

FLORIDA POWER & LIGHT PUTNAM 230KV SUBSTATION EXPANSION

Putnam County, Florida



STORMWATER CALCULATIONS

*Date: January 14, 2014
Revision #1: April 8, 2014*

Prepared By:
Parker Mynchenberg and Associates, Inc.
Professional Engineers * Land Planners * Landscape Architects
1729 Ridgewood Avenue
Holly Hill, Florida 32117
386-677-6891

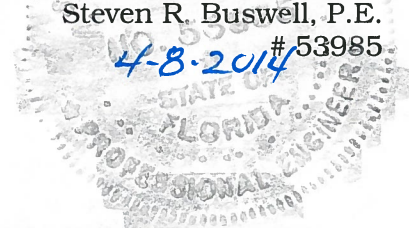

Steven R. Buswell, P.E.
#53985
4-8-2014


TABLE OF CONTENTS

1	NARRATIVE	3
1.1	LOCATION	3
1.2	SOILS.....	3
1.3	100 YEAR FLOOD PLAIN	3
2	DRAINAGE PATTERN.....	3
2.1	EXISTING.....	3
2.2	PROPOSED	3
2.2.1	<i>Nutrient Loading.....</i>	<i>3</i>
3	EXECUTIVE SUMMARY.....	4
3.1	BASIS OF DESIGN	4
4	ROUTING SUMMARY	4
	TREATMENT VOLUME / STAGE STORAGE CALCULATIONS	5
	LENGTH TO WIDTH CALCULATIONS / RECOVERY CALCULATIONS.....	6
	NUTRIENT LOADING CALCULATIONS	7
	NODAL DIAGRAM / PRE & POST DRAINAGE BASIN MAPS.....	8
	PRE/POST DEVELOPMENT ROUTING ANALYSIS.....	9
	SOILS INFORMATION.....	10
	INFORMATION MAPS	11
4.1	QUADRANGLE MAP	12
4.2	FIRM MAP	13
	GEOTECHNICAL REPORT.....	14

1 NARRATIVE

1.1 Location

The project site is located within Putnam County. The site is located east of Highway 100, more specifically, between Roberts Road and Cobblestone Road, west of Old San Mateo Road. A vicinity map is located on the Cover Sheet of the plans.

1.2 Soils

Soils as shown in the Soil Survey of Putnam County are #1-Candler fine sand, #16-Adamsville sand, #30-Hontoon Muck, and #55-Centenary. A copy of the National Cooperative Soil Survey (USDA 2009) has been included in the Soils Information Section of this Report. Based on the hydrologic grouping and discussion with the FDEP, the site is considered to be Type A.

1.3 100 Year Flood Plain

The site is shown as Zone X (outside the flood plain). A copy of the FIRM (map) dated February 2, 2012, is provided in the Information Maps Section of this Report. The Map Number is 12107C0214C. Please refer to the Flood Plain impact methodology and calculations included with this Report.

2 DRAINAGE PATTERN

2.1 Existing

The site is currently developed with an existing electrical station. Approximately two-thirds of the existing yard drains from the west to the east. The total project area (including the existing yard) is 3.58 acres.

The undeveloped portion of the project area is typically woods/grass combination in fair condition. The pre-development phase has been modeled as one (1) basin and one (1) discharge location. All runoff sheet flows to the retention pond to the east. A pre-development drainage basin map is included in the NODAL DIAGRAM/PRE-POST DRAINAGE BASIN MAP/ROUTING ANALYSIS Section of this report.

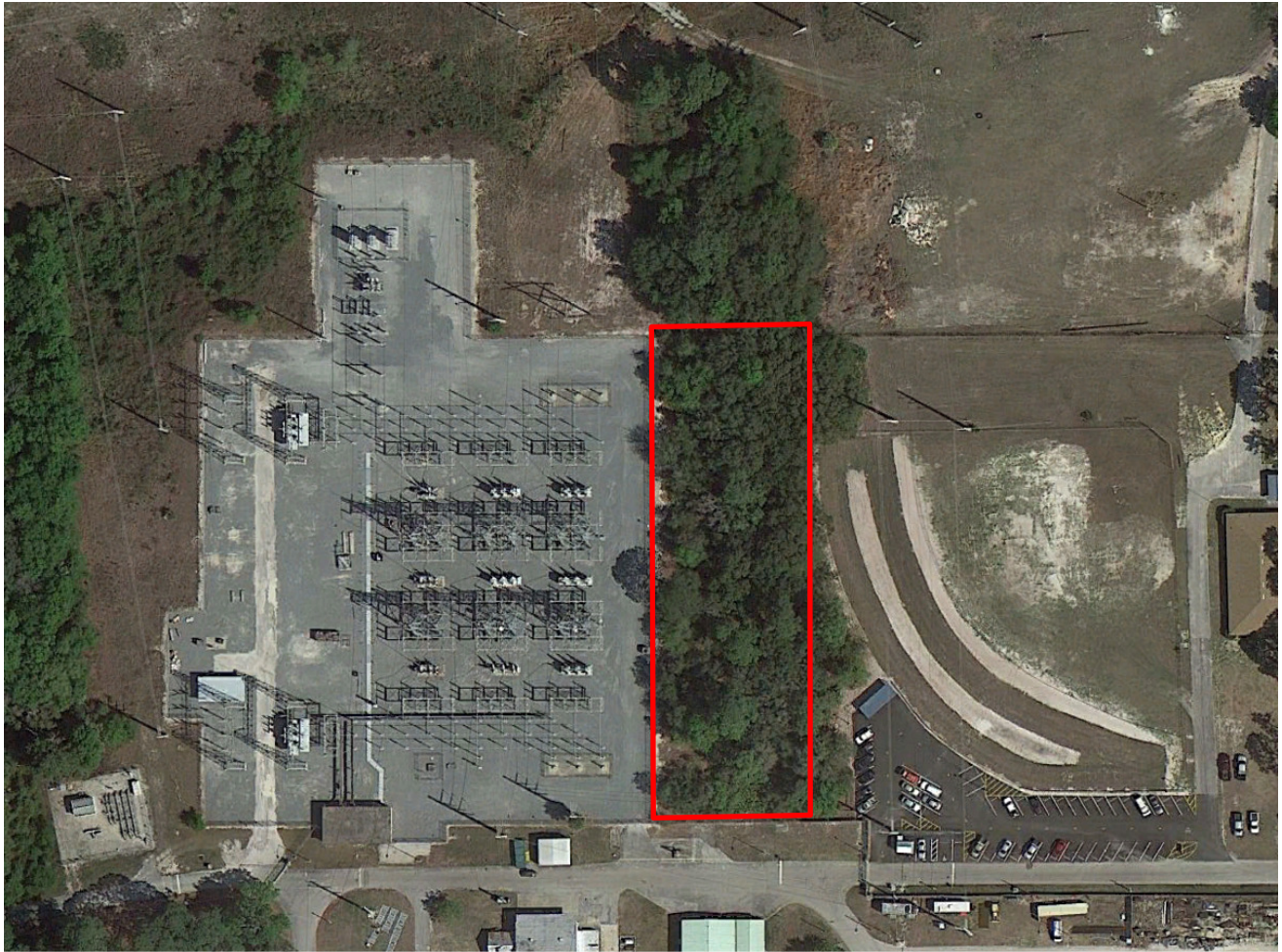
2.2 Proposed

The proposed improvements include the expansion of the existing electrical substation yard. The yard is being expanded 394' x 60'. The site consists of one (1) drainage basin, one (1) storage node, and one (1) point of discharge. The discharge location in the post-development is consistent with the pre-development discharge location.

The proposed method of stormwater treatment is dry retention. There is no tailwater constraint imposed on the proposed system as discharge occurs above the existing parking lot. The ultimate receiving water body is the St. Johns River.

2.2.1 Nutrient Loading

The St. Johns River is considered an Impaired Water body by the FDEP, and subsequently is required to meet the nutrient loading design criteria. Included in this report, are the nutrient calculations, which demonstrate the proposed dry retention system is sized adequately to remove the target elements through percolation. A volume equivalent to 1.00 inches over the drainage area is required. The proposed system meets the FDEP's nutrient removal criteria.



Project Aerial

3 EXECUTIVE SUMMARY

3.1 Basis of Design

- a) The retention volumes provided exceed the requirements of the FDEP (SJRWMD) and Putnam County.
- b) The detention volumes provided allows for the attenuation of the storm events such that the post development rates of discharge are all equal to or less than the pre development rates of discharge.
- c) There are no tailwater constraints associated with the proposed system.
- d) The drainage system proposed will be maintained and operated by Florida Power and Light (FPL)
- e) The minimum temporary erosion and sediment control measures are shown on the site plan. Additional measures may be needed based on field conditions at the time of construction.

4 ROUTING SUMMARY

A complete summary of the routing results is found in the PRE/POST ROUTING ANALYSIS Section on Master Design Summary page. The following table illustrates the Pre vs. Post summary of the peak flows to each discharge node:

TREATMENT VOLUME / STAGE STORAGE CALCULATIONS

FPL - PUTNAM 230 KV EXPANSION
TREATMENT VOLUME
BASIN A

St. John's River Water Management District's Storage Requirement.

The storage requirement for the St. Johns River Water Management District is the greater of

- a) the first 1.0 inch from the watershed
b) the first 1.25 inches over impervious plus 0.5 inches over the watershed

Pond = **DRY**
OFW = **NO**

BASIN A

Impervious Area Summary

	square feet	acre
Substation Yard	128,700	2.955
	-	-
	-	-
	-	-
	-	-
	-	-
	-	-
	-	-
	-	-
Total =	<u>128,700</u>	<u>2.955</u>

Impervious Area =	128,700 ft ²	2.955 ac
Remaining Area =	27,300 ft ²	0.627 ac
Total Area =	156,000 ft²	3.581 ac

Storage Volume (a) =	13,000 ft ³	0.298 ac-ft
Storage Volume (b) =	19,906 ft ³	0.457 ac-ft

SJRWMD Required Treatment Volume =	19,906 ft ³
	0.457 ac-ft

SJRWMD Required Treatment Volume =	0.457 ac-ft =	19,906 ft³
---	----------------------	------------------------------

Nutrient Loading =	0.298 ac-ft =	12,999 ft³
---------------------------	----------------------	------------------------------

SJRWMD Required Treatment Volume =	0.457 ac-ft =	19,906 ft³
---	----------------------	------------------------------

25yr/24hr Volume Differential

	<u>PRE-DEVELOPMENT</u>	<u>POST-DEVELOPMENT</u>
Total Area (Ac) -----	3.58	3.58
Composite CN -----	80.1	87.7
Initial Abstraction (Ia) -----	0.50	0.30
Ia/P(Mean) -----	0.113	0.068
Ia/P(25) -----	0.064	0.038
Rainfall (in.) Mean-year (P) -----	4.42	4.42
Rainfall (in.) 25-year (P) -----	7.79	7.79

Runoff (in) ==> $Q_{runoff} = \frac{(P - 0.2S)^2}{P + 0.8S}$

Runoff (in.) Mean-year -----	2.40 in -----	3.09 in
Runoff (in.) 25-year -----	5.44 in -----	6.32 in

Runoff (ac-ft) ==> $Vol_{runoff} = Q_{runoff} \bullet Area$

Runoff Vol (Ac.-ft) Mean-year -----	0.72 ac-ft -----	0.92 ac-ft
Runoff Vol (Ac.-ft) 25-year -----	1.62 ac-ft -----	1.89 ac-ft

	<u>Post</u>	<u>Pre</u>	<u>ΔV</u>	
25-year 24-hour volume differential	1.89	1.62	0.26 ac-ft =	11,473 ft ³

Additional Pre-development Storage =	0.000 ac-ft =	- ft³
---	----------------------	-------------------------

25yr/24hr Volume Differential =	0.263 ac-ft =	11,473 ft³
--	----------------------	------------------------------

MINIMUM REQUIRED TREATMENT VOLUME =	0.457 ac-ft	19,906 ft³
--	--------------------	------------------------------

FPL - PUTNAM 230 KV EXPANSION

BASIN A

Δ Elevation = 0.1 ft

Elevation = 20.0 ft	Area = 17,282 ft^2
Elevation = 21.0 ft	Area = 20,571 ft^2
Elevation = 22.0 ft	Area = 23,959 ft^2
Elevation = 23.0 ft	Area = 27,448 ft^2
Elevation = 24.0 ft	Area = 31,037 ft^2
Elevation = 25.0 ft	Area = - ft^2
Elevation = 26.0 ft	Area = - ft^2
Elevation = 27.0 ft	Area = - ft^2
Elevation = 28.0 ft	Area = - ft^2
Elevation = 29.0 ft	Area = - ft^2

Required Volume = 0.457 ac-ft

Bottom = 21.7 ft

Min Weir Elevation = 22.52 ft

	EI	Volume
top	22.60	0.505
mid	22.52	0.457
bottom	22.50	0.446

Weir Set Elevation = 22.60 ft

	Volume	EI
bottom	0.446	22.50
mid	0.505	22.60
top	0.505	22.60

Provided Volume = 0.505 ac-ft

OK
YES

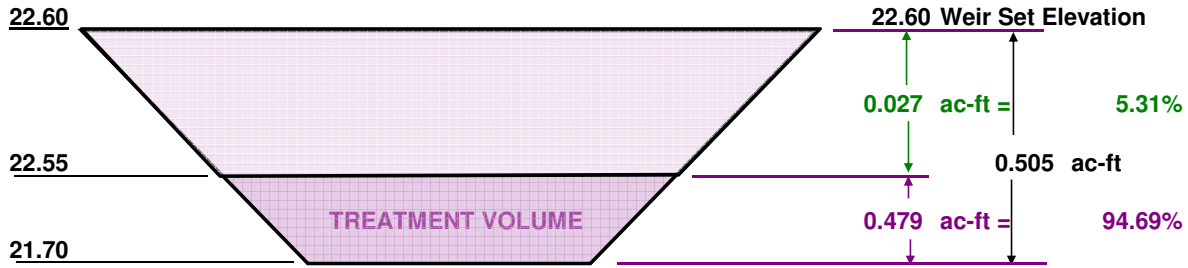
Elevation (ft)	Area (ft2)	Area (acre)	Volume (ft3)	Total Volume (ft3)	Total Volume (ac-ft)
20.00	17,282	0.40	-	-	-
20.10	17,611	0.40	-	-	-
20.20	17,940	0.41	-	-	-
20.30	18,269	0.42	-	-	-
20.40	18,598	0.43	-	-	-
20.50	18,927	0.43	-	-	-
20.60	19,255	0.44	-	-	-
20.70	19,584	0.45	-	-	-
20.80	19,913	0.46	-	-	-
20.90	20,242	0.46	-	-	-
21.00	20,571	0.47	-	-	-
21.10	20,910	0.48	-	-	-
21.20	21,249	0.49	-	-	-
21.30	21,587	0.50	-	-	-
21.40	21,926	0.50	-	-	-
21.50	22,265	0.51	-	-	-
21.60	22,604	0.52	-	-	-
21.70	22,943	0.53	-	-	-
21.80	23,281	0.53	2,309	2,309	0.053
21.90	23,620	0.54	2,343	4,652	0.107
22.00	23,959	0.55	2,377	7,028	0.161
22.10	24,308	0.56	2,411	9,439	0.217
22.20	24,657	0.57	2,446	11,885	0.273
22.30	25,006	0.57	2,481	14,365	0.330
22.40	25,355	0.58	2,515	16,881	0.388
22.50	25,704	0.59	2,550	19,431	0.446
22.60	26,052	0.60	2,585	22,016	0.505
22.70	26,401	0.61	2,620	24,636	0.566
22.80	26,750	0.61	2,655	27,291	0.627
22.90	27,099	0.62	2,690	29,981	0.688
23.00	27,448	0.63	2,725	32,706	0.751
23.10	27,807	0.64	2,760	35,466	0.814
23.20	28,166	0.65	2,796	38,262	0.878
23.30	28,525	0.65	2,832	41,093	0.943
23.40	28,884	0.66	2,868	43,961	1.009
23.50	29,243	0.67	2,903	46,864	1.076
23.60	29,601	0.68	2,939	49,803	1.143
23.70	29,960	0.69	2,975	52,778	1.212
23.80	30,319	0.70	3,011	55,789	1.281
23.90	30,678	0.70	3,047	58,836	1.351
24.00	31,037	0.71	3,083	61,919	1.421

LENGTH TO WIDTH CALCULATIONS / RECOVERY CALCULATIONS

FPL - PUTNAM 230 KV EXPANSION EQUIVALENT LENGTH & WIDTH

POND A

TREATMENT VOLUME CALCULATIONS



TREATMENT VOLUME

	Volume	EI
bottom	0.000	21.70
mid	0.239	22.14
top	0.479	22.55

TREATMENT VOLUME @ MID

EI =	22.14
Perimeter (P) =	863 ft
Volume (V) =	10,424 ft ³
Depth of Volume =	0.44 ft
Treatment Volume =	20,847 ft ³

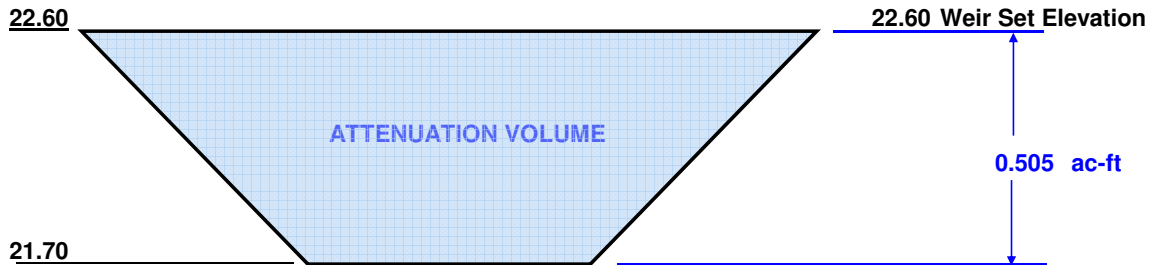
$$L = \frac{\frac{P}{2} + \sqrt{\frac{P^2}{4} - 4V}}{2}$$

L = 367 ft

$$W = \frac{\frac{P}{2} - \sqrt{\frac{P^2}{4} - 4V}}{2}$$

W = 65 ft

ATTENUATION VOLUME CALCULATIONS



ATTENUATION VOLUME

	Volume	EI
bottom	0.000	21.70
mid	0.253	22.16
top	0.505	22.60

ATTENUATION VOLUME @ MID

EI =	22.16
Perimeter (P) =	864 ft
Volume (V) =	11,008 ft ³
Depth of Volume =	0.46 ft
Attenuation Volume =	22,016 ft ³

$$L = \frac{\frac{P}{2} + \sqrt{\frac{P^2}{4} - 4V}}{2}$$

L = 367 ft

$$W = \frac{\frac{P}{2} - \sqrt{\frac{P^2}{4} - 4V}}{2}$$

W = 65 ft

PONDS - Version 2.20
Copyright 1993

Written By Devo Seereeram, Ph.D.
And Robert D. Casper

Licensed Solely For Use By:
Parker Mynchenberg & Associates

Retention Pond Recovery Analysis

I. Job Information

Job Name: **PUTNAM 230KV SUBSTATION EXPANSION - POND A**
Engineer: SRB
Date: January 15, 2014

II. Input Data

Equilavent Pond Length, [L] (ft):	367.00
Equilavent Pond Width, [W] (ft):	65.00
Pond Bottom Elevation, [PB] (ft above datum):	21.70
Porosity Of Material Within Pond, [p] (%):	100.00
Base of Aquifer Elevation, [B] (ft above datum) :	12.00
Water Table Elevation, [WT] (ft above datum) :	20.50
Horizontal Saturated Hydraulic Conductivity, [Kh] (ft/day):	20.00
Vertical Hydraulic Conductivity, [Kv] (ft/day):	20.00
Fillable Porosity of Aquifer, [n] (%) :	25.00
Runoff Volume, [V] (cubic feet)	20847.00
Percent Recovery of Runoff Volume, [PV] (%)	100.00

III. Results

UNSATURATED FLOW

Recovery Time From Unsaturated Flow, [T1] (days):	0.0150
Recovered Volume From Unsaturated Flow, [V1] (ft ³):	7156.504

SATURATED FLOW

Recovery Time From Saturated Flow, [T2] (days) :	2.3675
Recovered Volume From Saturated Flow, [V2] (ft ³) :	13690.5
Maximum Radius Of Influence, [R] (ft) :	87.20
Maxium Driving Head, [Hmax] (ft) :	1.774
Minimum Driving Head, [Hmin] (ft) :	1.200

TOTAL

Total Recovery Time, [T] (days) :	2.3825
Total Recovered Volume, [V] (ft ³) :	20847

RECOVERY TIME =	2.38	<=	3.0	OK	TREATMENT
				YES	VOLUME

PONDS - Version 2.20
Copyright 1993

Written By Devo Seereeram, Ph.D.
And Robert D. Casper

Licensed Solely For Use By:
Parker Mynchenberg & Associates

Retention Pond Recovery Analysis

I. Job Information

Job Name: **PUTNAM 230KV SUBSTATION EXPANSION - POND A**
Engineer: SRB
Date: January 15, 2014

II. Input Data

Equilavent Pond Length, [L] (ft):	367.00
Equilavent Pond Width, [W] (ft):	65.00
Pond Bottom Elevation, [PB] (ft above datum):	21.70
Porosity Of Material Within Pond, [p] (%):	100.00
Base of Aquifer Elevation, [B] (ft above datum) :	12.00
Water Table Elevation, [WT] (ft above datum) :	20.50
Horizontal Saturated Hydraulic Conductivity, [Kh] (ft/day):	20.00
Vertical Hydraulic Conductivity, [Kv] (ft/day):	20.00
Fillable Porosity of Aquifer, [n] (%) :	25.00
Runoff Volume, [V] (cubic feet)	22016.00
Percent Recovery of Runoff Volume, [PV] (%)	100.00

III. Results

UNSATURATED FLOW

Recovery Time From Unsaturated Flow, [T1] (days):	0.0150
Recovered Volume From Unsaturated Flow, [V1] (ft^3):	7156.504

SATURATED FLOW

Recovery Time From Saturated Flow, [T2] (days) :	2.7082
Recovered Volume From Saturated Flow, [V2] (ft^3) :	14859.5
Maximum Radius Of Influence, [R] (ft) :	93.48
Maxium Driving Head, [Hmax] (ft) :	1.823
Minimum Driving Head, [Hmin] (ft) :	1.200

TOTAL

Total Recovery Time, [T] (days) :	2.7232
Total Recovered Volume, [V] (ft^3) :	22016

RECOVERY TIME =	2.72	<=	14.0	OK	ATTENUATION
				YES	VOLUME

NUTRIENT LOADING CALCULATIONS

PUTNAM (ROBERTS) SUBSTATION
Site-Specific Pre-/Post- Pollutant Loading Analysis

PRE-DEVELOPMENT

Existing Condition	Land Use	Soil Type	Total P Loading (kg/ac-yr)		Basin Acreage (acres)		Inflow Mass Loading (kg/yr)	Treatment System	Inches of Retention Over Basin Area (inches)	Pollutant Removal Efficiency (%)	Outflow Mass Loading (kg/yr)
Pre-Basin A	COMM	HSG A	0.899	X	2.417	=	2.17				2.17
Pre-Basin A	TREE	HSG A	0.004	X	1.164	=	0.00				0.00
		HSG A			0.000						
		HSG A			0.000						
		HSG A			0.000						
					<u>3.581</u>		<u>2.18</u>				
Pre-Development Loading											2.178

POST-DEVELOPMENT

Proposed Condition	Land Use	Soil Type	Total P Loading (kg/ac-yr)		Basin Acreage (acres)		Inflow Mass Loading (kg/yr)	Treatment System	Inches of Retention Over Basin Area (inches)	Pollutant Removal Efficiency (%)	Outflow Mass Loading (kg/yr)
Post-Basin A	COMM	HSG A	0.899	X	2.955	=	2.66	Dry Retention	1.00	83	0.45
Post-Basin A	OPEN	HSG A	0.004	X	0.626	=	0.00	Dry Retention	1.00	96	0.00
					<u>3.581</u>		<u>2.66</u>				
Post Development Loading											0.452

Proposed Condition	Basin Acreage (acres)	Inches of Retention Over Basin Area (inches)	Retention Storage Required (ft3)	Retention Storage Provided (ft3)
Post-Basin A	3.581	1.00	12,999	22,016
		Total =	12,999	22,016

SUMMARY				
	cf	ac-ft		
Retention Storage Required =	12,999			OK
Retention Storage Provided =	22,016	0.505 ac-ft		YES

Derivation of the Methodology for Conversion of Stormwater Concentration to Pollutant Loading Rate And Its Application To The Analysis of Site-Specific Pre-/Post- Phosphorus Discharge To Lake Apopka

Based on Data from "Evaluation of Water Quality Stormwater Regulations for the Lake Apopka Basin" Final Report, December 2002

Data in Italics Derived From Report; Included in Table 11.7-3, AH:MSSW. No Hydrologic Data Available to Support Loading Result for GROVE.

