A letter request and supporting data for a continued exemption of the process wastewater treatment system is included herein.

10.4.5 Wastewater Collection/Transmission Systems

An application for discharge of the cooling water to the Baldwin Force Main is included herein.

Consumptive Use Permit Application

BRANDY BRANCH GENERATING STATION
CONSUMPTIVE USE PERMIT # 51629
REQUEST FOR MODIFICATION

PREFACE

JEA is currently constructing the Brandy Branch Generating Station (Station) a power plant located near Baldwin, in Duval County, Florida. JEA proposes to convert two of the three simple cycle units into a combined cycle unit by adding two heat recovery steam generators and associated plant equipment. The Station is presently operating under the Consumptive Use Permit referenced above. This permit modification is being submitted as part of the Site Certification Application process for the steam unit conversion, and is necessary since the modified unit will incorporate a cooling tower, which will increase water consumption. Commercial operation is scheduled for May of 2004.

WATER USE

The three simple cycle units are currently supplied by two wells at the site; each well has a 900 gpm pump. Two additional on-site well pumps are planned for the combined cycle unit. Process water demand, excluding cooling tower makeup, will be approximately 37 gpm. Additional water for the cooling tower will be approximately 1729 gpm, or 2.5 MGD when fired on natural gas. For the limited times when the units fire oil, the Station will require 3.2 MGD of water. Potable water is supplied by the City of Baldwin. Water mass balances are provided in the Water Conservation Plan attached as part of the application. A groundwater withdrawal study was performed to support the requested allocation, and is also included.

WASTEWATER

Process wastewater from cooling tower blowdown will be directed to the JEA publicly owned treatment works sewer system. Miscellaneous wastewaters from plant and equipment drains and site runoff from areas of potential oil contamination will be routed through an oil/water separator prior to disposal in a percolation pond, as regulated by the Florida Department of Environmental Protection.

PERMIT APPLICATION FOR CONSUMPTIVE USES OF WATER

Permit Type: Individual CUP ☐ Secondary Use ☐
Standard General CUP ☒
Application is for: New use ☐ Renewal ☐
Modification of Existing Permit ☒

APPLICANT INFORMATION

ORGANIZATION NAME (please print all responses)
JEA

LAST NAME (please print all responses)
BUSSELLS

FIRST NAME
WALTER P.

STREET NO. STREET NAME
21 WEST CHURCH ST

CITY
JACKSONVILLE

STATE
FL

ZIP
32202

PHONE
9046657220

AGENT OR CONSULTANT

☒ Same as above

ORGANIZATION NAME (please print all responses)

LAST NAME (please print all responses)

FIRST NAME

STREET NO. STREET NAME

CITY

STATE

ZIP

PHONE

Walter P. Bussells _____ 12/4/00
APPLICANT'S NAME (Please print) APPLICANT'S SIGNATURE DATE

If a person other than applicant has completed this form, that person certifies by his signature below that he is acting as an authorized agent of the applicant and his signature will be certification that he is in fact the authorized agent.

_____ _____ _____
AGENTS NAME (Please print) AGENTS SIGNATURE DATE

☒ Same as applicant | OWNER INFORMATION

LAST NAME (please print all responses)

FIRST NAME

STREET NO. STREET NAME TYPE CITY

STATE ZIP PHONE

SITE INFORMATION

COUNTY DUVAL ACRES OWNED 153

SECTION 13 & 18 TOWNSHIP 2S RANGE 23E

PROJ. NAME BRANDY BRANCH PROJECT ACRES 42

COUNTY PARCEL NO. 16 A,B,C,D

TYPE OF USE

DARKEN ALL THAT APPLY

AESTHETIC ○ AGRICULTURAL ○ AQUACULTURAL ○ COOLING AND AIR CONDITIONING ○

DEWATERING ○ COMMERCIAL AND INDUSTRIAL ⊗ ESSENTIAL ○ FREEZE PROTECTION ○

GOLF COURSE ○ RECREATION AREA ○ HOUSEHOLD TYPE ○ LIVESTOCK ○

NURSERY ○ URBAN LANDSCAPE IRRIGATION ○ WATER BASED RECREATION ○

UNACCOUNTED FOR WATER ○ OTHER ○

Permit No. 51 - 629 -

AMOUNT REQUESTED	
	INCHES PER YEAR N/A
	MILLION GALLONS PER YEAR 1,001.7
	MILLION GALLONS PER DAY 2.744 (Nat'l Gas)
	DATE OF START OF USE May 2004

WATER USE MONITORING

All permittees are required to measure their water usage on a continuous basis. All users must report their use using form EN-50 to the District at the intervals specified in their permit. If used, meters must be 95% accurate, verifiable and installed according to manufacturers' specifications. Meters or alternative methods utilized by the water supplier to charge for the water may suffice as a water use monitoring tool.

Alternative methods must be 90% accurate and verifiable. All alternative methods must be approved in advance and in writing by District staff.

O Same as applicant	COMPLIANCE ENTITY

Consumptive Use Permits require the periodic submittal of data to the District. Please provide the name, address and phone number of the person who will be responsible for ensuring that the permitted conditions are met. Submittal of this information does not relieve the permit holder from the responsibility for compliance.

Name: Susan N. Hughes
Address: 21 W. Church St., T-8
Jacksonville, FL 32202

Phone Number: (904)- 665-6248

SECONDARY TYPE USE

Please supply information regarding the source(s) of water for your activities.

1. The name of the supplier of water. City of Baldwin
2. Is this source of water potable or non-potable? (circle one)
3. What percentage of your total water use is from this supplier? 0.02%
4. If 100% of your water use is not provided from the supplier, please indicate what uses are self supplied.
   Process, Service
5. The applicant must also complete other packages which address the requested consumptive use identifed in question 4.

   The Commercial/Industrial package is attached

Description of Use Classes: Each permit shall be identified with one or more of the following use classifications:

(a) **Aesthetic use** - the use of water for fountains, waterfalls, and landscape lakes and ponds where such uses are entirely ornamental and decorative.

(b) **Agricultural use** - use of water for the commercial production of crops or the growing of farm products including, but not limited to, vegetables, citrus and other fruits, pasture, rice and sod.

(c) **Aquacultural use** - the use or withdrawal of water for cultivation of animal and plant life in a water environment, including but not limited to food fish, aquatic bait, game fish, aquatic plants (i.e. watercress), alligators, tropical fish, shellfish, and turtles.

(d) **Commercial and industrial process use** - the use of water essential to the production of the goods or services provided by a business establishment.

(e) **Cooling and air conditioning use** - the use of water for heating or cooling, or for air conditioning.

(f) **Dewatering use** - the removal of water from a specific area to facilitate mining or construction.

(g) **Essential use** - the use of water strictly for fire fighting purposes, health and medical purposes and the use of water to satisfy federal, state or local public health and safety requirements.

(h) **Freeze protection** - the periodc and infrequent use of water to protect agricultural and nursery crops from damage due to low temperatures.

(i) **Golf course use** - water used to irrigate an establishment designed and used for playing golf.

(j) **Household use** - the use of water for personal needs or for household purposes such as drinking, bathing, heating, cooking, sanitation or cleaning, whether the use occurs in a residence or in a business or industrial establishment.

(k) **Livestock use** - the use of water for watering or washing of livestock.

(l) **Nursery use** - the use of water on premises on or in which nursery stock is grown, propagated or held for sale or distribution or sold or reshipped.

(m) **Recreation area use** - the use of water for the maintenance and support of intensive recreational areas such as, but not limited to, playgrounds, football, baseball, and soccer fields.

(n) **Urban landscape irrigation** - the outside watering or sprinkling of shrubbery, trees, lawns, grass, ground covers, plants, vines, gardens and other such flora which are situated in such diverse locations as residential landscaping, recreational areas, cemeteries, public, commercial and industrial establishments, public medians and rights of way.

(o) **Water based recreation use** - water used for public or private swimming and wading pools, including water slides. This term does not include pools specifically maintained to provide habitat for aquatic life.

(p) **Water utility use** - water used for withdrawal, treatment, transmission and distribution by potable water systems.

SOURCES OF WATER
(Summary Data Sheet)

Please supply information regarding the source(s) of water for your activities. Include information regarding all wells/pumps on the property.

Table 1.
SUMMARY OF GROUND WATER SOURCES

Well or Pump Number	Wellfield or Facility Name	Casing Dia. (in)	Casing Depth (ft)	Total Depth (ft)	Operation Hrs/wk	Pump Capacity (in gpm)	Date Drilled	Existing or proposed (date)	Type of Use*
PW-1	*	12	500	800	89	900		Existing	(d)
PW-2	*	12	500	800	89	900		Exisitng	(d)
PW-3	*	12	500	800	89	900		5/04	(d)
PW-4	*	12	500	800	89	900		5/04	(d)

* - See use descriptions on page 4. If more than one use type, show predominate use

* Brandy Branch Generating Station

Table 2
SUMMARY OF SURFACE WATER SOURCES

Pump Number	Pump Capacity (gpm)	Operation Hrs/wk	Acreage of Surface Water Body	Name of Source	Status (date if proposed)	Type of Use

PROPERTY CONTROL AND LOCATION

I. PROPERTY CONTROL

1. Property Ownership - Provide a copy of the excuted deed indicating the current owner of the property which is the subject of this application. Attached

2. Leased Property - Provide a copy of the current lease, or a letter signed by the property owner describing the lease arrangement and the duration of the lease. N/A

II. LOCATION MAPS

Provide a recent map (preferably a USGS topographic quadrangle, a map from a county plat directory, or survey map) indicating the following:

Project/Well location map and site drawing attached.

(a) property boundaries (include approximate lengths of boundaries in feet); (public supply water uses please show service areas)
(b) All existing and proposed withdrawal point locations. Indicate well number and casing size for ground water withdrawals, and pump number and maximum pump capacity for surface water withdrawals;
(c) a north arrow;
(d) a scale designation - all maps should have a minimum scale of 1inch = 2,000 feet; and
(e) labeled landmarks such as roads and political boundaries.

Please provide identification numbers and date permitted if you obtained or are in the process of obtaining any of the following permits for this project

Environmental Resource Permit (ERP) 16-156348-002-EL

EPA Ordered Environmental Impact Statements _____

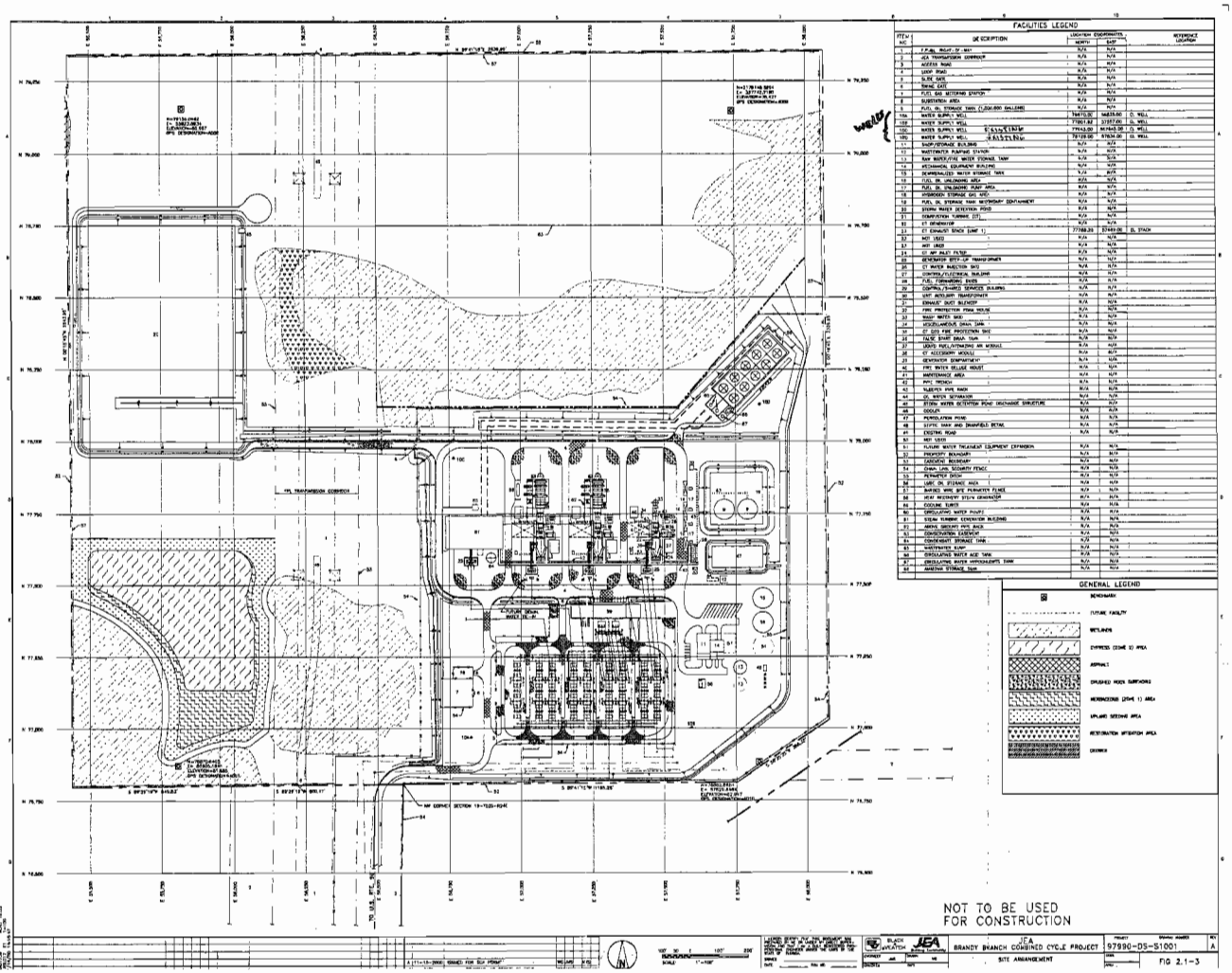
Agricultural Discharge _____

FDEP Wastewater Site Identification No. Exempt

FDEP Public Water Supply (PWS) Identification No. _____

IMAGE QUALITY

AS YOU REVIEW THE NEXT FEW PAGES, PLEASE NOTE THAT THE ORIGINAL DOCUMENT WAS OF POOR QUALITY.



FACILITIES LEGEND

ITEM NO.	DESCRIPTION	LOCATION COORDINATES NORTH	LOCATION COORDINATES EAST	REFERENCE LOCATION
1	T.P.&L. RIGHT-OF-WAY	N/A	N/A	
2	69 kV TRANSMISSION CORRIDOR	N/A	N/A	
3	ACCESS ROAD	N/A	N/A	
4	LOOP ROAD	N/A	N/A	
5	SLOPE GATE	N/A	N/A	
6	TURNING GATE	N/A	N/A	
7	FUEL GAS METERING STATION	N/A	N/A	
8	SUBSTATION AREA	N/A	N/A	
9	FUEL OIL STORAGE TANK (1,000,000 GALLONS)	N/A	N/A	
10A	WATER SUPPLY WELL	79615.82	44835.60	D. WELL
10B	WATER SUPPLY WELL	77901.82	31957.60	D. WELL
10C	WATER SUPPLY WELL	77943.00	44140.30	D. WELL
10D	WATER SUPPLY WELL	78159.00	47634.30	D. WELL
11	SHOP/STORAGE BUILDING	N/A	N/A	
12	WASTEWATER PUMPING STATION	N/A	N/A	
13	RAW WATER/FIRE WATER STORAGE TANK	N/A	N/A	
14	MECHANICAL EQUIPMENT BUILDING	N/A	N/A	
15	DEMINERALIZED WATER STORAGE TANK	N/A	N/A	
16	FUEL OIL UNLOADING AREA	N/A	N/A	
17	FUEL OIL UNLOADING PUMP AREA	N/A	N/A	
18	HYDROGEN STORAGE GAS YARD	N/A	N/A	
19	FUEL OIL STORAGE TANK WATERWAY CONTAINMENT	N/A	N/A	
20	STORM WATER DETENTION POND	N/A	N/A	
21	CWA/SYSTEM TURNING (T)	N/A	N/A	
22	CT DEMENTOR	N/A	N/A	
23	CT EXHAUST STACK (UNIT 1)	77788.23	37449.00	EL STACK
32	HOT WELL	N/A	N/A	
33	HOT LINER	N/A	N/A	
34	CT INF INLET FILTER	N/A	N/A	
35	GENERATOR STEP-UP TRANSFORMER	N/A	N/A	
36	CT WATER INJECTION SKID	N/A	N/A	
37	CONTROL/ELECTRICAL BUILDING	N/A	N/A	
38	FUEL FORWARDING SKIDS	N/A	N/A	
39	CONTROL/SHARED SERVICES BUILDING	N/A	N/A	
40	UNIT AUXILIARY TRANSFORMER	N/A	N/A	
41	EXHAUST DUCT SILENCER	N/A	N/A	
42	FIRE PROTECTION PUMP HOUSE	N/A	N/A	
43	WASH WATER SKID	N/A	N/A	
44	MISCELLANEOUS DRAIN TANK	N/A	N/A	
45	CT CO2 FIRE PROTECTION SKID	N/A	N/A	
46	TRUCK SHOP DRAIN TANK	N/A	N/A	
47	LIQUID FUEL/ATOMIZING AIR MODULE	N/A	N/A	
48	CT ACCESSORY MODULE	N/A	N/A	
49	GENERATOR COMPARTMENT	N/A	N/A	
50	FIRE WATER BELLOW HOUSE	N/A	N/A	
51	MAINTENANCE AREA	N/A	N/A	
52	HVAC TRENCH	N/A	N/A	
53	WASTEWATER RVR RACK	N/A	N/A	
54	OIL WATER SEPARATOR	N/A	N/A	
55	STORM WATER DETENTION POND DISCHARGE STRUCTURE	N/A	N/A	
56	GOOSE-C	N/A	N/A	
57	PERCOLATION POND	N/A	N/A	
58	SEPTIC TANK AND DRAINFIELD (ETAS)	N/A	N/A	
59	EXISTING ROAD	N/A	N/A	
60	MET TOWER	N/A	N/A	
61	FUTURE WATER TREATMENT EQUIPMENT EXPANSION	N/A	N/A	
62	PROPERTY BOUNDARY	N/A	N/A	
63	EASEMENT BOUNDARY	N/A	N/A	
64	BARBED WIRE SECURITY FENCE	N/A	N/A	
65	PERIMETER DITCH	N/A	N/A	
66	LAKE OR STORAGE AREA	N/A	N/A	
67	BARBED WIRE SITE PERIMETER FENCE	N/A	N/A	
68	HEAT RECOVERY STEAM GENERATOR	N/A	N/A	
69	COOLING TOWER	N/A	N/A	
70	CIRCULATING WATER PUMPS	N/A	N/A	
81	STEAM TURBINE GENERATOR BUILDING	N/A	N/A	
82	ABOVE GROUND PIPE RACK	N/A	N/A	
83	DEMINERALIZER EQUIPMENT	N/A	N/A	
84	CONDENSATE STORAGE TANK	N/A	N/A	
85	MAINTENANCE SUMP	N/A	N/A	
86	CIRCULATING WATER ACID TANK	N/A	N/A	
87	CIRCULATING WATER HYPOCHLORITE TANK	N/A	N/A	
88	HARDING STORAGE TANK	N/A	N/A	

GENERAL LEGEND

BENCHMARK

FUTURE FACILITY

WETLANDS

CYPRESS (ZONE 2) AREA

ASPHALT

CRUSHED ROCK SURFACING

HERBACEOUS (ZONE 1) AREA

SPLAME SEEDING AREA

REVEGETATION MITIGATION AREA

DRAINAGE

NOT TO BE USED FOR CONSTRUCTION

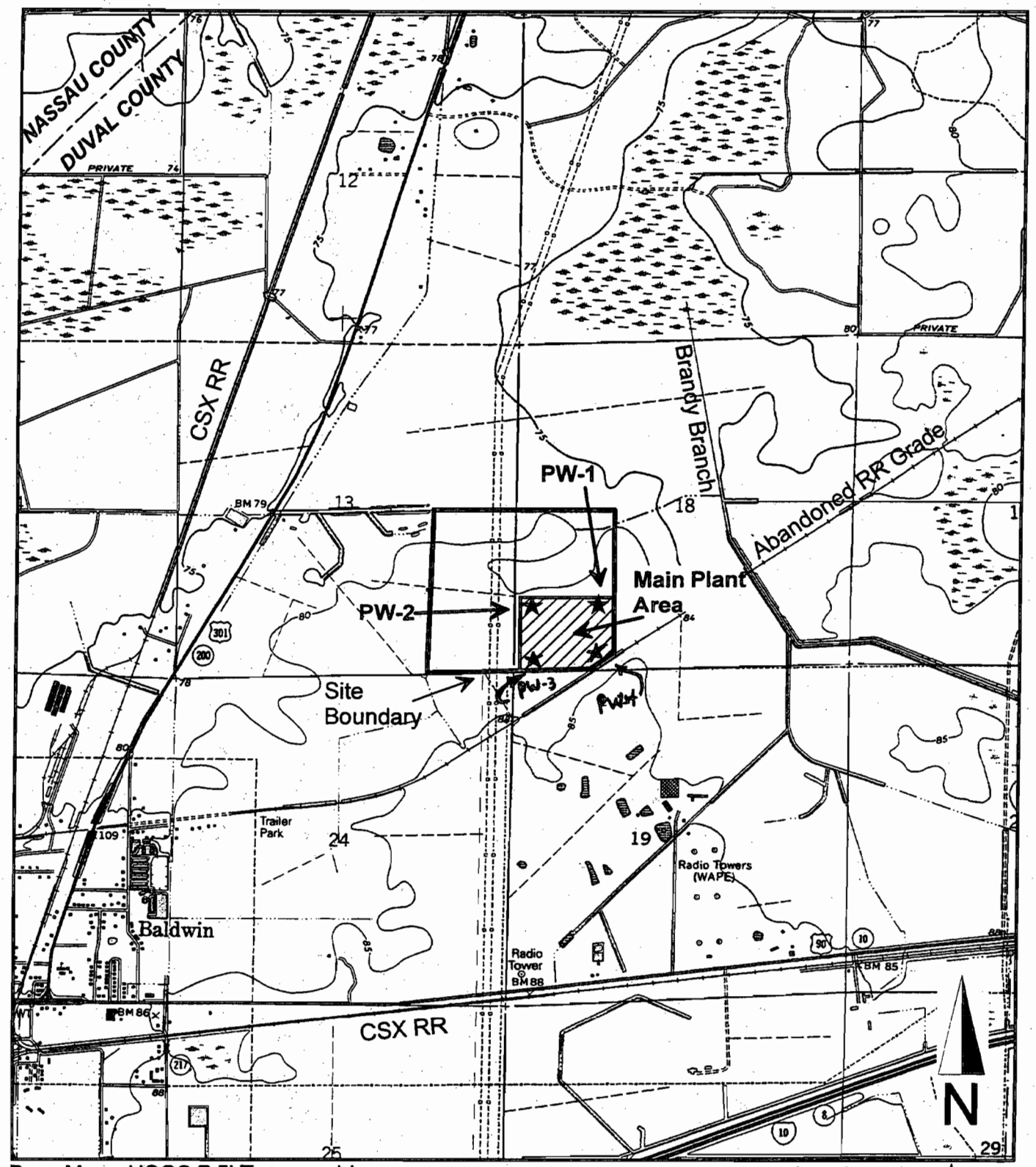
JEA

BRANDY BRANCH COMBINED CYCLE PROJECT

SITE ARRANGEMENT

97990-DS-S1001

FIG 2.1-3



Base Map: USGS 7.5' Topographic
Baldwin Quadrangle, Revised 1992

Project and Well Location (★)
Brandy Branch Generating Station

Mile
0 0.5 1

WELL NUMBER	CASING DIA.	Lat./Long.
PW-1	12"	N 30 19' 16.5" W 81 56' 43.4"
PW-2	12"	N 30 19' 17.1" W 81 56' 58.6"
Pw-3	12"	
Pw-4	12"	

III. ADJACENT PROPERTY OWNERS

(not applicable to Secondary Users Permits)

Provide a complete list of adjacent property owners and mailing address as prescribed in Tables #3 and 4. Attach additional sheets as needed.

Name	Address	City	State	Zip Code
1. I.H. Owen Jr., Trust	4076 McGirts Blvd.	Jacksonville,	FL	32210-4381
2. C.U. Miller, Trust	1840 Seminole Rd.	Jacksonville,	FL	32205-9130
3. W.C. Bostwick	P.O. Box 12	Jacksonville,	FL	32201-0012
4. F.B. Miller, Jr.	1840 Seminole Rd.	Jacksonville,	FL	32205-9130
5. I. Krieg	15551 W. Beaver St.	Baldwin,	FL	32234
6. Florida Power & Light	P.O. Box 14000	Juno Beach,	FL	33408-0420

USE OF LOWEST ACCEPTABLE QUALITY WATER SOURCE

1. Are you proposing to use the most appropriate (lowest quality) source of water?

   YES

2. Is reclaimed water readily available as a source of water?

   NO

WATER CONSERVATION PLAN

A water conservation plan must be submitted with this application. Please refer to Section 12.0 and Appendix I, Applicant's Handbook, Consumptive Uses of Water, for information on how to prepare a plan and the plan components.

ATTACHED

Table 3 - Ground Water Withdrawals

Withdrawal Amount	Property Owners to be Listed
less than 1,000,000 gallons maximum per day - and- less than 100,000 gallons per day annual average	None required
max day is between 1 and 5 million gallons -or- average day is between 100,000 and 500,000 gallons	All property owners within 600 feet of well or 100 feet of property boundary.
max day is between 5 and 10 million gallons -or- average day between 500,000 and 1,000,000 gallons	All property owners within 1,320 feet of each well or 200 feet of the property boundary.
max day exceeding 10 million gallons -or- average day exceeds 1,000,000 gallons	All property owners within 2,640 feet of the well, or 400 feet of the property boundary.

N/A

Table 4 - Surface Water Withdrawals

Withdrawal Amount	Property Owners to be Listed
surface area of the withdrawal lake is less than 80 acres	All riparian land owners on lake and those up to 600 feet downstream if the lake has an outlet
surface area of the withdrawal lake is greater than 80 acres	All riparian land owners up to 600 feet from the withdrawal point
Withdrawals from a stream and average daily pumpage is less than 5 million gallons	All riparian land owners up to 600 feet upstream and 1,320 feet downstream from the withdrawal point
Withdrawals from a stream and average daily pumpage is greater than 5 million gallons	All riparian land owners up to 1,320 feet upstream and 2,640 downstream from the withdrawal point

SECTION III

Applicant Checklist

Please verify that the following information has been provided as part of this application package:

			Attached
1.	Appropriate Fee	$	N/A
2.	Signature of Applicant and/or Agent		_____
3.	Authorization from Owner for Agent (if Agent is listed on application)		_____
4.	Copy of Executed Deed or Lease Agreement		_____
5.	Location Map		_____
6.	List of adjacent land owners		_____
7.	Completed Water Use Type Package*		_____
8.	Water Conservation Plan		_____

*NOTE: Applications for Public Supply, Commercial/Industrial, Agricultural, Aquacultural, Nursery/Fern, Golf Course Irrigation, Dewatering, and Landscape Irrigation water uses must also include the supplemental water use package specific to each use type. Those applying for a **Secondary Use Permit** must complete and submit each of the supplemenal water use packages that applies to their type use.

PUBLIC SUPPLY AND/OR ESSENTIAL TYPE USES

(Submit 2 copies of application, supplemental information, drawings, calculations, etc.)

COMMERCIAL/INDUSTRIAL TYPE USES

(Submit 2 copies of application, supplemental information drawings, calculations, etc.)

I. PROJECT DESCRIPTION

1. Type of business and/or operation, please describe:
   Electric power generation - combined cycle combustion turbine power plant

2 Requested Water Use:

	Existing (mgd)	Proposed (mgd) 5 years	Proposed (mgd) 10 years	Proposed (mgd) 15 years
Average Daily Use (nat'l gas)	0	2.74	2.74	2.74
Maximum Daily Use (oil)	0	3.21	3.21	3.21
Average Off-Site Discharge	0	0.32	0.32	0.32

*mgd - million gallons per day

3. Provide a graph (month vs mgd) or table summarizing monthly water use for the previous 3 years. N/A - new facility

4. Provide a flow chart (schematic diagram) depicting the flow of all sources of water, use and eventual discharge. Water Mass balance Attached

5. Please provide a table projecting expected growth over the next 15 years. What is the reason for the expected growth?
   Expected generation to be relatively constant.

II. WASTEWATER DISPOSAL

Describe in detail the flow of wastewater from the plant to its ultimate disposal. Also, provide the applicable Florida Department of Environmental Protection, Environmental Protection Agency permit numbers (EPA, FDEP) issued for discharge to surface waters. Attach daily flow amounts for effluent discharged to surface waters for the last 12 months. Include this information in the above requested schematic diagram.

1. There are no exisitng or proposed discharges to surface waters.
2. Sanitary wastewaters treated and disposed on-site by septic tank/tile drainfield.
3. Process wastewater routed to an on-site oil/water separator. Oil/Water separator effluent routed to an on-site dry pretreatment/percolation pond for additional treatment and groundwater discharge. Filter backwash from water pretreatment system (non-process wastewater) also routed to percolation pond.
4. Cooling tower blow-down from combined cycle process to be pumped to off-site JEA owned region wastewater colltion/treatment and disposal system.

III. REUSE

1. Provide water quality data for effluent discharged from this facility during the last 12 months.

N/A - New Facility

2. Provide the level of water quality required for each individual manufacturing and cooling process. Provide supporting documentation as to water quality and quantity limitation of reuse for each component of the process.

Process	Water Quality/Required	Comments
Injection Water foe NOx control	Demineralized, pure water	
Potable Water (City of Baldwin)	Drinking Water Quality	Additional treatment would be required to reuse this small amount (0.5 GPM) of water. Not economically justified.
Service Water	Drinking Water Quality	Additional treatment would be required to reuse this small amount (13 GPM) of water. Not economically feasible.
Cooling Tower Blowdown	Reclaimed Water Quality	The supply of this wate is from on-site wells and the water will be cycled 10 times through the cooling towers prio to discharging to JEA's regional sewer system.

Property Ownership

VOL 3449 PG 193
OFFICIAL RECORDS.

IN THE CIRCUIT COURT OF THE FOURTH JUDICIAL CIRCUIT, IN AND FOR DUVAL COUNTY, FLORIDA.

CASE NO. 72-11329 DIVISION "A"

JACKSONVILLE ELECTRIC AUTHORITY, a body politic and corporate,)
Plaintiff,)
vs.)
FRED B. MILLER, JR., et al.,)
Defendants.)

FILED
JAN 9 - 1973
CLERK - CIRCUIT COURT

ORDER OF TAKING

THIS CAUSE coming on to be heard by the Court, and it appearing that proper notice was first given to all the defendants, and all persons having or claiming to have any equity, lien, title, or other interest in or to the real property described in the Complaint for Condemnation, that the plaintiff would apply to this Court on the 5th day of January, 1973, for an Order of Taking, and the Court being fully advised in the premises, upon consideration, it is, therefore,

ORDERED AND ADJUDGED:

1. That the Court has jurisdiction of the subject matter of and the parties to this cause.

2. That the pleadings in this cause are sufficient, and the plaintiff is properly exercising its delegated authority.

3. The estate or interest in the property hereby sought to be acquired, and designated herein as Parcels 16A, 16C and 16D, respectively, is a permanent unobstructed right-of-way and easement over and across the above-described property for the purpose of furnishing electricity to the users of its electric system, together with the right to trim or remove all trees within a distance of twenty-five (25) feet parallel and adjacent to said right-of-way that could endanger the electric line. However, it is expressly reserved unto the owner, always, the right to cross the easement with roads, sidewalks, railroads, ditches, utilities and fences, and said owner shall have the right to use said easement right-of-way for any other purpose or use, so long as such does not obstruct

nor interfere with the electric transmission line easement right-of-way and such right of ingress and egress herein sought to be acquired through condemnation by right of eminent domain, provided that no construction shall be allowed on the property without the express written authority of the Jacksonville Electric Authority, and further provided that the installation of buildings and parking of vehicles or mobile home trailers shall be prohibited unless expressly agreed to by the Jacksonville Electric Authority.

The interest or estate in the property hereby sought to be acquired, and designated herein as Parcel 16B, is the fee simple absolute title.

4. That the estimate of values filed in this cause by the plaintiff was made in good faith, and based upon valid appraisals.

5. That the plaintiff is entitled to possession of the following described property prior to the entry of a final judgment, to-wit:

PARCEL 16B

That certain piece, parcel or tract of land, situate, lying and being a part of Section 18, Township 2 South, Range 24 East, together with a part of Section 13, Township 2 South, Range 23 East, City of Jacksonville, Duval County, Florida, and all being more particularly described as follows: Beginning at the Southwest corner of Section 18, said point of beginning being also the Southeast corner of said Section 13; thence South 89° 18' 44" West along the South line of Section 13, 1,150.00 feet; thence North 0° 29' 20" West, 2,643.96 feet; thence North 89° 30' 40" East, 2,640.00 feet; thence South 0° 29' 20" East, 2,426.96 feet to a point situate in the Northwesterly right of way line of the Seaboard Coast Line Railroad (a 100-foot right of way as now established); thence South 56° 14' 50" West along said Northwesterly right of way line, 388.41 feet to its intersection with the South line of said Section 18; thence South 89° 30' 40" West along said South line of Section 18, 1,165.23 feet to the Point of Beginning. Excepting, however, from the above described lands, the North 100.00 feet thereof.

PARCEL 16A

That certain piece, parcel or strip of land, situate, lying and being the South 100.00 feet of Sections 16 and 17, together with the South 100.00 feet of Section 15, lying West of the Westerly right of way line of Otis Road (an 80-foot right of way as now established), all being situate in Township 2 South, Range 24 East, City of Jacksonville, Duval County, Florida, and being more particularly described as follows: Beginning at the Southwest corner of said Section 17; thence North 01° 29' 00" East along the West line of said Section 17, 100.06 feet; thence North 89° 28' 40" East and parallel to the South line of said Sections 17 and 16, 10,666.38 feet; thence North 88° 51' 57" East and parallel to the South line of said Section 15, 1,317.95 feet to the Westerly right of way line of said Otis Road; thence South 0° 23' 45" West along said Westerly right of way line of Otis Road, 100.04 feet to its intersection with said South line of Section 15; thence South 88° 51' 57" West along said South line of Section 15, 1,318.49 feet to the Southwest corner of said Section 15; thence South 89° 28' 40" West along said South line of Sections 16 and 17, 10,667.72 feet to said Southwest corner of Section 17 and the Point of Beginning.

PARCEL 16C

That certain piece, parcel or tract of land, situate, lying and being a part of the East 1/2 of Section 13, Township 2 South, Range 23 East, City of Jacksonville, Duval County, Florida, and being more particularly described as follows: Commencing at the Northeast corner of said Section 13; thence South 89° 11' 44" West along the North line of said Section 13, 450.07 feet for a Point of Beginning; thence continuing South 89° 11' 44' West along said North line of Section 13, 200.03 feet; thence South 0° 13' 33" West, 2,673.30 feet; thence North 89° 30' 40" East, 200.02 feet; thence North 0° 13' 33" East parallel to the East line of said Section 13, and 450.00 feet westerly therefrom when measured at right angles thereto, 2,674.40 feet to the Point of Beginning.

PARCEL 16D.

A portion of the East 1/2 of Section 13, Township 2 South, Range 23 East, City of Jacksonville, Duval County, Florida, and being more particularly described as follows: Commencing at the Northeast corner of said Section 13; thence South 89° 11' 44" West along the North line of said Section 13,450.07 feet; thence South 0° 13' 33" West, 2,674.40 feet for a point of beginning; thence continuing South 0° 13' 33" West, 100.00 feet; thence South 89° 30' 40" West, 200.02 feet; thence North 0° 13' 33" East, 100.00 feet; thence North 89° 30' 40" East, 200.02 feet to the point of beginning.

upon payment into the Registry of this Court of the deposit hereafter specified; and that said deposit of money will fully secure and fully compensate the persons lawfully entitled to compensation, as will be determined ultimately by final judgment of the Court, and which said sum of money to be deposited is in no instance less than the value of the parcel described above, as fixed by the estimate of value as set by the plaintiff.

PROVIDED, FURTHER, that the sum of of ONE HUNDRED THIRTY-ONE THOUSAND TWO HUNDRED THIRTY AND NO/100 DOLLARS ($131,230) shall be deposited in the Registry of this Court within twenty (20) days after the date of this order, and, upon making such deposit, the plaintiff shall notify, in writing, all attorneys of record, and those defendants not represented by counsel, that the deposit has been made, and that on January 23rd 1973 the plaintiff shall be entitled to possession of the property described in the Complaint for Condemnation without further notice or order of this Court.

If the plaintiff shall default in the depositing of said sum of money within the time provided, this order shall be void and of no further force or effect.

DONE AND ORDERED in Jacksonville, Duval County, Florida, this 9th day of January, A. D. 1973.

Sam Goodgame
CIRCUIT COURT

Copies furnished to:

John M. McNatt, Jr., Esquire, 1530 American Heritage Building, Jacksonville, Florida 32202

Preston T. Everett, Jr., Esquire, State of Florida Department of Transportation, Haydon Burns Building, Tallahassee, Florida

Daniel U. Livermore, Esquire, 1300 City Hall, Jacksonville, Florida 32202

William Lee Allen, Esquire, 1300 City Hall, Jacksonville, Florida 32202

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OFFICIAL RECORDS

IN THE CIRCUIT COURT OF THE FOURTH JUDICIAL CIRCUIT, IN AND FOR DUVAL COUNTY, FLORIDA.

CASE NO. 72-11329 DIVISION "A"

JACKSONVILLE ELECTRIC AUTHORITY, a body politic and corporate,

Plaintiff,

vs.

FRED B. MILLER, JR., et al.,

Defendants.

FINAL JUDGMENT IN CONDEMNATION

FILED
MAY 14 1973
CLERK - CIRCUIT COURT

Comes now the parties in the above entitled cause by their respective attorneys, Honorable Sam Goodfriend presiding; comes also a jury of twelve good and lawful persons who were duly empaneled and sworn according to law to well and truly try what compensation should be made to the defendants for the property sought to be appropriated, irrespective of any benefit from any improvement proposed by the plaintiff, and rendered the following verdict, in words and figures, to-wit:

IN THE CIRCUIT COURT, IN AND FOR DUVAL COUNTY, FLORIDA. NO. 72-11329, DIVISION: A, JACKSONVILLE ELECTRIC AUTHORITY, a body politic and corporate, Plaintiff, vs. FRED B. MILLER, JR., et al., Defendants. V E R D I C T, Jacksonville, Florida. May 11, 1973. WE, THE JURY, find for the plaintiff, JACKSONVILLE ELECTRIC AUTHORITY, a body politic and corporate, and further find that the said plaintiff is entitled to acquire the interest set forth in the Complaint for Condemnation in and to the following described land, situate, lying, and being in the County of Duval, State of Florida, more particularly described as follows:

PARCEL 16A

That certain piece, parcel or strip of land, situate, lying and being the South 100.00 feet of Sections 16 and 17, together with the South 100.00 feet of Section 15, lying West of the Westerly right of way line of Otis Road (an 80-foot right of way as now established), all being situate in Township 2 South, Range 24 East, City of Jacksonville, Duval County, Florida, and being more particularly described as follows: Beginning at the Southwest corner of said Section 17; thence North 01° 29' 00" East along the West line of said Section 17, 100.06 feet; thence North 89° 28' 40" East and parallel to the South line of said Sections 17 and 16, 10,666.38 feet; thence North 88° 51' 57" East and parallel to the South line of said Section 15, 1,317.95 feet to the Westerly right of way line of said Otis Road; thence South 0° 23' 45" West along said Westerly right of way line of Otis Road, 100.04 feet to its intersection with said South line of Section 15; thence South 88° 51' 57" West along said South line of Section 15, 1,318.49 feet to the Southwest corner of said Section 15; thence South 89° 28' 40" West along said South line of Sections 16 and 17, 10,667.72 feet to said Southwest corner of Section 17 and the Point of Beginning.

WE, THE JURY, further find that the compensation to be paid by the plaintiff for the taking of the said interest in and to the said parcel hereinabove described, acquired, and condemned hereby, is the following sums:

PARCEL 16A....	Property Taken	$30,000
	Severance Damage	$ 1,640
	Business Damage	$21,000
	TOTAL	$52,640

SO SAY WE ALL. John T. Tuppy, FOREMAN.

A N D

IN THE CIRCUIT COURT, IN AND FOR DUVAL COUNTY, FLORIDA. NO. 72-11329, DIVISION: A, JACKSONVILLE ELECTRIC AUTHORITY, a body politic and corporate, Plaintiff, vs. FRED B. MILLER, JR., et al., Defendants. V E R D I C T, Jacksonville, Florida, May 11, 1973. WE THE JURY, find for the plaintiff JACKSONVILLE ELECTRIC AUTHORITY, a body politic and corporate, and further find that the said plaintiff is entitled to acquire the interest set forth in the Complaint for Condemnation in and to the following described land, situate, lying, and being in the County of Duval, State of Florida, more particularly described as follows:

PARCEL 16B

That certain piece, parcel or tract of land, situate, lying and being a part of Section 18, Township 2 South, Range 24 East, together with a part of Section 13, Township 2 South, Range 23 East, City of Jacksonville, Duval County, Florida, and all being more particularly described as follows: Beginning at the Southwest corner of Section 18, said point of beginning being also the Southeast corner of said Section 13; thence South 89° 18' 44" West along the South line of Section 13, 1,150.00 feet; thence North 0° 29' 20" West, 2,643.96 feet; thence North 89° 30' 40" East, 2,640.00 feet; thence South 0° 29' 20" East, 2,426.96 feet to a point situate in the Northwesterly right of way line of the Seaboard Coast Line Railroad (a 100-foot right of way as now established); thence South 56° 14' 50" West along said Northwesterly right of way line, 388.41 feet to its intersection with the South line of said Section 18; thence South 89° 30' 40" West along said South line of Section 18, 1,165.23 feet to the Point of Beginning. Excepting, however, from the above described lands, the North 100.00 feet thereof.

PARCEL 16C

That certain piece, parcel or tract of land, situate, lying and being a part of the East 1/2 of Section 13, Township 2 South, Range 23 East, City of Jacksonville, Duval County, Florida, and being more particularly described as follows: Commencing at the Northeast corner of said Section 13; thence South 89° 11' 44" West along the North line of said Section 13, 450.07 feet for a Point of Beginning; thence continuing South 89° 11' 44' West along said North line of Section 13, 200.03 feet; thence South 0° 13' 33" West, 2,673.30 feet; thence North 89° 30' 40" East, 200.02 feet; thence North 0° 13' 33" East parallel to the East line of said Section 13, and 450.00 feet westerly therefrom when measured at right angles thereto, 2,674.40 feet to the Point of Beginning.

PARCEL 16D

A portion of the East 1/2 of Section 13, Township 2 South, Range 23 East, City of Jacksonville, Duval County, Florida, and being more particularly described as follows: Commencing at the Northeast corner of said Section 13; thence South 89° 11' 44" West along the North line of said Section 13,450.07 feet; thence South 0° 13' 33" West, 2,674.40 feet for a point of beginning; thence continuing South 0° 13' 33" West, 100.00 feet; thence South 89° 30' 40" West, 200.02 feet; thence North 0° 13' 33" East, 100.00 feet; thence North 89° 30' 40" East, 200.02 feet to the point of beginning.

WE, THE JURY, further find that the compensation to be paid by the plaintiff for the taking of the said interest in and to the said parcels hereinabove described, acquired, and condemned hereby, is the following sums:

PARCELS 16B and 16D.....	Property Taken	$150,040
	Severance Damage	$ 34,800
	Business Damage	$ 0
	TOTAL	$184,870
PARCEL 16C.....	Property Taken	$ 9,205
	Severance Damage	$ 345
	Business Damage	$ 0
	TOTAL	$ 9,550

SO SAY WE ALL. Joseph T. Tuppy, FOREMAN.

Thereupon, the said Verdicts were duly filed and the Jury discharged from further consideration of this cause.

IT IS THEREUPON CONSIDERED, ORDERED, AND ADJUDGED by the Court that the interest in the land described in the foregoing Verdicts of the Jury, such interest being described in said Verdicts be, and the same is hereby appropriated to and vested in the plaintiff, JACKSONVILLE ELECTRIC AUTHORITY, it appearing unto the Court that pursuant to Declaration of Taking filed in this cause and order of this Court thereon, that the plaintiff has heretofore paid into the Registry of this Court, the amount of money specified in the Order of Taking.

DONE AND ORDERED at Jacksonville, Duval County, Florida, this 14th day of May, 1973.

Sam Goodgame
CIRCUIT JUDGE

Copies furnished to:

John M. McNatt, Jr., Esquire, 15th Floor American Heritage Building, Jacksonville, Florida 32202

Daniel U. Livermore, Esquire, 1300 City Hall, Jacksonville, Florida 32202

William Lee Allen, Esquire, 1300 City Hall, Jacksonville, Florida 32202

List of Legal Users in Project Area

Applicant: Southern Wood Piedmont Company
900 Center St
Baldwin, FL 32234

GRS # 873

STATION NAME	DIAMETER	CAPACITY FLOW RATE	DEPTH	SECTION	TOWNSHIP	RANGE	LAT	LONG
A	8.0	10 GPM	37'	23	2S	23	301858	815821
AA	36.0	7 GPM	3.5'	23	2S	23	301855	815817
AB	36.0	8 GPM	4'	23	2S	23	301854	815818
AC	36.0	8 GPM	4'	23	2S	23	301852	815819
B	8.0	10 GPM	40'	23	2S	23	301859	815822
C	8.0	10 GPM	33'	23	2S	23	301857	815823
D	36.0	10 GPM	5.5'	23	2S	23	301850	815824
E	36.0	10 GPM	5'	23	2S	23	301847	815824
F	36.0	10 GPM	5.5'	23	2S	23	301844	815824
G	48.0	10 GPM	8'	23	2S	23	301852	815826
H	36.0	1 GPM	8.5	23	2S	23	301849	815821
I	36.0	1 GPM	8.5'	23	2S	23	301848	815820
J	36.0	1 GPM	8.5'	23	2S	23	301848	815819
K	36.0	1 GPM	8.5'	23	2S	23	301848	815818
L	36.0	1 GPM	8.5'	23	2S	23	301847	815822
M	36.0	1 GPM	8'	23	2S	23	301846	815821
N	36.0	1 GPM	8'	23	2S	23	301846	815820
O	36.0	1 GPM	9'	23	2S	23	301846	815819
P	36.0	1 GPM	10'	23	2S	23	301844	815822
Q	4.0	1 GPM	50'	23	2S	23	301842	815822
R	36.0	1 GPM	7'	23	2S	23	301853	815824
S	36.0	1 GPM	7'	23	2S	23	301852	815824
T	36.0	1 GPM	6.5'	23	2S	23	301851	815825
U	36.0	1 GPM	5.5'	23	2S	23	301850	815825
V	36.0	1 GPM	6.5'	23	2S	23	301849	815824
W	36.0	1 GPM	6'	23	2S	23	301848	815824
X	36.0	1 GPM	5'	23	2S	23	301846	815824
Y	36.0	1 GPM	18.5'	23	2S	23	301845	815824
Z	16.0	UNKNOWN	836'	23	2S	23		

Applicant: Risser Petroleum Inc
c/o Environmental Consulting
3701 NW 98th St
Gainesville, FL 32606

GRS # 853

STATION NAME	DIAMETER	CAPACITY FLOW RATE	DEPTH	SECTION	TOWNSHIP	RANGE	LAT	LONG
A	6.0	2	21	35	2S	23	301715	815856
B	6.0	2	21	35	2S	23	301714	815857
C	6.0	UNKNOWN	21	35	2S	23	301714	815857

Applicant: Town of Baldwin
10 US 90 W
Baldwin, FL 32234

GRS # 784

STATION NAME	DIAMETER	CAPACITY FLOW RATE	DEPTH	SECTION	TOWNSHIP	RANGE	LAT	LONG
A	10.	500 GPM	764'	26	2S	23	301802	815849
B	8.0	250 GPM	716'	26	2S	23	301809	815828
C	8.0	250 GPM	716'	26	2S	23	301808	815828

Applicant: The David J Joseph Company
900 Yellow Water Rd
PO Box 578
Baldwin, FL 32234

GRS # 863

STATION NAME	DIAMETER	CAPACITY FLOW RATE	DEPTH	SECTION	TOWNSHIP	RANGE	LAT	LONG
A	6.0	25 GPM	95'	35	2S	23	301640	815842
B	6.0	25 GPM	128'	35	2S	23	301640	815847
C	4.0	200 GPM	806'	35	2S	23	301636	815847

Applicant: Champion International
109 Halsema Rd S
Whitehouse, FL 32220

GRS # 50053

	NAME	DIAMETER	FLOW RATE	DEPTH	SECTION	TOWNSHIP	RANGE	LAT	LONG
A		16.0	1500 GPM	1170'	23	2S	24	301835	815209
E		2.0	15 GPM	130'	23	2S	24	301829	815159
G		4.0	20 GPM	130'	23	2S	24	301838	815201
H		4.0	20 GPM	130'	23	2S	24	301838	815210
I		6.0	100 GPM	600'	23	2S	24	301841	815158

Applicant: Florida Department of Transportation
PO Box 1089
Lake City, FL 32056

GRS # 571

	STATION NAME	DIAMETER	CAPACITY FLOW RATE	DEPTH	SECTION	TOWNSHIP	RANGE	LAT	LONG
A		6	20 GPM	100'	24	2S	24	301826	815154

Applicant: Navy Public Works Center
Code 310
Jacksonville, FL 32212-0030

GRS # 814

	STATION NAME	DIAMETER	CAPACITY FLOW RATE	DEPTH	SECTION	TOWNSHIP	RANGE	LAT	LONG
A		8	225 GPM	770'	17	3S	24	301417	815542
B		8	225 GPM	780'	17	3S	24	301416	815541
C		12	500 GPM	610'	10	3S	24	301535	815353
D		12	500 GPM	620'	4	3S	24	301538	815402

Applicant: Westmeadows Golf Club Inc
11400 W Meadows Dr
Jacksonville, FL 32221

GRS # 850

STATION NAME	DIAMETER	CAPACITY FLOW RATE	DEPTH	SECTION	TOWNSHIP	RANGE	LAT	LONG
A	4.0	30 GPM	UNK	36	2S	24	301657	815126
B	2.0	15 GPM	100	36	2S	24		
C	2.0	15 GPM	100	36	2S	24		
D	4.0	30 GPM	UNK	36	2S	24		
E	2.0	15 GPM	100	36	2S	24		
F	2.0	70 GPM	680	36	2S	24		
G	4.0	70 GPM	680	36	2S	24		

Applicant: August Partners Inc
1808 Kinglet Ct
Coasta Mesa, CA 92626

GRS # 886

STATION NAME	DIAMETER	CAPACITY FLOW RATE	DEPTH	SECTION	TOWNSHIP	RANGE	LAT	LONG
A	6.0	150 GPM	760'	24	2S	24	301829	815059
B	6.0	150 GPM	762'	24	2S	24	301827	815058

Applicant: Fred Benson Miller Jr
1840 Seminole Rd
Jacksonville, FL 32205

GRS # 51

STATION NAME		DIAMETER	CAPACITY FLOW RATE	DEPTH	SECTION	TOWNSHIP	RANGE	LAT	LONG
A	8.		300 GPM	700'	15	2S	24	301913	815344

Water Conservation Plan

JEA

Brandy Branch Generating Station

Water Conservation Plan

June 1999

Prepared by

Black & Veatch

JEA

Brandy Branch Generating Station
Consumptive Use Permit #51629

MODIFIED CONSUMPTIVE USE PERMIT APPLICATION
Water Conservation Plan
December 4, 2000

Water Conservation Plan

Brandy Branch Generating Station

1.0 Introduction

JEA is currently constructing the Brandy Branch Generation Station (Station) power plant located near Baldwin, in Duval County, Florida. JEA proposes to convert two of the three units into a combined cycle unit by adding two heat recovery steam generators and associated plant equipment. The system will utilize a cooling tower, which increases the amount of water the Station will require beyond the allocation currently permitted (permit # 51629).

In compliance with the St. Johns River Water Management District's (SJRWMD) Permit Application for Consumptive Uses of Water, this Water Conservation Plan has been developed to demonstrate JEA's commitment to water conservation, and that the water quantities requested are reasonable for the Station needs. As directed, this plan was prepared in accordance with Section 12 and Appendix I of the Applicant's Handbook, Consumptive Uses of Water, June 1998.

2.0 Project Description

Electric power will be generated at the Station by three simple cycle combustion turbine generating units, two of which will be converted to a combined cycle unit. The primary fuel is natural gas; No. 2 fuel oil is stored onsite as backup fuel. The total generation capacity of the plan will be 716 MW.

The Station will use water from four onsite wells (three operational, one standby) to the Floridian Aquifer. The well water is used to supply the process and reserve fire water systems. Well waters not consumed in the generation/pollution control process are treated and disposed onsite, or discharged to the JEA publicly owned treatment works sewer system.

3.0 Project Water Use

Water mass balances (Figures 1 and 2) were developed to establish water requirements under natural gas and fuel oil operation. The basis for the water use request considered the number of hours of operation on natural gas and oil. JEA's Consumptive Use Permit Application is for an annual withdrawal of 1,000 million gallons from the deep Floridian Aquifer. Water from the Floridian Aquifer is withdrawn at an average rate of 2.7 million gallons per day (MGD) when firing natural gas, and 3.2 MGD when firing oil. The major use (93%) is for makeup to the cooling towers. The remaining 7% of the well water supplies the demineralized water and fire systems.

There is one land application wastewater disposal system incorporated into the Station design. Process wastewaters are routed to an oil/water seperator for treatment before discharge to a collection sump; there the contaminated waters are then routed to the onsite percolation pond (dry pretreatment) for additional treatment and groundwater discharge. Wastewaters are treated directly onsite by a tile field system. Uncontaminated stormwaters are directed to the sire drainage system and stormwater pond for treatment.

4.0 Water Use Audit

During the second year of operation (2006), an audit will be conducted of Station water used. Pumpage reports and meter readings will be used to determine the actual amounts of ground water used. The quantities used in the major systems will also be determined. These amounts will be compared to the mass balances design values.

5.0 Conservation Methods

Water conservation methods will be investigated and evaluated on a technical and economic basis following the audit. Conservation methods to be evaluated include recovery or recycling programs, and reduced consumption.

Station design has incorporated cost-efficient water recovery, reuse, and recycling procedures to the extent of efficient operations and within regulatory limits. Significant water conservation measures incorporated into the design include the following:

- Use of a high efficiency portable deminerlizer system to provide makeup water to the NO_x control injection system. Greater than 95 percent of the well water is produced into high quality demineralized water.
- Use of mechanical seals for pumps where possible to reduce seal water requirements and process leakage.

The areas with the greatest potential for water conservation or reduced consumption, other than leak repair, are the service and potable water systems. The service and potable water systems will be regularly inspected in conjunction with other routine Station and systems inspections. Conservation methods may include the following.

- Additional metering of uses.
- Improved plumbing and equipment maintenance.
- Reduced water supply pressure.
- Use of water-saving fixtures or devices: toilets, showerheads, mixing valves, pressure-reducing valves, faucet insert or aerators, hot water pipe insulation.

All normal Station wastewaters, including stormwater, are ultimately made available for onsite goundwater recharge. Percolation pond operation will recharge the surficial aquifer. Treated stormwaters are discharged to an onsite wetland.

6.0 Water Reuse

Potential alternative water sources were investigated. Refer to the attached narrative taken from the Site Certification Application for a detailed analysis (Section 8.2.3).

7.0 Awareness Program

Employee awareness is a major component of the Water Conservation Plan. Employee training in water conservation methods is included in the annual training sessions conducted for oil spill prevention. The goals of the water conservation awareness training are to ensure that all personnel are familiar with the uses onsite, and that they learn how to recognize water-related problems and how to bring water conservation suggestions to management.

8.0 Implementation

The following schedule will be used to implement this Water Conservation Plan.

2001: Submit modified Consumptive Use Permit Application and Water Conservation Plan to SJRWMD.

2001: Begin Station operation. Monitor water withdrawals from onsite wells, and quantities to major water use systems. Evaluate potential technical, procedural, and programmatic changes in Station water use to enhance water conservation. Initiate leak detection/repair program and employee awareness program.

2002: Conduct Station water use audit. Assess implementation of cost-effective water conservation measures.

2004: Construction ends and combined cycle unit begins commercial operation.

7.0 Plan Amendments

This Water Conservation Plan will be amended or revised in accordance with the following criteria.

- When there is a design, operation, or maintenance change that significantly affects the Station's water withdrawal, use, or discharge rates.
- When water use audits are completed or water conservation measures are installed.

All amendments to this Water Conservation Plan must be authorized by the Station Manager and documented on a Water Conservation Plan Amendment Form (example form included).

JEA understands that the SJRWMD has no requirements for reporting the results of the water use audit, requiring annual updates to the plan, or reporting changes in plan implementation. The SJRWMD will be notified of any request for increases in groundwater withdrawal allocations.

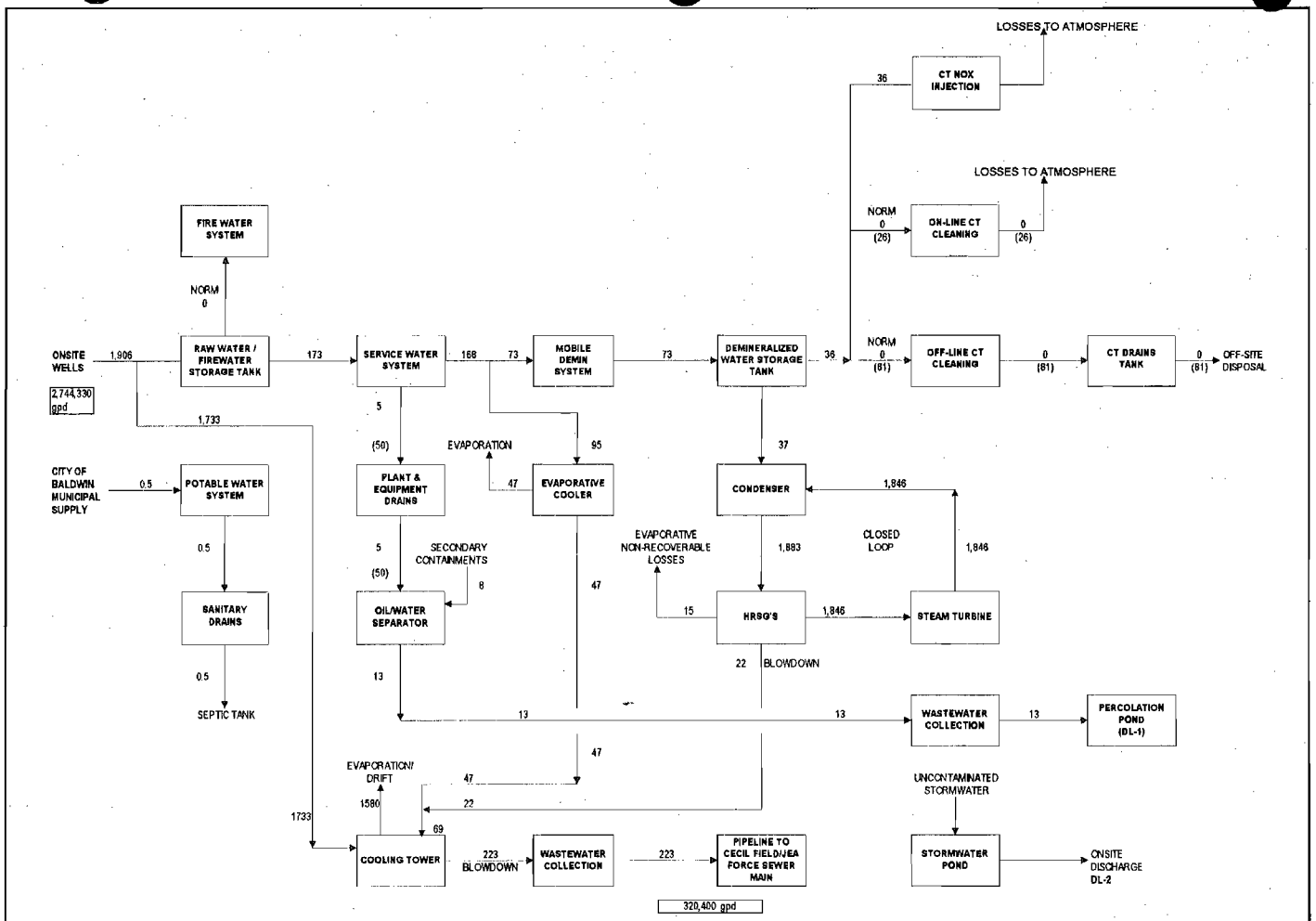
Water Conservation Plan Amendment Form

Amendment Date:

Reason for Amendment:

Amendment Authorization: _____

Station Manager



NOTES:
1. FLOWS ARE IN GALLONS PER MINUTE (gpm).
2. PEAK INSTANTANEOUS FLOWS ARE LISTED IN PARENTHESES.
3. NO INJECTION WATER OR STEAM FOR POWER AUGMENTATION.
4. COOLING TOWER WATER USE BASED ON 8 CYCLES OF CONCENTRATION.
5. ANNUAL AVERAGE IS BASED ON 288 HOURS PER YEAR, PER TURBINE ON OIL.

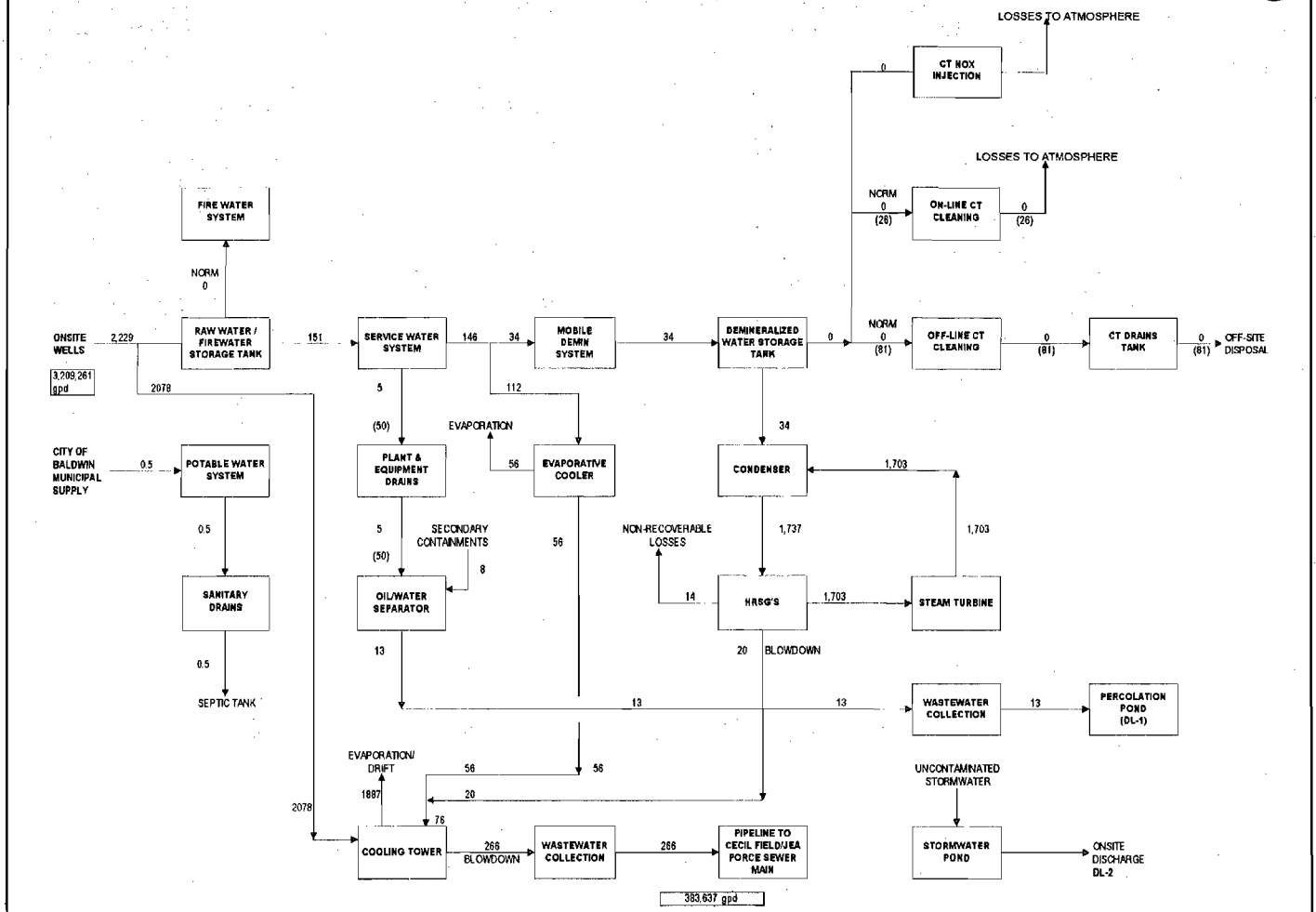
COMBUSTION TURBINE FUEL	GAS/OIL
TURBINE CONFIGURATION	GE 7FA, 2CC+1SC
OUTPUT (MW)	518
LOAD FACTOR	100%
NOx INJECTION, GPM PER TURBINE	261

BLACK & VEATCH LLP

Eng: TSA Dwg: TSA
Check: Date: 10/25/00

JACKSONVILLE ELECTRIC AUTHORITY
BRANDY BRANCH PROJECT
PRELIMINARY WATER MASS BALANCE
COMBINED CYCLE NATURAL GAS/OIL
ANNUAL AVERAGE

Project	Drawing	Rev
97990.0040	WMB-7	H



NOTES:
1. FLOWS ARE IN GALLONS PER MINUTE (gpm)
2. PEAK INSTANTANEOUS FLOWS ARE LISTED IN PARENTHESES.
3. NO INJECTION WATER OR STEAM FOR POWER AUGMENTATION.
4. COOLING TOWER WATER USE BASED ON 8 CYCLES OF CONCENTRATION.

COMBUSTION TURBINE FUEL	GAS
TURBINE CONFIGURATION	GE 7FA, 2CC + 1SC
OUTPUT (MW)	458
LOAD FACTOR	100%
NOx INJECTION, GPM PER TURBINE	0

BLACK & VEATCH LLP

Eng: TSA | Dwg: TSA
Check: | Date: 10/18/00

JACKSONVILLE ELECTRIC AUTHORITY
BRANDY BRANCH PROJECT
PRELIMINARY WATER MASS BALANCE
COMBINED CYCLE - NATURAL GAS
SUMMER PEAK CONDITIONS

Project	Drawing	Rev
97990.0040	WMB-2	G

Public Drinking Water System Extension
Permit Application

Department of Environmental Protection

Application for a Public Drinking Water Facility Construction Permit

INSTRUCTIONS: This form shall be completed and submitted by persons proposing to construct new, or alter existing, public drinking water facilities unless such proposed construction or alteration is permitted under the "General Permit for Construction of an Extension to a Public Drinking Water Distribution System," in which case Form 62-555.900(7) is to be completed and submitted. Complete this form and submit it in quadruplicate to the appropriate district office of the Department or the appropriate Approved County Public Health Unit (ACPHU) along with a check for the proper application processing fee and the following supporting documents: a signed and sealed engineering report (including design data); signed and sealed engineering plans and specifications; a certificate that the project has been approved by the governing body of the applicant (city commissioners, corporation, board, etc.); and, for each project involving the construction of a new drinking water treatment plant in a county regulated by the Florida Public Service Commission (PSC), a copy of the PSC certificate authorizing the applicant to provide service or a copy of the PSC order exempting the applicant from PSC regulation. All supporting documents, as well as this form, shall be submitted in quadruplicate. All information provided on this form shall be typed or printed in ink. Complete Parts I, II, IV, V, and VI.A of this form for all projects, and complete Parts III and VI.B through VI.E of this form when applicable. A signature page or cover letter for engineering reports, each sheet of engineering plans, and a cover or index sheet for engineering specifications shall be signed, dated, and sealed with an impression-type metal seal by the professional engineer(s) in responsible charge of the documents. Also, engineering plans and specifications shall be those intended for construction and shall not be stamped otherwise (e.g., "For Permitting Only," "For Review Only," etc.). Application processing fees are listed in Rule 62-4.050, Florida Administrative Code (F.A.C.). Checks for application processing fees shall be made payable to the Department of Environmental Protection or to the appropriate ACPHU. NOTE THAT A SEPARATE APPLICATION AND A SEPARATE PROCESSING FEE ARE REQUIRED FOR EACH NON-CONTIGUOUS PUBLIC DRINKING WATER DISTRIBUTION SYSTEM PROJECT.

I. NAME, DESCRIPTION, AND LOCATION OF PROJECT; APPLICANT; ETC.

- Project Name: Brandy Branch Electric Generating Station On-Site Water Main Installation
- Project Description: Installation of a water main to serve the electric generating facility
- Project Location

County: Duval Section: 13 & 18 Township: 2S Range: 23 & 24E

Latitude and Longitude of Each New Treatment Plant and Each New Raw Water Source (attach additional sheets if necessary):

Name of New Treatment Plant or Raw Water Source	Latitude	Longitude
N/A	" ' "N	" ' "W
	" ' "N	" ' "W
	" ' "N	" ' "W

- Applicant

Utility/Company Name: JEA Telephone No.: 665-6248
Address: 21 W. Church St., T-8
City: Jacksonville State: FL Zip Code: 32202

- Public Water System Supplying Water for Project (complete for distribution system projects)

System Name: Baldwin Water Treatment Plant PWS Identification No.:
System Owner: Baldwin Water System Telephone No.: 266-4221
Address: 10 U.S. 90 West
City: Baldwin State: FL Zip Code: 32234

Application for a Public Drinking Water Facility Construction Permit

Project Name: Brandy Branch Water Main Installation

Applicant: JEA

•Owner/Operator of Project After It Is Placed into Service

Utility/Company Name: JEA-Water and Sewer Telephone No.: 665-6248

Address: 21 W. Church St., T-8

City: Jacksonville State: FL Zip Code: 32202

•Professional Engineer in Responsible Charge of Designing Project

Name of Engineer:

Firm Name: Telephone No.:

Address:

City: State: Zip Code:

II. STATEMENT BY APPLICANT

I, the undersigned owner or authorized representative* of JEA, certify that all components that will be installed under this project and that will come into contact with drinking water or drinking water treatment chemicals (except components that will come into contact with raw water prior to its treatment by reverse osmosis) conform, or will conform, with American National Standards Institute/NSF International (ANSI/NSF) Standard 61. Also, I certify that all drinking water treatment chemicals that will be supplied under this project except fluoridation chemicals conform, or will conform, with ANSI/NSF Standard 60 and that all fluoridation chemicals that will be supplied under this project conform, or will conform, with ANSI and American Water Works Association Standard B701, B702, or B703 as applicable.

I agree that we will require the contractor to furnish us with record drawings for this project. Also, I agree that we will retain a professional engineer registered in Florida to inspect construction of this project for the purpose of determining if work proceeds in compliance with the construction permit and approved engineering plans and specifications. I expect this Engineer or firm to be:

Name Address

I am fully aware that we must obtain a letter of clearance from the Department before we place this project into service for any purpose other than disinfection, testing for leaks, or testing equipment operation. Also, I am fully aware that, if we sell or legally transfer ownership of this project before obtaining a letter of clearance from the Department, we must submit to the Department an "Application for Transfer of a Public Water System Construction Permit" within 30 days after such sale or legal transfer of ownership.

Heather Breetz 11/30/00 for

Signature and Date

Susan N. Hughes, P.E. V.P. Environmental Services

Name and Title (please type or print)

* *Attach a letter of authorization.*

III. STATEMENT BY PUBLIC WATER SYSTEM SUPPLYING WATER FOR PROJECT (complete for distribution system projects)

I, the undersigned owner or authorized representative* of Town of Baldwin, certify that we will provide the potable water supply required by this project. As indicated below, the water treatment plant to which this project will be connected has the capacity to provide the potable water supply required by this project, and I certify that said plant is in compliance with the standards and criteria set forth in Chapters 62-550, 62-555, and 62-560, F.A.C. Also, said plant was constructed under one or more valid Department construction permits as indicated below, and I certify that connection of this project to said plant will not be a violation of any condition of this(these) construction permit(s).

- Name of Water Treatment Plant to Which this Project Will Be Connected: **Baldwin WTP**
- Construction Permit Number(s) for Plant:
  Date(s) Permit(s) Issued:
- Permitted Maximum Day Capacity of Plant:
- Maximum Day Flow at Plant as Recorded on Monthly Operating Reports During Past 12 Months:

Marvin S Godball 11-30-00

Signature and Date

Marvin Godball, Baldwin Utilities

Name and Title (please type or print)

* *Attach a letter of authorization.*

Application for a Public Drinking Water Facility Construction Permit

Project Name: Brandy Branch Water Main Installation

Applicant: JEA

V. STATEMENT BY OWNER/OPERATOR OF PROJECT AFTER IT IS PLACED INTO SERVICE (off-site, tap & service to meter or dedication)

I, the undersigned owner or authorized representative* of JEA-Water and Sewer, certify that we will be the owner/operator of this project after it is placed into service. I agree that we will operate and maintain this project in a manner that will comply with Chapters 62-550, 62-555, 62-560, and 62-699, F.A.C.; and I certify that all drinking water treatment chemicals that we will use except fluoridation chemicals conform, or will conform, with American National Standards Institute/NSF International (ANSI/NSF) Standard 60 and that all fluoridation chemicals that we will use conform, or will conform, with ANSI and American Water Works Association Standard B701, B702, or B703 as applicable. Also, I agree that we will promptly notify the Department if we sell or legally transfer ownership of this project.

Heather Brevett 11/30/00

Signature and Date

Susan N. Hughes, P.E., V.P. Environmental Services

Name and Title (please type or print)

* *Attach a letter of authorization.*

V. STATEMENT BY PROFESSIONAL ENGINEER IN RESPONSIBLE CHARGE OF DESIGNING PROJECT

I, the undersigned professional engineer registered in Florida, certify that I am in responsible charge of the preparation and production of engineering documents for this project; that I have expertise in the design of water treatment, storage, and distribution facilities; and that, to the best of my knowledge and belief, the engineering design for this project complies with Chapter 62-555, F.A.C., and provides reasonable assurance of compliance with Chapters 62-550, F.A.C.

The plans and specifications for this project require that all new and relocated project components that will come into contact with drinking water or drinking water treatment chemicals (except components that will come into contact with raw water prior to its treatment by reverse osmosis) be in conformance with American National Standards Institute /NSF International (ANSI/NSF) Standard 61. Also, the plans and specifications for this project require that all drinking water treatment chemicals supplied under this project except fluoridation chemicals be in conformance with ANSI/NSF Standard 60 and that all fluoridation chemicals supplied under this project be in conformance with ANSI and American Water Works Association Standard B701, B702, or B703 as applicable.

Signature, Date, and Seal

Name and License Number (please type or print)

Application for a Public Drinking Water Facility Construction Permit

Project Name: Brandy Branch Water Main Installation

Applicant: JEA

VI. SUMMARY OF DESIGN DATA FOR PROJECT (Per D.O.H-Grid or Treating WTP Information Only- to be completed by Treatment Utility)

A. General

System PWS Identification Number, Name, Owner, and Type

1. System PWS Identification Number (if existing system): N/A
2. System Name:
3. System Owner:
4. System Type: ☒community; ☐non-transient non-community ☐non-community; ☐ consecutive;

System Service

5. Nature and Extent of Existing Service Area and Design/Projected Service Area:

Grid or Plant Service Area Description:

6. Number of Existing Service Connections: : EDU's
7. Existing Significant Industrial Water Users (industries with an average or maximum daily water demand that is 1% of the total average or maximum daily water demand on the system) (attach additional sheets if necessary):

Name of Facility	Type of Facility	Present Daily Water Demand	
		Average	Maximum

8. Regulated Consecutive Public Water Systems Presently Connected to this System (attach additional sheets if necessary):

Name of System	Type of System	Any Existing Significant Industrial Water Users?*

**IF YES, PROVIDE ON AN ATTACHMENT THE NAMES OF THE USERS AND THEIR PRESENT AVERAGE AND MAXIMUM DAILY WATER DEMANDS.*

Present Population Served by System and Present Water Demand

9. Present Population Served Directly (excluding all regulated consecutive public water systems):
10. Present Total Population Served (including all consecutive public water systems):
11. Present Annual Average Day Water Demand: MGD
12. Present Per Capita Annual Average Day Water Demand: 100 GPCD
13. Present Maximum Day Water Demand: MGD
14. Present Maximum Hour Water Demand: UNKNOWN 4.5 X (AADF) = MGD

Design Population and Water Demand for System

15. Design Year and Estimated Total Population to Be Served in Design Year:
16. Projected Annual Average Day Water Demand in Design Year and Basis of Projection:
17. Projected Maximum Day Water Demand in Design Year and Basis of Projection:
18. Projected Maximum Hour Water Demand in Design Year and Basis of Projection:
19. Design Fire Demand (flow rate and duration) and Basis of Design:

System Raw Water Sources and Collection Facilities

20. Existing Ground Water Sources and Wells (attach additional sheets if necessary):

Name of Treatment Plant Supplied	Name of Aquifer from Which Raw Water Is Withdrawn	Number of Existing Wells	Total Capacity of Existing Wells (All Wells in Service)	Total Capacity of Existing Wells When Largest Well Is Out of Service

This page was modified/condensed to include that part of Section VI. Summary of Design Data For Project from Page 3.

21. Existing Surface Water Sources and Raw Surface Water Pumps (attach additional sheets if necessary):

Name of Treatment Plant Supplied	Name of Surface Water from Which Raw Water Is Withdrawn	Number of Existing Pumps	Total Capacity of Existing Pumps When Largest Pump Is Out of Service

22. Existing Purchased Water Sources (attach additional sheets if necessary):

Name of Primary Water System Supplying Water

23. Will existing raw water sources and collection facilities (including raw water pumping facilities) be altered under this project, or are new raw water sources or collection facilities (including raw water pumping facilities) proposed under this project? _____ IF YES, COMPLETE PART VI.B BELOW.

System Treatment Facilities

24. Existing Treatment Plants (attach additional sheets if necessary):

Plant Name	Existing Permitted Maximum Day Capacity of Plant	Existing Maximum Hour Capacity of Plant*	Component That Limits Existing Capacity of Plant	Existing Type of Treatment at Plant

**Provide this only when increased treatment and/or finished water pumping capacity is provided in lieu of sufficient downstream/distribution storage volume to meet peak water demands.*

25. Will existing treatment facilities (including in-plant and finished water pumping facilities) be altered under this project, or are new treatment facilities (including in-plant and finished water pumping facilities) proposed under this project? IF YES, COMPLETE PART VI.C BELOW.

System Finished Water Storage Facilities

26. Existing Plant and Distribution System Finished Water Storage Facilities (attach additional sheets if necessary):

Storage Facility Name/Location	Type of Storage Facility (clearwell, hydropneumatic tank, ground-level reservoir, standpipe, elevated tank, etc.)	Existing Useful Volume of Storage Facility

27. Will existing plant or distribution system finished water storage facilities be altered under this project, or are new plant or distribution system finished water storage facilities proposed under this project? _____ IF YES, COMPLETE PART VI.D BELOW.

System Distribution Facilities

28. Will existing distribution facilities (including booster pumping facilities) be altered or extended under this project, or are new distribution facilities (including booster pumping facilities) proposed under this project? _____ IF YES, COMPLETE PART VI.E BELOW.

Interconnections with Other Public Water Systems that Have Separate Water Supply Sources

29. Names of Existing Interconnected Public Water Systems and Purpose of Each Existing Interconnection:

B. Proposed Altered/New Raw Water Sources and Collection Facilities (including raw water pumping facilities)

Ground Water Sources

1. Name of Treatment Plant to Be Supplied with Raw Water from Proposed Altered/New Wells: _____

2. Name of Aquifer from Which Raw Water Will Be Withdrawn by Proposed Altered/New Wells: _____

3. Existing and Proposed Altered/New Wells Supplying Raw Water to the Treatment Plant Named in Part VI.B.1 Above (attach additional sheets if necessary):

Well Location/Name/Number	Well Status (existing [not to be altered], proposed altered, or proposed new)	Elevation of Top of Well Casing*	Well Yield*	Pumping Water Level*	Type of Well Pump	Well Pump Capacity and Total Dynamic Head †
Total Capacity of Existing and Proposed Altered/New Wells (all wells in service):						
Total Capacity of Existing and Proposed Altered/New Wells When Largest Well Is Out of Service:						

* *Provide this only for proposed altered/new wells.*
† *ATTACH PUMP AND SYSTEM HEAD CURVES FOR PROPOSED ALTERED/NEW WELLS.*

4. Water Management District Construction Permit Number(s) (if applicable) for Proposed Altered/New Well(s) and Date(s) Permit(s) Issued _____

5. ATTACH A COPY OF THE LOG COMPLETION REPORT (if applicable) FOR EACH PROPOSED ALTERED/NEW WELL.
6. ATTACH A MAP OF THE AREA WITHIN 500 FEET OF EACH PROPOSED ALTERED/NEW WELL INDICATING SANITARY HAZARDS.
7. ATTACH RESULTS OF LABORATORY ANALYSES OF RAW WATER FROM NEW GROUND WATER SOURCES (analyses shall be conducted for each applicable water quality standard in Part III of Chapter 62-550, F.A.C., and for new sources in delineated areas, analyses shall be conducted pursuant to Rule 62-524.600, F.A.C.).
8. Standby Power Source for Well Pumps: _____
   Well Pumps Connected, or Proposed to Be Connected, to Standby Power: _____
9. 100-Year, or Highest Known, Flood Elevation in Area of Wells: _____

Surface Water Sources

10. Name of Treatment Plant to Be Supplied with Raw Water from Proposed Altered/New Facilities: _____

11. Name of Surface Water from Which Raw Water Will Be Withdrawn by Proposed Altered/New facilities: _____

12. Estimated Dry-Weather Flow at Surface Water Intake and Basis of Estimate: _____

13. Description of Existing and Proposed Altered/New Diverting Dams, Impounding Reservoirs, Intake Structures, and/or Infiltration Galleries (attach additional sheets if necessary) _____

14. FOR A PROPOSED NEW OR RELOCATED SURFACE WATER INTAKE, ATTACH A DESCRIPTION AND MAP OF THE WATERSHED AREA ABOVE THE INTAKE INDICATING SANITARY HAZARDS.

15. ATTACH RESULTS OF LABORATORY ANALYSES OF RAW WATER FROM NEW SURFACE WATER SOURCES (analyses shall be conducted for each applicable water quality standard in Part III of Chapter 62-550, F.A.C.).
16. Existing and Proposed Altered/New Raw Surface Water Pumps for the Treatment Plant Named in Part VI.B.9 Above (attach additional sheets if necessary):

Pump Name(s)/Number(s)	Pump Status (existing [not to be altered], proposed altered, or proposed new)	Type of Pump	Capacity and Total Dynamic Head for Each Pump*
Total Capacity of Existing and Proposed Altered/New Pumps When Largest Pump Is Out of Service:			

* *ATTACH PUMP AND SYSTEM HEAD CURVES FOR PROPOSED ALTERED/NEW PUMPS.*

17. Standby Power Source for Raw Surface Water Pumps: _____
    Raw Surface Water Pumps Connected, or Proposed to Be Connected, to Standby Power: _____
18. 100-Year, or Highest Known, Flood Elevation in Area of Intake: _____

C. Proposed Altered/New Treatment Facilities (including in-plant and finished water pumping facilities)

1. Name of Proposed Altered/New Treatment Plant: _____
2. Previous Construction Permit Number(s) for Plant and Date(s) Permit(s) Issued: _____
3. Design/Projected Annual Average Day Water Demand for Plant and Basis of Design/Projection:
4. Design/Projected Maximum Day Water Demand for Plant and Basis of Design/Projection: _____
5. Design/Projected Maximum Hour Water Demand and Design/Projected Fire Demand Plus Coincident Draft for Plant and Basis of Design/Projections (provide this only when increased treatment and/or finished water pumping capacity will be provided in lieu of sufficient downstream/distribution storage volume to meet peak water demands):
6. Design Daily Operating Period for Plant: _____
   Design Daily Operating Period for Finished Water Pumping Facilities: _____
7. Design Peak Sustained Operating Flow Rate Through Plant: _____
8. ATTACH RESULTS OF LABORATORY ANALYSES OF RAW WATER FOR THE PLANT (analyses shall be conducted for each applicable water quality standard in Part III of Chapter 62-550, F.A.C.).
9. ATTACH A FLOW DIAGRAM SHOWING ALL EXISTING AND PROPOSED ALTERED/NEW TREATMENT PROCESSES (including waste handling processes), CHEMICAL APPLICATION POINTS, PUMPING FACILITIES, AND TREATMENT BYPASS ARRANGEMENTS FOR THE PLANT.
10. ATTACH A SUMMARY OF DESIGN CRITERIA FOR EACH EXISTING OR PROPOSED ALTERED/NEW TREATMENT PROCESS (including waste handling processes) AND FOR EACH EXISTING OR PROPOSED ALTERED/NEW CHEMICAL TO BE APPLIED AT THE PLANT (design criteria should include basin capacities, retention times, unit loadings, surface loading rates, backwash rates, feeder capacities and ranges, etc.).

11. Existing and Proposed Altered/New In-Plant and Finished Water Pumps (attach additional sheets if necessary):

Pump Function/Flow Stream Pumped:			
Pump Name(s)/Number(s)	Pump Status (existing [not to be altered], proposed altered, or proposed new)	Type of Pump	Capacity and Total Dynamic Head for Each Pump*
Total Capacity of Existing and Proposed Altered/New Pumps When Largest Pump Is Out of Service:			

Pump Function/Flow Stream Pumped:			
Pump Name(s)/Number(s)	Pump Status (existing [not to be altered], proposed altered, or proposed new)	Type of Pump	Capacity and Total Dynamic Head for Each Pump*
Total Capacity of Existing and Proposed Altered/New Pumps When Largest Pump Is Out of Service:			

Pump Function/Flow Stream Pumped:			
Pump Name(s)/Number(s)	Pump Status (existing [not to be altered], proposed altered, or proposed new)	Type of Pump	Capacity and Total Dynamic Head for Each Pump*
Total Capacity of Existing and Proposed Altered/New Pumps When Largest Pump Is Out of Service:			

* *ATTACH PUMP AND SYSTEM HEAD CURVES FOR PROPOSED ALTERED/NEW PUMPS.*

12. Method of Disposal of Plant Wastes (Aluminum/Iron Coagulant or Lime Softening Sludge from Clarification, Waste Backwash Water from Filtration, and/or Waste Brine from Ion Exchange or Membrane Processes):

13. Standby Power Source for Plant _____;
Plant Equipment Connected, or Proposed to Be Connected, to Standby Power _____

14. 100-Year, or Highest Known, Flood Elevation in Area of Plant _____

D. Proposed Altered/New Plant and Distribution System Finished Water Storage Facilities

1. Existing and Proposed Altered/New Plant and Distribution System Finished Water Storage Facilities (attach additional sheets if necessary):

Storage Facility Name/Location	Status (existing [not to be altered], proposed altered, or proposed new)	Type of Storage Facility (clearwell, hydropneumatic tank, ground-level reservoir, standpipe, elevated tank, etc.)	Gross Volume of Storage Facility	Useful Volume of Storage Facility

2. Proposed Altered/New Distribution Facilities (including booster pumping facilities)

Distribution Facilities

1. Design/Projected Annual Average and Maximum Day Water Demands for Proposed Altered/New Distribution Facilities (i.e., water mains) Under this Project:

A = Type of Unit	B = Number of Units	C = Population per Unit	D = Total Population (Columns B x C)	E = Per Capita Average Day Water Demand	F = Total Average Day Water Demand (Columns D x E)	G = Total Maximum Day Water Demand†
Single-Family Home						
Mobile Home						
Apartment						
Commercial, Institutional, or Industrial Facility*	1				720 GPD	800 GPD
Total	1				720 GPD	800 GPD

* *Description of Commercial, Institutional, and Industrial Facilities and Explanation of Method Used to Estimate Average Day Water Demand for These Facilities:* 24 hour a day facility with 8 people on-site per shift. Estimate 100 gallons per person per day

† *Explanation of Method Used to Estimate Maximum Day Water Demand:*

2. Design/Projected Maximum Hour Water Demand for Proposed Altered/New Distribution Facilities Under this Project and Basis of Design/Projection: 30 gallons per hour

   Design/Projected Fire Demand Plus Coincident Draft (usually maximum day water demand) for Proposed Altered/New Distribution Facilities Under this Design/Projection: On-site well will be utilized for fire flow protection.

3. Operating Pressure Range for Proposed Altered/New Distribution Facilities Under this Project: 50-70 psi

4. Will any proposed altered/new distribution facilities under this project be installed in areas of groundwater for which there is existing documentation of the presence of low-molecular-weight petroleum products or organic solvents at concentrations exceeding ground water standards? No If yes, describe the nature and extent of such areas:

5. Will any proposed altered/new distribution facilities under this project connect previously separate public water systems that have separate water supply sources? No If yes, provide the names of the systems proposed to be interconnected explain the purpose of each proposed interconnection:

6. Will the proposed altered/new distribution facilities under this project be part of a community water system or a public water system that has a service area also served by a reclaimed water system? No If yes, document that the system has a routine cross-connection control plan, including a written plan, in accordance with Rule 62-555.360, F.A.C.:

Booster Pumping Facilities

7. Name/Location of Proposed Altered/New Booster Pumping Station:

8. Design/Projected Annual Average and Maximum Day Water Demands for Booster Pumping Station:

A = Type of Unit	B = Number of Units	C = Population per Unit	D = Total Population (Columns B x C)	E = Per Capita Average Day Water Demand	F = Total Average Day Water Demand (Columns D x E)	G = Total Maximum Day Water Demand†
Single-Family Home						
Mobile Home						
Apartment						
Commercial, Institutional, or Industrial Facility*						
Total						

* *Description of Commercial, Institutional, and Industrial Facilities and Explanation of Method Used to Estimate Average Day Water Demand for These Facilities:*

† *Explanation of Method Used to Estimate Maximum Day Water Demand:*

9. Design/Projected Maximum Hour Water Demand and Design/Projected Fire Demand Plus Coincident Draft (usually maximum day water sufficient downstream/distribution storage volume to meet peak water demands):

10. Existing and Proposed Altered/New Pumps at Booster Pumping Station (attach additional sheets if necessary):

Pump Name(s)/Number(s)	Pump Status (existing [not to be altered], proposed altered, or proposed new)	Type of Pump	Capacity and Total Dynamic Head for Each Pump*
Total Capacity of Existing and Proposed Altered/New Pumps When Largest Pump Is Out of Service:			

* *ATTACH PUMP AND SYSTEM HEAD CURVES FOR PROPOSED ALTERED/NEW PUMPS.*

11. Standby Power Source for Booster Pumping Station ;
Pumps Connected, or Proposed to Be Connected, to Standby Power

12. 100-Year, or Highest Known, Flood Elevation in Area of Booster Pumping Station

Industrial Wastewater Exemption Request

JEA
Brandy Branch Generating Station

December 8, 2000

Florida Dept. of Environmental Protection
Northeast District
Water Facilities Section-Industrial Wastewater Group
7825 Baymeadows Way, Suite B200
Jacksonville, FL 32256-7590

Subject: Industrial Wastewater System Exemption

To Whom It May Concern:

JEA intends to modify the Brandy Branch Generating Station (currently under construction) by converting two of the three simple cycle units into a combined cycle unit by adding two heat recovery steam generators, a steam turbine, an electric generator, and associated plant equipment. The conversion project is subject to review under the Florida Power Plant Siting Act. The process wastewater treatment and disposal system under construction for the simple cycle project has been exempted from permitting and ground water monitoring requirements as documented in an FDEP letter from Jerry M. Owen, Water Facilities Administrator, to Susan N. Hughes, JEA, dated October 6, 1999. JEA respectively requests that these exemptions continue during combined cycle operation. JEA believes the continuation of the exemptions is justified because there are no new wastewater streams entering the system (other than similar plant and equipment drains from the new steam turbine building), there are no proposed changes to the treatment methods or disposal locations, and the oil/water separator is adequately sized to treat the incremental flow. The footprint associated with the percolation pond will not change, due to a net decrease in flow to the pond. The initial design of the pond had a total inflow volume of 141,458 gallons. Flows from the combined cycle facility are decreased to 103,809 gallons due in most part to the removal of the filter backwash system and reduced fuel oil unloading area. Calculations are attached which indicate the revised flows to the pond.

We appreciate the Department's efforts and consideration of this important project. Please contact me at (904) 665-6247 if you have any questions regarding the project or this request.

Very truly yours,

Bert Gianazza
Site Certification Manager

BLACK & VEATCH

Calculation Record

Client Name: JEA Page 1 of 2

Project Name: Brandy Branch Station Project No.: 99262

Calculation Title: Percolation Pond Emergency Overflow Weir

Calculation No./File No.: 32.0544

Calculation Is: (check all that apply) ☐ Preliminary ☒ Final ☐ Nuclear Safety-Related

Objective: To determine if the emergency overflow weir designed in Ref. # 1 will still be adequate for the combined cycle plant.

Unverified Assumptions Requiring Subsequent Verification			
No.	Assumption	Verified By	Date

See Page _____ of this calculation for additional assumptions.

This Section Used for Computer Generated Calculations

Program Name/Number: _____ Version: _____

Evidence of or reference to computer program verification, if applicable:

Bases or reference thereto supporting application of the computer program to the physical problem:

Review and Approval						
Rev	Prepared By	Date	Verified By	Date	Approved By	Date
0	Julie M Stanek	12-5-00	JMCB	12/5/00		

Owner: JEA
Plant: Brandy Branch Station
Project No.: 099262
File No.: 32.0544
Title: Percolation Pond Emergency Overflow Weir

Computed By: J.M. Stanek
Date: 12-05-2000
Verified By: JB
Date: 12/06/00
Page: 2 of 2

OBJECTIVE: To determine if the emergency overflow weir designed in Ref. # 1 will still be adequate for the combined cycle plant.

REFERENCES: 1. Brandy Branch Calculations used in the Wastewater Discharge Permit Application for Brandy Branch Generating Station, File Number 52.5406.1114.

2.Brandy Branch Calculation, "Percolation Pond Mounding Study", Aug. 4, 1999.

CALCULATIONS:

Pond Characteristics:

Remain unchanged from Ref. # 1

- Pond Bottom Elevation = 84.5 ft
- Top of Berm Elevation = 88.5 ft
- Weir Invert Elevation = 87.25 ft
- Length of Weir = 4.0 ft

Areas that have rainfall runoff that contribute volume to the perc pond:

- Fuel Oil Secondary Containment Area (valved)
  Assume worst case that the area will be unvalved during the storm event.
- Fuel Oil Unloading Areas
- Transformers
- Lube Oil Tank
- Rain falling directly on the pond

Areas (measured off of Site Arrangement DWG # 97990-DS-S1001, Rev. A):

Areas Contributing to Percolation Pond	Previously Calculated Areas (Ref. # 1)	Actual Areas	Reason for Change
Fuel Oil Secondary Cont.	50,369 SF	47,215 SF	Removal of a fuel oil tank
Fuel Oil Unloading	10,492 SF	4,538 SF	Actual unloading area much smaller than the previously conservative design.
Transformers	3,611 SF	6,756 SF	Additional Transformers are contained (including the addition of the ST Step-up Transformer)
Lube Oil Tank	0 SF	744 SF	Not included in Ref. # 1
Percolation Pond	23,744 SF	23,744 SF	No Change
Totals =	**88,216**	**82,997**	

The total area contributing to the pond is now less then what was previously calculated due to the conversion to combined cycle units and the conservative assumptions made previously.

Mounding Study (Ref. # 2):

The percolation rate is still 15 ft/day and the percolation occurs only on the pond bottom and on the side slopes. No water percolates through the berm and daylights onto the site. The maximum stage in the perc pond is still at or below 85.0 feet under worst case condition.

RESULTS:

Since the total area contributing to the pond is less and the mounding study conditions are now conservative, the calculation performed in Ref. # 1 will be a conservative design. Therefore the maximum stage in the pond will still be at or below 86.5 ft, which is below the invert of the weir and the weir will be adequate.

BLACK & VEATCH

MEMORANDUM

JEA
Brandy Branch
Percolation Pond

B&V Project 99262
B&V File 32.0544
December 5, 2000

To: Mike Soltys

From: Ed Meyer/ Boris W Leoro

A percolation pond mounding study was previously performed for the JEA Brandy Branch Generating Station. Since this study was completed, the flows to the pond have changed.

The following table shows the modifications made to the projected 24-hour flow volumes to the percolation pond.

Origin of Flow	Original 24-hour Flow Volumes	New Estimated 24-hour Flow Volumes	Flow Volume Change	Reason for Change
Filter Backwash System	29,880 Gal	0 Gal	Eliminated 29,880 Gal	Removal of Filter Backwash System
Plant and Equipment Drains	500 Gal	750 Gal	Increase 250 Gal	Calculated Peak Flow for 15 minutes rather than 10 minutes
GSU Transformer, Fire Deluge	23,379 Gal	23,379 Gal	Same	No Change
Transformer & Lube Oil Containment	4,707 Gal	9,690 Gal	Increase 4,983 Gal	Additional Transformer Cont. Area
Fuel Oil Unloading Area	14,307 Gal	6,135 Gal	Decrease 8,172 Gal	Actual unloading area much smaller than the previously conservative design.
Fuel Oil Secondary Containment	68,685 Gal	63,855 Gal	Decrease 4,380 Gal	Size became smaller with the removal of a fuel oil tank.

The net change in flow to the percolation pond is a decrease of approximately 37,000 gallons for a 24-hour period. Since there is no change to the pond size and the flow to the pond decreases, no additional study is required. The conclusions reached in the previous study, that the pond will perform adequately and that there are no negative impacts to the surrounding area, are still valid.

The following are attached:

- JEA Brandy Branch Generating Station- "Percolation Pond Mounding Study", B&V Project 60903, August 1999.
- BV Calculation "Flow to Percolation Pond", prepared by Julie Stanek on 12/04/00, indicating flow volume calculations.

Mike Soltys

Poor Original

BLACK & VEATCH

8400 Ward Parkway
P.O. Box 8405
Kansas City, Missouri 64114 USA

Tel: (913) 458-2000

Black & Veatch Corporation

JEA
Brandy Branch Generating Station

B&V Project 60903
B&V File 32.0404
August 4, 1999

Mr. Ken Kohn
Florida Dept. of Environmental Protection
Northeast District
7825 Baymeadows Way, Suite B200
Jacksonville, FL 32256-7590

Subject: Wastewater Discharge Permit Application

Dear Mr. Kohn:

Please find enclosed four copies of the Percolation Pond Mounding Study conducted to support the recently submitted Wastewater Discharge Permit Application for the proposed Brandy Branch Generating Station.

As described in the application, treated process and untreated non-process wastewaters will be combined and directed to an onsite percolation pond for final treatment and groundwater discharge. The results of the mounding study indicate that the pond will operate as intended, without negative impacts to the surrounding area. Also, as a result of our discussion last Wednesday, July 28, we have added an emergency overflow weir to the east berm of the pond which will discharge to the east site perimeter ditch. The weir will be placed 1 foot above the design storm level.

We appreciate the Department's efforts and consideration of this important project. Please contact me at (913) 458-7563 if you have any questions regarding the project or the mounding study.

Very truly yours,
Black & Veatch

Mike Soltys

J. Michael Soltys
Permitting Manager

Enclosures

Poor Original

cc: S. Moser, JEA
G. Bergt
M. Schluter

JEA
Brandy Branch Generating Station

Percolation Pond Mounding Study

Black & Veatch
Project 60903

August 4, 1999

IMAGE QUALITY

AS YOU REVIEW THE NEXT FEW PAGES, PLEASE NOTE THAT THE ORIGINAL DOCUMENT WAS OF POOR QUALITY.

JEA Brandy Branch
Percolation Pond Mounding Study
B&V Project 60903

INTRODUCTION. This report summarizes the mounding study performed for the percolation pond at the JEA Brandy Branch Generating Station in support of the recently submitted Wastewater Discharge Permit Application. The mounding study was performed by using modeling techniques to estimate potential mounding of the groundwater table due to plant operations and rainfall runoff from selected plant facilities.

BASIS OF INFLOW QUANTITIES. Inflow quantities into the pond were calculated from expected plant operations and from runoff quantities routed through the oil/water separator. The maximum inflows to the pond will occur when the units are operated on fuel oil. The expected maximum continuous duration for the fuel oil operation will be 33 days. The model assumes that the design storm event will occur near the end of the 33 day period. The combined inflows represent the "worst" case for the percolation pond. Details are presented in the following table.

Filter backwash and plant equipment drain flows were assumed pumped to the pond for a consecutive 33 days. The rainfall runoff from the generator step-up (GSU) transformer, and the fuel oil unloading area for the 25 year, 24 hour storm event; and the fire deluge from the GSU transformer were assumed to be disposed on day 27 (these areas are not valved). The flow from the fuel oil secondary containment area (controlled by valve) was assumed to be disposed evenly from day 27 to day 33.

Table 1. Percolation Pond In-Flow

Origin of Flow	Flow Duration	Flow Quantity	Time Step for Model	
Filter Backwash System	33 days (Occurs only during Fuel Oil firing)	29,880 gpd	Day 0 to Day 33	0 gal/
Plant and Equipment Drains	Periodic	500 gpd	Day 0 to Day 33	750 gpd
GSU Transformer, Fire Deluge	One time Event	23,355 gal	Day 27	23,379
GSU Transformer Containment Area, Rain	25 year, 24 hour storm, One time Event	4,707 gal	Day 27	96 90 a
Fuel Oil Unloading Area, Rain	25 year, 24 hour storm, One time Event	14,307 gal	Day 27	6,135 a
Fuel Oil Secondary Containment Area, Rain	25 year, 24 hour storm, One time Event	68,685 gal	Day 27 to Day 33	63,855

DESCRIPTION OF THE MODEL. The groundwater mounding study was performed using Visual MODFLOW Version 2.8 by Waterloo Hydrogeologic, Inc. Aquifer parameters were determined from th following references.

1. Rising and Falling Head Slug Tests. Performed on-site in a piezometer installed adjacent to Boring B-6. Performed approximately 9 to 24 feet below existing grade, elevation 73.5 feet to 68.5 feet.

2. Double Ring Infiltrometer Test. Performed on-site approximately 18 inches below existing grade, at elevation 81.0 feet.

3. Soil Boring B-6. Performed on-site within the limits of the proposed pond.

4. Hand Auger Borings. Performed on-site to estimate maximum seasonal high groundwater in the project area.

The model was performed using inflows detailed above, and using the maximum estimated seasonal high groundwater. Details of the input parameters are presented in the following table.

Table 2. Model Parameters

Model Parameter	Input Value
Existing Ground Surface Elevation	Elevation 83.5 feet
Final Developed Ground Surface Elevation	Elevation 87.5 feet
Pond Size, Bottom Dimensions	70 feet x 170 feet
Pond Bottom Elevation	84.5 feet
Maximum Seasonal High Groundwater	83.0 feet
Thickness of Surficial Aquifer	50 feet
Conductivity	15 ft/day
Specific Storage	0.2
Specific Yield	0.2

70 x 170

SUMMARY AND CONCLUSIONS. Results of the mounding produced by the pond inflows are presented on the attached figures. The modeling results indicate that the pond will experience a total mounding effect of about 1.5 feet at the end of the 33 day period. The inflows to the pond will result in approximately 0.5 to 1.0 feet of water above the base of the pond at elevation 84.5 feet. Time step data is presented in the following table.

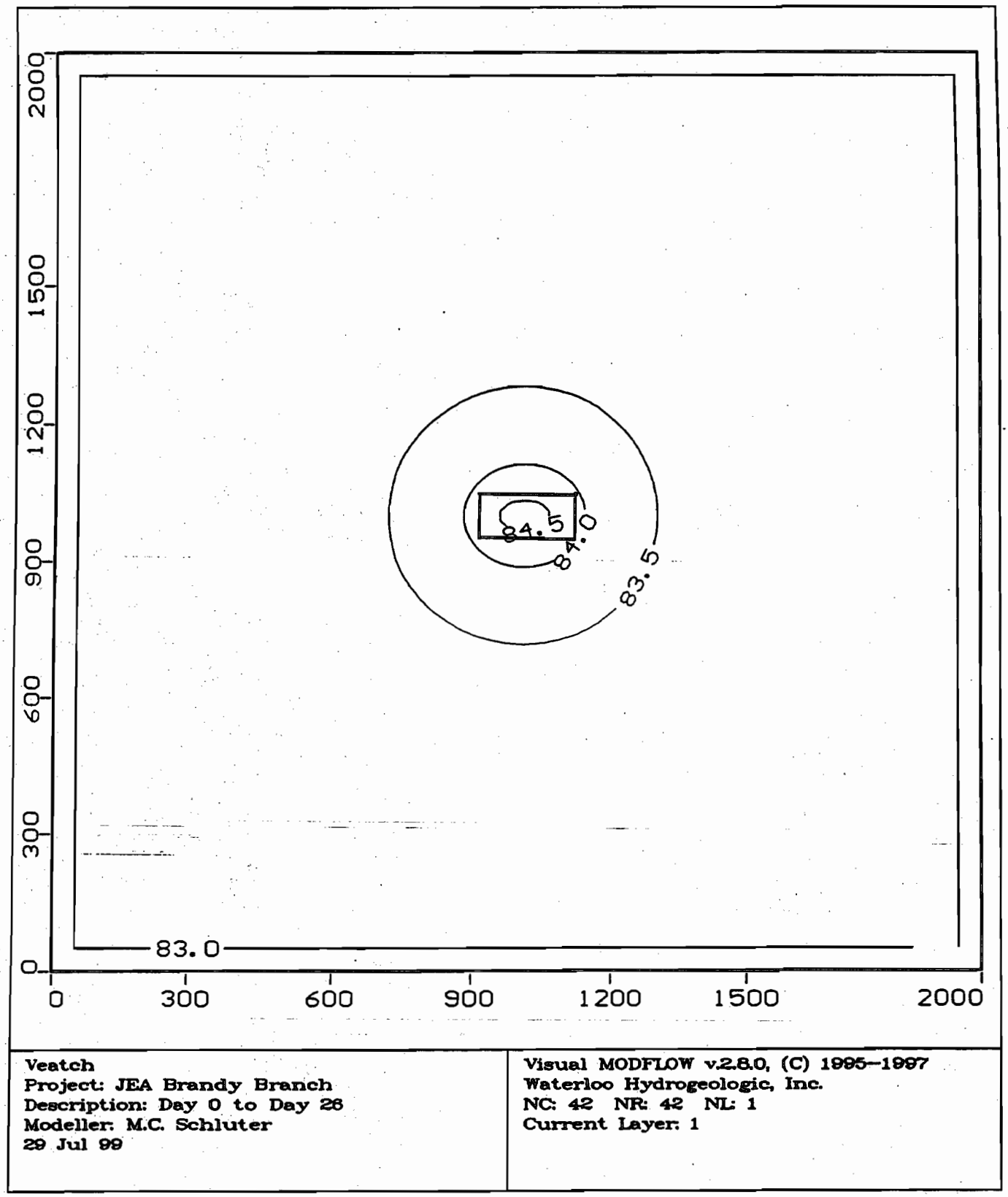
Table 3. Results of the Mounding Study

Time Step Period	Approximate Mounding Elevation Within the Pond
At the End of Day 26	Elevation 84.5
At the End of Day 27	Elevation 85.0
At the End of Day 33	Elevation 85.0

In summary, the percolation pond is capable of percolating the expected inflows from plant operations. The maximum anticipated water elevation within the pond would not exceed the maximum allowable water height of elevation 87.5 feet. The percolation pond will be able to fulfill the intended purpose of percolating plant water inflows to the groundwater table. There are no negative impacts to the surrounding area.

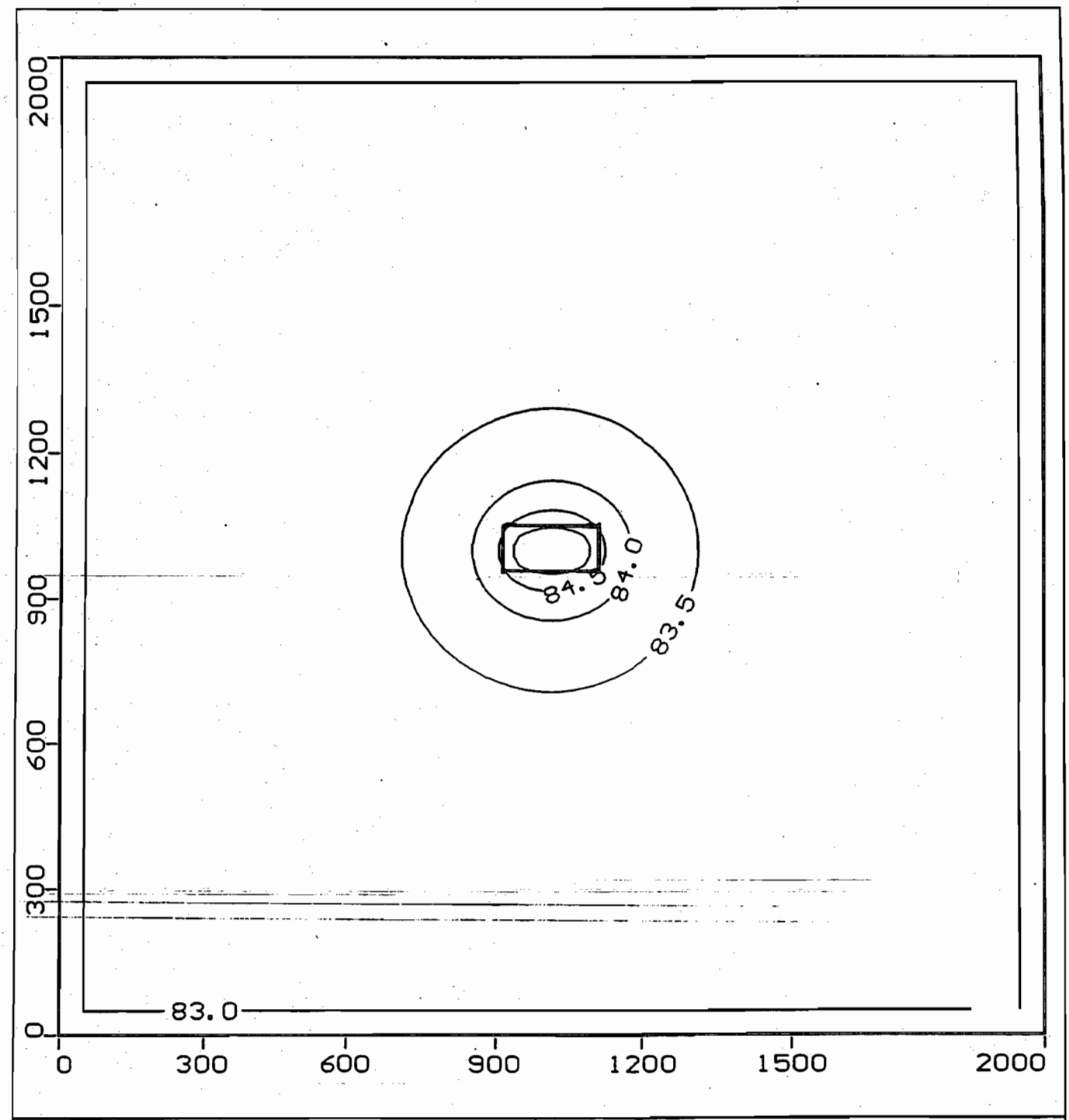
Attachments:

Figure 1. Mound Elevation at the End of Day 26
Figure 2. Mound Elevation at the End of Day 27
Figure 3. Mound Elevation at the End of Day 33



Veatch Project: JEA Brandy Branch Description: Day 0 to Day 26 Modeller: M.C. Schluter 29 Jul 99	Visual MODFLOW v.2.8.0, (C) 1995–1997 Waterloo Hydrogeologic, Inc. NC: 42 NR: 42 NL: 1 Current Layer: 1

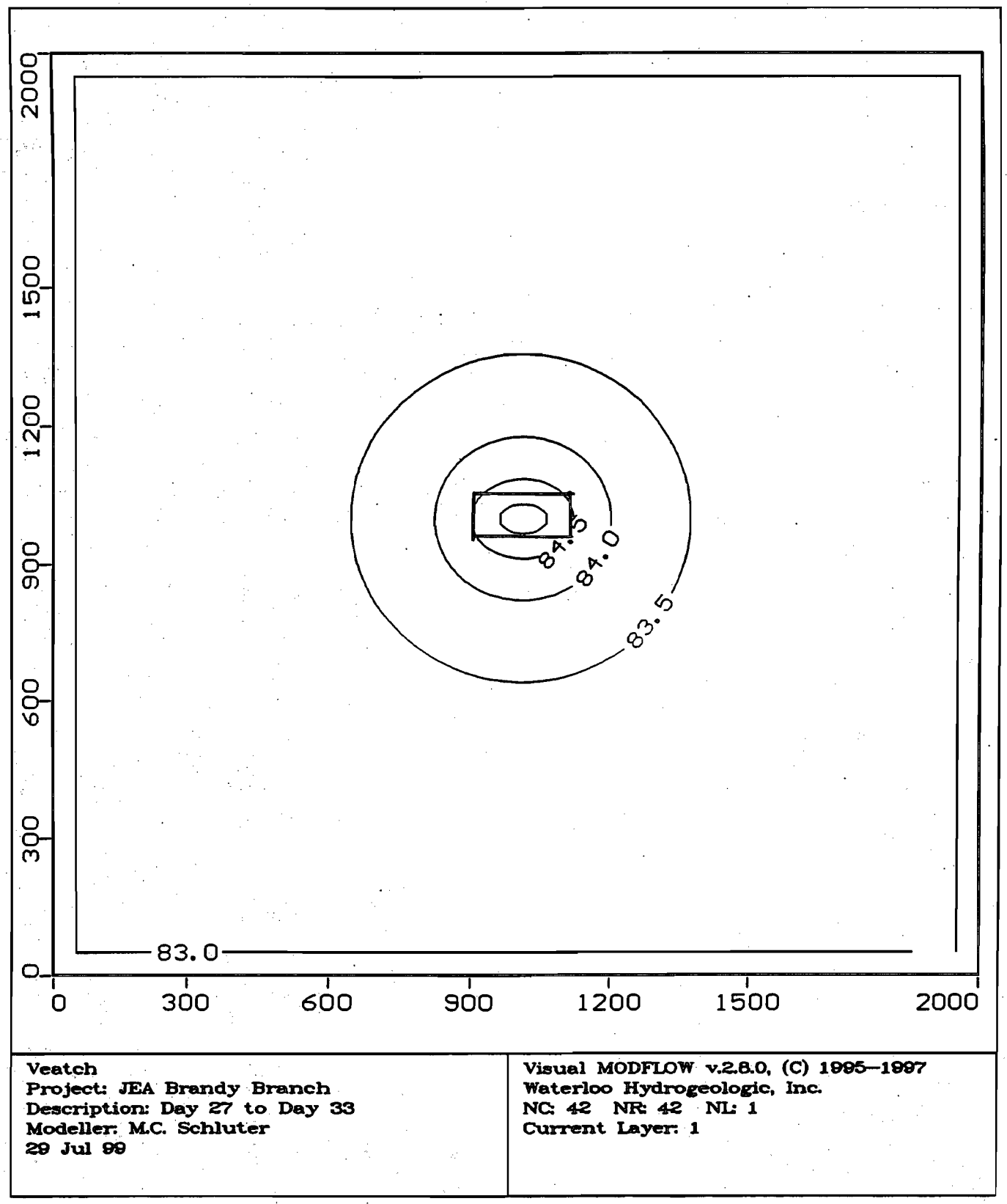
Figure 1. Mound Elevation at the End of Day 26



Veatch
Project: JEA Brandy Branch
Description: Day 26 to Day 27
Modeller: M.C. Schluter
29 Jul 99

Visual MODFLOW v.2.8.0, (C) 1995–1997
Waterloo Hydrogeologic, Inc.
NC: 42 NR: 42 NL: 1
Current Layer: 1

Figure 2. Mound Elevation at the End of Day 27



Veatch
Project: JEA Brandy Branch
Description: Day 27 to Day 33
Modeller: M.C. Schluter
29 Jul 99

Visual MODFLOW v.2.8.0, (C) 1995–1997
Waterloo Hydrogeologic, Inc.
NC: 42 NR: 42 NL: 1
Current Layer: 1

Figure 3. Mound Elevation at the End of Day 33

BLACK & VEATCH

Calculation Record

Client Name: JEA Page 1 of _____

Project Name: Brandy Branch Station Project No.: 99262

Calculation Title: Flows to Percolation Pond

Calculation No./File No.: 32.0544

Calculation Is: (check all that apply) ☐ Preliminary ☒ Final ☐ Nuclear Safety-Related

Objective: Determine the flows to the wastewater lift station and the volumes going to the percolation pond.

Unverified Assumptions Requiring Subsequent Verification			
No.	Assumption	Verified By	Date

See Page _____ of this calculation for additional assumptions.

This Section Used for Computer Generated Calculations

Program Name/Number: _____ Version: _____

Evidence of or reference to computer program verification, if applicable:

Bases or reference thereto supporting application of the computer program to the physical problem:

Review and Approval						
Rev	Prepared By	Date	Verified By	Date	Approved By	Date
0	Julie M Stanek	12-4-00	JMCB_J	12/5/00		

OBJECTIVE: Determine the flows to the wastewater lift station and the volumes going to the percolation pond.

REFERENCES: 1. Brandy Branch Calculations, File Number 52.5406.1113, Titled 'Wastewater Lift Station Design & Percolation Pond Volume'.

2. United States Department of Agriculture, Soil Conservation Service, Engineering Division, Technical Release 55 (TR55), June 1986, "Urban Hydrology for Small Watersheds".

3. U.S. Department of Commerce – Technical Paper No. 40 – Rainfall Frequency Atlas of the U.S., Washington, D.C., 1961.

4. U.S. Department of Commerce Weather Bureau – Technical Paper No. 25, "Rainfall – Intensity – Duration – Frequency Curves, Washington, D.C., 1955.

5. Conversation with Black & Veatch Chemical Engineer, Tonya Anton.

6. Preliminary Water Mass Balance for JEA Brandy Branch, Rev. H.

RESULTS: The following table shows the changes in the volumes going to the percolation pond since Ref. # 1 was completed.

Origin of Flow	Flow Volumes from Ref. # 1	Actual Flow Volumes	Reason for Change
Filter Backwash System	29,880 Gal	0 Gal	Removal of Filter Backwash System
Plant and Equipment Drains	500 Gal	750 Gal	Calculated Peak Flow for 15 minutes
GSU Transformer, Fire Deluge	23,379 Gal	23,379 Gal	No Change
Transformer & Lube Oil Containment	4,707 Gal	9,690 Gal	Additional Transformer Cont. Area
Fuel Oil Unloading Area	14,307 Gal	6,135 Gal	Actual unloading area much smaller than the previously conservative design.
Fuel Oil Secondary Containment	68,685 Gal	63,855 Gal	Size became smaller with the removal of a fuel oil tank.

Owner: JEA
Plant: Brandy Branch
Project No.: 99262
Title: Flows to Percolation Pond

File No.: 32.0544

Computed By: J.M. Stanek
Date: 12-4-2000
Verified By: YB
Date: 12/06/00
Page: 3 of 5

CALCULATIONS:

Transformer containment discharge for fire deluge = 1558.6 GPM (Same as used in Ref. # 1)

Plant & Equipment Drain Peak Flow = 50 GPM (Same as used in Ref. # 1) (Ref. # 6)

Filter Backwash Peak Flow = 0 GPM (Ref. # 5)
The filter backwash has been removed according to Black & Veatch engineer Tonya Anton.

Fuel Oil Containment Area:
Was calculated as 4,542 GPM (Ref. # 1), but the containment area was reduced due to the removal of the third fuel oil tank thus the flowrate will be reduced as well.

$Q = CIA$

Where: Q = Peak Discharge, cfs
C = Runoff Coeficient
I = Rainfall Intensity, in/hr
A = Drainage Area, acres

Will use a runoff coefficient of 1.0 since the containment area has a liner that does not allow for infiltration.
$C = 1.0$

Intensity is based on the Time of Concentration, t_c, and the Recurrence of the storm (25-year)
$T_t = [(0.007)*(n * L)^{0.8}] / [(P_2)^{0.5} * (S)^{0.4}]$ and $t_c = \Sigma T_t$
Where: Tt = Travel Time, hrs
n = Roughness Coeff.
n = 0.011 (Smooth Surfaces Ref. # 2)
L = Length of Flow Path, ft
P_2 = 2-year, 24-hour Rainfall, in
P_2 = 4.75 in (Ref. # 3)
S = Slope of Hydraulic Grade Line, ft/ft

$T_{t,1}$ = Travel Time down the berm of the containment area.
L = 19 ft
S = 3:1 (H:V) = 0.3333 ft/ft
$T_{t,1} = [(0.007) \times (0.011 \times 19 \text{ ft})^{0.8}] / [(4.75 \text{ in})^{0.5} \times (0.3333 \text{ ft/ft})^{0.4}]$
$T_{t,1} = 0.001544$ hrs = 0.093 min

$T_{t,2}$ = Travel Time across the bottom of the containment area.
L = 255 ft
S = 0.005 ft/ft
$T_{t,2} = [(0.007) \times (0.011 \times 255 \text{ ft})^{0.8}] / [(4.75 \text{ in})^{0.5} \times (0.005 \text{ ft/ft})^{0.4}]$
$T_{t,2} = 0.06103$ hrs = 3.66 min

$T_c = T_{t,1} + T_{t,2} = 0.093$ min + 3.66 min = 3.75 min
Will use a 5-minute minimum.

I = 8.75 for a T_c = 5 min. (Ref. # 4)

Drainage Area includes the area within the center of the berm.
A = 47,215 SF = 1.084 AC

$Q = (1.0) \times (8.75 \text{ in}) \times (1.084 \text{ AC})$
Q = 9.5 cfs = 4,257 GPM

Fuel Unloading Area:

Was calculated as 7,097 GPM (Ref. # 1), but the as built unloading area is smaller in overall area than the previously designed area.

Runoff Coefficient

$C = 1.0$

Intensity

$T_t = [(0.007)*(n * L)^{0.8}] / [(P_2)^{0.5} * (S)^{0.4}]$ and $t_c = \Sigma T_t$

$n = 0.011$ for Asphalt (Ref. # 2)

$P_2 = 4.75$ in (Ref. # 3)

T_t = Travel Time from the edge to the center of the unloading area.

$L = 26$ ft

$S = 0.005$ ft/ft

$T_t = [(0.007) \times (0.011 \times 26 \text{ ft})^{0.8}] / [(4.75 \text{ in})^{0.5} \times (0.005 \text{ ft/ft})^{0.4}]$

$T_t = 0.009823$ hrs $= 0.59$ min

$T_c = T_t = 0.59$ min

Will use a 5-minute minimum.

$I = 8.75$ for a $T_c = 5$ min. (Ref. # 4)

Drainage Area includes the area of the 4 unloading areas plus the area under the pump houses.

$A = 4{,}538$ SF $= 0.104$ AC

$Q = (1.0) \times (8.75 \text{ in}) \times (0.104 \text{ AC})$

$Q = 0.91$ cfs $= 409$ GPM

Transformer and Lube Oil Secondary Containment:

Runoff Coefficient for a concrete containment area

$C = 1.0$

Intensity

Will use a 5-minute minimum time of concentration.

$I = 8.75$ for a $T_c = 5$ min. (Ref. # 4)

Drainage Area includes all of the transformer containment areas going to the OWS and the lube oil tank containment area.

$A = 7{,}178.5$ SF $= 0.165$ AC

$Q = (1.0) \times (8.75 \text{ in}) \times (0.165 \text{ AC})$

$Q = 1.44$ cfs $= 646$ GPM

Total Peak Flow into Oil/Water Separator (OWS) and Percolation Pond

Total Flow = Transformer Containment Discharge + Plant & Equipment Drainage + Fuel Oil Tank Secondary Containment Area + Unloading Area + Transformer and Lube Oil Secondary Containment Area

Total Flow = 1,559 GPM + 50 GPM + 4,257 GPM + 409 GPM + 646 GPM

Total Flow = 6,921 GPM

Owner: JEA
Plant: Brandy Branch
Project No.: 99262
File No.: 32.0544
Title: Flows to Percolation Pond

Computed By: J.M. Stanek
Date: 12-4-2000
Verified By: JCB
Date: 12/05/00
Page: 5 of 5

Calculate Volumes assuming a 15-min duration:
Volume (gal) = Flowrate, Q (GPM) * 15 minute duration

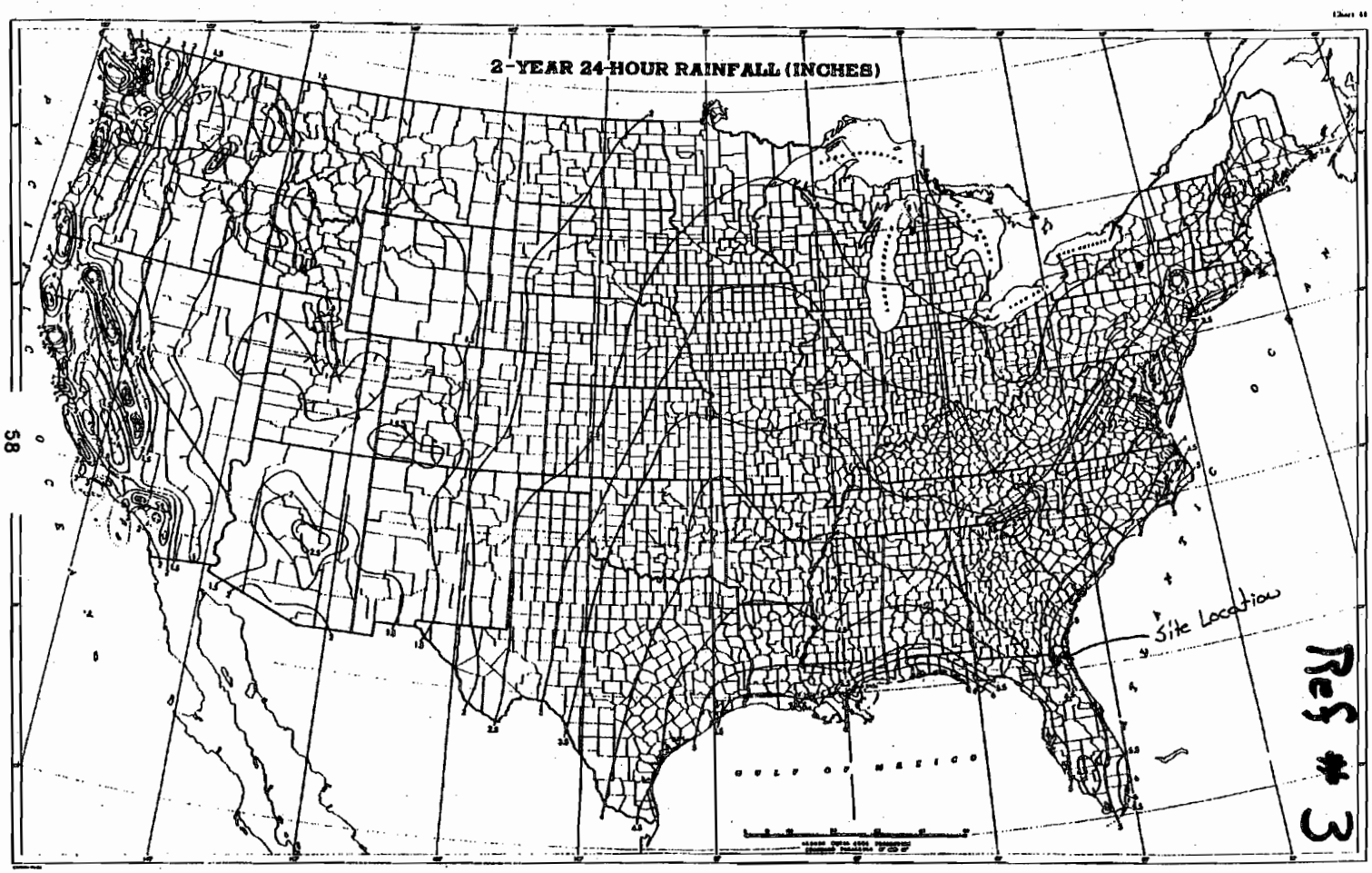
Fuel Oil Containment Area
Vol. = 4,257 GPM * 15 minutes
Vol. = 63,855 gallons

Unloading Area
Vol. = 409 GPM * 15 minutes
Vol. = 6,135 gallons

Transformer Areas
Fire Deluge Vol. = 1558.6 GPM * 15 minutes
Fire Deluge Vol. = 23,379 gallons

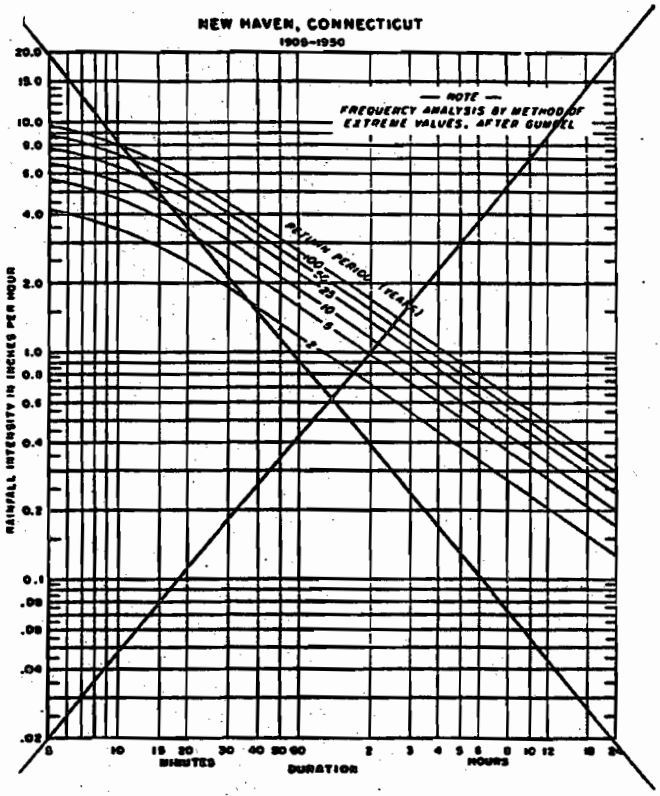
Transformer and Lube Oil Secondary Containment
Rainwater Volume = 646 GPM * 15 minutes
Rainwater Volume = 9690 gallons

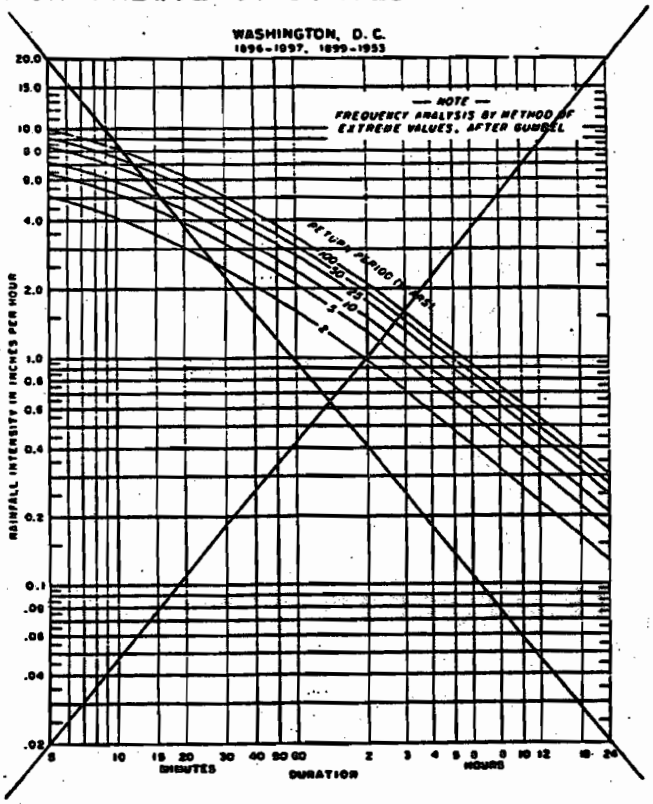
Plant Drains & Equipment
Vol. = 50 GPM * 15 minutes
Vol. = 750 gallons

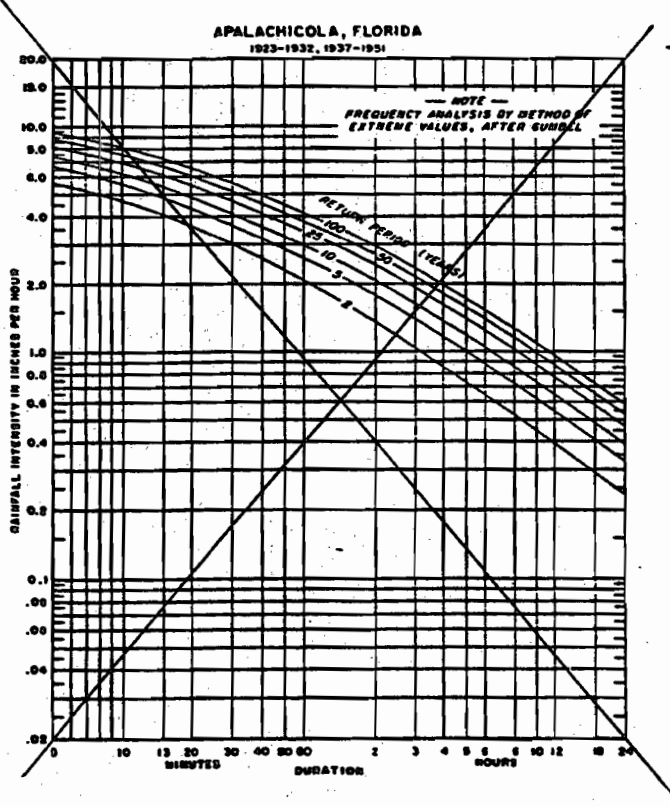


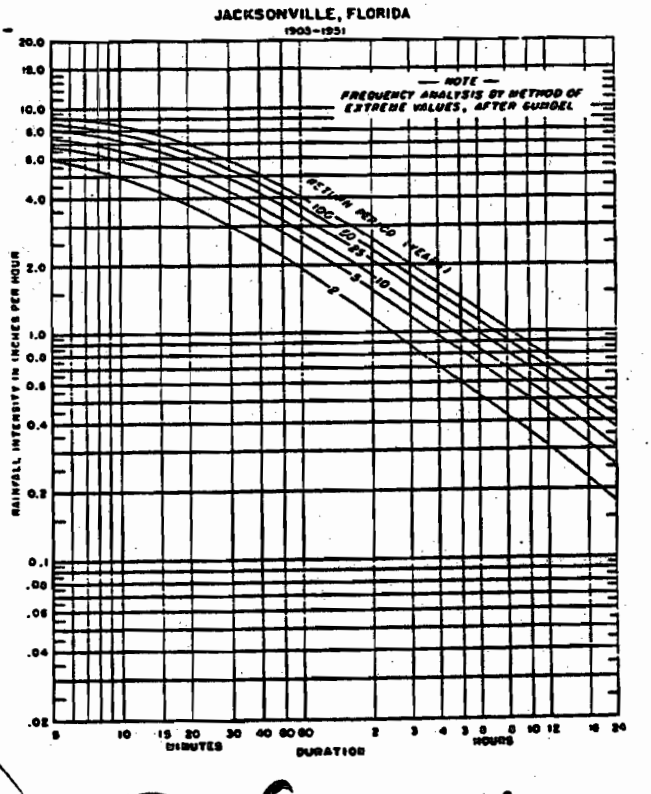
Ref # 3

RAINFALL INTENSITY-DURATION-FREQUENCY CURVES









Ref. # 4

Stanek, Julie M.

Ref #5

From: Anton, Tonya S.
Sent: Monday, December 04, 2000 11:18 AM
To: Stanek, Julie M.
Subject: RE: Brandy Branch Water Flows

No, we have removed the filter backwash from the water balance. We have gotten a better water analysis since this calculation was done, and it was determined that the filters would not be necessary. Any filtration done will be part of the mobile demineralization system, which will be regenerated off-site.

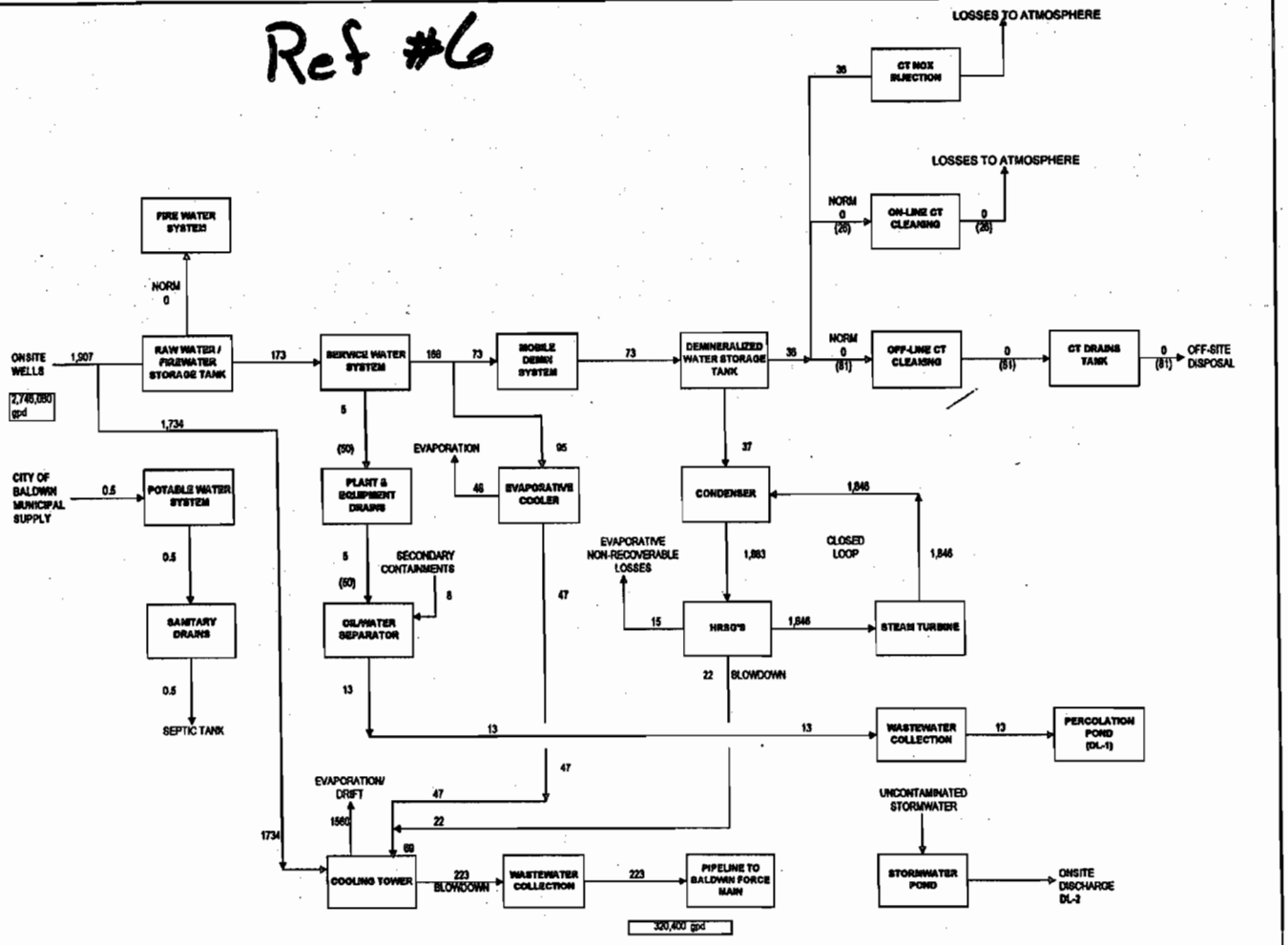
-----Original Message-----
From: Stanek, Julie M.
Sent: Monday, December 04, 2000 10:59 AM
To: Anton, Tonya S.
Subject: Brandy Branch Water Flows

Tonya - I am going over some calculation that Shelly Wood did for the BB Simple Cycle Units to see if they are still applicable for the combined cycle unit. On her calculation for the flowrates going to the wastewater lift station, she has a filter backwash peak flow of 1942 GPM. Is this still an accurate flowrate?

Thanks -

Julie Stanek
Black & Veatch Corp.
11401 Lamar Avenue
Overland Park, KS 66211
E-mail - stanekjm@bv.com
Phone - (913)458-4429
Fax - (913)458-2934

Ref #6



NOTES:
1. FLOWS ARE IN GALLONS PER MINUTE (gpm).
2. PEAK INSTANTANEOUS FLOWS ARE LISTED IN PARENTHESES.
3. NO INJECTION WATER OR STEAM FOR POWER AUGMENTATION.
4. COOLING TOWER WATER USE BASED ON 6 CYCLES OF CONCENTRATION.
5. ANNUAL AVERAGE IS BASED ON 288 HOURS PER YEAR, PER TURBINE ON OIL.

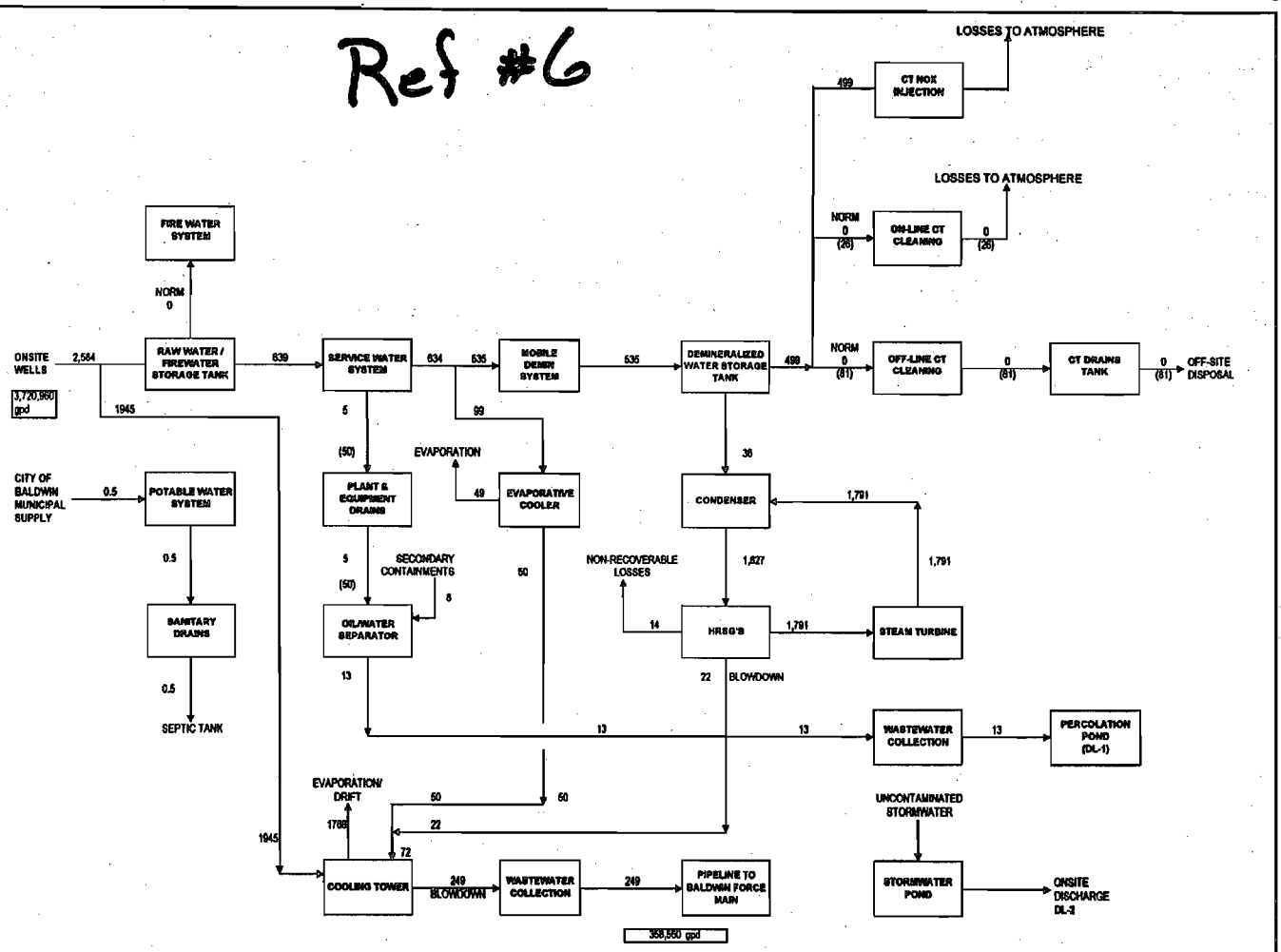
COMBUSTION TURBINE FUEL	GAS/OIL
TURBINE CONFIGURATION	GE 7FA, 2CC + 1SC
OUTPUT (MW)	518
LOAD FACTOR	100%
NOx INJECTION, GPM PER TURBINE	197

BLACK & VEATCH LLP
Eng: TBA Dwg: TBA
Check: Date: 10/25/2000

JACKSONVILLE ELECTRIC AUTHORITY
BRANDY BRANCH PROJECT
PRELIMINARY WATER MASS BALANCE
COMBINED CYCLE NATURAL GAS/OIL
ANNUAL AVERAGE

Project	Drawing	Rev
97990.0040	WMB-7	H

Ref #6



NOTES:
1. FLOWS ARE IN GALLONS PER MINUTE (gpm)
2. PEAK INSTANTANEOUS FLOWS ARE LISTED IN PARENTHESES.
3. NO INJECTION WATER OR STEAM FOR POWER AUGMENTATION.
4. COOLING TOWER WATER USE BASED ON 8 CYCLES OF CONCENTRATION.

COMBUSTION TURBINE FUEL	OIL
TURBINE CONFIGURATION	GE 7FA, 2CC + 1SC
OUTPUT (MW)	476
LOAD FACTOR	100%
NOx INJECTION, GPM PER TURBINE	187

BLACK & VEATCH LLP

Eng: TSA Dwg: TSA
Check: Date: 10/18/2000

JACKSONVILLE ELECTRIC AUTHORITY
BRANDY BRANCH PROJECT
PRELIMINARY WATER MASS BALANCE
COMBINED CYCLE - OIL
SUMMER PEAK CONDITIONS

Project	Drawing	Rev
97099.0040	WMB-5	0

Wastewater Collection/Transmission Systems

Florida Department of Environmental Protection
Twin Towers Office Bldg., 2600 Blair Stone Road, Tallahassee, Florida 32399-2400

APPLICATION TO CONSTRUCT DOMESTIC WASTEWATER COLLECTION/TRANSMISSION SYSTEMS

PART I - GENERAL

Subpart A: Directions

(1) This form must be completed for projects not permitted under the general permit procedures and criteria specified in Rule 62-604.700, Florida Administrative Code (F.A.C.). All items must be completed in full in order to avoid delay in processing of this application. Where attached sheets (or other technical documentation) are utilized in lieu of the blank spaces provided, indicate appropriate cross reference in the space and provide copies to the Department in accordance with (4) below.

(2) The applicability of requirements to new facilities and modifications of existing facilities is described in Chapter 62-604, F.A.C. Where certain items do not appear applicable to the proposed project, indicate N/A in the appropriate space provided.

(3) All information is to be typed or printed in ink.

(4) Two copies of this application (with supporting information) and a check for the application fee in accordance with Rule 62-4.050, F.A.C., and made payable to the State of Florida, Department of Environmental Protection, will be submitted with this application when sent to the appropriate Department District Office or approved local program.

(5) This application is to be accompanied by two sets of engineering drawings, specifications and design data as prepared by a Professional Engineer registered in Florida, where required by Chapter 471, Florida Statutes (F.S.). An engineering report (two copies) is also required to be submitted in support of this application pursuant to Rule 62-4.210(1)(b), F.A.C. For projects of limited scope (as determined by the Department), information contained in the application may suffice as the engineering report.

(6) Attach 81/2" x 11" sketch of the proposed project showing relationship to entire service area and how it ties into the existing system.

NOTE: Each non-contiguous project requires a separate application and fee pursuant to Rule 62-4.050(4)(s), F.A.C.

Subpart B.

Project Name: Brandy Branch Pump Station and Force Main Installation

Location: County: Duval City: Jacksonville Vicinity : Baldwin

Person(s) or entity owning the Collection/Transmission System

Name: JEA Title: V.P.,Environmental Services

Company Name : JEA

Address: 21 W. Church Street, T-8

City : Jacksonville Zip: 32202

Telephone Number : 665-6248

Northwest District
160 Governmental Center
Pensacola, Florida 32501-5794
904-444-8300

Northeast District
7825 Baymeadows Way, Suite B-200
Jacksonville, Florida 32256-7590
904-448-4300

Central District
3319 Maguire Blvd, Suite 232
Orlando, Florida 32803-3767
407-894-7555

Southwest District
3804 Coconut Palm Drive
Tampa, Florida 33619-8318
813-744-6100

South District
2295 Victoria Ave., Suite 364
Fort Myers, Florida 33901
813-332-6975

Southeast District
400 N. Congress Ave, P.O. Box 15425
West Palm Beach, Florida 33416
561-681-6600

PART II - PROJECT DOCUMENTATION

Subpart A: General Project Description

(1) Project type: ____ New X ____ Modification (specify ____

(2) Location, size, and development characteristics of service area covered by this application:
Pump station and 10" force main to serve an electric generating facility by collection cooling tower blowdown.

(3) Treatment plant serving project

a. Name: Buckman WWTF via future Cecil Field Pump Station

b. County: Duval City: Jacksonville

c. DEP identification number (also known as WAFR or GMS identification number 3116MO1973

d. Most recent DEP permit number: FL0026000 Expiration ___ Date: 2/17/05

e. Moratorium in effect? Yes ____ No X

f. Current monthly average daily flow: 36.38 MGD (from operating report)

g. Current three-month average daily flow: 31.93 MGD (from operating report)

h. Current permitted capacity: 52.50 MGD

i. Current outstanding flow commitments (including this project) against treatment plant capacity: 85836

(4) Start of construction, completion of construction and estimated date of connections to existing system or treatment plant:
Permit Issuance date

(5) Is the project design in accordance with the standards and criteria contained in the appropriate standard engineering References listed in Rule 62-604.300, F.A.C.? Yes X No ____

If no, supporting information shall be submitted in accordance with Rule 62-604.300, F.A.C., addressing the proposed design.

Subpart B. Project Details

(1) Design peak hour flow proposed: 0.35 MGD GPD

a. Design population to be served: Cooling tower blowdown only - approximately 913 EDUs

b. Total average daily flow: 0.32 MGD GPD

NOTE: This is the summation of the far right amount below.*

Indicate the following:

Number and Type of Unit	Population	Per Capita Flow	Total Average Daily Flow GPD)*
____ single family homes			
____ apartments			
____ motel rooms			
____ mobile homes			
X other (describe)	Cooling tower blowdown		

c. Contribution from: industrial sources 99 % % by flow commercial sources ____ % by flow

(2) Equivalent Dwelling Units (EDUs) served by this project 913 EDUs (An EDU = 3.5 persons).

(3) Attach in tabular form the pipe material and specification (e.g. ASTM number), joint specification, pipe length, minimum and maximum velocity to force mains, and peak flow for each pipe size comprising the proposed gravity or force main system

(4) Identify the drawing(s) on which manhole types, sizes, locations, spacings and joint specifications are detailed.

(5) Type of leakage test _____ Infiltration _____ Exfiltration

(6) Maximum allowable leakage rate _____ GPD per inch pipe diameter per mile.

(7) Identify the drawing(s) on which sewer lines crossing under or over potable water mains and reclaimed water lines are detailed (Rules 62-604.400 and 62-610.469, F.A.C.).

(8) Identify the drawing(s) on which sewer lines are horizontally within ten feet of water mains or horizontally within five feet (center to center) or three feet (outside to outside) from reclaimed water lines (Rules 62-604.300(4)(b) and 62-610.469, F.A.C.).

(9) Identify the drawing(s) on which design and construction provisions for conflict manholes are detailed (Rule 62-604.400, F.A.C.).

(10) Describe provisions for sewer lines involving subaqueous crossings to assure structural integrity of the lines, to test the integrity of the lines, to prevent discharge in the event lines are damaged, and to identify the nature and location of the crossings, in accordance with Rule 62-604.400, F.A.C. In lieu of this description, identify the drawing(s) on which the information is detailed.

(11) Pump station data (where more than one station is involved, supporting information shall be submitted with addresses the items listed below for each station):

a. Location:

b. Type:

c. Estimated flow to the station:

Maximum	0.35 MGD	GPD
Average	0.32 MGD	GPD
Minimum	0.30 MGD	GPD

d. Operating conditions 222 GPM @ _____ FT (TDH)

(12) Other design considerations for pump stations in accordance with Rule 62-604.400, F.A.C., (abstract and cross-reference where supporting technical documentation is submitted and contains this information).

a. Describe features such as emergency provisions which provide assurances of uninterrupted flow.

b. Describe features to control adverse effects resulting from odors, noise, and lighting.

c. Describe access-control features

d. Describe design criteria and measures which minimize damage or interruption of operation due to flooding (where required).

PART III - CERTIFICATIONS

A. Applicant

I, the undersigned owner or authorized representative* of JEA am fully aware that the statements made in this application for a construction permit are true, correct and complete to the best of my knowledge and belief. I agree to retain the design engineer or another professional engineer registered in Florida, to conduct on-site observation of construction, to prepare a certification of completion of construction, and to review record drawings for adequacy as reference in Rule 62-604,600(2), F.A.C. I, the undersigned, am fully aware that it is my responsibility to operate and maintain this facility in such manner as to function as it was designed. Responsibility may be transferred to another entity upon written notice to the Department from the entity assuming responsibility. Further, I agree to provide an appropriate operation and maintenance manual for the facilities pursuant to Rule 62-604.600(2)(f), F.A.C., and to retain a professional engineer registered in Florida to examine (or to prepare if desired) the manual. (*Attach a letter of authorization)

Signed: Heather Bruce for Date: 11/29/00

Name (type or print): **Susan N. Hughes, P.E.** Title: **V.P., Environmental Services**

Company Name: **JEA**

Address: **21 W. Church Street, T-8**

City: **Jacksonville** Zip: **32202-3139**

Telephone No.: **(904) 665-6248**

B. Professional Engineer Registered in Florida (where required by Chapter 471, F.S.)

I hereby certify that the engineering features of this collection/transmission system have been designed by me or by an individual(s) under my direct supervision in conformity with sound engineering principles, consistent with Chapter 62-604, F.A.C.

Design Engineer To Be Determined

Name (please type) Florida Registration No.

Signature of Engineer

Company Name

Date

Company Address

City Zip

(Affix Seal)

Telephone No.:

C. Professional Engineer Registered in Florida (where required by Chapter 471, F.S., and if different from project design engineer in B).

This is to acknowledge that this firm has been retained by the applicant to prepare a certification of completion of construction and to review record drawings for adequacy as reference in Rule 62-604.600(2), F.A.C.

Name (please type) Florida Registration No.

Signature of Engineer

Company Name

Date

Company Address

City Zip

(Affix Seal)

Telephone No.:

D. Treatment Plant Permittee

The undersigned permittee, of JEA hereby certifies that the above referenced plant has adequate reserve capacity to accept the wastewaters from this project and will provide the necessary treatment and disposal as required by Chapter 403, F.S., and applicable Department rules.

Signed: Heather Bruett for Date: 11/29/00

Name: **Susan N. Hughes, P.E.** Title: **V.P., Environmental Services**

Company Name: **JEA**

Address: **21 W. Church Street, T-8**

City: **Jacksonville** Zip: **32202-3139**

Telephone No.: **(904) 665-6248**

E. Operation and Maintenance Authority

The undersigned permittee, of JEA hereby certifies that the applicant's proposed pump station(s) will be compatible with available temporary service power generating and pumping equipment of the system for which I have the responsibility to operate and maintain.

Signed: Heather Bruett for Date: 11/29/00

Name: **Susan N. Hughes, P.E.** Title: **V.P. Environmental Services**

Company Name: **JEA**

Address: **21 W. Church Street, T-8**

City: **Jacksonville** Zip: **32202-3139**

Telephone No.: **(904) 665-6248**

10.5 Existing Local Permits

10.5.1 Land Use/Zoning Compliance

On October 18, 1999, the Office of the City Council, City of Jacksonville, approved rezoning of the project site from "PBF-1" District to "PUD" District.

10.5.2 Building Permit

On October 2, 2000, a building permit was issued by the Building Inspection Division, City of Jacksonville.

Land Use/Zoning Compliance

JEA BB File # 32.0571

OFFICE OF THE CITY COUNCIL
DEPARTMENT OF COUNCIL SECRETARY

BEVERLY S. DOMEN, CMC
COUNCIL SECRETARY
(904) 630-1404
FAX (904) 630-1242

117 W. DUVAL STREET
4TH FLOOR, CITY HALL
JACKSONVILLE, FLORIDA 32202
BSDOMEN@COJ.NET

October 18, 1999

Ms. Susan Hughes
c/o JEA
21 West Church Street, T-8
Jacksonville, FL 32202

Re: Ordinance 1999-803-E

Dear Ms. Hughes:

The City Council has approved the above rezoning which is effective as shown in the Certificate of Authentication. A copy is enclosed for your records.

If you require additional information, please contact the Planning & Development Department at 630-1904.

Sincerely,

Beverly S. Domen, CMC
Council Secretary

BSD/sli

Enc.
cc: Building & Zoning Department - Ordinance Only
Planning Department - Ordinance Only
Property Appraiser - Ordinance Only

Introduced by the Urban Affairs and Planning Committee:

ORDINANCE 1999-803-E

AN ORDINANCE REZONING PROPERTY HEREIN DESCRIBED, OWNED BY JEA, FROM "PBF-1" DISTRICT TO "PUD" DISTRICT AS DEFINED AND CLASSIFIED UNDER THE ZONING CODE; PROVIDING AN EFFECTIVE DATE.

WHEREAS, JEA, the owner of the real property described in this ordinance, has applied to the Council for a rezoning and reclassification of that property from "PBF-1" District to "PUD" District; and

WHEREAS, the Planning and Development Department has considered the application and has rendered an advisory opinion; and

WHEREAS, the Land Use and Zoning Committee, after due notice and public hearing has made its recommendation to the Council; and

WHEREAS, taking into consideration the above recommendations, the Council finds that such rezoning is consistent with the comprehensive plan adopted under the Comprehensive Planning Ordinance for future development of the City of Jacksonville;

WHEREAS, the Council finds that the proposed PUD does not affect adversely the orderly development of the City as embodied in the Zoning Code; will not affect adversely the health and safety of residents in the area; will not be detrimental to the natural environment or to the use or development of the adjacent properties in the general neighborhood; and the proposed PUD will accomplish the objectives and meet the standards of Section 656.340 (Planned Unit Development) of the Zoning Code of the City of Jacksonville; now, therefore

BE IT ORDAINED by the Council of the City of Jacksonville:

"EXHIBIT A"

LEGAL DESCRIPTION

OR 3514 PG 488
OFFICIAL RECORDS

PARCEL 16A

That certain piece, parcel or strip of land, situate, lying and being the South 100.00 feet of Sections 16 and 17, together with the South 100.00 feet of Section 15, lying West of the Westerly right of way line of Otis Road (an 80-foot right of way as now established), all being situate in Township 2 South, Range 24 East, City of Jacksonville, Duval County, Florida, and being more particularly described as follows: Beginning at the Southwest corner of said Section 17; thence North 01° 29' 00" East along the West line of said Section 17, 100.00 feet; thence North 89° 28' 40" East and parallel to the South line of said Sections 17 and 16, 10,666.38 feet; thence North 88° 51' 57" East and parallel to the South line of said Section 15, 1,317.95 feet to the Westerly right of way line of said Otis Road; thence South 0° 23' 45" West along said Westerly right of way line of Otis Road, 100.04 feet to its intersection with said South line of Section 15; thence South 88° 51' 57" West along said South line of Section 15, 1,318.49 feet to the Southwest corner of said Section 15; thence South 89° 28' 40" West along said South line of Sections 16 and 17, 10,667.72 feet to said Southwest corner of Section 17 and the Point of Beginning.

ORDINANCE 1999-803-E

CERTIFICATE OF AUTHENTICATION

ENACTED BY THE COUNCIL

SEPTEMBER 20, 1999

Ginger Soud

GINGER SOUD
COUNCIL PRESIDENT

ATTEST:

Beverly S. Bowen

BEVERLY S. BOWEN, CMC
COUNCIL SECRETARY

CITY OF JACKSONVILLE
FLORIDA

Building Permit

BUILDING INSPECTION DIVISION
CITY OF JACKSONVILLE, FLORIDA

OWNER'S COPY

BUILDING PERMIT: 47973.000 DUPLICATE
DATE ISSUED: 10/02/00 DATE PAID: 10/02/00 PERMIT FEE: EXEMPT

TOTAL FEE: $42,250.00

CONTRACTOR LICENSE: CGC051906 d.b.a.: FLUOR ENTERPRISES INC.
FOR: JEA AT: 15701 BEAVER ST W
LOT: 000 BLOCK: 000 SUBDIVISION: APPROVED: JS / TS
INSPECTION AREA: 31 INSPECTOR: HILL, MIKE PHONE: 0
NOTICE OF COMMENCEMENT: YES HANDICAPPED ACCESSIBILITY: NO
NEW BLDG. INDUSTRIAL 1

PERMIT IS ISSUED BASED ON SECTION 104.32
OF TH SBCCI AFFIDAVITS. JS
PLAN REVIEW BY AFFADIVIT/BLDG ARE TO MEE
T ALL APPLICABLE FIRE CODES

PERMIT REQUIREMENTS

1. ( ) SUBMIT REVISED DRAWINGS, AS INDICATED ON THE PERMIT SET PLANS, AND SECURE APPROVAL PRIOR TO COMMENCING CONSTRUCTION.
2. ( ) SUBMIT TWO SETS OF SHOP DRAWINGS FOR ( )STRUCTURAL STEEL ( )PRESTRESSED/POST-TENSIONED CONCRETE ( )WOOD TRUSSES ( ) AND SECURE APPROVAL PRIOR TO ERECTION.
3. ( ) SUBMIT THREE SETS OF REVISED ( )LANDSCAPE, ( )IRRIGATION PLANS WITHIN ( )WEEKS OF PERMIT ISSUE AND SECURE APPROVAL PRIOR TO INSTALLATION.
4. ( ) SUBMIT THREE SETS OF IRRIGATION SHOP DRAWINGS AND SECURE APPROVAL PRIOR TO INSTALLATION.
5. ( ) REQUIRED PROTECTED TREE REPLACEMENT IS ( )CALIPER INCHES.
6. (X)

THE WORK DESCRIBED HEREIN SHALL BE ACCOMPLISHED IN ACCORDANCE WITH THE PROVISIONS OF THE BUILDING AND ZONING CODES AND OTHER APPLICABLE REGULATIONS OF THE CITY OF JACKSONVILLE AND THE STATE OF FORIDA, SUBJECT TO THE INFORMATION SHOWN ON THE APPLICATION, APPROVED DRAWINGS, AND SPECIFICATIONS WHICH ARE MADE A PART OF THIS PERMIT. IF NO WORK IS DONE ON THE PERMIT DURING ANY SIX MONTHS PERIOD, PERMIT BECOMES VIOD. REQUIRED INSPECTIONS NOT PERFORMED UNDER THIS PERMIT WILL BE SUBJECT TO DISCIPLINARY ACTION. IN ADDITION TO THE REQUIREMENTS OF THIS PERMIT, THERE MAY BE ADDITIONAL RESTRICTIONS APPLICABLE TO THIS PROPERY THAT MAY BE FOUND IN THE PUBLIC RECORD OF THIS COUNTY (CITY) AND THEREIN MAY BE ADDITIONAL PERMITS REQUIRED FROM THE GOVERNMENTAL ENTITIES SUCH AS WATER MANAGEMENT DISTRICTS, STATE AGENCIES OR FEDERAL AGENCIES. THE PERMIT HOLDER MUST CONTACT ALL INVOLVED UTILITY COMPANIES TO OBTAIN ACCURATE LOCATION OF UNDERGROUND UTILITIES IN THE WORK AREA BEFORE COMMENCING ANY EXCAVATION OR SITE CLEARING. A LIST OF UTILITY COMPANIES FOR DUVAL COUNTY HAS BEEN COMPILED BY THE JACKSONVILLE AREA UTILITY COORDINATING COMMITTEE. COURTESY COPIES ARE AVAILABLE AT OUR PERMIT COUNTER. NOTICE OF A SEPERATE PERMIT IS REQUIRED TO WORK WITHIN THE CITY'S RIGHT OF WAY OR EASEMENT CONTACT THE DEVELOPMENT MANAGEMENT 630-1105. THE PERMIT HOLDER SHALL DELIVER A COPY OF THE PERMIT AND COPIES OF ALL FORMS RECEIVED WITH THIS PERMIT TO THE REAL PROPERTY OWNER.

WARNING TO OWNER: YOUR FAILURE TO RECORD A NOTICE OF COMMENCEMENT MAY RESULT IN YOUR PAYING TWICE FOR IMPROVEMENTS TO YOUR PROPERTY. IF YOU INTEND TO OBTAIN FINANCING, CONSULT WITH YOUR LENDER OR AN ATTORNEY BEFORE RECORDING YOUR NOTICE COMMENCEMENT.

COPIES OF THIS PERMIT, A SET OF APPROVED PLANS (IF ANY), AND THE RECORDED NOTICE OF COMMENCEMENT (OR A NOTARIZED STATEMENT THAT THE NOTICE OF COMMENCEMENT HAS BEEN FILED FOR RECORDING ALONG WITH A CERTIFIED COPY THEREOF) MUST BE POSTED IN A CONSPICUOUS PLACE ON THE JOB SITE FOR VERIFICATION BY OUR INSPECTORS.

10.6 Local Permit Applications

10.6.1 Land Use/Zoning Compliance Modification

An application for minor modification to a Planned Unit Development is attached.

10.6.2 Building Permit

A building permit application for the additional steam turbine building, cooling tower, and associated equipment is attached.

Land Use/Zoning Compliance
Permit Application

IMAGE QUALITY

AS YOU REVIEW THE NEXT FEW PAGES, PLEASE NOTE THAT THE ORIGINAL DOCUMENT WAS OF POOR QUALITY.

APPLICATION FOR MINOR MODIFICATION TO A PLANNED UNIT DEVELOPMENT

THIS APPLICATION MUST BE TYPED OR PRINTED IN BLACK INK AND SUBMITTED WITH FOUR (4) COPIES TO: PLANNING AND DEVELOPMENT DEPARTMENT, 128 EAST FORSYTH STREET, SUITE 700, JACKSONVILLE, FL 32202

1. DATE FILED:	2. PUD ORDINANCE NUMBER TO BE MODIFIED: 1999-803-E	3. APPLICATION NUMBER: (Assigned by Planning Department)

4. NAME AND ADDRESS OF OWNER OF RECORD:
(Application may be filed only by the owner of the property or the Owner's Authorized Agent)

Owner: Walter P. Bussells, CEO
21 West Church Street
Jacksonville, FL 32202-3139

Agent: Susan N. Hughes, P.E.
VP, Environmental Services

5. PROPERTY ADDRESS: 15701 Beaver Street West
Jacksonville, FL 32234
BETWEEN STREETS US-90 (Beaver Street) and US- 301

6. HAVE PREVIOUS APPLICATIONS FOR MINOR MODIFICATION BEEN FILED CONCERING THE PUD?
No IF YES, STATE APPLICATIN NUMBERS:

7. MINOR MODIFICATION REQUESTED:

8. REQUIRED ATTACHMENTS: Four (4) copies of each of the following must be filed with application, on 8-1/2" x 11" paper. Check all that apply:

[x] List of all owners of property within 350 feet of the boundaries of the subject property, including name, address and real estate number(s).

[x] Legal description, including real estate number(s) of the subject property. May either be lot and block or metes and bounds.

[x] Adopted ordinance from original PUD Application

[x] Written description indication the reason for the modification request, the changes in the PUD application, and supporting data

[x] Original and revised site plans

[x] Letter of authorization for agent to make application (required on if not made by owner)

[ ] OTHER: _____

(PLEASE DESCRIBE)

9. FEE $250.00

NOTIFICATION COSTS, PER ADDRESEE $2.00

FOR DEPARTMENT USE ONLY

Application No. _____

FLUM Cat. _____

Council District _____

Set for Public Hearing on _____

Planning and Development Department (initial) _____

PLEASE SEE OTHER SIDE

TO COMPLETE APPLICATION

Revised 6/7/00

10. No application will be accepted until all the requested information has been supplied and the required fee has been paid. The acceptance of an application as being complete does not guarantee its approval by the Planning Commission. The applicant will be notified of the public hearing dates for the hearings on the application upon the filing of this application. The applicant or his authorized agent MUST BE PRESENT at the public hearing.

11. Notice of the time and place of the public hearing which is required to be held by this section with respect to each Minor Modification shall be posted at least fourteen (14) days in advance of the scheduled public hearing by United States mail to all owners of real property within three hundred and fifty (350) feet of the boundaries of the land upon which a Minor Modification is requested; provided, that where such notice is determined by the Director to be insufficient to ensure actual notice to a majority of adjoining owners, he may require mailed notice to be given to such owners as the Director may determine to be appropriate. For the purpose of notice requirements to adjoining owners, the names and addresses of the owners shall be deemed to be those on the current tax records in the Office of the Property Appraiser. The failure of an owner required by this section to be notified by mail to receive the notice shall not invalidate or otherwise have any effect upon a public hearing or action taken by the Commission on an Application for Minor Modification, and the applicant for a Minor Modification shall post signs at intervals of not more than two hundred (200) feet along all street sides of property upon which the request is made in the form required by the Commission within three (3) working days after the filing for a Minor Modification. The sign shall be posted in full view of the public on each side of the land involved in a manner consistent with Section 656.124(c) and shall be maintained by the applicant until a final determination has been made on the minor modification. The sign shall be removed by the applicant within ten (10) working days after final action by the Commission. Appeals from decisions of the Commission shall be pursuant to Section 656, Part I, Subpart D, Ordinance Code.

12. Pursuant to Section 656.341 (f)(2) Zoning Code, the City Council may approve changes in the plans which comply with the following criteria:

(i) That there is no change in the approved land use(s), including the amount and general location thereof, no increase in the number of dwelling units or amount of non-residential floor area, or any associated characteristics of any use.

(ii) Driveways and /or streets do not significantly alter the general distribution of traffic or modify the public or private rights therein.

(iii) There is no change to any condition(s) set forth by the City Council in the ordinance which approved the Planned Unit Development district.

PLEASE STATE FACTS WHICH INDICATE THE PROPOSED CHANGES MEET THE ABOVE CRITERIA:

(a) This property will still be used for power generation, and will contain no dwelling units

(b) Changes to the property will be kept within the initial site boundaries without any additional clearing of trees needed. There also will be no added driveways or streets which would alter traffic patterns.

(c) The real property described in this application will be developed in accordance with all landscaping ordinances pursuant to the Planning and Development Department's review

I HEREBY CERTIFY THAT I HAVE READ AND UNDERSTAND the information contained in this application, that I am the owner or authorized agent for the owner with authority to make this application, and that all of the information contained in this application, including the attachments, is true and correct to the best of my knowledge. I HEREBY APPLY FOR A MINOR MODIFICATION TO A PLANNED UNIT DEVLOPMENT, AS REQUESTED.

PLEASE PRINT:

Name(s) of Owner(s)

Walter P. Bussells, CEO

Address of Owner(s)

21 West Church Street

Jacksonville, FL 32202

Telephone:

(904) 665-7220

Name of Authorized Agent:

Susan N. Hughes, P.E.

Address of Authorized Agent:

21 West Church Street, T-8

Jacksonville, FL 32202

Telephone:

(904) 665-6248

Signature of Owner or Authorized Agent: Susan N. Hughes

Revised 6/7/00

Property Owners Within 350 Feet of the Brandy Branch Generating Station

1. W.C. Bostwick
   PO Box 12
   Jacksonville, FL 32202-0012
   RE #: 001646 0000

2. I. Krieg
   15551 W. Beaver Street
   Baldwin, FL 32234
   RE #: 001649 0000

3. F.B. Miller
   1840 Seminole Road
   Jacksonville, FL 32205-9130
   RE #: 001645 0000

4. C.U. Miller Trust
   1840 Seminole Road
   Jacksonville, FL 32205-9130
   RE #: 000019 0000

5. I.H. Owen, Jr. Trust
   4076 McGirts Blvd.
   Jacksonville, FL 32210-4381
   RE #: 000476 0000

"EXHIBIT A"

LEGAL DESCRIPTION

VOL 3514 PAGE 488
OFFICIAL RECORDS

PARCEL 16A REF: 000019 0080

That certain piece, parcel or strip of land, situate, lying and being the South 100.00 feet of Sections 16 and 17, together with the South 100.00 feet of Section 15, lying West of the Westerly right of way line of Otis Road (an 80-foot right of way as now established), all being situate in Township 2 South, Range 24 East, City of Jacksonville, Duval County, Florida, and being more particularly described as follows: Beginning at the Southwest corner of said Section 17; thence North 01° 29' 00" East along the West line of said Section 17, 100.06 feet; thence North 89° 28' 40" East and parallel to the South line of said Sections 17 and 16, 10,666.38 feet; thence North 88° 51' 57" East and parallel to the South line of said Section 15, 1,317.95 feet to the Westerly right of way line of said Otis Road; thence South 0° 23' 45" West along said Westerly right of way line of Otis Road, 100.04 feet to its intersection with said South line of Section 15; thence South 88° 51' 57" West along said South line of Section 15, 1,318.49 feet to the Southwest corner of said Section 15; thence South 89° 28' 40" West along said South line of Sections 16 and 17, 10,667.72 feet to said Southwest corner of Section 17 and the Point of Beginning.

"EXHIBIT A"

LEGAL DESCRIPTION

FM 3514 PG 490
OFFICIAL RECORDS

PARCEL 16B RE#: 001647 0010

That certain piece, parcel or tract of land, situate, lying and being a part of Section 18, Township 2 South, Range 24 East, together with a part of Section 13, Township 2 South, Range 23 East, City of Jacksonville, Duval County, Florida, and all being more particularly described as follows: Beginning at the Southwest corner of Section 18, said point of beginning being also the Southeast corner of said Section 13; thence South 89° 18' 44" West along the South line of Section 13, 1,150.00 feet; thence North 0° 29' 20" West, 2,643.96 feet; thence North 89° 30' 40" East, 2,640.00 feet; thence South 0° 29' 20" East, 2,426.96 feet to a point situate in the Northwesterly right of way line of the Seaboard Coast Line Railroad (a 100-foot right of way as now established); thence South 56° 14' 50" West along said Northwesterly right of way line, 388.41 feet to its intersection with the South line of said Section 18; thence South 89° 30' 40" West along said South line of Section 18, 1,165.23 feet to the Point of Beginning. Excepting, however, from the above described lands, the North 100.00 feet thereof.

PARCEL 16C RE#: 000019 0010

That certain piece, parcel or tract of land, situate, lying and being a part of the East 1/2 of Section 13, Township 2 South, Range 23 East, City of Jacksonville, Duval County, Florida, and being more particularly described as follows: Commencing at the Northeast corner of said Section 13; thence South 89° 11' 44" West along the North line of said Section 13, 450.07 feet for a Point of Beginning; thence continuing South 89° 11' 44' West along said North line of Section 13, 200.03 feet; thence South 0° 13' 33" West, 2,673.30 feet; thence North 89° 30' 40" East, 200.02 feet; thence North 0° 13' 33" East parallel to the East line of said Section 13, and 450.00 feet westerly therefrom when measured at right angles thereto, 2,674.40 feet to the Point of Beginning.

PARCEL 16D RE#: 000019 0020

A portion of the East 1/2 of Section 13, Township 2 South, Range 23 East, City of Jacksonville, Duval County, Florida, and being more particularly described as follows: Commencing at the Northeast corner of said Section 13; thence South 89° 11' 44" West along the North line of said Section 13,450.07 feet; thence South 0° 13' 33" West, 2,674.40 feet for a point of beginning; thence continuing South 0° 13' 33" West, 100.00 feet; thence South 89° 30' 40" West, 200.02 feet; thence North 0° 13' 33" East, 100.00 feet; thence North 89° 30' 40" East, 200.02 feet to the point of beginning.

OFFICE OF THE CITY COUNCIL
DEPARTMENT OF COUNCIL SECRETARY

BEVERLY S. DOMEN, CMC
COUNCIL SECRETARY
(904) 630-1404
FAX (904) 630-1242

117 W. DUVAL STREET
4TH FLOOR, CITY HALL
JACKSONVILLE, FLORIDA 32202
BSDOMEN@COJ.NET

October 18, 1999

Ms. Susan Hughes
c/o JEA
21 West Church Street, T-8
Jacksonville, FL 32202

Re: Ordinance 1999-803-E

Dear Ms. Hughes:

The City Council has approved the above rezoning which is effective as shown in the Certificate of Authentication. A copy is enclosed for your records.

If you require additional information, please contact the Planning & Development Department at 630-1904.

Sincerely,

Beverly S. Domen, CMC
Council Secretary

BSD/slj

Enc.
cc: Building & Zoning Department - Ordinance Only
Planning Department - Ordinance Only
Property Appraiser - Ordinance Only

Introduced by the Urban Affairs and Planning Committee:

ORDINANCE 1999-803-E

AN ORDINANCE REZONING PROPERTY HEREIN DESCRIBED, OWNED BY JEA, FROM "PBF-1" DISTRICT TO "PUD" DISTRICT AS DEFINED AND CLASSIFIED UNDER THE ZONING CODE; PROVIDING AN EFFECTIVE DATE.

WHEREAS, JEA, the owner of the real property described in this ordinance, has applied to the Council for a rezoning and reclassification of that property from "PBF-1" District to "PUD" District; and

WHEREAS, the Planning and Development Department has considered the application and has rendered an advisory opinion; and

WHEREAS, the Land Use and Zoning Committee, after due notice and public hearing has made its recommendation to the Council; and

WHEREAS, taking into consideration the above recommendations, the Council finds that such rezoning is consistent with the comprehensive plan adopted under the Comprehensive Planning Ordinance for future development of the City of Jacksonville;

WHEREAS, the Council finds that the proposed PUD does not affect adversely the orderly development of the City as embodied in the Zoning Code; will not affect adversely the health and safety of residents in the area; will not be detrimental to the natural environment or to the use or development of the adjacent properties in the general neighborhood; and the proposed PUD will accomplish the objectives and meet the standards of Section 656.340 (Planned Unit Development) of the Zoning Code of the City of Jacksonville; now, therefore

BE IT ORDAINED by the Council of the City of Jacksonville:

Section 1. Property Rezoned. The real property described in Section 2 is rezoned and reclassified from "PBF-1" District to "PUD" District, as shown and described in the site plan and application for the Brandy Branch Generating Station PUD, on file in the Office of the Council Secretary.

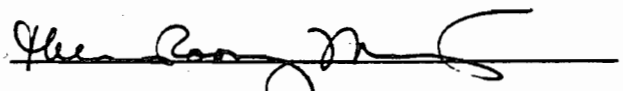
Section 2. Owner and Description. The land rezoned by this ordinance is owned by JEA, and is described in Exhibit A attached hereto and by this reference made a part hereof.

Section 3. Condition. This rezoning is approved subject to, and the real property described herein shall be developed in accordance with, the condition that a landscaping plan shall be submitted to the Planning and Development Department for review and approval prior to verification of substantial compliance with the PUD pursuant to Section 656.341(g) of the Zoning Code.

and renumber the remaining section accordingly.

Section 4. Effective Date. The adoption of this ordinance shall be deemed to constitute a quasi-judicial action of the City Council and shall become effective upon signature by the Council President and Council Secretary

Form Approved:



Office of General Counsel

Legislation Prepare By: Cheryl R. Peek

9/23/99 CRP/jt G:\shared\LEGIS.CC\99Legis\Ords\1999-803-E.wpd

ORDINANCE 1999-803-E

CERTIFICATE OF AUTHENTICATION

ENACTED BY THE COUNCIL

SEPTEMBER 20, 1999

Ginger Soud

GINGER SOUD
COUNCIL PRESIDENT

ATTEST:

Beverly S. Domen

BEVERLY S. DOMEN, CMC
COUNCIL SECRETARY

CITY OF JACKSONVILLE
FLORIDA

Descriptive Reason for Modification Request

The Brandy Branch Generating Station Conversion Project will convert two of the original simple cycle combustion turbines (Units 2 and 3) into a combined cycle operation. Unit 1 will remain in simple cycle mode, while Units 2 and 3 will become somewhat connected. Combined cycle operation adds a heat recovery steam generator (HRSG) to each combustion turbine to create steam from the waste heat in the combustion turbine exhaust. The steam is then pressurized and used to generate additional electricity through a steam turbine and generator. The steam turbine generator cycle will create approximately 200 additional megawatts. New major equipment associated with the conversion includes the HRSGs, steam turbine/generator, and a cooling tower to dissipate mechanical heat. The steam turbine/generator equipment will be housed in an enclosed building; the cooling tower (approximately 30 feet tall) will be a multi-cell, mechanical draft structure. The new facilities are highlighted on the enclosed Site Arrangement. In additional to the major equipment, support equipment such as piping, pumps, valves, and controls will be required. The status of Units 2 and 3 will also change from classification as "peaking" units to a baseload unit following the conversion. Unit 1 will remain a peaking unit.

21 West Church Street

Jacksonville, Florida 32202-3139

JEA

November 3, 2000

City of Jacksonville
City Council and Planning and Development Dept.
128 East Forsyth Street, Suite 700
Jacksonville, FL 32202

RE: Brandy Branch Generating Station Project, PUD Modification
(Ordinance 1999-803-E): Agent Letter

Dear Ladies and Gentlemen:

You are hereby advised that Susan N. Hughes, JEA Vice President of Environmental Services, will serve as the JEA agent during permitting procedures for the above pre-referenced modification. During the review of the enclosed PUD modification documentation, please correspond with Ms. Hughes at the following address:

Susan N. Hughes, P.E.
JEA, Vice President of Environmental Services
21 West Church Street, T-8
Jacksonville, FL 32202
(904)665-6248
hughsn@jea.com

Sincerely,

Walter P. Bussells
JEA, Managing Director

Building Permit Application

CITY OF JACKSONVILLE, FLORIDA
Building and Zoning Inspection Division

BUILDING PERMIT APPLICATION

(APPLICATION MUST BE TYPED OR PRINTED IN INK)
ONLY ORIGINAL APPLICATION WILL BE ACCEPTED

R.E. NO.: DATE ISSUED: PERMIT NO.:

OFFICIAL USE ONLY

HOUSE NUMBER _____ STREET NAME _____
TYPE _____ DIRECTION _____ APT/UNIT _____ ZONING _____
INSP. AREA _____ C.T. _____ ZONING APPROVAL _____
ZONING NOTES: _____
NOTICE OF COMMENCEMENT: YES, NO DATE _____ FINAL APPROVAL _____ FEE $ _____

HOUSE NUMBER 15701 STREET NAME Beaver Street West
INTERSECTING STREET: BETWEEN US-90 (Beaver St.) AND US-301
LEGAL LAND DESCRIPTION LOT NO. _____ BLOCK _____ SUBDIVISION _____
(State portion of lot if less than full lot — Attach legal description per deed in duplicate if metes and bounds)

ASSOCIATED PERMIT NO.

PROPERTY OWNER	LICENSED CONTRACTOR	FLA. ARCHITECT OR ENGINEER
COMPANY NAME JEA	COMPANY NAME	COMPANY NAME
NAME Susan N. Hughes, P.E.	LICENSEE NAME	LICENSEE NAME
TITLE V.P., Environmental Services	LICENSE NO	LICENSEE SIGNATURE
ADDRESS 21 West Church Street, T-8 Jacksonville, FL 32202	CITY ID NO / ADDRESS	ADDRESS
TELEPHONE NO (904) 665-6248	TELEPHONE NO	TELEPHONE NO / LICENSE NO
FEE SIMPLE TITLEHOLDER (If Other Than Owner)	BONDING COMPANY	MORTGAGE LENDER
NAME	NAME	NAME
ADDRESS	ADDRESS	ADDRESS

IMPORTANT: ALL APPLICANTS TO COMPLETE ALL ITEMS ON THIS SIDE AND ITEMS VIII. XIII. ON THE BACKSIDE.

Application is hereby made to obtain a permit to do the work and installations as indicated. I certify that no work or installation has commenced prior to the issuance of a permit and that all work will be performed to meet the standards of all laws regulating construction in this jurisdiction. I understand that a separate permit must be secured for ELECTRICAL WORK, PLUMBING, SIGNS, WELLS, POOLS, FURNACES, BOILERS, HEATERS, TANKS, AND AIR CONDITIONERS, etc.

OWNER'S AFFIDAVIT: I certify that all the foregoing information is accurate and that all work will be done in compliance with all applicable laws regulating construction and zoning. I will not occupy or use the referenced building or part thereof until all inspections are finaled and prior to obtaining a certificate of handicapped accessibility issued by the building official, as required by law.

WARNING TO OWNER: YOUR FAILURE TO RECORD A NOTICE OF COMMENCEMENT MAY RESULT IN YOUR PAYING TWICE FOR IMPROVEMENTS TO YOUR PROPERTY.

IF YOU INTEND TO OBTAIN FINANCING, CONSULT WITH YOUR LENDER OR AN ATTORNEY BEFORE RECORDING YOUR NOTICE OF COMMENCEMENT.

Signature Susan N. Hughes — Owner or Agent
Date 11/27/02
Cathy L Barnwell
NOTARY as to Owner or Agent
CATHY L. BARNWELL
Notary Public, State of Florida
My Commission Expires: Sept. 24, 2002
My comm. expires
Comm. No. CC 777997

Signature _____ — Contractor
Date _____
NOTARY as to Contractor
My Commission Expires:

I. TYPE OF IMPROVEMENT

A. New Building
(B) Addition or Accessory Building
C. Alterations and Repairs
D. Roofing/Re-roofing and Repairs
E. Demolition
F. Moving Building (See Reverse Side)
G. Foundation only
H. Swimming pool _____ gallons
J. Mobile home move-on (new)
K. Mobile home move-on (replacement)
L. Other _____
M. Address only
N. Moving outside city
O. Converting Use
R. Trailer Parks & Camps
S. Site Clearing
T. Tree Removal

For additions, alterations or other permits, provide brief description:
adding steam turbine building, cooling tower and associated equipment, piping, etc

NOTE:
For demolition/renovation projects involving a commercial, institutional or industrial structure or apartment building of more than four dwelling units, the following provisions are applicable:

I. Renovation: Is asbestos present? _____ Yes _____ No
If asbestos is subsequently discovered, the applicant shall immediately provide notice to the DER and AQD and amend this application.

II. Demolition: All applicants must provide Notice to DER and AQD regardless of whether asbestos is present.

II. OWNERSHIP

A. Private (individual, corporation, nonprofit, institution, etc.)
(B) Public (federal, state or local government)

III. COST

(Total costs to include plumbing, electrical and mechanical)
$ 150 million

V. NUMBER OF OFF-STREET PARKING SPACES

Outdoors _____ Enclosed _____

IV. PROPOSED USE

RESIDENTIAL	NO. OF UNITS
A. Single Family	
B. Duplex	
C. Condominiums	
D. Hotel, motel, or dormitory	
E. Garage	
F. Carport	
G. Other	
H. 3 or 4 Families	
I. Apartments	
J. Mobile Home	

NONRESIDENTIAL	NO. OF UNITS
A. Amusement, recreational	
B. Church, other religious	
(C) Industrial	
D. Parking garage	
E. Service station, repair garage	
F. Hospital, institutional	
G. Office, bank, professional	
H. Utility, towers, tanks	
I. School, library, other educational	
J. Stores, mercantile	
L. Other	
M. Convert Residence to Business	
N. Restaurants	

VI. WATER

A. Public-city
B. Private Utility Company
(C) Private well

VII. SEWAGE

A. Public-city
B. Private Utility Company
(C) Septic tank

VIII. DIMENSIONS

A. Number of stories 2
B. Total floor area sq. ft.
Enclosed 55,100
Unenclosed 0
C. Total land area sq. ft. 418,800
D. Building height ft. 100(generator bld)
E. Altered floor/story
F. Altered floor area sq. ft.
Enclosed
Unenclosed

IX. MECHANICAL

A. HVAC [X] Yes [ ] No
B. TYPE OF HEATING FUEL
(A. Electricity) B. Oil
C. Gas D. Coal
C. FIRE SPRINKLER SYSTEM
[X] Yes [ ] No
D. ELEVATOR
[ ] Yes [X] No

X. PRINCIPAL TYPE OF FRAME

A. Masonry (Load bearing)
B. Wood frame
C. Structural steel
D. Reinforced concrete
E. Other

Foundation
Load bearing walls
Columns
Floor framing
Roof Framing

XII. TOTAL IMPERVIOUS AREA 140,000 (SF)

XIII. S.I.D. CODE 4911

XI. RESIDENTIAL

SINGLE FAMILY
No. Bedrooms
Bathrooms
Full
Partial

MULTI-FAMILY
Bedrooms No.
1. 2.
3 or more

MOVING BUILDINGS (Note: This space to be used for present location. Use space on front of form for new location)

Building to be moved from
(Street Address)

Loaded size of building: Height Width Length

Travel Route:

CERTIFICATE OF OCCUPANCY INFORMATION	FLOOD PLAIN	Occupancy	Occupancy	Live	Standard Building Code
	[ ] Yes [X] No	Classification F	Load 50	Loads 100 sf	Type of Construction IV

SPACE BELOW FOR OFFICIAL USE ONLY. DO NOT WRITE OR CHANGE ANYTHING

CHECKING NOTES								
Fire Limits	[ ] Yes [ ] No	HC Parking Spaces		Monumental Stairs	[ ] Yes [ ] No	Return Air Plenum	[ ] Yes [ ] No	
Roof Covering		HC Code	[ ] 1990 [ ] ANSI	Threshold Building	[ ] Yes [ ] No	Residential Insulation	[ ] Yes [ ] No	
Area Modifications	[ ] 30' [ ] 60'	Restrooms	[ ] Unisex [ ] Separate	Dead End Corridor		Atrium	[ ] Yes [ ] No	
Mezzanine	[ ] Yes [ ] No	Mall Building	[ ] Yes [ ] No	Common Path of Travel		Secondary Roof Drain	[ ] Yes [ ] No	
Seating Capacity		Tenant Separation	[ ] Yes [ ] No	Horizontal Exits	[ ] Yes [ ] No	Exit Signs	[ ] Yes [ ] No	
Stairway Protection	[ ] Yes [ ] No	Occupancy Separation	[ ] Yes [ ] No	Partition Parking	[ ] Yes [ ] No	Stairs Identification	[ ] Yes [ ] No	
Number of Exits		Rated Corridors	[ ] Yes [ ] No	Energy Forms	[ ] Yes [ ] No	Toilet Exhaust Fan	[ ] Yes [ ] No	
		Rated Assemblies	[ ] Yes [ ] No	Safety Glazing	[ ] Yes [ ] No	Draftstopping	[ ] Yes [ ] No	

FEE CALCULATIONS:	AREA (SF)	FEE(S)
Enclosed Divided Area:		
1st thru 4th Floors		
Above 4th Floor		
Enclosed Undivided Area:		
Unenclosed Area:		
TOTAL FEE		

RADON SQ. FOOTAGE (SF)

HANDICAPPED [ ] Yes [ ] No

CHECKING COMMENTS

PERMIT REQUIREMENTS

1. ( ) Submit revised drawings, as indicated on the permit set plans, and secure approval prior to commencing construction.
2. ( ) Submit two sets of shop drawings for ( ) structural steel ( ) prestressed/post-tensioned concrete ( ) wood trusses ( ) and secure approval prior to erection.
3. ( ) Submit three sets of revised ( ) landscape, ( ) irrigation plans within ( ) weeks of permit issue and secure approval prior to installation.
4. ( ) Submit three sets of irrigation shop drawings and secure approval prior to erection.
5. ( ) Required protected tree replacement is ( ) caliper inches
6. (x) Permit is issued based on section 104.3.2 of the SBCC I AFFIDAVITS.

Plan review by affidavits/ buildings are to meet all applicable fire codes.

APPROVAL NOTES

WATER AND SEWER	PUBLIC WORKS	LANDSCAPE
N/A		
UTILITY CERTIFICATE	ST. JOHNS RIVER WATER MANAGEMENT DISTRICT PERMIT NO.	
FIRE OFFICIAL	HEALTH OFFICIAL	CONCURRENCY MANAGEMENT
		CRC/VPAC NUMBER
PLUMBING ( ) Fixture Layout Date ( ) Fixture Layout of Disconnect Approval	MECHANICAL ( ) Date ( ) Approval	ELECTRICAL ( ) Date ( ) Approval
		PLANNING DEPARTMENT/DDA

CONCURRENCY RESERVATION CERTIFICATE
APPLICATION FORM
CITY OF JACKSONVILLE, FLORIDA

OFFICIAL USE ONLY	APPLICATION #	DEVELOPMENT #	APPLICATION DATE

I. TYPE OF DEVELOPMENT:

RESIDENTIAL _____ NON-RESIDENTIAL X

DEVELOPMENT NAME: Brandy Branch Generating Station

PROJECT NAME: JEA: Brandy Branch Combined Cycle Project

ADDRESS: 15701 Beaver Street West

A. TYPE OF IMPROVEMENT: (CIRCLE ALL THAT APPLY)

A. NEW BUILDING
(B) ADDITION OR ACCESSORY BUILDING
C. ALTERATION AND REPAIRS
G. FOUNDATION ONLY
O. CONVERTING USE
R. TRAILER PARK
L. OTHER
J. MOBILE HOME (NEW)

B. IS THIS PROJECT LOCATED WITHIN THE BOUNDARIES OF AN APPROVED DEVELOPMENT AGREEMENT AREA? YES X NO___ IF YES, INCLUDE DEVELOPMENT AGREEMENT #. 21871.1 (THIS WILL BE AN EXISTING CCAS OR CRC APPLICATION #)

II. PROJECT OR DEVELOPMENT LOCATION

A. SECTION 13, 16, 17, 18 TOWNSHIP 2 South RANGE 23 & 24 East

B. COUNCIL DISTRICT 11 PD/TAZ 474
PLANNING DIST. 5 CENSUS TRACT 137.01
PANEL NUMBER 4 31

C. INTERSECTING STREETS: BETWEEN US-90 (Beaver Street West)
AND US-301

D. REAL ESTATE NUMBER: 001647 0010, 000019 0010

E. WATER SOURCE: (CIRCLE ONE) A. CITY B. PRIVATE UTILITY (C) PRIVATE WELL
SEWAGE DISPOSAL: (CIRCLE ONE) A. CITY B. PRIVATE UTILITY (C) PRIVATE WELL

F. LEGAL DESCRIPTION: see attachment

IF NEEDED, PLEASE CONTINUE ON A SEPARATE PAPER AND ATTACH TO THE APPLCATION

III. AGENT AND OWNER INFORMATION (PLEASE MAKE SURE THERE IS A ZIP CODE)

A. AGENT/DEVELOPER Lindsay N. Starner
ADDRESS 21 West Church Street, T-8

CITY Jacksonville ST FL ZIP 32202-3139
PHONE (904) 665-7605

B. OWNER ~~SAME AS ABOVE~~ Walter P. Bussells
ADDRESS 21 West Church Street, T-16

CITY Jacksonville ST FL ZIP 32202-3139
PHONE (904) 665-7220

C. MAIL THE CRC CERTIFICATE TO: AGENT X OWNER

IV. COMMENTS

V. PROJECT OR DEVELOPMENT SPECIFICATIONS

A. LAND USE CODE 170 PREVIOUS LAND USE CODE
CURRENT ZONING PUD PREVIOUS ZONING PBF-1

B. GROSS SQ FT BY LAND USE CODE 418,800±

C. DRAINAGE INFORMATION (*SEE ATTACHED SHEET*)

D. PROJECT PHASING SCHEDULE 2002- 2004 E. PROJECT BUILDOUT YEAR 2002

F. TOTAL LAND AREA 9.6 ACRES ESTIMATED COST $150 million

G. ENCLOSED AREA OF PROPOSED DEVELOPMENT 55,100 ENCLOSED SQUARE FEET

H. TOTAL NUMBER OF DWELLING UNITS N/A

SINGLE FAMILY DUPLEX TRIPLEX/QUAD

APARTMENT MOBILE HOMES CONDOS

NUMBER OF ROOMS NUMBER OF BERTHS
NUMBER OF PADS NUMBER OF BEDS
NUMBER OF PARKING SPACES NUMBER OF SEATS
OTHER (PLEASE SPECIFY)

I. THE PROPOSED DEVELOPMENT WILL GENERATE PERMANENT JOBS:

FULL TIME: 12 PART TIME: TOTAL: 12

VI. ADDRESS RANGES

IF THE PROPOSED DEVELPMENT OR PROJECT HAS ROADS AND/OR AN ADDRESS, PLEASE LIST ALL ROADS WITH THEIR RESPECTIVE STREET ADDRESS RANGES

LOW ADDRESS #	HIGH ADDRESS #	STREET NAME	TYPE	DIRECTION
15701	15701	Beaver Street West		

VII. SIGNATURES

AGENT/DEVELOPER Lindsay N. Starner DATE 11/20/00

OWNER [signature] SW DATE 11/27/00

GENERAL AUTHORIZATION

TO WHOM IT MAY CONCERN:

The undersigned hereby authorizes Lindsay N. Starner to act as my agent to obtain concurrency approval for development of lands which I currently own as described on the attached application.

[signature] SW

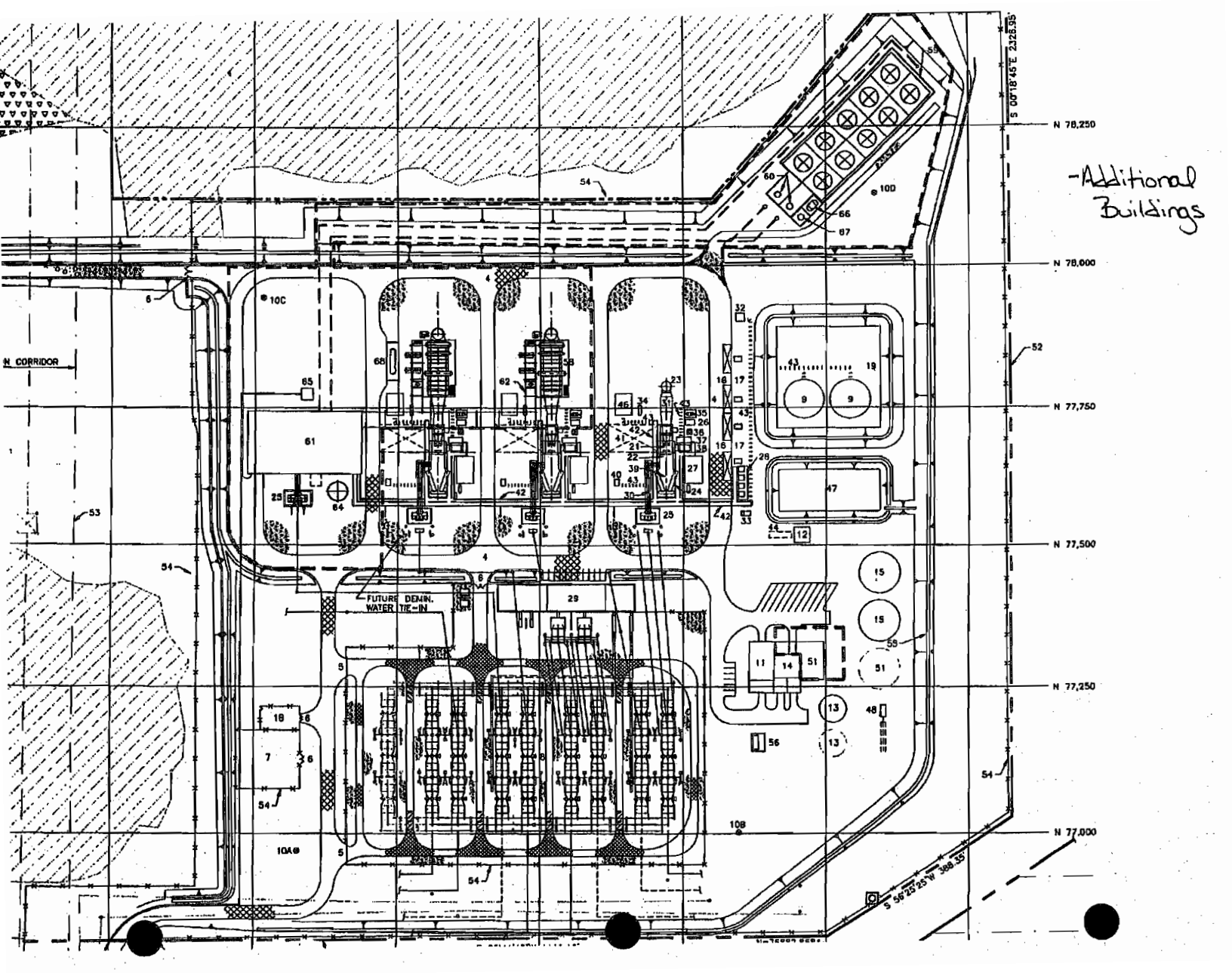
OWNER OF SUBJECT PROPERTY

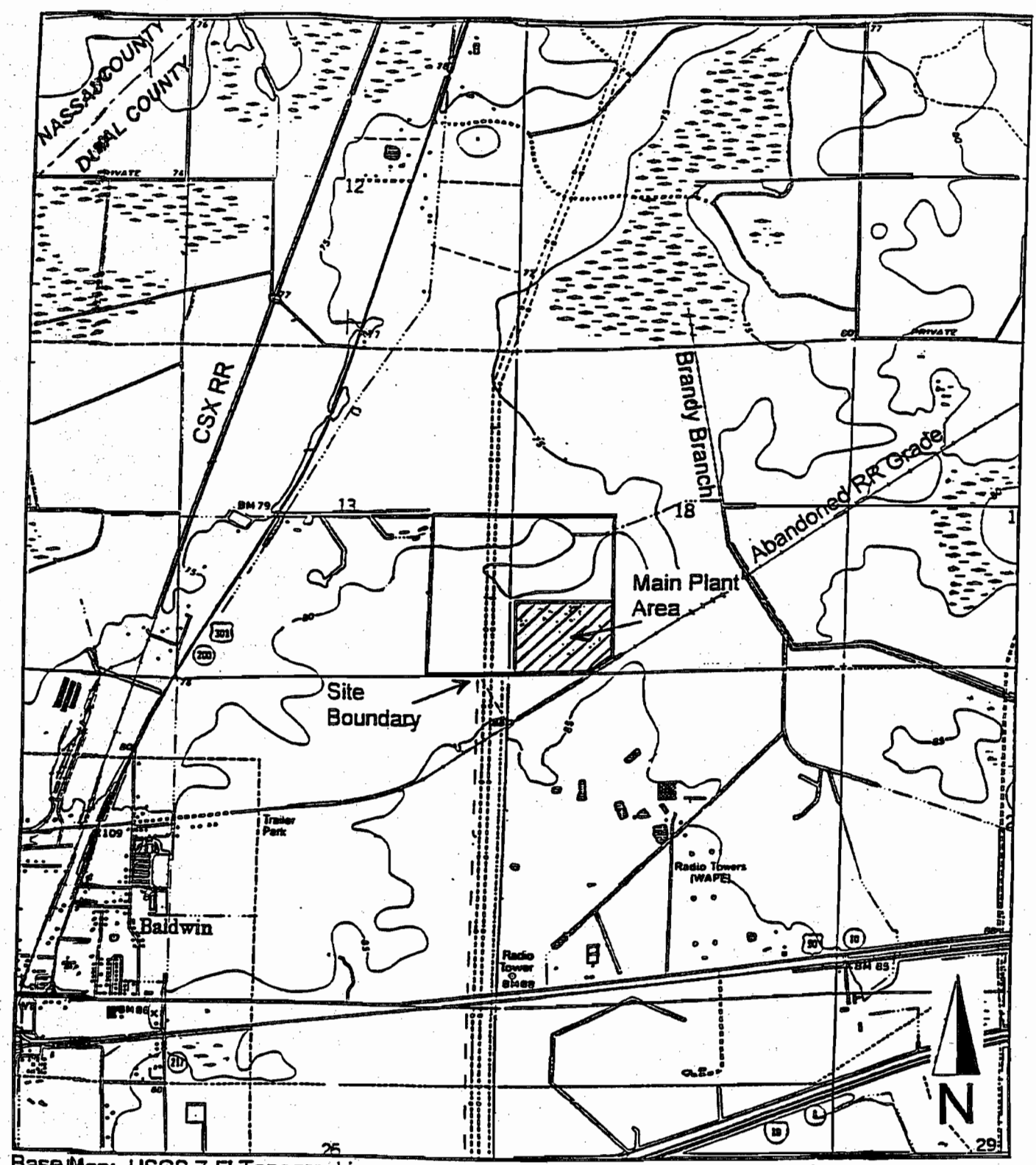
ITEMS REQUIRED FOR CRC REVIEW

1. COMPLETED APPLICATION
2. SITE PLAN
3. VICINITY MAP
4. OWNER AUTHORIZATION
5. LEGAL DESCRIPTION
6. DRAINAGE PLAN OR EVIDENCE OF PLAN REVIEW SUBMITTAL
7. FIXTURE UNIT BEAKDOWN FOR CITY WATER & SEWER
   OR AVAILABILITY LETTER FROM PRIVATE UTILITY COMPANY (PROJECTS NOT SERVED BY CITY)
8. FEE (CHECKS SHOULD BE MADE OUT TO TAX COLLECTOR.)
   N/A JEA PROJECT
   N/A Private well/septic tank

CONCURRENCY MANAGEMENT SYSTEM OFFICE
CITY HALL ANNEX
ROOM 100
220 EAST BAY STREET
JACKSONVILLE, FLORIDA 32202
(904) 630-1125
FAX (904) 630-1296

(NO FEE: JEA PROJECT)


-Additional Buildings
N 78,250
N 78,000
N 77,750
N 77,500
N 77,250
N 77,000
S 00°18'45"E 2325.35
S 56°25'25"W 388.35
N CORRIDOR
FUTURE DEMIN. WATER TIE-IN
10C
10D
10A



Base Map: USGS 7.5' Topographic
Baldwin Quadrangle, Revised 1992

Vicinity Map
Brandy Branch Power Plant

Mile
0 0.5 1

LEGAL DESCRIPTION

PAGE 3514 :: 488
OFFICIAL RECORDS

PARCEL 16A

That certain piece, parcel or strip of land, situate, lying and being the South 100.00 feet of Sections 16 and 17, together with the South 100.00 feet of Section 15, lying West of the Westerly right of way line of Otis Road (an 80-foot right of way as now established), all being situate in Township 2 South, Range 24 East, City of Jacksonville, Duval County, Florida, and being more particularly described as follows: .Beginning at the Southwest corner of said Section 17; thence North 01° 29' 00" East along the West line of said Section 17, 100.06 feet; thence North 89° 28' 40" East and parallel to the South line of said Sections 17 and 16, 10,666.38 feet; thence North 88° 51' 57" East and parallel to the South line of said Section 15, 1,317.95 feet to the Westerly right of way line of said Otis Road; thence South 0° 23' 45" West along said Westerly right of way line of Otis Road, 100.04 feet to its intersection with said South line of Section 15; thence South 88° 51' 57" West along said South line of Section 15, 1,318.49 feet to the Southwest corner of said Section 15; thence South 89° 28' 40" West along said South line of Sections 16 and 17, 10,667.72 feet to said Southwest corner of Section 17 and the Point of Beginning.

