Wekiva
Watershed Management Plan
Project Concept Alternatives Analysis

SEMINOLE COUNTY

Submitted by:
Geosyntec Consultants, Inc.
3504 Lake Lynda Drive, Suite 155
Orlando, Florida 32817

July 2023

Geosyntec consultants
engineers | scientists | innovators

Wekiva Watershed Management Plan

Project Concept Alternatives Analysis

July 2023

Prepared for

Seminole County Public Works
100 E 1st St
Sanford, FL 32771

Prepared by

Geosyntec Consultants, Inc.
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Project Number: FW8679

PS-0801-16/RTB Engineering Services Agreement for Wekiva Basin Stormwater and TMDL Services

Wekiva Watershed Management Plan

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The engineering material and data contained within the enclosed report was prepared by Geosyntec Consultants, Inc. for sole use by the Seminole County Public Works Department. This report was prepared under the supervision and direction of the respective undersigned, whose seal as a registered professional engineer is affixed below.

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Project Number: FW8679

July 2023

Project Concept Alternatives Analysis

Included in this report are improvement concepts for the consolidated project recommendations from the Watershed Management Report. This includes the following which are included as standalone project concept packages in this report.

- **Flooding Focused Projects**
  - Tributary C – Hunt Club to Lake Brantley
  - Markham Road at Timberbrook and Bridge Water
  - Bel Aire Estates
  - Cutler Road
  - Riverbend Boulevard
  - Banana Lake Road
  - Biltmore Point
  - Markham Road at Lake Markham
- **Flooding and Water Quality Focused Projects**
  - Sanlando Springs - Magnolia Street – Rolling Hills Area
  - Bear Lake Woods
  - Mobile Manor
  - Cecelia Drive
- **Water Quality Focused Projects**
  - Northwestern BMP 1
  - Northwestern BMP 2
  - Northwestern BMP 3
  - Spring Lake Outfall #12 BMP
  - Weathersfield BMP
  - Sabal Point BMP
  - Spring Landing BMP
  - Sweetwater BMP 1
  - Sweetwater BMP 2
  - Sweetwater BMP 3
- **Special Focused Projects**
  - Lake Markham Outfall
  - Lake Sylvan Outfall

It is noted that a meeting was held with the St. Johns River Water Management District in April 2023 to discuss the permitability of each of these proposed projects. That information was considered in the development of the final concepts to ensure implementability from a permitting standpoint.

A summary of the projected implementation costs for these recommended projects is provided in the table below, organized by project type. Note these costs include construction costs plus allocations for design, permitting and CEI. See individual project package for details.

Priority Project	Project Type	Estimated Implementation Cost
Sanlando Springs - Magnolia Street – Rolling Hills Area	Flooding and Water Quality	
Phase 1		$3,336,000
Phase 2		$3,323,000
Phase 3		$3,948,000
Phase 4		$6,298,000
Phase 5		$1,657,000
Bear Lake Woods	Flooding and Water Quality	$2,781,000
Mobile Manor	Flooding and Water Quality	$1,664,000
Cecelia Drive	Flooding and Water Quality	$1,852,000
Tributary C – Hunt Club to Lake Brantley	Flooding	$2,337,000
Markham Road at Timberbrook and Bridge Water	Flooding	$263,000
Bel Aire Estates	Flooding	$2,501,000
Cutler Road	Flooding	$996,000
Riverbend Boulevard	Flooding	$791,000
Banana Lake Road	Flooding	$446,000
Biltmore Point	Flooding	$327,000
Markham Road at Lake Markham	Flooding	$2,174,000
Northwestern BMP 1	Water Quality	$395,000
Northwestern BMP 2	Water Quality	$395,000
Northwestern BMP 3	Water Quality	$395,000
Spring Lake Outfall #12 BMP	Water Quality	$484,000
Weathersfield BMP	Water Quality	$610,000
Sabal Point BMP	Water Quality	$481,000
Spring Landing BMP	Water Quality	$1,331.000
Sweetwater BMP 1	Water Quality	$733,000
Sweetwater BMP 2	Water Quality	$443,000
Sweetwater BMP 3	Water Quality	$1,029,000
	TOTAL:	**$39,660,000**

In addition, costs associated with the two special focused projects are summarized below:

- Lake Markham Outfall - Cost projection to implement: $14,885,000
- Lake Sylvan Outfall - No construction cost – permitting effort

FLOOD BENEFIT COST EVALUATION

Flood damages were calculated for each improvement concept, where present, in order to quantify the benefit offered by each alternative. The methodology used to calculate flood damages and the benefit cost analysis method is described below.

Road Damage

Roadway inundation polygons were generated by intersecting the road polygons and the inundation polygons generated from the watershed or project specific ICPR model results.

Road damage costs were estimated for each road where the inundation elevation exceeded the apparent low point of the road. Vehicle delay costs were estimated for each road where the inundation depth exceeded what was considered the impassable depth for the road. For the purposes of this evaluation, six (6) inches of inundation was considered impassable for any inundated roads. The resulting road flooding costs were calculated as the road damage costs plus the vehicle delay costs using the following equation (unit conversion factors were applied to the below equation where needed):

Road Flooding Cost = Road Damage Cost + Vehicle Delay Cost

Where:

Road Damage Cost = length of road flooding (feet) x number of lanes[1] x unit repair cost[2] ($ / lane *ft)

Vehicle Delay Cost = traffic volume (vehicles/day) x average detour time (minutes) x flooding duration (hours) x delay cost[3] ($ / vehicle * hour) x conversion factor (1 day / 1440 min)

1 – Number of lanes consists of inundated lanes, not total lanes of the road.

2 – Unit repair costs were $300, $150, and $115 per lane-foot for Arterial, Collector, and Local Roads, respectively. These values were obtained from standard FDOT values with a cost escalation factor of 5% applied from 2016.

3 – $38.15 per vehicle-hour.

Structure Damage

Structure damages were calculated using FEMA's Benefit Cost Calculator (version 6.0.0). The total building size for each structure was obtained from the County's property appraiser website. Building and contents damages were estimated using depth-damage functions (DDFs), which express flood-related economic losses (i.e., percent damage to building and content value) as a function of flood depth relative to the FFE. FEMA provides numerous DDFs in its calculator which are compiled from historic data collected by agencies such as the Federal Insurance Administration (FIA) and US Army Corps of Engineers (USACE). For this assessment the *USACE Generic* damage curve was utilized to estimate structure damages.

Flood elevations and flood discharge rates are both required input parameters in the FEMA Benefit Cost Calculator. Flood elevations were referenced from the watershed or project specific ICPR model results for the design storms of interest and flood discharge rates were assumed to be equal to the maximum inflow rate at the contributing node of the subbasin where potential structure flooding was observed.

Ecosystem Services and Social Benefits

In FEMA's Benefit Cost Calculator, ecosystem services and social benefits can be calculated for drainage improvement projects. Per FEMA's reference documents, ecosystem services refer to the essential goods and services provided by nature that communities, governments, and businesses depend on. Ecosystem services are essential to human survival and economic prosperity, and include clean air, drinkable water, nourishing food, hazard risk reduction, habitat for fish and wildlife, and a stable climate. Social benefits can be used to represent displacement costs and the mental anguish associated with being displaced during structure flooding for example.

Ecosystem services benefits were calculated for roadway flooding based on the estimated project area associated with impacted roadways. These area values were entered in the FEMA Benefit Cost Calculator as the representative project area and the percentage of ecosystem service categories (e.g., urban green open space, inland wetlands, etc.) were populated based on estimated contributing area characteristics.

Ecosystem services benefits were also calculated for structure flooding based on the estimated inundation area within a subbasin that was determined to contain a potentially impacted structure. In addition to ecosystem services benefits, social benefits were also calculated for structure flooding in the FEMA Benefit Cost Calculator. It was assumed that all impacted structures had three (3) building residents and two (2) of the residents work to account for potential lost wages.

Ecosystem services and social benefits were calculated for each improvement project on an average annual basis. The calculated benefits were added to the road and structure flooding benefits (i.e., difference between existing and proposed damages) to develop an overall benefit value to be compared against the estimated construction cost of the project.

Benefit Cost Analysis Method

As mentioned above, road and structure benefits were calculated as the difference in damages between existing and proposed conditions. Additionally, ecosystem services were calculated for both road and structure flooding, and social benefits were calculated for structure flooding. These benefits were summed to get an average annual benefit value which was then extrapolated over the project lifespan (50 years) to develop the net present value (NPV) of the benefits. This value was then divided by the estimated project construction cost, result in a benefit cost ratio (BCR) for each improvement project. An interest rate of 7% was used in this assessment to determine NPV. In general, a BCR greater than 1.0 can be considered a cost-effective project (i.e., the benefits outweigh the costs).

The results of the benefit cost analysis for each improvement project are presented below and detailed in each of the individual project summary reports.

Flood Benefit Cost Results Summary Table								
Project	Existing Conditions Road Flood Damages ($/year)	Proposed Conditions Road Flood Damages ($/year)	Road Flood Damages Benefit ($/year)	Roadway Ecosystem Benefits ($/year)	[1]Structure Total Benefits ($/year)	[2]Lifecycle Benefit ($)	[3]Estimated Construction Cost ($)	B/C Ratio
Sanlando - Phase 1	$1,919	$136	$1,783	$217,574	$0	$3,027,348	$2,470,981	1.23
Sanlando - Phase 2	$118,464	$58,599	$59,866	$155,565	$1,378,039	$21,991,475	$2,461,701	8.93
Sanlando - Phase 3	$433	$133	$300	$187,114	$0	$2,586,502	$3,158,568	0.82
Sanlando - Phase 4	$16,082	$7,113	$8,969	$323,097	$1,517,946	$25,532,017	$5,038,394	5.07
Sanlando - Phase 5	$77,001	$60,119	$16,882	$104,902	$599,030	$9,947,960	$1,325,523	7.50
Sanlando - Combined	-	-	-	-	-	$63,085,302	$14,455,167	4.36
Trib C	$67,025	$58,344	$8,681	$22,496	$194,589	$3,115,796	$1,730,417	1.80
Bearlake Woods	$296,353	$25,756	$270,596	$12,433	$151,066	$5,990,949	$2,035,822	2.94
Biltmore	$12,351	$9,127	$3,223	$29,839	$0	$456,291	$233,059	1.96
Bel Aire	$144,763	$69,307	$75,456	$242,921	$546,809	$11,940,434	$2,084,544	5.73
Mobile Manor	$107,817	$2,721	$105,097	$116,402	$0	$3,056,901	$1,218,052	2.51
Markham Timberbrook	$16,749	$1,916	$14,833	$25,565	$0	$557,532	$187,740	2.97
Cutler Road	$30,045	$253	$29,792	$35,900	$0	$906,612	$796,481	1.14
Cecilia Drive	$100,483	$4,364	$96,119	$124,561	$0	$3,045,606	$1,355,620	2.25
Markham Road	$25,751	0	$25,751	$85,786	$0	$1,539,318	$1,739,266	0.89
Riverbend Boulevard	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Banana Lake Road	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

[1]*Structure total benefits include standard mitigation benefits and social benefits as outlined in the FEMA Benefit Cost Calculator.*

[2]*Lifecycle benefit is equal to (Road Flood Damages Benefit + Road Ecosystem Benefit + Structure Total Benefits) x 13.801 to calculate the NPV of benefits over the project's lifecycle.*

[3]*Estimated construction cost is the construction cost + contingency. Does not include design and permitting or CEI services.*

Note that the Lake Markham, Lake Sylvan, Banana Lake Road and Riverbend projects were identified to address specific flood management solutions not based on roadway or structural level of service deficiencies. As such, no flood benefit cost information is provided for those projects.

WATER QUALITY BENEFIT COST EVALUATION

The cost benefit of the water quality aspects of projects, where present, is provided in terms of cost per pound of total nitrogen and total phosphorus removed on an annual basis. This data is included in the individual project packages.

Flooding and Water Quality Focused Project

Sanlando Springs - Magnolia Street – Rolling Hills Area

Flood and Water Quality Improvement Alternatives Analysis

Sanlando Springs, Magnolia Street & Rolling Hills

Wekiva Watershed Management Plan

Seminole County, Florida

The purpose of this improvement concept is to provide a comprehensive solution to flooding and water quality deficiencies in this project area. The area is a combination of what is referred to as the Sanlando Springs development, the southeastern portions of Rolling Hills, and areas in the vicinity of Magnolia Street. This area has a mix of old development bult in the 1960s and 1970s before the advent of modern stormwater permitting and design practices. Much newer piecemeal development, in particular commercial parcels have been built in the areas resulting in a collection of mismatched, undersized, or simply non-existent infrastructure. Many of the more recent developments were permitted to current stormwater standards, but concurrency with the older areas for proper management of stormwater runoff is substandard.

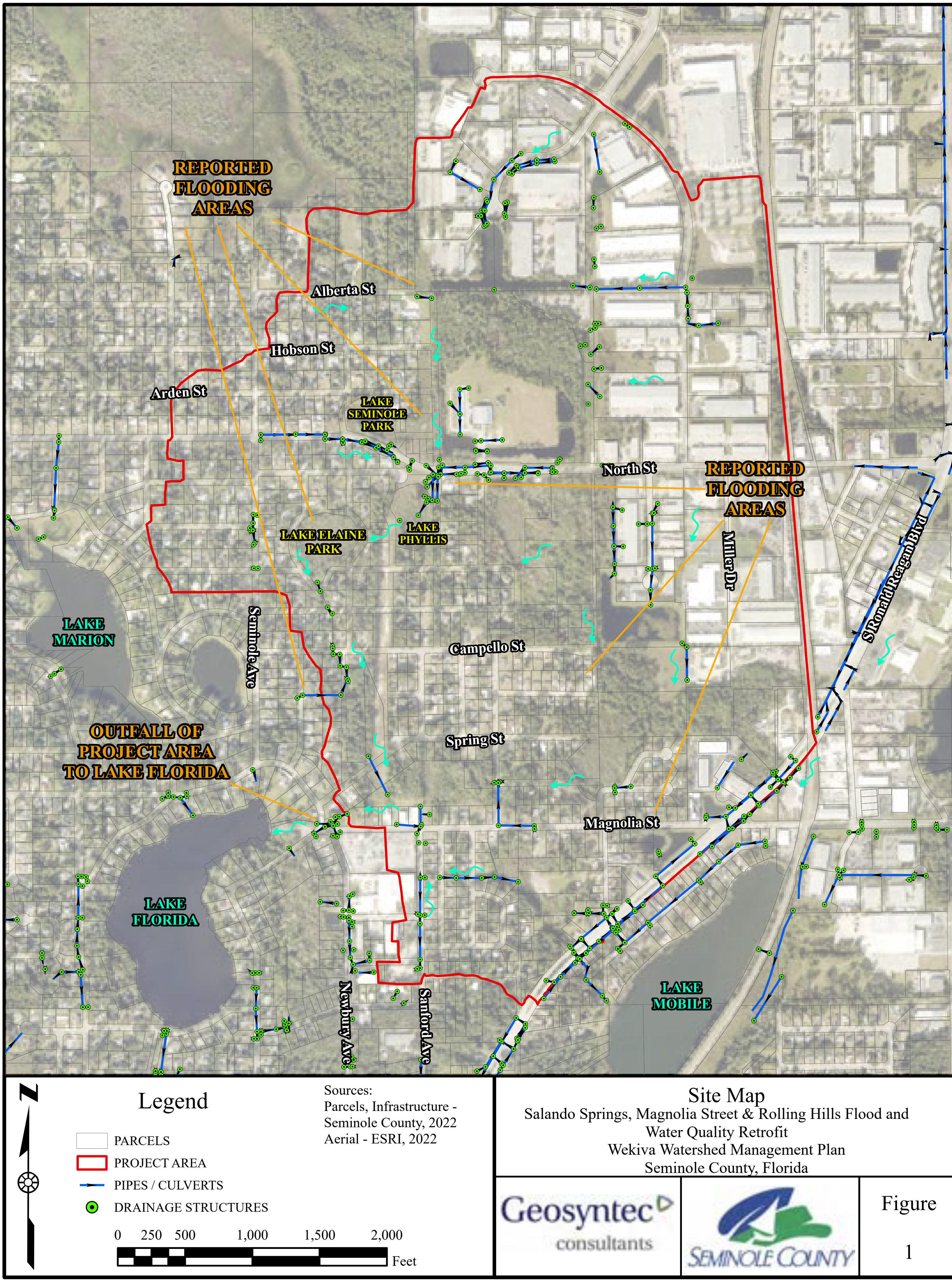
Ultimately all these areas discharge to Lake Florida in the City of Altamonte Springs in the southwest boundary of the project area. Historical aerials show these areas as generally interconnected. Remnants of these connections remain to present day, but the piecemeal development has strained them or in some cases rendered them severed.

The project area is shown on **Figure 1**. A topographical map is included on **Figure 2**. Representative photos of the areas are included on the following pages.

<u>Existing Conditions</u>

Various locations of nuisance and severe flooding during extreme storm events have been noted throughout the project area. Complaints of flooding have been logged during Hurricanes Irma and Ian, as well as noted as a problem by County staff. Hydrologic and hydraulic modeling performed under the greater Wekiva Watershed study indicated numerous level of service deficiencies, as well as the potential for impacts to habitable structures (LOS C & D).

The area generally consists of very old development with substandard to non-existent drainage infrastructures. Historically, the area was a series of interconnected waterbodies, connections between which have been severed or severely strained. In general, the areas all work to the south (Rolling Hills), west (Sanlando), or northwest (Magnolia Street) to work through the final depressional area west of Brentwood before all draining through a culvert to Lake Florida. Shown below is a 1940 aerial of the areas and depicts the pre-development drainage patterns in the area. These older residential areas have limited to no water quality treatment.



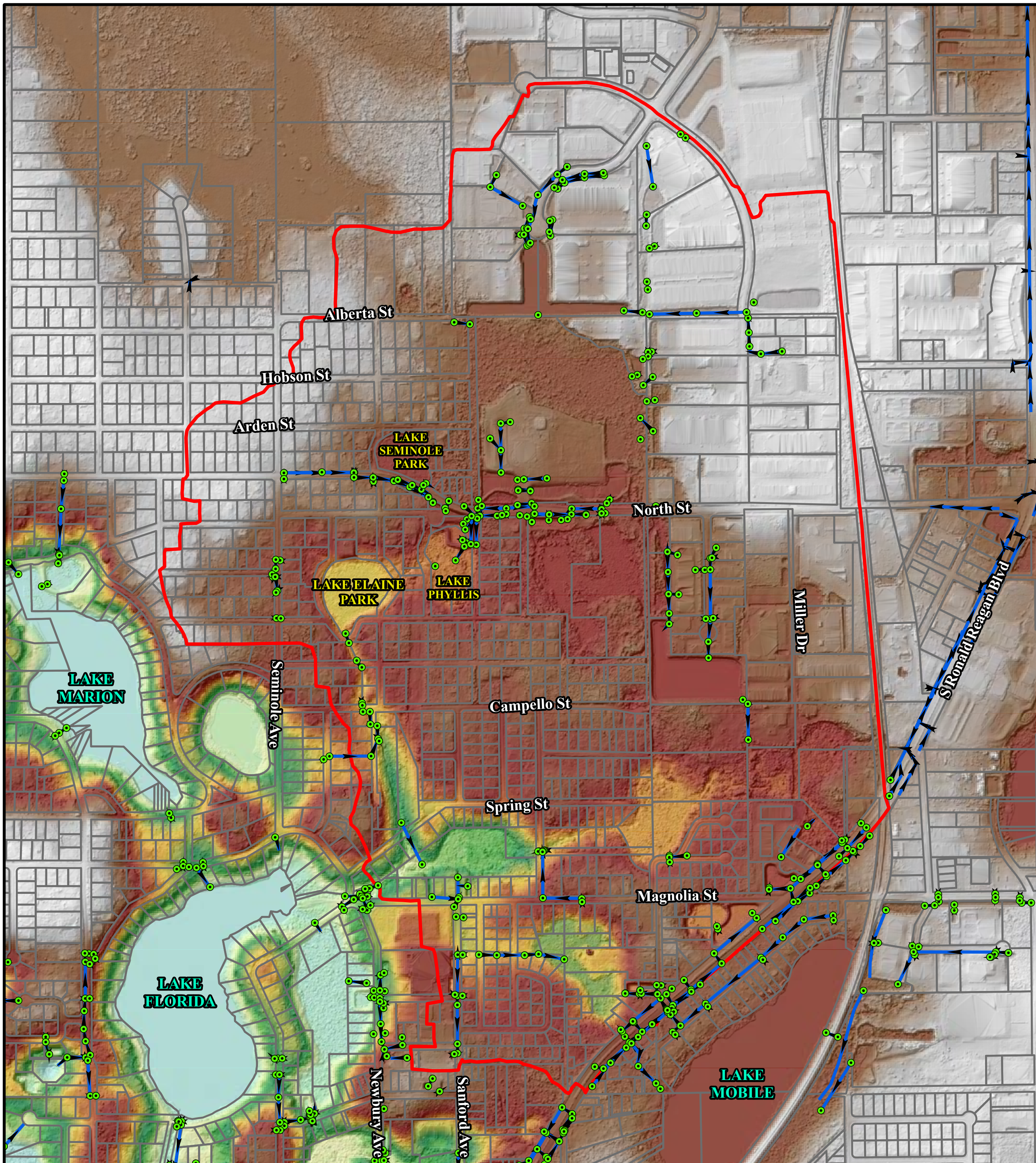
Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Site Map
Salando Springs, Magnolia Street & Rolling Hills Flood and Water Quality Retrofit
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure 1



Legend

- PARCELS
- PROJECT AREA
- PIPES / CULVERTS
- DRAINAGE STRUCTURES

DEM
FEET NAVD 1988
68.47
38.6

0 250 500 1,000 1,500 2,000 Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022
DEM - USGS LIDAR, 2018

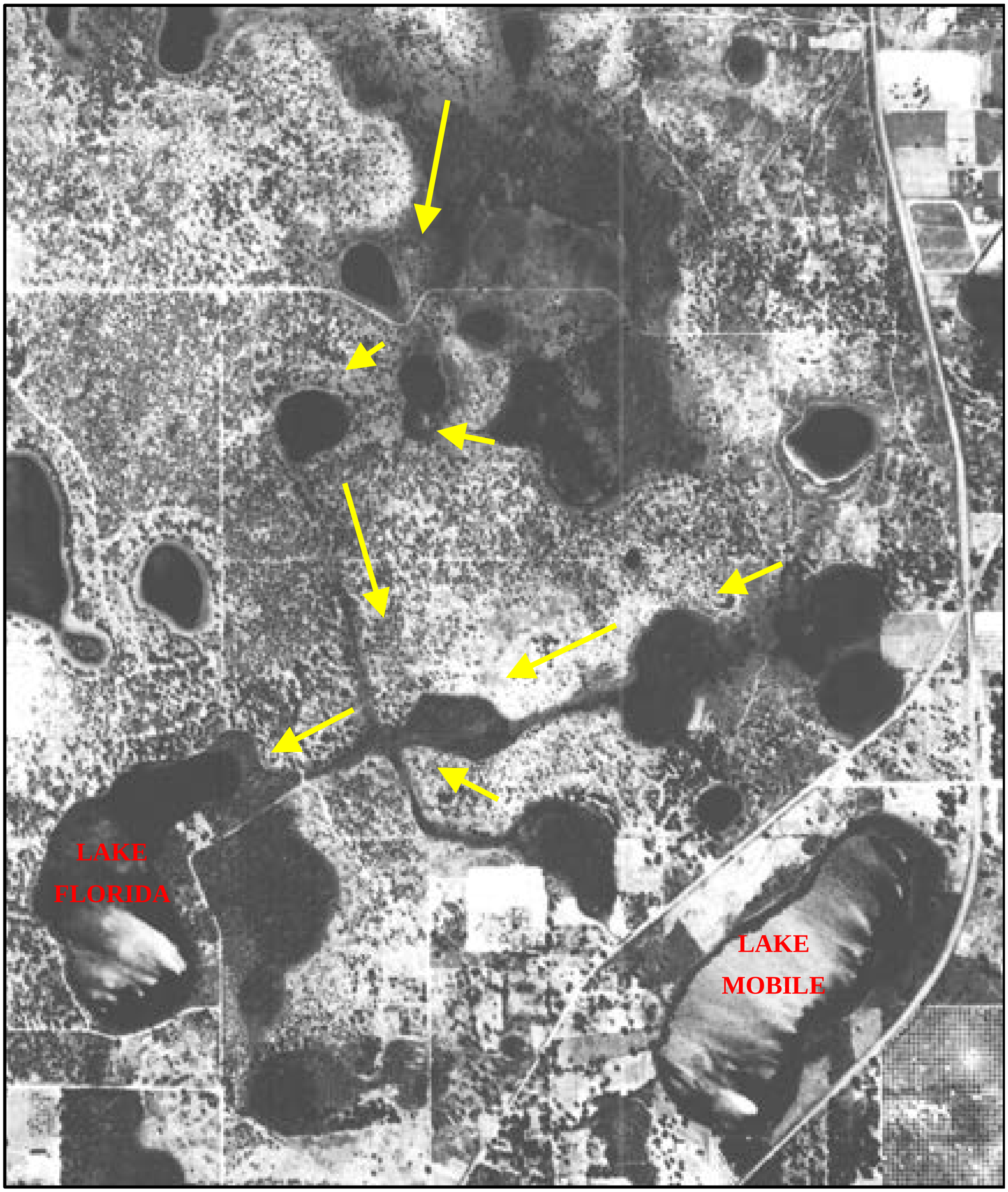
Topographical Map

Salando Springs, Magnolia Street & Rolling Hills Flood and Water Quality Retrofit
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure 2



1940 Historical Aerial of Project Area

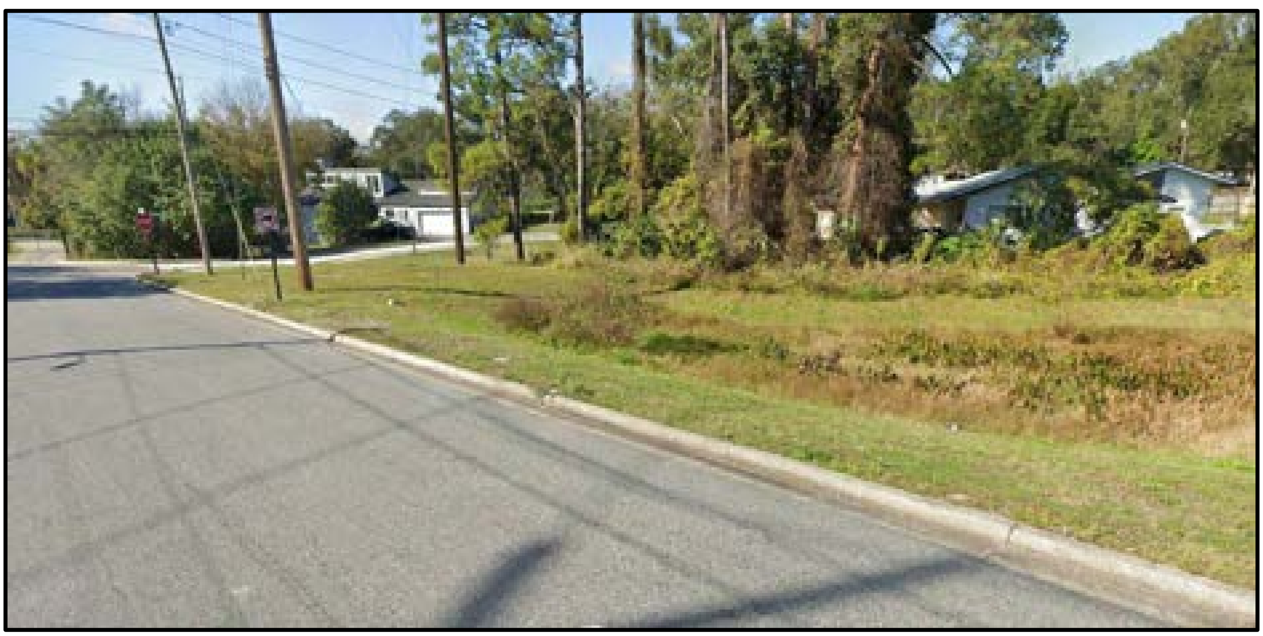
View of east end of Alberta Street (Google, 2013)

View to east of Lake Seminole from North Street (Google, 2023)

View to south along outfall ditch to Lake Phyllis from North Street (Google, 2023)

View to west of outfall location from Lake Elaine from Franklin Street (Google, 2014)

View to east towards wetland area from east end of Springs Street (Google, 2014)



View to west towards outfall area near west end of Magnolia Street (Google, 2021)

View to north along Desoto Avenue at cross drain location from wetland to east (Google, 2014)

View to north along Brentwood Avenue at cross-drain location between two wetlands (Google, 2014)

View to northeast of outfall area into Lake Florida (bottom) (Google, 2023)

View to east towards the Lake Seminole, Lake Phyllis, Lake Elaine area (Google, 2023)

View to west towards interconnected wetland areas, Lake Florida in background (top) (Google, 2023)

Proposed Improvements

The proposed project is to restore more efficient connections to drain the area consistently to the southwest. Opportunities are proposed to obtain additional storage for waterbody/wetland areas though leveraging County/City property and working with private property owners for easements in unusable portions of their properties. The objective is to eliminate or at least significantly reduce the incidence of flooding that impacts residential properties. Key elements of this concept include:

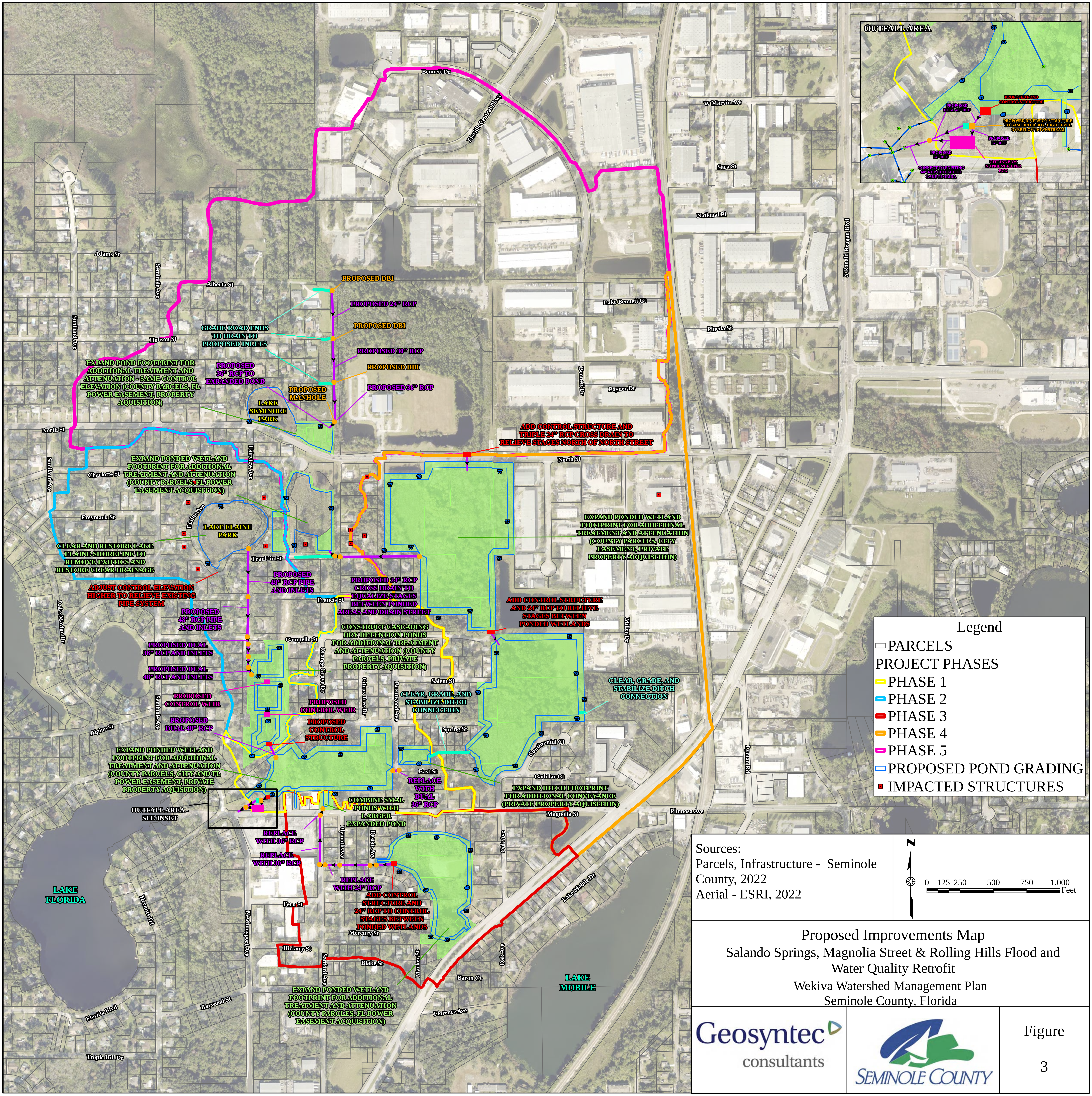
- Flooding reduction will be aided through improved conveyance at the following locations:
    - The outfall wetland area located between Spring Street and Magnolia Street, and on both sides of Brentwood Avenue will be expanded, taking advantage of the County owned parcel at Spring Street and Brentwood Avenue and obtaining a drainage easement from Florida Power and several residents. Also, acquisition of vacant parcels near Spring Street and Brentwood Avenue will be leveraged to provide the opportunity to create more flood storage for the common flow through area for the entire project.
    - The Lake Seminole pond is proposed to be expanded to the east utilizing County right-of-way and coordinating an easement with Florida Power. This will provide more flood attenuation volume. The pond outfall will be shifted to the east take in the new pipe system from the north (described below). The combined pond area will outflow through a modified control structure at the same control elevation.
    - Utilizing the north south right of way at the ends of Alberta Street, Hobson Street, and Arden Street to provide a direct pipe connection to the expanded Lake Seminole pond. This will use the east side of the Florida Power easement. At the dead ends of those street, swale grading and ditch bottom inlets will facilitate conveyance into the pipe system.
    - The wetland area at the east end of Franklin Street and south of North Street will be provided a high level outfall that will drain to Lake Phyllis to reduce overland flow that can occur through properties. Upgraded drainage infrastructure along Franklin Street is also proposed. These wetland parcels are owned by the City of Altamonte and Seminole County, so opportunities to increase storage will be evaluated along with wetland enhancement.
    - The vacant parcel to the south of Lake Phyllis will be obtained to increase the effective storage of the wetland. The overland/poorly defined ditch connection between Lake Phyllis and Lake Elaine to the west will be improved to provide consistent conveyance.
    - The undersized stormsewer piping that drains the outfall from Lake Elaine south to the wetland area between Spring Street and Magnolia Street (outfall point to Lake Florida) will be supplemented with a parallel pipe system along Fairview Avenue that will be easier to maintain. The sloped depressional properties east of Fairview Avenue and south of Campello Street will be acquired to provide additional storage and attenuation for drainage flowing south. This will be accomplished through construction of cascading dry ponds with weir overflow connections to the south. Coordination with Florida Power will be necessary. The culvert across the unused

right away on Springs Street will also be upgraded and replaced with a control drop structure from the proposed dry pond there.

- The outfall pipe/ditch system draining the ponded and wetland area south of Magnolia Street, between DeSoto Avenue and Oak Avenue, will be upsized to provide additional conveyance to Sanford Avenue then north to Magnolia Street. The connection across Magnolia Street through the small retention ponds will be upgraded as well, and the small ponds are proposed to be combined into the larger wetland area to the north.
- The wetland at the east end of Campello Street, Salem Street, and Springs Street will likewise be targeted for enhancement and expansion. Easements and partial property acquisition will be obtained from private property owners (focused on the portions of the property that is undevelopable wetlands) and opportunities for enhancement and providing additional storage will be leveraged. The poorly defined ditch connection between these areas to the west of the Springs/Magnolia wetlands will be improved for better conveyance, as well as the cross drain under Brentwood Avenue.
- A cross drain will be installed across North Street into the Franklin Street wetland. This will have a control structure on the north side of the road to allow for diversion of flow to the Franklin Street wetland to relieve high stages accumulating on the north side of the road.
- Lastly, a looping connection will be established by connecting the Franklin Street wetland area and the Campello/Salem Street wetland areas along the west side of the County detention pond. This will allow for secondary relief of stages from the northeastern portion of the project area, depending on downstream stages. This will also assist in better draining the east dead ends of Campello and Salem Streets. The Franklin Street wetland will be expanded to the south for additional storage through property acquisition. A cross drain will be constructed at the east end of Campello Street to provide an equalized connection between the two areas.

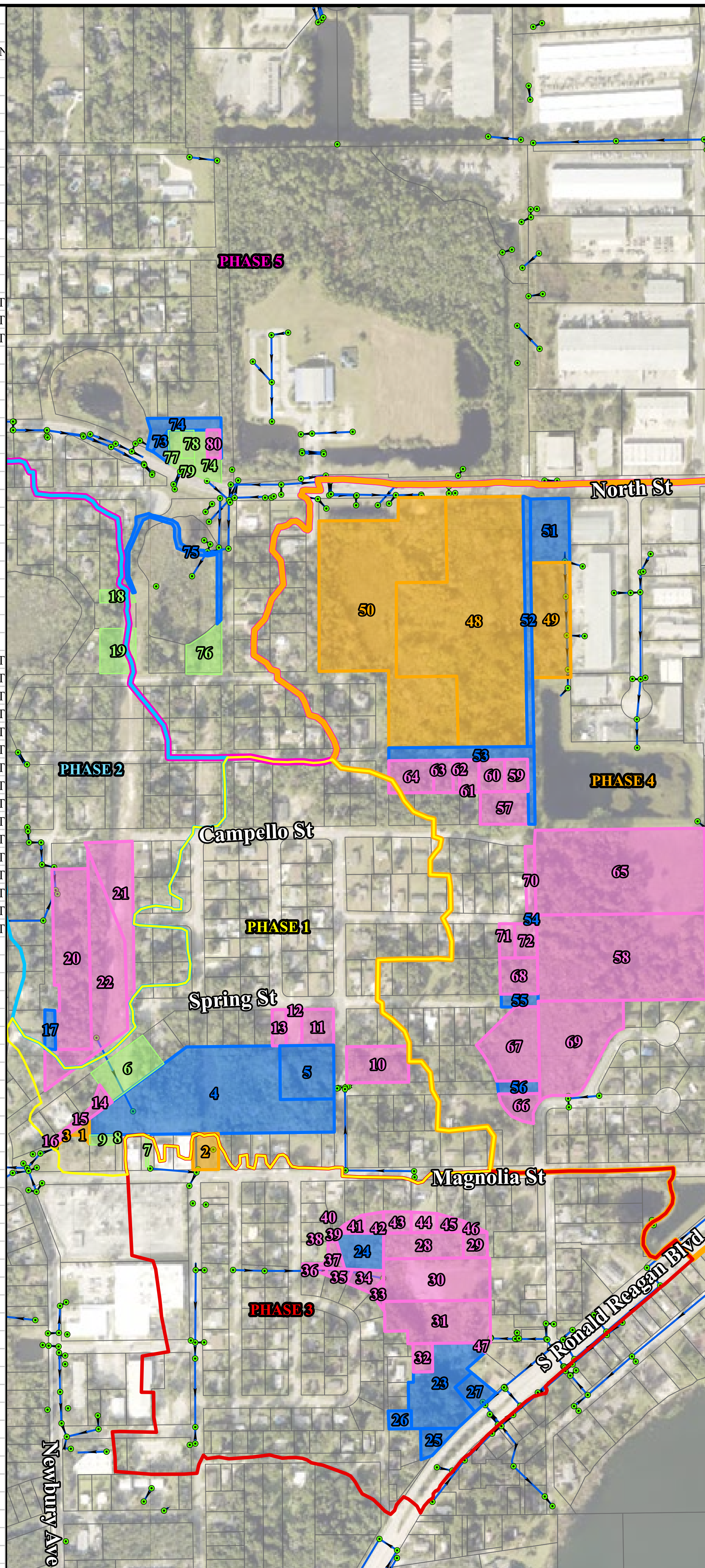
- Water quality benefits will be provided at the downstream end of the project area just upstream of the Lake Florida culvert. Here, an offline nutrient reducing biosorption activated media (BAM) filter unit is proposed to treat baseflow and seasonal storm flows before discharging to Lake Florida, which is impaired. The offline configuration will ensure flood level of service is maintained. This is in addition to the significant increase in residence time and volume in the system as a whole that will provide a significant water quality benefit to the area.
- Additional ecological benefits will be achieved through clearing areas of exotic species and restoring native species throughout the areas that are currently designated wetlands.

Due to the size of the proposed project, phasing of the improvements is proposed to streamline construction efforts and allow portions to be completed over time as funding becomes available. In total, five separate phases are proposed, and are recommended to be implemented in numerical order. The proposed improvements by phase are shown on **Figure 3**. Locations of proposed easements / property acquisition are depicted on **Figure 4**.



OUTFALL AREA
PROPOSED DBI
PROPOSED 24" RCP
GRADE ROAD ENDS TO DRAIN TO PROPOSED INLETS
PROPOSED DBI
PROPOSED 30" RCP
PROPOSED DBI
EXPAND POND FOOTPRINT FOR ADDITIONAL TREATMENT AND ATTENUATION - SAME CONTROL ELEVATION (COUNTY PARCELS, FL POWER EASEMENT PROPERTY AQUISITION)
PROPOSED 36" RCP TO EXPANDED POND
PROPOSED MANHOLE
PROPOSED 36" RCP
LAKE SEMINOLE PARK
ADD CONTROL STRUCTURE AND TRIPLE 24" RCP CROSS DRAIN TO RELIEVE STAGES NORTH OF NORTH STREET
EXPAND PONDED WETLAND FOOTPRINT FOR ADDITIONAL TREATMENT AND ATTENUATION (COUNTY PARCELS, FL POWER EASEMENT ACQUISITION)
LAKE ELAINE PARK
CLEAR AND RESTORE LAKE ELAINE SHORELINE TO REMOVE EXOTICS AND RESTORE CLEAR DRAINAGE
EXPAND PONDED WETLAND FOOTPRINT FOR ADDITIONAL TREATMENT AND ATTENUATION (COUNTY PARCELS, CITY EASEMENT, PRIVATE PROPERTY ACQUISITION)
PROPOSED 48" RCP PIPE AND INLETS
ADJUST CONTROL ELEVATION HIGHER TO RELIEVE EXISTING PIPE SYSTEM
PROPOSED 24" RCP CROSS DRAIN TO EQUALIZE STAGES BETWEEN PONDED AREAS AND DRAIN STREET
ADD CONTROL STRUCTURE AND 24" RCP TO RELIEVE STAGES BETWEEN PONDED WETLANDS
PROPOSED 48" RCP PIPE AND INLETS
CONSTRUCT CASCADING DRY DETENTION PONDS FOR ADDITIONAL TREATMENT AND ATTENUATION (COUNTY PARCELS, PRIVATE PROPERTY AQUISITION)
PROPOSED DUAL 36" RCP AND INLETS
PROPOSED DUAL 48" RCP AND INLETS
CLEAR, GRADE, AND STABILIZE DITCH CONNECTION
CLEAR, GRADE, AND STABILIZE DITCH CONNECTION
PROPOSED CONTROL WEIR
PROPOSED CONTROL WEIR
PROPOSED DUAL 48" RCP
PROPOSED CONTROL STRUCTURE
EXPAND PONDED WETLAND FOOTPRINT FOR ADDITIONAL TREATMENT AND ATTENUATION (COUNTY PARCELS, CITY AND FL POWER EASEMENT, PRIVATE PROPERTY AQUISITION)
REPLACE WITH DUAL 36" RCP
EXPAND DITCH FOOTPRINT FOR ADDITIONAL CONVEYANCE (PRIVATE PROPERTY AQUISITION)
OUTFALL AREA - SEE INSET
COMBINE SMALL PONDS WITH LARGER EXPANDED POND
REPLACE WITH 36" RCP
REPLACE WITH 30" RCP
REPLACE WITH 24" RCP
ADD CONTROL STRUCTURE AND 24" RCP TO CONTROL STAGES BETWEEN PONDED WETLANDS
EXPAND PONDED WETLAND FOOTPRINT FOR ADDITIONAL TREATMENT AND ATTENUATION (COUNTY PARCELS, FL POWER EASEMENT ACQUISITION)
LAKE FLORIDA
LAKE MOBILE
Bennett Dr
Florida Central Pkwy
W Marvin Ave
Sara St
National Pl
Lake Bennett Ct
Pineda St
Poyner Dr
North St
Adams St
Alberta St
Hobson St
Charlotte St
Freymark St
Franklin St
Francis St
Campello St
Salem St
Spring St
East St
Cadillac Ct
Continental Ct
Magnolia St
Plumosa Ave
Alpine St
Fern St
Hickory St
Mercury St
Blake St
Baron Cv
Florence Ave
Baywood St
Florida Blvd
Tropic Hill Dr
Lake Mobile Dr
S Ronald Reagan Blvd
Legend
PARCELS
PROJECT PHASES
PHASE 1
PHASE 2
PHASE 3
PHASE 4
PHASE 5
PROPOSED POND GRADING
IMPACTED STRUCTURES
Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022
N
0 125 250 500 750 1,000 Feet
Proposed Improvements Map
Salando Springs, Magnolia Street & Rolling Hills Flood and Water Quality Retrofit
Wekiva Watershed Management Plan
Seminole County, Florida
Geosyntec consultants
SEMINOLE COUNTY
Figure
3

PROPERTY ACQUISITION SUMMARY TABLE				
PHASE 1				
ID	PARCEL ID	OWNERSHIP	ACRES	TYPE OF ACQUISITION
1	1221295BD110000UB	CITY	0.0620	EASEMENT
2	1221295BD11000330	CITY	0.3214	EASEMENT
3	1221295BD110000UA	CITY	0.0245	EASEMENT
4	1221295BD110000U0	COUNTY	5.1580	N/A
5	1221295BD110000UC	COUNTY	1.0000	N/A
6	1221295BD11000130	FL POWER	0.7990	EASEMENT
7	1221295BD11000280	FL POWER	0.0382	EASEMENT
8	1221295BD11000270	FL POWER	0.0101	EASEMENT
9	1221295BD11000250	FL POWER	0.0894	EASEMENT
10	1221295BD13000110	PRIVATE	0.7709	FULL
11	1221295BD11000010	PRIVATE	0.3937	FULL
12	1221295BD11000030	PRIVATE	0.1969	FULL
13	1221295BD11000040	PRIVATE	0.1728	FULL
14	1221295BD11000180	PRIVATE	0.1328	FLOWAGE EASEMENT
15	1221295BD11000200	PRIVATE	0.0692	FLOWAGE EASEMENT
16	1221295BD11000230	PRIVATE	0.0141	FLOWAGE EASEMENT
PHASE 2				
17	NO PARCEL ID FOUND	COUNTY	0.1381	N/A
18	0121295CK760B0150	FL POWER	0.1508	EASEMENT
19	0121295CK760B0100	FL POWER	0.5638	EASEMENT
20	7213030007500000	PRIVATE	2.2061	FULL
21	7213030007200000	PRIVATE	1.1229	FULL
22	7213030007400000	PRIVATE	2.2148	FULL
PHASE 3				
23	7213030002000000	COUNTY	1.5035	N/A
24	0721305050D00021A	COUNTY	0.5541	N/A
25	072130300023B0000	COUNTY	0.2345	N/A
26	072130300020B0000	COUNTY	0.1423	N/A
27	072130300020D0000	COUNTY	0.2764	N/A
28	07213051400000 21J	PRIVATE	0.7125	FULL
29	0721305140000021C	PRIVATE	0.2081	FULL
30	7213030001400000	PRIVATE	1.5649	FULL
31	7213030001600000	PRIVATE	1.4527	FULL
32	72130300020	PRIVATE	0.1894	FLOWAGE EASEMENT
33	0721305050D000130	PRIVATE	0.0681	FLOWAGE EASEMENT
34	0721305050D000140	PRIVATE	0.2083	FLOWAGE EASEMENT
35	0721305050D000150	PRIVATE	0.0864	FLOWAGE EASEMENT
36	0721305050D000160	PRIVATE	0.0417	FLOWAGE EASEMENT
37	0721305050D000170	PRIVATE	0.1604	FLOWAGE EASEMENT
38	0721305050D000180	PRIVATE	0.0089	FLOWAGE EASEMENT
39	0721305050D00018A	PRIVATE	0.0041	FLOWAGE EASEMENT
40	0721305050D000210	PRIVATE	0.0161	FLOWAGE EASEMENT
41	0721305050D000220	PRIVATE	0.0934	FLOWAGE EASEMENT
42	0721305050D000230	PRIVATE	0.1321	FLOWAGE EASEMENT
43	0721305140000021G	PRIVATE	0.2013	FLOWAGE EASEMENT
44	0721305140000021B	PRIVATE	0.1759	FLOWAGE EASEMENT
45	0721305140000021E	PRIVATE	0.1355	FLOWAGE EASEMENT
46	0721305140000021C	PRIVATE	0.0476	FLOWAGE EASEMENT
47	072130300021A0000	PRIVATE	0.0217	FLOWAGE EASEMENT
PHASE 4				
48	0121295CK770A0010	CITY	8.1596	EASEMENT
49	072130300005K0000	CITY	1.5405	EASEMENT
50	0121295CK770A0000	CITY	7.1729	EASEMENT
51	7213030006000000	COUNTY	0.8594	N/A
52	NO PARCEL ID FOUND	COUNTY	0.5681	N/A
53	NO PARCEL ID FOUND	COUNTY	0.7901	N/A
54	NO PARCEL ID FOUND	COUNTY	0.0321	N/A
55	NO PARCEL ID FOUND	COUNTY	0.1641	N/A
56	NO PARCEL ID FOUND	COUNTY	0.1863	N/A
57	0121295CK770G0190	PRIVATE	0.5399	FULL
58	7213030001200000	PRIVATE	5.0064	FULL
59	0121295CK770G0010	PRIVATE	0.2573	FULL
60	0121295CK770G0030	PRIVATE	0.2870	FULL
61	0121295CK770G0050	PRIVATE	0.2178	FULL
62	0121295CK770G0060	PRIVATE	0.0724	FULL
63	0121295CK770G0070	PRIVATE	0.2164	FULL
64	0121295CK770G0080	PRIVATE	0.5030	FULL
65	0121295CK780A0000	PRIVATE	4.9804	FULL
66	1221295BD120000U0	PRIVATE	0.2946	FULL
67	1221295BD130000U0	PRIVATE	1.2030	FULL
68	1221295BD14000230	PRIVATE	0.4703	FULL
69	072130300011A0000	PRIVATE	2.1702	FULL
70	7213030007270000	PRIVATE	0.2187	FULL
71	072130300072A0000	PRIVATE	0.1816	FULL
72	072130300072B0000	PRIVATE	0.2609	FULL
PHASE 5				
73	0121295CK730H0050	COUNTY	0.0920	N/A
74	NO PARCEL ID FOUND	COUNTY	0.3962	N/A
75	NO PARCEL ID FOUND	COUNTY	0.3309	N/A
76	0121295CK730H0020	FL POWER	0.3227	EASEMENT
77	0121295CK760A0050	FL POWER	0.4972	EASEMENT
78	0121295CK730H0040	FL POWER	0.1244	EASEMENT
79	0121295CK730H0030	FL POWER	0.1242	EASEMENT
80	0121295CK730H0150	FL POWER	0.1053	EASEMENT
81	0121295CK730H0010	PRIVATE	0.1249	FULL



Legend

PARCELS
PIPES / CULVERTS
DRAINAGE STRUCTURES
PROPERTY ACQUISITION OWNERSHIP
CITY
COUNTY
FL POWER
PRIVATE
PROJECT PHASES
PHASE 1
PHASE 2
PHASE 3
PHASE 4
PHASE 5

0 112.5 225 450 675 900 Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Easement and Property Acquisition Summary Map

Salando Springs, Magnolia Street & Rolling Hills Flood and Water Quality Retrofit

Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure

4

Flood Benefits

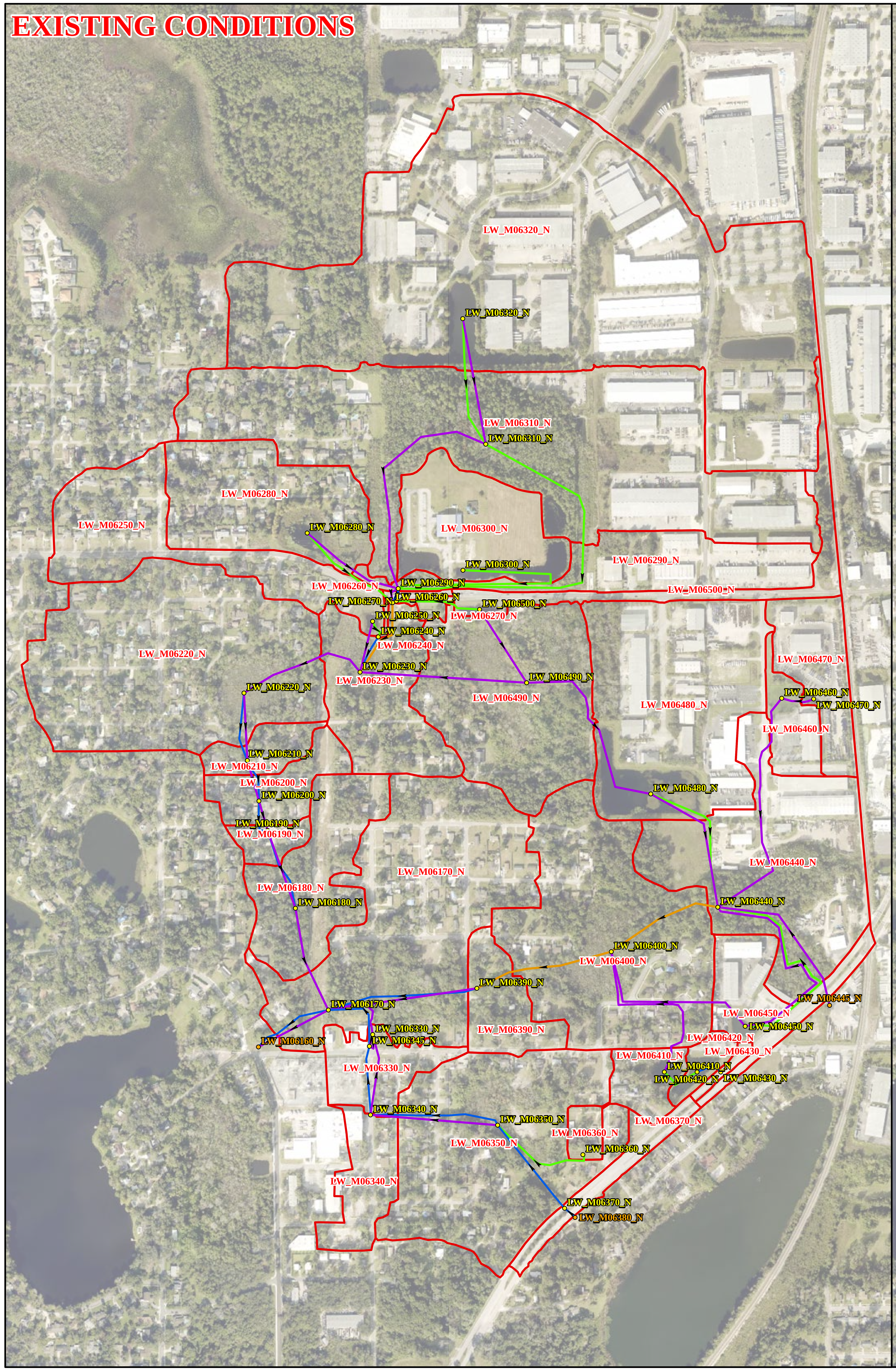
The project area was modeled conceptually, reflecting the additional storage provided by the expansion of the wetland / stormwater pond areas and the proposed drainage infrastructure upgrades. The flood benefits associated with this improvement concept are depicted in **Table 1**. As seen in **Table 1**, model results indicate that road flooding may be eliminated during the 10 year, 24 hour design storm event. Some small increases in stage are noted during the 25 year design storm, but the facilities generally meet their 10 year LOS. Similar results were observed for areas with a 25 year LOS, with nearly all areas meeting the 25 year LOS for stormwater ponds. Other ponding areas, such as Lake Elaine, generally showed a decrease in peak stages.

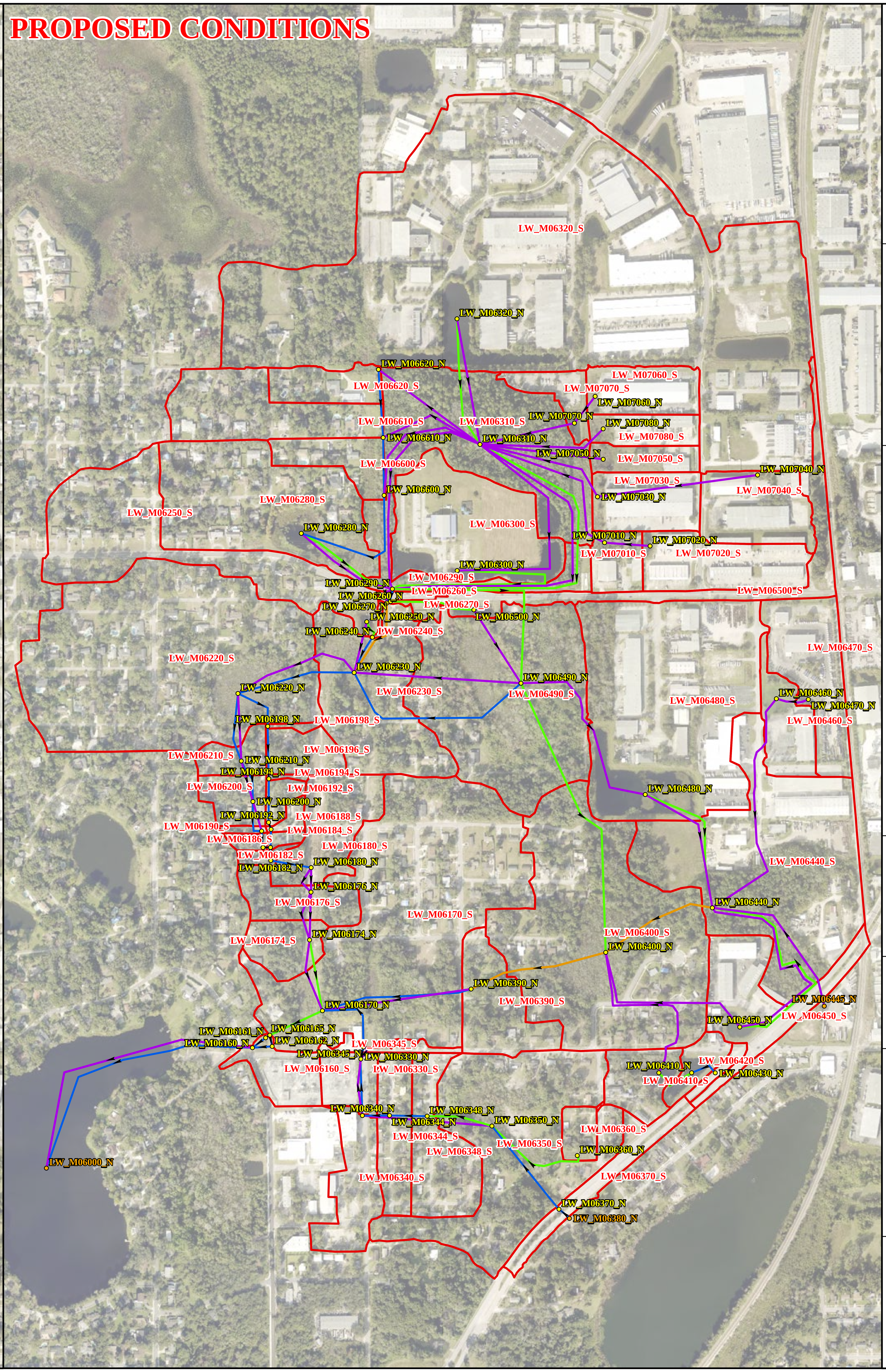
Peak stage reductions were achieved by providing additional storage at existing stormwater ponds and wetland areas, construction of new stormwater ponds, restoring and improving connectivity between the different drainage areas, upgrading existing drainage infrastructure, and constructing new drainage infrastructure.

The locations of the nodes found in **Table 1** are presented on **Figure 5** which depicts both the existing conditions and proposed conditions Node-Link model schematics.

TABLE 1 - NODE MAXIMUM CONDITIONS SUMMARY

STAGE/AREA NODE	WARNING STAGE	LOS CRITERIA	MEAN ANNUAL / 24 HOUR		10 YEAR / 24 HOUR		25 YEAR / 24 HOUR	
NAME	ELEVATION	DESIGN STORM	EXISTING PEAK STAGE (FT)	PROPOSED PEAK STAGE (FT)	EXISTING PEAK STAGE (FT)	PROPOSED PEAK STAGE (FT)	EXISTING PEAK STAGE (FT)	PROPOSED PEAK STAGE (FT)
LW_M06160_N	65.00	10 YEAR / 24 HOUR	61.68	61.49	62.84	62.10	63.38	62.29
LW_M06161_N	65.00	10 YEAR / 24 HOUR	#N/A	61.72	#N/A	63.19	#N/A	64.11
LW_M06162_N	65.00	10 YEAR / 24 HOUR	#N/A	62.00	#N/A	62.93	#N/A	63.45
LW_M06165_N	65.00	10 YEAR / 24 HOUR	#N/A	62.52	#N/A	63.77	#N/A	64.63
LW_M06170_N	68.00	LAKE / WETLAND	64.21	64.59	64.46	65.29	64.59	65.95
LW_M06174_N	72.00	10 YEAR / 24 HOUR	#N/A	66.50	#N/A	66.89	#N/A	67.27
LW_M06176_N	72.00	10 YEAR / 24 HOUR	#N/A	67.60	#N/A	67.91	#N/A	68.00
LW_M06180_N	72.00	25 YEAR / 24 HOUR	64.32	68.57	64.57	68.87	64.71	68.95
LW_M06182_N	71.50	10 YEAR / 24 HOUR	#N/A	68.64	#N/A	69.09	#N/A	69.24
LW_M06184_N	71.50	10 YEAR / 24 HOUR	#N/A	68.72	#N/A	69.40	#N/A	69.65
LW_M06186_N	71.50	10 YEAR / 24 HOUR	#N/A	68.87	#N/A	69.82	#N/A	70.25
LW_M06188_N	72.00	10 YEAR / 24 HOUR	#N/A	68.93	#N/A	70.22	#N/A	70.72
LW_M06190_N	73.50	10 YEAR / 24 HOUR	69.48	69.06	69.56	70.34	69.59	70.98
LW_M06192_N	72.50	10 YEAR / 24 HOUR	#N/A	69.33	#N/A	70.82	#N/A	71.43
LW_M06194_N	76.50	10 YEAR / 24 HOUR	#N/A	69.84	#N/A	72.29	#N/A	73.34
LW_M06196_N	77.00	10 YEAR / 24 HOUR	#N/A	71.06	#N/A	72.97	#N/A	74.16
LW_M06198_N	76.50	10 YEAR / 24 HOUR	#N/A	71.56	#N/A	74.38	#N/A	75.99
LW_M06200_N	72.50	10 YEAR / 24 HOUR	71.07	69.90	71.88	70.95	72.31	71.85
LW_M06210_N	74.50	10 YEAR / 24 HOUR	72.25	71.08	73.04	71.97	73.48	72.59
LW_M06220_N	75.00	LAKE / WETLAND	**75.89**	73.90	**77.82**	**75.78**	**78.89**	**77.06**
LW_M06230_N	76.00	LAKE / WETLAND	75.89	74.99	**77.82**	75.79	**78.89**	**77.07**
LW_M06240_N	78.00	LAKE / WETLAND	75.89	75.17	77.82	75.94	**78.89**	77.08
LW_M06250_N	78.50	25 YEAR / 24 HOUR	77.52	77.52	77.90	77.90	**78.89**	78.00
LW_M06260_N	79.50	10 YEAR / 24 HOUR	78.55	78.08	79.46	79.38	**80.01**	**80.11**
LW_M06270_N	79.50	10 YEAR / 24 HOUR	78.54	78.08	79.44	79.35	**79.98**	**80.07**





SEMINOLE COUNTY

Legend

- SUBBASINS
- ICPR NODE TYPE
  - STAGE AREA
  - TIME STAGE
- ICPR LINK TYPE
  - PIPE
  - WEIR
  - DROP STRUCTURE
  - CHANNEL

Sources:
Aerial - ESRI, 2022

Figure

5

Model Map

Salando Springs, Magnolia Street & Rolling Hills Flood and Water Quality Retrofit

Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

Pollutant Load Benefits

The average annual pollutant load discharged from the project area (subbasins LW_M02010_S, LW_M06170_S, LW_M06180_S, LW_M06190_S, LW_M06200_S, LW_M06210_S, LW_M06220_S, LW_M06230_S, LW_M06240_S, LW_M06250_S, LW_M06270_S, LW_M06280_S, LW_M06290_S, LW_M06300_S, LW_M06330_S, LW_M06350_S, LW_M06390_S, LW_M06400_S, and LW_M06490_S) was calculated as part of the Wekiva Watershed Management Plan utilizing a continuous simulation model run for a period of approximately 10 years. The pollutant load benefit for this water quality improvement concept was estimated based on engineering judgement and experience with similar types of stormwater BMP projects. The upflow media component of the offline NSBB was assigned a TN and TP removal rate of 45% based on manufacturer recommendations. The offline NSBB was assumed to treat 60% of the stormwater runoff on an average annual volumetric basis, which corresponds to a 40% bypass rate. The bypass rate accounts for high flow events when stormwater would bypass the BMP to avoid potential upstream flood stage impacts. The exact capture rate would be determined during design.

The estimated pollutant load benefit is summarized below in **Table 1**.

Table 1: Estimated Pollutant Load Benefit

Scenario	Average Annual TN Load (lb/yr)	Average Annual TP Load (lb/yr)	TN Load Removed (lb/yr)	TP Load Removed (lb/yr)	TN Load Removed over 20 Years (lb)	TP Load Removed over 20 Years (lb)
Proposed Conditions	2,138.7	261.4	577.5	70.6	11,549	1,412

Benefit Cost Analysis

Benefit cost calculations were performed in accordance with the methodology previously described. Roadway damages were determined for County maintained roads within the project area. Annual road flood damages benefits were calculated as the difference between damages in the existing and proposed conditions. Roadway ecosystem benefits were calculated in the FEMA Benefit Cost Calculator based on the project area (40.0 acres Phase 1, 28.6 acres Phase 2, 34.4 acres Phase 3, 59.4 acres Phase 4, and 45.0 acres Phase 5) and estimated percentage of urban green space within the project area (35% Phases 1, 2, 3, and 4 and 15% Phase 5). Roadways included in this assessment are listed below.

- Phase 1
  - Brentwood Avenue and East Street.
- Phase 2
  - Elaine Avenue, Fairview Avenue, Franklin Street, Freymark Street, and Seminole Avenue.
- Phase 3
  - Desoto Avenue and Plymouth Avenue.
- Phase 4
  - Cadillac Court, Continental Court, Hart Avenue, Imperial Street, and North Street.
- Phase 5
  - Alberta Street, Arden Street, Charlotte Street, Francis Street, and Stelle Avenue.

Structure benefits were calculated in the FEMA Benefit Cost Calculator and included both standard mitigation benefits (e.g., flood related damages) and social benefits (e.g., mental anguish from flooding related displacement). Structures that showed potential impacts were included in this assessment and are listed below.

- Phase 2
  - Parcel 01-21-29-5CK-760B-0050. 945 FAIRVIEW AVE ALTAMONTE SPRINGS FL 32701.
  - Parcel 01-21-29-5CK-760B-0080. 880 FRANKLIN ST ALTAMONTE SPRINGS FL 32701.
  - Parcel 01-21-29-5CK-760C-0040. 1713 ELAINE AVE ALTAMONTE SPRINGS FL 32701.
  - Parcel 01-21-29-5CK-760D-005A. 1708 ELAINE AVE ALTAMONTE SPRINGS FL 32701.
  - Parcel 01-21-29-5CK-760D-0100. 1702 ELAINE AVE ALTAMONTE SPRINGS FL 32701.

- Parcel 01-21-29-5CK-760D-0140. 1700 ELAINE AVE ALTAMONTE SPRINGS FL 32701.
- Parcel 01-21-29-5CK-760D-0210. 1718 ELAINE AVE ALTAMONTE SPRINGS FL 32701.
- Parcel 01-21-29-5CK-760D-0230. 921 CHARLOTTE ST LONGWOOD FL 32750.
- Parcel 01-21-29-5CK-760E-0040. 922 FRANKLIN ST ALTAMONTE SPRINGS FL 32701.

- Phase 4
  - Parcel 01-21-29-5CK-770B-0100. 943 STELLE AVE ALTAMONTE SPRINGS FL 32701.
  - Parcel 01-21-29-5CK-770B-0120. 790 FRANKLIN ST ALTAMONTE SPRINGS FL 32701.
  - Parcel 01-21-29-5CK-770B-0140. 770 FRANKLIN ST ALTAMONTE SPRINGS FL 32701.
  - Parcel 07-21-30-300-005H-0000. 1099 MILLER DR ALTAMONTE SPRINGS FL 32701.
- Phase 5
  - Parcel 01-21-29-5CK-760A-0030. 860 FRANKLIN ST ALTAMONTE SPRINGS FL 32701.
  - Parcel 01-21-29-5CK-770B-0100. 943 STELLE AVE ALTAMONTE SPRINGS FL 32701.
  - Parcel 01-21-29-5CK-770B-0120. 790 FRANKLIN ST ALTAMONTE SPRINGS FL 32701.

Results of the benefit cost analysis for this improvement project are summarized in **Table 2**. As seen in **Table 2**, the lifecycle benefits of the combined project exceed the estimated construction cost, resulting in a BCR of 4.36 which indicates that this project may be cost-effective.

Table 2: Benefit Cost Results for Sanlando Springs, Magnolia Street & Rolling Hills

Benefit Cost Results								
Project	Existing Conditions Road Flood Damages ($/year)	Proposed Conditions Road Flood Damages ($/year)	Road Flood Damages Benefit ($/year)	Roadway Ecosystem Benefits ($/year)	[1]Structure Total Benefits ($/year)	[2]Lifecycle Benefit ($)	[3]Estimated Construction Cost ($)	B/C Ratio
Sanlando - Phase 1	$1,919	$136	$1,783	$217,574	$0	$3,027,348	$2,470,981	1.23
Sanlando - Phase 2	$118,464	$58,599	$59,866	$155,565	$1,378,039	$21,991,475	$2,461,701	8.93
Sanlando - Phase 3	$433	$133	$300	$187,114	$0	$2,586,502	$3,158,568	0.82
Sanlando - Phase 4	$16,082	$7,113	$8,969	$323,097	$1,517,946	$25,532,017	$5,038,394	5.07
Sanlando - Phase 5	$77,001	$60,119	$16,882	$104,902	$599,030	$9,947,960	$1,325,523	7.50
Sanlando - Combined	-	-	-	-	-	$63,085,302	$14,455,167	4.36

[1]*Structure total benefits include standard mitigation benefits and social benefits as outlined in the FEMA Benefit Cost Calculator.*

[2]*Lifecycle benefit is equal to (Road Flood Damages Benefit + Road Ecosystem Benefit + Structure Total Benefits) x 13.801 to calculate the NPV of benefits over the project's lifecycle.*

[3]*Estimated construction cost is the construction cost + contingency. Does not include design and permitting or CEI services.*

Results of the benefit cost analysis including the FEMA Benefit Cost Calculator are included in the Electronic Deliverables.

Implementation Considerations

The following implementation considerations are provided for this improvement concept.

- Flood Benefit – This improvement concept provides a flood benefit by providing additional storage at existing stormwater ponds and wetland areas, construction of new stormwater ponds, restoring and improving connectivity between the different drainage areas, upgrading existing drainage infrastructure, and constructing new drainage infrastructure.
- Water Quality Benefit – This improvement provides a water quality benefit by providing treatment to the stormwater runoff prior to it discharging into Lake Florida.
- Permitting Considerations – It is anticipated that this improvement would require an individual permit from the St. Johns River Water Management District. Improvements would include temporary and permanent impacts which would require onsite or offsite mitigation.
- Engineering Design – Final engineering design should include collection of survey data, utility designation, geotechnical testing, preparation of design plans, preparation of a cost estimate, preparation of technical specifications, and utility coordination to address any needed conflict adjustments / relocations.
- Land Acquisition – Land or easement acquisition is anticipated for this improvement from private property owners. It was assumed that easements from the City and Florida Power would be donated in return for County maintenance.
- Wetland / Surface Water Impacts – Temporary and permanent wetland / surface water impacts are anticipated. Work in existing wetland areas is proposed; however, the work is aimed at wetland enhancement / restoration such as removing invasive species that that be adverse to wetland ecology.
- Benefit/Cost – The estimated NPV of the 50 year lifecycle benefits (road, structure, ecosystem services, and social) for the combined projects is $63,085,302. The estimated construction cost for the combined projects is $14,455,167, which includes construction and a 20% contingency. The resulting BCR for the combined projects is **4.36**. A detailed breakdown of the preliminary phase 1 cost estimate is provided in **Table 3a**. The preliminary cost estimates for the remaining phases are presented in **Table 3b – Table 3e**. Pollutant load removal rates on a cost basis are $197 per pound of TN and $1,608 per pound of TP based on the estimated Phase 1 construction cost plus maintenance.

Table 3a: Engineer's Estimate of Probable Improvement Costs based on Phase 1 Concept

Sanlando Springs, Magnolia Street & Rolling Hills - Phase 1						
Item	**Pay Item No.**	**Description**	**Units**	**Unit Cost**	**Quantity**	**Total**
1	101-1	Mobilization (15% of Construction Total)	LS	varies	1	$228,795
2	102-1	Maintenance of Traffic (5% of Construction Total)	LS	varies	1	$76,265
3	104-1	Prevention, Control and Abatement of Erosion and Water Pollution (5% of Construction Total)	LS	varies	1	$76,265
4	110-1-1	Clearing and Grubbing (10% of Construction Total)	LS	varies	1	$152,530
5	120-1	Regular Excavation	CY	$12.00	48500	$582,000
6	160-4	Type B Stabilization (12")	SY	$10.00	380	$3,800
7	285-704	Optional Base, Base Group 04 (6")	SY	$28.00	380	$10,640
8	334-1-13	Superpave Asphaltic Concrete, Traffic C (2")	SY	$140.00	380	$53,200
9	425-1-441	Inlets, Curb, Type J-4, <10'	EA	$21,000.00	0	$0
10	425-1-541	Inlets, Ditch Bottom, Type D, J Bottom, <10'	EA	$8,500.00	3	$25,500
11	425-1-583	Inlets, Ditch Bottom, Type H, J Bottom, <10'	EA	$11,000.00	1	$11,000
12	425-11	Modify Existing Drainage Structure	EA	$5,600.00	3	$16,800
13	425-2-71	Manhole, J-7, <10'	EA	$10,800.00	1	$10,800
14	430-175-124	Pipe Culvert, Concrete, Round, 24" S/CD	LF	$160.00	85	$13,600
15	430-175-130	Pipe Culvert, Concrete, Round, 30" S/CD	LF	$200.00	0	$0
16	430-175-136	Pipe Culvert, Concrete, Round, 36" S/CD	LF	$250.00	140	$35,000
17	430-175-148	Pipe Culvert, Concrete, Round, 48" S/CD	LF	$425.00	510	$216,750
18	570-1-2	Performance Turf, Sod	SY	$6.00	6340	$38,040
19	900-1	Nutrient Separating Baffle Box with Upflow Media Filter	EA	$185,000	1	$185,000
20	900-2	Easement / Property Acquisition	LS	varies	1	$309,667
21	900-3	Concrete Overflow Weir	EA	$10,000.00	0	$0
22	900-4	Drainage Ditch Clearing, Grading, and Stabilization	LF	$40.00	0	$0
23	900-5	Invasive Species Removal	AC	$1,500.00	9	$13,500
					SUBTOTAL COST:	$2,059,151
					CONTINGENCY (20%):	$411,830
					CONSTRUCTION SUBTOTAL:	$2,470,981
					DESIGN & PERMITTING:	$494,196
					CEI SERVICES:	$370,647
					ESTIMATED TOTAL IMPLEMENTATION COST:	**$3,335,824**

Notes:

1) *Above estimate does not include cost for potential utility relocations.*
2) *Assumes no muck or other removal of unsuitable soils.*
3) *Cost for 900-2 were obtained from the Seminole County property appraiser and were assumed to be 1.5 times the parcel value (land + buildings + features) to account for administrative costs. Assumed that City and Florida Power easements would be donated at no cost.*
4) *Design and permitting was assumed to be 20% of the construction subtotal cost based on engineering judgement.*
5) *Construction engineering and inspection (CEI) services was assumed to be 15% of the construction subtotal cost based on engineering judgement.*

Table 3b: Engineer's Estimate of Probable Improvement Costs based on Phase 2 Concept

Sanlando Springs, Magnolia Street & Rolling Hills - Phase 2						
Item	**Pay Item No.**	**Description**	**Units**	**Unit Cost**	**Quantity**	**Total**
1	101-1	Mobilization (15% of Construction Total)	LS	varies	1	$227,935
2	102-1	Maintenance of Traffic (5% of Construction Total)	LS	varies	1	$75,978
3	104-1	Prevention, Control and Abatement of Erosion and Water Pollution (5% of Construction Total)	LS	varies	1	$75,978
4	110-1-1	Clearing and Grubbing (10% of Construction Total)	LS	varies	1	$151,957
5	120-1	Regular Excavation	CY	$12.00	25300	$303,600
6	160-4	Type B Stabilization (12")	SY	$10.00	2000	$20,000
7	285-704	Optional Base, Base Group 04 (6")	SY	$28.00	2000	$56,000
8	334-1-13	Superpave Asphaltic Concrete, Traffic C (2")	SY	$140.00	2000	$280,000
9	425-1-441	Inlets, Curb, Type J-4, <10'	EA	$21,000.00	0	$0
10	425-1-541	Inlets, Ditch Bottom, Type D, J Bottom, <10'	EA	$8,500.00	7	$59,500
11	425-1-583	Inlets, Ditch Bottom, Type H, J Bottom, <10'	EA	$11,000.00	1	$11,000
12	425-11	Modify Existing Drainage Structure	EA	$5,600.00	4	$22,400
13	425-2-71	Manhole, J-7, <10'	EA	$10,800.00	0	$0
14	430-175-118	Pipe Culvert, Concrete, Round, 24" S/CD	LF	$160.00	0	$0
15	430-175-130	Pipe Culvert, Concrete, Round, 30" S/CD	LF	$200.00	0	$0
16	430-175-136	Pipe Culvert, Concrete, Round, 36" S/CD	LF	$250.00	440	$110,000
17	430-175-148	Pipe Culvert, Concrete, Round, 48" S/CD	LF	$425.00	775	$329,375
18	570-1-2	Performance Turf, Sod	SY	$6.00	15560	$93,360
19	900-1	Nutrient Separating Baffle Box with Upflow Media Filter	EA	$185,000	0	$0
20	900-2	Easement / Property Acquisition	LS	varies	1	$206,833
21	900-3	Concrete Overflow Weir	EA	$10,000.00	2	$20,000
22	900-4	Drainage Ditch Clearing, Grading, and Stabilization	LF	$40.00	0	$0
23	900-5	Invasive Species Removal	AC	$1,500.00	5	$7,500
					SUBTOTAL COST:	$2,051,417
					CONTINGENCY (20%):	$410,283
					CONSTRUCTION SUBTOTAL:	$2,461,701
					DESIGN & PERMITTING:	$492,340
					CEI SERVICES:	$369,255
					ESTIMATED TOTAL IMPLEMENTATION COST:	**$3,323,296**

Notes:

1) *Above estimate does not include cost for potential utility relocations.*
2) *Assumes no muck or other removal of unsuitable soils.*
3) *Cost for 900-2 were obtained from the Seminole County property appraiser and were assumed to be 1.5 times the parcel value (land + buildings + features) to account for administrative costs. Assumed that City and Florida Power easements would be donated at no cost.*
4) *Design and permitting was assumed to be 20% of the construction subtotal cost based on engineering judgement.*
5) *Construction engineering and inspection (CEI) services was assumed to be 15% of the construction subtotal cost based on engineering judgement.*

Table 3c: Engineer's Estimate of Probable Improvement Costs based on Phase 3 Concept

Sanlando Springs, Magnolia Street & Rolling Hills - Phase 3						
Item	**Pay Item No.**	**Description**	**Units**	**Unit Cost**	**Quantity**	**Total**
1	101-1	Mobilization (15% of Construction Total)	LS	varies	1	$292,460
2	102-1	Maintenance of Traffic (5% of Construction Total)	LS	varies	1	$97,487
3	104-1	Prevention, Control and Abatement of Erosion and Water Pollution (5% of Construction Total)	LS	varies	1	$97,487
4	110-1-1	Clearing and Grubbing (10% of Construction Total)	LS	varies	1	$194,973
5	120-1	Regular Excavation	CY	$12.00	21000	$252,000
6	160-4	Type B Stabilization (12")	SY	$10.00	1000	$10,000
7	285-704	Optional Base, Base Group 04 (6")	SY	$28.00	1000	$28,000
8	334-1-13	Superpave Asphaltic Concrete, Traffic C (2")	SY	$140.00	1000	$140,000
9	425-1-441	Inlets, Curb, Type J-4, <10'	EA	$21,000.00	5	$105,000
10	425-1-541	Inlets, Ditch Bottom, Type D, J Bottom, <10'	EA	$8,500.00	2	$17,000
11	425-1-583	Inlets, Ditch Bottom, Type H, J Bottom, <10'	EA	$11,000.00	1	$11,000
12	425-11	Modify Existing Drainage Structure	EA	$5,600.00	7	$39,200
13	425-2-71	Manhole, J-7, <10'	EA	$10,800.00	0	$0
14	430-175-118	Pipe Culvert, Concrete, Round, 24" S/CD	LF	$160.00	520	$83,200
15	430-175-130	Pipe Culvert, Concrete, Round, 30" S/CD	LF	$200.00	415	$83,000
16	430-175-136	Pipe Culvert, Concrete, Round, 36" S/CD	LF	$250.00	40	$10,000
17	430-175-148	Pipe Culvert, Concrete, Round, 48" S/CD	LF	$425.00	0	$0
18	570-1-2	Performance Turf, Sod	SY	$6.00	1500	$9,000
19	900-1	Nutrient Separating Baffle Box with Upflow Media Filter	EA	$185,000	0	$0
20	900-2	Easement / Property Acquisition	LS	varies	1	$1,150,333
21	900-3	Concrete Overflow Weir	EA	$10,000.00	0	$0
22	900-4	Drainage Ditch Clearing, Grading, and Stabilization	LF	$40.00	0	$0
23	900-5	Invasive Species Removal	AC	$1,500.00	8	$12,000
					SUBTOTAL COST:	$2,632,140
					CONTINGENCY (20%):	$526,428
					CONSTRUCTION SUBTOTAL:	$3,158,568
					DESIGN & PERMITTING:	$473,785
					CEI SERVICES:	$315,857
					ESTIMATED TOTAL IMPLEMENTATION COST:	**$3,948,210**

Notes:

1) *Above estimate does not include cost for potential utility relocations.*
2) *Assumes no muck or other removal of unsuitable soils.*
3) *Cost for 900-2 were obtained from the Seminole County property appraiser and were assumed to be 1.5 times the parcel value (land + buildings + features) to account for administrative costs. Assumed that City and Florida Power easements would be donated at no cost.*
4) *Design and permitting was assumed to be 15% of the construction subtotal cost based on engineering judgement.*
5) *Construction engineering and inspection (CEI) services was assumed to be 10% of the construction subtotal cost based on engineering judgement.*

Table 3d: Engineer's Estimate of Probable Improvement Costs based on Phase 4 Concept

Sanlando Springs, Magnolia Street & Rolling Hills - Phase 4						
Item	**Pay Item No.**	**Description**	**Units**	**Unit Cost**	**Quantity**	**Total**
1	101-1	Mobilization (15% of Construction Total)	LS	varies	1	$466,518
2	102-1	Maintenance of Traffic (5% of Construction Total)	LS	varies	1	$155,506
3	104-1	Prevention, Control and Abatement of Erosion and Water Pollution (5% of Construction Total)	LS	varies	1	$155,506
4	110-1-1	Clearing and Grubbing (10% of Construction Total)	LS	varies	1	$311,012
5	120-1	Regular Excavation	CY	$12.00	119200	$1,430,400
6	160-4	Type B Stabilization (12")	SY	$10.00	800	$8,000
7	285-704	Optional Base, Base Group 04 (6")	SY	$28.00	800	$22,400
8	334-1-13	Superpave Asphaltic Concrete, Traffic C (2")	SY	$140.00	800	$112,000
9	425-1-441	Inlets, Curb, Type J-4, <10'	EA	$21,000.00	0	$0
10	425-1-541	Inlets, Ditch Bottom, Type D, J Bottom, <10'	EA	$8,500.00	3	$25,500
11	425-1-583	Inlets, Ditch Bottom, Type H, J Bottom, <10'	EA	$11,000.00	1	$11,000
12	425-11	Modify Existing Drainage Structure	EA	$5,600.00	0	$0
13	425-2-71	Manhole, J-7, <10'	EA	$10,800.00	0	$0
14	430-175-118	Pipe Culvert, Concrete, Round, 24" S/CD	LF	$160.00	710	$113,600
15	430-175-130	Pipe Culvert, Concrete, Round, 30" S/CD	LF	$200.00	0	$0
16	430-175-136	Pipe Culvert, Concrete, Round, 36" S/CD	LF	$250.00	0	$0
17	430-175-148	Pipe Culvert, Concrete, Round, 48" S/CD	LF	$425.00	0	$0
18	570-1-2	Performance Turf, Sod	SY	$6.00	520	$3,120
19	900-1	Nutrient Separating Baffle Box with Upflow Media Filter	EA	$185,000	0	$0
20	900-2	Easement / Property Acquisition	LS	varies	1	$1,315,000
21	900-3	Concrete Overflow Weir	EA	$10,000.00	0	$0
22	900-4	Drainage Ditch Clearing, Grading, and Stabilization	LF	$40.00	340	$13,600
23	900-5	Invasive Species Removal	AC	$1,500.00	37	$55,500
					SUBTOTAL COST:	$4,198,662
					CONTINGENCY (20%):	$839,732
					CONSTRUCTION SUBTOTAL:	$5,038,394
					DESIGN & PERMITTING:	$755,759
					CEI SERVICES:	$503,839
					ESTIMATED TOTAL IMPLEMENTATION COST:	**$6,297,993**

Notes:

1) *Above estimate does not include cost for potential utility relocations.*
2) *Assumes no muck or other removal of unsuitable soils.*
3) *Cost for 900-2 were obtained from the Seminole County property appraiser and were assumed to be 1.5 times the parcel value (land + buildings + features) to account for administrative costs. Assumed that City and Florida Power easements would be donated at no cost.*
4) *Design and permitting was assumed to be 15% of the construction subtotal cost based on engineering judgement.*
5) *Construction engineering and inspection (CEI) services was assumed to be 10% of the construction subtotal cost based on engineering judgement.*

Table 3e: Engineer's Estimate of Probable Improvement Costs based on Phase 5 Concept

Sanlando Springs, Magnolia Street & Rolling Hills - Phase 5						
Item	**Pay Item No.**	**Description**	**Units**	**Unit Cost**	**Quantity**	**Total**
1	101-1	Mobilization (15% of Construction Total)	LS	varies	1	$122,734
2	102-1	Maintenance of Traffic (5% of Construction Total)	LS	varies	1	$40,911
3	104-1	Prevention, Control and Abatement of Erosion and Water Pollution (5% of Construction Total)	LS	varies	1	$40,911
4	110-1-1	Clearing and Grubbing (10% of Construction Total)	LS	varies	1	$81,822
5	120-1	Regular Excavation	CY	$12.00	18100	$217,200
6	160-4	Type B Stabilization (12")	SY	$10.00	200	$2,000
7	285-704	Optional Base, Base Group 04 (6")	SY	$28.00	200	$5,600
8	334-1-13	Superpave Asphaltic Concrete, Traffic C (2")	SY	$140.00	200	$28,000
9	425-1-441	Inlets, Curb, Type J-4, <10'	EA	$21,000.00	0	$0
10	425-1-541	Inlets, Ditch Bottom, Type D, J Bottom, <10'	EA	$8,500.00	5	$42,500
11	425-1-583	Inlets, Ditch Bottom, Type H, J Bottom, <10'	EA	$11,000.00	1	$11,000
12	425-11	Modify Existing Drainage Structure	EA	$5,600.00	0	$0
13	425-2-71	Manhole, J-7, <10'	EA	$10,800.00	1	$10,800
14	430-175-118	Pipe Culvert, Concrete, Round, 24" S/CD	LF	$160.00	595	$95,200
15	430-175-130	Pipe Culvert, Concrete, Round, 30" S/CD	LF	$200.00	335	$67,000
16	430-175-136	Pipe Culvert, Concrete, Round, 36" S/CD	LF	$250.00	355	$88,750
17	430-175-148	Pipe Culvert, Concrete, Round, 48" S/CD	LF	$425.00	0	$0
18	570-1-2	Performance Turf, Sod	SY	$6.00	37240	$223,440
19	900-1	Nutrient Separating Baffle Box with Upflow Media Filter	EA	$185,000	0	$0
20	900-2	Easement / Property Acquisition	LS	varies	1	$333
21	900-3	Concrete Overflow Weir	EA	$10,000.00	0	$0
22	900-4	Drainage Ditch Clearing, Grading, and Stabilization	LF	$40.00	660	$26,401
23	900-5	Invasive Species Removal	AC	$1,500.00	0	$0
SUBTOTAL COST:						$1,104,603
CONTINGENCY (20%):						$220,921
CONSTRUCTION SUBTOTAL:						$1,325,523
DESIGN & PERMITTING:						$198,828
CEI SERVICES:						$132,552
ESTIMATED TOTAL IMPLEMENTATION COST:						**$1,656,904**

Notes:

1) *Above estimate does not include cost for potential utility relocations.*
2) *Assumes no muck or other removal of unsuitable soils.*
3) *Cost for 900-2 were obtained from the Seminole County property appraiser and were assumed to be 1.5 times the parcel value (land + buildings + features) to account for administrative costs. Assumed that City and Florida Power easements would be donated at no cost.*
4) *Design and permitting was assumed to be 15% of the construction subtotal cost based on engineering judgement.*
5) *Construction engineering and inspection (CEI) services was assumed to be 10% of the construction subtotal cost based on engineering judgement.*

The information provided herein in considered to be preliminary for project planning purposes. As noted previously, design level efforts including detailed modeling will be necessary to quantify pumping rates, confirm flood stages, confirm pollutant load reductions, etc.

Conclusions

The proposed project is to restore more efficient connections to drain the area consistently to the southwest. Opportunities are proposed to obtain additional storage for waterbody/wetland areas though leveraging County/City property and working with private property owners for easements in unusable portions of their properties. The objective is to eliminate or at least significantly reduce the incidence of flooding that impacts residential properties.

This project will provide a flood benefit by providing additional storage and improving the conveyance of stormwater runoff throughout the project area and ultimately to the Lake Florida outfall.

- It is anticipated that the project area would achieve a 10 year, 24 hour design storm level of service (LOS) for roadway infrastructure and a 25 year, 24 hour design storm LOS for storage areas with the proposed improvements. This represents a LOS improvement from D to A.

The nutrient load reduction via the improvements over the 20 year expected life is estimated below:

- TN mass removed = 11,549 lbs.
- TP mass removed = 1,412 lbs.

The project benefit/cost from a pollutant load reduction perspective was determined to be:

- $197 per lb of TN.
- $1,608 per lb of TP.

It is noted that the project cost for the pollutant loading benefits was based on the construction cost, contingency, and maintenance. As noted previously, as additional phases are implemented, the estimated benefit cost should be revisited.

Estimated probable improvement costs for all phases is summarized below. These costs include construction, contingency, design and permitting, CEI services, and estimated annual maintenance costs.

Project Improvement Phase	Estimated Implementation Cost
Phase 1	$3,335,824
Phase 2	$3,323,296
Phase 3	$3,948,210
Phase 4	$6,297,993
Phase 5	$1,656,904
TOTAL	**$18,562,227**

Results of the benefit cost analysis are summarized below for all phases and the overall combined project. Results indicate that some of the phases may be more cost effective than others; however, the overall combined project may be cost effective.

Project Improvement Phase	BCR
Phase 1	1.23
Phase 2	8.93
Phase 3	0.82
Phase 4	5.07
Phase 5	7.50
COMBINED	**4.36**

Based on the foregoing, Geosyntec recommends that the County pursue design of this flooding and water quality improvement for the anticipated benefits.

Flooding and Water Quality Focused Project

Bear Lake Woods

Flood and Water Quality Improvement Alternatives Analysis

Bear Lake Woods Area

Wekiva Watershed Management Plan

Seminole County, Florida

The purpose of this flood and water quality improvement concept is to provide drainage and conveyance improvements to improve flood management in the project area as well as add water quality treatment to priority subbasin areas. The area is a mix of older developments including the Bear Lake Woods subdivision, which includes Jessica Drive, Bent Arrow Cove, Beaver Cove, Longfellow Place, and Mountbatten Cove, and the residential area immediately to the west south of Brenda Drive along Junior, Via Palma, Florence, and Sombrero Avenues.

The project area is shown on **Figure 1**. A topographical map is included on **Figure 2**. Photographs of the project area are included on the following pages.

<u>Existing Conditions</u>

Previous flooding had been noted associated with Jessica Avenue during Hurricane Irma (see **Figure 1**). Also, hydrologic and hydraulic modeling has indicated roadway level of service deficiencies in the area on Jessica Avenue, Beaver Cove, and Longfellow Place and potential structural flooding near the western areas and therefore was classified as LOS C and D.

The Bear Lake Woods Phase 2 (western portion) drains through storm sewer to a detention pond along the south edge of the development at the ends of Jessica Drive, Bent Arrow Cove, and Beaver Court. According to plans this was designed as a detention pond with underdrain system but based on review of historical areas appears to be consistently wet so possibly the underdrains are no longer functioning. This pond has a controlled outfall using a diversion structure with a high level weir that allows it to pop off to the east along Jessica Drive and convey the outfall to the other subdivision pond then to Little Bear Lake. Comparison of recent project topographical information and the construction plans indicated that storage in this pond may have decreased over time due to vegetation and slope erosion.

Bear Lake Woods Phase 1 (eastern portion) drains through storm sewer to a detention pond at the east end of the development. This outfalls to a ditch on the south side of Jessica Drive, then passes under a cross drain to a ditch that leads to Little Bear Lake. The upstream side of the cross drain also accepts outfall from another subdivision to the south.

The subdivision areas along Junior, Via Palma, Florence, and Sombrero Avenues to the west of Bear Lake Woods do not have an outfall, but generally drain to the south to a poorly defined ditch area that is along the north and east boundaries of the Freightliner private property to the south. The roadside drainage in the subdivision is not well defined, with some mix of poorly graded swales and side drains. When the ditch areas stage up sufficiently, it would overtop and drain towards the Bear Lake Woods Phase 2 detention pond to the east. Based on watershed modeling, this area can stage up and contribute significant overland flow to the Bear Lake Woods Phase 2 pond.

The western portions of the project area predate modern stormwater regulations and do not have purposed water quality treatment facilities. The subbasin LW_Q00740_S that contains the Freightliner site was identified as a top 10 pollutant load contributor based on the watershed modeling. The subbasin LW_Q00730_S contributing area to the north was identified in the top 20 top pollutant load contributors.

View to west along Jessica Drive near outfall to Little Bear Lake (on right) (Google 2019)

View to south along Beaver Cove, retention are beyond wall in background (Google 2019)

View from Jessica Drive towards proposed outfall location for retention pond (Google 2019)

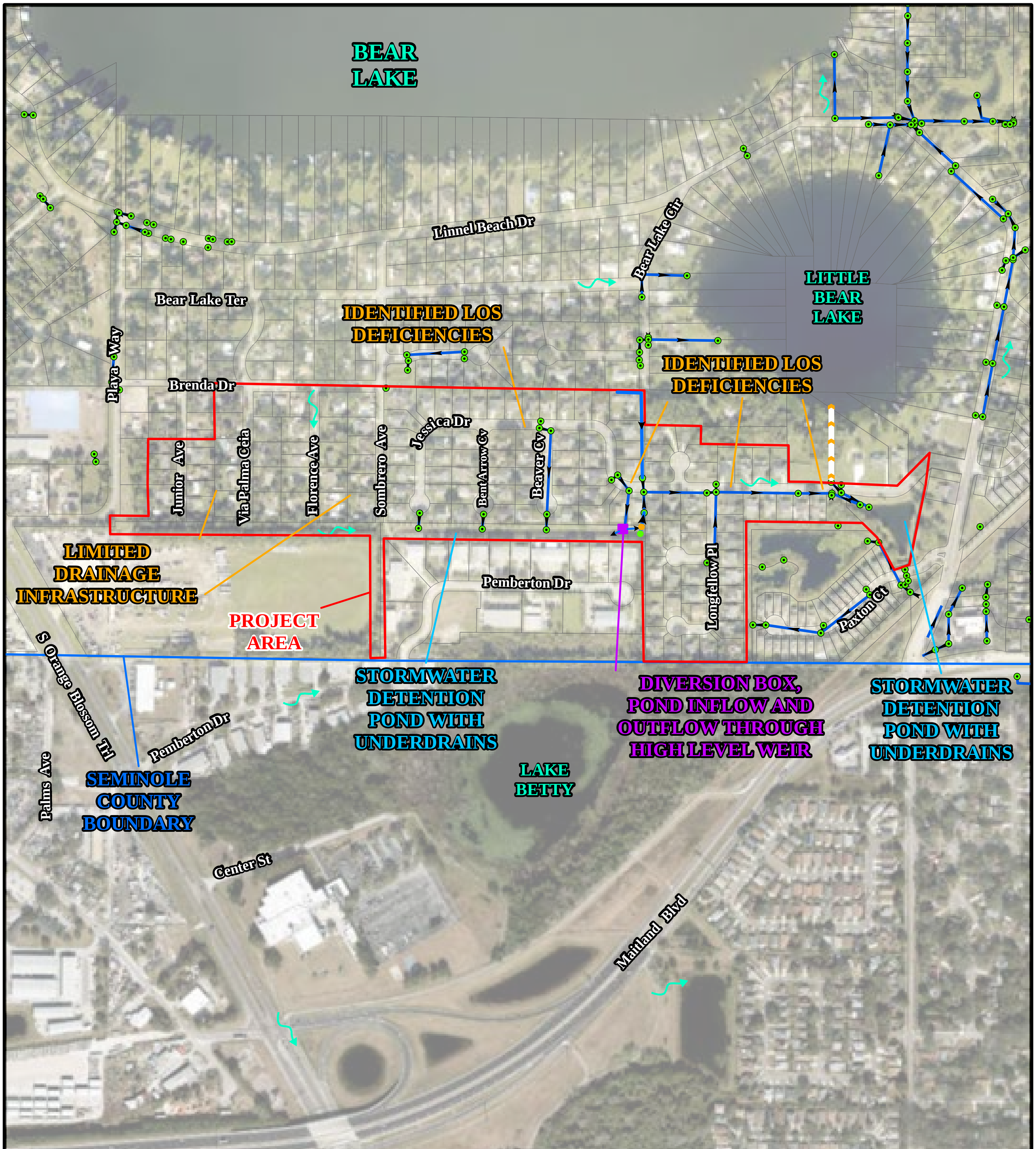
View to west of Bear Lake Woods, retention area on left (Google 2023)

View to south along Via Palma Ceia towards drainage ditch area (Google 2019)

View to south along Junior Avenue (Google 2019)

View to south along Sombrero Avenue, Bear Lake Woods retention pond in background (Google 2019)

View to northeast of Freightliner property and overgrown ditch areas along the residential street to the north (Google 2019)



N

Legend

PARCELS

PIPES / CULVERTS

DRAINAGE STRUCTURES

0 175 350 700 1,050 1,400 Feet

Sources:
Parcels, Infrastructure, County Boundary - Seminole County, 2022
Aerial - ESRI, 2022

Site Map

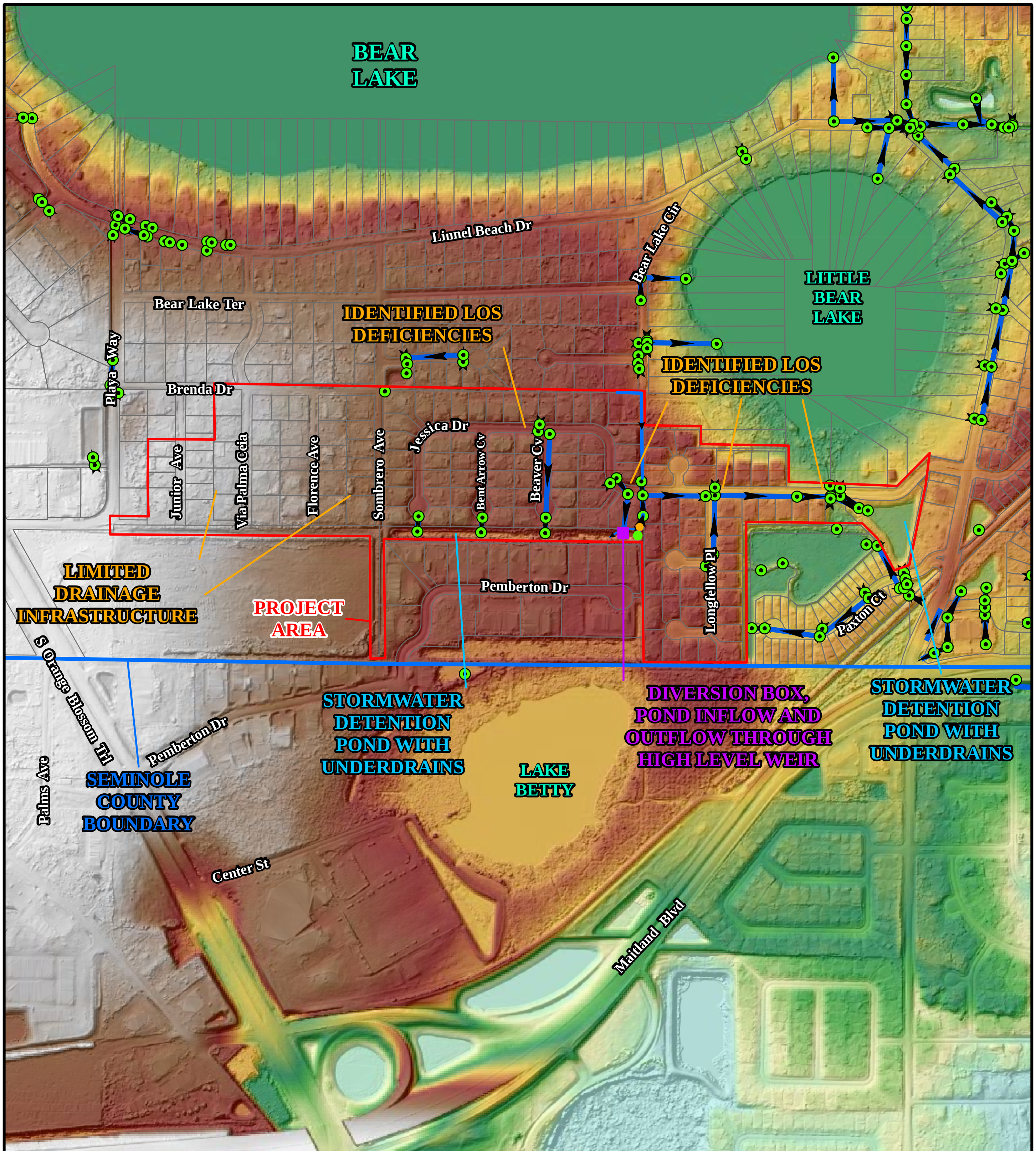
Bear Lake Woods
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

Seminole County

Figure

1



N

Legend

PARCELS

PIPES / CULVERTS

DRAINAGE STRUCTURES

DEM

FEET NAVD 1988

68.47

38.6

0 175 350 700 1,050 1,400

Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022
DEM - USGS LIDAR, 2018

Topographical Map

Bear Lake Woods

Wekiva Watershed Management Plan

Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure

2

Proposed Improvements

From a flooding standpoint, the proposed project is to gain some conveyance and storage efficiency Bear Lake Woods system to help address level of service issues. The following is proposed:

- Recommend maintenance dredge of the Bear Lake Phase 2 detention pond area to restore design slopes and storage.

Improvements noted below for water quality will also eliminate the overtopping of flow from the west areas to the Bear Lake Woods Phase 2 pond.

From a water quality standpoint, the proposed project is to provide water quality treatment to an older untreated subdivision area. The following is proposed:

- Proposed project is to construct a defined linear retention area along the shared border with the Freightliner Property replacing the current poorly defined ditch. This will require obtaining and easement from that property.
- The four streets to the north will be regraded with consistent drainage swales to the south to the new retention area. The swale along the back of the commercial area to the southwest of this area that currently overtops into this area will also be regraded to this new retention area.
- BAM media side bank and/or pond bottom filters will be used to provide additional treatment prior to infiltration.
- A controlled high level outfall will be configured to replace the current high stage overland pop off to the Bear Lake Woods Phase 2 detention pond area to the east.

The proposed improvements are depicted conceptually in **Figure 3**.


BEAR LAKE
CUB LAKE
LITTLE BEAR LAKE
LAKE BETTY
Linnel Beach Dr
Bear Lake Cir
Bear Lake Rd
Bear Lake Ter
Via Palma Ceia
Playa Way
Sombrero Ave
Courtney Cv
Ardele Ct
Brenda Dr
Junior Ave
Florence Ave
Jessica Dr
Bent Arrow Cv
Beaver Cv
Pineview Way
Don Mar St
W Paulinda Ave
Pepper Brunch Cv
Black Willow Trl
Center St
S Orange Blossom Trail
Pemberton Dr
Banks View Cir
Maitland Blvd
Rywood Dr
GRADE SWALES TO SOUTH
GRADE SWALE ON SOMBRERO AVE TO NEW DETENTION POND AT ELEV. 117'
GRADE SWALES TO DBI'S AT SOUTH ENDS OF JUNIOR AVE, VIA PALMA CEIA, AND FLORENCE AVE, PIPE TO PROPOSED POND WITH 24" RCP
HIGH LEVEL OUTFALL ELEV. 117.5'
PROPOSED 18" RCP PIPE
RESTORE POND RE-ESTABISH POND BOTTOM OF 109' AND 6:1 DESIGNED SIDE SLOPES TO 114.5'. INSPECT AND REPLACE UNDERDRAINS AS NEEDED
DETENTION POND WITH BAM TREATMENT MEDIA BOTTOM 110', 4:1 SIDE SLOPES TO ELEV. 118' THEN MATCH EXISTING GRADE. OBTAIN EASEMENT FROM PRIVATE PROPERTY
GRADE SWALE ALONG BACK OF BUSINESSES ALONG PEMBERTON DR TO NEW DETENTION POND AT ELEV. 117'
PROJECT AREA
Legend
PARCELS
COUNTY BOUNDARY
EXISTING PIPES / CULVERTS
EXISTING DRAINAGE STRUCUTRES
IMPACTED STRUCTURES
Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022
N
0 55 110 220 330 440
Feet
Proposed Improvements
Bear Lake Woods
Wekiva Watershed Management Plan
Seminole County, Florida
Geosyntec consultants
SEMINOLE COUNTY
Figure
3

Flood Benefits

The project area was modeled conceptually, reflecting the additional storage provided by the proposed pond improvements and the drainage infrastructure upgrades. The flood benefits associated with this improvement concept are depicted in **Table 1**. As seen in **Table 1**, model results indicate that road flooding may be eliminated during the 10 year, 24 hour design storm event. Ponding areas meet the respective 25 year criteria as well, except for the ponded area on the southeast corner of the Freightliners property which although it does not meet a 25 year LOS, the proposed stage is less than existing.

Peak stage reductions were achieved by creating a retention pond (west area) to attenuate stormwater runoff generated from Junior Avenue, Via Palma Ceia, Florence Avenue, and Sombrero Avenue. Results from the existing conditions assessment indicated that overland flow from this area to the east was contributing to the LOS deficiencies observed in the Bear Lake Woods Phase 2 detention pond. Restoration of the Bear Lake Woods Phase 2 pond to design conditions also resulted in additional flood storage which aided in addressing road flooding and LOS deficiencies. By better managing the runoff in the Bear Lake Woods Phase 2 area, flooding in the Bear Lake Woods Phase 1 area was reduced.

The locations of the nodes found in **Table 1** are presented on **Figure 4** which depicts both the existing conditions and proposed conditions Node-Link model schematics.

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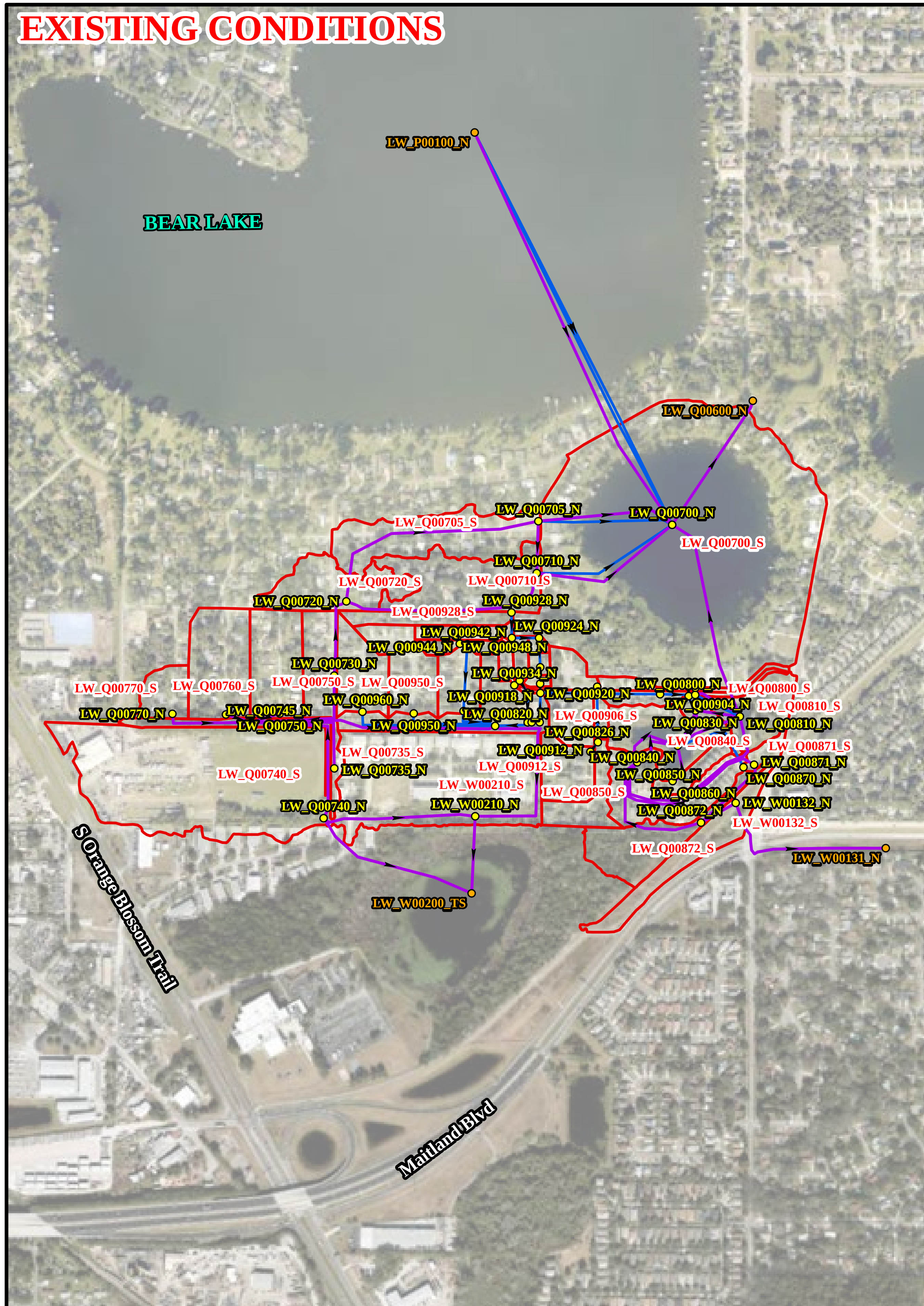
TABLE 1 - NODE MAXIMUM CONDITIONS SUMMARY

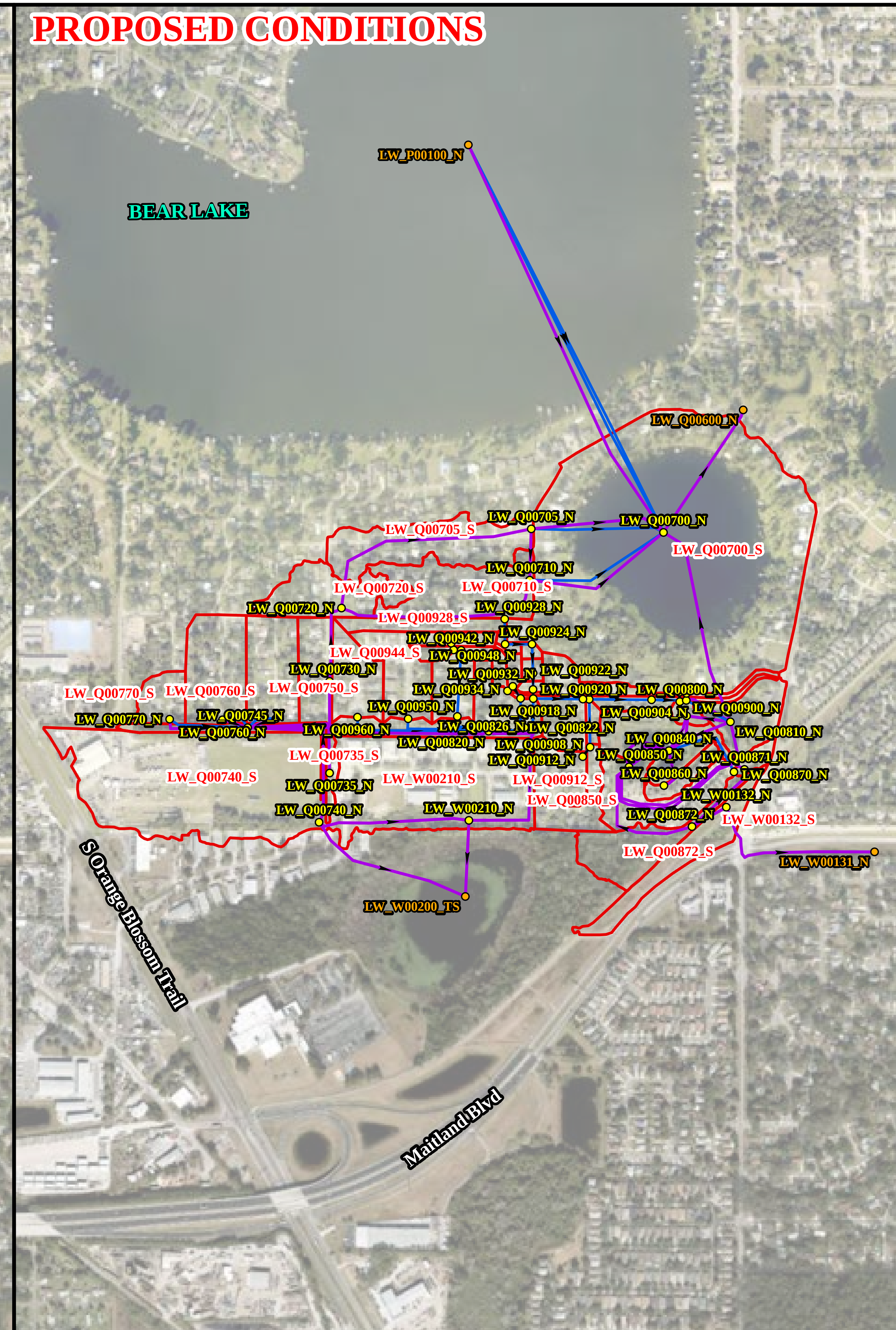
STAGE/AREA NODE	WARNING STAGE	LOS CRITERIA	MEAN ANNUAL / 24 HOUR		10 YEAR / 24 HOUR		25 YEAR / 24 HOUR	
NAME	ELEVATION	DESIGN STORM	EXISTING PEAK STAGE (FT)	PROPOSED PEAK STAGE (FT)	EXISTING PEAK STAGE (FT)	PROPOSED PEAK STAGE (FT)	EXISTING PEAK STAGE (FT)	PROPOSED PEAK STAGE (FT)
LW_Q00730_N	117.50	10 YEAR / 24 HOUR	**118.42**	116.89	**118.58**	116.95	**118.66**	117.00
LW_Q00735_N	118.00	N/A	**118.43**	116.96	**118.58**	117.02	**118.66**	117.05
LW_Q00740_N	117.50	25 YEAR / 24 HOUR	**118.56**	116.68	**118.62**	**117.89**	**118.67**	**118.32**
LW_Q00745_N	118.00	25 YEAR / 24 HOUR	**118.42**	113.15	**118.58**	114.31	**118.65**	116.65
LW_Q00750_N	119.00	10 YEAR / 24 HOUR	118.98	115.00	**119.03**	115.29	**119.07**	116.65
LW_Q00760_N	122.50	10 YEAR / 24 HOUR	121.65	118.03	121.71	118.37	121.74	118.60
LW_Q00770_N	125.00	10 YEAR / 24 HOUR	124.49	120.53	124.52	120.70	124.53	120.81
LW_Q00800_N	108.00	10 YEAR / 24 HOUR	104.79	103.46	105.89	104.17	106.64	104.65
LW_Q00805_N	108.00	10 YEAR / 24 HOUR	103.46	103.31	104.13	103.88	104.99	104.65
LW_Q00810_N	108.50	25 YEAR / 24 HOUR	107.67	106.79	107.84	107.31	107.93	107.60
LW_Q00820_N	115.00	25 YEAR / 24 HOUR	114.03	110.87	114.49	111.84	114.68	112.70
LW_Q00822_N	115.00	N/A	113.77	110.87	114.11	111.84	114.27	112.70
LW_Q00824_N	115.00	N/A	110.82	107.13	112.78	107.79	113.07	108.61
LW_Q00826_N	114.00	N/A	110.26	107.11	112.00	107.79	112.29	108.61
LW_Q00900_N	108.00	10 YEAR / 24 HOUR	107.84	106.79	**108.17**	107.34	**108.29**	107.68
LW_Q00902_N	108.00	10 YEAR / 24 HOUR	107.84	106.79	**108.17**	107.35	**108.30**	107.71
LW_Q00904_N	108.00	10 YEAR / 24 HOUR	**108.18**	106.79	**108.79**	107.43	**108.96**	107.96
LW_Q00906_N	108.50	10 YEAR / 24 HOUR	**108.77**	106.80	**109.78**	107.76	**110.07**	**108.58**
LW_Q00908_N	109.50	10 YEAR / 24 HOUR	108.77	106.80	**109.79**	107.98	**110.07**	108.95
LW_Q00912_N	109.00	10 YEAR / 24 HOUR	108.77	106.80	**109.79**	108.08	**110.08**	**109.11**
LW_Q00914_N	108.50	10 YEAR / 24 HOUR	**108.77**	106.80	**109.78**	107.77	**110.07**	**108.59**
LW_Q00916_N	108.50	10 YEAR / 24 HOUR	**108.89**	106.80	**109.99**	107.78	**110.29**	**108.60**
LW_Q00918_N	111.50	10 YEAR / 24 HOUR	109.33	107.11	110.72	107.79	111.02	108.61
LW_Q00920_N	110.00	10 YEAR / 24 HOUR	109.85	109.85	**110.90**	109.96	**111.22**	**110.02**
LW_Q00922_N	111.00	N/A	110.65	110.65	**111.44**	110.96	**111.76**	**111.10**

Geosyntec consultants

TABLE 1 - NODE MAXIMUM CONDITIONS SUMMARY

STAGE/AREA NODE	WARNING STAGE	LOS CRITERIA	MEAN ANNUAL / 24 HOUR		10 YEAR / 24 HOUR		25 YEAR / 24 HOUR	
NAME	ELEVATION	DESIGN STORM	EXISTING PEAK STAGE (FT)	PROPOSED PEAK STAGE (FT)	EXISTING PEAK STAGE (FT)	PROPOSED PEAK STAGE (FT)	EXISTING PEAK STAGE (FT)	PROPOSED PEAK STAGE (FT)
LW_Q00924_N	111.00	N/A	**111.63**	**111.63**	**112.34**	**112.19**	**112.64**	**112.40**
LW_Q00926_N	113.50	N/A	112.40	112.40	113.25	113.23	**113.57**	**113.52**
LW_Q00928_N	113.50	N/A	112.97	112.97	**114.04**	**114.04**	**114.44**	**114.44**
LW_Q00930_N	112.50	10 YEAR / 24 HOUR	**113.77**	112.39	**114.11**	112.39	**114.27**	**112.70**
LW_Q00932_N	113.00	10 YEAR / 24 HOUR	**113.77**	112.39	**114.11**	112.39	**114.27**	112.70
LW_Q00934_N	113.00	10 YEAR / 24 HOUR	**113.77**	112.39	**114.11**	112.39	**114.28**	112.70
LW_Q00940_N	115.00	10 YEAR / 24 HOUR	114.03	110.87	114.46	111.84	114.65	112.70
LW_Q00942_N	113.50	10 YEAR / 24 HOUR	**114.03**	110.87	**114.43**	111.84	**114.60**	112.71
LW_Q00944_N	113.00	10 YEAR / 24 HOUR	**114.03**	110.87	**114.43**	111.84	**114.60**	112.71
LW_Q00948_N	113.50	10 YEAR / 24 HOUR	**114.03**	110.99	**114.43**	111.84	**114.60**	112.71
LW_Q00950_N	115.00	10 YEAR / 24 HOUR	114.03	110.87	114.50	111.84	114.69	112.70
LW_Q00960_N	115.00	10 YEAR / 24 HOUR	114.03	110.87	114.50	111.84	114.69	112.70





SEMINOLE COUNTY

N

0 205 410 820
Feet

Legend

SUBBASINS

ICPR NODE TYPE

STAGE AREA

TIME STAGE

ICPR LINK TYPE

PIPE

WEIR

Sources:
Aerial - ESRI, 2022

Figure
4

Model Map

Bear Lake Woods

Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec
consultants

Pollutant Load Benefits

The average annual pollutant load discharged from the project area (subbasins LW_Q00730_S and LW_Q00740_S) was calculated as part of the Wekiva Watershed Management Plan utilizing a continuous simulation model run for a period of approximately 10 years. The pollutant load benefit for this water quality improvement concept was estimated based on engineering judgement and experience with similar types of stormwater BMP projects. The roadside drainage swales in combination with the stormwater retention pond were assumed to capture 90% of the stormwater runoff on a volumetric basis, which corresponds to a 10% bypass rate. The bypass rate accounts for high flow events when stormwater would bypass the retention pond filter media to avoid potential upstream flood stage impacts. The exact capture rate would be determined during design. Stormwater runoff captured and infiltrated within the retention pond was assumed to have a TN and TP removal rate of 100%.