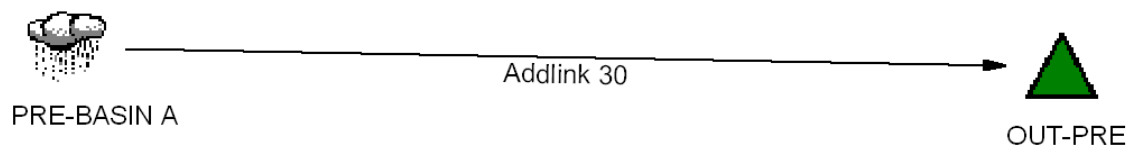
Land Use	HSG A Runoff Coefficient (unitless)	HSG B Runoff Coefficient (unitless)	HSG C Runoff Coefficient (unitless)	HSG D Runoff Coefficient (unitless)		Yearly Rainfall (in/year)		HSG A Rainfall Excess (in/year)	HSG B Rainfall Excess (in/year)	HSG C Rainfall Excess (in/year)	HSG D Rainfall Excess (in/year)
LDR	0.062	0.120	0.192	0.253	X	49.63	=	3.08	5.96	9.53	12.56
SFR 25%	0.131	0.165	0.221	0.269	X	49.63	=	6.50	8.19	10.97	13.35
SFR 40%	0.214	0.250	0.303	0.347	X	49.63	=	10.62	12.41	15.04	17.22
HDR	0.416	0.445	0.484	0.514	X	49.63	=	20.65	22.09	24.02	25.51
COMM	0.608	0.620	0.638	0.653	X	49.63	=	30.18	30.77	31.66	32.41
HWY 50%	0.410	0.437	0.472	0.503	X	49.63	=	20.35	21.69	23.43	24.96
HWY 75%	0.608	0.621	0.639	0.654	X	49.63	=	30.18	30.82	31.71	32.46
PSTR	0.015	0.068	0.138	0.200	X	49.63	=	0.74	3.37	6.85	9.93
CROP	0.015	0.068	0.138	0.200	X	49.63	=	0.74	3.37	6.85	9.93
GROVE											
OPEN	0.015	0.068	0.138	0.200	X	49.63	=	0.74	3.37	6.85	9.93
TREE	0.009	0.051	0.111	0.172	X	49.63	=	0.45	2.53	5.51	8.54

Land Use	HSG A Rainfall Excess (in/year)	HSG B Rainfall Excess (in/year)	HSG C Rainfall Excess (in/year)	HSG D Rainfall Excess (in/year)		Total P Concentration (mg/L)		HSG A Total P Loading (kg/ac-yr)	HSG B Total P Loading (kg/ac-yr)	HSG C Total P Loading (kg/ac-yr)	HSG D Total P Loading (kg/ac-yr)
LDR	3.08	5.96	9.53	12.56	X	0.22	=	0.069	0.135	0.215	0.284
SFR 25%	6.50	8.19	10.97	13.35	X	0.34	=	0.227	0.286	0.383	0.465
SFR 40%	10.62	12.41	15.04	17.22	X	0.23	=	0.250	0.333	0.446	0.536
HDR	20.65	22.09	24.02	25.51	X	0.51	=	1.082	1.156	1.257	1.336
COMM	30.18	30.77	31.66	32.41	X	0.29	=	0.899	0.916	0.943	0.964
HWY 50%	20.35	21.69	23.43	24.96	X	0.34	=	0.710	0.756	0.817	0.871
HWY 75%	30.18	30.82	31.71	32.46	X	0.34	=	1.053	1.076	1.106	1.133
PSTR	0.74	3.37	6.85	9.93	X	0.34	=	0.026	0.118	0.239	0.347
CROP	0.74	3.37	6.85	9.93	X	0.52	=	0.040	0.180	0.366	0.531
GROVE						0.52		0.007	0.036	0.079	0.123
OPEN	0.74	3.37	6.85	9.93	X	0.05	=	0.004	0.017	0.035	0.051
TREE	0.45	2.53	5.51	8.54	X	0.08	=	0.004	0.021	0.045	0.070

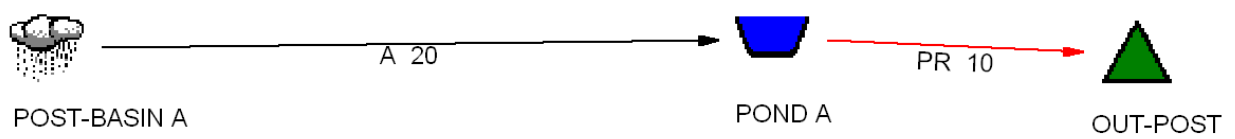
Hydrologic Assumptions For Land Use (Adapted from Table 2-8):

Land Use	Curve Number for Pervious Area				% Total / % DCIA (%)	Comments
	HSG A	HSG B	HSG C	HSG D		
LDR	49	69	79	84	15% / 5%	Open space, lawns, landscaping in fair condition
SFR 25%	39	61	74	80	25% / 15%	Open space, lawns, landscaping in good condition
SFR 40%	39	61	74	80	40% / 25%	Open space, lawns, landscaping in good condition
HDR	39	61	74	80	65% / 50%	Open space, lawns, landscaping in good condition
COMM	39	61	74	80	80% / 75%	Open space, lawns, landscaping in good condition
HWY 50%	49	69	79	84	50% / 50%	Area w/in R.O.W. as open space in fair condition
HWY 75%	49	69	79	84	75% / 75%	Area w/in R.O.W. as open space in fair condition

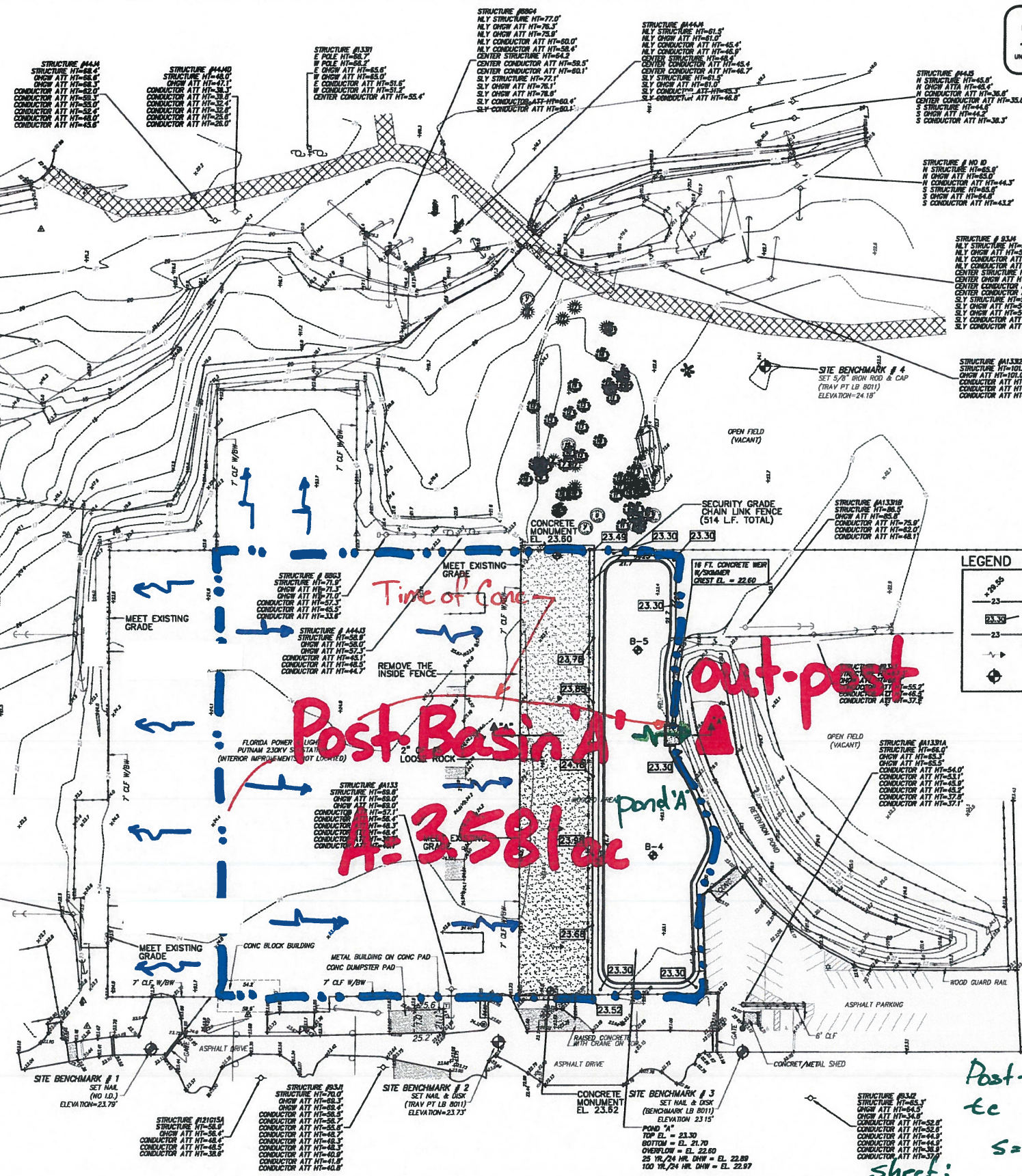
NODAL DIAGRAM / PRE & POST DRAINAGE BASIN MAPS



Pre-Development



Post-Development



48 HOURS BEFORE DIGGING
CALL SUNSHINE
TOLL FREE
1 800 432 4770
UNDERGROUND UTILITIES NOTIFICATION
CENTER OF FLORIDA

LEGEND AND ABBREVIATIONS:

Δ	MORE OR LESS	■	FOUND CONCRETE MONUMENT AS NOTED
▲	ELEVATION	■	FOUND NAIL AS NOTED
LB	LICENSED BUSINESS	■	FOUND NAIL & DISK (LB 1221)
NQ	NUMBER	●	UNLESS OTHERWISE NOTED
LS	LAND SURVEYOR	●	SET NAIL & DISK (LB 1221)
LD	IDENTIFICATION	●	FOUND IRON ROD & CAP AS NOTED
ORR	OFFICIAL RECORDS BOOK	●	UNLESS OTHERWISE NOTED
G	CENTERLINE	●	FOUND IRON ROD AS NOTED
R	RADIUS	●	SET 5/8" IRON ROD & CAP (LB 1221)
L	ARC LENGTH	⊕	CONTROL/BENCHMARK AS DESCRIBED
Δ	DELTA (CENTRAL ANGLE)	⊕	CURB INLET GRATE
C.B.	CHORD BEARING	■	CATCH BASIN
C.B.	CHORD BEARING	⊙	STORM MANHOLE
PCC	POINT ON CURVE	⊙	SANITARY MANHOLE
POL	POINT ON LINE	⊙	ELECTRIC MANHOLE
POL	POINT OF COMPLETION CURVATURE	⊙	ELECTRIC METER
PRC	POINT OF REVERSE CURVATURE	⊙	ELECTRIC RISER BOX
PC	POINT OF CURVATURE	⊙	CABLE TELEVISION RISER BOX
PT	POINT OF TANGENCY	⊙	UTILITY RISER
P	POINT OF INTERSECTION	⊙	WELL
P.O.C.	POINT OF COMMENCEMENT	⊙	WATER SPOUT
P.O.B.	POINT OF BEGINNING	⊙	IRRIGATION CONTROL VALVE
FEMA	FEDERAL EMERGENCY MANAGEMENT AGENCY	⊙	WATER VALVE
DP	DUCTILE IRON PIPE	⊙	FIRE HYDRANT
PVC	POLYVINYL CHLORIDE	⊙	AIR CONDITIONER PAD
CUP	CORRUGATED METAL PIPE	⊙	GAS VALVE
RCP	REINFORCED CONCRETE PIPE	⊙	GAS METER
NAVD	NORTH AMERICAN VERTICAL DATUM	△	CONCRETE UTILITY POLE
NGVD	NATIONAL GEODETIC VERTICAL DATUM	△	METAL UTILITY POLE
PB	PLAT BOOK	△	WOOD UTILITY POLE
ORR	OFFICIAL RECORDS BOOK	△	UTILITY POLE GUY ANCHOR
PG(S)	PAGE(S)	△	SPOT/GROUND LIGHT
R/W	RIGHT OF WAY	▽	ELECTRIC TRANSFORMER
ESMT	EASEMENT	●	WETLAND FLAG
SEC	SECTION	●	SIGN
FND	FOUND	●	BOLLARD
REC	RECOVERED	⌒	FLAG POLE
CR	CERTIFIED CORNER RECORD	⌒	MAILBOX
RLS	REGISTERED LAND SURVEYOR		
CM	CONCRETE MONUMENT		
IRC	IRON ROD AND CAP		
IP	IRON PIPE		
CLF	CHAIN LINK FENCE		

—	HEDGE ROW
—	LINE BREAK
—	FENCE LINE AS NOTED
—	OVERHEAD UTILITY LINE
—	APPROXIMATE TOP OF BANK
—	APPROXIMATE TOP OF SLOPE
—	EXISTING CONTOUR

SURVEY NOTES:

1. THE SPECIFIC PURPOSE OF THIS SURVEY IS TO SHOW THE ABOVE GROUND TOPOGRAPHIC FEATURES IN RELATION TO THE PUTNAM 230KV SUBSTATION.
2. ACCORDING TO FEDERAL EMERGENCY MANAGEMENT AGENCY'S FLOOD INSURANCE RATE MAP (FIRM) MAP NO. 1210702D14C, PUTNAM COUNTY, FLORIDA, EFFECTIVE DATE OF FEBRUARY 2, 2012, THE PROPERTY DESCRIBED HEREON LIES WITHIN ZONE(S) "X" AND "AE" SAID LANDS LIES PARTIALLY IN A 100 YEAR FLOOD HAZARD AREA.
3. UNDERGROUND FOUNDATIONS AND UTILITIES WERE NOT LOCATED AS PART OF THIS SURVEY.
4. INTERIOR IMPROVEMENTS WITHIN THE SUBSTATION FENCE AREA WERE NOT LOCATED AS PART OF THIS SURVEY.
5. LANDS SHOWN HEREON WERE NOT ABSTRACTED FOR RIGHTS-OF-WAY, EASEMENTS, OWNERSHIP, ADJOINERS OR OTHER INSTRUMENTS OF RECORD BY THIS FIRM.
6. NORTH-SOUTH AND EAST-WEST TIES TO FOUND MONUMENTATION AND IMPROVEMENTS ARE BASED ON CARDINAL DIRECTION.
7. WETLAND AREAS, IF EXISTING, WERE NOT ADDRESSED AS A PART OF THIS SURVEY.
8. THE ACCURACY OF THE SURVEY MEASUREMENTS USED FOR THIS SURVEY MEETS OR EXCEEDS THE EXPECTED USE OF THE PROPERTY DESCRIBED HEREON.
(COMMERCIAL/HIGH RISK) 1 FOOT IN 10,000 FEET.
9. ELEVATIONS SHOWN ARE BASED ON FLORIDA DEPARTMENT OF TRANSPORTATION BENCHMARK # TBMS60 AS REFERENCED IN CAICE DATABASE, PROJECT 7601020. SAID POINT BEING AN X CUT IN A CONCRETE HEADWALL AND HAVING AN ELEVATION OF 10.437 FEET, PURSUANT TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD1988).

CERTIFIED TO:

CERTIFIED TO:
FLORIDA POWER & LIGHT

SURVEYOR'S CERTIFICATE:

I HEREBY CERTIFY THIS SURVEY MEETS THE APPLICABLE "MINIMUM TECHNICAL STANDARDS" AS SET FORTH BY THE FLORIDA BOARD OF PROFESSIONAL SURVEYORS AND MAPPERS IN RULE 5J17.050-.052, FLORIDA ADMINISTRATIVE CODE.

WILLIAM D. DONLEY
FLORIDA LICENSED SURVEYOR & MAPPER NO. 5381

THIS SURVEY IS NOT VALID WITHOUT THE SIGNATURE AND ORIGINAL RAISED SEAL OF A FLORIDA LICENSED SURVEYOR AND MAPPER.

$$L_2 = 50'$$
$$S = 24.16 - 23.0$$
$$S = \underline{0.0232\%}$$

CONDUCTOR ATT HT=37'9"
Sheet:

PUTNAM 230KV
SWITCHYARD EXPANSION
FENCE, FILL & GRADE

SHEET 1 OF 2	REV NO
PUT02	0

POST-DEVELOPMENT DBM?

TREE LEGEND
(SIZE DENOTED INSIDE SYMBOL)

-  CAMPFLO
-  CEDAR
-  CHERRY
-  CHINABERRY
-  CYPRESS
-  DOGWOOD
-  ELM
-  GUM
-  HICKORY
-  HOLLY
-  LAUREL OAK
-  LIVE OAK
-  MAGNOLIA
-  MAPLE
-  MIMOSA
-  MISC
-  OAK
-  PALM
-  PECAN
-  PINE TREE
-  SUGAR HACKBERRY
-  SYCAMORE

**PARKER MYNCHENBERG
& ASSOCIATES, INC.**
PROFESSIONAL ENGINEERS • LANDSCAPE ARCHITECTS
1728 RIDGEWOOD AVENUE HOLLY HILL, FLORIDA 32117
(407) 877-8891 FAX (407) 877-2114 E-MAIL: info@parkermynchenberg.com
CERTIFICATE OF AUTHORIZATION NUMBER: 00003910

DATE 1/16/14	SCALE 0 50 75 100 150								
	<table border="1"> <tr> <td>DR CH</td> <td>ER</td> </tr> <tr> <td>CH CH</td> <td>COR</td> </tr> <tr> <td colspan="2">APPROVED</td> </tr> <tr> <td colspan="2">P. MYNCHENBERG</td> </tr> </table>	DR CH	ER	CH CH	COR	APPROVED		P. MYNCHENBERG	
DR CH	ER								
CH CH	COR								
APPROVED									
P. MYNCHENBERG									

PRE/POST DEVELOPMENT ROUTING ANALYSIS

Table of Contents

***** MASTER SUMMARY *****

Watershed..... Master Network Summary 1.01

***** NETWORK SUMMARIES (DETAILED) *****

Watershed..... 25
 Executive Summary (Nodes) 2.01
 Executive Summary (Links) 2.02

Watershed..... 100
 Executive Summary (Nodes) 2.03
 Executive Summary (Links) 2.04
 Network Calcs Sequence 2.05

Watershed..... 2.3
 Executive Summary (Nodes) 2.07
 Executive Summary (Links) 2.08

***** DESIGN STORMS SUMMARY *****

Putnam..... Design Storms 3.01

Putnam..... 2.3
 Design Storms 3.02

***** TC CALCULATIONS *****

POST-BASIN A.... Tc Calcs 4.01

PRE-BASIN A.... Tc Calcs 4.03

***** CN CALCULATIONS *****

POST-BASIN A.... Runoff CN-Area 5.01

Table of Contents (continued)

PRE-BASIN A.....	Runoff CN-Area	5.02
***** TIME VS.ELEV *****		
POND A	OUT 25 Time-Elev	6.01
POND A	OUT 100 Time-Elev	6.03
POND A	OUT 2.3 Time-Elev	6.05
***** POND VOLUMES *****		
POND A.....	Vol: Elev-Area	7.01
***** OUTLET STRUCTURES *****		
PR 10.....	Outlet Input Data	8.01
	Individual Outlet Curves	8.03
	Composite Rating Curve	8.04
***** POND ROUTING *****		
POND A.....	Pond E-V-Q Table	9.01
POND A	IN 25 Node: Pond Inflow Summary	9.02
POND A	IN 100 Node: Pond Inflow Summary	9.05

Table of Contents (continued)

POND A	IN 2.3	
	Node: Pond Inflow Summary	9.08
POND A	OUT 25	
	Pond Routing Summary	9.11
POND A	OUT 100	
	Pond Routing Summary	9.12
POND A	OUT 2.3	
	Pond Routing Summary	9.13

MASTER DESIGN STORM SUMMARY

Network Storm Collection: Putnam

Return Event	Total Depth in	Rainfall Type	RNF ID
2.3	4.4200	Synthetic Curve	TypeIII 24hr
25	7.9000	Synthetic Curve	TypeIII 24hr
100	9.9500	Synthetic Curve	TypeIII 24hr