LEGAL DESCRIPTION

PARCEL 16B

That certain piece, parcel or tract of land, situate, lying and being a part of Section 18, Township 2 South, Range 24 East, together with a part of Section 13, Township 2 South, Range 23 East, City of Jacksonville, Duval County, Florida, and all being more particularly described as follows: Beginning at the Southwest corner of Section 18, said point of beginning being also the Southeast corner of said Section 13; thence South 89° 18' 44" West along the South line of Section 13, 1,150.00 feet; thence North 0° 29' 20" West, 2,643.96 feet; thence North 89° 30' 40" East, 2,640.00 feet; thence South 0° 29' 20" East, 2,426.96 feet to a point situate in the Northwesterly right of way line of the Seaboard Coast Line Railroad (a 100-foot right of way as now established); thence South 56° 14' 50" West along said Northwesterly right of way line, 388.41 feet to its intersection with the South line of said Section 18; thence South 89° 30' 40" West along said South line of Section 18, 1,165.23 feet to the Point of Beginning. Excepting, however, from the above described lands, the North 100.00 feet thereof.

PARCEL 16C

That certain piece, parcel or tract of land, situate, lying and being a part of the East 1/2 of Section 13, Township 2 South, Range 23 East, City of Jacksonville, Duval County, Florida, and being more particularly described as follows: Commencing at the Northeast corner of said Section 13; thence South 89° 11' 44" West along the North line of said Section 13, 450.07 feet for a Point of Beginning; thence continuing South 89° 11' 44' West along said North line of Section 13, 200.03 feet; thence South 0° 13' 33" West, 2,673.30 feet; thence North 89° 30' 40" East, 200.02 feet; thence North 0° 13' 33" East parallel to the East line of said Section 13, and 450.00 feet westerly therefrom when measured at right angles thereto, 2,674.40 feet to the Point of Beginning.

PARCEL 16D

A portion of the East 1/2 of Section 13, Township 2 South, Range 23 East, City of Jacksonville, Duval County, Florida, and being more particularly described as follows: Commencing at the Northeast corner of said Section 13; thence South 89° 11' 44" West along the North line of said Section 13, 450.07 feet; thence South 0° 13' 33" West, 2,674.40 feet for a point of beginning; thence continuing South 0° 13' 33" West, 100.00 feet; thence South 89° 30' 40" West, 200.02 feet; thence North 0° 13' 33" East, 100.00 feet; thence North 89° 30' 40" East, 200.02 feet to the point of beginning.

10.7 PSD Permit Application

The construction and operation of the combined cycle project will require a PSD permit. The PSD Air Permit Application is attached to this Site Certification Application under separate cover as Appendix 10.7.

JACKSONVILLE ELECTRIC AUTHORITY
BRANDY BRANCH GENERATING STATION

GEOTECHNICAL DESIGN REPORT

B&V Project No. 60903

September 1999

Black & Veatch Corporation

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1.0 Introduction

This report presents a summary of the subsurface investigation, site conditions, geotechnical data, and geotechnical design recommendations for Jacksonville Electric Authority's (JEA) Brandy Branch Generating Station located near Baldwin, Florida. The project will include the construction of three simple cycle combustion turbines and supporting facilities. Black & Veatch was retained by JEA to provide engineering services for the project.

Black & Veatch conducted a subsurface investigation at the site consisting of soil borings, cone penetrometer soundings, installation of piezometers, electrical resistivity tests, groundwater permeability testing, and laboratory testing of selected samples.

The information and data obtained form the subsurface investigation was used to determine appropriate geotechnical design parameters and make construction recommendations.

This report provides the following information:

- Site location.
- Subsurface investigation program including all test results
- Subsurface characterization.
- Engineering recommendations.

2.0 Summary

Conclusions and recommendations based on the information obtained during the subsurface investigation are summarized below:

- The project area is suitable for the planned development from the geotechnical standpoint, provided that the recommendations of this report are followed.
- The geologic profile underlying the proposed facilities consists of 95 feet of loose to dense sand and silty sand underlain by bedrock. Site specific geology is presented in Section 5.
- Groundwater level was determined from piezometers installed at the site. Water level readings will continue to be taken through construction. For design purposes, the groundwater level is established at elevation 78 feet. The elevation of the groundwater will fluctuate due to seasonal conditions.
- Lightly loaded structures can be constructed on soil supported shallow foundations consisting of spread and strip footings. Spread and strip footings shall be designed in accordance with the load deflection curves presented in Figures 6-1 and 6-2, respectively. Bearing pressures were calculated assuming a 1.5-ft. embedment depth and a factor of safety of 3.0.
- Tank foundations can be constructed using a concrete ring beam footing and will experience less than 4 inches of total settlement. This settlement is within the tolerable range for tanks.
- Deep foundations should be used for the construction of the power block facilities. Two types of deep foundations, auger cast-in-place piles and square precast pre-stressed concrete piles, are suitable for supporting the structures. A summary of pile capacities for the two types of piles is presented in Table 6-2. Piles shall be load tested to confirm design capacities.
- Lateral earth pressure parameters for retaining walls and subsurface walls are presented in Figure 6-3.
- Earthwork at the site will consist of placing 6 to 8 feet of fill in the main power block area. Fill can be obtained from the stormwater pond area and the wetlands creation area.
- Soil boring logs, cone penetrometer soundings, soil resistivity, piezometer logs, infiltrometer, slug test, and laboratory test results are presented in the Appendices.

3.0 Site Location and Facility Description

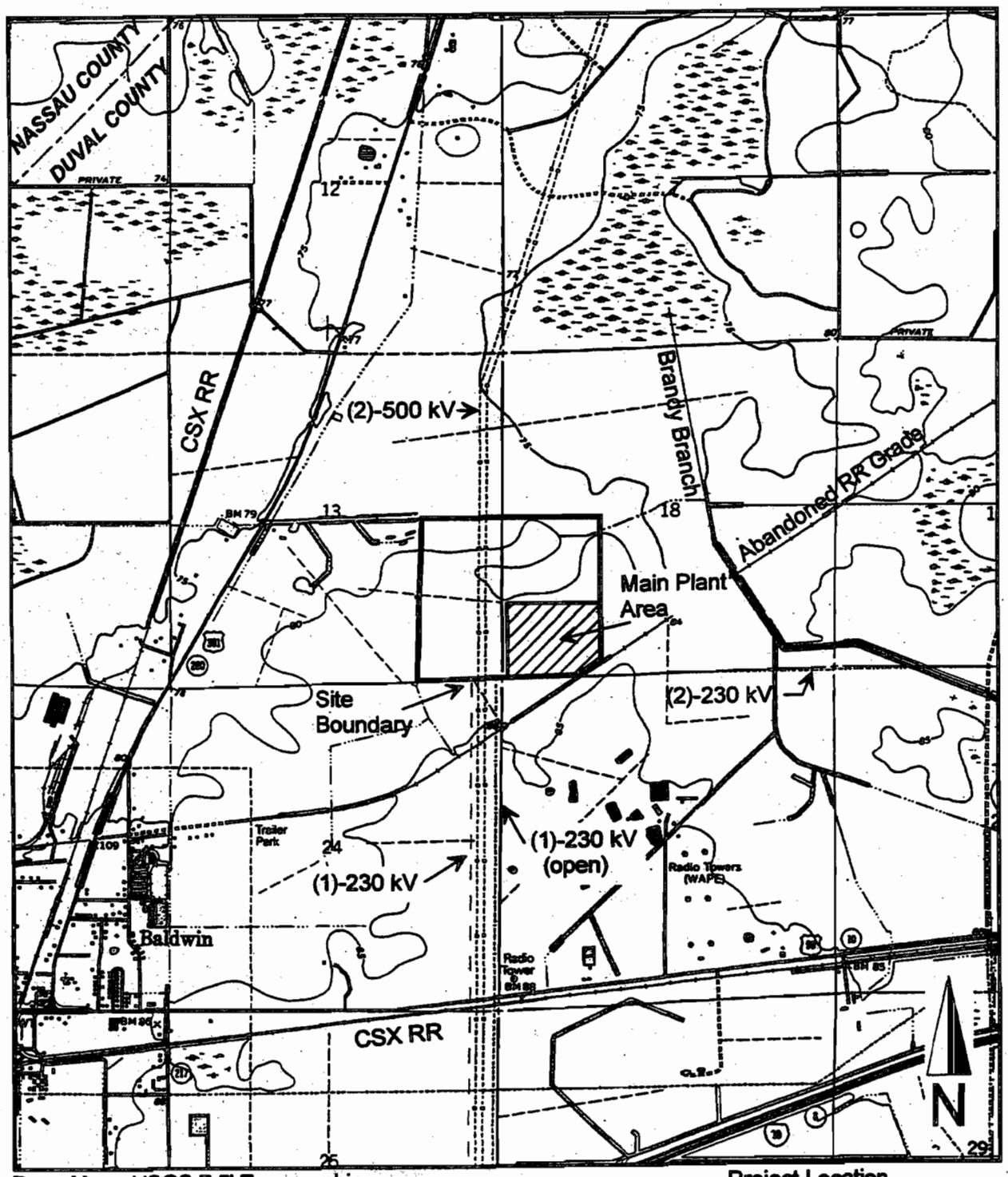
3.1 Site Location

The Brandy Branch Generating Station facility site is located within the western portion of Duval County, approximately 1 mile northeast of the city of Baldwin, Florida. A site location map is shown in Figure 3-1.

The site is a greenfield site that has been used mainly for agricultural purposes. The site is partly wooded and partly open meadow. An existing power transmission line traverses the site from north to south.

3.2 Facility Description

The Brandy Branch Generating Station is a new facility planned by JEA consisting of three simple cycle combustion turbines. The major components of each unit consist of a simple cycle combustion turbine, generator transformer, air inlet filter, and exhaust stack. Support facilities for the overall plant include water storage tanks, fuel oil storage tanks, shop/warehouse building, step-up transformers, control electrical building, oil water separator, stormwater detention pond, percolation pond, and other auxiliary equipment and miscellaneous pads and skids.



Base Map: USGS 7.5' Topographic
Baldwin Quadrangle, Revised 1992

Project Location
Brandy Branch Power Plant

Mile
0 0.5 1

Figure 3-1. Site Location Map

Poor Original

4.0 Subsurface Investigation

4.1 Field Investigation

The subsurface investigation was performed to determine the site stratigraphy and pertinent geotechnical engineering properties of the soil, which underlie the proposed combustion turbine and associated facilities.

The soil borings, soil resistivity, cone penetrometer soundings, permeability tests, and laboratory testing were performed by Law Engineering and Environmental Services, Inc. (Law) of Jacksonville, Florida. Planning and field supervision were performed by a Black & Veatch (B&V) geotechnical engineer. Fieldwork was completed in June 1999. Survey locations for the planned field testing were located and marked by Bowyer-Singleton & Associates. Test locations are presented in Appendix A of this report. The subsurface investigation consisted of:

- 21 rotary wash boreholes.
- 4 cone penetrometer soundings.
- 7 piezometers.
- 8 soil resistivity tests.
- 1 double-ring infiltrometer test.
- 4 rising and falling head slug tests.
- Laboratory tests on selected samples.

The soil borings were advanced by rotary drilling with either a 2-7/8 inch or 3-7/8 inch tri-cone bit. Depths for the borings ranged from 12 feet to 100 feet below ground surface (bgs). Borings were backfilled with cement-bentonite grout. Sampling while drilling consisted of standard penetration test (SPT) samples. B&V performed borehole logging and field classification of samples in the field. Boring logs are presented in Appendix B of this report.

Four cone penetrometer soundings were advanced within the main power block area. The soundings were advanced to refusal. Results are presented in Appendix C of this report.

Eight soil resistivity tests were performed at specific locations within the main plant area and the substation area. Resistances were measured using a Nilsson Model 400 4-pin soil resistance meter. The Wenner four point method was used with a pin spacing from 2.5 feet to 30.0 feet. Soil resistivity results are presented in Appendix D of this report and take into account pin spacing.

4.2 Groundwater Investigation

Groundwater levels were recorded in the piezometers at the time of installation. The

piezometer logs in Appendix E present the groundwater levels encountered during the investigation. Groundwater levels have been measured in the piezometers on a periodic basis since installation.

A double ring infiltrometer test was performed near the location of Boring B-6 to determine the permeability of the near surface soils. Results of the tests are presented in Appendix E of this report.

A series of rising and falling head slug tests were performed in piezometers P-1, P-6, P-9, and P-18 to determine the permeability of the near surface soils. Results of the tests are presented in Appendix E of this report.

A summary of the measured groundwater conditions is presented in Section 5.3 of this report.

4.3 Laboratory Testing Program

A laboratory testing program was performed in order to classify the soil layers and to estimate engineering properties. The laboratory test program was developed by B&V and performed by Law. The laboratory test results are included in Appendix F of this report. Laboratory tests included measuring organic contents, moisture contents, Atterberg limits, and grain size analysis.

5.0 Subsurface Conditions

5.1 Regional Geology

The Brandy Branch Generating Station is located on the Florida Peninsula, which has existed as part of a much broader plateau since at least the Early Cretaceous period. This plateau now consists of the present peninsula and a broad submerged shelf extending the length of the state and out into the Gulf of Mexico.

Pre-Oligocene sediments on the plateau were calcium and magnesium carbonates and evaporates. Little or no quartz sands or clay minerals were deposited. Most of the structural activity in the region occurred during the Oligocene epoch. The Post-Oligocene disturbances changed the depositional environments on the plateau: clastic sediments were deposited over the carbonate plateau. Miocene and younger sediments were deposited in a wide variety of environments.

Peninsular Florida and adjacent continental shelves have been tectonically stable throughout the Mesozoic and Cenozoic eras. Regional subsidence of the very thick marine sediments has been the dominant movement.

The seismic ground acceleration for the site was determined from the National Earthquake Hazards Reduction Program (NEHRP) recommended Provisions for Seismic Regulations. The effective peak acceleration (Aa) and the effective peak-velocity-related acceleration (Av) were determined to be less than 0.05.

5.2 Site Specific Geology

The existing topography slopes from south to north from approximately elevation 84 feet to elevation 80 feet. The general soil profile was determined from boreholes B-10, B-11, B-13 through B-16, B-18 through B-20, and CPT-1 through CPT-4. The geological cross-section detailed in the following discussion presents the proposed fill for the project site, and the subsurface conditions encountered from the soil investigation within the main power block area. In general, the proposed site consists of 10 soil layers. The numbered layers are, in descending order from the surface:

(1) Fine silty SAND and Fine SAND (FILL) from elevation 88 feet to elevation 81 feet. This layer is an engineered fill compacted to 98 percent of maximum dry density as determined by ASTM D698, Standard Proctor Test. The fill will be obtained from the excavation of the proposed storm water run-off pond and the wetlands creation area.

(2) Fine silty SAND and Fine SAND from elevation 81 feet to elevation 75 feet.

This layer consists of a black to gray, very loose to loose, fine-grained, dry to moist, silty sand to fine sand. A trace of organic content was found within this layer. The average standard penetration blowcount is 4 blows per foot (bpf). The average cone penetration tip resistance is 5 Mpa and the average friction ratio is 1.6 percent.

(3) Fine silty SAND and Fine SAND from elevation 75 feet to elevation 63 feet. This layer consists of gray to light brown, medium dense, fine-grained, wet, silty sand and sand. The average standard penetration blowcount is 15 bpf. The average cone penetration tip resistance is 13 Mpa and the average friction ratio is 1.2 percent.

(4) Fine silty SAND and Fine SAND from elevation 63 feet to elevation 49 feet. This layer consists of light brown to brown, loose, fine-grained, wet, silty sand and sand. The average standard penetration blowcount is 6 bpf. The average cone penetration tip resistance is 8 Mpa and the average friction ratio is 0.8 percent.

(5) Fine silty SAND and Fine SAND from elevation 49 feet to elevation 43 feet. This layer consists of gray, very loose, fine-grained, wet, silty sand and sand. The standard penetration blowcount ranges from 1 to 5 bpf. The average cone penetration tip resistance is 5 Mpa and the average friction ratio is 1.4 percent.

(6) Fine silty SAND and Fine SAND from elevation 43 feet to elevation 20.5 feet. This layer consists of gray, medium dense, fine-grained, poorly graded, wet, silty sand and sand. The average standard penetration blowcount is 17 bpf. The average cone penetration tip resistance is 13 Mpa and the average friction ratio is 1.4 percent.

(7) Fine silty SAND and Fine SAND from elevation 20.5 feet to elevation –2.0 feet. This layer consists of gray, loose, fine-grained, poorly graded, wet, silty sand and sand. The average standard penetration blowcount is 5 bpf. The average cone penetration tip resistance is 7 Mpa and the average friction ratio is 1.1 percent.

(8) Sandy SILT from elevation –2.0 feet to elevation –12.0 feet. This layer consists of gray, soft, medium plasticity, sandy silt. The standard penetration test sampler advanced under its own weight for this layer. The average cone

penetration tip resistance is 4 Mpa and the average friction ratio is 5.5 percent.

(9) Highly weathered Rock from elevation –12.0 feet to –19.0 feet. This layer consists of a combination of silt, sand, and rock fragments. The standard penetration blowcounts ranged from 17 to 44 bpf.

(10) Bedrock below elevation –19.0 feet. Standard penetration blowcounts exceeded 50 bpf for this layer. No rock coring was performed at the site.

5.3 Groundwater Conditions

The groundwater level was encountered during drilling operations at an approximate elevation of 75 feet. Piezometers were installed adjacent to soil borings BV-1, BV-6, BV-9, and BV-18, roughly in the power block area. Piezometers were also installed adjacent to soil borings BV-21, BV-22, and BV-23, within the vicinity of the wetlands creation area. Groundwater elevations have been recorded within the piezometers and are presented in Figures 5-1 and 5-2. Design groundwater elevation is set at elevation 78 feet.

The double ring infiltrometer was completed to measure the vertical permeability of the unsaturated, near surface soils. The test was performed near boring B-6 at approximately elevation 81 feet, 1.5 feet below existing ground surface. The permeability rate measured during the test was 8 feet/day (4 inches/hour).

The rising and falling slug tests were performed in piezometers P-1, P-6, P-9, and P-18 to determine the horizontal permeability of the soils below the groundwater table. Recovery of the piezometers was almost instantaneous which made the data acquisition very difficult. Much of the recovery occurred within the well in less than 5 seconds. The data was analyzed and the calculated permeability ranged from 11 to 45 feet/day.

The permeability of the site soils determined from the infiltrometer test, the slug tests, and correlation with grain size data was established for design purposes as 15 feet/day.

The elevation of the groundwater table will fluctuate slightly due to seasonal conditions. The groundwater is not anticipated to be brackish. Determination of groundwater gradient and flow direction was not within the scope of this investigation.

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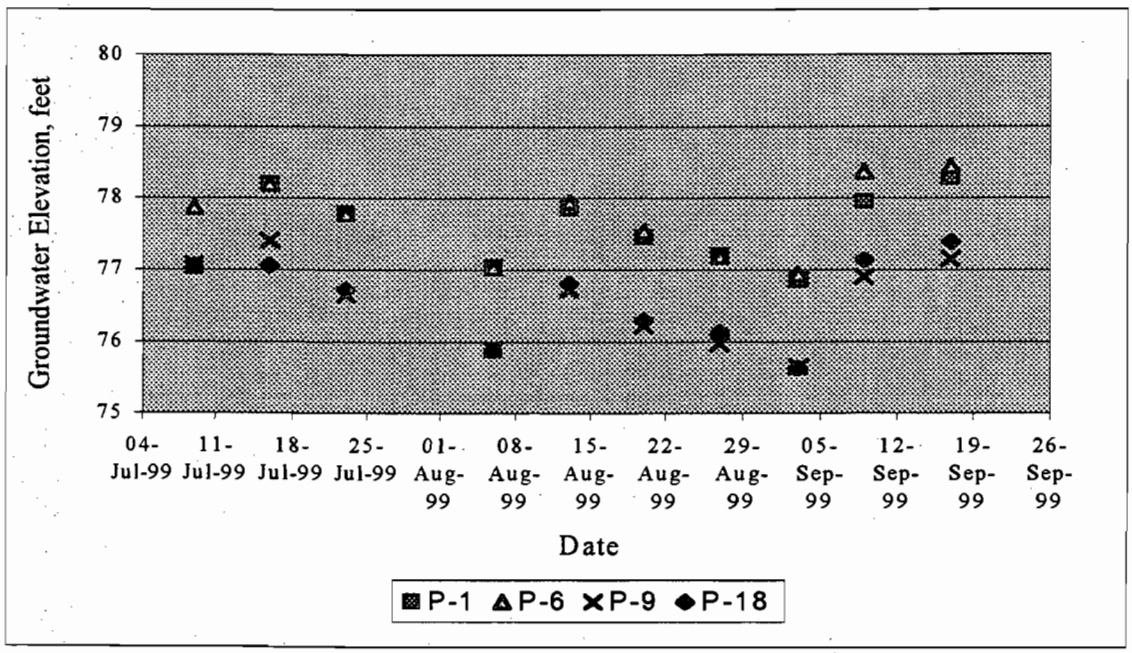


Figure 5-1. Groundwater Elevations, Main Plant Area

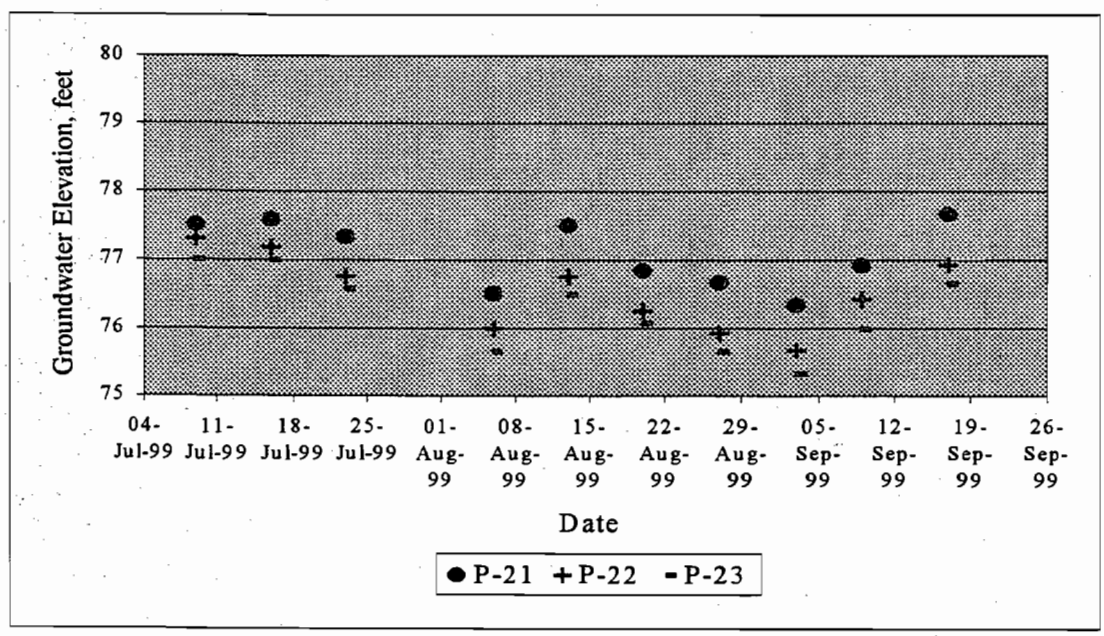


Figure 5-2. Groundwater Elevations, Wetlands Creation Area

6.0 Engineering Recommendations

The objective of the foundation analysis is to provide foundation designs with sufficient bearing capacity to meet appropriate factors of safety, and limit the differential and total settlements to acceptable tolerances based on foundation and equipment criteria. In addition, the analysis considers the need and responsibility for economical and practical foundation designs.

For the Brandy Branch Generating Station, lightly loaded structures such as the shop/warehouse building, control electrical building, oil water separator, and other auxiliary equipment and miscellaneous pads and skids can be constructed on soil supported shallow foundations consisting of spread and strip footings. Heavily loaded structures, such as the combustion turbine, generator step-up transformer, air inlet filter, and exhaust stack should be constructed on deep foundations. Deep foundations can consist of auger cast-in-place piles or pre-stressed concrete piles.

Recommendations for the above structures, water storage tanks, and fuel oil storage tanks are as follows.

6.1 Engineering Design Properties

A generalized design soil profile was developed based on the encountered subsurface conditions at the site and anticipated structures. This profile was used for determination of the foundation recommendations stated within this report. The profile was developed based on the following conditions.

- Final grade elevation is approximately elevation 88 feet.
- Excavations below elevation 78 feet are dewatered during construction.
- Mud mats are utilized for all large mat foundations to minimize disturbance of the subgrade during construction.

A summary of the subsurface geotechnical engineering properties is presented in Table 6-1. Any changes to the above assumptions should be reviewed by the geotechnical engineer for impact to the following recommendations.

Dynamic soil properties for use in vibration analysis of the combustion turbine will be determined later, when the size and loading conditions of the turbine are finalized.

Table 6-1. Engineering Properties

Soil Type (Layer Number)	Elevation (feet)	Effective Unit Weight (pcf)	Angle of Internal Friction (degrees)	Undrained Shear Strength (ksf)	Static Elastic Modulus (ksf)
Silty SAND and SAND (1)	88 to 81	126	37	---	400
Silty SAND and SAND (2)	81 to 78	121	35	---	200
	78 to 75	59	35	---	200
Silty SAND and SAND (3)	75 to 63	72	37	---	800
Silty SAND and SAND (4)	63 to 49	63	35	---	500
Silty SAND and SAND (5)	49 to 43	63	32	---	300
Silty SAND and SAND (6)	43 to 20.5	66	36	---	700
Silty SAND and SAND (7)	20.5 to –2	62	30	---	350
Sandy SILT (8)	-2 to –12	57	---	0.10	40
Weathered Bedrock (9)	-12 to –19	---	---	---	---
Bedrock (10)	Below -19	---	---	---	---

6.2 Shallow Foundations

Shallow foundations were considered for all lightly loaded structures such as the shop/warehouse building, control electrical building, oil water separator, and other auxiliary equipment and miscellaneous pads and skids. Settlements for shallow foundations will be elastic and will occur within days of the load application. The relatively rapid movements will occur prior to final connections of utilities, piping, etc., with very minimal net differential settlement between support points, interfaces, and adjacent structures. No significant long-term settlements are expected for structures constructed on shallow foundations. The following sections discuss requirements for the spread footings, strip footings, and ring beam foundations.

6.2.1 Spread and Strip Footings

Spread and strip footings shall be designed in accordance with the load deflection curves presented in Figures 6-1 and 6-2, respectively. Bearing pressures were calculated assuming a 1.5 ft embedment and a factor of safety of 3.0. Foundations meeting the

limitations listed below will experience less than 1.5 inches of settlement. The following limitations apply to these recommendations:

- Maximum footing width is 12 feet for square footings and 10 feet for strip footings. Larger footings may be acceptable, but should be analyzed on an individual basis.
- Minimum footing width is 2 feet for square footings and 2 foot for strip footings.
- Minimum depth of footing embedment below finished grade is 1.5 feet for shallow foundations.
- A strip footing is defined as having a ratio of length (L) to width (B) greater than 10. A square footing is defined as having L/B = 1. To estimate settlements for footings with 1<L/B<10: Obtain settlements from the design charts for both a square and strip footing using the actual footing width B. Interpolate the settlement for the actual L/B ratio assuming L/B = 1 for a square footing and L/B = 10 for a strip footing.
- No shallow footings shall be founded on topsoil, debris, or loose fill. Subgrades that are disturbed or subject to excess water or softening shall be overexcavated and recompacted.
- Subgrades shall be compacted using vibratory compactors prior to footing construction. Larger footings or excavations anticipated to be left open for longer periods should utilize a mud mat to stabilize the subgrade.
- Effect of adjacent footings on foundation settlement due to stress overlap is not included in the foundation analysis.
- Allowable bearing capacity may be increased by a factor of 1.33 for transient wind, seismic, or equipment loading.
- If the shallow foundations are located in close proximity to utility trenches, or any other type of excavations, no part of the footing should be located within a 1:1 plane projected upward from the closest bottom corner of the excavation.

Concrete floor slabs may be founded on existing site soils provided that the dry density of the top 1 foot of the subgrade is verified to be a minimum of 98 percent of the maximum dry density as determined according to ASTM D698, Standard Proctor. Floor slab loading should be limited to 300 psf. Floor slabs requiring higher load bearing capacities are possible but should be reviewed on an individual basis.

Sliding resistance along the base of the foundation will resist lateral loads for shallow foundations. An ultimate friction factor of 0.3 for an interface consisting of concrete on soils or fill should be used. Passive forces on the sides on the foundation should not be included in the sliding analysis.

6.2.2 Tank Foundations

Three fuel oil storage tanks, three demineralized water tanks, and two raw water/fire water storage tanks will be constructed on the site. The tanks were analyzed for an approximate load of 2600 psf, a water column height of approximately 40 feet. For the Brandy Branch Generating Station, this size tank can be founded on a concrete ring beam foundation. The minimum width shall be 1.5 feet and the base of the ring beam shall be embedded a minimum of 1.5 feet below final grade.

The tank foundation excavation should extend to the depth of the ring beam. The subgrade should be compacted using a large vibratory roller. The ring beam annulus from the base of the excavation to the tank base should consist of a compacted sand fill compacted to 98 percent of maximum dry density as determined by ASTM D698, Standard Proctor.

Predicted settlements for the estimated loads will be less than 4 inches at the center of the tank and 2 inches at the tank edge, for a total differential settlement of 2 inches. The total and differential settlements are within the acceptable limits. If the predicted movements at the edge exceed connection limitations, tank connections can be delayed until after the hydro test or flexible connections can be provided.

Tank settlement estimates should be revised accordingly if the tank diameter or fluid height changes significantly.

6.3 Deep Foundations

Deep foundations should be used for the construction of the combustion turbine, generator step-up transformer, air inlet filter, and exhaust stack. Two types of deep foundations, auger cast-in-place piles and square pre-stressed concrete piles, are suitable for supporting the estimated loads. Ground improvement methods were considered as an alternative to deep foundations.

The power block structures identified above were analyzed by using estimated loads and foundation sizes from a previous project. The analysis indicated that the mats would settle more than the allowable 1.5 inches, and would require the use of deep foundations or ground modification. Deep foundation recommendations contained within this report are for use in the immediate area of the power block. Other structures located outside of the power block area requiring deep foundations should be evaluated on an individual basis.

Deep foundations should be spaced a minimum of three pile diameters from center to center. Deep foundations spaced using this minimum distance will not require a reduction for group spacing. Deep foundations spaced closer than three pile diameters should be analyzed on an individual basis.

A minimum of two pile load tests shall be conducted on piles installed within the power block area. The test shall include axial compression only, uplift and lateral load tests are not required. The axial compression load test shall be conducted in accordance with ASTM D1143, Axial Compressive Load Test, using the Quick Load Test Method. The piles shall be load tested to two times the design capacity. The piles may be used for production piles if total net vertical deflection is less than 0.5 inches.

Pile capacities are based on anticipated needs of the project. Additional pile design can be completed on an individual basis for load cases that may not be covered by the following recommendations.

6.3.1 Auger Cast-in-Place Piles

Auger cast-in-place piles with a 14-inch diameter are suitable for the construction of the power block structures. Piles should be installed to a tip elevation of 53 feet.

The allowable compression, uplift, and lateral load capacities for the auger cast-in-place piles are presented in Table 6-2. Compression and uplift capacity are based on side friction of the pile. Axial compressive capacities can be increased by one third for short duration loads such as wind, seismic forces, or equipment failure. Settlements of the auger cast-in-place piles will be less then 0.5 inches.

Lateral capacity of the auger cast-in-place pile was analyzed assuming a 1.0 percent reinforcement replacement ratio. The reinforcing steel shall be placed to a depth of 16 feet below the intersection of the pile and the bottom of the foundation. Concrete was assumed to have a compressive strength of 4000 psi. Lateral capacities are based on 0.25 inches of lateral movement.

Uplift capacities for the pile assumed that the entire pile would be placed in tension. For this reason, all uplift piles shall have one No. 11 steel reinforcing bar placed full depth. The bar shall have centralizers installed prior to installation to keep the bar centered during placement.

It is recommended that the auger cast-in-place piles be installed from a working surface a minimum of 6 inches higher than the installed top of elevation of the reinforcing steel. The objective is to prevent construction equipment and activities from damaging or displacing the reinforcing steel prior to initial concrete set-up.

The pile installation contractor should be directed to configure the pile installation auger and leads to accommodate an additional five feet more length than the maximum design pile length. The additional installation capacity may be needed to repair installation defects, or add additional capacity to piles for unanticipated design conditions.

This site would be also be appropriate for the use of displacement auger cast-in-place piles. This pile type is very similar to the traditional auger cast-in-place pile except

that the installation technique minimizes the amount of spoil brought to the ground surface. The cost of spoil disposal is nearly eliminated resulting in pile installation cost savings. The displacement type pile can be specified during the bid process.

6.3.2 Pre-Stressed Concrete Piles

12-inch square pre-stressed concrete piles can also be used for the construction of the power block structures. Piles should be driven to a tip elevation of 58 feet.

The allowable compression, uplift, and lateral load capacities for the pre-stressed concrete pile are presented in Table 6-2. Compression and uplift capacity is based on side friction of the pile. Axial compressive capacities can be increased by one third for short duration loads such as wind, seismic forces, or equipment failure. Settlements of the pre-stressed concrete piles will be less then 0.5 inches. Lateral capacities are based on 0.25 inches of lateral movement. Precast prestressed piles shall be designed by the fabricator to withstand all stresses caused by transportation, handling and installation.

Table 6-2. Pile Capacity

	Auger Cast-in-Place Pile, 14 inch diameter	Pre-stressed Concrete Pile, 12 inch square
Installed Tip Elevation	53 ft	58 ft
Allowable Axial Compressive Load (F.S. = 2.0)	78 kips	100 kips
Allowable Uplift Load (F.S. = 2.5) Includes Pile Weight	68 kips	84 kips
Lateral Load Capacity (Based on 0.25 inches lateral deflection) Free Head	8 kips	7 kips
Lateral Load Capacity (Based on 0.25 inches lateral deflection) Fixed Head	17 kips	16 kips

6.3.3 Ground Improvement

Ground improvement was considered as an alternative to pile foundations. The ground improvement techniques that were considered to have potential for this site included stone columns, and a combination of compaction grouting and dynamic compaction.

Stone columns would be installed to approximately 35 feet in depth. The installation of the columns will densify the surrounding soils and also distribute load with depth. The installation of stone columns would reduce the estimated settlements for a soil supported

mat foundation to within acceptable limits.

The second ground improvement alternative, considered for the Brandy Branch site, was a combination of dynamic compaction and compaction grouting. The dynamic compaction would densify the near surface soils by dropping a weight from a predetermined height over a general area. The loose material encountered from approximately elevation 49 to 43 feet would be densified by pumping grout under pressure into the loose materials. The combination of dynamic compaction of the near-surface soils and the compaction grouting of the deeper buried loose layer would result in a reduction of predicted settlements to within project acceptable limits.

The two ground modification techniques were compared in cost to the installation of piles. The ground modification techniques were estimated to be approximately $150,000 higher in cost than the installation of piles. Ground modification and pile cost information were obtained from recent similar projects in the Jacksonville area.

The lack of cost savings resulted in the recommendation that the facility be constructed using piles for the major power block structures.

6.4 Lateral Earth Pressure

Lateral earth pressures used for the design of below grade structures should be based on the earth pressure coefficients presented in Figure 6-3. Recommended procedures for calculating pressures against yielding and non-yielding walls are also presented in Figure 6-3. Figure 6-3 is based on the evaluation and testing of the project site soils. If backfill is obtained from sources other than from this location, lateral earth pressure coefficients must be re-evaluated.

6.5 Earthwork

Earthwork at the site will consist of roadbed construction, general site fill, structural fill, construction of the stormwater pond and wetlands creation areas, and structural excavations. Structural fill is defined as all areas north and east of coordinates N76,810 and E56,720.

Following any required overexcavation, all areas to receive fill should be scarified and compacted using a large vibratory roller to a depth of 0.5 feet. General site fill should be placed in uniform, horizontal, loose lifts, moisture conditioned as necessary, and compacted by mechanical means. General site fill should be compacted to 95 percent of maximum density as determined by ASTM D698, Standard Proctor. Moisture content should fall within the range of minus 3 percent to plus 3 percent of optimum moisture content. General site fill should be tested at a minimum frequency of one test per 2000 cubic yards for compliance with the specified relative compaction. General site fill lifts

should be limited to 8 inches or less in uncompacted lift thickness.

Structural fill should be placed in uniform, horizontal, loose lifts, moisture conditioned as necessary and compacted by mechanical means. Structural fill should be compacted to 98 percent of maximum density as determined by ASTM D698, Standard Proctor. Moisture content should fall within the range of minus 2 percent to plus 2 percent of optimum moisture content. Backfill should be tested at a minimum frequency of one test per 1000 cubic yards for compliance with the specified relative compaction. Structural fill lifts should be limited to 8 inches or less in uncompacted lift thickness.

Cut slopes for the stormwater pond and wetlands creation area shall be no steeper than 3H:1V. It is recommended that these slopes be vegetated to minimize erosion or other maintenance problems.

Structural excavations should be analyzed on an individual basis using exact excavation limits and depths.

The existing wetlands located within the power block area should be grubbed of all organic material prior to the placement of fill. All loose, organic, or other deleterious materials should be removed. Dewatering of this area may be required in order for the grubbing to be completed.

6.6 Excavations

Excavations for shallow footings should conform to guidelines for excavations as described in Article 6.2. Footing embedment should not be allowed to be affected adversely, through erosion, softening, and digging around the footing. All footing excavations should be trimmed neat, level and square, and all loose unsuitable material should be removed prior to placement of concrete. Mud mats should be utilized for all large mat foundations to minimize disturbance of the subgrade during construction. Mud mats should also be utilized for smaller excavations anticipated to be left open for longer periods of time to stabilize the subgrade.

All excavations should comply with OSHA and current governmental and regulatory requirements. The site soils are classified using the OSHA criteria as a Type C soil. Deep cuts will require shoring and/or alternative designed excavation systems.

The estimated groundwater elevation is 78 feet based on measured data from the site. Seasonal variations may effect actual levels encountered during construction. Excavations below the groundwater elevation will require a dewatering system.

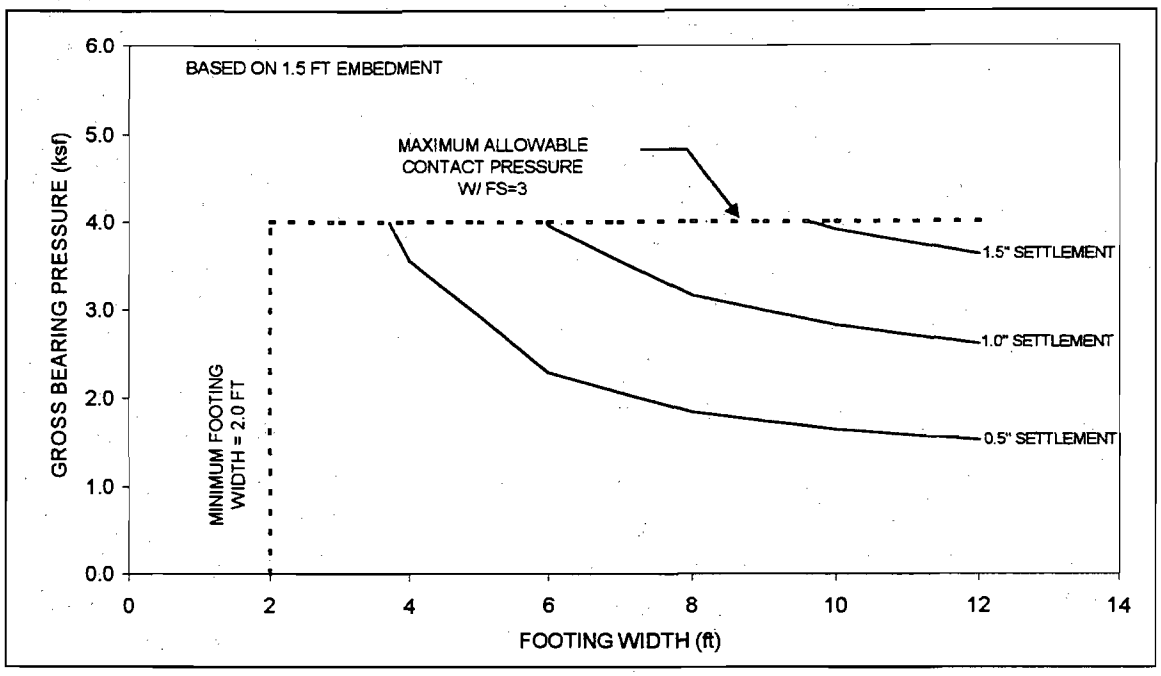


Figure 6-1. Settlement of Square Footings

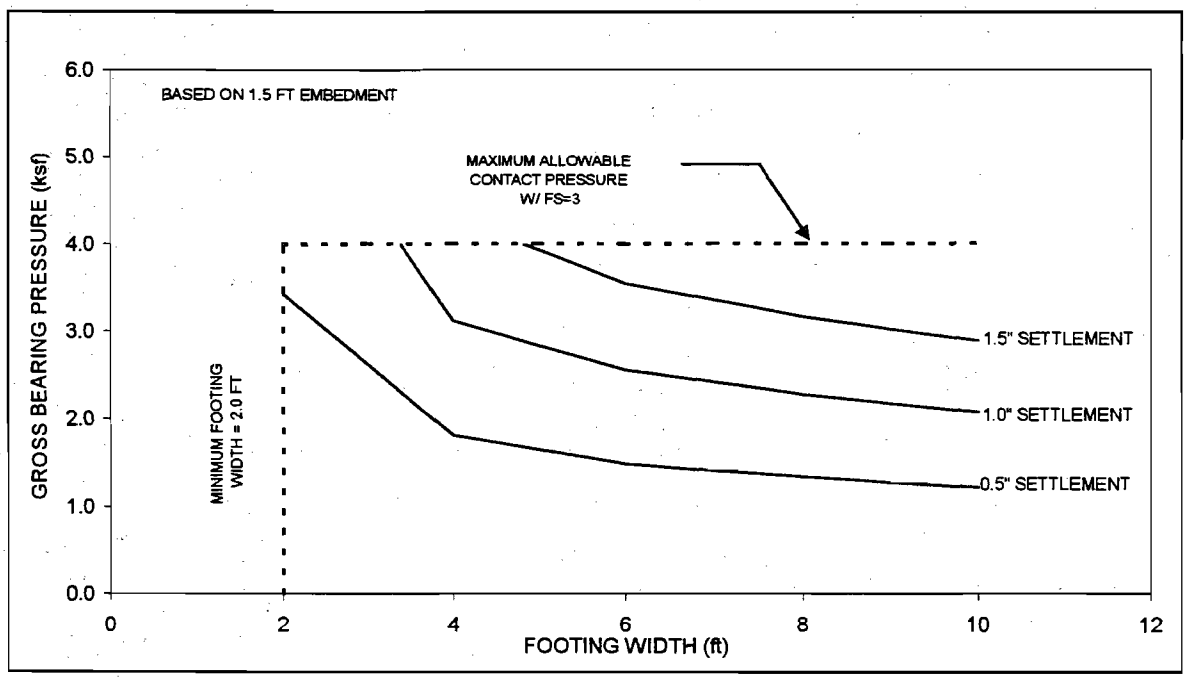
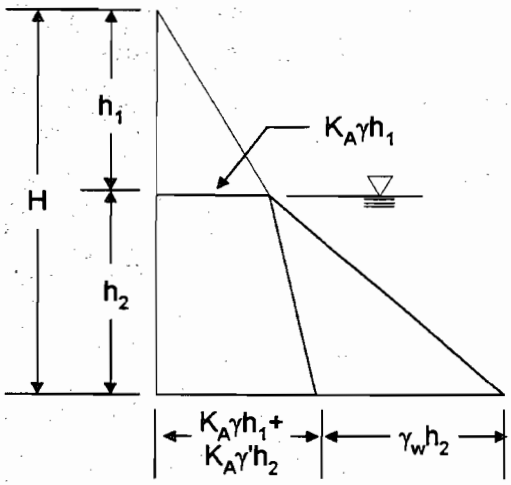


Figure 6-2. Settlement of Strip Footings

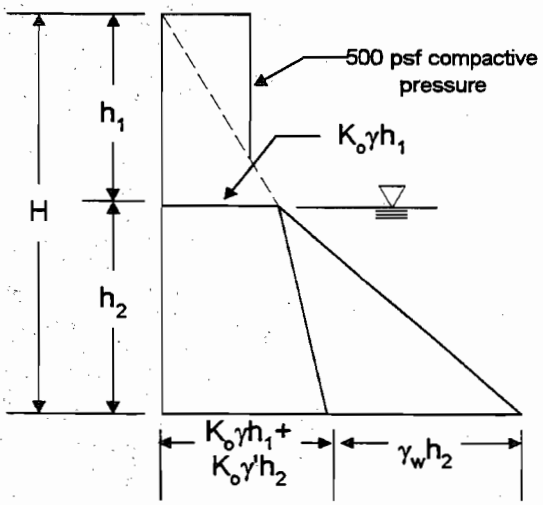
YIELDING WALLS



NOTES:

1. Surcharge loads (psf) add to static effect and rectangular pressure diagram of K_oS for non-yielding walls of K_AS for yielding walls.
2. Water table varies across site
3. The subsurface profile varies across site

NON-YIELDING WALLS



LEGEND:

H	total depth of wall
h	depth below grade
h_1	depth to water table
h_2	depth below water tableto depth of wall
γ	moist unit weight
γ`	buoyant unit weight
γ_S	saturated unit weight
γ_W	unit weight of water (62.4 pcf)
K_A	coefficient of active earth pressure
K_P	coefficient of passive earth pressure
K_o	coefficient of at-rest earth pressure

Material	γ (psf)	γ` (psf)	γ_S (psf)	K_A	K_P	K_o
Silty Sand	120	58	125	0.3	3.4	0.5

Figure 6-3. Lateral Earth Pressures

7.0 Limitations

The analysis, conclusions, and recommendations in this report were based on site conditions existing at the time of the investigation and on the assumption that the information obtained from the borings is representative of subsurface conditions throughout the site. Unanticipated conditions may be encountered during construction because of variations, which were not detected during the drilling program. If, during construction, conditions differ due to natural or manmade causes, this report should be reviewed to determine the applicability of the conclusions and recommendations concerning the differences in conditions.

Appendix A
Subsurface Investigation – Test Locations

OVERSIZE DOCUMENT WAS REMOVED AND INSERTED INTO OCULUS SEPARATELY.

Appendix B
Soil Boring Logs

BLACK & VEATCH — LOG OF BORING — BORING NO. BV-1

SHEET 1 OF 2

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 76912.2 E 57089.0	82.25 (MSL)	31.5 FEET	14 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	14 JUNE 1999

CHECKED BY: M.C. SCHLUTER

APPROVED BY: M.C. SCHLUTER

SAMPLING / CORING									
SAMPLE TYPE / CORE SIZE	SAMPLE NUMBER / RUN NUMBER	SET 0 INCHES / RUN LENGTH	2ND 0 INCHES / RUN RECOVERY	3RD 0 INCHES / ROD RECOVERY	N VALUE / PERCENT RECOVERY	SAMPLE RECOVERY / ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	1	1	2	2	4	0.8	1			SAND; black to dark gray; very loose; dry; fine grained; poorly graded; with ash (?)	Boring advanced with 2 7/8" O.D. solid stem augers. SPT samples driven with auto-hammer.
SPT	2	1	2	2	4	1.2	2				
							3			Grading dark gray to gray; some silt	
SPT	3	2	2	2	4	1.0	4				
							5			Grading yellowish brown and moist	Water encountered at 6.0 feet.
							6				
SPT	4	3	2	4	6	1.0	7			Grading loose; wet; trace silt	
							8				
							9				
SPT	5	4	4	6	10	1.2	10				Convert to rotary wash at 10.0 feet using 3 7/8" tricone bit with water and Quick Gel as drilling fluid.
							11				
							12				
							13				
							14				
							15				
SPT	6	4	5	5	10	0.8	16			Grading yellowish gray	
							17				
							18				
							19				
							20				
SPT	7	2	1	2	3	0.7	21			Grading gray; very loose	
							22				
							23				
							24				
							25				
SPT	8	4	4	5	9	1.0	26			Grading loose	
							27				
							28				
							29				

BLACK & VEATCH — LOG OF BORING

BORING NO. BV-1
SHEET 2 OF 2

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 76912.2 E 57089.0	82.25 (MSL)	31.5 FEET	14 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	14 JUNE 1999

CHECKED BY	APPROVED BY
M.C. SCHLUTER	M.C. SCHLUTER

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	9	3	3	4	7	0.9								31				
														32			End of boring at 31.5 feet. Boring backfilled with natural cuttings.	
														33				
														34				
														35				
														36				
														37				
														38				
														39				
														40				
														41				
														42				
														43				
														44				
														45				
														46				
														47				
														48				
														49				
														50				
														51				
														52				
														53				
														54				
														55				
														56				
														57				
														58				
														59				

BLACK & VEATCH — LOG OF BORING — BORING NO. BV-2

SHEET 1 OF 2

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 76912.2 E 57385.8	82.49 (MSL)	31.5 FEET	14 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS & BURNING ASH, NEARLY LEVEL	W.R. WU	14 JUNE 1999

CHECKED BY: M.C. SCHLUTER

APPROVED BY: M.C. SCHLUTER

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	1	1	2	3	5	1.0								1			SAND; black to dark gray; loose; dry; fine grained; poorly graded; some burning ash (?); trace silt	Boring advanced with 2 7/8" O.D. solid stem augers. SPT samples driven with auto-hammer.
SPT	2	WOH	2	2	4	0.8								2				
														3			Grading very loose	
SPT	3	3	5	4	9	1.7								4				
														5			Grading brown; loose; moist; some silt	
														6				Water encountered at 6.5 feet.
SPT	4	5	6	5	11	1.2								7			Grading brown to dark brown	
														8				
SPT	5	2	5	7	12	1.5								9				
														10			Grading medium dense and wet	Convert to rotary wash at 10.0 feet using 2 7/8" drag bit with water and Quick Gel as drilling fluid.
														11				
														12				
														13				
														14				
														15				
SPT	6	6	11	12	23	1.0								16			Grading yellowish brown	
														17				
														18				
														19				
														20			Grading yellowish gray	
SPT	7	5	6	9	15	1.1								21				
														22				
														23				
														24				
														25				
SPT	8	6	6	8	14	1.0								26				
														27				
														28				
														29				

BLACK & VEATCH

LOG OF BORING

BORING NO. BV-2
SHEET 2 OF 2

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 76912.2 E 57385.8	82.49 (MSL)	31.5 FEET	14 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS & BURNING ASH, NEARLY LEVEL	W.R. WU	14 JUNE 1999

CHECKED BY: M.C. SCHLUTER
APPROVED BY: M.C. SCHLUTER

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD					
SPT	9	3	2	4	6	1.0	31			Grading gray; loose	
							32–59				End of boring at 31.5 feet. Boring backfilled with cement/bentonite grout.

BLACK & VEATCH — LOG OF BORING — BORING NO. BV-3

SHEET 1 OF 2

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77202.6 E 57091.4	82.04 (MSL)	41.5 FEET	14 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS & BURNING ASH, NEARLY LEVEL	W.R. WU	14 JUNE 1999

CHECKED BY: M.C. SCHLUTER

APPROVED BY: M.C. SCHLUTER

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	RQD RECOVERY	PERCENT RECOVERY	RQD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	1	1	1	2	3	0.6								1			SAND: black to dark gray; very loose; dry; fine grained; poorly graded; some ash (?) (TOPSOIL?)	Boring advanced with 2 7/8" O.D. solid stem augers. SPT samples driven with auto-hammer.
SPT	2	2	2	2	4	1.0								2				
SPT	3	2	2	3	5	1.4								3			Grading gray; loose; moist; some silt	
SPT	4	3	4	5	9	1.1								4			Grading light gray and wet	Water encountered at 7.0 feet.
SPT	5	4	4	7	11	1.2								5			Grading medium dense	Convert to rotary wash at 10.0 feet using 2 7/8" drag bit with water and Quick Gel as drilling fluid.
SPT	6	5	6	9	15	1.0								6				
SPT	7	2	2	4	6	1.0								7			Grading yellowish gray and loose	
SPT	8	4	4	6	10	0.9								8				

BLACK & VEATCH

LOG OF BORING

BORING NO. BV-3
SHEET 2 OF 2

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77202.6 E 57091.4	82.04 (MSL)	41.5 FEET	14 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS & BURNING ASH, NEARLY LEVEL	W.R. WU	14 JUNE 1999

CHECKED BY: M.C. SCHLUTER
APPROVED BY: M.C. SCHLUTER

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	9	4	5	7	12	0.9								31			Grading medium dense	
														32				
														33				
														34				
														35				
SPT	10	3	2	3	5	1.0								36			Grading loose	
														37				
														38				
														39				
														40				
SPT	11	6	6	9	15	1.0								41			Grading gray to blueish gray and medium dense	
														42				End of boring at 41.5 feet. Boring backfilled with cement/bentonite grout.
														43				
														44				
														45				
														46				
														47				
														48				
														49				
														50				
														51				
														52				
														53				
														54				
														55				
														56				
														57				
														58				
														59				

BLACK & VEATCH — LOG OF BORING

BORING NO. BV-4
SHEET 1 OF 2

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77202.5 E 57385.4	82.43 (MSL)	41.5 FEET	23 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	23 JUNE 1999

CHECKED BY: M.C. SCHLUTER
APPROVED BY: M.C. SCHLUTER

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	1	1	1	2	3	1.4								1			SAND; gray to light gray; very loose; dry; fine grained; poorly graded; trace silt, roots, and wood chips	Boring advanced with 2 7/8" O.D. solid stem augers. SPT samples driven with auto-hammer.
SPT	2	2	3	4	7	1.3								2				
SPT	3	2	3	4	7	1.3								3			Grading loose	
SPT	4	3	4	3	7	1.5								4			Grading light gray; moist; some silt	Water encountered at 6.5 feet.
SPT	5	3	2	3	5	1.1								5				
														6			Grading wet	
SPT	6	4	5	6	11	0.6								7				Convert to rotary wash at 7.5 feet using 3 7/8" tricone bit with water and Quick Gel as drilling fluid.
														8				
														9				
														10			Grading light brown	
														11				
														12				
														13				
														14				
														15			Grading yellowish brown and medium dense	
														16				
														17				
														18				
														19				
														20			Grading light brown, loose, and trace silt	
SPT	7	2	2	3	5	1.1								21				
														22				
														23				
														24				
														25				
SPT	8	4	4	6	10	1.1								26				
														27				
														28				
														29				

BLACK & VEATCH

LOG OF BORING

BORING NO. BV-4
SHEET 2 OF 2

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77202.5 E 57385.4	82.43 (MSL)	41.5 FEET	23 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	23 JUNE 1999

CHECKED BY	APPROVED BY
M.C. SCHLUTER	M.C. SCHLUTER

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	9	2	2	2	4	1.5								31			Grading gray, very loose, and some silt	
														32				
														33				
														34				
														35			Grading loose	
SPT	10	1	2	3	5	1.2								36				
														37				
														38				
														39				
														40			Grading light brown and gray and medium dense	
SPT	11	7	9	12	21	1.5								41				
														42				End of boring at 41.5 feet. Boring backfilled with cement/bentonite grout.
														43				
														44				
														45				
														46				
														47				
														48				
														49				
														50				
														51				
														52				
														53				
														54				
														55				
														56				
														57				
														58				
														59				

BLACK & VEATCH — LOG OF BORING — BORING NO. BV-5

SHEET 1 OF 2

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77338.6 E 56800.4	81.79 (MSL)	31.5 FEET	22 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	22 JUNE 1999

CHECKED BY: M.C. SCHLUTER

APPROVED BY: M.C. SCHLUTER

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	1	1	1	2	3	1.0								1			SAND: black to dark gray; very loose; dry; fine grained; poorly graded; trace silt, roots and organics (TOPSOIL)	Boring advanced with 2 7/8" O.D. solid stem augers. SPT samples driven with auto-hammer.
SPT	2	2	3	2	5	0.8								2				
SPT	3	1	1	3	4	1.0								3				
														4			SAND: light gray; loose; dry; fine grained; poorly graded; trace roots	
														5				Water encountered at 5.0 feet.
														6			Grading grayish brown, very loose, and moist	
SPT	4	5	7	12	19	1.2								7				
														8			Grading brown; medium dense; wet; some silt	Convert to rotary wash at 6.0 feet using 3 7/8" tricone bit with water and Quick Gel as drilling fluid.
SPT	5	7	9	11	20	1.1								9				
														10				
														11				
														12				
														13				
														14				
														15			Grading light brown	
SPT	6	6	8	11	19	1.4								16				
														17				
														18				
														19				
														20			Grading loose	
SPT	7	2	2	3	5	1.2								21				
														22				
														23				
														24				
														25				
SPT	8	2	3	3	6	1.2								26				
														27				
														28				
														29				

BLACK & VEATCH

LOG OF BORING

BORING NO. BV-5
SHEET 2 OF 2

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77338.6 E 56800.4	81.79 (MSL)	31.5 FEET	22 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	22 JUNE 1999

CHECKED BY	APPROVED BY
M.C. SCHLUTER	M.C. SCHLUTER

SAMPLING							CORING										CLASSIFICATION OF MATERIAL	REMARKS
SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG		
SPT	9	2	3	3	6	1.0								31			Grading light grayish brown	
														32				End of boring at 31.5 feet. Boring backfilled with cement/bentonite grout.
														33				
														34				
														35				
														36				
														37				
														38				
														39				
														40				
														41				
														42				
														43				
														44				
														45				
														46				
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														53				
														54				
														55				
														56				
														57				
														58				
														59				

BLACK & VEATCH — LOG OF BORING

BORING NO. BV-6
SHEET 1 OF 2

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77359.5 E 57750.0	82.47 (MSL)	31.5 FEET	24 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	24 JUNE 1999

CHECKED BY: M.C. SCHLUTER
APPROVED BY: M.C. SCHLUTER

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	RQD	DEPTH IN FEET	CLASSIFICATION OF MATERIAL	REMARKS
SPT	1	1	2	1	3	1.4								1	SAND; gray; very loose; dry; fine grained; poorly graded; some silt; trace roots	Boring advanced with 2 7/8" O.D. solid stem augers. SPT samples driven with auto-hammer.
SPT	2	1	2	3	5	1.2								2		
SPT	3	2	2	2	4	1.5								3	Grading gray to light brown; loose; silt seam	
SPT	4	3	4	8	12	1.0								4		
SPT	5	10	10	12	22	1.5								5		
														6	Grading medium dense and moist	Water encountered at 7.5 feet.
														7		
														8		
														9		
														10	Grading brown to dark brown and wet	Convert to rotary wash at 7.5 feet using 3 7/8" tricone bit with water and Quick Gel as drilling fluid.
														11		
														12		
														13		
														14		
														15		
SPT	6	5	8	7	15	0.0								16		
														17		
														18		
														19		
														20		
SPT	7	1	2	2	4	0.7								21	Grading light gray and very loose; some silt	
														22		
														23		
														24		
														25		
SPT	8	1	2	2	4	1.1								26	Grading trace silt seam	
														27		
														28		
														29		

BLACK & VEATCH

LOG OF BORING

BORING NO. BV-6
SHEET 2 OF 2

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77359.5 E 57750.0	82.47 (MSL)	31.5 FEET	24 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS; NEARLY LEVEL	W.R. WU	24 JUNE 1999

CHECKED BY: M.C. SCHLUTER
APPROVED BY: M.C. SCHLUTER

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	9	1	1	1	2	1.1								31				
														32			End of boring at 31.5 feet. Boring backfilled with cement/bentonite grout.	
														33				
														34				
														35				
														36				
														37				
														38				
														39				
														40				
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														42				
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														44				
														45				
														46				
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														57				
														58				
														59				

BLACK & VEATCH — LOG OF BORING

BORING NO. BV-7
SHEET 1 OF 2

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 78564.1 E 55745.0	79.96 (MSL)	31.5 FEET	23 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	23 JUNE 1999

CHECKED BY	APPROVED BY
M.C. SCHLUTER	M.C. SCHLUTER

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	CLASSIFICATION OF MATERIAL	REMARKS
SPT	1	1	1	2	3	1.0								1	SAND; gray to dark gray; very loose; dry; fine grained; poorly graded; some silt; trace roots	Boring advanced with 2 7/8" O.D. solid stem augers. SPT samples driven with auto-hammer.
SPT	2	1	1	2	3	1.2								2		
														3		
SPT	3	2	3	6	9	1.4								4	Silty SAND; dark brown to black; loose; moist; fine grained; pooly graded	Water encountered at 6.0 feet.
														5		
														6		
SPT	4	2	2	2	4	1.3								7	Grading brown; very loose; wet	
														8		
SPT	5	2	2	4	6	1.4								9	Grading loose	
														10		
														11		
														12		
														13		
														14		
SPT	6	4	6	8	14	1.1								15	SAND; brown to light brown; medium dense; wet; fine grained; poorly graded; some silt	Convert to rotary wash at 7.5 feet using 3 7/8" tricone bit with water and Quick Gel as drilling fluid.
														16		
														17		
														18		
														19		
SPT	7	3	2	2	4	1.3								20	Grading loose	
														21		
														22		
														23		
														24		
SPT	8	1	1	1	2	1.5								25	Grading light grayish brown; very loose; trace silt	
														26		
														27		
														28		
														29		

BLACK & VEATCH

LOG OF BORING

BORING NO. BV-7
SHEET 2 OF 2

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 78564.1 E 55745.0	79.96 (MSL)	31.5 FEET	23 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	23 JUNE 1999

CHECKED BY: M.C. SCHLUTER
APPROVED BY: M.C. SCHLUTER

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	9	2	1	1	2	1.0								31				
														32			End of boring at 31.5 feet. Boring backfilled with sand-cement grout above cave-in depth.	
														33				
														34				
														35				
														36				
														37				
														38				
														39				
														40				
														41				
														42				
														43				
														44				
														45				
														46				
														47				
														48				
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														50				
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														52				
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														56				
														57				
														58				
														59				

BLACK & VEATCH — LOG OF BORING

BORING NO. BV-8
SHEET 1 OF 2

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 78187.8 E 55745.0	80.32 (MSL)	31.5 FEET	23 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
GRASSES, NEARLY LEVEL	W.R. WU	23 JUNE 1999

CHECKED BY: M.C. SCHLUTER
APPROVED BY: M.C. SCHLUTER

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	RQD RECOVERY	PERCENT RECOVERY	RQD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	1	1	2	2	4	1.0								1			SAND; gray; very loose; dry; fine grained; poorly graded; some silt and roots	Boring advanced with 2 7/8" O.D. solid stem augers. SPT samples driven with auto-hammer.
SPT	2	1	2	1	3	1.5								2				
SPT	3	1	1	1	2	1.3								3			Grading black to dark brown and moist	Water encountered at 5.5 feet.
SPT	4	10	10	16	26	1.5								4			Grading medium dense and wet	Convert to rotary wash at 7.5 feet using 3 7/8" tricone bit with water and Quick Gel as drilling fluid.
SPT	5	3	4	4	8	1.2								5			Grading brown; loose; trace silt	
														6				
														7				
														8				
														9				
														10				
														11				
														12				
														13				
														14				
SPT	6	3	3	5	8	0.8								15			Grading gray to light gray	
														16				
														17				
														18				
														19				
														20				
SPT	7	3	2	3	5	0.9								21			Grading gray; some silt	
														22				
														23				
														24				
														25				
SPT	8	2	1	1	2	1.5								26			Grading very loose	
														27				
														28				
														29				

BLACK & VEATCH

LOG OF BORING

BORING NO. BV-8
SHEET 2 OF 2

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 78187.8 E 55745.0	80.32 (MSL)	31.5 FEET	23 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
GRASSES, NEARLY LEVEL	W.R. WU	23 JUNE 1999

CHECKED BY: M.C. SCHLUTER
APPROVED BY: M.C. SCHLUTER

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY
CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD
SPT	9	1	1	2	3	1.5

DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
31			Silty SAND; light gray; very loose; wet; fine grained; poorly graded	
32				End of boring at 31.5 feet. Boring backfilled with sand cement grout above cave-in depth.
33				
34				
35				
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58				
59				

BLACK & VEATCH — LOG OF BORING — BORING NO. BV-9

SHEET 1 OF 2

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77710.2 E 56612.6	80.78 (MSL)	31.5 FEET	22 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	22 JUNE 1999

CHECKED BY: M.C. SCHLUTER

APPROVED BY: M.C. SCHLUTER

SAMPLING / CORING	SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD
SAMPLING	SPT	1	1	2	1	3	1.0							
SAMPLING	SPT	2	3	3	4	7	0.8							
SAMPLING	SPT	3	2	2	3	5	0.8							
SAMPLING	SPT	4	2	4	3	7	1.2							
SAMPLING	SPT	5	2	3	6	9	1.0							
SAMPLING	SPT	6	2	2	3	5	0.5							
SAMPLING	SPT	7	2	2	3	5	1.1							
SAMPLING	SPT	8	4	4	6	10	1.0							

DEPTH IN FEET: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29

SAMPLE TYPE / GRAPHIC LOG

CLASSIFICATION OF MATERIAL

SAND; gray to light gray; very loose; dry; fine grained; poorly graded; some silt and roots

Grading brown to dark brown; loose

Grading brown to light brown; wet; trace roots

Grading light grayish brown

REMARKS

Boring advanced with 2 7/8" O.D. solid stem augers. SPT samples driven with auto-hammer.

Water encountered at 5.5 feet.

Convert to rotary wash at 6.0 feet using 3 7/8" tricone bit with water and Quick Gel as drilling fluid.

BLACK & VEATCH

LOG OF BORING

BORING NO. BV-9
SHEET 2 OF 2

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77710.2 E 56612.6	80.78 (MSL)	31.5 FEET	22 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	22 JUNE 1999

CHECKED BY: M.C. SCHLUTER
APPROVED BY: M.C. SCHLUTER

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	9	4	4	5	9	0.8								31				
														32				End of boring at 31.5 feet. Boring backfilled with cement/bentonite grout.
														33				
														34				
														35				
														36				
														37				
														38				
														39				
														40				
														41				
														42				
														43				
														44				
														45				
														46				
														47				
														48				
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														50				
														51				
														52				
														53				
														54				
														55				
														56				
														57				
														58				
														59				

BLACK & VEATCH — LOG OF BORING — BORING NO. BV-10

SHEET 1 OF 4

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77788.1 E 56868.9	80.18 (MSL)	100.25 FEET	19 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	21 JUNE 1999

CHECKED BY: M.C. SCHLUTER

APPROVED BY: M.C. SCHLUTER

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	1	1	2	2	4	1.2								1			SAND; black to dark gray; very loose; dry; fine grained; poorly graded; some silt; with roots (TOPSOIL?)	Boring advanced with 2 7/8" O.D. solid stem augers. SPT samples driven with auto-hammer.
SPT	2	2	1	2	3	1.3								2				
														3				
SPT	3	1	1	1	2	1.2								4			Grading moist	
														5				Water encountered at 5.0 feet.
														6				
SPT	4	6	9	11	20	1.3								7			Grading black; medium dense; wet	
														8				
														9				
SPT	5	7	11	13	24	1.3								10			Silty SAND; black to dark brown; medium dense; wet; fine grained; poorly graded	
														11				
														12				
														13				
														14				
														15			SAND; brown to light brown; medium dense; wet; fine grained; poorly graded; some silt	
SPT	6	5	8	10	18	0.8								16				
														17				
														18				
														19				
														20			Grading light brown; very loose; some silt	
SPT	7	1	2	1	3	0.8								21				
														22				
														23				
														24				
														25			Grading light gray	
SPT	8	2	2	1	3	0.7								26				
														27				
														28				
														29				

BLACK & VEATCH

LOG OF BORING

BORING NO. BV-10
SHEET 2 OF 4

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77788.1 E 56868.9	80.18 (MSL)	100.25 FEET	19 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	21 JUNE 1999

CHECKED BY: M.C. SCHLUTER
APPROVED BY: M.C. SCHLUTER

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	9	4	6	6	12	0.8								31			Grading medium dense and trace silt	
														32				
														33				
														34				
SPT	10	2	1	1	2	1.0								35			Grading very loose; some silt	
														36				
														37				
														38				
														39				
SPT	11	5	7	6	13	1.2								40			Grading medium dense	
														41				
														42				
														43				
														44				
SPT	12	6	8	11	19	0.9								45			Grading gray; trace silt	
														46				
														47				
														48				
														49				
SPT	13	4	3	7	10	0.9								50			Grading loose; some silt	
														51				
														52				
														53				
														54				
SPT	14	11	12	15	27	0.9								55			Grading medium dense with silt seam	
														56				
														57				
														58				
														59				

BLACK & VEATCH — LOG OF BORING — BORING NO. BV-10

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77788.1 E 56868.9	80.18 (MSL)	100.25 FEET	19 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	21 JUNE 1999

CHECKED BY: M.C. SCHLUTER — APPROVED BY: M.C. SCHLUTER

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	15	1	4	3	7	1.4								61			Grading loose	
														62				
														63				
														64				
SPT	16	1	2	1	3	1.2								65			Silty SAND; gray; very loose; wet; fine grained; poorly graded	
														66				
														67				
														68				
														69				
SPT	17	1	2	2	4	1.0								70				
														71				
														72				
														73				
														74				
SPT	18	2	3	4	7	1.0								75				
														76			Grading loose	
														77				
														78				
														79				
SPT	19	WOH	1	4	5	1.4								80				
														81				
														82				
														83				
														84				
SPT	20	WOH	WOH	WOH	0	1.4								85				
														86			Grading very loose	
														87				
														88				
														89				

BLACK & VEATCH

LOG OF BORING

BORING NO. BV-10
SHEET 4 OF 4

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77788.1 E 56868.9	80.18 (MSL)	100.25 FEET	19 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	21 JUNE 1999

CHECKED BY	APPROVED BY
M.C. SCHLUTER	M.C. SCHLUTER

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	21	WOH	WOH	WOH	0	1.2								91			Sandy SILT; gary; very soft; low plasticity; wet	
														92				
														93				
														94				
SPT	22	9	7	10	17	1.4								95			Gravelly SILT and SAND; gray and brown; medium dense; wet; fine to medium grained; well graded; angular gravel (WEATHERED ROCK - Limestone)	
														96				
														97				
														98				
														99				
SPT	23	50/3"			50+	0.1								100			Grading hard	
														101				End of boring at 100.25 feet. Boring backfilled with cement/bentonite grout.
														102				
														103				
														104				
														105				
														106				
														107				
														108				
														109				
														110				
														111				
														112				
														113				
														114				
														115				
														116				
														117				
														118				
														119				

BLACK & VEATCH — LOG OF BORING — BORING NO. BV-11

SHEET 1 OF 4

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77555.5 E 56871.0	81.03 (MSL)	100.4 FEET	23 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	23 JUNE 1999

CHECKED BY: M.C. SCHLUTER

APPROVED BY: M.C. SCHLUTER

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	1	1	1	2	3	1.4								1			SAND; gray to dark gray; very loose; dry; fine grained; poorly graded; trace silt, roots and wood chips	Boring advanced with 2 7/8" O.D. solid stem augers. SPT samples driven with auto-hammer.
SPT	2	1	2	1	3	0.7								2				
SPT	3	1	1	3	4	1.2								3				
														4			Grading moist; some silt	
														5				Water encountered at 6.0 feet.
														6			Grading brown; medium dense; wet	
SPT	4	5	10	9	19	1.3								7				Convert to rotary wash at 7.5 feet using 2 7/8" drag bit with Quick Gel and water as drilling fluid.
SPT	5	6	10	10	20	1.2								8				
														9				
														10				
														11				
														12				
														13				
														14				
														15				
SPT	6	3	6	8	14	1.0								16			Grading trace silt	
														17				
														18				
														19				
														20				
SPT	7	1	2	3	5	0.8								21			Grading light brown; loose	
														22				
														23				
														24				
														25				
SPT	8	1	2	2	4	1.3								26			Grading very loose	
														27				
														28				
														29				

BLACK & VEATCH

LOG OF BORING

BORING NO. BV-11
SHEET 2 OF 4

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77555.5 E 56871.0	81.03 (MSL)	100.4 FEET	23 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	23 JUNE 1999

CHECKED BY: M.C. SCHLUTER
APPROVED BY: M.C. SCHLUTER

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	RQD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	9	3	3	4	7	0.7								31			Grading loose; trace silt	
														32				
														33				
														34				
SPT	10	1	2	3	5	1.4								35			Grading gray	
														36				
														37				
														38				
														39				
SPT	11	7	12	17	29	0.8								40			Grading medium dense	
														41				
														42				
														43				
														44				
SPT	12	7	14	18	32	0.7								45				
														46				
														47				
														48				
														49				
SPT	13	4	10	12	22	0.7								50				
														51				
														52				
														53				
														54				
SPT	14	3	4	5	9	1.4								55			Grading loose; some silt	
														56				
														57				
														58				
														59				

BLACK & VEATCH

LOG OF BORING

BORING NO. BV-11
SHEET 3 OF 4

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77555.5 E 56871.0	81.03 (MSL)	100.4 FEET	23 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	23 JUNE 1999

CHECKED BY	APPROVED BY
M.C. SCHLUTER	M.C. SCHLUTER

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	15	1	2	2	4	1.5								61			Grading very loose	
														62				
														63				
														64				
SPT	16	3	3	3	6	1.5								65			Grading loose	
														66				
														67				
														68				
														69				
SPT	17	3	4	3	7	1.5								70				
														71				
														72				
														73				
														74				
SPT	18	2	2	2	4	1.5								75			Grading very loose	
														76				
														77				
														78				
														79				
SPT	19	1	2	2	4	1.5								80			Grading some silt; trace gravel	
														81				
														82				
														83				
														84				
SPT	20	WOH	WOH	WOH	0	1.5								85			SAND and SILT; gray; very loose; medium coarse grained; poorly graded; wet; trace gravel	
														86				
														87				
														88				
														89				

BLACK & VEATCH

LOG OF BORING

BORING NO. BV-11
SHEET 4 OF 4

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77555.5 E 56871.0	81.03 (MSL)	100.4 FEET	23 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	23 JUNE 1999

CHECKED BY: M.C. SCHLUTER
APPROVED BY: M.C. SCHLUTER

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	21	WOH	WOH	WOH	0	1.5								91				
														92				
														93				
														94				
														95			Gravelly Silty SAND; gray and brown; dense; wet; fine to coarse grained; well graded; angular gravel; calcareous (WEATHERED ROCK - Limestone)	
SPT	22	13	18	23	41	1.4								96				
														97				
														98				
														99				
SPT	23	50/5"			50+	0.0								100			Grading hard	
														101				End of boring at 100.4 feet. Boring backfilled with cement/bentonite grout.
														102				
														103				
														104				
														105				
														106				
														107				
														108				
														109				
														110				
														111				
														112				
														113				
														114				
														115				
														116				
														117				
														118				
														119				

BLACK & VEATCH — LOG OF BORING

BORING NO. BV-13
SHEET 1 OF 4

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77557.1 E 57071.0	80.17 (MSL)	100.1 FEET	21 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	22 JUNE 1999

CHECKED BY: M.C. SCHLUTER
APPROVED BY: M.C. SCHLUTER

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	1	1	1	3	4	1.2								1			SAND; light gray to gray; very loose; dry; fine grained; poorly graded; trace roots and wood chips	Boring advanced with 2 7/8" O.D. solid stem augers. SPT samples driven with auto-hammer.
SPT	2	3	5	6	11	1.1								2				
														3			Grading light grayish brown; medium dense; some silt	
SPT	3	8	10	9	19	1.3								4				
														5			Silty SAND; light brown; medium dense; moist; fine grained; poorly graded	Water encountered at 5.0 feet.
SPT	4	4	5	7	12	1.4								6				
														7			Grading brown and wet	Convert to rotary wash at 7.5 feet using 2 7/8" drag bit with Quick Gel and water as drilling fluid.
SPT	5	4	5	6	11	1.2								8				
														9				
														10				
														11				
														12				
														13				
														14				
														15				
SPT	6	3	4	5	9	1.0								16			Grading dark brown and loose	
														17				
														18				
														19				
														20				
SPT	7	1	1	2	3	0.9								21			Grading light brown and very loose	
														22				
														23				
														24				
														25			SAND; light grayish brown; loose; wet; fine grained; poorly graded	
SPT	8	4	3	5	8	0.9								26				
														27				
														28				
														29				

BLACK & VEATCH — LOG OF BORING — BORING NO. BV-13

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77557.1 E 57071.0	80.17 (MSL)	100.1 FEET	21 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	22 JUNE 1999

CHECKED BY: M.C. SCHLUTER

APPROVED BY: M.C. SCHLUTER

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	RQD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	9	4	3	3	6	1.0								31			Grading gray	
														32				
														33				
														34				
SPT	10	WOH	2	2	4	1.4								35			Silty SAND; gray; very loose; wet; fine grained; poorly graded	
														36				
														37				
														38				
														39				
SPT	11	6	10	15	25	0.8								40			SAND; gray; medium dense; wet; fine grained; poorly graded; some silt	
														41				
														42				
														43				
														44				
SPT	12	6	8	12	20	0.8								45			Grading some silt seam	
														46				
														47				
														48				
														49				
SPT	13	1	3	2	5	0.9								50			Grading loose; trace silt	06/22/99
														51				
														52				
														53				
														54				
SPT	14	3	2	2	4	0.8								55			Grading trace silt	
														56				
														57				
														58				
														59				

BLACK & VEATCH — LOG OF BORING

BORING NO. BV-13
SHEET 3 OF 4

CLIENT: JACKSONVILLE ELECTRIC AUTHORITY	PROJECT: BRANDY BRANCH STATION			PROJECT NO.: 60903
PROJECT LOCATION: BALDWIN, FLORIDA	COORDINATES: N 77557.1 E 57071.0	ELEVATION (DATUM): 80.17 (MSL)	TOTAL DEPTH: 100.1 FEET	DATE START: 21 JUNE 1999
SURFACE CONDITIONS: WOOD DEBRIS, NEARLY LEVEL	LOGGED BY: W.R. WU			DATE FINISH: 22 JUNE 1999
CHECKED BY: M.C. SCHLUTER	APPROVED BY: M.C. SCHLUTER			

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	15	1	2	2	4	0.8								61			Grading very loose	
														62				
														63				
														64				
SPT	16	1	2	1	3	0.9								65			Grading some silt	
														66				
														67				
														68				
														69				
SPT	17	3	2	3	5	0.9								70			Grading loose	
														71				
														72				
														73				
														74				
SPT	18	1	2	3	5	0.7								75				
														76				
														77				
														78				
														79				
SPT	19	WOH	WOH	WOH	0	1.5								80			Sandy SILT; gray; very soft; wet; low plasticity	
														81				
														82				
														83				
														84			Gravelly CLAY; gray; hard; moderate plasticity; wet	
SPT	20	7	10	34	44	1.5								85				
														86			Sandy GRAVEL; yellowish gray; dense; wet; calcareous; some clay (Highly weathered rock – Limestone)	
														87				
														88				
														89				

BLACK & VEATCH

LOG OF BORING

BORING NO. BV-13
SHEET 4 OF 4

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77557.1 E 57071.0	80.17 (MSL)	100.1 FEET	21 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	22 JUNE 1999

CHECKED BY: M.C. SCHLUTER
APPROVED BY: M.C. SCHLUTER

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	21	12	10	20	30	1.5								91				
														92				
														93				
														94				
														95				
SPT	22	12	14	30	44	1.5								96			CLAY; gray; hard; moderate plasticity; trace gravel with seam of fine sand (Highly weathered rock – Shale)	
														97				
														98				
														99				
SPT	23	50/1"			50+	0.0								100				
														101				End of boring at 100.1 feet. Boring backfilled with cement/bentonite grout.
														102				
														103				
														104				
														105				
														106				
														107				
														108				
														109				
														110				
														111				
														112				
														113				
														114				
														115				
														116				
														117				
														118				
														119				

BLACK & VEATCH — LOG OF BORING — BORING NO. BV-14

SHEET 1 OF 4

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77791.5 E 57269.0	79.75 (MSL)	101.5 FEET	16 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS & GRASSES, EDGE OF WETLAND	W.R. WU	16 JUNE 1999

CHECKED BY: M.C. SCHLUTER

APPROVED BY: M.C. SCHLUTER

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	1	1	1	3	4	1.0								1			Silty SAND; black to dark brown; very loose; dry; fine grained; poorly graded; some wood chips; trace organics (TOPSOIL)	Boring advanced with 2 7/8" O.D. solid stem augers. SPT samples driven with auto-hammer.
SPT	2	2	2	3	5	1.0								2				
														3				
														4			Grading loose and moist	
SPT	3	2	3	4	7	1.2								5			SAND; brown; loose; moist; fine grained; poorly graded; trace silt	
														6				Water encountered at 6.0 feet.
SPT	4	5	6	10	16	1.5								7			Grading medium dense, wet, and some silt	
														8				
SPT	5	6	9	8	17	1.4								9				
														10			Grading trace silt	
														11				Convert to rotary wash at 7.5 feet using 2 7/8" dray bit with water and Quick Gel as drilling fluid.
														12				
														13				
														14				
														15				
SPT	6	4	5	7	12	1.0								16			Grading light brown	
														17				
														18				
														19				
														20				
SPT	7	2	2	2	4	1.2								21			Grading light brown; very loose; some silt	
														22				
														23				
														24				
														25				
SPT	8	6	7	7	14	0.8								26			SAND; light brown to brown; medium dense; wet; fine grained; poorly graded; some silt	
														27				
														28				
														29				

BLACK & VEATCH

LOG OF BORING

BORING NO. BV-14
SHEET 2 OF 4

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77791.5 E 57269.0	79.75 (MSL)	101.5 FEET	16 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS & GRASSES, EDGE OF WETLAND	W.R. WU	16 JUNE 1999

CHECKED BY	APPROVED BY
M.C. SCHLUTER	M.C. SCHLUTER

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	9	2	2	1	3	1.1								31			Grading very loose	
														32				
														33				
														34				
SPT	10	1	1	2	3	1.2								35			Silty SAND; gray; very loose; fine grained; poorly graded; wet	
														36				
														37				
														38				
														39				
SPT	11	3	1	2	3	1.4								40			SAND; gray; very loose; fine grained; poorly graded; some silt	
														41				
														42				
														43				
														44				
SPT	12	9	7	6	13	0.7								45			Grading medium dense	
														46				
														47				
														48				
														49				
SPT	13	9	9	17	26	1.0								50			Grading light gray and trace silt	
														51				
														52				
														53				
														54				
SPT	14	9	9	19	28	1.2								55				
														56				
														57				
														58				
														59				

BLACK & VEATCH

LOG OF BORING

BORING NO. BV-14

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77791.5 E 57269.0	79.75 (MSL)	101.5 FEET	16 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS & GRASSES, EDGE OF WETLAND	W.R. WU	16 JUNE 1999

CHECKED BY	APPROVED BY
M.C. SCHLUTER	M.C. SCHLUTER

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	15	3	4	3	7	0.2								61			Grading loose	
														62				
														63				
														64				
														65				
SPT	16	2	1	2	3	1.4								66			Grading very loose and some silt	
														67				
														68				
														69				
														70				
SPT	17	1	2	2	4	1.5								71				
														72				
														73				
														74				
														75				
SPT	18	1	1	1	2	1.5								76				
														77				
														78				
														79				
														80				
SPT	19	1	3	4	7	1.2								81			Grading loose	
														82				
														83				
														84				
														85				
SPT	20	WOH	WOH	WOH	0	1.3								86			Sandy SILT; gray; very soft; wet; low to moderate plasticity; trace gravel	
														87				
														88				
														89				

BLACK & VEATCH

LOG OF BORING

BORING NO. BV-14
SHEET 4 OF 4

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77791.5 E 57269.0	79.75 (MSL)	101.5 FEET	16 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS & GRASSES, EDGE OF WETLAND	W.R. WU	16 JUNE 1999

CHECKED BY: M.C. SCHLUTER
APPROVED BY: M.C. SCHLUTER

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	21	11	15	15	30	1.3								91			SAND; grayish yellow; medium dense; wet; medium to coarse grained; well graded; some gravel; trace silt; weakly cemented? (Highly weathered rock – Limestone?)	
														92				
														93				
														94				
														95			Sandy SILT; yellowish gray; very stiff; low plasticity; some gravel	
SPT	22	11	10	10	20	1.3								96				
														97				
														98				
														99			SAND; yellowish gray; medium dense; medium to coarse grained; well graded; weakly cemented (Highly weathered rock – Limestone?)	
														100				
SPT	23	10	8	11	19	1.4								101				
														102				End of boring at 101.5 feet. Boring backfilled with cement/bentonite grout.
														103				
														104				
														105				
														106				
														107				
														108				
														109				
														110				
														111				
														112				
														113				
														114				
														115				
														116				
														117				
														118				
														119				

BLACK & VEATCH — LOG OF BORING — BORING NO. BV-15

SHEET 1 OF 4

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77559.0 E 57271.0	81.37 (MSL)	101.0 FEET	14 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS	W.R. WU	15 JUNE 1999

CHECKED BY: M.C. SCHLUTER

APPROVED BY: M.C. SCHLUTER

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	1	1	1	2	3	0.8								1			SAND; black to dark gray; very loose; dry; fine grained; poorly graded; with ash (TOPSOIL)	Boring advanced with 2 7/8" O.D. solid stem augers. SPT samples driven with auto-hammer.
SPT	2	2	1	2	3	0.7								2				
														3			SILT; brown	
SPT	3	2	2	3	5	0.8								4			SAND; light brown; loose; wet; fine grained; poorly graded; some silt	
														5				
														6			Grading dark brown to brown; medium dense	Water encountered at 6.5 feet.
SPT	4	8	9	8	17	1.5								7				
														8				
														9				
SPT	5	6	7	7	14	1.3								10			Grading light brown	Convert to rotary wash at 10.0 feet using 2 7/8" dray bit with water and Quick Gel as drilling fluid.
														11				
														12				
														13				
														14				
														15				
SPT	6	4	7	9	16	0.8								16			Grading trace silt	
														17				
														18				
														19				
														20			Grading loose	
SPT	7	4	3	4	7	1.5								21				
														22				
														23				
														24				
														25			Grading medium dense	
SPT	8	5	7	11	18	1.1								26				
														27				
														28				
														29				

BLACK & VEATCH

LOG OF BORING

BORING NO. BV-15
SHEET 2 OF 4

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77559.0 E 57271.0	81.37 (MSL)	101.0 FEET	14 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS	W.R. WU	15 JUNE 1999

CHECKED BY: M.C. SCHLUTER
APPROVED BY: M.C. SCHLUTER

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	9	5	4	6	10	1.2								31			Grading loose	
														32				
														33				
														34				
SPT	10	WOH	WOH	WOH	0	1.5								35			Silty SAND; gray; very loose; wet; fine grained; poorly graded; with seam of silt/clay of moderate plasticity	
														36				
														37				
														38				
														39				
SPT	11	2	2	3	5	1.4								40			Grading loose; no seam of silt/clay	
														41				
														42				
														43				
														44				
SPT	12	4	8	10	18	1.1								45			SAND; gray; medium dense; wet; fine grained; poorly graded; some silt	
														46				
														47				
														48				
														49				
SPT	13	3	2	5	7	1.0								50			Grading loose	
														51				
														52				
														53				
														54				
SPT	14	3	4	9	13	1.2								55			Grading medium dense	
														56				
														57				
														58				
														59				

BLACK & VEATCH — LOG OF BORING

BORING NO. BV-15
SHEET 3 OF 4

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77559.0 E 57271.0	81.37 (MSL)	101.0 FEET	14 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS	W.R. WU	15 JUNE 1999

CHECKED BY: M.C. SCHLUTER
APPROVED BY: M.C. SCHLUTER

SAMPLING / CORING										
SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD
SPT	15	3	2	3	5	1.2							
SPT	16	2	1	4	5	1.1							
SPT	17	1	1	1	2	1.0							
SPT	18	WOH	2	2	4	1.3							
SPT	19	2	1	2	3	1.5							
SPT	20	WOH	WOH	WOH	0								
TW	21	2.0				0							

DEPTH IN FEET	CLASSIFICATION OF MATERIAL	REMARKS
61–64	Grading loose and trace silt	
65–68	Silty SAND; gray; loose; fine grained; poorly graded	
69–74	Grading very loose	
75–79	SAND; gray; very loose; wet; fine grained; poorly graded; some silt	
80–84	Silty SAND; very loose; wet; fine grained; poorly graded	
85	Grading trace gravel	No recovery in thin wall tube; sample too soft.
86–89	Sandy CLAY; gray; very soft; wet; moderate plasticity	

BLACK & VEATCH

LOG OF BORING

BORING NO. BV-15
SHEET 4 OF 4

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77559.0 E 57271.0	81.37 (MSL)	101.0 FEET	14 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS	W.R. WU	15 JUNE 1999

CHECKED BY M.C. SCHLUTER

APPROVED BY M.C. SCHLUTER

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	22	2	2	3	5	1.5								91			Sandy SILT; gray; firm; wet; low plasticity	
														92				
														93				
														94				
														95			SAND and CLAY; gray; dense; fine to medium grained; well graded; trace gravel; calcareous; weakly cemented? (Highly weathered rock - Limestone?)	
SPT	23	13	14	25	39	1.5								96				
														97				
														98				
														99				
SPT	24	59	50/4"		50+	0.8								100			Clayey SAND; grayish brown; hard; fine to medium grained; well graded; some coarse sand and gravel; calcareous (WEATHERED ROCK - Limestone ?)	
														101				End of boring at 101.0 feet. Boring backfilled with cement/bentonite grout.
														102				
														103				
														104				
														105				
														106				
														107				
														108				
														109				
														110				
														111				
														112				
														113				
														114				
														115				
														116				
														117				
														118				
														119				

BLACK & VEATCH — LOG OF BORING — BORING NO. BV-16

SHEET 1 OF 4

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77787.8 E 57469.0	80.96 (MSL)	100.0 FEET	17 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	17 JUNE 1999

CHECKED BY: M.C. SCHLUTER

APPROVED BY: M.C. SCHLUTER

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	1	1	1	2	3	1.2								1			SAND; dark gray to gray; very loose; dry; fine grained; poorly graded; trace silt and roots (TOPSOIL)	Boring advanced with 2 7/8" O.D. solid stem augers. SPT samples driven with auto-hammer.
SPT	2	2	2	2	4	1.2								2				
SPT	3	1	2	3	5	1.5								3			Grading light brown and loose	
SPT	4	4	4	6	10	1.0								4				
SPT	5	4	4	6	10	1.2								5				
														6			Grading wet	Water encountered at 6.25 feet.
														7				
														8				
														9				
														10				Convert to rotary wash at 8.0 feet using 2 7/8" dray bit with water and Quick Gel as drilling fluid.
														11				
														12				
														13				
														14				
														15				
SPT	6	3	5	6	11	1.0								16			Grading medium dense	
														17				
														18				
														19				
														20				
SPT	7	2	1	1	2	1.5								21			Grading light grayish brown, very loose, and some silt	
														22				
														23				
														24				
														25				
SPT	8	3	4	3	7	1.4								26			Grading loose	
														27				
														28				
														29				

BLACK & VEATCH — LOG OF BORING — BORING NO. BV-16

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77787.8 E 57469.0	80.96 (MSL)	100.0 FEET	17 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	17 JUNE 1999

CHECKED BY: M.C. SCHLUTER — APPROVED BY: M.C. SCHLUTER

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	RQD RECOVERY	PERCENT RECOVERY	RQD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	9	1	1	1	2	1.5								31			Grading gray and very loose	
														32				
														33				
														34				
SPT	10	1	2	1	3	1.5								35				
														36			Sandy SILT; gray; soft; wet; moderate plasticity	
														37				
														38				
														39			SAND; light gray; medium dense; wet; fine grained; poorly graded; trace silt	
SPT	11	1	6	6	12	1.2								40				
														41				
														42				
														43				
														44				
SPT	12	5	8	9	17	0.8								45				
														46				
														47				
														48				
														49				
SPT	13	1	1	1	2	1.5								50			Grading gray, very loose, and some silt, with 2" clay seam	
														51				
														52				
														53				
														54				
SPT	14	9	12	14	26	1.3								55			Grading medium dense	
														56				
														57				
														58				
														59				

BLACK & VEATCH — LOG OF BORING

BORING NO. BV-16
SHEET 3 OF 4

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77787.8 E 57469.0	80.96 (MSL)	100.0 FEET	17 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	17 JUNE 1999

CHECKED BY: M.C. SCHLUTER
APPROVED BY: M.C. SCHLUTER

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD					
SPT	15	5	5	10	15	1.5	61–64				
SPT	16	2	2	5	7	1.5	65–69			Grading loose	
SPT	17	2	1	3	4	1.5	70–74			Grading very loose	
SPT	18	4	2	2	4	1.5	75–79			Grading trace gravel	
SPT	19	6	4	3	7	1.5	80–84			Sandy SILT; gray; firm; wet; low to moderate plasticity	
SPT	20	6	6	9	15	1.5	85–89			Silty CLAY; gray; stiff; moderate plasticity	

BLACK & VEATCH

LOG OF BORING

BORING NO. BV-16
SHEET 4 OF 4

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77787.8 E 57469.0	80.96 (MSL)	100.0 FEET	17 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	17 JUNE 1999

CHECKED BY	APPROVED BY
M.C. SCHLUTER	M.C. SCHLUTER

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	RQD RECOVERY	PERCENT RECOVERY	RQD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	21	3	3	3	6	1.2								91			Sandy SILT; yellowish gray; firm; low plasticity; some gravel	
														92				
														93				
														94				
SPT	22	10	15	25	40	1.2								95			Gravelly SAND; yellowish gray; dense; medium to coarse grained; well graded; some silt; calcareous; weakly cemented? (WEATHERED ROCK - Sandstone ?)	Hard drilling from 98.5 feet.
														96				
														97				
														98				
														99				
SPT	23	50/3"			50+	0.0								100			Grading hard	
														101				End of boring at 100.0 feet. Boring backfilled with cement/bentonite grout.
														102				
														103				
														104				
														105				
														106				
														107				
														108				
														109				
														110				
														111				
														112				
														113				
														114				
														115				
														116				
														117				
														118				
														119				

BLACK & VEATCH — LOG OF BORING

BORING NO. BV-18
SHEET 1 OF 3

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77906.3 E 57701.6	81.01 (MSL)	81.5 FEET	18 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	18 JUNE 1999

CHECKED BY	APPROVED BY
M.C. SCHLUTER	M.C. SCHLUTER

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY
CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD
SPT	1	1	2	1	3	1.0
SPT	2	1	2	2	4	1.0
SPT	3	2	4	5	9	1.2
SPT	4	4	8	13	21	1.4
SPT	5	5	7	8	15	1.5
SPT	6	7	7	9	16	1.1
SPT	7	3	2	1	3	1.3
SPT	8	1	1	1	2	1.4

DEPTH IN FEET: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29

SAMPLE TYPE / GRAPHIC LOG

CLASSIFICATION OF MATERIAL

Silty SAND; dark gray; very loose; dry; fine grained; poorly graded; some silt; with roots (with 3" topsoil)

Grading brown, loose, and moist

Grading medium dense and wet

SAND; light brown to light gray; medium dense; wet; fine grained; poorly graded; some silt

Grading yellowish brown

Grading light grayish brown and very loose

Silty SAND; light gray; very loose; wet; fine grained; poorly graded

REMARKS

Boring advanced with 2 7/8" O.D. solid stem augers. SPT samples driven with auto-hammer.

Water encountered at 7.0 feet.

Convert to rotary wash using a 2 7/8" drag bit with Quick Gel and water as drilling fluid.

BLACK & VEATCH — LOG OF BORING

BORING NO. BV-18
SHEET 2 OF 3

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77906.3 E 57701.6	81.01 (MSL)	81.5 FEET	18 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	18 JUNE 1999

CHECKED BY	APPROVED BY
M.C. SCHLUTER	M.C. SCHLUTER

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	CLASSIFICATION OF MATERIAL	REMARKS
SPT	9	1	1	2	3	1.5								31		
														32		
														33		
														34		
														35	Grading gray	
SPT	10	WOH	WOH	WOH	0	1.5								36		
														37		
														38		
														39		
														40	Grading gray to grayish brown	
SPT	11	2	3	2	5	1.2								41		
														42		
														43		
														44		
														45	Grading very loose	
SPT	12	2	1	3	4	1.3								46		
														47		
														48		
														49		
														50	Grading gray	
SPT	13	WOH	WOH	WOH	0	1.5								51		
														52		
														53		
														54		
														55		
SPT	14	WOH	1	1	2	1.5								56		
														57		
														58		
														59		

BLACK & VEATCH — LOG OF BORING

BORING NO. BV-18
SHEET 3 OF 3

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77906.3 E 57701.6	81.01 (MSL)	81.5 FEET	18 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	18 JUNE 1999

CHECKED BY: M.C. SCHLUTER
APPROVED BY: M.C. SCHLUTER

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	15	2	3	4	7	1.2								61			SAND: gray; loose; wet; fine grained; poorly graded	
														62				
														63				
														64				
														65				
SPT	16	2	2	4	6	1.2								66				
														67				
														68				
														69				
														70			Grading very loose	
SPT	17	2	1	3	4	1.4								71				
														72				
														73				
														74				
														75			Grading loose	
SPT	18	1	2	3	5	1.3								76				
														77				
														78				
														79				
														80			Grading very loose	
SPT	19	WOR	WOR	WOR	0	1.5								81				
														82				End of boring at 81.5 feet. Boring backfilled with cement/bentonite grout.
														83				
														84				
														85				
														86				
														87				
														88				
														89				

BLACK & VEATCH — LOG OF BORING — BORING NO. BV-19

SHEET 1 OF 4

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77750.7 E 57701.6	81.35 (MSL)	100.25 FEET	18 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS	W.R. WU	19 JUNE 1999

CHECKED BY: M.C. SCHLUTER

APPROVED BY: M.C. SCHLUTER

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	1	1	1	1	2	0.7								1			SAND; dark brown to grayish brown; very loose; fine grained; poorly graded; trace roots (with 3" topsoil)	Boring advanced with 2 7/8" O.D. solid stem augers. SPT samples driven with auto-hammer.
SPT	2	2	2	3	5	1.2								2				
SPT	3	4	6	5	11	1.5								3				
														4			Silty SAND; yellowish brown; loose to medium dense; fine grained; poorly graded; dry	
SPT	4	3	4	5	9	1.4								5				
														6			Grading light brown; medium dense; moist	Water encountered at 6.5 feet.
														7				
														8			Grading wet	
SPT	5	3	5	7	12	1.1								9			SAND; light brown to brown; medium dense; wet; fine grained; poorly graded; trace silt	Convert to rotary wash at 8.0 feet using 2 7/8" dray bit with water and Quick Gel as drilling fluid.
														10				
														11				
														12				
														13				
														14				
SPT	6	4	4	6	10	0.8								15			Grading loose	
														16				
														17				
														18				
														19				
SPT	7	1	1	1	2	1.2								20			Grading light grayish brown and very loose	
														21				
														22				
														23				
														24				
SPT	8	1	2	2	4	1.3								25			Grading light gray	
														26				
														27				
														28				
														29				

BLACK & VEATCH — LOG OF BORING — BORING NO. BV-19

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77750.7 E 57701.6	81.35 (MSL)	100.25 FEET	18 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS	W.R. WU	19 JUNE 1999

CHECKED BY: M.C. SCHLUTER — APPROVED BY: M.C. SCHLUTER

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	RQD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	9	WOH	WOH	WOH	0	1.4								31			Silty SAND: gray; very loose; fine grained; poorly graded; wet	
														32				
														33				
														34				
SPT	10	3	2	3	5	1.5								35			Grading firm	
														36				
														37				
														38				
														39				
														40				
SPT	11	1	1	4	5	1.2								41				
														42				
														43				
														44				
														45			SAND: light gray; loose; wet; fine grained; poorly graded; trace silt	
SPT	12	4	3	4	7	1.4								46				
														47				
														48				
														49				
														50				
SPT	13	3	4	3	7	0.6								51				
														52				
														53				
														54				
														55				
SPT	14	2	2	4	6	1.0								56				
														57				
														58				
														59				

BLACK & VEATCH

LOG OF BORING

BORING NO. BV-19
SHEET 3 OF 4

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77750.7 E 57701.6	81.35 (MSL)	100.25 FEET	18 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS	W.R. WU	19 JUNE 1999

CHECKED BY: M.C. SCHLUTER
APPROVED BY: M.C. SCHLUTER

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	15	1	2	3	5	1.0								61				
														62				
														63				
														64				
														65			Grading medium dense	
SPT	16	2	3	9	12	1.4								66				
														67				
														68				
														69				
														70			Grading very loose	
SPT	17	2	2	2	4	0.8								71				
														72				
														73				
														74				
														75			Grading loose	
SPT	18	2	3	4	7	1.1								76				
														77				
														78				
														79				
														80				
SPT	19	4	4	3	7	0.7								81				
														82				
														83				
														84			Silty CLAY: gray with yellowish seam; very stiff; wet; high plasticity	
														85				
SPT	20	8	8	9	17	1.5								86				
														87				
														88				
														89				

BLACK & VEATCH

LOG OF BORING

BORING NO. BV-19
SHEET 4 OF 4

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77750.7 E 57701.6	81.35 (MSL)	100.25 FEET	18 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS	W.R. WU	19 JUNE 1999

CHECKED BY: M.C. SCHLUTER
APPROVED BY: M.C. SCHLUTER

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	21	20	17	17	34	1.5								91–95			Grading light yellowish gray and hard	
SPT	22	13	16	15	31	0.9								95–100			Gravelly SAND; yellowish gray; dense; medium to coarse grained; well graded; calcareous; weakly cemented? (Highly weathered rock - Limestone?)	
SPT	23	50/3"			50+	0.0												
														101–119				End of boring at 100.25 feet. Boring backfilled with cement/bentonite grout.

BLACK & VEATCH — LOG OF BORING — BORING NO. BV-20

SHEET 1 OF 4

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77581.0 E 57743.7	82.01 (MSL)	101.5 FEET	24 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	24 JUNE 1999

CHECKED BY: M.C. SCHLUTER

APPROVED BY: M.C. SCHLUTER

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	1	2	1	2	3	1.3	1			SAND: gray to dark gray; very loose; dry; fine grained; poorly graded; trace silt, roots and wood chips	Boring advanced with 2 7/8" O.D. solid stem augers. SPT samples driven with auto-hammer.
SPT	2	2	2	3	5	0.9	2				
SPT	3	2	2	3	5	1.5	3			Grading loose and trace silt	
SPT	4	2	2	3	5	1.2	4				
SPT	5	3	5	5	10	0.9	5			Silty SAND; brown; loose; moist; fine grained; poorly graded	Water encountered at 5.7 feet.
							6				
							7			Grading wet	Convert to rotary wash at 7.5 feet using 2 7/8" drag bit with Quick Gel and water as drilling fluid.
							8				
							9				
							10				
							11				
							12				
							13				
							14				
SPT	6	7	10	11	21	0.9	15			Grading yellowish brown and medium dense	
							16				
							17				
							18				
							19				
SPT	7	2	2	2	4	1.0	20			Grading light brown; very loose; some silt	
							21				
							22				
							23				
							24				
SPT	8	2	2	2	4	1.0	25				
							26				
							27				
							28				
							29				

CORING

CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD

BLACK & VEATCH — LOG OF BORING — BORING NO. BV-20

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77581.0 E 57743.7	82.01 (MSL)	101.5 FEET	24 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	24 JUNE 1999

CHECKED BY: M.C. SCHLUTER — APPROVED BY: M.C. SCHLUTER

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	9	1	1	1	2	1.1								31–34				
SPT	10	1	3	3	6	1.4								35–39			SAND; light gray; loose; wet; fine grained poorly graded; trace silt	
SPT	11	9	10	9	19	1.0								40–44			Grading medium dense and some silt	
SPT	12	2	8	8	16	0.8								45–49			Grading trace silt	
SPT	13	3	6	10	16	0.7								50–54			Grading some silt	
SPT	14	6	4	3	7	1.0								55–59			Grading loose	

BLACK & VEATCH — LOG OF BORING — BORING NO. BV-20

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77581.0 E 57743.7	82.01 (MSL)	101.5 FEET	24 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	24 JUNE 1999

CHECKED BY	APPROVED BY
M.C. SCHLUTER	M.C. SCHLUTER

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	15	1	2	2	4	1.5								61			Grading very loose	
														62				
														63				
														64				
														65				
SPT	16	5	2	2	4	1.3								66				
														67				
														68				
														69				
														70			Grading loose	
SPT	17	2	4	6	10	1.4								71				
														72				
														73				
														74				
														75				
SPT	18	2	2	3	5	1.4								76				
														77				
														78				
														79				
														80			Grading very loose	
SPT	19	3	2	2	4	1.3								81				
														82				
														83				
														84				
														85				
SPT	20	2	2	2	4	1.4								86				
														87				
														88				
														89				

BLACK & VEATCH — LOG OF BORING — BORING NO. BV-20

SHEET 4 OF 4

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77581.0 E 57743.7	82.01 (MSL)	101.5 FEET	24 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
WOOD DEBRIS, NEARLY LEVEL	W.R. WU	24 JUNE 1999

CHECKED BY: M.C. SCHLUTER

APPROVED BY: M.C. SCHLUTER

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	21	2	4	5	9	0.8								91			SILT; light gray; stiff; wet; moderate plasticity	
														92				
														93				
														94				
SPT	22	20	24	23	47	1.5								95			Silty Gravelly SAND; light gray; dense; wet; fine to coarse grained; well graded; calcareous (Highly weathered rock – Limestone)	
														96				
														97				
														98				
														99				
														100				
SPT	23	34	33	27	60	1.5								101			Grading very dense	
														102				End of boring at 101.5 feet. Boring backfilled with cement/bentonite grout.
														103				
														104				
														105				
														106				
														107				
														108				
														109				
														110				
														111				
														112				
														113				
														114				
														115				
														116				
														117				
														118				
														119				

BLACK & VEATCH — LOG OF BORING — BORING NO. BV-21

SHEET 1 OF 1

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 76881.8 E 55802.0	83.0 (MSL)	12.0 FEET	25 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
NEARLY LEVEL, GRASSES	W.R. WU	25 JUNE 1999

CHECKED BY: M.C. SCHLUTER

APPROVED BY: M.C. SCHLUTER

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	1	2	2	3	5	2.0								1			SAND: dark gray to brown; loose; dry; fine grained; poorly graded; some silt; trace roots and organics	Boring advanced with 2 7/8" O.D. solid stem augers. SPT samples driven with auto-hammer.
SPT	2	3	2	1	3	2.0								2				
SPT	3	2	3	4	7	1.8								3			Grading light brown to brown, very loose, and moist	
SPT	4	5	9	12	21	1.8								4				
SPT	5	2	4	8	12	1.5								5			Grading dark brown and wet	
SPT	6	8	8	8	16	1.5								6				
														7				
														8				Convert to rotary wash at 8.0 feet using 3 7/8" tricone bit with water and Quick Gel as drilling fluid.
														9			Grading black; trace silt	
														10				
														11				
														12				End of boring at 12.0 feet. Boring backfilled with natural cuttings and sands.
														13				
														14				
														15				
														16				
														17				
														18				
														19				
														20				
														21				
														22				
														23				
														24				
														25				
														26				
														27				
														28				
														29				

BLACK & VEATCH — LOG OF BORING — BORING NO. BV-22

SHEET 1 OF 1

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77541.1 E 56059.4	82.0 (MSL)	12.0 FEET	25 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
NEARLY LEVEL, GRASSES	W.R. WU	25 JUNE 1999

CHECKED BY: M.C. SCHLUTER

APPROVED BY: M.C. SCHLUTER

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	RQD RECOVERY	PERCENT RECOVERY	RQD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	1	1	1	2	3	2.0								1			SAND; light gray to gray; very loose; dry; fine grained; poorly graded; trace silt and roots	Boring advanced with 2 7/8" O.D. solid stem augers. SPT samples driven with auto-hammer.
SPT	2	1	1	2	3	1.5								2				
SPT	3	1	1	1	2	1.8								3				
														4			Grading brown to dark brown; moist; some silt	Water encountered at 6.2 feet.
SPT	4	4	5	7	12	1.8								5				
														6				
														7			Grading brown to light brown; loose to medium dense; wet; trace silt	
SPT	5	2	4	6	10	2.0								8				
														9				
														10				
SPT	6	WOH	1	1	2	1.8								11			Grading brown to dark brown; very loose; some silt	
														12				End of boring at 12.0 feet. Boring backfilled with natural cuttings and sands.
														13				
														14				
														15				
														16				
														17				
														18				
														19				
														20				
														21				
														22				
														23				
														24				
														25				
														26				
														27				
														28				
														29				

BLACK & VEATCH — LOG OF BORING

BORING NO. BV-23
SHEET 1 OF 1

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
BALDWIN, FLORIDA	N 77870.7 E 55523.9	82.0 (MSL)	12.0 FEET	25 JUNE 1999

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
NEARLY LEVEL, GRASSES	W.R. WU	25 JUNE 1999

CHECKED BY: M.C. SCHLUTER
APPROVED BY: M.C. SCHLUTER

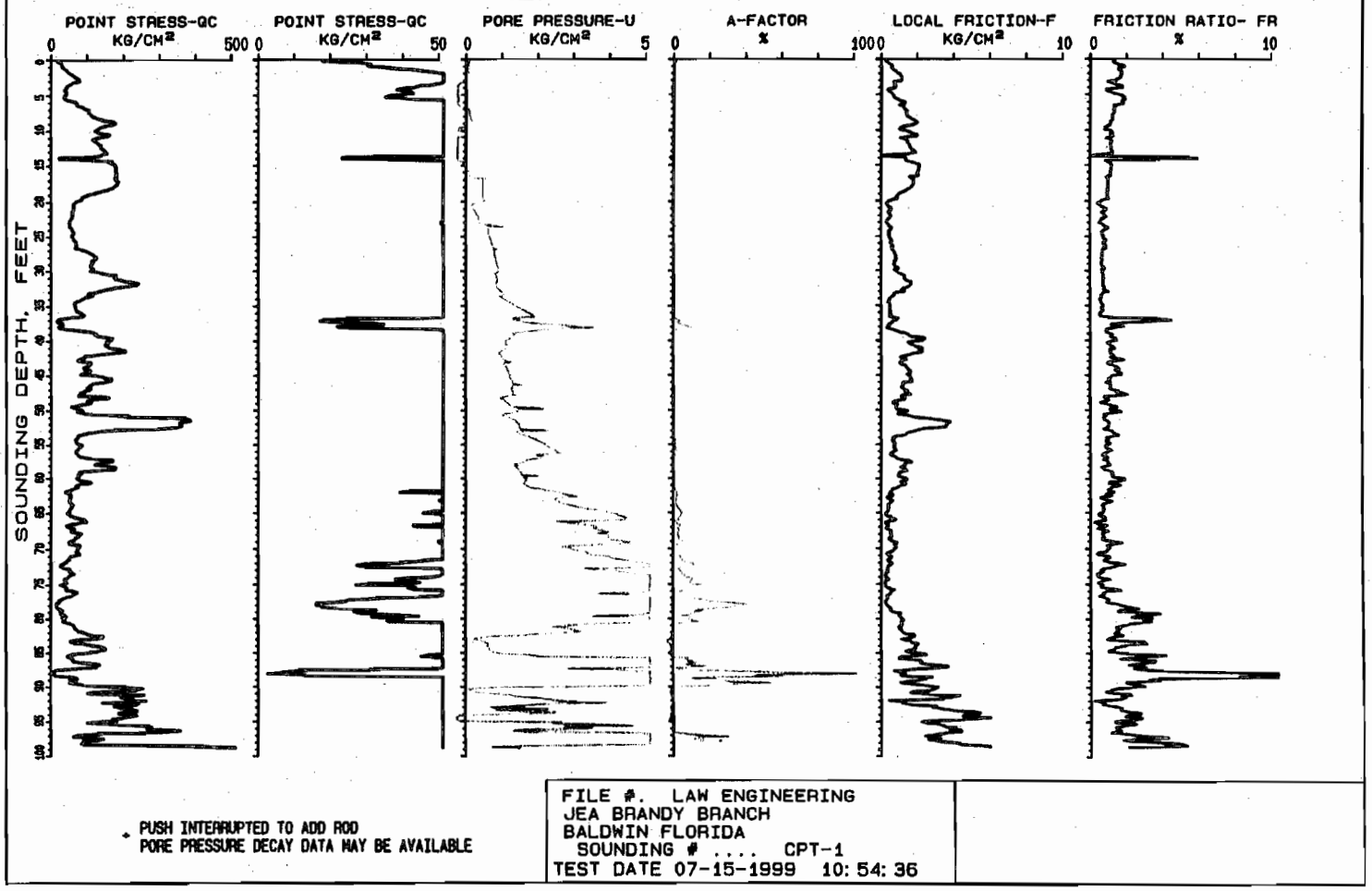
SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 0 INCHES	2ND 0 INCHES	3RD 0 INCHES	N VALUE	SAMPLE RECOVERY	CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	RQD RECOVERY	PERCENT RECOVERY	RQD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
SPT	1	1	1	1	2	1.9								1			SAND; dark gray to light gray; very loose; dry; fine grained; poorly graded; trace silt and roots	Boring advanced with 2 7/8" O.D. solid stem augers. SPT samples driven with auto-hammer.
SPT	2	2	2	3	5	1.6								2				
														3			Grading light gray to light brown; loose	
SPT	3	2	3	2	5	2.0								4				
														5			Grading light brown to dark brown	
SPT	4	5	4	8	12	1.6								6				
														7			Grading dark brown to black; medium dense; wet	
SPT	5	6	5	6	11	2.0								8				
														9			Grading some silt	
SPT	6	WOH	1	1	2	1.1								10				
														11			Grading light brown to light gray; very loose	
														12				End of boring at 12.0 feet. Boring backfilled with natural cuttings and sands.
														13				
														14				
														15				
														16				
														17				
														18				
														19				
														20				
														21				
														22				
														23				
														24				
														25				
														26				
														27				
														28				
														29				

Appendix C
Cone Penetrometer Soundings

IMAGE QUALITY

AS YOU REVIEW THE NEXT FEW PAGES, PLEASE NOTE THAT THE ORIGINAL DOCUMENT WAS OF POOR QUALITY.

PIEZOCONE SOUNDING TEST



* PUSH INTERRUPTED TO ADD ROD
PORE PRESSURE DECAY DATA MAY BE AVAILABLE

FILE #. LAW ENGINEERING
JEA BRANDY BRANCH
BALDWIN FLORIDA
SOUNDING # CPT-1
TEST DATE 07-15-1999 10:54:36

EARTH SERVICES INTERNATIONAL SOIL BEHAVIOR TABLE
SOUTHEASTERN UNITED STATES SOILS

JOB NAME ..... LAW ENGINERING
JEA BRANDY BRANCH
BALDWIN FLORIDA
FILE NAME..... CPT-1

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES #	N'	VERTICAL EFFECTIVE STRESS (KG/CM2)	RELATIVE DENSITY (%) *	FRICTION ANGLE (DEGREES) **	YOUNGS MODULUS (KG/CM2) ***	UNDRAINED SHEAR STRENGTH (KG/CM2) ****	SENSITIVITY	COMP.	OCR
1	CLAYEY FINE SAND	28.7	.5	11	7	.048	50%-60%	>48	63	--	--	--	--
2	SILTY FINE SAND	44.4	.79	14	12	.097	60%-70%	46-48	97	--	--	--	--
3	SILTY FINE SAND	71.2	1.03	23	18	.146	70%-80%	46-48	156	--	--	--	--
4	SILTY FINE SAND	53.5	.66	17	13	.177	60%-70%	44-46	117	--	--	--	--
5	SILTY FINE SAND	40.6	.47	13	10	.208	60%-70%	42-44	89	--	--	--	--
6	CLAYEY FINE SAND	46.3	.94	18	13	.238	60%-70%	42-44	101	--	--	--	--
7	SILTY FINE SAND	79.9	1.2	26	20	.269	70%-80%	44-46	175	--	--	--	--
8	SAND	109.3	1.39	21	27	.302	70%-80%	46-48	240	--	--	--	--
9	SAND	151.5	1.81	30	37	.335	>90%	46-48	333	--	--	--	--
10	SAND	144.6	1.23	28	33	.369	>90%	46-48	318	--	--	--	--
11	FINE SAND	144.7	1.6	36	35	.399	>90%	46-48	318	--	--	--	--
12	FINE SAND	124.2	1.4	31	30	.43	80%-90%	44-46	273	--	--	--	--
13	SAND	142.6	1.67	28	35	.463	80%-90%	44-46	313	--	--	--	--
14	SAND	120.8	.99	24	28	.497	70%-80%	44-46	265	--	--	--	--
15	SAND	146.6	1.8	29	36	.53	80%-90%	44-46	322	--	--	--	--
16	SAND	180.9	2.03	36	44	.563	>90%	44-46	397	--	--	--	--
17	SAND	180.4	1.78	36	43	.596	80%-90%	44-46	396	--	--	--	--
18	SAND	182.4	1.71	36	43	.629	80%-90%	44-46	401	--	--	--	--
19	SAND	137.7	1.16	27	32	.663	70%-80%	44-46	302	--	--	--	--
20	FINE SAND	84.1	.6	21	19	.693	60%-70%	40-42	185	--	--	--	--
21	FINE SAND	62.5	.4	15	14	.724	50%-60%	40-42	137	--	--	--	--
22	FINE SAND	60.1	.43	15	13	.755	40%-50%	38-40	132	--	--	--	--
23	FINE SAND	54.3	.3	13	12	.786	40%-50%	38-40	119	--	--	--	--
24	FINE SAND	54.1	.5	13	12	.817	40%-50%	38-40	119	--	--	--	--
25	FINE SAND	60.7	.4	15	13	.847	40%-50%	38-40	133	--	--	--	--
26	FINE SAND	66.6	.53	16	15	.878	40%-50%	38-40	146	--	--	--	--
27	FINE SAND	76.7	.6	19	17	.909	50%-60%	40-42	168	--	--	--	--
28	SAND	117.1	.76	23	26	.942	60%-70%	40-42	257	--	--	--	--
29	SAND	118.5	.71	23	26	.975	60%-70%	40-42	260	--	--	--	--
30	SAND	113.5	.81	22	25	1.008	60%-70%	40-42	249	--	--	--	--
31	SAND	162.3	1.19	32	37	1.042	70%-80%	42-44	357	--	--	--	--
32	SAND	216.4	1.55	43	49	1.075	80%-90%	44-46	476	--	--	--	--
33	SAND	169	1.18	33	38	1.108	70%-80%	42-44	371	--	--	--	--
34	SAND	104.1	.57	20	23	1.141	50%-60%	40-42	229	--	--	--	--
35	FINE SAND	69.4	.42	17	15	1.172	40%-50%	38-40	152	--	--	--	--

CPT-1 CONTINUED LAW ENGINERING

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES	N'	VERTICAL STRESS	RELATIVE DENSITY	FRICTION ANGLE	YOUNGS MODULUS	UNDRAINED SHEAR ST	Sensitivity	COMP.	OCR
36	FINE SAND	72.5	.45	18	16	1.203	40%-50%	38-40	159	--	--	--	--
37	FINE SAND	61.9	.64	15	14	1.234	<40%	36-38	136	--	--	--	--
38	CLAYEY FINE SAND	25.5	.42	10	6	1.264	<40%	30-32	56	--	--	--	--
39	SAND	80.3	.94	16	19	1.298	40%-50%	38-40	176	--	--	--	--
40	SAND	151	2.01	30	38	1.331	60%-70%	40-42	332	--	--	--	--
41	FINE SAND	156.3	1.79	39	38	1.362	60%-70%	40-42	343	--	--	--	--
42	SAND	186.3	1.96	37	45	1.395	70%-80%	42-44	409	--	--	--	--
43	SAND	90.6	1.16	18	22	1.428	40%-50%	38-40	199	--	--	--	--
44	SAND	101.2	1.24	20	25	1.461	40%-50%	38-40	222	--	--	--	--
45	SILTY FINE SAND	97.6	1.51	32	25	1.492	40%-50%	38-40	214	--	--	--	--
46	SAND	151.6	1.51	30	36	1.525	60%-70%	40-42	333	--	--	--	--
47	FINE SAND	108.1	1.16	27	26	1.556	50%-60%	38-40	237	--	--	--	--
48	SAND	95.8	1.31	19	24	1.589	40%-50%	38-40	210	--	--	--	--
49	SAND	120.1	.89	24	27	1.622	50%-60%	38-40	264	--	--	--	--
50	SILTY FINE SAND	74.2	.96	24	18	1.653	<40%	36-38	163	--	--	--	--
51	FINE SAND	128.7	1.39	32	31	1.684	50%-60%	38-40	283	--	--	--	--
[illegible]	SAND	365.8	3.46	73	87	1.717	>90%	44-46	804	--	--	--	--
[illegible]	SAND	312.7	2.59	62	72	1.75	>90%	42-44	687	--	--	--	--
[illegible]	FINE SAND	92.8	1.01	23	22	1.781	40%-50%	36-38	204	--	--	--	--
55	FINE SAND	70.8	.67	17	16	1.812	<40%	36-38	155	--	--	--	--
56	FINE SAND	77.9	.7	19	18	1.843	<40%	36-38	171	--	--	--	--
57	FINE SAND	79.5	.69	19	18	1.873	<40%	36-38	174	--	--	--	--
58	SAND	147.3	1.39	29	35	1.907	50%-60%	38-40	324	--	--	--	--
59	SAND	155.2	1.19	31	35	1.94	50%-60%	38-40	341	--	--	--	--
60	SILTY FINE SAND	76.9	1.11	25	19	1.971	<40%	36-38	169	--	--	--	--
61	SAND	89.5	1.18	17	22	2.004	<40%	36-38	196	--	--	--	--
62	FINE SAND	61.6	.61	15	14	2.034	<40%	34-36	135	--	--	--	--
63	FINE SAND	51.5	.44	12	12	2.065	<40%	32-34	113	--	--	--	--
64	FINE SAND	54.6	.45	13	12	2.096	<40%	32-34	120	--	--	--	--
65	FINE SAND	53.1	.33	13	11	2.127	<40%	32-34	116	--	--	--	--
66	FINE SAND	64.9	.49	16	14	2.158	<40%	34-36	142	--	--	--	--
67	FINE SAND	69.5	.27	17	15	2.188	<40%	34-36	152	--	--	--	--
68	FINE SAND	67.5	.45	16	15	2.219	<40%	34-36	148	--	--	--	--
69	FINE SAND	65.2	.56	16	15	2.25	<40%	34-36	143	--	--	--	--
70	FINE SAND	69.4	.73	17	16	2.281	<40%	34-36	152	--	--	--	--
71	FINE SAND	71.8	.43	17	16	2.311	<40%	34-36	157	--	--	--	--
72	SILTY FINE SAND	47.1	.45	15	11	2.342	<40%	30-32	103	--	--	--	--
73	SILTY FINE SAND	37.5	.35	12	8	2.373	<40%	30-32	82	--	--	--	--
74	FINE SAND	55	.24	13	11	2.404	<40%	32-34	121	--	--	--	--
75	FINE SAND	39.9	.22	9	8	2.434	<40%	30-32	87	--	--	--	--
76	SILTY FINE SAND	42.8	.45	14	10	2.465	<40%	30-32	94	--	--	--	--
77	FINE SAND	57.8	.33	14	12	2.496	<40%	32-34	127	--	--	--	--
[illegible]	CLAYEY FINE SAND	21.7	.25	8	5	2.527	<40%	<30	47	--	--	--	--
[illegible]	CLAYEY FINE SAND	23.9	.58	9	7	2.558	<40%	<30	52	--	--	--	--
80	CLAYEY FINE SAND	35.3	1.06	14	11	2.588	<40%	<30	77	--	--	--	--

CPT-1 CONTINUED LAW ENGINERING

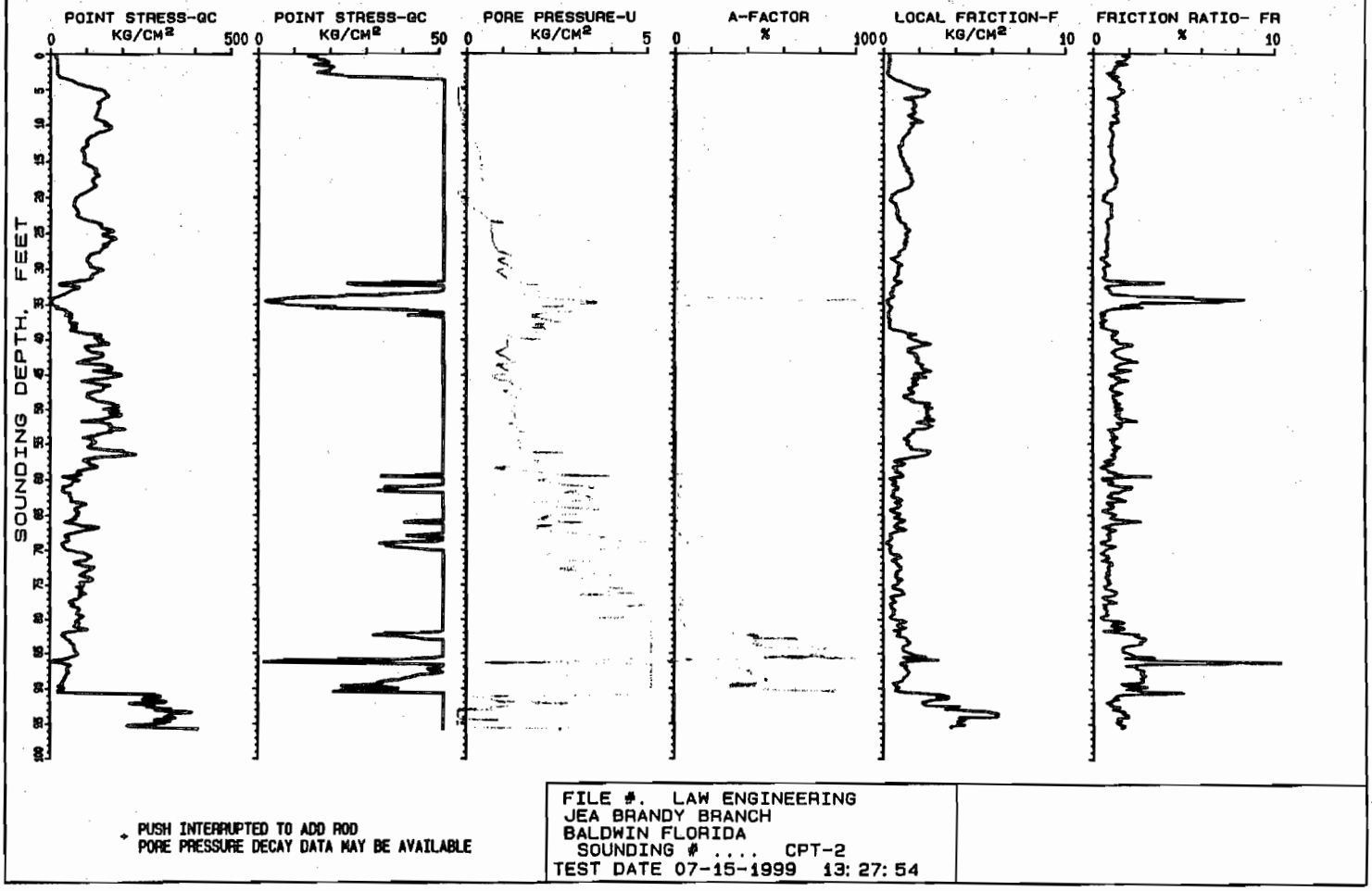
DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES	N'	VERTICAL STRESS	RELATIVE DENSITY	FRICTION ANGLE	YOUNGS MODULUS	UNDRAINED SHEAR ST	Sensitivity	COMP.	OCR
81	CLAYEY FINE SAND	47.4	1.08	18	13	2.619	<40%	30-32	104	--	--	--	--
82	SILTY FINE SAND	72.5	1.09	24	18	2.65	<40%	34-36	159	--	--	--	--
83	SAND	121.8	1.51	24	30	2.683	40%-50%	36-38	267	--	--	--	--
84	SILTY FINE SAND	79.6	1.83	26	23	2.714	<40%	34-36	175	--	--	--	--
85	SAND	140.7	1.76	28	35	2.747	40%-50%	36-38	309	--	--	--	--
86	CLAYEY FINE SAND	60.2	1.73	24	18	2.778	<40%	32-34	132	--	--	--	--
87	CLAYEY FINE SAND	100.8	2.9	40	31	2.809	<40%	34-36	221	--	--	--	--
88	CLAYEY FINE SAND	40.6	1.24	16	13	2.839	<40%	<30	89	--	--	--	--
89	CLAYS	32.3	2.02	32	14	2.864	--	--	--	1.67	--	UD	3
90	CLAYEY FINE SAND	79.7	2.17	31	24	2.895	<40%	34-36	175	--	--	--	--
91	SAND	193.9	2.33	38	48	2.928	50%-60%	38-40	426	--	--	--	--
92	SAND	205.2	2.68	41	51	2.961	60%-70%	38-40	451	--	--	--	--
93	SAND	206	2.53	41	51	2.995	60%-70%	38-40	453	--	--	--	--
94	SILTY FINE SAND	219.4	4.73	73	62	3.025	60%-70%	38-40	482	--	--	--	--
95	FINE SAND	195	3.73	48	53	3.056	50%-60%	38-40	429	--	--	--	--
96	FINE SAND	209	3.78	52	56	3.087	60%-70%	38-40	459	--	--	--	--
97	SAND	215.8	3.18	43	55	3.12	60%-70%	38-40	474	--	--	--	--
98	CLAYEY FINE SAND	105.1	3.47	42	34	3.151	<40%	34-36	231	--	--	--	--

\# N'=POINT STRESS*(.2+.04*FRICTION RATIO)
* NORMALLY CONSOLIDATED SANDS
** FOR OVERCONSOLIDATED SANDS,SLIGHTLY REDUCE ABOVE FRICTION ANGLES
*** FOR OVERCONSOLIDATED SANDS, YOUNG'S MODULUS MAY BE AS MUCH AS 3 TO 6 TIMES HIGHER
**** NK OF 16 USED. FOR OVERCONSOLIDATED CLAYS, AN NK OF 17 IS SUGGESTED

THE ABOVE DATA WAS COLLECTED AND COMPUTED UTILIZING THE 'IN-SITU SYSTEM'
FOLLOWING 'BASIC' GUIDELINES BY P. K. ROBERTSON AND R. G. CAMPANELLA IN THE
HANDBOOK 'GUIDELINES FOR USE AND INTERPERTATION OF THE ELECTRONIC CONE PENETRATION TEST'

ADDITIONAL LOCAL CORRELATIONS DEVELOPED BY THE IN-SITU SYSTEM HAVE ALSO BEEN USED IN COMPUTING THE ABOVE DATA.
IT IS THE POLICY OF THE IN-SITU SYSTEM TO CONTINUALLY UPGRADE AND MODIFY C.P.T CORRELATIONS AS
PUBLISHED RESEARCH AND LOCAL EXPERIENCE GROWS.

PIEZOCONE SOUNDING TEST



* PUSH INTERRUPTED TO ADD ROD
PORE PRESSURE DECAY DATA MAY BE AVAILABLE

FILE #. LAW ENGINEERING
JEA BRANDY BRANCH
BALDWIN FLORIDA
SOUNDING # CPT-2
TEST DATE 07-15-1999 13: 27: 54

EARTH SERVICES INTERNATIONAL SOIL BEHAVIOR TABLE
SOUTHEASTERN UNITED STATES SOILS

JOB NAME ..... LAW ENGINERING
JEA BRANDY BRANCH
BALDWIN FLORIDA
FILE NAME..... CPT-2

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES #	N'	VERTICAL EFFECTIVE STRESS (KG/CM2)	RELATIVE DENSITY (%) *	FRICTION ANGLE (DEGREES) **	YOUNGS MODULUS (KG/CM2) ***	UNDRAINED SHEAR STRENGTH (KG/CM2) ****	SENSITIVITY	COMP.	OCR
1	CLAYEY FINE SAND	16.1	.3	6	4	.048	40%-50%	46-48	35	--	--	--	--
2	CLAYEY FINE SAND	18.8	.25	7	4	.097	40%-50%	42-44	41	--	--	--	--
3	CLAYEY FINE SAND	18.7	.19	7	4	.146	40%-50%	42-44	41	--	--	--	--
4	SILTY FINE SAND	42	.6	14	10	.177	60%-70%	44-46	92	--	--	--	--
5	SILTY FINE SAND	98.5	1.57	32	25	.208	70%-80%	46-48	216	--	--	--	--
6	SAND	153.9	2.36	30	40	.241	>90%	>48	338	--	--	--	--
7	FINE SAND	145.7	1.54	36	35	.272	>90%	>48	320	--	--	--	--
8	SAND	135.3	1.67	27	33	.305	>90%	46-48	297	--	--	--	--
9	SAND	128.7	1.56	25	31	.338	80%-90%	46-48	283	--	--	--	--
10	SAND	140.9	1.75	28	35	.371	>90%	46-48	309	--	--	--	--
11	SAND	159.1	1.47	31	37	.404	>90%	46-48	350	--	--	--	--
12	FINE SAND	115.4	1.16	28	27	.435	70%-80%	44-46	253	--	--	--	--
13	FINE SAND	100.6	.95	25	23	.466	70%-80%	44-46	221	--	--	--	--
14	FINE SAND	90	.85	22	21	.497	70%-80%	42-44	198	--	--	--	--
15	FINE SAND	94	.97	23	22	.527	60%-70%	42-44	206	--	--	--	--
16	FINE SAND	104.9	1.15	26	25	.558	70%-80%	42-44	230	--	--	--	--
17	FINE SAND	130	1.38	32	31	.589	70%-80%	44-46	286	--	--	--	--
18	SAND	119.7	1.52	23	30	.622	70%-80%	42-44	263	--	--	--	--
19	FINE SAND	119.6	1.31	29	29	.653	70%-80%	42-44	263	--	--	--	--
20	FINE SAND	86.9	.55	21	19	.684	60%-70%	42-44	191	--	--	--	--
21	FINE SAND	67.1	.48	16	15	.714	50%-60%	40-42	147	--	--	--	--
22	FINE SAND	71.1	.72	17	17	.745	50%-60%	40-42	156	--	--	--	--
23	FINE SAND	77.5	.77	19	18	.776	50%-60%	40-42	170	--	--	--	--
24	SAND	124.7	1.03	24	29	.809	70%-80%	42-44	274	--	--	--	--
25	SAND	156.3	1.29	31	36	.842	70%-80%	42-44	343	--	--	--	--
26	SAND	163.9	1.23	32	37	.876	70%-80%	42-44	360	--	--	--	--
27	SAND	157.2	1.17	31	36	.909	70%-80%	42-44	345	--	--	--	--
28	SAND	133.8	.95	26	30	.942	70%-80%	42-44	294	--	--	--	--
29	SAND	104.2	.58	20	23	.975	60%-70%	40-42	229	--	--	--	--
30	SAND	114.2	.84	22	26	1.008	60%-70%	40-42	251	--	--	--	--
31	SAND	129	.77	25	28	1.042	60%-70%	40-42	283	--	--	--	--
32	FINE SAND	90.9	.73	22	21	1.072	50%-60%	40-42	199	--	--	--	--
33	FINE SAND	57.4	.59	14	13	1.103	<40%	36-38	126	--	--	--	--
34	SILTY FINE SAND	38.3	.45	12	9	1.134	<40%	34-36	84	--	--	--	--
35	CLAYS	5.2	.23	5	1	1.159	--	--	--	.19	--	.04	1

CPT-2 CONTINUED LAW ENGINERING

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES	N'	VERTICAL STRESS	RELATIVE DENSITY	FRICTION ANGLE	YOUNGS MODULUS	UNDRAINED SHEAR ST	Sensitivity	COMP.	OCR
36	CLAYEY FINE SAND	25	.37	10	6	1.19	<40%	32-34	55	--	--	--	--
37	FINE SAND	51.9	.26	12	11	1.22	<40%	36-38	114	--	--	--	--
38	FINE SAND	58.9	.31	14	13	1.251	<40%	36-38	129	--	--	--	--
39	FINE SAND	67.6	.68	16	16	1.282	<40%	36-38	148	--	--	--	--
40	FINE SAND	133.7	1.56	33	32	1.313	60%-70%	40-42	294	--	--	--	--
41	SAND	136	2.17	27	35	1.346	60%-70%	40-42	299	--	--	--	--
42	SAND	115.1	1.47	23	28	1.379	50%-60%	40-42	253	--	--	--	--
43	SAND	129.5	1.84	25	33	1.412	60%-70%	40-42	284	--	--	--	--
44	SAND	130.2	2.03	26	34	1.446	60%-70%	40-42	286	--	--	--	--
45	SAND	160.6	2.17	32	40	1.479	60%-70%	40-42	353	--	--	--	--
46	SAND	144.4	1.84	28	36	1.512	60%-70%	40-42	317	--	--	--	--
47	FINE SAND	142	1.63	35	34	1.543	60%-70%	40-42	312	--	--	--	--
48	FINE SAND	123.6	1.41	30	30	1.573	50%-60%	38-40	271	--	--	--	--
49	SAND	123.3	1.66	24	31	1.607	50%-60%	38-40	271	--	--	--	--
50	SAND	174.2	2.42	34	44	1.64	60%-70%	40-42	383	--	--	--	--
51	SAND	183.9	2.42	36	46	1.673	60%-70%	40-42	404	--	--	--	--
[illegible]	FINE SAND	135.1	2.35	33	36	1.704	50%-60%	38-40	297	--	--	--	--
[illegible]	SAND	175.1	2.25	35	44	1.737	60%-70%	40-42	385	--	--	--	--
54	SAND	143.5	1.45	28	34	1.77	50%-60%	40-42	315	--	--	--	--
55	FINE SAND	114.2	1.26	28	27	1.801	40%-50%	38-40	251	--	--	--	--
56	SAND	124.8	1.77	24	32	1.834	50%-60%	38-40	274	--	--	--	--
57	SAND	201.4	2.1	40	48	1.867	60%-70%	40-42	443	--	--	--	--
58	FINE SAND	105.9	.88	26	24	1.898	40%-50%	38-40	232	--	--	--	--
59	SAND	103.2	.66	20	23	1.931	40%-50%	36-38	227	--	--	--	--
60	FINE SAND	62.6	.7	15	15	1.962	<40%	34-36	137	--	--	--	--
61	FINE SAND	62.7	.61	15	15	1.993	<40%	34-36	137	--	--	--	--
62	SILTY FINE SAND	39.6	.62	13	10	2.024	<40%	30-32	87	--	--	--	--
63	SILTY FINE SAND	56.7	.68	18	14	2.055	<40%	34-36	124	--	--	--	--
64	FINE SAND	83.1	.8	20	19	2.085	<40%	36-38	182	--	--	--	--
65	FINE SAND	74.6	.65	18	17	2.116	<40%	34-36	164	--	--	--	--
66	SILTY FINE SAND	63.7	.9	21	16	2.147	<40%	34-36	140	--	--	--	--
67	FINE SAND	94.7	.84	23	22	2.178	<40%	36-38	208	--	--	--	--
68	FINE SAND	66.9	.5	16	15	2.208	<40%	34-36	147	--	--	--	--
69	FINE SAND	47.2	.29	11	10	2.239	<40%	32-34	103	--	--	--	--
70	SILTY FINE SAND	39.3	.36	13	9	2.27	<40%	30-32	86	--	--	--	--
71	FINE SAND	94.5	.67	23	21	2.301	<40%	36-38	207	--	--	--	--
72	FINE SAND	89.8	.63	22	20	2.331	<40%	36-38	197	--	--	--	--
73	FINE SAND	106.3	.87	26	24	2.362	<40%	36-38	233	--	--	--	--
74	FINE SAND	95.4	.73	23	22	2.393	<40%	36-38	209	--	--	--	--
75	FINE SAND	101.8	.75	25	23	2.424	<40%	36-38	223	--	--	--	--
76	FINE SAND	84.7	.83	21	20	2.454	<40%	34-36	186	--	--	--	--
77	FINE SAND	85.9	.56	21	19	2.485	<40%	34-36	188	--	--	--	--
[illegible]	FINE SAND	60.9	.46	15	14	2.516	<40%	32-34	133	--	--	--	--
[illegible]	FINE SAND	75.4	.52	18	17	2.547	<40%	34-36	165	--	--	--	--
80	FINE SAND	82.2	.52	20	18	2.578	<40%	34-36	180	--	--	--	--

CPT-2 CONTINUED LAW ENGINERING

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES	N'	VERTICAL STRESS	RELATIVE DENSITY	FRICTION ANGLE	YOUNGS MODULUS	UNDRAINED SHEAR ST	Sensitivity	COMP.	OCR
81	SAND	76.6	.95	15	19	2.611	<40%	34-36	168	--	--	--	--
82	FINE SAND	80	.88	20	19	2.642	<40%	34-36	176	--	--	--	--
83	CLAYEY FINE SAND	38.6	1.07	15	12	2.672	<40%	<30	84	--	--	--	--
84	SILTY FINE SAND	59.3	1.27	19	16	2.703	<40%	32-34	130	--	--	--	--
85	SILTY FINE SAND	68.6	1.27	22	18	2.734	<40%	32-34	150	--	--	--	--
86	CLAYEY FINE SAND	61.1	1.87	24	19	2.765	<40%	32-34	134	--	--	--	--
87	SILTS	34	1.07	17	11	2.792	--	--	--	1.79	--	.01	3
88	CLAYEY FINE SAND	49.4	1.31	19	15	2.823	<40%	30-32	108	--	--	--	--
89	CLAYEY FINE SAND	41.2	1.04	16	12	2.853	<40%	<30	90	--	--	--	--
90	CLAYEY FINE SAND	32.9	.65	13	9	2.884	<40%	<30	72	--	--	--	--
91	SILTY FINE SAND	99.1	2.26	33	28	2.915	<40%	34-36	218	--	--	--	--
92	SAND	286.9	2.62	57	67	2.948	70%-80%	40-42	631	--	--	--	--
93	SAND	275.6	3.57	55	69	2.981	70%-80%	40-42	606	--	--	--	--
94	FINE SAND	335.9	5.79	83	90	3.012	80%-90%	40-42	738	--	--	--	--
95	SAND	317.6	4.28	63	80	3.045	70%-80%	40-42	698	--	--	--	--

\# N'=POINT STRESS*(.2+.04*FRICTION RATIO)

* NORMALLY CONSOLIDATED SANDS

** FOR OVERCONSOLIDATED SANDS,SLIGHTLY REDUCE ABOVE FRICTION ANGLES

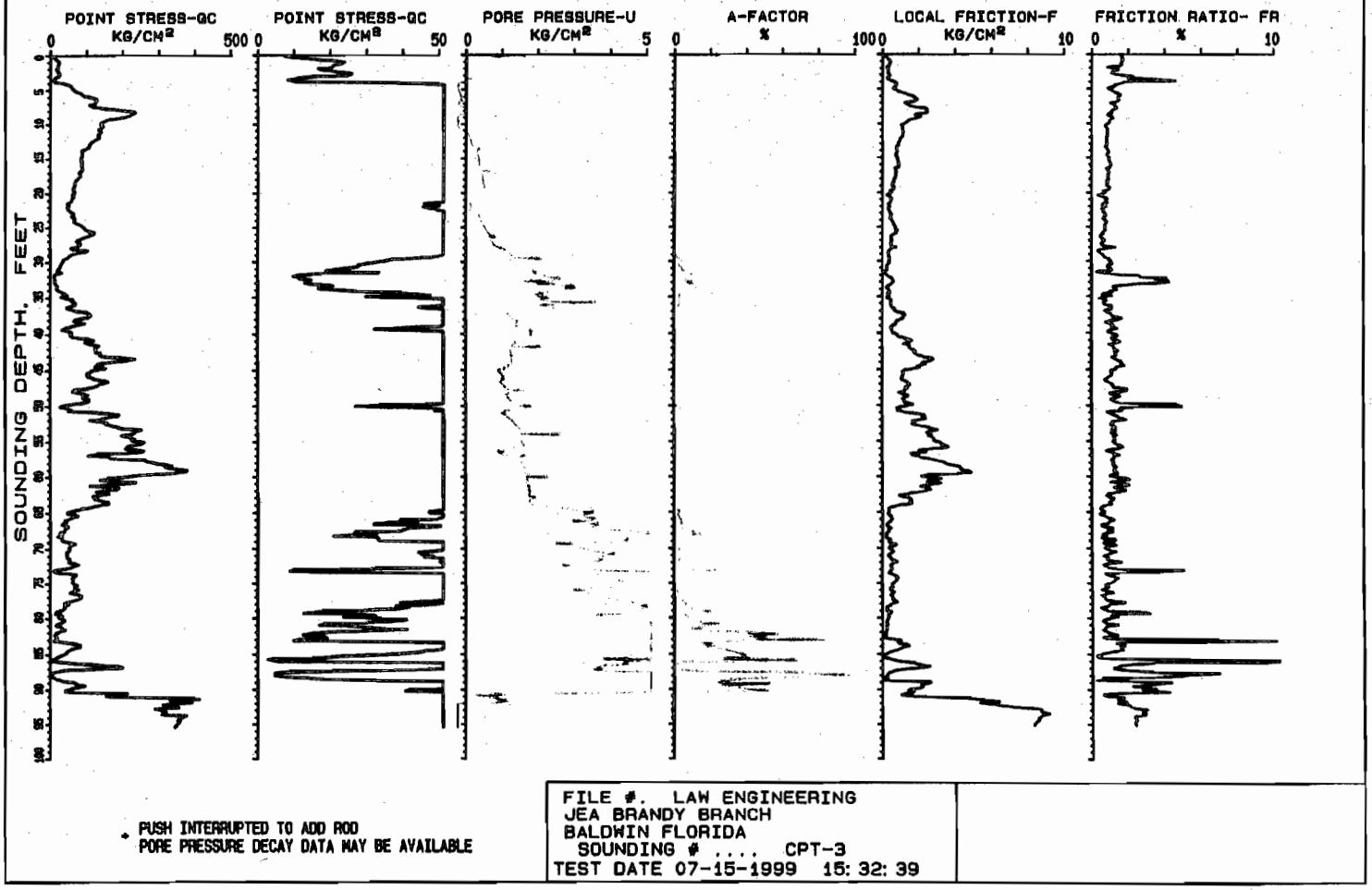
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PUBLISHED RESEARCH AND LOCAL EXPERIENCE GROWS.

PIEZOCONE SOUNDING TEST



* PUSH INTERRUPTED TO ADD ROD
PORE PRESSURE DECAY DATA MAY BE AVAILABLE

FILE #. LAW ENGINEERING
JEA BRANDY BRANCH
BALDWIN FLORIDA
SOUNDING # CPT-3
TEST DATE 07-15-1999 15: 32: 39

EARTH SERVICES INTERNATIONAL SOIL BEHAVIOR TABLE
SOUTHEASTERN UNITED STATES SOILS

JOB NAME ..... LAW ENGINERING
JEA BRANDY BRANCH
BALDWIN FLORIDA
FILE NAME..... CPT-3

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES #	N'	VERTICAL EFFECTIVE STRESS (KG/CM2)	RELATIVE DENSITY (%) *	FRICTION ANGLE (DEGREES) **	YOUNGS MODULUS (KG/CM2) ***	UNDRAINED SHEAR STRENGTH (KG/CM2) ****	SENSITIVITY	COMP.	OCR
1	SILTS	15.7	.31	7	4	.043	--	--	--	.98	--	.03	>6
2	CLAYEY FINE SAND	21.7	.28	8	5	.092	40%-50%	44-46	47	--	--	--	--
3	CLAYEY FINE SAND	21.8	.28	8	5	.141	40%-50%	42-44	47	--	--	--	--
4	SILTY CLAY	11.1	.36	7	3	.168	--	--	--	.68	--	.02	>6
5	SILTY FINE SAND	53.9	.65	17	13	.199	60%-70%	44-46	118	--	--	--	--
6	SILTY FINE SAND	85.7	1.31	28	22	.23	70%-80%	46-48	188	--	--	--	--
7	SAND	125.1	1.62	25	31	.263	80%-90%	46-48	275	--	--	--	--
8	SAND	146.5	2.06	29	37	.296	>90%	46-48	322	--	--	--	--
9	SAND	223.7	2.11	44	53	.33	>90%	>48	492	--	--	--	--
10	SAND	154.6	1.39	30	36	.363	>90%	46-48	340	--	--	--	--
11	SAND	138.6	1.04	27	31	.396	80%-90%	46-48	304	--	--	--	--
12	SAND	134.8	1.06	26	31	.429	80%-90%	44-46	296	--	--	--	--
13	SAND	117.4	.87	23	26	.462	70%-80%	44-46	258	--	--	--	--
14	FINE SAND	100.3	.75	25	23	.493	70%-80%	44-46	220	--	--	--	--
15	FINE SAND	85.7	.74	21	20	.524	60%-70%	42-44	188	--	--	--	--
16	FINE SAND	85	.83	21	20	.555	60%-70%	42-44	187	--	--	--	--
17	FINE SAND	85.3	.72	21	19	.586	60%-70%	42-44	187	--	--	--	--
18	FINE SAND	79	.68	19	18	.616	60%-70%	42-44	173	--	--	--	--
19	FINE SAND	67.7	.54	16	15	.647	50%-60%	40-42	148	--	--	--	--
20	FINE SAND	63.5	.5	15	14	.678	50%-60%	40-42	139	--	--	--	--
21	FINE SAND	61.4	.36	15	13	.709	50%-60%	40-42	135	--	--	--	--
22	FINE SAND	49.5	.34	12	11	.739	40%-50%	38-40	108	--	--	--	--
23	FINE SAND	54	.36	13	12	.77	40%-50%	38-40	118	--	--	--	--
24	FINE SAND	63.7	.44	15	14	.801	40%-50%	38-40	140	--	--	--	--
25	FINE SAND	79.2	.61	19	18	.832	50%-60%	40-42	174	--	--	--	--
26	SAND	108.6	.7	21	24	.865	60%-70%	40-42	238	--	--	--	--
27	FINE SAND	88.1	.46	22	19	.896	50%-60%	40-42	193	--	--	--	--
28	FINE SAND	73.7	.5	18	16	.926	50%-60%	38-40	162	--	--	--	--
29	FINE SAND	76.2	.31	19	16	.957	50%-60%	38-40	167	--	--	--	--
30	SILTY FINE SAND	41.1	.33	13	9	.988	<40%	36-38	90	--	--	--	--
31	SILTY FINE SAND	27.9	.25	9	6	1.019	<40%	34-36	61	--	--	--	--
32	SILTY FINE SAND	21.1	.14	7	4	1.049	<40%	30-32	46	--	--	--	--
33	CLAYS	12.1	.48	12	4	1.074	--	--	--	.63	--	.02	3
34	CLAYEY FINE SAND	17.6	.29	7	4	1.105	<40%	30-32	38	--	--	--	--
35	SILTY FINE SAND	35.8	.3	11	8	1.136	<40%	34-36	78	--	--	--	--

CPT-3 CONTINUED LAW ENGINERING

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES	N'	VERTICAL STRESS	RELATIVE DENSITY	FRICTION ANGLE	YOUNGS MODULUS	UNDRAINED SHEAR ST	Sensitivity	COMP.	OCR
36	FINE SAND	58.5	.39	14	13	1.167	<40%	36-38	128	--	--	--	--
37	FINE SAND	64.9	.6	16	15	1.197	<40%	38-40	142	--	--	--	--
38	FINE SAND	97.4	1.13	24	24	1.228	50%-60%	38-40	214	--	--	--	--
39	FINE SAND	72.6	.64	18	17	1.259	40%-50%	38-40	159	--	--	--	--
40	SILTY FINE SAND	48.4	.54	16	11	1.29	<40%	36-38	106	--	--	--	--
41	SAND	87.8	1.22	17	22	1.323	40%-50%	38-40	193	--	--	--	--
42	SAND	117.4	1.38	23	28	1.356	50%-60%	40-42	258	--	--	--	--
43	SAND	132	1.8	26	33	1.389	60%-70%	40-42	290	--	--	--	--
44	SAND	191.2	2.52	38	48	1.423	70%-80%	42-44	420	--	--	--	--
45	SAND	133.4	1.88	26	34	1.456	60%-70%	40-42	293	--	--	--	--
46	FINE SAND	105.5	1.09	26	25	1.487	50%-60%	38-40	232	--	--	--	--
47	SAND	140.4	1.25	28	33	1.52	60%-70%	40-42	308	--	--	--	--
48	SAND	95.2	1.27	19	24	1.553	40%-50%	38-40	209	--	--	--	--
49	SAND	89.6	1.17	17	22	1.586	40%-50%	38-40	197	--	--	--	--
50	SILTY FINE SAND	82.9	1.34	27	21	1.617	<40%	36-38	182	--	--	--	--
51	SILTY FINE SAND	55.5	.97	18	14	1.648	<40%	34-36	122	--	--	--	--
52	SAND	158.3	2.13	31	40	1.681	60%-70%	40-42	348	--	--	--	--
53	SAND	164.1	1.99	32	40	1.714	60%-70%	40-42	361	--	--	--	--
54	SAND	231.9	2.69	46	57	1.747	70%-80%	42-44	510	--	--	--	--
55	SAND	223.3	2.78	44	55	1.781	70%-80%	40-42	491	--	--	--	--
56	SAND	231	3.29	46	59	1.814	70%-80%	42-44	508	--	--	--	--
57	SAND	196.1	1.91	39	46	1.847	60%-70%	40-42	431	--	--	--	--
58	SAND	225.8	2.84	45	56	1.88	70%-80%	40-42	496	--	--	--	--
59	SAND	326	4.13	65	81	1.913	>90%	42-44	717	--	--	--	--
60	SAND	312.4	3.49	62	76	1.947	80%-90%	42-44	687	--	--	--	--
61	SAND	185.3	2.88	37	48	1.98	60%-70%	40-42	407	--	--	--	--
62	SAND	159.1	2.37	31	41	2.013	50%-60%	38-40	350	--	--	--	--
63	SAND	138.8	1.35	27	33	2.046	40%-50%	38-40	305	--	--	--	--
64	SAND	145.3	1.47	29	34	2.079	50%-60%	38-40	319	--	--	--	--
65	FINE SAND	84.6	.36	21	18	2.11	<40%	36-38	186	--	--	--	--
66	FINE SAND	60.8	.42	15	13	2.141	<40%	34-36	133	--	--	--	--
67	SILTY FINE SAND	40.7	.3	13	9	2.172	<40%	30-32	89	--	--	--	--
68	SILTY FINE SAND	36.7	.3	12	8	2.202	<40%	30-32	80	--	--	--	--
69	SILTY FINE SAND	31	.28	10	7	2.233	<40%	<30	68	--	--	--	--
70	FINE SAND	58.4	.51	14	13	2.264	<40%	32-34	128	--	--	--	--
71	SILTY FINE SAND	47.8	.45	15	11	2.295	<40%	30-32	105	--	--	--	--
72	SILTY FINE SAND	50.7	.55	16	12	2.326	<40%	32-34	111	--	--	--	--
73	FINE SAND	60.2	.47	15	13	2.356	<40%	32-34	132	--	--	--	--
74	SILTY FINE SAND	38.1	.52	12	9	2.387	<40%	30-32	83	--	--	--	--
75	SILTY FINE SAND	61.9	.71	20	15	2.418	<40%	32-34	136	--	--	--	--
76	FINE SAND	71	.48	17	16	2.449	<40%	34-36	156	--	--	--	--
77	FINE SAND	71	.53	17	16	2.479	<40%	34-36	156	--	--	--	--
78	FINE SAND	63.3	.59	15	15	2.51	<40%	32-34	139	--	--	--	--
79	SILTY FINE SAND	35.9	.26	11	8	2.541	<40%	<30	78	--	--	--	--
80	CLAYEY FINE SAND	22.8	.33	9	5	2.572	<40%	<30	50	--	--	--	--

CPT-3 CONTINUED LAW ENGINERING

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES	N'	VERTICAL STRESS	RELATIVE DENSITY	FRICTION ANGLE	YOUNGS MODULUS	UNDRAINED SHEAR ST	Sensitivity	COMP.	OCR
81	SILTY FINE SAND	29.1	.22	9	6	2.602	<40%	<30	64	--	--	--	--
82	SILTY FINE SAND	29.1	.18	9	6	2.633	<40%	<30	64	--	--	--	--
83	SILTS	15.3	.38	7	4	2.661	--	--	--	.63	--	.03	1
84	SILTY FINE SAND	60.5	1.12	20	16	2.691	<40%	32-34	133	--	--	--	--
85	FINE SAND	49.1	.42	12	11	2.722	<40%	30-32	108	--	--	--	--
86	CLAYS	14.4	.59	14	5	2.747	--	--	--	.57	--	.01	1
87	SAND	133.9	1.94	26	34	2.78	40%-50%	36-38	294	--	--	--	--
88	CLAYEY FINE SAND	19.9	.34	7	5	2.811	<40%	<30	43	--	--	--	--
89	SILTS	26.2	.97	13	9	2.838	--	--	--	1.29	--	.02	1-1.5
90	CLAYEY FINE SAND	73.9	1.9	29	22	2.869	<40%	32-34	162	--	--	--	--
91	SAND	122.5	1.65	24	31	2.902	<40%	36-38	269	--	--	--	--
92	SAND	330.1	5.51	66	88	2.936	80%-90%	40-42	726	--	--	--	--
93	SILTY TO CLAYEY F.S.	324.7	7.96	162	96	2.969	80%-90%	40-42	714	--	--	--	--
94	SILTY TO CLAYEY F.S.	334	8.79	167	101	3.002	80%-90%	40-42	734	--	--	--	--
95	SILTY TO CLAYEY F.S.	357.7	8.43	178	105	3.035	80%-90%	40-42	786	--	--	--	--

\# N'=POINT STRESS*(.2+.04*FRICTION RATIO)

* NORMALLY CONSOLIDATED SANDS

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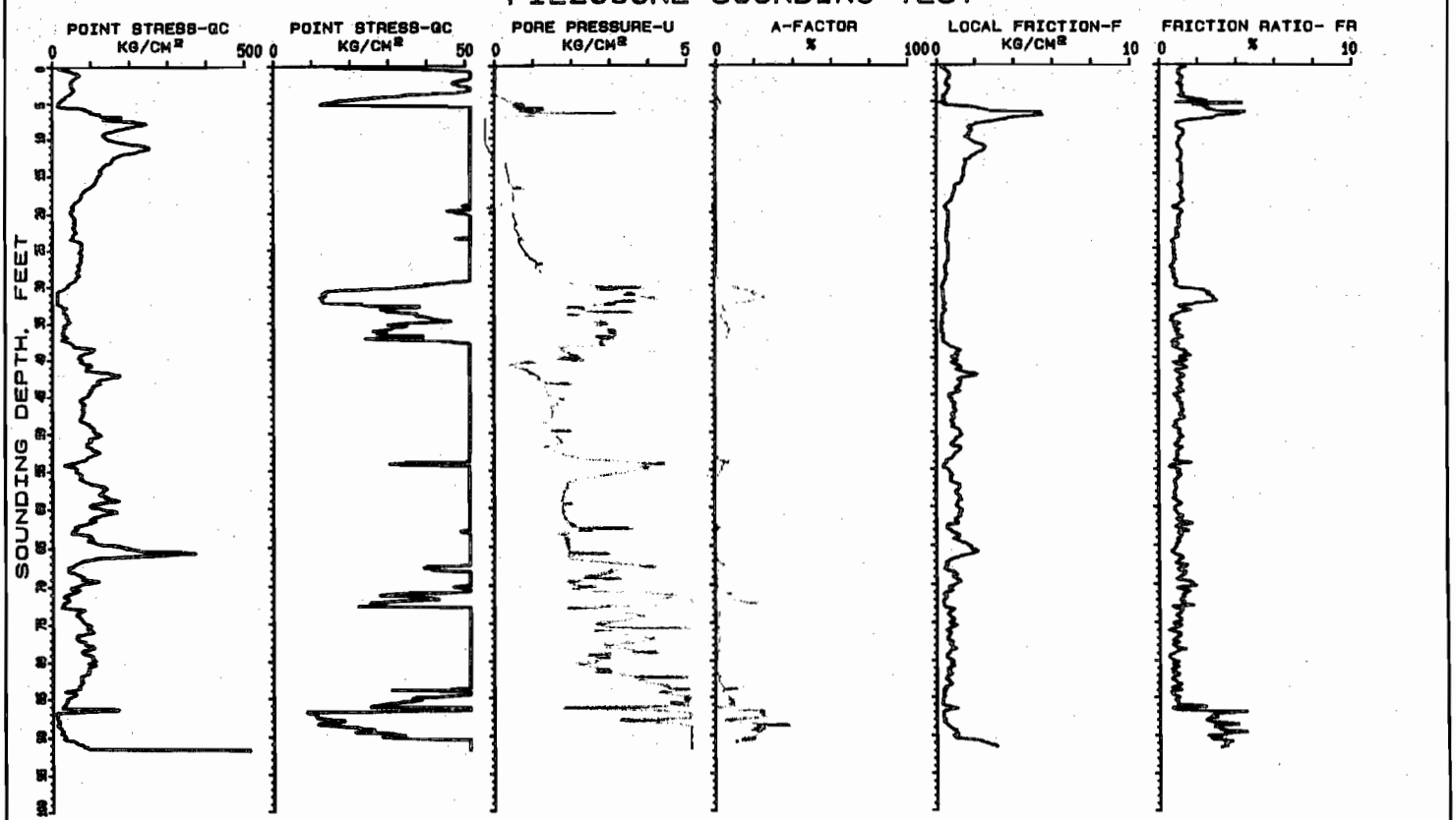
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PORE PRESSURE DECAY DATA MAY BE AVAILABLE

FILE #. LAW ENGINEERING
JEA BRANDY BRANCH
BALDWIN FLORIDA
SOUNDING # CPT-4
TEST DATE 07-16-1999 09: 20: 41

EARTH SERVICES INTERNATIONAL SOIL BEHAVIOR TABLE
SOUTHEASTERN UNITED STATES SOILS

JOB NAME ..... LAW ENGINERING
JEA BRANDY BRANCH
BALDWIN FLORIDA
FILE NAME..... CPT-4

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES #	N'	VERTICAL EFFECTIVE STRESS (KG/CM2)	RELATIVE DENSITY (%) *	FRICTION ANGLE (DEGREES) **	YOUNGS MODULUS (KG/CM2) ***	UNDRAINED SHEAR STRENGTH (KG/CM2) ****	SENSITIVITY	COMP.	OCR
1	SILTY FINE SAND	49.4	.55	16	12	.048	60%-70%	>48	108	--	--	--	--
2	FINE SAND	58.3	.6	14	14	.097	70%-80%	>48	128	--	--	--	--
3	SILTY FINE SAND	48.8	.53	16	11	.146	60%-70%	46-48	107	--	--	--	--
4	SILTY FINE SAND	48.1	.49	16	11	.177	60%-70%	44-46	105	--	--	--	--
5	CLAYEY FINE SAND	22.9	.31	9	5	.208	40%-50%	40-42	50	--	--	--	--
6	CLAYEY FINE SAND	45.6	1.18	18	13	.238	60%-70%	42-44	100	--	--	--	--
7	SILTY TO CLAYEY F.S.	123.5	4.76	61	43	.272	80%-90%	46-48	271	--	--	--	--
8	SAND	189.3	2.96	37	49	.305	>90%	>48	416	--	--	--	--
9	SAND	188.3	1.77	37	44	.338	>90%	>48	414	--	--	--	--
10	SAND	136.3	1.64	27	33	.371	80%-90%	46-48	299	--	--	--	--
11	SAND	194.4	2.08	38	47	.404	>90%	46-48	427	--	--	--	--
12	SAND	232	2.4	46	56	.438	>90%	>48	510	--	--	--	--
13	SAND	164.1	1.78	32	39	.471	>90%	46-48	361	--	--	--	--
14	FINE SAND	140.7	1.49	35	34	.502	80%-90%	44-46	309	--	--	--	--
15	FINE SAND	123.7	1.42	30	30	.532	70%-80%	44-46	272	--	--	--	--
16	SAND	114.5	1.34	22	28	.566	70%-80%	44-46	251	--	--	--	--
17	FINE SAND	95	1	23	23	.596	60%-70%	42-44	209	--	--	--	--
18	FINE SAND	74	.85	18	18	.627	50%-60%	40-42	162	--	--	--	--
19	SILTY FINE SAND	57.6	.62	19	14	.658	50%-60%	40-42	126	--	--	--	--
20	SILTY FINE SAND	49.5	.5	16	11	.689	40%-50%	38-40	108	--	--	--	--
21	SILTY FINE SAND	55.3	.59	18	13	.719	40%-50%	38-40	121	--	--	--	--
22	FINE SAND	55.5	.57	13	13	.75	40%-50%	38-40	122	--	--	--	--
23	FINE SAND	57	.52	14	13	.781	40%-50%	38-40	125	--	--	--	--
24	FINE SAND	60.1	.5	15	14	.812	40%-50%	38-40	132	--	--	--	--
25	FINE SAND	77.1	.57	19	17	.842	50%-60%	40-42	169	--	--	--	--
26	FINE SAND	74.6	.61	18	17	.873	50%-60%	40-42	164	--	--	--	--
27	FINE SAND	74.1	.58	18	17	.904	50%-60%	40-42	163	--	--	--	--
28	FINE SAND	68.3	.46	17	15	.935	40%-50%	38-40	150	--	--	--	--
29	FINE SAND	66.3	.51	16	15	.965	40%-50%	38-40	145	--	--	--	--
30	FINE SAND	47.5	.4	11	11	.996	<40%	36-38	104	--	--	--	--
31	CLAYEY FINE SAND	21.4	.32	8	5	1.027	<40%	30-32	47	--	--	--	--
32	SILTS	12.9	.36	6	4	1.054	--	--	--	.68	--	.04	3
33	CLAYEY FINE SAND	22.8	.4	9	6	1.085	<40%	32-34	50	--	--	--	--
34	SILTY FINE SAND	32.4	.41	10	8	1.116	<40%	34-36	71	--	--	--	--
35	SILTY FINE SAND	41.7	.28	13	9	1.147	<40%	36-38	91	--	--	--	--

CPT-4 CONTINUED LAW ENGINERING

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES	N'	VERTICAL STRESS	RELATIVE DENSITY	FRICTION ANGLE	YOUNGS MODULUS	UNDRAINED SHEAR ST	Sensitivity	COMP.	OCR
36	SILTY FINE SAND	32.7	.28	10	7	1.177	<40%	34-36	71	--	--	--	--
37	SILTY FINE SAND	30.7	.31	10	7	1.208	<40%	32-34	67	--	--	--	--
38	SILTY FINE SAND	38.4	.38	12	9	1.239	<40%	34-36	84	--	--	--	--
39	FINE SAND	88.4	.94	22	21	1.27	40%-50%	38-40	194	--	--	--	--
40	SILTY FINE SAND	73.6	.98	24	18	1.3	40%-50%	38-40	161	--	--	--	--
41	FINE SAND	89.4	.99	22	21	1.331	40%-50%	38-40	196	--	--	--	--
42	SAND	115.2	1.36	23	28	1.364	50%-60%	40-42	253	--	--	--	--
43	FINE SAND	145.1	1.58	36	35	1.395	60%-70%	40-42	319	--	--	--	--
44	FINE SAND	111.8	1.21	27	27	1.426	50%-60%	38-40	245	--	--	--	--
45	FINE SAND	96.7	.99	24	23	1.457	40%-50%	38-40	212	--	--	--	--
46	FINE SAND	77.9	.78	19	18	1.488	<40%	36-38	171	--	--	--	--
47	SAND	79.3	.93	15	19	1.521	<40%	36-38	174	--	--	--	--
48	SAND	75.3	.88	15	18	1.554	<40%	36-38	165	--	--	--	--
49	FINE SAND	86.5	.82	21	20	1.585	40%-50%	38-40	190	--	--	--	--
50	FINE SAND	110.5	1.1	27	26	1.615	50%-60%	38-40	243	--	--	--	--
51	FINE SAND	108.1	1.13	27	26	1.646	40%-50%	38-40	237	--	--	--	--
52	FINE SAND	95	.95	23	22	1.677	40%-50%	38-40	209	--	--	--	--
[redacted]	FINE SAND	112.3	1.06	28	26	1.708	40%-50%	38-40	247	--	--	--	--
[redacted]	FINE SAND	76.1	.63	19	17	1.739	<40%	36-38	167	--	--	--	--
55	FINE SAND	52.3	.44	13	12	1.769	<40%	34-36	115	--	--	--	--
56	FINE SAND	72.1	.76	18	17	1.8	<40%	36-38	158	--	--	--	--
57	FINE SAND	95.2	.9	23	22	1.831	40%-50%	36-38	209	--	--	--	--
58	SAND	135.2	1.15	27	31	1.864	50%-60%	38-40	297	--	--	--	--
59	SAND	144.1	1.19	28	33	1.897	50%-60%	38-40	317	--	--	--	--
60	FINE SAND	119	1.09	29	28	1.928	40%-50%	38-40	261	--	--	--	--
61	SAND	147.2	1.27	29	34	1.961	50%-60%	38-40	323	--	--	--	--
62	FINE SAND	103.1	1.09	25	25	1.992	40%-50%	36-38	226	--	--	--	--
63	SILTY FINE SAND	60.2	.71	20	14	2.023	<40%	34-36	132	--	--	--	--
64	FINE SAND	89	1.03	22	21	2.054	<40%	36-38	195	--	--	--	--
65	FINE SAND	135.6	1.45	33	32	2.084	40%-50%	38-40	298	--	--	--	--
66	SAND	268.7	1.94	53	61	2.118	70%-80%	42-44	591	--	--	--	--
67	SAND	124.5	.99	24	28	2.151	40%-50%	38-40	273	--	--	--	--
68	SILTY FINE SAND	47.7	.49	15	11	2.181	<40%	32-34	104	--	--	--	--
69	SILTY FINE SAND	70.7	.93	23	17	2.212	<40%	34-36	155	--	--	--	--
70	SAND	83.1	1.1	16	21	2.245	<40%	36-38	182	--	--	--	--
71	SILTY FINE SAND	55	.67	18	13	2.276	<40%	32-34	121	--	--	--	--
72	SILTY FINE SAND	36.4	.42	12	8	2.307	<40%	30-32	80	--	--	--	--
73	SILTY FINE SAND	32.7	.41	10	8	2.338	<40%	<30	71	--	--	--	--
74	FINE SAND	69.9	.71	17	16	2.369	<40%	34-36	153	--	--	--	--
75	FINE SAND	81.3	.77	20	19	2.399	<40%	34-36	178	--	--	--	--
76	FINE SAND	98.1	.71	24	22	2.43	<40%	36-38	215	--	--	--	--
77	FINE SAND	70.5	.62	17	16	2.461	<40%	34-36	155	--	--	--	--
[redacted]	FINE SAND	89.2	.71	22	20	2.492	<40%	34-36	196	--	--	--	--
[redacted]	FINE SAND	88.2	.75	22	20	2.522	<40%	34-36	194	--	--	--	--
80	SAND	106.6	.64	21	23	2.556	<40%	36-38	234	--	--	--	--

CPT-4 CONTINUED LAW ENGINERING

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES	N'	VERTICAL STRESS	RELATIVE DENSITY	FRICTION ANGLE	YOUNGS MODULUS	UNDRAINED SHEAR ST	Sensitivity	COMP.	OCR
81	FINE SAND	100.5	.73	25	23	2.586	<40%	36-38	221	--	--	--	--
82	FINE SAND	88.8	.66	22	20	2.617	<40%	34-36	195	--	--	--	--
83	FINE SAND	76.1	.61	19	17	2.648	<40%	34-36	167	--	--	--	--
84	FINE SAND	59.5	.46	14	13	2.679	<40%	32-34	130	--	--	--	--
85	FINE SAND	52	.36	13	11	2.709	<40%	30-32	114	--	--	--	--
86	SILTY FINE SAND	33.9	.28	11	7	2.74	<40%	<30	74	--	--	--	--
87	FINE SAND	62.7	.59	15	14	2.771	<40%	32-34	137	--	--	--	--
88	SILTS	12.9	.35	6	3	2.798	--	--	--	.46	--	.04	1
89	SILTY CLAY	16.9	.58	11	5	2.826	--	--	--	.71	--	.01	1-1.5
90	SILTS	28.3	.96	14	9	2.853	--	--	--	1.42	--	.02	1-1.5
91	SILTS	54.3	2.08	27	19	2.88	--	--	--	3.04	--	.01	6

\# N'=POINT STRESS*(.2+.04*FRICTION RATIO)

* NORMALLY CONSOLIDATED SANDS

** FOR OVERCONSOLIDATED SANDS,SLIGHTLY REDUCE ABOVE FRICTION ANGLES

*** FOR OVERCONSOLIDATED SANDS, YOUNG'S MODULUS MAY BE AS MUCH AS 3 TO 6 TIMES HIGHER

**** NK OF 16 USED. FOR OVERCONSOLIDATED CLAYS, AN NK OF 17 IS SUGGESTED

THE ABOVE DATA WAS COLLECTED AND COMPUTED UTILIZING THE 'IN-SITU SYSTEM'
FOLLOWING 'BASIC' GUIDELINES BY P. K. ROBERTSON AND R. G. CAMPANELLA IN THE
HANDBOOK 'GUIDELINES FOR USE AND INTERPERTATION OF THE ELECTRONIC CONE PENETRATION TEST'

ADDITIONAL LOCAL CORRELATIONS DEVELOPED BY THE IN-SITU SYSTEM HAVE ALSO BEEN USED IN COMPUTING THE ABOVE DATA.
IT IS THE POLICY OF THE IN-SITU SYSTEM TO CONTINUALLY UPGRADE AND MODIFY C.P.T CORRELATIONS AS
PUBLISHED RESEARCH AND LOCAL EXPERIENCE GROWS.

Appendix D
Soil Resistivity Test Results

LAW

LAWGIBB Group Member

SUMMARY OF FIELD ELECTRICAL RESISTIVITY TEST RESULTS

PROJECT: JEA BRANDY BRANCH
PROJECT NUMBER: 40521-9-8177
LOCATION: B3
DATE PERFORMED: 06/16/1999
PERFORMED BY: KEN BUNNELL
PIN ORIENTATION: EAST - WEST

TEST NO.	PIN SPACING (FT)	SMALL DIAL READING	LARGE DIAL READING	R	ELECTRICAL RESISTIVITY (0hm-cm)
1	2.5	100	3.4	340	162775
2	5.0	100	2.8	280	268100
3	10.0	100	1.5	150	287250
4	15.0	10	5.1	51	146498
5	20.0	10	3.2	32	122560
6	25.0	10	1.8	18	86175
7	30.0	10	1.1	11	63195

EQUIPMENT: NISSON MODEL 400 FOUR-PIN SOIL RESISTANCE METER
TEST METHOD: WENNER FOUR-POINT METHOD WITH EQUAL PIN SPACING

LAW ENGINEERING AND ENVIRONMENTAL SERVICES
3901 CARMICHAEL AVENUE
JACKSONVILLE, FLORIDA 32207
904-396-5173
fax 904-396-5703

LAW

LAWGIBB Group Member

SUMMARY OF FIELD ELECTRICAL RESISTIVITY TEST RESULTS

PROJECT: JEA BRANDY BRANCH
PROJECT NUMBER: 40521-9-8177
LOCATION: B4
DATE PERFORMED: 06/16/1999
PERFORMED BY: KEN BUNNELL
PIN ORIENTATION: EAST - WEST

TEST NO.	PIN SPACING (FT)	SMALL DIAL READING	LARGE DIAL READING	R	ELECTRICAL RESISTIVITY (0hm-cm)
1	2.5	100	1.8	180	86175
2	5.0	100	1.0	100	95750
3	10.0	10	6.2	62	118730
4	15.0	10	5.4	54	155115
5	20.0	10	3.2	32	122560
6	25.0	10	1.9	19	90963
7	30.0	10	1.1	11	63195

EQUIPMENT: NISSON MODEL 400 FOUR-PIN SOIL RESISTANCE METER
TEST METHOD: WENNER FOUR-POINT METHOD WITH EQUAL PIN SPACING

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LAW

LAWGIBB Group Member

SUMMARY OF FIELD ELECTRICAL RESISTIVITY TEST RESULTS

PROJECT: JEA BRANDY BRANCH
PROJECT NUMBER: 40521-9-8177
LOCATION: B10
DATE PERFORMED: 06/15/1999
PERFORMED BY: KEN BUNNELL
PIN ORIENTATION: NORTH - SOUTH

TEST NO.	PIN SPACING (FT)	SMALL DIAL READING	LARGE DIAL READING	R	ELECTRICAL RESISTIVITY (0hm-cm)
1	2.5	100	2.0	200	95750
2	5.0	100	1.2	120	114900
3	10.0	10	5.2	52	99580
4	15.0	10	2.8	28	80430
5	20.0	10	1.8	18	68940
6	25.0	10	1.6	16	76600
7	30.0	1	9.8	9.8	56301

EQUIPMENT: NISSON MODEL 400 FOUR-PIN SOIL RESISTANCE METER
TEST METHOD: WENNER FOUR-POINT METHOD WITH EQUAL PIN SPACING

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LAW

LAWGIBB Group Member

SUMMARY OF FIELD ELECTRICAL RESISTIVITY TEST RESULTS

PROJECT: JEA BRANDY BRANCH
PROJECT NUMBER: 40521-9-8177
LOCATION: B13
DATE PERFORMED: 06/15/1999
PERFORMED BY: KEN BUNNELL
PIN ORIENTATION: EAST - WEST

TEST NO.	PIN SPACING (FT)	SMALL DIAL READING	LARGE DIAL READING	R	ELECTRICAL RESISTIVITY (0hm-cm)
1	2.5	100	6.3	630	301613
2	5.0	100	2.5	250	239375
3	10.0	10	7.0	70	134050
4	15.0	10	3.6	36	103410
5	20.0	10	2.3	23	88090
6	25.0	10	2.0	20	95750
7	30.0	10	1.4	14	80430

EQUIPMENT: NISSON MODEL 400 FOUR-PIN SOIL RESISTANCE METER
TEST METHOD: WENNER FOUR-POINT METHOD WITH EQUAL PIN SPACING

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LAW

LAWGIBB Group Member

SUMMARY OF FIELD ELECTRICAL RESISTIVITY TEST RESULTS

PROJECT: JEA BRANDY BRANCH
PROJECT NUMBER: 40521-9-8177
LOCATION: B14
DATE PERFORMED: 06/15/1999
PERFORMED BY: KEN BUNNELL
PIN ORIENTATION: NORTH - SOUTH

TEST NO.	PIN SPACING (FT)	SMALL DIAL READING	LARGE DIAL READING	R	ELECTRICAL RESISTIVITY (0hm-cm)
1	2.5	100	3.0	300	143625
2	5.0	10	9.5	95	90963
3	10.0	10	5.5	55	105325
4	15.0	10	4.0	40	114900
5	20.0	10	3.0	30	114900
6	25.0	10	2.3	23	110113
7	30.0	10	1.1	11	63195

EQUIPMENT: NISSON MODEL 400 FOUR-PIN SOIL RESISTANCE METER
TEST METHOD: WENNER FOUR-POINT METHOD WITH EQUAL PIN SPACING

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fax 904-396-5703

LAW

LAWGIBB Group Member

SUMMARY OF FIELD ELECTRICAL RESISTIVITY TEST RESULTS

PROJECT: JEA BRANDY BRANCH
PROJECT NUMBER: 40521-9-8177
LOCATION: B17
DATE PERFORMED: 06/16/1999
PERFORMED BY: KEN BUNNELL
PIN ORIENTATION: NORTH - SOUTH

TEST NO.	PIN SPACING (FT)	SMALL DIAL READING	LARGE DIAL READING	R	ELECTRICAL RESISTIVITY (0hm-cm)
1	2.5	100	1.5	150	71813
2	5.0	100	1.1	110	105325
3	10.0	10	5.2	52	99580
4	15.0	10	3.4	34	97665
5	20.0	10	2.0	20	76600
6	25.0	10	1.4	14	67025
7	30.0	10	1.0	10	57450

EQUIPMENT: NISSON MODEL 400 FOUR-PIN SOIL RESISTANCE METER
TEST METHOD: WENNER FOUR-POINT METHOD WITH EQUAL PIN SPACING

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fax 904-396-5703

LAW

LAWGIBB Group Member

SUMMARY OF FIELD ELECTRICAL RESISTIVITY TEST RESULTS

PROJECT: JEA BRANDY BRANCH
PROJECT NUMBER: 40521-9-8177
LOCATION: B18
DATE PERFORMED: 06/15/1999
PERFORMED BY: KEN BUNNELL
PIN ORIENTATION: NORTH - SOUTH

TEST NO.	PIN SPACING (FT)	SMALL DIAL READING	LARGE DIAL READING	R	ELECTRICAL RESISTIVITY (0hm-cm)
1	2.5	100	4.6	460	220225
2	5.0	100	2.2	220	210650
3	10.0	10	7.1	71	135965
4	15.0	10	4.0	40	114900
5	20.0	10	3.5	35	134050
6	25.0	10	1.7	17	81388
7	30.0	10	1.2	11.5	66068

EQUIPMENT: NISSON MODEL 400 FOUR-PIN SOIL RESISTANCE METER
TEST METHOD: WENNER FOUR-POINT METHOD WITH EQUAL PIN SPACING

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fax 904-396-5703

LAW

LAWGIBB Group Member

SUMMARY OF FIELD ELECTRICAL RESISTIVITY TEST RESULTS

PROJECT: JEA BRANDY BRANCH
PROJECT NUMBER: 40521-9-8177
LOCATION: B20
DATE PERFORMED: 06/16/1999
PERFORMED BY: KEN BUNNELL
PIN ORIENTATION: NORTH - SOUTH

TEST NO.	PIN SPACING (FT)	SMALL DIAL READING	LARGE DIAL READING	R	ELECTRICAL RESISTIVITY (0hm-cm)
1	2.5	100	1.9	190	90963
2	5.0	100	1.4	140	134050
3	10.0	10	7.9	79	151285
4	15.0	10	4.0	40	114900
5	20.0	10	2.8	28	107240
6	25.0	10	2.0	20	95750
7	30.0	10	1.4	14	80430

TEST METHOD: WENNER FOUR-POINT METHOD WITH EQUAL PIN SPACING

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3901 CARMICHAEL AVENUE
JACKSONVILLE, FLORIDA 32207

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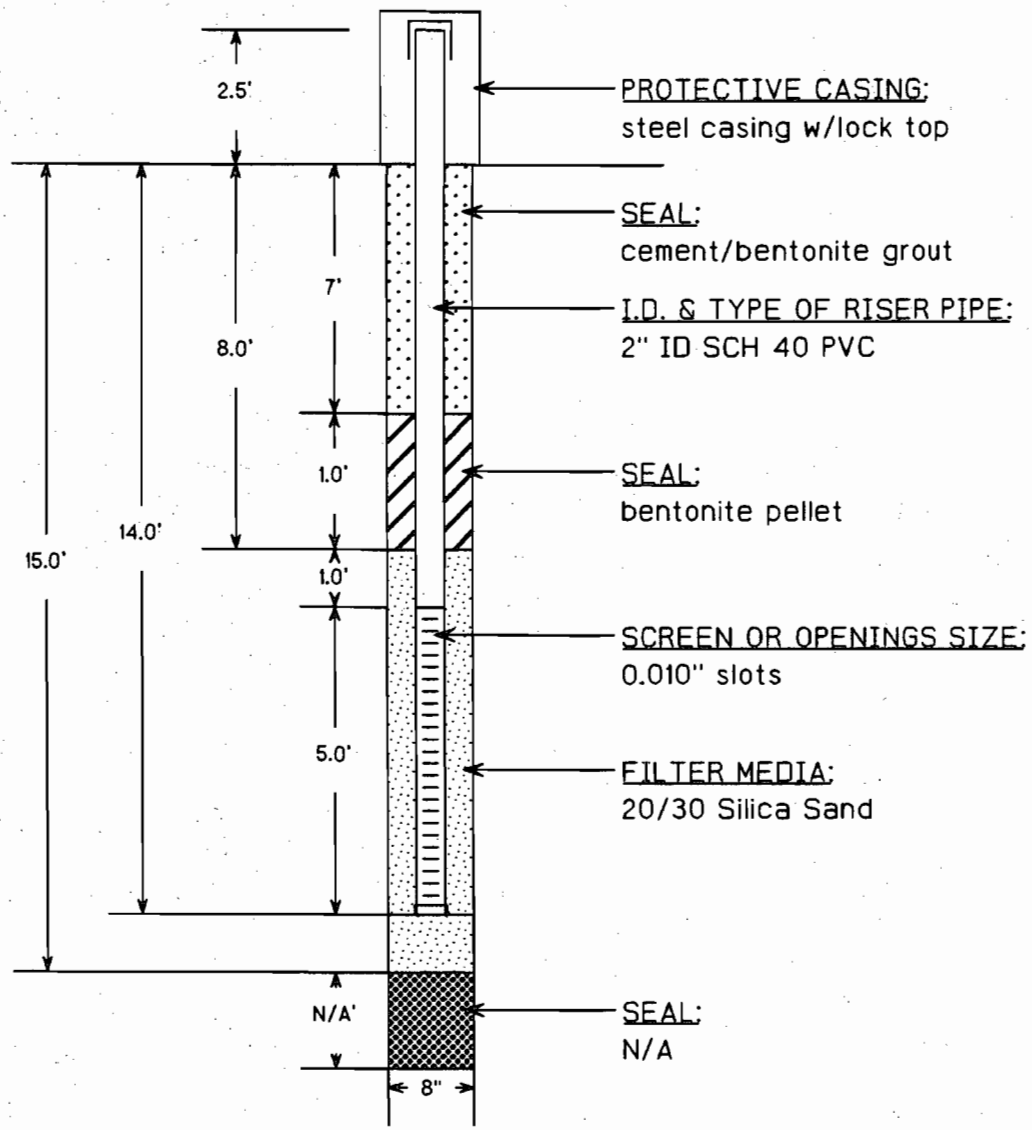
Appendix E
Piezometer Logs, Double Ring Infiltrometer Test Results,
Rising and Falling Head Slug Test Results

BLACK & VEATCH

PIEZOMETER INSTALLATION LOG

PIEZOMETER NO. B-1

CLIENT JACKSONVILLE ELECTRIC AUTHORITY		**PROJECT** BRANDY BRANCH STATION	**PROJECT NO.** 60903
PROJECT LOCATION BALDWIN, FLORIDA	**COORDINATES** N 76912.2 E 57089.0	**GROUND ELEVATION (DATUM)** 82.25 (MSL)	**DATE** 16 JUNE 1999
STRATUM MONITORED SAND		**INSPECTOR** W.R. WU	
CHECKED BY M.C. SCHLUTER		**APPROVED BY** M.C. SCHLUTER	



METHOD OF INSTALLATION:

Boring advanced with 6" I.D. hollow stem augers. Added 1 foot of sand , construct and install screen and riser through augers, bring filter sand to 8 feet; add 1 foot of bentonite pellet; all while removing augers; grout to suface from 7 feet; install protective casing and 3 guard posts.

REMARKS:

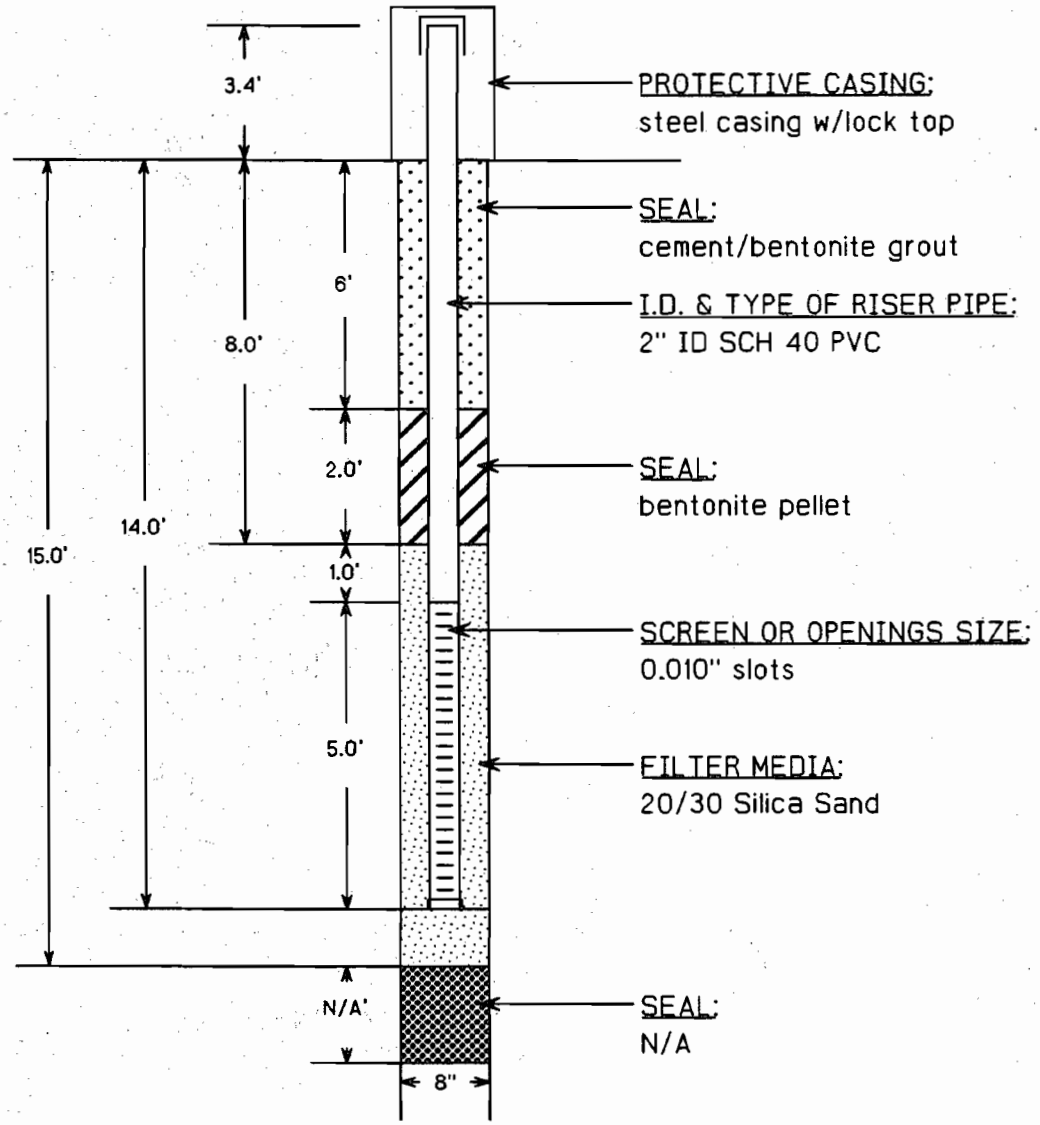
Piezometer developed for 30 minutes, until discharge water was clear. Water level at 6 feet in depth.

BLACK & VEATCH

PIEZOMETER INSTALLATION LOG

PIEZOMETER NO. B-6

CLIENT JACKSONVILLE ELECTRIC AUTHORITY		**PROJECT** BRANDY BRANCH STATION	**PROJECT NO.** 60903
PROJECT LOCATION BALDWIN, FLORIDA	**COORDINATES** N 77359.0 E 57772.4	**GROUND ELEVATION (DATUM)** 82.47 (MSL)	**DATE** 22 JUNE 1999
STRATUM MONITORED SAND		**INSPECTOR** W.R. WU	
CHECKED BY M.C. SCHLUTER		**APPROVED BY** M.C. SCHLUTER	



METHOD OF INSTALLATION:
Boring advanced with 6" I.D. hollow stem augers. Added 1 foot of sand , construct and install screen and riser through augers, bring filter sand to 8 feet; add 2 foot of bentonite pellet; all while removing augers; grout to suface from 6 feet; install protective casing and 3 guard posts.

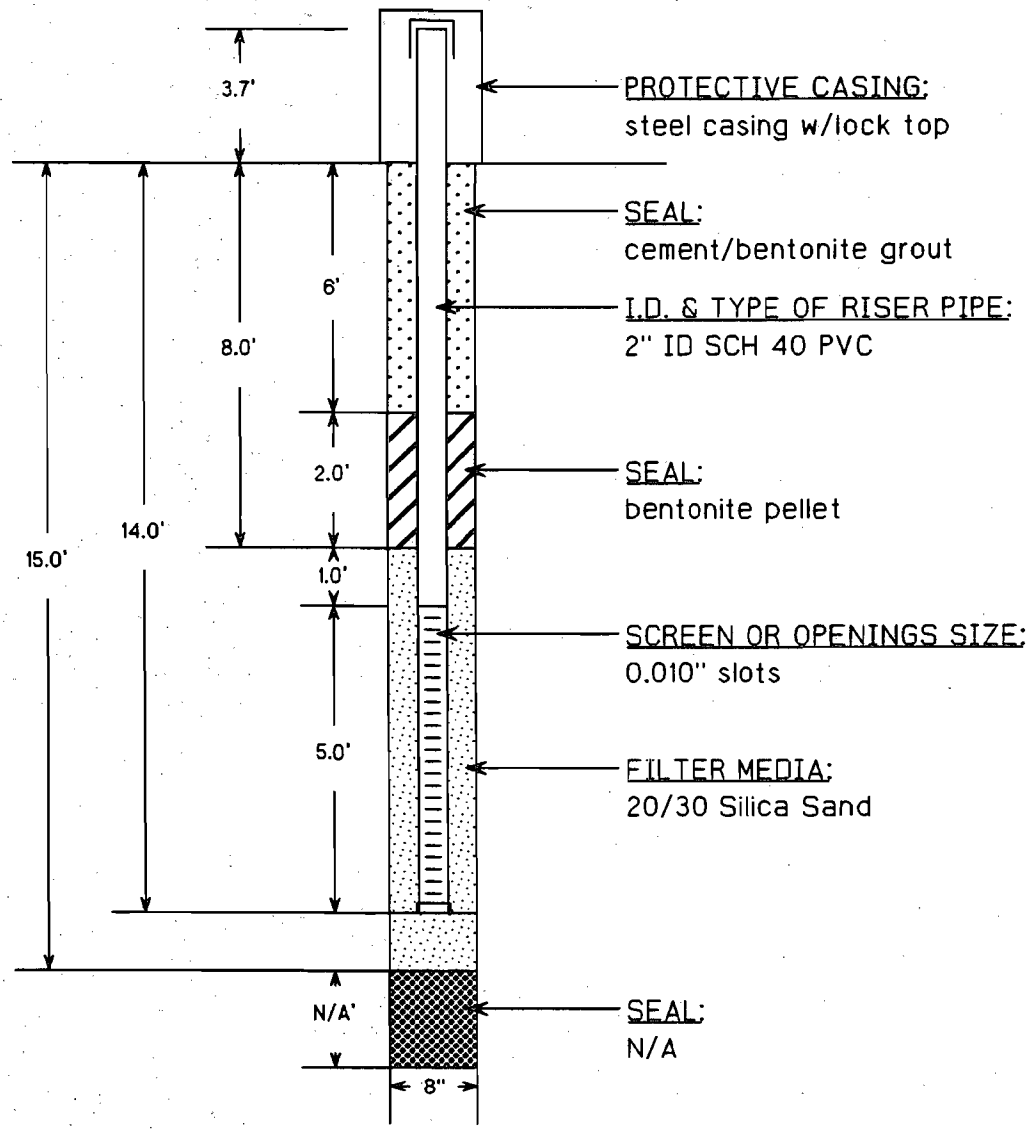
REMARKS:
Piezometer developed for 2.5 hours, discharge water was still light brown, not clear. Water level at 7 feet in depth.

BLACK & VEATCH

PIEZOMETER INSTALLATION LOG

PIEZOMETER NO. B-9

CLIENT JACKSONVILLE ELECTRIC AUTHORITY		**PROJECT** BRANDY BRANCH STATION	**PROJECT NO.** 60903
PROJECT LOCATION BALDWIN, FLORIDA	**COORDINATES** N 77711.6 E 56615.6	**GROUND ELEVATION (DATUM)** 80.78 (MSL)	**DATE** 22 JUNE 1999
STRATUM MONITORED SAND		**INSPECTOR** W.R. WU	
CHECKED BY M.C. SCHLUTER		**APPROVED BY** M.C. SCHLUTER	



METHOD OF INSTALLATION:

Boring advanced with 6" I.D. hollow stem augers. Added 1 foot of sand , construct and install screen and riser through augers, bring filter sand to 8 feet; add 2 foot of bentonite pellet; all while removing augers; grout to suface from 6 feet; install protective casing and 3 guard posts.

REMARKS:

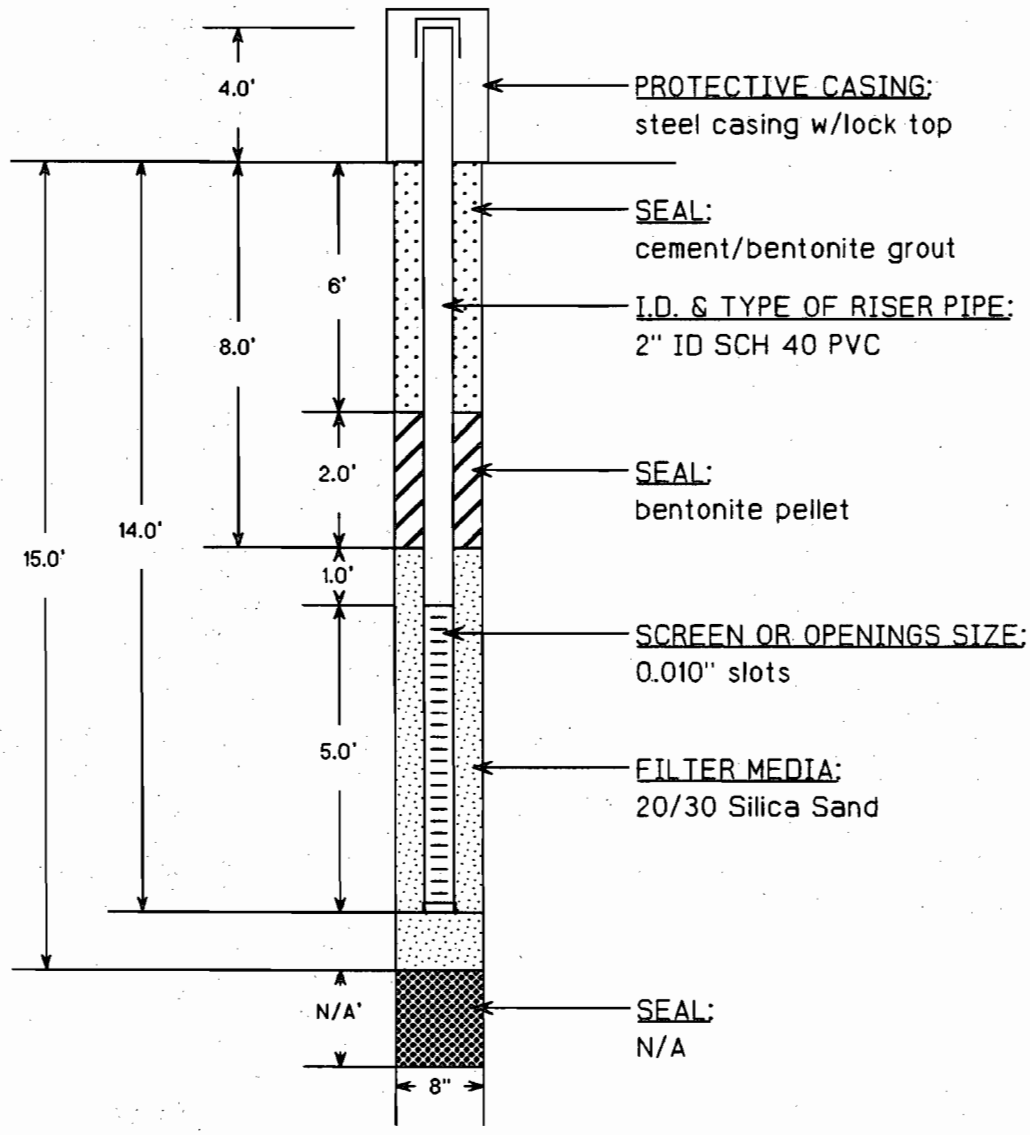
Piezometer developed for 20 minutes, until discharge water was clear. Water level at 5 feet in depth.

BLACK & VEATCH

PIEZOMETER INSTALLATION LOG

PIEZOMETER NO. B-18

CLIENT JACKSONVILLE ELECTRIC AUTHORITY		**PROJECT** BRANDY BRANCH STATION	**PROJECT NO.** 60903
PROJECT LOCATION BALDWIN, FLORIDA	**COORDINATES** N 77898.7 E 57697.1	**GROUND ELEVATION (DATUM)** 81.01 (MSL)	**DATE** 22 JUNE 1999
STRATUM MONITORED SAND		**INSPECTOR** W.R. WU	
CHECKED BY M.C. SCHLUTER		**APPROVED BY** M.C. SCHLUTER	



METHOD OF INSTALLATION:

Boring advanced with 6" I.D. hollow stem augers. Added 1 foot of sand , construct and install screen and riser through augers, bring filter sand to 8 feet; add 2 foot of bentonite pellet; all while removing augers; grout to suface from 6 feet; install protective casing and 3 guard posts.

REMARKS:

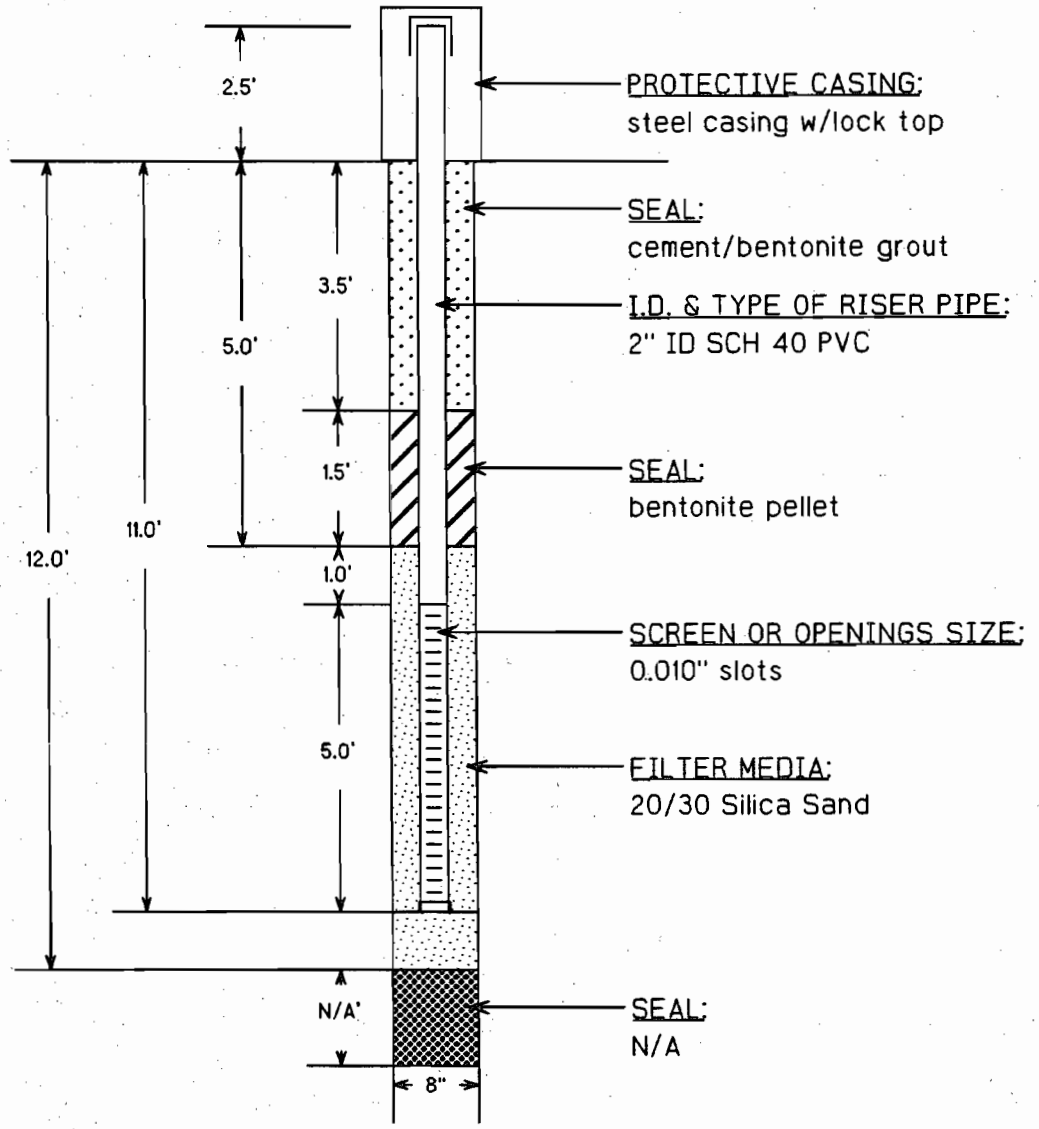
Piezometer developed for 30 minutes, discharge water was still light brown, no apparnet improvement. Water level at 6.4 feet in depth.