The estimated pollutant load benefit is summarized below in **Table 2**.

Table 2: Estimated Pollutant Load Benefit

Scenario	Average Annual TN Load (lb/yr)	Average Annual TP Load (lb/yr)	TN Load Removed (lb/yr)	TP Load Removed (lb/yr)	TN Load Removed over 20 Years (lb)	TP Load Removed over 20 Years (lb)
Proposed Conditions	538.5	79.8	484.6	71.8	9692	1436

Benefit Cost Analysis

Benefit cost calculations were performed in accordance with the methodology previously described. Roadway damages were determined for County maintained roads within the project area. Annual road flood damages benefits were calculated as the difference between damages in the existing and proposed conditions. Roadway ecosystem benefits were calculated in the FEMA Benefit Cost Calculator based on the project area (8.0 acres) and estimated percentage of urban green space within the project area (10%). Roadways included in this assessment are listed below.

- Beaver Cove, Bent Arrow Cove, Courtney Cove, Jessica Drive, Longfellow Place, Mountbatten Cove, Pemberton Drive, Redfish Cove, and Sombrero Avenue.

Structure benefits were calculated in the FEMA Benefit Cost Calculator and included both standard mitigation benefits (e.g., flood related damages) and social benefits (e.g., mental anguish from flooding related displacement). Structures that showed potential impacts were included in this assessment and are listed below.

- Parcel 19-21-29-507-0A00-0030. 5724 BEAR LAKE CIR APOPKA FL 32703.
- Parcel 19-21-29-509-0000-0100. 9616 BEAR LAKE RD APOPKA FL 32703.
- Parcel 19-21-29-5LZ-0000-0260. 5998 MOUNTBATTEN CV APOPKA FL 32703.
- Parcel 19-21-29-5LZ-0000-0320. 5997 JESSICA DR APOPKA FL 32703.
- Parcel 19-21-29-5LZ-0000-0330. 9300 REDFISH CV APOPKA FL 32703.
- Parcel 19-21-29-516-0000-0030. 2682 PEMBERTON DR APOPKA FL 32703.

Results of the benefit cost analysis for this improvement project are summarized in **Table 3**. As seen in **Table 3**, the lifecycle benefits of the project exceed the estimated construction cost, resulting in a BCR of 2.94 which indicates that this project may be cost-effective.

Table 3: Benefit Cost Results for Bear Lake Woods Area

Benefit Cost Results								
Project	Existing Conditions Road Flood Damages ($/year)	Proposed Conditions Road Flood Damages ($/year)	Road Flood Damages Benefit ($/year)	Roadway Ecosystem Benefits ($/year)	[1]Structure Total Benefits ($/year)	[2]Lifecycle Benefit ($)	[3]Estimated Construction Cost ($)	B/C Ratio
Bear Lake Woods	$296,353	$25,756	$270,596	$12,433	$151,066	$5,990,949	$2,035,822	2.94

[1]*Structure total benefits include standard mitigation benefits and social benefits as outlined in the FEMA Benefit Cost Calculator.*

[2]*Lifecycle benefit is equal to (Road Flood Damages Benefit + Road Ecosystem Benefit + Structure Total Benefits) x 13.801 to calculate the NPV of benefits over the project's lifecycle.*

[3]*Estimated construction cost is the construction cost + contingency. Does not include design and permitting or CEI services.*

Results of the benefit cost analysis including the FEMA Benefit Cost Calculator are included in the Electronic Deliverables.

Implementation Considerations

The following implementation considerations are provided for this improvement concept.

- Flood Benefit – This improvement concept provides a flood benefit to the project area by increasing flood attenuation volume and improving drainage conveyance which mitigated the overland flows observed in the existing conditions. A LOS improvement from D to A is anticipated for this improvement project.
- Water Quality Benefit – This improvement provides a water quality benefit by capturing and infiltrating stormwater runoff, thereby reducing the pollutant load discharged downstream.
- Permitting Considerations – It is anticipated that this improvement would require a general permit for stormwater retrofit from the St. Johns River Water Management District.
- Engineering Design – Final engineering design should include collection of survey data, utility designation, geotechnical testing, preparation of design plans, preparation of a cost estimate, preparation of technical specifications, and utility coordination to address any needed conflict adjustments / relocations.
- Land Acquisition – Land or easement acquisition from the industrial facility is anticipated to be necessary in order to construct the new stormwater retention pond. It is assumed that the County would request for the easement to be donated in exchange for County maintenance; however, the cost of the easement has been included to be conservative.
- Wetland / Surface Water Impacts – The proposed water quality improvement has no anticipated wetland / surface water impacts.
- Benefit/Cost – The estimated NPV of the 50 year lifecycle benefits (road, structure, ecosystem services, and social) for this improvement are $5,990,949. The estimated construction cost for this improvement is $2,035,822, which includes construction and a 20% contingency. The resulting BCR for this improvement is **2.94**. A detailed breakdown of the preliminary cost estimate is provided in **Table 4**. Pollutant load removal rates on a cost basis are $234 per pound of TN and $1,582 per pound of TP based on the estimated construction cost above plus maintenance.

Geosyntec consultants

Table 4: Engineer's Estimate of Probable Improvement Costs based on Concept

Bear Lake Woods Area						
Item	**Pay Item No.**	**Description**	**Units**	**Unit Cost**	**Quantity**	**Total**
1	101-1	Mobilization (15% of Construction Total)	LS	varies	1	$169,652
2	102-1	Maintenance of Traffic (10% of Construction Total)	LS	varies	1	$113,101
3	104-1	Prevention, Control and Abatement of Erosion and Water Pollution (10% of Construction Total)	LS	varies	1	$113,101
4	110-1-1	Clearing and Grubbing (15% of Construction Total)	LS	varies	1	$169,652
5	120-1	Regular Excavation	CY	$16.00	6100	$97,600
6	425-1-541	Inlets, Ditch Bottom, Type D, J Bottom, <10'	EA	$8,500.00	3	$25,500
7	425-1-583	Inlets, Ditch Bottom, Type H, J Bottom, <10'	EA	$11,000.00	1	$11,000
8	430-175-118	Pipe Culvert, Concrete, Round, 18" S/CD	LF	$175.00	100	$17,500
9	430-175-118	Pipe Culvert, Concrete, Round, 24" S/CD	LF	$160.00	60	$9,600
10	430-982-125	Mitered End Section, Round, 18" CD	EA	$4,100.00	1	$4,100
11	430-982-129	Mitered End Section, Round, 24" CD	EA	$4,600.00	3	$13,800
12	570-1-2	Performance Turf, Sod	SY	$8.00	7195	$57,560
13	900-1	Phase 2 Pond Improvements and Media Filter	LS	varies	1	$355,000
14	900-2	Phase 1 Pond Improvements	LS	varies	1	$25,000
15	900-3	Roadside Drainage Swales	LF	$25.00	3800	$95,000
16	900-4	Driveway Culverts (assumed concrete, round, 18")	LS	varies	1	$50,000
17	900-5	Easement / Property Acquisition	LS	varies	1	$369,352
					SUBTOTAL COST:	$1,696,518
					CONTINGENCY (20%):	$339,304
					CONSTRUCTION SUBTOTAL:	$2,035,822
					MAINTENANCE SUBTOTAL:	$236,033
					DESIGN & PERMITTING:	$305,373
					CEI SERVICES:	$203,582
					ESTIMATED TOTAL IMPLEMENTATION COST:	**$2,780,811**

Notes:

1) *Above estimate does not include cost for potential utility relocations.*
2) *Assumes no muck or other removal of unsuitable soils.*
3) *Maintenance Cost is assumed to be 1% of construction cost brought to Net Present Value (NPV) over 20 years using interest rate of 7%*
4) *Design and permitting was assumed to be 15% of the construction subtotal cost based on engineering judgement.*
5) *Construction engineering and inspection (CEI) services was assumed to be 10% of the construction subtotal cost based on engineering judgement.*
6) *Costs for 900-5 were obtained from the Seminole County property appraiser and were assumed to be 1.5 times the parcel value (land + buildings + features) to account for administrative costs. Assumed that City and Florida Power easements would be donated at no cost.*

The information provided herein in considered to be preliminary for project planning purposes. As noted previously, design level efforts including detailed modeling will be necessary to quantify pumping rates, confirm flood stages, confirm pollutant load reductions, etc.

Conclusions

From a flooding standpoint, the proposed project is to gain some conveyance and storage efficiency Bear Lake Woods system to help address level of service issues. This project will provide a flood benefit by improving the conveyance of stormwater runoff and providing additional storage in the stormwater ponds.

- It is anticipated that the project area would achieve a 10 year, 24 hour design storm level of service (LOS) for roadway infrastructure and a 25 year, 24 hour design storm LOS for storage areas with the proposed improvements. This represents a LOS improvement from C and D to A.

The nutrient load reduction via the improvements over the 20 year expected life is estimated below:

- TN mass removed = 9,692 lbs.
- TP mass removed = 1,436 lbs.

The total project implementation cost was estimated to be approximately $2,780,811 including construction, contingency, design and permitting, CEI services, estimated annual maintenance costs, and easement / property acquisition. The project cost benefit from a pollutant load reduction perspective was determined to be:

- $234 per lb of TN.
- $1,582 per lb of TP.

It is noted that the project cost for the pollutant loading benefits was based on the construction cost, contingency, and maintenance.

Results of the benefit cost analysis indicate a BCR of 2.94, indicating that this project may be cost-effective.

Based on the foregoing, Geosyntec recommends that the County pursue design of this water quality improvement for the anticipated water quality benefits.

Flooding and Water Quality Focused Project

Mobile Manor

Flood and Water Quality Improvement Alternatives Analysis

Mobile Manor

Wekiva Watershed Management Plan

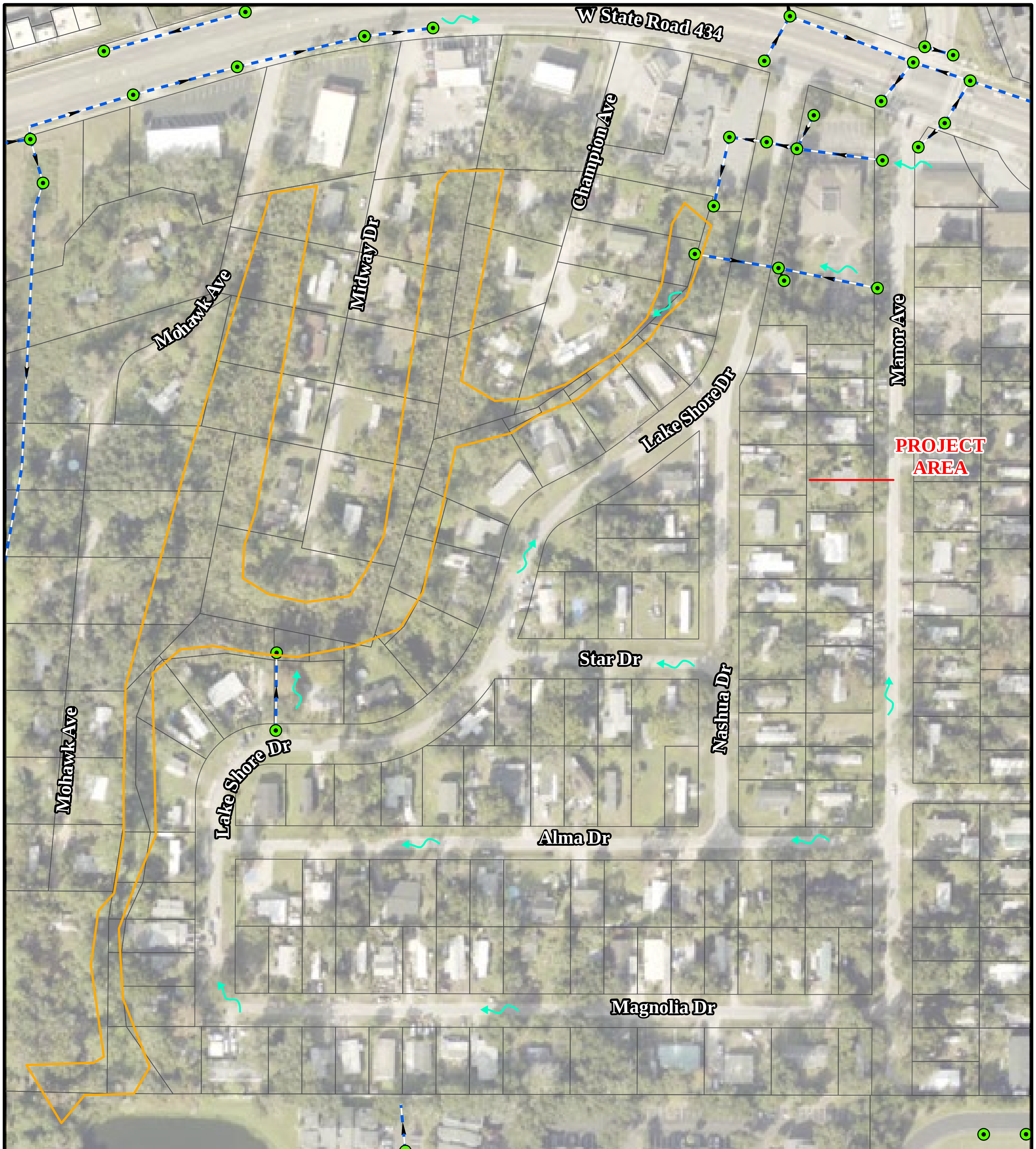
Seminole County, Florida

The purpose of this flood and water quality improvement concept is to provide improvements to drainage and conveyances to improve flood management and address pollutant loads discharged from the Mobile Manor development to the Little Wekiva River. The project area is located south of State Road 434 and west of Montgomery Road.

The project area with existing drainage infrastructure is shown on **Figure 1**. A topographical map is included on **Figure 2**.

Existing Conditions

The contributing area consists of high density residential land use. Existing drainage infrastructure in the project area is limited to roadside swales that appear to be unmaintained and three inlets that convey stormwater runoff north to a ditch system that ultimately drains into the Little Wekiva River. The existing ditch system to the west of the development appears to be overgrown due to the lack of maintenance and may not be functioning as intended. There are no existing stormwater BMPs in the contributing area.



N

Legend

PARCELS
OUTFALL DITCH
PIPES / CULVERTS
DRAINAGE STRUCTURES

0 50 100 200 300 400
Feet

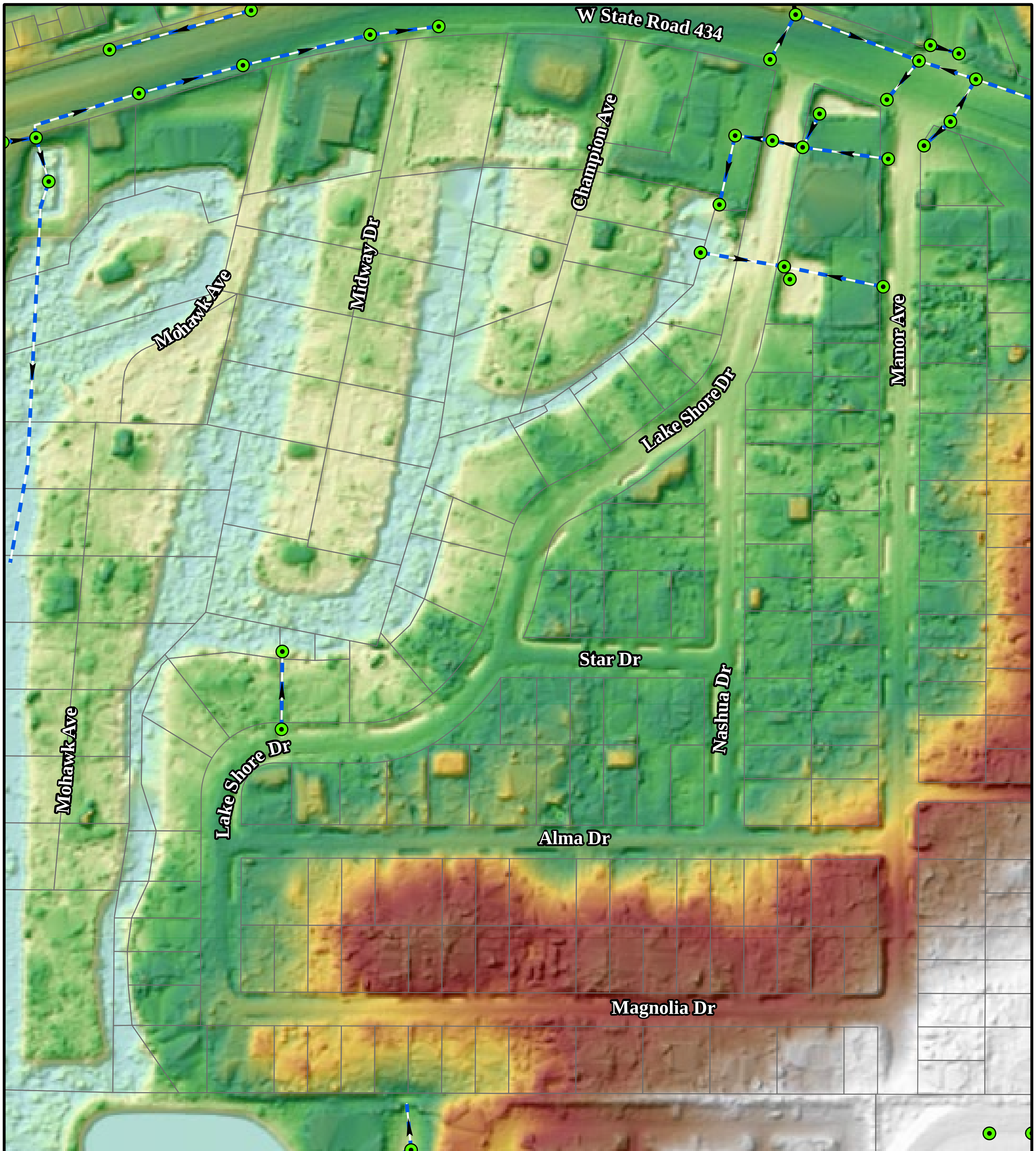
Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Site Map
Mobile Manor
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure
1



N

Legend

PARCELS
PIPES / CULVERTS
DRAINAGE STRUCTURES

DEM
FEET NAVD 1988
68.47
38.6

0 50 100 200 300 400
Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022
DEM - USGS LIDAR, 2018

Topographical Map

Mobile Manor
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

Seminole County

Figure
2

Photos of the contributing area are shown below.

Photo 1: Looking West along Star Drive

Photo 2: Existing Inlet on North side of Lake Shore Drive

Photo 3: Looking West along Alma Drive

Photo 4: Looking East along Magnolia Drive

Photo 5: Looking South at the intersection of Lake Shore Drive and W State Road -434

Photo 6: Looking North at the intersection of Lake Shore Drive and Nashua Ave

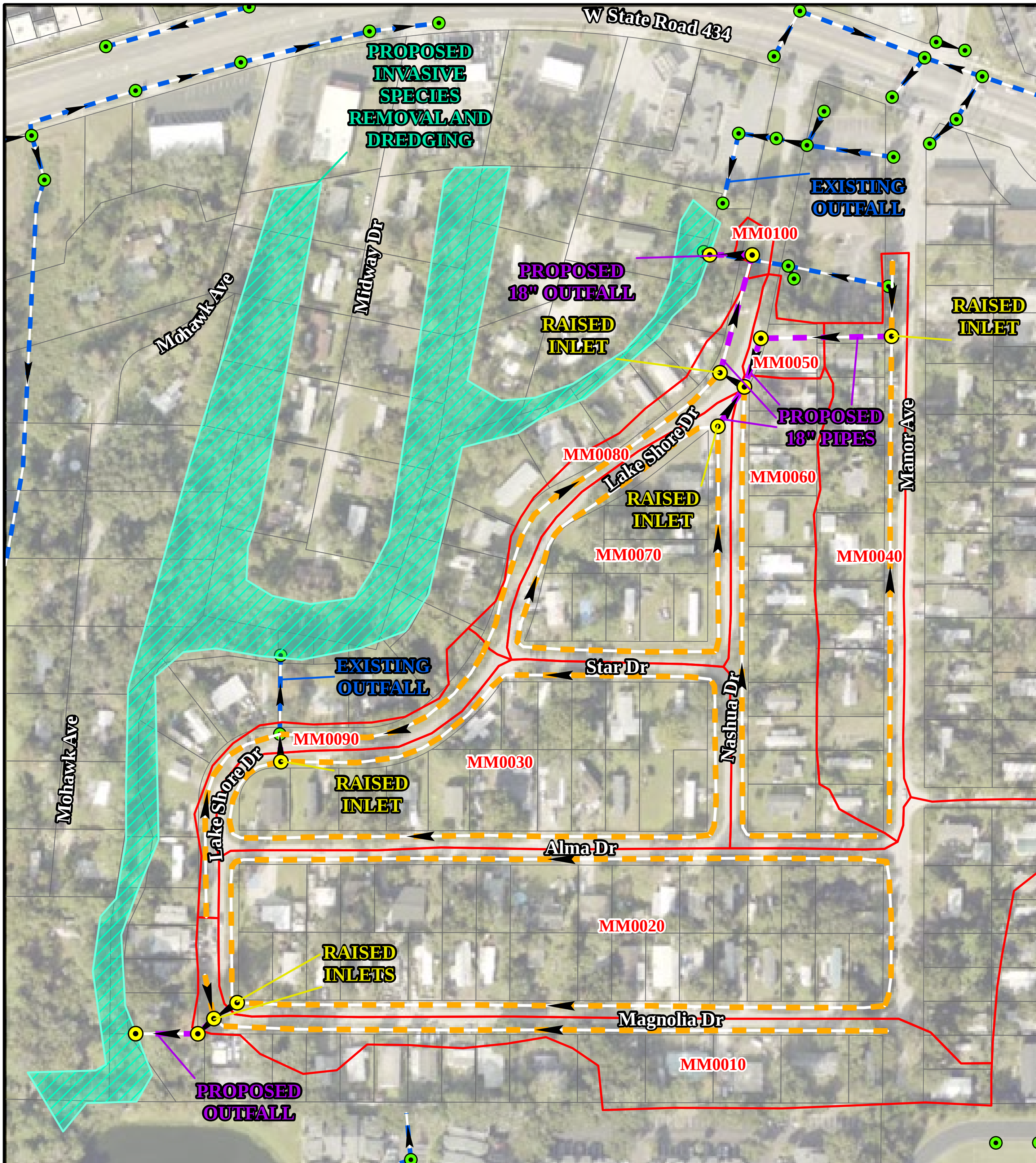
<u>Proposed Improvements</u>

The project improvements include the construction of interconnected roadside drainage swales throughout the development. Raised ditch bottom inlets will be incorporated to promote infiltration of stormwater runoff but also provide an outfall when the capacity of the swales is exceeded. Two additional outfalls to the existing ditch system west of the development are also proposed. Clearing and dredging of the existing ditch system is also proposed to remove invasive species and restore positive flow conditions. This improvement concept includes:

- Constructing / reconstructing approximately 9,185 linear feet of roadside drainage swales.
- Constructing 10 ditch bottom inlets that will utilize a raised top grate to promote infiltration of stormwater runoff in the proposed swales while also providing an outlet during more intense storm events.
- Constructing two 18-inch outfalls to the existing ditch system to better convey stormwater runoff from the development.

Additional, Geosyntec recommends the maintenance and dredging of approximately 24,240 square yards of the existing ditch system to remove invasive species and restore positive flow towards Merrill Park and then to the Little Wekiva River.

The improvement concept is shown on conceptually on **Figure 3**.



N

Legend

PARCELS	PROPOSED DITCH MAINTENANCE
SUBBASINS	PROPOSED PIPES
EXISTING PIPES / CULVERTS	PROPOSED SWALE
EXISTING DRAINAGE STRUCUTRES	PROPOSED STRUCTURES

0 50 100 200 300 400 Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Proposed Improvements Map

Mobile Manor
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure

3

Flood Benefits

The project area was modeled conceptually, reflecting the additional storage in the proposed swale system and assuming positive drainage from the delineated subbasin areas to the proposed outfalls. The flood benefits associated with this improvement concept are depicted in **Table 1**. As seen in **Table 1**, model results indicate that road flooding may be eliminated during the 10 year, 24 hour LOS reference design storm event.

Peak stage reductions were achieved by regrading the existing roadside swales for better conveyance and additional storage and the incorporation of two 18-inch outfalls at the north and south ends of the project area. It is noted that these peak stage reductions were achieved without the consideration of infiltration in the model that would occur in the roadside swales. Regrading of the roadside swales and promoting infiltration though the use of raised ditch bottom inlets would be anticipated to provide additional storage when compared to the existing conditions as well as a volumetric decrease in the quantity of stormwater runoff that is ultimately discharged.

The locations of the nodes found in **Table 1** are presented on **Figure 4** which depicts both the existing conditions and proposed conditions Node-Link model schematics.

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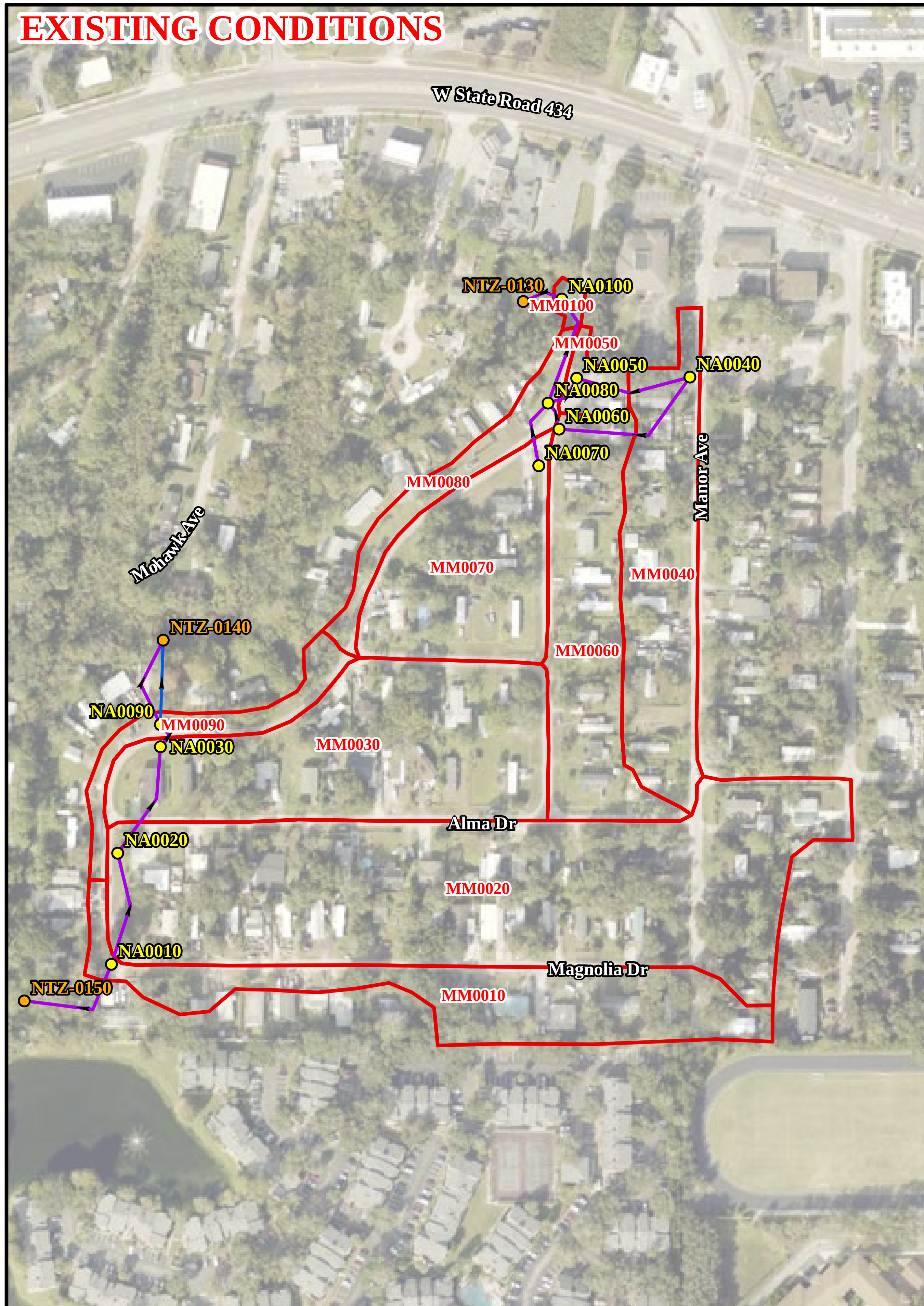
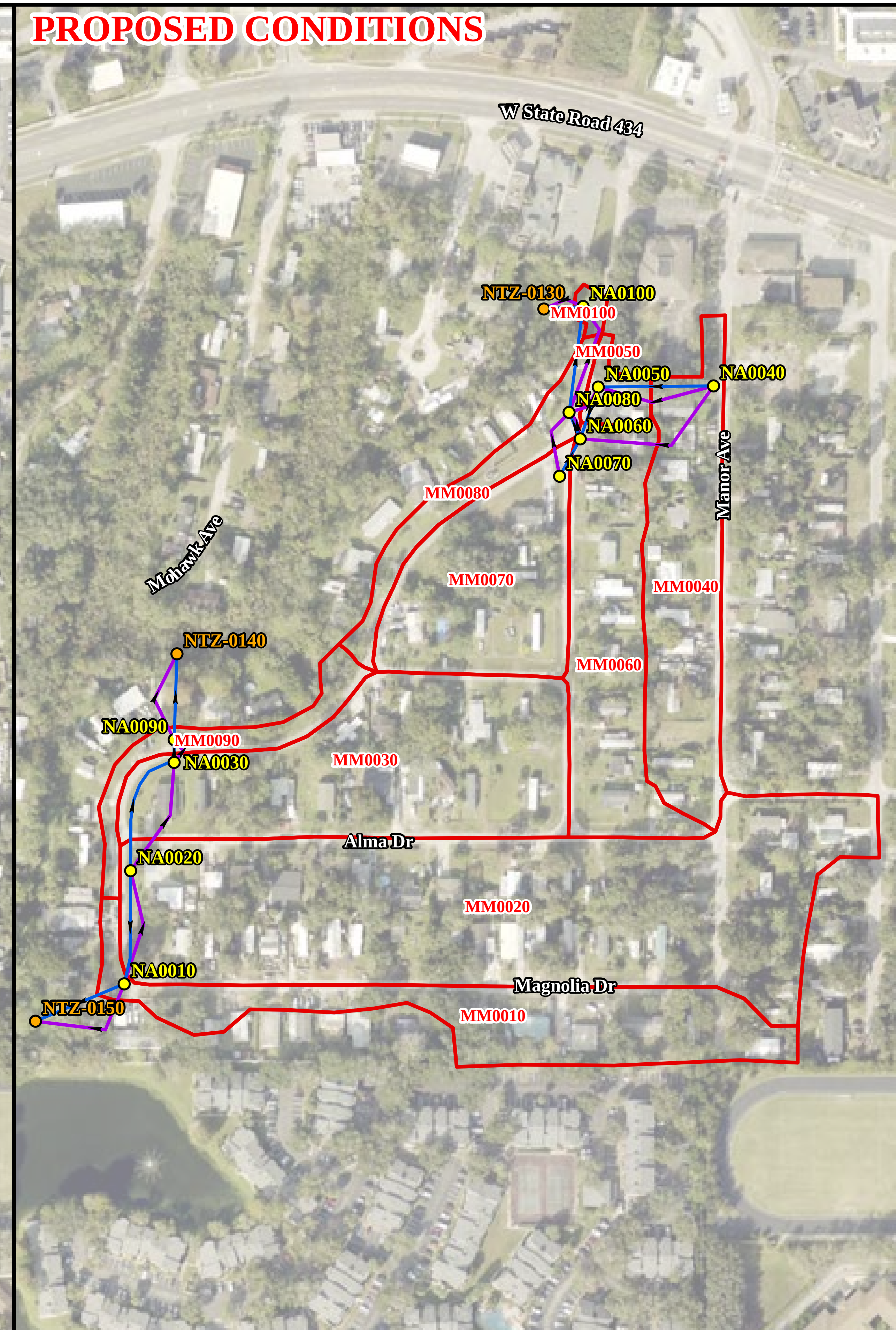
TABLE 1 - MOBILE MANOR FLOOD AND WATER QUALITY RETROFIT

STAGE/AREA NODE		INITIAL STAGE		WARNING STAGE		MEAN ANNUAL / 24 HOUR		10 YEAR / 24 HOUR	
NAME	DESCRIPTION	ELEVATION	DESCRIPTION	ELEVATION	DESCRIPTION	EXISTING PEAK STAGE (FT)	PROPOSED PEAK STAGE (FT)	EXISTING PEAK STAGE (FT)	PROPOSED PEAK STAGE (FT)
NA0010	Roadside Swale	41.75	Ground Surface	42.23	Edge of pavement	42.07	37.54	42.13	38.73
NA0020	Roadside Swale	41.19	Ground Surface	42.23	Edge of pavement	**42.38**	40.71	**42.41**	41.26
NA0030	Roadside Swale	40.29	Ground Surface	41.23	Edge of pavement	**41.38**	40.59	**41.40**	41.13
NA0040	Roadside Swale	39.82	Ground Surface	40.69	Edge of pavement	**41.10**	39.82	**41.15**	40.33
NA0050	Roadside Swale	39.44	Ground Surface	40.34	Edge of pavement	**40.40**	38.75	**40.40**	40.19
NA0060	Roadside Swale	39.99	Ground Surface	40.81	Edge of pavement	**40.94**	38.71	**41.00**	40.11
NA0070	Roadside Swale	39.31	Ground Surface	40.71	Edge of pavement	**40.77**	38.73	**40.78**	40.16
NA0080	Roadside Swale	40.01	Ground Surface	40.71	Edge of pavement	40.27	38.50	40.35	39.70
NA0090	Roadside Swale	39.73	Ground Surface	41.23	Edge of pavement	40.74	40.30	40.85	40.72
NA0100	Roadside Swale	39.15	Ground Surface	40.09	Edge of pavement	39.70	37.85	39.76	38.36





SEMINOLE COUNTY

N

0 55 110 220 Feet

Legend

Subbasins

ICPR NODE TYPE

STAGE AREA

TIME STAGE

ICPR LINK TYPE

PIPE

WEIR

Sources:
Aerial - ESRI, 2022

Figure 4

Model Map

Mobile Manor

Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

<u>Pollutant Load Benefits</u>

The average annual pollutant load discharged from the project area (subbasins LW_D03316_S, LW_D03317_S, LW_D03318_S, LW_D03319_S, LW_D03320_S, and LW_D03321_S) was calculated as part of the Wekiva Watershed Management Plan utilizing a continuous simulation model run for a period of approximately 10 years. The pollutant load benefit for this improvement concept was estimated based on engineering judgement and experience with similar types of stormwater BMP projects. The roadside drainage swales with raised ditch bottom inlets were assumed to capture 80% of the stormwater runoff on a volumetric basis, which corresponds to a 20% bypass rate. The bypass rate accounts for high flow events when stormwater would bypass the BMP to avoid potential upstream flood stage impacts. The exact capture rate would be determined during design. Stormwater runoff captured and infiltrated within the roadside drainage swales was assumed to have a TN and TP removal rate of 100%.

The estimated pollutant load benefit is summarized below in **Table 2**.

Table 2: Estimated Pollutant Load Benefit

Scenario	Average Annual TN Load (lb/yr)	Average Annual TP Load (lb/yr)	TN Load Removed (lb/yr)	TP Load Removed (lb/yr)	TN Load Removed over 20 Years (lb)	TP Load Removed over 20 Years (lb)
Proposed Conditions	261.3	36.2	209.0	29.0	4180	580

Benefit Cost Analysis

Benefit cost calculations were performed in accordance with the methodology previously described. Roadway damages were determined for County maintained roads within the project area. Annual road flood damages benefits were calculated as the difference between damages in the existing and proposed conditions. Roadway ecosystem benefits were calculated in the FEMA Benefit Cost Calculator based on the project area (21.4 acres) and estimated percentage of urban green space within the project area (35%). Roadways included in this assessment are listed below.

- Alma Drive, Lake Shore Drive, Manor Avenue, and Nashua Avenue.

Model results did not indicate the presence of any potentially impacted structures within the project area.

Results of the benefit cost analysis for this improvement project are summarized in **Table 3**. As seen in **Table 3**, the lifecycle benefits of the project exceed the estimated construction cost, resulting in a BCR of 2.51 which indicates that this project may be cost-effective.

Table 3: Benefit Cost Results for Mobile Manor

Benefit Cost Results								
Project	Existing Conditions Road Flood Damages ($/year)	Proposed Conditions Road Flood Damages ($/year)	Road Flood Damages Benefit ($/year)	Roadway Ecosystem Benefits ($/year)	[1]Structure Total Benefits ($/year)	[2]Lifecycle Benefit ($)	[3]Estimated Construction Cost ($)	B/C Ratio
Mobile Manor	$107,817	$2,721	$105,097	$116,402	$0	$3,056,901	$1,218,052	2.51

[1]Structure total benefits include standard mitigation benefits and social benefits as outlined in the FEMA Benefit Cost Calculator.

[2]Lifecycle benefit is equal to (Road Flood Damages Benefit + Road Ecosystem Benefit + Structure Total Benefits) x 13.801 to calculate the NPV of benefits over the project's lifecycle.

[3]Estimated construction cost is the construction cost + contingency. Does not include design and permitting or CEI services.

Results of the benefit cost analysis including the FEMA Benefit Cost Calculator are included in the Electronic Deliverables.

Implementation Considerations

The following implementation considerations are provided for this improvement concept.

- Water Quality Benefit – This improvement provides a water quality benefit by capturing and infiltrating stormwater runoff, thereby reducing the pollutant load discharged to the Little Wekiva River.
- Flood Benefit – This improvement concept also provides a flood benefit by improving the capture and conveyance of stormwater runoff from the project area to the Little Wekiva River.
- Permitting Considerations – It is anticipated that this improvement would require a general permit for stormwater retrofit from the St. Johns River Water Management District. If it is determined that any surface water / wetland impact will occur at the outfall, an individual permit may be required. Note that the clearing and grading of the outfall ditch system would be a separate effort than the landward improvements and may require separate permitting.
- Engineering Design – Final engineering design should include collection of survey data, utility designation, geotechnical testing, preparation of design plans, preparation of a cost estimate, preparation of technical specifications, and utility coordination to address any needed conflict adjustments / relocations.
- Land Acquisition – Land and/or easement acquisition will be necessary. Two easements will be needed to construct the proposed outfalls. It is assumed that the County would request for these easements to be donated in exchange for County maintenance; however, the cost of the easements has been included to be conservative. Right of entries may be needed from individual property owners on an as needed basis during construction to address the swale and side drain improvements.
- Wetland / Surface Water Impacts – The proposed improvement has potential temporary surface water impacts associated with constructing the piped outfalls.
- Benefit/Cost – The estimated NPV of the 50 year lifecycle benefits (road, structure, ecosystem services, and social) for this improvement are $3,056,901. The estimated construction cost for this improvement is $1,218,052, which includes construction and a 20% contingency. The resulting BCR for this improvement is **2.51**. A detailed breakdown of the preliminary cost estimate is provided in **Table 4**. Pollutant load removal rates on a cost basis are $325 per pound of TN and $2,344 per pound of TP based on the estimated construction cost above plus maintenance.

Table 4: Engineer's Estimate of Probable Improvement Costs based on Concept

Mobile Manor						
Item	**Pay Item No.**	**Description**	**Units**	**Unit Cost**	**Quantity**	**Total**
1	101-1	Mobilization (15% of Construction Total)	LS	varies	1	$101,504
2	102-1	Maintenance of Traffic (10% of Construction Total)	LS	varies	1	$67,670
3	104-1	Prevention, Control and Abatement of Erosion and Water Pollution (10% of Construction Total)	LS	varies	1	$67,670
4	110-1-1	Clearing and Grubbing (15% of Construction Total)	LS	varies	1	$101,504
5	425-152-1	Inlets, Ditch Bottom, Type C, <10'	EA	$8,750.00	10	$87,500
6	430-175-118	Pipe Culvert, Concrete, Round, 18" S/CD	LF	$175.00	830	$145,250
7	430-982-125	Mitered End Section, Round, 18" CD	EA	$4,100.00	2	$8,200
8	900-1	Roadside Drainage Swales	LF	$25.00	9185	$229,625
9	900-2	Driveway Culverts (assumed concrete, round, 18")	LS	varies	1	$150,000
10	900-3	Easement / Property Acquisition	LS	varies	1	$56,120
SUBTOTAL COST:						$1,015,043
CONTINGENCY (20%):						$203,009
CONSTRUCTION SUBTOTAL:						$1,218,052
MAINTENANCE SUBTOTAL:						$141,221
DESIGN & PERMITTING:						$182,708
CEI SERVICES:						$121,805
ESTIMATED TOTAL IMPLEMENTATION COST:						**$1,663,786**

Notes:

1) *Above estimate does not include cost for potential utility relocations.*
2) *Assumes no muck or other removal of unsuitable soils.*
3) *Maintenance Cost is assumed to be 1% of construction cost brought to Net Present Value (NPV) over 20 years using interest rate of 7%*
4) *Design and permitting was assumed to be 15% of the construction subtotal cost based on engineering judgement.*
5) *Construction engineering and inspection (CEI) services was assumed to be 10% of the construction subtotal cost based on engineering judgement.*
6) *Costs for 900-3 were obtained from the Seminole County property appraiser and were assumed to be 1.5 times the parcel value (land + buildings + features) to account for administrative costs. Assumed that City and Florida Power easements would be donated at no cost.*

The information provided herein in considered to be preliminary for project planning purposes. As noted previously, design level efforts including detailed modeling will be necessary to quantify bypass rates, confirm flood stages, confirm pollutant load reductions, etc.

Conclusions

The goal of this effort was to develop a flood and water quality improvement concept to reduce flooding and pollutant loads discharged from the project area. A concept was developed consisting of roadside drainage swales and raised ditch bottom inlets to promote the infiltration of stormwater runoff. Additionally, Geosyntec recommends the removal of invasive species and dredging of the existing ditch system west of the development is proposed to restore positive flow conditions.

This project will provide a flood benefit by improving the conveyance of stormwater runoff throughout the subdivision and providing two additional outfalls that will discharge to the western ditch system.

- It is anticipated that the project area would achieve a 10 year, 24 hour design storm LOS, resulting in the project area improving from LOS C to A with the proposed improvements.

The nutrient load reduction via the improvements over the 20 year expected life is estimated below:

- TN mass removed = 4,180 lbs.
- TP mass removed = 580 lbs.

The total project implementation cost was estimated to be approximately $1,663,786 including construction, contingency, design and permitting, CEI services, estimated annual maintenance costs, and easement / property acquisition. The project cost benefit from a pollutant load reduction perspective was determined to be:

- $325 per lb of TN.
- $2,344 per lb of TP.

It is noted that the project cost for the pollutant loading benefits was based on the construction cost, contingency, and maintenance.

Results of the benefit cost analysis indicate a BCR of 2.51, indicating that this project may be cost-effective.

Based on the foregoing, Geosyntec recommends that the County pursue design of this flooding and water quality improvement for the anticipated benefits.

Flooding and Water Quality Focused Project

Cecelia Drive

Flood and Water Quality Improvement Alternatives Analysis

Cecelia Drive

Wekiva Watershed Management Plan

Seminole County, Florida

The purpose of this flood and water quality improvement concept is to provide improvements to drainage and conveyances to improve flood management and reduce pollutants loads discharged from the project area. The project area is generally defined as the area of Cecelia Drive on the west side of Bear Lake, which includes the streets of Frances Drive and Neil Road, all east of Balmy Beach Drive.

The project area is shown on **Figure 1**. A topographical map is included on **Figure 2**.

Existing Conditions

Area has undersized and mismatched streetside drainage. Drainage does not have a consistent outfall point. Flooding has been noted in northeast and southwest portions of the area. Hydrologic and hydraulic modeling has indicated substandard level of service (LOS) and several habitable structures were noted to have the potential for flood impacts (LOS D). There were specific reports of impacts during both Hurricane Irma and Hurricane Ian.

There is existing swales and side drains that help manage runoff off the roads, but there is a high water table so limited infiltration. There is not specific outfall to convey these areas to Bear Lake. Heavy rains quickly cause the undersized system to reach capacity causing nuisance flooding and impact yards. There are no existing stormwater BMPs in the project area.

Representative photos of the area are included on the following pages.

Proposed Improvements

Proposed project is to gain some conveyance efficiency in the system to help relieve the area. Eliminating the possibility of flooding may be impractical so the improvements are focused on reducing flood stages and the duration of flooding through conveyance improvements, thereby increasing level of service. Raised ditch bottom inlets will be incorporated to promote infiltration of stormwater runoff but also provide an outfall when the capacity of the swales is exceeded. The proposed improvement concept is presented as **Figure 3**. The following is proposed:

- Construct / reconstruct approximately 8,660 linear feet of roadside drainage swales and driveway culverts throughout the subdivision.
- Add/replace cross drains at intersections of Cecelia and Neil Road and Frances Drive, consistent with swales grading.
- Construct 13 ditch bottom inlets that will utilize a raised top grate to promote infiltration of stormwater runoff in the proposed swales while also providing an outlet during more intense storm events.

- Add a new piped outfall thought the Paradise Community Club boat ramp access parcel at the north central portion of the area. Grade swales in the norther portion of the project area where possible to this new north outfall location as possible. Will require easement acquisition.
- Obtain easement from the Paradise Community Club parcel for outfall on the south portion of the project area to install drain area to lake. Grade swales in the southern portion of the project area to this location as possible.

Legend

- PARCELS
- PIPES / CULVERTS
- DRAINAGE STRUCTURES

0 50 100 200 300 400 Feet

N

Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

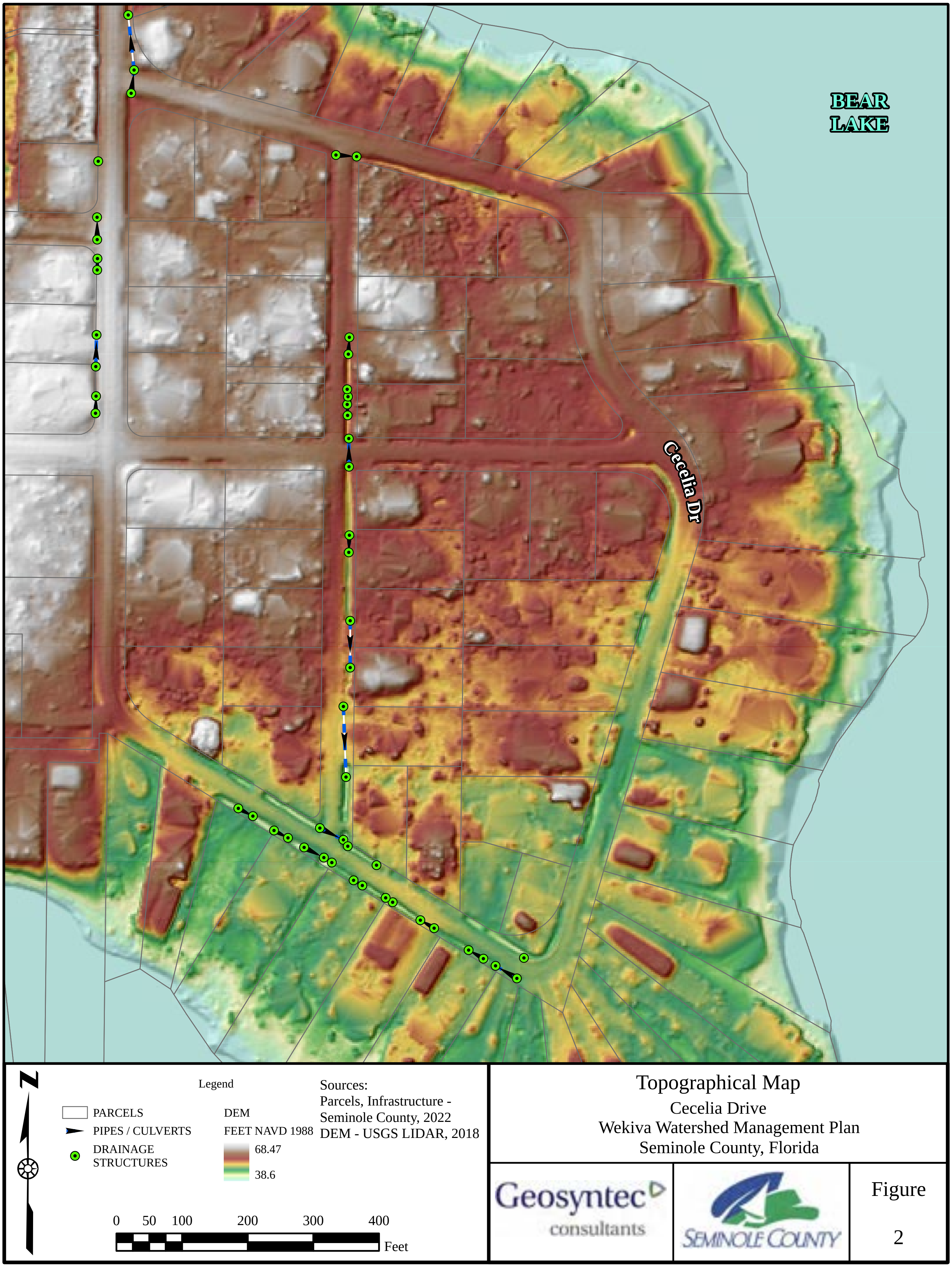
Site Map
Cecelia Drive
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure

1



Sources:
Parcels, Infrastructure - Seminole County, 2022
DEM - USGS LIDAR, 2018

Topographical Map
Cecelia Drive
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

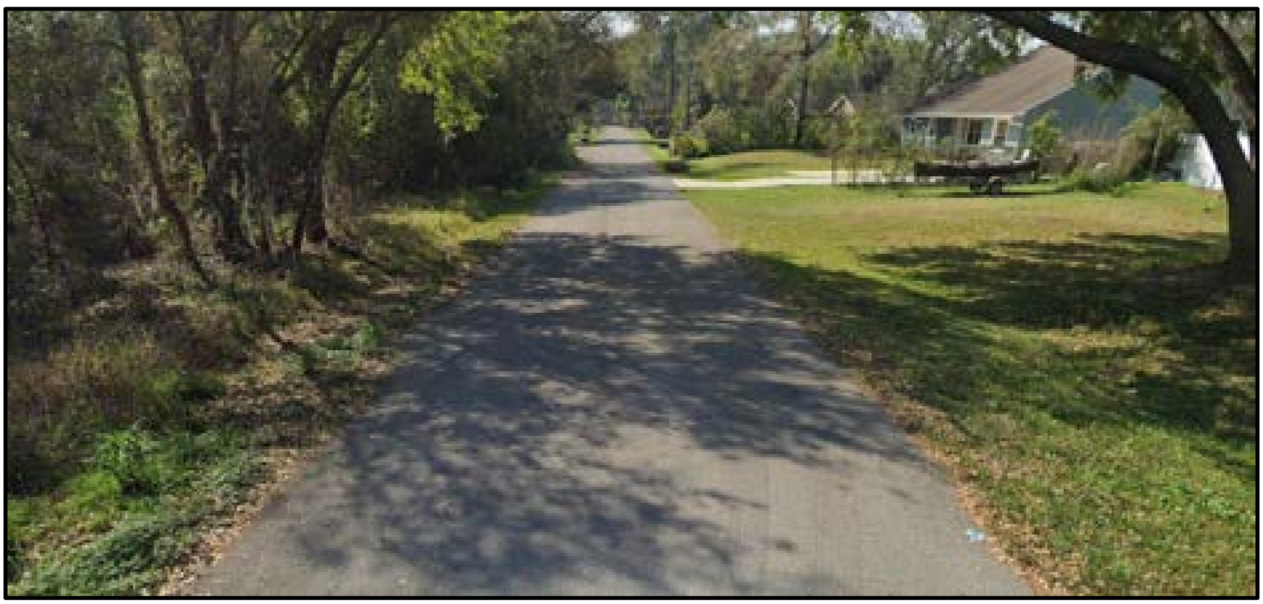
SEMINOLE COUNTY

Figure 2

View to north along Frances Drive from Cecelia Drive (Google, 2014)

View towards the southeast corner of Cecelia Drive (Google, 2014)

View to east along Cecelia Drive from Balmy Beach Drive (Google, 2014)



View to south along Frances Drive from Cecelia Drive (Google, 2014)

View to east along Neil Drive from Balmy Beach Drive (Google, 2014)

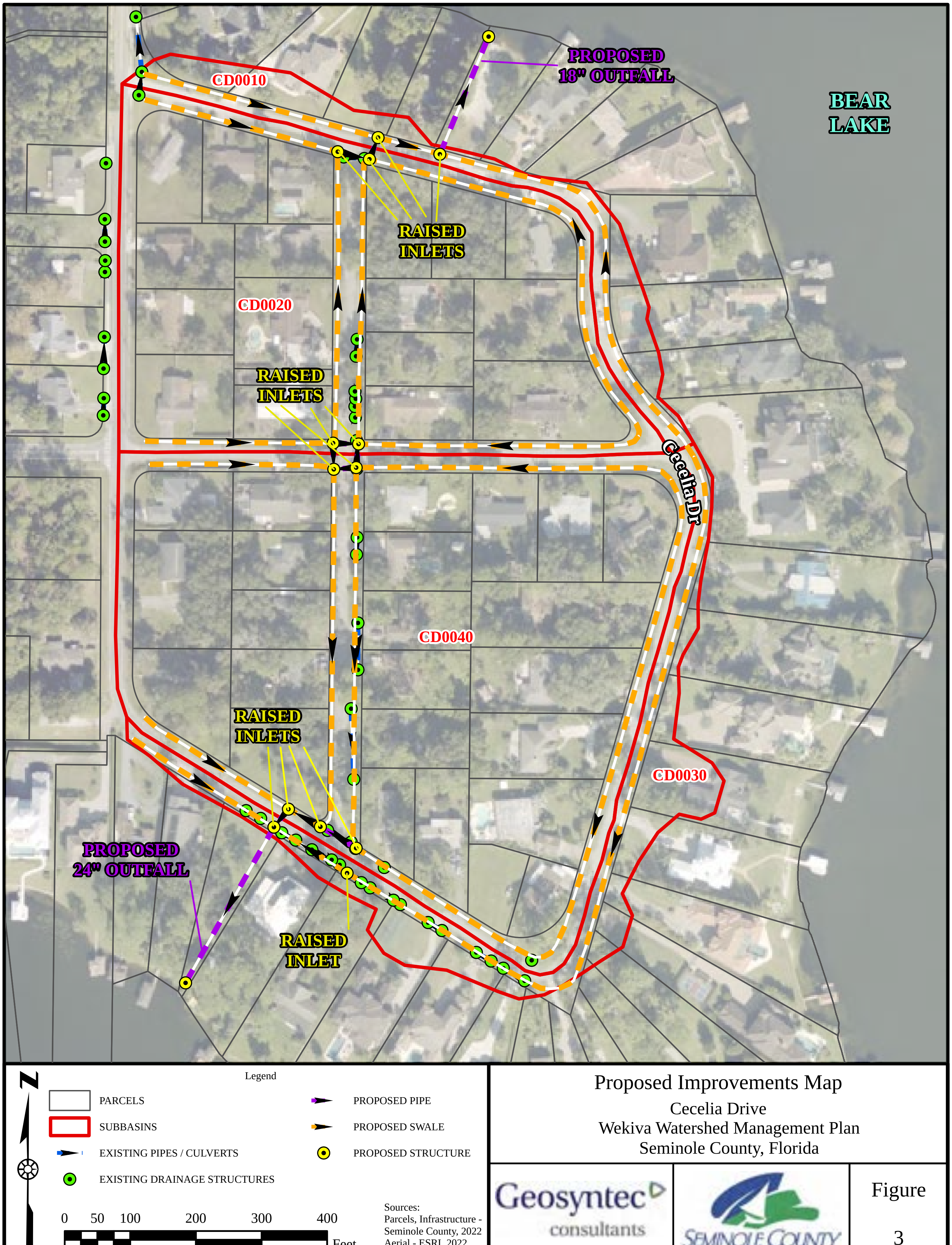
View to west along Neil Drive from Cecelia Drive (Google, 2014)

View towards the north along Frances Drive from Neil Drive (Google, 2014)

View to the north along east portion of Cecelia Drive South of Neil Drive (Google, 2014)

View of Paradise Community Club boat ramp parcel from north Cecelia Drive (Google, 2014)

View of Paradise Community Club park parcel from south Cecelia Drive (Google, 2014)



Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Proposed Improvements Map

Cecelia Drive

Wekiva Watershed Management Plan

Seminole County, Florida

Geosyntec consultants

Seminole County

Figure

3

Flood Benefits

The project area was modeled conceptually, reflecting the additional storage in the proposed swale system and assuming positive drainage from the delineated subbasin areas to the proposed outfalls. The flood benefits associated with this improvement concept are depicted in **Table 1**. As seen in **Table 1**, model results indicate that road flooding may be eliminated during the 10 year, 24 hour design storm event.

Peak stage reductions were achieved by improving the existing roadside swales for better conveyance and additional storage and the incorporation of an 18-inch outfall for the northern project area and a 24-inch outfall for the southern project area. The existing peak discharge rate to Bear Lake was determined to be approximately 28.7 cfs while the proposed peak discharge rate via the two piped outfalls was determined to be 24.6 cfs. Model results indicate that the proposed improvements would mitigate road flooding for the 10 year, 24 hour design storm while maintaining a peak discharge rate to Bear Lake that is less than existing conditions.

The locations of the nodes found in **Table 1** are presented on **Figure 4** which depicts both the existing conditions and proposed conditions Node-Link model schematics.

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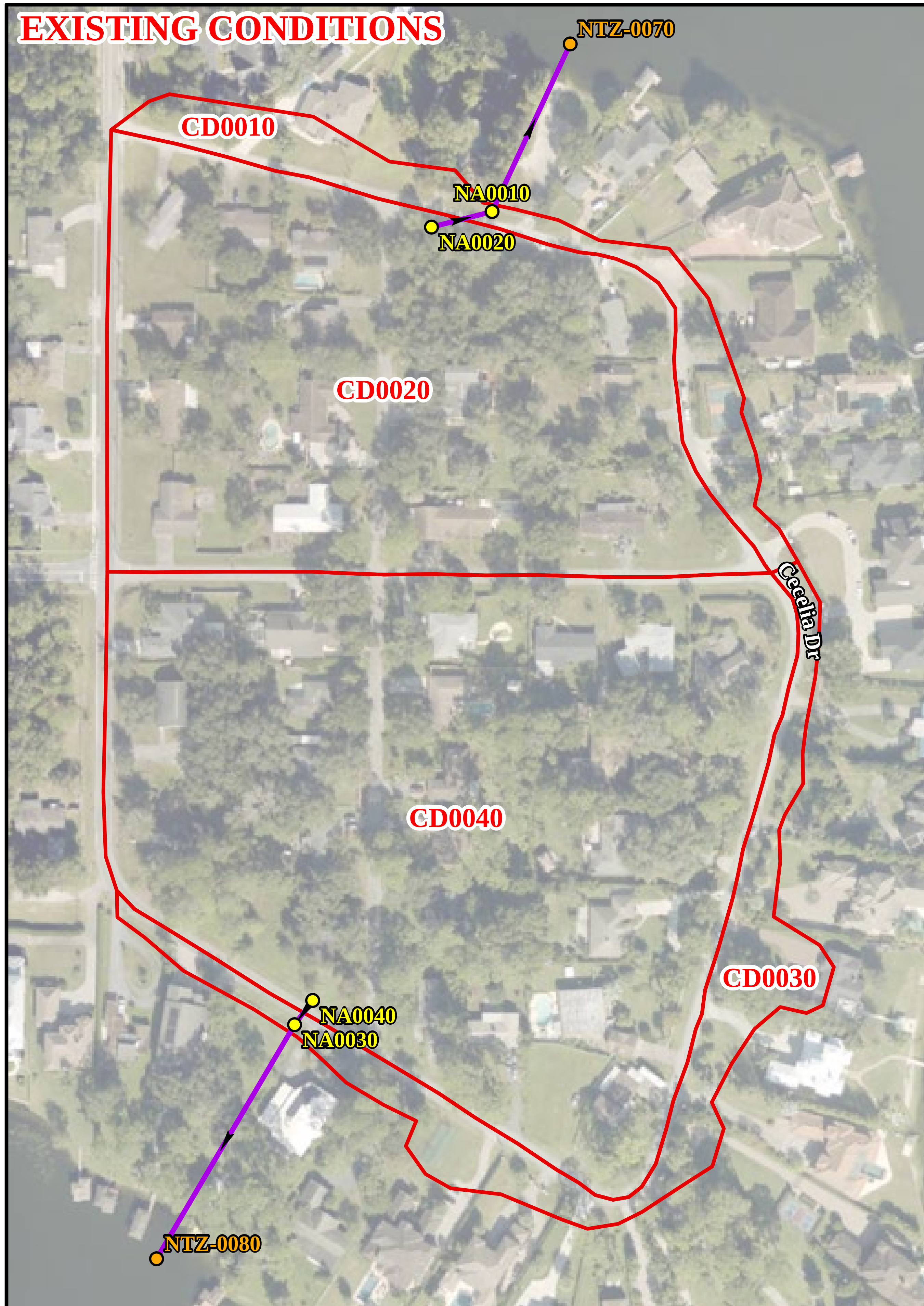
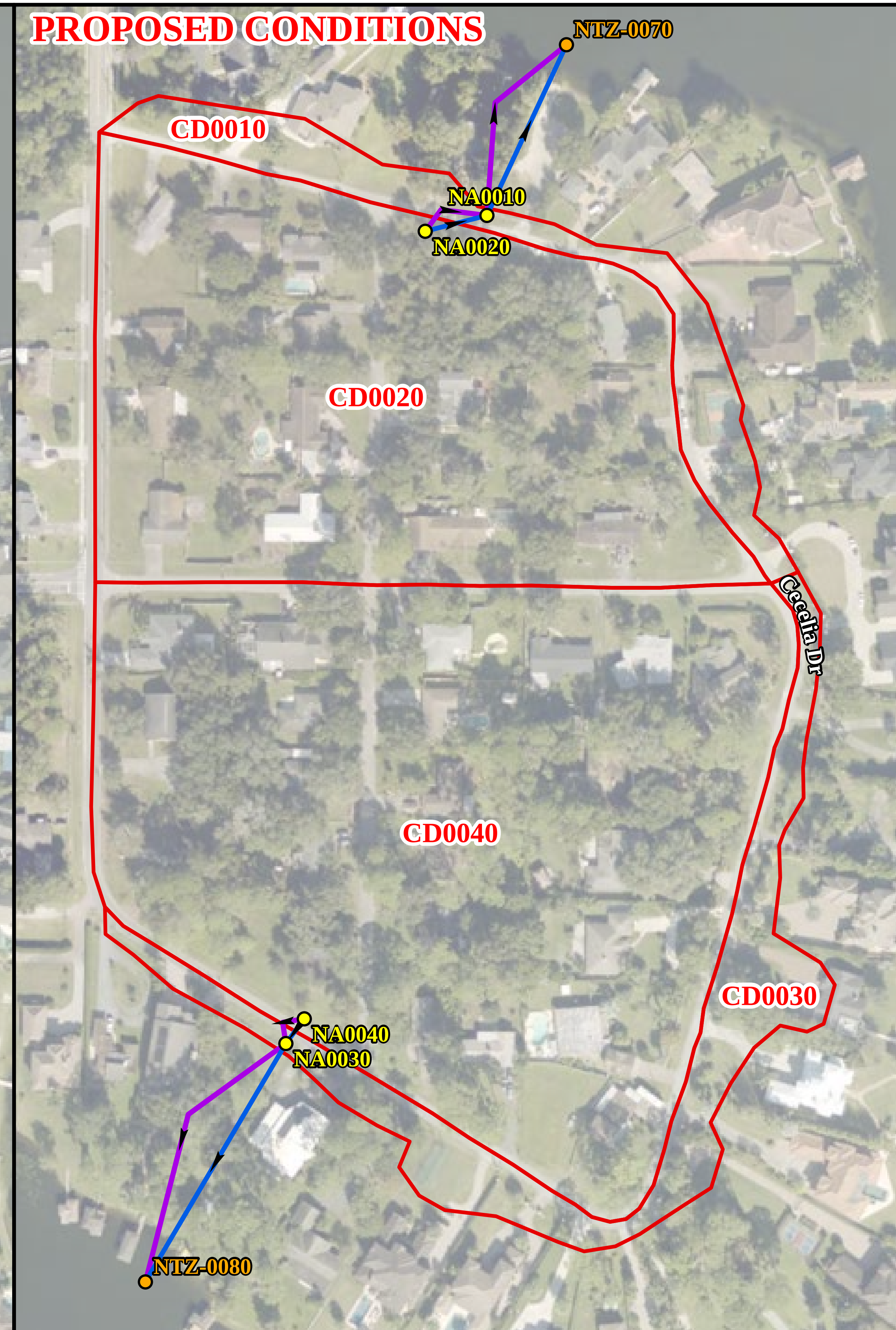
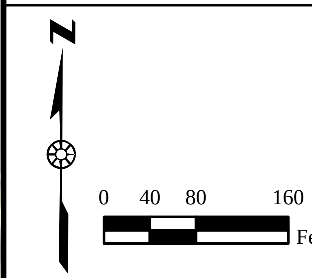
TABLE 1 - CECELIA DRIVE FLOOD AND WATER QUALITY RETROFIT

STAGE/AREA NODE		INITIAL STAGE		WARNING STAGE		MEAN ANNUAL / 24 HOUR		10 YEAR / 24 HOUR	
NAME	DESCRIPTION	ELEVATION	DESCRIPTION	ELEVATION	DESCRIPTION	EXISTING PEAK STAGE (FT)	PROPOSED PEAK STAGE (FT)	EXISTING PEAK STAGE (FT)	PROPOSED PEAK STAGE (FT)
NA0010	Roadside Swale	107.64	Ground Surface	108.35	Edge of pavement	107.84	107.49	107.90	107.70
NA0020	Roadside Swale	106.77	Ground Surface	108.35	Edge of pavement	**108.53**	107.80	**108.56**	108.20
NA0030	Roadside Swale	105.09	Ground Surface	106.56	Edge of pavement	**106.67**	105.67	**106.71**	106.16
NA0040	Roadside Swale	104.99	Ground Surface	106.56	Edge of pavement	**106.71**	105.80	**106.74**	106.41





SEMINOLE COUNTY



Legend

- SUBBASINS
- ICPR NODE TYPE
  - STAGE AREA
  - TIME STAGE
- ICPR LINK TYPE
  - PIPE
  - WEIR

Sources:
Aerial - ESRI, 2022

Figure
4

Model Map

Ceceila Drive

Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec
consultants

Pollutant Load Benefits

The average annual pollutant load discharged from the project area (subbasin LW_P00100_S) was calculated as part of the Wekiva Watershed Management Plan utilizing a continuous simulation model run for a period of approximately 10 years. The pollutant load benefit for this improvement concept was estimated based on engineering judgement and experience with similar types of stormwater BMP projects. The roadside drainage swales with raised ditch bottom inlets were assumed to capture 80% of the stormwater runoff on an average annual volumetric basis, which corresponds to a 20% bypass rate. The bypass rate accounts for high flow events when stormwater would bypass the BMP to avoid potential upstream flood stage impacts. The exact capture rate would be determined during design. Stormwater runoff captured and infiltrated within the roadside drainage swales was assumed to have a TN and TP removal rate of 100%.

The estimated pollutant load benefit is summarized below in **Table 2**.

Table 2: Estimated Pollutant Load Benefit

Scenario	Average Annual TN Load (lb/yr)	Average Annual TP Load (lb/yr)	TN Load Removed (lb/yr)	TP Load Removed (lb/yr)	TN Load Removed over 20 Years (lb)	TP Load Removed over 20 Years (lb)
Proposed Conditions	198.8	32.0	159.0	25.6	3181	512

Benefit Cost Analysis

Benefit cost calculations were performed in accordance with the methodology previously described. Roadway damages were determined for County maintained roads within the project area. Annual road flood damages benefits were calculated as the difference between damages in the existing and proposed conditions. Roadway ecosystem benefits were calculated in the FEMA Benefit Cost Calculator based on the project area (22.9 acres) and estimated percentage of urban green space within the project area (35%). Roadways included in this assessment are listed below.

- Cecelia Drive and Neil Road.

Model results did not indicate the presence of any potentially impacted structures within the project area.

Results of the benefit cost analysis for this improvement project are summarized in **Table 3**. As seen in **Table 3**, the lifecycle benefits of the project exceed the estimated construction cost, resulting in a BCR of 2.25 which indicates that this project may be cost-effective.

Table 3: Benefit Cost Results for Cecelia Drive

Benefit Cost Results								
Project	Existing Conditions Road Flood Damages ($/year)	Proposed Conditions Road Flood Damages ($/year)	Road Flood Damages Benefit ($/year)	Roadway Ecosystem Benefits ($/year)	[1]Structure Total Benefits ($/year)	[2]Lifecycle Benefit ($)	[3]Estimated Construction Cost ($)	B/C Ratio
Cecilia Drive	$100,483	$4,364	$96,119	$124,561	$0	$3,045,606	$1,355,620	2.25

[1]*Structure total benefits include standard mitigation benefits and social benefits as outlined in the FEMA Benefit Cost Calculator.*

[2]*Lifecycle benefit is equal to (Road Flood Damages Benefit + Road Ecosystem Benefit + Structure Total Benefits) x 13.801 to calculate the NPV of benefits over the project's lifecycle.*

[3]*Estimated construction cost is the construction cost + contingency. Does not include design and permitting or CEI services.*

Results of the benefit cost analysis including the FEMA Benefit Cost Calculator are included in the Electronic Deliverables.

Implementation Considerations

The following implementation considerations are provided for this improvement concept.

- Water Quality Benefit – This improvement provides a water quality benefit by capturing and infiltrating stormwater runoff, thereby reducing the pollutant load discharged to Bear Lake.
- Flood Benefit – This improvement concept also provides a flood benefit by improving the capture and conveyance of stormwater runoff from the project area to Bear Lake. LOS in the project area is anticipated to improve from D to A with the proposed improvements.
- Permitting Considerations – It is anticipated that this improvement would require a general permit for stormwater retrofit from the St. Johns River Water Management District. If it is determined that any surface water / wetland impacts will occur at the proposed outfalls, an individual permit may be required.
- Engineering Design – Final engineering design should include collection of survey data, utility designation, geotechnical testing, preparation of design plans, preparation of a cost estimate, preparation of technical specifications, and utility coordination to address any needed conflict adjustments / relocations.
- Land Acquisition – Land and/or easement acquisition will be necessary. Two easements will be needed to be obtained from the Paradise Community Club to construct the north piped outfall near the boat ramp and the south piped outfall. It is assumed that the County would request for these easements to be donated in exchange for County maintenance; however, the cost of the easement has been included to be conservative. Right of entries may be needed from individual property owners on an as needed basis during construction to address the swale and side drain improvements.
- Wetland / Surface Water Impacts – The proposed improvement has potential temporary surface water impacts associated with constructing the piped outfalls to Bear Lake.
- Benefit/Cost – The estimated NPV of the 50 year lifecycle benefits (road, structure, ecosystem services, and social) for this improvement are $3,045,606. The estimated construction cost for this improvement is $1,355,620, which includes construction and a 20% contingency. The resulting BCR for this improvement is **2.25**. A detailed breakdown of the preliminary cost estimate is provided in **Table 4**. Pollutant load removal rates on a cost basis are $476 per pound of TN and $2,955 per pound of TP based on the estimated construction cost above plus maintenance.

Table 4: Engineer's Estimate of Probable Improvement Costs based on Concept

Cecelia Drive						
Item	**Pay Item No.**	**Description**	**Units**	**Unit Cost**	**Quantity**	**Total**
1	101-1	Mobilization (15% of Construction Total)	LS	varies	1	$112,968
2	102-1	Maintenance of Traffic (10% of Construction Total)	LS	varies	1	$75,312
3	104-1	Prevention, Control and Abatement of Erosion and Water Pollution (10% of Construction Total)	LS	varies	1	$75,312
4	110-1-1	Clearing and Grubbing (15% of Construction Total)	LS	varies	1	$112,968
5	425-152-1	Inlets, Ditch Bottom, Type C, <10'	EA	$8,750.00	13	$113,750
6	430-175-118	Pipe Culvert, Concrete, Round, 18" S/CD	LF	$175.00	490	$85,750
7	430-175-124	Pipe Culvert, Concrete, Round, 24" S/CD	LF	$240.00	310	$74,400
8	430-982-125	Mitered End Section, Round, 18" CD	EA	$4,100.00	1	$4,100
9	430-982-129	Mitered End Section, Round, 24" CD	EA	$5,700.00	1	$5,700
10	900-1	Roadside Drainage Swales	LF	$25.00	8660	$216,500
11	900-2	Driveway Culverts (assumed concrete, round, 18")	LS	varies	1	$150,000
12	900-3	Easement / Property Acquisition	LS	varies	1	$102,922
SUBTOTAL COST:						$1,129,683
CONTINGENCY (20%):						$225,937
CONSTRUCTION SUBTOTAL:						$1,355,620
MAINTENANCE SUBTOTAL:						$157,171
DESIGN & PERMITTING:						$203,343
CEI SERVICES:						$135,562
ESTIMATED TOTAL IMPLEMENTATION COST:						**$1,851,696**

Notes:

1) *Above estimate does not include cost for potential utility relocations.*
2) *Assumes no muck or other removal of unsuitable soils.*
3) *Maintenance Cost is assumed to be 1% of construction cost brought to Net Present Value (NPV) over 20 years using interest rate of 7%*
4) *Design and permitting was assumed to be 15% of the construction subtotal cost based on engineering judgement.*
5) *Construction engineering and inspection (CEI) services was assumed to be 10% of the construction subtotal cost based on engineering judgement.*
6) *Costs for 900-3 were obtained from the Seminole County property appraiser and were assumed to be 1.5 times the parcel value (land + buildings + features) to account for administrative costs. Assumed that City and Florida Power easements would be donated at no cost.*

The information provided herein in considered to be preliminary for project planning purposes. As noted previously, design level efforts including detailed modeling will be necessary to quantify pumping rates, confirm flood stages, confirm pollutant load reductions, etc.

<u>Conclusions</u>

The goal of this effort was to develop a flood and water quality improvement concept to reduce flooding and pollutant loads discharged from the project area. A concept was developed consisting of roadside drainage swales, raised ditch bottom inlets, and two piped outfalls to Bear Lake.

This project will provide a flood benefit by improving the conveyance of stormwater runoff throughout the subdivision and directing runoff to two proposed outfalls that will discharge to Bear Lake.

- It is anticipated that the project area would achieve a 10 year, 24 hour design storm level of service (LOS) with the proposed improvements. This represents a LOS improvement from D to A.

The nutrient load reduction via the improvements over the 20 year expected life is estimated below:

- TN mass removed = 3,181 lbs.
- TP mass removed = 512 lbs.

The total project implementation cost was estimated to be approximately $1,851,696 including construction, contingency, design and permitting, CEI services, estimated annual maintenance costs, and easement / property acquisition. The project cost benefit from a pollutant load reduction perspective was determined to be:

- $476 per lb of TN.
- $2,955 per lb of TP.

It is noted that the project cost for the pollutant loading benefits was based on the construction cost, contingency, and maintenance.

Results of the benefit cost analysis indicate a BCR of 2.25, indicating that this project may be cost-effective.

Based on the foregoing, Geosyntec recommends that the County pursue design of this flooding and water quality improvement for the anticipated benefits.

Flooding Focused Project

Tributary C – Hunt Club to Lake Brantley

Flood Improvement Alternatives Analysis

Tributary C Flood Retrofit

Wekiva Watershed Management Plan
Seminole County, Florida

The purpose of this flood improvement concept is to provide improvements to drainage and conveyances to improve flood management in the project area. The project area is generally defined as the upstream areas contributing to Tributary C of the Little Wekiva River. This extends from the lake and pond areas just west of Hunt Club Boulevard to east to the cross drain at Lake Brantley Road. Between these locations are a series of depressional ponded and wetland areas that pass through the Highland Memorial Cemetery, Seventh Day Adventists property and the Palm Park subdivision (that includes Vonna Lake), at which point the tributary is channelized. East of the immediate project area past Lake Brantley Road the tributary passes through the Harriet Estates area through various channels and culverts before it outfalls into the large pond at SR 434. From there the tributary continues through a box culvert under SR 434 and then a channel until it meets the Little Wekiva River.

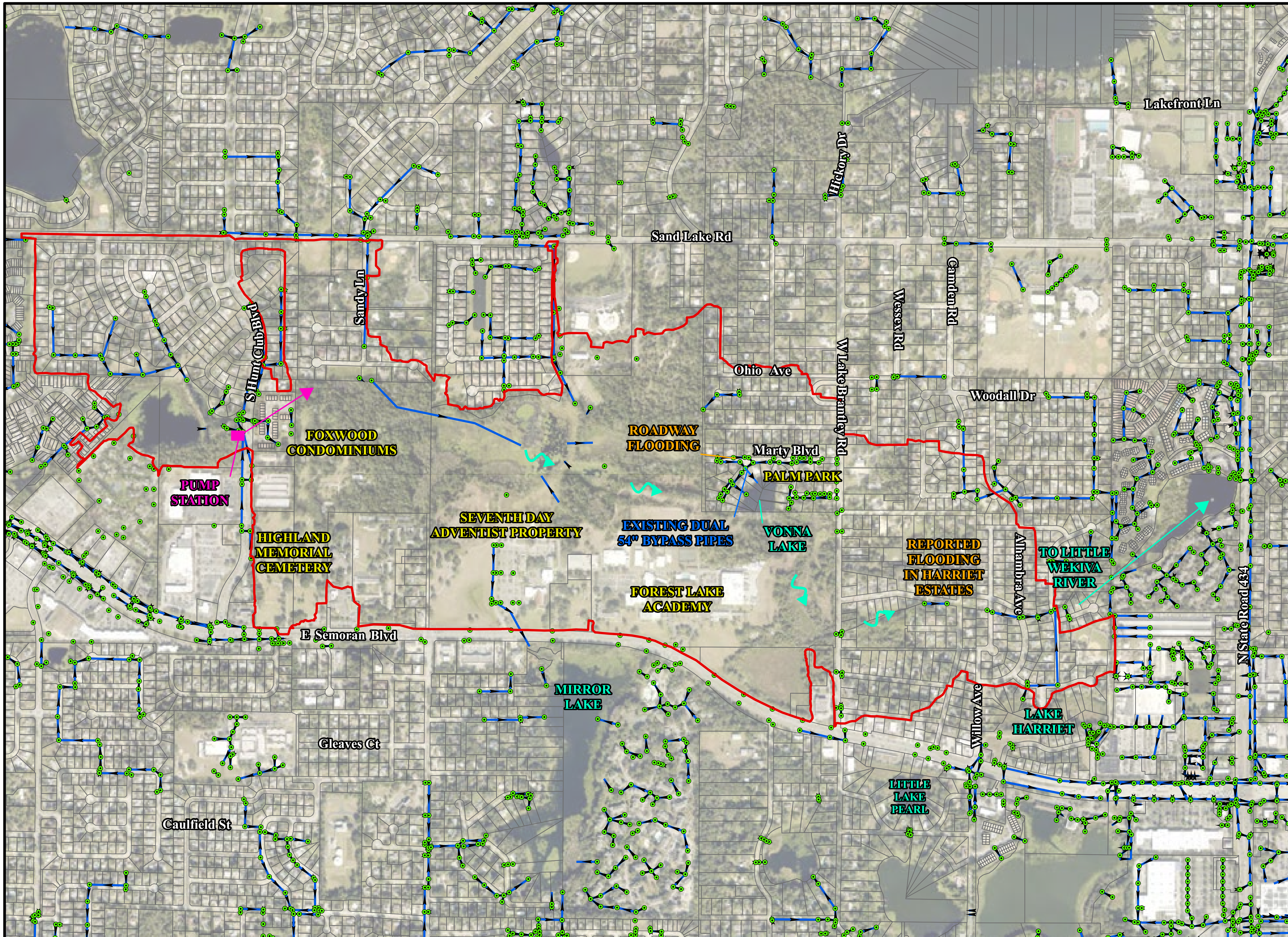
Several newer developments contribute to the area from the north. The Forest Lake Academy and other land owned by the Seventh Day Adventist abut on the south side north of SR 436. A stormwater pump station was installed to reduce stages in the ponds just to the west of Hunt Club Boulevard, which discharges into the wetland area just east of the Foxwood Condominiums. The area has a mix of old and new development which has resulted in a piecemeal series of drainage facilities, many of which the County does not have access or easements to maintenance.

The project vicinity map is shown on **Figure 1**. The project area is shown on **Figure 2** and a topographical map is included on **Figure 3**. Photographs of the area are provided on the following pages.

<u>Existing Conditions</u>

During heavy storm events flooding occurs along various points of the project area. In particular in the Palm Park subdivision along Cadillac Drive and Marty Boulevard. At this location a dual 54” culvert takes flow from the western contributing areas and drains to Vonna Lake. This area outfalls through a channel to the south which travels through private property until reaching the cross drain at Lake Brantley Road. There is a dirt road culvert in this channel path of unknown size. Flooding has been noted along Cadillac Drive and Marty Boulevard during extreme storm events, including Hurricanes Irma and Ian. Hydrologic and hydraulic modeling confirms several level of service deficiencies and potential habitable structure impacts (LOS C & D).

The primary issue appears to be that the areas around Vonna Lake and immediately downstream area a choke point where downstream capacity is limited in an outfall channel through a private property and then mismatched channels and culverts through Harriet Estates from Lake Brantley Road to the lake by SR434. The County has an ongoing project improving drainage through Harriet Estates by replacing mismatched and undersized culverts.



SEMINOLE COUNTY

N

0 225 450 900 Feet

Legend

- PARCELS
- PROJECT AREA
- PIPES / CULVERTS
- DRAINAGE STRUCTURES

Sources:
Aerial - ESRI, 2022

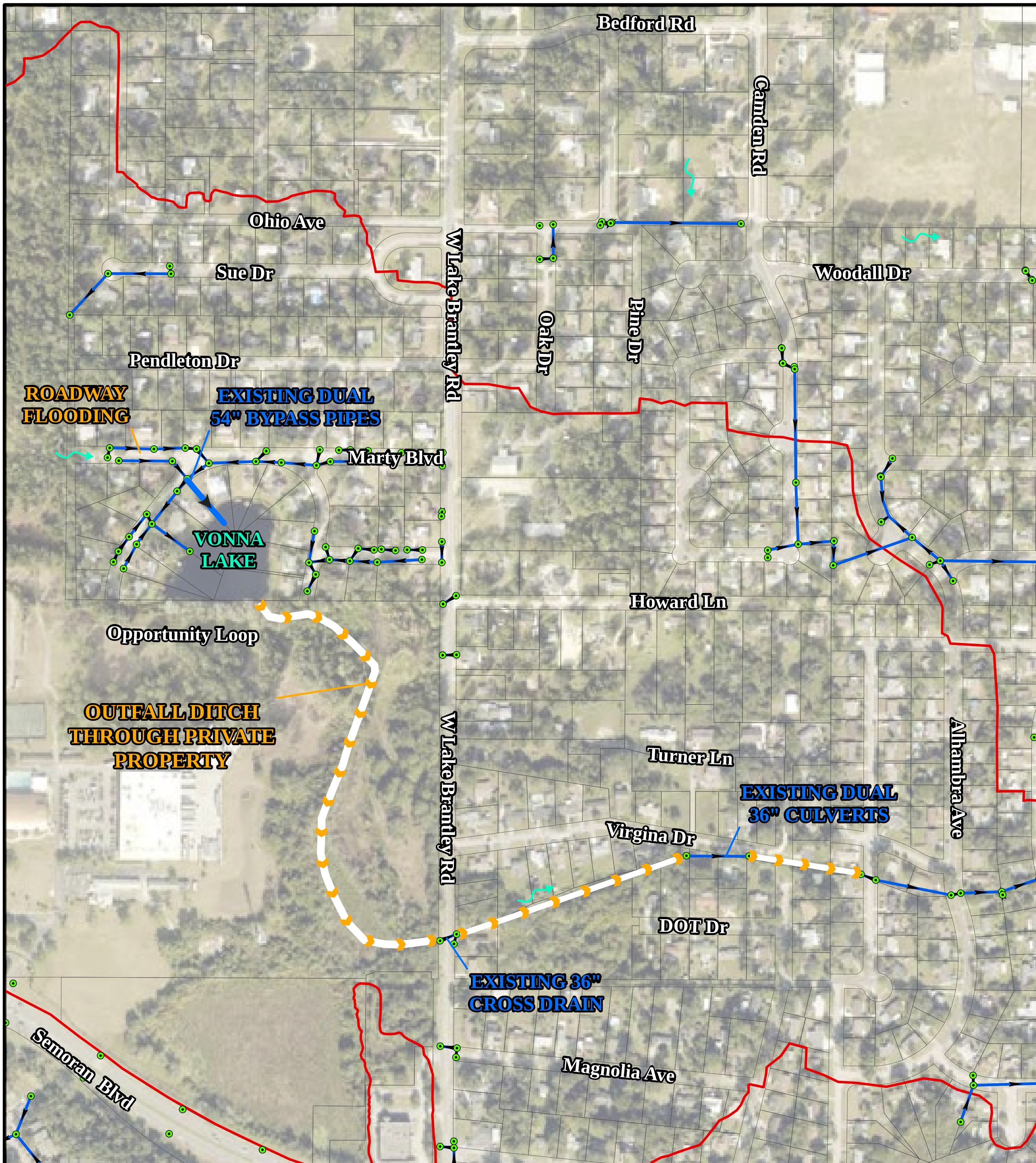
Figure 1

Vicinity Map

Tributary C

Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants



Legend

- PARCELS
- PROJECT AREA
- PIPES / CULVERTS
- DRAINAGE STRUCTURES

Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

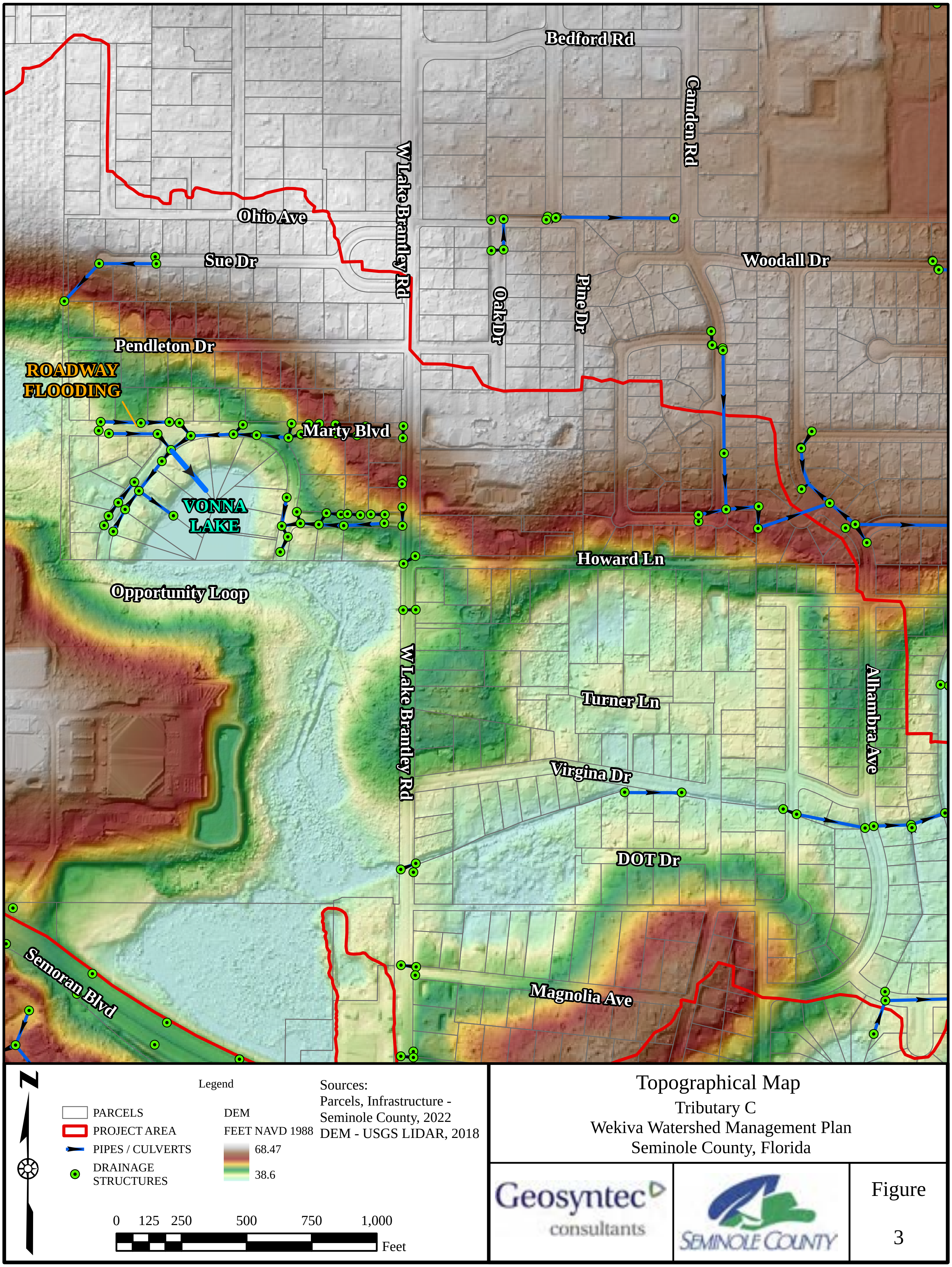
Site Map
Tributary C
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure

2



Sources:
Parcels, Infrastructure - Seminole County, 2022
DEM - USGS LIDAR, 2018

Topographical Map
Tributary C
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure 3

View to west along Marty Boulevard towards wetland area that contributes runoff to Vonna Lake through the dual 54” pipes (Google, 2019)

View to south towards end of Cadillac Drive (Google, 2019)

View to southeast of Vonna Lake and the area where it outfalls south though private property towards Lake Brantley Road (Google, 2023)

View towards Vonna Lake from its outfall ditch, note vegetation overgrowth (Echo, 2022)

View to west of contributing area to Vonna Lake including the Seventh Day Adventist Property and the cemetery, Hunt Club Boulevard far in top (Google, 2019)

View to north along Lake Brantley Road at the cross drain location (Google, 2020)

View from Alek Brantley Road to east from cross drain along downstream ditch (Google, 2020)

View of stormwater pumps station on Hunt Club Boulevard (Google, 2019)

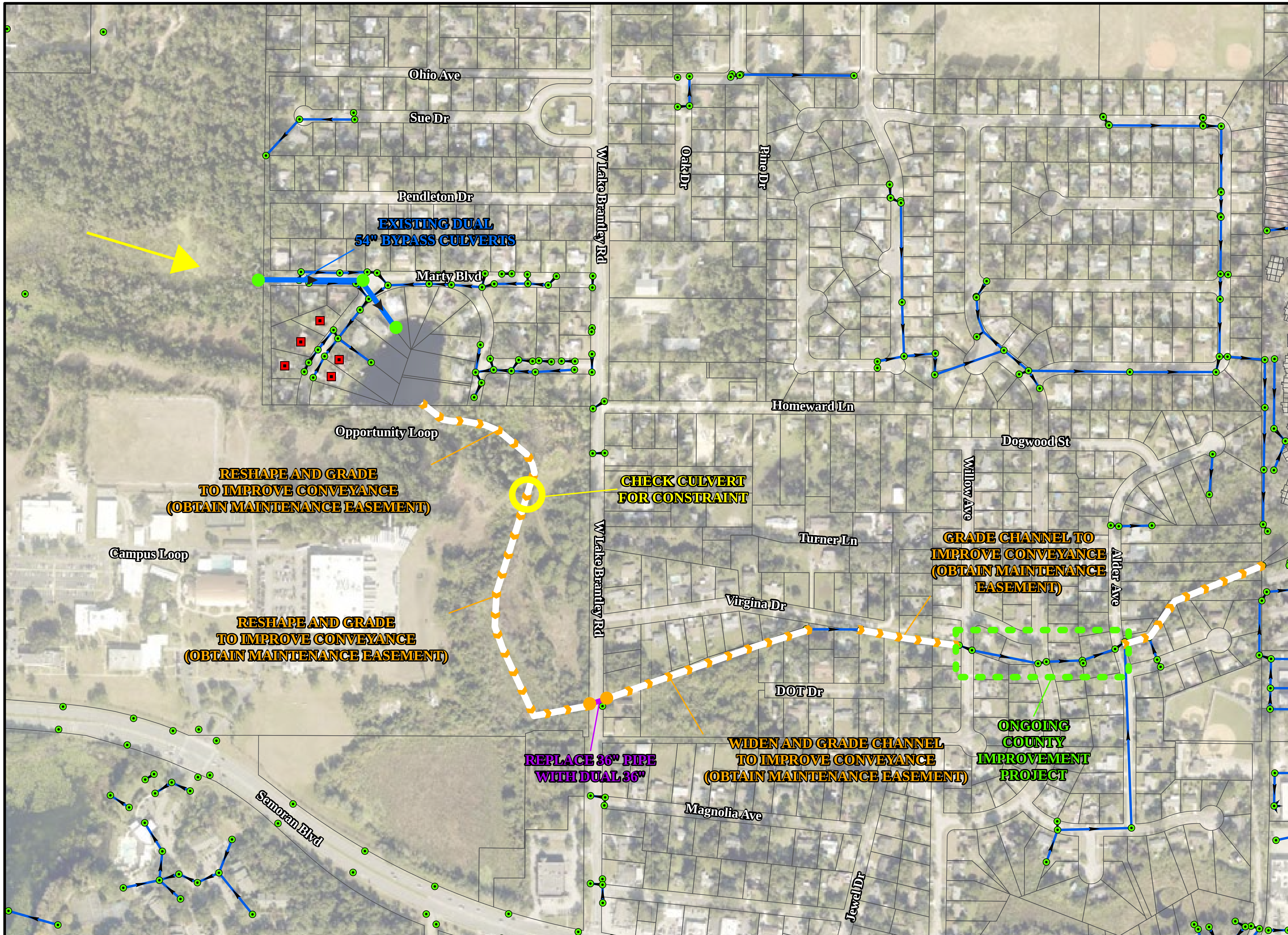
Proposed Improvements

Proposed project is to gain some conveyance efficiency in the system just west and east of Lake Brantley Road to help relieve the area around Vonna Lake. Eliminating the possibility of flooding is impractical so the improvements are focused of reducing flood stages and the duration of flooding through conveyance improvements. The following is proposed:

- Obtaining an easement or right of entry to clear the channelized outfall path immediately downstream of Vonna Lake.
- In conjunction with the above, confirm the size and inverts of the dirt road culvert immediately downstream of Vonna Lake, and evaluate capacity. If acting as a constricting to flow, work with property owner to upsize the culvert so it is not inhibiting proper drainage.
- Upgrading the 36" culvert under Lake Brantley Road with a second barrel to improve conveyance.
- Grading of the undersized channel immediately downstream of Lake Brantley Road to Virginia Drive is necessary to accommodate the improved conveyance from upstream improvements. This will require an easement or acquisition of right of way.

It is noted that the implementation of these improvements should be considered after the current downstream improvements through Harriet Estates are complete. The final design conveyance properties of those improvements will need to be considered in this project.

The proposed improvement concept is shown on **Figure 4**.



SEMINOLE COUNTY

N

0 90 180 360
Feet

Legend

PARCELS
DRAINAGE STRUCTURES
IMPACTED STRUCTURES
PIPES / CULVERTS

Sources:
Aerial - ESRI, 2022

Figure
4

Proposed Improvements

Tributary C

Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec
consultants

Flood Benefits

The flood benefits associated with this improvement concept are depicted in **Table 1**. As noted previously, eliminating the possibility of flooding is impractical so the improvements are focused of reducing flood stages somewhat and the duration of flooding (quicker recovery of stages) somewhat through conveyance improvements.

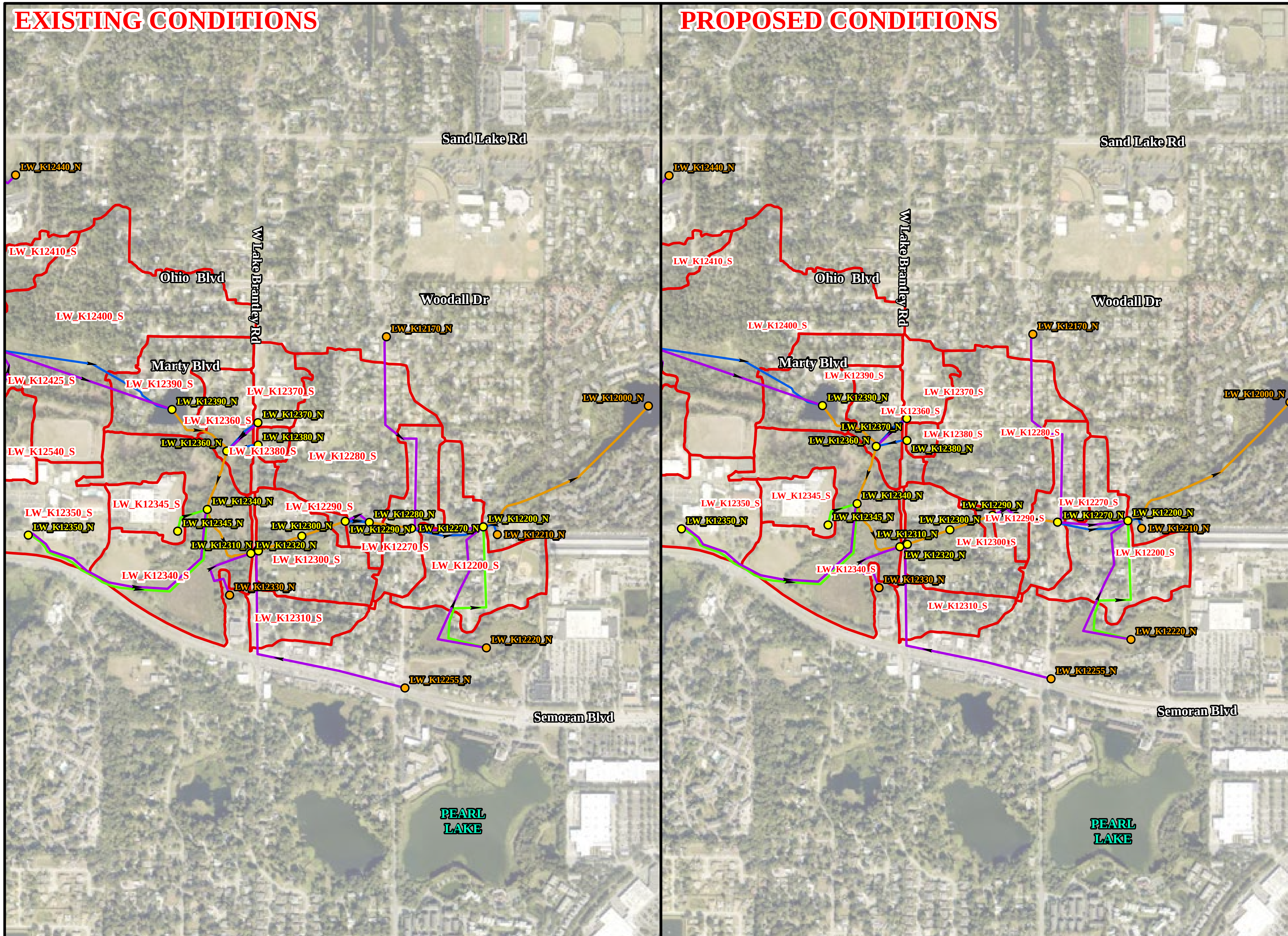
As seen in **Table 1**, some reductions in peak stage were observed with the proposed improvements near Vonna Lake. Vonna Lake itself decreased by approximately 0.3 to 0.5' in the design storm events. The locations of the nodes found in **Table 1** are presented on **Figure 5** which depicts both the existing conditions and proposed conditions Node-Link model schematics.

It is noted that some downstream nodes showed a minimal increase in peak stage (generally less than 0.1' and most still less than assigned warning elevation). The impacts to the downstream areas would have to be further investigated during design efforts and in conjunction with the final design associated with the County's current Harriet Estates project.

As seen in **Figure 6 – Figure 8**, flood stage recovery is improved somewhat under this improvement concept, reducing the duration of potential flooding when compared to existing conditions. It is noted that the system is tailwater controlled so stage recover is subject to the recovery rate in downstream areas.

TABLE 1 - NODE MAXIMUM CONDITIONS SUMMARY

STAGE/AREA NODE	WARNING STAGE	LOS CRITERIA	MEAN ANNUAL / 24 HOUR		10 YEAR / 24 HOUR		25 YEAR / 24 HOUR	
NAME	ELEVATION	DESIGN STORM	EXISTING PEAK STAGE (FT)	PROPOSED PEAK STAGE (FT)	EXISTING PEAK STAGE (FT)	PROPOSED PEAK STAGE (FT)	EXISTING PEAK STAGE (FT)	PROPOSED PEAK STAGE (FT)
LW_K12200_N	49.00	10 YEAR / 24 HOUR	46.36	46.40	46.83	46.87	47.12	47.16
LW_K12270_N	51.00	10 YEAR / 24 HOUR	47.96	48.25	48.52	48.82	48.88	49.42
LW_K12280_N	50.50	10 YEAR / 24 HOUR	50.30	50.14	**50.81**	**50.69**	**51.41**	**51.50**
LW_K12290_N	51.00	10 YEAR / 24 HOUR	50.31	50.25	50.93	50.92	**51.69**	**51.51**
LW_K12300_N	50.50	N/A	**50.61**	**50.67**	**51.23**	**51.26**	**51.85**	**51.79**
LW_K12310_N	54.00	10 YEAR / 24 HOUR	51.33	51.10	51.93	51.71	52.47	52.28
LW_K12320_N	54.00	10 YEAR / 24 HOUR	51.45	51.15	52.22	51.83	53.05	52.53
LW_K12340_N	56.00	N/A	51.68	51.29	52.40	52.03	53.15	52.65
LW_K12360_N	56.00	N/A	51.70	51.34	52.41	52.06	53.15	52.67
LW_K12390_N	50.00	25 YEAR / 24 HOUR	**51.71**	**51.36**	**52.42**	**52.07**	**53.16**	**52.69**



SEMINOLE COUNTY

N

0 215 430 860 Feet

Legend

- SUBBASINS
- ICPR NODE TYPE
  - STAGE AREA
  - TIME STAGE
- ICPR LINK TYPE
  - PIPE
  - WEIR
  - CHANNEL
  - DROP STRUCTURE
  - RATING CURVE

Sources:
Aerial - ESRI, 2022

Figure
5

Model Map

Tributary C

Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec
consultants

Figure 6 – Model Peak Stages and Recovery at Vonna Lake

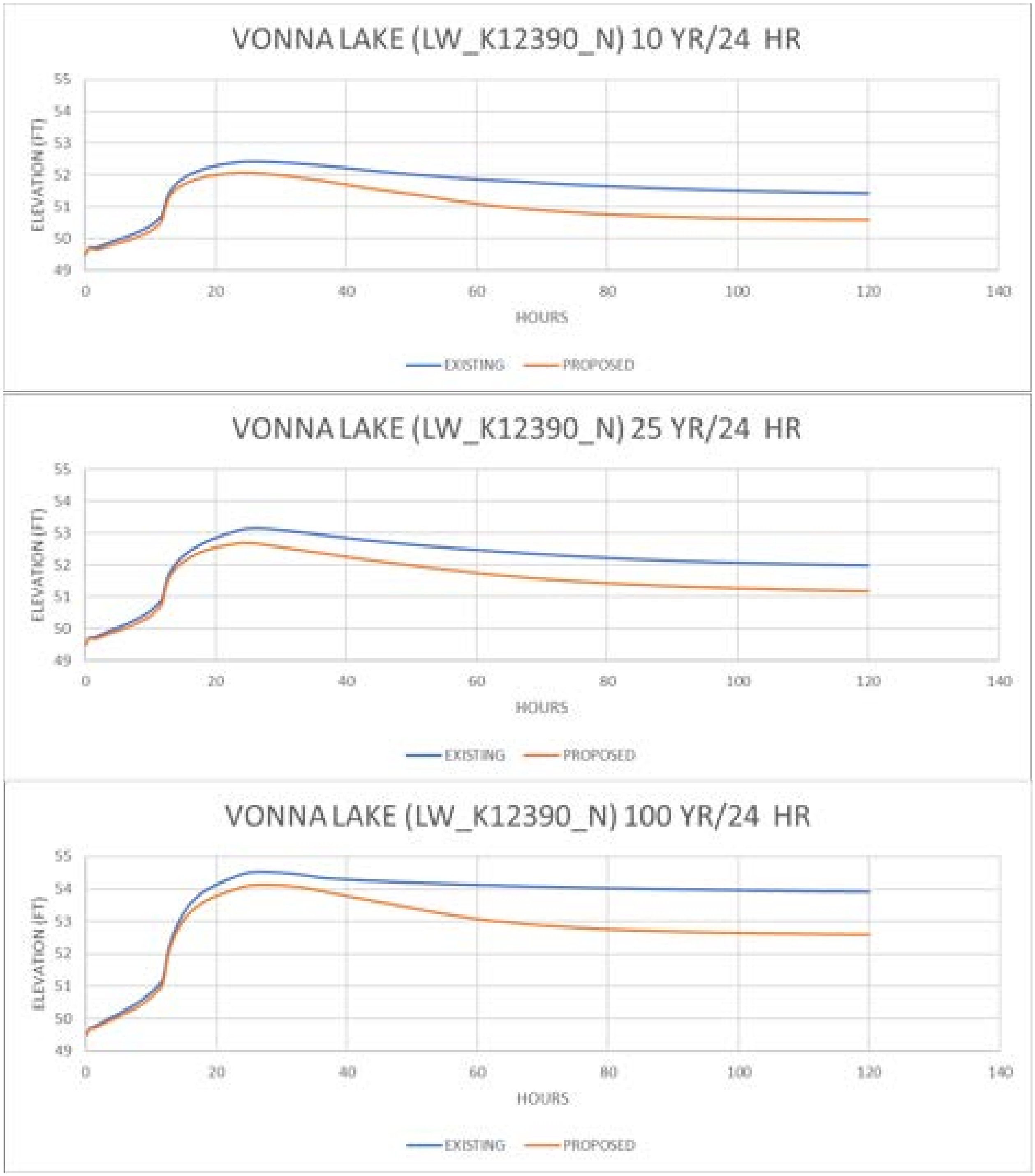


Figure 7 – Model Peak Stages and Recovery at Lake Brantley Road Culvert

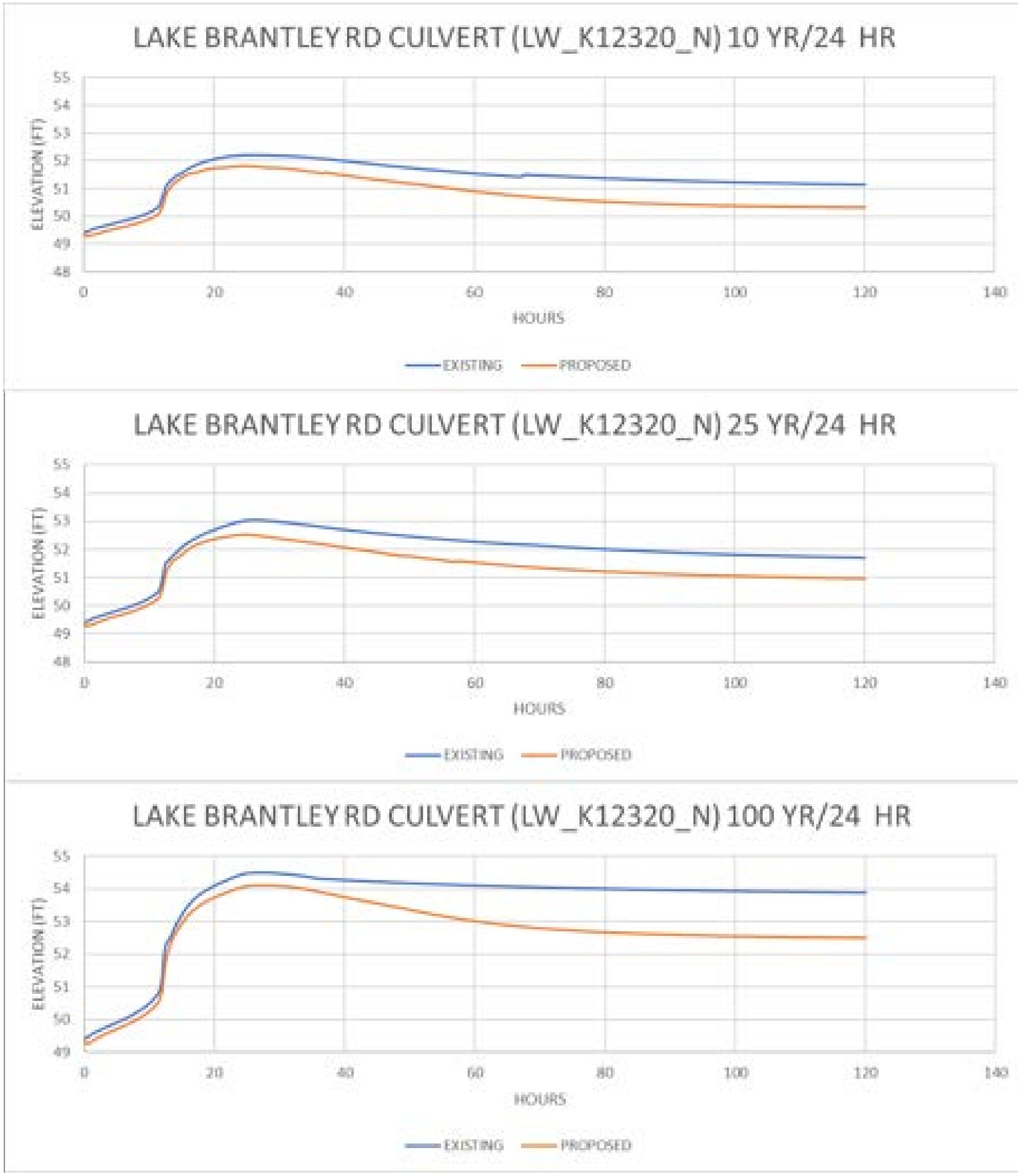
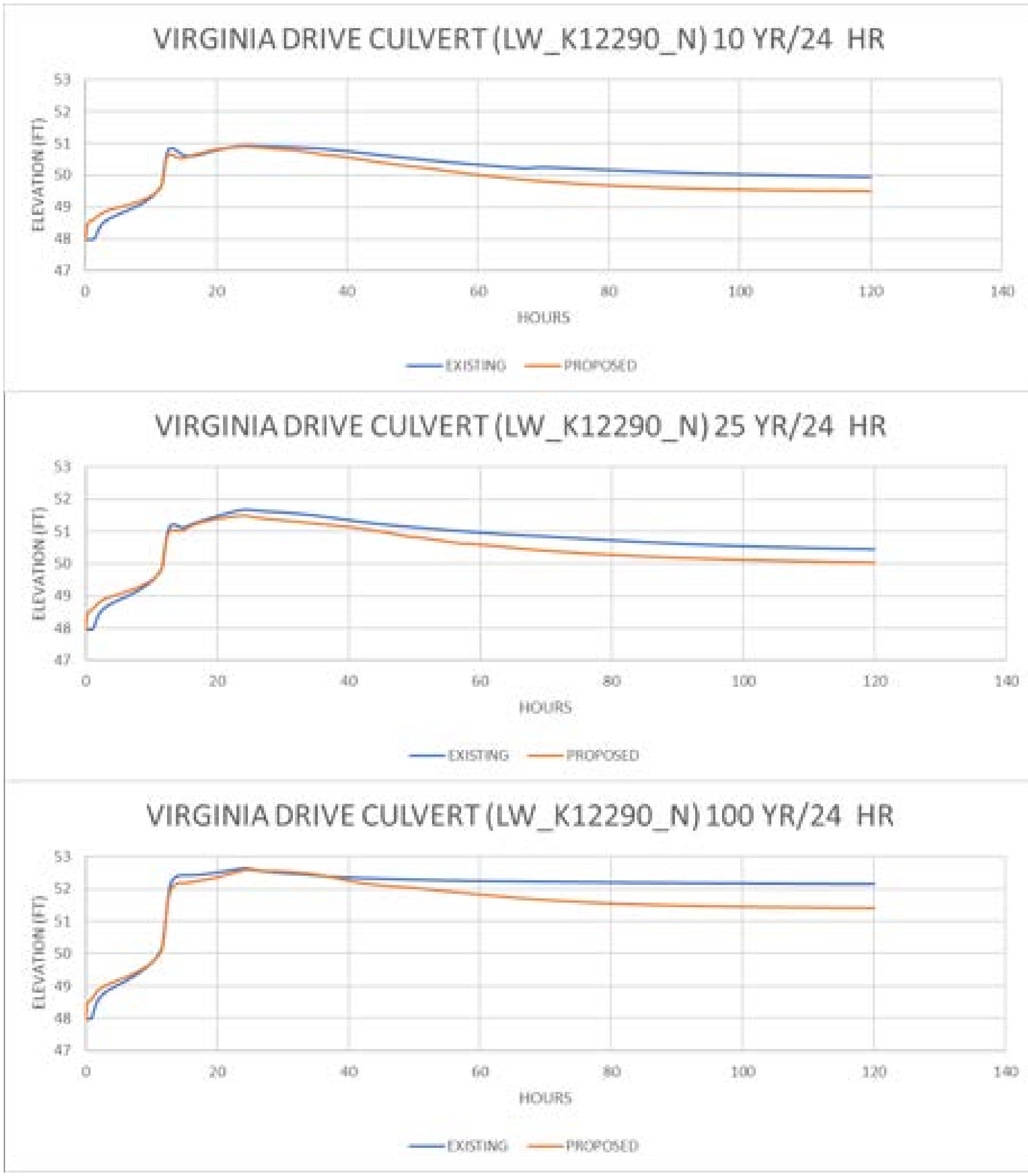


Figure 8 – Model Peak Stages and Recovery at Virginia Drive Culvert



Benefit Cost Analysis

Benefit cost calculations were performed in accordance with the methodology previously described. Roadway damages were determined for County maintained roads within the project area. Annual road flood damages benefits were calculated as the difference between damages in the existing and proposed conditions. Roadway ecosystem benefits were calculated in the FEMA Benefit Cost Calculator based on the project area (9.65 acres) and estimated percentage of urban green space within the project area (15%). Roadways included in this assessment are listed below.

- Cadillac Drive, Lake Brantley Road, Marty Boulevard, and Virginia Drive.

Structure benefits were calculated in the FEMA Benefit Cost Calculator and included both standard mitigation benefits (e.g., flood related damages) and social benefits (e.g., mental anguish from flooding related displacement). Structures that showed potential impacts were included in this assessment and are listed below.

- Parcel 08-21-29-510-0000-0170. 664 W CADILLAC DR ALTAMONTE SPRINGS FL 32714.
- Parcel 08-21-29-510-0000-0180. 660 W CADILLAC DR ALTAMONTE SPRINGS FL 32714.
- Parcel 08-21-29-510-0000-0190. 656 W CADILLAC DR ALTAMONTE SPRINGS FL 32714.
- Parcel 08-21-29-510-0000-0220. 659 W CADILLAC DR ALTAMONTE SPRINGS FL 32714.
- Parcel 08-21-29-510-0000-0230. 661 W CADILLAC DR ALTAMONTE SPRINGS FL 32714.

Results of the benefit cost analysis for this improvement project are summarized in **Table 2**. As seen in **Table 2**, the lifecycle benefits of the project exceed the estimated construction cost, resulting in a BCR of 1.80 which indicates that this project may be cost-effective.

Table 2: Benefit Cost Results for Tributary C

Benefit Cost Results								
Project	Existing Conditions Road Flood Damages ($/year)	Proposed Conditions Road Flood Damages ($/year)	Road Flood Damages Benefit ($/year)	Roadway Ecosystem Benefits ($/year)	[1]Structure Total Benefits ($/year)	[2]Lifecycle Benefit ($)	[3]Estimated Construction Cost ($)	B/C Ratio
Trib C	$67,025	$58,344	$8,681	$22,496	$194,589	$3,115,796	$1,730,417	1.80

[1]*Structure total benefits include standard mitigation benefits and social benefits as outlined in the FEMA Benefit Cost Calculator.*

[2]*Lifecycle benefit is equal to (Road Flood Damages Benefit + Road Ecosystem Benefit + Structure Total Benefits) x 13.801 to calculate the NPV of benefits over the project's lifecycle.*

[3]*Estimated construction cost is the construction cost + contingency. Does not include design and permitting or CEI services.*

Results of the benefit cost analysis including the FEMA Benefit Cost Calculator are included in the Electronic Deliverables.

Implementation Considerations

The following implementation considerations are provided for this improvement concept.