 MASTER NETWORK SUMMARY
 SCS Unit Hydrograph Method

 (*Node=Outfall; +Node=Diversion;)
 (Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
*OUT-POST	JCT	2	.426		14.0000	1.44		
*OUT-POST	JCT	25	1.426		13.0000	8.18		
*OUT-POST	JCT	100	2.026		12.9000	11.41		
*OUT-PRE	JCT	2	.714		12.6000	4.10		
*OUT-PRE	JCT	25	1.651		12.6000	9.43		
*OUT-PRE	JCT	100	2.230		12.6000	12.63		
POND A	IN POND	2	.932		12.7000	4.65		
POND A	IN POND	25	1.931		12.7000	9.40		
POND A	IN POND	100	2.532		12.7000	12.17		
POND A	OUT POND	2	.426		14.0000	1.44	22.69	.559
POND A	OUT POND	25	1.426		13.0000	8.18	22.89	.685
POND A	OUT POND	100	2.026		12.9000	11.41	22.97	.730
POST-BASIN A	AREA	2	.932		12.7000	4.65		
POST-BASIN A	AREA	25	1.931		12.7000	9.40		
POST-BASIN A	AREA	100	2.532		12.7000	12.17		

Name.... Watershed

File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
PRE-BASIN A	AREA	2	.714		12.6000	4.10		
PRE-BASIN A	AREA	25	1.651		12.6000	9.43		
PRE-BASIN A	AREA	100	2.230		12.6000	12.63		

Type.... Executive Summary (Nodes) Page 2.01
 Name.... Watershed Event: 25 yr
 File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW
 Storm... TypeIII 24hr Tag: 25

NETWORK SUMMARY -- NODES
 (Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = Putnam

Storm Tag Name = 25

 Data Type, File, ID = Synthetic Storm TypeIII 24hr
 Storm Frequency = 25 yr
 Total Rainfall Depth= 7.9000 in
 Duration Multiplier = 1
 Resulting Duration = 24.0000 hrs
 Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

	Node ID	Type	HYG Vol ac-ft	Trun. hrs	Qpeak cfs	Max WSEL ft
	-----	----	-----	----	-----	-----
Outfall	OUT-POST	JCT	1.426	13.0000	8.18	
Outfall	OUT-PRE	JCT	1.651	12.6000	9.43	
	POND A	IN POND	1.931	12.7000	9.40	
	POND A	OUT POND	1.426	13.0000	8.18	22.89
	POST-BASIN A	AREA	1.931	12.7000	9.40	
	PRE-BASIN A	AREA	1.651	12.6000	9.43	

Type.... Executive Summary (Links) Page 2.02
 Name.... Watershed Event: 25 yr
 File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW
 Storm... TypeIII 24hr Tag: 25

NETWORK SUMMARY -- LINKS
 (UN=Upstream Node; DL=DNstream End of Link; DN=DNstream Node)
 (Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File, ID = Putnam

Storm Tag Name = 25

 Data Type, File, ID = Synthetic Storm TypeIII 24hr
 Storm Frequency = 25 yr
 Total Rainfall Depth= 7.9000 in
 Duration Multiplier = 1
 Resulting Duration = 24.0000 hrs
 Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Link ID	Type		HYG Vol ac-ft	Peak Time Trun. hrs	Peak Q cfs	End Points
A 20	ADD	UN	1.931	12.7000	9.40	POST-BASIN A
		DL	1.931	12.7000	9.40	
		DN	1.931	12.7000	9.40	POND A IN
ADDLINK 30	ADD	UN	1.651	12.6000	9.43	PRE-BASIN A
		DL	1.651	12.6000	9.43	
		DN	1.651	12.6000	9.43	OUT-PRE
PR 10	PONDrt	UN	1.931	12.7000	9.40	POND A IN
PR 10			1.426	13.0000	8.18	POND A OUT
		DL	1.426	13.0000	8.18	
		DN	1.426	13.0000	8.18	OUT-POST

Type.... Executive Summary (Nodes) Page 2.03
 Name.... Watershed Event: 100 yr
 File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW
 Storm... TypeIII 24hr Tag: 100

NETWORK SUMMARY -- NODES
 (Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = Putnam

Storm Tag Name = 100

 Data Type, File, ID = Synthetic Storm TypeIII 24hr
 Storm Frequency = 100 yr
 Total Rainfall Depth= 9.9500 in
 Duration Multiplier = 1
 Resulting Duration = 24.0000 hrs
 Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

	Node ID	Type	HYG Vol ac-ft	Trun. hrs	Qpeak cfs	Max WSEL ft
	-----	----	-----	----	-----	-----
Outfall	OUT-POST	JCT	2.026	12.9000	11.41	
Outfall	OUT-PRE	JCT	2.230	12.6000	12.63	
	POND A	IN POND	2.532	12.7000	12.17	
	POND A	OUT POND	2.026	12.9000	11.41	22.97
	POST-BASIN A	AREA	2.532	12.7000	12.17	
	PRE-BASIN A	AREA	2.230	12.6000	12.63	

Type.... Executive Summary (Links) Page 2.04
 Name.... Watershed Event: 100 yr
 File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW
 Storm... TypeIII 24hr Tag: 100

NETWORK SUMMARY -- LINKS
 (UN=Upstream Node; DL=DNstream End of Link; DN=DNstream Node)
 (Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File, ID = Putnam

Storm Tag Name = 100

 Data Type, File, ID = Synthetic Storm TypeIII 24hr
 Storm Frequency = 100 yr
 Total Rainfall Depth= 9.9500 in
 Duration Multiplier = 1
 Resulting Duration = 24.0000 hrs
 Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Link ID	Type		HYG Vol ac-ft	Peak Time Trun. hrs	Peak Q cfs	End Points
A 20	ADD	UN	2.532	12.7000	12.17	POST-BASIN A
		DL	2.532	12.7000	12.17	
		DN	2.532	12.7000	12.17	POND A IN
ADDLINK 30	ADD	UN	2.230	12.6000	12.63	PRE-BASIN A
		DL	2.230	12.6000	12.63	
		DN	2.230	12.6000	12.63	OUT-PRE
PR 10	PONDrt	UN	2.532	12.7000	12.17	POND A IN
PR 10			2.026	12.9000	11.41	POND A OUT
		DL	2.026	12.9000	11.41	
		DN	2.026	12.9000	11.41	OUT-POST

Type.... Network Calcs Sequence

Page 2.05

Name.... Watershed

Event: 100 yr

File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW

Storm... TypeIII 24hr Tag: 100

NETWORK RUNOFF NODE SEQUENCE

Runoff Data		Apply to Node		Receiving Link	
SCS UH	POST-BASIN A	Subarea	POST-BASIN A	Add Hyd	POST-BASIN A
SCS UH	PRE-BASIN A	Subarea	PRE-BASIN A	Add Hyd	PRE-BASIN A

Type.... Network Calcs Sequence

Page 2.06

Name.... Watershed

Event: 100 yr

File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW

Storm... TypeIII 24hr Tag: 100

NETWORK ROUTING SEQUENCE

Link Operation		UPstream Node		DNstream Node		
Add Hyd A	20	Subarea POST-BASIN A		Pond	POND A	IN
POND ROUTE TOTAL OUTFLOW...						
Total Pond Outflow		Pond	POND A	IN	Outflow POND A	OUT
SET POND ROUTING LINK TO TOTAL POND OUTFLOW...						
Outlet PR	10	Outflow POND A		OUT	Jct	OUT-POST
Add Hyd ADDLINK	30	Subarea PRE-BASIN A		Jct	OUT-PRE	

Type.... Executive Summary (Nodes) Page 2.07
 Name.... Watershed Event: 2.3 yr
 File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW
 Storm... TypeIII 24hr Tag: 2.3

NETWORK SUMMARY -- NODES
 (Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = Putnam

Storm Tag Name = 2.3

 Data Type, File, ID = Synthetic Storm TypeIII 24hr
 Storm Frequency = 2.3 yr
 Total Rainfall Depth= 4.4200 in
 Duration Multiplier = 1
 Resulting Duration = 24.0000 hrs
 Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

	Node ID	Type	HYG Vol ac-ft	Trun. hrs	Qpeak cfs	Max WSEL ft
	-----	----	-----	-----	-----	-----
Outfall	OUT-POST	JCT	.426	14.0000	1.44	
Outfall	OUT-PRE	JCT	.714	12.6000	4.10	
	POND A	IN POND	.932	12.7000	4.65	
	POND A	OUT POND	.426	14.0000	1.44	22.69
	POST-BASIN A	AREA	.932	12.7000	4.65	
	PRE-BASIN A	AREA	.714	12.6000	4.10	

Type.... Executive Summary (Links) Page 2.08
 Name.... Watershed Event: 2.3 yr
 File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW
 Storm... TypeIII 24hr Tag: 2.3

NETWORK SUMMARY -- LINKS
 (UN=Upstream Node; DL=DNstream End of Link; DN=DNstream Node)
 (Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File, ID = Putnam

Storm Tag Name = 2.3

 Data Type, File, ID = Synthetic Storm TypeIII 24hr
 Storm Frequency = 2.3 yr
 Total Rainfall Depth= 4.4200 in
 Duration Multiplier = 1
 Resulting Duration = 24.0000 hrs
 Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Link ID	Type		HYG Vol ac-ft	Peak Time Trun. hrs	Peak Q cfs	End Points
A 20	ADD	UN	.932	12.7000	4.65	POST-BASIN A
		DL	.932	12.7000	4.65	
		DN	.932	12.7000	4.65	POND A IN
ADDLINK 30	ADD	UN	.714	12.6000	4.10	PRE-BASIN A
		DL	.714	12.6000	4.10	
		DN	.714	12.6000	4.10	OUT-PRE
PR 10	PONDrt	UN	.932	12.7000	4.65	POND A IN
PR 10			.426	14.0000	1.44	POND A OUT
		DL	.426	14.0000	1.44	
		DN	.426	14.0000	1.44	OUT-POST

Type.... Design Storms
Name.... Putnam

Page 3.01

File.... Y:\work\FPL\Putnam\230 KV Expansion\
Title... Project Date: 12/10/2008
Project Engineer:
Project Title: Watershed
Project Comments:

DESIGN STORMS SUMMARY

Design Storm File, ID = Putnam

Storm Tag Name = 2.3

Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 2.3 yr
Total Rainfall Depth= 4.4200 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = 25

Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 7.9000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = 100

Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 100 yr
Total Rainfall Depth= 9.9500 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Type.... Design Storms
Name.... Putnam
File.... Y:\work\FPL\Putnam\230 KV Expansion\
Storm... TypeIII 24hr Tag: 2.3

Page 3.02
Event: 2.3 yr

DESIGN STORMS SUMMARY

Design Storm File, ID = Putnam

Storm Tag Name = 2.3

Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 2.3 yr
Total Rainfall Depth= 4.4200 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = 25

Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 7.9000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = 100

Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 100 yr
Total Rainfall Depth= 9.9500 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Type.... Tc Calcs
Name.... POST-BASIN A

Page 4.01

File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW

.....
TIME OF CONCENTRATION CALCULATOR
.....

Segment #1: Tc: TR-55 Sheet

Mannings n .1500
Hydraulic Length 300.00 ft
2yr, 24hr P 5.0000 in
Slope .000800 ft/ft

Avg.Velocity .07 ft/sec

Segment #1 Time: 1.1401 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length 50.00 ft
Slope .023200 ft/ft
Unpaved

Avg.Velocity 2.46 ft/sec

Segment #2 Time: .0057 hrs

=====
Total Tc: 1.1458 hrs
=====

Type.... Tc Calcs
Name.... POST-BASIN A

Page 4.02

File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW

Tc Equations used...

==== SCS TR-55 Sheet Flow =====

$$Tc = (.007 * ((n * Lf)^{.8}) / ((P^{.5}) * (Sf^{.4}))$$

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, %

==== SCS TR-55 Shallow Concentrated Flow =====

Unpaved surface:

$$V = 16.1345 * (Sf^{.5})$$

Paved surface:

$$V = 20.3282 * (Sf^{.5})$$

$$Tc = (Lf / V) / (3600\text{sec/hr})$$

Where: V = Velocity, ft/sec
Sf = Slope, ft/ft
Tc = Time of concentration, hrs
Lf = Flow length, ft

Type.... Tc Calcs
Name.... PRE-BASIN A

Page 4.03

File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n .1500
Hydraulic Length 285.00 ft
2yr, 24hr P 5.0000 in
Slope .001298 ft/ft

Avg.Velocity .09 ft/sec

Segment #1 Time: .9017 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length 75.00 ft
Slope .005733 ft/ft
Unpaved

Avg.Velocity 1.22 ft/sec

Segment #2 Time: .0171 hrs

=====
Total Tc: .9187 hrs
=====

Type.... Tc Calcs
Name.... PRE-BASIN A

Page 4.04

File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW

Tc Equations used...

==== SCS TR-55 Sheet Flow =====

$$Tc = (.007 * ((n * Lf)^{.8})) / ((P^{.5}) * (Sf^{.4}))$$

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, %

==== SCS TR-55 Shallow Concentrated Flow =====

Unpaved surface:

$$V = 16.1345 * (Sf^{.5})$$

Paved surface:

$$V = 20.3282 * (Sf^{.5})$$

$$Tc = (Lf / V) / (3600\text{sec/hr})$$

Where: V = Velocity, ft/sec
Sf = Slope, ft/ft
Tc = Time of concentration, hrs
Lf = Flow length, ft

Type.... Runoff CN-Area
Name.... POST-BASIN A

Page 5.01

File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW

RUNOFF CURVE NUMBER DATA

.....

Soil/Surface Description	CN	Area acres	Impervious Adjustment		Adjusted CN
			%C	%UC	
Substation Yard	98	2.955			98.00
Open space (Lawns,parks etc.) - Goo	39	.627			39.00

COMPOSITE AREA & WEIGHTED CN ---> 3.582 87.67 (88)
.....

Type.... Runoff CN-Area
Name.... PRE-BASIN A

Page 5.02

File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW

RUNOFF CURVE NUMBER DATA

.....

Soil/Surface Description	CN	Area acres	Impervious Adjustment		Adjusted CN
			%C	%UC	
substation yard	98	2.417			98.00
Woods - grass combination - fair	43	1.164			43.00

COMPOSITE AREA & WEIGHTED CN ---> 3.581 80.12 (80)
.....

Type.... Time-Elev
Name.... POND A OUT Tag: 25 Event: 25 yr
File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW
Storm... TypeIII 24hr Tag: 25

TIME vs. ELEVATION (ft)

Time hrs	Output Time increment = .1000 hrs Time on left represents time for first value in each row.				
3.7000	21.70	21.70	21.70	21.70	21.70
4.2000	21.70	21.70	21.70	21.70	21.70
4.7000	21.70	21.70	21.70	21.70	21.70
5.2000	21.70	21.71	21.71	21.71	21.71
5.7000	21.71	21.71	21.71	21.71	21.72
6.2000	21.72	21.72	21.72	21.72	21.72
6.7000	21.73	21.73	21.73	21.73	21.74
7.2000	21.74	21.74	21.74	21.75	21.75
7.7000	21.76	21.76	21.76	21.77	21.77
8.2000	21.78	21.78	21.79	21.79	21.80
8.7000	21.80	21.81	21.81	21.82	21.83
9.2000	21.83	21.84	21.85	21.86	21.87
9.7000	21.88	21.89	21.90	21.91	21.92
10.2000	21.93	21.94	21.95	21.97	21.98
10.7000	22.00	22.01	22.03	22.04	22.06
11.2000	22.08	22.10	22.12	22.14	22.16
11.7000	22.18	22.21	22.24	22.28	22.33
12.2000	22.39	22.47	22.56	22.66	22.75
12.7000	22.82	22.86	22.88	22.89	22.89
13.2000	22.88	22.87	22.85	22.84	22.82
13.7000	22.81	22.79	22.78	22.77	22.76
14.2000	22.75	22.74	22.73	22.73	22.72
14.7000	22.71	22.71	22.71	22.70	22.70
15.2000	22.70	22.69	22.69	22.69	22.69
15.7000	22.68	22.68	22.68	22.67	22.67
16.2000	22.67	22.67	22.66	22.66	22.66
16.7000	22.66	22.66	22.65	22.65	22.65
17.2000	22.65	22.65	22.65	22.65	22.64
17.7000	22.64	22.64	22.64	22.64	22.64
18.2000	22.64	22.64	22.64	22.64	22.63
18.7000	22.63	22.63	22.63	22.63	22.63
19.2000	22.63	22.63	22.63	22.63	22.63
19.7000	22.63	22.63	22.63	22.63	22.63
20.2000	22.63	22.63	22.63	22.62	22.62
20.7000	22.62	22.62	22.62	22.62	22.62
21.2000	22.62	22.62	22.62	22.62	22.62
21.7000	22.62	22.62	22.62	22.62	22.62
22.2000	22.62	22.62	22.62	22.62	22.62
22.7000	22.62	22.62	22.62	22.62	22.62
23.2000	22.62	22.62	22.62	22.62	22.62
23.7000	22.62	22.62	22.62	22.62	22.62
24.2000	22.62	22.62	22.62	22.62	22.61
24.7000	22.61	22.61	22.61	22.61	22.61

Type.... Time-Elev

Page 6.02

Name.... POND A

OUT Tag: 25

Event: 25 yr

File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW

Storm... TypeIII 24hr

Tag: 25

TIME vs. ELEVATION (ft)					
Time	Output Time increment = .1000 hrs				
hrs	Time on left represents time for first value in each row.				
25.2000	22.61	22.61	22.61	22.61	22.60
25.7000	22.60	22.60	22.60	22.60	22.60
26.2000	22.60	22.60	22.60	22.60	22.60
26.7000	22.60	22.60	22.60	22.60	22.60
27.2000	22.60	22.60	22.60		

Type.... Time-Elev
Name.... POND A OUT Tag: 100 Event: 100 yr
File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW
Storm... TypeIII 24hr Tag: 100

TIME vs. ELEVATION (ft)

Time hrs	Output Time increment = .1000 hrs Time on left represents time for first value in each row.				
3.0000	21.70	21.70	21.70	21.70	21.70
3.5000	21.70	21.70	21.70	21.70	21.70
4.0000	21.70	21.70	21.70	21.70	21.70
4.5000	21.71	21.71	21.71	21.71	21.71
5.0000	21.71	21.71	21.72	21.72	21.72
5.5000	21.72	21.72	21.73	21.73	21.73
6.0000	21.73	21.74	21.74	21.74	21.74
6.5000	21.75	21.75	21.76	21.76	21.76
7.0000	21.77	21.77	21.78	21.78	21.79
7.5000	21.79	21.80	21.80	21.81	21.81
8.0000	21.82	21.83	21.83	21.84	21.85
8.5000	21.86	21.86	21.87	21.88	21.89
9.0000	21.90	21.91	21.92	21.93	21.94
9.5000	21.96	21.97	21.98	21.99	22.01
10.0000	22.02	22.04	22.05	22.07	22.09
10.5000	22.11	22.12	22.14	22.16	22.19
11.0000	22.21	22.23	22.25	22.28	22.30
11.5000	22.33	22.36	22.39	22.43	22.47
12.0000	22.52	22.58	22.65	22.73	22.80
12.5000	22.86	22.90	22.94	22.96	22.97
13.0000	22.96	22.95	22.94	22.92	22.90
13.5000	22.88	22.86	22.84	22.82	22.81
14.0000	22.80	22.78	22.77	22.76	22.76
14.5000	22.75	22.74	22.73	22.73	22.72
15.0000	22.72	22.72	22.71	22.71	22.71
15.5000	22.70	22.70	22.70	22.70	22.69
16.0000	22.69	22.69	22.69	22.68	22.68
16.5000	22.68	22.68	22.67	22.67	22.67
17.0000	22.67	22.67	22.66	22.66	22.66
17.5000	22.66	22.66	22.66	22.65	22.65
18.0000	22.65	22.65	22.65	22.65	22.65
18.5000	22.64	22.64	22.64	22.64	22.64
19.0000	22.64	22.64	22.64	22.64	22.64
19.5000	22.64	22.64	22.63	22.63	22.63
20.0000	22.63	22.63	22.63	22.63	22.63
20.5000	22.63	22.63	22.63	22.63	22.63
21.0000	22.63	22.63	22.63	22.63	22.63
21.5000	22.63	22.63	22.63	22.63	22.63
22.0000	22.63	22.63	22.63	22.63	22.63
22.5000	22.63	22.63	22.63	22.62	22.62
23.0000	22.62	22.62	22.62	22.62	22.62
23.5000	22.62	22.62	22.62	22.62	22.62
24.0000	22.62	22.62	22.62	22.62	22.62

Type.... Time-Elev

Page 6.04

Name.... POND A

OUT Tag: 100

Event: 100 yr

File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW

Storm... TypeIII 24hr Tag: 100

TIME vs. ELEVATION (ft)					
Time	Output Time increment = .1000 hrs				
hrs	Time on left represents time for first value in each row.				
24.5000	22.62	22.62	22.62	22.62	22.61
25.0000	22.61	22.61	22.61	22.61	22.61
25.5000	22.61	22.61	22.61	22.60	22.60
26.0000	22.60	22.60	22.60	22.60	22.60
26.5000	22.60	22.60	22.60	22.60	22.60
27.0000	22.60	22.60	22.60	22.60	22.60
27.5000	22.60				

Type.... Time-Elev
 Name.... POND A OUT Tag: 2.3 Event: 2.3 yr
 File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW
 Storm... TypeIII 24hr Tag: 2.3

TIME vs. ELEVATION (ft)

Time hrs	Output Time increment = .1000 hrs Time on left represents time for first value in each row.				
5.8000	21.70	21.70	21.70	21.70	21.70
6.3000	21.70	21.70	21.70	21.70	21.70
6.8000	21.70	21.70	21.70	21.70	21.70
7.3000	21.70	21.70	21.70	21.70	21.71
7.8000	21.71	21.71	21.71	21.71	21.71
8.3000	21.71	21.71	21.71	21.72	21.72
8.8000	21.72	21.72	21.72	21.72	21.73
9.3000	21.73	21.73	21.73	21.74	21.74
9.8000	21.74	21.75	21.75	21.75	21.76
10.3000	21.76	21.77	21.77	21.78	21.78
10.8000	21.79	21.80	21.80	21.81	21.82
11.3000	21.83	21.83	21.84	21.85	21.86
11.8000	21.88	21.89	21.91	21.93	21.96
12.3000	22.00	22.05	22.10	22.16	22.23
12.8000	22.30	22.36	22.43	22.48	22.53
13.3000	22.58	22.62	22.64	22.66	22.68
13.8000	22.68	22.69	22.69	22.69	22.69
14.3000	22.68	22.68	22.68	22.67	22.67
14.8000	22.67	22.66	22.66	22.66	22.66
15.3000	22.65	22.65	22.65	22.65	22.65
15.8000	22.64	22.64	22.64	22.64	22.64
16.3000	22.64	22.63	22.63	22.63	22.63
16.8000	22.63	22.63	22.63	22.63	22.63
17.3000	22.63	22.63	22.62	22.62	22.62
17.8000	22.62	22.62	22.62	22.62	22.62
18.3000	22.62	22.62	22.62	22.62	22.62
18.8000	22.62	22.62	22.62	22.62	22.62
19.3000	22.62	22.62	22.62	22.61	22.61
19.8000	22.61	22.61	22.61	22.61	22.61
20.3000	22.61	22.61	22.61	22.61	22.61
20.8000	22.61	22.61	22.61	22.61	22.61
21.3000	22.61	22.61	22.61	22.61	22.61
21.8000	22.61	22.61	22.61	22.61	22.61
22.3000	22.61	22.61	22.61	22.61	22.61
22.8000	22.61	22.61	22.61	22.61	22.61
23.3000	22.61	22.61	22.61	22.61	22.61
23.8000	22.61	22.61	22.61	22.61	22.61
24.3000	22.61	22.61	22.61	22.61	22.61
24.8000	22.61	22.61	22.61	22.61	22.60
25.3000	22.60	22.60	22.60	22.60	22.60
25.8000	22.60	22.60	22.60	22.60	22.60
26.3000	22.60	22.60	22.60	22.60	22.60
26.8000	22.60	22.60	22.60	22.60	

