

**SR 710 Stormwater Treatment Area/Regional Pond Feasibility Study
Preliminary Submittal**

**Financial Project ID
432644-1-32-01**

Okeechobee County, Florida

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October 6, 2014

PROFESSIONAL ENGINEER CERTIFICATION

I hereby certify that I am a registered professional engineer in the State of Florida practicing engineering with **The Balmoral Group** and that I have supervised the preparation of and approve the analysis, findings, opinions, conclusions and technical advice hereby reported for:

PROJECT: SR 710 Stormwater Treatment Area/Regional Pond Feasibility Study
Financial Project ID: **432644-1-32-01**
Okeechobee County, Florida

The engineering work represented by this document was performed through the following duly authorized engineering business:

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This report provides the results of the analysis required for the feasibility study of the SR 710 Regional Pond and Stormwater Treatment Area (STA) in Okeechobee County. I acknowledge that the procedures and references used to develop the results contained in this report are standard to the professional practice of hydrologic analysis and hydraulic engineering as applied through professional judgment and experience.

Any engineering analysis, documents, conclusions or recommendations relied upon from other professional sources or provided with responsibility by the client are referenced accordingly in the following report.

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Name

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DATE: _____

Executive Summary

The proposed Florida Department of Transportation (FDOT) new alignment for State Road (SR) 710 in Okeechobee County and the City of Okeechobee is currently under design by the FDOT. During the development of the Pond Siting Report, Pond Site Location 2B and the surrounding area were identified as a possible location for a regional stormwater treatment facility that could provide greater stormwater treatment benefits to the local area, as opposed to meeting only FDOT's needs. Two teleconferences were held between the FDOT, the Florida Department of Environmental Protection (FDEP) and South Florida Water Management District (SFWMD) to brainstorm the feasibility of regional treatment and possible cooperation between the agencies. At the last meeting, it was decided that the FDOT would perform a feasibility study for two options -

1. A Regional Pond constructed by the FDOT for SR 710 that would incorporate offsite areas associated with Lower Taylor Creek.
2. A Stormwater Treatment Area (STA) with interagency cooperation connected to the L-63N Canal and Upper Taylor Creek.

The goal of the study was to research these two options, including limited data collection, reaching out to stakeholders and discussing the willingness to participate with the property owner. A statement from the property owner is included in the correspondence section (**Appendix E**) as a supplement to the August 12, 2014 Meeting Minutes. The Regional Pond Option was researched as an FDOT-only facility with regard to design and construction and does not require financial assistance from other stakeholders. The STA options were developed for review by the other stakeholders to determine their willingness to participate in the facility. The FDOT would not be the lead agency for the design or construction of the STA facility.

The Regional Pond Option will require a 26-acre pond. There are two proposed sources for offsite water to be treated. The first source is from the Airport Ditch and would require an additional cross drain under US 441. The other source would be from L-63N Canal that would require a pumped connection. The first option reduces the nutrient loading by 496 kilograms per year (kg/yr) within Lower Taylor Creek and Lake Okeechobee, while the second option reduces the nutrient loading by up to 778 kg/yr to Lake Okeechobee. The costs are expected to be similar, since the first option is gravity flow but requires an additional 10-ft-by-6-ft cross drain and right-of-way (ROW) for the Airport Ditch Extension. The STA Option will require a pump station that will have long-term operating and maintenance costs.

Three options for the STA were evaluated. These options included a Stormwater Treatment Area (Option 1), a Biosorption Activated Media (BAM) (Option 2) and Wetland Rehydration Conservation Easement (Option 3). A 50-acre STA will reduce phosphorous by up to 727 kg/yr. The reduction of phosphorous by the BAM is based on the amount used. For this study, the reduction is up to 176 kg/yr for an initial cost of \$1.1M. Option 3 may reduce the phosphorous loading by up to 144 kg/yr and includes the purchase of a conservation easement over the wetland areas that will have increased stored water.

Summary of Options

Facility	Area (Acres)	FDOT to provide Design, Const. and Maintenance	Phosphorous Removal (kg/yr)
Regional Pond Opt A	26	Yes	496
Regional Pond Opt B	26	Yes/No	168-788
STA - Option 1	60	No	Up to 727
Biosorption - Option 2	0*	No	Up to 176
Rehydration - Option 3	162.5	No	Up to 144

*May be located in existing SFWMD Easement

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1. GENERAL INFORMATION

1.1 PROJECT BACKGROUND

The State Road (SR) 710 new alignment project is located in Okeechobee County, Florida. The project is a segment of the larger SR 710 upgrade project that stretches from U.S. Highway (US) 441 in Okeechobee County to County Road (CR) 714 (S.W. Martin Highway) in Martin County. The upgrading of SR 710 is required to meet the needs of the local community in terms of improved rural connectivity, enhanced emergency capabilities and to accommodate future population and traffic growth [Florida Department of Transportation (FDOT) Project Development and Environment (PD&E) Worksheet, 2010].

The SR 710 new alignment Project in Okeechobee County and the City of Okeechobee is currently under design by the FDOT. During the development of the Pond Siting Report, Pond Site Location 2B and the surrounding area were identified as a possible location for a regional stormwater treatment facility that could provide greater stormwater treatment benefits to the local area. Two teleconferences were held between the FDOT, Florida Department of Environmental Protection (FDEP) and South Florida Water Management District (SFWMD) to brainstorm the feasibility of the regional treatment and possible cooperation between the agencies (See **Appendix E** for minutes). At the last meeting, it was decided that the FDOT would perform a feasibility study for two options:

1. A Regional Pond constructed by the FDOT for SR 710 that would treat offsite areas associated with either Lower Taylor Creek or the L-63N Canal.
2. A Stormwater Treatment Area (STA) with interagency cooperation connected to the L-63N Canal and Upper Taylor Creek.

1.2 PURPOSE OF REPORT

FDOT contracted with The Balmoral Group to prepare a STA/Regional Pond Feasibility Study for the proposed construction of the SR 710 [Financial Project Identification (FPID) 419344-3-32-01].

The purpose of the study is to research whether these two options for stormwater management of SR 710 would provide a significantly greater improvement in water quality than the standard FDOT ponds. The study included limited data collection, reaching out to stakeholders and discussing the willingness to participate with the property owner.

1.3 PROJECT LOCATION AND AREA OF STUDY

The proposed SR 710 will cross Lower Taylor Creek just east of US 441 and north of NW 13th Street located in Okeechobee County, Florida. **Plate 1** shows this specific location and **Figure 1** in **Appendix A** shows the area of study. The project uses the North American Vertical Datum of 1988 (NAVD88), and the horizontal datum for the project is Florida State Plane [North American Datum (NAD) 1983], East Zone. To

convert to NAVD88, 1.17 feet (ft) was subtracted from all National Geodetic Vertical Datum (NGVD) 29 elevations

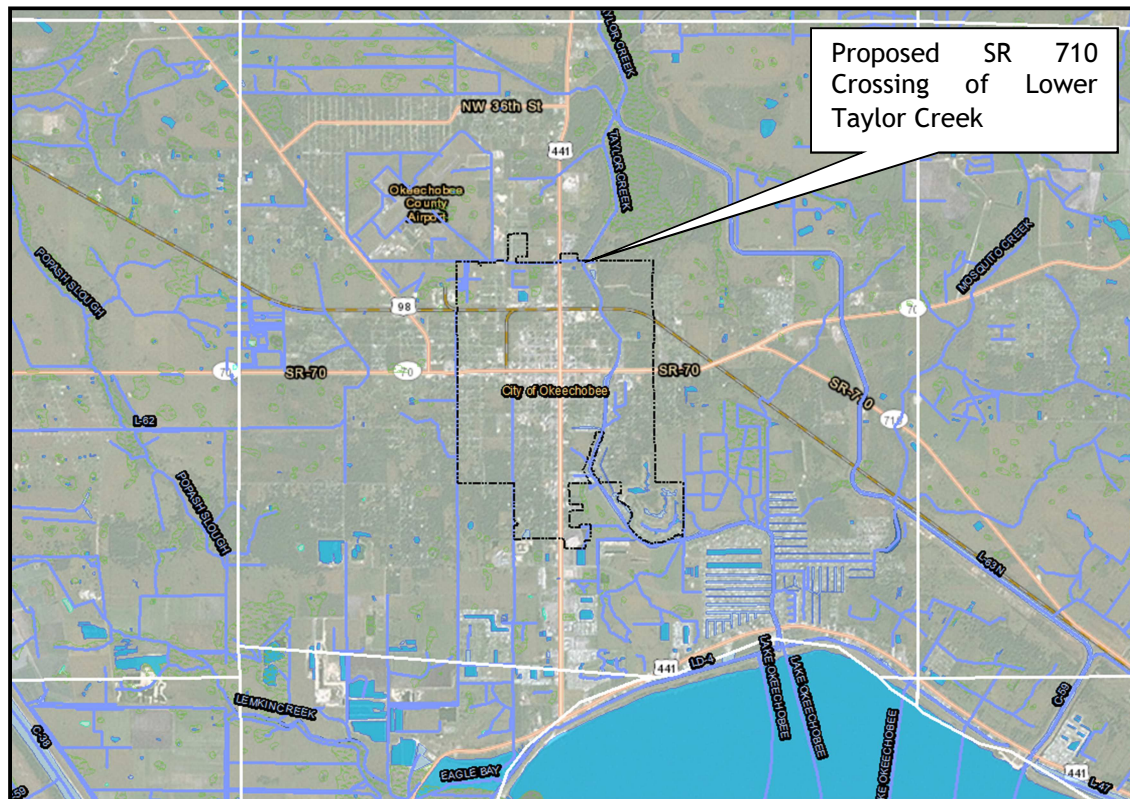


Plate 1: Taylor Creek and the City of Okeechobee

1.4 EXISTING DRAINAGE OVERVIEW

Taylor Creek is part of the Lake Okeechobee watershed (See Figure 3 in Appendix A), which drains to both the Everglades and the Gulf of Mexico through a number of canals and the Caloosahatchee River. Taylor Creek is divided by S-192 into two distinct sections - Upper Taylor Creek, north of S-192, and Lower Taylor Creek, south of S-192. Lower Taylor Creek drains a smaller area than it did historically, due to the construction of the Taylor Creek Levee (referred to as L64). The U.S. Army Corps of Engineers (USACE) built the levee in the 1960s for flood control and to divert flow into L-63N Canal. Both Lower Taylor Creek and the L-63N Canal flow into Lake Okeechobee by means of further canals, pumps and control structures. Figure 5 in Appendix A is an aerial photograph taken in 1953 before canal construction.

Upper Taylor Creek drains an area of approximately 110 square miles (to the start of the L-63N borrow canal) and predominantly drains in a north-to-south direction. Upper Taylor Creek has headwaters in central-west Okeechobee County in the White Hammock locality and flows from there through a number of artificially constructed drainage lines until a natural channel forms. At the intersection with CR 68 (NW 160th St), the creek flows into the Upper Taylor Creek Canal to the point of the Taylor Creek Levee, (S-192), where flow is diverted along the L-63N Canal. Downstream of the Taylor Creek Levee, Lower Taylor Creek, the creek is again an artificial channel to the point of the proposed SR 710 bridge crossing. At this point, Lower Taylor Creek takes the form of a natural channel until it meets structure S-133/S-193 (lock and

pump station) at Lake Okeechobee. **Plate 2** shows the location of the pumps and control structures associated with this system.



Plate 2: Location of USACE Structures

The Upper Taylor Creek basin contains a number of tributaries, namely Otter Creek, Wolff Creek and Williamson Ditch, which are primarily artificial drainage channels used for irrigation. Stages are maintained in all canals by controlling the stage in the L-63N Canal at Structure S-191 (the outlet of the L-63N Canal at Lake Okeechobee).

The normal operational drainage scenario for the Taylor Creek basin involves the diversion of flow from Upper Taylor Creek to the L-63N Canal at the location of the Upper Taylor Creek Levee and S-192 structure. S-192 prevents flow of water through the Upper Taylor Creek Levee to Lower Taylor Creek. The diverted flow then travels along the L-63N Canal to the C-59 Canal, where Structure S-191 controls discharge to Lake Okeechobee. Structure S-191 is operated to maintain a lake stage of 18.62 ft NAVD (19 ft NGVD) in the canals. S-191, C-59 Canal and L-63N Canal were designed for the 10-year storm event with a flow of 7440 cubic feet per second (cfs).

S-192 is a gated culvert and pump station at the Upper Taylor Creek Levee and start of the L-63N Canal. Its purpose is to divert flow from Upper Taylor Creek along L-63N

Canal. It is opened only for maintenance activity on L-63N Canal or to dilute low quality water in Lower Taylor Creek when Lake Okeechobee is below 12.83 ft NAVD (14 ft NGVD), allowing for gravity flow. S-192 permits back pumping from the Lower Taylor Creek into L-63N Canal in extreme flooding events. The S-192 is not designed to convey flood flows.

Lower Taylor Creek begins downstream of S-192 and flows in a southerly direction to its ultimate control structure of S-193, located 6 miles southeast of the City of Okeechobee. Structure S-192 was previously called HGS No. 6 and was left open to permit unrestricted navigation between Lake Okeechobee and Lower Taylor Creek. It was later modified to a lock structure to allow navigation when the lake regulation schedule was raised to the 15.5 to 17.5 ft NGVD range. This structure also acts as a hurricane control structure preventing hurricane tides from entering Lower Taylor Creek. There is no design flood for this structure since flood flows are discharged through adjacent pump station S-133. If the lake stage is below 12.83 ft NAVD (14 ft NGVD), S-193 is opened to allow tailwater flow from the lake to Lower Taylor Creek. The quantity introduced is pumped into the L-63N Canal at S-192 to maintain consistent stages. No standard practice of opening this structure occurs during flood conditions.

Adjacent to S-193, S-133 is a pump station with five 48-inch steel pipes that are designed to remove three-quarters of an inch of runoff per day from its tributary drainage area of 16,190 acres (25.3 square miles), resulting in a discharge of 625 cfs into Lake Okeechobee.

1.5 DRAINAGE BASIN HISTORY

A review of historical flood information was completed during the bridge hydraulics report (BHR) development for the proposed SR 710 crossing of Lower Taylor Creek. Significant flooding occurred around the lower-lying areas of Lake Okeechobee during the early 1900s. This flooding, mainly as a result of lake surges from hurricane wind forces, caused significant damage and claimed the lives of thousands of local residents. As a result, the USACE was engaged to build a system of canals, levees and locks to control water movement, as well as protect the areas surrounding the lake from storm surges.

Since USACE completed the works in the 1960s, and with strict operational standards, flooding in the area has declined in both frequency and magnitude. However, the 2013 Preliminary FEMA Flood Insurance Study (FIS) states that the existing creeks and sloughs in the area have inadequate capacities to drain local and upland areas during periods of heavy rainfall and ponding of floodwaters in those areas can be expected.

The Okeechobee 2010 Local Mitigation Strategy (LMS) noted that a number of low-lying or poorly drained areas regularly experience flooding with or without a storm. One such area is the southern portion of Okeechobee County adjacent to Lake Okeechobee. Floods have been experienced and regularly affect hundreds of homes and several roads for many days every few years (Okeechobee 2010 LMS). Available information indicates that the canals, structures and levees significantly influence the flooding problems.

1.6 PREVIOUS FLOOD STUDIES

FEMA Flood Insurance Study - Okeechobee County Florida Unincorporated Areas, August 4, 1980

The Federal Emergency Management Agency (FEMA) has published an FIS report for Okeechobee County and the incorporated areas. FEMA Federal Insurance Administration (FIA) staff with the assistance of USACE, investigated the major sources of flooding in the area of interest and the flood protection measures that were inexistent at the time of the report. Two methods were used to compute the flood stages for the S-133 basin since it presented riverine characteristics, but also acted as a large storage basin controlled by pump. The first method, a Hec-1 model, was created for the S-133 drainage basin, and peak discharges were calculated. Pumps were assumed to be operating at peak capacity with the lake level at 18.5 ft NGVD (17.33 ft NAVD). The second approach was to use a volumetric approach that compared the volume of rainfall for the design storms to the volume of water that could be pumped for a period of time. The resultant volume to be ponded was compared to a stage-storage curve and resulted in a peak stage. The results of the Hec-1 model produced slightly lower stages and were selected as the flood elevations for the S-133 basin. It was found that no ‘floodways’ existed due to the predominance of ponding as the primary cause of flooding.

Preliminary FEMA Flood Insurance Study - Okeechobee County Florida Unincorporated Areas, 2013 (prepared by Taylor Engineering Inc.)

Although preliminary in status, the information provided in this FIS (Taylor Engineering, Inc., 2013) is assumed to revise and supersede the information presented in the 1980 FIS for Okeechobee County. All vertical elevations presented in this study are in NAVD88. As part of this analysis, a detailed hydrologic and hydraulic study was performed for Lower Taylor Creek; this included the S-133 drainage basin previously studied under the 1980 FIS. Lower Taylor Creek was defined as from the S-193 to the L-63N. HEC-HMS was used to update the hydrologic data that was calibrated using U.S. Geological Survey (USGS) gage data and rainfall from tropical storms. Cross-section geometry was based on digital terrain data and field survey. Hydraulic analysis utilized the HEC-RAS step-backwater computer program, which employed a normal depth downstream boundary condition.

Technical Memorandum - An Atlas of Martin County Surface Water Management Basins, Richard M. Cooper and Ray Santee, (DRE-266) November 1988

This SFWMD-sponsored publication summarizes the events leading to USACE constructing these canals, levees and control structures and the uses of these canals. Of particular interest to this investigation is the detail contained for the C-59 (Taylor Creek-Nubbin Slough) Basin. A description of the flow routing and control structure operation is provided (Plate 3), along with a figure to show the basin, the location of the control structures and main channel alignments (Plate 4).

Structure	Type	Design HW Stage (ft NGVD)	Design TW Stage (ft NGVD)	Optimum Stage (ft NGVD)	Design Discharge (cfs)	Peak Stage (ft NGVD) Peak Discharge (cfs)	Date of Peak
S-191 Stage divide	Gated Spillway, 3-gates 17.6ft high x 27.8 ft wide NetCrest lgth = 81.0ft Crest elev = 7.4 ft NGVD	19.2	18.6	19.0 $19.2 \geq HW \geq 18.8$ (Gate closed if TW > HW)	7440	HW = 23.08 Q = 3236	7/18/74 6/25/87
S-192 Divide structure and pump station, Water supply from L-63N borrow canal to Taylor Creek	Gated Culvert 1-48in x 112ft CMP Invert elev = 8.0ft NGVD Pump Station, 1 unit: 13500 GPM	21.6 (water supply)	13.0 (water supply)	HW = 19.0 TW = 14.0 (water supply)	Normally Closed, open only for water supply		
G-106 Divide Structure and water supply from L-63N borrow canal to S-133 basin	Gated Culvert 1-36in x 90ft CMP Invert elev = 15.0ft NGVD				Ocassionally open for water supply		

in = inches
 ft = feet
 elev = elevation

lgth = Length
 TW = Tail water
 Q = discharge in cfs

CMP = Corrugated metal pipe
 RCP = Reinforced concrete pipe
 ft NGVD = Feet relative to National Geodetic Vertical Datum

HW = Head water
 CFS = Cubic feet per second

ds = downstream
 ups = upstream

Plate 3: C-59 Design Information

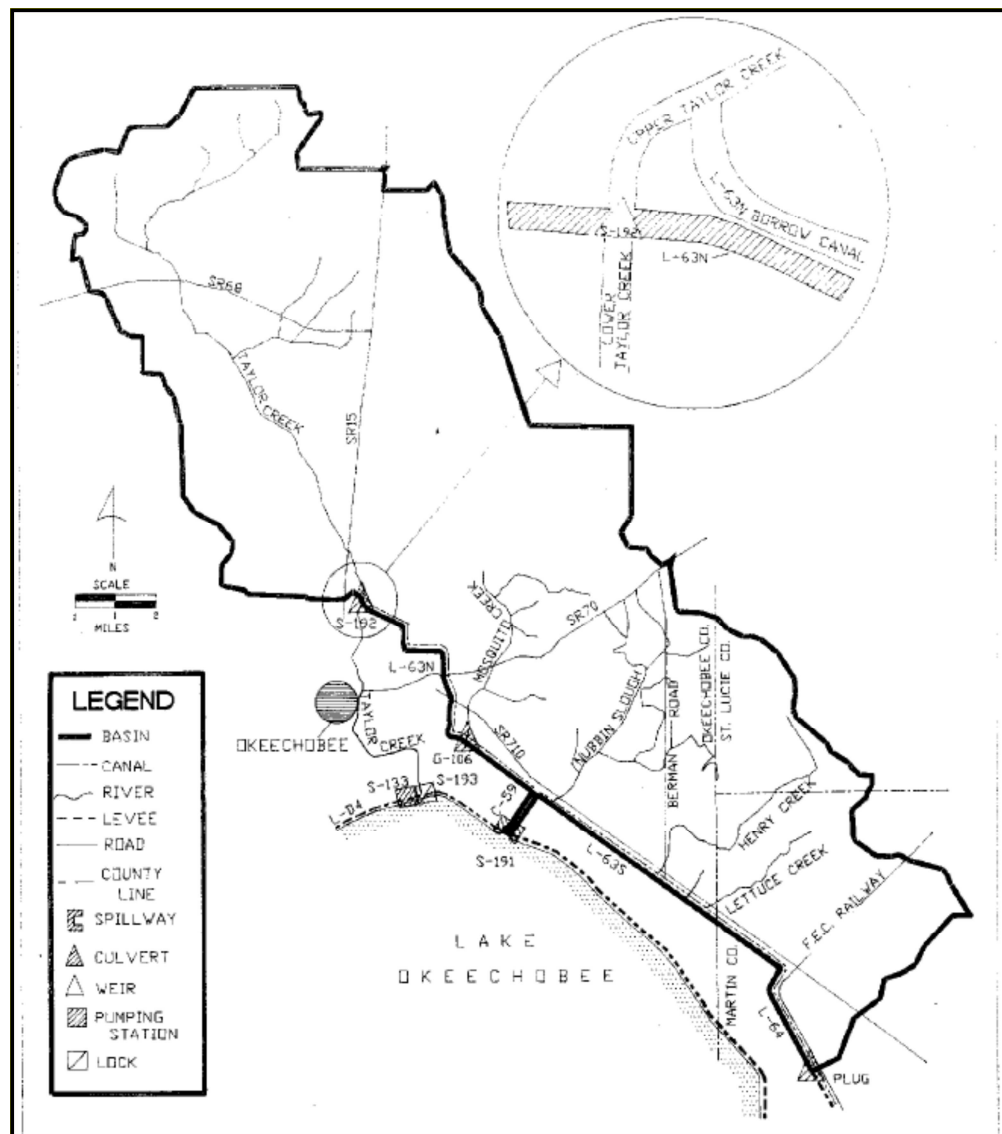


Plate 4: C-59 Control Structure Location

1.7 WETLAND FIELD REVIEW AND INFORMATION GATHERING

A preliminary ecological field review was performed to evaluate wetlands and species listed as threatened or endangered within the project vicinity. Current PD&E documents and biological evaluations currently underway under FPID 419344-3-32-01 were reviewed. A desktop review of available published information from federal and state online databases was performed to evaluate listed species that may occur in the project area. Data collection consisted of literature review of existing sources for information useful in identifying the occurrence or potential occurrence of wildlife species listed as threatened or endangered or as species of special concern (collectively recognized as listed species), as defined by U.S. Fish and Wildlife Service (USFWS) and/or the Florida Fish and Wildlife Conservation Commission (FWC). In addition, the presence of designated critical habitat and/or vegetative communities and land uses with the potential to support listed species was evaluated.

The literature review included the following sources: Natural Resources Conservation Service (NRCS) (formerly known as the Soil Conservation Service [SCS]) Soil Survey of Okeechobee County, Florida; USGS topographic quadrangle maps; FWC bald eagle and waterbird colony databases; Florida Natural Areas Inventory (FNAI) Okeechobee County tracking list; previous studies available; and false-color infrared and true-color aerial photography of the project corridor. Additional resources, such as the FNAI Field Guides and Rare and Endangered Biota of Florida Series, were used to evaluate habitat and vegetative community requirements for those species potentially occurring within the proposed project corridor.

Land use types located within the proposed project were identified through color aerial photograph interpretation and compared to land uses identified by FDOT Florida Land Use, Cover and Forms Classification System (FLUCFCS) (FDOT, 1999). Estimated wetland limits were identified on an aerial exhibit. A preliminary qualitative evaluation of the onsite wetlands system(s) was conducted. The wetlands were identified in general accordance with the USACE October 2008 Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region and the State of Florida's Delineation of the Landward Extent of Wetlands and Surface Waters (Chapter 62-340, Florida Administrative Code). Seasonal high water elevations were marked at six locations within the proposed STA and surveyed to better understand the normal water and allowable peak stage. Three Seasonal High Water Elevation (SHWE) nails were set at each location and the average elevation was used.

The wetland and wildlife evaluation is provided in **Appendix D**.

1.8 STAKEHOLDER COORDINATION

The project team contacted local stakeholders including the property owners, pump operators, City of Okeechobee, Okeechobee County, FDEP, SFWMD and USACE, etc. An introductory stakeholder meeting was held on July 31, 2014 in Okeechobee to discuss the proposed project. The meeting focused on providing project background and gauging the willingness of the stakeholders to participate via funding, design, construction, and maintenance. The data gathering included obtaining actual costs

and nutrient load reductions on recently constructed water quality improvement projects. Input was solicited for ideas and options, as well. The project team conducted follow-up meetings with various stakeholders. A summary of the meetings held in reference to the Regional Pond and STA feasibility study are as follows and the meeting minutes are included in **Appendix E**:

- Initial Brainstorming Meeting - September 13, 2013
- Second Brainstorming Meeting - April 4, 2014
- Introductory Meeting with the Hamrick property owners - July 11, 2014
- Introductory Stakeholder Meeting - July 31, 2014
- Goto Coordination Meeting with the Hamricks - August 12, 2014
 - o Includes Response from Mike Hamrick
- AVCON Meeting to discuss airport interests - August 14, 2014
- Email Coordination with the SFWMD Pump Operators - September 12, 2014

In addition to meetings, a telephone log was kept to document and track project calls.

2. REGIONAL POND ANALYSIS

2 GENERAL

The Regional Pond analysis evaluated two separate sources of runoff for the same proposed pond area. Option A treats runoff already within the Lower Taylor Creek basin. Option B diverts runoff from the L-63N Canal into Lower Taylor Creek basin for treatment in the Regional Pond.

2.1 OPTION A

2.1.1 General

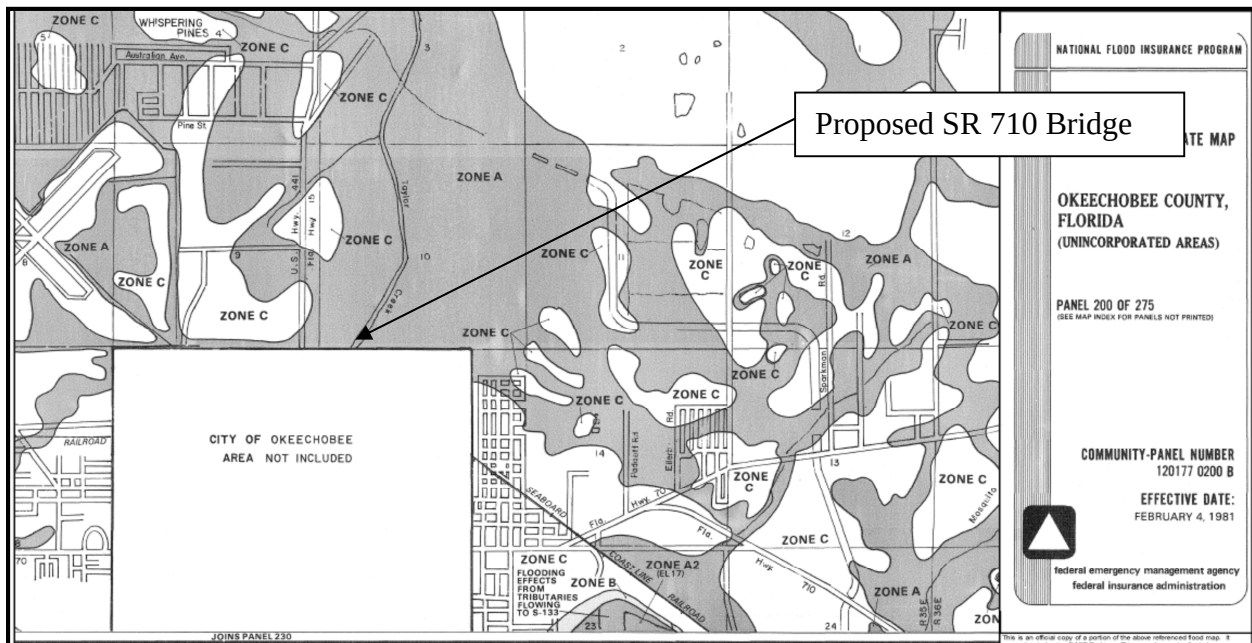
A preliminary HEC-RAS model was developed based on the draft Taylor Creek BHR model submitted for FPID 419344-3-32-01 (SR 710 New Alignment in Okeechobee). The pre-development model was based on the existing conditions model and flow rates developed during the BHR with the addition of adding to the HEC-RAS Model the portion of the Airport Ditch from US 441 back to the west to NW 9th Avenue. This would allow an analysis of the channel response to raising the tailwater levels where the Airport Ditch intersects Lower Taylor Creek. Limited survey data was obtained for areas along the Airport Ditch and the Lower Taylor Creek to verify critical elements.

The analysis includes nutrient loading calculations, preliminary design, and construction cost estimates. Permitted facilities within the Airport Ditch basin were reviewed to establish the treated areas versus untreated areas. Treatment calculations were performed to demonstrate compensatory treatment for a portion of SR 710. A large wet detention pond will be utilized for water quality and attenuation and will provide a source of fill material for the SR 710 project. All files developed during the current SR 710 project were utilized, including survey, ROW and the current design files. The pond was designed with 1:2 slopes to meet the Federal Aviation Administration (FAA) requirements for wildlife attractants since it is located within the 10,000-foot buffer shown in **Appendix A, Figure 4**.

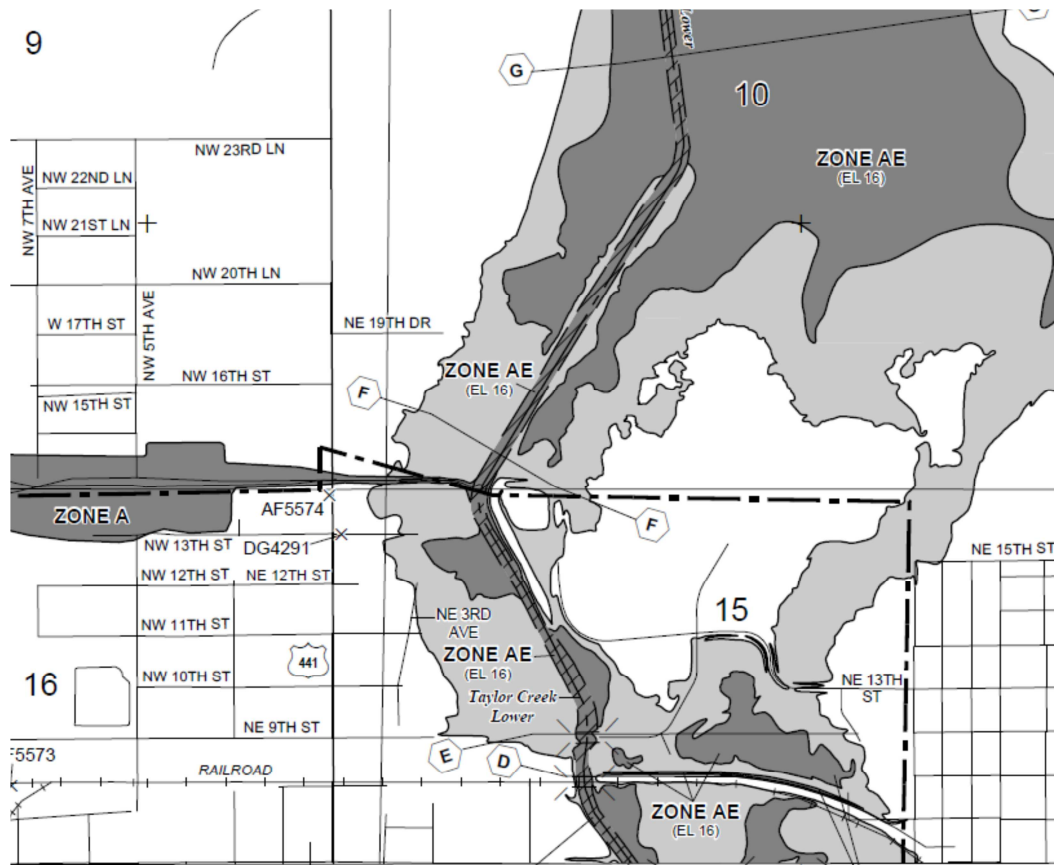
2.1.2 Drainage Basin Specific Documents

FEMA Flood Insurance Rate Map (FIRM), Okeechobee County, Florida, Unincorporated Areas, Panel 200 of 275, February 4, 1981

The FIRM provides details of the design 100-year flood extent, as well as flood zones for the area adjacent to Taylor Creek and the City of Okeechobee. This will provide details of the expected flood extent and any limitations on bridge design to account for regulated floodways. Lower Taylor Creek was not included in this information. **Plate 5** shows the available floodplain data for the area.



The Preliminary 2013 FEMA Maps became available in May 2013; however, these maps are not scheduled to become effective until March 20, 2015. See **Plate 6** for Preliminary 2013 FEMA FIRM.



Central and Southern Florida Project for Flood Control and Other Purposes System Operating Manual - Lake Okeechobee and Everglades Agricultural Area Volume 3 DRAFT, Department of the Army Corps of Engineers, Jacksonville District, December 2005

This manual provides operational instruction to both the SFWMD and USACE in the operation of the various structures controlling water movement around and into Lake Okeechobee, as well as its tributaries and the Everglades Agricultural Area. This manual will provide guidance on how the structures around the proposed SR 710 bridge site will operate and, hence, allow impacts of the operation to be considered within this BHR, ensuring appropriate design is achieved for all operational conditions.

Okeechobee County Local Mitigation Strategy 2010, Okeechobee LMS Working Group, 2010

This report was prepared to assist in mitigation planning, enhancing public awareness, providing a decision-making tool for management, complying with state and federal program requirements, and allowing mitigation coordination between agencies. The report provides detailed and comprehensive data and discussion for all potential natural disasters, including flooding. As a result, flood history can be extracted from this report and used to verify design floods and areas susceptible to inundation. Flood history was not extracted from this report since the areas susceptible to inundation appeared to be outside of the impacts of the L-63N Canal hydraulic model. **Plate 7** shows the extents of the 100-year event expected flood hazards.

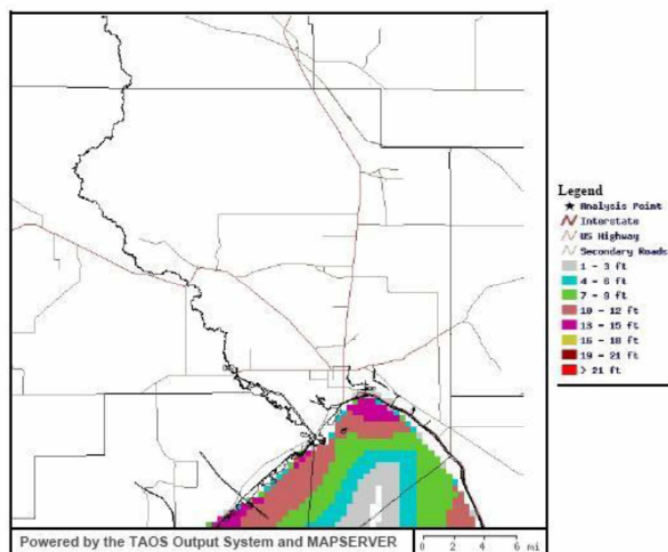


Plate 7- 100-year Event Expected Flood Hazards from 2010 Okeechobee LMS

2.1.3 Drainage Basin

Lower Taylor Creek drains a 5.46 square mile basin to the proposed SR 710 bridge. **Figure 7** in **Appendix A** shows the extent of the Lower Taylor Creek basin draining to SR 710. Lower Taylor Creek generally drains in a southerly direction towards the project site and consists primarily of manmade channels and tributaries that have a confluence immediately upstream of the proposed bridge site where the Airport Ditch meets Lower Taylor Creek. The existing Airport Ditch is a manmade channel that conveys flow west to

east toward Lower Taylor Creek. The Airport Ditch conveys runoff through SR 15 (US 441) via a 10-ft-by-6-ft box culvert just prior to draining into the main channel of Lower Taylor Creek immediately upstream of the proposed SR 710 crossing.

The Lower Taylor Creek basin area was delineated using light detection and ranging (LiDAR) data, existing permit information, and field information. This basin was divided into two sub-basins consisting of the sub-basin for the main channel of Lower Taylor Creek and the sub-basin for the Airport Ditch. **Table I** shows the breakdown of the two drainage areas flowing to the proposed crossing.

Table 1: Lower Taylor Creek at Proposed SR 710 Basin Summary

Basin	Area (sq. mi.)	10 YR Flow (CFS)	25 YR Flow (CFS)	50 YR Flow (CFS)	100 YR Flow (CFS)
Taylor Creek	2.20	201	281	346	417
Airport Ditch	3.26	437	570	699	838

The basin varies in elevation from approximately 40 ft (NAVD88) at the northern basin boundary to about 7.0 ft NAVD (bottom of the channel) at the project site. The upper and middle portion of the basin consists mostly of wetlands and rural properties (beef and dairy farmland), and the lower portion consists mostly of the low-density residential areas of Northern Okeechobee as well as the Okeechobee County Airport.

The proposed SR 710 crossing at Lower Taylor Creek is influenced by local surface water runoff and backwater flows from Lake Okeechobee (during certain operational circumstances).

The SR 710 Regional Pond is located within SFWMD jurisdiction, which will be responsible for review and issuing the environmental resource permit (ERP) for the project. The Regional Pond would be constructed as part of the new alignment construction of SR 710, and these improvements will be included in the roadway ERP permit.

2.1.4 HEC-RAS Analysis

The pre-development versus post-development HEC-RAS analysis was based on comparing the existing conditions to a proposed condition that extended the Airport Ditch over Lower Taylor Creek to the Regional Pond, a distance of approximately 1,000 ft east of Lower Taylor Creek. See **Figure 10** in **Appendix A** for the proposed modifications at the confluence of the Airport Ditch and Lower Taylor Creek. The concept diverts the Airport Ditch flow over Lower Taylor Creek in a ditch parallel to SR 710 into the proposed Regional Pond. The proposed Regional Pond has a control elevation at 18.0 ft NAVD. The existing 10-ft by-6-ft box culvert capacity at US 441 was expanded until the increase in tailwater would not cause an increase in the upstream stage. The existing headloss across the culvert for the 50-year storm event is 4.66 ft. By adding a culvert of the same size, the head loss is dramatically reduced. A tailwater in the Regional Pond of 21.0 ft NAVD was utilized for the post-construction conditions, which assumes 2.5 ft over the treatment weir at elevation 18.5 ft NAVD. The HEC-RAS model shows no rise in the stages in the Airport Ditch upstream of the proposed double 10-ft by-6-ft box culverts under US 441. Survey information was collected for cross sections further west of US 441

and includes the culvert under NW 9th Avenue. The HEC_RAS calculations are included in **Appendix B** and the results are provided in **Table 2**.

Table 2: Airport Ditch Pre-Post HEC-RAS Analysis

HEC-RAS Model Cross Section	10-Year Water Surface Elevation		Difference (feet)	25-Year Water Surface Elevation		Difference (feet)	50-Year Water Surface Elevation		Difference (feet)	100-Year Water Surface Elevation		Difference (feet)
	(feet NAVD88)			(feet NAVD88)			(feet NAVD88)			(feet NAVD88)		
	Exist	Proposed Double Culvert		Exist	Proposed Double Culvert		Exist	Proposed Double Culvert		Exist	Proposed Double Culvert	
4430.000	27.83	27.83	0.00	29.10	29.10	0.00	29.70	29.70	0.00	29.84	29.85	0.01
4330.000	27.77	27.77	0.00	29.05	29.05	0.00	29.64	29.64	0.00	29.76	29.77	0.01
Culvert	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4280.000	24.36	24.34	-0.02	25.16	25.02	-0.14	25.97	25.58	-0.39	26.99	26.10	-0.89
3550.000	23.74	23.71	-0.03	24.60	24.36	-0.24	25.52	24.89	-0.63	26.62	25.38	-1.24
2780.000	23.39	23.34	-0.05	24.29	23.97	-0.32	25.26	24.49	-0.77	26.43	24.96	-1.47
2100.591	23.05	22.99	-0.06	24.00	23.60	-0.40	25.05	24.10	-0.95	26.30	24.55	-1.75
1527.972	21.80	20.97	-0.83	23.15	21.55	-1.60	24.52	21.98	-2.54	26.25	22.38	-3.87
1344.355	21.85	20.78	-1.07	23.12	21.72	-1.40	24.50	22.10	-2.40	26.20	22.45	-3.75
Culvert	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1218.437	18.55	20.47	1.92	19.26	21.26	2.00	19.86	21.38	1.52	20.43	21.39	0.96
972.498	17.83	20.31	2.48	18.48	21.08	2.60	19.00	21.11	2.11	19.50	21.30	1.80
648.236	16.46	20.33	3.87	17.46	21.15	3.69	17.99	21.22	3.23	18.50	21.30	2.80
267.180	14.24	20.30	6.06	16.66	21.12	4.46	17.19	21.18	3.99	17.69	21.25	3.56
-232.820		20.24	20.24		21.06	21.06		21.09	21.09		21.13	21.13
-732.820		20.17	20.17		21.00	21.00		21.00	21.00		21.00	21.00

2.1.5 Treatment Volume Calculations

Option A is designed to treat the required presumptive runoff for the proposed SR 710 improvements only. **Figure 9** in **Appendix A** shows the location of the Regional Pond. The total area for proposed SR 710 Basin 1 through Basin 5 is 77.78 acres. The required treatment volume is 1 inch over this drainage area for wet detention ponds and results in 6.48 acre-feet (ac-ft) of treatment volume. Only SR 710 Basin 1 and Basin 2 will be routed to the pond. Compensating treatment volume will be provided for SR 710 Basin 3, Basin 4, and Basin 5 by treating a portion of the Airport Ditch drainage area. The proposed SR 710 Basin 1 and Basin 2 were delineated in the Draft Pond Siting Report and total 40.37 acres. The SR 710 Possible Regional Pond Brainstorming Meeting 2 Minutes in **Appendix E** show the proposed drainage basins for SR 710 for this option.

The proposed design provides 9.98 ac-ft of treatment with the weir elevation set at 18.5 ft NAVD. The treatment volume calculations are included in **Appendix B**.

2.1.6 Nutrient Loading Calculations

Option A is designed to provide nutrient loading reduction for total phosphorous (TP) and total nitrogen (TN) outflow to Lower Taylor Creek. The nutrient loading calculations were performed in accordance with the current basin management action plan (BMAP) land use designations and applied event mean concentration (EMC) values. **Figure 8** in **Appendix A** identifies the land uses utilized for the nutrient loading calculations.

The Airport Ditch drains a 2,086-acre area. A review of the permitted treatment areas within the drainage area determined that 231.78 acres of the basin have permitted treatment facilities. Thus, 1,855 acres remain untreated and discharge through The Airport Ditch to Lower Taylor Creek. The permitted treatment facilities are shown on **Figure 7** in **Appendix A**. Although the Regional Pond provides additional pollutant removal for those permitted treatment areas, those areas are excluded from the nutrient loading basin to provide a conservative estimate.

The total area included in the nutrient removal calculations for the Regional Pond is 1,895 acres, which includes the untreated areas of the Airport Ditch drainage basin and the proposed SR 710 Basin 1 and Basin 2.

The proposed SR 710 alignment provides a reduction in phosphorous and nitrogen compared to the pre-development loading due to the change in land use from pasture to highway. The Lower Taylor Creek basin will also have a reduction in post-development loading since the Regional Pond area will not generate a phosphorous or nitrogen loading.

With 227 ac-ft of permanent pool, the Regional Pond provides a TN removal of 34.7 percent and a TN removal of 63.0 percent across the total drainage area of 1,894.59 acres. This is a net benefit to Lake Okeechobee, with a TP removal of 39.7 percent and a TN removal of 25.0 percent for the 5.46 square miles draining to the SR 710 crossing of Lower Taylor Creek. **Table 3** summarizes the nutrient loading reductions.

Table 3: Option A Regional Pond Nutrient Loading Reductions

Nutrient	Pre-Dev (kg/yr)	Post-Dev (kg/yr)	Reduction (kg/yr)	Reduction (%)
Phosphorous	1250	754	496	39.7
Nitrogen	7489	5616	1873	25.0

The nutrient loading calculations are included in **Appendix B**.

2.1.7 Floodplain Impact Estimates

The 2013 Preliminary Flood Insurance Rate Map prepared for Taylor Creek shows that Lower Taylor Creek is a regulatory floodway. However, according to information obtained from Okeechobee County, the 2013 FEMA Flood Maps are not scheduled to be adopted until March 20, 2015. The FEMA FIRM Maps currently in effect do not show Lower Taylor Creek, and the FEMA FIS states that Lower Taylor Creek is not within a floodway.

No floodplain impacts are associated with the Regional Pond option.

2.2 OPTION B

Option B will utilize the same Regional Pond area and shape but will include only Basins 1 and 2 of the roadway basins as well as flows being diverted from the L-63N Canal. A pump system will be required to divert flow from the L-63N Canal to the Regional Pond. A pump system may also be needed to discharge treated stormwater back into the L-63N Canal.

The calculations in Appendix B for the SR 710 Regional Pond withdrawing L-63N water were performed by working the nutrient removal calculations backwards to determine an appropriate inflow rate. The nutrients from the roadway runoff were ignored. The calculations are based on the Harvey Harper methodology presented in the Evaluation of Current Stormwater Design Criteria within the State of Florida Final Report, June 2007 prepared by Harvey Harper and David Baker for the FDEP. The flow rate was controlled

by the assumed residence time for the permanent pool. The residence time then determined the removal efficiency. The flow rate controlled the volume of the high concentration runoff to be extracted from the L-63N Canal. Two residence times were evaluated to determine a range for the phosphorous removal: 21 days and 150 days. Once the removal rate was determined, the depth to anoxic conditions was calculated and the removal rate reduced for the reduction in permanent pool volume. The results are summarized in Table 4.

Table 4: Phosphorous Reduction for the Regional Pond Option B

Residence Time	Flow Rate (cfs)	Flow Rate (GPM)	Yearly Volume (Ac-Ft)	Reduction (kg/yr)	Depth to Anoxic Conditions (ft)
21 Days	5.44	2440	3940	778	8.7
150 Days	0.76	340	522	168	10.6

The results indicate that the higher flow rate would increase the reduction but it would also increase the cost of pumping. The water would need to be pumped out of the canal and into the pond and, if the discharge remains in the Lower Taylor Creek basin, it will need to be pumped to Lake Okeechobee at S-133. If the pond were relocated closer to the L-63N Canal, the pond may be able to gravity discharge back into the L-63N but would not be able to treat as much of the roadway runoff. Alternatively, the treated stormwater could be pumped back into L63-N, which would further increase the pumping costs.

3. STORMWATER TREATMENT AREA ANALYSIS

3.1 GENERAL

Three different types of alternative water quality treatment systems were evaluated. They include 1) a 60-acre STA, 2) use of BAM either within or beside Lower Taylor Creek downstream of S-192 to enhance nutrient removal, and 3) onsite retention of stormwater runoff in existing wetlands on the portion of the property lying east of Lower Taylor Creek. Estimates of both TN and TP load reduction were calculated for each of the alternatives, and estimates of design, construction and maintenance costs are provided.

3.2 LITERATURE AND EXPERT PANEL REVIEW

In preparation for development of the three alternative water quality treatment options, ATM interviewed experts from FDEP, SFWMD, USACE, and industry for background information on STA and alternative system experiences, costs, treatment effectiveness and design considerations. Literature supporting previous STA projects and outcomes was reviewed, and salient points are summarized in this section. Other items considered throughout these discussions include:

1. Feedback from SFWMD staff on how an STA at this site could fit in to the water management district's overall water quality improvement plan for the Lake Okeechobee basin.
2. Willingness of the property owner to participate in some fashion, either as a seller or other mode of participation, and identification of opportunities to work with

Florida Department of Agriculture and Consumer Services (FDACS) and the property owner to develop additional water storage on the property or to help fund structural agricultural best management practices (BMPs).

3. Incorporation of alternative technologies into the STA (e.g., BAM).

As part of this background review, three existing or planned STAs were reviewed to provide information on STA experience, costs, treatment effectiveness and design considerations. STAs reviewed are all located in the Taylor Creek-Nubbin Slough sub-watershed of the Lake Okeechobee basin and include the Taylor Creek STA, the Nubbin Slough STA, and the Lakeside Ranch STA. See **Figure 11 in Appendix A** for STA locations. Results of this review are presented in the following sections.

Taylor Creek STA

The Taylor Creek STA was constructed in April 2006 and began flow-through operations on June 26, 2008. The STA has an effective treatment area of 118 acres, which is small compared to the STAs operated by SFWMD south of Lake Okeechobee. The total site area is 142 acres. Up to four pumps, each with a discharge capacity of 6 cfs, divert water into the STA. Diverted water flows through two treatment cells and discharges back into Upper Taylor Creek approximately 1.2 miles downstream. Pumps operate automatically based on the stage in Upper Taylor Creek. Normal operational water depths average 1.5 ft, but during the dry season, a minimum water depth of 0.5 ft is maintained to prevent the treatment cells from drying out. Water levels in the treatment cells are regulated via adjustable gates between the two treatment cells and at the downstream discharge point.

This STA was designed to remove 2.08 metric tons (mt) of phosphorus annually, or about 9 percent of the TP load at that point in Upper Taylor Creek. The design removal efficiency is 38 percent (Goforth, 2005b). Since commencement of operations in June 2008 through the end of water year 2013 (April 30, 2013), phosphorus removal has ranged from 0.58 to 1.11 mt annually. This represents 37 months of flow-through operations over a total of 58 months. Operation statistics and water quality and loading information are presented in Table 5. The STA performed reasonably well during the first 2 years of operation, removing 31 percent and 64 percent of input load in WY2009 and WY2011, respectively. For the most recent 2 water years, however, measured load reductions were only 20 and 22 percent. This is attributed to reversals in TP concentration, i.e., the outflow concentration of phosphorus is higher than the inflow concentration, and is discussed below in more detail.

Table 5: Summary of calculated operational parameters and performance metrics for the Taylor Creek STA by water year (Source: 2014 South Florida Environmental Report)

Parameter	WY2009	WY2011	WY2012	WY2013
Period of operation, days	244	235	366	276
Total inflow, ac-ft	9,218	6,988	13,188	5,810
Hydraulic loading rate, cm/d	10.04	7.70	9.31	5.44
Inflow TP, µg/L	408	167	341	368

Parameter	WY2009	WY2011	WY2012	WY2013
Total Load In, MT	4.64	1.44	5.51	2.64
TP mass load rate, g/m ² /d	0.038	0.013	0.032	0.020
Total outflow, ac-ft	8,767	6,257	12,208	5,762
Outflow TP, µg/L	295	68	292	289
Total Load Out, MT	3.12	0.52	4.40	2.05
HRT, d	6.34	7.75	6.52	9.72
TP mass removed, MT	1.44	0.91	1.15	0.58
TP Conc reduction	27.5%	59.3%	14.4%	21.5%
TP Load Reduction	31.1%	63.6%	20.2%	22.0%

The Taylor Creek STA has experienced a number of operational challenges. In February 2009, the culvert at the STA outlet failed, and the STA was inoperable for 20 months, resuming normal operations in September 2010. In addition, for the past 2 water years, TP load removal efficiency was only about 20 percent. The poor performance is attributed to a large number of reversals in weekly outflow TP concentrations. Fifteen reversals occurred during WY2012, nine of which happened between November 10, 2011 and February 15, 2012. The average difference between inflow and outflow TP concentrations during these reversals was 43 parts per billion (ppb). In WY2013, a pattern of reversals was observed between October 2012 and January 2013, and flow-through operations were discontinued on February 1, 2013. During the 4-month period in which flow reversals were occurring, 309 kilograms (kg) of TP were released into Upper Taylor Creek. The STA remained offline through the end of the water year, April 30, 2013. Minimal pumping into the STA occurred during this time so that the desired water levels were maintained. One theory about the reason these flow reversals are occurring is that when the Grassy Island Hybrid Wetland Treatment Facility is functioning well, the inflow concentrations of phosphorus to Taylor Creek STA are low enough that to establish equilibrium, phosphorus is transferred from the sediments to the water column instead of the reverse (Joe Albers, personal communication). The Grassy Island facility is located on Upper Taylor Creek, approximately 1.2 miles upstream of the intake to the Taylor Creek STA.