BLACK & VEATCH

PIEZOMETER INSTALLATION LOG

PIEZOMETER NO. B-21

CLIENT JACKSONVILLE ELECTRIC AUTHORITY		**PROJECT** BRANDY BRANCH STATION	**PROJECT NO.** 60903
PROJECT LOCATION BALDWIN, FLORIDA	**COORDINATES** N 76881.8 E 55802.0	**GROUND ELEVATION (DATUM)** 83.0 (MSL)	**DATE** 22 JUNE 1999
STRATUM MONITORED SAND		**INSPECTOR** W.R. WU	
CHECKED BY M.C. SCHLUTER		**APPROVED BY** M.C. SCHLUTER	



METHOD OF INSTALLATION:

Boring advanced with 6" I.D. hollow stem augers. Added 1 foot of sand , construct and install screen and riser through augers, bring filter sand to 5 feet; add 1.5 feet of bentonite pellet; all while removing augers; grout to suface from 3.5 feet; install protective casing and 3 guard posts.

REMARKS:

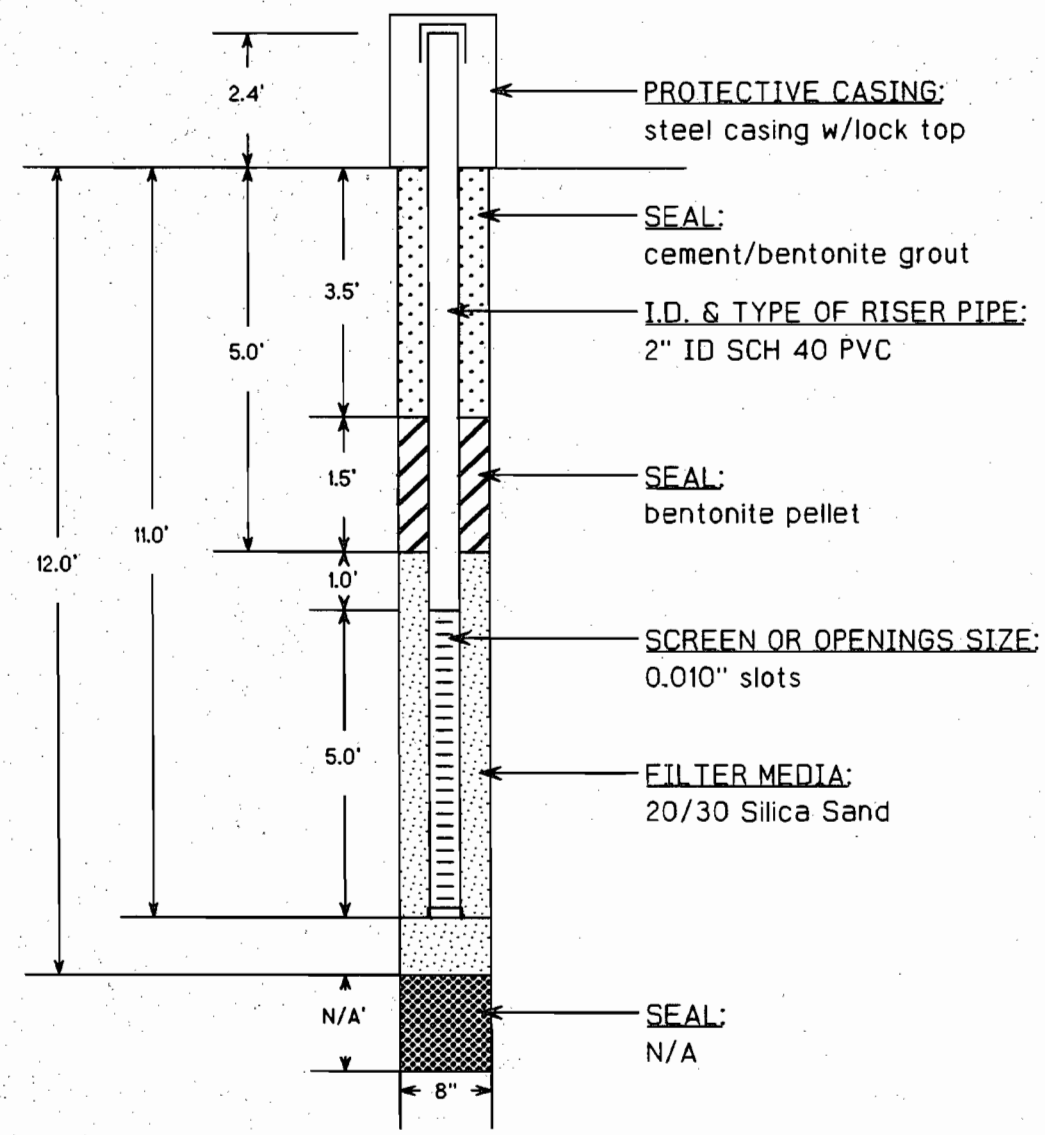
Piezometer developed for 15 minutes, until discharge water was clear. Water level at 5.5 feet in depth.

BLACK & VEATCH

PIEZOMETER INSTALLATION LOG

PIEZOMETER NO. B-22

CLIENT JACKSONVILLE ELECTRIC AUTHORITY		**PROJECT** BRANDY BRANCH STATION	**PROJECT NO.** 60903
PROJECT LOCATION BALDWIN, FLORIDA	**COORDINATES** N 77541.1 E 56059.4	**GROUND ELEVATION (DATUM)** 82.0 (MSL)	**DATE** 23 JUNE 1999
STRATUM MONITORED SAND		**INSPECTOR** W.R. WU	
CHECKED BY M.C. SCHLUTER		**APPROVED BY** M.C. SCHLUTER	



METHOD OF INSTALLATION:

Boring advanced with 6" I.D. hollow stem augers. Added 1 foot of sand , construct and install screen and riser through augers, bring filter sand to 5 feet; add 1.5 feet of bentonite pellet; all while removing augers; grout to suface from 3.5 feet; install protective casing and 3 guard posts.

REMARKS:

Piezometer developed for 15 minutes, until discharge water was clear. Water level at 5.9 feet in depth.

BLACK & VEATCH

PIEZOMETER INSTALLATION LOG

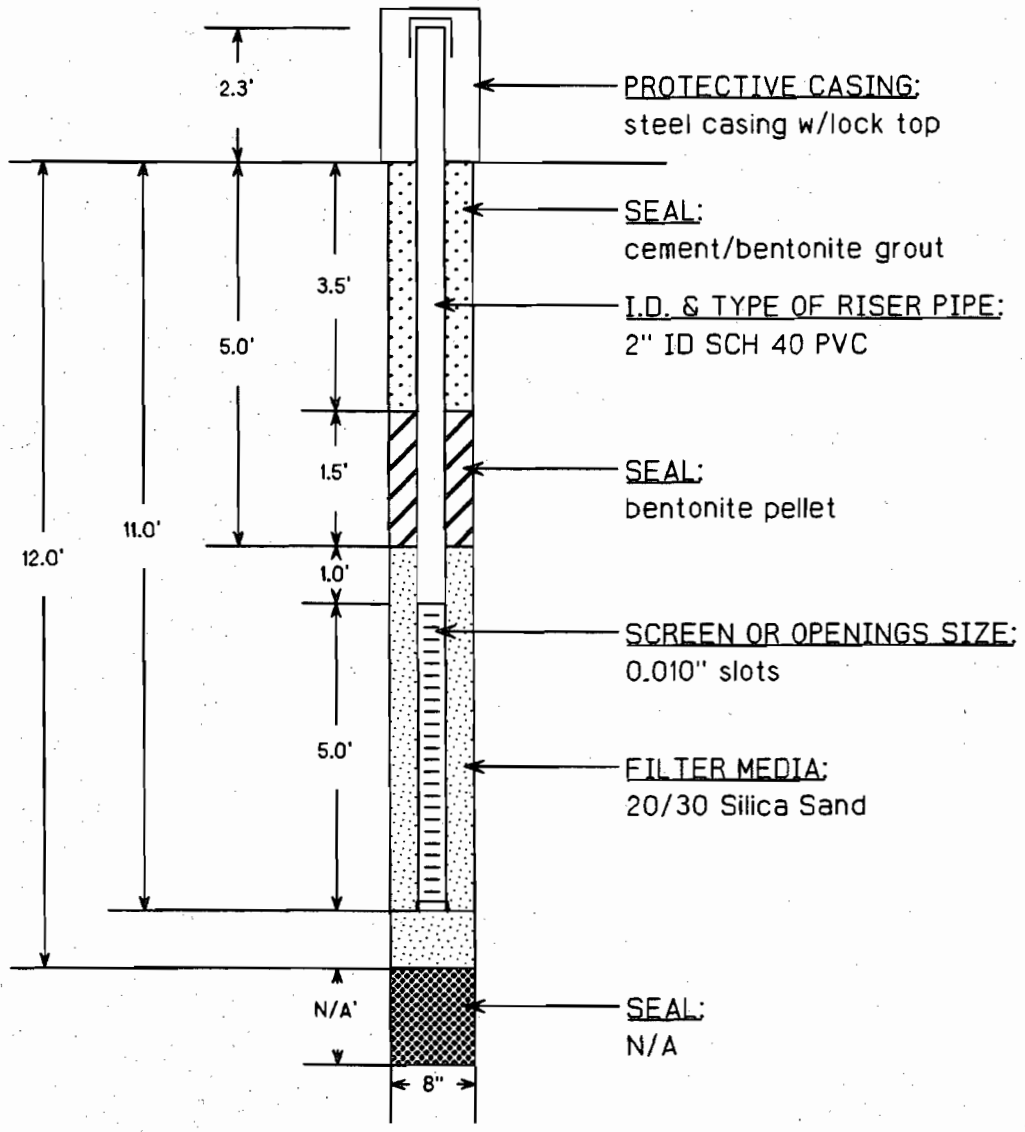
PIEZOMETER NO. B-23

CLIENT	PROJECT	PROJECT NO.
JACKSONVILLE ELECTRIC AUTHORITY	BRANDY BRANCH STATION	60903

PROJECT LOCATION	COORDINATES	GROUND ELEVATION (DATUM)	DATE
BALDWIN, FLORIDA	N 77870.7 E 55523.8	82.0 (MSL)	22 JUNE 1999

STRATUM MONITORED	INSPECTOR
SAND	W.R. WU

CHECKED BY	APPROVED BY
M.C. SCHLUTER	M.C. SCHLUTER



METHOD OF INSTALLATION:

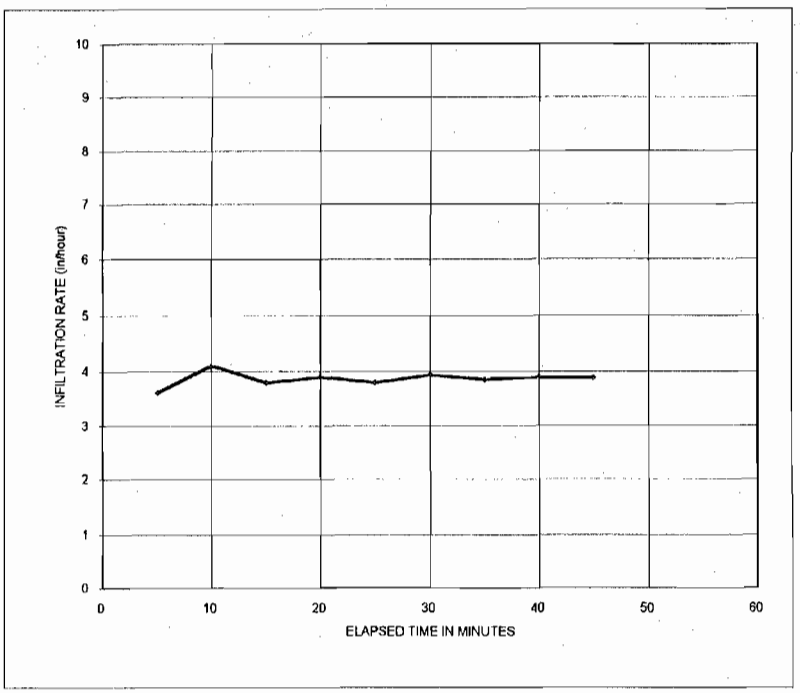
Boring advanced with 6" I.D. hollow stem augers. Added 1 foot of sand , construct and install screen and riser through augers, bring filter sand to 5 feet; add 1.5 feet of bentonite pellet; all while removing augers; grout to suface from 3.5 feet; install protective casing and 3 guard posts.

REMARKS:

Piezometer developed for 30 minutes, until discharge water was clear. Water level at 6.4 feet in depth.

elapsed time (min)	quantity of water (ml)	infiltration rate (in/hr)
5	560	3.62
10	1270	4.11
15	1760	3.79
20	2410	3.90
25	2930	3.79
30	3650	3.93
35	4170	3.85
40	4820	3.90
45	5410	3.89

DOUBLE RING INFILTROMETER TEST



SOIL PROFILE (DRI-1)	
DEPTH (ft)	SOIL DESCRIPTION

TEST DEPTH: -18" Below Ground Surface

TEST HEAD: 6"

LAW
LAWGIBB Group Member

PROJECT: JEA Brandy Branch	LOCATION: DRI No. 1 (Boring B-6)
CLIENT: Black & Veatch	DATE PERFORMED: June 22, 1999
PROJECT NO.: 40521-9-8177	WATER TEMPERATURE / pH:
SCALE: none / TECHNICIAN: GKB	INFILTRATION RATE: 3.9 in / hour

LAW

LAWGIBB Group Member

SUMMARY OF SLUG TEST DATA

PROJECT: JEA BRANDY BRANCH
PROJECT NO: 40521-9-8177
LOCATION B-1
DATE: 07/19/99

Static Water Level 6.57 feet
Total Depth of Piezometer 17.49 feet

Rising Head Recovery Data		Falling Head Recovery Data	
Time (minutes : seconds)	Depth to GW (feet)	Time (minutes : seconds)	Depth to GW (feet)
0	7.91	0	4.76
5	7.3	5	5.9
10	7.18	10	6.1
15	7.11	15	6.32
30	7.01	30	6.41
45	6.98	45	6.43
1:00	6.95	1:00	6.48
15	6.92	15	6.5
30	6.9	30	6.52
45	6.89	45	6.53
2:00	6.87	2:00	6.54
15	6.85	15	6.55
30	6.84	30	6.56
45	6.83	45	6.56
3:00	6.82	3:00	6.56
15	6.81	15	6.57
30	6.8		
45	6.79		
4:00	6.78		
15	6.77		
30	6.77		
45	6.76		
5:00	6.76		
15	6.75		
30	6.74		
45	6.74		
6:00	6.74		
15	6.73		
30	6.73		
45	6.72		
7:00	6.72		
15	6.72		
30	6.71		
45	6.71		
8:00	6.7		
15	6.7		
30	6.7		
45	6.69		
9:00	6.69		
15	6.69		
30	6.68		
45	6.68		
10:00	6.68		
15	6.68		
30	6.67		
45	6.67		
11:00	6.67		
15	6.66		
30	6.66		
45	6.66		
12:00	6.66		

LAW ENGINEERING AND ENVIRONMENTAL SERVICES
3901 CARMICHAEL AVENUE
JACKSONVILLE, FLORIDA 32207

904-396-5173
fax 904-396-5703

LAW

LAWGIBB Group Member

SUMMARY OF SLUG TEST DATA

PROJECT: JEA BRANDY BRANCH
PROJECT NO: 40521-9-8177
LOCATION B-6
DATE: 07/19/99

Static Water Level 7.74 feet
Total Depth of Piezometer 17.75 feet

Rising Head Recovery Data		Falling Head Recovery Data	
Time (minutes : seconds)	Depth to GW (feet)	Time (minutes : seconds)	Depth to GW (feet)
0	14.06	0	1.51
5	13.39	5	2.03
10	12.46	10	2.57
15	11.62	15	2.87
30	10.07	30	4.85
45	9.21	45	5.79
1:00	8.72	1:00	6.35
15	8.41	15	6.3
30	8.21	30	6.7
45	8.03	45	7
2:00	8	2:00	7.22
15	7.95	15	7.41
30	7.9	30	7.49
45	7.88	45	7.59
3:00	7.86	3:00	7.63
15	7.84	15	7.66
30	7.83	30	7.67
45	7.82	45	7.68
4:00	7.81	4:00	7.69
15	7.8	15	7.7
30	7.8	30	7.71
45	7.8	45	7.72
5:00	7.79	5:00	7.72
15	7.79	15	7.73
30	7.78	30	7.73
45	7.78	45	7.73
6:00	7.78	6:00	7.74
15	7.78		
30	7.78		
45	7.78		
7:00	7.77		
15	7.77		
30	7.77		
45	7.77		
8:00	7.77		

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LAW

LAWGIBB Group Member

SUMMARY OF SLUG TEST DATA

PROJECT: JEA BRANDY BRANCH
PROJECT NO: 40521-9-8177
LOCATION B-9
DATE: 07/19/99

Static Water Level 7.45 feet
Total Depth of Piezometer 18.25 feet

Rising Head Recovery Data		Falling Head Recovery Data	
Time (minutes : seconds)	Depth to GW (feet)	Time (minutes : seconds)	Depth to GW (feet)
0	16.05	0	na
5	12.76	5	na
10	10.91	10	na
15	9.99	15	na
30	8.55	30	na
45	8.06	45	na
1:00	7.98	1:00	na
15	7.85	15	na
30	7.82	30	na
45	7.76	45	na
2:00	7.74	2:00	na
15	7.72	15	na
30	7.69	30	na
45	7.67	45	na
3:00	7.65	3:00	na
15	7.64	15	na
30	7.63	30	na
45	7.61	45	na
4:00	7.59	4:00	na
15	7.59		
30	7.58	NOTE: na - not available; water level dropped too fast to get an	
45	7.557	accurate reading due to turbulence	
5:00	7.57		
15	7.56		
30	7.56		
45	7.55		
6:00	7.54		

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LAW

LAWGIBB Group Member

SUMMARY OF SLUG TEST DATA

PROJECT: JEA BRANDY BRANCH
PROJECT NO: 40521-9-8177
LOCATION B-18
DATE: 07/19/99

Static Water Level 7.99 feet
Total Depth of Piezometer 18.55 feet

Rising Head Recovery Data		Falling Head Recovery Data	
Time (minutes : seconds)	Depth to GW (feet)	Time (minutes : seconds)	Depth to GW (feet)
0	18.32	0	5
5	12.56	5	5.42
10	11.62	10	6.27
15	11	15	6.85
30	9.42	30	7.6
45	8.73	45	7.75
1:00	8.45	1:00	7.86
15	8.32	15	7.92
30	8.24	30	7.95
45	8.19	45	7.97
2:00	8.16	2:00	7.98
15	8.13	15	7.99
30	8.12	30	7.99
45	8.1	45	7.99
3:00	8.1	3:00	7.99
15	8.09		
30	8.08		
45	8.05		
4:00	8.03		
15	8.03		
30	8.02		
45	8.02		
5:00	8.02		
15	8.01		
30	8.01		
45	8		
6:00	8		
15	8		
30	8		
45	8		
7:00	8		

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Appendix F
Laboratory Test Results

LAW
LAWGIBB Group Member
3901 Carmichael Avenue
Jacksonville, FL 32207
(904) 396-5173 • (904) 396-5703

Report of Organic Test

CLIENT: Black and Veatch **JOB NO.:** 40521-9-8177

PROJECT: Brandy Branch Power Project **DATE:** July 15, 1999

Boring No.	Sample No.	Depth (ft)	Organic Content (%)
B-5	1	0.0 - 1.5	4.5
B-7	2	1.5 - 3.0	1.1
B-7	3	3.5 - 5.0	1.3
B-8	2	1.5 - 3.0	1.0
B-8	3	3.5 - 5.0	2.3
B-9	3	3.5 - 5.0	1.8
B-10	4	6.0 - 7.5	1.8
B-21	4	6.0 - 8.0	3.0
B-23	4	6.0 - 8.0	1.1

Respectfully Submitted,

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

John A. Unterspan, P.E.

LAW
LAWGIBB Group Member
3901 Carmichael Avenue
Jacksonville, FL 32207
(904) 396-5173 • (904) 396-5703

Report of Percent Finer than the No. 200 Sieve

CLIENT: Black and Veatch
JOB NO.: 40521-9-8177
PROJECT: Brandy Branch Power Project
DATE: July 15, 1999

Boring No.	Sample Nos.	Depth (ft)	Percent Fines
B-1	2	1.5 - 3.0	17.3
B-2	3	3.5 - 5.0	7.6
B-3	3	3.5 - 5.0	14.5
B-4	10	35.0 - 36.5	14.6
B-6	5	8.5 - 10.0	8.3
B-7	6	15.0 - 16.5	7.7
B-8	9	30.0 - 31.5	23.4
B-9	3	3.5 - 5.0	11.4
B-10	4	6.0 - 7.5	9.6
B-13	8	25.0 - 26.5	7.0
B-14	10	35.0 - 36.5	22.0
B-15	3	3.5 - 5.0	11.1
B-18	10	35.0 - 36.5	24.6
B-21	4	6.0 - 8.0	8.6
B-22	3	4.0 - 6.0	12.3
B-23	4	6.0 - 8.0	14.0
B-23	6	10.0 - 12.0	5.6

Respectfully Submitted,

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

John A. Unterspan, P.E.

LAW
LAWGIBB Group Member
3901 Carmichael Avenue
Jacksonville, FL 32207
(904) 396-5173 • (904) 396-5703

Report of Atterberg Limits and Moisture Content Test

CLIENT: Black and Veatch **JOB NO.:** 40521-9-8177

PROJECT: Brandy Branch Power Project **DATE:** July 15, 1999

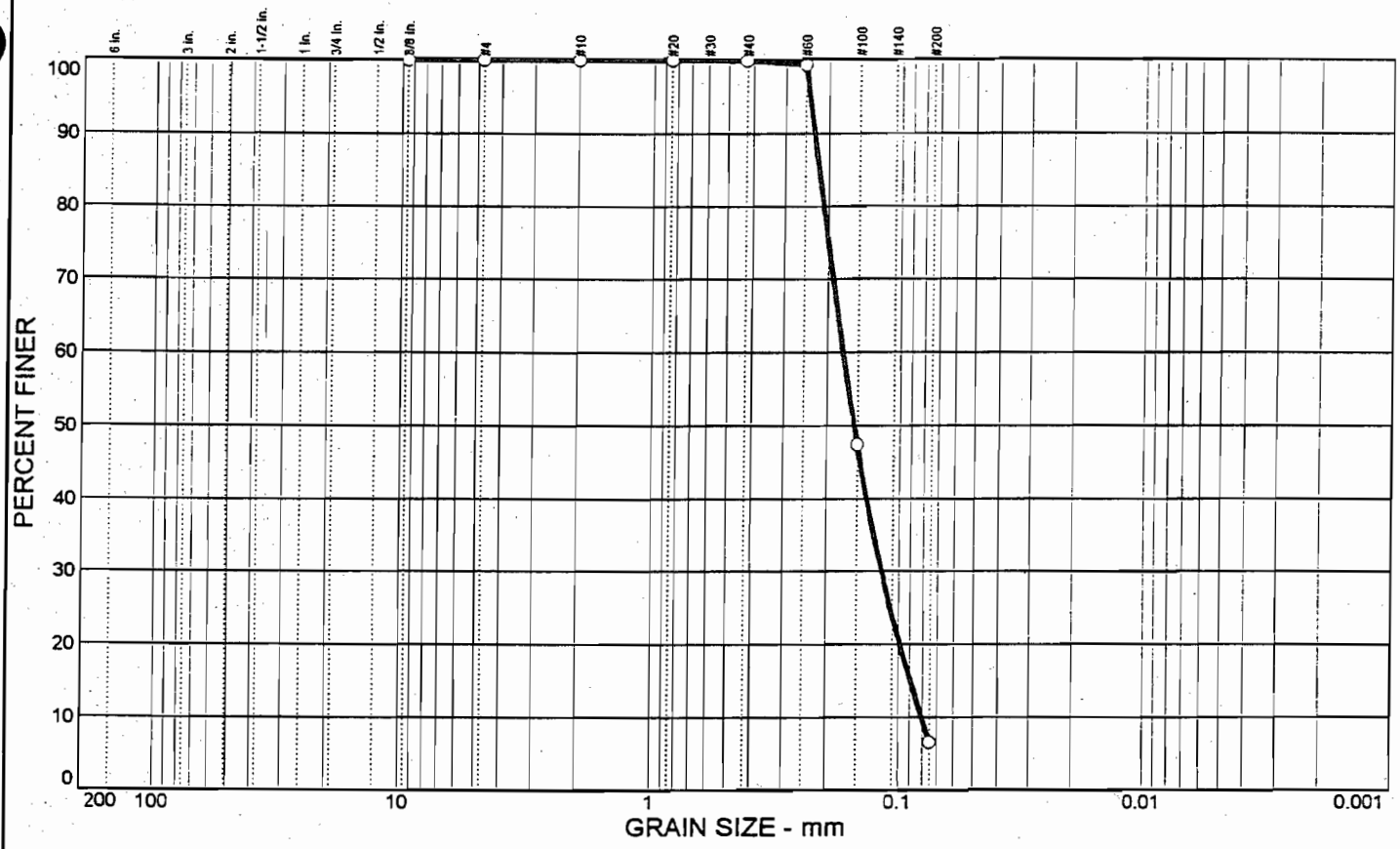
Boring No.	Sample No.	Depth (ft)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index	Moisture Content (%)
B-10	21	90.0 - 91.5	56	40	16	55.3
B-13	22	96.0 - 96.5	40	27	13	22.6
B-15	20	85.0 - 86.5	171	56	115	100.1
B-16	20	85.0 - 86.5	100	30	70	33.4
B-19	20	85.0 - 86.5	92	30	62	40.4
B-20	21	90.0 - 91.5	69	32	37	40.9

Respectfully Submitted,

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

John A. Unterspan, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			93.5	6.5		SP-SM	A-3		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		

	GRAIN SIZE		
D_{60}	0.172		
D_{30}	0.118		
D_{10}	0.0808		
	COEFFICIENTS		
C_c	1.00		
C_u	2.13		

SIEVE number size	PERCENT FINER ○
#4	100.0
#10	100.0
#20	100.0
#40	99.9
#60	99.3
#100	47.4
#200	6.5

SOIL DESCRIPTION

○ Brown Slightly Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 1 Sample No.: 4 Elev./Depth: 6.0'-7.5'

Law Engineering and Environmental Services, Inc.

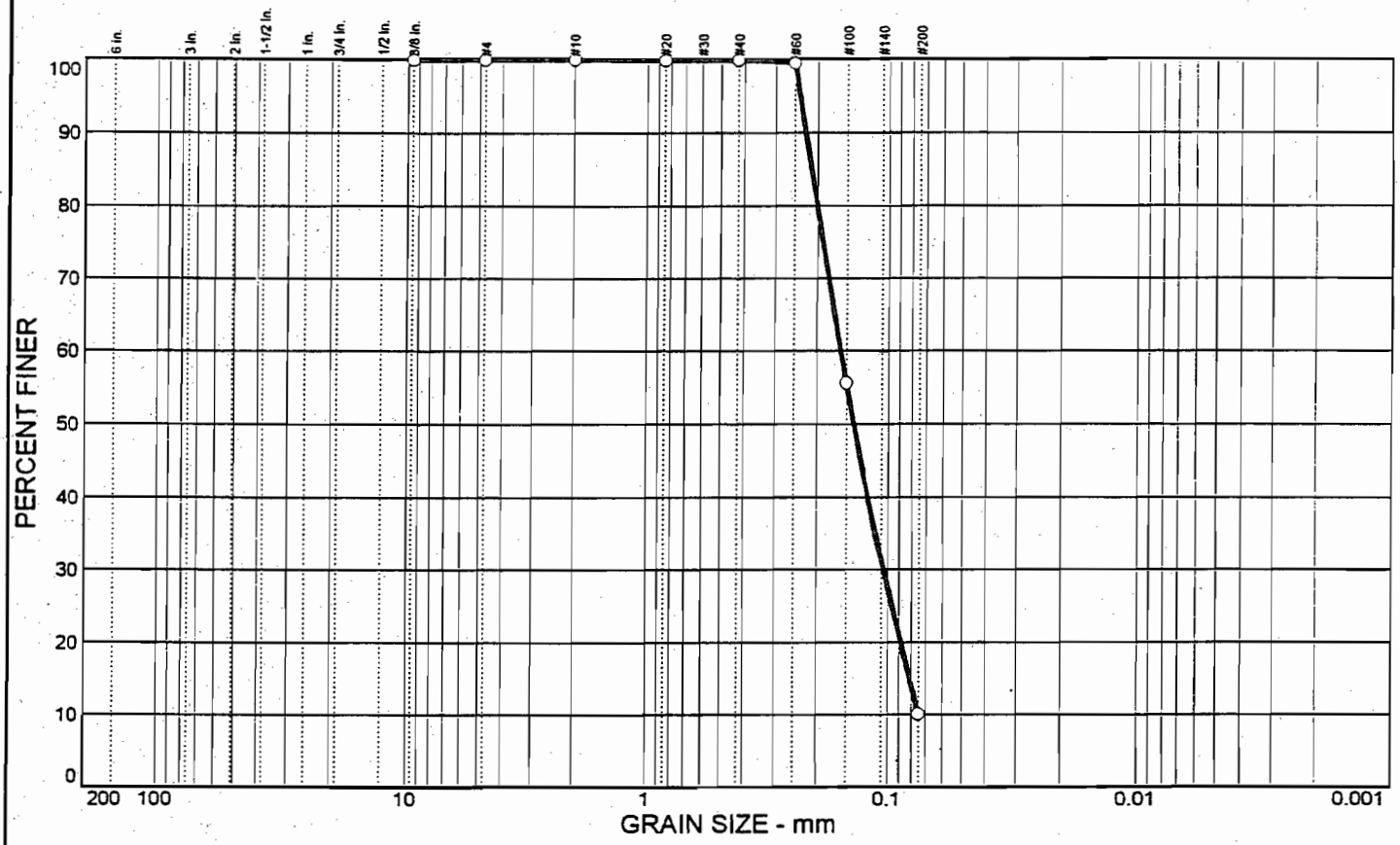
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			90.0	10.0		SP-SM	A-3		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		

	GRAIN SIZE		
D_{60}	0.159		
D_{30}	0.104		
D_{10}	0.0750		
	COEFFICIENTS		
C_c	0.91		
C_u	2.11		

SIEVE number size	PERCENT FINER ○
#4	100.0
#10	100.0
#20	99.9
#40	99.9
#60	99.5
#100	55.6
#200	10.0

SOIL DESCRIPTION

○ Brown Slightly Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 2 Sample No.: 6 Elev./Depth: 15.0'-16.5'

Law Engineering and Environmental Services, Inc.

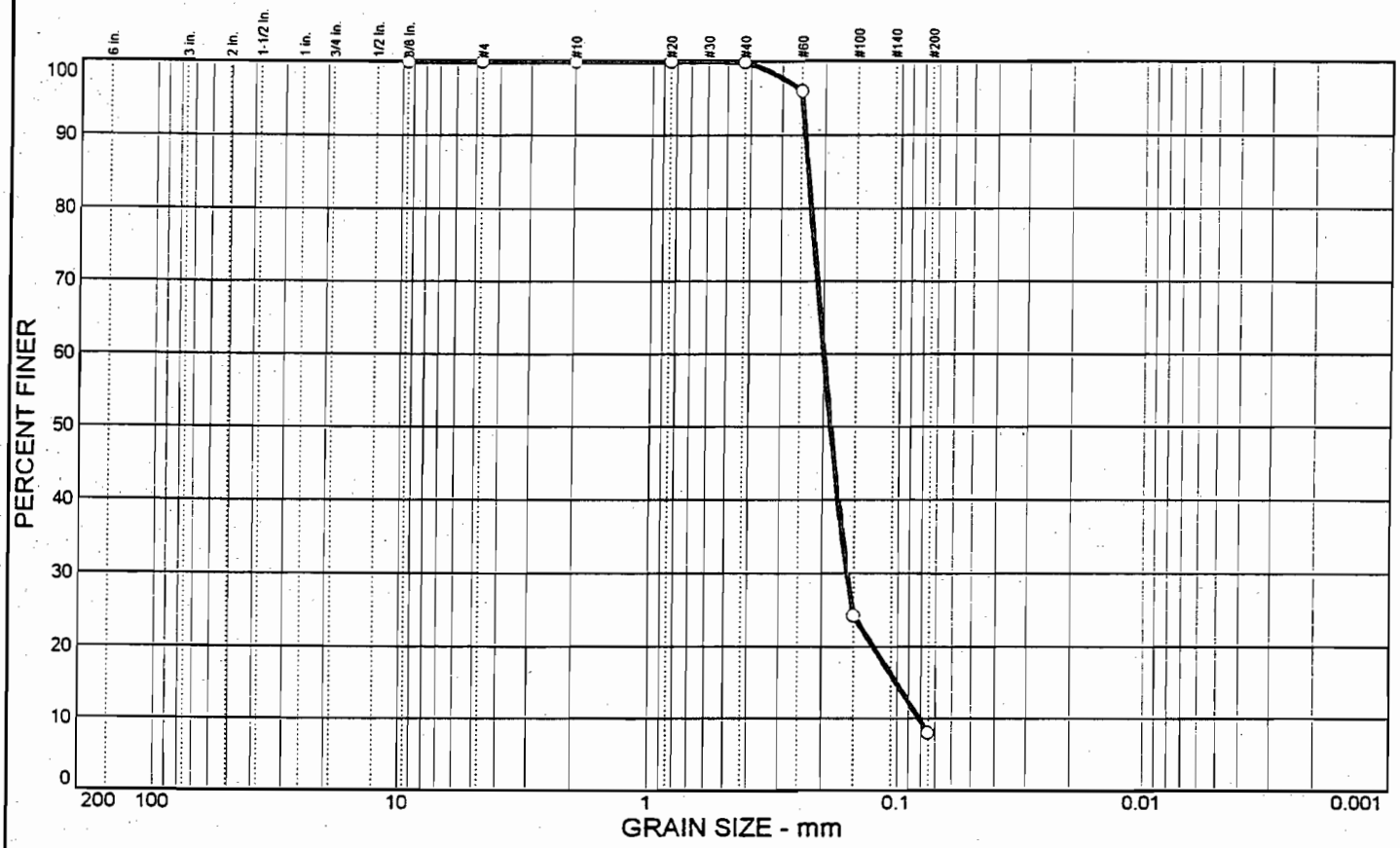
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			92.0	8.0		SP-SM	A-3		

SIEVE inches size	PERCENT FINER ○
.375	100.0

	GRAIN SIZE
D_{60}	0.200
D_{30}	0.159
D_{10}	0.0817

	COEFFICIENTS
C_c	1.55
C_u	2.44

SIEVE number size	PERCENT FINER ○
#4	100.0
#10	100.0
#20	100.0
#40	99.9
#60	96.0
#100	24.2
#200	8.0

SOIL DESCRIPTION

○ Light Brown Slightly Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 3 Sample No.: 8 Elev./Depth: 25.0'-26.5'

Law Engineering and Environmental Services, Inc.

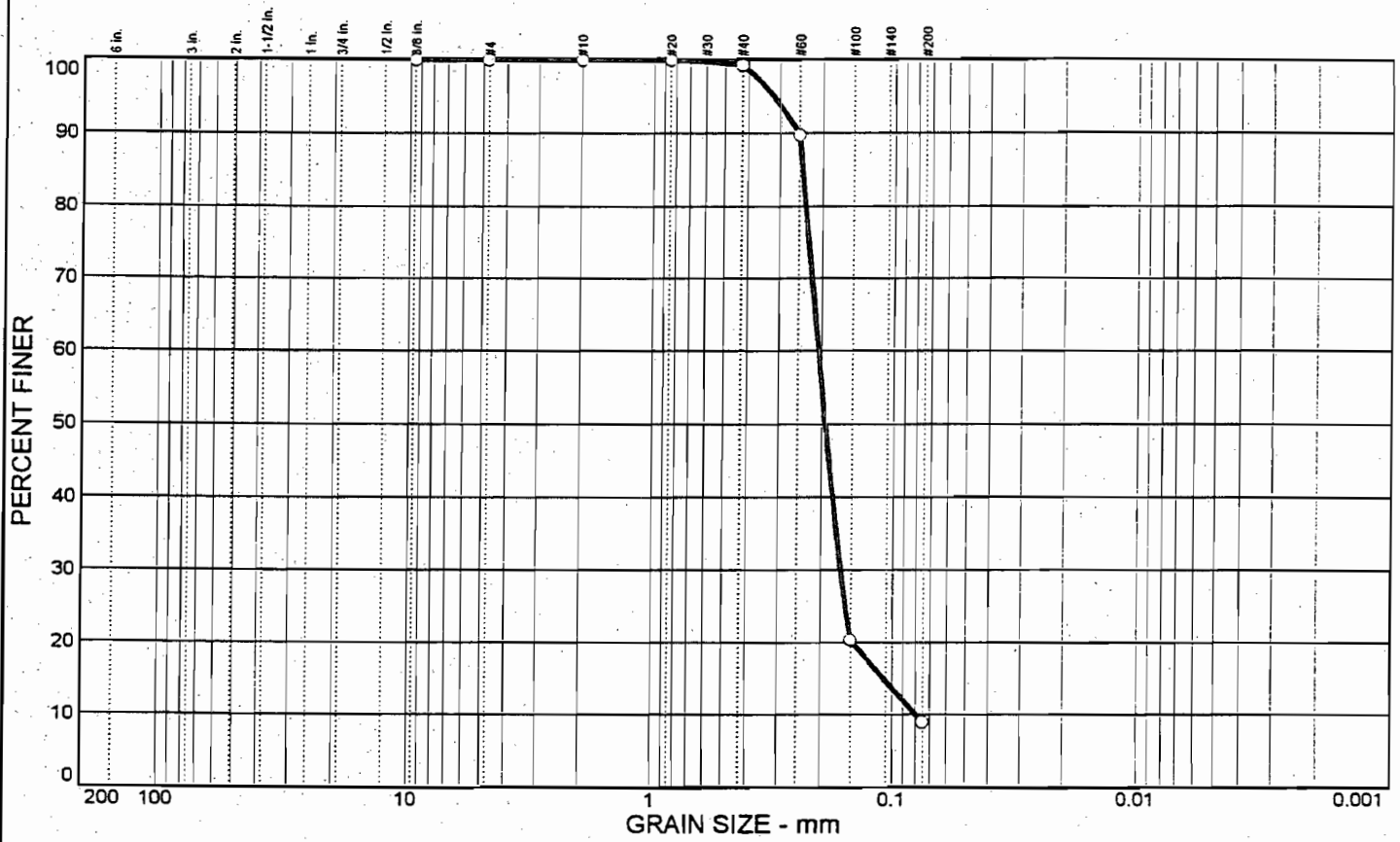
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			91.1	8.9		SP-SM	A-3		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		

GRAIN SIZE			
D_{60}	0.207		
D_{30}	0.165		
D_{10}	0.0802		

COEFFICIENTS			
C_c	1.65		
C_u	2.58		

SIEVE number size	PERCENT FINER ○		
#4	100.0		
#10	100.0		
#20	100.0		
#40	99.3		
#60	89.7		
#100	20.3		
#200	8.9		

SOIL DESCRIPTION

○ Tan Slightly Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 3 Sample No.: 9 Elev./Depth: 30.0'-31.5'

Law Engineering and Environmental Services, Inc.

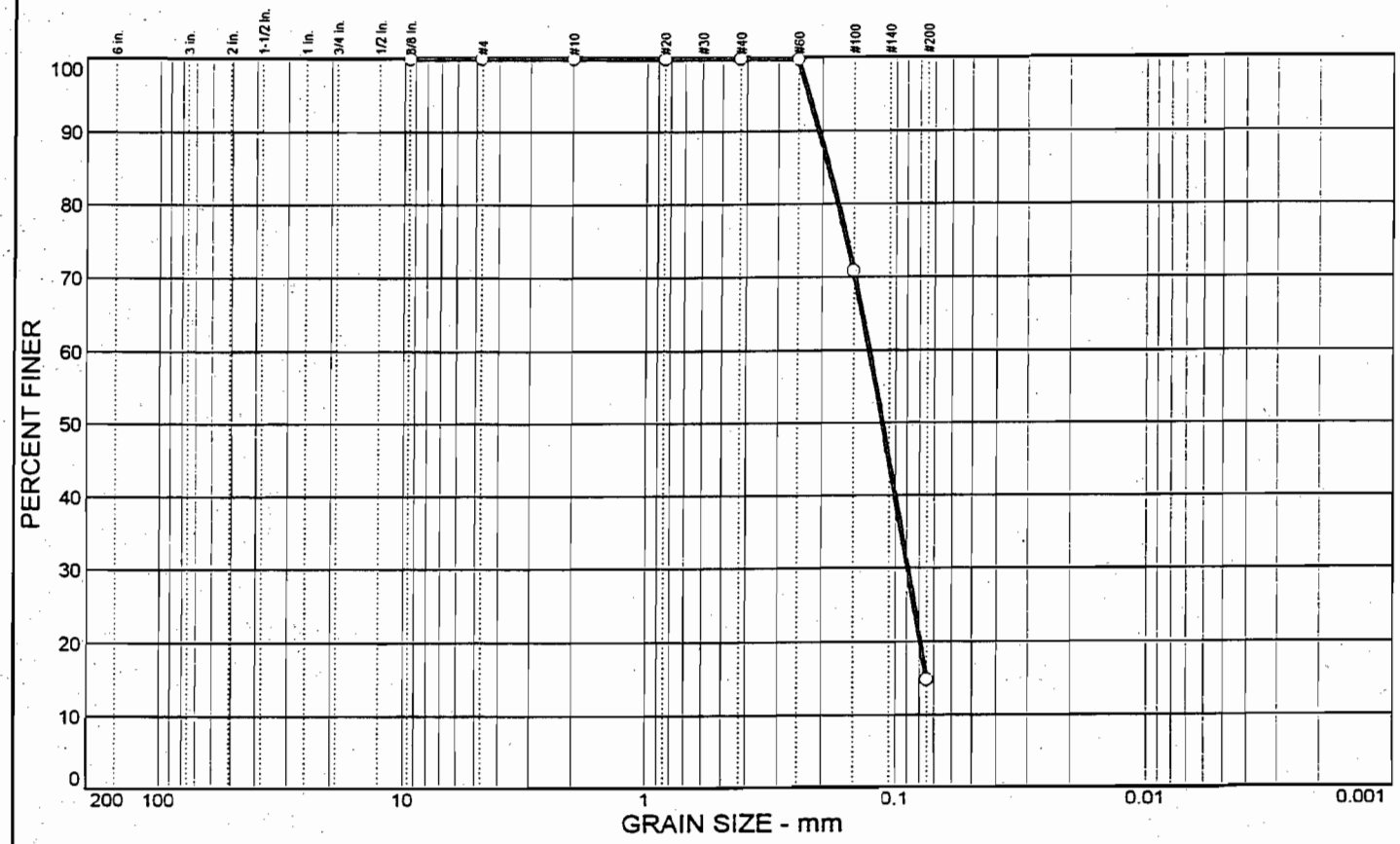
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			85.2	14.8		SM	A-2-4(0)		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		
	GRAIN SIZE		
D_{60}	0.129		
D_{30}	0.0893		
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○
#4	100.0
#10	100.0
#20	99.9
#40	99.9
#60	99.8
#100	70.8
#200	14.8

SOIL DESCRIPTION

○ Gray Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 3 Sample No.: 11 Elev./Depth: 40.0'-41.5'

Law Engineering and Environmental Services, Inc.

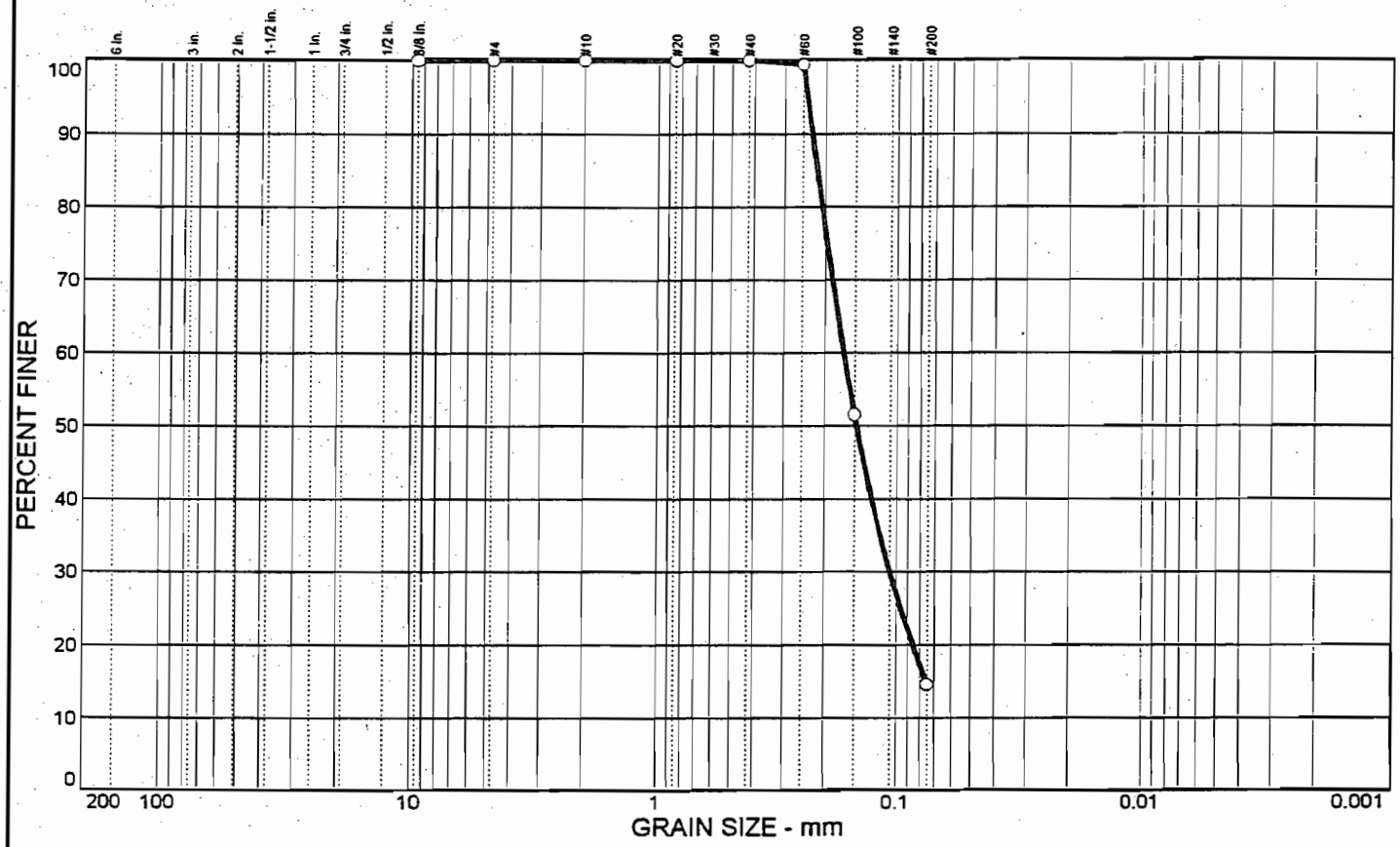
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. HINTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			85.5	14.5		SM	A-2-4(0)		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		

GRAIN SIZE			
D_{60}	0.166		
D_{30}	0.106		
D_{10}			

COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○		
#4	100.0		
#10	100.0		
#20	100.0		
#40	100.0		
#60	99.4		
#100	51.5		
#200	14.5		

SOIL DESCRIPTION

○ Tan Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 4 Sample No.: 3 Elev./Depth: 3.5'- 5.0'

Law Engineering and Environmental Services, Inc.

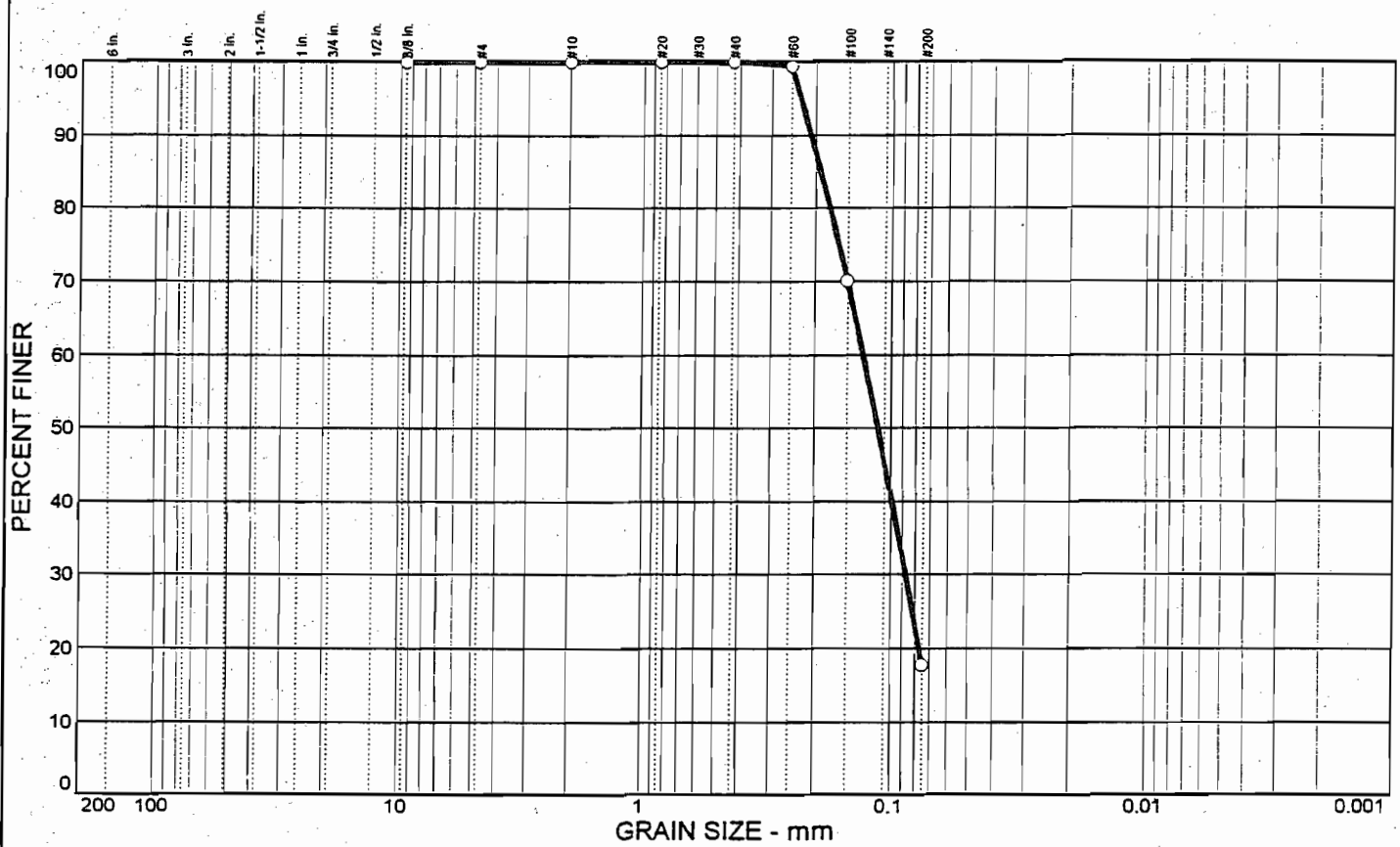
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			82.3	17.7		SM	A-2-4(0)		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		

GRAIN SIZE			
D_{60}	0.130		
D_{30}	0.0874		
D_{10}			

COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○		
#4	100.0		
#10	100.0		
#20	100.0		
#40	100.0		
#60	99.4		
#100	70.0		
#200	17.7		

SOIL DESCRIPTION

○ Dark Brown Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 5 Sample No.: 4 Elev./Depth: 6.0'- 7.5'

Law Engineering and Environmental Services, Inc.

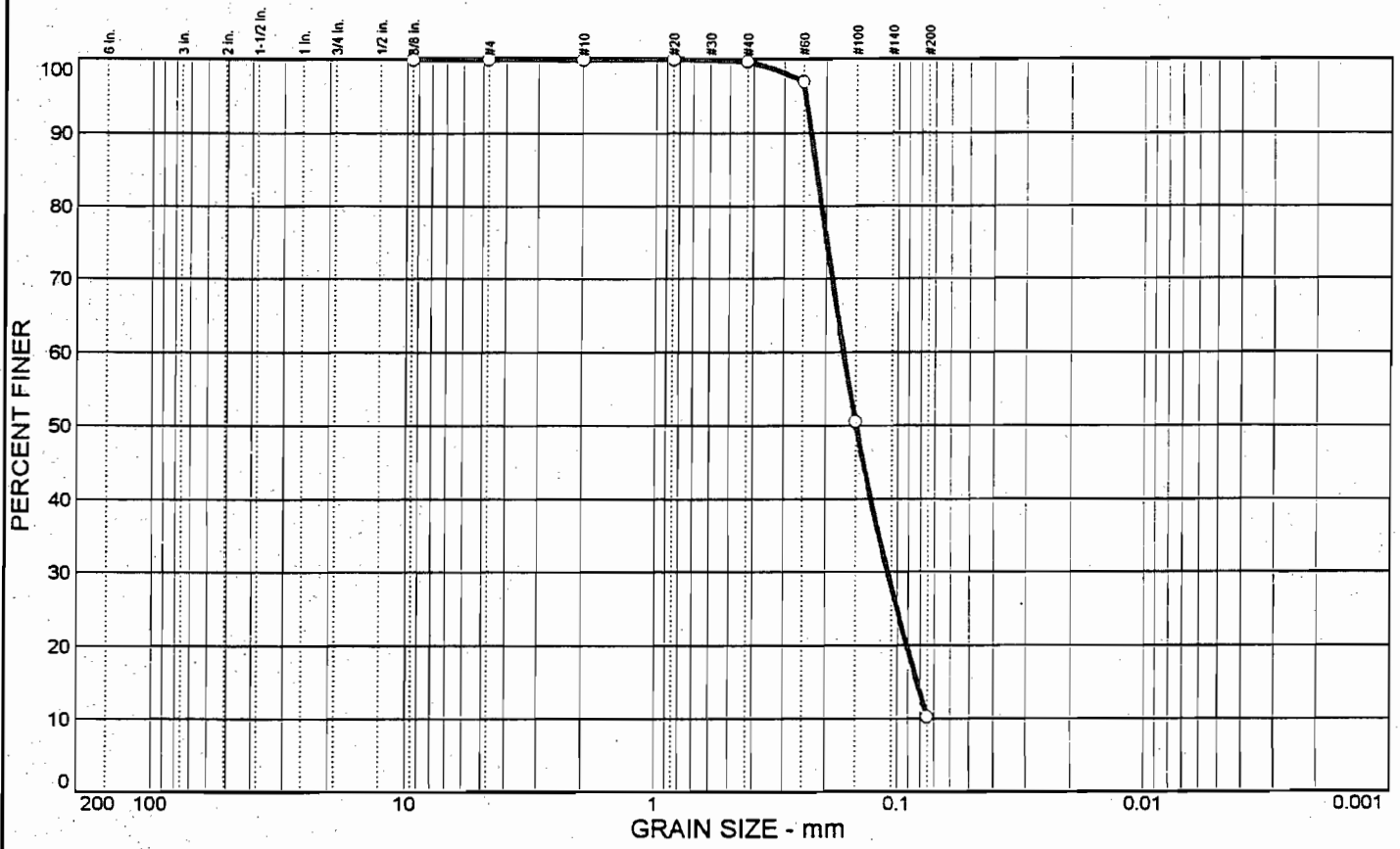
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			89.8	10.2		SP-SM	A-3		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		

	GRAIN SIZE
D_{60}	0.168
D_{30}	0.110
D_{10}	

	COEFFICIENTS
C_c	
C_u	

SIEVE number size	PERCENT FINER ○
#4	100.0
#10	100.0
#20	100.0
#40	99.7
#60	96.9
#100	50.6
#200	10.2

SOIL DESCRIPTION

○ Gray Brown Slightly Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 5 Sample No.: 9 Elev./Depth: 30.0'-31.5'

Law Engineering and Environmental Services, Inc.

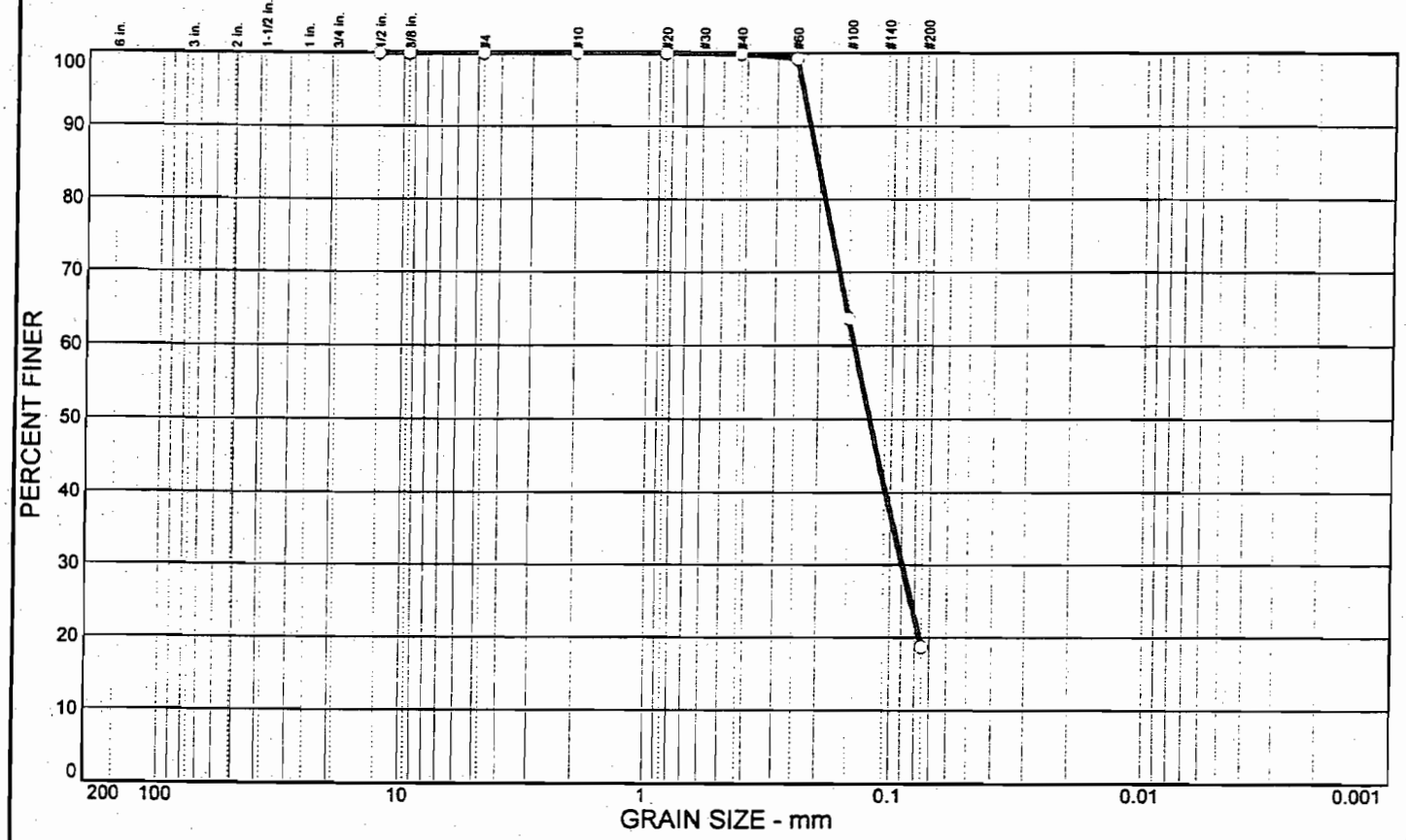
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			81.3	18.7		SM	A-2-4(0)		

SIEVE inches size	PERCENT FINER ○		
.50	100.0		
.375	100.0		

	GRAIN SIZE		
D_{60}	0.142		
D_{30}	0.0896		
D_{10}			

	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○		
#4	100.0		
#10	100.0		
#20	100.0		
#40	99.9		
#60	99.2		
#100	63.7		
#200	18.7		

SOIL DESCRIPTION

○ Light Tan Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 6 Sample No.: 2 Elev./Depth: 1.5'- 3.0'

Law Engineering and Environmental Services, Inc.

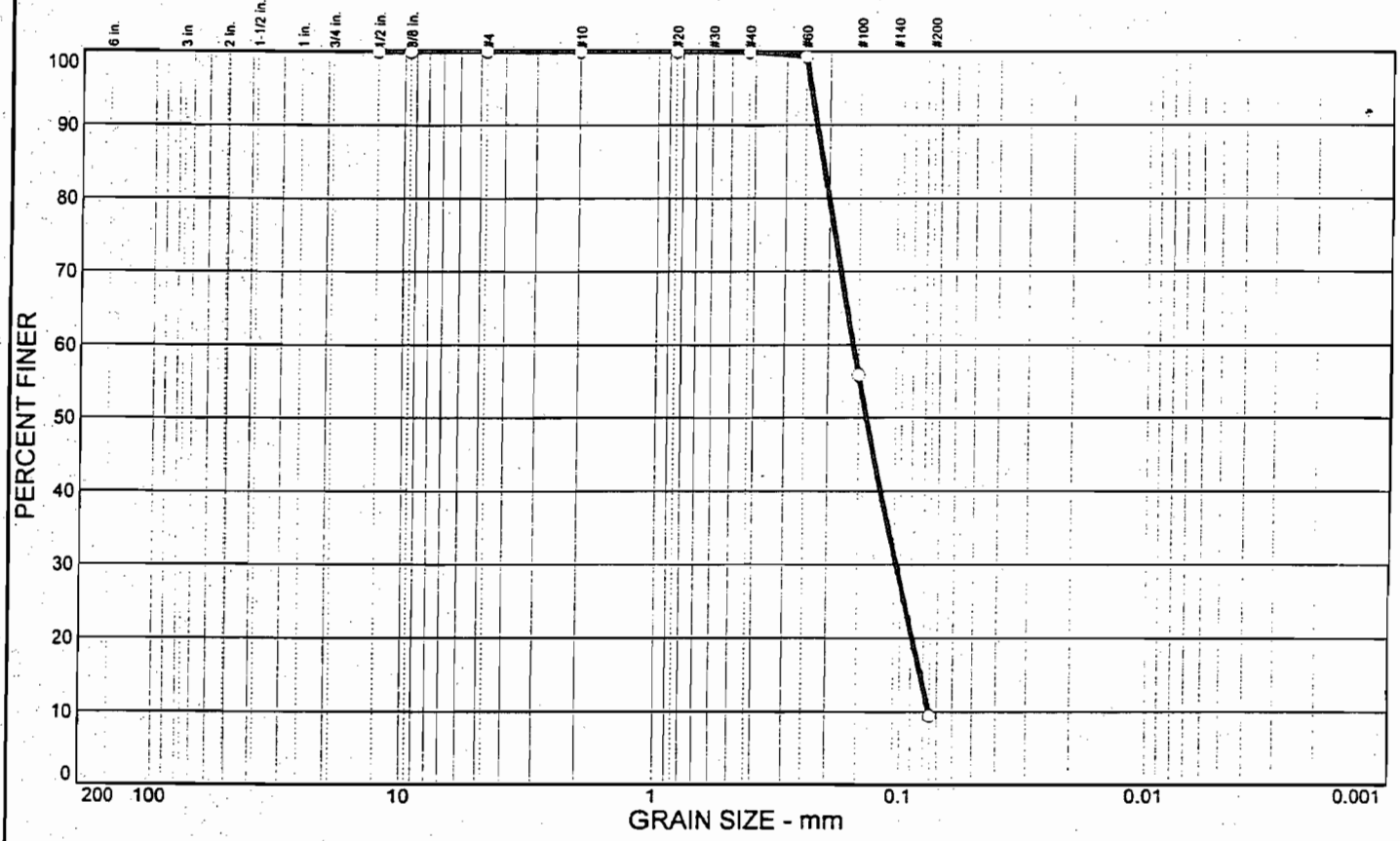
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			90.6	9.4		SP-SM	A-3		

SIEVE inches size	PERCENT FINER
.50	100.0
.375	100.0

GRAIN SIZE	
D_{60}	0.158
D_{30}	0.104
D_{10}	0.0757

COEFFICIENTS	
C_c	0.90
C_u	2.09

SIEVE number size	PERCENT FINER
#4	100.0
#10	100.0
#20	100.0
#40	99.9
#60	99.3
#100	55.8
#200	9.4

SOIL DESCRIPTION

○ Brown Slightly Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 6 Sample No.: 3 Elev./Depth: 3.5'- 5.0'

Law Engineering and Environmental Services, Inc.

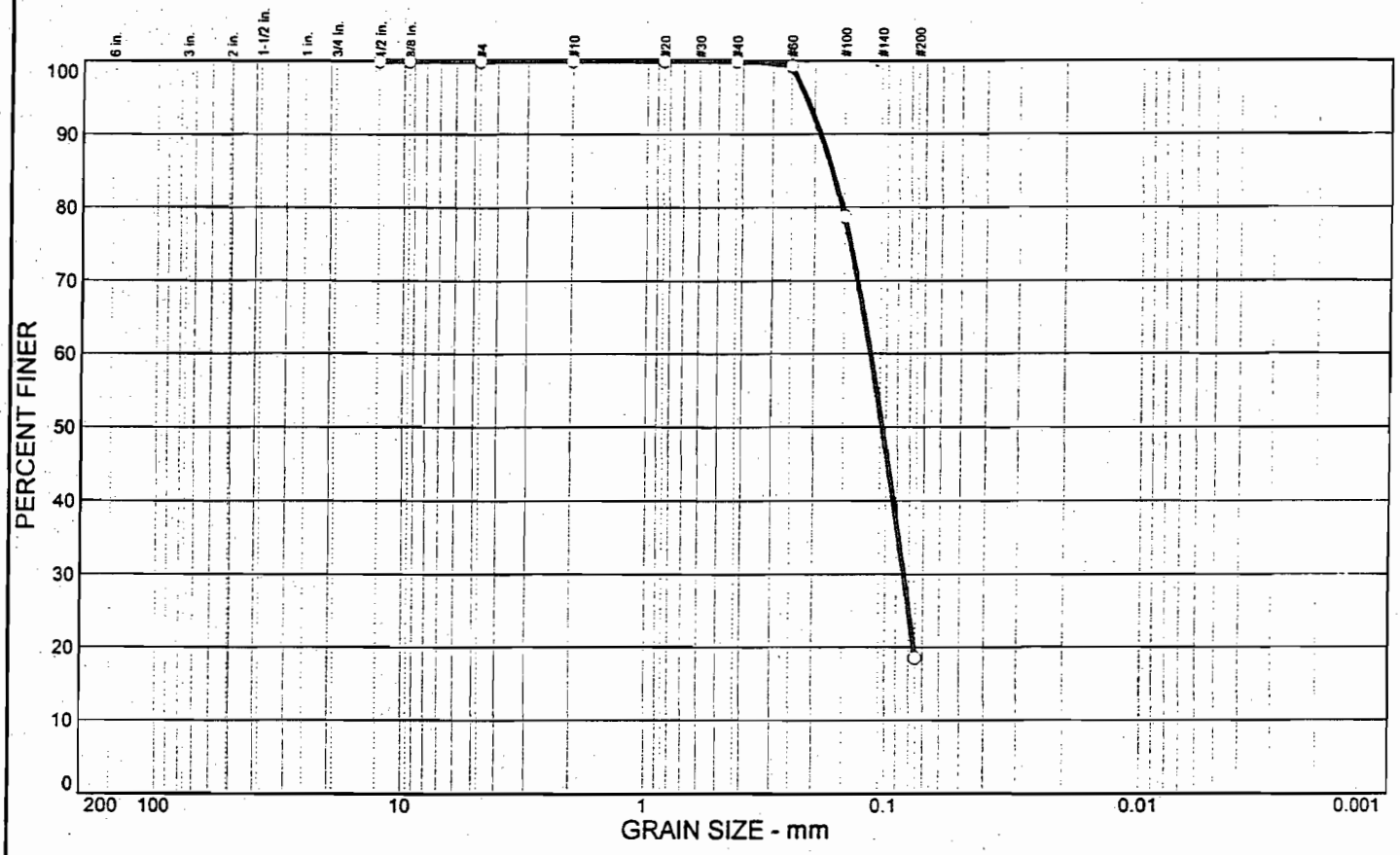
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			81.5	18.5		SM	A-2-4(0)		

SIEVE inches size	PERCENT FINER ○		
.50	100.0		
.375	100.0		
GRAIN SIZE			
D_{60}	0.116		
D_{30}	0.0842		
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○		
#4	100.0		
#10	100.0		
#20	100.0		
#40	100.0		
#60	99.3		
#100	78.7		
#200	18.5		

SOIL DESCRIPTION

○ Light Tan Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 6 Sample No.: 7 Elev./Depth: 20.0'- 21.5'

Law Engineering and Environmental Services, Inc.

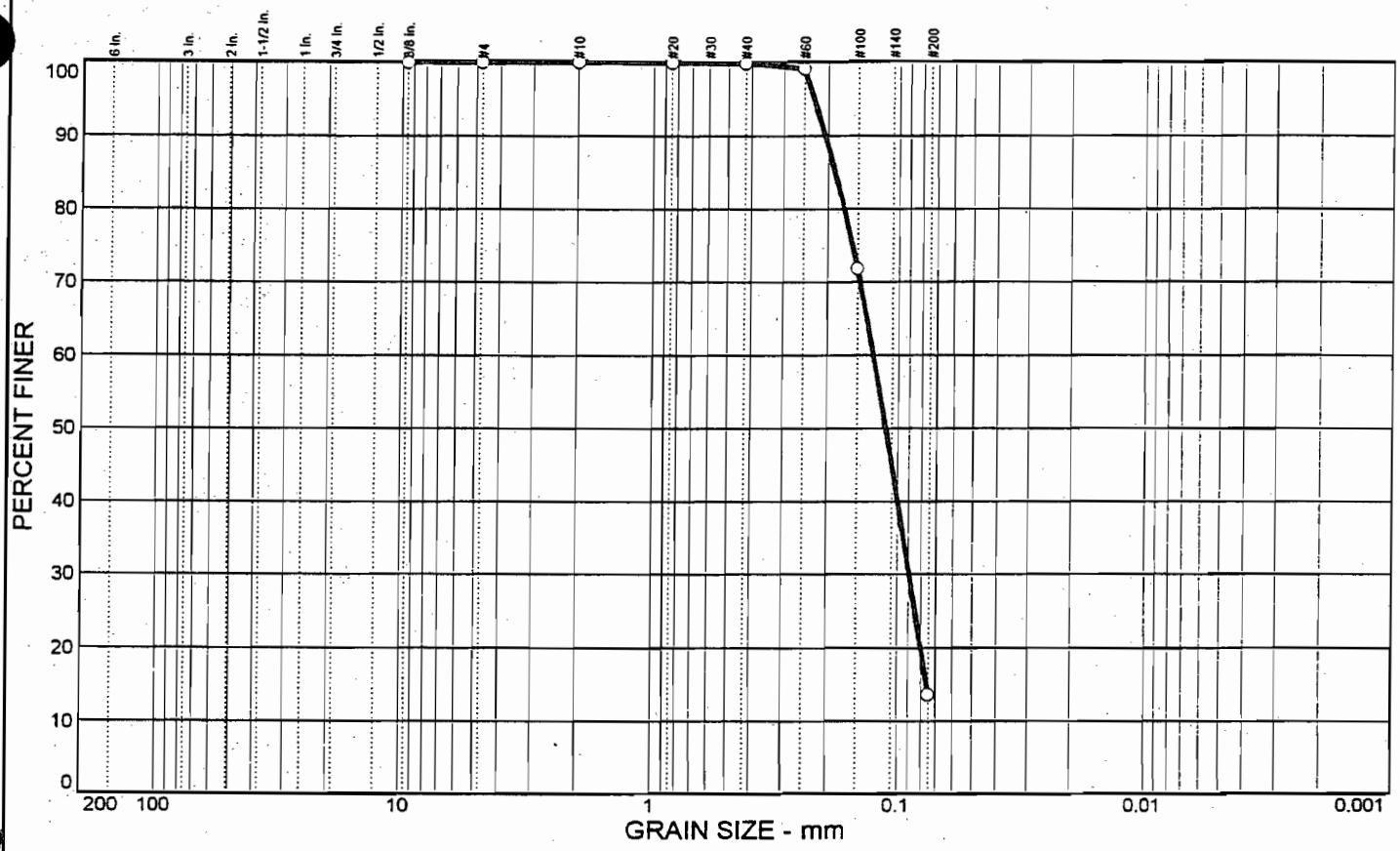
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A HINTERSPAN P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			86.4	13.6		SM	A-2-4(0)		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		

	GRAIN SIZE		
D_{60}	0.127		
D_{30}	0.0896		
D_{10}			

	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○
#4	100.0
#10	100.0
#20	99.9
#40	99.8
#60	99.1
#100	71.8
#200	13.6

SOIL DESCRIPTION

○ Gray-Brown Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 7 Sample No.: 2 Elev./Depth: 1.5'- 3.0'

Law Engineering and Environmental Services, Inc.

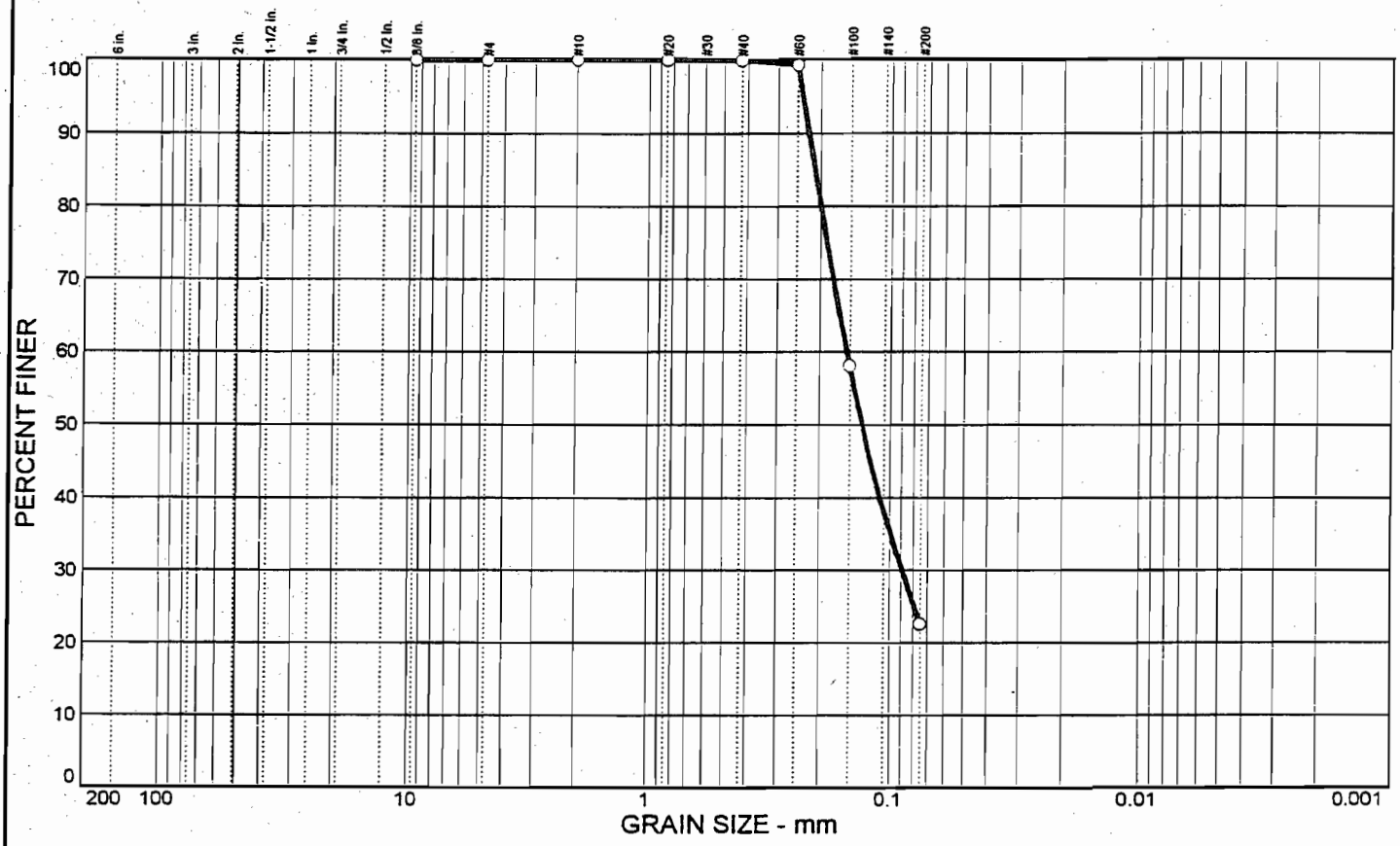
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A HINTERSPAN P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			77.4	22.6		SM	A-2-4(0)		

SIEVE inches size	PERCENT FINER ○
.375	100.0

GRAIN SIZE	
D_{60}	0.154
D_{30}	0.0890
D_{10}	

COEFFICIENTS	
C_c	
C_u	

SIEVE number size	PERCENT FINER ○
#4	100.0
#10	100.0
#20	100.0
#40	99.9
#60	99.3
#100	58.1
#200	22.6

SOIL DESCRIPTION

○ Brown Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 7 Sample No.: 4 Elev./Depth: 6.0'- 7.5'

Law Engineering and Environmental Services, Inc.

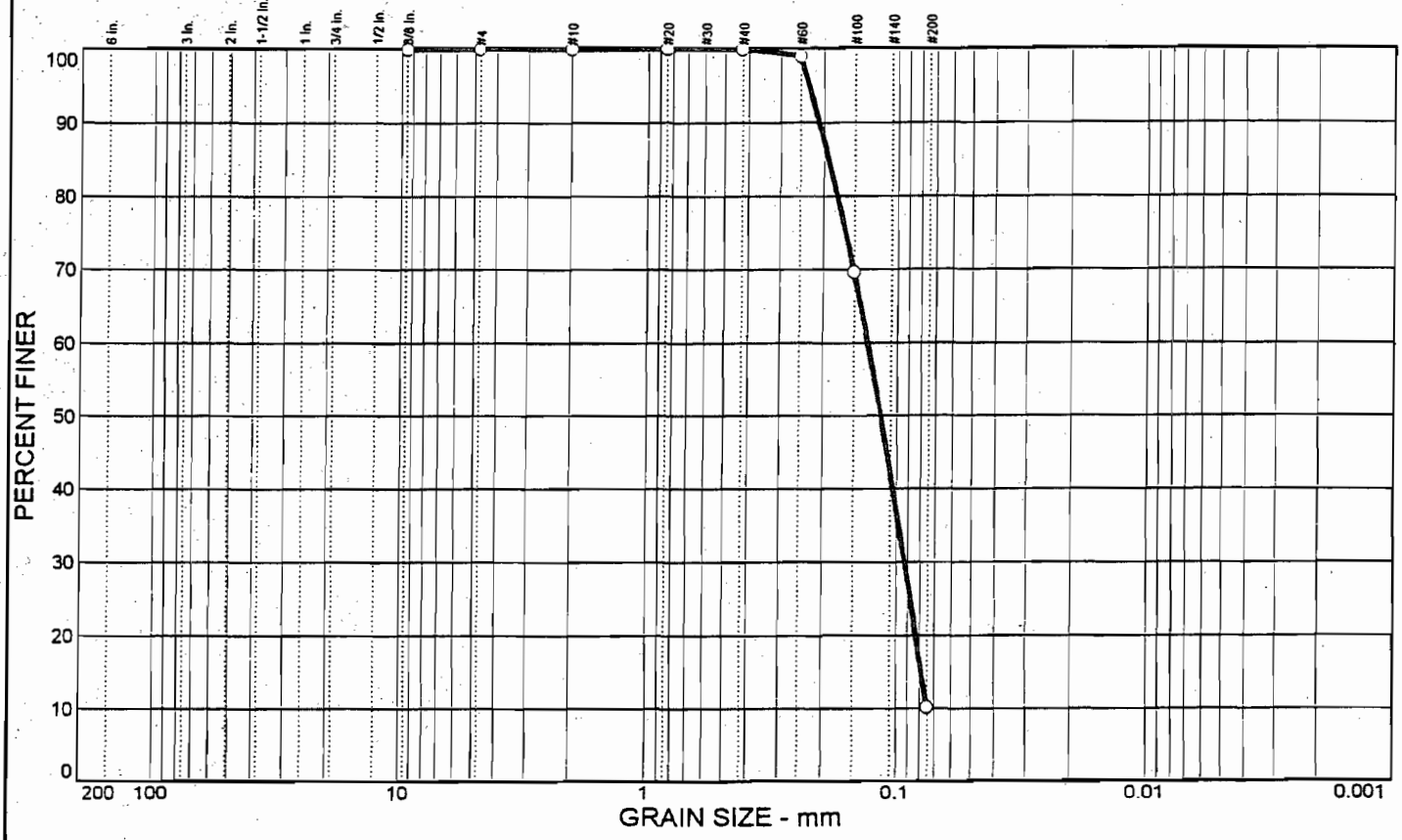
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			89.9	10.1		SP-SM	A-3		

SIEVE inches size	PERCENT FINER ○
.375	100.0

	GRAIN SIZE
D_{60}	0.132
D_{30}	0.0929
D_{10}	

	COEFFICIENTS
C_c	
C_u	

SIEVE number size	PERCENT FINER ○
#4	100.0
#10	100.0
#20	100.0
#40	99.9
#60	99.0
#100	69.6
#200	10.1

SOIL DESCRIPTION

○ Gray-Brown Slightly Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 8 Sample No.: 2 Elev./Depth: 1.5'- 3.0'

Law Engineering and Environmental Services, Inc.

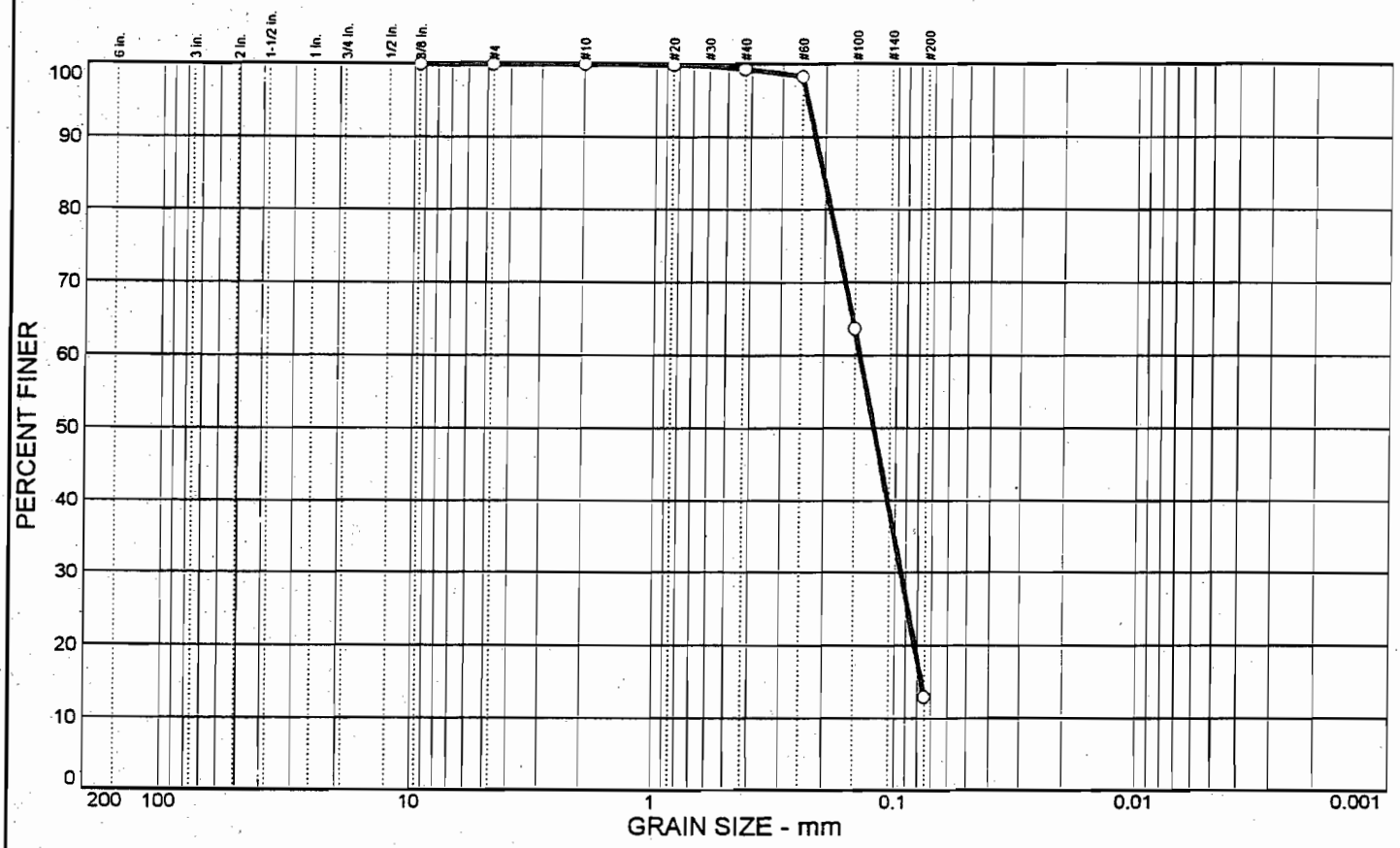
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			87.2	12.8		SM	A-2-4(0)		

SIEVE inches size	PERCENT FINER ○
.375	100.0

	GRAIN SIZE
D_{60}	0.143
D_{30}	0.0944
D_{10}	

	COEFFICIENTS
C_c	
C_u	

SIEVE number size	PERCENT FINER ○
#4	100.0
#10	100.0
#20	99.9
#40	99.3
#60	98.3
#100	63.6
#200	12.8

SOIL DESCRIPTION

○ Brown Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 8 Sample No.: 4 Elev./Depth: 6.0'- 7.5'

Law Engineering and Environmental Services, Inc.

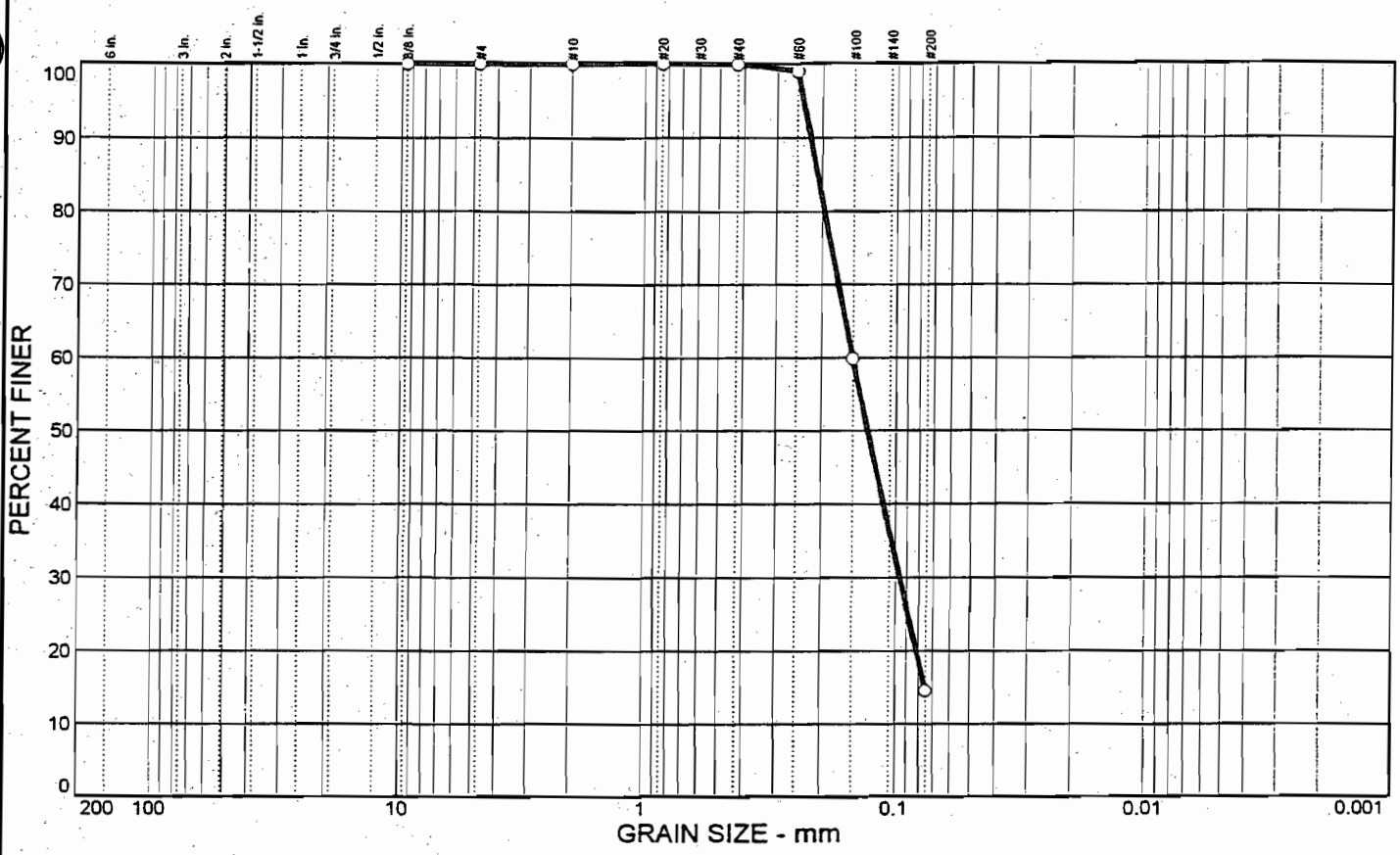
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			85.5	14.5		SM	A-2-4(0)		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		

GRAIN SIZE			
D_{60}	0.150		
D_{30}	0.0960		
D_{10}			

COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○		
#4	100.0		
#10	100.0		
#20	100.0		
#40	99.9		
#60	99.0		
#100	59.9		
#200	14.5		

SOIL DESCRIPTION

○ Light Brown Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 10 Sample No.: 7 Elev./Depth: 20.0'-21.5'

Law Engineering and Environmental Services, Inc.

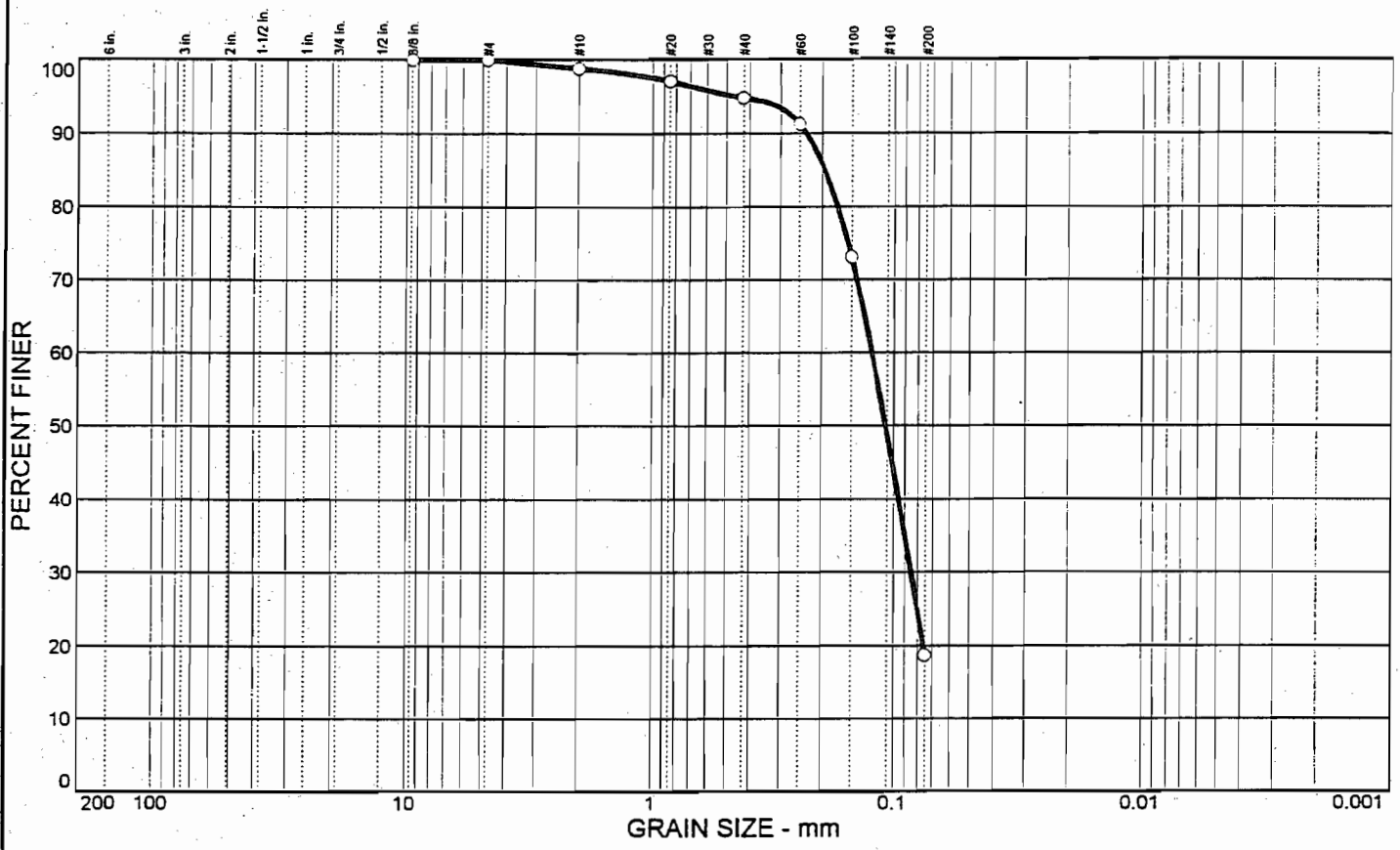
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			81.4	18.6		SM	A-2-4(0)		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		

GRAIN SIZE			
D_{60}	0.123		
D_{30}	0.0853		
D_{10}			

COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○		
#4	100.0		
#10	98.8		
#20	97.1		
#40	94.8		
#60	91.2		
#100	73.0		
#200	18.6		

SOIL DESCRIPTION

○ Gray Brown Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 10 Sample No.: 19 Elev./Depth: 80.0'-81.5'

Law Engineering and Environmental Services, Inc.

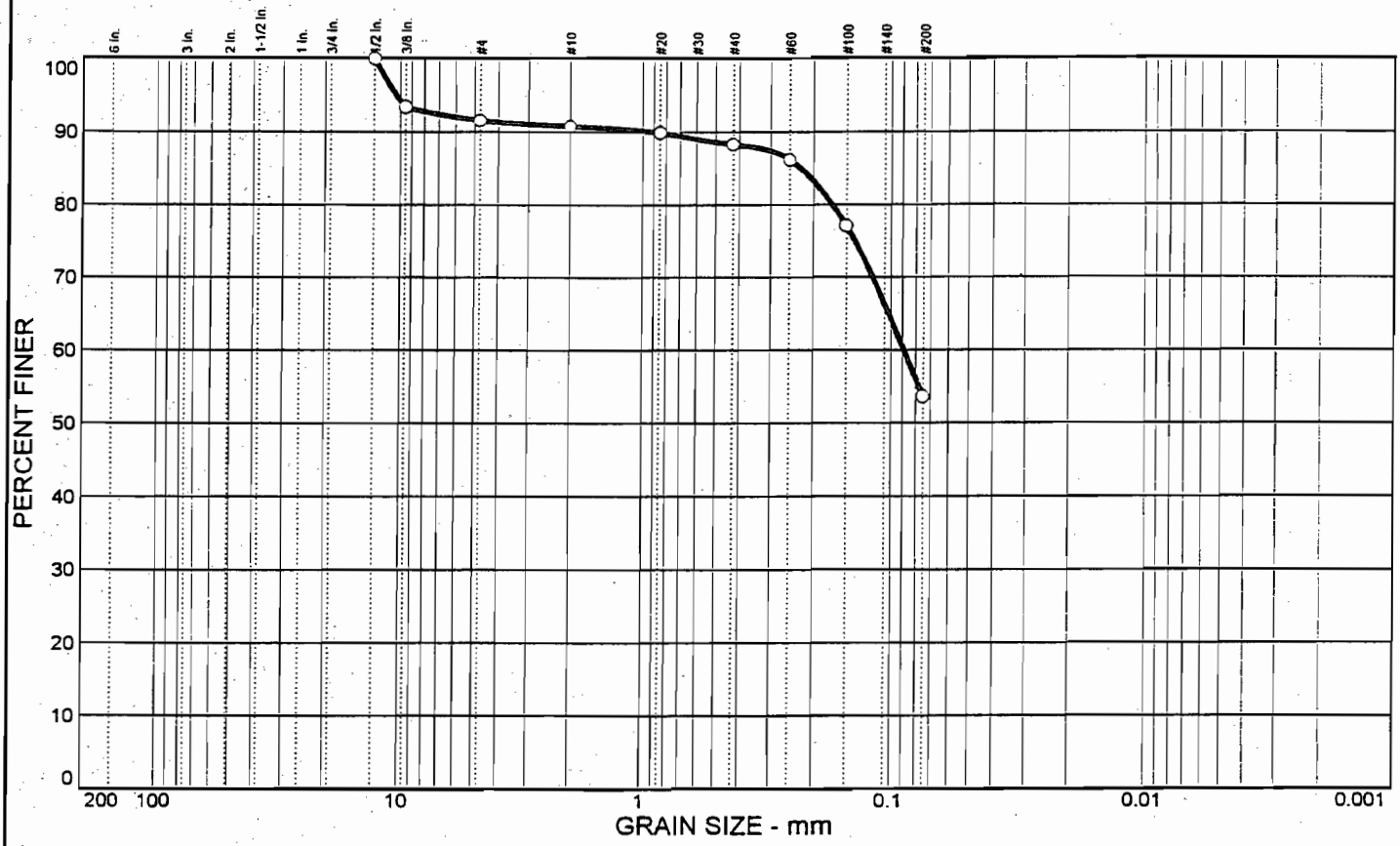
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. HINTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		8.5	37.9	53.6		ML	A-4(0)		

SIEVE inches size	PERCENT FINER ○		
.5	100.0		
.375	93.3		

	GRAIN SIZE		
D_{60}	0.0890		
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○		
#4	91.5		
#10	90.7		
#20	89.8		
#40	88.2		
#60	86.1		
#100	77.0		
#200	53.6		

SOIL DESCRIPTION

○ Gray Very Sandy SILT with rock fragments

REMARKS:

○

○ Source: Boring No. 10 Sample No.: 22 Elev./Depth: 95.0'-96.5'

Law Engineering and Environmental Services, Inc.

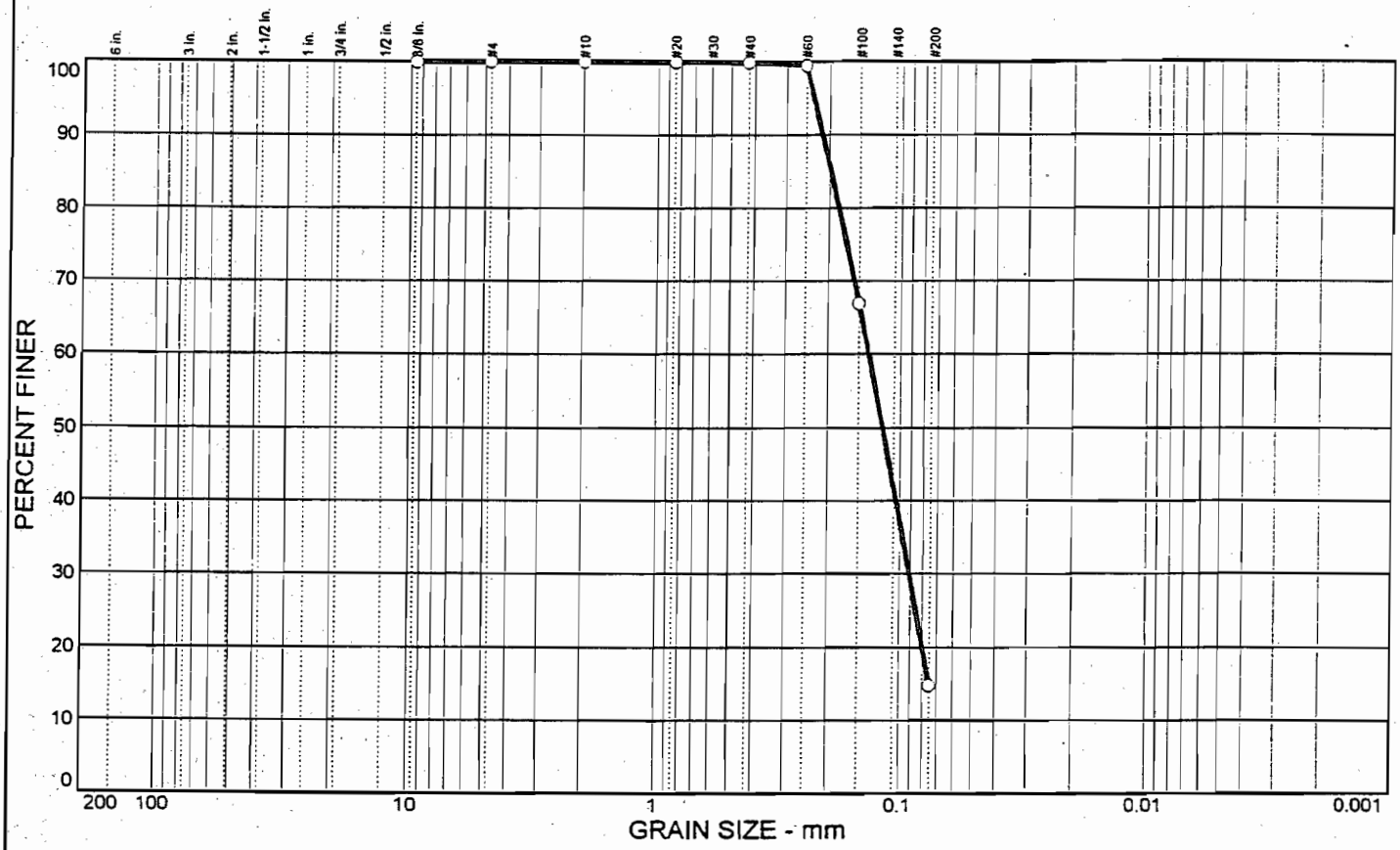
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			85.3	14.7		SM	A-2-4(0)		

SIEVE inches size	PERCENT FINER ○
.375	100.0

	GRAIN SIZE
D_{60}	0.136
D_{30}	0.0912
D_{10}	

	COEFFICIENTS
C_c	
C_u	

SIEVE number size	PERCENT FINER ○
#4	100.0
#10	100.0
#20	100.0
#40	99.9
#60	99.5
#100	66.9
#200	14.7

SOIL DESCRIPTION

○ Brown Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 11 Sample No.: 4 Elev./Depth: 6.0'- 7.5'

Law Engineering and Environmental Services, Inc.

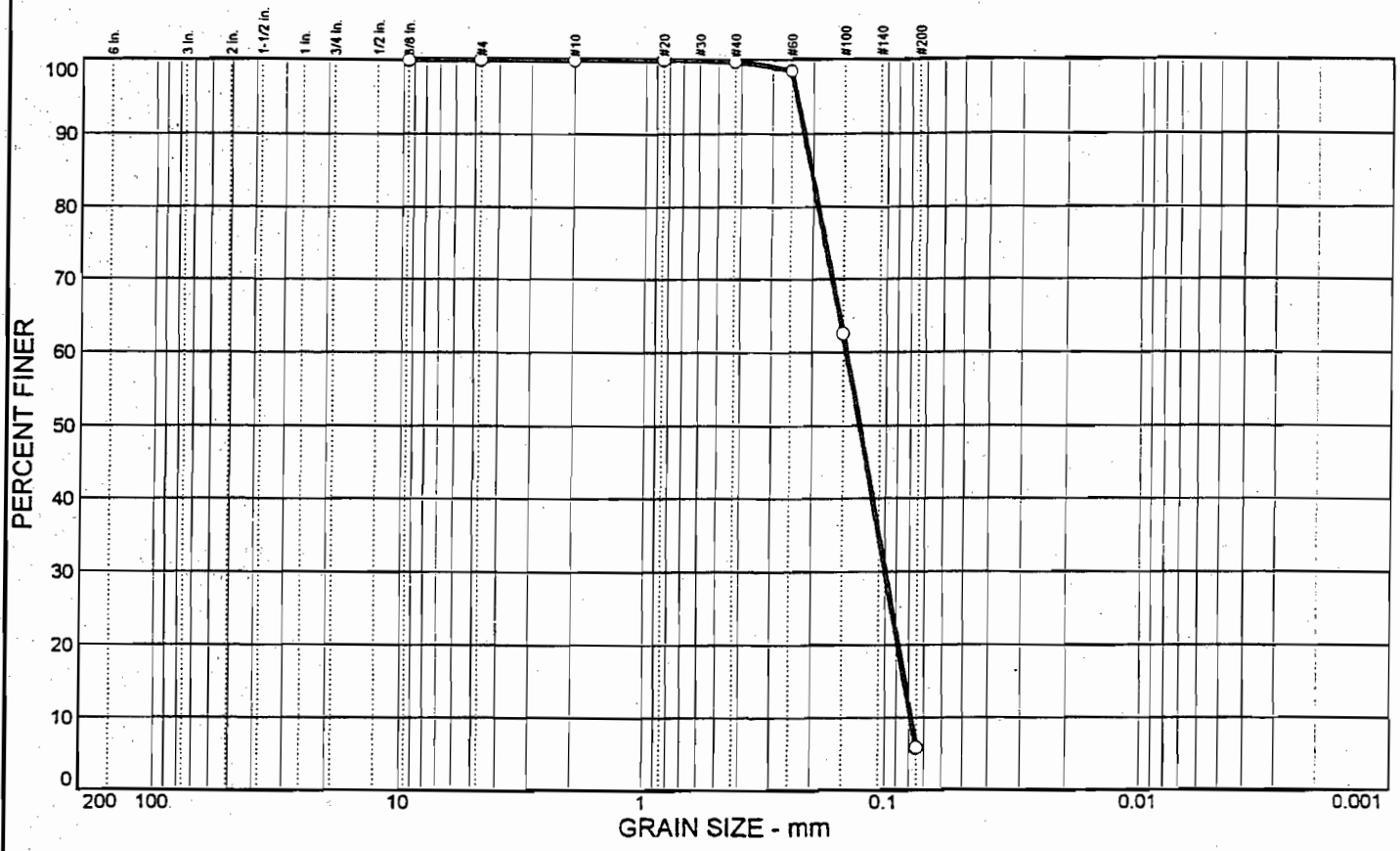
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			94.2	5.8		SP-SM	A-3		

SIEVE inches size	PERCENT FINER ○
.375	100.0

	GRAIN SIZE
D_{60}	0.145
D_{30}	0.0999
D_{10}	0.0788

	COEFFICIENTS
C_c	0.87
C_u	1.84

SIEVE number size	PERCENT FINER ○
#4	100.0
#10	100.0
#20	100.0
#40	99.7
#60	98.5
#100	62.5
#200	5.8

SOIL DESCRIPTION

○ Light Brown Slightly Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 11 Sample No.: 6 Elev./Depth: 15.0'-16.5'

Law Engineering and Environmental Services, Inc.

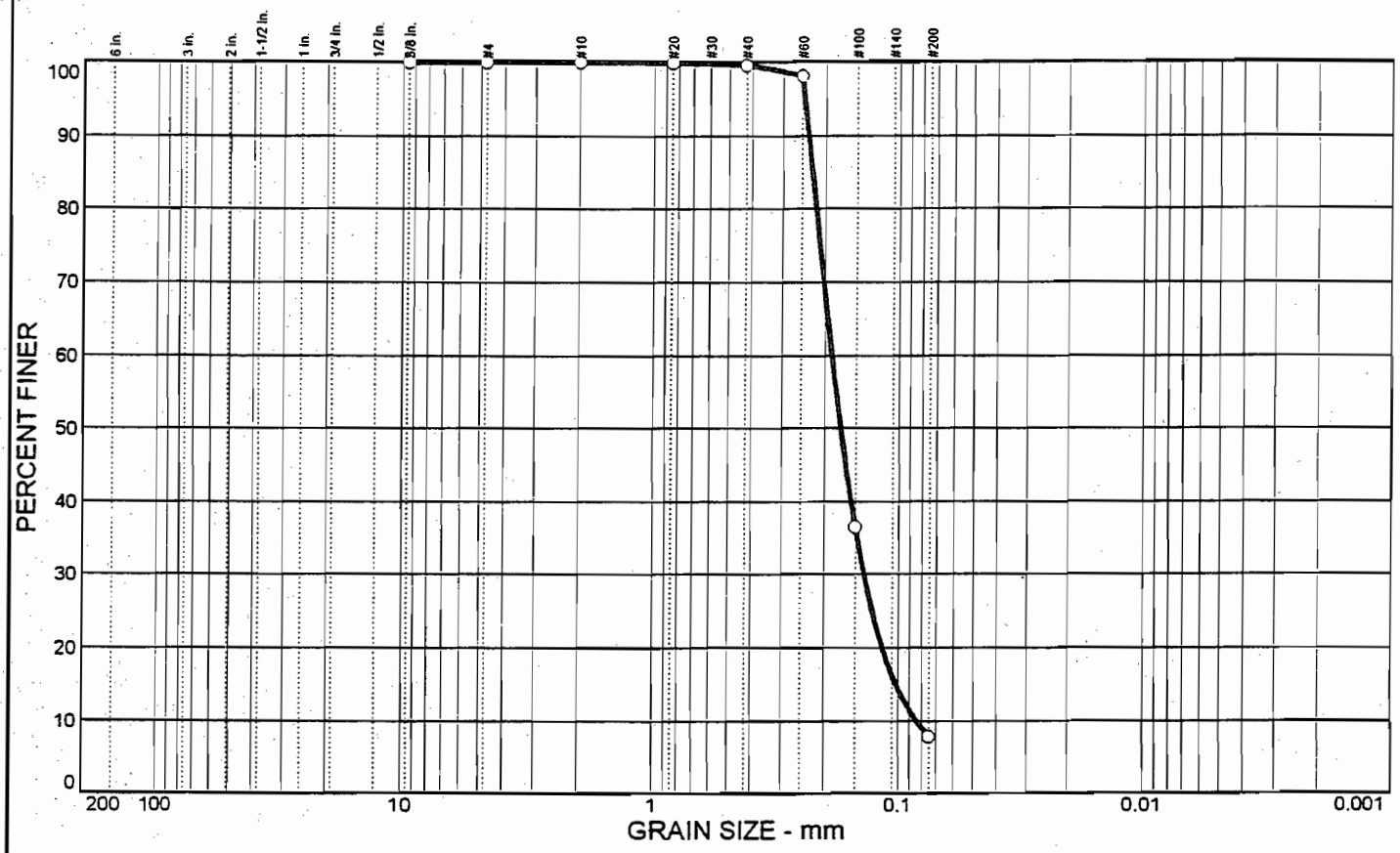
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			92.2	7.8		SP-SM	A-3		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		

GRAIN SIZE			
D_{60}	0.187		
D_{30}	0.138		
D_{10}	0.0841		

COEFFICIENTS			
C_c	1.21		
C_u	2.23		

SIEVE number size	PERCENT FINER ○		
#4	100.0		
#10	100.0		
#20	99.9		
#40	99.6		
#60	98.1		
#100	36.5		
#200	7.8		

SOIL DESCRIPTION

○ Tan Slightly Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 11 Sample No.: 9 Elev./Depth: 30.0'-31.5'

Law Engineering and Environmental Services, Inc.

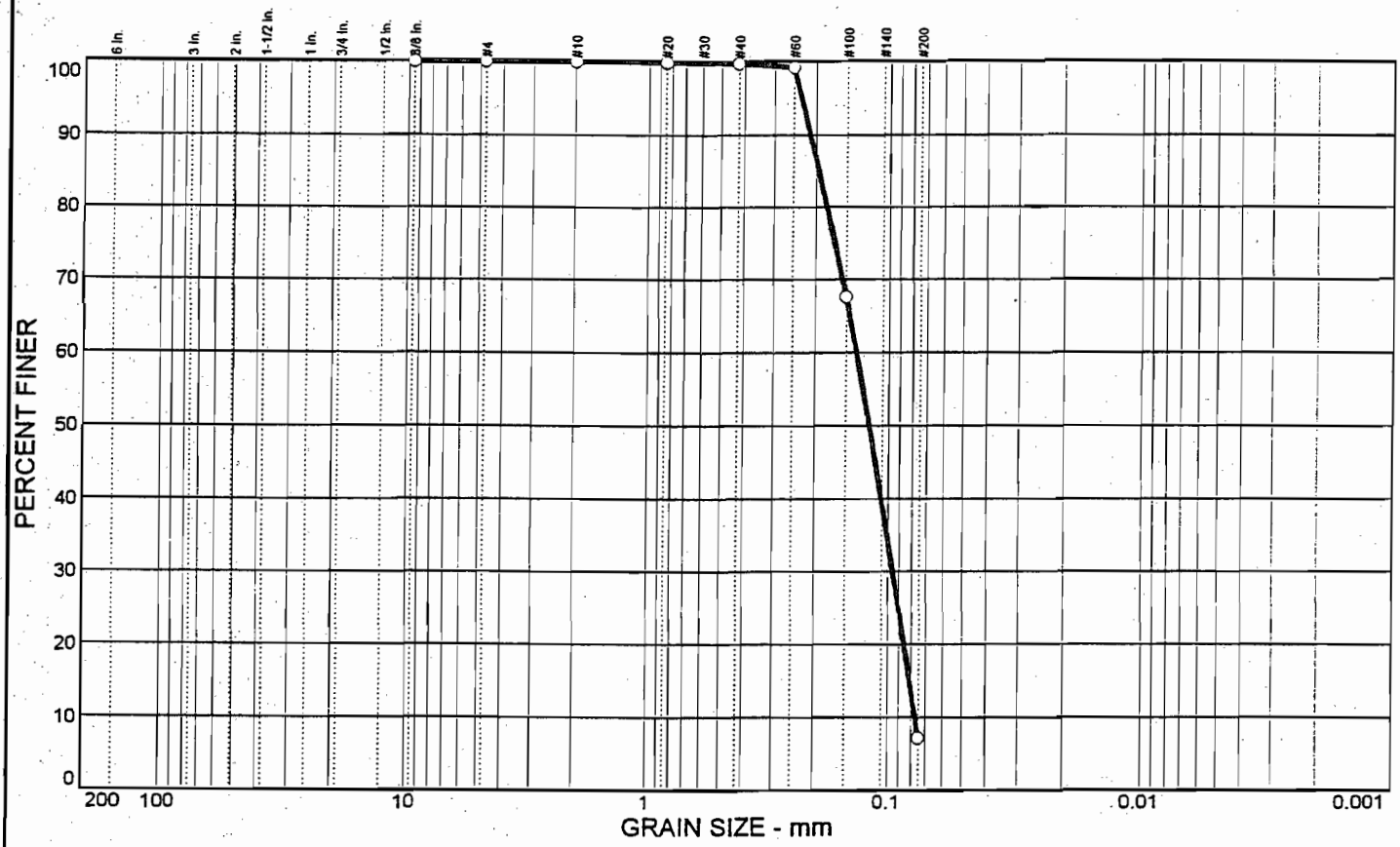
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			92.9	7.1		SP-SM	A-3		

SIEVE inches size	PERCENT FINER ○
.375	100.0

	GRAIN SIZE
D_{60}	0.136
D_{30}	0.0958
D_{10}	0.0773
	COEFFICIENTS
C_c	0.87
C_u	1.75

SIEVE number size	PERCENT FINER ○
#4	100.0
#10	100.0
#20	99.9
#40	99.7
#60	99.2
#100	67.6
#200	7.1

SOIL DESCRIPTION

○ Gray Slightly Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 11 Sample No.: 11 Elev./Depth: 40.0'-41.5'

Law Engineering and Environmental Services, Inc.

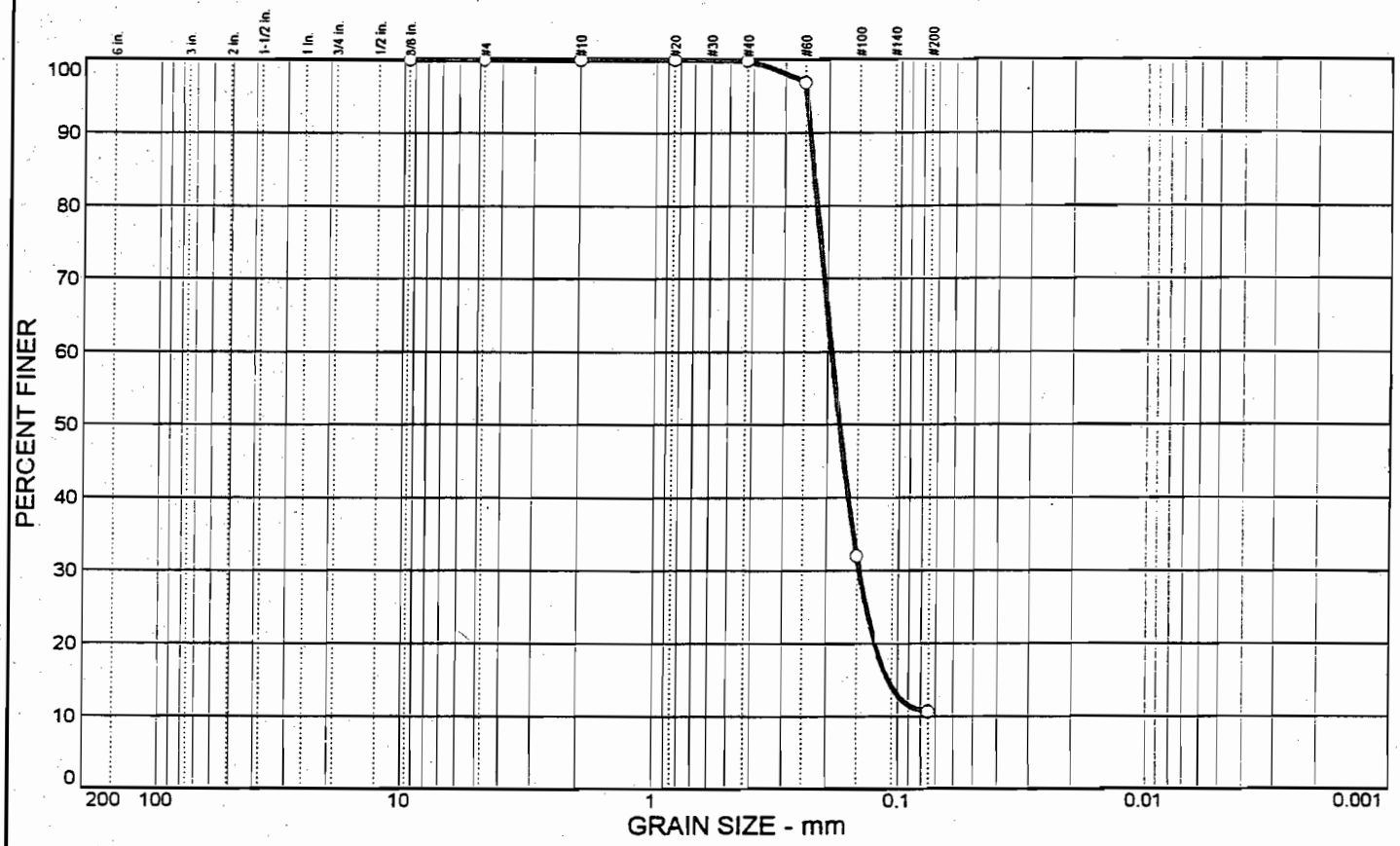
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. HINTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			89.4	10.6		SP-SM	A-2-4(0)		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		

	GRAIN SIZE		
D_{60}	0.193		
D_{30}	0.146		
D_{10}			

	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○
#4	100.0
#10	100.0
#20	100.0
#40	99.8
#60	96.8
#100	32.0
#200	10.6

SOIL DESCRIPTION

○ Gray Slightly Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 11 Sample No.: 14 Elev./Depth: 55.0'-56.5'

Law Engineering and Environmental Services, Inc.

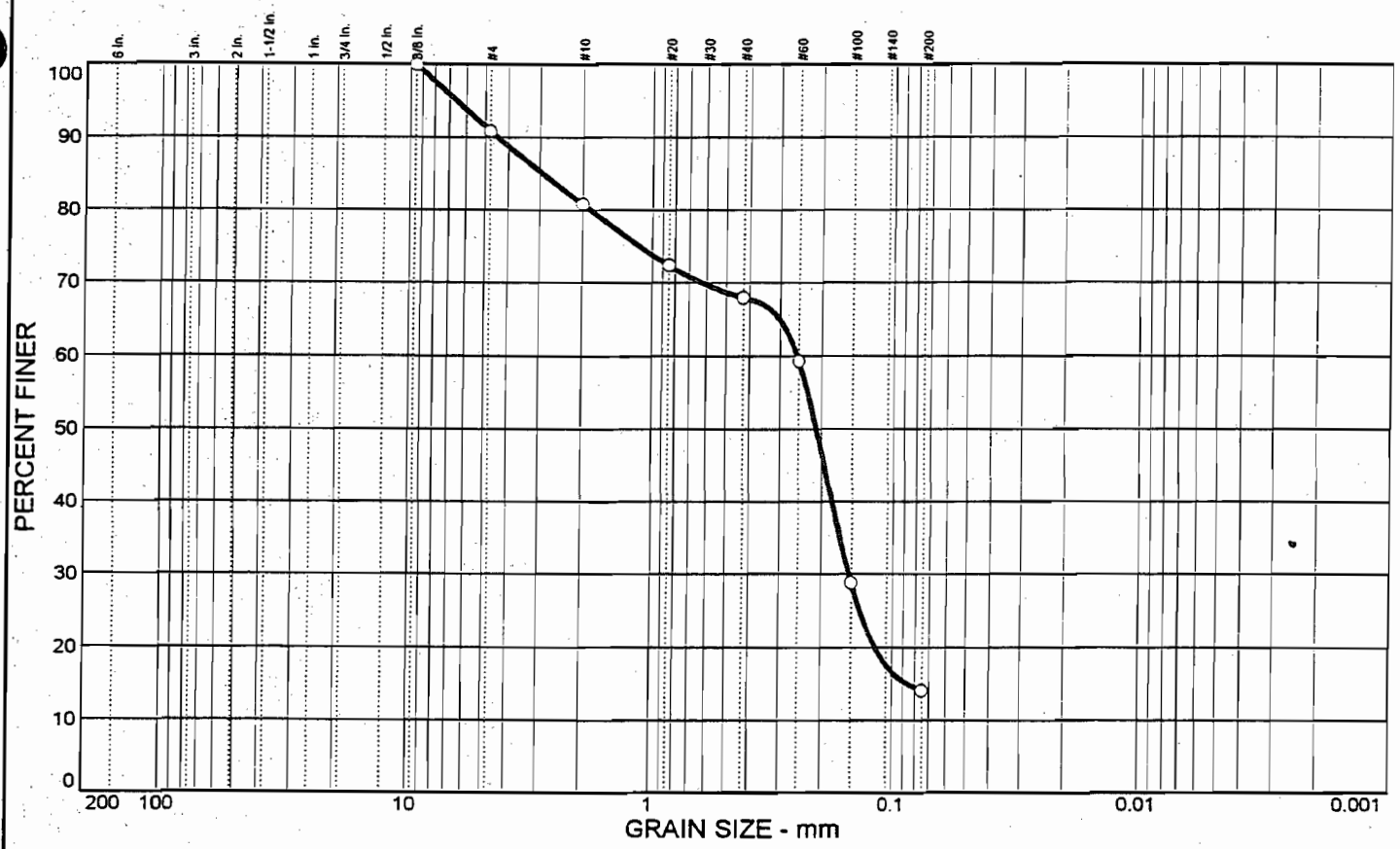
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		9.2	76.8	14.0		SM	A-2-4(0)		

SIEVE inches size	PERCENT FINER ○
.375	100.0

	GRAIN SIZE
D_{60}	0.254
D_{30}	0.153
D_{10}	

	COEFFICIENTS
C_c	
C_u	

SIEVE number size	PERCENT FINER ○
#4	90.8
#10	80.8
#20	72.3
#40	67.9
#60	59.3
#100	28.8
#200	14.0

SOIL DESCRIPTION

○ Dark Gray Silty Fine SAND with rock fragments

REMARKS:

○

○ Source: Boring No. 11 Sample No.: 19 Elev./Depth: 80.0'-81.5'

Law Engineering and Environmental Services, Inc.

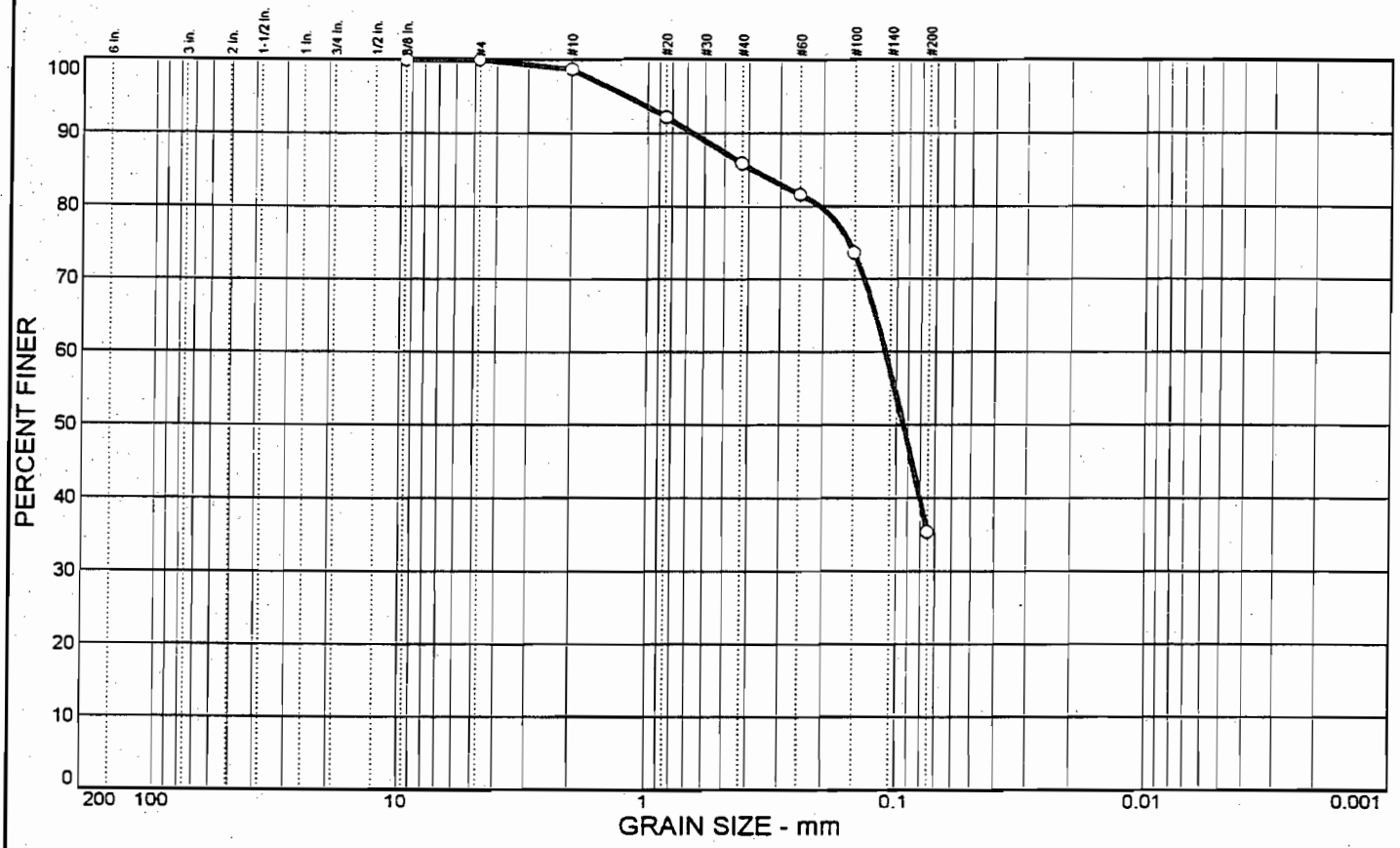
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			64.6	35.4		SM	A-2-4(0)		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		

GRAIN SIZE	
D_{60}	0.111
D_{30}	
D_{10}	

COEFFICIENTS	
C_c	
C_u	

SIEVE number size	PERCENT FINER ○
#4	100.0
#10	98.7
#20	92.1
#40	85.8
#60	81.6
#100	73.5
#200	35.4

SOIL DESCRIPTION

○ Gray Very Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 11 Sample No.: 20 Elev./Depth: 85.0'-86.5'

Law Engineering and Environmental Services, Inc.

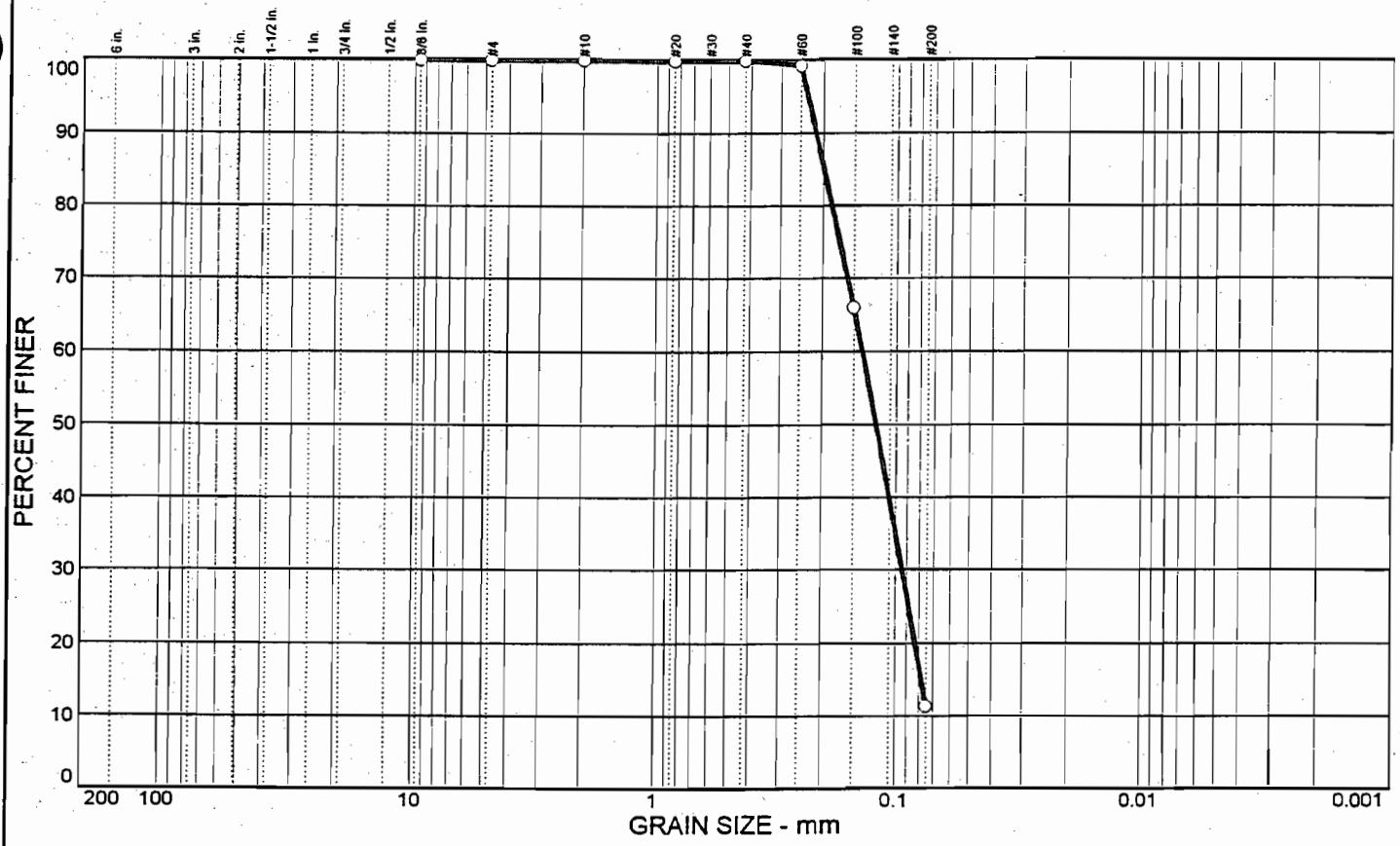
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			88.7	11.3		SP-SM	A-2-4(0)		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		

	GRAIN SIZE		
D_{60}	0.138		
D_{30}	0.0942		
D_{10}			

	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○		
#4	100.0		
#10	100.0		
#20	99.9		
#40	99.9		
#60	99.2		
#100	65.9		
#200	11.3		

SOIL DESCRIPTION

○ White Slightly Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 13 Sample No.: 2 Elev./Depth: 1.5'- 3.0'

Law Engineering and Environmental Services, Inc.

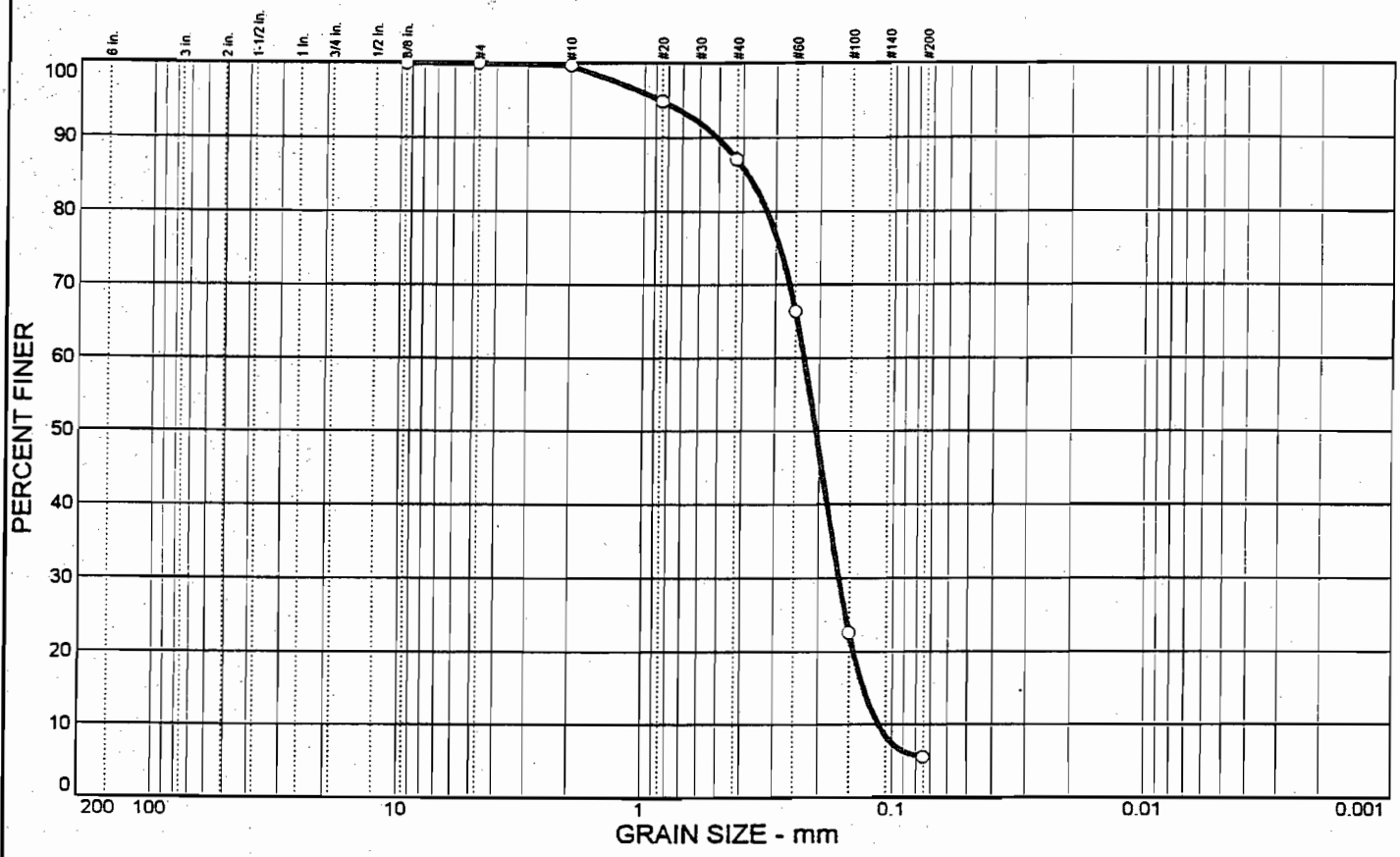
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			94.5	5.5		SP-SM	A-3		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		
	GRAIN SIZE		
D_{60}	0.231		
D_{30}	0.165		
D_{10}	0.114		
	COEFFICIENTS		
C_c	1.04		
C_u	2.03		

SIEVE number size	PERCENT FINER ○
#4	100.0
#10	99.7
#20	94.9
#40	87.0
#60	66.3
#100	22.6
#200	5.5

SOIL DESCRIPTION

○ Dark Gray Slightly Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 13 Sample No.: 13 Elev./Depth: 50.0'-51.5'

Law Engineering and Environmental Services, Inc.

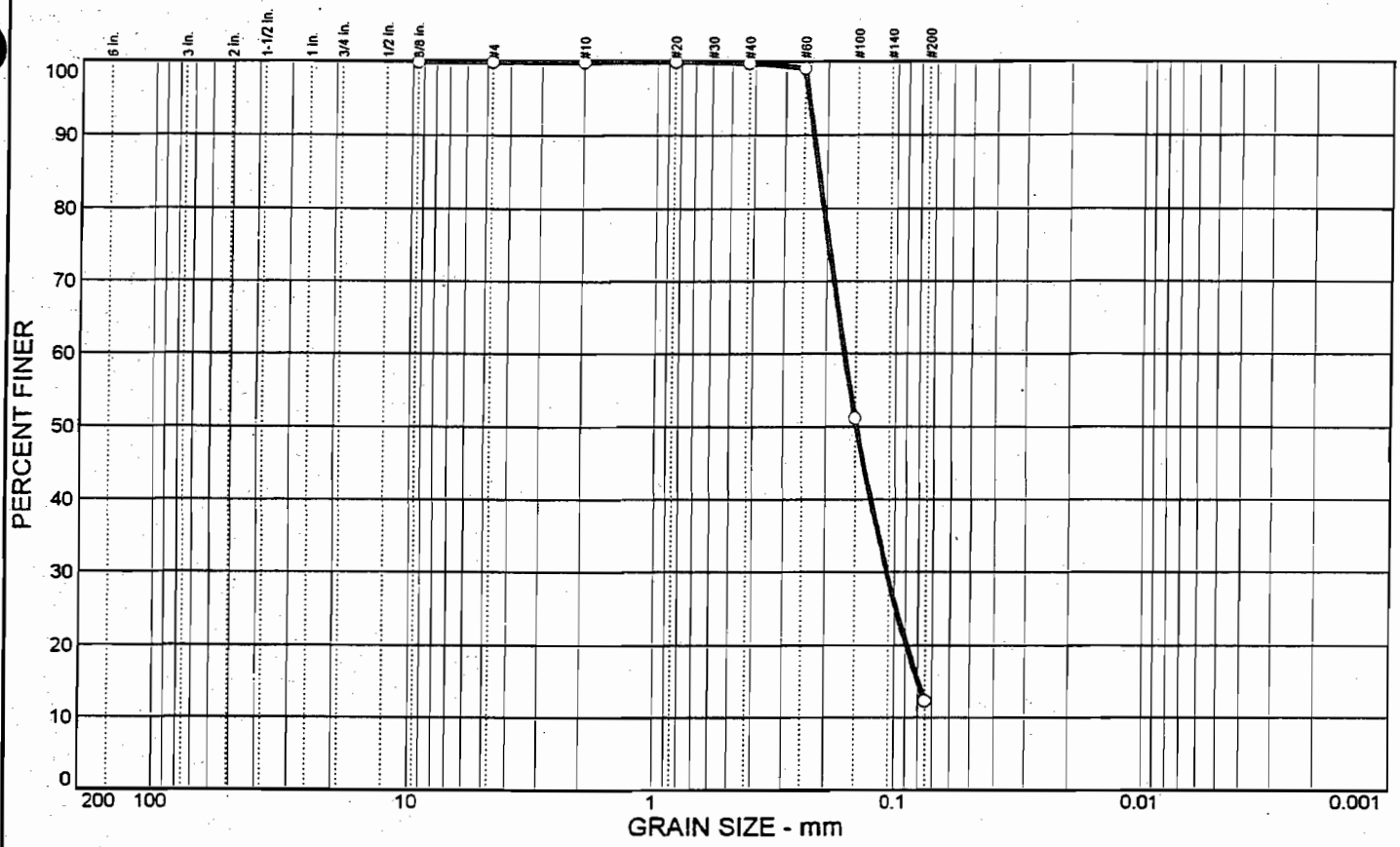
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. HINTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			87.8	12.2		SM	A-2-4(0)		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		

GRAIN SIZE			
D_{60}	0.167		
D_{30}	0.108		
D_{10}			

COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○
#4	100.0
#10	100.0
#20	100.0
#40	99.8
#60	99.1
#100	51.2
#200	12.2

SOIL DESCRIPTION

○ Brown Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 14 Sample No.: 5 Elev./Depth: 8.5'- 10.0'

Law Engineering and Environmental Services, Inc.

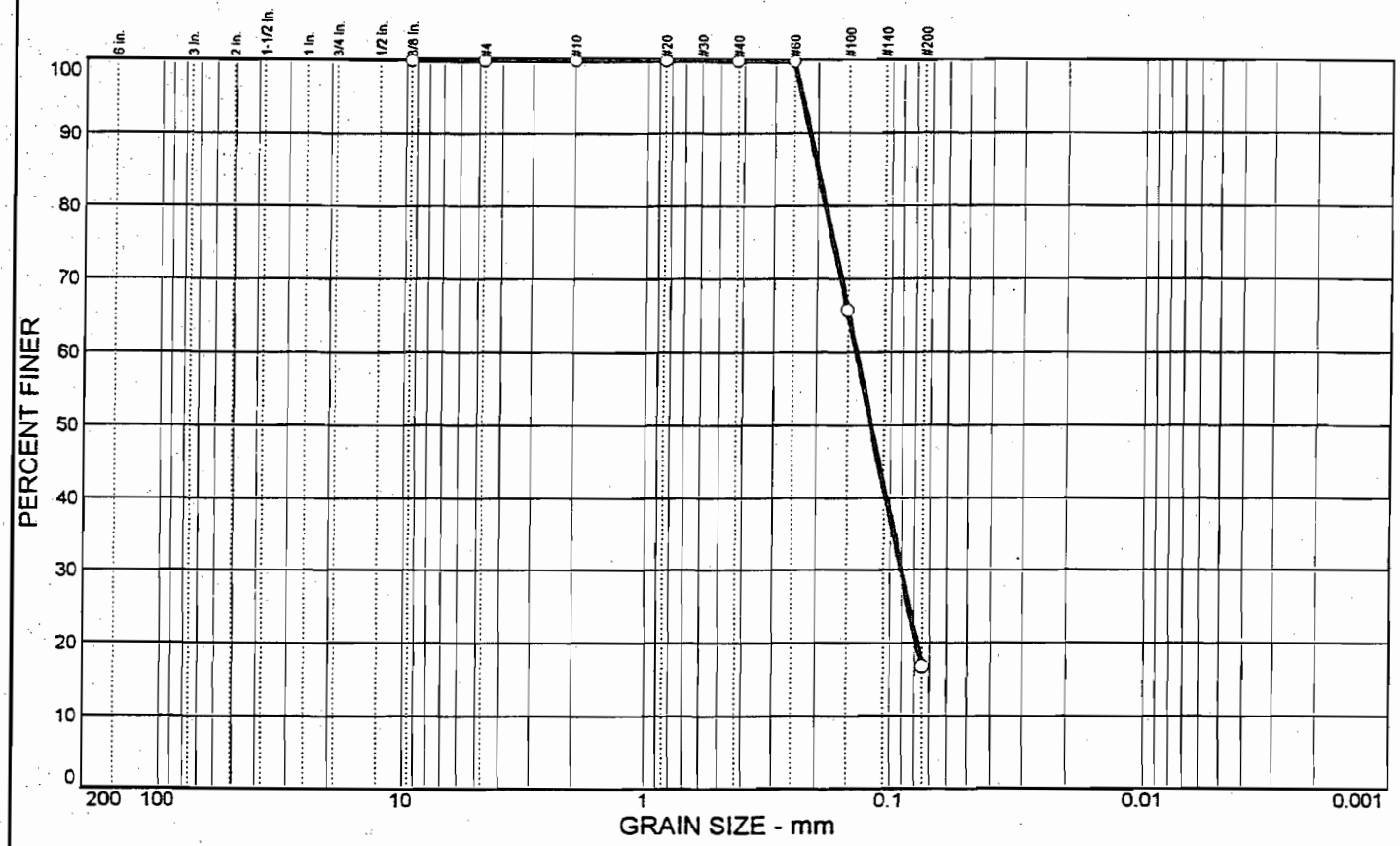
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A UNTERSPAN P E

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			83.3	16.7		SM	A-2-4(0)		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		

GRAIN SIZE			
D_{60}	0.138		
D_{30}	0.0903		
D_{10}			

COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○
#4	100.0
#10	100.0
#20	100.0
#40	99.9
#60	99.8
#100	65.7
#200	16.7

SOIL DESCRIPTION

○ Light Brown Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 14 Sample No.: 7 Elev./Depth: 20.0'-21.5'

Law Engineering and Environmental Services, Inc.

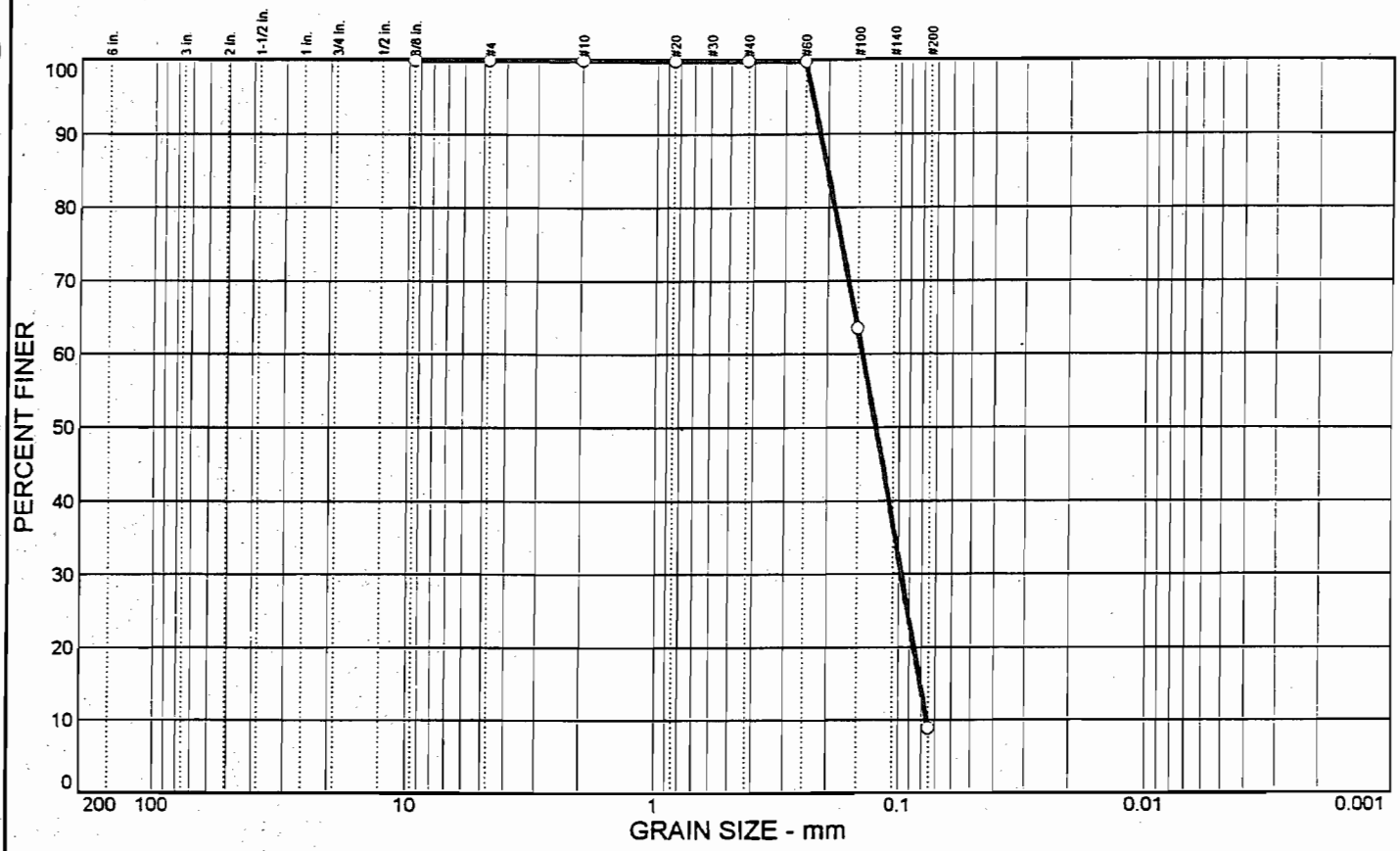
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			91.2	8.8		SP-SM	A-3		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		

GRAIN SIZE			
D_{60}	0.143		
D_{30}	0.0975		
D_{10}	0.0761		

COEFFICIENTS			
C_c	0.87		
C_u	1.88		

SIEVE number size	PERCENT FINER ○		
#4	100.0		
#10	100.0		
#20	99.9		
#40	99.9		
#60	99.8		
#100	63.5		
#200	8.8		

SOIL DESCRIPTION

○ Gray Slightly Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 14 Sample No.: 12 Elev./Depth: 45.0'-46.5'

Law Engineering and Environmental Services, Inc.

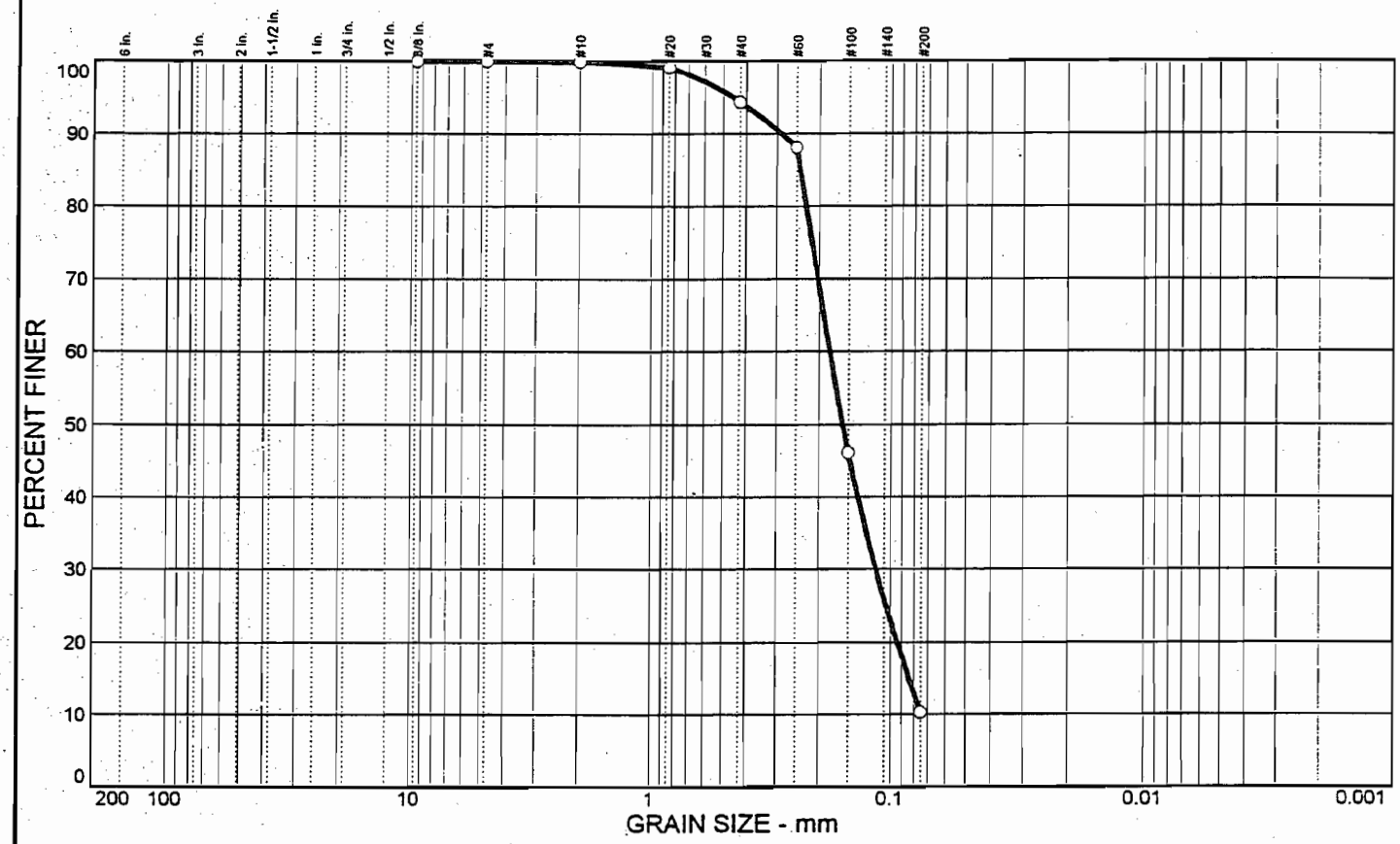
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			89.8	10.2		SP-SM	A-3		

SIEVE inches size	PERCENT FINER ○
.375	100.0

	GRAIN SIZE
D_{60}	0.180
D_{30}	0.115
D_{10}	

	COEFFICIENTS
C_c	
C_u	

SIEVE number size	PERCENT FINER ○
#4	100.0
#10	99.9
#20	99.1
#40	94.3
#60	88.0
#100	46.1
#200	10.2

SOIL DESCRIPTION

○ Gray Slightly Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 14 Sample No.: 15 Elev./Depth: 60.0'-61.5'

Law Engineering and Environmental Services, Inc.

Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		13.2	33.7	53.1		ML	A-4(0)		

SIEVE inches size	PERCENT FINER ○		
.5	100.0		
.375	90.2		
GRAIN SIZE			
D_{60}	0.108		
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○		
#4	86.8		
#10	83.8		
#20	81.4		
#40	79.0		
#60	75.0		
#100	66.3		
#200	53.1		

SOIL DESCRIPTION

○ Brown Gray Very Sandy SILT

REMARKS:

○

○ Source: Boring No. 14 Sample No.: 22 Elev./Depth: 95.0'-96.5'

Law Engineering and Environmental Services, Inc.

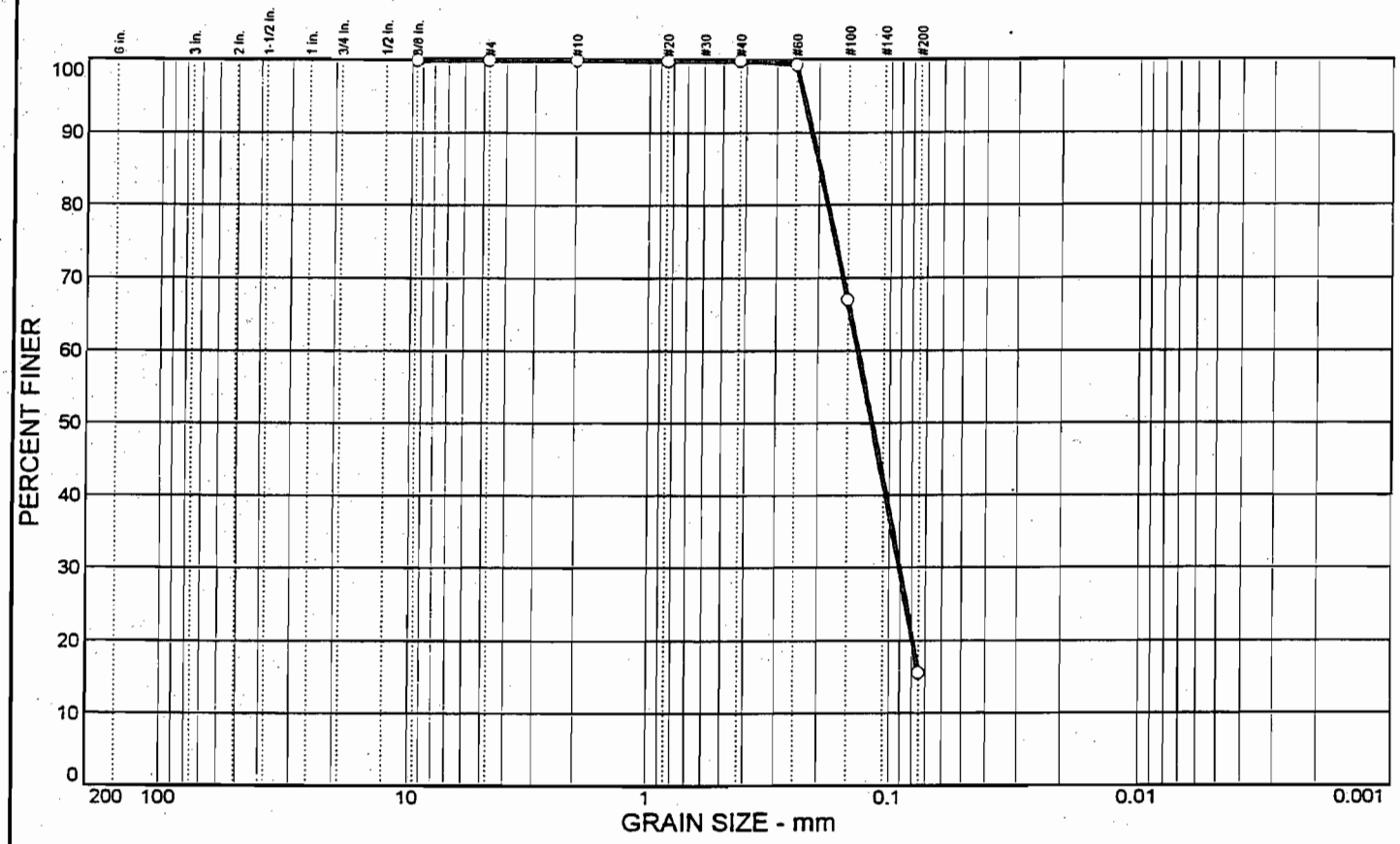
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			84.5	15.5		SM	A-2-4(0)		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		
	GRAIN SIZE		
D_{60}	0.136		
D_{30}	0.0905		
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○		
#4	100.0		
#10	100.0		
#20	99.9		
#40	99.9		
#60	99.4		
#100	67.0		
#200	15.5		

SOIL DESCRIPTION

○ Brown Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 15 Sample No.: 4 Elev./Depth: 6.0'- 7.5'

Law Engineering and Environmental Services, Inc.

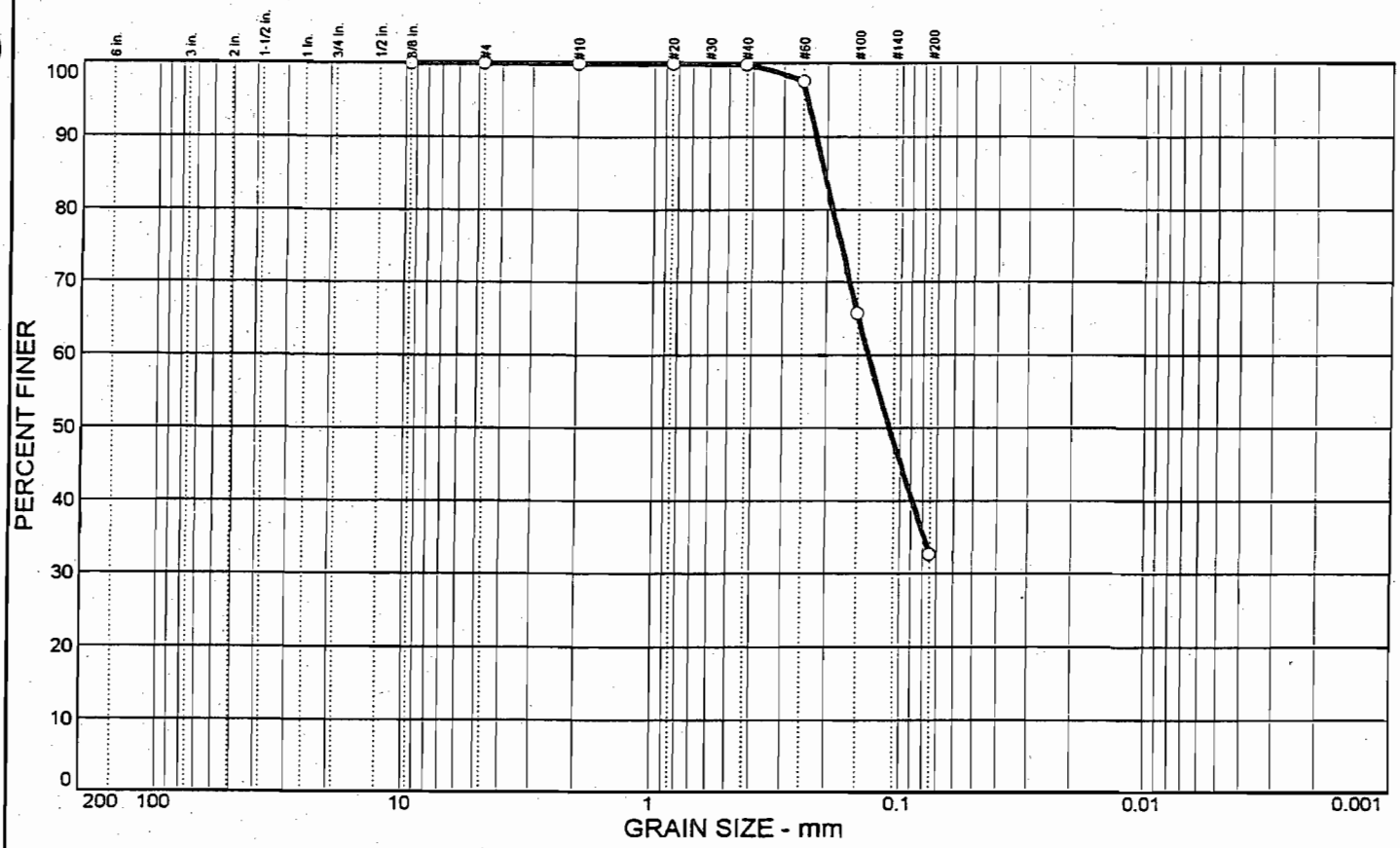
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			67.4	32.6		SM	A-2-4(0)		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		
	GRAIN SIZE		
D_{60}	0.135		
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○		
#4	100.0		
#10	100.0		
#20	100.0		
#40	99.8		
#60	97.5		
#100	65.7		
#200	32.6		

SOIL DESCRIPTION

○ Brown Gray Very Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 15 Sample No.: 10 Elev./Depth: 35.0'-36.5'

Law Engineering and Environmental Services, Inc.

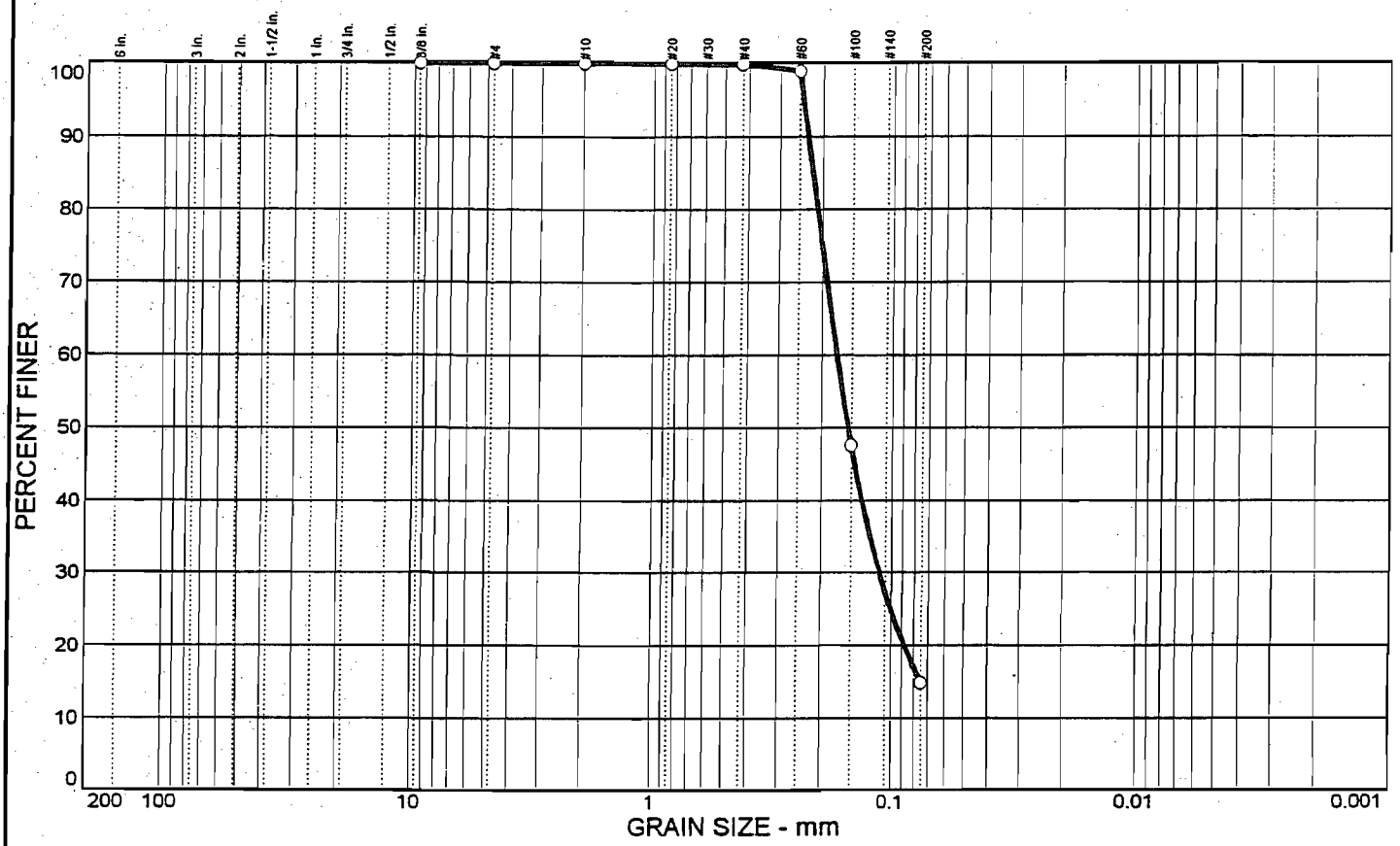
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			85.2	14.8		SM	A-2-4(0)		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		
	GRAIN SIZE		
D_{60}	0.173		
D_{30}	0.113		
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○
#4	100.0
#10	100.0
#20	99.9
#40	99.8
#60	98.9
#100	47.6
#200	14.8

SOIL DESCRIPTION

○ Gray Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 15 Sample No.: 13 Elev./Depth: 50.0'-51.5'

Law Engineering and Environmental Services, Inc.

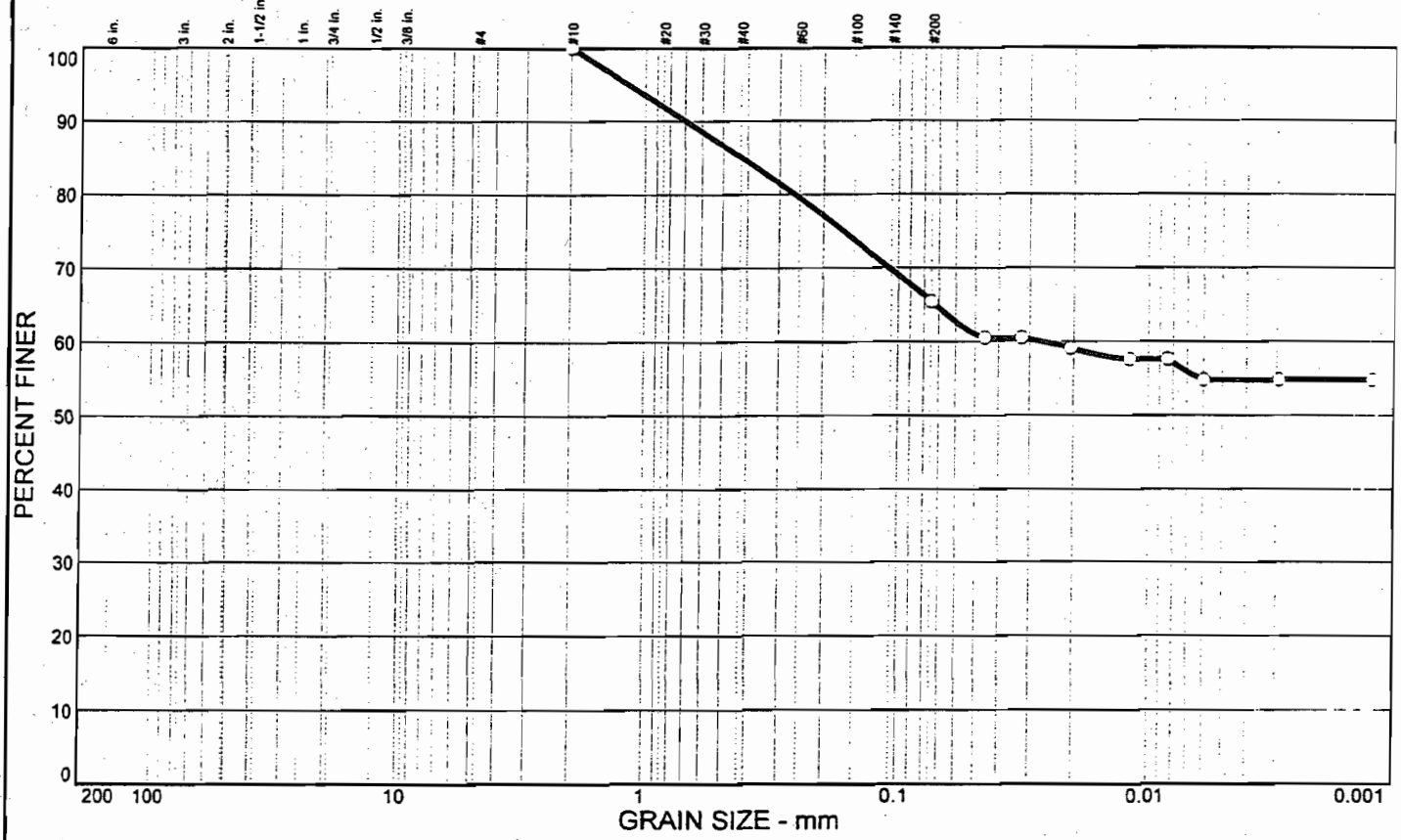
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN. P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			34.6	10.6	54.8	MH	A-7-5(13)	56	71

SIEVE inches size	PERCENT FINER ○		
	GRAIN SIZE		
D_{60}	0.0270		
D_{30}			
D_{10}			
	COEFFICIENTS		
C_C			
C_u			

SIEVE number size	PERCENT FINER ○		
#10	100.0		
#200	65.4		

SOIL DESCRIPTION

○ Gray Slightly Silty Very Sandy CLAY

REMARKS:

○

○ Source: Boring No. B-15 Sample No.: 20 Elev./Depth: 85.0'- 86.5'

Law Engineering and Environmental Services, Inc.

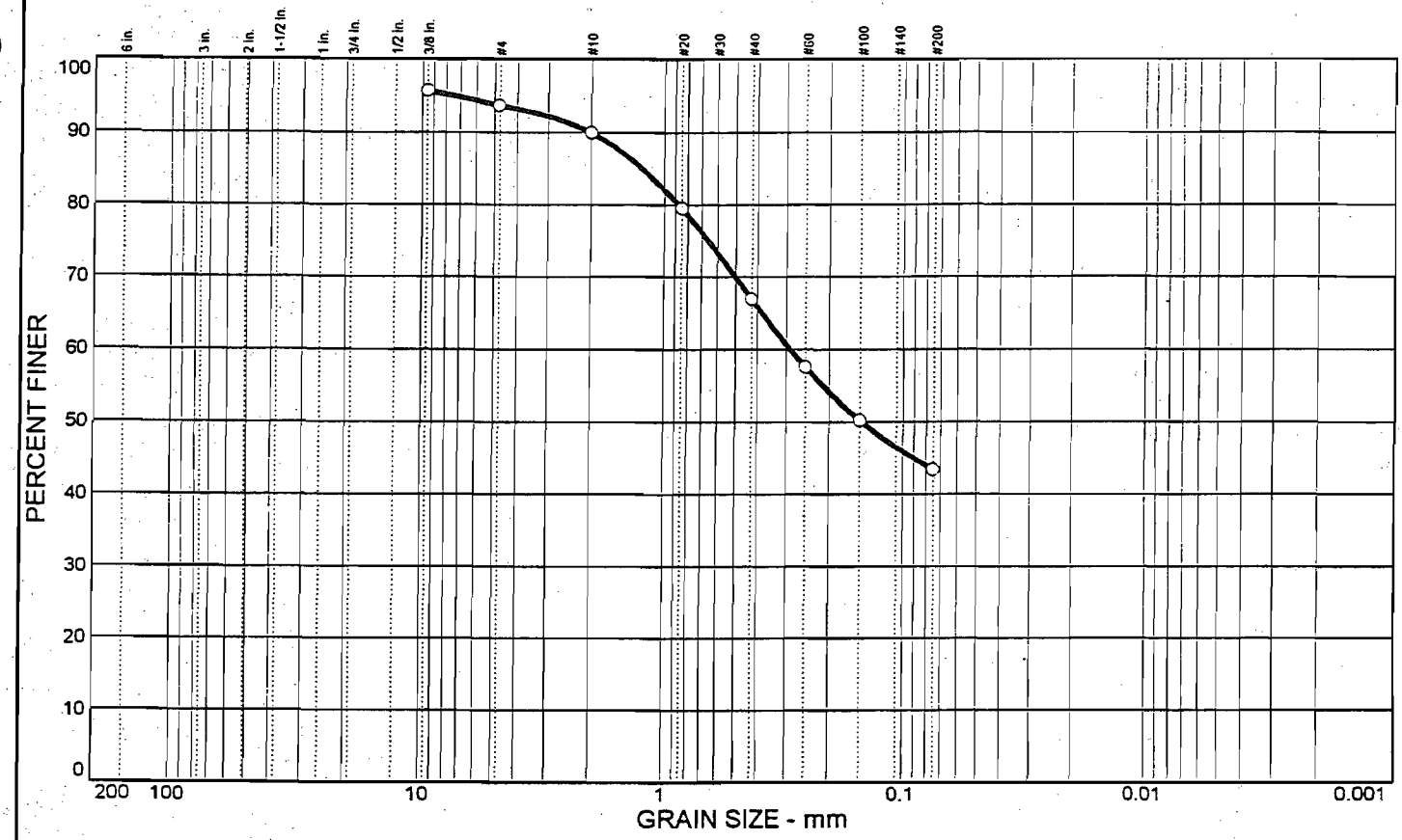
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			50.3	43.4		SC	A-4(0)		

SIEVE inches size	PERCENT FINER ○		
.375	95.7		
	GRAIN SIZE		
D_{60}	0.289		
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○		
#4	93.7		
#10	89.9		
#20	79.5		
#40	66.9		
#60	57.6		
#100	50.2		
#200	43.4		

SOIL DESCRIPTION

○ Brown Gray Very Clayey Fine SAND

REMARKS:

○

○ Source: Boring No. 15 Sample No.: 23 Elev./Depth: 95.0'-96.5'

Law Engineering and Environmental Services, Inc.

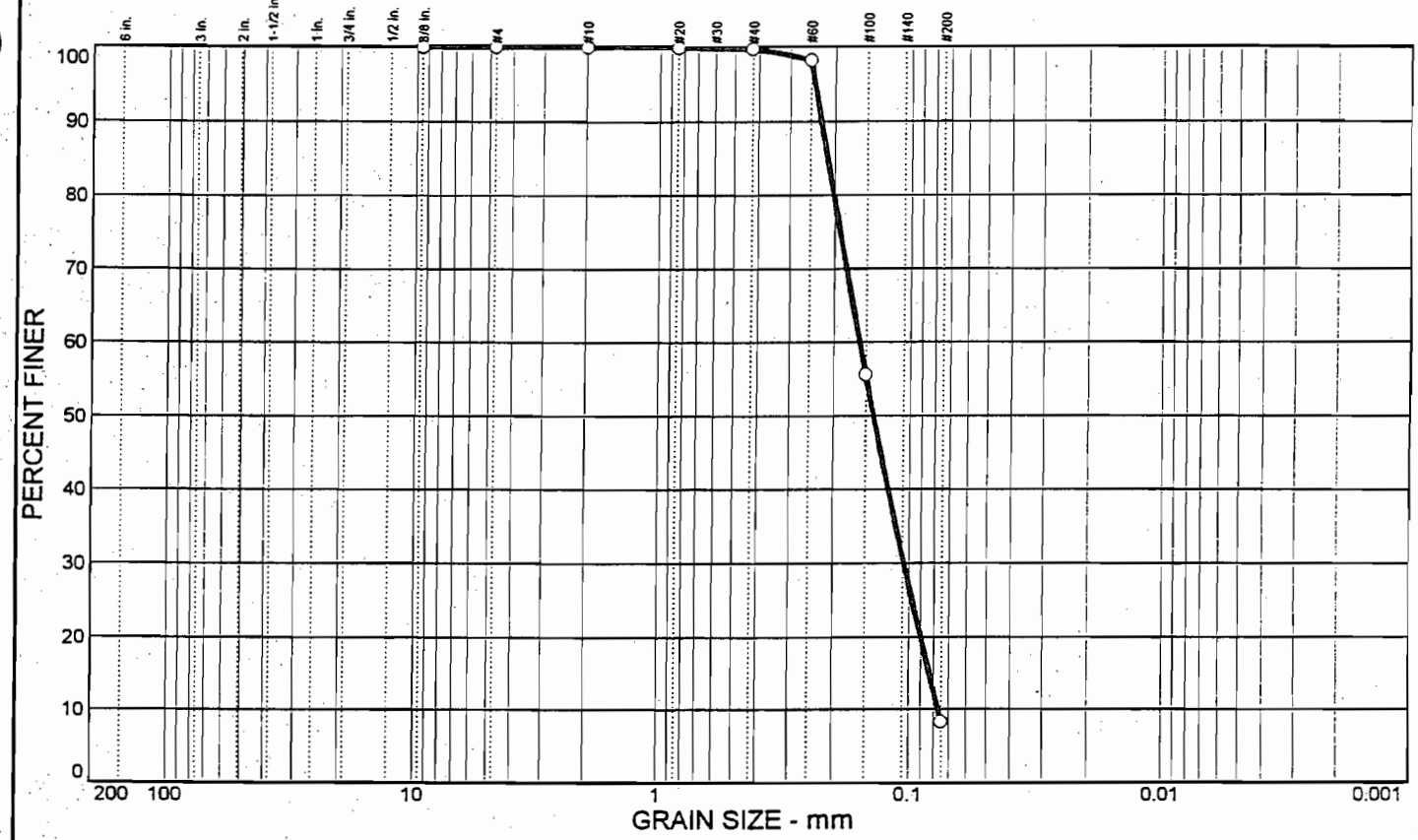
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			91.8	8.2		SP-SM	A-3		

SIEVE inches size	PERCENT FINER ○
.375	100.0

	GRAIN SIZE
D_{60}	0.159
D_{30}	0.105
D_{10}	0.0771

	COEFFICIENTS
C_c	0.90
C_u	2.06

SIEVE number size	PERCENT FINER ○
#4	100.0
#10	100.0
#20	99.9
#40	99.7
#60	98.2
#100	55.6
#200	8.2

SOIL DESCRIPTION

○ Light Brown Slightly Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 16 Sample No.: 6 Elev./Depth: 15.0'-16.5'

Law Engineering and Environmental Services, Inc.

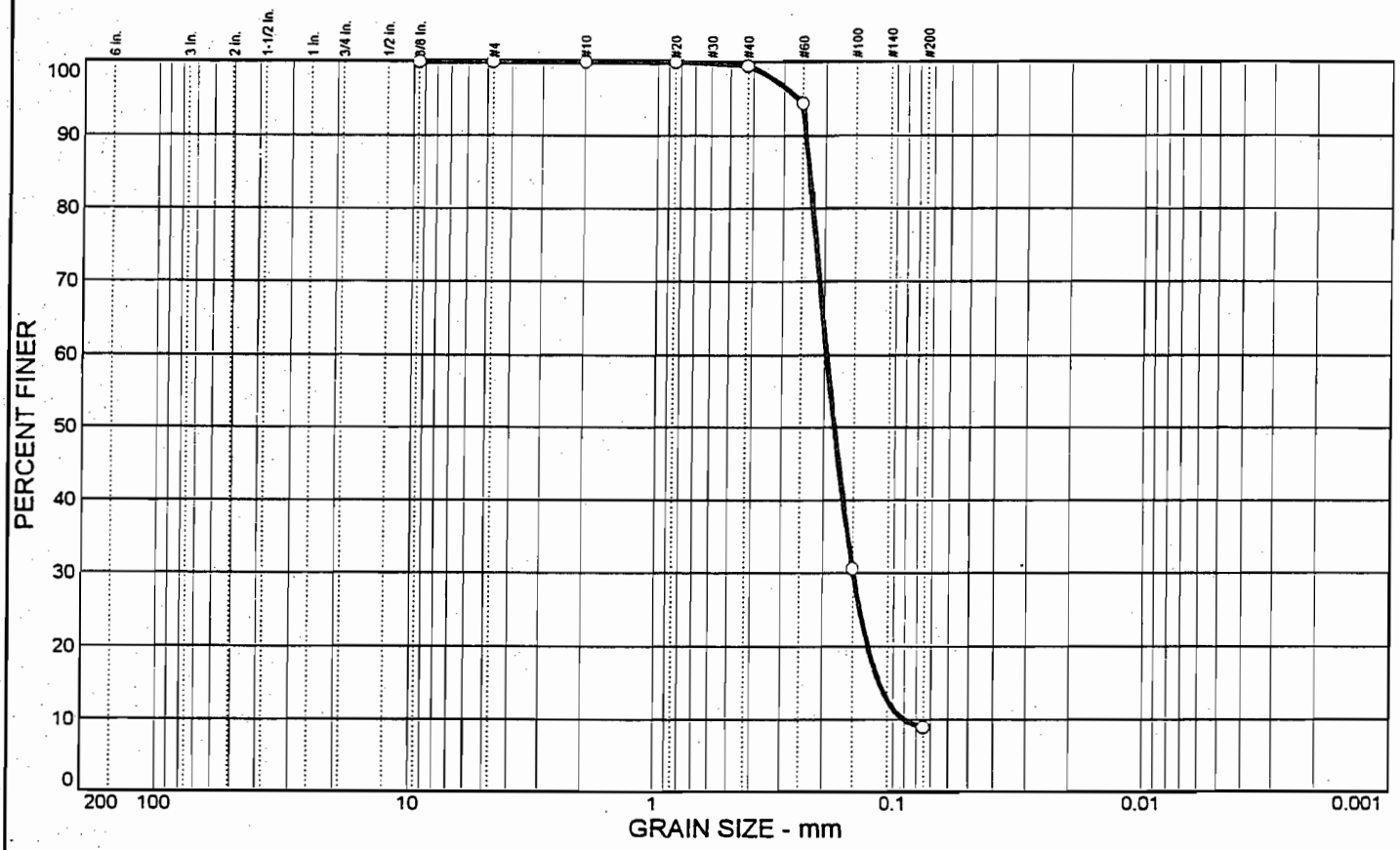
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			91.1	8.9		SP-SM	A-3		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		

	GRAIN SIZE		
D_{60}	0.195		
D_{30}	0.149		
D_{10}	0.0902		

	COEFFICIENTS		
C_c	1.26		
C_u	2.16		

SIEVE number size	PERCENT FINER ○		
#4	100.0		
#10	100.0		
#20	100.0		
#40	99.5		
#60	94.4		
#100	30.6		
#200	8.9		

SOIL DESCRIPTION

○ Light Brown Slightly Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 16 Sample No.: 8 Elev./Depth: 25.0'-26.5'

Law Engineering and Environmental Services, Inc.

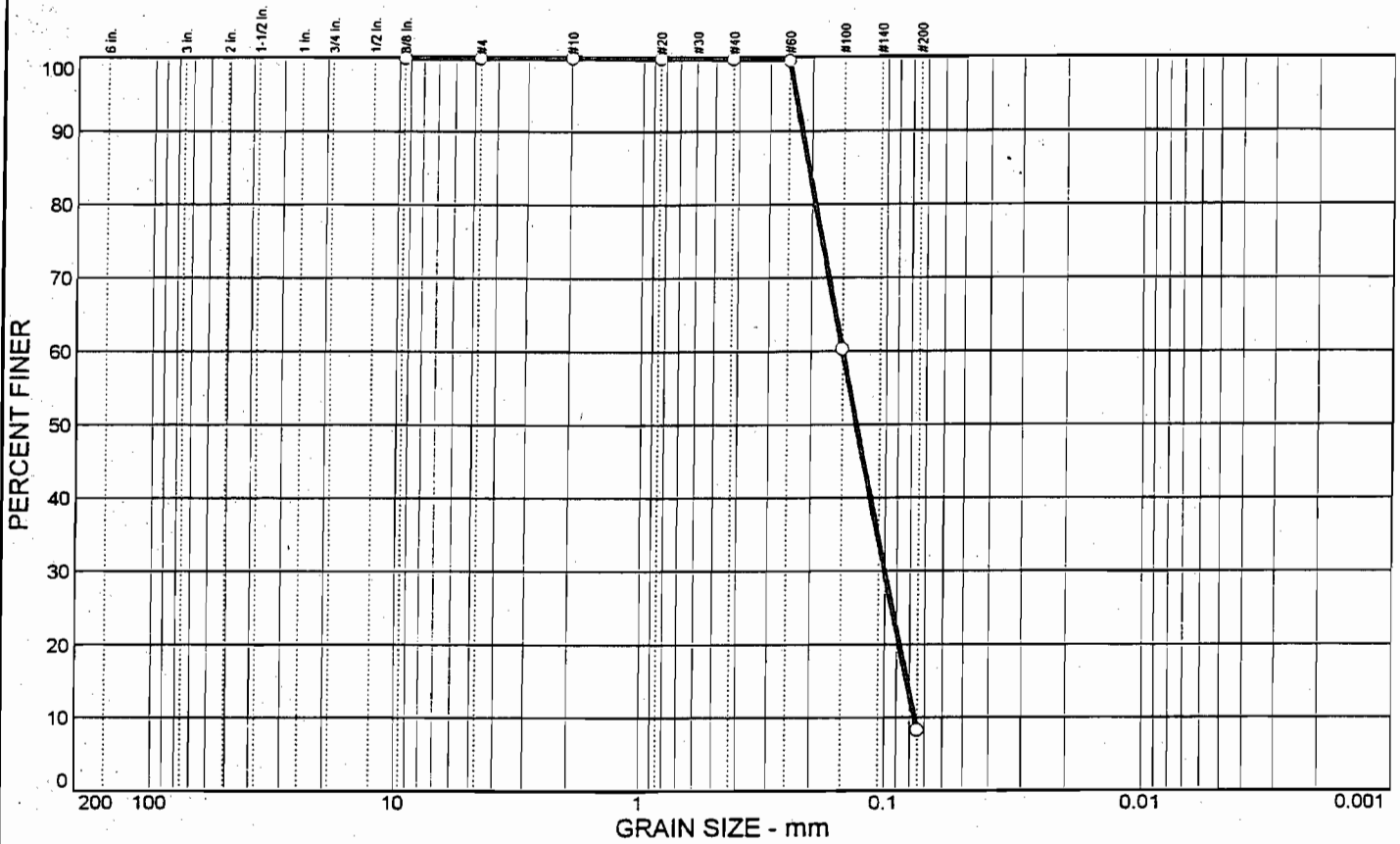
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			91.8	8.2		SP-SM	A-3		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		

	GRAIN SIZE		
D_{60}	0.149		
D_{30}	0.100		
D_{10}	0.0768		

	COEFFICIENTS		
C_c	0.88		
C_u	1.94		

SIEVE number size	PERCENT FINER ○
#4	100.0
#10	100.0
#20	99.9
#40	99.8
#60	99.6
#100	60.3
#200	8.2

SOIL DESCRIPTION

○ Gray Slightly Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 16 Sample No.: 11 Elev./Depth: 40.0'-41.5'

Law Engineering and Environmental Services, Inc.

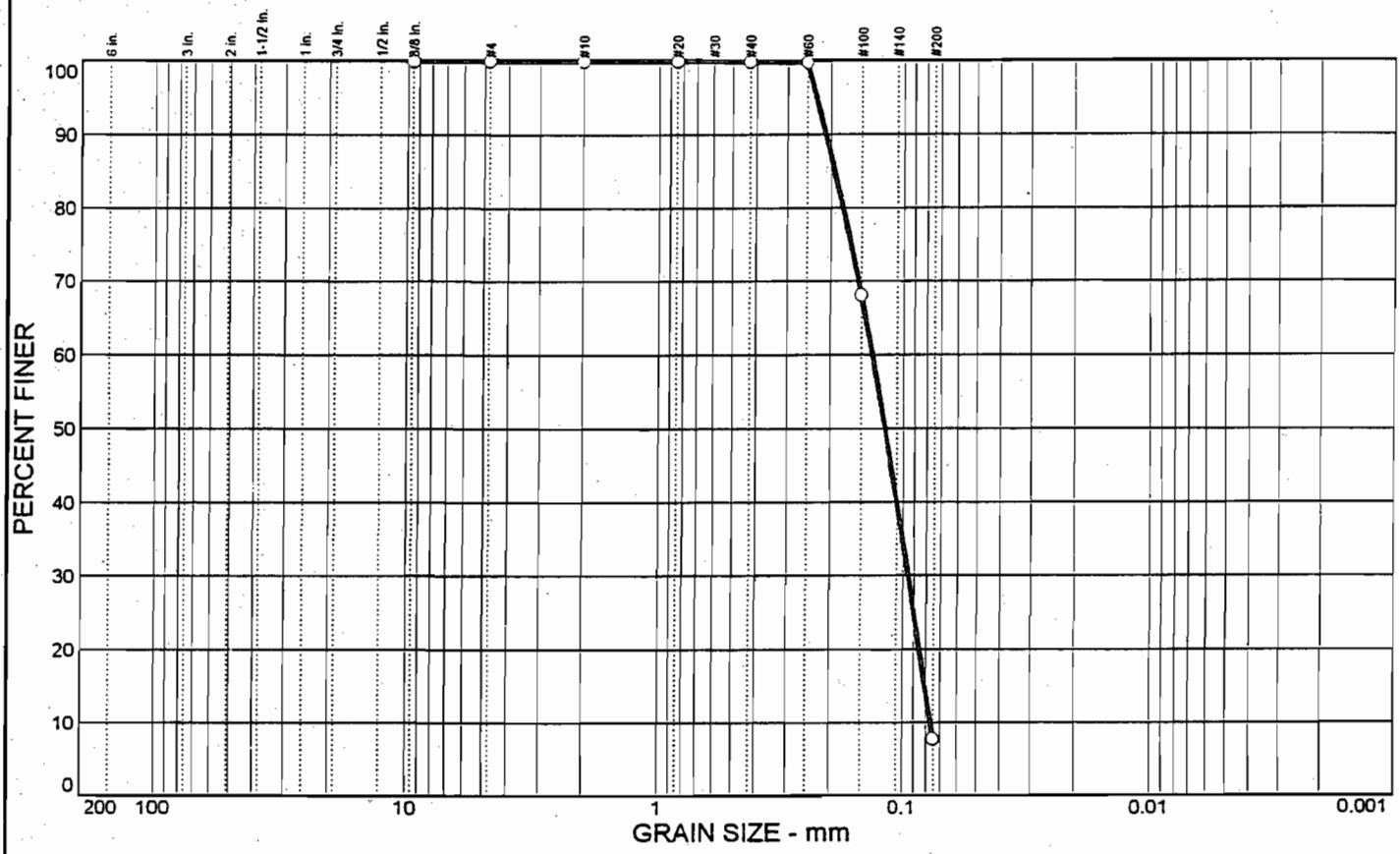
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			92.3	7.7		SP-SM	A-3		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		

GRAIN SIZE			
D_{60}	0.135		
D_{30}	0.0952		
D_{10}	0.0769		

COEFFICIENTS			
C_c	0.87		
C_u	1.75		

SIEVE number size	PERCENT FINER ○		
#4	100.0		
#10	100.0		
#20	100.0		
#40	99.9		
#60	99.8		
#100	68.1		
#200	7.7		

SOIL DESCRIPTION

○ Gray Slightly Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 16 Sample No.: 14 Elev./Depth: 55.0'-56.5'

Law Engineering and Environmental Services, Inc.

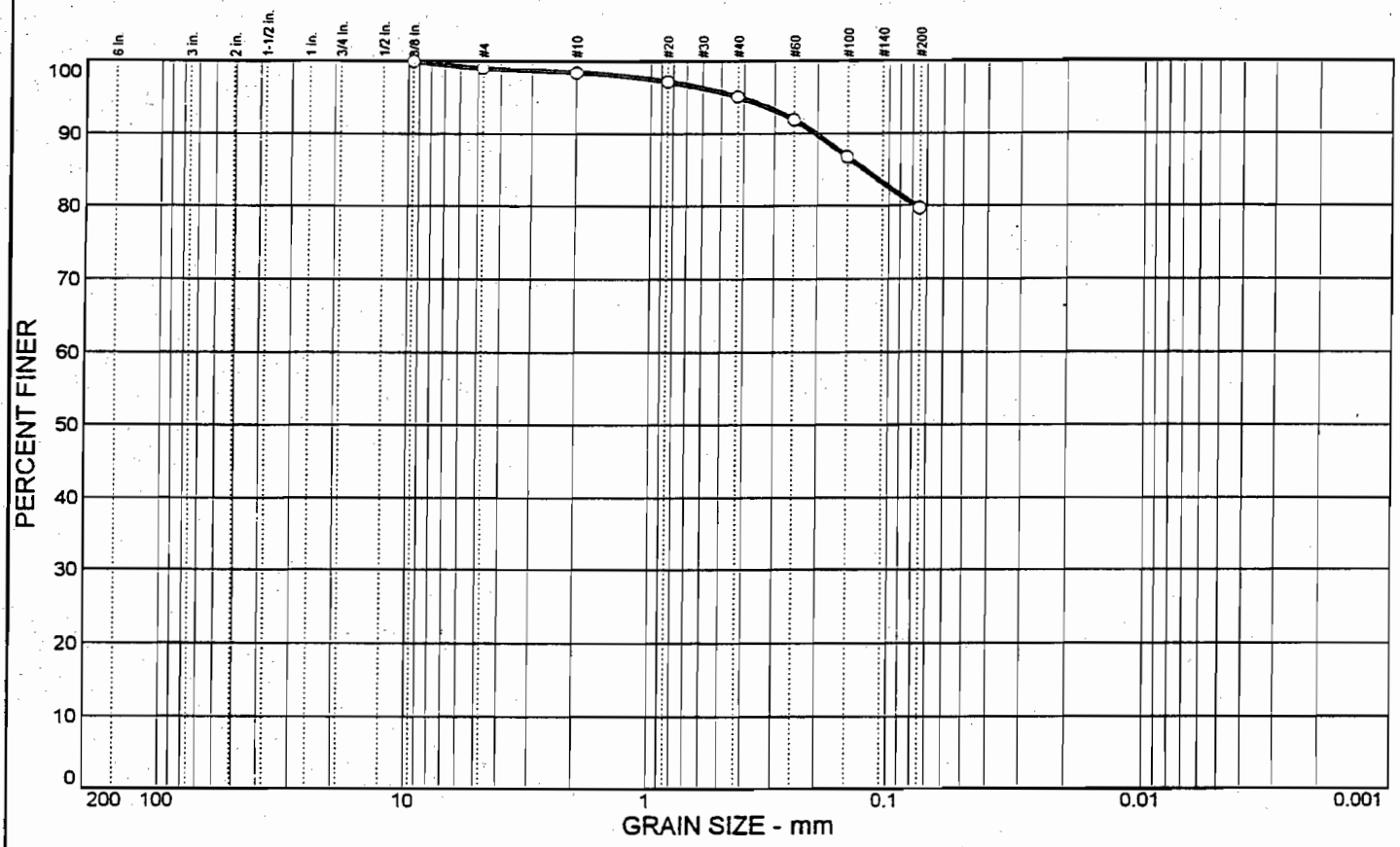
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		1.0	19.4	79.6		ML	A-4(0)		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		
	GRAIN SIZE		
D_{60}			
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○		
#4	99.0		
#10	98.4		
#20	97.1		
#40	95.0		
#60	91.8		
#100	86.7		
#200	79.6		

SOIL DESCRIPTION

○ White Sandy SILT

REMARKS:

○

○ Source: Boring No. 16 Sample No.: 21 Elev./Depth: 90.0'-91.5'

Law Engineering and Environmental Services, Inc.

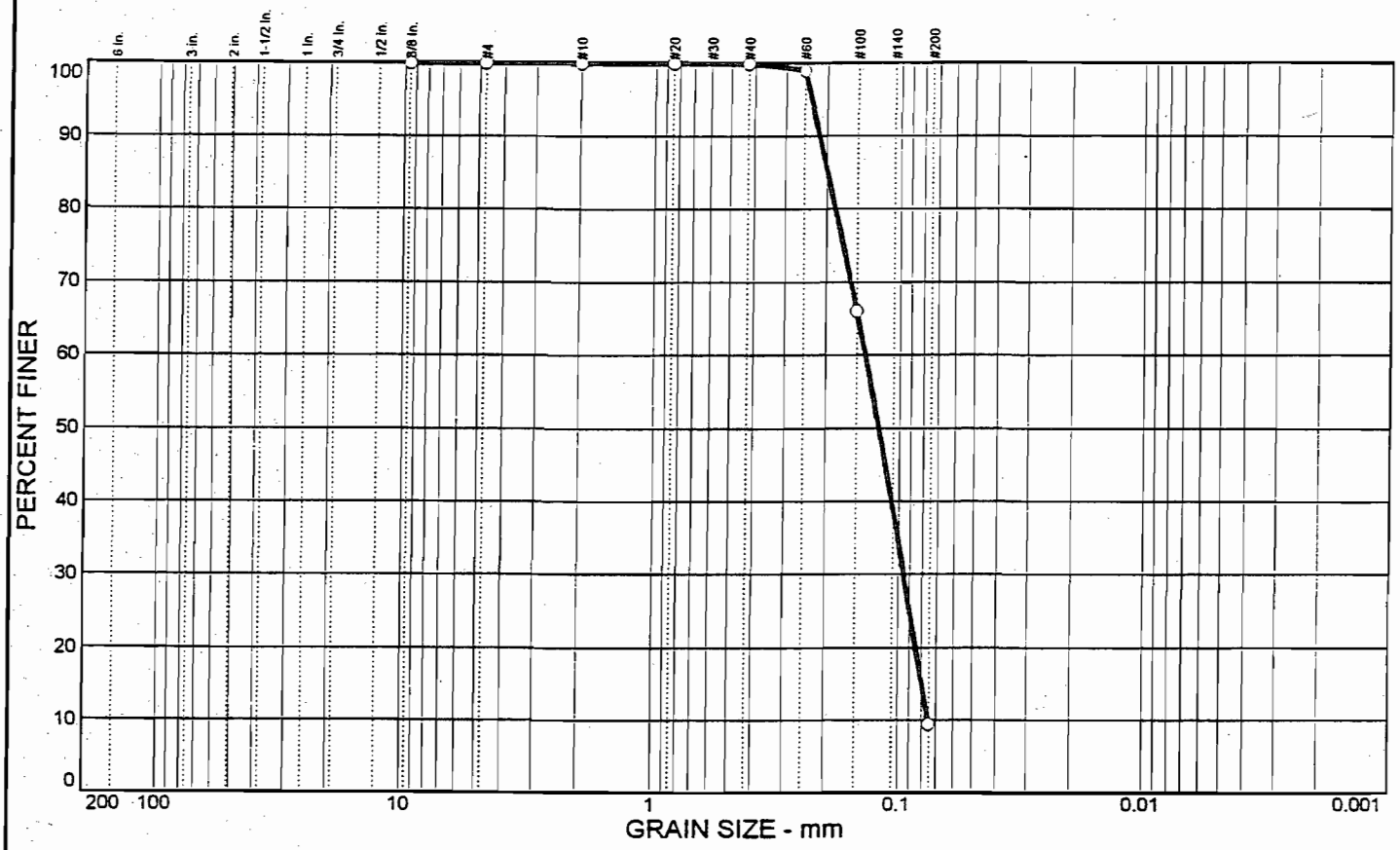
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			90.7	9.3		SP-SM	A-3		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		
	GRAIN SIZE		
D_{60}	0.138		
D_{30}	0.0954		
D_{10}	0.0756		
	COEFFICIENTS		
C_c	0.87		
C_u	1.83		

SIEVE number size	PERCENT FINER ○		
#4	100.0		
#10	100.0		
#20	100.0		
#40	99.9		
#60	99.0		
#100	66.0		
#200	9.3		

SOIL DESCRIPTION

○ Light Brown Slightly Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 18 Sample No.: 5 Elev./Depth: 8.5'- 10.0'

Law Engineering and Environmental Services, Inc.

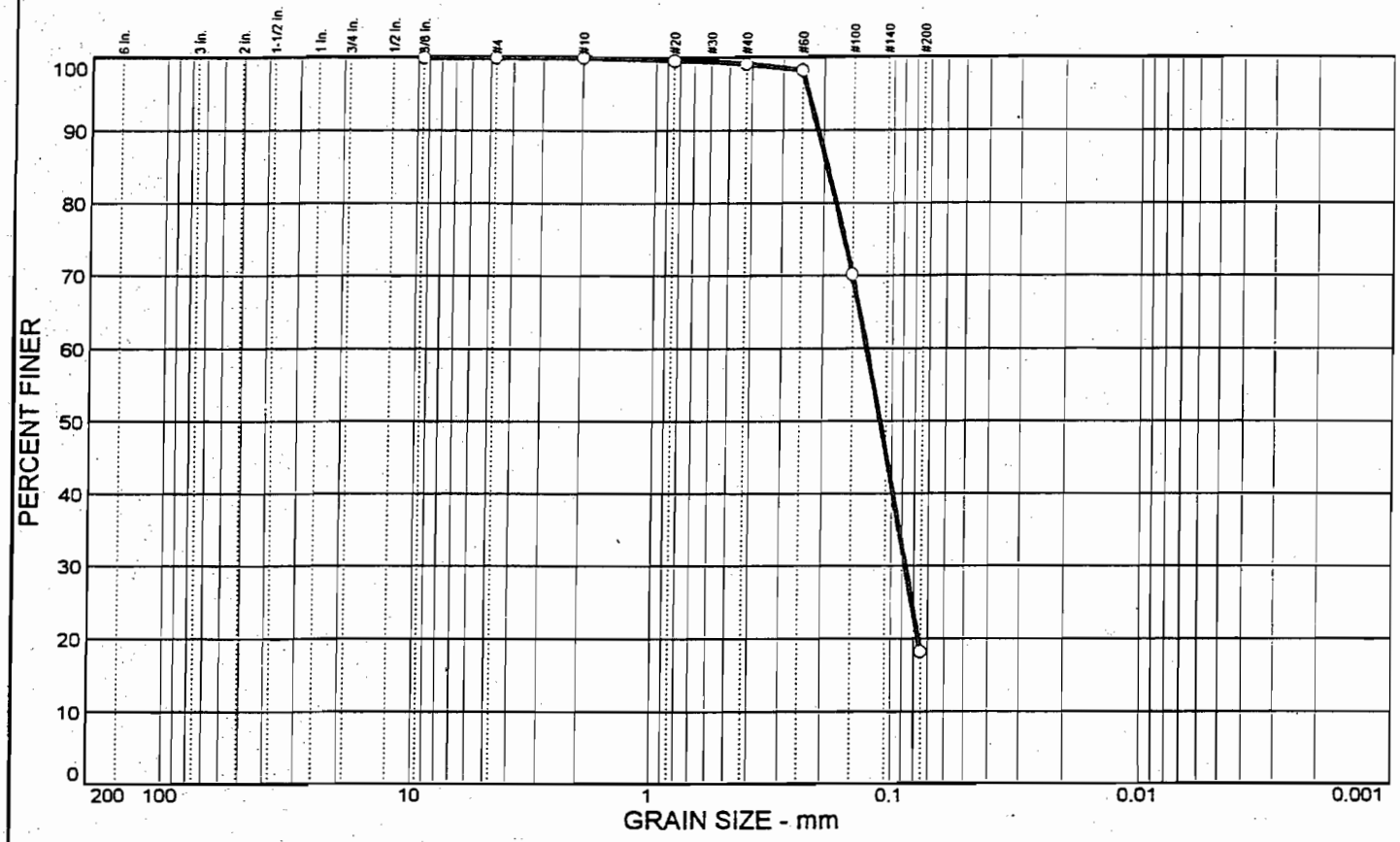
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			81.9	18.1		SM	A-2-4(0)		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		

GRAIN SIZE			
D_{60}	0.129		
D_{30}	0.0870		
D_{10}			

COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○
#4	100.0
#10	100.0
#20	99.6
#40	99.1
#60	98.2
#100	70.1
#200	18.1

SOIL DESCRIPTION

○ Gray-Brown Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 18 Sample No.: 13 Elev./Depth: 50.0'-51.5'

Law Engineering and Environmental Services, Inc.