Type.... Vol: Elev-Area
Name.... POND A

Page 7.01

File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW

Elevation (ft)	Planimeter (sq.in)	Area (sq.ft)	A1+A2+sqr(A1*A2) (sq.ft)	Volume (ac-ft)	Volume Sum (ac-ft)
21.70	-----	22943	0	.000	.000
22.00	-----	23959	70348	.161	.161
23.00	-----	27448	77051	.590	.751
23.20	-----	28166	83419	.128	.879

POND VOLUME EQUATIONS

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Areal + Area2 + sq.rt.(Areal*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Areal,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

Type.... Outlet Input Data
Name.... PR 10

File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW

REQUESTED POND WS ELEVATIONS:

Min. Elev.= 21.70 ft
Increment = .10 ft
Max. Elev.= 23.20 ft

OUTLET CONNECTIVITY

---> Forward Flow Only (UpStream to DnStream)
<--- Reverse Flow Only (DnStream to UpStream)
<---> Forward and Reverse Both Allowed

Structure	No.		Outfall	E1, ft	E2, ft
-----	----		-----	-----	-----
Weir-Rectangular	WR	--->	TW	22.600	23.200
TW SETUP, DS Channel					

Type.... Outlet Input Data
Name.... PR 10

Page 8.02

File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW

OUTLET STRUCTURE INPUT DATA

Structure ID = WR
Structure Type = Weir-Rectangular

of Openings = 1
Crest Elev. = 22.60 ft
Weir Length = 16.00 ft
Weir Coeff. = 3.200000

Weir TW effects (Use adjustment equation)

Structure ID = TW
Structure Type = TW SETUP, DS Channel

FREE OUTFALL CONDITIONS SPECIFIED

CONVERGENCE TOLERANCES...
Maximum Iterations= 30
Min. TW tolerance = .01 ft
Max. TW tolerance = .01 ft
Min. HW tolerance = .01 ft
Max. HW tolerance = .01 ft
Min. Q tolerance = .10 cfs
Max. Q tolerance = .10 cfs

File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = WR (Weir-Rectangular)

 Upstream ID = (Pond Water Surface)
 DNstream ID = TW (Pond Outfall)

WS Elev,Device Q		Tail Water		Notes
-----		-----		-----
WS Elev.	Q	TW Elev Converge		Computation Messages
ft	cfs	ft	+/-ft	
-----		-----		-----
21.70	.00	Free Outfall		HW & TW below Inv.El.=22.600
21.80	.00	Free Outfall		HW & TW below Inv.El.=22.600
21.90	.00	Free Outfall		HW & TW below Inv.El.=22.600
22.00	.00	Free Outfall		HW & TW below Inv.El.=22.600
22.10	.00	Free Outfall		HW & TW below Inv.El.=22.600
22.20	.00	Free Outfall		HW & TW below Inv.El.=22.600
22.30	.00	Free Outfall		HW & TW below Inv.El.=22.600
22.40	.00	Free Outfall		HW & TW below Inv.El.=22.600
22.50	.00	Free Outfall		HW & TW below Inv.El.=22.600
22.60	.00	Free Outfall		H=.00; Htw=.00; Qfree=.00;
22.70	1.62	Free Outfall		H=.10; Htw=.00; Qfree=1.62;
22.80	4.58	Free Outfall		H=.20; Htw=.00; Qfree=4.58;
22.90	8.41	Free Outfall		H=.30; Htw=.00; Qfree=8.41;
23.00	12.95	Free Outfall		H=.40; Htw=.00; Qfree=12.95;
23.10	18.10	Free Outfall		H=.50; Htw=.00; Qfree=18.10;
23.20	23.80	Free Outfall		H=.60; Htw=.00; Qfree=23.80;

Type.... Composite Rating Curve
 Name.... PR 10

File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW

***** COMPOSITE OUTFLOW SUMMARY *****

WS Elev, Total Q		Converge		Notes
Elev.	Q	TW Elev	Error	
ft	cfs	ft	+/-ft	Contributing Structures
21.70	.00	Free Outfall		None contributing
21.80	.00	Free Outfall		None contributing
21.90	.00	Free Outfall		None contributing
22.00	.00	Free Outfall		None contributing
22.10	.00	Free Outfall		None contributing
22.20	.00	Free Outfall		None contributing
22.30	.00	Free Outfall		None contributing
22.40	.00	Free Outfall		None contributing
22.50	.00	Free Outfall		None contributing
22.60	.00	Free Outfall		WR
22.70	1.62	Free Outfall		WR
22.80	4.58	Free Outfall		WR
22.90	8.41	Free Outfall		WR
23.00	12.95	Free Outfall		WR
23.10	18.10	Free Outfall		WR
23.20	23.80	Free Outfall		WR

Name.... POND A

File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW

LEVEL POOL ROUTING DATA

HYG Dir = Y:\work\FPL\Putnam\230 KV Expansion\
 Inflow HYG file = NONE STORED - POND A IN 2.3
 Outflow HYG file = NONE STORED - POND A OUT 2.3

Pond Node Data = POND A
 Pond Volume Data = POND A
 Pond Outlet Data = PR 10

No Infiltration

INITIAL CONDITIONS

 Starting WS Elev = 21.70 ft
 Starting Volume = .000 ac-ft
 Starting Outflow = .00 cfs
 Starting Infiltr. = .00 cfs
 Starting Total Qout= .00 cfs
 Time Increment = .1000 hrs

Elevation ft	Outflow cfs	Storage ac-ft	Area sq.ft	Infiltr. cfs	Q Total cfs	2S/t + O cfs
21.70	.00	.000	22943	.00	.00	.00
21.80	.00	.053	23279	.00	.00	12.84
21.90	.00	.107	23618	.00	.00	25.87
22.00	.00	.161	23959	.00	.00	39.08
22.10	.00	.217	24297	.00	.00	52.49
22.20	.00	.273	24638	.00	.00	66.08
22.30	.00	.330	24981	.00	.00	79.86
22.40	.00	.388	25326	.00	.00	93.84
22.50	.00	.446	25674	.00	.00	108.00
22.60	.00	.506	26024	.00	.00	122.36
22.70	1.62	.566	26376	.00	1.62	138.54
22.80	4.58	.627	26731	.00	4.58	156.25
22.90	8.41	.689	27088	.00	8.41	175.03
23.00	12.95	.751	27448	.00	12.95	194.72
23.10	18.10	.815	27806	.00	18.10	215.22
23.20	23.80	.879	28166	.00	23.80	236.46

Type.... Node: Pond Inflow Summary

Page 9.02

Name.... POND A IN

Event: 25 yr

File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW

Storm... TypeIII 24hr Tag: 25

SUMMARY FOR HYDROGRAPH ADDITION

at Node: POND A IN

HYG Directory: Y:\work\FPL\Putnam\230 KV Expansion\

Upstream Link ID	Upstream Node ID	HYG file	HYG ID	HYG tag
A 20	POST-BASIN A		POST-BASIN A	25

INFLOWS TO: POND A IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
	POST-BASIN A	25	1.931	12.7000	9.40

TOTAL FLOW INTO: POND A IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
	POND A	IN 25	1.931	12.7000	9.40

TOTAL NODE INFLOW...
HYG file =
HYG ID = POND A IN
HYG Tag = 25

Peak Discharge = 9.40 cfs
Time to Peak = 12.7000 hrs
HYG Volume = 1.931 ac-ft

HYDROGRAPH ORDINATES (cfs)						
Output Time increment = .1000 hrs						
Time	Time on left represents time for first value in each row.					
hrs						
3.7000	.00	.00	.00	.00	.01	
4.2000	.01	.01	.02	.02	.02	
4.7000	.03	.03	.04	.04	.05	
5.2000	.05	.06	.06	.07	.07	
5.7000	.08	.08	.09	.09	.10	
6.2000	.11	.11	.12	.13	.13	
6.7000	.14	.15	.16	.16	.17	
7.2000	.18	.19	.20	.21	.23	
7.7000	.24	.25	.26	.27	.29	
8.2000	.30	.31	.33	.34	.36	
8.7000	.38	.40	.42	.44	.46	
9.2000	.49	.51	.54	.56	.59	
9.7000	.62	.65	.68	.71	.74	
10.2000	.78	.81	.84	.88	.92	
10.7000	.97	1.01	1.06	1.11	1.17	
11.2000	1.23	1.30	1.38	1.47	1.58	
11.7000	1.76	2.00	2.33	2.95	3.73	
12.2000	4.76	5.99	7.21	8.30	8.98	
12.7000	9.40	9.34	8.97	8.41	7.60	
13.2000	6.80	6.00	5.32	4.71	4.18	
13.7000	3.76	3.39	3.06	2.81	2.57	
14.2000	2.37	2.21	2.06	1.93	1.82	
14.7000	1.71	1.63	1.55	1.48	1.42	
15.2000	1.36	1.31	1.26	1.22	1.17	
15.7000	1.13	1.09	1.05	1.02	.98	
16.2000	.95	.92	.89	.86	.83	
16.7000	.80	.78	.76	.74	.72	
17.2000	.70	.68	.67	.65	.63	
17.7000	.62	.60	.59	.57	.56	
18.2000	.54	.53	.52	.51	.49	
18.7000	.48	.47	.46	.46	.45	

Type.... Node: Pond Inflow Summary
Name.... POND A
IN
File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW
Storm... TypeIII 24hr Tag: 25

Page 9.04
Event: 25 yr

HYDROGRAPH ORDINATES (cfs)					
Output Time increment = .1000 hrs					
Time hrs	Time on left represents time for first value in each row.				
19.2000	.44	.44	.43	.43	.42
19.7000	.42	.41	.41	.40	.40
20.2000	.39	.39	.38	.38	.38
20.7000	.37	.37	.36	.36	.36
21.2000	.35	.35	.35	.34	.34
21.7000	.34	.33	.33	.33	.32
22.2000	.32	.32	.32	.31	.31
22.7000	.31	.30	.30	.30	.29
23.2000	.29	.29	.28	.28	.28
23.7000	.27	.27	.27	.27	.26
24.2000	.25	.24	.22	.20	.18
24.7000	.15	.13	.11	.09	.07
25.2000	.06	.05	.04	.03	.02
25.7000	.02	.02	.01	.01	.01
26.2000	.01	.01	.00	.00	.00
26.7000	.00	.00	.00	.00	

Type.... Node: Pond Inflow Summary
 Name.... POND A IN
 File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW
 Storm... TypeIII 24hr Tag: 100

SUMMARY FOR HYDROGRAPH ADDITION
 at Node: POND A IN

HYG Directory: Y:\work\FPL\Putnam\230 KV Expansion\

Upstream Link ID	Upstream Node ID	HYG file	HYG ID	HYG tag
A 20	POST-BASIN A		POST-BASIN A	100

INFLOWS TO: POND A IN			Volume	Peak Time	Peak Flow
HYG file	HYG ID	HYG tag	ac-ft	hrs	cfs
	POST-BASIN A	100	2.532	12.7000	12.17

TOTAL FLOW INTO: POND A IN			Volume	Peak Time	Peak Flow
HYG file	HYG ID	HYG tag	ac-ft	hrs	cfs
	POND A	IN 100	2.532	12.7000	12.17

Type.... Node: Pond Inflow Summary
 Name.... POND A IN
 File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW
 Storm... TypeIII 24hr Tag: 100

Page 9.06

Event: 100 yr

TOTAL NODE INFLOW...

HYG file =
 HYG ID = POND A IN
 HYG Tag = 100

 Peak Discharge = 12.17 cfs
 Time to Peak = 12.7000 hrs
 HYG Volume = 2.532 ac-ft

HYDROGRAPH ORDINATES (cfs)						
Output Time increment = .1000 hrs						
Time	Time on left represents time for first value in each row.					
hrs						
3.0000	.00	.00	.00	.00	.01	
3.5000	.01	.01	.02	.02	.03	
4.0000	.03	.04	.04	.05	.06	
4.5000	.06	.07	.08	.08	.09	
5.0000	.10	.11	.11	.12	.13	
5.5000	.14	.14	.15	.16	.17	
6.0000	.18	.18	.19	.20	.21	
6.5000	.22	.23	.24	.25	.26	
7.0000	.27	.28	.30	.31	.33	
7.5000	.34	.36	.37	.39	.40	
8.0000	.42	.44	.46	.47	.49	
8.5000	.51	.54	.56	.59	.61	
9.0000	.64	.68	.71	.74	.78	
9.5000	.81	.85	.89	.93	.97	
10.0000	1.01	1.05	1.09	1.13	1.18	
10.5000	1.23	1.28	1.34	1.40	1.46	
11.0000	1.53	1.60	1.68	1.77	1.87	
11.5000	1.99	2.13	2.36	2.67	3.11	
12.0000	3.91	4.92	6.25	7.83	9.40	
12.5000	10.79	11.65	12.17	12.08	11.58	
13.0000	10.84	9.80	8.75	7.72	6.83	
13.5000	6.06	5.37	4.83	4.34	3.92	
14.0000	3.59	3.29	3.03	2.82	2.63	
14.5000	2.46	2.32	2.19	2.07	1.98	
15.0000	1.89	1.81	1.74	1.67	1.61	
15.5000	1.55	1.49	1.44	1.39	1.34	
16.0000	1.29	1.25	1.21	1.17	1.13	
16.5000	1.09	1.06	1.02	.99	.96	
17.0000	.94	.91	.89	.87	.85	
17.5000	.83	.81	.79	.77	.75	
18.0000	.73	.71	.69	.68	.66	

Type.... Node: Pond Inflow Summary
Name.... POND A
IN
File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW
Storm... TypeIII 24hr Tag: 100

Page 9.07
Event: 100 yr

HYDROGRAPH ORDINATES (cfs)					
Output Time increment = .1000 hrs					
Time hrs	Time on left represents time for first value in each row.				
18.5000	.64	.63	.61	.60	.59
19.0000	.58	.57	.56	.55	.55
19.5000	.54	.53	.53	.52	.52
20.0000	.51	.50	.50	.49	.49
20.5000	.48	.48	.47	.47	.46
21.0000	.46	.45	.45	.45	.44
21.5000	.44	.43	.43	.42	.42
22.0000	.42	.41	.41	.40	.40
22.5000	.40	.39	.39	.38	.38
23.0000	.38	.37	.37	.36	.36
23.5000	.36	.35	.35	.34	.34
24.0000	.34	.33	.32	.31	.28
24.5000	.26	.23	.20	.17	.14
25.0000	.11	.09	.07	.06	.05
25.5000	.04	.03	.02	.02	.02
26.0000	.01	.01	.01	.01	.01
26.5000	.00	.00	.00	.00	.00
27.0000	.00	.00			

Type.... Node: Pond Inflow Summary
 Name.... POND A IN
 File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW
 Storm... TypeIII 24hr Tag: 2.3

SUMMARY FOR HYDROGRAPH ADDITION
 at Node: POND A IN

HYG Directory: Y:\work\FPL\Putnam\230 KV Expansion\

=====				
Upstream Link ID	Upstream Node ID	HYG file	HYG ID	HYG tag

A 20	POST-BASIN A		POST-BASIN A	2.3
=====				

INFLOWS TO: POND A		IN			
HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs

	POST-BASIN A	2.3	.932	12.7000	4.65

TOTAL FLOW INTO: POND A		IN			
HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs

	POND A	IN 2.3	.932	12.7000	4.65

Type.... Node: Pond Inflow Summary
 Name.... POND A IN
 File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW
 Storm... TypeIII 24hr Tag: 2.3

Page 9.09

Event: 2.3 yr

TOTAL NODE INFLOW...

HYG file =
 HYG ID = POND A IN
 HYG Tag = 2.3

 Peak Discharge = 4.65 cfs
 Time to Peak = 12.7000 hrs
 HYG Volume = .932 ac-ft

HYDROGRAPH ORDINATES (cfs)

Time hrs	Output Time increment = .1000 hrs				
	Time on left represents time for first value in each row.				
5.8000	.00	.00	.00	.00	.00
6.3000	.01	.01	.01	.01	.01
6.8000	.02	.02	.02	.02	.03
7.3000	.03	.04	.04	.04	.05
7.8000	.05	.06	.06	.07	.07
8.3000	.08	.08	.09	.10	.10
8.8000	.11	.12	.13	.14	.15
9.3000	.16	.17	.18	.19	.21
9.8000	.22	.23	.25	.26	.28
10.3000	.29	.31	.33	.35	.37
10.8000	.39	.41	.44	.47	.50
11.3000	.53	.57	.61	.67	.75
11.8000	.87	1.03	1.33	1.72	2.23
12.3000	2.85	3.47	4.04	4.41	4.65
12.8000	4.64	4.48	4.22	3.83	3.44
13.3000	3.05	2.71	2.41	2.14	1.93
13.8000	1.74	1.58	1.45	1.34	1.23
14.3000	1.15	1.07	1.01	.95	.90
14.8000	.86	.82	.78	.75	.72
15.3000	.69	.67	.64	.62	.60
15.8000	.58	.56	.54	.52	.51
16.3000	.49	.47	.46	.44	.43
16.8000	.42	.40	.39	.38	.37
17.3000	.36	.35	.35	.34	.33
17.8000	.32	.31	.31	.30	.29
18.3000	.28	.28	.27	.26	.26
18.8000	.25	.25	.24	.24	.24
19.3000	.23	.23	.23	.22	.22
19.8000	.22	.22	.21	.21	.21
20.3000	.21	.21	.20	.20	.20
20.8000	.20	.20	.19	.19	.19

HYDROGRAPH ORDINATES (cfs)						
Output Time increment = .1000 hrs						
Time hrs	Time on left represents time for first value in each row.					
21.3000		.19	.19	.18	.18	.18
21.8000		.18	.18	.18	.17	.17
22.3000		.17	.17	.17	.17	.16
22.8000		.16	.16	.16	.16	.16
23.3000		.15	.15	.15	.15	.15
23.8000		.15	.14	.14	.14	.14
24.3000		.13	.12	.11	.10	.08
24.8000		.07	.06	.05	.04	.03
25.3000		.02	.02	.02	.01	.01
25.8000		.01	.01	.01	.00	.00
26.3000		.00	.00	.00	.00	.00
26.8000		.00				

Type.... Pond Routing Summary Page 9.11
 Name.... POND A OUT Tag: 25 Event: 25 yr
 File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW
 Storm... TypeIII 24hr Tag: 25

LEVEL POOL ROUTING SUMMARY

HYG Dir = Y:\work\FPL\Putnam\230 KV Expansion\
 Inflow HYG file = NONE STORED - POND A IN 25
 Outflow HYG file = NONE STORED - POND A OUT 25

Pond Node Data = POND A
 Pond Volume Data = POND A
 Pond Outlet Data = PR 10

No Infiltration

INITIAL CONDITIONS

 Starting WS Elev = 21.70 ft
 Starting Volume = .000 ac-ft
 Starting Outflow = .00 cfs
 Starting Infiltr. = .00 cfs
 Starting Total Qout= .00 cfs
 Time Increment = .1000 hrs

INFLOW/OUTFLOW HYDROGRAPH SUMMARY

=====

Peak Inflow	=	9.40 cfs	at	12.7000 hrs
Peak Outflow	=	8.18 cfs	at	13.0000 hrs

Peak Elevation	=	22.89 ft
Peak Storage	=	.685 ac-ft

=====

MASS BALANCE (ac-ft)

+ Initial Vol	=	.000
+ HYG Vol IN	=	1.931
- Infiltration	=	.000
- HYG Vol OUT	=	1.426
- Retained Vol	=	.506

Unrouted Vol = -.000 ac-ft (.000% of Inflow Volume)

Type.... Pond Routing Summary Page 9.12
 Name.... POND A OUT Tag: 100 Event: 100 yr
 File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW
 Storm... TypeIII 24hr Tag: 100

LEVEL POOL ROUTING SUMMARY

HYG Dir = Y:\work\FPL\Putnam\230 KV Expansion\
 Inflow HYG file = NONE STORED - POND A IN 100
 Outflow HYG file = NONE STORED - POND A OUT 100

Pond Node Data = POND A
 Pond Volume Data = POND A
 Pond Outlet Data = PR 10

No Infiltration

INITIAL CONDITIONS

 Starting WS Elev = 21.70 ft
 Starting Volume = .000 ac-ft
 Starting Outflow = .00 cfs
 Starting Infiltr. = .00 cfs
 Starting Total Qout= .00 cfs
 Time Increment = .1000 hrs

INFLOW/OUTFLOW HYDROGRAPH SUMMARY

=====

Peak Inflow	=	12.17 cfs	at	12.7000 hrs
Peak Outflow	=	11.41 cfs	at	12.9000 hrs

Peak Elevation	=	22.97 ft
Peak Storage	=	.730 ac-ft

=====

MASS BALANCE (ac-ft)

+ Initial Vol	=	.000
+ HYG Vol IN	=	2.532
- Infiltration	=	.000
- HYG Vol OUT	=	2.026
- Retained Vol	=	.506

Unrouted Vol = -.000 ac-ft (.000% of Inflow Volume)

Type.... Pond Routing Summary Page 9.13
 Name.... POND A OUT Tag: 2.3 Event: 2.3 yr
 File.... Y:\work\FPL\Putnam\230 KV Expansion\PUTNAM 230KV SUBSTATION 1-14-14.PPW
 Storm... TypeIII 24hr Tag: 2.3

LEVEL POOL ROUTING SUMMARY

HYG Dir = Y:\work\FPL\Putnam\230 KV Expansion\
 Inflow HYG file = NONE STORED - POND A IN 2.3
 Outflow HYG file = NONE STORED - POND A OUT 2.3