- Flood Benefit – The project is intended to improve drainage conveyance and flood duration, but not necessarily mitigate the occurrence of flooding during an actual extreme storm event.
- Permitting Considerations – It is anticipated that this improvement would require a general permit for stormwater retrofit from the St. Johns River Water Management District since it would impact surface waters and involves upsizing of drainage infrastructure.
- Engineering Design – Final engineering design should include collection of survey data, utility designation, geotechnical testing, preparation of design plans, preparation of a cost estimate, preparation of technical specifications, and utility coordination to address any needed conflict adjustments / relocations.
- Water Quality Benefit – This improvement would not be purposed to provide a direct water quality benefit.
- Land Acquisition – Land and/or easement acquisition will be necessary to construct the proposed improvements. It is assumed that the County would request for these easements to be donated in exchange for County maintenance; however, the cost of the easements has been included to be conservative.
- Wetland / Surface Water Impacts – Surface water and/or wetland impacts are anticipated to construct the ditch widening and grading improvements. The extent of any impacts would have to be quantified during design based on an ecological assessment.
- Benefit/Cost – The estimated NPV of the 50 year lifecycle benefits (road, structure, ecosystem services, and social) for this improvement are $3,115,796. The estimated construction cost for this improvement is $1,730,417, which includes construction and a 20% contingency. The resulting BCR for this improvement is **1.80**. A detailed breakdown of the preliminary cost estimate is provided in **Table 3**.

Table 3: Engineer's Estimate of Probable Improvement Costs based on Concept

Tributary C						
Item	**Pay Item No.**	**Description**	**Units**	**Unit Cost**	**Quantity**	**Total**
1	101-1	Mobilization (15% of Construction Total)	LS	varies	1	$144,201
2	102-1	Maintenance of Traffic (10% of Construction Total)	LS	varies	1	$96,134
3	104-1	Prevention, Control and Abatement of Erosion and Water Pollution (10% of Construction Total)	LS	varies	1	$96,134
4	110-1-1	Clearing and Grubbing (15% of Construction Total)	LS	varies	1	$144,201
5	430-175-136	Pipe Culvert, Concrete, Round, 36" S/CD	LF	$375.00	130	$48,750
6	900-1	Channel Widening and Grading	LF	$75.00	3250	$243,750
7	900-2	Easement / Property Acquisition	LS	varies	1	$668,843
					SUBTOTAL COST:	$1,442,014
					CONTINGENCY (20%):	$288,403
					CONSTRUCTION SUBTOTAL:	$1,730,417
					DESIGN & PERMITTING:	$346,083
					CEI SERVICES:	$259,563
					ESTIMATED TOTAL IMPLEMENTATION COST:	**$2,336,063**

Notes:

1) *Above estimate does not include cost for potential utility relocations.*
2) *Assumes no muck or other removal of unsuitable soils.*
3) *Design and permitting was assumed to be 20% of the construction subtotal cost based on engineering judgement.*
4) *Construction engineering and inspection (CEI) services was assumed to be 15% of the construction subtotal cost based on engineering judgement.*
5) *Costs for 900-2 were obtained from the Seminole County property appraiser and were assumed to be 1.5 times the parcel value (land + buildings + features) to account for administrative costs. Assumed that City and Florida Power easements would be donated at no cost.*

The information provided herein in considered to be preliminary for project planning purposes. As noted previously, design level efforts including detailed modeling will be necessary to quantify pumping rates, confirm flood stages, confirm pollutant load reductions, etc.

Conclusions

The goal of this effort was to gain some conveyance efficiency in the system just west and east of Lake Brantley Road to help relieve the area around Vonna Lake. Eliminating the possibility of flooding is impractical so the improvements are focused of reducing flood stages and the duration of flooding through conveyance improvements. Based on model results, the proposed improvements are anticipated to result in a general decrease in peak stages in most locations as well as reduce the duration of flooding during extreme storm events.

The total project implementation cost was estimated to be approximately $2,336,063 including construction, contingency, design and permitting, CEI services, and easement / property acquisition.

Results of the benefit cost analysis indicate a BCR of 1.80, indicating that this project may be cost-effective.

Based on the foregoing, Geosyntec recommends that the County pursue design of this flood improvement for the anticipated flood reduction benefits.

Flooding Focused Project

Markham Road at Timberbrook and Bridge Water

Flood Improvement Alternatives Analysis

Markham Road at Timberbrook and Bridge Water Flood Retrofit

Wekiva Watershed Management Plan

Seminole County, Florida

The purpose of this flood improvement concept is to provide improvements to drainage and conveyances to improve flood management in the project area. The project area is generally defined as both the intersection of Markham Woods Road and Timberbrook Drive, and then Markham Woods Road just south of Bridge Water Drive to the south.

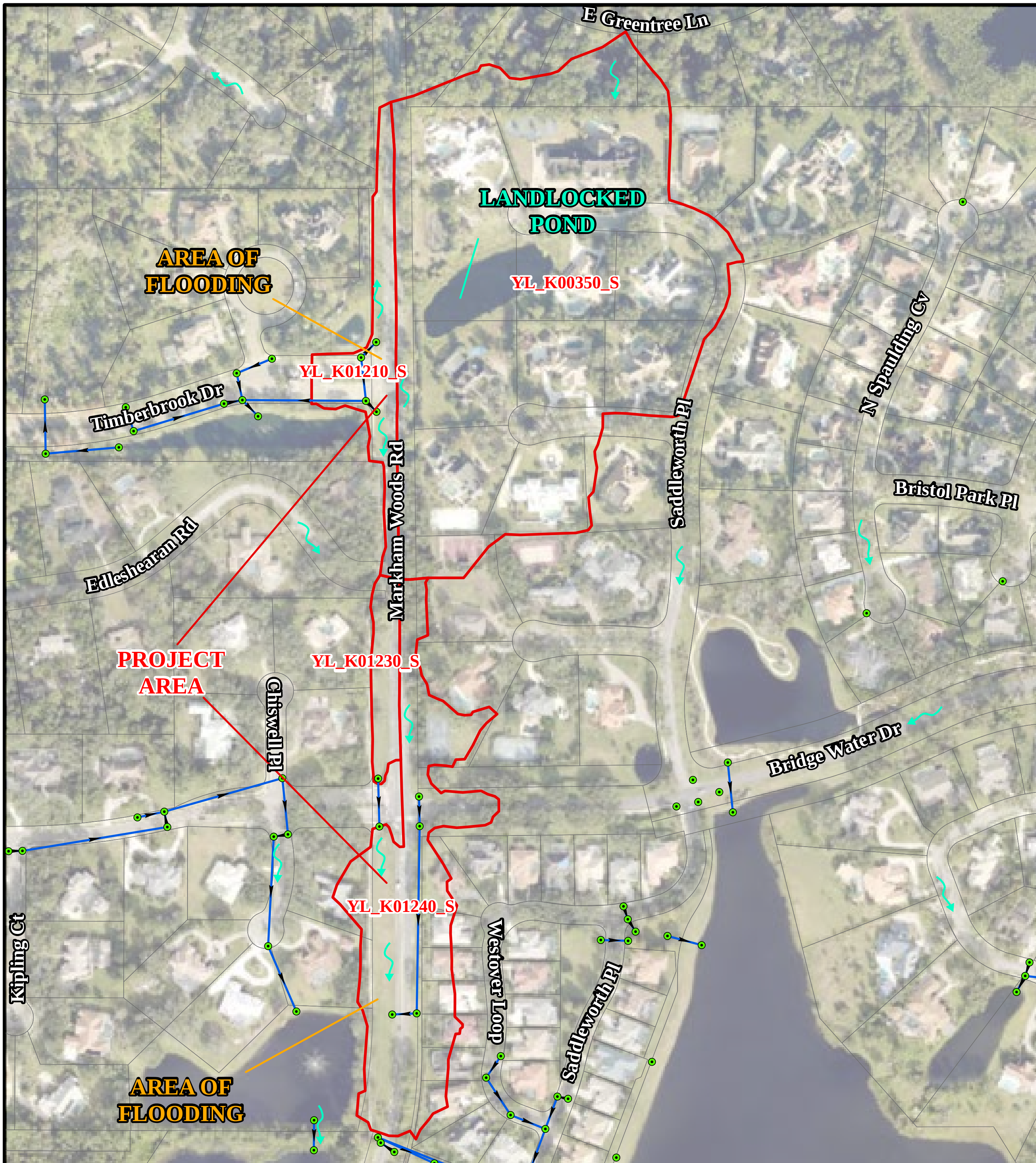
The project area is shown on **Figure 1**. A topographical map is included on **Figure 2**. Representative photos of the area are included on the following pages.

Existing Conditions

The area at the intersection of Timberbrook Drive has roadside swales that capture runoff from Markham Woods Road. The swales can pop off into a storm sewer system for the Magnolia Plantation subdivision (private) on the west side of the road. Flooding has been observed by County staff which impacts the roadway here and has been noted to persist for up to several days as recently as Hurricane Ian. Hydrologic and hydraulic modeling has indicated substandard level of service of C for the roadway. It appears the roadside swales have filled in overtime reducing their capacity and inhibiting conveyance to the outfall into Magnolia Plantation.

In addition, the ponded area to the east of the location in the Heathrow Subdivision off of Saddleworth Place, appears to exceed its banks at less than a 10 year level of services, which then can flood into the Markham Wood Road right of way thought openings underneath the subdivision privacy wall as well as what appears to be a corrugated plastic pipe under the privacy wall. If significant overflow drainage from this subdivision is entering the Markham Woods Road right-of-way it would be contributing to the flooding.

The area to the south of Bridgewater Drive likewise has roadside swales for conveyance of Markham Woods Road runoff. Reports of flooding associated with Hurricane Irma were noted and County observations. No significant road flooding has been noted here, but the sidewalk is inundated for periods of time making it inaccessible. Similar to the Timberbrook locations, it appears the roadside swales have filled in over time causing poor grading and reducing their capacity which inhibits conveyance to the outfall into the pond to the west associated with the Heathrow Woods subdivision.



Legend

PARCELS
SUBBASINS
PIPES / CULVERTS
DRAINAGE STRUCTURES

0 87.5 175 350 525 700 Feet

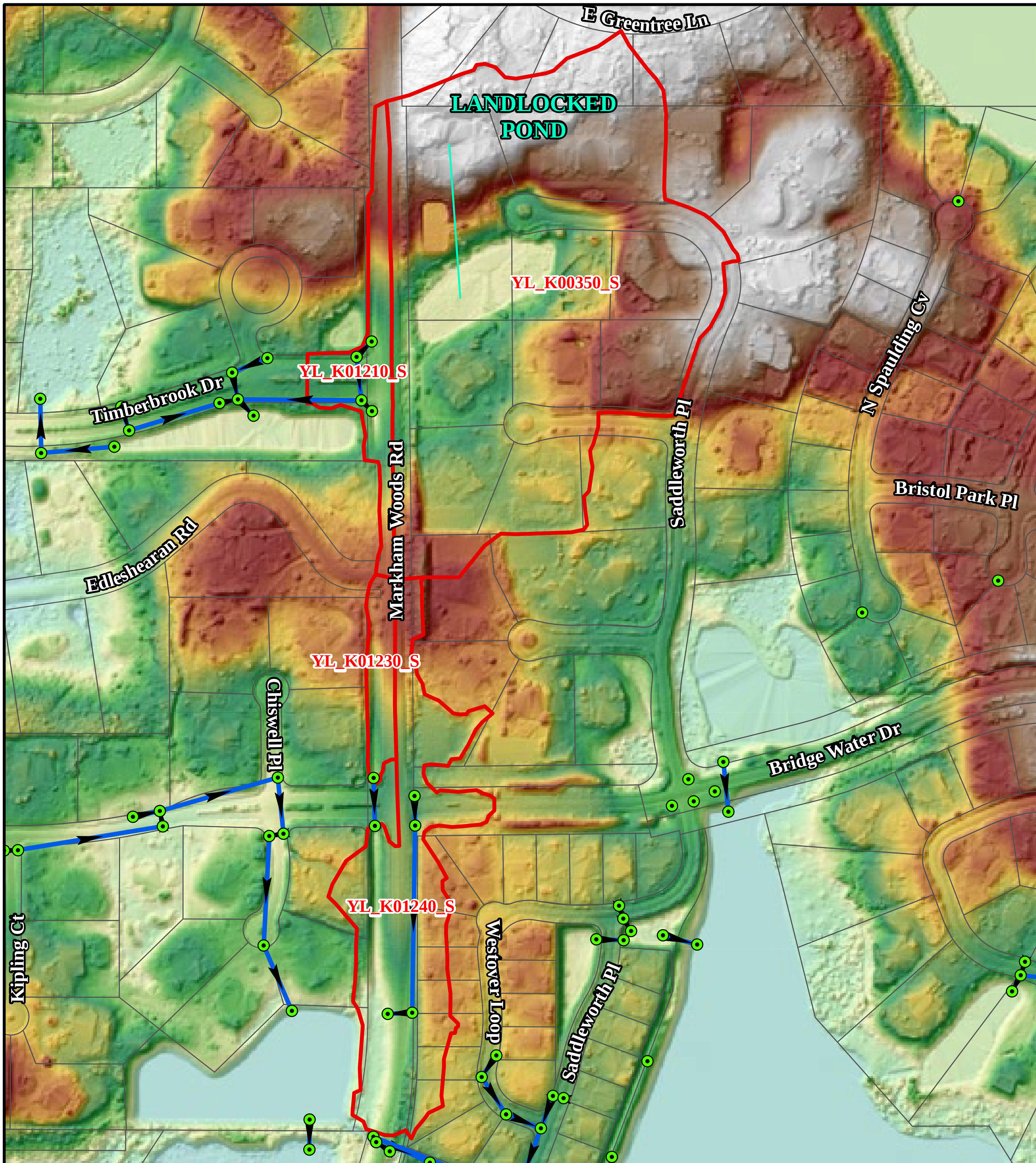
Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Site Map
Markham Road at Timberbrook and Bridge Water Flood Retrofit
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure
1



N

Legend

PARCELS

SUBBASINS

PIPES / CULVERTS

DRAINAGE STRUCTURES

DEM
FEET NAVD 1988
68.47
38.6

0 87.5 175 350 525 700
Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022
DEM - USGS LIDAR, 2018

Topographical Map
Markham Road at Timberbrook and Bridge Water Flood Retrofit
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure
2

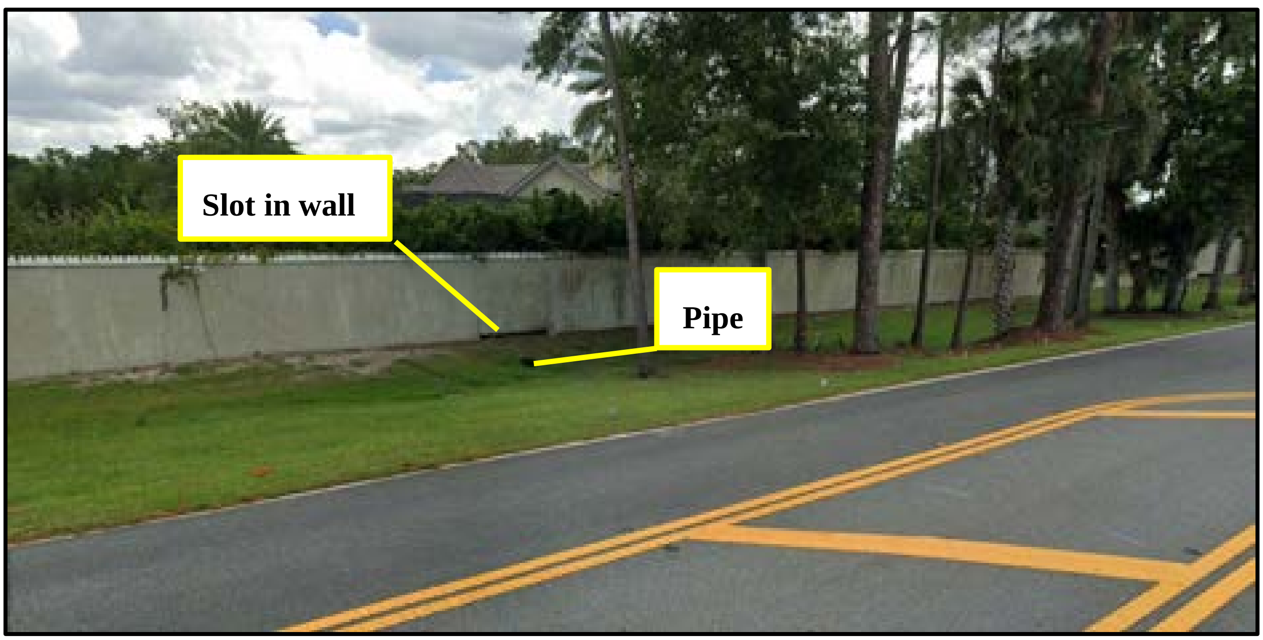
View to south along Markham Woods Road towards Timberbrook Drive (Google, 2022)

View to south along Markham Woods Road towards Timberbrook Drive (Google, 2022)

View to north along Markham Woods Road towards Timberbrook Drive (Google, 2022)

View to northwest from Markham Woods Road towards Timberbrook Drive (Google, 2022)

View of east side of Markham Woods Road near Timberbrook towards are with slot under the subdivision privacy wall draining to right of way (Google, 2022)



View of east side of Markham Woods Road near Timberbrook towards area with slot and pipe under the subdivision privacy wall draining to right of way (Google, 2022)

View to south from Markham Woods Road south of Bridge Water Drive (Google, 2021)

View to south from Markham Woods Road south of Bridge Water Drive (Google, 2021)

View to west from Markham Woods Road towards low sidewalk area (Google, 2021)

View to north from Markham Woods Road south of Bridge Water Drive (Google, 2021)

View to north from Markham Woods Road near swale outfall to pond (Google, 2021)

View to north from Markham Woods Road to swale outfall near pond (Google, 2021)

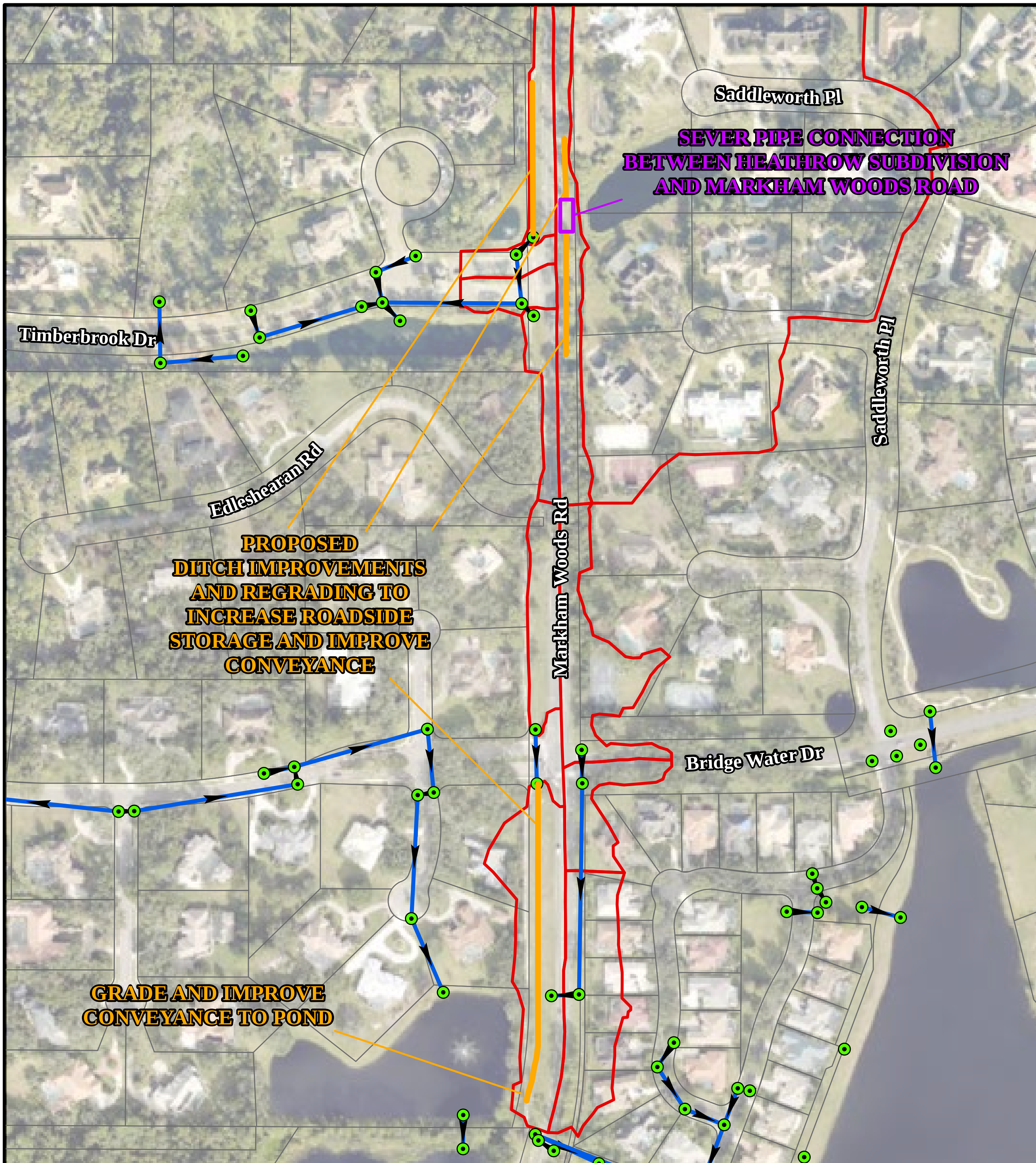
Proposed Improvements

The Wekiva Watershed modeling indicated substandard Level of Service (LOS) of C for the roadway in the subject areas. It is noted that initial improvement conditions modeling results indicated that during dry, design conditions roadway flooding was not observed at the intersection of Markham Woods Road and Timberbrook Drive, however, sidewalk flooding occurs at the intersection of Markham Woods Road and Bridge Water Drive. Based on these results, Geosyntec incrementally increased the initial stages of the Heathrow Subdivision pond and pond to the south of Timberbrook Drive to represent cumulative wet season conditions or conditions that may be experienced during back to back storm events. Ultimately, roadway flooding was observed when the initial stage of the Heathrow Subdivision pond was set to a minimum elevation of 45.75 feet, which resulted in the node representing the drainage ditch on the east side of Markham Woods Road starting in a wet condition. Under this scenario, model results appeared to match County reports of roadway inundation that persists over a period of time due to the lack of an engineered outfall for the Heathrow Subdivision pond. The connection from the Heathrow Subdivision does not appear on the subdivision plans and may have been added after the fact. It is uncertain of this connection was permitted but it appears to result in additional inundation contribution to Markham Woods Road.

The proposed project is to gain back some conveyance and storage efficiency in the roadside systems to help relieve flooding in the area. The following is proposed:

- Re-establish the roadside drainage swales with consistent grading to outfall locations.
- Reshape the swales to maximize storage while maintaining appropriate clear zone next to roadway.
- Sever the pipe connection and wall opening from the Heathrow Subdivision to the drainage ditch on the east side of Markham Woods Road.

The proposed improvement concept is shown on **Figure 3**.



N

Legend

PARCELS

SUBBASINS

PIPES / CULVERTS

DRAINAGE STRUCTURES

0 75 150 300 450 600 Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Proposed Improvements Map

Markham Road at Timberbrook and Bridge Water Flood Retrofit
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

Seminole County

Figure 3

Flood Benefits

The data from the Wekiva Watershed model was adapted for use in modeling this improvement alternative. The focus of the modeling effort was to improve the roadway LOS during the Mean Annual, 24 hour and 10 year, 24 hour design storm events.

The flood benefits associated with this improvement concept are depicted in **Table 1**. As seen in **Table 1**, model results indicate that road and sidewalk flooding may be eliminated during the 10 year, 24 hour design storm event.

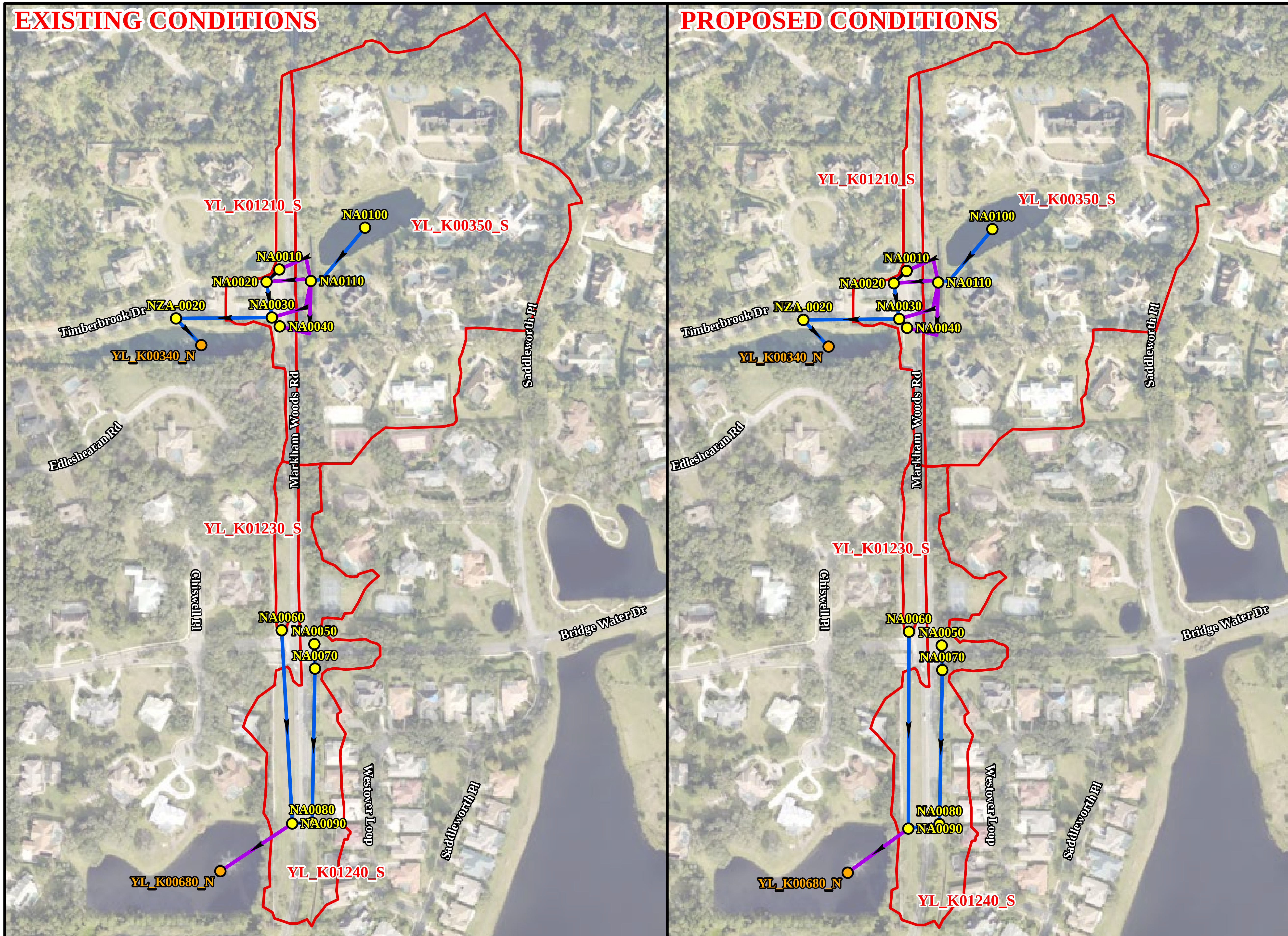
Peak stage reductions were achieved by severing the pipe connection from the Heathrow Subdivision pond and roadside drainage swale improvements including regrading to improve conveyance and storage.

The locations of the nodes found in **Table 1** are presented on **Figure 4** which depicts both the existing conditions and proposed conditions Node-Link model schematics.

Geosyntec consultants

TABLE 1 - MARKHAM WOODS ROAD FLOOD RETROFIT

STAGE/AREA NODE		INITIAL STAGE		WARNING STAGE		MEAN ANNUAL / 24 HOUR		10 YEAR / 24 HOUR	
NAME	DESCRIPTION	ELEVATION	DESCRIPTION	ELEVATION	DESCRIPTION	EXISTING PEAK STAGE (FT)	PROPOSED PEAK STAGE (FT)	EXISTING PEAK STAGE (FT)	PROPOSED PEAK STAGE (FT)
NA0010	Drainage inlet	42.23	Bottom of structure	45.47	Edge of pavement	44.53	44.51	45.13	44.70
NA0020	Drainage inlet	42.12	Pond Tailwater	45.00	Edge of pavement	44.52	44.51	**45.13**	44.70
NA0030	Drainage inlet	42.12	Pond Tailwater	44.71	Edge of pavement	44.52	44.51	**45.13**	44.69
NA0040	Drainage inlet	42.12	Pond Tailwater	45.43	Edge of pavement	44.52	44.51	45.13	44.70
NA0050	Drainage inlet	43.88	Bottom of structure	46.96	Edge of pavement	44.17	44.17	44.56	44.56
NA0060	Drainage inlet	43.17	Bottom of structure	46.53	Edge of pavement	43.37	43.37	43.54	43.54
NA0070	Drainage inlet	42.44	Bottom of structure	47.15	Edge of pavement	42.92	42.92	43.58	43.58
NA0080	Drainage inlet	41.49	Bottom of structure	45.23	Edge of pavement	42.30	42.30	43.13	43.13
NA0090	Drainage inlet	40.94	Bottom of structure	41.30	Edge of pavement	**41.88**	40.94	**42.09**	41.05
NA0100	Stormwater Pond	45.75	Pond Water Surface	47.65	Top of Bank	46.05	46.25	46.22	46.59
NA0110	Roadside Ditch	43.75	Ditch Bottom	45.90	Edge of pavement	**46.05**	45.29	**46.11**	45.81



SEMINOLE COUNTY

N

0 65 130 260 Feet

Legend

SUBBASINS

ICPR LINK TYPE

PIPE

WEIR

ICPR NODE TYPE

STAGE AREA

TIME STAGE

Sources:
Aerial - ESRI, 2022

Figure

4

Model Map

Markham Road at Timberbrook and Bridge Water Flood Retrofit

Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

Geosyntec consultants

Benefit Cost Analysis

Benefit cost calculations were performed in accordance with the methodology previously described. Roadway damages were determined for County maintained roads within the project area. Annual road flood damages benefits were calculated as the difference between damages in the existing and proposed conditions. Roadway ecosystem benefits were calculated in the FEMA Benefit Cost Calculator based on the project area (4.7 acres) and estimated percentage of urban green space within the project area (35%). Roadways included in this assessment are listed below.

- Markham Woods Road.

Model results did not indicate the presence of any potentially impacted structures within the project area.

Results of the benefit cost analysis for this improvement project are summarized in **Table 2**. As seen in **Table 2**, the lifecycle benefits of the project exceed the estimated construction cost, resulting in a BCR of 2.97 which indicates that this project may be cost-effective.

Table 2: Benefit Cost Results for Markham Road and Timberbrook and Bridge Water

Benefit Cost Results								
Project	Existing Conditions Road Flood Damages ($/year)	Proposed Conditions Road Flood Damages ($/year)	Road Flood Damages Benefit ($/year)	Roadway Ecosystem Benefits ($/year)	[1]Structure Total Benefits ($/year)	[2]Lifecycle Benefit ($)	[3]Estimated Construction Cost ($)	B/C Ratio
Markham Timberbrook	$16,749	$1,916	$14,833	$25,565	$0	$557,532	$187,740	2.97

[1]Structure total benefits include standard mitigation benefits and social benefits as outlined in the FEMA Benefit Cost Calculator.

[2]Lifecycle benefit is equal to (Road Flood Damages Benefit + Road Ecosystem Benefit + Structure Total Benefits) x 13.801 to calculate the NPV of benefits over the project's lifecycle.

[3]Estimated construction cost is the construction cost + contingency. Does not include design and permitting or CEI services.

Results of the benefit cost analysis including the FEMA Benefit Cost Calculator are included in the Electronic Deliverables.

Implementation Considerations

The following implementation considerations are provided for this improvement concept.

- Flood Benefit – The project is intended to improve drainage conveyance and storage within the roadside swales to address road and sidewalk flooding. Based on model results from the Wekiva Watershed Management Plan, subbasin YL_K01210_S at the intersection of Markham Woods Road and Timberbrook Drive received a level of service (LOS) score of C due to roadway flooding. Based on model results for the proposed improvements, roadway flooding may be mitigated, resulting in a LOS score of A. Similarly, subbasin YL_K01240_S at the intersection of Markham Woods Road and Bridge Water Drive received a LOS score of C due to roadway flooding. Based on proposed conditions model results, the score may increase to A based on mitigation of roadway flooding.
- Permitting Considerations – It is anticipated that this improvement would require an general permit for stormwater retrofit from the St. Johns River Water Management District. Further investigation into the feasibility of severing the pipe connection from the Heathrow subdivision will be necessary as well as more detailed modeling to ensure there are no adverse flood stage impacts in the subdivision.
- Engineering Design – Final engineering design should include collection of survey data, utility designation, geotechnical testing, preparation of design plans, preparation of a cost estimate, preparation of technical specifications, and utility coordination to address any needed conflict adjustments / relocations.
- Water Quality Benefit – This improvement would not be purposed to provide a water quality benefit.
- Land Acquisition – Land and/or easement acquisition is not anticipated as the improvements are proposed to be constructed in the County right-of-way.
- Wetland / Surface Water Impacts – Wetland and/or surface water impacts are not anticipated.
- Benefit/Cost – The estimated NPV of the 50 year lifecycle benefits (road, structure, ecosystem services, and social) for this improvement are $557,532. The estimated construction cost for this improvement is $187,740, which includes construction and a 20% contingency. The resulting BCR for this improvement is **2.97**. A detailed breakdown of the preliminary cost estimate is provided in **Table 3**.

Table 2: Engineer's Estimate of Probable Improvement Costs based on Concept

Markham Woods Road at Timberbrook and Bridge Water Flood Retrofit						
Item	**Pay Item No.**	**Description**	**Units**	**Unit Cost**	**Quantity**	**Total**
1	101-1	Mobilization (15% of Construction Total)	LS	varies	1	$16,763
2	102-1	Maintenance of Traffic (10% of Construction Total)	LS	varies	1	$11,175
3	104-1	Prevention, Control and Abatement of Erosion and Water Pollution (10% of Construction Total)	LS	varies	1	$11,175
4	110-1-1	Clearing and Grubbing (5% of Construction Total)	LS	varies	1	$5,588
5	425-11	Modify Existing Drainage Structure	EA	$6,650.00	1	$6,650
6	570-1-2	Performance Turf, Sod	SY	$6.00	3350	$20,100
7	900-1	Roadside Ditch Improvements (Excavation, Embankment, Grading)	LF	$50.00	1500	$75,000
8	900-2	Subdivision wall modifications	LS	$10,000.00	1	$10,000
SUBTOTAL COST:						$156,450
CONTINGENCY (20%):						$31,290
CONSTRUCTION SUBTOTAL:						$187,740
DESIGN & PERMITTING:						$46,935
CEI SERVICES:						$28,161
ESTIMATED TOTAL IMPLEMENTATION COST:						**$262,836**

Notes:

1) *Above estimate does not include cost for potential utility relocations.*
2) *Assumes no muck or other removal of unsuitable soils.*
3) *Pay item 900-1 includes cost to remove accumulated sediment and regrade existing ditches to increase storage and ensure positive drainage.*
4) *Design and permitting was assumed to be 25% of the construction subtotal cost based on engineering judgement.*
5) *Construction engineering and inspection (CEI) services was assumed to be 15% of the construction subtotal cost based on engineering judgement.*

The information provided herein in considered to be preliminary for project planning purposes. As noted previously, design level efforts including detailed modeling will be necessary to quantify pumping rates, confirm flood stages, confirm pollutant load reductions, etc.

Conclusions

The goal of this effort was to develop a flood improvement concept to reduce roadway flooding at the intersection of Markham Woods Road and Timberbrook Drive and sidewalk flooding at an area south of the Markham Woods Road and Bridge Water Drive intersection. A concept was developed consisting of re-establishing the existing roadside swales to improve conveyance of stormwater runoff. Additionally, the pipe connection from the Heathrow subdivision pond to the swale along the east side of Markham Woods Road is proposed to be removed.

The total project implementation cost was estimated to be approximately $262,836 including construction, contingency, design and permitting, and CEI services. The project benefits from a LOS perspective were determined to be:

- Subbasin YL_K01210_S LOS score improved from C to A.
- Subbasin YL_K01240_S LOS score improved from C to A.

Results of the benefit cost analysis indicate a BCR of 2.97, indicating that this project may be cost-effective.

Based on the foregoing, Geosyntec recommends that the County pursue design of this flooding improvement for the anticipated flood benefits.

Flooding Focused Project

Bel Aire Estates

Flood Improvement Alternatives Analysis

Bel Aire Hills Flood Retrofit

Wekiva Watershed Management Plan

Seminole County, Florida

The purpose of this flood improvement concept is to provide improvements to the drainage stormsewer system to improve flood management in the project area. The project area is generally defined as the entire Bel Aire Hills subdivision located east of Balmy Beach Drive.

The project area is shown on **Figure 1**. A topographical map is included on **Figure 2**. Representative photos of the area are included on the following pages.

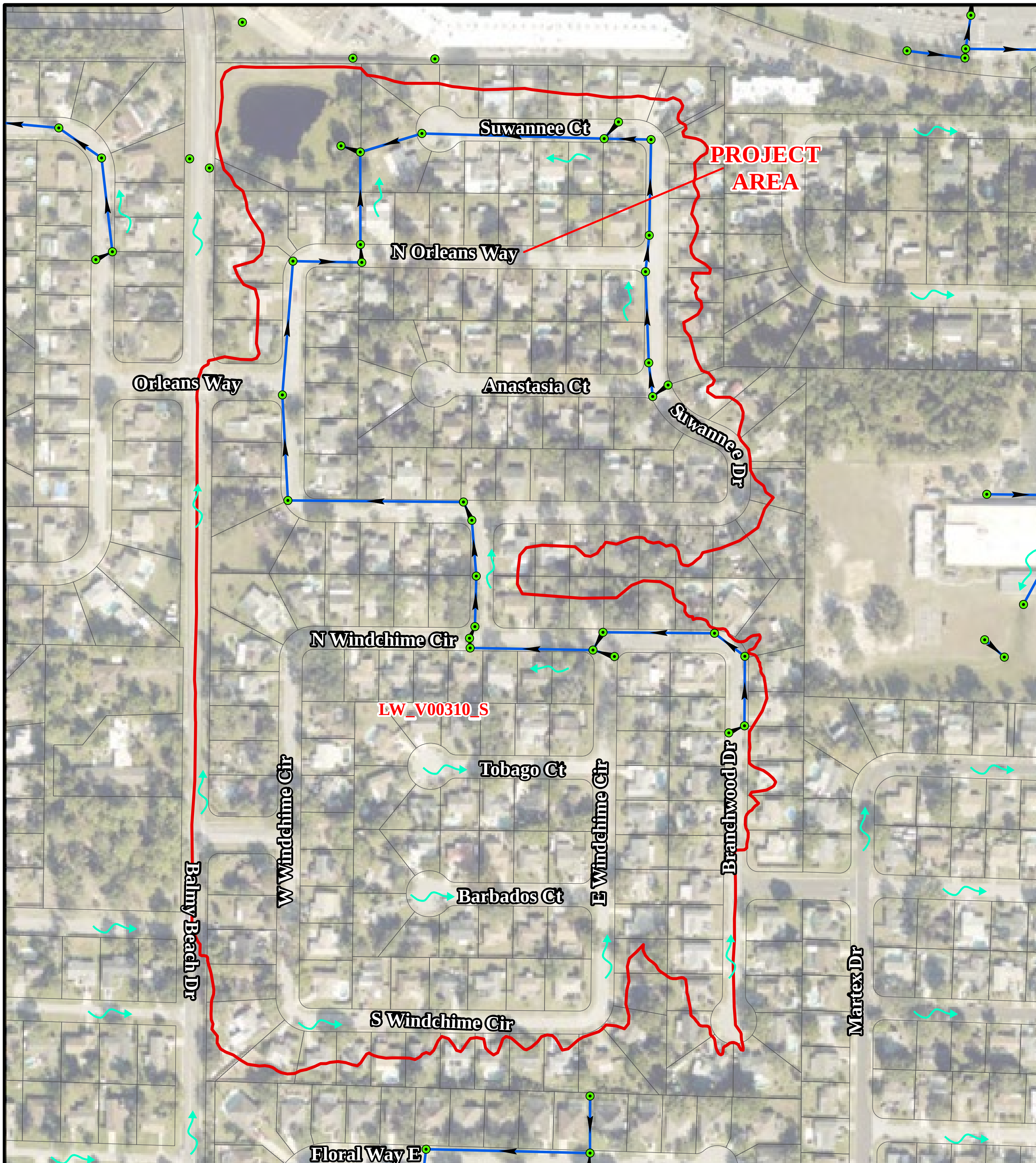
Existing Conditions

The subdivision has reports of insufficient drainage infrastructure and ineffective drainage. Level of service deficiencies noted on Suwannee Court from the hydrologic and hydraulic modeling. Existing conditions model results indicated that undersized drainage infrastructure and flat grading in the upstream areas of the subdivision was contributing to level of service (LOS) deficiencies. Additionally, the existing stormwater pond in the northwest corner of the subdivision was shown to have limited flood attenuation volume and model results indicated that the pond routinely backs up through existing drainage infrastructure, contributing to road flooding in the more downstream areas of the subdivision. As a result, simply upsizing of the existing drainage infrastructure is not sufficient to address roadway flooding.

Proposed Improvements

Based on the foregoing, the proposed improvements were aimed at providing additional storage through exfiltration and reducing the amount of stormwater runoff discharged to the existing stormwater pond by promoting infiltration. Proposed project is to add additional inlets and exfiltration pipe with diversion structures to better capture and convey stormwater runoff while also infiltrating a portion of runoff, reducing the demand on the existing stormwater pond. It is proposed that the improvements all be installed in County right of way.

The proposed improvement concept is shown on **Figure 3**.



N

Legend

PARCELS
SUBBASINS
PIPES / CULVERTS
DRAINAGE STRUCTURES

0 75 150 300 450 600
Feet

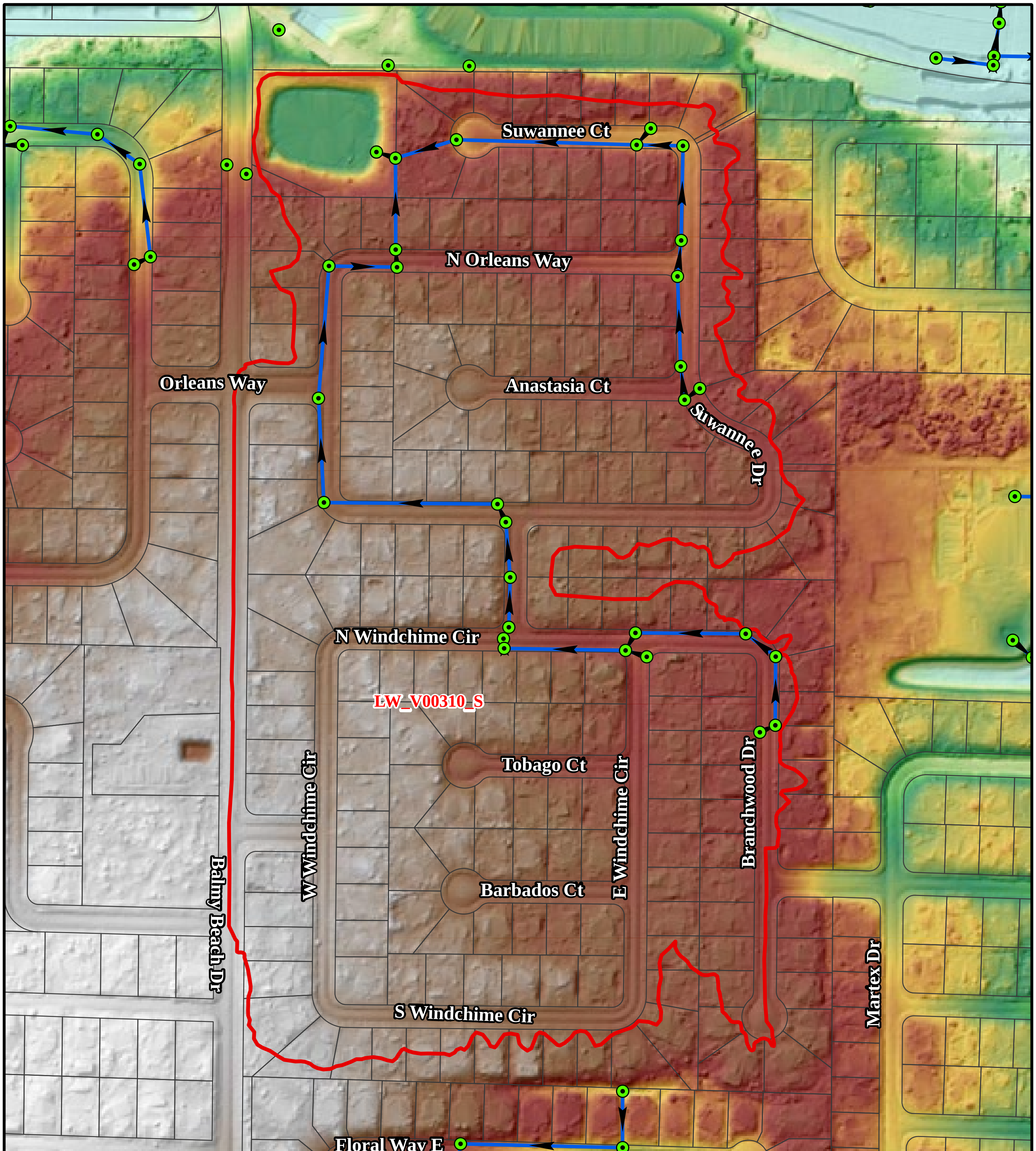
Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Site Map
Bel Aire Hills Flood Retrofit
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure
1



N

Legend

PARCELS
SUBBASINS
PIPES / CULVERTS
DRAINAGE STRUCTURES

DEM
FEET NAVD 1988
68.47
38.6

Sources:
Parcels, Infrastructure - Seminole County, 2022
DEM - USGS LIDAR, 2018

0 75 150 300 450 600 Feet

Topographical Map
Bel Aire Hills Flood Retrofit
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

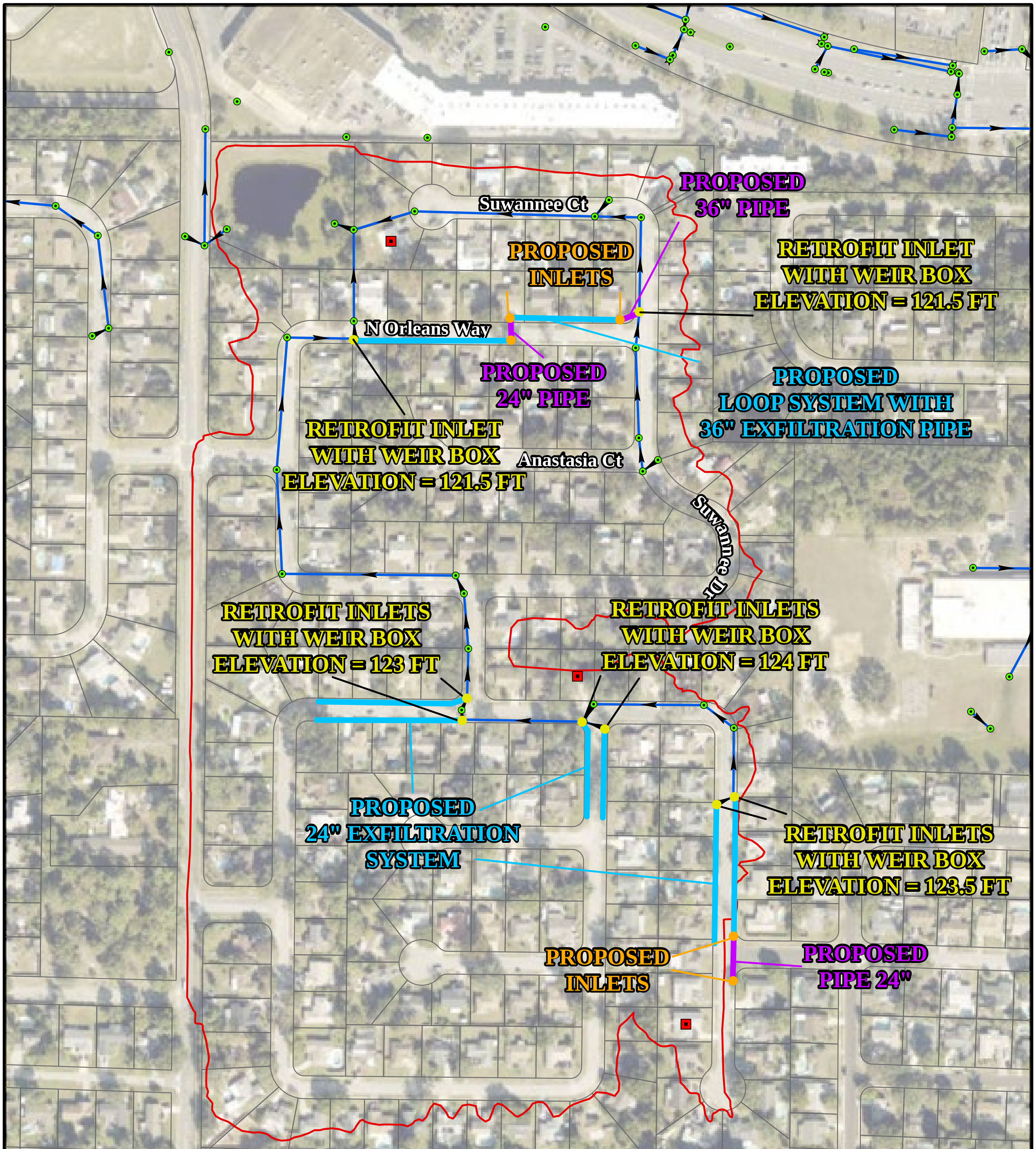
Figure 2

View to east along Suwannee Court (Google, 2019)

View to west along Suwannee Court (Google, 2019)

View to east along North Orleans Way (Google, 2016)

Aerial view to southeast of Bel Aire Hills, stormwater pond in foreground, Suwannee Court and North Orleans Way in background (Google, 2023)



Legend

- PARCELS
- SUBBASINS
- PIPES / CULVERTS
- DRAINAGE STRUCTURES
- IMPACTED STRUCTURES

Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

0 75 150 300 450 600 Feet

Proposed Improvements Map

Bel Aire Hills Flood Retrofit
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure 3

Flood Benefits

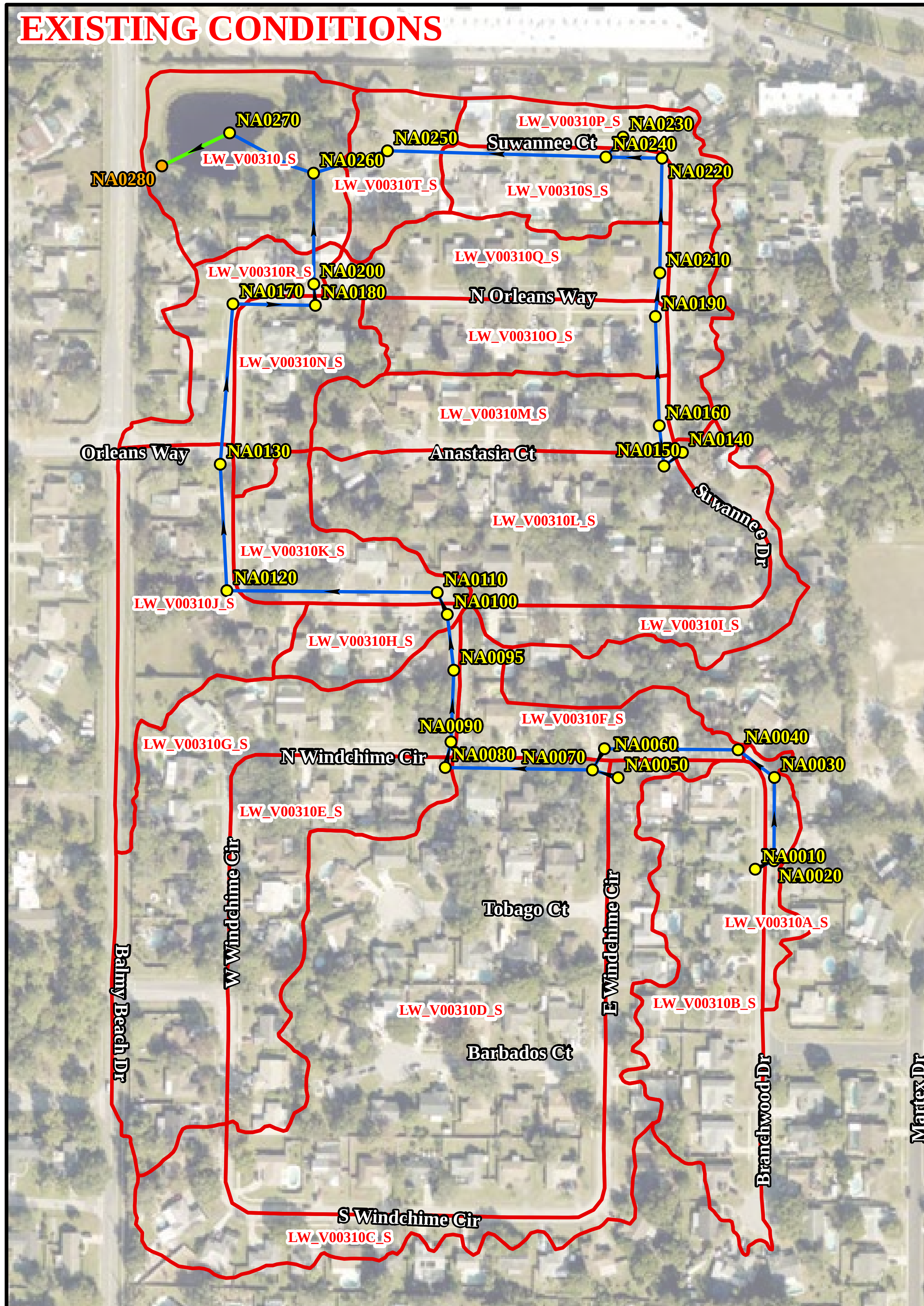
The flood benefits associated with this improvement concept are depicted in **Table 1**. As seen in **Table 1**, model results indicate that road flooding may be eliminated during the 10 year, 24 hour design storm event, with peak stage reductions observable during the 25 year, 24 hour design storm. It is noted that model results discussed herein are based on model assumptions related to groundwater conditions that would facilitate exfiltration, a detailed geotechnical assessment would be needed to confirm effectiveness.

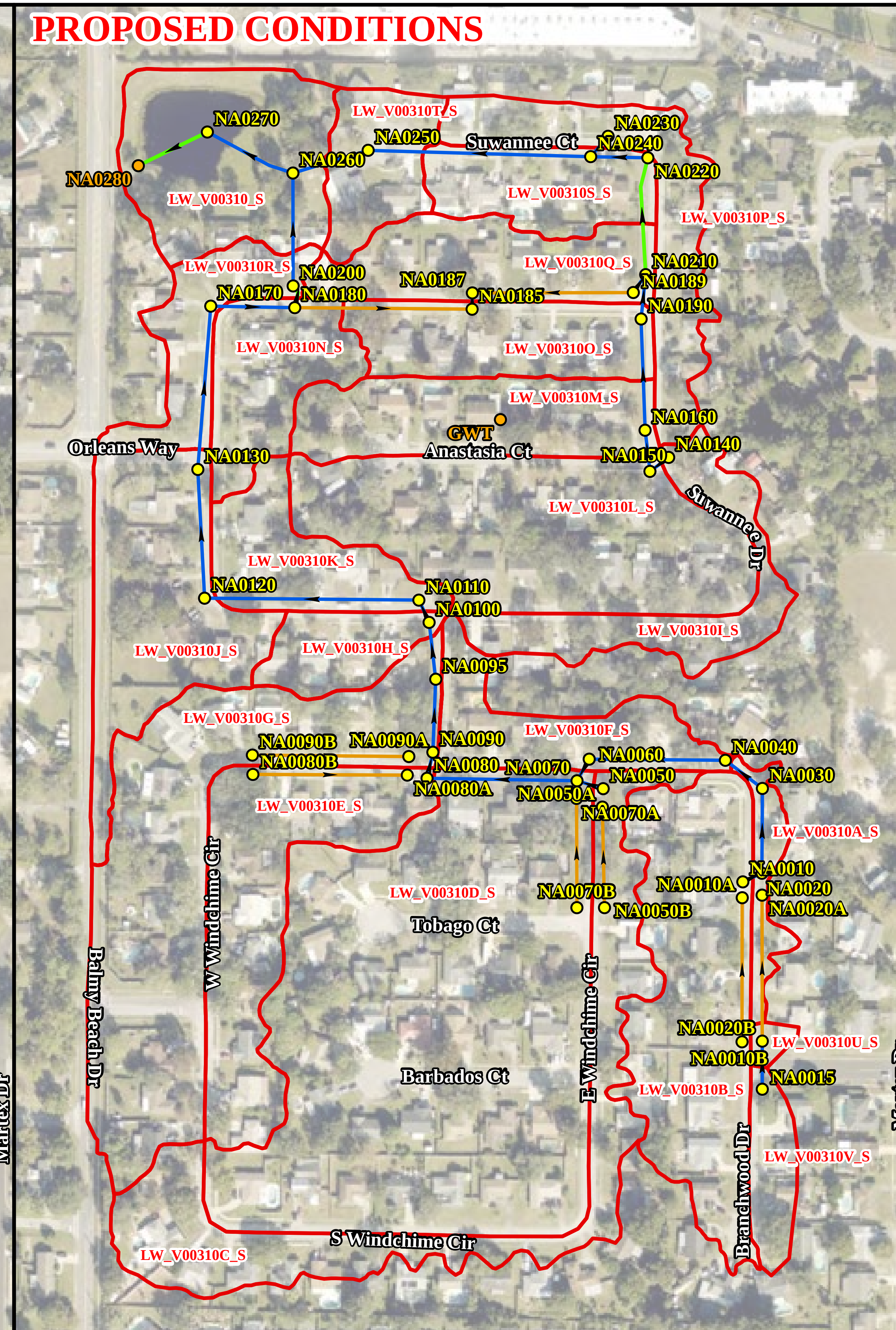
The locations of the nodes found in **Table 1** are presented on **Figure 4** which depicts both the existing conditions and proposed conditions Node-Link model schematics.

Geosyntec consultants

TABLE 1 - NODE MAXIMUM CONDITIONS SUMMARY

STAGE/AREA NODE		INITIAL STAGE		WARNING STAGE		MEAN ANNUAL / 24 HOUR		10 YEAR / 24 HOUR		25 YEAR / 24 HOUR	
NAME	DESCRIPTION	ELEVATION	DESCRIPTION	ELEVATION	DESCRIPTION	EXISTING PEAK STAGE (FT)	PROPOSED PEAK STAGE (FT)	EXISTING PEAK STAGE (FT)	PROPOSED PEAK STAGE (FT)	EXISTING PEAK STAGE (FT)	PROPOSED PEAK STAGE (FT)
NA0010	Drainage inlet	122.11	Invert Elevation	125.00	Edge of Pavement	124.87	123.59	**125.33**	124.93	**125.59**	**125.27**
NA0020	Drainage inlet	121.83	Invert Elevation	125.00	Edge of Pavement	124.83	123.55	**125.33**	124.91	**125.59**	**125.27**
NA0030	Drainage manhole	121.60	Invert Elevation	125.00	Edge of Pavement	124.78	123.52	**125.33**	124.90	**125.58**	**125.27**
NA0040	Drainage manhole	121.45	Invert Elevation	125.00	Edge of Pavement	124.76	123.50	**125.33**	124.90	**125.58**	**125.27**
NA0050	Drainage inlet	121.67	Invert Elevation	125.00	Edge of Pavement	124.75	123.46	**125.32**	124.92	**125.58**	**125.27**
NA0060	Drainage inlet	121.23	Invert Elevation	126.00	Edge of Pavement	124.72	123.45	125.32	124.91	125.58	125.27
NA0070	Drainage inlet	120.66	Invert Elevation	125.00	Edge of Pavement	124.71	123.45	**125.32**	124.91	**125.58**	**125.27**
NA0080	Drainage inlet	120.35	Invert Elevation	126.50	Edge of Pavement	124.49	123.28	125.17	124.72	125.46	125.18
NA0090	Drainage inlet	120.35	Invert Elevation	126.50	Edge of Pavement	124.39	123.21	125.10	124.63	125.41	125.12
NA0095	Drainage manhole	120.35	Invert Elevation	127.00	Edge of Pavement	124.29	123.14	125.01	124.53	125.33	125.03
NA0100	Drainage inlet	120.35	Invert Elevation	127.50	Edge of Pavement	124.17	123.07	124.92	124.43	125.24	124.93
NA0110	Drainage inlet	120.35	Invert Elevation	127.50	Edge of Pavement	124.10	123.02	124.85	124.35	125.18	124.86
NA0120	Drainage manhole	120.35	Invert Elevation	128.00	Edge of Pavement	123.81	122.81	124.58	124.05	124.92	124.55
NA0130	Drainage inlet	120.35	Invert Elevation	127.00	Edge of Pavement	123.62	122.67	124.40	123.84	124.74	124.35
NA0140	Drainage inlet	122.06	Invert Elevation	125.00	Edge of Pavement	123.54	123.18	124.70	124.48	124.78	124.78
NA0150	Drainage inlet	121.90	Invert Elevation	125.00	Edge of Pavement	123.52	123.17	124.69	124.43	124.78	124.78
NA0160	Drainage inlet	121.35	Invert Elevation	125.00	Edge of Pavement	123.35	122.71	124.34	124.01	124.49	124.50
NA0170	Drainage manhole	120.35	Invert Elevation	127.00	Edge of Pavement	123.37	122.47	124.15	123.53	124.47	124.02
NA0180	Drainage inlet	120.35	Invert Elevation	126.00	Edge of Pavement	123.23	122.34	124.01	123.34	124.33	123.84
NA0190	Drainage inlet	120.97	Invert Elevation	124.50	Edge of Pavement	123.22	122.43	123.95	123.63	124.24	124.12
NA0200	Drainage inlet	120.35	Invert Elevation	126.00	Edge of Pavement	123.15	121.81	123.95	123.14	124.28	123.68
NA0210	Drainage inlet	120.49	Invert Elevation	124.50	Edge of Pavement	123.20	122.27	123.91	123.35	124.24	123.84
NA0220	Drainage manhole	120.35	Invert Elevation	123.50	Edge of Pavement	123.13	121.85	**123.91**	123.16	**124.24**	**123.71**
NA0230	Drainage inlet	120.35	Invert Elevation	123.50	Edge of Pavement	123.13	121.84	**123.90**	123.16	**124.24**	**123.75**
NA0240	Drainage inlet	120.35	Invert Elevation	123.50	Edge of Pavement	123.13	121.84	**123.90**	123.15	**124.23**	**123.70**
NA0250	Drainage inlet	120.35	Invert Elevation	123.50	Edge of Pavement	123.09	121.81	**123.90**	123.11	**124.23**	**123.65**
NA0260	Drainage manhole	120.35	Invert Elevation	125.00	Edge of Pavement	123.08	121.81	123.89	123.09	124.23	123.64
NA0270	Stormwater Pond	120.35	Invert Elevation	123.00	Top of Bank	122.96	121.78	**123.76**	122.98	**124.10**	**123.51**





SEMINOLE COUNTY

N

0 55 110 220
Feet

Legend

Subbasins

ICPR LINK TYPES

PIPE

DROP STRUCTURE

FRENCH DRAIN

ICPR NODE TYPES

STAGE AREA

TIME STAGE

Sources:
Aerial - ESRI, 2022

Figure
4

Model Map

Bel Aire Hills Flood Retrofit

Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec
consultants

Benefit Cost Analysis

Benefit cost calculations were performed in accordance with the methodology previously described. Roadway damages were determined for County maintained roads within the project area. Annual road flood damages benefits were calculated as the difference between damages in the existing and proposed conditions. Roadway ecosystem benefits were calculated in the FEMA Benefit Cost Calculator based on the project area (44.6 acres) and estimated percentage of urban green space within the project area (35%). Roadways included in this assessment are listed below.

- Anastasia Court, Barbados Court, Blueridge Drive, Branchwood Drive, Orleans Way, Suwannee Court, Suwannee Drive, Tobago Court, Windchime Circle.

Structure benefits were calculated in the FEMA Benefit Cost Calculator and included both standard mitigation benefits (e.g., flood related damages) and social benefits (e.g., mental anguish from flooding related displacement). Structures that showed potential impacts were included in this assessment and are listed below.

- Parcel 18-21-29-524-0000-1200. 1108 BRANCHWOOD DR APOPKA FL 32703.
- Parcel 18-21-29-524-0000-1000. 3059 N WINDCHIME CIR APOPKA FL 32703.
- Parcel 18-21-29-523-0000-0300. 3034 SUWANNEE CT APOPKA FL 32703.

Results of the benefit cost analysis for this improvement project are summarized in **Table 2**. As seen in **Table 2**, the lifecycle benefits of the project exceed the estimated construction cost, resulting in a BCR of 5.73 which indicates that this project may be cost-effective.

Table 2: Benefit Cost Results for Bel Aire Hills

Benefit Cost Results								
Project	**Existing Conditions Road Flood Damages ($/year)**	**Proposed Conditions Road Flood Damages ($/year)**	**Road Flood Damages Benefit ($/year)**	**Roadway Ecosystem Benefits ($/year)**	**[1]Structure Total Benefits ($/year)**	**[2]Lifecycle Benefit ($)**	**[3]Estimated Construction Cost ($)**	**B/C Ratio**
Bel Aire	$144,763	$69,307	$75,456	$242,921	$546,809	$11,940,434	$2,084,544	5.73

[1]*Structure total benefits include standard mitigation benefits and social benefits as outlined in the FEMA Benefit Cost Calculator.*

[2]*Lifecycle benefit is equal to (Road Flood Damages Benefit + Road Ecosystem Benefit + Structure Total Benefits) x 13.801 to calculate the NPV of benefits over the project's lifecycle.*

[3]*Estimated construction cost is the construction cost + contingency. Does not include design and permitting or CEI services.*

Results of the benefit cost analysis including the FEMA Benefit Cost Calculator are included in the Electronic Deliverables.

Implementation Considerations

The following implementation considerations are provided for this improvement concept.

- Flood Benefit – The project is intended to improve stormwater runoff conveyance in the subdivision and promote infiltration of runoff by incorporating exfiltration piping. Based on model results, road flooding may be eliminated during the 10 year, 24 hour design storm event, and reduced peak stages were observed for the 25 year, 24 hour design storm.
- Permitting Considerations – It is anticipated that this improvement would require an individual permit for stormwater retrofit from the St. Johns River Water Management District.
- Engineering Design – Final engineering design should include collection of survey data, utility designation, geotechnical testing, preparation of design plans, preparation of a cost estimate, preparation of technical specifications, and utility coordination to address any needed conflict adjustments / relocations.
- Water Quality Benefit – The primary intent of this project is flood mitigation; however, a water quality benefit would also be provided through the proposed exfiltration which would reduce the pollutant load discharged to the existing stormwater pond.
- Land Acquisition – Land and/or easement acquisition is not anticipated to be necessary. The proposed improvements are to be constructed in the County ROW.
- Wetland / Surface Water Impacts – Wetland / surface water impacts are not anticipated with the proposed improvements.
- Benefit/Cost – The estimated NPV of the 50 year lifecycle benefits (road, structure, ecosystem services, and social) for this improvement are $11,940,434. The estimated construction cost for this improvement is $2,084,544, which includes construction and a 20% contingency. The resulting BCR for this improvement is **5.73**. A detailed breakdown of the preliminary cost estimate is provided in **Table 3**.

Table 3: Engineer's Estimate of Probable Improvement Costs based on Concept

Bel Aire Hills Flood Retrofit						
Item	**Pay Item No.**	**Description**	**Units**	**Unit Cost**	**Quantity**	**Total**
1	101-1	Mobilization (15% of Construction Total)	LS	varies	1	$186,120
2	102-1	Maintenance of Traffic (10% of Construction Total)	LS	varies	1	$124,080
3	104-1	Prevention, Control and Abatement of Erosion and Water Pollution (10% of Construction Total)	LS	varies	1	$124,080
4	110-1-1	Clearing and Grubbing (5% of Construction Total)	LS	varies	1	$62,040
5	160-4	Type B Stabilization (12")	SY	$12.00	1600	$19,200
6	285-704	Optional Base, Base Group 04 (6")	SY	$30.00	1600	$48,000
7	334-1-13	Superpave Asphaltic Concrete, Traffic C (2")	SY	$165.00	1600	$264,000
8	425-11	Modify Existing Drainage Structure	EA	$6,650.00	8	$53,200
9	425-14-41	Inlet, Curb, Type J-4, <10'	EA	$25,000.00	5	$125,000
10	430-175-124	Pipe Culvert, Concrete, Round, 24" S/CD	LF	$240.00	90	$21,600
11	443-70-4	French Drain, 24"	LF	$300.00	1550	$465,000
12	443-70-6	French Drain, 36"	LF	$360.00	680	$244,800
					SUBTOTAL COST:	$1,737,120
					CONTINGENCY (20%):	$347,424
					CONSTRUCTION SUBTOTAL:	$2,084,544
					DESIGN & PERMITTING:	$208,454
					CEI SERVICES:	$208,454
					ESTIMATED TOTAL IMPLEMENTATION COST:	**$2,501,453**

Notes:

1) *Above estimate does not include cost for potential utility relocations.*
2) *Assumes no muck or other removal of unsuitable soils.*
3) *Design and permitting was assumed to be 10% of the construction subtotal cost based on engineering judgement.*
4) *Construction engineering and inspection (CEI) services was assumed to be 10% of the construction subtotal cost based on engineering judgement.*

The information provided herein in considered to be preliminary for project planning purposes. As noted previously, design level efforts including detailed modeling will be necessary to quantify pumping rates, confirm flood stages, confirm pollutant load reductions, etc.

Conclusions

The goal of this effort was to develop a flood improvement concept to reduce roadway flooding in the Bel Aire Hills subdivision. A concept was developed consisting of upsized piping, exfiltration to promote infiltration of stormwater runoff, and lowering the control elevation of the existing pond to provide additional flood attenuation volume.

The total project implementation cost was estimated to be approximately $2,501,453 including construction, contingency, design and permitting, and CEI services. The project benefits from a LOS perspective were determined to be:

- Eliminating roadway flooding during the 10 year, 24 hour design storm event based on model results.
- Improving the subbasin LOS from C in existing conditions to A under the proposed conditions.

Results of the benefit cost analysis indicate a BCR of 5.73, indicating that this project may be cost-effective.

Based on the foregoing, Geosyntec recommends that the County pursue design of this water quality improvement for the anticipated water quality benefits.

Flooding Focused Project

Cutler Road

Flood Improvement Alternatives Analysis

Cutler Road Flood Retrofit

Wekiva Watershed Management Plan

Seminole County, Florida

The purpose of this flood improvement concept is to provide improvements to the drainage stormsewer and swale system to improve flood management in the project area. The project area is generally defined as the south portion of Cutler Road, west of Brantley Drive to just after the road turns east.

The project area is shown on **Figure 1**. A topographical map is included on **Figure 2**. Representative photos of the area are included on the following pages.

Existing Conditions

During heavy storm events flooding occurs along Cutler Road near its outfall, which apparently exceeds the capacity of storm sewer and swale system. It appears that several improvements have been made over time including additional inlets and trench drains, however the road still suffers from limited, mismatched drainage along the road and swales and flat grading. The outfall pipe from the areas is only 15" in diameter based on survey. Level of service (LOS) deficiencies were noted on Cutler Road from the watershed hydrologic and hydraulic modeling. Subbasin BW_BW11000_S received a LOS D for road flooding that potentially impacted structures.

Proposed Improvements

The proposed project improvements consist of adding additional inlets and pipe conveyance with curbing to better drain the roadway to the existing outfall ditch. Upsizing the outfall from 15" to 24" is proposed. Also, it is recommended to clean out the outfall ditch to ensure positive conveyance to Lake Brantley (which may require the acquisition of an easement).

The proposed improvement concept is shown on **Figure 3**.

Legend

PARCELS
PIPES / CULVERTS
DRAINAGE STRUCTURES

0 50 100 200 300 400 Feet

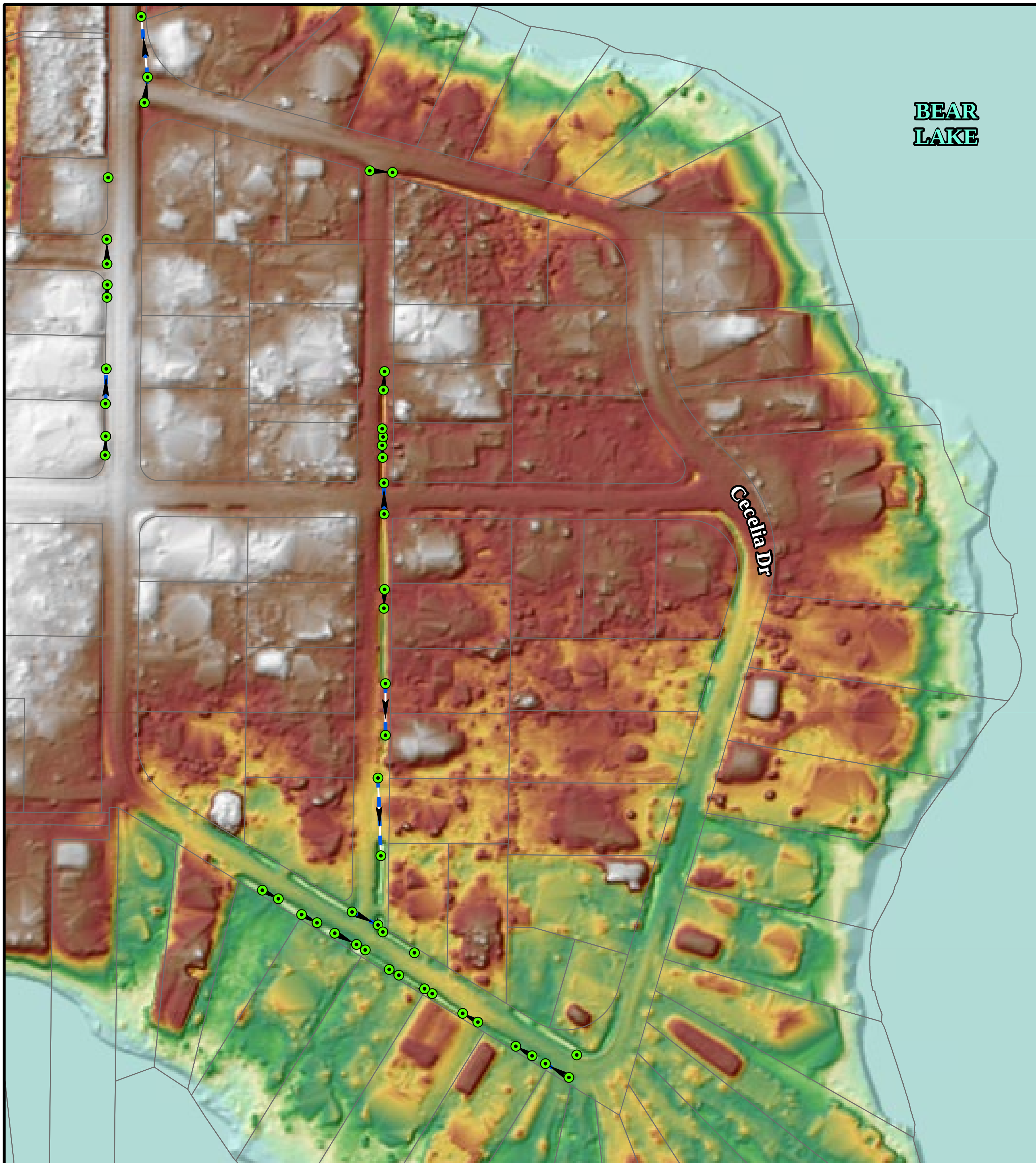
Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Site Map
Cecelia Drive
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure
1



Legend

PARCELS
PIPES / CULVERTS
DRAINAGE STRUCTURES

DEM
FEET NAVD 1988
68.47
38.6

0 50 100 200 300 400
Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022
DEM - USGS LIDAR, 2018

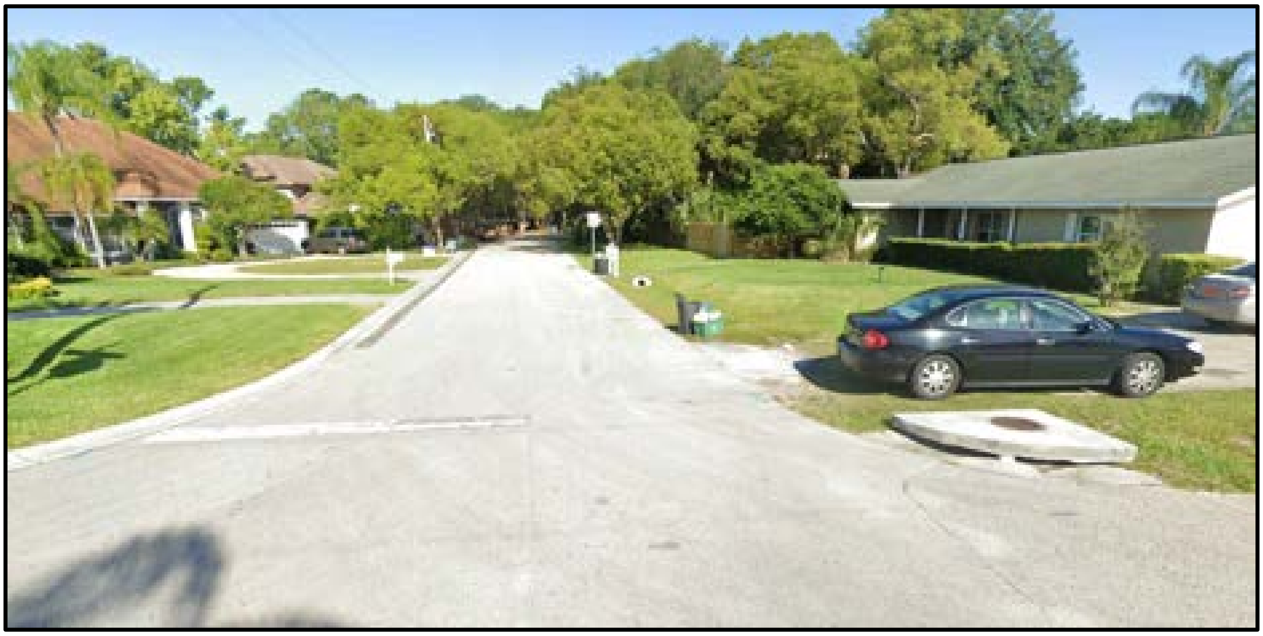
Topographical Map

Cecelia Drive
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure 2

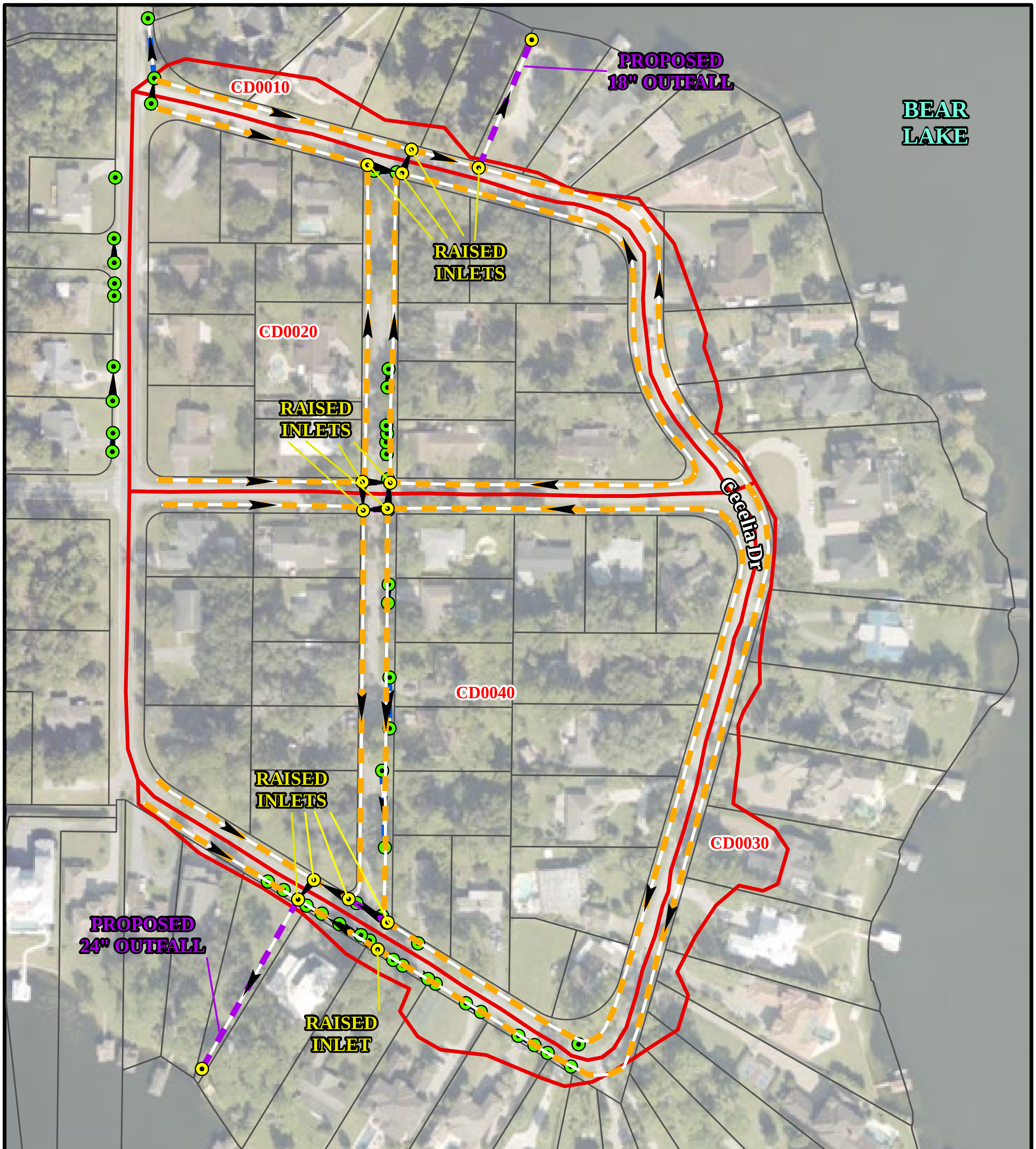


View to west along Cutler Drive from Brantley Drive (Google, 2019)

View to west along Cutler Drive, note trench drain across street (Google, 2019)

View to south along Cutler Drive towards turn (Google, 2019)

View to southeast along Cutler Drive towards at turn, note mismatched inlets, driveway trench drain, and undersized swales (Google, 2019)



Legend

- PARCELS
- SUBBASINS
- EXISTING PIPES / CULVERTS
- EXISTING DRAINAGE STRUCTURES
- PROPOSED PIPE
- PROPOSED SWALE
- PROPOSED STRUCTURE

N

0 50 100 200 300 400 Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Proposed Improvements Map

Cecelia Drive
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

Seminole County

Figure 3

Flood Benefits

The flood benefits associated with this improvement concept are depicted in **Table 1**. As seen in **Table 1**, model results indicate that road flooding may be eliminated during the 10 year, 24 hour design storm event. LOS is anticipated to improve from D to A for the project improvement area.

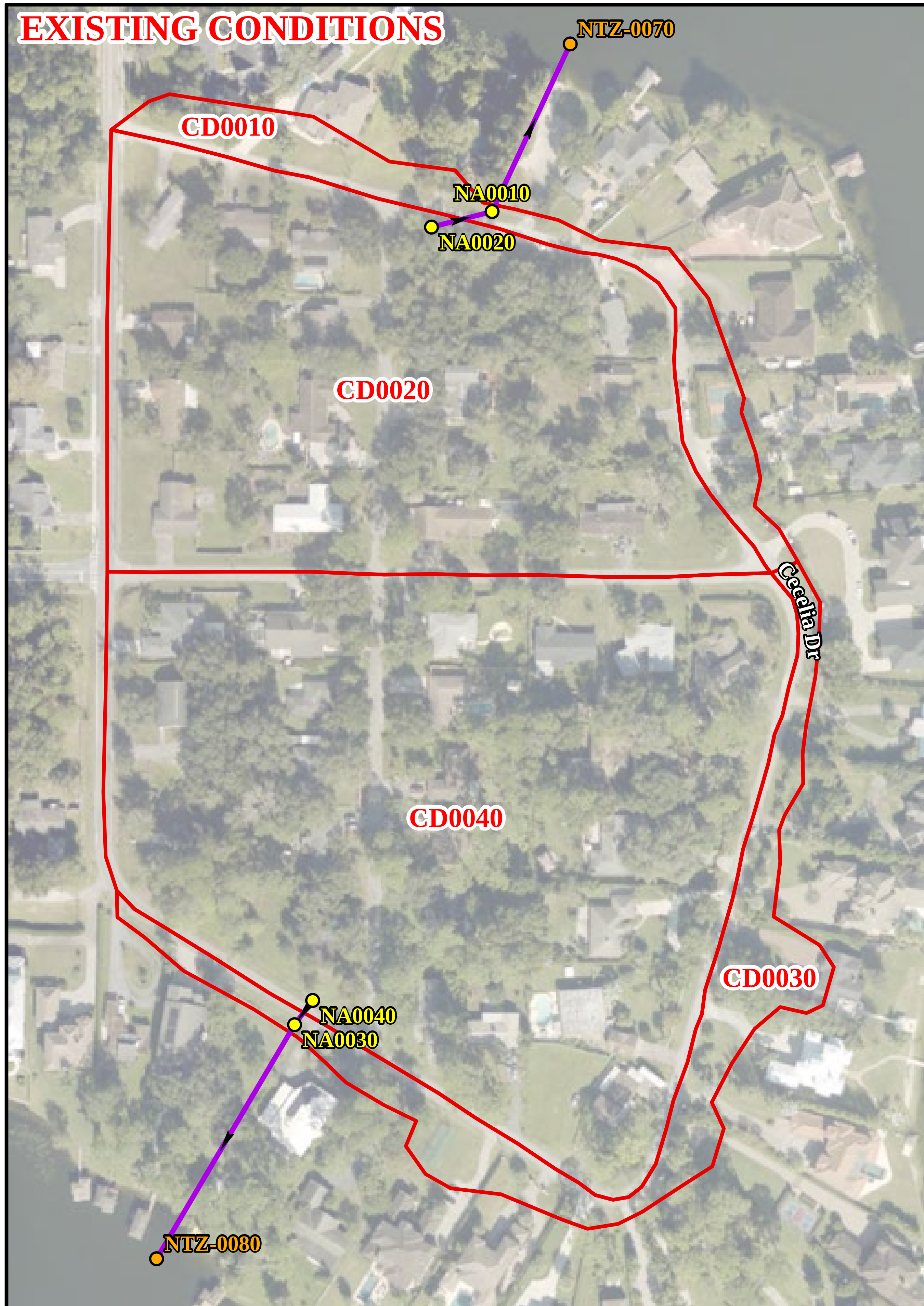
Peak stage reductions were achieved by incorporating additional drainage infrastructure to better capture and convey stormwater runoff, as well as upsizing the existing outfall to the drainage ditch that conveys runoff to Lake Brantley. It is noted that peak discharge rates to Lake Brantley increased slightly as a result of these proposed improvements, which would have to be considered during design and permitting. However, since Lake Brantley is a large, static waterbody, the slight increase in peak discharge rates from the relatively small contributing area would not be anticipated to adversely impact peak stages in the lake.

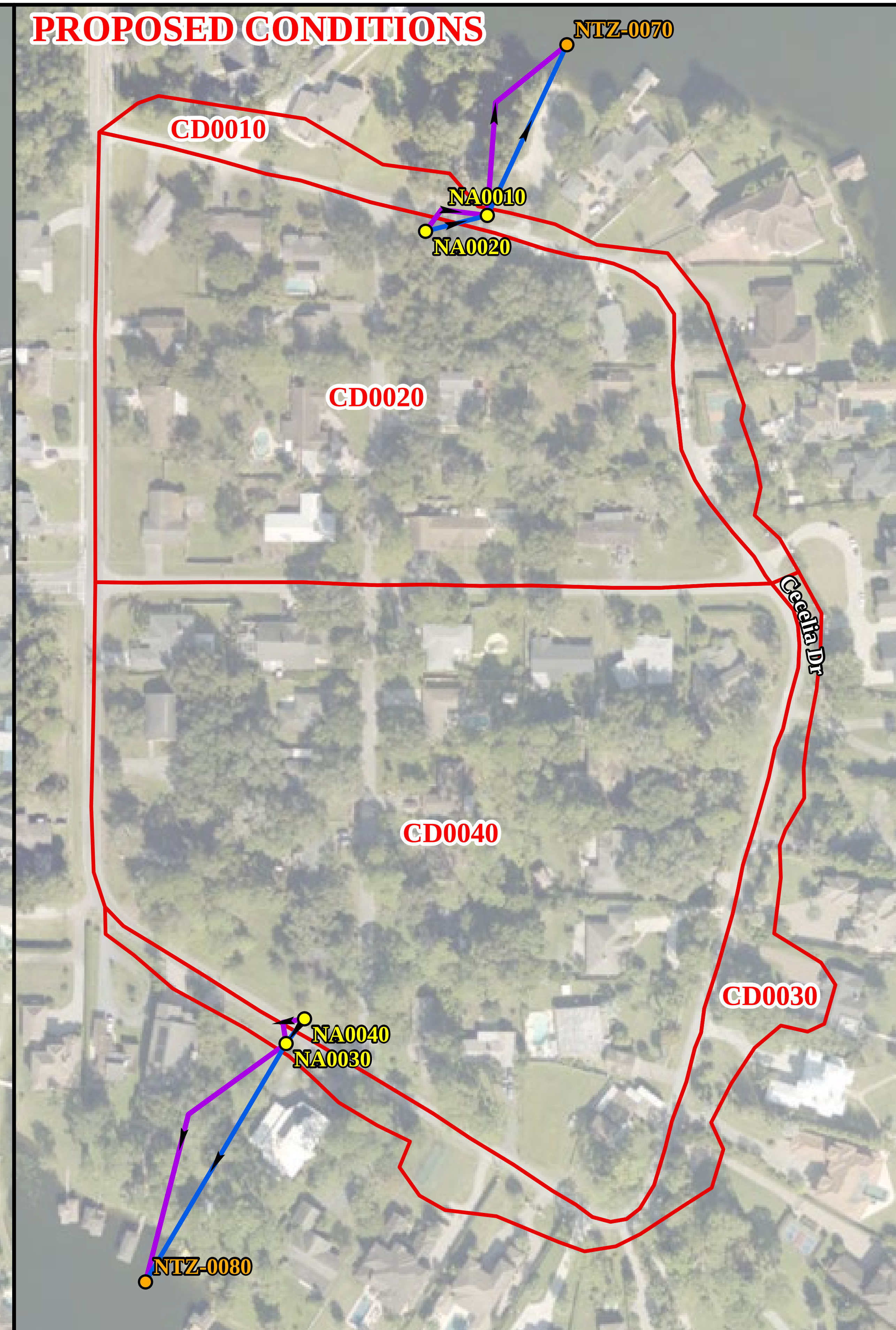
The locations of the nodes found in **Table 1** are presented on **Figure 4** which depicts both the existing conditions and proposed conditions Node-Link model schematics.

Geosyntec consultants

TABLE 1 - CECELIA DRIVE FLOOD AND WATER QUALITY RETROFIT

STAGE/AREA NODE		INITIAL STAGE		WARNING STAGE		MEAN ANNUAL / 24 HOUR		10 YEAR / 24 HOUR	
NAME	DESCRIPTION	ELEVATION	DESCRIPTION	ELEVATION	DESCRIPTION	EXISTING PEAK STAGE (FT)	PROPOSED PEAK STAGE (FT)	EXISTING PEAK STAGE (FT)	PROPOSED PEAK STAGE (FT)
NA0010	Roadside Swale	107.64	Ground Surface	108.35	Edge of pavement	107.84	107.49	107.90	107.70
NA0020	Roadside Swale	106.77	Ground Surface	108.35	Edge of pavement	**108.53**	107.80	**108.56**	108.20
NA0030	Roadside Swale	105.09	Ground Surface	106.56	Edge of pavement	**106.67**	105.67	**106.71**	106.16
NA0040	Roadside Swale	104.99	Ground Surface	106.56	Edge of pavement	**106.71**	105.80	**106.74**	106.41





SEMINOLE COUNTY

N

0 40 80 160

Feet

Legend

SUBBASINS

ICPR NODE TYPE

STAGE AREA

TIME STAGE

ICPR LINK TYPE

PIPE

WEIR

Sources:
Aerial - ESRI, 2022

Figure
4

Model Map

Ceceila Drive

Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

Geosyntec consultants

Benefit Cost Analysis

Benefit cost calculations were performed in accordance with the methodology previously described. Roadway damages were determined for County maintained roads within the project area. Annual road flood damages benefits were calculated as the difference between damages in the existing and proposed conditions. Roadway ecosystem benefits were calculated in the FEMA Benefit Cost Calculator based on the project area (6.6 acres) and estimated percentage of urban green space within the project area (35%). Roadways included in this assessment are listed below.

- Cutler Road.

Model results did not indicate the presence of any potentially impacted structures within the project area.

Results of the benefit cost analysis for this improvement project are summarized in **Table 2**. As seen in **Table 2**, the lifecycle benefits of the project exceed the estimated construction cost, resulting in a BCR of 1.14 which indicates that this project may be cost-effective.

Table 2: Benefit Cost Results for Cutler Road

Benefit Cost Results								
Project	Existing Conditions Road Flood Damages ($/year)	Proposed Conditions Road Flood Damages ($/year)	Road Flood Damages Benefit ($/year)	Roadway Ecosystem Benefits ($/year)	[1]Structure Total Benefits ($/year)	[2]Lifecycle Benefit ($)	[3]Estimated Construction Cost ($)	B/C Ratio
Cutler Road	$30,045	$253	$29,792	$35,900	$0	$906,612	$796,481	1.14

[1]Structure total benefits include standard mitigation benefits and social benefits as outlined in the FEMA Benefit Cost Calculator.

[2]Lifecycle benefit is equal to (Road Flood Damages Benefit + Road Ecosystem Benefit + Structure Total Benefits) x 13.801 to calculate the NPV of benefits over the project's lifecycle.

[3]Estimated construction cost is the construction cost + contingency. Does not include design and permitting or CEI services.

Results of the benefit cost analysis including the FEMA Benefit Cost Calculator are included in the Electronic Deliverables.

Implementation Considerations

The following implementation considerations are provided for this improvement concept.

- Flood Benefit – The project is intended to improve drainage conveyance to address roadway flooding. Based on model results from the Wekiva Watershed Management Plan, subbasin BW_BW11000_S which includes the western portion of Cutler Road received a level of service (LOS) score of D due to flooding that resulted in potential structure impacts. Subbasin BW_BW11030_S which includes the eastern portion of Cutler Road received a level of service (LOS) score of A. Based on model results for the proposed improvements, roadway flooding may be mitigated along Cutler Road, resulting in a LOS score of A for both subbasins with regard to the Cutler Road portion.

- Permitting Considerations – It is anticipated that this improvement would require a general permit for stormwater retrofit from the St. Johns River Water Management District. If it is determined that any surface water / wetland impacts will occur at the outfall, an individual permit may be required.

- Engineering Design – Final engineering design should include collection of survey data, utility designation, geotechnical testing, preparation of design plans, preparation of a cost estimate, preparation of technical specifications, and utility coordination to address any needed conflict adjustments / relocations.

- Water Quality Benefit – This improvement would not be purposed to provide a water quality benefit.

- Land Acquisition – The majority of the improvements will be within the County ROW. Land and/or easement acquisition will be necessary to upsize the outfall pipe and to maintain the existing drainage ditch that serves as the Cutler Road outfall to Lake Brantley. It is assumed that the County would request for these easements to be donated in exchange for County maintenance; however, the cost of the easements have been included to be conservative.

- Wetland / Surface Water Impacts – Potential wetland and/or surface water impacts associated with the ditch improvements would be quantified during design based on a wetland and surface water delineation.

- Benefit/Cost – The estimated NPV of the 50 year lifecycle benefits (road, structure, ecosystem services, and social) for this improvement are $906,612. The estimated construction cost for this improvement is $796,481, which includes construction and a 20% contingency. The resulting BCR for this improvement is **1.14**. A detailed breakdown of the preliminary cost estimate is provided in **Table 3**.

Table 3: Engineer's Estimate of Probable Improvement Costs based on Concept

Cutler Road Flood Retrofit						
Item	**Pay Item No.**	**Description**	**Units**	**Unit Cost**	**Quantity**	**Total**
1	101-1	Mobilization (15% of Construction Total)	LS	varies	1	$71,114
2	102-1	Maintenance of Traffic (10% of Construction Total)	LS	varies	1	$47,410
3	104-1	Prevention, Control and Abatement of Erosion and Water Pollution (10% of Construction Total)	LS	varies	1	$47,410
4	110-1-1	Clearing and Grubbing (5% of Construction Total)	LS	varies	1	$23,705
5	160-4	Type B Stabilization (12")	SY	$12.00	500	$6,000
6	285-704	Optional Base, Base Group 04 (6")	SY	$30.00	500	$15,000
7	334-1-13	Superpave Asphaltic Concrete, Traffic C (2")	SY	$165.00	500	$82,500
8	425-11	Modify Existing Drainage Structure	EA	$6,650.00	1	$6,650
9	425-14-41	Inlet, Curb, Type J-4, <10'	EA	$21,000.00	5	$105,000
10	430-175-118	Pipe Culvert, Concrete, Round, 18" S/CD	LF	$140.00	300	$42,000
11	430-175-124	Pipe Culvert, Concrete, Round, 24" S/CD	LF	$190.00	235	$44,650
12	430-982-129	Mitered End Section, Round, 24" CD	EA	$4,500.00	1	$4,500
13	520-1-10	Concrete Curb & Gutter, Type F	LF	$50.00	975	$48,750
14	900-1	Outfall Ditch Maintenance	LS	varies	1	$25,000
15	900-2	Easement / Property Acquisition	LS	varies	1	$94,046
SUBTOTAL COST:						$663,734
CONTINGENCY (20%):						$132,747
CONSTRUCTION SUBTOTAL:						$796,481
DESIGN & PERMITTING:						$119,472
CEI SERVICES:						$79,648
ESTIMATED TOTAL IMPLEMENTATION COST:						**$995,601**

Notes:

1) *Above estimate does not include cost for potential utility relocations.*
2) *Assumes no muck or other removal of unsuitable soils.*
3) *Pay item 900-1 includes cost to remove accumulated sediment and debris from drainage ditch to ensure positive drainage to Lake Brantley.*
4) *Design and permitting was assumed to be 15% of the construction subtotal cost based on engineering judgement.*
5) *Construction engineering and inspection (CEI) services was assumed to be 10% of the construction subtotal cost based on engineering judgement.*
6) *Costs for 900-2 were obtained from the Seminole County property appraiser and were assumed to be 1.5 times the parcel value (land + buildings + features) to account for administrative costs. Assumed that City and Florida Power easements would be donated at no cost.*

The information provided herein in considered to be preliminary for project planning purposes. As noted previously, design level efforts including detailed modeling will be necessary to quantify pumping rates, confirm flood stages, confirm pollutant load reductions, etc.

Conclusions

The goal of this effort was to develop a flood improvement concept to reduce roadway flooding along Cutler Road. A concept was developed consisting of curbing a stretch of Cutler Road to more effectively collect stormwater runoff, additional curb inlets and piping, upsizing the outfall from 15" to 24", and re-establishing the outfall drainage ditch to ensure positive drainage conditions to Lake Brantley.

The total project implementation cost was estimated to be approximately $995,601 including construction, contingency, design and permitting, CEI services, and easement / property acquisition. The project benefits from a LOS perspective were determined to be:

- Subbasin BW_BW11000_S LOS score improved from D to A for the Cutler Road contributing area.

Results of the benefit cost analysis indicate a BCR of 1.14, indicating that this project may be cost-effective.

Based on the foregoing, Geosyntec recommends that the County pursue design of this flood improvement for the anticipated flood reduction benefits.

Flooding Focused Project

Riverbend Boulevard

Flood Improvement Alternatives Analysis

Riverbend Boulevard Flood Retrofit

Wekiva Watershed Management Plan

Seminole County, Florida

The purpose of this flood improvement concept is to provide improvements to the drainage stormsewer system to improve flood management in the project area. The project area is generally defined as Riverbend Boulevard and Magnolia Oak Drive, north of Wekiva Springs Road.

The project area is shown on **Figure 1**. A topographical map is included on **Figure 2**. Representative photos of the area are included on the following pages.

Existing Conditions

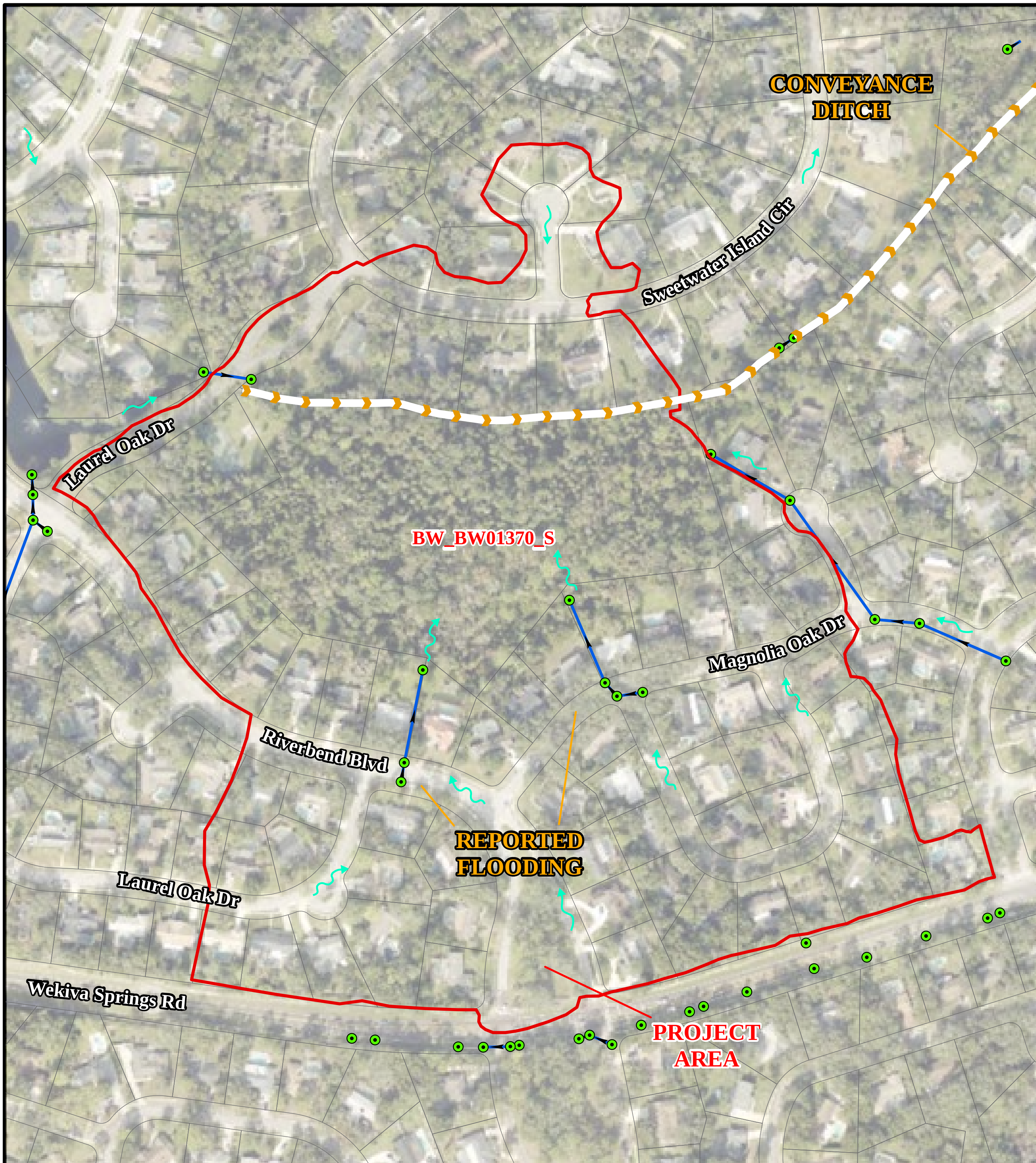
During heavy storm events flooding has been reported to occur along streets, noted specifically during Hurricane Irma, exceeding capacity of the storm sewer outfalls. The western outfall is a 14”x23” concrete pipe and the eastern outfall is a 24” concrete pipe. Limited drainage inlets are present along road and there are instances of flat grading along the roadside. Level of service deficiencies were noted in the vicinity from the watershed hydrologic and hydraulic modeling.

Proposed Improvements

Based on detailed modeling of the existing conditions, level of service (LOS) deficiencies were not observed in the project area. Road flooding was only observed during the 25 year, 96 hour design storm, 100 year, 24 hour design storm, and 100 year, 96 hour design storm. Based on these observations, the project area would achieve its intended 10 year design storm LOS. Based on these results, roadway flooding may only occur during extreme events, such as during Hurricane Irma, which is consistent with County reports of when flooding has occurred in the past. Based on the foregoing, an improvement concept was developed to improve drainage conditions and address roadway flooding during an extreme event.

The proposed improvement for this project area is to upsize the existing drainage infrastructure to be better suited to handle stormwater flow during an extreme event.

The proposed improvement concept is shown on **Figure 3**.



Legend

PARCELS

SUBBASIN

PIPES / CULVERTS

DRAINAGE STRUCTURES

0 75 150 300 450 600

Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Site Map

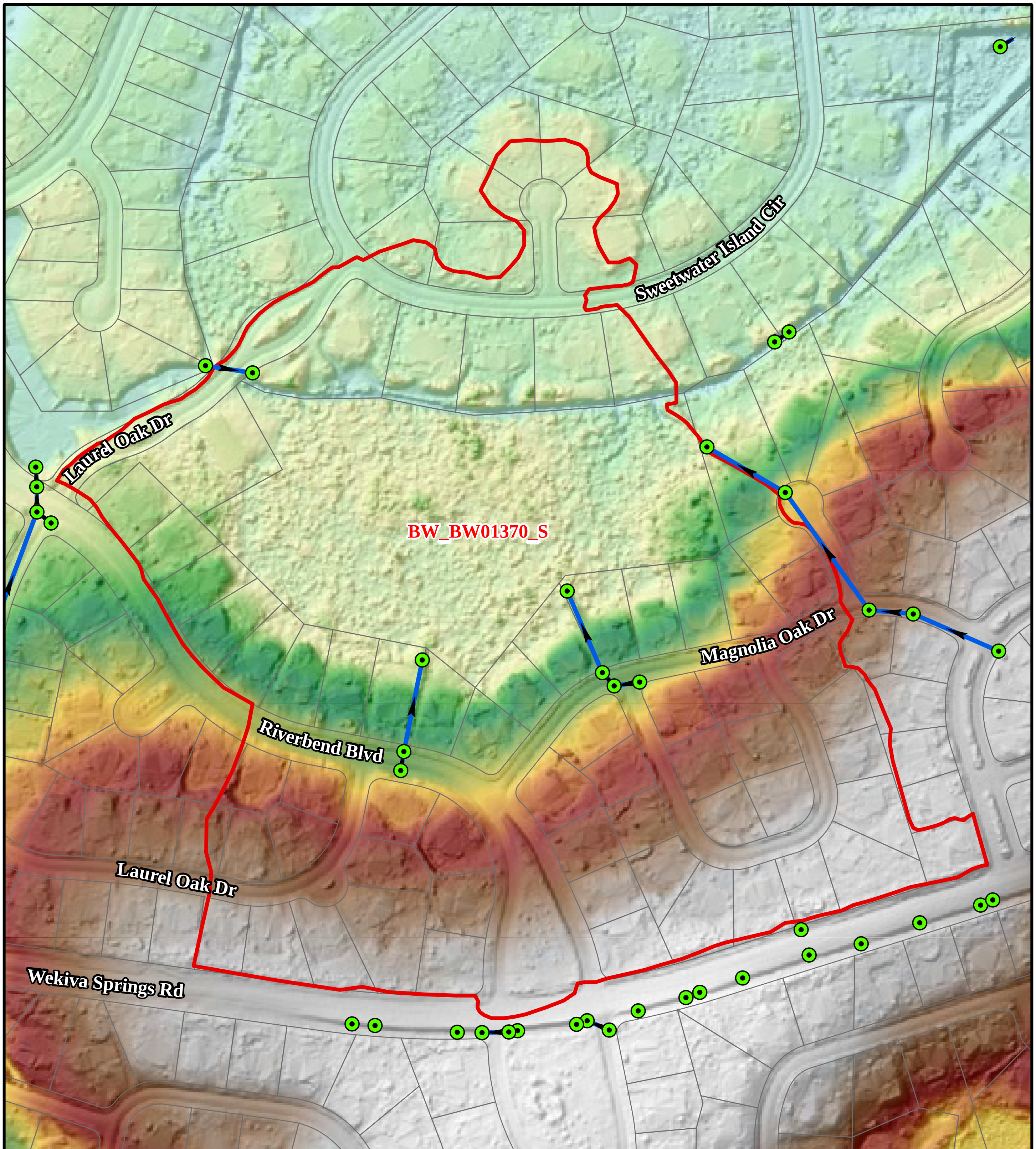
Riverbend Boulevard Flood Retrofit
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure

1



N

Legend

PARCELS
SUBBASIN
PIPES / CULVERTS
DRAINAGE STRUCTURES

DEM
FEET NAVD 1988
68.47
38.6

0 75 150 300 450 600
Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022
DEM - USGS LIDAR, 2018

Topographical Map
Riverbend Boulevard Flood Retrofit
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

Seminole County

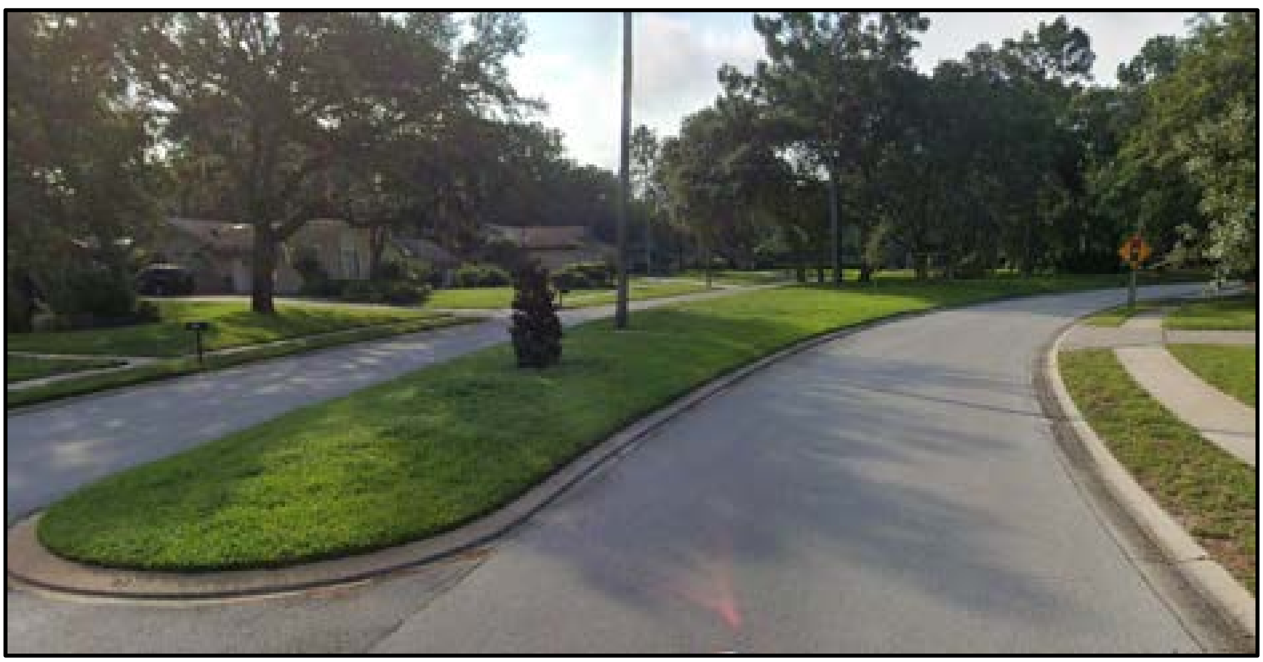
Figure

2

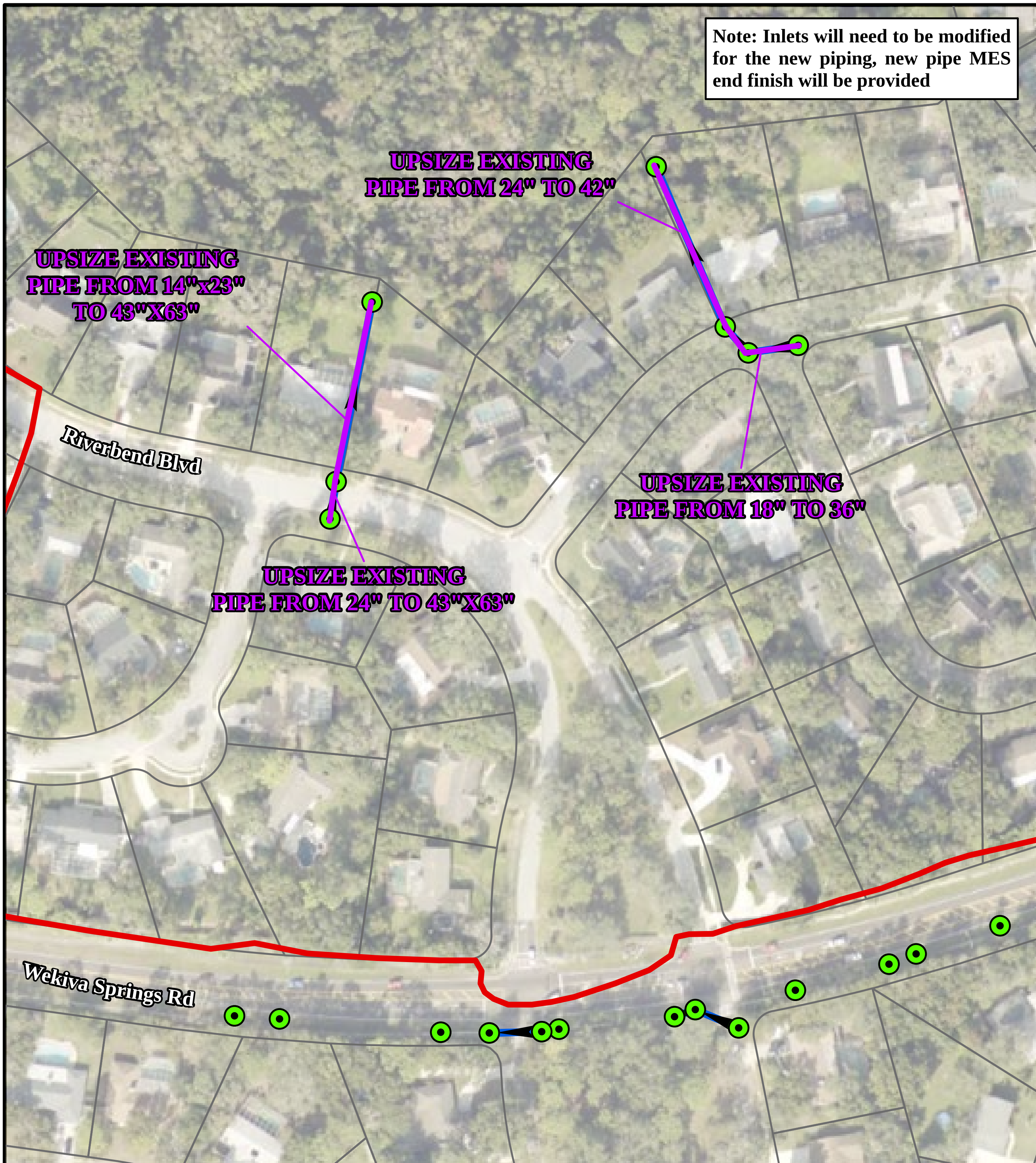
View to southeast along Riverbend Boulevard towards inlets leading to outfall to north (Google, 2019)

View to southeast along Magnolia Oak Drive towards inlets leading to outfall to north (Google, 2013)

View to north at intersection of Riverbend Boulevard and Magnolia Oak Drive (Google, 2019)



View to south towards median area along subdivision entrance way from intersection of Riverbend Boulevard and Magnolia Oak Drive (Google, 2019)



Legend

- PARCELS
- SUBBASIN
- PIPES / CULVERTS
- DRAINAGE STRUCTURES

Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Proposed Improvements Map

Riverbend Boulevard Flood Retrofit
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure

3

Flood Benefit

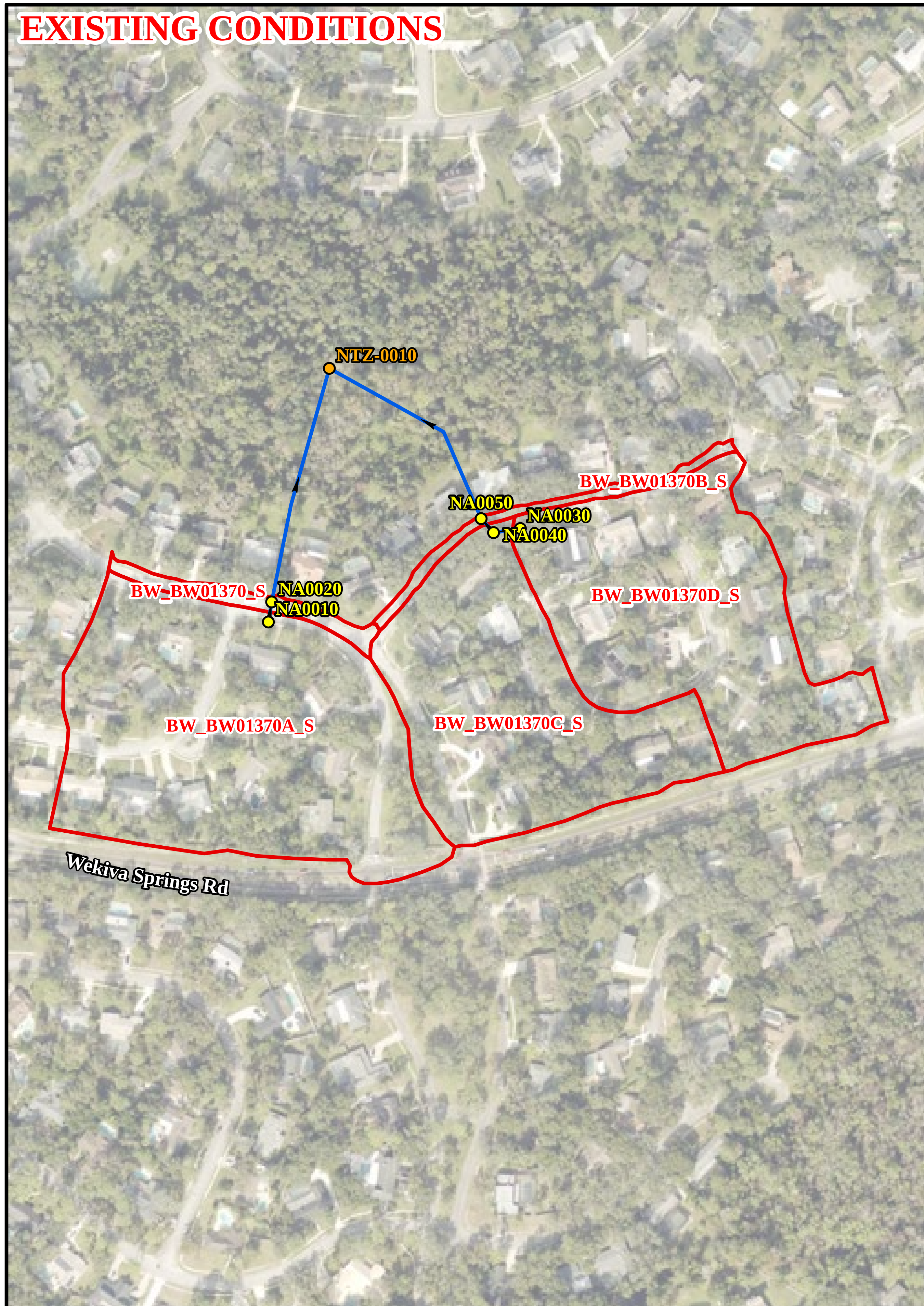
The flood benefits associated with this improvement concept are depicted in **Table 1**. As seen in **Table 1**, model results indicate that road flooding may be eliminated during the most extreme event modeled, the 100 year, 96 hour design storm event.