Nubbin Slough STA

The Nubbin Slough STA was designed and built in conjunction with the Taylor Creek STA. Although construction was completed in 2006, the facility is not yet operational due to a number of issues, including mechanical problems discovered during pump tests. There have also been problems with accumulation of sediment in the pump basin. The final repair to a damaged outfall structure is expected to be completed by the end of October 2014, with responsibility transferred from USACE to SFWMD shortly thereafter.

Nubbin Slough STA is a two-cell system, with a total treatment area of 773 acres. SFWMD recognized a significant operational constraint in that the system cannot pump sufficient water to keep the entire STA wet. If the STA goes dry, there can be a net export of phosphorus from the system. To help maintain a more consistent water supply, the Nubbin Slough design includes a 30-acre pond that can store up to 90 ac-ft of water to be released as needed into the STA. Even with this additional storage, the STA is expected

to go dry, and SFWMD will be monitoring the system for the occurrence of TP export once the system is operational.

Lakeside Ranch STA

The Lakeside Ranch STA is located on a 2,700-acre property in western Martin County and adjacent to Lake Okeechobee. The project was designed in two phases. Phase I is on the north side of the property and includes 1,200 acres of treatment. Phase II will provide an additional 788 acres of effective treatment. Construction of Phase I was completed in 2012 and flow-through operations commenced in July 2013. The 2015 South Florida Environmental Report will include the first year of water quality reporting under operational conditions for the period between July 2013 and April 30, 2014.

Initial TP reduction estimates for Lakeside Ranch based on modeled results totaled 25.8 mt, including 15.4 mt in Phase I and 10.4 mt in Phase II (Hazen and Sawyer, 2011). Current reductions for both phases are 19 mt (Odi Villapando, personal communication). The total load reduction estimate included in the draft Lake Okeechobee BMAP for both phases is 21.6 mt, 14 mt for Phase I and 7.6 mt for Phase II.

Summary of Existing and Planned STA Costs

Costs for these three STAs are summarized in Table 6. Except for the costs for the Lakeside Ranch Phase II and design, permitting and construction costs for Taylor Creek STA, costs were obtained from the draft Lake Okeechobee BMAP document. Initial costs for Phase II of Lakeside Ranch are based on personal communication with SFWMD staff and initial capital costs for Taylor Creek STA were obtained from Hazen and Sawyer (2011).

Table 6: Summary of Existing STA Costs

Facility	Design, Permitting, and Construction (\$)	Annual Operation and Maintenance (\$)	Initial Cost per Treatment Acre (\$)
Taylor Creek	5,642,293	50,000	47,816
Nubbin Slough	21,257,707	100,000	27,500
Lakeside Ranch Phase I	22,800,000	341,000	19,000
Lakeside Ranch Phase II	25,000,000	Not available	31,726

Alternative Technologies

Permeable Reactive Barriers (PRBs)

SFWMD recently completed a pilot study to assess the feasibility of using PRBs to reduce TP loads to Lake Okeechobee (IFAS 2014). The configuration of PRBs for this study consisted of trenches dug perpendicular to the direction of groundwater flow and filled with a medium that is capable of reacting to and binding the pollutant of concern. The medium used in this study was potable water treatment residuals produced from aluminum salts (Al-WTRs). Al-WTRs are capable of long-term sequestration of phosphorus, and they are readily available at little to no cost. Two study sites were

selected. The first site was at an abandoned dairy and the second was at an active dairy. The first site selected did not have sufficient topography to provide adequate groundwater flow through the PRBs for phosphorus removal. In addition, the placement of the PRBs was too far from the water bodies of interest, and the benefit of the PRB was lost because the groundwater picked up phosphorus from the soil before discharge into the surface water. The up-gradient and down-gradient TP concentrations were not statistically different. The conclusion was that placement of PRBs in the middle of highly impacted areas is not a good idea. The PRBs should be placed down-gradient of the impacted soils. The second site had much better hydraulic conditions, i.e., greater flow through the PRB, but the amount of phosphorus removed was low because the concentration of phosphorus in the groundwater was lower than expected.

Floating Aquatic Vegetation Treatment

The potential use of a new technology called Floating Aquatic Vegetation Treatment (FAVT) is being evaluated concurrent with this study. FDACS is providing funding this fiscal year for the development of an FAVT system in conjunction with a willing property owner. FAVT is a type of wetland treatment system that uses a combination of floating and submerged vegetation for phosphorus removal. Floating vegetation, typically water hyacinth, is used in the top one third of the water column. Water hyacinth is efficient at nutrient removal, but will eventually stop growing and need to be removed. The FAVT system consists of a deep zone treatment area and a shallow zone treatment area. To remove the vegetation, the shallow zone is allowed to dry out during the dry season, and the vegetation is tilled into the soil. Based on results of a pilot-scale study and work done for a dissertation at the University of Florida, FAVTs are estimated to be eight times more efficient than conventional STAs (Tony Federico, personal communication). An FAVT project in the Fisheating Creek sub-basin is included in the draft Lake Okeechobee BMAP. The annual removal of TP and TN for that project is estimated to be 8.6 mt and 29.2 mt, respectively.

3.3 OPTION 1 - STORMWATER TREATMENT AREA

The subject 684-acre property between Lower Taylor Creek and the L-63N Canal includes approximately 305 acres of wetland. Because of the high cost of mitigating for wetland impacts, potential STAs in the wetland areas of the property were eliminated from consideration early in the study. In addition, the proposed location of the STA on the east side of the property is outside the 10,000-ft airport buffer requirement. The Taylor Creek STA was used as the basis for development of the performance efficiencies of Option 1 because it is the most similar in size and because it is the only facility of the three evaluated for which operational data are available.

The total STA footprint shown in **Figure 13** in **Appendix A** is 60 acres and is configured to avoid impacts to wetlands. Of this total area, it is estimated that 50 acres will be available for treatment. This is consistent with the ratio of treatment area to non-treatment area for the Taylor Creek STA. This option would require establishment of a pump system on the north end of the STA with gravity outflow back into the L-63N Canal at the south end. Initially, consideration was given to pumping water from S-192 to hydrate the STA. This would require a major modification in the way the pump at S-192 is operated currently. The required pumping distance along the L-63N Canal from S-192 to

the north end of the STA is approximately 1.2 miles. To facilitate adaptive management for the STA and to provide for a constant inflow of water, it will be necessary for the STA to have an independent pump system. To achieve average hydraulic loading rates of 5 to 10 centimeters per day (cm/day), the pump system will need to pump an average of 4 to 8 cfs on an annual basis. At these pumping rates, the hydraulic residence time in the STA for an average operating depth of 2.0 ft ranges from 6.1 to 12.2 days.

The annual removal of TP will vary depending upon the total load into the STA. The average annual measured inflow TP concentration to the Taylor Creek STA for water years 2009, 2011, 2012, and 2013 was 321 ppb (range 167 to 408 ppb) (SFER, 2014). This compares well with the average annual geometric mean of TP in Upper Taylor Creek at Cemetery Road for calendar years 2008 through 2011 of 354 ppb (range 298 to 439 ppb). See **Figures 11 and 12 in Appendix A** for the basin map and land use map. For purposes of calculating an estimated average annual removal rate for TP, an inflow concentration of 354 ppb was used because the Cemetery Road site is downstream of the existing Taylor Creek STA and closer to the site under consideration. The assumed removal efficiency is 28.7 percent, which is the average TP removal efficiency for the Taylor Creek STA since the start of operations. For a hydraulic loading rate ranging from 5 to 10 cm/day over 50 treatment acres, Option 1 is expected to yield TP reductions of 465 to 727 kg/yr.

This relatively small facility is expected to cost more on a per-acre basis than the larger STAs discussed in Section 3.2 because there is no economy of scale. Taylor Creek STA is the most similar in size to Option 1 of the three STAs evaluated, and the initial cost per acre of treatment is \$47,816. The Powell Creek Filter Marsh in Lee County has 40 treatment acres and is even closer in size to the Option 1 STA. Powell Creek Filter Marsh was completed in 2013 at a cost of \$2,100,000 for design, permitting, and construction, or at an initial cost per treatment acre was \$52,500. The Powell Creek system includes the cost of a pump station. Because it is comparable in size to the proposed STA and was completed more recently, costs from the Powell Creek project are used to calculate the estimated initial cost for Option 1 of \$2,650,000. Operating and maintenance costs are assumed to be similar to Taylor Creek STA, at \$50,000 annually.

3.4 OPTION 2 - BIOSORPTION ACTIVATED MEDIA (BAM)

Option 2 considers the use of BAM for nutrient removal. Marion County is using BAM in several stormwater retention basins to reduce nitrate leaching to groundwater in karst areas. Monitoring data from the springshed sites indicates that BAM is also effective at removing orthophosphate, with reductions of greater than 70 percent in the unsaturated soil zone beneath the BAM layer. The BAM removes nitrogen through biological processes in an anaerobic environment. Phosphorus is reduced by sorption onto the BAM. The BAM used for the retention pond in the springsheds consists of a 1.0:1.9:4.0 mixture of tire crumb, silt+clay, and sand. The tire crumbs increase the sorption capacity of the BAM, the silt+clay layer increases water retention and sorption capacity, and the sand promotes infiltration. To be effective at removing phosphorus, the minimum contact time with the BAM is 15 minutes.

BAM could be used downstream of S-192 in either an in-stream system or an offline swale system adjacent to Lower Taylor Creek. Both concepts require the diversion of water from the L-63N Canal into Lower Taylor Creek and would require a modification in the current manner in which the gate and/or the pump are operated. S-192 consists of a manually operated sluice gate and a pump with a design rating of 30 cfs. The gate is normally closed and opened for two reasons:

1. To divert flows from the L-63N Canal for maintenance purposes, and
2. When water quality is degraded in Lower Taylor Creek and Lake Okeechobee is sufficiently low to permit gravity flow into the lake (below elevation 14.0).

The pump is operated only when the water quality in Lower Taylor Creek is degraded and when the water level in Lake Okeechobee is too high to permit gravity flow. When the pump is discharging, S-193 is opened enough to discharge about the same amount of water as S-192 is pumping (SFWMD Operations Control Center Structure Book, Structure S-192, Revised 8/15/1994). Pump operations would not require modification if water was only supplied to the system when water levels in the L-63N Canal and lake allow for gravity flow.

For the 3,300 ft offline swale shown in **Figure 14** in **Appendix A**, diverted water flows through a swale with a bottom width of 50 ft and underlain with BAM to a depth of 1 ft. To maintain a minimum depth of 1 ft in the swale, a control berm is installed on the downstream end of the swale. The approximate volume in the swale at a depth of 1 ft is 4.1 ac-ft. Assuming an infiltration rate of 0.25 inches per hour (in/hr), this volume would have to be replaced every 48 hours, requiring an average flow from the structure of approximately 1 cfs. Assuming an average TP concentration of 354 ppb, the annual TP load to the BAM system is 316 kg/yr. Orthophosphorus is almost 80 percent of the TP in Taylor Creek water (2013, SFER), so the load of orthophosphorus is estimated at 253 kg/yr. Using a range of removal efficiency for orthophosphorus of 35 to 70 percent, this configuration can be expected to remove at least 88 to 176 kg/yr of orthophosphorus. The TN removal rate observed in the Marion County study was up to about 50 percent.

For planning purposes, in-place costs for the BAM system are estimated at \$180 per cubic yard (Wanielista, personal communication). Costs could be reduced if soils onsite can be used to mix the BAM. For the swale system shown, 6,111 cubic yards are required, and the estimated cost is \$1,100,000. This is likely conservative, because for a project of this size, it is expected that there would be economies of scale.

The second BAM concept that was considered, but in less detail, is an in-stream application, in which a structure is used to increase the water elevation on the structure's upstream side, forcing water downward and through a BAM layer installed under the streambed to a depth of 2 ft. The minimum downstream length of the layer is determined based on the rate of flow through the layer to maintain a minimum contact time of 15 minutes. This concept is untested, but the Stormwater Management Academy at the University of Central Florida recently received a grant from FDOT to test an in-line system for nitrate removal in a springshed. An in-stream system would not require as much land acquisition as the offline system, but the lack of demonstration projects make functional parameters less well known.

Many factors are involved with the development of a BAM system, and the needs of each site are unique and require site-specific detailed design. The numbers presented are conceptual but believed to be achievable. An important design factor to consider is the phosphorus removal design life of the BAM. Because phosphorus is removed by sorption onto the BAM, eventually the BAM will become saturated and need replacement. This is not a problem for nitrogen removal because nitrogen is removed using biological processes. Ease and cost of future maintenance is a consideration.

3.5 STA OPTION 3

Option 3 considers increasing water storage in the existing onsite wetlands to contain runoff from the property. A 162.5-acre wetland area is proposed for improvement (**Figure 15 in Appendix A**) by installation of risers or other structures to restore seasonal high water lines (SHWLs) to levels more indicative of pre-disturbance. Nutrient reduction benefits are calculated for this option by assuming that whatever load from the property would have entered Lower Taylor Creek will be contained onsite. The TP and TN loads for the entire 684-acre property between Lower Taylor Creek and the L-63N Canal based on the Lake Okeechobee BMAP Load Estimation Tool are 180 and 858 kg/yr, respectively. The SHWLs and water levels in Lower Taylor Creek shown in **Appendix A Figure 6** indicate that there is an additional 1 to 2 ft of storage available in this wetland area. One foot of extra storage will completely contain runoff from an 8-inch storm event. This corresponds to the 50-year return period, 1-day maximum rainfall for the area (Pathak, 2001). During the wet season, it is unlikely that all runoff can be fully contained without some discharge into Lower Taylor Creek. Therefore, the load reduction benefit is reduced by whatever load eventually makes it to Lower Taylor Creek. Without more detailed modeling of specific rainfall events over time, it is difficult to estimate how much water will actually be discharged. For purposes of this study, a range of 50 to 80 percent retention will be assumed, resulting in TP reductions of 90 to 144 kg/yr and TN reductions of 429 to 686 kg/yr.

A secondary benefit of Option 3 is restoration of some of the wetland functions. A quantification of the potential environmental lift that could be realized by rehydration of this wetland was determined using the Uniform Mitigation Assessment Method (UMAM). The UMAM calculated the potential environmental lift per acre, known as the relative functional gain (RFG), for the 338 acres of cypress wetland contained within the property to be 0.076. The functional gain for the 162.5-acre wetland area placed in a conservation easement based on the UMAM is 12.35. Restoration of larger or smaller wetland acres would correspondingly increase or decrease the environmental lift achieved.

Potential costs for Option 3 can vary considerably depending upon the type and number of structures required to restore water levels in the wetlands and the contract with the property owners for the use of their properties. For the purposes of this discussion, initial costs would include payment to the landowner for the cost of acquiring a conservation easement over the wetland areas that are being rehydrated.

3.6 STA DISCUSSION AND SUMMARY

Estimated nutrient reductions for each of the three options are summarized in Table 7.

Table 7: STA Estimated Nutrient Loading Reductions

	Estimated TP Reduction (kg/yr)	Estimated TN Reduction (kg/yr)
Option 1 - Stormwater Treatment Area	465 - 727	Not calculated
Option 2 - Biosorption Activated Media	88 - 176	50 percent
Option 3 - Increased Wetland Storage	90 - 144	429 - 686

Each option presented has advantages and disadvantages. Option 1 has the potential to provide substantial nutrient reductions, but requires a large amount of privately owned land. SFWMD would be the most logical entity to operate this facility, but the agency already has a backlog of projects that lack funding, including Lakeside Ranch STA Phase II. STA operation in the northern Everglades is relatively new to the agency, and the systems function differently than the STAs in the southern Everglades. SFWMD is still working through substantive operational issues at the Taylor Creek STA related to the periodic net export of phosphorus. The Nubbin Slough STA, despite being completed in 2006, has never been operational due to a number of mechanical problems and needed repairs that should be completed by the end of October. Once Nubbin Slough is online, the SFWMD already understands that it is likely to have problems with insufficient flow to operate the STA and will have to address those issues as they arise. Since the start of flow-through operations in July 2013, Lakeside Ranch Phase I seems to be working well but is still in its stabilization phase. The first year of nutrient reduction calculations for Lakeside Ranch Phase II will be included in the 2015 South Florida Environmental Report. Given its funding constraints as well as its efforts to work through operational difficulties with existing STAs, SFWMD is likely unable to commit to managing another STA.

Option 2 can achieve reasonable nutrient reductions within a small footprint, thus minimizing land acquisition requirements. Although a number of projects have been constructed throughout the state, this is still a relatively new technology for which new applications and uses are continually being investigated. In addition, much of the effort has been focused on the use of BAM in karst areas because of its ability to reduce nitrate loads to groundwater, with less research focused on reducing phosphorus. While a relatively simplistic model was presented as part of this analysis, there are many factors involved in design of a successful system. This may be a good opportunity, however, to investigate the use of BAM in the Lake Okeechobee watershed for phosphorus removal on a larger scale.

Option 3 provides estimated reductions comparable to Option 2 but, unlike BAM, reduction estimates are not based on research data. Rehydration of the wetland will improve a disturbed wetland habitat so Option 3 has an additional ecological benefit. SFWMD funds water storage and restoration projects but is more interested in larger scale projects that have a higher benefit-to-cost ratio. In addition, SFWMD has no money available for additional water storage projects that are not already planned, in progress, or completed. Implementation of this option would require acquisition of a permanent conservation easement from the property owner. For purposes of this discussion, initial project costs are the costs to acquire the easement.

4. CONCLUSIONS

The feasibility report has presented several options worthy of investigation for both the

FDOT Regional Pond and the multi-agency STA. It is recommended that the report be shared with the property owner, SFMWD, FDEP and FDACS for consideration of the alternatives to determine if partners are available to pursue the STA option.

5. REFERENCES

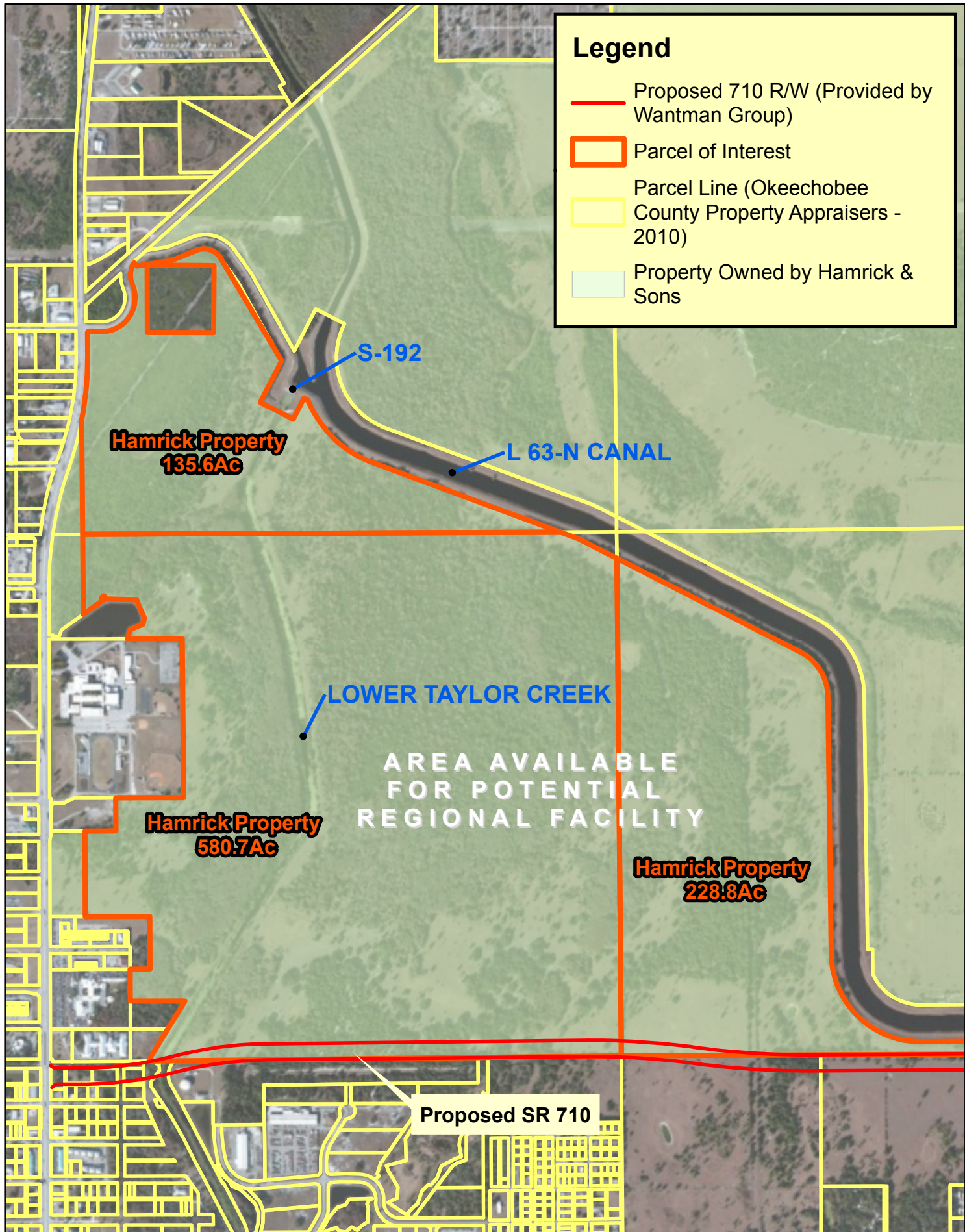
1. Federal Emergency Management Agency (May 2013). Flood Insurance Rate Maps, Okeechobee County, Florida and Incorporated Areas. Community-Panel Number 12093C0415C.
2. Federal Emergency Management Agency (May 2013). Preliminary Flood Insurance Study: Okeechobee County, Florida and Incorporated Areas.
3. Gary Goforth, Inc. 2005a. Operation Plan Nubbin Slough/New Palm Stormwater Treatment Area. Submitted to South Florida Water Management District.
4. Gary Goforth, Inc. 2005b. Operation Plan Taylor Creek/Grassy Island Stormwater Treatment Area. Submitted to South Florida Water Management District.
5. Hazen and Sawyer. 2011. Compilation of Benefits and Costs of STA and Reservoir Projects in the South Florida Water Management District. Submitted to the World Wildlife Fund acting on behalf of the Florida Ranchlands Environmental Services Project.
6. Institute of Food and Agricultural Sciences (IFAS). 2014. Permeable Reactive Barriers for Passive Management of Phosphorus in the Lake Okeechobee Basin: Final Report. Submitted to South Florida Water Management District, West Palm Beach, FL. Environmental Hydrology Laboratory, Soil and Water Science Department, Gainesville FL.
7. South Florida Water Management District. 2014. 2014 South Florida Environmental Report.
8. South Florida Water Management District. 2013. 2013 South Florida Environmental Report.
9. South Florida Water Management District. 2012. 2012 South Florida Environmental Report.
10. Stanley Consultants, Inc. 2003. Lake Okeechobee Water Retention/Phosphorus Removal Project Design Analysis Final Submittal. Submitted to Department of the Army Corps of Engineers, Jacksonville District.
11. Stanley Consultants, Inc. 2003. Lake Okeechobee Water Retention/Phosphorus Removal Project Design Documentation Final Submittal. Submitted to Department of the Army Corps of Engineers, Jacksonville District.

Appendix A: Figures

SR 710 Stormwater Treatment Area/Regional Pond Feasibility Study Preliminary Submittal

**Financial Project ID
432644-1-32-01**

Okeechobee County, Florida



Legend

- Proposed 710 R/W (Provided by Wantman Group)
- Parcel of Interest
- Parcel Line (Okeechobee County Property Appraisers - 2010)
- Property Owned by Hamrick & Sons

AREA AVAILABLE
FOR POTENTIAL
REGIONAL FACILITY

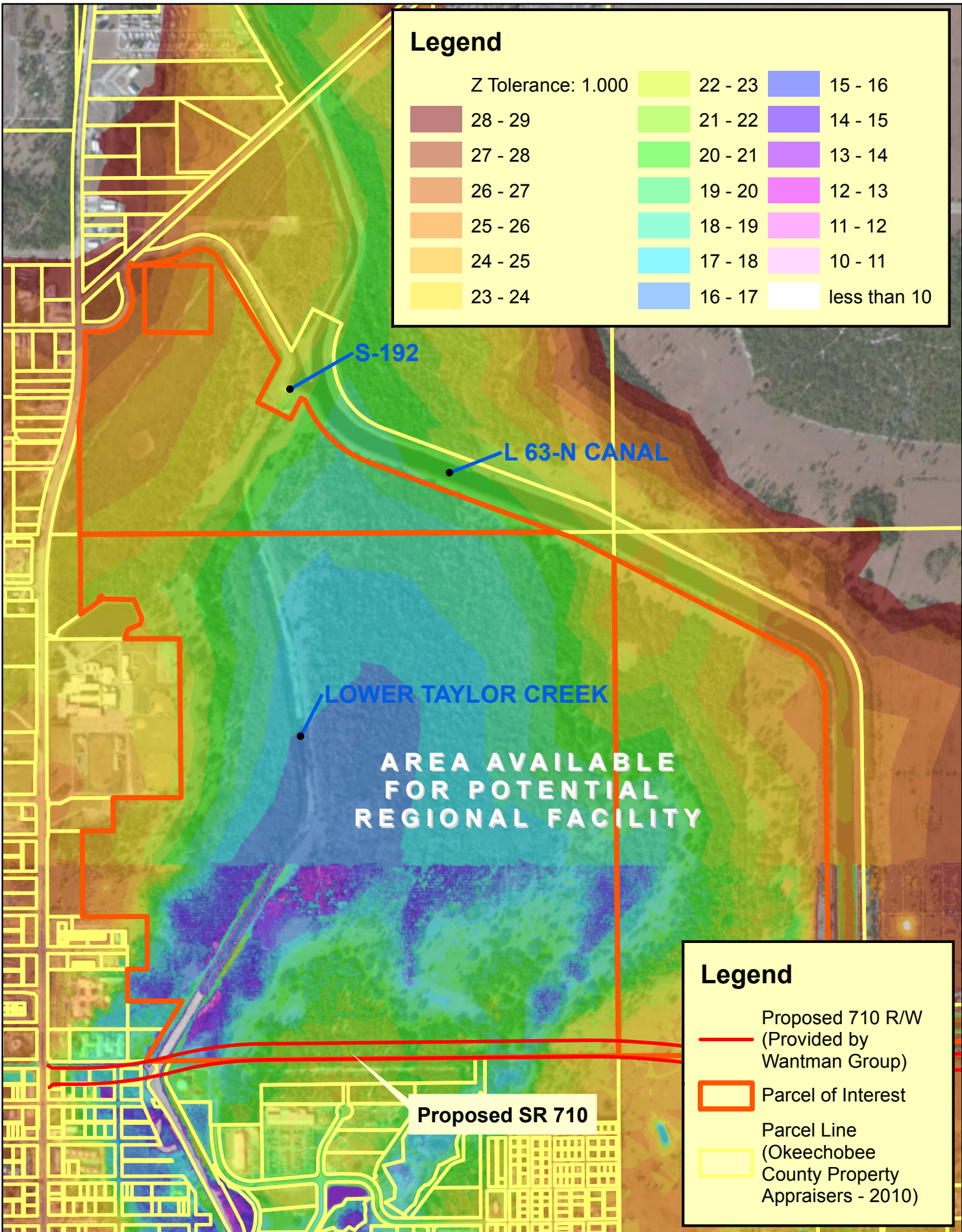
Proposed SR 710

Aerial Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN,

0 0.125 0.25
Miles



FIG 1 - LOCATION MAP
SR 710 Regional Facility
Conceptual Analysis



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Earthstar Geographics, CNES/Airbus DS,
USDA, USGS, AEX, Getmapping,

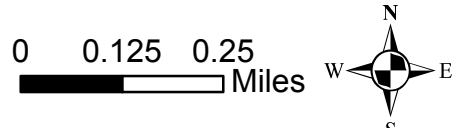
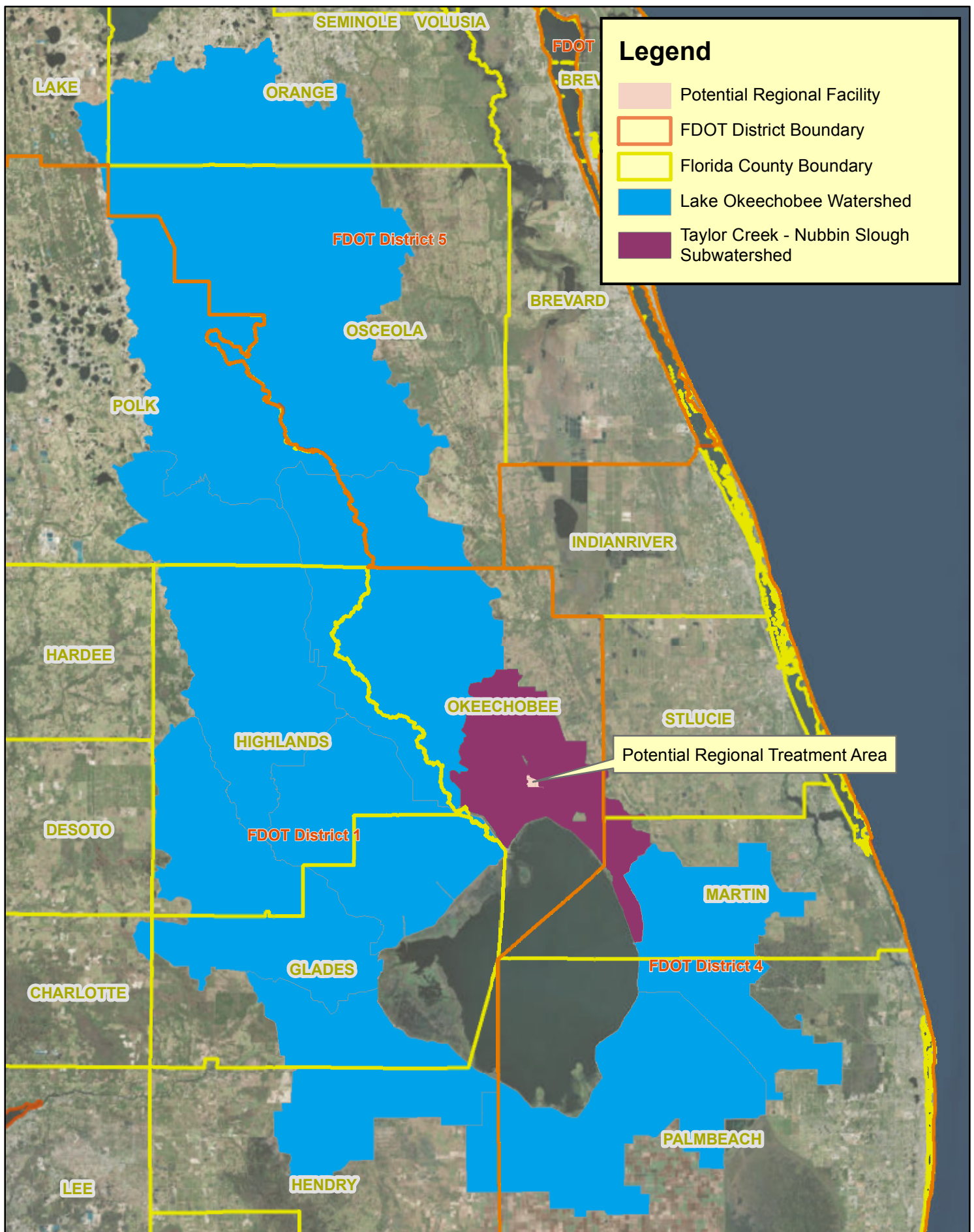


FIG 2 - TERRAIN MAP
SR 710 Regional Facility
Conceptual Analysis

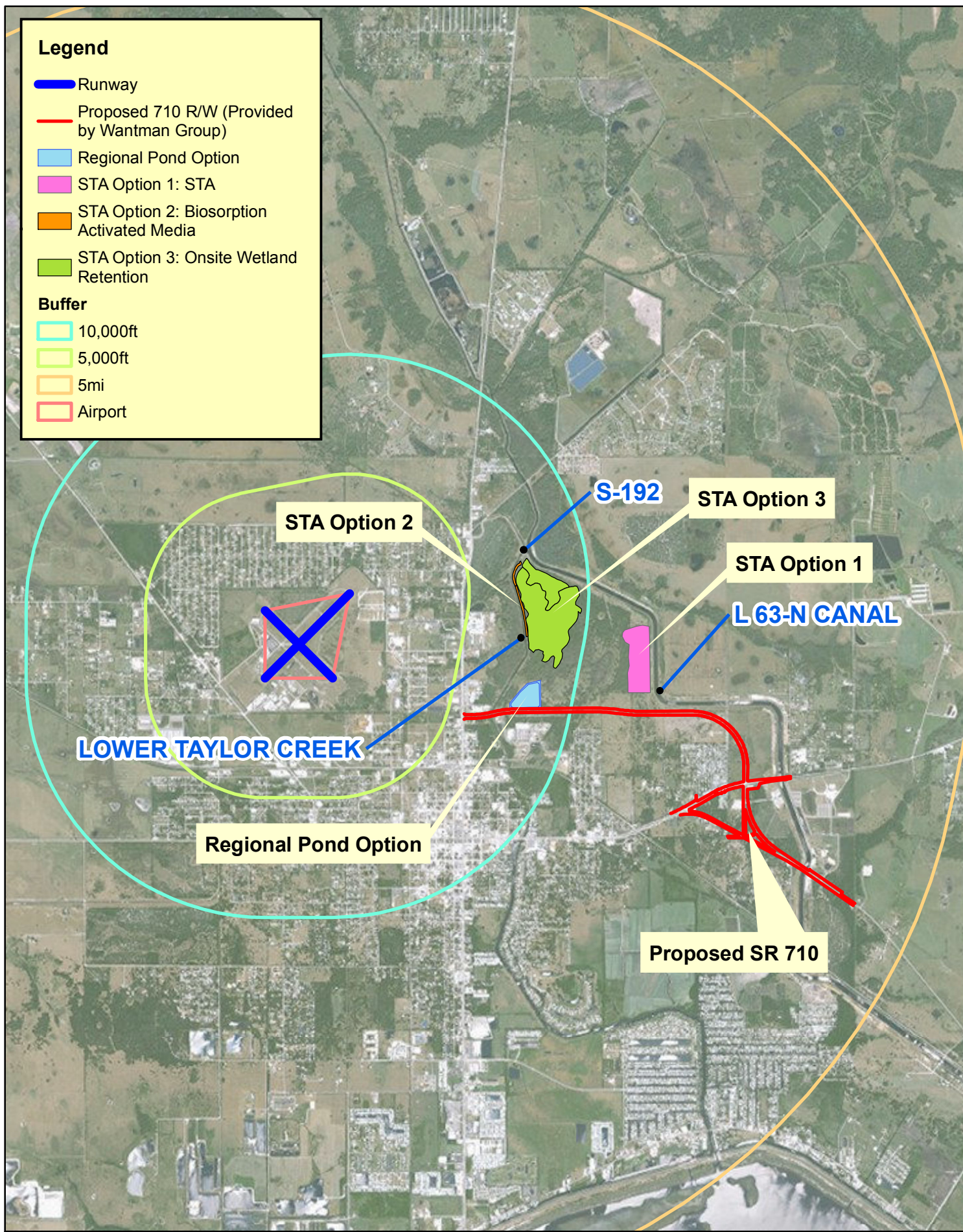


Aerial Service Layer Credits: Source:
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Earthstar Geographics, CNES/Airbus
DS, USDA, USGS, AEX, Getmapping,

0 7.5 15
Miles



**FIG 3 - LAKE OKEECHOBEE
WATERSHED
SR 710 Regional Facility
Conceptual Analysis**



Legend

- Runway
- Proposed 710 R/W (Provided by Wantman Group)
- Regional Pond Option
- STA Option 1: STA
- STA Option 2: Biosorption Activated Media
- STA Option 3: Onsite Wetland Retention

Buffer

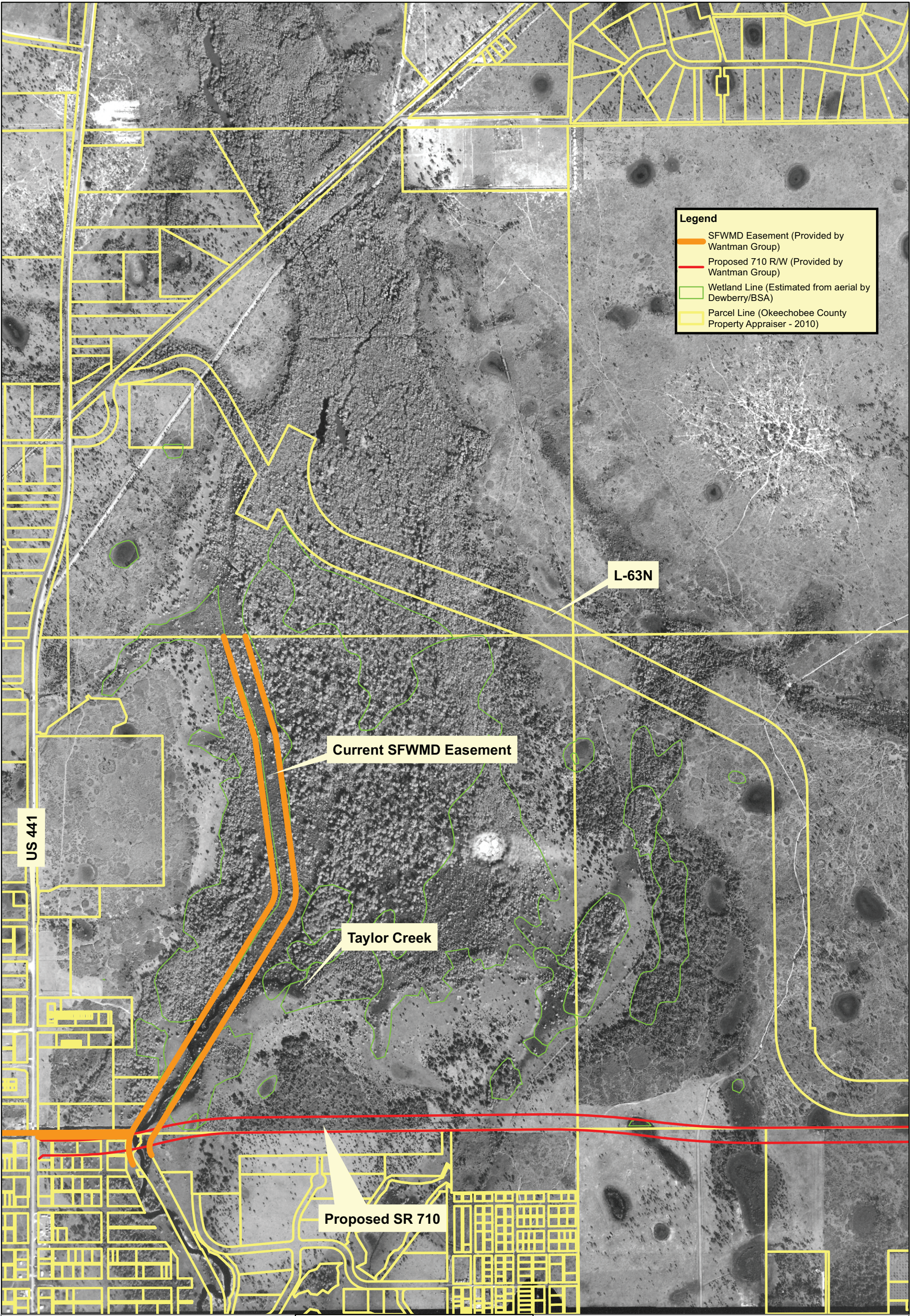
- 10,000ft
- 5,000ft
- 5mi
- Airport

Aerial Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN,

0 0.5 1 Miles

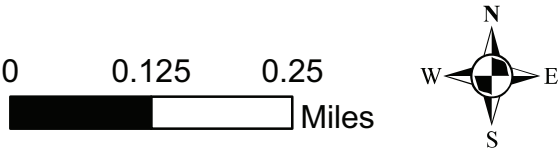


FIG 4 - FAA BUFFER
SR 710 Regional Facility
Conceptual Analysis



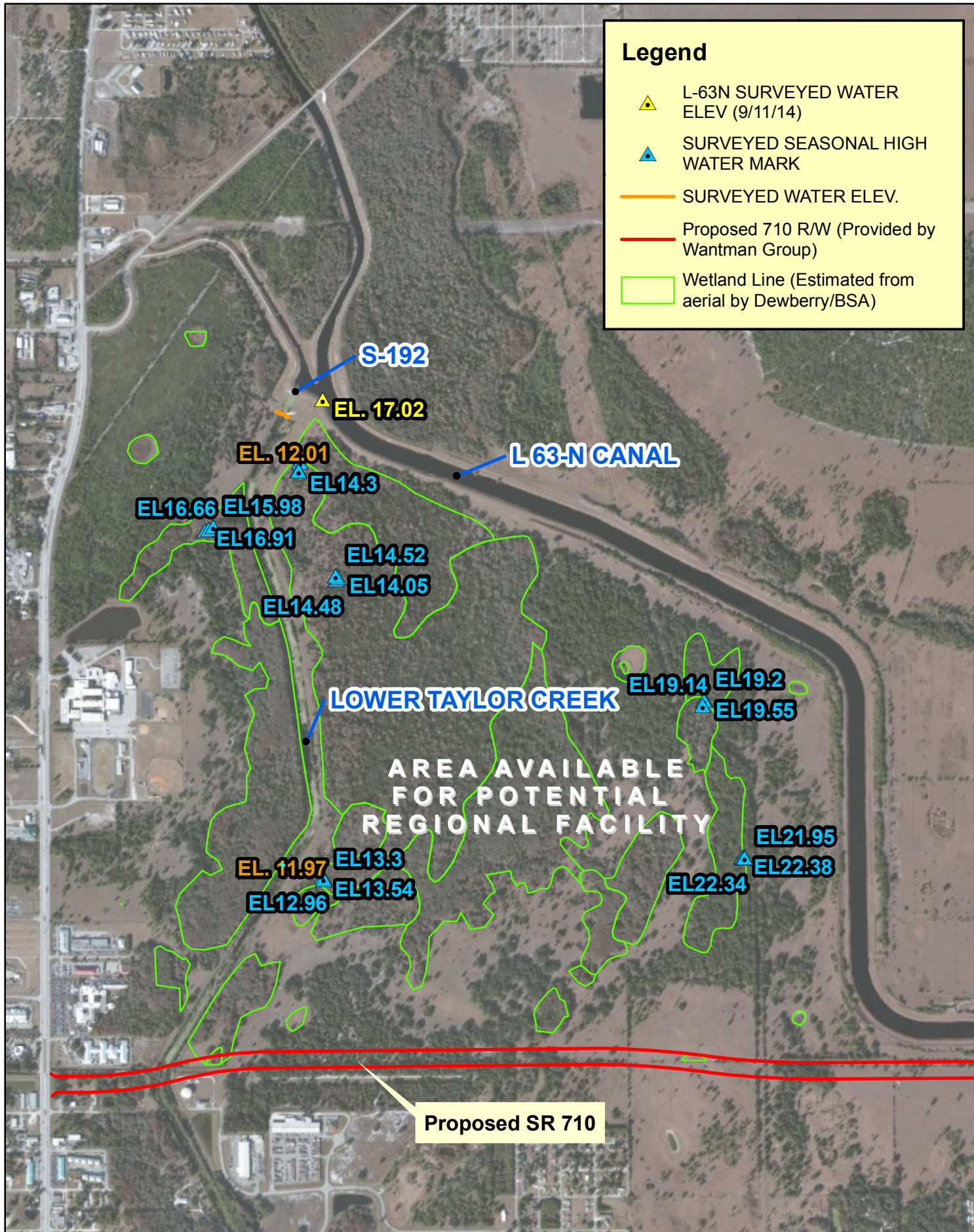
Legend

- SFWMD Easement (Provided by Wantman Group)
- Proposed 710 R/W (Provided by Wantman Group)
- Wetland Line (Estimated from aerial by Dewberry/BSA)
- Parcel Line (Okeechobee County Property Appraiser - 2010)



Source: Online Aerial Photography: Florida Collection (<http://ufdc.ufl.edu/aerials>)
Note: Aerial spatial coordinates were unknown. The image was georeferenced using 2013 aerial imagery and 2010 parcel data.

FIGURE 5
1953 HISTORIC AERIAL
REGIONAL POND/STA LOCATION



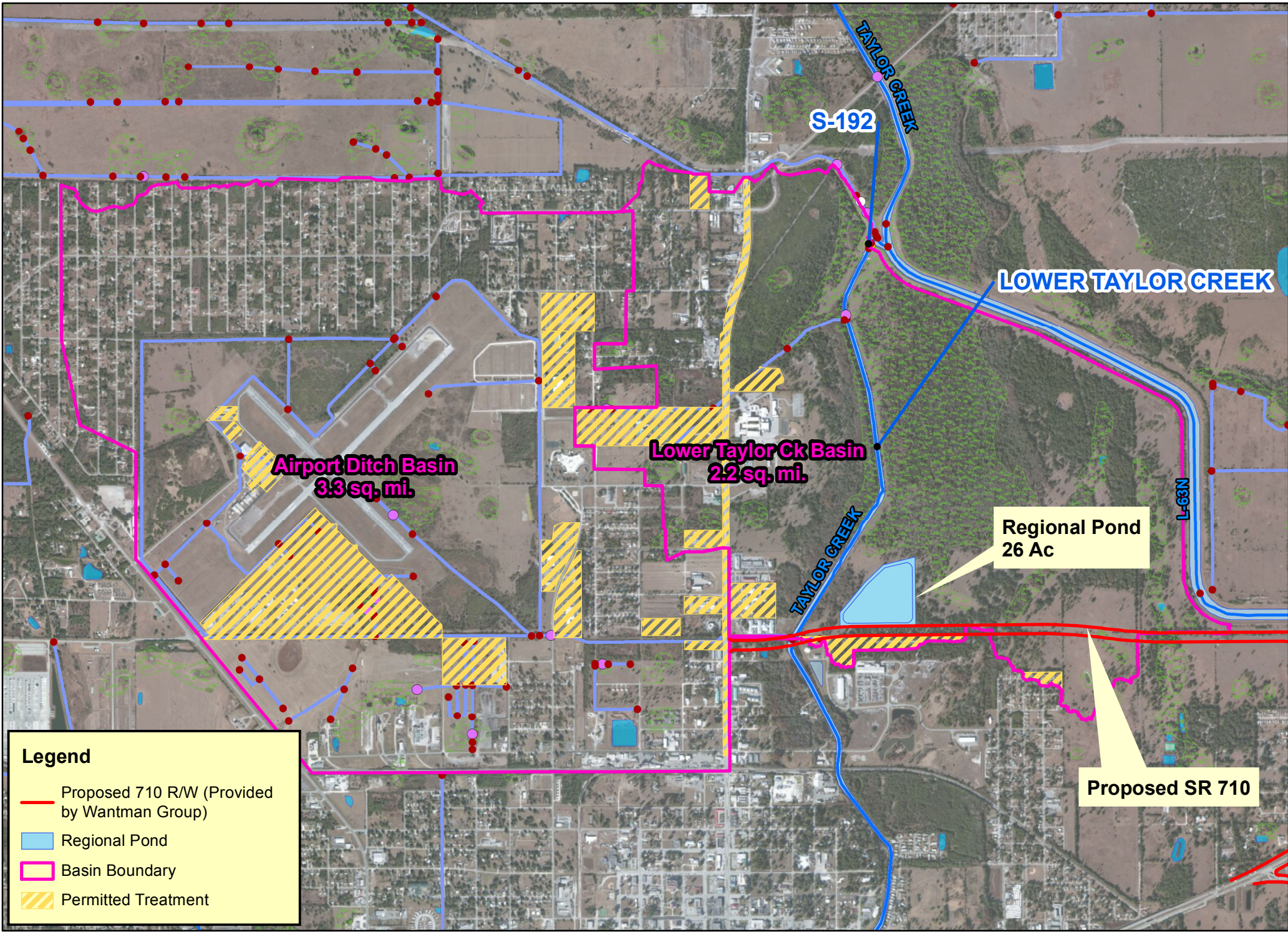
Aerial Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping,

0 0.125 0.25 Miles



FIG 6 - WETLAND AND SURVEYED WATER ELEV.