Pond Node Data = POND A
 Pond Volume Data = POND A
 Pond Outlet Data = PR 10

No Infiltration

INITIAL CONDITIONS

```
-----
Starting WS Elev  = 21.70 ft
Starting Volume   = .000 ac-ft
Starting Outflow  = .00 cfs
Starting Infiltr. = .00 cfs
Starting Total Qout= .00 cfs
Time Increment    = .1000 hrs
```

INFLOW/OUTFLOW HYDROGRAPH SUMMARY

```
=====
Peak Inflow      = 4.65 cfs at 12.7000 hrs
Peak Outflow     = 1.44 cfs at 14.0000 hrs
-----
Peak Elevation   = 22.69 ft
Peak Storage     = .559 ac-ft
=====
```

MASS BALANCE (ac-ft)

```
-----
+ Initial Vol  = .000
+ HYG Vol IN   = .932
- Infiltration = .000
- HYG Vol OUT  = .426
- Retained Vol = .506
-----
Unrouted Vol = -.000 ac-ft (.000% of Inflow Volume)
```

Index of Starting Page Numbers for ID Names

----- P -----

POND A... 7.01, 9.01

POND A IN 25... 9.02, 9.05,
9.08POND A OUT 25... 6.01, 9.11,
6.03, 9.12, 6.05, 9.13

POST-BASIN A... 4.01, 5.01

PR 10... 8.01, 8.03, 8.04

PRE-BASIN A... 4.03, 5.02

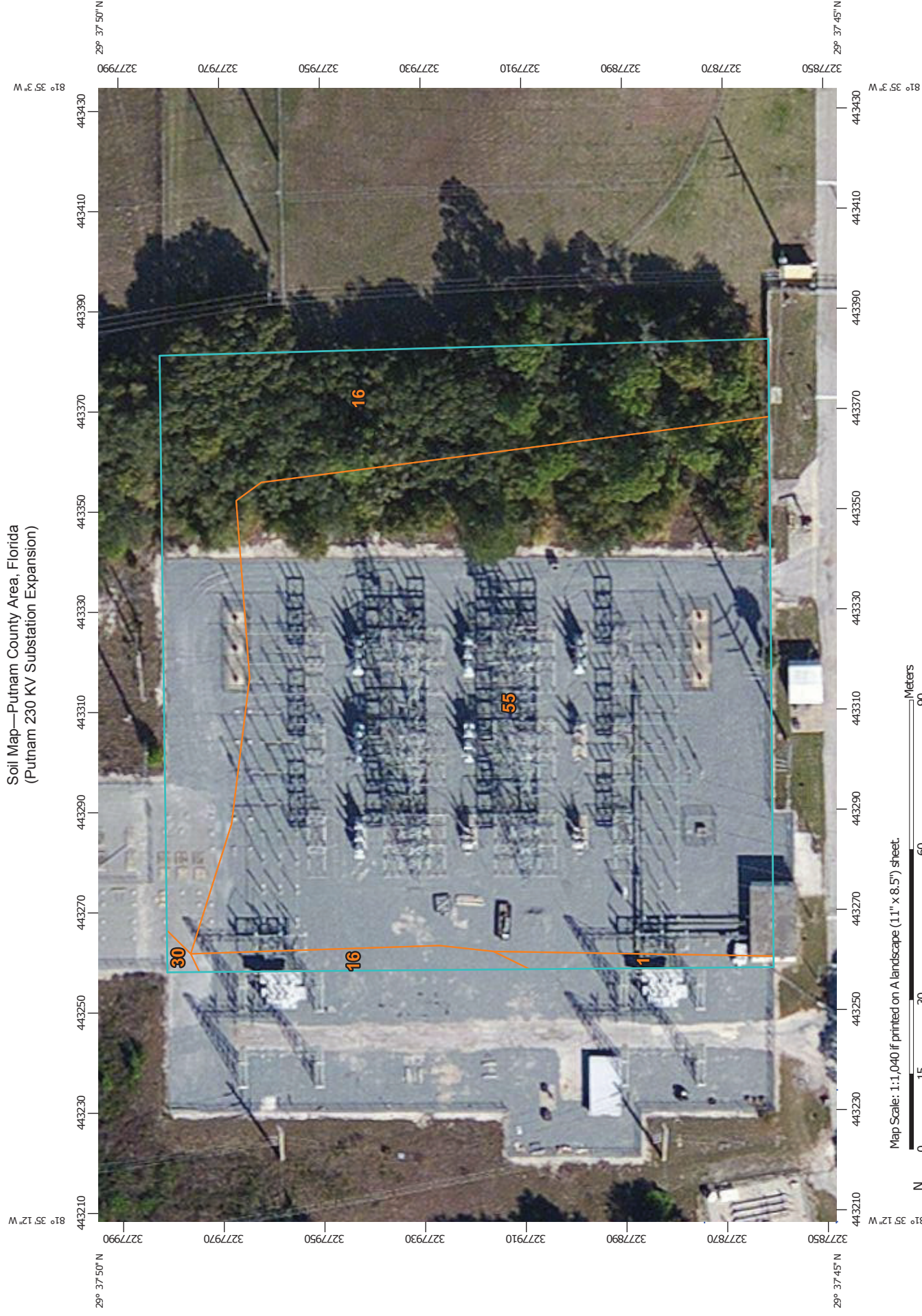
Putnam... 3.01, 3.02

----- W -----

Watershed... 1.01, 2.01, 2.02, 2.03,
2.04, 2.05, 2.07, 2.08

SOILS INFORMATION

Soil Map—Putnam County Area, Florida
(Putnam 230 KV Substation Expansion)



Natural Resources
Conservation Service

Web Soil Survey
National Cooperative Soil Survey

MAP LEGEND

Area of Interest (AOI)		Area of Interest (AOI)		Soils		Soil Map Unit Polygons			Soil Map Unit Lines			Soil Map Unit Points			Special Point Features																																																																																																																																																																																																																																																																																																																																																																											
-------------------------------	---	-------------------------------	---	--------------	---	-------------------------------	---	---	----------------------------	---	---	-----------------------------	---	---	-------------------------------	---	---	---	---	---	---	---	---	---	---	---	---	---	--	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Map Unit Legend

Putnam County Area, Florida (FL107)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1	Candler fine sand, 0 to 5 percent slopes	0.0	1.0%
16	Adamsville sand, 0 to 2 percent slopes	1.0	27.7%
30	Hontoon muck	0.0	0.2%
55	Centenary-Urban land complex, 0 to 5 percent slopes	2.6	71.1%
Totals for Area of Interest		3.7	100.0%

Hydrologic Soil Group—Putnam County Area, Florida (Putnam 230 KV Substation Expansion)



**Natural Resources
Conservation Service**

Web Soil Survey
National Cooperative Soil Survey

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil Rating Polygons

	A
	A/D
	B
	B/D
	C
	C/D
	D
	Not rated or not available

Soil Rating Lines

	A
	A/D
	B
	B/D
	C
	C/D
	D
	Not rated or not available

Soil Rating Points

	A
	A/D
	B
	B/D

Water Features

 Streams and Canals

Transportation

 Rails

 Interstate Highways

 US Routes

 Major Roads

 Local Roads

Background

 Aerial Photography

C

 C

C/D

 C/D

D

 D

Not rated or not available

 Not rated or not available

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Putnam County Area, Florida
Survey Area Data: Version 9, Dec 7, 2013

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 8, 2010—Mar 15, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Putnam County Area, Florida (FL107)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Candler fine sand, 0 to 5 percent slopes	A	0.0	1.0%
16	Adamsville sand, 0 to 2 percent slopes	A	1.0	27.7%
30	Hontoon muck	A/D	0.0	0.2%
55	Centenary-Urban land complex, 0 to 5 percent slopes	A	2.6	71.1%
Totals for Area of Interest			3.7	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

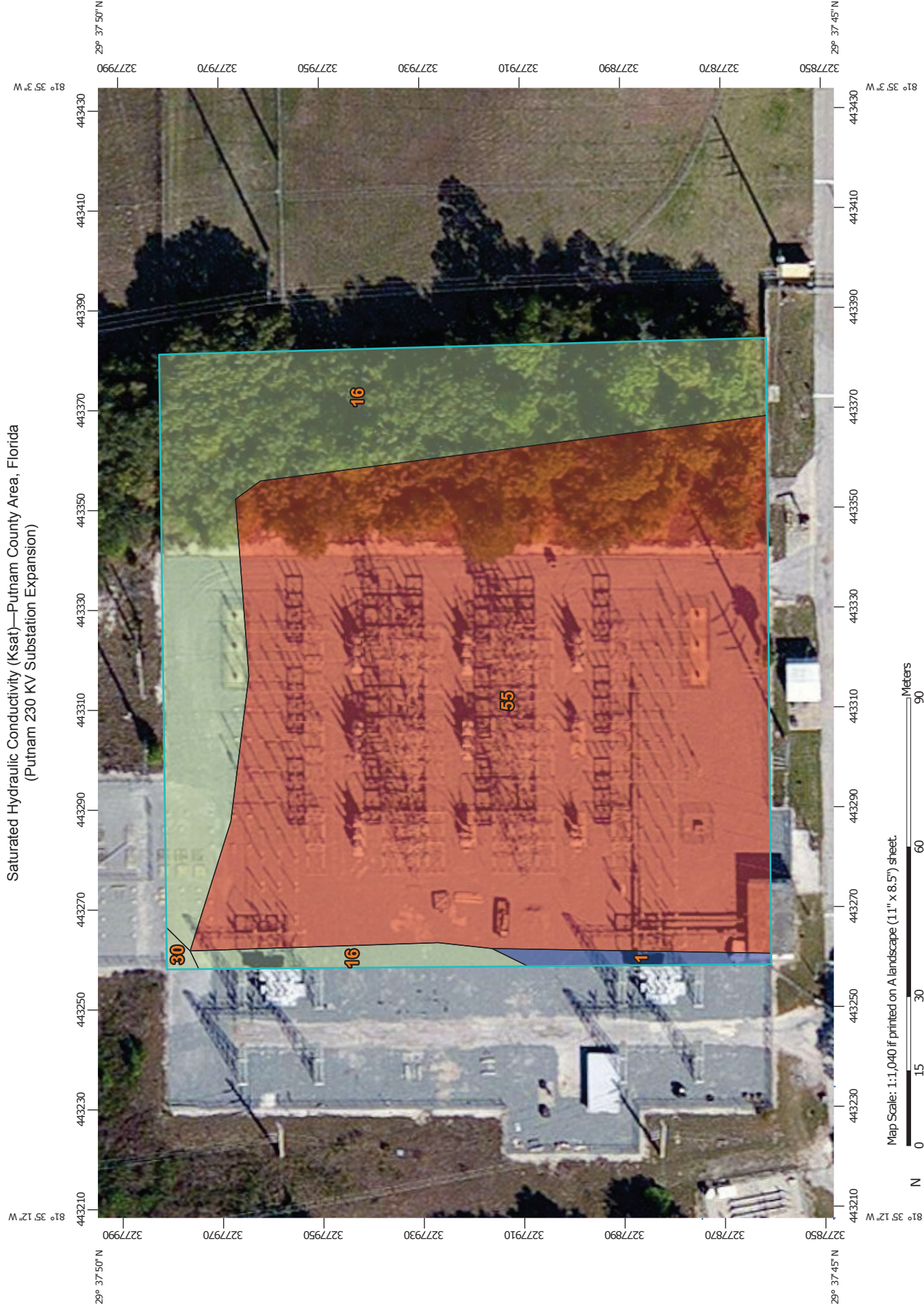
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Saturated Hydraulic Conductivity (Ksat)—Putnam County Area, Florida
(Putnam 230 KV Substation Expansion)

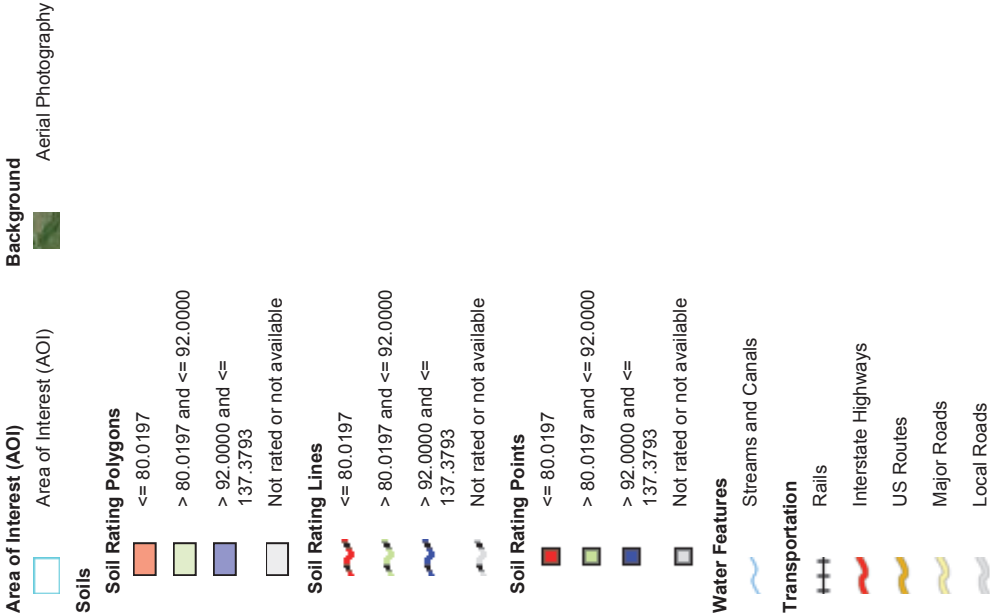


Natural Resources
Conservation Service

Web Soil Survey
National Cooperative Soil Survey

1/15/2014
Page 1 of 3

MAP LEGEND



MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Putnam County Area, Florida
Survey Area Data: Version 9, Dec 7, 2013

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 8, 2010—Mar 15, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Saturated Hydraulic Conductivity (Ksat)

Saturated Hydraulic Conductivity (Ksat)— Summary by Map Unit — Putnam County Area, Florida (FL107)				
Map unit symbol	Map unit name	Rating (micrometers per second)	Acres in AOI	Percent of AOI
1	Candler fine sand, 0 to 5 percent slopes	137.3793	0.0	1.0%
16	Adamsville sand, 0 to 2 percent slopes	92.0000	1.0	27.7%
30	Hontoon muck	92.0000	0.0	0.2%
55	Centenary-Urban land complex, 0 to 5 percent slopes	80.0197	2.6	71.1%
Totals for Area of Interest			3.7	100.0%

Description

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity is considered in the design of soil drainage systems and septic tank absorption fields.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

The numeric Ksat values have been grouped according to standard Ksat class limits.

Rating Options

Units of Measure: micrometers per second

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Fastest

Interpret Nulls as Zero: No

Layer Options (Horizon Aggregation Method): All Layers (Weighted Average)

Engineering Properties

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Hydrologic group is a group of soils having similar runoff potential under similar storm and cover conditions. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission rate. Changes in soil properties caused by land management or climate changes also cause the hydrologic soil group to change. The influence of ground cover is treated independently. There are four hydrologic soil groups, A, B, C, and D, and three dual groups, A/D, B/D, and C/D. In the dual groups, the first letter is for drained areas and the second letter is for undrained areas.

The four hydrologic soil groups are described in the following paragraphs:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and plasticity index (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

References:

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Report—Engineering Properties

Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash.

Engineering Properties—Putnam County Area, Florida														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
1—Candler fine sand, 0 to 5 percent slopes			In				Pct	Pct					Pct	
Candler	90	A	0-5	Fine sand	SM, SP, SP-SM	A-2-4, A-3	0	0	100	95-100	75-100	1-15	0-21	NP-2
			5-74	Fine sand, sand	SM, SP, SP-SM	A-2-4, A-3	0	0	100	95-100	60-100	1-15	0-18	NP-2
			74-80	Fine sand, sand	SP-SM, SM, SP, SC-SM	A-2-4, A-3	0	0	100	95-100	60-100	3-20	0-20	NP-4
16—Adamsville sand, 0 to 2 percent slopes														
Adamsville	92	A	0-4	Sand	SP-SM, SC-SM	A-2-4, A-3	0	0	100	100	80-97	6-18	0-25	NP-4
			4-33	Sand, fine sand	SP-SM, SC-SM	A-2-4, A-3	0	0	100	100	73-95	5-16	0-22	NP-4
			33-80	Fine sand, sand	SP, SP-SM, SC-SM	A-2-4, A-3	0	0	100	100	74-96	4-16	0-21	NP-4
30—Hontoon muck														
Hontoon	85	A/D	0-80	Muck	PT	A-8	0	0	100	100	100	100	—	—

Engineering Properties—Putnam County Area, Florida														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			<i>In</i>				<i>Pct</i>	<i>Pct</i>					<i>Pct</i>	
55—Centenary—Urban land complex, 0 to 5 percent slopes														
Centenary	60	A	0-4	Fine sand	SP, SP-SM	A-3	0	0	100	100	60-100	4-10	0-14	NP
			4-65	Sand, fine sand	SM, SP, SP-SM	A-2-4, A-3	0	0	100	100	65-100	4-20	0-14	NP
			65-80	Sand, fine sand, loamy fine sand	SP-SM, SM, SP	A-2-4, A-3	0	0	100	100	60-100	3-20	0-14	NP

Data Source Information

Soil Survey Area: Putnam County Area, Florida
 Survey Area Data: Version 9, Dec 7, 2013



Physical Soil Properties

This table shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In this table, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In this table, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, saturated hydraulic conductivity (Ksat), plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3- or 1/10-bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute linear extensibility, shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates in the table are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity (Ksat) is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each soil layer. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Linear extensibility refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod at 1/3- or 1/10-bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is reported in the table as percent change for the whole soil. The amount and type of clay minerals in the soil influence volume change.

Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design commonly is needed.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In this table, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. The content of organic matter in a soil can be maintained by returning crop residue to the soil.

Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

Erosion factors are shown in the table as the K factor (Kw and Kf) and the T factor. Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and Ksat. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor Kw indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind and/or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are described in the "National Soil Survey Handbook."

Wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Reference:

United States Department of Agriculture, Natural Resources Conservation Service.
National soil survey handbook, title 430-VI. (<http://soils.usda.gov>)

Report—Physical Soil Properties

Physical Soil Properties—Putnam County Area, Florida														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
	In	Pct	Pct	Pct	g/cc	micro m/sec	In/In	Pct	Pct	Kw	Kf	T		
1—Candler fine sand, 0 to 5 percent slopes														
Candler	0-5	90-98-10 ₀	0- 1- 5	0- 2- 5	1.45-1.60	42.00-353.00	0.04-0.10	0.0-0.3	0.5-2.0	.02	.02	5	1	250
	5-74	90-98-10 ₀	0- 1- 5	0- 2- 5	1.50-1.65	42.00-353.00	0.02-0.08	0.0-0.3	0.0-1.0	.02	.02			
	74-80	85-95- 97	0- 1- 8	3- 4- 8	1.55-1.70	42.00-141.00	0.03-0.09	0.2-0.7	0.0-0.5	.02	.02			
16—Adamsville sand, 0 to 2 percent slopes														
Adamsville	0-4	90-94- 99	0- 3- 8	1- 2- 8	1.35-1.50	42.00-141.00	0.03-0.10	0.1-0.6	0.5-2.0	.05	.05	5	1	220
	4-33	90-97- 99	0- 2- 8	1- 2- 8	1.55-1.65	42.00-141.00	0.03-0.10	0.0-0.5	0.0-1.0	.02	.02			
	33-80	90-98- 99	0- 0- 8	1- 2- 8	1.55-1.65	42.00-141.00	0.03-0.10	0.0-0.4	0.0-0.5	.02	.02			
30—Hontoon muck														
Hontoon	0-80	- 0-	- 0-	0- 0- 0	0.20-0.40	42.00-141.00	0.30-0.50	—	75.0-85.0			2	2	134

Physical Soil Properties—Putnam County Area, Florida														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	micro m/sec	In/In	Pct	Pct					
55—Centenary- Urban land complex, 0 to 5 percent slopes														
Centenary	0-4	-97-	0- 1- 15	1- 2- 8	1.40-1.60	42.00-141.00	0.03-0.08	0.0-2.9	0.5-1.0	.02	.02	5	1	250
	4-65	-97-	0- 2- 15	1- 1- 8	1.40-1.60	42.00-141.00	0.03-0.05	0.0-2.9	0.0-0.5	.02	.02			
	65-80	-88-	0- 8- 15	2- 4- 10	1.50-1.70	14.00-42.00	0.03-0.10	0.0-2.9	0.5-2.0	.10	.10			
Urban land	—	—	—	—	—	—	—	—	—					