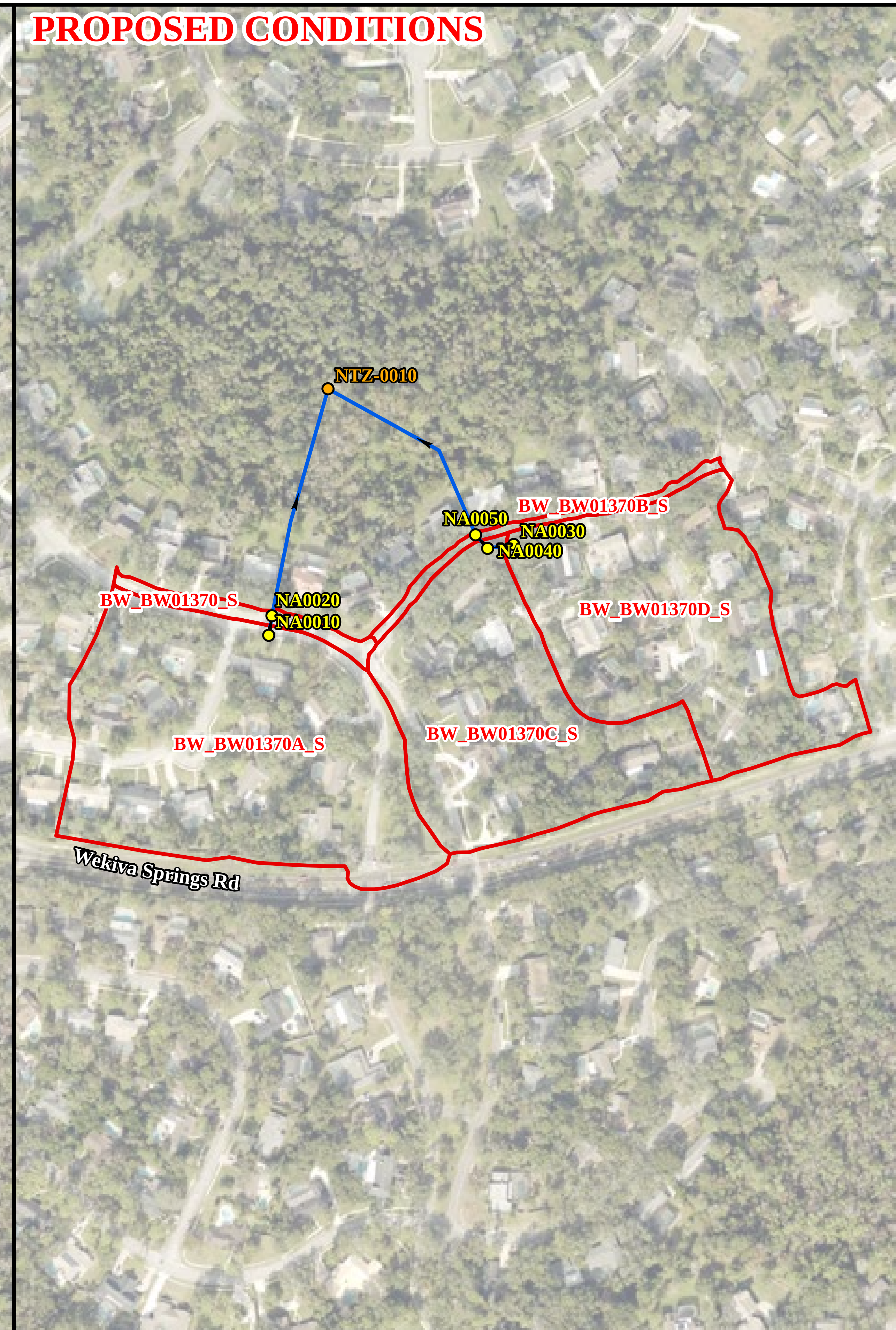
These benefits were achieved by upsizing the western outfall to a 43”x68” concrete elliptical pipe and upsizing the eastern outfall to a 42” round concrete pipe. The infrastructure upstream of the outfalls was also upsized to better convey stormwater runoff from the roads to the outfalls during an extreme event. Pipe upsizing would occur along the same path as the exiting pipes along the exiting easement.

The locations of the nodes found in **Table 1** are presented on **Figure 4** which depicts both the existing conditions and proposed conditions Node-Link model schematics.

RIVERBEND BOULEVARD ROAD FLOOD RETROFIT

STAGE/AREA NODE		INITIAL STAGE		WARNING STAGE		MEAN ANNUAL / 24 HOUR		10 YEAR / 24 HOUR		25 YEAR / 24 HOUR		25 YEAR / 96 HOUR		100 YEAR / 24 HOUR		100 YEAR / 96 HOUR	
NAME	**DESCRIPTION**	**ELEVATION**	**DESCRIPTION**	**ELEVATION**	**DESCRIPTION**	**EXISTING PEAK STAGE (FT)**	**PROPOSED PEAK STAGE (FT)**	**EXISTING PEAK STAGE (FT)**	**PROPOSED PEAK STAGE (FT)**	**EXISTING PEAK STAGE (FT)**	**PROPOSED PEAK STAGE (FT)**	**EXISTING PEAK STAGE (FT)**	**PROPOSED PEAK STAGE (FT)**	**EXISTING PEAK STAGE (FT)**	**PROPOSED PEAK STAGE (FT)**	**EXISTING PEAK STAGE (FT)**	**PROPOSED PEAK STAGE (FT)**
NA0010	Drainage inlet	37.07	Bottom of structure	40.00	Edge of pavement	38.37	37.07	38.80	37.07	39.10	37.07	**40.61**	37.07	**41.25**	37.07	**43.03**	37.54
NA0020	Drainage inlet	34.86	Bottom of structure	40.03	Edge of pavement	36.29	35.11	37.25	35.33	38.19	35.47	**40.16**	35.82	**40.72**	35.96	**42.20**	36.86
NA0030	Drainage inlet	33.10	Bottom of structure	40.14	Edge of pavement	34.93	34.03	36.80	34.39	38.63	34.65	**41.30**	35.38	**42.44**	35.69	**45.27**	39.12
NA0040	Drainage inlet	32.55	Bottom of structure	39.83	Edge of pavement	34.77	33.98	36.42	34.37	38.02	34.62	**40.37**	35.33	**41.34**	35.62	**43.69**	38.76
NA0050	Drainage inlet	31.73	Bottom of structure	39.43	Edge of pavement	33.39	33.02	34.02	33.38	34.55	33.61	35.36	34.22	35.68	34.47	36.54	36.45





SEMINOLE COUNTY

N

0 65 130 260
Feet

Legend

SUBBASINS

ICPR NODE TYPES

STAGE AREA

TIME STAGE

ICPR LINK TYPES

PIPE

Sources:
Aerial - ESRI, 2022

Figure
4

Model Map

Riverbend Boulevard

Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec
consultants

Implementation Considerations

The following implementation considerations are provided for this improvement concept.

- Flood Benefit – The project is intended to improve drainage conveyance to address roadway flooding during an extreme storm event, such as a hurricane. Based on model results, roadway flooding may be eliminated during the most extreme event modeled, the 100 year, 96 hour design storm.
- Permitting Considerations – It is anticipated that this improvement would require a general permit for stormwater retrofit from the St. Johns River Water Management District. If it is determined that any surface water / wetland impact will occur at the outfall, an individual permit may be required.
- Engineering Design – Final engineering design should include collection of survey data, utility designation, geotechnical testing, preparation of design plans, preparation of a cost estimate, preparation of technical specifications, and utility coordination to address any needed conflict adjustments / relocations.
- Water Quality Benefit – This improvement would not be purposed to provide a water quality benefit.
- Land Acquisition – Land and/or easement acquisition is not anticipated for this improvement concept as it consists of upsizing existing drainage infrastructure along an existing easement.
- Wetland / Surface Water Impacts – Potential wetland and/or surface water impacts associated with constructing the new outfalls would be quantified during design based on a wetland and surface water delineation.
- Benefit/Cost – The estimated total implementation cost for this improvement is $608,118. This cost includes construction and a 20% contingency. The benefit associated with these improvements is addressing roadway flooding during an extreme storm event. A detailed breakdown of the preliminary cost estimate is provided in **Table 2**.

Table 2: Engineer's Estimate of Probable Improvement Costs based on Concept

Riverbend Boulevard Flood Retrofit						
Item	**Pay Item No.**	**Description**	**Units**	**Unit Cost**	**Quantity**	**Total**
1	101-1	Mobilization (15% of Construction Total)	LS	varies	1	$54,296
2	102-1	Maintenance of Traffic (10% of Construction Total)	LS	varies	1	$36,198
3	104-1	Prevention, Control and Abatement of Erosion and Water Pollution (10% of Construction Total)	LS	varies	1	$36,198
4	110-1-1	Clearing and Grubbing (5% of Construction Total)	LS	varies	1	$18,099
5	160-4	Type B Stabilization (12")	SY	$12.00	165	$1,980
6	285-704	Optional Base, Base Group 04 (6")	SY	$30.00	165	$4,950
7	334-1-13	Superpave Asphaltic Concrete, Traffic C (2")	SY	$165.00	165	$27,225
8	425-11	Modify Existing Drainage Structure	EA	$6,650.00	3	$19,950
9	425-14-41	Inlet, Curb, Type J-4, <10'	EA	$21,000.00	2	$42,000
10	430-175-136	Pipe Culvert, Concrete, Round, 36" S/CD	LF	$260.00	95	$24,700
11	430-175-142	Pipe Culvert, Concrete, Round, 42" S/CD	LF	$310.00	200	$62,000
12	430-175-254	Pipe Culvert, Concrete, Elliptical, 54" S/CD	LF	$590.00	245	$144,550
13	430-982-140	Mitered End Section, Round, 42" CD	EA	$13,620.00	1	$13,620
14	430-982-642	Mitered End Section, Elliptical, 54" CD	EA	$21,000.00	1	$21,000
					SUBTOTAL COST:	$506,765
					CONTINGENCY (20%):	$101,353
					CONSTRUCTION SUBTOTAL:	$608,118
					DESIGN & PERMITTING:	$121,624
					CEI SERVICES:	$60,812
					ESTIMATED TOTAL IMPLEMENTATION COST:	**$790,553**

Notes:

1) *Above estimate does not include cost for potential utility relocations.*
2) *Assumes no muck or other removal of unsuitable soils.*
3) *Design and permitting was assumed to be 20% of the construction subtotal cost based on engineering judgement.*
4) *Construction engineering and inspection (CEI) services was assumed to be 10% of the construction subtotal cost based on engineering judgement.*

The information provided herein in considered to be preliminary for project planning purposes. As noted previously, design level efforts including detailed modeling will be necessary to quantify pumping rates, confirm flood stages, confirm pollutant load reductions, etc.

Conclusions

The goal of this effort was to develop a flood improvement concept to reduce roadway flooding along Riverbend Boulevard and Magnolia Oak Drive during an extreme storm event. A concept was developed consisting of upsizing the existing drainage infrastructure including the western outfall to a 43”x68” concrete elliptical pipe and the eastern outfall to a 42” round concrete pipe.

The total project implementation cost was estimated to be approximately $790,553 including construction, contingency, design and permitting, and CEI services. As noted previously, based on modeling results, the project area appears to be achieving its intended LOS and these improvements were aimed at addressing potential roadway flooding associated with an extreme storm event, such as a hurricane.

Based on the foregoing, Geosyntec recommends that the County consider if the benefits associated with addressing flooding during an extreme storm event outweigh the anticipated project costs.

Flooding Focused Project

Banana Lake Road

Flood Improvement Alternatives Analysis

Banana Lake Road Flood Retrofit

Wekiva Watershed Management Plan

Seminole County, Florida

The purpose of this flood improvement concept is to provide improvements to the drainage system to allow a safe high level overflow from a County pond. The project area is generally defined as the County pond south of H.E. Thomas Jr. Parkway between Banana Lake Road and Business Center Drive.

The project area is shown on **Figure 1**. A topographical map is included on **Figure 2**. Representative photos of the area are included on the following pages.

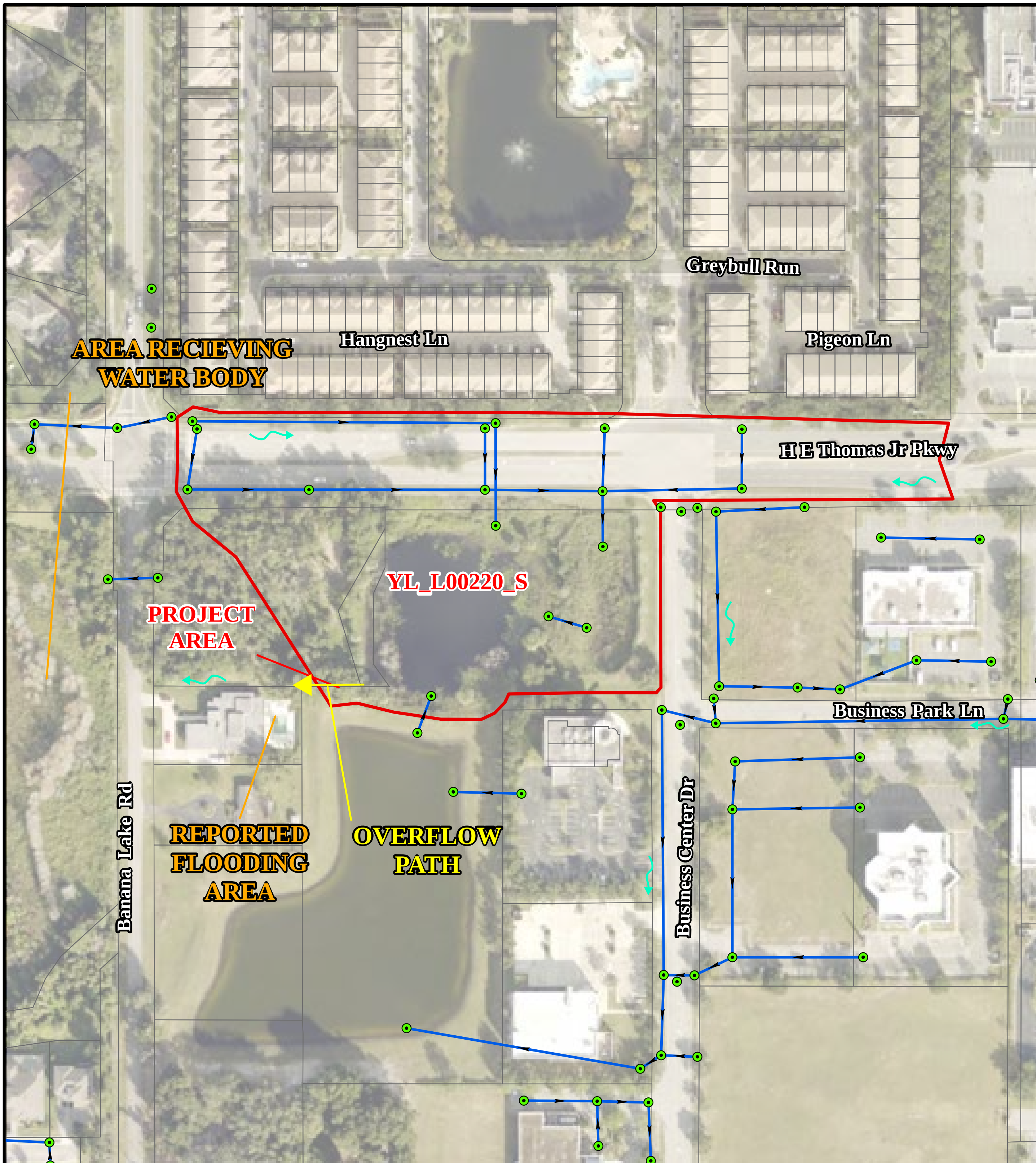
Existing Conditions

A natural County maintained lake depressional area receives runoff from H.E. Thomas Parkway and receives discharges from the detention pond between Business Center Drive and Banana Lake Road. When combined stages reach approximately 64', overtopping has occurred to the west with runoff impacting the adjacent homes to the west on its way to get to the ultimate receiving pond west of Banana Lake Road. The detention pond to the south discharges to the County pond, so that pond is impacted when the County pond is at capacity. One such reported incident is during Hurricane Irma when the Granada Oak Apartments north of H.E. Thomas Jr. Parkway was pumping flood waters to the County pond which contributed to it exceeding its capacity. Note that no level of service deficiencies were noted in the vicinity from the hydrologic and hydraulic modeling. The primary driver for the project was previous instances of reported flooding and County staff input.

Proposed Improvements

The proposed improvements for this project areas are to provide a higher berm and high level pop-off pipe at the County pond site to safely convey the overtopping runoff towards and under Banana Lake Road to get to the downstream pond without impacting properties. This would require obtaining an easement to allow for the installation of a pipe outfall to the east right of way of Banana Lake Road. A cross drain would then be installed under Banana Lake Road to the west to drain into the lake to the west.

The proposed improvement concept is shown on **Figure 3**.



N

Legend

PARCELS
SUBBASIN
PIPES / CULVERTS
DRAINAGE STRUCTURES

0 50 100 200 300 400
Feet

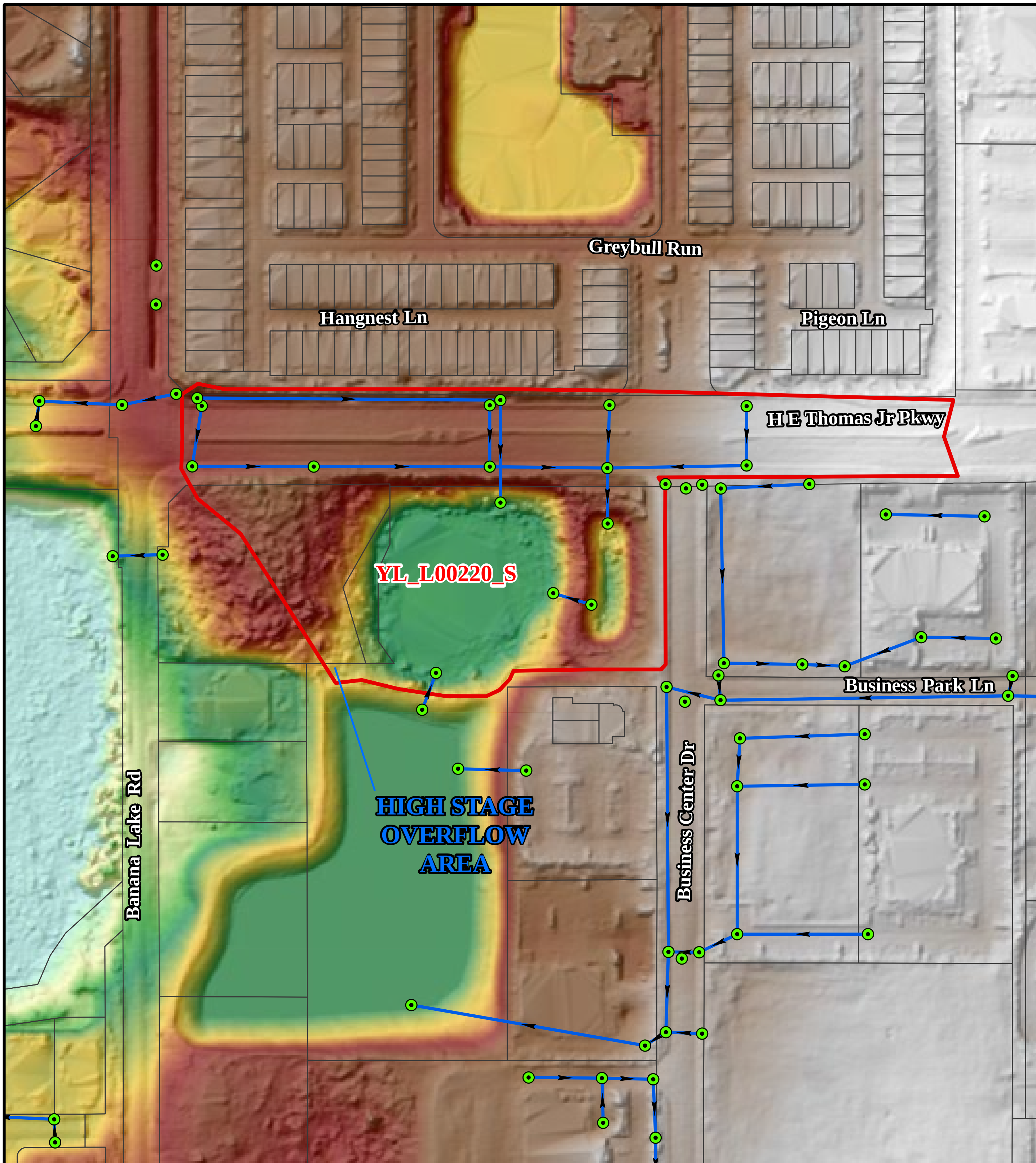
Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Site Map
Banana Lake Road Flood Retrofit
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

Seminole County

Figure
1



N

Legend

PARCELS
SUBBASIN
PIPES / CULVERTS
DRAINAGE STRUCTURES

DEM
FEET NAVD 1988
68.47
38.6

0 50 100 200 300 400
Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022
DEM - USGS LIDAR, 2018

Topographical Map
Banana Lake Road Flood Retrofit
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

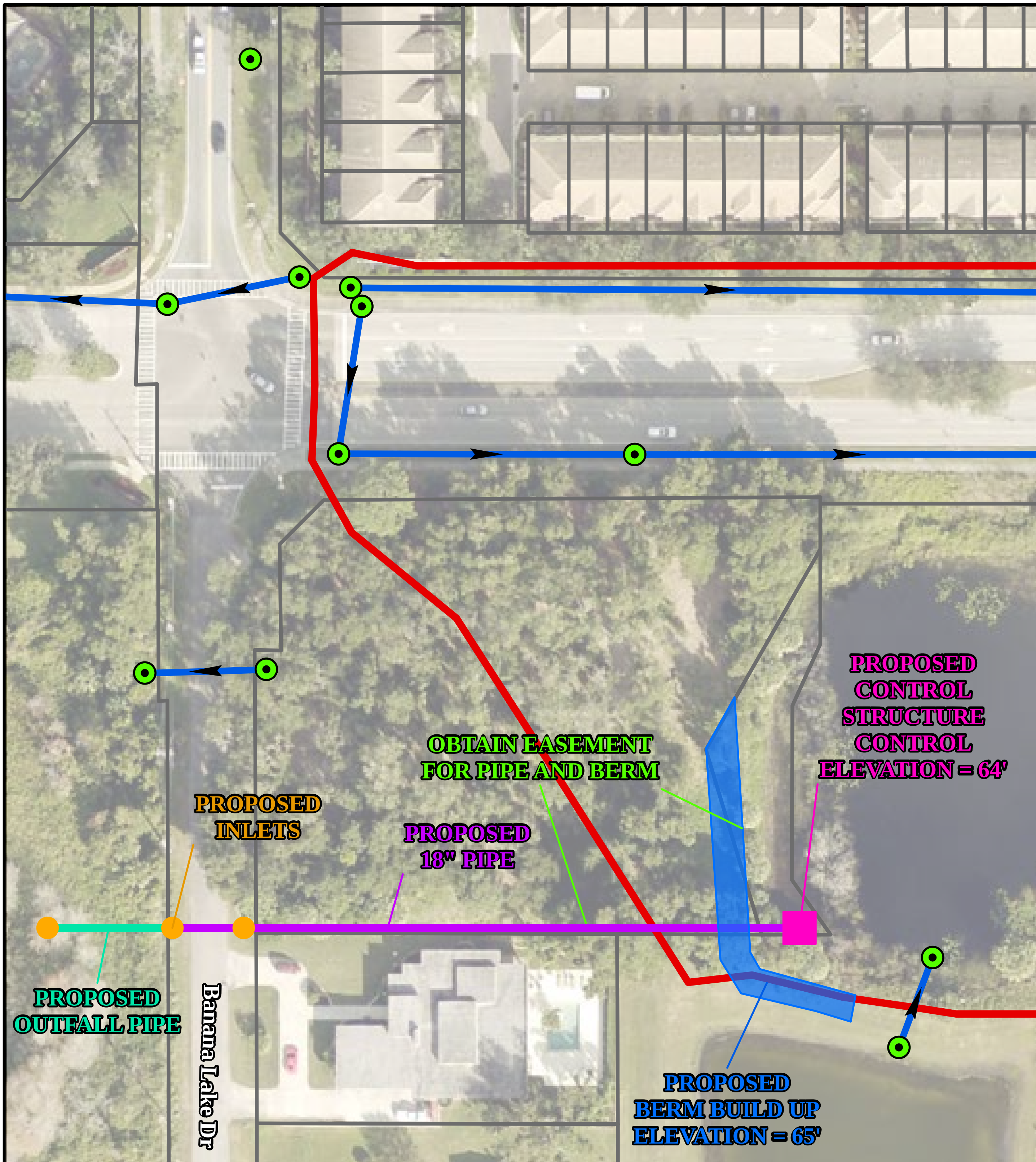
Figure
2

View to southwest towards County pond from H.E. Thomas Jr. Parkway (Google, 2021)

View to north along Banana Lake Road (Google, 2021)

View to northeast from Banana Lake Road along the proposed outfall path (Google, 2021)

View to northwest at County pond (right), detention pond (bottom) and impacted residences (left) (Google, 2023)



Legend
- PARCELS
- SUBBASIN
- PIPES / CULVERTS
- DRAINAGE STRUCTURES

0 20 40 80 120 160 Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Proposed Improvements Map
Banana Lake Road Flood Retrofit
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure 3

Flood Benefits

The flood benefits associated with this improvement concept are based on providing a controlled structural outfall.

Reductions in uncontrolled conveyance conditions were achieved by incorporating a control structure at the existing stormwater pond to convey runoff under Banana Lake Road to the downstream pond rather than having it overtop the pond bank and flow through the resident's property. The County pond contains the 100 year, 96 hour storm at an elevation of 64 feet based on the watershed modeling. Therefore, this elevation was used as the target for controlled discharge for the purposes of the proposed outfall structure. Additionally, raising of the southwestern pond bank to an elevation of 65 feet is proposed to establish a more uniform top of bank elevation and provide approximately 1 foot of freeboard in the pond during high flow storm events. The outfall pipe was sized by setting the pond initial stage to the proposed top of bank elevation and simulating a no rainfall event to assess stage recovery time in the pond. Based on model results, the pond recovered to the proposed control structure grate elevation in approximately 16.5 hours.

Implementation Considerations

The following implementation considerations are provided for this improvement concept.

- Flood Benefit – The project is intended to raise the berm of the stormwater pond to allow a safe high level overflow from a County pond. The high level pop-off pipe at the County pond site will safely convey the overtopping runoff towards and under Banana Lake Road to get to the downstream pond during significant storm events.
- Permitting Considerations – It is anticipated that this improvement would require an individual permit for stormwater retrofit from the St. Johns River Water Management District.
- Engineering Design – Final engineering design should include collection of survey data, utility designation, geotechnical testing, preparation of design plans, preparation of a cost estimate, preparation of technical specifications, and utility coordination to address any needed conflict adjustments / relocations.
- Water Quality Benefit – This improvement would not be purposed to provide a water quality benefit.
- Land Acquisition – Land and/or easement acquisition will be necessary for the proposed outfall pipe. It is assumed that the County would request for the easement to be donated in exchange for County maintenance; however, the cost of the easement has been included to be conservative. Right of entries may be needed from individual property owners on an as needed basis during construction to address the outfall pipe.
- Wetland / Surface Water Impacts – The proposed flood improvement has a minor surface water impacts at the receiving pond. The proposed project will change the hydrology of a natural county pond.
- Benefit/Cost – The estimated construction cost for this improvement is $317,967. This cost includes construction and a 20% contingency. A detailed breakdown of the preliminary cost estimate is provided in **Table 1.**

Table 1: Engineer's Estimate of Probable Improvement Costs based on Concept

Banana Lake Road Flood Retrofit						
Item	**Pay Item No.**	**Description**	**Units**	**Unit Cost**	**Quantity**	**Total**
1	101-1	Mobilization (15% of Construction Total)	LS	varies	1	$28,390
2	102-1	Maintenance of Traffic (10% of Construction Total)	LS	varies	1	$18,927
3	104-1	Prevention, Control and Abatement of Erosion and Water Pollution (10% of Construction Total)	LS	varies	1	$18,927
4	110-1-1	Clearing and Grubbing (5% of Construction Total)	LS	varies	1	$9,463
5	120-6	Embankment	CY	$20.00	50	$1,000
6	160-4	Type B Stabilization (12")	SY	$12.00	30	$360
7	285-704	Optional Base, Base Group 04 (6")	SY	$30.00	30	$900
8	334-1-13	Superpave Asphaltic Concrete, Traffic C (2")	SY	$165.00	30	$4,950
9	425-1-583	Inlets, Ditch Bottom, Type H, J Bottom, <10'	EA	$11,000.00	1	$11,000
10	425-14-41	Inlet, Curb, Type J-4, <10'	EA	$25,000.00	2	$50,000
11	430-175-118	Pipe Culvert, Concrete, Round, 18" S/CD	LF	$140.00	340	$47,600
12	430-984-129	Mitered End Section, 18" SD	EA	$3,150.00	1	$3,150
13	900-1	Easement / Property Acquisition	LS	varies	1	$70,306
					SUBTOTAL COST:	$264,972
					CONTINGENCY (20%):	$52,994
					CONSTRUCTION SUBTOTAL:	$317,967
					DESIGN & PERMITTING:	$79,492
					CEI SERVICES:	$47,695
					ESTIMATED TOTAL IMPLEMENTATION COST:	**$445,153**

Notes:

1) *Above estimate does not include cost for potential utility relocations.*
2) *Assumes no muck or other removal of unsuitable soils.*
3) *Design and permitting was assumed to be 25% of the construction subtotal cost based on engineering judgement.*
4) *Construction engineering and inspection (CEI) services was assumed to be 15% of the construction subtotal cost based on engineering judgement.*
5) *Costs for 900-1 were obtained from the Seminole County property appraiser and were assumed to be 1.5 times the parcel value (land + buildings + features) to account for administrative costs. Assumed that City and Florida Power easements would be donated at no cost.*

The information provided herein in considered to be preliminary for project planning purposes. As noted previously, design level efforts including detailed modeling will be necessary to quantify pumping rates, confirm flood stages, confirm pollutant load reductions, etc.

Conclusions

The goal of this effort was to develop a flood mitigation solution to provide improvements to the existing drainage system allowing for a safe high level overflow from a County pond. A concept was developed consisting of raising the existing berm and installing a control structure that would safely convey elevated stages in the pond towards and under Banana Lake Road and minimize the future potential for high lake stages impacting the surrounding properties.

The proposed outfall system will control stages in excess of a 100 year, 96 hour storm event and/or impacts from cumulative stage increases with 1 foot of freeboard.

The total project implementation cost was estimated to be approximately $445,153 including construction, contingency, design and permitting, CEI services, and easement / property acquisition.

Based on the foregoing, Geosyntec recommends that the County pursue design of this flood improvement alternative.

Flooding Focused Project

Biltmore Point

Flood Improvement Alternatives Analysis

Biltmore Point Road Flood Retrofit

Wekiva Watershed Management Plan

Seminole County, Florida

The purpose of this flood improvement concept is to provide improvements to reduce flooding associate with the subdivision drainage system. The project area is generally defined as Biltmore Point west of Estates Place, including the receiving stormwater pond.

The project area is shown on **Figure 1**. A topographical map is included on **Figure 2**. Representative photos of the area are included on the following pages.

Existing Conditions

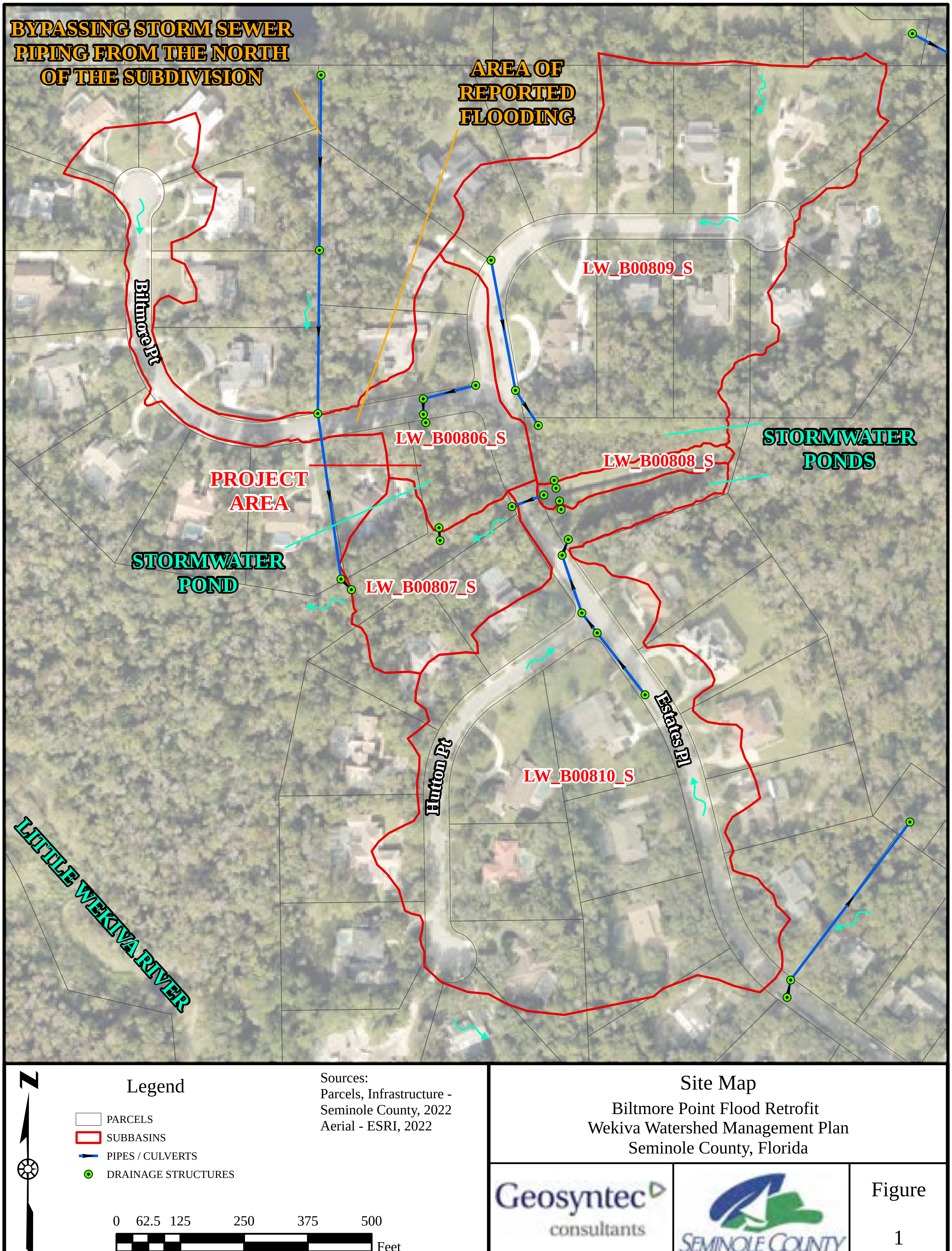
During heavy storm events flooding has been reported along Biltmore Point, specifically during Hurricane Ian, apparently exceeding capacity of storm sewer / pond system. Limited drainage inlets are located along the road and the grading is somewhat flat. The receiving stormwater pond is overgrown and may not be functioning per design. The pond discharges to an outfall canal for the subdivisions which runs west and discharges into the wetlands adjacent to the Little Wekiva River. Roads in the project area are County right-of-way, but the pond appears to be on the home owner's association property.

Watershed Hydrologic and hydraulic modeling indicated level of service deficiencies in this area, and potential habitable structure impacts from extreme storm events. The project area is highly influenced by Little Wekiva River Floodplain, so improvements to this area would not be expected to eliminate flooding during extreme storm events and are targeted for design level events, 10 year for roads and 25 year for the pond.

Proposed Improvements

The proposed project is to add an inlet along Biltmore Point connecting to the existing drainage infrastructure to address flat grading in the area, upsize the existing pipe at the intersection of Estates Place and Biltmore Point from 19"x30" to 30" to more effectively convey stormwater runoff from the road to the stormwater pond on the east side of Estates Place, remove debris and excess vegetation to increase storage of the existing stormwater pond on the west side of Estates Place, and construct a bleed down orifice to lower the control elevation of the stormwater pond on the west side of Estates Place while still providing water quality treatment.

These proposed improvements will increase conveyance from Biltmore Point to the existing stormwater pond as well as provide additional storage to the area addressing the reported flooding. The proposed improvement concept is shown on **Figure 3**.



Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Site Map

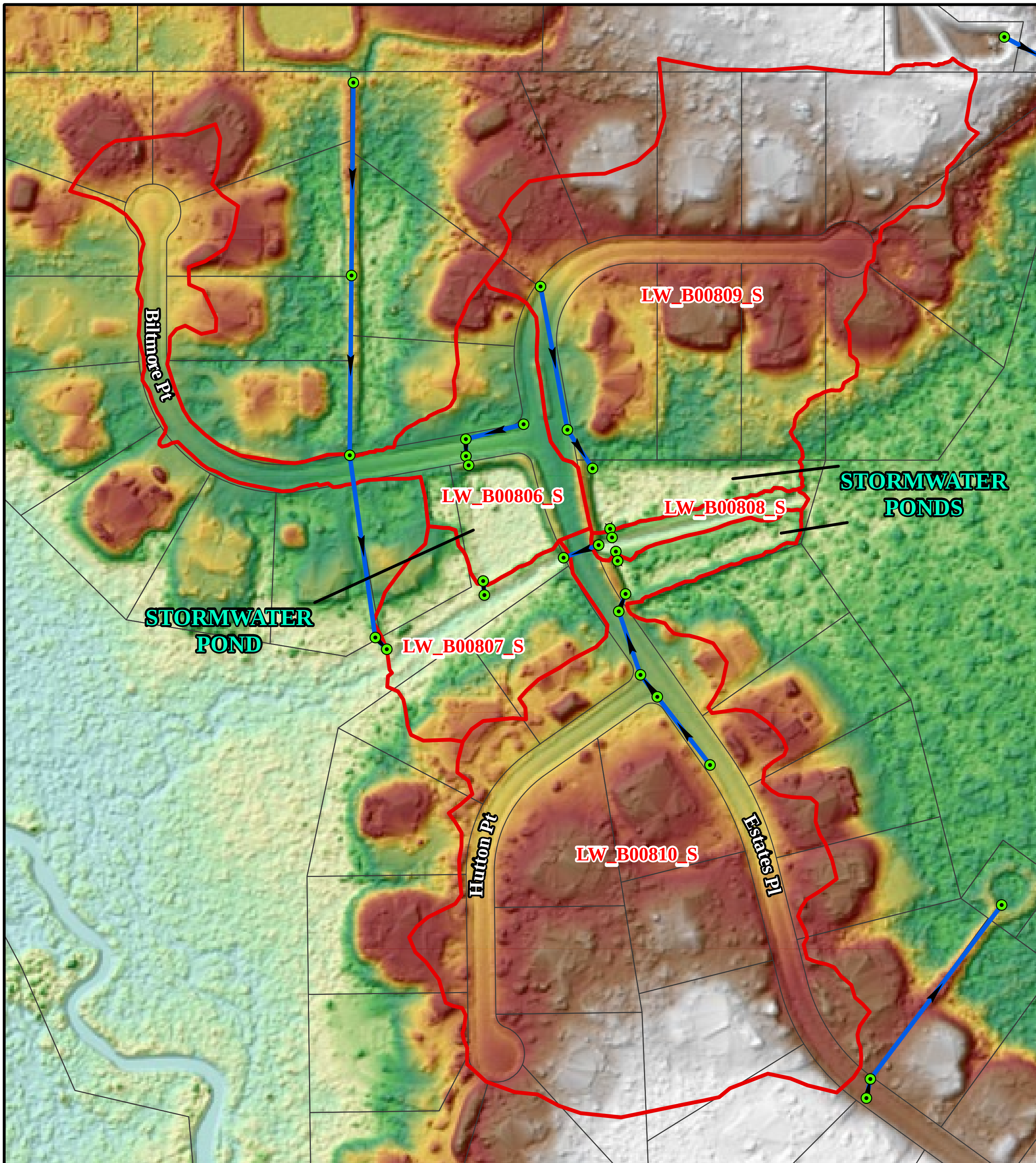
Biltmore Point Flood Retrofit
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure

1



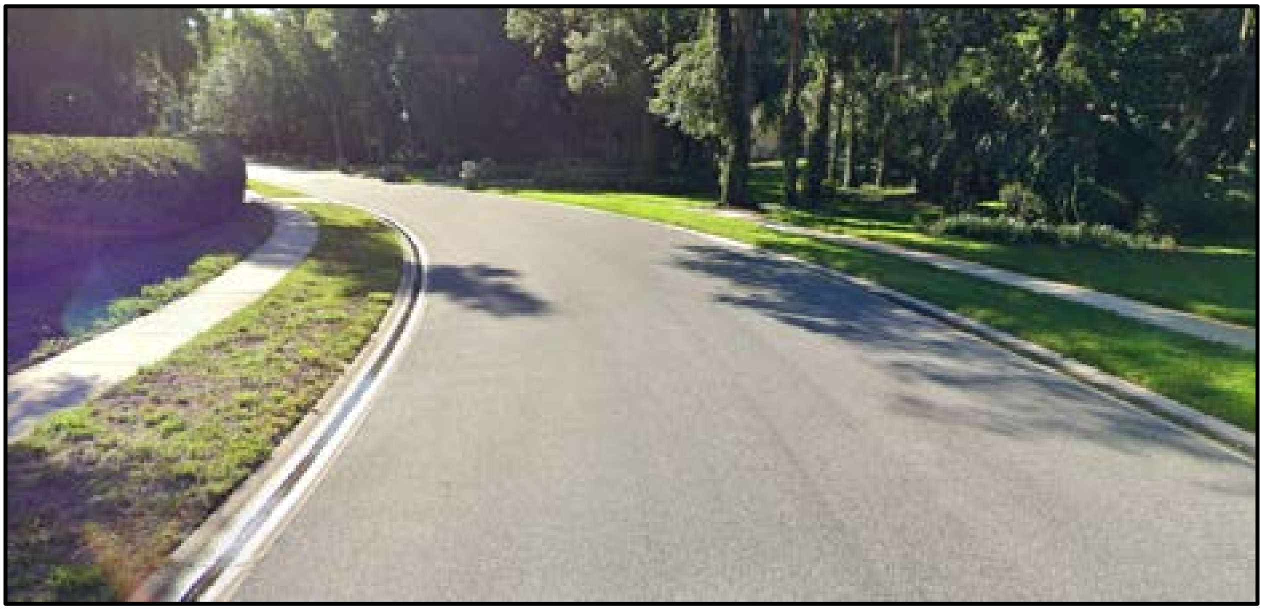
Sources:
Parcels, Infrastructure - Seminole County, 2022
DEM - USGS LIDAR, 2018

Topographical Map
Biltmore Point Flood Retrofit
Wekiva Watershed Management Plan
Seminole County, Florida

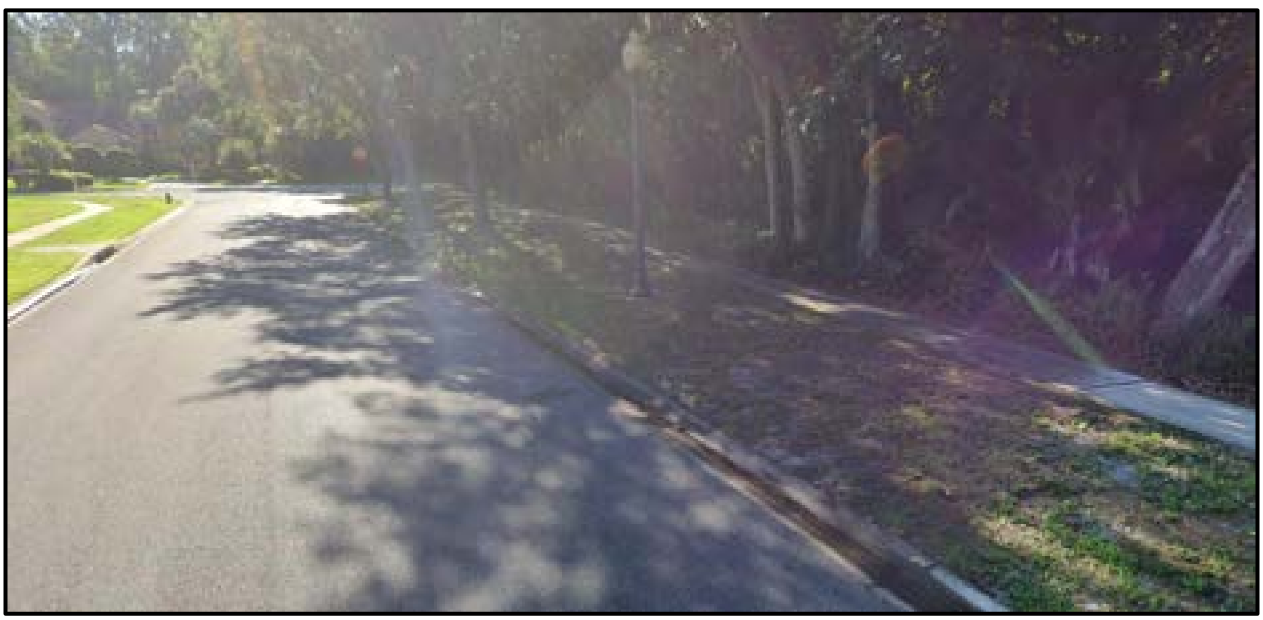
Geosyntec consultants

SEMINOLE COUNTY

Figure 2



View to southeast along Biltmore Point (Google, 2019)



View to east along Biltmore Point, inlets shown which drain to the overgrown ponded area to the right (south). Google, 2019)

View to southwest along Biltmore Point from Estates Place, inlets shown which drain to the overgrown ponded area to the left (south). (Google, 2019)

View to southwest at the Biltmore Point / Estates Place intersection and overgrown pond area in center. (Google, 2023)

Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Proposed Improvements Map
Biltmore Point Flood Retrofit
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

Seminole County

Figure 3

Flood Benefits

The flood benefits associated with this improvement concept are depicted in **Table 1**. As seen in **Table 1**, model results indicate that road flooding may be eliminated during the mean annual and 10 year, 24 hour design storm events, with peak stage reductions observable during the 25 year, 24 hour design storm event.

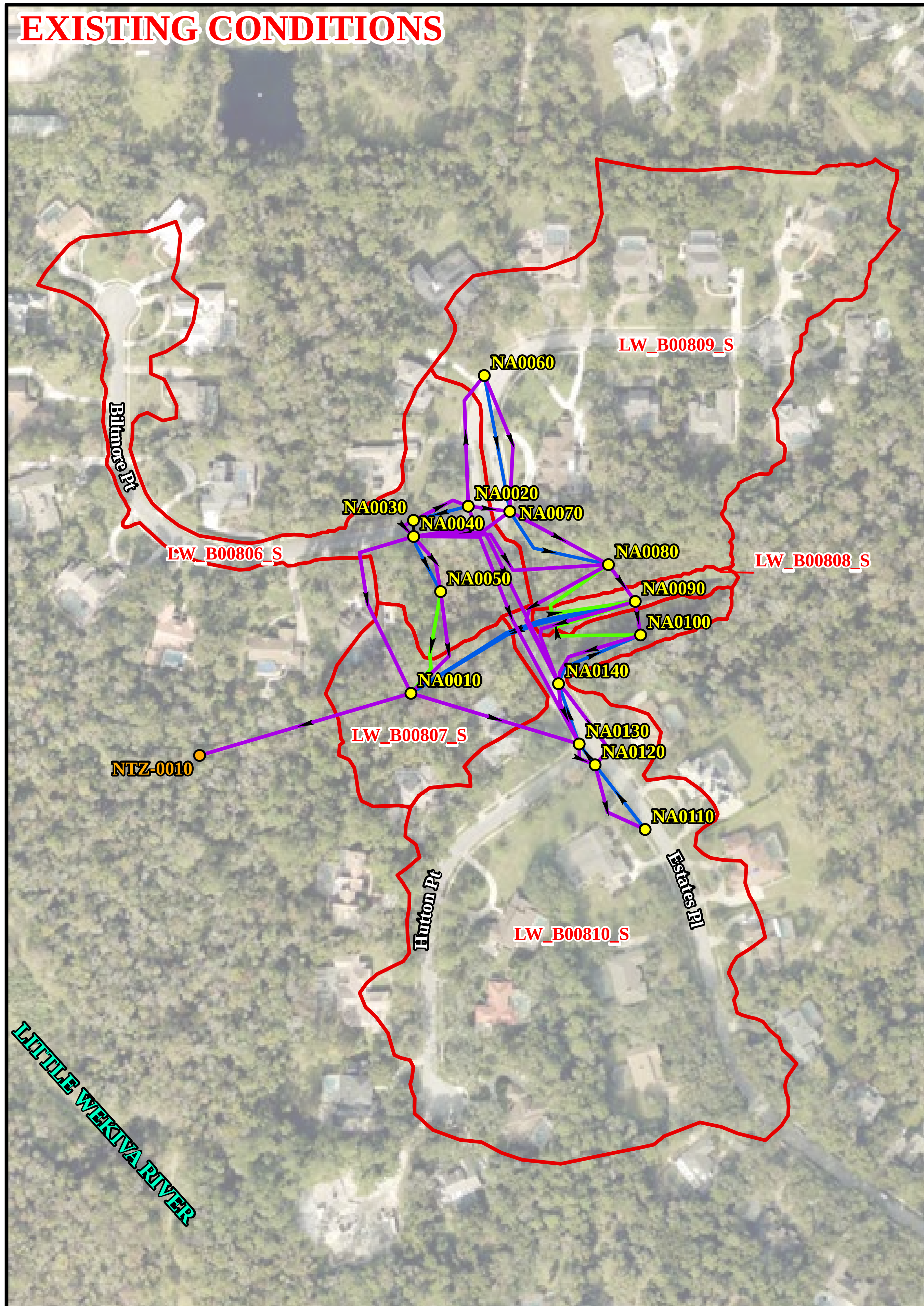
Based on model results, these peak stage reductions were achieved without increasing the peak discharge rate from the stormwater pond on the west side of Estates Place to the drainage ditch upstream of the Little Wekiva River. For example, the peak discharge rate during the 10 year, 24 hour design storm in the existing conditions was 15.17 cfs and in the proposed conditions was 10.08 cfs. This was achieved by lowering the control elevation of the stormwater pond which provides additional flood attenuation volume and optimizing storage in the pond through regrading and removal of debris/vegetation.

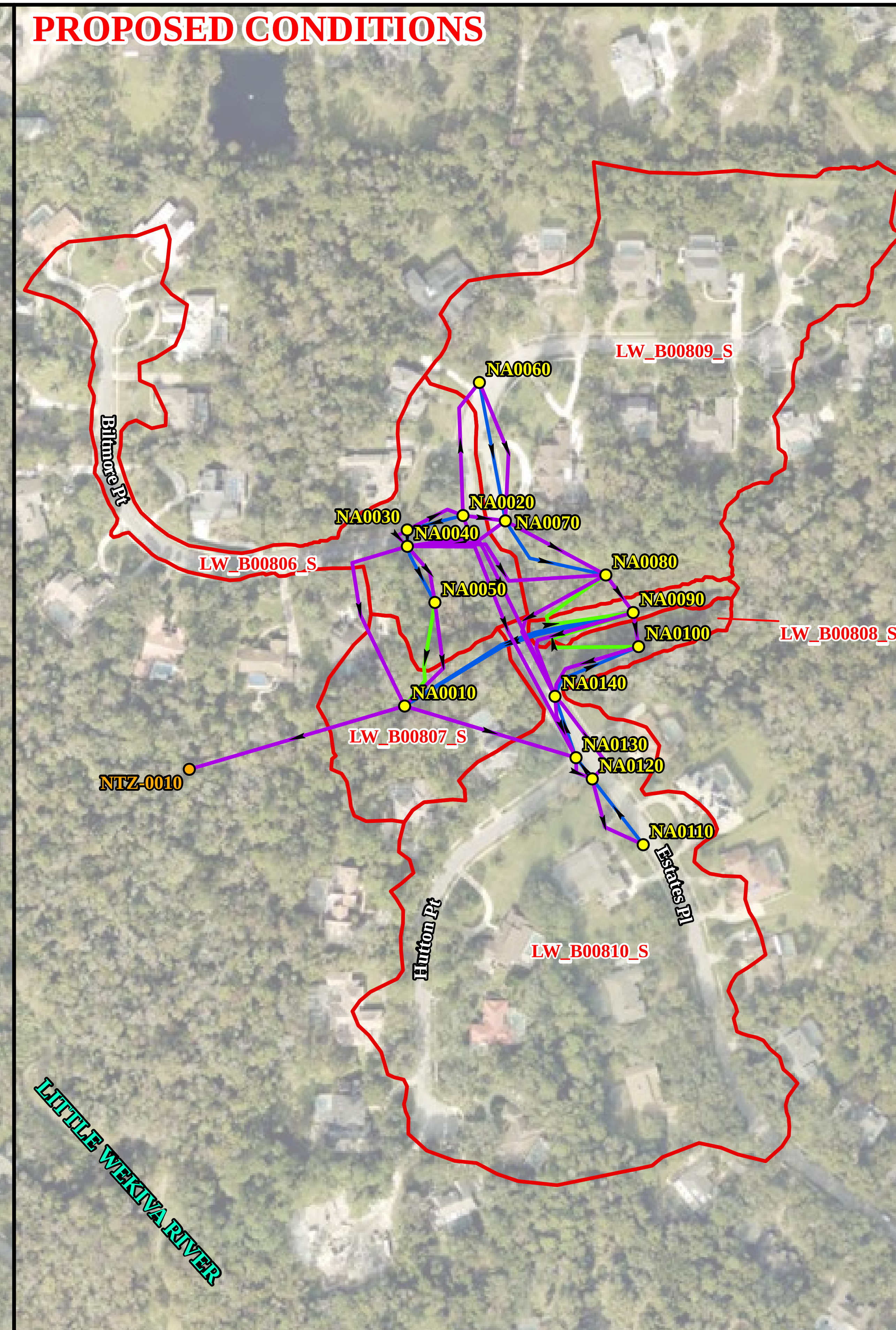
It is noted that the ecological and water quality treatment implications associated with lowering the pond control elevation would have to be investigated during design. It is noted that the development appears to be pre current SJRWMD permitting and no plans or drainage calculations were available to confirm design intent.

The locations of the nodes found in **Table 1** are presented on **Figure 4** which depicts both the existing conditions and proposed conditions Node-Link model schematics.

TABLE 1 - BILTMORE POINT FLOOD RETROFIT

STAGE/AREA NODE		INITIAL STAGE		WARNING STAGE		MEAN ANNUAL / 24 HOUR		10 YEAR / 24 HOUR		25 YEAR / 24 HOUR	
NAME	DESCRIPTION	ELEVATION	DESCRIPTION	ELEVATION	DESCRIPTION	EXISTING PEAK STAGE (FT)	PROPOSED PEAK STAGE (FT)	EXISTING PEAK STAGE (FT)	PROPOSED PEAK STAGE (FT)	EXISTING PEAK STAGE (FT)	PROPOSED PEAK STAGE (FT)
NA0010	Drainage Ditch	17.73	Bottom of structure	23.06	Top of Bank	19.02	18.98	19.22	19.18	19.33	19.28
NA0020	Drainage Inlet	18.10	Bottom of structure	21.01	Edge of pavement	20.21	19.68	**21.07**	20.66	**21.42**	**21.36**
NA0030	Drainage Inlet	18.06	Pond Initial Stage	20.63	Edge of pavement	20.15	19.61	**20.77**	20.49	**21.40**	**21.26**
NA0040	Drainage Inlet	18.06	Pond Initial Stage	20.68	Edge of pavement	20.08	19.54	20.55	20.29	**21.18**	**20.88**
NA0050	Stormwater Pond	18.06	Control Elevation	21.06	Top of Bank	19.96	19.30	20.15	19.71	20.26	20.12
NA0060	Drainage Inlet	18.50	Bottom of structure	22.89	Edge of pavement	19.99	19.95	22.43	21.99	22.59	22.56
NA0070	Drainage Inlet	18.02	Bottom of structure	21.22	Edge of pavement	19.96	19.92	**21.44**	20.86	**21.64**	**21.27**
NA0080	Stormwater Pond	17.95	Pond Bottom	23.97	Top of Bank	19.91	19.90	20.59	20.59	20.70	20.75
NA0090	Stormwater Pond	16.75	Pond Bottom	22.37	Top of Bank	19.21	19.18	19.97	19.98	20.37	20.54
NA0100	Stormwater Pond	18.50	Pond Bottom	22.63	Top of Bank	19.88	19.88	20.58	20.58	20.67	20.68
NA0110	Drainage Inlet	19.63	Bottom of structure	22.90	Edge of pavement	20.70	20.70	22.90	22.90	**23.11**	**23.11**
NA0120	Drainage Inlet	19.19	Bottom of structure	22.40	Edge of pavement	20.19	20.19	22.36	22.36	**22.67**	**22.67**
NA0130	Drainage Inlet	19.10	Bottom of structure	22.30	Edge of pavement	20.10	20.10	21.90	21.90	22.02	22.02
NA0140	Drainage Inlet	18.20	Bottom of structure	22.06	Edge of pavement	19.95	19.95	20.94	20.94	21.52	21.51





SEMINOLE COUNTY

N

0 60 120 240 Feet

Legend

SUBBASINS

ICPR LINK TYPE

- PIPE
- WEIR
- DROP STRUCTURE

ICPR NODE TYPE

- Stage Area
- Time Stage

Sources:
Aerial - ESRI, 2022

Figure 4

Model Map

Biltmore Point Flood Retrofit

Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

Benefit Cost Analysis

Benefit cost calculations were performed in accordance with the methodology previously described. Roadway damages were determined for County maintained roads within the project area. Annual road flood damages benefits were calculated as the difference between damages in the existing and proposed conditions. Roadway ecosystem benefits were calculated in the FEMA Benefit Cost Calculator based on the project area (12.8 acres) and estimated percentage of urban green space within the project area (15%). Roadways included in this assessment are listed below.

- Biltmore Point, Estates Place, and Hutton Point.

Model results did not indicate the presence of any potentially impacted structures within the project area.

Results of the benefit cost analysis for this improvement project are summarized in **Table 2**. As seen in **Table 2**, the lifecycle benefits of the project exceed the estimated construction cost, resulting in a BCR of 1.96 which indicates that this project may be cost-effective.

Table 2: Benefit Cost Results for Biltmore Point

Benefit Cost Results								
Project	Existing Conditions Road Flood Damages ($/year)	Proposed Conditions Road Flood Damages ($/year)	Road Flood Damages Benefit ($/year)	Roadway Ecosystem Benefits ($/year)	[1]Structure Total Benefits ($/year)	[2]Lifecycle Benefit ($)	[3]Estimated Construction Cost ($)	B/C Ratio
Biltmore	$12,351	$9,127	$3,223	$29,839	$0	$456,291	$233,059	1.96

[1]*Structure total benefits include standard mitigation benefits and social benefits as outlined in the FEMA Benefit Cost Calculator.*

[2]*Lifecycle benefit is equal to (Road Flood Damages Benefit + Road Ecosystem Benefit + Structure Total Benefits) x 13.801 to calculate the NPV of benefits over the project's lifecycle.*

[3]*Estimated construction cost is the construction cost + contingency. Does not include design and permitting or CEI services.*

Results of the benefit cost analysis including the FEMA Benefit Cost Calculator are included in the Electronic Deliverables.

Implementation Considerations

The following implementation considerations are provided for this improvement concept.

- Flood Benefit – The project is intended to improve drainage conveyance and address roadway flooding. Based on model results from the Wekiva Watershed Management plan subbasins LW_B00806_S – LW_B00810_S received a level of service (LOS) score of D due to roadway flooding that potentially impacted structures. Based on model results for the proposed improvements, roadway flooding may be mitigated along Biltmore Point, resulting in a LOS score of A. It is noted that flooding in the existing conditions was determined to be partly attributed to elevated stages in the Little Wekiva River located southwest of the project area. The improvements discussed herein are not intended to address flooding resulting from elevated stages in the river.
- Permitting Considerations – It is anticipated that this improvement would require an individual permit for stormwater retrofit from the St. Johns River Water Management District.
- Engineering Design – Final engineering design should include collection of survey data, utility designation, geotechnical testing, preparation of design plans, preparation of a cost estimate, preparation of technical specifications, and utility coordination to address any needed conflict adjustments / relocations.
- Water Quality Benefit – This improvement would not be purposed to directly provide a water quality benefit. The alteration of the pond control structure would need to be evaluated for its impact to water quality treatment.
- Land Acquisition – Land and/or easement acquisition may be necessary to upsize the existing drainage infrastructure at the intersection of Estates Place and Biltmore Point as well as over the pond area. It is assumed that the County would request for these easements to be donated in exchange for County maintenance; however, the cost of the easements has been included to be conservative.
- Wetland / Surface Water Impacts – The proposed cleaning and updating of the stormwater pond may have wetland / surface water impacts which would need to be accounted for during permitting.
- Benefit/Cost – The estimated NPV of the 50 year lifecycle benefits (road, structure, ecosystem services, and social) for this improvement are $456,291. The estimated construction cost for this improvement is $233,059, which includes construction and a 20% contingency. The resulting BCR for this improvement is **1.96**. A detailed breakdown of the preliminary cost estimate is provided in **Table 3**.

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Table 3: Engineer's Estimate of Probable Improvement Costs based on Concept

Biltmore Point Flood Retrofit						
Item	**Pay Item No.**	**Description**	**Units**	**Unit Cost**	**Quantity**	**Total**
1	101-1	Mobilization (15% of Construction Total)	LS	varies	1	$19,422
2	102-1	Maintenance of Traffic (10% of Construction Total)	LS	varies	1	$12,948
3	104-1	Prevention, Control and Abatement of Erosion and Water Pollution (10% of Construction Total)	LS	varies	1	$12,948
4	110-1-1	Clearing and Grubbing (15% of Construction Total)	LS	varies	1	$19,422
5	120-1	Regular Excavation	CY	$10.00	4050	$40,500
6	425-11	Modify Existing Drainage Structure	EA	$6,650.00	1	$6,650
7	430-175-130	Pipe Culvert, Concrete, Round, 30" S/CD	LF	$240.00	85	$20,400
8	430-175-224	Pipe Culvert, Concrete, Elliptical. 24" S/CD	LF	$270.00	30	$8,100
9	430-982-133	Mitered End Section, Round, 30" CD	EA	$7,600.00	1	$7,600
10	570-1-2	Performance Turf, Sod	SY	$6.00	4050	$24,300
11	900-1	Easement / Property Acquisition	LS	varies	1	$21,927
SUBTOTAL COST:						$194,216
CONTINGENCY (20%):						$38,843
CONSTRUCTION SUBTOTAL:						$233,059
DESIGN & PERMITTING:						$58,265
CEI SERVICES:						$34,959
ESTIMATED TOTAL IMPLEMENTATION COST:						**$326,283**

Notes:

1) *Above estimate does not include cost for potential utility relocations.*
2) *Assumes no muck or other removal of unsuitable soils.*
3) *Design and permitting was assumed to be 25% of the construction subtotal cost based on engineering judgement.*
4) *Construction engineering and inspection (CEI) services was assumed to be 15% of the construction subtotal cost based on engineering judgement.*
5) *Costs for 900-1 were obtained from the Seminole County property appraiser and were assumed to be 1.5 times the parcel value (land + buildings + features) to account for administrative costs. Assumed that City and Florida Power easements would be donated at no cost.*

The information provided herein in considered to be preliminary for project planning purposes. As noted previously, design level efforts including detailed modeling will be necessary to quantify pumping rates, confirm flood stages, confirm pollutant load reductions, etc.

Conclusions

The goal of this effort was to develop a flood mitigation solution to reduce roadway flooding along Biltmore Point. A concept was developed consisting of adding an additional inlet, upsizing the existing pipe at the intersection of Estates Place and Biltmore Point from 19"x30" to 30", removing debris and excessive vegetation to increase storage at the existing stormwater pond, and the addition of a bleed down orifice to lower the control elevation of the stormwater pond.

The total project implementation cost was estimated to be approximately $326,283 including construction, contingency, design and permitting, CEI services, and easement / property acquisition. The project benefits from a LOS perspective were determined to be:

- Subbasins LW_B00806_S - LW_B00810_S LOS score improved from a D to A for the contributing area.

Results of the benefit cost analysis indicate a BCR of 1.96, indicating that this project may be cost-effective.

Based on the foregoing, Geosyntec recommends that the County pursue design of this flood improvement for the anticipated LOS benefits.

Flooding Focused Project

Markham Road at Lake Markham

Improvement Alternatives Analysis
Markham Road at Lake Markham Road Flooding
Wekiva Watershed Management Plan
Seminole County, Florida

The purpose of this alternatives analysis is to address flooding concerns located in the vicinity of the intersection of Markham Road and Lake Markham Road. Moderate rain events have been observed to cause flooding in this area, particularly north of the intersection and near where the Seminole Wekiva Trail passes. Drainage infrastructure in this location includes small roadside swales and a side drain along Lake Markham Road which are undersized to handle the runoff from the road corridor and contributing areas associated with the adjacent Sports Complex. There is a drainage system along Markham Road that consists of several drainage inlets that pass through the Carisbrooke subdivision discharging into a wetland. The areas along Lake Markham Road are not directly connected to this outfall system along Markham Road, which results in stormwater runoff staging up into the road as it finds its way to the lower areas along Markham Road.

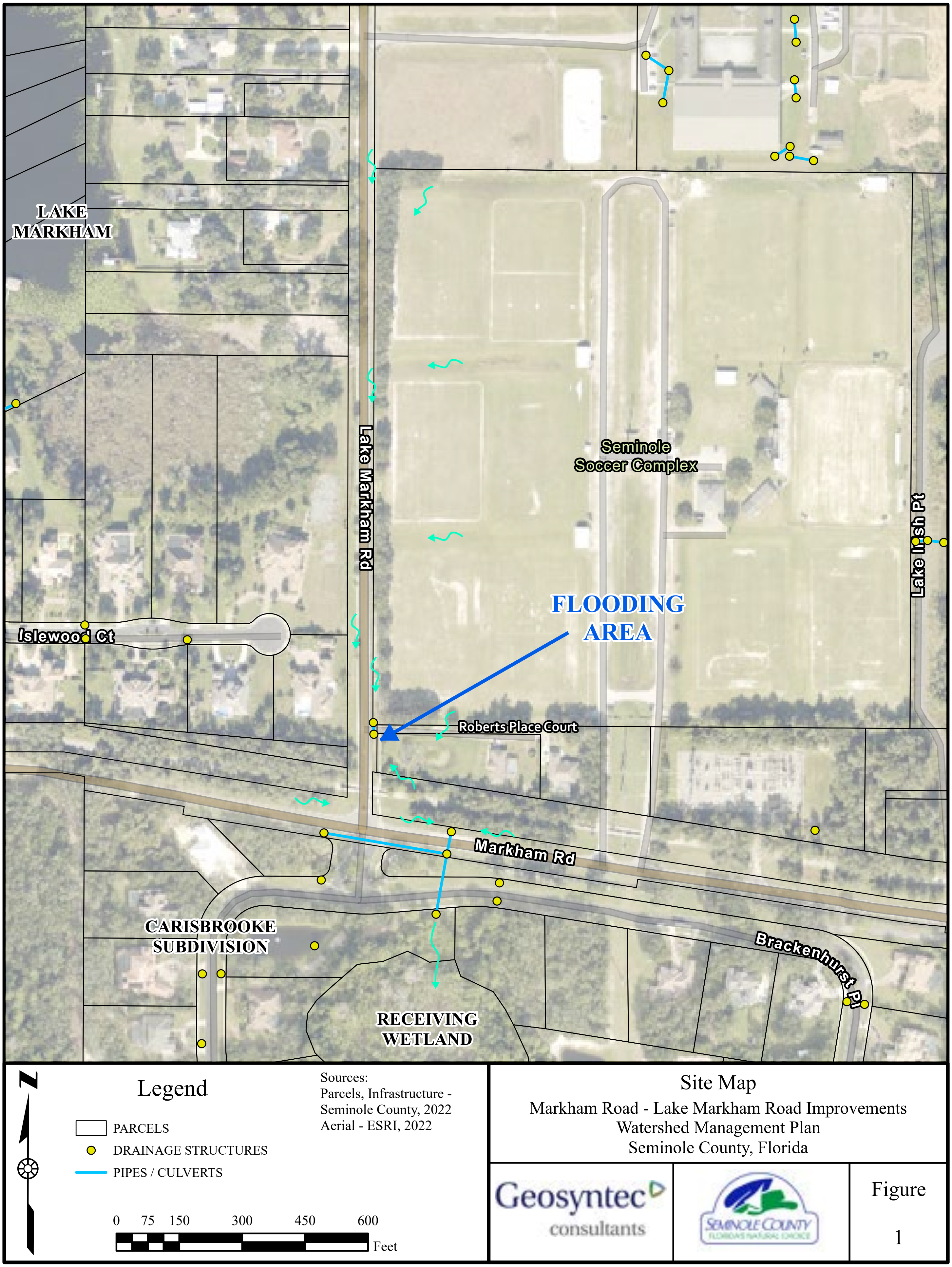
The project area with existing drainage infrastructure is shown on **Figure 1**. A topographical map is included on **Figure 2**.

The County has proposed an improvement project which includes the installation of new stormwater piping along Lake Markham Road to capture runoff, replacing the existing undersized swales. This piping would be continued down to the Markham Road - Lake Markham Road intersection and connect to the existing piped outfall system to the south through the Carisbrooke subdivision. The pipe across Markham Road to the wetland outfall would be upsized to accommodate additional flows. The County has prepared preliminary design plans for this proposed improvement and have corresponded with SJRWMD to secure a permit exemption (October 2022). A copy of these plans is included in **Attachment A**.

The goal of this improvement alternatives analysis was to provide a basis of comparison for proof of concept of the County proposed improvements design using the Wekiva Watershed model. In this way the downstream impact of the project was assessed using the regional model tool. Specifically, impacts from the proposed improvements to the receiving wetland were evaluated as this area receives drainage from a much larger area than just the immediate project.

Existing Conditions

The project area has no formalized drainage on Lake Markham Road. Drainage consists of just roadside retention swales. The swales have been observed to become overwhelmed with the large amount of water coming from the combination of the roadway and the retention areas located on the Seminole Soccer Complex to the east. This accumulated storm runoff has been observed to be undermining the sidewalk and traveling through the swales to the lowest point which is the south end of Lake Markham Road near the Wekiva Trail. The swale also has been observed to overflow into the private pond on Roberts Place Court causing the driveway to have standing water. It has reportedly taken over a week of no rain for flood waters to subside. The Wekiva Trail is built at a higher elevation causing water to flow into the road where the trail crosses Lake Markham Road. Runoff spilling past the trail travels east along Markham Road to an inlet located on the north side of Markham Road just east of the intersection.



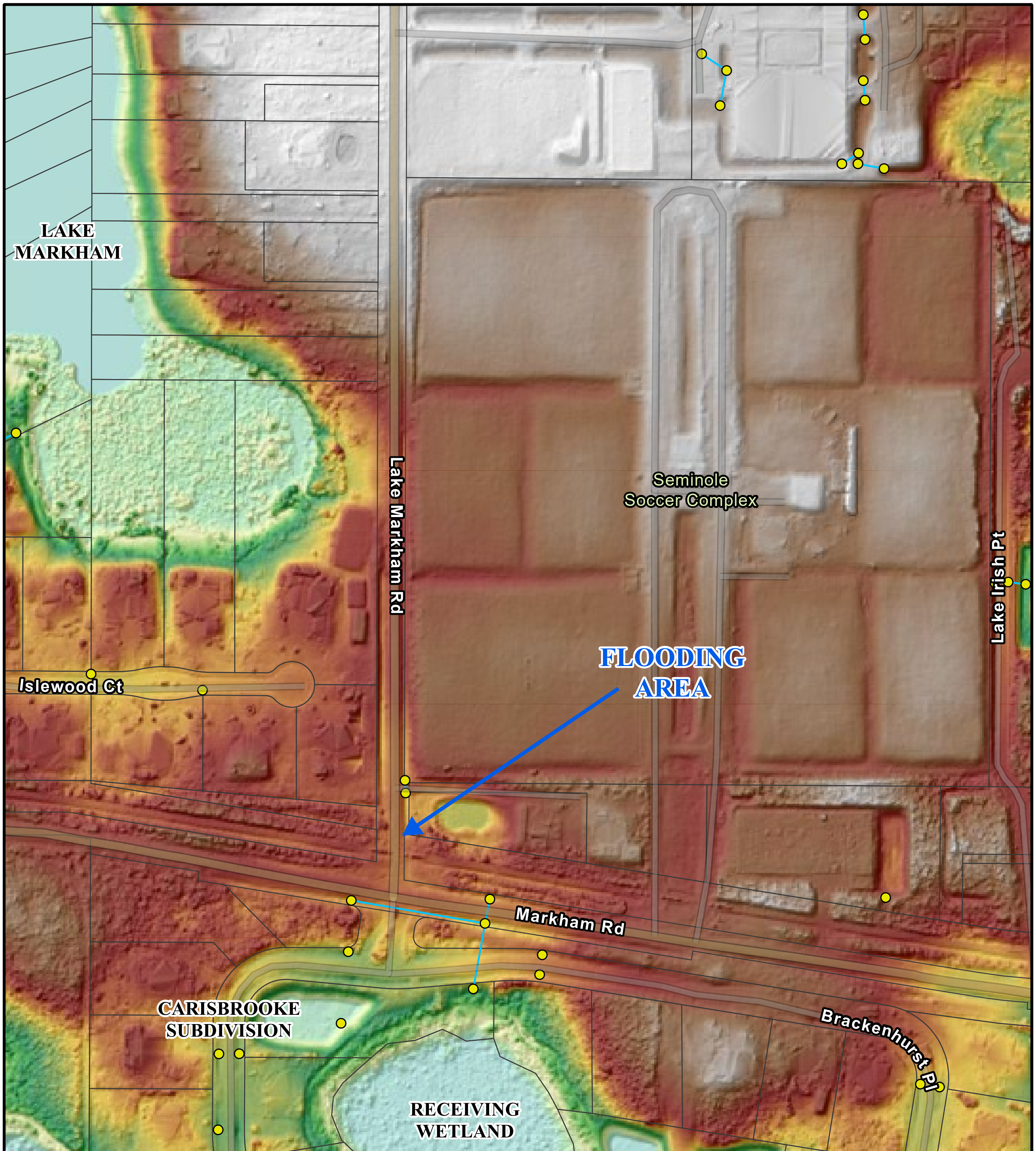
Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Site Map
Markham Road - Lake Markham Road Improvements
Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY FLORIDA'S NATURAL CHOICE

Figure 1



N

Legend

PARCELS
DRAINAGE STRUCTURES
PIPES / CULVERTS

DEM
FEET NAVD 1988
68.47
38.6

Sources:
Parcels, Infrastructure - Seminole County, 2022
DEM - USGS LIDAR, 2018

0 75 150 300 450 600
Feet

Topographical Map
Markham Road - Lake Markham Road Improvements
Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY FLORIDA'S NATURAL CHOICE

Figure

2

Photos of the project area are shown below showing flooding issues were provided by Seminole County from the summer of 2019.

Photo 1 – View to north from intersection of Lake Markham Road and Markham Road, Wekiva Trail crossing shown – flooding extending into travel lanes.

Photo 2 – View to south towards the from intersection of Lake Markham Road and Markham Road from Roberts Place Court – flooded pond area.

Photo 3 – View to northeast towards the intersection of Lake Markham Road and Roberts Place Court – flooding in swale and across street.

Photo 4 – View to north from the intersection of Lake Markham Road and Roberts Place Court – flooding in swale and sidewalk.

Photo 5 – View to south along Lake Markham Road, flooding in swale and into travel lane on east side of road (~900' north of Markham Road).

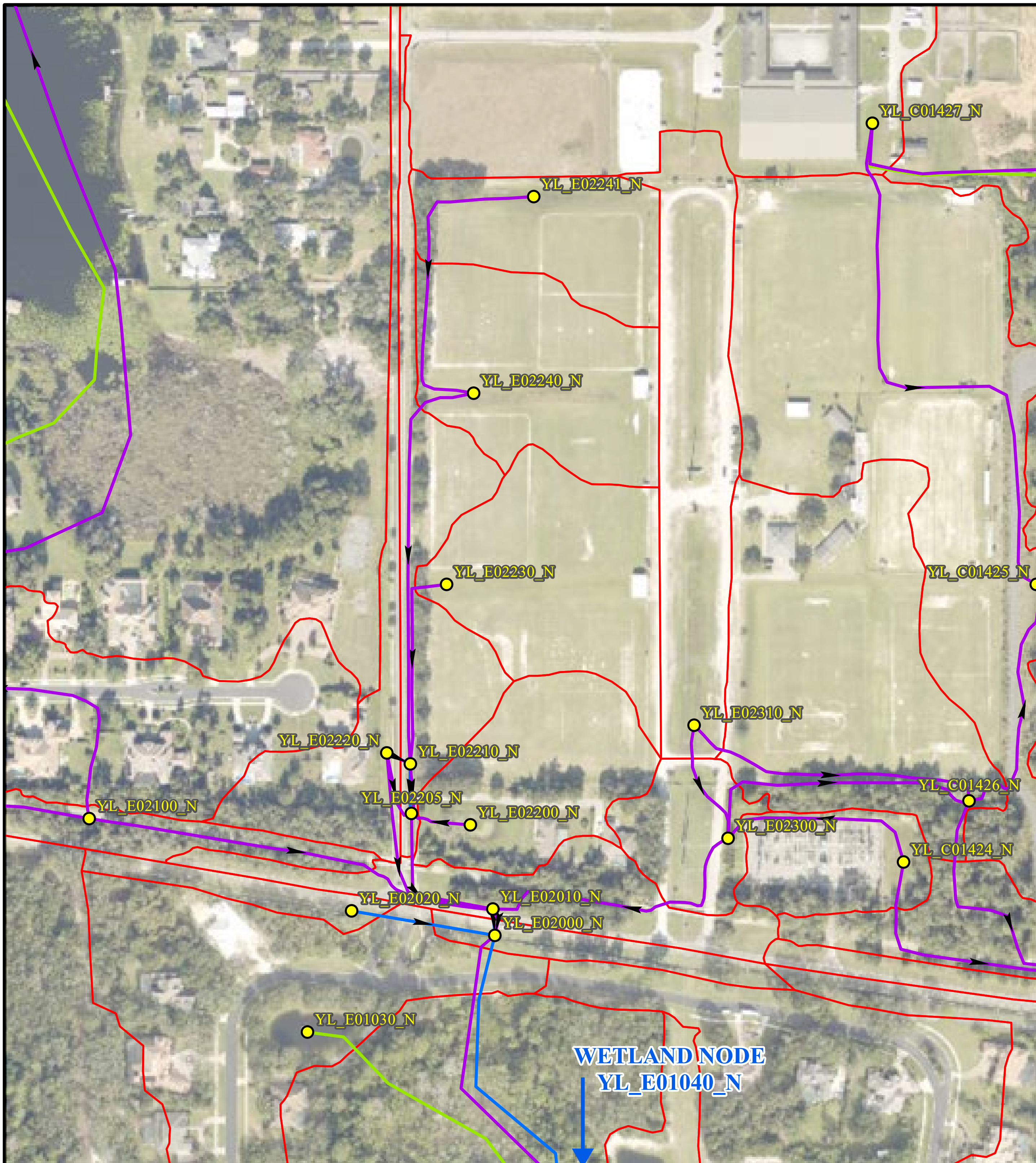
Photo 6 – View to northeast from Lake Markham Road, flooding in swale and apparent contributing flow from sports field.

Photo 7 – View to west from east side of Lake Markham Road, flooding in swale on west side of road.

This analysis under the Wekiva Watershed Management plan entails confirming the effectiveness of this proposed improvement by incorporating the elements of it into the greater watershed model tool. This will help to confirm no significant negative impacts will be caused to the downstream wetland since there are residential homes in close proximity to this receiving water. There are areas in the project corridor that are currently without positive outfall and the proposed improvements will provide a positive outfall. As such, it is expected that the overall volume discharged though surface drainage to the receiving wetland will increase well as peak discharges. Based on this, the primary indicator of impacts to downstream areas would be increases in flood stage in the wetland from existing to proposed conditions.

The Wekiva Watershed existing conditions model schematic for the project area is shown on **Figure 3.** Results from the existing conditions model are shown on **Figure 4** including inundation areas from the mean annual, 10 year, 25, and 100 year storm events modeled. The model predicts road flooding starting at the mean annual design storm event. This appears consistent with County reports of flooding.

Based on the existing conditions Flood Protection Level of Service (FPLOS) analysis done for the watershed, the problem area graded out as a FPLOS C, based on road inundation above edge of pavement, but no apparent structure flooding.



N

Legend

ICPR BASIN

ICPR NODE

ICPR LINK

PIPE

CHANNEL

WEIR

DROP STRUCTURE

RATING CURVE

0 75 150 300 450 600

Feet

Sources:
Aerial - ESRI, 2022

Existing Conditions ICPR Model Map

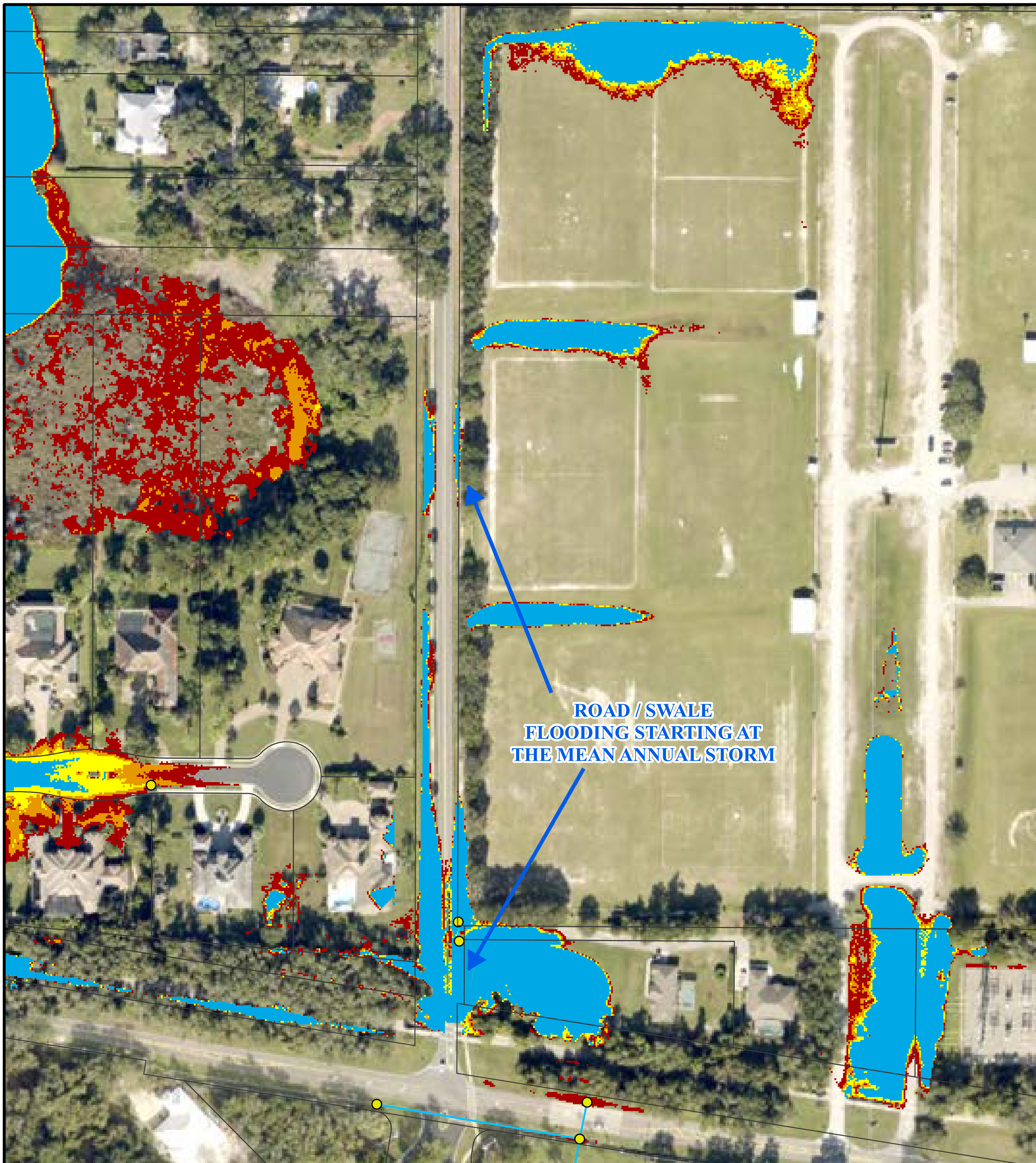
Markham Road - Lake Markham Road Improvements
Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

Seminole County Florida's Natural Choice

Figure

3



Legend

MODELED FLOOD INUNDATION

- MEAN ANNUAL 24 HOUR STORM
- 10 YEAR 24 HOUR STORM
- 25 YEAR 24 HOUR STORM
- 100 YEAR 24 HOUR STORM

- PARCELS
- DRAINAGE STRUCTURES
- PIPES / CULVERTS

0 50 100 200 300 400 Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022

Existing Model Inundation Results
Markham Road - Lake Markham Road Improvements
Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY FLORIDA'S NATURAL CHOICE

Figure 4

Improvement Concept

This improvement concept includes the installation of new storm sewer piping to drain Lake Markham Road to connect with the Markham Road drainage system that outfalls to the wetland to the south of the Carisbrooke subdivision. This includes:

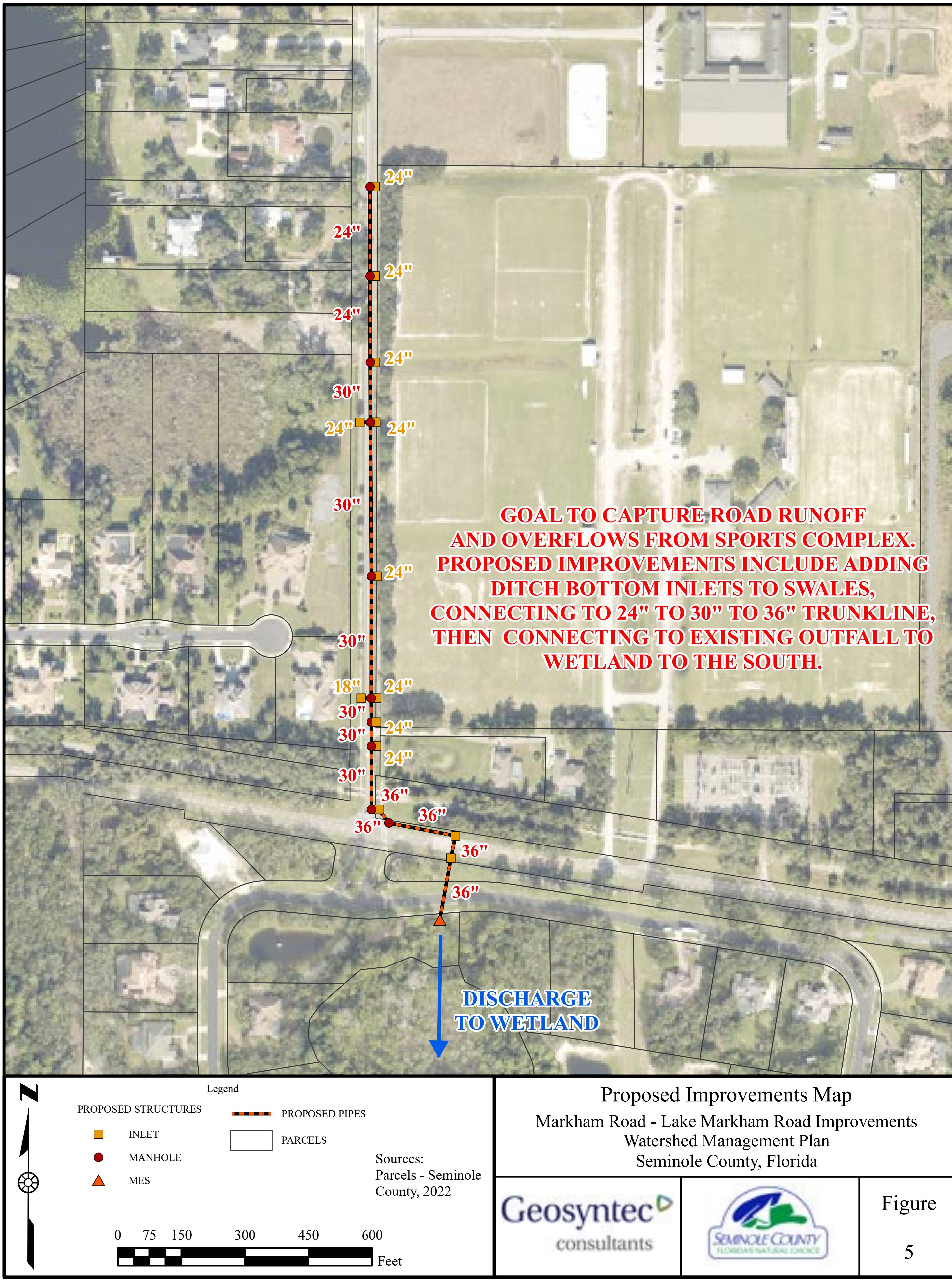
- Approximately 1700 feet of new 24" to 36" storm sewer piping installed along Lake Markham Road just inside the edge of pavement and then improved swales.
- Several ditch bottom and back of the sidewalk inlets would be placed along the east side of Lake Markham Road to help facilitate controlled drainage from the road right of way and adjacent Sports Complex through 24" pipes.
- Inlet connections would also be provided through 18" to 24" pipes to more effectively drain the west side of Lake Markham Road to the new system. Swales would be regraded on the west side as well.
- The proposed storm sewer system would connect under the Seminole Wekiva Trail to the south then east along Markham Road for ~180' though 36" piping to tie into the existing inlet.
- From the existing inlet on the north side of Markham Road, the outfall piping would be upsized to 36" to the point of discharge ~200' to the south, just past Brackenhurst Place in the Carisbrooke subdivision. Existing inlets and the MES at the outfall would be replaced.

The improvements are shown on conceptually on **Figure 5**.

The existing conditions model was modified to reflect these improvements to compare the effectiveness of the improvements. This included adding nodes and links to represent each proposed drainage structure and pipe in the proposed improvement design. In addition, the contributing subbasins in the area were subdivided to each proposed drainage inlet. The proposed conditions model schematic is shown on **Figure 6.**

A comparison of peak stages from existing to proposed is included on **Table 1** along with flood elevation references. Based on the table, all stages along the roadway are significantly below existing conditions. All road inlets and manhole nodes had peak stage elevations for the 10 year storm below 0.5' from the edge of pavement elevation. This represents a FPLOS of A. It is noted that the nodes representing the Sports Complex still stage to similar elevations before discharging towards Lake Markham Road where the overflows are accommodated by the proposed roadway drainage system. The ponded area near Roberts Place Court still stages up and discharges towards Lake Markham Road, but stages are significantly lower for each storm event. Stages in the receiving wetland remain essentially the same from existing to proposed, and do not show significant increases for any of the design storm events (no stages increasing in excess of 0.005 feet).

Flood inundation results for proposed conditions are shown on **Figure 7**. The inundation map shows that the proposed improvements result in no apparent flooding of the roadway through the 100 year 24 hour storm.



Sources:
Parcels - Seminole County, 2022

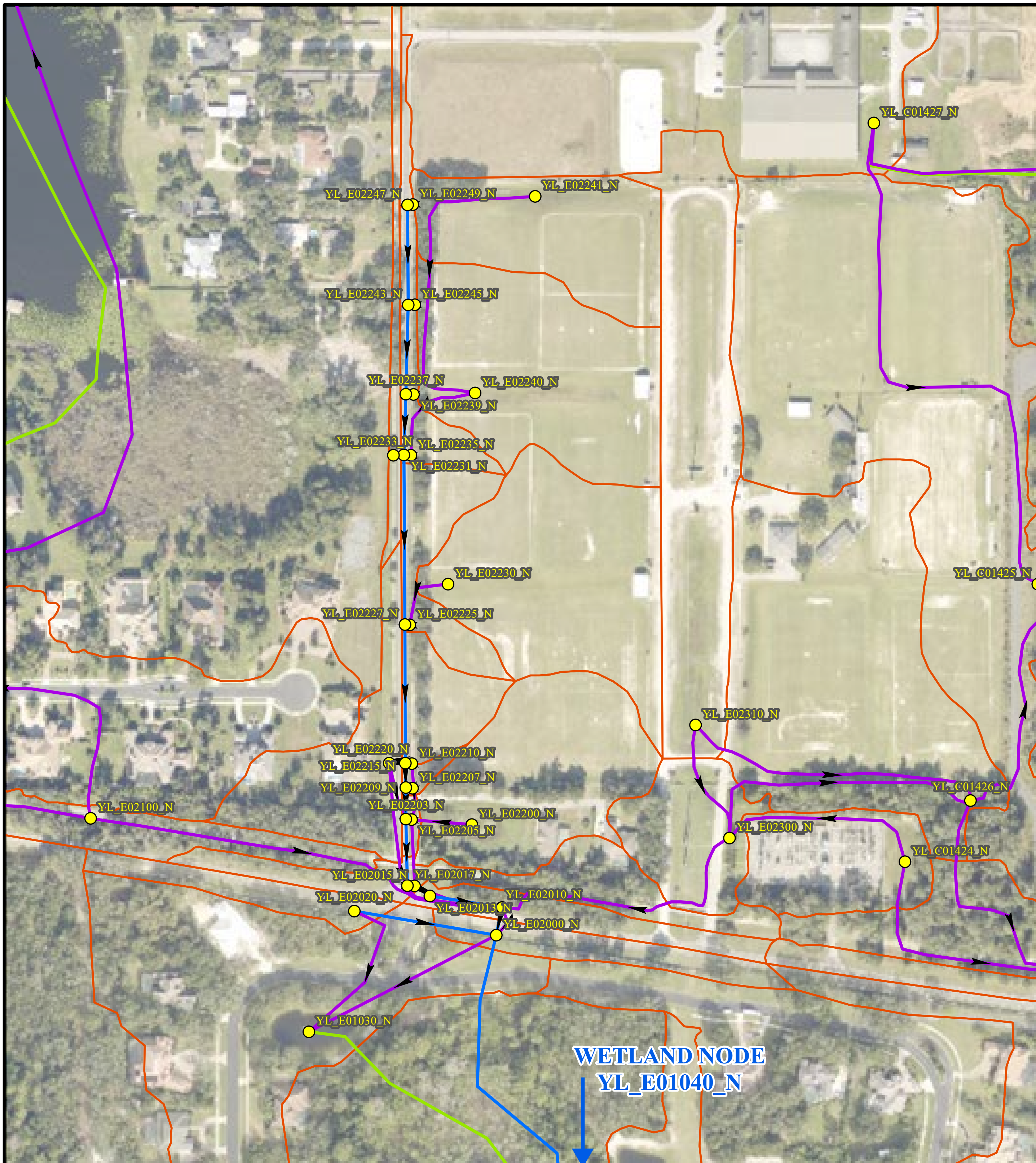
Proposed Improvements Map

Markham Road - Lake Markham Road Improvements
Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

Seminole County Florida's Natural Choice

Figure 5



Legend

BASINS - PROPOSED
NODES - PROPOSED

LINKS PROPOSED
Channel
Drop Structure
Pipe
Rating Curve
Weir

Sources:
Aerial - ESRI, 2022

0 75 150 300 450 600
Feet

Proposed Conditions ICPR Model Map

Markham Road - Lake Markham Road Improvements
Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY FLORIDA'S NATURAL CHOICE

Figure

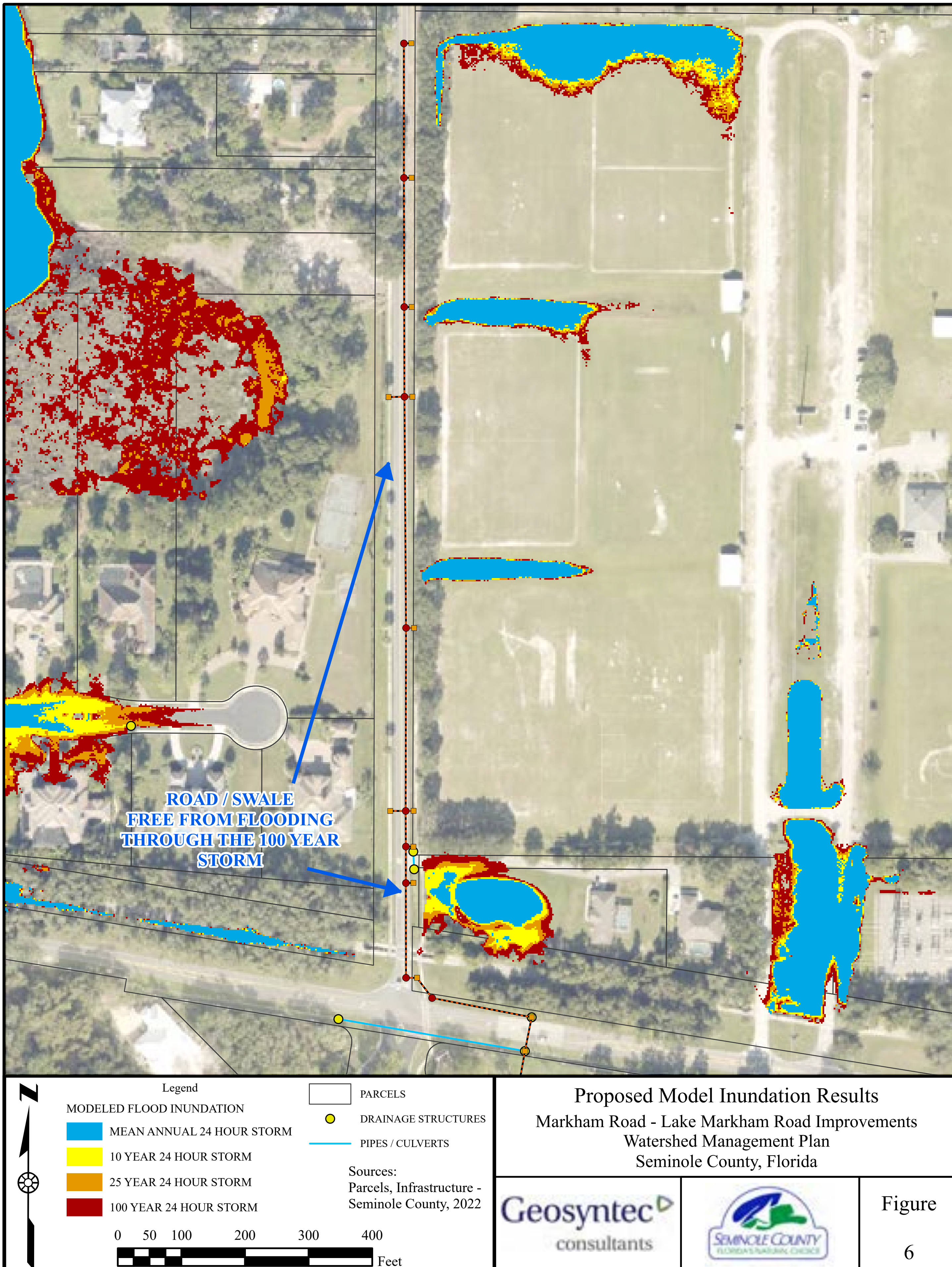
6

TABLE 1 - MODEL RESULTS SUMMARY
IMPROVEMENT ALTERNATIVES ANALYSIS
MARKHAM ROAD AT LAKE MARKHAM ROAD FLOODING
WEKIVA WATERSHED MANAGEMENT PLAN
SEMINOLE COUNTY, FLORIDA

MODEL NODE	NODE DESCRIPTION	WARNING STAGE REFERENCE	WARNING STAGE SOURCE*	WARNING STAGE DESCRIPTION	MODEL RESULTS											
					EXISTING MEAN-24HR	PROPOSED MEAN-24HR	DIFFERENCE	EXISTING 10YR-24HR	PROPOSED 10YR-24HR	DIFFERENCE	EXISTING 25YR-24HR	PROPOSED 25YR-24HR	DIFFERENCE	EXISTING 100YR-24HR	PROPOSED 100YR-24HR	DIFFERENCE
YL_E01040_N	WETLAND	41.0	DEM	LOWEST YARD ELEVATION	39.153	39.157	0.004	39.233	39.236	0.003	39.285	39.289	0.004	39.369	39.371	0.002
YL_E02000_N	MARKHAM ROAD	49.0	PLANS	EDGE OF PAVEMENT	42.94	42.20	-0.74	43.57	42.61	-0.96	44.17	42.86	-1.31	48.05	43.40	-4.66
YL_E02010_N	MARKHAM ROAD	49.0	PLANS	EDGE OF PAVEMENT	46.16	42.26	-3.90	46.48	42.67	-3.81	46.70	42.93	-3.77	49.34	43.49	-5.84
YL_E02013_N	LAKE MARKHAM - MARKHAM ROAD INTERSECTION	49.5	PLANS	EDGE OF PAVEMENT	- -	42.37	- -	- -	42.76	- -	- -	43.02	- -	- -	43.61	- -
YL_E02015_N	LAKE MARKHAM - MARKHAM ROAD INTERSECTION	49.0	PLANS	EDGE OF PAVEMENT	- -	42.68	- -	- -	42.96	- -	- -	43.14	- -	- -	43.71	- -
YL_E02017_N	LAKE MARKHAM - MARKHAM ROAD INTERSECTION	49.0	PLANS	EDGE OF PAVEMENT	- -	42.74	- -	- -	43.02	- -	- -	43.20	- -	- -	43.80	- -
YL_E02020_N	MARKHAM ROAD	50.0	DEM	EDGE OF PAVEMENT	43.30	43.30	0.00	43.57	43.36	-0.22	44.17	43.39	-0.78	48.06	43.46	-4.59
YL_E02200_N	YARD POND AREA	49.0	DEM	OVERFLOW ELEVATION	49.98	48.93	-1.04	50.07	49.32	-0.74	50.12	49.53	-0.59	50.23	49.99	-0.24
YL_E02203_N	PROPOSED MANHOLE	49.5	PLANS	EDGE OF PAVEMENT	- -	43.36	- -	- -	43.65	- -	- -	43.84	- -	- -	44.31	- -
YL_E02205_N	EXISTING SIDE DRAIN / PROPOSED DBI	49.5	PLANS	EDGE OF PAVEMENT	50.06	43.36	-6.70	50.09	43.65	-6.44	50.12	43.84	-6.28	50.23	44.31	-5.92
YL_E02207_N	PROPOSED DBI	49.5	PLANS	EDGE OF PAVEMENT	- -	44.44	- -	- -	44.49	- -	- -	44.51	- -	- -	44.56	- -
YL_E02209_N	PROPOSED MANHOLE	49.5	PLANS	EDGE OF PAVEMENT	- -	43.53	- -	- -	43.82	- -	- -	44.01	- -	- -	44.48	- -
YL_E02210_N	EXISTING SIDE DRAIN / PROPOSED DBI	49.5	PLANS	EDGE OF PAVEMENT	50.15	45.10	-5.05	50.19	45.17	-5.01	50.20	45.22	-4.99	50.24	45.34	-4.91
YL_E02215_N	PROPOSED MANHOLE	49.5	PLANS	EDGE OF PAVEMENT	- -	43.69	- -	- -	43.97	- -	- -	44.16	- -	- -	44.65	- -
YL_E02220_N	EXISTING SWALE / PROPOSED DBI	49.5	PLANS	EDGE OF PAVEMENT	50.06	45.97	-4.09	50.09	46.05	-4.05	50.12	46.09	-4.03	50.23	46.16	-4.07
YL_E02225_N	PROPOSED DBI	50.5	PLANS	EDGE OF PAVEMENT	- -	45.89	- -	- -	46.09	- -	- -	46.21	- -	- -	46.50	- -
YL_E02227_N	PROPOSED MANHOLE	50.5	PLANS	EDGE OF PAVEMENT	- -	44.46	- -	- -	44.72	- -	- -	44.89	- -	- -	45.31	- -
YL_E02230_N	SPORTS COMPLEX SWALE OVERFLOW	51.4	DEM	OVERFLOW ELEVATION	51.61	51.61	0.00	51.65	51.65	0.00	51.68	51.68	0.00	51.73	51.73	0.00
YL_E02231_N	PROPOSED MANHOLE	50.0	PLANS	EDGE OF PAVEMENT	- -	45.23	- -	- -	45.41	- -	- -	45.52	- -	- -	45.80	- -
YL_E02233_N	PROPOSED DBI	50.0	PLANS	EDGE OF PAVEMENT	- -	45.37	- -	- -	45.42	- -	- -	45.53	- -	- -	45.80	- -
YL_E02235_N	PROPOSED DBI	50.0	PLANS	EDGE OF PAVEMENT	- -	45.91	- -	- -	46.08	- -	- -	46.21	- -	- -	46.51	- -
YL_E02237_N	PROPOSED MANHOLE	51.5	PLANS	EDGE OF PAVEMENT	- -	47.13	- -	- -	47.18	- -	- -	47.21	- -	- -	47.28	- -
YL_E02239_N	PROPOSED DBI	51.5	PLANS	EDGE OF PAVEMENT	- -	47.13	- -	- -	47.18	- -	- -	47.21	- -	- -	47.29	- -
YL_E02240_N	SPORTS COMPLEX SWALE OVERFLOW	52.2	DEM	OVERFLOW ELEVATION	52.43	52.43	0.00	52.48	52.48	0.00	52.52	52.52	0.00	52.60	52.60	0.00
YL_E02241_N	SPORTS COMPLEX SWALE OVERFLOW	54.5	DEM	OVERFLOW ELEVATION	54.63	54.63	0.00	54.69	54.69	0.00	54.73	54.73	0.00	54.79	54.79	0.00
YL_E02243_N	PROPOSED MANHOLE	55.0	PLANS	EDGE OF PAVEMENT	- -	50.43	- -	- -	50.47	- -	- -	50.49	- -	- -	50.56	- -
YL_E02245_N	PROPOSED DBI	55.0	PLANS	EDGE OF PAVEMENT	- -	50.47	- -	- -	50.51	- -	- -	50.53	- -	- -	50.59	- -
YL_E02247_N	PROPOSED MANHOLE	57.5	PLANS	EDGE OF PAVEMENT	- -	52.56	- -	- -	52.57	- -	- -	52.58	- -	- -	52.60	- -
YL_E02249_N	PROPOSED DBI	57.5	PLANS	EDGE OF PAVEMENT	- -	52.61	- -	- -	52.63	- -	- -	52.64	- -	- -	52.66	- -

NOTES:

- - NODE NOT PRESENT IN EXISTING CONDITIONS MODEL
* WARNING STAGE SOURCE: DEM = ESTIMATED FROM DEM, PLANS = ESTIMATED (NEAREST 0.5') FROM MARKHAM ROAD / LAKE MARKHAM ROAD DRAINAGE IMPROVEMENT PLANS, SEMINOLE COUNTY, 2022
RED VALUES INDICATE STAGES EXCEEDING WARNING STAGE REFERENCE
GREEN VALUES INDICATE NODE MEETS FPLOS A: >0.5' BELOW EDGE OF PAVEMENT ELEVATION FOR 10 YEAR - 24 HOUR STORM.



Sources:
Parcels, Infrastructure - Seminole County, 2022

Proposed Model Inundation Results

Markham Road - Lake Markham Road Improvements
Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

Seminole County Florida's Natural Choice

Figure 6

A comparison of peak discharges at the outfall area are included on **Table 3**. For each design storm event, the peak discharge rates increase from existing to proposed as would be expected with adding additional storm piping and the connectivity to the outfall. These discharges enter the static large wetland to the south; therefore, these increases are not considered significant and impacts from peak stages would be of more concern (as noted above).

Table 4 provides a comparison of total inflow volume to the node representing the receiving wetland. It is noted that results represent the total inflow to the wetland node which includes the project area and other surrounding discharge locations. The differences noted should represent solely the differences brought about by the proposed project. For each design storm, the total volume increases as would be expected with the provision of the positive outfall for the flooded area. These volumes enter the static large wetland to the south; therefore, these increases are not considered significant and impacts from peak stages would be of more concern (as noted above).

An engineer's estimate of probable construction costs based on the County's plans was developed to provide a costs basis for the project. The estimate total was $2,174,082 which includes construction, contingency, design and permitting, and CEI services. The cost estimate is summarized on **Table 5.**

Benefit Cost Analysis

Benefit cost calculations were performed in accordance with the methodology previously described. Roadway damages were determined for County maintained roads within the project area. Annual road flood damages benefits were calculated as the difference between damages in the existing and proposed conditions. Roadway ecosystem benefits were calculated in the FEMA Benefit Cost Calculator based on the project area (9.2 acres) and estimated percentage of urban green space within the project area (60%). Roadways included in this assessment are listed below.

- Lake Markham Road.

Model results did not indicate the presence of any potentially impacted structures within the project area.

Results of the benefit cost analysis for this improvement project are summarized in **Table 2**. As seen in **Table 2**, the lifecycle benefits of the project exceed the estimated construction cost, resulting in a BCR of 0.87 which indicates that this project is near to being cost-effective.

Table 2: Benefit Cost Results for Markham Woods Road at Lake Markham Road

Benefit Cost Results								
Project	Existing Conditions Road Flood Damages ($/year)	Proposed Conditions Road Flood Damages ($/year)	Road Flood Damages Benefit ($/year)	Roadway Ecosystem Benefits ($/year)	[1]Structure Total Benefits ($/year)	[2]Lifecycle Benefit ($)	[3]Estimated Construction Cost ($)	B/C Ratio
Markham Road	$25,751	0	$25,751	$85,786	$0	$1,539,318	$1,775,500	0.87

[1]*Structure total benefits include standard mitigation benefits and social benefits as outlined in the FEMA Benefit Cost Calculator.*

[2]*Lifecycle benefit is equal to (Road Flood Damages Benefit + Road Ecosystem Benefit + Structure Total Benefits) x 13.801 to calculate the NPV of benefits over the project's lifecycle.*

[3]*Estimated construction cost is the construction cost + contingency. Does not include design and permitting or CEI services.*

Results of the benefit cost analysis including the FEMA Benefit Cost Calculator are included in the Electronic Deliverables.

Summary

Based on the modeling results, the proposed improvements successfully drain the Lake Markham Road and intersection with Markham Road to reduce flooding and provide an FPLOS of A. Discharge volume and rates increase somewhat for design storms, however due to the size of the receive wetland relative to the discharge volume, peak stages do not increase more than 0.005'.

Results of the benefit cost analysis indicate a BCR of 0.87, indicating that this project is near to being cost-effective.

It is noted that these results are based on adaptation of the regional Wekiva Watershed model as a basis for comparison to provide a proof of concept for the proposed improvements design completed by the County. The detailed design efforts completed by the County should be relied upon for implementation and to confirm specific flood stages, flows, and other drainage specifics required, and as well for permitting.

Geosyntec consultants

Table 3 – Summary of Modeled Peak Discharges to Wetland

DESIGN STORM	EXISTING CONDITIONS	PROPOSED CONDITIONS	DIFFERENCE
	MAXIMUM FLOW RATE [CFS]	MAXIMUM FLOW RATE [CFS]	
MEAN ANNUAL -24 HOUR	3.11	5.51	2.40
10 YEAR - 24 HOUR	5.68	9.43	3.75
25 YEAR - 24 HOUR	7.42	12.15	4.73
100 YEAR - 24 HOUR	14.21	18.85	4.64
Results from model link YL_E02000_P representing the downstream outfall pipe to the wetland.			

Table 4 – Summary of Total Inflow Volume to Wetland

DESIGN STORM	EXISTING CONDITIONS	PROPOSED CONDITIONS	DIFFERENCE
	TOTAL INFLOW VOLUME [FT3]	TOTAL INFLOW VOLUME [FT3]	
MEAN ANNUAL -24 HOUR	1141904	1167241	25337
10 YEAR - 24 HOUR	2090429	2110926	20497
25 YEAR - 24 HOUR	2828420	2845563	17143
100 YEAR - 24 HOUR	4317369	4326767	9398
Results from model node YL_E01040_N representing the downstream outfall pipe to the wetland. Results represent the total inflow to the wetland node which includes the project area and other surrounding discharge locations.			

TABLE 5 - ENGINEER'S ESTIMATE OF PROBABLE CONSTRUCTION COSTS
IMPROVEMENT ALTERNATIVES ANALYSIS
MARKHAM ROAD AT LAKE MARKHAM ROAD FLOODING
WEKIVA WATERSHED MANAGEMENT PLAN
SEMINOLE COUNTY, FLORIDA

Geosyntec consultants

PAY ITEM NUMBER	DESCRIPTION	UNIT	QTY	UNIT PRICE	TOTAL
102-99	CHANGEABLE VARIABLE MESSAGE SIGN (TEMPORARY)	ED	240	$ 12.60	$ 3,024.00
104-10-3	SEDIMENT BARRIER	LF	2900	$ 2.78	$ 8,073.60
104-18	INLET PROTECTION SYSTEM	EA	13	$ 196.48	$ 2,554.19
104-11	FLOATING TURBIDITY BARRIER	LF	50	$ 18.23	$ 911.40
110-4-10	REMOVAL OF EXISTING CONCRETE	SY	1549	$ 41.95	$ 64,983.65
120-1	REGULAR EXCAVATION	CY	134	$ 12.04	$ 1,612.82
120-6	EMBANKMENT	CY	247	$ 29.16	$ 7,202.52
160-4	TYPE B STABILIZATION, 8"	SY	1321	$ 13.82	$ 18,261.50
285-704	OPTIONAL BASE COURSE, GROUP 04	SY	1097	$ 27.35	$ 30,000.76
327-70-5	MILLING EXISTING ASPHALT PAVEMENT, 2" AVG DEPTH	SY	1,767.00	$ 5.34	$ 9,435.78
334-1-12	SUPERPAVE ASPHALTIC CONCRETE, TRAFFIC B, 1-1/2" (FOR SHOULDERS)	TN	129	$ 145.02	$ 18,707.58
337-7-81	ASPHALTIC CONCRETE FRICTION COURSE, TRAFFIC B, FC-12.5, PG 76-22, 2"	TN	162	$ 204.42	$ 33,116.04
425-1-521	INLET, DITCH BOTTOM, TYPE C, < 10'	EA	2	$ 6,766.54	$ 13,533.07
425-1-541	INLET, DITCH BOTTOM, TYPE D, < 10'	EA	8	$ 10,525.42	$ 84,203.33
425-1-543	INLET, DITCH BOTTOM, TYPE D, J BOTTOM, <10'	EA	3	$ 20,053.90	$ 60,161.69
425-1-543A	INLET, DITCH BOTTOM, TYPE D, J BOTTOM (10'x4.5'), <10' (MOD)	EA	1	$ 30,080.84	$ 30,080.84
425-2-61	MANHOLES, P-8, <10'	EA	6	$ 10,166.11	$ 60,996.67
425-2-91	MANHOLES, J-8, <10'	EA	2	$ 19,118.88	$ 38,237.76
430-175-118	PIPE CULVERT, OPT. MATERIAL (RCP ONLY), ROUND, 18" S/CD	LF	29	$ 166.45	$ 4,827.11
430-175-124	PIPE CULVERT, OPT. MATERIAL (RCP ONLY), ROUND, 24" S/CD	LF	93	$ 203.24	$ 18,901.69
430-175-130	PIPE CULVERT, OPT. MATERIAL (RCP ONLY), ROUND, 30" S/CD	LF	1441	$ 238.31	$ 343,401.83
430-175-136	PIPE CULVERT, OPT. MATERIAL (RCP ONLY), ROUND, 36" S/CD	LF	398	$ 299.78	$ 119,314.03
430-982-138	MITERED END SECTION, OPTIONAL MATERIAL (RCP ONLY), ROUND 36"	EA	1	$ 6,788.51	$ 6,788.51
520-2-4	CONCRETE CURB, TYPE D	LF	100	$ 56.35	$ 5,635.20
522-1	CONCRETE SIDEWALK 4" THICK	SY	1606	$ 77.11	$ 123,841.87
522-2	CONCRETE DRIVEWAYS 6" THICK	SY	42	$ 78.76	$ 3,307.75
527-2	DETECTABLE WARNING (PERFORMED THERMOPLASTIC)	SF	12	$ 41.84	$ 502.13
550-10-228	FENCING (TYPE B)(5.1'-6.0' HEIGHT)(RESET EXISTING)	LF	413	$ 28.85	$ 11,914.22
570-1-2	PERFORMANCE TURF, SOD	SY	2,672	$ 5.40	$ 14,428.80
700-1-50	SINGLE POST SIGN, RELOCATE	AS	7	$ 470.00	$ 3,290.03
	SUBTOTAL				$ 1,141,250.38
110-1-1	CLEARING AND GRUBBING	LS		5%	$ 57,062.52
102-1	MAINTENANCE OF TRAFFIC	LS		12%	$ 136,950.05
101-1	MOBILIZATION	LS		10%	$ 114,125.04
				SUBTOTAL:	$1,449,388
				CONTINGENCY (20%):	$289,878
				CONSTRUCTION SUBTOTAL:	$1,739,266
				DESIGN & PERMITTING:	$260,890
				CEI SERVICES:	$173,927
				ESTIMATED TOTAL IMPLEMENTATION COST:	**$2,174,082**

Notes:

1) *Above estimate does not include cost for potential utility relocations.*
2) *Assumes no muck or other removal of unsuitable soils.*
3) *Maintenance Cost is assumed to be 1% of construction cost brought to Net Present Value (NPV) over 20 years using interest rate of 7%*
4) *Design and permitting was assumed to be 15% of the construction subtotal cost based on engineering judgement.*
5) *Construction engineering and inspection (CEI) services was assumed to be 10% of the construction subtotal cost based on engineering judgement.*

ATTACHMENT A

CONSTRUCTION PLANS - MARKHAM ROAD / LAKE MARKHAM ROAD DRAINAGE IMPROVEMENTS, SEMINOLE COUNTY CIP No. 02307084, OCTOBER 2022

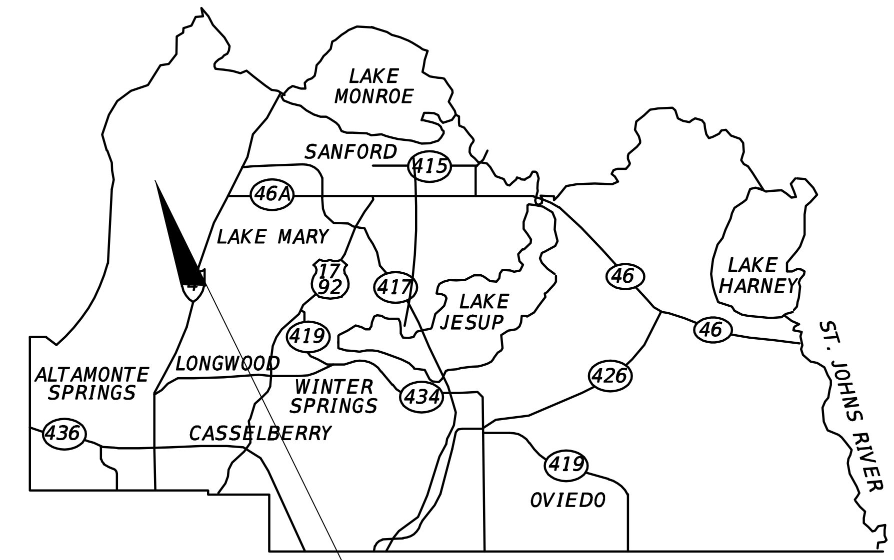
COMPONENTS OF CONTRACT PLANS SET

DRAINAGE AND SIDEWALK PLANS

SEMINOLE COUNTY
ENGINEERING DIVISION

CONTRACT PLANS

SEMINOLE COUNTY
FLORIDA'S NATURAL CHOICE



PROJECT LOCATION
COUNTY COMMISSION DISTRICT 5

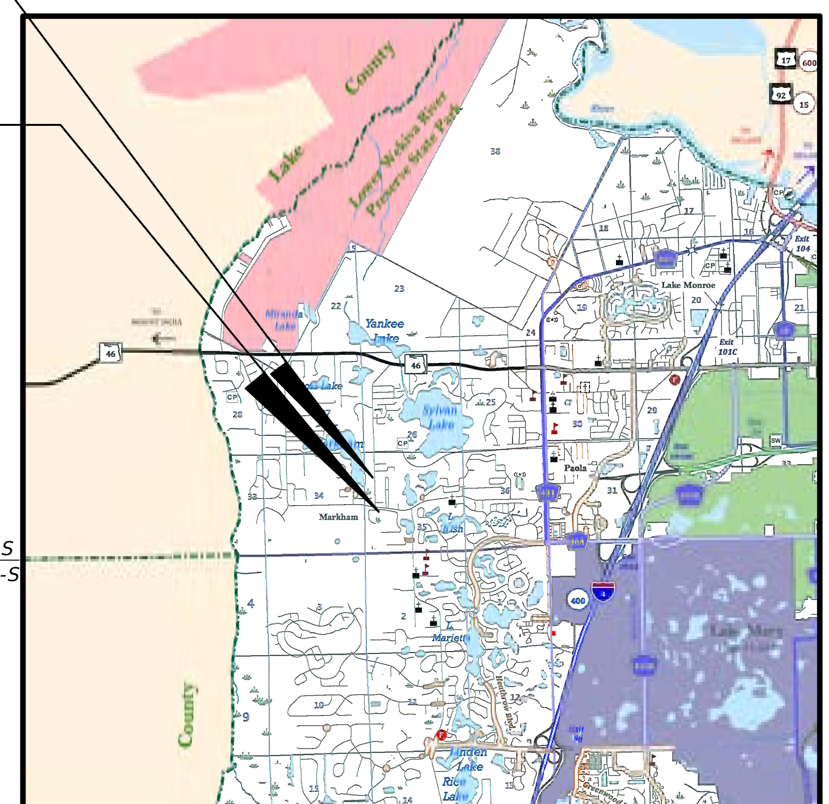
MARKHAM ROAD / LAKE MARKHAM ROAD
DRAINAGE IMPROVEMENTS
SEMINOLE COUNTY CIP No. 02307084

INDEX OF ROADWAY PLANS

SHEET NO.	SHEET DESCRIPTION
1	KEY SHEET
2	SUMMARY OF PAY ITEMS
3	PROPOSED CONDITION DRAINAGE MAP
4	SUMMARY OF DRAINAGE STRUCTURES
5	TYPICAL SECTIONS
6	PROJECT LAYOUT AND CONTROL
7	GENERAL NOTES
8 - 14	PLAN VIEW
15 - 19	PROFILE VIEW
20	SPECIAL PROFILE
21 - 23	DRAINAGE STRUCTURE SHEETS
24 - 30	CROSS SECTIONS
31	EROSION CONTROL DETAILS
32	SPECIAL DETAILS SHEET
33	STORMWATER POLLUTION PREVENTION PLAN (SWPPP)
SQ-1 - SQ-4	SUMMARY OF QUANTITIES (NOT INCL.)