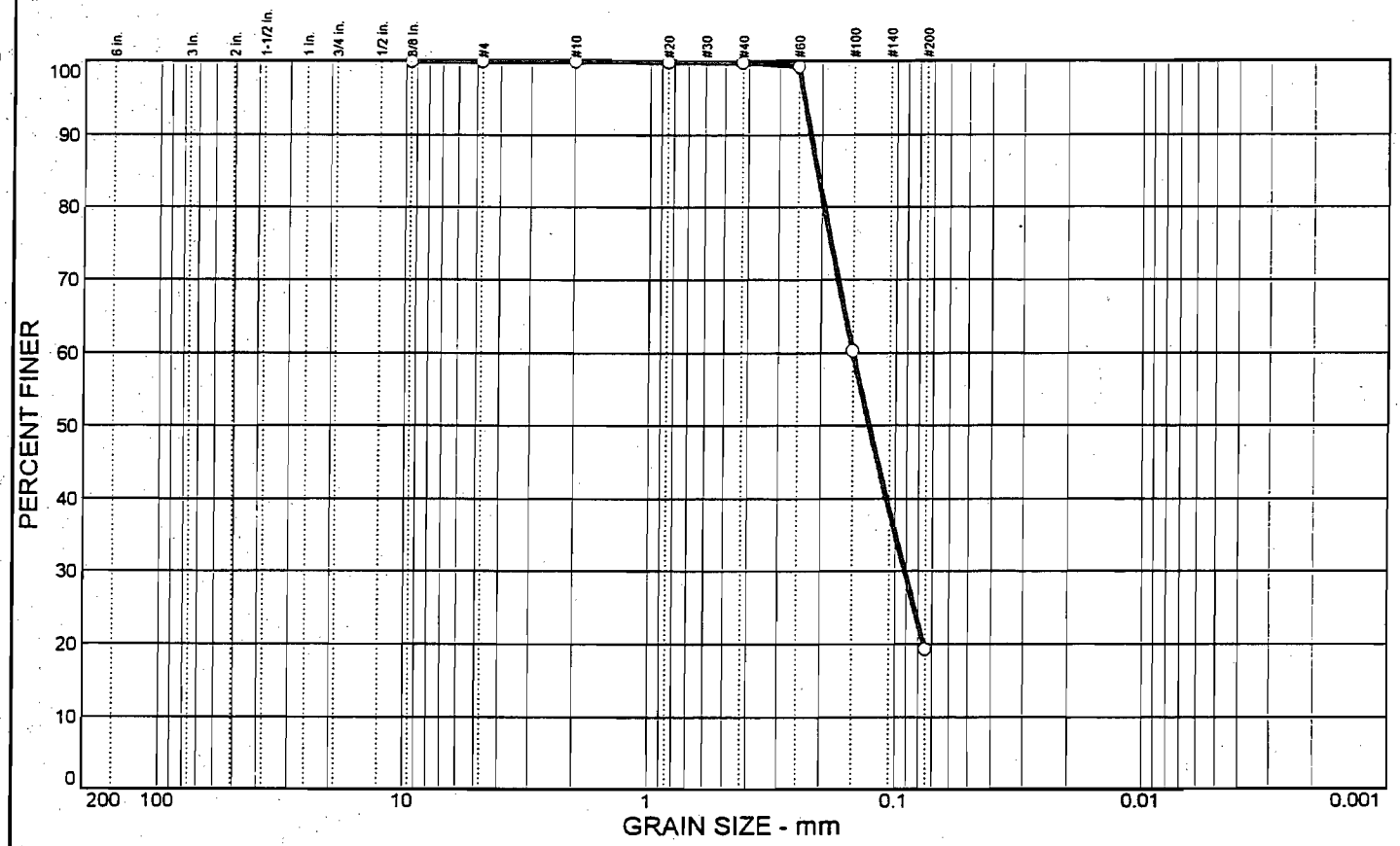
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			80.8	19.2		SM	A-2-4(0)		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		

GRAIN SIZE	
D_{60}	0.149
D_{30}	0.0914
D_{10}	

COEFFICIENTS	
C_c	
C_u	

SIEVE number size	PERCENT FINER ○
#4	100.0
#10	100.0
#20	99.9
#40	99.8
#60	99.3
#100	60.3
#200	19.2

SOIL DESCRIPTION

○ Light Brown Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 19 Sample No.: 3 Elev./Depth: 3.0'- 4.5'

Law Engineering and Environmental Services, Inc.

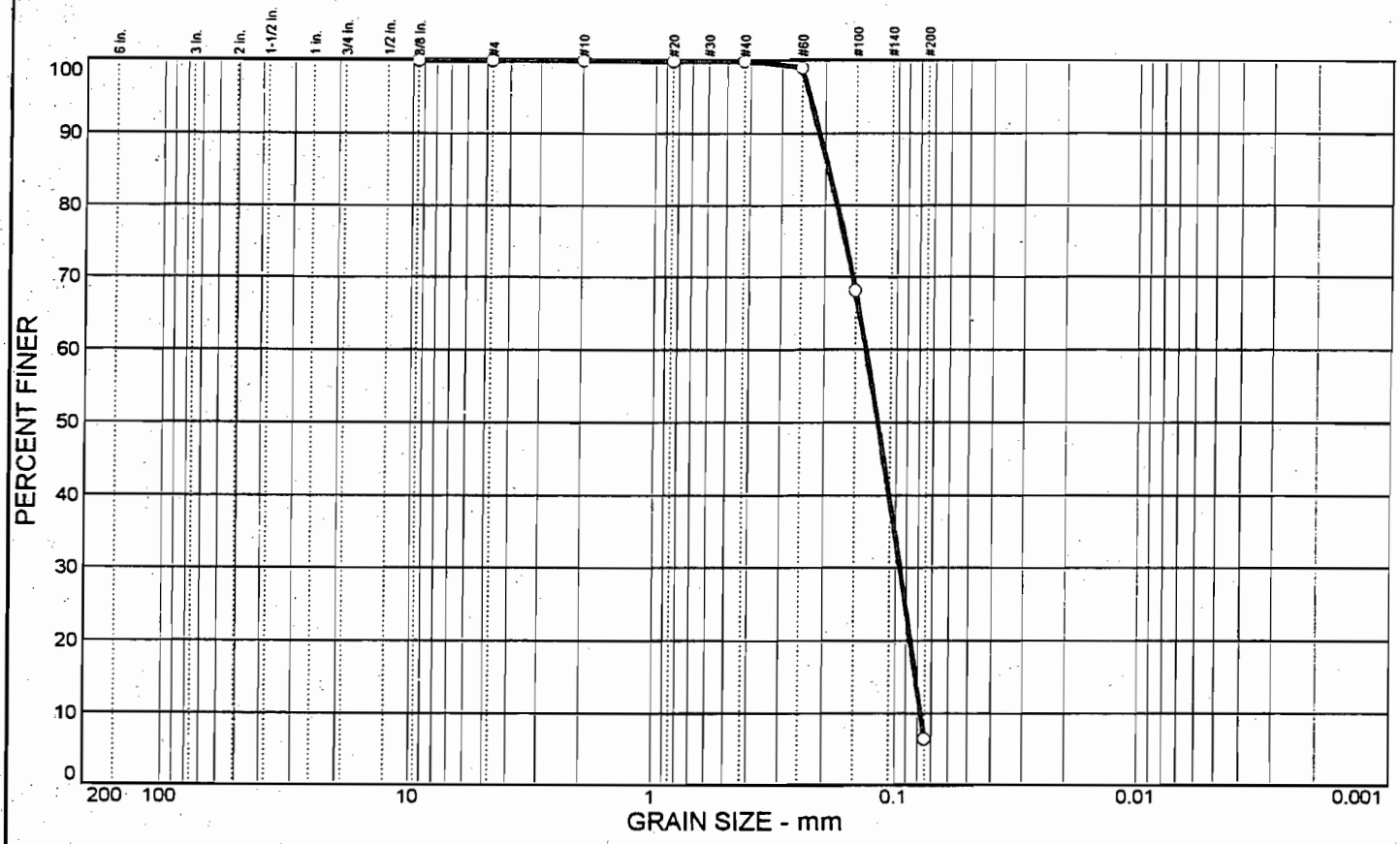
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A HINTERSPAN P E

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			93.6	6.4		SP-SM	A-3		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		

	GRAIN SIZE
D_{60}	0.135
D_{30}	0.0959
D_{10}	0.0778
	COEFFICIENTS
C_c	0.88
C_u	1.73

SIEVE number size	PERCENT FINER ○
#4	100.0
#10	100.0
#20	99.9
#40	99.9
#60	99.0
#100	68.1
#200	6.4

SOIL DESCRIPTION

○ Tan Slightly Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 19 Sample No.: 6 Elev./Depth: 15.0'-16.5'

Law Engineering and Environmental Services, Inc.

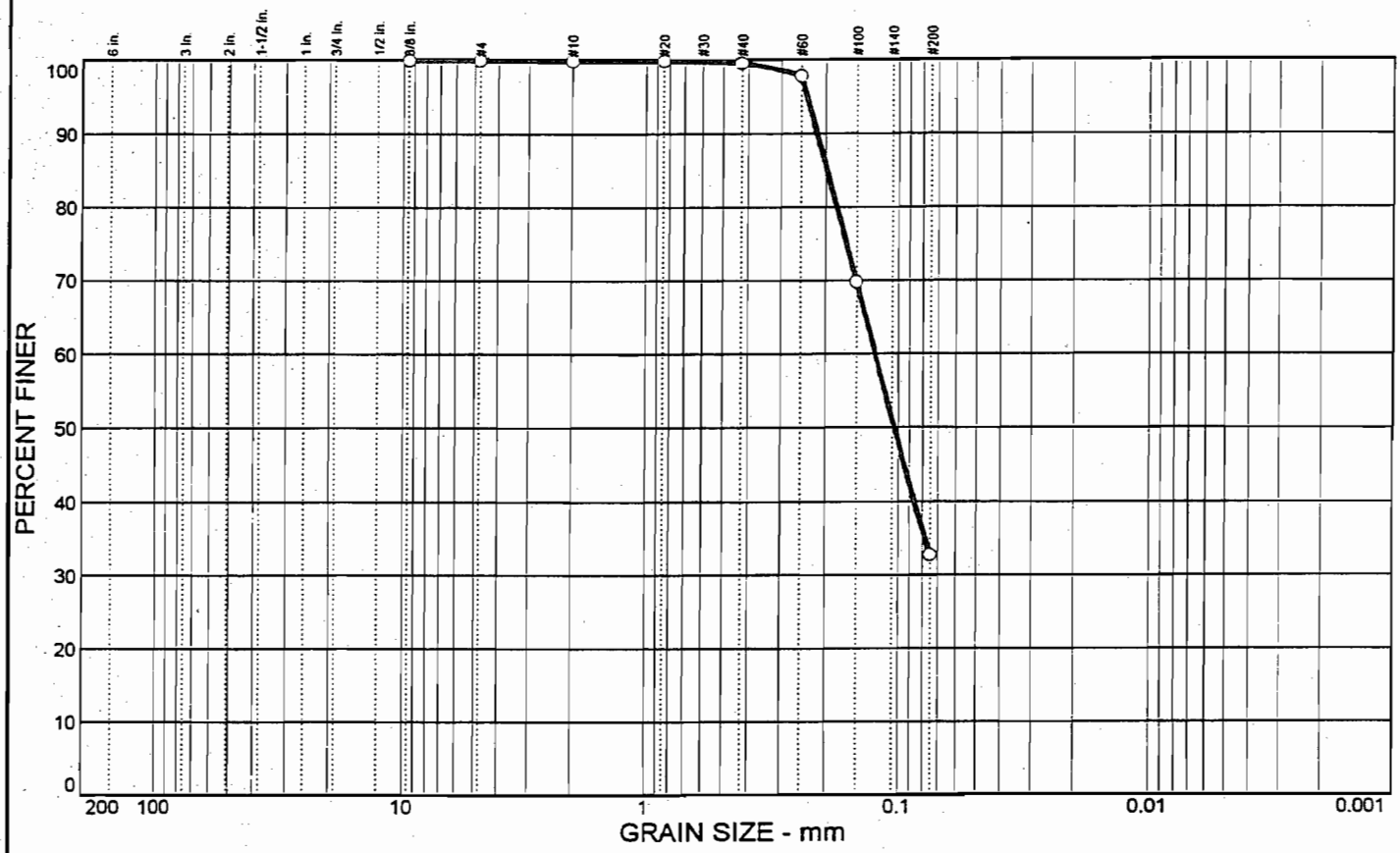
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			67.3	32.7		SM	A-2-4(0)		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		
	GRAIN SIZE		
D_{60}	0.125		
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○		
#4	100.0		
#10	99.9		
#20	99.9		
#40	99.6		
#60	97.8		
#100	69.8		
#200	32.7		

SOIL DESCRIPTION

○ Brown Very Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 19 Sample No.: 9 Elev./Depth: 30.0'-31.5

Law Engineering and Environmental Services, Inc.

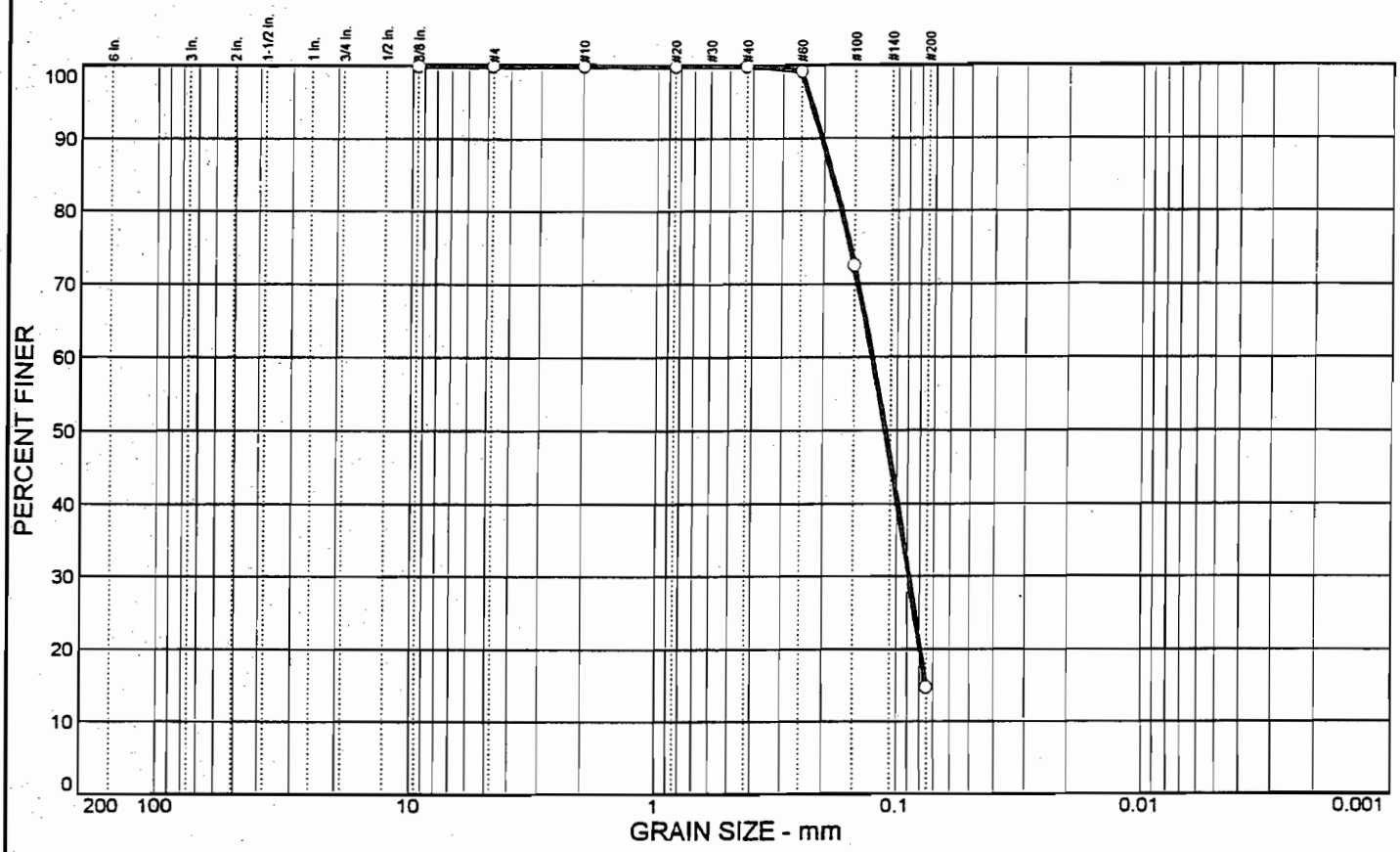
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			85.4	14.6		SM	A-2-4(0)		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		

	GRAIN SIZE		
D_{60}	0.126		
D_{30}	0.0887		
D_{10}			

	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○		
#4	100.0		
#10	100.0		
#20	99.9		
#40	99.9		
#60	99.2		
#100	72.5		
#200	14.6		

SOIL DESCRIPTION

○ Tan Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 20 Sample No.: 7 Elev./Depth: 20.0'-21.5'

Law Engineering and Environmental Services, Inc.

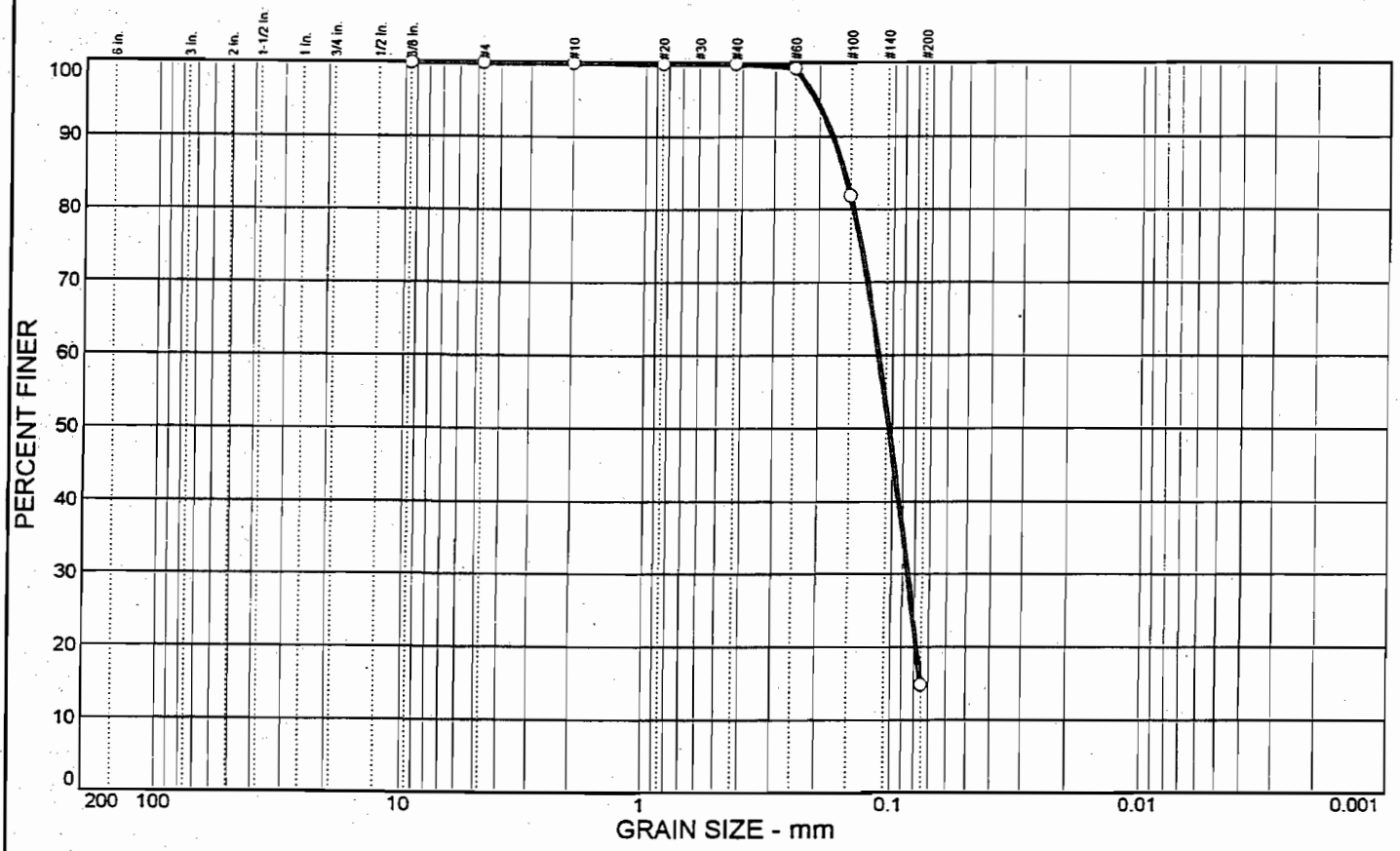
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			85.2	14.8		SM	A-2-4(0)		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		

	GRAIN SIZE
D_{60}	0.114
D_{30}	0.0857
D_{10}	

	COEFFICIENTS
C_c	
C_u	

SIEVE number size	PERCENT FINER ○
#4	100.0
#10	100.0
#20	99.9
#40	99.9
#60	99.3
#100	81.8
#200	14.8

SOIL DESCRIPTION

○ Gray Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 20 Sample No.: 11 Elev./Depth: 40.0'-41.5'

Law Engineering and Environmental Services, Inc.

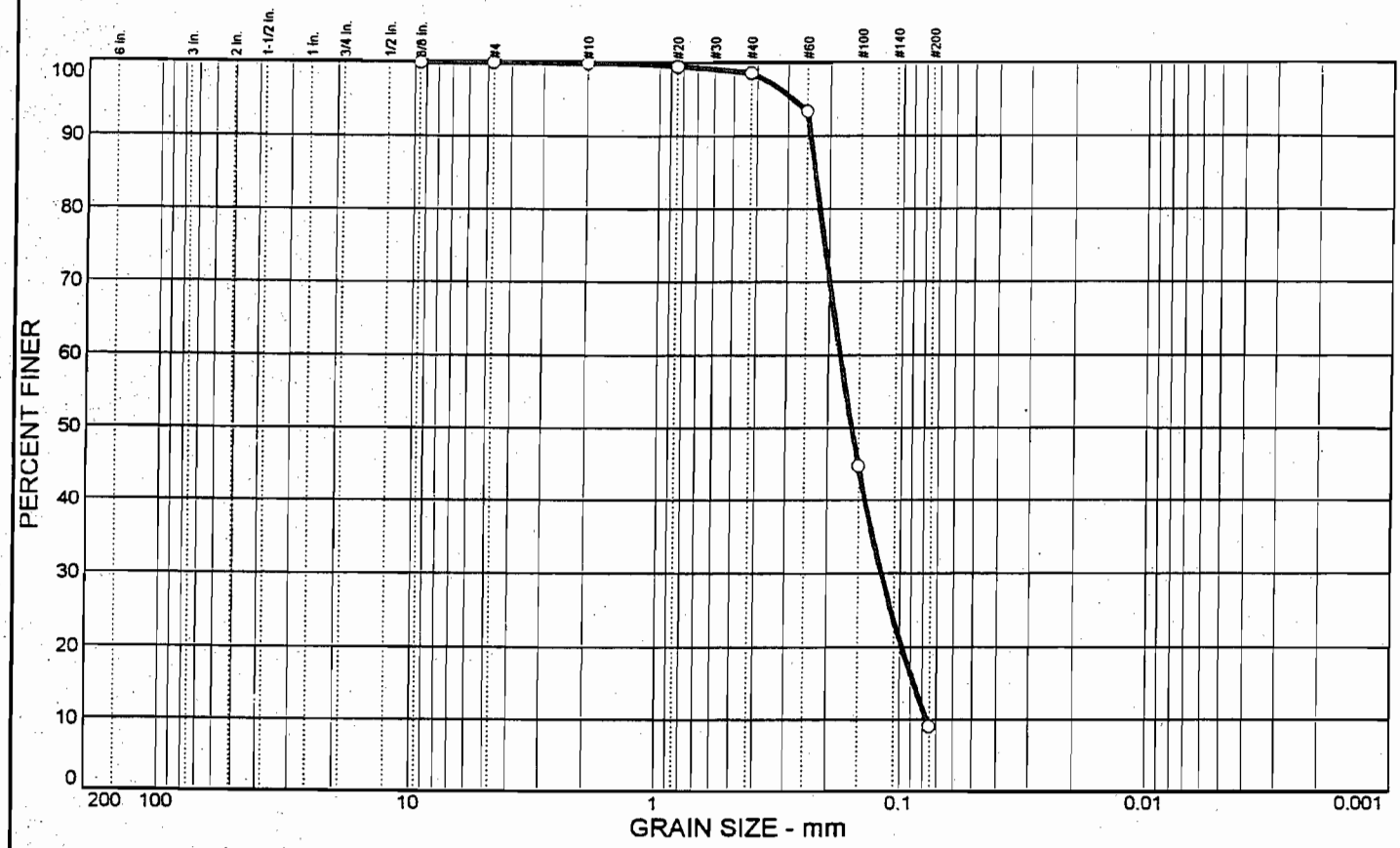
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN. P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			91.0	9.0		SP-SM	A-3		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		

	GRAIN SIZE
D_{60}	0.179
D_{30}	0.120
D_{10}	0.0770
	COEFFICIENTS
C_c	1.04
C_u	2.33

SIEVE number size	PERCENT FINER ○
#4	100.0
#10	99.9
#20	99.5
#40	98.6
#60	93.3
#100	44.8
#200	9.0

SOIL DESCRIPTION

○ Gray Slightly Silty Fine SAND

REMARKS:

○

○ Source: Boring No. 20 Sample No.: 14 Elev./Depth: 55.0'-56.5'

Law Engineering and Environmental Services, Inc.

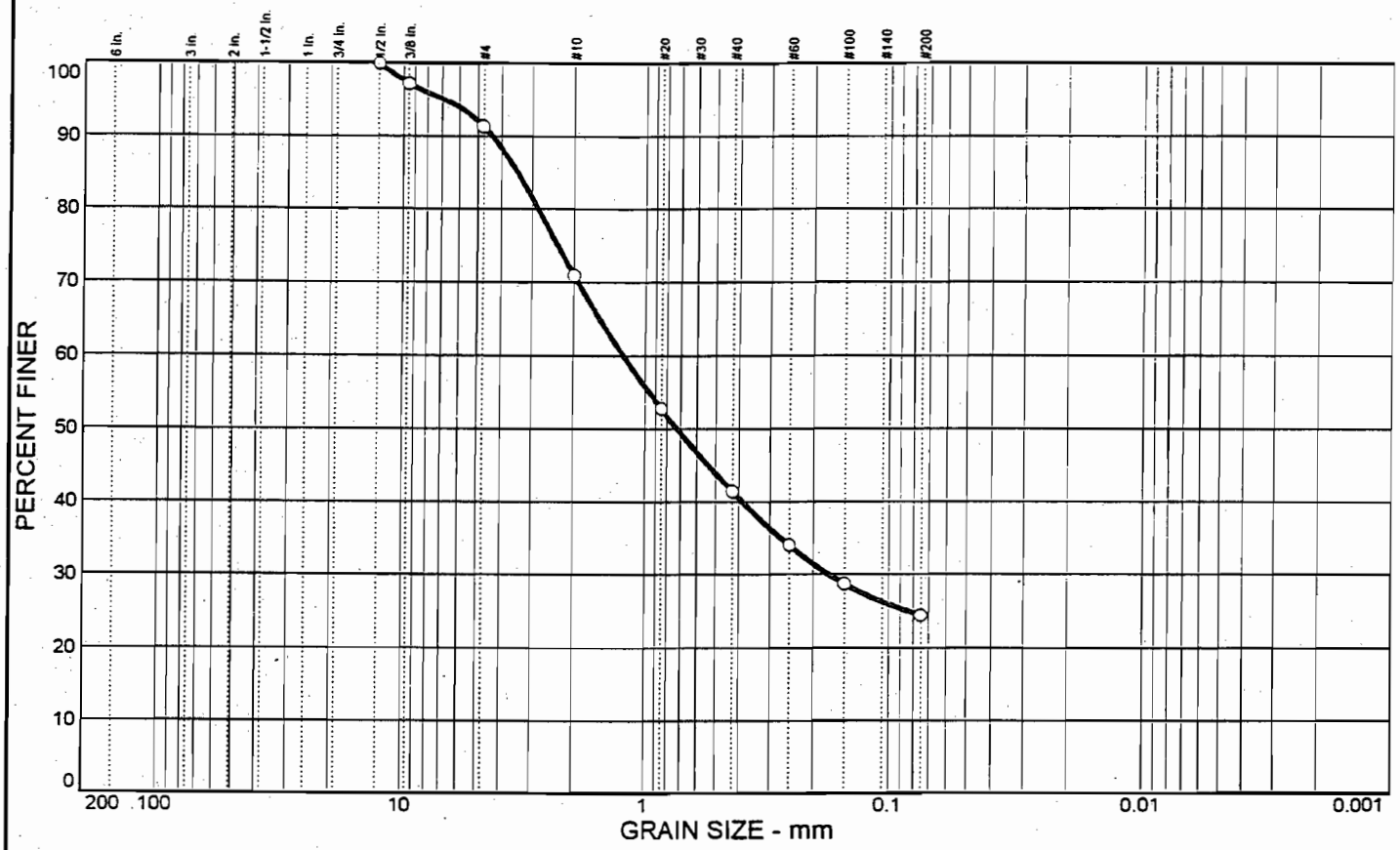
Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

Grain Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		8.7	66.9	24.4		SM	A-1-b		

SIEVE inches size	PERCENT FINER ○
.5	100.0
.375	97.2

	GRAIN SIZE
D_{60}	1.24
D_{30}	0.174
D_{10}	

	COEFFICIENTS
C_c	
C_u	

SIEVE number size	PERCENT FINER ○
#4	91.3
#10	70.9
#20	52.8
#40	41.4
#60	34.0
#100	28.7
#200	24.4

SOIL DESCRIPTION

○ Gray Silty Fine SAND w/ rock fragments

REMARKS:

○

○ Source: Boring No. 20 Sample No.: 22 Elev./Depth: 95.0'-96.5'

Law Engineering and Environmental Services, Inc.

Client: Black and Veatch

Project: JEA Brandy Branch Power Project

Project No.: 40521-9-8177

JOHN A. UNTERSPAN, P.E.

JEA Brandy Branch

Hydrogeologic Report

June, 2000

B&V Project 60903

B&V File 32.0406



BLACK & VEATCH

June 28, 2000

Engineering Certification Statement

I, the undersigned, hereby certify under penalty of law that:

The engineering features of the MODFLOW Study contained in the Hydrogeologic Report dated June 28, 2000, provided in support of the Brandy Branch Generating Station Consumptive Use Permit Application #51629, have been prepared, designed, or examined by me or individuals under my direct supervision and found to be in conformity with sound engineering principles applicable to groundwater withdrawal modeling and hydrogeologic studies; and,

To the best of my knowledge, the information submitted in the MODFLOW Study and Hydrogeologic Report is true, accurate, and complete and is based upon reasonable techniques, estimates, materials, and information gathered and evaluated by qualified personnel; and,

To the best of my knowledge, there is reasonable assurance that groundwater wells described in the MODFLOW Study and Hydrogeologic Report, when properly operated and maintained, will comply with all applicable standards found in the Florida Statutes and rules of the Department of Environmental Protection.

Richard Z. Ward 6/28/00

Signature Date

Richard Z. Ward
6/28/00

Poor Original

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1 Introduction

This report summarizes the groundwater withdrawal study for the JEA Brandy Branch Station. The withdrawal study was performed by using modelling techniques to estimate potential drawdown thus providing an estimate of the the impact to the aquifer and adjacent users. The proposed source of the groundwater is the Floridian Aquifer.

Two wells have been constructed on the site, the first to be utilized as the primary well and the second well to serve as a backup well. The wells are located on the east and west side of the southern portion of the site approximately 770 feet apart. The anticipated average discharge rate for the site is 0.1181 million gallons per day (82 gpm) average and the anticipated maximum is 1.23 million gallons per day (854 gpm).

The results of the MODFLOW analysis indicate that at one mile radius from the well, the 854 gpm capacity creates a drawdown of less than 0.5 feet. At an average daily discharge of 82 gpm, the drawdown at one mile radius is less than 0.1 feet. Therefore, there will be negligible impact on the adjacent users.

2 Geologic and Hydrogeologic Site Conditions

2.1 Geology

The Brandy Branch Generating Station is located in western Duval County, in northeast Florida near the city of Baldwin. The topography of northeast Florida is controlled by a series of ancient marine terraces (Cooke, 1945) formed during the Pleistocene. Seven terraces are recognized in northeast Florida. These are the Coharie, Sunderland, Wicomico, Penholoway, Talbot, Pamlico, and Silver Bluff terraces. The project site is situated on the Wicomico terrace which is one of the oldest and highest in this area.

The underlying stratigraphy at the Brandy Branch Generating Station consists of several thousand feet of sedimentary deposits that range in age from Eocene to Holocene. In ascending order these formations include the Oldsmar Limestone of lower Eocene age, the Lake City and the Avon Park Limestone of middle Eocene age, the Ocala Group of upper Eocene age, the Hawthorn Formation of Miocene age, and undifferentiated surficial deposits of Miocene to Holocene age. A generalized geologic column is shown in Figure 2-1.

Structurally, the limestone formations of Eocene age in the western part of the county dip northeastward, and the in the eastern part of the county dip northwestward, forming an irregular trough or basin. This trough or basin extends from south central Duvall County, northeastward into northeastern Nassau County. A fault extends generally along the axis of the basin with the upthrown side to the west. Displacement of the Ocala group and Avon Park limestone by the fault in southern Duval County is about 125 feet. The displacement decreases northward and the fault probably does not extend farther than northern Duval County. Figure 2-2 shows a regional cross section west to east across Duval County south of Baldwin.

2.2 Hydrogeology

In northeastern Florida, groundwater occurs in two separate aquifer systems. These are the shallow aquifer system and the Floridian aquifer system. The shallow aquifer system consists of permeable sand, shell, and limestone within the upper Hawthorn formation and the surficial Pleistocene-Holocene deposits. The Floridian aquifer system is comprised of the Ocala group, Avon Park, Lake City, and Oldsmar limestone formations.

IMAGE QUALITY

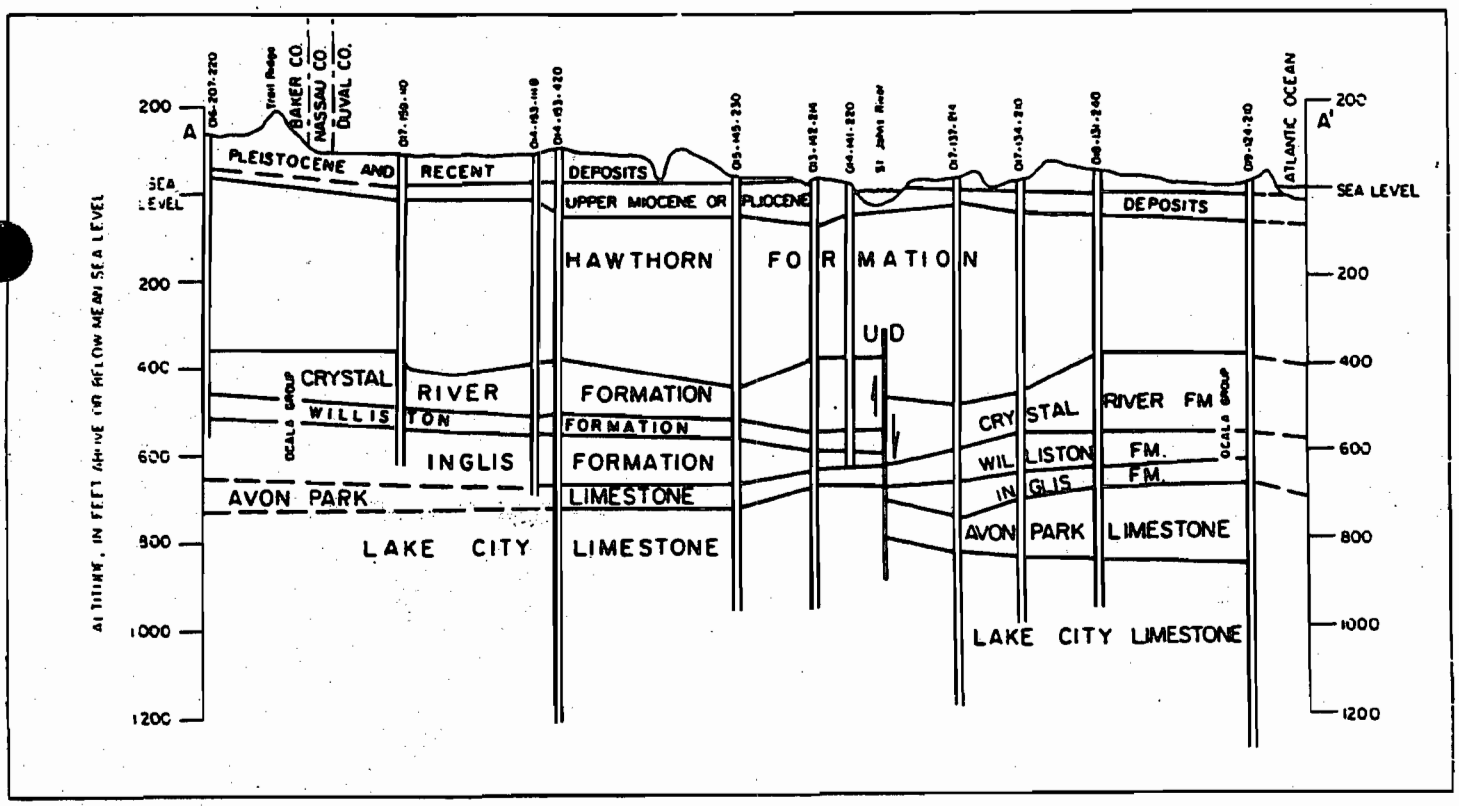
AS YOU REVIEW THE NEXT FEW PAGES, PLEASE NOTE THAT THE ORIGINAL DOCUMENT WAS OF POOR QUALITY.

Figure 2-1. Generalized Geologic Column

TABLE 3. Stratigraphic units and aquifer systems in Duval, Nassau, and and Baker counties.

Geologic age	Stratigraphic unit	Approximate thickness (feet)	Lithologic character	Aquifer systems	Water-bearing properties
Recent and Pleistocene	Recent and Pleistocene deposits	0-150	Soil, muck, coarse to fine sand, shell, and some clayey sand	Shallow aquifer system	Surficial sand yields small amounts of water. Sand and shell bed along coast yields moderate quantities.
Pliocene?	Pliocene or Upper Miocene deposits	20-110	Gray-green calcareous, silty clay and clayey sand; contains shell beds and white soft, friable limestone beds		Limestone, sand, and shell bed near base of deposits yield moderate to (locally) large amounts.
Miocene	Hawthorn Formation	260-490	Gray to blue-green calcareous phosphatic, sandy clays and clayey sands; contains fine to medium phosphatic sand lenses and limestone and dolomite beds, particularly near the base of the formation	Aquiclude	Relatively impermeable clays and marls in both the late Miocene or Pliocene deposits and the Hawthorn Formation confines the artesian water in the Eocene limestone and in the limestone and shell beds above the Eocene limestone. Yields small to moderate supplies.
Eocene	Ocala Group: Crystal River Formation	50-800	White to cream chalk, massive fossiliferous marine limestone.	Floridan aquifer system	Marine limestone foamrtions utilized as the primary source of water in the area.
	Ocala Group: Williston Formation	20-100	Tan to buff granular, marine limestone		
	Ocala Group: Inglis Formation	40-120	Tan to buff granular, calcitic, marine limestone; contains thin dolomite lenses and zones of Miliolidae foraminiferal coquina		
	Avon Park Limestone	50-250	Alternating beds of brown to tan hard, massive dolomite, brown finely crystalline dolomite, and granular calcitic limestone	Aquiclude	Massive dolomite beds restrict vertical movement of water.
	Lake City Limestone	425-500+	White to brown, purple-tinted lignitic, granular limestone and gray hard, massive dolomite; contains lignite beds and zones of Valvulinidae foraminiferal coquina		Limestone and porous dolomite beds yield large to very large quantities of water. Hard dolomite and limestone beds restrict vertical movement of water within certain zones. Potentially the greatest source of water in the area.
	Oldsmar Limestone	846	Cream to brown massive to chalky, granular limestone and tan to brown massive to finely crystalline dolomite		

Figure 2-2. Regional Cross Section West to East across Duval County South of Baldwin



The aquifer testing program at the Brandy Branch Generating Station consists of two borings drilled to a depth of 837 feet. The stratigraphy encountered in the boreholes includes the Avon Park Limestone, the Ocala Group, the Hawthorn Formation, and undifferentiated surficial deposits.

The Avon Park unconformably underlies the Ocala Group. At the site it is encountered at 750 and 755 feet below ground surface (Figure 2-3). The Avon Park limestone varies both laterally and vertically in northeast Florida. It consists predominantly of tan to brown, hard, massive dolomite beds containing thin zones of tan granular fossiliferous limestone. The top of the formation usually can be detected during drilling because the hard dolomite beds in the upper part of the formation retard the drilling rate. The hard dolomite of the Avon Park is relatively impermeable and acts as a confining bed at the base of the Ocala Group.

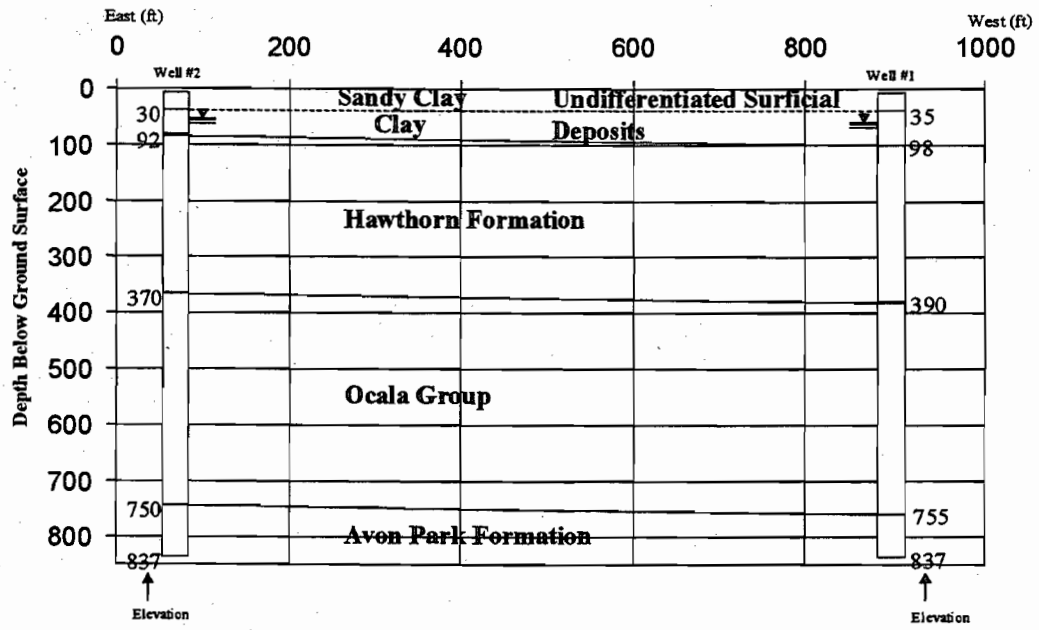


Figure 2-3. Geotechnical Cross Section at JEA Brandy Branch Site

The top of the Ocala Group was encountered at 387 and 390 feet below ground surface (Figure 2-3) giving it a thickness of approximately 163 feet. The Ocala Group is the

upper most water-bearing unit of the Floridian Aquifer. The Ocala Group consists of three separate formations. These are, in ascending order, the Inglis, the Williston, and the Crystal River formation. All three formations of the Ocala Group are fragmental marine limestones and are differentiated by slight changes in lithology and on the basis of fossil content. The formations of the Ocala are undifferentiated at the site.

The Hawthorn Formation lies unconformably on the eroded surface of the Ocala Group. The top of the Hawthorn was encountered at 92 and 96 feet below ground surface (Figure 3). The total thickness is approximately 195 feet. The Hawthorn consists of gray to blue-green calcareous, phosphatic sandy clays and clayey sands, interbedded with thin, discontinuous lenses of fine to medium phosphatic sand, phosphatic sandy limestone, and gray hard dolomite. The Hawthorn Formation acts as an upper confining unit for the Ocala Group and an aquiclude separating the Floridian aquifer from the surfical aquifer.

Approximated 95 feet of undifferentiated surficial deposits are found at the site. These deposits consist of approximately 33 feet of clayey sand underlain by 62 feet of clay.

3 JEA Brandy Branch Pump Test

W. Earl Floyd & Son, Inc. installed the two onsite wells and performed the pump testing. The well completion reports are included in Appendix A. Water levels were determined by manual measurement with dedicated water-indicating probes and with automated data loggers as described in Section 3.2. The hydrostatic water level for the wells Floridian Aquifer corresponded with the background readings taken prior to testing (see Figure 3-1 on page 9). Background readings were established as described in Section 3.3. No rainfall occurred throughout the withdrawal testing program.

3.1 Production Well Construction

The well completion reports are attached in Appendix A. As per Ref. 2, the cased portion of the production wells penetrating the confining strata were cemented using the Haliburton method. Formation changes are reported on the well completion reports in Appendix A and shown on Figure 2-3 on page 5.

3.2 Data Acquisition

Electronic data loggers manufactured by In-Situ, Inc., were used during the APT to collect background, pumping, and recovery water level data. A Hermit 2000 equipped with a pressure transducer was used to monitor water levels in the east pumping well. Mini-Trolls, which are down-hole data loggers, were installed in the shallow monitoring well and the west Floridan aquifer production well.

Table 3-1. Automated data acquisition schedules.

	Background		Step Drawdown		Constant Rate		
	Start	Stop	Start of test(1)	Stop	Start of Pumping 900gpm	Stop Pumping	Stop Reading
East (pumped) well)	5/19/00 13:27 30-min interval	5/25/00 7:27	5/25/00 7:45 Loarithm-mic intervals	5/25/00 14:00	5/30/00 8:00 Logarith-mic intervals	6/1/00 8:00 Logarith-mic intervals	6/3/00 9:00
West (monitoring well)	5/19/00 13:27 30-min interval		5/25/00 7:45 1-minute intervals	5/25/00 14:00	5/30/00 8:00 Logarith-mic intervals	6/1/00 8:00 Logarith-mic intervals	6/3/00 9:00
Shallow	5/19/00 13:04 30-min interval	5/25/00 7:34	5/25/00 7:46 1-minute intervals	5/25/00 13:54	5/30/00 8:00 Logarith-mic intervals	6/1/00 8:00 Logarith-mic intervals	6/3/00 9:00

(1) The step drawdown test, as discussed in Section 10 , consisted of 30 minute intervals of increasing pumping rates as follows: 450 gpm, 585 gpm, 765 gpm, 900 gpm, and 1100 gpm.

3.3 Background Readings

Background readings were taken for approximately 5.8 days in the east and west wells. The test pump was run a number of times during the background readings. These periods are easily identified in Figure 3-1 by the spikes in the east and west well readings on the plot. The spike in the west well data at 4200 minutes does not have a corresponding spike in the east well. This spike represents data points at 30-minute intervals and was discounted in analyses.

Background readings indicate there are no localized external influences to the Floridian Aquifer that significantly affect the results of the withdrawal testing program.

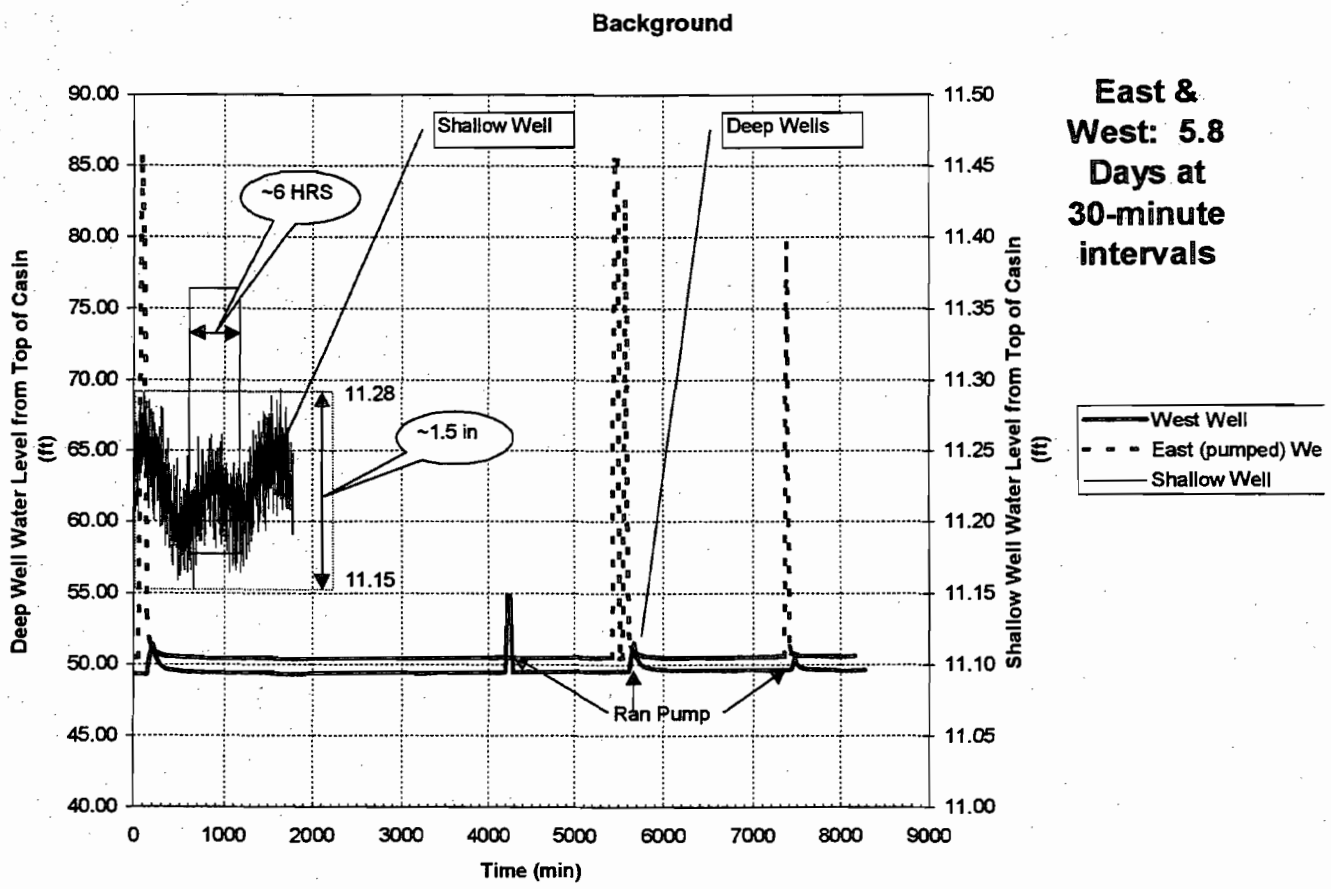


Figure 3-1. Background readings at JEA Brandy Branch

3.4 Step Drawdown Test

3.4.1 Procedure

The step drawdown test consisted of 30 minute intervals of increasing pumping rates as follows: 450 gpm, 585 gpm, 765 gpm, 900 gpm, and 1100 gpm. These pumping rates correspond to 50%, 65%, 85%, 100%, and 122% of the rate used for the constant rate test.

Depth to water (DTW) in the west well and the shallow well, are shown in Figure 3-2.

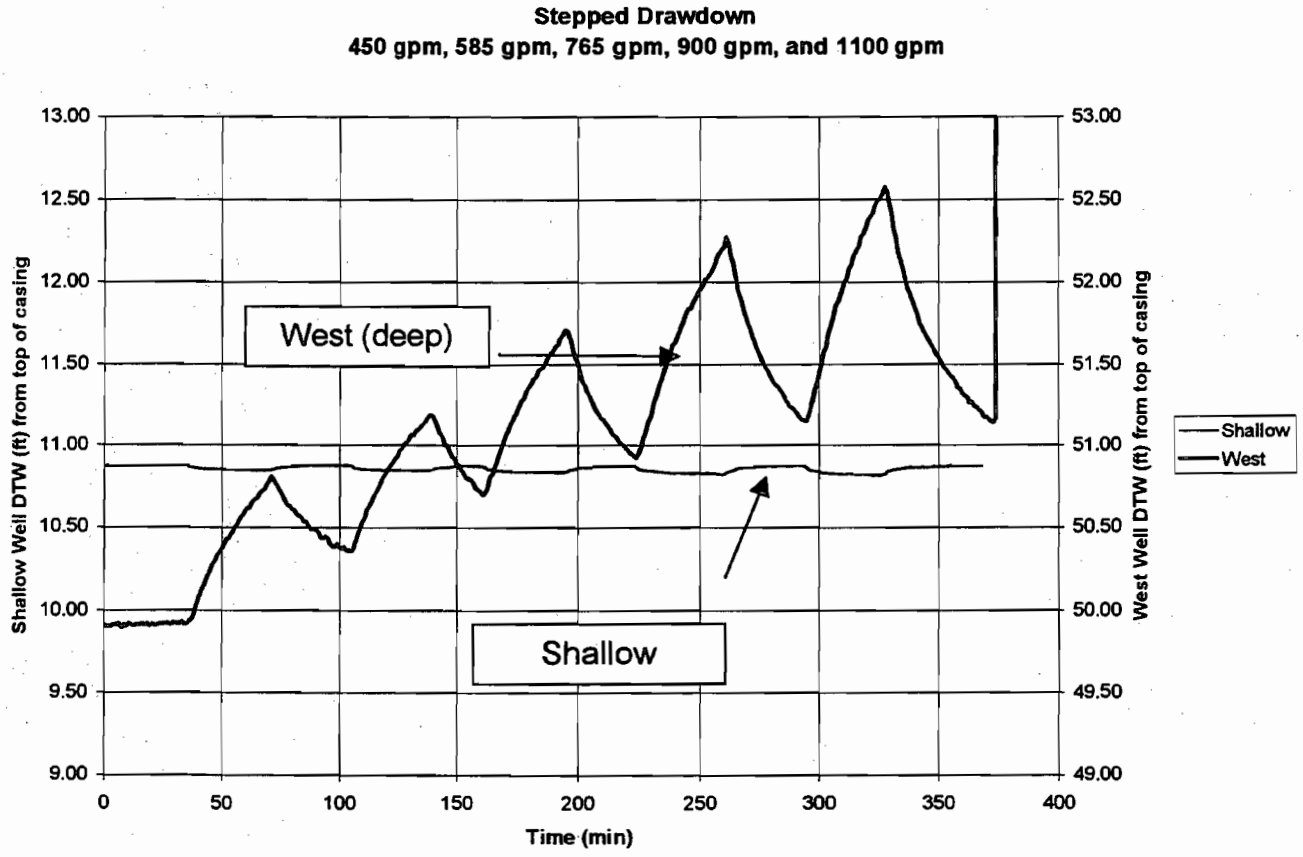


Figure 3-2. Step Drawdown Test, Monitored Wells

Figure 3-2 shows less than 0.1 inch reactions of the shallow well water levels during the step drawdown test. It was indicated in the geologic review that the shallow aquifer is reactive to fluctuations in the Floridian Aquifer system. The mild vacillation of the shallow aquifer shown in Figure 3-1 indicates that the Hawthorn formations acts locally as an aquitard between the shallow and Floridian Aquifer rather than an aquiclude. The magnitude of reactive fluctuation of the shallow aquifer about 0.1 inch and will not significantly affect adjacent wetland areas.

The specific yield was determined for the east pumped well as shown in Figure 3-3. Pump test data is presented in Appendix C.

Pumped well (East)

Flow Rate (gpm)	DTW @ 30min (ft)	Drawdown (ft)	Spec Cap gpm/ft	Spec Cap ft^3/m/ft
0	50.9	0		
450	65	14.1	31.9	4.3
585	67.6	16.7	35.0	4.7
760	73.5	22.6	33.6	4.5
920	78.1	27.2	33.8	4.5
1100	83.8	32.9	33.4	4.5

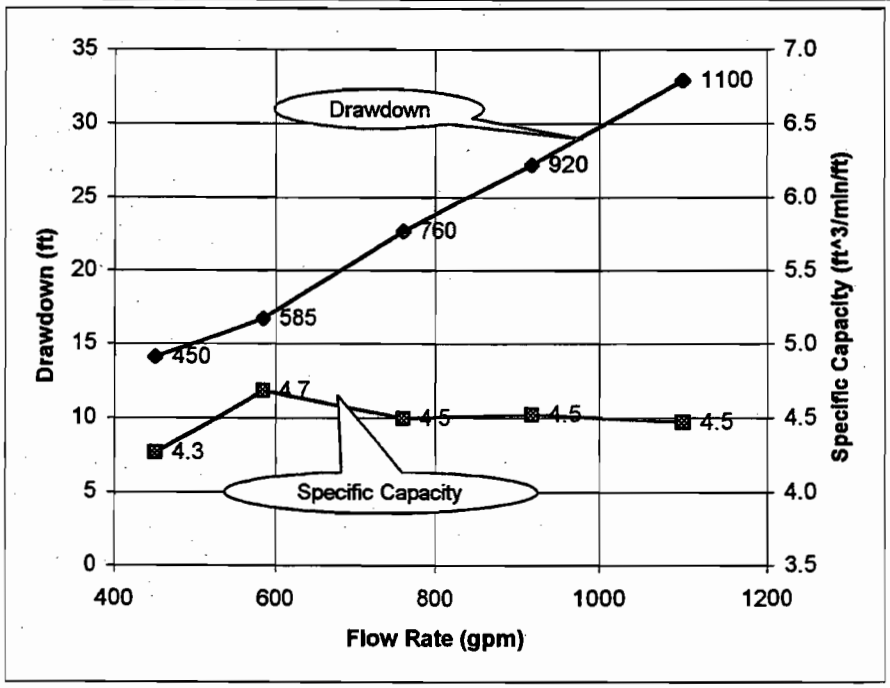


Figure 3-3. Specific capacity from step drawdown test.

3.5 Constant Rate Discharge Test

3.5.1 Procedure

Approximately 34 feet of drawdown occurred in the pumped well and less than 5 feet occurred in the monitoring well 770 feet to the west. Drawdown and recovery water level measurements were recorded to the nearest 1/100th of a foot. The predetermined schedule recommended in Ref. 2 was followed as described in Table 3-1 on page 8. Water quality samples were collected and analysed as per recommendations in Ref. 2 and results are included in Appendix F. The constant rate pump test was performed at 900 gpm for 48 hours as shown in Figure 3-4. Recovery measurements were then taken for more than 24 hours following the termination of the test and are included in the appendices. Pump test data is presented in Appendix C.

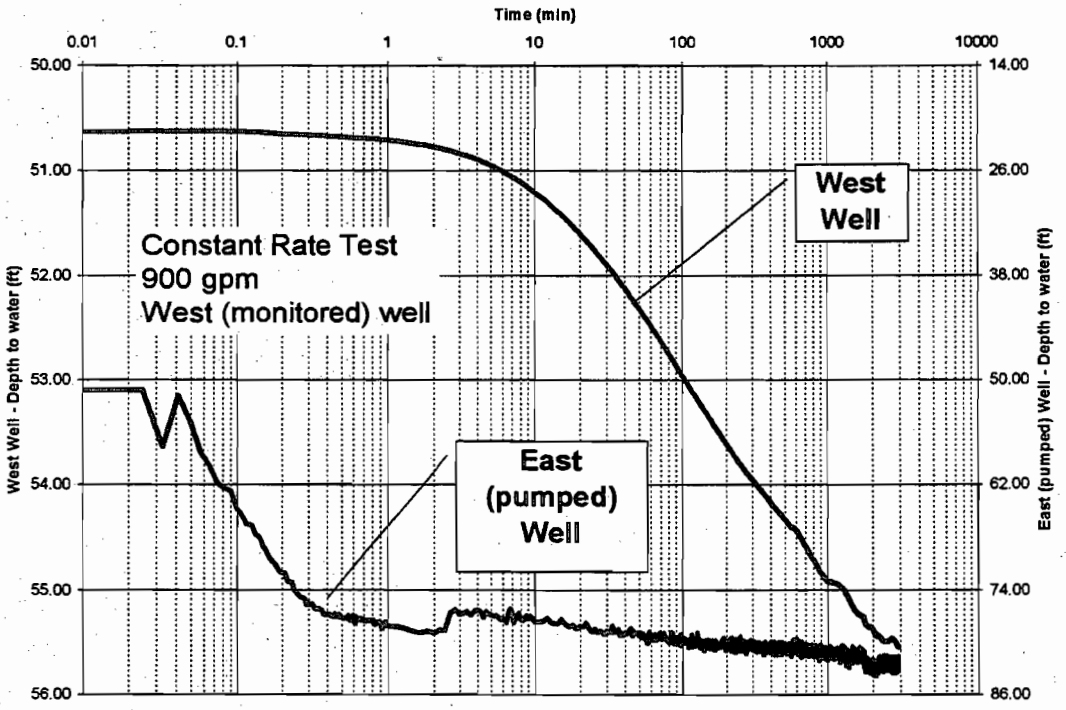


Figure 3-4. Constant Rate Pump Test.

4 Transmissivity and Storativity of Floridian Aquifer

The transmissivity and storativity coefficients used for modeling were selected based on a calibration of Visual MODFLOW v.2.8.2. The initial values used in calibration were those calculated using the Theis and Jacob methods. The Jacob Method yielded a transmissivity of 15,855 ft^2/day and a storage coefficient of 2.94×10^{-4}. The Theis curve-matching method produced a transmissivity of 15,319 ft^2/day and a storage coefficient of 3.23×10^{-4}. The transmissivity and storage coefficient calculations are presented in Appendix D. Values of 15,000 ft^2/day and 3.1×10^{-4} were used as initial estimates in the Visual MODFLOW v.2.8.2 calibration as described in Section 5. Calculated values compared well with historical values as shown in Table 4-1.

Table 4-1. Calculated versus historical transmissivity and storage values of the Floridian Aquifer in western Duval County.

Model Parameter	Reference No. 3, USGS 79-84	Reference No. 4, Mandarin 1988	Brandy Branch Calculated Values
Transmissivity	80, 000 ft^2/day	11,940 ft^2/day	15,000 ft^2/day
Storage Coefficient	0.00031	0.0024	0.00031
Pumping Rate, Steady State	870 gpm	870 gpm	900 gpm

5 MODFLOW Analysis

The Visual MODFLOW v.2.8.2 model was calibrated by matching the model drawdowns to the actal pump test results. The hydraulic conductivity and storativity were varied to manipulate the modelled cone of depression to match that measured in the field. Leakage and tidal effects of the Floridian Aquifer were not incorporated into the model. The final hydraulic conductivity and storativity values based on this iterative procedure were 36 ft/day and 1.5×10^{-6} ft^{-1}. Therefore, using an aquifer thickness of 314 ft, the transmissivity was modeled as 11,304 ft^2/day and storage coefficient as 4.7×10^{-4}. The calibration curve is shown in Figure 5-1. The model values correlate reasonably well with the calculated values from the pump test results.

The two cases analysed using Visual MODFLOW v.2.8.2 were as follows:

1. Average daily demand of 82 gpm using steady state conditions.

2. Maximum daily demand of 854 gpm using transient conditions and a 20 day time period.

The resulting cones of depression of the Floridian Aquifer are shown on Figure 5-2 for case 1 and on Figure 5-3 for case 2.

5.1 MODFLOW Results

As indicated in Figure 5-2, the drawdown associated with a withdrawal rate of 854 gpm varies from 7.5 feet in the southeast corner of the site boundary to 3.0 feet at the northwest corner. The drawdown at one mile radius is less than 0.5 feet.

As indicated in Figure 5-3, the drawdown associated with a withdrawal rate of 82 gpm varies from 0.7 feet in the southeast corner of the site boundary to 0.3 feet at the northwest corner. The drawdown at one mile radius is less than 0.1 feet.

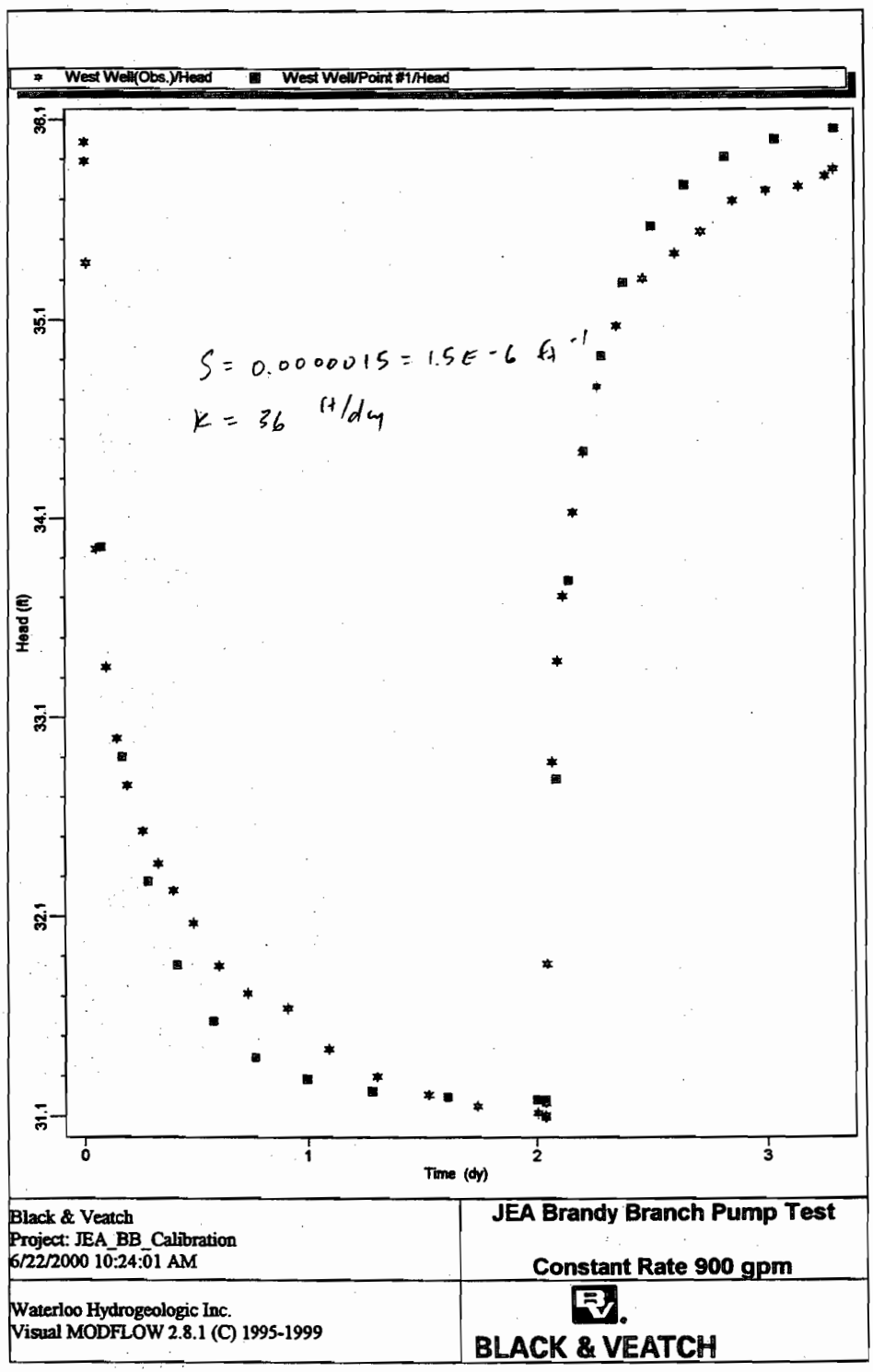


Figure 5-1. Calibration curve from MODLOW v.2.8.1 analysis.

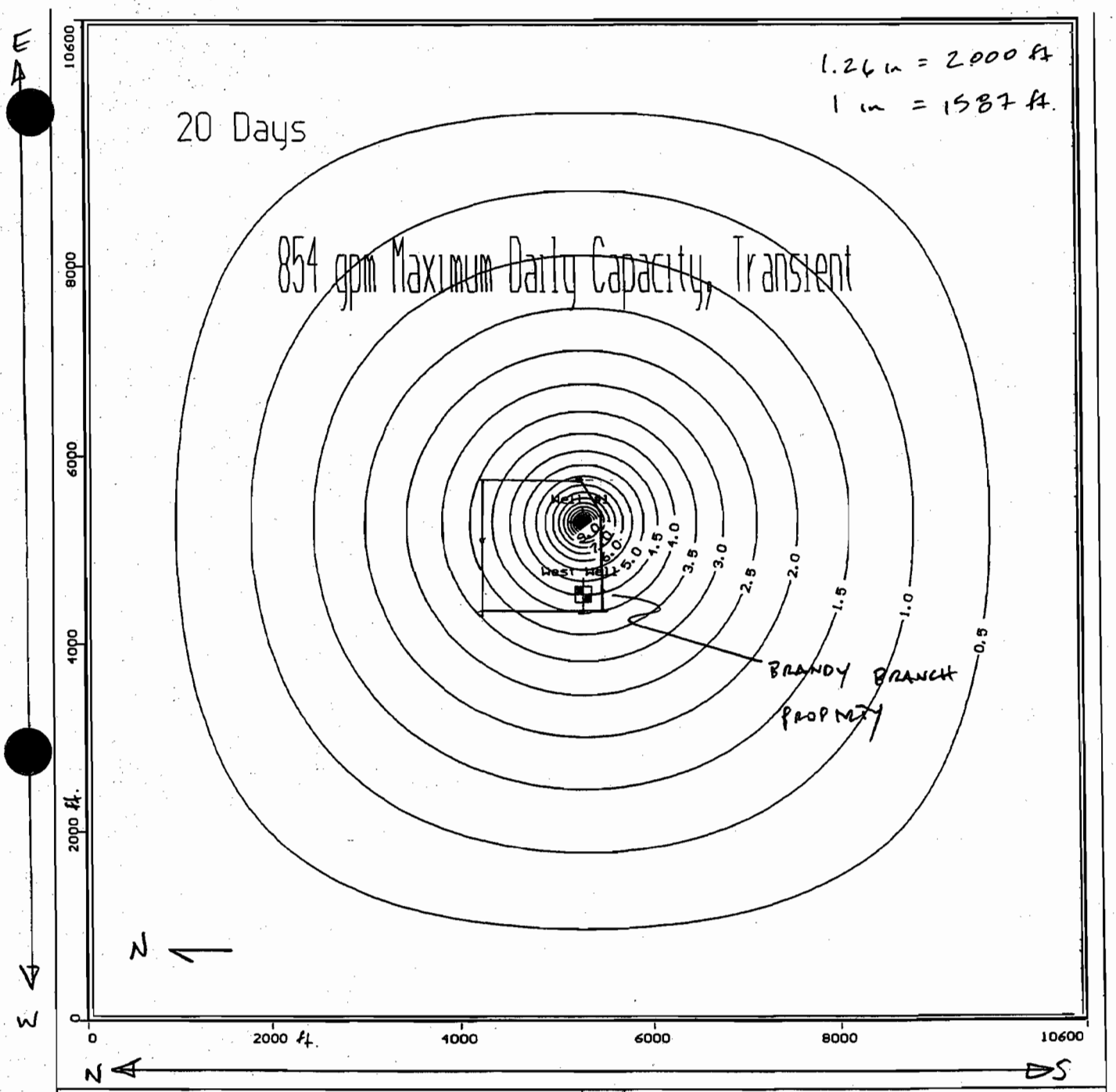


Figure 5-2. Visual MODFLOW v.2.8.2 calculated cone of depression for 854 gpm withdrawal rate, transient conditions, and a 20-day withdrawal period.

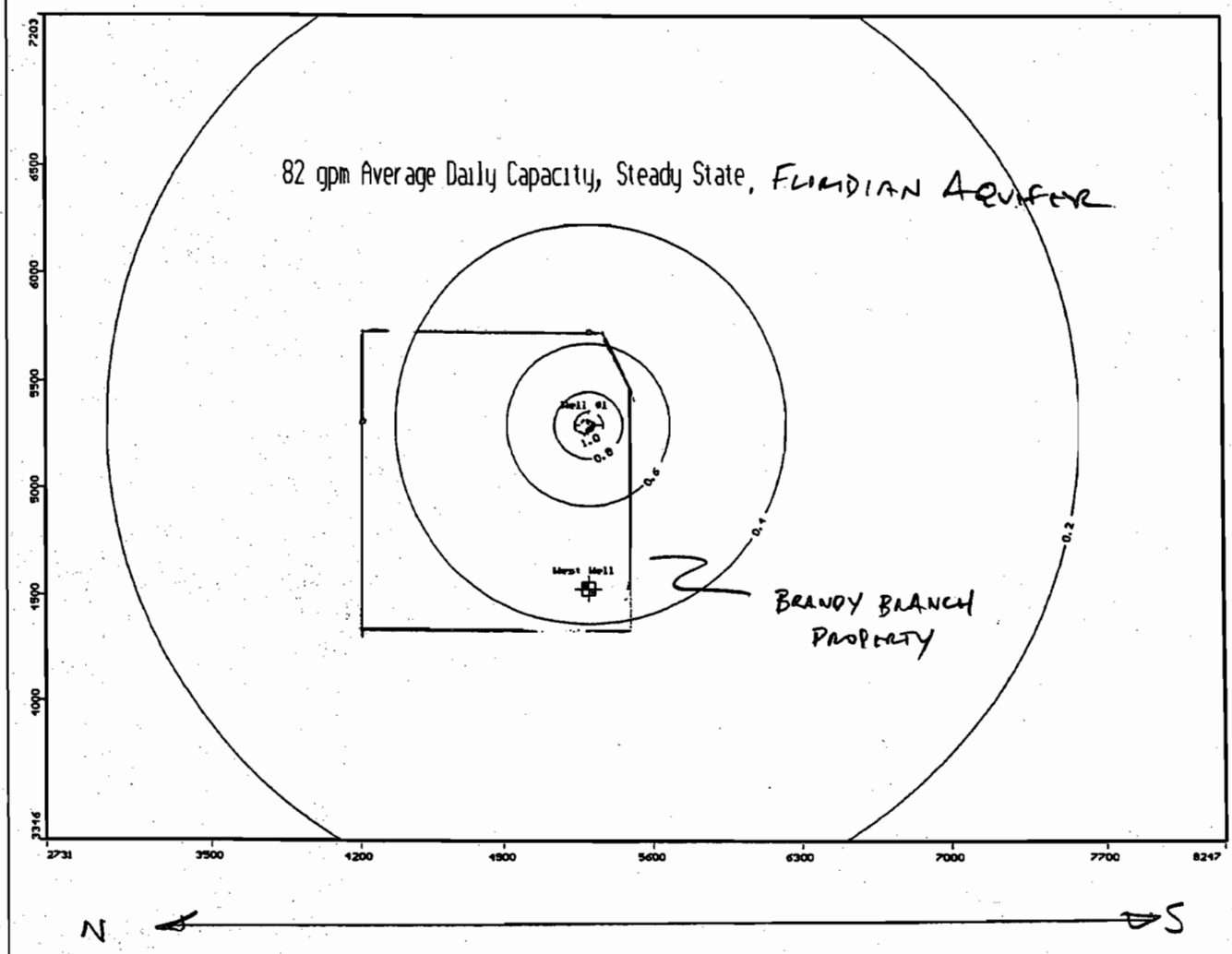


Figure 5-3. Visual MODFLOW v.2.8.2 calculated cone of depression for 82 gpm withdrawal rate, steady state conditions.

5.2 Impacts

It was indicated in Ref. 6 that there are no existing, installed, or permitted wells within one mile of the site boundary. In addition, visual field reconnaissance did not identify any wells within approximately one mile radius of the site. Larry Floyd of W. Earl Floyd & Son, Inc. indicated that the adjacent dairy and some mobile homes potentially withdraw water from either the Floridian or shallow aquifers. It is estimated that the impacts of the proposed withdrawal will have negligible impacts on adjacent users.

6 References

1. Lawrence, J.C.; letter dated 30 SEPT 99, RE: CUP application #51629, JEA, Brandy Branch Generating Station

2. SJRWMD; Consumptive Use Rule – Applicant's Handbook, Appendix F – Guidelines for Developing a Standard Aquifer Performance Test Program

3. "Estimated Drawdowns in the Floridan Aquifer Due to Increased Withdrawals, Duval County, Florida", by B.J. Franks and G.G. Phelps, USGS Water Resources Investigations 79-84, 1979.

4. "Results of Hydrogeological Investigation for Mandarin Utilities Community Hall Wellfield", by Warren Leve, CUP 2-031-0012, 1988.

5. Cooke, 1945

6. Fax from Linda Champion of St. Johns River Water Management District, RE: well Search for Permitted Wells; 27 MAY 99 (attached in Appendix E)

7. Leve, Gilbert W., Groundwater in Duval and Nassau Counties, Florida, Report of Investigation No. 43, U.S. Geological Survey, 1966.

8. Cooke, C.W., Geology of Florida, Florida Geologic Survey Bulletin 29, 1945.

9. Brown, D.P., Impact of Development on Availability and Quality of Ground Water in Eastern Nassau County, Florida and Southeaster Camden County, Georgia, Water Resources Investigation Report 83-4190, U.S. Geological Survey, Tallahassee, Florida, 1984.

Appendix A

Well Completion Reports

IMAGE QUALITY

AS YOU REVIEW THE NEXT FEW PAGES, PLEASE NOTE THAT THE ORIGINAL DOCUMENT WAS OF POOR QUALITY.

W. EARL FLOYD & SON

Lab No.	Parameter	Result		Code	Method	Detection Limit
00060024	Turbidity	< 0.05	NTU	U	EPA 180.1	0.05
00060024	Specific Conductance	429	umhos/cm	A	EPA 120.1	0.01
00060024	Total Organic Carbon	6	mg/L		EPA 415.1	1
00060024	Manganese	< 0.003	mg/L	U	EPA 200.7	0.003
00060024	Barium (2)	0.014	mg/L		EPA 200.7	0.002
00060024	Strontium	1.28	mg/L		SW 6010	0.001
00060024	Total Hardness	129	mg CaCO3/L		EPA 200.7	
00060024	M - Alkalinity	126	mg/L		SM 2320B	0.2
00060024	P - Alkalinity	< 0.2	mg/L	U	SM 2320B	0.2

W. EARL FLOYD & SON

Lab No.	Parameter	Date of Analysis	Analysis Time	Analyst	Prep Date
00060023	Turbidity	06/01/2000	16:00	NSM	
00060023	Specific Conductance	06/01/2000	20:00	NSM	
00060023	Total Organic Carbon	06/08/2000	9:00	SMG	
00060023	Manganese	06/02/2000		REM	
00060023	Barium (2)	06/02/2000		REM	
00060023	Strontium	06/02/2000		REM	
00060023	Total Hardness	06/02/2000		REM	
00060023	M - Alkalinity	06/09/2000	12:00	SMG	
00060023	P - Alkalinity	06/09/2000	12:00	SMG	

00060023 1-3.

Technical Services, Inc.
2901 Danese St., Jacksonville, FL 32206
(904) 353-5761 / fax (904) 358-2908

CHAIN of CUSTODY RECORD

CLIENT NAME & ADDRESS (REPORT TO BE SENT TO:)

W. EARL FLOYD + SON
2901 HEDLONG RD.
JAX, FL
ATTN: MR. LARRY FLOYD

REMARKS: # 6

PROJ. NO.

PROJECT NAME/ ADDRESS:
JEA JOB
BRANDY BRANCH

SAMPLERS: (SIGNATURE)
Larry F. Floyd

Sa	Location ID	DATE	TIME	COMP	GRAB	TOTAL NO. of Containers	BOTTLE MAKEUP: QT/poly HNO3	GALLON/poly	QT/poly H2SO4	PARAMETERS
	EAST WELL	5-31 2000	8:00 pm		✓	1	1			Ca, Mg, Na, Mn, Ba, Sr Al, K, Fe, TOT. HARDNESS
						1		1		SILICA, M + P ALKALINITY, Cl⁻
						1			1	F⁻, SO4, TDS, TSS, COLOR, TURB, C NITRATE, TOT. PHOS., TOC
						1	1			Ca, Mg, Na, Mn, Ba, Sr Al, K, Fe, TOT. HARDNESS
						1		1		SILICA, M+P ALKALINITY, Cl⁻, F⁻
						1			1	SO4, TDS, TSS, COLOR, TURB, Ca NITRATE, TOT. PHOS., TOC

RELINQUISHED BY	DATE/TIME	RECEIVED BY:	DATE/TIME
Larry F. Floyd	6-1 2000 12:45		
RELINQUISHED BY	DATE/TIME	RECEIVED BY:	DATE/TIME
RELINQUISHED BY	DATE/TIME	RECEIVED BY:	DATE/TIME
		RECEIVED FOR LABORATORY BY	DATE/TIME
		D. Allen	6-1-00 1345

TECHNICAL SERVICES, INC.
ENVIRONMENTAL CONSULTANTS

For W. EARL FLOYD & SON
8901 HERLONG RD
JACKSONVILLE, FLORIDA
Contact: MR. LARRY FLOYD

Report Date 12-Jun-00
Date Received 06/01/2000 @ 12:45
Purchase Order #:

CERTIFICATE OF ANALYSIS

LAB	MATRIX	SAMPLE DATE	SAMPLE TIME	SAMPLED BY
SAMPLE DESCRIPTION				
00060024	DW	06/01/2000	0200	CLIENT REP
BRANDY BRANCH, EAST WELL				

Respectfully submitted,
Technical Services, Inc.

Walter Mock

W. EARL FLOYD & SON

Lab No.	Parameter	Result		Code	Method	Detection Limit
00060024	Calcium	31.0	mg/L		EPA 200.7	0.015
00060024	Magnesium	12.4	mg/L		EPA 200.7	0.02
00060024	Sodium	7.77	mg/L		EPA 200.7	0.017
00060024	Aluminum (0.2)	< 0.025	mg/L	U	EPA 200.7	0.025
00060024	Potassium	1.58	mg/L		EPA 200.7	0.2
00060024	Iron	< 0.004	mg/L	U	EPA 200.7	0.004
00060024	Silica	8.55	mg/L		EPA 200.7	0.02
00060024	Chloride (250)	8.98	mg/L		EPA 300.0	0.05
00060024	Fluoride (4)	0.75	mg/L		EPA 300.0	0.1
00060024	Nitrate	0.067	mg/L N		EPA 353.2	0.02
00060024	Sulfate (250)	27.7	mg/L		EPA 300.0	0.05
00060024	Total Phosphorus	< 0.05	mg/L	U	EPA 365.4_CU	0.05
00060024	Total Dissolved Solids (5	179	mg/L	A	SM 2540C	1
00060024	Total Suspended Solids	< 1	mg/L	U	EPA 160.2	1
00060024	Color (15 CU)	< 5	CU	U	SM 2120B	5

W. EARL FLOYD & SON

Lab No.	Parameter	Result		Code	Method	Detection Limit
00060022	Calcium	32.4	mg/L		EPA 200.7	0.015
00060022	Magnesium	12.8	mg/L		EPA 200.7	0.02
00060022	Sodium	8.02	mg/L		EPA 200.7	0.017
00060022	Aluminum (0.2)	< 0.025	mg/L	U	EPA 200.7	0.025
00060022	Potassium	1.61	mg/L		EPA 200.7	0.2
00060022	Iron	< 0.004	mg/L	U	EPA 200.7	0.004
00060022	Silica	8.86	mg/L		EPA 200.7	0.02
00060022	Chloride (250)	9.00	mg/L		EPA 300.0	0.05
00060022	Fluoride (4)	0.75	mg/L		EPA 300.0	0.1
00060022	Nitrate	< 0.02	mg/L N	U	EPA 353.2	0.02
00060022	Sulfate (250)	27.8	mg/L		EPA 300.0	0.05
00060022	Total Phosphorus	< .05	mg/L	U	EPA 365.4_CU	0.05
00060022	Total Dissolved Solids (5	174	mg/L		SM 2540C	1
00060022	Total Suspended Solids	2	mg/L		EPA 160.2	1
00060022	Color (15 CU)	< 5	CU	U	SM 2120B	5

W. EARL FLOYD & SON

Lab No.	Parameter	Result		Code	Method	Detection Limit
00060022	Turbidity	< 0.05	NTU	U	EPA 180.1	0.05
00060022	Specific Conductance	432	umhos/cm		EPA 120.1	0.01
00060022	Total Organic Carbon	7	mg/L		EPA 415.1	1
00060022	Manganese	< 0.003	mg/L	U	EPA 200.7	0.003
00060022	Barium (2)	0.015	mg/L		EPA 200.7	0.002
00060022	Strontium	1.32	mg/L		SW 6010	0.001
00060022	Total Hardness	134	mg CaCO3/L		EPA 200.7	
00060022	M - Alkalinity	121	mg/L		SM 2320B	0.2
00060022	P - Alkalinity	< 0.2	mg/L	U	SM 2320B	0.2

W. EARL FLOYD & SON

Lab No.	Parameter	Date of Analysis	Analysis Time	Analyst	Prep Date
00060022	Calcium	06/02/2000		REM	
00060022	Magnesium	06/02/2000		REM	
00060022	Sodium	06/02/2000		REM	
00060022	Aluminum (0.2)	06/02/2000		REM	
00060022	Potassium	06/02/2000		REM	
00060022	Iron	06/02/2000		REM	
00060022	Silica	07/02/2000		REM	
00060022	Chloride (250)	06/06/2000	11:40	SMG	
00060022	Fluoride (4)	06/06/2000	11:40	SMG	
00060022	Nitrate	06/02/2000	13:30	SMG	
00060022	Sulfate (250)	06/06/2000	11:40	SMG	
00060022	Total Phosphorus	06/08/2000	14:45	SMG	
00060022	Total Dissolved Solids (5	06/01/2000	20:00	NSM	
00060022	Total Suspended Solids	06/02/2000	23:50	NSM	
00060022	Color (15 CU)	06/01/2000	16:00	NM	

W. EARL FLOYD & SON

Lab No.	Parameter	Date of Analysis	Analysis Time	Analyst	Prep Date
00060022	Turbidity	06/01/2000	16:00	NSM	
00060022	Specific Conductance	06/01/2000	20:00	NSM	
00060022	Total Organic Carbon	06/08/2000	9:00	SMG	
00060022	Manganese	06/02/2000		REM	
00060022	Barium (2)	06/02/2000		REM	
00060022	Strontium	06/02/2000		REM	
00060022	Total Hardness	06/02/2000		REM	
00060022	M - Alkalinity	06/09/2000	12:00	SMG	
00060022	P - Alkalinity	06/09/2000	12:00	SMG	

V. EARL FLOYD & SON

Lab No.	Parameter		Date of Analysis	Analysis Time	Analyst	Prep Date
00060023	Calcium		06/02/2000		REM	
00060023	Magnesium		06/02/2000		REM	
00060023	Sodium		06/02/2000		REM	
00060023	Aluminum	(0.2)	06/02/2000		REM	
00060023	Potassium		06/02/2000		REM	
00060023	Iron		06/02/2000		REM	
00060023	Silica		07/02/2000		REM	
00060023	Chloride	(250)	06/06/2000	11:40	SMG	
00060023	Fluoride	(4)	06/06/2000	11:40	SMG	
00060023	Nitrate		06/02/2000	13:30	SMG	
00060023	Sulfate	(250)	06/06/2000	11:40	SMG	
00060023	Total Phosphorus		06/08/2000	14:45	SMG	
00060023	Total Dissolved Solids	(5	06/01/2000	20:00	NSM	
00060023	Total Suspended Solids		06/02/2000	23:50	NSM	
00060023	Color	(15 CU)	06/01/2000	16:00	NM	

00060022

Technical Services, Inc.
2901 Danese St., Jacksonville, FL 32206
(904) 353-5761 / fax (904) 358-2908

CHAIN of CUSTODY RECORD

CLIENT NAME & ADDRESS (REPORT TO BE SENT TO:)

W. EARL FLOYD + SON
2901 HEALING RD.
JAX, FL
ATTN: MR. LARRY FLOYD

REMARKS:

(5)

PROJ. NO.

PROJECT NAME/ ADDRESS:
JEA JOB
BRANDY BRANCH

SAMPLERS: (SIGNATURE)

Larry J. Floyd

Sample Location ID	DATE	TIME	COMP	GRAB	TOTAL NO. of Containers	BOTTLE MAKEUP: 125 ml/poly w/HNO3	BOTTLE MAKEUP: 1 Gallon/poly	BOTTLE MAKEUP: 125 ml/poly w/H2SO4	PARAMETERS
EAST WELL	5-31-2000	2:00 pm		L	1	1			Ca, Mg, Na, Mn, Ba, Sr, Al, K, Fe, TOT. HARDNESS, SILICA, N + P ALKALINITY, Cl-, FL, SO4, TDS, TSS, COLOR, TURB, NITRATE, TOT. PHOS., TOC
					1		1		
					1			1	
					1	1			Ca, Mg, Na, Mn, Ba, Sr, Al, K, Fe, TOT. HARDNESS, SILICA, N+P ALKALINITY, Cl-, SO4, TDS, TSS, COLOR, TURB, NITRATE, TOT. PHOS., TOC
					1		1		
					1			1	

RELINQUISHED BY	DATE/TIME	RECEIVED BY	DATE/TIME
Larry J. Floyd	6-1 2000 12:45		
RELINQUISHED BY	DATE/TIME	RECEIVED BY	DATE/TIME
RELINQUISHED BY	DATE/TIME	RECEIVED BY	DATE/TIME
		RECEIVED FOR LABORATORY BY: D. Williams	DATE/TIME: 6-1-00 1245

TECHNICAL SERVICES, INC.
ENVIRONMENTAL CONSULTANTS

For W. EARL FLOYD & SON
8901 HERLONG RD
JACKSONVILLE, FLORIDA
Contact: MR. LARRY FLOYD

Report Date 12-Jun-00
Date Received 06/01/2000 @ 12:45
Purchase Order #:

CERTIFICATE OF ANALYSIS

LAB	MATRIX	SAMPLE DATE	SAMPLE TIME	SAMPLED BY
SAMPLE DESCRIPTION				
00060023	DW	05/31/2000	2000	CLIENT REP
BRANDY BRANCH, EAST WELL				

Respectfully submitted,
Technical Services, Inc.

Walter Mark

Air and Water Pollution Sampling, Surveys, Testing and Analytical Services

2901 Danese Street • Jacksonville, Florida 32206 • (904) 353-5761 • FAX (904) 358-2908
DHRS / HRS #82145 / E82016

0005006 - F-3

Technical Services, Inc.
2901 Danese St., Jacksonville, FL 32206
(904) 353-5761 / fax (904) 358-2908

CHAIN of CUSTODY RECORD

CLIENT NAME & ADDRESS (REPORT TO BE SENT TO:)

W. EARL FLOYD + SON
2901 HEALING RD.
JAX, FL
ATTN: MR. EARL FLOYD

REMARKS: # 4

PROJ. NO.

PROJECT NAME/ ADDRESS:
JEA JOB
BRANDY BRANCH

SAMPLERS: (SIGNATURE)
Larry F. Floyd

Sample Location ID	DATE	TIME	COMP	GRAB	TOTAL NO. of Containers	40 ml/poly w/HNO3	Gallon/poly	40 ml/vial w/H2SO4	PARAMETERS
EAST WELL	5-31-2000	8:00 AM		✓	1	1			Ca, Mg, Na, Mn, Ba, Sr, Al, K, Fe, TOT. HARDNESS, SILICA, M + P ALKALINITY, Cl, FL-SO4, TDS, TSS, COLOR, TURB, NITRATE, TOT. PHOS., TOC
					1		1		
					1			1	
					1	1			Ca, Mg, Na, YA, Ba, Sr, Al, K, Fe, TOT. HARDNESS, SILICA, M+P ALKALINITY, Cl, SO4, TDS, TSS, COLOR, TURB, NITRATE, TOT. PHOS., TOC
					1		1		
					1			1	

RELINQUISHED BY	DATE/TIME	RECEIVED BY	DATE/TIME
Larry F. Floyd	5-31-2000 8:07 AM	Erik Howard	5-31-00 8:07 AM
RELINQUISHED BY	DATE/TIME	RECEIVED BY	DATE/TIME
RELINQUISHED BY	DATE/TIME	RECEIVED BY	DATE/TIME
Erik Howard	5-31-00 4:25	RECEIVED FOR LABORATORY BY: D. Allen	DATE/TIME 5-31-00 921

TECHNICAL SERVICES, INC.
ENVIRONMENTAL CONSULTANTS

For W. EARL FLOYD & SON
8901 HERLONG RD
JACKSONVILLE, FLORIDA
Contact: MR. LARRY FLOYD

Report Date 12-Jun-00
Date Received 06/01/2000 @ 12:45
Purchase Order #:

CERTIFICATE OF ANALYSIS

LAB	MATRIX	SAMPLE DATE	SAMPLE TIME	SAMPLED BY
SAMPLE DESCRIPTION				
00060022	DW	05/31/2000	1400	CLIENT REP
BRANDY BRANCH, EAST WELL				

Respectfully submitted,
Technical Services, Inc.

Walter Mack

Technical Services, Inc.
2901 Danese St., Jacksonville, FL 32206
(904) 353-5761 / fax (904) 358-2908

CHAIN of CUSTODY RECORD

CLIENT NAME & ADDRESS (REPORT TO BE SENT TO:)

W. EARL FLOYD + SON
8901 HEALING RD.
JAX, FL
ATTN: MR. EARL FLOYD

REMARKS: # 8

PROJ. NO.

PROJECT NAME/ ADDRESS:
JEA JOB
BRANDY BRANCH

SAMPLERS: (SIGNATURE)
Larry J. Floyd

Sample Location ID	DATE	TIME	COMP	GRAB	TOTAL NO. of Containers	8oz/poly w/HNO3	Gallon/poly	8oz/poly w/H2SO4	PARAMETERS
EAST WELL	6-1 2000	8:00 AM		✓	1	1			Ca, Mg, Na, Mn, Ba, Sr, Al, K, Fe, TOT. HARDNESS, SILICA, M+P ALKALINITY, Cl, F, SO4, TDS, TSS, COLOR, TURB, NITRATE, TOT. PHOS., TOC
		12:45			1		1		
		80			1			1	
					1	1			Ca, Mg, Na, Mn, Ba, Sr, Al, K, Fe, TOT. HARDNESS, SILICA, M+P ALKALINITY, Cl, F, SO4, TDS, TSS, COLOR, TURB, NITRATE, TOT. PHOS., TOC
					1		1		
					1			1	

RELINQUISHED BY	DATE/TIME	RECEIVED BY	DATE/TIME
Larry J. Floyd	6-1 2000 1245		
RELINQUISHED BY	DATE/TIME	RECEIVED BY	DATE/TIME
RELINQUISHED BY	DATE/TIME	RECEIVED BY	DATE/TIME
		RECEIVED FOR LABORATORY BY: D. Allen	DATE/TIME: 6-1-00 1245

EARL FLOYD & SON

Lab No.	Parameter	Date of Analysis	Analysis Time	Analyst	Prep Date
00060024	Calcium	06/02/2000		REM	
00060024	Magnesium	06/02/2000		REM	
00060024	Sodium	06/02/2000		REM	
00060024	Aluminum (0.2)	06/02/2000		REM	
00060024	Potassium	06/02/2000		REM	
00060024	Iron	06/02/2000		REM	
00060024	Silica	07/02/2000		REM	
00060024	Chloride (250)	06/06/2000	11:40	SMG	
00060024	Fluoride (4)	06/06/2000	11:40	SMG	
00060024	Nitrate	06/02/2000	13:30	SMG	
00060024	Sulfate (250)	06/06/2000	11:40	SMG	
00060024	Total Phosphorus	06/08/2000	14:45	SMG	
00060024	Total Dissolved Solids (5	06/01/2000	20:00	NSM	
00060024	Total Suspended Solids	06/02/2000	23:50	NSM	
00060024	Color (15 CU)	06/01/2000	16:00	NM	

W. EARL FLOYD & SON

Lab No.	Parameter	Date of Analysis	Analysis Time	Analyst	Prep Date
00060024	Turbidity	06/01/2000	16:00	NSM	
00060024	Specific Conductance	06/01/2000	20:00	NSM	
00060024	Total Organic Carbon	06/08/2000	9:00	SMG	
00060024	Manganese	06/02/2000		REM	
00060024	Barium (2)	06/02/2000		REM	
00060024	Strontium	06/02/2000		REM	
00060024	Total Hardness	06/02/2000		REM	
00060024	M - Alkalinity	06/09/2000	12:00	SMG	
00060024	P - Alkalinity	06/09/2000	12:00	SMG	

OC060024 F-3

Technical Services, Inc.
2901 Danese St., Jacksonville, FL 32206
(904) 353-5761 / fax (904) 358-2908

CHAIN of CUSTODY RECORD

CLIENT NAME & ADDRESS (REPORT TO BE SENT TO:)

W. EARL FLOYD + SON
8901 HELLONG RD.
JAX, FL
ATTN: MR. EARL FLOYD

REMARKS:

#7

PROJ. NO

PROJECT NAME/ ADDRESS:
JEA JOB
BRANDY BRANCH

SAMPLERS: (SIGNATURE)

Larry J. Floyd

Sample Location ID	DATE	TIME	COMP	GRAB	TOTAL NO. of Containers	BOTTLE MAKEUP: 0T/poly HNO3	BOTTLE MAKEUP: Gallon/poly	BOTTLE MAKEUP: 0T/poly H2SO4	PARAMETERS
EAST well	6-1-2000	2:00 AM		✓	1	1			Ca, Mg, Na, Mn, Ba, Sr, Al, K, Fe, TOT. HARDNESS, SILICA, M + P ALKALINITY, Cl, FL, SO4, TDS, TSS, COLOR, TURB, NITRATE, TOT. PHOS., TOC
					1		1		
					1			1	
					1	1			Ca, Mg, Na, Mn, Ba, Sr, Al, K, Fe, TOT. HARDNESS, SILICA, M+P ALKALINITY, Cl, FL, SO4, TDS, TSS, COLOR, TURB, NITRATE, TOT. PHOS., TOC
					1		1		
					1			1	

RELINQUISHED BY:	DATE/TIME	RECEIVED BY	DATE/TIME
Larry J. Floyd	6-1-2000	12:45	
RELINQUISHED BY:	DATE/TIME	RECEIVED BY	DATE/TIME
RELINQUISHED BY:	DATE/TIME	RECEIVED BY	DATE/TIME
		RECEIVED FOR LABORATORY BY: D. Allman	DATE/TIME 6-1-00 1245

TECHNICAL SERVICES, INC.
ENVIRONMENTAL CONSULTANTS

For W. EARL FLOYD & SON
8901 HERLONG RD
JACKSONVILLE, FLORIDA
Contact: MR. LARRY FLOYD

Report Date 12-Jun-00
Date Received 06/01/2000 @ 12:45
Purchase Order #:

CERTIFICATE OF ANALYSIS

LAB	MATRIX	SAMPLE DATE	SAMPLE TIME	SAMPLED BY
SAMPLE DESCRIPTION				
00060025	DW	06/01/2000	0800	CLIENT REP
BRANDY BRANCH, EAST WELL				

Respectfully submitted,
Technical Services, Inc.

Walter Mock

W. EARL FLOYD & SON

Lab No.	Parameter	Result		Code	Method	Detection Limit
00060025	Calcium	31.9	mg/L		EPA 200.7	0.015
00060025	Magnesium	12.7	mg/L		EPA 200.7	0.02
00060025	Sodium	7.87	mg/L		EPA 200.7	0.017
00060025	Aluminum (0.2)	< 0.025	mg/L	U	EPA 200.7	0.025
00060025	Potassium	1.59	mg/L		EPA 200.7	0.2
00060025	Iron	< 0.004	mg/L	U	EPA 200.7	0.004
00060025	Silica	8.28	mg/L		EPA 200.7	0.02
00060025	Chloride (250)	9.05	mg/L	A	EPA 300.0	0.05
00060025	Fluoride (4)	0.76	mg/L	A	EPA 300.0	0.1
00060025	Nitrate	0.067	mg/L N		EPA 353.2	0.02
00060025	Sulfate (250)	27.9	mg/L	A	EPA 300.0	0.05
00060025	Total Phosphorus	< 0.05	mg/L	U	EPA 365.4_CU	0.05
00060025	Total Dissolved Solids (5	175	mg/L		SM 2540C	1
00060025	Total Suspended Solids	3	mg/L		EPA 160.2	1
00060025	Color (15 CU)	< 5	CU	U	SM 2120B	5

W. EARL FLOYD & SON

Lab No.	Parameter	Result		Code	Method	Detection Limit
00060025	Turbidity	< 0.05	NTU	U	EPA 180.1	0.05
00060025	Specific Conductance	434	umhos/cm		EPA 120.1	0.01
00060025	Total Organic Carbon	6	mg/L		EPA 415.1	1
00060025	Manganese	< 0.003	mg/L	U	EPA 200.7	0.003
00060025	Barium (2)	0.014	mg/L		EPA 200.7	0.002
00060025	Strontium	1.30	mg/L		SW 6010	0.001
00060025	Total Hardness	132	mg CaCO3/L		EPA 200.7	
00060025	M - Alkalinity	120	mg/L		SM 2320B	0.2
00060025	P - Alkalinity	< 0.2	mg/L	U	SM 2320B	0.2

EARL FLOYD & SON

Lab No.	Parameter	Date of Analysis	Analysis Time	Analyst	Prep Date
00060025	Calcium	06/02/2000		REM	
00060025	Magnesium	06/02/2000		REM	
00060025	Sodium	06/02/2000		REM	
00060025	Aluminum (0.2)	06/02/2000		REM	
00060025	Potassium	06/02/2000		REM	
00060025	Iron	06/02/2000		REM	
00060025	Silica	07/02/2000		REM	
00060025	Chloride (250)	06/06/2000	11:40	SMG	
00060025	Fluoride (4)	06/06/2000	11:40	SMG	
00060025	Nitrate	06/02/2000	13:30	SMG	
00060025	Sulfate (250)	06/06/2000	11:40	SMG	
00060025	Total Phosphorus	06/08/2000	14:45	SMG	
00060025	Total Dissolved Solids (5	06/01/2000	20:00	NSM	
00060025	Total Suspended Solids	06/02/2000	23:50	NSM	
00060025	Color (15 CU)	06/01/2000	16:00	NM	

W. EARL FLOYD & SON

Lab No.	Parameter	Date of Analysis	Analysis Time	Analyst	Prep Date
00060025	Turbidity	06/01/2000	16:00	NSM	
00060025	Specific Conductance	06/01/2000	20:00	NSM	
00060025	Total Organic Carbon	06/08/2000	9:00	SMG	
00060025	Manganese	06/02/2000		REM	
00060025	Barium (2)	06/02/2000		REM	
00060025	Strontium	06/02/2000		REM	
00060025	Total Hardness	06/02/2000		REM	
00060025	M - Alkalinity	06/09/2000	12:00	SMG	
00060025	P - Alkalinity	06/09/2000	12:00	SMG	

. EARL FLOYD & SON

Lab No.	Parameter	Result		Code	Method	Detection Limit
00060023	Calcium	32.5	mg/L		EPA 200.7	0.015
00060023	Magnesium	12.5	mg/L		EPA 200.7	0.02
00060023	Sodium	7.86	mg/L		EPA 200.7	0.017
00060023	Aluminum (0.2)	< 0.025	mg/L	U	EPA 200.7	0.025
00060023	Potassium	1.61	mg/L		EPA 200.7	0.2
00060023	Iron	< 0.004	mg/L	U	EPA 200.7	0.004
00060023	Silica	8.46	mg/L		EPA 200.7	0.02
00060023	Chloride (250)	8.77	mg/L		EPA 300.0	0.05
00060023	Fluoride (4)	0.75	mg/L		EPA 300.0	0.1
00060023	Nitrate	0.025	mg/L N		EPA 353.2	0.02
00060023	Sulfate (250)	27.9	mg/L		EPA 300.0	0.05
00060023	Total Phosphorus	< 0.05	mg/L	U	EPA 365.4_CU	0.05
00060023	Total Dissolved Solids (5	186	mg/L		SM 2540C	1
00060023	Total Suspended Solids	< 1	mg/L	U	EPA 160.2	1
00060023	Color (15 CU)	< 5	CU	U	SM 2120B	5

W. EARL FLOYD & SON

Lab No.	Parameter	Result		Code	Method	Detection Limit
00060023	Turbidity	< 0.05	NTU	U	EPA 180.1	0.05
00060023	Specific Conductance	432	umhos/cm		EPA 120.1	0.01
00060023	Total Organic Carbon	6	mg/L		EPA 415.1	1
00060023	Manganese	< 0.003	mg/L	U	EPA 200.7	0.003
00060023	Barium (2)	0.015	mg/L		EPA 200.7	0.002
00060023	Strontium	1.29	mg/L		SW 6010	0.001
00060023	Total Hardness	133	mg CaCO3/L		EPA 200.7	
00060023	M - Alkalinity	126	mg/L		SM 2320B	0.2
00060023	P - Alkalinity	< 0.2	mg/L	U	SM 2320B	0.2

W. Earl Floyd & Son Inc.

Lab No.	Parameter	Date of Analysis	Analysis Time	Analyst	Prep Date
00051006	Total Dissolved Solids	05/31/2000	13:00	NSM	
00051006	Total Suspended Solids	05/31/2000	18:00	NSM	
00051006	Color (15 CU)	05/31/2000	14:20	AW/NM	
00051006	Turbidity	05/31/2000	14:00	NSM	
00051006	Specific Conductance	05/31/2000	11:00	NM	
00051006	Total Organic Carbon	06/08/2000	9:00	SMG	
00051006	Total Hardness	06/02/2000		REM	
00051006	M - Alkalinity	06/09/2000	12:00	SMG	
00051006	P - Alkalinity	06/09/2000	12:00	SMG	

W. Earl Floyd & Son Inc.

Lab No.	Parameter	Date of Analysis	Analysis Time	Analyst	Prep Date
00051005	Total Dissolved Solids	05/31/2000	13:00	NSM	
00051005	Total Suspended Solids	05/31/2000	18:00	NSM	
00051005	Color (15 CU)	05/31/2000	14:20	AW/NM	
00051005	Turbidity	05/31/2000	14:00	NSM	
00051005	Specific Conductance	05/31/2000	11:00	NM	
00051005	Total Organic Carbon	06/08/2000	9:00	SMG	
00051005	Total Hardness	06/02/2000		REM	
00051005	M - Alkalinity	06/09/2000	12:00	SMG	
00051005	P - Alkalinity	06/09/2000	12:00	SMG	

0005100S-F3

Technical Services, Inc.
2901 Danese St., Jacksonville, FL 32206
(904) 353-5761 / fax (904) 358-2908

CHAIN of CUSTODY RECORD

CLIENT NAME & ADDRESS (REPORT TO BE SENT TO:)

W. EARL FLOYD + SON
2901 HELLING RD.
JAX, FL
ATTN: MR. EARL FLOYD

REMARKS: #3

PROJ. NO.

PROJECT NAME/ ADDRESS:
JEA JOB
BRANDY BRANCH

SAMPLERS: (SIGNATURE)
Larry J. Floyd

Sample Location ID	DATE	TIME	COMP	GRAB	TOTAL NO. of Containers	0.5 gal/poly w/HNO3	1 gal/poly	0.5 gal/poly w/H2SO4	PARAMETERS
EASTWELL	5-31-2000	2:00 AM		✓	1	1			Ca, Mg, Na, Mn, Ba, Sr, Al, K, Fe, TOT. HARDNESS, SILICA, M+P ALKALINITY, Cl
					1		1		Fl, SO4, TDS, TSS, COLOR, TURB, NITRATE, TOT. PHOS., TOC
					1			1	
					1	1			Ca, Mg, Na, Ya, Ba, Sr, Al, K, Fe, TOT. HARDNESS, SILICA, M+P ALKALINITY, Cl, SO4, TDS, TSS, COLOR, TURB, N. RATE, TOT. PHOS., TOC
					1		1		
					1			1	

RELINQUISHED BY	DATE/TIME	RECEIVED BY	DATE/TIME
Larry J. Floyd	5-31-2000 8:07 AM	Eliz Moore	5-31-00 8:07 AM
RELINQUISHED BY	DATE/TIME	RECEIVED BY	DATE/TIME
RELINQUISHED BY	DATE/TIME	RECEIVED BY	DATE/TIME
Eliz Moore	5-31-00 9:25	RECEIVED FOR LABORATORY BY: D. Allen	DATE/TIME: 5-31-00 9:25

TECHNICAL SERVICES, INC.
ENVIRONMENTAL CONSULTANTS

For W. Earl Floyd & Son Inc.
8901 Herlong Rd.
Jacksonville, FL 32210
Contact: Larry J. Floyd

Report Date 12-Jun-00
Date Received 05/31/2000 @ 9:25
Purchase Order #:

CERTIFICATE OF ANALYSIS

LAB	MATRIX	SAMPLE DATE	SAMPLE TIME	SAMPLED BY
SAMPLE DESCRIPTION				
00051006	DW	05/31/2000	0800	CLIENT REP
JEA JOB, EAST WELL				

Respectfully submitted,
Technical Services, Inc.

Walter Mack

W. Earl Floyd & Son Inc.

Lab No.	Parameter	Result		Code	Method	Detection Limit
00051006	Calcium	31.4	mg/L		EPA 200.7	0.015
00051006	Magnesium	12.5	mg/L		EPA 200.7	0.02
00051006	Sodium (160)	7.71	mg/L		EPA 200.7	0.017
00051006	Manganese (0.05)	< 0.003	mg/L	U	EPA 200.7	0.003
00051006	Barium (2)	0.014	mg/L		EPA 200.7	0.002
00051006	Strontium	1.28	mg/L		SW 6010	0.001
00051006	Aluminum (0.2)	< 0.025	mg/L	U	EPA 200.7	0.025
00051006	Potassium	1.54	mg/L		EPA 200.7	0.2
00051006	Iron (0.3)	< 0.004	mg/L	U	EPA 200.7	0.004
00051006	Silica	8.80	mg/L		EPA 200.7	0.02
00051006	Chloride (250)	8.86	mg/L		EPA 300.0	0.05
00051006	Fluoride (4)	0.76	mg/L		EPA 300.0	0.1
00051006	Nitrate	0.04	mg/L N		EPA 353.2	0.02
00051006	Sulfate (250)	25.5	mg/L		EPA 300.0	0.05
00051006	Total Phosphorus	< 0.05	mg/L	U	EPA 365.4_CU	0.05

W. Earl Floyd & Son Inc.

Lab No.	Parameter	Result		Code	Method	Detection Limit
00051006	Total Dissolved Solids	133	mg/L		EPA 160.1	1
00051006	Total Suspended Solids	< 1	mg/L	U	EPA 160.2	1
00051006	Color (15 CU)	< 5	CU	U	SM 2120B	5
00051006	Turbidity	1.0	NTU		EPA 180.1	0.02
00051006	Specific Conductance	366	umhos/cm		EPA 120.1	0.01
00051006	Total Organic Carbon	7	mg/L		EPA 415.1	1
00051006	Total Hardness	130	mg CaCO3/L		EPA 200.7	
00051006	M - Alkalinity	118	mg/L	A	SM 2320B	0.2
00051006	P - Alkalinity	< 0.2	mg/L	U	SM 2320B	0.2

W. Earl Floyd & Son Inc.

Lab No.	Parameter	Date of Analysis	Analysis Time	Analyst	Prep Date
00051006	Calcium	06/02/2000		REM	
00051006	Magnesium	06/02/2000		REM	
00051006	Sodium (160)	06/02/2000		REM	
00051006	Manganese (0.05)	06/02/2000		REM	
00051006	Barium (2)	06/02/2000		REM	
00051006	Strontium	06/02/2000		REM	
00051006	Aluminum (0.2)	06/02/2000		REM	
00051006	Potassium	06/02/2000		REM	
00051006	Iron (0.3)	06/02/2000		REM	
00051006	Silica	07/02/2000		REM	
00051006	Chloride (250)	06/06/2000	11:40	SMG	
00051006	Fluoride (4)	06/06/2000	11:40	SMG	
00051006	Nitrate	05/31/2000	12:50	SMG	
00051006	Sulfate (250)	06/06/2000	11:40	SMG	
00051006	Total Phosphorus	06/02/2000	10:00	SMG	

0005100A-1

Technical Services, Inc.
2901 Danese St., Jacksonville, FL 32206
(904) 353-5761 / fax (904) 358-2908

CHAIN of CUSTODY RECORD

CLIENT NAME & ADDRESS (REPORT TO BE SENT TO:)

W. EARL FLOYD + SON
2901 HEDLONG RD.
JAX, FL
ATTN: MR. LARRY FLOYD

REMARKS:

#2

PROJ. NO.

PROJECT NAME/ ADDRESS:
JEA JOB
BRAND BRANCH

SAMPLERS: (SIGNATURE)

Larry F. Floyd

Sample Location ID	DATE	TIME	COMP/GRAB	TOTAL NO. of Containers	BOTTLE MAKEUP: Qt/poly w/HNO3	Gallon/poly	Qt/poly w/H2SO4	PARAMETERS
EAST WELL	5-30-2000	8:00pm	✓	1	1			Ca, Mg, Na, Mn, Ba, Sr, Al, K, Fe, TOT. HARDNESS, SILICA, M + P ALKALINITY, Cl, FL, SO4, TDS, TSS, COLOR, TURB, NITRATE, TOT. PHOS., TOC
				1		1		
				1			1	
				1	1			Ca, Mg, Na, Mn, Ba, Sr, Al, K, Fe, TOT. HARDNESS, SILICA, M+P ALKALINITY, Cl, FL, SO4, TDS, TSS, COLOR, TURB, NITRATE, TOT. PHOS., TOC
				1		1		
				1			1	

RELINQUISHED BY:	DATE/TIME	RECEIVED BY	DATE/TIME
Larry F. Floyd	5-31-2000 8:07 AM	Eliz Hancock	5-31-00 8:07 AM
RELINQUISHED BY:	DATE/TIME	RECEIVED BY	DATE/TIME
RELINQUISHED BY:	DATE/TIME	RECEIVED BY	DATE/TIME
Eliz Hancock	5-31-00 9:25	RECEIVED FOR LABORATORY BY: D. Allen	DATE/TIME: 5-31-00 925

TECHNICAL SERVICES, INC.
ENVIRONMENTAL CONSULTANTS

For W. Earl Floyd & Son Inc.
8901 Herlong Rd.
Jacksonville, FL 32210
Contact: Larry J. Floyd

Report Date 12-Jun-00
Date Received 05/31/2000 @ 9:25
Purchase Order #:

CERTIFICATE OF ANALYSIS

LAB	MATRIX	SAMPLE DATE	SAMPLE TIME	SAMPLED BY
SAMPLE DESCRIPTION				
00051005	DW	05/31/2000	0200	CLIENT REP
JEA JOB, EAST WELL				

Respectfully submitted,
Technical Services, Inc.

Walter Mack

W. Earl Floyd & Son Inc.

Lab No.	Parameter	Result		Code	Method	Detection Limit
00051005	Calcium	32.3	mg/L		EPA 200.7	0.015
00051005	Magnesium	12.8	mg/L		EPA 200.7	0.02
00051005	Sodium (160)	8.02	mg/L		EPA 200.7	0.017
00051005	Manganese (0.05)	< 0.003	mg/L	U	EPA 200.7	0.003
00051005	Barium (2)	0.015	mg/L		EPA 200.7	0.002
00051005	Strontium	1.31	mg/L		SW 6010	0.001
00051005	Aluminum (0.2)	< 0.025	mg/L	U	EPA 200.7	0.025
00051005	Potassium	1.65	mg/L		EPA 200.7	0.2
00051005	Iron (0.3)	< 0.004	mg/L	U	EPA 200.7	0.004
00051005	Silica	8.51	mg/L		EPA 200.7	0.02
00051005	Chloride (250)	8.81	mg/L		EPA 300.0	0.05
00051005	Fluoride (4)	0.76	mg/L		EPA 300.0	0.1
00051005	Nitrate	< 0.02	mg/L N	U	EPA 353.2	0.02
00051005	Sulfate (250)	25.2	mg/L		EPA 300.0	0.05
00051005	Total Phosphorus	< 0.05	mg/L	U	EPA 365.4_CU	0.05

W. Earl Floyd & Son Inc.

Lab No.	Parameter	Result		Code	Method	Detection Limit
00051005	Total Dissolved Solids	152	mg/L	A	EPA 160.1	1
00051005	Total Suspended Solids	< 1	mg/L	U	EPA 160.2	1
00051005	Color (15 CU)	< 5	CU	U	SM 2120B	5
00051005	Turbidity	1.0	NTU		EPA 180.1	0.02
00051005	Specific Conductance	366	umhos/cm		EPA 120.1	0.01
00051005	Total Organic Carbon	10	mg/L	A	EPA 415.1	1
00051005	Total Hardness	133	mg CaCO3/L		EPA 200.7	
00051005	M - Alkalinity	119	mg/L		SM 2320B	0.2
00051005	P - Alkalinity	< 0.2	mg/L	U	SM 2320B	0.2

W. Earl Floyd & Son Inc.

Lab No.	Parameter	Date of Analysis	Analysis Time	Analyst	Prep Date
00051005	Calcium	06/02/2000		REM	
00051005	Magnesium	06/02/2000		REM	
00051005	Sodium (160)	06/02/2000		REM	
00051005	Manganese (0.05)	06/02/2000		REM	
00051005	Barium (2)	06/02/2000		REM	
00051005	Strontium	06/02/2000		REM	
00051005	Aluminum (0.2)	06/02/2000		REM	
00051005	Potassium	06/02/2000		REM	
00051005	Iron (0.3)	06/02/2000		REM	
00051005	Silica	07/02/2000		REM	
00051005	Chloride (250)	06/06/2000	11:40	SMG	
00051005	Fluoride (4)	06/06/2000	11:40	SMG	
00051005	Nitrate	05/31/2000	12:30	SMG	
00051005	Sulfate (250)	06/06/2000	11:40	SMG	
00051005	Total Phosphorus	06/02/2000	10:00	SMG	

W. Earl Floyd & Son Inc.

Lab No.	Parameter	Date of Analysis	Analysis Time	Analyst	Prep Date
00051003	Calcium	06/02/2000		REM	
00051003	Magnesium	06/02/2000		REM	
00051003	Sodium (160)	06/02/2000		REM	
00051003	Manganese (0.05)	06/02/2000		REM	
00051003	Barium (2)	06/02/2000		REM	
00051003	Strontium	06/02/2000		REM	
00051003	Aluminum (0.2)	06/02/2000		REM	
00051003	Potassium	06/02/2000		REM	
00051003	Iron (0.3)	06/02/2000		REM	
00051003	Silica	07/02/2000		REM	
00051003	Chloride (250)	06/06/2000	11:40	SMG	
00051003	Fluoride (4)	06/06/2000	11:40	SMG	
00051003	Nitrate	05/31/2000	12:10	SMG	
00051003	Sulfate (250)	06/06/2000	11:40	SMG	
00051003	Total Phosphorus	06/02/2000	10:00	SMG	

W. Earl Floyd & Son Inc.

Lab No.	Parameter	Date of Analysis	Analysis Time	Analyst	Prep Date
00051003	Total Dissolved Solids	05/31/2000	13:00	NSM	
00051003	Total Suspended Solids	05/31/2000	18:00	NSM	
00051003	Color (15 CU)	05/31/2000	14:20	AW/NM	
00051003	Turbidity	05/31/2000	14:00	NSM	
00051003	Specific Conductance	05/31/2000	11:00	NM	
00051003	Total Organic Carbon	06/08/2000	9:00	SMG	
00051003	Total Hardness	06/02/2000		REM	
00051003	M - Alkalinity	06/09/2000	12:00	SMG	
00051003	P - Alkalinity	06/09/2000	12:00	SMG	

00051003-4-3-

Technical Services, Inc.
2901 Danese St., Jacksonville, FL 32206
(904) 353-5761 / fax (904) 358-2908

CHAIN of CUSTODY RECORD

CLIENT NAME & ADDRESS (REPORT TO BE SENT TO:)

W. EARL FLOYD + SON
2901 HELLONG RD.
JAX, FL
ATTN: MR. LARRY FLOYD

REMARKS: #1

PROJ. NO.: JEA. BRANCH

PROJECT NAME/ ADDRESS: JEA JOB

SAMPLERS: (SIGNATURE): Larry J. Floyd

Sample Location ID	DATE	TIME	COMP	GRAB	TOTAL NO. of Containers	BOTTLE MAKEUP: Qt/poly w/HNO3	Gallon/poly	Qt/poly w/H2SO4	PARAMETERS
EAST WELL	5-30-2000	2:00 PM.		✓	1	1			Ca, Mg, Na, Mn, Ba, Sr, Al, K, Fe, TOT. HARDNESS, SILICA, NH3 + ALKALINITY, Cl
					1		1		Cl-, SO4, TDS, TSS, COLOR, TURB, NITRATE, TOT. PHOS., TOC
					1			1	
					1	1			Ca, Mg, Na, Mn, Ba, Sr, Al, K, Fe, TOT. HARDNESS, SILICA, NH3 + ALKALINITY, Cl
					1		1		SO4, TDS, TSS, COLOR, TURB, NITRATE, TOT. PHOS., TOC
					1			1	

RELINQUISHED BY	DATE/TIME	RECEIVED BY	DATE/TIME
Larry J. Floyd	5.31.2000 8:07	[signature]	5-31-00 8:07 am
[signature]	5-31-00 4:25	RECEIVED FOR LABORATORY BY: D. Q. Allen	DATE/TIME: 5-31-00 9:25

TECHNICAL SERVICES, INC.
ENVIRONMENTAL CONSULTANTS

For W. Earl Floyd & Son Inc.
8901 Herlong Rd.
Jacksonville, FL 32210
Contact: Larry J. Floyd

Report Date 12-Jun-00
Date Received 05/31/2000 @ 9:25
Purchase Order #:

CERTIFICATE OF ANALYSIS

LAB	MATRIX	SAMPLE DATE	SAMPLE TIME	SAMPLED BY
SAMPLE DESCRIPTION				
00051004	DW	05/30/2000	2000	CLIENT REP
JEA JOB, EAST WELL				

Respectfully submitted,
Technical Services, Inc.

Walter Mack

V. Earl Floyd & Son Inc.

Lab No.	Parameter	Result		Code	Method	Detection Limit
00051004	Calcium	34.0	mg/L		EPA 200.7	0.015
00051004	Magnesium	13.4	mg/L		EPA 200.7	0.02
00051004	Sodium (160)	8.35	mg/L		EPA 200.7	0.017
00051004	Manganese (0.05)	< 0.003	mg/L	U	EPA 200.7	0.003
00051004	Barium (2)	0.015	mg/L		EPA 200.7	0.002
00051004	Strontium	1.37	mg/L		SW 6010	0.001
00051004	Aluminum (0.2)	< 0.025	mg/L	U	EPA 200.7	0.025
00051004	Potassium	1.70	mg/L		EPA 200.7	0.2
00051004	Iron (0.3)	< 0.004	mg/L	U	EPA 200.7	0.004
00051004	Silica	7.52	mg/L		EPA 200.7	0.02
00051004	Chloride (250)	8.82	mg/L		EPA 300.0	0.05
00051004	Fluoride (4)	0.76	mg/L		EPA 300.0	0.1
00051004	Nitrate	0.04	mg/L N		EPA 353.2	0.02
00051004	Sulfate (250)	25.3	mg/L		EPA 300.0	0.05
00051004	Total Phosphorus	< 0.05	mg/L	U	EPA 365.4_CU	0.05

W. Earl Floyd & Son Inc.

Lab No.	Parameter	Result		Code	Method	Detection Limit
00051004	Total Dissolved Solids	160	mg/L		EPA 160.1	1
00051004	Total Suspended Solids	< 1	mg/L	U	EPA 160.2	1
00051004	Color (15 CU)	< 5	CU	U	SM 2120B	5
00051004	Turbidity	1.0	NTU		EPA 180.1	0.02
00051004	Specific Conductance	357	umhos/cm		EPA 120.1	0.01
00051004	Total Organic Carbon	6	mg/L		EPA 415.1	1
00051004	Total Hardness	140	mg CaCO3/L		EPA 200.7	
00051004	M - Alkalinity	126	mg/L		SM 2320B	0.2
00051004	P - Alkalinity	< 0.2	mg/L	U	SM 2320B	0.2

V. Earl Floyd & Son Inc.

Lab No.	Parameter	Date of Analysis	Analysis Time	Analyst	Prep Date
00051004	Calcium	06/02/2000		REM	
00051004	Magnesium	06/02/2000		REM	
00051004	Sodium (160)	06/02/2000		REM	
00051004	Manganese (0.05)	06/02/2000		REM	
00051004	Barium (2)	06/02/2000		REM	
00051004	Strontium	06/02/2000		REM	
00051004	Aluminum (0.2)	06/02/2000		REM	
00051004	Potassium	06/02/2000		REM	
00051004	Iron (0.3)	06/02/2000		REM	
00051004	Silica	07/02/2000		REM	
00051004	Chloride (250)	06/06/2000	11:40	SMG	
00051004	Fluoride (4)	06/06/2000	11:40	SMG	
00051004	Nitrate	05/31/2000	12:20	SMG	
00051004	Sulfate (250)	06/06/2000	11:40	SMG	
00051004	Total Phosphorus	06/02/2000	10:00	SMG	

W. Earl Floyd & Son Inc.

Lab No.	Parameter	Date of Analysis	Analysis Time	Analyst	Prep Date
00051004	Total Dissolved Solids	05/31/2000	13:00	NSM	
00051004	Total Suspended Solids	05/31/2000	18:00	NSM	
00051004	Color (15 CU)	05/31/2000	14:20	AW/NM	
00051004	Turbidity	05/31/2000	14:00	NSM	
00051004	Specific Conductance	05/31/2000	11:00	NM	
00051004	Total Organic Carbon	06/08/2000	9:00	SMG	
00051004	Total Hardness	06/02/2000		REM	
00051004	M - Alkalinity	06/09/2000	12:00	SMG	
00051004	P - Alkalinity	06/09/2000	12:00	SMG	

Applic[redacted] Fred Benson Miller Jr
1840 Seminole Rd
Jacksonville, FL 32205

GRS # 51

STATION NAME	DIAMETER	CAPACITY FLOW RATE	DEPTH	SECTION	TOWNSHIP	RANGE	LAT	LONG
A	8.	300 GPM	700'	15	2S	24	301913	815344

NO AS-BUILTS ?

PERMITTED WATER WELL CONSTRUCTION PERMIT PAGE: 1

PERMIT NO.: 3-089-0046P
RELATED CUP:
DATE RECD: / /
DATE ISSUED: 4/17/89
EXPIRATION: 10/17/89

CONTRACTOR: 7013

OWNER: RALPH T. SPENCER
P. O. BOX 5014
CALLAHAN FL 32011

SUR. CASING: 0.00
OPEN HOLE: 2"
CASED DEPTH:
TOTAL DEPTH:

TOP 20:
BOTTOM-TOP: X
BOTTOM 5:

METHOD USED: ROTARY
CASING MATL: SCH. 40 GALVANIZED
ANNULAR MATL:

WELL USE: PUBLIC SUPPLY
PROJECT: MULCH MANUFACTURING
LOCATION:
COUNTY:
SECTION: 33 TOWNSHIP: 01 RANGE: 24
LATITUDE: LONGITUDE:
MOD. DESC.:

AB. DESC.:

COMMENTS:

CONDITIONS: SEE PERMIT

NEW WELL: XX
MODIFIED:
ABANDONMENT:
CASING

WATER WELL CONSTRUCTION LOGS:

THICK	DIAMETER	C. DEPTH	F. DEPTH	T. DEPTH	G. DEPTH	LOG
	3.00	0				SAND
0	0.00	0	0	0	0	HARD PAN
0	0.00	0	0	0	0	SAND
0	0.00	0	0	0	0	SHELL & GRAVEL
0	0.00	0	0	0	0	BLACK ROCK
0	0.00	0	0	0	0	CAVITY
	0.00	0	0	0	0	

PERMITTED WATER WELL CONSTRUCTION PERMIT PAGE: 1

ERMIT NO.: 3-031-0285AP
ATED CUP:
ATE RECD: 10/ 1/90
ATE ISSUED: 10/ 5/90
XPIRATION: 10/ 5/91

ONTRACTOR: 1515

WNER: CHAMPION INTERNATIONAL CORP.
109 HALSEMA RD. P.O. BOX 308
JACKSONVILLE FL 32220

SUR. CASING: 6.00
OPEN HOLE: 3"
CASED DEPTH:
TOTAL DEPTH:

TOP 20:
BOTTOM-TOP: X
BOTTOM 5:

METHOD USED: ROTARY
CASING MATL: BLACK STEEL
ANNULAR MATL: CEMENT GROUT

ELL USE: PUBLIC SUPPLY
ROJECT: 109 HALSEMI RD.
OCATION:
OUNTY: 31
ECTION: 23 TOWNSHIP: 02 RANGE: 24
ATITUDE: LONGITUDE:
OD. DESC.:

B. DESC.:

ON NTS:

ONDITIONS: SEE PERMIT

EW WELL: XX
ODIFIED:
BANDONMENT:
ASING

WATER WELL CONSTRUCTION LOGS:

HICK	DIAMETER	C. DEPTH	F. DEPTH	T. DEPTH	G. DEPTH	LOG

PERMIT NO.: 3-089-0050P
RELATED CUP:
DATE RECD: / /
DATE ISSUED: / /
EXPIRATION: / /

CONTRACTOR: 2474

OWNER: →◎◎BREAD OF LIFE CHURCH
RT. 2 BOX 348
HILLIARD FL 32046

SUR. CASING: 0.00
OPEN HOLE:
CASED DEPTH:
TOTAL DEPTH:

TOP 20:
BOTTOM-TOP: X
BOTTOM 5:

METHOD USED:
CASING MATL: ROTARY
ANNULAR MATL: PVC SCH 40

WELL USE: PUBLIC SUPPLY
PROJECT:
LOCATION:
COUNTY:
SECTION: 10 TOWNSHIP: 03 RANGE: 24
LATITUDE: LONGITUDE:
MOD. DESC.:

AB. DESC.:
CEMENT GROUT
COMMENTS:

CONDITIONS: SEE PERMIT

NEW WELL: XX
MODIFIED:
ABANDONMENT:
CASING

WATER WELL CONSTRUCTION LOGS:

THICK	DIAMETER	C. DEPTH	F. DEPTH	T. DEPTH	G. DEPTH	LOG
	4.00	0				SAND
0	0.00	0	0	0	0	
0	0.00	0	0	0	0	BRN. HARD PAN
0	0.00	0	0	0	0	SAND AND CLAY
0	0.00	0	0	0	0	GRAY CLAY
0	0.00	0	0	0	0	GREEN CLAY & SHE
0	0.00	0	0	0	0	TAN ROCK
	0.00	0	0	0	0	ROCK TO CLAY

PERMITTED WATER WELL CONSTRUCTION PERMIT PAGE: 1

PERMIT NO.: 3-083-5703
ATED CUP:
DATE RECD: / /
DATE ISSUED: 05/04/80
EXPIRATION: / /

CONTRACTOR: 2048

OWNER: RICHARDS JOHN
PO BOX 117
CITRA FL 32627

SUR. CASING: 0.00
OPEN HOLE: 2
CASED DEPTH: 83
TOTAL DEPTH: 0

TOP 20:
BOTTOM-TOP:
BOTTOM 5:

METHOD USED: XX
CASING MATL: G
ANNULAR MATL: SEATED IN ROCK

WELL USE: PRIVATE
PROJECT:
LOCATION:
COUNTY:
SECTION: 01 TOWNSHIP: 03 RANGE: 23
LATITUDE: LONGITUDE:
MOD. DESC.:

AB. DESC.:

COMMENTS:

CONDITIONS:

NEW WELL: XX
MODIFIED:
ABANDONMENT:
CASING

WATER WELL CONSTRUCTION LOGS:

THICK	DIAMETER	C. DEPTH	F. DEPTH	T. DEPTH	G. DEPTH	LOG
0	0.00	0	900	101	0	WHITE SAND
0	0.00	0	0	0	0	BROKEN SHL
0	0.00	0	0	0	0	LIMESTONE

PERMITTED WATER WELL CONSTRUCTION PERMIT PAGE: 1

PERMIT NO.: 3-089-0070P
RELATED CUP:
DATE RECD: 9/20/90
DATE ISSUED: 10/ 1/90
EXPIRATION: 10/ 1/91

CONTRACTOR: 2737

OWNER: JOHN M. GORDIE
P.O. BOX 896
HILLIARD FL 32046

SUR. CASING: 5.00
OPEN HOLE: 2"
CASED DEPTH:
TOTAL DEPTH:

TOP 20:
BOTTOM-TOP: X
BOTTOM 5:

METHOD USED: ROTARY
CASING MATL: SCH 40 PVC/GALV.
ANNULAR MATL: NEAT CEMENT

WELL USE: PUBLIC SUPPLY
PROJECT: HOLLIDAY TERRACE MOTEL REST.
LOCATION:
COUNTY: 89
SECTION: 05 TOWNSHIP: 03 RANGE: 24
LATITUDE: LONGITUDE:
MOD. DESC.:

AB. DESC.:

COMMENTS:

CONDITIONS: SEE PERMIT

NEW WELL: XX
MODIFIED:
ABANDONMENT:
CASING

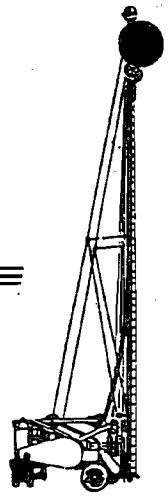
WATER WELL CONSTRUCTION LOGS:

THICK	DIAMETER	C. DEPTH	F. DEPTH	T. DEPTH	G. DEPTH	LOG

Appendix F

Water Quality Analyses

W. Earl Floyd
Larry J. Floyd
Co-Founders



Larry, J. Floyd, President
Ann R. Floyd, Sec'y-Treas.
Owners

W. Earl Floyd & Son Inc.

EST. 1962

WELL DRILLING CONTRACTORS
INDUSTRIAL – MUNICIPAL – IRRIGATION
TURBINE AND SUBMERSIBILE - SALES & SERVICE

Distributor for
PEERLESS PUMP
Line Shaft and Submersible Turbines

TELEPHONE 781-1313
8901 HERLONG ROAD
JACKSONVILLE, FLORIDA 32210

JUNE 15, 2000

MR. CHARLES UTTER
FLUOR GLOBAL
11349 NEW BERLIN ROAD
JACKSONVILLE, FLORIDA

RE: JEA - BRANDY BRANCH JOB

DEAR MR. UTTER:

WE CONDUCTED A CONSTANT RATE PUMPING TEST AT THE NEW BRANDY BRANCH POWER PLANT IN ACCORDANCE WITH THE CONTRACT REQUIREMENTS.

THE TEST WAS STARTED ON JUNE 6, 2000, AND ENDED ON JUNE 8, 2000. THE NEW EAST FLORIDAN AQUIFER PRODUCTION WELL WAS USED AS THE TEST WELL AND WAS PUMPED AT A FLOW RATE OF 900 GPMs.

AFTER APPROXIMATELY 49 HOURS OF PUMPING AT THIS RATE, THE PUMPING LEVEL IN THE WELL WAS APPROXIMATELY 81 TO 82 FEET BELOW THE TOP OF THE CASING. THIS RESULTED IN A DRAWDOWN OF ABOUT 32 FEET FROM THE STATIC WATER LEVEL AND A SPECIFIC CAPACITY OF ABOUT 28.1 GPMs PER FOOT OF DRAWDOWN.

COMPLETE PUMP TEST DATA FILES WERE ELECTRONICALLY SUBMITTED TO CRAIG WISE AND GARY SOMMERFELD, BOTH WITH BLACK AND VEATCH, BY MIKE DYKES OF CH2MHILL ON JUNE 14, 2000.

IF YOU HAVE ANY QUESTIONS ABOUT THE TESTING, PLEASE CALL ME.

VERY TRULY YOURS,

Larry J. Floyd

LARRY J. FLOYD, PRESIDENT

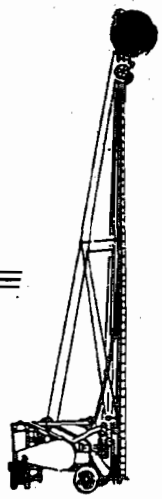
LJF:AF

ENCLOSURES: COPIES OF INVOICE NO. 5
E-MAILS FROM M. DYKES TO BLACK & VEATCH
LOGS FOR WELLS 1 & 2
TEST RESULTS FROM TECHNICAL SERVICES
CHEMICAL FIELD TESTING BY WEFS&I
CHANGE ORDER FOR WATER SAMPLING

N. Earl Floyd
Larry J. Floyd
Co-Founders

W. Earl Floyd & Son Inc.

EST. 1962



Larry, J. Floyd, President
Ann R. Floyd, Sec'y-Treas.
Owners

WELL DRILLING CONTRACTORS
INDUSTRIAL – MUNICIPAL – IRRIGATION
TURBINE AND SUBMERSIBILE - SALES & SERVICE

Distributor for
PEERLESS PUMP
Line Shaft and Submersible Turbines

TELEPHONE 781-1313
8901 HERLONG ROAD
JACKSONVILLE, FLORIDA 32210

MAY 30, 2000

MR. CHARLES UTTER
FLUOR GLOBAL
11349 NEW BERLIN ROAD
JACKSONVILLE, FLORIDA 32226

CHEMICAL FIELD TESTING
JEA - BRANDY BRANCH SITE - EAST WELL

DURING THE CONSTANT RATE TESTING, THE WELL ANALYSES WERE AS FOLLOWS:

CONDUCTIVITY:	BETWEEN 290 & 305
TEMPERATURE:	22.7 - 24.0
CHLORIDES	15 THROUGHOUT THE TEST
ph:	7.5

THE FIELD TESTING BEGAN MAY 30, 2000, AT APPROXIMATELY 8:00 A.M. AND WAS DONE EVERY SIX HOURS.

Larry J. Floyd

LARRY J. FLOYD, PRESIDENT

Service and Satisfaction Guaranteed

IMAGE QUALITY

AS YOU REVIEW THE NEXT FEW PAGES, PLEASE NOTE THAT THE ORIGINAL DOCUMENT WAS OF POOR QUALITY.

TECHNICAL SERVICES, INC.
ENVIRONMENTAL CONSULTANTS

For W. Earl Floyd & Son Inc.
8901 Herlong Rd.
Jacksonville, FL. 32210
Contact: Larry J. Floyd

Report Date 12-Jun-00
Date Received 05/31/2000 @ 9:25
Purchase Order #:

CERTIFICATE OF ANALYSIS

LAB	MATRIX	SAMPLE DATE	SAMPLE TIME	SAMPLED BY
SAMPLE DESCRIPTION				
00051003	DW	05/30/2000	1400	CLIENT REP
JEA JOB, EAST WELL				

Respectfully submitted,
Technical Services, Inc.

Walter Mock

Air and Water Pollution Sampling, Surveys, Testing and Analytical Services

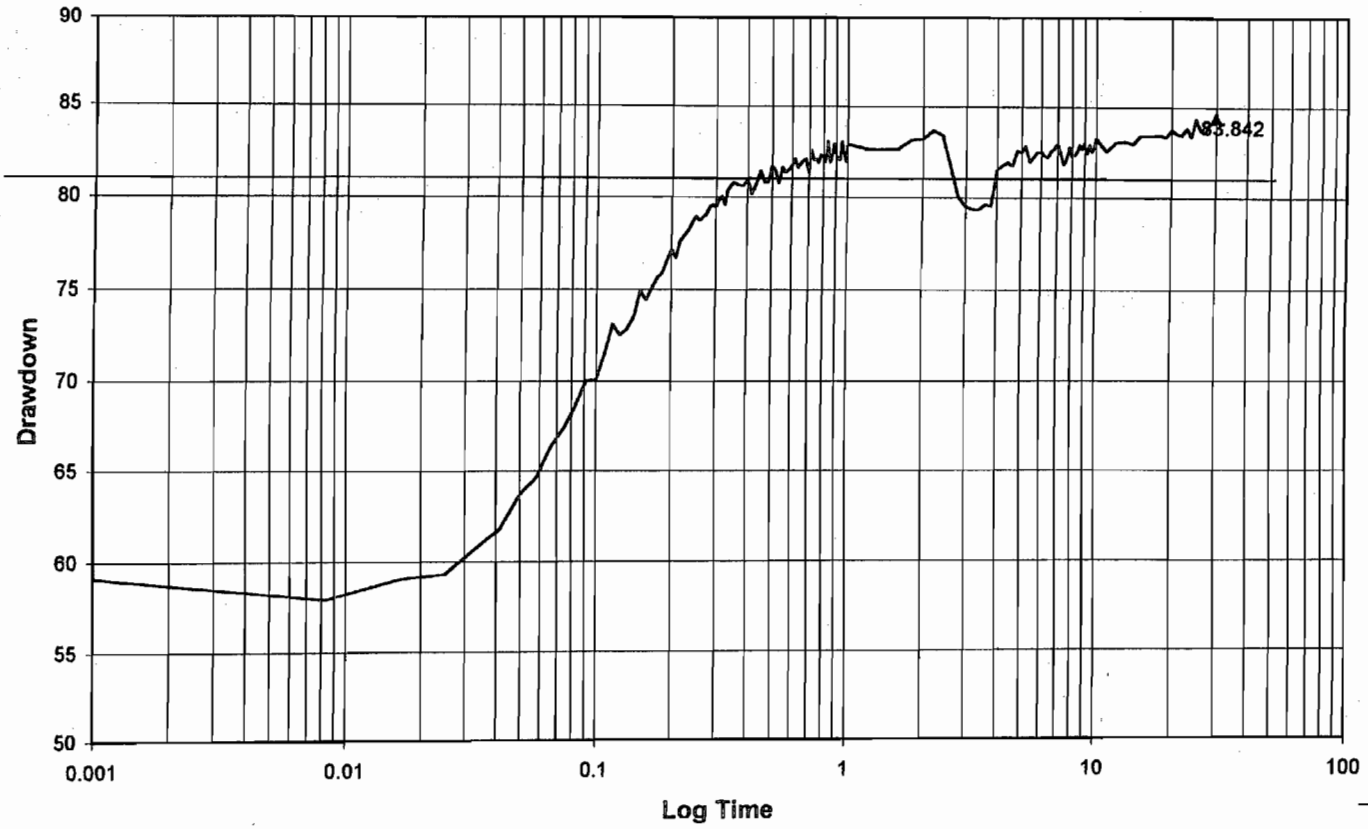
2901 Danese Street • Jacksonville, Florida 32206 • (904) 353-5761 • FAX (904) 358-2908
DHRS / HRS #82145 / E82016

V. Earl Floyd & Son Inc.

Lab No.	Parameter	Result		Code	Method	Detection Limit
00051003	Calcium	32.4	mg/L		EPA 200.7	0.015
00051003	Magnesium	12.9	mg/L		EPA 200.7	0.02
00051003	Sodium (160)	11.1	mg/L		EPA 200.7	0.017
00051003	Manganese (0.05)	< 0.003	mg/L	U	EPA 200.7	0.003
00051003	Barium (2)	0.015	mg/L		EPA 200.7	0.002
00051003	Strontium	1.30	mg/L		SW 6010	0.001
00051003	Aluminum (0.2)	< 0.025	mg/L	U	EPA 200.7	0.025
00051003	Potassium	1.58	mg/L		EPA 200.7	0.2
00051003	Iron (0.3)	0.010	mg/L		EPA 200.7	0.004
00051003	Silica	7.12	mg/L		EPA 200.7	0.02
00051003	Chloride (250)	8.98	mg/L		EPA 300.0	0.05
00051003	Fluoride (4)	0.76	mg/L		EPA 300.0	0.1
00051003	Nitrate	< 0.02	mg/L N	U	EPA 353.2	0.02
00051003	Sulfate (250)	25.5	mg/L		EPA 300.0	0.05
00051003	Total Phosphorus	< 0.05	mg/L	U	EPA 365.4_CU	0.05

W. Earl Floyd & Son Inc.

Lab No.	Parameter	Result		Code	Method	Detection Limit
00051003	Total Dissolved Solids	173	mg/L		EPA 160.1	1
00051003	Total Suspended Solids	< 1	mg/L	U	EPA 160.2	1
00051003	Color (15 CU)	< 5	CU	U	SM 2120B	5
00051003	Turbidity	1.0	NTU		EPA 180.1	0.02
00051003	Specific Conductance	351	umhos/cm		EPA 120.1	0.01
00051003	Total Organic Carbon	5	mg/L		EPA 415.1	1
00051003	Total Hardness	134	mg CaCO3/L		EPA 200.7	
00051003	M - Alkalinity	120	mg/L		SM 2320B	0.2
00051003	P - Alkalinity	< 0.2	mg/L	U	SM 2320B	0.2



JAR
PUMP TEST ANALYSIS
R 6 E
C. WISE

BLACK & VEATCH

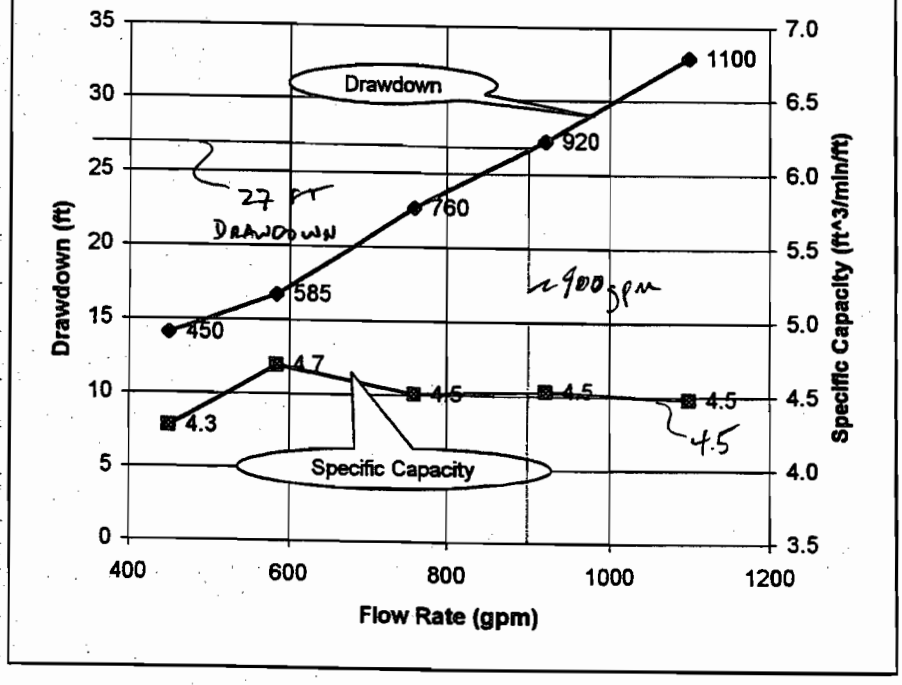
Owner JEA
Plant BRANDY BRANCH Unit
Project No. 60903.0050 File No.
Title PUMP TEST ANALYSIS

Computed By C. WISE
Date 5 JUN 2000
Verified By
Date 20
Page 7 of 9

Pumped well (East)

(a) Flow Rate (gpm)	(b) DTW @ 30min (ft)	(c) Drawdown (ft) (b-b₀)	(d) Spec Cap gpm/ft (a/c)	(e) Spec Cap ft^3/m/ft (d/7.48)
0	b₀ = 50.9	0	#DIV/0!	
450	65	14.1	31.9	4.3
585	67.6	16.7	35.0	4.7
760	73.5	22.6	33.6	4.5
920	78.1	27.2	33.8	4.5
1100	83.8	32.9	33.4	4.5

← FROM STEP-DRAWDOWN TEST



TRANSMISSIVITY / STORAGE COEFICIENT.

AS PER REF 4, CALCULATE STORATIVITY & TRANSMISSIVITY USING THE JACOB & THEIS METHODS

DO NOT WRITE IN THIS SPACE

GN-172B

BLACK & VEATCH

Owner JEA | Computed By C. WISE
Plant BRANDY BRANCH | Unit | Date 7 JUNE 20 00
Project No. 60903 | File No. | Verified By GDS
Title | Date 6-8 20
Page 8 of 9

DO NOT WRITE IN THIS SPACE

GN-172B

JACOB METHOD — FROM ATTACHED PLOT, DRAWDOWN VS. TIME

$\Delta(h_o - h) = 2.0$ ft.

$t_o = 7$ min $\times 1/1440 = 0.0049$ DAY

$Q = 900$ GPM $\times 192.5$ ft³/day/GPM $= 173{,}250$ ft³/day

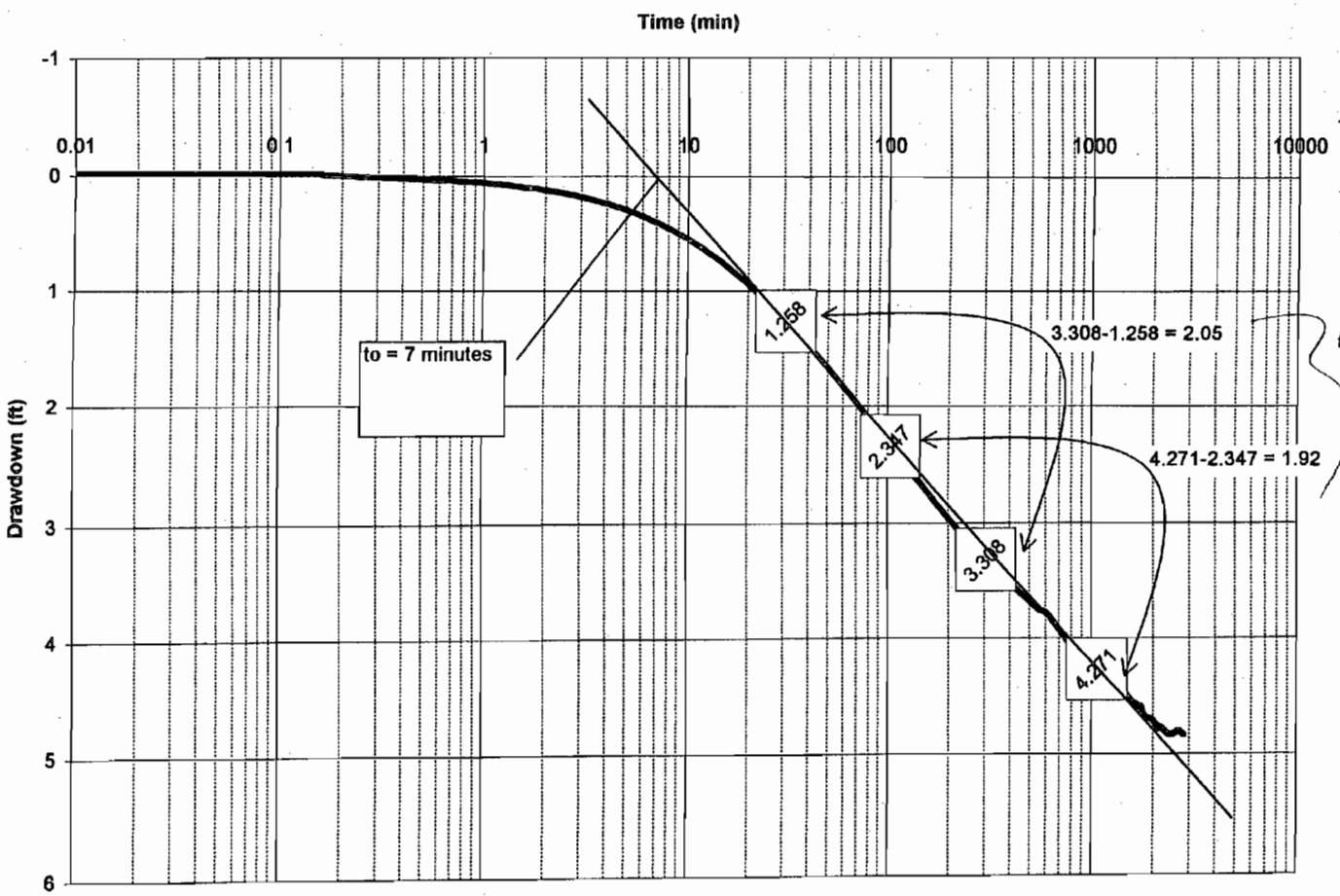
$$T = \frac{2.3Q}{4\pi\Delta(h_o - h)} = \frac{2.3\,(173{,}250\ ft^3/day)}{4\pi\,(2)} = 15855\ ft^2/day$$

$$S = \frac{2.25\,(15855\ ft^2/day)\,(0.0049\ day)}{(770\ ft)^2}$$

$= 0.000295 = 2.94 \times 10^{-4}$

SEE EXCEL CHART, p. 8A

JACOB METHOD



JEA
PUMP TEST ANALYSIS
C. WEST
P. 84

BLACK & VEATCH

Owner JEA — Computed By C. WISE
Plant BRANDY BRANCH — Unit — Date 6 JUN 20 00
Project No. 60903 — File No. — Verified By
Title PUMP TEST ANALYSIS — Date — 20
Page 9 of 9

DO NOT WRITE IN THIS SPACE

PGN-172B

THEIS METHOD

$$T = \frac{Q}{4\pi (h_o - h)} W(u)$$

$$S = \frac{4Tut}{r^2}$$

$h_o - h$ = DRAWDOWN
Q = FLOW RATE
$W(u)$ = WELL FUNCTION OF u
t = TIME SINCE PUMPING BEGAN
u = DIMENSIONLESS CONSTANT
r = RADIAL DISTANCE FROM PUMPING WELL
T = TRANSMISSIVITY

SEE ADJUSTED OVERLAY (p. 9A)
AT MATCH POINT $u = 1$ & $W(u) = 1$, $t = 4.5$ & $h_o - h = 0.9$

$$T = \frac{(900 \text{ gpm}) \times (192.5 \text{ ft}^3/\text{day/gpm})}{4\pi (0.9)} = \underline{15{,}319 \text{ ft}^3/\text{day/ft}}$$

$$S = \frac{4Tut}{r^2} = \frac{4 (15{,}319 \text{ ft}^3/\text{day/ft})(1)(4.5 \text{ min} \times 1 \text{ day}/60 \times 24 \text{ min})}{(770 \text{ ft})^2}$$

$$= \underline{3.23 \times 10^{-4}}$$

REVISED. SUPERSEDED. AND VOID CALCULATIONS MUST BE CLEARLY IDENTIFIED.

p. 9A

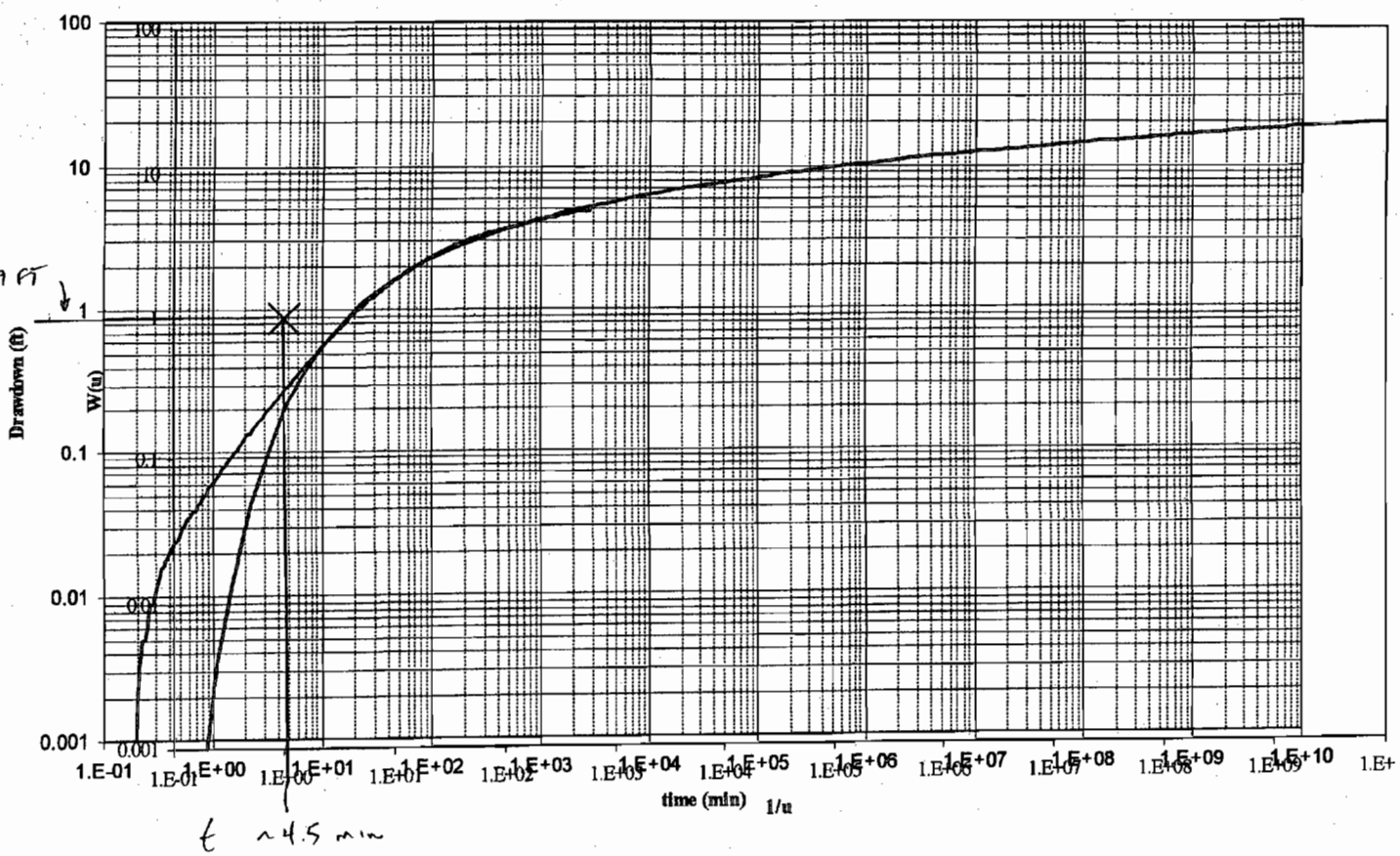
THEIS CURVE OVERLAY

PUMP TEST ANALYSIS

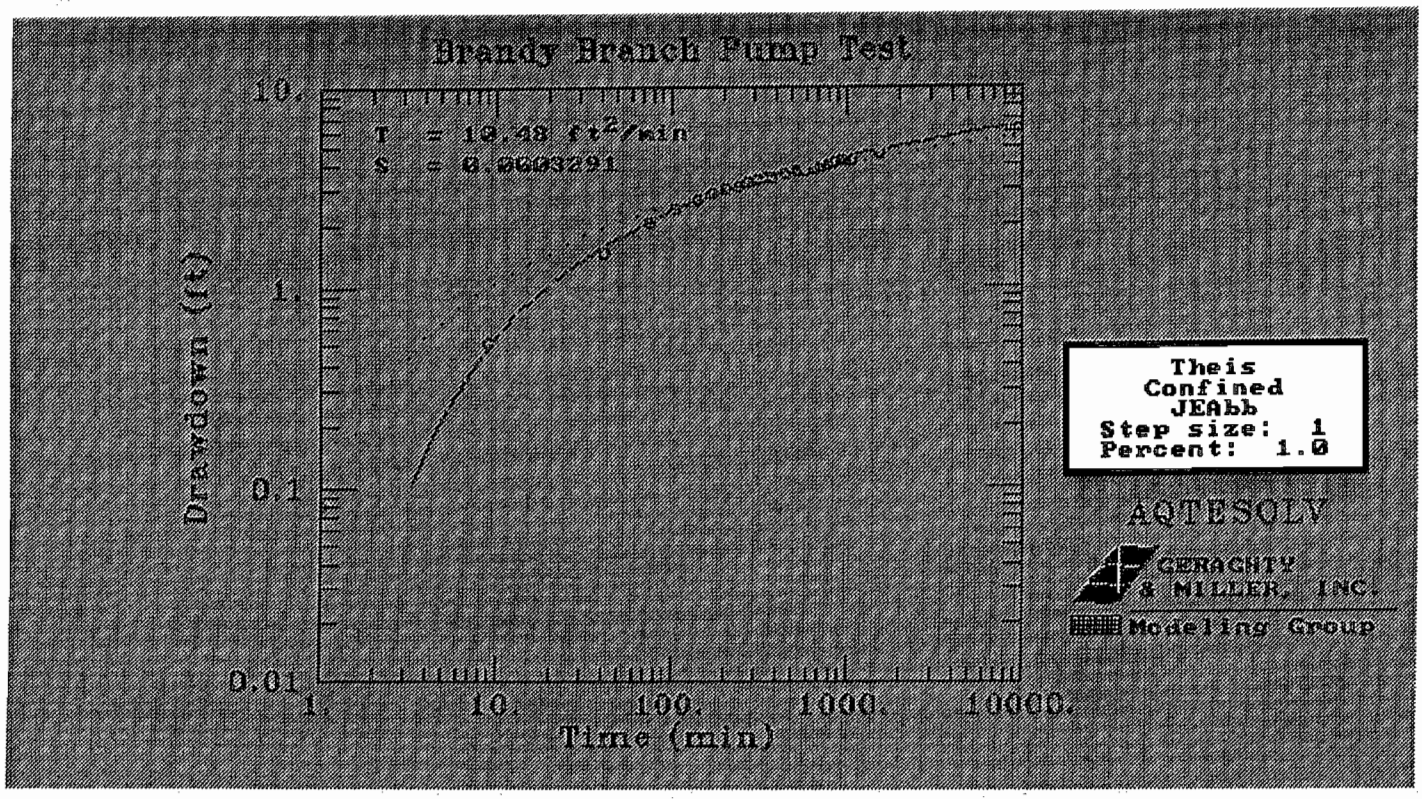
$(h_o - h)$

0.9 FT

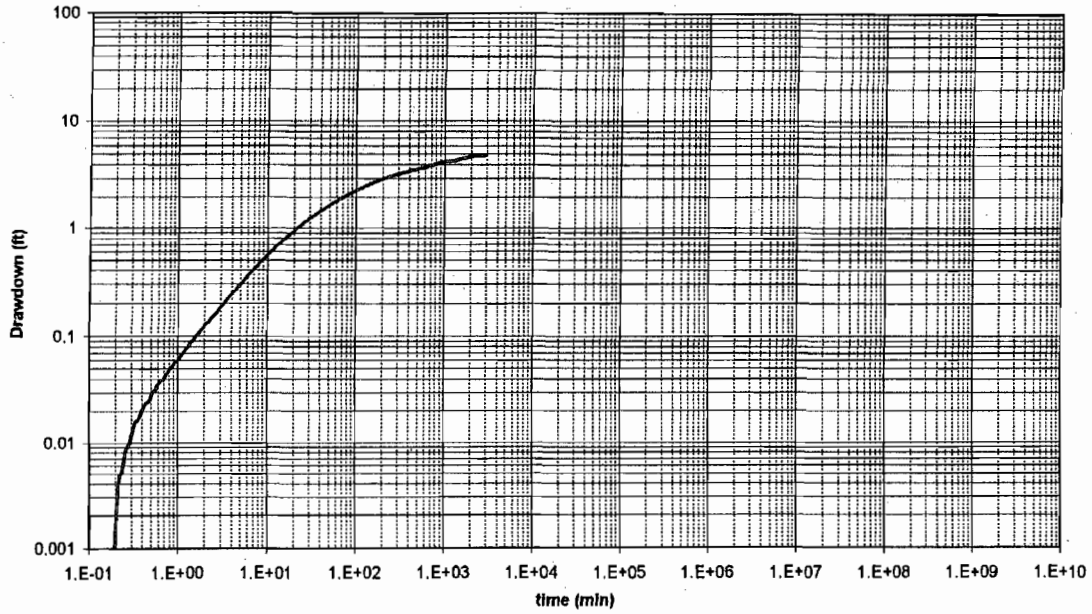
Theis Curve



$t \sim 4.5$ min


Brandy Branch Pump Test
T = 19.48 ft²/min
S = 0.0003291
Drawdown (ft)
10.
1.
0.1
0.01
1.
10
100.
1000.
10000.
Time (min)
Theis
Confined
JEAbb
Step size: 1
Percent: 1.0
AQTESOLV
GERAGHTY & MILLER, INC.
Modeling Group

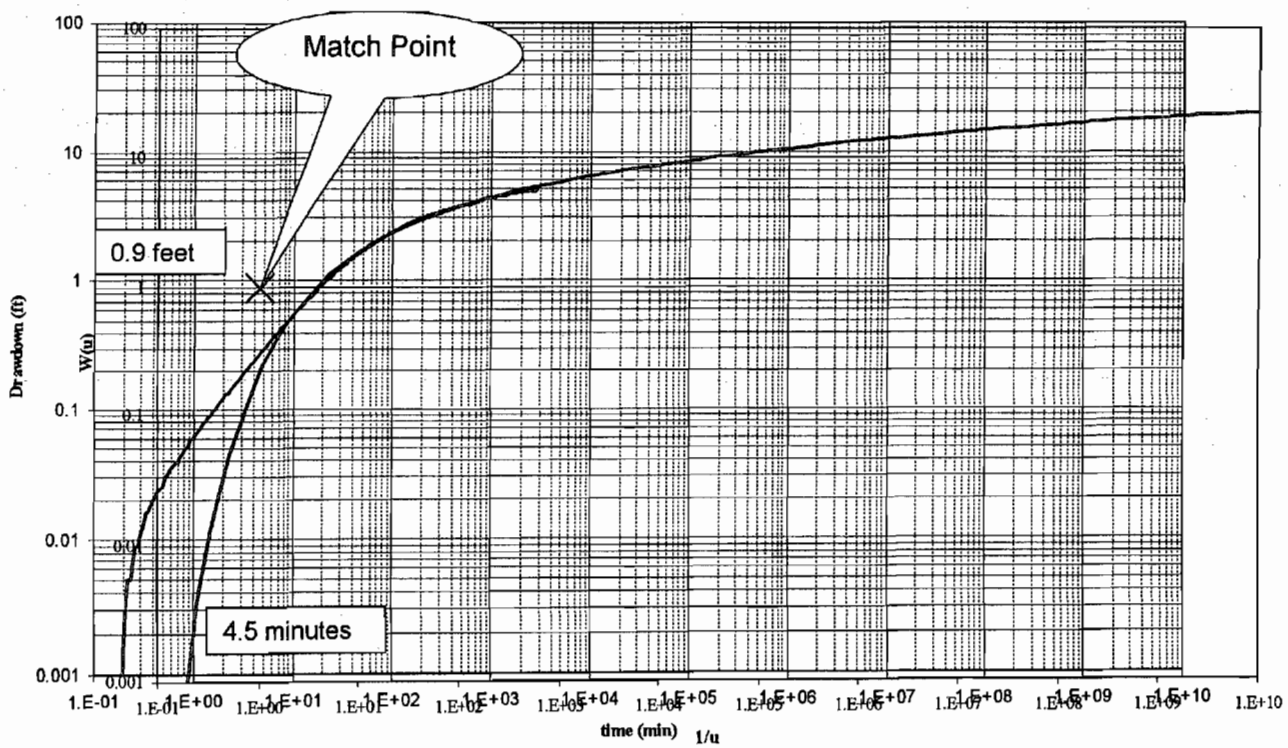
East Well Constant Rate Drawdown
Drawdown vs Time
for matching with Theis Curve



Project 60903

6/27/00

Theis Curve



Project 60903

6/27/00

Appendix E

Search for Existing Wells

BLACK & VEATCH

8400 Ward Parkway
P.O. Box 8405
Kansas City, Missouri 64114

Tel: (913) 458-2000

Black & Veatch Corporation

FAX NUMBER: 913-458-2934 913-458-2936 913-458-2939

FACSIMILE TRANSMISSION

TO: Linda Champion
COMPANY: SJRWMD
FAX NUMBER: (904) 329-4490
TELEPHONE NUMBER: (913) 329-4564
FROM: Myron C. Schluter
EXTENSION: 2864 LOCATION: P3F2

B&V PROJECT: 01-60903
B&V PHASE: 030
B&V FILE: 60903.030

PAGE: 1 of 2
DATE: May 24, 1999

NOTE TO RECEIVING OPERATOR
In the event of incomplete transmission, please call (913) 458-7218.

TRANSMITTAL DATE/TIME: _____ OPERATOR'S INITIALS: _____

SUBJECT: Search for Existing Wells

MESSAGE: As we discussed on the telephone, I have attached a list of sections that I need to search for existing, installed, permitted wells. I do not need information for monitoring wells or non-permitted wells.

My contact information is as follows.

Myron C. Schluter
Black & Veatch
11401 Lamar
Overland Park, KS 66209

(913) 458-2864
(913) 458-2934 (Fax)

cc: M. Soltys

Black & Veatch

Request For Existing Well Information

Myron C. Schluter 4/C4
May 24, 1999

Township	Range	Section
T1S	R23E	25
		26
		27
		28
		29
		32
		33
		34
		35
		36
T1S	R24E	26
		27
		28
		29
		30
		31
		32
		33
		34
		35
T2S	R23E	1
		2
		3
		4
		5
		8
		9
		10
		11
		12
		13
		14
		15
		16
		17
		20
		21
		22
		23
		24
		25
		26
		27
		28
		29
		32
		33
		34
		35
		36

Township	Range	Section
T2S	R24E	2
		3
		4
		5
		6
		7
		8
		9
		10
		11
		14
		15
		16
		17
		18
		19
		20
		21
		22
		23
		26
		27
		28
		29
		30
		31
		32
		33
		34
		35
T3S	R23E	1
		2
		3
		4
		5
		8
		9
		10
		11
		12
T3S	R24E	2
		3
		4
		5
		6
		7
		8
		9
		10
		11

BLACK & VEATCH

Owner JEA — Computed By NCS

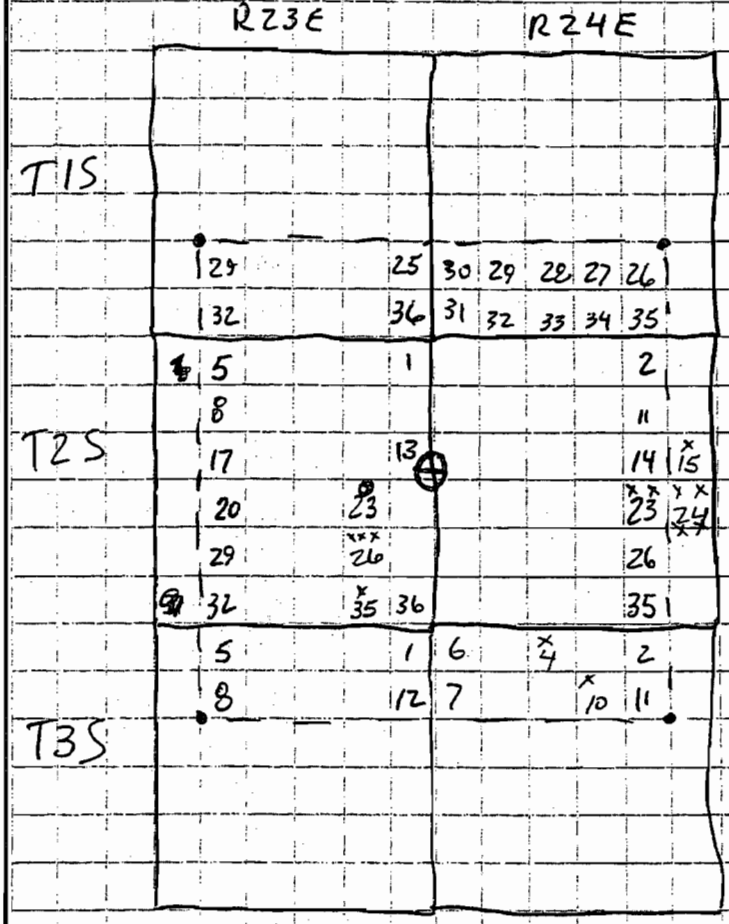
Plant Brandy Branch — Unit — Date 5-24 — 19 99

Project No. 60903.030 — File No. — Verified By

Title Search for Existing Wells — Date — 19

Page 1 of 1

NW T1S R23E 27
26



DO NOT WRITE IN THIS SPACE

N-172B

District Inventory of Wells (904) 329-4500

Linda Champion 904-329-4564
-4490 (Fax)

(Helen Cleveland for actual copies of permits)

PAGES FAXED
(1)

ST. JOHNS RIVER WATER MANAGEMENT DISTRICT
P. O. BOX 1429, PALATKA, FL 32178
(904)329-4490 - FACSIMILE

FAX COVER SHEET AND TRANSMITTAL LETTER

DATE: 3/22/99

COMPANY NAME: BLACK & VEATCH

ATTENTION: MYRON SCHLUTER

ADDRESS:

PHONE NO.: (913) 458-2764 FAX NO.: (913) 458-2934

RE: WELLSEARCH PERMITTED WELLS FOR S-11, T-35, R-24E
S-26, T-15, R-24E
S-8, T-35, R-23E
S-[illegible], T-15, R-23E

COMMENTS: Nothing found for these locations.

Any questions just call.

N/C

FROM: Linda Champion

TELEPHONE: (904) 329-4564

Applicant: Southern Wood Piedmont Company
900 Center St
Baldwin, FL 32234

GRS # 873

STATION NAME	DIAMETER	CAPACITY FLOW RATE	DEPTH	SECTION	TOWNSHIP	RANGE	LAT	LONG
A	8.0	10 GPM	37'	23	2S	23	301858	815821
AA	36.0	7 GPM	3.5'	23	2S	23	301855	815817
AB	36.0	8 GPM	4'	23	2S	23	301854	815818
AC	36.0	8 GPM	4'	23	2S	23	301852	815819
B	8.0	10 GPM	40'	23	2S	23	301859	815822
C	8.0	10 GPM	33'	23	2S	23	301857	815823
D	36.0	10 GPM	5.5'	23	2S	23	301850	815824
E	36.0	10 GPM	5'	23	2S	23	301847	815824
F	36.0	10 GPM	5.5'	23	2S	23	301844	815824
G	48.0	10 GPM	8'	23	2S	23	301852	815826
H	36.0	1 GPM	8.5	23	2S	23	301849	815821
I	36.0	1 GPM	8.5'	23	2S	23	301848	815820
J	36.0	1 GPM	8.5'	23	2S	23	301848	815819
K	36.0	1 GPM	8.5'	23	2S	23	301848	815818
L	36.0	1 GPM	8.5'	23	2S	23	301847	815822
M	36.0	1 GPM	8'	23	2S	23	301846	815821
N	36.0	1 GPM	8'	23	2S	23	301846	815820
O	36.0	1 GPM	9'	23	2S	23	301846	815819
P	36.0	1 GPM	10'	23	2S	23	301844	815822
Q	4.0	1 GPM	50'	23	2S	23	301842	815822
R	36.0	1 GPM	7'	23	2S	23	301853	815824
S	36.0	1 GPM	7'	23	2S	23	301852	815824
T	36.0	1 GPM	6.5'	23	2S	23	301851	815825
U	36.0	1 GPM	5.5'	23	2S	23	301850	815825
V	36.0	1 GPM	6.5'	23	2S	23	301849	815824
W	36.0	1 GPM	6'	23	2S	23	301848	815824
X	36.0	1 GPM	5'	23	2S	23	301846	815824
Y	36.0	1 GPM	18.5'	23	2S	23	301845	815824
Z	16.0	UNKNOWN	836'	23	2S	23		

Applicant: Risser Petroleum Inc
c/o Environmental Consulting
3701 NW 98th St
Gainesville, FL 32606

GRS # 853

STATION NAME	DIAMETER	CAPACITY FLOW RATE	DEPTH	SECTION	TOWNSHIP	RANGE	LAT	LONG
A	6.0	2	21	35	2S	23	301715	815856
B	6.0	2	21	35	2S	23	301714	815857
C	6.0	UNKNOWN	21	35	2S	23	301714	815857

Applicant: Town of Baldwin
10 US 90 W
Baldwin, FL 32234

GRS # 784

STATION NAME	DIAMETER	CAPACITY FLOW RATE	DEPTH	SECTION	TOWNSHIP	RANGE	LAT	LONG
A	10.	500 GPM	764'	26	2S	23	301802	815849
B	8.0	250 GPM	716'	26	2S	23	301809	815828
C	8.0	250 GPM	716'	26	2S	23	301808	815828

Applicant: The David J Joseph Company
900 Yellow Water Rd
PO Box 578
Baldwin, FL 32234

GRS # 863

STATION NAME	DIAMETER	CAPACITY FLOW RATE	DEPTH	SECTION	TOWNSHIP	RANGE	LAT	LONG
A	6.0	25 GPM	95'	35	2S	23	301640	815842
B	6.0	25 GPM	128'	35	2S	23	301640	815847
C	4.0	200 GPM	806'	35	2S	23	301636	815847

Applicant: Champion International
109 Halsema Rd S
Whitehouse, FL 32220

GRS # 50053

NAME	DIAMETER	FLOW RATE	DEPTH	SECTION	TOWNSHIP	RANGE	LAT	LONG
A	16.0	1500 GPM	1170'	23	2S	24	301835	815209
E	2.0	15 GPM	130'	23	2S	24	301829	815159
G	4.0	20 GPM	130'	23	2S	24	301838	815201
H	4.0	20 GPM	130'	23	2S	24	301838	815210
I	6.0	100 GPM	600'	23	2S	24	301841	815158

Applicant: Florida Department of Transportation
PO Box 1089
Lake City, FL 32056

GRS # 571

STATION NAME	DIAMETER	CAPACITY FLOW RATE	DEPTH	SECTION	TOWNSHIP	RANGE	LAT	LONG
A	6	20 GPM	100'	24	2S	24	301826	815154

Applicant: Navy Public Works Center
Code 310
Jacksonville, FL 32212-0030

GRS # 814

STATION NAME	DIAMETER	CAPACITY FLOW RATE	DEPTH	SECTION	TOWNSHIP	RANGE	LAT	LONG
A	8	225 GPM	770'	17	3S	24	301417	815542
B	8	225 GPM	780'	17	3S	24	301416	815541
C	12	500 GPM	610'	10	3S	24	301535	815353
D	12	500 GPM	620'	4	3S	24	301538	815402

Applicant: Westmeadows Golf Club Inc
11400 W Meadows Dr
Jacksonville, FL 32221

GRS # 850

STATION NAME	DIAMETER	CAPACITY FLOW RATE	DEPTH	SECTION	TOWNSHIP	RANGE	LAT	LONG
A	4.0	30 GPM	UNK	36	2S	24	301657	815126
B	2.0	15 GPM	100	36	2S	24		
C	2.0	15 GPM	100	36	2S	24		
D	4.0	30 GPM	UNK	36	2S	24		
E	2.0	15 GPM	100	36	2S	24		
F	2.0	70 GPM	680	36	2S	24		
G	4.0	70 GPM	680	36	2S	24		

Applicant: August Partners Inc
1808 Kinglet Ct
Coasta Mesa, CA 92626

GRS # 886

STATION NAME	DIAMETER	CAPACITY FLOW RATE	DEPTH	SECTION	TOWNSHIP	RANGE	LAT	LONG
A	6.0	150 GPM	760'	24	2S	24	301829	815059
B	6.0	150 GPM	762'	24	2S	24	301827	815058

W. Earl Floyd
Larry J. Floyd
Co-Founders

Larry, J. Floyd, President
Ann R. Floyd, Sec'y-Treas.
Owners

W. Earl Floyd & Son Inc.

EST. 1962



WELL DRILLING CONTRACTORS
INDUSTRIAL – MUNICIPAL – IRRIGATION
TURBINE AND SUBMERSIBILE - SALES & SERVICE

Distributor for
PEERLESS PUMP
Line Shaft and Submersible Turbines

TELEPHONE 781-1313
8901 HERLONG ROAD
JACKSONVILLE, FLORIDA 32210

DSI Jacksonville, Fl. P-311 O

EA - BRANDY BRANCH
LUOR GLOBAL
ELL #2

OWNER'S NAME JEA

ELL COMPLETION REPORT (Please complete in black ink or type.)

RMIT # 63850 2 CUP # _____ DID # _____
mber of wells drilled _____ /WUP # _____
icate remaining wells to be cancelled _____
l wells drilled need an individual completion report)
ATER WELL CONTRACTOR'S
GNATURE Larry J Floyd License # 1515
I certify that the information provided in this report is accurate and true)

COMPLETION DATE 4-4-2000 Florida Unique I.D _____

WELL USE: DEP/Public XX Irrigation _____ Domestic _____ Monitor _____
HRS Limited _____ 62-524 _____ Other _____

DRILL METHOD XX Rotary ☐ Cable Tool ☐ Combination
☐ Jet ☐ Auger Other _____

	No. of Bags	From (ft.)	To (ft.)
at Co	BULK CEMENT	PUMPED BOTTOM TO TOP	
ntonite			

MI N OF US 90, 1 MI NE OF BALDWIN

LOCATION: Site Address _____ County DUVAL
SW Qtr: SW Sec: 18 Twp: 2S Rge: 23E
itude _____ Longitude _____

Measured Static Water Level 50 Measured Pumping Water Level 83
After 48 Hours at 900 G.P.M. Measuring Pt. (Describe): WELL FLANGE
Which is 1 Ft. ☒ Above ☐ Below Land Surface
Casing: ☒ Black Steel ☐ Galv. ☐ PVC Other _____

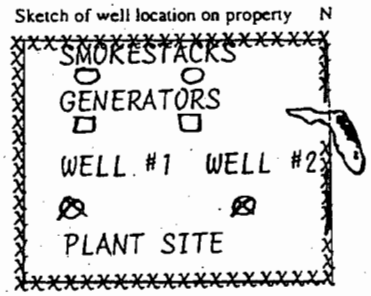
DATE STAMP

Official Use Only

EMICAL ANALYSIS

n: ___ ppm Sulfate: ___ ppm
lorides: 15 ppm
Lab Test XX Field Test Kit
mp Type
Centrifugal [ ] Jet [ ] Submersible
Turbine
rsepower _____ Capacity _____ G.P.M. _____
mp Depth _____ Ft. Intake Depth _____ Ft.

Sketch of well location on property N



Give distances from septic tank and house or other reference points

XX Open Hole ☐ Screen	Depth (Ft.)		DRILL CUTTINGS LOG Examine cuttings every 20 ft. or at formation changes. Give color, grain size, and type of material. Note cavities, depth to producing zones.
Casing Diameter & Depth (Ft.) 18"	From	To	
Diameter 18"	0	18	HARDPAN
From 0'	18	30	WHITE SANDY CLAY
To 90'	30	92	BLUE CLAY
	92	125	ROCK
Diameter 12"	125	370	GREY MARL
From 0'	370	387	ROCK
To 538'	387	434	ROCK & MARL
	434	490	GREEN MARL
Liner ☐ or	490	520	HARD ROCK
Casing ☐	520	750	OCALA LIME
Diameter ___ ___	750	790	HARD GREY ROCK
From _____	790	837	SOFT BROWN LIME
To _____			

Driller's Name: LARRY J. FLOYD
(print or type) _____

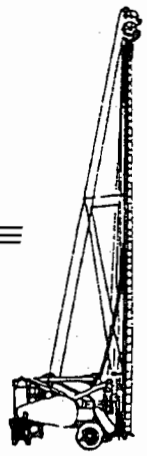
Service and Satisfaction Guaranteed

W. Earl Floyd
Larry J. Floyd
Co-Founders

Larry, J. Floyd, President
Ann R. Floyd, Sec'y-Treas.
Owners

W. Earl Floyd & Son Inc.

EST. 1962



WELL DRILLING CONTRACTORS
INDUSTRIAL – MUNICIPAL – IRRIGATION
TURBINE AND SUBMERSIBILE - SALES & SERVICE

Distributor for
PEERLESS PUMP
Line Shaft and Submersible Turbines

TELEPHONE 781-1313
8901 HERLONG ROAD
JACKSONVILLE, FLORIDA 32210

DSI Jacksonville, Fl. P-311 Q

EA - BRANDY BRANCH
LUOR GLOBAL
ELL #1

ELL COMPLETION REPORT (Please complete in black ink or type.)

RMIT # 63843 2 CUP # _____ DID # _____
mber of wells drilled _____ /WUP # _____
licate remaining wells to be cancelled _____
ll wells drilled need an individual completion report)
ATER WELL CONTRACTOR'S
GNATURE _____ License # 1515
(I certify that the information provided in this report is accurate and true)

OWNER'S NAME JEA

COMPLETION DATE 5-15-2000 Florida Unique I.D. _____

WELL USE: DEP/Public _____ Irrigation _____ Domestic _____ Monitor _____
HRS Limited _____ 62-524 _____ Other _____

DRILL METHOD ☒ Rotary ☐ Cable Tool ☐ Combination
☐ Jet ☐ Auger Other _____

	No. of Bags	From (ft.)	To (ft.)
at C	BULK CEMENT	PUMPED BOTTOM TO TOP	
ntonite			

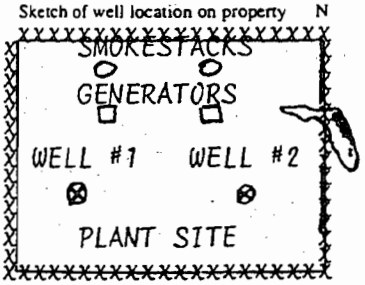
ELL LOCATION Site Address MI N OF US 90, 1 MI NE OF BALDWIN County DUVAL
SW Qtr: SW Sec: 18 Twp: 2S Rge: 23E
titude _____ Longitude _____

DATE STAMP

Official Use Only

EMICAL ANALYSIS
n: ____ ppm Sulfate: ____ ppm
lorides: 75 ppm
Lab Test XX Field Test Kit
mp Type
Centrifugal [ ] Jet [ ] Submersible
Turbine
rsepower _____ Capacity _____ G.P.M. _____
mp Depth _____ Ft. Intake Depth _____ Ft.

Sketch of well location on property N



Give distances from septic tank and house or other reference points

Measured Static Water Level 50 Measured Pumping Water Level 73
After 2 Hours at 800 G.P.M. Measuring Pt. (Describe) WELL FLANGE
Which is 1 Ft. ☒ Above ☐ Below Land Surface
Casing: XX ☒ Black Steel ☐ Galv. ☐ PVC Other _____

XX Open Hole / ☐ Screen; Casing Diameter & Depth (Ft.)	Depth (Ft.) From	To	DRILL CUTTINGS LOG Examine cuttings every 20 ft. or at formation changes. Give color, grain size, and type of material. Note cavities, depth to producing zones.
Diameter 16"	0	5	FILL
From 0'	5	20	HARDPAN
To 106'	20	35	WHITE SANDY CLAY
	35	98	BLUE CLAY
Diameter 12"	98	130	ROCK
From 0'	130	390	MARL
To 536'	390	400	ROCK
	400	440	ROCK & MARL
Liner ☐ or Casing ☐	440	500	GREEN MARL
Diameter ___ ___	500	525	HARD ROCK
From _____	525	755	OCALA LIME
To _____	755	795	HARD ROCK
	795	837	SOFT BROWN LIME

Driller's Name: LARRY J. FLOYD
(print or type) _____

Service and Satisfaction Guaranteed

Appendix B

Geophysical Logs

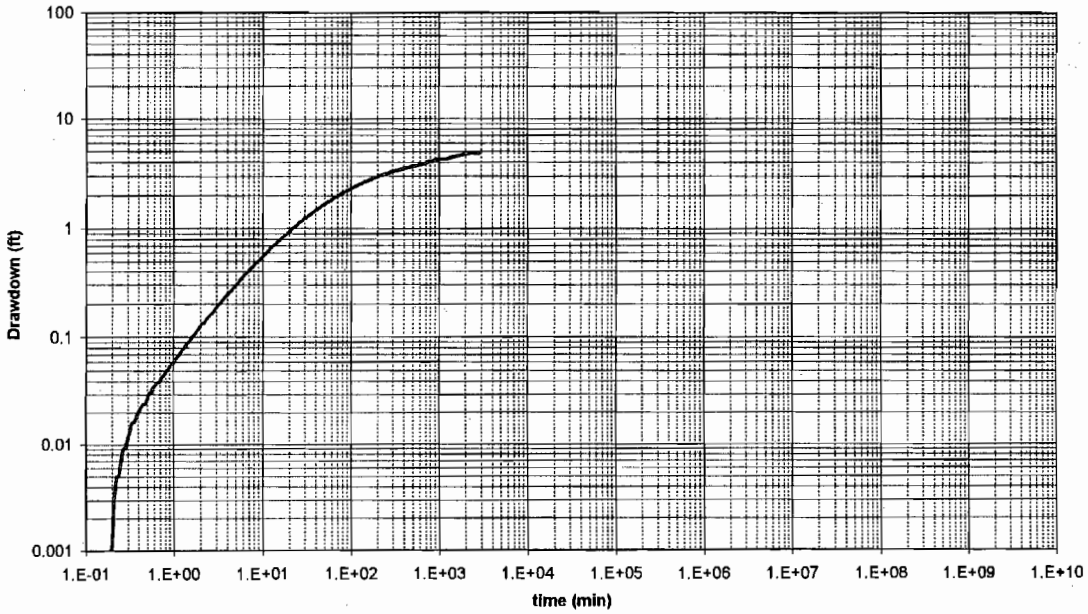
Appendix C

Pump Test Results

IMAGE QUALITY

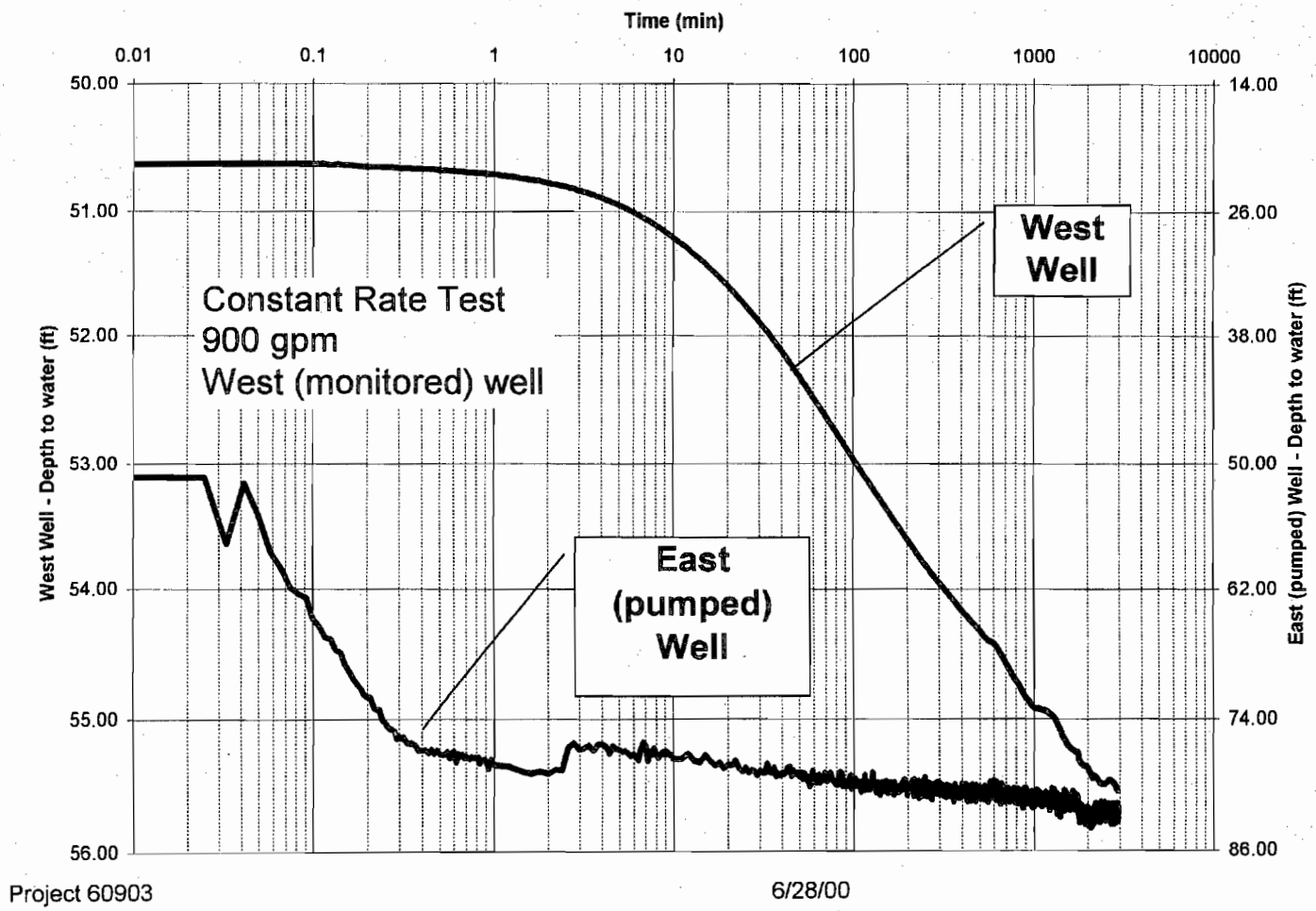
AS YOU REVIEW THE NEXT FEW PAGES, PLEASE NOTE THAT THE ORIGINAL DOCUMENT WAS OF POOR QUALITY.