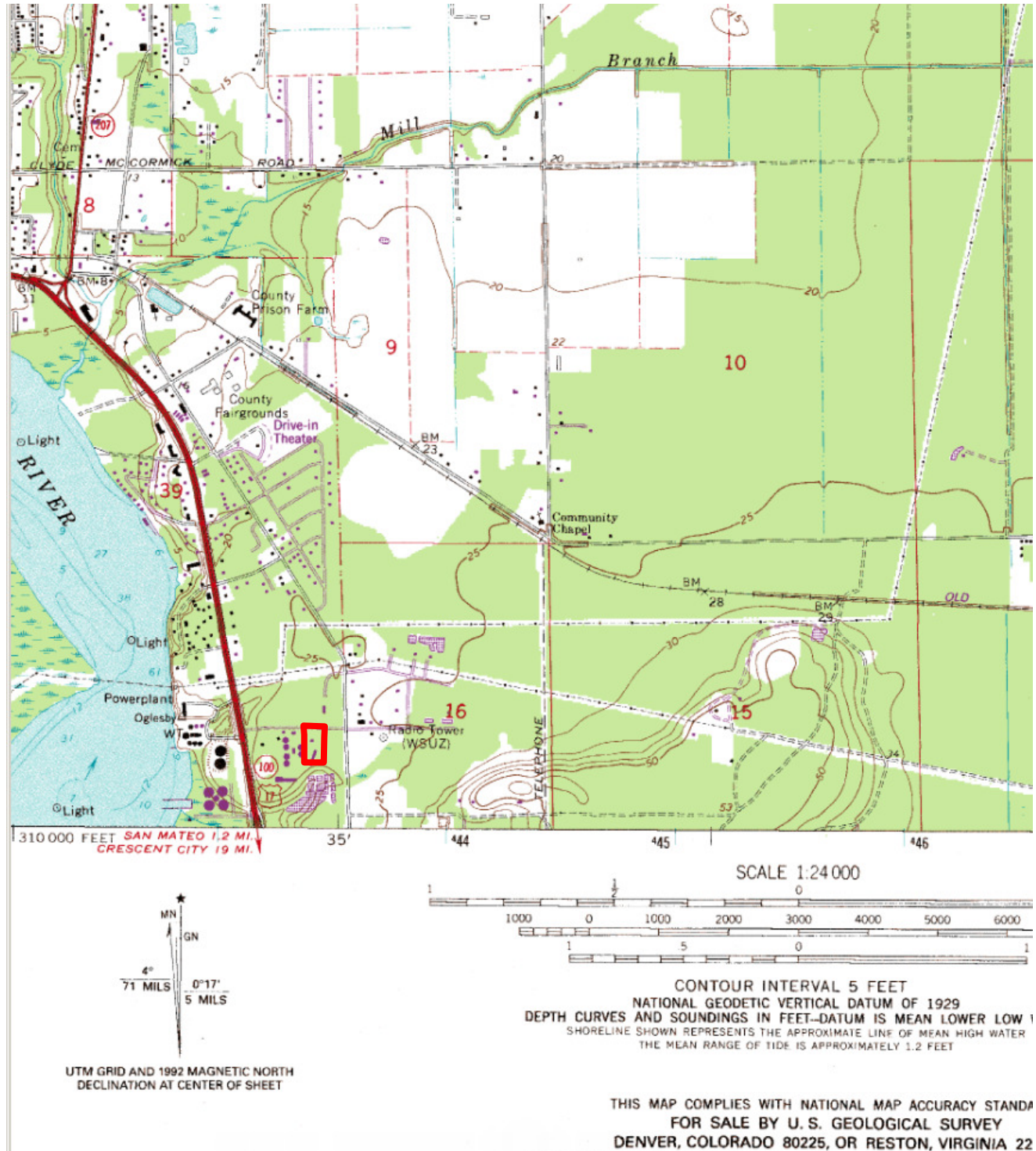
Data Source Information

Soil Survey Area: Putnam County Area, Florida

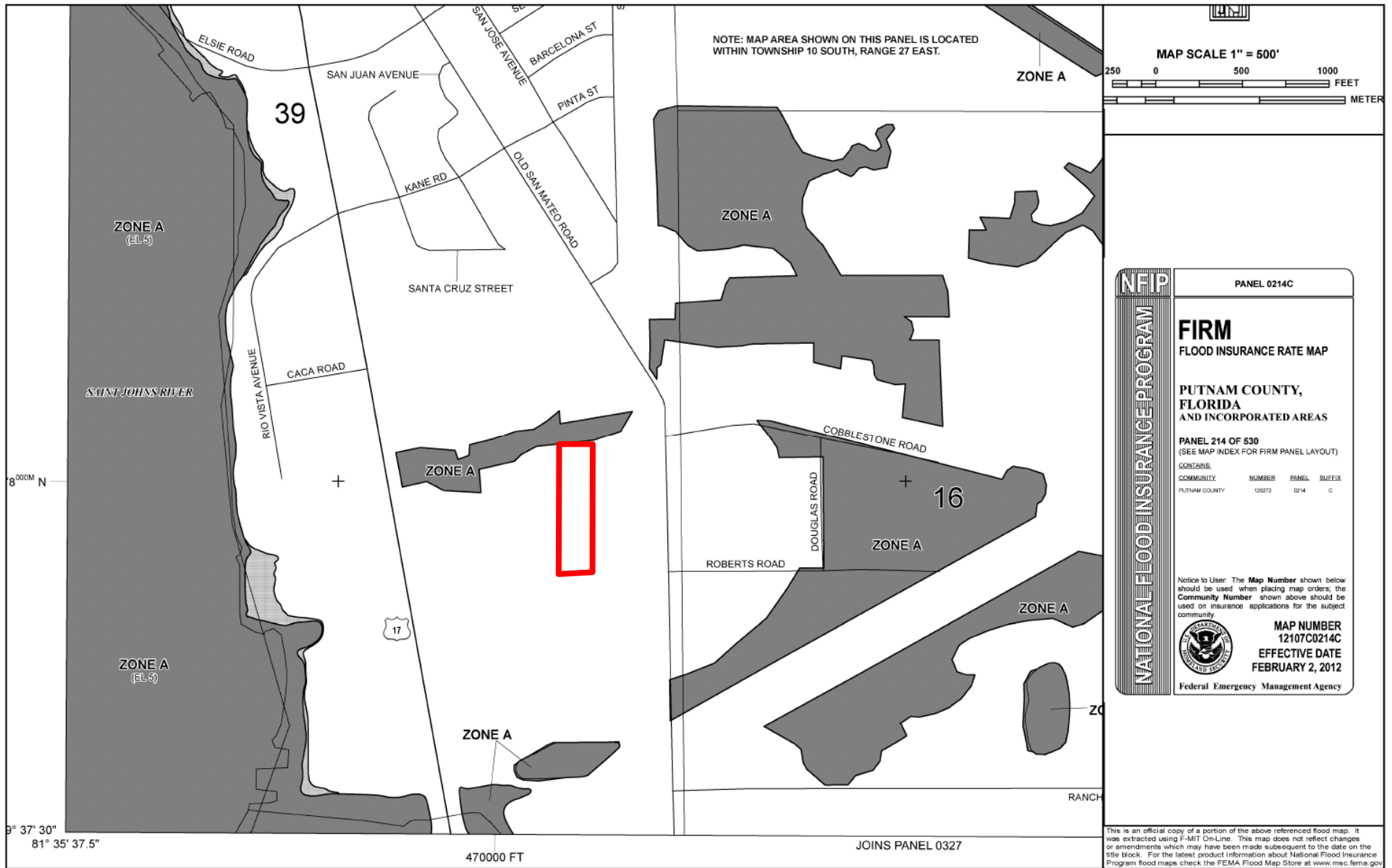
Survey Area Data: Version 9, Dec 7, 2013



INFORMATION MAPS



4.1 QUADRANGLE MAP



4.2 FIRM MAP

GEOTECHNICAL REPORT

**Subsurface Soil Exploration and
Geotechnical Engineering Evaluation
Putnam Power Plant
380 S. Highway 17
East Palatka, Putnam County, Florida**



Ardaman & Associates, Inc.

OFFICES

Orlando – 8009 S. Orange Avenue, Orlando Florida 328098 – Phone (407) 855-3860

Alexandria – 3609 Mac Lee Drive, Alexandria, Louisiana 71302 – Phone (318) 443-2888

Bartow – 1525 Centennial Drive, Bartow, Florida 33830 – Phone (863) 533-0858

Baton Rouge – 316 Highlandia Drive, Baton Rouge, Louisiana 70884 – phone (225) 752-4790

Cocoa – 1300 N. Cocoa Blvd., Cocoa, Florida 32922 – Phone (321) 632-2503

Fort Myers – 9970 Bavaria Road, Fort Myers, Florida 33913 – Phone (239) 768-6600

Miami – 2608 W. 84th Street, Hialeah, Florida 33016 – Phone (305) 825-2683

Monroe – 1122 Hayes Street, West Monroe, Louisiana 71292 – Phone (318) 387-4103

New Orleans – 1305 Distributors Row, Suite I, Jefferson, Louisiana 70123 – Phone (504) 835-2593

Port St. Lucie – 460 Concourse Place NW, Unit 1, Port St. Lucie, Florida 34986 – Phone (772) 878-0072

Sarasota – 79 Sarasota Center Blvd., Sarasota, Florida 34240 – Phone (941) 922-3526

Shreveport – 72022 Greenwood Road, Shreveport, Louisiana 71119 – Phone (318) 636-3673

Tallahassee – 3175 West Tharpe Street, Tallahassee, Florida 32303 – Phone (850) 576-6131

Tampa – 3925 Coconut Palm Drive, Suite 115, Tampa, Florida 33619 – Phone (813) 620-3389

West Palm Beach – 2200 North Florida Mango Road, Suite 101, West Palm Beach, Florida 33409 – Phone (561) 687-8200

MEMBERS:

A.S.F.E.

American Concrete Institute

ASTM International

Florida Institute of Consulting Engineers



Florida Power & Light
700 Universe Boulevard
Juno Beach, Florida 33408

Attention: Mr. Daryl B. Kilpatrick

Subject: Subsurface Soil Exploration and
Geotechnical Engineering Evaluation
Putnam Power Plant
380 S. Highway 17
East Palatka, Putnam County, Florida

Dear Mr. Kilpatrick:

As requested and authorized by you, we have completed a shallow subsurface soil exploration for the subject project, which is a substation expansion on the Putnam Power Plant Campus. The purposes of performing this exploration were to evaluate the general subsurface conditions within the structure and stormwater retention areas and to provide recommendations for site preparation and foundation support for the shallow foundations. In addition, we have estimated the normal seasonal high groundwater level at the boring locations and have provided ultimate soil strength parameters for foundation design by others for the drilled shaft foundations on site. This report documents our findings and presents our engineering recommendations.

SITE LOCATION AND SITE DESCRIPTION

The site for the proposed substation expansion is located to the east of the substation located on the north side of the of the Putnam Power Plant at 380 S. Highway 17 in East Palatka, Putnam County, Florida (Section 16, Township 10 South, Range 27 East). The general site location is shown superimposed on the Hastings, Florida U.S.G.S. quadrangle map presented on Figure 1.

The central portion of the proposed expansion is in a wooded area with dense underbrush, and the east portion is cleared and grassy. The west edge of the proposed expansion is on existing substation grounds.

PROPOSED CONSTRUCTION AND GRADING

It is our understanding that the proposed development includes a transmission pull off tower on drilled shaft foundations (at the location of Boring B-1), a substation breaker foundation on shallow foundations (at the location of B-2), and a transmission pole on drilled shaft foundations (at the location of B-3). The substation breaker foundation (on shallow foundations) will consist of a structural slab to support the equipment loads. For the purposes of our analysis, we have assumed the maximum loading conditions for the substation breaker structure to be on the order of 200 kips. Grading plans are not complete at this time, therefore we have assumed that up to 3 feet of fill is required to raise the structure area to final elevations. If actual structure loads or fill height exceed our assumptions, then the recommendations in this report may not be valid.

We understand that the stormwater run-off is to be retained on-site by means of retention ponds.

REVIEW OF SOIL SURVEY MAPS

Based on the 1990 Soil Survey for Putnam County, Florida, as prepared by the U.S. Department of Agriculture Soil Conservation Service, the site is located in an area mapped as the "Adamsville sand" soil series. The "Adamsville sand" soil series consists of nearly level sandy soils on low knolls on the flatwoods and on low side slopes on the uplands. The internal drainage of the "Adamsville sand" is somewhat poor and the soil permeability is rapid throughout. According to the Soil Survey, the seasonal high water table for the "Adamsville sand" soil series is typically within 10 to 20 inches of the natural ground surface.

FIELD EXPLORATION PROGRAM

SPT and Auger Borings

The field exploration program included performing 6 Standard Penetration Test (SPT) borings and 2 hand auger borings. The SPT borings were performed at structure locations designated by FPL. Very loose soil conditions were encountered in Boring B-1, so Ms. Melanie Bragdon of FPL requested that Ardaman & Associates perform three extra borings around B-1 to further explore the soils in this area.

The SPT borings were advanced to depths of 30 and 85 feet below the ground surface using the methodology outlined in ASTM D-1586. A summary of this field procedure is included in the Appendix. Split-spoon soil samples recovered during performance of the borings were visually classified in the field and representative portions of the samples were transported to our laboratory in sealed sample jars.

The auger borings were performed in the proposed stormwater retention area. They were drilled using a handheld 3.5-inch bucket auger to a depth of 5 feet below the ground surface. A summary of this field procedure is included in the Appendix. Representative soil samples were recovered from the auger borings and transported to our laboratory for further analysis.

The groundwater level at each of the boring locations was measured during drilling. The borings were backfilled with soil cuttings.

Permeability Test Sampling

Pits were excavated by hand to a depth of 1 foot below existing ground surface adjacent to Borings B-4 and B-5 (total of two pits). One 3-inch diameter Shelby-tube sample was obtained in a vertical orientation in the bottom of each excavation and one 3-inch diameter Shelby-tube sample was obtained in a horizontal orientation in the sidewall of the excavation just above the bottom of the excavation (two Shelby-tube samples per pit for a total of four Shelby-tube samples). The Shelby-tube samples were capped and transported to our laboratory for soil permeability testing.

Test Locations

The approximate locations of the borings are schematically illustrated on a site plan shown on Figure 2. The laboratory permeability test samples were collected adjacent to Borings B-4 and B-5. Boring locations B-1 through B-5 were determined in the field using a hand-held GPS unit and coordinates provided by Florida Power and Light. Boring locations B-6 through B-8 were determined by estimating distances from existing site features. The locations should be considered accurate only to the degree implied by the method of measurement/estimation used.

LABORATORY PROGRAM

Representative soil samples obtained during our field sampling operation were packaged and transferred to our laboratory for further visual examination and classification. The soil samples were visually classified in general accordance with the Unified Soil Classification System (ASTM D-2488). The resulting soil descriptions are shown on the soil boring profiles presented on Figures 3 through 5.

In addition, we conducted four natural moisture content tests (ASTM D2216) and four percent fines analyses (ASTM D1140) on selected soil samples obtained from the borings. The results of these tests are presented adjacent to the sample depth on the boring profiles on Figures 3 through 5.

Constant head permeability tests were performed on the Shelby-tube samples obtained from the test pits near the location of Borings B-4 and B-5. The results of the laboratory permeability tests are tabulated in the "Soil Permeability" section of this report.

GENERAL SUBSURFACE CONDITIONS

General Soil Profile

The results of the field exploration and laboratory programs are graphically summarized on the soil boring profiles presented on Figures 3 through 5. The stratification of the boring profiles represents our interpretation of the field boring logs and the results of laboratory examinations of the recovered samples. The stratification lines represent the approximate boundary between soil types. The actual transitions may be more gradual than implied.

The results of all borings (excluding Boring B-1) indicate a general soil profile consisting of loose to medium dense fine sand (SP), fine sand with silt (SP-SM) and fine sand with clay (SP-SC) in the top 12.5 feet underlain by medium dense to very dense fine sand (SP) or fine sand with clay (SP-SC) and medium stiff clay (CH) to the boring termination depth.

The results of Boring B-1 indicate a general soil profile consisting of very loose fine sand (SP), fine sand with clay (SP-SC) and silty clayey fine sand (SM/SC) in the top 42.5 feet underlain by very loose to medium dense fine sand with clay (SP-SC), silty clayey fine sand (SM/SC) and clayey fine sand (SC) and medium stiff clay (CH) to a depth of 80 feet. Below this, the boring generally encountered very dense silty clayey fine sand (SM/SC) to the boring termination depth of 85 feet.

The above soil profiles are outlined in general terms only. Please refer to Figures 3 through 5 for soil profile details.

Groundwater Level

The groundwater level was measured in the boreholes on the day drilled after stabilization of the downhole water level. As shown on Figures 3 through 5, groundwater was encountered at depths ranging from 3.4 to 6.2 feet below the existing ground surface on the dates indicated. Fluctuation in groundwater levels should be anticipated throughout the year primarily due to seasonal variations in rainfall and other factors that may vary from the time the borings were conducted.

NORMAL SEASONAL HIGH GROUNDWATER LEVEL

The normal seasonal high groundwater level each year is the level in the August-September period at the end of the rainy season during a year of normal (average) rainfall. The water table elevations associated with a higher than normal rainfall and in the extreme case, flood, would be higher to much higher than the normal seasonal high groundwater level. The normal high water levels would more approximate the normal seasonal high groundwater levels.

The seasonal high groundwater level is affected by a number of factors. The drainage characteristics of the soils, the land surface elevation, relief points such as drainage ditches, lakes, rivers, swamp areas, etc., and distance to relief points are some of the more important factors influencing the seasonal high groundwater level.

Based on our interpretation of the site conditions using our boring logs, we estimate the normal seasonal high groundwater level at the boring locations to be approximately 2 feet above the groundwater levels measured at the time of our field exploration.

ENGINEERING EVALUATION AND RECOMMENDATIONS

General

The results of our exploration indicate that, with proper site preparation as recommended in this report, the existing soils, except for the soils encountered in Boring B-1, are suitable for supporting proposed structures on conventional shallow foundation systems. Mat foundations should provide an adequate support system for the substation breaker structure proposed at the location of B-2.

It is our understanding that the structures in the area of B-1 are to be founded on drilled shaft foundations, and that Florida Power & Light is planning on hiring a contractor to remediate the very loose soil conditions encountered in B-1. As discussed with FPL, remediation will likely include pressure grouting to improve the soils before installing the foundations. If the soils are improved by this process, the ultimate strength soil parameters of the soils and/or grout will be different than what is presented in this report. Ardaman & Associates would be pleased to discuss the challenges and benefits of various remediation programs for the soils encountered in Boring B-1 with Florida Power & Light and/or remediation contractors.

The following are our recommendations for overall site preparation and foundation support in the mat foundation areas (near Boring B-2) which we feel are best suited for the proposed facility and existing soil conditions. (Shallow mat foundations should not be used in the vicinity of Boring B-1 without improving the very loose soil conditions at this location). The recommendations are made as a guide for the design engineer and/or architect, parts of which should be incorporated into the project's specifications.

Stripping and Grubbing

The "footprint" of the proposed mat foundation structure areas, plus a minimum margin of five feet, should be stripped of all surface vegetation, stumps, debris, organic topsoil or other deleterious materials, as encountered. Buried utilities should be removed or plugged to eliminate conduits into which surrounding soils could erode.

After stripping, the site should be grubbed or root-raked such that roots with a diameter greater than ½ inch, stumps, or small roots in a dense state, are completely removed. The actual depth(s) of stripping and grubbing must be determined by visual observation and judgment during the earthwork operation.

Proof-rolling

We recommend proof-rolling the cleared surface to locate any unforeseen soft areas or unsuitable surface or near-surface soils, to increase the density of the upper soils, and to prepare the existing surface for the addition of the fill soils (as required). Proof-rolling of the mat foundation structure areas should consist of at least 10 passes of a compactor capable of achieving the density requirements described in the next paragraph. Each pass should overlap the preceding pass by 30 percent to achieve complete coverage. If deemed necessary, in areas that continue to "yield", remove all deleterious material and replace with clean, compacted sand backfill. The proof-rolling should occur after cutting and before filling.

A density equivalent to or greater than 95 percent of the modified Proctor (ASTM D-1557) maximum dry density value for a depth of 2 feet in the mat foundation structure areas must be achieved beneath the stripped and grubbed ground surface. Additional passes and/or overexcavation and recompaction may be required if these minimum density requirements are not achieved. The soil moisture should be adjusted as necessary during compaction.

Proof-rolling may cause upward movement or "pumping" of the groundwater. However, we recommend that the existing surface be level and firm prior to the addition of fill soils. Proof-rolling with a front-end loader may help achieve the desired surface and compaction condition before adding the fill soils. The site should be dewatered as necessary. Depending on the time of year, a 12- to 18-inch layer of clean fine sand (SP) fill may be required prior to proof-rolling.

Care should be exercised to avoid damaging any neighboring structures or utilities while the compaction operation is underway. Prior to commencing compaction, occupants of adjacent structures should be notified and the existing condition (i.e. cracks) of the structures documented with photographs and survey (if deemed necessary). Compaction should cease if deemed detrimental to adjacent structures, and Ardaman & Associates should be notified immediately.

Heavy vibratory compaction should not be performed within 150 feet of any existing structures.

Suitable Fill Material and the Compaction of Fill Soils

All fill materials should be free of organic materials, such as roots and vegetation. We recommend using fill with less than 12 percent by dry weight of material passing the U.S. Standard No. 200 sieve size. The fine sand, fine sand with silt and fine sand with clay (Strata No. 1, 2 and 3 without roots, as shown on Figures 3 through 5) are suitable for use as structural fill materials and, with proper moisture control, should densify using conventional compaction methods. Soils with more than 12 percent passing the No. 200 sieve can be used in some applications, but will be more difficult to compact due to their inherent nature to retain soil moisture.

All structural fill should be placed in level lifts not to exceed 12 inches in uncompacted thickness. Each lift should be compacted to at least 95 percent of the modified Proctor (ASTM D-1557) maximum dry density value. The filling and compaction operations should continue in lifts until the desired elevation(s) is achieved. If hand-held compaction equipment is used, the lift thickness should be reduced to no more than 6 inches.

The use of soils with relatively high fines content (i.e; silty and clayey soils) as fill should be avoided near the ground surface in green-space areas since these relatively low permeability soils promote ponding of water during and following rainfall. Also, in high groundwater areas, silty and clayey soils may cause a rise in the water table elevation due to capillary action.

Foundation Support by Mat Foundations and Foundation Compaction Criteria

Excavate the foundations to the proposed bottom of foundation elevations and, thereafter, verify the in-place compaction for a depth of 2 feet below the foundation bottoms. If necessary, compact the soils at the bottom of the excavations to at least 95 percent of the modified Proctor maximum dry density (ASTM D-1557) for a depth of 2 feet below the foundation bottoms. Based on the existing soil conditions and, assuming the above outlined proof-rolling and compaction criteria are implemented, an allowable soil bearing pressure of 2,000 pounds per square foot (psf) may be used in the foundation design. This bearing pressure should result in foundation settlement within tolerable limits (i.e., 1 inch or less).

All mat foundations should be a minimum of 24 inches wide. A minimum soil cover of 12 inches should be maintained from the bottom of the foundations to the adjacent finished grades.

Dewatering

The control of the groundwater may be required to achieve the necessary stripping and subsequent construction, backfilling, and compaction requirements presented in the preceding sections. The requirement for control of groundwater should particularly be anticipated for footing and utility excavations. The actual method(s) of dewatering should be determined by the contractor. However, regardless of the method(s) used, we suggest drawing down the water table sufficiently, say 2 to 3 feet, below the bottom of any excavation or compaction surface to preclude "pumping" and/or compaction-related problems with the foundation soils.

General – Drilled Shaft Parameters

We understand that drilled shaft foundations may be designed for this project. For this purpose, classification in accordance with the Unified Soil Classification System, along with estimates of the unit weights, the angles of internal friction, and the moduli of lateral subgrade reaction for the types of soil encountered in the borings are presented in Table 1. The following should be noted when reviewing Table 1:

- $\gamma_{\text{Buoyant}} = \gamma_{\text{Sat}} - \gamma_{\text{Water}}$
- Values given in Table 1 are based on empirical correlations with the average soil conditions encountered in the referenced boring. Appropriate safety factors should be used with these values.

We caution that the soil layers shown in Table 1 are very generalized and should be used for design purposes only. The soil stratigraphy on the boring profiles (Figures 3 through 5) is more detailed than presented in Table 1. The information in Table 1 should not be used for assessing the constructability of the structure foundations.

Retention Pond

We understand that a dry bottom retention pond is planned. For this study, soil conditions were explored in the proposed pond area with 2 hand auger borings to a depth of 5 feet.