SR 710 Regional Facility Conceptual Analysis



Aerial Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,

0 0.25 0.5 Miles

N
S
W
E

FIG 7 - REGIONAL POND BASIN MAP
SR 710 Regional Facility Conceptual Analysis

Legend

Regional Pond

Pond Basin Nutrient Land Use

Barren Land

Citrus Groves

Dairies

Improved Pasture

Other Agriculture

Rangeland

Row and Field Crops

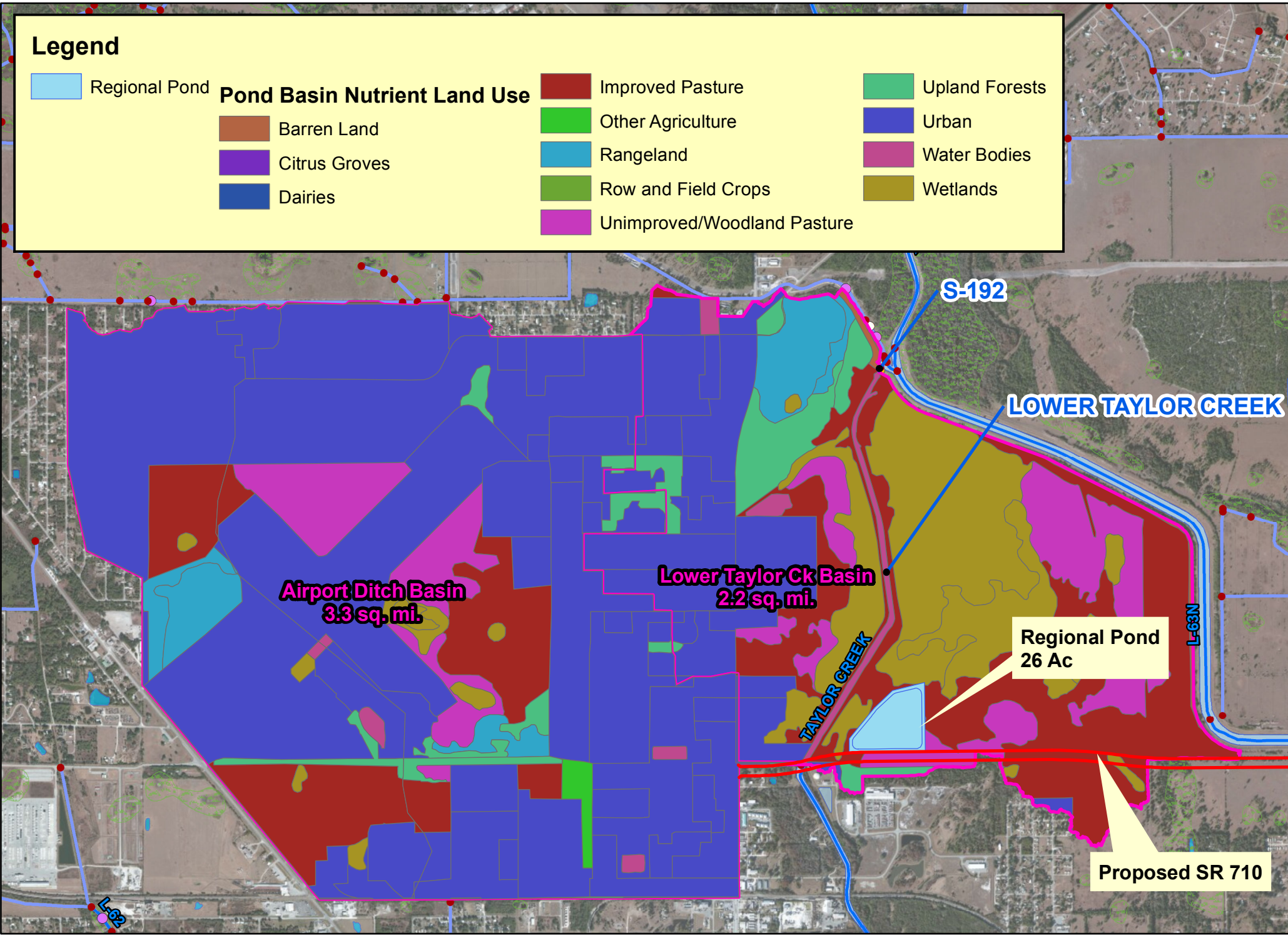
Unimproved/Woodland Pasture

Upland Forests

Urban

Water Bodies

Wetlands



Aerial Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus

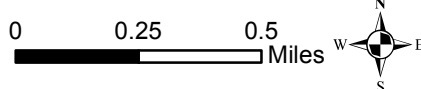
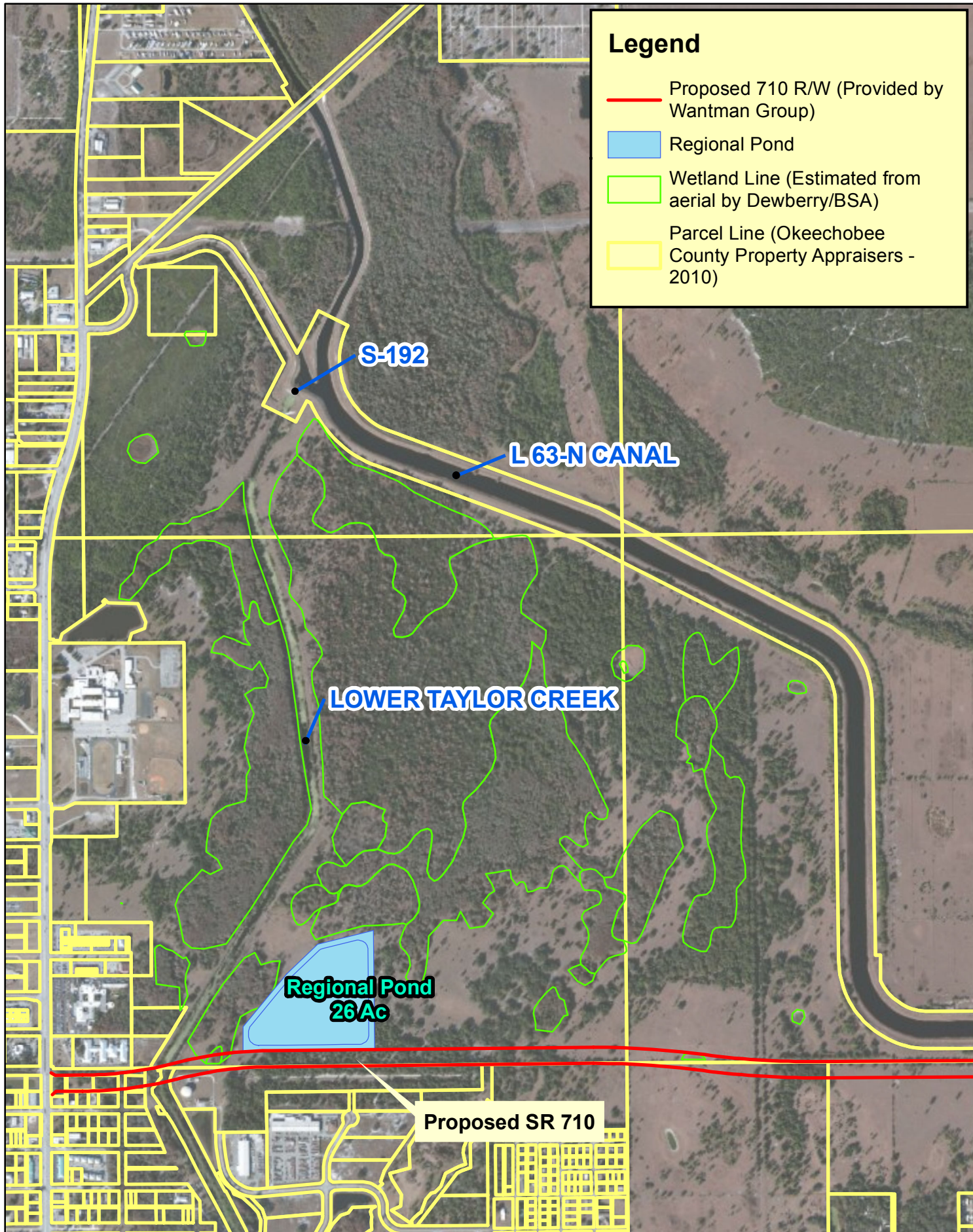


FIG 8 - REGIONAL POND NUTRIENT LAND USE MAP
SR 710 Regional Facility Conceptual Analysis

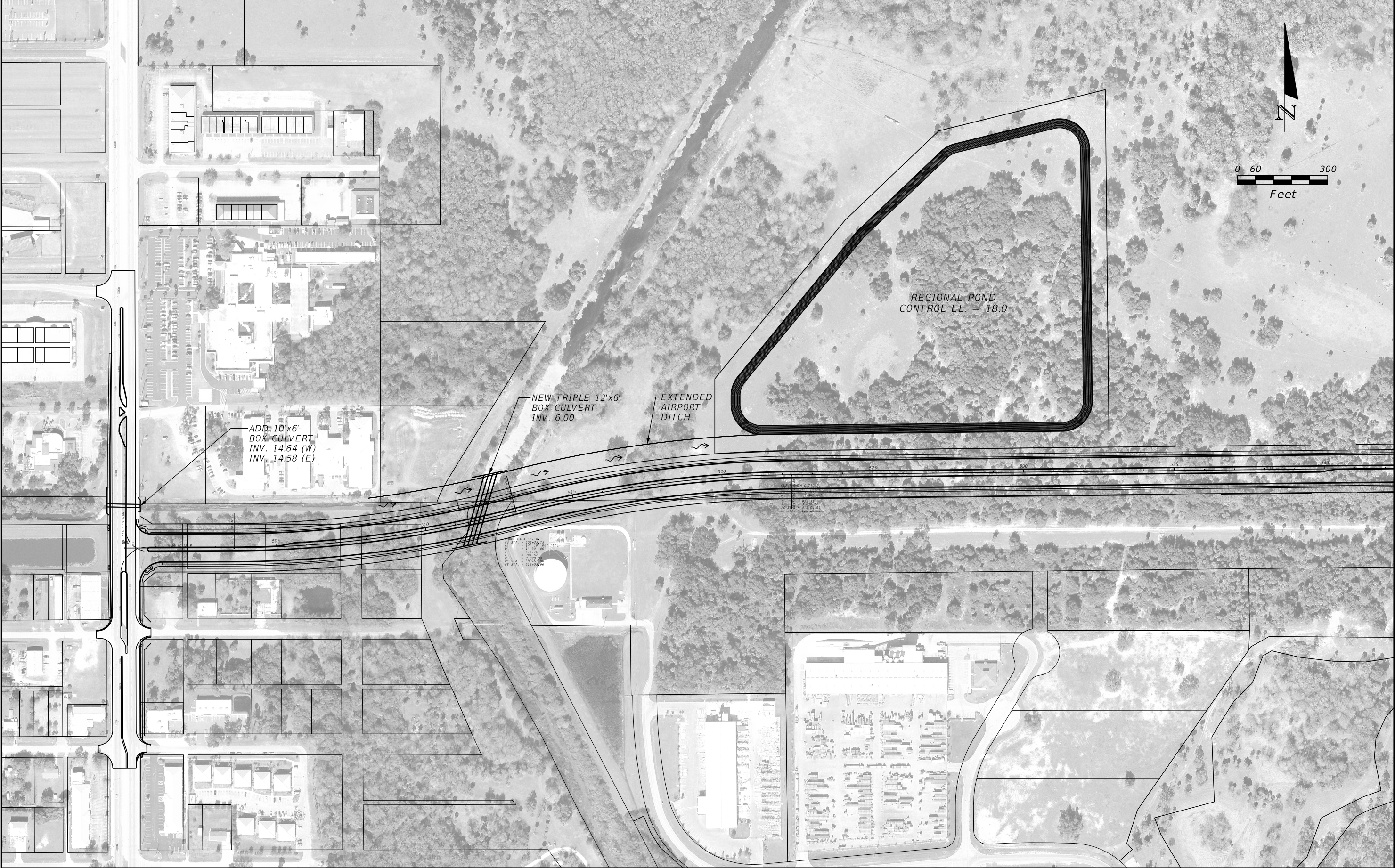


Aerial Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN,

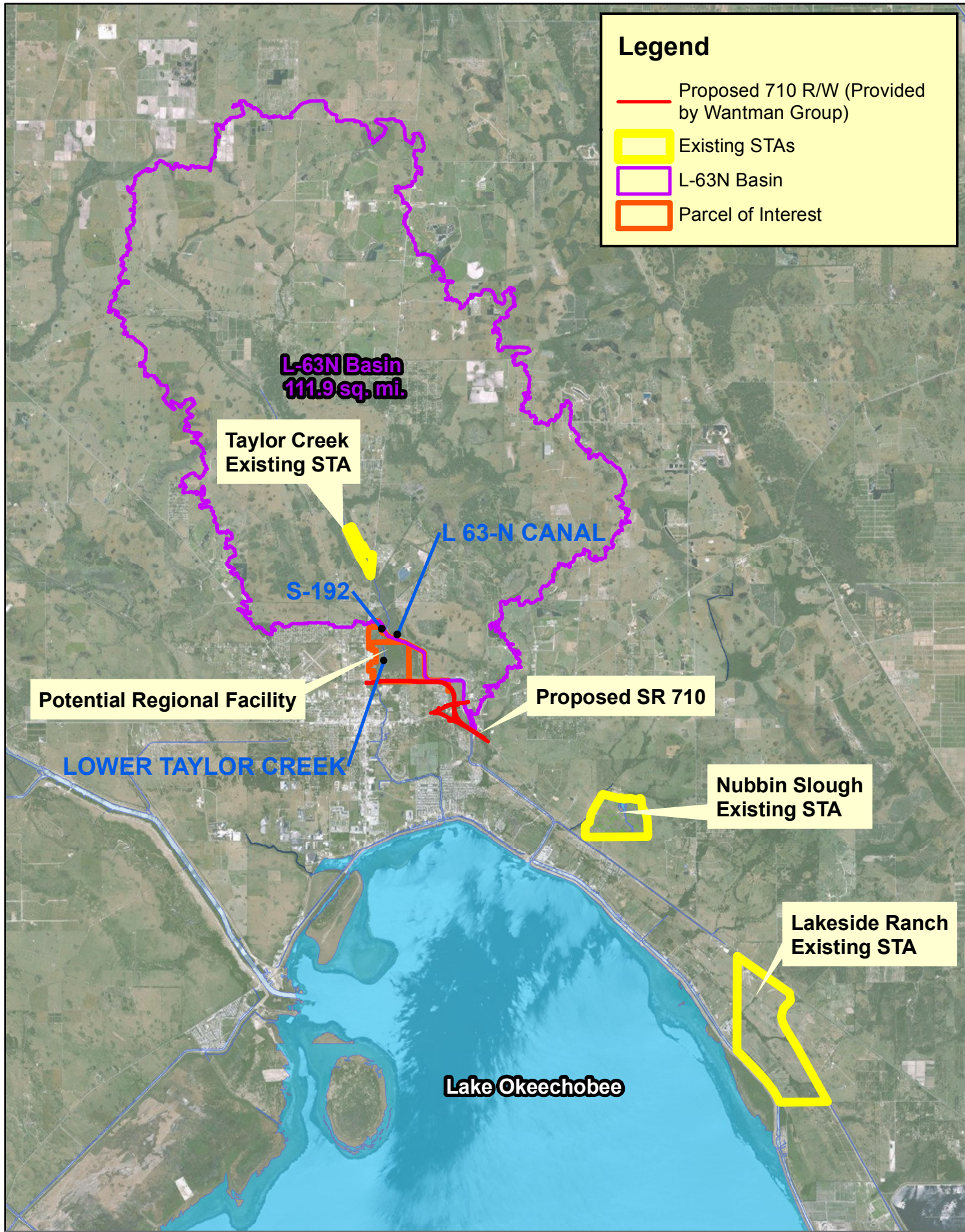
0 0.125 0.25 Miles

N
W E
S

FIG 9 - REGIONAL POND LOCATION
SR 710 Regional Facility Conceptual Analysis



REVISIONS				The Balmoral Group 165 Lincoln Avenue Winter Park, FL 32789 Phone: (407) 629-2185 www.balmoralgroup.us Certificate of Authorization No. 26123 E.O.R.: Gregory S. Seidel, P.E. No. 47571	FDOT DISTRICT 1		FIG 10 - REGIONAL POND CONVEYANCE SR 710 Regional Facility Conceptual Analysis	SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION		ROAD NO.	PROJECT NO.		
					SR 710	001106.00		



Aerial Service Layer Credits: Source:
Esri, DigitalGlobe, GeoEye, i-cubed,
Earthstar Geographics, CNES/Airbus DS,
USDA, USGS, AEX, Getmapping,

0 1 2
Miles



FIG 11 - STA BASIN MAP
SR 710 Regional Facility
Conceptual Analysis

Legend

L63N Basin Nutrient Land Use

Barren Land

Citrus Groves

Dairies

Improved Pasture

Other Agriculture

Rangeland

Row and Field Crops

Unimproved/Woodland Pasture

Upland Forests

Urban

Water Bodies

Wetlands

L-63N Basin
111.9 sq. mi.

Taylor Creek/Nubbin Slough
Existing STA

Potential Regional Facility

LOWER TAYLOR CREEK

L-63N CANAL

S-102

MOSQUITO CREEK

L-62

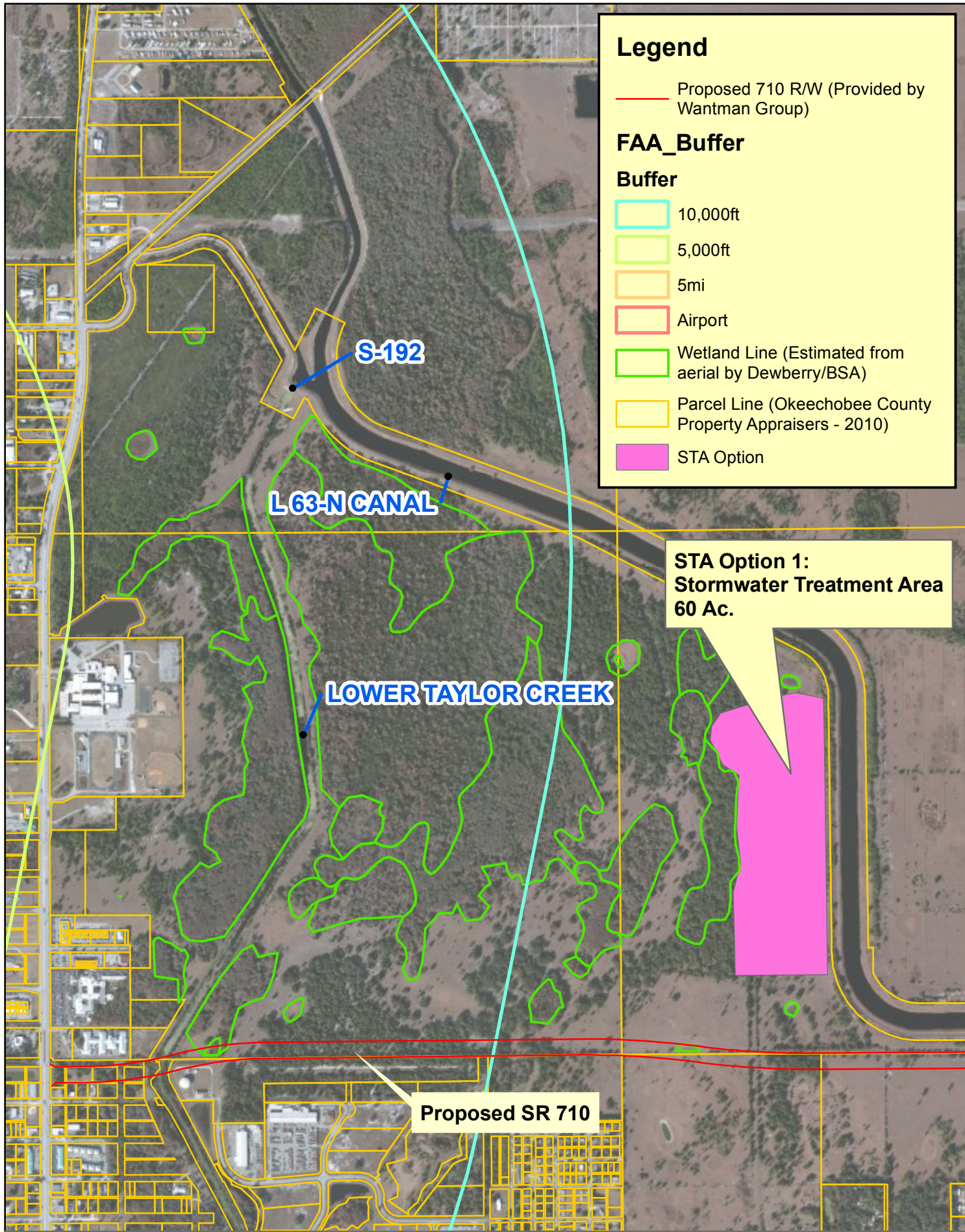
Proposed SR 710

Aerial Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN,

0 1 2 Miles



FIG 12 - STA NUTRIENT
LAND USE MAP
SR 710 Regional Facility
Conceptual Analysis



Legend

Proposed 710 R/W (Provided by Wantman Group)

FAA_Buffer

Buffer

10,000ft

5,000ft

5mi

Airport

Wetland Line (Estimated from aerial by Dewberry/BSA)

Parcel Line (Okeechobee County Property Appraisers - 2010)

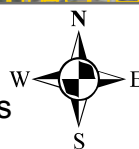
STA Option

**STA Option 1:
Stormwater Treatment Area
60 Ac.**

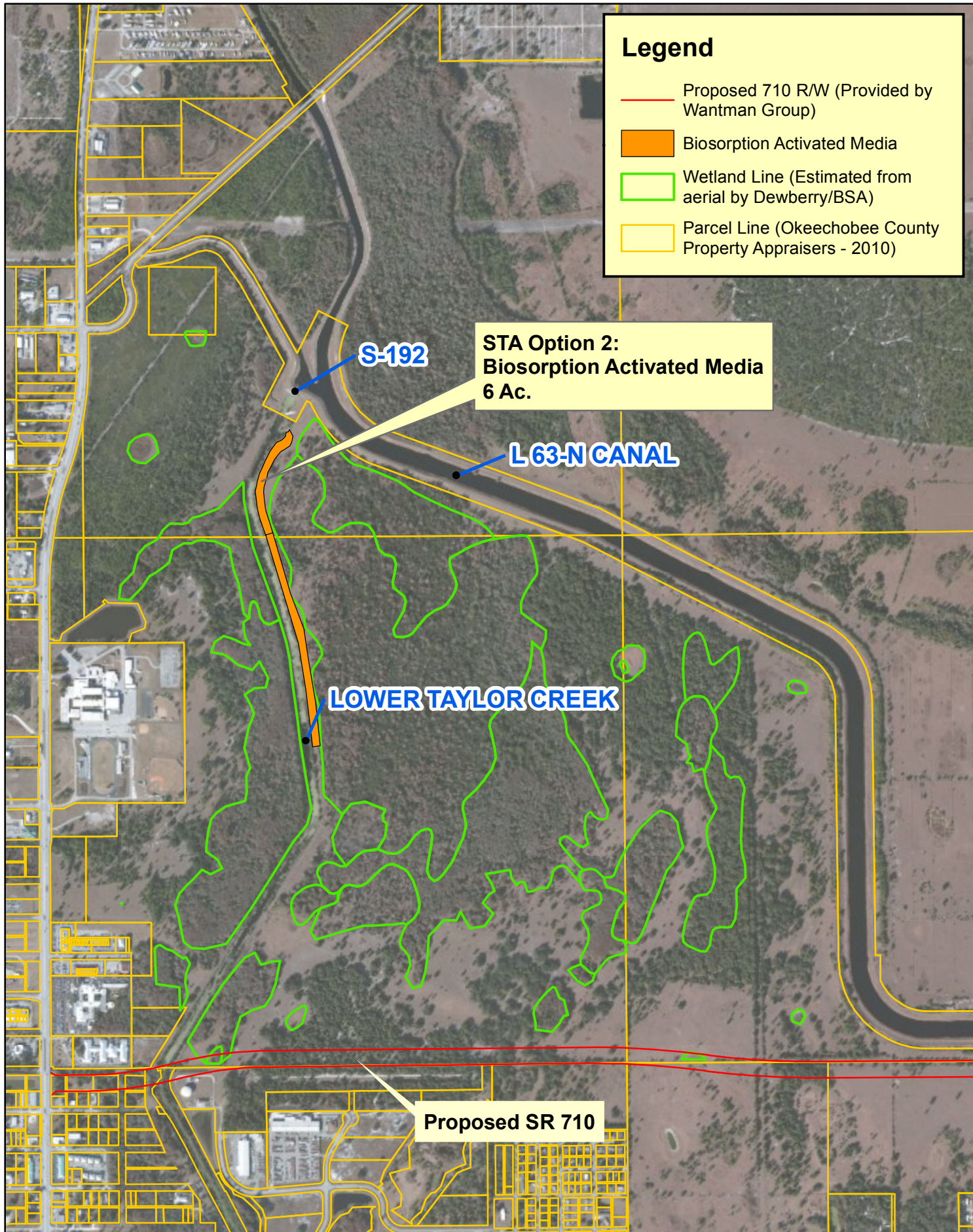
Proposed SR 710

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Earthstar Geographics, CNES/Airbus
DS, USDA, USGS, AEX, Getmapping,

0 0.125 0.25 Miles



**FIG 13 - STA OPTION 1:
Stormwater Treatment Area
SR 710 Regional Facility
Conceptual Analysis**

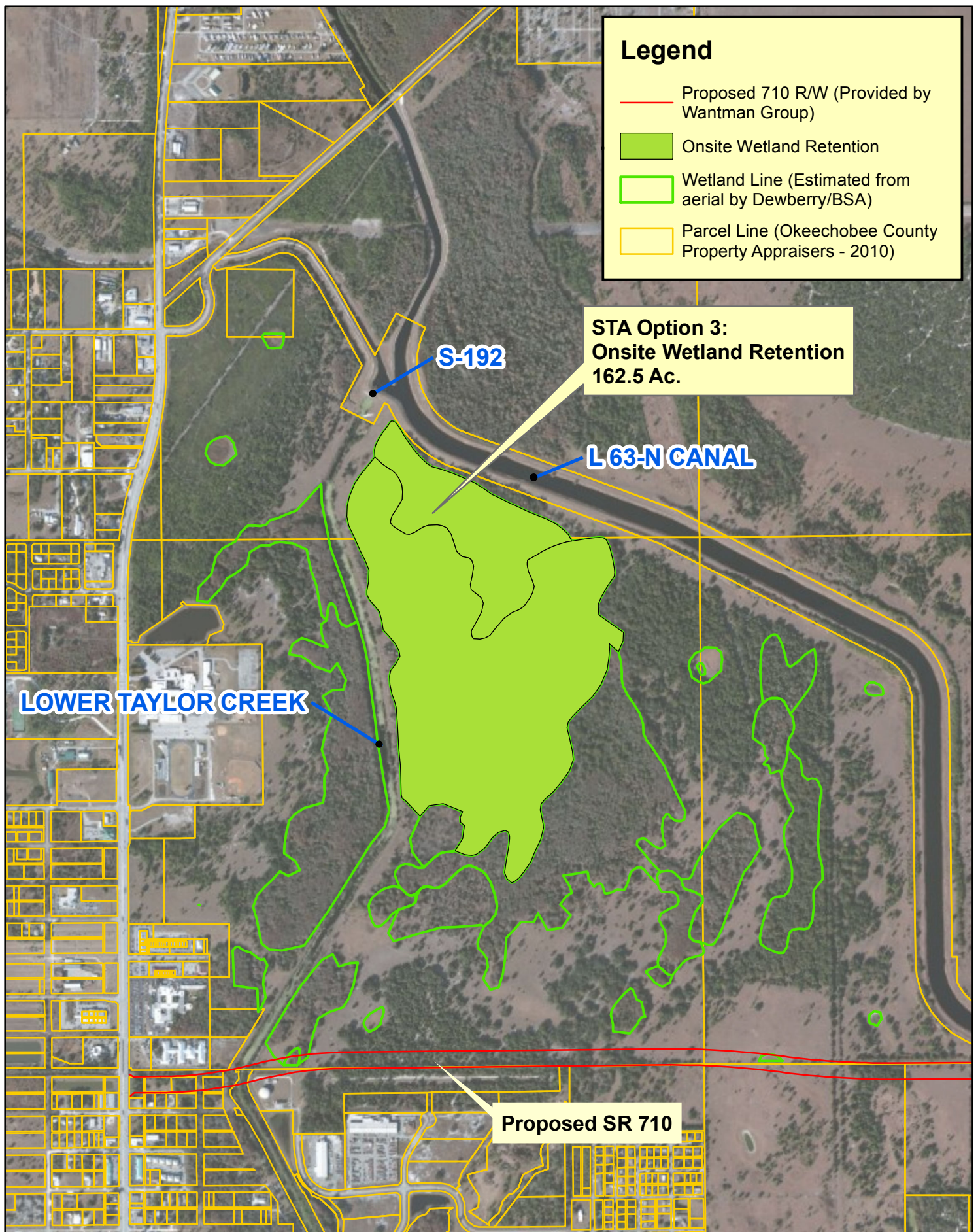


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Earthstar Geographics, CNES/Airbus
DS, USDA, USGS, AEX, Getmapping,

0 0.125 0.25 Miles



**FIG 14 - STA OPTION 2:
Biosorption Activated Media
SR 710 Regional Facility
Conceptual Analysis**



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Earthstar Geographics, CNES/Airbus
DS, USDA, USGS, AEX, Getmapping,

0 0.125 0.25
Miles



**FIG 15 - STA OPTION 3:
Onsite Wetland Retention
SR 710 Regional Facility
Conceptual Analysis**

Appendix B: Regional Pond Analysis

**SR 710 Stormwater Treatment Area/Regional Pond Feasibility Study
Preliminary Submittal**

**Financial Project ID
432644-1-32-01**

Okeechobee County, Florida

TREATMENT VOLUME CALCULATIONS FOR REGIONAL POND

PROJECT: SR 710 - Regional Pond Option A PREPARED: JAN 7/24/2014

LOCATION: OKEECHOBEE COUNTY, FLORIDA CHECKED: GSS 7/30/2014

Wet Detention Online Pond Treatment Calculations:

Total Airport Ditch Drainage area =	2086.00 Ac	
Total Treated within Airport Ditch Drainage Area =	231.78 Ac	
Remaining Area of Airport Basin Untreated =	1854.22 Ac	
SR 710 Drainage area (Basin 1 and Basin 2) =	40.37 Ac	
SR 710 Drainage area (Basin 3, Basin 4, and Basin 5) =	37.41 Ac	
Total Drainage Area Draining to Regional Pond =	2126.37 Ac	(Includes Airport and SR 710 Basins 1 and 2 only)
Total Area to be treated =	77.78 Ac	(Includes only SR 710 Basins)
1" runoff from drainage area =	6.48 Ac-Ft	
Required Treatment Volume (T.V.) =	6.48	Ac-ft
=	282,341	ft ³

STAGE-STORAGE FOR PROPOSED CONDITION

PROJECT: SR 710 - Regional Pond PREPARED: GSS 9/21/2014
 LOCATION: OKEECHOBEE COUNTY, FLORIDA CHECKED: JAN 9/22/2014

Required Roadway Embankment = 413,721 CY
 Shrinkage Factor = 10% = 41,372 CY
 Required Pond Excavation = 455,093 CY
 Required Pond Excavation = 282 Ac-Ft

Pond Storage Calculations (Wet Detention): 1:2 Slopes

Elev. (NAVD) (ft)	h ft	Area sf	Area ac	Inc. Volume Ac-ft	Cum. Volume Ac-ft	Cum. Volume Cu-ft	Total Volume Ac-ft	Total Volume Cu-ft
Parcel		1,126,640	25.864					
21.00	1.0	890,600	20.445	20.358	60.551	2,637,602	287.273	12,513,612
20.00	1.0	883,000	20.271	20.184	40.193	1,750,807	266.915	11,626,817
19.00	1.0	875,400	20.096	20.009	20.009	871,592	246.731	10,747,602
18.00	1.0	867,800	19.922	19.836	0.000	0	226.722	9,876,010
17.00	1.0	860,300	19.750	19.663			206.886	9,011,954
16.00	1.0	852,700	19.575	19.489			187.223	8,155,434
15.00	1.0	845,200	19.403	19.317			167.734	7,306,493
14.0	1.0	837,700	19.231	19.146	---	---	148.417	6,465,045
13.0	1.0	830,300	19.061	18.975	---	---	129.271	5,631,045
12.0	1.0	822,800	18.889	18.804	---	---	110.296	4,804,494
11.0	1.0	815,400	18.719	18.635	---	---	91.492	3,985,392
10.0	1.0	808,100	18.551	18.466	---	---	72.857	3,173,651
9.0	1.0	800,700	18.382	18.298	---	---	54.391	2,369,272
8.0	1.0	793,400	18.214	18.130	---	---	36.093	1,572,211
7.0	1.0	786,100	18.046	17.963	---	---	17.963	782,468
6.0	0.0	778,800	17.879	0.000	---	---	0.000	0

Top of Berm = App Exist Ground
 NWL

PPV = Cum. Vol - Total = 227 Ac-Ft

Bottom of Pond

NUTRIENT LOADING CALCULATIONS FOR REGIONAL POND

PROJECT: SR 710 - Regional Pond Option A

PREPARED: JAN 7/24/2014

LOCATION: OKEECHOBEE COUNTY, FLORIDA

CHECKED: GSS 9/21/2014

Annual Runoff Calculation

Basin	C*	Annual Runoff (in.)	Basin Area (ac)**
Regional Pond	0.6156	51	1894.59

* Assume Non DCIA = 61 & DCIA = 75%, using Zone 2 Table from SQA

** Basin area = SR 710 Post Basins 1-2 and Airport Ditch Basin - Treated portion of Airport Basin

Regional Pond Nutrient Removal Calculation

Basin	Annual Runoff (ac/ft/yr)	Permanent Pool (ac-ft)	Residence Time (days)	Wet Detention TP Removal (%)	Wet Detention TN Removal (%)
Regional Pond	4956.8	227.00	16.7	63.0	34.7

Pre-Development Loading Summary

Basin	TP Outflow (kg/yr)	TN Outflow (kg/yr)
Airport Basin	762.09	4971.29
Lower Taylor Creek Basin	460.75	2353.67
SR 710 Basins 1-2	14.16	78.85
SR 710 Basins 3-5	12.53	84.70
Total Outflow	1249.53	7488.51

Post-Development Loading TP Summary

Basin	TP (kg/yr)	% Removal	TP Outflow (kg/yr)
Airport Basin	762.09	62.99	282.05
Lower Taylor Creek Basin***	456.47	N/A	456.47
SR 710 Basin 1-2	10.15	62.99	3.76
SR 710 Basin 3-5	11.52	N/A	11.52
Total Post TP Outflow			753.80

*** Post Lower Taylor Creek Basin loading is less than Pre due to the regional pond area (~ 20 ac)

Post-Development Loading TN Summary

Basin	TN (kg/yr)	% Removal	TN Outflow (kg/yr)
Airport Basin	4971.29	34.67	3247.93
Lower Taylor Creek Basin***	2321.50	N/A	2321.50
SR 710 Basin 1-2	26.21	34.67	17.12
SR 710 Basin 3-5	29.72	N/A	29.72
Total Post TN Outflow			5616.27

*** Post Lower Taylor Creek Basin loading is less than Pre due to the regional pond area (~ 20 ac)

Total TP Removed	495.7 kg/yr
Total TN Removed	1872.2 kg/yr

SR 710 Regional Pond (Option B) - Withdrawal of Water from L-63N

PROJECT: SR 710 - Regional Pond Option B

PREPARED: GSS 9/21/2014

LOCATION: OKEECHOBEE COUNTY, FLORIDA

CHECKED: JAN 9/22/2014

Scenario - 150 Day Residence Time

1. Determine Permanent Pool Residence Time

Assume the primary component in the treatment train will be a wet detention pond with a residence time of 150 days

Anticipate TN removal: with 150 days residence time (td)

$$\text{Eff} = (43.75)(\text{td}) / (4.38 + \text{td}) = 42.5 \%$$

Anticipate TP removal: with 150 days residence time (td)

$$\text{Eff.} = 40.13 + 6.372 \ln(\text{td}) + 0.213 (\ln \text{td})^2 = 77.4 \%$$

2. Wet Detention Pond Characteristics

a. Calculate annual runoff inputs to pond:

$$226.70 \text{ ac-ft} = \text{Permanent Pool Volume}$$

For a 150-day residence time, the allowable volume of runoff into the pond will be:

$$\text{Allowable Volume} = 365 \text{ days} / 1 \text{ Year} / 150 \text{ days} = 552 \text{ Ac-Ft}$$

$$\text{Flow Rate from L63-N} = 0.76 \text{ cfs} \quad (\text{Assumes 0 roadway runoff})$$

b. Estimate Max. Allowable Pond Depth:

1. Estimate runoff characteristics:

$$\text{TP} = 0.354 \text{ mg/l} \quad (\text{from STA calculations})$$

2. Calculate TP loading to wet detention pond and Reduction:

$$\text{TP loading to wet det. Pond} = \boxed{241} \text{ kg TP/yr} \quad \text{Allowable Volume} \times \text{TP} \times 43560 \times 7.48 \times 3.785 \times 10^{-6}$$

$$\text{TP Removal Rate} = 77.41 \%$$

$$\text{TP removal by Wet Det. Pond} = \boxed{187} \text{ kg TP/yr}$$

3. Calculate TP concentration in pond:

$$\text{TP removal} = 77.4 \% \quad (\text{from calcs. Above})$$

$$\begin{aligned} \text{Annual mass of TP remaining in water column} &= \text{TP load to pond} \times (1 - \text{TP removal}) \\ &= 54.45 \text{ kg TP/yr} \end{aligned}$$

This phosphorous mass will be distributed within the pond permanent pool and the pond outflow. Assuming that inflow and outflow are approx. equal, the

$$\text{Outflow} = 552.00 \text{ ac-ft/yr}$$

$$\text{Mean Pond Concentration} = 0.0567 \text{ mg TP/liter} \quad \left(\frac{\text{Annual Mass of TP}}{\text{Outflow Vol.} + \text{PPV}} \right) \frac{10^{-5}}{43560 \times 7.48 \times 3.785}$$

SR 710 Regional Pond (Option B) - Withdrawal of Water from L-63N

PROJECT: SR 710 - Regional Pond Option B

PREPARED: GSS 9/21/2014

LOCATION: OKEECHOBEE COUNTY, FLORIDA

CHECKED: JAN 9/22/2014

Scenario - 150 Day Residence Time

4. Calculate mean chlorophyll-a concentration in pond:

$$\ln(\text{chl-a}) = 1.058 \ln(\text{TP}) - 0.934$$

$$\ln(\text{chl-a}) = 3.34$$

$$\text{chl-a} = 28.16 \text{ mg/cu. Meter}$$

5. Calculate mean Secchi disk depth:

$$\text{SD} = (24.2386 + (0.3041)(\text{chl-a})) / (6.0632 + \text{chl-a}) =$$

$$\text{SD} = 0.958 \text{ m} = 3.14 \text{ feet}$$

6. Calculate depth of anoxic conditions in pond:

$$\text{Depth of DO}<1 = 3.035 \times \text{SD} + 0.02164 \times (\text{chl-a}) - 0.004979 \times \text{Total P}$$

$$\text{Depth of DO}<1 = 3.24 \text{ m} = 10.6 \text{ feet}$$

7. Adjust Volume Reduction for Permanent Pool

$$\begin{aligned} \text{Permanent Pool Volume} &= 226.70 \text{ Ac-Ft} \\ \text{Permanent Pool Above Anoxic Conditions} &= 203.70 \text{ Ac-Ft} \end{aligned}$$

Actual Estimated TP Removal =	168 kg TP/yr
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SR 710 Regional Pond (Option B) - Withdrawal of Water from L-63N

PROJECT: SR 710 - Regional Pond Option B

PREPARED: GSS 9/21/2014

LOCATION: OKEECHOBEE COUNTY, FLORIDA

CHECKED: JAN 9/22/2014

Scenario - 21 Day Residence Time

1. Determine Permanent Pool Residence Time

Assume the primary component in the treatment train will be a wet detention pond with a residence time of 150 days

Anticipate TN removal: with 21 days residence time (td)

$$\text{Eff} = (43.75)(\text{td}) / (4.38 + \text{td}) = 36.2 \%$$

Anticipate TP removal: with 21 days residence time (td)

$$\text{Eff.} = 40.13 + 6.372 \ln(\text{td}) + 0.213 (\ln \text{td})^2 = 61.5 \%$$

2. Wet Detention Pond Characteristics

a. Calculate annual runoff inputs to pond:

$$226.70 \text{ ac-ft} = \text{Permanent Pool Volume}$$

For a 21-day residence time, the allowable volume of runoff into the pond will be:

$$\text{Allowable Volume} = 365 \text{ days} / 1 \text{ Year} / 21 \text{ days} = 3940 \text{ Ac-Ft}$$

$$\text{Flow Rate from L63-N} = 5.44 \text{ cfs} \quad (\text{Assumes 0 roadway runoff})$$

b. Estimate Max. Allowable Pond Depth:

1. Estimate runoff characteristics:

$$\text{TP} = 0.354 \text{ mg/l} \quad (\text{from STA calculations})$$

2. Calculate TP loading to wet detention pond and Reduction:

$$\text{TP loading to wet det. Pond} = 1,720 \text{ kg TP/yr} \quad \text{Allowable Volume} \times \text{TP} \times 43560 \times 7.48 \times 3.785 \times 10^{-5}$$

$$\text{TP Removal Rate} = 61.50 \%$$

$$\text{TP removal by Wet Det. Pond} = 1,058 \text{ kg TP/yr}$$

3. Calculate TP concentration in pond:

$$\text{TP removal} = 61.5 \% \quad (\text{from calcs. Above})$$

$$\begin{aligned} \text{Annual mass of TP remaining in water column} &= \text{TP load to pond} \times (1 - \text{TP removal}) \\ &= 662.13 \text{ kg TP/yr} \end{aligned}$$

This phosphorous mass will be distributed within the pond permanent pool and the pond outflow. Assuming that inflow and outflow are approx. equal, the

SR 710 Regional Pond (Option B) - Withdrawal of Water from L-63N

PROJECT: SR 710 - Regional Pond Option B

PREPARED: GSS 9/21/2014

LOCATION: OKEECHOBEE COUNTY, FLORIDA

CHECKED: JAN 9/22/2014

Scenario - 21 Day Residence Time

Outflow = 3940.00 ac-ft/yr

Mean Pond Concentration = 0.12885 mg TP/liter $\left(\frac{\text{Annual Mass of TP}}{\text{Outflow Vol.} + \text{PPV}} \right) \frac{10^{-5}}{43560 \times 7.48 \times 3.785}$

4. Calculate mean chlorophyll-a concentration in pond:

$\ln(\text{chl-a}) = 1.058 \ln(\text{TP}) - 0.934$

$\ln(\text{chl-a}) = 4.21$

$\text{chl-a} = 67.12 \text{ mg/cu. Meter}$

5. Calculate mean Secchi disk depth:

$\text{SD} = (24.2386 + (0.3041)(\text{chl-a})) / (6.0632 + \text{chl-a}) =$

$\text{SD} = 0.610 \text{ m} = 2.00 \text{ feet}$

6. Calculate depth of anoxic conditions in pond:

$\text{Depth of DO}<1 = 3.035 \times \text{SD} + 0.02164 \times (\text{chl-a}) - 0.004979 \times \text{Total P}$

$\text{Depth of DO}<1 = 2.66 \text{ m} = 8.7 \text{ feet}$

7. Adjust Volume Reduction for Permanent Pool

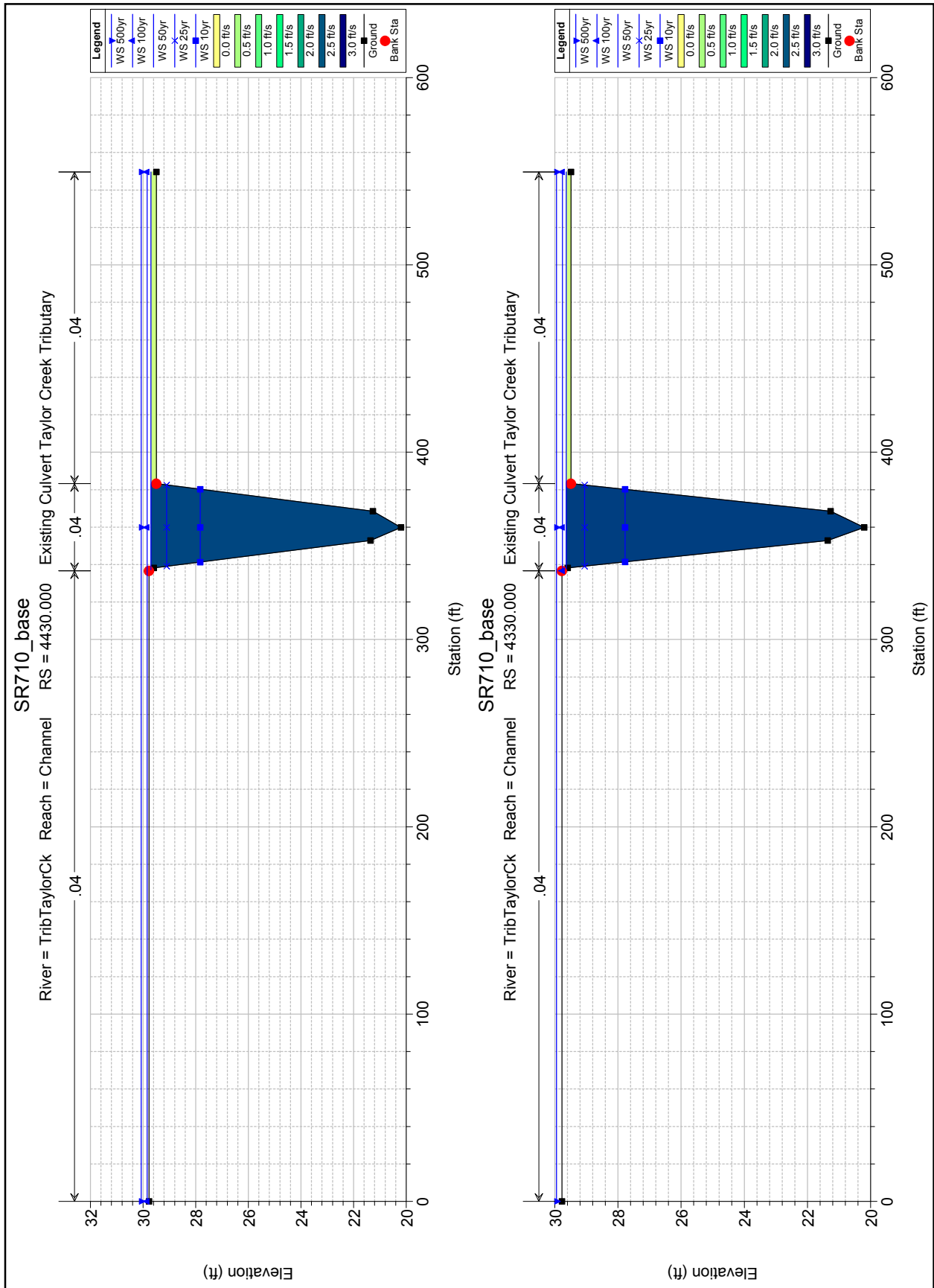
Permanent Pool Volume = 226.70 Ac-Ft

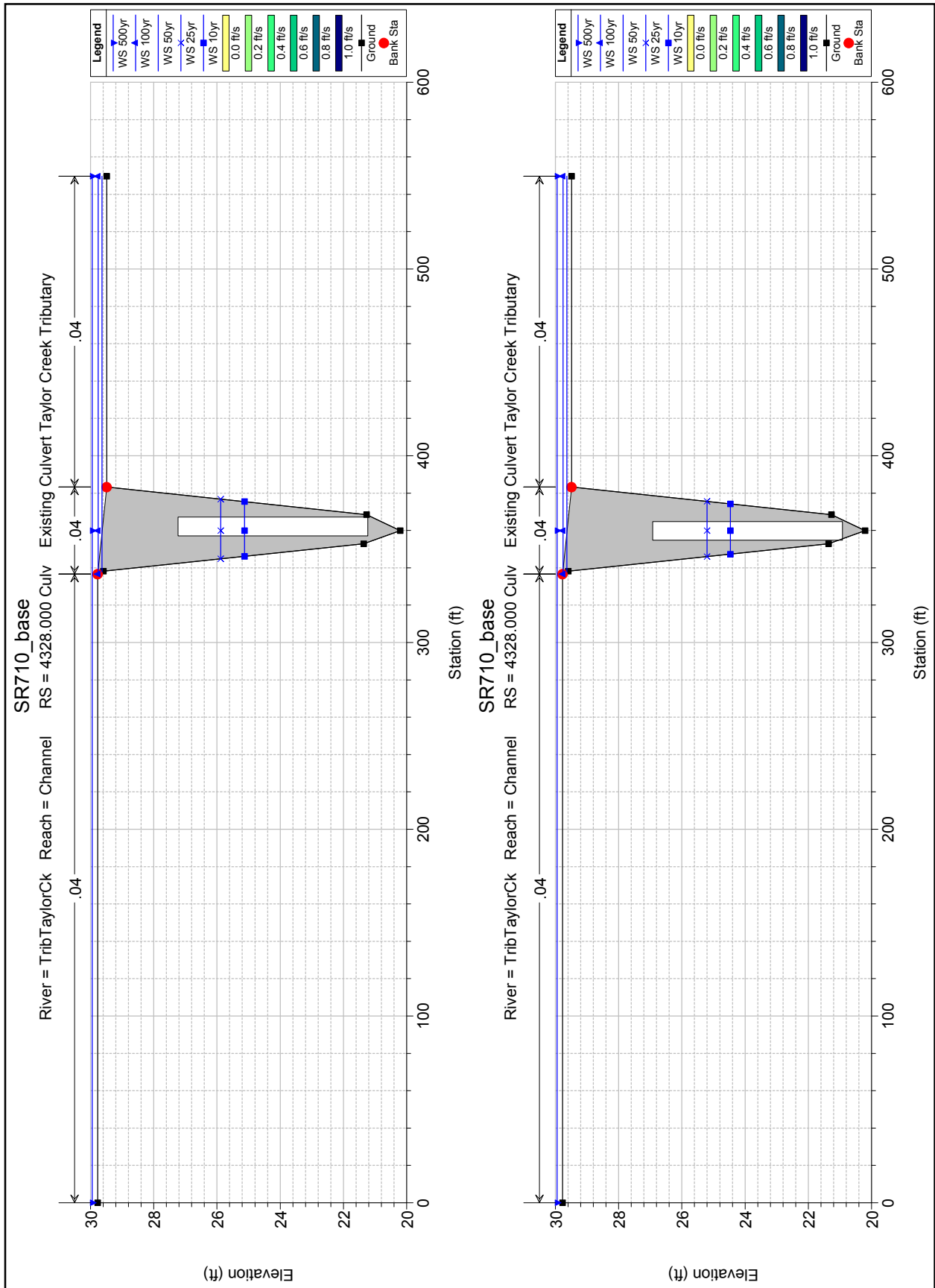
Permanent Pool Above Anoxic Conditions = 166.70 Ac-Ft