East Well Constant Rate Drawdown
Drawdown vs Time
for matching with Theis Curve



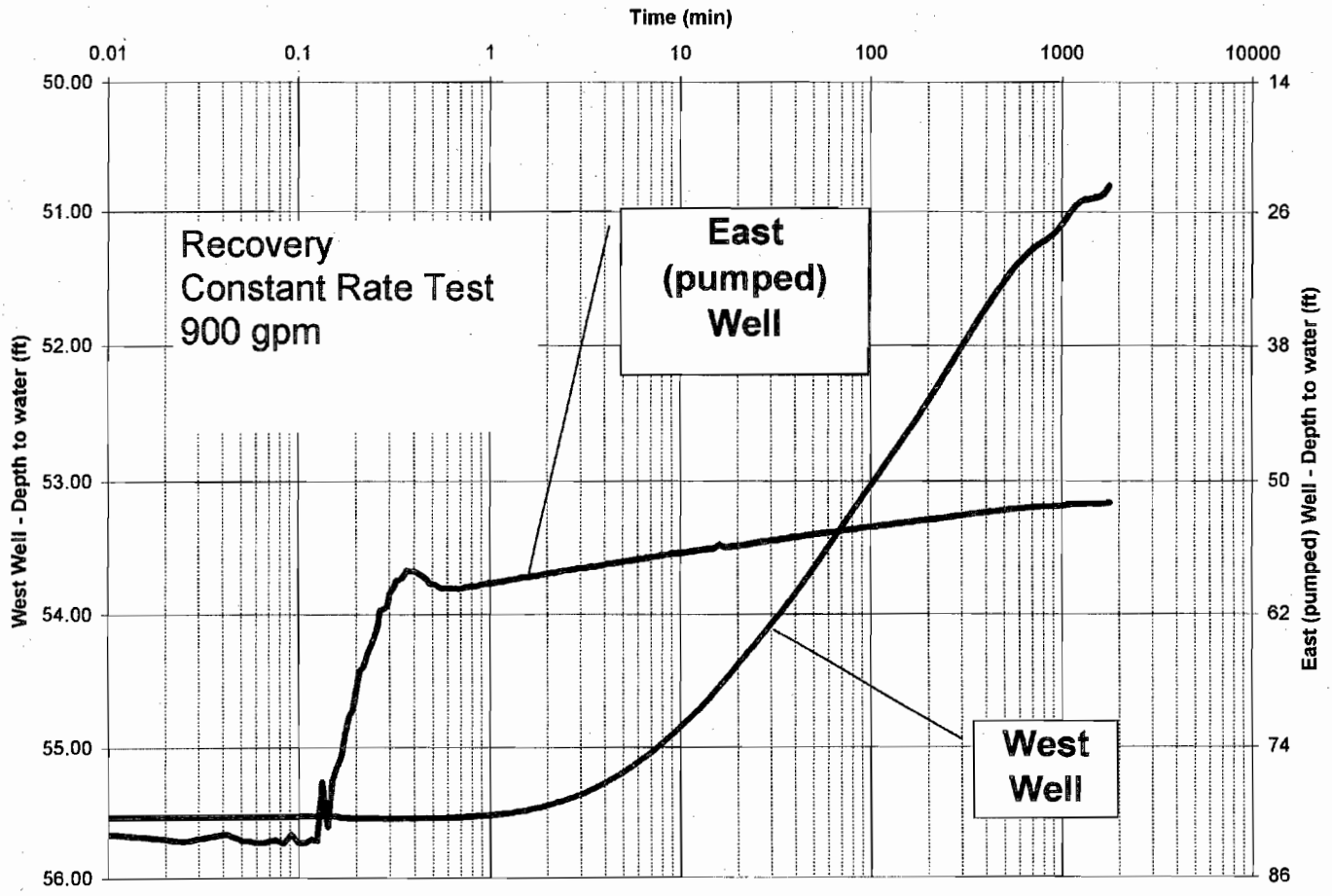
Project 60903

6/28/00



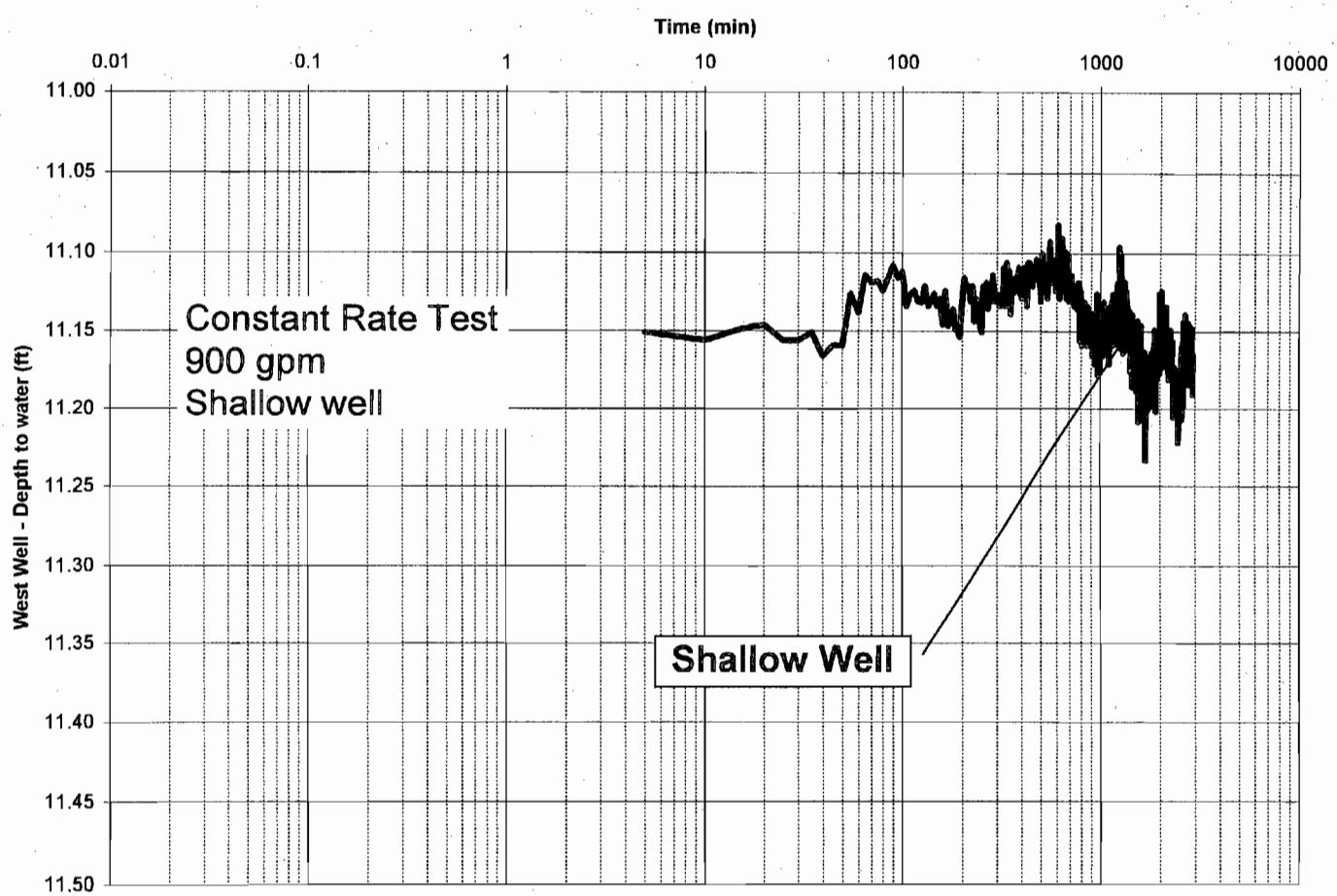
Project 60903

6/28/00



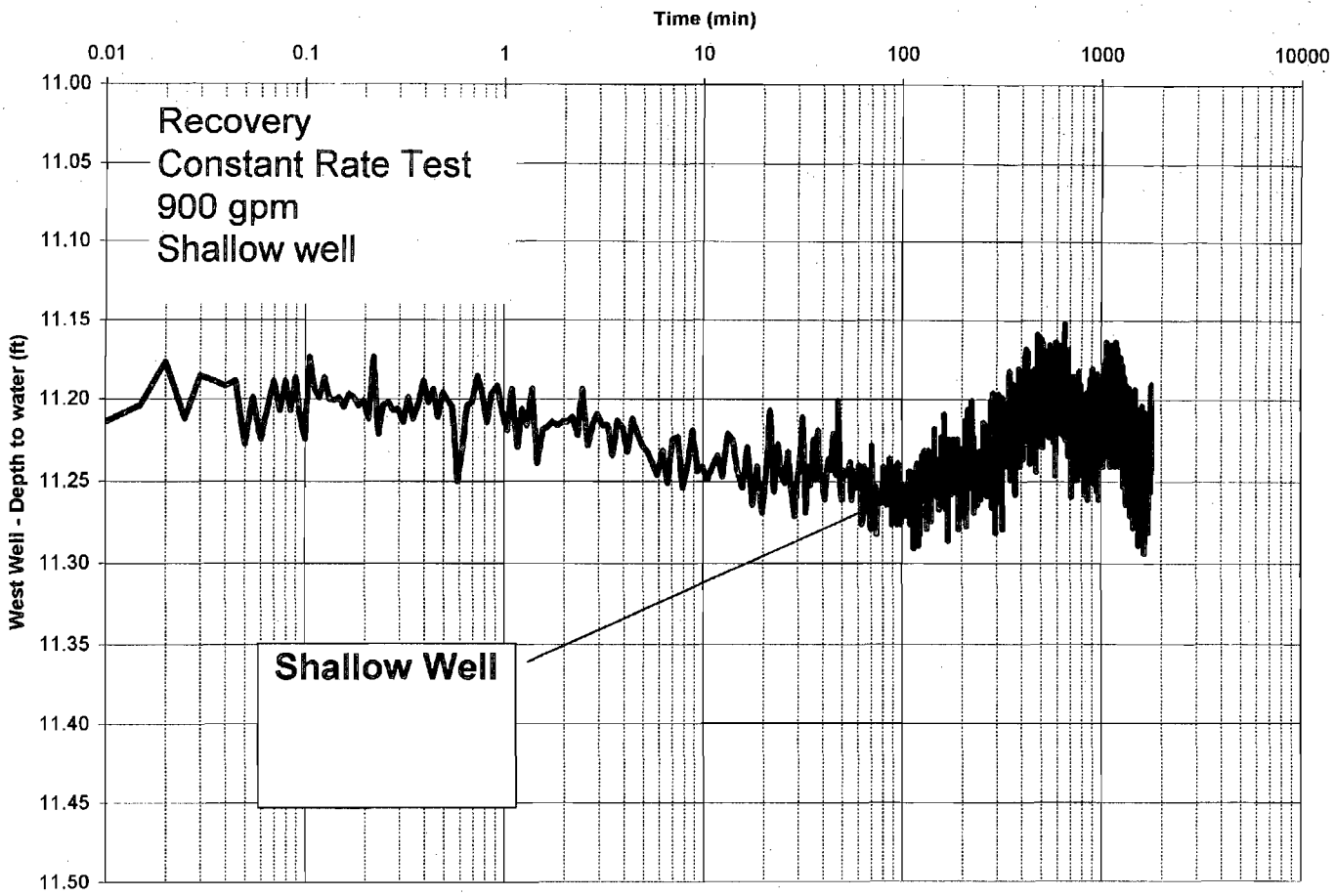
Project 60903

6/28/00



Project 60903

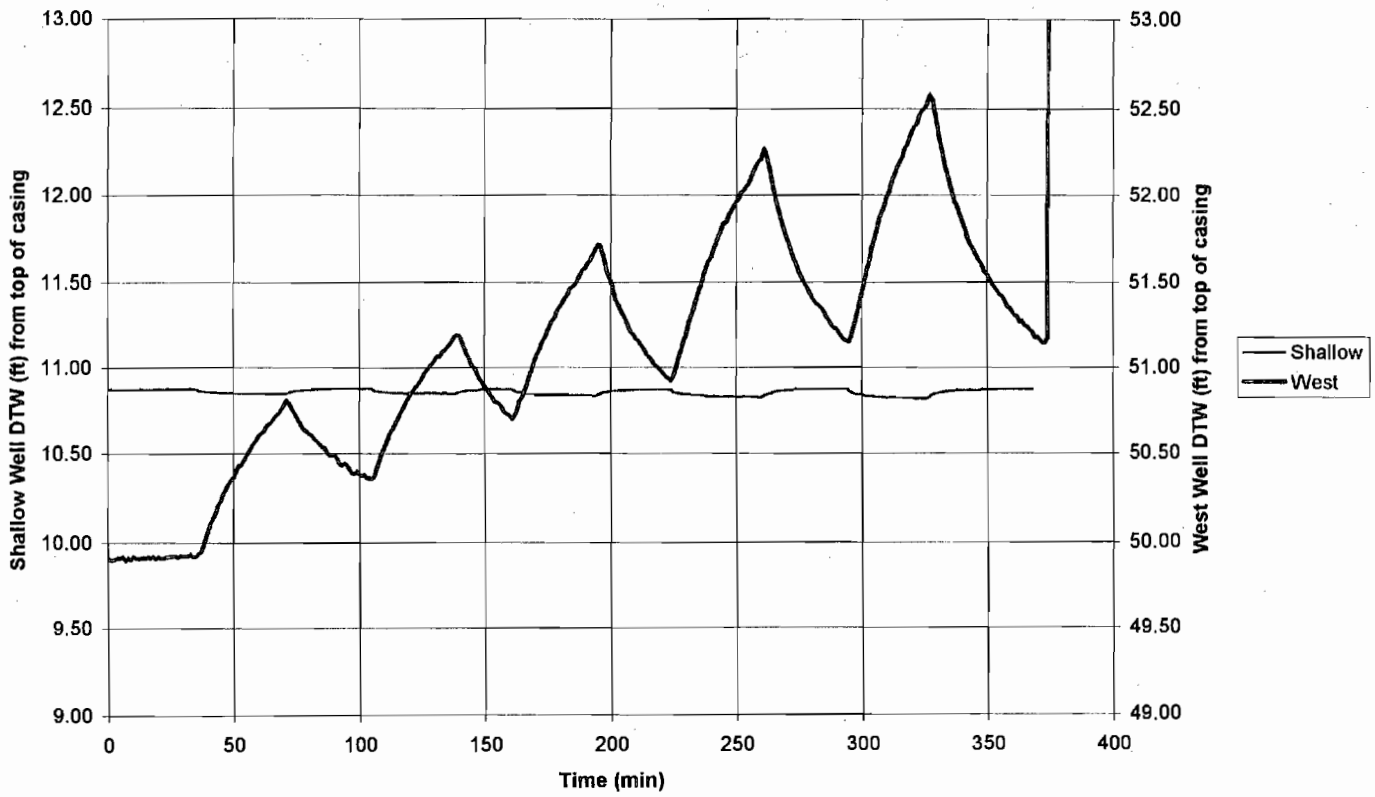
6/28/00



Project 60903

6/28/00

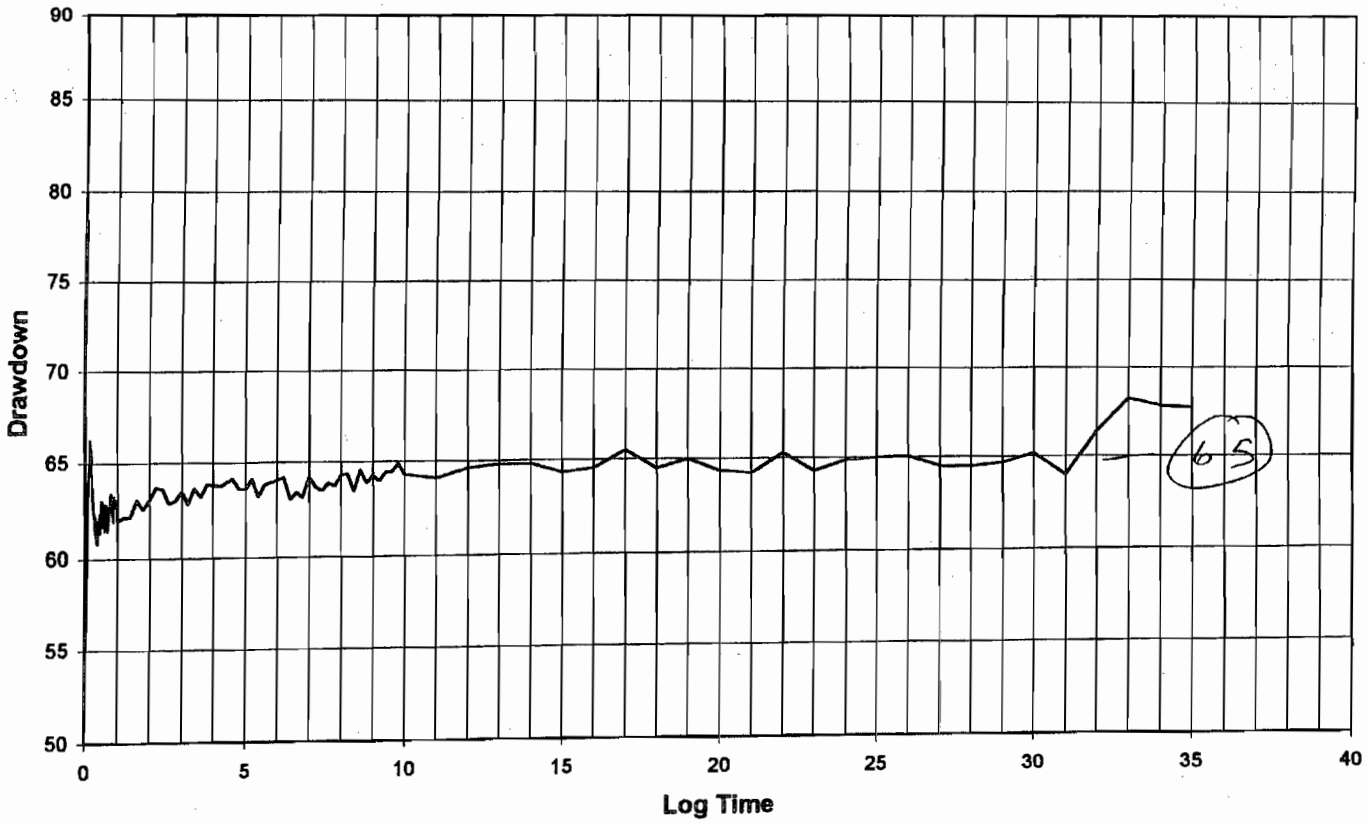
Stepped Drawdown
450 gpm, 585 gpm, 765 gpm, 900 gpm, and 1100 gpm



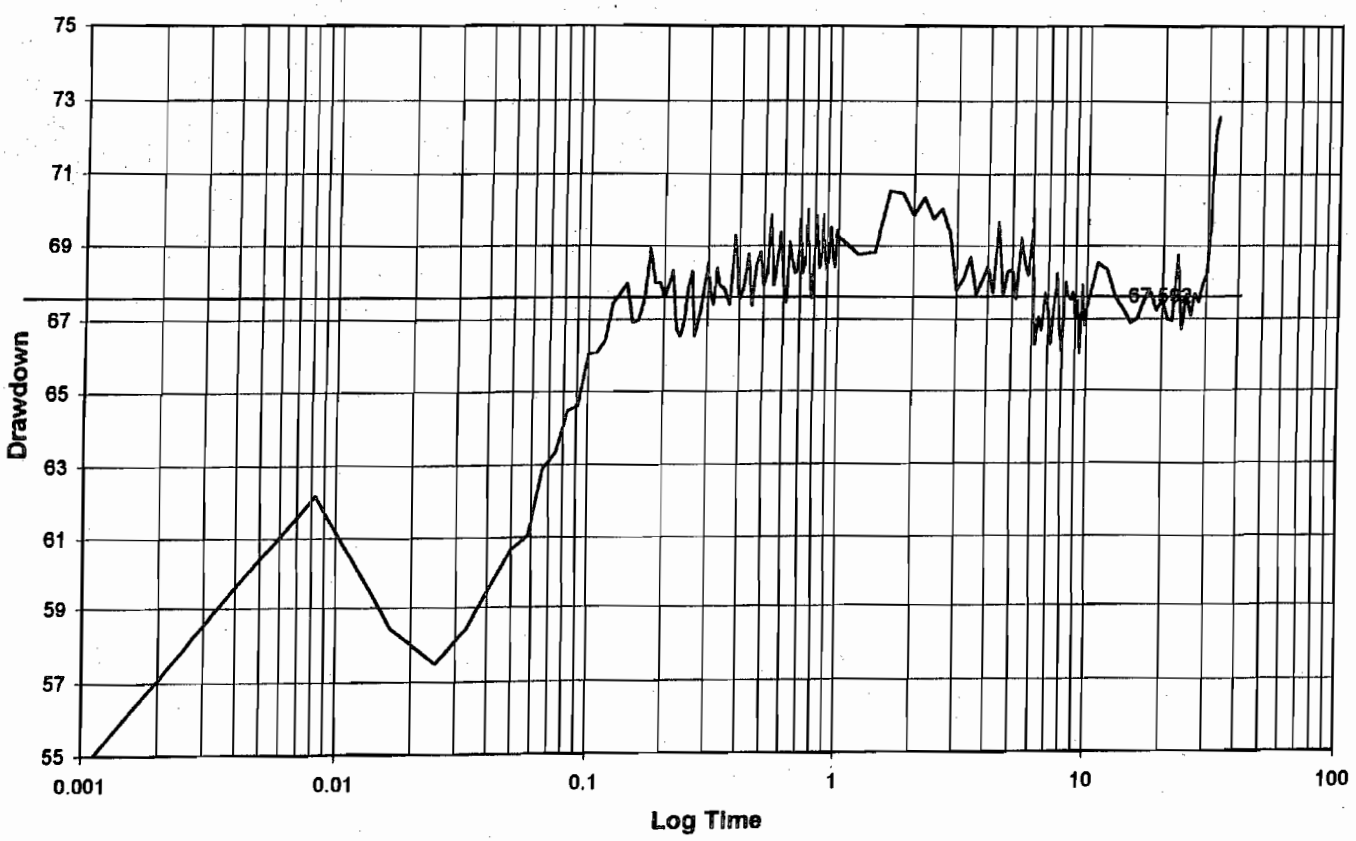
Project 60903

6/28/00

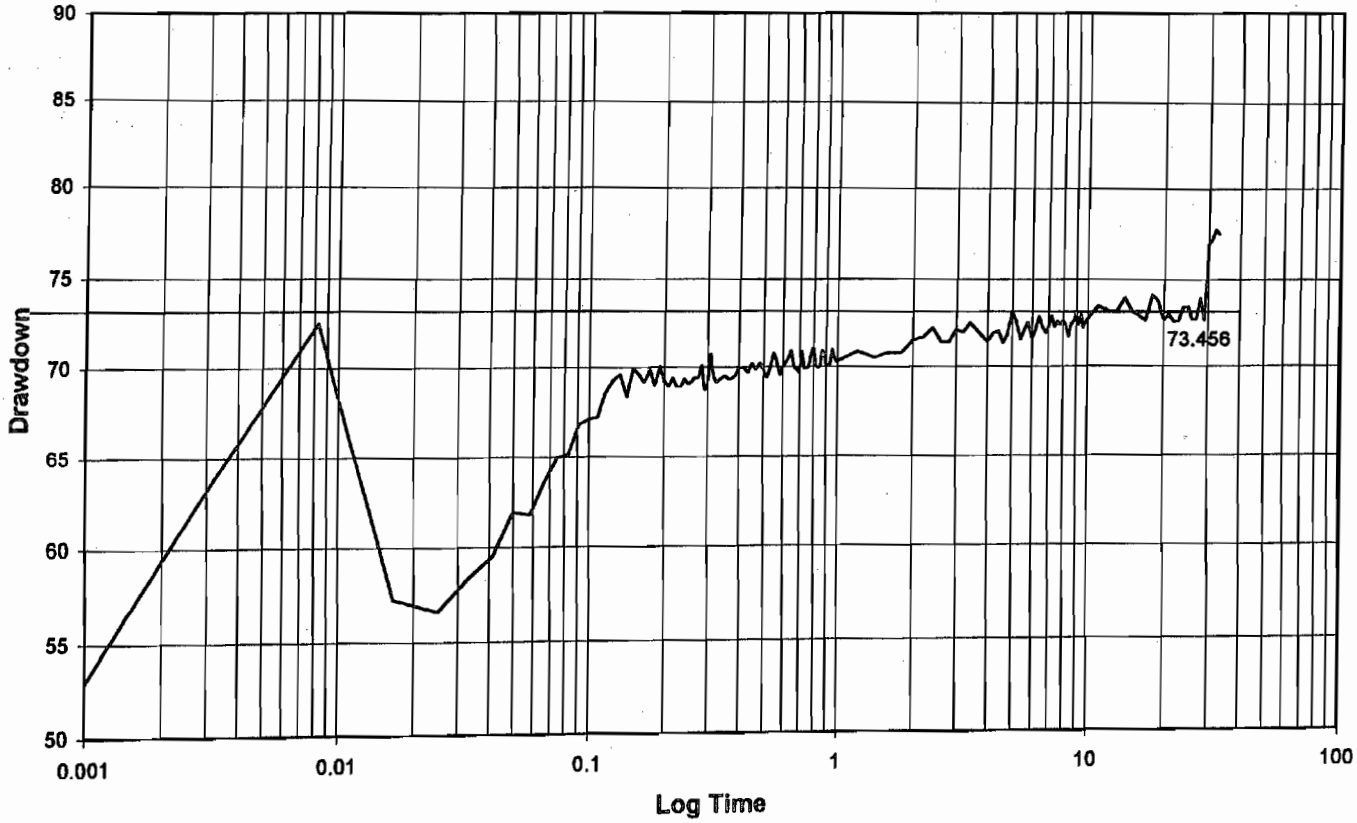
Brandy Branch Step Drawdown: Pumped Well @ 450 gpm



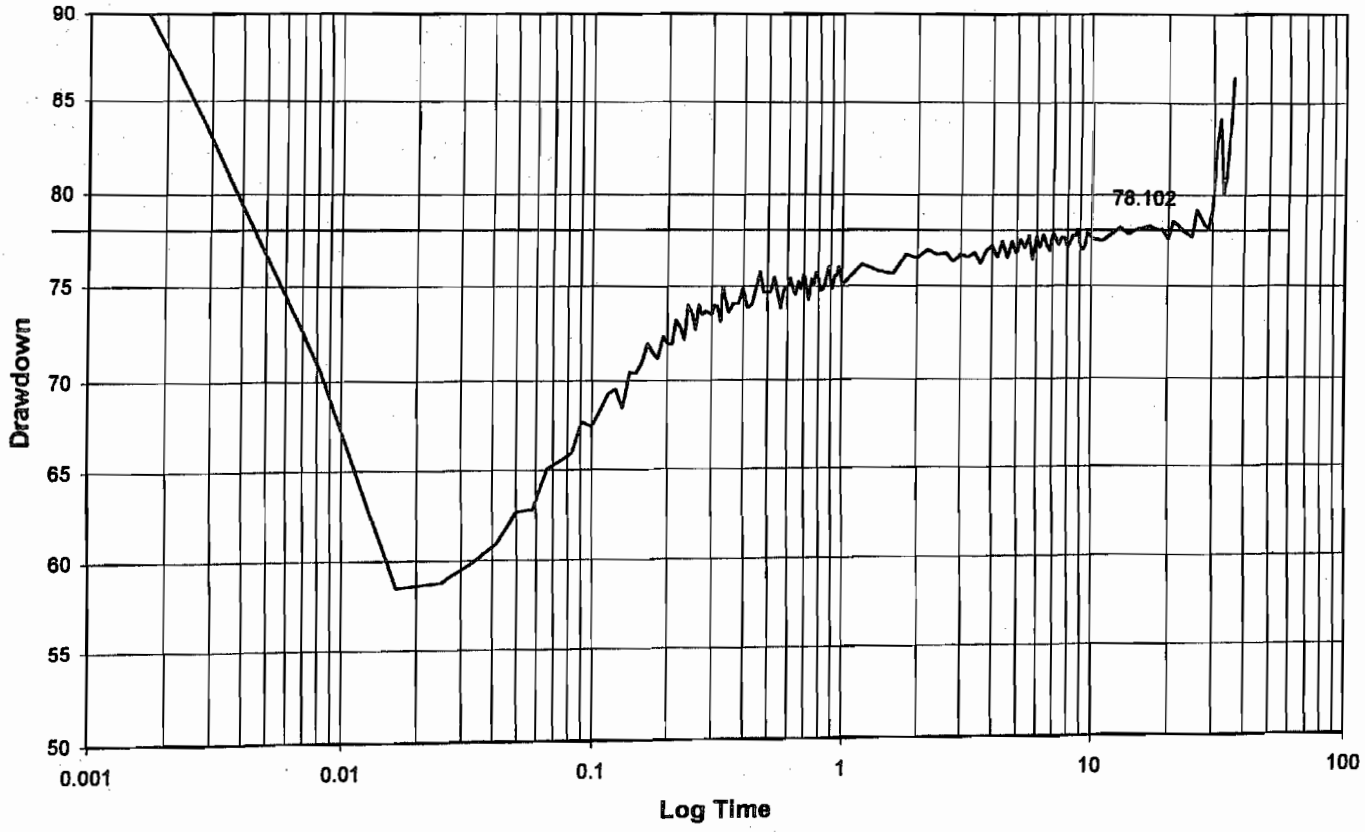
Brandy Branch Step Drawdown: Pumped Well @ 585 gpm



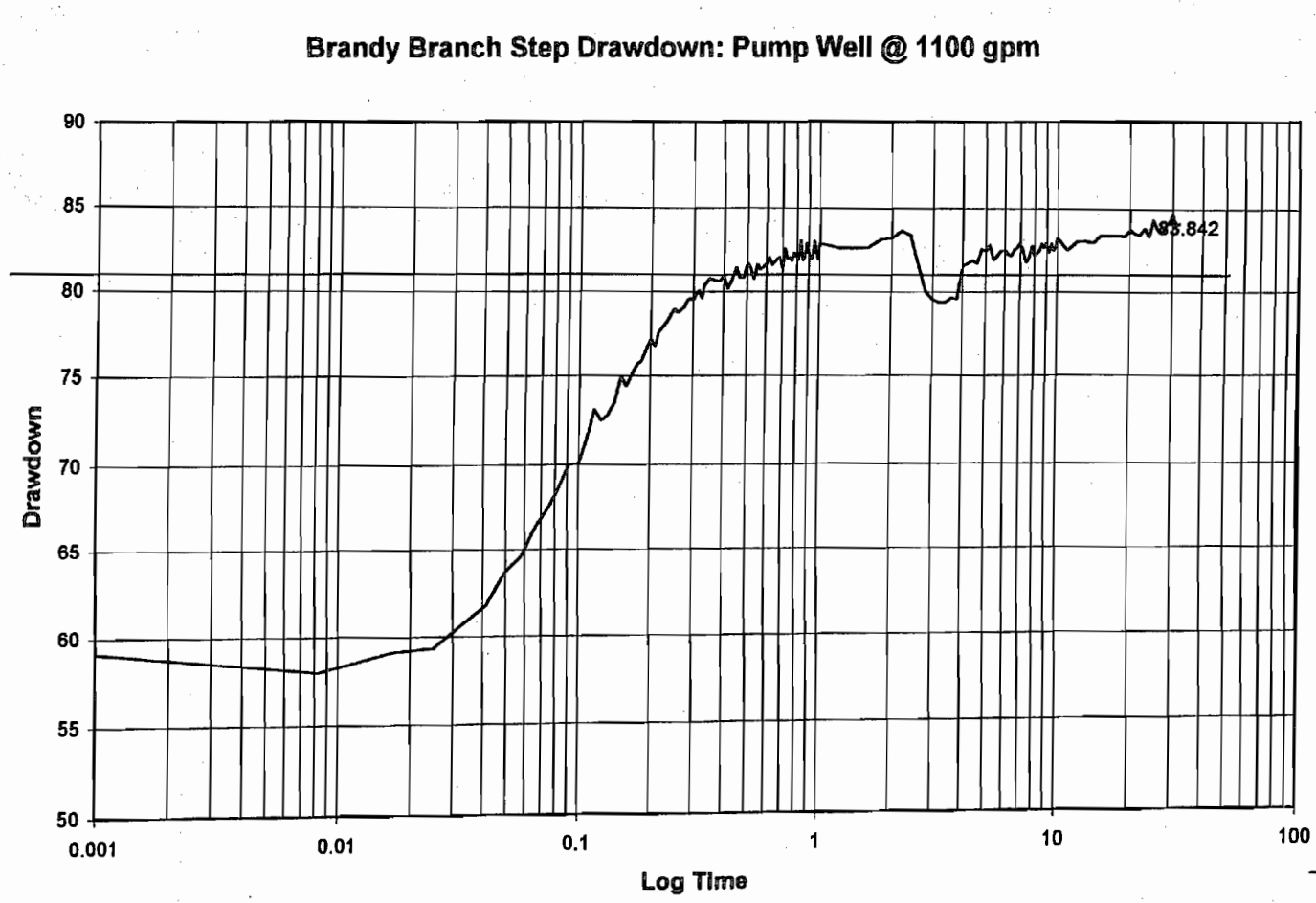
Brandy Branch Step Drawdown: Pumped Well @ 760 gpm



JHA
PUMP TEST ANALYSIS



C.W.S.
6/2



UPA
PUMP TEST ANALYSIS
R 6 E
C. WISE

Appendix D

Transmissivity and Storage Coefficient Calculations

BLACK & VEATCH

Calculation Record

Client Name: JEA Page 1 of 9

Project Name: Brandy Branch Project No.: 60903.0050

Calculation Title: Pump test analysis

Calculation No./File No.:

Calculation Is: (check all that apply) ☐ Preliminary ☒ Final ☐ Nuclear Safety-Related

Objective Estimate transmissivity and storage coefficients of Floridian acquifer based on pump test results

Unverified Assumptions Requiring Subsequent Verification			
No.	Assumption	Verified By	Date

See Page ____ of this calculation for additional assumptions.

This Section Used for Computer Generated Calculations

Program Name/Number: Version:

Evidence of or reference to computer program verification, if applicable:

Bases or reference thereto supporting application of the computer program to the physical problem:

Review and Approval						
Rev	Prepared By	Date	Verified By	Date	Approved By	Date
0	C. Wise	05 Jun 00				

OBJECTIVE: Complete an analysis of pump test and determine aquifer parameters for a well field analysis using MODFLOW

REFERENCES:

1. "Subsurface Hydrology", Unknown, June 16, 1998

2. "GROUNDWATER HYDROLOGY" DEPARTMENT OF THE ARMY EM 1110-2-1421 U.S. Army Corps of Engineers CECW-EH Washington, DC 20314-1000 Manual No. 1110-2-1421 28 February 1999 Engineering and Design

3. Results of pump test conducted 5/29/00 through 6/1/00; Larry Floyd driller, Michael Dykes, data acquisition and technical consultant, CH2MHill

4. BV Calculation, 58291.51.1037.001, *Pump Test Analysis – Aquifer Parameters*, prepared by G. Sommerfeld, 5/18/00

5. "Groundwater Manual" US Dept. of the Interior, BOR

6. Drawing # 60903-DS-S1001 Rev 4, 2/29/2000, JEA Brandy Branch Station, Site Arrangement

7. Information compiled on aquifer parameters in Duval County, Florida. From Betty Levin, hydrologist, St. Johns River Water Management District, Feb. 21 1989; attached

8. Well Installation logs, W. Earl Floyd & Son Inc., JEA Brandy Branch, Fluor Global Well #1 & Well #2, completed 5/15/2000 and 4/4/2000 respectively.

ASSUMPTIONS:

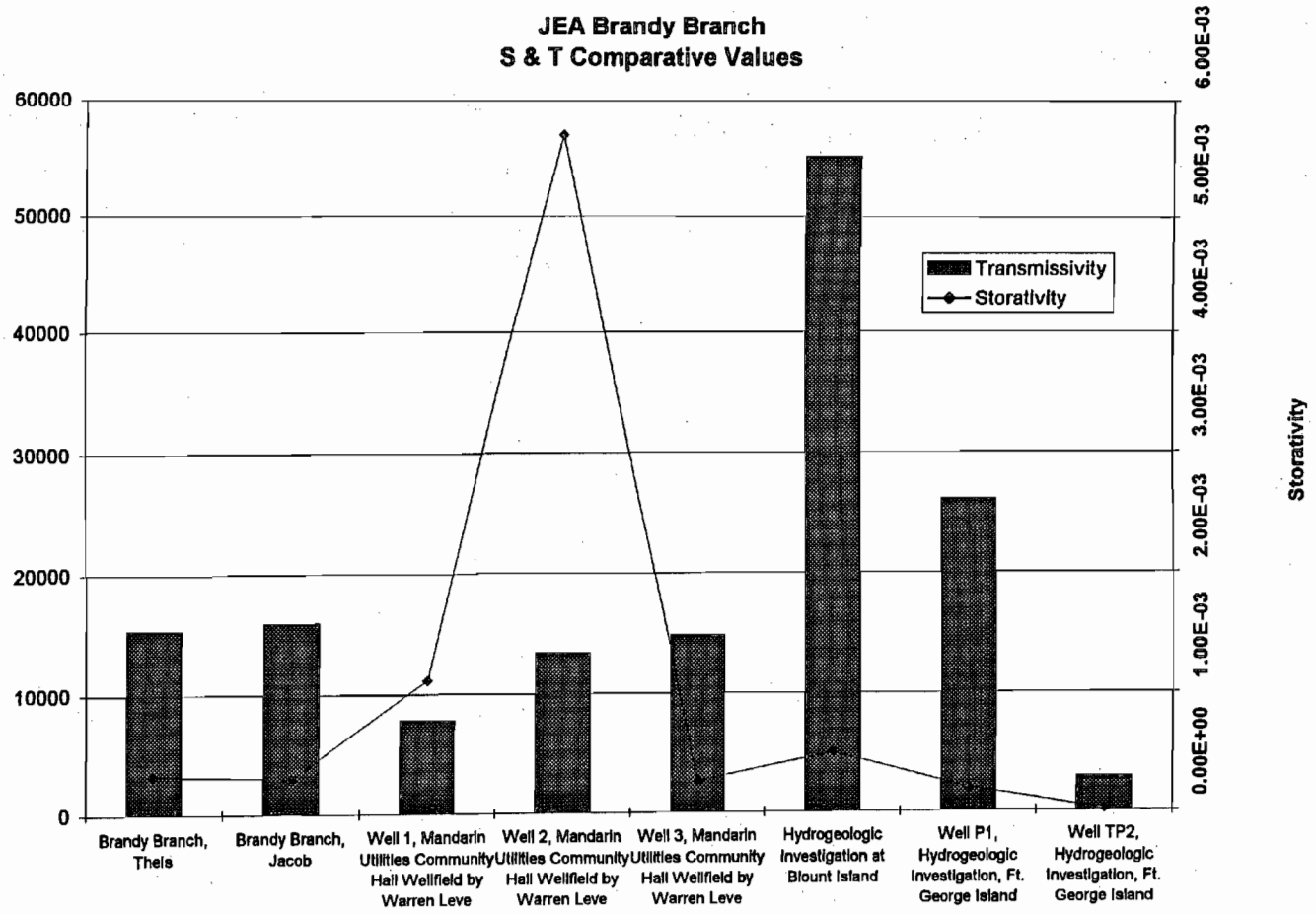
1. The drawdown in the aquifer reached steady state conditions.
2. The pumping rate remained relatively constant throughout the test.

SUMMARY:

- Both the pumped well (East well) and the monitored well (West well) are located on the Brandy Branch property, approximately 770 feet apart (REF 6).

SUMMARY (cont')

Source / Method	Transmissivity (ft^2/day)	Storativity	Reference
Brandy Branch, Theis	15319	3.23×10^{-4}	Current Investigation
Brandy Branch, Jacob	15855	2.94×10^{-4}	Current Investigation
Well 1, Mandarin Utilities Community Hall Wellfield by Warren Leve	7709	1.12×10^{-3}	Ref. 7
Well 2, Mandarin Utilities Community Hall Wellfield by Warren Leve	13371	5.7×10^{-3}	Ref. 7
Well 3, Mandarin Utilities Community Hall Wellfield by Warren Leve	14738	2.6×10^{-4}	Ref. 7
Hydrogeologic Investigation at Blount Island	55120	5×10^{-4}	Ref. 7
Well P1, Hydrogeologic Investigation, Ft. George Island	26151	2×10^{-4}	Ref. 7
Well TP2, Hydrogeologic Investigation, Ft. George Island	2842	1.3×10^{-5}	Ref. 7

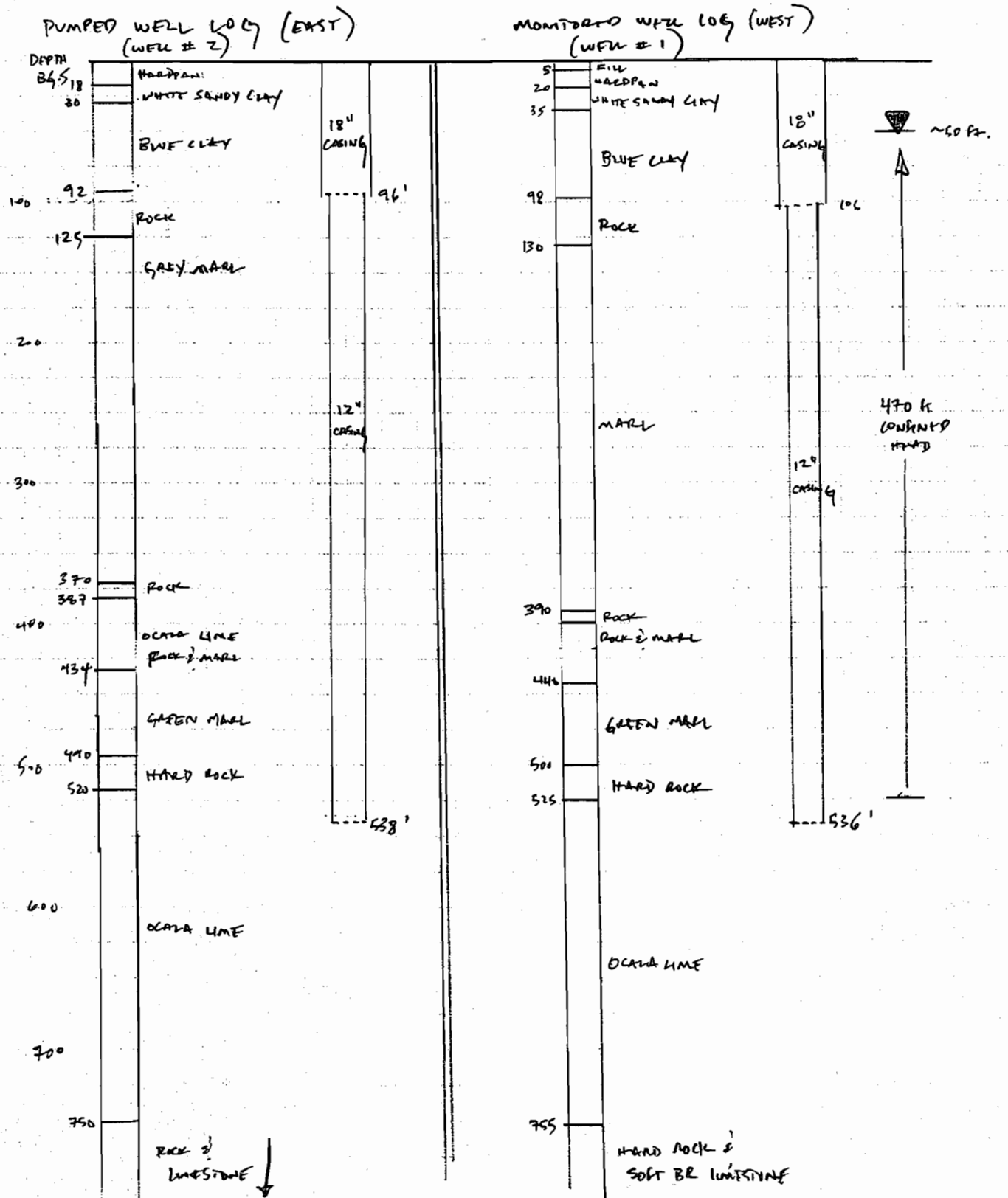

JEA Brandy Branch
S & T Comparative Values
60000
50000
40000
30000
20000
10000
0
6.00E-03
5.00E-03
4.00E-03
3.00E-03
2.00E-03
1.00E-03
0.00E+00
Storativity
Transmissivity
Storativity
Brandy Branch, Theis
Brandy Branch, Jacob
Well 1, Mandarin Utilities Community Hall Wellfield by Warren Leve
Well 2, Mandarin Utilities Community Hall Wellfield by Warren Leve
Well 3, Mandarin Utilities Community Hall Wellfield by Warren Leve
Hydrogeologic Investigation at Blount Island
Well P1, Hydrogeologic Investigation, Ft. George Island
Well TP2, Hydrogeologic Investigation, Ft. George Island

BLACK & VEATCH

Owner JEA
Plant BRANDY BRANCH Unit
Project No. 60903.0650 File No.
Title PUMP TEST ANALYSIS
Page 5 of 9

Computed By C. WISE
Date 5 JUN 20 00
Verified By
Date 20

REFERENCE INFORMATION:



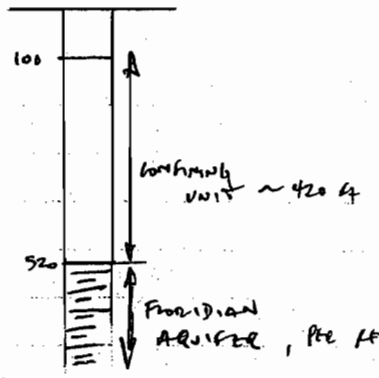
DO NOT WRITE IN THIS SPACE

PGN-172B

REVISED, SUPERSEDED, AND VOID CALCULATIONS MUST BE CLEARLY IDENTIFIED.

DO NOT WRITE IN THIS SPACE

1. AQUIFER MODEL:



PUMP TEST ANALYSIS:

SPECIFIC CAPACITY OF PUMPED WELL = $\frac{\text{FLOW RATE}}{\text{DRAWDOWN}}$

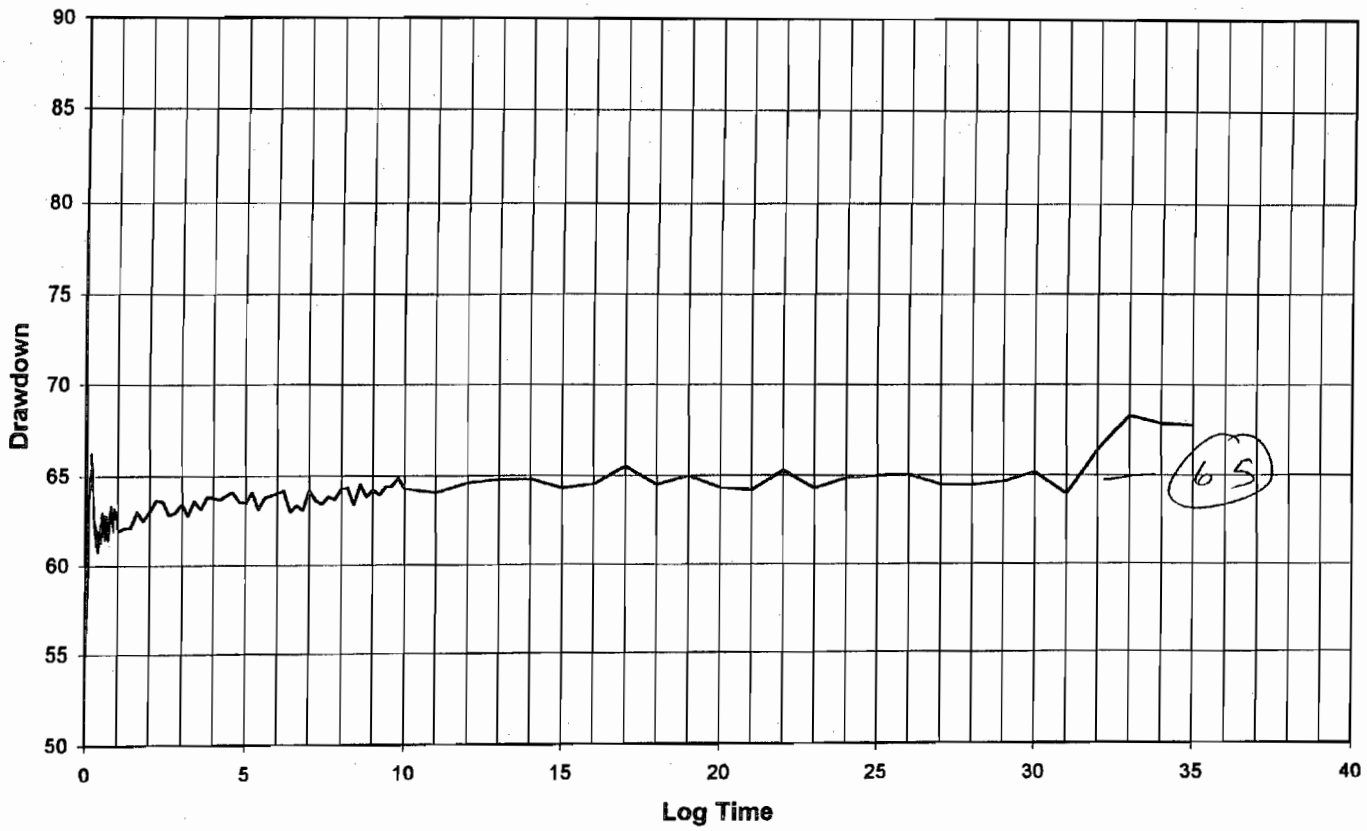
e.g. @ 450 gpm, $\frac{450 \text{ gal/min}}{(65 - 50.9)} = \frac{450 \text{ gpm}}{14.1 \text{ ft DRAWDOWN}} = 31.9 \text{ gpm/ft}$

$31.9 \text{ gal/min} \times 1 \text{ ft}^3/7.48 \text{ gal} = 4.26 \text{ ft}^3/\text{min/ft}$.

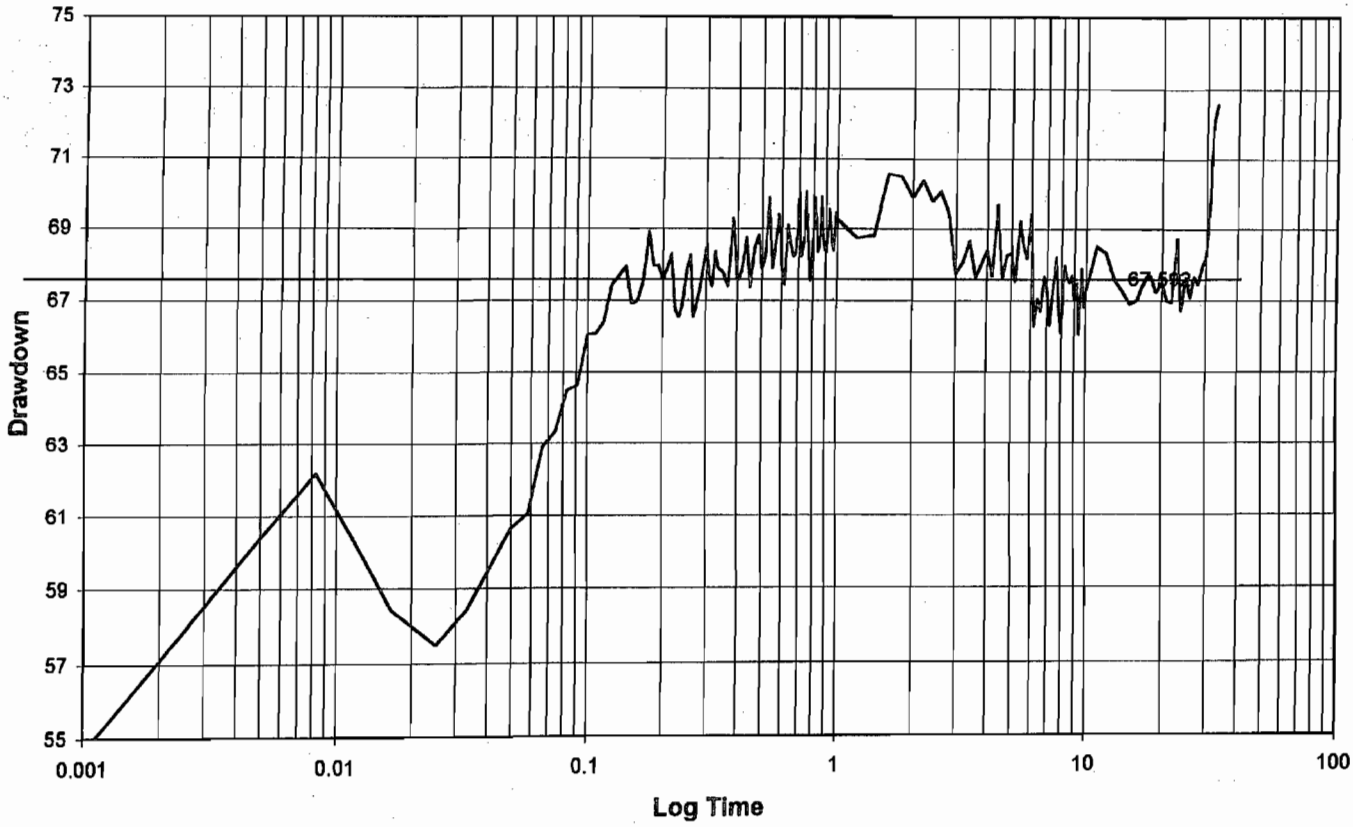
SEE ATTACHED DRAWDOWN CHARTS (REF. 3) - pp. 6A THROUGH 6E

REVISED, SUPERSEDED, AND VOID CALCULATIONS MUST BE CLEARLY IDENTIFIED

Brandy Branch Step Drawdown: Pumped Well @ 450 gpm



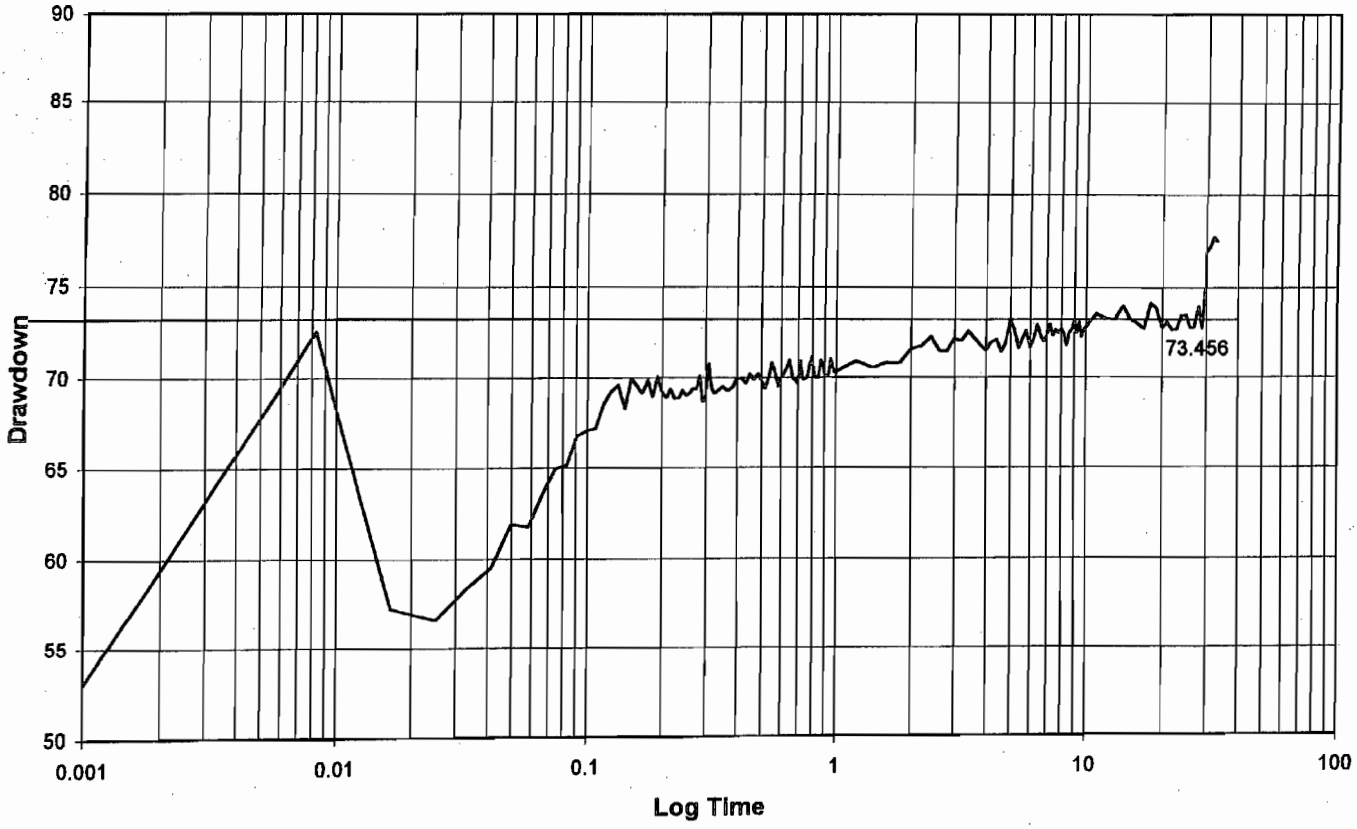
JDA
Pump Test Analysis
P. 64
C. Wise

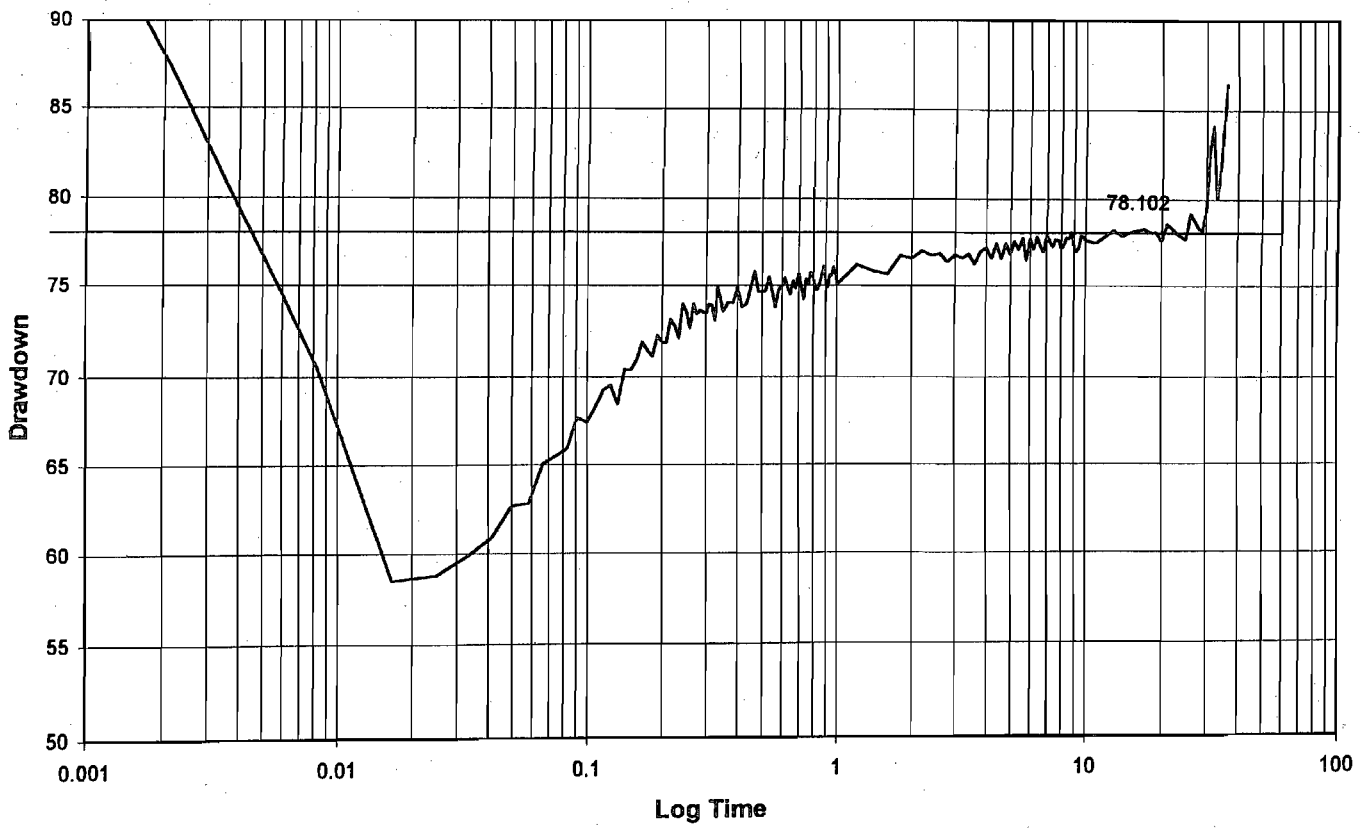


JTA
Pump Test Analysis

C. Wist
P. 6 D

Brandy Branch Step Drawdown: Pumped Well @ 760 gpm





JH
Pump Test Analysis

Table 7. Chemical analyses* of water from the shallow aquifer in Duval County, Florida.

Well Number	Date Collected	Depth (feet)	Depth Cased (feet)	Iron (Fe)	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (Fl)	Nitrate (NO_3)	Phosphate (PO_4)	Dissolved Solids**	Hardness: Calcium Magnesium (CaMg)	Hardness: Noncarbonate	Specific Conductance (micromhos at 25°C)	pH	Color
300857N0813444.2	5-20-65	92	–	2.0	29	83	15	14	1.3	0	328	0.0	21	.2	.0	–	326	268	0	533	7.3	0
301110N0820115.2	11-8-65	135	–	2.6	19	58	22	7.8	2.2	–	284	.4	8.0	.2	.1	.04	253	225	0	440	7.8	5
301145N0813727.1	5-19-65	126	98	.5	43	83	14	14	2.9	0	328	4.0	15	.2	.0	–	338	264	0	521	7.5	0
301255N0813710.1	5-20-65	89	–	.9	25	99	5.1	15	2.2	0	344	0.0	16	.1	.0	–	331	268	0	542	7.2	0
301324N0815506.1	11-8-68	125	–	1.0	26	58	13	14	2.1	–	256	.8	12	.4	.1	.04	253	198	0	418	7.9	5
301340N0814754.1	11-3-66	60	–	.01	19	43	16	6.6	1.2	–	213	.8	12	.5	.1	.56	205	174	0	349	7.8	0
301443N0814244.1	5-27-65	165	125	.04	29	57	11	12	2.5	0	236	4.8	9.0	.3	.0	–	242	186	0	395	7.6	5
301450N0814802.1	8-6-65	–	–	.21	9.0	33	9.5	3.8	.6	0	166	0.0	6.0	.2	.0	–	149	134	0	272	7.8	0
301454N0814754.1	4-16-68	68	–	–	9.7	43	9.1	4.1	.7	–	172	.4	6.0	.2	.6	–	159	145	4	279	7.5	0
301602N0815054.2	10-11-67	146	–	.65	22	56	20	6.4	1.9	–	270	0.0	14	.3	.2	.27	254	222	2	548	8.1	10
301706N0812957.1	11-7-68	85	–	2.8	13	61	2.2	8.8	.6	–	206	.8	11	.1	.1	.25	199	162	0	338	7.9	5
301718N0812538.1	6-6-66	140	92	–	52	63	29	19	5.7	0	212	122	16	1.4	.1	0	393	288	114	600	7.9	10
301747N0813624.1	11-1-66	55	–	.02	32	39	3.3	9.2	1.2	–	138	3.6	12	.2	.0	.27	165	111	0	270	7.4	10
301812N0815932.1	11-8-68	135	–	.1	38	75	13	28	2.9	–	324	.8	28	.2	.3	.14	347	241	0	560	7.7	5
301817N0813749.2	3-19-65	–	–	.31	43	39	16	15	6.1	0	204	4.0	18	1.4	.0	–	243	162	0	353	7.8	0
301820N0815007.1	7-2-68	140	–	–	32	90	5.4	8.7	2.1	–	304	0.0	12	.3	.2	–	301	249	0	440	7.3	0
301820N0815007.2	7-2-68	60	–	–	6.8	.2	2.2	7.8	1.1	–	0	16	9.8	.1	.0	–	44	10	10	97	4.3	30
301905N0815111.1	5-13-66	–	–	.03	33	85	52	0	1.5	0	296	.8	8.0	.4	.2	.16	289	234	0	470	7.9	10
301907N0814821.1	8-02-65	286	–	.02	26	88	2.3	7.4	1.8	0	286	.4	10	.2	.3	–	278	230	0	450	8.0	10
301915N0813515.1	5-20-65	200	–	–	22	72	25	14	2.1	0	160	146	24	.7	.0	–	385	284	153	580	7.6	0
301922N0812634.1	9-21-66	40	40	1.6	2.3	1.9	2.0	2.0	.3	0	8	0.0	25	.1	.1	0	48	12	6	105	5.5	5
301017N0815228.1	3-25-68	190	–	–	36	596	100	23	8.2	0	232	1660	12	1.0	.1	–	2560	1910	1720	2700	7.5	5
302136N0814255.1	5-27-65	80	–	2.8	18	73	12	13	1.1	0	236	38	18	.3	.0	–	289	232	38	472	7.9	10
302148N0813307.1	5-19-65	38	–	.11	11	32	14	5.8	.9	0	164	.8	8.0	.1	.0	–	154	136	2	263	7.5	0
302155N0813310.1	5-19-65	39	–	.09	11	34	2.7	6.1	.8	0	116	0.0	10	.1	.0	–	122	96	1	208	7.6	0
302203N0812455.1	9-26-68	162	–	–	55	46	16	25	4.7	–	228	14	25	.9	.3	0	299	182	0	442	8.1	5
302424N0815042.1	7-2-68	107	–	–	15	41	7.5	4.4	.3	–	108	0.0	7.0	.2	.0	–	159	134	0	275	7.7	0
302703N0813819.1	9-22-66	120	100	.08	33	32	2.4	7.6	1.3	0	112	0.0	8.0	.2	.0	.10	140	90	0	220	7.4	10
302829N0814128.1	4-3-68	150	–	–	31	630	70	20	22	0	220	1650	12	.7	.0	–	2550	1870	1690	2620	7.3	5
302915N0814215.1	9-27-67	142	126	–	35	64	9.9	17	4.4	126	256	0.0	16	.2	.0	–	272	200	0	440	7.9	5
302923N0813053.1	1-19-68	87	87	.68	23	111	6.2	17	.9	0	372	.4	25	.3	.0	–	367	303	0	615	7.5	10
303125N0813715.1	1-19-68	100	–	.92	14	55	28	8.5	1.4	0	300	.4	12	.4	.5	–	268	252	6	480	8.0	0
303356N0813645.1	9-22-66	90	–	2.7	49	59	9.0	19	1.8	0	188	80	23	.5	.0	–	344	226	72	535	7.3	0

*Chemical analyses in milligrams per liter except where otherwise indicated.
**Sum of determined constituents.

Applicant: Southern Wood Piedmont Company
900 Center St
Baldwin, FL 32234

GRS # 873

STATION NAME	DIAMETER	CAPACITY FLOW RATE	DEPTH	SECTION	TOWNSHIP	RANGE	LAT	LONG
A	8.0	10 GPM	37'	23	2S	23	301858	815821
AA	36.0	7 GPM	3.5'	23	2S	23	301855	815817
AB	36.0	8 GPM	4'	23	2S	23	301854	815818
AC	36.0	8 GPM	4'	23	2S	23	301852	815819
B	8.0	10 GPM	40'	23	2S	23	301859	815822
C	8.0	10 GPM	33'	23	2S	23	301857	815823
D	36.0	10 GPM	5.5'	23	2S	23	301850	815824
E	36.0	10 GPM	5'	23	2S	23	301847	815824
F	36.0	10 GPM	5.5'	23	2S	23	301844	815824
G	48.0	10 GPM	8'	23	2S	23	301852	815826
H	36.0	1 GPM	8.5	23	2S	23	301849	815821
I	36.0	1 GPM	8.5'	23	2S	23	301848	815820
J	36.0	1 GPM	8.5'	23	2S	23	301848	815819
K	36.0	1 GPM	8.5'	23	2S	23	301848	815818
L	36.0	1 GPM	8.5'	23	2S	23	301847	815822
M	36.0	1 GPM	8'	23	2S	23	301846	815821
N	36.0	1 GPM	8'	23	2S	23	301846	815820
O	36.0	1 GPM	9'	23	2S	23	301846	815819
P	36.0	1 GPM	10'	23	2S	23	301844	815822
Q	4.0	1 GPM	50'	23	2S	23	301842	815822
R	36.0	1 GPM	7'	23	2S	23	301853	815824
S	36.0	1 GPM	7'	23	2S	23	301852	815824
T	36.0	1 GPM	6.5'	23	2S	23	301851	815825
U	36.0	1 GPM	5.5'	23	2S	23	301850	815825
V	36.0	1 GPM	6.5'	23	2S	23	301849	815824
W	36.0	1 GPM	6'	23	2S	23	301848	815824
X	36.0	1 GPM	5'	23	2S	23	301846	815824
Y	36.0	1 GPM	18.5'	23	2S	23	301845	815824
Z	16.0	UNKNOWN	836'	23	2S	23		

Applicant: Risser Petroleum Inc
c/o Environmental Consulting
3701 NW 98th St
Gainesville, FL 32606

GRS # 853

STATION NAME	DIAMETER	CAPACITY FLOW RATE	DEPTH	SECTION	TOWNSHIP	RANGE	LAT	LONG
A	6.0	2	21	35	2S	23	301715	815856
B	6.0	2	21	35	2S	23	301714	815857
C	6.0	UNKNOWN	21	35	2S	23	301714	815857

Applicant: Town of Baldwin
10 US 90 W
Baldwin, FL 32234

GRS # 784

STATION NAME	DIAMETER	CAPACITY FLOW RATE	DEPTH	SECTION	TOWNSHIP	RANGE	LAT	LONG
A	10.	500 GPM	764'	26	2S	23	301802	815849
B	8.0	250 GPM	716'	26	2S	23	301809	815828
C	8.0	250 GPM	716'	26	2S	23	301808	815828

Applicant: The David J Joseph Company
900 Yellow Water Rd
PO Box 578
Baldwin, FL 32234

GRS # 863

STATION NAME	DIAMETER	CAPACITY FLOW RATE	DEPTH	SECTION	TOWNSHIP	RANGE	LAT	LONG
A	6.0	25 GPM	95'	35	2S	23	301640	815842
B	6.0	25 GPM	128'	35	2S	23	301640	815847
C	4.0	200 GPM	806'	35	2S	23	301636	815847

Applicant: Champion International
109 Halsema Rd S
Whitehouse, FL 32220

GRS # 50053

	NAME	DIAMETER	FLOW RATE	DEPTH	SECTION	TOWNSHIP	RANGE	LAT	LONG
A		16.0	1500 GPM	1170'	23	2S	24	301835	815209
E		2.0	15 GPM	130'	23	2S	24	301829	815159
G		4.0	20 GPM	130'	23	2S	24	301838	815201
H		4.0	20 GPM	130'	23	2S	24	301838	815210
I		6.0	100 GPM	600'	23	2S	24	301841	815158

Applicant: Florida Department of Transportation
PO Box 1089
Lake City, FL 32056

GRS # 571

	STATION NAME	DIAMETER	CAPACITY FLOW RATE	DEPTH	SECTION	TOWNSHIP	RANGE	LAT	LONG
A		6	20 GPM	100'	24	2S	24	301826	815154

Applicant: Navy Public Works Center
Code 310
Jacksonville, FL 32212-0030

GRS # 814

STATION NAME	DIAMETER	CAPACITY FLOW RATE	DEPTH	SECTION	TOWNSHIP	RANGE	LAT	LONG
	8	225 GPM	770'	17	3S	24	301417	815542
	8	225 GPM	780'	17	3S	24	301416	815541
	12	500 GPM	610'	10	3S	24	301535	815353
	12	500 GPM	620'	4	3S	24	301538	815402

Applicant: Westmeadows Golf Club Inc
11400 W Meadows Dr
Jacksonville, FL 32221

GRS # 850

STATION NAME	DIAMETER	CAPACITY FLOW RATE	DEPTH	SECTION	TOWNSHIP	RANGE	LAT	LONG
A	4.0	30 GPM	UNK	36	2S	24	301657	815126
B	2.0	15 GPM	100	36	2S	24		
C	2.0	15 GPM	100	36	2S	24		
D	4.0	30 GPM	UNK	36	2S	24		
E	2.0	15 GPM	100	36	2S	24		
F	2.0	70 GPM	680	36	2S	24		
G	4.0	70 GPM	680	36	2S	24		

Applicant: August Partners Inc
1808 Kinglet Ct
Coasta Mesa, CA 92626

GRS # 886

STATION NAME	DIAMETER	CAPACITY FLOW RATE	DEPTH	SECTION	TOWNSHIP	RANGE	LAT	LONG
A	6.0	150 GPM	760'	24	2S	24	301829	815059
B	6.0	150 GPM	762'	24	2S	24	301827	815058

Applicant: Fred Benson Miller Jr
1840 Seminole Rd
Jacksonville, FL 32205

GRS # 51

STATION NAME	DIAMETER	CAPACITY FLOW RATE	DEPTH	SECTION	TOWNSHIP	RANGE	LAT	LONG
A	8.	300 GPM	700'	15	2S	24	301913	815344

NO AS-BUILTS ?

PERMITTED WATER WELL CONSTRUCTION PERMIT PAGE: 1

PERMIT NO.: 3-089-0046P
RELATED CUP:
DATE RECD: / /
DATE ISSUED: 4/17/89
EXPIRATION: 10/17/89

CONTRACTOR: 7013

OWNER: RALPH T. SPENCER
P. O. BOX 5014
CALLAHAN FL 32011

SUR. CASING: 0.00
OPEN HOLE: 2"
CASED DEPTH:
TOTAL DEPTH:

TOP 20:
BOTTOM-TOP: X
BOTTOM 5:

METHOD USED: ROTARY
CASING MATL: SCH. 40 GALVANIZED
ANNULAR MATL:

WELL USE: PUBLIC SUPPLY
PROJECT: MULCH MANUFACTURING
LOCATION:
COUNTY:
SECTION: 33 TOWNSHIP: 01 RANGE: 24
LATITUDE: LONGITUDE:
MOD. DESC.:

AB. DESC.:

COMMENTS:

CONDITIONS: SEE PERMIT

NEW WELL: XX
MODIFIED:
ABANDONMENT:
CASING

WATER WELL CONSTRUCTION LOGS:

THICK	DIAMETER	C. DEPTH	F. DEPTH	T. DEPTH	G. DEPTH	LOG
	3.00	0				SAND
0	0.00	0	0	0	0	HARD PAN
0	0.00	0	0	0	0	SAND
0	0.00	0	0	0	0	SHELL & GRAVEL
0	0.00	0	0	0	0	BLACK ROCK
0	0.00	0	0	0	0	CAVITY
	0.00	0	0	0	0	

PERMITTED WATER WELL CONSTRUCTION PERMIT PAGE: 1

ERMIT NO.: 3-031-0285AP
ATED CUP:
ATE RECD: 10/ 1/90
ATE ISSUED: 10/ 5/90
PIRATION: 10/ 5/91

ONTRACTOR: 1515

WNER: CHAMPION INTERNATIONAL CORP.
109 HALSEMA RD. P.O. BOX 308
JACKSONVILLE FL 32220

SUR. CASING: 6.00
OPEN HOLE: 3"
CASED DEPTH:
TOTAL DEPTH:

TOP 20:
BOTTOM-TOP: X
BOTTOM 5:

METHOD USED: ROTARY
CASING MATL: BLACK STEEL
ANNULAR MATL: CEMENT GROUT

LL USE: PUBLIC SUPPLY
ROJECT: 109 HALSEMI RD.
OCATION:
OUNTY: 31
ECTION: 23 TOWNSHIP: 02 RANGE: 24
ATITUDE: LONGITUDE:
OD. DESC.:

B. DESC.:

ENTS:

ONDITIONS: SEE PERMIT

EW WELL: XX
ODIFIED:
BANDONMENT:
ASING

WATER WELL CONSTRUCTION LOGS:

HICK	DIAMETER	C. DEPTH	F. DEPTH	T. DEPTH	G. DEPTH	LOG

PERMITTED WATER WELL CONSTRUCTION PERMIT PAGE: 2

PERMIT NO.: 3-089-0050P
ATED CUP:
ATE RECD: / /
DATE ISSUED: / /
XPIRATION: / /

CONTRACTOR: 2474

OWNER: →◎◎BREAD OF LIFE CHURCH
RT. 2 BOX 348
HILLIARD FL 32046

SUR. CASING: 0.00
OPEN HOLE:
CASED DEPTH:
TOTAL DEPTH:

TOP 20:
BOTTOM-TOP: X
BOTTOM 5:

METHOD USED:
CASING MATL: ROTARY
ANNULAR MATL: PVC SCH 40

ELL USE: PUBLIC SUPPLY
ROJECT:
LOCATION:
COUNTY:
ECTION: 10 TOWNSHIP: 03 RANGE: 24
LATITUDE: LONGITUDE:
MOD. DESC.:

B. DESC.:
CEMENT GROUT
MENTS:

CONDITIONS: SEE PERMIT

EW WELL: XX
MODIFIED:
ABANDONMENT:
CASING

WATER WELL CONSTRUCTION LOGS:

THICK	DIAMETER	C. DEPTH	F. DEPTH	T. DEPTH	G. DEPTH	LOG
	4.00	0				SAND
0	0.00	0	0	0	0	
0	0.00	0	0	0	0	BRN. HARD PAN
0	0.00	0	0	0	0	SAND AND CLAY
0	0.00	0	0	0	0	GRAY CLAY
0	0.00	0	0	0	0	GREEN CLAY & SHE
0	0.00	0	0	0	0	TAN ROCK
0	0.00	0	0	0	0	ROCK TO CLAY

PERMITTED WATER WELL CONSTRUCTION PERMIT PAGE: 1

ERMIT NO.: 3-083-5703
ATED CUP:
TE RECD: / /
ATE ISSUED: 05/04/80
XPIRATION: / /

CONTRACTOR: 2048

WNER: RICHARDS JOHN
PO BOX 117
CITRA FL 32627

SUR. CASING: 0.00
OPEN HOLE: 2
CASED DEPTH: 83
TOTAL DEPTH: 0

TOP 20:
BOTTOM-TOP:
BOTTOM 5:

METHOD USED: XX
CASING MATL: G
ANNULAR MATL: SEATED IN ROCK

ELL USE: PRIVATE
ROJECT:
LOCATION:
OUNTY:
ECTION: 01 TOWNSHIP: 03 RANGE: 23
ATITUDE: LONGITUDE:
MOD. DESC.:

B. DESC.:

NTS:

CONDITIONS:

EW WELL: XX
ODIFIED:
ABANDONMENT:
ASING

WATER WELL CONSTRUCTION LOGS:

THICK	DIAMETER	C. DEPTH	F. DEPTH	T. DEPTH	G. DEPTH	LOG
0	0.00	0	900	101	0	WHITE SAND
0	0.00	0	0	0	0	BROKEN SHL
0	0.00	0	0	0	0	LIMESTONE

PERMITTED WATER WELL CONSTRUCTION PERMIT PAGE: 1

ERMIT NO.: 3-089-0070P
ATED CUP:
TE RECD: 9/20/90
ATE ISSUED: 10/ 1/90
PIRATION: 10/ 1/91

ONTRACTOR: 2737

WNER: JOHN M. GORDIE
P.O. BOX 896
HILLIARD FL 32046

ELL USE: PUBLIC SUPPLY
ROJECT: HOLLIDAY TERRACE MOTEL REST.
OCATION:
OUNTY: 89
ECTION: 05 TOWNSHIP: 03 RANGE: 24
ATITUDE: LONGITUDE:
OD. DESC.:

B. DESC.:

NTS:

ONDITIONS: SEE PERMIT

EW WELL: XX
ODIFIED:
ABANDONMENT:
ASING

SUR. CASING: 5.00
OPEN HOLE: 2"
CASED DEPTH:
TOTAL DEPTH:

TOP 20:
BOTTOM-TOP: X
BOTTOM 5:

METHOD USED: ROTARY
CASING MATL: SCH 40 PVC/GALV.
ANNULAR MATL: NEAT CEMENT

WATER WELL CONSTRUCTION LOGS:

THICK	DIAMETER	C. DEPTH	F. DEPTH	T. DEPTH	G. DEPTH	LOG

Engineering Certification Statement

I, the undersigned, hereby certify under penalty of law that:

The engineering features of the management and storage of surface waters system described in this application and in the following calculations have been prepared, designed, or examined by me or individuals under my direct supervision and found to be in conformity with sound engineering principles applicable to the control and management of stormwaters; and,

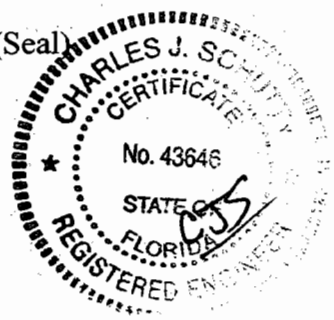
To the best of my knowledge, the information submitted in support of the stormwater control and management system design is true, accurate, and complete and is based upon reasonable techniques, estimates, materials, and information gathered and evaluated by qualified personnel; and,

To the best of my knowledge, there is reasonable assurance that the stormwater control and management system described in this application, when properly operated and maintained, will comply with all applicable standards for control of water pollution discharges found in the Florida Statutes and rules of the Department of Environmental Protection.

Charles J. Schutty — Signature

11/28/00 — Date

(Seal)



Poor Original

BLACK & VEATCH

Calculation Record

Client Name: JEA Page 1 of 12

Project Name: Brandy Branch Station Project No.: 99262

Calculation Title: Wet Detention System

Calculation No./File No.: 32.0541

Calculation Is: (check all that apply) ☐ Preliminary ☒ Final ☐ Nuclear Safety-Related

Objective: To design the wet detention basin for the site.

Unverified Assumptions Requiring Subsequent Verification			
No.	Assumption	Verified By	Date

See Page _____ of this calculation for additional assumptions.

This Section Used for Computer Generated Calculations

Program Name/Number: _____ Version: _____

Evidence of or reference to computer program verification, if applicable:

Bases or reference thereto supporting application of the computer program to the physical problem:

Review and Approval						
Rev	Prepared By	Date	Verified By	Date	Approved By	Date
0	Julie M Stanek	11-17-00	Kim Stanley	11/17/00	M. J. Tafi	11/22/2000

OBJECTIVE: To design the wet detention basin for the site.

DESIGN CRITERIA:
1. The wet detention basin must draw down the required treatment volume in 48 to 60 hours.
2. The post development peak discharges must be less than or equal to the pre-development rate of the design storm.

REFERENCES:
1. St. Johns River Water Management District, Applicant's Handbook: Management and Storage of Surface Waters.
2. St. Johns River Water Management District, Applicants Handbook: Regulation of Stormwater Management Systems, Chapter 40C-42, F.A.C.
3. U.S. Department of Commerce, Weather Bureau, Technical Paper No. 40, Rainfall Frequency Atlas of the United States.
4. U.S Department of Agriculture, Soil Conservation Service, Engineering Division Technical Release 55 (TR55), 'Urban Hydrology For Small Watersheds', June
   - text
   - software
5. HEC-1 Flood Hydrograph Package, US Army Corps of Engineers.
6. 'Handbook of Applied Hydrology', Chow, McGraw-Hill Book Company, 1964.
7. 'Civil Engineering Reference Manuel', Fifth Edition, Michael R. Lindeburg P.E., Professional Publications, Inc. 1989.
8. Brandy Branch Calculations used in the Environmental Resource Permit Application for Brandy Branch Generating Station Phase II: Main Site, File Number 52.5406.1100.01.
9. Brandy Branch Calculations used in the Environmental Resource Permit Modification Application for Brandy Branch Generating Station ERP No. 16-156348-002-E1, File Numbers 52.5406.1117.

RESULTS:

Changes made to the Brandy Branch site since Ref. # 8 & 9 have been completed.

- Increased size of sub-basin # 1 by adding the area for the cooling tower, circulating water lines, and the small additional area needed for the steam turbine generation building.
  - Refer to Figure A on page 9 of this calculation set for illustration of sub-basin # 1.
  - Additional Area equals = 2.904 Acres
- Changes to ground surfacing due to site arrangement layout changes for the conversion to combined cycle.
  - Refer to Drawing 97990-DS-S1001 for new site arrangement layout.
  - Impervious areas will increase slightly due to the cooling tower.
  - Aggregate surfacing area will increase around the cooling tower.
  - Grass cover will increase along the circulating water pipeline.

Effects of Changes.

The changes made to the drainage area did not affect the drainage system from Ref. 8 & 9.

- The Bottom of Pond is still at elevation 76.5' and the top of pond berm is still at elevation 82.5'.
- The discharge structures still include 3-4" drawdown pipes at elevation 79.5' and a 14.75 ft weir at elevation 80.03.
- The post development flow for the 25 year, 24 hour event is still lower than the pre development flow for the same design storm..

Calculations – Predevelopment Conditions:

Area:

- Addition of new area to sub-basin # 1.
- New Area = 2.904 Acres
- New Total Area of sub-basin # 1 = 44.716 AC + 2.904 AC (Ref. # 9, page 5 of 15)
  - **New Total Area of sub-basin # 1 = 47.620 Acres**

Find Time of Concentration (Tc):

- Use TR55 software (Ref # 4)
- For Figure of Tc path see Figure B on page 10.
- Refer to TR55 output on page 8.
- Inputs into TR-55:
  - 300' of sheet flow at [(84.25 - 83.60) / 300] = 0.00217 ft/ft with a surface code of Dense Woods
  - 980' of shallow concentrated flow at [(83.60 – 80.51) / 980] = 0.00315 ft/ft with a surface code of unpaved.
- **Tc = 3.28 hours**

Weighted CN Value:

- Woods:
  - Same physical characteristic (i.e. dense woods) and same soil conditions (i.e. 'good') as in Ref. # 9.
  - CN = 77 (Ref. # 4, page 2.7, table 2.2c)
  - Area of Woods = 36.004 Acres
    - New area added to site is all in a dense wooded region.
- Grass:
  - Same physical characteristics and same soul conditions as in Ref. # 9
  - CN = 80 (Ref. # 4, page 2.7, table 2.2c)
- Weighted CN Value:
  - Percent wooded area = (36.004 AC / 47.620 AC) x 100% = 75.61%
  - Remaining area is grass. Percent grass area = 100% - 75.6% = 24.39%
  - CN (weighted) = [(77) x (0.7561) + (80) x (0.2439)] = 77.73
  - **CN = 77.7**

Inputs into HEC-1:

- Basin Area (BA) = 47.620 AC = 0.07366 sq. miles
- Rainfall depth (PB) = (Ref. # 3)
  - Same as in Ref. # 8 & 9.
  - Mean Annual Storm – 24 hour storm event (PB) =4.6 inches
  - 25 year – 24 hour storm event (PB) = 8.75 inches
- Hydrograph (PC) – 30 minute interval used
  - Same as in Ref. # 8 & 9.
  - NRCS Type II FL Modified Hydrograph (Ref. # 1, Page 14-2)
- Weighted CN value (middle value of LS)
  - Calculated above – CN = 77.7
- Time lag (UD)
  - Time lag = Time of concentration * 0.6
  - Time Lag = 3.28 hours x 0.6 = 1.968 hours

HEC-1 Output (Pre-Development Runoff Peak Flowrates):

STORM EVENT	PEAK FLOW (CFS)	OUTPUT LOCATION
Mean annual, 24 hour	23	Appendix A
25 year, 24 hour	60	Appendix B

Postdevelopment Conditions:

Area:

- Total area excluding pond:
  - Total area = 47.620 AC = 2,074,327 SF
  - Area of pond = 453,958 SF
  - Self-Contained areas not going to pond = 80,250 SF
  - Total area excluding pond and self-contained areas = 2,074,327 SF – 453,958 SF – 80,250 SF = **1,540,119 SF**
- Impervious Areas:
  - CT Units 1, 2, 3, and 4 areas within loop road
    - Previously calculated as 282,150 sq. feet (Ref. # 9, page 6 of 15)
    - Actual area is 92,300 sq. feet
      - Area decreased since the impervious area was previously assumed to be 75% of the area.
  - Roads
    - Previously calculated as 249,125 sq. feet (Ref. # 9, page 6 of 15)
    - Actual area is 265,550 sq. feet
      - Area increased since the loop road had to be extended around the steam turbine building.
  - Buildings, Tanks, Miscellaneous
    - Previously calculated as 34,712 sq. feet (Ref. # 9, page 6 of 15)
    - Actual area is 34,712 sq. feet
      - There were no changes to this area.
  - Concrete lined ditches
    - Actual area is 75,280 sq. feet
  - Total Impervious Area
    - Previously calculated as 525,987 SF (Ref # 9, page 6 of 15)
    - Area = 92,300 SF + 265,550 SF + 34,712 SF + 75,280 SF = **467,842 SF**
      - Refer to Figure D, page 12 to see illustration of impervious areas.
- Aggregate Surfaced Areas:
  - CT Units 1, 2, 3, and 4 areas within loop road
    - Previously calculated as 94,050 sq. feet (Ref. # 9, page 6 of 15)
    - Actual area is 240,352 sq. feet
      - Area increased since the aggregate surfacing was previously assumed to be 25% of the area.
  - Roads
    - Included in miscellaneous areas.
  - Substation:
    - Previously calculated as 180,475 sq. feet (Ref. # 9, page 6 of 15)
    - Actual area is 180,475 sq. feet
  - Miscellaneous
    - Previously calculated as 15,400 sq. feet (Ref. # 9, page 6 of 15)
    - Area (road to pond, fuel gas metering station, hydrogen storage gas area) = 15,400 sq. feet
    - Area around cooling tower = 44,375 sq. feet
  - Total Aggregate Surfacing Area
    - Previously calculated as 289,925 SF (Ref. # 9, page 6 of 15)
    - Area = 240,352 SF + 180,475 SF + 15,400 SF + 44,375 SF = **480,602 SF**
      - Refer to Figure D, page 12 to see illustration of aggregate areas.
- Grassed Areas:
  - All areas, which do not have impervious surfacing of aggregate surfacing, are grassed.
    - Grassed Area = (Total area – pond area) – Impervious area – Aggregate surfaced area
    - Grassed Area = [1,540,119 SF] – 467,842 SF – 480,602 SF = **591,675 SF**

Find Time of Concentration (Tc):

- The time of concentration for Sub-Basin # 1 will not be changed from that calculated in Ref. # 9. The flow path from the southeast corner of the site to the pond is still the longest path. (Refer to Figure C, Page 11 for Flow Path)
- **Tc = 0.74 hours or 45 minutes**

Weighted CN Value:

- % Areas of sub-basin # 1 , excluding pond:
  - Impervious area
    - (467,842 SF / 1,540,119 SF) x 100% = 30.4 %
    - **% Area = 30.4%**
  - Aggregate Surfaced area
    - (480,602 SF / 1,540,119 SF) x 100% = 31.2%
    - **% Area = 31.2%**
  - Grass area
    - (591,675 / 1,540,119) x 100% = 38.4%
    - **% Area = 38.4%**
- CN Value (Ref # 4, page 2-5, table 2.2a, manual):
  - CN = 98 for Impervious areas
  - CN = 91 for Aggregate Surfaced
  - CN = 80 for grassed areas
- Weighted CN Value:
  - **CN (weighted) = [(0.304 x 98) + (0.312 x 91) + (0.384 x 80) = 88.9**

Wet Detention System:

- Guideline (Ref. # 2, page 14-1)
  - For wet detention systems, the design treatment volume (TV) is the greater of the following:
  - (a) one inch of runoff over the drainage area or (b) 2.5 inches times the impervious area (excluding water bodies).
- Area of drainage basin, with pond = 47.620 AC = 2,074,327 SF
- Area of drainage basin w/o pond or self-contained areas = 2,074,327 SF – 453,958 SF – 80,250 SF = 1,540,119 SF
- (a) (2,074,327 SF) x (1in / [12 in / 1 ft]) = 172,861 CF
- (b) Impervious area = 467,842 SF x 1.10 = 514,626 SF
  (Multiply by 10 % factor of safety.)
  - (514,626 SF) x (2.5 in / [12 in / 1 ft] = 107,214 CF
- **Controlling Treatment Volume = 172,861 CF**
  (This is less than what was calculated in Ref. # 9. Therefore the previous design will be adequate.)

Permanent Pool Volume: (Refer to Ref. # 2, page 29-1)

- RT = PPV / FR
  Where: RT = Residence Time (days) = 14 days (Ref. # 2)
  PPV = Permanent Pool Volume (AC – ft)
  FR = Ave. Flow Rate (AC – ft / day)
- PPV = (RT) x (FR)
- FR = [(DA) x (C) x (R)] / WS
  Where: DA = Drainage Area to Pond (AC) = 1,540,119 SF = 35.356 AC
  C = Weighted Runoff Coefficient - (Ref. # 6, page 14-8)
    - C (Impervious) = 0.95
    - C (Aggregate Surfacing) = 0.40
    - C (Grass) = 0.20
    - % Impervious = 30.4%
    - % Aggregate Surfacing = 31.2%
    - % Grass = 38.4%
      - C (weighted) = [(0.304 x 0.95) + (0.312 x 0.40) + (0.384 x 0.20)] = 0.49

  R = Wet Season Rainfall Depth (in) = 30 in (Ref. # 2, page 29-2)
  WS = Length of wet season (days) = 153 days
  (June – Oct = 153 days)

- FR = [(DA) x (C) x (R)] / WS = [(35.356 AC) (0.49) (30 in / [12 in / 1 ft])] / 153 days = 0.28 AC – ft / day
  FR = 0.28 AC-ft / day
- PPV (min)= (RT) x (FR) = (14 days) x (0.28 AC-ft / day) = 3.9 AC-ft
- **PPV (min) = (3.9 AC-ft) x (43,560 SF / AC) = 169,884 CF**
- PPV (required) = Min PPV plus 50% increase in PPV because the no littoral zone option is exercised for a wet detention pond under section 14.7a of Ref. # 2.
  - PPV (required) = 1.5 x PPV(min)
  - **PPV (required) = 1.5 x 169,884 CF = 254,826 CF**
- Min average depth of 2.0 feet needs to be observed for the PPV.

Check the Drawdown Structure: (Refer to Ref. # 2, pages 29-1 through 29-5)

- No more than half the treatment volume should be discharged in the first 48 to 60 hours after the storm event. (Ref. # 2, page 29-1)
- Use discharge structures established in Reference # 8 & 9. Determine whether changed flowrate will be treated in the 48 to 60 hour time frame.
- Parameters established in Ref. # 8 & 9.
  - 2 - 4" diameter PVC pipes at invert elevation of 79.5 ft
  - Invert of weir at elevation 80.03 ft
  - Length of Weir = 14.75 feet
  - Top of berm elevation = 82.5 feet
- Find h
  - h = (h1 + h2) / 2
  - h1 = Depth of water between top of the treatment volume and the invert elevation of the drawdown pipes.
    - Determine actual TV elevation:
      - Top of TV elevation = {[(81.5' – 79.5')] x {172,861 CF / 849,856 CF]} + 79.5' = 79.91 ft
        Where: 172,861 CF is the Controlling Treatment Volume.
        8,49,856CF is the volume at 81.5 if you set the volume at 79.5 = 0
      - Top of TV = 80.03 ft (from Ref. # 8 & 9), therefore extra treatment volume will exist.
    - h1 = 79.91 ft - 79.50 ft = 0.41 feet
  - h2 = Depth of water between the stage when half the treatment volume has been released and the invert elevation of the orifice (ft)
    - Stage at half the TV = {[(81.5ft – 79.5ft)] x [(172,861 CF x 0.5) / 849,856 CF] + 79.5 ft = 79.70 feet
    - h2 = 79.70 ft – 79.50 ft = 0.20 feet
  - h = (h1 + h2) / 2 = (0.41 ft + 0.20 ft) / 2 = 0.305 ft
    - **h = 0.31 feet**
- Find flowrate from orifices:
  - Orifice equation:
    $Q = CA\,(2gh)^{(1/2)}$
    Where: Q = Discharge, cfs
    A = Orifice Area, SF (2 – 4" diameter PVC) = 0.175 SF
    g = 32.2 ft / sec^2
    h = 0.31 feet (from above)
    C = Orifice coefficient = 0.6
    $Q = CA\,(2gh)^{(1/2)} = [(0.6) \times (0.175\ SF)] \times [(2) \times (32.2\ ft / sec^2) \times (0.31\ ft)]^{(1/2)} = 0.469$ cfs
  - **Q = 0.469 cfs**
- Check whether drawdown time follows the 48 to 60 hour rule:
  - Q = TV / [(2) x (t) x (cf)]
    Where: TV = Treatment Volume, CF = 172,861 CF
    t = recovery time, hrs
    cf = conversion factor, 3600 sec/hr
    Rearrange the equation for Q to solve for t.
    t = TV / [(2) x (Q) x (cf)] = 172,861 CF / [(2) x (0.469 cfs) x (3600 sec/hr)] = 51.2 hrs
    t = 51.2 hrs

- Therefore, the water will be treated in the 48 to 60 hour time frame, and the existing drawdown structure is an adequate design.

- Check Permanent Pool vs. pond bottom elevation and mean depth
  - PPV (required) = 254,826 CF
  - Pond Bottom Elevation = 76.5 ft
  - Volume between pond bottom (EL 76.5 ft) and control elevation (EL 79.5 ft) = 1,196,856 CF
  - PPV (required) = 254,826 CF < Actual Permanent Pool Volume = 1,196,856 CF, therefore ok.
  - Mean depth of permanent pool must be between 2 – 8 feet.
    - MD = PPV / Ap

      Where: MD = Mean depth, ft

      PPV (Actaul) = 1,196,856 CF

      Ap = Area of pond measured at the control elevation (79.5 ft), ft = 414,385 SF

      MD = PPV / Ap = 1,196,856 CF / 414,384 SF = 2.9 ft. > 2.0 ft min

Inputs into HEC-1:

- Basin Area (BA)
  - Total area = 47.620 AC = 2,074,327 SF
  - Area of pond = 453,958 SF = 0.01628 mi^2
  - Area of self-contained areas = 80,250 SF
  - Area excluding pond and self-contained areas = 1,540,119 SF = 0.05524 mi^2
- Rainfall depth (PB) = (Ref. # 3)
  - Same as in Ref. # 8 & 9.
  - Mean Annual Storm – 24 hour storm event (PB) = 4.6 inches
  - 25 year – 24 hour storm event (PB) = 8.75 inches
- Hydrograph (PC) – 30 minute interval used
  - Same as in Ref. # 8 & 9.
  - NRCS Type II FL Modified Hydrograph (Ref. # 1, Page 14-2)
- Weighted CN value (middle value of LS)
  - Calculated above – CN = 88.9
- Time lag (UD)
  - Time lag = Time of concentration * 0.6
  - Time Lag = 0.74 hours x 0.6 = 0.444 hours

HEC-1 Output (Post-Development Runoff Peak Flowrates):

STORM EVENT	PEAK FLOW (CFS)	OUTPUT LOCATION
Mean annual, 24 hour	16	Appendix C
25 year, 24 hour	59	Appendix D

4

OVERSIZE DOCUMENT WAS REMOVED AND INSERTED INTO OCULUS SEPARATELY.

Pretr55.prn

TIME OF CONCENTRATION AND TRAVEL TIME Version 2.10

Project : JEA - Brandy Branch User: JMS Date: 11-11-2000
County : Duval State: FL Checked: ____ Date: _____
Subtitle: Pre-Development

Subarea #1

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	4.75	300	.0022	I					2.978
Shallow Concent'd		980	.0032	U					0.298
								Time of Concentration =	3.28*

--- Sheet Flow Surface Codes ---

A Smooth Surface	F Grass, Dense	--- Shallow Concentrated ---
B Fallow (No Res.)	G Grass, Burmuda	--- Surface Codes ---
C Cultivated < 20 % Res.	H Woods, Light	P Paved
D Cultivated > 20 % Res.	I Woods, Dense	U Unpaved
E Grass-Range, Short	J Range, Natural	

Owner: JEA
Plant: Brandy Branch Station
Project No.: 099262
File No.: 32.0541
Title: Wet Detention System

Computed By: J.M. Stanek
Date: 11-17-2000
Verified By:_____
Date:_____

APPENDIX A

IMAGE QUALITY

AS YOU REVIEW THE NEXT FEW PAGES, PLEASE NOTE THAT THE ORIGINAL DOCUMENT WAS OF POOR QUALITY.

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*          FEBRUARY 1981               *
*        REVISED 02 AUG 88             *
*                                      *
*  RUN DATE  11/17/2000  TIME  07:31:47 *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*  THE HYDROLOGIC ENGINEERING CENTER   *
*          609 SECOND STREET           *
*        DAVIS, CALIFORNIA 95616       *
*          (916) 551-1748              *
*                                      *
****************************************
```

```
X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX          XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

   1          ID   JEA - Brandy Branch
   2          ID   HEC-1 Analysis - 24 hr Storm - Mean (2.5) Year Event
   3          ID   Predevelopment Flow
   4          ID   Black & Veatch Project No. 099262.0040
   5          ID   Input File: pre2-5.in  Output File:  pre2-5.out
   6          IT      15 04JAN00    0600     150
   7          IO       0       0
   8          IN      30
              * **********

   9          KK  POST25
  10          KM   PRE-DEVELOPMENT RUNOFF
  11          BA  .07366
  12          PB    4.6
  13          PC  0.0000  0.0060  0.0120  0.0190  0.0250  0.0320  0.0390  0.0470  0.0540  0.0620
  14          PC  0.0710  0.0800  0.0890  0.0990  0.1100  0.1220  0.1340  0.1480  0.1640  0.1810
  15          PC  0.2010  0.2260  0.2580  0.3080  0.6070  0.7190  0.7570  0.7850  0.8070  0.8260
  16          PC  0.8420  0.8570  0.8700  0.8820  0.8930  0.9040  0.9130  0.9230  0.9310  0.9400
  17          PC  0.9480  0.9550  0.9620  0.9690  0.9760  0.9830  0.9890  0.9950  1.0000
```

```
            18           LS       0    77.7       0
            19           UD   1.968
                         * **********
                         *DIAGRAM
            20           ZZ
1
                 SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

     9      POST25

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*             FEBRUARY 1981            *
*           REVISED 02 AUG 88          *
*                                      *
*  RUN DATE  11/17/2000  TIME  07:31:47 *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*  THE HYDROLOGIC ENGINEERING CENTER   *
*          609 SECOND STREET           *
*        DAVIS, CALIFORNIA 95616       *
*           (916) 551-1748             *
*                                      *
****************************************
```

JEA - Brandy Branch
HEC-1 Analysis - 24 hr Storm - Mean (2.5) Year Event
Predevelopment Flow
Black & Veatch Project No. 099262.0040
Input File: pre2-5.in Output File: pre2-5.out

```
   7 IO          OUTPUT CONTROL VARIABLES
                       IPRNT          0  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN         15  MINUTES IN COMPUTATION INTERVAL
                       IDATE     4JAN 0  STARTING DATE
                       ITIME       0600  STARTING TIME
                          NQ        150  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     5JAN 0  ENDING DATE
                      NDTIME       1915  ENDING TIME
                       ICENT         19  CENTURY MARK

                  COMPUTATION INTERVAL      .25 HOURS
                      TOTAL TIME BASE    37.25 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
```

STORAGE VOLUME ACRE-FEET
SURFACE AREA ACRES
TEMPERATURE DEGREES FAHRENHEIT

*** ***

```
**************
*            *
*    POST25  *
*            *
**************
```

POST-DEVELOPMENT RUNOFF

8 IN TIME DATA FOR INPUT TIME SERIES

JXMIN	30	TIME INTERVAL IN MINUTES
JXDATE	4JAN 0	STARTING DATE
JXTIME	600	STARTING TIME

SUBBASIN RUNOFF DATA

11 BA SUBBASIN CHARACTERISTICS

TAREA	.07	SUBBASIN AREA

PRECIPITATION DATA

12 PB

STORM	4.60	BASIN TOTAL PRECIPITATION

13 PI INCREMENTAL PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.01	.00	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.02	.02	.03	.03	.15	.15	.06	.06
.02	.02	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00				

18 LS SCS LOSS RATE

STRTL	.57	INITIAL ABSTRACTION
CRVNBR	77.70	CURVE NUMBER
RTIMP	.00	PERCENT IMPERVIOUS AREA

19 UD SCS DIMENSIONLESS UNITGRAPH

TLAG	1.97	LAG

***

UNIT HYDROGRAPH
41 END-OF-PERIOD ORDINATES

1.	2.	4.	7.	11.	14.	16.	17.	17.	16.
14.	13.	10.	8.	7.	6.	5.	4.	3.	3.
2.	2.	1.	1.	1.	1.	1.	1.	0.	0.

0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
0.

****

HYDROGRAPH AT STATION POST25

****

DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q
4	JAN	0600	1	.00	.00	.00	0.	5	JAN	0045	76	.02	.00	.01	5.
4	JAN	0615	2	.01	.01	.00	0.	5	JAN	0100	77	.02	.00	.01	5.
4	JAN	0630	3	.01	.01	.00	0.	5	JAN	0115	78	.02	.00	.02	5.
4	JAN	0645	4	.01	.01	.00	0.	5	JAN	0130	79	.02	.00	.02	4.
4	JAN	0700	5	.01	.01	.00	0.	5	JAN	0145	80	.02	.00	.01	4.
4	JAN	0715	6	.02	.02	.00	0.	5	JAN	0200	81	.02	.00	.01	4.
4	JAN	0730	7	.02	.02	.00	0.	5	JAN	0215	82	.02	.00	.01	4.
4	JAN	0745	8	.01	.01	.00	0.	5	JAN	0230	83	.02	.00	.01	4.
4	JAN	0800	9	.01	.01	.00	0.	5	JAN	0245	84	.02	.00	.01	4.
4	JAN	0815	10	.02	.02	.00	0.	5	JAN	0300	85	.02	.00	.01	3.
4	JAN	0830	11	.02	.02	.00	0.	5	JAN	0315	86	.02	.00	.01	3.
4	JAN	0845	12	.02	.02	.00	0.	5	JAN	0330	87	.02	.00	.01	3.
4	JAN	0900	13	.02	.02	.00	0.	5	JAN	0345	88	.02	.00	.01	3.
4	JAN	0915	14	.02	.02	.00	0.	5	JAN	0400	89	.02	.00	.01	3.
4	JAN	0930	15	.02	.02	.00	0.	5	JAN	0415	90	.02	.00	.01	3.
4	JAN	0945	16	.02	.02	.00	0.	5	JAN	0430	91	.02	.00	.01	3.
4	JAN	1000	17	.02	.02	.00	0.	5	JAN	0445	92	.01	.00	.01	3.
4	JAN	1015	18	.02	.02	.00	0.	5	JAN	0500	93	.01	.00	.01	3.
4	JAN	1030	19	.02	.02	.00	0.	5	JAN	0515	94	.01	.00	.01	3.
4	JAN	1045	20	.02	.02	.00	0.	5	JAN	0530	95	.01	.00	.01	3.
4	JAN	1100	21	.02	.02	.00	0.	5	JAN	0545	96	.01	.00	.01	3.
4	JAN	1115	22	.02	.02	.00	0.	5	JAN	0600	97	.01	.00	.01	3.
4	JAN	1130	23	.02	.02	.00	0.	5	JAN	0615	98	.00	.00	.00	2.
4	JAN	1145	24	.02	.02	.00	0.	5	JAN	0630	99	.00	.00	.00	2.
4	JAN	1200	25	.02	.02	.00	0.	5	JAN	0645	100	.00	.00	.00	2.
4	JAN	1215	26	.02	.02	.00	0.	5	JAN	0700	101	.00	.00	.00	2.
4	JAN	1230	27	.02	.02	.00	0.	5	JAN	0715	102	.00	.00	.00	2.
4	JAN	1245	28	.03	.03	.00	0.	5	JAN	0730	103	.00	.00	.00	2.
4	JAN	1300	29	.03	.03	.00	0.	5	JAN	0745	104	.00	.00	.00	2.
4	JAN	1315	30	.03	.03	.00	0.	5	JAN	0800	105	.00	.00	.00	1.
4	JAN	1330	31	.03	.03	.00	0.	5	JAN	0815	106	.00	.00	.00	1.
4	JAN	1345	32	.03	.03	.00	0.	5	JAN	0830	107	.00	.00	.00	1.
4	JAN	1400	33	.03	.03	.00	0.	5	JAN	0845	108	.00	.00	.00	1.
4	JAN	1415	34	.03	.03	.00	0.	5	JAN	0900	109	.00	.00	.00	1.
4	JAN	1430	35	.03	.03	.00	0.	5	JAN	0915	110	.00	.00	.00	1.
4	JAN	1445	36	.04	.03	.00	0.	5	JAN	0930	111	.00	.00	.00	0.
4	JAN	1500	37	.04	.03	.00	0.	5	JAN	0945	112	.00	.00	.00	0.
4	JAN	1515	38	.04	.03	.00	0.	5	JAN	1000	113	.00	.00	.00	0.
4	JAN	1530	39	.04	.03	.01	0.	5	JAN	1015	114	.00	.00	.00	0.
4	JAN	1545	40	.05	.04	.01	0.	5	JAN	1030	115	.00	.00	.00	0.
4	JAN	1600	41	.05	.04	.01	0.	5	JAN	1045	116	.00	.00	.00	0.
4	JAN	1615	42	.06	.04	.01	0.	5	JAN	1100	117	.00	.00	.00	0.
4	JAN	1630	43	.06	.04	.01	0.	5	JAN	1115	118	.00	.00	.00	0.
4	JAN	1645	44	.07	.05	.02	1.	5	JAN	1130	119	.00	.00	.00	0.
4	JAN	1700	45	.07	.05	.02	1.	5	JAN	1145	120	.00	.00	.00	0.
4	JAN	1715	46	.12	.08	.04	1.	5	JAN	1200	121	.00	.00	.00	0.

4 JAN 1730	47	.12	.07	.04	1.	*	5 JAN 1215	122	.00	.00	.00	0.
4 JAN 1745	48	.69	.35	.34	2.	*	5 JAN 1230	123	.00	.00	.00	0.
4 JAN 1800	49	.69	.25	.43	3.	*	5 JAN 1245	124	.00	.00	.00	0.
4 JAN 1815	50	.26	.08	.18	5.	*	5 JAN 1300	125	.00	.00	.00	0.
4 JAN 1830	51	.26	.07	.19	8.	*	5 JAN 1315	126	.00	.00	.00	0.
4 JAN 1845	52	.09	.02	.06	11.	*	5 JAN 1330	127	.00	.00	.00	0.
4 JAN 1900	53	.09	.02	.07	15.	*	5 JAN 1345	128	.00	.00	.00	0.
4 JAN 1915	54	.06	.02	.05	18.	*	5 JAN 1400	129	.00	.00	.00	0.
4 JAN 1930	55	.06	.02	.05	21.	*	5 JAN 1415	130	.00	.00	.00	0.
4 JAN 1945	56	.05	.01	.04	22.	*	5 JAN 1430	131	.00	.00	.00	0.
4 JAN 2000	57	.05	.01	.04	23.	*	5 JAN 1445	132	.00	.00	.00	0.
4 JAN 2015	58	.04	.01	.03	23.	*	5 JAN 1500	133	.00	.00	.00	0.
4 JAN 2030	59	.04	.01	.03	22.	*	5 JAN 1515	134	.00	.00	.00	0.
4 JAN 2045	60	.04	.01	.03	20.	*	5 JAN 1530	135	.00	.00	.00	0.
4 JAN 2100	61	.04	.01	.03	18.	*	5 JAN 1545	136	.00	.00	.00	0.
4 JAN 2115	62	.03	.01	.03	16.	*	5 JAN 1600	137	.00	.00	.00	0.
4 JAN 2130	63	.03	.01	.03	15.	*	5 JAN 1615	138	.00	.00	.00	0.
4 JAN 2145	64	.03	.01	.02	13.	*	5 JAN 1630	139	.00	.00	.00	0.
4 JAN 2200	65	.03	.01	.02	12.	*	5 JAN 1645	140	.00	.00	.00	0.
4 JAN 2215	66	.03	.01	.02	11.	*	5 JAN 1700	141	.00	.00	.00	0.
4 JAN 2230	67	.03	.01	.02	10.	*	5 JAN 1715	142	.00	.00	.00	0.
4 JAN 2245	68	.03	.01	.02	9.	*	5 JAN 1730	143	.00	.00	.00	0.
4 JAN 2300	69	.03	.01	.02	8.	*	5 JAN 1745	144	.00	.00	.00	0.
4 JAN 2315	70	.03	.01	.02	8.	*	5 JAN 1800	145	.00	.00	.00	0.
4 JAN 2330	71	.03	.01	.02	7.	*	5 JAN 1815	146	.00	.00	.00	0.
4 JAN 2345	72	.02	.00	.02	7.	*	5 JAN 1830	147	.00	.00	.00	0.
5 JAN 0000	73	.02	.00	.02	6.	*	5 JAN 1845	148	.00	.00	.00	0.
5 JAN 0015	74	.02	.00	.02	6.	*	5 JAN 1900	149	.00	.00	.00	0.
5 JAN 0030	75	.02	.00	.02	5.	*	5 JAN 1915	150	.00	.00	.00	0.
						*						

****

TOTAL RAINFALL = 4.60, TOTAL LOSS = 2.25, TOTAL EXCESS = 2.35

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	37.25-HR
		(CFS)	14.	5.	3.	3.
23.	14.00	(INCHES)	1.726	2.350	2.350	2.350
		(AC-FT)	7.	9.	9.	9.

CUMULATIVE AREA = .07 SQ MI

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	POST25	23.	14.00	14.	5.	3.	.07		

*** NORMAL END OF HEC-1 ***

Owner: JEA
Plant: Brandy Branch Station
Project No.: 099262
File No.: 32.0541
Title: Wet Detention System

Computed By: J.M. Stanek
Date: 11-17-2000
Verified By:_____
Date:_____

APPENDIX B

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             FEBRUARY 1981             *
*           REVISED 02 AUG 88           *
*                                       *
*  RUN DATE  11/17/2000  TIME  07:31:58 *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*  THE HYDROLOGIC ENGINEERING CENTER    *
*         609 SECOND STREET             *
*        DAVIS, CALIFORNIA 95616        *
*          (916) 551-1748               *
*                                       *
*****************************************
```

```
X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
X     X  X        X                X
XXXXXXX  XXXX     X        XXXXX   X
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX           XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   1          ID   JEA - Brandy Branch
   2          ID   HEC-1 Analysis - 24 hr Storm - 25 Year Event
   3          ID   Predevelopment Flow
   4          ID   Black & Veatch Project No. 099262.0040
   5          ID   Input File: pre25.in  Output File:  pre25.out
   6          IT      15 04JAN00    0600     150
   7          IO       0       0
   8          IN      30
              * **********

   9          KK  POST25
  10          KM   PRE-DEVELOPMENT RUNOFF
  11          BA  .07366
  12          PB    8.75
  13          PC  0.0000  0.0060  0.0120  0.0190  0.0250  0.0320  0.0390  0.0470  0.0540  0.0620
  14          PC  0.0710  0.0800  0.0890  0.0990  0.1100  0.1220  0.1340  0.1480  0.1640  0.1810
  15          PC  0.2010  0.2260  0.2580  0.3080  0.6070  0.7190  0.7570  0.7850  0.8070  0.8260
  16          PC  0.8420  0.8570  0.8700  0.8820  0.8930  0.9040  0.9130  0.9230  0.9310  0.9400
  17          PC  0.9480  0.9550  0.9620  0.9690  0.9760  0.9830  0.9890  0.9950  1.0000
```

```
            18           LS       0    77.7       0
            19           UD   1.968
                         * **********
                         *DIAGRAM
            20           ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

     9      POST25

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*             FEBRUARY 1981            *
*           REVISED 02 AUG 88          *
*                                      *
*  RUN DATE  11/17/2000  TIME  07:31:58 *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*  THE HYDROLOGIC ENGINEERING CENTER   *
*          609 SECOND STREET           *
*        DAVIS, CALIFORNIA 95616       *
*           (916) 551-1748             *
*                                      *
****************************************
```

JEA - Brandy Branch
HEC-1 Analysis - 24 hr Storm - 25 Year Event
Predevelopment Flow
Black & Veatch Project No. 099262.0040
Input File: pre25.in Output File: pre25.out

```
   7 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          0  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT           HYDROGRAPH TIME DATA
                       NMIN         15  MINUTES IN COMPUTATION INTERVAL
                      IDATE      4JAN 0  STARTING DATE
                      ITIME       0600  STARTING TIME
                         NQ        150  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      5JAN 0  ENDING DATE
                     NDTIME       1915  ENDING TIME
                     ICENT          19  CENTURY MARK

                  COMPUTATION INTERVAL      .25 HOURS
                      TOTAL TIME BASE   37.25 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
```

STORAGE VOLUME ACRE-FEET
SURFACE AREA ACRES
TEMPERATURE DEGREES FAHRENHEIT

*** ***

```
          **************
          *            *
 9 KK     *    POST25  *
          *            *
          **************
                    POST-DEVELOPMENT RUNOFF

 8 IN           TIME DATA FOR INPUT TIME SERIES
                     JXMIN          30  TIME INTERVAL IN MINUTES
                    JXDATE      4JAN 0  STARTING DATE
                    JXTIME         600  STARTING TIME

              SUBBASIN RUNOFF DATA

11 BA           SUBBASIN CHARACTERISTICS
                    TAREA         .07  SUBBASIN AREA

                PRECIPITATION DATA

12 PB                STORM        8.75  BASIN TOTAL PRECIPITATION

13 PI             INCREMENTAL PRECIPITATION PATTERN
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .01       .00       .01       .01       .01       .01
                    .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                    .01       .01       .02       .02       .03       .03       .15       .15       .06       .06
                    .02       .02       .01       .01       .01       .01       .01       .01       .01       .01
                    .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00

18 LS           SCS LOSS RATE
                     STRTL         .57  INITIAL ABSTRACTION
                    CRVNBR       77.70  CURVE NUMBER
                     RTIMP         .00  PERCENT IMPERVIOUS AREA

19 UD           SCS DIMENSIONLESS UNITGRAPH
                      TLAG        1.97  LAG

                                    ***

                                                UNIT HYDROGRAPH
                                            41 END-OF-PERIOD ORDINATES
                    1.        2.        4.        7.       11.       14.       16.       17.       17.       16.
                   14.       13.       10.        8.        7.        6.        5.        4.        3.        3.
                    2.        2.        1.        1.        1.        1.        1.        1.        0.        0.
```

0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
0.

HYDROGRAPH AT STATION POST25

DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q
4	JAN	0600	1	.00	.00	.00	0.
4	JAN	0615	2	.03	.03	.00	0.
4	JAN	0630	3	.03	.03	.00	0.
4	JAN	0645	4	.03	.03	.00	0.
4	JAN	0700	5	.03	.03	.00	0.
4	JAN	0715	6	.03	.03	.00	0.
4	JAN	0730	7	.03	.03	.00	0.
4	JAN	0745	8	.03	.03	.00	0.
4	JAN	0800	9	.03	.03	.00	0.
4	JAN	0815	10	.03	.03	.00	0.
4	JAN	0830	11	.03	.03	.00	0.
4	JAN	0845	12	.03	.03	.00	0.
4	JAN	0900	13	.03	.03	.00	0.
4	JAN	0915	14	.04	.04	.00	0.
4	JAN	0930	15	.03	.03	.00	0.
4	JAN	0945	16	.03	.03	.00	0.
4	JAN	1000	17	.03	.03	.00	0.
4	JAN	1015	18	.04	.04	.00	0.
4	JAN	1030	19	.03	.03	.00	0.
4	JAN	1045	20	.04	.04	.00	0.
4	JAN	1100	21	.04	.04	.00	0.
4	JAN	1115	22	.04	.04	.00	0.
4	JAN	1130	23	.04	.04	.00	0.
4	JAN	1145	24	.04	.04	.00	0.
4	JAN	1200	25	.04	.03	.00	0.
4	JAN	1215	26	.04	.04	.01	0.
4	JAN	1230	27	.04	.04	.01	0.
4	JAN	1245	28	.05	.04	.01	0.
4	JAN	1300	29	.05	.04	.01	0.
4	JAN	1315	30	.05	.04	.01	0.
4	JAN	1330	31	.05	.04	.01	1.
4	JAN	1345	32	.05	.04	.01	1.
4	JAN	1400	33	.05	.04	.02	1.
4	JAN	1415	34	.06	.04	.02	1.
4	JAN	1430	35	.06	.04	.02	1.
4	JAN	1445	36	.07	.04	.03	2.
4	JAN	1500	37	.07	.04	.03	2.
4	JAN	1515	38	.07	.04	.03	2.
4	JAN	1530	39	.07	.04	.03	2.
4	JAN	1545	40	.09	.05	.04	3.
4	JAN	1600	41	.09	.04	.04	3.
4	JAN	1615	42	.11	.05	.06	3.
4	JAN	1630	43	.11	.05	.06	4.
4	JAN	1645	44	.14	.06	.08	4.
4	JAN	1700	45	.14	.06	.08	5.
4	JAN	1715	46	.22	.08	.14	6.
5	JAN	0045	76	.04	.00	.03	11.
5	JAN	0100	77	.04	.00	.03	11.
5	JAN	0115	78	.04	.00	.04	10.
5	JAN	0130	79	.04	.00	.04	10.
5	JAN	0145	80	.04	.00	.03	9.
5	JAN	0200	81	.04	.00	.03	9.
5	JAN	0215	82	.03	.00	.03	8.
5	JAN	0230	83	.03	.00	.03	8.
5	JAN	0245	84	.03	.00	.03	8.
5	JAN	0300	85	.03	.00	.03	8.
5	JAN	0315	86	.03	.00	.03	7.
5	JAN	0330	87	.03	.00	.03	7.
5	JAN	0345	88	.03	.00	.03	7.
5	JAN	0400	89	.03	.00	.03	6.
5	JAN	0415	90	.03	.00	.03	6.
5	JAN	0430	91	.03	.00	.03	6.
5	JAN	0445	92	.03	.00	.02	6.
5	JAN	0500	93	.03	.00	.02	6.
5	JAN	0515	94	.03	.00	.02	6.
5	JAN	0530	95	.03	.00	.02	6.
5	JAN	0545	96	.02	.00	.02	6.
5	JAN	0600	97	.02	.00	.02	5.
5	JAN	0615	98	.00	.00	.00	5.
5	JAN	0630	99	.00	.00	.00	5.
5	JAN	0645	100	.00	.00	.00	5.
5	JAN	0700	101	.00	.00	.00	5.
5	JAN	0715	102	.00	.00	.00	4.
5	JAN	0730	103	.00	.00	.00	4.
5	JAN	0745	104	.00	.00	.00	3.
5	JAN	0800	105	.00	.00	.00	3.
5	JAN	0815	106	.00	.00	.00	2.
5	JAN	0830	107	.00	.00	.00	2.
5	JAN	0845	108	.00	.00	.00	2.
5	JAN	0900	109	.00	.00	.00	1.
5	JAN	0915	110	.00	.00	.00	1.
5	JAN	0930	111	.00	.00	.00	1.
5	JAN	0945	112	.00	.00	.00	1.
5	JAN	1000	113	.00	.00	.00	1.
5	JAN	1015	114	.00	.00	.00	1.
5	JAN	1030	115	.00	.00	.00	0.
5	JAN	1045	116	.00	.00	.00	0.
5	JAN	1100	117	.00	.00	.00	0.
5	JAN	1115	118	.00	.00	.00	0.
5	JAN	1130	119	.00	.00	.00	0.
5	JAN	1145	120	.00	.00	.00	0.
5	JAN	1200	121	.00	.00	.00	0.

4 JAN 1730	47	.22	.08	.14	7.	*	5 JAN 1215	122	.00	.00	.00	0.
4 JAN 1745	48	1.31	.34	.97	9.	*	5 JAN 1230	123	.00	.00	.00	0.
4 JAN 1800	49	1.31	.22	1.08	12.	*	5 JAN 1245	124	.00	.00	.00	0.
4 JAN 1815	50	.49	.07	.42	17.	*	5 JAN 1300	125	.00	.00	.00	0.
4 JAN 1830	51	.49	.06	.43	24.	*	5 JAN 1315	126	.00	.00	.00	0.
4 JAN 1845	52	.17	.02	.15	32.	*	5 JAN 1330	127	.00	.00	.00	0.
4 JAN 1900	53	.17	.02	.15	42.	*	5 JAN 1345	128	.00	.00	.00	0.
4 JAN 1915	54	.12	.01	.11	50.	*	5 JAN 1400	129	.00	.00	.00	0.
4 JAN 1930	55	.12	.01	.11	56.	*	5 JAN 1415	130	.00	.00	.00	0.
4 JAN 1945	56	.10	.01	.09	59.	*	5 JAN 1430	131	.00	.00	.00	0.
4 JAN 2000	57	.10	.01	.09	60.	*	5 JAN 1445	132	.00	.00	.00	0.
4 JAN 2015	58	.08	.01	.08	58.	*	5 JAN 1500	133	.00	.00	.00	0.
4 JAN 2030	59	.08	.01	.08	55.	*	5 JAN 1515	134	.00	.00	.00	0.
4 JAN 2045	60	.07	.01	.06	51.	*	5 JAN 1530	135	.00	.00	.00	0.
4 JAN 2100	61	.07	.01	.06	46.	*	5 JAN 1545	136	.00	.00	.00	0.
4 JAN 2115	62	.07	.01	.06	41.	*	5 JAN 1600	137	.00	.00	.00	0.
4 JAN 2130	63	.07	.01	.06	36.	*	5 JAN 1615	138	.00	.00	.00	0.
4 JAN 2145	64	.06	.00	.05	32.	*	5 JAN 1630	139	.00	.00	.00	0.
4 JAN 2200	65	.06	.00	.05	29.	*	5 JAN 1645	140	.00	.00	.00	0.
4 JAN 2215	66	.05	.00	.05	26.	*	5 JAN 1700	141	.00	.00	.00	0.
4 JAN 2230	67	.05	.00	.05	24.	*	5 JAN 1715	142	.00	.00	.00	0.
4 JAN 2245	68	.05	.00	.04	21.	*	5 JAN 1730	143	.00	.00	.00	0.
4 JAN 2300	69	.05	.00	.04	19.	*	5 JAN 1745	144	.00	.00	.00	0.
4 JAN 2315	70	.05	.00	.04	18.	*	5 JAN 1800	145	.00	.00	.00	0.
4 JAN 2330	71	.05	.00	.04	16.	*	5 JAN 1815	146	.00	.00	.00	0.
4 JAN 2345	72	.04	.00	.04	15.	*	5 JAN 1830	147	.00	.00	.00	0.
5 JAN 0000	73	.04	.00	.04	14.	*	5 JAN 1845	148	.00	.00	.00	0.
5 JAN 0015	74	.04	.00	.04	13.	*	5 JAN 1900	149	.00	.00	.00	0.
5 JAN 0030	75	.04	.00	.04	12.	*	5 JAN 1915	150	.00	.00	.00	0.
						*						

****

TOTAL RAINFALL = 8.75, TOTAL LOSS = 2.70, TOTAL EXCESS = 6.05

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	37.25-HR
		(CFS)				
60.	14.00		35.	12.	8.	8.
		(INCHES)	4.423	6.049	6.052	6.052
		(AC-FT)	17.	24.	24.	24.

CUMULATIVE AREA = .07 SQ MI

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	POST25	60.	14.00	35.	12.	8.	.07		

*** NORMAL END OF HEC-1 ***

Owner: JEA
Plant: Brandy Branch Station
Project No.: 099262
File No.: 32.0541
Title: Wet Detention System

Computed By: J.M. Stanek
Date: 11-17-2000
Verified By:_____
Date:_____

APPENDIX C

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             FEBRUARY 1981             *
*           REVISED 02 AUG 88           *
*                                       *
*  RUN DATE  11/17/2000  TIME  07:30:17 *
*                                       *
*****************************************
```


```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*  THE HYDROLOGIC ENGINEERING CENTER    *
*          609 SECOND STREET            *
*        DAVIS, CALIFORNIA 95616        *
*           (916) 551-1748              *
*                                       *
*****************************************
```


```
X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
X     X  X        X                X
XXXXXXX  XXXX     X        XXXXX   X
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX          XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  1           ID   JEA - Brandy Branch
  2           ID   HEC-1 Analysis - 24 hr Storm - Mean (2.5) Year Event
  3           ID   Postdevelopment Flow
  4           ID   Black & Veatch Project No. 099262.0040
  5           ID   Input File: post25.in  Output File:  post25.out
  6           IT      15 04JAN00     0600      150
  7           IO       0       0
  8           IN      30
              * **********

  9           KK  POST25
 10           KM   POST-DEVELOPMENT RUNOFF
 11           BA  .05524
 12           PB    4.6
 13           PC  0.0000  0.0060  0.0120  0.0190  0.0250  0.0320  0.0390  0.0470  0.0540  0.0620
 14           PC  0.0710  0.0800  0.0890  0.0990  0.1100  0.1220  0.1340  0.1480  0.1640  0.1810
 15           PC  0.2010  0.2260  0.2580  0.3080  0.6070  0.7190  0.7570  0.7850  0.8070  0.8260
 16           PC  0.8420  0.8570  0.8700  0.8820  0.8930  0.9040  0.9130  0.9230  0.9310  0.9400
 17           PC  0.9480  0.9550  0.9620  0.9690  0.9760  0.9830  0.9890  0.9950  1.0000
```

```
            18          LS       0    88.9       0
            19          UD   0.444
                        * **********

            20          KK    Pond
            21          KM   Runoff Pond
            22          BA  .01628
            23          LS       0      98       0
            24          UD   0.001
                        * **********

            25          KK    Comb
            26          KM   Combine Two Hydrographs
            27          HC       2
                        * **********

            28          KK   Resvr
            29          KM   Reservoir Routing Operation
            30          RS       1    ELEV    79.5
            31          SA   9.372   9.421   9.484   9.547   9.623   9.925   10.23
            32          SE   79.67   79.83   80.03   80.25   80.50   81.50   82.50
            33          SQ       0   0.504   0.756    5.53   15.41   80.58   173.9
            34          SE   79.67   79.83   80.03   80.25   80.50   81.50   82.50
                        * **********
                        *DIAGRAM
            35          ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (---->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

     9      POST25
                .
                .
    20          .         Pond
                .           .
                .           .
    25        Comb.............
                V
                V
    28       Resvr

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             FEBRUARY 1981             *
*           REVISED 02 AUG 88           *
*                                       *
*  RUN DATE  11/17/2000  TIME  07:30:17 *
*                                       *
*****************************************

*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*  THE HYDROLOGIC ENGINEERING CENTER    *
*          609 SECOND STREET            *
*        DAVIS, CALIFORNIA 95616        *
*            (916) 551-1748             *
*                                       *
*****************************************
```

JEA - Brandy Branch
HEC-1 Analysis - 24 hr Storm - Mean (2.5) Year Event
Postdevelopment Flow
Black & Veatch Project No. 099262.0040
Input File: post25.in Output File: post25.out

```
 7 IO          OUTPUT CONTROL VARIABLES
                    IPRNT           0  PRINT CONTROL
                    IPLOT           0  PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE

   IT         HYDROGRAPH TIME DATA
                   NMIN          15  MINUTES IN COMPUTATION INTERVAL
                  IDATE      4JAN 0  STARTING DATE
                  ITIME        0600  STARTING TIME
                     NQ         150  NUMBER OF HYDROGRAPH ORDINATES
                 NDDATE      5JAN 0  ENDING DATE
                 NDTIME        1915  ENDING TIME
                  ICENT          19  CENTURY MARK

               COMPUTATION INTERVAL      .25 HOURS
                   TOTAL TIME BASE   37.25 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
 9 KK       *    POST25  *
            *            *
            **************
                       POST-DEVELOPMENT RUNOFF

 8 IN          TIME DATA FOR INPUT TIME SERIES
                    JXMIN          30  TIME INTERVAL IN MINUTES
                   JXDATE      4JAN 0  STARTING DATE
                   JXTIME         600  STARTING TIME

              SUBBASIN RUNOFF DATA

11 BA          SUBBASIN CHARACTERISTICS
                    TAREA         .06  SUBBASIN AREA

               PRECIPITATION DATA
```

```
 12 PB                STORM        4.60  BASIN TOTAL PRECIPITATION

 13 PI            INCREMENTAL PRECIPITATION PATTERN
                    .00    .00    .00    .00    .00    .00    .00    .00    .00    .00
                    .00    .00    .00    .00    .00    .00    .00    .00    .00    .00
                    .00    .00    .00    .00    .01    .00    .01    .01    .01    .01
                    .01    .01    .01    .01    .01    .01    .01    .01    .01    .01
                    .01    .01    .02    .02    .03    .03    .15    .15    .06    .06
                    .02    .02    .01    .01    .01    .01    .01    .01    .01    .01
                    .01    .01    .01    .01    .01    .01    .01    .01    .01    .01
                    .00    .00    .00    .00    .00    .00    .00    .00    .00    .00
                    .00    .00    .00    .00    .00    .00    .00    .00    .00    .00
                    .00    .00    .00    .00    .00    .00

 18 LS           SCS LOSS RATE
                      STRTL         .25  INITIAL ABSTRACTION
                     CRVNBR       88.90  CURVE NUMBER
                      RTIMP         .00  PERCENT IMPERVIOUS AREA

 19 UD           SCS DIMENSIONLESS UNITGRAPH
                       TLAG         .44  LAG

                                                  ***

WARNING *** TIME INTERVAL IS GREATER THAN .29*LAG

                                          UNIT HYDROGRAPH
                                      11 END-OF-PERIOD ORDINATES
                18.       46.       40.       20.       10.        5.        2.        1.        1.        0.
                 0.
```

****

HYDROGRAPH AT STATION POST25

****

DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q
4	JAN	0600	1	.00	.00	.00	0.	5	JAN	0045	76	.02	.00	.02	3.
4	JAN	0615	2	.01	.01	.00	0.	5	JAN	0100	77	.02	.00	.02	3.
4	JAN	0630	3	.01	.01	.00	0.	5	JAN	0115	78	.02	.00	.02	3.
4	JAN	0645	4	.01	.01	.00	0.	5	JAN	0130	79	.02	.00	.02	3.
4	JAN	0700	5	.01	.01	.00	0.	5	JAN	0145	80	.02	.00	.02	3.
4	JAN	0715	6	.02	.02	.00	0.	5	JAN	0200	81	.02	.00	.02	3.
4	JAN	0730	7	.02	.02	.00	0.	5	JAN	0215	82	.02	.00	.02	3.
4	JAN	0745	8	.01	.01	.00	0.	5	JAN	0230	83	.02	.00	.02	2.
4	JAN	0800	9	.01	.01	.00	0.	5	JAN	0245	84	.02	.00	.02	2.
4	JAN	0815	10	.02	.02	.00	0.	5	JAN	0300	85	.02	.00	.02	2.
4	JAN	0830	11	.02	.02	.00	0.	5	JAN	0315	86	.02	.00	.02	2.
4	JAN	0845	12	.02	.02	.00	0.	5	JAN	0330	87	.02	.00	.02	2.
4	JAN	0900	13	.02	.02	.00	0.	5	JAN	0345	88	.02	.00	.02	2.
4	JAN	0915	14	.02	.02	.00	0.	5	JAN	0400	89	.02	.00	.02	2.
4	JAN	0930	15	.02	.02	.00	0.	5	JAN	0415	90	.02	.00	.02	2.
4	JAN	0945	16	.02	.02	.00	0.	5	JAN	0430	91	.02	.00	.02	2.
4	JAN	1000	17	.02	.02	.00	0.	5	JAN	0445	92	.01	.00	.01	2.

4	JAN 1015	18	.02	.02	.00	0.	*	5	JAN 0500	93	.01	.00	.01	2.
4	JAN 1030	19	.02	.02	.00	0.	*	5	JAN 0515	94	.01	.00	.01	2.
4	JAN 1045	20	.02	.02	.00	0.	*	5	JAN 0530	95	.01	.00	.01	2.
4	JAN 1100	21	.02	.02	.00	0.	*	5	JAN 0545	96	.01	.00	.01	2.
4	JAN 1115	22	.02	.02	.00	0.	*	5	JAN 0600	97	.01	.00	.01	2.
4	JAN 1130	23	.02	.02	.00	0.	*	5	JAN 0615	98	.00	.00	.00	1.
4	JAN 1145	24	.02	.02	.00	0.	*	5	JAN 0630	99	.00	.00	.00	1.
4	JAN 1200	25	.02	.02	.00	0.	*	5	JAN 0645	100	.00	.00	.00	0.
4	JAN 1215	26	.02	.02	.01	1.	*	5	JAN 0700	101	.00	.00	.00	0.
4	JAN 1230	27	.02	.02	.01	1.	*	5	JAN 0715	102	.00	.00	.00	0.
4	JAN 1245	28	.03	.02	.01	1.	*	5	JAN 0730	103	.00	.00	.00	0.
4	JAN 1300	29	.03	.02	.01	1.	*	5	JAN 0745	104	.00	.00	.00	0.
4	JAN 1315	30	.03	.02	.01	1.	*	5	JAN 0800	105	.00	.00	.00	0.
4	JAN 1330	31	.03	.02	.01	1.	*	5	JAN 0815	106	.00	.00	.00	0.
4	JAN 1345	32	.03	.02	.01	1.	*	5	JAN 0830	107	.00	.00	.00	0.
4	JAN 1400	33	.03	.02	.01	1.	*	5	JAN 0845	108	.00	.00	.00	0.
4	JAN 1415	34	.03	.02	.01	1.	*	5	JAN 0900	109	.00	.00	.00	0.
4	JAN 1430	35	.03	.02	.01	2.	*	5	JAN 0915	110	.00	.00	.00	0.
4	JAN 1445	36	.04	.02	.02	2.	*	5	JAN 0930	111	.00	.00	.00	0.
4	JAN 1500	37	.04	.02	.02	2.	*	5	JAN 0945	112	.00	.00	.00	0.
4	JAN 1515	38	.04	.02	.02	2.	*	5	JAN 1000	113	.00	.00	.00	0.
4	JAN 1530	39	.04	.02	.02	3.	*	5	JAN 1015	114	.00	.00	.00	0.
4	JAN 1545	40	.05	.02	.03	3.	*	5	JAN 1030	115	.00	.00	.00	0.
4	JAN 1600	41	.05	.02	.03	3.	*	5	JAN 1045	116	.00	.00	.00	0.
4	JAN 1615	42	.06	.02	.03	4.	*	5	JAN 1100	117	.00	.00	.00	0.
4	JAN 1630	43	.06	.02	.04	4.	*	5	JAN 1115	118	.00	.00	.00	0.
4	JAN 1645	44	.07	.03	.05	5.	*	5	JAN 1130	119	.00	.00	.00	0.
4	JAN 1700	45	.07	.02	.05	6.	*	5	JAN 1145	120	.00	.00	.00	0.
4	JAN 1715	46	.12	.04	.08	7.	*	5	JAN 1200	121	.00	.00	.00	0.
4	JAN 1730	47	.12	.03	.08	9.	*	5	JAN 1215	122	.00	.00	.00	0.
4	JAN 1745	48	.69	.14	.54	18.	*	5	JAN 1230	123	.00	.00	.00	0.
4	JAN 1800	49	.69	.09	.60	41.	*	5	JAN 1245	124	.00	.00	.00	0.
4	JAN 1815	50	.26	.03	.23	56.	*	5	JAN 1300	125	.00	.00	.00	0.
4	JAN 1830	51	.26	.02	.23	51.	*	5	JAN 1315	126	.00	.00	.00	0.
4	JAN 1845	52	.09	.01	.08	39.	*	5	JAN 1330	127	.00	.00	.00	0.
4	JAN 1900	53	.09	.01	.08	28.	*	5	JAN 1345	128	.00	.00	.00	0.
4	JAN 1915	54	.06	.00	.06	19.	*	5	JAN 1400	129	.00	.00	.00	0.
4	JAN 1930	55	.06	.00	.06	14.	*	5	JAN 1415	130	.00	.00	.00	0.
4	JAN 1945	56	.05	.00	.05	11.	*	5	JAN 1430	131	.00	.00	.00	0.
4	JAN 2000	57	.05	.00	.05	9.	*	5	JAN 1445	132	.00	.00	.00	0.
4	JAN 2015	58	.04	.00	.04	8.	*	5	JAN 1500	133	.00	.00	.00	0.
4	JAN 2030	59	.04	.00	.04	7.	*	5	JAN 1515	134	.00	.00	.00	0.
4	JAN 2045	60	.04	.00	.03	6.	*	5	JAN 1530	135	.00	.00	.00	0.
4	JAN 2100	61	.04	.00	.03	6.	*	5	JAN 1545	136	.00	.00	.00	0.
4	JAN 2115	62	.03	.00	.03	5.	*	5	JAN 1600	137	.00	.00	.00	0.
4	JAN 2130	63	.03	.00	.03	5.	*	5	JAN 1615	138	.00	.00	.00	0.
4	JAN 2145	64	.03	.00	.03	5.	*	5	JAN 1630	139	.00	.00	.00	0.
4	JAN 2200	65	.03	.00	.03	4.	*	5	JAN 1645	140	.00	.00	.00	0.
4	JAN 2215	66	.03	.00	.03	4.	*	5	JAN 1700	141	.00	.00	.00	0.
4	JAN 2230	67	.03	.00	.03	4.	*	5	JAN 1715	142	.00	.00	.00	0.
4	JAN 2245	68	.03	.00	.02	4.	*	5	JAN 1730	143	.00	.00	.00	0.
4	JAN 2300	69	.03	.00	.02	4.	*	5	JAN 1745	144	.00	.00	.00	0.
4	JAN 2315	70	.03	.00	.02	4.	*	5	JAN 1800	145	.00	.00	.00	0.
4	JAN 2330	71	.03	.00	.02	3.	*	5	JAN 1815	146	.00	.00	.00	0.
4	JAN 2345	72	.02	.00	.02	3.	*	5	JAN 1830	147	.00	.00	.00	0.
5	JAN 0000	73	.02	.00	.02	3.	*	5	JAN 1845	148	.00	.00	.00	0.
5	JAN 0015	74	.02	.00	.02	3.	*	5	JAN 1900	149	.00	.00	.00	0.

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      5 JAN 0030   75     .02     .00     .02          3.          *          5 JAN 1915  150     .00     .00     .00          0.
                                                                   *
*****************************************************************************************************************************************************

    TOTAL RAINFALL =     4.60, TOTAL LOSS =     1.22, TOTAL EXCESS =     3.38

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR         24-HR         72-HR      37.25-HR
+   (CFS)         (HR)
                    (CFS)
+      56.      12.25                  15.           5.           3.           3.
                 (INCHES)            2.572        3.380        3.380        3.380
                 (AC-FT)               8.           10.          10.          10.

                 CUMULATIVE AREA =      .06 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


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            *            *
   20 KK    *      Pond  *
            *            *
            **************
                        Runoff Pond

               SUBBASIN RUNOFF DATA

   22 BA          SUBBASIN CHARACTERISTICS
                       TAREA         .02  SUBBASIN AREA

                  PRECIPITATION DATA

   12 PB                STORM        4.60  BASIN TOTAL PRECIPITATION

   13 PI             INCREMENTAL PRECIPITATION PATTERN
                        .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                        .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                        .00       .00       .00       .00       .01       .00       .01       .01       .01       .01
                        .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                        .01       .01       .02       .02       .03       .03       .15       .15       .06       .06
                        .02       .02       .01       .01       .01       .01       .01       .01       .01       .01
                        .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                        .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                        .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                        .00       .00       .00       .00       .00       .00

   23 LS          SCS LOSS RATE
                       STRTL         .04  INITIAL ABSTRACTION
                      CRVNBR       98.00  CURVE NUMBER
                       RTIMP         .00  PERCENT IMPERVIOUS AREA

   24 UD          SCS DIMENSIONLESS UNITGRAPH
                        TLAG         .00  LAG
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WARNING *** TIME INTERVAL IS GREATER THAN .29*LAG

UNIT HYDROGRAPH
5 END-OF-PERIOD ORDINATES

31. 9. 2. 0. 0.

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HYDROGRAPH AT STATION Pond

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DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q
4	JAN	0600	1	.00	.00	.00	0.	5	JAN	0045	76	.02	.00	.02	1.
4	JAN	0615	2	.01	.01	.00	0.	5	JAN	0100	77	.02	.00	.02	1.
4	JAN	0630	3	.01	.01	.00	0.	5	JAN	0115	78	.02	.00	.02	1.
4	JAN	0645	4	.01	.01	.00	0.	5	JAN	0130	79	.02	.00	.02	1.
4	JAN	0700	5	.01	.01	.00	0.	5	JAN	0145	80	.02	.00	.02	1.
4	JAN	0715	6	.02	.01	.00	0.	5	JAN	0200	81	.02	.00	.02	1.
4	JAN	0730	7	.02	.01	.00	0.	5	JAN	0215	82	.02	.00	.02	1.
4	JAN	0745	8	.01	.01	.01	0.	5	JAN	0230	83	.02	.00	.02	1.
4	JAN	0800	9	.01	.01	.01	0.	5	JAN	0245	84	.02	.00	.02	1.
4	JAN	0815	10	.02	.01	.01	0.	5	JAN	0300	85	.02	.00	.02	1.
4	JAN	0830	11	.02	.01	.01	0.	5	JAN	0315	86	.02	.00	.02	1.
4	JAN	0845	12	.02	.01	.01	0.	5	JAN	0330	87	.02	.00	.02	1.
4	JAN	0900	13	.02	.01	.01	0.	5	JAN	0345	88	.02	.00	.02	1.
4	JAN	0915	14	.02	.01	.01	0.	5	JAN	0400	89	.02	.00	.02	1.
4	JAN	0930	15	.02	.01	.01	1.	5	JAN	0415	90	.02	.00	.02	1.
4	JAN	0945	16	.02	.00	.01	0.	5	JAN	0430	91	.02	.00	.02	1.
4	JAN	1000	17	.02	.00	.01	1.	5	JAN	0445	92	.01	.00	.01	1.
4	JAN	1015	18	.02	.00	.01	1.	5	JAN	0500	93	.01	.00	.01	1.
4	JAN	1030	19	.02	.00	.01	1.	5	JAN	0515	94	.01	.00	.01	1.
4	JAN	1045	20	.02	.00	.02	1.	5	JAN	0530	95	.01	.00	.01	1.
4	JAN	1100	21	.02	.00	.02	1.	5	JAN	0545	96	.01	.00	.01	1.
4	JAN	1115	22	.02	.00	.02	1.	5	JAN	0600	97	.01	.00	.01	0.
4	JAN	1130	23	.02	.00	.02	1.	5	JAN	0615	98	.00	.00	.00	0.
4	JAN	1145	24	.02	.00	.02	1.	5	JAN	0630	99	.00	.00	.00	0.
4	JAN	1200	25	.02	.00	.02	1.	5	JAN	0645	100	.00	.00	.00	0.
4	JAN	1215	26	.02	.00	.02	1.	5	JAN	0700	101	.00	.00	.00	0.
4	JAN	1230	27	.02	.00	.02	1.	5	JAN	0715	102	.00	.00	.00	0.
4	JAN	1245	28	.03	.00	.02	1.	5	JAN	0730	103	.00	.00	.00	0.
4	JAN	1300	29	.03	.00	.02	1.	5	JAN	0745	104	.00	.00	.00	0.
4	JAN	1315	30	.03	.00	.03	1.	5	JAN	0800	105	.00	.00	.00	0.
4	JAN	1330	31	.03	.00	.03	1.	5	JAN	0815	106	.00	.00	.00	0.
4	JAN	1345	32	.03	.00	.03	1.	5	JAN	0830	107	.00	.00	.00	0.
4	JAN	1400	33	.03	.00	.03	1.	5	JAN	0845	108	.00	.00	.00	0.
4	JAN	1415	34	.03	.00	.03	1.	5	JAN	0900	109	.00	.00	.00	0.
4	JAN	1430	35	.03	.00	.03	1.	5	JAN	0915	110	.00	.00	.00	0.
4	JAN	1445	36	.04	.00	.03	1.	5	JAN	0930	111	.00	.00	.00	0.
4	JAN	1500	37	.04	.00	.03	1.	5	JAN	0945	112	.00	.00	.00	0.
4	JAN	1515	38	.04	.00	.04	2.	5	JAN	1000	113	.00	.00	.00	0.
4	JAN	1530	39	.04	.00	.04	2.	5	JAN	1015	114	.00	.00	.00	0.
4	JAN	1545	40	.05	.00	.04	2.	5	JAN	1030	115	.00	.00	.00	0.

4	JAN 1600	41	.05	.00	.04	2.	*	5	JAN 1045	116	.00	.00	.00	0.
4	JAN 1615	42	.06	.00	.06	2.	*	5	JAN 1100	117	.00	.00	.00	0.
4	JAN 1630	43	.06	.00	.06	2.	*	5	JAN 1115	118	.00	.00	.00	0.
4	JAN 1645	44	.07	.00	.07	3.	*	5	JAN 1130	119	.00	.00	.00	0.
4	JAN 1700	45	.07	.00	.07	3.	*	5	JAN 1145	120	.00	.00	.00	0.
4	JAN 1715	46	.12	.00	.11	4.	*	5	JAN 1200	121	.00	.00	.00	0.
4	JAN 1730	47	.12	.00	.11	5.	*	5	JAN 1215	122	.00	.00	.00	0.
4	JAN 1745	48	.69	.01	.68	22.	*	5	JAN 1230	123	.00	.00	.00	0.
4	JAN 1800	49	.69	.00	.68	28.	*	5	JAN 1245	124	.00	.00	.00	0.
4	JAN 1815	50	.26	.00	.26	15.	*	5	JAN 1300	125	.00	.00	.00	0.
4	JAN 1830	51	.26	.00	.26	12.	*	5	JAN 1315	126	.00	.00	.00	0.
4	JAN 1845	52	.09	.00	.09	6.	*	5	JAN 1330	127	.00	.00	.00	0.
4	JAN 1900	53	.09	.00	.09	4.	*	5	JAN 1345	128	.00	.00	.00	0.
4	JAN 1915	54	.06	.00	.06	3.	*	5	JAN 1400	129	.00	.00	.00	0.
4	JAN 1930	55	.06	.00	.06	3.	*	5	JAN 1415	130	.00	.00	.00	0.
4	JAN 1945	56	.05	.00	.05	2.	*	5	JAN 1430	131	.00	.00	.00	0.
4	JAN 2000	57	.05	.00	.05	2.	*	5	JAN 1445	132	.00	.00	.00	0.
4	JAN 2015	58	.04	.00	.04	2.	*	5	JAN 1500	133	.00	.00	.00	0.
4	JAN 2030	59	.04	.00	.04	2.	*	5	JAN 1515	134	.00	.00	.00	0.
4	JAN 2045	60	.04	.00	.04	2.	*	5	JAN 1530	135	.00	.00	.00	0.
4	JAN 2100	61	.04	.00	.04	2.	*	5	JAN 1545	136	.00	.00	.00	0.
4	JAN 2115	62	.03	.00	.03	1.	*	5	JAN 1600	137	.00	.00	.00	0.
4	JAN 2130	63	.03	.00	.03	1.	*	5	JAN 1615	138	.00	.00	.00	0.
4	JAN 2145	64	.03	.00	.03	1.	*	5	JAN 1630	139	.00	.00	.00	0.
4	JAN 2200	65	.03	.00	.03	1.	*	5	JAN 1645	140	.00	.00	.00	0.
4	JAN 2215	66	.03	.00	.03	1.	*	5	JAN 1700	141	.00	.00	.00	0.
4	JAN 2230	67	.03	.00	.03	1.	*	5	JAN 1715	142	.00	.00	.00	0.
4	JAN 2245	68	.03	.00	.03	1.	*	5	JAN 1730	143	.00	.00	.00	0.
4	JAN 2300	69	.03	.00	.03	1.	*	5	JAN 1745	144	.00	.00	.00	0.
4	JAN 2315	70	.03	.00	.03	1.	*	5	JAN 1800	145	.00	.00	.00	0.
4	JAN 2330	71	.03	.00	.03	1.	*	5	JAN 1815	146	.00	.00	.00	0.
4	JAN 2345	72	.02	.00	.02	1.	*	5	JAN 1830	147	.00	.00	.00	0.
5	JAN 0000	73	.02	.00	.02	1.	*	5	JAN 1845	148	.00	.00	.00	0.
5	JAN 0015	74	.02	.00	.02	1.	*	5	JAN 1900	149	.00	.00	.00	0.
5	JAN 0030	75	.02	.00	.02	1.	*	5	JAN 1915	150	.00	.00	.00	0.
							*							

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TOTAL RAINFALL = 4.60, TOTAL LOSS = .24, TOTAL EXCESS = 4.36

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	37.25-HR
		(CFS)				
28.	12.00		5.	2.	1.	1.
		(INCHES)	3.082	4.364	4.364	4.364
		(AC-FT)	3.	4.	4.	4.

CUMULATIVE AREA = .02 SQ MI

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          *              *
25 KK     *      Comb    *
          *              *
          ****************
                    Combine Two Hydrographs

27 HC          HYDROGRAPH COMBINATION
                    ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

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HYDROGRAPH AT STATION Comb
SUM OF 2 HYDROGRAPHS

DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW
4	JAN	0600	1	0.	4	JAN	1530	39	4.	5	JAN	0100	77	4.	5	JAN	1030	115	0.
4	JAN	0615	2	0.	4	JAN	1545	40	5.	5	JAN	0115	78	4.	5	JAN	1045	116	0.
4	JAN	0630	3	0.	4	JAN	1600	41	5.	5	JAN	0130	79	4.	5	JAN	1100	117	0.
4	JAN	0645	4	0.	4	JAN	1615	42	6.	5	JAN	0145	80	3.	5	JAN	1115	118	0.
4	JAN	0700	5	0.	4	JAN	1630	43	6.	5	JAN	0200	81	3.	5	JAN	1130	119	0.
4	JAN	0715	6	0.	4	JAN	1645	44	8.	5	JAN	0215	82	3.	5	JAN	1145	120	0.
4	JAN	0730	7	0.	4	JAN	1700	45	9.	5	JAN	0230	83	3.	5	JAN	1200	121	0.
4	JAN	0745	8	0.	4	JAN	1715	46	11.	5	JAN	0245	84	3.	5	JAN	1215	122	0.
4	JAN	0800	9	0.	4	JAN	1730	47	13.	5	JAN	0300	85	3.	5	JAN	1230	123	0.
4	JAN	0815	10	0.	4	JAN	1745	48	41.	5	JAN	0315	86	3.	5	JAN	1245	124	0.
4	JAN	0830	11	0.	4	JAN	1800	49	69.	5	JAN	0330	87	3.	5	JAN	1300	125	0.
4	JAN	0845	12	0.	4	JAN	1815	50	71.	5	JAN	0345	88	3.	5	JAN	1315	126	0.
4	JAN	0900	13	0.	4	JAN	1830	51	62.	5	JAN	0400	89	3.	5	JAN	1330	127	0.
4	JAN	0915	14	0.	4	JAN	1845	52	45.	5	JAN	0415	90	3.	5	JAN	1345	128	0.
4	JAN	0930	15	1.	4	JAN	1900	53	32.	5	JAN	0430	91	3.	5	JAN	1400	129	0.
4	JAN	0945	16	0.	4	JAN	1915	54	22.	5	JAN	0445	92	3.	5	JAN	1415	130	0.
4	JAN	1000	17	1.	4	JAN	1930	55	17.	5	JAN	0500	93	3.	5	JAN	1430	131	0.
4	JAN	1015	18	1.	4	JAN	1945	56	13.	5	JAN	0515	94	3.	5	JAN	1445	132	0.
4	JAN	1030	19	1.	4	JAN	2000	57	11.	5	JAN	0530	95	2.	5	JAN	1500	133	0.
4	JAN	1045	20	1.	4	JAN	2015	58	10.	5	JAN	0545	96	2.	5	JAN	1515	134	0.
4	JAN	1100	21	1.	4	JAN	2030	59	9.	5	JAN	0600	97	2.	5	JAN	1530	135	0.
4	JAN	1115	22	1.	4	JAN	2045	60	8.	5	JAN	0615	98	2.	5	JAN	1545	136	0.
4	JAN	1130	23	1.	4	JAN	2100	61	7.	5	JAN	0630	99	1.	5	JAN	1600	137	0.
4	JAN	1145	24	1.	4	JAN	2115	62	7.	5	JAN	0645	100	0.	5	JAN	1615	138	0.
4	JAN	1200	25	1.	4	JAN	2130	63	6.	5	JAN	0700	101	0.	5	JAN	1630	139	0.
4	JAN	1215	26	1.	4	JAN	2145	64	6.	5	JAN	0715	102	0.	5	JAN	1645	140	0.
4	JAN	1230	27	1.	4	JAN	2200	65	6.	5	JAN	0730	103	0.	5	JAN	1700	141	0.
4	JAN	1245	28	2.	4	JAN	2215	66	5.	5	JAN	0745	104	0.	5	JAN	1715	142	0.
4	JAN	1300	29	2.	4	JAN	2230	67	5.	5	JAN	0800	105	0.	5	JAN	1730	143	0.
4	JAN	1315	30	2.	4	JAN	2245	68	5.	5	JAN	0815	106	0.	5	JAN	1745	144	0.
4	JAN	1330	31	2.	4	JAN	2300	69	5.	5	JAN	0830	107	0.	5	JAN	1800	145	0.
4	JAN	1345	32	2.	4	JAN	2315	70	5.	5	JAN	0845	108	0.	5	JAN	1815	146	0.
4	JAN	1400	33	2.	4	JAN	2330	71	5.	5	JAN	0900	109	0.	5	JAN	1830	147	0.
4	JAN	1415	34	3.	4	JAN	2345	72	4.	5	JAN	0915	110	0.	5	JAN	1845	148	0.
4	JAN	1430	35	3.	5	JAN	0000	73	4.	5	JAN	0930	111	0.	5	JAN	1900	149	0.
4	JAN	1445	36	3.	5	JAN	0015	74	4.	5	JAN	0945	112	0.	5	JAN	1915	150	0.
4	JAN	1500	37	4.	5	JAN	0030	75	4.	5	JAN	1000	113	0.					

4 JAN 1515 38 4. * 5 JAN 0045 76 4. * 5 JAN 1015 114 0. *

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	37.25-HR
(CFS)	(HR)					
		(CFS)				
71.	12.25		21.	7.	4.	4.
		(INCHES)	2.678	3.603	3.604	3.604
		(AC-FT)	10.	14.	14.	14.

CUMULATIVE AREA = .07 SQ MI

20 KK Resvr

Reservoir Routing Operation

HYDROGRAPH ROUTING DATA

30 RS STORAGE ROUTING
NSTPS 1 NUMBER OF SUBREACHES
ITYP ELEV TYPE OF INITIAL CONDITION
RSVRIC 79.50 INITIAL CONDITION
X .00 WORKING R AND D COEFFICIENT

31 SA	AREA	9.4	9.4	9.5	9.5	9.6	9.9	10.2
32 SE	ELEVATION	79.67	79.83	80.03	80.25	80.50	81.50	82.50
33 SQ	DISCHARGE	0.	1.	1.	6.	15.	81.	174.
34 SE	ELEVATION	79.67	79.83	80.03	80.25	80.50	81.50	82.50

***

COMPUTED STORAGE-ELEVATION DATA

STORAGE	.00	1.50	3.39	5.49	7.88	17.66	27.73
ELEVATION	79.67	79.83	80.03	80.25	80.50	81.50	82.50

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	.00	1.50	3.39	5.49	7.88	17.66	27.73
OUTFLOW	.00	.50	.76	5.53	15.41	80.58	173.90
ELEVATION	79.67	79.83	80.03	80.25	80.50	81.50	82.50

HYDROGRAPH AT STATION Resvr

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
4	JAN	0600	1	0.	.0	79.7	4	JAN	1830	51	9.	6.3	80.3	5	JAN	0700	101	4.	4.6	80.2
4	JAN	0615	2	0.	.0	79.7	4	JAN	1845	52	12.	7.2	80.4	5	JAN	0715	102	3.	4.6	80.2
4	JAN	0630	3	0.	.0	79.7	4	JAN	1900	53	15.	7.7	80.5	5	JAN	0730	103	3.	4.5	80.1
4	JAN	0645	4	0.	.0	79.7	4	JAN	1915	54	16.	7.9	80.5	5	JAN	0745	104	3.	4.4	80.1
4	JAN	0700	5	0.	.0	79.7	4	JAN	1930	55	16.	8.0	80.5	5	JAN	0800	105	3.	4.4	80.1
4	JAN	0715	6	0.	.0	79.7	4	JAN	1945	56	16.	8.0	80.5	5	JAN	0815	106	3.	4.3	80.1
4	JAN	0730	7	0.	.0	79.7	4	JAN	2000	57	16.	7.9	80.5	5	JAN	0830	107	3.	4.3	80.1
4	JAN	0745	8	0.	.0	79.7	4	JAN	2015	58	15.	7.8	80.5	5	JAN	0845	108	3.	4.2	80.1
4	JAN	0800	9	0.	.0	79.7	4	JAN	2030	59	15.	7.7	80.5	5	JAN	0900	109	2.	4.2	80.1
4	JAN	0815	10	0.	.0	79.7	4	JAN	2045	60	14.	7.6	80.5	5	JAN	0915	110	2.	4.1	80.1
4	JAN	0830	11	0.	.0	79.7	4	JAN	2100	61	14.	7.4	80.5	5	JAN	0930	111	2.	4.1	80.1
4	JAN	0845	12	0.	.0	79.7	4	JAN	2115	62	13.	7.3	80.4	5	JAN	0945	112	2.	4.0	80.1
4	JAN	0900	13	0.	.0	79.7	4	JAN	2130	63	12.	7.2	80.4	5	JAN	1000	113	2.	4.0	80.1
4	JAN	0915	14	0.	.0	79.7	4	JAN	2145	64	12.	7.0	80.4	5	JAN	1015	114	2.	3.9	80.1
4	JAN	0930	15	0.	.1	79.7	4	JAN	2200	65	11.	6.9	80.4	5	JAN	1030	115	2.	3.9	80.1
4	JAN	0945	16	0.	.1	79.7	4	JAN	2215	66	11.	6.8	80.4	5	JAN	1045	116	2.	3.8	80.1
4	JAN	1000	17	0.	.1	79.7	4	JAN	2230	67	11.	6.7	80.4	5	JAN	1100	117	2.	3.8	80.1
4	JAN	1015	18	0.	.1	79.7	4	JAN	2245	68	10.	6.6	80.4	5	JAN	1115	118	2.	3.8	80.1
4	JAN	1030	19	0.	.1	79.7	4	JAN	2300	69	10.	6.5	80.4	5	JAN	1130	119	2.	3.7	80.1
4	JAN	1045	20	0.	.1	79.7	4	JAN	2315	70	9.	6.4	80.3	5	JAN	1145	120	1.	3.7	80.1
4	JAN	1100	21	0.	.1	79.7	4	JAN	2330	71	9.	6.3	80.3	5	JAN	1200	121	1.	3.7	80.1
4	JAN	1115	22	0.	.1	79.7	4	JAN	2345	72	8.	6.2	80.3	5	JAN	1215	122	1.	3.7	80.1
4	JAN	1130	23	0.	.2	79.7	5	JAN	0000	73	8.	6.1	80.3	5	JAN	1230	123	1.	3.6	80.1
4	JAN	1145	24	0.	.2	79.7	5	JAN	0015	74	8.	6.0	80.3	5	JAN	1245	124	1.	3.6	80.1
4	JAN	1200	25	0.	.2	79.7	5	JAN	0030	75	7.	6.0	80.3	5	JAN	1300	125	1.	3.6	80.0
4	JAN	1215	26	0.	.2	79.7	5	JAN	0045	76	7.	5.9	80.3	5	JAN	1315	126	1.	3.6	80.0
4	JAN	1230	27	0.	.3	79.7	5	JAN	0100	77	7.	5.8	80.3	5	JAN	1330	127	1.	3.5	80.0
4	JAN	1245	28	0.	.3	79.7	5	JAN	0115	78	7.	5.8	80.3	5	JAN	1345	128	1.	3.5	80.0
4	JAN	1300	29	0.	.3	79.7	5	JAN	0130	79	6.	5.7	80.3	5	JAN	1400	129	1.	3.5	80.0
4	JAN	1315	30	0.	.4	79.7	5	JAN	0145	80	6.	5.6	80.3	5	JAN	1415	130	1.	3.5	80.0
4	JAN	1330	31	0.	.4	79.7	5	JAN	0200	81	6.	5.6	80.3	5	JAN	1430	131	1.	3.4	80.0
4	JAN	1345	32	0.	.4	79.7	5	JAN	0215	82	6.	5.5	80.3	5	JAN	1445	132	1.	3.4	80.0
4	JAN	1400	33	0.	.5	79.7	5	JAN	0230	83	6.	5.5	80.2	5	JAN	1500	133	1.	3.4	80.0
4	JAN	1415	34	0.	.5	79.7	5	JAN	0245	84	5.	5.4	80.2	5	JAN	1515	134	1.	3.4	80.0
4	JAN	1430	35	0.	.6	79.7	5	JAN	0300	85	5.	5.4	80.2	5	JAN	1530	135	1.	3.4	80.0
4	JAN	1445	36	0.	.7	79.7	5	JAN	0315	86	5.	5.3	80.2	5	JAN	1545	136	1.	3.4	80.0
4	JAN	1500	37	0.	.7	79.7	5	JAN	0330	87	5.	5.3	80.2	5	JAN	1600	137	1.	3.4	80.0
4	JAN	1515	38	0.	.8	79.8	5	JAN	0345	88	5.	5.2	80.2	5	JAN	1615	138	1.	3.3	80.0
4	JAN	1530	39	0.	.9	79.8	5	JAN	0400	89	5.	5.2	80.2	5	JAN	1630	139	1.	3.3	80.0
4	JAN	1545	40	0.	1.0	79.8	5	JAN	0415	90	5.	5.2	80.2	5	JAN	1645	140	1.	3.3	80.0
4	JAN	1600	41	0.	1.0	79.8	5	JAN	0430	91	5.	5.1	80.2	5	JAN	1700	141	1.	3.3	80.0
4	JAN	1615	42	0.	1.2	79.8	5	JAN	0445	92	5.	5.1	80.2	5	JAN	1715	142	1.	3.3	80.0
4	JAN	1630	43	0.	1.3	79.8	5	JAN	0500	93	5.	5.0	80.2	5	JAN	1730	143	1.	3.3	80.0
4	JAN	1645	44	0.	1.4	79.8	5	JAN	0515	94	4.	5.0	80.2	5	JAN	1745	144	1.	3.2	80.0
4	JAN	1700	45	1.	1.6	79.8	5	JAN	0530	95	4.	5.0	80.2	5	JAN	1800	145	1.	3.2	80.0
4	JAN	1715	46	1.	1.8	79.9	5	JAN	0545	96	4.	4.9	80.2	5	JAN	1815	146	1.	3.2	80.0
4	JAN	1730	47	1.	2.0	79.9	5	JAN	0600	97	4.	4.9	80.2	5	JAN	1830	147	1.	3.2	80.0
4	JAN	1745	48	1.	2.5	79.9	5	JAN	0615	98	4.	4.8	80.2	5	JAN	1845	148	1.	3.2	80.0
4	JAN	1800	49	1.	3.7	80.1	5	JAN	0630	99	4.	4.8	80.2	5	JAN	1900	149	1.	3.2	80.0
4	JAN	1815	50	5.	5.0	80.2	5	JAN	0645	100	4.	4.7	80.2	5	JAN	1915	150	1.	3.2	80.0

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	37.25-HR
(CFS)	(HR)					
		(CFS)				
16.	13.50		12.	5.	3.	3.
		(INCHES)	1.564	2.717	2.777	2.777
		(AC-FT)	6.	10.	11.	11.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE 6-HR	24-HR	72-HR	37.25-HR
(AC-FT)	(HR)				
8.	13.50	7.	5.	3.	3.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE 6-HR	24-HR	72-HR	37.25-HR
(FEET)	(HR)				
80.51	13.50	80.41	80.20	80.04	80.04

CUMULATIVE AREA = .07 SQ MI

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	POST25	56.	12.25	15.	5.	3.	.06		
HYDROGRAPH AT	Pond	28.	12.00	5.	2.	1.	.02		
2 COMBINED AT	Comb	71.	12.25	21.	7.	4.	.07		
ROUTED TO	Resvr	16.	13.50	12.	5.	3.	.07	80.51	13.50

*** NORMAL END OF HEC-1 ***

Owner: JEA
Plant: Brandy Branch Station
Project No.: 099262
File No.: 32.0541
Title: Wet Detention System

Computed By: J.M. Stanek
Date: 11-17-2000
Verified By:_____
Date:_____

APPENDIX D

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             FEBRUARY 1981             *
*           REVISED 02 AUG 88           *
*                                       *
*  RUN DATE  11/17/2000  TIME  07:28:52 *
*                                       *
*****************************************
```

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*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*  THE HYDROLOGIC ENGINEERING CENTER    *
*         609 SECOND STREET             *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 551-1748              *
*                                       *
*****************************************
```

```
X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
X     X  X        X                X
XXXXXXX  XXXX     X        XXXXX   X
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX           XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9.....10

   1          ID   JEA - Brandy Branch
   2          ID   HEC-1 Analysis - 24 hr Storm - 25 Year Event
   3          ID   Postdevelopment Flow
   4          ID   Black & Veatch Project No. 099262.0040
   5          ID   Input File: post25.in  Output File:  post25.out
   6          IT      15 04JAN00    0600      150
   7          IO       0        0
   8          IN      30
              * **********

   9          KK  POST25
  10          KM   POST-DEVELOPMENT RUNOFF
  11          BA  .05524
  12          PB    8.75
  13          PC  0.0000  0.0060  0.0120  0.0190  0.0250  0.0320  0.0390  0.0470  0.0540  0.0620
  14          PC  0.0710  0.0800  0.0890  0.0990  0.1100  0.1220  0.1340  0.1480  0.1640  0.1810
  15          PC  0.2010  0.2260  0.2580  0.3080  0.6070  0.7190  0.7570  0.7850  0.8070  0.8260
  16          PC  0.8420  0.8570  0.8700  0.8820  0.8930  0.9040  0.9130  0.9230  0.9310  0.9400
  17          PC  0.9480  0.9550  0.9620  0.9690  0.9760  0.9830  0.9890  0.9950  1.0000
```

```
18          LS       0    88.9       0
19          UD   0.444
            * **********

20          KK    Pond
21          KM   Runoff Pond
22          BA  .01628
23          LS       0      98       0
24          UD   0.001
            * **********

25          KK    Comb
26          KM   Combine Two Hydrographs
27          HC       2
            * **********

28          KK   Resvr
29          KM   Reservoir Routing Operation
30          RS       1    ELEV    79.5
31          SA   9.372   9.421   9.484   9.547   9.623   9.925   10.23
32          SE   79.67   79.83   80.03   80.25   80.50   81.50   82.50
33          SQ       0   0.504   0.756    5.53   15.41   80.58   173.9
34          SE   79.67   79.83   80.03   80.25   80.50   81.50   82.50
            * **********
            *DIAGRAM
35          ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK

 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    9      POST25
               .
               .
   20          .        Pond       ,
               .          .
               .          .
   25        Comb.............
              V
              V
   28       Resvr

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*            FEBRUARY 1981             *
*          REVISED 02 AUG 88           *
*                                      *
*  RUN DATE  11/17/2000  TIME  07:28:52 *
*                                      *
****************************************

****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*  THE HYDROLOGIC ENGINEERING CENTER   *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 551-1748             *
*                                      *
****************************************
```

```
                    JEA - Brandy Branch
                    HEC-1 Analysis - 24 hr Storm - 25 Year Event
                    Postdevelopment Flow
                    Black & Veatch Project No. 099262.0040
                    Input File: post25.in  Output File:  post25.out

 7 IO          OUTPUT CONTROL VARIABLES
                    IPRNT          0  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE

   IT          HYDROGRAPH TIME DATA
                     NMIN         15  MINUTES IN COMPUTATION INTERVAL
                    IDATE      4JAN 0  STARTING DATE
                    ITIME        0600  STARTING TIME
                       NQ         150  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE      5JAN 0  ENDING DATE
                   NDTIME        1915  ENDING TIME
                   ICENT           19  CENTURY MARK

                COMPUTATION INTERVAL      .25 HOURS
                    TOTAL TIME BASE   37.25 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


              **************
              *            *
 9 KK         *    POST25  *
              *            *
              **************
                        POST-DEVELOPMENT RUNOFF

 8 IN          TIME DATA FOR INPUT TIME SERIES
                    JXMIN          30  TIME INTERVAL IN MINUTES
                   JXDATE      4JAN 0  STARTING DATE
                   JXTIME         600  STARTING TIME

               SUBBASIN RUNOFF DATA

11 BA            SUBBASIN CHARACTERISTICS
                    TAREA         .06  SUBBASIN AREA

                 PRECIPITATION DATA
```

```
 12 PB                STORM        8.75  BASIN TOTAL PRECIPITATION

 13 PI            INCREMENTAL PRECIPITATION PATTERN
                    .00    .00    .00    .00    .00    .00    .00    .00    .00    .00
                    .00    .00    .00    .00    .00    .00    .00    .00    .00    .00
                    .00    .00    .00    .00    .01    .00    .01    .01    .01    .01
                    .01    .01    .01    .01    .01    .01    .01    .01    .01    .01
                    .01    .01    .02    .02    .03    .03    .15    .15    .06    .06
                    .02    .02    .01    .01    .01    .01    .01    .01    .01    .01
                    .01    .01    .01    .01    .01    .01    .01    .01    .01    .01
                    .00    .00    .00    .00    .00    .00    .00    .00    .00    .00
                    .00    .00    .00    .00    .00    .00    .00    .00    .00    .00
                    .00    .00    .00    .00    .00    .00

 18 LS           SCS LOSS RATE
                      STRTL         .25  INITIAL ABSTRACTION
                     CRVNBR       88.90  CURVE NUMBER
                      RTIMP         .00  PERCENT IMPERVIOUS AREA

 19 UD           SCS DIMENSIONLESS UNITGRAPH
                       TLAG         .44  LAG

                                                ***

WARNING *** TIME INTERVAL IS GREATER THAN .29*LAG

                                          UNIT HYDROGRAPH
                                       11 END-OF-PERIOD ORDINATES
              18.       46.       40.       20.       10.        5.        2.        1.        1.        0.
               0.
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HYDROGRAPH AT STATION POST25

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DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q
4	JAN	0600	1	.00	.00	.00	0.	5	JAN	0045	76	.04	.00	.03	6.
4	JAN	0615	2	.03	.03	.00	0.	5	JAN	0100	77	.04	.00	.03	6.
4	JAN	0630	3	.03	.03	.00	0.	5	JAN	0115	78	.04	.00	.04	5.
4	JAN	0645	4	.03	.03	.00	0.	5	JAN	0130	79	.04	.00	.04	5.
4	JAN	0700	5	.03	.03	.00	0.	5	JAN	0145	80	.04	.00	.03	5.
4	JAN	0715	6	.03	.03	.00	0.	5	JAN	0200	81	.04	.00	.03	5.
4	JAN	0730	7	.03	.03	.00	0.	5	JAN	0215	82	.03	.00	.03	5.
4	JAN	0745	8	.03	.03	.00	0.	5	JAN	0230	83	.03	.00	.03	5.
4	JAN	0800	9	.03	.03	.00	0.	5	JAN	0245	84	.03	.00	.03	4.
4	JAN	0815	10	.03	.03	.00	0.	5	JAN	0300	85	.03	.00	.03	4.
4	JAN	0830	11	.03	.03	.00	0.	5	JAN	0315	86	.03	.00	.03	4.
4	JAN	0845	12	.03	.03	.00	0.	5	JAN	0330	87	.03	.00	.03	4.
4	JAN	0900	13	.03	.03	.00	0.	5	JAN	0345	88	.03	.00	.03	4.
4	JAN	0915	14	.04	.03	.01	0.	5	JAN	0400	89	.03	.00	.03	4.
4	JAN	0930	15	.03	.03	.01	1.	5	JAN	0415	90	.03	.00	.03	4.
4	JAN	0945	16	.03	.02	.01	1.	5	JAN	0430	91	.03	.00	.03	4.
4	JAN	1000	17	.03	.02	.01	1.	5	JAN	0445	92	.03	.00	.03	4.

4	JAN 1015	18	.04	.02	.01	1.	*	5	JAN 0500	93	.03	.00	.03	4.
4	JAN 1030	19	.03	.02	.01	1.	*	5	JAN 0515	94	.03	.00	.03	4.
4	JAN 1045	20	.04	.03	.01	1.	*	5	JAN 0530	95	.03	.00	.03	4.
4	JAN 1100	21	.04	.02	.02	2.	*	5	JAN 0545	96	.02	.00	.02	4.
4	JAN 1115	22	.04	.02	.02	2.	*	5	JAN 0600	97	.02	.00	.02	3.
4	JAN 1130	23	.04	.02	.02	2.	*	5	JAN 0615	98	.00	.00	.00	3.
4	JAN 1145	24	.04	.02	.02	2.	*	5	JAN 0630	99	.00	.00	.00	2.
4	JAN 1200	25	.04	.02	.02	2.	*	5	JAN 0645	100	.00	.00	.00	1.
4	JAN 1215	26	.04	.02	.02	3.	*	5	JAN 0700	101	.00	.00	.00	0.
4	JAN 1230	27	.04	.02	.02	3.	*	5	JAN 0715	102	.00	.00	.00	0.
4	JAN 1245	28	.05	.02	.03	3.	*	5	JAN 0730	103	.00	.00	.00	0.
4	JAN 1300	29	.05	.02	.03	3.	*	5	JAN 0745	104	.00	.00	.00	0.
4	JAN 1315	30	.05	.02	.03	4.	*	5	JAN 0800	105	.00	.00	.00	0.
4	JAN 1330	31	.05	.02	.03	4.	*	5	JAN 0815	106	.00	.00	.00	0.
4	JAN 1345	32	.05	.02	.03	4.	*	5	JAN 0830	107	.00	.00	.00	0.
4	JAN 1400	33	.05	.02	.03	5.	*	5	JAN 0845	108	.00	.00	.00	0.
4	JAN 1415	34	.06	.02	.04	5.	*	5	JAN 0900	109	.00	.00	.00	0.
4	JAN 1430	35	.06	.02	.04	5.	*	5	JAN 0915	110	.00	.00	.00	0.
4	JAN 1445	36	.07	.02	.05	6.	*	5	JAN 0930	111	.00	.00	.00	0.
4	JAN 1500	37	.07	.02	.05	6.	*	5	JAN 0945	112	.00	.00	.00	0.
4	JAN 1515	38	.07	.02	.06	7.	*	5	JAN 1000	113	.00	.00	.00	0.
4	JAN 1530	39	.07	.02	.06	7.	*	5	JAN 1015	114	.00	.00	.00	0.
4	JAN 1545	40	.09	.02	.07	8.	*	5	JAN 1030	115	.00	.00	.00	0.
4	JAN 1600	41	.09	.02	.07	9.	*	5	JAN 1045	116	.00	.00	.00	0.
4	JAN 1615	42	.11	.02	.09	10.	*	5	JAN 1100	117	.00	.00	.00	0.
4	JAN 1630	43	.11	.02	.09	11.	*	5	JAN 1115	118	.00	.00	.00	0.
4	JAN 1645	44	.14	.02	.12	12.	*	5	JAN 1130	119	.00	.00	.00	0.
4	JAN 1700	45	.14	.02	.12	14.	*	5	JAN 1145	120	.00	.00	.00	0.
4	JAN 1715	46	.22	.03	.19	17.	*	5	JAN 1200	121	.00	.00	.00	0.
4	JAN 1730	47	.22	.03	.19	21.	*	5	JAN 1215	122	.00	.00	.00	0.
4	JAN 1745	48	1.31	.11	1.20	42.	*	5	JAN 1230	123	.00	.00	.00	0.
4	JAN 1800	49	1.31	.06	1.24	91.	*	5	JAN 1245	124	.00	.00	.00	0.
4	JAN 1815	50	.49	.02	.47	120.	*	5	JAN 1300	125	.00	.00	.00	0.
4	JAN 1830	51	.49	.02	.47	107.	*	5	JAN 1315	126	.00	.00	.00	0.
4	JAN 1845	52	.17	.00	.16	82.	*	5	JAN 1330	127	.00	.00	.00	0.
4	JAN 1900	53	.17	.00	.16	57.	*	5	JAN 1345	128	.00	.00	.00	0.
4	JAN 1915	54	.12	.00	.12	39.	*	5	JAN 1400	129	.00	.00	.00	0.
4	JAN 1930	55	.12	.00	.12	29.	*	5	JAN 1415	130	.00	.00	.00	0.
4	JAN 1945	56	.10	.00	.09	22.	*	5	JAN 1430	131	.00	.00	.00	0.
4	JAN 2000	57	.10	.00	.09	18.	*	5	JAN 1445	132	.00	.00	.00	0.
4	JAN 2015	58	.08	.00	.08	15.	*	5	JAN 1500	133	.00	.00	.00	0.
4	JAN 2030	59	.08	.00	.08	14.	*	5	JAN 1515	134	.00	.00	.00	0.
4	JAN 2045	60	.07	.00	.07	12.	*	5	JAN 1530	135	.00	.00	.00	0.
4	JAN 2100	61	.07	.00	.07	11.	*	5	JAN 1545	136	.00	.00	.00	0.
4	JAN 2115	62	.07	.00	.06	10.	*	5	JAN 1600	137	.00	.00	.00	0.
4	JAN 2130	63	.07	.00	.06	10.	*	5	JAN 1615	138	.00	.00	.00	0.
4	JAN 2145	64	.06	.00	.06	9.	*	5	JAN 1630	139	.00	.00	.00	0.
4	JAN 2200	65	.06	.00	.06	9.	*	5	JAN 1645	140	.00	.00	.00	0.
4	JAN 2215	66	.05	.00	.05	8.	*	5	JAN 1700	141	.00	.00	.00	0.
4	JAN 2230	67	.05	.00	.05	8.	*	5	JAN 1715	142	.00	.00	.00	0.
4	JAN 2245	68	.05	.00	.05	8.	*	5	JAN 1730	143	.00	.00	.00	0.
4	JAN 2300	69	.05	.00	.05	7.	*	5	JAN 1745	144	.00	.00	.00	0.
4	JAN 2315	70	.05	.00	.05	7.	*	5	JAN 1800	145	.00	.00	.00	0.
4	JAN 2330	71	.05	.00	.05	7.	*	5	JAN 1815	146	.00	.00	.00	0.
4	JAN 2345	72	.04	.00	.04	7.	*	5	JAN 1830	147	.00	.00	.00	0.
5	JAN 0000	73	.04	.00	.04	6.	*	5	JAN 1845	148	.00	.00	.00	0.
5	JAN 0015	74	.04	.00	.04	6.	*	5	JAN 1900	149	.00	.00	.00	0.

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      5 JAN 0030   75     .04     .00     .04          6.          *          5 JAN 1915  150     .00     .00     .00          0.
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    TOTAL RAINFALL =     8.75, TOTAL LOSS =     1.34, TOTAL EXCESS =     7.41

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     37.25-HR
+   (CFS)         (HR)
                    (CFS)
+     120.       12.25                33.          11.           7.           7.
                (INCHES)             5.481        7.412        7.412        7.412
                 (AC-FT)              16.          22.          22.          22.

                CUMULATIVE AREA =      .06 SQ MI
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            **************
            *            *
  20 KK     *      Pond  *
            *            *
            **************
                    Runoff Pond

          SUBBASIN RUNOFF DATA

  22 BA       SUBBASIN CHARACTERISTICS
                  TAREA          .02  SUBBASIN AREA

              PRECIPITATION DATA

  12 PB           STORM         8.75  BASIN TOTAL PRECIPITATION

  13 PI         INCREMENTAL PRECIPITATION PATTERN
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .01       .00       .01       .01       .01       .01
                  .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                  .01       .01       .02       .02       .03       .03       .15       .15       .06       .06
                  .02       .02       .01       .01       .01       .01       .01       .01       .01       .01
                  .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00

  23 LS       SCS LOSS RATE
                  STRTL          .04  INITIAL ABSTRACTION
                 CRVNBR        98.00  CURVE NUMBER
                  RTIMP          .00  PERCENT IMPERVIOUS AREA

  24 UD       SCS DIMENSIONLESS UNITGRAPH
                  TLAG          .00  LAG
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WARNING *** TIME INTERVAL IS GREATER THAN .29*LAG

UNIT HYDROGRAPH
5 END-OF-PERIOD ORDINATES

31. 9. 2. 0. 0.

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HYDROGRAPH AT STATION Pond

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DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q
4	JAN	0600	1	.00	.00	.00	0.	5	JAN	0045	76	.04	.00	.03	2.
4	JAN	0615	2	.03	.03	.00	0.	5	JAN	0100	77	.04	.00	.03	1.
4	JAN	0630	3	.03	.03	.00	0.	5	JAN	0115	78	.04	.00	.04	2.
4	JAN	0645	4	.03	.02	.01	0.	5	JAN	0130	79	.04	.00	.04	2.
4	JAN	0700	5	.03	.02	.01	0.	5	JAN	0145	80	.04	.00	.03	2.
4	JAN	0715	6	.03	.02	.01	1.	5	JAN	0200	81	.04	.00	.03	1.
4	JAN	0730	7	.03	.01	.02	1.	5	JAN	0215	82	.03	.00	.03	1.
4	JAN	0745	8	.03	.01	.02	1.	5	JAN	0230	83	.03	.00	.03	1.
4	JAN	0800	9	.03	.01	.02	1.	5	JAN	0245	84	.03	.00	.03	1.
4	JAN	0815	10	.03	.01	.02	1.	5	JAN	0300	85	.03	.00	.03	1.
4	JAN	0830	11	.03	.01	.02	1.	5	JAN	0315	86	.03	.00	.03	1.
4	JAN	0845	12	.03	.01	.02	1.	5	JAN	0330	87	.03	.00	.03	1.
4	JAN	0900	13	.03	.01	.03	1.	5	JAN	0345	88	.03	.00	.03	1.
4	JAN	0915	14	.04	.01	.03	1.	5	JAN	0400	89	.03	.00	.03	1.
4	JAN	0930	15	.03	.00	.03	1.	5	JAN	0415	90	.03	.00	.03	1.
4	JAN	0945	16	.03	.00	.03	1.	5	JAN	0430	91	.03	.00	.03	1.
4	JAN	1000	17	.03	.00	.03	1.	5	JAN	0445	92	.03	.00	.03	1.
4	JAN	1015	18	.04	.00	.03	1.	5	JAN	0500	93	.03	.00	.03	1.
4	JAN	1030	19	.03	.00	.03	1.	5	JAN	0515	94	.03	.00	.03	1.
4	JAN	1045	20	.04	.00	.04	1.	5	JAN	0530	95	.03	.00	.03	1.
4	JAN	1100	21	.04	.00	.04	2.	5	JAN	0545	96	.02	.00	.02	1.
4	JAN	1115	22	.04	.00	.04	2.	5	JAN	0600	97	.02	.00	.02	1.
4	JAN	1130	23	.04	.00	.04	2.	5	JAN	0615	98	.00	.00	.00	0.
4	JAN	1145	24	.04	.00	.04	2.	5	JAN	0630	99	.00	.00	.00	0.
4	JAN	1200	25	.04	.00	.04	2.	5	JAN	0645	100	.00	.00	.00	0.
4	JAN	1215	26	.04	.00	.04	2.	5	JAN	0700	101	.00	.00	.00	0.
4	JAN	1230	27	.04	.00	.04	2.	5	JAN	0715	102	.00	.00	.00	0.
4	JAN	1245	28	.05	.00	.05	2.	5	JAN	0730	103	.00	.00	.00	0.
4	JAN	1300	29	.05	.00	.05	2.	5	JAN	0745	104	.00	.00	.00	0.
4	JAN	1315	30	.05	.00	.05	2.	5	JAN	0800	105	.00	.00	.00	0.
4	JAN	1330	31	.05	.00	.05	2.	5	JAN	0815	106	.00	.00	.00	0.
4	JAN	1345	32	.05	.00	.05	2.	5	JAN	0830	107	.00	.00	.00	0.
4	JAN	1400	33	.05	.00	.05	2.	5	JAN	0845	108	.00	.00	.00	0.
4	JAN	1415	34	.06	.00	.06	2.	5	JAN	0900	109	.00	.00	.00	0.
4	JAN	1430	35	.06	.00	.06	3.	5	JAN	0915	110	.00	.00	.00	0.
4	JAN	1445	36	.07	.00	.07	3.	5	JAN	0930	111	.00	.00	.00	0.
4	JAN	1500	37	.07	.00	.07	3.	5	JAN	0945	112	.00	.00	.00	0.
4	JAN	1515	38	.07	.00	.07	3.	5	JAN	1000	113	.00	.00	.00	0.
4	JAN	1530	39	.07	.00	.07	3.	5	JAN	1015	114	.00	.00	.00	0.
4	JAN	1545	40	.09	.00	.09	3.	5	JAN	1030	115	.00	.00	.00	0.

4	JAN 1600	41	.09	.00	.09	4.	*	5	JAN 1045	116	.00	.00	.00	0.
4	JAN 1615	42	.11	.00	.11	4.	*	5	JAN 1100	117	.00	.00	.00	0.
4	JAN 1630	43	.11	.00	.11	5.	*	5	JAN 1115	118	.00	.00	.00	0.
4	JAN 1645	44	.14	.00	.14	5.	*	5	JAN 1130	119	.00	.00	.00	0.
4	JAN 1700	45	.14	.00	.14	6.	*	5	JAN 1145	120	.00	.00	.00	0.
4	JAN 1715	46	.22	.00	.22	8.	*	5	JAN 1200	121	.00	.00	.00	0.
4	JAN 1730	47	.22	.00	.22	9.	*	5	JAN 1215	122	.00	.00	.00	0.
4	JAN 1745	48	1.31	.00	1.30	43.	*	5	JAN 1230	123	.00	.00	.00	0.
4	JAN 1800	49	1.31	.00	1.31	53.	*	5	JAN 1245	124	.00	.00	.00	0.
4	JAN 1815	50	.49	.00	.49	29.	*	5	JAN 1300	125	.00	.00	.00	0.
4	JAN 1830	51	.49	.00	.49	22.	*	5	JAN 1315	126	.00	.00	.00	0.
4	JAN 1845	52	.17	.00	.17	11.	*	5	JAN 1330	127	.00	.00	.00	0.
4	JAN 1900	53	.17	.00	.17	8.	*	5	JAN 1345	128	.00	.00	.00	0.
4	JAN 1915	54	.12	.00	.12	6.	*	5	JAN 1400	129	.00	.00	.00	0.
4	JAN 1930	55	.12	.00	.12	5.	*	5	JAN 1415	130	.00	.00	.00	0.
4	JAN 1945	56	.10	.00	.10	4.	*	5	JAN 1430	131	.00	.00	.00	0.
4	JAN 2000	57	.10	.00	.10	4.	*	5	JAN 1445	132	.00	.00	.00	0.
4	JAN 2015	58	.08	.00	.08	4.	*	5	JAN 1500	133	.00	.00	.00	0.
4	JAN 2030	59	.08	.00	.08	4.	*	5	JAN 1515	134	.00	.00	.00	0.
4	JAN 2045	60	.07	.00	.07	3.	*	5	JAN 1530	135	.00	.00	.00	0.
4	JAN 2100	61	.07	.00	.07	3.	*	5	JAN 1545	136	.00	.00	.00	0.
4	JAN 2115	62	.07	.00	.07	3.	*	5	JAN 1600	137	.00	.00	.00	0.
4	JAN 2130	63	.07	.00	.07	3.	*	5	JAN 1615	138	.00	.00	.00	0.
4	JAN 2145	64	.06	.00	.06	2.	*	5	JAN 1630	139	.00	.00	.00	0.
4	JAN 2200	65	.06	.00	.06	2.	*	5	JAN 1645	140	.00	.00	.00	0.
4	JAN 2215	66	.05	.00	.05	2.	*	5	JAN 1700	141	.00	.00	.00	0.
4	JAN 2230	67	.05	.00	.05	2.	*	5	JAN 1715	142	.00	.00	.00	0.
4	JAN 2245	68	.05	.00	.05	2.	*	5	JAN 1730	143	.00	.00	.00	0.
4	JAN 2300	69	.05	.00	.05	2.	*	5	JAN 1745	144	.00	.00	.00	0.
4	JAN 2315	70	.05	.00	.05	2.	*	5	JAN 1800	145	.00	.00	.00	0.
4	JAN 2330	71	.05	.00	.05	2.	*	5	JAN 1815	146	.00	.00	.00	0.
4	JAN 2345	72	.04	.00	.04	2.	*	5	JAN 1830	147	.00	.00	.00	0.
5	JAN 0000	73	.04	.00	.04	2.	*	5	JAN 1845	148	.00	.00	.00	0.
5	JAN 0015	74	.04	.00	.04	2.	*	5	JAN 1900	149	.00	.00	.00	0.
5	JAN 0030	75	.04	.00	.04	2.	*	5	JAN 1915	150	.00	.00	.00	0.
							*							

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TOTAL RAINFALL = 8.75, TOTAL LOSS = .24, TOTAL EXCESS = 8.51

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	37.25-HR
+ (CFS)	(HR)					
		(CFS)				
+ 53.	12.00		10.	4.	2.	2.
		(INCHES)	5.910	8.509	8.510	8.510
		(AC-FT)	5.	7.	7.	7.

CUMULATIVE AREA = .02 SQ MI

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          *            *
25 KK     *    Comb    *
          *            *
          **************
                Combine Two Hydrographs

27 HC          HYDROGRAPH COMBINATION
                    ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                ***
```

HYDROGRAPH AT STATION Comb
SUM OF 2 HYDROGRAPHS

DA MON HRMN	ORD	FLOW	DA MON HRMN	ORD	FLOW	DA MON HRMN	ORD	FLOW	DA MON HRMN	ORD	FLOW
4 JAN 0600	1	0.	4 JAN 1530	39	10.	5 JAN 0100	77	7.	5 JAN 1030	115	0.
4 JAN 0615	2	0.	4 JAN 1545	40	11.	5 JAN 0115	78	7.	5 JAN 1045	116	0.
4 JAN 0630	3	0.	4 JAN 1600	41	12.	5 JAN 0130	79	7.	5 JAN 1100	117	0.
4 JAN 0645	4	0.	4 JAN 1615	42	14.	5 JAN 0145	80	7.	5 JAN 1115	118	0.
4 JAN 0700	5	0.	4 JAN 1630	43	15.	5 JAN 0200	81	7.	5 JAN 1130	119	0.
4 JAN 0715	6	1.	4 JAN 1645	44	18.	5 JAN 0215	82	6.	5 JAN 1145	120	0.
4 JAN 0730	7	1.	4 JAN 1700	45	20.	5 JAN 0230	83	6.	5 JAN 1200	121	0.
4 JAN 0745	8	1.	4 JAN 1715	46	25.	5 JAN 0245	84	6.	5 JAN 1215	122	0.
4 JAN 0800	9	1.	4 JAN 1730	47	30.	5 JAN 0300	85	6.	5 JAN 1230	123	0.
4 JAN 0815	10	1.	4 JAN 1745	48	85.	5 JAN 0315	86	6.	5 JAN 1245	124	0.
4 JAN 0830	11	1.	4 JAN 1800	49	143.	5 JAN 0330	87	6.	5 JAN 1300	125	0.
4 JAN 0845	12	1.	4 JAN 1815	50	149.	5 JAN 0345	88	6.	5 JAN 1315	126	0.
4 JAN 0900	13	1.	4 JAN 1830	51	129.	5 JAN 0400	89	6.	5 JAN 1330	127	0.
4 JAN 0915	14	2.	4 JAN 1845	52	92.	5 JAN 0415	90	6.	5 JAN 1345	128	0.
4 JAN 0930	15	2.	4 JAN 1900	53	65.	5 JAN 0430	91	6.	5 JAN 1400	129	0.
4 JAN 0945	16	2.	4 JAN 1915	54	45.	5 JAN 0445	92	5.	5 JAN 1415	130	0.
4 JAN 1000	17	2.	4 JAN 1930	55	34.	5 JAN 0500	93	5.	5 JAN 1430	131	0.
4 JAN 1015	18	2.	4 JAN 1945	56	27.	5 JAN 0515	94	5.	5 JAN 1445	132	0.
4 JAN 1030	19	3.	4 JAN 2000	57	22.	5 JAN 0530	95	5.	5 JAN 1500	133	0.
4 JAN 1045	20	3.	4 JAN 2015	58	19.	5 JAN 0545	96	5.	5 JAN 1515	134	0.
4 JAN 1100	21	3.	4 JAN 2030	59	17.	5 JAN 0600	97	4.	5 JAN 1530	135	0.
4 JAN 1115	22	4.	4 JAN 2045	60	15.	5 JAN 0615	98	3.	5 JAN 1545	136	0.
4 JAN 1130	23	4.	4 JAN 2100	61	14.	5 JAN 0630	99	2.	5 JAN 1600	137	0.
4 JAN 1145	24	4.	4 JAN 2115	62	13.	5 JAN 0645	100	1.	5 JAN 1615	138	0.
4 JAN 1200	25	4.	4 JAN 2130	63	13.	5 JAN 0700	101	0.	5 JAN 1630	139	0.
4 JAN 1215	26	4.	4 JAN 2145	64	12.	5 JAN 0715	102	0.	5 JAN 1645	140	0.
4 JAN 1230	27	5.	4 JAN 2200	65	11.	5 JAN 0730	103	0.	5 JAN 1700	141	0.
4 JAN 1245	28	5.	4 JAN 2215	66	11.	5 JAN 0745	104	0.	5 JAN 1715	142	0.
4 JAN 1300	29	5.	4 JAN 2230	67	10.	5 JAN 0800	105	0.	5 JAN 1730	143	0.
4 JAN 1315	30	6.	4 JAN 2245	68	10.	5 JAN 0815	106	0.	5 JAN 1745	144	0.
4 JAN 1330	31	6.	4 JAN 2300	69	9.	5 JAN 0830	107	0.	5 JAN 1800	145	0.
4 JAN 1345	32	7.	4 JAN 2315	70	9.	5 JAN 0845	108	0.	5 JAN 1815	146	0.
4 JAN 1400	33	7.	4 JAN 2330	71	9.	5 JAN 0900	109	0.	5 JAN 1830	147	0.
4 JAN 1415	34	7.	4 JAN 2345	72	8.	5 JAN 0915	110	0.	5 JAN 1845	148	0.
4 JAN 1430	35	8.	5 JAN 0000	73	8.	5 JAN 0930	111	0.	5 JAN 1900	149	0.
4 JAN 1445	36	9.	5 JAN 0015	74	8.	5 JAN 0945	112	0.	5 JAN 1915	150	0.
4 JAN 1500	37	9.	5 JAN 0030	75	8.	5 JAN 1000	113	0.			