Soil Profile and Soil Permeability

The fine sand (Stratum 1 on Figures 3 through 5) are generally considered to be relatively permeable. The underlying fine sand with clay, silty clayey fine sand, clayey fine sand and clay (Strata 3, 4, 5 and 6 on Figures 3 through 5) are likely less permeable than the fine sand and fine sand with silt and should be considered to be aquitards for retention pond drawdown evaluation. The fine sand with silt (Stratum 2 on Figures 3 through 5) is likely less permeable than the fine sand, but more permeable than the fine sand with clay, silty clayey fine sand, clayey fine sand and clay.

The results of the falling head field permeability tests are presented in the following table:

Test Location	Test Depth (feet)	Measured Permeability (feet/day)
B-4 (vert.)	1 – 1.5	40
B-4 (horiz.)	1	40
B-5 (vert.)	1 – 1.5	40
B-5 (horiz.)	1	40

QUALITY ASSURANCE

We recommend establishing a comprehensive quality assurance program to verify that all site preparation and foundation construction is conducted in accordance with the appropriate plans and specifications. Materials testing and inspection services should be provided by Ardaman & Associates.

As a minimum, an on-site engineering technician should monitor all stripping and grubbing to verify that all deleterious materials have been removed and should observe the proof-rolling operation to verify that the appropriate number of passes are applied to the subgrade. In-situ density tests should be conducted during filling activities and below all foundations to verify that the required densities have been achieved. In-situ density values should be compared to laboratory Proctor moisture-density results for each of the different natural and fill soils encountered.

Finally, we recommend inspecting and testing the construction materials for the foundations and other structural components.

CLOSURE

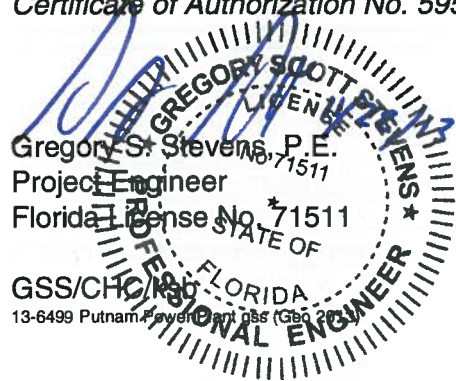
The analyses and recommendations submitted herein are based on the data obtained from the soil borings presented on Figures 3 through 5 and the assumed loading conditions. This report does not reflect any variations which may occur adjacent to or between the borings. The nature and extent of the variations between the borings may not become evident until during construction. If variations then appear evident, it will be necessary to re-evaluate the recommendations presented in this report after performing on-site observations during the construction period and noting the characteristics of the variations.

This study is based on a relatively shallow exploration and is not intended to be an evaluation for sinkhole potential. This study does not include an evaluation of the environmental (ecological or hazardous/toxic material related) condition of the site and subsurface.

This report has been prepared for the exclusive use of Florida Power & Light in accordance with generally accepted geotechnical engineering practices. In the event any changes occur in the design, nature, or location of the proposed facility, we should review the applicability of conclusions and recommendations in this report. We recommend a general review of final design and specifications by our office to verify that earthwork and foundation recommendations are properly interpreted and implemented in the design specifications. Ardaman and Associates should attend the pre-bid and preconstruction meetings to verify that the bidders/contractor understand the recommendations contained in this report.

We are pleased to be of assistance to you on this phase of the project. When we may be of further service to you or should you have any questions, please contact us.

Very truly yours,
ARDAMAN & ASSOCIATES, INC.
Certificate of Authorization No. 5950


GREGORY S. STEVENS
P.E.
Project Engineer
Florida License No. 71511
STATE OF FLORIDA
PROFESSIONAL ENGINEER

GSS/CHC/KSD
13-6499 Putnam Power Plant GSS (Geo)


Charles H. Cunningham, P.E.
Orlando Branch Manager
Florida License No. 38189

TABLE 1

**Recommended Design Soil Parameters
Putnam Power Plant
East Palatka, Putnam County, Florida**

Boring No.	Depth Below Ground Surface (ft)	Soil Type ¹	Avg. SPT "N" Values	Moist Unit Weight, γ_{moist} (pcf)	Saturated Unit Weight, γ_{Sat} (pcf)	Angle of Internal Friction ² (degrees)	Cohesion (psf)	Modulus of Lateral Subgrade Reaction ³ (pci)
B-1	0 – 12.5	SP	2	100	108	29	--	20
	12.5 – 42.5	SP, SP-SC, SM/SC	0	100	108	28	--	0
	42.5 – 47.5	SC	12	108	116	31	--	35
	47.5 – 52.5	CH	8	104	111	--	1,000	233
	52.5 – 57.5	SP-SC	13	106	114	31	--	38
	57.5 – 62.5	CH	7	104	111	--	888	167
	62.5 – 80	SM/SC, SC	10	107	115	31	--	29
	80 - 85	SM/SC	60	120	128	34	--	125
B-3	0 – 3	SP	3	101	109	29	--	20
	3 – 7.5	SP-SM	8	104	112	30	--	23
	7.5 – 27.5	SP, SP-SC	34	110	118	34	--	106
	27.5 - 30	CH	4	102	109	--	500	53
B-6	0 – 12.5	SP	9	102	110	30	--	26
	12.5 – 27.5	SP	38	109	117	34	--	119
	27.5 – 30	CH	4	102	109	--	500	53

(1) Unified Soil Classification System (refer to Figure 3).

(2) Reference: after Teng. 1962

(3) Values shown are in units of: lb/in³, Reference: FHWA IP-84-11 Handbook on Design of Piles and drilled shafts under lateral loads.

(4) $\gamma_{\text{Buoyant}} = \gamma_{\text{Sat}} - \gamma_{\text{Water}}$

TABLE 1

**Recommended Design Soil Parameters
Putnam Power Plant
East Palatka, Putnam County, Florida**

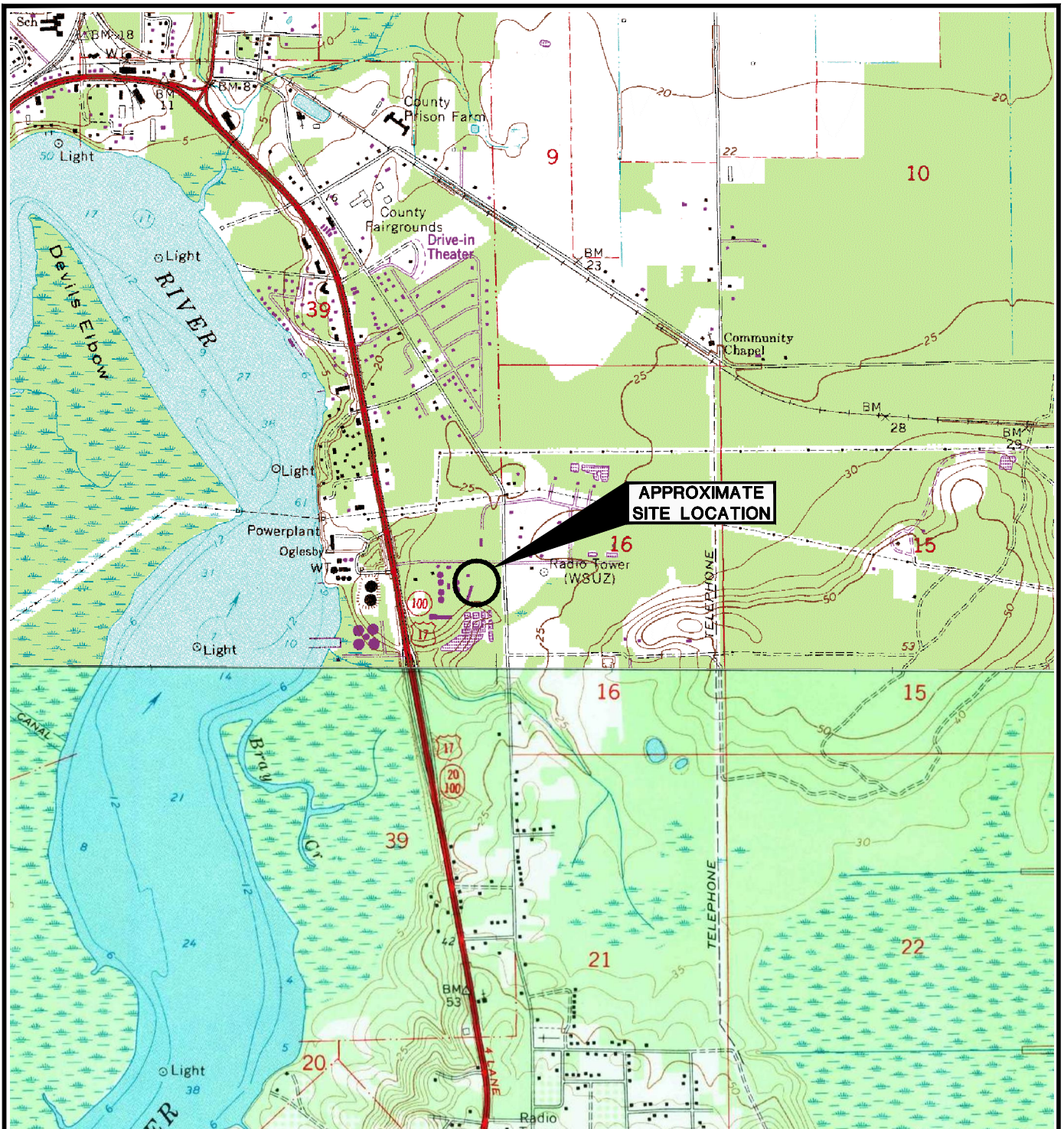
Boring No.	Depth Below Ground Surface (ft)	Soil Type ¹	Avg. SPT "N" Values	Moist Unit Weight, γ_{moist} (pcf)	Saturated Unit Weight, γ_{Sat} (pcf)	Angle of Internal Friction ² (degrees)	Cohesion (psf)	Modulus of Lateral Subgrade Reaction ³ (pci)
B-7	0 – 12.5	SP	12	103	111	31	--	35
	12.5 – 17.5	SP	22	105	113	32	--	67
	17.5 - 30	SP	40	110	118	34	--	125
B-8	0 – 12.5	SP	7	102	110	30	--	20
	12.5 – 17.5	SP	15	104	112	31	--	45
	17.5 - 30	SP	46	111	119	34	--	125

(1) Unified Soil Classification System (refer to Figure 3).

(2) Reference: after Teng. 1962

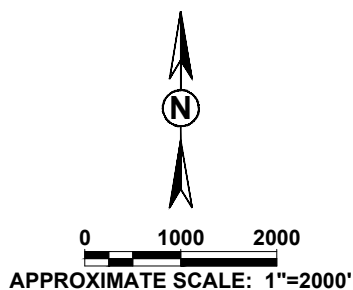
(3) Values shown are in units of: lb/in³, Reference: FHWA IP-84-11 Handbook on Design of Piles and drilled shafts under lateral loads.

(4) $\gamma_{\text{Buoyant}} = \gamma_{\text{Sat}} - \gamma_{\text{Water}}$



SECTION 16
TOWNSHIP 10 SOUTH
RANGE 27 EAST

OBTAINED FROM U.S.G.S. QUAD MAP: HASTINGS, FLORIDA 1992



QUADRANGLE LOCATION

SITE LOCATION MAP



Ardaman & Associates, Inc.
Geotechnical, Environmental and
Materials Consultants

**SUBSURFACE SOIL EXPLORATION
PUTNAM POWER PLANT
380 S. HIGHWAY 17
EAST PALATKA, PUTNAM COUNTY, FLORIDA**

DRAWN BY: CD	CHECKED BY:	DATE: 11/06/13
FILE NO. 13-6499	APPROVED BY:	FIGURE: 1

T:\Orlando\13-6499\13649902.dwg 11/22/2013 9:51:27 AM, Chris.Drew



LEGEND

- TH STANDARD PENETRATION TEST (SPT) BORING LOCATION
- AB AUGER BORING LOCATION
- NOTE: THE AERIAL PHOTOGRAPH FOR THE BORING LOCATION PLAN WAS OBTAINED FROM GOOGLE EARTH PRO, DATED 03/28/13.



0 50 100

APPROXIMATE SCALE: 1"=100'

BORING LOCATION PLAN



**SUBSURFACE SOIL EXPLORATION
PUTNAM POWER PLANT
380 S. HIGHWAY 17
EAST PALATKA, PUTNAM COUNTY, FLORIDA**

DRAWN BY: CD	CHECKED BY:	DATE: 11/06/13
FILE NO. 13-6499	APPROVED BY:	FIGURE: 2

LEGEND

SOIL DESCRIPTIONS

- 1

FINE SAND (SP)
- 2

FINE SAND WITH SILT (SP-SM)
- 3

FINE SAND WITH CLAY (SP-SC)
- 4

SILTY CLAYEY FINE SAND (SM/SC)
- 5

CLAYEY FINE SAND (SC)
- 6

CLAY (CH)
- 7

ORGANIC TOPSOIL

COLORS

- A

LIGHT BROWN TO BROWN
- B

LIGHT GRAY TO GRAY

- NSTANDARD PENETRATION RESISTANCE IN BLOWS PER FOOT
- GROUNDWATER LEVEL MEASURED ON DATE DRILLED
- WOR SAMPLER ADVANCED BY STATIC WEIGHT OF RODS ONLY
- WOH SAMPLER ADVANCED BY STATIC WEIGHT OF HAMMER AND RODS ONLY
- 50/3 50 BLOWS FOR 3-INCHES PENETRATION INTO SOIL

SP,SP-SM
SM,SC,CH

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D-2487)

- NOTES: 1. UPON COMPLETION OF EACH SPT BORING, THE BOREHOLE WAS GROUTED WITH CEMENT-BENTONITE SLURRY.
2. UPON COMPLETION OF EACH HAND AUGER BORING, THE BOREHOLE WAS BACKFILLED WITH SOIL CUTTINGS.
3. ALL SPT BORINGS WERE PERFORMED USING A SAFETY HAMMER IN THE UPPER 10 FEET AND AN AUTOMATIC HAMMER BELOW 10 FEET TO THE BORING TERMINATION DEPTH. AUTOMATIC HAMMER N-VALUES MAY BE CONVERTED TO EQUIVALENT SAFETY HAMMER N-VALUES BY MULTIPLYING BY 1.24.
4. SHELL TO 1/4-INCH SIZE UNLESS NOTED OTHERWISE ON THE BORING PROFILE.

ENGINEERING CLASSIFICATION

I COHESIONLESS SOILS

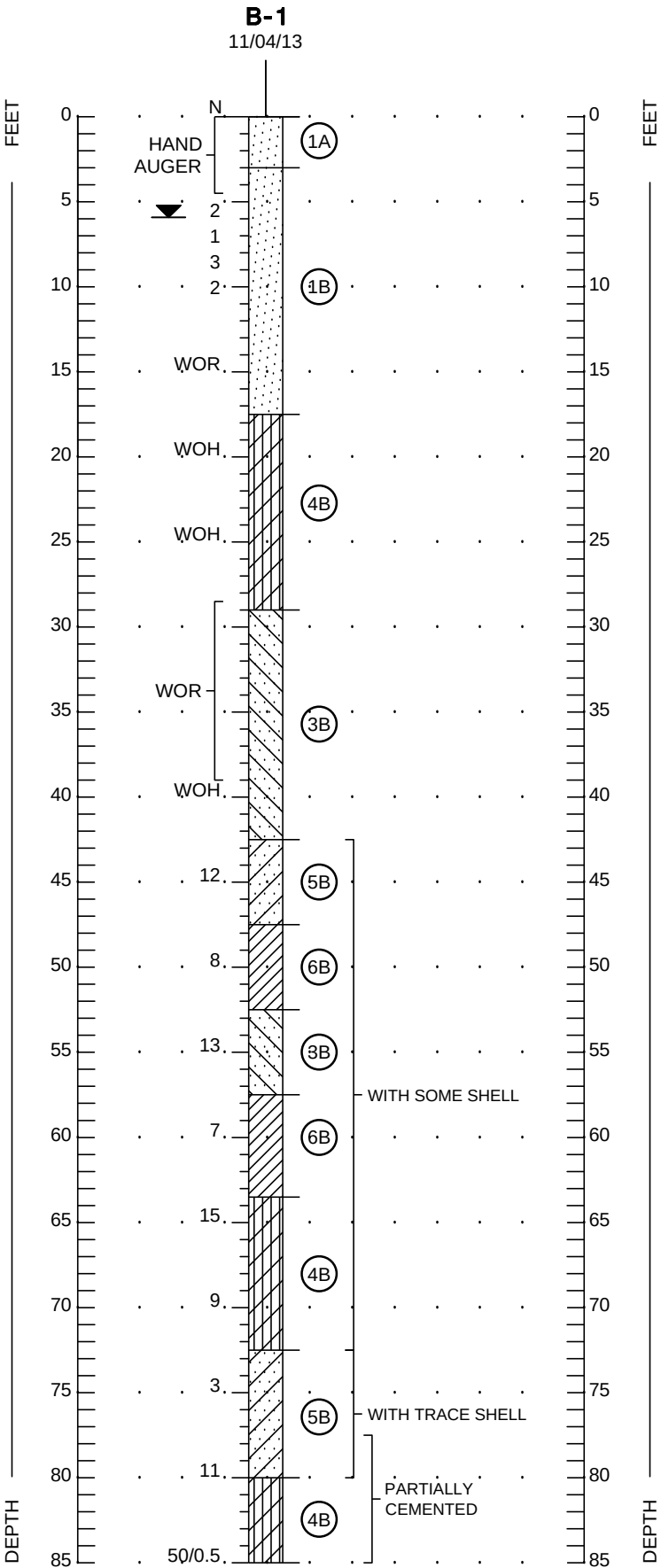
DESCRIPTION	BLOW COUNT "N"
VERY LOOSE	<4
LOOSE	4 TO 10
MEDIUM DENSE	10 TO 30
DENSE	30 TO 50
VERY DENSE	>50

II COHESIVE SOILS

DESCRIPTION	UNCONFINED COMPRESSIVE STRENGTH, QU, TSF	BLOW COUNT "N"
VERY SOFT	<1/4	<2
SOFT	1/4 TO 1/2	2 TO 4
MEDIUM STIFF	1/2 TO 1	4 TO 8
STIFF	1 TO 2	8 TO 15
VERY STIFF	2 TO 4	15 TO 30
HARD	>4	>30

WHILE THE BORINGS ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT THEIR RESPECTIVE LOCATIONS AND FOR THEIR RESPECTIVE VERTICAL REACHES, LOCAL VARIATIONS CHARACTERISTIC OF THE SUBSURFACE MATERIALS OF THE REGION ARE ANTICIPATED AND MAY BE ENCOUNTERED. THE BORING LOGS AND RELATED INFORMATION ARE BASED ON THE DRILLER'S LOGS AND VISUAL EXAMINATION OF SELECTED SAMPLES IN THE LABORATORY. THE DELINEATION BETWEEN SOIL TYPES SHOWN ON THE LOGS IS APPROXIMATE AND THE DESCRIPTION REPRESENTS OUR INTERPRETATION OF SUBSURFACE CONDITIONS AT THE DESIGNATED BORING LOCATIONS ON THE PARTICULAR DATE DRILLED.

GROUNDWATER ELEVATIONS SHOWN ON THE BORING LOGS REPRESENT GROUNDWATER SURFACES ENCOUNTERED ON THE DATES SHOWN. FLUCTUATIONS IN WATER TABLE LEVELS SHOULD BE ANTICIPATED THROUGHOUT THE YEAR.



SHELL CONTENT

- TRACE: <5%
- FEW: 5 TO 10%
- LITTLE: 15 TO 25%
- SOME: 30 TO 45%
- MOSTLY: 50 TO 100%

SOIL BORING PROFILES



SUBSURFACE SOIL EXPLORATION
PUTNAM POWER PLANT
380 S. HIGHWAY 17
EAST PALATKA, PUTNAM COUNTY, FLORIDA

DRAWN BY: CD	CHECKED BY:	DATE: 11/06/13
FILE NO. 13-6499	APPROVED BY:	FIGURE: 3

LEGEND

SOIL DESCRIPTIONS

- 1

FINE SAND (SP)
- 2

FINE SAND WITH SILT (SP-SM)
- 3

FINE SAND WITH CLAY (SP-SC)
- 4

SILTY CLAYEY FINE SAND (SM/SC)
- 5

CLAYEY FINE SAND (SC)
- 6

CLAY (CH)
- 7

ORGANIC TOPSOIL

COLORS

- A

LIGHT BROWN TO BROWN
- B

LIGHT GRAY TO GRAY

- N

STANDARD PENETRATION RESISTANCE IN BLOWS PER FOOT
- GROUNDWATER LEVEL MEASURED ON DATE DRILLED
- WOR

SAMPLER ADVANCED BY STATIC WEIGHT OF RODS ONLY
- WOH

SAMPLER ADVANCED BY STATIC WEIGHT OF HAMMER AND RODS ONLY
- 50/3

50 BLOWS FOR 3-INCHES PENETRATION INTO SOIL

SP,SP-SM
SM,SC,CH

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D-2487)

- NOTES: 1. UPON COMPLETION OF EACH SPT BORING, THE BOREHOLE WAS GROUTED WITH CEMENT-BENTONITE SLURRY.
2. UPON COMPLETION OF EACH HAND AUGER BORING, THE BOREHOLE WAS BACKFILLED WITH SOIL CUTTINGS.
3. ALL SPT BORINGS WERE PERFORMED USING A SAFETY HAMMER IN THE UPPER 10 FEET AND AN AUTOMATIC HAMMER BELOW 10 FEET TO THE BORING TERMINATION DEPTH. AUTOMATIC HAMMER N-VALUES MAY BE CONVERTED TO EQUIVALENT SAFETY HAMMER N-VALUES BY MULTIPLYING BY 1.24.
4. SHELL TO 1/4-INCH SIZE UNLESS NOTED OTHERWISE ON THE BORING PROFILE.