END PROJECT
END CONSTRUCTION
℄ LAKE MARKHAM ROAD
STA 106+31.93

BEGIN PROJECT
BEGIN CONSTRUCTION
℄ LAKE MARKHAM ROAD
STA 88+60.00



T-19-S
T-20-S

R-29-E
R-30-E

N

GOVERNING DESIGN STANDARDS:

Florida Department of Transportation, fY2021-22 Standard Plans
and applicable Design Standards Revisions (DSRs) at the following website:
http://www.fdot.gov/design/standardplans/sprbc.shtm

GOVERNING STANDARD SPECIFICATIONS:
Florida Department of Transportation, JANUARY 2022 Standard Specifications
for Road and Bridge Construction at the following website:
http://www.fdot.gov/programmanagement/Implemented/SpecBooks

DRAINAGE PLANS
ENGINEER OF RECORD:

JEFFREY L. SLOMAN, PE No. 56160
SEMINOLE COUNTY, ENGINEERING DIVISION
100 E 1ST STREET
SANFORD, FLORIDA 32771
(407) 665-5572 FAX(407) 665-5772

BOARD OF COUNTY COMMISSIONERS

BOB DALLARI	DISTRICT 1
JAY ZEMBOWER	DISTRICT 2
LEE CONSTANTINE	DISTRICT 3
AMY LOCKHART	DISTRICT 4
ANDRIA HERR	DISTRICT 5

A. BRYANT APPLEGATE, INTERIM COUNTY MANAGER

PUBLIC WORKS DIRECTOR: JEAN JREIJ, P.E.

COUNTY PROJECT MANAGER:
JEFFREY L. SLOMAN, P.E. 56160

FISCAL YEAR	SHEET NO.
22	1

SUMMARY OF PAY ITEMS

PAY ITEM NO.	ITEM DESCRIPTION	UNIT	QUANTITY
101-1	MOBILIZATION	LS	
102-1	MAINTENANCE OF TRAFFIC	LS	
102-99	CHANGEABLE VARIABLE MESSAGE SIGN (TEMPORARY)	ED	
104-10-3	SEDIMENT BARRIER	LF	
104-11	FLOATING TURBIDITY BARRIER	LF	
104-18	INLET PROTECTION SYSTEM	EA	
110-1-1	CLEARING AND GRUBBING	LS	
110-4-10	REMOVAL OF EXISTING CONCRETE	SY	
120-1	REGULAR EXCAVATION	CY	
120-6	EMBANKMENT	CY	
160-4	TYPE B STABILIZATION, 8"	SY	
285-704	OPTIONAL BASE COURSE, GROUP 04	SY	
327-70-6	MILLING EXISTING ASPHALT PAVEMENT, 1.5" AVG. DEPTH	SY	
334-1-12	SUPER PAVE ASPHALTIC CONC., TRAFFIC B, 2", PG 76-22	TN	
337-7-81	ASPHALT CONCRETE FRICTION COURSE, TRAFFIC B, FC-12.5, 1.5", PG 76-22	TN	
425-1-521	INLET, DITCH BOTTOM, TYPE C, <10'	EA	
425-1-541	INLET, DITCH BOTTOM, TYPE D, <10'	EA	
425-1-543	INLET, DITCH BOTTOM, TYPE D, J BOTTOM,<10'	EA	
425-1-543A	INLET, DITCH BOTTOM, MODIFIED TYPE D, J BOTTOM,<10'	EA	
425-2-61	MANHOLE, P-8, <10'	EA	
430-175-118	**PIPE CULVERT, OPT. MATERIAL (RCP ONLY), ROUND, 18" S/CD**	LF	
430-175-124	**PIPE CULVERT, OPT. MATERIAL (RCP ONLY), ROUND, 24" S/CD**	LF	
430-175-130	**PIPE CULVERT, OPT. MATERIAL (RCP ONLY), ROUND, 30" S/CD**	LF	
430-982-133	MITERED END SECTION, OPT. MATERIAL (RCP ONLY), ROUND, 30"	LF	
520-2-4	CONCRETE CURB, TYPE D	LF	
522-1	CONCRETE SIDEWALK, 4" THICK	SY	
522-2	CONCRETE DRIVEWAY, 6" THICK	SY	
527-2	DETECTABLE WARNING (PREFORMED THERMOPLASTIC)	SF	
550-10-228	FENCING (TYPE B)(5.1'-6.0' HEIGHT)(RESET EXISTING)	LF	
570-1-2	PERFORMANCE TURF, SOD	SY	
700-1-50	SINGLE POST SIGN, RELOCATE	AS	

PAY ITEM NOTES

102-1 INCLUDES ALL ITEMS AND LABOR NECESSARY FOR THE IMPLEMENTATION OF THE TRAFFIC CONTROL PLAN (WITH EXCEPTION OF VARIABLE MESSAGE SIGNS) THE CONTRACTOR SHALL NOTIFY SURROUNDING RESIDENCES AND BUSINESSES OF THE CONSTRUCTION BY FLYER PROVIDED BY SEMINOLE COUNTY.

102-1 INCLUDES THE COST OF THE TRAFFIC CONTROL PLAN. THE TRAFFIC CONTROL / MOT PLAN SHALL BE SIGNED AND SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF FLORIDA. THE TRAFFIC CONTROL / PLAN SHALL BE APPROVED BY SEMINOLE COUNTY PRIOR TO BEGINNING CONSTRUCTION.

102-99 INCLUDES COST FOR 2 PCMS TO BE SET-UP 7 DAYS PRIOR TO CONSTRUCTION. CONTRACTOR TO COORDINATE LOCATION WITH SEMINOLE COUNTY PROJECT MANAGER.

104-1 INCLUDES THE COST OF ALL ITEMS, NOT LISTED SEPARATELY, NEEDED FOR EROSION CONTROL. REFER TO GENERAL NOTES SHEET, EROSION CONTROL NOTES AND STORMWATER POLLUTION PREVENTION PLAN.

110-1-1 INCLUDES THE COST OF REMOVAL AND DISPOSAL OF ALL OBSTRUCTIONS, SUCH AS ALL VEGETATION, DEBRIS, TRIMMING OF TREES AND SHRUBS, ROOT REMOVAL, EXISTING SIDEWALK, CURB AND GUTTER, WALL, FENCES, DRAIN FIELDS PIPE, PAVEMENT, AND OTHER ITEMS, IN ORDER TO CONSTRUCT THE PROJECT. NO TREES ARE TO BE REMOVED WITHOUT THE APPROVAL FROM THE SEMINOLE COUNTY PROJECT MANAGER. ALSO INCLUDES THE CUTS FOR SAWCUTTING EXISTING PAVEMENT OR CONCRETE REMOVAL.

110-1-1 INCLUDES THE COST OF IRRIGATION LINES DAMAGED DURING CONSTRUCTION ARE TO BE CAPPED IMMEDIATELY AND REPORTED TO THE SEMINOLE COUNTY ENGINEER INSPECTOR. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO REPAIR AND/OR REPLACE ALL DAMAGED IRRIGATION COMPONENTS TO THE PRE-CONSTRUCTION CONDITION AT HIS EXPENSE PRIOR TO COMPLETION OF THE PROJECT.

110-1-1 INCLUDES THE COST EXISTING PIPE REMOVAL

110-4-10 INCLUDES THE COST OF EXISTING CONCRETE SIDEWALK AND CURB REMOVAL

120-6 UNSUITABLE MATERIALS SHALL BE REMOVED FROM THE CONSTRUCTION AREAS AND BACK FILLED WITH SUITABLE MATERIALS. UNSUITABLE MATERIALS SHALL BE DISPOSED OF OFF SITE BY THE CONTRACTOR. THIS PAY ITEM INCLUDES THIS COST.

425-1-543A INCLUDES THE COST OF THE TOP OF THE BACK OF SIDEWALK DRAINAGE AND ITS RAILING FOR S-106

430-175-130 INCLUDES THE COST OF FURNISHING AND INSTALLING THE CONCRETE JACKETS / COLLARS

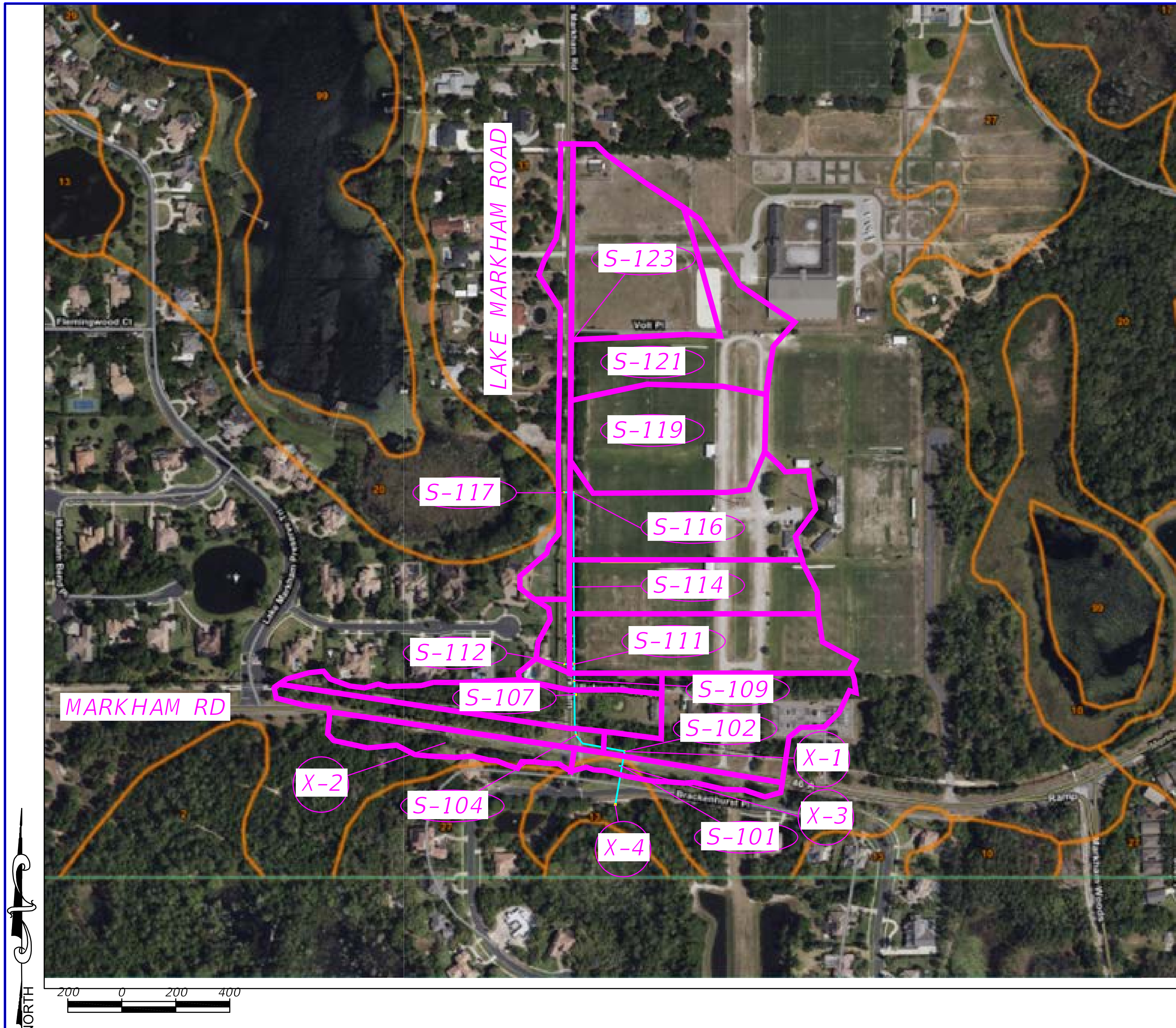
430-175-XXX INCLUDES THE COST OF ANY DEWATERING, PROVIDING, TEMPORARY DRAINAGE, DIVERSION OF STORMWATER, COFFERDAMS, AND OTHER RELATED ACTIVITES NECESSARY FOR THE CONSTRUCTION OF THE PROJECT.

430-175-XXX INCLUDES THE COST OF PAVEMENT RESTORATION

522-1 INCLUDES THE COST OF WATER VALVE ADJUSTMENT AND OTHER UTILITY ADJUSTMENTS OR COORDINATION DUE TO SIDEWALK PLACEMENT. INCLUDES THE COST OF CURB RAMPS AND THICKENED EDGE FOR HANDRAIL. NO CURING COMPOUND SHALL BE APPLIED.

570-1-2 INCLUDES THE COST AND APPLICATION OF FERTILIZER AND WATER IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS. TYPES OF SOD MAY VARY. CONTRACTOR TO MATCH EXISTING SOD.

700-1-50 INCLUDES THE COST OF NEW POST IF NECESSARY TO MEET THE STANDARD MOUNTING HEIGHT REQUIREMENTS



DRAINAGE AREA TABLE

DRAINAGE STRUCTURE	CONTRIBUTING DRAINAGE AREA (Ac)
S-123	6.61
S-121	4.81
S-119	6.11
S-117	2.45
S-116	5.54
S-114	4.14
S-112	0.57
S-111	4.94
S-109	0.82
S-107	3.42
S-104	1.98
S-102	5.34
S-101	1.12
X-2	2.00

SEE PLAN, PROFILE, AND DRAINAGE STRUCTURE SHEETS FOR PROPOSED STRUCTURE DATA

EXISTING DRAINAGE STRUCTURES

X-1 Catch Basin
Top Elev. = 48.2'
S. Invert Elev. = 45.3'

X-2 Catch Basin
Top Elev. = 48.4'
Invert Elev. = 43.1'

X-3 Catch Basin
Top Elev. = 47.7'
N. Invert Elev. = 45.2'
S. Invert Elev. = 41.9'
W. Invert Elev. = 42.4'

X-4 Mitered End Section (15")
Invert Elev. = 36.5"

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

SEMINOLE COUNTY ENGINEERING DIVISION
JEFFREY L. SLOMAN
P.E. No. 56160
100 East 1st. Street
Sanford, Fl 32771

SEMINOLE COUNTY ENGINEERING DIVISION

ROAD	COUNTY CIP No.
MARKHAM RD. / LAKE MARKHAM RD. DRAINAGE IMPROVEMENTS	02307084

PROPOSED CONDITION DRAINAGE MAP

SHEET NO. 3

QUANTITY	STR. NO.	STATION	SIDE	DESCRIPTION	BARRELS	STORM DRAIN OPTIONAL MATERIAL (RCP)					DITCH BOTTOM INLETS				MANHOLE		MES (OPTIONAL MATERIAL) RCP ONLY	REMARKS
											C	D	D (J BOT)	MOD D (J BOT)	P-8 (4' DIA.)	J-8 (5' DIA.)		
							18"	24"	30"	36"	<10'	<10'	<10'	<10'	<10'	<10'	36"	
P F	S-100	89+24.55	CL	MES													1	
P F																		
P F	S-101	90+65.31	CL	INLET, PIPE	1					139		1						
P F	S-102	22+40	LT	INLET, PIPE	1		8			54			1					CONCRETE COLLAR
P F	S-103	22+82.35	LT	MH, PIPE	1					154						1		
P F	S-104	91+50.00	RT	INLET, PIPE	1					37			1					
P F	S-105	91+50.00	RT	MH, PIPE	1					14						1		
P F	S-106	93+00.00	RT	MH, PIPE	1				146						1			
P F	S-107	93+00.00	RT	INLET, PIPE	1			9						1				BACK OF SIDEWALK DRAINAGE
P F	S-108	93+56.95	RT	MH, PIPE	1				54						1			
P F	S-109	93+56.95	RT	INLET, PIPE	1			9				1						
P F	S-110	94+13.34	RT	MH, PIPE	1				53						1			
P F	S-111	94+13.34	RT	INLET, PIPE	1			9				1						
P F	S-112	94+13.34	LT	INLET, PIPE	1		21				1							
P F	S-113	97+00.00	RT	MH, PIPE	1				283						1			
P F	S-114	97+00.00	RT	INLET, PIPE	1			9				1						
P F	S-115	100+50.00	RT	MH, PIPE	1				346						1			
P F	S-116	100+50.00	RT	INLET, PIPE	1			9				1						
P F	S-117	100+50.00	LT	INLET, PIPE	1			21			1							
P F	S-118	101+88.67	RT	MH, PIPE	1				135						1			
P F	S-119	101+88.67	RT	INLET, PIPE	1			9				1						
P F	S-120	104+00.00	RT	MH, PIPE	1				208						1			
P F	S-121	104+00.00	RT	INLET, PIPE	1			9				1						
P F	S-122	106+20.00	RT	MH, PIPE	1				216						1			
P F	S-123	106+20.00	RT	INLET, PIPE	1			9				1						
				SUMMARY			29	93	1,441	398	2	8	3	1	6	2	1	

NOTE: MODIFIED TYPE 'D' DBI (J BOTTOM) INCLUDES BACK OF SIDEWALK DRAINAGE

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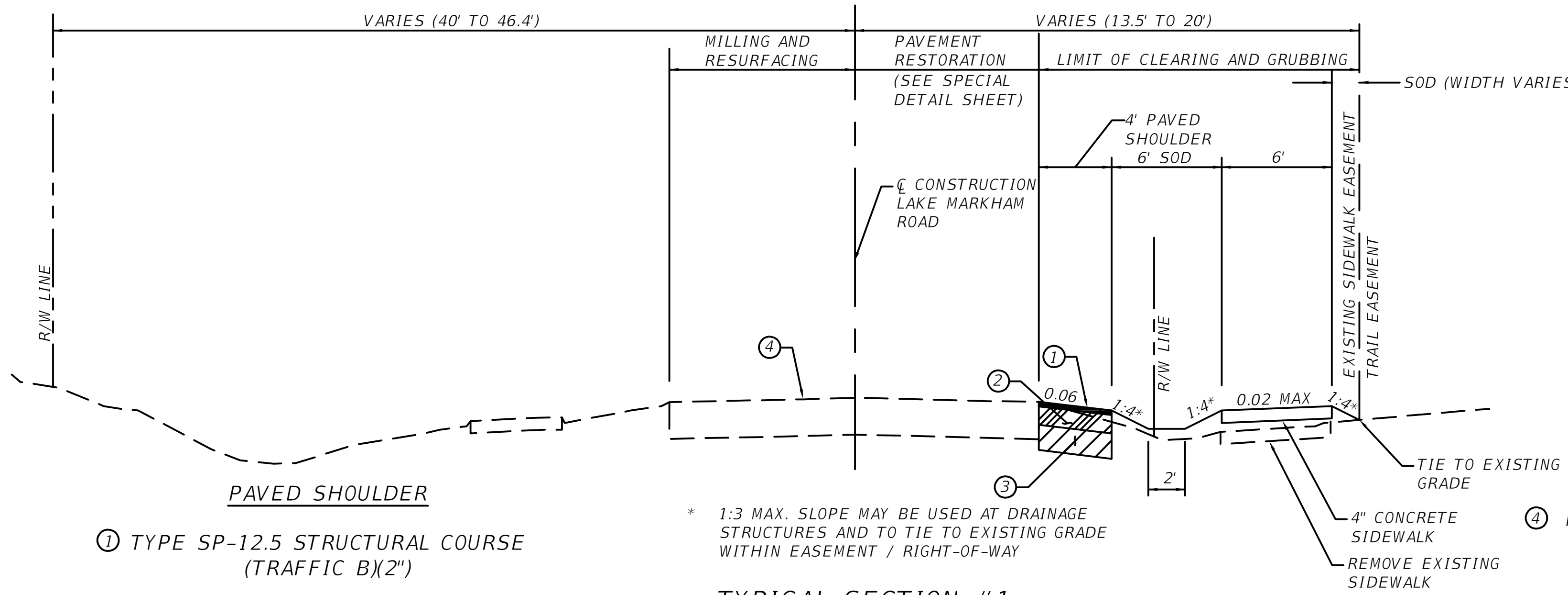
SUMMARY OF DRAINAGE STRUCTURES

SHEET NO.

4



* 1:3 MAX. SLOPE MAY BE USED AT DRAINAGE STRUCTURES AND TO TIE TO EXISTING GRADE WITHIN EASEMENT / RIGHT-OF-WAY

PAVED SHOULDER

① TYPE SP-12.5 STRUCTURAL COURSE (TRAFFIC B)(2")

② OPTIONAL BASE COURSE GROUP 04

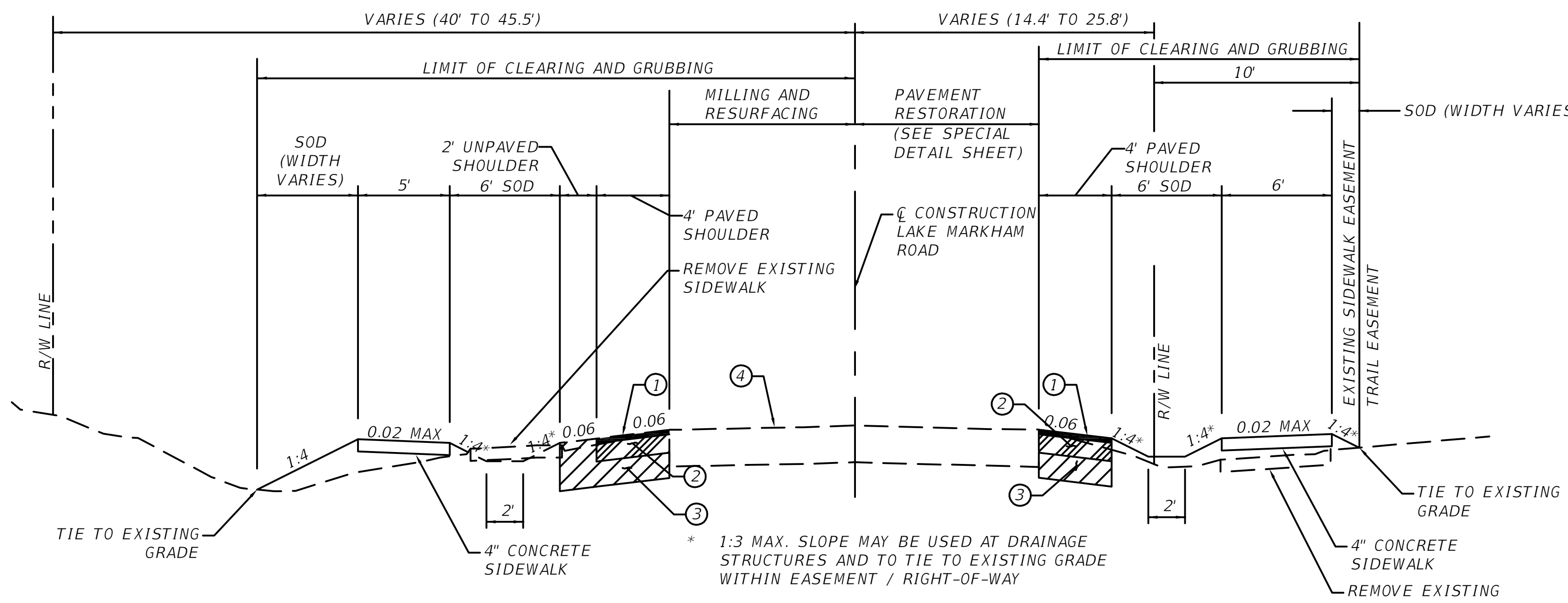
③ 8" STABILIZATION (MIN. LBR 40)

TYPICAL SECTION #1
LAKE MARKHAM ROAD
91+22.46 TO 92+20.90
102+25.03 TO 106+31.93

NOT TO SCALE

MILLING & RESURFACING

④ MILLING EXISTING PAVEMENT (1.5" DEPTH) TYPE FC-12.5 FRICTION COURSE (TRAFFIC B)(1.5")(PG 76-22)



* 1:3 MAX. SLOPE MAY BE USED AT DRAINAGE STRUCTURES AND TO TIE TO EXISTING GRADE WITHIN EASEMENT / RIGHT-OF-WAY

PAVED SHOULDER

① TYPE SP-12.5 STRUCTURAL COURSE (TRAFFIC B)(2")

② OPTIONAL BASE COURSE GROUP 04

③ 8" STABILIZATION (MIN. LBR 40)

TYPICAL SECTION #2
LAKE MARKHAM ROAD
STA 92+20.90 TO 102+25.03

NOT TO SCALE

MILLING & RESURFACING

④ MILLING EXISTING PAVEMENT (1.5" DEPTH) TYPE FC-12.5 FRICTION COURSE (TRAFFIC B)(1.5")(PG 76-22)

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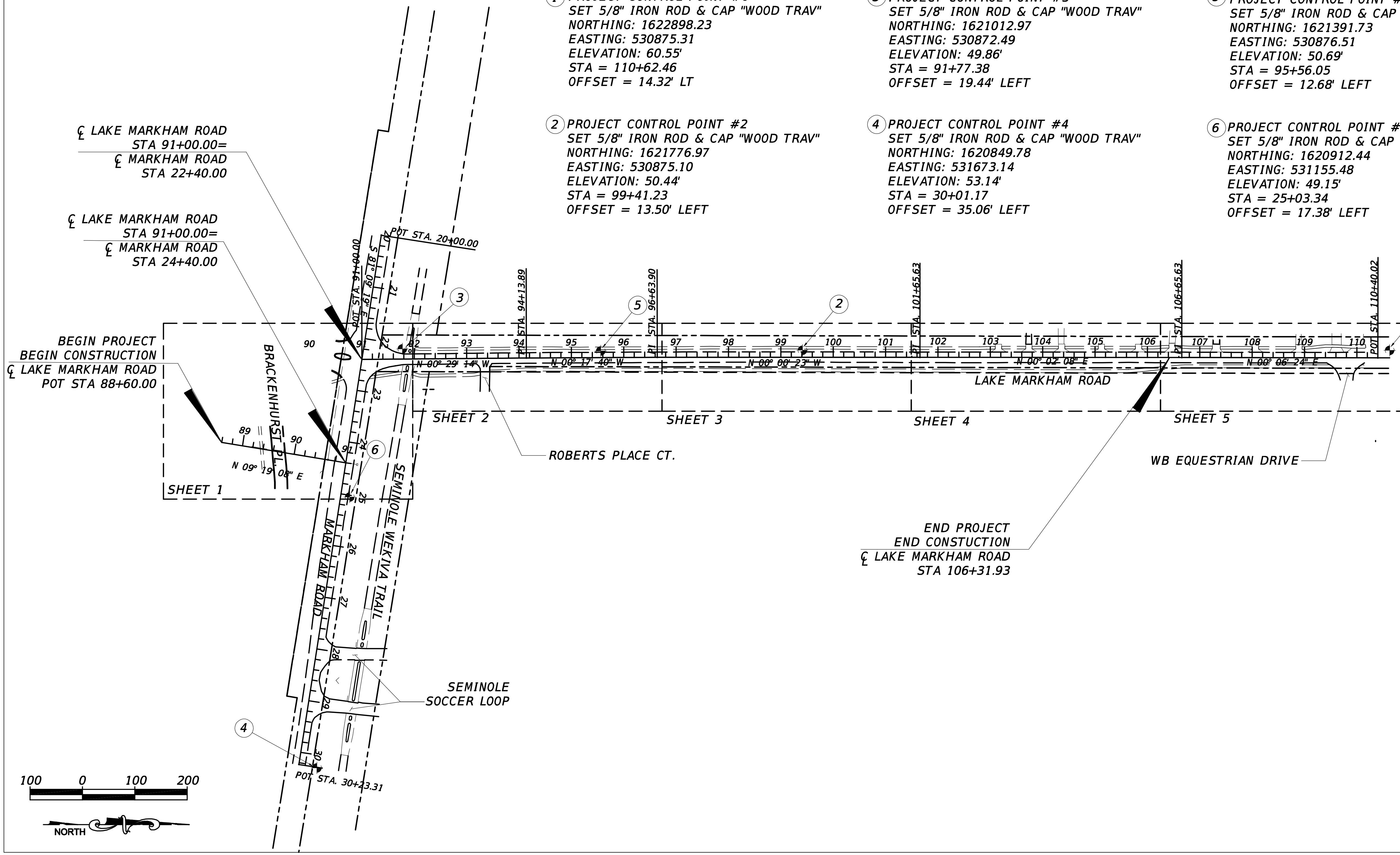
TYPICAL SECTIONS

SHEET NO. 5



1. PROJECT CONTROL POINT #1
SET 5/8" IRON ROD & CAP "WOOD TRAV"
NORTHING: 1622898.23
EASTING: 530875.31
ELEVATION: 60.55'
STA = 110+62.46
OFFSET = 14.32' LT

2. PROJECT CONTROL POINT #2
SET 5/8" IRON ROD & CAP "WOOD TRAV"
NORTHING: 1621776.97
EASTING: 530875.10
ELEVATION: 50.44'
STA = 99+41.23
OFFSET = 13.50' LEFT

3. PROJECT CONTROL POINT #3
SET 5/8" IRON ROD & CAP "WOOD TRAV"
NORTHING: 1621012.97
EASTING: 530872.49
ELEVATION: 49.86'
STA = 91+77.38
OFFSET = 19.44' LEFT

4. PROJECT CONTROL POINT #4
SET 5/8" IRON ROD & CAP "WOOD TRAV"
NORTHING: 1620849.78
EASTING: 531673.14
ELEVATION: 53.14'
STA = 30+01.17
OFFSET = 35.06' LEFT

5. PROJECT CONTROL POINT #5
SET 5/8" IRON ROD & CAP "WOOD TRAV"
NORTHING: 1621391.73
EASTING: 530876.51
ELEVATION: 50.69'
STA = 95+56.05
OFFSET = 12.68' LEFT

6. PROJECT CONTROL POINT #6
SET 5/8" IRON ROD & CAP "WOOD TRAV"
NORTHING: 1620912.44
EASTING: 531155.48
ELEVATION: 49.15'
STA = 25+03.34
OFFSET = 17.38' LEFT

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PROJECT LAYOUT AND CONTROL

SHEET NO. 6

GENERAL NOTES

1. BENCHMARK ELEVATIONS SHOWN ON THE PLANS ARE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88)

2. ANY PUBLIC LAND CORNER OR COUNTY MONUMENT WITHIN THE LIMITS OF CONSTRUCTION IS TO BE PROTECTED. IF A CORNER MONUMENT IS IN DANGER OF BEING DESTROYED AND HAS NOT BEEN PROPERLY REFERENCED, THE CONTRACTOR SHOULD NOTIFY THE SEMINOLE COUNTY SURVEYOR, SEMINOLE COUNTY PUBLIC WORKS DEPARTMENT IMMEDIATELY BY PHONE @ (407) 665-5656.

3. SURVEY PREPARED BY WOOD, INC. APRIL, 2022.

4. ONE WEEK PRIOR TO CONSTRUCTION THE CONTRACTOR SHALL OBTAIN A "CONSTRUCTION PERMIT" FROM SEMINOLE COUNTY PUBLIC WORKS ENGINEERING DIVISION. CONTACT PERMIT COORDINATOR AT 100 E. FIRST STREET, SANFORD, FLORIDA 32773. TELEPHONE (407) 665-5674. NO FEES REQUIRED.

5. ALL PRIVATE PROPERTY WITHIN THE RIGHT-OF-WAY SHALL BE RELOCATED BY THE PROPERTY OWNER OR IT SHALL BE REMOVED BY THE CONTRACTOR AS NECESSARY TO CONSTRUCT THE PROJECT IN ACCORDANCE WITH THE PLANS.

6. ALL PRIVATE AND PUBLIC PROPERTY AFFECTED BY THE CONSTRUCTION WORK SHALL BE RESTORED TO A CONDITION EQUAL TO OR BETTER, THAN THE EXISTING PRE- CONSTRUCTION CONDITION, UNLESS SPECIFICALLY EXEMPTED BY THE PLAN. COST TO BE INCIDENTAL TO CONSTRUCTION AND NO EXTRA COMPENSATION TO BE ALLOWED.

7. EXISTING UTILITY LOCATIONS SHOWN IN THE PLANS ARE ONLY APPROXIMATE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO HAVE ALL EXISTING UNDERGROUND UTILITIES LOCATED IN THE FIELD AND NOTIFY ALL UTILITY OWNERS WHETHER PUBLIC OR PRIVATE, WITH FACILITIES IN THE AREA OF CONSTRUCTION ACTIVITIES FOR POSSIBLE CONFLICTS AND COORDINATE ANY ADJUSTMENT AND/OR RELOCATION AS NECESSARY TO COMPLETE THE PROJECT. ALL NOTIFICATIONS TO BE MADE ONE WEEK PRIOR TO THE COMMENCEMENT OF CONSTRUCTION.
CONTACT SUNSHINE STATE ONE- CALL 1-800-432-4770.

8. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO COMPLY WITH THE CURRENT STATE UNDERGROUND FACILITY DAMAGE PREVENTION AND SAFETY ACT AND/OR RELATED STATE LAW. THE FOLLOWING INFORMATION IS BEING PROVIDED BY SEMINOLE COUNTY IN AN EFFORT TO ASSIST THE CONTRACTOR BY LISTING UTILITIES THAT MAY PROVIDE SERVICE IN THE APPROXIMATE AREA OF THE PROPOSED CONSTRUCTION.
THE CONTRACTOR SHOULD ASSUME OTHER UTILITIES THAT ARE NOT LISTED BELOW MAY PROVIDE SERVICE IN THE APPROXIMATE AREA OF THE PROPOSED CONSTRUCTION.

UTILITY (CONTACT)	PHONE / EMAIL
CHARTER COMMUNICATIONS (MARVIN USRY)	(407)532-8509 / Marvin.Usryjr@charter.com
FLORIDA POWER AND LIGHT - SEMINOLE (CHRISTOPHER BUONANNI)	(407)328-1911 / Christopher.buonanni@fpl.com
FLORIDA PUBLIC UTILITIES (GAS) (JOHNNY HILL)	(386)668-9842 / Jhill@chpk.com
COMCAST COMMUNICATIONS / LK CNTY CBLV (SCOTT OSEBOLD)	(352)315-8527 / scott_osebold@comcast.com
AT&T DISTRIBUTION (SHAUN PURVIS)	(407)999-2636 / sp761p@att.com
SEMINOLE COUNTY TRAFFIC ENGINEERING (CHARLES WETZEL)	(407)665-5686 / cwetzel@seminolefl.gov
SEMINOLE COUNTY ENVIRONMENTAL SERVICES (PAUL ZIMMERMAN)	(407)665-2021 / pzimmerman@seminolecountyfl.gov

9. ANY MAILBOX CONFLICTING WITH THE CONSTRUCTION OF THE PROJECT IS TO BE RELOCATED BY THE CONTRACTOR IN ACCORDANCE WITH FDOT STANDARD PLAN 110-200. NEW LOCATIONS TO BE COORDINATED WITH LOCAL POST OFFICE. REPLACEMENTS OF MAILBOXES SHALL HAVE A MINIMUM 3" HIGH NUMBERS REPLACED ON BOTH SIDES OF THE MAILBOX, PER SEMINOLE COUNTY ORDINANCE90.5 (6). PER USPS DO 41.2.4. IF THE MAILBOX IS ON A DIFFERENT STREET FROM THE COSTUMER'S RESIDENCE, THE STREET NAME AND HOUSE NUMBER SHALL BE INSCRIBED ON THE BOX ON BOTH SIDES.

10. ALL DISTURBED AREAS WILL BE RE- SODDED TO MATCH THE EXISTING SOD TYPE, UNLESS OTHERWISE NOTED IN THE PLANS. SOD SHALL BE CERTIFIED "SODA APPLE FREE". SUBCONTRACTOR SHALL REMOVE AND REPLACE ANY AREAS INFESTED FOR A PERIOD OF ONE YEAR FROM THE COMPLETION OF THE PROJECT.

11. SOIL MATERIALS USED FOR FILL OR GRADING ACTIVITIES SHALL BE APPROVED FOR USE BY THE SEMINOLE COUNTY ENGINEERING INSPECTOR PRIOR TO USE.

12. ANY GRASSED AREAS OUTSIDE THE PROJECT LIMITS DISTURBED BY THE CONTRACTOR WILL BE SODDED AT THE CONTRACTOR'S EXPENSE WITHIN 48 HOURS OF NOTIFICATION BY THE SEMINOLE COUNTY PROJECT MANAGER.

13. IRRIGATION LINES DAMAGED DURING CONSTRUCTION ARE TO BE CAPPED IMMEDIATELY AND REPORTED TO THE SEMINOLE COUNTY ENGINEER INSPECTOR. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO REPAIR AND/OR REPLACE THE DAMAGE IRRIGATION COMPONENTS TO PRE- CONSTRUCTION CONDITION AT HIS EXPENSE PRIOR TO COMPLETION OF THE PROJECT.

14. THE CONTRACTOR SHALL REMOVE AND DISPOSE PROPERLY OF ALL CONSTRUCTION DEBRIS PRIOR TO COMPLETION OF THE PROJECT.

15. SHRUBS AND TREES LOCATED IN THE RIGHT-OF-WAY SHALL REMAIN AND BE PROTECTED FROM DAMAGE UNLESS OTHERWISE NOTED ON THE PLANS OR DIRECTED BY THE ENGINEER.

16. EXISTING DRAINAGE STRUCTURES AND PIPES WITHIN CONSTRUCTION LIMITS TO REMAIN UNLESS OTHERWIDE SPECIFIED IN THE PLANS. EXISTING DRAINAGE STRUCTURES AND FACILITIES SHALL BE MAINTAINED AND FULLY FUNCTIONAL DURING CONSTRUCTION.

17. ANY DRAINAGE PROBLEMS, CREATED BY CONSTRUCTION OR EXISTING BEFORE CONSTRUCTION, THAT ARE NOT ALLEVIATED SHALL BE BROUGHT TO THE ATTENTION TO THE SEMINOLE COUNTY ENGINEERING DIVISION PROJECT MANAGER.

18. THE CONTRACTOR SHALL GIVE THE POST MAKER OF THE DELIVERY ROUTE(S) WRITTEN NOTICE OF PROJECT CONSTRUCTION 7 DAYS PRIOR TO THE BEGINNING OF WORK, WITH SATURDAYS, SUNDAYS AND HOLIDAYS EXCLUDED.

19. NO TRENCHES SHALL BE ALLOWED TO REMAIN OPEN OVERNIGHT.

20. NO DISTURBANCE OUTSIDE OF THE PUBLIC RIGHT-OF-WAY IS PERMITTED UNLESS SPECIFICALLY NOTED ON THE PLANS.

21. THE CONTRACTOR IS ENTIRELY RESPONSIBLE AND LIABLE FOR ALL DAMAGE OR INJURY AS A RESULT OF HIS OPERATIONS TO ALL ADJACENT PUBLIC AND PRIVATE PROPERTY, LANDSCAPING, TREES, UTILITIES, STRUCTURES OF ANY KIND AND APPURTENANCES DURING THE PROGRESS OF THE WORK.

22. ALL EXISTING STRUCTURES AND PIPES, PAVEMENT, SIDEWALKS, CURBS, ETC. WITHIN THE LIMITS OF CONSTRUCTION SHALL REMAIN UNLESS OTHERWISE NOTED ON THE DRAWINGS OR DIRECTED BY THE ENGINEER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE REPLACEMENT OF ANY DAMAGE TO THE AFOREMENTIONED ITEMS IN KIND, AT NO ADDITIONAL COST TO THE COUNTY.\

23. IF ENCOUNTERED, UNSUITABLE MATERIALS SHALL BE REMOVED FROM CONSTRUCTION AREAS AND BACK FILLED WITH SUITABLE MATERIALS.

24. THE CONTRACTOR SHALL SAWCUT EXISTING PAVEMENT TO A NEAT EDGE IN ALL AREAS WHERE TYING INTO EXISTING PAVEMENT. IN AREAS WHERE THE TIE-IN IS AT THE R/W LINE (i.e. DRIVEWAYS), THE CONTRACTOR SHALL TAKE EXTRA CARE TO STAY WITHIN THE R/W.

25. CAUTION SHALL BE EXERCISED WHILE RELOCATING EXISTING SIGNS TO PREVENT UNNECESSARY DAMAGE TO SIGNS. IF THE SIGNS ARE DAMAGED BEYOND USE, AS DETERMINED BY THE SEMINOLE COUNTY ENGINEERING INSPECTOR, THE SIGNS SHALL BE REPLACED BY THE CONTRACTOR AT HIS EXPENSE. ALL SIGNS SHALL REMAIN UNLESS OTHERWISE NOTED IN THE PLANS.

26. THE CONTRACTOR SHALL PERFORM ANY DEWATERING, TEMPORARY DRAINAGE, DIVERSION OF STORMWATER, COFFERDAMS AND OTHER RELATED ACITVITIES NECESSARY TO CONSTRUCT THE PROJECT. (SEE SUMMARY OF PAY ITEMS).

EROSION CONTROL NOTES

1. THE EROSION CONTROL MEASURES PER FDOT EROSION AND SEDIMENT CONTROL MANUAL ARE THE MINIMUM REQUIRED. ADDITIONAL EROSION CONTROL MEASURES MAY BE REQUIRED DUE TO FIELD CONDITIONS AS DETERMINED BY THE SEMINOLE COUNTY PROJECT MANAGER OR THE REGULATORY AGENCIES.

2. PROVIDE EROSION AND SEDIMENTATION CONTROL MEASURES CONSISTING OF STAKED SILT FENCES AND ADDITIONAL MEASURES AS NECESSARY, UTILIZING INDUSTRY STANDARD BEST MANAGEMENT PRACTICES AND FOLLOWING REQUIREMENTS BELOW, TO AVOID ADVERSE IMPACTS TO JURISDICTIONAL AREAS (WETLANDS, WATER BODIES, AND UPLAND BUFFERS) AND OFF SITE LANDS AND WATER BODIES. MAINTAIN THESE MEASURES DAILY UNTIL CONSTRUCTION ACCEPTANCE BY SEMINOLE COUNTY AND THEN REMOVE AND LEGALLY DISPOSE OF SAID MEASURES.

3. NO DISCHARGE OF CONTAMINANTS INTO ADJACENT WETLANDS, WATER BODIES, OR UPLAND BUFFERS WILL BE PERMITTED AT ANY TIME.

4. DAMAGE WETLANDS AND/OR UPLAND BUFFERS ADJACENT TO CONSTRUCTION AREAS SHALL BE PREVENTED BY DELINEATING THE LIMITS OF CONSTRUCTION, AND INSTALLING SEDIMENT BARRIERS PRIOR TO THE COMMENCEMENT OF CONSTRUCTION ACTIVITIES, THEREBY RETAINING SEDIMENT WITHIN THE CONSTRUCTION AREA. CONTRACTOR WILL BE REQUIRED TO ADEQUATELY MAINTAIN THESE PROTECTION MEASURES AT ALL TIMES.

5. EROSION CONTROL AND DUST CONTROL SHALL BE MAINTAINED WITHIN CONSTRUCTION AREAS BY QUICKLY STABILIZING DISTURBED AREAS TO PREVENT THE RELEASE OF SEDIMENT. THIS SHALL BE ACCOMPLISHED USING GRASS COVER, TURBIDITY FENCES, PERIODIC WATERING, AND OTHER BEST MANAGEMENT PRACTICES WHICH ARE ACCEPTABLE TO THE SEMINOLE COUNTY ENGINEERING INSPECTOR AND REGULATORY AGENCIES.

6. TURBIDITY BARRIERS SHALL BE USED TO PREVENT RELEASE OF SEDIMENT AND/OR TURBID WATER INTO SURROUNDING WATERS. THESE SEDIMENT AND TURBIDITY BARRIERS SHALL BE MAINTAINED THROUGHOUT THE CONSTRUCTION PERIOD.

7. ALL EROSION PREVENTION AND CONTROL MEASURES MUST BE INSPECTED AND APPROVED BY THE COUNTY COMPLIANCE PERSONNEL, AS REQUIRED, PRIOR TO ANY CONSTRUCTION ACTIVITIES. REMOVAL OF THESE SAME EROSION CONTROLS AND PREVENTION MEASURES MAY BE DONE ONLY AFTER AUTHORIZATION BY COUNTY PERSONNEL IS OBTAINED.

8. ALL SURFACE WATER DISCHARGE FROM SITE, INCLUDING DEWATERING DISCHARGE, SHALL MEET CURRENT STATE WATER QUALITY STANDARDS PRIOR TO REACHING ANY WATERS OF THE STATE INCLUDING WETLANDS.

9. ALL STORM DRAINAGE INLETS AND PIPES SHALL BE PROTECTED FROM SILT, SAND AND DEBRIS DURING CONSTRUCTION. ANY ACCUMULATION WITHIN THE STORM DRAINAGE PIPE SYSTEM SHALL BE REMOVED WITHOUT PUMPING OR FLUSHING. STORM DRAINAGE SYSTEM SHALL BE CLEANED AND FREE OF DEBRIS PRIOR TO ENGINEER'S INSPECTOR'S ACCEPTANCE.

10. NPDES CONSTRUCTION PERMIT IT IS REQUIRED. IT IS THE RESPONSIBILITY OF THE CONTRACTOR T ACQUIRE THE NPDES PERMIT.

TEMPORARY TRAFFIC CONTROL NOTES

1. VEHICULAR AND PEDESTRIAN TRAFFIC SHALL BE MAINTAINED IN ACCORDANCE WITH FDOT STANDARD PLAN 102 SERIES, AND THE STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION AND THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) AS A MINIMUM.

2. THE CONTRACTOR WILL BE REQUIRED TO SUBMIT A MAINTENANCE OF TRAFFIC CONTROL PLAN (MOTP) SIGNED AND SEALED BY A STATE OF FLORIDA REGISTERED PROFESSIONAL ENGINEER TO THE COUNTY FOR REVIEW AND APPROVAL PRIOR TO BEGINNING THE PROJECT. THE CONTRACTOR SHALL OBTAIN AN "MOT PERMIT" FROM SEMINOLE COUNTY TRAFFIC DIVISION. CONTACT MOT COORDINATOR AT (407)665-5699 FOLLOWING THE APPROVAL OF THE CONTRACTOR'S MTOP.

3. LANE CLOSURES SHALL BE PERMITTED ONLY DURING ACTIVE WORK PERIODS AND AS FOLLOWS: LAKE BOULEVARD, FROM 9 A.M. TO 4:00 P.M. TIME MAY BE ADJUSTED BY SEMINOLE COUNTY PROJECT MANAGER OR THE COUNTY TRAFFIC DIVISION. AT LEAST ONE LANE OF TRAFFIC MUST REMAIN OPEN AT ALL TIMES.

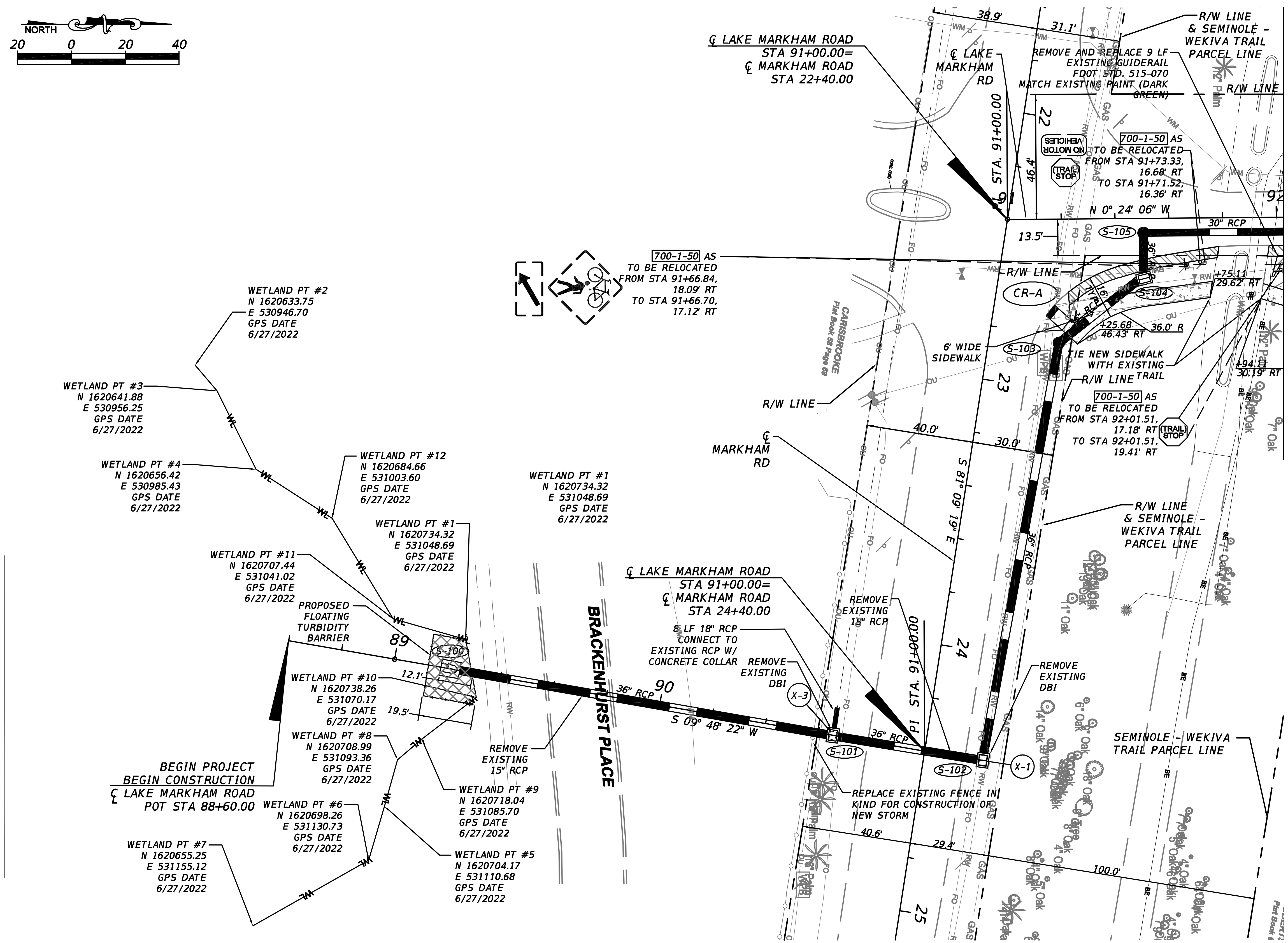
SPECIFICATIONS

1. THE CONTRACTOR SHALL HAVE THE GOVERNING SPECIFICATIONS ON-SITE AT ALL TIMES.

2. ALL SHALL BE IN ACCORDANCE WITH THE PLANS AND SPECIFICATIONS CONTAINED HEREIN AND / OR OTHERWISE REQUIRED BY APPLICABLE REGULATORY BODIES. IN THE EVENT OF A CONFLICT IN THE REQUIREMENTS, THE APPLICABLE REQUIREMENT SHALL BE DETERMINED BY THE ENGINEER.

3. APPARENT ERRORS, DISCREPANCIES OR OMISSIONS ON THE DRAWINGS SHALL BE BROUGHT TO THE ENGINEER'S ATTENTION PROMPTLY. NO EXTRA PAYMENT SHALL BE ALLOWED FOR ANY WORK REQUIRED DUE TO MISUNDERSTANDING OF JOB SITE CONDITIONS AFFECTING THE WORK AS DESCRIBED IN THE SPECIFICATIONS OR SHOWN ON THE DRAWINGS. THE CONTRACTOR SHALL NOT TAKE ADVANTAGE OF ANY APPARENT ERROR OR OMISSION IN THE DRAWINGS OR SPECIFICATIONS, AND THE ENGINEER SHALL BE PERMITTED TO MAKE CORRECTIONS AND INTERPRETATIONS AS MAY BE DEEMED NECESSARY FOR FULFILLMENT OF THE INTENT OF THE CONTRACT DOCUMENTS.

4. THE CONTRACTOR SHALL MAKE THE PROJECT SITE AVAILABLE FOR REVIEW AND INSPECTION TO ALL APPLICABLE REGULATORY AGENCIES, ENGINEERING PERSONNEL AND OWNER REPRESENTATIVES.



LEGEND

- 4" THICK CONRETE SIDEWALK
- 6" THICK CONRETE DRIVEWAY
- PAVED SHOULDER
- DETECTABLE WARNING
- WETLAND IMPACTS (373 SF / 0.0085 Ac)

NOTE: ALL EXISTING TREES TO REMAIN UNLESS OTHERWISE NOTED

NOTE: SEE 'SPECIAL DETAILS SHEET' FOR TRAIL STOP SIGN DETAILS

NOTE: HAND DIG ONLY WITHIN TEN (10) FEET OF EXISTING GAS MAIN

NOTE: NO VIBRATORY COMPACTION ALLOWED WITHIN TEN (10) FEET OF EXISTING GAS MAIN

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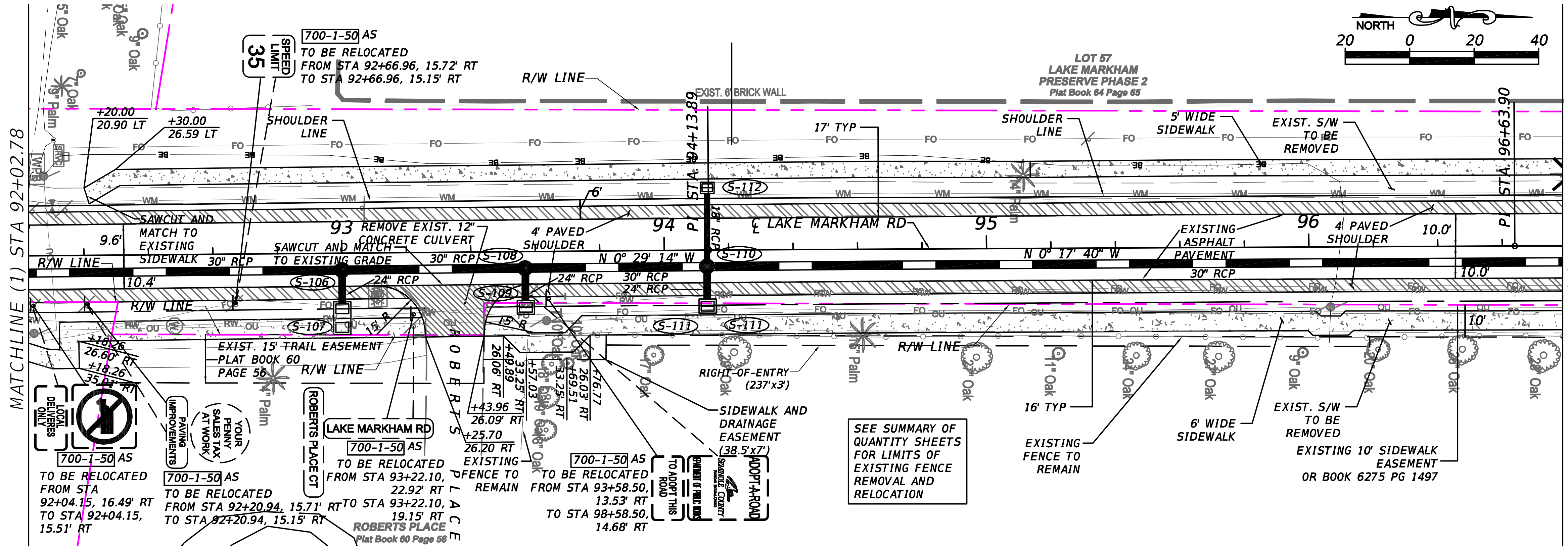
PLAN VIEW (1)- LAKE MARKHAM ROAD

SHEET NO. 8



LEGEND

- 4" THICK CONRETE SIDEWALK
- 6" THICK CONRETE DRIVEWAY
- PAVED SHOULDER
- DETECTABLE WARNING

NOTE: ALL EXISTING TREES TO REMAIN UNLESS OTHERWISE NOTED

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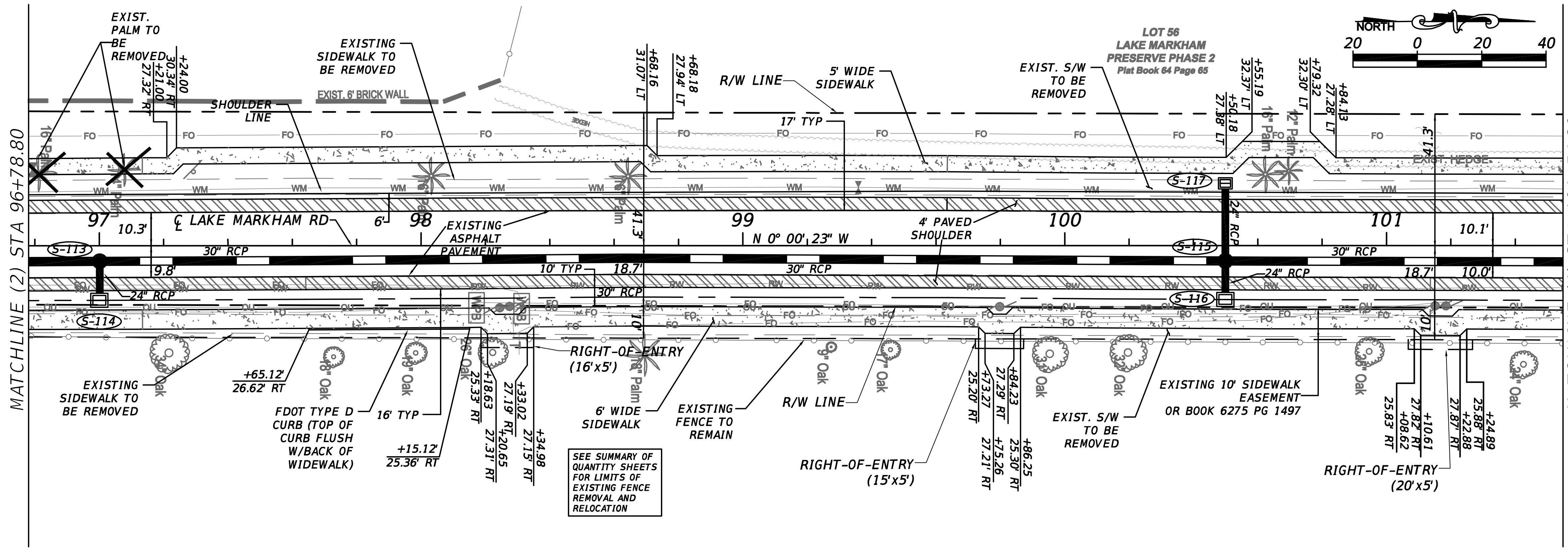
MARKHAM RD. / LAKE MARKHAM RD. DRAINAGE IMPROVEMENTS	02307084

PLAN VIEW (2)- LAKE MARKHAM ROAD

SHEET NO. 9



LEGEND

- 4" THICK CONRETE SIDEWALK
- 6" THICK CONRETE DRIVEWAY
- PAVED SHOULDER
- DETECTABLE WARNING

NOTE: ALL EXISTING TREES TO REMAIN UNLESS OTHERWISE NOTED

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

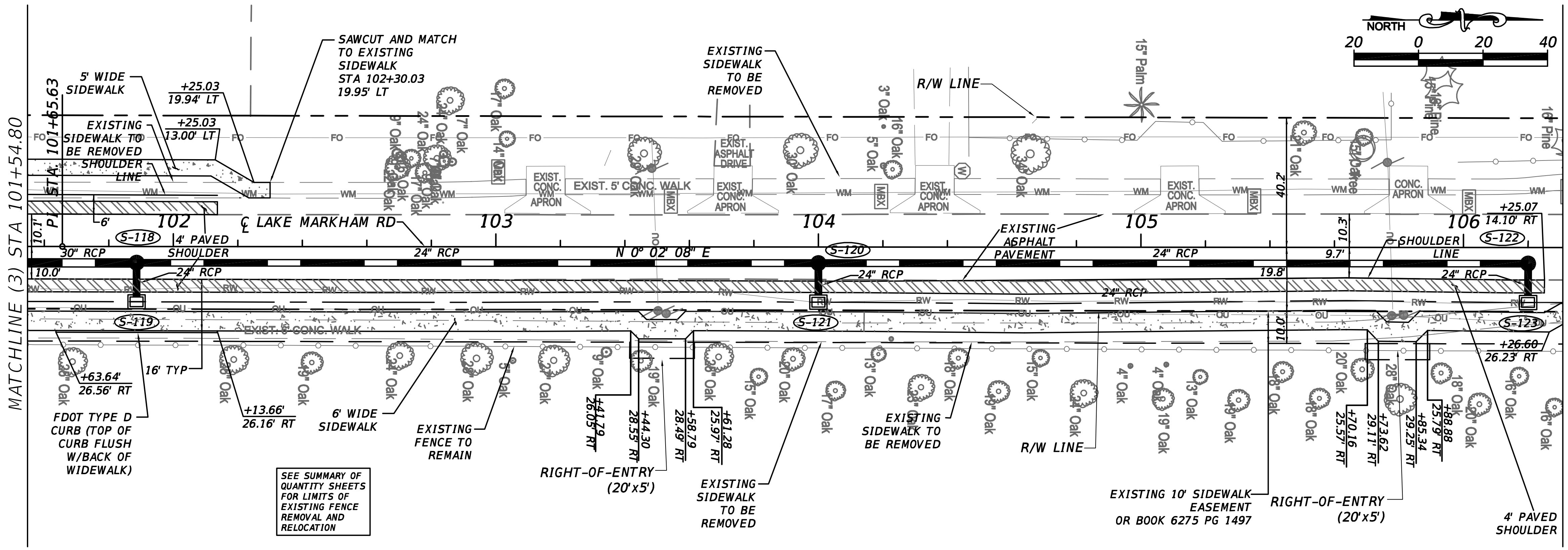
SEMINOLE COUNTY ENGINEERING DIVISION
JEFFREY L. SLOMAN
P.E. No. 56160
100 East 1st. Street
Sanford, Fl 32771

SEMINOLE COUNTY ENGINEERING DIVISION

ROAD	COUNTY CIP No.
MARKHAM RD. / LAKE MARKHAM RD. DRAINAGE IMPROVEMENTS	02307084

PLAN VIEW (3)- LAKE MARKHAM ROAD

SHEET NO. 10



LEGEND

- 4" THICK CONRETE SIDEWALK
- 6" THICK CONRETE DRIVEWAY
- PAVED SHOULDER
- DETECTABLE WARNING

NOTE: ALL EXISTING TREES TO REMAIN UNLESS OTHERWISE NOTED

REVISIONS			
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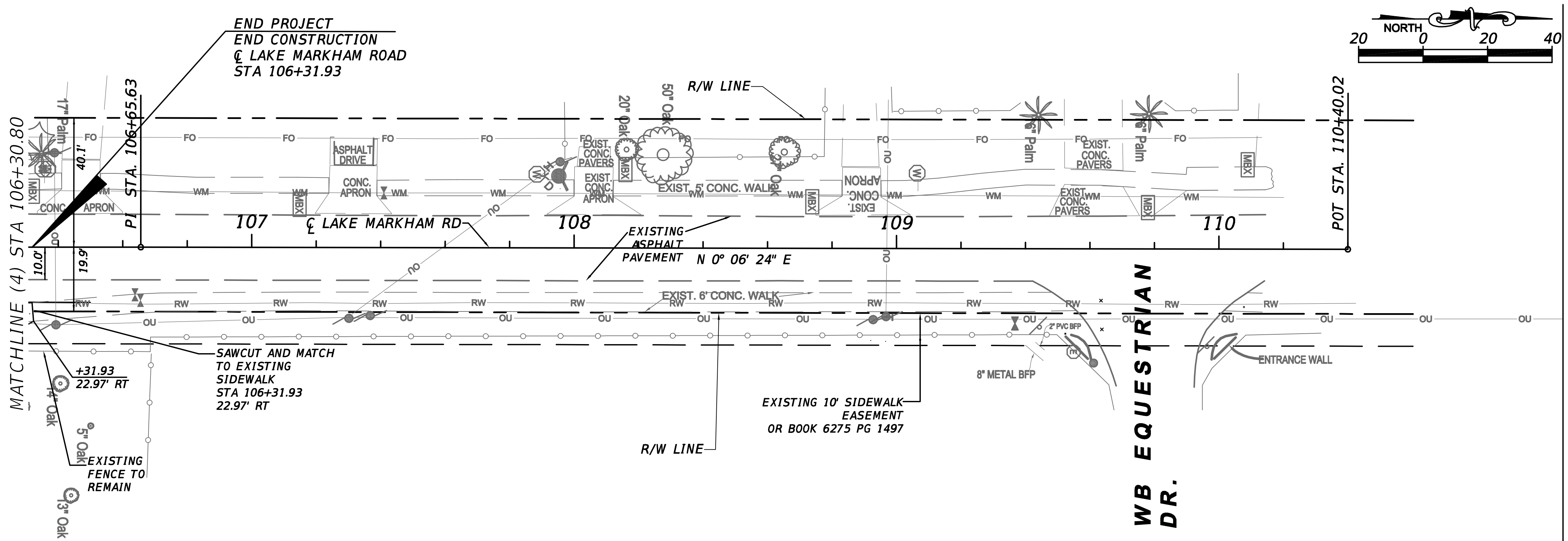
SEMINOLE COUNTY ENGINEERING DIVISION

ROAD	COUNTY CIP No.
MARKHAM RD. / LAKE MARKHAM RD. DRAINAGE IMPROVEMENTS	02307084

PLAN VIEW (4)- LAKE MARKHAM ROAD

SHEET NO.
11



LEGEND

4" THICK CONRETE SIDEWALK
6" THICK CONRETE DRIVEWAY
PAVED SHOULDER
DETECTABLE WARNING

NOTE: ALL EXISTING TREES TO REMAIN UNLESS OTHERWISE NOTED

REVISIONS			
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SEMINOLE COUNTY ENGINEERING DIVISION

ROAD	COUNTY CIP No.
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PLAN VIEW (5)- LAKE MARKHAM ROAD

SHEET NO. 12

THIS SHEET INTENTIONALLY LEFT BLANK

REVISIONS			
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SEMINOLE COUNTY
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ROAD	COUNTY CIP No.
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PLAN VIEW (6)

SHEET NO. 13

THIS SHEET INTENTIONALLY LEFT BLANK

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

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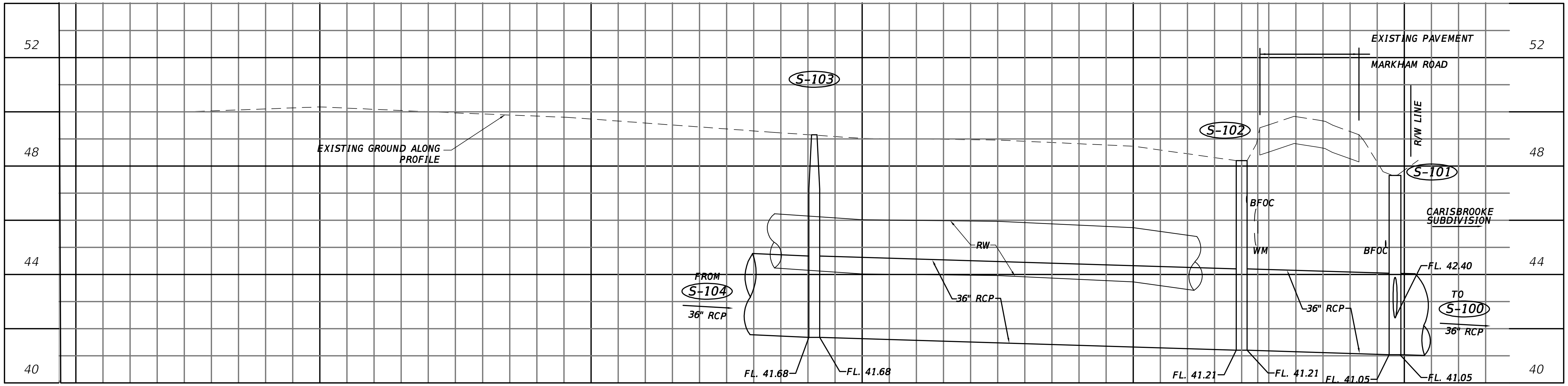
ENGINEERING DIVISION

ROAD	COUNTY CIP No.
MARKHAM RD. / LAKE MARKHAM RD. DRAINAGE IMPROVEMENTS	02307084

PLAN VIEW (7)

SHEET NO.
14



SPECIAL PROFILE

NOTE: EXISTING GAS RUNS PARALLEL TO NEW STORM BETWEEN S-103 & S-102 @ 5'± OFFSET FROM STORM PIPE EDGE
EXISTING FIBER OPTIC RUNS PARALLEL TO NEW STORM BETWEEN S-103 & S-102 @ 1'± OFFSET FROM STORM PIPE EDGE

SCALE: 1"=40' HOR
1"=4' VER

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

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ENGINEERING DIVISION

ROAD	COUNTY CIP No.
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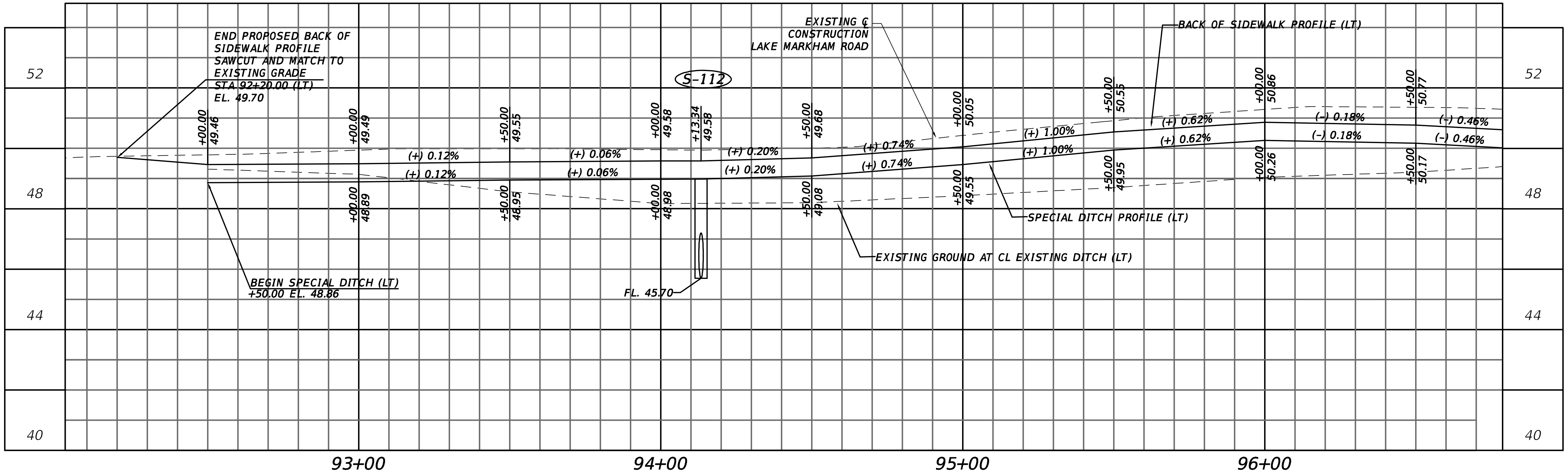
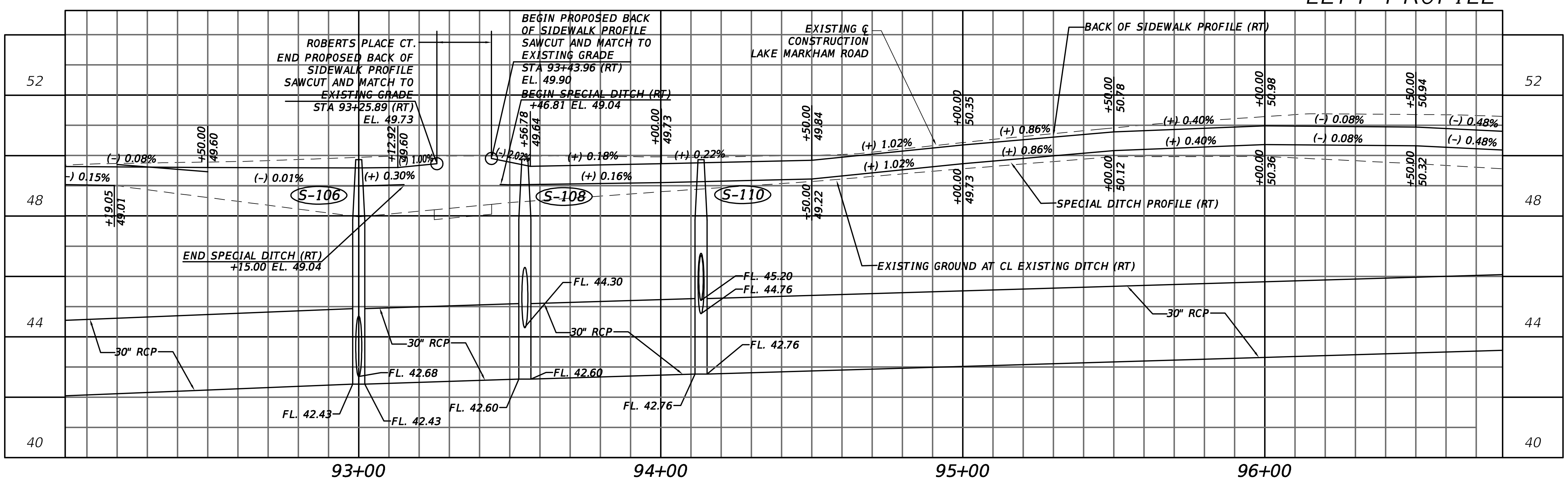
SPECIAL PROFILE

SHEET NO. 20



LEFT PROFILE



RIGHT PROFILE

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

SEMINOLE COUNTY ENGINEERING DIVISION
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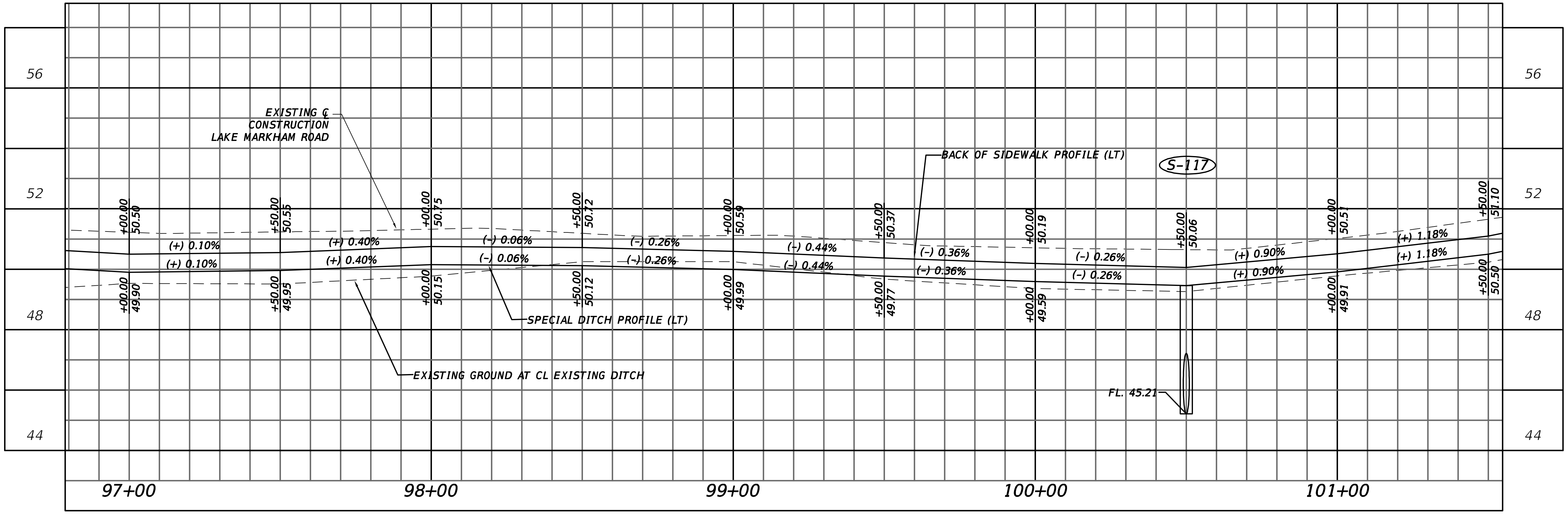
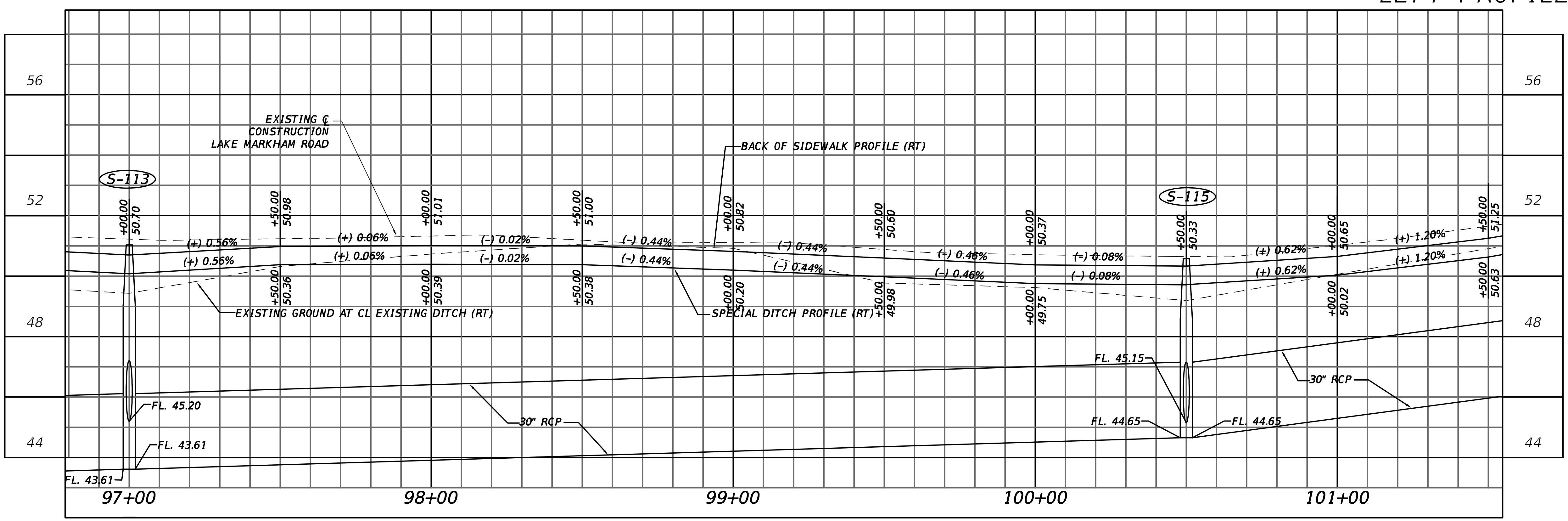
ROAD	COUNTY CIP No.
MARKHAM RD. / LAKE MARKHAM RD. DRAINAGE IMPROVEMENTS	02307084

PROFILE VIEW (2) - LAKE MARKHAM ROAD

SHEET NO. 16



LEFT PROFILE



RIGHT PROFILE

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

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SEMINOLE COUNTY ENGINEERING DIVISION

ROAD	COUNTY CIP No.
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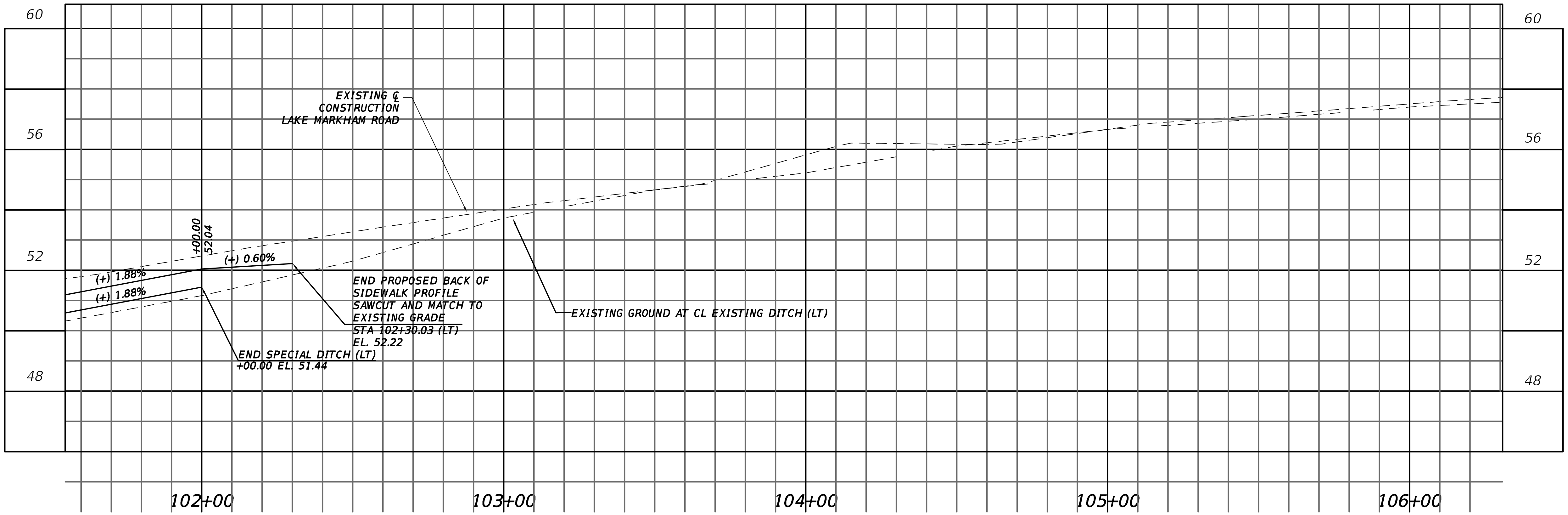
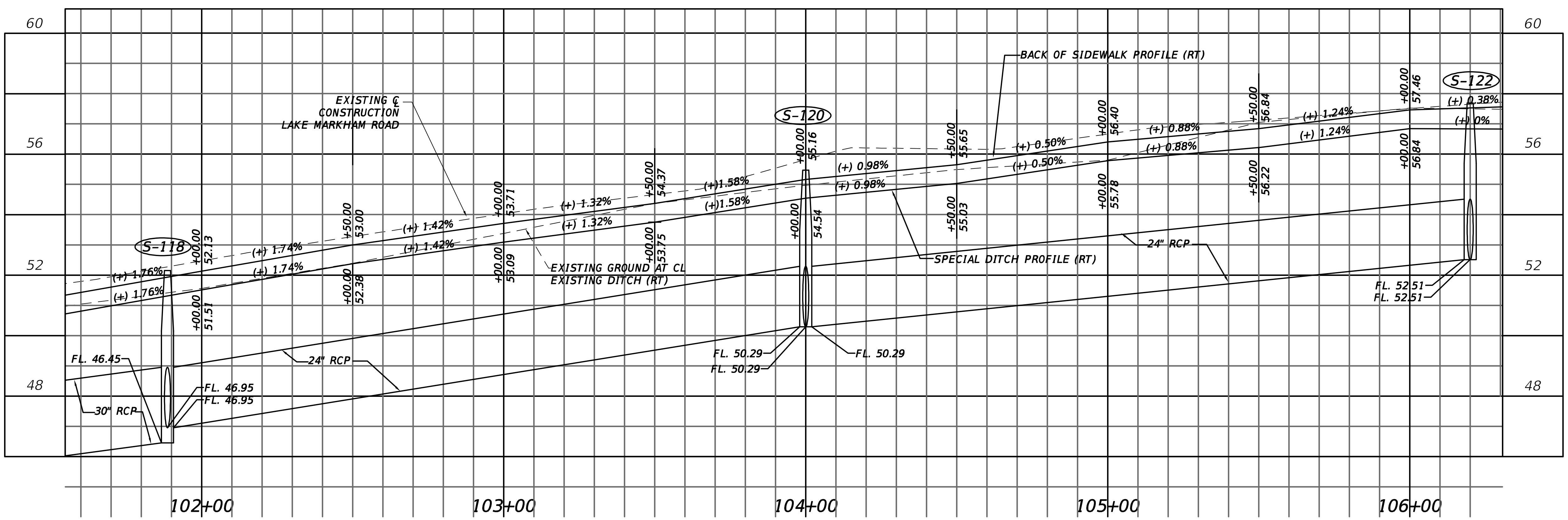
PROFILE VIEW (3) - LAKE MARKHAM ROAD

SHEET NO. 17



LEFT PROFILE



RIGHT PROFILE

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

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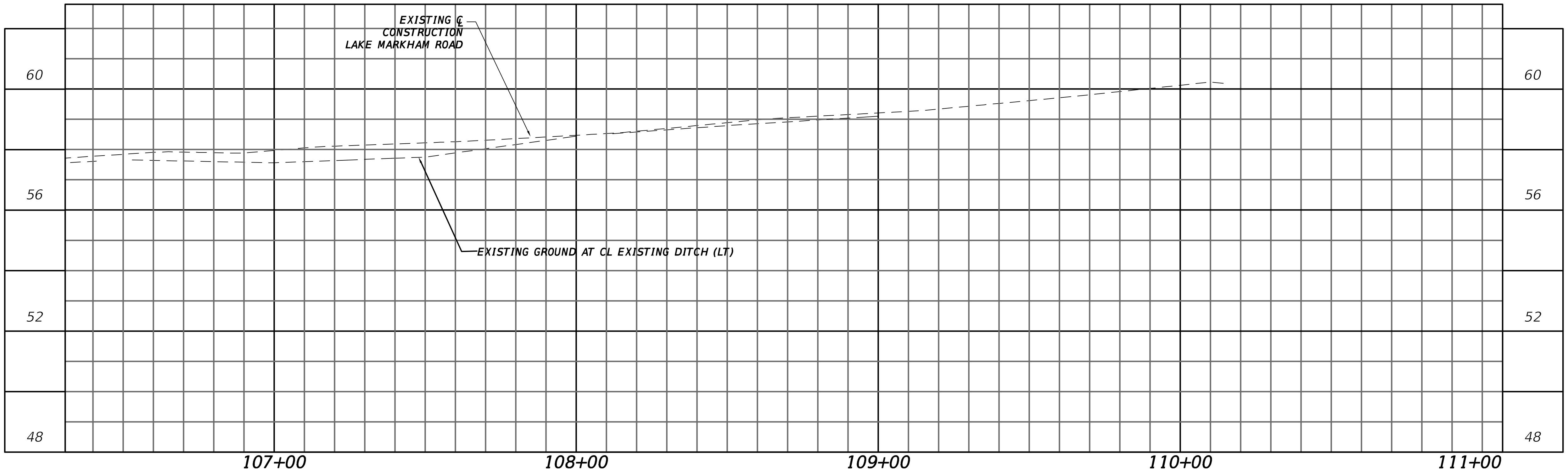
SEMINOLE COUNTY ENGINEERING DIVISION

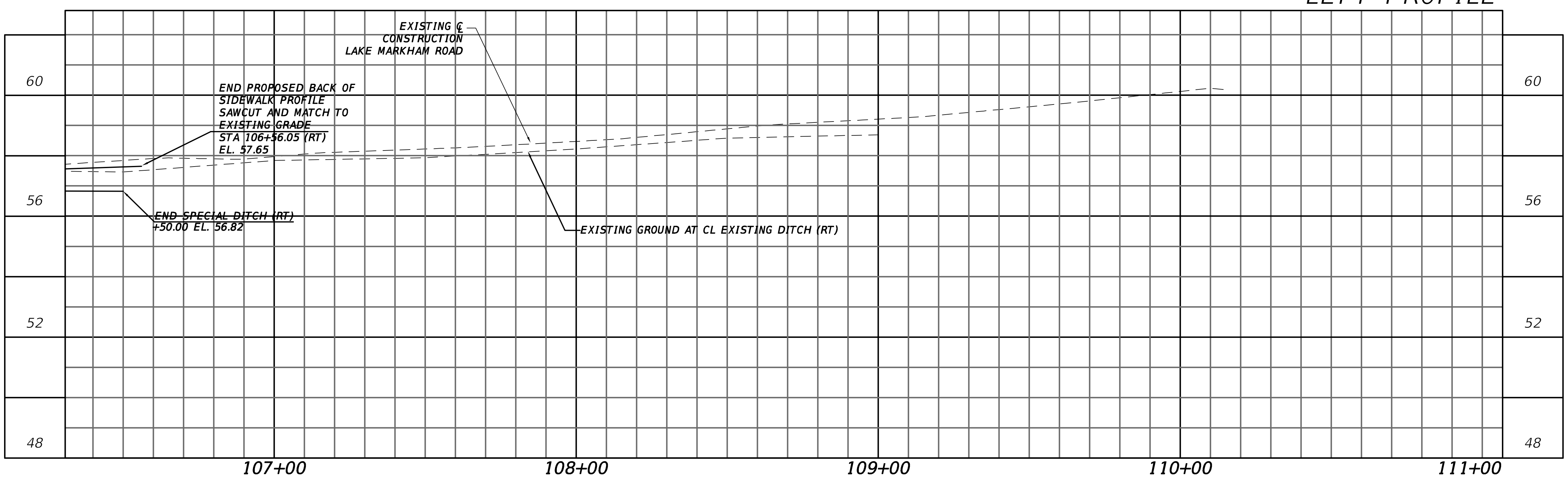
ROAD	COUNTY CIP No.
MARKHAM RD. / LAKE MARKHAM RD. DRAINAGE IMPROVEMENTS	02307084

PROFILE VIEW (4) - LAKE MARKHAM ROAD

SHEET NO.
18



LEFT PROFILE



RIGHT PROFILE

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

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SEMINOLE COUNTY
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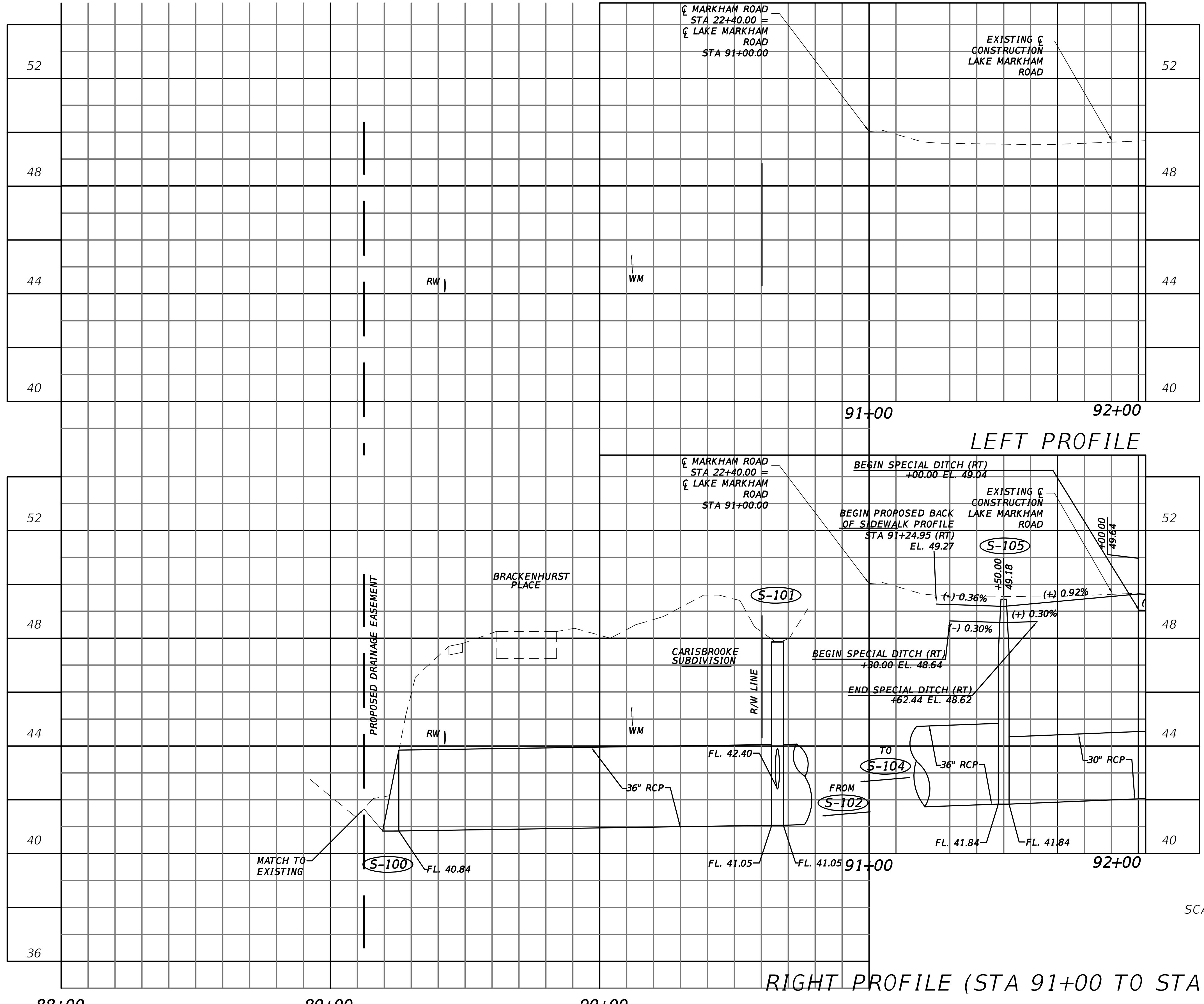
ROAD	COUNTY CIP No.
MARKHAM RD. / LAKE MARKHAM RD. DRAINAGE IMPROVEMENTS	02307084

PROFILE VIEW (5) - LAKE MARKHAM ROAD

SHEET NO.
19



LEFT PROFILE

RIGHT PROFILE (STA 91+00 TO STA 92+02.78)

CENTERLINE PROFILE (STA 88+60 TO STA 91+00)

SCALE: 1"=40' HOR
1"=4' VER

REVISIONS			
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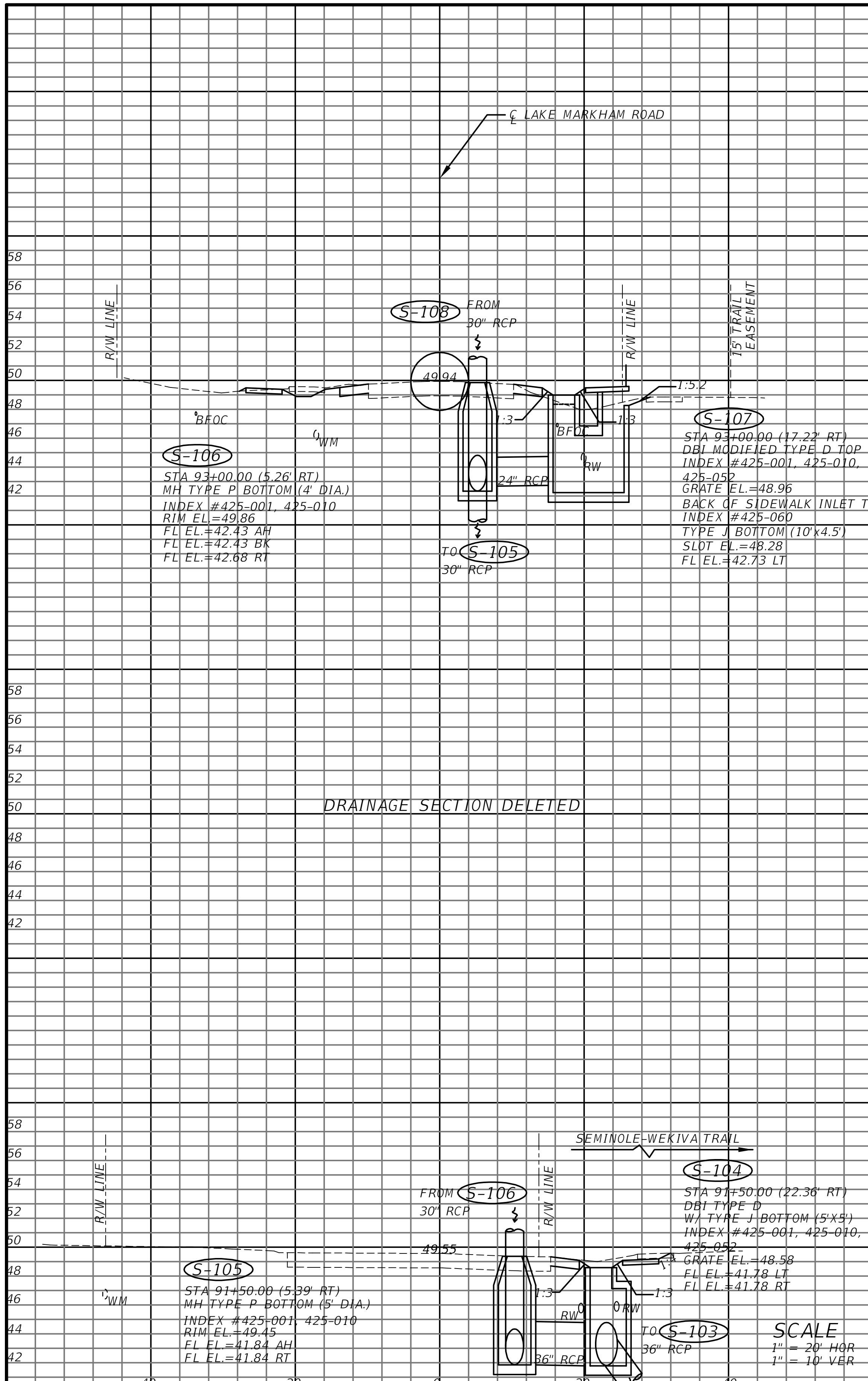
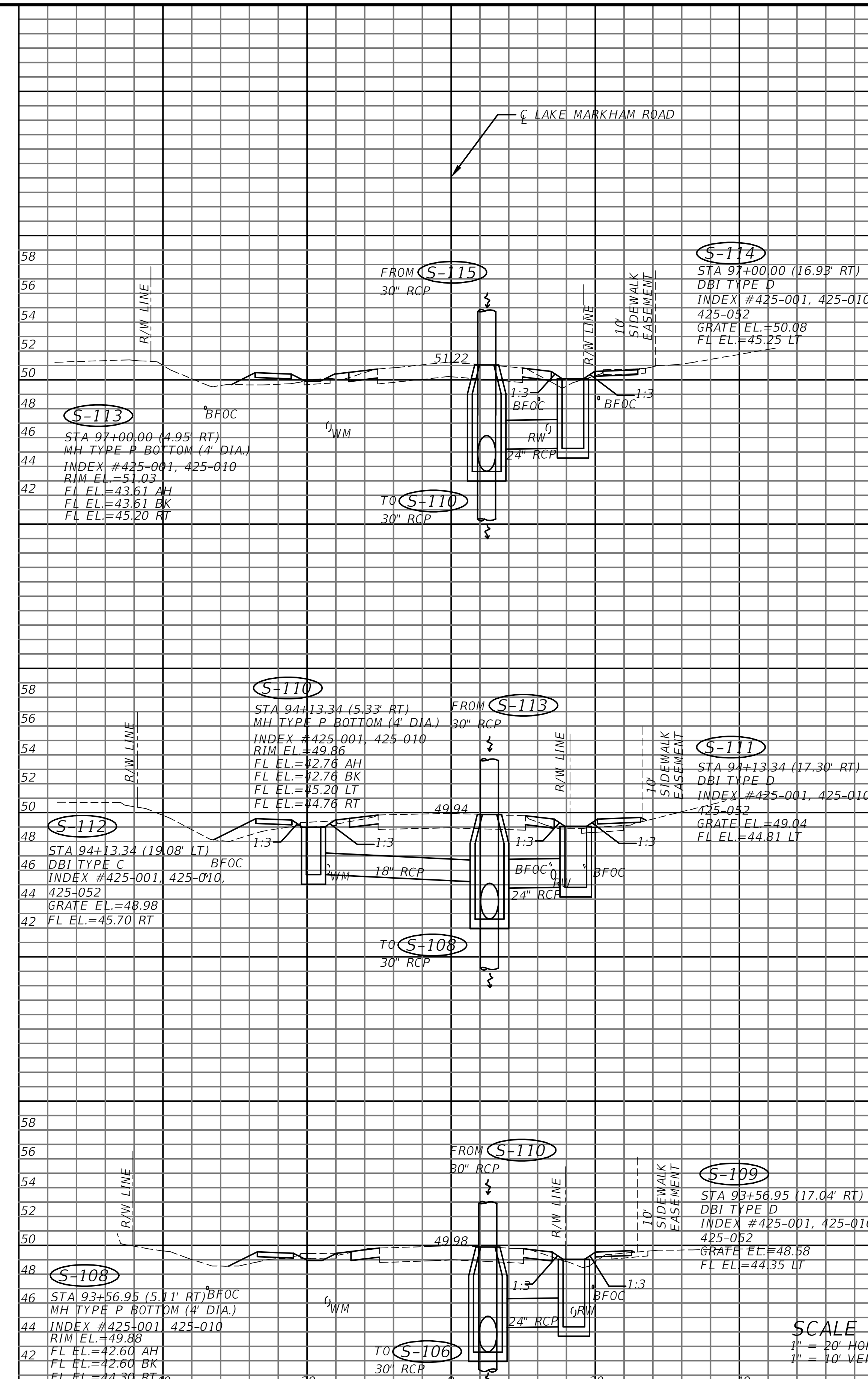
SEMINOLE COUNTY ENGINEERING DIVISION

ROAD	COUNTY CIP No.
MARKHAM RD. / LAKE MARKHAM RD. DRAINAGE IMPROVEMENTS	02307084

PROFILE VIEW (1) - LAKE MARKHAM ROAD

SHEET NO. 15





REVISIONS			
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ROAD	COUNTY CIP No.
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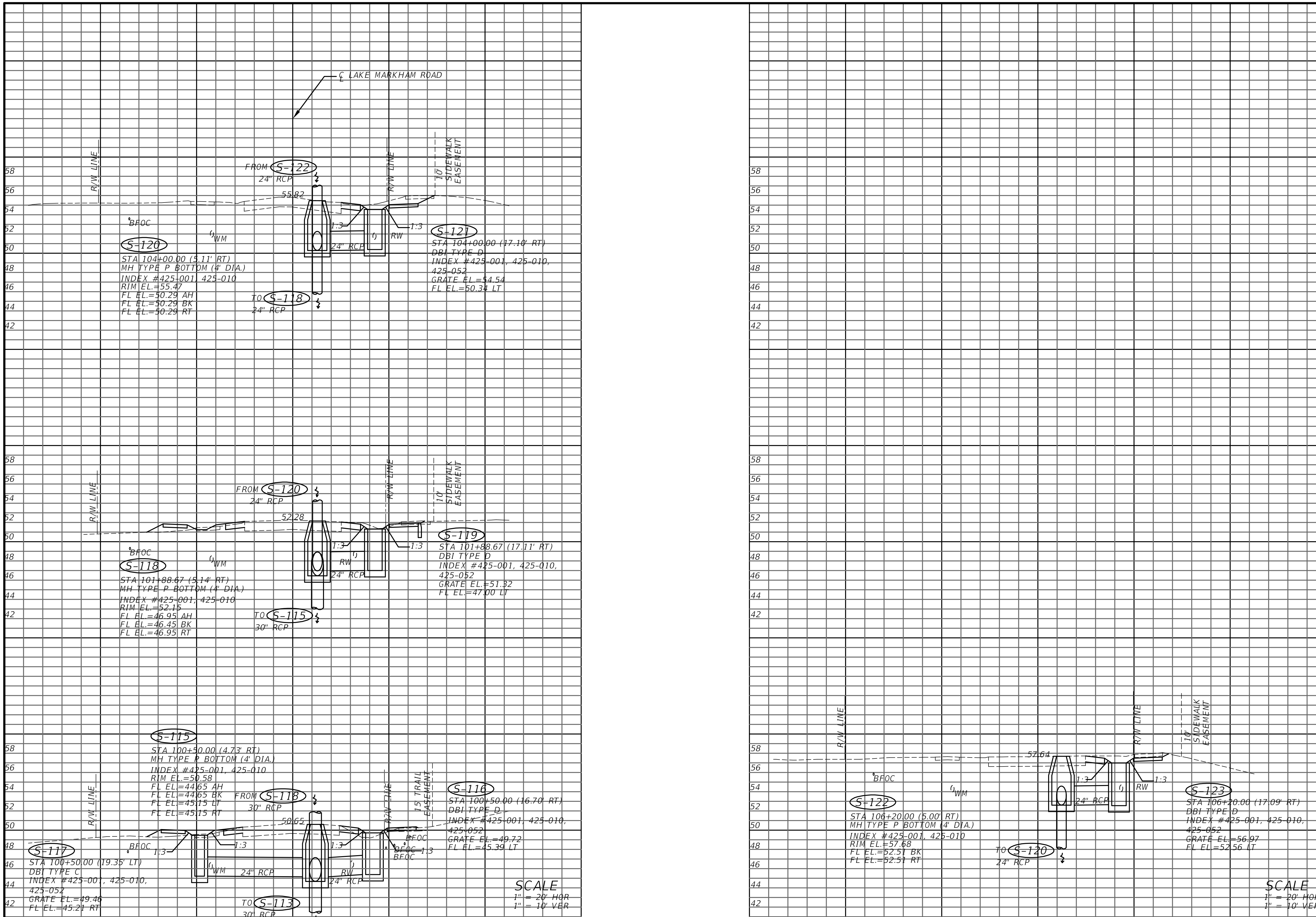
DRAINAGE STRUCTURE SHEET
LAKE MARKHAM ROAD (1)

SHEET NO.
21



REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

SEMINOLE COUNTY ENGINEERING DIVISION

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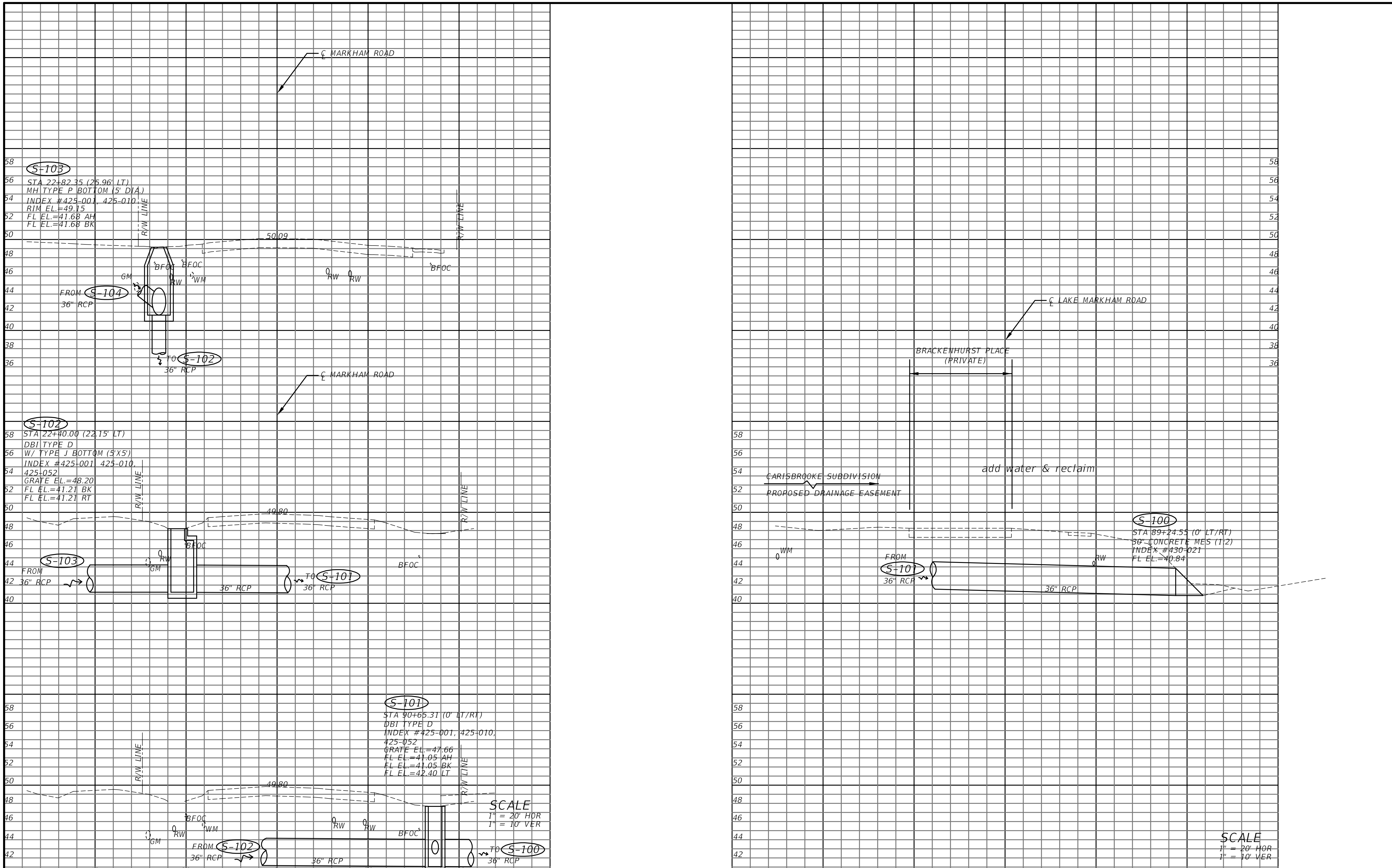
ROAD	COUNTY CIP No.
MARKHAM RD. / LAKE MARKHAM RD. DRAINAGE IMPROVEMENTS	02307084

DRAINAGE STRUCTURE SHEET LAKE MARKHAM ROAD (2)

SHEET NO. 22



REVISIONS

DATE	DESCRIPTION	DATE	DESCRIPTION

SEMINOLE COUNTY
ENGINEERING DIVISION
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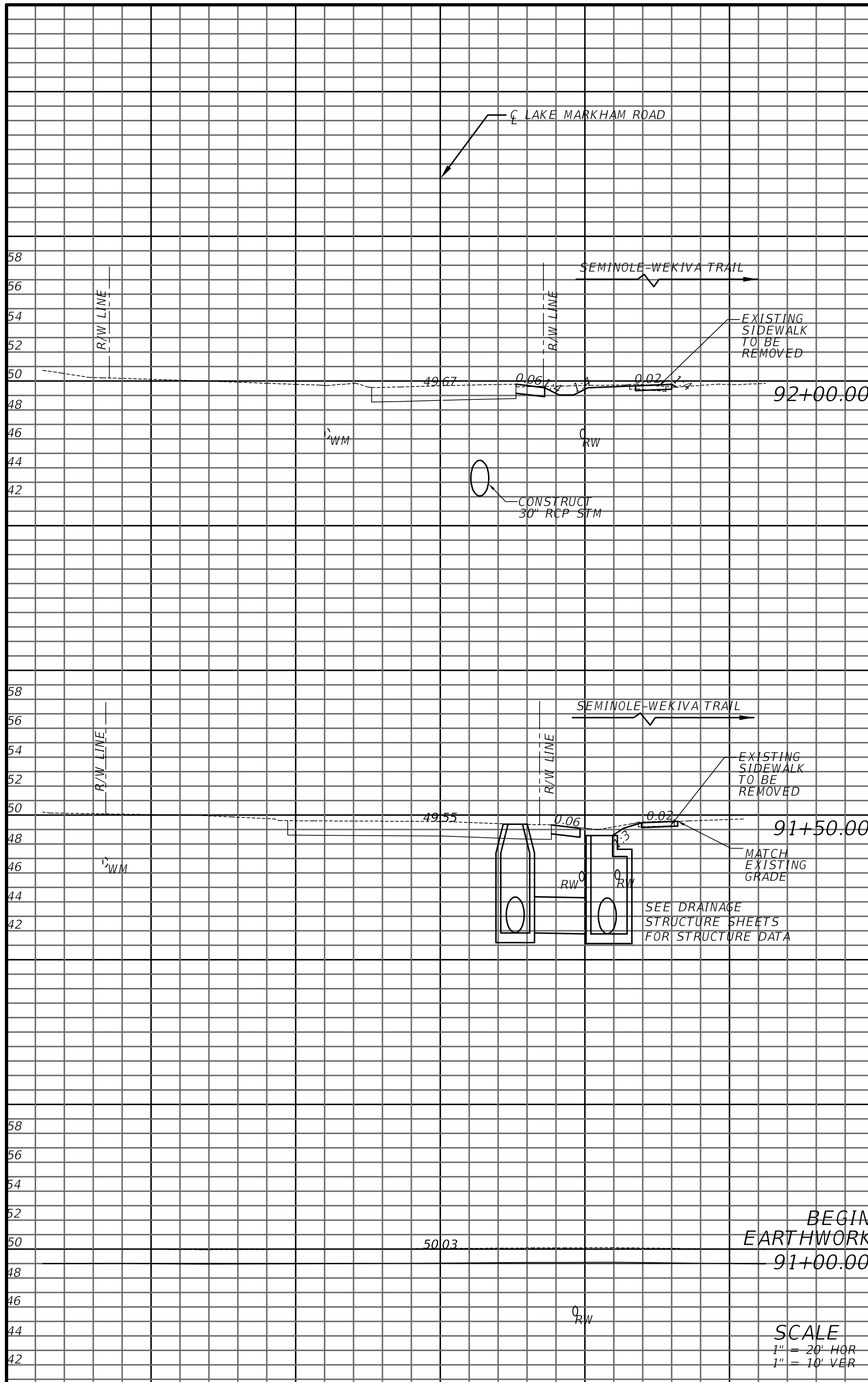
SEMINOLE COUNTY
ENGINEERING DIVISION

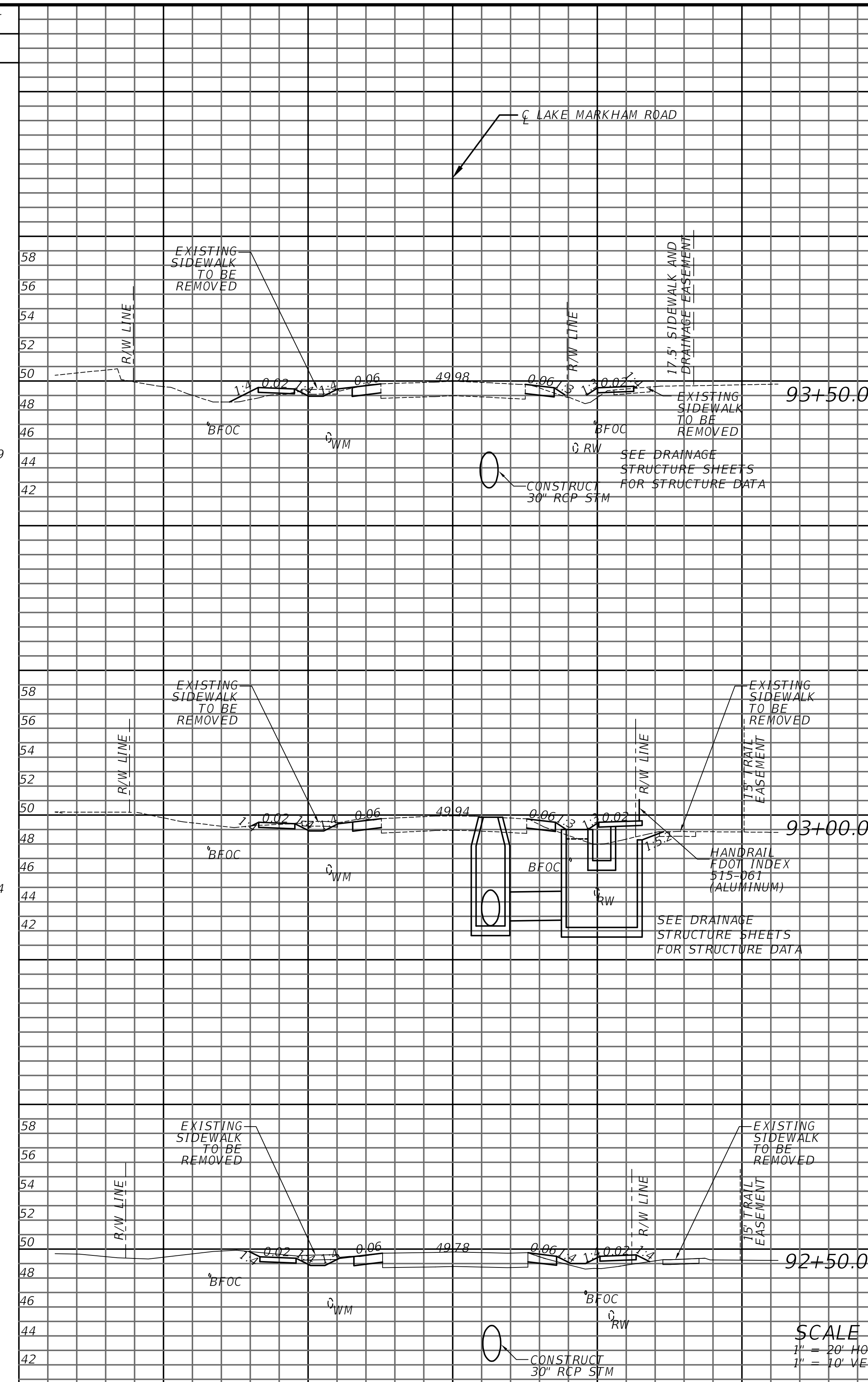
ROAD	COUNTY CIP No.
MARKHAM RD. / LAKE MARKHAM RD. DRAINAGE IMPROVEMENTS	02307084

DRAINAGE STRUCTURE SHEET
MARKHAM ROAD (3)

SHEET NO.
23



Station	Regular Exc. A	Regular Exc. V	Embankment A	Embankment V
92+00.00	3.4	6.1	1.7	1.9
91+50.00	3.2	3.0	0.4	0.4
91+00.00	0.0		0.0	



Station	Regular Exc. A	Regular Exc. V	Embankment A	Embankment V
93+50.00	0.4	2.5	1.2	2.7
93+00.00	2.3	4.9	1.6	3.0
92+50.00	3.0	5.9	1.6	3.0