```
    4 JAN 1515   38       10.   *    5 JAN 0045   76        7.   *    5 JAN 1015  114        0.   *
                                 *                                  *                             *
```

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	37.25-HR
(CFS)	(HR)					
		(CFS)				
149.	12.25		43.	15.	9.	9.
		(INCHES)	5.569	7.656	7.662	7.662
		(AC-FT)	21.	29.	29.	29.

CUMULATIVE AREA = .07 SQ MI

```
          **************
          *            *
  28 KK   *     Resvr  *
          *            *
          **************
```

Reservoir Routing Operation

HYDROGRAPH ROUTING DATA

```
  30 RS     STORAGE ROUTING
                 NSTPS          1  NUMBER OF SUBREACHES
                  ITYP       ELEV  TYPE OF INITIAL CONDITION
                RSVRIC      79.50  INITIAL CONDITION
                     X        .00 WORKING R AND D COEFFICIENT
```

31 SA	AREA	9.4	9.4	9.5	9.5	9.6	9.9	10.2
32 SE	ELEVATION	79.67	79.83	80.03	80.25	80.50	81.50	82.50
33 SQ	DISCHARGE	0.	1.	1.	6.	15.	81.	174.
34 SE	ELEVATION	79.67	79.83	80.03	80.25	80.50	81.50	82.50

***

COMPUTED STORAGE-ELEVATION DATA

STORAGE	.00	1.50	3.39	5.49	7.88	17.66	27.73
ELEVATION	79.67	79.83	80.03	80.25	80.50	81.50	82.50

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	.00	1.50	3.39	5.49	7.88	17.66	27.73
OUTFLOW	.00	.50	.76	5.53	15.41	80.58	173.90
ELEVATION	79.67	79.83	80.03	80.25	80.50	81.50	82.50

HYDROGRAPH AT STATION Resvr

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
4	JAN	0600	1	0.	.0	79.7	4	JAN	1830	51	48.	12.8	81.0	5	JAN	0700	101	5.	5.5	80.2
4	JAN	0615	2	0.	.0	79.7	4	JAN	1845	52	56.	14.0	81.1	5	JAN	0715	102	5.	5.3	80.2
4	JAN	0630	3	0.	.0	79.7	4	JAN	1900	53	59.	14.4	81.2	5	JAN	0730	103	5.	5.2	80.2
4	JAN	0645	4	0.	.0	79.7	4	JAN	1915	54	58.	14.3	81.2	5	JAN	0745	104	5.	5.1	80.2
4	JAN	0700	5	0.	.0	79.7	4	JAN	1930	55	56.	14.0	81.1	5	JAN	0800	105	5.	5.1	80.2
4	JAN	0715	6	0.	.0	79.7	4	JAN	1945	56	53.	13.5	81.1	5	JAN	0815	106	4.	5.0	80.2
4	JAN	0730	7	0.	.0	79.7	4	JAN	2000	57	49.	12.9	81.0	5	JAN	0830	107	4.	4.9	80.2
4	JAN	0745	8	0.	.0	79.7	4	JAN	2015	58	45.	12.4	81.0	5	JAN	0845	108	4.	4.8	80.2
4	JAN	0800	9	0.	.1	79.7	4	JAN	2030	59	42.	11.8	80.9	5	JAN	0900	109	4.	4.7	80.2
4	JAN	0815	10	0.	.1	79.7	4	JAN	2045	60	39.	11.4	80.9	5	JAN	0915	110	4.	4.6	80.2
4	JAN	0830	11	0.	.1	79.7	4	JAN	2100	61	35.	10.9	80.8	5	JAN	0930	111	3.	4.6	80.2
4	JAN	0845	12	0.	.1	79.7	4	JAN	2115	62	33.	10.5	80.8	5	JAN	0945	112	3.	4.5	80.1
4	JAN	0900	13	0.	.1	79.7	4	JAN	2130	63	30.	10.1	80.7	5	JAN	1000	113	3.	4.4	80.1
4	JAN	0915	14	0.	.2	79.7	4	JAN	2145	64	28.	9.7	80.7	5	JAN	1015	114	3.	4.4	80.1
4	JAN	0930	15	0.	.2	79.7	4	JAN	2200	65	26.	9.4	80.7	5	JAN	1030	115	3.	4.3	80.1
4	JAN	0945	16	0.	.2	79.7	4	JAN	2215	66	24.	9.1	80.6	5	JAN	1045	116	3.	4.2	80.1
4	JAN	1000	17	0.	.3	79.7	4	JAN	2230	67	22.	8.9	80.6	5	JAN	1100	117	3.	4.2	80.1
4	JAN	1015	18	0.	.3	79.7	4	JAN	2245	68	20.	8.6	80.6	5	JAN	1115	118	2.	4.1	80.1
4	JAN	1030	19	0.	.4	79.7	4	JAN	2300	69	19.	8.4	80.6	5	JAN	1130	119	2.	4.1	80.1
4	JAN	1045	20	0.	.4	79.7	4	JAN	2315	70	18.	8.2	80.5	5	JAN	1145	120	2.	4.0	80.1
4	JAN	1100	21	0.	.5	79.7	4	JAN	2330	71	17.	8.1	80.5	5	JAN	1200	121	2.	4.0	80.1
4	JAN	1115	22	0.	.5	79.7	4	JAN	2345	72	16.	7.9	80.5	5	JAN	1215	122	2.	4.0	80.1
4	JAN	1130	23	0.	.6	79.7	5	JAN	0000	73	15.	7.8	80.5	5	JAN	1230	123	2.	3.9	80.1
4	JAN	1145	24	0.	.7	79.7	5	JAN	0015	74	14.	7.6	80.5	5	JAN	1245	124	2.	3.9	80.1
4	JAN	1200	25	0.	.8	79.8	5	JAN	0030	75	14.	7.5	80.5	5	JAN	1300	125	2.	3.8	80.1
4	JAN	1215	26	0.	.9	79.8	5	JAN	0045	76	13.	7.4	80.4	5	JAN	1315	126	2.	3.8	80.1
4	JAN	1230	27	0.	.9	79.8	5	JAN	0100	77	13.	7.2	80.4	5	JAN	1330	127	2.	3.8	80.1
4	JAN	1245	28	0.	1.0	79.8	5	JAN	0115	78	12.	7.1	80.4	5	JAN	1345	128	2.	3.7	80.1
4	JAN	1300	29	0.	1.1	79.8	5	JAN	0130	79	12.	7.0	80.4	5	JAN	1400	129	1.	3.7	80.1
4	JAN	1315	30	0.	1.2	79.8	5	JAN	0145	80	11.	6.9	80.4	5	JAN	1415	130	1.	3.7	80.1
4	JAN	1330	31	0.	1.4	79.8	5	JAN	0200	81	11.	6.8	80.4	5	JAN	1430	131	1.	3.6	80.1
4	JAN	1345	32	0.	1.5	79.8	5	JAN	0215	82	11.	6.7	80.4	5	JAN	1445	132	1.	3.6	80.1
4	JAN	1400	33	1.	1.6	79.8	5	JAN	0230	83	10.	6.7	80.4	5	JAN	1500	133	1.	3.6	80.1
4	JAN	1415	34	1.	1.7	79.9	5	JAN	0245	84	10.	6.6	80.4	5	JAN	1515	134	1.	3.6	80.0
4	JAN	1430	35	1.	1.9	79.9	5	JAN	0300	85	10.	6.5	80.4	5	JAN	1530	135	1.	3.5	80.0
4	JAN	1445	36	1.	2.0	79.9	5	JAN	0315	86	9.	6.4	80.3	5	JAN	1545	136	1.	3.5	80.0
4	JAN	1500	37	1.	2.2	79.9	5	JAN	0330	87	9.	6.3	80.3	5	JAN	1600	137	1.	3.5	80.0
4	JAN	1515	38	1.	2.4	79.9	5	JAN	0345	88	9.	6.3	80.3	5	JAN	1615	138	1.	3.5	80.0
4	JAN	1530	39	1.	2.6	79.9	5	JAN	0400	89	8.	6.2	80.3	5	JAN	1630	139	1.	3.5	80.0
4	JAN	1545	40	1.	2.8	80.0	5	JAN	0415	90	8.	6.1	80.3	5	JAN	1645	140	1.	3.4	80.0
4	JAN	1600	41	1.	3.0	80.0	5	JAN	0430	91	8.	6.1	80.3	5	JAN	1700	141	1.	3.4	80.0
4	JAN	1615	42	1.	3.3	80.0	5	JAN	0445	92	8.	6.0	80.3	5	JAN	1715	142	1.	3.4	80.0
4	JAN	1630	43	1.	3.6	80.0	5	JAN	0500	93	8.	6.0	80.3	5	JAN	1730	143	1.	3.4	80.0
4	JAN	1645	44	2.	3.9	80.1	5	JAN	0515	94	7.	5.9	80.3	5	JAN	1745	144	1.	3.4	80.0
4	JAN	1700	45	3.	4.2	80.1	5	JAN	0530	95	7.	5.9	80.3	5	JAN	1800	145	1.	3.4	80.0
4	JAN	1715	46	4.	4.6	80.2	5	JAN	0545	96	7.	5.8	80.3	5	JAN	1815	146	1.	3.3	80.0
4	JAN	1730	47	5.	5.1	80.2	5	JAN	0600	97	7.	5.8	80.3	5	JAN	1830	147	1.	3.3	80.0
4	JAN	1745	48	8.	6.2	80.3	5	JAN	0615	98	7.	5.7	80.3	5	JAN	1845	148	1.	3.3	80.0
4	JAN	1800	49	18.	8.2	80.5	5	JAN	0630	99	6.	5.6	80.3	5	JAN	1900	149	1.	3.3	80.0
4	JAN	1815	50	34.	10.7	80.8	5	JAN	0645	100	6.	5.6	80.3	5	JAN	1915	150	1.	3.3	80.0

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	37.25-HR
(CFS)	(HR)	(CFS)				
59.	13.00		35.	13.	8.	8.
		(INCHES)	4.562	6.692	6.800	6.800
		(AC-FT)	17.	26.	26.	26.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE 6-HR	24-HR	72-HR	37.25-HR
(AC-FT)	(HR)				
14.	13.00	11.	7.	5.	5.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE 6-HR	24-HR	72-HR	37.25-HR
(FEET)	(HR)				
81.17	13.00	80.80	80.36	80.17	80.17

CUMULATIVE AREA = .07 SQ MI

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	POST25	120.	12.25	33.	11.	7.	.06		
HYDROGRAPH AT	Pond	53.	12.00	10.	4.	2.	.02		
2 COMBINED AT	Comb	149.	12.25	43.	15.	9.	.07		
ROUTED TO	Resvr	59.	13.00	35.	13.	8.	.07	81.17	13.00

*** NORMAL END OF HEC-1 ***

BLACK & VEATCH

Calculation Record

Client Name: JEA Page 1 of 26

Project Name: Brandy Branch Station Project No.: 99262

Calculation Title: Brandy Branch Hydraulic Conveyances

Calculation No./File No.: 32.0541

Calculation Is: (check all that apply) ☐ Preliminary ☒ Final ☐ Nuclear Safety-Related

Objective: Hydraulic Calculations for all proposed traversing works. This includes the design of the culverts and ditches.

Unverified Assumptions Requiring Subsequent Verification			
No.	Assumption	Verified By	Date

See Page _____ of this calculation for additional assumptions.

This Section Used for Computer Generated Calculations

Program Name/Number: _____ Version: _____

Evidence of or reference to computer program verification, if applicable:

Bases or reference thereto supporting application of the computer program to the physical problem:

Review and Approval						
Rev	Prepared By	Date	Verified By	Date	Approved By	Date
0	Julie M Stanek	11-10-00	Vanthong Tho	11-16-00	M. J. Stanek	11/22/2000

OBJECTIVE: Hydraulic Calculations for all proposed traversing works. This includes the design of the culverts and ditches.

REFERENCES:

1. Brandy Branch Calculations used in the Environmental Resource Permit Application for Brandy Branch Generating Station Phase II: Main Site, File Number 52.5406.1100.01.

2.Brandy Branch Calculations used in the Environmental Resource Permit Application for Brandy Branch Generating Station Phase II: Main Site, File Number 52.5406.1100.02.

3. Brandy Branch Calculations used in the Environmental Resource Permit Modification Application for Brandy Branch Generating Station ERP No. 16-156348-002-E1, File Numbers 52.5406.1117.

4. Brandy Branch Calculations used in the Environmental Resource Permit Modification Application for Brandy Branch Generating Station ERP No. 16-156348-002-E1, File Numbers 52.5406.1118.

5. 'Handbook of Applied Hydrology', Chow, McGraw-Hill Book Company, 1964.

6. U.S Department of Agriculture, Soil Conservation Service, Engineering Division Technical Release 55 (TR55), 'Urban Hydrology For Small Watersheds', June 1986.

7. U.S. Department of Commerce, Weather Bureau, Technical Paper No. 25, Rainfall Intensity – Duration – Frequency Curves.

8. Haestad Methods, FlowMaster Package, version 5.15, 1994.

9. 'Open – Channel Hydraulics', Chow, McGraw-Hill Book Company, 1959.

10. Haestad Methods, CulvertMaster Package, version 1.0, 1995.

RESULTS:

Culverts:

- All culverts have been checked for capacity. Refer to drawing 97990-DS-S3010 for details of the new or changed culverts.

Trench Drains:

- All trench drains have been checked for capacity. Refer to drawing 97990-DS-S3010 for details of the new or changed trench drains.

Ditch Capacity:

- All ditches as shown on drawing 97990-DS-S3001 are capable of handling the flow.

CALCULATIONS:

Areas to Culverts/ Trench Drains:

- Refer to Figure E, page 22 for culvert and trench drain call outs and the breakdown of area inputting into each culvert or trench drain.

- **Areas to Culverts:**
  - Area to Culvert 1 = Same area as shown in Ref. # 2 = 83,155 SF = 1.909 AC
  - Area to Culvert 2 = Same area as shown in Ref. # 2 = 83,155 SF = 1.909 AC
  - Area to Culvert 3 = Same area as shown in Ref. # 2 = 83,155 SF = 1.909 AC
  - Area to Culvert 6 = Same area as shown in Ref. # 4 = 41,600 SF = 0.955 AC
  - Area to Culvert 7 = 164,760 SF = 3.782 AC
  - Area to Culvert 10 = 159,190 SF = 3.654 AC
  - Area to Culvert 11 = 75,550 SF = 1.734 AC

- **Area to Trench Drains:**
  - Area to Trench Drain 1 = Same area as shown in Ref. # 4 = 20,845 SF = 0.479 AC
  - Area to Trench Drain 2 = Same area as shown in Ref. # 4 = 20,845 SF = 0.479 AC
  - Area to Trench Drain 3 = Same area as shown in Ref. # 4 = 20,845 SF = 0.479 AC
  - Area to Trench Drain 4 = Same area as shown in Ref. # 4 = 49,300 SF = 1.132 AC
  - Area to Trench Drain 5 = Same area as shown in Ref. # 4 = 54,600 SF = 1.253 AC
  - Area to Trench Drain 6 = Same area as shown in Ref. # 4 = 54,600 SF = 1.253 AC
  - Area to Trench Drain 7 = Same area as shown in Ref. # 4 = 54,600 SF = 1.253 AC
  - Area to Trench Drain 8 = Same area as shown in Ref. # 4 = 56,600 SF = 1.299 AC
  - Area to Trench Drain 9 = Same area as shown in Ref. # 4 = 197,700 SF = 4.539 AC
  - Area to Trench Drain 10 = Same area as shown in Ref. # 4 = 72,000 SF = 1.653 AC
  - Area to Trench Drain 11 = Same area as shown in Ref. # 4 = 24,800 SF = 0.569 AC
  - Area to Trench Drain 15 = 46,125 = 1.059 AC

  - Area to Ditch 6 = 64825 SF = 1.488 AC

Find Flowrates:

- **Culvert 1:**

  Area attributing to culvert 1:
  - Area to Culvert 1

  Changes made to the Area to Culvert 1 since Ref. # 4 was completed:
  - Converted Unit 3 from simple cycle to combined cycle.
    - Total area remains unchanged
    - The impervious area is now 32,250 SF and was previously assumed to be 75% of the total area or 62,366.25 SF (Ref. # 2, pg. 5 of 60)
    - The aggregate surfacing area is now 50,905 SF and was previously assumed to be 25% of the total area or 20,788.75 SF (Ref. # 2, pg. 5 of 60)
    - Time of Concentration will be the same as before = 5.0 min (Ref. # 2, pg. 5 of 60)

  Effects of changes:
  - Since the actual impervious areas are less then what were assumed previously, the previous design will give a slight over estimate of the runoff and will be used in this design as well.

  Use rational method to find flow rate:
  - Q = same as calculated in Ref. # 2 = 12.37 cfs
  - **Q (area to culvert 1) = 12.37 cfs (Ref. # 2, pg. 6 of 60)**

- **Culvert 2:**

  Area attributing to culvert 2:
  - Area to Culvert 2

  Changes made to the Area to Culvert 2 since Ref. # 4 was completed:
  - Converted Unit 2 from simple cycle to combined cycle.
    - Total area remains unchanged
    - The impervious area is now 30,850 SF and was previously assumed to be 75% of the total area or 62,366.25 SF (Ref. # 2, pg. 5 of 60)
    - The aggregate surfacing area is now 52,305 SF and was previously assumed to be 25% of the total area or 20,788.75 SF (Ref. # 2, pg. 5 of 60)
    - Time of Concentration will be the same as before = 5.0 min (Ref. # 2, pg. 5 of 60)

  Effects of changes:
  - Since the actual impervious areas are less then what were assumed previously, the previous design will give a slight over estimate of the runoff and will be used in this design as well.

  Use rational method to find flow rate:
  - Q = same as calculated in Ref. # 2 = 12.37 cfs
  - **Q (area to culvert 2) = 12.37 cfs (Ref. # 2, pg. 6 of 60)**

- **Culvert 3:**

  Area attributing to culvert 3:
  - Area to Culvert 3

  Changes made to the Area to Culvert 3 since Ref. # 4 was completed:
  - No changes were made to this area.
    - Total area remains unchanged.
    - Surfacing in area remains unchanged.
    - Time of Concentration remains unchanged.

  Effects of changes:
  - Since the impervious area that was assumed previously (75%) is a conservative value, the previous design will give a slight over estimate of the runoff and will be used in this design as well.

  Use rational method to find flow rate:
  - Q = same as calculated in Ref. # 2 = 12.37 cfs
  - **Q (area to culvert 3) = 12.37 cfs (Ref. # 2, pg. 6 of 60)**

- **Trench Drain 1:**

  Area attributing to trench drain 1:
  - Area to Trench Drain 1

  Changes made to the Area to Trench Drain 1 since Ref. # 4 was completed:
  - No changes were made to this area.
    - Total area remains unchanged
    - Surfacing in area remains unchanged.
    - Time of Concentration remains unchanged.

  Effects of changes:
  - Since the impervious area that was assumed previously (75%) is a conservative value, the previous design will give a slight over estimate of the runoff and will be used in this design as well.

  Use rational method to find flow rate:
  - Q = Same as calculated in Ref. # 4 = 3.10 cfs
  - **Q (area to trench drain 1) = 3.10 cfs (Ref. # 4, pg. 6 of 39)**

- **Trench Drain 2:**

  Area attributing to trench drain 2:
  - Area to Trench Drain 2

  Changes made to the Area to Trench Drain 2 since Ref. # 4 was completed:
  - No changes were made to this area.
    - Total area remains unchanged.
    - Surfacing in area remains unchanged.
    - Time of Concentration remains unchanged.

  Effects of changes:
  - Since the impervious area that was assumed previously (75%) is a conservative value, the previous design will give a slight over estimate of the runoff and will be used in this design as well.

  Use rational method to find flow rate:
  - Q = Same as calculated in Ref. # 4 = 3.10 cfs
  - **Q (area to trench drain 2) = 3.10 cfs (Ref. # 4, pg. 6 of 39)**

- **Trench Drain 3:**

  Area attributing to trench drain 3:
  - Area to Trench Drain 3

  Changes made to the Area to Trench Drain 3 since Ref # 4 was completed:
  - No changes were made to this area.
    - Total area remains unchanged.
    - Surfacing in area remains unchanged.
    - Time of Concentration remains unchanged.

  Effects of changes:
  - Since the impervious area that was assumed previously (75%) is a conservative value, the previous design will give a slight over estimate of the runoff and will be used in this design as well.

  Use rational method to find flow rate:
  - Q = same as calculated in Ref. # 4 = 3.10 cfs
  - **Q (area to trench drain 3) = 3.10 cfs (Ref. # 4, pg. 6 of 39)**

- **Trench Drain 4:**

  Area attributing to trench drain 4:
  - Area to Trench Drain 4

  Changes made to the Area to Trench Drain 4 since Ref. # 4 was completed:
  - No changes were made to this area.
    - Total area remains unchanged.
    - Surfacing in area remains unchanged.
    - Time of Concentration remains unchanged

  Effects of changes:
  - Since this entire area remains unchanged, there will be no changes in the design flowrate.

  Use rational method to find flow rate:
  - Q = same as calculated in Ref. # 4 = 2.87 cfs
  - **Q (area to trench drain 4) = 2.87 cfs (Ref. # 4, pg. 7 of 39)**

- **Trench Drain 5:**

  Area attributing to trench drain 5:
  - Area to Trench Drain 5

  Changes made to the Area to Trench Drain 5 since Ref. # 4 was completed:
  - No changes were made to this area
    - Total area remains unchanged.
    - Surfacing in area remains unchanged.
    - Time of Concentration remains unchanged

  Effects of changes:
  - Since this entire area remains unchanged, there will be no changes in the design flowrate.

  Use rational method to find flow rate:
  - Q = same as calculated in Ref. # 4 = 3.10 cfs
  - **Q (area to trench drain 5) = 3.10 cfs (Ref. # 4, pg. 8 of 39)**

- **Trench Drain 6:**

  Area attributing to trench drain 6:
  - Area to Trench Drain 6

  Changes made to the Area to Trench Drain 6 since Ref. # 4 was completed:
  - No changes were made to this area.
    - Total area remains unchanged.
    - Surfacing in area remains unchanged.
    - Time of Concentration remains unchanged

  Effects of changes:
  - Since this entire area remains unchanged, there will be no changes in the design flowrate.

  Use rational method to find flow rate:
  - Q = same as calculated in Ref. # 4 = 3.10 cfs
  - **Q (area to trench drain 6) = 3.10 cfs (Ref. # 4, pg. 9 of 39)**

- **Trench Drain 7:**

  Area attributing to trench drain 7:
  - Area to Trench Drain 7

  Changes made to the Area to Trench Drain 7 since Ref. # 4 was completed:
  - No changes were made to this area.
    - Total area remains unchanged.
    - Surfacing in area remains unchanged.
    - Time of Concentration remains unchanged

  Effects of changes:
  - Since this entire area remains unchanged, there will be no changes in the design flowrate.

  Use rational method to find flow rate:
  - Q = same as calculated in Ref. # 4 = 3.10 cfs
  - **Q (area to trench drain 7) = 3.10 cfs (Ref. # 4, pg. 10 of 39)**

- **Trench Drain 8:**

  Area attributing to trench drain 8:
  - Area to Trench Drain 8

  Changes made to the Area to Trench Drain 8 since Ref. # 4 was completed:
  - No changes were made to this area.
    - Total area remains unchanged.
    - Surfacing in area remains unchanged.
    - Time of Concentration remains unchanged

  Effects of changes:
  - Since this entire area remains unchanged, there will be no changes in the design flowrate.

  Use rational method to find flow rate:
  - Q = same as calculated in Ref. # 4 = 3.14 cfs
  - **Q (area to trench drain 8) = 3.14 cfs (Ref. # 4, pg. 11 of 39)**

- **Trench Drain 9:**

  Area attributing to trench drain 9:
  - Area to Trench Drain 9

  Changes made to the Area to Trench Drain 9 since Ref. # 4 was completed:
  - No changes were made to this area.
    - Total area remains unchanged.
    - Surfacing in area remains unchanged.
    - Time of Concentration remains unchanged

  Effects of changes:
  - Since this entire area remains unchanged, there will be no changes in the design flowrate.

  Use rational method to find flow rate:
  - Q = same as calculated in Ref. # 4 = 8.50 cfs
  - **Q (area to trench drain 9) = 8.50 cfs (Ref. # 4, pg. 6 of 39)**

- **Trench Drain 10:**

  Area attributing to trench drain 10:
  - Area to Trench Drain 3
  - Area to Trench Drain 7
  - Area to Trench Drain 8
  - Area to Trench Drain 9
  - Area to Trench Drain 10

  Changes made to the Area to Trench Drain 10 since Ref. # 4 was completed:
  - No changes were made to this area.
    - Total area remains unchanged.
    - Surfacing in area remains unchanged.
    - Time of Concentration remains unchanged

  Effects of changes:
  - Since this entire area remains unchanged, there will be no changes in the design flowrate.

  Use rational method to find flow rate:
  - Q = same as calculated in Ref. # 4 = 2.98 cfs
  - **Q (area to trench drain 10) = 2.98 cfs (Ref. # 4, pg. 12 of 39)**
  - Total Q going through trench drain 10 is the same as calculated in Ref. # 4 (20.82 cfs) since there were no changes to the flowrate from any of the contributing areas.
  - **Total Q going through trench drain 10 = 20.82 cfs (Ref. # 4, pg. 12 of 39)**

- **Trench Drain 11:**

Area attributing to trench drain 11:

- Area to Trench Drain 2
- Area to Trench Drain 6
- Area to Trench Drain 11
- Area to Trench Drain 10

Changes made to the Area to Trench Drain 11 since Ref. # 4 was completed:

- No changes were made in this area.
  - Total area remains unchanged.
  - Surfacing in area remains unchanged.
  - Time of Concentration remains unchanged

Effects of changes:

- Since this entire area remains unchanged, there will be no changes in the design flowrate.

Use rational method to find flow rate:

- Q = same as calculated in Ref. # 4 = 3.19 cfs
- **Q (area to trench drain 11) = 3.19 cfs (Ref. # 4, pg. 13 of 39)**
- Total Q going through trench drain 11 is the same as calculated in Ref. # 4 (30.21 cfs) since there were no changes to the flowrate from any of the contributing areas.
- **Total Q going through trench drain 11 = 30.21 cfs (Ref. # 4, pg. 13 of 39)**

- **Culvert 6:**

Area attributing to culvert 6:

- Area to Trench Drain 1
- Area to Trench Drain 4
- Area to Trench Drain 5
- Area to Culvert 6
- All areas which contributed to trench drain 11

Changes made to the Area to Culvert 6 since Ref. # 4 was completed:

- No changes were made in this area
  - Total area remains unchanged.
  - Surfacing in area remains unchanged.
  - Time of Concentration remains unchanged

Effects of changes:

- Since this entire area remains unchanged, there will be no changes in the design flowrate.

Use rational method to find flow rate:

- Q = same as calculated in Ref. # 4 = 2.79 cfs
- **Q (area to culvert 6) = 2.79 cfs (Ref. # 4, pg. 14 of 39)**
- Total Q going through culvert 6 is the same as calculated in Ref. # 4 (42.07 cfs) since there were no changes to the flowrate from any of the contributing areas.
- **Total Q going through culvert 6 = 42.07 cfs (Ref. # 4, pg. 14 of 39)**

- **Trench Drain 15:**

Area attributing to trench drain 15:

- Area to Trench Drain 15

Changes made to the Area to Trench Drain 15 since Ref. # 4 was completed:

- The steam turbine (ST) building was added to this area and the plant loop road was extended around the ST building.
- The area previously sheet flowed into ditch 4 and to culvert 7. A trench drain has now been added to transfer the water across the plant loop road on the south side of the ST building.

Use rational method to find flow rate:

Rational Method

- Q = CIA (Ref # 5, pg. 14-7)
  - Q = Flowrate, cfs
  - C = Runoff coefficient
  - I = Rainfall Intensity, in/hr
  - A = Area, Acres (AC)
- C Values: (Ref. # 5, pg. 14-8)
  - C (impervious) = 0.95
  - C (aggregate surfacing) = 0.40
  - C (grass) = 0.20
- Find weighted C value
  - Refer to Figure D, page 23, for illustration of site surfacing plan.
  - Impervious area within the area to trench drain 15 = 23,500 SF
  - Rest of area = aggregate surfacing
  - Calculated percent impervious = (23,500 SF/ 46,125 SF) = 50.9%
    - Will add an additional 5% to the impervious area for a conservative design
    - **Percent Impervious = 50.9 % +5 % = 55.9%**
  - Calculated percent aggregate surfacing = 100% - 55.9% = 44.1%
    - **Percent Aggregate Surfacing = 44.1%**
  - Cw = [(0.559 x 0.95) + (0.441 x 0.40)] = 0.71
    - **Cw = 0.71**
- Find Time of Concentration (Tc):
  - Use TR55 software (Ref. # 6)
  - Refer to TR55 out put on page 24.
  - Inputs into TR55:
    - 235' of sheet flow at 0.01 ft/ft on aggregate surfacing (smooth surface)
  - Tc = 0.04 hours or 2.4 minutes – will round up to a minimum of 5 minutes
    - **Tc = 5 minutes**
- Determine Rainfall Intensity (I):
  - Refer to Frequency – Duration – Intensity chart (Ref # 7)
    See page 25 for a copy of the above chart.
  - Tc = 5 min
  - Design Storm = 25 year – 24 hour
    - **I = 8.0 in/hr**
- Apply Rational Method:
  - Q = CIA
  - Q = (0.71) (8.0 in/hr) (1.059 AC) = 6.02 cfs
    - **Q (area to trench drain 15) = 6.02 cfs**

- **Culvert 11:**

Area attributing to culvert 11:

- Area to culvert 11

Changes made to the Area to Culvert 11 since Ref. # 4 was completed:

- The steam turbine (ST) building was added to this area and the plant loop road was extended around the ST building.
- The area previously sheet flowed into ditch 4 and to culvert 7. A trench drain has now been added to transfer the water across the plant loop road on the north side of the ST building.

Use rational method to find flow rate:

Rational Method

- Q = CIA (Ref # 5, pg. 14-7)
  - Q = Flowrate, cfs
  - C = Runoff coefficient
  - I = Rainfall Intensity, in/hr
  - A = Area, Acres (AC)
- C Values: (Ref. # 5, pg. 14-8)
  - C (impervious) = 0.95
  - C (aggregate surfacing) = 0.40
  - C (grass) = 0.20
- Find weighted C value
  - Refer to Figure D, page 23, for illustration of site surfacing plan.
  - Impervious area within the area to culvert 11 = 33,500 SF
  - Rest of area = aggregate surfacing
  - Calculated percent impervious = (33,500 SF/ 75,550 SF) = 44.3%
    - Will add an additional 5% to the impervious area for a conservative design
    - **Percent Impervious = 44.3 % + 5 % = 49.3%**
  - Calculated percent aggregate surfacing = 100% - 49.3% = 50.7%
    - **Percent Aggregate Surfacing = 50.7%**
  - Cw = [(0.493 x 0.95) + (0.507 x 0.40)] = 0.67
    - **Cw = 0.67**
- Find Time of Concentration (Tc):
  - Use TR55 software (Ref. # 6)
  - Refer to TR55 out put on page 24.
  - Inputs into TR55:
    - 300' of sheet flow at 0.0033 ft/ft on aggregate surfacing (smooth surface)
    - 135' of shallow concentrated flow at 0.01 ft/ft on aggregate surfacing
  - Tc = 0.10 hours = 6 minutes
    - **Tc = 6 minutes**
- Determine Rainfall Intensity (I):
  - Refer to Frequency – Duration – Intensity chart (Ref # 7)
    See page 25 for a copy of the above chart.
  - Tc = 6 min
  - Design Storm = 25 year – 24 hour
    - **I = 7.9 in/hr**
- Apply Rational Method:
  - Q = CIA
  - Q = (0.67) (7.9 in/hr) (1.734 AC) = 9.18 cfs
    - **Q (area to culvert 11) = 9.18 cfs**

- **Culvert 7:**

Area attributing to culvert 7:

- All areas which contributed to culvert 6
- Area to Trench Drain 15
- Area to Culvert 7
- Area to Culvert 11

Changes made to the Area to Culvert 7 since Ref. # 4 was completed:

- Area to Culvert 7 has become smaller with the addition of trench drain 15 and culvert 11.

Use rational method to find flow rate for the area to culvert 7:

Rational Method

- Q = CIA (Ref # 5, pg. 14-7)
  - Q = Flowrate, cfs
  - C = Runoff coefficient
  - I = Rainfall Intensity, in/hr
  - A = Area, Acres (AC)
- C Values: (Ref. # 5, pg. 14-8)
  - C (impervious) = 0.95
  - C (aggregate surfacing) = 0.40
  - C (grass) = 0.20
- Find weighted C value
  - Refer to Figure D, page 23, for illustration of site surfacing plan.
  - Impervious area within the area to culvert 7 = 61,500 SF
  - Aggregate Surfacing within the area to culvert 7 = 27,750 SF
  - Rest of area = grass
  - Calculated percent impervious = (61,500 SF/ 164,760 SF) = 37.3%
    - Will add an additional 5% to the impervious area for a conservative design
    - **Percent Impervious = 37.3 % +5 % = 42.3%**
  - Calculated percent aggregate surfacing = (27,750 SF/ 164,760 SF) = 16.8%
    - Will add an additional 5% to the aggregate surfacing area for a conservative design
    - **Percent Aggregate Surfacing = 16.8 % +5 % = 21.8%**
  - Calculated percent grass = 100% - 42.3% - 21.8% = 35.9%
    - **Percent Grass = 35.9%**
  - Cw = [(0.423 x 0.95) + (0.218 x 0.40) + (0.359 x 0.20)] = 0.56
    - **Cw = 0.56**
- Find Time of Concentration (Tc):
  - Use TR55 software (Ref. # 6)
  - Refer to TR55 out put on page 24.
  - Inputs into TR55:
    - 150' of sheet flow at 0.01 ft/ft on grass
    - 1090' of channel flow at 0.0025 ft/ft at a velocity of 5.44 fps (from page 14 of this calculation)
  - Tc = 0.30 hours = 18 minutes
    - **Tc = 18 minutes**
- Determine Rainfall Intensity (I):
  - Refer to Frequency – Duration – Intensity chart (Ref # 7)
    See page 25 for a copy of the above chart.
  - Tc = 18 min
  - Design Storm = 25 year – 24 hour
    - **I = 6.0 in/hr**
- Apply Rational Method:
  - Q = CIA
  - Q = (0.56) (6.0 in/hr) (3.782 AC) = 12.71 cfs
    - **Q (area to culvert 7) = 12.71 cfs**
- Total Q going through culvert 7 = Q (Going through culvert 6) + Q (area to trench drain 15) + Q (area to culvert 11) + Q (area to culvert 7)
  - Total Q = 42.07 cfs + 6.02 cfs + 9.18 cfs + 12.71 cfs = 69.98 cfs
  - **Total Q = 69.98 cfs**

- **Culvert 10:**

Area attributing to culvert 10:

- Area to Culvert 10

Changes made to the Area to Culvert 10 since Ref. # 4 was completed:

- A cooling tower has been added to the site and a road will be crossing the existing ditch 5 to obtain access to the cooling tower.
- The self-contained area around the fuel oil tanks also reduced in size with the removal of a fuel oil tank.

Use rational method to find flow rate:

Rational Method

- Q = CIA (Ref # 5, pg. 14-7)
  - Q = Flowrate, cfs
  - C = Runoff coefficient
  - I = Rainfall Intensity, in/hr
  - A = Area, Acres (AC)
- C Values: (Ref. # 5, pg. 14-8)
  - C (impervious) = 0.95
  - C (aggregate surfacing) = 0.40
  - C (grass) = 0.20
- Find weighted C value
  - Refer to Figure D, page 23, for illustration of site surfacing plan.
  - Impervious area within the area to culvert 10 = 43,750 SF
  - Aggregate Surfacing within the area to culvert 10 = 40,000 SF
  - Rest of area = grass
  - Calculated percent impervious = (43,750 SF/ 159,190 SF) = 27.5 %
    - Will add an additional 5% to the impervious area for a conservative design
    - **Percent Impervious = 27.5 % +5 % = 32.5%**
  - Calculated percent aggregate surfacing = (40,000 SF/ 159,190 SF) = 25.1%
    - Will add an additional 5% to the aggregate surfacing area for a conservative design
    - **Percent Aggregate Surfacing = 25.1 % +5 % = 30.1%**
  - Calculated percent grass = 100% - 32.5% - 30.1% = 37.4%
    - **Percent Grass = 37.4%**
  - Cw = [(0.325 x 0.95) + (0.301 x 0.40) + (0.374 x 0.20)] = 0.50
    - **Cw = 0.50**
- Find Time of Concentration (Tc):
  - Use TR55 software (Ref. # 6)
  - Refer to TR55 out put on page 24.
  - Inputs into TR55:
    - 210' of sheet flow at 0.005 ft/ft on grass
    - 300' of shallow concentrated flow at 0.005 ft/ft on grass
    - 310' of open channel flow at 0.0025 ft/ft at a velocity of 2.75 fps (from page 15 of this calculation)
  - Tc = 0.53 hours = 32 minutes
    - **Tc = 32 minutes**
- Determine Rainfall Intensity (I):
  - Refer to Frequency – Duration – Intensity chart (Ref # 7)
    See page 25 for a copy of the above chart.
  - Tc = 32 min
  - Design Storm = 25 year – 24 hour
    - **I = 4.8 in/hr**
- Apply Rational Method:
  - Q = CIA
  - Q = (0.50) (4.8 in/hr) (3.654 AC) = 8.77 cfs
    - **Q (area to culvert 10) = 8.77 cfs**

- **Area to Ditch 6:**

Area attributing to Ditch 6:

- Area to Ditch 6

Changes made to the Area to Ditch 6 since Ref. # 4 was completed:

- Area has increased due to the placement of the circulating waterlines.

Use rational method to find flow rate:

Rational Method

- Q = CIA (Ref # 5, pg. 14-7)
  - Q = Flowrate, cfs
  - C = Runoff coefficient
  - I = Rainfall Intensity, in/hr
  - A = Area, Acres (AC)
- C Values: (Ref. # 5, pg. 14-8)
  - C (impervious) = 0.95
  - C (aggregate surfacing) = 0.40
  - C (grass) = 0.20
- Find weighted C value
  - Refer to Figure D, page 23, for illustration of site surfacing plan.
  - Impervious area within the area to ditch 6 = 33,500 SF
  - Rest of area = grass
  - Calculated percent impervious = (33,500 SF/ 64,825 SF) = 51.7 %
    - Will add an additional 5% to the impervious area for a conservative design
    - **Percent Impervious = 51.7 % +5 % = 56.7%**
  - Calculated percent aggregate surfacing = (4,000 SF/ 64,825 SF) = 6.2 %
    - Will add an additional 5% to the impervious area for a conservative design
    - **Percent Impervious = 6.2 % +5 % = 11.2%**
  - Calculated percent grass = 100% - 56.7% - 11.2% = 32.1%
    - **Percent Grass = 32.1%**
  - Cw = [(0.567 x 0.95) + (0.112 x 0.40) + (0.321 x 0.20)] = 0.65
    - **Cw = 0.65**
- Find Time of Concentration (Tc):
  - Use TR55 software (Ref. # 6)
  - Refer to TR55 out put on page 24.
  - Inputs into TR55:
    - 220' of sheet flow at 0.005 ft/ft on aggregate
  - Tc = 0.05 hours = 3 minutes – will round up to a minimum of 5 minutes.
    - **Tc = 5 minutes**
- Determine Rainfall Intensity (I):
  - Refer to Frequency – Duration – Intensity chart (Ref # 7)
    See page 25 for a copy of the above chart.
  - Tc = 5 min
  - Design Storm = 25 year – 24 hour
    - **I = 8.0 in/hr**
- Apply Rational Method:
  - Q = CIA
  - Q = (0.65) (8.0 in/hr) (1.488 AC) = 7.74 cfs
    - **Q (area to ditch 6) = 7.74 cfs**

Verify Ditch Capacity:

- Refer to diagram on page 26 of this calculation for illustration of ditch labels.

- **Ditch 1:**
  - There are no changes made to this ditch or to the flow coming into this ditch.
    - **Design in Ref. # 4 on page 16 of 39 will still be adequate.**
- **Ditch 2:**
  - There are no changes made to this ditch or to the flow coming into this ditch.
    - **Design in Ref. # 4 on page 16 of 39 will still be adequate.**
- **Ditch 3:**
  - There are no changes made to this ditch or to the flow coming into this ditch.
    - **Design in Ref. # 4 on page 17 of 39 will still be adequate.**
- **Ditch 4:**
  - Use FlowMaster software (Ref. # 8) to determine depth and velocity in channel.
    - Inputs:
      - n value (concrete lined ditch) = 0.013 (Ref. # 8)
      - Channel slope = 0.25%
      - Left and right side slopes = 3 : 1 (H : V)
      - Bottom width = 5 feet
      - Q in ditch 4 = Q entering culvert at end of ditch 4 for maximum water in ditch at any time.
        Q in ditch 4 = Q going through culvert 7
        Q in ditch 4 = 69.98 (from page 11 of this calculation)
    - Outputs:
      - Channel depth = 1.40 feet
      - Velocity = 5.44 ft/sec
    - Analysis of output for channel depth:
      - Lowest height in the ditch = 2.64
      - Lowest height in ditch > Channel depth
      - Height in ditch satisfies the needed flow capacity
    - Analysis of output for velocity:
      - Max permissible velocity (max velocity that will not cause erosion) is a factor not to be considered in a concrete lined channel. (Ref. # 9)
      - Minimum permissible velocity (non-silting velocity) = 2.0 – 3.0 ft/sec (Ref. # 9)
        - Velocity (5.44 ft/sec) > Min. Permissible velocity (3.0 ft/sec)
      - Velocity is adequate
    - See Appendix A for FlowMaster Output.

- **Ditch 5:**
  - Use FlowMaster software (Ref. # 8) to determine depth and velocity in channel.
    - Inputs
      - n value (concrete lined ditch) = 0.013 (Ref. # 8)
      - Channel slope = 0.20%
      - Left and right side slopes = 3 : 1 (H : V)
      - Bottom width = 5 feet
      - Q in ditch 5 = Q entering culvert at the end of ditch 5 for maximum water in ditch at any time.
        Q in ditch 5 = Q going through culvert 10
        Q in ditch 5 = 8.77 cfs (from page 12 of this calculation)
    - Outputs
      - Channel depth = 0.49 feet
      - Velocity = 2.75 ft/sec
    - Analysis of output for channel depth:
      - Lowest height in the ditch = 1.0 feet
      - Lowest height in ditch > Channel depth
      - Height in ditch satisfies the needed flow capacity
    - Analysis of output for velocity
      - Max permissible velocity (max velocity that will not cause erosion) is a factor not to be considered in a concrete lined channel. (Ref. # 9)
      - Minimum permissible velocity (non-silting velocity) = 2.0 – 3.0 ft/sec (Ref. # 9)
        - Velocity (2.75 ft/sec) > Min. Permissible velocity (2.0 ft/sec)
      - Velocity is adequate
    - See Appendix A for FlowMaster Output.
- **Ditch 6:**
  - Use FlowMaster software (Ref. # 8) to determine depth and velocity in channel.
    - Inputs:
      - n value (concrete lined ditch) = 0.013 (Ref. # 8)
      - Channel slope = 0.20%
      - Left and right side slopes = 3 : 1 (H : V)
      - Bottom width = 5 feet
      - Q in ditch 6 = Q going through culverts 1-3, culvert 10, and the Area to Ditch 6.
        Q in ditch 6 = 12.37 cfs each for culverts 1 thru 3 + 8.77 cfs for culvert 10 + 7.74 cfs for ditch 6
        Q in ditch 6 = 53.62 cfs (from pages 3, 4, 12, and 13 of this calculation)
    - Outputs:
      - Channel depth = 1.29 feet
      - Velocity = 4.66 ft/sec
    - Analysis of output for channel depth:
      - Lowest height in the ditch = 2.52 feet
      - Lowest height in ditch > Channel depth
      - Height in ditch satisfies the needed flow capacity
    - Analysis of output for velocity:
      - Max permissible velocity (max velocity that will not cause erosion) is a factor not to be considered in a concrete lined channel. (Ref. # 9)
      - Minimum permissible velocity (non-silting velocity) = 2.0 – 3.0 ft/sec (Ref. # 9)
        - Velocity (4.66 ft/sec) > Min. Permissible velocity (3.0 ft/sec)
      - Velocity is adequate
    - See Appendix A for FlowMaster Output.

- **Ditch 7:**
  - Use FlowMaster software (Ref. # 8) to determine depth and velocity in channel.
    - Inputs:
      - n value (concrete lined ditch) = 0.013 (Ref. # 8)
      - Channel slope = 0.25%
      - Left and right side slopes = 3 : 1 (H : V)
      - Bottom width = 5 feet
      - Q in ditch 7 = Q entering pond.
        Q in ditch 7 = flow in ditch 4 + flow in ditch 6
        Q in ditch 7 = 123.60 cfs (from pages 14 and 15 of this calculation)
    - Outputs:
      - Channel depth = 1.85 feet
      - Velocity = 6.34 ft/sec
    - Analysis of output for channel depth:
      - Lowest height in the ditch = 3.25 feet
      - Lowest height in ditch > Channel depth
      - Height in ditch satisfies the needed flow capacity
    - Analysis of output for velocity:
      - Max permissible velocity (max velocity that will not cause erosion) is a factor not to be considered in a concrete lined channel. (Ref. # 9)
      - Minimum permissible velocity (non-silting velocity) = 2.0 – 3.0 ft/sec (Ref. # 9)
        - Velocity (6.34 ft/sec) > Min. Permissible velocity (3.0 ft/sec)
      - Velocity is adequate
    - See Appendix A for FlowMaster Output.
- **Ditch 8:**
  - Use FlowMaster software (Ref. # 8) to determine depth and velocity in channel.
    - Inputs:
      - n value (concrete lined ditch) = 0.013 (Ref. # 8)
      - Channel slope = 0.25%
      - Left and right side slopes = 3 : 1 (H : V)
      - Bottom width = 5 feet
      - Q in ditch 8 = One half of Q going to Culvert 7 is a very conservative value and will be used.
        Q in ditch 8 = 69.98/2 cfs (from page 11 of this calculation)
        Q in ditch 8 = 34.99 cfs
    - Outputs:
      - Channel depth = 0.98 feet
      - Velocity = 4.49 ft/sec
    - Analysis of output for channel depth:
      - Lowest height in the ditch = 1.0 feet
      - Lowest height in ditch > Channel depth
      - Height in ditch satisfies the needed flow capacity
    - Analysis of output for velocity:
      - Max permissible velocity (max velocity that will not cause erosion) is a factor not to be considered in a concrete lined channel. (Ref. # 9)
      - Minimum permissible velocity (non-silting velocity) = 2.0 – 3.0 ft/sec (Ref. # 9)
        - Velocity (4.49 ft/sec) > Min. Permissible velocity (3.0 ft/sec)
      - Velocity is adequate
    - See Appendix A for FlowMaster Output.

Size Culverts/Check Velocities:

- Refer to Figure E, page 22, for culvert call outs.
- **Culvert 1:**
  - There are no changes made to the flows entering this culvert or to the grades of the invert or outlet.
    - **Design in Ref. # 4 on page 20 of 39 will still be adequate.**
- **Culvert 2:**
  - There are no changes made to the flows entering this culvert or to the grades of the invert or outlet.
    - **Design in Ref. # 4 on page 20 of 39 will still be adequate.**
- **Culvert 3:**
  - There are no changes made to the flows entering this culvert or to the grades of the invert or outlet.
    - **Design in Ref. # 4 on page 20 of 39 will still be adequate.**
- **Culvert 6:**
  - There are no changes made to the flows entering this culvert or to the grades of the invert or outlet.
    - **Design in Ref. # 4 on page 20 of 39 will still be adequate.**
- **Culvert 7:**
  - Culverts were sized using CulvertMaster software (Ref. # 10) to determine the required number and size of culverts, the velocity out of the culverts, and the headwater elevation at the culverts.
    - Inputs:
      - Invert of culvert
        - Up Stream Invert = 81.78 feet
        - Down Stream Invert = 81.50 feet
      - Length of Culvert = 62.25 feet
      - Tailwater Properties
        - Culvert outlet is entering ditch number 7 at a 90 degree angle.
        - Tailwater will be set at a constant elevation equal to the depth of water in ditch 7 (calculated on page 16 of this calculation = 1.85 ft) above the outlet of the culvert
        - Tailwater Elevation = 81.50 + 1.85 = 83.35 ft.
      - Q going through Culvert 7 (from page 11 of this calculation) = 69.98 cfs
      - Maximum allowable headwater = 85.25 feet
      - Inlet Type = Groove end projecting
    - Outputs:
      - **Number of culverts needed = 2 RCP class 5 culverts**
      - **Size of culverts needed = 30 inch diameter**
      - Velocity out of the culverts = 8.28 ft/sec
      - Tailwater Elevation = 83.35 feet
      - Headwater Elevation = 85.14 feet
    - Analysis of output for channel depth:
      - Maximum allowable headwater is 85.25 to keep from getting into the subgrade of the road.
      - Headwater elevation < Maximum allowable headwater elevation
      - Design is adequate.
    - Analysis of velocity out of culvert:
      - Max permissible velocity (max velocity that will not cause erosion) is a factor not to be considered in a concrete lined channel. (Ref. # 9)
      - Minimum permissible velocity (non-silting velocity) = 2.0 – 3.0 ft/sec (Ref. # 9)
        - Velocity (8.28 ft/sec) > Min. Permissible velocity (3.0 ft/sec)
      - Velocity is adequate.
    - See Appendix B for CulvertMaster Output.

- **Culvert 10:**
  - Culverts were sized using CulvertMaster software (Ref. # 10) to determine the required number and size of culverts, the velocity out of the culverts, and the headwater elevation at the culverts.
    - Inputs:
      - Invert of culvert
        - Up Stream Invert = 83.35 feet
        - Down Stream Invert = 83.23 feet
      - Length of Culvert = 60.40 feet
      - Tailwater Properties
        - Trapezoidal Shaped Channel
        - Slope = 0.20%
        - Side Slopes = 3 : 1 (H : V)
        - Mannings Coefficient (Concrete Lined Ditch) = 0.013 (Ref. # 10)
        - Bottom Width = 5 feet
      - Q going through Culvert 10 (from page 12 of this calculation) = 8.77 cfs
      - Maximum headwater allowed = 85.00 feet
      - Inlet Type = Groove end projecting
    - Outputs:
      - **Number of culverts needed = 2 RCP class 5 culverts**
      - **Size of culverts needed = 15 inch diameter**
      - Velocity out of the culverts = 4.94 ft/sec
      - Tailwater Elevation = 83.72 feet
      - Headwater Elevation = 84.77 feet
    - Analysis of output for channel depth:
      - Maximum allowable headwater is 85.00 feet to keep from getting into the subgrade of the road.
      - Headwater elevation < Maximum allowable headwater elevation
      - Design is adequate.
    - Analysis of velocity out of culvert:
      - Max permissible velocity (max velocity that will not cause erosion) is a factor not to be considered in a concrete lined channel. (Ref. # 9)
      - Minimum permissible velocity (non-silting velocity) = 2.0 – 3.0 ft/sec (Ref. # 9)
        - Velocity (4.94 ft/sec) > Min. Permissible velocity (3.0 ft/sec)
      - Velocity is adequate.
    - See Appendix B for CulvertMaster Output.

- **Culvert 11:**
  - Culverts were sized using CulvertMaster software (Ref. # 10) to determine the required number and size of culverts, the velocity out of the culverts, and the headwater elevation at the culverts.
    - Inputs:
      - Invert of culvert
        - Up Stream Invert = 83.50 feet
        - Down Stream Invert = 81.93 feet
      - Length of Culvert = 55.25 feet
      - Tailwater Properties
        - Culvert outlet is entering ditch number 4 at a 90 degree angle.
        - Tailwater will be set at a constant elevation equal to the depth of water in ditch 4 (calculated on page 14 of this calculation = 1.40 ft) above the outlet of the culvert
        - Tailwater Elevation = 81.93 + 1.40 = 83.33 ft.
      - Q going through Culvert 11 (from page 10 of this calculation) = 9.18 cfs
      - Maximum headwater allowed = 85.50 feet
      - Inlet Type = Groove end projecting
    - Outputs:
      - **Number of culverts needed = 1 RCP class 5 culverts**
      - **Size of culverts needed = 18 inch diameter**
      - Velocity out of the culverts = 5.35 ft/sec
      - Tailwater Elevation = 83.33 feet
      - Headwater Elevation = 85.39 feet
    - Analysis of output for channel depth:
      - Maximum allowable headwater is 85.50 feet to keep from getting into equipment in the area of unit 4.
      - Headwater elevation < Maximum allowable headwater elevation
      - Design is adequate.
    - Analysis of velocity out of culvert:
      - Max permissible velocity (max velocity that will not cause erosion) is a factor not to be considered in a concrete lined channel. (Ref. # 9)
      - Minimum permissible velocity (non-silting velocity) = 2.0 – 3.0 ft/sec (Ref. # 9)
        - Velocity (5.35 ft/sec) > Min. Permissible velocity (3.0 ft/sec)
      - Velocity is adequate.
    - See Appendix B for CulvertMaster Output.

Verify Size of Trench Drains:

- Refer to Figure E, page 22, for trench drain call outs.
- **Trench Drain 1:**
  - There are no changes made to the flows entering this trench drain or to the grades of the invert or outlet.
    - **Design in Ref. # 4 on page 21 of 39 will still be adequate.**
- **Trench Drain 2:**
  - There are no changes made to the flows entering this trench drain or to the grades of the invert or outlet.
    - **Design in Ref. # 4 on page 21 of 39 will still be adequate.**
- **Trench Drain 3:**
  - There are no changes made to the flows entering this trench drain or to the grades of the invert or outlet.
    - **Design in Ref. # 4 on page 21 of 39 will still be adequate.**
- **Trench Drain 4:**
  - There are no changes made to the flows entering this trench drain or to the grades of the invert or outlet.
    - **Design in Ref. # 4 on page 22 of 39 will still be adequate.**
- **Trench Drain 5:**
  - There are no changes made to the flows entering this trench drain or to the grades of the invert or outlet.
    - **Design in Ref. # 4 on page 22 of 39 will still be adequate.**
- **Trench Drain 6:**
  - There are no changes made to the flows entering this trench drain or to the grades of the invert or outlet.
    - **Design in Ref. # 4 on page 22 of 39 will still be adequate.**
- **Trench Drain 7:**
  - There are no changes made to the flows entering this trench drain or to the grades of the invert or outlet.
    - **Design in Ref. # 4 on page 22 of 39 will still be adequate.**
- **Trench Drain 8:**
  - There are no changes made to the flows entering this trench drain or to the grades of the invert or outlet.
    - **Design in Ref. # 4 on page 23 of 39 will still be adequate.**
- **Trench Drain 9:**
  - There are no changes made to the flows entering this trench drain or to the grades of the invert or outlet.
    - **Design in Ref. # 4 on page 23 of 39 will still be adequate.**
- **Trench Drain 10:**
  - There are no changes made to the flows entering this trench drain or to the grades of the invert or outlet.
    - **Design in Ref. # 4 on page 24 of 39 will still be adequate.**
- **Trench Drain 11:**
  - There are no changes made to the flows entering this trench drain or to the grades of the invert or outlet.
    - **Design in Ref. # 4 on page 24 of 39 will still be adequate.**

- **Trench Drain 15:**
  - Flow going through trench drain 15 = 6.02 cfs (found on page 9 of this calculation)
  - Analyze as open channel flow in FlowMaster (Ref. # 8)
    - Assume channel with no side slopes (rectangular channel) and a worst case cross section.
  - Inputs:
    - n = 0.013 for concrete (Ref. # 8)
    - Slope = 0.05 ft/ft
    - Bottom width = 1.0 ft
    - Q = 6.02 cfs
  - Outputs:
    - Channel Depth = 0.57 ft
    - Velocity = 10.58 ft/sec
  - Analysis of output for channel depth:
    - Lowest Height in the trench drain = 1.5 feet
    - Lowest height in trench drain > Channel Depth
    - Height in trench drain satisfies the needed flow capacity
  - Analysis of output for velocity:
    - Max permissible velocity (max velocity that will not cause erosion) is a factor not to be considered in a concrete lined channel. (Ref. # 9)
    - Minimum permissible velocity (nonsilting velocity) = 2.0 – 3.0 ft/sec (Ref. # 9)
      - Velocity (10.58 ft/sec) > Min Permissible Velocity (3.0 ft/sec)
      - Velocity is adequate
  - See Appendix A for FlowMaster outputs.

2 OVERSIZE DOCUMENT WAS REMOVED AND INSERTED INTO OCULUS SEPARATELY.

TIME OF CONCENTRATION AND TRAVEL TIME Version 2.10

Project : JEA - Brandy Branch Station User: JMS Date: 11-08-2000

County : Duval State: FL Checked: ____ Date: _____

Subtitle: Tc for culverts and trench drains

Subarea #1 - TD-15

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	4.75	235	.01	A					0.043

Time of Concentration = 0.04*

Subarea #2 - C-11

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	4.75	300	.0033	A					0.082
Shallow Concent'd		135	.01	P					0.018

Time of Concentration = 0.10*

Subarea #3 - C-7

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	4.75	150	.01	E					0.245
Open Channel		1090						5.44	0.056

Time of Concentration = 0.30*

Subarea #4 - C-10

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	4.75	210	.005	E					0.422
Shallow Concent'd		300	.005	U					0.073
Open Channel		310						2.75	0.031

Time of Concentration = 0.53*

Subarea #5 - D-6

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	4.75	220	.005	A					0.054

Time of Concentration = 0.05*

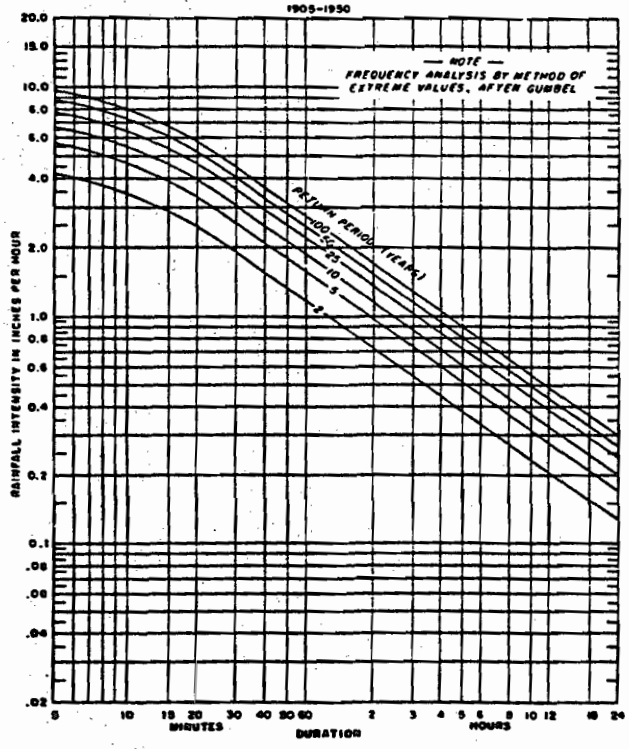
--- Sheet Flow Surface Codes ---

A Smooth Surface	F Grass, Dense	--- Shallow Concentrated ---
B Fallow (No Res.)	G Grass, Burmuda	--- Surface Codes ---
C Cultivated < 20 % Res.	H Woods, Light	P Paved
D Cultivated > 20 % Res.	I Woods, Dense	U Unpaved
E Grass-Range, Short	J Range, Natural	

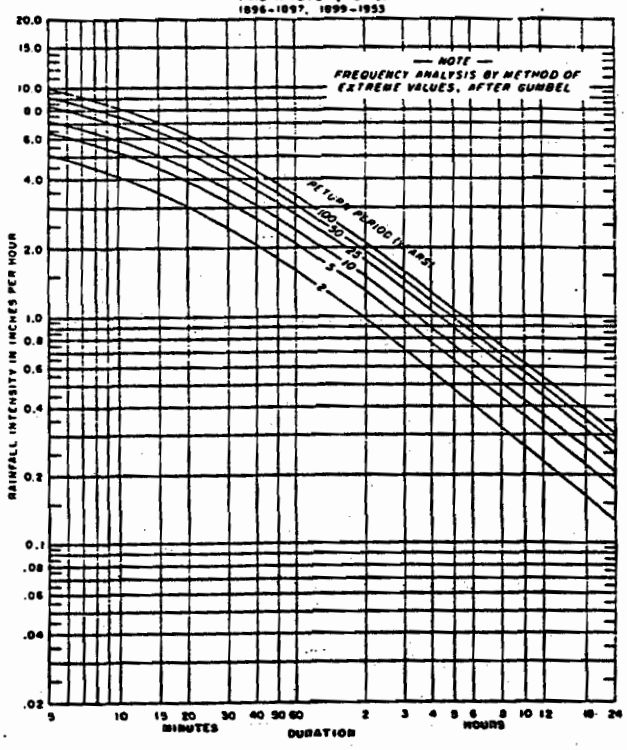
25

RAINFALL INTENSITY-DURATION-FREQUENCY CURVES

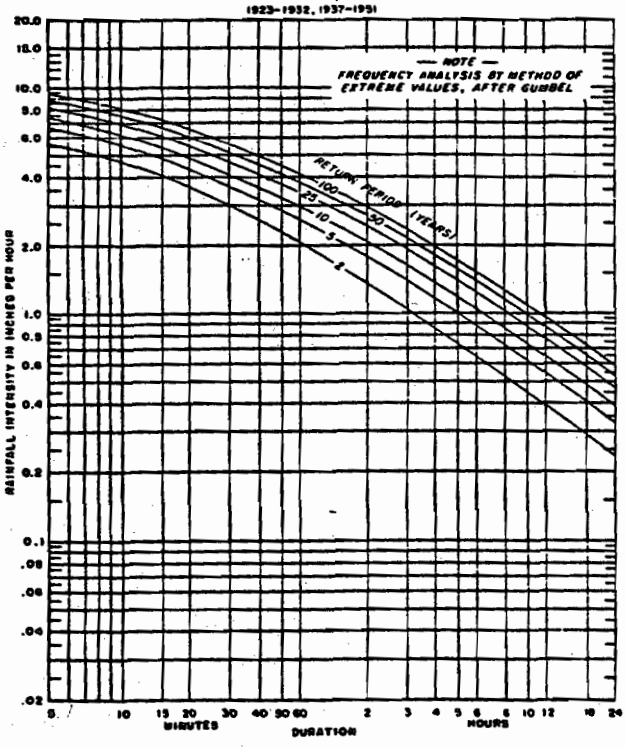
NEW HAVEN, CONNECTICUT
1905-1950



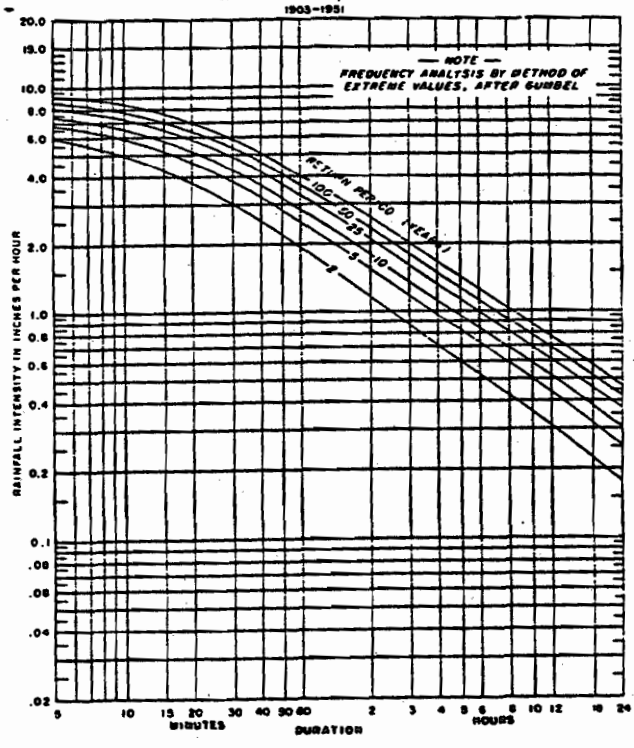
WASHINGTON, D. C.
1896-1897, 1899-1953



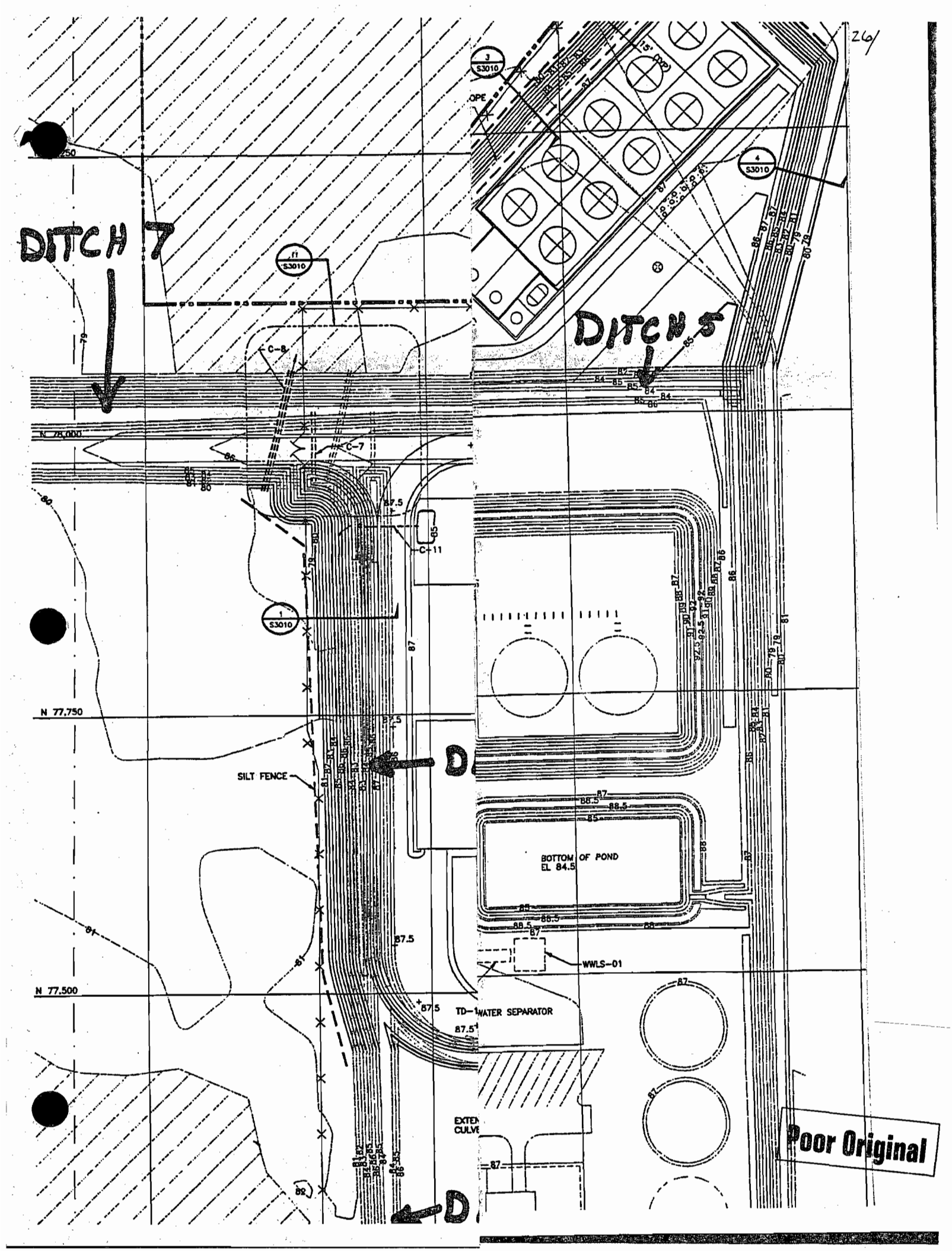
APALACHICOLA, FLORIDA
1923-1932, 1937-1951



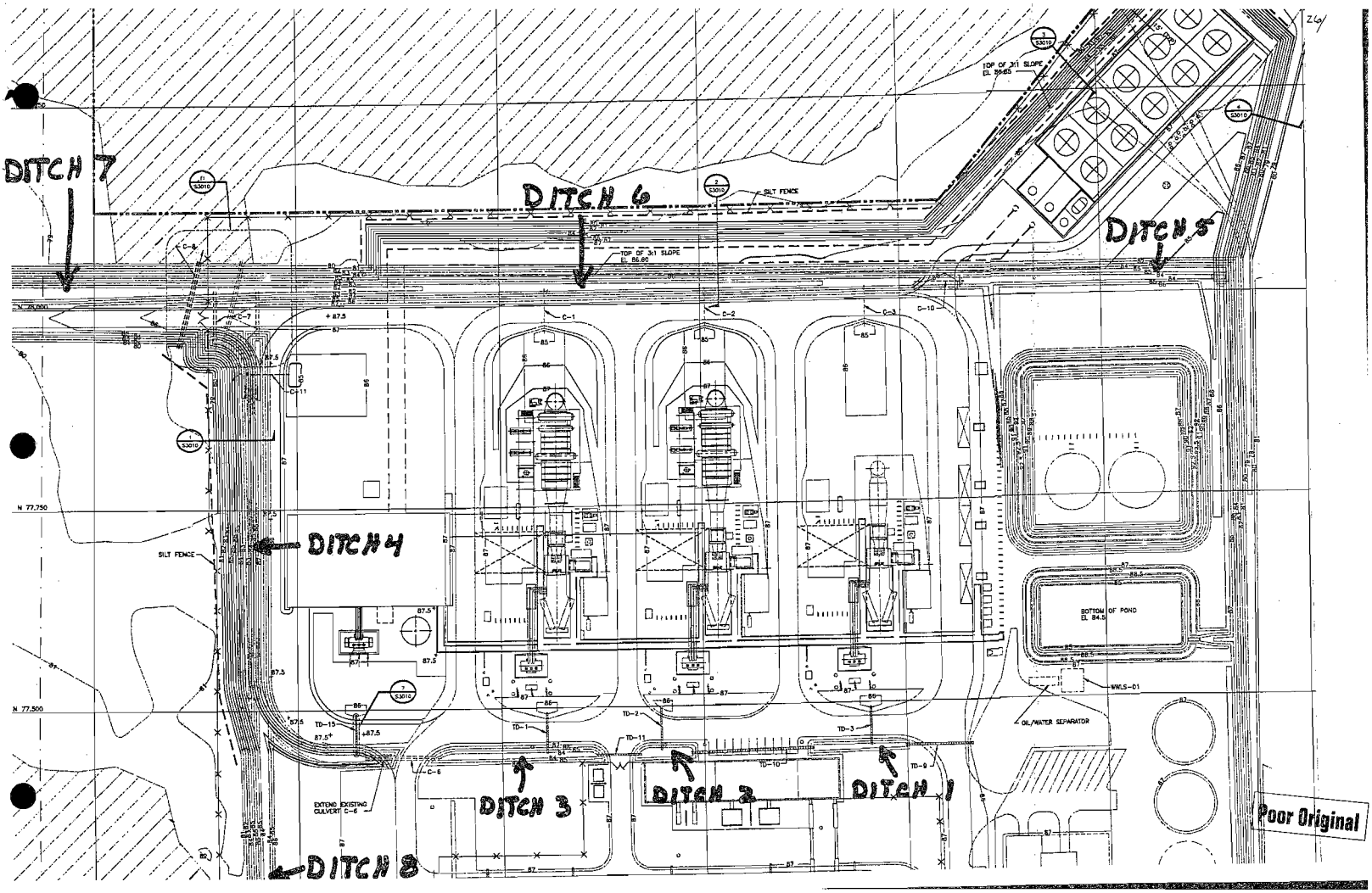
JACKSONVILLE, FLORIDA
1903-1951



Poor Original



Poor Original



Poor Original

Owner: JEA
Plant: Brandy Branch Station
Project No.: 099262
File No.: 32.0541
Title: Brandy Branch Hydraulic Conveyances

Computed By: J.M. Stanek
Date: 11-10-2000
Verified By:_____
Date:_____

APPENDIX A

Ditch - 4
Worksheet for Trapezoidal Channel

Project Description	
Project File	d:\2wil27751\brandy branch\dit_des.fm2
Worksheet	Ditch - 4
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.002500	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	5.00	ft
Discharge	69.98	cfs

Results		
Depth	1.40	ft
Flow Area	12.86	ft²
Wetted Perimeter	13.85	ft
Top Width	13.39	ft
Critical Depth	1.38	ft
Critical Slope	0.002617	ft/ft
Velocity	5.44	ft/s
Velocity Head	0.46	ft
Specific Energy	1.86	ft
Froude Number	0.98	
Flow is subcritical.		

Ditch - 5
Worksheet for Trapezoidal Channel

Project Description	
Project File	d:\2wil27751\brandy branch\dit_des.fm2
Worksheet	Ditch - 5
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.002000	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	5.00	ft
Discharge	8.77	cfs

Results		
Depth	0.49	ft
Flow Area	3.19	ft^2
Wetted Perimeter	8.12	ft
Top Width	7.96	ft
Critical Depth	0.42	ft
Critical Slope	0.003584	ft/ft
Velocity	2.75	ft/s
Velocity Head	0.12	ft
Specific Energy	0.61	ft
Froude Number	0.76	
Flow is subcritical.		

Ditch - 6
Worksheet for Trapezoidal Channel

Project Description	
Project File	d:\2wil27751\brandy branch\dit_des.fm2
Worksheet	Ditch - 6
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.002000	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	5.00	ft
Discharge	53.62	cfs

Results		
Depth	1.29	ft
Flow Area	11.49	ft²
Wetted Perimeter	13.18	ft
Top Width	12.76	ft
Critical Depth	1.20	ft
Critical Slope	0.002717	ft/ft
Velocity	4.66	ft/s
Velocity Head	0.34	ft
Specific Energy	1.63	ft
Froude Number	0.87	
Flow is subcritical.		

Ditch - 7
Worksheet for Trapezoidal Channel

Project Description	
Project File	d:\2wil27751\brandy branch\dit_des.fm2
Worksheet	Ditch - 7
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.002500	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	5.00	ft
Discharge	123.60	cfs

Results		
Depth	1.85	ft
Flow Area	19.50	ft^2
Wetted Perimeter	16.69	ft
Top Width	16.09	ft
Critical Depth	1.86	ft
Critical Slope	0.002421	ft/ft
Velocity	6.34	ft/s
Velocity Head	0.62	ft
Specific Energy	2.47	ft
Froude Number	1.02	
Flow is supercritical.		

Ditch - 8
Worksheet for Trapezoidal Channel

Project Description	
Project File	d:\2wil27751\brandy branch\dit_des.fm2
Worksheet	Ditch - 8
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.002500	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	5.00	ft
Discharge	34.99	cfs

Results		
Depth	0.98	ft
Flow Area	7.80	ft²
Wetted Perimeter	11.21	ft
Top Width	10.89	ft
Critical Depth	0.95	ft
Critical Slope	0.002889	ft/ft
Velocity	4.49	ft/s
Velocity Head	0.31	ft
Specific Energy	1.29	ft
Froude Number	0.93	
Flow is subcritical.		

Trench Drain - 15
Worksheet for Rectangular Channel

Project Description	
Project File	d:\2wil27751\brandy branch\dit_des.fm2
Worksheet	Trench Drain - 15
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.050000	ft/ft
Bottom Width	1.00	ft
Discharge	6.02	cfs

Results		
Depth	0.57	ft
Flow Area	0.57	ft^2
Wetted Perimeter	2.14	ft
Top Width	1.00	ft
Critical Depth	1.04	ft
Critical Slope	0.010895	ft/ft
Velocity	10.58	ft/s
Velocity Head	1.74	ft
Specific Energy	2.31	ft
Froude Number	2.47	
Flow is supercritical.		

Owner: JEA
Plant: Brandy Branch Station
Project No.: 099262
File No.: 32.0541
Title: Brandy Branch Hydraulic Conveyances

Computed By: J.M. Stanek
Date: 11-10-2000
Verified By:_____
Date:_____

APPENDIX B

Culvert Designer/Analyzer Report
Culvert - 7

Peak Discharge Method: User-Specified

Design Discharge	69.98 cfs	Check Discharge	69.98 cfs

Grades Model: Inverts

Invert Upstream	81.78 ft	Invert Downstream	81.50 ft
Length	62.25 ft	Slope	0.004498 ft/ft
Drop	0.28 ft		

Tailwater Conditions: Constant Tailwater

Tailwater Elevation	83.35 ft

	Name	Desc	Discharge	HW Elev	Velocity
x	Trial-1	2-30 inch Circular	69.98 cfs	85.14 ft	8.28 ft/s

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Black & Veatch
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Culvert Designer/Analyzer Report
Culvert - 7

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	N/A ft	Storm Event	Design
Computed Headwater Elevation	85.14 ft	Discharge	69.98 cfs
Headwater Depth/ Height	1.34	Tailwater Elevation	83.35 ft
Inlet Control HW Elev	85.11 ft	Control Type	Outlet Control
Outlet Control HW Elev	85.14 ft		

Grades			
Upstream Invert	81.78 ft	Downstream Invert	81.50 ft
Length	62.25 ft	Constructed Slope	0.004498 ft/ft

Hydraulic Profile			
Profile	M2	Depth, Downstream	2.01 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	2.01 ft
Velocity Downstream	8.28 ft/s	Critical Slope	0.007550 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	2.50 ft
Section Size	30 inch	Rise	2.50 ft
Number Sections	2		

Outlet Control Properties			
Outlet Control HW Elev	85.14 ft	Upstream Velocity Head	0.82 ft
Ke	0.20	Entrance Loss	0.16 ft

Inlet Control Properties			
Inlet Control HW Elev	85.11 ft	Flow Control	Submerged
Inlet Type	Groove end projecting	Area Full	9.8 ft²
K	0.00450	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	3
C	0.03170	Equation Form	1
Y	0.69000		

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Culvert Designer/Analyzer Report
Culvert - 10

Peak Discharge Method: User-Specified

Design Discharge	8.77 cfs	Check Discharge	10.00 cfs

Grades Model: Inverts

Invert Upstream	83.35 ft	Invert Downstream	83.23 ft
Length	60.40 ft	Slope	0.001987 ft/ft
Drop	0.12 ft		

Headwater Model: Maximum Allowable HW

Headwater Elevation	85.00 ft

Tailwater properties: Trapezoidal Channel

Slope	0.002000 ft/ft	Mannings Coefficient	0.013
Depth	0.53 ft	Left Side Slope	3 H : V
Right Side Slope	3 H : V	Bottom Width	5.00 ft

Tailwater conditions for Design Storm.

Discharge	8.77 cfs	Bottom Elevation	83.23 ft
Depth	0.49 ft	Velocity	2.75 ft/s

Tailwater conditions for Check Storm.

Discharge	10.00 cfs	Bottom Elevation	83.23 ft
Depth	0.53 ft	Velocity	2.86 ft/s

	Name	Desc	Discharge	HW Elev	Velocity
x	Trial-4	1-24 inch Circular	8.77 cfs	84.95 ft	5.21 ft/s
	Trial-5	2-15 inch Circular	8.77 cfs	84.77 ft	4.94 ft/s

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Culvert Designer/Analyzer Report
Culvert - 10

Design:Trial-4

Solve For: Section Size

Culvert Summary			
Allowable HW Elevation	85.00 ft	Storm Event	Design
Computed Headwater Elevation	84.95 ft	Discharge	8.77 cfs
Headwater Depth/ Height	0.80	Tailwater Elevation	83.72 ft
Inlet Control HW Elev	84.86 ft	Control Type	Outlet Control
Outlet Control HW Elev	84.95 ft		

Grades			
Upstream Invert	83.35 ft	Downstream Invert	83.23 ft
Length	60.40 ft	Constructed Slope	0.001987 ft/ft

Hydraulic Profile			
Profile	M2	Depth, Downstream	1.06 ft
Slope Type	Mild	Normal Depth	1.44 ft
Flow Regime	Subcritical	Critical Depth	1.06 ft
Velocity Downstream	5.21 ft/s	Critical Slope	0.004997 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	2.00 ft
Section Size	24 inch	Rise	2.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	84.95 ft	Upstream Velocity Head	0.26 ft
Ke	0.20	Entrance Loss	0.05 ft

Inlet Control Properties			
Inlet Control HW Elev	84.86 ft	Flow Control	N/A
Inlet Type	Groove end projecting	Area Full	3.1 ft²
K	0.00450	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	3
C	0.03170	Equation Form	1
Y	0.69000		

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Culvert Designer/Analyzer Report
Culvert - 10

Design:Trial-5

Solve For: Section Size

Culvert Summary			
Allowable HW Elevation	85.00 ft	Storm Event	Design
Computed Headwater Elevation	84.77 ft	Discharge	8.77 cfs
Headwater Depth/ Height	1.14	Tailwater Elevation	83.72 ft
Inlet Control HW Elev	84.63 ft	Control Type	Outlet Control
Outlet Control HW Elev	84.77 ft		

Grades			
Upstream Invert	83.35 ft	Downstream Invert	83.23 ft
Length	60.40 ft	Constructed Slope	0.001987 ft/ft

Hydraulic Profile			
Profile	M2	Depth, Downstream	0.85 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	0.85 ft
Velocity Downstream	4.94 ft/s	Critical Slope	0.007135 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	1.25 ft
Section Size	15 inch	Rise	1.25 ft
Number Sections	2		

Outlet Control Properties			
Outlet Control HW Elev	84.77 ft	Upstream Velocity Head	0.21 ft
Ke	0.20	Entrance Loss	0.04 ft

Inlet Control Properties			
Inlet Control HW Elev	84.63 ft	Flow Control	N/A
Inlet Type	Groove end projecting	Area Full	2.5 ft²
K	0.00450	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	3
C	0.03170	Equation Form	1
Y	0.69000		

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Culvert Designer/Analyzer Report
Culvert - 11

Peak Discharge Method: User-Specified

Design Discharge	9.18 cfs	Check Discharge	9.18 cfs

Grades Model: Inverts

Invert Upstream	83.50 ft	Invert Downstream	81.93 ft
Length	55.25 ft	Slope	0.028416 ft/ft
Drop	1.57 ft		

Headwater Model: Maximum Allowable HW

Headwater Elevation	85.50 ft

Tailwater Conditions: Constant Tailwater

Tailwater Elevation	83.33 ft

	Name	Desc	Discharge	HW Elev	Velocity
x	Trial-1	1-18 inch Circular	9.18 cfs	85.39 ft	5.35 ft/s

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Culvert Designer/Analyzer Report
Culvert - 11

Design:Trial-1

Solve For: Section Size

Culvert Summary			
Allowable HW Elevation	85.50 ft	Storm Event	Check
Computed Headwater Elevation	85.39 ft	Discharge	9.18 cfs
Headwater Depth/ Height	1.26	Tailwater Elevation	83.33 ft
Inlet Control HW Elev	85.37 ft	Control Type	Entrance Control
Outlet Control HW Elev	85.39 ft		

Grades			
Upstream Invert	83.50 ft	Downstream Invert	81.93 ft
Length	55.25 ft	Constructed Slope	0.028416 ft/ft

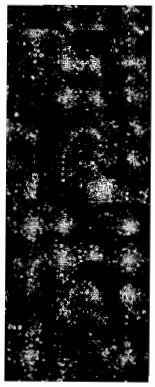
Hydraulic Profile			
Profile	CompositeS1S2	Depth, Downstream	1.40 ft
Slope Type	Steep	Normal Depth	0.77 ft
Flow Regime	N/A	Critical Depth	1.17 ft
Velocity Downstream	5.35 ft/s	Critical Slope	0.008392 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	1.50 ft
Section Size	18 inch	Rise	1.50 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	85.39 ft	Upstream Velocity Head	0.60 ft
Ke	0.20	Entrance Loss	0.12 ft

Inlet Control Properties			
Inlet Control HW Elev	85.37 ft	Flow Control	Submerged
Inlet Type	Groove end projecting	Area Full	1.8 ft²
K	0.00450	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	3
C	0.03170	Equation Form	1
Y	0.69000		

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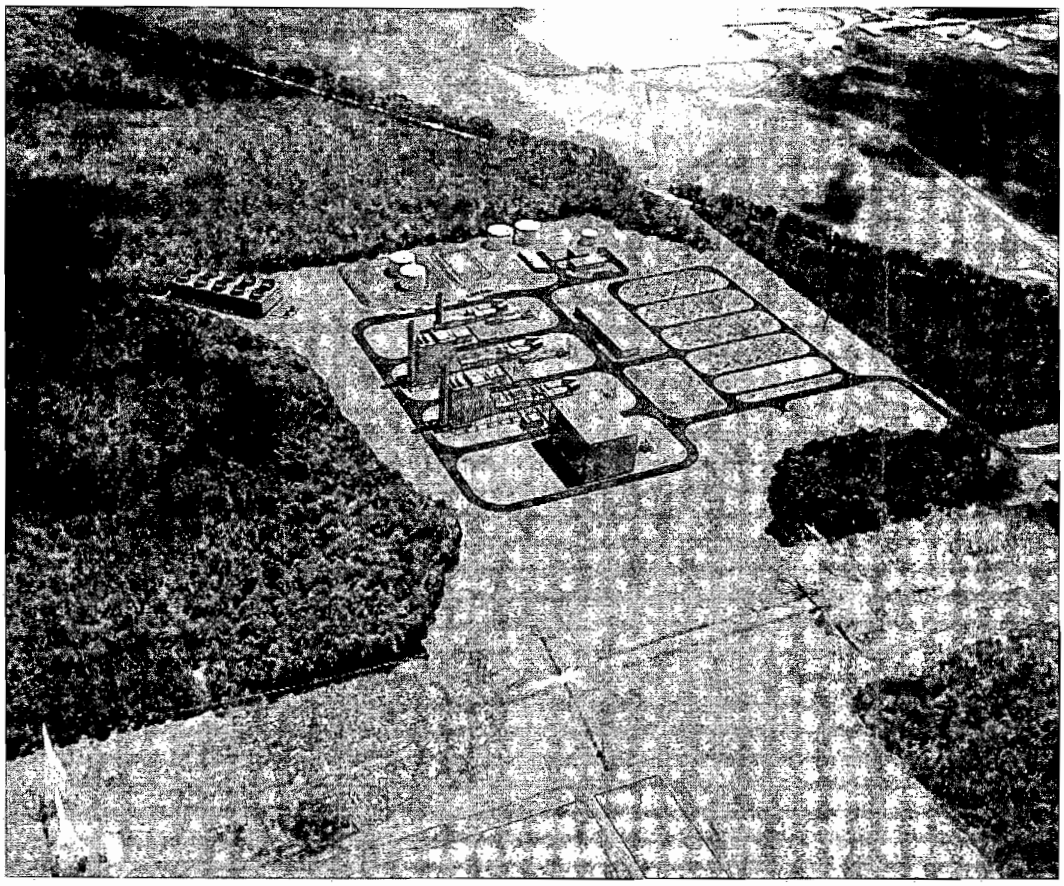


SITE CERTIFICATION APPLICATION
Appendix 10.7 – PSD Application
JEA Brandy Branch Combined Cycle Conversion

Building Community

SITE CERTIFICATION APPLICATION

Appendix 10.7 – PSD Application



JEA Brandy Branch Combined Cycle Conversion

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JEA Brandy Branch
Combined Cycle Conversion

Site Certification Application

Appendix 10.7 – PSD Application

Manual Number JEA/BB - 02

Issued to Mr. Hamilton (Buck) Over

Location _____

Appendix 10.7

PREVENTION OF SIGNIFICANT DETERIORATION AIR PERMIT APPLICATION FOR THE BRANDY BRANCH COMBINED CYCLE FACILITY

Submitted by

JEA

Prepared by

Black & Veatch

December 2000

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Attachment 2 Potential-To-Emit (PTE) and Enveloped Spreadsheet
Attachment 3 BACT Tables
Attachment 4 Air Modeling Protocol and FDEP Approval
Attachment 5 Air Modeling Results
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1.0 Introduction

JEA proposes to convert two of the three already-permitted simple cycle electric generating units into a 2x1 combined cycle configuration at the Brandy Branch facility (hereinafter referred to as the "Generating Station") near Baldwin City, Duval County, Florida. The Generating Station is currently permitted to construct and operate three simple cycle combustion turbine (SCCT) units.

The Generating Station will include the conversion of two of the three SCCT units (Units 2 and 3), to combined cycle combustion turbine (CCCT) units rated at approximately 170 MW each, firing natural gas as the primary fuel and No. 2 distillate fuel oil as a backup fuel. Units 2 and 3 are located adjacent to Unit 1. The only new major support facilities for Units 2 and 3 will be the heat recovery steam generators (HRSGs), a steam turbine, and a cooling tower. All other needed facilities such as fuel oil storage tanks exist or are currently under construction as part of the simple cycle project.

This report is a technical support document for the Prevention of Significant Deterioration (PSD) Air Permit Application. The following sections contain a project characterization, Best Available Control Technology (BACT) determination, air quality impact analysis (AQIA), and additional impact analyses designed to provide a basis for the Florida Department of Environmental Protection's (FDEP) preparation of an air construction permit for the Generating Station.

2.0 Project Characterization

The following sections briefly characterize the Generating Station including a general description of the location, the Generating Station, and emission units, as well as a summary of the estimated emissions and a discussion of New Source Review (NSR) applicability.

2.1 Project Location

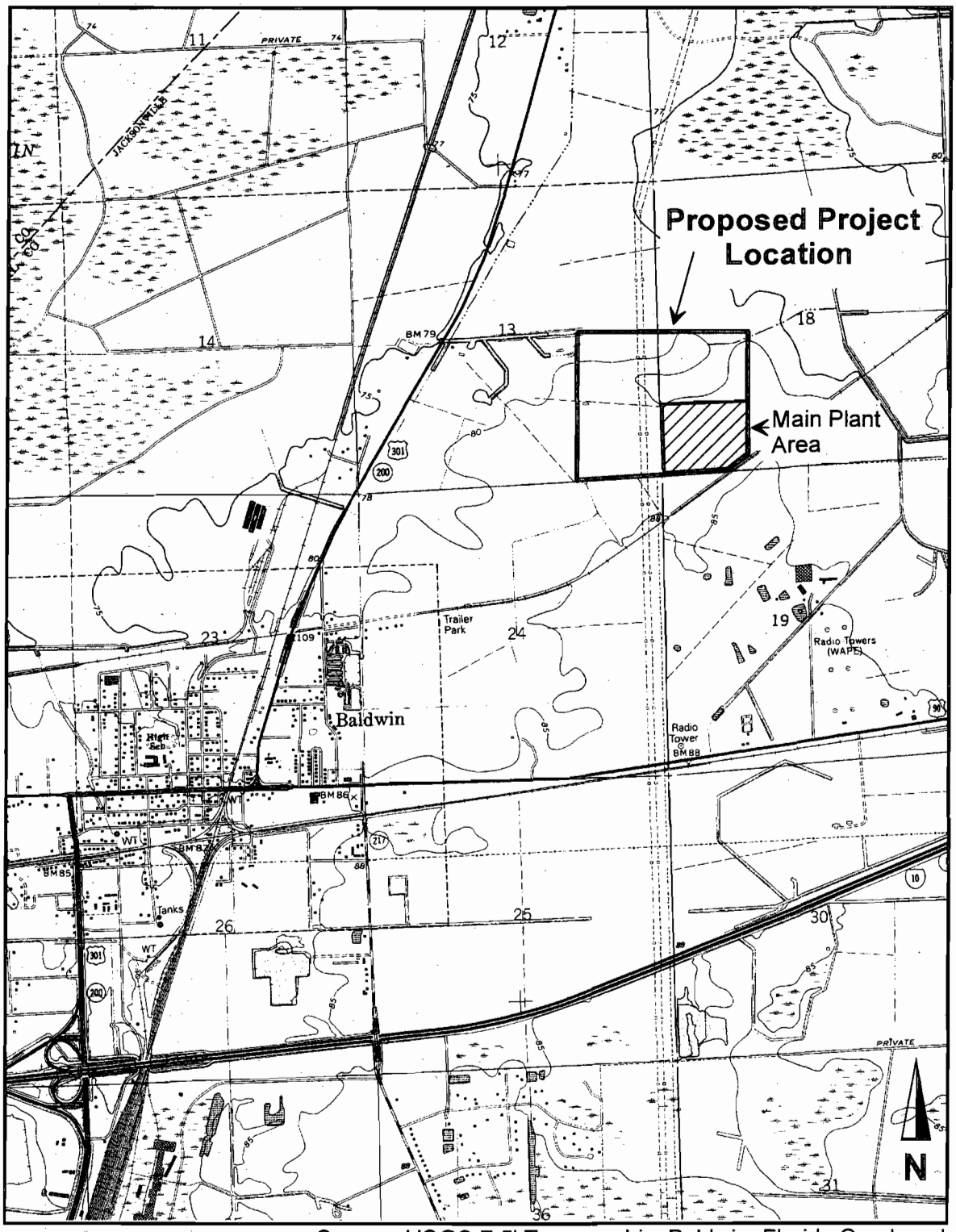
The Generating Station is located in the western, rural part of Duval County, Florida. Figure 2-1 shows the general location of the Generating Station which is approximately 1 mile northeast of Baldwin City. The approximate UTM coordinates of the Generating station are 408,774.1 m East and 3,354,530.8 m North. The nearest Federal PSD Class I Areas are the Okefenokee Wilderness Area and the Wolf Island Wilderness Area located approximately 34 kilometers (km) northwest and 127 km northeast of the Generating Station, respectively.

The topography of the area is unpronounced and considered relatively flat.

2.2 Project Description

The Generating Station will be located at the Brandy Branch facility which currently is permitted to construct three SCCT units and related support facilities. Two of the three SCCT units are proposed to be converted to CCCT units. The two CCCT units will be operated in a 2x1 configuration. Major equipment associated with the each CCCT unit will consist of a General Electric (Model PG7241FA) combustion turbine generator (CTG), heat recovery steam generator (HRSG) with supplemental firing, steam generator, and a cooling tower. Fuel oil storage tanks for each of the CCCT have already been permitted as part of the Brandy Branch SCCT Facility.

The CTG/HRSG will use evaporative coolers as necessary to cool the compressor inlet air prior to its combining with fuel in the combustor of the CCCT. The thermal energy of the combustion gases exiting the combustor will be transformed into rotating mechanical energy as these gases expand through the turbine sections of the CCCTs. The rotating mechanical energy will be converted into electrical energy via a shaft on the CCCT connected to an electrical generator. The remaining usable thermal energy in the combustion gases will be exchanged with water/steam in the HRSG.



Source: USGS 7.5' Topographic, Baldwin, Florida Quadrangle

Proposed Project Location

Figure 2-1

JEASITE.SRF

Poor Original

Supplemental (duct) firing with natural gas will be used to increase the thermal energy of the combustion gases exhausting from each CCCT. The resulting high pressure steam produced in each HRSG will be expanded through a single steam turbine. The rotating mechanical energy generated by the steam turbine will be converted into electrical energy via a shaft connected to an electrical generator. The exhaust gases will exit to the atmosphere after leaving the HRSG stack.

A site arrangement showing the various emission units and structures/buildings at the Generating Station is presented in Figure 2-2.

2.3 Project Emissions

This section discusses the potential to emit (PTE) of all regulated PSD air pollutants resulting from the Generating Station. Emissions from the Generating Station will be generated from the following sources:

- Two General Electric CCCT/HRSGs with supplemental firing.
- One ten (10) cell cooling tower.

2.3.1 Project Emissions

Performance data for the CTG/HRSG, based on vendor data from GE at design loads of 50, 75, and 100 percent, natural gas and distillate fuel oil firing, and ambient air temperatures of 20° F, 59° F, and 95° F are provided in Attachment 1.

Ambient temperature data was selected based on meteorological data from Jacksonville, FL. An ambient temperature of 20° F represents the lowest anticipated site temperature and maximum power generation. An ambient temperature of 59° F represents the average annual site temperature which is representative of the average heat input rate. An ambient temperature of 95° F represents the highest anticipated site temperature which corresponds to the lowest heat input rate for the combustion turbine and results in the maximum required duct firing and evaporative cooling rates to maintain the desired plant electrical output.

The maximum pound per hour emission rates at the annual average site temperature for combined cycle operation for natural gas and distillate fuel oil firing are presented in Table 2-1.

2.4 Maximum Potential to Emit

The potential to emit was estimated from the maximum hourly emission rate for each pollutant at an ambient temperature of 59° F (average annual) in combined cycle operation, 50 to 100 percent load, and 288 hours of distillate fuel oil firing (0.05 percent

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sulfur) with the remainder of the year on natural gas. The potential to emit for each pollutant is summarized in Table 2-2. The potential to emit estimate for PM/PM_{10} includes the particulate emissions resulting from the operation of the cooling tower. The applicable PSD significant emission levels for each pollutant are included for reference purposes in the table, and a spreadsheet used to calculate the potential to emit is included in Attachment 2.

2.5 New Source Review Applicability

The federal Clean Air Act (CAA) NSR provisions are implemented for new major stationary sources and major modifications under two programs: the PSD program outlined in 40 CFR 52.21; and, the Nonattainment NSR program outlined in 40 CFR 51 and 52. The proposed facility is in an attainment area with respect to all pollutants. As such, the PSD program will apply to the Generating Station, as administered by the State of Florida under 62-212.400, FAC, Stationary Sources - Preconstruction Review, Prevention of Significant Deterioration.

Table 2-1
CTG/HRSG Maximum Emission Rates (lb/h)*

Pollutant	Natural Gas Firing (lb/h)	Distillate Oil Firing (lb/h)
NO_x	23.62	112.41
SO_2	1.16	102.97
CO	52.58	67.86
PM/PM_{10}**	19.80	62.10
VOC	3.49	7.68
H_2SO_4	0.18	12.61

*Maximum pound per hour emission rates at 59° F, combined cycle operation, burning natural gas and distillate fuel oil.
** Includes the effects of SO_2 oxidation and SCR formation of ammonium sulfates.

Table 2-2
PSD Applicability

Pollutant	Project PTE (tpy)	PSD Significant Emission Rate (tpy)	PSD Review Required
NO_x	232.48[a]	40	yes
SO_2	39.48[a,b]	40	no
CO	465.00[a]	100	yes
PM/PM_{10}	185.63[a,c]	25/15	yes
VOC	31.78[a]	40	no
Sulfuric Acid Mist	5.16[a]	7	no
Total Reduced Sulfur	negl.	10	no
Hydrogen Sulfide	negl.	10	no
Vinyl Chloride	negl.	1	no
Total Fluorides	negl.	3	no
Mercury	0.0000495[d]	0.1	no
Beryllium	0.00000228[d]	0.0004	no
Lead	0.01[d]	0.6	no
Total HAPs	6.61[e]	10/25	no

[a]Based on maximum lb/h emission rate at 59° F conditions for all loads and operating scenarios; assuming 8,472 and 288 hours per year of natural gas and distillate fuel oil firing, per turbine, respectively.

[b]Based on 0.05% sulfur distillate fuel oil and 0.2 gr/100 scf sulfur natural gas.

[c]Includes the effects of SO_2 oxidation and SCR formation of ammonium sulfates.

[d]Based on AP-42 emission factors, a maximum heat input of 2,059.4 MMBtu/hr and distillate fuel oil firing for 288 hours per year.

[e]HAP calculation sheet in Attachment 2.

Note: PTE calculations are provided in a spreadsheet included in Attachment 2.

2.5.1 Prevention of Significant Deterioration

The PSD regulations are designed to ensure that the air quality in existing attainment areas does not significantly deteriorate or exceed the ambient air quality standards (AAQS) while providing a margin for future industrial and commercial growth. PSD regulations apply to major stationary sources and major modifications at major existing sources undergoing construction in areas designated as attainment or unclassifiable.

A major stationary source is defined as any one of the listed major source categories which emits, or has the potential to emit, 100 tpy or more of any regulated pollutant, or 250 tpy or more of any regulated pollutant if the facility is not one of the listed major source categories. The Brandy Branch Simple Cycle facility is a major source, having a PTE greater than 250 tpy for at least one regulated pollutant. Additionally, the estimated emission increases of NO_x, CO, and PM/PM_{10} resulting from the proposed modification (i.e., conversion of Units 2 and 3 from simple cycle turbine units to combined cycle turbine units), exceed the PSD significant emissions levels of 40, 100, 25/15 tpy, respectively. Therefore, the Generating Station emissions of NO_x, CO, and PM/PM_{10} are subject to PSD review as a modification to an existing major source. The PSD review includes a BACT analysis, air quality impact analysis, and an assessment of the Generating Station's impact on general commercial, residential, and commercial growth, soils and vegetation, and visibility, as well as a Class I impact analysis.

3.0 Best Available Control Technology

The 1977 Clean Air Act (CAA) established revised conditions for the approval of pre-construction permit applications under the Prevention of Significant Deterioration (PSD) program. One of these requirements is that the best available control technology (BACT) be installed for all pollutants regulated under the act emitted in significant amounts from new major sources or modifications. The new major sources proposed for this Generating Station include two combined cycle combustion turbines and a cooling tower that are subject to the BACT rules. This document presents the BACT analysis and results for the new major sources on this Generating Station.

The following is a summary of the BACT determination and associated emission rates for two GE 7241(FA) combustion turbines operating with duct burners in combined cycle mode to be installed for JEA. Emissions are based on the GE 7241(FA) combined cycle combustion turbine units with duct burner firing. The combustion turbines will fire natural gas and No. 2 fuel oil. The duct burners will fire only natural gas. Emissions for the BACT analysis are based on each combustion turbine-generator/heat recovery steam generator (CTG/HRSG) unit operating at full load with duct firing for 8,472 hours per year on natural gas at an ambient temperature of 59 °F. Also included in this BACT are emissions for each combustion turbine-generator (CTG) unit firing fuel oil at full load operation without duct firing for 288 hours per year at an ambient temperature of 59 °F.

GE 7241(FA) CTG/HRSG Units:

Nitrogen oxides (NO_x) emissions -- BACT was determined to be the use of dry low NO_x burners with an SCR during natural gas firing and water injection with an SCR for fuel oil firing to achieve the following emission limits.

- Burning natural gas at full load, an emission limit of 0.0131 lb/MMBtu (23.6 lb/hr, 3.5 ppmvd at 15 percent O_2).
- Burning fuel oil at full load, an emission limit of 0.0580 lb/MMBtu (112.4 lb/hr, 15 ppmvd at 15 percent O_2).

Carbon monoxide (CO) emissions – BACT was determined to be good combustion controls to achieve a CO emission limit of 0.0291 lb/MMBtu (52.6 lb/hr, 12.21 ppmvd at 15 percent O_2) during natural gas firing and 0.0350 lb/MMBtu (67.9 lb/hr, 14.17 ppmvd at 15 percent O_2) during fuel oil firing.

Particulate emissions (PM/PM_{10}) -- BACT was determined to be good combustion controls and combustion air filters to achieve a PM/PM_{10} emission limit of 0.0110 lb/MMBtu (19.8 lb/hr) during natural gas firing. BACT was determined to be good combustion controls and combustion air filters to achieve a PM/PM_{10} emission limit of 0.0320 lb/MMBtu (62.1 lb/hr). The PM/PM_{10} emission estimates conservatively include front and back half catch as well as the effects of SO_2 oxidation and SCR formation of ammonium sulfates.

Cooling Tower:

Particulate emissions -- BACT is determined to be the use of drift eliminators with a control efficiency of 0.002 percent resulting in emissions of 0.08 lb/hr.

3.1 Project Description

The electric generating facility (hereinafter referred to as the "Generating Station") to be installed for JEA at the Brandy Branch site will consist of two (2) General Electric (GE) 7241(FA) combined cycle combustion turbines (CCCT) and respective cooling towers. The combined cycle operation consists of using two combustion turbines and two-heat recovery steam generators (HRSGs) with a steam turbine in a Rankine power cycle. The configuration is used to generate additional power, although the CTG/HRSG power plant is well suited for continuous operation at full load, it is not well suited for large load changes or quick and frequent startups and shutdowns. Each CTG/HRSG configuration will also include a supplemental duct burner (DB) located in the outlet duct from the combustion turbine to provide additional heat for high power demand periods. The HRSG will be used to recover energy from the high temperature flue gas generated by each combustion turbine and duct burner. A steam turbine will be used to generate additional electricity from the steam produced in the HRSG. The combustion turbines will fire natural gas and No. 2 fuel oil. The duct burners will fire only natural gas.

The output ratings of each GE PG7241(FA) combine cycle combustion turbine will be nominally 170 MW. The proposed operating scenario for the combustion turbines consists of operating up to 8,472 hours per year while firing natural gas and operating up to 288 hours per year while firing fuel oil.

3.2 Basis of Combustion Turbine BACT Analysis

This section describes the basis of the combustion turbine BACT analysis. Information is provided on such issues as the BACT methodology and approach used. The parameters and factors used in developing the analysis are identified.

3.2.1 Regulatory and Methodology Basis

The BACT analysis for the GE 7241(FA) combustion turbine units with and without duct burner firing is based on certain regulatory requirements and Generating Station assumptions. The following is a summary of the requirements and assumptions for which this BACT analysis is based.

- Federal and state ambient air quality standards, emission limitations, and other applicable regulations will be met.
- Federal New Source Performance Standards (NSPS) for combustion turbines with heat input greater than 10 MMBtu/hr (40 CFR 60 Subpart GG) establish limiting criteria for NO_x emissions. No NSPS criteria have been established for limiting CO, VOC and PM/PM_{10} emissions. The following flue gas emission limit is established by NSPS for Subpart GG units:
- NO_x: 75 ppmvd at 15 percent O_2, corrected for fuel nitrogen content and turbine heat rate.
- Federal NSPS for electric utility steam generating units for which construction is commenced after June 9, 1989 with a maximum design heat input (fuel burn rate) of 100 MMBtu/hr or less, but greater than or equal to 10 MMBtu/hr (40 CFR 60 Subpart Dc) establish limiting criteria for SO_2 and particulate emissions only. No NSPS criteria have been established for limiting NO_x, CO and VOC emissions. Each duct burner for this Generating Station is approximately 85 MMBtu/hr.

As defined in the air permit application, operation of the Generating Station will result in an increase in the potential to emit emissions of NO_x, CO, and PM/PM_{10} in excess of the major source PSD threshold levels set for these pollutants. BACT is defined as an emission limitation established based on the maximum degree of pollutant reduction determined on a case-by-case basis considering technical, economic, energy and environmental considerations. However, BACT cannot be less stringent than the emissions limits established by an applicable New Source Performance Standard (NSPS).

To bring consistency to the BACT process, the United States Environmental Protection Agency (USEPA) has authorized the development of a guidance document (March 15, 1990) on the use of the "top-down" approach to BACT determinations. The first step in a top-down BACT analysis is to determine, for the pollutant in question, the most stringent control technology and emission limit available for a similar source or source category. Technologies required under Lowest Achievable Emission Rate (LAER) determinations must be considered. These technologies represent the top control alternative under the BACT analysis. If it can be shown that this level of control is infeasible on the basis of

technical, economic, energy, and environmental impacts for the source in question, then the next most stringent level of control is identified and similarly evaluated. This process continues until the BACT level under consideration cannot be eliminated by any technical, economic, energy, or environmental consideration.

3.2.2 Operations/Emissions Basis

As mentioned previously, the proposed operating scenario for the CTG/HRSGs with duct firing is 8,472 hours per year while firing natural gas. Moreover, the proposed operating scenario for firing fuel oil for each CTG is 288 hours per year. Table 3-1 shows the uncontrolled emission rates for a GE 7241(FA) combined cycle combustion turbine unit with duct burner firing natural gas and without duct burner firing fuel oil at 100 percent of base load at an average annual site temperature of 59 °F. The emissions shown in Table 3-1 are controlled with dry low NO_x burners during natural gas firing and water injection during fuel oil firing and lb/MMBtu values are based on the higher heating value (HHV).

Table 3-1 Uncontrolled Emission Rates Per GE 7241(FA) CCCT Unit		
Emission Parameter	GE 7241(FA) with Duct Firing (Natural Gas)[a]	GE 7241(FA) without Duct Firing (Fuel Oil)[b]
NO_x, ppmvd at 15% O_2	9.2	42.0
NO_x, lb/hr	61.8	331.5
NO_x, lb/MMBtu (HHV)	0.0342	0.1709
CO, ppmvd at 15% O_2	12.2	14.2
CO, lb/hr	52.6	67.9
CO, lb/MMBtu (HHV)	0.0291	0.0350
PM, lb/hr	19.8	62.1
PM, lb/MMBtu (HHV)	0.0110	0.0320
PM_{10}, lb/hr	19.7	60.4
PM_{10}, lb/MMBtu (HHV)	0.0110	0.0311

Notes:

[a] Total emissions are based on 8,472 hours per year firing natural gas at 100 percent of base load with duct firing at an ambient temperature of 59 °F.

[b] Total emissions are based on 288 hours per year firing fuel oil at 100 percent of base load without duct firing at an ambient temperature of 59 °F.

3.2.3 Economic Basis

Economic analysis used to determine the capital and annualized costs of the control technologies were based on EPA methodologies shown in the EPA Best Available Control Technology Draft Guidance Document (October 1990), "Top Down" Best Available Control Technology Guidance Document (March 1990), The Office of Air Quality Planning and Standards (OAQPS) Control Cost Manual (February 1996, Fifth Edition), internal project developer cost factors and vendor budgetary cost quotes. Table 3-2 lists the economic criteria used in the analysis of BACT alternatives.

Table 3-2
Generating Station Economic Evaluation Criteria

Economic Parameters	Value
Contingency, percent	20
Real Interest Rate, percent	9.64
Economic Life years	20
Capital Recovery Factor, (20 years)	0.1146
Capital Recovery Factor, (3 years)	0.3996
Labor Cost, $/man-hr	38.0
Natural Gas Cost, $/MMBtu	2.74
Anhydrous Ammonia Cost, $/ton	250
Energy Cost, $/kWhr	0.022
Catalyst Life Guarantee, years	3
Sales Tax, percent	3

3.3 Combustion Turbine NO_x and CO BACT Analysis

The objective of this analysis is to determine BACT for NO_x and CO emissions from the combined cycle combustion turbines. This includes the CTs and supplemental firing in the HRSG as a total unit during natural gas firing. The CTs without supplemental firing in the HRSG will only be considered when fuel oil firing. Unless otherwise noted the NO_x and CO emission rates described in this section are corrected to 15 percent oxygen.

3.3.1 NO_x BACT/LAER Clearinghouse Reviews

A list of the top pertinent BACT/LAER decisions is attached in Attachment 3. A review of the BACT/LAER Clearinghouse documents (CAPCOA, 1985 - 2000; USEPA, 1990 - 2000) indicates that the lowest emissions achieved for a natural gas fired combustion turbine is 2.0 ppmvd for the Federal Cold Storage Cogeneration facility located in California. The 2.0 ppmvd was achieved for six months (June 1997 to December 1997) with 15 minute CEM averaging periods. Further, Region IX of the EPA has deemed the limit of 2.0 ppmvd at 15 percent oxygen was achieved in practice with three hour averaging. The emissions from that unit are controlled through the use of water injection and a $SCONO_x$ system. It should be noted that the Federal Cold Storage Cogeneration facility is located in a non-attainment area for ozone, with NO_x regulated as a non-attainment pollutant. Thus, this emission level represents LAER for CTG/HRSG. It should also be noted that this is a small, 222 MMBtu/hr GE model LM2500-M-2 combine cycle gas turbine that is producing 32 MW (cogeneration). The current use of this specific control application on CTG/HRSG Generating Station applications (e.g., units under 30 MW) is not considered applicable to the Generating Station as will be discussed.

In addition, the Sacramento Power Authority (Campbell Soup) located in the Sacramento Metropolitan AQMD in California has set a 3.0 ppmvd NO_x emission limit for a natural gas fired CTG/HRSG. The emissions from that unit are controlled through the use of standard combustors, water injection, and selective catalytic reduction (SCR). This unit consists of a 1,257 MMBtu/hr combined cycle natural gas fired Siemens V84.2 gas turbine generator with water injection for power augmentation and 200 MMBtu/hr of supplemental firing capacity producing 103 MW. This combustion turbine emission limit is noted in the Clearinghouse as being representative of LAER at the time of the permit (1994). Another stringent NO_x emissions limit for a gas fired CT is 3.5 ppmvd for the Brooklyn Navy Yard Cogeneration Project located in New York. The emissions from that unit are controlled through the use of dry low NO_x burners and SCR. Furthermore, a recent project listed in the CAPCOA BACT/LAER Clearinghouse database is the Sutter Power Plant in the Feather River AQMD in California has been permitted at 2.5 ppmvd at 15 percent O_2 for a one hour

average. The facility will consist of two-combined cycle 1,900 MMBtu/hr gas fired, 170 MW Siemens Westinghouse 501FD turbines with 170 MMBtu/hr HRSGs driving a common 160 MW steam turbine. The NO_x emissions are to be controlled by dry low NO_x combustors, selective catalytic reduction, and low NO_x duct burners. It should also be noted that this facility has an ammonia slip permitted at 10 ppmvd at 15 percent O_2 to achieve such low NO_x emissions. The facility is listed in the CAPCOA BACT/LAER Clearinghouse documents, but is still under construction and demonstration of this level of NO_x control has not been achieved in practice at this time.

3.3.2 CO BACT/LAER Clearinghouse Reviews

A list of the top pertinent BACT/LAER decisions is attached in Attachment 3. A review of the BACT/LAER Clearinghouse documents indicates that the most stringent CO emission level for a combustion turbine is 1.8 ppmvd at 15 percent O_2 for the Newark Bay Cogeneration L.P. project located in New Jersey. The 617 MMBtu/hr combustion turbine units fire natural gas. The low emissions are achieved by reducing CO emissions by 80 percent (from 9 ppmvd to 1.8) through the use of an oxidation catalyst. It should be noted that the Newark Bay project represents LAER, which is located in non-attainment areas for CO and ozone (VOC control required).

3.3.3 Alternative NO_x Emission Reduction Systems

During combustion, NO_x is formed from two sources. Emissions formed through the oxidation of the fuel bound nitrogen are called fuel NO_x. NO_x emissions formed through the oxidation of a portion of the nitrogen contained in the combustion air are called thermal NO_x and are a function of combustion temperature. NO_x production in a gas turbine combustor occurs predominantly within the flame zone, where localized high temperatures sustain the NO_x forming reactions. The overall average gas temperature required to drive the turbine is well below the flame temperature, but the flame region is required to achieve stable combustion.

Nitrogen oxide control methods may be divided into two categories: in-combustor NO_x formation control and post-combustion emission reduction. An in-combustor NO_x formation control process reduces the quantity of NO_x formed in the combustion process. A post-combustion technology reduces the NO_x emissions in the flue gas stream after the NO_x has been formed in the combustion process. Both of these methods may be used alone or in combination to achieve the various degrees of NO_x emissions required. The six different types of emission controls reviewed by this BACT analysis are as noted below.

In Combustor Type:

1) Water/Steam Injection
2) Dry Low-NO_x (DLN) Burners
3) Xonon

Post Combustion Type:

1) Selective Non-Catalytic Reduction (SNCR)
2) Selective Catalytic Reduction (SCR)
3) $SCONO_x$

3.3.3.1 Water or Steam Injection. NO_x emissions from the combustion turbines can be controlled by either water or steam injection. This type of control injects water or steam into the primary combustion zone with the fuel. The water or steam serves to reduce NO_x formation by reducing the peak flame temperature. The degree of reduction in NO_x formation is proportional to the amount of water injected into the combustion turbine. Since the combustion turbine NSPS was last revised in 1982, manufacturers have improved combustion turbine tolerances to the water necessary to control NO_x emissions below the current NSPS level. However, there is a point at which the amount of water injected into the combustion turbine seriously degrades its reliability and operational life. This type of control can also be counterproductive with regard to carbon monoxide (CO) and volatile organic compound (VOC) emissions that are formed as a result of incomplete combustion.

The development of DLN burners has replaced the use of wet controls except for certain cases such as oil firing. Therefore, the use of water injection will be considered for operations during oil firing and will be eliminated from further evaluation for control during natural gas firing for reducing NO_x emissions in this BACT analysis.

3.3.3.2 Dry Low NO_x Burners. NO_x can be limited by lowering combustion temperatures and by staging combustion (i.e., creating a reducing atmosphere followed by an oxidizing atmosphere). The use of DLN burners as a way to reduce flame temperature is one common NO_x control method. These combustor designs are called DLN burners, because when firing fuel, no water needs to be injected into the combustion chamber to achieve low NO_x emissions. Most industry gas turbine manufacturers today have developed this type of lean premix combustion systems as the state of the art for NO_x controls in combustion turbines.

DLN combustion turbine burner designs are available which use improved air/fuel mixing and reduced flame temperatures to limit thermal NO_x formation. DLN burner

technology uses a two-stage combustor that premixes a portion of the air and fuel in the first stage and the remaining air and fuel are injected into the second stage. This two-stage process ensures good mixing of the air and fuel and minimizes the amount of air required, which results in low NO_x emissions.

The controlled emission level will vary from manufacturer to manufacturer of the combustion turbine. The F-Class combustion turbines proposed for the Generating Station are manufactured by GE and have DLN burners that can achieve a NO_x emission level of approximately 9 ppmvd at 15 percent O_2. It should also be noted that as with the standard combustor with water injection, the DLN burners could be counterproductive with regard to CO and VOC emissions. The staged combustion and lower combustion temperatures will result in higher CO and VOC emissions.

Due to the proven performance of the DLN burner technology, this method of NO_x emissions control will be considered in this BACT analysis.

3.3.3.3 XONON. Another form of in-combustor control is XONON. This technology, developed by Catalytica Combustion Systems, is designed to avoid the high temperatures created in conventional combustors. The XONON combustor operates below 2,700 °F at full power generation, which significantly reduces NO_x emissions without raising and possibly even lowering emissions of carbon monoxide and unburned hydrocarbons. XONON uses a proprietary flameless process in which fuel and air react on the surface of a catalyst in the turbine combustor to produce energy in the form of hot gases, which drive the turbine. This technology is being commercialized by several joint ventures that Catalytica has with turbine manufacturers. To date, commercialization of this technology on utility size combustion turbines such as proposed for the Generating Station has not been developed.

Due to the technical and commercial limitations of this technology, this method of post-combustion control will be eliminated from further evaluation for control of NO_x emissions in this BACT analysis.

3.3.3.4 Selective Non-Catalytic Reduction. Selective non-catalytic reduction (SNCR) is one method of post-combustion control. SNCR selectively reduces NO_x into nitrogen and water vapor by reacting the flue gas with a reagent. The SNCR system is dependent upon the reagent injector location and temperature to achieve proper reagent/flue gas mixing for maximum NO_x reduction. SNCR systems require a fairly narrow temperature range for reagent injection in order to achieve a specific NO_x reduction efficiency. The optimum temperature range for injection of ammonia or urea is 1,500 to

1,900 °F. The NO_x reduction efficiency of an SNCR system decreases rapidly at temperatures outside the optimum temperature window. Operation below this temperature window results in excessive ammonia emissions (slip). Operation above the temperature window results in increased NO_x emissions. The exhaust temperature at the exit of a combustion turbine, which is approximately 1,100 °F for these units, is too low for any consideration of this technology.

Due to the technical and operational limitations on temperature and available reaction time, this method of post-combustion control will be eliminated from further evaluation for control of NO_x emissions in this BACT analysis.

3.3.3.5 Selective Catalytic Reduction. Another post-combustion method is selective catalytic reduction (SCR). SCR systems have been used quite extensively in CTG/HRSG projects for the past five years. The SCR process combines vaporized ammonia with NO_x in the presence of a catalyst to form nitrogen and water. The vaporized ammonia is injected into the combustion turbine exhaust gases prior to passage through the catalyst bed. The use of SCR results in small levels of ammonia emissions (ammonia slip). As the catalyst degrades ammonia slip will increase to approximately 10 ppm, ultimately requiring catalyst replacement.

The performance and effectiveness of SCR systems are directly dependent on the temperature of the flue gas when it passes through the catalyst. Vanadium/titanium catalysts have been used on the vast majority of SCR system installations (greater than 95 percent). The flue gas temperature range for optimum SCR operation using a conventional vanadium/titanium catalyst is approximately 600 to 750 °F. At temperatures above 800 °F permanent damage to the vanadium/titanium catalyst occurs. For the combined cycle turbines proposed for the Generating Station, this temperature window does exist. The flue gas temperature is reduced in the HRSG of the CTG/HRSG proposed for this Generating Station and would typically range from 200 to 700 °F. Accordingly, a vanadium/titanium catalyst can be installed at this Generating Station. Therefore, the vanadium/titanium-based catalyst will be evaluated further for these units.

The operation of an SCR could present a negative impact on the environmental performance of the combustion turbine units. The environmental impact is due to the reaction of the excess ammonia that passes through the SCR with the sulfur trioxide (SO_3) in the flue gas to form ammonia-sulfur salts, such as ammonium bisulfate. These compounds form when the flue gas cools upon leaving the stack. This particulate adds to the emissions of PM_{10} from the unit.

Limitations to accurate measurements of emissions consistently below the 3 to 3.5 ppmvd are also a concern. Limitations in measuring any lower level of emission include sampling methods, analyzer limitations, and calibration gas error. Current EPA procedures and standards recognize such limitations. Currently, 40 CFR Part 75 allows emission monitors with span ranges of less than 200 ppmvd to have calibrations that deviate by up to 10 ppmvd and still be considered "in control." The difference of 1 ppmvd in the low values being measured will be in the "noise" range of the emission monitoring system. Lowering the limit to a level below 3.5 ppmvd will only magnify this lack of accuracy, thereby increasing the potential for emission exceedances without providing any further real reduction in emissions. A report by the American Society of Mechanical Engineers (ASME) on reviewing current measuring and monitoring practices indicated that relative accuracy results varied from 1.3 to 34 percent when testing low NO_x emitters.

Because the SCR system requires the regulation of ammonia injection based on the emission monitors, the accuracy of the emission reading directly influences the amount of actual error in the ammonia injection rate. Therefore, erroneous emission readings can result in excess ammonia levels even when the actual NO_x values is below the permitted values. This may result in excessive ammonia "slip" being discharged to the atmosphere with little or no improvement in NO_x emissions. Reduction of the NO_x emission concentrations to levels below 3.5 ppmvd also raises concerns with the additional ammonia that maybe emitted to obtain further reduced levels. Although SCR catalyst vendors have indicated that ammonia emissions will not be increased, these vendors are not solely responsible for guaranteeing ammonia slip. The distribution of the ammonia in the duct is the key parameter since localized maldistribution of the ammonia will cause the ammonia to pass through the catalyst without reacting with the NO_x. The proper distribution of the gas and ammonia is difficult to obtain when both reactants, NO_x and NH_3, are at such low concentrations. This distribution would be even more difficult, if not impossible, to maintain during transient operations, such as load changes, when flow patterns are changing. Changes in operation from one stable load to another stable load may present problems since the flow patterns and the loads may be different. Since the catalyst vendors are not responsible for the ammonia distribution, they typically limit their guarantees to some distribution level. Such conditions that increase ammonia emissions will be counter productive to the reduction of overall emissions since ammonia presents an emission problem itself and is a precursor to $PM_{2.5}$.

This method of post-combustion control will be considered in this BACT analysis to control NO_x emissions.

3.3.3.6 SCONO$_x$. A third, relatively new post-combustion technology from Goal Line Environmental Technologies in conjunction with ABB Alstom Power, is $SCONO_x$, which utilizes a coated oxidation catalyst to remove both NO_x and CO without a reagent such as ammonia. As previously noted, the South Coast Management District has declared LAER as 2.0 ppm of NO_x, based on this technology. Although this system has been proven on a small size unit, scale up concerns still exist with regard to the use of this technology on large units. To date, $SCONO_x$ has not been demonstrated in practice for a GE 7241(FA) (i.e., Frame 7 or F-Class) combustion turbine.

The $SCONO_x$ system utilizes hydrogen (H_2) (which is created by reforming natural gas) as the basis for a proprietary catalyst regeneration process. The system consists of a platinum-based catalyst coated with potassium carbonate (K_2CO_3) to oxidize both NO_x and CO and thereby reducing plant emissions. CO emissions are decreased by the oxidation of CO to carbon dioxide (CO_2). The catalyst is installed in the flue gas at a point where the temperature is between 300 to 700 F. ABB Alstom/Goal Line guarantees the performance of the catalyst for 3 years. When the catalyst reaches the end of its service life, it can be recycled to recover the precious metal contained within the catalyst. This recycled material can account for as much as one-third the cost of the replacement catalyst.

The $SCONO_x$ catalyst is very susceptible to fouling by sulfur in the flue gas. The impact of sulfur can be minimized by a sulfur absorption $SCOSO_x$ catalyst. The $SCOSO_x$ catalyst is located upstream of the $SCONO_x$ catalyst. The SO_2 is oxidized to sulfur trioxide (SO_3) by the $SCOSO_x$ catalyst. The SO_3 is then deposited on the catalyst and removed from the catalyst when it is regenerated. The $SCOSO_x$ catalyst is regenerated along with the $SCONO_x$ catalyst.

The $SCONO_x$ catalyst will require that it be re-coated or "washed" every six months to one year. The frequency of washing is dependent on the sulfur content in the fuel and the effectiveness of the $SCOSO_x$ catalyst. The "washing" consists of removing the catalyst modules from the unit and placing each module with a potassium carbonate reagent, which is the active ingredient of the catalyst. The $SCOSO_x$ catalyst will also require washing, but due to limited operating experience with the $SCOSO_x$ catalyst, it is uncertain how often it will be required. However, it is expected that the $SCOSO_x$ catalyst will require annual washing.

The current $SCONO_x$ catalyst technology is in its second generation. The first generation operated for approximately ten months on a small LM-2500 combined cycle CT unit before it was taken out of service because of poor regeneration gas distribution.

A letter dated November 19, 1999 from EPA Region I had concerns regarding if $SCONO_x$ could handle the increased gas flow, mechanical durability and scale-up of the damper/louver system, reliability of the regenerative gas distribution system, the performance of the sulfur removal method, and catalyst performance guarantees. The EPA had concerns with the technical uncertainties and was apprehensive about applying $SCONO_x$ technology to large combined cycle turbines that burn primarily natural gas. In addition there are major issues with applying $SCONO_x$ to distillate fuel oil applications, given the higher sulfur content in the fuel. According to the EPA letter, ABB Alstom Power has executed a re-design and testing program to develop the $SCONO_x$ system for large turbine applications, but to date this new re-designed system has not been demonstrated in practice.

The November 19, 1999 EPA letter addresses that ABB Alstom had redesigned and fabricated a full-scale louver prototype system for larger turbine applications. In addition ABB had cycled the prototype louver system 102,000 times (approximately 5 years of operation) at operating temperatures of 620 F and enclosed the system in a hot casing shell design to avoid thermal stresses from the heat recovery steam generator. ABB Alstom has increased the catalyst module and regenerative gas distribution system that supplies gas to each individual module. Although, ABB Alstom has only performed computational fluid dynamics (CFD) modeling to try and verify the gas regeneration system. ABB Alstom has addressed degradation of the $SCONO_x$ catalyst from sulfur compounds found in natural gas, causing frequent system shutdowns, by verifying that a $SCOSO_x$ catalyst can be used upstream of the $SCONO_x$ catalyst. Furthermore, they claim the two catalysts are compatible and that the combined system will maintain sulfur and NO_x removal performance levels under different gas stream conditions. ABB Alstom Power will provide performance guarantees to all owners and operators of natural gas fired combined cycle combustion turbines, regardless of size or O&M. The EPA had them confirm the accuracy and correctness of their technical information in a response dated November 29, 1999. ABB Alstom has re-designed their $SCONO_x$ system for large turbine applications, but to date this new re-designed system has not been demonstrated in practice.

Another concern is the removal and replacement of the catalyst for re-coating without adversely impacting unit availability. The larger volume of catalyst used in an F class combustion turbine will require a significant period of washing or will necessitate the purchase of several spare catalyst modules.

The $SCONO_x$ system would also impact the power generation of the proposed facility. The flue gas pressure drop due to the catalyst is larger for the $SCONO_x$ process (approximately 4 to 5 in. w.g.) than the SCR process (approximately 2 to 3 in. w.g.). This increase in backpressure would result in an increase in lost power generation.

$SCONO_x$ is a technology that has effectively reduced emissions at the Federal Cold Storage facility thus far, and may have future promise. While mechanically very complicated, $SCONO_x$ technology allows for transient operation (load changes) and no ammonia issues are present, such as transportation, storage, or slip emissions. In addition, the wide operating temperature range has the potential for flexibility for future projects. The $SCONO_x$ catalyst can be placed in the most cost-effective location in an HRSG. The $SCONO_x$ catalyst can also significantly reduce CO emissions, thus reducing the need for an oxidation catalyst. However, there are a number of serious concerns regarding $SCONO_x$ that still need to be addressed prior to application to a Frame 7 or Class F machine. They include:

- Scale-up design issues for increasing the size of the application by 6 times from a LM-2500 to a Frame F combustion turbine. Scale-up design issues include damper size and proper distribution of regeneration gas.
- Mechanical system reliability: Damper and damper bearings are moving parts in the flue gas system that may present maintenance problems.
- On-line removal of catalyst for washing, including mechanics of how it is to be accomplished, time period, labor (cost), and safety issues.
- $SCOSO_x$ reliability: The SO_2 guard catalyst bed ($SCOSO_x$) can cause contaminated regeneration gas (containing sulfur and sulfur acids) to be handled, thereby questioning the effectiveness and reliability of the catalyst.
- Increased pressure drop.
- Proprietary Issue: $SCONO_x$ catalyst is a proprietary catalyst leading to concerns regarding long-term pricing.
- Warranty Issues: Since Goal Line is a relatively small company, there has been concern in the past regarding their ability to follow through with respect to potential warranty claims, not only for any single installation, but also in the event that multiple claims were to be made. ABB Alstom has signed a licensing agreement which will provide the financial backing and credibility required for warranties and guarantees. ABB Alstom has guaranteed the performance of their system, but operational risks associated with the use of $SCONO_x$ still need to be resolved.
- Financial Concerns: Lenders will have to assume performance and operational risks associated with the use of $SCONO_x$. The full-scope price without installation for a

$SCONO_x$ system is estimated to be 4 times larger than installing an SCR system on a large scale combined cycle facility.

As discussed above, the $SCONO_x$ technology may have future promise. The application of this technology is currently limited to combined cycle CT units under 32 MW. Although, there are technical concerns with using this new technology related to the operating plant size proposed for the Generating Station, this system will be evaluated in this BACT analysis.

3.3.4 Alternative CO Emission Reduction Systems

Typically, measures taken to minimize the formation of NO_x during combustion inhibit complete combustion, which increase the emissions of CO. CO is formed during the combustion process due to incomplete oxidation of the carbon contained in the fuel. CO formation is limited by ensuring complete and efficient combustion of the fuel in the combustion turbine. High combustion temperatures, adequate excess air, and good air/fuel mixing during combustion minimize CO emissions. The development of good combustion practice improvements with state of the art DLN burners has reduced CO emissions as compared to those previously obtained by the use of water injection as the main NO_x control method. These improved combustion characteristics have allowed minimization of CO emissions without sacrificing NO_x control performance. For this reason, the use of low NO_x burners that use good combustion practices is the standard method of also controlling CO emissions.

A current CO reduction technology available that will not impact NO_x emissions is the use of an oxidation catalyst to convert the CO to CO_2. The oxidation catalyst is typically a precious metal catalyst. None of the catalyst components are considered toxic. No reagent injection is necessary and oxidizing catalysts, dependent on the uncontrolled emission level, are capable of reducing CO emissions from 80 to 90 percent.

Another CO control technology that was screened was the previously discussed $SCONO_x$ process. The $SCONO_x$ system reduces CO emissions by oxidizing the CO to CO_2. As noted for the NO_x control evaluation, the $SCONO_x$ technology may have future promise. The application for this technology is currently limited to combined cycle CT units under 32 MW. The large size of the units proposed for this Generating Station (170 MW) as compared to the size of the $SCONO_x$ operating plant makes the potential scale-up challenging and unpractical. Although, there are technical concerns with using this new technology related to the operating plant size proposed for the Generating Station, this system will be evaluated in this BACT analysis.

This technology evaluation indicates that an oxidation catalyst and a SCONO$_x$ system are the control technologies suitable for further evaluation beyond the use of good combustion practices, as provided by a DLN burner.

3.3.5 Combined NO$_x$ and CO Control Technology Summary

In-combustor NO$_x$ and CO control by advanced combustion controls using dry low NOx burners is the least stringent control technology considered for this Generating Station. However, the use of an SCR system and oxidation catalyst or the SCONO$_x$ system to reduce emissions after combustion are technologies capable of achieving significantly lower emissions. Because the SCONO$_x$ system is capable of reducing NO$_x$ and CO emissions, the NO$_x$ and CO BACT analyses have been combined to avoid double counting the SCONO$_x$ technology, thus inflating its economic impacts. The following control technologies will be evaluated in this NO$_x$ and CO BACT analysis and are ranked in order of relative control effectiveness:

- In-combustor NO$_x$ and CO control consisting of DLN combustors to limit outlet emissions during natural gas and fuel oil firing for all operating loads for the CTG/HRSGs.
- The addition of an SCR system and oxidation catalyst to reduce outlet NO$_x$ to 3.5 ppmvd at 15 percent O_2 and CO to 1.2 ppmvd at 15 percent O_2 emissions from each combustion turbine with duct burner firing natural gas. The addition of an SCR system and oxidation catalyst to reduce outlet NO$_x$ to 15 ppmvd at 15 percent O_2 and CO to 1.4 ppmvd at 15 percent O_2 emissions from each combustion turbine while firing fuel oil.
- The addition of a SCONO$_x$ system to reduce outlet NO$_x$ emissions from each combustion turbine with duct burner firing natural gas and each combustion turbine firing fuel oil to 2.0 ppmvd at 15 percent O_2.

The SCR system with a 3.5-ppmvd NO$_x$ emission limit and an oxidation catalyst will be compared to the SCONO$_x$ system with a 2.0 ppmvd NO$_x$ emission limit.

The NO$_x$ and CO emissions per CTG/HRSG unit with application of the above possible controls are summarized in Tables 3-3 and 3-4 for natural gas and fuel oil firing, respectively.

Table 3-3
Estimated NO_x and CO Emissions
From Alternate Combined Control Technologies Per GE 7FA CCCT with Duct Firing During Natural Gas Firing.

	Control Technology Alternatives		
	Dry Low NO_x Combustors	SCR/Oxidation Catalyst	$SCONO_x$
NO_x Emissions			
ppmvd (at 15 percent O_2)	9.2	3.5	2.0
lb/hr	61.8	23.6	14.4
lb/MMBtu	0.0342	0.0131	0.0079
tons per year	261.8	100.0	57.2
Percent reduction	N/A	62%	78%
NO_x BACT Analysis (Annual)[a]	261.8	100.0	57.2
tons per year			
CO Emissions			
ppmvd (at 15 percent O_2)	12.2	1.2	1.2
lb/hr	52.6	5.3	5.3
lb/MMBtu	0.0291	0.0029	0.0029
tons per year	222.7	22.5	22.5
percent reduction	N/A	90%	90%
CO BACT Analysis (Annual)[a]	222.7	22.5	22.5
tons per year			

Notes:

[a] Total emissions are based on 8,472 hours per year firing natural gas at 100 percent of base load with duct firing at an ambient temperature of 59 F.

Table 3-4
Estimated NO_x and CO Emissions
From Alternate Combined Control Technologies Per GE 7FA CCCT
During Fuel Oil Firing.

	Control Technology Alternatives		
	Dry Low NO_x Combustors	SCR/Oxidation Catalyst	$SCONO_x$
NO_x Emissions			
ppmvd (at 15 percent O_2)	42.0	15	2.0
lb/hr	331.5	112.4	15.8
lb/MMBtu	0.1709	0.0580	0.0081
tons per year	47.7	16.2	2.3
percent reduction	N/A	64%	95%
NO_x BACT Analysis (Annual)[a]	47.7	16.2	2.3
tons per year			
CO Emissions			
Ppmvd (at 15 percent O_2)	14.2	1.4	1.4
lb/hr	67.9	6.8	6.8
lb/MMBtu	0.0035	0.0035	0.0035
tons per year	9.8	0.98	0.98
Percent reduction	N/A	90%	90%
CO BACT Analysis (Annual)[a]	9.8	0.98	0.98
tons per year			

Notes:

[a] Total emissions are based on 288 hours per year firing fuel oil at 100 percent of base load without duct firing at an ambient temperature of 59 °F.

3.3.6 Evaluation of Feasible Technologies

The following evaluation considers energy, environmental and economic impacts for the potential NO_x and CO BACT scenarios evaluated.

3.3.6.1 SCONO$_x$ Energy Impacts. The use of a SCONO$_x$ system will increase the energy requirements on the system. The SCONO$_x$ system will increase the backpressure on each combustion turbine by about 4 inches water gauge (in. w.g.). This will reduce the output of each CTG/HRSG by approximately 0.3 percent and increase the lost power generation. In addition, the period required for catalyst washing will result in increasing the lost power generation. It is estimated the unit will be offline for a period of 4 days per year to accommodate the washing process. Furthermore, there will be an energy lost due to steam consumption from the regeneration system. The steam serving as a carrier gas for the natural gas will be required regardless of the SCONO$_x$ location in the HRSG. ABB Alstom estimated that between 15,000 to 20,000 lb/hr of steam will be used in the regeneration production. These three effects will be added together to determine the total lost power generation and are included in the annualized cost estimate. The SCONO$_x$ system will have minimal effect on power consumption that will be necessary to operate the damper actuators and regeneration system. ABB Alstom estimated that approximately 10 to 20 kW would be consumed during operation of the SCONO$_x$ system. This increase in power consumption will be included in the annualized cost estimate. The natural gas required for the production of the regeneration gas will increase the annualized cost associated with using the SCONO$_x$ system. ABB Alstom estimated that 2 percent of the carrier gas will consist of the regeneration gas. Therefore, approximately 7,000 ft^3/hr (300 lb/hr) will be consumed in the regeneration process of the SCONO$_x$/SCOSO$_x$ catalyst. The annualized cost of natural gas consumption is included in the annualized cost analysis.

3.3.6.2 SCONO$_x$ Environmental Impacts. The SCONO$_x$ catalyst is composed of precious metals coated with potassium carbonate. When the potassium carbonate coating can no longer be regenerated the precious metal content of the remaining catalyst can be recycled. The oxidation of CO also directly results in increased production of CO_2, a greenhouse gas. There is currently a worldwide effort to reduce industrial emissions of CO_2 because of its contribution to global climate change. Installation of a SCONO$_x$ system would directly counter this initiative.

3.3.6.3 SCR Energy Impacts. The use of an SCR system impacts the energy requirements of the Generating Station. The SCR system requires vaporizers and blowers

to vaporize and dilute the aqueous ammonia reagent for injection. In addition, an SCR system catalyst will increase the backpressure on each combustion turbine. The SCR system will add about 1.6-inch water gauge (in. w.g.) backpressure to the units, respectively. This will reduce the output of the each unit by approximately 0.1 percent. Increased power consumption and lost power generation are included in the annualized cost estimate.

3.3.6.4 SCR Environmental Impacts. The vanadium content of the SCR catalyst may contribute to its classification as a hazardous waste. Therefore, spent catalyst may need to be handled and disposed of following hazardous waste procedures. Because of this, recycling of SCR catalysts for vanadium has become common.

The use of ammonia in an SCR system introduces an element of environmental risk. Ammonia is listed as a hazardous substance under Title III Section 302 of the Superfund Amendments and Reauthorization Act of 1986 (SARA). However, the storage and use of ammonia has been a relatively routine practice in utility power plants and industrial plant processes. According to Committee on Toxicology of the National Academy of Sciences and the Committee on Medical and Biological Effects of Environmental Pollutants (both of the National Research Council), the following threshold concentrations exist for ammonia:

Human Response	Concentration (ppm)
Immediate throat irritation	Equal to or greater than 400
Eye irritation	Equal to or greater than 700
Coughing	Equal to or greater than 1,700
Life threatening for short exposure	2,500 to 6,500
Rapidly fatal for short exposure	5,000 to 10,000

Some ammonia slip from the HRSG stack is unavoidable due to the imperfect distribution of the reagent and catalyst deactivation. Although ammonia emissions are not regulated nationally, the Northeast States for Coordinated Air Use Management (NESCAUM) has recommended an ammonia slip emissions limit of 10 ppmvd (uncorrected), unless that limit is shown to be inappropriate. Ammonia slip emissions from an SCR system is a design consideration that establishes catalyst life. Therefore, lower ammonia slip requirements ultimately limit catalyst life and dictates associated catalyst replacement. A design value of 10 ppmvd (uncorrected) is appropriate for a clean fuel facility such as this Generating Station. With fresh catalyst ammonia slip emissions will be

very low. However, as the catalyst deactivates, ammonia slip will increase approaching the design value at the end of the guaranteed catalyst life.

SCR catalysts can become contaminated over a period of time due to trace elements in the flue gas and may be classified as hazardous waste. Therefore, spent catalyst may need to be handled and disposed of following hazardous waste procedures.

The SCR catalyst will oxidize approximately 2 to 3 percent of the SO_2 in the flue gas to SO_3. Once the flue gas cools below approximately 600 °F the ammonia present in the flue gas may react with SO_3 to form ammonium sulfate and bisulfate salts. This formation may be dependent on the particular plume dispersion characteristics at the given time of stack discharge, which is dependent upon the temperature reached once the flue gas has left the stack. However, if the ammonia sulfate compounds are not formed, the SO_3 will react with the moisture in the flue gas to form sulfuric acid mist in the atmosphere. Any ammonium sulfate and bisulfate salts and sulfuric acid mist formed will increase the amount of particulate matter emitted in the flue gas.

3.3.6.5 Oxidation Catalyst Energy Impacts. An oxidation catalyst reactor located downstream of the combustion turbine exhaust will increase the backpressure on the combustion turbine. The additional backpressure of about 1.2 inches, water gauge, will reduce the combustion turbine output by approximately 0.1 percent. The cost of lost power revenue due to the backpressure is included in the economic analysis.

3.3.6.6 Oxidation Catalyst Environmental Impacts. The major environmental disadvantage that exists when using an oxidation catalyst to reduce CO emissions is that a percentage of the SO_2 in the flue gas will oxidize to SO_3. The higher the operating temperature the higher the SO_2 to SO_3 oxidation potential. It is estimated that approximately 30 percent of the SO_2 in the flue gas will oxidize to SO_3 as a result of the CO oxidation catalyst being installed after the combustion turbine outlet with high temperatures. The SO_3 will react with the moisture in the flue gas to form sulfuric acid (H_2SO_4) mist in the atmosphere. The increase in H_2SO_4 emissions would increase PM_{10} (matter less than 10 microns in diameter) emissions.

Spent oxidation catalyst is made up of precious metals that are not considered toxic. This allows the catalyst to be handled and disposed of following normal waste procedures. Because of the precious metal content of the catalyst, the CO oxidation catalyst can also be recycled to recover the precious metals.

As mentioned previously, the installation of an oxidation catalyst will also increase the backpressure on the turbine, thereby decreasing efficiency. This decrease in efficiency will

lead to increased emissions of all pollutants on a unit power output basis. The oxidation of CO also directly results in increased production of CO_2, a greenhouse gas. There is currently a worldwide effort to reduce industrial emissions of CO_2 because of its contribution to global climate change. Installation of an oxidation catalyst would directly counter this initiative.

3.3.6.7 Economic Impacts for SCR/Oxidation Catalyst and SCONOx. The use of an SCR and oxidation catalyst has significant economic impacts to the Generating Station. An analysis of the economic impact is provided in this section. The BACT costs presented in this analysis are based on operating each combustion turbine with duct firing at 100 percent of base load for 8,472 hours per year on natural gas and operating the combustion turbine for 288 hours per year of fuel oil. The capital and annualized cost for the $SCONO_x$ system also includes the $SCOSO_x$ system.

3.3.6.7.1 Capital Costs for SCR/Oxidation Catalyst and SCONOx. Table 3-5 presents the capital costs for installing an SCR/Oxidation Catalyst and $SCONO_x$ system on each CTG/HRSG unit during natural gas and fuel oil firing. The cost of the SCR/Oxidation Catalyst system includes the ammonia receiving, storage, transfer, vaporization, and injection; catalytic reactor housing; controls and instrumentation, sales taxes and freight. The cost of the $SCONO_x$ system includes the catalyst, regenerative gas distribution system, catalytic reactor housing, controls and instrumentation, sales taxes and freight. The balance of plant equipment cost for $SCONO_x$ was estimated to be the same percentage as an SCR/Oxidation Catalyst system. Capital costs were based on budgetary quotations from equipment manufacturers and other engineering estimates. Quotations for the SCR and oxidation catalyst material were based on vanadium/titanium and precious metal type catalysts, respectively. The direct installation costs included the balance of plant items listed in Table 3-5 and were calculated as percentages of the total purchased equipment costs. The total direct cost less the catalyst cost was determined such that the catalyst would be excluded, thereby eliminating the possibility of "double counting" the catalyst cost as an annualized O&M cost per OAQPS cost methods. The indirect costs were percentages of the equipment cost and are site specific. The 3 percent contingency value suggested in the OAQPS Cost Control Manual is judged to be inaccurate as compared to actual values typically used in the construction field for this level of estimating.

Total capital costs for the SCR and oxidation catalyst control system is calculated as the sum of the total direct cost less the catalyst cost and indirect installed costs per OAQPS cost

methods. The total capital cost per unit for a 3.5 ppmvd (0.0131 lb/MMBtu) NO_x and 1.2 ppmvd (0.0029 lb/MMBtu) CO outlet emission during natural gas firing and a 15 ppmvd (0.0610 lb/MMBtu) NO_x and 1.4 ppmvd (0.0035 lb/MMBtu) CO outlet emission during fuel oil firing SCR/Oxidation Catalyst system for the combustion turbines is estimated to be $3,269,000.

The total capital costs for the $SCONO_x$ control system is also calculated as the sum of the total direct cost less the catalyst cost and indirect installed costs per OAQPS cost methods. The total capital cost per unit for a 2.0 ppmvd (0.0079 lb/MMBtu) NO_x and 1.2 ppmvd (0.0029 lb/MMBtu) CO outlet emission during natural gas firing and a 2.0 ppmvd (0.0081 lb/MMBtu) NO_x and 1.4 ppmvd (0.0035 lb/MMBtu) CO outlet emission during fuel oil firing $SCONO_x$ system for each combustion turbine is estimated to be $14,716,000.

Table 3-5
Combined NO_x and CO Control Alternative Capital Cost Per GE 7FA CTG/HRSG Unit

	SCONO$_x$ System	**SCR/ Oxidation Catalyst**	**Low NO_x Burners**	**Remarks**
Direct Capital Cost				Cost based on emissions in Tables 3-3 and 3-4
SCR and Oxidation Catalysts System	Included	1,721,000	N/A	Estimated from Engelhard Corporation
SCONO$_x$ Catalyst	7,800,000	N/A	N/A	Estimated from ABB Alstom Power
SCONO$_x$ System	5,200,000	N/A	N/A	Estimated from ABB Alstom Power
Catalyst Reactor Housing	Included	268,000	N/A	Estimated from ABB Alstom and scaled from an estimate from Engelhard Corporation
Control/Instrumentation	Included	180,000	N/A	Estimated; includes controls and monitoring equipment.
Ammonia (Equipment/Storage)	N/A	200,000	N/A	Estimated from previous projects
Purchased Equipment Costs	13,000,000	2,369,000	N/A	
Sales Tax	390,000	71,000	N/A	3% of Purchased Equipment Costs
Freight	650,000	118,000	N/A	5% of Purchased Equipment Costs
Total Purchased Equipment Costs	14,040,000	2,558,000	N/A	
Direct Installation Costs				
Balance of Plant	4,212,000	767,000	N/A	For SCR & SCONO$_x$: 8% Foundation & Supports, 14% Handling & Erection, 4% Electrical Installation, 2% Piping, 1% Insulation and 1% Painting
Total Direct Cost Less Catalyst	**10,452,000**	**2,040,000**	Base	Catalyst cost is excluded as annual O&M cost
Indirect Capital Costs				
Contingency	2,808,000	512,000	N/A	20% of Direct Capital Cost
Engineering and Supervision	520,000	256,000	N/A	10% of Direct Capital Cost
Construction & Field Expense	260,000	128,000	N/A	5% of Direct Capital Cost
Construction Fee	520,000	256,000	N/A	10% of Direct Capital Cost,
Start-up Assistance	104,000	51,000	N/A	2% of Direct Capital Cost
Performance Test	52,000	26,000	N/A	1% of Direct Capitol Cost
Total Indirect Capital Costs	4,264,000	1,229,000	Base	
Total Installed Cost	**14,716,000**	**3,269,000**	Base	

3.3.6.7.2 Operating Costs for SCR/Oxidation Catalyst and SCONOx. Table 3-6 presents the annualized operating costs and emission rates using an SCR/Oxidation catalyst and $SCONO_x$ system during natural gas and fuel oil firing. Annualized operating costs for the SCR/Oxidation Catalyst include catalyst replacement, energy impacts, operating personnel, maintenance, reagent and heat rate penalty. Throughout the life of the plant, catalyst elements for both the SCR and the oxidation catalyst will require periodic replacement. As the SCR catalyst becomes deactivated, ammonia slip emissions will increase. At the point ammonia slip approaches 10 ppmvd the catalyst must be replaced. The oxidation catalyst is installed upstream of the ammonia injection grid and SCR catalyst, therefore there are no problems associated with ammonia slip but the CO catalyst degrade such that CO emissions increase. Currently, catalyst manufacturers are willing to guarantee an SCR and oxidation catalyst life of three years of equivalent operating hours. The catalyst replacement cost was calculated by multiplying the cost of the catalyst replacement modules by 15 percent for installation cost, 8 percent that includes sales taxes and freight, and a capital recovery factor based on the real interest rate over the 3 year guaranteed life of the catalyst.

For conservatism in cost, ammonia consumption rates were based on a stoichiometric ratio of 1.4 for reacting NO. The higher stoichiometric ratio allows for a higher molar ratio of ammonia required to react with NO_2. The heat rate penalty cost item reflects the cost due to the SCR and oxidation catalyst backpressure losses. The additional backpressure will derate the combustion turbine resulting in lost electric sales revenue. The costs associated with these impacts are included in the annualized cost estimate.

The annualized operating costs for the $SCONO_x$ system include catalyst replacement, energy impacts, operating personnel, maintenance, natural gas consumption, catalyst washing, and heat rate penalty due to backpressure losses and steam usage. The $SCONO_x$ catalyst will require periodic washing and replacement throughout the life of the facility. The emissions will increase as the catalyst becomes deactivated, resulting in more frequent washing cycles. Replacement of the catalyst will result in lost power generation during the outage period. ABB Alstom is willing to guarantee $SCONO_x$ catalyst life of 3 years of equivalent operating hours.

Table 3-6
Combined NO_x and CO Control Annualized Cost Per GE 7FA CTG/HRSG Unit

	$SCONO_x$ System	SCR/Oxidation Catalyst	Low NO_x Burners	Remarks
Direct Annual Cost				Cost based on emissions in Tables 3-3 and 3-4
Catalyst Replacement	3,871,000	638,000	N/A	Catalyst life of 3 yr. of equivalent operating hours
Operation and Maintenance	192,000	39,000	N/A	See text for background information on this item
Reagent Feed	N/A	52,000	N/A	Assumes 1.4 stoichiometric ratio
Natural Gas Consumption	170,000	N/A	N/A	Based on 7,000 ft^3/hr required
Power Consumption	3,000	4,000	N/A	Includes injection blower and vaporization of ammonia for SCR and damper actuation for $SCONO_x$
Lost Power Generation				
$SCONO_x$ Washing	544,000	N/A	N/A	Down time due to $SCONO_x$ washing period
Steam Consumption	491,000	N/A	N/A	Loss based on 15,000 lb/hr of steam required
Backpressure	103,000	72,000	N/A	Includes backpressure on CT
Annual Distribution Check	N/A	8,000	N/A	Required for SCR, estimated as 0.5% of total direct cost less catalyst cost
Total Direct Annual Cost	5,374,000	813,000	N/A	
Indirect Annual Costs				
Overhead	53,000	19,000	N/A	60% of O&M Labor
Administrative Charges	294,000	65,000	N/A	2% of Total Installed Cost
Property Taxes	405,000	90,000	N/A	2.75% of Total Installed Cost
Insurance	147,000	33,000	N/A	1% of Total Installed Cost
Capital Recovery	1,686,000	177,000	N/A	Capital Recovery Factor times Total Installed Cost
Total Indirect Annual Costs	2,585,000	384,000	N/A	
Total Annualized Cost	**7,959,000**	**1,197,000**	N/A	
Annual Emissions, tpy	82.7	139.5	542.0	Emissions taken from Tables 3-3 and 3-4
Emissions Reduction, tpy	459.3	402.6	N/A	Emissions calculated from Tables 3-3 and 3-4
Total Cost Effectiveness, $/ton	**17,300**	**3,000**	N/A	Total Annualized Cost/Emissions Reduction
Incremental Annualized Cost	**6,762,000**	N/A	N/A	See text for background information on this item
Incremental Reduction	**119,000**	N/A	N/A	See text for background information on this item.

The use of either an SCR/Oxidation Catalyst system or a $SCONO_x$ system increases the energy requirements of the project. The SCR system requires vaporizers and blowers to vaporize and dilute the aqueous ammonia reagent for injection. Increased NO_x reduction rates require increased ammonia consumption resulting in increased power consumption of the project. $SCONO_x$ consumes a relatively small amount of power to open and close the catalyst dampers and to produce the regenerating gas. Maintenance costs will consist of routine system maintenance for each system. However, there is an additional maintenance cost associated with catalyst washing for the $SCONO_x$ system. The replacement materials are assumed to be two percent of the original cost for equipment and labor is assumed to be equal to materials. The $SCONO_x$ system will include the additional O&M cost for catalyst washing.

3.3.6.7.3 Total Annualized Costs for SCR/Oxidation Catalyst and SCONOx.

Total annualized costs for the SCR and oxidation catalyst control systems are calculated as the sum of operating costs plus capital recovery factor times the total installed costs. Table 3-6 shows the total annualized cost per unit for a SCR/Oxidation Catalyst system per combustion turbine is estimated to be $1,197,000. This annualized cost for the CTG/HRSG unit results in a cost effectiveness of approximately $3,000 per ton of NO_x and CO removed.

The total annualized costs for the $SCONO_x$ control system are calculated as the sum of the operating costs plus capital recovery factor times the total installed costs. The total annualized cost per unit for a $SCONO_x$ system per combustion turbine is estimated to be $7,959,000. This annualized cost for the CTG/HRSG unit results in a cost effectiveness of approximately $17,300 per ton of NO_x and CO removed.

The incremental annualized cost system is calculated as the difference in annualized cost between the $SCONO_x$ and SCR/Oxidation catalyst. In addition, the incremental NO_x and CO reduction in tons per year is calculated as the difference in combined tons per year of NO_x and CO removed (alternative controlled baseline) between the two control technologies. Furthermore, the incremental removal cost is determined by dividing the incremental annualized cost by the controlled baseline reduction. It should be noted that this incremental cost effectiveness is considered relative to the next most stringent control alternative baseline (i.e., $SCONO_x$ compared to SCR/Oxidation Catalyst rather than just DLN). These cost increments will allow a comparison between the two removal technologies. The incremental annualized cost between $SCONO_x$ and the SCR/Oxidation Catalyst system is estimated to be $6,762,000. This results in an incremental cost effectiveness of approximately $119,000. This cost is considered high and for this

application it is not cost effective to use SCONO$_x$ over a SCR/Oxidation catalyst system per CTG/HRSG unit.

3.3.7 Economic Impacts for SCR

The control of NO_x emissions separate from CO emission control is possible through the application of an SCR to the CTG/HRSG units without additional CO emission controls. To determine the BACT levels for NO_x controls without the influence of the CO emissions a separate economic analysis is required. The BACT costs presented in this analysis are based on operating each combustion turbine with duct firing at 100 percent of base load for 8,472 hours per year on natural gas and each combustion turbine at 100 percent of base load for 288 hours per year on fuel oil.

3.3.7.1 Capital Costs for SCR System. Table 3-7 presents the capital costs for installing an SCR system on the CTG/HRSG units during natural gas and fuel oil firing to achieve a NO_x outlet emission level of 3.5 and 15.0 ppmvd. The cost of the SCR system includes the ammonia receiving, storage, transfer, vaporization, and injection; catalytic reactor housing; controls and instrumentation, sales taxes and freight. Capital costs were based on budgetary quotations from equipment manufacturers and other engineering estimates. Quotations for the SCR catalyst material were based on vanadium/titanium type catalysts. The direct installation costs included the balance of plant items listed in Table 3-7 and were calculated as percentages of the total purchased equipment costs. The total direct cost less the catalyst cost was determined such that the catalyst would be excluded, thereby eliminating the possibility of "double counting" the catalyst cost as an annualized O&M cost per OAQPS cost methods. The indirect costs were percentages of the equipment cost and are site specific. The 3 percent contingency value suggested in the OAQPS Cost Control Manual is judged to be inaccurate as compared to actual values typically used in the construction field for this level of estimating.

Total capital costs for the SCR system to reduce NO_x is calculated as the sum of the total direct cost less the catalyst cost and indirect installed costs per OAQPS cost methods. The total capital cost per unit for an SCR catalyst system per combustion turbine is estimated to be $2,421,000.

Table 3-7
NO_x Control Capital Cost Per GE 7FA CTG/HRSG Unit

Cost Item	SCR	Low NO_x Burners	Remarks
Direct Capital Cost			Cost based on emissions in Tables 3-3 and 3-4
SCR Catalysts System	975,000	N/A	Estimated from Engelhard Corporation
Catalyst Reactor Housing	268,000	N/A	Scaled from an estimate from Engelhard Corporation
Control/Instrumentation	140,000	N/A	Estimated; includes controls and monitoring equipment.
Ammonia Injection/Dilution Equipment	Included	N/A	Estimated from Engelhard Corporation
Ammonia Storage	200,000	N/A	Estimated from previous projects
Purchased Equipment Costs	1,583,000	N/A	
Sales Tax	47,000	N/A	3% of Purchased Equipment Cost
Freight	79,000	N/A	5% of Purchased Equipment Cost
Total Purchased Equipment Costs	1,709,000	N/A	
Direct Installation Costs			
Balance of Plant	513,000	N/A	For SCR: 8% Foundation & Supports, 14% Handling & Erection, 4% Electrical Installation, 2% Piping, 1% Insulation and 1% Painting
Total Direct Cost Less Catalyst	1,601,000	Base	Catalyst Cost is excluded as annual O&M Cost
Indirect Capital Costs			
Contingency	342,000	N/A	20% of Direct Capital Cost
Engineering and Supervision	171,000	N/A	10% of Direct Capital Cost
Construction & Field Expense	85,000	N/A	5% of Direct Capital Cost
Construction Fee	171,000	N/A	10% of Direct Capital Cost,
Start-up Assistance	34,000	N/A	2% of Direct Capital Cost
Performance Test	17,000	N/A	1% of Direct Capitol Cost
Total Indirect Capital Costs	820,000	Base	
Total Installed Cost	**2,421,000**	Base	

3.3.7.2 Operating Costs for SCR. Table 3-8 presents the annualized operating costs and emission rates using an SCR during natural gas and fuel oil firing. Annualized operating costs for SCR use include catalyst replacement, energy impacts, operating personnel, maintenance, reagent and heat rate penalty. The description of the operating costs and effects of ammonia consumption, backpressure, and catalyst life have already been described in Section 3.4.6.

3.3.7.3 Total Annualized Costs for SCR. The total annualized costs for the SCR system are calculated as the sum of operating costs plus capital recovery factor times the total installed costs. The total annualized cost per unit for an SCR system per combustion turbine is estimated to be $881,000. This annualized cost for each CTG/HRSG unit results in an incremental cost effectiveness of approximately $4,600 per ton of NO_x removed.

Table 3-8
NO_x Control Annualized Cost Per GE 7FA CTG/HRSG Unit

	SCR	Low NO_x Burners	Remarks
Direct Annual Cost			Cost based on emissions in Tables 3-3 and 3-4
Catalyst Replacement	308,000	N/A	Catalyst life of 3 yr. of equivalent operating hours
Operation and Maintenance	35,000	N/A	See text for background information on this item
Reagent Feed	52,000	N/A	Assumes 1.4 stoichiometric ratio
Power Consumption	4,000	N/A	Includes injection blower and vaporization of ammonia for SCR
Lost Power Generation	41,000		Back Pressure on CT
Annual Distribution Check	8,000	N/A	Required for SCR, estimated as 0.5% of total direct cost less catalyst cost
Total Direct Annual Cost	448,000	N/A	
Indirect Annual Costs			
Overhead	17,000	N/A	60% of O&M Labor
Administrative Charges	48,000	N/A	2% of Total Installed Cost
Property Taxes	67,000	N/A	2.75% of Total Installed Cost
Insurance	24,000	N/A	1% of Total Installed Cost
Capital Recovery	277,000	N/A	Capital Recovery Factor times Total Installed Cost
Total Indirect Annual Costs	433,000	N/A	
Total Annualized Cost	**881,000**	N/A	
Annual Emissions, tpy	116.7	309.5	Emissions taken from Tables 3-3 and 3-4
Emissions Reduction, tpy	193.3	N/A	Emissions calculated from Tables 3-3 and 3-4
Total Cost Effectiveness, $/ton	**4,600**	N/A	Total Annualized Cost/Emissions Reduction

3.3.8 Economic Impacts for Oxidation Catalyst

The use of an oxidation catalyst has significant economic impacts to the Generating Station. An analysis of the economic impact is provided in this section. The BACT costs presented in this analysis are based on operating each combustion turbine with duct firing at 100 percent of base load for 8,472 hours per year on natural gas and operating the combustion turbine for 288 hours per year of fuel oil.

3.3.8.1 Capital Cost for Oxidation Catalyst. Table 3-9 presents the capital costs for installing an oxidation catalyst on the CTG/HRSG units during natural gas and fuel oil firing to achieve a CO outlet emission level of 1.2 and 1.4 ppmvd, respectively. The capital costs for the systems includes the oxidation catalyst reactor, controls and instrumentation, sales taxes and freight, and were based on budgetary quotations from equipment manufacturers and other engineering estimates. The direct installation costs included the balance of plant items listed in Table 3-9 and were calculated as percentages of the total purchased equipment costs. The total direct cost less the catalyst cost was determined such that the catalyst would be excluded, thereby eliminating the possibility of "double counting" the catalyst cost as an annualized O&M cost per OAQPS cost methods. The indirect costs were percentages of the equipment cost and are site specific. The 3 percent contingency value suggested in the OAQPS Cost Control Manual is judged to be inaccurate as compared to actual values typically used in the construction field for this level of estimating.

Total capital costs for the oxidation catalyst control system to reduce CO is calculated as the sum of the direct and indirect installed costs. The total capital cost per unit for an oxidation catalyst system is estimated to be $1,364,000.

3.3.8.2 Operating Costs for Oxidation Catalyst. Table 3-10 presents the annualized operating costs and emission rates using an oxidation catalyst to achieve a 90 percent reduction in CO emissions while firing natural gas for the CTG/HRSG units. CO outlet emissions would be reduced to a maximum of 1.2 and 1.4 ppmvd during natural gas and fuel oil firing respectively, for the CTG/HRSG units. Annualized operating costs for the system includes catalyst replacement, operating personnel, maintenance costs, and lost power generation. Throughout the life of the plant, catalyst elements will require periodic replacement. Currently, catalyst manufacturers are willing to guarantee an oxidation catalyst life of three years of equivalent operating hours for an oxidation catalyst.

3.3.8.3 Total Annualized Costs for Oxidation Catalyst. Total annualized costs for using the oxidation catalyst are calculated as the sum of operating costs plus capital recovery factor times the total installed costs. The total annualized cost per combustion turbine unit is estimated to be $602,000. This annualized cost per CTG/HRSG unit results in a cost effectiveness of approximately $2,900 per ton of CO removed.

Table 3-9
CO Reduction System Capital Cost Per GE 7FA CTG/HRSG Unit

	Oxidation Catalyst	Good Combustion Controls	Remarks
Direct Capital Cost			
Oxidation Catalyst	746,000	NA	Estimated from Engelhard Corporation
Catalyst Reactor Housing	268,000	NA	Scaled from an estimate from Engelhard Corporation based on catalyst size
Control/Instrumentation	40,000	NA	Estimated
Purchased Equipment Costs	1,054,000	NA	
Sales Tax	32,000	NA	3% of Purchased Equipment Cost
Freight	53,000	NA	5% of Purchased Equipment Cost
Total Purchased Equipment Costs	1,139,000	NA	
Direct Installation Costs			
Balance of Plant	342,000	NA	8% For Foundations & Supports,14% Handling & Erection, 4% Electrical Installation, 2% Piping, 1% Insulation and 1% Painting.
Total Direct Capital Cost Less Catalyst	817,000	Base	
Indirect Capital Costs			
Contingency	228,000	NA	20% of Direct Capital Cost
Engineering and Supervision	114,000	NA	10% of Direct Capital Cost
Construction & Field Expense	57,000	NA	5% of Direct Capital Cost
Construction Fee	114,000	NA	10% of Direct Capital Cost
Start-up Assistance	23,000	NA	2% of Direct Capital Cost
Performance Test	11,000	NA	1% of Direct Capital Cost
Total Indirect Capital Costs	547,000	Base	
Total Installed Cost	**1,364,000**	Base	

Table 3-10
CO Reduction System Annualized Cost Per GE 7FA CTG/HRSG Unit

	Oxidation Catalyst	Good Combustion Controls	Remarks
Direct Annual Cost			Cost based on emissions in Tables 3-3 and 3-4
Catalyst Replacement	330,000	NA	Catalyst life of 3 yr. of equivalent operating hours
Operation and Maintenance	4,000	NA	See text for background information on this item
Lost Power Generation	31,000	NA	Back Pressure on Combustion Turbine
Total Direct Annual Cost	365,000	NA	
Indirect Annual Costs Indirect Annual Costs			
Overhead	2,000	NA	60% of Operating and Maintenance Labor
Administrative Charges	27,000	NA	2% of Total Installed Cost
Property Taxes	38,000	NA	2.75% of Total Installed Cost
Insurance	14,000	NA	1% of Total Installed Cost
Capital Recovery	156,000	NA	Capital Recovery Factor times Total Installed Cost
Total Indirect Annual Costs	237,000	NA	
Total Annualized Cost	**602,000**	NA	
Annual Emissions, tpy	23.3	232.5	Emissions taken from Tables 3-3 and 3-4
Emissions Reduction, tpy	209.3	NA	Emissions calculated from Tables 3-3 and 3-4
Total Cost Effectiveness, $/ton	**2,900**	NA	Total Annualized Cost/Emissions Reduction

3.3.9 Conclusions

To summarize the information discussed in this section of the NO_x and CO BACT, there are several significant technological concerns with utilizing the $SCONO_x$ system. First, $SCONO_x$ is still in the development and demonstration stage. Even though ABB Alstom has re-designed their $SCONO_x$ system for large turbine applications, to date this new re-designed system has not been demonstrated in practice. The LAER level of 2 ppmvd NO_x emissions based on using a combination of water injection and a $SCONO_x$ catalyst is considered unproven and technically unacceptable for this Generating Station. Although, that system was proven successful for operation at 32 MW, the plant size proposed for the Generating Station raises technical concerns with using this new technology. Second, the higher capital and annualized O&M cost of the $SCONO_x$ system will negatively impact the Projects economics. The capital cost for a $SCONO_x$ system would be approximately $14,716,000 per CTG/HRSG unit. Furthermore, installation of a $SCONO_x$ system designed to reduce NO_x and CO emissions would add approximately $7,959,000 to the annualized operating cost per CTG/HRSG unit. The resultant cost effectiveness is approximately $17,300 per ton of NO_x and CO removed for each CTG/HRSG unit. These costs are considered high for reducing NO_x and CO emissions for this Generating Station compared to an equivalent SCR and oxidation catalyst system.

The annualized and capital costs for the SCONOx system are approximately 4 and 5 times the cost for an equivalent SCR and oxidation catalyst system. The capital cost for an SCR/Oxidation catalyst system would be about $3,269,000 per CTG/HRSG unit. Installation of a SCR/Oxidation catalyst system would add approximately $1,197,000 to the annualized operating cost of each CTG/HRSG unit. The resultant cost effectiveness is approximately $3,000 per ton of NO_x and CO removed per CTG/HRSG unit. Furthermore, the incremental annualized cost of the $SCONO_x$ system compared to the SCR/Oxidation catalyst system is about $6,762,000 for each CTG/HRSG unit, which is considered high in light of the existing feasible technologies that can attain the same reductions at a lower overall cost. The $SCONO_x$ system at its current capital and annualized cost can not compete economically to a SCR/Oxidation catalyst system for this combustion turbine application. Therefore, based on economics and the lack of a demonstrated emission limit on larger CTG/HRSG units, this new system was not considered BACT for the Generating Station.

SCR catalysts have proven emissions reduction capabilities and low maintenance requirements at a variety of different facilities throughout the United States, Europe and Asia. SCR systems are representative of the BACT/LAER level of NO_x emissions reduction. SCR systems have been successfully used on numerous combined cycle combustion turbine applications. The capital and annualized operating cost for an SCR

system per CTG/HRSG unit is $2,421,000 and $881,000, respectively. The incremental cost effectiveness for the CTG/HRSG unit is estimated to be $4,600 per additional ton of NO_x removed. The operation of an SCR at lower emission rates will likely result in increased PM_{10} emissions caused by the additional SO_2 to SO_3 oxidation, as well as associated ammonium bisulfate/sulfate and H_2SO_4 emissions. Therefore, based on energy, environmental and economic impacts, the use of DLN combustors with an SCR to meet an emissions level of 3.5 ppmvd (0.0131 lb/MMBtu, 23.6 lb/hr) for each natural gas fired CTG/HRSG with duct burners and 15 ppmvd (0.0580 lb/MMBtu, 112.4 lb/hr) for each combustion turbine during fuel oil firing are proposed as BACT for NO_x.

Installation of an oxidation catalyst would have negative energy, environmental and economic impacts. In summary, the oxidation catalyst would increase the backpressure on the turbine; thereby increasing emissions per unit of electric generation due to decreased turbine efficiency and increased fuel consumption. The oxidation catalyst would increase particulate emissions as a result of increased SO_3 production. In addition, the oxidation catalyst results in an increase in CO_2 emissions, which may contribute to global warming. The negative economic impacts include increased production costs due to decreased efficiency, increased capital cost for the installation of the oxidation catalyst, and increased operating cost due to periodic replacement of the oxidation catalyst.

The capital cost to install an oxidation catalyst system for a CTG/HRSG unit designed to reduce CO emissions by 90 percent would be $1,364,000 and the annualized operating cost would be increased by $602,000 per year. The resultant cost effectiveness on a per ton of CO removed basis is approximately $2,900. Therefore, based on economic, environmental, and energy impacts, the proposed CO BACT for the control of CO emissions from each combustion turbine is good combustion practices to achieve a CO emission limit of 12 and 14 ppmvd at 15 percent O_2 during natural gas and fuel oil firing.

3.4 Combustion Turbine PM/PM_{10} BACT Analysis

The objective of this analysis is to determine BACT for PM/PM_{10} emissions from the combined cycle combustion turbines. This includes the combustion turbines and supplemental firing in the HRSG as a total unit.

The emissions of particulate matter from the Generating Station will be controlled by ensuring as complete combustion of the fuel as possible and by minimizing SO_2 to SO_3 oxidation. The NSPS for combustion turbines do not establish a particulate emission limit. Natural gas contains only trace quantities of non-combustible material.

The manufacturer's standard operating procedures include filtering the turbine inlet air and combustion controls. The BACT/LAER Clearinghouse documents do not list any

post-combustion particulate matter control technologies being used on combustion turbines. Consistent with the previous determinations as referenced by the State of Florida, such as the FPL Fort Myers, Santa Rosa and Tallahassee projects, the use of combustion controls is considered BACT for particulate matter and is proposed for this Generating Station. BACT was determined to be good combustion controls and combustion air filters to achieve a PM/PM_{10} emission limit of 0.0110 lb/MMBtu (19.8 lb/hr) during natural gas firing. BACT was determined to be good combustion controls and combustion air filters to achieve a PM emission limit of 0.0320 lb/MMBtu (62.1 lb/hr) and a PM_{10} emissions limit of 0.0311 lb/MMBtu (60.4 lb/hr) during fuel oil firing. PM/PM_{10} emissions conservatively include front and back half catch as well as the effects of SO_2 oxidation and SCR formation of ammonium sulfates.

3.5 Cooling Tower BACT Analysis

Uncontrolled cooling towers can be high emitters of PM/PM_{10} under certain conditions. PM/PM_{10} from cooling towers is generated by the presence of dissolved and suspended solids in the cooling tower circulation water, which is potentially lost as drift. A portion of the water droplets emitted from the tower exhausts will evaporate leaving the suspended or dissolved solids in the atmosphere and thus subject to dispersion. Typically, drift eliminators are used to minimize drift (droplet) losses. The drift eliminator control efficiency for the proposed cooling towers is 0.002 percent resulting in emissions of 0.08 lb/hr. The drift eliminators are proposed as BACT for PM/PM_{10} for the cooling towers.

3.6 Conclusions

The following is a summary of the BACT determination and associated emission rates for two GE 7241(FA) combustion turbines operating with duct burners in combined cycle mode to be installed for JEA. Emissions are currently based on the GE 7241(FA) combined cycle combustion turbine units with duct burner firing. The combustion turbines will fire natural gas and No. 2 fuel oil. The duct burners will fire only natural gas. Emissions for each combustion turbine-generator/heat recovery steam generator (CTG/HRSG) unit are for full load operation with duct firing at 8,472 hours per year firing natural gas at an ambient temperature of 59 °F. Also included in this BACT are emissions for each combustion turbine-generator (CTG) unit firing fuel oil at full load operation without duct firing for 288 hours per year at an ambient temperature of 59 °F.

GE 7241(FA) CTG/HRSG Units:

Nitrogen oxides (NO_x) emissions -- BACT was determined to be the use of dry low NO_x burners with an SCR during natural gas firing and water injection with an SCR for fuel oil firing to achieve the following emission limits.

- Burning natural gas at full load, an emission limit of 0.0131 lb/MMBtu (23.6 lb/hr, 3.5 ppmvd at 15 percent O_2).
- Burning fuel oil at full load, an emission limit of 0.0580 lb/MMBtu (112.4 lb/hr, 15 ppmvd at 15 percent O_2).

Carbon monoxide (CO) emissions – BACT was determined to be good combustion controls to achieve a CO emission limit of 0.0291 lb/MMBtu (52.6 lb/hr, 12.21 ppmvd at 15 percent O_2) during natural gas firing and 0.0350 lb/MMBtu (67.9 lb/hr, 14.17 ppmvd at 15 percent O_2) during fuel oil firing.

Particulate emissions -- BACT was determined to be good combustion controls and combustion air filters to achieve a PM/PM_{10} emission limit of 0.0110 lb/MMBtu (19.8 lb/hr) during natural gas firing. BACT was determined to be good combustion controls and combustion air filters to achieve a PM emission limit of 0.0320 lb/MMBtu (62.1 lb/hr) and a PM_{10} emissions limit of 0.0311 lb/MMBtu (60.4 lb/hr) during fuel oil firing. PM/PM_{10} emissions conservatively include front and back half catch as well as the effects of SO_2 oxidation and SCR formation of ammonium sulfates.

Cooling Tower:

Particulate emissions -- BACT is determined to be the use of drift eliminators with a control efficiency of 0.002 percent resulting in emissions of 0.08 lb/hr.

4.0 Air Quality Impact Analysis

The following sections discuss the air dispersion modeling performed for the PSD air quality impact analysis for those PSD pollutants which will have a PTE greater than the PSD significant emission rate (i.e., NO_x, CO, and PM/PM_{10}). The air dispersion modeling analysis was conducted in accordance with EPA's air dispersion modeling guidelines (incorporated as Appendix W of 40 CFR 51), as well as a mutually agreed upon air dispersion modeling protocol submitted to FDEP on behalf of JEA in a letter from Black & Veatch dated September 20, 2000. The FDEP provided approval of the protocol via email on September 22, 2000. A copy of the protocol and FDEP approval are presented in Attachment 4.

4.1 Model Selection

The Industrial Source Complex Short-Term (ISCST3 Version 00101) air dispersion model was used to predict maximum ground level concentrations associated with the Generating Station. The ISCST3 model is an EPA approved, steady-state, straight-line Gaussian plume model, which may be used to access pollutant concentrations from a wide variety of sources associated with an industrial source complex. In addition, ISCST3, unlike its predecessors, incorporates the COMPLEX1 dispersion algorithm for determining intermediate and complex terrain concentration impacts in accordance with EPA guidance.

4.2 Model Input and Options

This section discusses the model input parameters, source and emission parameters, and the ISCST3 model default options and input databases.

4.2.1 Model Input Source Parameters

The ISCST3 model was used determine the maximum predicted ground-level concentration for each pollutant and applicable averaging period resulting from various operating loads, operating scenarios (i.e., combined or simple cycle operation), fuels (i.e., natural gas and distillate fuel oil), and ambient temperatures. This was accomplished by representing the Generating Station's proposed operating load range (i.e., 50, 75, and 100 percent loads) with a representative set of stack parameters and pollutant emission rates to produce the worst-case plume dispersion conditions and highest model predicted concentrations (i.e., lowest exhaust temperature and exit velocity and the highest emission rate). This process is referred to as enveloping.

The representative stack parameters and emission rates for each load, fuel type, and operating scenario considered in the analysis are presented in Table 4-1. A spreadsheet used in determining the load based representative emissions and stack parameters from the vendor performance data is included in Attachment 2.

4.2.2 Land Use Dispersion Coefficient Determination

The EPA's land use method was used to determine whether rural or urban dispersion coefficients should be used in the ISCST3 air dispersion model. In this procedure, land circumscribed within a 3 km radius of the site was classified as rural or urban using the Auer land use classification method. Based on a visual inspection of the USGS 7.5 minute topographic map of the Generating Station location, it was concluded that over 50 percent of the area surrounding the Generating Station is classified as rural. Accordingly, the rural dispersion modeling option was used in the ISCST3 air dispersion modeling.

4.2.3 GEP Stack Height Determination

Existing (Unit 1) and proposed (Units 2 and 3) buildings and structures were analyzed to determine the potential to influence the dispersion of stack emissions. EPA's Guideline for Determination of Good Engineering Practice Stack Height guidance document was followed in this evaluation. Structure dimensions and relative locations were entered into EPA's Building Profile Input Program (BPIP) to produce an ISCST3 input file with the proper Huber-Snyder or Schulman-Scire direction specific building downwash parameters. The BPIP formula GEP height for the Generating Station is 77.72 m (255 ft). The actual modeled height for each HRSG stack is 57.91 m (190 ft).

4.2.4 Model Defaults

The following standard USEPA default regulatory modeling options were initialized in the ISCST3 air dispersion modeling:

- Final plume rise.
- Stack-tip downwash.
- Buoyancy induced dispersion.
- Default vertical wind profile exponents and vertical potential temperature gradient values.
- Calm processing option.
- Flat terrain option.

Table 4-1
Representative (*Enveloped*) Stack Parameters and Pollutant Emissions Used in ISCST3 Modeling Analysis

							Pollutant Emission Rate (g/s)		
Operating Scenario/Fuel	ISCST3 Source ID*	Load	Stack Height (m)	Stack Diameter (m)	Exit Velocity (m/s)	Exit Temp (K)	NO_x	PM/PM_{10}***	CO
CCCT/HRSG Natural Gas	S#NG1	100	57.91	5.49	18.71	368.71	3.14	2.60	6.84
	S#NG7	75	57.91	5.49	15.27	363.15	2.52	2.42	5.44
	S#NG5	50	57.91	5.49	12.68	358.15	2.01	2.42	4.48
CCCT/HRSG Distillate Fuel Oil	S#FO1	100	57.91	5.49	21.28	402.59	15.04	5.67	9.13
	S#FO7	75	57.91	5.49	16.70	397.04	12.18	5.00	6.78
	S#FO5	50	57.91	5.49	14.17	394.26	9.51	4.37	9.71
CCCT/HRSG Annualized**	S#CC1	100	57.91	5.49	18.71	368.71	3.53	2.70	n/a
	S#CC7	75	57.91	5.49	15.27	363.15	2.84	2.50	n/a
	S#CC5	50	57.91	5.49	12.68	358.15	2.26	2.48	n/a

*The "S#" character in the ISCST3 Source ID name refers to either S2,or S3, which refer to stack 2 or stack 3; CC refers to combined cycle; 1,7,or 5 refer to 100, 75, or 50 percent load; and NG or FO refer to natural gas or distillate fuel oil fired.
**Annualized emission rate based on 288 hours of distillate fuel oil firing and 8472 hours of natural gas firing.
***Estimates of PM/PM_{10} emissions for air dispersion modeling include front half catch PM/PM_{10} estimates and the effects of SO_2 oxidation and SCR formation of ammonium sulfates.

4.2.5 Receptor Grid and Terrain Considerations