ENGINEERING CLASSIFICATION

I COHESIONLESS SOILS

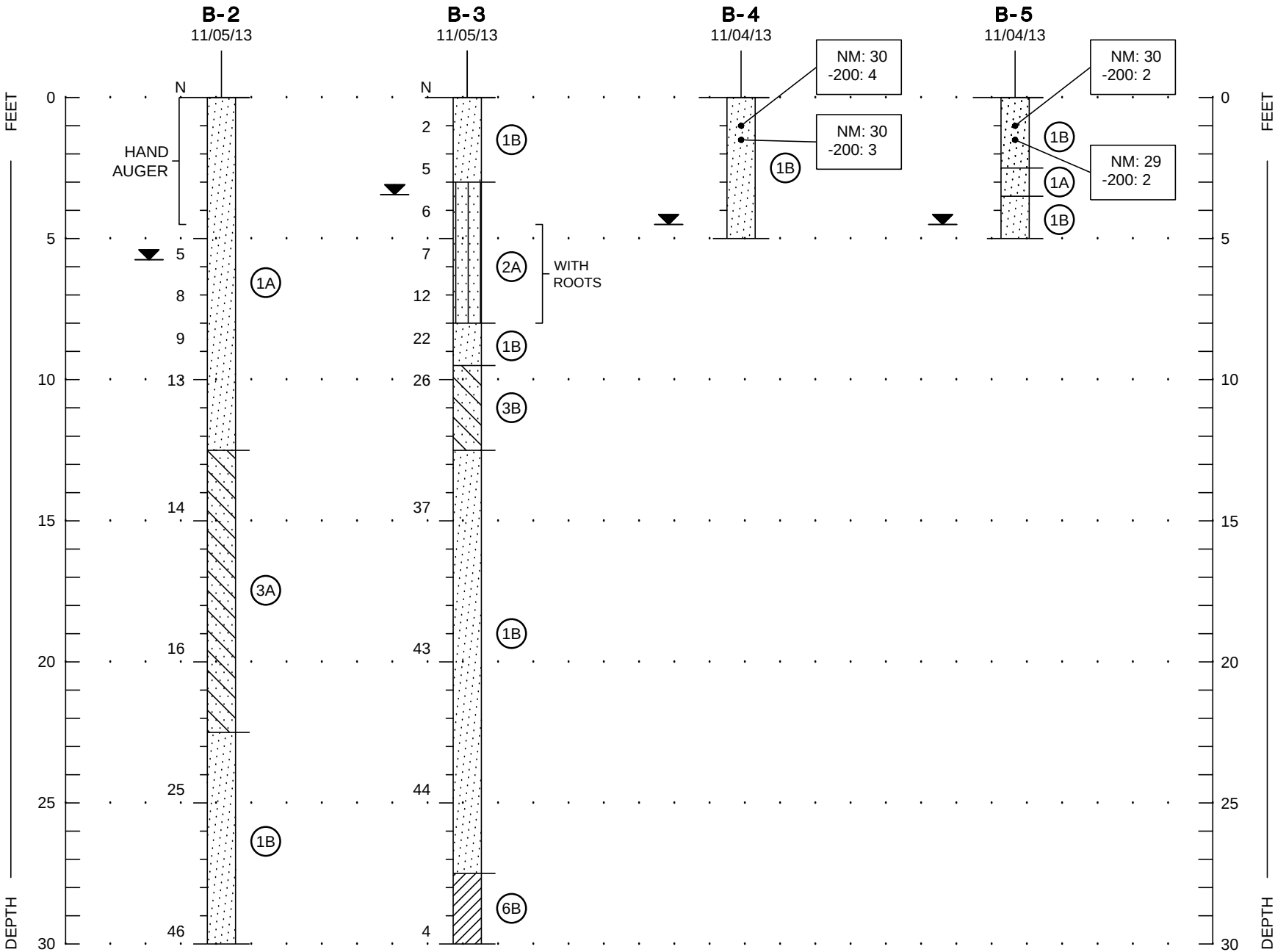
DESCRIPTION	BLOW COUNT "N"
VERY LOOSE	<4
LOOSE	4 TO 10
MEDIUM DENSE	10 TO 30
DENSE	30 TO 50
VERY DENSE	>50

II COHESIVE SOILS

DESCRIPTION	UNCONFINED COMPRESSIVE STRENGTH, QU, TSF	BLOW COUNT "N"
VERY SOFT	<1/4	<2
SOFT	1/4 TO 1/2	2 TO 4
MEDIUM STIFF	1/2 TO 1	4 TO 8
STIFF	1 TO 2	8 TO 15
VERY STIFF	2 TO 4	15 TO 30
HARD	>4	>30

WHILE THE BORINGS ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT THEIR RESPECTIVE LOCATIONS AND FOR THEIR RESPECTIVE VERTICAL REACHES, LOCAL VARIATIONS CHARACTERISTIC OF THE SUBSURFACE MATERIALS OF THE REGION ARE ANTICIPATED AND MAY BE ENCOUNTERED. THE BORING LOGS AND RELATED INFORMATION ARE BASED ON THE DRILLER'S LOGS AND VISUAL EXAMINATION OF SELECTED SAMPLES IN THE LABORATORY. THE DELINEATION BETWEEN SOIL TYPES SHOWN ON THE LOGS IS APPROXIMATE AND THE DESCRIPTION REPRESENTS OUR INTERPRETATION OF SUBSURFACE CONDITIONS AT THE DESIGNATED BORING LOCATIONS ON THE PARTICULAR DATE DRILLED.

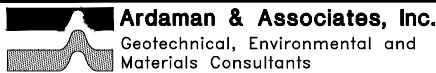
GROUNDWATER ELEVATIONS SHOWN ON THE BORING LOGS REPRESENT GROUNDWATER SURFACES ENCOUNTERED ON THE DATES SHOWN. FLUCTUATIONS IN WATER TABLE LEVELS SHOULD BE ANTICIPATED THROUGHOUT THE YEAR.



SHELL CONTENT

TRACE: <5%
FEW: 5 TO 10%
LITTLE: 15 TO 25%
SOME: 30 TO 45%
MOSTLY: 50 TO 100%

SOIL BORING PROFILES



SUBSURFACE SOIL EXPLORATION
PUTNAM POWER PLANT
380 S. HIGHWAY 17
EAST PALATKA, PUTNAM COUNTY, FLORIDA

DRAWN BY: CD	CHECKED BY:	DATE: 11/06/13
FILE NO. 13-6499	APPROVED BY:	FIGURE: 4

LEGEND

SOIL DESCRIPTIONS

- ① FINE SAND (SP)
- ② FINE SAND WITH SILT (SP-SM)
- ③ FINE SAND WITH CLAY (SP-SC)
- ④ SILTY CLAYEY FINE SAND (SM/SC)
- ⑤ CLAYEY FINE SAND (SC)
- ⑥ CLAY (CH)
- ⑦ ORGANIC TOPSOIL

COLORS

- (A) LIGHT BROWN TO BROWN
- (B) LIGHT GRAY TO GRAY

- N STANDARD PENETRATION RESISTANCE IN BLOWS PER FOOT
- ▽ GROUNDWATER LEVEL MEASURED ON DATE DRILLED
- WOR SAMPLER ADVANCED BY STATIC WEIGHT OF RODS ONLY
- WOH SAMPLER ADVANCED BY STATIC WEIGHT OF HAMMER AND RODS ONLY
- 50/3 50 BLOWS FOR 3-INCHES PENETRATION INTO SOIL

SP,SP-SM UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D-2487)
SM,SC,CH

- NOTES:
- UPON COMPLETION OF EACH SPT BORING, THE BOREHOLE WAS GROUTED WITH CEMENT-BENTONITE SLURRY.
 - UPON COMPLETION OF EACH HAND AUGER BORING, THE BOREHOLE WAS BACKFILLED WITH SOIL CUTTINGS.
 - ALL SPT BORINGS WERE PERFORMED USING A SAFETY HAMMER IN THE UPPER 10 FEET AND AN AUTOMATIC HAMMER BELOW 10 FEET TO THE BORING TERMINATION DEPTH. AUTOMATIC HAMMER N-VALUES MAY BE CONVERTED TO EQUIVALENT SAFETY HAMMER N-VALUES BY MULTIPLYING BY 1.24.
 - SHELL TO 1/4-INCH SIZE UNLESS NOTED OTHERWISE ON THE BORING PROFILE.

ENGINEERING CLASSIFICATION

I COHESIONLESS SOILS

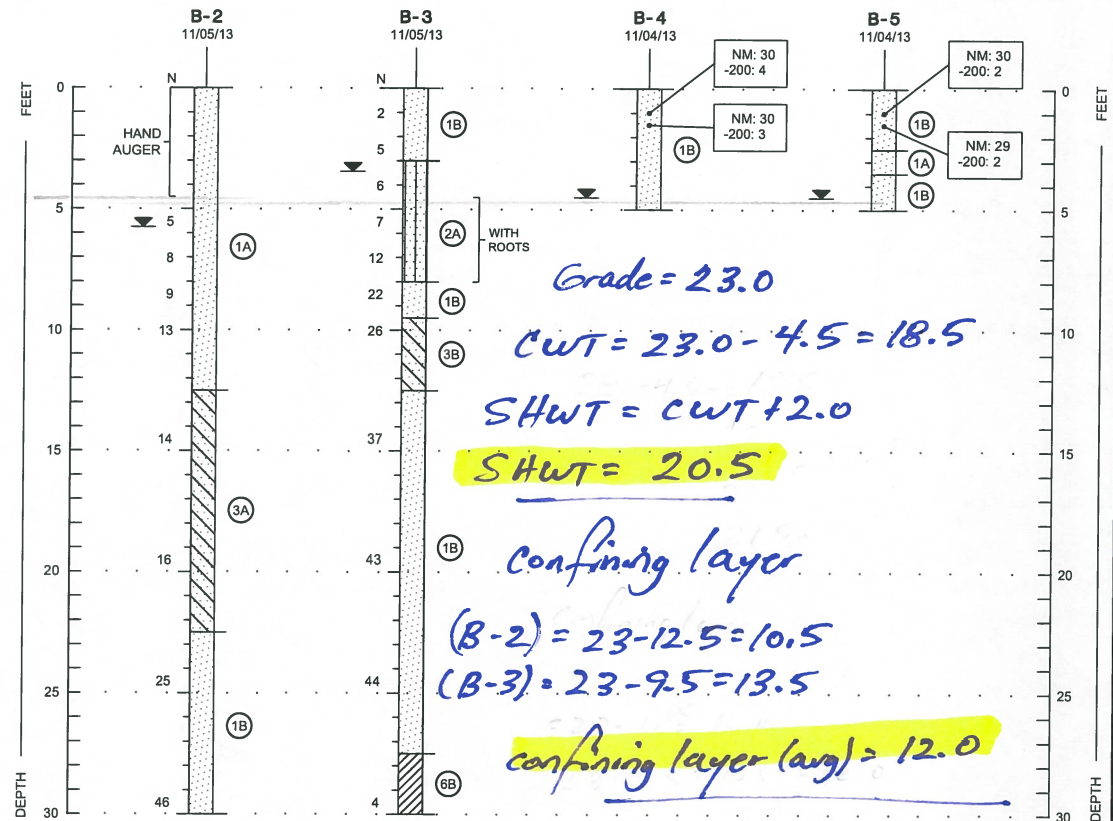
DESCRIPTION	BLOW COUNT "N"
VERY LOOSE	<4
LOOSE	4 TO 10
MEDIUM DENSE	10 TO 30
DENSE	30 TO 50
VERY DENSE	>50

II COHESIVE SOILS

DESCRIPTION	UNCONFINED COMPRESSIVE STRENGTH, QU, TSF	BLOW COUNT "N"
VERY SOFT	<1/4	<2
SOFT	1/4 TO 1/2	2 TO 4
MEDIUM STIFF	1/2 TO 1	4 TO 8
STIFF	1 TO 2	8 TO 15
VERY STIFF	2 TO 4	15 TO 30
HARD	>4	>30

WHILE THE BORINGS ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT THEIR RESPECTIVE LOCATIONS AND FOR THEIR RESPECTIVE VERTICAL REACHES, LOCAL VARIATIONS CHARACTERISTIC OF THE SUBSURFACE MATERIALS OF THE REGION ARE ANTICIPATED AND MAY BE ENCOUNTERED. THE BORING LOGS AND RELATED INFORMATION ARE BASED ON THE DRILLER'S LOGS AND VISUAL EXAMINATION OF SELECTED SAMPLES IN THE LABORATORY. THE DELINEATION BETWEEN SOIL TYPES SHOWN ON THE LOGS IS APPROXIMATE AND THE DESCRIPTION REPRESENTS OUR INTERPRETATION OF SUBSURFACE CONDITIONS AT THE DESIGNATED BORING LOCATIONS ON THE PARTICULAR DATE DRILLED.

GROUNDWATER ELEVATIONS SHOWN ON THE BORING LOGS REPRESENT GROUNDWATER SURFACES ENCOUNTERED ON THE DATES SHOWN. FLUCTUATIONS IN WATER TABLE LEVELS SHOULD BE ANTICIPATED THROUGHOUT THE YEAR.



SOIL BORING PROFILES

Ardaman & Associates, Inc.
Geotechnical, Environmental and
Materials Consultants

SUBSURFACE SOIL EXPLORATION
PUTNAM POWER PLANT
380 S. HIGHWAY 17
EAST PALATKA, PUTNAM COUNTY, FLORIDA

DRAWN BY: CD CHECKED BY: DATE: 11/08/13
FILE NO. 13-6489 APPROVED BY: FIGURE: 4

LEGEND

SOIL DESCRIPTIONS

- 1

FINE SAND (SP)
- 2

FINE SAND WITH SILT (SP-SM)
- 3

FINE SAND WITH CLAY (SP-SC)
- 4

SILTY CLAYEY FINE SAND (SM/SC)
- 5

CLAYEY FINE SAND (SC)
- 6

CLAY (CH)
- 7

ORGANIC TOPSOIL

COLORS

- A

LIGHT BROWN TO BROWN
- B

LIGHT GRAY TO GRAY

- N

STANDARD PENETRATION RESISTANCE IN BLOWS PER FOOT
- GROUNDWATER LEVEL MEASURED ON DATE DRILLED
- WOR

SAMPLER ADVANCED BY STATIC WEIGHT OF RODS ONLY
- WOH

SAMPLER ADVANCED BY STATIC WEIGHT OF HAMMER AND RODS ONLY
- 50/3

50 BLOWS FOR 3-INCHES PENETRATION INTO SOIL

SP,SP-SM
SM,SC,CH
UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D-2487)

- NOTES: 1. UPON COMPLETION OF EACH SPT BORING, THE BOREHOLE WAS GROUTED WITH CEMENT-BENTONITE SLURRY.
2. UPON COMPLETION OF EACH HAND AUGER BORING, THE BOREHOLE WAS BACKFILLED WITH SOIL CUTTINGS.
3. ALL SPT BORINGS WERE PERFORMED USING A SAFETY HAMMER IN THE UPPER 10 FEET AND AN AUTOMATIC HAMMER BELOW 10 FEET TO THE BORING TERMINATION DEPTH. AUTOMATIC HAMMER N-VALUES MAY BE CONVERTED TO EQUIVALENT SAFETY HAMMER N-VALUES BY MULTIPLYING BY 1.24.
4. SHELL TO 1/4-INCH SIZE UNLESS NOTED OTHERWISE ON THE BORING PROFILE.

ENGINEERING CLASSIFICATION

I COHESIONLESS SOILS

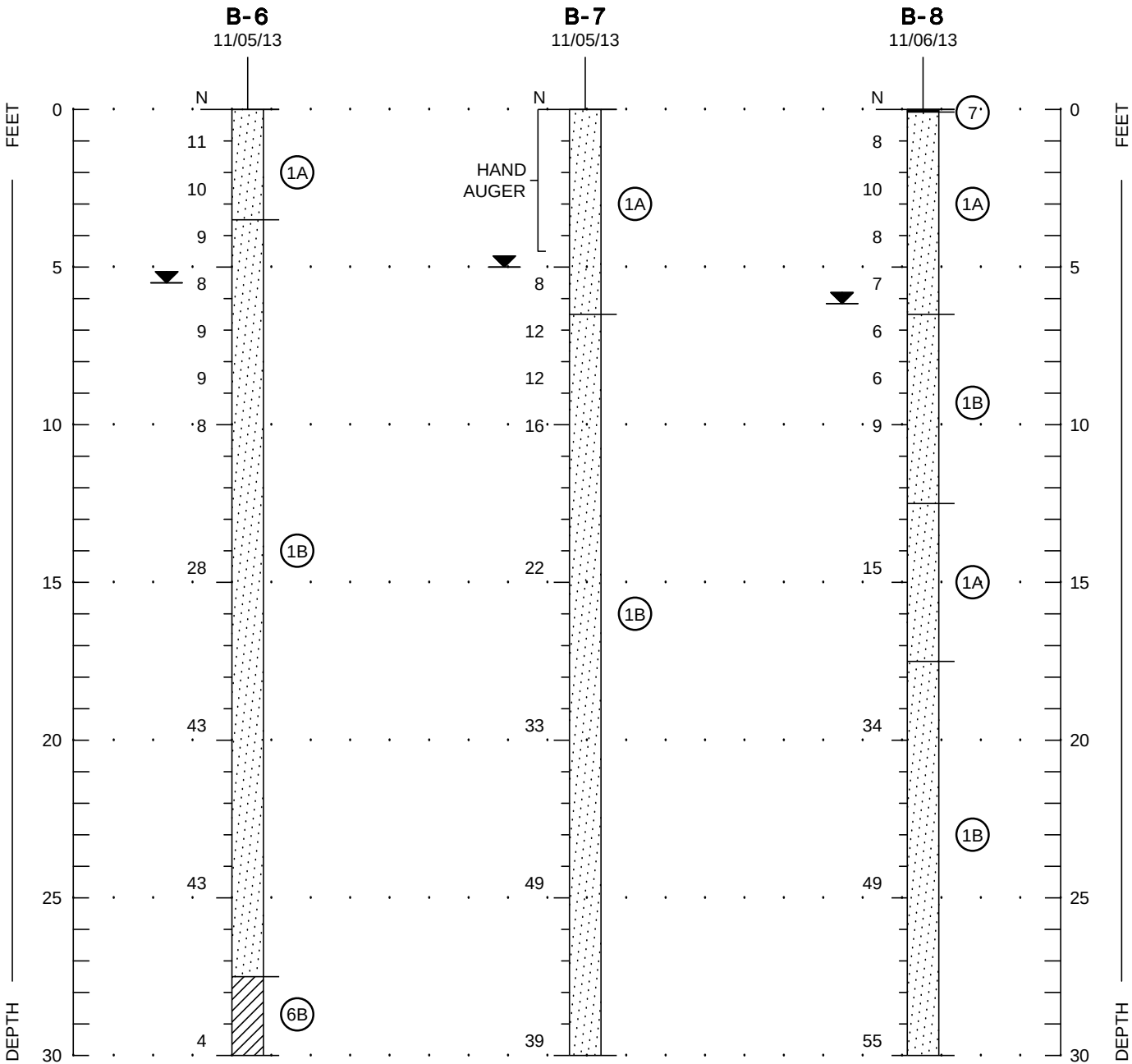
DESCRIPTION	BLOW COUNT "N"
VERY LOOSE	<4
LOOSE	4 TO 10
MEDIUM DENSE	10 TO 30
DENSE	30 TO 50
VERY DENSE	>50

II COHESIVE SOILS

DESCRIPTION	UNCONFINED COMPRESSIVE STRENGTH, QU, TSF	BLOW COUNT "N"
VERY SOFT	<1/4	<2
SOFT	1/4 TO 1/2	2 TO 4
MEDIUM STIFF	1/2 TO 1	4 TO 8
STIFF	1 TO 2	8 TO 15
VERY STIFF	2 TO 4	15 TO 30
HARD	>4	>30

WHILE THE BORINGS ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT THEIR RESPECTIVE LOCATIONS AND FOR THEIR RESPECTIVE VERTICAL REACHES, LOCAL VARIATIONS CHARACTERISTIC OF THE SUBSURFACE MATERIALS OF THE REGION ARE ANTICIPATED AND MAY BE ENCOUNTERED. THE BORING LOGS AND RELATED INFORMATION ARE BASED ON THE DRILLER'S LOGS AND VISUAL EXAMINATION OF SELECTED SAMPLES IN THE LABORATORY. THE DELINEATION BETWEEN SOIL TYPES SHOWN ON THE LOGS IS APPROXIMATE AND THE DESCRIPTION REPRESENTS OUR INTERPRETATION OF SUBSURFACE CONDITIONS AT THE DESIGNATED BORING LOCATIONS ON THE PARTICULAR DATE DRILLED.

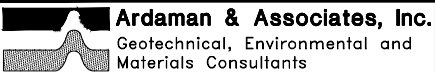
GROUNDWATER ELEVATIONS SHOWN ON THE BORING LOGS REPRESENT GROUNDWATER SURFACES ENCOUNTERED ON THE DATES SHOWN. FLUCTUATIONS IN WATER TABLE LEVELS SHOULD BE ANTICIPATED THROUGHOUT THE YEAR.



SHELL CONTENT

TRACE: <5%
FEW: 5 TO 10%
LITTLE: 15 TO 25%
SOME: 30 TO 45%
MOSTLY: 50 TO 100%

SOIL BORING PROFILES



SUBSURFACE SOIL EXPLORATION
PUTNAM POWER PLANT
380 S. HIGHWAY 17
EAST PALATKA, PUTNAM COUNTY, FLORIDA

DRAWN BY: CD	CHECKED BY:	DATE: 11/06/13
FILE NO. 13-6499	APPROVED BY:	FIGURE: 5

APPENDIX

Standard Penetration Test and Auger Boring Procedures

STANDARD PENETRATION TEST

The standard penetration test is a widely accepted test method of *in situ* testing of foundation soils (ASTM D 1586). A 2-foot long, 2-inch O.D. split-barrel sampler attached to the end of a string of drilling rods is driven 18 inches into the ground by successive blows of a 140-pound hammer freely dropping 30 inches. The number of blows needed for each 6 inches of penetration is recorded. The sum of the blows required for penetration of the second and third 6-inch increments of penetration constitutes the test result or N-value. After the test, the sampler is extracted from the ground and opened to allow visual examination and classification of the retained soil sample. The N-value has been empirically correlated with various soil properties allowing a conservative estimate of the behavior of soils under load.

The tests are usually performed at 5-foot intervals. However, more frequent or continuous testing is done by our firm through depths where a more accurate definition of the soils is required. The test holes are advanced to the test elevations by rotary drilling with a cutting bit, using circulating fluid to remove the cuttings and hold the fine grains in suspension. The circulating fluid, which is a bentonitic drilling mud, is also used to keep the hole open below the water table by maintaining an excess hydrostatic pressure inside the hole. In some soil deposits, particularly highly pervious ones, NX-size flush-coupled casing must be driven to just above the testing depth to keep the hole open and/or prevent the loss of circulating fluid.

Representative split-spoon samples from the soils at every 5 feet of drilled depth and from every different stratum are brought to our laboratory in air-tight jars for further evaluation and testing, if necessary. Samples not used in testing are stored for 30 days prior to being discarded. After completion of a test boring, the hole is kept open until a steady state groundwater level is recorded. The hole is then sealed, if necessary, and backfilled.

AUGER BORINGS

Auger borings are used when a relatively large, continuous sampling of soil strata close to ground surface is desired. A 4-inch diameter, continuous flite, helical auger with a cutting head at its end is screwed into the ground in 5-foot sections. It is powered by the rotating action of the Kelly bar of a rotary drill rig. The sample is recovered by withdrawing the auger out of the ground without rotating it. The soil sample so obtained, is classified and representative samples put in bags or jars and brought back to the laboratory for classification testing.