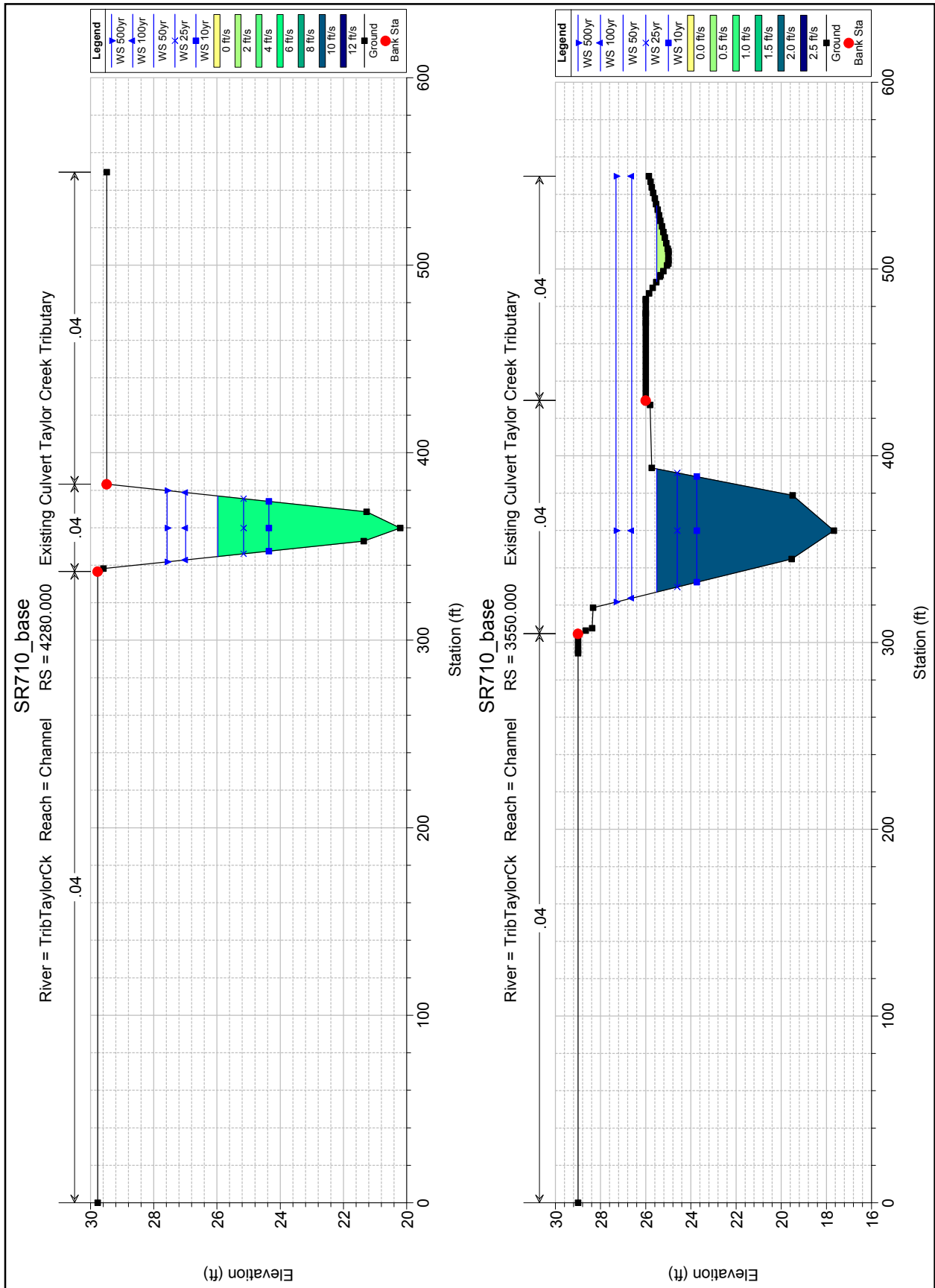
Actual Estimated TP Removal = 778 kg TP/yr
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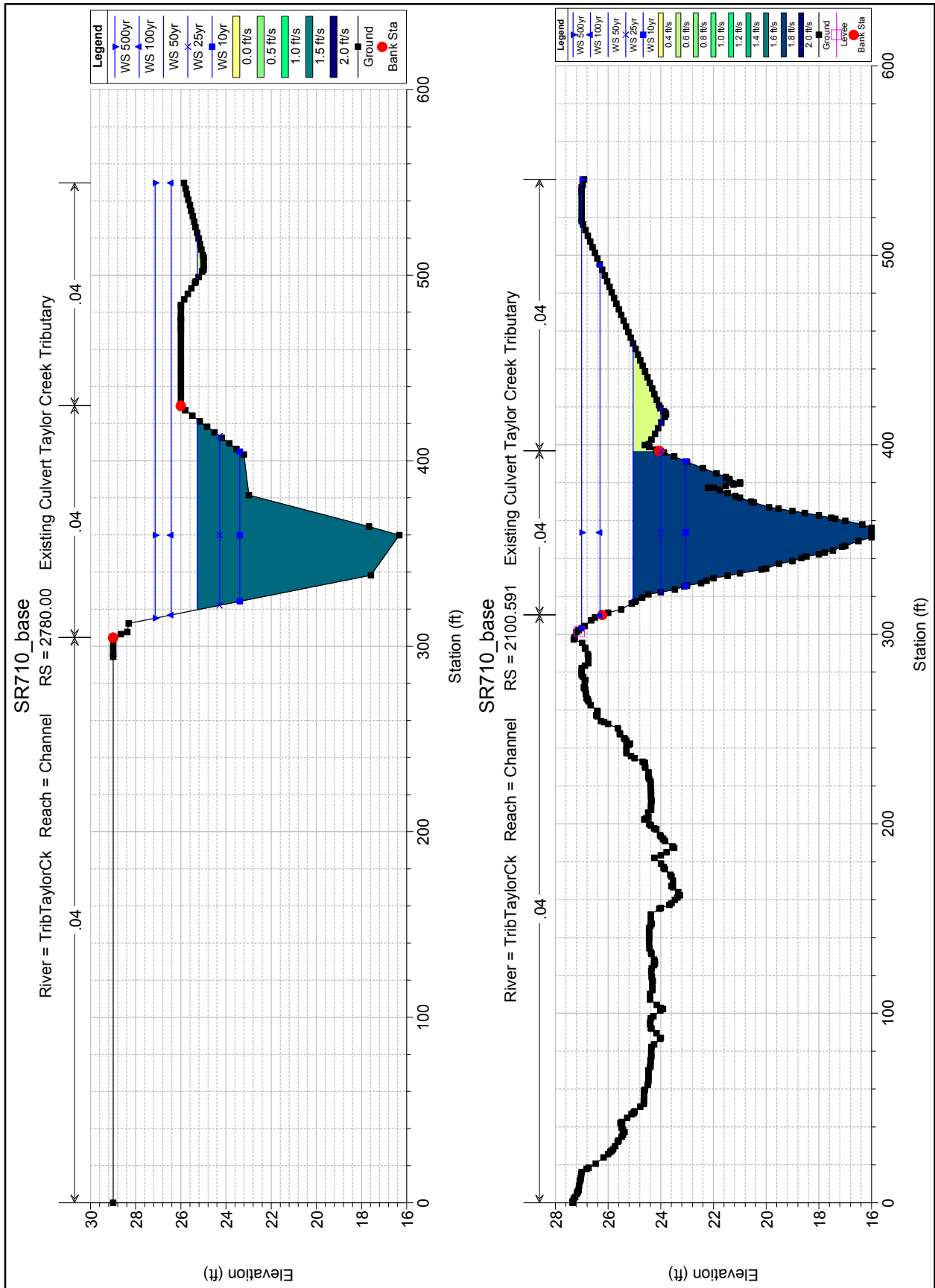
HEC-RAS Plan: Exist_US&DSnew River: TribTaylorCk Reach: Channel

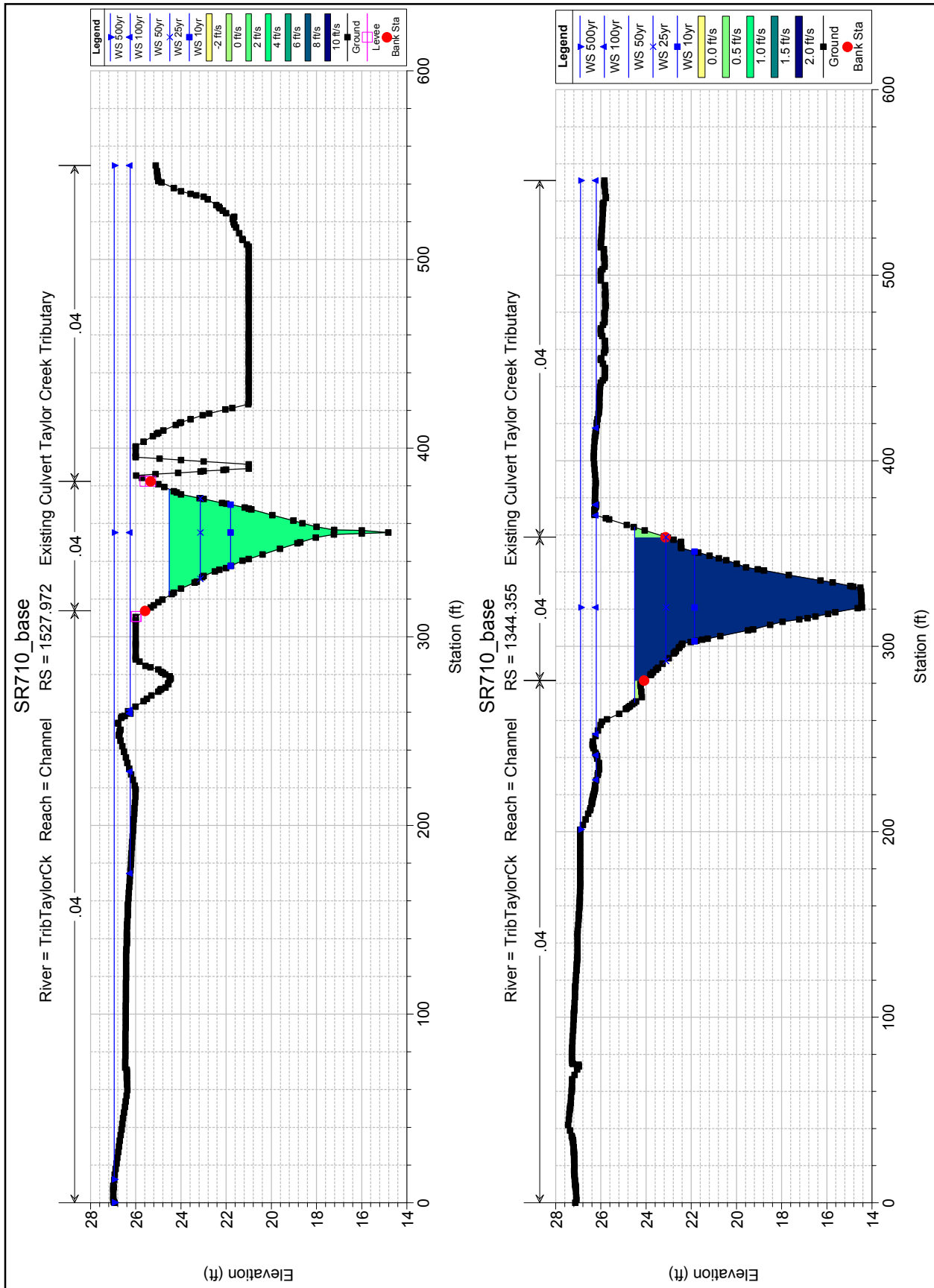
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Channel	4430.000	50yr	699.00	20.20	29.70		29.80	0.000531	2.59	300.69	212.44	0.19
Channel	4430.000	100yr	838.00	20.20	29.84		29.97	0.000680	2.96	355.78	549.69	0.22
Channel	4430.000	500yr	1080.00	20.20	30.07		30.23	0.000844	3.38	482.53	549.69	0.24
Channel	4430.000	25yr	570.00	20.20	29.10		29.19	0.000479	2.38	239.22	43.47	0.18
Channel	4430.000	10yr	437.00	20.20	27.83		27.92	0.000551	2.34	186.73	38.93	0.19
Channel	4330.000	50yr	699.00	20.20	29.64	24.38	29.75	0.000548	2.63	288.30	211.93	0.19
Channel	4330.000	100yr	838.00	20.20	29.76	24.78	29.90	0.000735	3.05	313.74	212.97	0.22
Channel	4330.000	500yr	1080.00	20.20	29.95	25.42	30.14	0.000999	3.63	412.48	549.69	0.26
Channel	4330.000	25yr	570.00	20.20	29.05	23.98	29.14	0.000491	2.40	237.04	43.29	0.18
Channel	4330.000	10yr	437.00	20.20	27.77	23.50	27.86	0.000570	2.37	184.47	38.72	0.19
Channel	4328.000		Culvert									
Channel	4280.000	50yr	699.00	20.20	25.97		26.49	0.004668	5.80	120.53	32.30	0.53
Channel	4280.000	100yr	838.00	20.20	26.99		27.45	0.003340	5.39	155.46	35.95	0.46
Channel	4280.000	500yr	1080.00	20.20	27.58		28.16	0.003894	6.10	177.02	38.02	0.50
Channel	4280.000	25yr	570.00	20.20	25.16		25.71	0.005911	5.97	95.45	29.40	0.58
Channel	4280.000	10yr	437.00	20.20	24.36		24.91	0.007313	5.98	73.08	26.55	0.64
Channel	3550.000	50yr	699.00	17.67	25.52		25.59	0.000386	2.09	344.27	106.63	0.16
Channel	3550.000	100yr	838.00	17.67	26.62		26.67	0.000342	1.74	551.91	225.94	0.15
Channel	3550.000	500yr	1080.00	17.67	27.31		27.36	0.000296	1.77	708.40	227.98	0.14
Channel	3550.000	25yr	570.00	17.67	24.60		24.67	0.000445	2.08	273.79	61.13	0.17
Channel	3550.000	10yr	437.00	17.67	23.74		23.80	0.000464	1.96	223.20	56.57	0.17
Channel	2780.00	50yr	699.00	16.33	25.26		25.30	0.000271	1.59	443.92	126.52	0.14
Channel	2780.00	100yr	838.00	16.33	26.43		26.46	0.000174	1.41	657.90	232.87	0.11
Channel	2780.00	500yr	1080.00	16.33	27.14		27.17	0.000169	1.50	822.17	234.56	0.11
Channel	2780.00	25yr	570.00	16.33	24.29		24.33	0.000347	1.65	345.04	91.15	0.15
Channel	2780.00	10yr	437.00	16.33	23.39		23.43	0.000405	1.63	267.72	80.71	0.16
Channel	2100.591	50yr	699.00	16.00	25.05	20.02	25.10	0.000320	1.81	413.67	137.00	0.15
Channel	2100.591	100yr	838.00	16.00	26.30	20.38	26.34	0.000190	1.57	615.58	184.88	0.12
Channel	2100.591	500yr	1080.00	16.00	27.00	20.94	27.04	0.000198	1.73	754.95	236.93	0.12
Channel	2100.591	25yr	570.00	16.00	24.00	19.63	24.06	0.000458	1.94	294.96	82.10	0.17
Channel	2100.591	10yr	437.00	16.00	23.05	19.19	23.11	0.000538	1.92	227.57	65.70	0.18
Channel	1527.972	50yr	699.00	14.82	24.52	21.83	24.72	0.001986	3.58	195.41	56.29	0.34
Channel	1527.972	100yr	838.00	14.82	26.25	22.19	26.26	0.000084	0.88	1018.85	342.74	0.07
Channel	1527.972	500yr	1080.00	14.82	26.96	22.75	26.97	0.000077	0.93	1350.22	537.54	0.07
Channel	1527.972	25yr	570.00	14.82	23.15	21.43	23.45	0.003813	4.45	128.21	42.62	0.45
Channel	1527.972	10yr	437.00	14.82	21.80	20.97	22.28	0.008360	5.59	78.13	32.48	0.64
Channel	1344.355	50yr	699.00	14.44	24.50	18.35	24.56	0.000306	1.83	387.24	94.33	0.15
Channel	1344.355	100yr	838.00	14.44	26.20	18.75	26.24	0.000151	1.57	603.26	265.03	0.11
Channel	1344.355	500yr	1080.00	14.44	26.91	19.38	26.95	0.000153	1.69	837.85	349.91	0.11
Channel	1344.355	25yr	570.00	14.44	23.12	17.92	23.19	0.000478	2.04	278.98	66.69	0.18
Channel	1344.355	10yr	437.00	14.44	21.85	17.46	21.92	0.000496	2.10	207.69	48.27	0.18
Channel	1281.855		Culvert									
Channel	1218.437	50yr	699.00	13.50	19.86		20.12	0.001086	4.11	169.89	39.43	0.35
Channel	1218.437	100yr	838.00	13.50	20.43		20.72	0.001099	4.34	193.74	46.81	0.36
Channel	1218.437	500yr	1080.00	13.50	21.33		21.66	0.001079	4.61	242.74	59.87	0.36
Channel	1218.437	25yr	570.00	13.50	19.26		19.50	0.001069	3.87	147.17	37.06	0.34
Channel	1218.437	10yr	437.00	13.50	18.55		18.75	0.001057	3.59	121.75	34.20	0.34
Channel	972.498	50yr	699.00	13.10	19.00	17.37	19.60	0.002969	6.25	111.82	27.92	0.55
Channel	972.498	100yr	838.00	13.10	19.50	17.81	20.18	0.003072	6.64	126.23	29.45	0.57
Channel	972.498	500yr	1080.00	13.10	20.29	18.51	21.09	0.003166	7.17	150.63	31.87	0.58
Channel	972.498	25yr	570.00	13.10	18.48	16.91	19.00	0.002851	5.84	97.67	26.34	0.53
Channel	972.498	10yr	437.00	13.10	17.83	16.38	18.28	0.002761	5.37	81.35	24.38	0.52
Channel	648.236	50yr	699.00	12.60	17.99	16.66	18.60	0.003249	6.24	112.05	31.57	0.58
Channel	648.236	100yr	838.00	12.60	18.50	17.07	19.16	0.003218	6.52	128.54	33.59	0.59
Channel	648.236	500yr	1080.00	12.60	19.28	17.71	20.02	0.003323	6.91	156.32	38.41	0.60
Channel	648.236	25yr	570.00	12.60	17.46	16.24	18.01	0.003312	5.95	95.74	29.43	0.58
Channel	648.236	10yr	437.00	12.60	16.46	15.74	17.10	0.004858	6.38	68.51	25.46	0.69
Channel	267.180	50yr	699.00	7.17	17.19	12.29	17.29	0.002826	2.58	270.65	58.65	0.21
Channel	267.180	100yr	838.00	7.17	17.69	12.81	17.81	0.003014	2.79	300.51	60.87	0.22
Channel	267.180	500yr	1080.00	7.17	18.52	13.65	18.65	0.002935	3.01	389.35	167.49	0.22
Channel	267.180	25yr	570.00	7.17	16.66	11.81	16.74	0.002656	2.38	239.93	56.27	0.20
Channel	267.180	10yr	437.00	7.17	14.24	11.24	14.45	0.009574	3.65	119.75	38.02	0.36

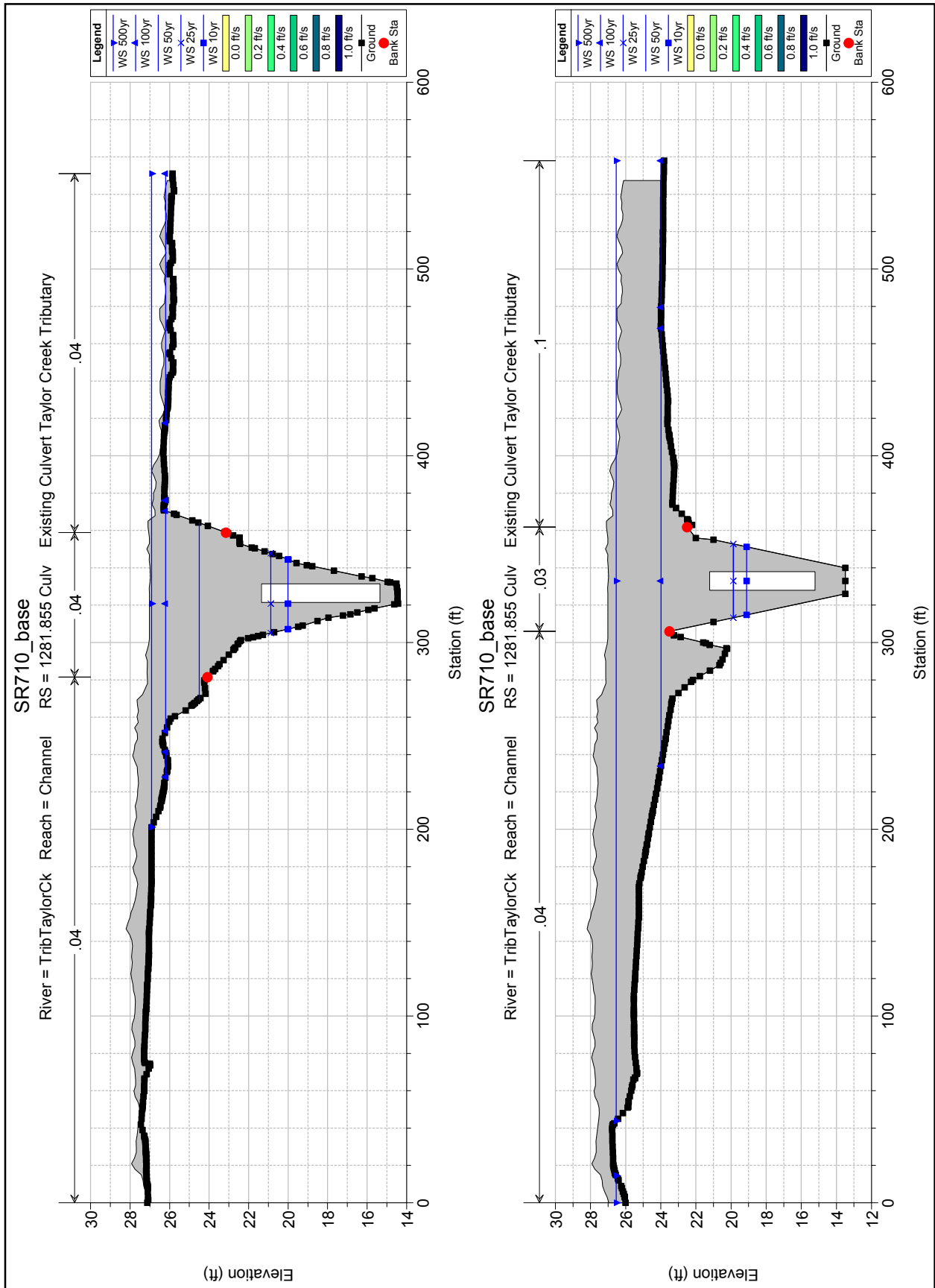


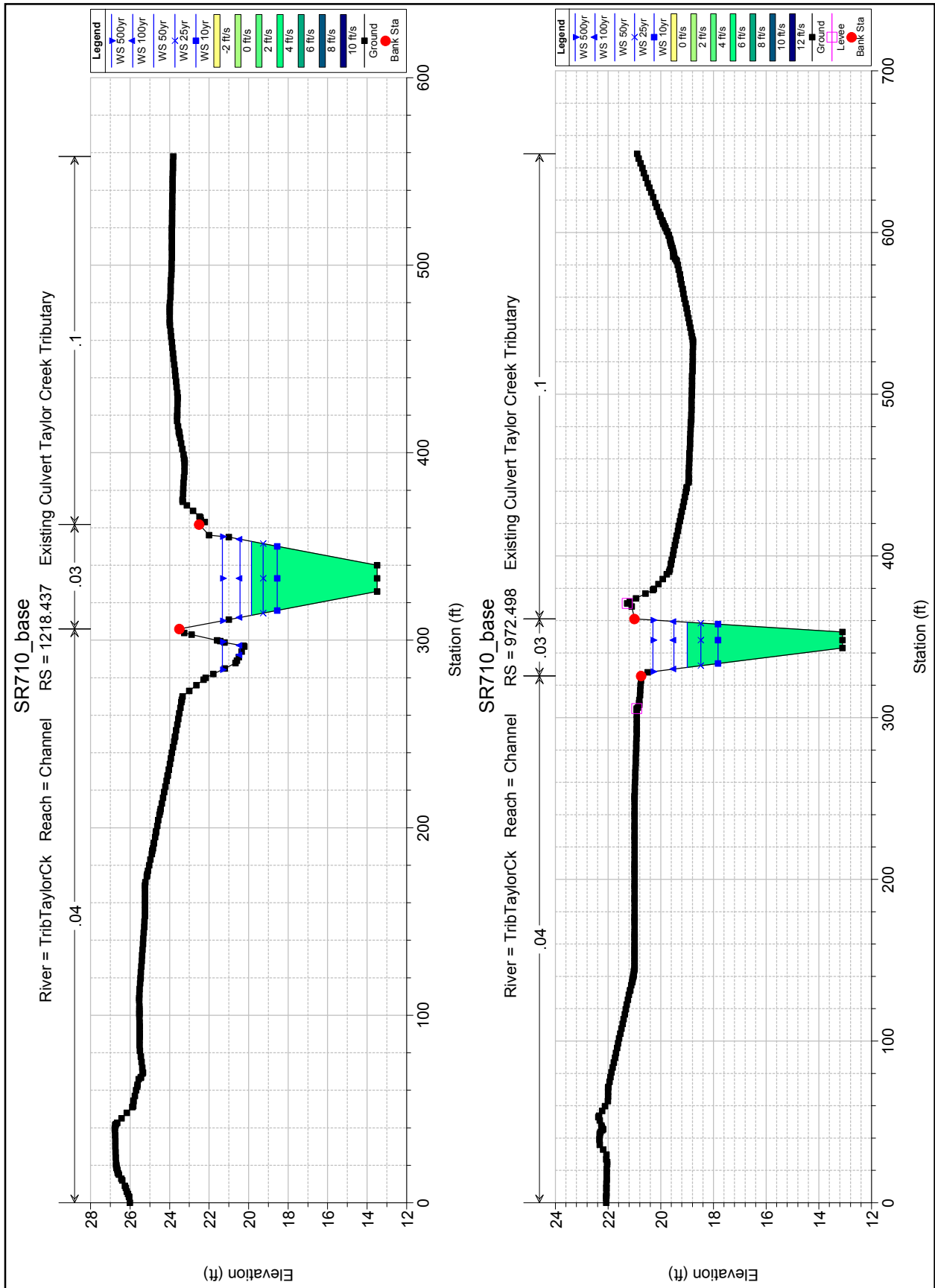


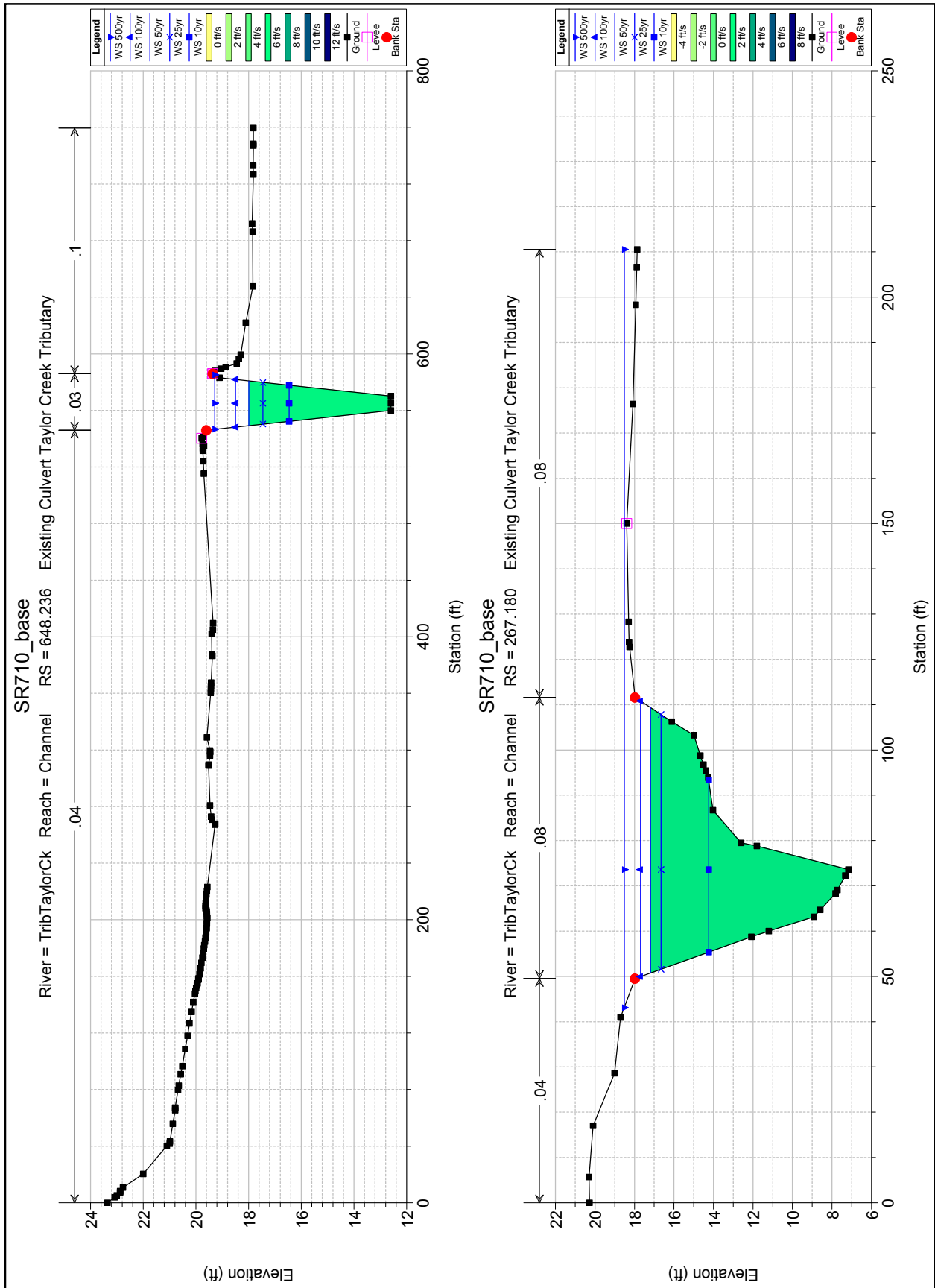


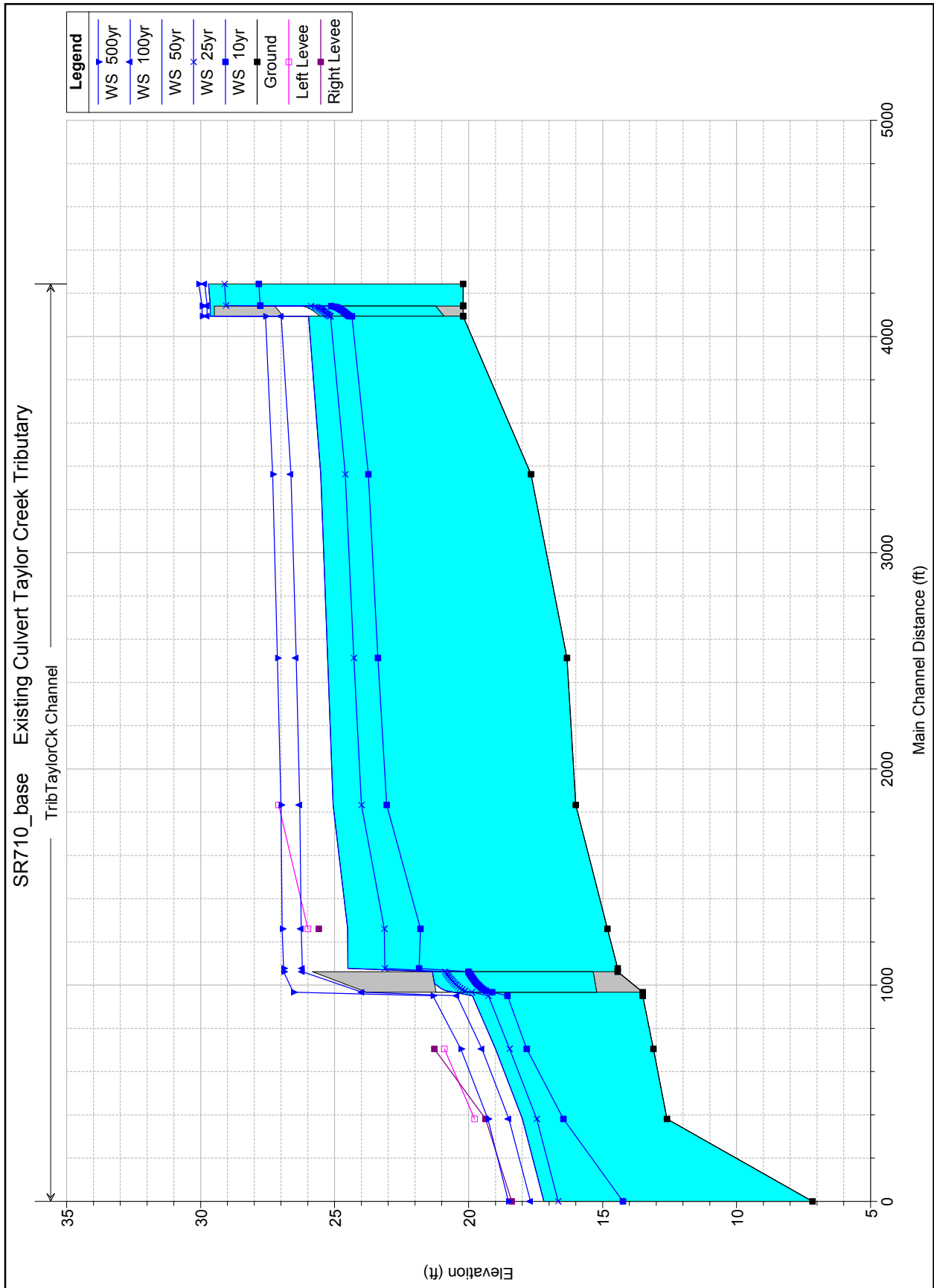










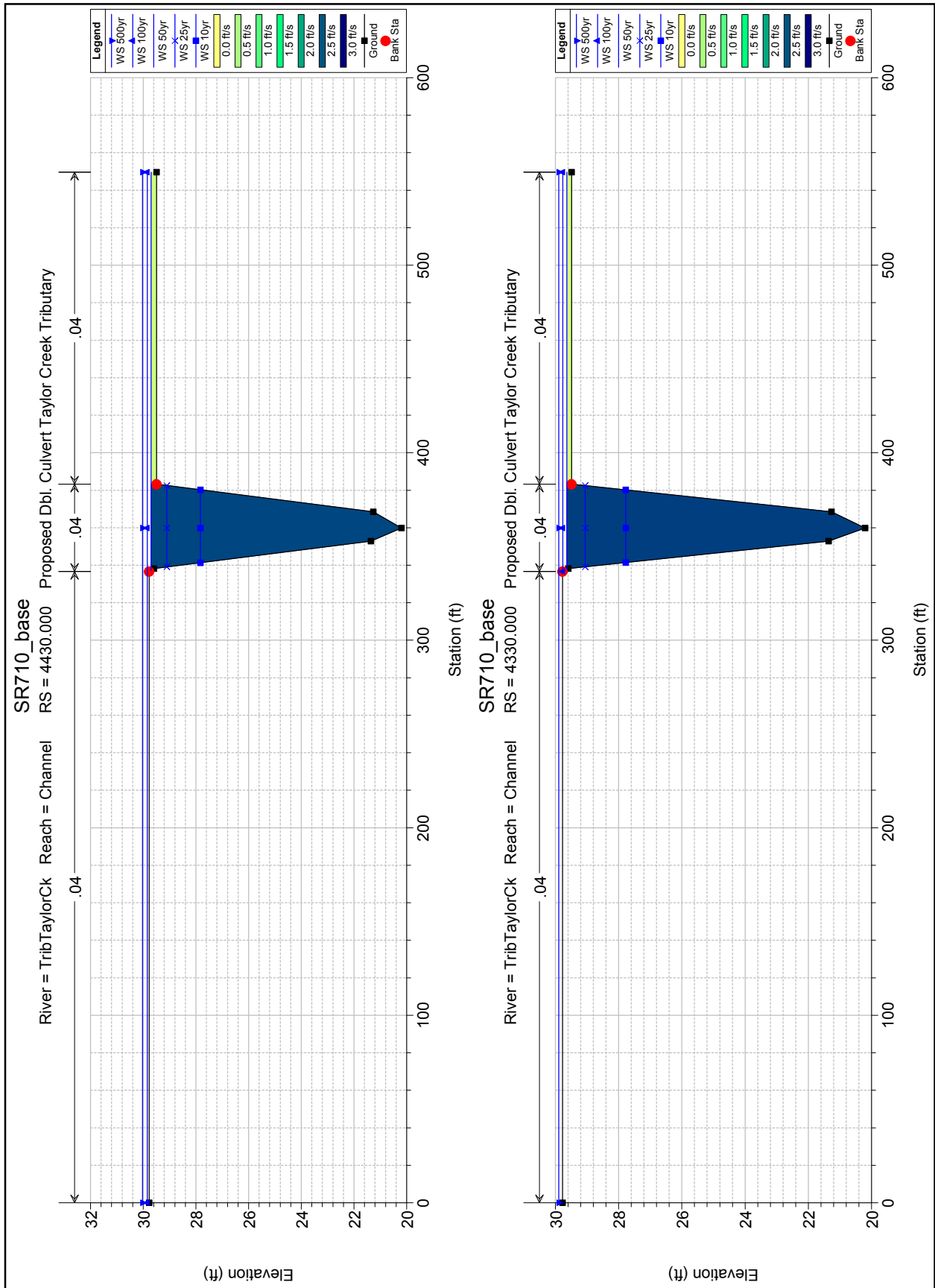


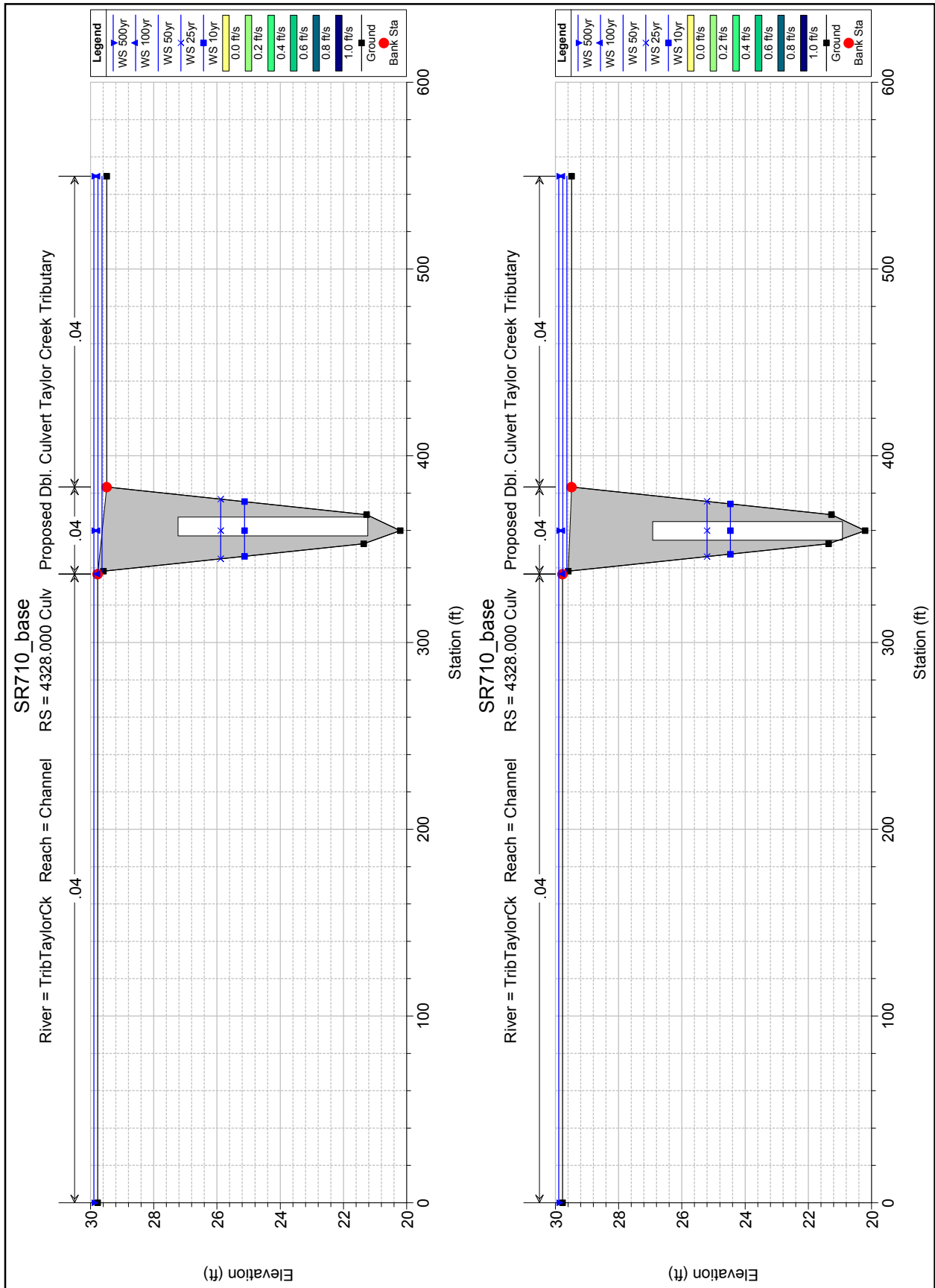
HEC-RAS Plan: US&DS River: TribTaylorCk Reach: Channel

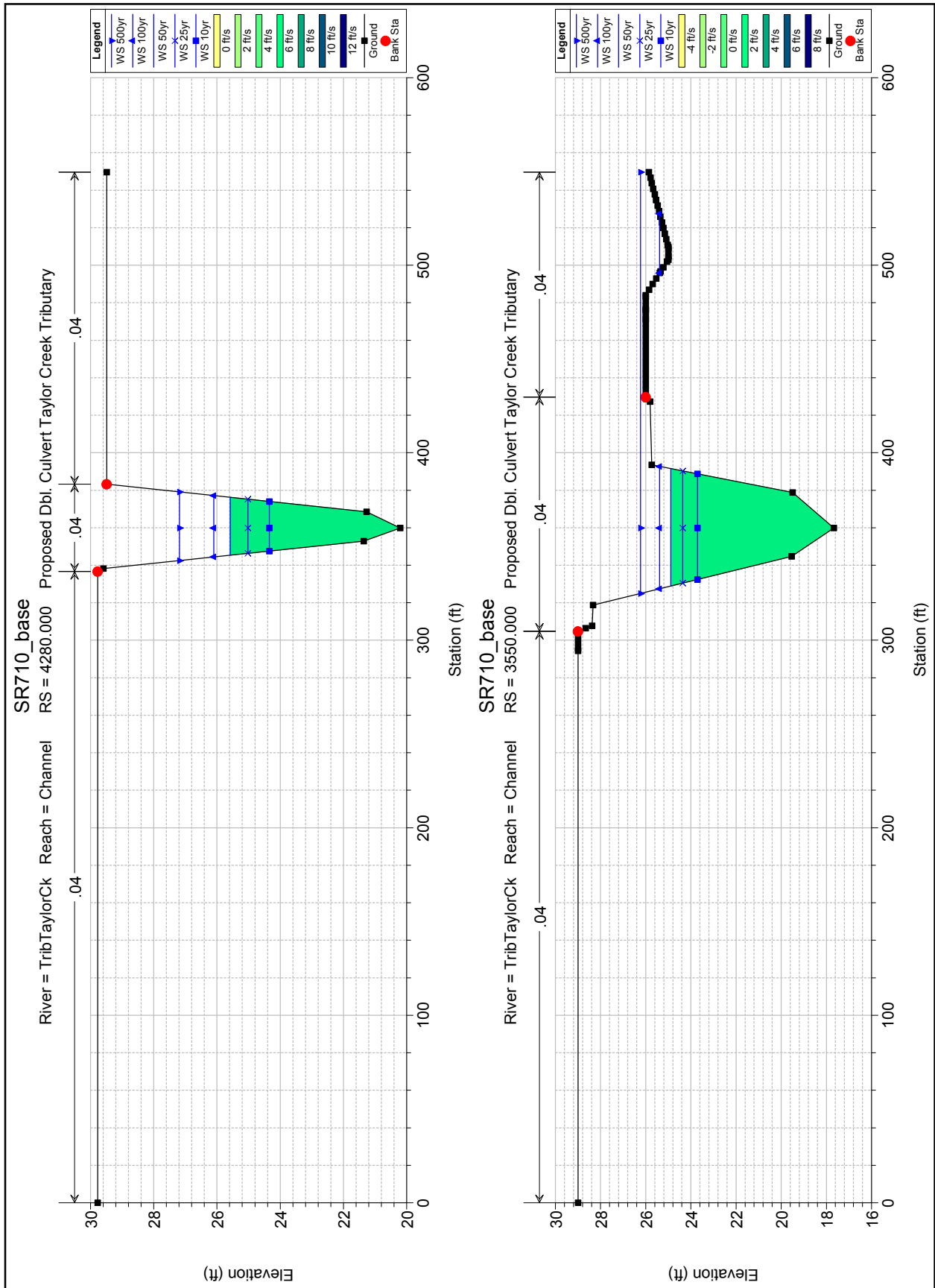
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Channel	4430.000	50yr	699.00	20.20	29.70		29.80	0.000531	2.59	300.69	212.44	0.19
Channel	4430.000	100yr	838.00	20.20	29.85		29.98	0.000676	2.95	358.38	549.69	0.21
Channel	4430.000	500yr	1080.00	20.20	30.03		30.20	0.000897	3.47	457.64	549.69	0.25
Channel	4430.000	25yr	570.00	20.20	29.10		29.19	0.000479	2.38	239.22	43.47	0.18
Channel	4430.000	10yr	437.00	20.20	27.83		27.92	0.000551	2.34	186.73	38.93	0.19
Channel	4330.000	50yr	699.00	20.20	29.64	24.39	29.75	0.000548	2.63	288.30	211.93	0.19
Channel	4330.000	100yr	838.00	20.20	29.77	24.79	29.91	0.000733	3.05	314.67	213.01	0.22
Channel	4330.000	500yr	1080.00	20.20	29.89	25.42	30.10	0.001068	3.73	382.51	549.69	0.27
Channel	4330.000	25yr	570.00	20.20	29.05	23.98	29.14	0.000491	2.40	237.04	43.29	0.18
Channel	4330.000	10yr	437.00	20.20	27.77	23.50	27.86	0.000570	2.37	184.47	38.72	0.19
Channel	4328.000		Culvert									
Channel	4280.000	50yr	699.00	20.20	25.58		26.23	0.006273	6.46	108.27	30.91	0.61
Channel	4280.000	100yr	838.00	20.20	26.10		26.80	0.006092	6.71	124.83	32.77	0.61
Channel	4280.000	500yr	1080.00	20.20	27.18		27.87	0.004928	6.65	162.36	36.62	0.56
Channel	4280.000	25yr	570.00	20.20	25.02		25.62	0.006656	6.23	91.45	28.91	0.62
Channel	4280.000	10yr	437.00	20.20	24.34		24.90	0.007441	6.02	72.63	26.49	0.64
Channel	3550.000	50yr	699.00	17.67	24.89		24.98	0.000559	2.39	291.87	62.68	0.20
Channel	3550.000	100yr	838.00	17.67	25.38		25.49	0.000601	2.58	330.72	97.00	0.20
Channel	3550.000	500yr	1080.00	17.67	26.23		26.33	0.000857	2.60	463.40	224.78	0.24
Channel	3550.000	25yr	570.00	17.67	24.36		24.43	0.000519	2.20	259.12	59.84	0.19
Channel	3550.000	10yr	437.00	17.67	23.71		23.77	0.000476	1.97	221.27	56.39	0.18
Channel	2780.000	50yr	699.00	16.33	24.49		24.55	0.000453	1.92	363.80	93.54	0.17
Channel	2780.000	100yr	838.00	16.33	24.96		25.02	0.000475	2.05	409.07	98.97	0.18
Channel	2780.000	500yr	1080.00	16.33	25.71		25.79	0.000485	2.20	508.28	161.06	0.18
Channel	2780.000	25yr	570.00	16.33	23.97		24.02	0.000436	1.80	317.04	87.53	0.17
Channel	2780.000	10yr	437.00	16.33	23.34		23.38	0.000420	1.66	264.02	80.19	0.16
Channel	2100.591	50yr	699.00	16.00	24.10	20.02	24.18	0.000640	2.32	303.31	88.18	0.20
Channel	2100.591	100yr	838.00	16.00	24.55	20.38	24.65	0.000650	2.48	350.08	116.06	0.21
Channel	2100.591	500yr	1080.00	16.00	25.30	20.94	25.41	0.000642	2.62	449.31	147.26	0.21
Channel	2100.591	25yr	570.00	16.00	23.60	19.63	23.67	0.000612	2.15	265.08	71.22	0.20
Channel	2100.591	10yr	437.00	16.00	22.99	19.19	23.05	0.000564	1.95	223.62	65.08	0.19
Channel	1527.972	50yr	699.00	14.82	21.98	21.83	23.05	0.017666	8.32	84.05	33.91	0.93
Channel	1527.972	100yr	838.00	14.82	22.38	22.19	23.51	0.016473	8.54	98.15	36.29	0.91
Channel	1527.972	500yr	1080.00	14.82	23.56	22.75	24.40	0.009702	7.35	146.97	46.63	0.73
Channel	1527.972	25yr	570.00	14.82	21.55	21.43	22.57	0.018835	8.12	70.19	30.49	0.94
Channel	1527.972	10yr	437.00	14.82	20.97	20.97	21.99	0.022534	8.11	53.85	26.43	1.00
Channel	1344.355	50yr	699.00	14.44	22.10	18.35	22.26	0.001089	3.18	220.00	49.72	0.27
Channel	1344.355	100yr	838.00	14.44	22.45	18.75	22.64	0.001306	3.53	237.64	52.70	0.29
Channel	1344.355	500yr	1080.00	14.44	23.47	19.38	23.67	0.001402	3.57	303.05	71.82	0.30
Channel	1344.355	25yr	570.00	14.44	21.72	17.92	21.85	0.000915	2.83	201.45	47.54	0.24
Channel	1344.355	10yr	437.00	14.44	20.78	17.46	20.90	0.001003	2.75	159.18	42.09	0.25
Channel	1281.855		Culvert									
Channel	1218.437	50yr	699.00	13.50	21.38		21.52	0.000439	2.95	245.91	60.51	0.23
Channel	1218.437	100yr	838.00	13.50	21.39		21.58	0.000630	3.53	245.98	60.53	0.27
Channel	1218.437	500yr	1080.00	13.50	21.58		21.87	0.000939	4.38	257.70	62.62	0.33
Channel	1218.437	25yr	570.00	13.50	21.26		21.36	0.000313	2.47	238.71	59.04	0.19
Channel	1218.437	10yr	437.00	13.50	20.47		20.55	0.000293	2.24	195.42	47.78	0.18
Channel	972.498	50yr	699.00	13.10	21.11	17.37	21.34	0.000834	3.87	207.71	234.00	0.30
Channel	972.498	100yr	838.00	13.10	21.30	17.81	21.39	0.000477	3.00	781.44	526.92	0.23
Channel	972.498	500yr	1080.00	13.10	21.47	18.51	21.60	0.000637	3.54	873.04	539.76	0.27
Channel	972.498	25yr	570.00	13.10	21.08	16.91	21.24	0.000572	3.19	199.64	229.62	0.25
Channel	972.498	10yr	437.00	13.10	20.31	16.38	20.44	0.000515	2.89	151.02	31.91	0.23
Channel	648.236	50yr	699.00	12.60	21.22	16.66	21.23	0.000061	1.20	1538.04	721.85	0.09
Channel	648.236	100yr	838.00	12.60	21.30	17.07	21.32	0.000079	1.37	1600.40	723.76	0.10
Channel	648.236	500yr	1080.00	12.60	21.48	17.71	21.49	0.000106	1.62	1725.34	727.56	0.12
Channel	648.236	25yr	570.00	12.60	21.15	16.24	21.16	0.000045	1.01	1487.81	720.31	0.07
Channel	648.236	10yr	437.00	12.60	20.33	15.74	20.35	0.000084	1.26	927.50	642.78	0.10
Channel	267.180	50yr	699.00	7.17	21.18	12.29	21.19	0.000172	0.94	904.97	210.57	0.06
Channel	267.180	100yr	838.00	7.17	21.25	12.81	21.27	0.000235	1.11	920.37	210.57	0.07
Channel	267.180	500yr	1080.00	7.17	21.40	13.65	21.43	0.000353	1.38	951.69	210.57	0.08
Channel	267.180	25yr	570.00	7.17	21.12	11.81	21.13	0.000119	0.78	892.69	210.57	0.05
Channel	267.180	10yr	437.00	7.17	20.30	11.24	20.31	0.000125	0.75	719.30	210.28	0.05

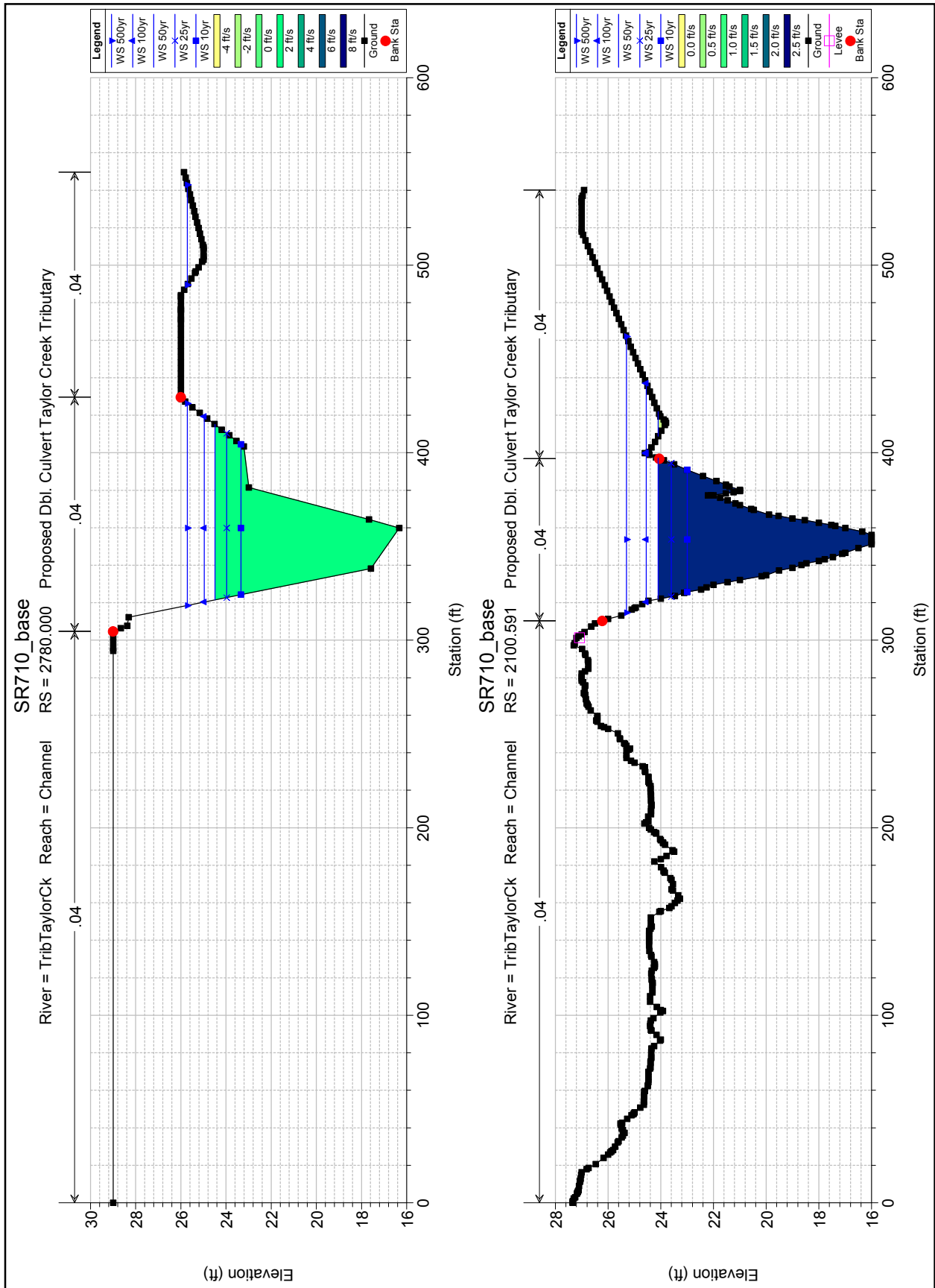
HEC-RAS Plan: US&DS River: TribTaylorCk Reach: Channel (Continued)