The air dispersion modeling receptor locations were established at appropriate distances to ensure sufficient density and aerial extent to adequately characterize the pattern of pollutant impacts in the area. Specifically, a nested rectangular grid network that extends 15 km from the center of Generating Station was used. The rectangular grid network consists of 100 m spacing from the proposed fenceline out to 1,000 m, 250 m spacing out from 1 km to 2.5 km, 500 m spacing from 2.5 km out to 5 km, and then 1,000 m spacing from 5 to 10 km. Receptor spacing of 100 m intervals was used along the Generating Station fenceline, and a 100 m fine grid was used at the maximum impact receptors, if the maximum predicted impacts are beyond 1,000 m and the impacts were greater than the PSD SILs. Figure 4-1 illustrates the nested rectangular grid, fence line receptors, and the relative location of the emission sources and downwash structures. The flat terrain option was used for all receptor points.

4.2.6 Meteorological Data

The ISCST3 air dispersion model requires hourly input of specific surface and upper-air meteorological data. These data include the wind flow vector, wind speed, ambient temperature, stability category, and the mixing height. Five years (1984-1988) of surface and upper air meteorological data from Jacksonville, FL and Waycross, GA, respectively, were used in the ISCST3 air dispersion modeling analysis. These meteorological data were downloaded from EPA's SCRAM web site and processed with PCRAMMET to combine the surface and mixing height data, interpolate hourly mixing heights from the twice-daily mixing heights, and calculate atmospheric stability class.

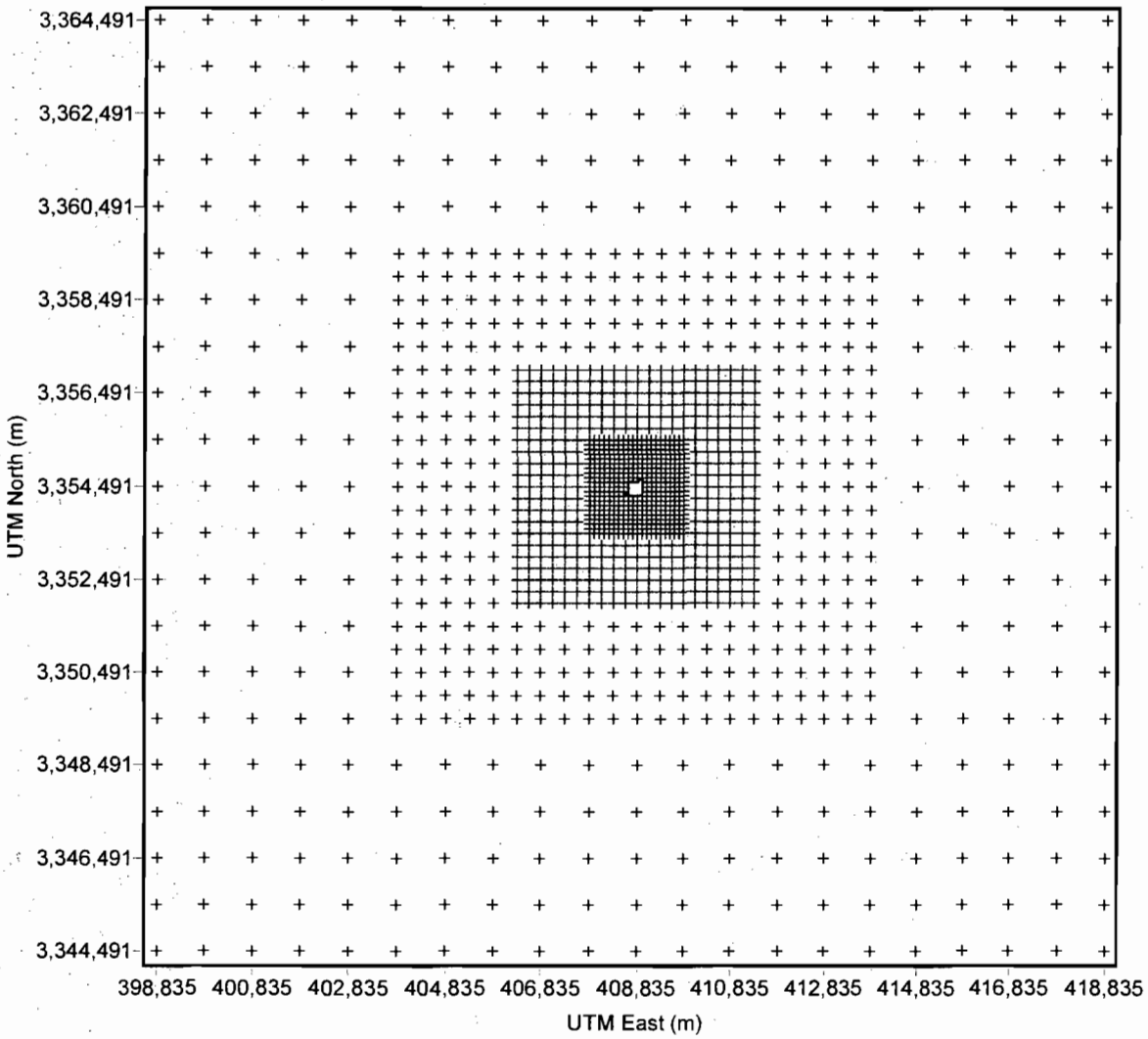
4.3 Model Results

As presented in Section 2.0, the Generating Station PTE exceeds the PSD significant emission thresholds for NO_x, CO, and PM/PM_{10}. In accordance with the approved modeling protocol, ISCST3 air dispersion modeling was performed (as described in the preceding sections) using the enveloped emission rates for NO_x, CO, and PM/PM_{10} for each applicable averaging period. The modeled source groups for NO_x (annual), CO (1-hour and 8-hour), and PM/PM_{10} (annual) included enveloped emissions for all loads. However, the 50 percent fuel oil fired cases for PM/PM_{10} (24-hour) were modeled individually at the various temperatures presented in Section 2.3.1.

Tables 4-2 through 4-6 present the results for the 5 year modeling analysis (1984-1988) for each pollutant and applicable averaging period. The underlined concentrations in each table represent the maximum modeled predicted impacts in each case.

IMAGE QUALITY

AS YOU REVIEW THE NEXT FEW PAGES, PLEASE NOTE THAT THE ORIGINAL DOCUMENT WAS OF POOR QUALITY.



Receptor Locations

Figure 4-1

RECEPTORS.SRF

Table 4-2
ISCST3 Model Predicted Maximum Annual Concentrations of NO_x

ISCST Operating Scenario Source Code	Averaging Period	Load	Year	Maximum Predicted Conc. ($\mu g/m^3$)	UTM Location	
					East (m)	North (m)
CC1	Annual	100	1984	0.05	406,585.0	3,356,491.5
CC7		75		0.07	409,019.4	3,354,676.7
CC5		50		0.08	409,019.4	3,354,676.7
CC1		100	1985	0.05	409,019.4	3,354,460.5
CC7		75		0.08	409,019.4	3,354,460.5
CC5		50		0.10	409,019.4	3,354,460.5
CC1		100	1986	0.06	409,019.4	3,354,676.7
CC7		75		0.08	409,019.4	3,354,676.7
CC5		50		0.11	409,019.4	3,354,676.7
CC1		100	1987	0.10	409,019.4	3,354,360.5
CC7		75		0.13	409,019.4	3,354,360.5
CC5		50		**0.15**	409,019.4	3,354,360.5
CC1		100	1988	0.07	409,019.4	3,354,360.5
CC7		75		0.10	409,019.4	3,354,360.5
CC5		50		0.12	409,019.4	3,354,360.5

Table 4-3
ISCST3 Model Predicted Maximum 1-Hour Concentrations of CO

ISCST Operating Scenario Source Code	Averaging Period	Load	Year	Maximum Predicted Conc. ($\mu g/m^3$)	UTM Location	
					East (m)	North (m)
Natural Gas Firing						
CCNG1	1-Hour	100	1984	43.74	409,019.4	3,354,560.5
CCNG7		75		42.99	409,019.4	3,354,560.5
CCNG5		50		41.71	409,019.4	3,354,560.5
CCNG1		100	1985	22.59	409,035.0	3,354,291.5
CCNG7		75		20.94	409,035.0	3,354,291.5
CCNG5		50		21.28	409,035.0	3,354,491.5
CCNG1		100	1986	27.04	409,035.0	3,354,591.5
CCNG7		75		28.97	409,035.0	3,354,591.5
CCNG5		50		30.03	409,035.0	3,354,591.5
CCNG1		100	1987	27.65	409,035.0	3,354,391.5
CCNG7		75		26.80	409,035.0	3,354,391.5
CCNG5		50		25.74	409,035.0	3,354,391.5
CCNG1		100	1988	27.15	409,035.0	3,354,491.5
CCNG7		75		27.11	409,035.0	3,354,491.5
CCNG5		50		26.62	409,035.0	3,354,491.5
Fuel Oil Firing						
CCFO1	1-Hour	100	1984	44.16	409,019.4	3,354,560.5
CCFO7		75		43.37	409,019.4	3,354,560.5
CCFO5		50		**72.55**	409,019.4	3,354,560.5
CCFO1		100	1985	24.86	409,035.0	3,354,291.5
CCFO7		75		22.59	409,035.0	3,354,291.5
CCFO5		50		36.23	409,035.0	3,354,291.5
CCFO1		100	1986	24.58	409,035.0	3,354,591.5
CCFO7		75		27.07	409,035.0	3,354,591.5
CCFO5		50		48.26	409,035.0	3,354,591.5
CCFO1		100	1987	29.00	409,035.0	3,354,391.5
CCFO7		75		27.98	409,035.0	3,354,391.5
CCFO5		50		46.39	409,035.0	3,354,391.5
CCFO1		100	1988	27.05	409,035.0	3,354,491.5
CCFO7		75		27.14	409,035.0	3,354,491.5
CCFO5		50		45.95	409,035.0	3,354,491.5

Table 4-4
ISCST3 Model Predicted Maximum 8-Hour Concentrations of CO

ISCST Operating Scenario Source Code	Averaging Period	Load	Year	Maximum Predicted Conc. ($\mu g/m^3$)	UTM Location	
					East (m)	North (m)
Natural Gas Firing						
CCNG1	8-Hour	100	1984	9.83	409,019.4	3,354,460.5
CCNG7		75		10.31	409,019.4	3,354,460.5
CCNG5		50		10.52	409,019.4	3,354,460.5
CCNG1		100	1985	7.49	409,019.4	3,354,460.5
CCNG7		75		8.64	409,019.4	3,354,460.5
CCNG5		50		9.64	409,019.4	3,354,460.5
CCNG1		100	1986	6.79	409,019.4	3,354,660.5
CCNG7		75		7.18	409,019.4	3,354,660.5
CCNG5		50		7.85	409,019.4	3,354,660.5
CCNG1		100	1987	7.64	409,019.4	3,354,360.5
CCNG7		75		8.55	409,019.4	3,354,360.5
CCNG5		50		9.72	409,019.4	3,354,360.5
CCNG1		100	1988	10.07	409,019.4	3,354,360.5
CCNG7		75		10.61	409,019.4	3,354,360.5
CCNG5		50		10.96	409,019.4	3,354,360.5
Fuel Oil Firing						
CCFO1	8-Hour	100	1984	9.32	409,019.4	3,354,460.5
CCFO7		75		9.99	409,019.4	3,354,460.5
CCFO5		50		17.53	409,019.4	3,354,460.5
CCFO1		100	1985	7.22	409,019.4	3,354,460.5
CCFO7		75		7.71	409,019.4	3,354,460.5
CCFO5		50		14.73	409,019.4	3,354,460.5
CCFO1		100	1986	6.01	409,019.4	3,354,660.5
CCFO7		75		6.50	409,019.4	3,354,660.5
CCFO5		50		11.82	409,019.4	3,354,660.5
CCFO1		100	1987	7.35	409,019.4	3,354,360.5
CCFO7		75		7.37	409,019.4	3,354,360.5
CCFO5		50		14.28	409,019.4	3,354,360.5
CCFO1		100	1988	9.40	409,019.4	3,354,360.5
CCFO7		75		10.03	409,019.4	3,354,360.5
CCFO5		50		**17.70**	409,019.4	3,354,360.5

Table 4-5
ISCST3 Model Predicted Maximum Annual Concentrations of PM/PM_{10}

ISCST Operating Scenario Source Code	Averaging Period	Load	Year	Maximum Predicted Conc. ($\mu g/m^3$)	UTM Location	
					East (m)	North (m)
CC1	Annual	100	1984	0.04	406,585.0	3,356,491.5
CC7		75		0.06	409,019.4	3,354,676.7
CC5		50		0.09	409,019.4	3,354,676.7
CC1		100	1985	0.04	409,019.4	3,354,460.5
CC7		75		0.07	409,019.4	3,354,460.5
CC5		50		0.11	409,019.4	3,354,460.5
CC1		100	1986	0.05	409,019.4	3,354,676.7
CC7		75		0.07	409,019.4	3,354,676.7
CC5		50		0.12	409,019.4	3,354,676.7
CC1		100	1987	0.08	409,019.4	3,354,360.5
CC7		75		0.11	409,019.4	3,354,360.5
CC5		50		**0.17**	409,019.4	3,354,360.5
CC1		100	1988	0.06	409,019.4	3,354,360.5
CC7		75		0.09	409,019.4	3,354,360.5
CC5		50		0.13	409,019.4	3,354,360.5

Table 4-6
ISCST3 Model Predicted Maximum 24-Hour Concentrations of PM/PM_{10}

ISCST Operating Scenario Source Code	Averaging Period	Load	Year	Maximum Predicted Conc. ($\mu g/m^3$)	UTM Location	
					East (m)	North (m)
Natural Gas Firing						
CCNG1	24-Hour	100	1984	2.22	409,035.0	3,354,691.5
CCNG7		75		2.65	409,035.0	3,354,691.5
CCNG5		50		3.42	409,035.0	3,354,491.5
CCNG1		100	1985	2.10	409,019.4	3,354,460.5
CCNG7		75		2.91	409,019.4	3,354,460.5
CCNG5		50		4.05	409,019.4	3,354,460.5
CCNG1		100	1986	1.10	409,019.4	3,354,660.5
CCNG7		75		1.52	409,019.4	3,354,660.5
CCNG5		50		2.19	409,019.4	3,354,660.5
CCNG1		100	1987	1.37	409,019.4	3,354,360.5
CCNG7		75		2.03	409,019.4	3,354,360.5
CCNG5		50		2.74	409,019.4	3,354,360.5
CCNG1		100	1988	1.57	409,019.4	3,354,360.5
CCNG7		75		2.05	409,019.4	3,354,360.5
CCNG5		50		2.82	409,019.4	3,354,360.5
Fuel Oil Firing						
CCFO1		100	1984	3.49	409,035.0	3,354,691.5
CCFO7		75		4.24	409,035.0	3,354,691.5
FO5HI		50		4.15	409,035.0	3,354,691.5
FO5AV		50		4.23	409,035.0	3,354,691.5
FO5LO		50		4.27	409,035.0	3,354,691.5
CCFO1		100	1985	3.24	409,019.4	3,354,460.5
CCFO7		75		4.28	409,019.4	3,354,460.5
FO5HI		50		4.75	409,019.4	3,354,460.5
FO5AV		50		4.75	409,019.4	3,354,460.5
FO5LO		50		4.76	409,019.4	3,354,460.5
CCFO1		100	1986	1.44	409,019.4	3,354,660.5
CCFO7		75		2.15	409,019.4	3,354,660.5
FO5HI		50		2.39	408,535.0	3,354,291.5
FO5AV		50		2.38	409,019.4	3,354,660.5
FO5LO		50		2.39	409,019.4	3,354,660.5
CCFO1		100	1987	2.12	409,019.4	3,354,360.5
CCFO7		75		2.99	409,019.4	3,354,360.5
FO5HI		50		3.16	409,019.4	3,354,360.5
FO5AV		50		3.18	409,019.4	3,354,360.5
FO5LO		50		3.19	409,019.4	3,354,360.5
CCFO1		100	1988	2.37	409,019.4	3,354,360.5
CCFO7		75		3.02	409,019.4	3,354,360.5
FO5HI		50		3.19	409,019.4	3,354,360.5
FO5AV		50		3.20	409,019.4	3,354,360.5
FO5LO		50		3.20	409,019.4	3,354,360.5

Note: The Fuel Oil 50 percent load was modeled per High , Average, and Low temperature cases (High=95° F, Average=59°F, Low=20° F).

Electronic copies of the modeled inputs and outputs are presented in Attachment 5.

4.3.1 Comparison to PSD Significant Impact Levels and Preconstruction Monitoring Requirements

Table 4-7 compares the maximum model predicted concentrations for each pollutant and applicable averaging period with the PSD Class II significant impact levels and the preconstruction monitoring requirements. As Table 4-7 indicates, the Generating Station maximum predicted concentrations are less than the PSD Class II significant impact levels (SILs) for each pollutant and applicable averaging period. Therefore, under the PSD program, no further air quality impact analyses (i.e., PSD increment and AAQS analyses) are required.

Additionally, the maximum predicted concentrations are less than the preconstruction monitoring de minus levels for each pollutant and applicable averaging period. Therefore, by this application, the applicant requests an exemption from the PSD preconstruction monitoring requirements.

Table 4-7
Comparison of Maximum Predicted Impacts with the PSD Class II Significant Impact Levels and the PSD De Minimis Monitoring Levels

Pollutant	Averaging Period	Maximum Predicted Impact ($\mu g/m^3$)	PSD Class II Significant Impact Level	PSD De Minimis Monitoring Level
NO_x	Annual	0.15	1	14
CO	1-Hour	72.55	2,000	--
	8-Hour	17.70	500	575
PM/PM_{10}	Annual	0.17	1	--
	24-Hour	4.76	5	10
VOC (Ozone)	N/A	31.8 tpy*	N/A	100 tpy

*Ozone preconstruction monitoring applicability based on an annualized Generating Station emission rate assuming 288 hours of distillate fuel oil firing and 8,472 hours of natural gas firing during base load (100 percent) conditions at 59° F ambient temperature.

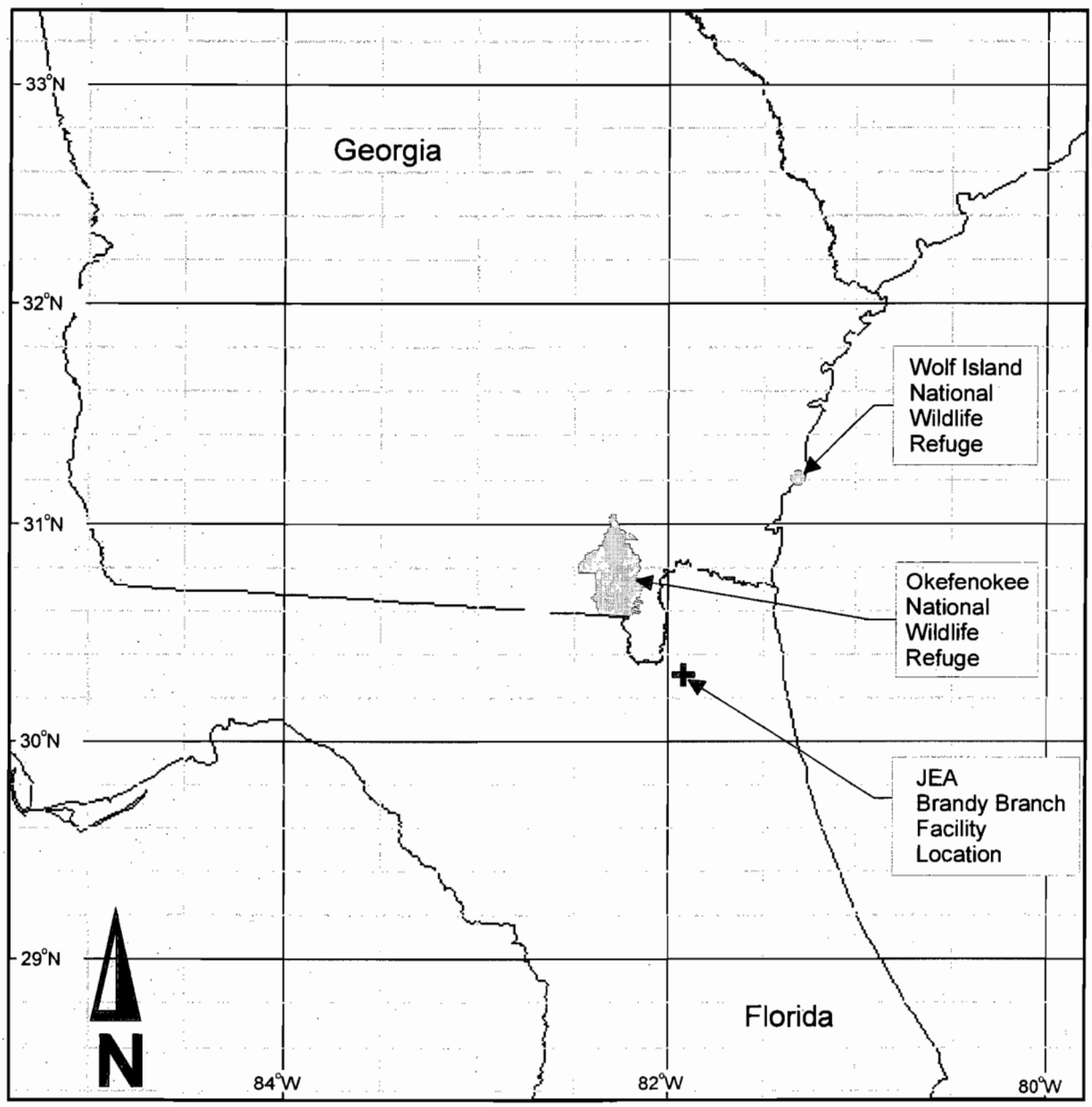
5.0 Additional and Class I Area Impact Analyses

As part of the air impact evaluation for the proposed facility, the Florida Department of Environmental Protection (FDEP) has requested that analyses of the proposed facility's affect on the Okefenokee National Wildlife Refuge (ONWR) and Wolf Island National Wildlife Refuge (WINWR) be performed. The ONWR and WINWR are Prevention of Significant Deterioration (PSD) Class I areas located in southeastern Georgia approximately 34 km north-northwest and 127 km north-northeast, respectively, of the proposed Generating Station site. Class I areas are afforded special environmental protection through the use of Air Quality Related Values (AQRVs). The AQRVs of interest in these air analyses are regional haze, deposition, and Class I Significant Impact Levels (SILs). Figure 5-1 presents the locations of the proposed Generating Station site with respect to the ONWR and WINWR.

The air analyses closely follow those procedures recommended in the *Interagency Workgroup on Air Quality Modeling (IWAQM) Phase I & II* reports dated April 1993 and December 1998 (respectively), the *Draft Phase I Federal Land Managers' Air Quality Related Values Workgroup (FLAG)* dated October 1999, *EPA's Workbook for Plume Visual Impact Screening and Analysis* dated September 1988, as well as coordination with the FDEP who has communicated as necessary with the U.S. Fish and Wildlife Service (FWS) which is the Federal Land Manager (FLM) for both areas. This section includes a discussion of the meteorological and geophysical databases to be used in the analysis, the preparation of those databases for introduction into the modeling system, and the air modeling approach.

5.1 Model Selection and Inputs

The Industrial Source Complex Short-Term (ISCST3 Version 00101) air dispersion model was used to characterize pollutant impacts at those portions of the Class I areas that lie within 50 km of the proposed site (i.e., ONWR). The ISCST3 model is an EPA approved, steady-state, straight-line Gaussian plume model, which may be used to assess pollutant concentrations from a wide variety of sources associated with an industrial source complex. The ISCST3 air dispersion model was used to determine the maximum ground level impacts of those PSD pollutants for which the Generating Station is significant and which have applicable significant impact levels for a Class I area (i.e., NO_x and PM_{10}).



Location of Brandy Branch Facility
with Respect to
Okefenokee and Wolf Island
National Wildlife Refuges

Figure 5-1

Site wrt Class I areas.srf

The California Puff (CALPUFF, version 5.4) air modeling system was used to model the emissions associated with the two combined-cycle combustion turbines at the proposed facility and assess the AQRVs at those portions of ONWR and WINWR that lie beyond 50 km from the proposed site. CALPUFF is a non-steady state, Lagrangian, Gaussian puff long-range transport model that includes algorithms for building downwash effects as well as chemical transformations (important for visibility controlling pollutants), and wet/dry deposition. The model was first used in a screening mode called CALPUFF 'Lite' to determine impacts onto the Class I areas. This method simplifies the modeling process while introducing a high level of conservatism. 'Lite' results which fell below the required thresholds of the previously listed AQRVs completed the demonstration of compliance for that particular AQRV and a refined CALPUFF analysis was not pursued. CALPUFF 'Lite' bypasses the need for the intensive meteorological processor, CALMET. The CALMET model, a preprocessor to CALPUFF, is a diagnostic meteorological model that produces a three-dimensional field of wind and temperature and a two-dimensional field of other meteorological parameters. Simply, CALMET was designed to process raw meteorological, terrain, and land-use databases to be used in the air modeling analysis. The CALPUFF modeling system uses a number of FORTRAN preprocessor programs that extract data from large databases and converts the data into formats suitable for input to CALMET. For the refined analyses, the processed data produced from CALMET was input to CALPUFF to assess pollutant specific impacts. Both CALMET and CALPUFF (including the 'Lite' and refined methodology) were used in a manner that is recommended by the IWAQM Phase I and II reports and Draft Phase I FLAG repor.

5.1.1. CALPUFF Model Settings

The CALPUFF settings contained in Table 5-1 were used for the modeling analyses.

5.1.2 Building Wake Effects

The ISCST3 modeling as well as the screening and refined CALPUFF analyses include the proposed facility's building dimensions to account for the effects of building-induced downwash on the emission sources. Dimensions for all significant building structures were processed with the Building Profile Input Program (BPIP), Version 95086, and included in the CALPUFF model input.

5.1.3 Receptor Locations

The ISCST3 analysis used a set of 5 discrete receptors placed along the closest boundary of that portion of the ONWR that lies within 50 km of the proposed site. The ISCST3 receptors are shown in Figure 5-2.

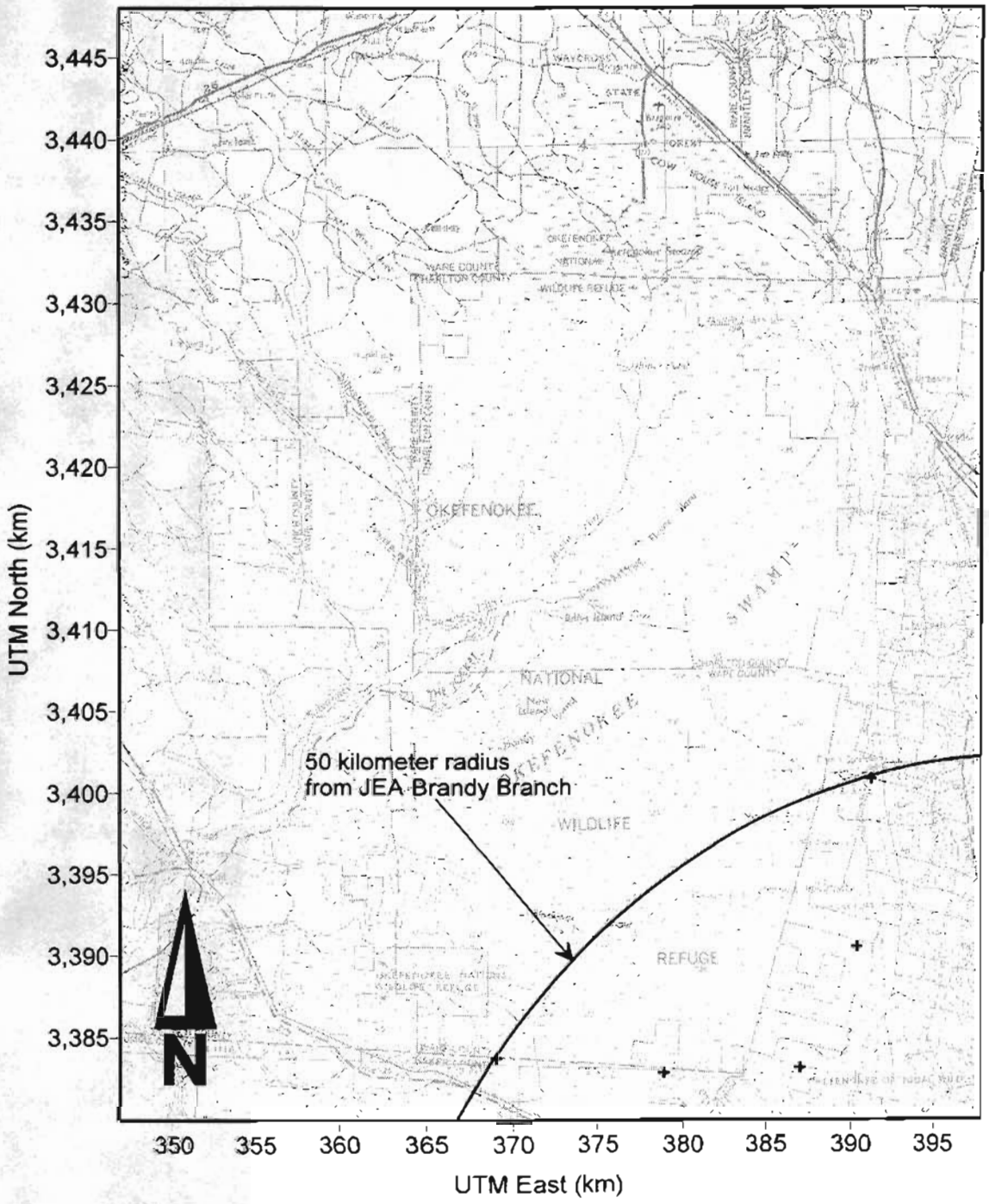
The CALPUFF 'Lite' analysis used rings of discrete Cartesian receptors located at distances equal to that of the closest and furthest boundaries of the Class I areas to the proposed Generating Station location. Specifically, the rings consist of receptor spacing of every 1-degree beginning at the appropriate distances from the proposed facility location. The receptor rings for ONWR and WINWR are shown in Figures 5-3 and 5-4, respectively.

The refined CALPUFF analysis used an array of discrete receptors at appropriate distances to ensure sufficient density and aerial extent to adequately characterize the pattern of pollutant impacts in the ONWR. The same modeling grid as was used in the refined CALPUFF analysis for the previously submitted simple cycle project was again used here. Specifically, the array consists of receptor spacing of 2 km within the Class I area beginning at a distance of 50 km from the proposed Generating Station location and continuing to the farthest extent of the ONWR. The refined CALPUFF receptors on the ONWR are shown in Figure 5-5.

5.1.4 Meteorological Data Processing

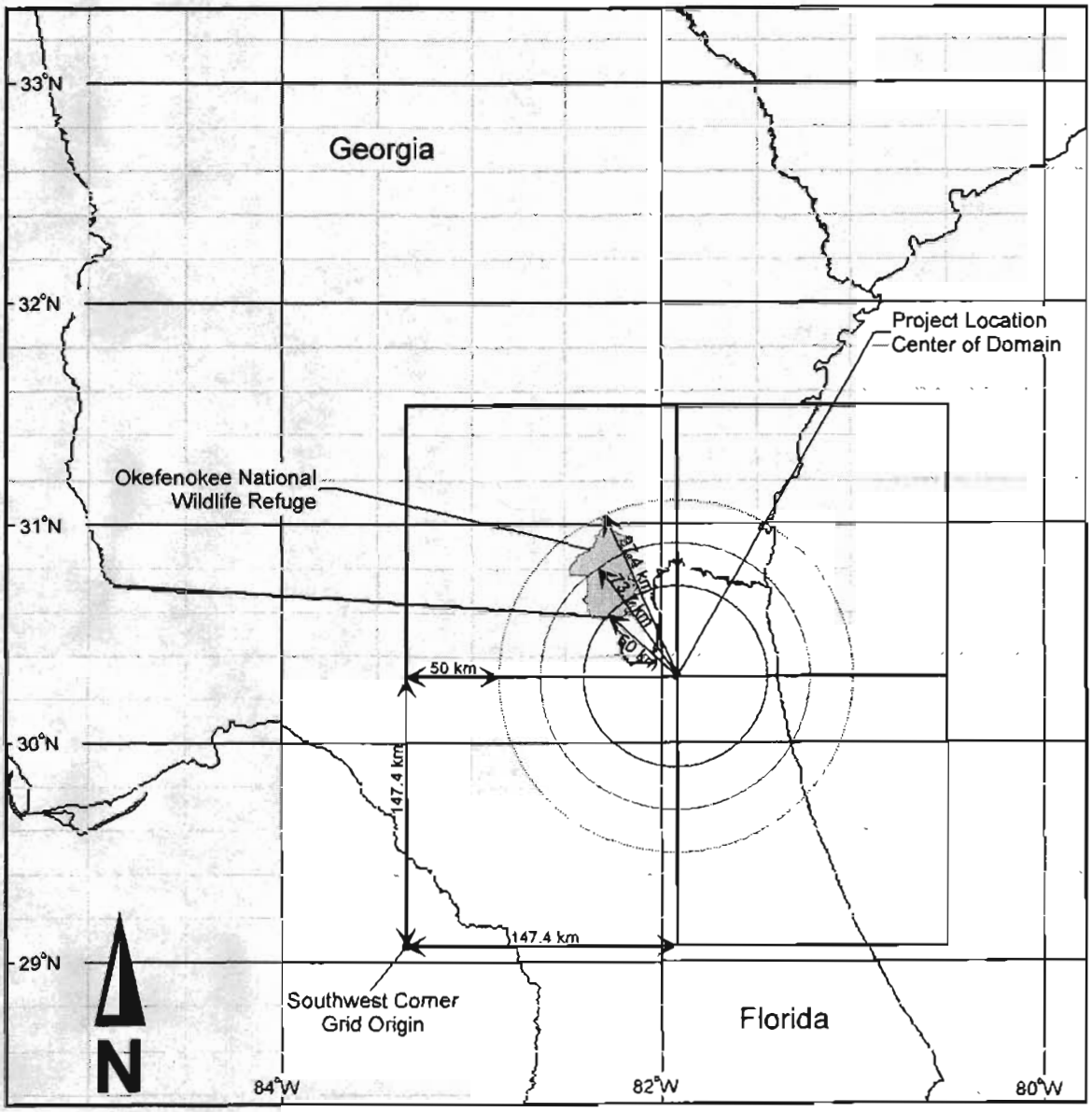
The meteorological data used in both the ISC modeling and the CALPUFF screening modeling consists of 5 years of surface observations (1984-1988) for Jacksonville, Florida extracted from the National Climatic Data Center's (NCDC) Solar and Meteorological Surface Observational Network (SAMSON) CD-ROM set. These five years were combined with upper air, twice-daily mixing height data from Waycross, Georgia downloaded from the SCRAM BBS for the same five-year period. Both data sets were processed with PCRammet. However, the CALPUFF screening meteorological data was processed for wet deposition to give CALPUFF enough information to perform the Mesopuff II chemistry transformations. This type of processing allows CALPUFF to run in screening mode by providing extended meteorological variables such as surface friction, surface roughness, albedo, Bowen ratio, precipitation, etc. used in the atmospheric plume dispersion algorithms.

Table 5-1 CALPUFF Model Settings	
Parameter	**Setting**
Pollutant Species	SO2, SO4, NOx, HNO3, and NO3, and PM10
Chemical Transformation	MESOPUFF II scheme
Deposition	Include both dry and wet deposition, plume depletion
Meteorological/Land Use Input	CALPUFF 'Lite' – screening mode 5 years of Jacksonville data (including precipitation) processed to include such parameters as the surface roughness, Bowen ratio, albedo, etc. CALPUFF – refined mode CALMET
Plume Rise	Transitional, Stack-tip downwash, Partial plume penetration
Dispersion	Puff plume element, PG/MP coefficients, rural mode, ISC building downwash scheme.
Terrain Effects	Partial plume path adjustment.
Output	Create binary concentration and wet/dry deposition files including output species for all pollutants.
Model Processing	Regional Haze: Highest predicted 24-hour SO4, NO3 and PM10 concentrations for the year. Deposition: Highest predicted 24-hour, SO2 and HNO3 values in deposition units. Class I SILs: Highest predicted concentrations at the applicable averaging periods for those pollutants that exceed the respective PSD Significant Emission Levels (SELs).
Background Values	Lite: Ozone = 80 ppb; Ammonia =10 ppb Refined: Ozone = 60 ppb; Ammonia = 3 ppb



ISCST3 Receptors for Class I SILs Modeling within 50 km of the Site

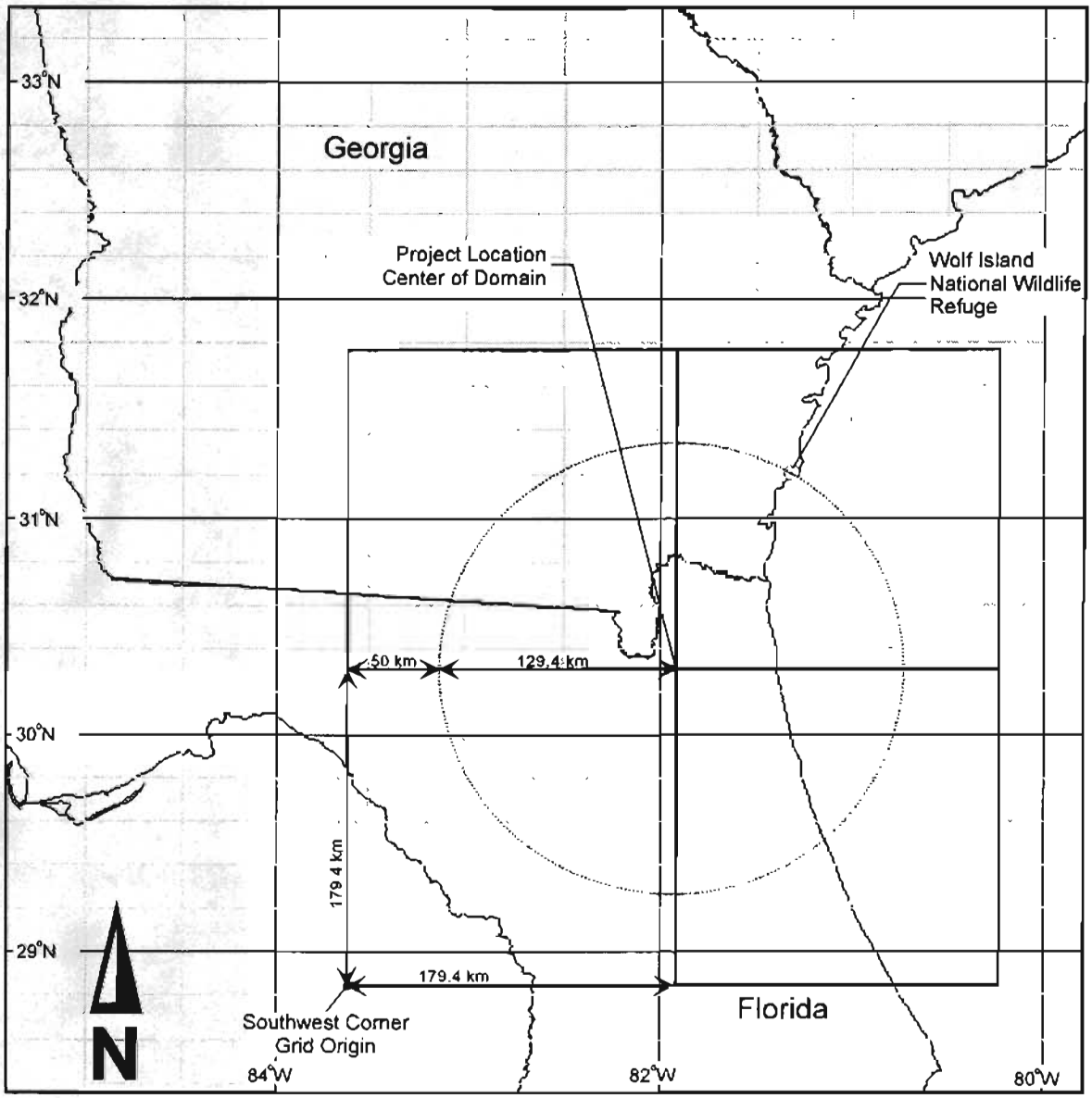
Figure 5-2



Okefenokee National Wildlife Refuge
CALPUFF Lite Receptor Rings

Figure 5-3

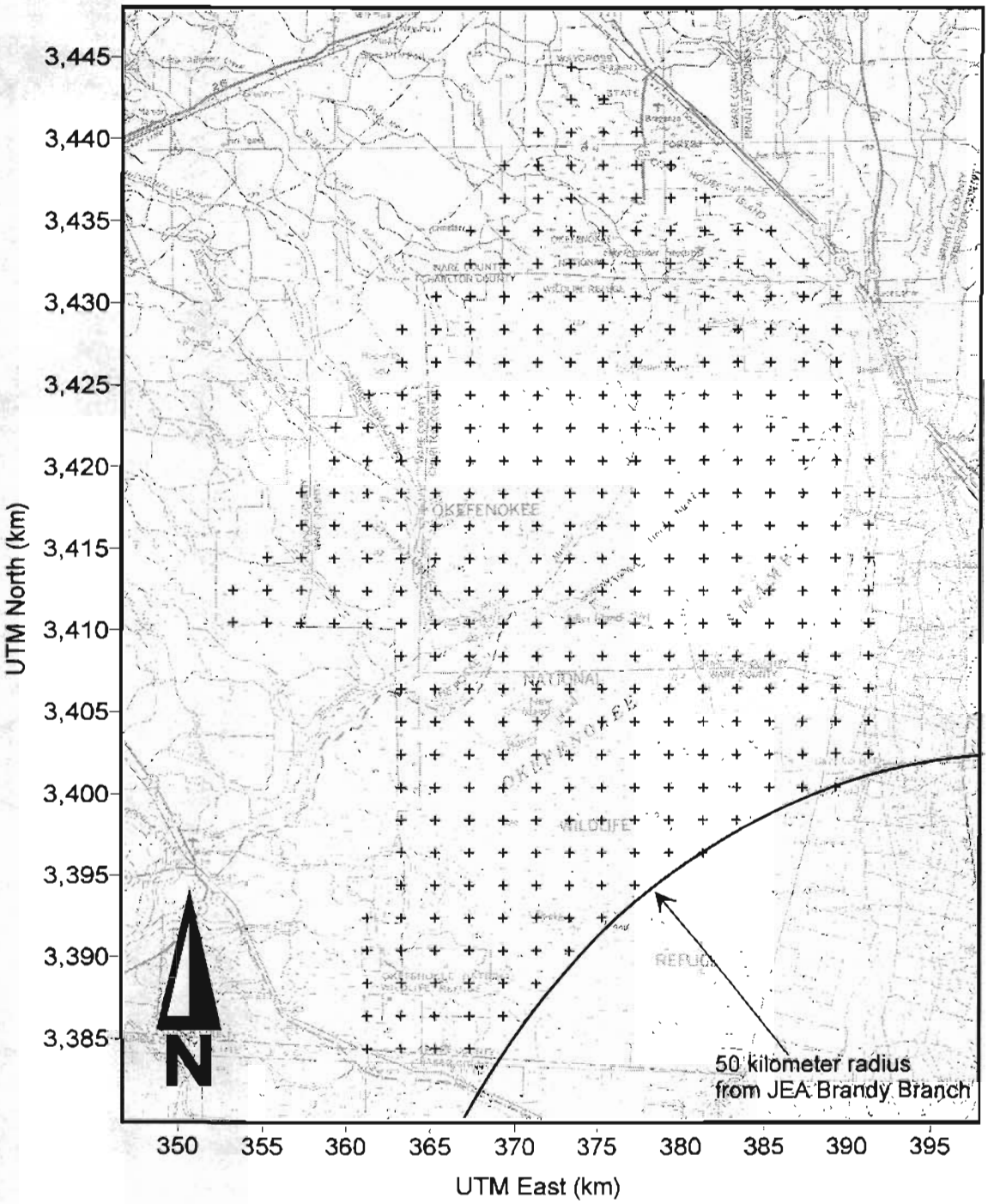
ONWR Calpuff Lite Receptors.srf



Wolf Island National Wildlife Refuge
CALPUFF Lite Receptor Ring

Figure 5-4

Wolf Island Calpuff Lite Receptors.srf



Dense 2 km Receptor Grid for Refined CALPUFF Modeling

Figure 5-5

Oke Refined Receptors.srf

The refined CALPUFF analysis employed the California Puff meteorological and geophysical data preprocessor (CALMET, Version 5.2) to develop the gridded parameter fields required for the refined AQRV modeling analysis. The following sections discuss the data used and processed in the CALMET model.

5.1.5 CALMET Settings

The CALMET settings, including horizontal and vertical grid coverage, number of weather stations (surface, upper air, and precipitation), and resolution of prognostic mesoscale meteorological data, are contained in Table 5-2.

5.1.6 Modeling Domain

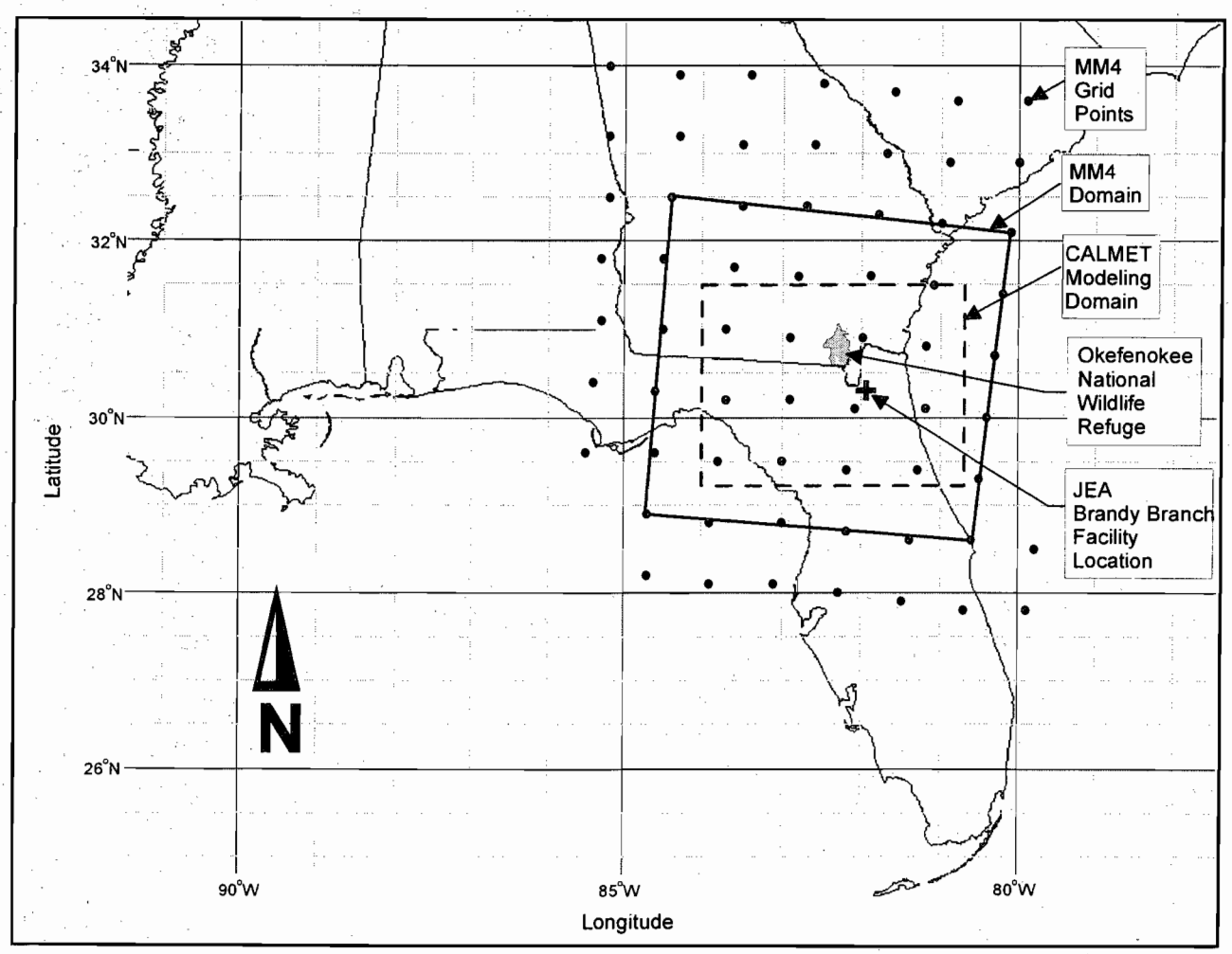
A rectangular modeling domain extending 325 km in the east-west (x) direction and 250 km in the north-south (y) direction was used for the refined modeling analysis. The boundary of the domain is represented by the dashed line in Figure 5-6. The southwest corner of the domain is the origin and is located at 29.25 N degrees latitude and 84 W degrees longitude. This location is in the northeastern Gulf of Mexico approximately 140 km due south of Tallahassee. The size of the domain used for the modeling was based on the distances needed to cover the area from the proposed Generating Station to the receptors at the ONWR with an 80-km buffer zone in each direction.

For the processing of meteorological and geophysical data, 65 grid cells were used in the x-direction and 50 grid cells were used in the y-direction. A 5-km grid spacing was used. The air modeling analysis was performed in the UTM coordinate system.

5.1.7 Mesoscale Model Data

Pennsylvania State University in conjunction with the NCAR Assessment Laboratory developed the MM4 data set, a prognostic wind field or "guess" field, for the United States. The hourly meteorological variables used to create this data set (wind, temperature, dew point depression, and geopotential height for eight standard levels and up to 15 significant levels) are extensive and only allow for one data base set for the year 1990. The analysis used the MM4 data to initialize the CALMET wind field. The MM4

Table 5-2 CALMET Settings	
PARAMETER	**SETTING**
Horizontal Grid Dimensions	325 by 250 km, 5 km grid resolution
Vertical Grid	8 layers
Weather Station Data Inputs	8 surface, 5 upper air, 35 precipitation stations
Wind model options	Diagnostic wind model, no kinematic effects
Prognostic wind field model	MM4 data, 80 km resolution, 6 x 6 grid, used for wind field initialization
Output	Binary hourly gridded meteorological data file for CALPUFF input



CALMET Domain

Domain.srf

Figure 5-6

data have a horizontal spacing of 80 km and are used to simulate atmospheric variables within the modeling domain.

To apply a national MM4 dataset to the modeling domain, a sub-set domain was developed that fully enclosed the area of the modeling domain. The MM4 subset domain consisted of a 6 x 6-cell rectangle, with 80 km grid resolution, extending from the MM4 grid points (49,13) to (54, 18). These data were processed to create a MM4.Dat file, for input to the CALMET model. The MM4 subset domain is represented by the solid line rectangle in Figure 5-6.

The MM4 data set used in CALMET, although advanced, lacks the fine detail of specific temporal and spatial meteorological variables and geophysical data. These variables were processed into the appropriate format and introduced into the CALMET model through the additional data files obtained from the following sources.

5.1.8 Surface Data Stations and Processing

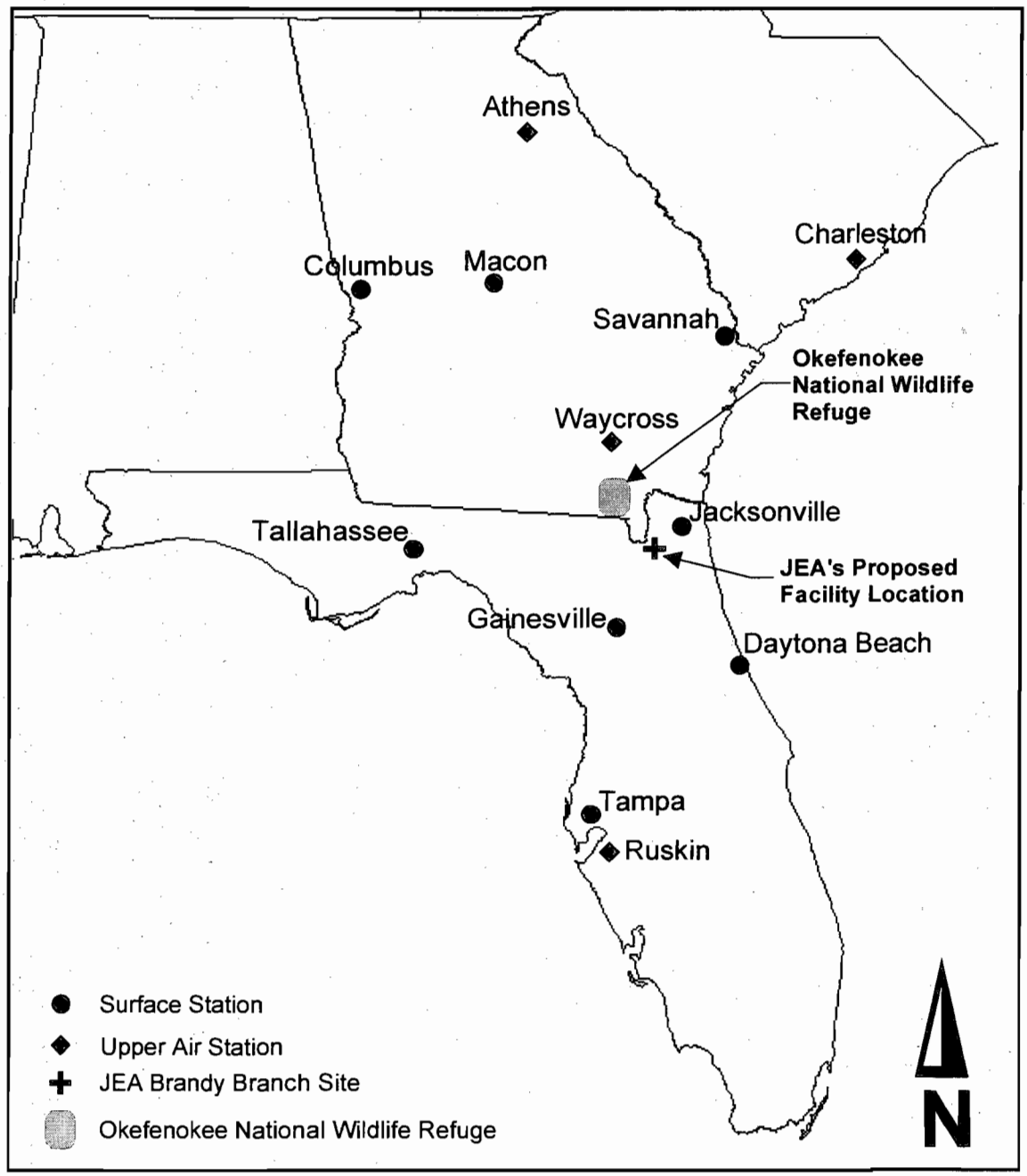
The surface station data processed for the refined CALPUFF analysis consisted of data from eight National Weather Service (NWS) stations or Federal Aviation Administration (FAA) Flight Service stations for Jacksonville, Tallahassee, Gainesville, Tampa and Daytona Beach (FL) and Columbus, Macon and Savannah (GA). A summary of the surface station information and locations are presented in Table 5-3 and Figure 5-7, respectively. The surface station parameters include wind speed, wind direction, cloud ceiling height, opaque cloud cover, dry bulb temperature, relative humidity, station pressure, and a precipitation code that is based on current weather conditions.

The weather station data for all stations but Gainesville was downloaded for the year 1990 from the National Climatic Data Center's (NCDC) Solar and Meteorological Surface Observational Network (SAMSON) CD-ROM set. The surface data from Gainesville was processed from NCDC CD-144 format. The data was processed with the CALMET preprocessor utility program, SMERGE, to create one surface file, SURF.DAT.

Table 5-3
Surface and Upper Air Stations Used in the CALPUFF Analysis

Station Name	Station Symbol	WBAN Number	UTM Coordinates			Anemometer Height (m)
			Easting (km)	Northing (km)	Zone	
Surface Stations						
Tampa, FL	TPA	12842	349.17	3094.25	17	6.7
Jacksonville, FL	JAX	13889	432.82	3374.19	17	6.1
Daytona Beach, FL	DAB	12834	495.14	3228.09	17	9.1
Tallahassee, FL	TLH	93805	173.04[a]	3363.99	16	7.6
Columbus, GA	COL	93842	112.57[a]	3599.35	16	9.1
Macon, GA	MCN	03813	251.58	3620.93	17	7.0
Savannah, GA	SAV	03822	481.13	3555.03	17	9.1
Gainesville, FL	GNV	12816	377.43	3284.16	17	6.7
Upper Air Stations						
Ruskin, FL	TBW	12842	361.95	3064.55	17	NA
Waycross, GA	AYS	13861	366.68	3457.95	17	NA
Athens, GA	AHN	13873	285.91	3758.83	17	NA
Charleston, SC	CHS	13880	590.42	3640.42	17	NA
Apalachicola, FL	AQQ	12832	110.22	3290.65	17	NA

[a] Equivalent Coordinate for Zone 17



National Weather Service
Meteorological Surface & Upper Air Stations
Used in the CALMET Model

Figure 5-7

Met Stations.srf

5.1.9 Upper Air Data Stations and Processing

The analysis included five upper air NWS stations located in Ruskin and Apalachicola (FL), Athens and Waycross (GA), and Charleston (SC). Data for these stations was obtained from the NCDC Radiosonde Data CD and processed into the NCDC Tape Deck (TD) 6201 format by the READ62 utility program for input to CALMET. The data and locations for the upper air stations are presented in Table 5-3 and Figure 5-7, respectively.

5.1.10 Precipitation Data Stations and Processing

Precipitation data was processed from a network of hourly precipitation data files collected from primary and secondary NWS precipitation recording stations located in southern Georgia and northern Florida. Data for 35 stations within or just beyond the modeling domain (dashed rectangular box in Figure 5-6) were obtained in NCDC TD-3240 variable format and converted into a fixed-length format. The utility programs PXTRACT and PMERGE were used to process the data into the format for the Precip.Dat file that is used by CALMET. A listing of the precipitation stations used for the modeling analysis is presented in Table 5-4.

5.1.11 Geophysical Data Processing

Terrain elevations for each grid cell of the modeling domain were obtained from Digital Elevation Model (DEM) files obtained from US Geographical Survey (USGS). The DEM data was extracted for the modeling domain grid using the utility extraction program LCELEV. Land-use data was obtained from the USGS GIS.DAT which is based on the ARM3 data. The resolution of the GIS.DAT file is one-eighth of a degree in the east-west direction and one-twelfth of a degree in the north-south direction. Land-use values for the domain grid were obtained with the utility program CAL-LAND. Other parameters processed for the modeling domain by CAL-LAND include surface roughness, surface albedo, Bowen ratio, soil heat flux, and leaf index field. Once processed, all of the land-use parameters were combined with the terrain information into a GEO.DAT file for input to CALMET. The land-use parameter values were based on annual averaged values.

Table 5-4
Hourly Precipitation Stations Used in the CALPUFF Analysis

Station Name	Station Number	UTM Coordinates		
Florida		Easting (km)	Northing (km)	Zone
Branford	80975	315.61	3315.96	17
Bristol	81020	113.72[a]	3366.47	16
Brooksville 7 SSW	81048	358.03	3149.55	17
Cross city 2 WNW	82008	290.27	3281.75	17
Daytona Beach WSO AP	82158	495.14	3228.09	17
Deland 1 SSE	82229	470.78	3209.66	17
Dowling Park 1 W	82391	283.51	3348.42	17
Gainesville 11 WNW	83322	354.85	3284.43	17
Inglis 3 E	84273	342.63	3211.65	17
Jacksonville WSO AP	84358	434.27	3372.40	17
Lakeland	84797	409.87	3099.18	17
Lisbon	85076	423.59	3193.26	17
Lynne	85237	409.26	3230.30	17
Marineland	85391	479.19	3282.03	17
Melbourne WSO	85612	534.38	3109.97	17
Monticello 3 W	85879	220.17	3381.29	17
Orlando WSO McCoy	86628	468.99	3146.88	17
Panacea 3 s	86828	172.45[a]	3319.61	16
Raiford State Prison	87440	385.93	3326.55	17
Saint Leo	87851	376.48	3135.09	17
Tallahassee WSO AP	88758	173.04[a]	3363.99	16
Woodruff Dam	89795	124.29[a]	3399.94	16

Table 5-4 (Continued)
Hourly Precipitation Stations Used in the CALPUFF Analysis

Georgia				
Abbeville 4 S	90010	281.84	3535.69	17
Bainbridge Intl Paper Co	90586	144.85[a]	3409.59	16
Brunswick	91340	452.34	3447.98	17
Coolidge	92238	226.34	3434.77	17
Doles	92728	226.73	3510.59	17
Edison	93028	135.13[a]	3494.43	16
Fargo	93312	349.92	3395.35	17
Folkston 3 SW	93460	401.13	3407.69	17
Hazlehurst	94204	348.49	3526.08	17
Jesup	94671	416.21	3498.08	17
Pearson	96879	325.50	3464.09	17
Richmond Hill	97468	468.92	3535.69	17
Valdosta 4 NW	98974	276.90	3416.95	17

[a] Equivalent Coordinate for Zone 17

5.1.12 Facility Emissions

Performance data for the combustion turbines was based on vendor data at certain design ambient temperatures at base load operation, considering both natural gas and distillate fuel oil firing. The maximum pound per hour emission rates considering three representative ambient temperatures at base load operation for natural gas and distillate fuel oil firing were used for the pollutants modeled. The emission rates and stack parameters are listed in Table 5-5.

5.2 Class I Analyses

The preceding model inputs and settings for the ISCST3 and CALPUFF modeling system (both screening and refined mode) were used to complete the Class I analyses on the ONWR and WINWR, including visibility/regional haze, deposition (both sulfate and nitrate), and Class I SILs. The following analyses were performed as described below regardless of the modeling methodology (i.e., ISCST3 or CALPUFF - screening or refined modeling).

5.3 Visiblity/Regional Haze Analyses

A visibility analysis was performed for that portion of the ONWR that lies within 50 km of the proposed site. The VISCREEN model was used to assess the visual impact of the proposed facility onto that portion of the ONWR Class I area. Regional haze analyses were performed, using the CALPUFF modeling system, for those portions of the Class I areas that lie beyond 50 km from the proposed site for ammonium sulfates, ammonium nitrates, and particulate matter by appropriately characterizing model predicted outputs of SO_4, NO_3, and PM_{10} concentrations.

Table 5-5

Stack Parameters and Pollutant Emissions used in the CALPUFF Analysis

Stack No.	Easting (m)	Northing (m)	Stack Height	Stack Diameter	Exit Velocity (m/s)	Exit Temp (K)	Pollutant Emission Rate (g/s)		
							NO_x	SO_2	PM_{10}
3	408,713	3,354,531	57.9	5.49	21.28	402.6	15.04	13.78	5.67
2	408,774	3,354,531	57.9	5.49	21.28	402.6	15.04	13.78	5.67

*Assumes operation on distillate fuel oil will yield worst-case impacts.

5.3.1 Visibility

Visibility is an AQRV for both the ONWR and WINWR. Visibility can take the form of plume blight for nearby areas, or regional haze for long distances (e.g., distances beyond 50 km). Because either all or portions of the Class I areas lie beyond 50 km from the proposed facility, the change in visibility will be analyzed as regional haze at those locations. Regional haze impairs visibility in all directions over a large area by obscuring the clarity, color, texture, and form of what is seen. Current guidelines characterize a change in visibility by either of the following methods:

- Change in the visual range, defined as the greatest distance that a large dark object can be seen, or
- Change in the light-extinction coefficient (b_{ext}).

Visual range can be related to extinction with the following equation:

bext(Mm-1) = 3912 / vr(Mm-1)

Visual range (vr) is a measure of how far away a large black object can be seen in the atmosphere under several severe assumptions including: an absolutely dark target, uniform lighting conditions (cloud free skies), uniform extinction in all directions, a limiting contrast discrimination level, a target high enough in elevation to account for earth curvature, and several other factors. Visual range is, at best, a limited concept that allows relatively simple comparisons between visual air quality levels and should not be thought of as the absolute distance that can be seen through the atmosphere.

The b_{ext} is the attenuation of light per unit distance due to the scattering (light reduced away from the site path) and absorption (light captured by aerosols and turned into heat energy) by gases and particles in the atmosphere. A change in the extinction coefficient produces a perceived visual change that is measured by the percentage change in extinctions. The change is defined as:

$$\Delta\% = (b_{exts} / b_{extb}) \times 100$$

where: b_{exts} is the extinction coefficient calculated for the source, and
b_{extb} is the background extinction coefficient

A uniform incremental change in b_{extb} or visual range does not necessarily result in uniform changes in perceived visual air quality. In fact, perceived changes in visibility are best related to a change in b_{extb}, or; percent change in extinction. Based on the IWAQM Phase II guidance, if the change in extinction is less than 5 percent, no further analysis is required.

5.3.2 Background Visual Ranges and Relative Humidity Factors

The background visual range is based on data representative of the top 20-percentile air quality days. The background visual ranges for the ONWR and WINWR were obtained from Bud Rolefson of the United State Fish and Wildlife Service (USFWS). Mr. Rolefson, as the Federal Land Manager of the ONWR and WINWR, supplied the values used in the analyses. The average relative humidity factor for each species' worst day was computed by determining the relative humidity factor for each hour's relative humidity for the 24-hour period that the maximum impact occurred. This factor, based on each relative humidity was obtained by using Table 2.A-1 of Appendix 2.A of the Draft Phase I FLAG Report. These factors (a relative humidity factor for each relative humidity) were then used to determine the average relative humidity factor for that day (24-hour period).

5.3.3 Interagency Workgroup On Air Quality Modeling (IWAQM) Guidelines

The CALPUFF air modeling analysis (both screening and refined) followed the recommendations contained in the IWAQM Phase I and II Summary Reports and Recommendations for Modeling Long Range Transport Impacts, (EPA, 4/93 and 12/98). Table 5-6 summarizes the IWAQM recommendations. The methodology below was used to compute the results of the regional haze analysis. A typical calculation methodology is illustrated below.

Calculation

Refined impacts will be calculated as follows:

1. Obtain maximum 24-hour SO_4, NO_3, and PM_{10} impacts, in units of micrograms per cubic meter ($\mu g/m^3$).
2. Convert the SO_4 impact to $(NH_4)_2SO_4$ by the following formula:
   - $(NH_4)_2SO_4$ ($\mu g/m3$) = SO_4 ($\mu g/m^3$) x molecular weight $(NH_4)_2SO_4$ / molecular weight SO_4
   - $(NH_4)_2SO_4$ ($\mu g/m^3$) = SO_4 ($\mu g/m^3$) x 132/96 = SO_4 ($\mu g/m^3$) x 1.375
3. Convert the NO_3 impact to NH_4NO_3 by the following formula:
   - NH_4NO_3 ($\mu g/m3$) = NO_3 ($\mu g/m^3$) x molecular weight NH_4NO_3 / molecular weight NO_3
   - NH_4NO_3 ($\mu g/m^3$) = NO_3 ($\mu g/m^3$) x 80/62 = NO_3 ($\mu g/m^3$) x 1.29
4. Compute b_{exts} (extinction coefficient calculated for the source) with the following formula:

   b_{exts} = 3 x NH_4NO_3 x f(RH) + 3 x $(NH_4)_2SO_4$ x f(RH) + 1 x PM_{10}
5. Compute b_{extb} (background extinction coefficient) using the background visual range (km) obtained from Mr. Bud Rolefson of the USFWS:

b_{extb} = 3.912 / Visual range (km)

6. Compute the change in extinction coefficients:
   in terms of percent change of visibility:
   $\Delta\% = (b_{exts} / b_{extsb}) \times 100$

Based on the predicted SO_4, NO_3, and PM_{10} concentrations, the proposed facility's emissions will be compared to a 5 percent change in light extinction of the background levels.

5.3.4 Visibility/Regional Haze Results

The VISCREEN plume visual impact screening model was used with default worst-case Level-1 visual screening parameters using the maximum estimated emission rates of NO_x and PM_{10} for distillate oil firing as presented in Table 5-5. The model output indicates the possibility of an exceedance of the conservative Level-1 threshold values. Thus, a more refined Level-2 analysis was employed. The Level-2 analysis used more representative meteorological conditions and plume characteristics. That is, the Jacksonville meteorological data was analyzed for the average meteorological conditions (i.e., wind speed of 3.53 m/s and a stability of D) rather than the conservative Level-1 values of 1 m/s and stability of F. Also, the particle size of the plume was modeled at 10 μm. Results of the Level-2 visual screening analysis indicate that the conservative criteria are not exceeded. Therefore, further analyses to quantify the extent of any reductions in visibility due to the proposed Generating Station are not warranted based on the results of the Level-2 visual impairment analysis. The report output of the VISCREEN model for both the Level-1 and Level-2 analyses are included in Attachment 6.

Table 5-6 Outline of IWAQM Refined Modeling Analyses Recommendations*	
Meteorology	CALPUFF 'Lite' 5 years of the closest surface station and upper air station. Refined CALPUFF Use CALMET (minimum 6 to 10 layers in the vertical; top layer must extend above the maximum mixing depth expected); horizontal domain extends 50 to 80 km beyond outer receptors and sources being modeled; terrain elevation and land-use data is resolved for the situation.
Receptors	CALPUFF 'Lite' Rings of receptors spaced every 1-degree. Refined CALPUFF Within Class I area(s) of concern.
Dispersion	1. CALPUFF with default dispersion settings. 2. Use MESOPUFF II chemistry with wet and dry deposition. 3. Define background values for ozone and ammonia for area.
Processing	Use highest predicted 24-hr SO_4, NO_3, and PM_{10} values; compute a day-average relative humidity factor (f(RH)) for the worst day for each predicted species, calculate extinction coefficients and compute percent change in extinction using the supplied background extinction.
**IWAQM Phase II Summary Report and Recommendations for Modeling Long Range Transport Impacts (EPA, 12/98).*	

The CALPUFF air modeling system was used to assess regional haze impacts onto the Class I areas beyond 50 km from the proposed Generating Station. Tables 5-7 and 5-8 summarize the species' maximum impacts and predicted worst days for the 'Lite' visibility analyses for ONWR and WINWR, respectively. For each worst day, the hourly relative humidities and corresponding hourly relative humidity factors [f(RH)] were averaged and appear in the Tables. The maximum predicted change in extinction due to the proposed Generating Station operation for each Class I area is also presented. The 'Lite' results indicate that the change in extinction due to the operation of the proposed Generating Station on the ONWR is greater than the 5 percent change allowed, while the change at WINWR is less than the 5 percent threshold (i.e., no further regional haze analysis is warranted for WINWR). Since the ONWR CALPUFF 'Lite' results indicate the possibility of an exceedance of the extinction threshold, a refined CALPUFF modeling analysis (as described in previous sections) was performed for ONWR. The results from the refined CALPUFF modeling at ONWR are presented in Table 5-9. The maximum predicted change is 2.83 percent. This impact is below the 5 percent change criteria indicating that the proposed facility operation does not adversely impact the existing regional haze at the ONWR. The regional haze calculations, using the output from CALPUFF, are included in Attachment 7.

5.4 Deposition Analysis

Deposition analyses were performed for the ONWR and WINWR for both sulfates and nitrates. The analyses followed those procedures and methodologies set forth in the IWAQM Phase I Report. Specifically, deposition analyses were performed as follows:

1. Perform CALPUFF model runs using the specified options previously mentioned (including output of both dry and wet deposition).
2. Perform individual CALPOST post-processor runs to output the maximum 24-hour average wet and dry deposition impacts of SO_2 and HNO_3 in μg/m2/s units.
3. Apply the appropriate scaling factors to the above CALPOST runs to account for the conversion of micrograms to kilograms, square meters to hectares (ha), seconds to hours, and hours to a day. Thus, the CALPOST results are output in kg/hectare.
4. For sulfate deposition, sum the results of both the wet deposition and dry deposition values for the SO_2 CALPOST runs.
5. For nitrate deposition, sum the results of both the wet deposition and dry deposition values for the HNO_3 CALPOST runs.

The results of the sulfate and nitrate deposition analyses for ONWR and WINWR are presented in Table 5-10. Since there are no published threshold values for comparison, the values presented in the Table are for review and evaluation by the FLM of the affected Class I areas.

5.5 Class I Impact Analysis

Ground-level impacts (in μg/m3) onto to the ONWR and WINWR were calculated for the criteria pollutants that exceed PSD Significant Emission Levels (SELs) for each applicable averaging period (i.e., NO_x – Annual, PM_{10} – Annual, and PM_{10} – 24 hour). The ISCST3 air dispersion model was used for that portion of the ONWR that lies with 50 km of the proposed site. The CALPUFF air modeling system was used for those portions of ONWR and WINWR that lie beyond 50 km. As in the regional haze analyses, CALPUFF was used in the screening mode ('Lite') for WINWR and refined mode for ONWR. The results of this analysis, presented in Table 5-11, are compared with the Class I Significant Impact Levels (SILs) calculated as 4 percent of the Class I Increment values. There are no exceedances of the Class I SILs. Therefore, no further analyses are warranted.

5.6 Commercial, Residential, and Industrial Growth

The Generating Station is at the new electrical power generating station Brandy Branch Facility near Baldwin City within Duval County. There will be an increase in the local labor force during the construction phase of the Generating Station, but this increase will be temporary, short-lived, and will not result in permanent/significant commercial and residential growth occurring in the vicinity of the Generating Station.

It is anticipated that most of the labor force during the construction phase will commute from nearby communities. The electrical generating capacity created by the Generating Station will not have a significant effect upon the industrial growth in the immediate area considering that the electrical generating capacity will be supplied to the JEA grid as opposed to a nearby industrial host. Population increase is a secondary growth indicator of potential increases in air quality levels. Changes in air quality due to population increase are related to the amount of new, permanent jobs which will be created by the Generating Station is estimated to be six. It can be concluded that the air quality impacts associated with secondary growth will not be significant because the increase in population due to the operation of the proposed facility will be very small, compared to the overall population size of the surrounding area.

Table 5-7
CALPUFF 'Lite' Analysis Results on ONWR

Item	Predicted Worst Days (Year – Day)		
	1985 – 333	1987 – 357	1987 – 357
Maximum Predicted Conc. ($\mu g/m^3$)			
SO_4	0.009554	0.064811	0.064811
NO_3	0.037555	0.119000	0.119000
PM_{10}	0.237610	0.141430	0.141430
Average Relative Humidity Factor[a]	6.0	5.7	5.7
Background Visual Range[b], Vr (km)	65	65	65
Background Extinction Coeff. (b_{extb}) (Mm^{-1})	60.2	60.2	60.2
Source Extinction Coeff. (b_{exts}) (Mm^{-1})			
$(NH_4)_2SO_4$	0.236462	1.523869	1.523869
NH_4NO_3	0.872027	2.625021	2.625021
PM_{10}	0.237610	0.141430	0.141430
Total (b_{exts}) (Mm^{-1})	1.35	4.29	4.29
Percent Change (%)	2.24	7.13	7.13

[a]Computed from Jacksonville RH data.
[b]Provided by U.S. Fish and Wildlife Service.

Table 5-8
CALPUFF 'Lite' Analysis Results on WINWR

Item	Predicted Worst Days (Year – Day)		
	1984 – 246	1984 – 362	1988 – 345
Maximum Predicted Conc. ($\mu g/m^3$)			
SO_4	0.014663	0.005798	0.036017
NO_3	0.016575	0.090114	0.033520
PM_{10}	0.125220	0.033451	0.067145
Average Relative Humidity Factor[a]	4.9	3.4	5.1
Background Visual Range[b], Vr (km)	65	65	65
Background Extinction Coeff. (b_{extb}) (Mm^{-1})	60.2	60.2	60.2
Source Extinction Coeff. (b_{exts}) (Mm^{-1})			
$(NH_4)_2SO_4$	0.296376	0.081317	0.757708
NH_4NO_3	0.314312	1.185720	0.661584
PM_{10}	0.125220	0.033451	0.067145
Total (b_{exts}) (Mm^{-1})	0.74	1.30	1.49
Percent Change (%)	1.22	2.16	2.47

[a]Computed from Jacksonville RH data.
[b]Provided by U.S. Fish and Wildlife Service.

Table 5-9
CALPUFF Refined Analysis Results on ONWR

Item	Predicted Worst Days (Year – Day)		
	1990 – 007	1990 – 157	1990 – 157
Maximum Predicted Conc. ($\mu g/m^3$)			
SO_4	0.016911	0.038374	0.038374
NO_3	0.034835	0.019226	0.019226
PM_{10}	0.064405	0.224280	0.224280
Average Relative Humidity Factor[a]	8.0	3.4	3.4
Background Visual Range[b], Vr (km)	65	65	65
Background Extinction Coeff. (b_{extb}) (Mm^{-1})	60.2	60.2	60.2
Source Extinction Coeff. (b_{exts}) (Mm^{-1})			
$(NH_4)_2SO_4$	0.5577	0.5386	0.538195
NH_4NO_3	1.0774	0.2526	0.252976
PM_{10}	0.0644	0.2243	0.224280
Total (b_{exts}) (Mm^{-1})	1.70	1.02	1.02
Percent Change (%)	2.83	1.69	1.69

[a]Computed from Jacksonville RH data.
[b]Provided by U.S. Fish and Wildlife Service.

Table 5-10
Sulfate and Nitrate Deposition Results

Class I Area	Dry Deposition[a] (kg/hectare)		Wet Deposition[a] (kg/hectare)		Total Deposition[a] (kg/hectare)	
	SO_2	HNO_3	SO_2	HNO_3	SO_2	HNO_3
Okefenokee[b]	0.0030	0.0011	0.0052	0.0026	0.0082	0.0037
Wolf Island[c]	0.0005	0.0002	0.0038	0.0009	0.0043	0.0011

[a]Results are 24-hour average values.
[b]Okefenokee results were obtained using refined CALPUFF modeling due to the outcome of the regional haze analysis necessitating its use.
[c]Wolf Island results were obtained using screening CALPUFF modeling (i.e., 'Lite').

Table 5-11
Class I Significant Impact Level (SIL) Results

Class I Area	NO_x – Annual		PM_{10} – Annual		PM_{10} – 24 hour	
	Impact ($\mu g/m^3$)	SIL[a] ($\mu g/m^3$)	Impact ($\mu g/m^3$)	SIL[a] ($\mu g/m^3$)	Impact ($\mu g/m^3$)	SIL[a] ($\mu g/m^3$)
Okefenokee[b]	0.012	0.1	0.009	0.16	0.213	0.32
Okefenokee[c]	0.009	0.1	0.009	0.16	0.224	0.32
Wolf Island[d]	0.005	0.1	0.005	0.16	0.125	0.32

[a]Class I Significant Impact Levels calculated as 4 percent of the Class I Increment Levels.

[b]For that portion of Okefenokee within 50 km of the proposed Generating Station location, the ISCST3 air dispersion model was used to obtain impacts.

[c]For that portion of Okefenokee beyond 50 km from the proposed Generating Station location, the CALPUFF air modeling system was used in refined mode to obtain impacts.

[d]Wolf Island lies beyond 50 km from the proposed Generating Station location. As such, the CALPUFF air dispersion modeling system was used in the screening mode (i.e., 'Lite') to obtain impacts.

5.7 Vegetation and Soils

Combustion turbine projects are typically considered "clean facilities" that have very low predicted ground level pollutant impacts. The low predicted impacts are the direct result of complete combustion and very effective pollutant dispersion. Dispersion is enhanced by the thermal and momentum buoyancy characteristics of the combustion turbine exhaust. Therefore, the Generating Station's impacts on soils and vegetation will be minimal.

The NAAQS were established to protect public health and welfare from any adverse effects of air pollutants. The definition of public welfare also encompasses vegetation and soils. Specifically, ambient concentrations of NO_2, SO_2, CO, and PM/PM_{10} below the secondary NAAQS will not result in harmful effects for most types of soils and vegetation.

The criteria pollutants, which triggered an additional impact analysis, include NO_x, SO_2, CO, and PM/PM_{10}. The modeled impacts were compared to the secondary NAAQS as the basis for assessing cumulative impacts. The modeling in Section 4.0 showed that the NO_x, SO_2, CO, and PM/PM_{10} impacts are below the NAAQS. The impacts are even less than the much lower significant impact level thresholds. Because the Generating Station's emissions do not even significantly impact the NAAQS, it is reasonable to conclude that no adverse effects on soils and vegetation will occur.

Attachment 1
Performance Data

IMAGE QUALITY

AS YOU REVIEW THE NEXT FEW PAGES, PLEASE NOTE THAT THE ORIGINAL DOCUMENT WAS OF POOR QUALITY.

***** WITH INLET BLEED HEATING *****

ESTIMATED PERFORMANCE PG7241(FA)

Load Condition		BASE	75%	50%	25%	BASE	75%	50%	25%
Ambient Temp.	Deg F.	95.	95.	95.	95.	95.	95.	95.	95.
Fuel Type		Cust Gas	Cust Gas	Cust Gas	Cust Gas	Liquid	Liquid	Liquid	Liqu
Fuel LHV	Btu/lb	20,675	20,675	20,675	20,675	18,550	18,550	18,550	18,5:
Fuel Temperature	Deg F	60	60	60	60	60	60	60	60
Liquid Fuel H/C Ratio						1.9	1.9	1.9	1.9
Output	kW	150,500.	112,800.	75,200.	37,600.	160,100.	120,100.	80,100.	40,0(
Heat Rate (LHV)	Btu/kWh	9,760.	10,690.	12,940.	18,180.	10,240.	11,170.	13,270.	18,1:
Heat Cons. (LHV) X 10^6	Btu/h	1,468.9	1,205.8	973.1	683.6	1,639.4	1,341.5	1,062.9	727.:
Auxiliary Power	kW	608	608	608	608	1,542	1,542	1,542	1,54:
Output Net	kW	149,890.	112,190.	74,590.	36,990.	158,560.	118,560.	78,560.	38,4(
Heat Rate (LHV) Net	Btu/kWh	9,800.	10,750.	13,050.	18,480.	10,340.	11,320.	13,530.	18,91
Exhaust Flow X 10^3	lb/h	3254.	2691.	2265.	2064.	3365.	2693.	2318.	2089.
Exhaust Temp.	Deg F.	1144.	1170.	1200.	1043.	1133.	1200.	1200.	1053.
Exhaust Heat (LHV) X 10^6	Btu/h	901.9	776.4	679.4	527.2	936.0	810.4	701.1	540.4
Water Flow	lb/h	0.	0.	0.	0.	93,590.	69,010.	46,070.	19,72

EMISSIONS

NOx (KGS Unit)	ppmvd @ 15% O2	15.	15.	15.	58.	42.	42.	42.	42.
NOx AS NO2 (KGS Unit)	lb/h	89.	73.	58.	156.	286.	232.	182.	123.
NOx (BB Units)	ppmvd @ 15% O2	9.	9.	9.	58.	42.	42.	42.	42.
NOx AS NO2 (BB Units)	lb/h	54.	44.	35.	156.	286.	232.	182.	123.
CO	ppmvd	15.	15.	15.	61.	20.	20.	36.	254.
CO	lb/h	43.	36.	30.	115.	59.	47.	74.	480.
UHC	ppmvw	7.	7.	7.	28.	7.	7.	7.	21.
UHC	lb/h	13.	11.	9.	33.	13.	11.	9.	25.
Particulates	lb/h	9.	9.	9.	9.	17.	17.	17.	17.

EXHAUST ANALYSIS % VOL.

Argon	0.87	0.86	0.86	0.87	0.84	0.84	0.85	0.86
Nitrogen	72.71	72.76	72.89	73.50	70.25	70.48	71.33	73.01
Oxygen	12.10	12.24	12.64	14.42	10.97	10.92	11.83	14.06
Carbon Dioxide	3.82	3.75	3.57	2.74	5.37	5.45	4.99	3.78
Water	10.51	10.39	10.04	8.47	12.57	12.31	11.01	8.29

SITE CONDITIONS

Elevation	ft.	27.0
Site Pressure	psia	14.69
Inlet Loss	in Water	3.0
Exhaust Loss	in Water	5.5
Relative Humidity	%	60
Application		7FH2 Hydrogen-Cooled Generator
Combustion System		15/42 DLN Combustor

Emission information based on GE recommended measurement methods. NOx emissions are corrected to 15% O2 without heat rate correction and are not corrected to ISO reference condition per 40CFR 60.335(c)(1). NOx levels shown will be controlled by algorithms within the SPEEDTRONIC control system.
Liquid Fuel is Assumed to have 0.015% Fuel-Bound Nitrogen, or less.
FBN Amounts Greater Than 0.015% Will Add to the Reported NOx Value.
Sulfur Emissions Based On 0 WT% Sulfur Content in the Fuel.

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***** WITH INLET BLEED HEATING *****

ESTIMATED PERFORMANCE PG7241(FA)

Load Condition		BASE	75%	50%	25%	BASE	75%	50%	25%
Ambient Temp.	Deg F.	59.	59.	59.	59.	59.	59.	59.	59.
Fuel Type		Cust Gas	Cust Gas	Cust Gas	Cust Gas	Liquid	Liquid	Liquid	Liq
Fuel LHV	Btu/lb	20,675	20,675	20,675	20,675	18,550	18,550	18,550	18.5
Fuel Temperature	Deg F	60	60	60	60	60	60	60	60
Liquid Fuel H/C Ratio						1.9	1.9	1.9	1.9
Output	kW	173,200.	129,900.	86,600.	43,300.	182,000.	136,500.	91,000.	45.5
Heat Rate (LHV)	Btu/kWh	9,370.	10,120.	12,190.	16,820.	10,010.	10,830.	12,780.	17,0
Heat Cons. (LHV) X 10^6	Btu/h	1,622.9	1,314.6	1,055.7	728.3	1,821.8	1,478.3	1,163.	776.
Auxiliary Power	kW	608	608	608	608	1,542	1,542	1,542	1,54
Output Net	kW	172,590.	129,290.	85,990.	42,690.	180,460.	134,960.	89,460.	43,9
Heat Rate (LHV) Net	Btu/kWh	9,400.	10,170.	12,280.	17,060.	10,100.	10,950.	13,000.	17,6
Exhaust Flow X 10^3	lb/h	3542.	2890.	2397.	2182.	3683.	2827.	2406.	2215
Exhaust Temp.	Deg F.	1116.	1139.	1184.	1013.	1098.	1194.	1200.	1013
Exhaust Heat (LHV) X 10^6	Btu/h	973.0	823.2	720.4	551.1	1011.7	865.3	744.8	562.
Water Flow	lb/h	0.	0.	0.	0.	119,700.	90,620.	61,970.	27,1

EMISSIONS

NOx (KGS Unit)	ppmvd @ 15% O2	15.	15.	15.	77.	42.	42.	42.	42.
NOx AS NO2 (KGS Unit)	lb/h	99.	79.	63.	220.	318.	256.	199.	131.
NOx (BB Units)	ppmvd @ 15% O2	9.	9.	9.	77.	42.	42.	42.	42.
NOx AS NO2 (BB Units)	lb/h	60.	48.	38.	220.	318.	256.	199.	131.
CO	ppmvd	15.	15.	15.	65.	20.	20.	30.	254.
CO	lb/h	48.	39.	33.	131.	65.	50.	63.	514.
UHC	ppmvw	7.	7.	7.	30.	7.	7.	7.	23.
UHC	lb/h	14.	11.	9.	36.	15.	11.	9.	28.
Particulates	lb/h	9.	9.	9.	9.	17.	17.	17.	17.

EXHAUST ANALYSIS % VOL.

Argon	0.89	0.90	0.90	0.90	0.86	0.84	0.86	0.90
Nitrogen	74.39	74.44	74.55	75.23	71.30	71.26	72.20	74.38
Oxygen	12.38	12.51	12.85	14.80	11.09	10.69	11.62	14.35
Carbon Dioxide	3.90	3.84	3.69	2.78	5.48	5.75	5.28	3.83
Water	8.44	8.32	8.02	6.29	11.28	11.46	10.04	6.55

SITE CONDITIONS

Elevation	ft.	27.0
Site Pressure	psia	14.69
Inlet Loss	in Water	3.0
Exhaust Loss	in Water	5.5
Relative Humidity	%	60
Application		7FH2 Hydrogen-Cooled Generator
Combustion System		15/42 DLN Combustor

Emission information based on GE recommended measurement methods. NOx emissions are corrected to 15% O2 without heat rate correction and are not corrected to ISO reference condition per 40CFR 60.335(c)(1). NOx levels shown will be controlled by algorithms within the SPEEDTRONIC control system.
Liquid Fuel is Assumed to have 0.015% Fuel-Bound Nitrogen, or less.
FBN Amounts Greater Than 0.015% Will Add to the Reported NOx Value.
Sulfur Emissions Based On 0 WT% Sulfur Content in the Fuel.

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***** WITH INLET BLEED HEATING *****

ESTIMATED PERFORMANCE PG7241(FA)

Load Condition		BASE	75%	50%	25%	BASE	75%	50%	25%
Ambient Temp.	Deg F.	20.	20.	20.	20.	20.	20.	20.	20.
Fuel Type		Cust Gas	Cust Gas	Cust Gas	Cust Gas	Liquid	Liquid	Liquid	Liqu
Fuel LHV	Btu/lb	20,675	20,675	20,675	20,675	18,550	18,550	18,550	18.5
Fuel Temperature	Deg F	60	60	60	60	60	60	60	60
Liquid Fuel H/C Ratio						1.9	1.9	1.9	1.9
Output	kW	186,500.	139,900.	93,300.	46,600.	192,700.	144,500.	96,400.	48,2(
Heat Rate (LHV)	Btu/kWh	9,310.	9,950.	11,910.	16,280.	10,040.	10,840.	12,680.	16,6
Heat Cons. (LHV) X 10^6	Btu/h	1,736.3	1,392.	1,111.2	758.6	1,934.7	1,566.4	1,222.4	804.5
Auxiliary Power	kW	608	608	608	608	1,542	1,542	1,542	1,542
Output Net	kW	185,890.	139,290.	92,690.	45,990.	191,160.	142,960.	94,860.	46,6(
Heat Rate (LHV) Net	Btu/kWh	9,340.	9,990.	11,990.	16,500.	10,120.	10,960.	12,890.	17,24
Exhaust Flow X 10^3	lb/h	3801.	3025.	2486.	2297.	3914.	2925.	2439.	2332.
Exhaust Temp.	Deg F.	1081.	1112.	1160.	966.	1068.	1183.	1200.	962.
Exhaust Heat (LHV) X 10^6	Btu/h	1036.9	863.8	751.3	569.2	1074.8	913.4	777.8	578.7
Water Flow	lb/h	0.	0.	0.	0.	130,530.	100,950.	68,710.	28.73

EMISSIONS

NOx (KGS Unit)	ppmvd @ 15% O2	15.	15.	15.	80.	42.	42.	42.	42.
NOx AS NO2 (KGS Unit)	lb/h	106.	84.	66.	238.	338.	271.	209.	136.
NOx (BB Units)	ppmvd @ 15% O2	9.	9.	9.	80.	42.	42.	42.	42.
NOx AS NO2 (BB Units)	lb/h	64.	51.	40.	238.	338.	271.	209.	136.
CO	ppmvd	15.	15.	15.	104.	20.	20.	26.	282.
CO	lb/h	52.	41.	34.	221.	69.	51.	57.	605.
UHC	ppmvw	7.	7.	7.	47.	7.	7.	7.	27.
UHC	lb/h	15.	12.	10.	60.	15.	12.	10.	35.
Particulates	lb/h	9.	9.	9.	9.	17.	17.	17.	17.

EXHAUST ANALYSIS % VOL.

Argon	0.91	0.89	0.89	0.90	0.86	0.84	0.86	0.91
Nitrogen	74.99	75.00	75.11	75.86	71.77	71.48	72.40	74.99
Oxygen	12.54	12.57	12.88	15.00	11.20	10.54	11.39	14.59
Carbon Dioxide	3.90	3.89	3.75	2.77	5.49	5.89	5.48	3.78
Water	7.67	7.65	7.37	5.48	10.69	11.25	9.87	5.74

SITE CONDITIONS

Elevation	ft.	27.0
Site Pressure	psia	14.69
Inlet Loss	in Water	3.0
Exhaust Loss	in Water	5.5
Relative Humidity	%	60
Application		7FH2 Hydrogen-Cooled Generator
Combustion System		15/42 DLN Combustor

Emission information based on GE recommended measurement methods. NOx emissions are corrected to 15% O2 without heat r correction and are not corrected to ISO reference condition per 40CFR 60.335(c)(1). NOx levels shown will be controlled by algorithms within the SPEEDTRONIC control system.
Liquid Fuel is Assumed to have 0.015% Fuel-Bound Nitrogen, or less.
FBN Amounts Greater Than 0.015% Will Add to the Reported NOx Value.
Sulfur Emissions Based On 0 WT% Sulfur Content in the Fuel.

IPS- 70600 version code- 1.4.1 Opt: 10
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Jacksonville Electric Authority
Brandy Branch 2x1 7FA Combined Cycle Project
Estimated Combustion Turbine and Heat Recovery Steam Generator Emissions, Rev.5

Preparer's Initials: UZ
10/26/00

Project number 99252.0040

Case Number	1	2	3	4	5	6	7
CTG Performance Reference	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted
CTG Model	7241FA	7241FA	7241FA	7241FA	7241FA	7241FA	7241FA
Diluent/NOx Emission Rate	DLN/9	DLN/9	DLN/9	DLN/9	DLN/9	DLN/9	DLN/9
CTG Fuel Type	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas
CTG Load	100%	100%	100%	100%	100%	100%	100%
Ambient Temperature, F	95	95	95	95	59	59	20
HRSG Firing	Fired	Unfired	Unfired	Fired	Unfired	Fired	Unfired
STG Output with two Combustion Turbine Generators in operation, kW	192,550	173,260	175,940	192,770	187,860	193,000	192,430
Ambient Temperature, F	95.0	95.0	95.0	95.0	59.0	59.0	20.0
Ambient Temperature, C	35.0	35.0	35.0	35.0	15.0	15.0	(6.7)
Ambient Relative Humidity, %	60.0	60.0	60.0	60.0	60.0	60.0	60.0
Atmospheric Pressure, psia	14.690	14.690	14.690	14.690	14.690	14.690	14.690
Atmospheric Pressure, bar(a)	1.013	1.013	1.013	1.013	1.013	1.013	1.013
CTG Compressor Inlet Dry Bulb Temperature, F	95.0	95.0	84.5	84.5	59.0	59.0	20.0
CTG Compressor Inlet Temperature, C	35.0	35.0	29.2	29.2	15.0	15.0	(6.7)
CTG Compr. Inlet Relative Humidity, %	60.1	60.1	92.6	92.6	80.2	80.2	60.3
CTG Inlet Air Conditioning Included?	No	No	Yes (Evap. Cooler)	Yes (Evap. Cooler)	No	No	No
Inlet Loss, in. H2O	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Inlet Loss, mm. H2O	88.9	88.9	88.9	88.9	88.9	88.9	88.9
Exhaust Loss, in. H2O	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Exhaust Loss, mm. H2O	381.0	381.0	381.0	381.0	381.0	381.0	381.0
CTG Load Level (percent of Base Load)	100%	100%	100%	100%	100%	100%	100%
Gross CTG Output, kW	148,500	148,500	155,290	155,290	170,900	170,900	184,020
Gross CTG Heat Rate, Btu/kWh (LHV)	9,803	9,803	9,684	9,684	9,406	9,406	9,347
Gross CTG Heat Rate, KJ/KWh (LHV)	10,342	10,342	10,217	10,217	9,924	9,924	9,861
Gross CTG Heat Rate, kJ/kWh (HHV)	10,887	10,887	10,755	10,755	10,446	10,446	10,380
Gross CTG Heat Rate, KJ/KWh (HHV)	11,486	11,486	11,347	11,347	11,021	11,021	10,951
CTG Heat Input, MBtu/h (LHV)	1,455.7	1,455.7	1,503.8	1,503.8	1,607.5	1,607.5	1,719.9
CTG Heat Input, GJ/h (LHV)	1,535.8	1,535.8	1,586.5	1,586.5	1,696.0	1,696.0	1,814.6
CTG Heat Input, MBtu/h (HHV)	1,616.7	1,616.7	1,670.1	1,670.1	1,785.3	1,785.3	1,910.2
CTG Heat Input, GJ/h (HHV)	1,705.7	1,705.7	1,762.0	1,762.0	1,883.6	1,883.6	2,015.4
CTG Water Injection Flow, lb/h	0	0	0	0	0	0	0
CTG Water Injection Flow, kg/h	0	0	0	0	0	0	0
CTG Steam Injection Flow, lb/h	0	0	0	0	0	0	0
CTG Steam Injection Flow, kg/h	0	0	0	0	0	0	0
Injection Fluid/Fuel Ratio	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CTG Exhaust Flow, lb/h	3,254,000	3,254,000	3,331,310	3,331,310	3,542,000	3,542,000	3,801,000
CTG Exhaust Flow, kg/h	1,475,990	1,475,990	1,511,057	1,511,057	1,606,624	1,606,624	1,724,105
CTG Exhaust Temperature, F	1,151	1,151	1,143	1,143	1,123	1,123	1,088
CTG Exhaust Temperature, C	621.7	621.7	617.2	617.2	606.1	606.1	586.7
CTG Exhaust Enthalpy, Btu/lb	284.13	284.13	282.51	282.51	281.91	281.91	280.56
CTG Exhaust Enthalpy, kJ/lb	299.77	299.77	298.06	298.06	297.43	297.43	296.01
CTG Exhaust Enthalpy Reference Temperature, F	95	95	95	95	59	59	20
CTG Exhaust Enthalpy Reference Temperature, C	35.0	35.0	35.0	35.0	15.0	15.0	(6.7)
CTG Exhaust Heat, MBtu/h	924.6	924.6	941.1	941.1	998.5	998.5	1,066.4
CTG Exhaust Heat, GJ/h	975.5	975.5	992.9	992.9	1,053.5	1,053.5	1,125.1
CTG Exhaust Heat/CTG Output, kW/kW	182.5%	182.5%	177.6%	177.6%	171.2%	171.2%	169.8%
Total CTG Fuel Flow, lb/h	70410	70410	72730	72730	77750	77750	83190
CTG Fuel Temperature, F	365	365	365	365	365	365	365
CTG Fuel LHV, Btu/lb	20,675	20,675	20,675	20,675	20,675	20,675	20,675
CTG Fuel LHV, kJ/lb	48,090	48,090	48,090	48,090	48,090	48,090	48,090
CTG Fuel HHV, Btu/lb	22,962	22,962	22,962	22,962	22,962	22,962	22,962
CTG Fuel HHV, kJ/lb	53,410	53,410	53,410	53,410	53,410	53,410	53,410
HHV/LHV Ratio	1.1106	1.1106	1.1106	1.1106	1.1106	1.1106	1.1106
CTG Fuel Composition (Ultimate Analysis by Weight)							
Ar	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
C	74.87%	74.87%	74.87%	74.87%	74.87%	74.87%	74.87%
H2	25.13%	25.13%	25.13%	25.13%	25.13%	25.13%	25.13%
N2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
O2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
S	0.00070%	0.00070%	0.00070%	0.00070%	0.00070%	0.00070%	0.00070%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Fuel Sulfur Content (grains/100 standard cubic feet)	0.2	0.2	0.2	0.2	0.2	0.2	0.2

Jacksonville Electric Authority
Brandy Branch 2x1 7FA Combined Cycle Project
Estimated Combustion Turbine and Heat Recovery Steam Generator Emissions, Rev.5

Preparer's Initials: UZ
10/26/00

Project number 99262.0040

Case Number	1	2	3	4	5	6	7
CTG Performance Reference	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted
CTG Model	7241FA	7241FA	7241FA	7241FA	7241FA	7241FA	7241FA
Diluent/NOx Emission Rate	DLN/9	DLN/9	DLN/9	DLN/9	DLN/9	DLN/9	DLN/9
CTG Fuel Type	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas
CTG Load	100%	100%	100%	100%	100%	100%	100%
Ambient Temperature, F	95	95	95	95	59	59	20
HRSG Firing	Fired	Unfired	Unfired	Fired	Unfired	Fired	Unfired
STG Output with two Combustion Turbine Generators in operation, kW	192,550	173,260	175,940	192,770	187,880	193,000	192,430
Combustion Turbine Exhaust Emissions							
CTG Exhaust Analysis (Volume Basis - Wet)							
Ar	0.91%	0.91%	0.91%	0.91%	0.93%	0.93%	0.94%
CO2	3.79%	3.79%	3.82%	3.82%	3.88%	3.88%	3.88%
H2O	10.79%	10.79%	11.20%	11.20%	8.72%	8.72%	7.06%
N2	72.57%	72.57%	72.27%	72.27%	74.25%	74.25%	74.85%
O2	11.93%	11.93%	11.80%	11.80%	12.21%	12.21%	12.37%
SO2	0.00001%	0.00001%	0.00001%	0.00001%	0.00001%	0.00001%	0.00001%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
NOx, ppmvd @15% O2	9.00	9.00	9.00	9.00	9.00	9.00	9.00
NOx, ppmvd @ 15% O2	9.00	9.00	9.00	9.00	9.00	9.00	9.00
NOx, ppmvd	11.44	11.44	11.58	11.58	11.44	11.44	11.34
NOx, ppmvw (wet - uncorrected exhaust gas)	10.20	10.20	10.28	10.28	10.44	10.44	10.44
NOx Massflow Added to Match CTG Manufacturer's NOx Emissions Estimate	(3.00)	(3.00)	(3.00)	(3.00)	(3.00)	(3.00)	(3.00)
Additonal Percent Margin included in NOx Emissions below	5%	5%	5%	5%	5%	5%	5%
NOx, lb/h as NO2	54.03	54.03	55.91	55.91	59.97	59.97	64.38
NOx, lb/MBtu (LHV)	0.04	0.04	0.04	0.04	0.04	0.04	0.04
NOx, lb/MBtu (HHV)	0.03	0.03	0.03	0.03	0.03	0.03	0.03
NOx, mg/Nm3 as NO2 (dry, 15% O2)	18.38	18.38	18.41	18.41	18.48	18.48	18.54
NOx, mg/Nm3 as NO2 (dry, 15% O2)	18.38	18.38	18.41	18.41	18.48	18.48	18.54
NOx, mg/Nm3 as NO2 (dry)	23.36	23.36	23.69	23.69	23.48	23.48	23.36
NOx, mg/Nm3 as NO2 (wet - uncorrected exhaust flow)	20.84	20.84	21.03	21.03	21.43	21.43	21.50
NOx, mg/MJ (LHV)	15.96	15.96	15.98	15.98	16.04	16.04	16.09
NOx, mg/MJ (HHV)	14.37	14.37	14.39	14.39	14.44	14.44	14.49
CO, ppmvd @ 15% O2	11.80	11.80	11.66	11.66	11.81	11.81	11.90
CO, ppmvd @ 15% O2	11.80	11.80	11.66	11.66	11.81	11.81	11.90
CO, ppmvd	15.00	15.00	15.00	15.00	15.00	15.00	15.00
CO, ppmvw (wet - uncorrected exhaust gas)	13.38	13.38	13.32	13.32	13.69	13.69	13.81
CO Massflow Added to Match CTG Manufacturer's CO Emissions Estimate	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Additional Percent Margin included in CO Emissions below	5%	5%	5%	5%	5%	5%	5%
CO, lb/h	45.53	45.53	46.47	46.47	50.29	50.29	54.26
CO, lb/MBtu (LHV)	0.03	0.03	0.03	0.03	0.03	0.03	0.03
CO, lb/MBtu (HHV)	0.03	0.03	0.03	0.03	0.03	0.03	0.03
CO, mg/Nm3 (wet - uncorrected exhaust flow)	17.56	17.56	17.48	17.48	17.97	17.97	18.12
CO, mg/Nm3 (dry)	19.69	19.69	19.69	19.69	19.69	19.69	19.69
CO, mg/Nm3 (dry, 15% O2)	15.49	15.49	15.30	15.30	15.49	15.49	15.62
CO, mg/Nm3 (dry, 15% O2)	15.49	15.49	15.30	15.30	15.49	15.49	15.62
CO, mg/MJ (LHV)	13.45	13.45	13.28	13.28	13.45	13.45	13.56
CO, mg/MJ (HHV)	12.11	12.11	11.96	11.96	12.11	12.11	12.21
NOTE: SO2 estimate does not include the effects of SO2 oxidation							
SO2, ppmvd @ 15% O2 (with no SO2 oxidation)	0.12	0.12	0.12	0.12	0.12	0.12	0.12
SO2, ppmvd @ 15% O2 (with no SO2 oxidation)	0.12	0.12	0.12	0.12	0.12	0.12	0.12
SO2, ppmvd (with no SO2 oxidation)	0.15	0.15	0.15	0.15	0.15	0.15	0.15
SO2, ppmvw (with no SO2 oxidation)(wet - uncorrected exhaust gas)	0.13	0.13	0.13	0.13	0.14	0.14	0.14
SO2 Massflow Added to Match CTG Manufacturer's CO Emissions Estimate	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Additional Percent Margin included in SO2 Emissions below	5%	5%	5%	5%	5%	5%	5%
SO2, lb/h (with no SO2 oxidation)	1.03	1.03	1.07	1.07	1.14	1.14	1.22
SO2, lb/MBtu (LHV) (with no SO2 oxidation)	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007
SO2, lb/MBtu (HHV) (with no SO2 oxidation)	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
SO2, mg/Nm3 (wet - uncorrected exhaust flow) (with no SO2 oxidation)	0.40	0.40	0.40	0.40	0.41	0.41	0.41
SO2, mg/Nm3 (dry, 15% O2) (with no SO2 oxidation)	0.35	0.35	0.35	0.35	0.35	0.35	0.35
SO2, mg/Nm3 (dry, 15% O2) (with no SO2 oxidation)	0.35	0.35	0.35	0.35	0.35	0.35	0.35
SO2, mg/Nm3 (dry) (with no SO2 oxidation)	0.45	0.45	0.45	0.45	0.45	0.45	0.44
SO2, mg/MJ (LHV) (with no SO2 oxidation)	0.31	0.31	0.31	0.31	0.31	0.31	0.31
SO2, mg/MJ (HHV) (with no SO2 oxidation)	0.27	0.27	0.27	0.27	0.27	0.27	0.27

Jacksonville Electric Authority
Brandy Branch 2x1 7FA Combined Cycle Project
Estimated Combustion Turbine and Heat Recovery Steam Generator Emissions, Rev.5

Preparer's Initials: UZ
10/26/00

Project number 99262.0040

Case Number	1	2	3	4	5	6	7
CTG Performance Reference	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted
CTG Model	7241FA	7241FA	7241FA	7241FA	7241FA	7241FA	7241FA
Diluent/NOx Emission Rate	DLN/9	DLN/9	DLN/9	DLN/9	DLN/9	DLN/9	DLN/9
CTG Fuel Type	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas
CTG Load	100%	100%	100%	100%	100%	100%	100%
Ambient Temperature, F	95	95	95	95	59	59	20
HRSG Firing	Fired	Unfired	Unfired	Fired	Unfired	Fired	Unfired
STG Output with two Combustion Turbine Generators in operation, kW	192,550	173,260	175,940	192,770	187,860	193,000	192,430
Combustion Turbine Exhaust Emissions - continued							
UHC, ppmvd @ 15% O2	6.17	6.17	6.13	6.13	6.04	6.04	6.04
UHC, ppmvd @ 15% O2	6.17	6.17	6.13	6.13	6.04	6.04	6.04
UHC, ppmvd	7.85	7.85	7.88	7.88	7.67	7.67	7.61
UHC, ppmvw (wet - uncorrected exhaust gas)	7.00	7.00	7.00	7.00	7.00	7.00	7.00
UHC Massflow Added to Match CTG Manufacturer's CO Emissions Estimate	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Additional Percent Margin included in UHC Emissions Below	5%	5%	5%	5%	5%	5%	5%
UHC, lb/h as CH4	13.64	13.64	13.99	13.99	14.73	14.73	15.76
UHC, lb/MBtu as CH4 (LHV)	0.0094	0.0094	0.0093	0.0093	0.0092	0.0092	0.0092
UHC, lb/MBtu as CH4 (HHV)	0.0084	0.0084	0.0084	0.0084	0.0082	0.0082	0.0082
UHC, mg/Nm3 as CH4 (dry, 15% O2)	4.64	4.64	4.61	4.61	4.54	4.54	4.54
UHC, mg/Nm3 as CH4 (dry, 15% O2)	4.64	4.64	4.61	4.61	4.54	4.54	4.54
UHC, mg/Nm3 as CH4 (dry)	5.90	5.90	5.93	5.93	5.76	5.76	5.72
UHC, mg/Nm3 as CH4 (wet - uncorrected exhaust flow)	5.26	5.26	5.26	5.26	5.26	5.26	5.26
UHC, mg/MJ as CH4 (LHV)	4.03	4.03	4.00	4.00	3.94	3.94	3.94
UHC, mg/MJ as CH4 (HHV)	3.63	3.63	3.60	3.60	3.55	3.55	3.55
VOC percentage of UHC	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%
VOC, ppmvd @ 15% O2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
VOC, ppmvd @ 15% O2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
VOC, ppmvd	1.57	1.57	1.58	1.58	1.53	1.53	1.52
VOC, ppmvw (wet - uncorrected exhaust flow)	1.40	1.40	1.40	1.40	1.40	1.40	1.40
VOC Massflow Added to Match CTG Manufacturer's VOC Emissions Estimate	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Additional Percent Margin included in VOC Emissions below	5%	5%	5%	5%	5%	5%	5%
VOC, lb/h as CH4	2.73	2.73	2.80	2.80	2.95	2.95	3.15
VOC, lb/MBtu as CH4 (LHV)	0.0019	0.0019	0.0019	0.0019	0.0018	0.0018	0.0018
VOC, lb/MBtu as CH4 (HHV)	0.0017	0.0017	0.0017	0.0017	0.0016	0.0016	0.0016
VOC, mg/Nm3 as CH4 (dry, 15% O2)	0.93	0.93	0.92	0.92	0.91	0.91	0.91
VOC, mg/Nm3 as CH4 (dry, 15% O2)	0.93	0.93	0.92	0.92	0.91	0.91	0.91
VOC, mg/Nm3 as CH4 (dry)	1.18	1.18	1.19	1.19	1.15	1.15	1.14
VOC, mg/Nm3 as CH4 (wet - uncorrected exhaust flow)	1.05	1.05	1.05	1.05	1.05	1.05	1.05
VOC, mg/MJ as CH4 (LHV)	0.81	0.81	0.80	0.80	0.79	0.79	0.79
VOC, mg/MJ as CH4 (HHV)	0.73	0.73	0.72	0.72	0.71	0.71	0.71
Percent Margin included in Particulates Emissions below	5%	5%	5%	5%	5%	5%	5%
Particulates, lb/h (front half catch only)	9.45	9.45	9.45	9.45	9.45	9.45	9.45
Particulates, lb/h (front and back half catch)	18.90	18.90	18.90	18.90	18.90	18.90	18.90
Particulates, lb/MBtu (LHV) (front half catch only)	0.0065	0.0065	0.0063	0.0063	0.0059	0.0059	0.0055
Particulates, lb/MBtu (HHV) (front half catch only)	0.0058	0.0058	0.0057	0.0057	0.0053	0.0053	0.0049
Particulates, mg/Nm3 (dry, 15% O2) (front half catch only)	3.22	3.22	3.11	3.11	2.91	2.91	2.72
Particulates, mg/Nm3 (dry, 15% O2) (front half catch only)	3.22	3.22	3.11	3.11	2.91	2.91	2.72
Particulates, mg/Nm3 (dry) (front half catch only)	4.09	4.09	4.00	4.00	3.70	3.70	3.43
Particulates, mg/Nm3 (wet - uncorrected exhaust flow) (front half catch only)	3.65	3.65	3.56	3.56	3.38	3.38	3.16
Particulates, mg/MJ (LHV) (front half catch only)	2.79	2.79	2.70	2.70	2.53	2.53	2.36
Particulates, mg/MJ (HHV) (front half catch only)	2.51	2.51	2.43	2.43	2.28	2.28	2.13
Percent Margin included in PM10 Emissions below	5%	5%	5%	5%	5%	5%	5%
PM10, lb/h (front half catch only)	9.45	9.45	9.45	9.45	9.45	9.45	9.45
PM10, lb/h (front and back half catch)	18.90	18.90	18.90	18.90	18.90	18.90	18.90
PM10, lb/MBtu (LHV) (front and back half catch)	0.01	0.01	0.01	0.01	0.01	0.01	0.01
PM10, lb/MBtu (HHV) (front and back half catch)	0.01	0.01	0.01	0.01	0.01	0.01	0.01
PM10, mg/Nm3 (dry, 15% O2) (front and back half catch)	6.43	6.43	6.23	6.23	5.82	5.82	5.44
PM10, mg/Nm3 (dry, 15% O2) (front and back half catch)	6.43	6.43	6.23	6.23	5.82	5.82	5.44
PM10, mg/Nm3 (dry) (front and back half catch)	8.17	8.17	8.01	8.01	7.40	7.40	6.86
PM10, mg/Nm3 (wet - uncorrected exhaust flow) (front and back half catch)	7.29	7.29	7.11	7.11	6.75	6.75	6.31
PM10, mg/MJ (LHV) (front and back half catch)	5.58	5.58	5.40	5.40	5.05	5.05	4.72
PM10, mg/MJ (HHV) (front and back half catch)	5.03	5.03	4.87	4.87	4.55	4.55	4.25
CTG Wet (Total) Exhaust Gas Analysis							
Molecular Wt, lb/mol	28.13	28.13	28.09	28.09	28.36	28.36	28.45
Molecular Wt, kg/mol	12.76	12.76	12.74	12.74	12.86	12.86	12.90
Gas Constant, ft-lb/lbm-R	54.927	54.927	55.011	55.011	54.474	54.474	54.314
Specific Volume, ft^3/lb	40.33	40.33	40.20	40.20	39.31	39.31	38.32
Specific Volume, m^3/kg	2.52	2.52	2.51	2.51	2.45	2.45	2.39
Exhaust Gas Flow, acfm	2,187,230	2,187,230	2,231,978	2,231,978	2,320,600	2,320,600	2,427,572
Specific Volume, scf/lb	13.48	13.49	13.51	13.51	13.38	13.38	13.34
Exhaust Gas Flow, scfm	731,608	731,608	750,100	750,100	789,866	789,866	845,089
Specific Volume, Nm3/kg	0.7967	0.7967	0.7979	0.7979	0.7901	0.7901	0.7878
Exhaust Gas Flow, Nm3/s	326.64	326.64	334.91	334.91	352.61	352.61	377.29

Jacksonville Electric Authority
Brandy Branch 2x1 7FA Combined Cycle Project
Estimated Combustion Turbine and Heat Recovery Steam Generator Emissions, Rev.5

Preparer's Initials: UZ
10/26/00

Project number 99282.0040

Case Number	1	2	3	4	5	6	7
CTG Performance Reference	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted
CTG Model	7241FA	7241FA	7241FA	7241FA	7241FA	7241FA	7241FA
Diluent/NOx Emission Rate	DLN/9	DLN/9	DLN/9	DLN/9	DLN/9	DLN/9	DLN/9
CTG Fuel Type	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas
CTG Load	100%	100%	100%	100%	100%	100%	100%
Ambient Temperature, F	95	95	95	95	59	59	20
HRSG Firing	Fired	Unfired	Unfired	Fired	Unfired	Fired	Unfired
STG Output with two Combustion Turbine Generators in operation, kW	192,550	173,260	175,940	192,770	187,880	193,000	192,430
Duct Burner Emissions							
Duct Burner Heat Input, MBtu/h (LHV) (margin included)	76.7	0.0	0.0	66.9	0.0	20.6	0.0
Duct Burner Heat Input, GJ/h (LHV) (margin included)	80.9	0.0	0.0	70.6	0.0	21.7	0.0
Duct Burner Heat Input, MBtu/h (HHV) (margin included)	85.2	0.0	0.0	74.3	0.0	22.9	0.0
Duct Burner Heat Input, GJ/h (HHV) (margin included)	89.9	0.0	0.0	78.4	0.0	24.1	0.0
Total Duct Burner Fuel Flow, lb/h	3,710	0	0	3,236	0	996	0
Duct Burner Fuel LHV, Btu/lb	20,675	20,675	20,675	20,675	20,675	20,675	20,675
Duct Burner Fuel HHV, kJ/kg	48,090	48,090	48,090	48,090	48,090	48,090	48,090
Duct Burner Fuel HHV, Btu/lb	22,962	22,962	22,962	22,962	22,962	22,962	22,962
Duct Burner Fuel HHV, kJ/kg	53,410	53,410	53,410	53,410	53,410	53,410	53,410
Duct Burner Fuel Composition (Ultimate Analysis by Weight)							
Ar	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
C	74.87%	74.87%	74.87%	74.87%	74.87%	74.87%	74.87%
H2	25.13%	25.13%	25.13%	25.13%	25.13%	25.13%	25.13%
N2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
O2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
S	0.00070%	0.00070%	0.00070%	0.00070%	0.00070%	0.00070%	0.00070%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Fuel Sulfur Content (grains/100 standard cubic feet)	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Duct Burner NOx, lb/MBtu (HHV)	0.080	0.080	0.080	0.080	0.080	0.080	0.080
Duct Burner NOx, kg/kJ (HHV)	0.034	0.034	0.034	0.034	0.034	0.034	0.034
Duct Burner CO, lb/MBtu (HHV)	0.100	0.100	0.100	0.100	0.100	0.100	0.100
Duct Burner CO, kg/kJ (HHV)	0.043	0.043	0.043	0.043	0.043	0.043	0.043
Duct Burner UHC (as CH4), lb/MBtu (HHV)	0.060	0.060	0.060	0.060	0.060	0.060	0.060
Duct Burner UHC, kg/kJ (HHV)	0.026	0.026	0.026	0.026	0.026	0.026	0.026
Duct Burner VOC (as CH4), lb/MBtu (HHV)	0.024	0.024	0.024	0.024	0.024	0.024	0.024
Duct Burner VOC (as CH4), kg/kJ (HHV)	0.010	0.010	0.010	0.010	0.010	0.010	0.010
Duct Burner Particulate, lb/MBtu (HHV) (front half catch only)	0.010	0.010	0.010	0.010	0.010	0.010	0.010
Duct Burner Particulate, kg/kJ (HHV) (front half catch only)	0.004	0.004	0.004	0.004	0.004	0.004	0.004
Duct Burner Particulate, lb/MBtu (HHV) (front and back half catch)	0.020	0.020	0.020	0.020	0.020	0.020	0.020
Duct Burner Particulate, kg/kJ (HHV) (front and back half catch)	0.009	0.009	0.009	0.009	0.009	0.009	0.009
Duct Burner PM10, lb/MBtu (HHV) (front half catch only)	0.008	0.008	0.008	0.008	0.008	0.008	0.008
Duct Burner PM10, kg/kJ (HHV) (front half catch only)	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Duct Burner PM10, lb/MBtu (HHV) (front and back half catch)	0.016	0.016	0.016	0.016	0.016	0.016	0.016
Duct Burner PM10, kg/kJ (HHV) (front and back half catch)	0.007	0.007	0.007	0.007	0.007	0.007	0.007
Total SO2, lb/h from Duct Burner	0.052	0.000	0.000	0.045	0.000	0.014	0.000
Total SO2, kg/h from Duct Burner	0.024	0.000	0.000	0.021	0.000	0.006	0.000
DB NOx, lb/h	6.81	0.00	0.00	5.94	0.00	1.83	0.00
DB NOx, kg/h	3.09	0.00	0.00	2.70	0.00	0.83	0.00
DB CO, lb/h	8.52	0.00	0.00	7.43	0.00	2.29	0.00
DB CO, kg/h	3.86	0.00	0.00	3.37	0.00	1.04	0.00
DB UHC (as CH4), lb/h	5.11	0.00	0.00	4.46	0.00	1.37	0.00
DB UHC (as CH4), kg/h	2.32	0.00	0.00	2.02	0.00	0.62	0.00
DB VOC (as CH4), lb/h	2.04	0.00	0.00	1.78	0.00	0.55	0.00
DB VOC (as CH4), kg/h	0.93	0.00	0.00	0.81	0.00	0.25	0.00
DB Particulate, lb/h (front half catch only)	0.85	0.00	0.00	0.74	0.00	0.23	0.00
DB Particulate, kg/h (front half catch only)	0.39	0.00	0.00	0.34	0.00	0.10	0.00
DB Particulate, lb/h (front and back half catch)	1.70	0.00	0.00	1.49	0.00	0.46	0.00
DB Particulate, kg/h (front and back half catch)	0.77	0.00	0.00	0.67	0.00	0.21	0.00
DB PM10, lb/h (front half catch only)	0.68	0.00	0.00	0.59	0.00	0.18	0.00
DB PM10, kg/h (front half catch only)	0.31	0.00	0.00	0.27	0.00	0.08	0.00
DB PM10, lb/h (front and back half catch)	1.36	0.00	0.00	1.19	0.00	0.37	0.00
DB PM10, kg/h (front and back half catch)	0.62	0.00	0.00	0.54	0.00	0.17	0.00

Jacksonville Electric Authority
Brandy Branch 2x1 7FA Combined Cycle Project
Estimated Combustion Turbine and Heat Recovery Steam Generator Emissions, Rev.5

Preparer's Initials: UZ
10/26/00

Project number 99262.0040

Case Number	1	2	3	4	5	6	7
CTG Performance Reference	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted
CTG Model	7241FA	7241FA	7241FA	7241FA	7241FA	7241FA	7241FA
Diluent/NOx Emission Rate	DLN/9	DLN/9	DLN/9	DLN/9	DLN/9	DLN/9	DLN/9
CTG Fuel Type	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas
CTG Load	100%	100%	100%	100%	100%	100%	100%
Ambient Temperature, F	95	95	95	95	59	59	20
HRSG Firing	Fired	Unfired	Unfired	Fired	Unfired	Fired	Unfired
STG Output with two Combustion Turbine Generators in operation, kW	192,550	173,260	175,940	192,770	187,860	193,000	192,430
Heat Recovery Steam Generator Stack Emissions							
NOTE: Exhaust Analysis does not include the effects of post combustion control							
Stack Exhaust Analysis (Volume Basis - Wet)							
Ar	0.91%	0.91%	0.91%	0.91%	0.93%	0.93%	0.94%
CO2	3.99%	3.79%	3.82%	3.99%	3.88%	3.93%	3.88%
H2O	11.16%	10.79%	11.20%	11.52%	8.72%	8.82%	7.96%
N2	72.43%	72.57%	72.27%	72.15%	74.25%	74.21%	74.85%
O2	11.51%	11.93%	11.80%	11.44%	12.21%	12.11%	12.37%
SO2	0.00001%	0.00001%	0.00001%	0.00001%	0.00001%	0.00001%	0.00001%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Stack Emissions							
NOx, ppmvd @15% O2 w/o SCR	9.62	9.00	9.00	9.53	9.00	9.16	9.00
NOx, ppmvd@ user defined oxygen w/o SCR	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
NOx, ppmvd w/o SCR	12.90	11.44	11.58	12.83	11.44	11.79	11.34
NOx, ppmvw w/o SCR	11.46	10.20	10.28	11.35	10.44	10.75	10.44
NOx, lb/h as NO2 w/o SCR	60.84	54.03	55.91	61.85	59.97	61.80	64.38
NOx, lb/MBtu (LHV) as NO2 (incl. duct burner fuel) w/o SCR	0.04	0.04	0.04	0.04	0.04	0.04	0.04
NOx, lb/MBtu (HHV) as NO2 (incl. duct burner fuel) w/o SCR	0.04	0.03	0.03	0.04	0.03	0.03	0.03
NOx, kg/h as NO2	27.60	24.51	25.36	28.05	27.20	28.03	29.20
NOx, mg/Nm3 as NO2 (uncorrected exhaust flow) w/o SCR	23.42	20.84	21.03	23.23	21.43	22.07	21.50
NOx, mg/MJ (LHV) (including duct burner fuel) w/o SCR	17.07	15.96	15.98	16.93	16.04	16.32	16.09
NOx, mg/MJ (HHV) (including duct burner fuel) w/o SCR	15.37	14.37	14.39	15.24	14.44	14.69	14.49
NOx, ppmvd @15% O2 w/ SCR	3.50	3.50	3.50	3.50	3.50	3.50	3.50
NOx, ppmvd@ user defined oxygen w/ SCR	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
NOx, ppmvd w SCR	4.69	4.45	4.50	4.71	4.45	4.51	4.41
NOx, ppmvw w SCR	4.17	3.97	4.00	4.17	4.06	4.11	4.06
NOx, lb/h as NO2 w/ SCR	22.23	21.12	21.82	22.79	23.32	23.62	24.95
NOx, lb/MBtu (LHV) as NO2 (incl. duct burner fuel) w SCR	0.01	0.01	0.01	0.01	0.01	0.01	0.01
NOx, lb/MBtu (HHV) as NO2 (incl. duct burner fuel) w SCR	0.01	0.01	0.01	0.01	0.01	0.01	0.01
NOx, kg/h as NO2	10.09	9.58	9.90	10.34	10.58	10.71	11.32
NOx, mg/Nm3 as NO2 (uncorrected exhaust flow) w SCR	8.56	8.15	8.21	8.56	8.33	8.44	8.33
NOx, mg/MJ (LHV) (including duct burner fuel) w SCR	6.24	6.24	6.24	6.24	6.24	6.24	6.24
NOx, mg/MJ (HHV) (including duct burner fuel) w SCR	5.62	5.62	5.62	5.62	5.62	5.62	5.62
SCR NH3 slip, ppmvd @15% O2	10.00	10.00	10.00	10.00	10.00	10.00	10.00
SCR NH3 slip, lb/h	23.52	22.34	23.08	24.10	24.67	24.98	26.39
CO, ppmvd @ 15% O2 w/o Catalyst	13.41	11.80	11.66	13.04	11.81	12.21	11.90
CO, ppmvd @ user defined O2 w/o Catalyst	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
CO, ppmvd w/o Catalyst	17.99	15.00	15.00	17.55	15.00	15.73	15.00
CO, ppmvw w/o Catalyst	15.98	13.38	13.32	15.53	13.69	14.34	13.81
CO, lb/h w/o Catalyst	54.05	45.53	46.47	53.90	50.29	52.58	54.26
CO, lb/MBtu (LHV) (incl. duct burner fuel) w/o SCR	0.04	0.03	0.03	0.03	0.03	0.03	0.03
CO, lb/MBtu (HHV) (incl. duct burner fuel) w/o SCR	0.03	0.03	0.03	0.03	0.03	0.03	0.03
CO Reduction % w/ Catalyst	0%	0%	0%	0%	0%	0%	0%
CO, ppmvd @ 15% O2 w/ Catalyst	13.41	11.80	11.66	13.04	11.81	12.21	11.90
CO, ppmvd @ user defined O2 w/ Catalyst	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
CO, ppmvd w/ Catalyst	17.99	15.00	15.00	17.55	15.00	15.73	15.00
CO, ppmvw w/ Catalyst	15.98	13.38	13.32	15.53	13.69	14.34	13.81
CO, lb/h w/ Catalyst	51.88	43.36	44.25	51.68	47.89	50.18	51.67
CO, lb/MBtu (LHV) (incl. duct burner fuel) w SCR	0.034	0.030	0.029	0.033	0.030	0.031	0.030
CO, lb/MBtu (HHV) (incl. duct burner fuel) w SCR	0.030	0.027	0.026	0.030	0.027	0.028	0.027
SO2, ppmvd@15% O2 (with no SO2 oxidation)	0.12	0.12	0.12	0.12	0.12	0.12	0.12
SO2, ppmvd at user defined O2 (with no SO2 oxidation)	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
SO2, ppmvd (with no SO2 oxidation)	0.16	0.15	0.15	0.16	0.15	0.15	0.15
SO2, ppmvw (with no SO2 oxidation)	0.14	0.13	0.13	0.14	0.14	0.14	0.14
SO2, lb/h (with no SO2 oxidation)	1.09	1.03	1.07	1.11	1.14	1.16	1.22
SO2, lb/MBtu (LHV) (incl. duct burner fuel)	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007
SO2, lb/MBtu (HHV) (incl. duct burner fuel)	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006

Jacksonville Electric Authority
Brandy Branch 2x1 7FA Combined Cycle Project
Estimated Combustion Turbine and Heat Recovery Steam Generator Emissions, Rev.5

Preparer's Initials: UZ
10/26/00

Project number 99262.0040

Case Number	1	2	3	4	5	6	7
CTG Performance Reference	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted
CTG Model	7241FA	7241FA	7241FA	7241FA	7241FA	7241FA	7241FA
Diluent/NOx Emission Rate	DLN/9	DLN/9	DLN/9	DLN/9	DLN/9	DLN/9	DLN/9
CTG Fuel Type	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas
CTG Load	100%	100%	100%	100%	100%	100%	100%
Ambient Temperature, F	95	95	95	95	59	59	20
HRSG Firing	Fired	Unfired	Unfired	Fired	Unfired	Fired	Unfired
STG Output with two Combustion Turbine Generators in operation, kW	192,550	173,260	175,940	192,770	187,860	193,000	192,430
Heat Recovery Steam Generator Stack Emissions - continued							
NOTE: UHC calculations do NOT include the effect of any oxidation in the CO catalyst.							
UHC, ppmvd @ 15% O2	8.17	8.17	8.13	7.83	8.04	8.54	8.04
UHC, ppmvd @ user defined O2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
UHC, ppmvd	10.96	7.85	7.88	10.54	7.87	8.42	7.61
UHC, ppmvw	9.73	7.00	7.00	9.33	7.00	7.68	7.00
UHC, lb/h as CH4	18.75	13.64	13.99	18.44	14.73	16.10	15.76
UHC, lb/MBtu (LHV) (incl. duct burner fuel)	0.012	0.009	0.009	0.012	0.009	0.010	0.009
UHC, lb/MBtu (HHV) (incl. duct burner fuel)	0.011	0.008	0.008	0.011	0.008	0.009	0.008
VOC, ppmvd @ 15% O2 w/o Catalyst	2.10	1.23	1.23	1.96	1.21	1.43	1.21
VOC, ppmvd @ user defined O2 w/o CO catalyst	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
VOC, ppmvd w/o Catalyst	2.81	1.57	1.58	2.64	1.53	1.84	1.52
VOC, ppmvw w/o Catalyst	2.50	1.40	1.40	2.33	1.40	1.67	1.40
VOC, lb/h as CH4 w/o Catalyst	4.77	2.73	2.80	4.58	2.95	3.49	3.15
VOC, lb/MBtu (LHV) (incl. duct burner fuel) w/o CO catalyst	0.0031	0.0019	0.0019	0.0029	0.0018	0.0021	0.0018
VOC, lb/MBtu (HHV) (incl. duct burner fuel) w/o CO catalyst	0.0028	0.0017	0.0017	0.0026	0.0016	0.0019	0.0016
VOC Reduction % w/ Catalyst	0%	0%	0%	0%	0%	0%	0%
VOC, ppmvd @ 15% O2 w/ Catalyst	2.10	1.23	1.23	1.96	1.21	1.43	1.21
VOC, ppmvd @ user defined O2 w/ Catalyst	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
VOC, ppmvd w/ Catalyst	2.81	1.57	1.58	2.64	1.53	1.84	1.52
VOC, ppmvw w/ Catalyst	2.50	1.40	1.40	2.33	1.40	1.67	1.40
VOC, lb/h as CH4 w/ Catalyst	4.64	2.60	2.66	4.45	2.80	3.35	3.00
VOC, lb/MBtu (LHV) (incl. duct burner fuel) w CO catalyst	0.0030	0.0018	0.0018	0.0028	0.0017	0.0021	0.0017
VOC, lb/MBtu (HHV) (incl. duct burner fuel) w CO catalyst	0.0027	0.0016	0.0016	0.0025	0.0015	0.0019	0.0016
Particulate without the effect of SO2 oxidation and SCR catalysts							
Particulates, lb/h (front half catch only)	10.3	9.5	9.5	10.2	9.5	9.7	9.5
Particulates, lb/MBtu (incl. duct burner fuel) (front half catch only)	0.0067	0.0065	0.0063	0.0065	0.0059	0.0059	0.0055
Particulates, lb/h (front and back half catch)	20.6	18.9	18.9	20.4	18.9	19.4	18.9
Particulates, lb/MBtu (incl. duct burner fuel) (front and back half catch)	0.013	0.013	0.013	0.013	0.012	0.012	0.011
PM10, lb/h (front half catch only)	10.1	9.5	9.5	10.0	9.5	9.6	9.5
PM10, lb/MBtu (incl. duct burner fuel) (front half catch only)	0.007	0.006	0.006	0.006	0.006	0.006	0.005
PM10, lb/h (front and back half catch)	20.3	18.9	18.9	20.1	18.9	19.3	18.9
PM10, lb/MBtu (incl. duct burner fuel) (front and back half catch)	0.013	0.013	0.013	0.013	0.012	0.012	0.011
Particulate including the effect of SO2 oxidation and SCR catalysts [includes 2[NH4SO4]]							
Particulates, lb/h (front half catch only)	10.7	9.8	9.8	10.6	9.9	10.1	9.9
Particulates, lb/MBtu (incl. duct burner fuel)(front half catch only)	0.0070	0.0067	0.0065	0.0067	0.0061	0.0062	0.0057
Particulates, lb/h (front and back half catch)	21.0	19.3	19.3	20.8	19.3	19.8	19.3
Particulates, lb/MBtu (incl. duct burner fuel)(front and back half catch)	0.014	0.013	0.013	0.013	0.012	0.012	0.011
PM10, lb/h (front half catch only)	10.5	9.8	9.8	10.4	9.9	10.0	9.9
PM10, lb/MBtu (incl. duct burner fuel)(front half catch only)	0.007	0.007	0.007	0.007	0.006	0.006	0.006
PM10, lb/h (front and back half catch)	20.6	19.3	19.3	20.5	19.3	19.7	19.3
PM10, lb/MBtu (incl. duct burner fuel)(front and back half catch)	0.013	0.013	0.013	0.013	0.012	0.012	0.011
NOTE: SO2 to SO3 conversion rate (assumed), wt%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
SO3 conversion rate (assumed) to ammonium sulfates [2[NH4SO4]]	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Remaining SO2 in Exhaust Gas, lb/h	0.98	0.93	0.96	1.00	1.03	1.04	1.10
Amount of SO2 converted to SO3	0.11	0.10	0.11	0.11	0.11	0.12	0.12
Maximum Exhaust Gas ammonium sulfate [2(NH4SO4)], lb/h	0.39	0.37	0.38	0.40	0.41	0.41	0.44
Maximum H2SO4 (assuming 100% conversion from SO3 to H2SO4), lb/hr	0.17	0.16	0.16	0.17	0.17	0.18	0.19
Stack Exit Temperature, F	205	208	209	207	206	294	208
Stack Diameter, ft (estimated)	19	19	19	19	19	19	19
Stack Flow, lb/h	3,257,710	3,254,000	3,331,310	3,334,546	3,542,000	3,542,996	3,801,000
Stack Flow, scfm	732,985	731,608	750,100	751,384	789,866	790,088	845,089
Stack Flow, acfm	938,220	939,864	966,080	964,239	1,011,241	1,009,754	1,085,819
Stack Exit Velocity, ft/s	55.2	55.2	56.8	56.7	59.4	59.4	63.8
Selective Catalytic Reduction (SCR)							
NOx Removed, lb/h as NO2	38.6	32.9	34.1	39.1	36.6	38.2	39.4
NOx Removed, percent	63.5%	60.9%	61.0%	63.2%	61.1%	61.8%	61.2%
NH3 Slip, lb/h	23.5	22.3	23.1	24.1	24.7	25.0	26.4
Total NH3 consumption, lb/h (1:1 stoichiometric ratio, incl. slip)	37.8	34.5	35.7	38.6	38.2	39.1	41.0
Adjusted Stack Diameter (ft) estimated	18.0	18.0	18.0	18.0	18.0	18.0	18.0
Stack Exit Velocity, ft/s	61.4	61.5	63.3	63.1	66.2	66.1	71.1

Notes:

1. The emissions estimates shown in the table above are per stack.
2. The combustion turbine generator performance and emissions is based on a General Electric performance estimate provided by JEA.
3. The combustion turbine emissions estimate may include margin as indicated in the table.

   Where catalysts are involved to reduce emissions, the margin applied to the CTG emissions only effects the amount of emissions removed, but not the stack emissions.
4. UHC calculations do not include the effects of any oxidation in the CO catalyst. It was assumed that the VOC/UHC ratio is 20% for natural gas firing, and 50% for distillate oil firing.
5. It was assumed that the front and back half catch of CTG particulate emissions is twice the amount of front half catch only.
6. Duct Burner emissions are Black & Veatch estimates based on typical vendor data.
7. It was assumed that ammonium sulfate is measured as front half particulates. The assumption that 100% SO3 is converted to ammonium sulfates results in "worst case" particulate emissions.
8. The maximum amount of ammonium sulfates and sulfuric acid shown in the table can not occur in parallel at the same time.

Preparer: UZ Filepath: c:_projects\jea duct firing study\[exh_082700r5.xls]calculations Reviewer: UZ

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10/26/00

Jacksonville Electric Authority
Brandy Branch 2x1 7FA Combined Cycle Project
Estimated Combustion Turbine and Heat Recovery Steam Generator Emissions, Rev.5

Project number 99262.0040

Case Number	8	9	10	11	12	13
CTG Performance Reference	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted
CTG Model	7241FA	7241FA	7241FA	7241FA	7241FA	7241FA
Diluent/NOx Emission Rate	DLN/9	DLN/9	DLN/9	DLN/9	DLN/9	DLN/9
CTG Fuel Type	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas
CTG Load	75%	50%	75%	50%	75%	50%
Ambient Temperature, F	95	95	59	59	20	20
HRSG Firing	Unfired	Unfired	Unfired	Unfired	Unfired	Unfired
STG Output with two Combustion Turbine Generators in operation, kW	148,020	128,570	159,780	140,760	161,900	142,180
Ambient Temperature, F	95.0	95.0	59.0	59.0	20.0	20.0
Ambient Temperature, C	35.0	35.0	15.0	15.0	(6.7)	(6.7)
Ambient Relative Humidity, %	60.0	60.0	60.0	60.0	60.0	60.0
Atmospheric Pressure, psia	14.690	14.690	14.690	14.690	14.690	14.690
Atmospheric Pressure, bar(a)	1.013	1.013	1.013	1.013	1.013	1.013
CTG Compressor Inlet Dry Bulb Temperature, F	95.0	95.0	59.0	59.0	20.0	20.0
CTG Compressor Inlet Temperature, C	35.0	35.0	15.0	15.0	(6.7)	(6.7)
CTG Compr. Inlet Relative Humidity, %	60.1	60.1	60.2	60.2	60.3	60.3
CTG Inlet Air Conditioning Included?	No	No	No	No	No	No
Inlet Loss, in. H2O	3.5	3.5	3.5	3.5	3.5	3.5
Inlet Loss, mm. H2O	88.9	88.9	88.9	88.9	88.9	88.9
Exhaust Loss, in. H2O	15.0	15.0	15.0	15.0	15.0	15.0
Exhaust Loss, mm. H2O	381.0	381.0	381.0	381.0	381.0	381.0
CTG Load Level (percent of Base Load)	75%	50%	75%	50%	75%	50%
Gross CTG Output, kW	111,300	74,200	128,170	85,450	138,040	92,060
Gross CTG Heat Rate, Btu/kWh (LHV)	10,734	12,994	10,159	12,241	9,991	11,963
Gross CTG Heat Rate, kJ/kWh (LHV)	11,325	13,709	10,719	12,915	10,541	12,622
Gross CTG Heat Rate, kJ/kWh (HHV)	11,921	14,431	11,283	13,595	11,096	13,287
Gross CTG Heat Rate, KJ/KWh (HHV)	12,577	15,226	11,904	14,343	11,707	14,019
CTG Heat Input, MBtu/h (LHV)	1,194.7	964.2	1,302.1	1,046.0	1,379.1	1,101.3
CTG Heat Input, GJ/h (LHV)	1,260.5	1,017.2	1,373.8	1,103.6	1,455.1	1,162.0
CTG Heat Input, MBtu/h (HHV)	1,326.9	1,070.8	1,446.2	1,161.7	1,531.7	1,223.2
CTG Heat Input, GJ/h (HHV)	1,399.9	1,129.8	1,525.8	1,225.6	1,616.0	1,290.5
CTG Water Injection Flow, lb/h	0	0	0	0	0	0
CTG Water Injection Flow, kg/h	0	0	0	0	0	0
CTG Steam Injection Flow, lb/h	0	0	0	0	0	0
CTG Steam Injection Flow, kg/h	0	0	0	0	0	0
Injection Fluid/Fuel Ratio	0.0	0.0	0.0	0.0	0.0	0.0
CTG Exhaust Flow, lb/h	2,691,000	2,265,000	2,890,000	2,397,000	3,025,000	2,486,000
CTG Exhaust Flow, kg/h	1,220,617	1,027,387	1,310,882	1,087,261	1,372,117	1,127,631
CTG Exhaust Temperature, F	1,177	1,207	1,146	1,191	1,119	1,167
CTG Exhaust Temperature, C	636.1	652.8	618.9	643.9	603.9	630.6
CTG Exhaust Enthalpy, Btu/lb	291.52	299.63	288.32	300.69	289.38	302.54
CTG Exhaust Enthalpy, kJ/lb	307.57	316.13	304.19	317.24	305.31	319.20
CTG Exhaust Enthalpy Reference Temperature, F	95	95	59	59	20	20
CTG Exhaust Enthalpy Reference Temperature, C	35.0	35.0	15.0	15.0	(6.7)	(6.7)
CTG Exhaust Heat, MBtu/h	784.5	678.7	833.2	720.8	875.4	752.1
CTG Exhaust Heat, GJ/h	827.7	716.0	879.1	760.4	923.6	793.5
CTG Exhaust Heat/CTG Output, kW/kW	206.6%	268.0%	190.5%	247.2%	185.8%	239.4%
Total CTG Fuel Flow, lb/h	57790	46630	62980	50590	66710	53270
CTG Fuel Temperature, F	365	365	365	365	365	365
CTG Fuel LHV, Btu/lb	20,675	20,675	20,675	20,675	20,675	20,675
CTG Fuel LHV, kJ/lb	48,090	48,090	48,090	48,090	48,090	48,090
CTG Fuel HHV, Btu/lb	22,962	22,962	22,962	22,962	22,962	22,962
CTG Fuel HHV, kJ/lb	53,410	53,410	53,410	53,410	53,410	53,410
HHV/LHV Ratio	1.1106	1.1106	1.1106	1.1106	1.1106	1.1106
CTG Fuel Composition (Ultimate Analysis by Weight)						
Ar	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
C	74.87%	74.87%	74.87%	74.87%	74.87%	74.87%
H2	25.13%	25.13%	25.13%	25.13%	25.13%	25.13%
N2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
O2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
S	0.00070%	0.00070%	0.00070%	0.00070%	0.00070%	0.00070%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Fuel Sulfur Content (grains/100 standard cubic feet)	0.2	0.2	0.2	0.2	0.2	0.2

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10/26/00

Jacksonville Electric Authority
Brandy Branch 2x1 7FA Combined Cycle Project
Estimated Combustion Turbine and Heat Recovery Steam Generator Emissions, Rev.5

Project number 99262.0040

Case Number	8	9	10	11	12	13
CTG Performance Reference	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted
CTG Model	7241FA	7241FA	7241FA	7241FA	7241FA	7241FA
Diluent/NOx Emission Rate	DLN/9	DLN/9	DLN/9	DLN/9	DLN/9	DLN/9
CTG Fuel Type	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas
CTG Load	75%	50%	75%	50%	75%	50%
Ambient Temperature, F	95	95	59	59	20	20
HRSG Firing	Unfired	Unfired	Unfired	Unfired	Unfired	Unfired
STG Output with two Combustion Turbine Generators in operation, kW	148,020	128,570	159,780	140,760	161,900	142,180
Combustion Turbine Exhaust Emissions						
CTG Exhaust Analysis (Volume Basis - Wet)						
Ar	0.91%	0.91%	0.93%	0.93%	0.94%	0.94%
CO2	3.77%	3.61%	3.85%	3.73%	3.91%	3.80%
H2O	10.73%	10.43%	8.67%	8.43%	8.02%	7.80%
N2	72.59%	72.71%	74.27%	74.36%	74.82%	74.91%
O2	12.00%	12.33%	12.27%	12.54%	12.31%	12.55%
SO2	0.00001%	0.00001%	0.00001%	0.00001%	0.00001%	0.00001%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
NOx, ppmvd @15% O2	9.00	9.00	9.00	9.00	9.00	9.00
NOx, ppmvd @ 15% O2	9.00	9.00	9.00	9.00	9.00	9.00
NOx, ppmvd	11.35	10.85	11.36	10.97	11.43	11.09
NOx, ppmvw (wet - uncorrected exhaust gas)	10.13	9.72	10.36	10.04	10.52	10.22
NOx Massflow Added to Match CTG Manufacturer's NOx Emissions Estimate	(3.00)	(3.00)	(3.00)	(3.00)	(3.00)	(3.00)
Additonal Percent Margin included in NOx Emissions below	5%	5%	5%	5%	5%	5%
NOx, lb/h as NO2	43.81	34.77	48.01	37.97	51.03	40.14
NOx, lb/MBtu (LHV)	0.04	0.04	0.04	0.04	0.04	0.04
NOx, lb/MBtu (HHV)	0.03	0.03	0.03	0.03	0.03	0.03
NOx, mg/Nm3 as NO2 (dry, 15% O2)	18.16	17.86	18.26	17.98	18.32	18.05
NOx, mg/Nm3 as NO2 (dry, 15% O2)	18.16	17.86	18.26	17.98	18.32	18.05
NOx, mg/Nm3 as NO2 (dry)	22.89	21.53	23.02	21.91	23.28	22.24
NOx, mg/Nm3 as NO2 (wet - uncorrected exhaust flow)	20.43	19.28	21.03	20.06	21.41	20.51
NOx, mg/MJ (LHV)	15.76	15.50	15.85	15.61	15.91	15.67
NOx, mg/MJ (HHV)	14.19	13.96	14.27	14.05	14.32	14.11
CO, ppmvd @ 15% O2	11.90	12.44	11.90	12.31	11.81	12.18
CO, ppmvd @ 15% O2	11.90	12.44	11.90	12.31	11.81	12.18
CO, ppmvd	15.00	15.00	15.00	15.00	15.00	15.00
CO, ppmvw (wet - uncorrected exhaust gas)	13.39	13.44	13.70	13.74	13.80	13.83
CO Massflow Added to Match CTG Manufacturer's CO Emissions Estimate	0.00	0.00	0.00	0.00	0.00	0.00
Additional Percent Margin included in CO Emissions below	5%	5%	5%	5%	5%	5%
CO, lb/h	37.87	31.79	41.05	34.12	43.16	35.53
CO, lb/MBtu (LHV)	0.03	0.03	0.03	0.03	0.03	0.03
CO, lb/MBtu (HHV)	0.03	0.03	0.03	0.03	0.03	0.03
CO, mg/Nm3 (wet - uncorrected exhaust flow)	17.57	17.63	17.98	18.03	18.11	18.15
CO, mg/Nm3 (dry)	19.69	19.69	19.69	19.69	19.69	19.69
CO, mg/Nm3 (dry, 15% O2)	15.62	16.33	15.61	16.16	15.50	15.98
CO, mg/Nm3 (dry, 15% O2)	15.62	16.33	15.61	16.16	15.50	15.98
CO, mg/MJ (LHV)	13.56	14.18	13.55	14.02	13.45	13.87
CO, mg/MJ (HHV)	12.21	12.76	12.20	12.63	12.11	12.49
NOTE: SO2 estimate does not include the effects of SO2 oxidation						
SO2, ppmvd @ 15% O2 (with no SO2 oxidation)	0.12	0.12	0.12	0.12	0.12	0.12
SO2, ppmvd @ 15% O2 (with no SO2 oxidation)	0.12	0.12	0.12	0.12	0.12	0.12
SO2, ppmvd (with no SO2 oxidation)	0.15	0.14	0.15	0.14	0.15	0.14
SO2, ppmvw (with no SO2 oxidation)(wet - uncorrected exhaust gas)	0.13	0.13	0.13	0.13	0.14	0.13
SO2 Massflow Added to Match CTG Manufacturer's CO Emissions Estimate	0.00	0.00	0.00	0.00	0.00	0.00
Additional Percent Margin included in SO2 Emissions below	5%	5%	5%	5%	5%	5%
SO2, lb/h (with no SO2 oxidation)	0.85	0.68	0.92	0.74	0.98	0.78
SO2, lb/MBtu (LHV) (with no SO2 oxidation)	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007
SO2, lb/MBtu (HHV) (with no SO2 oxidation)	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
SO2, mg/Nm3 (wet - uncorrected exhaust flow) (with no SO2 oxidation)	0.40	0.38	0.41	0.39	0.41	0.40
SO2, mg/Nm3 (dry, 15% O2) (with no SO2 oxidation)	0.35	0.35	0.35	0.35	0.35	0.35
SO2, mg/Nm3 (dry, 15% O2) (with no SO2 oxidation)	0.35	0.35	0.35	0.35	0.35	0.35
SO2, mg/Nm3 (dry) (with no SO2 oxidation)	0.44	0.42	0.44	0.43	0.45	0.43
SO2, mg/MJ (LHV) (with no SO2 oxidation)	0.31	0.31	0.31	0.31	0.31	0.31
SO2, mg/MJ (HHV) (with no SO2 oxidation)	0.27	0.27	0.27	0.27	0.27	0.27

Preparer's initials: UZ
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Jacksonville Electric Authority
Brandy Branch 2x1 7FA Combined Cycle Project
Estimated Combustion Turbine and Heat Recovery Steam Generator Emissions, Rev.5

Project number 99262.0040

Case Number	8	9	10	11	12	13
CTG Performance Reference	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted
CTG Model	7241FA	7241FA	7241FA	7241FA	7241FA	7241FA
Diluent/NOx Emission Rate	DLN/9	DLN/9	DLN/9	DLN/9	DLN/9	DLN/9
CTG Fuel Type	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas
CTG Load	75%	50%	75%	50%	75%	50%
Ambient Temperature, F	95	95	59	59	20	20
HRSG Firing	Unfired	Unfired	Unfired	Unfired	Unfired	Unfired
STG Output with two Combustion Turbine Generators in operation, kW	148,020	128,570	159,780	140,760	161,900	142,180
Combustion Turbine Exhaust Emissions - continued						
UHC, ppmvd @ 15% O2	6.22	6.48	6.08	6.27	5.99	6.16
UHC, ppmvd @ 15% O2	6.22	6.48	6.08	6.27	5.99	6.16
UHC, ppmvd	7.84	7.82	7.66	7.64	7.61	7.58
UHC, ppmvw (wet - uncorrected exhaust gas)	7.00	7.00	7.00	7.00	7.00	7.00
UHC Massflow Added to Match CTG Manufacturer's CO Emissions Estimate	0.00	0.00	0.00	0.00	0.00	0.00
Additional Percent Margin included in UHC Emissions Below	5%	5%	5%	5%	5%	5%
UHC, lb/h as CH4	11.28	9.49	12.01	9.96	12.54	10.30
UHC, lb/MBtu as CH4 (LHV)	0.0094	0.0098	0.0092	0.0095	0.0091	0.0094
UHC, lb/MBtu as CH4 (HHV)	0.0085	0.0089	0.0083	0.0086	0.0082	0.0084
UHC, mg/Nm3 as CH4 (dry, 15% O2)	4.68	4.87	4.57	4.72	4.50	4.63
UHC, mg/Nm3 as CH4 (dry, 15% O2)	4.68	4.87	4.57	4.72	4.50	4.63
UHC, mg/Nm3 as CH4 (dry)	5.89	5.87	5.76	5.75	5.72	5.71
UHC, mg/Nm3 as CH4 (wet - uncorrected exhaust flow)	5.26	5.26	5.26	5.26	5.26	5.26
UHC, mg/MJ as CH4 (LHV)	4.06	4.23	3.97	4.09	3.91	4.02
UHC, mg/MJ as CH4 (HHV)	3.65	3.81	3.57	3.69	3.52	3.62
VOC percentage of UHC	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%
VOC, ppmvd @ 15% O2	1.2	1.3	1.2	1.3	1.2	1.2
VOC, ppmvd @ 15% O2	1.2	1.3	1.2	1.3	1.2	1.2
VOC, ppmvd	1.57	1.56	1.53	1.53	1.52	1.52
VOC, ppmvw (wet - uncorrected exhaust flow)	1.40	1.40	1.40	1.40	1.40	1.40
VOC Massflow Added to Match CTG Manufacturer's VOC Emissions Estimate	0.00	0.00	0.00	0.00	0.00	0.00
Additional Percent Margin included in VOC Emissions below	5%	5%	5%	5%	5%	5%
VOC, lb/h as CH4	2.28	1.90	2.40	1.99	2.51	2.06
VOC, lb/MBtu as CH4 (LHV)	0.0019	0.0020	0.0018	0.0019	0.0018	0.0019
VOC, lb/MBtu as CH4 (HHV)	0.0017	0.0018	0.0017	0.0017	0.0016	0.0017
VOC, mg/Nm3 as CH4 (dry, 15% O2)	0.94	0.97	0.91	0.94	0.90	0.93
VOC, mg/Nm3 as CH4 (dry, 15% O2)	0.94	0.97	0.91	0.94	0.90	0.93
VOC, mg/Nm3 as CH4 (dry)	1.18	1.17	1.15	1.15	1.14	1.14
VOC, mg/Nm3 as CH4 (wet - uncorrected exhaust flow)	1.05	1.05	1.05	1.05	1.05	1.05
VOC, mg/MJ as CH4 (LHV)	0.81	0.85	0.79	0.82	0.78	0.80
VOC, mg/MJ as CH4 (HHV)	0.73	0.76	0.71	0.74	0.70	0.72
Percent Margin included in Particulates Emissions below	5%	5%	5%	5%	5%	5%
Particulates, lb/h (front half catch only)	9.45	9.45	9.45	9.45	9.45	9.45
Particulates, lb/h (front and back half catch)	18.90	18.90	18.90	18.90	18.90	18.90
Particulates, lb/MBtu (LHV) (front half catch only)	0.0079	0.0096	0.0073	0.0090	0.0069	0.0086
Particulates, lb/MBtu (HHV) (front half catch only)	0.0071	0.0088	0.0065	0.0081	0.0062	0.0077
Particulates, mg/Nm3 (dry, 15% O2) (front half catch only)	3.92	4.85	3.59	4.47	3.39	4.25
Particulates, mg/Nm3 (dry, 15% O2) (front half catch only)	3.92	4.85	3.59	4.47	3.39	4.25
Particulates, mg/Nm3 (dry) (front half catch only)	4.94	5.85	4.53	5.45	4.31	5.24
Particulates, mg/Nm3 (wet - uncorrected exhaust flow) (front half catch only)	4.41	5.24	4.14	4.99	3.96	4.83
Particulates, mg/MJ (LHV) (front half catch only)	3.40	4.21	3.12	3.88	2.95	3.89
Particulates, mg/MJ (HHV) (front half catch only)	3.06	3.79	2.81	3.50	2.65	3.32
Percent Margin included in PM10 Emissions below	5%	5%	5%	5%	5%	5%
PM10, lb/h (front half catch only)	9.45	9.45	9.45	9.45	9.45	9.45
PM10, lb/h (front and back half catch)	18.90	18.90	18.90	18.90	18.90	18.90
PM10, lb/MBtu (LHV) (front and back half catch)	0.02	0.02	0.01	0.02	0.01	0.02
PM10, lb/MBtu (HHV) (front and back half catch)	0.01	0.02	0.01	0.02	0.01	0.02
PM10, mg/Nm3 (dry, 15% O2) (front and back half catch)	7.83	9.71	7.19	8.95	6.79	8.50
PM10, mg/Nm3 (dry, 15% O2) (front and back half catch)	7.83	9.71	7.19	8.95	6.79	8.50
PM10, mg/Nm3 (dry) (front and back half catch)	9.88	11.70	9.06	10.91	8.62	10.47
PM10, mg/Nm3 (wet - uncorrected exhaust flow) (front and back half catch)	8.82	10.48	8.28	9.99	7.93	9.65
PM10, mg/MJ (LHV) (front and back half catch)	6.80	8.43	6.24	7.77	5.89	7.38
PM10, mg/MJ (HHV) (front and back half catch)	6.12	7.59	5.62	6.99	5.30	6.64
CTG Wet (Total) Exhaust Gas Analysis						
Molecular Wt, lb/mol	28.13	28.15	28.37	28.38	28.44	28.46
Molecular Wt, kg/mol	12.76	12.77	12.87	12.87	12.90	12.91
Gas Constant, ft-lbf/lbm-R	54.920	54.882	54.467	54.438	54.321	54.294
Specific Volume, ft^3/lb	40.98	41.70	39.87	40.97	39.10	40.27
Specific Volume, m^3/kg	2.56	2.60	2.49	2.56	2.44	2.51
Exhaust Gas Flow, acfm	1,837,953	1,574,175	1,920,405	1,636,752	1,971,292	1,668,520
Specific Volume, scf/lb	13.49	13.48	13.38	13.37	13.34	13.33
Exhaust Gas Flow, scfm	605,027	508,870	644,470	534,132	672,558	552,306
Specific Volume, Nm3/kg	0.7966	0.7960	0.7900	0.7896	0.7879	0.7875
Exhaust Gas Flow, Nm3/s	270.10	227.17	287.67	238.47	300.30	246.67

Preparer's Initials: UZ
10/26/00

Jacksonville Electric Authority
Brandy Branch 2x1 7FA Combined Cycle Project
Estimated Combustion Turbine and Heat Recovery Steam Generator Emissions, Rev.5

Project number 99262.0040

Case Number	8	9	10	11	12	13
CTG Performance Reference	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted
CTG Model	7241FA	7241FA	7241FA	7241FA	7241FA	7241FA
Diluent/NOx Emission Rate	DLN/9	DLN/9	DLN/9	DLN/9	DLN/9	DLN/9
CTG Fuel Type	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas
CTG Load	75%	50%	75%	50%	75%	50%
Ambient Temperature, F	95	95	59	59	20	20
HRSG Firing	Unfired	Unfired	Unfired	Unfired	Unfired	Unfired
STG Output with two Combustion Turbine Generators in operation, kW	148,020	128,570	159,780	140,760	161,900	142,180
Duct Burner Emissions						
Duct Burner Heat Input, MBtu/h (LHV) (margin included)	0.0	0.0	0.0	0.0	0.0	0.0
Duct Burner Heat Input, GJ/h (LHV) (margin included)	0.0	0.0	0.0	0.0	0.0	0.0
Duct Burner Heat Input, MBtu/h (HHV) (margin included)	0.0	0.0	0.0	0.0	0.0	0.0
Duct Burner Heat Input, GJ/h (HHV) (margin included)	0.0	0.0	0.0	0.0	0.0	0.0
Total Duct Burner Fuel Flow, lb/h	0	0	0	0	0	0
Duct Burner Fuel LHV, Btu/lb	20,675	20,675	20,675	20,675	20,675	20,675
Duct Burner Fuel HHV, kJ/kg	48,090	48,090	48,090	48,090	48,090	48,090
Duct Burner Fuel HHV, Btu/lb	22,962	22,962	22,962	22,962	22,962	22,962
Duct Burner Fuel HHV, kJ/kg	53,410	53,410	53,410	53,410	53,410	53,410
Duct Burner Fuel Composition (Ultimate Analysis by Weight)						
Ar	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
C	74.87%	74.87%	74.87%	74.87%	74.87%	74.87%
H2	25.13%	25.13%	25.13%	25.13%	25.13%	25.13%
N2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
O2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
S	0.00070%	0.00070%	0.00070%	0.00070%	0.00070%	0.00070%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Fuel Sulfur Content (grains/100 standard cubic feet)	0.2	0.2	0.2	0.2	0.2	0.2
Duct Burner NOx, lb/MBtu (HHV)	0.080	0.080	0.080	0.080	0.080	0.080
Duct Burner NOx, kg/kJ (HHV)	0.034	0.034	0.034	0.034	0.034	0.034
Duct Burner CO, lb/MBtu (HHV)	0.100	0.100	0.100	0.100	0.100	0.100
Duct Burner CO, kg/kJ (HHV)	0.043	0.043	0.043	0.043	0.043	0.043
Duct Burner UHC (as CH4), lb/MBtu (HHV)	0.060	0.060	0.060	0.060	0.060	0.060
Duct Burner UHC, kg/kJ (HHV)	0.026	0.026	0.026	0.026	0.026	0.026
Duct Burner VOC (as CH4), lb/MBtu (HHV)	0.024	0.024	0.024	0.024	0.024	0.024
Duct Burner VOC (as CH4), kg/kJ (HHV)	0.010	0.010	0.010	0.010	0.010	0.010
Duct Burner Particulate, lb/MBtu (HHV) (front half catch only)	0.010	0.010	0.010	0.010	0.010	0.010
Duct Burner Particulate, kg/kJ (HHV) (front half catch only)	0.004	0.004	0.004	0.004	0.004	0.004
Duct Burner Particulate, lb/MBtu (HHV) (front and back half catch)	0.020	0.020	0.020	0.020	0.020	0.020
Duct Burner Particulate, kg/kJ (HHV) (front and back half catch)	0.009	0.009	0.009	0.009	0.009	0.009
Duct Burner PM10, lb/MBtu (HHV) (front half catch only)	0.008	0.008	0.008	0.008	0.008	0.008
Duct Burner PM10, kg/kJ (HHV) (front half catch only)	0.003	0.003	0.003	0.003	0.003	0.003
Duct Burner PM10, lb/MBtu (HHV) (front and back half catch)	0.016	0.016	0.016	0.016	0.016	0.016
Duct Burner PM10, kg/kJ (HHV) (front and back half catch)	0.007	0.007	0.007	0.007	0.007	0.007
Total SO2, lb/h from Duct Burner	0.000	0.000	0.000	0.000	0.000	0.000
Total SO2, kg/h from Duct Burner	0.000	0.000	0.000	0.000	0.000	0.000
DB NOx, lb/h	0.00	0.00	0.00	0.00	0.00	0.00
DB NOx, kg/h	0.00	0.00	0.00	0.00	0.00	0.00
DB CO, lb/h	0.00	0.00	0.00	0.00	0.00	0.00
DB CO, kg/h	0.00	0.00	0.00	0.00	0.00	0.00
DB UHC (as CH4), lb/h	0.00	0.00	0.00	0.00	0.00	0.00
DB UHC (as CH4), kg/h	0.00	0.00	0.00	0.00	0.00	0.00
DB VOC (as CH4), lb/h	0.00	0.00	0.00	0.00	0.00	0.00
DB VOC (as CH4), kg/h	0.00	0.00	0.00	0.00	0.00	0.00
DB Particulate, lb/h (front half catch only)	0.00	0.00	0.00	0.00	0.00	0.00
DB Particulate, kg/h (front half catch only)	0.00	0.00	0.00	0.00	0.00	0.00
DB Particulate, lb/h (front and back half catch)	0.00	0.00	0.00	0.00	0.00	0.00
DB Particulate, kg/h (front and back half catch)	0.00	0.00	0.00	0.00	0.00	0.00
DB PM10, lb/h (front half catch only)	0.00	0.00	0.00	0.00	0.00	0.00
DB PM10, kg/h (front half catch only)	0.00	0.00	0.00	0.00	0.00	0.00
DB PM10, lb/h (front and back half catch)	0.00	0.00	0.00	0.00	0.00	0.00
DB PM10, kg/h (front and back half catch)	0.00	0.00	0.00	0.00	0.00	0.00

Preparer's Initials: LIZ
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Jacksonville Electric Authority
Brandy Branch 2x1 7FA Combined Cycle Project
Estimated Combustion Turbine and Heat Recovery Steam Generator Emissions, Rev.5

Project number 99262.0040

Case Number	8	9	10	11	12	13
CTG Performance Reference	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted
CTG Model	7241FA	7241FA	7241FA	7241FA	7241FA	7241FA
Diluent/NOx Emission Rate	DLN/9	DLN/9	DLN/9	DLN/9	DLN/9	DLN/9
CTG Fuel Type	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas
CTG Load	75%	50%	75%	50%	75%	50%
Ambient Temperature, F	95	95	59	59	20	20
HRSG Firing	Unfired	Unfired	Unfired	Unfired	Unfired	Unfired
STG Output with two Combustion Turbine Generators in operation, kW	148,020	128,570	159,780	140,760	161,900	142,180
Heat Recovery Steam Generator Stack Emissions						
NOTE: Exhaust Analysis does not include the effects of post combustion control						
Stack Exhaust Analysis (Volume Basis - Wet)						
Ar	0.91%	0.91%	0.93%	0.93%	0.94%	0.94%
CO2	3.77%	3.61%	3.85%	3.73%	3.91%	3.80%
H2O	10.73%	10.43%	8.67%	8.43%	8.02%	7.80%
N2	72.59%	72.71%	74.27%	74.36%	74.82%	74.91%
O2	12.00%	12.33%	12.27%	12.54%	12.31%	12.55%
SO2	0.00001%	0.00001%	0.00001%	0.00001%	0.00001%	0.00001%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Stack Emissions						
NOx, ppmvd @15% O2 w/o SCR	9.00	9.00	9.00	9.00	9.00	9.00
NOx, ppmvd@ user defined oxygen w/o SCR	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
NOx, ppmvd w/o SCR	11.35	10.85	11.35	10.97	11.43	11.09
NOx, ppmvw w/o SCR	10.13	9.72	10.36	10.04	10.52	10.22
NOx, lb/h as NO2 w/o SCR	43.81	34.77	48.01	37.97	51.03	40.14
NOx, lb/MBtu (LHV) as NO2 (incl. duct burner fuel) w/o SCR	0.04	0.04	0.04	0.04	0.04	0.04
NOx, lb/MBtu (HHV) as NO2 (incl. duct burner fuel) w/o SCR	0.03	0.03	0.03	0.03	0.03	0.03
NOx, kg/h as NO2	19.87	15.77	21.78	17.22	23.15	18.21
NOx, mg/Nm3 as NO2 (uncorrected exhaust flow) w/o SCR	20.43	19.28	21.03	20.06	21.41	20.51
NOx, mg/MJ (LHV) (including duct burner fuel) w/o SCR	15.76	15.50	15.85	15.61	15.91	15.67
NOx, mg/MJ (HHV) (including duct burner fuel) w/o SCR	14.19	13.96	14.27	14.05	14.32	14.11
NOx, ppmvd @15% O2 w/ SCR	3.50	3.50	3.50	3.50	3.50	3.50
NOx, ppmvd@ user defined oxygen w/ SCR	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
NOx, ppmvd w SCR	4.41	4.22	4.41	4.27	4.45	4.31
NOx, ppmvw w SCR	3.94	3.78	4.03	3.91	4.09	3.98
NOx, lb/h as NO2 w/ SCR	17.34	13.99	18.89	15.18	20.01	15.98
NOx, lb/MBtu (LHV) as NO2 (incl. duct burner fuel) w SCR	0.01	0.01	0.01	0.01	0.01	0.01
NOx, lb/MBtu (HHV) as NO2 (incl. duct burner fuel) w SCR	0.01	0.01	0.01	0.01	0.01	0.01
NOx, kg/h as NO2	7.86	6.34	8.57	6.88	9.08	7.25
NOx, mg/Nm3 as NO2 (uncorrected exhaust flow) w SCR	8.09	7.76	8.27	8.02	8.40	8.16
NOx, mg/MJ (LHV) (including duct burner fuel) w SCR	6.24	6.24	6.24	6.24	6.24	6.24
NOx, mg/MJ (HHV) (including duct burner fuel) w SCR	5.62	5.62	5.62	5.62	5.62	5.62
SCR NH3 slip, ppmvd @15% O2	10.00	10.00	10.00	10.00	10.00	10.00
SCR NH3 slip, lb/h	18.34	14.79	19.98	16.05	21.17	16.90
CO, ppmvd @ 15% O2 w/o Catalyst	11.90	12.44	11.90	12.31	11.81	12.18
CO, ppmvd @ user defined O2 w/o Catalyst	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
CO, ppmvd w/o Catalyst	15.00	15.00	15.00	15.00	15.00	15.00
CO, ppmvw w/o Catalyst	13.39	13.44	13.70	13.74	13.80	13.83
CO, lb/h w/o Catalyst	37.67	31.79	41.05	34.12	43.16	35.53
CO, lb/MBtu (LHV) (incl. duct burner fuel) w/o SCR	0.03	0.03	0.03	0.03	0.03	0.03
CO, lb/MBtu (HHV) (incl. duct burner fuel) w/o SCR	0.03	0.03	0.03	0.03	0.03	0.03
CO Reduction % w/ Catalyst	0%	0%	0%	0%	0%	0%
CO, ppmvd @ 15% O2 w/ Catalyst	11.90	12.44	11.90	12.31	11.81	12.18
CO, ppmvd @ user defined O2 w/ Catalyst	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
CO, ppmvd w/ Catalyst	15.00	15.00	15.00	15.00	15.00	15.00
CO, ppmvw w/ Catalyst	13.39	13.44	13.70	13.74	13.80	13.83
CO, lb/h w/ Catalyst	35.88	30.28	39.10	32.49	41.10	33.84
CO, lb/MBtu (LHV) (incl. duct burner fuel) w SCR	0.030	0.031	0.030	0.031	0.030	0.031
CO, lb/MBtu (HHV) (incl. duct burner fuel) w SCR	0.027	0.028	0.027	0.028	0.027	0.028
SO2, ppmvd@15% O2 (with no SO2 oxidation)	0.12	0.12	0.12	0.12	0.12	0.12
SO2, ppmvd at user defined O2 (with no SO2 oxidation)	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
SO2, ppmvd (with no SO2 oxidation)	0.15	0.14	0.15	0.14	0.15	0.14
SO2, ppmvw (with no SO2 oxidation)	0.13	0.13	0.13	0.13	0.14	0.13
SO2, lb/h (with no SO2 oxidation)	0.85	0.68	0.92	0.74	0.98	0.78
SO2, lb/MBtu (LHV) (incl. duct burner fuel)	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007
SO2, lb/MBtu (HHV) (incl. duct burner fuel)	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006

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Brandy Branch 2x1 7FA Combined Cycle Project
Estimated Combustion Turbine and Heat Recovery Steam Generator Emissions, Rev.5

Project number 99262.0040

Case Number	8	9	10	11	12	13
CTG Performance Reference	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted
CTG Model	7241FA	7241FA	7241FA	7241FA	7241FA	7241FA
Diluent/NOx Emission Rate	DLN/9	DLN/9	DLN/9	DLN/9	DLN/9	DLN/9
CTG Fuel Type	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas
CTG Load	75%	50%	75%	50%	75%	50%
Ambient Temperature, F	95	95	59	59	20	20
HRSG Firing	Unfired	Unfired	Unfired	Unfired	Unfired	Unfired
STG Output with two Combustion Turbine Generators in operation, kW	148,020	128,570	159,780	140,760	161,900	142,180
Heat Recovery Steam Generator Stack Emissions - continued						
NOTE: UHC calculations do NOT include the effect of any oxidation in the CO catalyst.						
UHC, ppmvd @ 15% O2	6.22	6.48	6.08	6.27	5.99	6.16
UHC, ppmvd @ user defined O2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
UHC, ppmvd	7.84	7.82	7.66	7.84	7.61	7.59
UHC, ppmvw	7.00	7.00	7.00	7.00	7.00	7.00
UHC, lb/h as CH4	11.28	9.49	12.01	9.96	12.54	10.30
UHC, lb/MBtu (LHV) (incl. duct burner fuel)	0.009	0.010	0.009	0.010	0.009	0.009
UHC, lb/MBtu (HHV) (incl. duct burner fuel)	0.009	0.009	0.008	0.009	0.008	0.008
VOC, ppmvd @ 15% O2 w/o Catalyst	1.24	1.30	1.22	1.25	1.20	1.23
VOC, ppmvd @ user defined O2 w/o CO catalyst	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
VOC, ppmvd w/o Catalyst	1.57	1.56	1.53	1.53	1.52	1.52
VOC, ppmvw w/o Catalyst	1.40	1.40	1.40	1.40	1.40	1.40
VOC, lb/h as CH4 w/o Catalyst	2.26	1.90	2.40	1.99	2.51	2.06
VOC, lb/MBtu (LHV) (incl. duct burner fuel) w/o CO catalyst	0.0019	0.0020	0.0018	0.0019	0.0018	0.0019
VOC, lb/MBtu (HHV) (incl. duct burner fuel) w/o CO catalyst	0.0017	0.0018	0.0017	0.0017	0.0016	0.0017
VOC Reduction % w/ Catalyst	0%	0%	0%	0%	0%	0%
VOC, ppmvd @ 15% O2 w/ Catalyst	1.24	1.30	1.22	1.25	1.20	1.23
VOC, ppmvd @ user defined O2 w/ Catalyst	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
VOC, ppmvd w/ Catalyst	1.57	1.56	1.53	1.53	1.52	1.52
VOC, ppmvw w/ Catalyst	1.40	1.40	1.40	1.40	1.40	1.40
VOC, lb/h as CH4 w/ Catalyst	2.15	1.81	2.29	1.90	2.39	1.96
VOC, lb/MBtu (LHV) (incl. duct burner fuel) w CO catalyst	0.0018	0.0019	0.0018	0.0018	0.0017	0.0018
VOC, lb/MBtu (HHV) (incl. duct burner fuel) w CO catalyst	0.0016	0.0017	0.0016	0.0016	0.0016	0.0016
Particulate without the effect of SO2 oxidation and SCR catalysts						
Particulates, lb/h (front half catch only)	9.5	9.5	9.5	9.5	9.5	9.5
Particulates, lb/MBtu (incl. duct burner fuel) (front half catch only)	0.0079	0.0098	0.0073	0.0090	0.0089	0.0086
Particulates, lb/h (front and back half catch)	18.9	18.9	18.9	18.9	18.9	18.9
Particulates, lb/MBtu (incl. duct burner fuel) (front and back half catch)	0.016	0.020	0.015	0.018	0.014	0.017
PM10, lb/h (front half catch only)	9.5	9.5	9.5	9.5	9.5	9.5
PM10, lb/MBtu (incl. duct burner fuel) (front half catch only)	0.008	0.010	0.007	0.009	0.007	0.009
PM10, lb/h (front and back half catch)	18.9	18.9	18.9	18.9	18.9	18.9
PM10, lb/MBtu (incl. duct burner fuel) (front and back half catch)	0.016	0.020	0.015	0.018	0.014	0.017
Particulate including the effect of SO2 oxidation and SCR catalysts [includes 2[NH4SO4]]						
Particulates, lb/h (front half catch only)	9.8	9.7	9.8	9.7	9.8	9.7
Particulates, lb/MBtu (incl. duct burner fuel)(front half catch only)	0.0082	0.0101	0.0075	0.0093	0.0071	0.0088
Particulates, lb/h (front and back half catch)	19.2	19.1	19.2	19.2	19.2	19.2
Particulates, lb/MBtu (incl. duct burner fuel)(front and back half catch)	0.016	0.020	0.015	0.018	0.014	0.017
PM10, lb/h (front half catch only)	9.8	9.7	9.8	9.7	9.8	9.7
PM10, lb/MBtu (incl. duct burner fuel)(front half catch only)	0.008	0.010	0.008	0.009	0.007	0.009
PM10, lb/h (front and back half catch)	19.2	19.1	19.2	19.2	19.2	19.2
PM10, lb/MBtu (incl. duct burner fuel)(front and back half catch)	0.016	0.020	0.015	0.018	0.014	0.017
NOTE: SO2 to SO3 conversion rate (assumed), wt%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
SO3 conversion rate (assumed) to ammonium sulfates [2(NH4SO4)]	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Remaining SO2 in Exhaust Gas, lb/h	0.76	0.62	0.83	0.67	0.88	0.70
Amount of SO2 converted to SO3	0.08	0.07	0.09	0.07	0.10	0.08
Maximum Exhaust Gas ammonium sulfate [2(NH4SO4)], lb/h	0.30	0.24	0.33	0.26	0.35	0.28
Maximum H2SO4 (assuming 100% conversion from SO3 to H2SO4), lb/hr	0.13	0.10	0.14	0.11	0.15	0.12
Stack Exit Temperature, F	198	190	194	185	194	185
Stack Diameter, ft (estimated)	19	19	19	19	19	19
Stack Flow, lb/h	2,691,000	2,265,000	2,890,000	2,397,000	3,025,000	2,486,000
Stack Flow, scfm	605,027	508,870	644,470	534,132	672,558	552,306
Stack Flow, acfm	765,590	635,710	811,127	662,371	846,495	685,307
Stack Exit Velocity, ft/s	45.0	37.4	47.7	38.9	49.8	40.3
Selective Catalytic Reduction (SCR)						
NOx Removed, lb/h as NO2	26.5	20.8	29.1	22.8	31.0	24.2
NOx Removed, percent	60.4%	59.8%	60.6%	60.0%	60.8%	60.2%
NH3 Slip, lb/h	18.3	14.8	20.0	16.1	21.2	16.9
Total NH3 consumption, lb/h (1:1 stoichiometric ratio, incl. slip)	28.1	22.5	30.8	24.5	32.6	25.8
Adjusted Stack Diameter (ft) estimated	18.0	18.0	18.0	18.0	18.0	18.0
Stack Exit Velocity, ft/s	50.1	41.6	53.1	43.4	56.4	44.9

Notes:

1. The emissions estimates shown in the table above are per stack.
2. The combustion turbine generator performance and emissions is based on a General Electric performance estimate provided by JEA.
3. The combustion turbine emissions estimate may include margin as indicated in the table.

   Where catalysts are involved to reduce emissions, the margin applied to the CTG emissions only effects the amount of emissions removed, but not the stack emissions.
4. UHC calculations do not include the effects of any oxidation in the CO catalyst. It was assumed that the VOC/UHC ratio is 20% for natural gas firing, and 50% for distillate oil firing.
5. It was assumed that the front and back half catch of CTG particulate emissions is twice the amount of front half catch only.
6. Duct Burner emissions are Black & Veatch estimates based on typical vendor data.
7. It was assumed that ammonium sulfate is measured as front half particulates. The assumption that 100% SO3 is converted to ammonium sulfates results in "worst case" particulate emissions.
8. The maximum amount of ammonium sulfates and sulfuric acid shown in the table can not occur in parallel at the same time.

Jacksonville Electric Authority
Brandy Branch 2x1 7FA Combined Cycle Project
Estimated Combustion Turbine and Heat Recovery Steam Generator Emissions, Rev.5

Preparer's Initials: UZ
10/26/00

Case Number	14	15	16	17	18	19	20
CTG Performance Reference	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted
CTG Model	7241FA	7241FA	7241FA	7241FA	7241FA	7241FA	7241FA
Diluent/NOx Emission Rate	DLN/42	DLN/42	DLN/42	DLN/42	DLN/42	DLN/42	DLN/42
CTG Fuel Type	Dist. Oil	Dist. Oil	Dist. Oil	Dist. Oil	Dist. Oil	Dist. Oil	Dist. Oil
CTG Load	100%	100%	100%	100%	75%	75%	75%
Ambient Temperature, F	95	59	20	95	95	59	20
HRSG Firing	Unfired	Unfired	Unfired	Unfired	Unfired	Unfired	Unfired
STG Output with two Combustion Turbine Generators in operation, kW	172,650	187,310	199,870	175,490	149,830	162,700	166,920
Ambient Temperature, F	95.0	59.0	20.0	95.0	95.0	59.0	20.0
Ambient Temperature, C	35.0	15.0	(6.7)	35.0	35.0	15.0	(6.7)
Ambient Relative Humidity, %	60.0	60.0	60.0	60.0	60.0	60.0	60.0
Atmospheric Pressure, psia	14.690	14.690	14.690	14.690	14.690	14.690	14.690
Atmospheric Pressure, bar(a)	1.013	1.013	1.013	1.013	1.013	1.013	1.013
CTG Compressor Inlet Dry Bulb Temperature, F	95.0	59.0	20.0	84.5	95.0	59.0	20.0
CTG Compressor Inlet Temperature, C	35.0	15.0	(6.7)	29.2	35.0	15.0	(6.7)
CTG Compr. Inlet Relative Humidity, %	60.1	60.2	60.3	92.6	60.1	60.2	60.3
CTG Inlet Air Conditioning Included?	No	No	No	Yes (Evap. Cooler)	No	No	No
Inlet Loss, in. H2O	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Inlet Loss, mm. H2O	88.9	88.9	88.9	88.9	88.9	88.9	88.9
Exhaust Loss, in. H2O	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Exhaust Loss, mm. H2O	381.0	381.0	381.0	381.0	381.0	381.0	381.0
CTG Load Level (percent of Base Load)	100%	100%	100%	100%	75%	75%	75%
Gross CTG Output, kW	157,970	179,580	190,140	165,200	118,600	134,680	142,580
Gross CTG Heat Rate, Btu/kWh (LHV)	10,380	10,140	10,170	10,250	11,320	10,970	10,980
Gross CTG Heat Rate, KJ/KWh (LHV)	10,951	10,698	10,730	10,814	11,943	11,574	11,585
Gross CTG Heat Rate, kJ/kWh (HHV)	11,055	10,799	10,831	10,916	12,056	11,683	11,694
Gross CTG Heat Rate, KJ/KWh (HHV)	11,664	11,394	11,427	11,517	12,720	12,326	12,338
CTG Heat Input, MBtu/h (LHV)	1,639.7	1,820.9	1,893.7	1,693.3	1,341.4	1,477.4	1,565.5
CTG Heat Input, GJ/h (LHV)	1,730.0	1,921.2	2,040.2	1,786.5	1,415.3	1,558.8	1,651.7
CTG Heat Input, MBtu/h (HHV)	1,746.3	1,939.3	2,059.4	1,803.4	1,428.6	1,573.5	1,667.3
CTG Heat Input, GJ/h (HHV)	1,842.5	2,046.1	2,172.8	1,902.7	1,507.3	1,660.1	1,759.1
CTG Water Injection Flow, lb/h	93,590	119,700	130,530	100,900	69,010	90,620	100,950
CTG Water Injection Flow, kg/h	42,452	54,295	59,207	45,787	31,302	41,105	45,790
CTG Steam Injection Flow, lb/h	0	0	0	0	0	0	0
CTG Steam Injection Flow, kg/h	0	0	0	0	0	0	0
Injection Fluid/Fuel Ratio	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CTG Exhaust Flow, lb/h	3,365,000	3,683,000	3,914,000	3,444,950	2,693,000	2,827,000	2,925,000
CTG Exhaust Flow, kg/h	1,526,338	1,670,581	1,775,361	1,562,603	1,221,524	1,282,306	1,326,758
CTG Exhaust Temperature, F	1,140	1,105	1,075	1,132	1,207	1,201	1,190
CTG Exhaust Temperature, C	615.6	596.1	579.4	611.1	652.8	649.4	643.3
CTG Exhaust Enthalpy, Btu/lb	284.00	280.95	281.28	282.85	303.25	309.19	315.53
CTG Exhaust Enthalpy, kJ/lb	299.64	296.42	296.77	298.21	319.95	326.21	332.90
CTG Exhaust Enthalpy Reference Temperature, F	95	59	20	95	95	59	20
CTG Exhaust Enthalpy Reference Temperature, C	35.0	15.0	(6.7)	35.0	35.0	15.0	(6.7)
CTG Exhaust Heat, MBtu/h	955.7	1,034.7	1,100.9	973.7	816.7	874.1	922.9
CTG Exhaust Heat, GJ/h	1,008.3	1,091.7	1,161.5	1,027.3	861.6	922.2	973.7
CTG Exhaust Heat/CTG Output, kW/kW	177.3%	168.9%	169.7%	172.7%	202.0%	190.2%	189.7%
Total CTG Fuel Flow, lb/h	88400	98160	104240	91280	72310	79650	84400
CTG Fuel Temperature, F	60	60	60	60	60	60	60
CTG Fuel LHV, Btu/lb	18,550	18,550	18,550	18,550	18,550	18,550	18,550
CTG Fuel LHV, kJ/lb	43,147	43,147	43,147	43,147	43,147	43,147	43,147
CTG Fuel HHV, Btu/lb	19,756	19,756	19,756	19,756	19,756	19,756	19,756
CTG Fuel HHV, kJ/lb	45,952	45,952	45,952	45,952	45,952	45,952	45,952
HHV/LHV Ratio	1.0650	1.0650	1.0650	1.0650	1.0650	1.0650	1.0650
CTG Fuel Composition (Ultimate Analysis by Weight)							
Ar	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
C	85.59%	85.59%	85.59%	85.59%	85.59%	85.59%	85.59%
H2	14.35%	14.35%	14.35%	14.35%	14.35%	14.35%	14.35%
N2	0.02%	0.02%	0.02%	0.02%	0.02%	0.02%	0.02%
O2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
S	0.05000%	0.05000%	0.05000%	0.05000%	0.05000%	0.05000%	0.05000%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Fuel Sulfur Content (grains/100 standard cubic feet)	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Jacksonville Electric Authority
Brandy Branch 2x1 7FA Combined Cycle Project
Estimated Combustion Turbine and Heat Recovery Steam Generator Emissions, Rev.5

Preparer's Initials: UZ
10/26/00

Case Number	14	15	16	17	18	19	20
CTG Performance Reference	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted
CTG Model	7241FA	7241FA	7241FA	7241FA	7241FA	7241FA	7241FA
Diluent/NOx Emission Rate	DLN/42	DLN/42	DLN/42	DLN/42	DLN/42	DLN/42	DLN/42
CTG Fuel Type	Dist. Oil	Dist. Oil	Dist. Oil	Dist. Oil	Dist. Oil	Dist. Oil	Dist. Oil
CTG Load	100%	100%	100%	100%	75%	75%	75%
Ambient Temperature, F	95	59	20	95	95	59	20
HRSG Firing	Unfired	Unfired	Unfired	Unfired	Unfired	Unfired	Unfired
STG Output with two Combustion Turbine Generators in operation, kW	172,650	187,310	189,870	175,490	149,830	162,700	165,920
Combustion Turbine Exhaust Emissions							
CTG Exhaust Analysis (Volume Basis - Wet)							
Ar	0.88%	0.89%	0.90%	0.88%	0.88%	0.89%	0.90%
CO2	5.27%	5.37%	5.38%	5.30%	5.39%	5.68%	5.82%
H2O	12.70%	11.39%	10.81%	13.29%	12.49%	11.63%	11.44%
N2	70.17%	71.23%	71.69%	69.72%	70.38%	71.17%	71.38%
O2	10.98%	11.11%	11.22%	10.81%	10.85%	10.63%	10.46%
SO2	0.00115%	0.00118%	0.00118%	0.00116%	0.00118%	0.00124%	0.00127%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
NOx, ppmvd @15% O2	42.00	42.00	42.00	42.00	42.00	42.00	42.00
NOx, ppmvd @ 15% O2	42.00	42.00	42.00	42.00	42.00	42.00	42.00
NOx, ppmvd	59.00	59.30	59.00	59.78	60.24	62.87	64.33
NOx, ppmvw (wet - uncorrected exhaust gas)	51.51	52.54	52.62	51.84	52.71	55.58	56.97
NOx Massflow Added to Match CTG Manufacturer's NOx Emissions Estimate	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Additonal Percent Margin Included in NOx Emissions below	5%	5%	5%	5%	5%	5%	5%
NOx, lb/h as NO2	298.63	331.49	351.96	308.33	244.46	269.17	285.16
NOx, lb/MBtu (LHV)	0.18	0.18	0.18	0.18	0.18	0.18	0.18
NOx, lb/MBtu (HHV)	0.17	0.17	0.17	0.17	0.17	0.17	0.17
NOx, mg/Nm3 as NO2 (dry, 15% O2)	90.84	90.81	90.80	90.84	90.91	90.88	90.86
NOx, mg/Nm3 as NO2 (dry, 15% O2)	90.84	90.81	90.80	90.84	90.91	90.88	90.86
NOx, mg/Nm3 as NO2 (dry)	127.61	128.22	127.56	129.29	130.38	136.04	139.17
NOx, mg/Nm3 as NO2 (wet - uncorrected exhaust flow)	111.41	113.62	113.77	112.11	114.10	120.21	123.25
NOx, mg/MJ (LHV)	78.30	78.27	78.25	78.28	78.35	78.33	78.31
NOx, mg/MJ (HHV)	73.52	73.49	73.47	73.50	73.57	73.55	73.53
CO, ppmvd @ 15% O2	14.24	14.17	14.24	14.05	13.94	13.36	13.06
CO, ppmvd @ 15% O2	14.24	14.17	14.24	14.05	13.95	13.36	13.06
CO, ppmvd	20.00	20.00	20.00	20.00	20.00	20.00	20.00
CO, ppmvw (wet - uncorrected exhaust gas)	17.46	17.72	17.84	17.34	17.50	17.67	17.71
CO Massflow Added to Match CTG Manufacturer's CO Emissions Estimate	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Additional Percent Margin Included in CO Emissions below	5%	5%	5%	5%	5%	5%	5%
CO, lb/h	61.43	67.86	72.43	62.59	49.21	51.94	53.79
CO, lb/MBtu (LHV)	0.04	0.04	0.04	0.04	0.04	0.04	0.03
CO, lb/MBtu (HHV)	0.04	0.03	0.04	0.03	0.03	0.03	0.03
CO, mg/Nm3 (wet - uncorrected exhaust flow)	22.92	23.26	23.41	22.76	22.97	23.19	23.25
CO, mg/Nm3 (dry)	26.25	26.25	26.25	26.25	26.25	26.25	26.25
CO, mg/Nm3 (dry, 15% O2)	18.69	18.59	18.68	18.44	18.30	17.54	17.14
CO, mg/Nm3 (dry, 15% O2)	18.69	18.59	18.68	18.44	18.30	17.54	17.14
CO, mg/MJ (LHV)	16.11	16.02	16.10	15.89	15.77	15.11	14.77
CO, mg/MJ (HHV)	15.12	15.04	15.12	14.92	14.81	14.19	13.87
NOTE: SO2 estimate does not include the effects of SO2 oxidation							
SO2, ppmvd @ 15% O2 (with no SO2 oxidation)	9.40	9.40	9.40	9.40	9.40	9.40	9.40
SO2, ppmvd @ 15% O2 (with no SO2 oxidation)	9.40	9.40	9.40	9.40	9.40	9.40	9.40
SO2, ppmvd (with no SO2 oxidation)	13.20	13.27	13.20	13.38	13.48	14.07	14.39
SO2, ppmvw (with no SO2 oxidation)(wet - uncorrected exhaust gas)	11.53	11.76	11.78	11.60	11.80	12.43	12.75
SO2 Massflow Added to Match CTG Manufacturer's CO Emissions Estimate	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Additional Percent Margin Included in SO2 Emissions below	5%	5%	5%	5%	5%	5%	5%
SO2, lb/h (with no SO2 oxidation)	92.73	102.97	109.36	95.75	75.85	83.55	88.54
SO2, lb/MBtu (LHV) (with no SO2 oxidation)	0.0566	0.0565	0.0565	0.0565	0.0565	0.0566	0.0566
SO2, lb/MBtu (HHV) (with no SO2 oxidation)	0.0531	0.0531	0.0531	0.0531	0.0531	0.0531	0.0531
SO2, mg/Nm3 (wet - uncorrected exhaust flow) (with no SO2 oxidation)	34.60	35.29	35.35	34.82	35.40	37.31	38.27
SO2, mg/Nm3 (dry, 15% O2) (with no SO2 oxidation)	28.21	28.21	28.21	28.21	28.21	28.21	28.21
SO2, mg/Nm3 (dry, 15% O2) (with no SO2 oxidation)	28.21	28.21	28.21	28.21	28.21	28.21	28.21
SO2, mg/Nm3 (dry) (with no SO2 oxidation)	39.63	39.83	39.63	40.15	40.46	42.23	43.21
SO2, mg/MJ (LHV) (with no SO2 oxidation)	24.31	24.31	24.31	24.31	24.31	24.31	24.31
SO2, mg/MJ (HHV) (with no SO2 oxidation)	22.83	22.83	22.83	22.83	22.83	22.83	22.83

Jacksonville Electric Authority
Brandy Branch 2x1 7FA Combined Cycle Project
Estimated Combustion Turbine and Heat Recovery Steam Generator Emissions, Rev.5

Preparer's Initials: LIZ
10/25/00

Case Number	14	15	16	17	18	19	20
CTG Performance Reference	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted
CTG Model	7241FA	7241FA	7241FA	7241FA	7241FA	7241FA	7241FA
Diluent/NOx Emission Rate	DLN/42	DLN/42	DLN/42	DLN/42	DLN/42	DLN/42	DLN/42
CTG Fuel Type	Dist. Oil	Dist. Oil	Dist. Oil	Dist. Oil	Dist. Oil	Dist. Oil	Dist. Oil
CTG Load	100%	100%	100%	100%	75%	75%	75%
Ambient Temperature, F	95	59	20	95	95	59	20
HRSG Firing	Unfired	Unfired	Unfired	Unfired	Unfired	Unfired	Unfired
STG Output with two Combustion Turbine Generators in operation, kW	172,650	187,310	189,870	175,490	149,630	162,700	165,920
Combustion Turbine Exhaust Emissions - continued							
UHC, ppmvd @ 15% O2	5.71	5.60	5.59	5.67	5.58	5.29	5.16
UHC, ppmvd @ 15% O2	5.71	5.60	5.59	5.67	5.58	5.29	5.16
UHC, ppmvd	8.02	7.90	7.85	8.07	8.00	7.92	7.90
UHC, ppmvw (wet - uncorrected exhaust gas)	7.00	7.00	7.00	7.00	7.00	7.00	7.00
UHC Massflow Added to Match CTG Manufacturer's CO Emissions Estimate	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Additional Percent Margin included in UHC Emissions Below	5%	5%	5%	5%	5%	5%	5%
UHC, lb/h as CH4	14.10	15.35	16.28	14.47	11.27	11.78	12.17
UHC, lb/MBtu as CH4 (LHV)	0.0086	0.0084	0.0084	0.0085	0.0084	0.0080	0.0078
UHC, lb/MBtu as CH4 (HHV)	0.0081	0.0079	0.0079	0.0080	0.0079	0.0075	0.0073
UHC, mg/Nm3 as CH4 (dry, 15% O2)	4.29	4.21	4.20	4.26	4.19	3.98	3.88
UHC, mg/Nm3 as CH4 (dry, 15% O2)	4.29	4.21	4.20	4.26	4.19	3.96	3.88
UHC, mg/Nm3 as CH4 (dry)	6.03	5.94	5.90	6.07	6.01	5.95	5.94
UHC, mg/Nm3 as CH4 (wet - uncorrected exhaust flow)	5.26	5.26	5.26	5.26	5.26	5.26	5.26
UHC, mg/MJ as CH4 (LHV)	3.70	3.62	3.62	3.67	3.61	3.43	3.34
UHC, mg/MJ as CH4 (HHV)	3.47	3.40	3.40	3.45	3.39	3.22	3.14
VOC percentage of UHC	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
VOC, ppmvd @ 15% O2	2.9	2.8	2.8	2.8	2.8	2.6	2.6
VOC, ppmvd @ 15% O2	2.9	2.8	2.8	2.8	2.8	2.6	2.6
VOC, ppmvd	4.01	3.95	3.92	4.04	4.00	3.96	3.95
VOC, ppmvw (wet - uncorrected exhaust flow)	3.50	3.50	3.50	3.50	3.50	3.50	3.50
VOC Massflow Added to Match CTG Manufacturer's VOC Emissions Estimate	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Additional Percent Margin included in VOC Emissions below	5%	5%	5%	5%	5%	5%	5%
VOC, lb/h as CH4	7.05	7.68	8.14	7.24	5.64	5.89	6.09
VOC, lb/MBtu as CH4 (LHV)	0.0043	0.0042	0.0042	0.0043	0.0042	0.0040	0.0039
VOC, lb/MBtu as CH4 (HHV)	0.0040	0.0040	0.0040	0.0040	0.0039	0.0037	0.0037
VOC, mg/Nm3 as CH4 (dry, 15% O2)	2.15	2.10	2.10	2.13	2.10	1.99	1.94
VOC, mg/Nm3 as CH4 (dry, 15% O2)	2.15	2.10	2.10	2.13	2.10	1.99	1.94
VOC, mg/Nm3 as CH4 (dry)	3.01	2.97	2.95	3.03	3.01	2.98	2.97
VOC, mg/Nm3 as CH4 (wet - uncorrected exhaust flow)	2.63	2.63	2.63	2.63	2.63	2.63	2.63
VOC, mg/MJ as CH4 (LHV)	1.85	1.81	1.81	1.84	1.81	1.71	1.67
VOC, mg/MJ as CH4 (HHV)	1.74	1.70	1.70	1.72	1.70	1.61	1.57
Percent Margin included in Particulates Emissions below	5%	5%	5%	5%	5%	5%	5%
Particulates, lb/h (front half catch only)	17.85	17.85	17.85	17.85	17.85	17.85	17.85
Particulates, lb/h (front and back half catch)	35.70	35.70	35.70	35.70	35.70	35.70	35.70
Particulates, lb/MBtu (LHV) (front half catch only)	0.0109	0.0098	0.0092	0.0105	0.0133	0.0121	0.0114
Particulates, lb/MBtu (HHV) (front half catch only)	0.0102	0.0092	0.0087	0.0099	0.0125	0.0113	0.0107
Particulates, mg/Nm3 (dry, 15% O2) (front half catch only)	5.43	4.89	4.60	5.26	6.64	6.03	5.69
Particulates, mg/Nm3 (dry, 15% O2) (front half catch only)	5.43	4.89	4.60	5.26	6.64	6.03	5.69
Particulates, mg/Nm3 (dry) (front half catch only)	7.63	6.90	6.47	7.49	9.52	9.02	8.71
Particulates, mg/Nm3 (wet - uncorrected exhaust flow) (front half catch only)	6.66	6.12	5.77	6.49	8.33	7.97	7.71
Particulates, mg/MJ (LHV) (front half catch only)	4.68	4.21	3.97	4.53	5.72	5.19	4.90
Particulates, mg/MJ (HHV) (front half catch only)	4.39	3.96	3.73	4.26	5.37	4.88	4.60
Percent Margin included in PM10 Emissions below	0%	0%	0%	0%	0%	0%	0%
PM10, lb/h (front half catch only)	17.00	17.00	17.00	17.00	17.00	17.00	17.00
PM10, lb/h (front and back half catch)	34.00	34.00	34.00	34.00	34.00	34.00	34.00
PM10, lb/MBtu (LHV) (front and back half catch)	0.02	0.02	0.02	0.02	0.03	0.02	0.02
PM10, lb/MBtu (HHV) (front and back half catch)	0.02	0.02	0.02	0.02	0.02	0.02	0.02
PM10, mg/Nm3 (dry, 15% O2) (front and back half catch)	10.34	9.31	8.77	10.02	12.64	11.48	10.83
PM10, mg/Nm3 (dry, 15% O2) (front and back half catch)	10.34	9.31	8.77	10.02	12.64	11.48	10.83
PM10, mg/Nm3 (dry) (front and back half catch)	14.53	13.15	12.32	14.26	18.13	17.18	16.59
PM10, mg/Nm3 (wet - uncorrected exhaust flow) (front and back half catch)	12.68	11.65	10.99	12.36	15.87	15.18	14.70
PM10, mg/MJ (LHV) (front and back half catch)	8.91	8.03	7.56	8.63	10.90	9.89	9.34
PM10, mg/MJ (HHV) (front and back half catch)	8.37	7.54	7.10	8.11	10.23	9.29	8.77
CTG Wet (Total) Exhaust Gas Analysis							
Molecular Wt, lb/mol	28.13	28.29	28.35	28.07	28.17	28.29	28.33
Molecular Wt, kg/mol	12.76	12.83	12.86	12.73	12.78	12.83	12.85
Gas Constant, ft-lbf/lbm-R	54.921	54.622	54.498	55.041	54.862	54.810	54.539
Specific Volume, ft^3/lb	40.05	38.96	38.13	39.94	41.68	41.35	41.02
Specific Volume, m^3/kg	2.50	2.43	2.38	2.49	2.60	2.58	2.56
Exhaust Gas Flow, acfm	2,246,138	2,391,495	2,487,347	2,293,188	1,870,737	1,948,274	1,999,725
Specific Volume, scf/lb	13.49	13.41	13.38	13.52	13.47	13.41	13.39
Exhaust Gas Flow, scfm	756,564	823,151	872,822	776,262	604,579	631,835	652,763
Specific Volume, Nm3/kg	0.7966	0.7922	0.7904	0.7983	0.7956	0.7921	0.7910
Exhaust Gas Flow, Nm3/s	337.74	367.62	389.79	346.51	269.96	282.14	291.52

Jacksonville Electric Authority
Brandy Branch 2x1 7FA Combined Cycle Project
Estimated Combustion Turbine and Heat Recovery Steam Generator Emissions, Rev 5

Preparer's Initials: UZ
10/26/00

Case Number	14	15	16	17	18	19	20
CTG Performance Reference	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted
CTG Model	7241FA	7241FA	7241FA	7241FA	7241FA	7241FA	7241FA
Diluent/NOx Emission Rate	DLN/42	DLN/42	DLN/42	DLN/42	DLN/42	DLN/42	DLN/42
CTG Fuel Type	Dist. Oil	Dist. Oil	Dist. Oil	Dist. Oil	Dist. Oil	Dist. Oil	Dist. Oil
CTG Load	100%	100%	100%	100%	75%	75%	75%
Ambient Temperature, F	95	59	20	95	95	59	20
HRSG Firing	Unfired	Unfired	Unfired	Unfired	Unfired	Unfired	Unfired
STG Output with two Combustion Turbine Generators in operation, kW	172,850	187,310	189,870	175,490	149,830	162,700	165,920
Duct Burner Emissions							
Duct Burner Heat Input, MBtu/h (LHV) (margin included)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Duct Burner Heat Input, GJ/h (LHV) (margin included)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Duct Burner Heat Input, MBtu/h (HHV) (margin included)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Duct Burner Heat Input, GJ/h (HHV) (margin included)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Duct Burner Fuel Flow, lb/h	0	0	0	0	0	0	0
Duct Burner Fuel LHV, Btu/lb	18,550	18,550	18,550	18,550	18,550	18,550	18,550
Duct Burner Fuel HHV, kJ/kg	43,147	43,147	43,147	43,147	43,147	43,147	43,147
Duct Burner Fuel HHV, Btu/lb	19,756	19,756	19,756	19,756	19,756	19,756	19,756
Duct Burner Fuel HHV, kJ/kg	45,952	45,952	45,952	45,952	45,952	45,952	45,952
Duct Burner Fuel Composition (Ultimate Analysis by Weight)							
Ar	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
C	85.59%	85.59%	85.59%	85.59%	85.59%	85.59%	85.59%
H2	14.35%	14.35%	14.35%	14.35%	14.35%	14.35%	14.35%
N2	0.02%	0.02%	0.02%	0.02%	0.02%	0.02%	0.02%
O2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
S	0.05000%	0.05000%	0.05000%	0.05000%	0.05000%	0.05000%	0.05000%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Fuel Sulfur Content (grains/100 standard cubic feet)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Duct Burner NOx, lb/MBtu (HHV)	0.080	0.080	0.080	0.080	0.080	0.080	0.080
Duct Burner NOx, kg/kJ (HHV)	0.034	0.034	0.034	0.034	0.034	0.034	0.034
Duct Burner CO, lb/MBtu (HHV)	0.100	0.100	0.100	0.100	0.100	0.100	0.100
Duct Burner CO, kg/kJ (HHV)	0.043	0.043	0.043	0.043	0.043	0.043	0.043
Duct Burner UHC (as CH4), lb/MBtu (HHV)	0.060	0.060	0.060	0.060	0.060	0.060	0.060
Duct Burner UHC, kg/kJ (HHV)	0.026	0.026	0.026	0.026	0.026	0.026	0.026
Duct Burner VOC (as CH4), lb/MBtu (HHV)	0.024	0.024	0.024	0.024	0.024	0.024	0.024
Duct Burner VOC (as CH4), kg/kJ (HHV)	0.010	0.010	0.010	0.010	0.010	0.010	0.010
Duct Burner Particulate, lb/MBtu (HHV) (front half catch only)	0.010	0.010	0.010	0.010	0.010	0.010	0.010
Duct Burner Particulate, kg/kJ (HHV) (front half catch only)	0.004	0.004	0.004	0.004	0.004	0.004	0.004
Duct Burner Particulate, lb/MBtu (HHV) (front and back half catch)	0.020	0.020	0.020	0.020	0.020	0.020	0.020
Duct Burner Particulate, kg/kJ (HHV) (front and back half catch)	0.009	0.009	0.009	0.009	0.009	0.009	0.009
Duct Burner PM10, lb/MBtu (HHV) (front half catch only)	0.008	0.008	0.008	0.008	0.008	0.008	0.008
Duct Burner PM10, kg/kJ (HHV) (front half catch only)	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Duct Burner PM10, lb/MBtu (HHV) (front and back half catch)	0.016	0.016	0.016	0.016	0.016	0.016	0.016
Duct Burner PM10, kg/kJ (HHV) (front and back half catch)	0.007	0.007	0.007	0.007	0.007	0.007	0.007
Total SO2, lb/h from Duct Burner	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total SO2, kg/h from Duct Burner	0.000	0.000	0.000	0.000	0.000	0.000	0.000
DB NOx, lb/h	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DB NOx, kg/h	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DB CO, lb/h	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DB CO, kg/h	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DB UHC (as CH4), lb/h	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DB UHC (as CH4), kg/h	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DB VOC (as CH4), lb/h	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DB VOC (as CH4), kg/h	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DB Particulate, lb/h (front half catch only)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DB Particulate, kg/h (front half catch only)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DB Particulate, lb/h (front and back half catch)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DB Particulate, kg/h (front and back half catch)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DB PM10, lb/h (front half catch only)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DB PM10, kg/h (front half catch only)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DB PM10, lb/h (front and back half catch)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DB PM10, kg/h (front and back half catch)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Jacksonville Electric Authority
Brandy Branch 2x1 7FA Combined Cycle Project
Estimated Combustion Turbine and Heat Recovery Steam Generator Emissions, Rev 5

Preparer's Initials: UZ
10/26/00

Case Number	14	15	16	17	18	19	20
CTG Performance Reference	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted
CTG Model	7241FA	7241FA	7241FA	7241FA	7241FA	7241FA	7241FA
Diluent/NOx Emission Rate	DLN/42	DLN/42	DLN/42	DLN/42	DLN/42	DLN/42	DLN/42
CTG Fuel Type	Dist. Oil	Dist. Oil	Dist. Oil	Dist. Oil	Dist. Oil	Dist. Oil	Dist. Oil
CTG Load	100%	100%	100%	100%	75%	75%	75%
Ambient Temperature, F	95	59	20	95	95	59	20
HRSG Firing	Unfired	Unfired	Unfired	Unfired	Unfired	Unfired	Unfired
STG Output with two Combustion Turbine Generators in operation, kW	172,650	187,310	189,870	175,490	149,830	162,700	165,920
Heat Recovery Steam Generator Stack Emissions							
NOTE: Exhaust Analysis does not include the effects of post combustion control							
Stack Exhaust Analysis (Volume Basis - Wet)							
Ar	0.88%	0.89%	0.90%	0.88%	0.89%	0.89%	0.90%
CO2	5.27%	5.37%	5.38%	5.30%	5.39%	5.68%	5.82%
H2O	12.70%	11.39%	10.81%	13.29%	12.49%	11.83%	11.44%
N2	70.17%	71.23%	71.69%	69.72%	70.38%	71.17%	71.38%
O2	10.98%	11.11%	11.22%	10.81%	10.85%	10.63%	10.46%
SO2	0.00115%	0.00118%	0.00118%	0.00116%	0.00118%	0.00124%	0.00127%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Stack Emissions							
NOx, ppmvd @15% O2 w/o SCR	42.00	42.00	42.00	42.00	42.00	42.00	42.00
NOx, ppmvd@ user defined oxygen w/o SCR	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
NOx, ppmvd w/o SCR	59.00	59.30	59.00	59.78	60.24	62.87	64.33
NOx, ppmvw w/o SCR	51.51	52.54	52.62	51.84	52.71	55.56	56.97
NOx, lb/h as NO2 w/o SCR	298.63	331.49	351.96	308.33	244.46	269.17	285.16
NOx, lb/MBtu (LHV) as NO2 (incl. duct burner fuel) w/o SCR	0.18	0.18	0.18	0.18	0.18	0.18	0.18
NOx, lb/MBtu (HHV) as NO2 (incl. duct burner fuel) w/o SCR	0.17	0.17	0.17	0.17	0.17	0.17	0.17
NOx, kg/h as NO2	135.46	150.36	159.65	139.86	110.88	122.09	129.35
NOx, mg/Nm3 as NO2 (uncorrected exhaust flow) w/o SCR	111.41	113.62	113.77	112.11	114.10	120.21	123.25
NOx, mg/MJ (LHV) (including duct burner fuel) w/o SCR	78.30	78.27	78.25	78.28	78.35	78.33	78.31
NOx, mg/MJ (HHV) (including duct burner fuel) w/o SCR	73.52	73.49	73.47	73.50	73.57	73.55	73.53
NOx, ppmvd @15% O2 w/ SCR	15.00	15.00	15.00	15.00	15.00	15.00	15.00
NOx, ppmvd@ user defined oxygen w/ SCR	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
NOx, ppmvd w SCR	21.07	21.18	21.07	21.35	21.51	22.45	22.97
NOx, ppmvw w SCR	18.40	18.76	18.79	18.51	18.83	19.84	20.35
NOx, lb/h as NO2 w/ SCR	101.23	112.41	119.37	104.53	82.81	91.21	96.65
NOx, lb/MBtu (LHV) as NO2 (incl. duct burner fuel) w SCR	0.06	0.06	0.06	0.06	0.06	0.06	0.06
NOx, lb/MBtu (HHV) as NO2 (incl. duct burner fuel) w SCR	0.06	0.06	0.06	0.06	0.06	0.06	0.06
NOx, kg/h as NO2	45.92	50.99	54.15	47.42	37.56	41.37	43.84
NOx, mg/Nm3 as NO2 (uncorrected exhaust flow) w SCR	37.77	38.53	38.59	38.01	38.65	40.73	41.77
NOx, mg/MJ (LHV) (including duct burner fuel) w SCR	26.54	26.54	26.54	26.54	26.54	26.54	26.54
NOx, mg/MJ (HHV) (including duct burner fuel) w SCR	24.92	24.92	24.92	24.92	24.92	24.92	24.92
SCR NH3 slip, ppmvd @15% O2	9.00	9.00	9.00	9.00	9.00	9.00	9.00
SCR NH3 slip, lb/h	22.49	24.97	26.52	23.22	18.39	20.26	21.47
CO, ppmvd @ 15% O2 w/o Catalyst	14.24	14.17	14.24	14.05	13.95	13.36	13.06
CO, ppmvd @ user defined O2 w/o Catalyst	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
CO, ppmvd w/o Catalyst	20.00	20.00	20.00	20.00	20.00	20.00	20.00
CO, ppmvw w/o Catalyst	17.46	17.72	17.84	17.34	17.50	17.67	17.71
CO, lb/h w/o Catalyst	61.43	67.86	72.43	62.59	49.21	51.94	53.79
CO, lb/MBtu (LHV) (incl. duct burner fuel) w/o SCR	0.04	0.04	0.04	0.04	0.04	0.04	0.03
CO, lb/MBtu (HHV) (incl. duct burner fuel) w/o SCR	0.04	0.03	0.04	0.03	0.03	0.03	0.03
CO Reduction % w/ Catalyst	0%	0%	0%	0%	0%	0%	0%
CO, ppmvd @ 15% O2 w/ Catalyst	14.24	14.17	14.24	14.05	13.95	13.36	13.06
CO, ppmvd @ user defined O2 w/ Catalyst	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
CO, ppmvd w/ Catalyst	20.00	20.00	20.00	20.00	20.00	20.00	20.00
CO, ppmvw w/ Catalyst	17.46	17.72	17.84	17.34	17.50	17.67	17.71
CO, lb/h w/ Catalyst	58.50	64.63	68.98	59.61	46.87	49.47	51.23
CO, lb/MBtu (LHV) (incl. duct burner fuel) w SCR	0.036	0.035	0.036	0.035	0.035	0.033	0.033
CO, lb/MBtu (HHV) (incl. duct burner fuel) w SCR	0.033	0.033	0.033	0.033	0.033	0.031	0.031
SO2, ppmvd@15% O2 (with no SO2 oxidation)	9.40	9.40	9.40	9.40	9.40	9.40	9.40
SO2, ppmvd at user defined O2 (with no SO2 oxidation)	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
SO2, ppmvd (with no SO2 oxidation)	13.20	13.27	13.20	13.38	13.48	14.07	14.39
SO2, ppmvw (with no SO2 oxidation)	11.53	11.76	11.78	11.60	11.80	12.43	12.75
SO2, lb/h (with no SO2 oxidation)	92.73	102.97	109.35	95.75	75.85	83.55	88.54
SO2, lb/MBtu (LHV) (incl. duct burner fuel)	0.0566	0.0565	0.0565	0.0565	0.0565	0.0566	0.0566
SO2, lb/MBtu (HHV) (incl. duct burner fuel)	0.0531	0.0531	0.0531	0.0531	0.0531	0.0531	0.0531

Jacksonville Electric Authority
Brandy Branch 2x1 7FA Combined Cycle Project
Estimated Combustion Turbine and Heat Recovery Steam Generator Emissions, Rev.5

Preparer's Initials: UZ
10/26/00

Case Number	14	15	16	17	18	19	20
CTG Performance Reference	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted
CTG Model	7241FA	7241FA	7241FA	7241FA	7241FA	7241FA	7241FA
Diluent/NOx Emission Rate	DLN/42	DLN/42	DLN/42	DLN/42	DLN/42	DLN/42	DLN/42
CTG Fuel Type	Dist. Oil	Dist. Oil	Dist. Oil	Dist. Oil	Dist. Oil	Dist. Oil	Dist. Oil
CTG Load	100%	100%	100%	100%	75%	75%	75%
Ambient Temperature, F	95	59	20	95	95	59	20
HRSG Firing	Unfired	Unfired	Unfired	Unfired	Unfired	Unfired	Unfired
STG Output with two Combustion Turbine Generators in operation, kW	172,650	187,310	189,870	175,490	149,830	162,700	165,920
Heat Recovery Steam Generator Stack Emissions - continued							
NOTE: UHC calculations do NOT include the effect of any oxidation in the CO catalyst.							
UHC, ppmvd @ 15% O2	5.71	5.80	5.59	5.67	5.58	5.29	5.18
UHC, ppmvd @ user defined O2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
UHC, ppmvd	8.02	7.90	7.85	8.07	8.00	7.92	7.90
UHC, ppmvw	7.00	7.00	7.00	7.00	7.00	7.00	7.00
UHC, lb/h as CH4	14.10	15.35	16.28	14.47	11.27	11.78	12.17
UHC, lb/MBtu (LHV) (incl. duct burner fuel)	0.009	0.008	0.008	0.009	0.008	0.008	0.008
UHC, lb/MBtu (HHV) (incl. duct burner fuel)	0.008	0.008	0.008	0.008	0.008	0.007	0.007
VOC, ppmvd @ 15% O2 w/o Catalyst	2.85	2.80	2.79	2.84	2.79	2.65	2.58
VOC, ppmvd @ user defined O2 w/o CO catalyst	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
VOC, ppmvd w/o Catalyst	4.01	3.95	3.92	4.04	4.00	3.96	3.95
VOC, ppmvw w/o Catalyst	3.50	3.50	3.50	3.50	3.50	3.50	3.50
VOC, lb/h as CH4 w/o Catalyst	7.05	7.68	8.14	7.24	5.64	5.89	6.09
VOC, lb/MBtu (LHV) (incl. duct burner fuel) w/o CO catalyst	0.0043	0.0042	0.0042	0.0043	0.0042	0.0040	0.0039
VOC, lb/MBtu (HHV) (incl. duct burner fuel) w/o CO catalyst	0.0040	0.0040	0.0040	0.0040	0.0039	0.0037	0.0037
VOC Reduction % w/ Catalyst	0%	0%	0%	0%	0%	0%	0%
VOC, ppmvd @ 15% O2 w/ Catalyst	2.85	2.80	2.79	2.84	2.79	2.65	2.58
VOC, ppmvd @ user defined O2 w/ Catalyst	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
VOC, ppmvd w/ Catalyst	4.01	3.95	3.92	4.04	4.00	3.96	3.95
VOC, ppmvw w/ Catalyst	3.50	3.50	3.50	3.50	3.50	3.50	3.50
VOC, lb/h as CH4 w/ Catalyst	6.72	7.31	7.75	6.89	5.37	5.61	5.80
VOC, lb/MBtu (LHV) (incl. duct burner fuel) w CO catalyst	0.0041	0.0040	0.0040	0.0041	0.0040	0.0038	0.0037
VOC, lb/MBtu (HHV) (incl. duct burner fuel) w CO catalyst	0.0038	0.0038	0.0038	0.0038	0.0038	0.0036	0.0035
Particulate without the effect of SO2 oxidation and SCR catalysts							
Particulates, lb/h (front half catch only)	17.9	17.9	17.9	17.9	17.9	17.9	17.9
Particulates, lb/MBtu (incl. duct burner fuel) (front half catch only)	0.0109	0.0098	0.0092	0.0105	0.0133	0.0121	0.0114
Particulates, lb/h (front and back half catch)	35.7	35.7	35.7	35.7	35.7	35.7	35.7
Particulates, lb/MBtu (incl. duct burner fuel) (front and back half catch)	0.022	0.020	0.018	0.021	0.027	0.024	0.023
PM10, lb/h (front half catch only)	17.0	17.0	17.0	17.0	17.0	17.0	17.0
PM10, lb/MBtu (incl. duct burner fuel) (front half catch only)	0.010	0.009	0.009	0.010	0.013	0.012	0.011
PM10, lb/h (front and back half catch)	34.0	34.0	34.0	34.0	34.0	34.0	34.0
PM10, lb/MBtu (incl. duct burner fuel) (front and back half catch)	0.021	0.019	0.018	0.020	0.025	0.023	0.022
Particulate including the effect of SO2 oxidation and SCR catalysts [includes 2(NH4SO4)]							
Particulates, lb/h (front half catch only)	41.6	44.3	45.9	42.4	37.3	39.3	40.6
Particulates, lb/MBtu (incl. duct burner fuel)(front half catch only)	0.0254	0.0243	0.0237	0.0250	0.0278	0.0266	0.0259
Particulates, lb/h (front and back half catch)	59.5	62.1	63.7	60.3	55.2	57.1	58.4
Particulates, lb/MBtu (incl. duct burner fuel)(front and back half catch)	0.036	0.034	0.033	0.036	0.041	0.039	0.037
PM10, lb/h (front half catch only)	40.8	43.4	45.0	41.6	36.5	38.4	39.7
PM10, lb/MBtu (incl. duct burner fuel)(front half catch only)	0.025	0.024	0.023	0.025	0.027	0.026	0.025
PM10, lb/h (front and back half catch)	57.8	60.4	62.0	58.6	53.5	55.4	56.7
PM10, lb/MBtu (incl. duct burner fuel)(front and back half catch)	0.035	0.033	0.032	0.035	0.040	0.038	0.036
NOTE: SO2 to SO3 conversion rate (assumed), wt%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%
SO3 conversion rate (assumed) to ammonium sulfates [2(NH4SO4)]	90.0%	90.0%	90.0%	90.0%	90.0%	90.0%	90.0%
Remaining SO2 in Exhaust Gas, lb/h	85.31	94.73	100.60	88.09	69.79	76.87	81.45
Amount of SO2 converted to SO3	7.42	8.24	8.75	7.66	6.07	6.68	7.08
Maximum Exhaust Gas ammonium sulfate [2(NH4SO4)], lb/h	23.78	26.41	28.05	24.56	19.46	21.43	22.71
Maximum H2SO4 (assuming 100% conversion from SO3 to H2SO4), lb/hr	11.36	12.61	13.39	11.73	9.29	10.23	10.84
Stack Exit Temperature, F	272	265	265	274	259	255	255
Stack Diameter, ft (estimated)	19	19	19	19	19	19	19
Stack Flow, lb/h	3,365,000	3,683,000	3,914,000	3,444,950	2,693,000	2,827,000	2,925,000
Stack Flow, scfm	756,564	823,151	872,822	776,262	604,579	631,835	652,763
Stack Flow, acfm	1,068,144	1,149,096	1,217,254	1,095,494	836,625	868,831	898,950
Stack Exit Velocity, ft/s	62.7	67.5	71.6	64.4	49.2	51.1	52.8
Selective Catalytic Reduction (SCR)							
NOx Removed, lb/h as NO2	197.4	219.1	232.6	203.8	161.7	178.0	188.5
NOx Removed, percent	66.1%	66.1%	66.1%	66.1%	66.1%	66.1%	66.1%
NH3 Slip, lb/h	22.5	25.0	26.5	23.2	18.4	20.3	21.5
Total NH3 consumption, lb/h (1:1 stoichiometric ratio, incl. slip)	95.6	106.1	112.6	98.7	78.2	86.1	91.3
Adjusted Stack Diameter (ft) estimated	18.0	18.0	18.0	18.0	18.0	18.0	18.0
Stack Exit Velocity, ft/s	69.8	75.3	79.7	71.7	54.8	56.9	58.9

Notes:

1. The emissions estimates shown in the table above are per stack.

2. The combustion turbine generator performance and emissions is based on a General Electric performance estimate provided by JEA.

3. The combustion turbine emissions estimate may include margin as indicated in the table.

Where catalysts are involved to reduce emissions, the margin applied to the CTG emissions only effects the amount of emissions removed, but not the stack emissions.

4. UHC calculations do not include the effects of any oxidation in the CO catalyst. It was assumed that the VOC/UHC ratio is 20% for natural gas firing, and 50% for distillate oil firing.

5. It was assumed that the front and back half catch of CTG particulate emissions is twice the amount of front half catch only.

6. Duct Burner emissions are Black & Veatch estimates based on typical vendor data.

7. It was assumed that ammonium sulfate is measured as front half particulates. The assumption that 100% SO3 is converted to ammonium sulfates results in "worst case" particulate emissions.

8. The maximum amount of ammonium sulfates and sulfuric acid shown in the table can not occur in parallel at the same time.

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Preparer's Initials: UZ
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Project number 99262.0040

Case Number	21	22	23
CTG Performance Reference	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted
CTG Model	7241FA	7241FA	7241FA
Diluent/NOx Emission Rate	DLN/42	DLN/42	DLN/42
CTG Fuel Type	Dist. Oil	Dist. Oil	Dist. Oil
CTG Load	50%	50%	50%
Ambient Temperature, F	95	59	20
HRSG Firing	Unfired	Unfired	Unfired
STG Output with two Combustion Turbine Generators in operation, kW	128,150	139,530	141,360
Ambient Temperature, F	95.0	59.0	20.0
Ambient Temperature, C	35.0	15.0	(6.7)
Ambient Relative Humidity, %	60.0	60.0	60.0
Atmospheric Pressure, psia	14.690	14.690	14.690
Atmospheric Pressure, bar(a)	1.013	1.013	1.013
CTG Compressor Inlet Dry Bulb Temperature, F	95.0	59.0	20.0
CTG Compressor Inlet Temperature, C	35.0	15.0	(6.7)
CTG Compr. Inlet Relative Humidity, %	60.1	60.2	60.3
CTG Inlet Air Conditioning Included?	No	No	No
Inlet Loss, in. H2O	3.5	3.5	3.5
Inlet Loss, mm. H2O	88.9	88.9	88.9
Exhaust Loss, in. H2O	15.0	15.0	15.0
Exhaust Loss, mm. H2O	381.0	381.0	381.0
CTG Load Level (percent of Base Load)	50%	50%	50%
Gross CTG Output, kW	79,030	89,790	95,120
Gross CTG Heat Rate, Btu/kWh (LHV)	13,450	12,950	12,850
Gross CTG Heat Rate, KJ/KWh (LHV)	14,191	13,663	13,557
Gross CTG Heat Rate, kJ/kWh (HHV)	14,324	13,792	13,685
Gross CTG Heat Rate, KJ/KWh (HHV)	15,113	14,551	14,438
CTG Heat Input, MBtu/h (LHV)	1,063.0	1,162.8	1,222.3
CTG Heat Input, GJ/h (LHV)	1,121.5	1,226.8	1,289.6
CTG Heat Input, MBtu/h (HHV)	1,132.1	1,238.4	1,301.8
CTG Heat Input, GJ/h (HHV)	1,194.4	1,306.6	1,373.4
CTG Water Injection Flow, lb/h	46,070	61,970	68,710
CTG Water Injection Flow, kg/h	20,897	28,109	31,166
CTG Steam Injection Flow, lb/h	0	0	0
CTG Steam Injection Flow, kg/h	0	0	0
Injection Fluid/Fuel Ratio	0.0	0.0	0.0
CTG Exhaust Flow, lb/h	2,318,000	2,406,000	2,439,000
CTG Exhaust Flow, kg/h	1,051,427	1,091,343	1,106,312
CTG Exhaust Temperature, F	1,207	1,207	1,207
CTG Exhaust Temperature, C	652.8	652.8	652.8
CTG Exhaust Enthalpy, Btu/lb	300.97	308.44	318.00
CTG Exhaust Enthalpy, kJ/lb	317.54	325.42	335.51
CTG Exhaust Enthalpy Reference Temperature, F	95	59	20
CTG Exhaust Enthalpy Reference Temperature, C	35.0	15.0	(6.7)
CTG Exhaust Heat, MBtu/h	697.6	742.1	775.6
CTG Exhaust Heat, GJ/h	736.1	783.0	818.3
CTG Exhaust Heat/CTG Output, kW/kW	258.7%	242.2%	239.0%
Total CTG Fuel Flow, lb/h	57300	62680	65890
CTG Fuel Temperature, F	60	60	60
CTG Fuel LHV, Btu/lb	18,550	18,550	18,550
CTG Fuel LHV, kJ/lb	43,147	43,147	43,147
CTG Fuel HHV, Btu/lb	19,756	19,756	19,756
CTG Fuel HHV, kJ/lb	45,952	45,952	45,952
HHV/LHV Ratio	1.0650	1.0650	1.0650
CTG Fuel Composition (Ultimate Analysis by Weight)			
Ar	0.00%	0.00%	0.00%
C	85.59%	85.59%	85.59%
H2	14.35%	14.35%	14.35%
N2	0.02%	0.02%	0.02%
O2	0.00%	0.00%	0.00%
S	0.05000%	0.05000%	0.05000%
Total	100.0%	100.0%	100.0%
Fuel Sulfur Content (grains/100 standard cubic feet)	N/A	N/A	N/A

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Project number 99262.0040

Case Number	21	22	23
CTG Performance Reference	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted
CTG Model	7241FA	7241FA	7241FA
Diluent/NOx Emission Rate	DLN/42	DLN/42	DLN/42
CTG Fuel Type	Dist. Oil	Dist. Oil	Dist. Oil
CTG Load	50%	50%	50%
Ambient Temperature, F	95	59	20
HRSG Firing	Unfired	Unfired	Unfired
STG Output with two Combustion Turbine Generators in operation, kW	128,150	139,530	141,360
Combustion Turbine Exhaust Emissions			
CTG Exhaust Analysis (Volume Basis - Wet)			
Ar	0.89%	0.91%	0.91%
CO2	4.98%	5.27%	5.47%
H2O	11.23%	10.26%	10.11%
N2	71.21%	72.08%	72.28%
O2	11.69%	11.48%	11.23%
SO2	0.00109%	0.00115%	0.00120%
Total	100.0%	100.0%	100.0%
NOx, ppmvd @15% O2	42.00	42.00	42.00
NOx, ppmvd @ 15% O2	42.00	42.00	42.00
NOx, ppmvd	54.85	57.46	59.56
NOx, ppmvw (wet - uncorrected exhaust gas)	48.69	51.56	53.54
NOx Massflow Added to Match CTG Manufacturer's NOx Emissions Estimate	1.00	1.00	1.00
Additonal Percent Margin Included in NOx Emissions below	5%	5%	5%
NOx, lb/h as NO2	193.92	212.04	222.84
NOx, lb/MBtu (LHV)	0.18	0.18	0.18
NOx, lb/MBtu (HHV)	0.17	0.17	0.17
NOx, mg/Nm3 as NO2 (dry, 15% O2)	91.01	90.97	90.95
NOx, mg/Nm3 as NO2 (dry, 15% O2)	91.01	90.97	90.95
NOx, mg/Nm3 as NO2 (dry)	118.86	124.46	128.99
NOx, mg/Nm3 as NO2 (wet - uncorrected exhaust flow)	105.51	111.68	115.95
NOx, mg/MJ (LHV)	78.43	78.40	78.38
NOx, mg/MJ (HHV)	73.65	73.61	73.60
CO, ppmvd @ 15% O2	27.57	21.93	18.33
CO, ppmvd @ 15% O2	27.57	21.93	18.33
CO, ppmvd	36.00	30.00	26.00
CO, ppmvw (wet - uncorrected exhaust gas)	31.96	26.92	23.37
CO Massflow Added to Match CTG Manufacturer's CO Emissions Estimate	0.00	0.00	0.00
Additional Percent Margin included in CO Emissions below	5%	5%	5%
CO, lb/h	77.09	67.08	58.96
CO, lb/MBtu (LHV)	0.07	0.06	0.05
CO, lb/MBtu (HHV)	0.07	0.05	0.05
CO, mg/Nm3 (wet - uncorrected exhaust flow)	41.94	35.33	30.67
CO, mg/Nm3 (dry)	47.25	39.37	34.12
CO, mg/Nm3 (dry, 15% O2)	36.18	28.78	24.06
CO, mg/Nm3 (dry, 15% O2)	36.18	28.78	24.06
CO, mg/MJ (LHV)	31.18	24.60	20.74
CO, mg/MJ (HHV)	29.28	23.29	19.47
NOTE: SO2 estimate does not include the effects of SO2 oxidation			
SO2, ppmvd @ 15% O2 (with no SO2 oxidation)	9.40	9.40	9.40
SO2, ppmvd @ 15% O2 (with no SO2 oxidation)	9.40	9.40	9.40
SO2, ppmvd (with no SO2 oxidation)	12.27	12.86	13.33
SO2, ppmvw (with no SO2 oxidation)(wet - uncorrected exhaust gas)	10.90	11.54	11.98
SO2 Massflow Added to Match CTG Manufacturer's CO Emissions Estimate	0.00	0.00	0.00
Additional Percent Margin Included in SO2 Emissions below	5%	5%	5%
SO2, lb/h (with no SO2 oxidation)	60.11	65.75	69.12
SO2, lb/MBtu (LHV) (with no SO2 oxidation)	0.0565	0.0565	0.0565
SO2, lb/MBtu (HHV) (with no SO2 oxidation)	0.0531	0.0531	0.0531
SO2, mg/Nm3 (wet - uncorrected exhaust flow) (with no SO2 oxidation)	32.70	34.63	35.96
SO2, mg/Nm3 (dry, 15% O2) (with no SO2 oxidation)	28.21	28.21	28.21
SO2, mg/Nm3 (dry, 15% O2) (with no SO2 oxidation)	28.21	28.21	28.21
SO2, mg/Nm3 (dry) (with no SO2 oxidation)	36.84	36.59	40.01
SO2, mg/MJ (LHV) (with no SO2 oxidation)	24.31	24.31	24.31
SO2, mg/MJ (HHV) (with no SO2 oxidation)	22.83	22.83	22.83

Preparer's Initials: UZ
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Project number 99262.0040

Case Number	21	22	23
CTG Performance Reference	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted
CTG Model	7241FA	7241FA	7241FA
Diluent/NOx Emission Rate	DLN/42	DLN/42	DLN/42
CTG Fuel Type	Dist. Oil	Dist. Oil	Dist. Oil
CTG Load	50%	50%	50%
Ambient Temperature, F	95	59	20
HRSG Firing	Unfired	Unfired	Unfired
STG Output with two Combustion Turbine Generators in operation, kW	128,150	139,530	141,360
Combustion Turbine Exhaust Emissions - continued			
UHC, ppmvd @ 15% O2	6.04	5.70	5.49
UHC, ppmvd @ 15% O2	6.04	5.70	5.49
UHC, ppmvd	7.89	7.80	7.79
UHC, ppmvw (wet - uncorrected exhaust gas)	7.00	7.00	7.00
UHC Massflow Added to Match CTG Manufacturer's CO Emissions Estimate	0.00	0.00	0.00
Additional Percent Margin included in UHC Emissions Below	5%	5%	5%
UHC, lb/h as CH4	9.87	9.99	10.11
UHC, lb/MBtu as CH4 (LHV)	0.0091	0.0086	0.0083
UHC, lb/MBtu as CH4 (HHV)	0.0085	0.0081	0.0078
UHC, mg/Nm3 as CH4 (dry, 15% O2)	4.54	4.29	4.13
UHC, mg/Nm3 as CH4 (dry, 15% O2)	4.54	4.29	4.13
UHC, mg/Nm3 as CH4 (dry)	5.93	5.86	5.85
UHC, mg/Nm3 as CH4 (wet - uncorrected exhaust flow)	5.26	5.26	5.26
UHC, mg/MJ as CH4 (LHV)	3.91	3.69	3.56
UHC, mg/MJ as CH4 (HHV)	3.67	3.47	3.34
VOC percentage of UHC	50.0%	50.0%	50.0%
VOC, ppmvd @ 15% O2	3.0	2.9	2.7
VOC, ppmvd @ 15% O2	3.0	2.9	2.7
VOC, ppmvd	3.94	3.90	3.89
VOC, ppmvw (wet - uncorrected exhaust flow)	3.50	3.50	3.50
VOC Massflow Added to Match CTG Manufacturer's VOC Emissions Estimate	0.00	0.00	0.00
Additional Percent Margin included in VOC Emissions below	5%	5%	5%
VOC, lb/h as CH4	4.84	4.99	5.06
VOC, lb/MBtu as CH4 (LHV)	0.0045	0.0043	0.0041
VOC, lb/MBtu as CH4 (HHV)	0.0043	0.0040	0.0039
VOC, mg/Nm3 as CH4 (dry, 15% O2)	2.27	2.14	2.06
VOC, mg/Nm3 as CH4 (dry, 15% O2)	2.27	2.14	2.06
VOC, mg/Nm3 as CH4 (dry)	2.96	2.93	2.93
VOC, mg/Nm3 as CH4 (wet - uncorrected exhaust flow)	2.63	2.63	2.63
VOC, mg/MJ as CH4 (LHV)	1.96	1.85	1.78
VOC, mg/MJ as CH4 (HHV)	1.84	1.73	1.67
Percent Margin included in Particulates Emissions below	5%	5%	5%
Particulates, lb/h (front half catch only)	17.85	17.85	17.85
Particulates, lb/h (front and back half catch)	35.70	35.70	35.70
Particulates, lb/MBtu (LHV) (front half catch only)	0.0168	0.0154	0.0146
Particulates, lb/MBtu (HHV) (front half catch only)	0.0158	0.0144	0.0137
Particulates, mg/Nm3 (dry, 15% O2) (front half catch only)	8.38	7.66	7.29
Particulates, mg/Nm3 (dry, 15% O2) (front half catch only)	8.38	7.66	7.29
Particulates, mg/Nm3 (dry) (front half catch only)	10.94	10.48	10.33
Particulates, mg/Nm3 (wet - uncorrected exhaust flow) (front half catch only)	9.71	9.40	9.29
Particulates, mg/MJ (LHV) (front half catch only)	7.22	6.60	6.28
Particulates, mg/MJ (HHV) (front half catch only)	6.78	6.20	5.90
Percent Margin included in PM10 Emissions below	0%	0%	0%
PM10, lb/h (front half catch only)	17.00	17.00	17.00
PM10, lb/h (front and back half catch)	34.00	34.00	34.00
PM10, lb/MBtu (LHV) (front and back half catch)	0.03	0.03	0.03
PM10, lb/MBtu (HHV) (front and back half catch)	0.03	0.03	0.03
PM10, mg/Nm3 (dry, 15% O2) (front and back half catch)	15.96	14.59	13.88
PM10, mg/Nm3 (dry, 15% O2) (front and back half catch)	15.96	14.59	13.88
PM10, mg/Nm3 (dry) (front and back half catch)	20.84	19.96	19.68
PM10, mg/Nm3 (wet - uncorrected exhaust flow) (front and back half catch)	18.50	17.91	17.69
PM10, mg/MJ (LHV) (front and back half catch)	13.75	12.57	11.96
PM10, mg/MJ (HHV) (front and back half catch)	12.91	11.80	11.23
CTG Wet (Total) Exhaust Gas Analysis			
Molecular Wt, lb/mol	28.26	28.40	28.44
Molecular Wt, kg/mol	12.82	12.88	12.90
Gas Constant, ft-lbf/lbm-R	54.667	54.404	54.331
Specific Volume, ft^3/lb	41.54	41.34	41.28
Specific Volume, m^3/kg	2.59	2.58	2.58
Exhaust Gas Flow, acfm	1,604,829	1,657,734	1,678,032
Specific Volume, scf/lb	13.42	13.36	13.34
Exhaust Gas Flow, scfm	518,459	535,736	542,271
Specific Volume, Nm3/kg	0.7929	0.7891	0.7880
Exhaust Gas Flow, Nm3/s	231.56	239.22	242.16

Preparer's Initials: UZ
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Case Number	21	22	23
CTG Performance Reference	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted
CTG Model	7241FA	7241FA	7241FA
Diluent/NOx Emission Rate	DLN/42	DLN/42	DLN/42
CTG Fuel Type	Dist. Oil	Dist. Oil	Dist. Oil
CTG Load	50%	50%	50%
Ambient Temperature, F	95	59	20
HRSG Firing	Unfired	Unfired	Unfired
STG Output with two Combustion Turbine Generators in operation, kW	128,150	139,530	141,360
Duct Burner Emissions			
Duct Burner Heat Input, MBtu/h (LHV) (margin included)	0.0	0.0	0.0
Duct Burner Heat Input, GJ/h (LHV) (margin included)	0.0	0.0	0.0
Duct Burner Heat Input, MBtu/h (HHV) (margin included)	0.0	0.0	0.0
Duct Burner Heat Input, GJ/h (HHV) (margin included)	0.0	0.0	0.0
Total Duct Burner Fuel Flow, lb/h	0	0	0