REVISIONS

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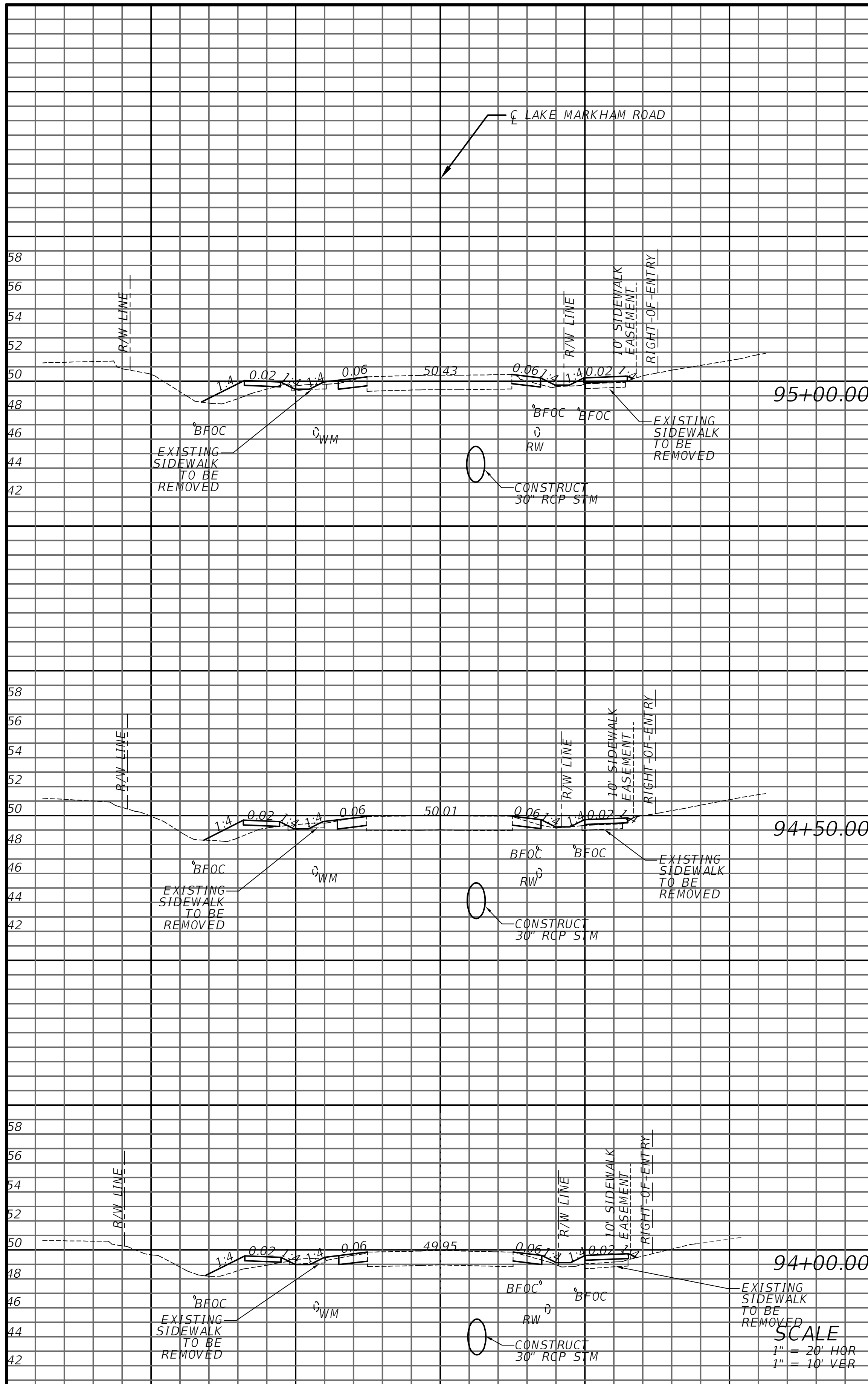
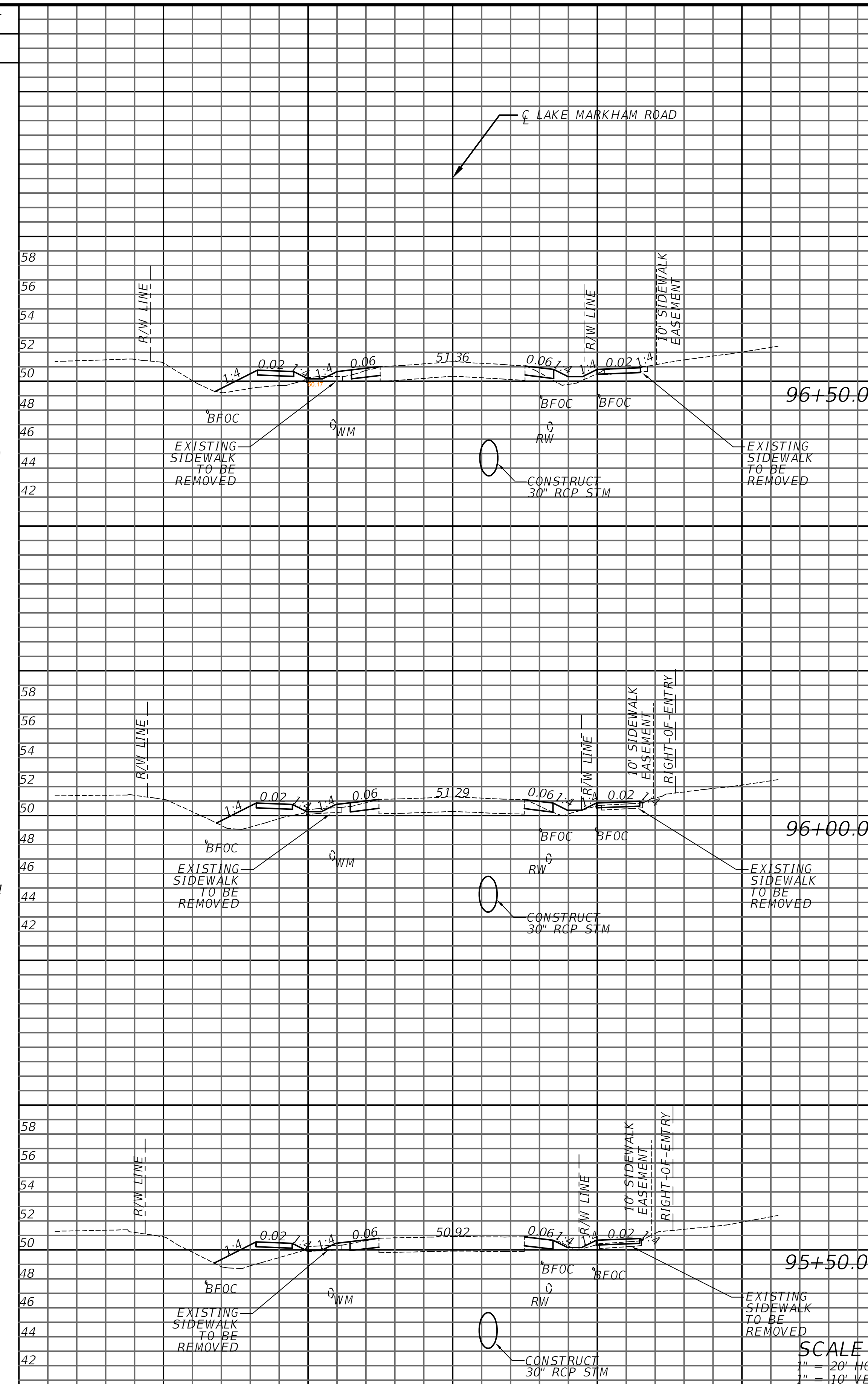
ROAD	COUNTY CIP No.
MARKHAM RD. / LAKE MARKHAM RD. DRAINAGE IMPROVEMENTS	02307084

CROSS SECTIONS LAKE MARKHAM ROAD (1)

SHEET NO. 24



REGULAR EXC. A	REGULAR EXC. V	EMBANKMENT A	EMBANKMENT V
0.1		10.2	
	0.1		17.9
0		9.2	
	0.1		18.1
0.1		10.3	
	0.5		10.7



REGULAR EXC. A	REGULAR EXC. V	EMBANKMENT A	EMBANKMENT V
0.0		12.4	
	0.0		23.5
0.0		13.0	
	0.2		25.0
0.2		14	
	0.3		22.4

REVISIONS

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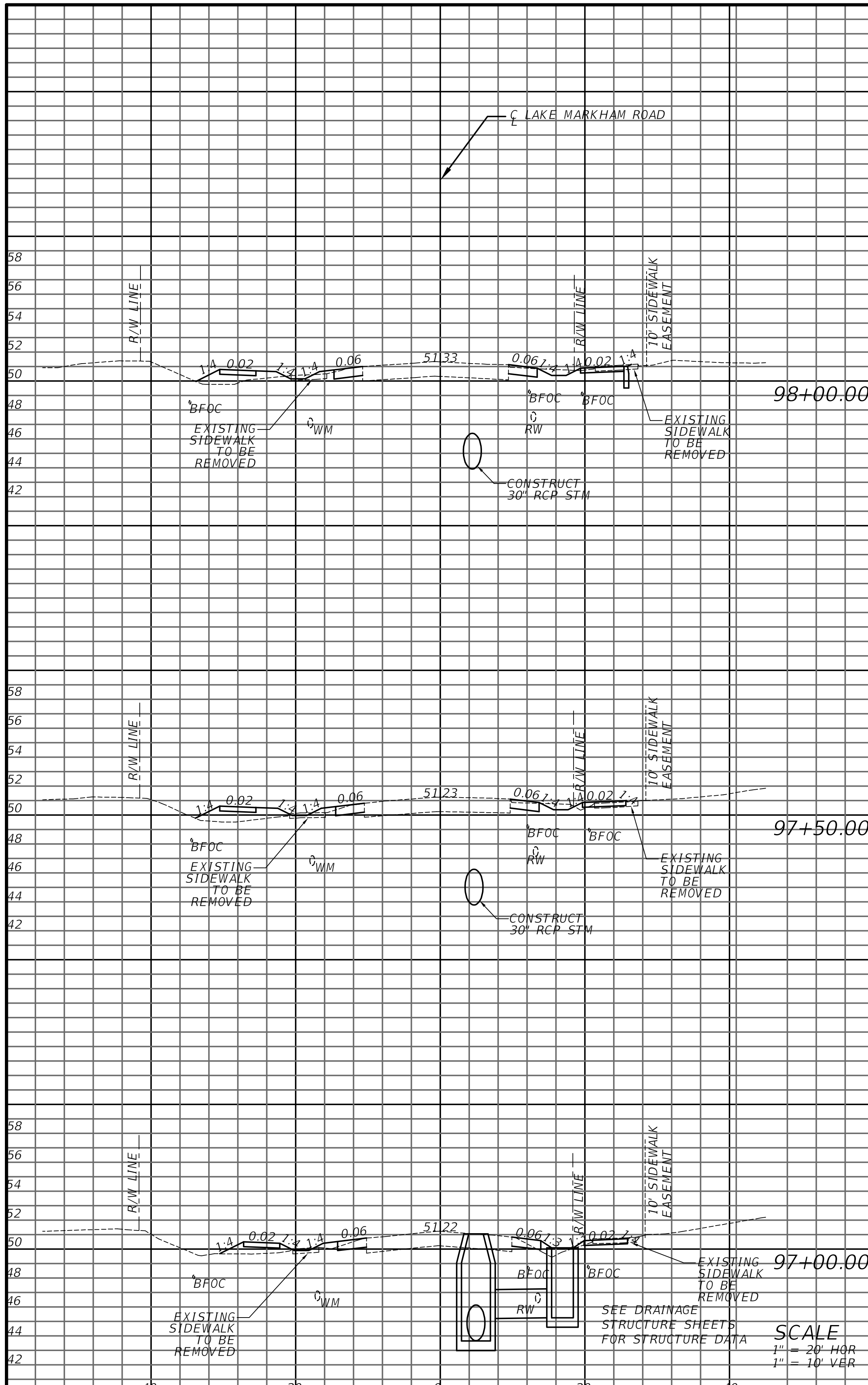
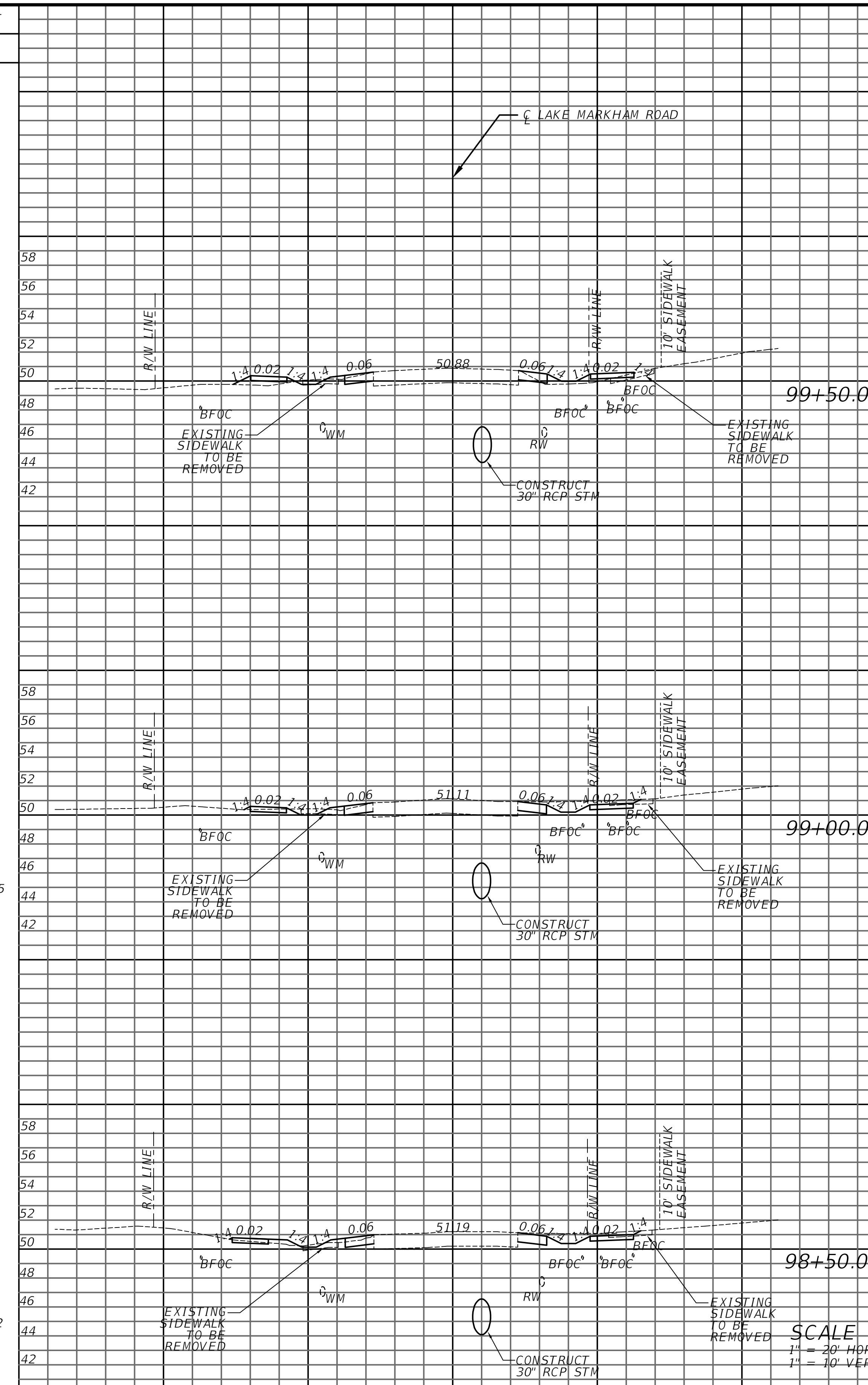
ROAD	COUNTY CIP No.
MARKHAM RD. / LAKE MARKHAM RD. DRAINAGE IMPROVEMENTS	02307084

CROSS SECTIONS LAKE MARKHAM ROAD (2)

SHEET NO. 25



REGULAR EXC. A	REGULAR EXC. V	EMBANKMENT A	EMBANKMENT V
1.5	2.6	5.8	13.1
1.3	1.2	8.3	14.5
0.0	0.0	7.3	18.2



REGULAR EXC. A	REGULAR EXC. V	EMBANKMENT A	EMBANKMENT V
0.2	4.6	6	7.4
4.8	8.1	2.0	4.5
4.0	5.1	2.9	8.1

REVISIONS			
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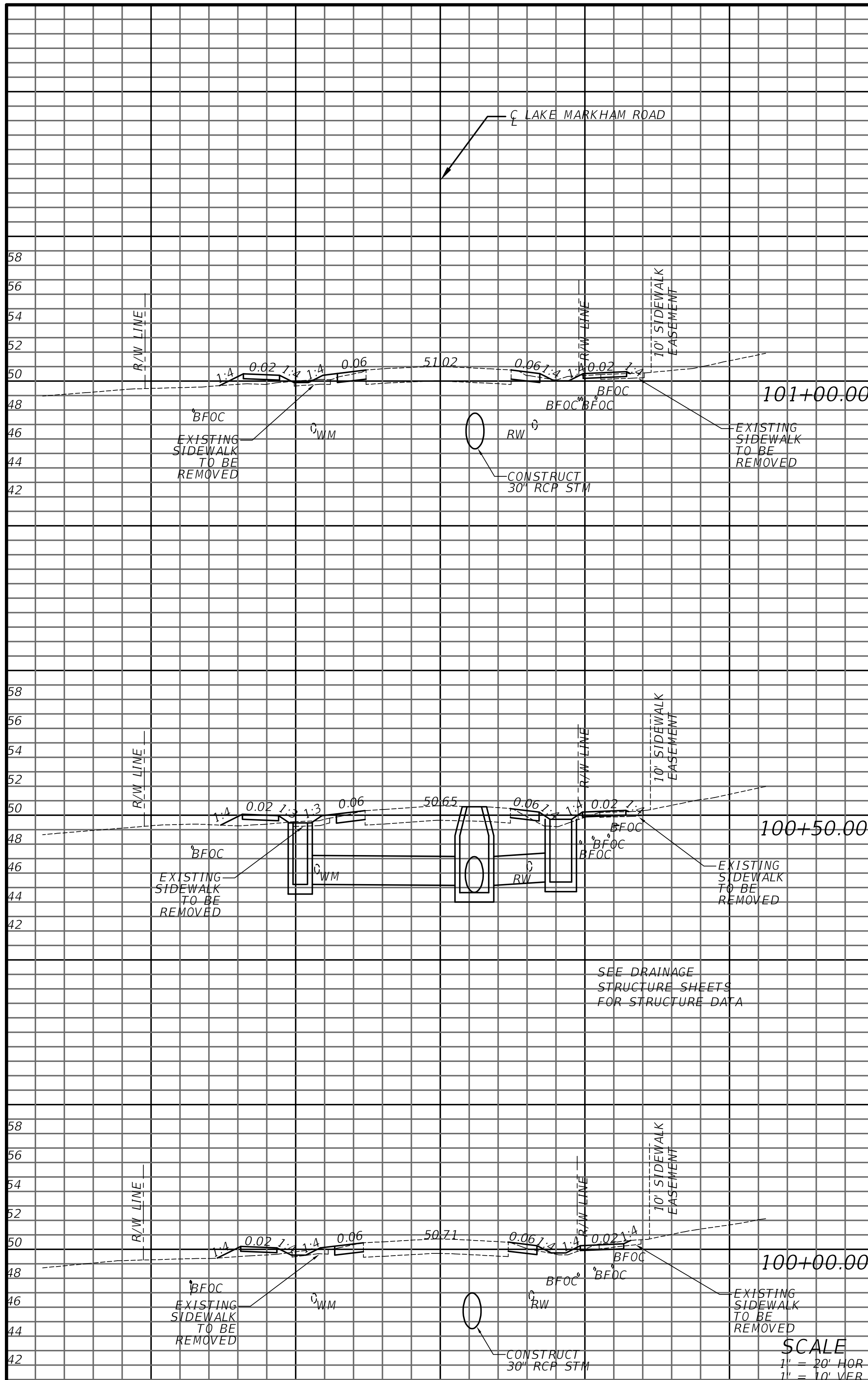
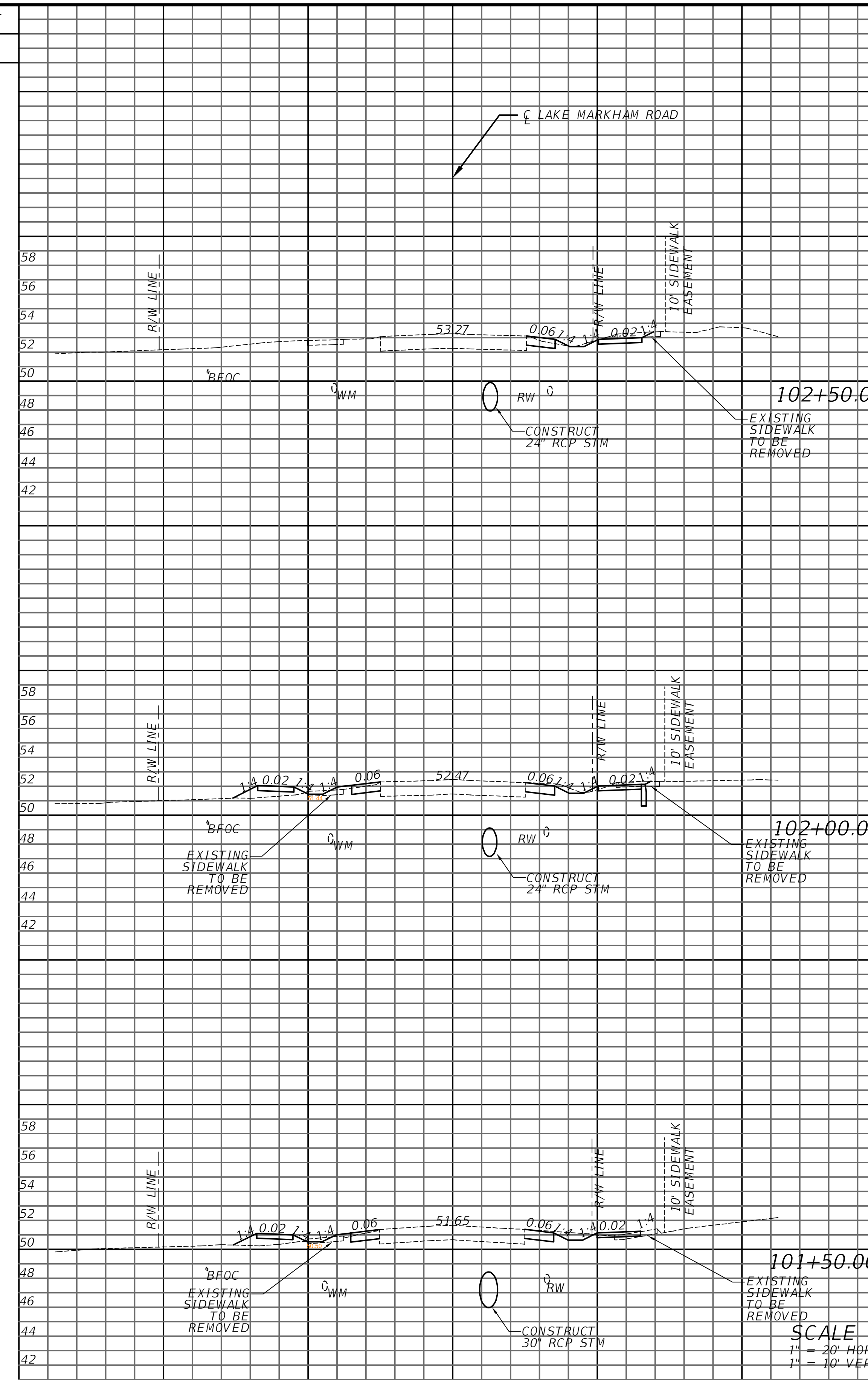
ROAD	COUNTY CIP No.
MARKHAM RD. / LAKE MARKHAM RD. DRAINAGE IMPROVEMENTS	02307084

CROSS SECTIONS LAKE MARKHAM ROAD (3)

SHEET NO. 26



Station	REGULAR EXC. A	REGULAR EXC. V	EMBANKMENT A	EMBANKMENT V
101+00.00	0.5	0.5	4.3	8.4
100+50.00	0	0.1	4.8	8.7
100+00.00	0.1	0.2	4.6	9.8



Station	REGULAR EXC. A	REGULAR EXC. V	EMBANKMENT A	EMBANKMENT V
102+50.00	0.3	1.5	0.8	5.4
102+00.00	1.3	3.2	5.0	9.5
101+50.00	2.2	2.5	5.3	8.8

REVISIONS

DATE	DESCRIPTION	DATE	DESCRIPTION

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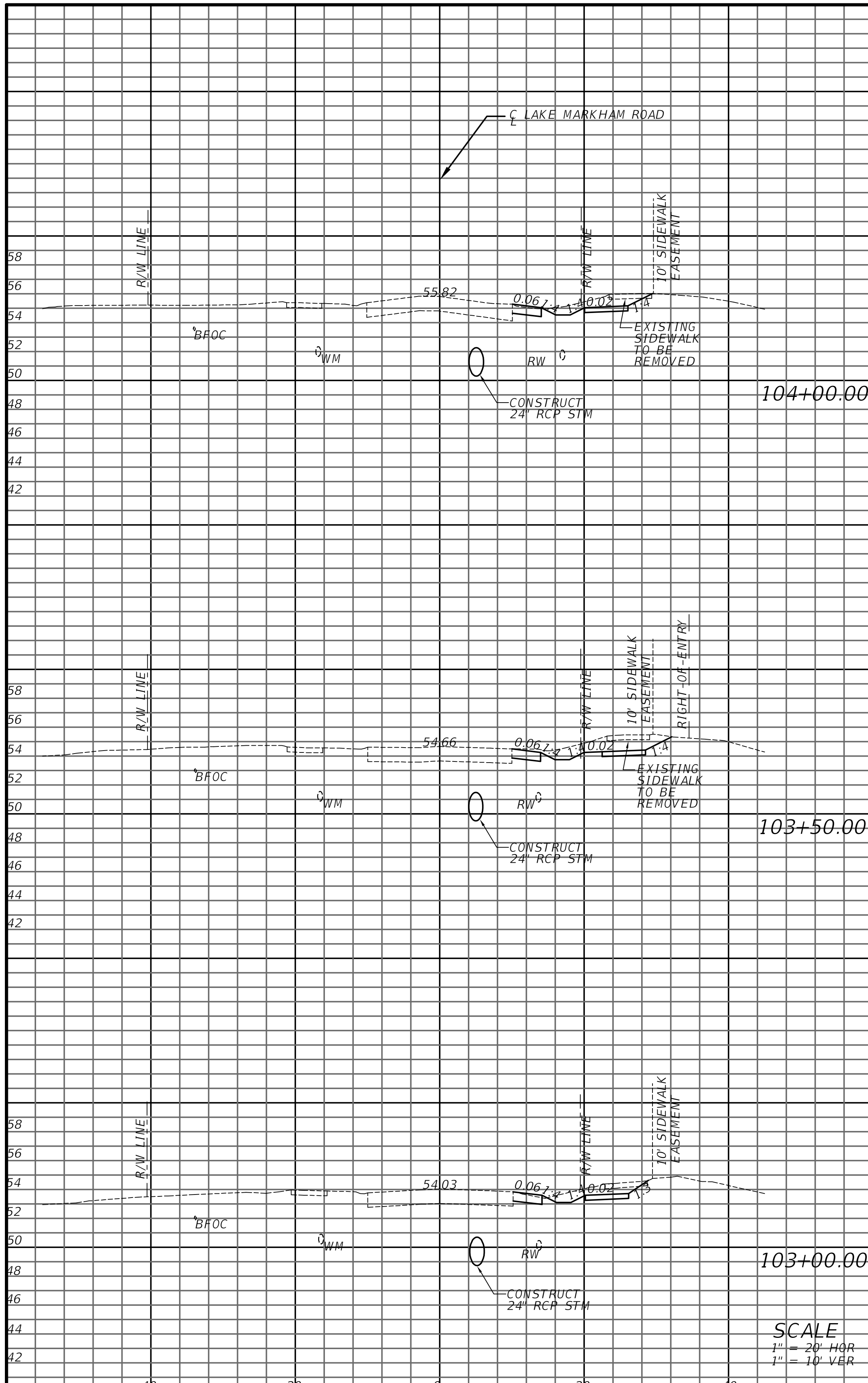
SEMINOLE COUNTY ENGINEERING DIVISION

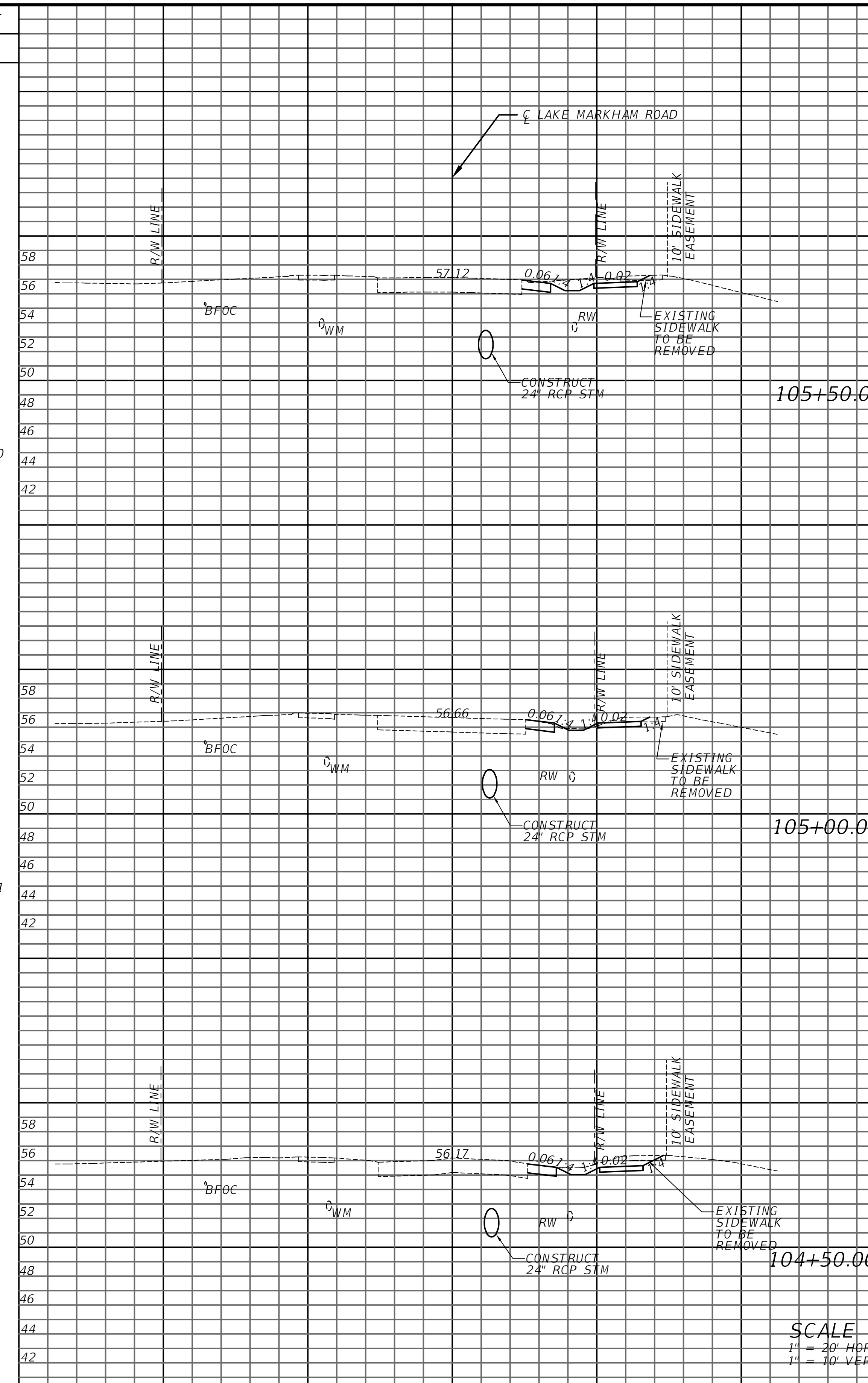
ROAD	COUNTY CIP No.
MARKHAM RD. / LAKE MARKHAM RD. DRAINAGE IMPROVEMENTS	02307084

CROSS SECTIONS LAKE MARKHAM ROAD (4)

SHEET NO.
27



REGULAR EXC.		EMBANKMENT	
A	V	A	V
6.5		0.0	
	15.2		0.0
9.9		0	
	14.8		0.1
6.1		0.1	
	5.9		0.8



REGULAR EXC.		EMBANKMENT	
A	V	A	V
5.2		0.0	
	5.4		0.3
0.7		0.3	
	5.3		0.3
5		0.0	
	10.6		0.0

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

SEMINOLE COUNTY ENGINEERING DIVISION
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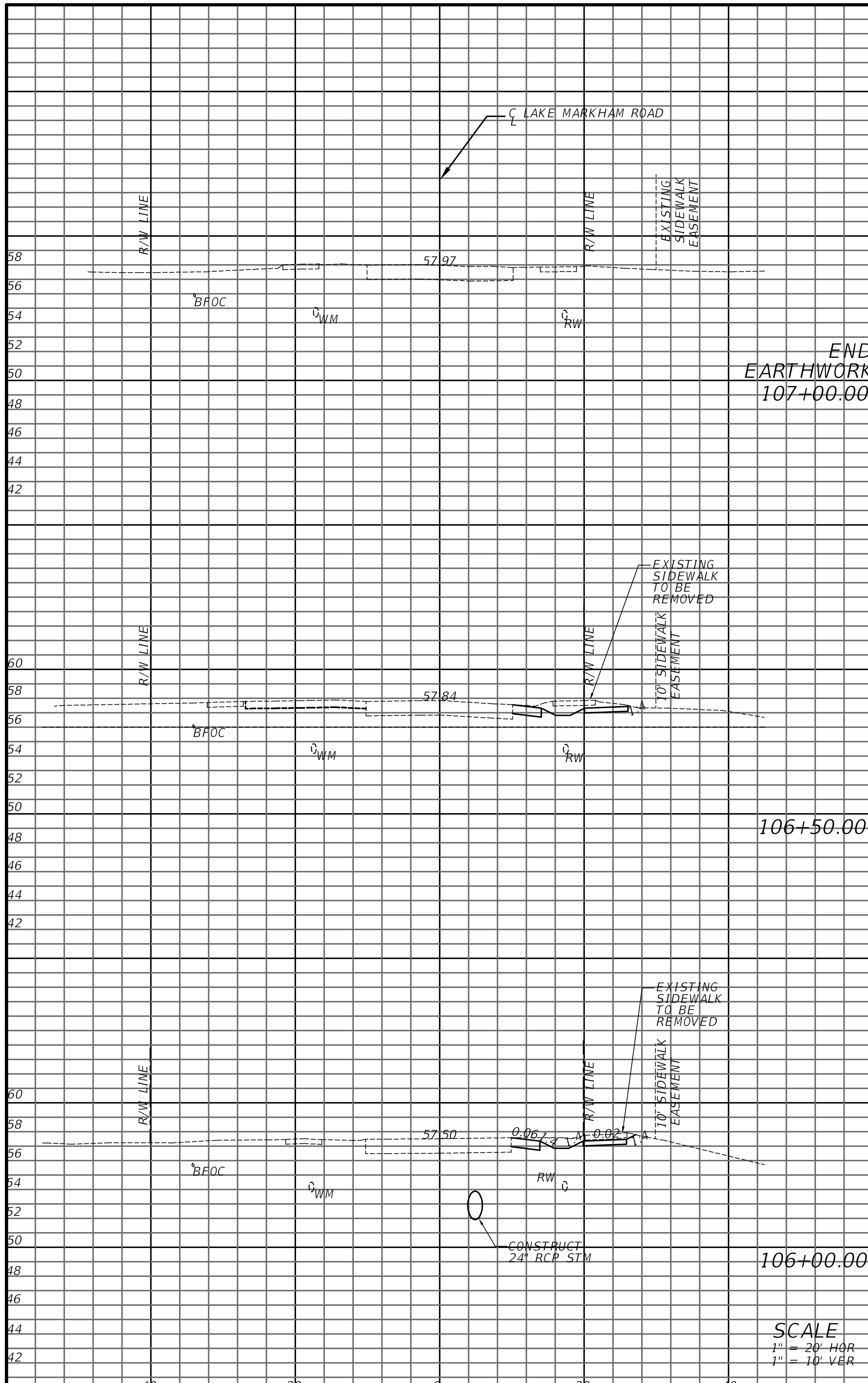
SEMINOLE COUNTY ENGINEERING DIVISION

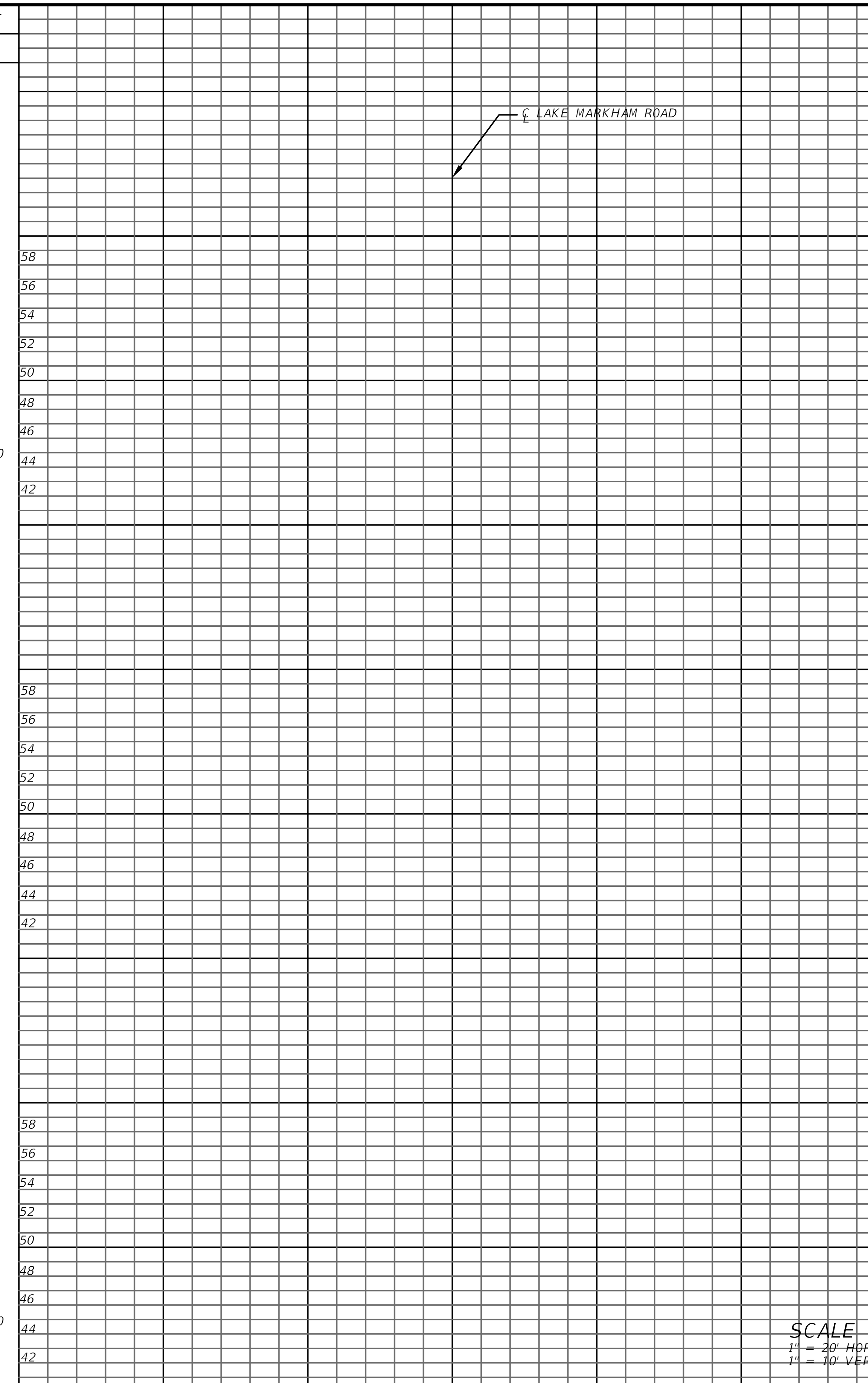
ROAD	COUNTY CIP No.
MARKHAM RD. / LAKE MARKHAM RD. DRAINAGE IMPROVEMENTS	02307084

CROSS SECTIONS
LAKE MARKHAM ROAD (5)

SHEET NO.



Station	REGULAR EXC. A	REGULAR EXC. V	EMBANKMENT A	EMBANKMENT V
107+00.00	0.0		0.0	
		4.7		0.0
106+50.00	5.1		0.0	
		9.1		0.0
106+00.00	4.7		0.0	
		9.1		0.0



REGULAR EXC. A	REGULAR EXC. V	EMBANKMENT A	EMBANKMENT V

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

SEMINOLE COUNTY
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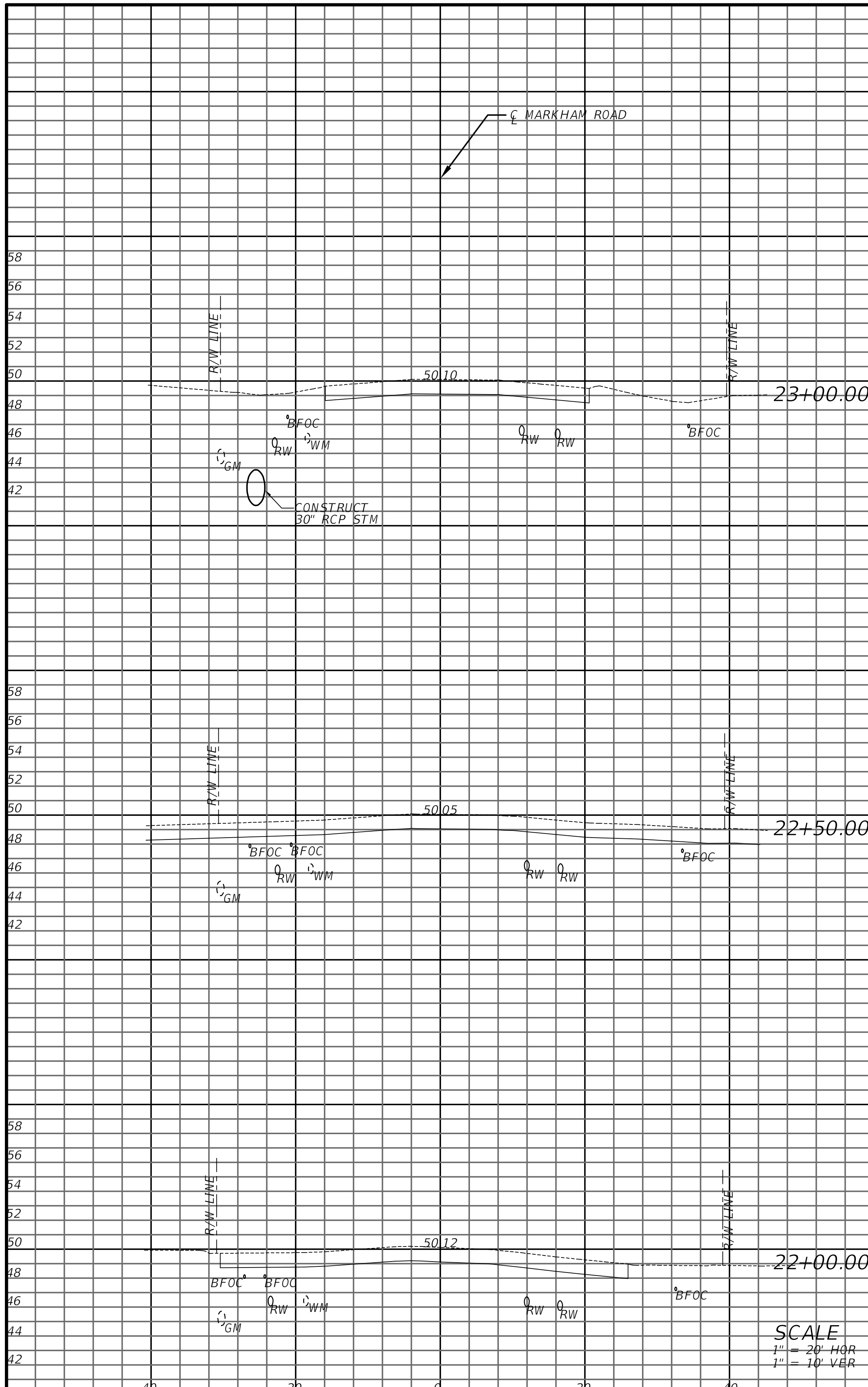
SEMINOLE COUNTY
ENGINEERING DIVISION

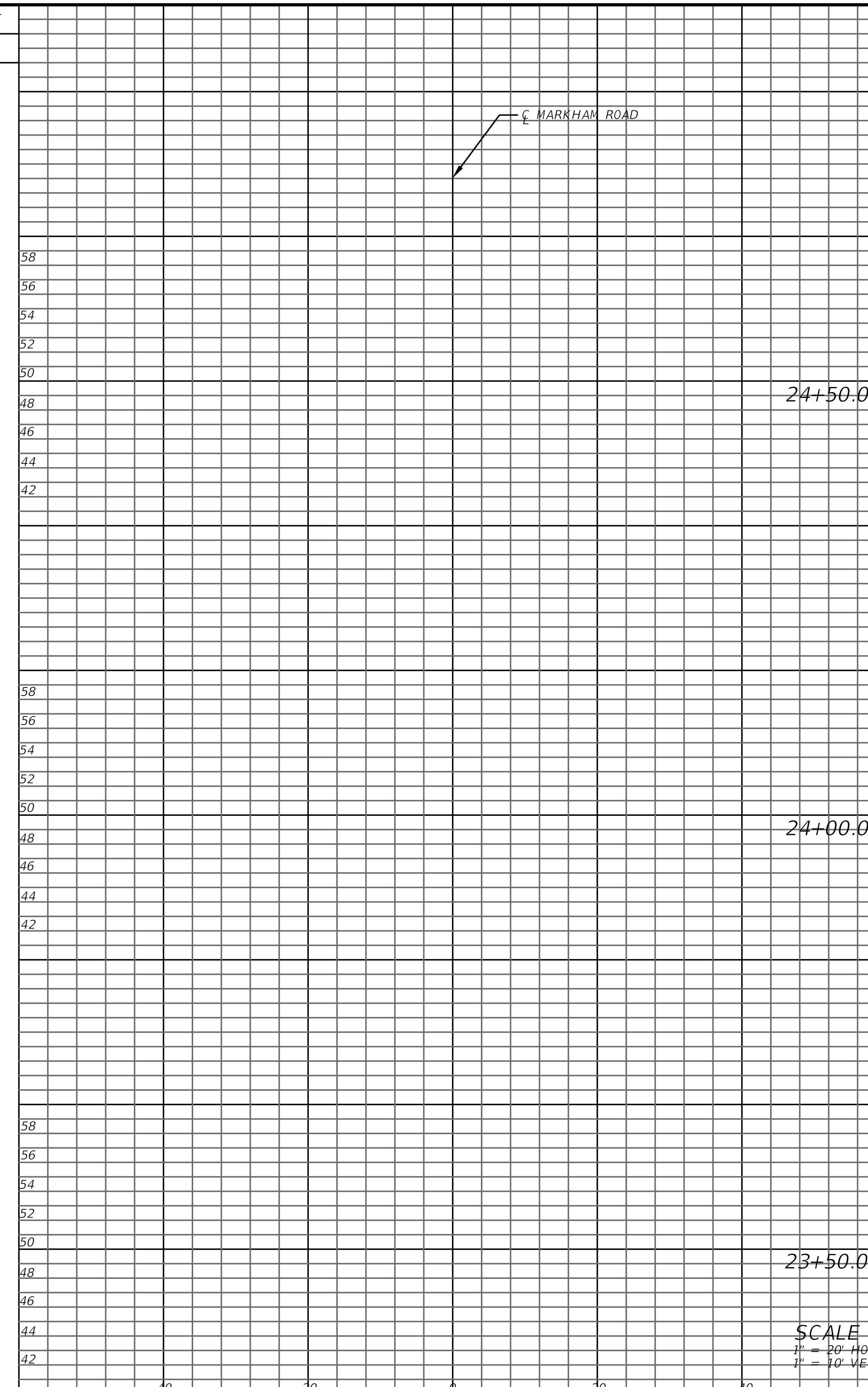
ROAD	COUNTY CIP No.
MARKHAM RD. / LAKE MARKHAM RD. DRAINAGE IMPROVEMENTS	02307084

CROSS SECTIONS
LAKE MARKHAM ROAD (6)

SHEET NO.



REGULAR EXC.		EMBANKMENT	
A	V	A	V
0.0		0.0	
	0.0		0.0
0.0		0.0	
	0.0		0.0
0.0		0.0	
	0.0		0.0



REGULAR EXC.		EMBANKMENT	
A	V	A	V

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

SEMINOLE COUNTY ENGINEERING DIVISION

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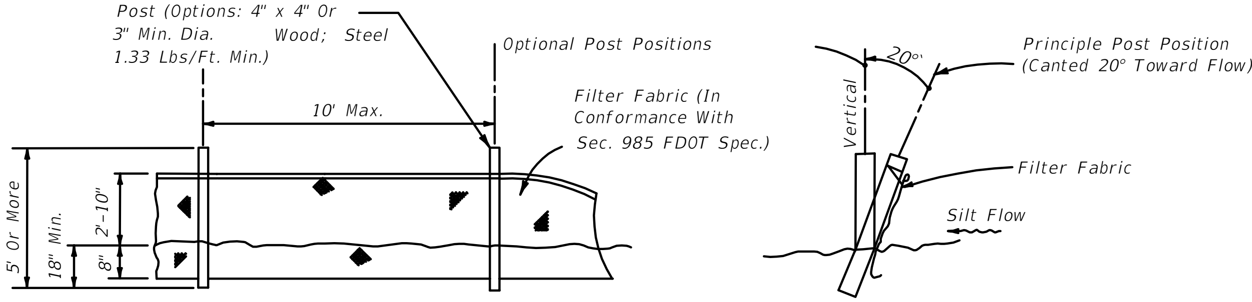
SEMINOLE COUNTY ENGINEERING DIVISION

ROAD	COUNTY CIP No.
MARKHAM RD. / LAKE MARKHAM RD. DRAINAGE IMPROVEMENTS	02307084

CROSS SECTIONS MARKHAM ROAD (7)

SHEET NO.

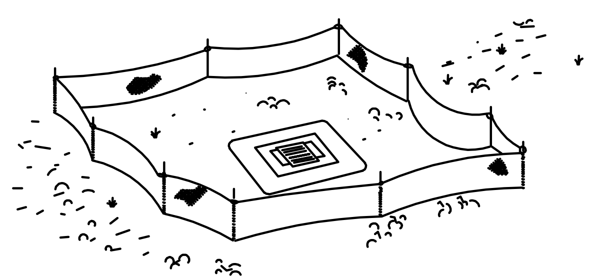
30



ELEVATION

SECTION

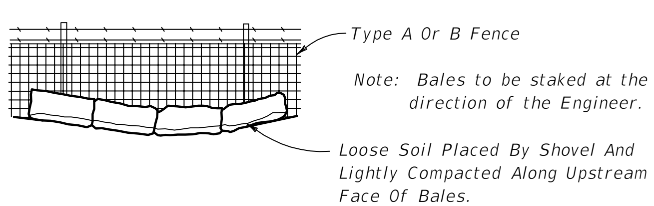
TYPE IV SILT FENCE



Type IV Silt Fence Protection
Around Ditch Bottom Inlets.

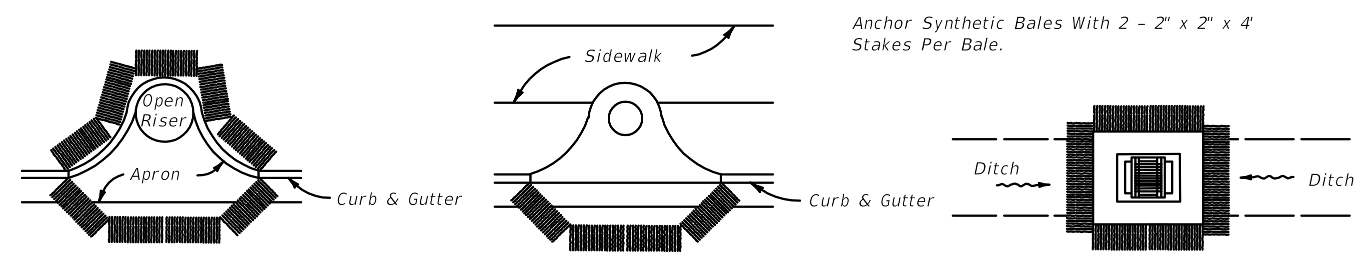
Do not deploy in a manner that silt fences will act as a dam across permanent flowing watercourses. Silt fences are to be used at upland locations and turbidity barriers used at permanent bodies of water.

SILT FENCE APPLICATIONS



EROSION CONTROL NOTES

1. THE CONTRACTOR SHALL EXECUTE ALL MEASURES NECESSARY TO LIMIT THE TRANSPORT OF SEDIMENTS OUTSIDE THE LIMITS OF THE PROJECT TO THE VOLUME AND AMOUNT THAT ARE EXISTING PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. THIS CONDITION WILL BE SATISFIED FOR THE TOTAL ANTICIPATED CONSTRUCTION PERIOD. PROVISION MUST BE MADE TO PRESERVE THE INTEGRITY AND CAPACITY OF CHECK WEIRS, SEDIMENT BASINS, SLOPE DRAINS, GRADING PATTERNS, ETC. REQUIRED TO MEET THIS PROVISION THROUGHOUT THE LIFE OF THE CONSTRUCTION. THE CONTRACTOR SHALL PROVIDE SYNTHETIC BALES, SILT BARRIERS, TEMPORARY GRASSING, ETC. AS REQUIRED TO FULLY COMPLY WITH THE INTENT OF THIS SPECIFICATION.
2. NO EXCAVATED MATERIAL SHALL BE STOCKPILED IN SUCH A MANNER AS TO DIRECT RUNOFF DIRECTLY OFF THE PROJECT SITE OR INTO ANY ADJACENT WATER BODY OR STORMWATER COLLECTION FACILITY.
3. THE SURFACE AREA OF OPEN, RAW ERODIBLE SOIL EXPOSED BY CLEARING AND GRUBBING OPERATIONS OR EXCAVATION AND FILLING OPERATIONS SHALL BE CONTROLLED, SO THAT THIS OPERATION WILL NOT SIGNIFICANTLY AFFECT OFF-SITE DEPOSIT OF SEDIMENTS.
4. INLETS AND CATCH BASINS SHALL BE PROTECTED FROM SEDIMENT LADEN STORMWATER RUNOFF UNTIL THE COMPLETION OF ALL CONSTRUCTION OPERATIONS THAT MAY CONTRIBUTE SEDIMENT TO THE INLET. (SEE NOTE 16).
5. AREAS OPENED BY CONSTRUCTION OPERATIONS THAT ARE NOT ANTICIPATED TO BE DRESSED OR RECEIVE FINAL GRASSING TREATMENT WITHIN THIRTY DAYS SHALL BE SEEDED WITH A QUICK GROWING GRASS SPECIES WHICH WILL PROVIDE AN EARLY COVER, DURING THE SEASON IN WHICH IT IS PLANTED. TEMPORARY SEEDING SHALL BE CONTROLLED SO AS TO NOT ALTER OR COMPETE WITH PERMANENT GRASSING. THE RATE OF SEEDING SHALL BE 30 POUNDS PER ACRE.
6. THE SEEDED OR SEEDED AND MULCHED AREA(S) SHALL BE ROLLED AND WATERED AS REQUIRED TO ASSURE OPTIMUM GROWING CONDITIONS FOR THE ESTABLISHMENT OF A GOOD GRASS COVER.
7. IF AFTER 14 DAYS, THE TEMPORARY GRASSES AREAS HAVE NOT ATTAINED A MINIMUM OF 75% GOOD GRASS COVER, THE AREA WILL BE REWORKED AND ADDITIONAL SEED APPLIED TO ESTABLISH THE DESIRED VEGETATION COVER.
8. ALL FEATURES OF THE PROJECT SHALL BE CONSTRUCTED TO PREVENT EROSION AND SEDIMENT AND SHALL BE MAINTAINED DURING THE LIFE OF THE CONSTRUCTION SO AS TO FUNCTION PROPERLY WITHOUT THE TRANSPORT OF SEDIMENTS OUTSIDE THE LIMITS OF THE PROJECT.
9. ALL DISTURBED AREAS OUTSIDE THE EXCAVATION AND FILL LIMITS WILL BE RESTORED TO A CONDITION EQUAL TO OR BETTER THAN THEIR CONDITION PRIOR TO CONSTRUCTION.
10. THE CONTRACTOR WILL BE RESPONSIBLE FOR MAINTENANCE OF ALL NEWLY PLANTED GRASSES OR VEGETATION AND RETENTION/DETENTION FACILITIES UNTIL THE WORK HAS BEEN ACCEPTED BY THE COUNTY.
11. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE STABILITY OF EMBANKMENTS AND SHALL REPLACE ANY PORTION, WHICH IN THE OPINION OF THE ENGINEER, HAS BECOME DISPLACED DUE TO EROSION OR DUE TO CARELESSNESS OR NEGLIGENCE ON THE PART OF THE CONTRACTOR.
12. THE CONTRACTOR SHALL COMPLY WITH ALL FEDERAL, STATE, AND LOCAL LAWS AND REGULATIONS CONTROLLING POLLUTION OF THE ENVIRONMENT. MEASURES SHALL BE TAKEN BY THE CONTRACTOR TO CONTROL EROSION AND SEDIMENT RUNOFF FROM THE SITE DURING CONSTRUCTION. SUCH METHODS SHALL BE IN ACCORDANCE WITH THE CURRENT FLORIDA DEPARTMENT OF TRANSPORTATION STANDARDS.
13. ABSOLUTELY NO WORK WILL BE ALLOWED WITHIN ANY CONSERVATION AREA, BUFFER AREA, MITIGATION AREA OR DESIGNATED WETLAND AREA UNLESS SO SPECIFICALLY DESCRIBED BY THE PLANS AND GRANTED BY REASON OF PERMIT FROM THE GOVERNMENTAL ENTITY HAVING JURISDICTION OVER SAID AREA.
14. PRIOR TO CLEARING AND GRUBBING, THE LIMITS OF WETLANDS, BUFFERS, AND MITIGATION AREAS SHALL BE CLEARLY MARKED ALONG THE PROPOSED RIGHT OF WAY LINE TO PROTECT THESE AREAS FROM ENCROACHMENT FROM CONSTRUCTION ACTIVITIES.
15. ALL FILL EMBANKMENT AND GRADED AREAS SHALL BE PROTECTED AGAINST EROSION BY METHODS STATED IN "SECTION 104," F.D.O.T. STANDARD SPECIFICATIONS FOR BRIDGE AND ROAD CONSTRUCTION. SIDE SLOPE MAY BE SEEDED AND MULCHED, PROVIDED THAT THE MULCH MATERIAL IS DISC HARROWED AND THE SIDE SLOPES ARE NEITHER GREATER THAN 4:1 NOR PART OF A DRAINAGE CONVEYANCE.
16. EROSION CONTROL AT ALL INLET DRAINAGE STRUCTURES DURING CONSTRUCTION SHALL BE DONE IN ACCORDANCE WITH SECTION 104 PREVENTION, CONTROL AND ABATEMENT OF EROSION AND WATER POLLUTION.



PARTIAL INLET

COMPLETED INLET

DITCH BOTTOM INLET

PROTECTION AROUND INLETS OR SIMILAR STRUCTURES

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

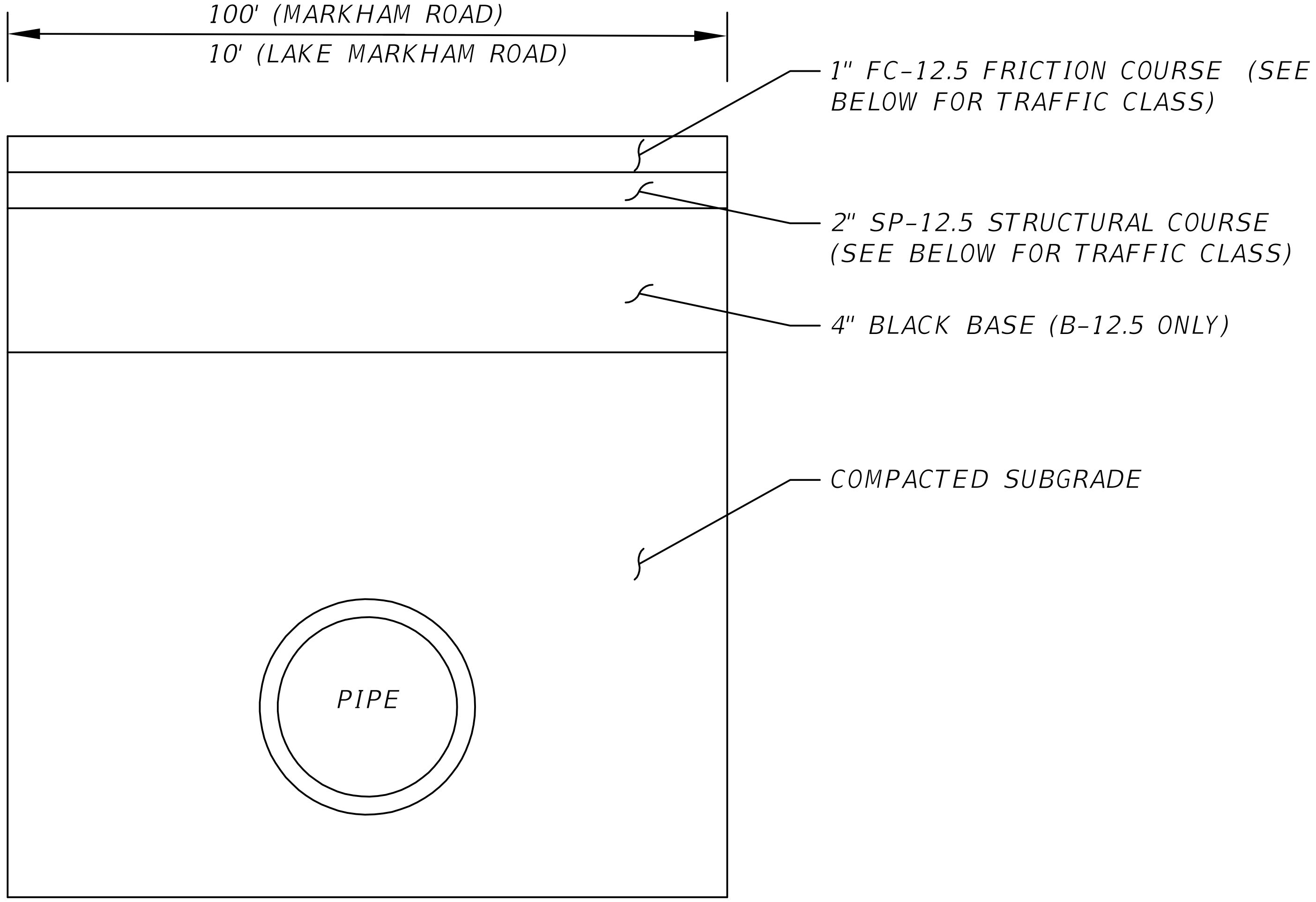
SEMINOLE COUNTY
ENGINEERING DIVISION
JEFFREY L. SLOMAN
P.E. No. 56160
100 East 1st. Street
Sanford, Fl 32771

SEMINOLE COUNTY
ENGINEERING DIVISION

ROAD	COUNTY CIP No.
MARKHAM RD. / LAKE MARKHAM RD. DRAINAGE IMPROVEMENTS	02307084

EROSION CONTROL NOTES

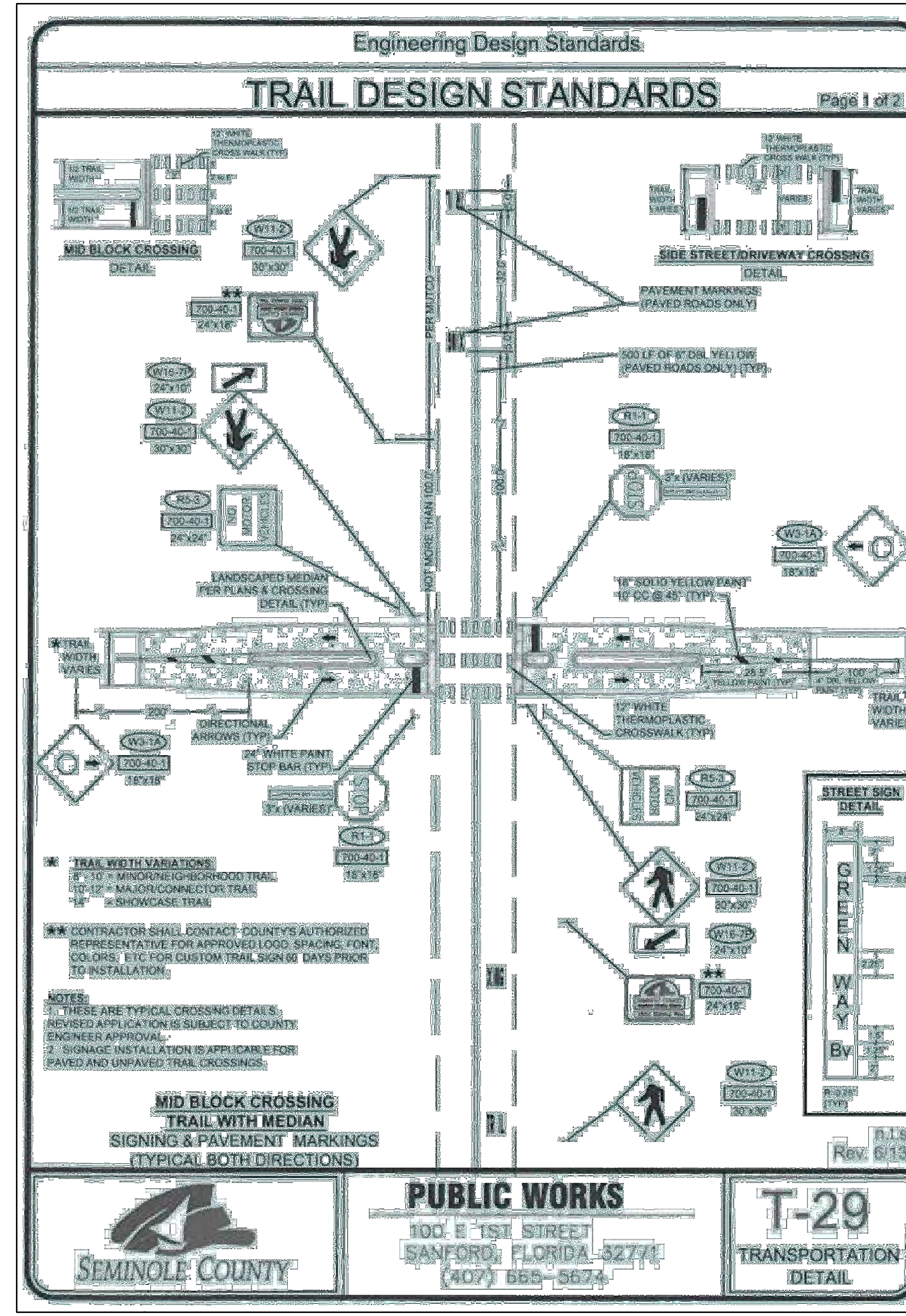
SHEET NO. 31



LAKE MARKHAM ROAD - TRAFFIC CLASS B
MARKHAM ROAD - TRAFFIC CLASS C

PAVEMENT RESTORATION DETAIL

NOT SCALE



REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

SEMINOLE COUNTY ENGINEERING DIVISION
JEFFREY L. SLOMAN
P.E. No. 56160
100 East 1st. Street
Sanford, Fl 32771

SEMINOLE COUNTY ENGINEERING DIVISION

ROAD	COUNTY CIP No.
MARKHAM RD. / LAKE MARKHAM RD. DRAINAGE IMPROVEMENTS	02307084

SPECIAL DETAILS SHEET

SHEET NO. 32

1. SITE DESCRIPTION

A. CONSTRUCTION ACTIVITY
THE CONSTRUCTION ACTIVITIES INCLUDE CONSTRUCTING SIDEWALK ON THE WEST SIDE OF W. AIRPORT BLVD., CONSTRUCTING SIDEWALK ON THE NORTH SIDE OF COUNTRY CLUB RD., AND CONSTRUCTING SIDEWALK ON THE WEST SIDE OF SOUTHWEST RD. DRAINAGE ACTIVITIES INCLUDE THE RETROFIT OF EXISTING DITCHES AND STORM DRAIN SYSTEMS THAT WILL BE IMPACTED BY THE ADDITION OF THE SIDEWALK AS INDICATED IN THE ROADWAY CROSS SECTIONS OF THE CONSTRUCTION PLANS.

PROJECT LIMITS
STA. 91+00.00 TO STA. 106+65.93 BASELINE OF SURVEY OF LAKE MARKHAM ROAD, STA. 22+40.00 TO STA. 24+40.00 BASELINE OF SURVEY OF MARKHAM ROAD IN SECTION 35, TOWNSHIP 19 SOUTH, RANGE 29 EAST, IN SEMINOLE COUNTY FOR A TOTAL OF 0.33 MILES.

PROJECT DESCRIPTION
THE OVERALL PROJECT ADDRESSES THE FLOODING THAT OCCURS WITH TYPICAL SUMMER RAIN AT THE MARKHAM ROAD / LAKE MARKHAM ROAD INTERSECTION. THIS EXISTING STORM DRAIN SYSTEM IS UNDERSIZED AND LACKS STORM DRAIN AND STRUCTURES AT LOW SPOTS ALONG LAKE MARKHAM ROAD

B. MAJOR SOIL DISTURBING ACTIVITIES
SOIL DISTURBING ACTIVITIES WILL INCLUDE CONSTRUCTING SIDEWALK AND DITCH GRADING AND STORM DRAIN CONSTRUCTION

C. TOTAL PROJECT AREA: 2.2 ACRES
TOTAL AREA TO BE DISTURBED: 1.4 ACRES

D. (1) RUNOFF COEFFICIENTS BEFORE, DURING AND AFTER CONSTRUCTION:

RUNOFF COEFFICIENT FOR: GRASSED AREA ADJACENT TO PAVEMENT, C = 0.20
IMPERVIOUS SURFACE, C = 0.95
DISTURBED AREAS DURING CONSTRUCTION, C = 0.40

BEFORE CONSTRUCTION C = 0.27
DURING CONSTRUCTION (VARIES) C = 0.27
AFTER CONSTRUCTION C = 0.27

(2) DESCRIPTION OF SOIL OR QUALITY OF DISCHARGE:
SOILS WITHIN THE PROJECT AREA ARE DESCRIBED IN GENERAL AS URBAN LAND. DETAILED DATA IS SUPPLIED IN THE SOIL SURVEY OF SEMINOLE COUNTY, PREPARED BY THE NATURAL RESOURCE CONSERVATION SERVICE.

(3) ESTIMATES OF SIZE OF DRAINAGE AREA FOR EACH OUTFALL:
(a) SITE MAP: THE CONSTRUCTION PLANS ARE BEING USED AS THE SITE MAP
(b) DRAINAGE MAP: THE CONSTRUCTION PLANS ARE BEING USED AS THE DRAINAGE MAP. BASIN 1: 49.85 AC (TOTAL DRAINAGE TO OUTFALL TO CARISBROOKE WETLAND)

E. LOCATIONS OF DRAINAGE AREAS AND POND OUTFALL:
BASIN 1: INCLUDES ENTIRE STORM DRAIN SYSTEM THAT DRAINS INTO EXISTING WETLAND WITHIN CARISBROOKE SUBDIVISION. NO PROPOSED POND.

F. (1) NAME OF RECEIVING WATERS:
BIG WEKIVA RIVER / YANKEE LAKE

(2) WETLAND AREA:
WETLAND IMPACTS: 373 SQUARE FEET (0.0085 Ac)

2. CONTROLS

NARRATIVE – SEQUENCE OF SOIL DISTURBING ACTIVITIES AND IMPLEMENTATION OF CONTROLS. CONSTRUCTION ACTIVITIES ON THIS PROJECT CONSIST OF FOUR (4) DISTINCT ELEMENTS.

ALL ITEMS REPRESENTED IN THE FOLLOWING DISCUSSION ARE DETAILED IN THE "FDOT STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION AND WILL BE IMPLEMENTED BY THE ENGINEER IN A MANNER APPROPRIATE TO ENVIRONMENTALLY SENSITIVE CONSTRUCTION PRACTICES.

2.1 THE CONTRACTOR WILL BE REQUIRED TO PREPARE A SITE-SPECIFIC EROSION CONTROL PLAN. THE CONTRACTOR WILL ALSO BE REQUIRED TO MODIFY THE PLAN OR MATERIALS TO ADAPT TO SEASONAL VARIATIONS. THE PLAN WILL INCLUDE:

THE CONSTRUCTION PROJECT SCHEDULE WITH EROSION AND SEDIMENT CONTROL INSTALLATION AND MAINTENANCE TIED TO SPECIFIC DATES OR CONSTRUCTION ACTIVITIES.
MODIFICATIONS TO THE COUNTY'S SWPPP AND EROSION CONTROL PLANS DUE TO CONTRACTOR'S PROPOSED CONSTRUCTION MEANS, METHODS AND PHASING. THE CONTRACTOR'S EROSION CONTROL PLAN WILL BE UTILIZED AS THE FIRST FORMAL UPDATE TO THE SWPPP.
NAME AND PHONE NUMBER OF CONTRACTOR'S REPRESENTATIVE RESPONSIBLE FOR EROSION AND SEDIMENT CONTROL INSTALLATION AND MAINTENANCE ON A 24-HOUR BASIS.

THE CONTRACTOR IS ADVISED THAT THE CONTRACT DRAWINGS ONLY INDICATE EROSION, SEDIMENT, AND TURBIDITY CONTROLS AT LOCATIONS DETERMINED IN THE DESIGN PROCESS. HOWEVER, THE CONTRACTOR IS REQUIRED TO UPDATE THE SWPPP TO REFLECT ANY ADDITIONAL CONTROLS NECESSARY TO PREVENT THE POSSIBILITY OF SILTING ANY ADJACENT LOWLAND PARCEL, RECEIVING WATER, OR OTHERWISE VIOLATING STATE AND FEDERAL PERMIT REQUIREMENTS.

2.2 AREAS OUTSIDE THE LIMITS OF CONSTRUCTION WILL NOT BE DISTURBED. SEALING ACTIVITIES WILL BE CONDUCTED IN A LINE FASHION ON THE EXISTING PAVEMENT. NO CONSEQUENTIAL QUANTITIES OF EXPOSED SOIL WILL RESULT FROM THIS ACTIVITY.

2.3 THE CONTRACTOR WILL PROVIDE POLLUTION CONTROL BY IMPLEMENTING DUST CONTROL DURING SEALING OPERATIONS. EXCAVATED MATERIAL WILL NOT BE DEPOSITED IN LOCATIONS WHERE IT COULD BE WASHED AWAY BY HIGH WATER OR STORM WATER RUNOFF, AND STOCKPILES SHALL BE COVERED OR ENCIRCLED WITH SEDIMENT CONTAINMENT DEVICES. ROADWAY SWEEPERS WILL ALSO BE USED IN CONJUNCTION WITH SEALING OPERATIONS. ALL TRUCKS WILL REQUIRE A COVERED BED.

2.4 THE EROSION CONTROL DEVICES FOR THESE ACTIVITIES ARE SPECIFIED IN THE PLANS AND ACCORDING TO THE "FDOT STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION" SECTION 104. SPECIFICALLY, SILT FENCE WHERE RUNOFF MAY LEAVE THE CONSTRUCTION SITE, AS NEEDED. FOR EROSION CONTROL MEASURES SEE PLAN SHEETS IN THE CONTRACT PLANS.

A. EROSION AND SEDIMENT CONTROLS
(1) STABILIZATION PRACTICES
___ TEMPORARY SODDING
___ TEMPORARY GRASSING
_X_ PERMANENT PLANTING OR SODDING
___ TEMPORARY MULCHING
___ ARTIFICIAL COVERING
_X_ BUFFER ZONES
_X_ PRESERVATION OF NATURAL RESOURCES

OTHER:
STABILIZATION MEASURES SHALL BE INITIATED FOR EROSION AND SEDIMENT CONTROL ON DISTURBED AREAS AS SOON AS PRACTICABLE, BUT IN NO CASE AFTER MORE THAN 7 DAYS, IN PORTIONS OF THE SITE WHERE CONSTRUCTION ACTIVITIES HAVE TEMPORARILY OR PERMANENTLY CEASED.

PERMANENT SOIL EROSION CONTROL MEASURES FOR ALL SLOPES, CHANNELS, DITCHES OR ANY DISTURBED LAND AREAS SHALL BE COMPLETED IMMEDIATELY AFTER FINAL GRADING. WHEN IT IS NOT POSSIBLE TO PERMANENTLY PROTECT A DISTURBED AREA IMMEDIATELY AFTER GRADING OPERATION, TEMPORARY EROSION CONTROL MEASURES SHALL BE INSTALLED. ALL TEMPORARY PROTECTION SHALL BE MAINTAINED UNTIL PERMANENT MEASURES ARE IN PLACE AND ESTABLISHED.

(2) STRUCTURAL PRACTICES
___ SAND BAGGING
_X_ SILT FENCES
_X_ HAY BALES / INLET PROTECTION
___ ROCK BAGS
___ BERMS
___ DIVERSION, INTERCEPTOR, OR PERIMETER DITCHES
___ PIPE SLOPE DRAINS
___ FLUMES
___ ROCK BEDDING AT CONSTRUCTION EXIT
___ TIMBER BEDDING AT CONSTRUCTION EXIT
___ DITCH LINER
___ SEDIMENT TRAPS
___ SEDIMENT BASINS
___ STORM INLET SEDIMENT TRAP
___ STORM OUTLET STRUCTURES
___ CURBS AND GUTTERS
___ STORM SEWERS
___ VELOCITY CONTROL DEVICES
___ TURBIDITY BARRIER
___ RIP RAP
___ DITCH BLOCKS

OTHER:
THE DEVICES INDICATED ABOVE WILL BE IMPLEMENTED ACCORDING TO THE MANDATES AND STANDARD PRACTICES. OTHER STRUCTURAL PRACTICES MAY BE IMPLEMENTED AT THE DIRECTION OF THE ENGINEER.

THE CONTRACTOR SHALL FURNISH, INSTALL, MAINTAIN AND SUBSEQUENTLY REMOVE, ALL NECESSARY EROSION CONTROL, INCLUDING BUT NOT LIMITED TO SILT FENCES AND ANY OTHER MISCELLANEOUS ITEMS AS INDICATED WITHIN THE CONTRACT DOCUMENTS, CONTRACTOR'S EROSION CONTROL PLAN, OR AS REQUIRED PER APPLICABLE STANDARDS OR THE ENGINEER.

B. OTHER CONTROLS
(1) WASTE DISPOSAL
THE CONTRACTOR WILL PROVIDE LITTER CONTROL AND COLLECTION WITHIN THE PROJECT BOUNDARIES DURING CONSTRUCTION ACTIVITIES. ALL FERTILIZER, HYDROCARBON OR OTHER CHEMICAL CONTAINERS SHALL BE DISPOSED OF BY THE CONTRACTOR ACCORDING TO EPA'S STANDARD PRACTICES AS DETAILED BY THE MANUFACTURER. DETAILED ELEMENTS OF WASTE DISPOSAL CONTROLS ARE TO BE DEVELOPED AS PART OF THE CONTRACTOR'S SWPPP.

(2) OFFSITE VEHICLE TRACKING
___ HAUL ROADS DAMPENED FOR DUST CONTROL
_X_ LOADED HAUL TRUCKS TO BE COVERED WITH TARPAULIN
_X_ EXCESS DIRT ON ROAD REMOVED DAILY
___ STABILIZED CONSTRUCTION ENTRANCE

OTHER:
DETAILED ELEMENTS OF OFFSITE VEHICLE TRACKING CONTROLS ARE TO BE DEVELOPED AS PART OF THE CONTRACTOR'S EROSION CONTROL PLAN (ECP).

(3) SANITARY WASTE
FIELD OFFICES MAY HAVE CONNECTIONS TO MUNICIPAL SEWAGE TREATMENT IF AVAILABLE. IF MUNICIPAL SEWAGE TREATMENT IS NOT AVAILABLE THE CONTRACTOR WILL PROVIDE FOR SEWAGE TREATMENT IN ACCORDANCE WITH F.A.C. 64E-6 "STANDARDS FOR ON-SITE SEWAGE DISPOSAL SYSTEMS." DETAILED ELEMENTS OF SANITARY WASTE CONTROLS ARE TO BE DEVELOPED AS PART OF THE CONTRACTOR'S ECP.

(4) FERTILIZERS AND PESTICIDES
FERTILIZERS: FERTILIZERS WILL BE USED ON THIS PROJECT IN ACCORDANCE WITH FDOT STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, SECTION 982, AT THE DISCRETION OF THE CONTRACTOR WITH COORDINATION OF THE ENGINEER. DETAILED ELEMENTS OF FERTILIZER AND PESTICIDE CONTROLS ARE TO BE DEVELOPED AS PART OF THE CONTRACTOR'S ECP.

PESTICIDES: NONE REQUIRED

(5) NON-STORM WATER DISCHARGE, INCLUDING SPILL REPORTING
THE CONTRACTOR IS RESPONSIBLE FOR DOCUMENTING THIS PORTION OF THE SWPPP IN THE SECTION 104 EROSION CONTROL PLAN. WHEN THE CONTRACTOR ENCOUNTERS A SPILL, CONSTRUCTION WILL STOP AND WORK WILL NOT RESUME UNTIL DIRECTED BY THE PROJECT ENGINEER. DISPOSITION OF HAZARDOUS WASTE WILL BE MADE IN ACCORDANCE WITH ANY REQUIREMENTS AND REGULATIONS OF ANY LOCAL, STATE, OR FEDERAL AGENCY HAVING JURISDICTION.

D. APPROVED STATE, LOCAL PLANS OR STORM WATER PERMIT(S)
A PERMIT WILL BE REQUIRED FROM THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT.

3. MAINTENANCE

THE CONTRACTOR SHALL BE RESPONSIBLE FOR DAILY INSPECTIONS AND MAINTENANCE OF ALL EROSION CONTROL DEVICES AND PRACTICES THROUGHOUT THE CONSTRUCTION PHASE OF THE PROJECT. REMEDIAL ACTION SHALL BE PERFORMED IMMEDIATELY. MAINTENANCE SHALL BE CONDUCTED IN ACCORDANCE WITH THE "FDOT STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, SECTION 104 AND "FDOT EROSION AND SEDIMENT CONTROL MANUAL".

4. INSPECTION

THE CONTRACTOR IS REQUIRED TO INSPECT ALL EROSION CONTROL FEATURES AT LEAST ONCE EVERY SEVEN CALENDAR DAYS AND WITHIN 24 HOURS OF THE END OF A RAIN EVENT OF 0.5 INCHES OR GREATER. IN ADDITION, MAINTAIN ALL EROSION CONTROL FEATURES AS REQUIRED HEREIN AND AS SPECIFIED IN STATE AND/OR FEDERAL ENVIRONMENTAL REGULATORY PERMITS. THIS INCLUDES, BUT IS NOT LIMITED TO, THE DAILY REVIEW OF THE LOCATION OF SILT FENCES IN AREAS WHERE CONSTRUCTION ACTIVITIES HAVE CHANGED THE NATURAL CONTOUR AND DRAINAGE RUNOFF TO ENSURE THAT SILT FENCES ARE PROPERLY LOCATED FOR EFFECTIVENESS. THE CONTRACTOR WILL USE FDOT FORM 650-040-03 TO REPORT ALL INSPECTION FINDINGS AND CORRECTIVE ACTIONS TAKEN AS A RESULT OF THE INSPECTION. THE CONTRACTOR WILL SIGN EACH INSPECTION REPORT AND SUBMIT IT WEEKLY TO THE ENGINEER. IT IS THE CONTRACTOR'S RESPONSIBILITY TO MAINTAIN RAIN GAUGES ON THE PROJECT SITE AND RECORD WEEKLY RAINFALL. WHERE SITES HAVE BEEN FINALLY STABILIZED, INSPECTIONS SHALL BE CONDUCTED AT LEAST ONCE A MONTH.

REVISIONS

DATE	DESCRIPTION	DATE	DESCRIPTION

SUMMARY OF CLEARING AND GRUBBING & REMOVAL ITEMS

PAY ITEM NO.	PAY ITEM DESCRIPTION	LOCATION	SIDE	AREA ID	LENGTH	WIDTH	UNITS	SECONDARY UNITS (IF LUMP SUM)	QUANTITY		TOTAL		DESIGN NOTES	CONSTRUCTION REMARKS
		STA. TO STA.						AREA (AC.)	P	F	P	F		
110-4-1	REMOVAL OF EXISTING CONCRETE	91+12.97 TO 91+75.19	RT				SY		33.4		1,549		6' SIDEWALK	
		91+94.31 TO 93+26.03	RT				SY		85.8				6' SIDEWALK	
		93+43.93 TO 106+31.93	RT				SY		833.6				6' SIDEWALK	
		92+20.23 TO 102+30.03	LT				SY		558.4				5' SIDEWALK	
		93+18.05 TO 93+48.16	RT				SY		37.8				DRIVEWAY	

SUMMARY OF EARTHWORK

PAY ITEM NO.	PAY ITEM DESCRIPTION	CY		DESIGN NOTES	CONSTRUCTION NOTES
		P	F		
120-1	EXCAVATION, REGULAR	133.4			
120-6	EMBANKMENT (FILL)	246.3		VALUE DOES NOT INCORPORATE ANY SHRINKAGE FACTORS FOR FILL	

550-10-228 LF

SUMMARY OF FENCING

LOCATION	SIDE	AREA ID	LENGTH	WIDTH	FENCING (TYPE B) (5.1'-6.0' HEIGHT) (RESET EXISTING) 550-10-228 LF		DESIGN NOTES	CONSTRUCTION REMARKS
STA. TO STA.					P	F		
93+57.34 TO 96+18.73	RT		271.4				TO BE RELOCATED 1' BEHIND BACK OF SIDEWALK	
98+18.62 TO 98+34.97	RT		26.4				TO BE RELOCATED 1' BEHIND BACK OF SIDEWALK	
99+72.23 TO 99+87.23	RT		25.0				TO BE RELOCATED 1' BEHIND BACK OF SIDEWALK	
101+06.74 TO 101+26.74	RT		30.0				TO BE RELOCATED 1' BEHIND BACK OF SIDEWALK	
103+41.52 TO 103+61.52	RT		30.0				TO BE RELOCATED 1' BEHIND BACK OF SIDEWALK	
105+69.51 TO 105+89.51	RT		30.0				TO BE RELOCATED 1' BEHIND BACK OF SIDEWALK	
SUBTOTAL			412.8					
TOTAL			413					

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

SEMINOLE COUNTY ENGINEERING DIVISION
JEFFREY L. SLOMAN
P.E. No. 56160
100 East 1st. Street
Sanford, Fl 32771

SEMINOLE COUNTY ENGINEERING DIVISION

ROAD	COUNTY CIP No.
MARKHAM RD. / LAKE MARKHAM RD. DRAINAGE IMPROVEMENTS	02307084

TABULATION OF QUANTITIES

SHEET NO. SQ-1

SUMMARY OF PAVEMENT

PAY ITEM NO.	PAY ITEM DESCRIPTION	LOCATION: STA. TO STA.	LOCATION: DESCRIPTION	SIDE	AREA ID	LENGTH	WIDTH	UNITS	QUANTITY P	QUANTITY F	TOTAL P	TOTAL F	DESIGN NOTES	CONSTRUCTION REMARKS
160-4	TYPE B STABILIZATION, 8"	91+22.46 TO 91+78.59		RT				SY	26.6		1,321.3		4' PAVED SHOULDER	
		91+97.26 TO 93+20.90		RT				SY	53.7				4' PAVED SHOULDER	
		93+48.77 TO 106+25.07		RT				SY	567.2				4' PAVED SHOULDER	
		92+02.95 TO 102+13.70		LT				SY	673.8				4' PAVED SHOULDER + 2' UNPAVED	
285-704	OPTIONAL BASE COURSE, GROUP 04	91+22.46 TO 91+78.59		RT				SY	26.6		1,096.7		4' PAVED SHOULDER	
		91+97.26 TO 93+20.90		RT				SY	53.7				4' PAVED SHOULDER	
		93+48.77 TO 106+25.07		RT				SY	567.2				4' PAVED SHOULDER	
		92+02.95 TO 102+13.70		LT				SY	449.2				4' PAVED SHOULDER	
327-70-6	MILLING EXISTING ASPHALT PAVEMENT 1.5" AVERAGE DEPTH	91+22.46 TO 106+25.07		LT				SY	1,767.0		1,767.0			
334-1-12	SUPER PAVE ASPHALTIC CONC., TRAFFIC B, 2", PG 76-22	91+22.46 TO 91+78.59		RT				TN	2.9		120.8		4' PAVED SHOULDER (110 LBS / SY / IN)	
		91+97.26 TO 93+20.90		RT				TN	6.0				4' PAVED SHOULDER (110 LBS / SY / IN)	
		93+48.77 TO 106+25.07		RT				TN	62.4				4' PAVED SHOULDER (110 LBS / SY / IN)	
		92+02.95 TO 102+13.70		LT				TN	49.5				4' PAVED SHOULDER (110 LBS / SY / IN)	
337-7-81	ASPHALT CONCRETE FRICTION COURSE TRAFFIC B, FC-12.5, 1.5", PG 76-22	91+22.46 TO 106+25.07		LT				TN	146.1		161.1		(RESURFACING 110 LBS / SY / IN)	

SUMMARY OF CURB & GUTTER AND / OR TRAFFIC SEPARATORS

PAY ITEM NO.	PAY ITEM DESCRIPTION	LOCATION: STA. TO STA.	SIDE	AREA ID	UNITS	QUANTITY: GROSS LENGTH	DEDUCTIONS: TYPE	DEDUCTIONS: LENGTH	NET LENGTH P	NET LENGTH F	TOTAL P	TOTAL F	DESIGN NOTES	CONSTRUCTION REMARKS
520-2-4	CONCRETE CURB, TYPE D	97+65.12 TO 98+15.12	RT		LF	50			50		100			
		101+63.66 TO 102+13.66	RT		LF	50			50					

REVISIONS: DATE	DESCRIPTION	DATE	DESCRIPTION

SEMINOLE COUNTY ENGINEERING DIVISION
JEFFREY L. SLOMAN
P.E. No. 56160
100 East 1st. Street
Sanford, Fl 32771

SEMINOLE COUNTY ENGINEERING DIVISION

ROAD	COUNTY CIP No.
MARKHAM RD. / LAKE MARKHAM RD. DRAINAGE IMPROVEMENTS	02307084

TABULATION OF QUANTITIES

SHEET NO. SQ-2

SUMMARY OF SIDEWALK, DRIVEWAY & DETECTABLE WARNINGS

LOCATION	SIDE	AREA ID	LENGTH	WIDTH	CONC. SIDEWALK 4"		CONC. DRIVEWAY 6"		DETECTABLE WARNINGS		DESIGN NOTES	CONSTRUCTION REMARKS
STA. TO STA.					522-1		522-2		527-2			
					SY		SY		SF			
					P	F	P	F	P	F		
91+10.54 TO 91+76.65	RT				49.7						6' SIDEWALK	
91+94.68 TO 93+25.71	RT				86.7						6' SIDEWALK	
93+43.96 TO 106+31.93	RT				884.8						6' SIDEWALK	
92+20.23 TO 102+30.00	LT				584.5						5' SIDEWALK	
SUBTOTAL					1,605.7							
TOTAL					1,606							

SUMMARY OF PERFORMANCE TURF

LOCATION	SIDE	AREA ID	LENGTH	WIDTH	PERFORMANCE TURF (SOD)		DESIGN NOTES	CONSTRUCTION REMARKS
STA. TO STA.					570-1-2			
					SY			
					P	F		
91+24.66 TO 91+77.93	RT				56.1			
91+94.64 TO 93+27.97	RT				131.6			
93+43.98 TO 106+95.23	RT				1327.9			
92+02.90 TO 102+30.03	LT				1156.3			
SUBTOTAL					2,671.9			
TOTAL					2,672			

SUMMARY OF PAVEMENT STRIPING AND SIGNAGE

PAY ITEM NO.	PAY ITEM DESCRIPTION	UNIT	SHEET NUMBERS 8		9		10		11		12		TOTAL THIS SHEET		GRAND TOTAL	
			PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL
700-1-50	SINGLE POST SIGN RELOCATE	AS	2		5								7		7	

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

SEMINOLE COUNTY
ENGINEERING DIVISION
JEFFREY L. SLOMAN
P.E. No. 56160
100 East 1st. Street
Sanford, Fl 32771

SEMINOLE COUNTY
ENGINEERING DIVISION

ROAD	COUNTY CIP No.
MARKHAM RD. / LAKE MARKHAM RD. DRAINAGE IMPROVEMENTS	02307084

TABULATION OF QUANTITIES

SHEET NO.
SQ-3

SUMMARY OF EROSION AND SEDIMENT CONTROL DEVICES

LOCATION	SIDE	AREA ID	STAKE SILT FENCE		INLET PROTECTION SYSTEM		FLOATING TURBIDITY BARRIER		DESIGN NOTES	CONSTRUCTION REMARKS
			104-13-1		104-18		104-11			
			LF		EA		LF			
STA. TO STA.			P	F	P	F	P	F		
91+22.86 to 91+75.31	RT		58.5							
91+94.67 to 106+31.93	RT		1,441.0							
92+01.42 to 102+35.03	LT		1,036.0							
89+79.83 to 90+78.47	LT		98.6							
89+85.33 to 90+78.63	RT		93.4							
22+75.02 to 24+46.33	LT		171.3							
90+65.31	CL				1					
22+40.00	LT				1					
91+50.00	RT				1					
93+00.00	RT				1					
93+56.95	RT				1					
94+13.34	LT				1					
94+13.34	RT				1					
97+00.00	RT				1					
100+50.00	LT				1					
100+50.00	RT				1					
101+88.67	RT				1					
104+00.00	RT				1					
106+20.00	RT				1					
89+12.77 to 89+31.63	CL						50.3			
SUBTOTAL			2,898.8		13		50.3			
TOTAL			2,899		13		50			

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

SEMINOLE COUNTY
ENGINEERING DIVISION

JEFFREY L. SLOMAN
P.E. No. 56160
100 East 1st. Street
Sanford, Fl 32771

SEMINOLE COUNTY
ENGINEERING DIVISION

ROAD	COUNTY CIP No.
MARKHAM RD. / LAKE MARKHAM RD. DRAINAGE IMPROVEMENTS	02307084

TABULATION OF QUANTITIES

SHEET NO.
SQ-4

Water Quality Focused Project

Northwestern BMP 1

Water Quality Improvement Alternatives Analysis

Northwestern BMP #1

Wekiva Watershed Management Plan

Seminole County, Florida

The purpose of this water quality improvement concept is to address pollutant loads discharged from Balsa Drive to Trout Lake upstream of the Little Wekiva River. This site was identified as a priority location for a water quality enhancement project based on the Wekiva Watershed Management Plan.

The project area with existing drainage infrastructure is shown on **Figure 1**. A topographical map is included on **Figure 2**.

The goal of this improvement analysis was to provide a conceptual level assessment of the water quality benefits anticipated from the proposed best management practice (BMP). Specifically, cost benefit on a nutrient load reduction basis for total nitrogen (TN) and total phosphorus (TP) was estimated.

Existing Conditions

The project area is located east of State Road 434, at a cul-de-sac located at the west end of Balsa Drive. The contributing area consists of medium density residential land use. There is a system of curb inlets and storm piping that conveys stormwater runoff north from the intersection with Trailwood Drive and ultimately outfalls to Trout Lake. There are no existing stormwater BMPs in the contributing area.

N

Legend

- PARCELS
- SUBBASIN
- PIPES / CULVERTS
- DRAINAGE STRUCTURES

0 50 100 200 300 400 Feet

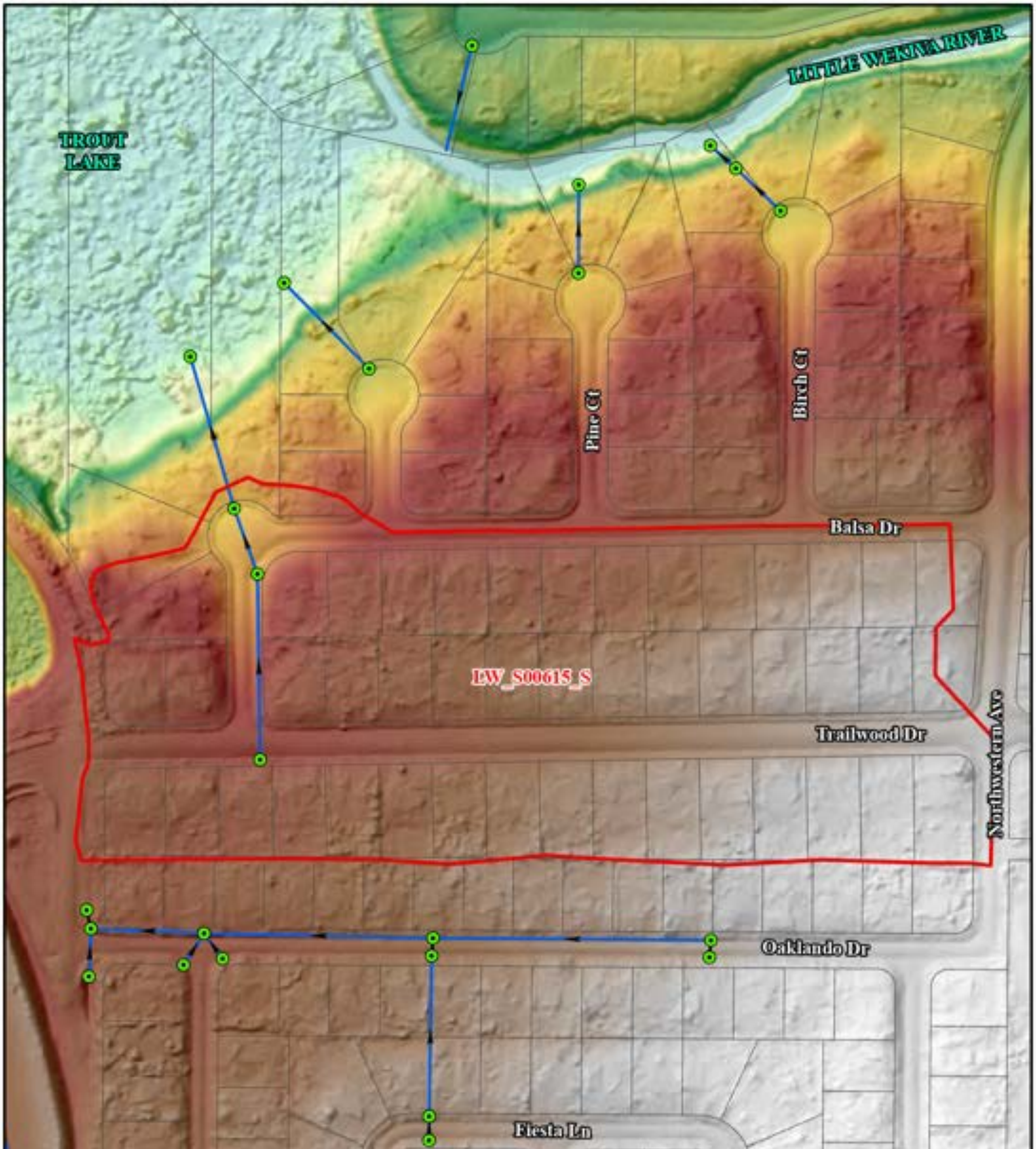
Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Site Map
Northwestern BMP #1
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure
1



N

Legend

PARCELS
SUBBASIN
PIPES / CULVERTS
DRAINAGE STRUCTURES

DEM
FEET NAVD 1988
68.47
38.6

Sources:
Parcels, Infrastructure - Seminole County, 2022
DEM - USGS LIDAR, 2018

0 50 100 200 300 400 Feet

Topographical Map
Northwestern BMP #1
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure 2

Photos of the contributing area are shown below.

Photo 1: Intersection of Trailwood Drive and Balsa Drive, Looking North

Photo 2: Balsa Drive, Looking East

Photo 3: Balsa Drive, Looking West

Photo 4: Cul-de-sac at West End of Balsa Drive

Water Quality Improvement Concept

This water quality improvement concept includes the installation of a nutrient separating baffle box (NSBB) with upflow media filter. A NSBB is a water quality treatment technology that incorporates a screening system to capture large organics and debris, as well as a series of baffles and settling chambers to settle out smaller, lighter particles. The NSBB can also incorporate treatment media in an upflow configuration that is intended to provide both physical and biological removal of TN and TP. A high level overflow is incorporated in the NSBB to allow stormwater runoff to bypass the system when needed. A concept detail of the BMP is provided in **Photo 5**.

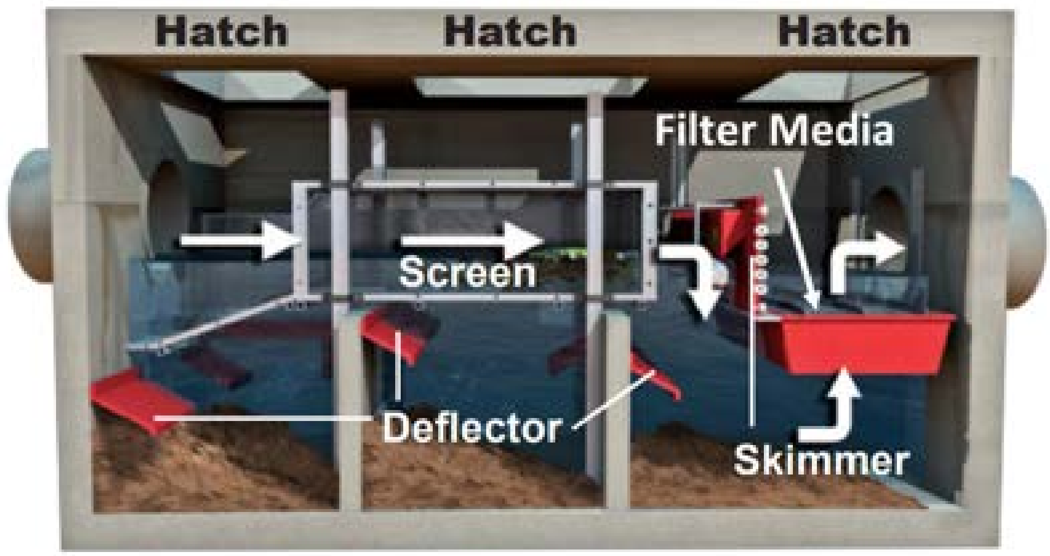
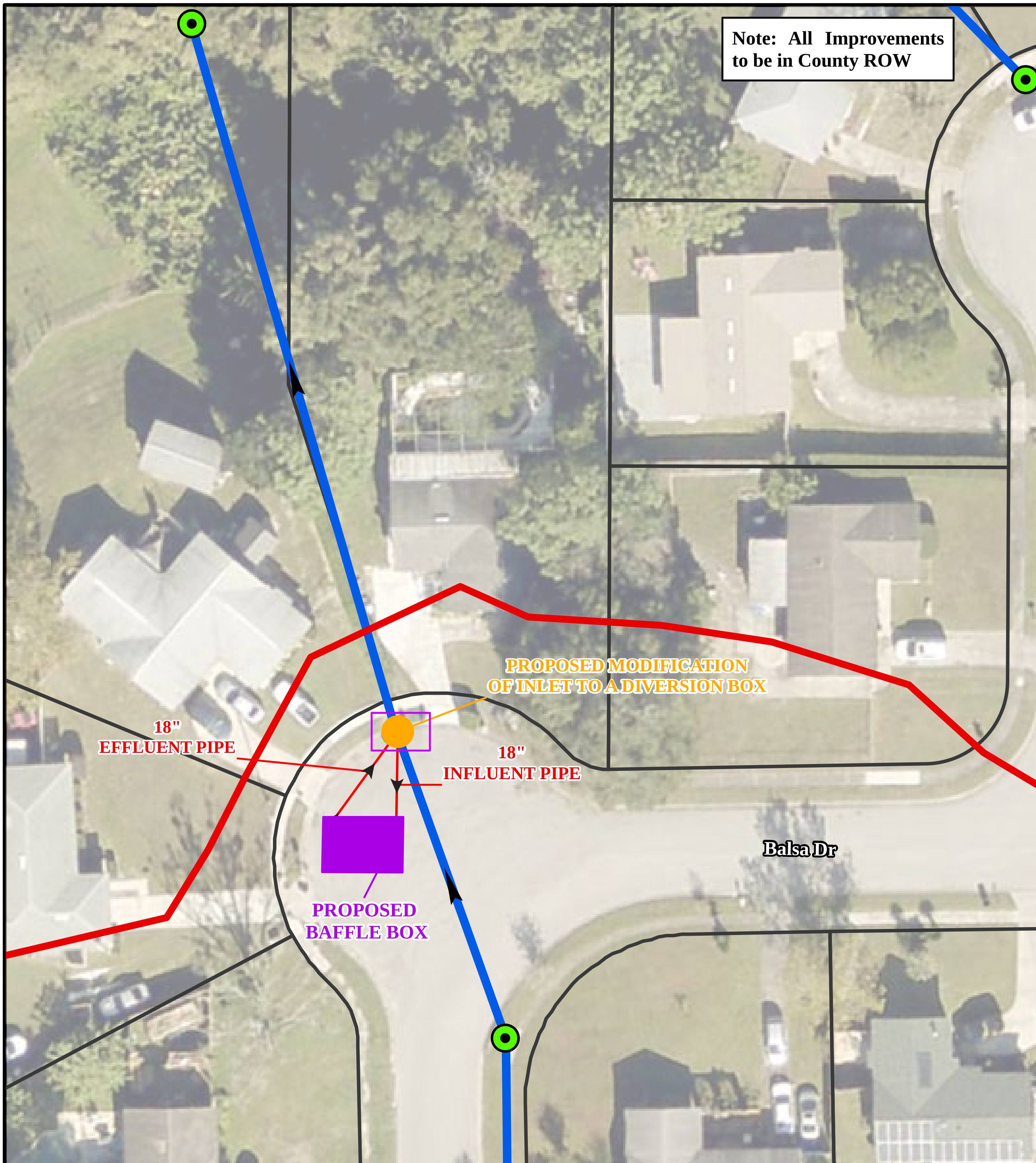


Photo 5: NSBB with Upflow Media Filter Concept (image from Oldcastle Infrastructure)

This improvement concept includes:

- Constructing the NSBB with upflow media filter in the cul-de-sac located at the west end of Balsa Drive.
- Rerouting the northern most curb inlet south to the proposed NSBB to treat stormwater runoff from the entire contributing area.
- Connecting the proposed NSBB to the existing outfall pipe that discharges to Trout lake.

The water quality improvement concept is shown on conceptually on **Figure 3**.



N

Legend

- PARCELS
- SUBBASIN
- PIPES / CULVERTS
- DRAINAGE STRUCUTRES

0 10 20 40 60 80 Feet

Sources:
Parcels - Seminole County, 2022
Infrastructure - Seminole County, 2022

Proposed Improvements Map

Northwestern BMP #1
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

Seminole County

Figure 3

Pollutant Load Benefits

The average annual pollutant load discharged from the project area (subbasin LW_S00615_S) was calculated as part of the Wekiva Watershed Management Plan utilizing a continuous simulation model run for a period of approximately 10 years. The pollutant load benefit for this water quality improvement concept was estimated based on engineering judgement and experience with similar types of stormwater BMP projects. The upflow media component of the NSBB was assigned a TN and TP removal rate of 45% based on manufacturer recommendations. The NSBB was assumed to treat 90% of the average annual stormwater runoff on a volumetric basis, which corresponds to a 10% bypass rate. The bypass rate accounts for high flow events when stormwater would bypass the BMP to avoid potential upstream flood stage impacts. The exact capture rate would be determined during design.

The estimated pollutant load benefit is summarized below in **Table 1**.

Table 1: Estimated Pollutant Load Benefit

Scenario	Average Annual TN Load (lb/yr)	Average Annual TP Load (lb/yr)	TN Load Removed (lb/yr)	TP Load Removed (lb/yr)	TN Load Removed over 20 Years (lb)	TP Load Removed over 20 Years (lb)
Proposed Conditions	114.0	18.4	46.2	7.4	924	149

Implementation Considerations

The following implementation considerations are provided for this improvement concept.

- Water Quality Benefit – This improvement provides a water quality benefit by providing treatment to the stormwater runoff prior to it discharging into Trout Lake.
- Flood Benefit – This improvement concept is not intended to provide a direct flood benefit to the project area. The proposed water quality improvement concept is not anticipated to result in peak stage increases based on model results. This would be confirmed during design.
- Permitting Considerations – It is anticipated that this improvement would require a general permit for stormwater retrofit from the St. Johns River Water Management District. Based on the location of the NSBB, the project may meet exemption criteria since there are no anticipated wetland or surface water impacts.
- Engineering Design – Final engineering design should include collection of survey data, utility designation, geotechnical testing, preparation of design plans, preparation of a cost estimate, preparation of technical specifications, and utility coordination to address any needed conflict adjustments / relocations.
- Land Acquisition – Land or easement acquisition is not anticipated for this improvement. The BMP is proposed to be constructed in the County ROW.

- Wetland / Surface Water Impacts – The proposed water quality improvement has no anticipated wetland / surface water impacts.
- Benefit/Cost – The estimated total implementation cost for this improvement is $395,133. This cost includes construction, a 20% contingency, estimated annual maintenance, design and permitting, and CEI services. This translates to load removal rates on a cost basis of $350 per pound of TN and $2,172 per pound of TP. It is noted that loading removal rates were based on the estimated construction cost and maintenance. A detailed breakdown of the preliminary cost estimate is provided in **Table 2**.

Table 2: Engineer's Estimate of Probable Improvement Costs based on Concept

Northwestern BMP #1						
Item	**Pay Item No.**	**Description**	**Units**	**Unit Cost**	**Quantity**	**Total**
1	101-1	Mobilization (15% of Construction Total)	LS	varies	1	$26,785
2	102-1	Maintenance of Traffic (5% of Construction Total)	LS	varies	1	$8,928
3	104-1	Prevention, Control and Abatement of Erosion and Water Pollution (10% of Construction Total)	LS	varies	1	$17,857
4	110-1-1	Clearing and Grubbing (5% of Construction Total)	LS	varies	1	$8,928
5	160-4	Type B Stabilization (12")	SY	$20.00	77	$1,540
6	285-704	Optional Base, Base Group 04 (6")	SY	$50.00	77	$3,850
7	334-1-13	Superpave Asphaltic Concrete, Traffic C (2")	SY	$275.00	77	$21,175
8	430-175-118	Pipe Culvert, Concrete, Round, 18" S/CD	LF	$175.00	40	$7,000
9	900-1	Nutrient Separating Baffle Box with Upflow Media Filter	EA	$145,000.00	1	$145,000
SUBTOTAL COST:						$241,063
CONTINGENCY (20%):						$48,213
CONSTRUCTION SUBTOTAL:						$289,275
MAINTENANCE SUBTOTAL:						$33,539
DESIGN & PERMITTING:						$43,391
CEI SERVICES:						$28,928
ESTIMATED TOTAL IMPLEMENTATION COST:						**$395,133**

Notes:

1) *Above estimate does not include cost for potential utility relocations.*
2) *Assumes no muck or other removal of unsuitable soils.*
3) *900-1 is the estimated installed cost for the proposed Nutrient Separating Baffle Box*
4) *Maintenance Cost is assumed to be 1% of construction cost brought to Net Present Value (NPV) over 20 years using interest rate of 7%*
5) *Design and permitting was assumed to be 15% of the construction subtotal cost based on engineering judgement.*
6) *Construction engineering and inspection (CEI) services was assumed to be 10% of the construction subtotal cost based on engineering judgement.*

The information provided herein in considered to be preliminary for project planning purposes. As noted previously, design level efforts including detailed modeling will be necessary to quantify bypass rates, confirm flood stages, confirm pollutant load reductions, etc.

Conclusions

The goal of this effort was to develop a water quality improvement concept to reduce the pollutant loads discharged from the project area. A concept was developed consisting of installing a NSBB with upflow media filter at the cul-de-sac located at the west end of Balsa Drive. The existing drainage infrastructure would be rerouted to the proposed NSBB for treatment and the NSBB would discharge treated stormwater runoff to the existing outfall pipe.

The nutrient load reduction via the NSBB over the 20 year expected life is estimated below:

- TN mass removed = 924 lbs.
- TP mass removed = 149 lbs.

The total project implementation cost was estimated to be approximately $395,133 including construction, contingency, maintenance, design and permitting, and CEI services. The project cost benefit from a pollutant load reduction perspective was determined to be:

- $350 per lb of TN.
- $2,172 per lb of TP.

Based on the foregoing, Geosyntec recommends that the County pursue design of this water quality improvement for the anticipated water quality benefits.

Water Quality Focused Project

Northwestern BMP 2

Water Quality Improvement Alternatives Analysis

Northwestern BMP #2

Wekiva Watershed Management Plan
Seminole County, Florida

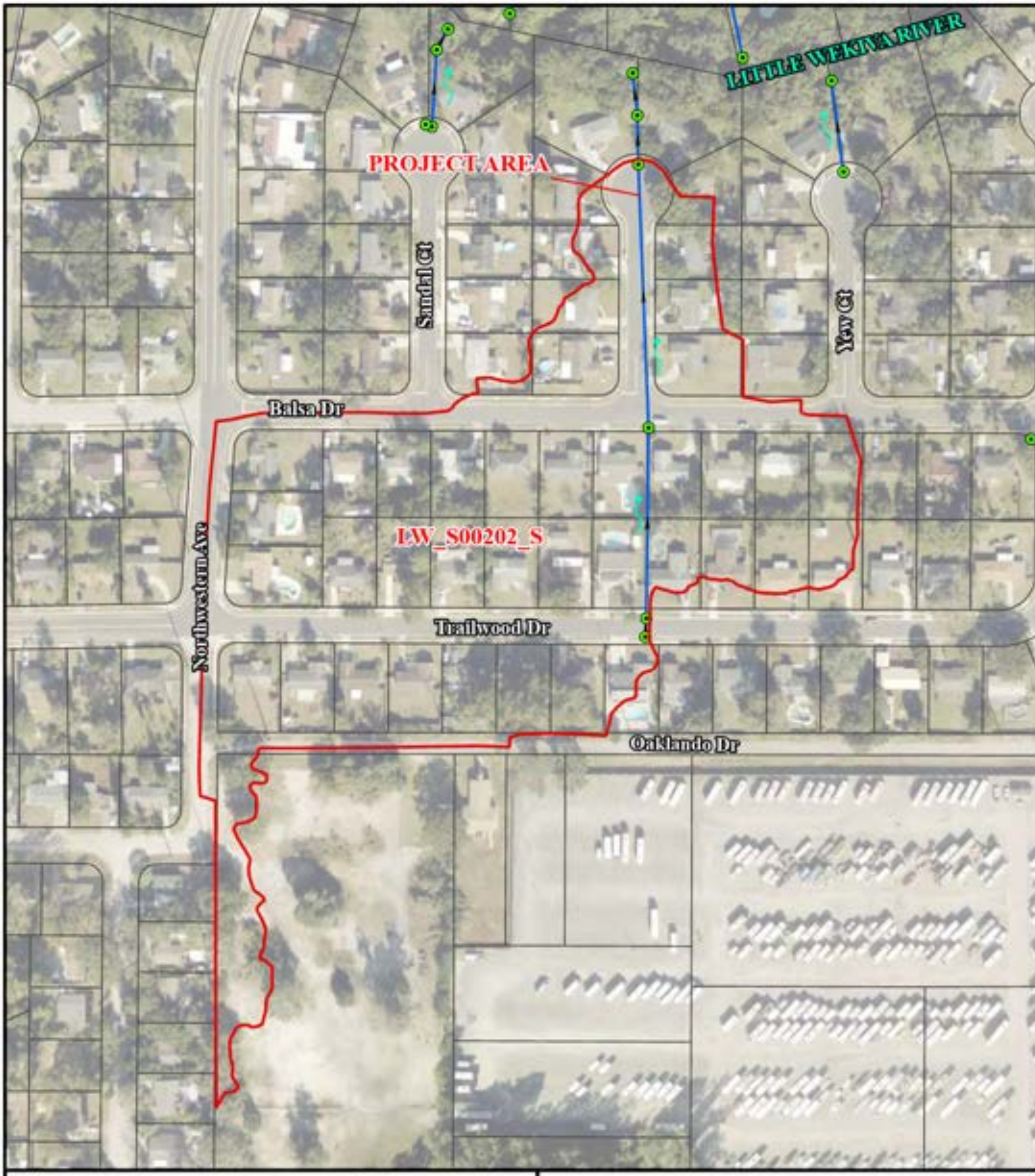
The purpose of this water quality improvement concept is to address pollutant loads discharged from Hickory Court to the Little Wekiva River. This site was identified as a priority location for a water quality enhancement project based on the Wekiva Watershed Management Plan.

The project area with existing drainage infrastructure is shown on **Figure 1**. A topographical map is included on **Figure 2**.

The goal of this improvement analysis was to provide a conceptual level assessment of the water quality benefits anticipated from the proposed best management practice (BMP). Specifically, cost benefit on a nutrient load reduction basis for total nitrogen (TN) and total phosphorus (TP) was estimated.

Existing Conditions

The project area is located east of State Road 434, at a cul-de-sac located at the end of Hickory Court. The contributing area consists of medium density residential land use. There is a system of curb inlets and storm piping that conveys stormwater runoff north from Trailwood Drive and ultimately outfalls to the Little Wekiva River. There are no existing stormwater BMPs in the contributing area.