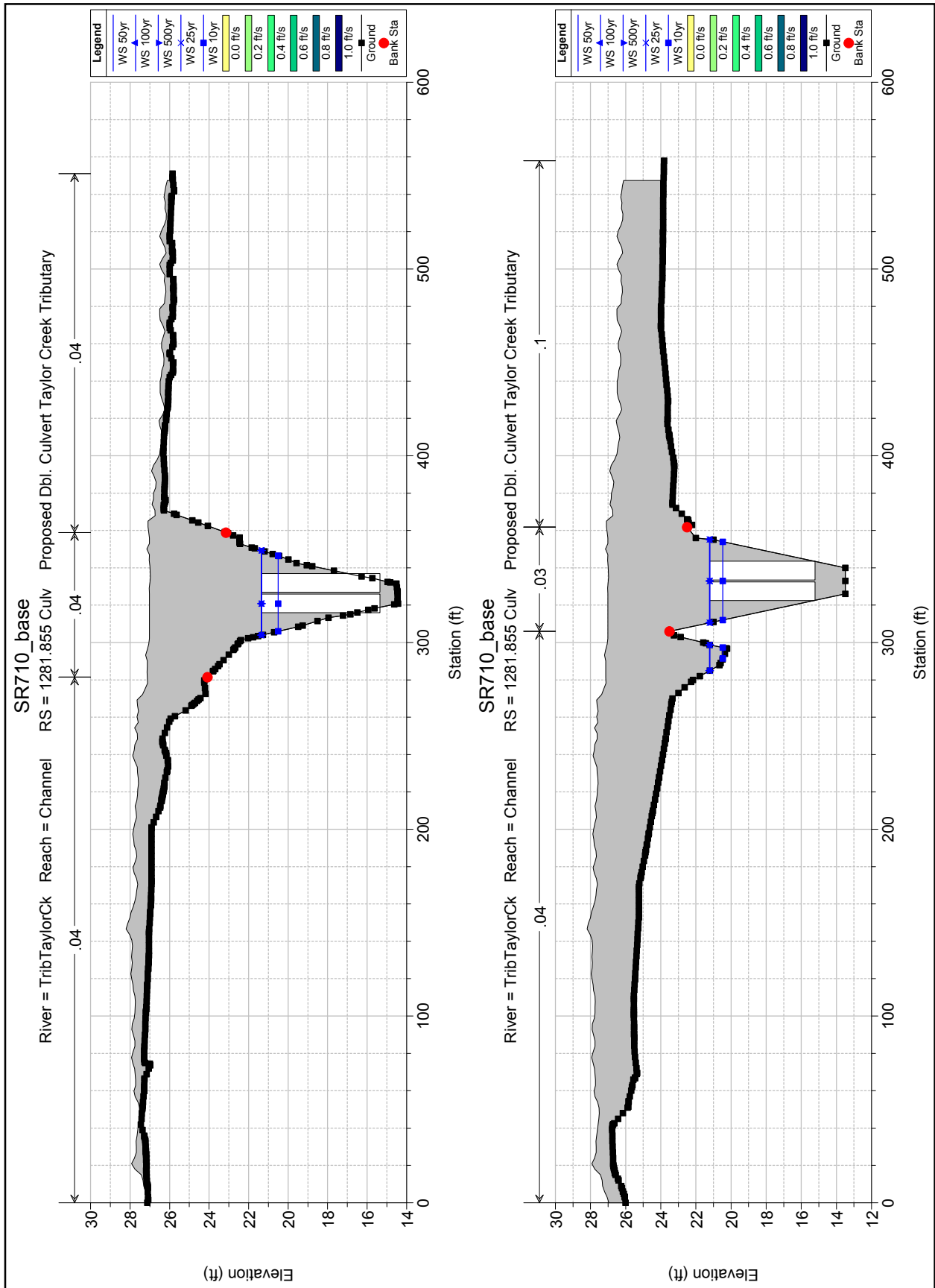
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Channel	-232.82	50yr	699.00	6.67	21.09	12.02	21.10	0.000179	0.96	891.16	210.57	0.06
Channel	-232.82	100yr	838.00	6.67	21.13	12.51	21.15	0.000251	1.14	899.37	210.57	0.07
Channel	-232.82	500yr	1080.00	6.67	21.21	13.41	21.24	0.000395	1.44	916.65	210.57	0.09
Channel	-232.82	25yr	570.00	6.67	21.06	11.52	21.07	0.000122	0.79	884.74	210.57	0.05
Channel	-232.82	10yr	437.00	6.67	20.24	10.95	20.24	0.000128	0.75	711.04	201.38	0.05
Channel	-732.82	50yr	699.00	6.17	21.00	11.73	21.01	0.000188	0.98	876.64	210.57	0.06
Channel	-732.82	100yr	838.00	6.17	21.00	12.24	21.02	0.000271	1.17	876.64	210.57	0.07
Channel	-732.82	500yr	1080.00	6.17	21.00	13.13	21.03	0.000449	1.51	876.64	210.57	0.09
Channel	-732.82	25yr	570.00	6.17	21.00	11.22	21.01	0.000125	0.80	876.64	210.57	0.05
Channel	-732.82	10yr	437.00	6.17	20.17	10.62	20.18	0.000131	0.76	702.98	197.86	0.05

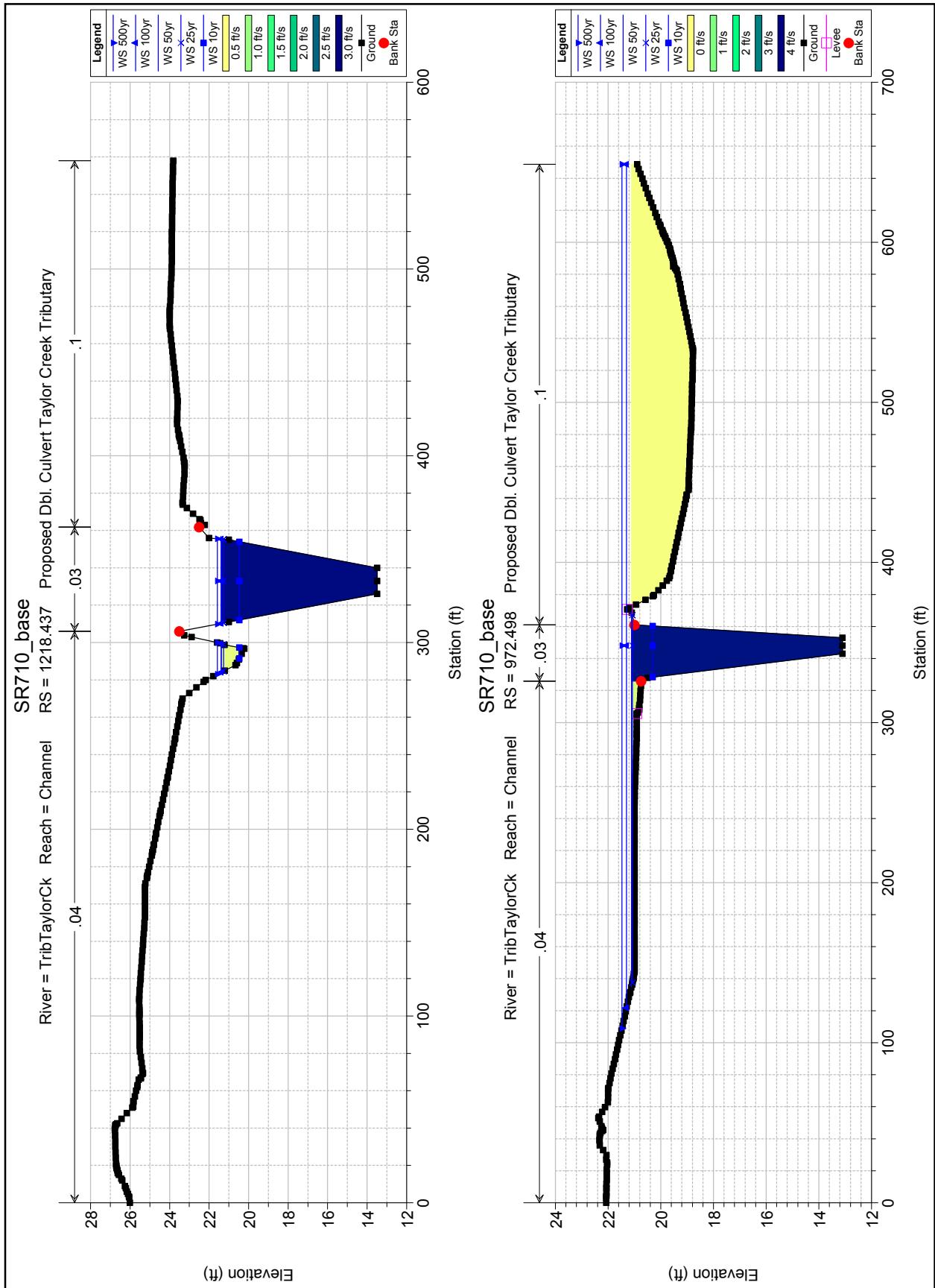


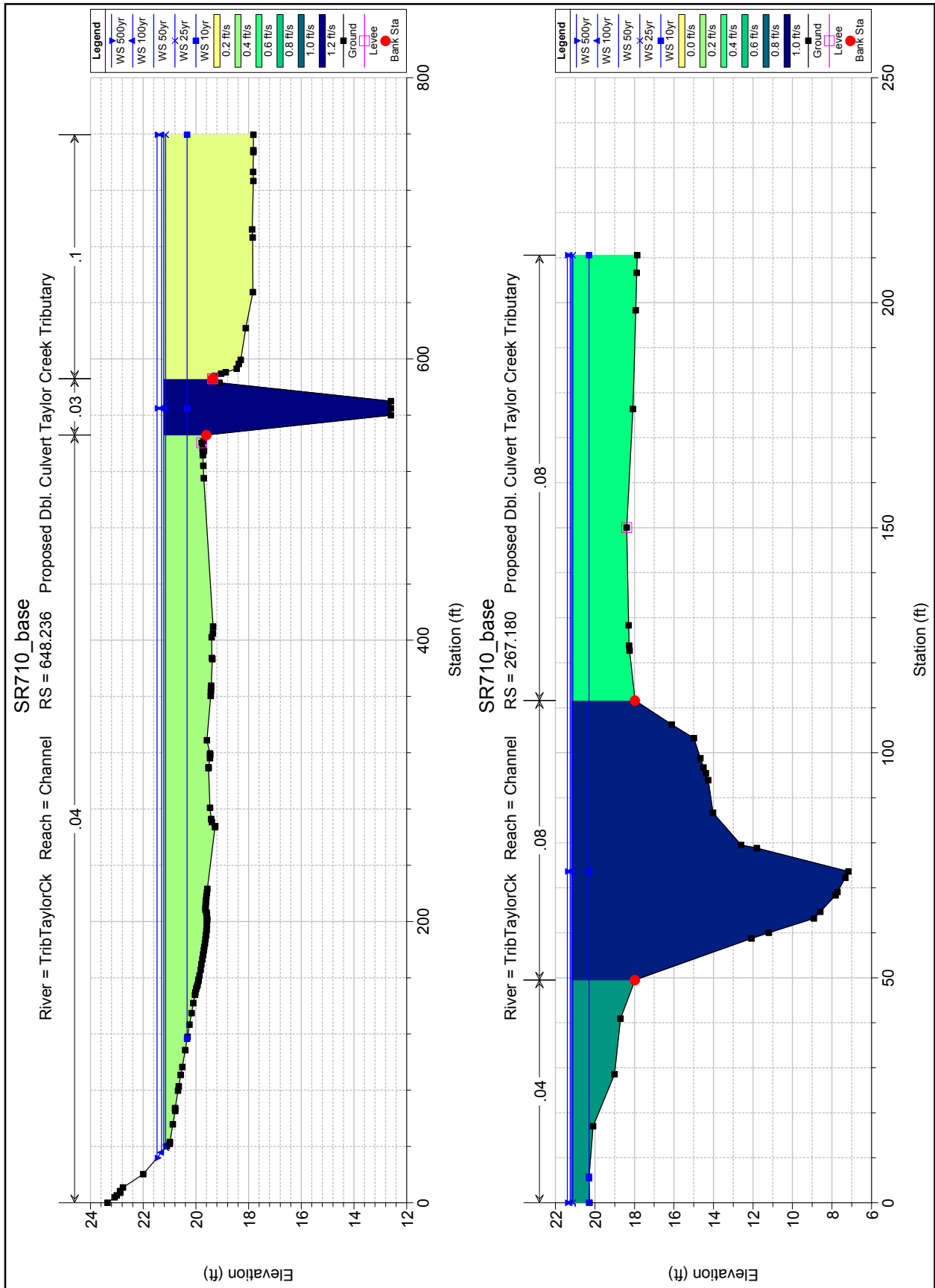


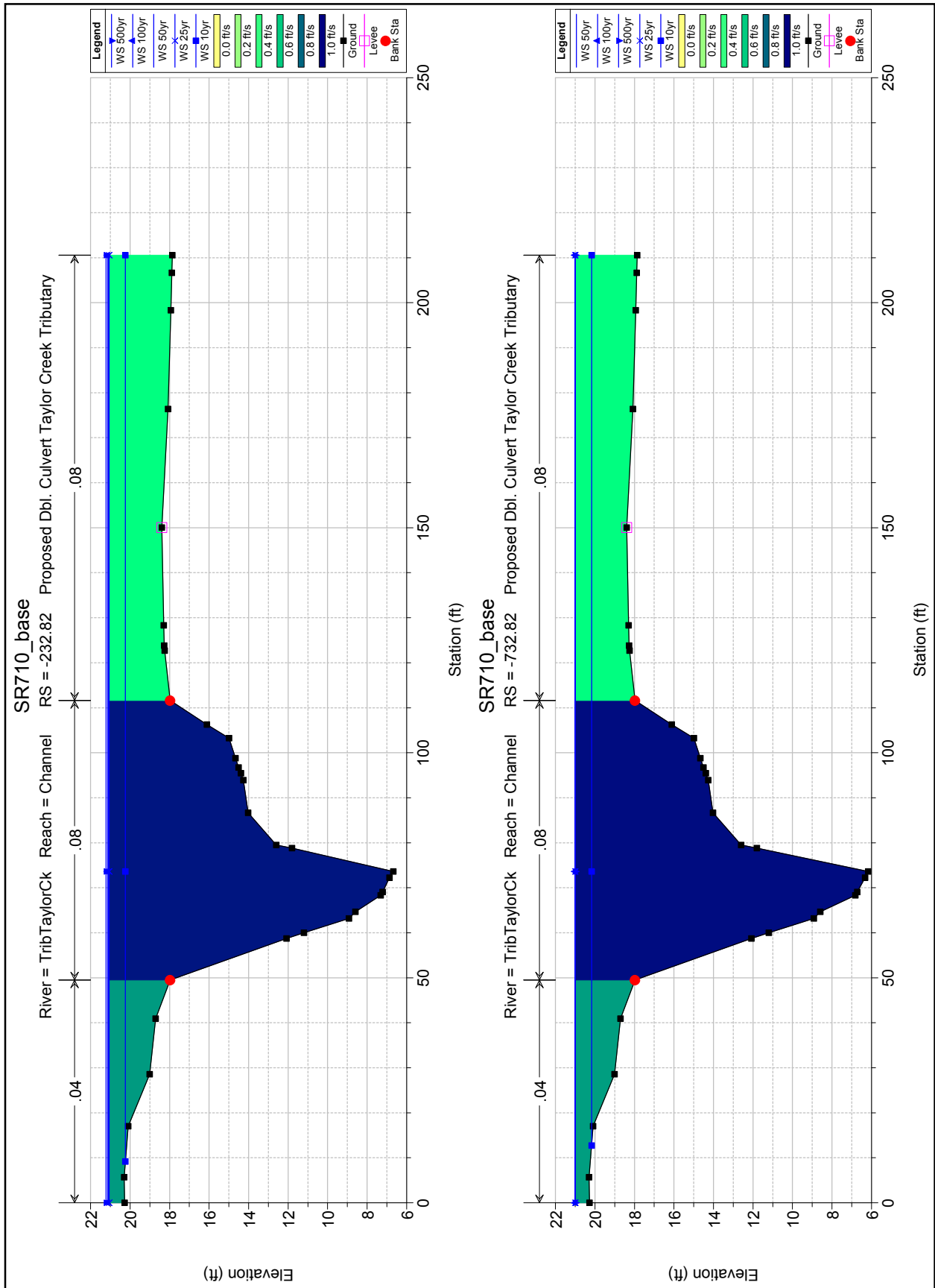


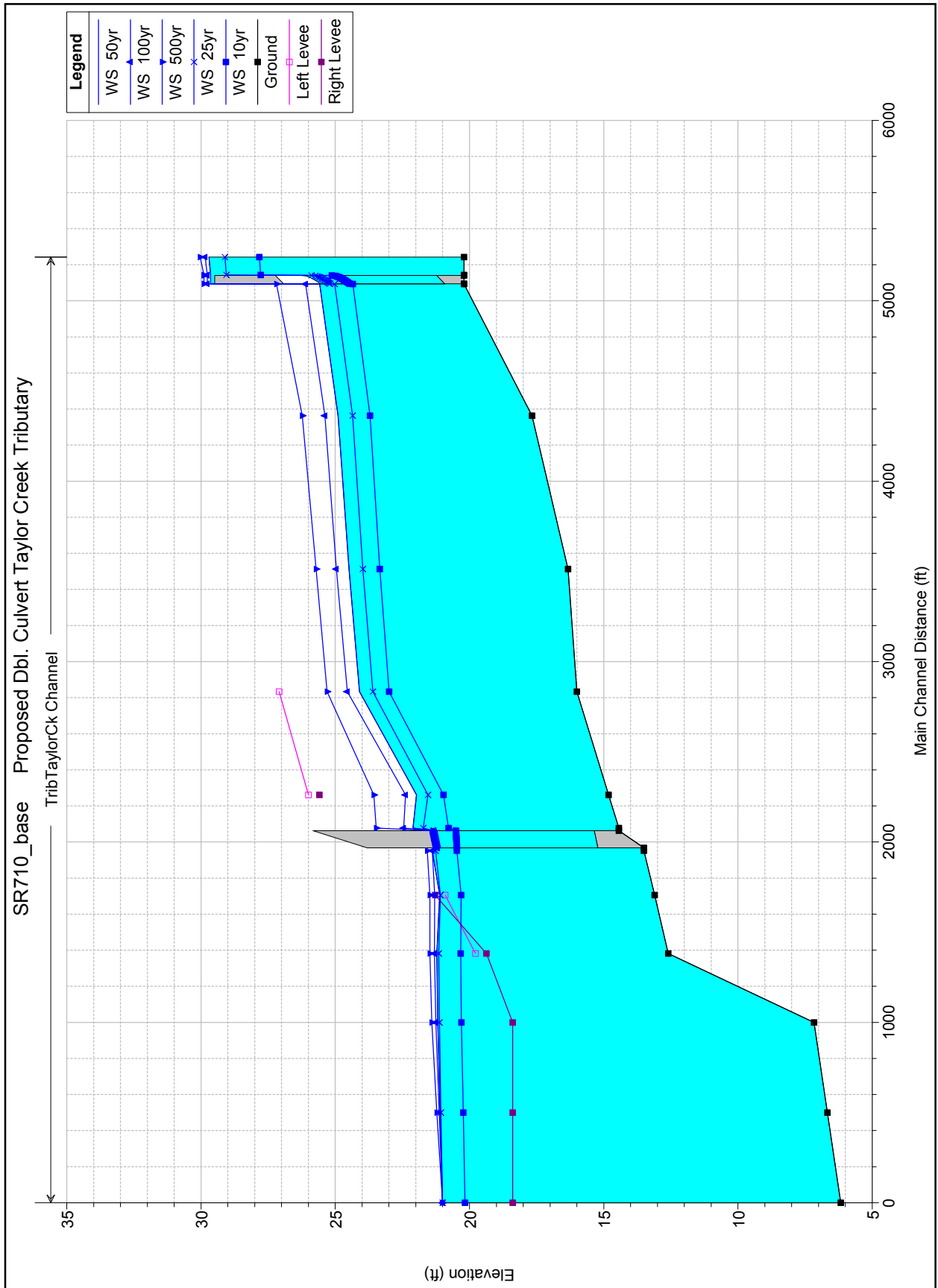












HEC-RAS Model Cross Section	River	10-Year Water Surface Elevation (feet NAVD88)		Difference (feet)	25-Year Water Surface Elevation (feet NAVD88)		Difference (feet)	50-Year Water Surface Elevation (feet NAVD88)		Difference (feet)	100-Year Water Surface Elevation (feet NAVD88)		Difference (feet)	500-Year Water Surface Elevation (feet NAVD88)		Difference (feet)
		Exist	Proposed Double Culvert		Exist	Proposed Double Culvert		Exist	Proposed Double Culvert		Exist	Proposed Double Culvert				
4430.000	TribTaylor Ck	27.83	27.83	0.00	29.10	29.70	0.00	29.70	29.85	0.01	29.84	29.85	0.01	30.07	30.03	-0.04
4330.000	TribTaylor Ck	27.77	27.77	0.00	29.05	29.64	0.00	29.64	29.77	0.01	29.76	29.77	0.01	29.95	29.89	-0.06
Culvert	TribTaylor Ck	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TribTaylor Ck	24.36	24.34	-0.02	25.16	25.97	-0.14	25.58	26.10	-0.89	26.99	26.10	-0.89	27.58	27.18	-0.40
4280.000	TribTaylor Ck	23.74	23.71	-0.03	24.60	24.36	-0.24	24.89	25.38	-1.24	26.62	25.38	-1.24	27.31	26.23	-1.08
3550.000	TribTaylor Ck	23.39	23.34	-0.05	24.29	23.97	-0.32	24.49	24.96	-1.47	26.43	24.96	-1.47	27.14	25.71	-1.43
2780.000	TribTaylor Ck	23.05	22.99	-0.06	24.00	23.60	-0.40	24.10	24.55	-1.75	26.30	24.55	-1.75	27.00	25.30	-1.70
2100.591	TribTaylor Ck	21.80	20.97	-0.83	23.15	21.55	-1.60	21.98	22.38	-3.87	26.25	22.38	-3.87	26.96	23.56	-3.40
1527.972	TribTaylor Ck	21.85	20.78	-1.07	23.12	21.72	-1.40	24.50	22.10	-2.40	26.20	22.45	-3.75	26.91	23.47	-3.44
1344.355	TribTaylor Ck	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Culvert	TribTaylor Ck	18.55	20.47	1.92	19.26	21.26	2.00	19.86	21.38	1.52	20.43	21.39	0.96	21.33	21.58	0.25
	TribTaylor Ck	17.83	20.31	2.48	18.48	21.08	2.60	19.00	21.11	2.11	19.50	21.11	1.80	20.29	21.47	1.18
972.498	TribTaylor Ck	16.46	20.33	3.87	17.46	21.15	3.69	17.99	21.22	3.23	18.50	21.30	2.80	19.28	21.48	2.20
648.236	TribTaylor Ck	14.24	20.30	6.06	16.66	21.12	4.46	17.19	21.18	3.99	17.69	21.25	3.56	18.52	21.40	2.88
267.180	TribTaylor Ck															

Appendix C: STA Costs

**SR 710 Stormwater Treatment Area/Regional Pond Feasibility Study
Preliminary Submittal**

**Financial Project ID
432644-1-32-01**

Okeechobee County, Florida

Cost information for STAs reviewed

Facility	Design, Permitting, and Construction (\$)	Annual Operation and Maintenance (\$)	Treatment Acres	Initial Cost per Treatment Acre (\$)
Taylor Creek	5,642,293	50,000	118	47,816
Nubbin Slough	21,257,707	100,000	773	27,500
Lakeside Ranch Phase I	22,800,000	341,000	1,200	19,000
Lakeside Ranch Phase II	25,000,000	Not available	788	31,726
Powell Creek Filter Marsh - Lee County	2,100,000	45,000	40	52,500
Option 1	2,625,000	50,000	50	52,500

Option 2 - Cost based on in place unit price per cubic yard

Depth of Coverage (ft)	Width of Coverage (ft)	Length of coverage(ft)	In Place Cost per CY (\$)	Estimated Initial Cost (\$)
1	50	3,300	180	1,100,000

Option 3 - Initial costs include payment to the landowner for the cost of acquiring a conservation easement over the wetland areas that are being rehydrated.

Appendix D: Wetland and Wildlife Site Evaluation

SR 710 Stormwater Treatment Area/Regional Pond Feasibility Study Preliminary Submittal

**Financial Project ID
432644-1-32-01**

Okeechobee County, Florida

September 15, 2014

File No. SR-710 STA (50063866)

Mr. Gregory S. Seidel, P.E.
The Balmoral Group
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Winter Park, FL 32789



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Orlando, Florida 32801
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407.649.8664 fax
www.dewberry.com

Subject: **State Road 710 – Stormwater Treatment Area (STA)**
City of Okeechobee, Okeechobee, Florida
Parcel ID Nos.: 1-03-37-35-0A00-00002-0000, 1-10-37-35-0A00-00001-0000, 1-11-37-35-0A00-00001-0000

Dear Mr. Seidel:

The purpose of this letter is to summarize our site evaluation for the approximately 895-acre referenced property. A qualified biologist of Dewberry Bowyer Singleton (DBS) reviewed the referenced property to evaluate general site conditions and environmental conditions that may influence the use of the site as a stormwater treatment area. Specifically, the site was evaluated for identifying the presence of wildlife species listed as threatened (T), endangered (E) or species of special concern (SSC) as defined by the United States Fish and Wildlife Service (FWS) and/or the Florida Fish and Wildlife Conservation Commission (FWC) and their habitat. Land use types located within the proposed project were identified via vehicular and pedestrian transects and through color aerial photograph interpretation and compared to land uses identified by the Florida Department of Transportation (FDOT) *Florida Land Use, Cover and Forms Classification System* (FLUCFCS) (FDOT 1999) utilizing the South Florida Water Management District (SFWMD) aerial interpretation of these codes available in Geographic Information System (GIS).

PROJECT DESCRIPTION

The overall subject Property consists of approximately 895-acres located within Okeechobee County, Florida. Specifically, the subject property includes the all or portions of the following parcels:

1-03-37-35-0A00-00002-0000
1-10-37-35-0A00-00001-0000
1-11-37-35-0A00-00001-0000

The Property is located north of State Road 70E, east of U.S. Highway 441 N approximately 3 miles north of Lake Okeechobee within the City of Okeechobee. The surrounding areas consists of commercial development, Okeechobee High School, the Okeechobee County Airport, channelized Taylor Creek and other agricultural use specifically cattle ranching.

The SR 710 New Alignment Project in Okeechobee County and the City of Okeechobee is currently under design by the FDOT. During the development of the Pond Siting Report, the Pond Site location 2B and the surrounding area were identified as a possible location for a regional stormwater treatment facility that could provide greater stormwater treatment benefits to the local area. Two teleconferences were held between the FDOT, FDEP and SFWMD to brainstorm the feasibility of the site and possible cooperation between the agencies. At the last meeting, it was decided that the FDOT would perform a feasibility study for two options –

1. A Stormwater Treatment Area (STA) with interagency cooperation connected to the L63-N canal and Upper Taylor Creek.

2. A Regional Pond constructed by the FDOT for the SR 710 that would incorporate offsite areas associated with Lower Taylor Creek.

Dewberry | Bowyer-Singleton was contracted to perform the evaluation of onsite wetlands to assist in determining the ability to restore the wetlands using stormwater treatment and attenuation. Qualified environmental scientists with Dewberry | Bowyer-Singleton performed a preliminary ecological field review to evaluate onsite wetlands and listed species within the project vicinity. Dewberry reviewed the current PD&E documents and biological evaluations currently underway by the Wantman Group, Inc. We conducted a desktop review of available published information from federal and state online databases to evaluate listed species that may occupy the project area. Data collection consisted of literature review of existing sources for information useful in identifying the occurrence or potential occurrence of wildlife species listed as T, E or SSC (collectively recognized as listed species), as defined by FWS and/or the FWC. The literature review included the following sources: Natural Resources Conservation Service (f/k/a Soil Conservation Service [SCS]) Soil Survey of Okeechobee County, Florida, U.S. Geological Survey Topographic Quadrangle Maps, FWC Bald Eagle and Waterbird Colony databases, Florida Natural Areas Inventory (FNAI) Okeechobee County Tracking List, previous studies available, and false-color infrared and true color aerial photography of the project corridor, FNAI Field Guides and Rare and Endangered Biota of Florida Series.

Land use types located within the proposed project were identified through color aerial photograph interpretation and compared to land uses identified by the Florida Department of Transportation (FDOT) Florida Land Use, Cover and Forms Classification System (FLUCFCS) (FDOT 1999). Estimated wetland limits were identified on an aerial exhibit. A preliminary qualitative evaluation of the on-site wetlands system(s) was conducted. The wetlands were identified in general accordance with the U.S. Army Corps of Engineers (USACOE) October 2008 Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region and the State of Florida's Delineation of the Landward Extent of Wetlands and Surface Waters (Chapter 62-340, Florida Administrative Code). Seasonal High Water Elevations were marked at six (6) locations in the field adjacent to Taylor Creek (east) within the proposed STA and surveyed to better understand the normal water and allowable peak stage. Three (3) SHWE nails were set at each location and the elevation at each is provided.

ENVIRONMENTAL CONSIDERATIONS

Soils

The *Soil Surveys of Okeechobee County, Florida* (Exhibit 1 - SCS Soils Map) were reviewed and mapped on-site soil types as follows:

<u>Identification Number</u>	<u>Soil Name</u>	<u>Permeability</u>	<u>Native Vegetation</u>
Ph	Placid, Pamlico and Delray soils, ponded	Placid (Rapid); Pamlico (N/A); Delray (Rapid)	Sweetbay, sweetgum, cypress, bracken fern, sawgrass and other hyrophytes
Pn	Pompano fine sand	Rapid	Grassy sloughs and depressions
Ad	Adamsville fine sand	Rapid	Pine trees, saw-palmetto, cabbage palms, other native grasses and shrubs
Fr	Ft. Drum fine sand	Rapid	Open growth pines, scattered cabbage palm, saw palmetto, native grasses
Pf	Placid fine sand	Rapid	Pickernelweed and maidencane
Bm	Basinger and Pompano	Basinger (Rapid);	Maidencane, St. Johnswort, water

	fine sands, ponded	Pompano (Rapid)	lilies, pickerelweed and other hydrophytic grasses
Im	Immokalee fine sand	Rapid	Native flatwoods, saw palmetto, scattered pines and grasses
Mo	Manatee, Delray and Okeelanta soils	Manatee (Rapid); Delray (Rapid); Okeelanta (N/A)	Dense pickerelweed, iris, smartweed, maidencane, black willow and other aquatic shrubs and grasses
*N/A listed when permeability is not provided in the Soil Survey.			

General site review found soil types to be generally consistent with the mapped soil types.

Land Use

The SFWMD maintains a GIS database with a land use layer covering the entire SFWMD area. This land use layer was overlain on an aerial map using ArcGIS software. Land use types located within the proposed project were verified and/or modified through color aerial photograph interpretation and field reconnaissance. Each on-site land use form was classified using the Florida Department of Transportation (FDOT) *Florida Land Use, Cover and Forms Classification System* (FLUCFCS) as defined in the FDOT handbook, 1999 (**Exhibit 2 – FLUCFCS Map**).

The SR 710 STA project site supports six (6) land use type/vegetative communities within its boundaries. The illustration provided in **Exhibit 2** depicts the locations of all wetlands and the vegetative cover and community types for all wetlands, surface waters and uplands within the project boundaries. The uplands on the subject property consist of Improved Pasture (2110), Upland Hardwood Forest (4200) and Pine Flatwoods (4110). The wetlands and surface waters include Taylor Creek (5120), Mixed Wetland Hardwood (6170) and Cypress (6210). The following provides a brief description of the land use type/vegetative communities identified on the site:

UPLANDS

Improved Pasture – 310 acres

FLUCFCS 2110

The majority of the subject site is most consistent with the Improved Pasture classification. This area is dominated by bahia grass (*Paspalum notatum*) and dog fennel where management has not been recently intensive. This area is actively maintained under a cattle management plan so very little other vegetation is present. Those vegetative species that do exist in the less managed areas are opportunistic, weed-type species, including dog fennel (*Eupatorium capillifolium*), broomsedge (*Andropogon virginicus*), blackberry (*Rubus betulifolius*), soda apple (*Solanum capsicoides*), and Caesar weed (*Urena lobata*). Widely scattered and mostly solitary longleaf pines (*Pinus palustris*) are present.

Upland Hardwood Forest – 185 acres

FLUCFCS 4200

There are four large oak hammocks located within the property and these are located adjacent to cypress wetlands. These areas (including “Wetland 6”) were likely mixed hardwood wetlands serving as floodplain storage prior to the onsite drainage feature construction. Historical aerials depict these areas as part of the historic Taylor Creek flow way and the cypress and freshwater marsh mosaic. These areas currently consist of a mature canopy of water oak (*Quercus nigra*), cabbage palm, sweetgum and elm.

Pine Flatwoods - 60 acres

FLUCFCS 4110

The on-site pine flatwoods community is located in the northwest portion of the project, on the west side of Taylor Creek. This upland community contains a canopy of slash pine (*Pinus elliotti*).

The groundcover is dominated by saw palmetto, wiregrass (*Aristida stricta*), bracken fern (*Pteridium aquilinum*), prickly pear cactus, shiny blueberry (*Vaccinium myrsinites*), gallberry (*Ilex glabra*) and runner oak (*Quercus pumila*). The soils are well drained and sandy throughout. The pines throughout the flatwoods system have died from unknown cause.

WETLANDS/OTHER SURFACE WATERS

The wetlands and surface waters illustrated in **Exhibit 3 (Wetlands and Seasonal High Water Level Map)** were approximated using aerial photography and the National Wetlands Inventory (NWI) by qualified biologists from Dewberry | Bowyer Singleton in general accordance with the U.S. Army Corps of Engineers (USACOE) *October 2008 Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region* and the State of Florida's *Delineation of the Landward Extent of Wetlands and Surface Waters* (Chapter 62-340, Florida Administrative Code). Seasonal High Wetland Levels were also set within the 6 wetland areas and are shown on **Exhibit 3**.

Wetlands 1, 2, 3, 4, 5

FLUCFCS 6210 Cypress - 338 acres

The wetland types are similar and contain a mature canopy of bald cypress (*Taxodium ascendens*), with a heterogenous mixture of sweet bay (*Magnolia virginiana*), red bay (*Persea palustris*) and water oak (*Quercus nigra*) with a subcanopy dominated in some areas by Brazilian pepper and a mixture of cabbage palm.

Groundcover includes wild coffee, cabbage palm, grapevine (*Vitis* spp.), smilax, blackberry (*Rubus* spp.), broomsedge (*Andropogon virginicus*), chain fern (*Woodwardia virginica*), air potato, and lizards tail (*Saururus cernuus*).

Seasonal High Water Elevations set within wetlands 1, 3 and 5 were established at flow ways (either an excavated ditch within the wetland or a historic tributary leading into Taylor Creek) which is the only location standing water was found in the wetlands. Seasonal high water indicators used to set these elevations were primarily lichen lines and the moss collar lowest extent (where present) which generally corresponded to an elevation near the top of the creek/ditch bank. These lichen lines generally maintained a relationship to the cypress knees and also a slight inflection point on the cypress trunk. Individually, these indicators are not considered the strongest; however, cumulatively they appear to be consistent and reliable for establishing a wet season peak elevation.

The cypress trees within most of the wetlands exhibit alteration to varying degrees. Cypress roots are exposed at numerous trunk bases and there is multiple inflection points present on the cypress. The USDA Soil Survey mentions that soil oxidation and subsidence can be observed in the onsite soils when water level controls are installed. Soil subsidence occurs throughout the wetlands, indicated prolonged muck exposure to oxygen, uncharacteristic for the system prior to anthropogenic manipulation.

Identifier	Elevation (ft)
Wetland 1	
SHWL 1-1	13.30
SHWL 1-2	12.96
SHWL 1-3	13.54
Wetland 2	
SHWL 2-1	14.48
SHWL 2-2	14.05
SHWL 2-3	14.52
Wetland 3	

SHWL 3-1	15.98
SHWL 3-2	16.66
SHWL 3-3	16.91
Wetland 4	
SHWL 4-1	14.30
SHWL 4-2	14.03
SHWL 4-3	14.46
Wetland 5	
SHWL 5-1	19.55
SHWL 5-2	19.20
SHWL 5-3	19.14
Wetland 6	
SHWL 6-1	22.34
SHWL 6-2	22.38
SHWL 6-3	21.95

6410 Freshwater Marsh – 2 acres

This wetland type is present in a flatwoods depression in the northern section of the property and along the southern boundary where agricultural activities have altered drainage and this area is a low pasture. Freshwater marshes are described by the Florida Natural Areas Inventory (FNAI) as “having the outer, or driest, zone often occupied by sparse herbaceous vegetation consisting of longleaf threeawn (*Aristida palustris*), beaksedges (*Rhynchospora microcarpa*, *R. cephalantha*, *R. tracyi*, *R. filifolia*, etc.), Elliott’s yellow-eyed grass (*Xyris elliottii*), the subshrub, myrtleleaf St. John’s wort (*Hypericum myrtifolium*), and patches of blue maidencane (*Amphicarpum muhlenbergianum*) or sand cordgrass (*Spartina bakeri*). This sparse zone may be followed downslope by a sparse to dense zone of peelbark St. John’s wort (*Hypericum fasciculatum*), water toothleaf (*Stillingia aquatica*) and scattered herbs, such as fringed yellow-eyed grass (*Xyris fimbriata*), pipeworts (*Eriocaulon compressum* and *E. decangulare*), narrowfruit horned beaksedge (*Rhynchospora inundata*), and Baldwin’s spikerush (*Eleocharis baldwinii*). The innermost, deepest zone is occupied by maidencane (*Panicum hemitomon*), pickerelweed (*Pontederia cordata*), bulltongue arrowhead (*Sagittaria lancifolia*), or sawgrass (*Cladium jamaicense*). Floating-leaved plants, such as white waterlily (*Nymphaea odorata*), may be found in open water portions of the marsh.”

FISH, WILDLIFE, LISTED SPECIES AND THEIR HABITAT

Data collection consisted of a literature review of existing sources for information useful in identifying the occurrence or potential occurrence of wildlife species listed as T, E or SSC (collectively recognized as listed species), as defined by the United States Fish and Wildlife Service (USFWS) and/or the Florida Fish and Wildlife Conservation Commission (FWC). In addition, the presence of designated critical habitat and/or vegetative communities and land uses with the potential to support listed species was evaluated. The literature review included, but was not limited to, the following sources: Natural Resources Conservation Service (f/k/a Soil Conservation Service [SCS]) Soil Survey of Okeechobee County, Florida, U.S. Geological Survey Topographic Quadrangle Maps, FWC Bald Eagle and Waterbird Colony databases, previous studies available, and false-color infrared and true color aerial photography of the project corridor.

Following the initial assessment, limited pedestrian and vehicular transects were conducted throughout all habitat types to determine the presence of protected wildlife species (**Tables 1 - Listed Species Occurrence in Okeechobee County, Florida**). Special attention was given to the following species: Everglades snail kite (*Rostrhamus sociabilis plumbeus*), crested caracara, gopher tortoise (*Gopherus polyphemus*) (T), sandhill crane (*Grus Canadensis pratensis*), Sherman’s fox squirrel (*Sciurus niger*

shermani), wood stork (*Mycteria americana*) and bald eagle (*Haliaeetus leucocephalus*), recently delisted by FWC and FWS due to recovery, though all appropriate species were considered.

The potential occurrence of listed species to be identified within the proposed project is based on the vegetative communities present, as well as, surrounding land uses.

Everglades Snail Kite

The Everglades snail kite (*Rostrhamus sociabilis plumbeus*) is listed as endangered by the USFWS. The project corridor falls within the USFWS CA for the species. The nearest Everglades snail kite observation occurred 3 miles south of the project area on Lake Okeechobee. Very small areas of suboptimal habitat (ditches) exist within the project limits. No evidence of the Everglades snail kite was detected during field surveys, no historic sightings of this species were documented near the project area, and suitable habitat is limited.

Audubon's Crested Caracara

The Audubon's crested caracara (*Caracara cheriway*) is listed as threatened by the USFWS. In Florida, the caracara historically occupied native dry prairies with some wet areas and scattered cabbage palms (*Sabal palmetto*), but fire suppression has caused widespread conversion of prairies to open brushland. Currently, the majority of Florida's caracara population inhabits large cattle ranches with improved pastures and scattered cabbage palms. Caracaras also occur in some improved pasturelands and even in lightly wooded areas with limited stretches of open grassland. Within these habitats, caracaras exhibit a propensity for nesting in cabbage palms, followed by live oaks (*Quercus virginiana*).

The entire project is located within the CA for the Audubon's crested caracara. The surrounding land use consists of agriculture and since cabbage palms also exist within the upland hardwoods within the project limits, caracara habitat is classified as optimal. During the two field visits, no individuals were observed flying overhead, foraging or perching in the project area. The USFWS caracara survey protocol should be undertaken to determine presence or absence of the species on site.

Indigo Snake

The eastern indigo snake is listed by the USFWS as threatened. The species inhabits a wide variety of habitats present within the project, including pine flatwoods, hardwood forests, as well as wet and dry prairies. The nearest recorded eastern indigo snake observation was approximately 5 miles to the southeast of the project in 2005. No individuals were observed during the two site visits.

Sherman's fox squirrel

The Sherman's fox squirrel (*Sciurus niger shermani*) is listed as an SSC by the FWC. The optimal habitat for this species includes pine forests which are limited within the project area and oak hammocks which are found throughout the project area. No Sherman's fox squirrels were observed during field surveys and no nests were identified. The nearest Sherman's fox squirrel observation, documented in 2011, occurred approximately 1 mile east of the project.

Gopher Tortoise

The gopher tortoise (*Gopherus polyphemus*) is listed as threatened by FWC. The gopher tortoise occurs in sandhill (pine-turkey oak associations), sand pine scrub, xeric hammock, pine flatwoods, dry prairie, coastal grasslands and dunes and mixed hardwood pine communities. These burrows are known to serve as refuge to many species, some of which are protected (eastern indigo snake, Florida mouse, gopher frog, and Florida pine snake).

Gopher tortoise burrows were identified in the project's uplands adjacent to the large canal on the project's northern end.

Florida Sandhill Crane

The Florida sandhill crane (*Grus canadensis pratensis*) is listed as threatened by FWC and is protected under the Federal Migratory Bird Treaty Act. The Florida sandhill crane is commonly found in wet prairies, marshy lake regions, low-lying pastures (including improved pastures), and shallow water open areas. Nesting occurs in marshy depressional ponds vegetated by pickerelweed, arrowhead, fireflag, maidencane, and other herbaceous vegetation.

There were no nests or species identified on the project site during the two inspections, although suitable freshwater marsh habitat and low pasture occurs on the site.

Wood Stork

The wood stork (*Mycteria americana*) is listed as endangered by FWS and FWC. This species is typically found in freshwater marshes, swamps, lagoons, ponds, flooded fields, depressions in marshes and brackish wetlands. The critical foraging areas for this species include areas of very shallow water, generally six (6) to ten (10) inches in depth, where there is an abundance of small fishes and other aquatic life.

The project does fall within the Wood Stork Core Foraging area for two (2) wood stork colonies: 616108 Wescott Grove Reservoir and 616047A Cypress Creek. During site reviews, wood storks were observed foraging within the shallow portions of Taylor Creek.

Bald Eagle

The Bald Eagle (*Haliaeetus leucocephalus*) was previously listed as Threatened by the FWC and is now provided species protection by the State. Bald eagles are generally associated with large bodies of water where their dietary requirements (fish) are readily available. Bald eagles in Florida have also been observed consuming various types of waterfowl, carrion, and occasionally mammals and snakes (Scott 2004). Bald eagles prefer to roost in conifers or other sheltered sites in winter, usually selecting large, more accessible trees.

Initial research of databases containing information from the Florida Fish and Wildlife Conservation Commission (FWC), the U.S. Fish and Wildlife Service (FWS), and other agencies identifies that the project corridor is located near bald eagle habitat. The 2012 FWC database of known bald eagle nest sites identified two documented nest sites within a one (1) mile radius of the project, OK028 is located within the project and was active during the last survey period and OK022 which was last active in 2003.

Federal and state guidelines for the bald eagle require that certain activities may be conducted outside a 660-foot radius distance outward from a nest tree (FWS 2007). Per the 2007 FWS Bald Eagle Monitoring guidelines, monitoring of the active nest is required if construction activities are to take place within the 660-foot radius during the nesting season (October 1 – May 15).

FWC's 1999 Waterbird Colony Locator database of documented colonies was queried and yielded no documented occurrences within one (1) mile of the proposed project and is the only published data available to the public.

Other wildlife observed on-site includes the limpkin, little blue heron (SCC), mourning dove, anhinga, snowy egret (SSC), tri-colored heron (SSC), white ibis (SSC), cattle egret, turkey vulture, white tailed deer, red shouldered hawk, and armadillo.

Mr. Greg Seidel
The Balmoral Group
SR 710 – Stormwater Treatment Area
September 15, 2014
Page 8 of 9

Mr. Seidel, we thank you for the opportunity of providing our services. Dewberry | Bowyer Singleton looks forward to working with you in the near future. Should you have any questions or require additional information, please contact our office at 321.354.9640.

Sincerely,



Matthew P. Miller, P.W.S.
Environmental Scientist
Dewberry | Bowyer-Singleton

MPM
SR710/Env
Enclosures

c: Alexis Preisser

Table 1
Listed Species Occurrence-Okeechobee County, Florida

Table 1: Summary table of those federal and state listed species known to be present in Okeechobee County, Florida as documented by the FWS and FWC and their potential for occurrence within the SR 710 STA project area.

Code Key: E = Endangered, T = Threatened, P = Proposed, SSC= Species of Special Concern S/A = Similar in Appearance

Scientific Name	Common Name	FWS Status	FWC Status	Occurrence Potential
Amphibians				
<i>Rana capito</i>	gopher frog	N/A	SSC	Low
Reptiles				
<i>Alligator mississippiensis</i>	American alligator	T(S/A)	SSC	Observed
<i>Drymarchon corais couperi</i>	eastern indigo snake	N/A	T	Moderate
<i>Gopherus polyphemus</i>	gopher tortoise	N/A	SSC	Moderate
Birds				
<i>Ammodramus savannarum floridanus</i>	Florida grasshopper sparrow	E	E	Low
<i>Aramus guarana</i>	limpkin	N/A	SSC	Moderate
<i>Aphelocoma coerulescens</i>	Florida scrub-jay	T	T	Low
<i>Athene cunicularia floridana</i>	Florida burrowing owl	N/A	SSC	Low
<i>Egretta caerulea</i>	little blue heron	N/A	SSC	Observed
<i>Egretta thula</i>	snowy egret	N/A	SSC	Observed
<i>Egretta tricolor</i>	tricolored heron	N/A	SSC	Moderate
<i>Eudocimus albus</i>	white ibis	N/A	SSC	Observed
<i>Falco sparverius paulus</i>	southeastern American kestrel	N/A	T	Low
<i>Grus canadensis pratensis</i>	Florida sandhill crane	N/A	T	Low
<i>Haliaeetus leucocephalus</i>	bald eagle	T	T	Observed
<i>Mycteria americana</i>	wood stork	E	E	Observed
<i>Pandion haliaetus</i>	osprey	N/A	SSC	Low
<i>Rostrhamus sociabilis plumbeus</i>	Snail Kite	E	E	Low
<i>Sterna antillarum</i>	least tern	N/A	T	Low
Mammals				
<i>Eumops floridanus</i>	Florida bonneted bat	E	E	Low
<i>Sciurus niger shermani</i>	Sherman's fox squirrel	N/A	SSC	Moderate

Data Source: URL: <http://southeast.fws.gov/es/county%20lists.htm>. Last modified on August 7, 2000 and URL: <http://floridaconservation.org/pubs/endanger.html> and Florida Natural Areas Inventory (FNAI). Occurrence Potential represents the likelihood of that particular species to be found within the project area. Occurrence Potential = Observed, High, Medium and Low.