Duct Burner Fuel LHV, Btu/lb	18,550	18,550	18,550
Duct Burner Fuel HHV, kJ/kg	43,147	43,147	43,147
Duct Burner Fuel HHV, Btu/lb	19,756	19,756	19,756
Duct Burner Fuel HHV, kJ/kg	45,952	45,952	45,952
Duct Burner Fuel Composition (Ultimate Analysis by Weight)			
Ar	0.00%	0.00%	0.00%
C	85.59%	85.59%	85.59%
H2	14.35%	14.35%	14.35%
N2	0.02%	0.02%	0.02%
O2	0.00%	0.00%	0.00%
S	0.05000%	0.05000%	0.05000%
Total	100.0%	100.0%	100.0%
Fuel Sulfur Content (grains/100 standard cubic feet)	N/A	N/A	N/A
Duct Burner NOx, lb/MBtu (HHV)	0.080	0.080	0.080
Duct Burner NOx, kg/kJ (HHV)	0.034	0.034	0.034
Duct Burner CO, lb/MBtu (HHV)	0.100	0.100	0.100
Duct Burner CO, kg/kJ (HHV)	0.043	0.043	0.043
Duct Burner UHC (as CH4), lb/MBtu (HHV)	0.060	0.060	0.060
Duct Burner UHC, kg/kJ (HHV)	0.026	0.026	0.026
Duct Burner VOC (as CH4), lb/MBtu (HHV)	0.024	0.024	0.024
Duct Burner VOC (as CH4), kg/kJ (HHV)	0.010	0.010	0.010
Duct Burner Particulate, lb/MBtu (HHV) (front half catch only)	0.010	0.010	0.010
Duct Burner Particulate, kg/kJ (HHV) (front half catch only)	0.004	0.004	0.004
Duct Burner Particulate, lb/MBtu (HHV) (front and back half catch)	0.020	0.020	0.020
Duct Burner Particulate, kg/kJ (HHV) (front and back half catch)	0.009	0.009	0.009
Duct Burner PM10, lb/MBtu (HHV) (front half catch only)	0.008	0.008	0.008
Duct Burner PM10, kg/kJ (HHV) (front half catch only)	0.003	0.003	0.003
Duct Burner PM10, lb/MBtu (HHV) (front and back half catch)	0.016	0.016	0.016
Duct Burner PM10, kg/kJ (HHV) (front and back half catch)	0.007	0.007	0.007
Total SO2, lb/h from Duct Burner	0.000	0.000	0.000
Total SO2, kg/h from Duct Burner	0.000	0.000	0.000
DB NOx, lb/h	0.00	0.00	0.00
DB NOx, kg/h	0.00	0.00	0.00
DB CO, lb/h	0.00	0.00	0.00
DB CO, kg/h	0.00	0.00	0.00
DB UHC (as CH4), lb/h	0.00	0.00	0.00
DB UHC (as CH4), kg/h	0.00	0.00	0.00
DB VOC (as CH4), lb/h	0.00	0.00	0.00
DB VOC (as CH4), kg/h	0.00	0.00	0.00
DB Particulate, lb/h (front half catch only)	0.00	0.00	0.00
DB Particulate, kg/h (front half catch only)	0.00	0.00	0.00
DB Particulate, lb/h (front and back half catch)	0.00	0.00	0.00
DB Particulate, kg/h (front and back half catch)	0.00	0.00	0.00
DB PM10, lb/h (front half catch only)	0.00	0.00	0.00
DB PM10, kg/h (front half catch only)	0.00	0.00	0.00
DB PM10, lb/h (front and back half catch)	0.00	0.00	0.00
DB PM10, kg/h (front and back half catch)	0.00	0.00	0.00

Preparer's Initials. UZ
10/26/00

Project number 99262.0040

Case Number	21	22	23
CTG Performance Reference	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted
CTG Model	7241FA	7241FA	7241FA
Diluent/NOx Emission Rate	DLN/42	DLN/42	DLN/42
CTG Fuel Type	Dist. Oil	Dist. Oil	Dist. Oil
CTG Load	50%	50%	50%
Ambient Temperature, F	95	59	20
HRSG Firing	Unfired	Unfired	Unfired
STG Output with two Combustion Turbine Generators in operation, kW	128,150	139,530	141,360
Heat Recovery Steam Generator Stack Emissions			
NOTE: Exhaust Analysis does not include the effects of post combustion control			
Stack Exhaust Analysis (Volume Basis - Wet)			
Ar	0.89%	0.91%	0.91%
CO2	4.96%	5.27%	5.47%
H2O	11.23%	10.26%	10.11%
N2	71.21%	72.08%	72.28%
O2	11.69%	11.48%	11.23%
SO2	0.00109%	0.00115%	0.00120%
Total	100.0%	100.0%	100.0%
Stack Emissions			
NOx, ppmvd @15% O2 w/o SCR	42.00	42.00	42.00
NOx, ppmvd@ user defined oxygen w/o SCR	#N/A	#N/A	#N/A
NOx, ppmvd w/o SCR	54.85	57.46	59.56
NOx, ppmvw w/o SCR	48.69	51.56	53.54
NOx, lb/h as NO2 w/o SCR	193.92	212.04	222.84
NOx, lb/MBtu (LHV) as NO2 (incl. duct burner fuel) w/o SCR	0.18	0.18	0.18
NOx, lb/MBtu (HHV) as NO2 (incl. duct burner fuel) w/o SCR	0.17	0.17	0.17
NOx, kg/h as NO2	87.96	96.18	101.08
NOx, mg/Nm3 as NO2 (uncorrected exhaust flow) w/o SCR	105.51	111.68	115.95
NOx, mg/MJ (LHV) (including duct burner fuel) w/o SCR	78.43	78.40	78.38
NOx, mg/MJ (HHV) (including duct burner fuel) w/o SCR	73.65	73.61	73.60
NOx, ppmvd @15% O2 w/ SCR	15.00	15.00	15.00
NOx, ppmvd@ user defined oxygen w/ SCR	#N/A	#N/A	#N/A
NOx, ppmvd w SCR	19.59	20.52	21.27
NOx, ppmvw w SCR	17.39	18.42	19.12
NOx, lb/h as NO2 w/ SCR	65.62	71.78	75.46
NOx, lb/MBtu (LHV) as NO2 (incl. duct burner fuel) w SCR	0.06	0.06	0.06
NOx, lb/MBtu (HHV) as NO2 (incl. duct burner fuel) w SCR	0.06	0.06	0.06
NOx, kg/h as NO2	29.76	32.56	34.23
NOx, mg/Nm3 as NO2 (uncorrected exhaust flow) w SCR	35.70	37.81	39.26
NOx, mg/MJ (LHV) (including duct burner fuel) w SCR	26.54	26.54	26.54
NOx, mg/MJ (HHV) (including duct burner fuel) w SCR	24.92	24.92	24.92
SCR NH3 slip, ppmvd @15% O2	9.00	9.00	9.00
SCR NH3 slip, lb/h	14.58	15.94	16.76
CO, ppmvd @ 15% O2 w/o Catalyst	27.57	21.93	18.33
CO, ppmvd @ user defined O2 w/o Catalyst	#N/A	#N/A	#N/A
CO, ppmvd w/o Catalyst	36.00	30.00	26.00
CO, ppmvw w/o Catalyst	31.96	26.92	23.37
CO, lb/h w/o Catalyst	77.09	67.08	58.98
CO, lb/MBtu (LHV) (incl. duct burner fuel) w/o SCR	0.07	0.06	0.05
CO, lb/MBtu (HHV) (incl. duct burner fuel) w/o SCR	0.07	0.05	0.05
CO Reduction % w/ Catalyst	0%	0%	0%
CO, ppmvd @ 15% O2 w/ Catalyst	27.57	21.93	18.33
CO, ppmvd @ user defined O2 w/ Catalyst	#N/A	#N/A	#N/A
CO, ppmvd w/ Catalyst	36.00	30.00	26.00
CO, ppmvw w/ Catalyst	31.96	26.92	23.37
CO, lb/h w/ Catalyst	73.42	63.89	56.15
CO, lb/MBtu (LHV) (incl. duct burner fuel) w SCR	0.069	0.055	0.046
CO, lb/MBtu (HHV) (incl. duct burner fuel) w SCR	0.065	0.052	0.043
SO2, ppmvd@15% O2 (with no SO2 oxidation)	9.40	9.40	9.40
SO2, ppmvd at user defined O2 (with no SO2 oxidation)	#N/A	#N/A	#N/A
SO2, ppmvd (with no SO2 oxidation)	12.27	12.86	13.33
SO2, ppmvw (with no SO2 oxidation)	10.90	11.54	11.98
SO2, lb/h (with no SO2 oxidation)	80.11	66.75	69.12
SO2, lb/MBtu (LHV) (incl. duct burner fuel)	0.0565	0.0565	0.0565
SO2, lb/MBtu (HHV) (incl. duct burner fuel)	0.0531	0.0531	0.0531

Preparer's Initials: UZ
10/26/00

Project number 99262.0040

Case Number	21	22	23
CTG Performance Reference	GE/JEA-adjusted	GE/JEA-adjusted	GE/JEA-adjusted
CTG Model	7241FA	7241FA	7241FA
Diluent/NOx Emission Rate	DLN/42	DLN/42	DLN/42
CTG Fuel Type	Dist. Oil	Dist. Oil	Dist. Oil
CTG Load	50%	50%	50%
Ambient Temperature, F	95	59	20
HRSG Firing	Unfired	Unfired	Unfired
STG Output with two Combustion Turbine Generators in operation, kW	128,150	139,530	141,360
Heat Recovery Steam Generator Stack Emissions - continued			
NOTE: UHC calculations do NOT include the effect of any oxidation in the CO catalyst.			
UHC, ppmvd @ 15% O2	6.04	5.76	5.49
UHC, ppmvd @ user defined O2	#N/A	#N/A	#N/A
UHC, ppmvd	7.89	7.80	7.79
UHC, ppmvw	7.00	7.00	7.00
UHC, lb/h as CH4	9.67	9.99	10.11
UHC, lb/MBtu (LHV) (incl. duct burner fuel)	0.009	0.009	0.008
UHC, lb/MBtu (HHV) (incl. duct burner fuel)	0.009	0.008	0.008
VOC, ppmvd @ 15% O2 w/o Catalyst	3.02	2.85	2.75
VOC, ppmvd @ user defined O2 w/o CO catalyst	#N/A	#N/A	#N/A
VOC, ppmvd w/o Catalyst	3.94	3.90	3.89
VOC, ppmvw w/o Catalyst	3.50	3.50	3.50
VOC, lb/h as CH4 w/o Catalyst	4.84	4.99	5.06
VOC, lb/MBtu (LHV) (incl. duct burner fuel) w/o CO catalyst	0.0045	0.0043	0.0041
VOC, lb/MBtu (HHV) (incl. duct burner fuel) w/o CO catalyst	0.0043	0.0040	0.0039
VOC Reduction % w/ Catalyst	0%	0%	0%
VOC, ppmvd @ 15% O2 w/ Catalyst	3.02	2.85	2.75
VOC, ppmvd @ user defined O2 w/ Catalyst	#N/A	#N/A	#N/A
VOC, ppmvd w/ Catalyst	3.94	3.90	3.89
VOC, ppmvw w/ Catalyst	3.50	3.50	3.50
VOC, lb/h as CH4 w/ Catalyst	4.81	4.76	4.82
VOC, lb/MBtu (LHV) (incl. duct burner fuel) w CO catalyst	0.0043	0.0041	0.0039
VOC, lb/MBtu (HHV) (incl. duct burner fuel) w CO catalyst	0.0041	0.0038	0.0037
Particulate without the effect of SO2 oxidation and SCR catalysts			
Particulates, lb/h (front half catch only)	17.9	17.9	17.9
Particulates, lb/MBtu (incl. duct burner fuel) (front half catch only)	0.0168	0.0154	0.0146
Particulates, lb/h (front and back half catch)	35.7	35.7	35.7
Particulates, lb/MBtu (incl. duct burner fuel) (front and back half catch)	0.034	0.031	0.029
PM10, lb/h (front half catch only)	17.0	17.0	17.0
PM10, lb/MBtu (incl. duct burner fuel) (front half catch only)	0.016	0.015	0.014
PM10, lb/h (front and back half catch)	34.0	34.0	34.0
PM10, lb/MBtu (incl. duct burner fuel) (front and back half catch)	0.032	0.029	0.028
Particulate including the effect of SO2 oxidation and SCR catalysts [includes 2(NH4SO4)]			
Particulates, lb/h (front half catch only)	33.3	34.7	35.6
Particulates, lb/MBtu (incl. duct burner fuel)(front half catch only)	0.0313	0.0299	0.0291
Particulates, lb/h (front and back half catch)	51.1	52.6	53.4
Particulates, lb/MBtu (incl. duct burner fuel)(front and back half catch)	0.048	0.045	0.044
PM10, lb/h (front half catch only)	32.4	33.9	34.7
PM10, lb/MBtu (incl. duct burner fuel)(front half catch only)	0.030	0.029	0.028
PM10, lb/h (front and back half catch)	49.4	50.9	51.7
PM10, lb/MBtu (incl. duct burner fuel)(front and back half catch)	0.046	0.044	0.042
NOTE: SO2 to SO3 conversion rate (assumed), wt%	8.0%	8.0%	8.0%
SO3 conversion rate (assumed) to ammonium sulfates [2(NH4SO4)]	90.0%	90.0%	90.0%
Remaining SO2 in Exhaust Gas, lb/h	55.30	60.49	63.59
Amount of SO2 converted to SO3	4.81	5.26	5.53
Maximum Exhaust Gas ammonium sulfate [2(NH4SO4)], lb/h	15.42	16.86	17.73
Maximum H2SO4 (assuming 100% conversion from SO3 to H2SO4), lb/hr	7.36	8.05	8.47
Stack Exit Temperature, F	252	250	250
Stack Diameter, ft (estimated)	19	19	19
Stack Flow, lb/h	2,318,000	2,406,000	2,439,000
Stack Flow, scfm	518,459	535,736	542,271
Stack Flow, acfm	710,081	731,825	741,456
Stack Exit Velocity, ft/s	41.7	43.0	43.6
Selective Catalytic Reduction (SCR)			
NOx Removed, lb/h as NO2	128.3	140.3	147.4
NOx Removed, percent	66.2%	66.1%	66.1%
NH3 Slip, lb/h	14.6	15.9	16.8
Total NH3 consumption, lb/h (1:1 stoichiometric ratio, incl. slip)	62.1	67.9	71.3
Adjusted Stack Diameter (ft) estimated	18.0	18.0	19.0
Stack Exit Velocity, ft/s	46.5	47.9	48.6

Notes:

1. The emissions estimates shown in the table above are per stack.
2. The combustion turbine generator performance and emissions is based on a General Electric performance estimate provided by JEA.
3. The combustion turbine emissions estimate may include margin as indicated in the table.

   Where catalysts are involved to reduce emissions, the margin applied to the CTG emissions only effects the amount of emissions removed, but not the stack emissions.

4. UHC calculations do not include the effects of any oxidation in the CO catalyst. It was assumed that the VOC/UHC ratio is 20% for natural gas firing, and 50% for distillate oil firing.
5. It was assumed that the front and back half catch of CTG particulate emissions is twice the amount of front half catch only.
6. Duct Burner emissions are Black & Veatch estimates based on typical vendor data.
7. It was assumed that ammonium sulfate is measured as front half particulates. The assumption that 100% SO3 is converted to ammonium sulfates results in "worst case" particulate emissions.
8. The maximum amount of ammonium sulfates and sulfuric acid shown in the table can not occur in parallel at the same time.

Attachment 2
Potential-To-Emit (PTE) and Enveloped Spreadsheet

POTENTIAL TO EMIT EMISSION ESTIMATES FOR CRITERIA EMISSIONS

Criteria Emissions from Natural Gas Combustion Per Turbine

Pollutant	Max lb/h @59F	Hours of operation (h/yr)	Total Emission (tpy)
NO_x	23.62	8472.0	100.05
CO	52.58	8472.0	222.73
PM/PM_{10}	19.80	8472.0	83.87
SO_2	1.16	8472.0	4.91
VOC	3.49	8472.0	14.78
H2SO4	0.18	8472.0	0.76

Criteria Emissions from Fuel Oil Combustion Per Turbine

Pollutant	Max lb/h @59f	Hours of operation (h/yr)	Total Emission (tpy)
NO_x	112.41	288	16.19
CO	67.86	288	9.77
PM/PM_{10}	62.10	288	8.94
SO_2	102.97	288	14.83
VOC	7.68	288	1.11
H2SO4	12.61	288	1.82
LEAD	2.72E-03	288	3.91E-03

Combined Natural Gas and Fuel Oil for two turbines

Pollutant	Total (tpy)	No of turbines	Total Emission (tpy)
NO_x	116.24	2	232.48
CO	232.50	2	465.00
PM/PM_{10}	92.82	2	185.63
SO_2	19.74	2	39.48
VOC	15.89	2	31.78
H2SO4	2.58	2	5.16
LEAD	3.91E-03	2	0.01

Brandy Branch Hazardous Air Pollutants (HAP)

Pollutant	CC Combustion Turbines[c]-Natural Gas			CC Combustion Turbines[c]-Fuel Oil			Duct Burner[d]	
	Emission Factor lb/MMBtu	Emission rate (tons/yr)[a]		Emission Factor lb/MMBtu	Emission rate (tons/yr)[a]		Emission Factor (lb/10^6 scf)	Emission rate (tons/yr)[b]
1,3 Butadiene	4.30E-07	3.25E-03		1.60E-05	4.47E-03			
Acetaldehyde	4.00E-05	3.03E-01						
Acrolein	6.40E-06	4.84E-02						
Arsenic							2.00E-04	1.90E-05
Benzene	1.20E-05	9.08E-02		5.50E-05	1.54E-02		2.10E-03	2.00E-04
Beryllium							1.20E-05	1.14E-06
Cadmium							1.10E-03	1.05E-04
Chromium							1.40E-03	1.33E-04
Cobalt							8.40E-05	7.99E-06
Dichlorobenzene							1.20E-03	1.14E-04
Ethylbenzene	3.20E-05	2.42E-01						
Formaldehyde[e]	8.42E-05	6.37E-01		2.80E-04	7.82E-02		7.50E-02	7.13E-03
Hexane							1.80E+00	1.71E-01
Manganese							3.80E-04	3.61E-05
Mercury							2.60E-04	2.47E-05
Naphthalene	1.30E-06	9.83E-03		3.50E-05	9.77E-03		6.10E-04	5.80E-05
Nickel							2.10E-03	2.00E-04
Propylene Oxide	2.90E-05	2.19E-01						
Selenium							2.40E-05	2.28E-06
Toluene	1.30E-04	9.83E-01					3.40E-03	3.23E-04
Xylenes	6.40E-05	4.84E-01						

(a)The highest HHV was used from 59 degree Natural Gas and Fuel Oil turbine data (1785.3 MBtu/hr, 1939.3 MBtu/hr respecitvely). The limit of operation for Natural Gas and Fuel Oil are 8472 and 288 hours per year, respectively.
(b)The highest HHV was used from 59 degree Natural Gas turbine data (22.9 MBtu/hr).
(c)AP-42 Emission Factor Table 3.1-3 for Natural Gas and Table 3.1-4 for Fuel Oil.
(d)AP-42 Emission Factor Table 1.4-3 and Table 1.4-4.
(e)AP-42 database for combustion turbine only.

Pollutant	Natural Gas[f] Emission rate (tons/yr)	Fuel Oil Emission rate (tons/yr)	Per Turbine Emission rate (tons/yr)	Total[g] Emission rate (tons/yr)
1,3 Butadiene	3.25E-03	4.47E-03	7.72E-03	1.54E-02
Acetaldehyde	3.03E-01		3.03E-01	6.05E-01
Acrolein	4.84E-02		4.84E-02	9.68E-02
Arsenic	1.90E-05		1.90E-05	3.80E-05
Benzene	9.10E-02	1.54E-02	1.06E-01	2.13E-01
Beryllium	1.14E-06		1.14E-06	2.28E-06
Cadmium	1.05E-04		1.05E-04	2.09E-04
Chromium	1.33E-04		1.33E-04	2.66E-04
Cobalt	7.99E-06		7.99E-06	1.60E-05
Dichlorobenzene	1.14E-04		1.14E-04	2.28E-04
Ethylbenzene	2.42E-01		2.42E-01	4.84E-01
Formaldehyde	6.44E-01	7.82E-02	7.22E-01	1.44E+00
Hexane	1.71E-01		1.71E-01	3.42E-01
Manganese	3.61E-05		3.61E-05	7.23E-05
Mercury	2.47E-05		2.47E-05	4.95E-05
Naphthalene	9.89E-03	9.77E-03	1.97E-02	3.93E-02
Nickel	2.00E-04		2.00E-04	3.99E-04
Propylene Oxide	2.19E-01		2.19E-01	4.39E-01
Selenium	2.28E-06		2.28E-06	4.56E-06
Toluene	9.83E-01		9.83E-01	1.97E+00
Xylenes	4.84E-01		4.84E-01	9.68E-01
Total HAP Emissions				**6.61**

(f)Natural gas combustion turbine and duct burner combined.
(g)Total Facility hes 2 combined cycle combustion turbines.

JEA - Brandy Branch Combined Cycle Facility - Florida

Determination of Representative Emission and Stack Parameters and Potential to Emit Calculator

Rev 5a

Combined Cycle Operation - Natural Gas

GE7FA

NOTE Ref. 10/26/00 performance data.

GE7FA

Load 100 percent

Case Name	Case1	Case2	Case3	Case4	Case5	Case6	Case7
Ambient Temp (F)	95	95	95	95	59	59	20
Evap Cooler			X	X			
Duct Firing (k)	X			X		X	
Exit Temp (F)	205	208	209	207	205	204	208
Exit Velocity (ft/s)	61.4	61.5	63.3	63.1	66.2	66.1	71.1
Emissions (lb/h)							
NO_x	22.23	21.12	21.82	22.79	23.32	23.62	24.95
CO	54.05	45.53	46.47	53.90	50.29	52.58	54.26
PM/PM_{10}	20.60	19.30	19.30	20.50	19.30	19.70	19.30
SO_2	1.09	1.03	1.07	1.11	1.14	1.16	1.22
VOC	4.77	2.73	2.60	4.58	2.95	3.49	3.15

Load 75 percent Ref. 10/26/00 performance data.

Case Name	Case8	Case10	Case12
Ambient Temp (F)	95	59	20
Evap Cooler			
Duct Firing			
Exit Temp (F)	198	194	194
Exit Velocity (ft/s)	50.1	53.1	55.4
Emissions (lb/h)			
NO_x	17.34	18.89	20.01
CO	37.67	41.05	43.16
PM/PM_{10}	19.20	19.20	19.20
SO_2	0.85	0.92	0.98
VOC	2.26	2.40	2.51

Load 50 percent Ref. 10/26/00 performance data.

Case Name	Case9	Case11	Case13
Ambient Temp (F)	95	59	20
Evap Cooler			
Duct Firing			
Exit Temp (F)	190	185	165
Exit Velocity (ft/s)	41.6	43.4	44.9
Emissions (lb/h)			
NO_x	13.99	15.18	15.98
CO	31.79	34.12	35.53
PM/PM_{10}	19.10	19.20	19.20
SO_2	0.68	0.74	0.78
VOC	1.90	1.99	2.06

GE7FA
Enveloped-Short Term (Load Representative)
Emissions and Stack Parameters

Exit Temp (F)	204.00	368.71	K
Exit Velocity (ft/s)	61.40	18.71	m/s
Emissions (lb/h)			
NO_x	24.95	3.14	g/s
CO	54.26	6.84	g/s
PM/PM_{10}	20.60	2.60	g/s
SO_2	1.22	0.15	g/s
VOC	4.77	0.60	g/s

Exit Temp (F)	194.00	363.15	K
Exit Velocity (ft/s)	50.10	15.27	m/s
Emissions (lb/h)			
NO_x	20.01	2.52	g/s
CO	43.16	5.44	g/s
PM/PM_{10}	19.20	2.42	g/s
SO_2	0.98	0.12	g/s
VOC	2.51	0.32	g/s

Exit Temp (F)	185.00	358.15	K
Exit Velocity (ft/s)	41.60	12.68	m/s
Emissions (lb/h)			
NO_x	15.96	2.01	g/s
CO	35.53	4.48	g/s
PM/PM_{10}	19.20	2.42	g/s
SO_2	0.78	0.10	g/s
VOC	2.06	0.26	g/s

Distillate Oil

GE7FA

NOTE Ref. 10/26/00 performance data

GE7FA

Load 100 percent

Case Name	Case14	Case15	Case16	Case17
Ambient Temp (F)	95	59	20	95
Evap Cooler				X
Duct Firing (k)				
Exit Temp (F)	272	265	265	274
Exit Velocity (ft/s)	69.8	75.3	79.7	71.7
Emissions (lb/h)				
NO_x	101.23	112.41	119.37	104.53
CO	61.43	67.86	72.43	62.59
PM/PM_{10}	40.80	43.40	45.00	41.60
SO_2	92.73	102.97	109.35	95.75
VOC	7.05	7.66	8.14	7.24

Load 75 percent Ref. 10/26/00 performance data.

Case Name	Case18	Case19	Case20
Ambient Temp (F)	95	59	20
Evap Cooler			
Duct Firing			
Exit Temp (F)	259	255	255
Exit Velocity (ft/s)	54.8	56.9	58.9
Emissions (lb/h)			
NO_x	82.81	91.21	96.65
CO	49.21	51.94	53.79
PM/PM_{10}	36.50	38.40	39.70
SO_2	75.85	83.55	88.54
VOC	5.64	5.89	6.09

Load 50 percent Ref. 10/26/00 performance data.

Case Name	Case21	Case22	Case23
Ambient Temp (F)	95	59	20
Evap Cooler			
Duct Firing			
Exit Temp (F)	252	250	250
Exit Velocity (ft/s)	46.5	47.9	48.6
Emissions (lb/h)			
NO_x	65.62	71.78	75.46
CO	77.09	67.08	58.96
PM/PM_{10}	32.40	33.90	34.70
SO_2	60.11	65.75	69.12
VOC	4.84	4.99	5.06

GE7FA
Enveloped-Short Term (Load Representative)
Emissions and Stack Parameters

Exit Temp (F)	255.00	402.59	K
Exit Velocity (ft/s)	69.80	21.28	m/s
Emissions (lb/h)			
NO_x	119.37	15.04	g/s
CO	72.43	9.13	g/s
PM/PM_{10}	45.00	5.67	g/s
SO_2	109.35	13.78	g/s
VOC	8.14	1.03	g/s

Exit Temp (F)	255.00	397.04	K
Exit Velocity (ft/s)	54.80	16.70	m/s
Emissions (lb/h)			
NO_x	96.65	12.18	g/s
CO	53.79	6.78	g/s
PM/PM_{10}	39.70	5.00	g/s
SO_2	88.54	11.16	g/s
VOC	6.09	0.77	g/s

Exit Temp (F)	250.00	394.26	K
Exit Velocity (ft/s)	46.50	14.17	m/s
Emissions (lb/h)			
NO_x	75.46	9.51	g/s
CO	77.09	9.71	g/s
PM/PM_{10}	34.70	4.37	g/s
SO_2	69.12	8.71	g/s
VOC	5.06	0.64	g/s

Attachment 3
BACT Tables

Table 1 NO_x BACT Clearinghouse Review List						
Facility	**State**	**Permit Date**	**Process**	**Output**	**Emission limit, ppmvd**	**Control Technology**
Federal Cold Storage Cogeneration	CA	Dec-96	GE LM2500-M-2	222 MMBtu/hr	2.0	Water Injection, SCONOx
Sutter Power Plant	CA	APR-99	SW 501F	170 MW	2.5	Dry low NOx, SCR
La Paloma Generating Co.LLC	CA	MAY-99	ABB Model GT-24	262 MW	2.5	Dry-low NOx, SCR
Turlock Irrigation District	CA	AUG-94	GE LM5000	417 MMBtu/hr	3.0	SCR, Steam Injection
Sacramento Power Authority (Campbell Soup)	CA	AUG-94	Siemens V84.2	1257 MMBtu/hr	3.0	Water injection, SCR
Brooklyn Navy Yard Cogeneration Partners L.P.	NY	JUN-95	Turbine, Natural Gas Fired	240 MW	3.5	SCR
Casco Ray Energy Co.	ME	JUL-98	Turbine, Combined Cycle, Natural Gas	170 MW	3.5	SCR
Granite Road Limited	CA	MAY-91	Turbine, Gas	460.9 MMBtu/hr	3.5	SCR, Steam Injection

Table 2 CO BACT Clearinghouse Review List						
Facility	**State**	**Permit Date**	**Process**	**Output, MW**	**Emission limit ppmvd**	**Control Technology**
Newark Bay Cogeneration Partnership, L.P.	NJ	JUN-93	Turbines, Combustion Natural Gas Fired	617	1.8 ppmvd	Oxidation Catalyst
Saranac Energy Company	NY	JUL-92	Turbines, Combustion Natural Gas Fired	1123	3 ppmvd	Oxidation Catalyst
Alabama Power, Plant Barry	AL	AUG-98	GE 7FA	170	0.057 lb/MMBtu	Good Combustion Control
Alabama Power, Plant Barry	AL	AUG-99	GE 7FA	170	0.06 lb/MMBtu	Good Combustion Control
Mobile Energy, LLC - Hog Bayou	AL	JAN-99	GE 7FA	170	0.04 lb/MMBtu	Good Combustion Control
Sutter Power Plant	CA	APR-99	Turbine, SW 501F	170	4 ppmvd	Oxidation Catalyst
Alabama Power Theodore Cogeneration Facility	AL	MAR-99	GE 7FA	170	0.086 lb/MMBtu	No Control
Blue Mountain Power, L.P	PA	JUL-96	Combustion Turbine with Heat Recovery Boiler	153	3.1 ppmvd	Oxidation Catalyst
Brooklyn Navy Yard Cogeneration Partners, L.P	NY	JUN-95	Turbine, Natural Gas Fired	240	4 ppmvd	No Control
Crockett Cogeneration (C&H Sugar)	CA	OCT-93	GE PG7221 (FA)	240	5.9 ppmvd	Good Combustion Control

Table 3 VOC BACT Clearinghouse Review List						
Facility	**State**	**Permit Date**	**Process**	**Output, MW**	**Emission limit**	**Control Technology**
Bear Mountain Limited	CA	AUG-94	Turbine, GE, Cogeneration, 48 MW	48	0.6 ppmvd	Oxidation Catalyst
Casco Ray Energy Co.	ME	JUL-98	Turbine, Combined Cycle, Natural Gas, two	170	1.0 ppmvd	Low NOx Burner
Florida Power and Light	FL	MAR-91	Turbine, Gas, 4 Each	240	1.0 ppmvd	Combustion Control
Sutter Power Plant	CA	APR-99	SW 501F, Combined Cycle	170	1.0 ppmvd	Oxidation Catalyst
Florida Power and Light	FL	JUN-91	Turbine, Gas, 4 Each	400	1.6 ppmvd	Combustion Control
Sacramento Cogeneration Authority	CA	AUG-94	GE LM6000	42	1.1 lb/hr	Oxidation Catalyst
Carson Energy Group and Central Valley Financing	CA	JUL-93	GE LM6000	42	2.46 lb/hr	Oxidation Catalyst

Attachment 4
Air Modeling Protocol and FDEP Approval

Enclosure 1

Air Dispersion Modeling Protocol

Introduction

The purpose of this enclosure is to summarize and document the mutually agreed upon air dispersion modeling protocol for the JEA Brandy Branch Combined Cycle Conversion Project, as discussed in our meeting held at the FDEP offices on September 11, 2000. As discussed in the cover letter, please review the following air dispersion modeling assumptions and methodology and provide comments and/or concurrence at your earliest convenience, but preferably no later than September 29, 2000.

Project Introduction

JEA intends to convert two of the three simple cycle combustion turbines at their Brandy Branch Facility into a combined cycle configuration. The combined cycle conversion project includes the addition of heat recovery steam generators (HRSGs) to Units 2 and 3 in a standard 2 on 1 configuration, duct burners in each HRSG, a cooling tower, and a steam turbine generator. The combined cycle conversion will be permitted to operate 8,760 hours per year at loads ranging from 50 to 100 percent. The combined cycle conversion will primarily fire natural gas, with low sulfur (0.05 percent) No.2 distillate fuel oil as back up.

The resulting steam generating capacity of the combined cycle conversion will automatically subject the Brandy Branch Facility to review and certification under the Florida Electrical Power Plant Siting Act.

Air Quality Modeling Assumptions and Methodology

Modeling Scenario:	As a major modification to an existing PSD major source, the air quality impact analysis (AQIA) will be performed only for Units 2 and 3, which are proposed to be converted into combined cycle units, and only units undergoing any modification. If the modeled predicted impacts from the combined cycle units exceed the PSD Significant Impact Levels (SILs), then Unit 1 will be included as part of the cumulative impact analysis.
Air Dispersion Model:	ISCST3 (Latest version)
Model Options:	EPA Default and Flat terrain.
GEP & Downwash:	EPA's BPIP program will be used to determine GEP stack height and direction specific building downwash parameters for each of the combined cycle stacks.

	Structures associated with the existing site, as well as the proposed additions will be included in the BPIP analysis.
Receptor Grids:	A 10 km nested rectangular receptor grid consisting of 100 m spacing out to 1 km, 250 m spacing from 1 km to 2.5 km, 500 m spacing from 2.5 km to 5 km, and 1,000 m spacing from 5 km to 10 km. Fenceline receptors will be placed at 100 m intervals, and a 100 m fine grid will be placed at maximum impact locations.
Dispersion Coefficients:	Rural: Based on visual inspection of a 7.5 minute USGS topographic map of the site using the Auer method.
Meteorological Data:	Refined level modeling sequential meteorological data will consist of surface data from Jacksonville, FL and upper air data from Waycross, GA for the years 1984-1988.
Pollutants to be Modeled:	The only pollutants that are currently expected to be modeled are PM_{10}, NO_x and CO. SO_2 emissions will likely be limited to less than 40 tpy by limiting the amount of fuel oil firing.
Source Modeling Parameters:	Worst-case hourly emission rates and operating parameters will be used for short-term modeling impacts. These data will be enveloped across 50, 75 and 100 percent load cases from representative combustion turbine performance and emissions data. Potential to emit calculations and operating parameters for annual modeling impacts will be based on annual average data.
Modeled impacts:	It is anticipated that the maximum model predicted pollutant impacts will be less than their respective PSD SILs. If the model predicted impacts exceed the SILs, additional agency consultation will be initiated regarding increment and cumulative air quality impact analyses.
Class I Analysis:	A regional haze visibility study and Class I SIL analysis will be performed for the Class I areas within 150 km of the proposed facility location. These areas will consist of the Okefenokee and Wolf Island Wilderness areas. For those areas within 50 km of the proposed facility location, the VISCREEN model will be used. For analysis of Class I areas beyond 50 km, the CALPUFF model will be used. The CALPUFF modeling protocol is discussed in Enclosure 2 of this submittal.
Toxics:	No toxic modeling analysis is required.

ENCLOSURE 2

BRANDY BRANCH COMBINED CYCLE CONVERSION PROJECT
CALPUFF MODELING PROTOCOL

PREPARED BY
BLACK & VEATCH

SEPTEMBER 2000

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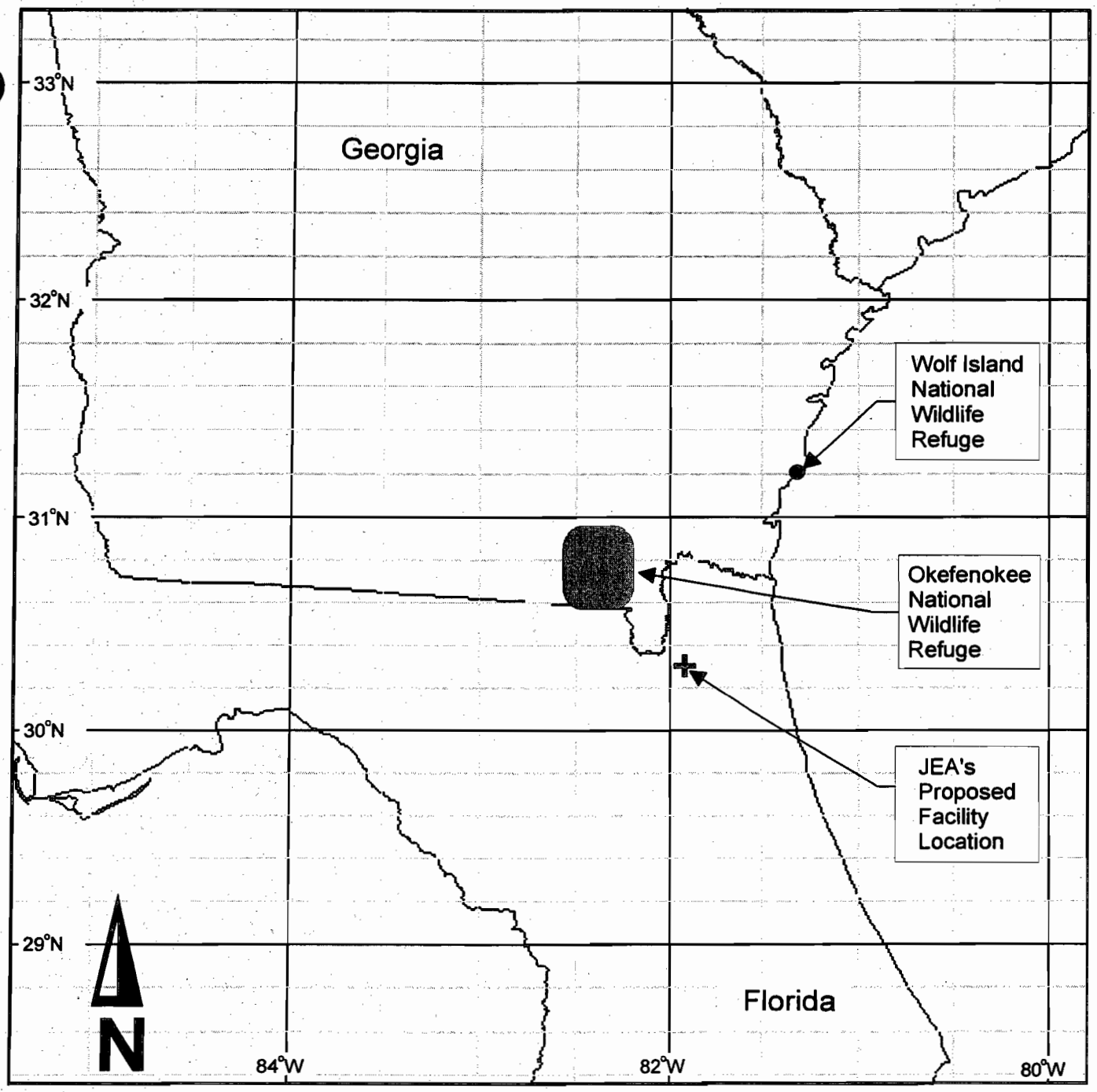
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1.0 Introduction

JEA is proposing to convert two simple-cycle combustion turbines into combined-cycle combustion turbines serving one steam turbine (2x1), for a total nominal output of approximately 530 MW, at the existing Brandy Branch Facility, which is located near the city of Baldwin in northeastern Florida. As part of the air impact evaluation for the proposed facility, the Florida Department of Environmental Projection (FDEP) has requested that analyses of the proposed facility's affect on the Okefenokee National Wildlife Refuge (ONWR) and Wolf Island National Wildlife Refuge (WINWR) be performed. The ONWR and WINWR are Prevention of Significant Deterioration (PSD) Class I areas located in southeastern Georgia approximately 34 km north-northwest and 127 km north-northeast, respectively, of the proposed facility site. Class I areas are afforded special environmental protection through the use of Air Quality Related Values (AQRVs). The AQRVs of interest in this protocol are regional haze, deposition, and Class I Significant Impact Levels (SILs). Figure 1-1 presents the locations of the proposed project site with respect to the ONWR and WINWR.

The CALPUFF analysis will closely follow those procedures recommended in the Interagency Workgroup on Air Quality Modeling (IWAQM) Phase II report dated December 1998, the Draft Phase I Federal Land Managers' Air Quality Related Values Workgroup (FLAG) dated October 1999, as well as coordination with the FDEP who will in turn communicate as necessary with the U.S. Fish and Wildlife Service (FWS) which is the Federal Land Manager (FLM) for both areas. This protocol includes a discussion of the meteorological and geophysical databases to be used in the analysis, the preparation of those databases for introduction into the modeling system, and the air modeling approach.



Poor Original

Location of Brandy Branch Facility
with Respect to
Okefenokee and Wolf Island
National Wildlife Refuges

Figure 1-1

Site wrt Class I areas.srf

2.0 Model Selection and Inputs

2.1 Model Selection

The California Puff (CALPUFF, version 5.4) air modeling system will be used to model the emissions associated with the two combined-cycle combustion turbines at the proposed facility and assess the AQRVs at ONWR and WINWR. CALPUFF is a non-steady state Lagrangian Gaussian puff long-range transport model that includes algorithms for building downwash effects as well as chemical transformations (important for visibility controlling pollutants), and wet/dry deposition. The model will first be used in a screening mode called CALPUFF 'Lite' to determine impacts onto the Class I areas. This method simplifies the modeling process while introducing a high level of conservatism. If the 'Lite' results are below the required thresholds of the previously listed AQRVs, the demonstration will be considered complete and a refined CALPUFF analysis will not be pursued. CALPUFF 'Lite' bypasses the need for the intensive meteorological processor, CALMET. The CALMET model, a preprocessor to CALPUFF, is a diagnostic meteorological model that produces a three-dimensional field of wind and temperature and a two-dimensional field of other meteorological parameters. Simply, CALMET was designed to process raw meteorological, terrain, and land-use databases to be used in the air modeling analysis. The CALPUFF modeling system uses a number of FORTRAN preprocessor programs that extract data from large databases and converts the data into formats suitable for input to CALMET. If a refined analysis is necessary, the processed data produced from CALMET will be input to CALPUFF to assess pollutant specific impacts. Both CALMET and CALPUFF (including the 'Lite' and refined methodology) will be used in a manner that is recommended by the IWAQM Phase 2 Report and Draft Phase I FLAG Report.

2.2 CALPUFF Model Settings

The CALPUFF settings contained in Table 2-1 will be used for the modeling analyses.

2.3 Building Wake Effects

Both the screening and refined (if necessary) CALPUFF analyses will include the proposed facility's building dimensions to account for the effects of building-induced

Table 2-1 CALPUFF Model Settings	
Parameter	**Setting**
Pollutant Species	SO_2, SO_4, NO_x, HNO_3, and NO_3, and PM_{10}
Chemical Transformation	MESOPUFF II scheme
Deposition	Include both dry and wet deposition, plume depletion
Meteorological/Land Use Input	CALPUFF 'Lite' – screening mode 5 years of Jacksonville data (including precipitation) processed to include such parameters as the surface roughness, Bowen ratio, albedo, etc. CALPUFF – refined mode CALMET
Plume Rise	Transitional, Stack-tip downwash, Partial plume penetration
Dispersion	Puff plume element, PG/MP coefficients, rural mode, ISC building downwash scheme.
Terrain Effects	Partial plume path adjustment.
Output	Create binary concentration and wet/dry deposition files including output species for all pollutants.
Model Processing	Regional Haze: Highest predicted 24-hour SO_4, NO_3 and PM_{10} concentrations for the year. Deposition: Highest predicted annual, SO_4 and NO_3 values in deposition units. Class I SILs: Highest predicted concentrations at the applicable averaging periods for those pollutants that exceed the respective PSD Significant Emission Levels (SELs).
Background Values	Ozone: 80 ppb; Ammonia: 10 ppb

downwash on the emission sources. Dimensions for all significant building structures will be processed with the Building Profile Input Program (BPIP), Version 95086, and included in the CALPUFF model input.

2.4 Receptor Locations

The CALPUFF 'Lite' analysis will use rings of discrete Cartesian receptors located at distances equal to that of the closest and furthest boundaries of the Class I areas to the proposed project location. Specifically, the rings will consist of receptor spacing of every 1-degree beginning at the appropriate distances from the proposed facility location.

The refined CALPUFF analysis, if necessary, will use an array of discrete receptors at appropriate distances to ensure sufficient density and aerial extent to adequately characterize the pattern of pollutant impacts in the ONWR and WINWR. The same modeling grid as was used in the simple cycle project will again be used here. Specifically, the array will consist of receptor spacing of 2 km within the Class I areas beginning at a distance of 50 km from the proposed facility location and continuing to the farthest extent of the ONWR and WINWR.

2.5 Meteorological Data Processing

The meteorological data that will be used in the CALPUFF screening modeling will consist of 5 years of surface observations (1984-1988) for Jacksonville, Florida extracted from the National Climatic Data Center's (NCDC) Solar and Meteorological Surface Observational Network (SAMSON) CD-ROM set. These five years will be combined with upper air, twice-daily mixing height data from Waycross, Georgia downloaded from the SCRAM BBS for the same five-year period. The data set will be processed with PCRammet for wet deposition to give CALPUFF enough information to perform the Mesopuff II chemistry transformations. This processing allows CALPUFF to run in screening mode by providing extended meteorological variables such as surface friction, surface roughness, albedo, Bowen ratio, precipitation, etc. used in the atmospheric plume dispersion.

If the refined CALPUFF analysis is employed, the California Puff meteorological and geophysical data preprocessor (CALMET, Version 5.2) will be used to develop the

gridded parameter fields required for the refined AQRV modeling analyses. The following sections discuss the data to be used and processed in the CALMET model.

2.5.1 CALMET Settings

The CALMET settings, including horizontal and vertical grid coverage, number of weather stations (surface, upper air, and precipitation), and resolution of prognostic mesoscale meteorological data, will be chosen to adequately characterize the area within the CALMET domain.

2.5.2 Modeling Domain

The size of the domain used for the modeling will be based on the distances needed to cover the area from the proposed facility to the receptors at the ONWR and WINWR with at least a 50-km buffer zone in each direction. The air modeling analysis will be performed in the UTM coordinate system.

2.5.3 Mesoscale Model Data

Pennsylvania State University in conjunction with the National Center for Atmospheric Research (NCAR) Assessment Laboratory have developed mesoscale meteorological data sets, prognostic wind fields or "guess" fields, for the United States. The hourly meteorological variables used to create these data sets (wind, temperature, dew point depression, and geopotential height for eight standard levels and up to 15 significant levels) are extensive and only allow for a one-year data base set; specifically, 1990. The analysis will use the MM4 mesoscale meteorological data set to initialize the CALMET wind field. The data will be extracted from a 12-volume CD-ROM set distributed by the National Climatic Data Center (NCDC). The MM4 data have a horizontal spacing or resolution of 80 km and are used to simulate atmospheric variables within the modeling domain.

The mesoscale meteorological data set (MM4) to be used in CALMET, although advanced, lacks the fine detail of specific temporal and spatial meteorological variables and geophysical data. These variables will be processed into the appropriate format and introduced into the CALMET model through the utilization of additional data files obtained from numerous sources. These ancillary data files are described in more detail in the following sections.

2.5.4 Surface Data Stations and Processing

The surface station data for the CALPUFF analyses will consist of data from several National Weather Service (NWS) stations or Federal Aviation Administration (FAA) Flight Service stations. The surface station parameters include wind speed, wind direction, cloud ceiling height, opaque cloud cover, dry bulb temperature, relative humidity, station pressure, and a precipitation code that is based on current weather conditions. The station data may be obtained directly from NCDC or extracted from a CD-ROM set put out by NCDC. The data will be processed with the CALMET preprocessor utility program, SMERGE, to create one surface file.

2.5.5 Upper Air Data Stations and Processing

The analysis will include several upper air NWS stations located within the CALMET domain. Data for these stations will be obtained from the NCDC Radiosonde Data CD and processed into the NCDC Tape Deck (TD) 6201 format by the READ62 utility program for input to CALMET.

2.5.6 Precipitation Data Stations and Processing

Precipitation data will be processed from a network of hourly precipitation data files collected from primary and secondary NWS precipitation recording stations within the CALMET domain. The precipitation files are contained in a 2-volume CD-ROM set from NCDC. The utility programs PXTRACT and PMERGE will be used to process the data into the format for the Precip.dat file that is used by CALMET.

2.5.7 Geophysical Data Processing

Terrain elevations for each grid cell of the modeling domain will be obtained from Digital Elevation Model (DEM) files obtained from US Geographical Survey (USGS). The DEM data will be extracted for the modeling domain grid using the CALMET preprocessor program TERREL. Land-use data, based on annual averaged values, will also be obtained from the USGS. Land-use values for the domain grid will be extracted with the preprocessor programs CTGCOMP and CTGPROC. Other parameters processed for the modeling domain include surface roughness, surface albedo, Bowen ratio, soil heat flux, and leaf index field. Once preprocessed, all of the land-use parameters will be combined with the terrain information in a processor called MAKEGEO. This processor will produce one GEO.DAT file for input to CALMET.

2.6 Facility Emissions

Performance data for the combustion turbines will be based on vendor data at certain design ambient temperatures at base load operation, considering both natural gas and distillate fuel oil firing. The maximum pound per hour emission rates considering representative ambient temperatures at base load operation for natural gas and distillate fuel oil firing will be used for the pollutants modeled with CALPUFF.

3.0 CALPUFF Analyses

The preceding model inputs and settings for the CALPUFF modeling system (either screening or refined mode) will be used to complete the Class I analyses on the ONWR and WINWR, including regional haze, deposition (both sulfur and nitrogen), and Class I SILs. The following analyses will be performed as described regardless of the modeling methodology (i.e., screening or refined modeling).

3.1 Regional Haze Analysis

Regional haze analyses will be performed for the Class I areas for ammonium sulfates, ammonium nitrates, and particulate matter by appropriately characterizing model predicted outputs of SO_4, NO_3, and PM_{10} concentrations.

3.1.1 Visibility

Visibility is an AQRV for both the ONWR and WINWR. Visibility can take the form of plume blight for nearby areas, or regional haze for long distances (e.g., distances beyond 50 km). Because either all or portions of the Class I areas lie beyond 50 km from the proposed facility, the change in visibility will be analyzed as regional haze at those locations. Regional haze impairs visibility in all directions over a large area by obscuring the clarity, color, texture, and form of what is seen. Current regional haze guidelines characterize a change in visibility by either of the following methods:

1. Change in the visual range, defined as the greatest distance that a large dark object can be seen, or
2. Change in the light-extinction coefficient (b_{ext}).

Visual range can be related to extinction with the following equation:

$$bext(Mm\text{-}1) = 3912 / vr(Mm\text{-}1)$$

Visual range (vr) is a measure of how far away a large black object can be seen in the atmosphere under several severe assumptions including: an absolutely dark target, uniform lighting conditions (cloud free skies), uniform extinction in all directions, a limiting contrast discrimination level, a target high enough in elevation to account for earth curvature, and several other factors. Visual range is, at best, a limited concept that

allows relatively simple comparisons between visual air quality levels and should not be thought of as the absolute distance that can be seen through the atmosphere.

The b_{ext} is the attenuation of light per unit distance due to the scattering (light reduced away from the site path) and absorption (light captured by aerosols and turned into heat energy) by gases and particles in the atmosphere. A change in the extinction coefficient produces a perceived visual change that is measured by a visibility index called the deciview. The deciview (dv) is defined as:

$$dv = 10 \ln (1 + b_{exts} / b_{extb})$$

where: b_{exts} is the extinction coefficient calculated for the source, and
b_{extb} is the background extinction coefficient

A uniform incremental change in b_{extb} or visual range does not necessarily result in uniform changes in perceived visual air quality. In fact, perceived changes in visibility are best related to a change in b_{extb}, or; percent change in extinction. Based on the IWAQM Phase II guidance, if the change in extinction is less than 5 percent, no further analysis is required. An index similar to the deciview that simply quantifies the percent change in visibility due to the operation of a source is calculated as:

$$\Delta\% = (b_{exts} / b_{extsb}) \times 100$$

3.1.2 Background Visual Ranges and Relative Humidity Factors

The background visual range is based on data representative of the top 20-percentile air quality days. The background visual ranges for the ONWR and WINWR will be obtained from the Draft Phase I FLAG document. The average relative humidity factor for each species' worst day will be computed by determining the relative humidity factor for each hour's relative humidity for the 24-hour period that the maximum impact occurred. This factor, based on each relative humidity will be obtained by using Table 2.A-1 of Appendix 2.A of the Draft Phase I FLAG Report. These factors (a relative humidity factor for each relative humidity) will then be used to determine the average relative humidity factor for that day (24-hour period). Again, all of this can be accomplished with the use of the CALPOST post-processor.

3.1.3 Interagency Workgroup On Air Quality Modeling (IWAQM) Guidelines

The CALPUFF air modeling analysis (both screening and refined) will follow the recommendations contained in the IWAQM Phase II Summary Report and Recommendations for Modeling Long Range Transport Impacts, (EPA, 12/98). Table 3-1 summarizes the IWAQM Phase II recommendations. The methodology below will be used to compute the results of the regional haze analysis. However, CALPOST now possesses the ability to post-process the modeling results specific to the regional haze analysis through the selection of one of six modeling options. The post-processing selection will be made to calculate regional haze based on the appropriate available data/resources. A typical calculation methodology is illustrated below.

Calculation

Refined impacts will be calculated as follows:

1. Obtain maximum 24-hour SO_4, NO_3, and PM_{10} impacts, in units of micrograms per cubic meter ($\mu g/m^3$).
2. Convert the SO_4 impact to $(NH_4)_2SO_4$ by the following formula:

   $(NH_4)_2SO_4$ ($\mu g/m3$) = SO_4 ($\mu g/m^3$) x molecular weight $(NH_4)_2SO_4$ / molecular weight SO_4

   $(NH_4)_2SO_4$ ($\mu g/m^3$) = SO_4 ($\mu g/m^3$) x 132/96 = SO_4 ($\mu g/m^3$) x 1.375

   Convert the NO_3 impact to NH_4NO_3 by the following formula:

   NH_4NO_3 ($\mu g/m3$) = NO_3 ($\mu g/m^3$) x molecular weight NH_4NO_3 / molecular weight NO_3

   NH_4NO_3 ($\mu g/m^3$) = NO_3 ($\mu g/m^3$) x 80/62 = NO_3 ($\mu g/m^3$) x 1.29
3. Compute b_{exts} (extinction coefficient calculated for the source) with the following formula:

   b_{exts} = 3 x NH_4NO_3 x f(RH) + 3 x $(NH_4)_2SO_4$ x f(RH) + 1 x PM_{10}
4. Compute b_{extb} (background extinction coefficient) using the background visual range (km) from the FALG document with the following formula:

   b_{extb} = 3.912 / Visual range (km)
5. Compute the change in extinction coefficients:

   in terms of deciviews:

   $dv = 10 \ln (1 + b_{exts} / b_{extb})$

   in terms of percent change of visibility:

   $\Delta\% = (b_{exts} / b_{extsb}) \times 100$

Based on the predicted SO_4, NO_3, and PM_{10} concentrations, the proposed facility's emissions will be compared to a 5 percent change in light extinction of the background levels. This is equivalent to a change in deciview of 0.5.

Table 3-1 Outline of IWAQM Refined Modeling Analyses Recommendations*	
Meteorology	CALPUFF 'Lite' 5 years of the closest surface station and upper air station. Refined CALPUFF Use CALMET (minimum 6 to 10 layers in the vertical; top layer must extend above the maximum mixing depth expected); horizontal domain extends 50 to 80 km beyond outer receptors and sources being modeled; terrain elevation and land-use data is resolved for the situation.
Receptors	CALPUFF 'Lite' Rings of receptors spaced every 1-degree. Refined CALPUFF Within Class I area(s) of concern.
Dispersion	1. CALPUFF with default dispersion settings. 2. Use MESOPUFF II chemistry with wet and dry deposition. 3. Define background values for ozone and ammonia for area.
Processing	Use highest predicted 24-hr SO_4, NO_3, and PM_{10} values; compute a day-average relative humidity factor (f(RH)) for the worst day for each predicted species, calculate extinction coefficients and compute percent change in extinction using the FLAG supplied background extinction. This can all now be accomplished with the use of the CALPOST post-processor.
**IWAQM Phase II Summary Report and Recommendations for Modeling Long Range Transport Impacts (EPA, 12/98).*	

3.2 Deposition Analyses

Deposition analyses will be performed for the ONWR and WINWR for both sulfates and nitrates. The analyses will follow those procedures and methodologies set forth in the IWAQM Phase II Report. Specifically, deposition analyses will be performed as follows:

1. Perform CALPUFF model runs using the specified options previously mentioned in Section 3.1 (including output of both dry and wet deposition).
2. Perform individual CALPOST post-processor runs to output the maximum annual average wet and dry deposition impacts of SO_4 and NO_3 in $g/m^2/s$ units.
3. Apply the appropriate scaling factors found in IWAQM Phase II Report (Section 3.3 Deposition Calculations) to the above CALPOST runs to account for normalization based on the ratio of molecular weights, as well as the conversion of grams to kilograms, square meters to hectares (ha), seconds to hours, and hours to a year. Thus, the CALPOST results will be in kg/ha/yr.
4. For sulfate deposition, sum the results of both the wet deposition and dry deposition values for the SO_4 CALPOST runs.
5. For nitrate deposition, sum the results of both the wet deposition and dry deposition values for the NO_3 CALPOST runs.

3.3 Class I Impact Analysis

Ground-level impacts (in $\mu g/m^3$) onto to the ONWR and WINWR will be calculated for the criteria pollutants that exceed PSD Significant Emission Levels (SELs) for each applicable averaging period. The results of this analysis will be compared with the Class I Significant Impact Levels (SILs) calculated as 4 percent of the Class I Increment values.

Gujjarlapudi, Ebenezer S.

From: Chris Carlson TAL 850/921-9537 [Chris.Carlson@dep.state.fl.us]
Sent: Friday, September 22, 2000 2:00 PM
To: Gujjarlapudi, Ebenezer S.
Cc: Mike Halpin
Subject: JEA Brandy Branch Modeling Protocols

Dear Ebensezer,

I am sending this e-mail to inform you that I have reviewed the two modeling protocols that Black & Veatch submitted for the JEA Brandy Branch Project. As a result of our phone conversation earlier today, I no longer have any questions about the protocols and this e-mail will serve as the Department's approval of the two protocols. If you have any further questions, please contact me.

Sincerely,
Chris Carlson
Meteorologist
Florida Dept. of Environmental Protection
Division of Air Resources Management
2600 Blair Stone Road
MS # 5505
Tallahassee, FL 32399-2400
phone: (850)921-9537
fax: (850)922-6979
Chris.Carlson@dep.state.fl.us

Attachment 5
Air Modeling Results

Attachment 6
VISCREEN

Visual Effects Screening Analysis for
Source: Brandy Branch Combined C
Class I Area: Okefenokee

*** Level-1 Screening ***

Input Emissions for

Particulates	90.00	LB /HR
NOx (as NO2)	238.74	LB /HR
Primary NO2	.00	LB /HR
Soot	.00	LB /HR
Primary SO4	.00	LB /HR

**** Default Particle Characteristics Assumed

Transport Scenario Specifications:

Background Ozone:	.04 ppm
Background Visual Range:	65.00 km
Source-Observer Distance:	34.00 km
Min. Source-Class I Distance:	34.00 km
Max. Source-Class I Distance:	80.00 km
Plume-Source-Observer Angle:	11.25 degrees
Stability:	6
Wind Speed:	1.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	135.	43.3	34.	2.00	5.106*	.05	.035
SKY	140.	135.	43.3	34.	2.00	1.875	.05	-.046
TERRAIN	10.	84.	34.0	84.	2.00	4.538*	.05	.050
TERRAIN	140.	84.	34.0	84.	2.00	.740	.05	.022

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	0.	1.0	168.	2.00	9.044*	.05	.111*
SKY	140.	0.	1.0	168.	2.00	1.687	.05	-.067*
TERRAIN	10.	0.	1.0	168.	2.00	10.283*	.05	.113*
TERRAIN	140.	0.	1.0	168.	2.00	3.253*	.05	.109*

Visual Effects Screening Analysis for
Source: Brandy Branch Combined C
Class I Area: Okefenokee

*** User-selected Screening Scenario Results ***

Input Emissions for

Particulates	90.00	LB /HR
NOx (as NO2)	238.74	LB /HR
Primary NO2	.00	LB /HR
Soot	.00	LB /HR
Primary SO4	.00	LB /HR

PARTICLE CHARACTERISTICS

	Density	Diameter
Primary Part.	2.5	9
Soot	2.0	1
Sulfate	1.5	4

Transport Scenario Specifications:

Background Ozone:	.04 ppm
Background Visual Range:	65.00 km
Source-Observer Distance:	34.00 km
Min. Source-Class I Distance:	34.00 km
Max. Source-Class I Distance:	80.00 km
Plume-Source-Observer Angle:	11.25 degrees
Stability:	4
Wind Speed:	3.53 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	140.	45.4	29.	2.08	.321	.05	-.001
SKY	140.	140.	45.4	29.	2.00	.130	.05	-.002
TERRAIN	10.	84.	34.0	84.	2.87	.098	.06	.001
TERRAIN	140.	84.	34.0	84.	2.00	.043	.06	.000

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	15.	19.9	154.	2.00	.477	.05	-.002
SKY	140.	15.	19.9	154.	2.00	.193	.05	-.003
TERRAIN	10.	0.	1.0	168.	2.00	.512	.05	.008
TERRAIN	140.	0.	1.0	168.	2.00	.178	.05	.007

Attachment 7
CALPUFF

Regional Haze Analysis - CALPUFF - Lite 11/10/2000 15:17

Location: Okefenokee National Wildlife Refuge

Background extinction:[1] 60.20 Mm-1 Background Visual Range: 65 km

SO4 Maximum Impact Day 1987/357 Avg. f(RH)[2] = 5.7

SO4

Impact(ug/m3)	Receptor #	x	y
6.48E-02	173	414.837	3304.904

NO3

Impact(ug/m3)	Receptor #	x	y
1.19E-01	175	413.101	3304.721

PM10

Impact(ug/m3)	Receptor #	x	y
1.41E-01	237	366.81	3327.299

Background Extinction of the Source: 4.29 Mm-1

Percent Change in Extinction: 7.13 %

NO3 Maximum Impact Day 1987/357 Avg. f(RH)[2] = 5.7

SO4

Impact(ug/m3)	Receptor #	x	y
6.48E-02	173	414.837	3304.904

NO3

Impact(ug/m3)	Receptor #	x	y
1.19E-01	175	413.101	3304.721

PM10

Impact(ug/m3)	Receptor #	x	y
1.41E-01	237	366.81	3327.299

Background Extinction of the Source: 4.29 Mm-1

Percent Change in Extinction: 7.13 %

PM10 Maximum Impact Day 1985/333 Avg. f(RH)[2] = 6.0

SO4

Impact(ug/m3)	Receptor #	x	y
9.55E-03	737	437.211	3447.675

NO3

Impact(ug/m3)	Receptor #	x	y
3.76E-02	1079	407.044	3451.916

PM10

Impact(ug/m3)	Receptor #	x	y
2.38E-01	359	407.871	3404.523

Background Extinction of the Source: 1.35 Mm-1

Percent Change in Extinction: 2.24 %

[1]Values from Bud Rolefson of the FWS.
[2]Average relative humidity factor for that day.

Regional Haze Analysis - CALPUFF - Lite 11/10/2000 15:17

Location: Wolf Island National Wild Life Refuge

Background extinction:[1] 60.20 Mm-1 Background Visual Range: 65 km

SO4 Maximum Impact Day 1987/357 Avg. f(RH)[2] = 5.1

SO4

Impact(ug/m3)	Receptor #	x	y
3.60E-02	133	503.381	3266.28

NO3

Impact(ug/m3)	Receptor #	x	y
3.35E-02	167	437.852	3328.447

PM10

Impact(ug/m3)	Receptor #	x	y
6.71E-02	166	440.048	3228.975

Background Extinction of the Source: 1.49 Mm-1

Percent Change in Extinction: 2.47 %

NO3 Maximum Impact Day 1987/357 Avg. f(RH)[2] = 3.4

SO4

Impact(ug/m3)	Receptor #	x	y
5.80E-03	231	308.181	3273.097

NO3

Impact(ug/m3)	Receptor #	x	y
9.01E-02	221	323.85	3256.871

PM10

Impact(ug/m3)	Receptor #	x	y
3.35E-02	221	323.85	3256.871

Background Extinction of the Source: 1.30 Mm-1

Percent Change in Extinction: 2.16 %

PM10 Maximum Impact Day 1985/333 Avg. f(RH)[2] = 4.9

SO4

Impact(ug/m3)	Receptor #	x	y
1.47E-02	302	299.006	3423.102

NO3

Impact(ug/m3)	Receptor #	x	y
1.66E-02	290	287.147	3398.788

PM10

Impact(ug/m3)	Receptor #	x	y
1.25E-01	73	532.489	3392.364

Background Extinction of the Source: 0.74 Mm-1

Percent Change in Extinction: 1.22 %

[1]Values from Bud Rolefson of the FWS.
[2]Average relative humidity factor for that day.

JEA
Brandy Branch Generating Station

Construction Permit Application

December 2000

BLACK & VEATCH

Contents

I. Applicable Information
II. Facility Information
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Attachments

Facility

Attachment A	Facility Applicable Regulations
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Combustion Turbine

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Department of Environmental Protection

Division of Air Resources Management

APPLICATION FOR AIR PERMIT - TITLE V SOURCE

See Instructions for Form No. 62-210.900(1)

I. APPLICATION INFORMATION

Identification of Facility

1. Facility Owner/Company Name: JEA	
2. Site Name: Brandy Branch Generating Station	
3. Facility Identification Number: 0310485	[ ] Unknown
4. Facility Location: JEA Brandy Branch Facility Street Address or Other Locator: City: Baldwin City County: Duval	Zip Code: 32234
5. Relocatable Facility? [ ] Yes [X] No	6. Existing Permitted Facility? [X] Yes [ ] No

Application Contact

1. Name and Title of Application Contact: Name : N. Bert Gianazza, P.E. Title : Environmental Permitting and Compliance	
2. Application Contact Mailing Address: Organization/Firm: JEA Street Address: 21 West Church Street City: Jacksonville State: FL	Zip Code: 32202-3139
3. Application Contact Telephone Numbers: Telephone: (904) 665 - 6247	Fax: (904) 665 - 7376

Application Processing Information (DEP Use)

1. Date of Receipt of Application:	
2. Permit Number:	
3. PSD Number (if applicable):	
4. Siting Number (if applicable):	

Purpose of Application

Air Operation Permit Application

This Application for Air Permit is submitted to obtain: (Check one)

[ ] Initial Title V air operation permit for an existing facility which is classified as a Title V source.

[ ] Initial Title V air operation permit for a facility which, upon start up of one or more newly constructed or modified emissions units addressed in this application, would become classified as a Title V source.

Current construction permit number:_____

[ ] Title V air operation permit revision to address one or more newly constructed or modified emissions units addressed in this application.

Current construction permit number:_____

Operation permit number to be revised:_____

[ ] Title V air operation permit revision or administrative correction to address one or more proposed new or modified emissions units and to be processed concurrently with the air construction permit application. (Also check Air Construction Permit Application below.)

Operation permit number to be revised/corrected:_____

[ ] Title V air operation permit revision for reasons other than construction or modification of an emissions unit. Give reason for the revision; e.g., to comply with a new applicable requirement or to request approval of an "Early Reductions" proposal.

Operation permit number to be revised:_____

Reason for revision:_____

Air Construction Permit Application

This Application for Air Permit is submitted to obtain: (Check one)

[X] Air construction permit to construct or modify one or more emissions units.

[ ] Air construction permit to make federally enforceable an assumed restriction on the potential emissions of one or more existing, permitted emissions units.

[ ] Air construction permit for one or more existing, but unpermitted, emissions units.

Owner/Authorized Representative or Responsible Official

1. Name and Title of Owner/Authorized Representative or Responsible Official:
   Walter P. Bussells, Managing Director and CEO

2. Owner/Authorized Representative or Responsible Official Mailing Address:
   Organization/Firm: JEA
   Street Address: 21 West Church Street
   City: Jacksonville State: FL Zip Code: 32202-3139

3. Owner/Authorized Representative or Responsible Official Telephone Numbers:
   Telephone: (904) 665-7220 Fax: (904) 665-7366

4. Owner/Authorized Representative or Responsible Official Statement:

   I, the undersigned, am the owner or authorized representative(check here [ ], if so) or the responsible official (check here [x], if so) of the Title V source addressed in this application, whichever is applicable. I hereby certify, based on information and belief formed after reasonable inquiry, that the statements made in this application are true, accurate and complete and that, to the best of my knowledge, any estimates of emissions reported in this application are based upon reasonable techniques for calculating emissions. The air pollutant emissions units and air pollution control equipment described in this application will be operated and maintained so as to comply with all applicable standards for control of air pollutant emissions found in the statutes of the State of Florida and rules of the Department of Environmental Protection and revisions thereof. I understand that a permit, if granted by the Department, cannot be transferred without authorization from the Department, and I will promptly notify the Department upon sale or legal transfer of any permitted emissions unit.*

   Signature 11/30/00 Date

* Attach letter of authorization if not currently on file.

Professional Engineer Certification

1.	Professional Engineer Name: Charles J. Schutty Registration Number: 43646
2.	Professional Engineer Mailing Address: Organization/Firm: Black & Veatch Corporation Street Address 8400 Ward Parkway City: State:Zip Code: Kansas City, MO 64114
3.	Professional Engineer Telephone Numbers: Telephone: (913) 458 - 2369 Fax: (913) 458 - 2934

4. Professional Engineer Statement:

I, the undersigned, hereby certify, except as particularly noted herein, that:*

(1) To the best of my knowledge, there is reasonable assurance that the air pollutant emissions unit(s) and the air pollution control equipment described in this Application for Air Permit, when properly operated and maintained, will comply with all applicable standards for control of air pollutant emissions found in the Florida Statutes and rules of the Department of Environmental Protection; and

(2) To the best of my knowledge, any emission estimates reported or relied on in this application are true, accurate, and complete and are either based upon reasonable techniques available for calculating emissions or, for emission estimates of hazardous air pollutants not regulated for an emissions unit addressed in this application, based solely upon the materials, information and calculations submitted with this application.

If the purpose of this application is to obtain a Title V source air operation permit (check here [ ], if so), I further certify that each emissions unit described in this Application for Air Permit, when properly operated and maintained, will comply with the applicable requirements identified in this application to which the unit is subject, except those emissions units for which a compliance schedule is submitted with this application.

If the purpose of this application is to obtain an air construction permit for one or more proposed new or modified emissions units (check here [X], if so), I further certify that the engineering features of each such emissions unit described in this application have been designed or examined by me or individuals under my direct supervision and found to be in conformity with sound engineering principles applicable to the control of emissions of the air pollutants characterized in this application.

If the purpose of this application is to obtain an initial air operation permit or operation permit revision for one or more newly constructed or modified emissions units (check here [ ], if so), I further certify that, with the exception of any changes detailed as part of this application, each such emissions unit has been constructed or modified in substantial accordance with the information given in the corresponding application for air construction permit and with all provisions contained in such permit.

Signature

December 8, 2000
Date

(seal)

CHARLES J. SCHUTTY CERTIFICATE No. 43646 STATE OF FLORIDA REGISTERED ENGINEER

* Attach any exception to certification statement.

Poor Original

Scope of Application

Emissions Unit ID	Description of Emissions Unit	Permit Type	Processing Fee
002	Unit 2 – 170 MW Combined Cycle Combustion turbine with supplemental firing	AC1A	N/A
003	Unit 3 – 170 MW Combined Cycle Combustion turbine with supplemental firing	AC1A	N/A

Application Processing Fee

Check one: [ ] Attached - Amount: $_____ [x] Not Applicable ***(Part of the Site Certification Fee)***

Construction/Modification Information

1. Description of Proposed Project or Alterations:

See also project description in SCA Appendix 10.7

The Brandy Branch facility consists of three simple cycle combustion turbines permitted to operate for 4,750 hours per year. The proposed project, also known as the "Brandy Branch Generating Station", consists of the conversion of two (Units 2 and 3) of the three already permitted simple cycle combustion turbine units into a two-on-one combined cycle configuration. The conversion involves the addition of two heat recovery steam generators (HRSGs), one per turbine, connected to a single steam turbine.

2. Projected or Actual Date of Commencement of Construction:	2Q, 2003
3. Projected Date of Completion of Construction:	2Q, 2004

Application Comment

This permit is for the construction/modification of two combustion turbines (emission unit IDs 002 and 003) from simple to combined cycle.

II. FACILITY INFORMATION

A. GENERAL FACILITY INFORMATION

Facility Location and Type

1. Facility UTM Coordinates: Zone: 17	East (km): 408.81	North (km): 3354.38	
2. Facility Latitude/Longitude: Latitude (DD/MM/SS): 30 19 14	Longitude (DD/MM/SS): 81 56 55		
3. Governmental Facility Code: 4	4. Facility Status Code: A	5. Facility Major Group SIC Code: 49	6. Facility SIC(s): 4911
7. Facility Comment (limit to 500 characters):			

Facility Contact

1. Name and Title of Facility Contact: N. Bert Gianazza, P.E. Environmental Permitting and Compliance.		
2. Facility Contact Mailing Address: Organization/Firm: JEA Street Address: 21 West Church Street		
City : Jacksonville	State: FL	Zip Code: 32202-3139
3. Facility Contact Telephone Numbers: Telephone: (904) 665-6247	Fax: (904) 665-7376	

Facility Regulatory Classifications

Check all that apply:

1. [ ] Small Business Stationary Source? [ ] Unknown
2. [X] Major Source of Pollutants Other than Hazardous Air Pollutants (HAPs)?
3. [ ] Synthetic Minor Source of Pollutants Other than HAPs?
4. [ ] Major Source of Hazardous Air Pollutants (HAPs)?
5. [ ] Synthetic Minor Source of HAPs?
6. [X] One or More Emissions Units Subject to NSPS?
7. [ ] One or More Emission Units Subject to NESHAP?
8. [X] Title V Source by EPA Designation?
9. Facility Regulatory Classifications Comment (limit to 200 characters):

List of Applicable Regulations

See Attachment A for Facility Applicable regulations.

B. FACILITY POLLUTANTS

List of Pollutants Emitted

1. Pollutant Emitted	2. Pollutant Classif.	3. Requested Emissions Cap lb/hour	tons/year	4. Basis for Emissions Cap	5. Pollutant Comment
NOX	A				
CO	A				
VOC	B				
SO2	B		39.5	ESCPSD	288 hrs of operation on fuel oil per emission unit (units 2 and 3)
PM	A				
PM10	A				
PB	B				
HAPS	B				

C. FACILITY SUPPLEMENTAL INFORMATION

Supplemental Requirements

1. Area Map Showing Facility Location: [X] Attached, Document ID: Attachment B [ ] Not Applicable [ ] Waiver Requested
2. Facility Plot Plan: [X] Attached, Document ID: Attachment C [ ] Not Applicable [ ] Waiver Requested
3. Process Flow Diagram(s): [X] Attached, Document ID: Attachment D [ ] Not Applicable [ ] Waiver Requested
4. Precautions to Prevent Emissions of Unconfined Particulate Matter: [X] Attached, Document ID: SCA Section 4 [ ] Not Applicable [ ] Waiver Requested
5. Fugitive Emissions Identification: [ ] Attached, Document ID:_____ [X] Not Applicable [ ] Waiver Requested
6. Supplemental Information for Construction Permit Application: [X] Attached, Document ID: SCA Appendix 10.7_____ [ ] Not Applicable
7. Supplemental Requirements Comment:

Additional Supplemental Requirements for Title V Air Operation Permit Applications

8. List of Proposed Insignificant Activities:
   [ ] Attached, Document ID:_____ [X] Not Applicable

9. List of Equipment/Activities Regulated under Title VI:
   [ ] Attached, Document ID:_____
   [ ] Equipment/Activities On site but Not Required to be Individually Listed
   [X] Not Applicable

10. Alternative Methods of Operation:
    [ ] Attached, Document ID:_____ [X] Not Applicable

11. Alternative Modes of Operation (Emissions Trading):
    [ ] Attached, Document ID:_____ [X] Not Applicable

12. Identification of Additional Applicable Requirements:
    [ ] Attached, Document ID:_____ [X] Not Applicable

13. Risk Management Plan Verification:
    [ ] Plan previously submitted to Chemical Emergency Preparedness and Prevention Office (CEPPO). Verification of submittal attached (Document ID:_____) or previously submitted to DEP (Date and DEP Office:_____)
    [ ] Plan to be submitted to CEPPO (Date required:_____)
    [X] Not Applicable

14. Compliance Report and Plan:
    [ ] Attached, Document ID:_____[X] Not Applicable

15. Compliance Certification (Hard-copy Required):
    [ ] Attached, Document ID:_____[X] Not Applicable

III. EMISSIONS UNIT INFORMATION

A separate Emissions Unit Information Section (including subsections A through J as required) must be completed for each emissions unit addressed in this Application for Air Permit. If submitting the application form in hard copy, indicate, in the space provided at the top of each page, the number of this Emissions Unit Information Section and the total number of Emissions Unit Information Sections submitted as part of this application.

A. GENERAL EMISSIONS UNIT INFORMATION

(All Emissions Units)

Emissions Unit Description and Status

1. Type of Emissions Unit Addressed in This Section: (Check one)

[X] This Emissions Unit Information Section addresses, as a single emissions unit, a single process or production unit, or activity, which produces one or more air pollutants and which has at least one definable emission point (stack or vent).

[ ] This Emissions Unit Information Section addresses, as a single emissions unit, a group of process or production units and activities which has at least one definable emission point (stack or vent) but may also produce fugitive emissions.

[ ] This Emissions Unit Information Section addresses, as a single emissions unit, one or more process or production units and activities which produce fugitive emissions only.

2. Regulated or Unregulated Emissions Unit? (Check one)

[X] The emissions unit addressed in this Emissions Unit Information Section is a regulated emissions unit.

[ ] The emissions unit addressed in this Emissions Unit Information Section is an unregulated emissions unit.

3. Description of Emissions Unit Addressed in This Section (limit to 60 characters):

Unit 2 – 170 MW Combined Cycle Combustion Turbine with supplemental firing (40 CFR Subpart Dc duct burners).

4. Emissions Unit Identification Number: ID: 002 [ ] No ID [ ] ID Unknown

5. Emissions Unit Status Code:	6. Initial Startup Date:	7. Emissions Unit Major Group SIC Code:	8. Acid Rain Unit?
C		49	[X]

9. Emissions Unit Comment: (Limit to 500 Characters)
The 170 MW combined cycle combustion turbine is comprised of one combustion turbine, which exhausts through a heat recovery steam generator (HRSG) which, is used to power a steam turbine.
Natural gas is the primary fuel; low sulfur distillate fuel oil is the back-up fuel.

Applicant requests the following permit condition:
Excess emissions resulting form startup, shutdown, or malfunction shall be permitted provided that best operational practices are adhered to and the duration of excess emission shall be minimized. Excess emissions occurrences shall in no case exceed two hours in any 24-hour period except during both "cold start-up" to or shutdowns from combined cycle plant operation. During start-up to simple cycle operation, up to four hours of excess emissions are allowed. During shutdowns from combined cycle operation, up to three hours of excess emissions are allowed. Cold start-up is defined as a startup to combined cycle operation following a complete shutdown lasting at least 48 hours.

Emissions Unit Control Equipment

1. Control Equipment/Method Description (Limit to 200 characters per device or method):

   Dry Low NO_x (DLN) Combustor.

   Water injection during fuel oil firing.

   Selective Catalytic Reduction (SCR).

2. Control Device or Method Code(s): 024, 028, 065

Emissions Unit Details

1. Package Unit: Combined cycle combustion turbine generator
   Manufacturer: General Electric Model Number: PG 7241 FA
2. Generator Nameplate Rating: 170 MW
3. Incinerator Information: N/A
   Dwell Temperature: °F
   Dwell Time: seconds
   Incinerator Afterburner Temperature: °F

B. EMISSIONS UNIT CAPACITY INFORMATION
(Regulated Emissions Units Only)

Emissions Unit Operating Capacity and Schedule

1. Maximum Heat Input Rate:	(Natural gas firing)	1,910.2 (HHV)	MMBtu/hr
	(Fuel oil firing)	2,059.4 (HHV)	MMBtu/hr
2. Maximum Incineration Rate:	N/A	lb/hr	tons/day
3. Maximum Process or Throughput Rate: N/A			
4. Maximum Production Rate: N/A			
5. Requested Maximum Operating Schedule:			
For Natural Gas:	24 hours/day		7 days/week
	52 weeks/year		8760 hours/year
For Fuel Oil:	24 hours/day		7 days/week
	12 days/year		288 hours/year

6. Operating Capacity/Schedule Comment (limit to 200 characters):

Maximum Heat Input Rate in Field 1 is based on and includes supplementary firing for natural gas firing, (Higher heating value (HHV))

Maximum heat Input Rate during No.2 oil firing is 2059.4 mmBtu/hr (HHV)

*Maximum hours of operation on natural gas are 8,760 hr/yr and 288 hr/yr for No.2 Fuel oil.

C. EMISSIONS UNIT REGULATIONS
(Regulated Emissions Units Only)

List of Applicable Regulations

40 CFR 60, Subpart A- General Provisions	Emission unit applicable regulations hereby incorporates by reference the Title V Core List of Applicable Regulations that all Title V sources are presumptively subject.
40 CFR 60, Subpart Dc- Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units	
40 CFR 60, Subpart GG- Standards of Performance for Stationary Gas Turbines	
40 CFR 72, Permits Regulation	
40 CFR 73, Sulfur Dioxide Allowance System	
40 CFR 75, Continuos Emission Monitoring	
62-204.800(7)(b), Federal Regulations Adopted by Reference- Standards of Performance for New Stationary Sources	
62-297.520, Stationary Sources- Emissions Monitoring	
Ordinance Code, City of Jacksonville (JOC), Title X, Chapter 376, Odor Control	
Jacksonville Environmental Protection Board (JEPB), Rule 2 Part IX, General Pollutant Emission Limiting Standards – Objectionable Odor Prohibited	
Ordinance Code, City of Jacksonville (JOC), Title V, Chapter 362, Air and Water Pollution	

D. EMISSION POINT (STACK/VENT) INFORMATION
(Regulated Emissions Units Only)

Emission Point Description and Type

1. Identification of Point on Plot Plan or Flow Diagram? ID #23 on Plot Plan in Attachment C	2. Emission Point Type Code: 1

3. Descriptions of Emission Points Comprising this Emissions Unit for VE Tracking (limit to 100 characters per point): One 190-foot vertical cylindrical exhaust stack associated with the CT/HRSG

4. ID Numbers or Descriptions of Emission Units with this Emission Point in Common: N/A

5. Discharge Type Code: V	6. Stack Height: 190 feet	7. Exit Diameter: 18 feet
8. Exit Temperature: 210 °F	9. Actual Volumetric Flow Rate: 1,011,200 acfm	10. Water Vapor: N/A

11. Maximum Dry Standard Flow Rate: N/A	12. Nonstack Emission Point Height: N/A

13. Emission Point UTM Coordinates: Zone:17 East (km):408.774 North (km):3354.531

14. Emission Point Comment (limit to 200 characters):

E. SEGMENT (PROCESS/FUEL) INFORMATION
(All Emissions Units)

Segment Description and Rate: Segment 1 of 2

1. Segment Description (Process/Fuel Type) (limit to 500 characters): Combustion turbine operating in combined cycle on natural gas. This unit is allowed to operate on natural gas for an entire year (i.e., 8,760 hours)		
2. Source Classification Code (SCC): 20100201	3. SCC Units: Million Cubic Feet Burned (all gaseous fuel)	
4. Maximum Hourly Rate: 1.87	5. Maximum Annual Rate: 16,405.25	6. Estimated Annual Activity Factor: N/A
7. Maximum % Sulfur:	8. Maximum % Ash: N/A	9. Million Btu per SCC Unit: 1020
10. Segment Comment (limit to 200 characters): Maximum Hourly Rate = $\frac{1910.2 \text{ mmBtu/hr}}{1020 \text{ mmBtu/mmscf}}$ = 1.87 mmscf/hr Maximum Annual Rate = $\frac{8760 \text{ hrs/yr} \times 1910.2 \text{ mmBtu/hr}}{1020 \text{ mmBtu/mmscsf}}$ = 16,405.25 mmscf/hr		

Segment Description and Rate: Segment 2 of 2

1. Segment Description (Process/Fuel Type) (limit to 500 characters): Combustion turbine operating in combined cycle on No. 2 distillate fuel oil. Unit 2 will operate on No.2 distillate fuel oil for 288 hours per year.		
9. Source Classification Code (SCC): 20100101	3. SCC Units: Thousand Gallons Burned (all liquid fuels)	
4. Maximum Hourly Rate: 14.82	5. Maximum Annual Rate: 4,266.96	6. Estimated Annual Activity Factor: N/A
7. Maximum % Sulfur: 0.05	8. Maximum % Ash: N/A	9. Million Btu per SCC Unit: 139
10. Segment Comment (limit to 200 characters): Maximum Hourly Rate = $\frac{2059.4 \text{ mmBtu/hr}}{139 \text{ mmBtu/thousand gallons}}$ = 14.82 thousand gallons/hr Maximum Annual Rate = $\frac{288 \text{ hrs/yr} \times 2059.4 \text{ mmBtu/hr}}{139 \text{ mmBtu/thousand gallons}}$ = 4,266.96 thousand gallons/yr		

F. EMISSIONS UNIT POLLUTANTS
(All Emissions Units)

1. Pollutant Emitted	2. Primary Control Device Code	3. Secondary Control Device Code	4. Pollutant Regulatory Code
NOX	065	024, 028	EL
CO			EL
VOC			EL
SO2			EL
PM			EL
PM10			EL
PB			EL
HAPS			NS

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units -
Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: NO_x	2. Total Percent Efficiency of Control: 61%

3. Potential Emissions: Natural Gas Firing 24.95 lb/hour 109.28 tons/year Fuel Oil Firing 119.37 lb/hour 17.19 tons/year	4. Synthetically Limited? [ ]

5. Range of Estimated Fugitive Emissions:
[ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year

6. Emission Factor:	7. Emissions Method Code: 0

8. Calculation of Emissions (limit to 600 characters):

Potential annual emissions:
Natural Gas Firing:
24.95 lb/hr * 8760 hr/yr * 1/2000 lb = 109.28 tons per year
Fuel Oil Firing:
119.37 lb/hr * 288 hr/yr* 1/ 2000 lb = 17.19 tons per year

9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):

Allowable Emissions Allowable Emissions 1 of 3

1. Basis for Allowable Emissions Code: OTHER	2. Future Effective Date of Allowable Emissions: N/A
3. Requested Allowable Emissions and Units: 3.5 ppm (at 15% O_2 for Natural Gas)	4. Equivalent Allowable Emissions: 24.95 lb/hour 109.28 tons/year

5. Method of Compliance (limit to 60 characters):
- Record Keeping – hours of operation per fuel type per 12 month period
- Stack testing
- CEMS

6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters):

8,760 hours of Natural gas firing.

OTHER Explanation : BACT

Allowable Emissions Allowable Emissions 2 of 3

1. Basis for Allowable Emissions Code: OTHER	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 15 ppm (at 15% O_2) for Fuel Oil	4. Equivalent Allowable Emissions: 119.37 lb/hour 17.19 tons/year
5. Method of Compliance (limit to 60 characters): - Record Keeping – hours of operation per fuel type per 12 month period - Stack testing - CEMS	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): 288 hours/yr of fuel oil firing. OTHER Explanation : BACT.	

Allowable Emissions Allowable Emissions 3 of 3

1. Basis for Allowable Emissions Code: RULE	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 75 ppm (at 15% O_2) for Natural Gas	4. Equivalent Allowable Emissions:
5. Method of Compliance (limit to 60 characters): - Record Keeping – hours of operation per fuel type per 12 month period - Stack testing - CEMS	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): 8,760 hours of Natural gas firing.	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: CO	2. Total Percent Efficiency of Control:
3. Potential Emissions: Natural Gas Firing: 54.26 lb/hour 237.66 tons/year Fuel Oil Firing 72.43 lb/hour 10.43 tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor:	7. Emissions Method Code: 0
8. Calculation of Emissions (limit to 600 characters): Potential annual emissions: Natural Gas Firing: 54.26 lb/hr * 8760 hr/yr * 1/2000 lb = 237.66 tons per year Fuel Oil Firing: 72.43 lb/hr * 288 hr/yr* 1/ 2000 lb = 10.43 tons per year	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):	

Allowable Emissions Allowable Emissions 1 of 2

1. Basis for Allowable Emissions Code: OTHER	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 54.26 lb/hour	4. Equivalent Allowable Emissions: 54.26 lb/hour 237.66 tons/year
5. Method of Compliance (limit to 60 characters): - Record Keeping – hours of operation per fuel type per 12 month period - Stack testing	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): 8,760 hours of Natural gas firing. OTHER Explanation : BACT.	

Allowable Emissions Allowable Emissions _2____ of __2___

1. Basis for Allowable Emissions Code: OTHER	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 72.43 lb/hour	4. Equivalent Allowable Emissions: 72.43 lb/hour 10.43 tons/year
5. Method of Compliance (limit to 60 characters): - Record Keeping – hours of operation per fuel type per 12 month period - Stack testing	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): 288 hours/yr of Fuel oil firing. OTHER Explanation : BACT.	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units –
Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: PM/PM_{10}	2. Total Percent Efficiency of Control:

3. Potential Emissions: Natural Gas Firing 20.60 lb/hour 90.23 tons/year Fuel Oil Firing 62.10 lb/hour 8.94 tons/year	4. Synthetically Limited? [ ]

5. Range of Estimated Fugitive Emissions:
[ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year

6. Emission Factor:	7. Emissions Method Code: 0

8. Calculation of Emissions (limit to 600 characters):

Potential annual emissions:
Natural Gas Firing:
20.60 lb/hr * 8760 hr/yr * 1/2000 lb = 90.23 tons per year
Fuel Oil Firing:
62.10 lb/hr * 288 hr/yr* 1/ 2000 lb = 8.94 tons per year

9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: OTHER	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units:	4. Equivalent Allowable Emissions:

5. Method of Compliance (limit to 60 characters):
- Record Keeping – hours of operation per fuel type per 12 month period
- Fuel monitoring schedule.
- VE Limitation

6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters):

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: SO_2	2. Total Percent Efficiency of Control:
3. Potential Emissions: Natural Gas Firing: 1.22 lb/hour 5.34 tons/year Fuel Oil Firing 109.35 lb/hour 15.74 tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor:	7. Emissions Method Code: 0
10. Calculation of Emissions (limit to 600 characters): Potential annual emissions: Natural Gas Firing: 1.22 lb/hr * 8760 hr/yr * 1/2000 lb = 5.34 tons per year Fuel Oil Firing: 109.35 lb/hr * 288 hr/yr* 1/ 2000 lb = 15.74 tons per year	
11. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):	

Allowable Emissions Allowable Emissions _1____ of _2___

1. Basis for Allowable Emissions Code: OTHER	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 1.22 lb/hour	4. Equivalent Allowable Emissions: 1.22 lb/hour 5.34 tons/year
5. Method of Compliance (limit to 60 characters): - Record Keeping – hours of operation per fuel type per 12 month period	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): 8,760 hours of Natural gas firing.	

Allowable Emissions Allowable Emissions 2 of 2

1. Basis for Allowable Emissions Code: OTHER	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 109.35 lb/hour	4. Equivalent Allowable Emissions: 109.35 lb/hour 15.74 tons/year
5. Method of Compliance (limit to 60 characters): - Record Keeping – hours of operation per fuel type per 12 month period	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): 288 hours/yr of Fuel oil firing.	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units -
Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: VOC	2. Total Percent Efficiency of Control:
3. Potential Emissions: Natural Gas Firing: 4.77 lb/hour 20.89 tons/year Fuel Oil Firing 8.14 lb/hour 1.17 tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor:	7. Emissions Method Code: 0
12. Calculation of Emissions (limit to 600 characters): Potential annual emissions: Natural Gas Firing: 4.77 lb/hr * 8760 hr/yr * 1/2000 lb = 20.89 tons per year Fuel Oil Firing: 8.14 lb/hr * 288 hr/yr* 1/ 2000 lb = 1.17 tons per year	
13. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):	

Allowable Emissions Allowable Emissions _1____ of _2___

1. Basis for Allowable Emissions Code: OTHER	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 4.77 lb/hour	4. Equivalent Allowable Emissions: 4.77 lb/hour 20.89 tons/year
5. Method of Compliance (limit to 60 characters): - Record Keeping – hours of operation per fuel type per 12 month period	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): 8,760 hours of Natural gas firing.	

Allowable Emissions Allowable Emissions 2 of 2

1. Basis for Allowable Emissions Code: OTHER	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 8.14 lb/hour	4. Equivalent Allowable Emissions: 8.14 lb/hour 1.17 tons/year
5. Method of Compliance (limit to 60 characters): - Record Keeping – hours of operation per fuel type per 12 month period	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): 288 hours/yr of Fuel oil firing.	

H. VISIBLE EMISSIONS INFORMATION
(Only Regulated Emissions Units Subject to a VE Limitation)

Visible Emissions Limitation: Visible Emissions Limitation __1__of__1__

1. Visible Emissions Subtype: VE20	2. Basis for Allowable Opacity: [X] Rule [ ] Other
3. Requested Allowable Opacity: Normal Conditions: 20% Exceptional Conditions: 27 % Maximum Period of Excess Opacity Allowed: 6 min/hour	
4. Method of Compliance: - stack testing (USEPA Method 9 Visual Determination of Opacity) - VE limit proposed in lieu of PM/PM_{10} pound per hour limit.	
5. Visible Emissions Comment (limit to 200 characters): Florida Air Regulation: Rule 62.296	

I. CONTINUOUS MONITOR INFORMATION
(Only Regulated Emissions Units Subject to Continuous Monitoring)

Continuous Monitoring System: Continuous Monitor __1__ of __6_

1. Parameter Code: EM	2. Pollutant(s): NO_x
3. CMS Requirement:	[X] Rule [ ] Other
4. Monitor Information: Later Manufacturer: Later Model Number: Later	Serial Number:
5. Installation Date: Later	6. Performance Specification Test Date: Later
7. Continuous Monitor Comment (limit to 200 characters): Rule: 40 CFR Part 60 and 40 CFR Part 75.	

Continuous Monitoring System: Continuous Monitor __2__ of __6_

1. Parameter Code: WTF	2. Pollutant(s):
3. CMS Requirement:	[X] Rule [ ] Other
4. Monitor Information: Manufacturer: Model Number:	Serial Number:
5. Installation Date:	6. Performance Specification Test Date:
7. Continuous Monitor Comment (limit to 200 characters): CMS will be installed before operation of the emission source. Rule: New Source Performance Standards 40 CFR 60, Subpart GG	

Continuous Monitoring System: Continuous Monitor 3 of 6

1. Parameter Code: FLOW	2. Pollutant(s):
3. CMS Requirement:	[ ] Rule [X] Other
4. Monitor Information: Later Manufacturer: Later Model Number: Later	Serial Number:
5. Installation Date: Later	6. Performance Specification Test Date: Later
7. Continuous Monitor Comment (limit to 200 characters): CMS will be installed before operation of the emission source. Fuel oil flow monitoring will be operated pursuant to 40 CFR Part 75.	

Continuous Monitoring System: Continuous Monitor 4 of 6

1. Parameter Code: FLOW	2. Pollutant(s):
3. CMS Requirement: Later	[ ] Rule [X] Other
4. Monitor Information: Later Manufacturer: Later Model Number:Later	Serial Number: Later
5. Installation Date: Later	6. Performance Specification Test Date: Later
7. Continuous Monitor Comment (limit to 200 characters): CMS will be installed before operation of the emission source. Natural Gas flow monitor installed pursuant to 40 CFR 75.	

Continuous Monitoring System: Continuous Monitor 5 of 6

1. Parameter Code: O2	2. Pollutant(s):
3. CMS Requirement:	[X] Rule [ ] Other
4. Monitor Information: Later Manufacturer: Later Model Number: Later	Serial Number: Later
5. Installation Date: Later	6. Performance Specification Test Date: Later
7. Continuous Monitor Comment (limit to 200 characters): CMS will be installed before operation of the emission source. This CMS will be installed on the HRSG stack. Required by 40 CFR Part 75.	

Continuous Monitoring System: Continuous Monitor 6 of 6

1. Parameter Code: VE	2. Pollutant(s):
3. CMS Requirement:	[ ] Rule [X] Other
4. Monitor Information: Later Manufacturer: Later Model Number: Later	Serial Number: Later
5. Installation Date: Later	6. Performance Specification Test Date: Later
7. Continuous Monitor Comment (limit to 200 characters): CMS for Opacity will be installed before operation of the emission source. This CMS will be installed on the HRSG stack. Required by 40 CFR Part 75.	

J. EMISSIONS UNIT SUPPLEMENTAL INFORMATION
(Regulated Emissions Units Only)

Supplemental Requirements

1. Process Flow Diagram [X] Attached, Document ID: Attachment D [ ] Not Applicable [ ] Waiver Requested
2. Fuel Analysis or Specification [X] Attached, Document ID: Attachment E [ ] Not Applicable [ ] Waiver Requested
3. Detailed Description of Control Equipment [X] Attached, Document ID: SCA BACT Analysis Appendix 10.7, Section 3.0
4. Description of Stack Sampling Facilities [X] Attached, Document ID: Attachment F [ ] Not Applicable [ ] Waiver Requested
5. Compliance Test Report [ ] Attached, Document ID:_____ [ ] Previously submitted, Date: [X] Not Applicable
6. Procedures for Startup and Shutdown [ ] Attached, Document ID:_____ [X] Not Applicable [ ] Waiver Requested
7. Operation and Maintenance Plan [ ] Attached, Document ID:_____ [X] Not Applicable [ ] Waiver Requested
8. Supplemental Information for Construction Permit Application [X] Attached, Document ID: SCA PSD Application Appendix 10.7 [ ] Not Applicable
9. Other Information Required by Rule or Statute [ ] Attached, Document ID:_____ [X] Not Applicable
10. Supplemental Requirements Comment: None

Additional Supplemental Requirements for Title V Air Operation Permit Applications

11. Alternative Methods of Operation
[ ] Attached, Document ID:_____ [X] Not Applicable

12. Alternative Modes of Operation (Emissions Trading)
[ ] Attached, Document ID:_____ [X] Not Applicable

13. Identification of Additional Applicable Requirements
[ ] Attached, Document ID:_____ [X] Not Applicable

14. Compliance Assurance Monitoring Plan
[ ] Attached, Document ID:_____ [X] Not Applicable

15. Acid Rain Part Application (Hard-copy Required)

[x] Acid Rain Part - Phase II (Form No. 62-210.900(1)(a))
Attached, Document ID: Attachment G

[ ] Repowering Extension Plan (Form No. 62-210.900(1)(a)1.)
Attached, Document ID:_____

[ ] New Unit Exemption (Form No. 62-210.900(1)(a)2.)
Attached, Document ID:_____

[ ] Retired Unit Exemption (Form No. 62-210.900(1)(a)3.)
Attached, Document ID:_____

[ ] Phase II NOx Compliance Plan (Form No. 62-210.900(1)(a)4.)
Attached, Document ID:_____

[ ] Phase NOx Averaging Plan (Form No. 62-210.900(1)(a)5.)
Attached, Document ID:_____

[ ] Not Applicable

III. EMISSIONS UNIT INFORMATION

A separate Emissions Unit Information Section (including subsections A through J as required) must be completed for each emissions unit addressed in this Application for Air Permit. If submitting the application form in hard copy, indicate, in the space provided at the top of each page, the number of this Emissions Unit Information Section and the total number of Emissions Unit Information Sections submitted as part of this application.

A. GENERAL EMISSIONS UNIT INFORMATION

(All Emissions Units)

Emissions Unit Description and Status

1. Type of Emissions Unit Addressed in This Section: (Check one)

[X] This Emissions Unit Information Section addresses, as a single emissions unit, a single process or production unit, or activity, which produces one or more air pollutants and which has at least one definable emission point (stack or vent).

[ ] This Emissions Unit Information Section addresses, as a single emissions unit, a group of process or production units and activities which has at least one definable emission point (stack or vent) but may also produce fugitive emissions.

[ ] This Emissions Unit Information Section addresses, as a single emissions unit, one or more process or production units and activities which produce fugitive emissions only.

2. Regulated or Unregulated Emissions Unit? (Check one)

[X] The emissions unit addressed in this Emissions Unit Information Section is a regulated emissions unit.

[ ] The emissions unit addressed in this Emissions Unit Information Section is an unregulated emissions unit.

4. Description of Emissions Unit Addressed in This Section (limit to 60 characters):

Unit 3 – 170 MW Combined Cycle Combustion Turbine with supplemental firing.

4. Emissions Unit Identification Number: [ ] No ID
ID: 003 [ ] ID Unknown

5. Emissions Unit Status Code:	6. Initial Startup Date:	7. Emissions Unit Major Group SIC Code:	8. Acid Rain Unit?
C		49	[X]

9. Emissions Unit Comment: (Limit to 500 Characters)
The 170 MW combined cycle combustion turbine is comprised of one combustion turbine, which exhausts through a heat recovery steam generator (HRSG) which, is used to power a steam turbine.
Natural gas is the primary fuel; low sulfur distillate fuel oil is the back-up fuel.

Applicant requested emission limitation:
Excess emissions resulting form startup, shutdown, or malfunction shall be permitted provided that best operational practices are adhered to and the duration of excess emission shall be minimized. Excess emissions occurrences shall in no case exceed two hours in any 24-hour period except during both "cold start-up" to or shutdowns from combined cycle plant operation. During start-up to simple cycle operation, up to four hours of excess emissions are allowed. During shutdowns from combined cycle operation, up to three hours of excess emissions are allowed. Cold start-up is defined as a startup to combined cycle operation following a complete shutdown lasting at least 48 hours.

Emissions Unit Control Equipment

2. Control Equipment/Method Description (Limit to 200 characters per device or method): Dry Low NO_x (DLN) Combustor. Water injection during fuel oil firing. Selective Catalytic Reduction (SCR).
2. Control Device or Method Code(s): 024, 028, 065

Emissions Unit Details

1. Package Unit: Combined cycle combustion turbine generator Manufacturer: General Electric	Model Number: 7FA	
2. Generator Nameplate Rating:		
3. Incinerator Information:		
	Dwell Temperature:	°F
	Dwell Time:	seconds
	Incinerator Afterburner Temperature:	°F

B. EMISSIONS UNIT CAPACITY INFORMATION
(Regulated Emissions Units Only)

Emissions Unit Operating Capacity and Schedule

1. Maximum Heat Input Rate:	(Natural gas firing)	1,910.2 (HHV)	mmBtu/hr
	(Fuel oil firing)	2,059.4 (HHV)	mmBtu/hr
2. Maximum Incineration Rate:	N/A	lb/hr	tons/day
3. Maximum Process or Throughput Rate: N/A			
4. Maximum Production Rate: N/A			
5. Requested Maximum Operating Schedule:			
For Natural Gas:	24 hours/day	7 days/week	
	52 weeks/year	8760 hours/year	
For Fuel Oil:	24 hours/day	7 days/week	
	12 days/year	288 hours/year	

7. Operating Capacity/Schedule Comment (limit to 200 characters):

Maximum Heat Input Rate in Field 1 is based on and includes supplementary firing for natural gas firing, (Higher heating value (HHV))

Maximum heat Input Rate during No.2 oil firing is 2059.4 mmBtu/hr (HHV)

*Maximum hours of operation on natural gas are 8,760 hr/yr and 288 hr/yr for No.2 Fuel oil.

C. EMISSIONS UNIT REGULATIONS
(Regulated Emissions Units Only)

List of Applicable Regulations

40 CFR 60, Subpart A- General Provisions	Emission unit applicable regulations hereby incorporates by reference the Title V Core List of Applicable Regulations that all Title V sources are presumptively subject.
40 CFR 60, Subpart Dc-	
40 CFR 60, Subpart GG- Standards of Performance for Stationary Gas Turbines	
40 CFR 72, Permits Regulation	
40 CFR 73, Sulfur Dioxide Allowance System	
40 CFR 75, Continuos Emission Monitoring	
62-204.800(7)(b), Federal Regulations Adopted by Reference- Standards of Performance for New Stationary Sources	
62-297.520, Station Sources- Emissions Monitoring	
Ordinance Code, City of Jacksonville (JOC), Title X, Chapter 376, Odor Control	
Jacksonville Environmental Protection Board (JEPB), Rule 2 Part IX, General Pollutant Emission Limiting Standards – Objectionable Odor Prohibited	
Ordinance Code, City of Jacksonville (JOC), Title V, Chapter 362, Air and Water Pollution	

D. EMISSION POINT (STACK/VENT) INFORMATION
(Regulated Emissions Units Only)

Emission Point Description and Type

4. Identification of Point on Plot Plan or Flow Diagram? ID #23 on Plot Plan in Attachment 2	6. Emission Point Type Code: 1

7. Descriptions of Emission Points Comprising this Emissions Unit for VE Tracking (limit to 100 characters per point):

One 190-foot vertical cylindrical exhaust stack associated with the combustion turbine

8. ID Numbers or Descriptions of Emission Units with this Emission Point in Common:

N/A

9. Discharge Type Code: V	6. Stack Height: 190 feet	7. Exit Diameter: 18 feet
8. Exit Temperature: 210 °F	9. Actual Volumetric Flow Rate: 1,011,200 acfm	10. Water Vapor: N/A

11. Maximum Dry Standard Flow Rate: N/A	12. Nonstack Emission Point Height: N/A

13. Emission Point UTM Coordinates:

Zone:17 East (km):408.713 North (km):3354.531

14. Emission Point Comment (limit to 200 characters):

E. SEGMENT (PROCESS/FUEL) INFORMATION
(All Emissions Units)

Segment Description and Rate: Segment _1____ of __2___

2. Segment Description (Process/Fuel Type) (limit to 500 characters): Combustion turbine operating in combined cycle on natural gas. This unit is allowed to operate on natural gas for an entire year (i.e., 8,760 hours)		
2. Source Classification Code (SCC): 20100201	3. SCC Units: Million Cubic Feet Burned (all gaseous fuel)	
4. Maximum Hourly Rate: 1.87	5. Maximum Annual Rate: 16,405.25	6. Estimated Annual Activity Factor: N/A
7. Maximum % Sulfur:	10. Maximum % Ash: N/A	9. Million Btu per SCC Unit: 1020
11. Segment Comment (limit to 200 characters): Maximum Hourly Rate = $\frac{1910.2 \text{ mmBtu/hr}}{1020 \text{ mmBtu/mmscf}}$ = 1.87 mmscf/hr Maximum Annual Rate = $\frac{8760 \text{ hrs/yr} \times 1910.2 \text{ mmBtu/hr}}{1020 \text{ mmBtu/mmscsf}}$ = 16,405.25 mmscf/hr		

Segment Description and Rate: Segment _2____ of ___2__

1. Segment Description (Process/Fuel Type) (limit to 500 characters): Combustion turbine operating in combined cycle on No. 2 distillate fuel oil. Unit 2 will operate on No.2 distillate fuel oil for 288 hours per year.		
11. Source Classification Code (SCC): 20100101	3. SCC Units: Thousand Gallons Burned (all liquid fuels)	
4. Maximum Hourly Rate: 14.82	5. Maximum Annual Rate: 4,266.96	6. Estimated Annual Activity Factor: N/A
7. Maximum % Sulfur: 0.05	10. Maximum % Ash: N/A	11. Million Btu per SCC Unit: 139
11. Segment Comment (limit to 200 characters): Maximum Hourly Rate = $\frac{2059.4 \text{ mmBtu/hr}}{139 \text{ mmBtu/thousand gallons}}$ = 14.82 thousand gallons/hr Maximum Annual Rate = $\frac{288 \text{ hrs/yr} \times 2059.4 \text{ mmBtu/hr}}{139 \text{ mmBtu/thousand gallons}}$ = 4,266.96 thousand gallons/yr		

F. EMISSIONS UNIT POLLUTANTS
(All Emissions Units)

1. Pollutant Emitted	2. Primary Control Device Code	3. Secondary Control Device Code	4. Pollutant Regulatory Code
NOX	065	024, 028	EL
CO			EL
VOC			EL
SO2			EL
PM			EL
PM10			EL
PB			EL
HAPS			NS

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units -
Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: NO_x	2. Total Percent Efficiency of Control: 61%

3. Potential Emissions:					4. Synthetically Limited? [ ]
Natural Gas Firing	24.95	lb/hour	109.28	tons/year	
Fuel Oil Firing	119.37	lb/hour	17.19	tons/year	

5. Range of Estimated Fugitive Emissions:
[ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year

6. Emission Factor:	7. Emissions Method Code: 0

10. Calculation of Emissions (limit to 600 characters):

Potential annual emissions:
Natural Gas Firing:
24.95 lb/hr * 8760 hr/yr * 1/2000 lb = 109.28 tons per year
Fuel Oil Firing:
119.37 lb/hr * 288 hr/yr* 1/ 2000 lb = 17.19 tons per year

11. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):

Allowable Emissions Allowable Emissions 1 of 3

1. Basis for Allowable Emissions Code: OTHER	2. Future Effective Date of Allowable Emissions: N/A
5. Requested Allowable Emissions and Units: 3.5 ppm (at 15% O_2 for Natural Gas)	4. Equivalent Allowable Emissions: 24.95 lb/hour 109.28 tons/year

5. Method of Compliance (limit to 60 characters):
- Record Keeping – hours of operation per fuel type per 12 month period
- Stack testing
- CEMS

6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters):

8,760 hours of Natural gas firing.

OTHER Explanation : BACT

Allowable Emissions Allowable Emissions 2 of 3

1. Basis for Allowable Emissions Code: OTHER	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 15 ppm (at 15% O_2) for Fuel Oil	4. Equivalent Allowable Emissions: 119.37 lb/hour 17.19 tons/year
5. Method of Compliance (limit to 60 characters): - Record Keeping – hours of operation per fuel type per 12 month period - Stack testing - CEMS	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): 288 hours/yr of fuel oil firing. OTHER Explanation : BACT.	

Allowable Emissions Allowable Emissions 3 of 3

1. Basis for Allowable Emissions Code: RULE	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 75 ppm (at 15% O_2) for Natural Gas	4. Equivalent Allowable Emissions:
5. Method of Compliance (limit to 60 characters): - Record Keeping – hours of operation per fuel type per 12 month period - Stack testing - CEMS	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): 8,760 hours of Natural gas firing.	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units -
Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: CO	2. Total Percent Efficiency of Control:
3. Potential Emissions: Natural Gas Firing: 54.26 lb/hour 237.66 tons/year Fuel Oil Firing 72.43 lb/hour 10.43 tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor:	7. Emissions Method Code: 0
14. Calculation of Emissions (limit to 600 characters): Potential annual emissions: Natural Gas Firing: 54.26 lb/hr * 8760 hr/yr * 1/2000 lb = 237.66 tons per year Fuel Oil Firing: 72.43 lb/hr * 288 hr/yr* 1/ 2000 lb = 10.43 tons per year	
15. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):	

Allowable Emissions Allowable Emissions _1___ of _2___

1. Basis for Allowable Emissions Code: OTHER	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 54.26 lb/hour	4. Equivalent Allowable Emissions: 54.26 lb/hour 237.66 tons/year
5. Method of Compliance (limit to 60 characters): - Record Keeping – hours of operation per fuel type per 12 month period - Stack testing	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): 8,760 hours of Natural gas firing. OTHER Explanation : BACT.	

Allowable Emissions Allowable Emissions 2 of 2

1. Basis for Allowable Emissions Code: OTHER	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 72.43 lb/hour	4. Equivalent Allowable Emissions: 72.43 lb/hour 10.43 tons/year
5. Method of Compliance (limit to 60 characters): - Record Keeping – hours of operation per fuel type per 12 month period - Stack testing	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): 288 hours/yr of Fuel oil firing. OTHER Explanation : BACT.	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units –
Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: PM/PM_{10}	2. Total Percent Efficiency of Control:

3. Potential Emissions: Natural Gas Firing 20.60 lb/hour 90.23 tons/year Fuel Oil Firing 62.10 lb/hour 8.94 tons/year	4. Synthetically Limited? [ ]

5. Range of Estimated Fugitive Emissions:
[ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year

6. Emission Factor:	7. Emissions Method Code: 0

9. Calculation of Emissions (limit to 600 characters):

Potential annual emissions:
Natural Gas Firing:
20.60 lb/hr * 8760 hr/yr * 1/2000 lb = 90.23 tons per year
Fuel Oil Firing:
62.10 lb/hr * 288 hr/yr* 1/ 2000 lb = 8.94 tons per year

9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: OTHER	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units:	4. Equivalent Allowable Emissions:

5. Method of Compliance (limit to 60 characters):
- Record Keeping – hours of operation per fuel type per 12 month period
- Fuel monitoring schedule.
- VE Limitation

6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters):

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units -
Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: SO_2	2. Total Percent Efficiency of Control:
3. Potential Emissions: Natural Gas Firing: 1.22 lb/hour 5.34 tons/year Fuel Oil Firing 109.35 lb/hour 15.74 tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor:	7. Emissions Method Code: 0
16. Calculation of Emissions (limit to 600 characters): Potential annual emissions: Natural Gas Firing: 1.22 lb/hr * 8760 hr/yr * 1/2000 lb = 5.34 tons per year Fuel Oil Firing: 109.35 lb/hr * 288 hr/yr* 1/ 2000 lb = 15.74 tons per year	
17. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):	

Allowable Emissions Allowable Emissions 1 of 2

1. Basis for Allowable Emissions Code: OTHER	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 1.22 lb/hour	4. Equivalent Allowable Emissions: 1.22 lb/hour 5.34 tons/year
5. Method of Compliance (limit to 60 characters): - Record Keeping – hours of operation per fuel type per 12 month period	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): 8,760 hours of Natural gas firing.	

Allowable Emissions Allowable Emissions 2 of 2

1. Basis for Allowable Emissions Code: OTHER	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 109.35 lb/hour	4. Equivalent Allowable Emissions: 109.35 lb/hour 15.74 tons/year
5. Method of Compliance (limit to 60 characters): - Record Keeping – hours of operation per fuel type per 12 month period	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): 288 hours/yr of Fuel oil firing.	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units -
Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: VOC	2. Total Percent Efficiency of Control:
3. Potential Emissions: Natural Gas Firing: 4.77 lb/hour 20.89 tons/year Fuel Oil Firing 8.14 lb/hour 1.17 tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor:	7. Emissions Method Code: 0
18. Calculation of Emissions (limit to 600 characters): Potential annual emissions: Natural Gas Firing: 4.77 lb/hr * 8760 hr/yr * 1/2000 lb = 20.89 tons per year Fuel Oil Firing: 8.14 lb/hr * 288 hr/yr* 1/ 2000 lb = 1.17 tons per year	
19. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):	

Allowable Emissions Allowable Emissions _1___ of _2___

1. Basis for Allowable Emissions Code: OTHER	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 4.77 lb/hour	4. Equivalent Allowable Emissions: 4.77 lb/hour 20.89 tons/year
5. Method of Compliance (limit to 60 characters): - Record Keeping – hours of operation per fuel type per 12 month period	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): 8,760 hours of Natural gas firing.	

Allowable Emissions Allowable Emissions 2 of 2

1. Basis for Allowable Emissions Code: OTHER	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 8.14 lb/hour	4. Equivalent Allowable Emissions: 8.14 lb/hour 1.17 tons/year
5. Method of Compliance (limit to 60 characters): - Record Keeping – hours of operation per fuel type per 12 month period	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): 288 hours/yr of Fuel oil firing.	

H. VISIBLE EMISSIONS INFORMATION
(Only Regulated Emissions Units Subject to a VE Limitation)

Visible Emissions Limitation: Visible Emissions Limitation 1 of 1

1. Visible Emissions Subtype: VE20	2. Basis for Allowable Opacity: [X] Rule [ ] Other
3. Requested Allowable Opacity: Normal Conditions: 20% Exceptional Conditions: 27 % Maximum Period of Excess Opacity Allowed: 6 min/hour	
4. Method of Compliance: - stack testing (USEPA Method 9 Visual Determination of Opacity) - VE limit proposed in lieu of PM/PM_{10} pound per hour limit.	
5. Visible Emissions Comment (limit to 200 characters): Florida Air Regulation: Rule 62.296	

I. CONTINUOUS MONITOR INFORMATION
(Only Regulated Emissions Units Subject to Continuous Monitoring)

Continuous Monitoring System: Continuous Monitor ___1__ of ___6_

1. Parameter Code: EM	2. Pollutant(s): NO_x
3. CMS Requirement:	[X] Rule [ ] Other
4. Monitor Information: Later Manufacturer: Later Model Number: Later	Serial Number:
5. Installation Date: Later	6. Performance Specification Test Date: Later
7. Continuous Monitor Comment (limit to 200 characters): Rule: 40 CFR Part 60 and 40 CFR Part 75.	

Continuous Monitoring System: Continuous Monitor ___2__ of ___6_

1. Parameter Code: WTF	2. Pollutant(s):
3. CMS Requirement:	[X] Rule [ ] Other
4. Monitor Information: Manufacturer: Model Number:	Serial Number:
5. Installation Date:	6. Performance Specification Test Date:
7. Continuous Monitor Comment (limit to 200 characters): CMS will be installed before operation of the emission source. Rule: New Source Performance Standards 40 CFR 60, Subpart GG	

Continuous Monitoring System: Continuous Monitor 3 of 6

1. Parameter Code: FLOW	2. Pollutant(s):
3. CMS Requirement:	[ ] Rule [X] Other
4. Monitor Information: Later Manufacturer: Later Model Number: Later	Serial Number:
5. Installation Date: Later	6. Performance Specification Test Date: Later
7. Continuous Monitor Comment (limit to 200 characters): CMS will be installed before operation of the emission source. Fuel oil flow monitoring will be operated pursuant to 40 CFR Part 75.	

Continuous Monitoring System: Continuous Monitor 4 of 6

1. Parameter Code: FLOW	2. Pollutant(s):
3. CMS Requirement: Later	[ ] Rule [X] Other
4. Monitor Information: Later Manufacturer: Later Model Number:Later	Serial Number: Later
5. Installation Date: Later	6. Performance Specification Test Date: Later
7. Continuous Monitor Comment (limit to 200 characters): CMS will be installed before operation of the emission source. Natural Gas flow monitor installed pursuant to 40 CFR 75.	

Continuous Monitoring System: Continuous Monitor 5 of 6

1. Parameter Code: O2	2. Pollutant(s):
3. CMS Requirement:	[X] Rule [ ] Other
4. Monitor Information: Later Manufacturer: Later Model Number: Later	Serial Number: Later
5. Installation Date: Later	6. Performance Specification Test Date: Later
7. Continuous Monitor Comment (limit to 200 characters): CMS will be installed before operation of the emission source. This CMS will be installed on the HRSG stack. Required by 40 CFR Part 75.	

Continuous Monitoring System: Continuous Monitor 6 of 6

1. Parameter Code: VE	2. Pollutant(s):
3. CMS Requirement:	[ ] Rule [X] Other
4. Monitor Information: Later Manufacturer: Later Model Number: Later	Serial Number: Later
5. Installation Date: Later	6. Performance Specification Test Date: Later
7. Continuous Monitor Comment (limit to 200 characters): CMS for Opacity will be installed before operation of the emission source. This CMS will be installed on the HRSG stack. Required by 40 CFR Part 75.	

J. EMISSIONS UNIT SUPPLEMENTAL INFORMATION
(Regulated Emissions Units Only)

Supplemental Requirements

1. Process Flow Diagram [X] Attached, Document ID: Attachment D [ ] Not Applicable [ ] Waiver Requested
2. Fuel Analysis or Specification [X] Attached, Document ID: Attachment E [ ] Not Applicable [ ] Waiver Requested
3. Detailed Description of Control Equipment [X] Attached, Document ID: SCA BACT Analysis Appendix 10.7, Section 3.0
4. Description of Stack Sampling Facilities [X] Attached, Document ID: Attachment F [ ] Not Applicable [ ] Waiver Requested
5. Compliance Test Report [ ] Attached, Document ID:_____ [ ] Previously submitted, Date: [X] Not Applicable
6. Procedures for Startup and Shutdown [ ] Attached, Document ID:_____ [X] Not Applicable [ ] Waiver Requested
7. Operation and Maintenance Plan [ ] Attached, Document ID:_____ [X] Not Applicable [ ] Waiver Requested
8. Supplemental Information for Construction Permit Application [X] Attached, Document ID: SCA PSD Application Appendix 10.7 [ ] Not Applicable
9. Other Information Required by Rule or Statute [ ] Attached, Document ID:_____ [X] Not Applicable
10. Supplemental Requirements Comment: None

Additional Supplemental Requirements for Title V Air Operation Permit Applications

11. Alternative Methods of Operation
[ ] Attached, Document ID:_____ [X] Not Applicable

12. Alternative Modes of Operation (Emissions Trading)
[ ] Attached, Document ID:_____ [X] Not Applicable

13. Identification of Additional Applicable Requirements
[ ] Attached, Document ID:_____ [X] Not Applicable

14. Compliance Assurance Monitoring Plan
[ ] Attached, Document ID:_____ [X] Not Applicable

15. Acid Rain Part Application (Hard-copy Required)

[X] Acid Rain Part - Phase II (Form No. 62-210.900(1)(a))
Attached, Document ID: Attachment G

[ ] Repowering Extension Plan (Form No. 62-210.900(1)(a)1.)
Attached, Document ID:_____

[ ] New Unit Exemption (Form No. 62-210.900(1)(a)2.)
Attached, Document ID:_____

[ ] Retired Unit Exemption (Form No. 62-210.900(1)(a)3.)
Attached, Document ID:_____

[ ] Phase II NOx Compliance Plan (Form No. 62-210.900(1)(a)4.)
Attached, Document ID:_____

[ ] Phase NOx Averaging Plan (Form No. 62-210.900(1)(a)5.)
Attached, Document ID:_____

[ ] Not Applicable

Attachment A
Facility Applicable Regulations

List of Applicable Regulations

FDEP Title V Core List (effective 3/25/95) incorporated by reference

40 CFR Part 60, Subpart A – Standards of Performance for New Stationary Sources

40 CFR Part 60, Subpart GG – Standards of Performance for Stationary Gas Turbines

Part 70 – State Operating Permit Programs

Section 70.1 - Program Overview

Section 70.2 - Definitions

Section 70.3 - Applicability

Section 70.4 - State Program Submittals and Transition

Section 70.5 - Permit Applications

Section 70.6 - Permit Content

Section 70.7 - Permit Issuance, Renewal, Reopenings, and Revisions

Section 70.8 – Permit Review by the EPA and Affected States

Section 70.9 – Fee Determination and Certification

Section 70.10 – Federal Oversight and Sanctions

Section 70.11 – Requirements for Enforcement Authority

Part 72 – Regulations on Permits

Subpart A – Acid Rain program General Provisions

Section 72.1 Purpose and Scope

Section 72.2 – Definitions

Section 72.3 – Measurements, Abbreviations, and Acronyms

Section 72.4 – Federal Authority

Section 72.5 – State Authority

Section 72.6 – Applicability

Section 72.9 – Standard Requirements

Section 72.10 – Availability of Information

Section 72.11 – Computation of Time

Section 72.12 – Administrative Appeals

Section 72.13 – Incorporation by Reference

Subpart B – Designated Representative

Section 72.20 – Authorization and Responsibilities of the Designated

Section 72.21 – Submissions

Section 72.22 – Alternate Designed Representative
Section 72.23 – Changing the Seignated Representative, Alternate Designated
Section 72.24 – Certificate of Representation
Section 72.25 – Objections
Subpart C – Acid Rain Application
Section 72.30 – Requirements to Apply
Section 72.31 – Information Requirements for Acid Rain Permit
Section 72.32 – Permit Application Shield and Binding Effect of Permit
Section 72.33 – Identification if Dispatch System
Subpart D – Acid Rain Compliance Plan and Compliance Options
Section 72.40 – General
Subpart E – Acid Rain Permit Conditions
Section 72.50 – General
Section 72.51 – Permit Shield
Subpart F – Federal Acid Rain Permit Issuance Procedure
Section 72.60 – General
Section 72.61 – Completeness
Section 72.62 – Draft Permit
Section 72.63 – Administrative Board
Section 72.64 – Statement of Basis
Section 72.65 – Public Notice of Opportunities for Public Comment
Section 72.66 – Public Comments
Section 72.67 – Opportunity for Public Hearing
Section 72.68 – Response to Comments
Section 72.69 – Issuance and effective Date of Acid Rain Permits
Subpart G – Acid Rain Phase II Implementation
Section 72.70 – Relationship to Title V Operating Permit Program
Section 72.71 – Approval of State Programs – General
Section 72.72 – State Permit Program Approval Criteria
Section 72.73 – State Issue of Phase II Permits

Section 72.74 – Federal Issuance of Phase II Permits
Subpart H – Permit Revisions
Section 72.80 – General
Section 72.81 – Permit Modifications
Section 72.82 – Fast Track Modifications
Section 72.83 – Administrative Permit Amendment
Section 72.84 – Automatic Permit Amendment
Section 72.85 – Permit Reopening
Subpart I – Compliance Certification
Section 72.90 – Annual Compliance Certification Report
Section 72.95 – Allowance Deduction Formula
Section 72.96 Administrator's Action on Compliance Certifications
Part 73 – Sulfur Dioxide Allowance Systems
Subpart A – Background and Summary
Section 73.1 – Purpose and Scope
Section 73.2 – Applicability
Section 73.3 – General
Subpart B – Allowance Allocations
Section 73.10 – Initial Allocations for Phase I and II
Section 73.11 – Revision of Allocations
Section 73.12 – Rounding procedures
Section 73.13 – Procedures for Submittals
Section 73.26 – Conservation and Renewable Energy Reserve
Section 73.27 – Special Allowance Reserve
Subpart C – Allowance Tracking System
Section 73.30 – Allowance Tracking System Accounts
Section 73.31 – Establishment of Accounts
Section 73.32 – Allowance Accounts Contents
Section 73.33 – Authorized Account Representative
Section 73.34 – Recordation in Accounts

Section 73.35 – Compliance

Section 73.36 – Banking

Section 73.37 – Account Error and Dispute Resolution

Section 73.38 – Closing of Accounts

Subpart D – Allowance Transfers

Section 73.50 – Scope and Submission of Transfers

Section 73.51 – Prohibition

Section 73.52 – EPA Recordation

Section 73.53 – Notification

Subpart E – Auctions, Direct Sales, and Independent Power Producers Written

Section 73.70 – Auctions

Section 73.71 – Bidding

Section 73.72 – Direct Sales

Section 73.73 – Selegation of Auctions and Sales and Termination of Auctions

Section 73.74 – Independent Power Producers Written Guarantee

Section 73.75 – Application for an IPP Written Guarantee

Section 73.76 – Approval and Exercise of the IPP Written Guarantee

Section 73.77 – Relationship of Independent Power Producers Written Guarantee

Section 75.5 – Prohibitions

Section 75.6 – Incorporation by Reference

Section 76.7 – EPA Study

Section 76.8 – [Reserved]

Subpart – Monitoring Provisions

Section 75.10 – General Operating Requirements

Section 75.11 – Specific Provisions for Monitoring SO2 Emissions

Section 75.12 – Specific Provisions for Monitoring NOx Emissions (NOx and Flow)

Section 75.13 – Specific Provisions for Monitoring CO2 Emissions

Section 75.14 – Specific Provisions for Monitoring Capacity

Section 75.15 – Specific Provisions for Monitoring SO2 Emissions Removal By

Section 75.16 – Specific Provisions for Monitoring Emissions from Common, By

Section 75.17 – Specific Provisions for Monitoring Emissions from Common, By
Section 75.18 – Specific Provisions for Monitoring Emissions from Common and
Section 75.41 – Precision Criteria
Section 75.42 – Reliability Criteria
Section 75.43 – Accessibility Criteria
Section 75.44 – Timeliness Criteria
Section 75.45 – Daily Quality Assurance Criteria
Section 75.46 – Missing Data Substitution Criteria
Section 75.47 – Criteria for a Class of Affected Units
Section 75.48 – Petition for an Alternative Monitoring System
Subpart F – Recordkeeping Requirements
Section 75.50 – General Recordkeeping Provisions
Section 75.51 – General Recordkeeping Provisions for Specific Situations
Section 75.52 – Certifications, Quality Assurance and Quality Control Record
Section 75.53 – Monitoring Plan
Subpart G – Reporting Requirements
Section 75.60 – General Provisions
Section 75.61 – Notification and Recertification Test Dates
Section 75.62 – Monitoring Plan
Section 75.63 – Certification or Recertification Applications
Section 75.64 – Quarterly Reports
Section 75.65 – Capacity Reports
Section 75.66 – Petitions to the Administrator
Section 75.67 – Retired Units Petitions
Part 76 – EPA Regulations on Acid Rain Nitrogen Oxides
Section 76.1 – Applicability
Section 76.2 – Definitions
Section 76.3 – General Acid Rain Program Provisions
Section 76.4 –Incorporation by Reference
Section 76.5 – NOx Emission Limitations for Group 1 Boilers

Section 76.6 – NOx Emission Limitations for Group 2 Boilers [Reserved]

Section 76.7 – Revised NOx Emission Limitations for Group 1, Phase II Boilers

Section 76.8 – Early Election for Group 1, Phase II Boilers

Section 76.9 – Permit Application and Compliance Plans

Section 76.10 – Alternative Emission Limitations

Section 76.11 – Emissions Averaging

Section 76.12 – Phase I NOx Compliance Extensions

Section 76.13 – Compliance and Excess Emissions

Section 76.14 – Monitoring, Recordkeeping, and Reporting

Section 76.15 – Test Methods and Procedures

Section 76.16 – [Reserved]

Part 77 – Excess Emissions

State Applicable Requirements

Chapter 62-4, F.A.C.; PERMITS

62-4.055 – Permit Processing

Chapter 62-210, F.A.C.; STATIONARY SOURCES – GENERAL REQUIREMENTS

62-210.550 – Stack Height Policy

62-210.700 Excess Emissions

Chapter 62-212, F.A.C.; STATIONARY SOURCES – PRECONSTRUCTION REVIEW

62-212.300 – General Preconstruction Review Requirements

62-212.400 – Prevention of Significant Deterioration

62-212.410 – Best Available Control Technology

Chapter 62-213, F.A.C.; OPERATION PERMITS FOR MAJOR SOURCES OF AIR POLLUTION

62-213.413 – Fast-Track Revisions of Acid Rain Parts

Chapter 62-214, F.A.C.; REQUIREMENTS FOR SOURCES SUBJECT TO THE FEDERAL ACID RAIN PR

62-214.300 – Applicability

62-214.320 – Applications

62-214.330 – Acid Rain Compliance Plan and Compliance Options

62-214.350 – Certification

62-214.370 – Revisions Administration Corrections

62-214.420 – Acid Rain Part Content

62-214.430 – Implementation and Termination of Compliance Options

Chapter 62-272, F.A.C.; AMBIENT AIR QUALITY STANDARDS

62-272.500 – Maximum Allowable Increases

Chapter 62-273, F.A.C.; AIR POLLUTION EPISODES

62-273.300 – Air Pollution Episodes

62-273.400 – Air Alert

62-273.500 – Air Warning

62-273.600 – Air Emergency

Chapter 62-296, F.A.C.; STATIONARY SOURCES – EMISSION STANDARDS

62-296.405 – Fossil Fuel Steam Generators

Chapter 62-297, F.A.C.; STATIONARY SOURCES – EMISSIONS MONITORING

62-297.401 – Compliance Test Methods

62-297.440 – Supplementary Test Procedures

62-297.520 – EPA Performance Specifications

62-297.620 – Exceptions and Approval of Alternate Procedures and Requirements

62-297.310 – General Test Requirements

Subpart F – Energy Conservation and Renewable Energy Reserve

Section 73.80 – Operation of Allowance Reserve Program for Conservation..

Section 73.81 – Quantified Conservation Measures and Renewable Energy

Section 73.82 – Application for Allowances from Reserve Program

Section 73.83 – Secretary of Energy's Action on New Income Neutality

Section 73.84 – Administrator's Action on Applications

Section 73.85 – Administrator Review of the Reserve Program

Section 73.86 – State Regulatory Autonomy, Appendix A to Subpart F....List of

Part 75 – Emission Monitoring

Subpart A – General

Section 75.1 – Purpose and Scope

Section 75.2 – Applicability

Section 75.3 – General Acid Rain Program Provisions

Section 75.4 – Compliance Dates

Subpart C – Operation and Maintenance Requirements

Section 75.20 – Certification and Recertification Procedures

Section 75.21 – Quality Assurance and Quality Control Requirements

Section 75.22 – Reference Test Methods

Section 75.23 – Alternatives to ASTM Methods

Section 75.24 – Out-of-Control Periods

Subpart D – Missing Data Substitution Procedures

Section 75.30 – General Procedures

Section 75.31 – Initial Missing Data Procedures

Section 75.32 – Determinations of Monitor Data Availability for Standard Missing Data

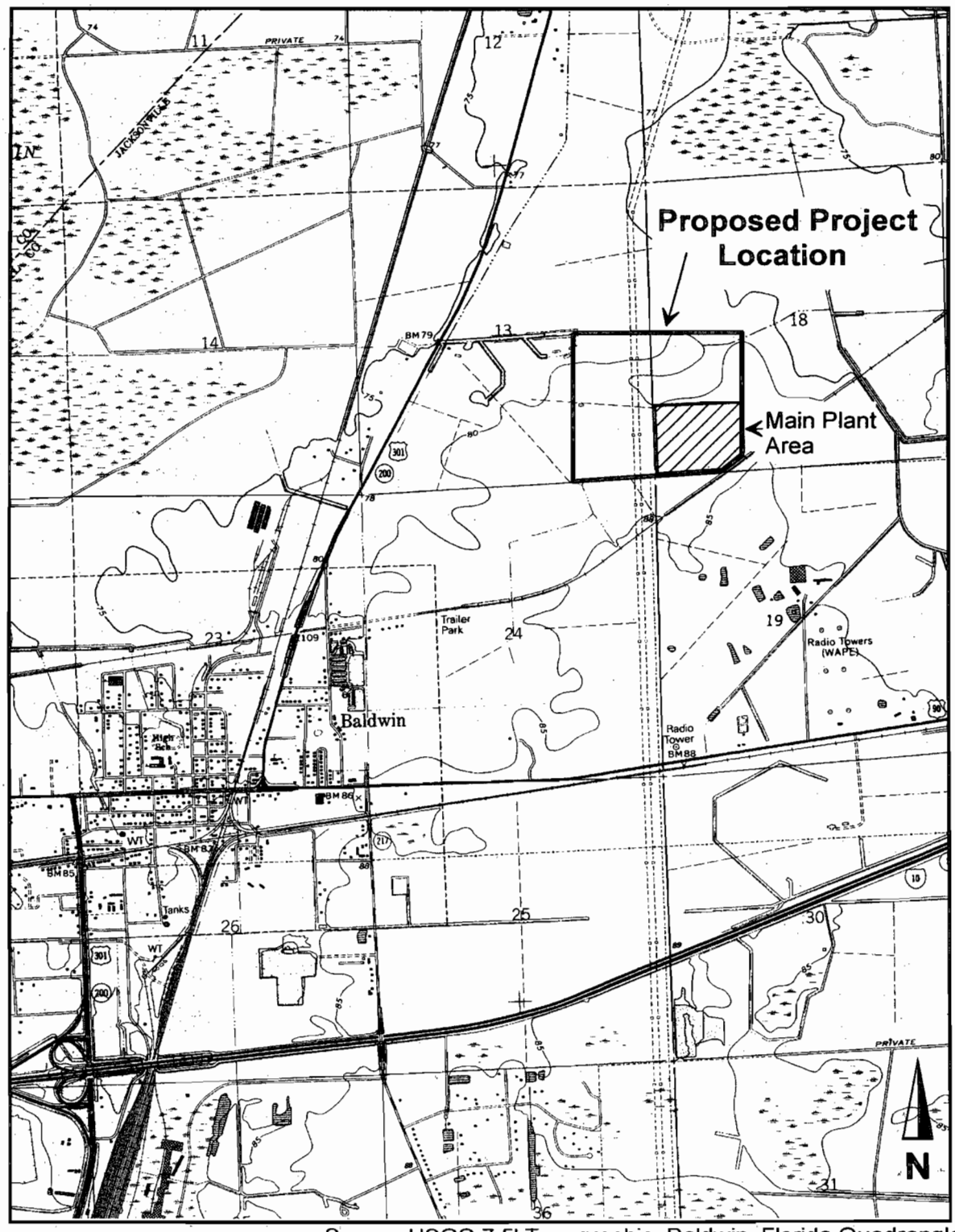
Section 75.33 – Standard Missing Data Procedures

Section 75.34 – Units with Add-on Emission Controls

Subpart E – Alternative Monitoring Systems

Subpart 75.40 – General Demonstration Requirements

Attachment B
Area Map Showing Facility Location



Source: USGS 7.5' Topographic, Baldwin, Florida Quadrangle

Proposed Project Location

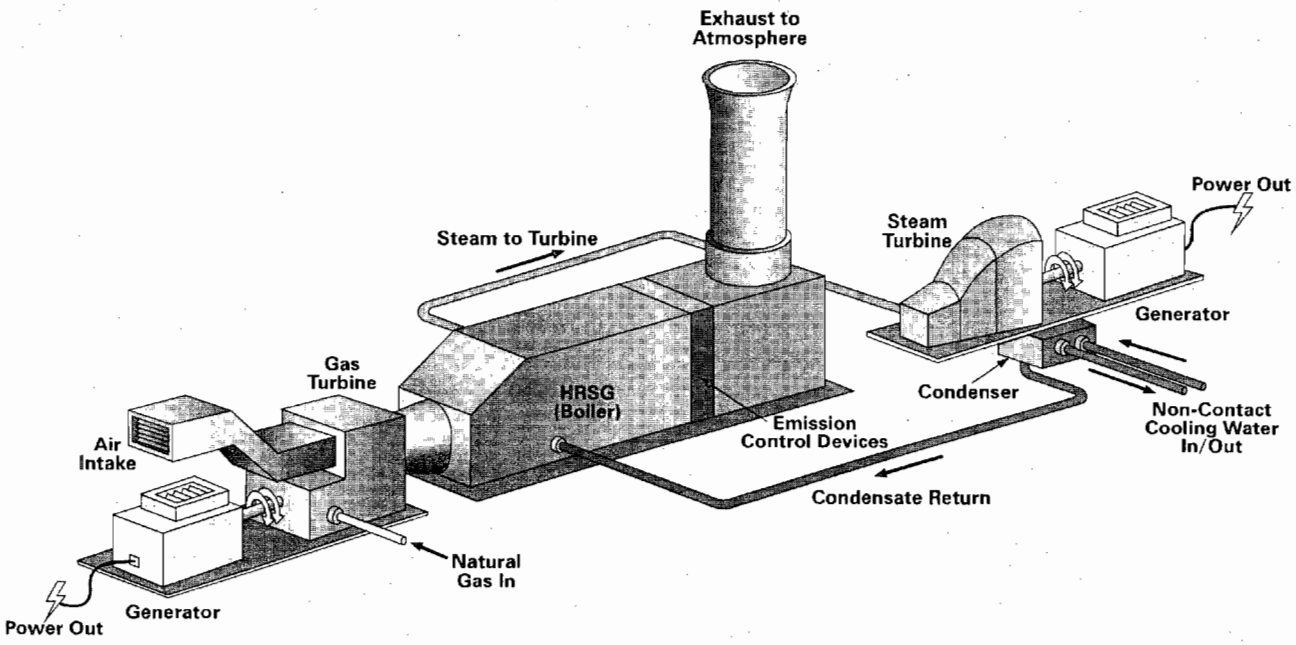
Poor Original

JEASITE.SRF

Attachment C
Facility Plot Plan

OVERSIZE DOCUMENT WAS REMOVED AND INSERTED INTO OCULUS SEPARATELY.

Attachment D
Process Flow Diagram



Poor Original

Attachment E
Fuel Analysis

Fuel is specified as pipeline quality sweet natural gas and No. 2 fuel oil containing no more than 0.05 percent sulfur.

IMAGE QUALITY

AS YOU REVIEW THE NEXT FEW PAGES, PLEASE NOTE THAT THE ORIGINAL DOCUMENT WAS OF POOR QUALITY.

index of pages previous page next page

FLORIDA GAS TRANSMISSION COMPANY
FERC Gas Tariff
Third Revised Volume No. 1

Third Revised Sheet No. 102C
Superseding
Second Revised Sheet No. 102C

GENERAL TERMS AND CONDITIONS
(continued)

am. GISB Definitions - shall mean any such definitions issued by GISB which have been adopted by the FERC. Transporter incorporates GISB Definitions (Version 1.3, July 31, 1998) 1.2.8 through 1.2.12 and 4.2.1 through 4.2.8 by reference herein.

2. QUALITY

A. Gas delivered by Shipper or for its account into Transporter's pipeline system at receipt points shall conform to the following quality standards:

1. shall be free from objectionable odors, solid matter, dust, gums, and gum forming constituents, or any other substance which might interfere with the merchantability of the gas stream, or cause interference with proper operation of the lines, meters, regulators, or other appliances through which it may flow;

2. shall contain not more than seven (7) pounds of water vapor per one thousand (1,000) MCF;

3. shall contain not more than one quarter (1/4) grain of hydrogen sulphide per one hundred (100) cubic feet of gas;

4. shall contain not more than ten (10) grains of total sulphur per one hundred (100) cubic feet of gas;

5. shall contain not more than a combined total three percent (3%) by volume of carbon dioxide and/or nitrogen;

6. shall contain not more than one quarter percent (1/4%) by volume of oxygen;

Issued by: Robert B. Kilmer, Vice President
Issued on: July 1, 1999

Effective: August 1, 1999

ndex of pages previous page next page

SPECIFICATIONS FOR #2 LOW SULFUR DIESEL FUEL

The oil shall be hydrocarbon oil, free from alkali, mineral acid, grit, fibrous or other foreign matter and shall meet the following physical and chemical properties:

1) Gravity: A.P.I. 30 minimum (ASTM D287)

2) Flash: 130 F minimum (ASTM D93)

3) Viscosity: Kinematic, Centistokes at 100 F, minimum 2.0, maximum 3.0 (ASTM D445)

4) Water & Sediment: .50% maximum, (ASTM D1796 or D2700)

5) Pour Point: 0 F maximum (ASTM D97)

6) Distillation: 10% Point, 480 F maximum, 90% Point, 640 F maximum, End Point 690 F maximum (ASTM D86)

7) Sulfur: Low Sulfur - 0.05% maximum (ASTM D129 or D1552),

8) BTU: minimum 138,000 BTU's per gallon (ASTM D240)

9) Carbon Residue on 10% bottoms: .25 Max (ASTM D189)

10) Trace Metals (PPM, Max):
- Calcium 4.0
- Lead 1.0
- Potassium 2.0
- Vanadium 1.5.

Attachment F
Stack Sampling Facilities

"The stack sampling facilities will be installed in accordance with Rule 62-297.310 (6)."

Attachment G
Acid Rain Permit Application

JEA

December 30, 1999

Mr. Scott Sheplak, P.E.
Title V Administrator
Department of Environmental Protection
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee. FL 32399-2400

RE: Brandy Branch Facility
Acid Rain Application Forms

Dear Mr. Sheplak:

Enclosed please find the Acid Rain Application Forms for the Brandy Branch Facility.

If you have any questions with regard to this matter, please contact me at (904) 665-6247.

Sincerely,

N. Bert Gianazza, P.E.
Environmental Permitting
& Compliance Group

cc: USEPA
USEPA, Region 4

bc: J. Connolly
E. Mims
L. Starner
B. Gianazza
File

bbacidrain

Phase II Permit Application

For more information, see instructions and refer to 40 CFR 72.30 and 72.31 and Chapter 62-214, F.A.C.

This submission is: ☒ New ☐ Revised

STEP 1
Identify the source by plant name, State, and ORIS code from NADB

Plant Name	Brandy Branch	State	FL	ORIS Code	7846

STEP 2 Enter the boiler ID# from NADB for each affected unit and indicate whether a repowering plan is being submitted for the unit by entering "yes" or "no" at column c. For new units, enter the requested information in columns d and e.

a	b	c	d	e
Boiler ID#	Compliance Plan: Unit will hold allowances in accordance with 40 CFR 72.9(c)(1)	Repowering Plan	New Units: Commence Operation Date	New Units: Monitor Certification Deadline
001	Yes		Dec. 2000	Dec. 2000
002	Yes		Dec. 2000	Dec. 2000
003	Yes		Dec. 2001	Dec. 2001
	Yes			
	Yes			
	Yes			
	Yes			
	Yes			
	Yes			
	Yes			
	Yes			
	Yes			

STEP 3
Check the box if the response in column c of Step 2 is "Yes for any unit

☐ For each unit that will be repowered, the Repowering Extension Plan form is included and the Repowering Technology Petition form has been submitted or will be submitted by June 1, 1997.

Plant Name (from Step 1) **Brandy Branch**

STEP 4
Read the standard requirements and certification, enter the name of the designated representative, and sign and date

Standard Requirements

Permit Requirements.

(1) The designated representative of each Acid Rain source and each Acid Rain unit at the source shall:
(i) Submit a complete Acid Rain part application (including a compliance plan) under 40 CFR part 72, Rules 62-214.320 and 330, F.A.C. in accordance with the deadlines specified in Rule 62-214.320, F.A.C.; and
(ii) Submit in a timely manner any supplemental information that the permitting authority determines is necessary in order to review an Acid Rain part application and issue or deny an Acid Rain permit;
(2) The owners and operators of each Acid Rain source and each Acid Rain unit at the source shall:
(i) Operate the unit in compliance with a complete Acid Rain part application or a superseding Acid Rain part issued by the permitting authority; and
(ii) Have an Acid Rain Part.

Monitoring Requirements.

(1) The owners and operators and, to the extent applicable, designated representative of each Acid Rain source and each Acid Rain unit at the source shall comply with the monitoring requirements as provided in 40 CFR part 75, and Rule 62-214.420, F.A.C.
(2) The emissions measurements recorded and reported in accordance with 40 CFR part 75 shall be used to determine compliance by the unit with the Acid Rain emissions limitations and emissions reduction requirements for sulfur dioxide and nitrogen oxides under the Acid Rain Program.
(3) The requirements of 40 CFR part 75 shall not affect the responsibility of the owners and operators to monitor emissions of other pollutants or other emissions characteristics at the unit under other applicable requirements of the Act and other provisions of the operating permit for the source.

Sulfur Dioxide Requirements.

(1) The owners and operators of each source and each Acid Rain unit at the source shall:
(i) Hold allowances, as of the allowance transfer deadline, in the unit's compliance subaccount (after deductions under 40 CFR 73.34(c)) not less than the total annual emissions of sulfur dioxide for the previous calendar year from the unit; and
(ii) Comply with the applicable Acid Rain emissions limitations for sulfur dioxide.
(2) Each ton of sulfur dioxide emitted in excess of the Acid Rain emissions limitations for sulfur dioxide shall constitute a separate violation of the Act.
(3) An Acid Rain unit shall be subject to the requirements under paragraph (1) of the sulfur dioxide requirements as follows:
(i) Starting January 1, 2000, an Acid Rain unit under 40 CFR 72.6(a)(2); or
(ii) Starting on the later of January 1, 2000 or the deadline for monitor certification under 40 CFR part 75, an Acid Rain unit under 40 CFR 72.6(a)(3).
(4) Allowances shall be held in, deducted from, or transferred among Allowance Tracking System accounts in accordance with the Acid Rain Program.
(5) An allowance shall not be deducted in order to comply with the requirements under paragraph (1)(i) of the sulfur dioxide requirements prior to the calendar year for which the allowance was allocated.
(6) An allowance allocated by the Administrator under the Acid Rain Program is a limited authorization to emit sulfur dioxide in accordance with the Acid Rain Program. No provision of the Acid Rain Program, the Acid Rain permit application, the Acid Rain permit, or the written exemption under 40 CFR 72.7 and 72.8 and no provision of law shall be construed to limit the authority of the United States to terminate or limit such authorization.
(7) An allowance allocated by the Administrator under the Acid Rain Program does not constitute a property right.

Nitrogen Oxides Requirements. The owners and operators of the source and each Acid Rain unit at the source shall comply with the applicable Acid Rain emissions limitation for nitrogen oxides.

Excess Emissions Requirements.

(1) The designated representative of an Acid Rain unit that has excess emissions in any calendar year shall submit a proposed offset plan, as required under 40 CFR part 77.
(2) The owners and operators of an Acid Rain unit that has excess emissions in any calendar year shall:
(i) Pay without demand the penalty required, and pay upon demand the interest on that penalty, as required by 40 CFR part 77; and
(ii) Comply with the terms of an approved offset plan, as required by 40 CFR part 77.

Recordkeeping and Reporting Requirements.

(1) Unless otherwise provided, the owners and operators of the source and each Acid Rain unit at the source shall keep on site at the source each of the following documents for a period of 5 years from the date the document is created. This period may be extended for cause, at any time prior to the end of 5 years, in writing by the Administrator or permitting authority:
(i) The certificate of representation for the designated representative for the source and each Acid Rain unit at the source and all documents that demonstrate the truth of the statements in the certificate of representation, in accordance with Rule 62-214.350, F.A.C.; provided that the certificate and documents shall be retained on site at the source beyond such 5-year period until such documents are superseded because of the submission of a new certificate of representation changing the designated representative;
(ii) All emissions monitoring information, in accordance with 40 CFR part 75;
(iii) Copies of all reports, compliance certifications, and other submissions and all records made or required under the Acid Rain Program; and,

Plant Name (from Step 1) **Brandy Branch**

Recordkeeping and Reporting Requirements (cont)

(iv) Copies of all documents used to complete an Acid Rain part application and any other submission under the Acid Rain Program or to demonstrate compliance with the requirements of the Acid Rain Program.

(2) The designated representative of an Acid Rain source and each Acid Rain unit at the source shall submit the reports and compliance certifications required under the Acid Rain Program, including those under 40 CFR part 72 subpart I and 40 CFR part 75.

Liability.

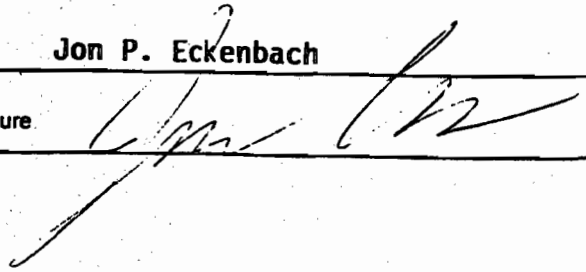
(1) Any person who knowingly violates any requirement or prohibition of the Acid Rain Program, a complete Acid Rain part application, an Acid Rain part, or a written exemption under 40 CFR 72.7 or 72.8, including any requirement for the payment of any penalty owed to the United States, shall be subject to enforcement pursuant to section 113(c) of the Act.
(2) Any person who knowingly makes a false, material statement in any record, submission, or report under the Acid Rain Program shall be subject to criminal enforcement pursuant to section 113(c) of the Act and 18 U.S.C. 1001.
(3) No permit revision shall excuse any violation of the requirements of the Acid Rain Program that occurs prior to the date that the revision takes effect.
(4) Each Acid Rain source and each Acid Rain unit shall meet the requirements of the Acid Rain Program.
(5) Any provision of the Acid Rain Program that applies to an Acid Rain source (including a provision applicable to the designated representative of an Acid Rain source) shall also apply to the owners and operators of such source and of the Acid Rain units at the source.
(6) Any provision of the Acid Rain Program that applies to an Acid Rain unit (including a provision applicable to the designated representative of an Acid Rain unit) shall also apply to the owners and operators of such unit. Except as provided under 40 CFR 72.44 (Phase II repowering extension plans), and except with regard to the requirements applicable to units with a common stack under 40 CFR part 75 (including 40 CFR 75.16, 75.17, and 75.18), the owners and operators and the designated representative of one Acid Rain unit shall not be liable for any violation by any other Acid Rain unit of which they are not owners or operators or the designated representative and that is located at a source of which they are not owners or operators or the designated representative.
(7) Each violation of a provision of 40 CFR parts 72, 73, 75, 77, and 78 by an Acid Rain source or Acid Rain unit, or by an owner or operator or designated representative of such source or unit, shall be a separate violation of the Act.

Effect on Other Authorities. No provision of the Acid Rain Program, an Acid Rain part application, an Acid Rain part, or a written exemption under 40 CFR 72.7 or 72.8 shall be construed as:

(1) Except as expressly provided in title IV of the Act, exempting or excluding the owners and operators and, to the extent applicable, the designated representative of an Acid Rain source or Acid Rain unit from compliance with any other provision of the Act, including the provisions of title I of the Act relating to applicable National Ambient Air Quality Standards or State Implementation Plans;
(2) Limiting the number of allowances a unit can hold; *provided*, that the number of allowances held by the unit shall not affect the source's obligation to comply with any other provisions of the Act;
(3) Requiring a change of any kind in any State law regulating electric utility rates and charges, affecting any State law regarding such State regulation, or limiting such State regulation, including any prudence review requirements under such State law;
(4) Modifying the Federal Power Act or affecting the authority of the Federal Energy Regulatory Commission under the Federal Power Act; or,
(5) Interfering with or impairing any program for competitive bidding for power supply in a State in which such program is established.

Certification

I am authorized to make this submission on behalf of the owners and operators of the Acid Rain source or Acid Rain units for which the submission is made. I certify under penalty of law that I have personally examined, and am familiar with, the statements and information submitted in this document and all its attachments. Based on my inquiry of those individuals with primary responsibility for obtaining the information, I certify that the statements and information are to the best of my knowledge and belief true, accurate, and complete. I am aware that there are significant penalties for submitting false statements and information or omitting required statements and information, including the possibility of fine or imprisonment.

Name Jon P. Eckenbach	
Signature 	Date 12-14-99

STEP 5 (optional)
Enter the source AIRS
FINDS identification

AIRS
FINDS

United States
Environmental Protection Agency
Acid Rain Program

OMB No. 2060-0258

Certificate of Representation

For more information, see instructions and refer to 40 CFR 72.24

This submission is: [X] New [ ] Revised (revised submissions must be completed in full; see instructions)

This submission includes combustion or process sources under 40 CFR part 74 [ ]

STEP 1
Identify the source by plant name, State, and ORIS code.

Plant Name	State	ORIS Code
Brandy Branch	FL	7846

STEP 2
Enter requested information for the designated representative.

Name	Jon P. Eckenbach
Address	21 West Church Street Jacksonville, Florida 32202
Phone Number	(904) 665-6315
Fax Number	(904) 554-7366
E-mail address (if available)	eckejp@jea.com

STEP 3
Enter requested information for the alternate designated representative, if applicable.

Name	Tim E. Perkins
Phone Number	(904) 665-4520
Fax Number	(904) 665-7376
E-mail address (if available)	perkte@jea.com

STEP 4
Complete Step 5, read the certifications, and sign and date. For a designated representative of a combustion or process source under 40 CFR part 74, the references in the certifications to "affected unit" or "affected units" also apply to the combustion or process source under 40 CFR part 74 and the references to "affected source" also apply to the source at which the combustion or process source is located.

I certify that I was selected as the designated representative or alternate designated representative, as applicable, by an agreement binding on the owners and operators of the affected source and each affected unit at the source.

I certify that I have given notice of the agreement, selecting me as the designated representative for the affected source and each affected unit at the source identified in this certificate of representation, in a newspaper of general circulation in the area where the source is located or in a State publication designed to give general public notice.

I certify that I have all necessary authority to carry out my duties and responsibilities under the Acid Rain Program on behalf of the owners and operators of the affected source and of each affected unit at the source and that each such owner and operator shall be fully bound by my actions, inactions, or submissions.

I certify that I shall abide by any fiduciary responsibilities imposed by the agreement by which I was selected as designated representative or alternate designated representative, as applicable.

I certify that the owners and operators of the affected source and of each affected unit at the source shall be bound by any order issued to me by the Administrator, the permitting authority, or a court regarding the source or unit.

Where there are multiple holders of a legal or equitable title to, or a leasehold interest in, an affected unit, or where a utility or industrial customer purchases power from an affected unit under life-of-the-unit, firm power contractual arrangements, I certify that:

I have given a written notice of my selection as the designated representative or alternate designated representative, as applicable, and of the agreement by which I was selected to each owner and operator of the affected source and of each affected unit at the source; and

Allowances and the proceeds of transactions involving allowances will be deemed to be held or distributed in proportion to each holder's legal, equitable, leasehold, or contractual reservation or entitlement or, if such multiple holders have expressly provided for a different distribution of allowances by contract, that allowances and the proceeds of transactions involving allowances will be deemed to be held or distributed in accordance with the contract.

The agreement by which I was selected as the alternate designated representative, if applicable, includes a procedure for the owners and operators of the source and affected units at the source to authorize the alternate designated representative to act in lieu of the designated representative.

Plant Name (from Step 1)	Brandy Branch

I am authorized to make this submission on behalf of the owners and operators of the affected source or affected units for which the submission is made. I certify under penalty of law that I have personally examined, and am familiar with, the statements and information submitted in this document and all its attachments. Based on my inquiry of those individuals with primary responsibility for obtaining the information, I certify that the statements and information are to the best of my knowledge and belief true, accurate, and complete. I am aware that there are significant penalties for submitting false statements and information or omitting required statements and information, including the possibility of fine or imprisonment.

Signature (designated representative)	Date 12-14-99
Signature (alternate designated representative)	Date 12-16-99

STEP 5
Provide the name of every owner and operator of the source and identify each affected unit (or combustion or process source) they own and/or operate.

Name JEA					☒ Owner	☒ Operator
ID# 001	ID# 002	ID# 003	ID#	ID#	ID#	ID#
ID#	ID#	ID#	ID#	ID#	ID#	ID#

Name					☐ Owner	☐ Operator
ID#	ID#	ID#	ID#	ID#	ID#	ID#
ID#	ID#	ID#	ID#	ID#	ID#	ID#

Name					☐ Owner	☐ Operator
ID#	ID#	ID#	ID#	ID#	ID#	ID#
ID#	ID#	ID#	ID#	ID#	ID#	ID#

Name					☐ Owner	☐ Operator
ID#	ID#	ID#	ID#	ID#	ID#	ID#
ID#	ID#	ID#	ID#	ID#	ID#	ID#

Department of Environmental Protection

Jeb Bush
Governor

Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

David B. Struhs
Secretary

January 19, 2000

Mr. N. Bert Gianazza, P.E.
Environmental Permitting & Compliance Group
Jacksonville Electric Authority
21 West Church Street
Jacksonville, FL 32202-3139

Re: Acid Rain Phase II Permit Application
Brandy Branch Facility; ORIS Code: 7846

Dear Mr. Gianazza:

Thank you for your recent submission of the Acid Rain Phase II Permit Application for the subject facility. We have reviewed the document and found it to be complete.

Sincerely,

Scott M. Sheplak, P.E.
Administrator
Title V Section

cc: Jenny Jachim, EPA Region 4

United States
Environmental Protection Agency
Acid Rain Program

OMB No. 2060-0258

Certificate of Representation

For more information, see instructions and refer to 40 CFR 72.24
This submission is: ☐ New ☒ Revised (revised submissions must be completed in full; see instructions)
This submission includes combustion or process sources under 40 CFR part 74 ☐

STEP 1
Identify the source by plant name, State, and ORIS code.

Plant Name	State	ORIS Code
Brandy Branch	FL	7846

STEP 2
Enter requested information for the designated representative.

Name	Jon P. Eckenbach, Executive Vice President
Address	21 West Church Street Jacksonville, FL 32202
Phone Number	(904) 665-6315
Fax Number	(904) 665-7366
E-mail address (if available)	eckejp@jea.com

STEP 3
Enter requested information for the alternate designated representative, if applicable.

Name	Susan Hughes, Vice President
Phone Number	(904) 665-6248
Fax Number	(904) 665-7376
E-mail address (if available)	hughsn@jea.com

STEP 4
Complete Step 5, read the certifications, and sign and date. For a designated representative of a combustion or process source under 40 CFR part 74, the references in the certifications to "affected unit" or "affected units" also apply to the combustion or process source under 40 CFR part 74 and the references to "affected source" also apply to the source at which the combustion or process source is located.

I certify that I was selected as the designated representative or alternate designated representative, as applicable, by an agreement binding on the owners and operators of the affected source and each affected unit at the source.

I certify that I have given notice of the agreement, selecting me as the 'designated representative' for the affected source and each affected unit at the source identified in this certificate of representation, in a newspaper of general circulation in the area where the source is located or in a State publication designed to give general public notice.

I certify that I have all necessary authority to carry out my duties and responsibilities under the Acid Rain Program on behalf of the owners and operators of the affected source and of each affected unit at the source and that each such owner and operator shall be fully bound by my actions, inactions, or submissions.

I certify that I shall abide by any fiduciary responsibilities imposed by the agreement by which I was selected as designated representative or alternate designated representative, as applicable.

I certify that the owners and operators of the affected source and of each affected unit at the source shall be bound by any order issued to me by the Administrator, the permitting authority, or a court regarding the source or unit.

Where there are multiple holders of a legal or equitable title to, or a leasehold interest in, an affected unit, or where a utility or industrial customer purchases power from an affected unit under life-of-the-unit, firm power contractual arrangements, I certify that:

I have given a written notice of my selection as the designated representative or alternate designated representative, as applicable, and of the agreement by which I was selected to each owner and operator of the affected source and of each affected unit at the source; and

Allowances and the proceeds of transactions involving allowances will be deemed to be held or distributed in proportion to each holder's legal, equitable, leasehold, or contractual reservation or entitlement or, if such multiple holders have expressly provided for a different distribution of allowances by contract, that allowances and the proceeds of transactions involving allowances will be deemed to be held or distributed in accordance with the contract.

The agreement by which I was selected as the alternate designated representative, if applicable, includes a procedure for the owners and operators of the source and affected units at the source to authorize the alternate designated representative to act in lieu of the designated representative.

Plant Name (from Step 1) Brandy Branch

I am authorized to make this submission on behalf of the owners and operators of the affected source or affected units for which the submission is made. I certify under penalty of law that I have personally examined, and am familiar with, the statements and information submitted in this document and all its attachments. Based on my inquiry of those individuals with primary responsibility for obtaining the information, I certify that the statements and information are to the best of my knowledge and belief true, accurate, and complete. I am aware that there are significant penalties for submitting false statements and information or omitting required statements and information, including the possibility of fine or imprisonment.

Signature (designated representative)	Date 11/14/00
Signature (alternate designated representative)	Date 11/17/00

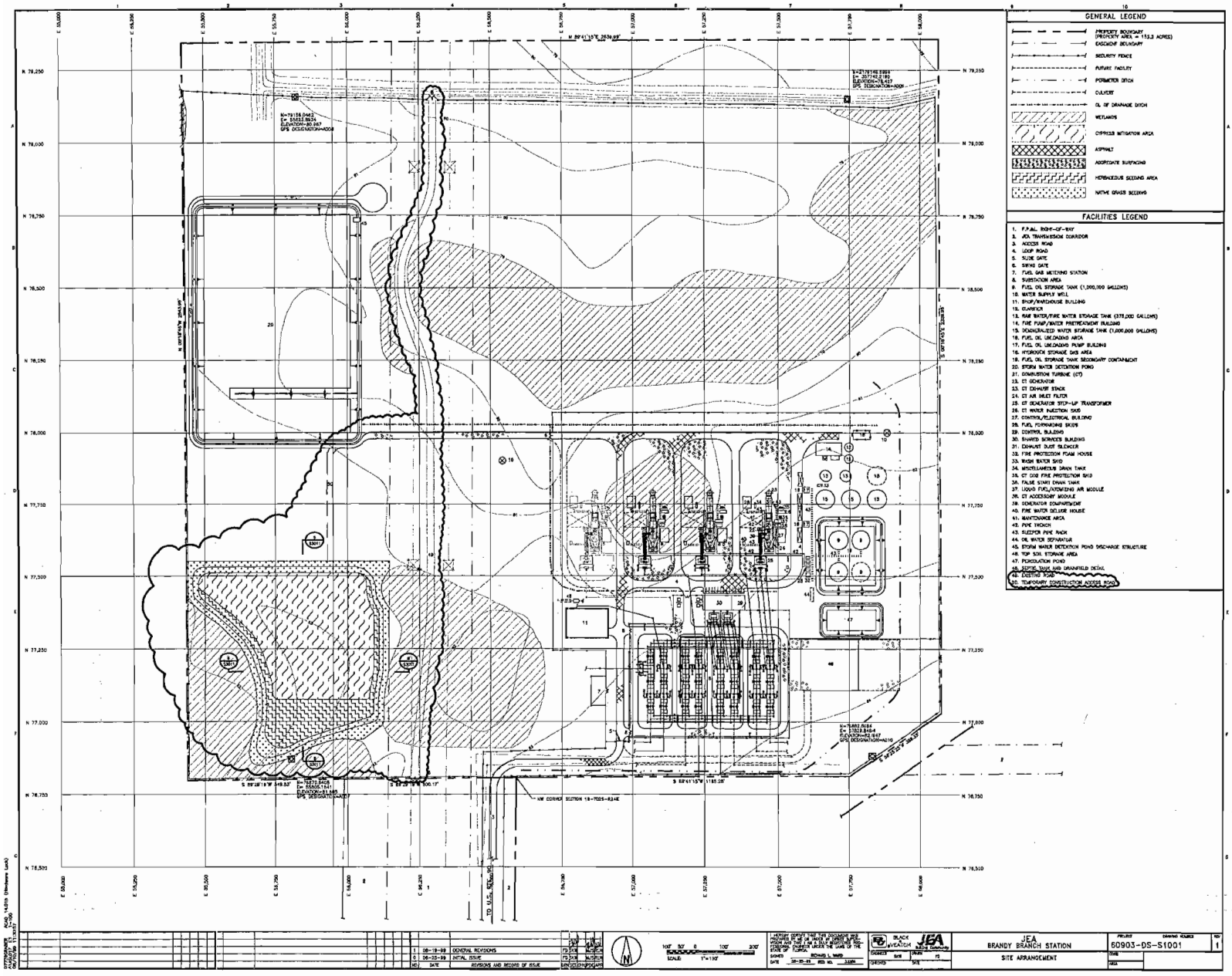
STEP 5
Provide the name of every owner and operator of the source and identify each affected unit (or combustion or process source) they own and/or operate.

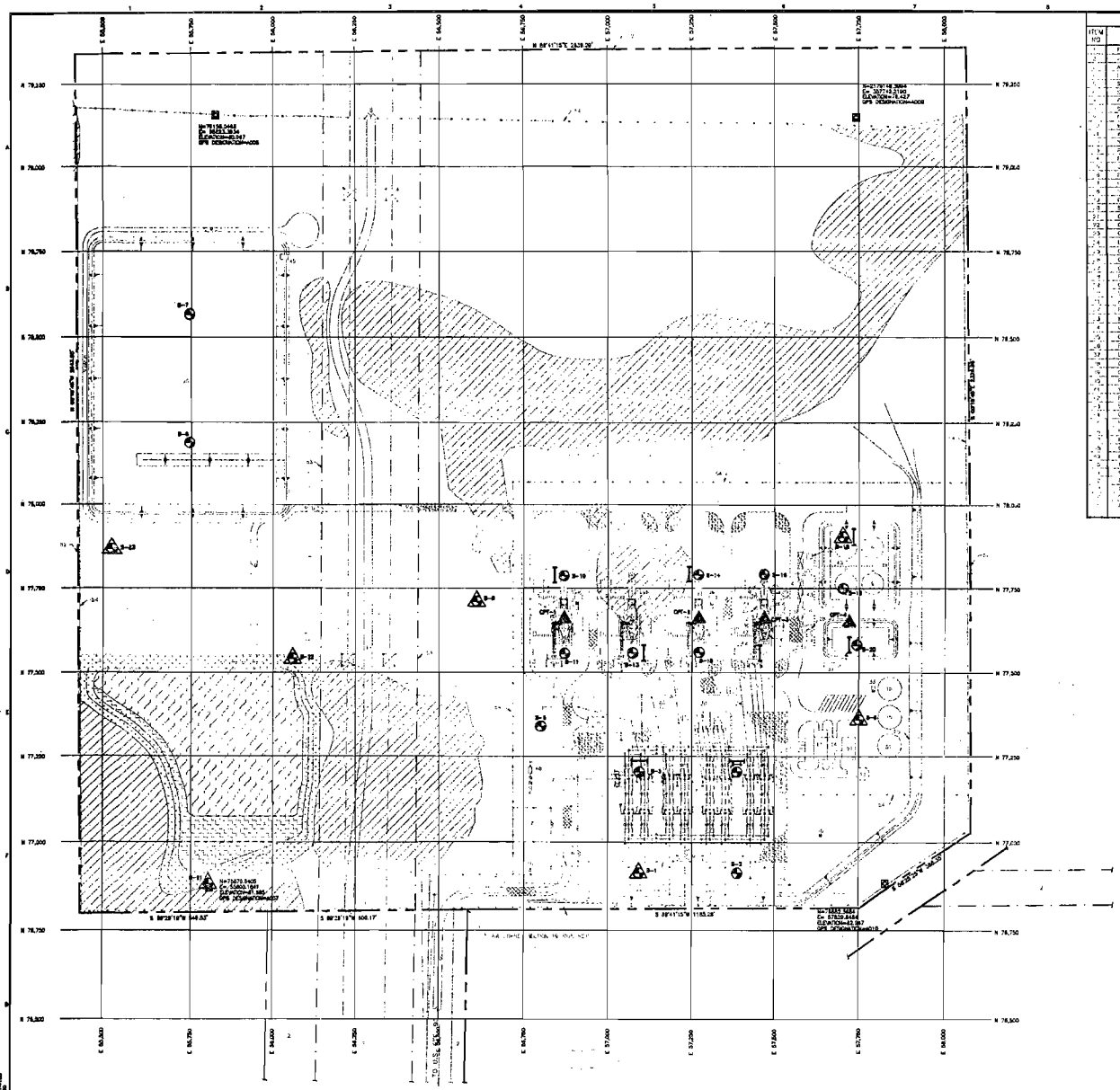
Name JEA					☒ Owner	☒ Operator
ID# 1	ID# 2	ID# 3	ID#	ID#	ID#	ID#
ID#	ID#	ID#	ID#	ID#	ID#	ID#

Name					☐ Owner	☐ Operator
ID#	ID#	ID#	ID#	ID#	ID#	ID#
ID#	ID#	ID#	ID#	ID#	ID#	ID#

Name					☐ Owner	☐ Operator
ID#	ID#	ID#	ID#	ID#	ID#	ID#
ID#	ID#	ID#	ID#	ID#	ID#	ID#

Name					☐ Owner	☐ Operator
ID#	ID#	ID#	ID#	ID#	ID#	ID#
ID#	ID#	ID#	ID#	ID#	ID#	ID#


GENERAL LEGEND
PROPERTY BOUNDARY (PROPERTY AREA = 153.3 ACRES)
EASEMENT BOUNDARY
SECURITY FENCE
FUTURE FACILITY
PERIMETER DITCH
CULVERT
DL OF DRAINAGE DITCH
WETLANDS
CYPRESS MITIGATION AREA
ASPHALT
AGGREGATE SURFACING
HERBACEOUS SEEDING AREA
NATIVE GRASS SEEDING
FACILITIES LEGEND
1. P.P.&L. RIGHT-OF-WAY
2. JEA TRANSMISSION CORRIDOR
3. ACCESS ROAD
4. LOOP ROAD
5. SLIDE GATE
6. SWING GATE
7. FUEL GAS METERING STATION
8. SUBSTATION AREA
9. FUEL OIL STORAGE TANK (1,000,000 GALLONS)
10. WATER SUPPLY WELL
11. SHOP/WAREHOUSE BUILDING
12. CLARIFIER
13. RAW WATER/FIRE WATER STORAGE TANK (378,000 GALLONS)
14. FIRE PUMP/WATER PRETREATMENT BUILDING
15. DEMINERALIZED WATER STORAGE TANK (1,000,000 GALLONS)
16. FUEL OIL UNLOADING AREA
17. FUEL OIL UNLOADING PUMP BUILDING
18. HYDROGEN STORAGE GAS AREA
19. FUEL OIL STORAGE TANK SECONDARY CONTAINMENT
20. STORM WATER DETENTION POND
21. COMBUSTION TURBINE (CT)
23. CT GENERATOR
23. CT EXHAUST STACK
24. CT AIR INLET FILTER
25. CT GENERATOR STEP-UP TRANSFORMER
26. CT WATER INJECTION SKID
27. CONTROL/ELECTRICAL BUILDING
28. FUEL FORWARDING SKIDS
29. CONTROL BUILDING
30. SHARED SERVICES BUILDING
31. EXHAUST DUST SILENCER
32. FIRE PROTECTION FOAM HOUSE
33. WASH WATER SKID
34. MISCELLANEOUS DRAIN TANK
35. CT DOG FIRE PROTECTION SKID
36. FALSE START DRAIN TANK
37. LIQUID FUEL/ATOMIZING AIR MODULE
38. CT ACCESSORY MODULE
39. GENERATOR COMPARTMENT
40. FIRE WATER DELUGE HOUSE
41. MAINTENANCE AREA
42. PIPE TRENCH
43. SLEEPER PIPE RACK
44. OIL WATER SEPARATOR
45. STORM WATER DETENTION POND DISCHARGE STRUCTURE
46. TOP SOIL STORAGE AREA
47. PERCOLATION POND
48. SEPTIC TANK AND DRAINFIELD DETAIL
49. EXISTING ROAD
50. TEMPORARY CONSTRUCTION ACCESS ROAD
N 89°41'15"E 2636.99'
S 89°41'15"W 1185.05'
S 89°38'18"W 649.53'
NW CORNER SECTION 19-T02S-R24E
TO U.S. HWY. NO. 1
SCALE 1"=100'
JEA
BRANDY BRANCH STATION
SITE ARRANGEMENT
60903-DS-S1001
1 08-19-99 GENERAL REVISIONS
0 06-25-99 INITIAL ISSUE
REVISIONS AND RECORD OF ISSUE



FACILITIES LEGEND

ITEM NO	DESCRIPTION	LOCATION COORDINATES NORTH	LOCATION COORDINATES EAST	INTERVIEW LOCATION
1	[illegible]			
2	[illegible]			
3	[illegible]			
4	[illegible]			
5	[illegible]			
6	[illegible]			
7	[illegible]			
8	[illegible]			
9	[illegible]			
10	[illegible]			
11	[illegible]			
12	[illegible]			
13	[illegible]			
14	[illegible]			
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27	[illegible]			
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32	[illegible]			
33	[illegible]			
34	[illegible]			
35	[illegible]			
36	[illegible]			
37	[illegible]			
38	[illegible]			
39	[illegible]			
40	[illegible]			
41	[illegible]			
42	[illegible]			
43	[illegible]			
44	[illegible]			
45	[illegible]			
46	[illegible]			
47	[illegible]			
48	[illegible]			
49	[illegible]			
50	[illegible]			

GENERAL LEGEND

- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]

SUBSURFACE INVESTIGATION LEGEND

- ROL BORING (31 TOTAL)
- ROL MONITORY (2 TOTAL)
- ROL BORING W/ PIEZOMETER
- CONE PENETROMETER SOUNDING (6 TOTAL)

BORING LOCATION

BORING NO.	NORTHING	EASTING	DEPTH
B-1	7691.50	57888.00	30'
B-2	7691.38	57388.00	30'
B-3	77205.81	57381.45	40'
B-4	77205.81	57388.45	40'
B-5	77336.75	56900.53	30'
B-6	77386.00	57790.00	30'
B-7	7884.00	58748.00	30'
B-8	7818.00	58748.00	30'
B-9	77715.40	58812.38	30'
B-10	77766.00	58859.00	100'
B-11	77585.94	58870.88	100'
B-12	77867.36	57870.88	100'
B-14	77791.42	57788.38	100'
B-15	77886.98	57870.87	100'
B-16	77798.00	57488.38	100'
B-18	77806.38	57791.46	80'
B-19	77796.41	57791.46	100'
B-20	77886.98	57743.76	100'
B-21	76861.77	58801.38	15'
B-22	77861.12	58068.38	15'
B-23	77870.87	58863.38	15'
OPT-1	77886.00	58870.38	80'
OPT-2	77886.00	57870.88	80'
OPT-3	77886.00	57478.38	80'
OPT-4	77886.00	57738.00	81'

NO	DATE	REVISIONS AND RECORD OF ISSUE	DRAWN	CHECKED
3	06-30-98	ISSUED FOR REPORT	JWS/ACE	RLR/RLR
1	06-26-98	REVISED BORING LOCATIONS	JWS/ACE	RLR/RLR
0	04-27-98	INITIAL ISSUE	JWS/ACE	RLR/RLR

SCALE: 1"=100'

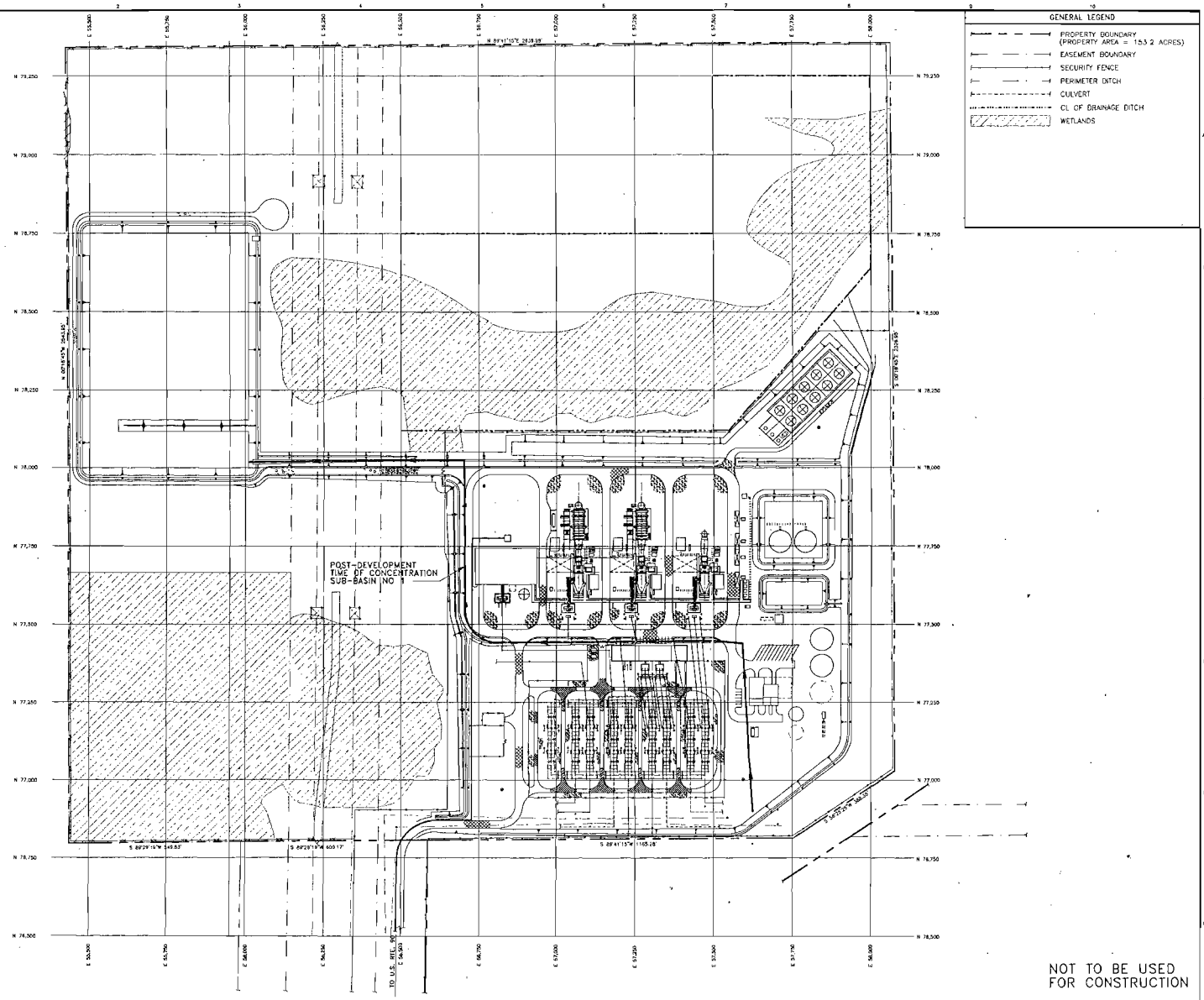
BLACK & VEATCH | JEA Large Utility

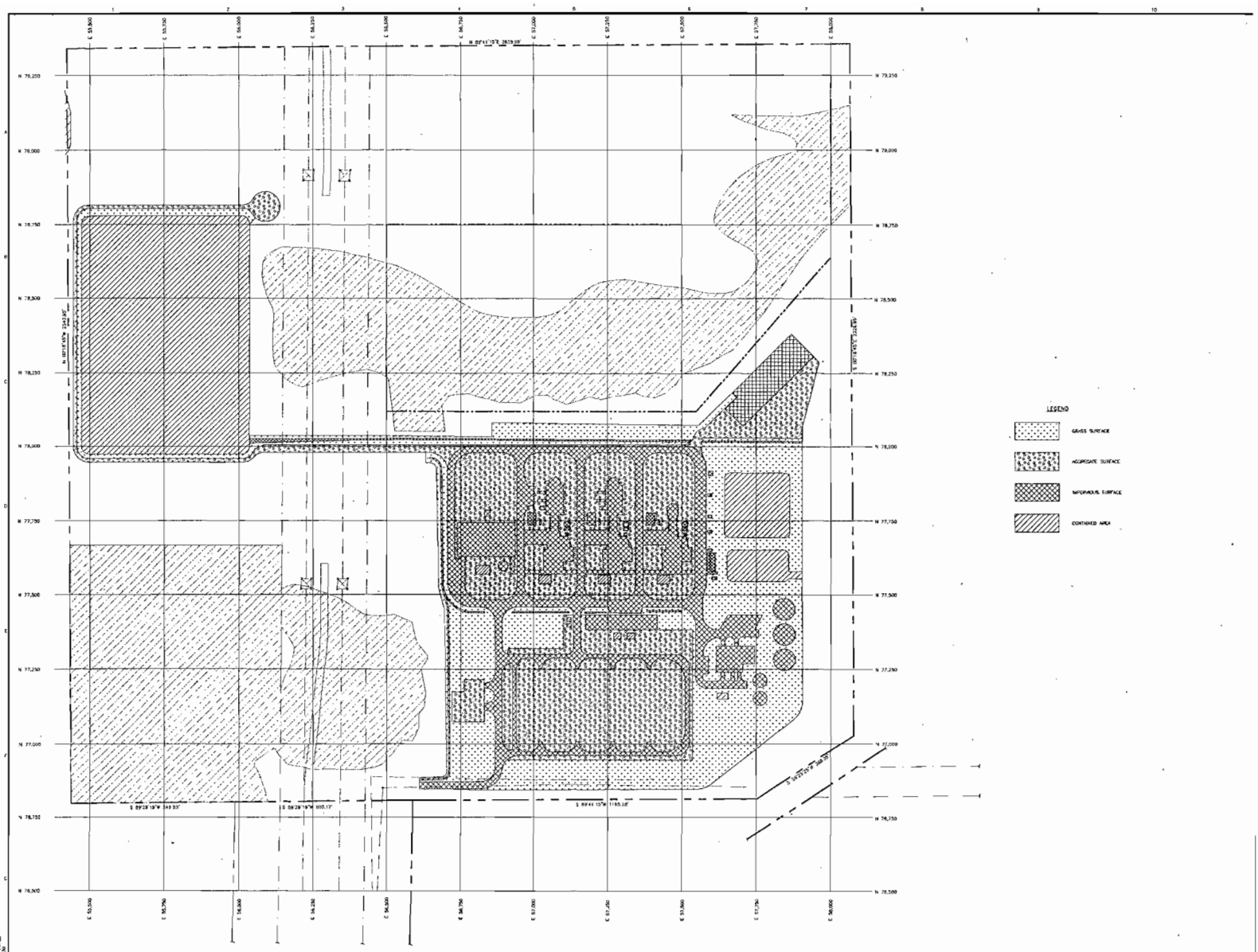
DESIGNED MCS DRAWN JWS
CHECKED DATE

JEA
BRANDY BRANCH STATION
SUBSURFACE INVESTIGATION

PROJECT 60903-SS-0001
DRAWING NUMBER 2
DATE
APPR.

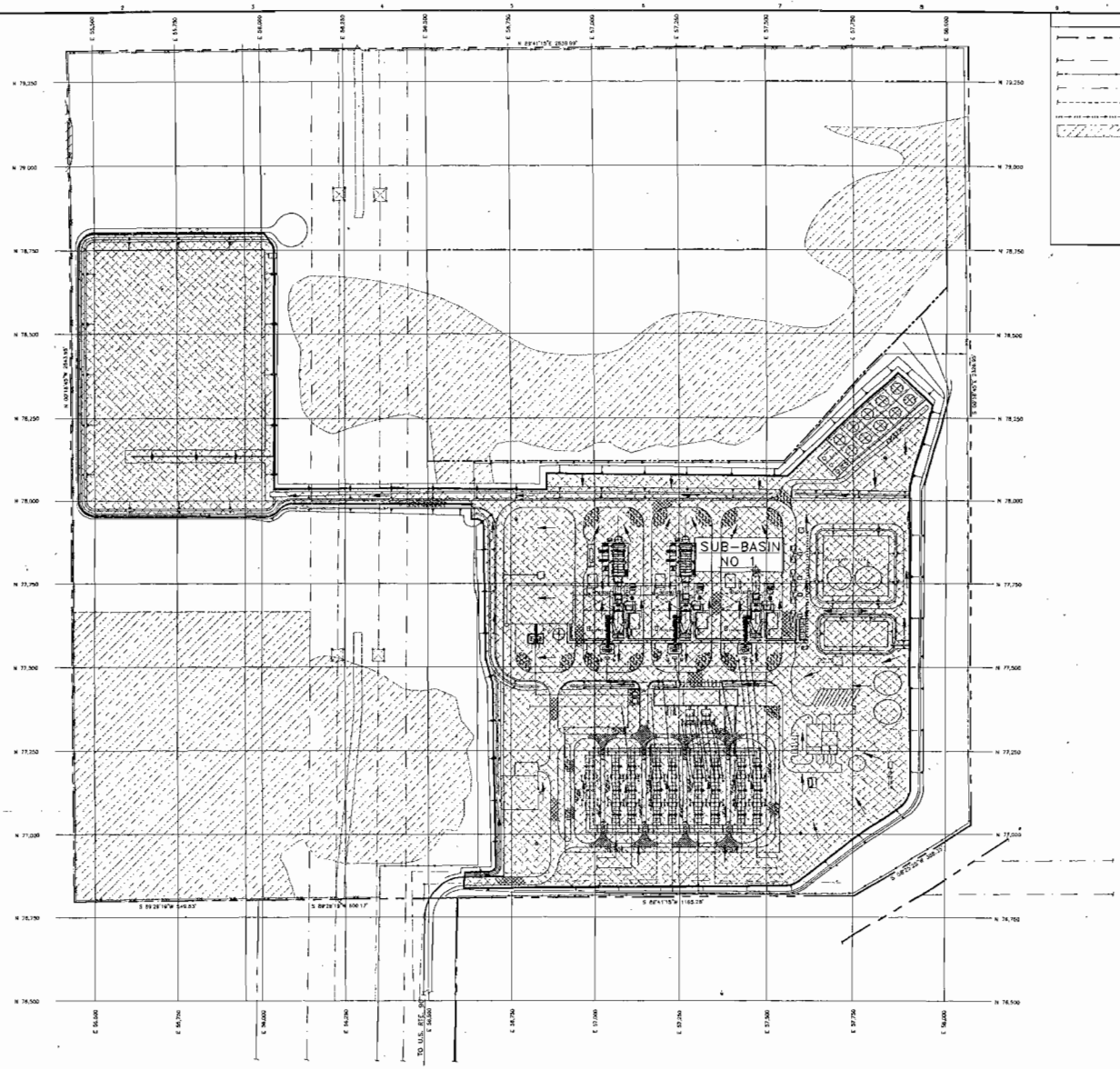
Poor Original


GENERAL LEGEND
PROPERTY BOUNDARY (PROPERTY AREA = 153.2 ACRES)
EASEMENT BOUNDARY
SECURITY FENCE
PERIMETER DITCH
CULVERT
CL OF DRAINAGE DITCH
WETLANDS
POST-DEVELOPMENT TIME OF CONCENTRATION SUB-BASIN NO. 1
TO U.S. HWY. 301
NOT TO BE USED FOR CONSTRUCTION
JEA
BRANDY BRANCH STATION
POST-DEVELOPMENT TIME OF CONCENTRATION
FIGURE C



JEA
BRANDY BRANCH STATION
SITE
SURFACING PLAN

FIGURE D



GENERAL LEGEND

- PROPERTY BOUNDARY (PROPERTY AREA = 153.2 ACRES)
- EASEMENT BOUNDARY
- SECURITY FENCE
- PERIMETER DITCH
- CULVERT
- CL OF DRAINAGE DITCH
- WETLANDS

NOT TO BE USED FOR CONSTRUCTION

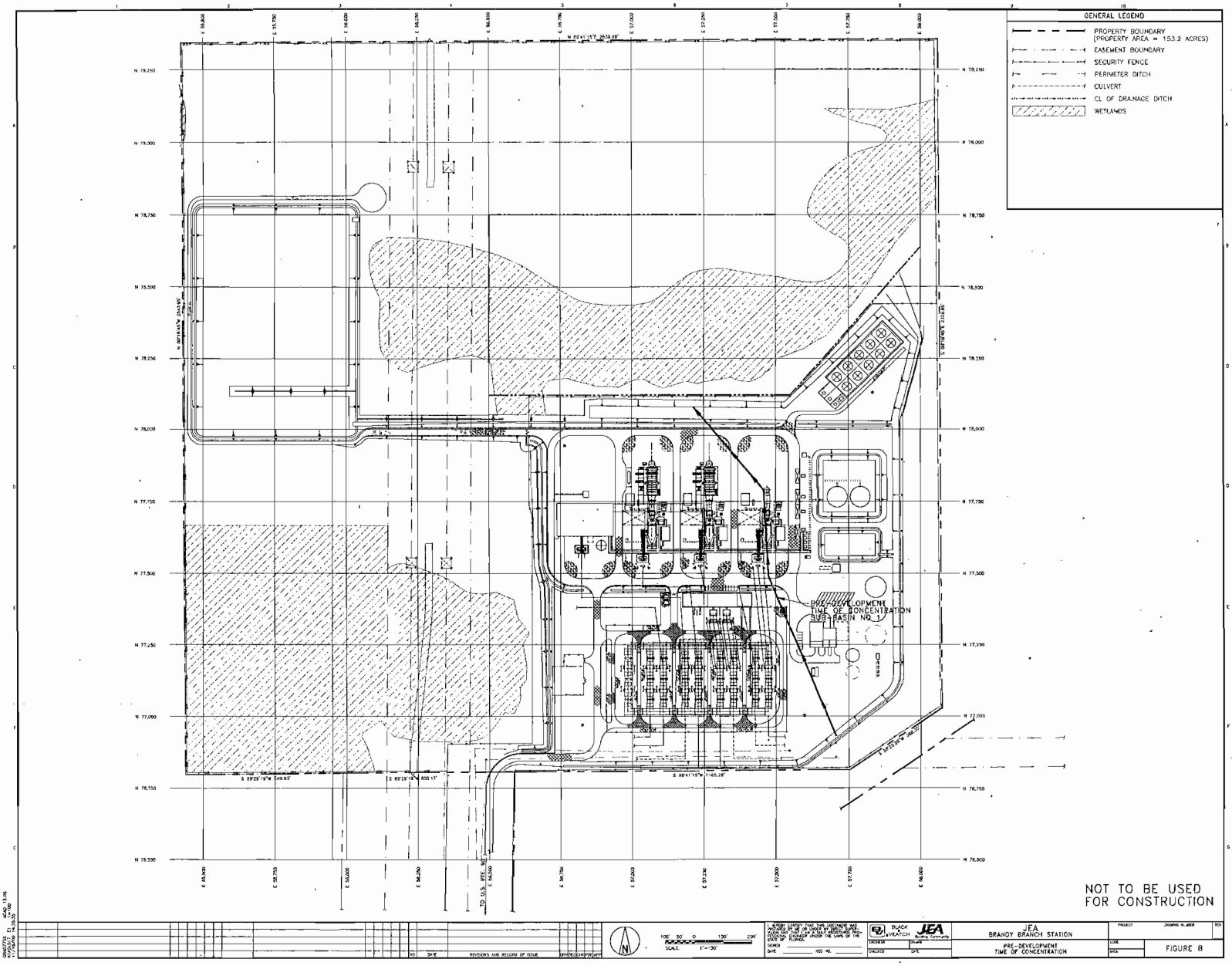
NO	DATE	REVISIONS AND RECORD OF ISSUE	DRAWN/DESIGNED/CHKD

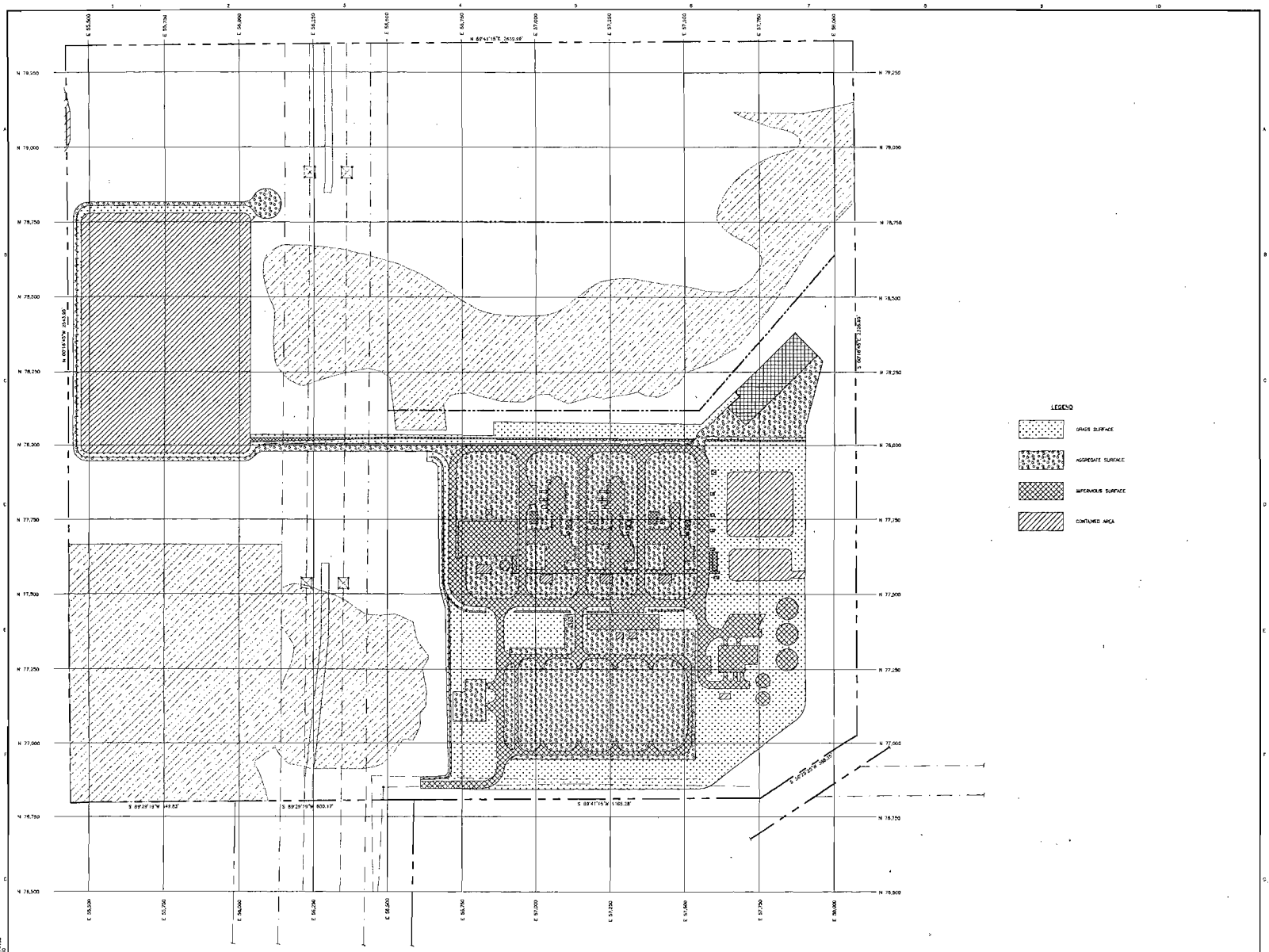
SCALE 1"=100'

BLACK & VEATCH — JEA

JEA
BRANDY BRANCH STATION
SUB-BASIN AREA 1

FIGURE A


GENERAL LEGEND
PROPERTY BOUNDARY (PROPERTY AREA = 153.2 ACRES)
EASEMENT BOUNDARY
SECURITY FENCE
PERIMETER DITCH
CULVERT
CL OF DRAINAGE DITCH
WETLANDS
PRE-DEVELOPMENT TIME OF CONCENTRATION SUB-BASIN NO. 1
TO U.S. 301
NOT TO BE USED FOR CONSTRUCTION
JEA
BRANDY BRANCH STATION
PRE-DEVELOPMENT TIME OF CONCENTRATION
FIGURE 8



NO.	DATE	REVISIONS AND RECORD OF ISSUE	APPROVED		

SCALE: 1"=100'

DESIGNED	DRAWN	CHECKED	DATE
SCALE	AS NOTED		

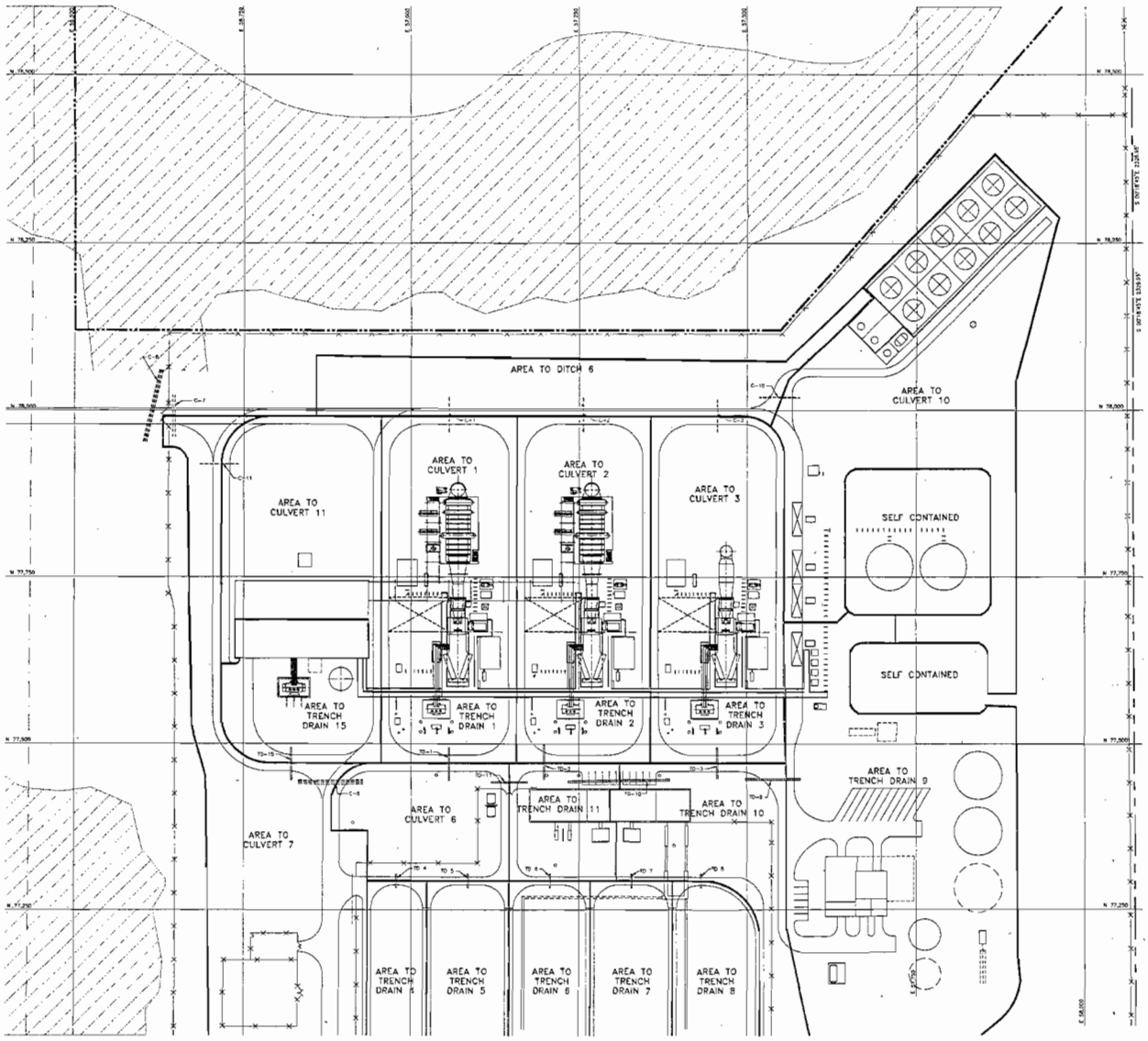
BLACK & VEATCH Building a Smarter Community

JEA

JEA
BRANDY BRANCH STATION

SITE
SURFACING PLAN

FIGURE D



NOT TO BE USED FOR CONSTRUCTION

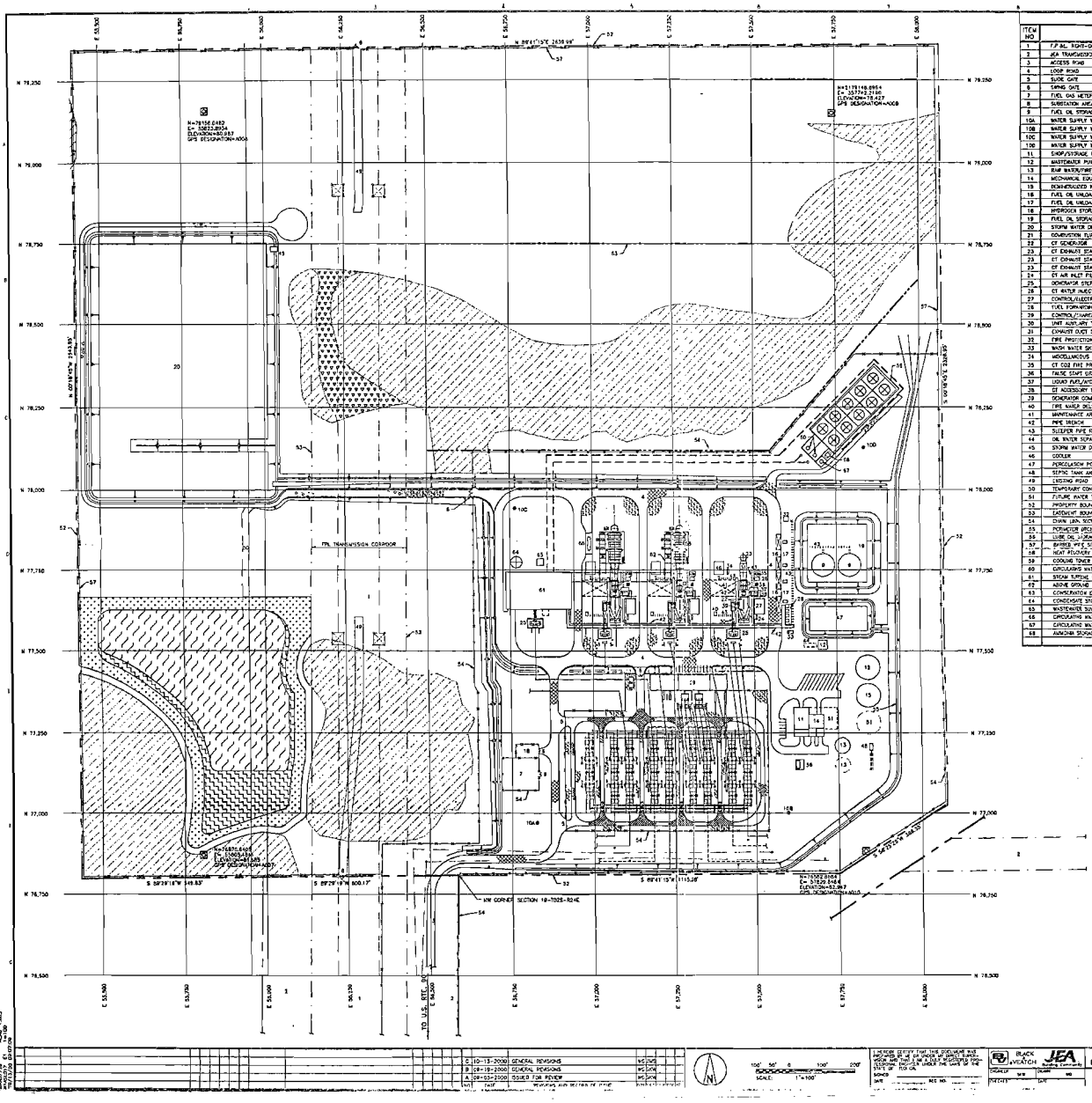
NO.	DATE	REVISIONS AND RECORD OF ISSUE	BY	CHK'D	APP'D

SCALE 1"=50'

BLACK & VEATCH | JEA

JEA
BRANDY BRANCH STATION
CULVERT DRAINAGE AREAS

FIGURE E



FACILITIES LEGEND

ITEM NO	DESCRIPTION	LOCATION COORDINATES NORTH	EAST	REFERENCE LOCATION
1	F.P.&L. RIGHT-OF-WAY	N/A	N/A	
2	JEA TRANSMISSION CORRIDOR	N/A	N/A	
3	ACCESS ROAD	N/A	N/A	
4	LOOP ROAD	N/A	N/A	
5	SLIDE GATE	N/A	N/A	
6	SWING GATE	N/A	N/A	
7	FUEL GAS METERING STATION	N/A	N/A	
8	SUBSTATION AREA	N/A	N/A	
9	FUEL OIL STORAGE TANK (1,000,000 GALLONS)	N/A	N/A	
10A	WATER SUPPLY WELL	76870.00	56825.00	CL WELL
10B	WATER SUPPLY WELL	77061.82	57587.00	CL WELL
10C	WATER SUPPLY WELL	77943.96	56764.00	CL WELL
10D	WATER SUPPLY WELL	78129.06	57834.08	CL WELL
11	SHOP/STORAGE BUILDING	N/A	N/A	
12	WASTEWATER PUMPING STATION	N/A	N/A	
13	RAW WATER/FIRE WATER STORAGE TANK	N/A	N/A	
14	MECHANICAL EQUIPMENT BUILDING	N/A	N/A	
15	DEMINERALIZED WATER STORAGE TANK	N/A	N/A	
16	FUEL OIL UNLOADING AREA	N/A	N/A	
17	FUEL OIL UNLOADING PUMP AREA	N/A	N/A	
18	HYDROGEN STORAGE GAS AREA	N/A	N/A	
19	FUEL OIL STORAGE TANK SECONDARY CONTAINMENT	N/A	N/A	
20	STORM WATER DETENTION POND	N/A	N/A	
21	COMBUSTION TURBINE (CT)	N/A	N/A	
22	CT GENERATOR	N/A	N/A	
23	CT EXHAUST STACK (UNIT 1)	77768.28	57466.00	CL STACK
23	CT EXHAUST STACK (UNIT 2)	N/A	N/A	
23	CT EXHAUST STACK (UNIT 3)	N/A	N/A	
24	CT AIR INLET FILTER	N/A	N/A	
25	GENERATOR STEP-UP TRANSFORMER	N/A	N/A	
26	CT WATER INJECTION SKID	N/A	N/A	
27	CONTROL/ELECTRICAL BUILDING	N/A	N/A	
28	FUEL FORWARDING SKIDS	N/A	N/A	
29	CONTROL/ADMIN/SERVICES BUILDING	N/A	N/A	
30	UNIT AUXILIARY TRANSFORMER	N/A	N/A	
31	EXHAUST DUCT SILENCER	N/A	N/A	
32	FIRE PROTECTION FOAM HOUSE	N/A	N/A	
33	WASH WATER SKID	N/A	N/A	
34	MISCELLANEOUS DRAIN TANK	N/A	N/A	
35	CT CO2 FIRE PROTECTION SKID	N/A	N/A	
36	FALSE START STEAM TANK	N/A	N/A	
37	LIQUID FUEL/ATOMIZING AIR MODULE	N/A	N/A	
38	CT ACCESSORY MODULE	N/A	N/A	
39	GENERATOR COMPARTMENT	N/A	N/A	
40	FIRE WATER DELUGE HOUSE	N/A	N/A	
41	MAINTENANCE AREA	N/A	N/A	
42	PIPE RACK	N/A	N/A	
43	SLEEPER PIPE RACK	N/A	N/A	
44	OIL WATER SEPARATOR	N/A	N/A	
45	STORM WATER DETENTION POND DISCHARGE STRUCTURE	N/A	N/A	
46	COOLER	N/A	N/A	
47	PERCOLATION POND	N/A	N/A	
48	SEPTIC TANK AND DRAINFIELD BITAL	N/A	N/A	
49	EXISTING ROAD	N/A	N/A	
50	TEMPORARY CONSTRUCTION ACCESS ROAD	N/A	N/A	
51	FUTURE WATER TREATMENT EQUIPMENT EXPANSION	N/A	N/A	
52	PROPERTY BOUNDARY	N/A	N/A	
53	EASEMENT BOUNDARY	N/A	N/A	
54	CHAIN LINK SECURITY FENCE	N/A	N/A	
55	PERIMETER BERM	N/A	N/A	
56	LUBE OIL STORAGE AREA	N/A	N/A	
57	BARBED WIRE SITE PERIMETER FENCE	N/A	N/A	
58	HEAT RECOVERY STEAM GENERATOR	N/A	N/A	
59	COOLING TOWER	N/A	N/A	
60	CIRCULATING WATER PUMPS	N/A	N/A	
61	STEAM TURBINE GENERATOR BUILDING	N/A	N/A	
62	ABOVE GROUND PIPE RACK	N/A	N/A	
63	CONSERVATION EASEMENT	N/A	N/A	
64	CONDENSATE STORAGE TANK	N/A	N/A	
65	WASTEWATER SUMP	N/A	N/A	
66	CIRCULATING WATER ACID TANK	N/A	N/A	
67	CIRCULATING WATER HYPOCHLORITE TANK	N/A	N/A	
68	AMMONIA STORAGE TANK	N/A	N/A	

GENERAL LEGEND

- BENCHMARK
- FUTURE FACILITY
- WETLANDS
- CYPRESS (ZONE 3) AREA
- ASPHALT
- CRUSHED ROCK SURFACING
- HERBACEOUS (ZONE 1) AREA
- UPLAND BUFFER AREA
- RESTORATION MITIGATION AREA
- GEORGE

NOT TO BE USED FOR CONSTRUCTION

REV	DESCRIPTION	BY	DATE
C	10-13-2000 GENERAL REVISIONS	WS	10/00
B	09-19-2000 GENERAL REVISIONS	WS	09/00
A	08-03-2000 ISSUED FOR REVIEW	WS	08/00

SCALE: 1"=100'

BLACK & VEATCH

JEA

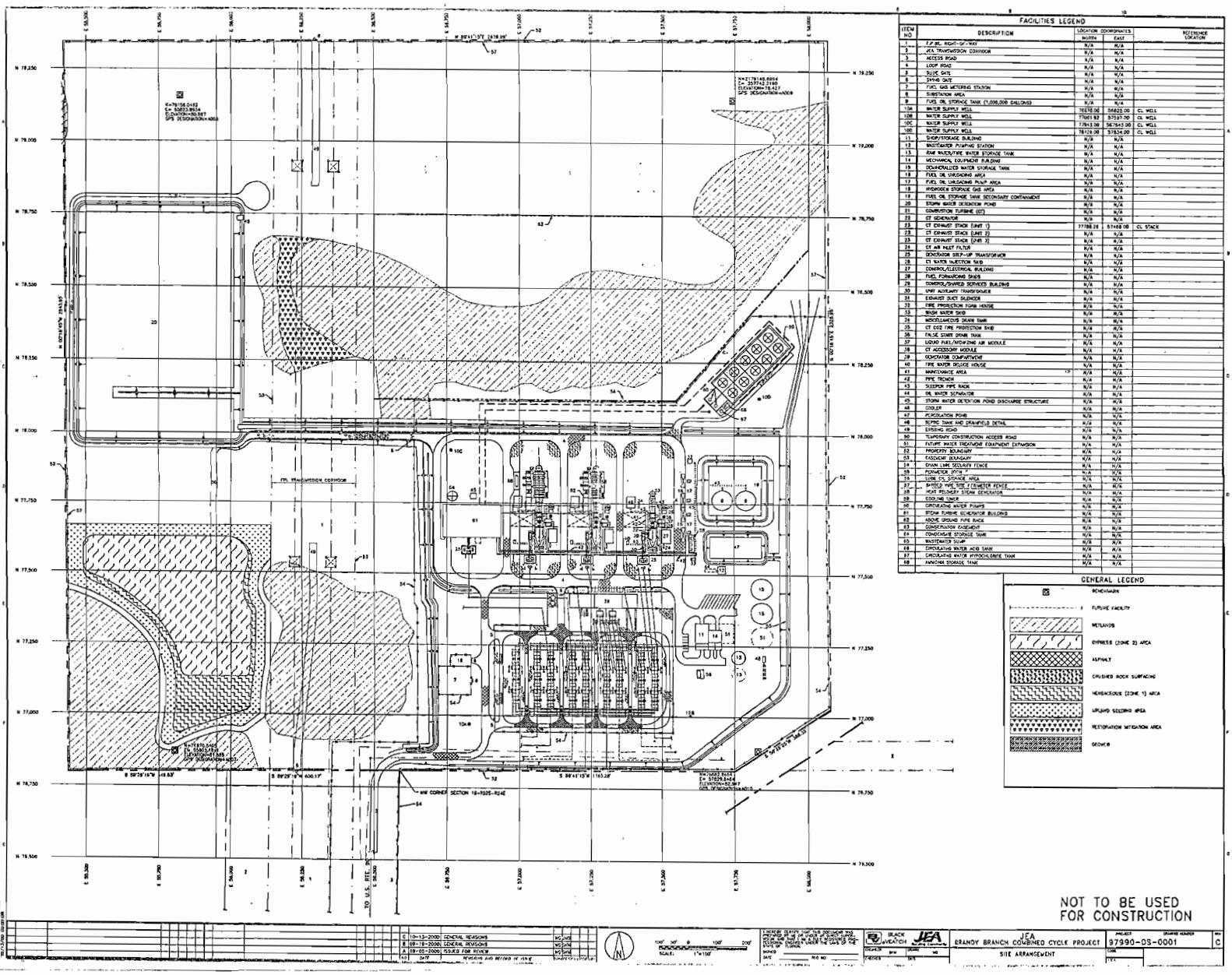
Building Community

BRANDY BRANCH COMBINED CYCLE PROJECT

SITE ARRANGEMENT

PROJECT 97990-DS-0001

REV C



FACILITIES LEGEND

ITEM NO	DESCRIPTION	LOCATION COORDINATES NORTH	EAST	REFERENCE LOCATION
1	P.P.M.L. RIGHT-OF-WAY	N/A	N/A	
2	JEA TRANSMISSION CORRIDOR	N/A	N/A	
3	ACCESS ROAD	N/A	N/A	
4	LOOP ROAD	N/A	N/A	
5	SLIDE GATE	N/A	N/A	
6	SWING GATE	N/A	N/A	
7	FUEL GAS METERING STATION	N/A	N/A	
8	SUBSTATION AREA	N/A	N/A	
9	FUEL OIL STORAGE TANK (1,000,000 GALLONS)	N/A	N/A	
10A	WATER SUPPLY WELL	78678.00	58625.00	CL WELL
10B	WATER SUPPLY WELL	77691.82	57597.00	CL WELL
10C	WATER SUPPLY WELL	77913.00	56765.00	CL WELL
10D	WATER SUPPLY WELL	78128.00	57834.00	CL WELL
11	SHOP/STORAGE BUILDING	N/A	N/A	
12	WASTEWATER PUMPING STATION	N/A	N/A	
13	RAW WATER/FIRE WATER STORAGE TANK	N/A	N/A	
14	MECHANICAL EQUIPMENT BUILDING	N/A	N/A	
15	DEMINERALIZED WATER STORAGE TANK	N/A	N/A	
16	FUEL OIL UNLOADING AREA	N/A	N/A	
17	FUEL OIL UNLOADING PUMP AREA	N/A	N/A	
18	HYDROGEN STORAGE GAS AREA	N/A	N/A	
19	FUEL OIL STORAGE TANK SECONDARY CONTAINMENT	N/A	N/A	
20	STORM WATER DETENTION POND	N/A	N/A	
21	COMBUSTION TURBINE (CT)	N/A	N/A	
22	CT GENERATOR	N/A	N/A	
23	CT EXHAUST STACK (UNIT 1)	77788.38	57488.98	CL STACK
23	CT EXHAUST STACK (UNIT 2)	N/A	N/A	
23	CT EXHAUST STACK (UNIT 3)	N/A	N/A	
24	CT AIR INLET FILTER	N/A	N/A	
25	GENERATOR STEP-UP TRANSFORMER	N/A	N/A	
26	CT WATER INJECTION SKID	N/A	N/A	
27	CONTROL/ELECTRICAL BUILDING	N/A	N/A	
28	FUEL FORWARDING SKIDS	N/A	N/A	
29	CONTROL/SHARED SERVICES BUILDING	N/A	N/A	
30	UNIT AUXILIARY TRANSFORMER	N/A	N/A	
31	EXHAUST DUCT SILENCER	N/A	N/A	
32	FIRE PROTECTION FOAM HOUSE	N/A	N/A	
33	WASH WATER SKID	N/A	N/A	
34	MISCELLANEOUS DRAIN TANK	N/A	N/A	
35	CT CO2 FIRE PROTECTION SKID	N/A	N/A	
36	FALSE START DRAIN TANK	N/A	N/A	
37	LIQUID FUEL/ATOMIZING AIR MODULE	N/A	N/A	
38	CT ACCESSORY MODULE	N/A	N/A	
39	GENERATOR COMPARTMENT	N/A	N/A	
40	FIRE WATER DELUGE HOUSE	N/A	N/A	
41	MAINTENANCE AREA	N/A	N/A	
42	PIPE TRENCH	N/A	N/A	
43	SLEEPER PIPE RACK	N/A	N/A	
44	OIL WATER SEPARATOR	N/A	N/A	
45	STORM WATER DETENTION POND DISCHARGE STRUCTURE	N/A	N/A	
46	COOLER	N/A	N/A	
47	PERCOLATION POND	N/A	N/A	
48	SEPTIC TANK AND DRAINFIELD DETAIL	N/A	N/A	
49	EXISTING ROAD	N/A	N/A	
50	TEMPORARY CONSTRUCTION ACCESS ROAD	N/A	N/A	
51	FUTURE WATER TREATMENT EQUIPMENT EXPANSION	N/A	N/A	
52	PROPERTY BOUNDARY	N/A	N/A	
53	EASEMENT BOUNDARY	N/A	N/A	
54	CHAIN LINK SECURITY FENCE	N/A	N/A	
55	PERIMETER BERM	N/A	N/A	
56	LUBE OIL STORAGE AREA	N/A	N/A	
57	BARBED WIRE SITE PERIMETER FENCE	N/A	N/A	
58	HEAT RECOVERY STEAM GENERATOR	N/A	N/A	
59	COOLING TOWER	N/A	N/A	
60	CIRCULATING WATER PUMPS	N/A	N/A	
61	STEAM TURBINE GENERATOR BUILDING	N/A	N/A	
62	ABOVE GROUND PIPE RACK	N/A	N/A	
63	CONSERVATION EASEMENT	N/A	N/A	
64	CONDENSATE STORAGE TANK	N/A	N/A	
65	WASTEWATER SUMP	N/A	N/A	
66	CIRCULATING WATER ACID TANK	N/A	N/A	
67	CIRCULATING WATER HYPOCHLORITE TANK	N/A	N/A	
68	AMMONIA STORAGE TANK	N/A	N/A	

GENERAL LEGEND

- BENCHMARK
- FUTURE FACILITY
- WETLANDS
- CYPRESS (ZONE 2) AREA
- ASPHALT
- CRUSHED ROCK SURFACING
- HERBACEOUS (ZONE 1) AREA
- UPLAND SEEDING AREA
- RESTORATION MITIGATION AREA
- GROWCB

NOT TO BE USED FOR CONSTRUCTION

REV	DATE	REVISIONS AND METHOD OF ERASE	INITIALS
C	10-13-2000	GENERAL REVISIONS	WS/MB
B	09-19-2000	GENERAL REVISIONS	WS/MB
A	09-05-2000	ISSUED FOR REVIEW	WS/MB

SCALE: 1"=100'

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JEA
BRANDY BRANCH COMBINED CYCLE PROJECT
SITE ARRANGEMENT

PROJECT 97990-03-0001
DRAWING NUMBER
REV C