Legend

- PARCELS
- SUBBASINS
- PIPES / CULVERTS
- DRAINAGE STRUCTURES

0 50 100 200 300 400 Feet

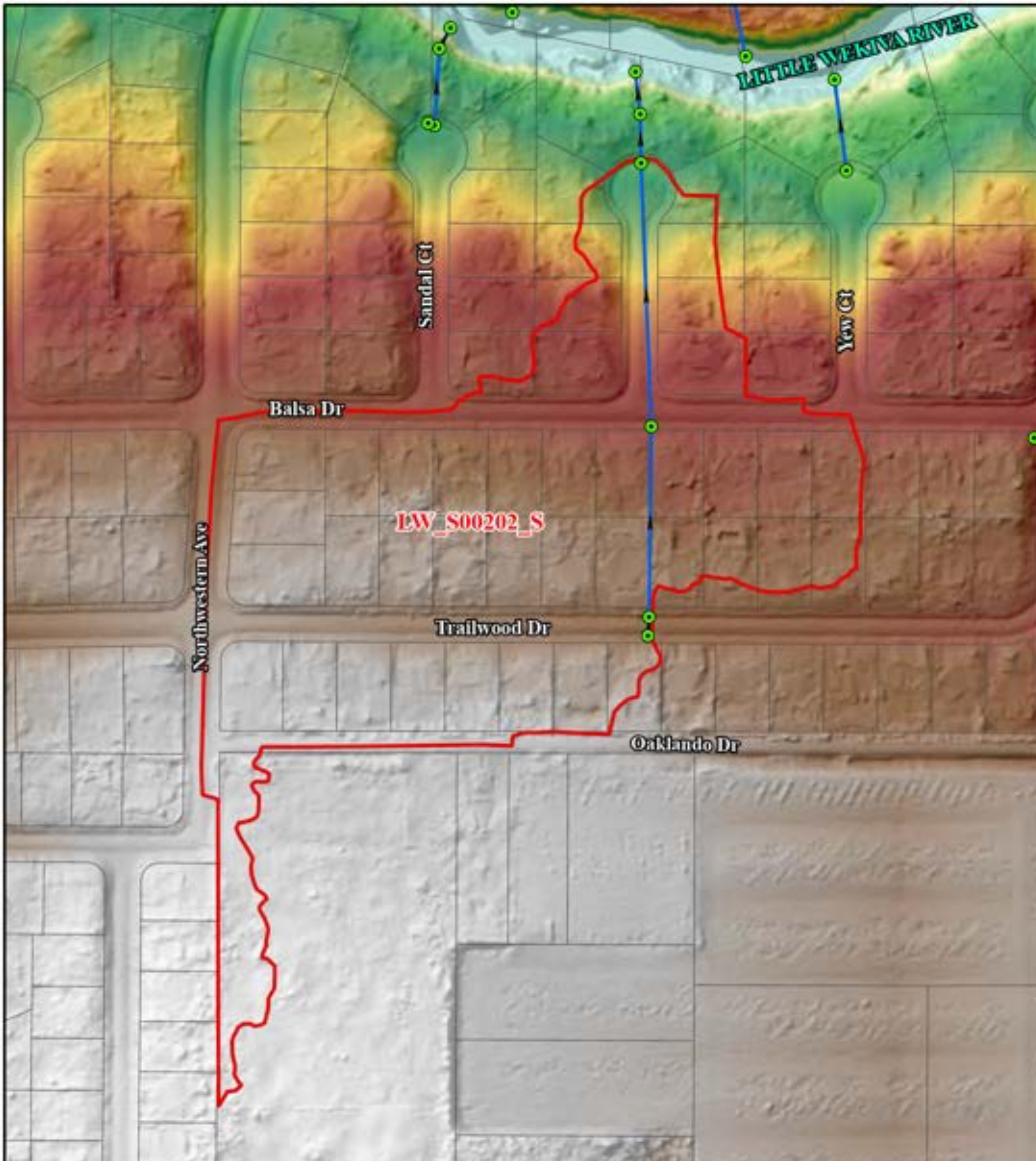
Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Site Map
Northwestern BMP #2
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure 1



Legend

- PARCELS
- SUBBASINS
- DRAINAGE STRUCTURES
- PIPES / CULVERTS

DEM
FEET NAVD 1988
68.47
38.6

Sources:
Parcels, Infrastructure - Seminole County, 2022
DEM - USGS LIDAR, 2018

0 50 100 200 300 400 Feet

Topographical Map
Northwestern BMP #2
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure
2

Photos of the contributing area are shown below.

Photo 1: Intersection of Hickory Court and Balsa Drive, Looking North

Photo 2: Intersection of Hickory Court and Balsa Drive, Looking South

Photo 3: Balsa Drive, Looking West

Photo 4: Cul-de-sac at the North End of Hickory Court

Water Quality Improvement Concept

This water quality improvement concept includes the installation of a nutrient separating baffle box (NSBB) with upflow media filter. A NSBB is a water quality treatment technology that incorporates a screening system to capture large organics and debris, as well as a series of baffles and settling chambers to settle out smaller, lighter particles. The NSBB can also incorporate treatment media in an upflow configuration that is intended to provide both physical and biological removal of TN and TP. A high level overflow is incorporated in the NSBB to allow stormwater runoff to bypass the system when needed. A concept detail of the BMP is provided in **Photo 5**.

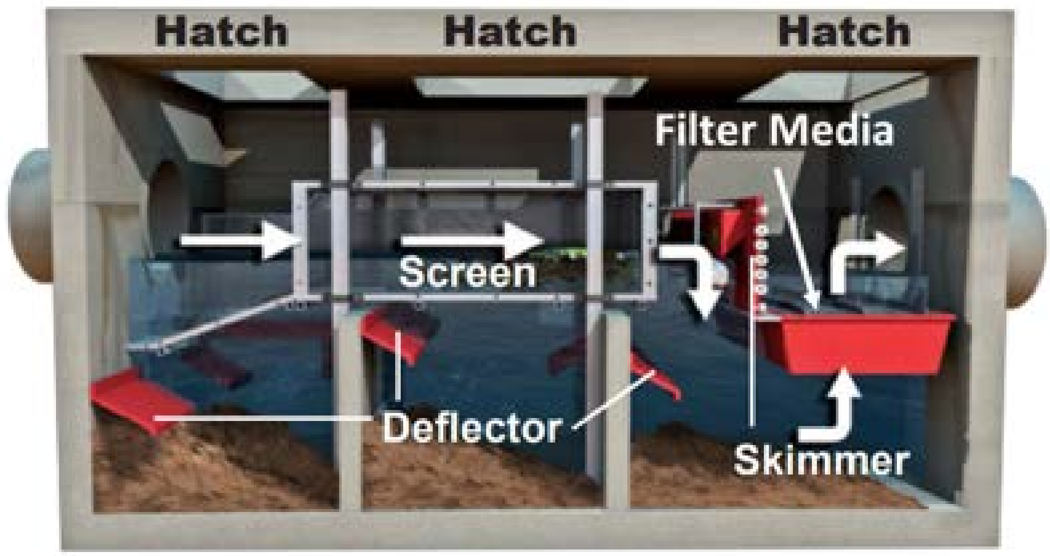
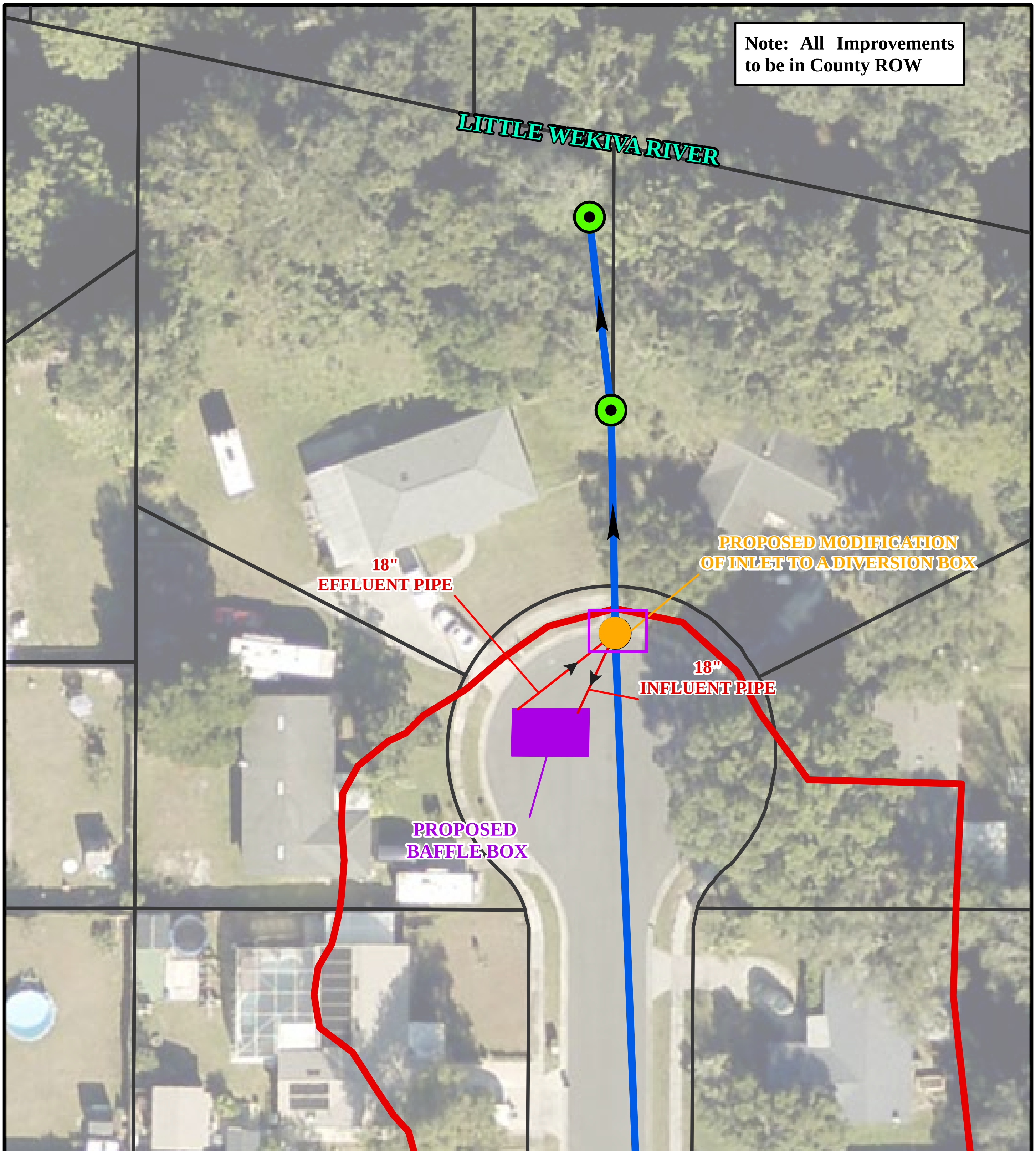


Photo 5: NSBB with Upflow Media Filter Concept (image from Oldcastle Infrastructure)

This improvement concept includes:

- Constructing the NSBB with upflow media filter in the cul-de-sac located at the end of Hickory Court.
- Rerouting the northern most curb inlet south to the proposed NSBB to treat stormwater runoff from the entire contributing area.
- Connecting the proposed NSBB to the existing outfall pipe that discharges to the Little Wekiva River.

The water quality improvement concept is shown on conceptually on **Figure 3**.



N

Legend

PARCELS

SUBBASINS

PIPES / CULVERTS

DRAINAGE STRUCUTRES

0 10 20 40 60 80 Feet

Sources:
Parcels - Seminole County, 2022
Infrastructure - Seminole County, 2022

Proposed Improvements Map

Northwestern BMP #2
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

Seminole County

Figure

3

Pollutant Load Benefits

The average annual pollutant load discharged from the project area (subbasin LW_S00202_S) was calculated as part of the Wekiva Watershed Management Plan utilizing a continuous simulation model run for a period of approximately 10 years. The pollutant load benefit for this water quality improvement concept was estimated based on engineering judgement and experience with similar types of stormwater BMP projects. The upflow media component of the NSBB was assigned a TN and TP removal rate of 45% based on manufacturer recommendations. The NSBB was assumed to treat 90% of the average annual stormwater runoff on a volumetric basis, which corresponds to a 10% bypass rate. The bypass rate accounts for high flow events when stormwater would bypass the BMP to avoid potential upstream flood stage impacts. The exact capture rate would be determined during design.

The estimated pollutant load benefit is summarized below in **Table 1**.

Table 1: Estimated Pollutant Load Benefit

Scenario	Average Annual TN Load (lb/yr)	Average Annual TP Load (lb/yr)	TN Load Removed (lb/yr)	TP Load Removed (lb/yr)	TN Load Removed over 20 Years (lb)	TP Load Removed over 20 Years (lb)
Proposed Conditions	86.4	13.9	35.0	5.6	700	113

Implementation Considerations

The following implementation considerations are provided for this improvement concept.

- Water Quality Benefit – This improvement provides a water quality benefit by providing treatment to the stormwater runoff prior to it discharging into the Little Wekiva River.
- Flood Benefit – This improvement concept is not intended to provide a direct flood benefit to the project area. The proposed water quality improvement concept is not anticipated to result in peak stage increases based on model results. This would be confirmed during design.
- Permitting Considerations – It is anticipated that this improvement would require a general permit for stormwater retrofit from the St. Johns River Water Management District. Based on the location of the NSBB, the project may meet exemption criteria since there are no anticipated wetland or surface water impacts.
- Engineering Design – Final engineering design should include collection of survey data, utility designation, geotechnical testing, preparation of design plans, preparation of a cost estimate, preparation of technical specifications, and utility coordination to address any needed conflict adjustments / relocations.
- Land Acquisition – Land or easement acquisition is not anticipated for this improvement. The BMP is proposed to be constructed in the County ROW.

- Wetland / Surface Water Impacts – The proposed water quality improvement has no anticipated wetland / surface water impacts.
- Benefit/Cost – The estimated total implementation cost for this improvement is $395,133. This cost includes construction, a 20% contingency, estimated annual maintenance, design and permitting, and CEI services. This translates to load removal rates on a cost basis of $461 per pound of TN and $2,864 per pound of TP. It is noted that loading removal rates were based on the estimated construction cost and maintenance. A detailed breakdown of the preliminary cost estimate is provided in **Table 2**.

Table 2: Engineer's Estimate of Probable Improvement Costs based on Concept

Northwestern BMP #2						
Item	**Pay Item No.**	**Description**	**Units**	**Unit Cost**	**Quantity**	**Total**
1	101-1	Mobilization (15% of Construction Total)	LS	varies	1	$26,785
2	102-1	Maintenance of Traffic (5% of Construction Total)	LS	varies	1	$8,928
3	104-1	Prevention, Control and Abatement of Erosion and Water Pollution (10% of Construction Total)	LS	varies	1	$17,857
4	110-1-1	Clearing and Grubbing (5% of Construction Total)	LS	varies	1	$8,928
5	160-4	Type B Stabilization (12")	SY	$20.00	77	$1,540
6	285-704	Optional Base, Base Group 04 (6")	SY	$50.00	77	$3,850
7	334-1-13	Superpave Asphaltic Concrete, Traffic C (2")	SY	$275.00	77	$21,175
8	430-175-118	Pipe Culvert, Concrete, Round, 18" S/CD	LF	$175.00	40	$7,000
9	900-1	Nutrient Separating Baffle Box with Upflow Media Filter	EA	$145,000.00	1	$145,000
SUBTOTAL COST:						$241,063
CONTINGENCY (20%):						$48,213
CONSTRUCTION SUBTOTAL:						$289,275
MAINTENANCE SUBTOTAL:						$33,539
DESIGN & PERMITTING:						$43,391
CEI SERVICES:						$28,928
ESTIMATED TOTAL IMPLEMENTATION COST:						**$395,133**

Notes:

1) *Above estimate does not include cost for potential utility relocations.*
2) *Assumes no muck or other removal of unsuitable soils.*
3) *900-1 is the estimated installed cost for the proposed Nutrient Separating Baffle Box*
4) *Maintenance Cost is assumed to be 1% of construction cost brought to Net Present Value (NPV) over 20 years using interest rate of 7%*
5) *Design and permitting was assumed to be 15% of the construction subtotal cost based on engineering judgement.*
6) *Construction engineering and inspection (CEI) services was assumed to be 10% of the construction subtotal cost based on engineering judgement.*

The information provided herein in considered to be preliminary for project planning purposes. As noted previously, design level efforts including detailed modeling will be necessary to quantify bypass rates, confirm flood stages, confirm pollutant load reductions, etc.

Conclusions

The goal of this effort was to develop a water quality improvement concept to reduce the pollutant loads discharged from the project area. A concept was developed consisting of installing a NSBB with upflow media filter at the cul-de-sac located at the end of Hickory Court. The existing drainage infrastructure would be rerouted to the proposed NSBB for treatment and the NSBB would discharge treated stormwater runoff to the existing outfall pipe.

The nutrient load reduction via the NSBB over the 20 year expected life is estimated below:

- TN mass removed = 700 lbs.
- TP mass removed = 113 lbs.

The total project implementation cost was estimated to be approximately $395,133 including construction, contingency, maintenance, design and permitting, and CEI services. The project cost benefit from a pollutant load reduction perspective was determined to be:

- $461 per lb of TN.
- $2,864 per lb of TP.

Based on the foregoing, Geosyntec recommends that the County pursue design of this water quality improvement for the anticipated water quality benefits.

Water Quality Focused Project

Northwestern BMP 3

Water Quality Improvement Alternatives Analysis

Northwestern BMP #3

Wekiva Watershed Management Plan

Seminole County, Florida

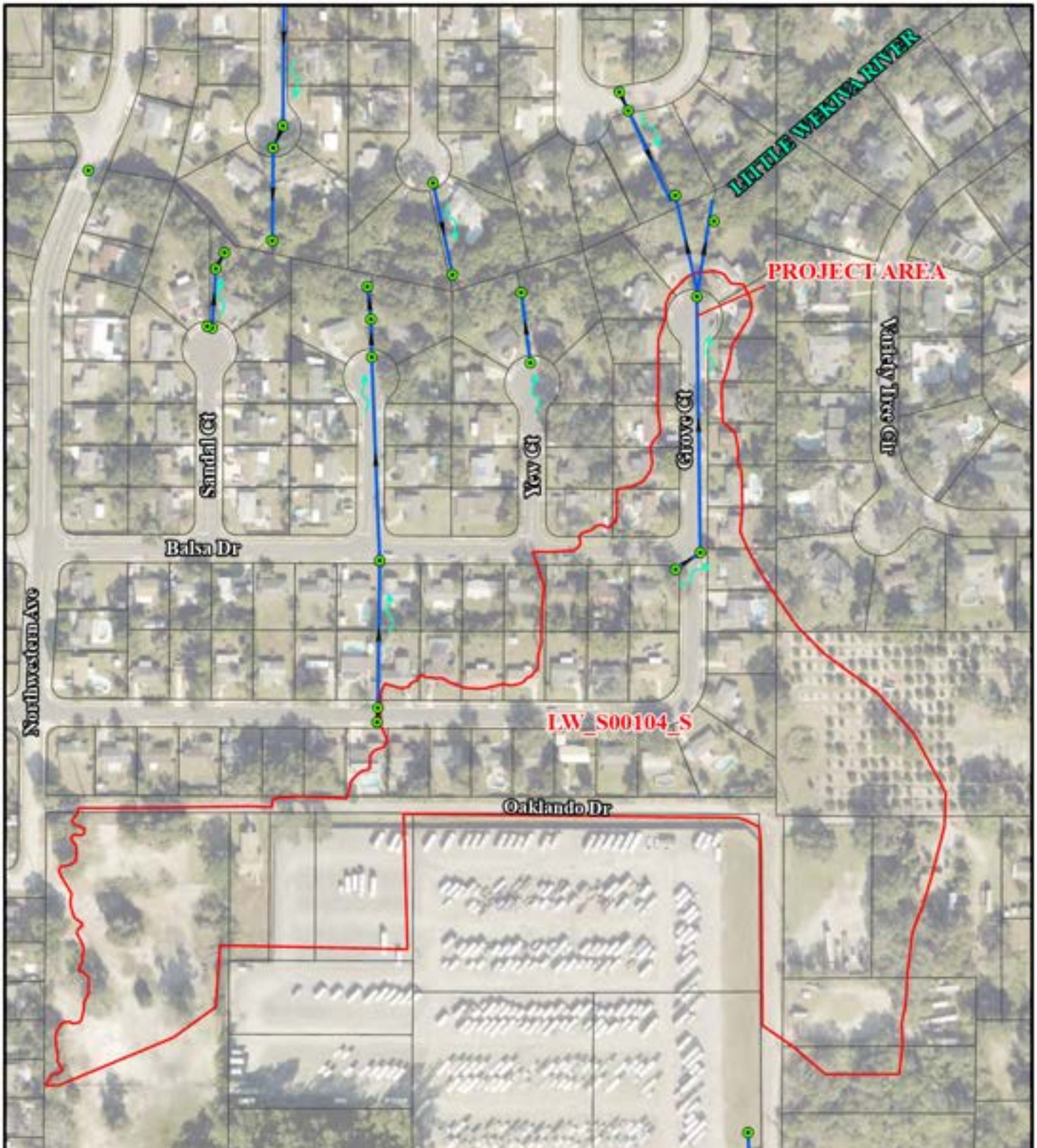
The purpose of this water quality improvement concept is to address pollutant loads discharged from Grove Court to the Little Wekiva River. This site was identified as a priority location for a water quality enhancement project based on the Wekiva Watershed Management Plan.

The project area with existing drainage infrastructure is shown on **Figure 1**. A topographical map is included on **Figure 2**.

The goal of this improvement analysis was to provide a conceptual level assessment of the water quality benefits anticipated from the proposed best management practice (BMP). Specifically, cost benefit on a nutrient load reduction basis for total nitrogen (TN) and total phosphorus (TP) was estimated.

Existing Conditions

The project area is located east of State Road 434, at a cul-de-sac located at the north end of Grove Court. The contributing area consists of medium density residential land use. There is a system of curb inlets and storm piping that conveys stormwater runoff north from Balsa Drive and ultimately outfalls to the Little Wekiva River. There are no existing stormwater BMPs in the contributing area.



Legend

PARCELS
SUBBASINS
PIPES / CULVERTS
DRAINAGE STRUCTURES

0 62.5 125 250 375 500 Feet

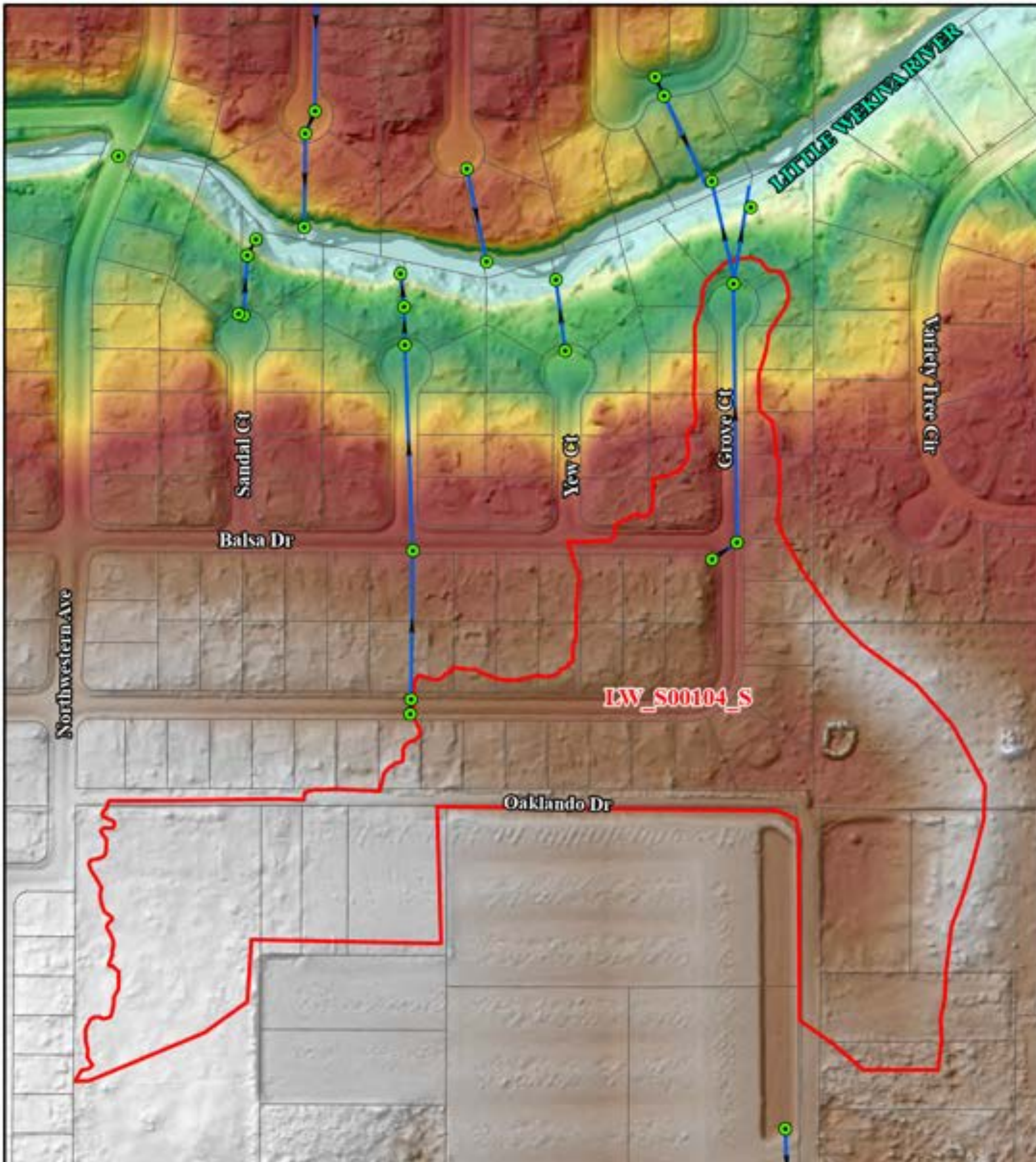
Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Site Map
Northwestern BMP #3
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure 1



Legend

PARCELS
SUBBASINS
PIPES / CULVERTS
DRAINAGE STRUCTURES

DEM
FEET NAVD 1988
68.47
38.6

Sources:
Parcels, Infrastructure - Seminole County, 2022
DEM - USGS LIDAR, 2018

0 62.5 125 250 375 500 Feet

Topographical Map
Northwestern BMP #3
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure 2

Photos of the contributing area are shown below.

Photo 1: Intersection of Balsa Drive and Grove Court, Looking North

Photo 2: Intersection of Balsa Drive and Grove Court, Looking East

Photo 3: Grove Court, Looking South

Photo 4: Cul-de-sac at the North End of Grove Court

Water Quality Improvement Concept

This water quality improvement concept includes the installation of a nutrient separating baffle box (NSBB) with upflow media filter. A NSBB is a water quality treatment technology that incorporates a screening system to capture large organics and debris, as well as a series of baffles and settling chambers to settle out smaller, lighter particles. The NSBB can also incorporate treatment media in an upflow configuration that is intended to provide both physical and biological removal of TN and TP. A high level overflow is incorporated in the NSBB to allow stormwater runoff to bypass the system when needed. A concept detail of the BMP is provided in **Photo 5**.

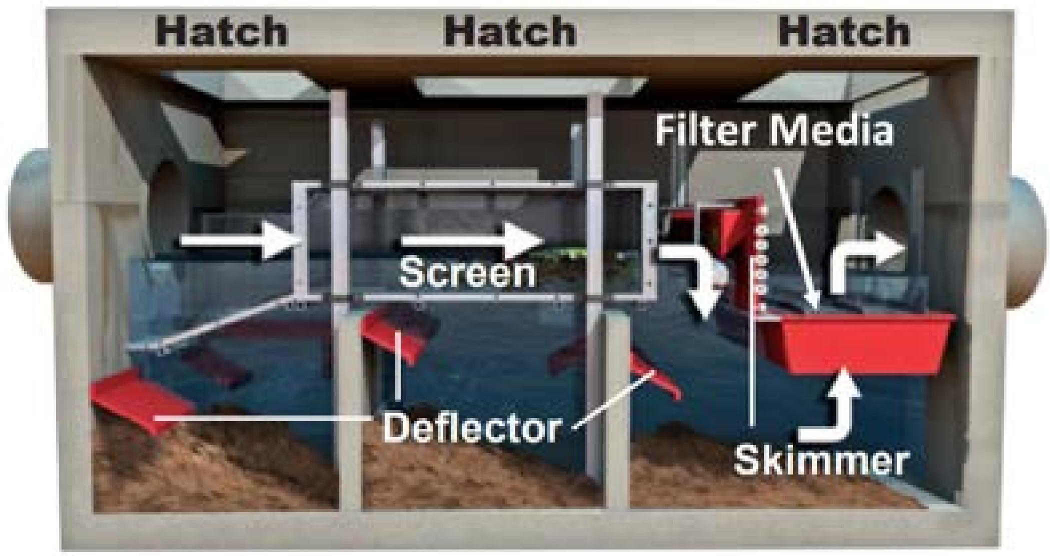
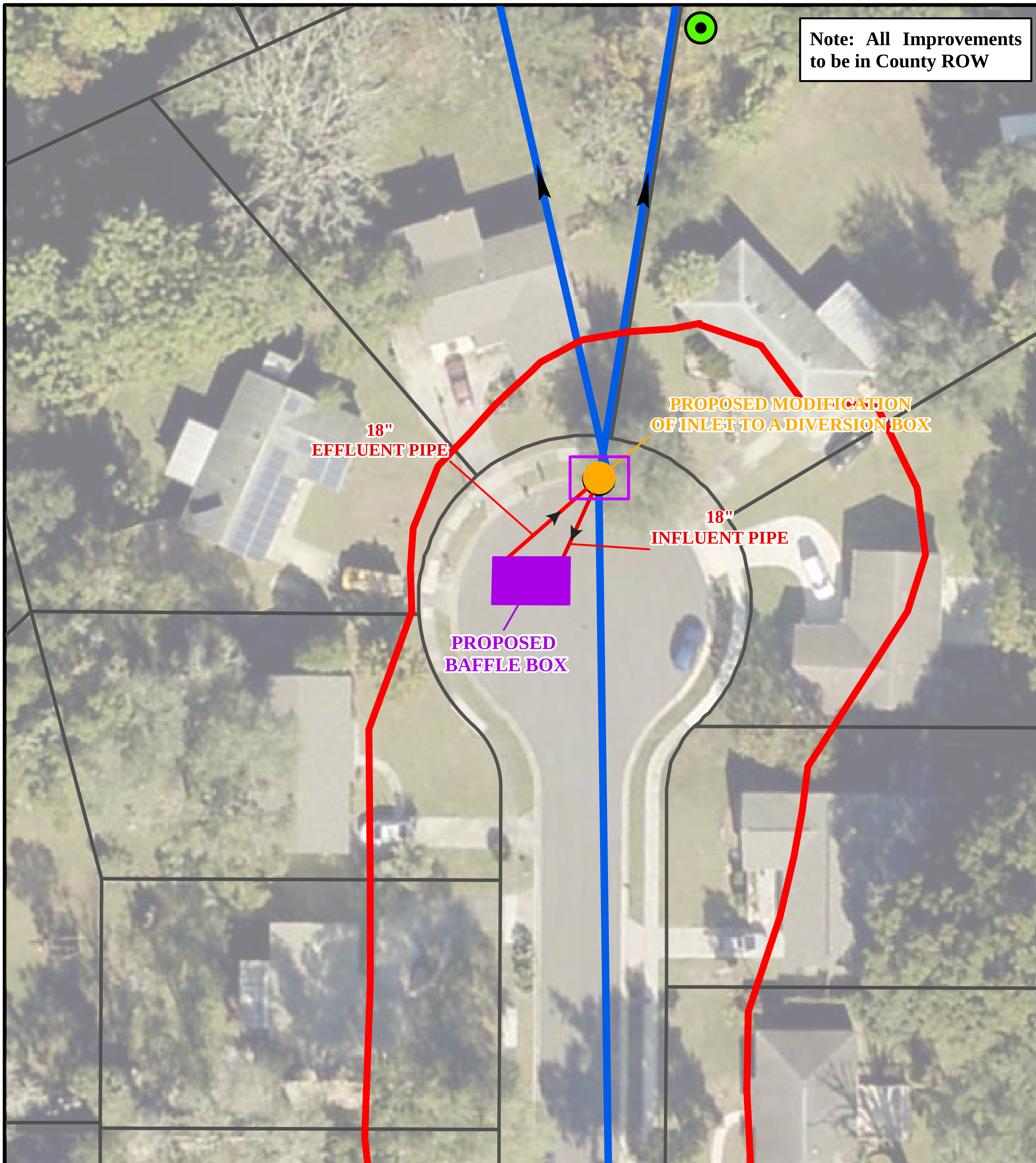


Photo 5: NSBB with Upflow Media Filter Concept (image from Oldcastle Infrastructure)

This improvement concept includes:

- Constructing the NSBB with upflow media filter in the cul-de-sac located at the end of Grove Court.
- Rerouting the northern most curb inlet south to the proposed NSBB to treat stormwater runoff from the entire contributing area.
- Connecting the proposed NSBB to the existing outfall pipe that discharges to the Little Wekiva River.

The water quality improvement concept is shown on conceptually on **Figure 3**.



Legend

PARCELS

SUBBASINS

PIPES / CULVERTS

DRAINAGE STRUCUTRES

0 10 20 40 60 80 Feet

Sources:
Parcels - Seminole County, 2022
Infrastructure - Seminole County, 2022

Proposed Improvements Map

Northwestern BMP #3
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

Seminole County

Figure 3

Pollutant Load Benefits

The average annual pollutant load discharged from the project area (subbasin LW_S00202_S) was calculated as part of the Wekiva Watershed Management Plan utilizing a continuous simulation model run for a period of approximately 10 years. The pollutant load benefit for this water quality improvement concept was estimated based on engineering judgement and experience with similar types of stormwater BMP projects. The upflow media component of the NSBB was assigned a TN and TP removal rate of 45% based on manufacturer recommendations. The NSBB was assumed to treat 90% of the average annual stormwater runoff on a volumetric basis, which corresponds to a 10% bypass rate. The bypass rate accounts for high flow events when stormwater would bypass the BMP to avoid potential upstream flood stage impacts. The exact capture rate would be determined during design.

The estimated pollutant load benefit is summarized below in **Table 1**.

Table 1: Estimated Pollutant Load Benefit

Scenario	Average Annual TN Load (lb/yr)	Average Annual TP Load (lb/yr)	TN Load Removed (lb/yr)	TP Load Removed (lb/yr)	TN Load Removed over 20 Years (lb)	TP Load Removed over 20 Years (lb)
Proposed Conditions	131.3	20.2	53.2	8.2	1,064	164

Implementation Considerations

The following implementation considerations are provided for this improvement concept.

- Water Quality Benefit – This improvement provides a water quality benefit by providing treatment to the stormwater runoff prior to it discharging into the Little Wekiva River.
- Flood Benefit – This improvement concept is not intended to provide a direct flood benefit to the project area. The proposed water quality improvement concept is not anticipated to result in peak stage increases based on model results. This would be confirmed during design.
- Permitting Considerations – It is anticipated that this improvement would require a general permit for stormwater retrofit from the St. Johns River Water Management District. Based on the location of the NSBB, the project may meet exemption criteria since there are no anticipated wetland or surface water impacts.
- Engineering Design – Final engineering design should include collection of survey data, utility designation, geotechnical testing, preparation of design plans, preparation of a cost estimate, preparation of technical specifications, and utility coordination to address any needed conflict adjustments / relocations.
- Land Acquisition – Land or easement acquisition is not anticipated for this improvement. The BMP is proposed to be constructed in the County ROW.

- Wetland / Surface Water Impacts – The proposed water quality improvement has no anticipated wetland / surface water impacts.
- Benefit/Cost – The estimated total implementation cost for this improvement is \$395,133. This cost includes construction, a 20% contingency, estimated annual maintenance, design and permitting, and CEI services. This translates to load removal rates on a cost basis of \$304 per pound of TN and \$1,973 per pound of TP. It is noted that loading removal rates were based on the estimated construction cost and maintenance. A detailed breakdown of the preliminary cost estimate is provided in **Table 2**.

Table 2: Engineer's Estimate of Probable Improvement Costs based on Concept

Northwestern BMP #3						
Item	**Pay Item No.**	**Description**	**Units**	**Unit Cost**	**Quantity**	**Total**
1	101-1	Mobilization (15% of Construction Total)	LS	varies	1	$26,785
2	102-1	Maintenance of Traffic (5% of Construction Total)	LS	varies	1	$8,928
3	104-1	Prevention, Control and Abatement of Erosion and Water Pollution (10% of Construction Total)	LS	varies	1	$17,857
4	110-1-1	Clearing and Grubbing (5% of Construction Total)	LS	varies	1	$8,928
5	160-4	Type B Stabilization (12")	SY	$20.00	77	$1,540
6	285-704	Optional Base, Base Group 04 (6")	SY	$50.00	77	$3,850
7	334-1-13	Superpave Asphaltic Concrete, Traffic C (2")	SY	$275.00	77	$21,175
8	430-175-118	Pipe Culvert, Concrete, Round, 18" S/CD	LF	$175.00	40	$7,000
9	900-1	Nutrient Separating Baffle Box with Upflow Media Filter	EA	$145,000.00	1	$145,000
					SUBTOTAL COST:	$241,063
					CONTINGENCY (20%):	$48,213
					CONSTRUCTION SUBTOTAL:	$289,275
					MAINTENANCE SUBTOTAL:	$33,539
					DESIGN & PERMITTING:	$43,391
					CEI SERVICES:	$28,928
					ESTIMATED TOTAL IMPLEMENTATION COST:	**$395,133**

Notes:

1) *Above estimate does not include cost for potential utility relocations.*
2) *Assumes no muck or other removal of unsuitable soils.*
3) *900-1 is the estimated installed cost for the proposed Nutrient Separating Baffle Box*
4) *Maintenance Cost is assumed to be 1% of construction cost brought to Net Present Value (NPV) over 20 years using interest rate of 7%*
5) *Design and permitting was assumed to be 15% of the construction subtotal cost based on engineering judgement.*
6) *Construction engineering and inspection (CEI) services was assumed to be 10% of the construction subtotal cost based on engineering judgement.*

The information provided herein in considered to be preliminary for project planning purposes. As noted previously, design level efforts including detailed modeling will be necessary to quantify bypass rates, confirm flood stages, confirm pollutant load reductions, etc.

Conclusions

The goal of this effort was to develop a water quality improvement concept to reduce the pollutant loads discharged from the project area. A concept was developed consisting of installing a NSBB with upflow media filter at the cul-de-sac located at the end of Grove Court. The existing drainage infrastructure would be rerouted to the proposed NSBB for treatment and the NSBB would discharge treated stormwater runoff to the existing outfall pipe.

The nutrient load reduction via the NSBB over the 20 year expected life is estimated below:

- TN mass removed = 1,064 lbs.
- TP mass removed = 164 lbs.

The total project implementation cost was estimated to be approximately $395,133 including construction, continency, maintenance, design and permitting, and CEI services. The project cost benefit from a pollutant load reduction perspective was determined to be:

- $304 per lb of TN.
- $1,973 per lb of TP.

Based on the foregoing, Geosyntec recommends that the County pursue design of this water quality improvement for the anticipated water quality benefits.

Geosyntec consultants

Water Quality Focused Project

Spring Lake Outfall #12 BMP

Water Quality Improvement Alternatives Analysis

Spring Lake Outfall BMP

Wekiva Watershed Management Plan

Seminole County, Florida

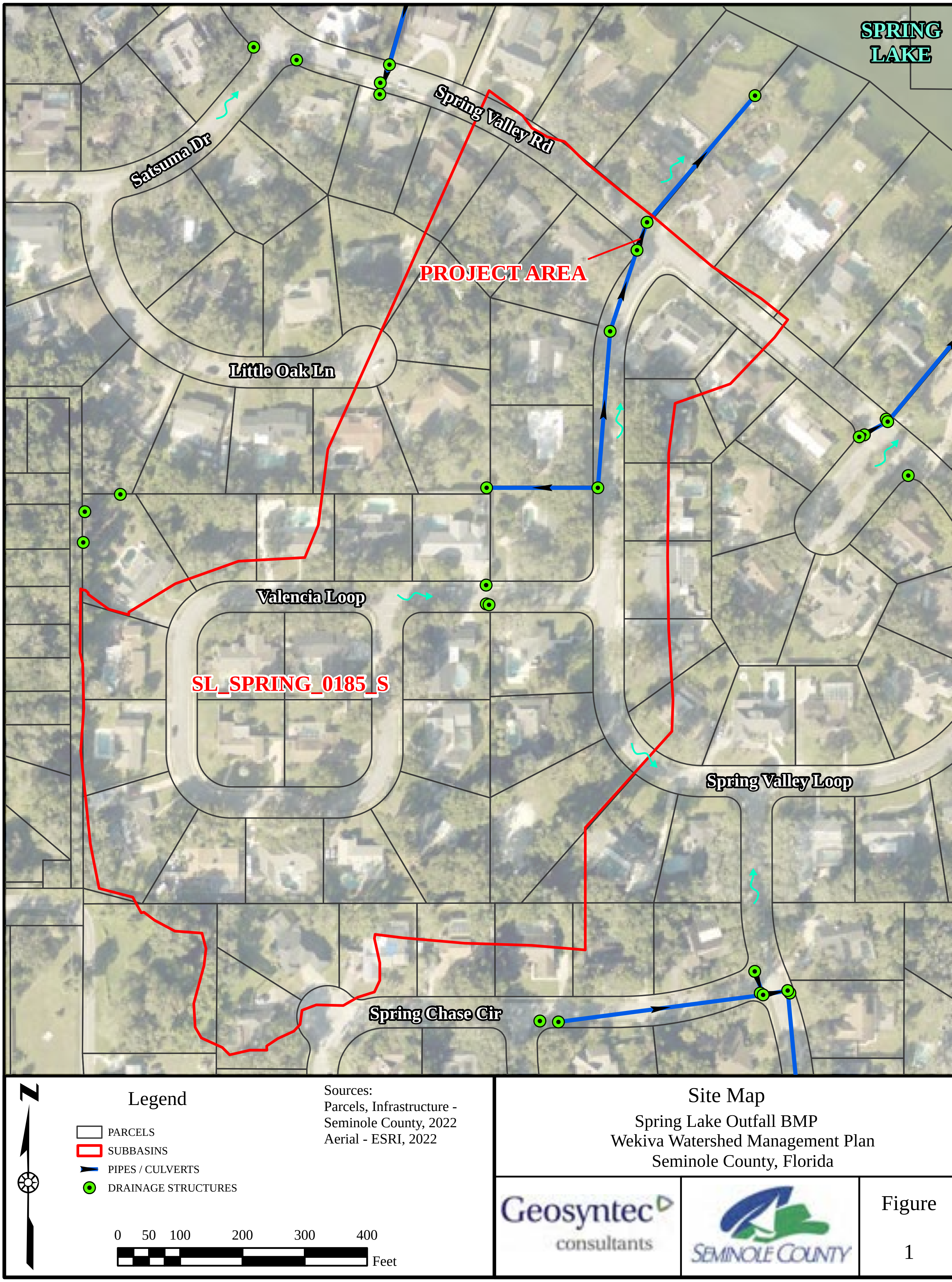
The purpose of this water quality improvement concept is to address pollutant loads discharged from Spring Valley Road to Spring Lake. This site was identified as a priority location for a water quality enhancement project based on the Wekiva Watershed Management Plan.

The project area with existing drainage infrastructure is shown on **Figure 1**. A topographical map is included on **Figure 2**.

The goal of this improvement analysis was to provide a conceptual level assessment of the water quality benefits anticipated from the proposed best management practice (BMP). Specifically, cost benefit on a nutrient load reduction basis for total nitrogen (TN) and total phosphorus (TP) was estimated.

Existing Conditions

The project area is located west of I-4, at the intersection where Spring Valley Road transitions into Spring Valley Loop. The contributing area consists of medium density residential land use. There is a system of curb inlets and storm piping that conveys stormwater runoff north from Spring Valley Loop and ultimately outfalls to Spring Lake. There are no existing stormwater BMPs in the contributing area.



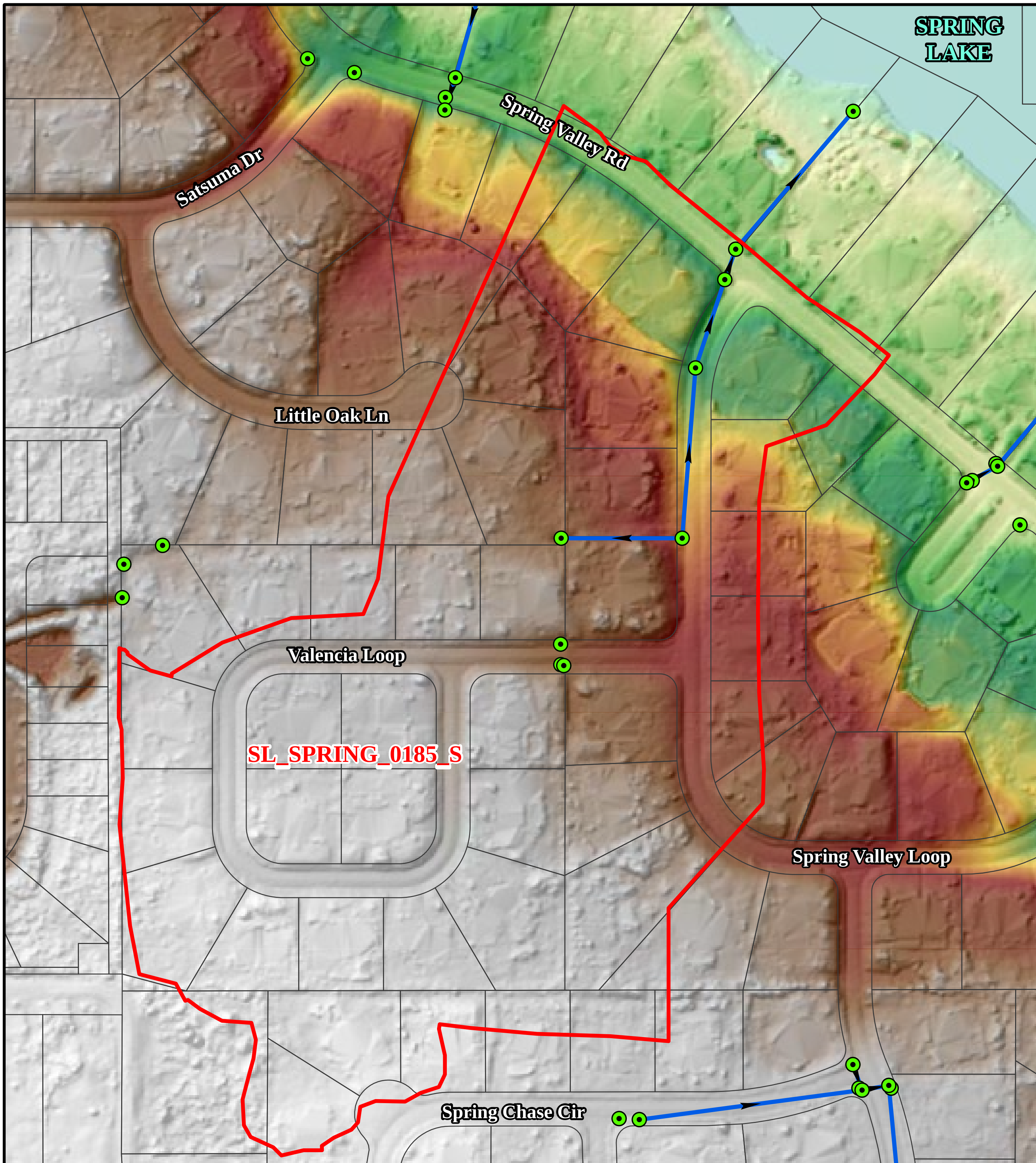
Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Site Map
Spring Lake Outfall BMP
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

Seminole County

Figure
1



N

Legend

PARCELS
SUBBASINS
PIPES / CULVERTS
DRAINAGE STRUCTURES

DEM
FEET NAVD 1988
68.47
38.6

0 50 100 200 300 400
Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022
DEM - USGS LIDAR, 2018

Topographical Map
Spring Lake Outfall BMP
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

Seminole County

Figure
2

Photos of the contributing area are shown below.

Photo 1: Spring Valley Road, Looking Southeast

Photo 2: Spring Valley Road, Looking Northwest

Photo 3: Intersection of Spring Valley Road and Spring Valley Loop, Looking Northeast

Photo 4: Intersection of Spring Valley Road and Spring Valley Loop, Looking Southwest

Water Quality Improvement Concept

This water quality improvement concept includes the installation of a nutrient separating baffle box (NSBB) with upflow media filter. A NSBB is a water quality treatment technology that incorporates a screening system to capture large organics and debris, as well as a series of baffles and settling chambers to settle out smaller, lighter particles. The NSBB can also incorporate treatment media in an upflow configuration that is intended to provide both physical and biological removal of TN and TP. A high level overflow is incorporated in the NSBB to allow stormwater runoff to bypass the system when needed. A concept detail of the BMP is provided in **Photo 5**.

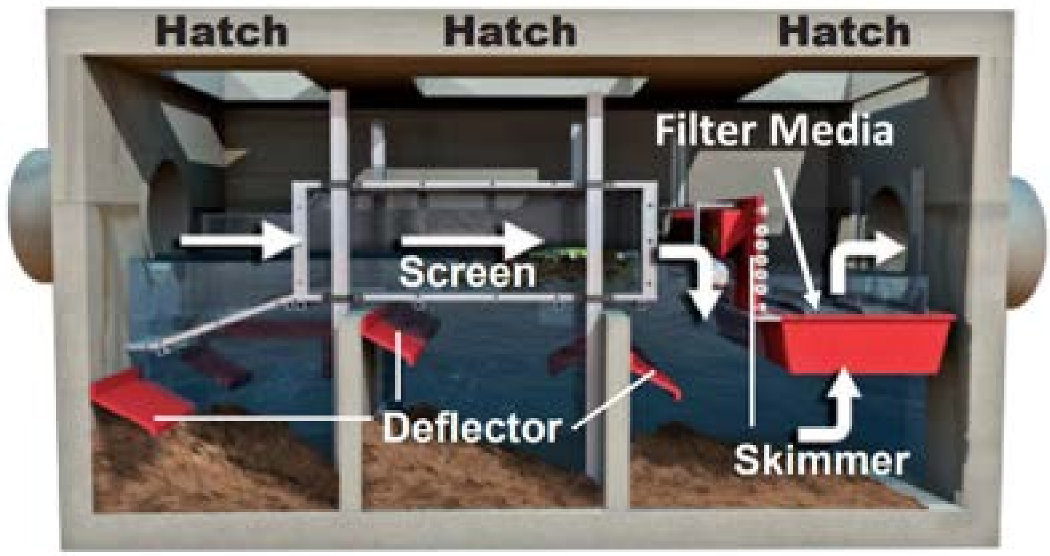
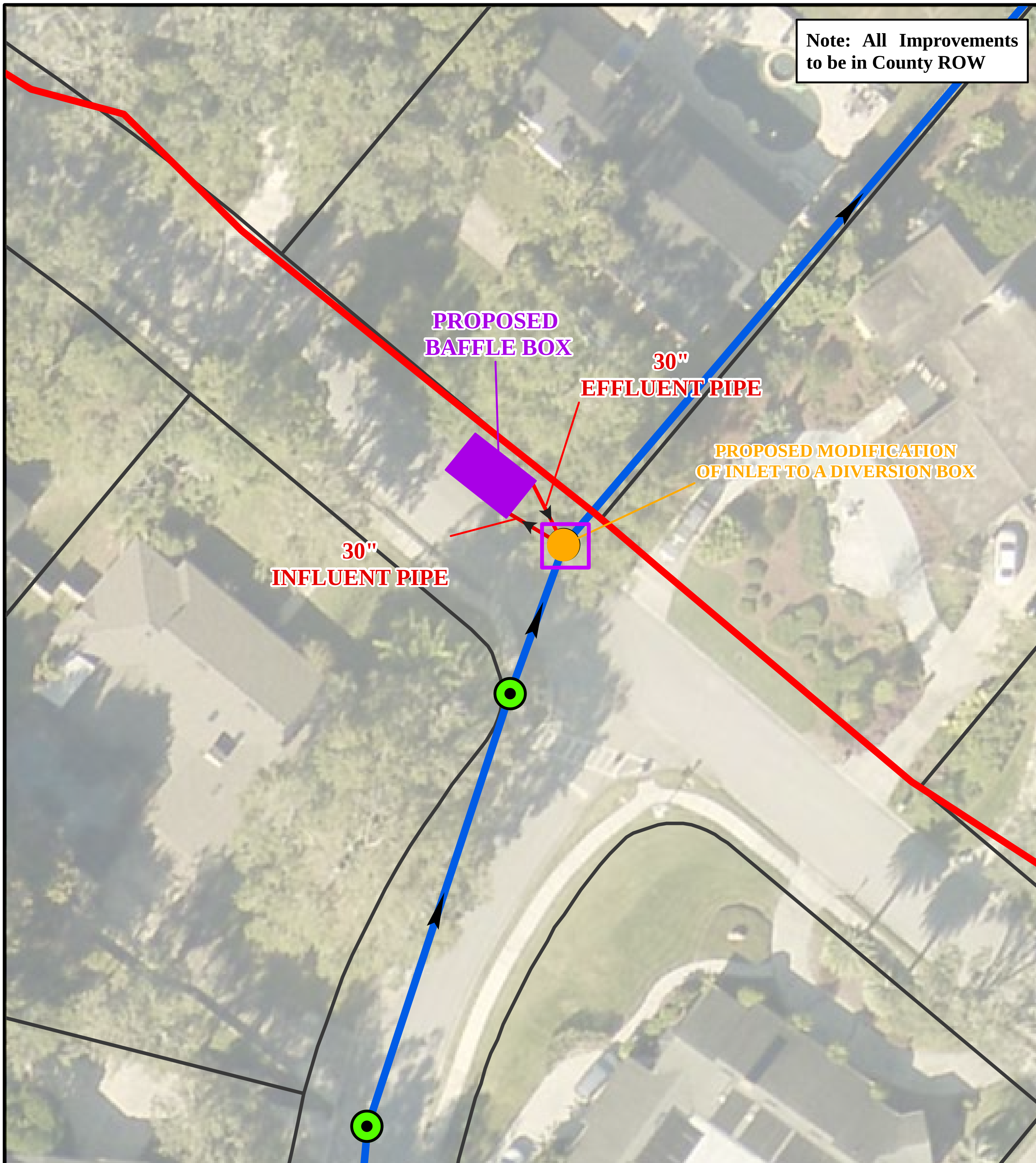


Photo 5: NSBB with Upflow Media Filter Concept (image from Oldcastle Infrastructure)

This improvement concept includes:

- Constructing the NSBB with upflow media filter in the intersection of Spring Valley Road where it transitions into Spring Valley Loop.
- Rerouting the northern most curb inlet south to the proposed NSBB to treat stormwater runoff from the entire contributing area.
- Connecting the proposed NSBB to the existing outfall pipe that discharges to Spring Lake.

The water quality improvement concept is shown on conceptually on **Figure 3**.



Legend

PARCELS

SUBBASINS

PIPES / CULVERTS

DRAINAGE STRUCTURES

0 10 20 40 60 80 Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Proposed Improvements Map

Spring Lake Outfall BMP
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

Seminole County

Figure 3

Pollutant Load Benefits

The average annual pollutant load discharged from the project area (subbasin SL_SPRING_0185_S) was calculated as part of the Wekiva Watershed Management Plan utilizing a continuous simulation model run for a period of approximately 10 years. The pollutant load benefit for this water quality improvement concept was estimated based on engineering judgement and experience with similar types of stormwater BMP projects. The upflow media component of the NSBB was assigned a TN and TP removal rate of 45% based on manufacturer recommendations. The NSBB was assumed to treat 90% of the average annual stormwater runoff on a volumetric basis, which corresponds to a 10% bypass rate. The bypass rate accounts for high flow events when stormwater would bypass the BMP to avoid potential upstream flood stage impacts. The exact capture rate would be determined during design.

The estimated pollutant load benefit is summarized below in **Table 1**.

Table 1: Estimated Pollutant Load Benefit

Scenario	Average Annual TN Load (lb/yr)	Average Annual TP Load (lb/yr)	TN Load Removed (lb/yr)	TP Load Removed (lb/yr)	TN Load Removed over 20 Years (lb)	TP Load Removed over 20 Years (lb)
Proposed Conditions	175.3	28.2	71.0	11.4	1,420	229

Implementation Considerations

The following implementation considerations are provided for this improvement concept.

- Water Quality Benefit – This improvement provides a water quality benefit by providing treatment to the stormwater runoff prior to it discharging into Spring Lake.
- Flood Benefit – This improvement concept is not intended to provide a direct flood benefit to the project area. The proposed water quality improvement concept is not anticipated to result in peak stage increases based on model results. This would be confirmed during design.
- Permitting Considerations – It is anticipated that this improvement would require a general permit for stormwater retrofit from the St. Johns River Water Management District. Based on the location of the NSBB, the project may meet exemption criteria since there are no anticipated wetland or surface water impacts.
- Engineering Design – Final engineering design should include collection of survey data, utility designation, geotechnical testing, preparation of design plans, preparation of a cost estimate, preparation of technical specifications, and utility coordination to address any needed conflict adjustments / relocations.
- Land Acquisition – Land or easement acquisition is not anticipated for this improvement. The BMP is proposed to be constructed in the County ROW.

- Wetland / Surface Water Impacts – The proposed water quality improvement has no anticipated wetland / surface water impacts.
- Benefit/Cost – The estimated total implementation cost for this improvement is $483,646. This cost includes construction, a 20% contingency, estimated annual maintenance, design and permitting, and CEI services. This translates to load removal rates on a cost basis of $278 per pound of TN and $1,728 per pound of TP. It is noted that loading removal rates were based on the estimated construction cost and maintenance. A detailed breakdown of the preliminary cost estimate is provided in **Table 2**.

Table 2: Engineer's Estimate of Probable Improvement Costs based on Concept

Spring Lake Outfall BMP						
Item	**Pay Item No.**	**Description**	**Units**	**Unit Cost**	**Quantity**	**Total**
1	101-1	Mobilization (15% of Construction Total)	LS	varies	1	$32,785
2	102-1	Maintenance of Traffic (5% of Construction Total)	LS	varies	1	$10,928
3	104-1	Prevention, Control and Abatement of Erosion and Water Pollution (10% of Construction Total)	LS	varies	1	$21,857
4	110-1-1	Clearing and Grubbing (5% of Construction Total)	LS	varies	1	$10,928
5	160-4	Type B Stabilization (12")	SY	$20.00	77	$1,540
6	285-704	Optional Base, Base Group 04 (6")	SY	$50.00	77	$3,850
7	334-1-13	Superpave Asphaltic Concrete, Traffic C (2")	SY	$275.00	77	$21,175
8	430-175-118	Pipe Culvert, Concrete, Round, 18" S/CD	LF	$175.00	40	$7,000
9	900-1	Nutrient Separating Baffle Box with Upflow Media Filter	EA	$185,000.00	1	$185,000
					SUBTOTAL COST:	$295,063
					CONTINGENCY (20%):	$59,013
					CONSTRUCTION SUBTOTAL:	$354,075
					MAINTENANCE SUBTOTAL:	$41,052
					DESIGN & PERMITTING:	$53,111
					CEI SERVICES:	$35,408
					ESTIMATED TOTAL IMPLEMENTATION COST:	**$483,646**

Notes:

1) *Above estimate does not include cost for potential utility relocations.*
2) *Assumes no muck or other removal of unsuitable soils.*
3) *900-1 is the estimated installed cost for the proposed Nutrient Separating Baffle Box*
4) *Maintenance Cost is assumed to be 1% of construction cost brought to Net Present Value (NPV) over 20 years using interest rate of 7%*
5) *Design and permitting was assumed to be 15% of the construction subtotal cost based on engineering judgement.*
6) *Construction engineering and inspection (CEI) services was assumed to be 10% of the construction subtotal cost based on engineering judgement.*

The information provided herein in considered to be preliminary for project planning purposes. As noted previously, design level efforts including detailed modeling will be necessary to quantify bypass rates, confirm flood stages, confirm pollutant load reductions, etc.

Conclusions

The goal of this effort was to develop a water quality improvement concept to reduce the pollutant loads discharged from the project area. A concept was developed consisting of installing a NSBB with upflow media filter at the intersection of Spring Valley Road where it transitions into Spring Valley Loop. The existing drainage infrastructure would be rerouted to the proposed NSBB for treatment and the NSBB would discharge treated stormwater runoff to the existing outfall pipe.

The nutrient load reduction via the NSBB over the 20 year expected life is estimated below:

- TN mass removed = 1,420 lbs.
- TP mass removed = 229 lbs.

The total project implementation cost was estimated to be approximately $483,646 including construction, contingency, maintenance, design and permitting, and CEI services. The project cost benefit from a pollutant load reduction perspective was determined to be:

- $278 per lb of TN.
- $1,728 per lb of TP.

Based on the foregoing, Geosyntec recommends that the County pursue design of this water quality improvement for the anticipated water quality benefits.

Water Quality Focused Project

Weathersfield BMP

Water Quality Improvement Alternatives Analysis

Weathersfield BMP

Wekiva Watershed Management Plan

Seminole County, Florida

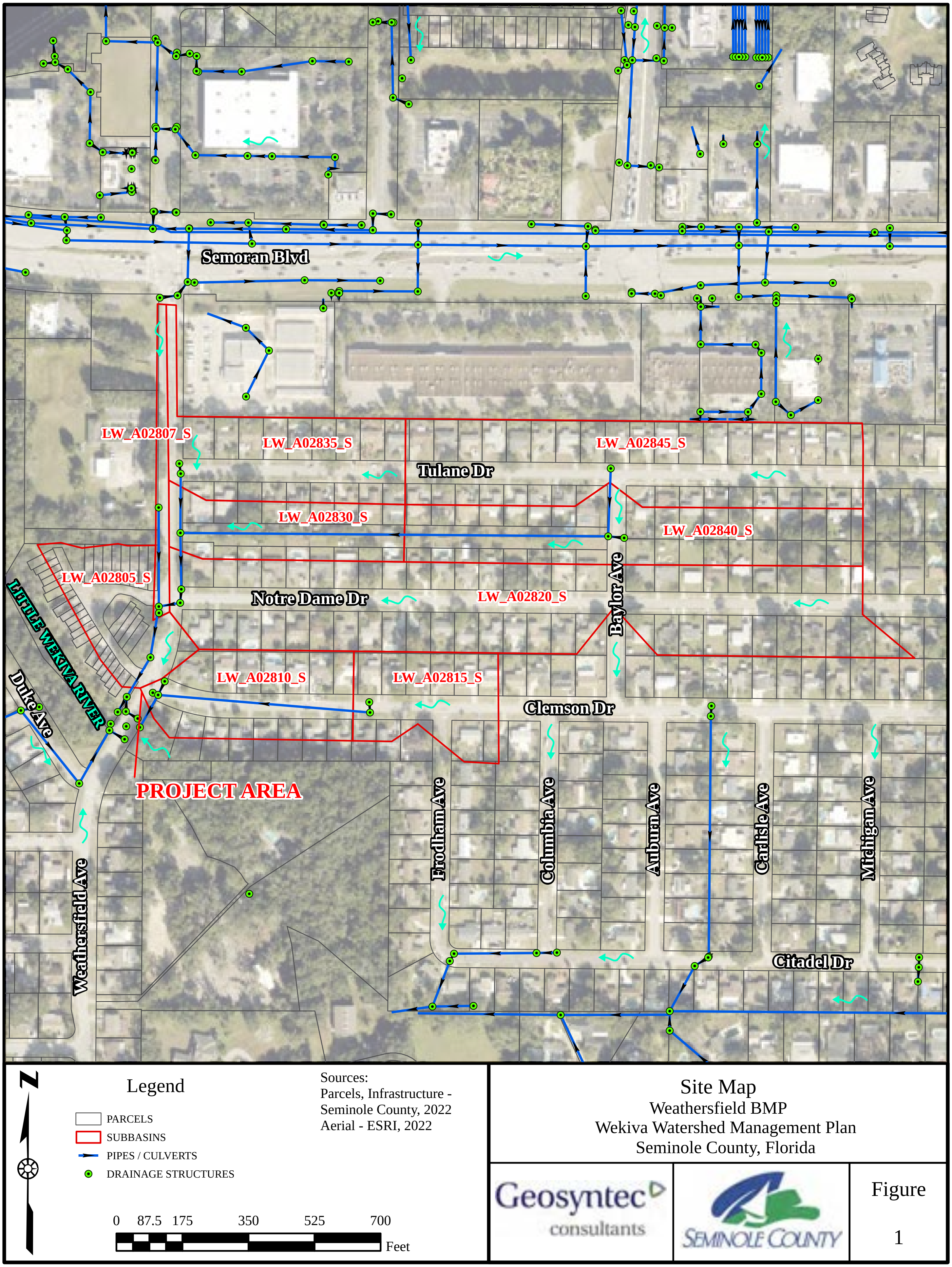
The purpose of this water quality improvement concept is to address pollutant loads discharged from Weathersfield Avenue to the Little Wekiva River. This site was identified as a priority location for a water quality enhancement project based on the Wekiva Watershed Management Plan.

The project area with existing drainage infrastructure is shown on **Figure 1**. A topographical map is included on **Figure 2**.

The goal of this improvement analysis was to provide a conceptual level assessment of the water quality benefits anticipated from the proposed best management practice (BMP). Specifically, cost benefit on a nutrient load reduction basis for total nitrogen (TN) and total phosphorus (TP) was estimated.

Existing Conditions

The project area is located south of Semoran Boulevard, along Weathersfield Avenue where it discharges into the Little Wekiva River. The contributing area consists of medium density residential land use. There is a system of curb inlets and storm piping that conveys stormwater runoff west from the subdivision and ultimately outfalls to the Little Wekiva River. There are no existing stormwater BMPs in the contributing area.



Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

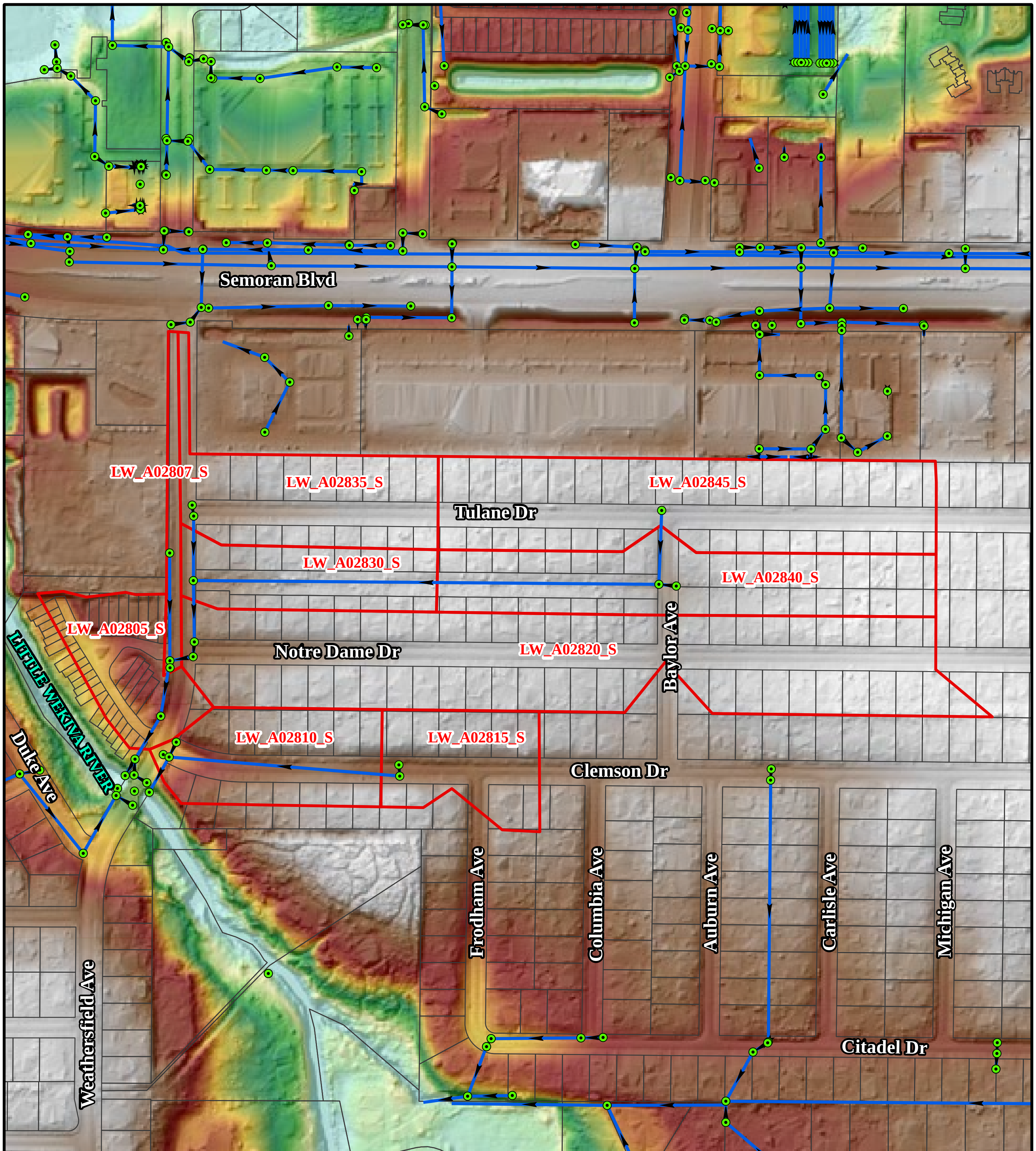
Site Map
Weathersfield BMP
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

Seminole County

Figure

1



N

Legend

PARCELS
SUBBASINS
PIPES / CULVERTS
DRAINAGE STRUCTURES

DEM
FEET NAVD 1988
68.47
38.6

Sources:
Parcels, Infrastructure - Seminole County, 2022
DEM - USGS LIDAR, 2018

0 87.5 175 350 525 700 Feet

Topographical Map

Weathersfield BMP
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

Seminole County

Figure

2

Photos of the contributing area are shown below.

Photo 1: Intersection of Weathersfield Avenue and Clemson Drive, Looking West

Photo 2: Intersection of Weathersfield Avenue and Clemson Drive, Looking East

Photo 3: Intersection of Weathersfield Avenue and Clemson Drive, Looking Southeast

Photo 4: Intersection of Spring Valley Road and Spring Valley Loop, Looking Northwest

Water Quality Improvement Concept

This water quality improvement concept includes the installation of a nutrient separating baffle box (NSBB) with upflow media filter. A NSBB is a water quality treatment technology that incorporates a screening system to capture large organics and debris, as well as a series of baffles and settling chambers to settle out smaller, lighter particles. The NSBB can also incorporate treatment media in an upflow configuration that is intended to provide both physical and biological removal of TN and TP. A high level overflow is incorporated in the NSBB to allow stormwater runoff to bypass the system when needed. A concept detail of the BMP is provided in **Photo 5**.

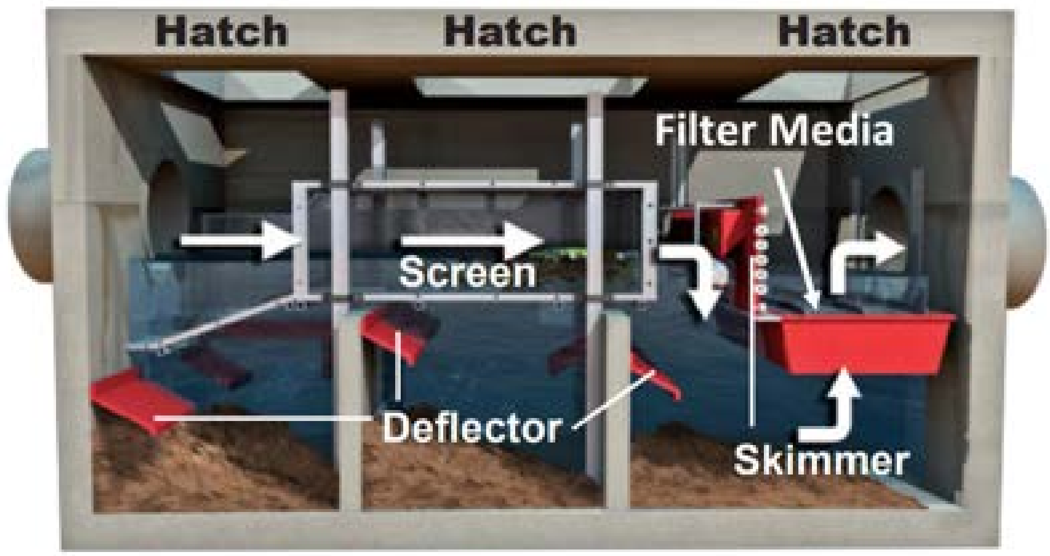
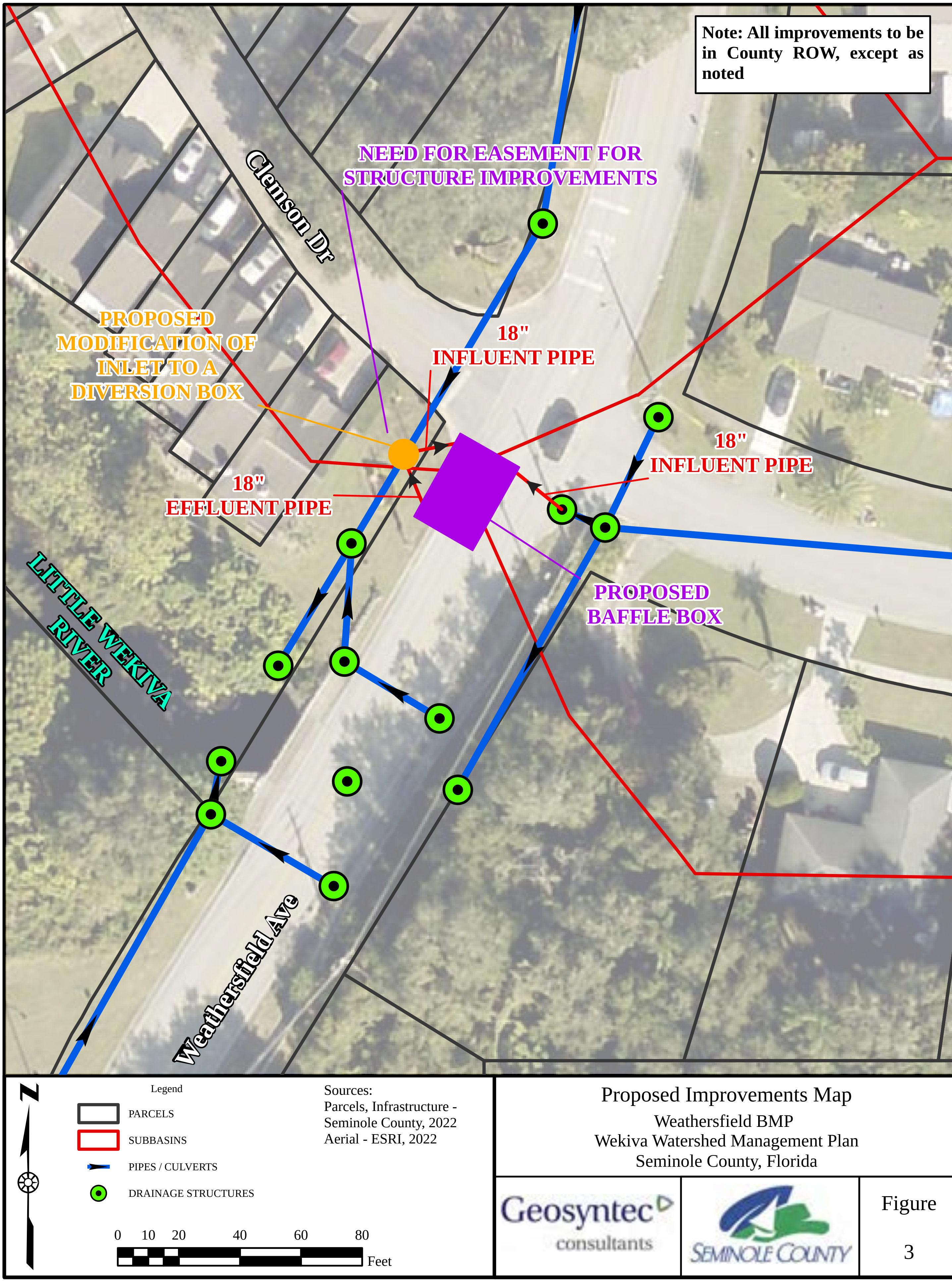


Photo 5: NSBB with Upflow Media Filter Concept (image from Oldcastle Infrastructure)

This improvement concept includes:

- Constructing the NSBB with upflow media filter at the intersection of Weathersfield Avenue and Clemson Drive.
- Rerouting the eastern most curb inlet west to the proposed NSBB to treat stormwater runoff from the entire contributing area.
- Connecting the proposed NSBB to the existing outfall pipe that discharges to the Little Wekiva River.

The water quality improvement concept is shown on conceptually on **Figure 3**.



Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Proposed Improvements Map

Weathersfield BMP
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

Seminole County

Figure 3

Pollutant Load Benefits

The average annual pollutant load discharged from the project area (subbasins LW_A02805_S, LW_A02807_S, LW_A02810_S, LW_A02815_S, LW_A02820_S, LW_A02830_S, LW_A02835_S, LW_A02840_S, and LW_A02845_S) was calculated as part of the Wekiva Watershed Management Plan utilizing a continuous simulation model run for a period of approximately 10 years. The pollutant load benefit for this water quality improvement concept was estimated based on engineering judgement and experience with similar types of stormwater BMP projects. The upflow media component of the NSBB was assigned a TN and TP removal rate of 45% based on manufacturer recommendations. The NSBB was assumed to treat 90% of the average annual stormwater runoff on a volumetric basis, which corresponds to a 10% bypass rate. The bypass rate accounts for high flow events when stormwater would bypass the BMP to avoid potential upstream flood stage impacts. The exact capture rate would be determined during design.

The estimated pollutant load benefit is summarized below in **Table 1**.

Table 1: Estimated Pollutant Load Benefit

Scenario	Average Annual TN Load (lb/yr)	Average Annual TP Load (lb/yr)	TN Load Removed (lb/yr)	TP Load Removed (lb/yr)	TN Load Removed over 20 Years (lb)	TP Load Removed over 20 Years (lb)
Proposed Conditions	325.9	76.2	88.0	20.6	1,760	411

Implementation Considerations

The following implementation considerations are provided for this improvement concept.

- Water Quality Benefit – This improvement provides a water quality benefit by providing treatment to the stormwater runoff prior to it discharging into the Little Wekiva River.
- Flood Benefit – This improvement concept is not intended to provide a direct flood benefit to the project area. The proposed water quality improvement concept is not anticipated to result in peak stage increases based on model results. This would be confirmed during design.
- Permitting Considerations – It is anticipated that this improvement would require a general permit for stormwater retrofit from the St. Johns River Water Management District. Based on the location of the NSBB, the project may meet exemption criteria since there are no anticipated wetland or surface water impacts.
- Engineering Design – Final engineering design should include collection of survey data, utility designation, geotechnical testing, preparation of design plans, preparation of a cost estimate, preparation of technical specifications, and utility coordination to address any needed conflict adjustments / relocations.
- Land Acquisition –Easement acquisition is anticipated for this improvement in order to construct the proposed improvements.

- Wetland / Surface Water Impacts – The proposed water quality improvement has no anticipated wetland / surface water impacts.
- Benefit/Cost – The estimated total implementation cost for this improvement is $609,777. This cost includes construction, a 20% contingency, estimated annual maintenance, design and permitting, CEI services, and easement / property acquisition. This translates to load removal rates on a cost basis of $283 per pound of TN and $1,212 per pound of TP. It is noted that loading removal rates were based on the estimated construction cost and maintenance. A detailed breakdown of the preliminary cost estimate is provided in **Table 2**.

Table 2: Engineer's Estimate of Probable Improvement Costs based on Concept

Weathersfield BMP						
Item	**Pay Item No.**	**Description**	**Units**	**Unit Cost**	**Quantity**	**Total**
1	101-1	Mobilization (15% of Construction Total)	LS	varies	1	$41,335
2	102-1	Maintenance of Traffic (5% of Construction Total)	LS	varies	1	$13,778
3	104-1	Prevention, Control and Abatement of Erosion and Water Pollution (10% of Construction Total)	LS	varies	1	$27,557
4	110-1-1	Clearing and Grubbing (5% of Construction Total)	LS	varies	1	$13,778
5	160-4	Type B Stabilization (12")	SY	$20.00	77	$1,540
6	285-704	Optional Base, Base Group 04 (6")	SY	$50.00	77	$3,850
7	334-1-13	Superpave Asphaltic Concrete, Traffic C (2")	SY	$275.00	77	$21,175
8	425-2-71	Manhole, J-7, <10'	EA	$22,000.00	1	$22,000
9	430-175-118	Pipe Culvert, Concrete, Round, 18" S/CD	LF	$175.00	60	$10,500
10	900-1	Nutrient Separating Baffle Box with Upflow Media Filter	EA	$185,000.00	1	$185,000
11	900-2	Easement / Property Acquisition	LS	varies	1	$31,500
					SUBTOTAL COST:	$372,013
					CONTINGENCY (20%):	$74,403
					CONSTRUCTION SUBTOTAL:	$446,415
					MAINTENANCE SUBTOTAL:	$51,757
					DESIGN & PERMITTING:	$66,962
					CEI SERVICES:	$44,642
					ESTIMATED TOTAL IMPLEMENTATION COST:	**$609,777**

Notes:

1) *Above estimate does not include cost for potential utility relocations.*
2) *Assumes no muck or other removal of unsuitable soils.*
3) *900-1 is the estimated installed cost for the proposed Nutrient Separating Baffle Box*
4) *Maintenance Cost is assumed to be 1% of construction cost brought to Net Present Value (NPV) over 20 years using interest rate of 7%*
5) *Design and permitting was assumed to be 15% of the construction subtotal cost based on engineering judgement.*
6) *Construction engineering and inspection (CEI) services was assumed to be 10% of the construction subtotal cost based on engineering judgement.*
7) *Costs for 900-2 were obtained from the Seminole County property appraiser and were assumed to be 1.5 times the parcel value (land + buildings + features) to account for administrative costs. Assumed that City and Florida Power easements would be donated at no cost.*

The information provided herein in considered to be preliminary for project planning purposes. As noted previously, design level efforts including detailed modeling will be necessary to quantify bypass rates, confirm flood stages, confirm pollutant load reductions, etc.

Conclusions

The goal of this effort was to develop a water quality improvement concept to reduce the pollutant loads discharged from the project area. A concept was developed consisting of installing a NSBB with upflow media filter at the intersection of Weathersfield Avenue and Clemson Drive. The existing drainage infrastructure would be rerouted to the proposed NSBB for treatment and the NSBB would discharge treated stormwater runoff to the existing outfall pipe.

The nutrient load reduction via the NSBB over the 20 year expected life is estimated below:

- TN mass removed = 1,760 lbs.
- TP mass removed = 411 lbs.

The total project implementation cost was estimated to be approximately $609,777 including construction, contingency, maintenance, design and permitting, CEI services, and easement / property acquisition. The project cost benefit from a pollutant load reduction perspective was determined to be:

- $283 per lb of TN.
- $1,212 per lb of TP.

Based on the foregoing, Geosyntec recommends that the County pursue design of this water quality improvement for the anticipated water quality benefits.

Water Quality Focused Project

Sabal Point BMP

Water Quality Improvement Alternatives Analysis

Sabal Point BMP

Wekiva Watershed Management Plan

Seminole County, Florida

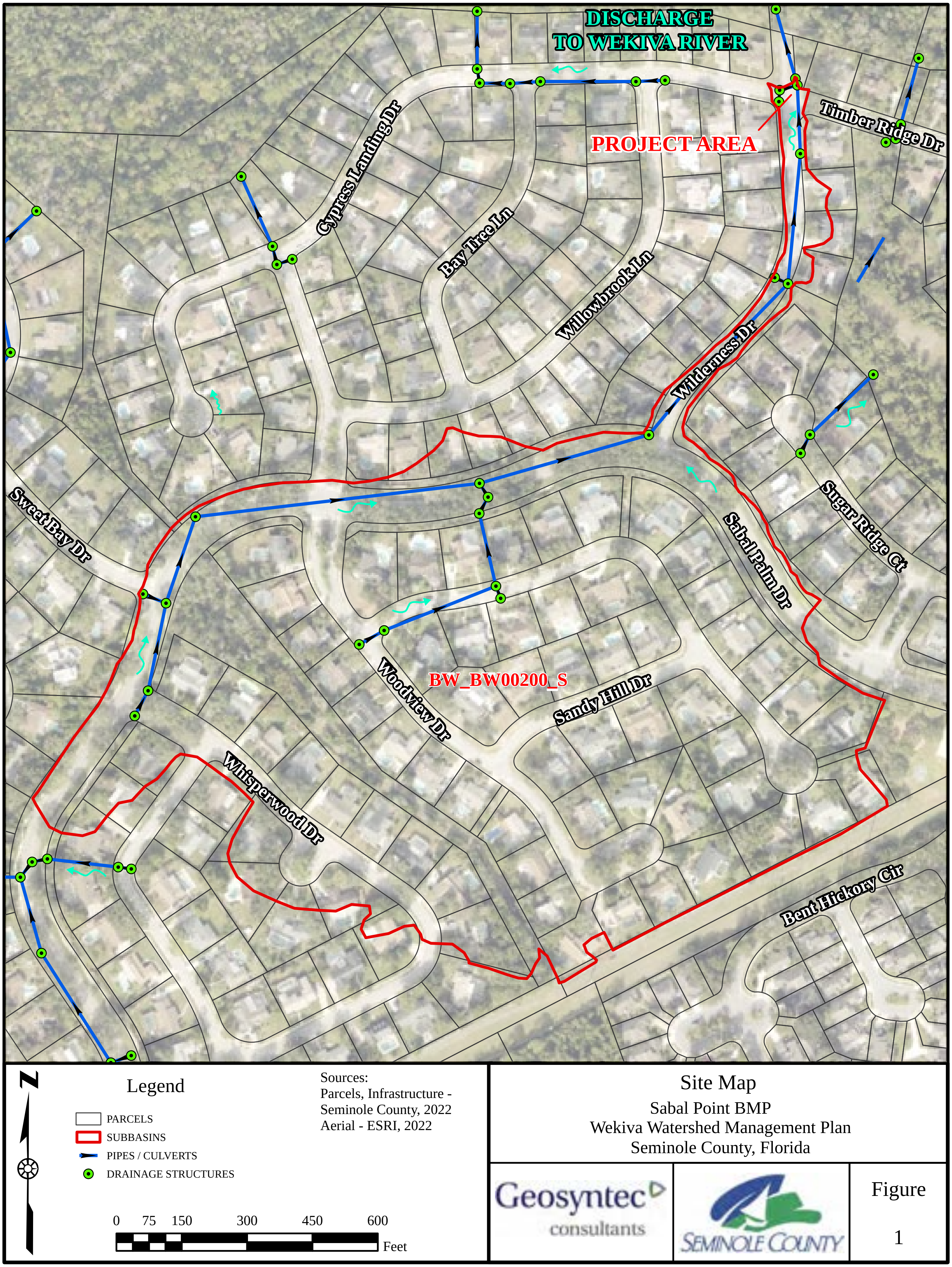
The purpose of this water quality improvement concept is to address pollutant loads discharged from Wilderness Drive to the Sabal Point Preserve. This site was identified as a priority location for a water quality enhancement project based on the Wekiva Watershed Management Plan.

The project area with existing drainage infrastructure is shown on **Figure 1**. A topographical map is included on **Figure 2**.

The goal of this improvement analysis was to provide a conceptual level assessment of the water quality benefits anticipated from the proposed best management practice (BMP). Specifically, cost benefit on a nutrient load reduction basis for total nitrogen (TN) and total phosphorus (TP) was estimated.

Existing Conditions

The project area is located west of I-4, along the north end of Wilderness Drive where it discharges into the Sabal Point Preserve. The contributing area consists of medium density residential land use. There is a system of curb inlets and storm piping that conveys stormwater runoff north from Wilderness Drive and ultimately outfalls to the Sabal Point Preserve. There are no existing stormwater BMPs in the contributing area.



Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

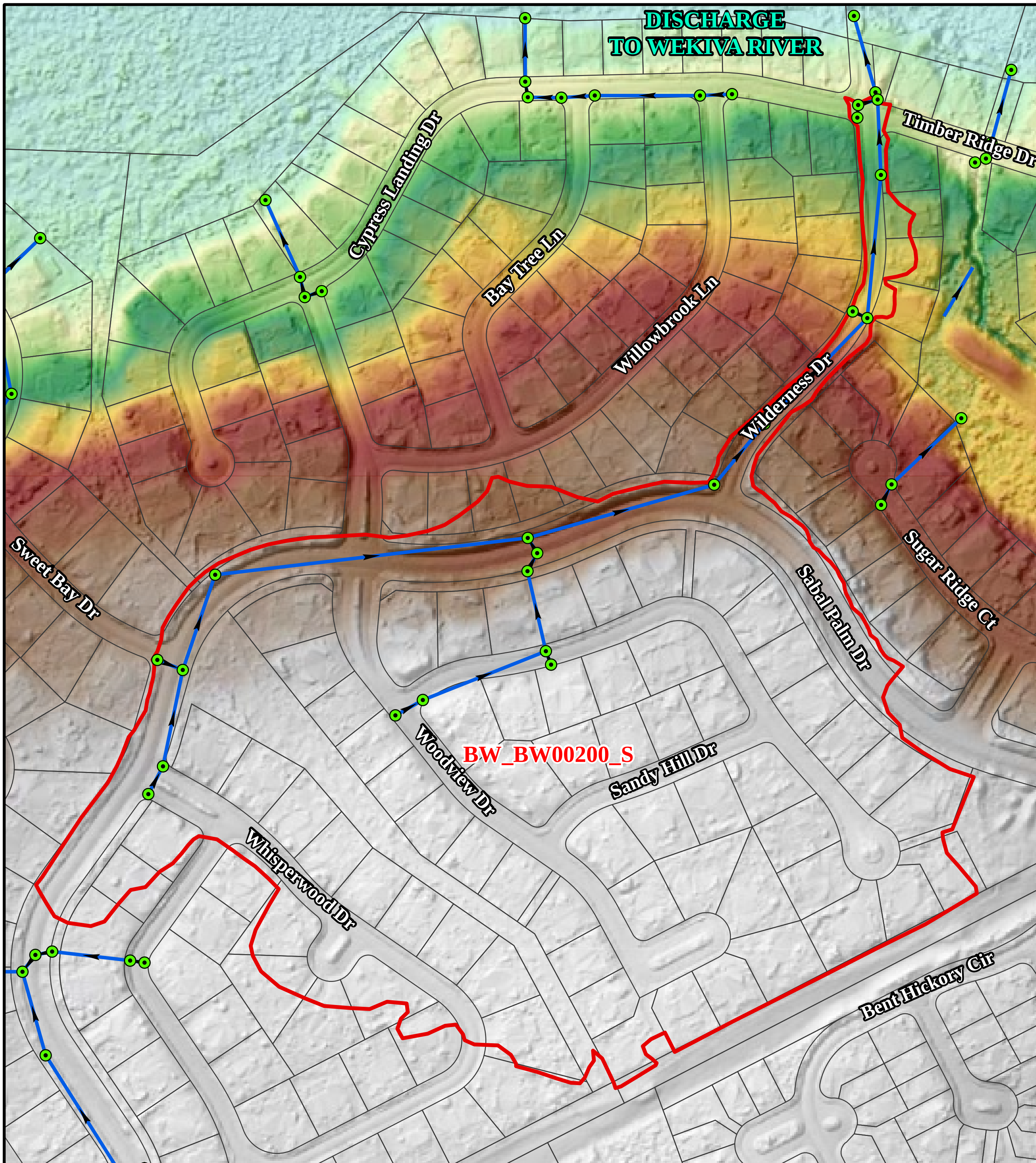
Site Map
Sabal Point BMP
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

Seminole County

Figure

1



N

Legend

PARCELS
SUBBASINS
PIPES / CULVERTS
DRAINAGE STRUCTURES

DEM
FEET NAVD 1988
68.47
38.6

0 75 150 300 450 600
Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022
DEM - USGS LIDAR, 2018

Topographical Map
Sabal Point BMP
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure
2

Photos of the contributing area are shown below.

Photo 1: Intersection of Wilderness Drive and Timber Ridge Drive, Looking North

Photo 2: Wilderness Drive, Looking South

Photo 3: Intersection of Wilderness Drive and Timber Ridge Drive, Looking West

Photo 4: Intersection of Wilderness Drive and Cypress Landing Drive, Looking East

Water Quality Improvement Concept

This water quality improvement concept includes the installation of a nutrient separating baffle box (NSBB) with upflow media filter. A NSBB is a water quality treatment technology that incorporates a screening system to capture large organics and debris, as well as a series of baffles and settling chambers to settle out smaller, lighter particles. The NSBB can also incorporate treatment media in an upflow configuration that is intended to provide both physical and biological removal of TN and TP. A high level overflow is incorporated in the NSBB to allow stormwater runoff to bypass the system when needed. A concept detail of the BMP is provided in **Photo 5**.

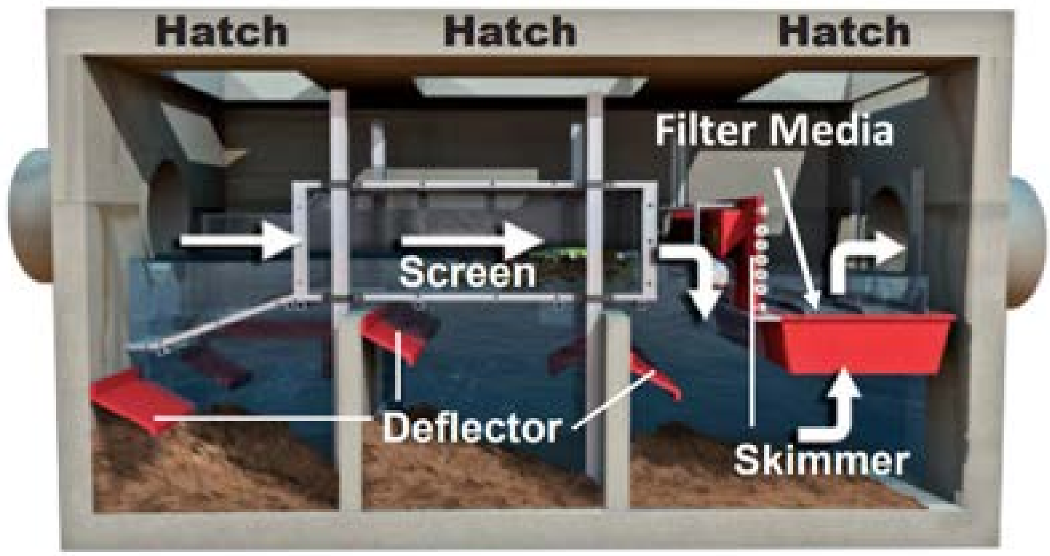
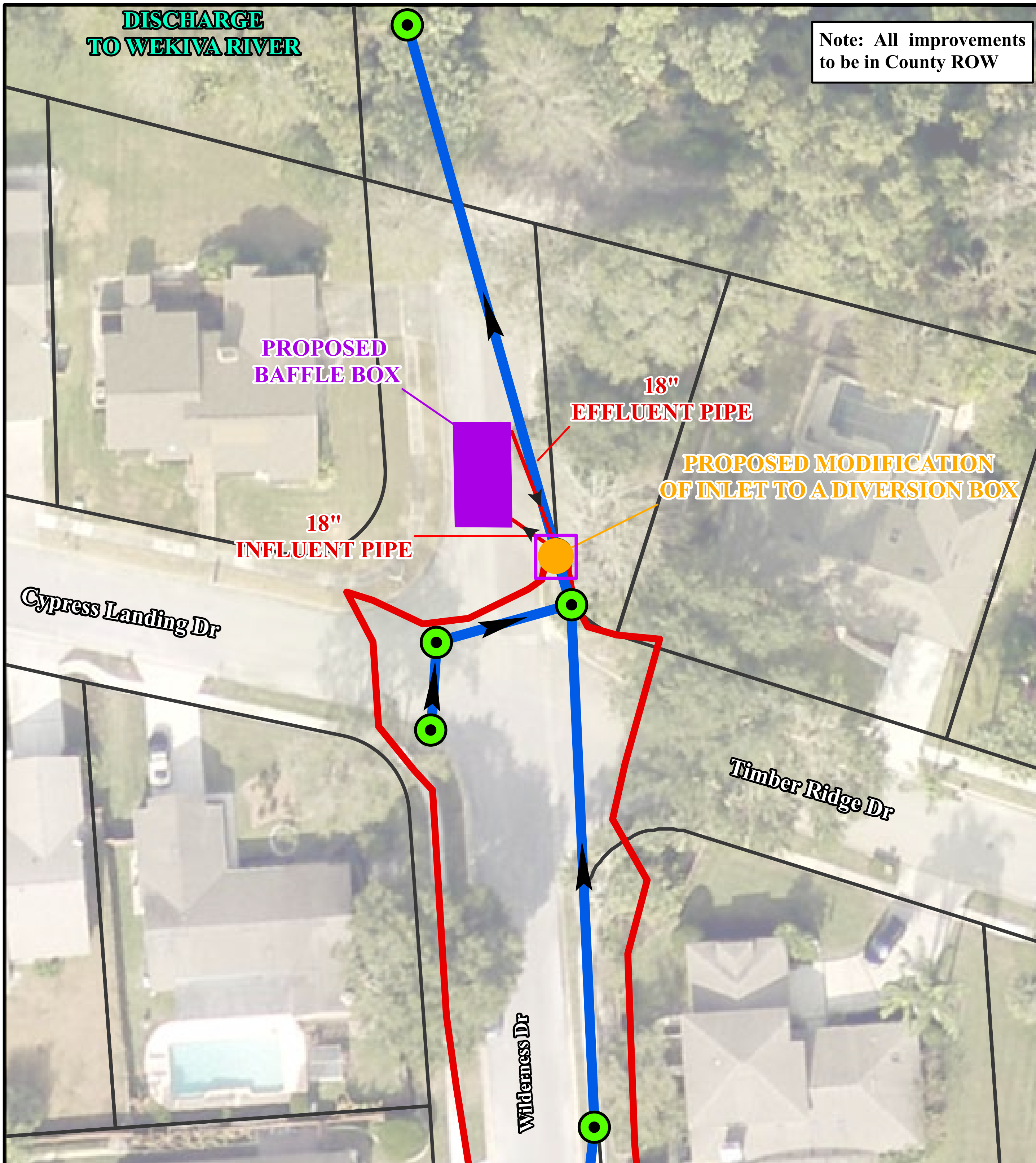


Photo 5: NSBB with Upflow Media Filter Concept (image from Oldcastle Infrastructure)

This improvement concept includes:

- Constructing the NSBB with upflow media filter just north of the intersection of Wilderness Drive and Timber Ridge Drive.
- Rerouting the north most curb inlet south to the proposed NSBB to treat stormwater runoff from the entire contributing area.
- Connecting the proposed NSBB to the existing outfall pipe that discharges to the Sabal Point Preserve.

The water quality improvement concept is shown on conceptually on **Figure 3**.



Legend

PARCELS

SUBBASINS

PIPES / CULVERTS

DRAINAGE STRUCUTRES

0 10 20 40 60 80 Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Proposed Improvements Map
Sabal Point BMP
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure 3

Pollutant Load Benefits

The average annual pollutant load discharged from the project area (subbasin BW_BW00200_S) was calculated as part of the Wekiva Watershed Management Plan utilizing a continuous simulation model run for a period of approximately 10 years. The pollutant load benefit for this water quality improvement concept was estimated based on engineering judgement and experience with similar types of stormwater BMP projects. The upflow media component of the NSBB was assigned a TN and TP removal rate of 45% based on manufacturer recommendations. The NSBB was assumed to treat 90% of the average annual stormwater runoff on a volumetric basis, which corresponds to a 10% bypass rate. The bypass rate accounts for high flow events when stormwater would bypass the BMP to avoid potential upstream flood stage impacts. The exact capture rate would be determined during design.

The estimated pollutant load benefit is summarized below in **Table 1**.

Table 1: Estimated Pollutant Load Benefit

Scenario	Average Annual TN Load (lb/yr)	Average Annual TP Load (lb/yr)	TN Load Removed (lb/yr)	TP Load Removed (lb/yr)	TN Load Removed over 20 Years (lb)	TP Load Removed over 20 Years (lb)
Proposed Conditions	302.1	48.6	122.4	19.7	2,447	394

Implementation Considerations

The following implementation considerations are provided for this improvement concept.

- Water Quality Benefit – This improvement provides a water quality benefit by providing treatment to the stormwater runoff prior to it discharging into the Sabal Point Preserve.
- Flood Benefit – This improvement concept is not intended to provide a direct flood benefit to the project area. The proposed water quality improvement concept is not anticipated to result in peak stage increases based on model results. This would be confirmed during design.
- Permitting Considerations – It is anticipated that this improvement would require a general permit for stormwater retrofit from the St. Johns River Water Management District. Based on the location of the NSBB, the project may meet exemption criteria since there are no anticipated wetland or surface water impacts.
- Engineering Design – Final engineering design should include collection of survey data, utility designation, geotechnical testing, preparation of design plans, preparation of a cost estimate, preparation of technical specifications, and utility coordination to address any needed conflict adjustments / relocations.
- Land Acquisition – Land or easement acquisition is not anticipated for this improvement. The BMP is proposed to be constructed in the County ROW.

- Wetland / Surface Water Impacts – The proposed water quality improvement has no anticipated wetland / surface water impacts.
- Benefit/Cost – The estimated total implementation cost for this improvement is $480,548. This cost includes construction, a 20% contingency, estimated annual maintenance, design and permitting, and CEI services. This translates to load removal rates on a cost basis of $160 per pound of TN and $997 per pound of TP. It is noted that loading removal rates were based on the estimated construction cost and maintenance. A detailed breakdown of the preliminary cost estimate is provided in **Table 2**.

Table 2: Engineer's Estimate of Probable Improvement Costs based on Concept

Sabal Point BMP						
Item	**Pay Item No.**	**Description**	**Units**	**Unit Cost**	**Quantity**	**Total**
1	101-1	Mobilization (15% of Construction Total)	LS	varies	1	$32,575
2	102-1	Maintenance of Traffic (5% of Construction Total)	LS	varies	1	$10,858
3	104-1	Prevention, Control and Abatement of Erosion and Water Pollution (10% of Construction Total)	LS	varies	1	$21,717
4	110-1-1	Clearing and Grubbing (5% of Construction Total)	LS	varies	1	$10,858
5	160-4	Type B Stabilization (12")	SY	$20.00	77	$1,540
6	285-704	Optional Base, Base Group 04 (6")	SY	$50.00	77	$3,850
7	334-1-13	Superpave Asphaltic Concrete, Traffic C (2")	SY	$275.00	77	$21,175
8	430-175-118	Pipe Culvert, Concrete, Round, 18" S/CD	LF	$175.00	40	$5,600
9	900-1	Nutrient Separating Baffle Box with Upflow Media Filter	EA	$185,000.00	1	$185,000
					SUBTOTAL COST:	$293,173
					CONTINGENCY (20%):	$58,635
					CONSTRUCTION SUBTOTAL:	$351,807
					MAINTENANCE SUBTOTAL:	$40,789
					DESIGN & PERMITTING:	$52,771
					CEI SERVICES:	$35,181
					ESTIMATED TOTAL IMPLEMENTATION COST:	**$480,548**

Notes:

1) *Above estimate does not include cost for potential utility relocations.*
2) *Assumes no muck or other removal of unsuitable soils.*
3) *900-1 is the estimated installed cost for the proposed Nutrient Separating Baffle Box*
4) *Maintenance Cost is assumed to be 1% of construction cost brought to Net Present Value (NPV) over 20 years using interest rate of 7%*
5) *Design and permitting was assumed to be 15% of the construction subtotal cost based on engineering judgement.*
6) *Construction engineering and inspection (CEI) services was assumed to be 10% of the construction subtotal cost based on engineering judgement.*

The information provided herein in considered to be preliminary for project planning purposes. As noted previously, design level efforts including detailed modeling will be necessary to quantify bypass rates, confirm flood stages, confirm pollutant load reductions, etc.

Conclusions

The goal of this effort was to develop a water quality improvement concept to reduce the pollutant loads discharged from the project area. A concept was developed consisting of installing a NSBB with upflow media filter just north of the intersection of Wilderness Drive and Timber Ridge Drive. The existing drainage infrastructure would be rerouted to the proposed NSBB for treatment and the NSBB would discharge treated stormwater runoff to the existing outfall pipe.

The nutrient load reduction via the NSBB over the 20 year expected life is estimated below:

- TN mass removed = 2,447 lbs.
- TP mass removed = 394 lbs.

The total project implementation cost was estimated to be approximately $480,548 including construction, contingency, maintenance, design and permitting, and CEI services. The project cost benefit from a pollutant load reduction perspective was determined to be:

- $160 per lb of TN.
- $997 per lb of TP.

Based on the foregoing, Geosyntec recommends that the County pursue design of this water quality improvement for the anticipated water quality benefits.

Water Quality Focused Project

Spring Landing BMP

Water Quality Improvement Alternatives Analysis

Spring Landing BMP

Wekiva Watershed Management Plan

Seminole County, Florida

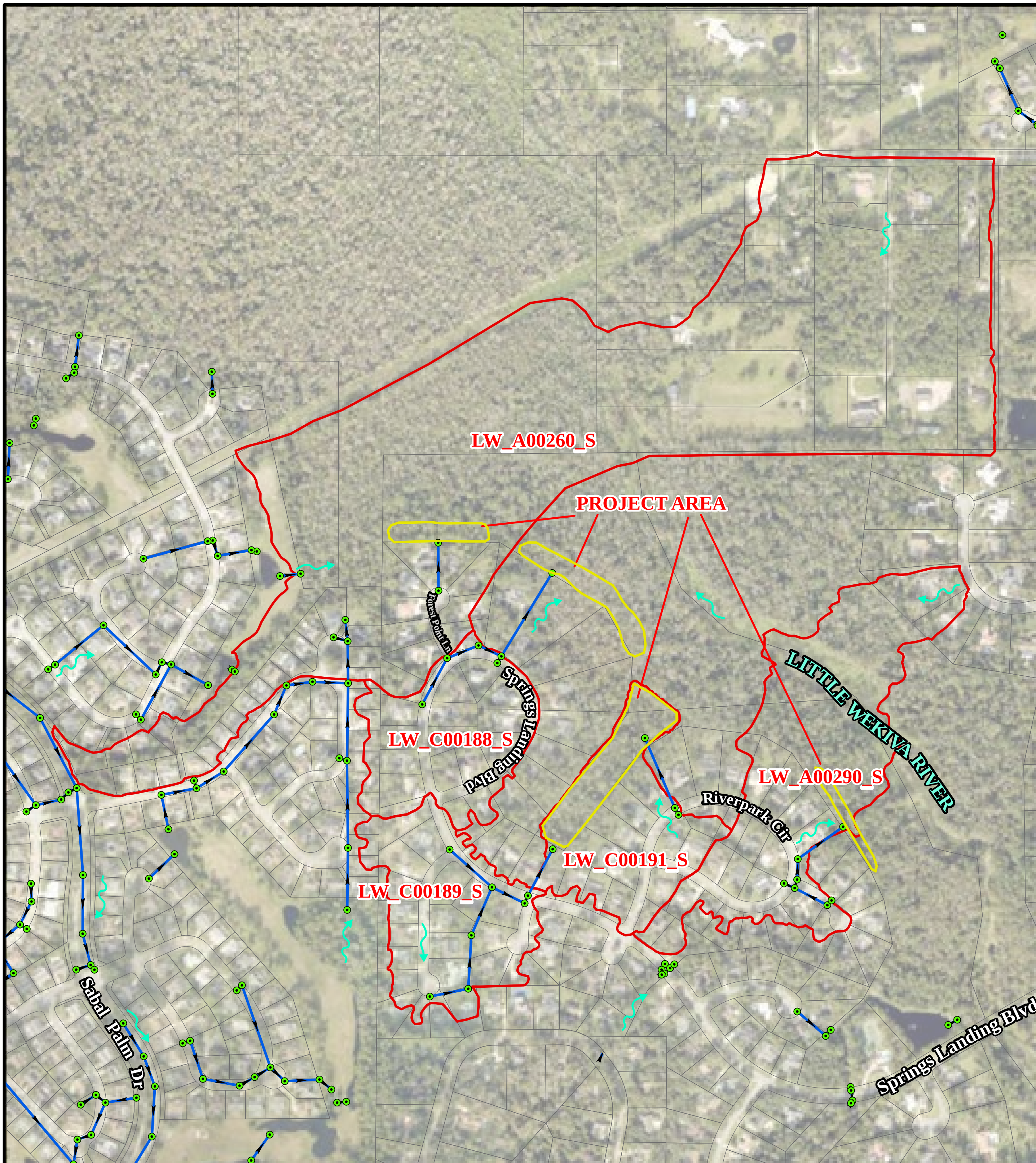
The purpose of this water quality improvement concept is to address pollutant loads discharged from Springs Landing Boulevard to the Little Wekiva River. This site was identified as a priority location for a water quality enhancement project based on the Wekiva Watershed Management Plan.

The project area with existing drainage infrastructure is shown on **Figure 1**. A topographical map is included on **Figure 2**.

The goal of this improvement analysis was to provide a conceptual level assessment of the water quality benefits anticipated from the proposed best management practice (BMP). Specifically, cost benefit on a nutrient load reduction basis for total nitrogen (TN) and total phosphorus (TP) was estimated.

Existing Conditions

The project area is located west of I-4, along Springs Landing Boulevard where it discharges into the Little Wekiva River. The contributing area consists of medium density residential land use. There is a system of curb inlets and storm piping that conveys stormwater runoff northeast along Springs Landing Boulevard until it ultimately discharges into the Little Wekiva River. There are no existing stormwater BMPs in the contributing area.



N

Legend

- PARCELS
- SUBBASINS
- PIPES / CULVERTS
- DRAINAGE STRUCTURES

0 165 330 660 990 1,320 Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

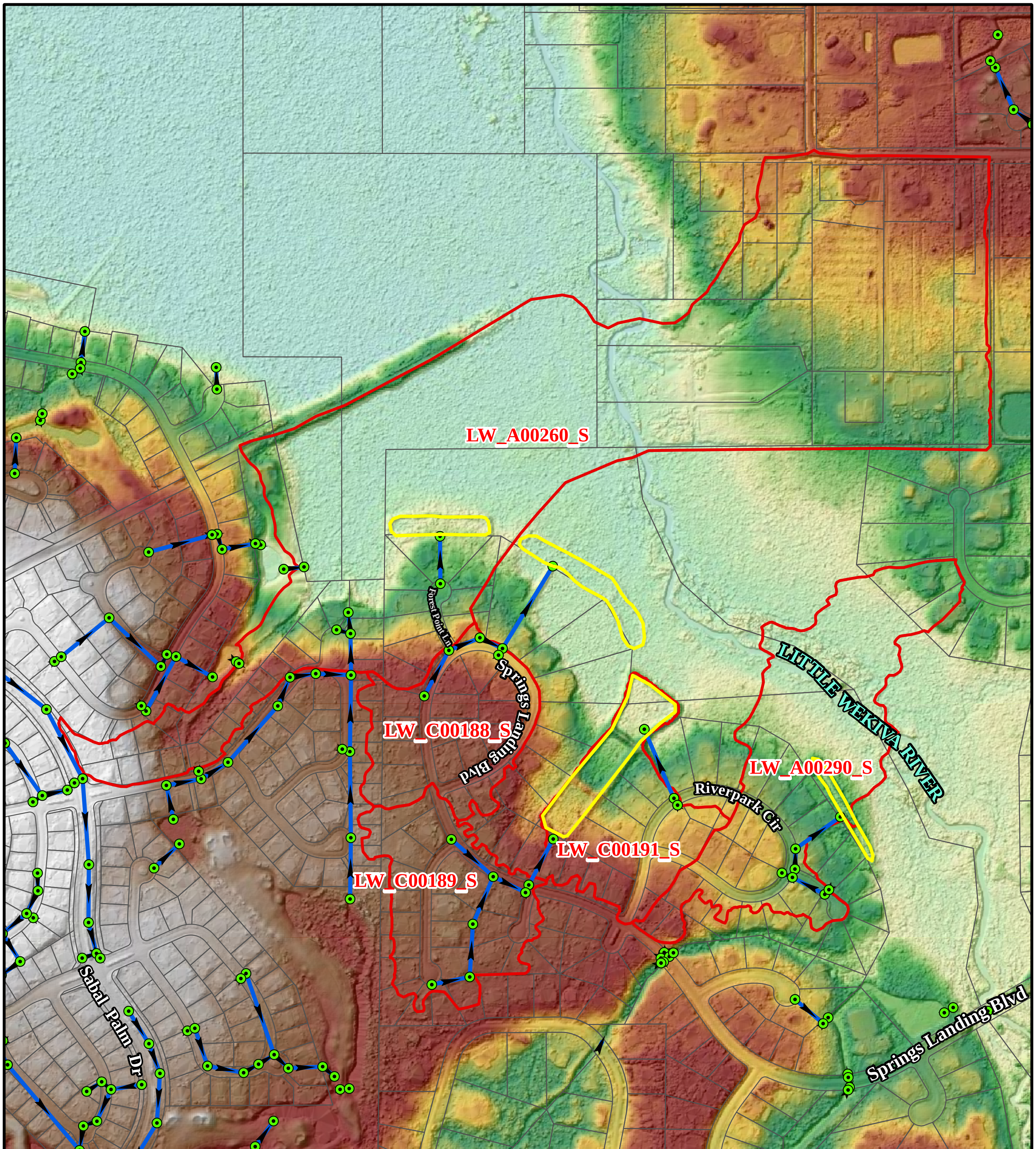
Site Map
Spring Landing BMP
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure

1



N

Legend

- PARCELS
- SUBBASINS
- PIPES / CULVERTS
- DRAINAGE STRUCTURES

DEM
FEET NAVD 1988
68.47
38.6

0 165 330 660 990 1,320 Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022
DEM - USGS LIDAR, 2018

Topographical Map
Spring Landing BMP
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure

2

Photos of the contributing area are shown below.

Photo 1: Cul-de-sac at Forest Point Lane, Looking North

Photo 2: Inlets located on Springs Landing Boulevard, Looking East

Photo 3: Inlets located on the west side of Riverpark Circle, Looking Northwest

Photo 4: Intersection of Riverpark Circle and Riverpark Court, Looking North

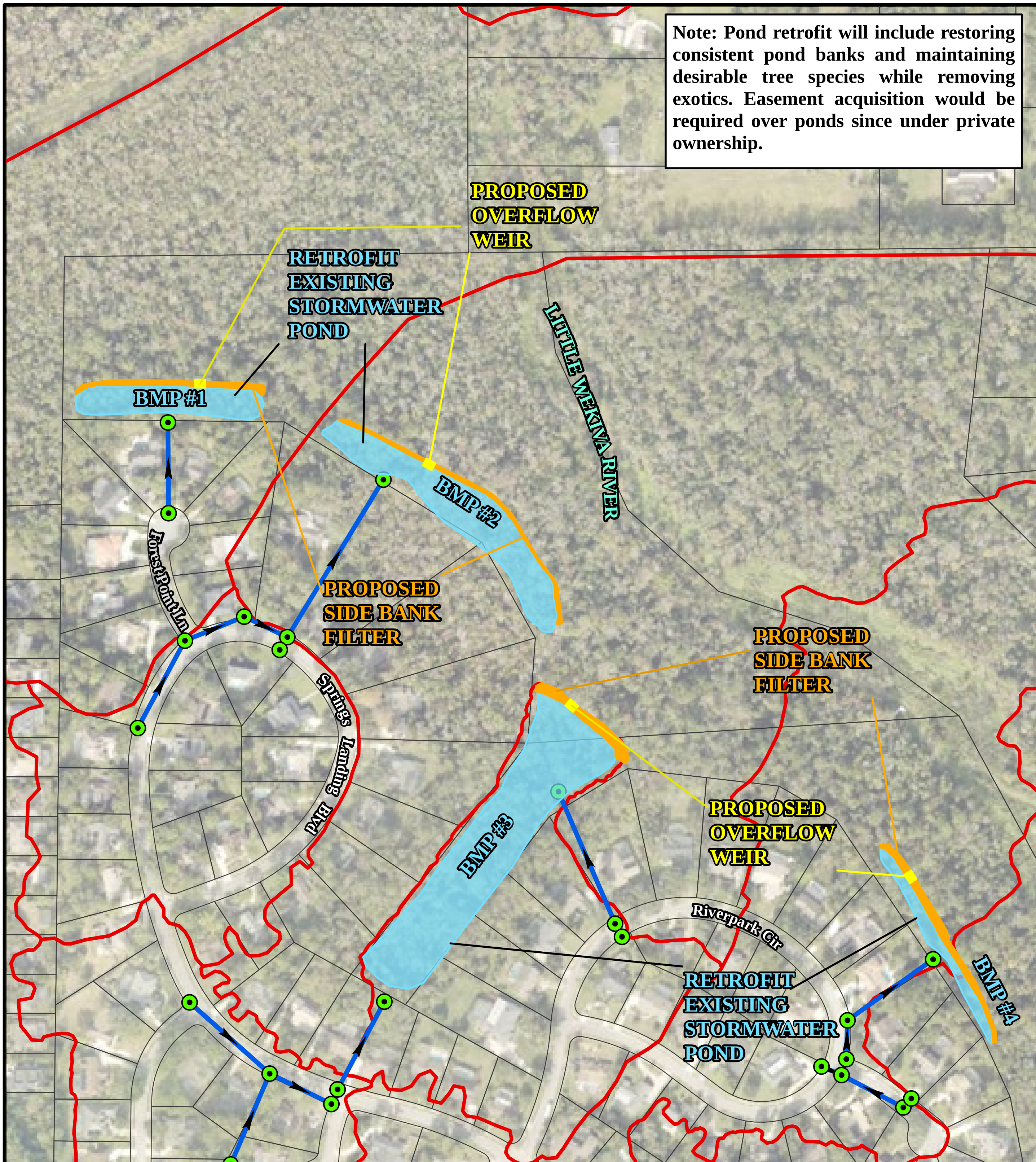
Water Quality Improvement Concept

This water quality improvement concept includes retrofitting four existing ponded areas into functioning stormwater ponds to provide a water quality benefit. Due to a lack of design information and overgrown nature of the ponded areas, they do not currently appear to provide substantial water quality benefits for the contributing area. The proposed stormwater ponds will provide water quality treatment to the runoff prior to it discharging into the Little Wekiva River. The proposed stormwater ponds will have a side bank media filter that will provide both physical and biological removal of TN and TP. The proposed stormwater ponds will incorporate a high-level overflow weir to allow stormwater runoff to bypass the system when needed.

This improvement concept includes:

- Retrofit existing ponded areas by removing invasive species and leveling out the existing ground surface.
- Replace downstream bank with side bank media filter.
- Install a concrete overflow weir to allow bypass during high flow storm events.

The water quality improvement concept is shown on conceptually on **Figure 3**.



N

Legend

PARCELS

SUBBASINS

PIPES / CULVERTS

DRAINAGE STRUCTURES

0 87.5 175 350 525 700 Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Proposed Improvements Map

Spring Landing BMP
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

Seminole County

Figure

3

Pollutant Load Benefits

The average annual pollutant load discharged from the project area (subbasins LW_C00188_S, LW_C00189_S, LW_C0191_S, LW_A00260_S, and LW_A00290_S) was calculated as part of the Wekiva Watershed Management Plan utilizing a continuous simulation model run for a period of approximately 10 years. The pollutant load benefit for this water quality improvement concept was estimated based on engineering judgement and experience with similar types of stormwater BMP projects. The upflow media component of the side bank filter was assigned a TN and TP removal rate of 45% based on manufacturer recommendations. The side bank filter was assumed to treat 90% of the average annual stormwater runoff on a volumetric basis, which corresponds to a 10% bypass rate. The bypass rate accounts for high flow events when stormwater would bypass the BMP to avoid potential upstream flood stage impacts. The exact capture rate would be determined during design.

The estimated pollutant load benefit is summarized below in **Table 1**.

Table 1: Estimated Pollutant Load Benefit

Scenario	Average Annual TN Load (lb/yr)	Average Annual TP Load (lb/yr)	TN Load Removed (lb/yr)	TP Load Removed (lb/yr)	TN Load Removed over 20 Years (lb)	TP Load Removed over 20 Years (lb)
BMP #1	20.3	3.3	8.2	1.3	165	26
BMP #2	88.2	14.2	35.7	5.8	715	115
BMP #3	157.8	18.0	63.9	7.3	1,278	146
BMP #4	60.9	9.8	24.6	4.0	493	79

Implementation Considerations

The following implementation considerations are provided for this improvement concept.

- Water Quality Benefit – This improvement provides a water quality benefit by providing treatment to the stormwater runoff prior to it discharging into the Little Wekiva River.
- Flood Benefit – This improvement concept is not intended to provide a direct flood benefit to the project area. The proposed water quality improvement concept is not anticipated to result in peak stage increases based on model results. This would be confirmed during design.
- Permitting Considerations – It is anticipated that this improvement would require a general permit for stormwater retrofit from the St. Johns River Water Management District. Based on the location of the stormwater ponds, the project may meet exemption criteria since there are no anticipated wetland or surface water impacts.
- Engineering Design – Final engineering design should include collection of survey data, utility designation, geotechnical testing, preparation of design plans, preparation of a cost estimate, preparation of technical specifications, and utility coordination to address any needed conflict adjustments / relocations.

- Land Acquisition – Easement acquisition from the subdivision home owners association is anticipated for this improvement.
- Wetland / Surface Water Impacts – The proposed water quality improvement has no anticipated wetland / surface water impacts.
- Benefit/Cost – The estimated total implementation cost for this improvement is $1,330,759. This cost includes construction, a 20% contingency, estimated annual maintenance, design and permitting, CEI services, and easement / property acquisition. This translates to load removal rates on a cost basis of $410 per pound of TN and $2,965 per pound of TP. It is noted that loading removal rates were based on the estimated construction cost and maintenance. A detailed breakdown of the preliminary cost estimate is provided in **Table 2**.