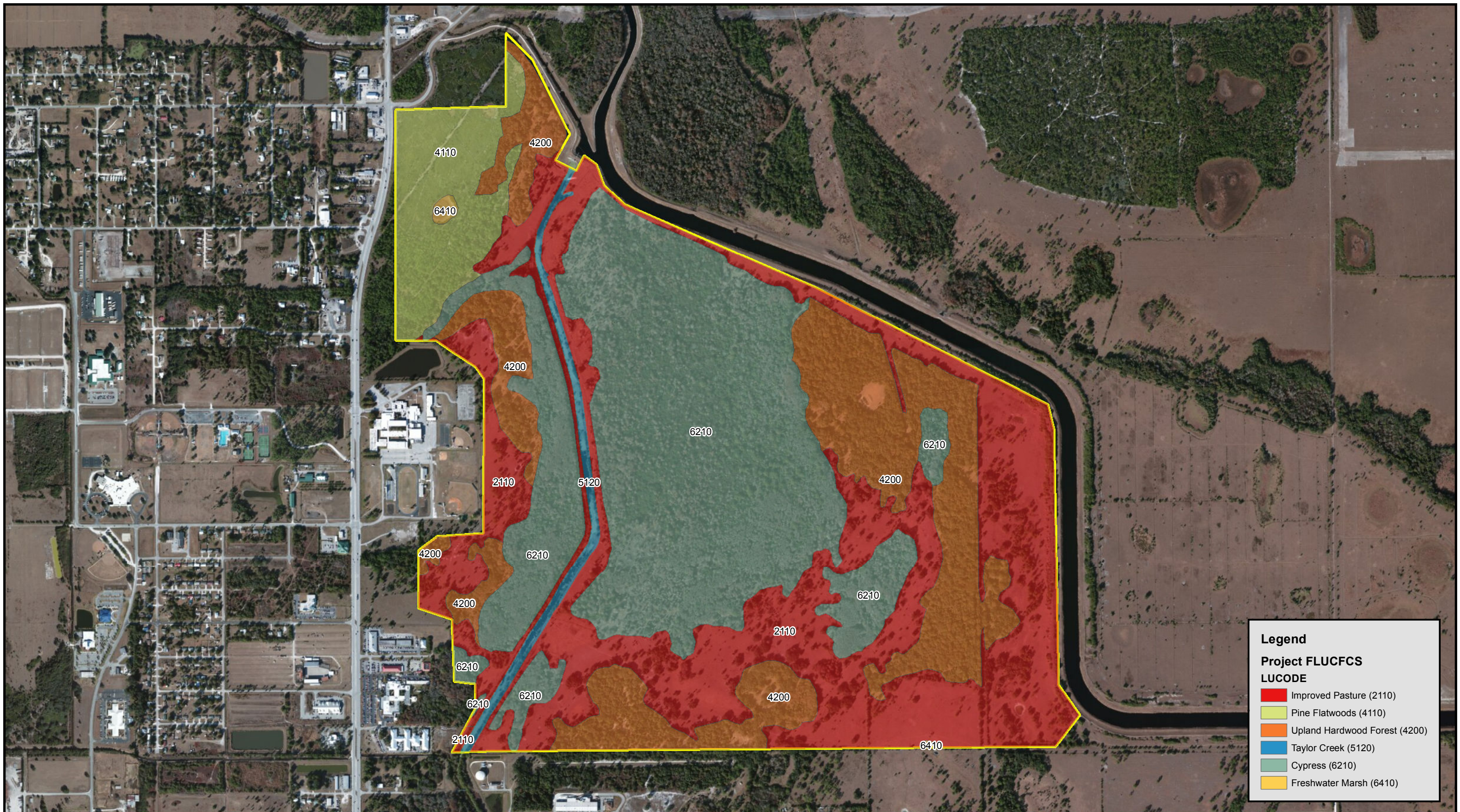
Dewberry



SR 710 Stormwater Treatment Area (STA)
Exhibit 1 - USDA (NRCS) Soils Map
Okeechobee, Florida



Image Source: USDA Okeechobee Soil Survey
 Document Path: G:\MXD\County\Okeechobee\SR710 STA\Approximate Soils Map.mxd





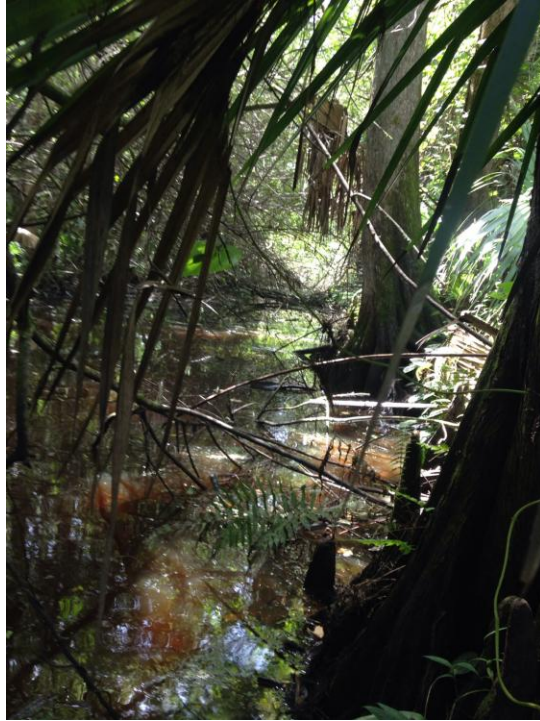
Appendix 1. Site Photographs



Photograph 1. Wetland 1 facing North



Photograph 2. Wetland 1 facing East



Photograph 3. Wetland 1 facing South



Photograph 4. Wetland 1 facing West



Photograph 5. Wetland 2 facing North



Photograph 6. Wetland 2 facing East



Photograph 7. Wetland 2 facing South



Photograph 8. Wetland 2 facing West



Photograph 9. Wetland 3 facing North



Photograph 10. Wetland 3 facing East



Photograph 11. Wetland 3 facing South



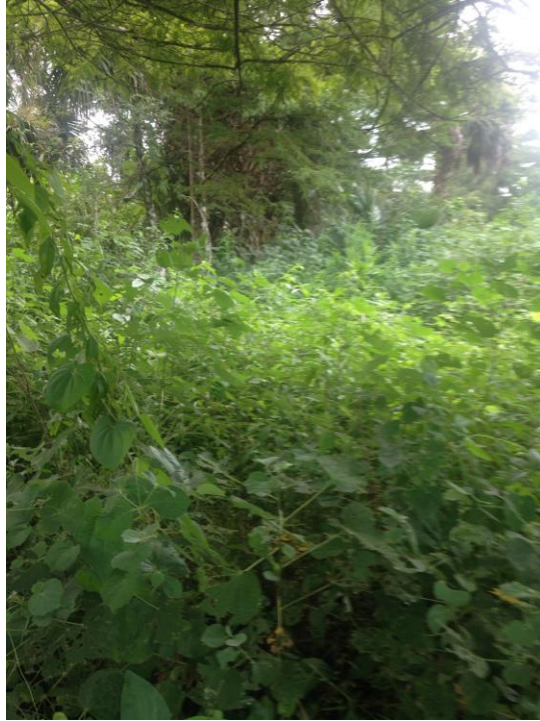
Photograph 12. Wetland 3 facing West



Photograph 13. Wetland 4 facing North



Photograph 14. Wetland 4 facing East



Photograph 15. Wetland 4 facing West



Photograph 16. Wetland 4 facing West



Photograph 17. Wetland 5 facing North



Photograph 18. Wetland 5 facing East



Photograph 19. Wetland 5 facing South



Photograph 20. Wetland 5 facing West



Photograph 21. Wetland 6 facing North



Photograph 22. Wetland 6 facing East



Photograph 23. Wetland 6 facing South



Photograph 24. Wetland 6 facing West

Appendix 2. UMAM Evaluation

PART I – Qualitative Description
(See Section 62-345.400, F.A.C.)

Site/Project Name State Road 710		Application Number	Assessment Area Name or Number Cypress
FLUCCs code 621 - Cypress	Further classification (optional)		Impact or Mitigation Site? Mitigation
			Assessment Area Size 338 acres
Basin/Watershed Name/Number Lake Okeechobee	Affected Waterbody (Class)	Special Classification (i.e.OFW, AP, other local/state/federal designation of importance) OFW	
Geographic relationship to and hydrologic connection with wetlands, other surface water, uplands The cypress wetlands onsite are hydrologically connected to the Taylor Creek Canal through both groundwater flow and surface water connection in the agricultural ditching.			
Assessment area description The wetland types are similar and contain a mature canopy of bald cypress (<i>Taxodium ascendens</i>), with a heterogenous mixture of sweet bay (<i>Magnolia virginiana</i>), red bay (<i>Persea palustris</i>) and water oak (<i>Quercus nigra</i>) with a subcanopy dominated in some areas by Brazilian pepper and a mixture of cabbage palm. Groundcover includes wild coffee, cabbage palm, grapevine (<i>Vitis</i> spp.), smilax, blackberry (<i>Rubus</i> spp.), broomsedge (<i>Andropogon virginicus</i>), chain fern (<i>Woodwardia virginica</i>), air potato, and lizards tail (<i>Saururus cernuus</i>).			
Significant nearby features Taylor Creek Canal, Lake Okeechobee, Okeechobee County Airport		Uniqueness (considering the relative rarity in relation to the regional landscape.) The relative wetland size in close proximity to Lake Okeechobee, makes this wetland unique.	
Functions providing cover, substrate, and refuge; breeding, nesting, denning, and nursery areas; corridors for wildlife movement; food chain support; and natural water storage, natural flow attenuation, and water quality improvement, which enhances fish, wildlife, and listed species utilization;		Mitigation for previous permit/other historic use None	
Anticipated Wildlife Utilization Based on Literature Review (List of species that are representative of the assessment area and reasonably expected to be found) Cypress swamps provide important habitat for many wildlife species (Casey and Ewel 1998). They provide critical breeding habitat for flatwoods salamanders (<i>Ambystoma cingulatum</i> and <i>Ambystoma bishopi</i>) and are important roosting sites for wading birds such as white ibis (<i>Eudocimus albus</i>) and wood stork (<i>Mycteria americana</i>). Other species may include the limpkin, american alligator, little blue heron, great egret, crested caracara, snowy egret, tricolored heron		Anticipated Utilization by Listed Species (List species, their legal classification (E, T, SSC), type of use, and intensity of use of the assessment area) Woodstork (E), limpkin (SSC), american alligator (T, S/A), little blue heron (SSC), crested caracara (T), snowy egret (SSC), tricolored heron (SSC), white ibis (SSC)	
Observed Evidence of Wildlife Utilization (List species directly observed, or other signs such as tracks, droppings, casings, nests, etc.): Woodstork, Limpkin, American Alligator, Little Blue Heron, Snowy Egret, Cattle Egret, Red Shouldered Hawk			
Additional relevant factors: The Cypress wetlands have been heavily impacted by agricultural drainage and the creation of the Taylor Creek canal for flood control purposes.			
Assessment conducted by: MPM		Assessment date(s): 9.15.2014	

PART II – Quantification of Assessment Area (impact or mitigation)
(See Sections 62-345.500 and .600, F.A.C.)

Site/Project Name State Road 710 - STA	Application Number	Assessment Area Name or Number Cypress Wetlands
Impact or Mitigation Enhancement	Assessment conducted by: MPM	Assessment date: 9.15.2014

Scoring Guidance	Optimal (10)	Moderate(7)	Minimal (4)	Not Present (0)
The scoring of each indicator is based on what would be suitable for the type of wetland or surface water assessed	Condition is optimal and fully supports wetland/surface water functions	Condition is less than optimal, but sufficient to maintain most wetland/surface waterfunctions	Minimal level of support of wetland/surface water functions	Condition is insufficient to provide wetland/surface water functions

.500(6)(a) Location and Landscape Support w/o pres or current with 5 5	The "Location" score will not be impacted or enhanced with the project design.
.500(6)(b)Water Environment (n/a for uplands) w/o pres or current with 5 7	Seasonal High Water Elevations set within wetlands 1, 3 and 5 were established at flow ways (either an excavated ditch within the wetland or a historic tributary leading into Taylor Creek) which is the only location standing water was found in the wetlands. Seasonal high water indicators used to set these elevations were primarily lichen lines and the moss collar lowest extent (where present) which generally corresponded to an elevation near the top of the creek/ditch bank. These lichen lines generally maintained a relationship to the cypress knees and also a slight inflection point on the cypress trunk. Individually, these indicators are not considered the strongest; however, cumulatively they appear to be consistent and reliable for establishing a wet season peak elevation. The cypress trees within most of the wetlands exhibit alteration to varying degrees. Cypress roots are exposed at numerous trunk bases and there is multiple inflection points present on the cypress. Depending on the system design these wetlands may receive a lift from either increased surface water input, decreased groundwater loss due to the low control elevation from nearby drainage ditches, or a combination of the two restoration methods.
.500(6)(c)Community structure 1. Vegetation and/or 2. Benthic Community w/o pres or current with 5 7	The wetland types are similar and contain a mature canopy of bald cypress (<i>Taxodium ascendens</i>), with a heterogenous mixture of sweet bay (<i>Magnolia virginiana</i>), red bay (<i>Persea palustris</i>) and water oak (<i>Quercus nigra</i>) with a subcanopy dominated in some areas by Brazilian pepper and a mixture of cabbage palm. Groundcover includes wild coffee, cabbage palm, grapevine (<i>Vitis</i> spp.), smilax, blackberry (<i>Rubus</i> spp.), broomsedge (<i>Andropogon virginicus</i>), chain fern (<i>Woodwardia virginica</i>), air potato, and lizards tail (<i>Saururus cernuus</i>). The wetland edges are particularly invaded by upland and invasive vegetation, presumably outcompeting native wetland vegetation due to the change in hydrologic conditions. Functional gains may be obtained in community structure, if the design allows water to rehydrate the system to the edges for a period of time sufficient to terminate upland vegetation. Hydrologic indicators such as historic inflection points suggest water levels may only need to achieve the historic seasonal high for a duration of 2-3% of the year (Carr 2006, COMPARISON OF SIX BIOLOGIC INDICATORS OF HYDROLOGY AND THE LANDWARD EXTENT OF HYDRIC SOILS IN WEST-CENTRAL FLORIDA, USA CYPRESS DOMES).

Score = sum of above scores/30 (if uplands, divide by 20)
current
or w/o pres with
0.5 0.63

If preservation as mitigation,
Preservation adjustment factor =
Adjusted mitigation delta =

For impact assessment areas
FL = delta x acres =

Delta = [with-current]
0.13

If mitigation
Time lag (t-factor) = 1.14
Risk factor = 1.5

For mitigation assessment areas
RFG = delta/(t-factor x risk) = 0.076

Appendix E: Correspondence

SR 710 Stormwater Treatment Area/Regional Pond Feasibility Study Preliminary Submittal

**Financial Project ID
432644-1-32-01**

Okeechobee County, Florida



MEETING MINUTES

SR 710 Possible Regional Pond Brainstorming Meeting

SR 710 from US 441 to the L63-N Canal

FPID No. 419344-3-52-01

September 13, 2013, 11:00 am; GoToMeeting

Attendees:

Lesley Bertolotti – SFWMD, Principal Scientist
Kevin Carter – SFWMD, Lead Scientist
Kelly Cranford – SFWMD, Permitting Section Leader
Orlando Diaz – SFWMD, Sr. Environmental Scientist
Eric Gonzalez – SFWMD, Project Manager Principal
Susan Martin – SFWMD, Senior Specialist Attorney
John Morgan – SFWMD, Lead Policy Analyst
Gary Ritter – SFWMD, Intergovernmental & Outreach Representative
Steve Sentes – SFWMD, Regulatory Professional Lead
Tony Waterhouse – SFWMD, Assistant Executive Director, Regulation
Misty Alderman – FDEP, Nonpoint Source Management
Elizabeth Alvi – FDEP, Env Consultant
Ken Kuhl – FDEP, Env Consultant
Trina Vielhauer – FDEP, Env. Assessment and Restoration
Bonnie Wolff Pelaez – FDACS, Env Specialist
Brent Setchell – FDOT, Permitting
Carl Spirio – FDOT, Drainage
Amy Setchell – FDOT – Project Manager
Brian Kirwan – The Wantman Group, PM - Design
Alfredo Rodriguez – The Wantman Group, Roadway
Greg Griffith – The Wantman Group, Permitting
Greg Seidel – The Balmoral Group, Drainage
Jennifer Nunn – The Balmoral Group, Drainage
Tim Desmarais – The Balmoral Group, Drainage

Purpose: The purpose of the meeting was to present the SR 710 project and possible regional pond opportunity to the SFWMD and FDEP, brainstorm on ideas, discuss feasibility and develop a go forward strategy. Below are highlights of the meeting -

1. Greg Seidel began the meeting with introductions. Participants announced who they represent and what role they would presumably play in this concept.
 - a) FDOT – regional pond approach has cost savings benefits and is in alignment with BMAP efforts
 - b) SFWMD – permitting and also involved in BMAP process
 - c) FDEP – BMAP coordinator
 - d) FDACS – land owner of the potential site enrolled in the BMP program

Mr. Seidel added that he is the drainage engineer of record for the SR 710 new alignment project from US 441 to East of the L-63N Canal. As such, he is responsible for developing the stormwater management plan for the project and has been asked to evaluate regional opportunities by the FDOT.

Brent Setchell stated the FDOT position of looking for better ways to spend stormwater management dollars that would provide more treatment than just the roadway and help reduce costs to the FDOT while providing a better “product” to the public.

2. Timeframe – Pond Siting Report – November 2013
 Right-of-Way Acquisition – July 2015 (tentative)
3. Mr. Seidel began the brainstorming session with an overview of the proposed road alignment and overview of the local/regional hydrology. (Please see attached exhibits from the meeting agenda)
 - a) Water levels governed by operation of S-133 and S-191. Taylor Creek is pumped into Lake Okeechobee. This pump station was not designed to pump both ways.
 - b) Most of the runoff in Taylor Creek is from urbanized areas. Flows from the large agricultural areas to the north bypass Taylor Creek and flow around the city via the L-63 Canal. Much of the ag-based runoff is treated via an existing SFWMD Stormwater Treatment area to the north.
 - c) Discussed ongoing stormwater improvements and needs in the area:
 - i. Oak Park – reconstructed swales
 - ii. SW 32nd Ave ditch
 - iii. TMDL-related improvements
 - iv. E-W conveyance project
 - v. Miscellaneous retrofits for direct connections to Taylor Creek
 - d) One option is to reverse the typical flow water in Taylor Creek, rout it through the proposed regional facility for treatment, and discharging back to Taylor Creek (or possibly L-63N). Routing water northward into L-63N may create a problem with septic tanks in the south, which have reported to have issues whenever the water reaches 13.8’.
 - e) Another suggestion was to route some of the water flowing in L-63N into the proposed regional facility for treatment and release it back to L-63N.
 - f) The landowners have been contacted about the roadway project.
4. It was suggested to contact USACE about this concept, as they may have interests from a permitting perspective and possible cost-sharing. It was agreed to this at a later date following an additional coordination meeting.

5. Water Quality data on Taylor Creek, L-63N, and Lake Okeechobee would be helpful in determining how to maximize the potential benefit from this concept.
6. It was noted that Taylor Creek used to have a sand bottom and is now covered with organic silt and muck. The southern portion of the basin contains homes on septic tank.
7. The meeting ended with an agreement to revisit and discuss more in detail when the draft Pond Siting Report is completed which will be in November. At this time, the FDOT will know more about pond sizes, locations and costs. The FDOT will contact the participants to schedule the meeting at a later date.

c. Attendees (Via Email)

Attachment – Agenda Exhibits



PROPOSED AREA FOR LOWER TAYLOR CREEK SMF



Legend

- Proposed SR 710 Alignment
- Parcel Lines

NORMAN

HAMRICK & SONS INC

L 63-N CANAL

OKEECHOBEE HIGH SCHOOL

LOWER TAYLOR CREEK

AREA AVAILABLE
FOR POTENTIAL
REGIONAL FACILITY

RAULERSON HOSPITAL

HAMRICK & SONS INC

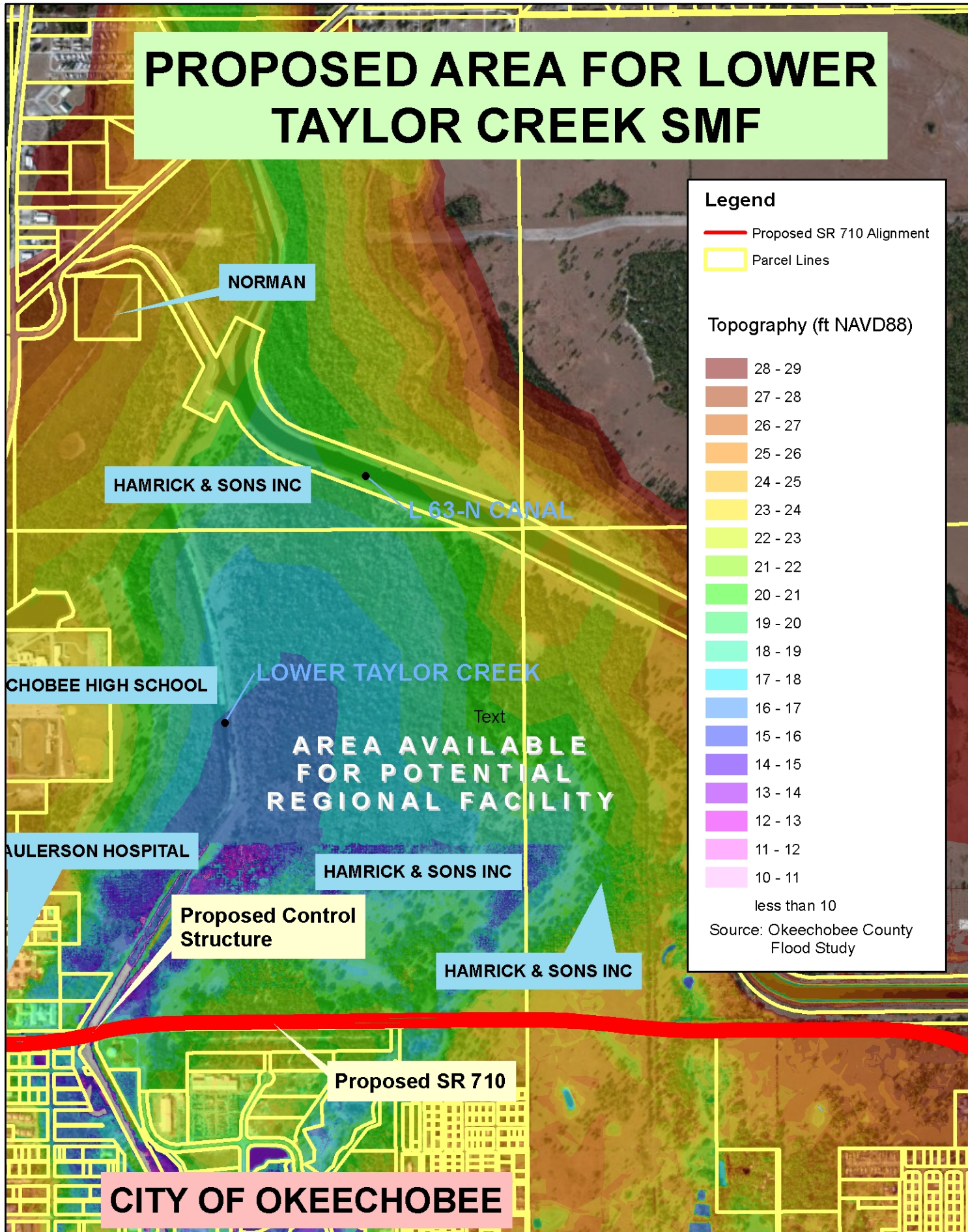
HAMRICK & SONS INC

Proposed Control
Structure

Proposed SR 710

CITY OF OKEECHOBEE

PROPOSED AREA FOR LOWER TAYLOR CREEK SMF



Memo



To: Gregory Seidel, P.E.

From: Lori Stanfill, P.E.

CC:

Date: September 11, 2013

Re: SR 710 - Pump Information for Taylor Creek (Structures S-192 & S-133)

According to the System Operation Manual for Lake Okeechobee, Structure S-192 is located at the junction of L-63N Canal and Taylor Creek (North of the City of Okeechobee). This structure is a single 48" culvert with a gate and a pump. When the gate is open, it allows passage of water from L-63N to Taylor Creek (gravity flow), however, the gate is typically closed. The structure also permits back pumping from Taylor Creek to L-63N (See References).

The purpose of S-192 is to prevent stagnation in the lower reaches of Taylor Creek. The S-192 gate is normally closed, except for the following reasons: 1) Maintenance purposes, where it is needed to divert flows from L-63N Canal; 2) When the water quality in Taylor Creek is degraded (i.e. by discharge of the sewage treatment plant) and Lake Okeechobee is sufficiently low to allow gravity flow to the south into the lake (below elevation 14.0 ft, NGVD).

Similarly, the S-192 pump is only activated when the water quality in lower Taylor Creek is degraded (i.e. from discharge from the sewage treatment plant), and Lake Okeechobee is too high to allow flow into the lake (above elevation 14.0 ft, NGVD). When this occurs, structure S-193 (located at south end of Taylor Creek, at entry into Lake Okeechobee) is also open to discharge the same flow into Taylor Creek from Lake Okeechobee as is being pumped out to the north (into L-63N Canal).

S-192 is not designed to pass flood flows. Flood flows are routed to Lake Okeechobee via L-63N Canal, L-59 Canal, and structure S-191 (See Reference).

Stage and discharge Information for S-192 was obtained from the SFWMD website, and is shown below:

Location	Stage (ft NGVD)	Discharge	Date
S-192		Unavailable	11-15-2012
S-192 (US at L-63N)	19.42		3-12-2013
S-192 (DS at Taylor Creek)	13.67		3-12-2013

There is daily information for the stages and structures on Lake Okeechobee which can be accessed from the Army Corps of Engineers website (See References & Attachments). Structure S-133 is located at the southernmost end of Taylor Creek where it drains into Lake Okeechobee (at northeast bank of lake).

Structure S-133 includes 5 pumping units with a combined capacity of 625 cfs (or greater). It is designed to remove $\frac{3}{4}$ inch per day of runoff from the 16,190 acre drainage area. There are five – 48 inch steel pipes which convey pumped discharge into Lake Okeechobee. There are slidegates on the intake end (Taylor Creek side) and flapgates on the discharge end (Lake Okeechobee side).

Structure S-193 (mentioned above) is located 1200' to the east of S-133. It is a lock which can be opened to pass flows to the north or south depending on the stage in Lake Okeechobee (See Reference).

Information for the abovementioned structures can be obtained on the SFWMD website (See References). Stage and discharge Information for S-133 and S-193 was obtained from the SFWMD website, and is shown below:

Location	Stage (ft NGVD)	Discharge (cfs)	Date
S-133		282*	9-11-2013
S-133 (US at Taylor Creek)	13.67		9-11-2013
S-133 (DS at Lk. Okeechobee)	15.23		9-11-2013

Note: 2 pumps @ 1178.79 rpm discharging on 9-11-2013

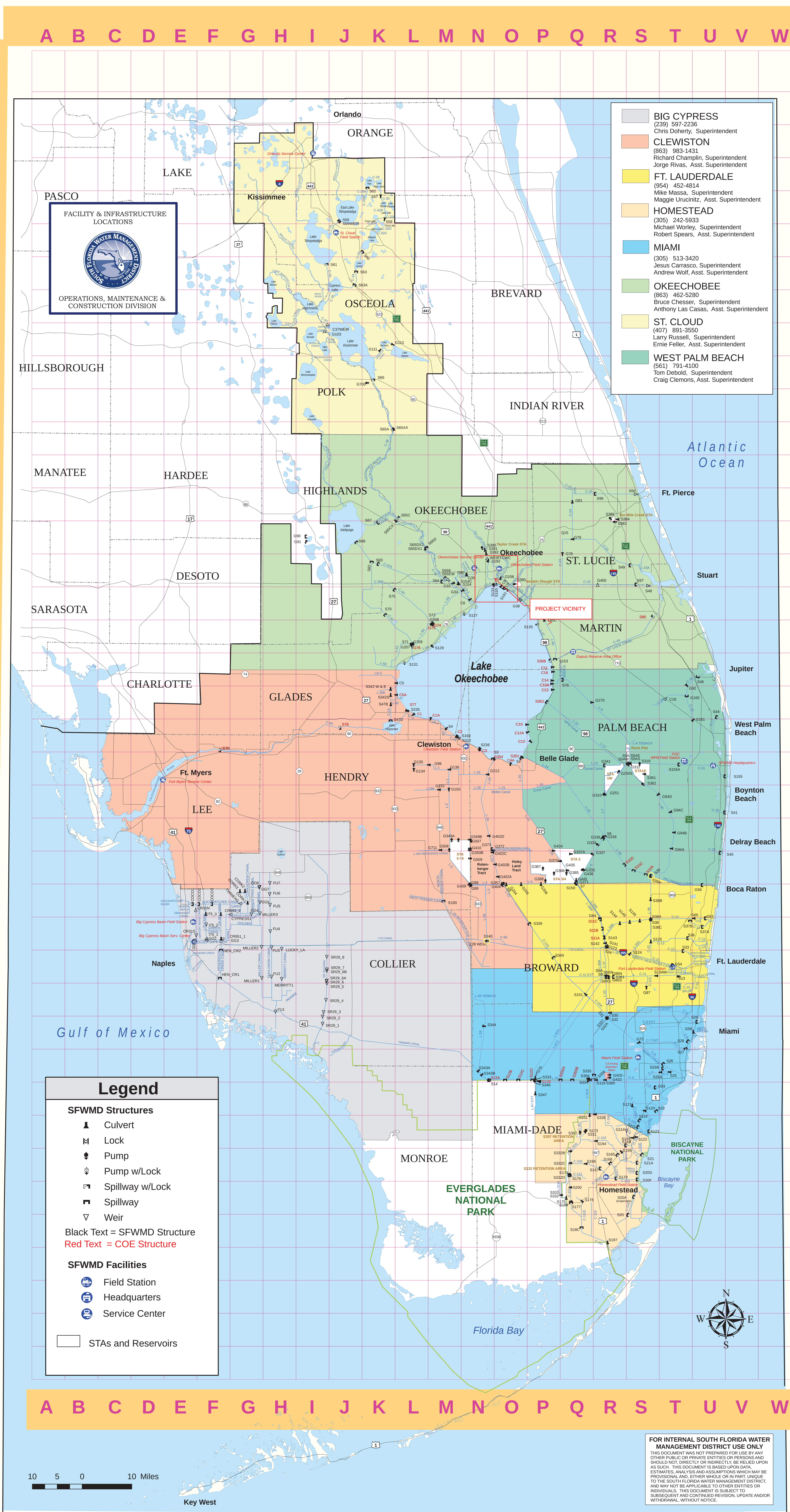
According to the Army Corps of Engineers website, the pumps from Lake Okeechobee to the Caloosahatchee River were turned on in Feb. 2013, but turned off in late Aug. 2013 as the water level was sufficiently reduced and within the range the Corps likes to maintain. On September 10, 2013, the stage in Lake Okeechobee is 15.46 feet NGVD. The Corps acceptable range (Operational Management Band) for which no pumping is necessary is between 12.59 feet NGVD to 16.48 feet NGVD. The stage on the upstream side (Taylor Creek) of S-133 was 13.46 feet NGVD on Sept. 10, 2013. See attached chart for Lake Okeechobee stage information from January 2012 to September 2013 and Lake Okeechobee Vicinity Report.

References:

1. Central and Southern Florida Project for Flood Control and Other Purposes System Operating Manual, Lake Okeechobee & EAA Vol. 3, Version 1 Draft
4. Dept. of the Army Corps of Engineers, Jacksonville District, December 2005.
2. <http://w3.saj.usace.army.mil/h2o/plots.htm>. Army Corps of Engineers Website.
3. http://www.sfwmd.gov/portal/pls/portal/realtime.pkg_rr.proc_rr?p_op=OKEECHOBEE&p_wcs_name=TAYLOR_CK_1. SFWMD Website.

FIELD STATION AREAS OF RESPONSIBILITY

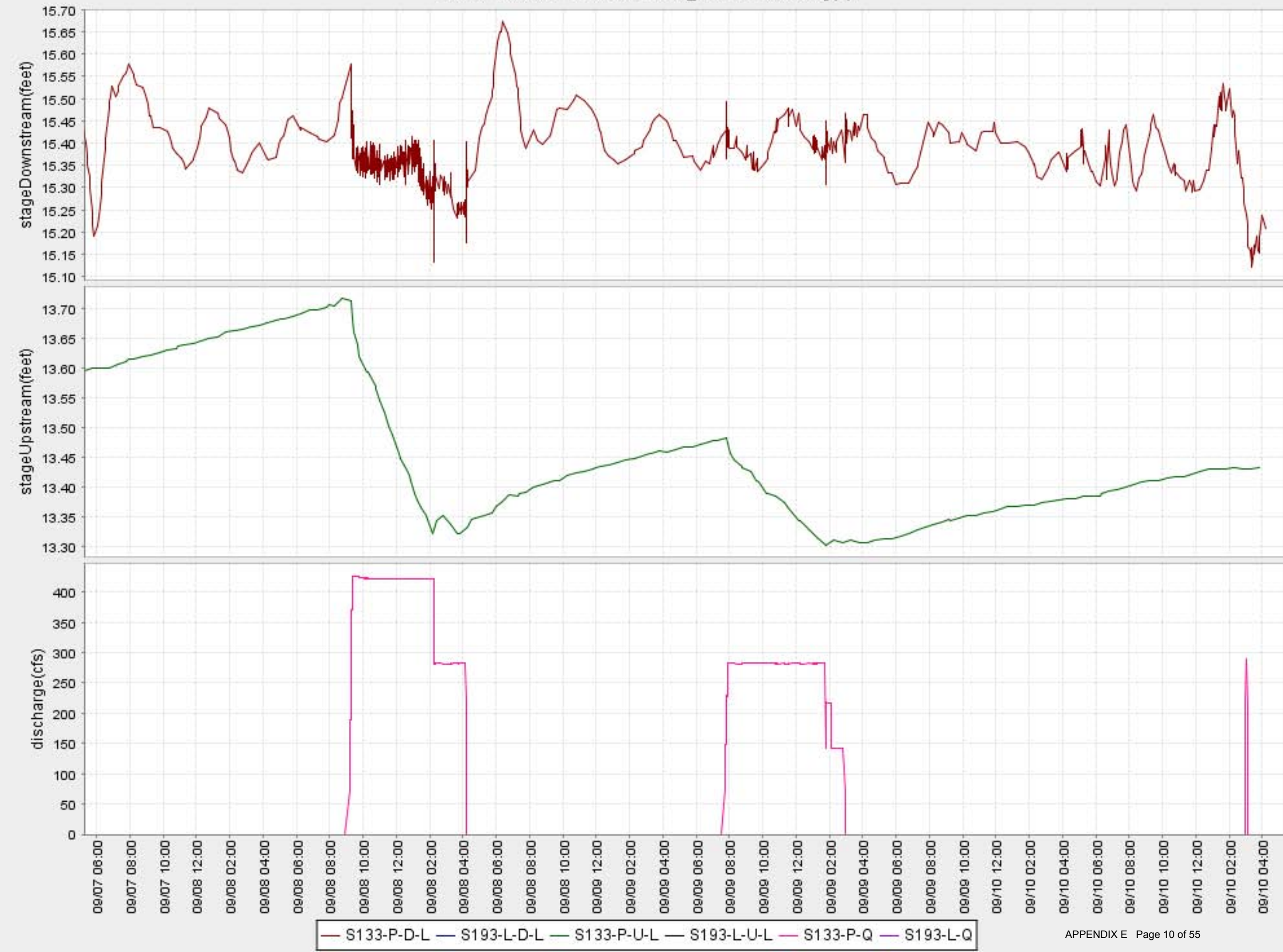
STRUCTURE INDEX



STADIUM	NUMBER	TYPE (Cont.)
S1400	N	27
S1411	R	27
S1422	S	27
S1433	R	27
S1444	S	27
S1455	S	27
S1466	S	27
S1477	S	27
S1488	S	27
S1499	S	27
S1500	S	29
S1511	P	16
S1522	S	27
S1533	P	16
S1544	S	27
S1555	S	27
S1566	T	22
S1577	S	27
S1588	R	34
S1599	R	34
S1600	R	34
S1611	R	34
S1622	R	34
S1633	R	34
S1644	R	34
S1655	R	34
S1666	R	34
S1677	R	34
S1688	R	34
S1699	R	34
S1700	R	34
S1711	R	34
S1722	R	34
S1733	R	34
S1744	R	34
S1755	R	34
S1766	R	34
S1777	R	34
S1788	R	34
S1799	R	34
S1800	R	34
S1811	R	34
S1822	R	34
S1833	R	34
S1844	R	34
S1855	R	34
S1866	R	34
S1877	R	34
S1888	R	34
S1899	R	34
S1900	R	34
S1911	R	34
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S1944	R	34
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S1977	R	34
S1988	R	34
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S2077	R	34
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S2099	R	34
S2100	R	34
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S2155	R	34
S2166	R	34
S2177	R	34
S2188	R	34
S2199	R	34
S2200	R	34
S2211	R	34
S2222	R	34
S2233	R	34
S2244	R	34
S2255	R	34
S2266	R	34
S2277	R	34
S2288	R	34
S2299	R	34
S2300	R	34
S2311	R	34
S2322	R	34
S2333	R	34
S2344	R	34
S2355	R	34
S2366	R	34
S2377	R	34
S2388	R	34
S2399	R	34
S2400	R	34
S2411	R	34
S2422	R	34
S2433	R	34
S2444	R	34
S2455	R	34
S2466	R	34
S2477	R	34
S2488	R	34
S2499	R	34
S2500	R	34
S2511	R	34
S2522	R	34
S2533	R	34
S2544	R	34
S2555	R	34
S2566	R	34
S2577	R	34
S2588	R	34
S2599	R	34
S2600	R	34
S2611	R	34
S2622	R	34
S2633	R	34
S2644	R	34
S2655	R	34
S2666	R	34
S2677	R	34
S2688	R	34
S2699	R	34
S2700	R	34
S2711	R	34
S2722	R	34
S2733	R	34
S2744	R	34
S2755	R	34
S2766	R	34
S2777	R	34
S2788	R	34
S2799	R	34
S2800	R	34
S2811	R	34
S2822	R	34
S2833	R	34
S2844	R	34
S2855	R	34
S2866	R	34
S2877	R	34
S2888	R	34
S2899	R	34
S2900	R	34
S2911	R	34
S2922	R	34
S2933	R	34
S2944	R	34
S2955	R	34</

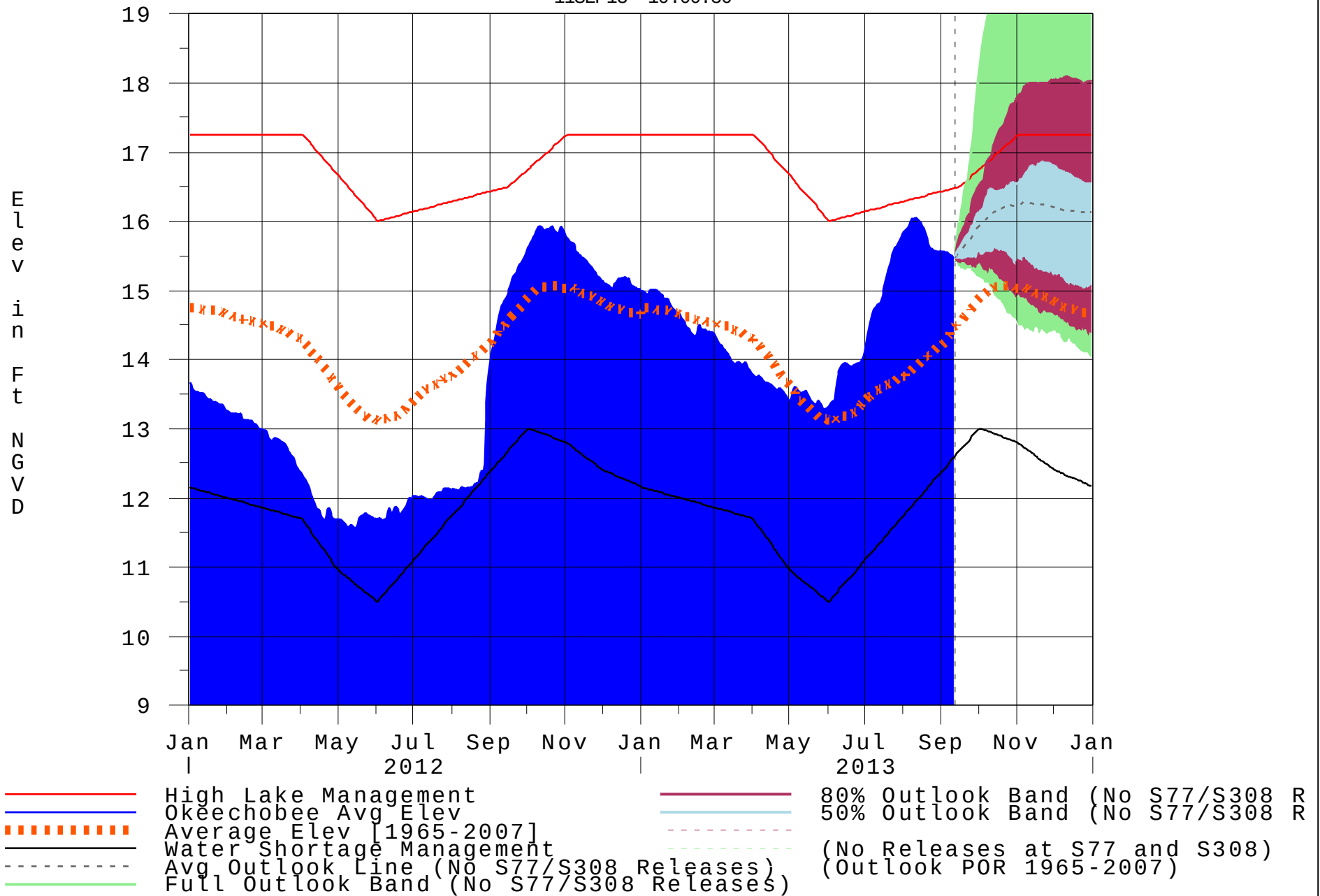
CANAL / LEVEE INDEX	
ARROCK ROAD CANAL	E27
BARRETT CREEK	122
BARNUM RIVER	134
BARNUM CREEK	139
C-1 CONNECTOR CANAL	130
C-1	U29
C-10	U29
C-10A	U29
C-10B	U29
C-10C	U29
C-10D	U29
C-10E	U29
C-10F	U29
C-10G	U29
C-10H	U29
C-10I	U29
C-10J	U29
C-10K	U29
C-10L	U29
C-10M	U29
C-10N	U29
C-10O	U29
C-10P	U29
C-10Q	U29
C-10R	U29
C-10S	U29
C-10T	U29
C-10U	U29
C-10V	U29
C-10W	U29
C-10X	U29
C-10Y	U29
C-10Z	U29
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C-11A	U29
C-11B	U29
C-11C	U29
C-11D	U29
C-11E	U29
C-11F	U29
C-11G	U29
C-11H	U29
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C-11J	U29
C-11K	U29
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C-11M	U29
C-11N	U29
C-11O	U29
C-11P	U29
C-11Q	U29
C-11R	U29
C-11S	U29
C-11T	U29
C-11U	U29
C-11V	U29
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C-12B	U29
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C-12D	U29
C-12E	U29
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C-12N	U29
C-12O	U29
C-12P	U29
C-12Q	U29
C-12R	U29
C-12S	U29
C-12T	U29
C-12U	U29
C-12V	U29
C-12W	U29
C-12X	U29
C-12Y	U29
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C-13	U29
C-13A	U29
C-13B	U29
C-13C	U29
C-13D	U29
C-13E	U29
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C-13H	U29
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C-13Q	U29
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C-13S	U29
C-13T	U29
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C-13V	U29
C-13W	U29
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C-14O	U29
C-14P	U29
C-14Q	U29
C-14R	U29
C-14S	U29
C-14T	U29
C-14U	U29
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C-15I	U29
C-15J	U29
C-15K	U29
C-15L	U29
C-15M	U29
C-15N	U29
C-15O	U29
C-15P	U29
C-15Q	U29
C-15R	U29
C-15S	U29
C-15T	U29
C-15U	U29
C-15V	U29
C-15W	U29
C-15X	U29
C-15Y	U29
C-15Z	U29
C-16	U29
C-16A	U29
C-16B	U29
C-16C	U29
C-16D	U29
C-16E	U29
C-16F	U29
C-16G	U29
C-16H	U29
C-16I	U29
C-16J	U29
C-16K	U29
C-16L	U29
C-16M	U29
C-16N	U29
C-16O	U29
C-16P	

Combined Realtime Chart of S133_S193 for last 3 Day(s)



Lake Okeechobee

11SEP13 10:00:36



U. S. Army Corps of Engineers, Jacksonville District
 Lake Okeechobee and Vicinity Report
 ** Preliminary Data - Subject to Revision **

Data Ending 2400 hours 10 SEP 2013

Okeechobee Lake Regulation	Elevation (ft-NGVD)	Last Year (ft-NGVD)	2YRS Ago (ft-NGVD)
*Okeechobee Lake Elevation	15.46	14.81	10.86 (Official Elv)
Bottom of High Lake Mngmt=	16.48	Top of Water Short Mngmt=	12.59
Currently in Operational Management Band			

Simulated Average LORS2008 [1965-2000]	13.41
Difference from Average LORS2008	2.05

10SEP (1965-2007) Period of Record Average	14.47
Difference from POR Average	0.99

Today Lake Okeechobee elevation is determined from the 4 Int & 4 Edge stations

++Navigation Depth (Based on 2007 Channel Condition Survey) Route 1 ÷ 9.40'
 ++Navigation Depth (Based on 2008 Channel Condition Survey) Route 2 ÷ 7.60'
 Bridge Clearance = 49.24'

4 Interior and 4 Edge Okeechobee Lake Average (Avg-Daily values):

L001	L005	L006	LZ40	S4	S352	S308	S133
15.24	15.47	15.49	15.56	15.61	15.59	15.32	15.37

*Combination Okeechobee Avg-Daily Lake Average = 15.46
 (*See Note)

Okeechobee Inflows (cfs):

S65E	3077	S191	162	Fisheating Cr	600
S154	152	S133 Pumps	0	S135 Pumps	0
S84	4	S127 Pumps	0	S2 Pumps	0
S71	156	S129 Pumps	0	S3 Pumps	0
S72	166	S131 Pumps	0	S4 Pumps	0
Total Inflows:	4317				

Okeechobee Outflows (cfs):

S135 Culverts	0	S354	0	S77	4001 (Used)
S127 Culverts	0	S351	0	S77Below	4449 (NOT USED)
S129 Culverts	0	S352	250	S308	1300 (Used)
S131 Culverts		L8 Canal Pt	352	S308Below	1212 (NOT USED)
C5	0				
Total Outflows:	5903				

****S77 Structure outflow is being used to compute Total Outflow.
 ****S308 Structure outflow is being used to compute Total Outflow.

Okeechobee Pan Evaporation (inches):

S77	0.41	S308	0.39
Average Pan Evap x 0.75 Pan Coefficient = 0.30" = 0.02'			

Lake Average Precipitation using NEXRAD: = 0.03" = 0.00'

Evaporation - Precipitation: = 0.27" = 0.02'
 Evaporation - Precipitation using Lake Area of 730 square miles
 is equal to 5300 cfs out of the lake.
 Lake Okeechobee (Change in Storage) Flow is -6504 cfs or -12900 AC-FT

Note: Headwater, tailwater, and stage values below are instantaneous values
 unless otherwise specified.

	Headwater Elevation (ft-msl)	Tailwater Elevation (ft-msl)	Disch (cfs)	----- Gate Positions -----							
				#1 (ft)	#2 (ft)	#3 (ft)	#4 (ft)	#5 (ft)	#6 (ft)	#7 (ft)	#8 (ft)
(I) see note at bottom											
North East Shore											
S133 Pumps:	13.46	15.52	0	0	0	0	0	0	0		(cfs)
S193:											
S191:	19.23	15.50	162	0.0	0.0	0.5					
S135 Pumps:	13.46	15.35	0	0	0	0	0				(cfs)
S135 Culverts:			0	0.0	0.0						
North West Shore											
S65E:	21.13	15.71	3077	2.0	1.5	1.5	1.5	1.0	1.0		
S127 Pumps:	13.46	15.40	0	0	0	0	0	0			(cfs)
S127 Culvert:			0	0.0							
S129 Pumps:	12.97	15.56	0	0	0	0					(cfs)
S129 Culvert:			0	0.1							
S131 Pumps:	12.93	15.68	0	0	0						(cfs)
S131 Culvert:											
Fisheating Creek											
nr Palmdale		32.33	600								
nr Lakeport		16.02									
C5:	16.71	15.46	0	0.0	0.0	0.0					
South Shore											
S4 Pumps:	10.88	15.58	0	0	0	0					(cfs)
S169:	14.41	10.90	0	0.0	0.0	0.0					
S310:	15.55		2								
S3 Pumps:	10.59	15.60	0	0	0	0					(cfs)
S354:	15.60	10.59	0	0.0	0.0						
S2 Pumps:	9.87	15.52	0	0	0	0	0				(cfs)
S351:	15.52	9.87	0	0.0	0.0	0.0					
S352:	15.49	11.48	250	0.8	0.8						
C10A:	-NR-	-NR-		10.0	10.0	8.0	10.0	10.0			
L8 Canal PT		15.35	352								
S351 and S352 Temporary Pumps/S354 Spillway											
S351:	9.87	15.52	0	-NR-	-NR-	-NR-	-NR-	-NR-	-NR-		
S352:	11.48	15.49	250	-NR-	-NR-	-NR-	-NR-				
S354:	10.59	15.60	0	-NR-	-NR-	-NR-	-NR-				

Caloosahatchee River (S77, S78, S79)

S47B: 13.04 12.03 0.0 0.5

S47D: 12.03 10.71 -NR- 0.0

S77:

Spillway and Sector Flow:

15.26 10.86 4000 -NR- 3.7 3.7 3.7

Flow Due to Lockages+: 1

S77 Below USGS Flow Gage 4449

S78:

Spillway and Sector Flow:

10.32 3.16 5255 4.0 4.0 4.5 4.0

Flow Due to Lockages+: 4

S79:

Spillway and Sector Flow:

2.92 1.40 7862 3.0 3.0 3.0 4.0 4.0 3.0 3.0 3.0

Flow Due to Lockages+: 2

Percent of flow from S77 51%

Chloride (ppm) 48

St. Lucie Canal (S308, S80)

S308:

Spillway and Sector Flow:

15.30 14.26 1298 0.0 3.0 3.5 0.0

Flow Due to Lockages+: 2

S308 Below USGS Flow Gage 1212

S153: 18.95 14.14 84 0.5 0.0

S80:

Spillway and Sector Flow:

14.08 0.85 1808 0.0 1.0 1.0 0.0 1.0 1.0 0.0

Flow Due to Lockages+: 13

Percent of flow from S308 72%

Steele Point Top Salinity (mg/ml) ****

Steele Point Bottom Salinity (mg/ml) ****

Speedy Point Top Salinity (mg/ml) 7089

Speedy Point Bottom Salinity (mg/ml) 7723

+ Flow Due to lockages is computed utilizing average daily headwater and tailwater along with total number of lockages for the day to calculate a volume which is then converted to an average discharge in cfs.

Daily Precipitation Totals	1-Day (inches)	3-Day (inches)	7-Day (inches)	----- Wind -----	
				Direction (DegØ)	Speed (mph)
S133 Pump Station:	-NR-	0.13	1.38		
S193:	-NR-	0.00	0.00	-NR-	-NR-
Okeechobee Field Station:	-NR-	0.00	0.00		
S135 Pump Station:	-NR-	0.98	2.15		
S127 Pump Station:	-NR-	0.00	0.08		
S129 Pump Station:	-NR-	0.70	1.62		
S131 Pump Station:	-NR-	0.00	0.07		
S77:	0.00	0.00	0.33	114	2
S78:	0.00	0.00	1.57	25	1
S79:	0.15	0.16	1.40	36	2

S4 Pump Station:	-NR-	0.00	0.00		
Clewiston Field Station:	-NR-	0.17	1.30		
S3 Pump Station:	-NR-	0.01	0.87		
S2 Pump Station:	-NR-	0.02	0.35		
S308:	0.18	0.18	0.24	270	0
S80:	0.57	0.77	0.78	90	0
Okeechobee Average	0.09	0.17	0.65		
(Sites S78, S79 and S80 not included)					

Oke Nexrad Basin Avg	0.03	0.06	0.67
----------------------	------	------	------

Okeechobee Lake Elevations	10 SEP 2013	15.46	Difference from 10SEP13
10SEP13 -1 Day =	09 SEP 2013	15.49	0.03
10SEP13 -2 Days =	08 SEP 2013	15.51	0.05
10SEP13 -3 Days =	07 SEP 2013	15.52	0.06
10SEP13 -4 Days =	06 SEP 2013	15.51	0.05
10SEP13 -5 Days =	05 SEP 2013	15.53	0.07
10SEP13 -6 Days =	04 SEP 2013	15.54	0.08
10SEP13 -7 Days =	03 SEP 2013	15.55	0.09
10SEP13 -30 Days =	11 AUG 2013	16.03	0.57
10SEP13 -1 Year =	10 SEP 2012	14.81	-0.65
10SEP13 -2 Year =	10 SEP 2011	10.86	-4.60

Long Term Mean 30day Avearge ET for Lake Alfred (Inches) = 4.21

Lake Okeechobee Net Inflow (LONIN)					
Average Flow over the previous 14 days					Avg-Daily Flow
10SEP13	Today =	10 SEP 2013	4652	WED	-604
10SEP13	-1 Day =	09 SEP 2013	5146	TUE	1328
10SEP13	-2 Days =	08 SEP 2013	5509	MON	3524
10SEP13	-3 Days =	07 SEP 2013	5282	SUN	8285
10SEP13	-4 Days =	06 SEP 2013	5105	SAT	2180
10SEP13	-5 Days =	05 SEP 2013	5485	FRI	4287
10SEP13	-6 Days =	04 SEP 2013	5528	THU	4081
10SEP13	-7 Days =	03 SEP 2013	5221	WED	6085
10SEP13	-8 Days =	02 SEP 2013	5055	TUE	3705
10SEP13	-9 Days =	01 SEP 2013	4672	MON	8314
10SEP13	-10 Days =	31 AUG 2013	4174	SUN	4563
10SEP13	-11 Days =	30 AUG 2013	3916	SAT	4619
10SEP13	-12 Days =	29 AUG 2013	3934	FRI	10499
10SEP13	-13 Days =	28 AUG 2013	3342	THU	4261

S65E					
Average Flow over previous 14 days					Avg-Daily Flow
10SEP13	Today=	10 SEP 2013	3223	WED	3077
10SEP13	-1 Day =	09 SEP 2013	3200	TUE	3217
10SEP13	-2 Days =	08 SEP 2013	3149	MON	3216
10SEP13	-3 Days =	07 SEP 2013	3114	SUN	3378
10SEP13	-4 Days =	06 SEP 2013	3057	SAT	3009
10SEP13	-5 Days =	05 SEP 2013	3072	FRI	2776
10SEP13	-6 Days =	04 SEP 2013	3097	THU	3200
10SEP13	-7 Days =	03 SEP 2013	3081	WED	3234
10SEP13	-8 Days =	02 SEP 2013	3064	TUE	3130
10SEP13	-9 Days =	01 SEP 2013	3062	MON	3393
10SEP13	-10 Days =	31 AUG 2013	3041	SUN	3218
10SEP13	-11 Days =	30 AUG 2013	3105	SAT	3283

10SEP13 -12 Days =	29 AUG 2013	3197	FRI		3501
10SEP13 -13 Days =	28 AUG 2013	3278	THU		3496

Lake Okeechobee Outlets Last 14 Days

DATE	S-77 Discharge (0700-2100) (AC-FT)	S-77 Discharge (ALL DAY) (AC-FT)	Below S-77 Discharge (ALL-DAY) (AC-FT)	S-78 Discharge (0700-2100) (AC-FT)	S-78 Discharge (ALL DAY) (AC-FT)	S-79 Discharge (ALL DAY) (AC-FT)
10 SEP 2013	4738	7934	8822	6192	10429	15595
09 SEP 2013	4626	7771	8697	6240	10466	17759
08 SEP 2013	4554	7673	8528	5960	9945	17447
07 SEP 2013	4692	7895	8778	5889	9977	14918
06 SEP 2013	4782	8158	9020	6229	10457	16324
05 SEP 2013	5029	8434	9256	6521	10981	16496
04 SEP 2013	4866	8168	9168	6620	11170	17692
03 SEP 2013	4713	7952	8694	6532	10854	18873
02 SEP 2013	4878	8225	8778	6024	10130	19373
01 SEP 2013	4020	8386	8845	4812	10098	15902
31 AUG 2013	3853	8386	8850	4618	10162	16993
30 AUG 2013	3820	8326	8759	4686	10251	18255
29 AUG 2013	3827	8366	8851	4610	10025	18838
28 AUG 2013	3880	8438	8769	4459	9759	19453

DATE	S-310 Discharge (ALL DAY) (AC-FT)	S-351 Discharge (ALL DAY) (AC-FT)	S-352 Discharge (ALL DAY) (AC-FT)	S-354 Discharge (ALL DAY) (AC-FT)	L8 Canal Pt Discharge (ALL DAY) (AC-FT)
10 SEP 2013	3	0	496	0	698
09 SEP 2013	8	0	333	0	718
08 SEP 2013	-0	0	621	0	724
07 SEP 2013	10	0	682	0	779
06 SEP 2013	2	0	1130	0	808
05 SEP 2013	12	0	851	0	796
04 SEP 2013	18	0	944	0	784
03 SEP 2013	2	0	758	0	804
02 SEP 2013	-5	0	258	0	743
01 SEP 2013	2	0	389	0	782
31 AUG 2013	60	0	1251	0	797
30 AUG 2013	29	0	1384	0	808
29 AUG 2013	-2	0	325	0	718
28 AUG 2013	93	0	1222	0	753

DATE	S-308 Discharge (ALL DAY) (AC-FT)	Below S-308 Discharge (ALL-DAY) (AC-FT)	S-80 Discharge (ALL-DAY) (AC-FT)
10 SEP 2013	2578	2404	3611
09 SEP 2013	2419	2236	3596
08 SEP 2013	2276	2163	3640
07 SEP 2013	2781	2741	3600
06 SEP 2013	2831	2814	3573
05 SEP 2013	2722	2751	3596
04 SEP 2013	2507	2431	3624
03 SEP 2013	2560	2320	3620
02 SEP 2013	2432	2114	3640
01 SEP 2013	2636	2491	3628
31 AUG 2013	2920	2712	3604
30 AUG 2013	2951	2672	3600
29 AUG 2013	2820	2650	3580

28 AUG 2013 2344 2517 3620

*** NOTE: 1) Discharge from (0700-2100) is computed using Spillway and Sector Gate Discharges from 0700 hrs to 2100 hrs.
 2) Discharge (ALL DAY) is computed using Spillway, Sector Gate and Lockages Discharges from 0015 hrs to 2400 hrs.

(I) - Flows preceded by "I" signify an instantaneous flow computed from the single value reported for the day

- * On 11 May 1999, Lake Okeechobee Elevation was switched from Instantaneous 2400 value to an average-daily lake average.
 On 14 Mar 2001, due to the isolation of various gages within the standard 10 stations, the average of the interior 4 station gages was used as the Lake Okeechobee Elevation.
 On 05 November 2010, Lake Okeechobee Elevation was switched to a 9 gage mix of interior and edge gages to obtain a more reliable representation of the lake level.
 On 09 May 2011, Lake Okeechobee Elevation was switched to a 8 gage mix of interior and edge gages to obtain a more reliable representation of the lake level due to isolation of S135 from low lake levels.
 Today Lake Okechobee elevation is determined from the 4 Int & 4 Edge stations
- ++ For more information see the Jacksonville District Navigation website at <http://www.saj.usace.army.mil/>
- \$ For information regarding Lake Okeechobee Service Area water restrictions please refer to www.sfwmd.gov

Report Generated 11SEP2013 @ 09:46 ** Preliminary Data - Subject to Revision **

MEETING MINUTES

SR 710 Possible Regional Pond Brainstorming Meeting 2 SR 710 from US 441 to the L-63N Canal FPID No. 419344-3-52-01

April 4, 2014, 2:00 pm; GoToMeeting

Attendees:

Name		E-mail	Office Phone Number
FDOT			
Rick Renna	State Drainage Engineer	rick.renna@dot.state.fl.us	850-414-5351
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Eric Gonzalez	Project Manager Principal (Northern Everglades)	ergonzal@sfwmd.gov	(561) 682-6391
Jesse Markle	Okeechobee Regulatory Service Center Administrator	jmarkle@sfwmd.gov	(863) 462-5260 x3005
Damon Meiers	Principal Engineer (Dispersed Water Management)	dmeiers@sfwmd.gov	(561) 682-6876
Gary Ritter	Intergovernmental Representative: Okeechobee, Glades, and Highlands Counties	gritter@sfwmd.gov	(863) 462-5260 x3017
Steve Sentes	Regulatory Professional Lead (West Coast and Local Projects)	ssentes@sfwmd.gov	(239) 338-2929 x7754
Tony Waterhouse	Assistant Director Regulation Division	twaterho@sfwmd.gov	(561) 682-6867

Name		Email	Phone
FDEP			
Kim Dinkins	Environmental Consultant	Kimberleigh.Dinkins@dep.state.fl.us	850-245-8825
Katie Hallas	Environmental Consultant	Katie.Hallas@dep.state.fl.us	850-245-8432
Beth Alvi	Program Administrator	Elizabeth.Alvi@dep.state.fl.us	850-245-8559
Trina Veilhauer	Deputy Director	Trina.Vielhauer@dep.state.fl.us	850-245-8338
Wantman Group			
Henri Belrose	Project Manager	henri.belrose@wantmangroup.com	813-574-3190
Eric Lanning	Project Engineer	Eric.Lanning@WantmanGroup.com	407-581-1221
Kasey Carrere	Environmental Scientist	Kasey.Carrere@WantmanGroup.com	407-581-1221
Balmoral Group			
Greg Seidel	Project Drainage Engineer	gseidel@balmoralgroup.us	407-629-2185
Jennifer Nunn	Asst. Project Drainage Engineer	JNunn@Balmoralgroup.us	407-629-2185
Lori Stanfill	Asst. Project Drainage Engineer	LStanfill@balmoralgroup.us	407-629-2185
ATM			
Janet Hearn	Senior Engineer	JHearn@AppliedTM.com	386-256-1018

Purpose: The purpose of the meeting is for the FDOT to present the results of draft Pond Siting Report and continue discussion. Below are highlights of the meeting -

1. Greg Seidel began the meeting with introduction of the lead contacts for each agency and a brief description of the roles.
2. Brent Setchell reiterated from the previous meeting the FDOT's interest in providing as much nutrient loading reduction as possible based on the FDOT budget for "typical postage stamp ponds" on a project. He added that the FDOT is very interested in partnering in regional treatment. Rick Renna affirmed the FDOT position.
3. Mr. Setchell summarized the current SR 710 status - the pond costs for the project are estimated at [REDACTED]. The FDOT has not completed its review and this number is subject to change. The SR 710 project has ROW funding beginning in FY 2016 (July 2015). The goal for completing a partnering agreement for regional treatment would be April 2015 prior to finalizing our ROW maps. The project is not currently funded for construction, but the earliest construction could be funded would be FY 2019 (July 2018). Mr. Seidel provided a brief review of the SR 710 project utilizing the meeting exhibits (See

Attachments) and google maps. The project will be a four-lane curb and gutter typical section. The roadway begins at US 441 at the Airport Ditch and runs east along a new alignment across Taylor Creek then turns south tying into the existing SR 710 before crossing the L-63N Canal and ending at Mosquito Creek. The project length is approximately 3.85 miles.

4. Mr. Seidel gave a review of the Taylor Creek and L-63N Canal Bridge Hydraulics Reports (BHR) at SR 710 noting that the reports were completed in NAVD datum. The Taylor Creek BHR indicated that the Lower Taylor Creek basin is comprised of a 3.26 square mile Airport Ditch Basin and a 2.20 square mile Lower Taylor Creek Basin for a total drainage basin of 5.46 square miles. From the BHR for the L-63N Canal, the drainage basin upstream of the SR 710 crossing is 111.89 square miles.
5. Mr. Seidel provided the control elevations within Taylor Creek as 12.83 NAVD and within the L-63 as 17.83 NAVD.
6. Mr. Seidel gave a review of the pond siting report for the project and focused on the different elements reviewed such as drainage patterns, wetlands, cultural resources, utilities, geotechnical data and contamination screenings and estimated costs. For each of the areas, Mr. Seidel highlighted the evaluations for Pond Site 2C which would be within the location of the regional facility. He noted the study area did not include the entire regional pond area shown in the first meeting.
7. Mr. Renna made a comment that the 2C site would likely contain wetlands which could be used for wetland enhancement and nutrient uptake.
8. Mr. Seidel commented that the regional pond would reduce pollutants at a much higher concentration than the smaller SR 710 ponds. Specifically, the PSR estimated a reduction of 12 kg/yr for the post stamp ponds vs an estimated 2-3 MT/yr for a regional facility depending on the size.
9. Mr. Seidel went over the preliminary stormwater management concept for SR 710 utilizing the regional pond. This concept includes 3 drainage basins: the first basin will discharge to the regional pond; the second basin will discharge for pre-treatment to an existing (SR 70) pond without meeting pre/post requirements prior to discharging to L-63N Canal; and the third basin will discharge directly to the L-63N Canal. Mr. Renna commented that the existing permitting rules allow for compensatory treatment, and that approval of discharge

into the L-63N Canal would not be difficult. There was no objection from either SFWMD or FDEP participants.

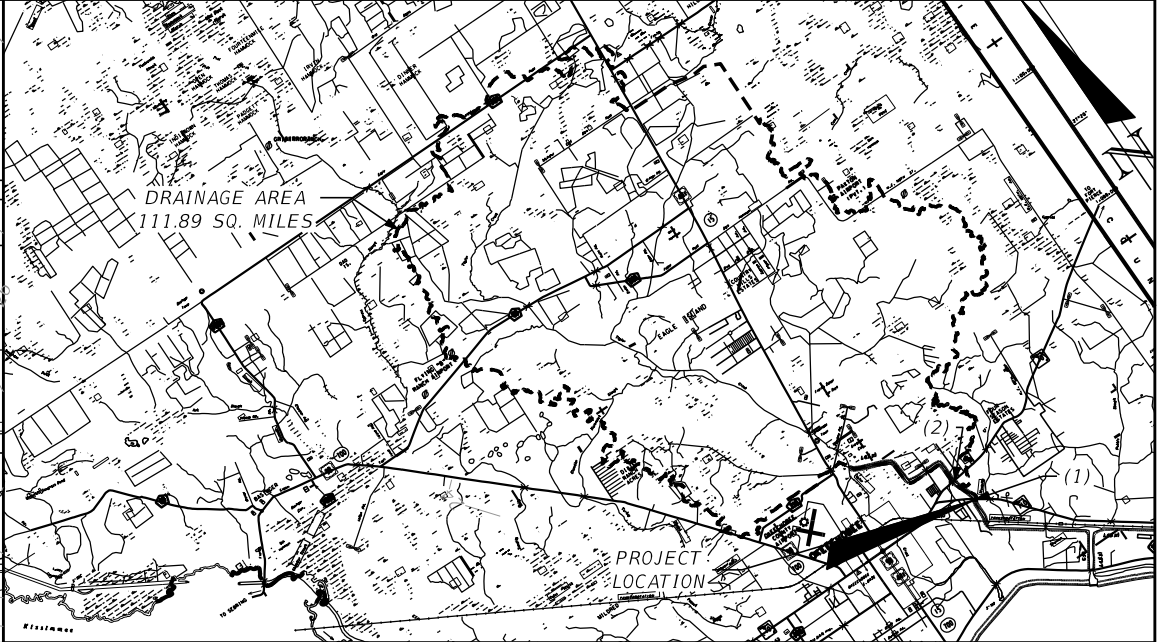
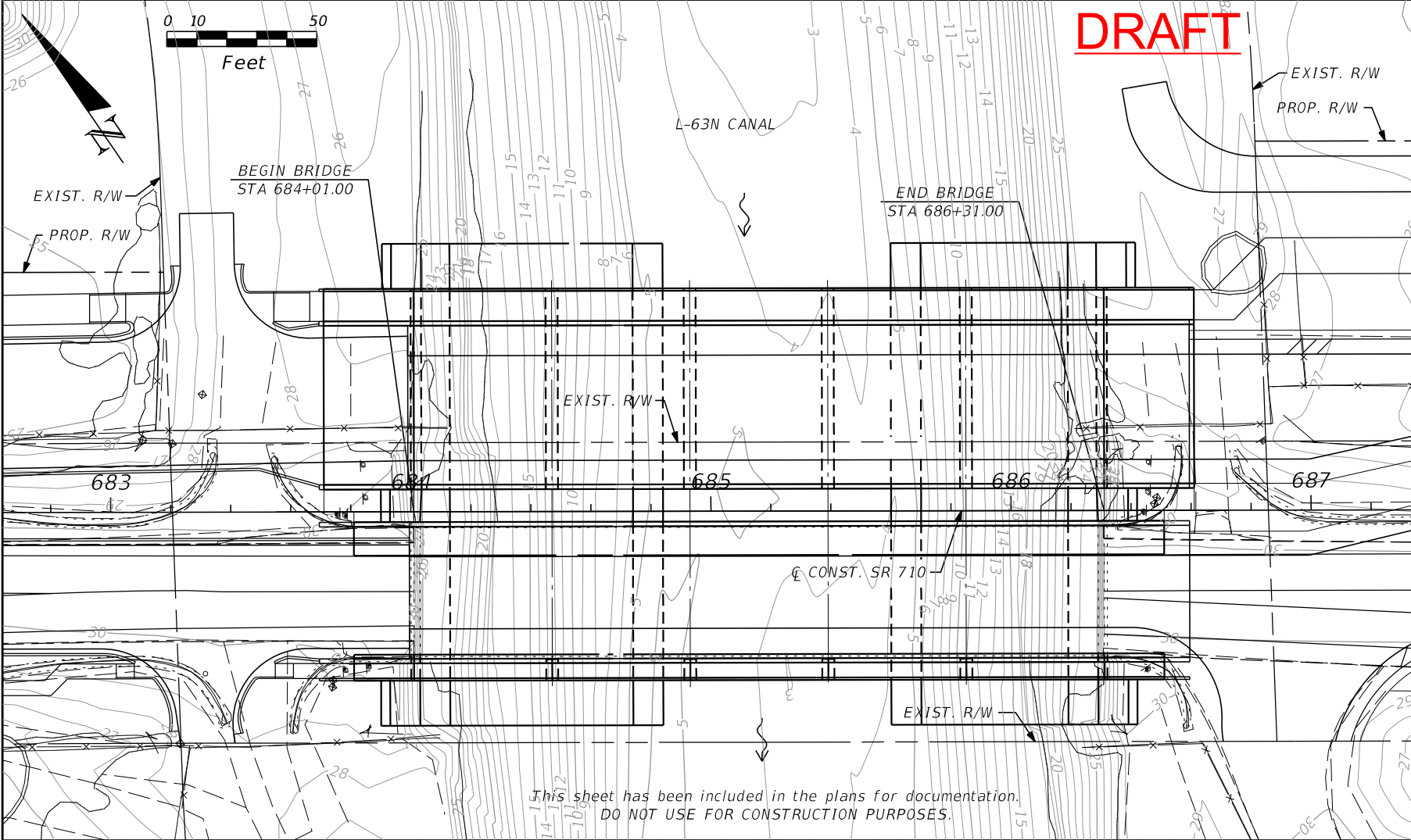
10. Several local projects were noted including the Nubbin Slough STA, the Upper Taylor Creek STA, Treasure Island and Oak Park.
11. Gary Ritter commented that there is water demand from the L-63N Canal. If S-192 is utilized, project needs to be cognizant of water supply needs.
12. Concerns were expressed with the proximity of the Okeechobee airport to the proposed regional treatment facility and need to be at least 10,000 feet away to reduce the risk of bird strikes.
13. Mr. Renna indicated that he was meeting with Tom Frick from FDEP on Thursday to discuss this project among others.
14. Trina Veilhauer indicated the FDEP is quite interested and asked how we best move forward from this point. Brent Setchell offered that FDOT could fund The Balmoral Group through their District 1 Districtwide Drainage contract to perform a feasibility study for the regional treatment. It was agreed that the feasibility study would analyze two options – a project option funded and constructed entirely by the FDOT to meet permit requirements and a Stormwater Treatment Area (STA) option that investigated partnering and a much larger facility. Mr. Seidel indicated that a scope of services would be prepared to investigate the two options, which would include meetings and coordination with stakeholders. A draft report will be submitted to FDOT, SFWMD and FDEP for review prior to finalizing the report.
15. Brent Setchell noted that FDOT staff is not “experts” in the design of STAs and would look for either SFWMD or FDEP to take the lead in the design and construction of a larger STA.
16. Brent Setchell noted that FDOT would like to utilize suitable excavated material from the regional pond for use as fill on its SR 710 project.
17. It was noted that the project is not within the Central Florida Water Initiative (CFWI) boundaries.

Action Items

1. FDOT shall negotiate a Task Work Order with the Balmoral Group to prepare the feasibility study for the regional treatment options. The draft report is expected to be sent to FDEP & SFWMD for review by August 15, 2014.
2. FDEP and SFWMD to explore funding participation options and be prepared to make a funding commitment no later December 31, 2014 so that we may move forward with preparing an agreement.

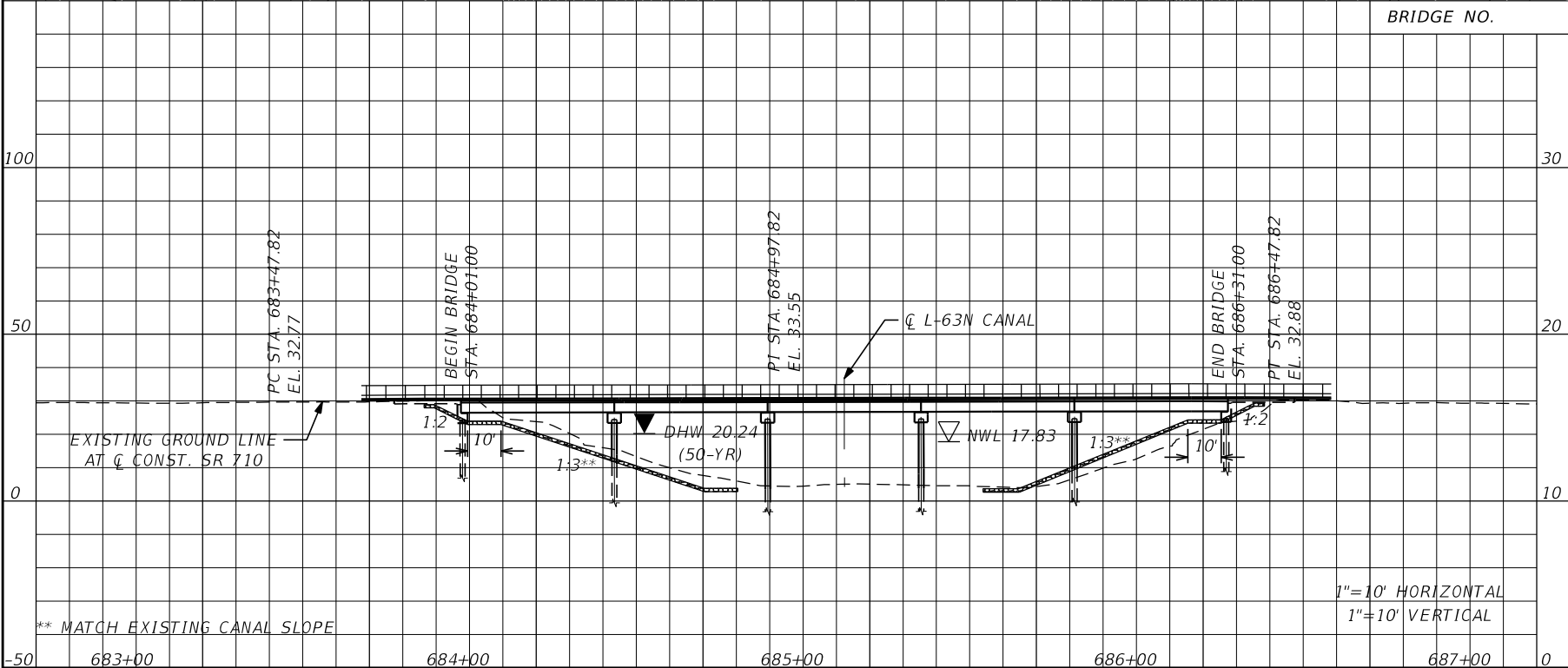
c. Attendees (Via Email)

Attachment – Agenda Exhibits



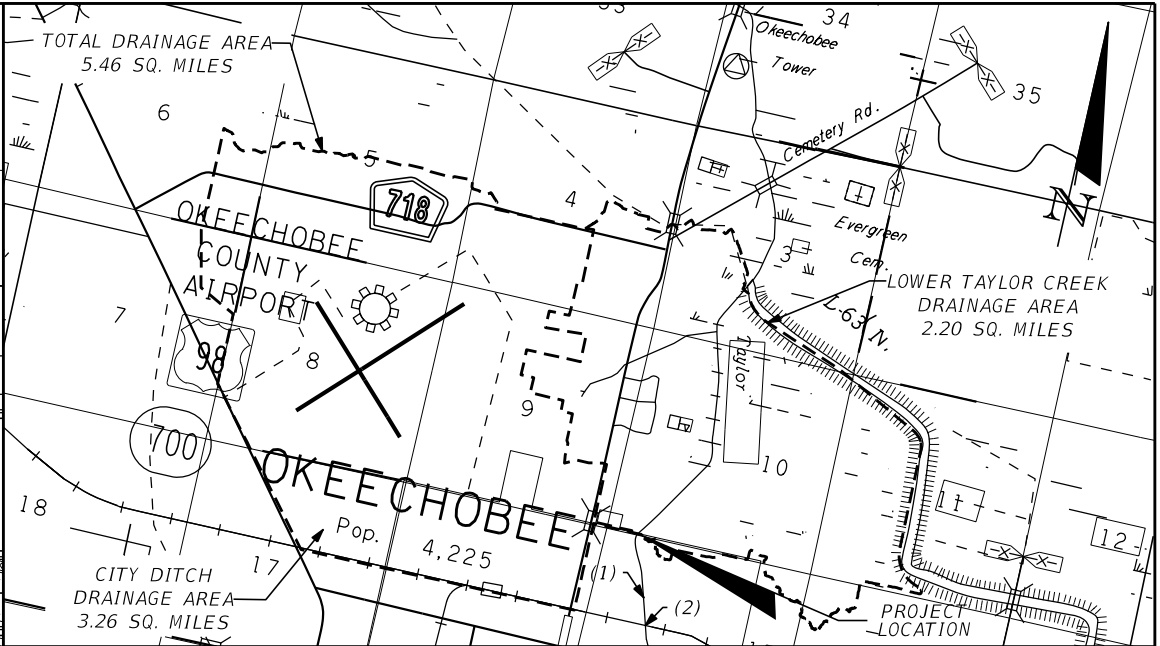
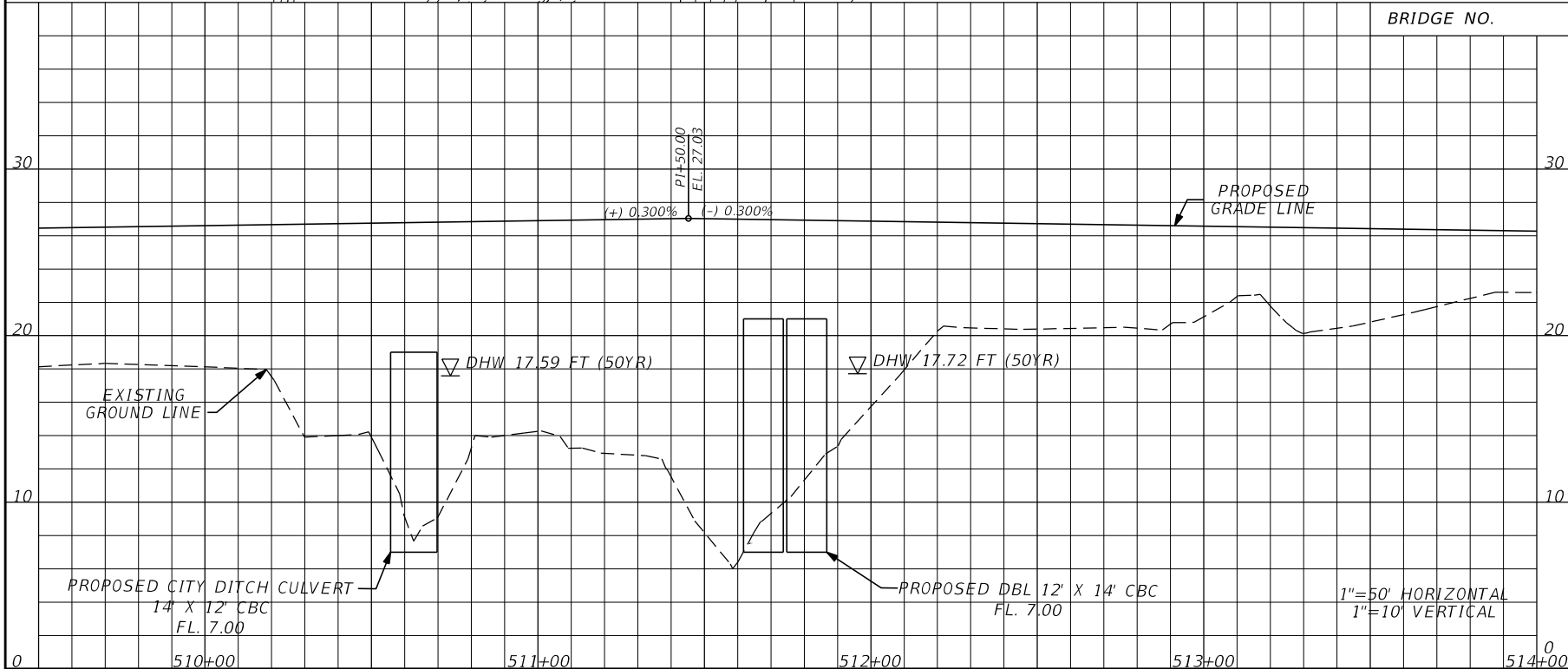
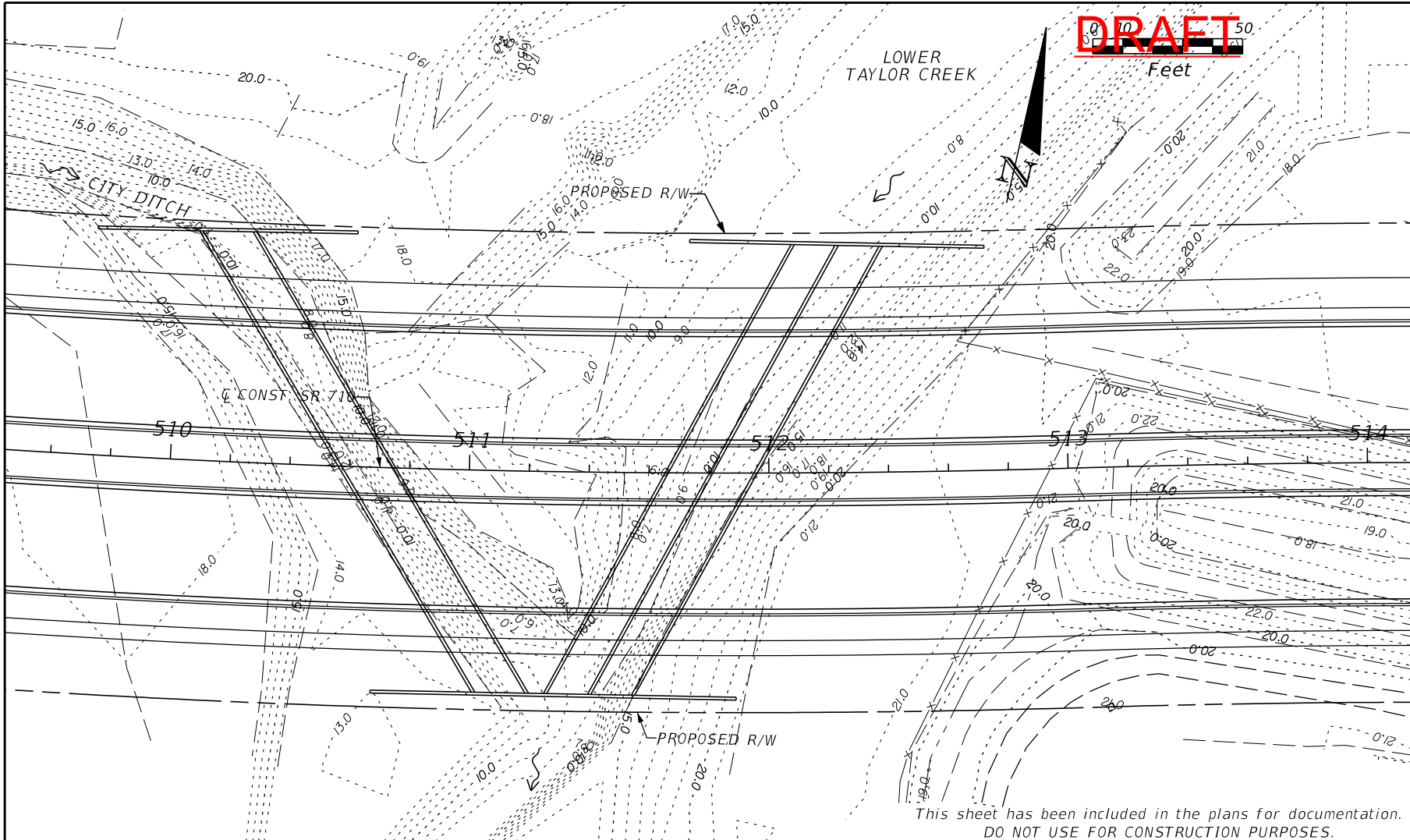
(REFERENCE)	EXISTING STRUCTURES				PROPOSED STRUCTURE
	(1)	(2)	(3)	(4)	
FOUNDATION	CONCRETE PILES	24" SO. CONCRETE PILES			CONCRETE PILES
OVERALL LENGTH	230'	231'			230'
SPAN LENGTH	5 @ 46'	3 @ 77.0'			5 @ 46'
TYPE CONSTRUCTION	CONCRETE	CONCRETE COMPOSITE			CONCRETE
AREA OF OPENING @ D.F.		3120 SF			
BRIDGE WIDTH	46.25'	44.292' & 56.292'			130.6'
ELEV. LOW MEMBER	26.33 FT NAVD	27.62 FT NAVD			26.33 FT NAVD

HYDRAULIC DESIGN DATA				
NOTE: The hydraulic data is shown for informational purposes only to indicate the flood discharges and water surface elevations which may be anticipated in any given year. This data was generated using highly variable factors determined by a study of the watershed. Many judgements and assumptions are required to establish these factors. The resultant hydraulic data is sensitive to changes, particularly antecedent conditions, urbanization, channelization, and land use. Users of this data are cautioned against the assumption of precision which cannot be obtained.				
TERMS: Design Flood: Utilized to assure a desired level of hydraulic performance. Base Flood: Has a 1% chance of being exceeded in any given year (100 year frequency) Overtopping Flood: Causes flow over the highway, over a watershed divide, or thru emergency relief structures. Greatest Flood: The most severe that can be predicted where overtopping is not practicable.				
WATER SURFACE ELEVATIONS: N.H.W. (Non-Tidal) 17.83 FT NAVD M.H.W. (Tidal) _____ CONTROL (Non-Tidal) 17.83 FT NAVD M.L.W. (Tidal) _____				
FLOOD DATA: MAX. EVENT OF RECORD DESIGN FLOOD BASE FLOOD STAGE ELEV. NAVD (ft) 20.24 21.04 23.26 DISCHARGE (cfs) 6797 8202 12063 AVERAGE VELOCITY (f/s) 2.94 3.34 4.18 EXCEEDANCE PROB. (%) 2 1 0.2 FREQUENCY (yr.) 50 100 500				
SCOUR PREDICTIONS FOR PROPOSED STRUCTURE DESCRIBED ABOVE: TOTAL SCOUR ELEVATION _____ PIER INFORMATION: LONG TERM SCOUR ELEV. PROPOSED WORST CASE < 100 yr. FREQ. (yr.) 5.01 WORST CASE < 500 yr. FREQ. (yr.) 5.54				
NUMBERS SIZE AND TYPE				



HYDRAULIC RECOMMENDATIONS											
1. BEGIN BRIDGE STATION		684+01.00		END BRIDGE STATION		686+31.00		SKEW ANGLE		0	
2. CLEARANCE PROVIDED:		NAV: HORIZ. <u>N/A</u>		VERT. <u>N/A</u>		ABOVE EL. <u>N/A</u>		DRIFT: HORIZ. <u>43</u>		VERT. <u>8.5</u> ABOVE EL. <u>17.83 (NHW)</u>	
3. MINIMUM CLEARANCE:		NAV: HORIZ. <u>N/A</u>		VERT. <u>N/A</u>		ABOVE EL. <u>N/A</u>		DRIFT: HORIZ. <u>43</u>		VERT. <u>6.09</u> ABOVE EL. <u>20.24 (DHW)</u>	
4. ABUTMENTS:											
BEGIN BRIDGE						END BRIDGE					
RUBBLE GRADE: STANDARD RUBBLE						STANDARD RUBBLE					
SLOPE: 3:1						SLOPE: 3:1					
BURIED OR NON-BURIED HORIZ. TOE: BURIED						BURIED					
TOE HORIZ. DISTANCE: 10.00' TO EL. 4.00						10.00' TO EL. 4.00					
LIMIT OF PROTECTION: R/W TO R/W						R/W TO R/W					
5. DECK DRAINAGE:											

REMARKS: PRELIMINARY DESIGN ONLY - FURTHER ANALYSIS REQUIRED



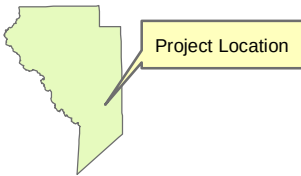
(REFERENCE)	EXISTING STRUCTURES				PROPOSED STRUCTURE
	(1)	(2)	(3)	(4)	
FOUNDATION	CONCRETE PILES	CONCRETE PILES			N/A
OVERALL LENGTH	150'	180'			DBL 12'W X 14'H CBC
SPAN LENGTH	5 @ 30'	18 @ 10'			N/A
TYPE CONSTRUCTION					CONCRETE
AREA OF OPENING @ D.F.					N/A
BRIDGE WIDTH	40'	60'			N/A
ELEV. LOW MEMBER	18.83 FT NAVD	23.00 FT NAVD			N/A

HYDRAULIC DESIGN DATA				
NOTE: The hydraulic data is shown for informational purposes only to indicate the flood discharges and water surface elevations which may be anticipated in any given year. This data was generated using highly variable factors determined by a study of the watershed. Many judgements and assumptions are required to establish these factors. The resultant hydraulic data is sensitive to changes, particularly antecedent conditions, urbanization, channelization and land use. Users of this data are cautioned against the assumption of precision which cannot be obtained.				
TERMS: Design Flood: Utilized to assure a desired level of hydraulic performance. Base Flood: Has a 1% chance of being exceeded in any given year (100 year frequency) Overtopping Flood: Causes flow over the highway, over a watershed divide, or thru emergency relief structures. Greatest Flood: The most severe that can be predicted where overtopping is not practicable.				
WATER SURFACE ELEVATIONS: N.H.W. (Non-Tidal) 12.83 FT NAVD M.H.W. (Tidal) _____ CONTROL (Non-Tidal) 12.83 FT NAVD M.L.W. (Tidal) _____				
FLOOD DATA: MAX. EVENT OF RECORD DESIGN FLOOD BASE FLOOD				
STAGE ELEV. NAVD (ft) 17.72 18.22				
DISCHARGE (cfs) 346 417				
AVERAGE VELOCITY (f/s) 0.32 0.35				
EXCEEDANCE PROB. (%) 2 1				
FREQUENCY (yr.) 50 100				
SCOUR PREDICTIONS FOR PROPOSED STRUCTURE DESCRIBED ABOVE:				
TOTAL SCOUR ELEVATION _____				
PIER INFORMATION LONG TERM WORST CASE < 100 yr. WORST CASE < 500 yr.				
NUMBERS SIZE AND TYPE SCOUR ELEV. FREQ. (yr.) FREQ. (yr.)				

HYDRAULIC RECOMMENDATIONS				
1. BEGIN BRIDGE STATION _____		END BRIDGE STATION _____		SKEW ANGLE _____
2. CLEARANCE PROVIDED: NAV: HORIZ. _____ VERT. _____ ABOVE EL. _____		DRIFT: HORIZ. _____ VERT. _____ ABOVE EL. _____		
3. MINIMUM CLEARANCE: NAV: HORIZ. _____ VERT. _____ ABOVE EL. _____		DRIFT: HORIZ. _____ VERT. _____ ABOVE EL. _____		
4. ABUTMENTS:		BEGIN BRIDGE		END BRIDGE
RUBBLE GRADE: _____		_____		_____
SLOPE: _____		_____		_____
BURIED OR NON-BURIED HORIZ. TOE: _____		_____		_____
TOE HORIZ. DISTANCE: _____		_____		_____
LIMIT OF PROTECTION: _____		_____		_____
5. DECK DRAINAGE: _____				

REMARKS: CITY DITCH CULVERT INFORMATION IS SHOWN FOR REFERENCE ONLY.

DRAFT

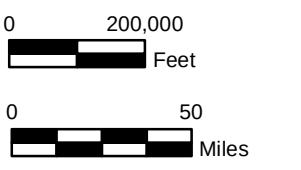


Legend

- Proposed Roadway
- Proposed Ponds
- Parcels
- Proposed ROW

Notes:

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- The existing contour information has been compiled from multiple sources including the National Elevation Dataset, Okeechobee County contours, LIDAR from Herbert Hooper Dike Area, existing permits, and recent survey files.



Location Map
Figure 1

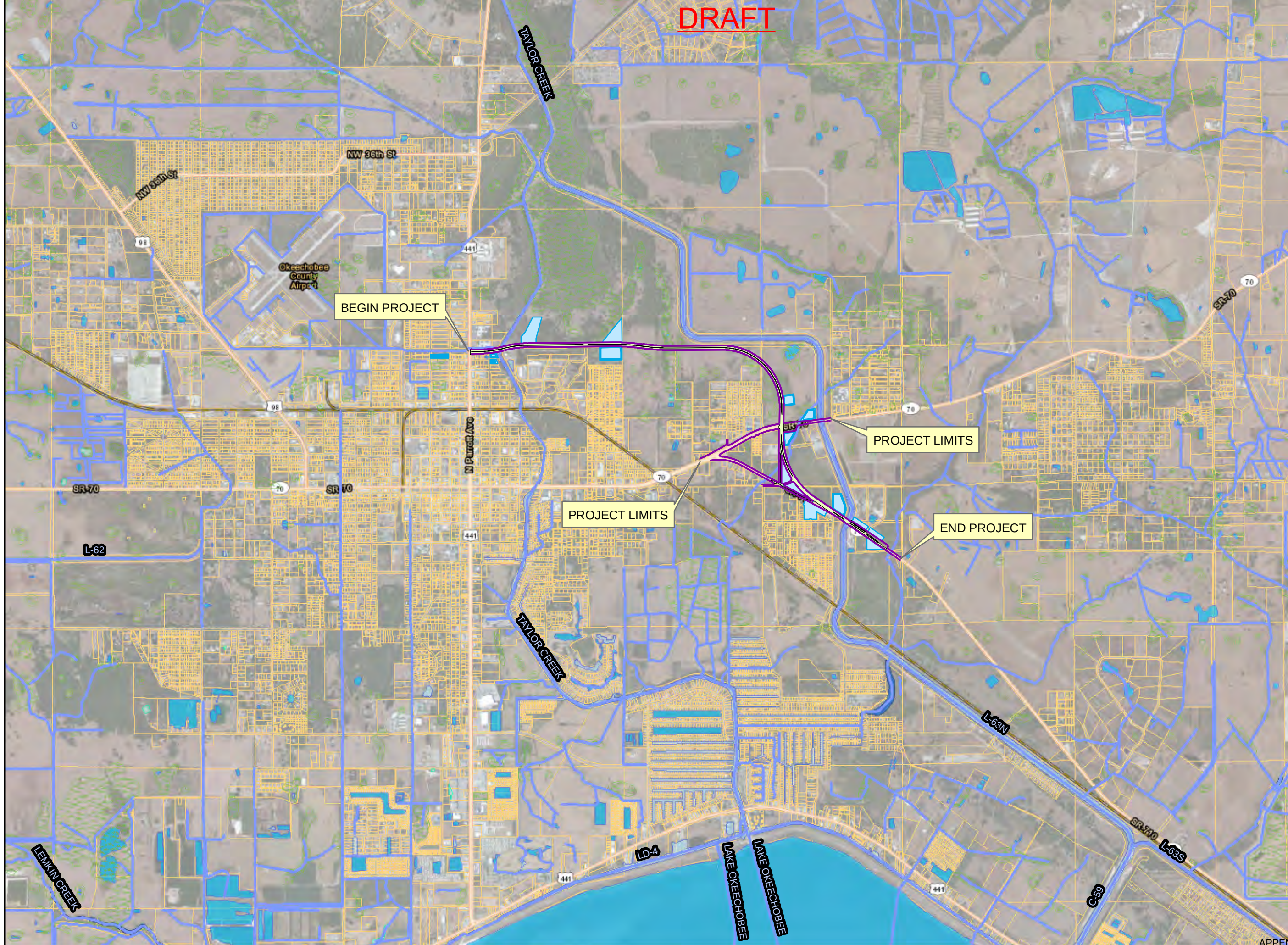
The Balmoral Group
165 Lincoln Avenue
Winter Park, FL 32789
Phone: (407) 629-2185
www.balmoralgroup.us
Certificate of Authorization No. 26123

TBG Proj. No.: 00809.00
FPID No.: 419344-3-32-01

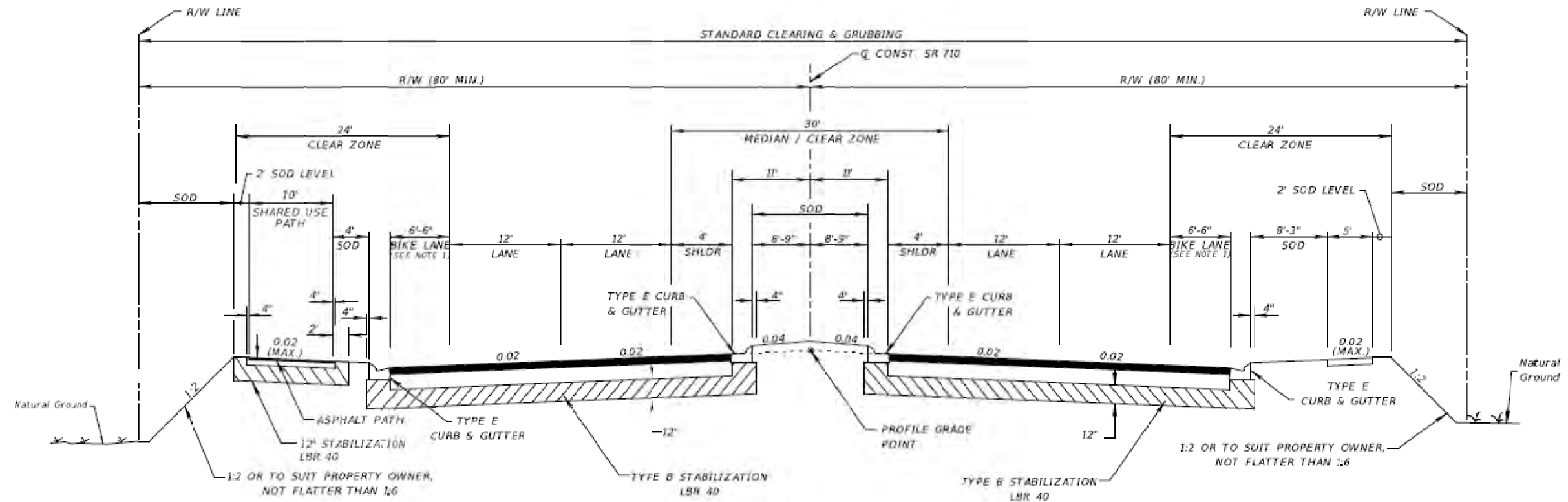
SR 710 from US 441 to
the L-63N Canal

Okeechobee County, Florida

Filename: FIG1_Location_SR710.mxd	Map Date: October, 2013	Map Prepared By: The Balmoral Group
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DRAFT



TYPICAL SECTION NO. 1
SR 710
STA. 500+00.00 TO STA. 703+50.00

TYPICAL SECTION NOTES:
1. PROVIDES FOR 8' USABLE SHOULDER.

NEW CONSTRUCTION

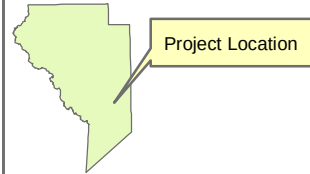
OPTIONAL BASE GROUP 11 WITH
TYPE SP STRUCTURAL COURSE (TRAFFIC C) (4")
AND FRICTION COURSE FC-5 (3/4") (RUBBER)

PATH

OPTIONAL BASE GROUP 1 WITH
TYPE SP STRUCTURAL COURSE (TRAFFIC A) (1")

TRAFFIC DATA

CURRENT YEAR = 2013 AADT = 7,100
ESTIMATED OPENING YEAR = 2015 AADT = 11,400
ESTIMATED DESIGN YEAR = 2035 AADT = 14,190
K = 9.0% D = 56.2% T = 20.9% (24 HOUR)
DESIGN HOUR T = 10.5%
DESIGN SPEED = 50 MPH



Typical Section
Figure 2

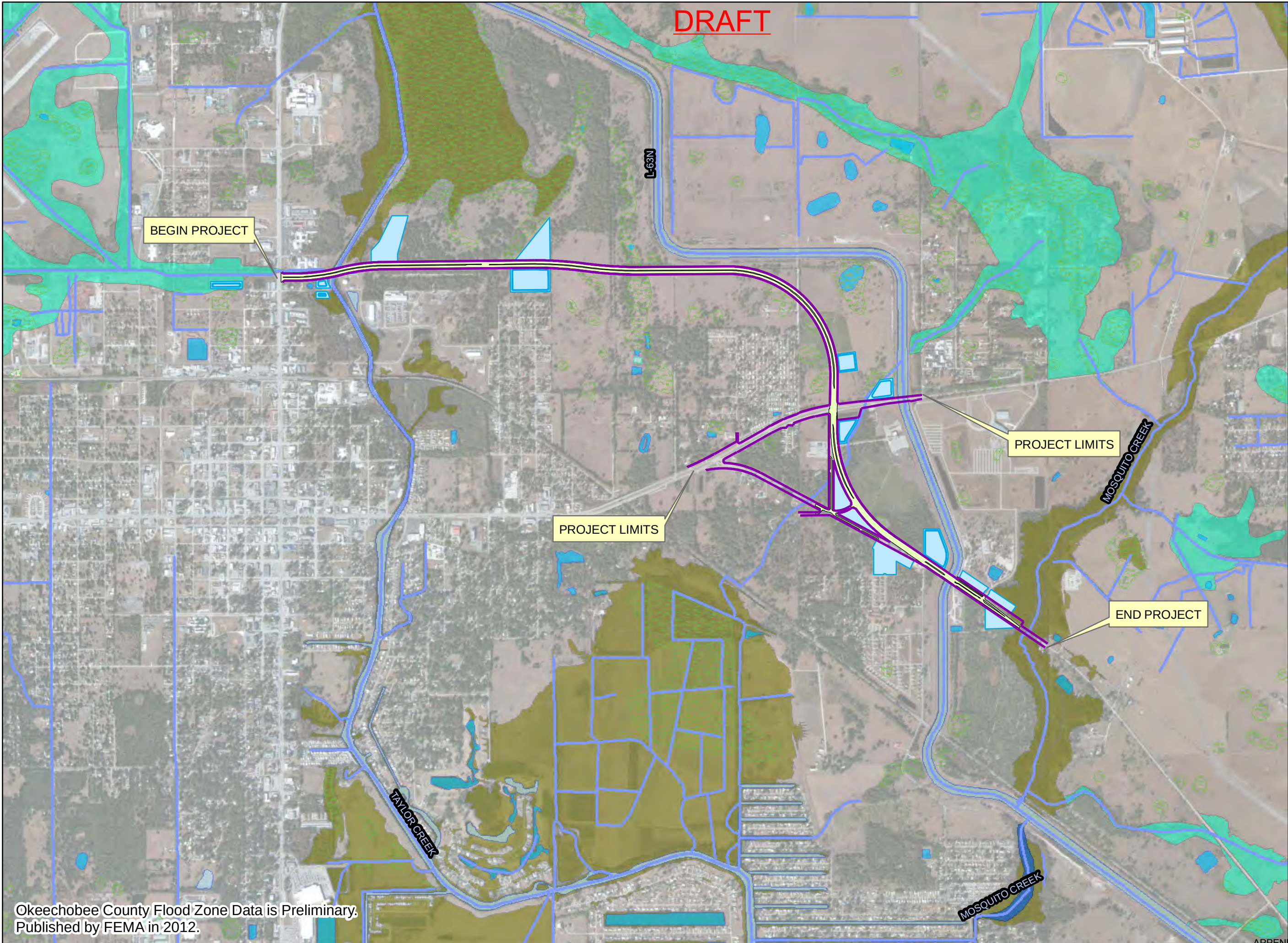
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TBG Proj. No.: 00809.00
FPID No.: 419344-3-32-01

SR 710 from US 441 to
the L-63N Canal

Okeechobee County, Florida

Filename: F002_TypicalSection_SR710.mxd
Map Date: October, 2013
Map Prepared By: The Balmoral Group



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BEGIN PROJECT

PROJECT LIMITS

PROJECT LIMITS

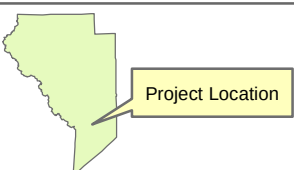
END PROJECT

TAYLOR CREEK

MOSQUITO CREEK

MOSQUITO CREEK

L-63N



Legend

- Proposed Roadway
- Proposed Ponds
- Proposed ROW

Flood Zones

- A
- AE

Notes:

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0 1,000 2,000 Feet

0 0.25 Miles

FEMA FIRM Map
Figure 5

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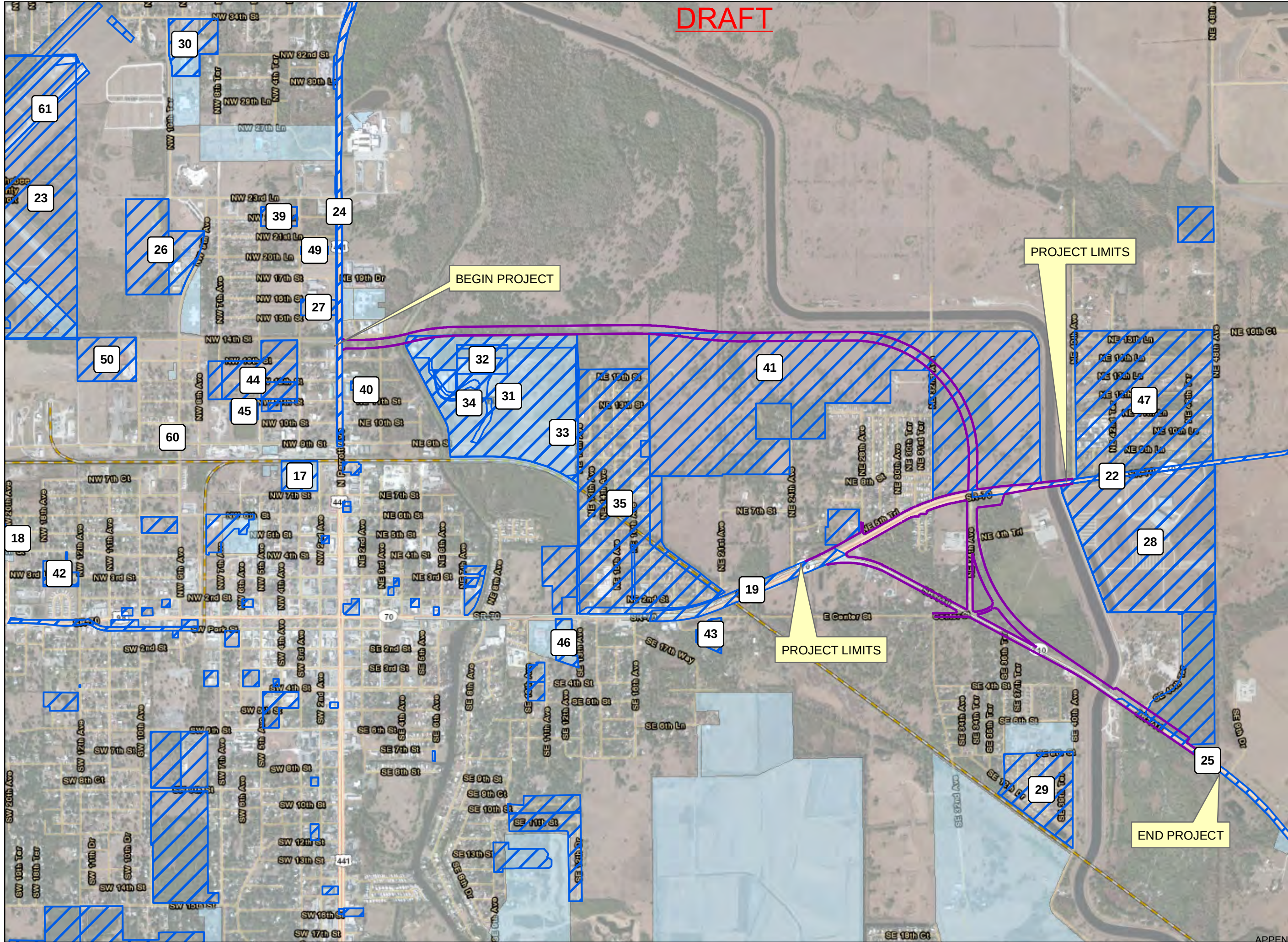
TBG Proj. No.: 00809.00
FPID No.: 419344-3-32-01

SR 710 from US 441 to
the L-63N Canal

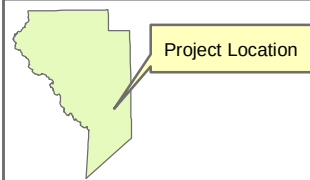
Okeechobee County, Florida

Filename: FIS_FIRMMap_SR710.mxd	Map Date: October, 2013	Map Prepared By: The Balmoral Group
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Okeechobee County Flood Zone Data is Preliminary.
Published by FEMA in 2012.



DRAFT



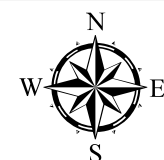
Legend

Existing Permits

-  ERP
-  SWIM
-  Proposed ROW

Notes:

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0 200,000
Feet

0 50
Miles

Existing SFWMD Permits Map
Figure 8A

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Certificate of Authorization No. 26123

TBG Proj. No.: 00809.00
FPID No.: 419344-3-32-01

SR 710 from US 441 to
the L-63N Canal

Okeechobee County, Florida

Filename: H200_ExistingPermits_SR710.mxd	Map Date: October, 2013	Map Prepared By: The Balmoral Group
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DRAFT

 Pond 2C Option 1

 Pond 2C Option 2

POND 2C1

POND 2C2

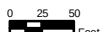


Legend

 Proposed ROW

 Parcels





Notes:

1. The information on this sheet is for information purposes only and is not to be used for construction. The sheet is to be used for documentation and to assist agencies and construction personnel with drainage concerns.

2. The aerial source is LF. Rooks and Associates, March, 2013.

Pond 2C Aerial
Figure 12F

The Balmoral Group
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Winter Park, FL 32789
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Certificate of Authorization No. 26123

TBG Proj. No.: 00809.00
FPID No.: 419344-3-32-01

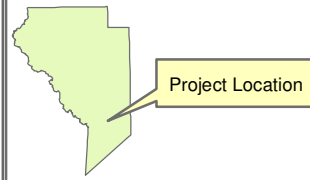
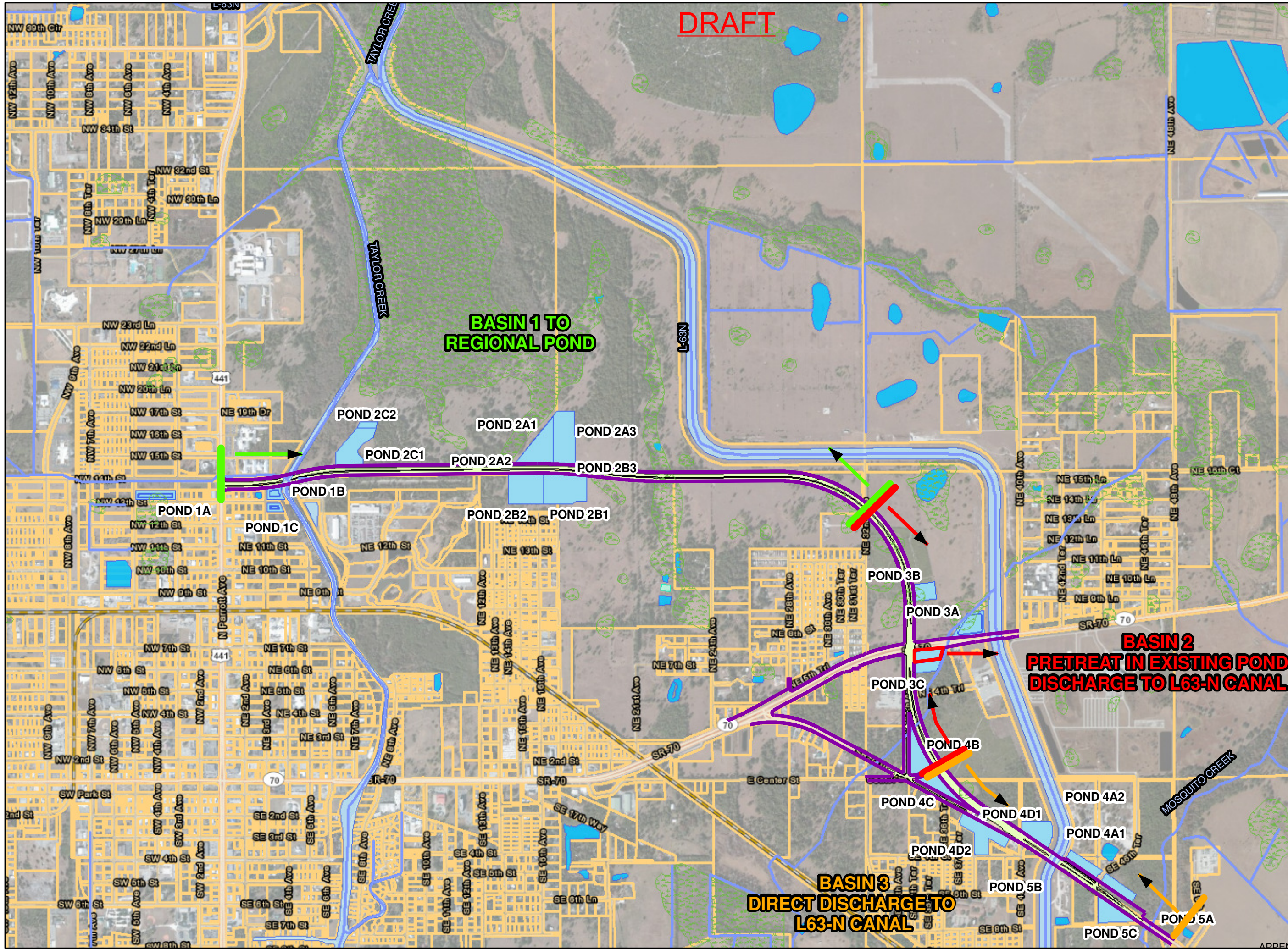
SR 710 from US 441 to
SR 638 Camp

APPENDIX E Page 29 of 55

Okeechobee County, Florida

Revised:
February 2013

Map Preparer:
Balmoral Group

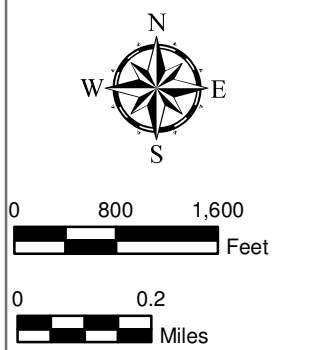


- Legend**
- Proposed Roadway
 - Proposed Ponds
 - Parcels
 - Proposed ROW

Notes:

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2. The existing contour information has been compiled from multiple sources including the National Elevation Dataset, Okeechobee County contours, LIDAR from Herbert Hooper Dike Area, existing permits, and recent survey files.



Regional Pond Post Basin Map

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www.balmoralgroup.us
Certificate of Authorization No. 26123

TBG Proj. No.: 00809.00
FPID No.: 419344-3-32-01

SR 710 from US 441 to the L-63N Canal

Okeechobee County, Florida

Filename:	Map Date:	Map Prepared By:
SR710_Regional_Pond_Post_Basin_Map.dwg	October, 2013	The Balmoral Group

**SR 710 Stormwater Treatment Area/Regional Pond Feasibility Study
Initial Meeting with Hamrick Property Owner
Meeting Minutes
FPID No. 432644-1-32-01 - D1 DW Drainage**

Location: District One, Bartow
Date: July 11, 2014
Time 11:00 am

The purpose of the meeting is to introduce the SR 710 Stormwater Treatment Area/Regional Pond Feasibility Study as an investigation being undertaken by the FDOT District One as a part of the SR 710 new alignment project in Okeechobee.

Attendees: See attached Sign-In Sheet

1. Mr. Brent Setchell gave an introduction and project background on the SR 710 Feasibility Study to the property owners, Mr. Michael and Ms. Maryann Hamrick and their consultant, Morris Crady.
2. Mr. Greg Seidel introduced the regional pond alternative that is to be constructed by the FDOT for the SR 710. This option would incorporate offsite areas associated with Lower Taylor Creek.

Ms. Janet Hearn introduced the Stormwater Treatment Area (STA) alternative which would require interagency cooperation and be hydraulically connected to the L63-N canal and Upper Taylor Creek. Ms. Hearn said that the amount of nutrient reduction achieved by the STA would depend in part on the area of the STA but that a minimum size of 100 acres is desirable. This is comparable to the Taylor Creek STA which has a treatment area of 118 acres.

3. Ms. Amy Setchell gave a brief update on the SR 710 new alignment project from L-63N to US-41.
4. Mr. Hamrick reiterated that maintaining the integrity of the property is important to them.
5. As part of the study, a portion of the property will be surveyed to verify design assumptions. Access to the site will be coordinated with the ranch manager. Contact information to be provided by The Wantman Group. Survey will need to get started as soon as possible.
6. The next step is to set-up a Stakeholder Meeting in Okeechobee. This will be scheduled in the next two weeks. The Balmoral Group will be contacting the Hamricks regarding availability.

End of Minutes

SIGN IN SHEET

SR 710 Stormwater Treatment Area/Regional Pond Feasibility Study Initial Meeting with Hamrick Property Owner Meeting Agenda FPID No. 432644-1-32-01 - D1 DW Drainage

Location: District One, Bartow
Date: July 11, 2014
Time: 11:00 am

NAME	FIRM/AGENCY	OFFICE / RESPONSIBILITY	EMAIL ADDRESS	Initials
Carlton Spirio	FDOT	Drainage	Carlton.Spirio@dot.state.fl.us	
Brent Setchell	FDOT	Drainage	Brent.Setchell@dot.state.fl.us	BS
Amy Setchell	FDOT	PM	Amy.Setchell@dot.state.fl.us	AES
Michael Hamrick	Property Owner		MHamrick@manateelegal.com	mh
Morris Crady				Mac
Gregory Seidel	The Balmoral Group	Consultant	gseidel@balmoralgroup.us	MS
Jennifer Nunn	The Balmoral Group	Consultant	jnunn@balmoralgroup.us	JN
Janet Hearn	ATM	Consultant	jhearn@appliedtm.com	JH
Henri Belrose	Wantman Group	Consultant	Henri.belrose@wantmangroup.com	HB
Alfredo Rodriguez	Wantman Group	Consultant	Alfredo.rodriguez@wantmangroup.com	AR
Gregory Bowne	FDOT	Right-of-way	Gregory.Bowne@dot.state.fl.us	Greg
Jennie Richard	FDOT	Right-of-way	Jennie.Richard@dot.state.fl.us	JR
Morris Crady Lucido & Assoc. Hamrick & Sons			mcrady@lucidodesign.com	MC
MARYANN HAMRICK HAMRICK & SONS			ANNIE40F@AOL.COM	MAH
Nicole Monies	FDOT	Permits	nicole.monies@dot.state.fl.us	NM

**SR 710 Stormwater Treatment Area/Regional Pond Feasibility Study
Stakeholder Meeting Minutes
FPID No. 432644-1-32-01 - D1 DW Drainage**

Location: SFWMD Okeechobee Service Center, Okeechobee
Date: July 31, 2014
Time 10:30 am

The purpose of the meeting is to introduce the SR 710 Stormwater Treatment Area/Regional Pond Feasibility Study as an investigation being undertaken by the FDOT District One as a part of the SR 710 new alignment project in Okeechobee.

Attendees: See attached Sign-In Sheet

1. Mr. Brent Setchell gave an introduction on the SR 710 Feasibility Study.
2. Mr. Greg Seidel gave a brief project history explaining how the SR 710 Feasibility Study has progressed to this point.
3. Mr. Greg Seidel introduced the regional pond alternative that is to be constructed by the FDOT for the SR 710. This option would incorporate offsite areas associated with Lower Taylor Creek.
 - a. Representatives from Okeechobee County confirmed the airport ditch is owned by the County from Taylor Creek up to airport property.
 - b. Mr. Setchell voiced his concern about conveying water from the airport ditch to the regional pond. He mentioned the preferred option on behalf of the FDOT would be to provide the required 1-inch of treatment for the SR 710 roadway and demonstrate that the nutrient removal shows a net benefit to the community.
 - c. Mr. Seidel mentioned that a lower treatment depth could be provided. He also indicated that a control structure could be located at Taylor Creek and securing flood rights from the property owners could be an option.
 - d. Mr. Setchell explained the SR 710 Regional Pond approach in that Basins 1 and 2 would be treated by the Regional Pond, Basin 3 and a portion of Basin 4 would pre-treat via the existing pond and that the remaining runoff would discharge directly to the L-63N Canal.
4. Ms. Janet Hearn introduced the Stormwater Treatment Area (STA) alternatives which would require interagency cooperation and be hydraulically connected to the L63-N canal and Upper Taylor Creek.
 - a. Ms. Hearn said that for planning purposes a 100-acre STA is being evaluated. This is comparable to the Taylor Creek STA which has a treatment area of 118 acres. A 100 acre STA could remove about 1,500 to 1,600 kg of TP per year. An overview of three potential locations for a 100 acre STA within the Hamrick property was presented. These three sites were selected to avoid wetlands.

- b. The Lake Okeechobee TMDL requires an in-lake concentration of 40 parts per billion (ppb) TP.
 - c. FDEP added that the existing Taylor Creek STA provides approximately 1520 kg of removal.
 - d. The STA 2 option would require some rehabilitation of the existing wetland in order to retain runoff from the surrounding property. This would provide additional storage and remove approximately 180 kg TP per year without additional flow from the L-63N Canal or Upper Taylor Creek.
 - e. The STA 2 option could provide up to 1000 kg of removal if inflow was augmented with flow from L-63N Canal.
 - f. Mr. Morris Crady asked if a combination of STA 1 and STA 2 would be possible in order to still use the property (i.e. for walking trails) in the winter. Mr. Seidel responded by saying the final STA choice is not part of the feasibility study and would be coordinated under final design.
 - g. Mr. Setchell liked the fact that the STA 2 option would provide some treatment and attenuation. However, he expressed some concern for the STA 2 option since the restored wetlands would be limited on the treatment volume depth (storage) provided. Would this option still require a control structure and how would the western bank of Lower Taylor Creek be affected?
 - h. If an STA option is chosen, FDOT would still need to obtain fill for the SR 710 project and this could be coordinated through agreements.
 - i. Mr. Hamrick asked if an STA option would impact ranch operations. Ms. Bonnie Wolff Pelaez confirmed that the BMAP manual does not restrict cattle from the wetlands.
 - j. Mr. Hamrick mentioned that the wetland portion of his property is the emotional piece, and the upland portion of his property is the economic piece.
5. Mr. Seidel mentioned that if an STA option was selected, FDOT would not be taking the lead on this design and this would most likely fall to the FDEP or SFWMD.
6. Mr. Jim Threewits reiterated his concerns with ponds adjacent to the right-of-way. The County has requested from FDOT that the new SR 710 alignment be a main corridor to attract development. The County wants this gateway to be pretty and attractive for development and does not want unattractive ponds or ponds along the roadway frontage. Mr. Threewits feels this is a chance to do something good and doesn't want to miss out and added that this is a very valuable piece of the land to the county.
- a. Mr. Setchell responded by saying that FDOT is evaluating the need for pond fencing. FDOT is open to providing drainage easements for property owners to provide pond maintenance.
 - b. Mr. Setchell stated that FDOT does not want to move ponds away from the right-of-way due to the hydraulics and increase in cost.
7. Mr. Seidel commented that the current schedule calls for a decision to be reached by the end of the year.
- a. Ms. Amy Setchell responded that the draft Feasibility report is due Sept. 22nd with the final report due Oct. 22nd.

- b. The next step is to review the information presented today individually with the stakeholders and obtain feedback as necessary.
- c. Final calculations need to be performed.

End of Minutes

- c. Attendees
Carl Spirio, P.E., FDOT Drainage
Alfredo Rodriguez, P.E., Wantman

SR 710 Stormwater Treatment Area/Regional Pond Feasibility Study
Stakeholder Meeting
Sign-In Sheet
FPID No. 432644-1-32-01 - D1 DW Drainage

Location: SFWMD Okeechobee Service Center Auditorium
 3800 NW 16th Boulevard, Suite A, Okeechobee, FL 34972
 Date: July 31, 2014
 Time: 10:30 am

NAME	FIRM/AGENCY	OFFICE / RESPONSIBILITY	EMAIL ADDRESS	Initials
Carlton Spirio	FDOT	Drainage	Carlton.Spirio@dot.state.fl.us	
Brent Setchell	FDOT	Permitting	Brent.Setchell@dot.state.fl.us	BS
Amy Setchell	FDOT	PM	Amy.Setchell@dot.state.fl.us	AS
Kevin Inlge	FDOT		Kevin.Inlge@dot.state.fl.us	KSI
Jeffrey Mednick	FDOT		Jeffrey.Mednick@dot.state.fl.us	JLM
Michael Hamrick	Property Owner	Hamrick & Sons	MHamrick@manateelegal.com	MH
Morris Crady	Lucido & Assoc.	Hamrick & Sons	mcrady@lucidodesign.com	MRC
Maryann Hamrick	Property Owner	Hamrick & Sons	Annie4UF@aol.com	mah
Regina Hamrick	Property Owner	Hamrick & Sons		
Gregory Seidel	The Balmoral Group	Project Drainage Engineer	gseidel@balmoralgroup.us	GS
Jennifer Nunn	The Balmoral Group	Project Drainage Engineer	jnunn@balmoralgroup.us	JN
Janet Hearn	ATM	STA Designer	jhearn@appliedtm.com	JH
Henri Belrose	Wantman Group	Consultant PM	Henri.belrose@wantmangroup.com	
Alfredo Rodriguez	Wantman Group	Consultant Asst. PM	Alfredo.rodriguez@wantmangroup.com	AR
Kathy Scott	Okeechobee Co.	Kathy Airport/HDC	kscott@co.okeechobee.fl.us	KS
Lee Evett	Okeechobee Co.		levett@co.okeechobee.fl.us	LE
Jim Threewits	Okeechobee Co.	Admstr	jthreewits@co.okeechobee.fl.us	JT
Kelly Baney	Okeechobee Co.		kbaney@co.okeechobee.fl.us	
Katie Hallas	FDEP	PHONE	Katie.Hallas@dep.state.fl.us	
Elizabeth Alvi	FDEP	PHONE	Elizabeth.Alvi@dep.state.fl.us	
Jim Jeffords	USACE		jim.w.jeffords@usace.army.mil	
David Allen	City of Okeechobee		dallen@cityofokeechobee.com	
Lesley Bertolotti	SFWMD		lbortolo@sfwmd.gov	
Bonnie Wolff Pelaez	FDACS		Bonnie.WolffPelaez@freshfromflorida.com	
Regina Hamrick				

Location: SFWMD Okeechobee Service Center Auditorium
3800 NW 16th Boulevard, Suite A, Okeechobee, FL 34972

Date: July 31, 2014

Time: 10:30 am

[illegible]

DRAFT

Legend

- Proposed 710 R/W
- Parcel of Interest
- Parcel Line
- Property Owned by Hamrick & Sons

S-192

**Hamrick Property
135.6Ac**

L 63-N CANAL

LOWER TAYLOR CREEK

AREA AVAILABLE
FOR POTENTIAL
REGIONAL FACILITY

**Hamrick Property
580.7Ac**

**Hamrick Property
228.8Ac**

Proposed SR 710

Service Layer Credits: Source: Esri,
DigitalGlobe, GeoEye, i-cubed, Earthstar
Geographics, CNES/Airbus DS, USDA,
USGS, AEX, Getmapping, Aerogrid, IGN, IGP,

0 0.125 0.25
Miles

FIG 1 - LOCATION MAP
SR 710 Regional Facility
Conceptual Analysis

DRAFT

Legend

Elevation (ft NAVD)	
28 - 29	22 - 23
27 - 28	21 - 22
26 - 27	20 - 21
25 - 26	19 - 20
24 - 25	18 - 19
23 - 24	17 - 18
	16 - 17
	15 - 16
	14 - 15
	13 - 14
	12 - 13
	11 - 12
	10 - 11
	less than 10

S-192

L 63-N CANAL

LOWER TAYLOR CREEK

**AREA AVAILABLE
FOR POTENTIAL
REGIONAL FACILITY**

Proposed SR 710

Legend

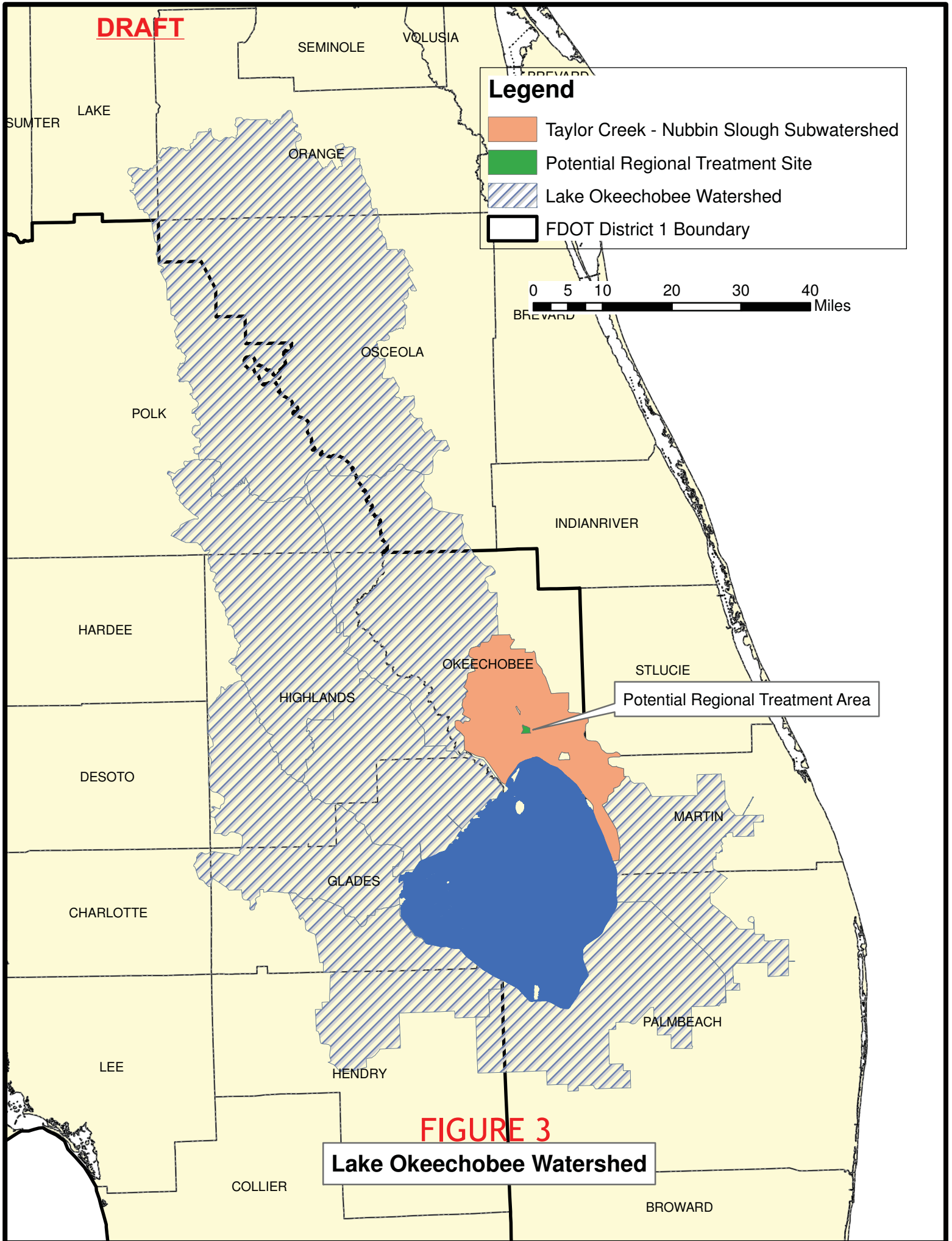
- Proposed 710 R/W
- Parcel of Interest
- Parcel Line

Service Layer Credits: Source: Esri,
DigitalGlobe, GeoEye, i-cubed, Earthstar
Geographics, CNES/Airbus DS, USDA,
USGS, AEX, Getmapping, Aerogrid, IGN, IGP,

0 0.125 0.25
Miles

FIG 2 - TERRAIN MAP
SR 710 Regional Facility
Conceptual Analysis

DRAFT



DRAFT

Legend

- Taylor Creek/Nubbin Slough STA
- Proposed 710 R/W
- L-63N Basin
- Parcel of Interest

**L-63N Basin
111.9 sq. mi.**

**Taylor Creek/Nubbin Slough
Existing STA**

**Area Available for
Potential Regional Facility**

LOWER TAYLOR CREEK

L 63-N CANAL

S-192

MOSQUITO CREEK

L-62

Proposed SR 710

Service Layer Credits: Source: Esri,
DigitalGlobe, GeoEye, i-cubed, Earthstar
Geographics, CNES/Airbus DS, USDA,
USGS, AEX, Getmapping, Aerogrid, IGN, IGP,

0 1 2
Miles

FIG 4 - STA BASIN MAP
SR 710 Regional Facility
Conceptual Analysis

DRAFT

Legend

L63N Basin Nutrient Land Use

- Barren Land
- Citrus Groves
- Dairies
- Improved Pasture
- Other Agriculture

- Rangeland
- Row and Field Crops
- Unimproved/Woodland Pasture
- Upland Forests
- Urban
- Water Bodies
- Wetlands

**L-63N Basin
111.9 sq. mi.**

**Taylor Creek/Nubbin Slough
Existing STA**

**Area Available for
Potential Regional Facility**

LOWER TAYLOR CREEK

L 63-N CANAL

MOSQUITO CREEK

Proposed SR 710

L-62

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP,

0 1 2
Miles

FIG 5 - STA NUTRIENT LAND USE

**SR 710 Regional Facility
Conceptual Analysis**

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Annual Geomean of Total Phosphorus
Concentration in Taylor Creek,
Measured at Cemetary Rd

2008 - 298 ppb
2009 - 334 ppb
2010 - 343 ppb
2011 - 439 ppb

Legend

- Cypress
- Improved Pastures
- Mixed Wetland Hardwoods
- Wet Prairies
- Woodland Pastures

L 63-N CANAL

S-192

LOWER TAYLOR CREEK

Proposed SR 710

Service Layer Credits: Source: Esri,
DigitalGlobe, GeoEye, i-cubed, Earthstar
Geographics, CNES/Airbus DS, USDA,
USGS, AEX, Getmapping, Aerogrid, IGN, IGP,

0 0.125 0.25
Miles

FIG 6 POTENTIAL 100 ACRE STA LOCATIONS

**SR 710 Regional Facility
Conceptual Analysis**

APPENDIX E - Page 43 of 55

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Annual Geomean of Total Phosphorus
Concentration in Taylor Creek,
Measured at Cemetary Rd

2008 - 298 ppb
2009 - 334 ppb
2009 - 343 ppb
2011 - 439 ppb

0 0.25 0.5
Miles

Legend

- Cypress
- Improved Pastures
- Mixed Wetland Hardwoods
- Wet Prairies
- Woodland Pastures

FIGURE 7

Potential Stormwater Treatment Area Locations - All areas approximately 100 acres

DRAFT

Annual Geomean of Total Phosphorus
Concentration in Taylor Creek,
Measured at Cemetary Rd

2008 - 298 ppb
2009 - 334 ppb
2010 - 343 ppb
2011 - 439 ppb

Legend

- Cypress
- Improved Pastures
- Mixed Wetland Hardwoods
- Wet Prairies
- Woodland Pastures

S-192

L 63-N CANAL

Dispersed Water
Storage Area
249 acres

LOWER TAYLOR CREEK

Proposed SR 710

Service Layer Credits: Source: Esri,
DigitalGlobe, GeoEye, i-cubed, Earthstar
Geographics, CNES/Airbus DS, USDA,
USGS, AEX, Getmapping, Aerogrid, IGN, IGP,

0 0.125 0.25
Miles

FIG 8 AREA FOR POTENTIAL DISPERSED WATER
STORAGE

**SR 710 Regional Facility
Conceptual Analysis**

APPENDIX E Page 45 of 55

DRAFT

Annual Geomean of Total Phosphorus
Concentration in Taylor Creek,
Measured at Cemetary Rd

2008 - 298 ppb
2009 - 334 ppb
2010 - 343 ppb
2011 - 439 ppb

0 0.25 0.5
Miles

Legend

- Cypress
- Improved Pastures
- Mixed Wetland Hardwoods
- Wet Prairies
- Woodland Pastures

Dispersed Water Storage Area
249 acres

SR 15

FIGURE 9

DRAFT

S-192

TAYLOR CREEK

LOWER TAYLOR CREEK

TAYLOR CREEK

L-63N

City Ditch Basin
3.3 sq. mi.

Lower Taylor Ck Basin
2.2 sq. mi.

Regional Pond
30 Ac

Proposed SR 710

Legend

- Proposed 710 R/W
- Regional Pond
- Regional Pond Basin
- Parcel of Interest
- Permitted Treatment

Legend **DRAFT**

Regional Pond

Pond Basin Nutrient Land Use

Barren Land

Citrus Groves

Dairies

Improved Pasture

Other Agriculture

Rangeland

Row and Field Crops

Unimproved/Woodland Pasture

Upland Forests

Urban

Water Bodies

Wetlands

City Ditch Basin
3.3 sq. mi.

Lower Taylor Ck Basin
2.2 sq. mi.

Regional Pond
30 Ac

Proposed SR 710

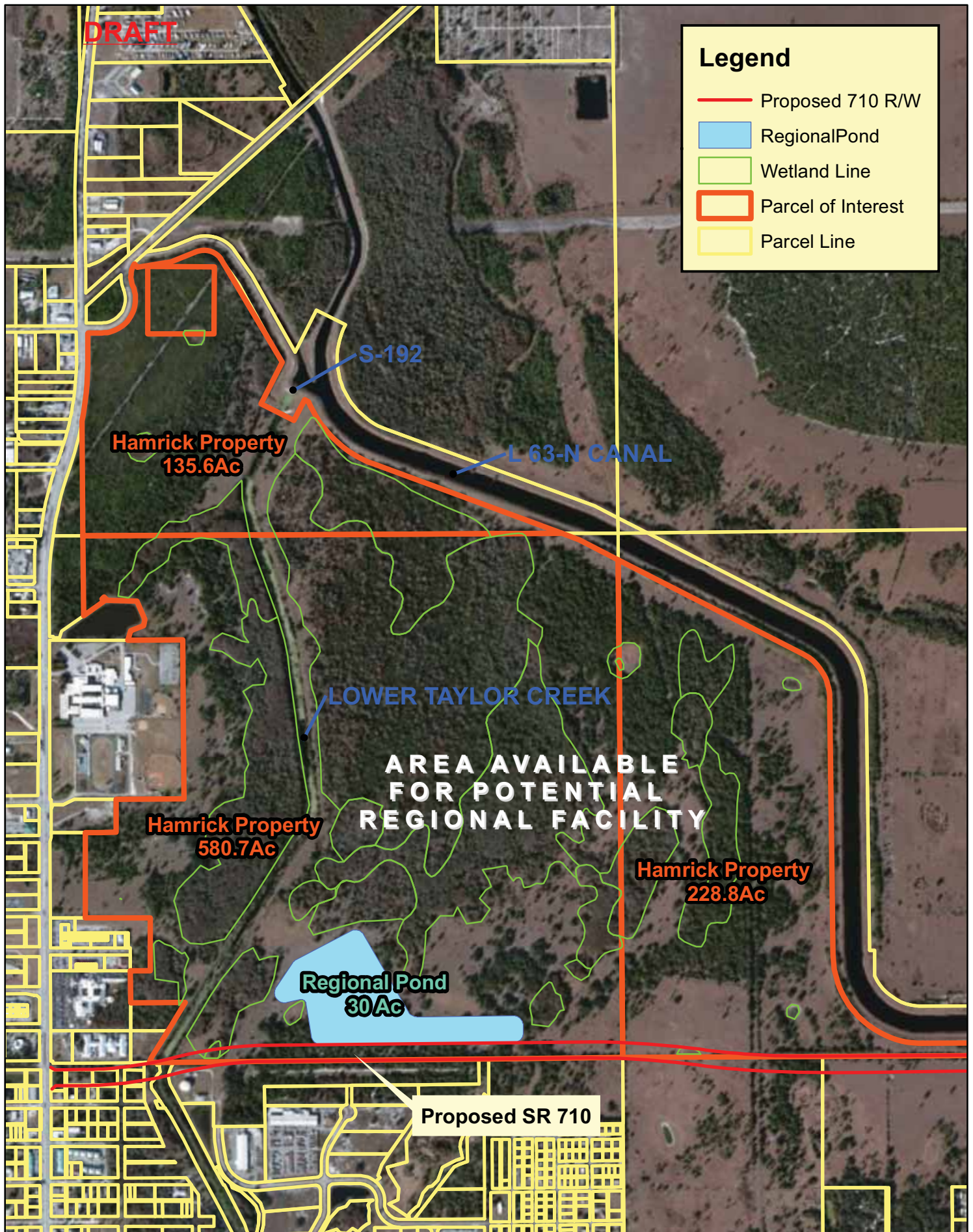


FIG 12 - REGIONAL POND LOCATION

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP,

0 0.125 0.25 Miles

**SR 710 Regional Facility
Conceptual Analysis**

DRAFT

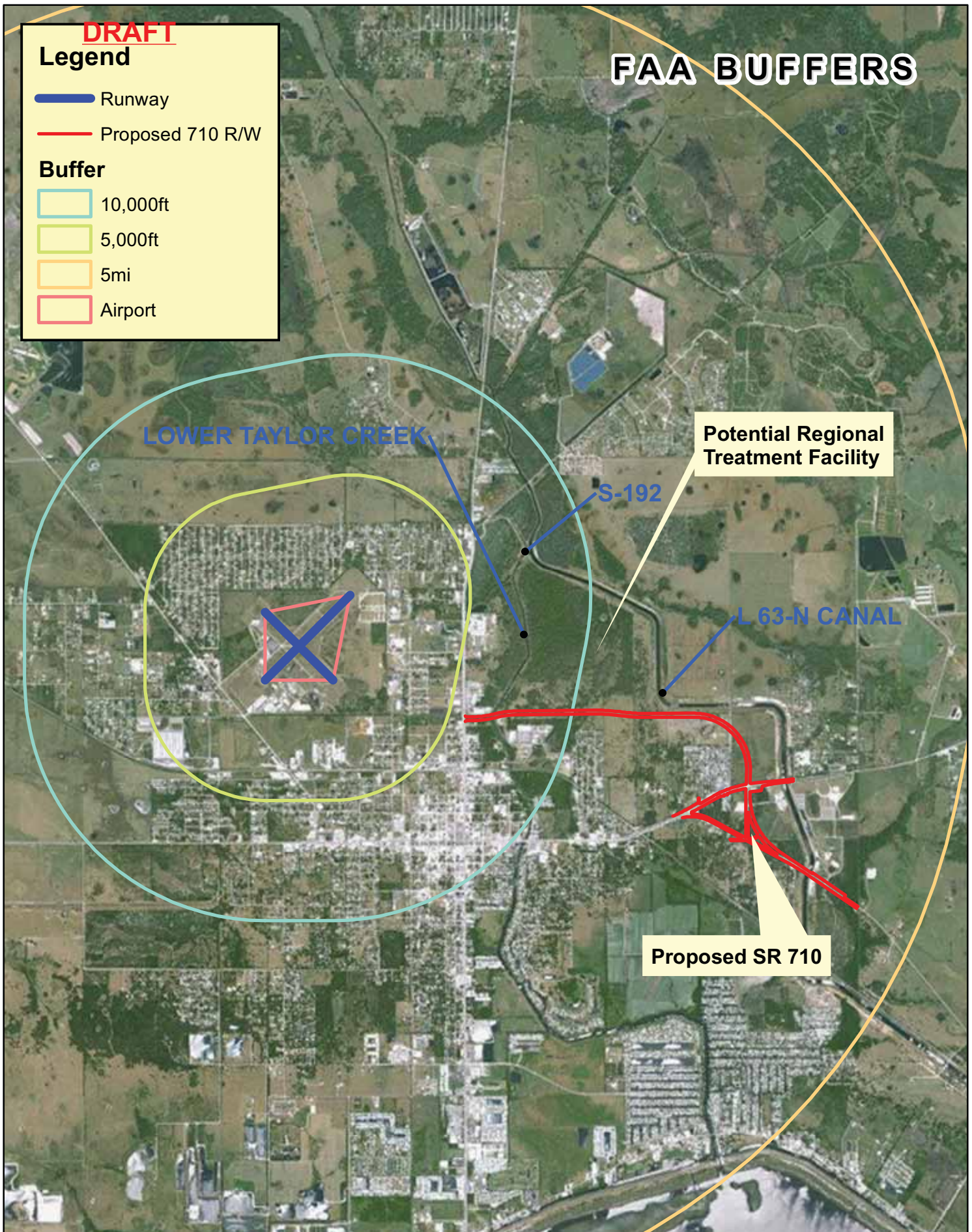
Legend

- Runway
- Proposed 710 R/W

Buffer

- 10,000ft
- 5,000ft
- 5mi
- Airport

FAA BUFFERS



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP,

0 0.5 1 Miles

FIG 13 - FAA Buffer

**SR 710 Stormwater Treatment Area/Regional Pond Feasibility Study
GOTO Meeting with Mike Hamrick, Property Owner
Meeting Minutes
FPID No. 432644-1-32-01 - D1 DW Drainage**

Location: GotoMeeting
Date: August 12, 2014
Time 9:00 am

By: Greg Seidel Checked By: Janet Hearn

Attendees: Mike Hamrick, Tony Federico, Greg Seidel, Janet Hearn,

1. A Gotomeeting was held between Greg Seidel, Janet Hearn, Mr. Hamrick and Mr. Hamrick's consultant, Tony Federico, to advise him regarding pollutant loadings and discharges. Mr. Federico is a principal at Federico, Lamb and Associates and has worked extensively on water quality issues in the Lake Okeechobee basin.
 2. Greg Seidel went through the Regional Pond/ STA options that are being reviewed by the FDOT and gave a brief project history of SR 710 and how we have gotten to this point. Mr. Federico asked multiple questions for clarification and inquired as to the preliminary loading rate calculations. Janet Hearn will provide preliminary rate calculations for his review.
 3. Mr. Hamrick indicated that their preferred location for an STA would be in the triangle of land to the north of where Taylor Creek and the L-63 canal diverge but that they have not ruled out any of the other locations presented to date. Greg noted that putting something in the north triangle would be difficult because of the gas line that runs through that portion of the property. Mr. Hamrick said that the easement he negotiated for the gas line is more flexible than the standard easement language and may give FDOT more flexibility. The exhibit developed for the Hamricks that was shown at the stakeholder meeting was just an exhibit to demonstrate a size comparison; it was not a location exhibit.
 4. Mr. Hamrick said that it is important to maintain the integrity of the property and the current level of use of the property.
- c. Attendees
Brent Setchell, FDOT
Carl Spirio, FDOT
Amy Setchell, FDOT
Jennifer Nunn, Balmoral Group

From: Setchell, Amy <Amy.Setchell@dot.state.fl.us>
Sent: Thursday, September 04, 2014 1:25 PM
To: Mike Hamrick; Greg Seidel; federico@fla-inc.com; JHearn@AppliedTM.com
Cc: Setchell, Brent; Spirio, Carlton D; Jennifer Nunn
Subject: RE: SR 710 Regional Pond Hamrick Meeting Minutes.2014.08.12

Mr. Hamrick,

The Department has received your email and it will be documented as part of the SR710 Feasibility Study. We appreciate your participation and interest in the project and look forward to sharing the results of study with you.

Thank you,

Amy Setchell, P.E.
Project Manager
FDOT District 1
801 N. Broadway Ave.
Bartow, FL 33830
P:(863)519-2609
Email: Amy.Setchell@dot.state.fl.us

From: Mike Hamrick [<mailto:MHamrick@manateelegal.com>]
Sent: Thursday, September 04, 2014 11:45 AM
To: Greg Seidel; federico@fla-inc.com; JHearn@AppliedTM.com
Cc: Setchell, Brent; Spirio, Carlton D; Setchell, Amy; Jennifer Nunn
Subject: RE: SR 710 Regional Pond Hamrick Meeting Minutes.2014.08.12

Greg,

Thank you for the minutes. As to your 4th point in the minutes (which are similarly stated in prior minutes as well), I thought it might be helpful for me to express in writing what I have attempted to say by spoken word. Thus, in hopes of avoiding a misunderstanding, let me express the position of Hamrick & Sons, Inc. this way:

Hamrick & Sons, Inc. has been approached by DOT and other entities with various concepts and ideas relating to drainage options in the construction of the SR 710 Extension. Thus far, these ideas have consisted of a "Regional Pond", a Stormwater Treatment Area and a Water Dispersal Area. Thus far, for understandable reasons, there has been limited information on acreage to be used and no information whatsoever on compensation to the landowner. Hamrick & Sons, Inc. has made no demands on the continued use of the property or the size of the project. What we have said is that the property is currently an operating cattle ranch (both to the north and the south of the L-63 canal). If the purposes of the relevant entities could be accomplished with minimal disruption to the present use of the property, that is a factor making such an endeavor attractive to Hamrick & Sons, Inc. If the relevant entities desire to use the property in a way that would substantially impair or eliminate part or all of the use of the property to the south of the L-63 canal for cattle purposes, then Hamrick & Sons, Inc. would simply have to evaluate the compensation being proposed against the lost revenue from a cut back in the existing cattle operations. While continued "integrity" of the property in its current use is attractive to Hamrick & Sons, Inc., at no time have we indicated that we would not look at any proposed project where more substantial changes would occur. Having said that, Hamrick & Sons is left without much of a way to evaluate anything without more definitive direction from the relevant entities, including, at some point, an indication of dollars associated with each decision. Nothing has been ruled off the table. For that matter, I don't have

a good feeling for what is on the table as no “discussion” has yet led to what I would categorize as a firm proposal on how to proceed.

Mike Hamrick
President, Hamrick & Sons, Inc.

601 12th Street West
Bradenton, Florida 34205
mhamrick@manateelegal.com
Phone: (941) 747-1871
Facsimile: (941) 745-2866
www.manateelegal.com

From: Greg Seidel [<mailto:GSeidel@balmoralgroup.us>]
Sent: Thursday, September 04, 2014 11:05 AM
To: Mike Hamrick; federico@fla-inc.com; JHearn@AppliedTM.com
Cc: Setchell, Brent (Brent.Setchell@dot.state.fl.us); CARLTON.SPIRIO@DOT.STATE.FL.US; Amy.Setchell@dot.state.fl.us; Jennifer Nunn
Subject: SR 710 Regional Pond Hamrick Meeting Minutes.2014.08.12

Dear All –

Please find attached the notes from the GotoMeeting with Mike Hamrick and Tony Federico regarding the proposed Regional Pond/Stormwater Treatment Area at the proposed SR 710, Airport Ditch and Lower Taylor Creek confluence. Please let me know if you have any questions or comments.

Regards,

Greg



Gregory S. Seidel, P.E.

The Balmoral Group
165 Lincoln Ave.
Winter Park, FL 32789
Phone: 407.629.2185, ext 103
Mobile: 407.739.4899
Fax: 407.629.2183
e-Mail: gseidel@balmoralgroup.us
Web: <http://www.balmoralgroup.us>

SR 710 Stormwater Treatment Area/Regional Pond Feasibility Study
SR 710 Conceptual Regional Pond/STA Meeting with Avcon Representing Okeechobee
Meeting Minutes
FPID No. 432644-1-32-01 - D1 DW Drainage

Location: AVCON, 5555 E. Michigan Street, Suite 200 Orlando, FL 32822-2779
Date: Thursday, August 14, 2014
Time: 3:00pm

Attendees:

1. Greg Seidel – The Balmoral Group, Drainage
2. Jim Kriss-AVCON, Principal
3. Hilary Maull – AVCON, Project Manager-Airports
4. Brent Setchell (by phone) - FDOT, Project Manager

Purpose: The purpose of the meeting is for The Balmoral Group to present a brief recap of the stakeholder kickoff meeting to the Okeechobee Airport General Consultant and to share information to help determine if the airport may benefit from the project and be a contributing stakeholder should the project move forward.

1. Greg Seidel began the meeting by giving a project background to AVCON. Avcon is the general consultant for the Okeechobee County Airport and has developed their master stormwater plan.
2. Greg Seidel gave the background review.
3. Discussion was held regarding FAA requirements for a new pond within the FAA Wildlife Management Area. Mr. Seidel presented the map showing that the new proposed ponds would lie within this area. It was noted that if the airport got involved the requirements may be more stringent because the FAA dollars would be included in the project.
4. Mr. Kriss indicated that there was certainly some possibility for the group to work together and it all seemed very reasonable. The other issue the airport had was they were looking for mitigation credits for wetland impacts to their site. There was a previous worked out deal on the table with a mitigation bank, however that deal fell through and so this is an ongoing issue and the airport is pursuing possible mitigation options.
5. The meeting ended with the decision that AVCON would approach the FAA regarding non project specific questions and once those questions were answered they would return to discuss the responses with the FDOT. We would go forward from that point.

- c. Attendees
Amy Setchell, FDOT
Carl Spirio, FDOT
Jim Threewits, Okeechobee County
Kathy Scott, Okeechobee County
Kelly Baney, Okeechobee County
Jennifer Nunn, Balmoral Group

From: Jennifer Nunn
Sent: Friday, September 12, 2014 8:24 AM
To: Jose Otero (jotero@sfwmd.gov)
Cc: Hearn, Janet; Greg Seidel; Ostrovsky, Moysey
Subject: SR 710 Regional Pond/STA Feasibility Study - SFWMD Operations
Attachments: Location.pdf

Jose,
Per our phone conversation on 9/9/14, I am following up with an email to request additional information regarding the structures S-192 and S-133/S-193. The Balmoral Group has been contracted to perform a feasibility study for regional pond and STA options in the Lower Taylor Creek area. This is being undertaken by the FDOT District One as a part of the SR 710 new alignment project in Okeechobee. The SR 710 New Alignment Project in Okeechobee County and the City of Okeechobee is currently under design by the FDOT. During the development of the Pond Siting Report, one of the pond sites was identified as a possible location for a regional stormwater treatment facility that could provide greater stormwater treatment benefits to the local area. This undeveloped area is located east of the City of Okeechobee, just south of the confluence of Lower Taylor Creek and the L-63N Canal. This property appears to be owned and controlled by Hamrick and Sons based on the local property appraiser website and the FDOT deed research. Please see attached map.

Per our discussion Tuesday, it was confirmed that the US Army Corps built and conveyed S-192 and S-133/S-193 to the SFWMD.

Please answer and provide clarification on the following:

- Who has the authority to modify the structure or operation of the structure?
- What is the process of modifying the structure or operation manual? Who performs the review of these changes?
- Who controls the levees along the L-63N and who would review additional connections to the L-63N?
- Specifically, how is the S-192 and S-193/S-133 structures operated to date? The information we obtained is from a Draft 2005 Central and Southern Florida Project For Flood Control and Other Purposes System Operating Manual for Lake Okeechobee and Everglades Agricultural Area Volume 3, December 2005. Is there a more recent Operating Manual with update information?

Let me know if you have any questions.

Thanks,



Jennifer A. Nunn, P.E.

The Balmoral Group
165 Lincoln Avenue
Winter Park, FL 32789
T: 407.629.2185 ext 108
F: 407.629.2183