Table 2: Engineer's Estimate of Probable Improvement Costs based on Concept

Spring Landing BMP						
Item	**Pay Item No.**	**Description**	**Units**	**Unit Cost**	**Quantity**	**Total**
1	101-1	Mobilization (15% of Construction Total)	LS	varies	1	$81,187
2	102-1	Maintenance of Traffic (10% of Construction Total)	LS	varies	1	$54,125
3	104-1	Prevention, Control and Abatement of Erosion and Water Pollution (10% of Construction Total)	LS	varies	1	$54,125
4	110-1-1	Clearing and Grubbing (15% of Construction Total)	LS	varies	1	$81,187
5	120-1	Excavation, Embankment, and Grading	CY	$20.00	2600	$52,000
6	570-1-2	Performance Turf, Sod	SY	$14.00	3720	$52,080
7	900-1	Selective Vegetation Clearing	LS	varies	4	$30,000
8	900-2	Side Bank Media Filter	LS	varies	4	$88,000
9	900-3	Concrete Overflow Weir	LS	varies	4	$40,000
10	900-4	Easement / Property Acquisition	LS	varies	1	$279,167
					SUBTOTAL COST:	$811,870
					CONTINGENCY (20%):	$162,374
					CONSTRUCTION SUBTOTAL:	$974,244
					MAINTENANCE SUBTOTAL:	$112,954
					DESIGN & PERMITTING:	$146,137
					CEI SERVICES:	$97,424
					ESTIMATED TOTAL IMPLEMENTATION COST:	**$1,330,759**

Notes:

1) *Above estimate does not include cost for potential utility relocations.*
2) *Assumes no muck or other removal of unsuitable soils.*
3) *Maintenance Cost is assumed to be 1% of construction cost brought to Net Present Value (NPV) over 20 years using interest rate of 7%*
4) *Design and permitting was assumed to be 15% of the construction subtotal cost based on engineering judgement.*
5) *Construction engineering and inspection (CEI) services was assumed to be 10% of the construction subtotal cost based on engineering judgement.*
6) *Costs for 900-4 were obtained from the Seminole County property appraiser and were assumed to be 1.5 times the parcel value (land + buildings + features) to account for administrative costs. Assumed that City and Florida Power easements would be donated at no cost.*

The information provided herein in considered to be preliminary for project planning purposes. As noted previously, design level efforts including detailed modeling will be necessary to quantify bypass rates, confirm flood stages, confirm pollutant load reductions, etc.

Conclusions

The goal of this effort was to develop a water quality improvement concept to reduce the pollutant loads discharged from the project area. A concept was developed consisting of retrofitting four existing stormwater ponds with side bank media filters. The existing drainage infrastructure would discharge into the stormwater ponds for treatment and then discharge into the Little Wekiva River.

The nutrient load reduction via the BMPs over the 20 year expected life is estimated below:

Table 3: Pollutant Load Removed

Scenario	TN Load Removed over 20 Years (lb)	TP Load Removed over 20 Years (lb)
BMP #1	165	26
BMP #2	715	115
BMP #3	1,278	146
BMP #4	493	79
Overall Project	**2,650**	**367**

The total project implementation cost was estimated to be approximately $1,330,759 including construction, contingency, maintenance, design and permitting, CEI services, and easement / property acquisition. The project cost benefit from a pollutant load reduction perspective was determined to be:

Table 4: Pollutant Load Cost

Scenario	TN ($/lb)	TP ($/lb)
BMP #1	$1,428	$9,059
BMP #2	$534	$3,322
BMP #3	$602	$5,267
BMP #4	$245	$1,531
Overall Project	**$410**	**$2,965**

Based on the foregoing, Geosyntec recommends that the County pursue design of this water quality improvement for the anticipated water quality benefits.

Water Quality Focused Project

Sweetwater BMP 1

Water Quality Improvement Alternatives Analysis

Sweetwater BMP #1

Wekiva Watershed Management Plan

Seminole County, Florida

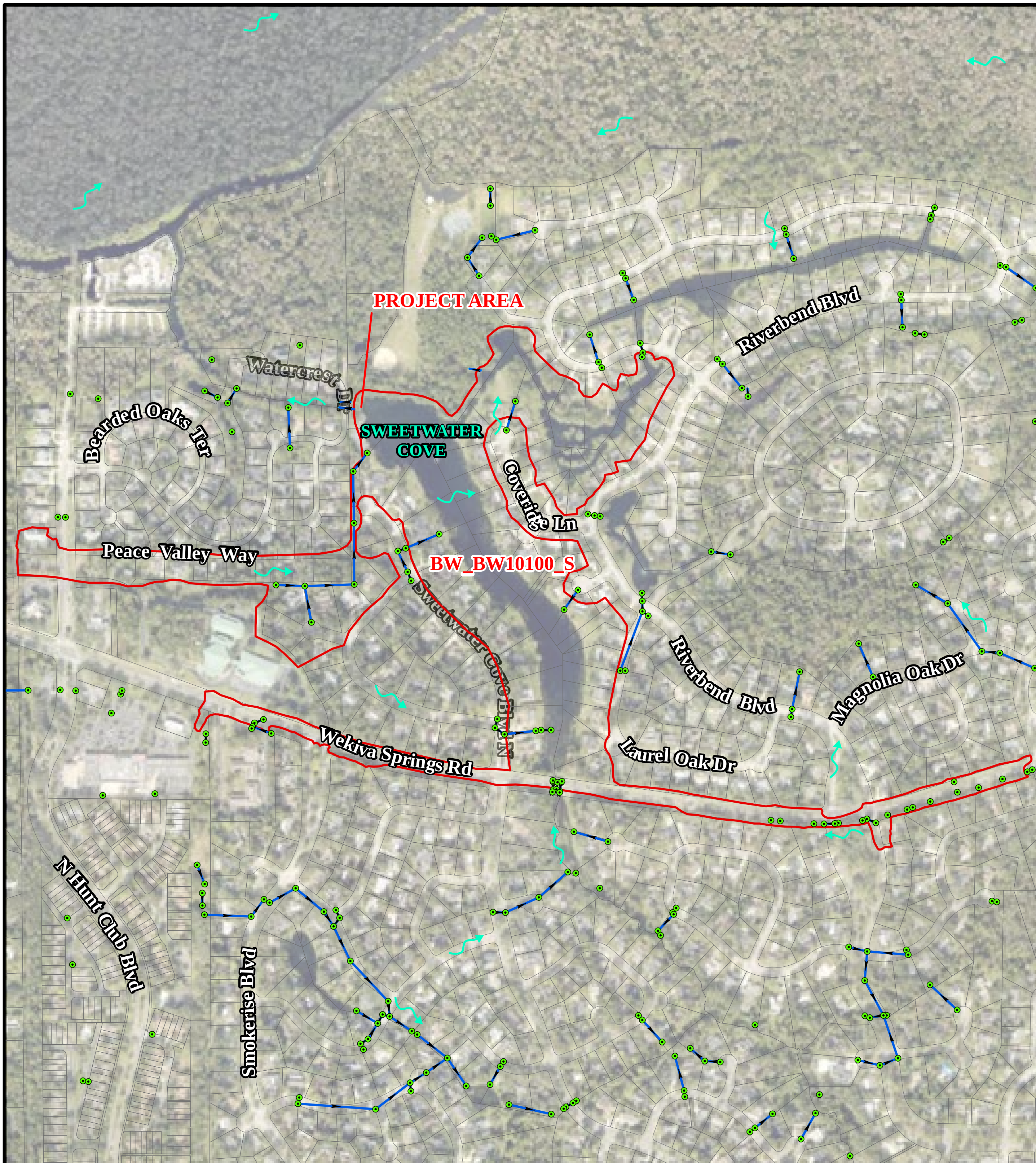
The purpose of this water quality improvement concept is to address pollutant loads discharged from a subdivision stormwater pond on the north side of Wekiva Springs Road to a ditch upstream of the Little Wekiva River. This site was identified as a priority location for a water quality enhancement project based on the Wekiva Watershed Management Plan.

The project area with existing drainage infrastructure is shown on **Figure 1**. A topographical map is included on **Figure 2**.

The goal of this improvement analysis was to provide a conceptual level assessment of the water quality benefits anticipated from the proposed best management practice (BMP). Specifically, cost benefit on a nutrient load reduction basis for total nitrogen (TN) and total phosphorus (TP) was estimated.

Existing Conditions

The project area is located at the stormwater pond outfall along Watercrest Drive. The contributing area consists of medium density residential land use. Existing drainage infrastructure in the project area consists of curb inlets and storm piping that discharge to the stormwater pond. The stormwater pond outfall consists of a structural weir followed by a 30" pipe that convey water under Watercrest Drive and discharge to the ditch upstream of the Little Wekiva River. There existing stormwater pond functions as a BMP for the contributing area.



N

Legend

PARCELS
SUBBASIN
PIPES / CULVERTS
DRAINAGE STRUCTURES

0 187.5 375 750 1,125 1,500
Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Site Map

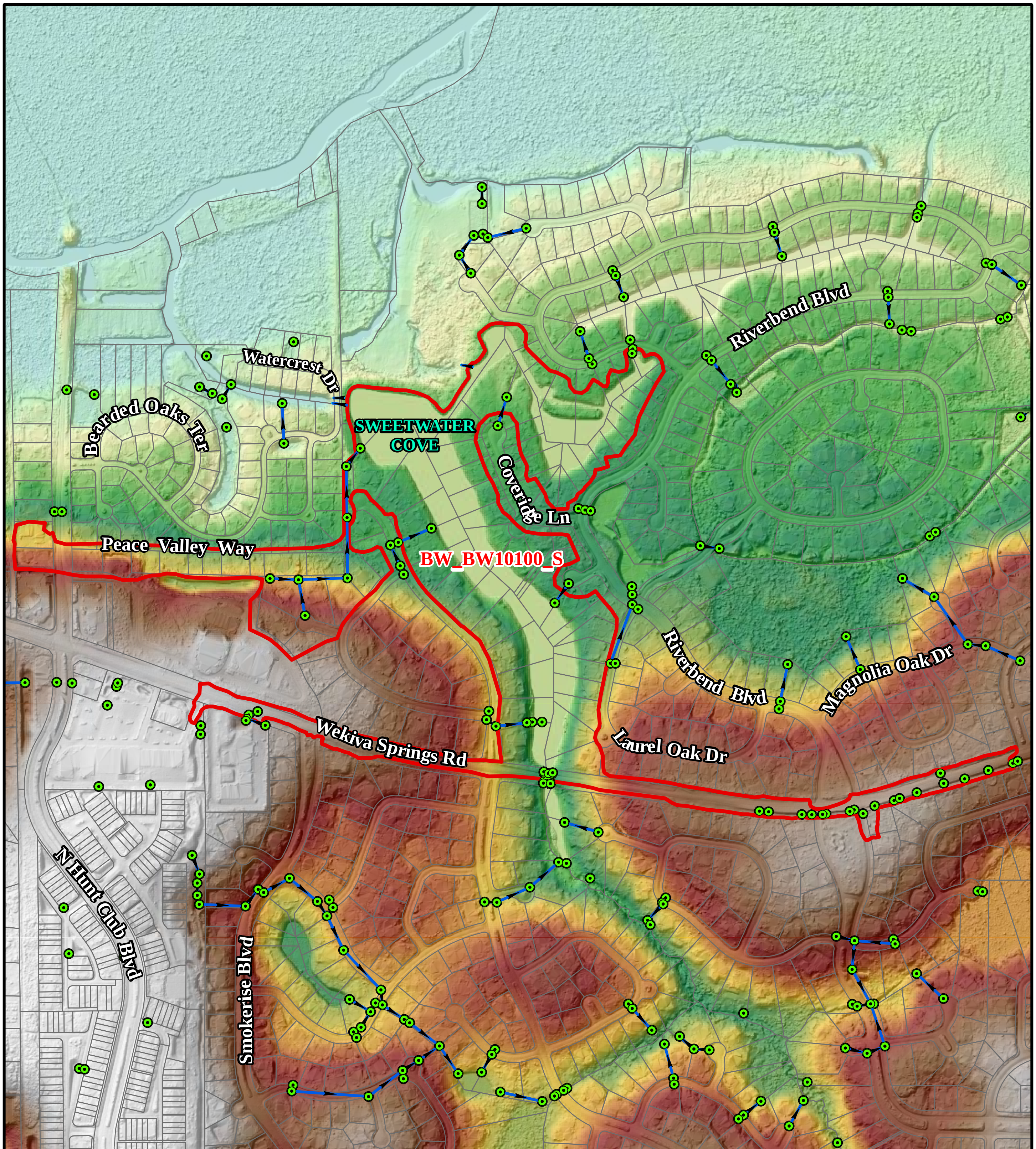
Sweetwater BMP #1
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure

1



N

Legend

PARCELS

SUBBASIN

PIPES / CULVERTS

DRAINAGE STRUCTURES

DEM

FEET NAVD 1988

68.47

38.6

0 187.5 375 750 1,125 1,500

Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022
DEM - USGS LIDAR, 2018

Topographical Map

Sweetwater BMP #1

Wekiva Watershed Management Plan

Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure

2

Photos of the contributing area are shown below.

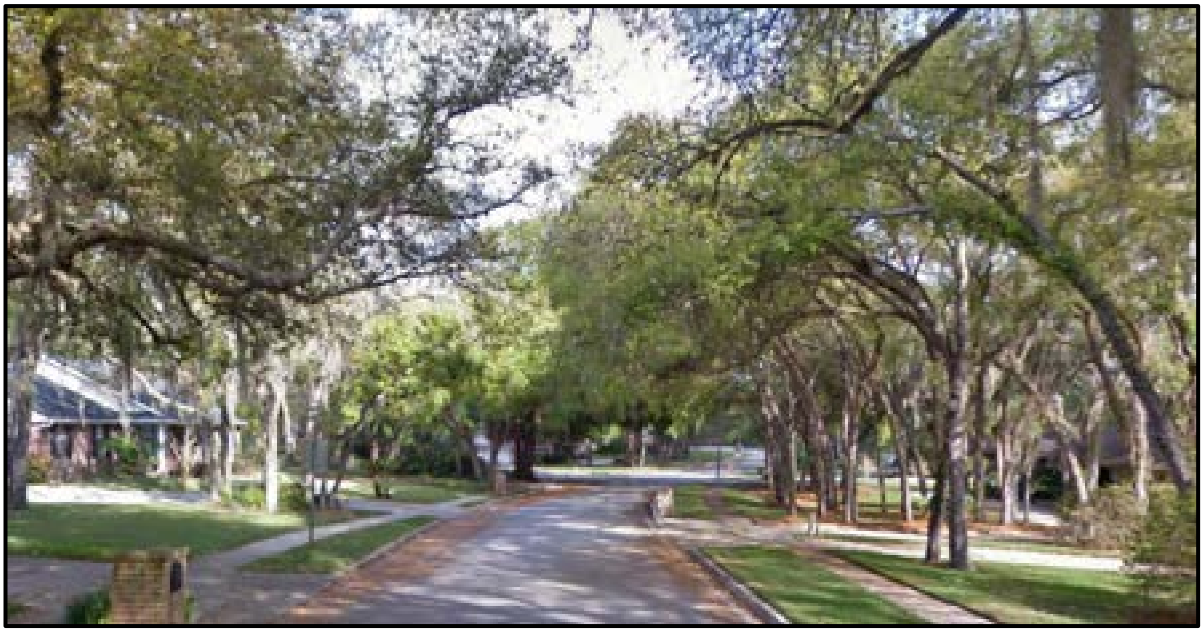


Photo 1: Sweetwater Cove Boulevard North, Looking Northwest

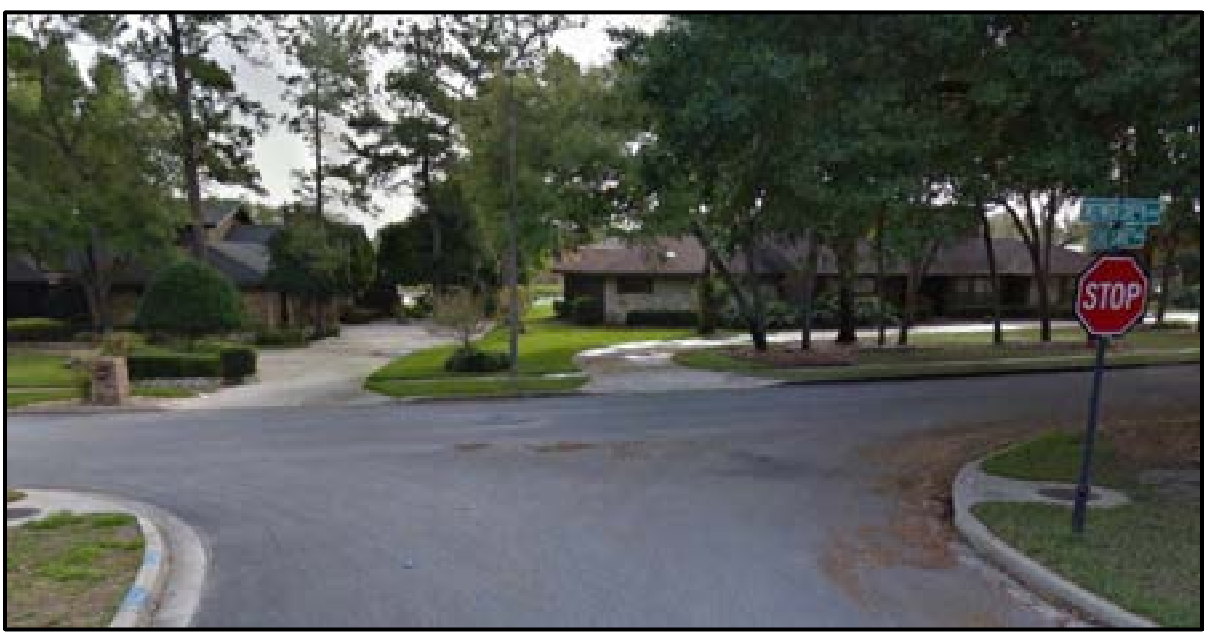


Photo 2: Intersection of Sweetwater Cove Boulevard North and Cove Lake Drive, Looking East

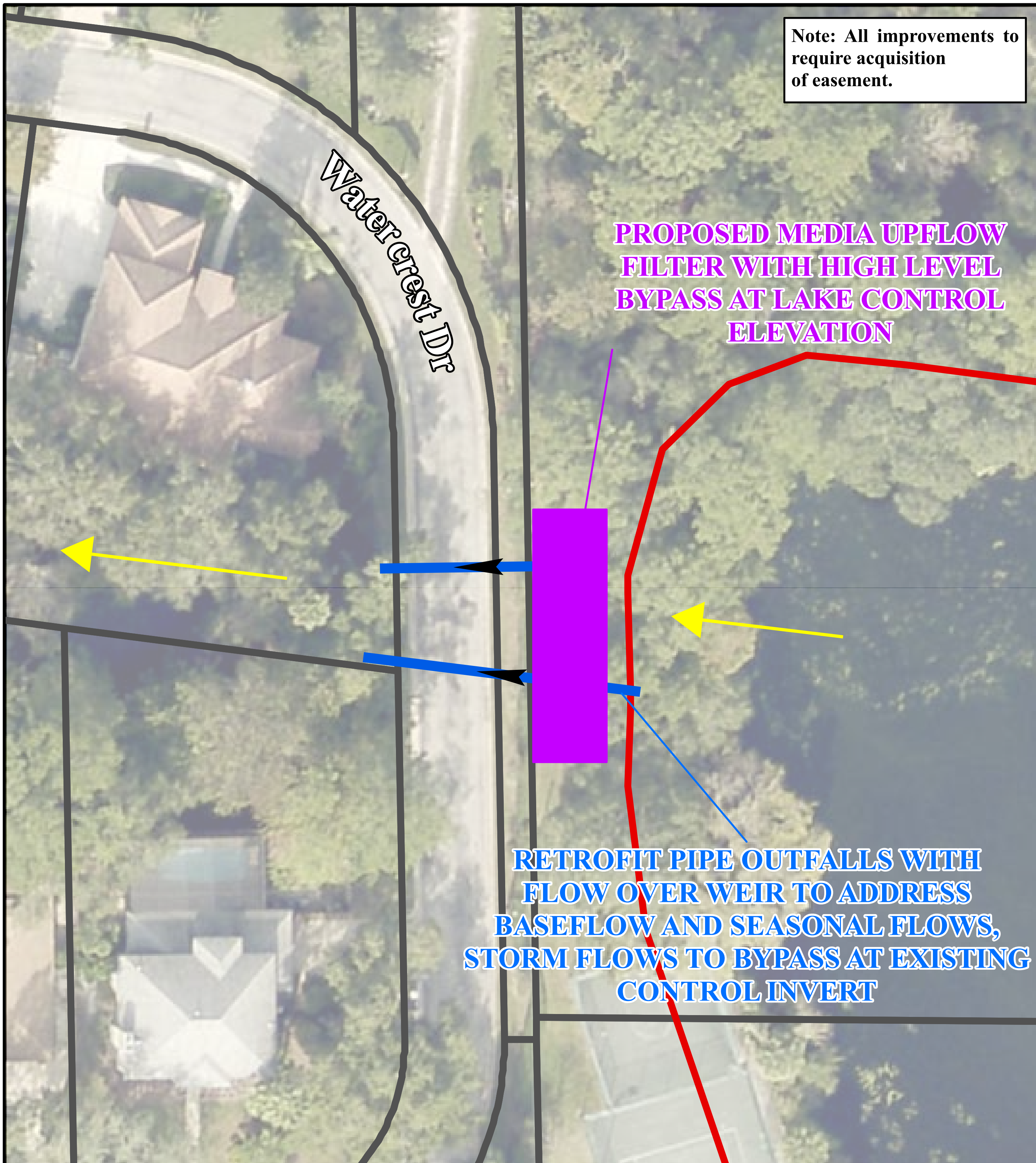
Photo 3: Intersection of Sweetwater Cove Boulevard North and Cove Lake Drive, Looking South

Photo 4: Cul-de-sac at the end of Sweetwater Cove Boulevard North, Looking Northwest

Water Quality Improvement Concept

This water quality improvement concept includes constructing an upflow media filter box with high level bypass under Watercrest Drive to provide additional treatment to stormwater discharged from the existing lake. This concept is similar to a nutrient separating baffle box (NSBB) but does not incorporate the screening and baffles as the majority of solids should have already settled out in the existing lake. This concept is focused on reducing TN and TP loads through physical and biological removal processes in the filter media. The treatment will be focused on baseflow and seasonal discharges over the lake control elevation. A high level bypass is included to allow stormwater to bypass the media filter when needed during high flow storm events.

The water quality improvement concept is shown on conceptually on **Figure 3**.



N

Legend

PARCELS

SUBBASIN

PIPES / CULVERTS

DRAINAGE STRUCTURES

0 10 20 40 60 80 Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Proposed Improvements Map

Sweetwater BMP #1
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure

3

Pollutant Load Benefits

The average annual pollutant load discharged from the project area (subbasin BW_BW01390_S) was calculated as part of the Wekiva Watershed Management Plan utilizing a continuous simulation model run for a period of approximately 10 years. The pollutant load benefit for this water quality improvement concept was estimated based on engineering judgement and experience with similar types of stormwater BMP projects. The upflow media component of the BMP was assigned a TN and TP removal rate of 45% based on manufacturer recommendations. The upflow media filter box with high level bypass was assumed to capture 90% of the average annual stormwater runoff on a volumetric basis, which corresponds to a 10% bypass rate. The bypass rate accounts for high flow events when stormwater would bypass the BMP to avoid potential upstream flood stage impacts. The exact capture rate would be determined during design.

The estimated pollutant load benefit is summarized below in **Table 1**.

Table 1: Estimated Pollutant Load Benefit

Scenario	Average Annual TN Load (lb/yr)	Average Annual TP Load (lb/yr)	TN Load Removed (lb/yr)	TP Load Removed (lb/yr)	TN Load Removed over 20 Years (lb)	TP Load Removed over 20 Years (lb)
Proposed Conditions	212.1	17.0	85.9	6.9	1,718	137

Implementation Considerations

The following implementation considerations are provided for this improvement concept.

- Water Quality Benefit – This improvement provides a water quality benefit by treating stormwater discharged from the existing pond, thereby reducing the pollutant load discharged to the Little Wekiva River.
- Flood Benefit – This improvement concept is not intended to provide a direct flood benefit to the project area. The proposed water quality improvement concept is not anticipated to result in peak stage increases based on model results. This would be confirmed during design.
- Permitting Considerations – It is anticipated that this improvement would require a general permit for stormwater retrofit from the St. Johns River Water Management District. The improvement may qualify for certain exemption criteria based on the location since there are no anticipated wetland or surface water impacts.
- Engineering Design – Final engineering design should include collection of survey data, utility designation, geotechnical testing, preparation of design plans, preparation of a cost estimate, preparation of technical specifications, and utility coordination to address any needed conflict adjustments / relocations.
- Land Acquisition – Easement acquisition is anticipated to be necessary from the home owners association to construct this improvement.

- Wetland / Surface Water Impacts – The proposed water quality improvement has no anticipated wetland / surface water impacts.
- Benefit/Cost – The estimated total implementation cost for this improvement is $732,786. This cost includes construction, a 20% contingency, estimated annual maintenance, design and permitting, CEI services, and easement / property acquisition. This translates to load removal rates on a cost basis of $348 per pound of TN and $4,370 per pound of TP. It is noted that loading removal rates were based on the estimated construction cost and maintenance. A detailed breakdown of the preliminary cost estimate is provided in **Table 2**.

Table 2: Engineer's Estimate of Probable Improvement Costs based on Concept

Sweetwater BMP #1						
Item	**Pay Item No.**	**Description**	**Units**	**Unit Cost**	**Quantity**	**Total**
1	101-1	Mobilization (15% of Construction Total)	LS	varies	1	$44,706
2	102-1	Maintenance of Traffic (10% of Construction Total)	LS	varies	1	$29,804
3	104-1	Prevention, Control and Abatement of Erosion and Water Pollution (10% of Construction Total)	LS	varies	1	$29,804
4	110-1-1	Clearing and Grubbing (15% of Construction Total)	LS	varies	1	$44,706
5	570-1-2	Performance Turf, Sod	SY	$14.00	150	$2,100
6	900-1	Upflow Media Filter Box with High Level Bypass	EA	$190,000.00	1	$190,000
7	900-2	Easement / Property Acquisition	LS	varies	1	$105,939
					SUBTOTAL COST:	$447,059
					CONTINGENCY (20%):	$89,412
					CONSTRUCTION SUBTOTAL:	$536,470
					MAINTENANCE SUBTOTAL:	$62,198
					DESIGN & PERMITTING:	$80,471
					CEI SERVICES:	$53,647
					ESTIMATED TOTAL IMPLEMENTATION COST:	**$732,786**

Notes:

1) *Above estimate does not include cost for potential utility relocations.*
2) *Assumes no muck or other removal of unsuitable soils.*
3) *900-1 is the estimated installed cost for the proposed Nutrient Separating Baffle Box*
4) *Maintenance Cost is assumed to be 1% of construction cost brought to Net Present Value (NPV) over 20 years using interest rate of 7%*
5) *Design and permitting was assumed to be 15% of the construction subtotal cost based on engineering judgement.*
6) *Construction engineering and inspection (CEI) services was assumed to be 10% of the construction subtotal cost based on engineering judgement.*
7) *Costs for 900-2 were obtained from the Seminole County property appraiser and were assumed to be 1.5 times the parcel value (land + buildings + features) to account for administrative costs. Assumed that City and Florida Power easements would be donated at no cost.*

The information provided herein in considered to be preliminary for project planning purposes. As noted previously, design level efforts including detailed modeling will be necessary to quantify bypass rates, confirm flood stages, confirm pollutant load reductions, etc.

Conclusions

The goal of this effort was to develop a water quality improvement concept to reduce the pollutant loads discharged from the project area. A concept was developed consisting of an upflow media filter box with high level bypass under Watercrest Drive to provide additional treatment to stormwater discharged from the existing lake.

The nutrient load reduction via the improvements over the 20 year expected life is estimated below:

- TN mass removed = 1,718 lbs.
- TP mass removed = 137 lbs.

The total project implementation cost was estimated to be approximately $732,786 including construction, contingency, maintenance, design and permitting, CEI services, and easement / property acquisition. The project cost benefit from a pollutant load reduction perspective was determined to be:

- $348 per lb of TN.
- $4,370 per lb of TP.

Based on the foregoing, Geosyntec recommends that the County pursue design of this water quality improvement for the anticipated water quality benefits.

Water Quality Focused Project

Sweetwater BMP 2

Water Quality Improvement Alternatives Analysis

Sweetwater BMP #2

Wekiva Watershed Management Plan

Seminole County, Florida

The purpose of this water quality improvement concept is to address pollutant loads discharged from a subdivision stormwater pond on the north side of Wekiva Springs Road to a ditch upstream of the Little Wekiva River. This site was identified as a priority location for a water quality enhancement project based on the Wekiva Watershed Management Plan.

The project area with existing drainage infrastructure is shown on **Figure 1**. A topographical map is included on **Figure 2**.

The goal of this improvement analysis was to provide a conceptual level assessment of the water quality benefits anticipated from the proposed best management practice (BMP). Specifically, cost benefit on a nutrient load reduction basis for total nitrogen (TN) and total phosphorus (TP) was estimated.

Existing Conditions

The project area is located at the stormwater pond outfall along Riverbend Boulevard. The contributing area consists of medium density residential land use. Existing drainage infrastructure in the project area consists of curb inlets and storm piping that discharge to the stormwater pond. The stormwater pond outfall consists of a structural weir followed by three 48”x76” pipes that convey water under Riverbend Boulevard and discharge to the ditch upstream of the Little Wekiva River. There existing stormwater pond functions as a BMP for the contributing area.

Legend

PARCELS
SUBBASIN
PIPES / CULVERTS
DRAINAGE STRUCTURES

0 87.5 175 350 525 700 Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Site Map

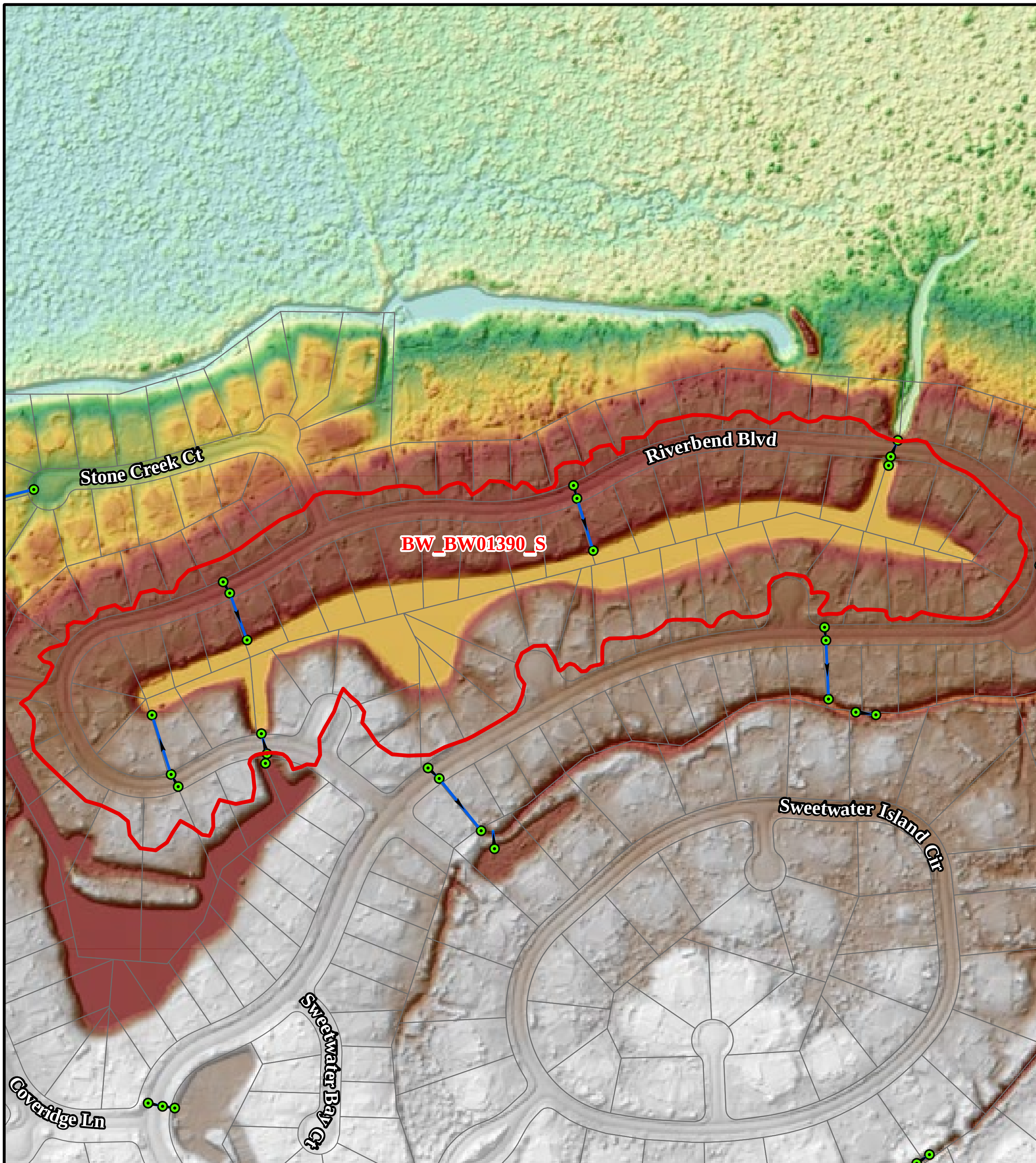
Sweetwater BMP #2
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure

1



N

Legend

PARCELS
SUBBASIN
PIPES / CULVERTS
DRAINAGE STRUCTURES

DEM
FEET NAVD 1988
68.47
38.6

0 87.5 175 350 525 700 Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022
DEM - USGS LIDAR, 2018

Topographical Map

Sweetwater BMP #2
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

Seminole County

Figure 2

Photos of the contributing area are shown below.

Photo 1: Existing Curb Inlets along Riverbend Boulevard, Looking East

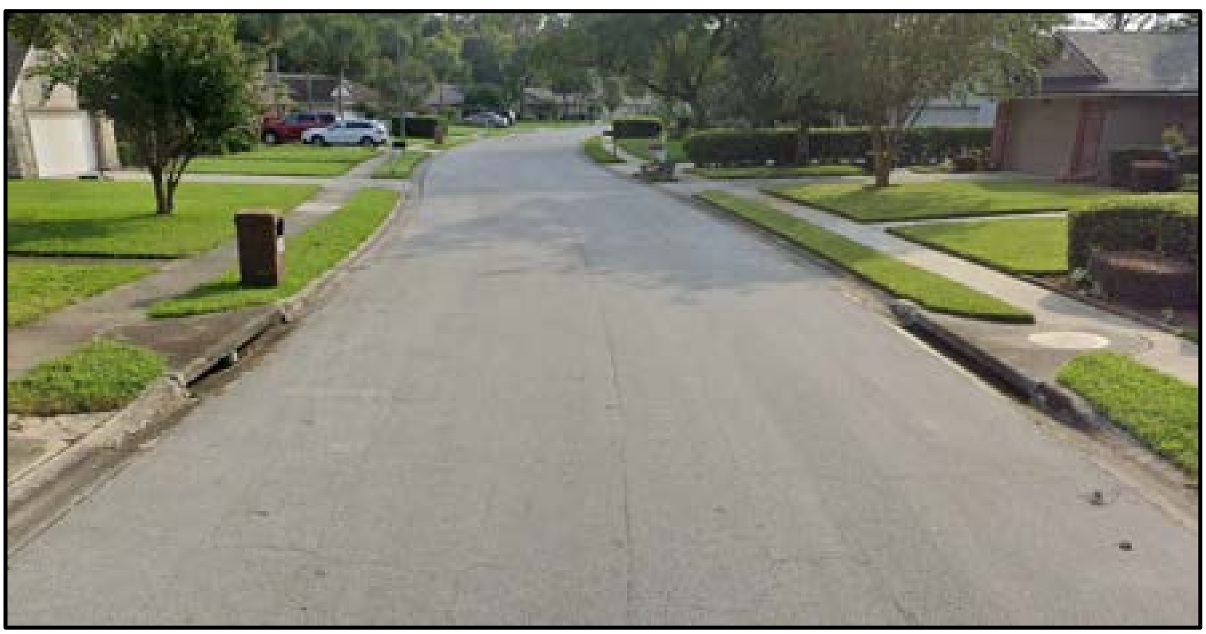


Photo 2: Looking East along Riverbend Boulevard

Photo 3: Stormwater Pond Outfall Weir Structure

Photo 4: Outfall Ditch upstream of the Little Wekiva River

Water Quality Improvement Concept

This water quality improvement concept includes retrofitting the existing pond outfall weir with an upflow media filter to provide additional treatment of baseflow and seasonal discharges. This concept is focused on reducing TN and TP loads through physical and biological removal processes in the filter media. Stormwater will be allowed to bypass the upflow media filter at the existing control elevation during high flow storm events.

The water quality improvement concept is shown on conceptually on **Figure 3**.

N

Legend

- PARCELS
- SUBBASIN
- PIPES / CULVERTS
- DRAINAGE STRUCTURES

0 5 10 20 30 40 Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Proposed Improvements Map
Sweetwater BMP #2
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

Seminole County

Figure 3

Pollutant Load Benefits

The average annual pollutant load discharged from the project area (subbasin BW_BW01390_S) was calculated as part of the Wekiva Watershed Management Plan utilizing a continuous simulation model run for a period of approximately 10 years. The pollutant load benefit for this water quality improvement concept was estimated based on engineering judgement and experience with similar types of stormwater BMP projects. The upflow media component of the BMP was assigned a TN and TP removal rate of 45% based on manufacturer recommendations. The upflow media filter box with high level bypass was assumed to capture 90% of the average annual stormwater runoff on a volumetric basis, which corresponds to a 10% bypass rate. The bypass rate accounts for high flow events when stormwater would bypass the BMP to avoid potential upstream flood stage impacts. The exact capture rate would be determined during design.

The estimated pollutant load benefit is summarized below in **Table 1**.

Table 1: Estimated Pollutant Load Benefit

Scenario	Average Annual TN Load (lb/yr)	Average Annual TP Load (lb/yr)	TN Load Removed (lb/yr)	TP Load Removed (lb/yr)	TN Load Removed over 20 Years (lb)	TP Load Removed over 20 Years (lb)
Proposed Conditions	106.1	8.5	43.0	3.5	860	69

Implementation Considerations

The following implementation considerations are provided for this improvement concept.

- Water Quality Benefit – This improvement provides a water quality benefit by treating stormwater discharged from the existing pond, thereby reducing the pollutant load discharged to the Little Wekiva River.
- Flood Benefit – This improvement concept is not intended to provide a direct flood benefit to the project area. The proposed water quality improvement concept is not anticipated to result in peak stage increases based on model results. This would be confirmed during design.
- Permitting Considerations – It is anticipated that this improvement would require a general permit for stormwater retrofit from the St. Johns River Water Management District. The improvement may qualify for certain exemption criteria based on the location since there are no anticipated wetland or surface water impacts.
- Engineering Design – Final engineering design should include collection of survey data, utility designation, geotechnical testing, preparation of design plans, preparation of a cost estimate, preparation of technical specifications, and utility coordination to address any needed conflict adjustments / relocations.
- Land Acquisition – Easement acquisition is anticipated to be necessary from the home owners association to construct this improvement. It is assumed that the County would request for these easements to be donated in exchange for County

maintenance; however, the cost of the easements has been included to be conservative.

- Wetland / Surface Water Impacts – The proposed water quality improvement has no anticipated wetland / surface water impacts.
- Benefit/Cost – The estimated total implementation cost for this improvement is $442,962. This cost includes construction, a 20% contingency, estimated annual maintenance, design and permitting, CEI services, and easement / property acquisition. This translates to load removal rates on a cost basis of $421 per pound of TN and $5,245 per pound of TP. It is noted that loading removal rates were based on the estimated construction cost and maintenance. A detailed breakdown of the preliminary cost estimate is provided in **Table 2**.

Table 2: Engineer's Estimate of Probable Improvement Costs based on Concept

Sweetwater BMP #2						
Item	**Pay Item No.**	**Description**	**Units**	**Unit Cost**	**Quantity**	**Total**
1	101-1	Mobilization (15% of Construction Total)	LS	varies	1	$27,024
2	102-1	Maintenance of Traffic (10% of Construction Total)	LS	varies	1	$18,016
3	104-1	Prevention, Control and Abatement of Erosion and Water Pollution (10% of Construction Total)	LS	varies	1	$18,016
4	110-1-1	Clearing and Grubbing (15% of Construction Total)	LS	varies	1	$27,024
5	160-4	Type B Stabilization (12")	SY	$20.00	150	$3,000
6	285-704	Optional Base, Base Group 04 (6")	SY	$50.00	150	$7,500
7	334-1-13	Superpave Asphaltic Concrete, Traffic C (2")	SY	$275.00	150	$41,250
8	570-1-2	Performance Turf, Sod	SY	$14.00	120	$1,680
9	900-1	Retrofit Existing Weir with Upflow Media Filter	EA	$115,000	1	$115,000
10	900-2	Easement / Property Acquisition	LS	varies	1	$11,731
					SUBTOTAL COST:	$270,242
					CONTINGENCY (20%):	$54,048
					CONSTRUCTION SUBTOTAL:	$324,291
					MAINTENANCE SUBTOTAL:	$37,598
					DESIGN & PERMITTING:	$48,644
					CEI SERVICES:	$32,429
					ESTIMATED TOTAL IMPLEMENTATION COST:	**$442,962**

Notes:

1) *Above estimate does not include cost for potential utility relocations.*
2) *Assumes no muck or other removal of unsuitable soils.*
3) *900-1 is the estimated installed cost for the proposed Nutrient Separating Baffle Box*
4) *Maintenance Cost is assumed to be 1% of construction cost brought to Net Present Value (NPV) over 20 years using interest rate of 7%*
5) *Design and permitting was assumed to be 15% of the construction subtotal cost based on engineering judgement.*
6) *Construction engineering and inspection (CEI) services was assumed to be 10% of the construction subtotal cost based on engineering judgement.*
7) *Costs for 900-2 were obtained from the Seminole County property appraiser and were assumed to be 1.5 times the parcel value (land + buildings + features) to account for administrative costs. Assumed that City and Florida Power easements would be donated at no cost.*

The information provided herein in considered to be preliminary for project planning purposes. As noted previously, design level efforts including detailed modeling will be necessary to quantify bypass rates, confirm flood stages, confirm pollutant load reductions, etc.

Conclusions

The goal of this effort was to develop a water quality improvement concept to reduce the pollutant loads discharged from the project area. A concept was developed consisting of retrofitting the existing pond outfall weir with an upflow media filter and high level bypass to provide additional treatment to baseflow and seasonal discharges from the existing stormwater pond.

The nutrient load reduction via the improvements over the 20 year expected life is estimated below:

- TN mass removed = 860 lbs.
- TP mass removed = 69 lbs.

The total project implementation cost was estimated to be approximately $442,962 including construction, contingency, maintenance, design and permitting, CEI services, and easement / property acquisition. The project cost benefit from a pollutant load reduction perspective was determined to be:

- $421 per lb of TN.
- $5,245 per lb of TP.

Based on the foregoing, Geosyntec recommends that the County pursue design of this water quality improvement for the anticipated water quality benefits.

Water Quality Focused Project

Sweetwater BMP 3

Water Quality Improvement Alternatives Analysis

Sweetwater BMP #3

Wekiva Watershed Management Plan

Seminole County, Florida

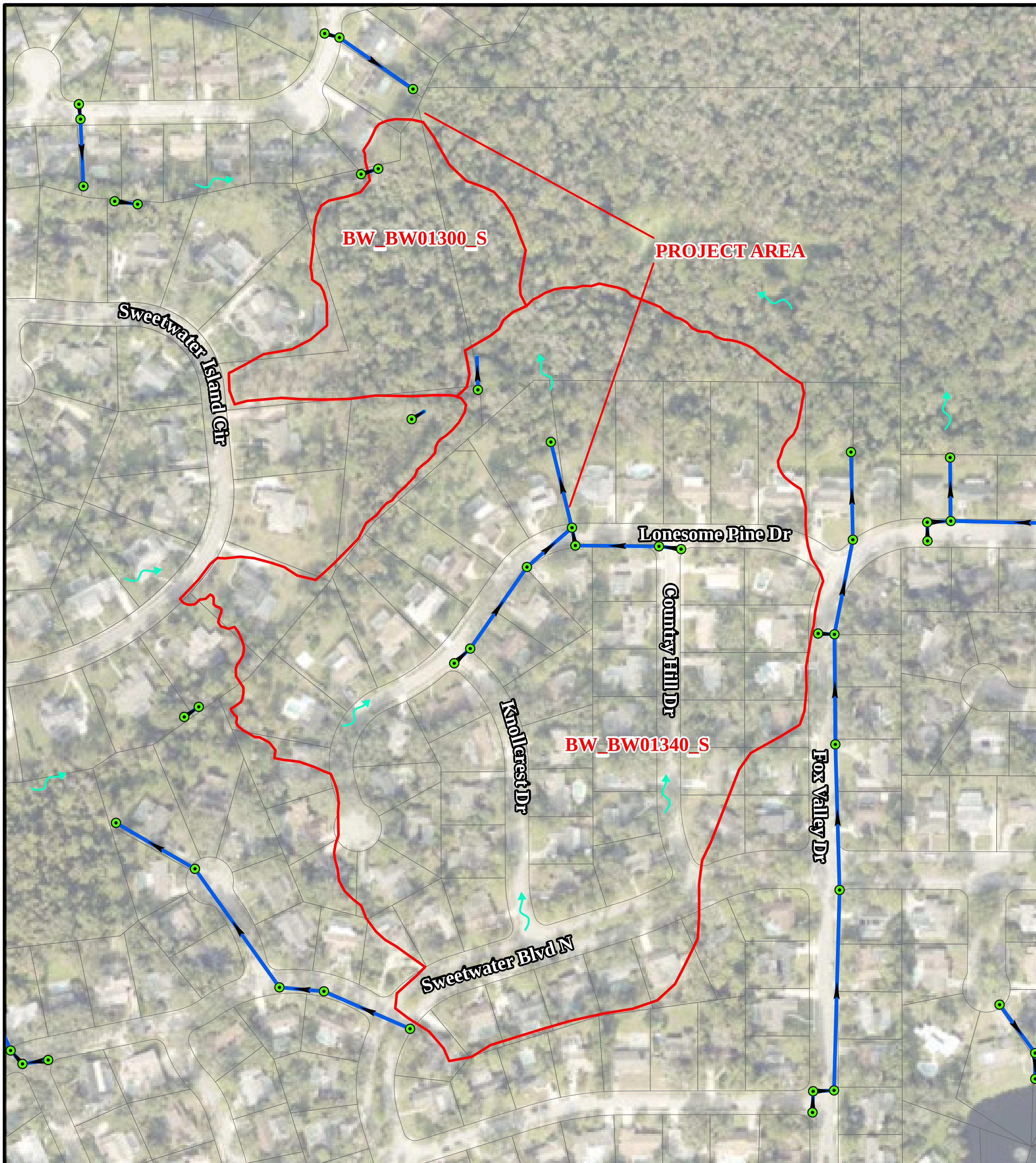
The purpose of this water quality improvement concept is to address pollutant loads discharged from a subdivision on the north side of Wekiva Springs Road to a ditch upstream of the Little Wekiva River. This site was identified as a priority location for a water quality enhancement project based on the Wekiva Watershed Management Plan.

The project area with existing drainage infrastructure is shown on **Figure 1**. A topographical map is included on **Figure 2**.

The goal of this improvement analysis was to provide a conceptual level assessment of the water quality benefits anticipated from the proposed best management practice (BMP). Specifically, cost benefit on a nutrient load reduction basis for total nitrogen (TN) and total phosphorus (TP) was estimated.

Existing Conditions

The project area is located along an existing ditch, north of Lonesome Pine Drive and east of Riverbend Boulevard. The contributing area consists of medium density residential land use. Existing drainage infrastructure in the project area consists of curb inlets and storm piping that discharge to the ditch upstream of the Little Wekiva River. There are no existing stormwater BMPs in the contributing area.



N

Legend

PARCELS
SUBBASINS
PIPES / CULVERTS
DRAINAGE STRUCTURES

0 75 150 300 450 600
Feet

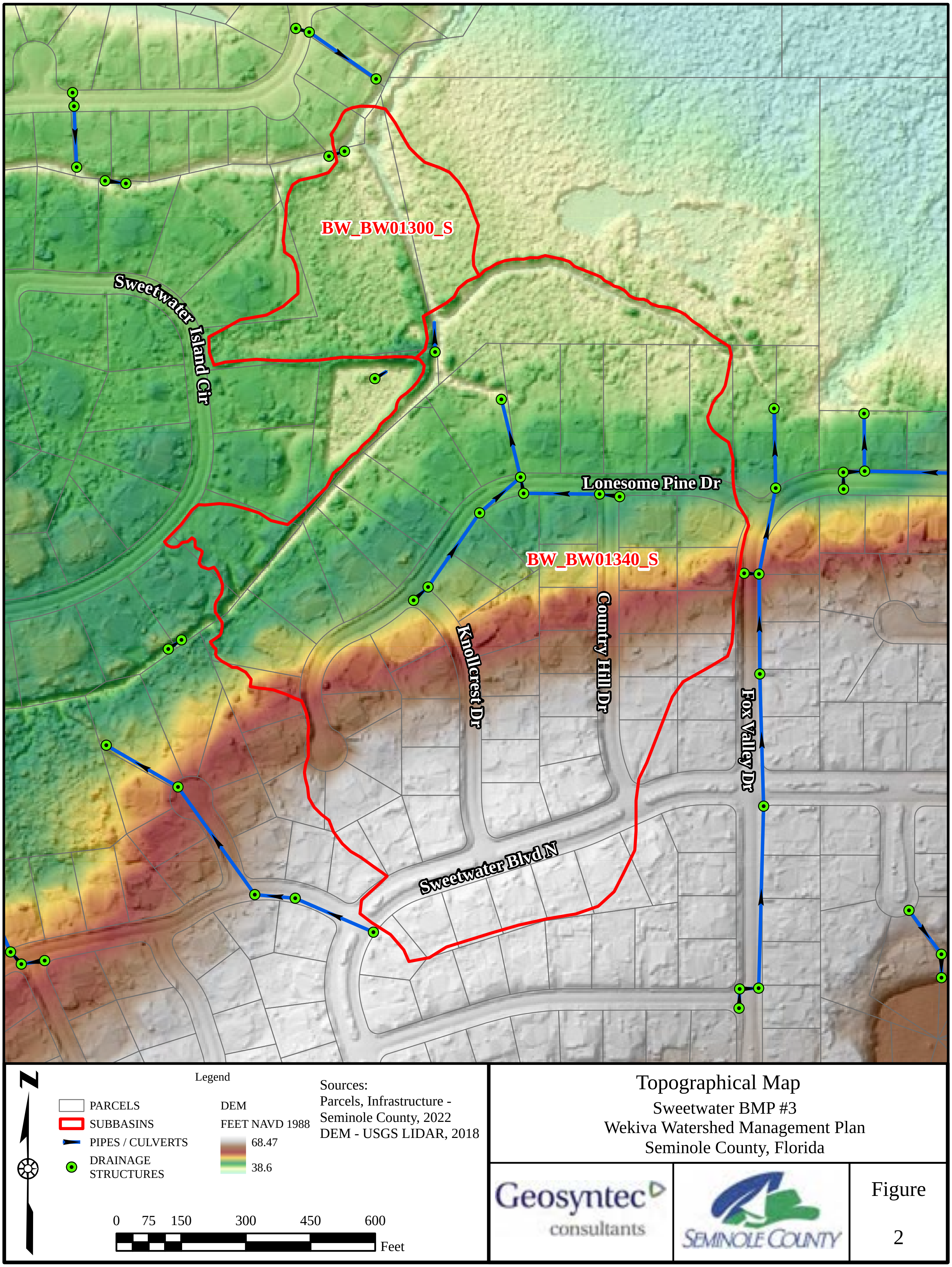
Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Site Map
Sweetwater BMP #3
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

Seminole County

Figure
1


BW_BW01300_S
BW_BW01340_S
Sweetwater Island Cir
Lonesome Pine Dr
Knollcrest Dr
Country Hill Dr
Fox Valley Dr
Sweetwater Blvd N
N
Legend
PARCELS
SUBBASINS
PIPES / CULVERTS
DRAINAGE STRUCTURES
DEM
FEET NAVD 1988
68.47
38.6
0 75 150 300 450 600
Feet
Sources:
Parcels, Infrastructure -
Seminole County, 2022
DEM - USGS LIDAR, 2018
Topographical Map
Sweetwater BMP #3
Wekiva Watershed Management Plan
Seminole County, Florida
Geosyntec consultants
SEMINOLE COUNTY
Figure
2

Photos of the contributing area are shown below.

Photo 1: Existing Curb Inlets at the Intersection of Country Hill Road and Lonesome Pine Drive

Photo 2: Looking West along Lonesome Pine Drive

Photo 3: Outfall Location to Ditch along Lonesome Pine Drive, Looking North

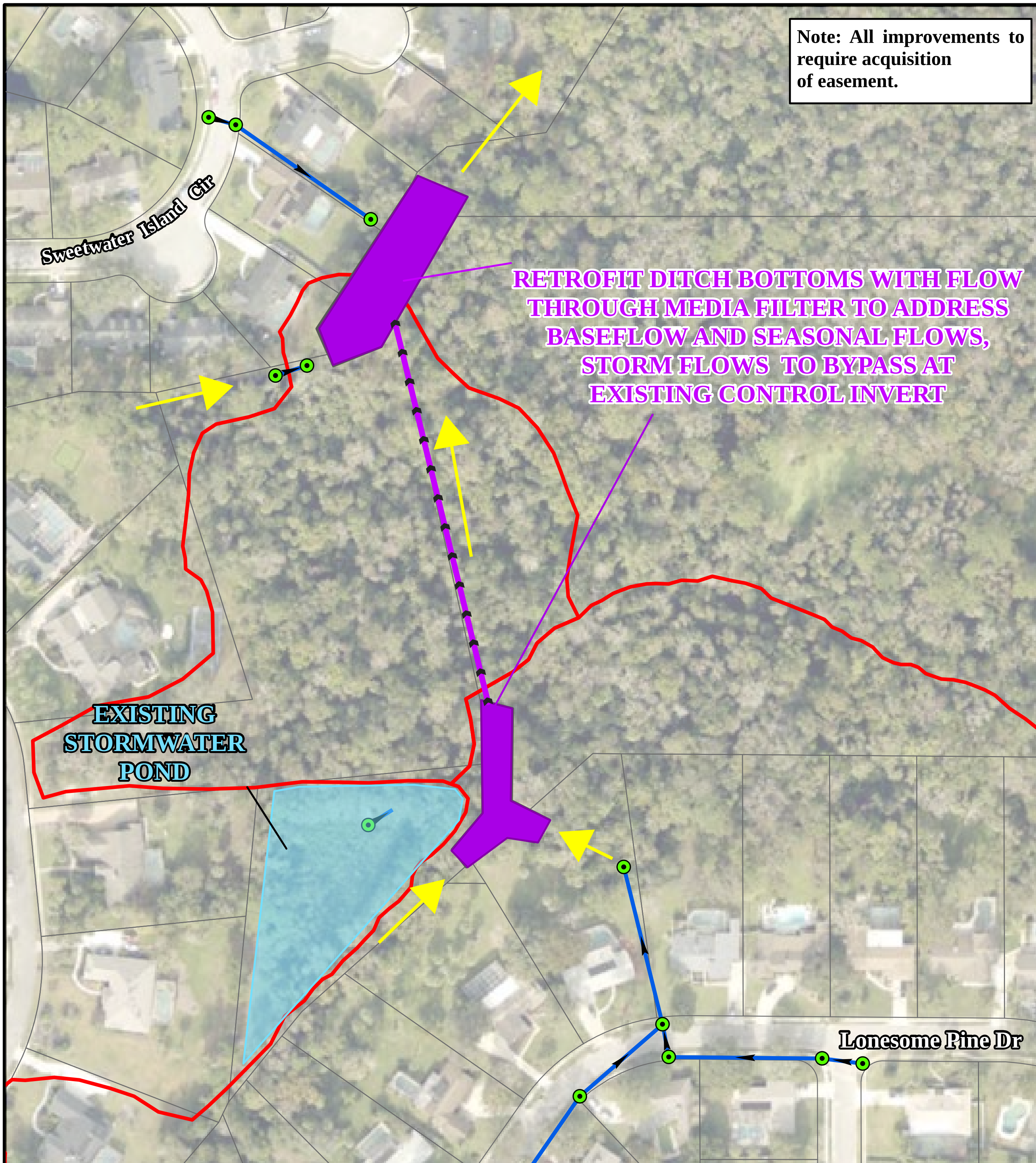
Photo 4: Existing Curb Inlets at the Intersection of Lonesome Pine Drive and Knollcrest Drive

Water Quality Improvement Concept

This water quality improvement concept includes enhancing the existing drainage ditch with filter media that will provide physical and biological removal of nutrients. The proposed at-grade media filter ditch will promote infiltration of stormwater runoff during low flow events, while allowing high flow events to bypass the media filter and discharge similar to existing conditions. Treatment will be focused on baseflow and seasonal discharges over the control elevation. This improvement concept includes:

- Replacing approximately 11,000 square feet of ditch bottom with an at-grade media filter to promote infiltration and treatment of stormwater runoff as well as baseflow. The at-grade media filter will consist of subgrade treatment media combined with surface baffles to promote flow through the treatment media while maintaining the conveyance capacity of the existing ditch.

The water quality improvement concept is shown on conceptually on **Figure 3**.



N

Legend

PARCELS

SUBBASINS

PIPES / CULVERTS

DRAINAGE STRUCTURES

0 40 80 160 240 320

Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Proposed Improvements Map

Sweetwater BMP #3
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

Seminole County

Figure 3

Pollutant Load Benefits

The average annual pollutant load discharged from the project area (subbasins BW_BW01340_S, BW_BW01300_S, and BW_BW00010_S) was calculated as part of the Wekiva Watershed Management Plan utilizing a continuous simulation model run for a period of approximately 10 years. The pollutant load benefit for this water quality improvement concept was estimated based on engineering judgement and experience with similar types of stormwater BMP projects. The enhanced drainage ditch with at-grade media filter was assumed to capture 50% of the average annual stormwater runoff on a volumetric basis, which corresponds to a 50% bypass rate. The bypass rate accounts for high flow events when stormwater would be flowing at too high of a rate to infiltrate through the media filter. The exact capture rate would be determined during design. Stormwater runoff captured and infiltrated was assumed to have a TN and TP removal rate of 100%.

The estimated pollutant load benefit is summarized below in **Table 1**.

Table 1: Estimated Pollutant Load Benefit

Scenario	Average Annual TN Load (lb/yr)	Average Annual TP Load (lb/yr)	TN Load Removed (lb/yr)	TP Load Removed (lb/yr)	TN Load Removed over 20 Years (lb)	TP Load Removed over 20 Years (lb)
Proposed Conditions	330.6	40.2	165.3	20.1	3306	402

Implementation Considerations

The following implementation considerations are provided for this improvement concept.

- Water Quality Benefit – This improvement provides a water quality benefit by capturing and infiltrating stormwater runoff, thereby reducing the pollutant load discharged to the Little Wekiva River.
- Flood Benefit – This improvement concept is not intended to provide a direct flood benefit to the project area. The proposed water quality improvement concept is not anticipated to result in peak stage increases based on model results. This would be confirmed during design.
- Permitting Considerations – It is anticipated that this improvement would require a general permit for stormwater retrofit from the St. Johns River Water Management District. The improvement may qualify for certain exemption criteria since there is no proposed grade change within the existing ditch.
- Engineering Design – Final engineering design should include collection of survey data, utility designation, geotechnical testing, preparation of design plans, preparation of a cost estimate, preparation of technical specifications, and utility coordination to address any needed conflict adjustments / relocations.
- Land Acquisition – Easement acquisition is anticipated to be necessary from the home owners association to construct this improvement. It is assumed that the County

would request for these easements to be donated in exchange for County maintenance; however, the cost of the easements has been included to be conservative.

- Wetland / Surface Water Impacts – The BMP has potential wetland / surface water impacts based on the conceptual location. Potential wetland / surface water impacts would be quantified during design based on an ecological assessment.
- Benefit/Cost – The estimated total implementation cost for this improvement is $1,028,626. This cost includes construction, a 20% contingency, estimated annual maintenance, design and permitting, CEI services, and easement / property acquisition. This translates to load removal rates on a cost basis of $254 per pound of TN and $2,090 per pound of TP. It is noted that loading removal rates were based on the estimated construction cost and maintenance. A detailed breakdown of the preliminary cost estimate is provided in **Table 2**.

Table 2: Engineer's Estimate of Probable Improvement Costs based on Concept

Sweetwater BMP #3						
Item	**Pay Item No.**	**Description**	**Units**	**Unit Cost**	**Quantity**	**Total**
1	101-1	Mobilization (15% of Construction Total)	LS	varies	1	$62,754
2	102-1	Maintenance of Traffic (10% of Construction Total)	LS	varies	1	$41,836
3	104-1	Prevention, Control and Abatement of Erosion and Water Pollution (10% of Construction Total)	LS	varies	1	$41,836
4	110-1-1	Clearing and Grubbing (15% of Construction Total)	LS	varies	1	$62,754
5	120-1	Regular Excavation	CY	$20.00	1020	$20,400
6	900-1	Ditch Bottom Media Filter	LS	varies	1	$300,000
7	900-2	Easement / Property Acquisition	LS	varies	1	$97,963
					SUBTOTAL COST:	$627,545
					CONTINGENCY (20%):	$125,509
					CONSTRUCTION SUBTOTAL:	$753,054
					MAINTENANCE SUBTOTAL:	$87,309
					DESIGN & PERMITTING:	$112,958
					CEI SERVICES:	$75,305
					ESTIMATED TOTAL IMPLEMENTATION COST:	**$1,028,626**

Notes:

1) *Above estimate does not include cost for potential utility relocations.*
2) *Assumes no muck or other removal of unsuitable soils.*
3) *Maintenance Cost is assumed to be 1% of construction cost brought to Net Present Value (NPV) over 20 years using interest rate of 7%*
4) *Design and permitting was assumed to be 15% of the construction subtotal cost based on engineering judgement.*
5) *Construction engineering and inspection (CEI) services was assumed to be 10% of the construction subtotal cost based on engineering judgement.*
6) *Costs for 900-2 were obtained from the Seminole County property appraiser and were assumed to be 1.5 times the parcel value (land + buildings + features) to account for administrative costs. Assumed that City and Florida Power easements would be donated at no cost.*

The information provided herein in considered to be preliminary for project planning purposes. As noted previously, design level efforts including detailed modeling will be necessary to quantify bypass rates, confirm flood stages, confirm pollutant load reductions, etc.

Conclusions

The goal of this effort was to develop a water quality improvement concept to reduce the pollutant loads discharged from the project area. A concept was developed consisting of enhancing the existing drainage ditch with an at-grade media filter to promote infiltration of stormwater runoff.

The nutrient load reduction via the improvements over the 20 year expected life is estimated below:

- TN mass removed = 3,306 lbs.
- TP mass removed = 402 lbs.

The total project implementation cost was estimated to be approximately $1,028,626 including construction, contingency, maintenance, design and permitting, CEI services, and easement / property acquisition. The project cost benefit from a pollutant load reduction perspective was determined to be:

- $254 per lb of TN.
- $2,090 per lb of TP.

Based on the foregoing, Geosyntec recommends that the County pursue design of this water quality improvement for the anticipated water quality benefits.

Special Focused Project

Lake Markham Outfall

Flood Improvement Alternatives Analysis

Lake Markham Outfall

Wekiva Watershed Management Plan

Seminole County, Florida

The purpose of this improvement concept is to provide an active control to address high stage on Lake Markham. The lake is land-locked with no positive gravity outfall. As such, is subject to varying lake levels based on short- and long-term precipitation trends. The greater Lake Markham extent includes the interconnected Lakes Gary, Don, and Howard adjacent to the west that all function at the same level. When referring to Lake Markham, it also includes the collective of these water bodies as well. There are 122 property parcels that abut Lake Markham, the majority with houses.

The project area is shown on **Figure 1**. A topographical map is included on **Figure 2**.

Existing Conditions

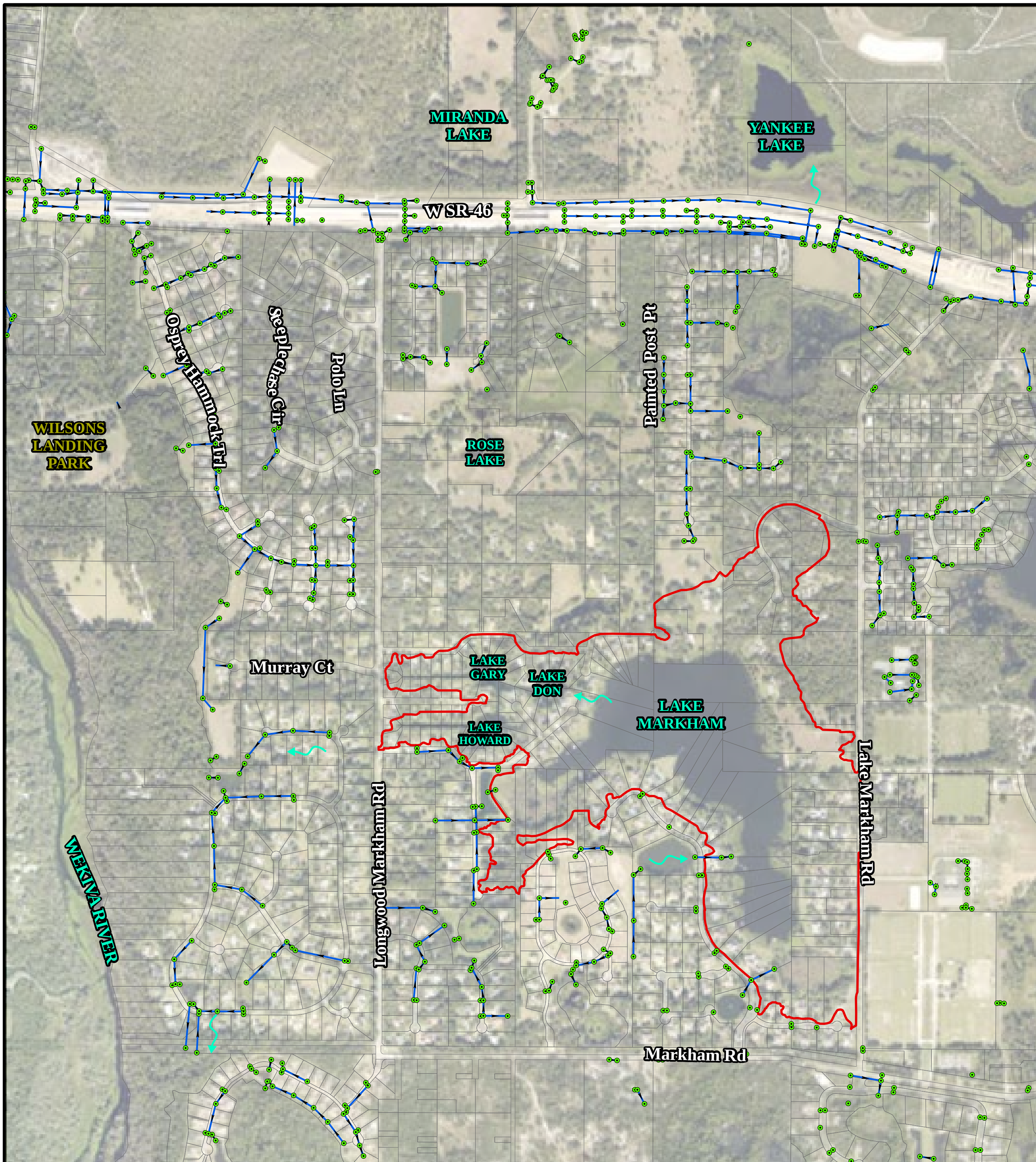
Statistics of the lake levels based on the Seminole County Water Atlas and other data provided by the County are summaries below (all elevations in NAVD 1988):

- Historic Wet Season Average = 39.82' (based on the average of month August levels)
- Historic High = 44.74' (2022 Post Ian)
- Historic Low = 34.11'
- 75^{th}/90^{th} Percentiles = 41.77' / 43.09' (percentile high stage based on total available stage records, indicate the stage at which the lake is higher 25% or 10% of the time)
- FEMA 100 YEAR = 46.8'
- Lowest residential Finished Floor Elevation (FFE) 46.8' (from County survey)

Note that based on the topography (2018 LiDAR based), the approximate lowest point at which levels would overtop the land locked basin is approximately 46.8'. This corresponds to the lowest surveyed finished floor elevation around the lake.

Recent record elevation in Markham have raised concerns from residents. In recent years, and particularly after Hurricane Ian, stages have been observed to encroach on backyards, submerging some docks and has been suspected of impacting septic systems. No reports of structure flooding have been received, as it appears the historic high of 44.74' is still approximately 2' below the lowest FFE. It is noted that County right of way has not been impacted to date.

A plot of the historical water level data from the water atlas is presented below in **Figure 3**.



Legend

- PARCELS
- CONTRIBUTING AREA
- PIPES / CULVERTS
- DRAINAGE STRUCTURES

0 350 700 1,400 2,100 2,800 Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

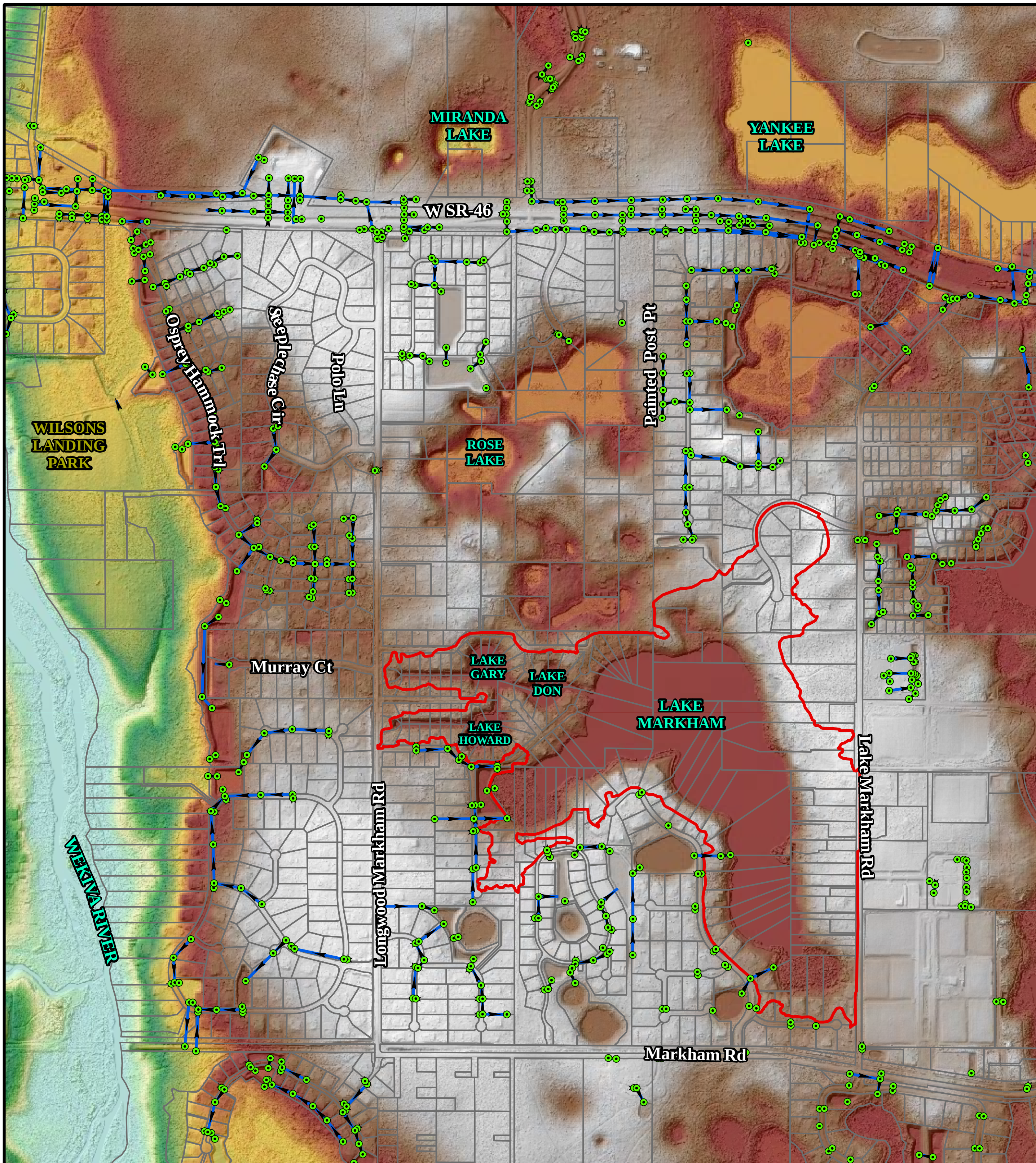
Site Map
Lake Markham Outfall
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure

1



N

Legend

PARCELS

CONTRIBUTING AREA

PIPES / CULVERTS

DRAINAGE STRUCTURES

DEM
FEET NAVD 1988
68.47
38.6

0 350 700 1,400 2,100 2,800
Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022
DEM - USGS LIDAR, 2018

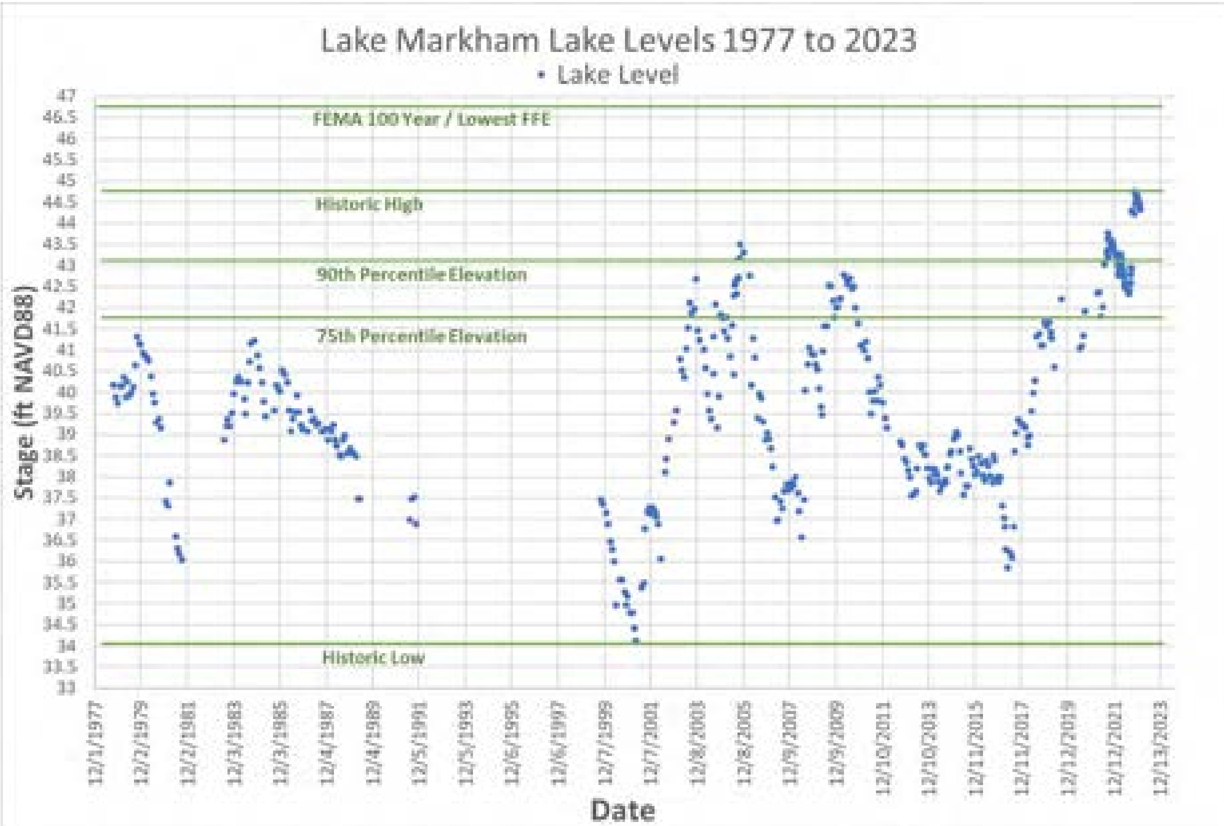
Topographical Map
Lake Markham Outfall
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure
2

Figure 3 – Historical Lake Markham Levels



Improvement Concept

Since there is not a feasible option to provide a gravity outfall, the feasibility of a pumped solution to relieve stages in Lake Markham was investigated. The construction of a pump station affords flexibility in where the intake may be placed as well as where the water may be pumped to via a force main. The viable locations to pump to are as follows:

- Wekiva River – this is the ultimate discharge location receiving water for this area of Seminole County and is the closest water body approximately 0.5 miles west of Lake Markham. The most feasible pump path would be from the west ends on Lake Gary or Lake Howard to Longwood Markham Road, then down Murray Court to the Wekiva River just past the retention pond. At that location there is a small drainage tributary to the river.
- Yankee Lake – this location is approximately 0.75 miles north of Lake Markham and would provide a degree of separation from direct discharges to the Wekiva River (Yankee Lake dishrags north to the Wekiva River through a long channel) but would require a longer force main. The most feasible pump path would be from the west ends on Lake Gary or Lake Howard to Longwood Markham Road, then north to the sough SR 46 right of way. There east to just east of Bella Foresta Place where the force main would be jack and bored under SR 46 to get to Yankee Lake. The additional length and need for jack and bore under SR 46 would make this option significant more expensive.

- Lake Sylvan – this location is approximately 0.5 miles east of Lake Markham and would provide two degrees of separation form the Wekiva River as it discharges into Yankee Lake. However, Lake Sylvan has had concerns with higher lake levels in recent years similar to Lake Markham, so discharging to Lake Sylvan is considered impractical.

The additional of a pumped system to control levels would need to target a control elevation which makes sense in the context of flood protection whole allowing for natural seasonal fluctuations in the lake. A target pump level of 42.5' is recommended which is the approximately average between the 75^{th} and 90^{th} percentile high stages based on the period of record. This would allow over 4' of freeboard to the level of the lowest FFE around the lake and approximately 2' lower that the highest level of record. The additional freeboard provided by maintaining this level would also provide more protection from cumulative intense seasonal rainfall or back to back extreme storm events.

The volume of water pumped downstream is a concern. It is noted that most stage recovery pumping would occur outside of a specific extreme storm event to maintain levels, however there would need to be controls on the pumping that may inhibit pumping if downstream levels in the Wekiva River or Yankee Lake are at elevations of concern. That may more likely happen as a result so extreme storm event when Lake Markham may also be reaching elevations of concern. As such the pumped management of this concept should be considered primary for maintaining a target level rather than mitigation during and immediately after an extreme storm event. Under normal conditions the Wekiva river is a significant sink to receive discharges and what would be pumped would likely be a small fraction of the overall flow of the river at any given time. Yankee Lake may not be sensitive from a flood risk standpoint as there is no significant development immediately adjacent to the lake, so it may be able to provide a buffer for Lake Markham discharges.

Water Quality is a concern with any transfer of water from one body to another. In general, concerns would arise from taking water with poorer quality and discharging directly to a water body of better water quality without some considerations of water quality treatment to reduce pollutant loads. The primary constituents of concern would be nutrients (total nitrogen (TN) and total phosphorus (TP)). A summary of water quality data is presented on **Table 1**.

Table 1 – Water Quality Summary for Lake Markham, Wekiva River, and Yankee Lake

Named Water Bodies	Water Quality Summary							
	Latest TN Value	Latest TN Value Date	Historic TN Range Low	Historic TN Range High	Latest TP Value	Latest TP Value Date	Historic TP Range Low	Historic TP Range High
Lake Markham	740	12/13/2021	115	2200	5	12/13/2021	2.8	120
Wekiva River	602.9	6/8/2022	20	4270	114.7	6/8/2022	3	1192
Yankee Lake	670	1/11/2022	115	1920	12	1/11/2022	2	143
Data from Seminole County Water Atlas as of August 2022.								

Based on the summary in **Table 1**, Lake Markham does appear to have water quality better that may range above or below of the ranges for Yankee Lake and the Wekiva River, more particularly for total nitrogen but also for total phosphorus. Since this is not a clear cut, consistent historical evidence for better water quality in Lake Markham in all cases, consideration for water quality treatment would need to be accommodated.

Water quality treatment could occur at the end of pipe utilizing a spreader swale/retention/detention type system to promote energy dissipation along with some infiltration. The system could be fitted with e flow through BAM filter to treat nutrients. The relative size of the features would be a function of the available space and soil characteristics.

Based on the foregoing, the most feasible approach for this improvement concept would be to propose a pumped discharge to the Wekiva River. Other challenges and criteria being similar, this would appear to be a much less cost option than discharging to Yankee Lake. This would likely be best accomplished by going an easement from a property owner(s) near the west ends of Lake Gary or Lake Howard and siting a pumps station in the available right of way on Longwood Markham Road. From there the force main would be installed in the right of way along Murray Court (or in easement if necessary) and discharges to the west across the subdivision retention pond and into the County property upstream of the river. At this location energy dissipation and water quality treatment could be accomplished in a small footprint to minimize impact to wetlands. If this path proves to be infeasible, the back of alternative of pumping to Yankee Lake could be explored at the greater cost.

At the target elevation 42.5' the lake area is approximately 95 acres (4,138,200 ft2). For context, one foot of recovery at that elevation would be approximately 4,138,200 ft3 (30,955,885) gallons.

An analysis of the ability of a pump to provide flood protection was undertaken. Based on the watershed modeling (as of June 2023), the following conditions (Table 2) were noted for design storms:

Table 2 – Watershed Model Design Storm Results Summary for Lake Markham

Design Storm	Total Lake Storm Inflow Volume	Peak Lake Storm Inflow Rate	Peak Lake Storm Stage
10 year / 24 hour	3,477,450 ft3	369.1 cfs	42.63 ft
25 year / 24 hour	4,727,708 ft3	484.3 cfs	42.93 ft
25 year / 96 hour	6,720,125 ft3	540.1 cfs	43.39 ft
100 year / 24 hour	6,964,259 ft	715.9 cfs	43.45 ft
100 year / 96 hour	10,609,407 ft3	796.5 cfs	44.27 ft

The watershed model was modified to include a pump link from Lake Markham to the Wekiva River boundary to evaluate flood stage and recovery control under varying pump discharge rates. Trial pump rates were applied to evaluate the impact to the resultant peak storm stage, and then the recovery time needed from the time of the peak stage to return to a stage of 42.5'. The results of this analysis are represented below in Table 3. For the purpose of this analysis, recovery of stages within a period of 72 hours (3 days) or less was considered a reasonable target for an extreme storm event.

Table 3 – Watershed Model Analysis of Pumping Impact

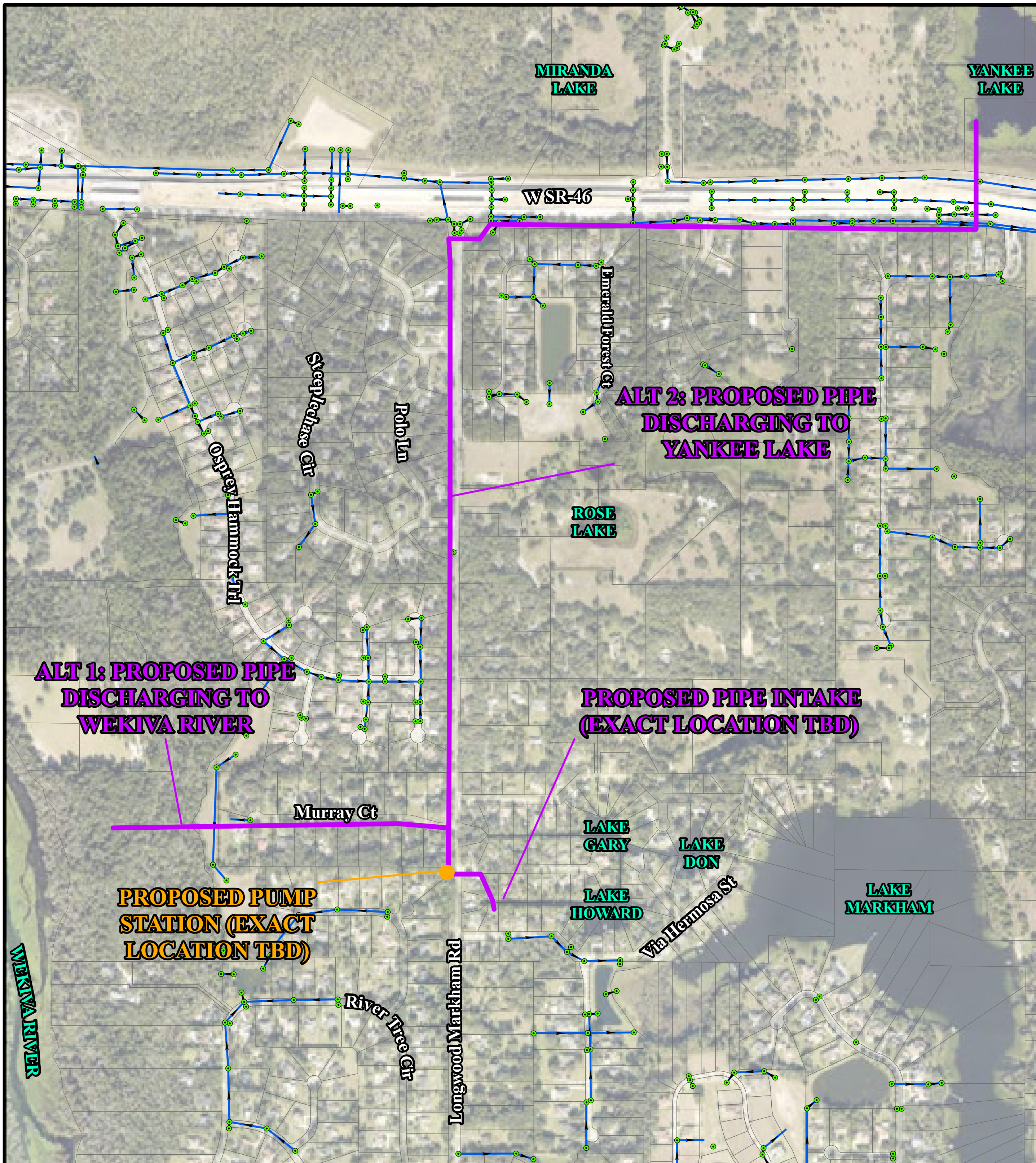
Design Storm Scenario	Pump Station Scenario											
	10 cfs (3,737 gpm) (5.4 mgd)		25 cfs (9,343 gpm) (13.5 mgd)		50 cfs (18,687 gpm) (26.9 mgd)		62.5 cfs (23,358 gpm) (33.6 mgd)		75 cfs (28,030 gpm) (40.4 mgd)		100 cfs (37373 gpm) (53.8 mgd)	
	Peak Stage	Rec-over Hrs.	Peak Stage	Rec-over Hrs.	Peak Stage	Rec-over Hrs.	Peak Stage	Rec-over Hrs.	Peak Stage	Rec-over Hrs.	Peak Stage	Rec-over Hrs.
10 year / 24 hour	42.57	17	42.50	0	42.50	0	**42.50**	**0**	42.50	0	42.5	0
25 year / 24 hour	42.83	66	42.70	13	42.57	6	**42.55**	**2.5**	42.53	1.5	42.52	1
25 year / 96 hour	43.21	>336	42.95	45	42.81	38	**42.77**	**11**	42.75	7	42.71	5
100 year / 24 hour	43.34	>336	43.20	50	42.98	17	**42.91**	**15**	42.86	12	42.80	8
100 year / 96 hour	44.26	>336	44.25	>336	43.74	>336	**43.27**	**69**	43.21	35	43.14	16
Note: Recover hours is time to recover to a stage of 42.5’ from the time of peak storm stage.												

Based on table 3, a minimum target of an ap[proximate 62.5 cfs pump station would provide a reasonable flood mitigation results through the 100 year 96 hour storm. This pump station is able to maintain a static lake level though the 10 year storm and only result in a slight rise in the 25 year storm. This would maintain a lake level protection of finished floors, but also property as well below the historic high level that has reportedly impacted yards around the lake.

It is noted that the above flow rate would be considered an effective flow rate after consideration of all head and friction losses in the proposed pump intake and discharge system. As such an approximate 70 cfs pump station is assumed for conceptual costing purposes.

Typical residential pumps stations for municipal pumping are constructed as duplex stations (two pumps) for redundancy. For maintaining stages irrespective of storm impacts the pumps may run intermittently but call upon a higher flow rates when needed. It is estimated for conceptual costing purposes that a 48” force main would be required for the pump station intake/discharge, which would be confirmed during design efforts.

The improvement concept is shown on conceptually on **Figure 4**, and in detail on **Figure 5.**



N

Legend

PARCELS

PIPES / CULVERTS

DRAINAGE STRUCTURES

0 250 500 1,000 1,500 2,000 Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Proposed Improvements Map

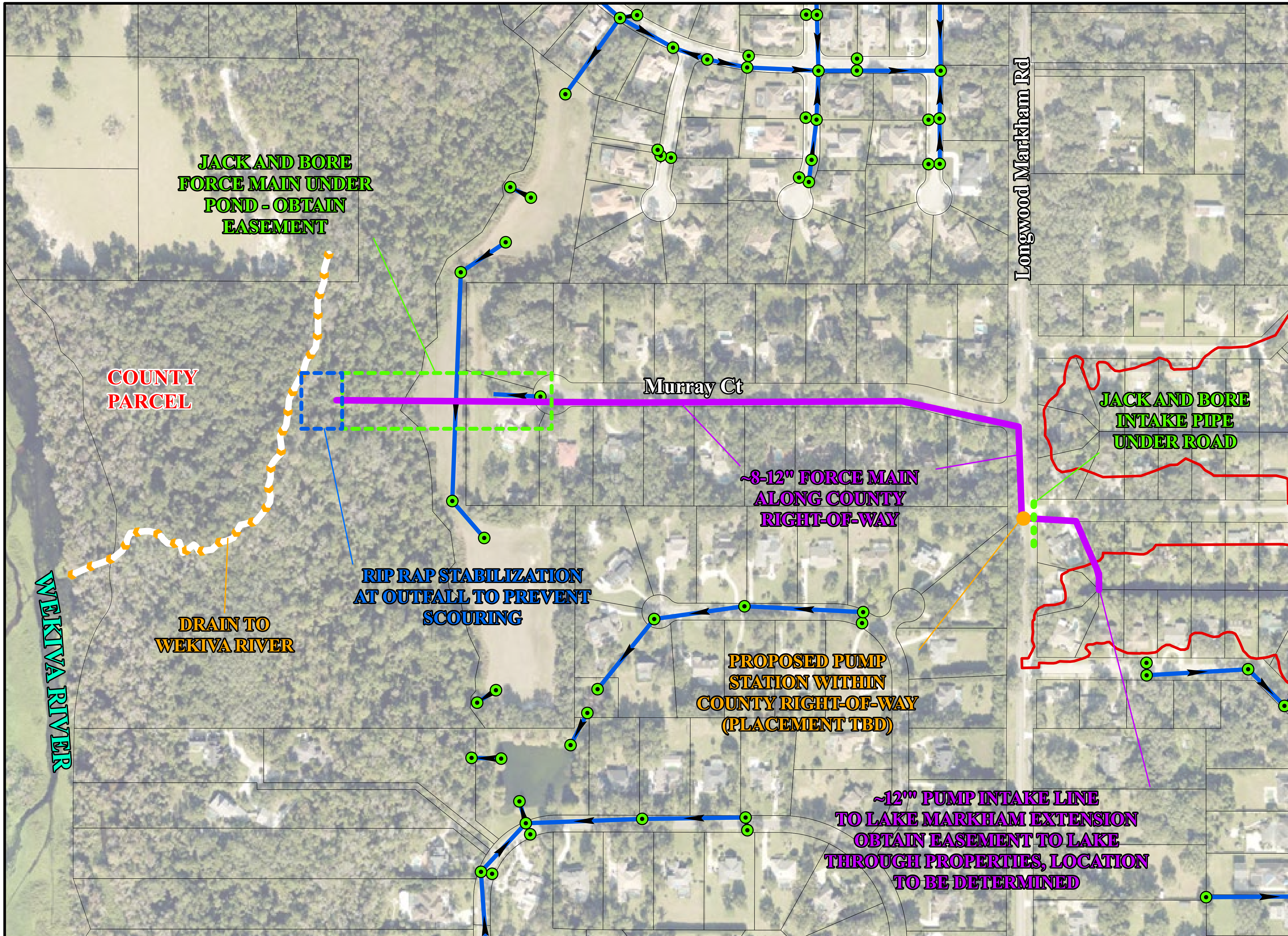
Lake Markham Outfall
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure

4



Sources:
Aerial - ESRI, 2022

Figure
5

Proposed Improvements
Detail Map - Alt 1

Lake Markham Outfall

Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec
consultants

Implementation Considerations

The following implementation considerations are provided for this improvement concept.

- Flood Benefit – The project is intended to allow for a managed positive outfall to help normalize stages in the lake. It would be intended to provide a long-term maintenance of stages and aide in the recovery of stages after significant storm event, but not necessarily mitigate stage during an actual extreme storm event. It is noted that the flood benefit would be to private property as County right of way has not been impacted.
- Permitting Considerations – It is anticipated that this improvement would require an individual permit for stormwater retrofit from the St. Johns River Water Management District since it would impact surface waters and involves a transfer of water from a land locked basin. There would also likely be some minor wetland impacts at the discharge point where energy dissipation and water quality treatment would occur. This will include the investigation of any hydrological impacts to the conservation easements currently in place around the lake.
- Engineering Design – Final engineering design should include collection of survey data, utility designation, geotechnical testing, preparation of design plans, preparation of a cost estimate, preparation of technical specifications, and utility coordination to address any needed conflict adjustments / relocations.
- Water Quality Benefit – This improvement would not be purposed to provide a water quality benefit. However, consideration for treatment of the pumped water prior to entering the downstream water body would need to be considered to prevent adverse impacts.
- Land Acquisition – Land and/or easement acquisition will be necessary. The intake pipe would need to be installed via easement between existing residential parcels to reach the lake (actual location is flexible depending on coordination with property owners). The lift station discharge force main would be targeted for County right of way but may require an easement to pass though homeowner's association property to get to the ultimate outfall point.
- Wetland / Surface Water Impacts – Transfer of surface water form a land locked basin to another water body would be considered a surface water impact. Additional wetland impacts would be likely at the proposed outfall location adjacent to the river.
- Benefit/Cost – The estimated total implementation cost for this improvement for the Alternative 1 option to the Wekiva River is $14,885,000. This cost includes construction, a 20% contingency. This represents a cost of approximately $122,000 per lakeside property parcel benefitted. A detailed breakdown of the preliminary cost estimate for the option of pumping to the Wekiva River is provided in **Table 4**.

Note that if this option is not permittable then the option of pumping to Yankee Lake would be considered, which due to the increased length of force main necessary, and possibly more powerful pump, would be significantly more expensive.

Geosyntec consultants

Table 4: Engineer's Estimate of Probable Improvement Costs based on Concept

Lak Markham Pump Station to the Wekiva River						
Item	**Pay Item No.**	**Description**	**Units**	**Unit Cost**	**Quantity**	**Total**
1	101-1	Mobilization (15% of Construction Total)	LS	varies	1	$1,353,150
2	102-1	Maintenance of Traffic (2.5% of Construction Total)	LS	varies	1	$225,525
3	104-1	Prevention, Control and Abatement of Erosion and Water Pollution (2.5% of Construction Total)	LS	varies	1	$225,525
4	110-1-1	Clearing and Grubbing (5% of Construction Total)	LS	varies	1	$451,050
5	160-4	Type B Stabilization (12")	SY	$15	150	$2,250
6	285-704	Optional Base, Base Group 04 (6")	SY	$50	150	$7,500
7	334-1-13	Superpave Asphaltic Concrete, Traffic C (2")	SY	$175	150	$26,250
8	530-1	Rip Rap	TN	$200.00	50	$10,000
9	900-1	Steel Intake, 48"	LF	$500.00	350	$175,000
10	900-2	Steel Force Main, 48"	LF	$750.00	1700	$1,275,000
11	900-3	Steel Force Main, 48" Jack and Bore	LF	$1,500.00	550	$825,000
11	900-4	Jack & Bore Jacking and Receiving Pits	LS	$200,000	1	$200,000
12	900-5	Pump Station (70 cfs) Duplex with Generator and Accessories	LS	$6,500,000	1	$6,500,000
SUBTOTAL COST:						$11,276,250
CONTINGENCY (20%):						$2,255,250
CONSTRUCTION TOTAL:						$13,531,500
DESIGN & PERMITTING ALLOWANCE (5% of Construction Total):						$676,575
CEI ALLOWANCE (5% of Construction Total):						$676,575
ESTIMATED TOTAL IMPLEMENTATION COST:						**$14,884,650**

Notes:

1) *Above estimate does not include cost for potential utility relocations.*
2) *Assumes no muck or other removal of unsuitable soils.*

The information provided herein in considered to be preliminary for project planning purposes. As noted previously, design level efforts including detailed modeling will be necessary to quantify pumping rates, confirm flood stages, confirm pollutant load reductions, etc.

Conclusions

The goal of this effort was to develop a flood mitigation solution to provide a positive outfall to Lake Markham. This outfall would be in the form of a pump station and force main that would be set to provide flood protection to address extreme storm events with stage recovery to a set elevation. This would provide an opportunity for positive drainage to minimize the future potential for high lake stages impacting private property.

Based on the foregoing, a feasible option may be to install a stormwater pump station to pump west to the Wekiva River. This would include an intake through private property, and pumps station and force main in County right of way along Longwood Markham Road and then Murray Court, then via an easement under a stormwater pond to an outfall conveyance way just east of the Wekiva River. Based on targeted flood protection criteria, an approximate 70 cfs pump station would be appropriate.

Based on the concept, an engineer's estimate of probable construction cost for this concept is on the order of $14,885,000. The benefit of this project would be to private property. Implementation of the project would entail significant design and permitting, supported by significant surveying, geotechnical testing, and ecological and water quality assessment.

Special Focused Project

Lake Sylvan Outfall

Flood Improvement Alternatives Analysis

Lake Sylvan Outfall

Wekiva Watershed Management Plan

Seminole County, Florida

The purpose of this improvement is to provide active management of the control elevation of Lake Sylvan to a lower elevation to help better maintain flood control and reduce property impacts from high lake stages. The lake currently has a high-level piped outfall to the north that discharges into a wetland on the south side of SR 46. From there the flow passes under SR 46 thought a cross drain ultimately discharging into Yankee Lake. There are 93 property parcels that abut Lake Sylvan, the majority with houses.

The project area is shown on **Figure 1**. A topographical map is included on **Figure 2**. An aerial detail of the outfall area is shown on **Figure 3**.

Existing Conditions

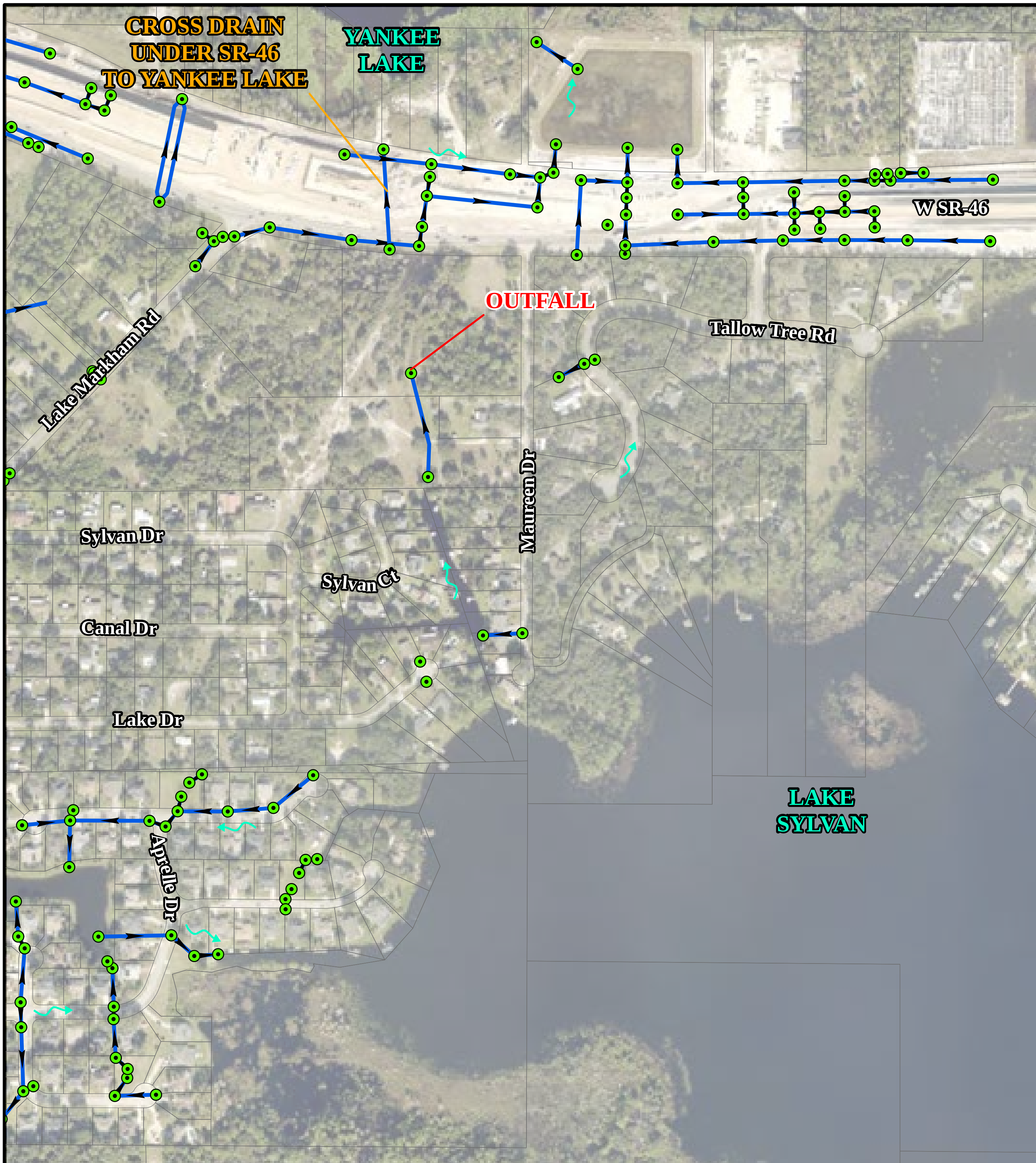
Statistics of the lake levels based on the Seminole County Water Atlas and other data provided by the County are summarized below (all elevations in NAVD 1988):

- Historic Wet Season Average = 39.02' (based on the average of month August levels)
- Historic High = 41.99'
- Historic Low = 32.93'
- $75^{th}/90^{th}$ Percentiles = 40.14 / 40.68’ (percentile high stage based on total available stage records, indicate the stage at which the lake is higher 25% or 10% of the time)
- FEMA 100 YEAR = 42.14'

The gravity outfall from the lake occurs through 2 2’x’4 box culverts at an elevation of 40.43’. At this outfall culvert there is a sluice gate installed which can allow discharge to occur at a lower elevation of down to 39.57’. In the recent past, the County has secured emergency authorizations from the SJRWMD to allow opening of the sluice gate and lowering of stages due to persistent high lake stages.

Due to the persistent high stages in recent years and the need for several emergency authorizations to open the sluice gate, the County desired to obtain a permit for a permanent lake stage regulation schedule which would allow them to operate the sluice gate on an as needed basis subject to observed field conditions. It is noted that no reports of structure flooding as a result of high lake levels have been received by the County to date, but apparently some docks have become submerged for periods of time.

A plot of the historical water level data from the water atlas is presented below as **Figure 4**. A photo of the sluice gate structure is included below as **Figure 5**.



N

Legend

PARCELS
PIPES / CULVERTS
DRAINAGE STRUCTURES

0 125 250 500 750 1,000
Feet

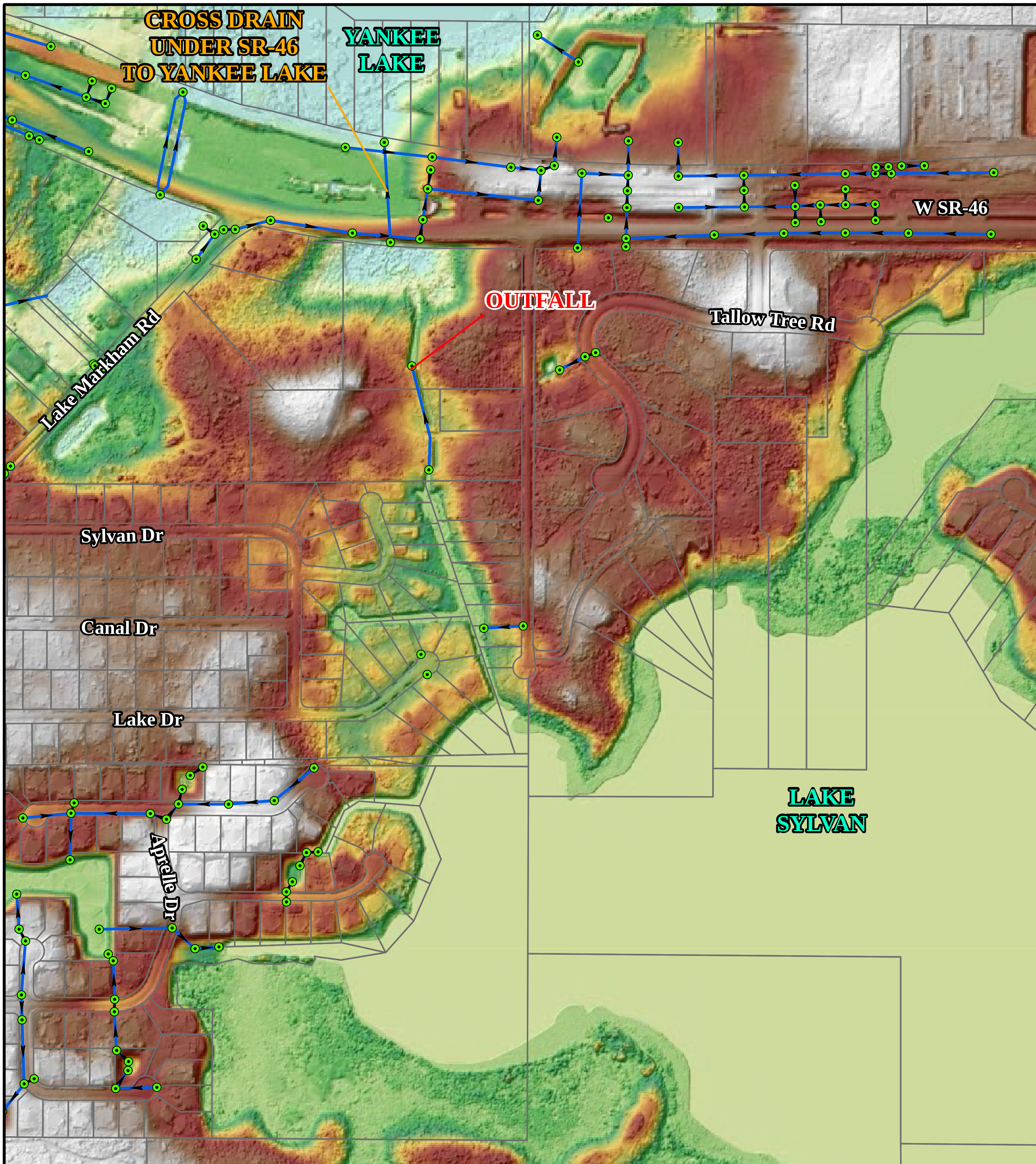
Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Site Map
Lake Sylvan Outfall
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

Seminole County

Figure
1



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Legend

PARCELS

PIPES / CULVERTS

DRAINAGE STRUCTURES

0 125 250 500 750 1,000 Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022
DEM - USGS LIDAR, 2018

Topographical Map

Lake Sylvan Outfall

Wekiva Watershed Management Plan

Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure

2

Figure 3 – Aerial Detail of Lake Sylvan Outfall Area

Figure 4 – Historical Lake Sylvan Levels

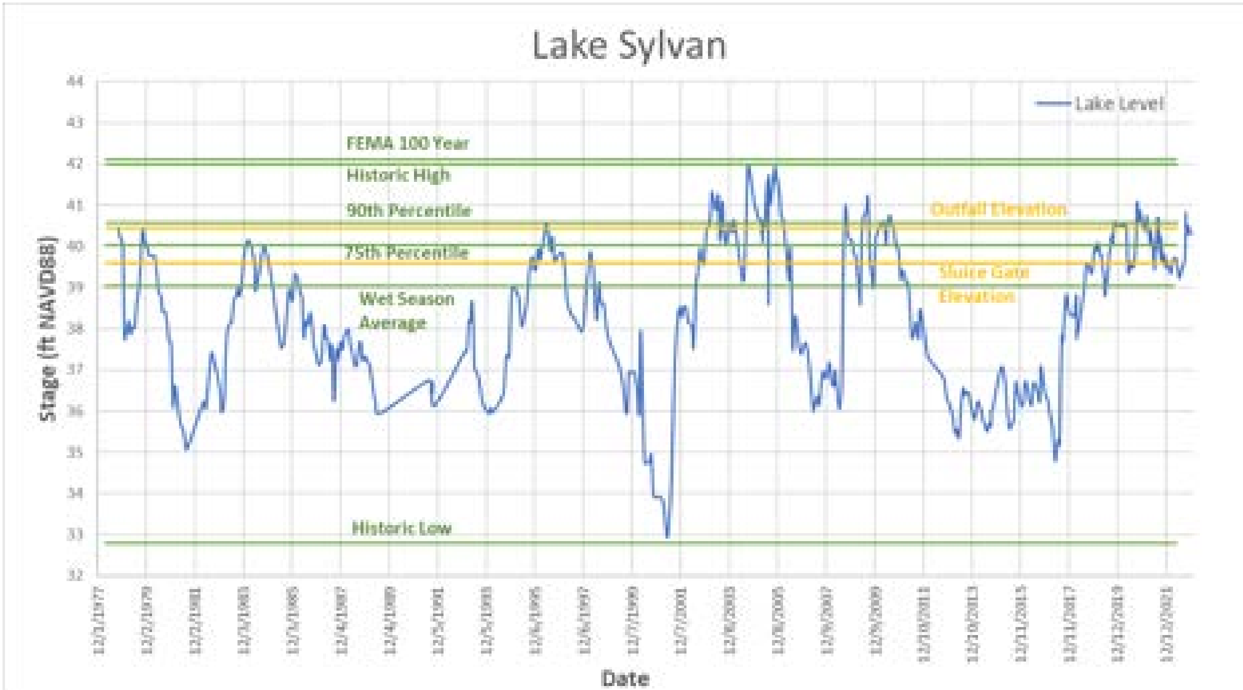


Figure 5 – Photo of Outfall Sluice Gate

Improvement Concept

The proposed improvement concept is to obtain a permit to create an active lake regulation schedule that the County can use to maintain the lake levels between the current permitted outfall elevation and the bottom of the sluice gate elevation. The current normal control elevation of 40.43' is very close to the statistical 90th percentile historical lake stage elevation of 40.68' which indicates the elevation at which the lake only gets above 10% of the time based on the period of record. The sluice gate elevation of 39.57' is approximately a half foot below the 75th percentile elevation of 40.14' and close to an approximate average wet season elevation of 39.02'.

It is proposed the operation schedule allow for the sluice gate to be kept open to maintain the long-term elevations of the lake lower than previous and provide additional flood protection buffer from extreme storm events. There would be considerations in the operation schedule for conditions downstream which may dictate closing the sluice gate partially or completely to mitigate any downstream adverse impacts. This would likely be a condition in which flooding of SR 46 was imminent or if for some reason Yankee Lake was exceeding its flood stage.

Hydrologic simulations were run with the Wekiva Watershed ICPR model to determine the impact to lake stages during design storm events from the various lake initial and control stage assumptions. Below is a summary of the response of Lake Sylvan to design storm events based on three initial stage / control elevation scenarios.

- First case uses the initial stage used in the primary watershed model of 40.14' which is the 75th percentile of the period of record and uses the current outfall elevation of 40.43'.
- The second case uses the current control elevation, but with the initial late stage set at that control elevation at 40.43'.
- The third case uses the control elevation set to the lower level associated with the sluice gate of 39.57 and then also starting the initial stage of the lake at that same elevation.

Lake Sylvan

Initial Stage / Control Scenario	Mean Annual / 24 hour	10 Year / 24 hour	25 year / 24 hour	25 Year / 96 Hour	100 Year / 24 hour	100 Year / 96 Hour
Current 75th Percentile	40.734	41.078	41.32	41.617	41.798	42.240
Current Control Elevation	40.963	41.294	41.529	41.772	41.997	42.375
Lowered Control Elevation	40.289	40.654	40.902	41.122	41.384	41.760
Difference Between Control Elevation Scenarios	-0.674	-0.64	-0.627	-0.65	-0.613	-0.615

Since Yankee Lake is the receiving water for Lake Sylvan discharges, the stages in Yankee Lake for the above refences scenarios were likewise evaluated and summarized below.

Yankee Lake

Initial Stage / Control Scenario	Mean Annual / 24 hour	10 Year / 24 hour	25 year / 24 hour	25 Year / 96 Hour	100 Year / 24 hour	100 Year / 96 Hour
Current 75th Percentile	35.925	36.260	36.507	36.882	37.012	37.709
Current Control Elevation	35.998	36.354	36.609	37.010	37.112	37.812
Lowered Control Elevation	36.064	36.445	36.708	37.124	37.219	37.860
Difference Between Control Elevation Scenarios	+0.066	+0.091	+0.099	+0.114	+0.107	+0.048

As would be expected the lower control elevation affords the ability to mitigate the impacts of extreme design storm events in excess of a half a foot. This occurs while not impacting downstream stages in Yankee Lake more than approximately one tenth of a foot. It is noted that there is one habitable structure surrounding Yankee Lake with a finished floor approximately at about 42'+ (based on LiDAR DEM data - not surveyed) and the nearest roadway edge of pavement is approximately 48'+ (SR46 plans), well above these modeled stage levels. It is also noted that the highest observed water level for Yankee Lake based on the water atlas is 39.86'.

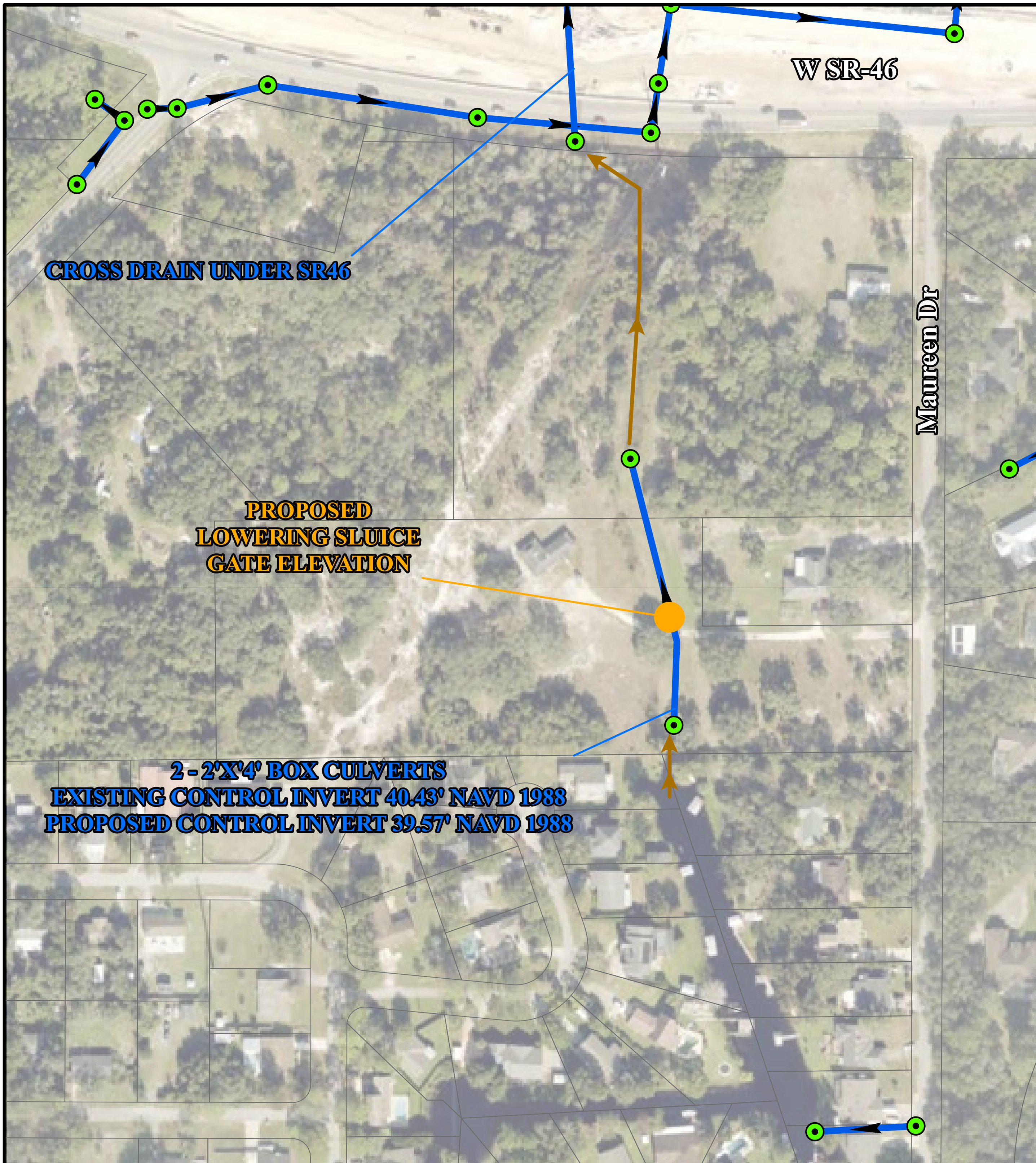
The proposed improvement is shown on **Figure 6.**

Proposed Lake Level Schedule

Based on the foregoing the following lake schedule is proposed.

- Normal Lake Level Operation at 39.57' NAVD 1988 (Open Sluice Gate)
- Alternative Lake Level Operation at 40.43 NAVD 1988 (Closed Sluice Gate), based on the following conditions:
    - Downstream levels in Yankee Lake exceed 40' NAVD 1988

Seminole County staff ill be the responsible entity for maintaining the operation schedule for the outfall and maintaining a monthly log of Lake Sylva and Yankee Lake stages in order to comply with the operation schedule.



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Legend

PARCELS

PIPES / CULVERTS

DRAINAGE STRUCTURES

0 50 100 200 300 400 Feet

Sources:
Parcels, Infrastructure - Seminole County, 2022
Aerial - ESRI, 2022

Proposed Improvements Map
Lake Sylvan Outfall
Wekiva Watershed Management Plan
Seminole County, Florida

Geosyntec consultants

SEMINOLE COUNTY

Figure
6

Implementation Considerations

The following implementation considerations are provided for this improvement concept.

- Flood Benefit – The project is intended to allow for a managed positive outfall to help normalize stages in the lake. It would be intended to provide a long-term maintenance of stages and aide in the better management of stages after significant storm event, and too a smaller degree mitigate peak stages during extreme storm events.
- Water Quality Benefit – This improvement would not be purposed to provide a water quality benefit, not would be expected to significantly impact either in lake water quality or downstream receiving water quality.
- Land Acquisition – Land and/or easement acquisition will not be necessary as the existing outfall structure is under County easement.
- Wetland / Surface Water Impacts –Surface water and wetland impacts due to the changing of the lake stage schedule would be considered to be insignificant due to the control change being within a range of historical lake level fluctuations.
- Permitting Considerations – It is anticipated that this improvement would require an individual permit from the St. Johns River Water Management District since it would involve surface waters and an existing permitted outfall.
- Benefit/Cost – The estimated total implementation cost for this improvement is nominal since the control infrastructure is already in place. Permitting efforts would be necessary to secure the operational schedule.

Conclusions

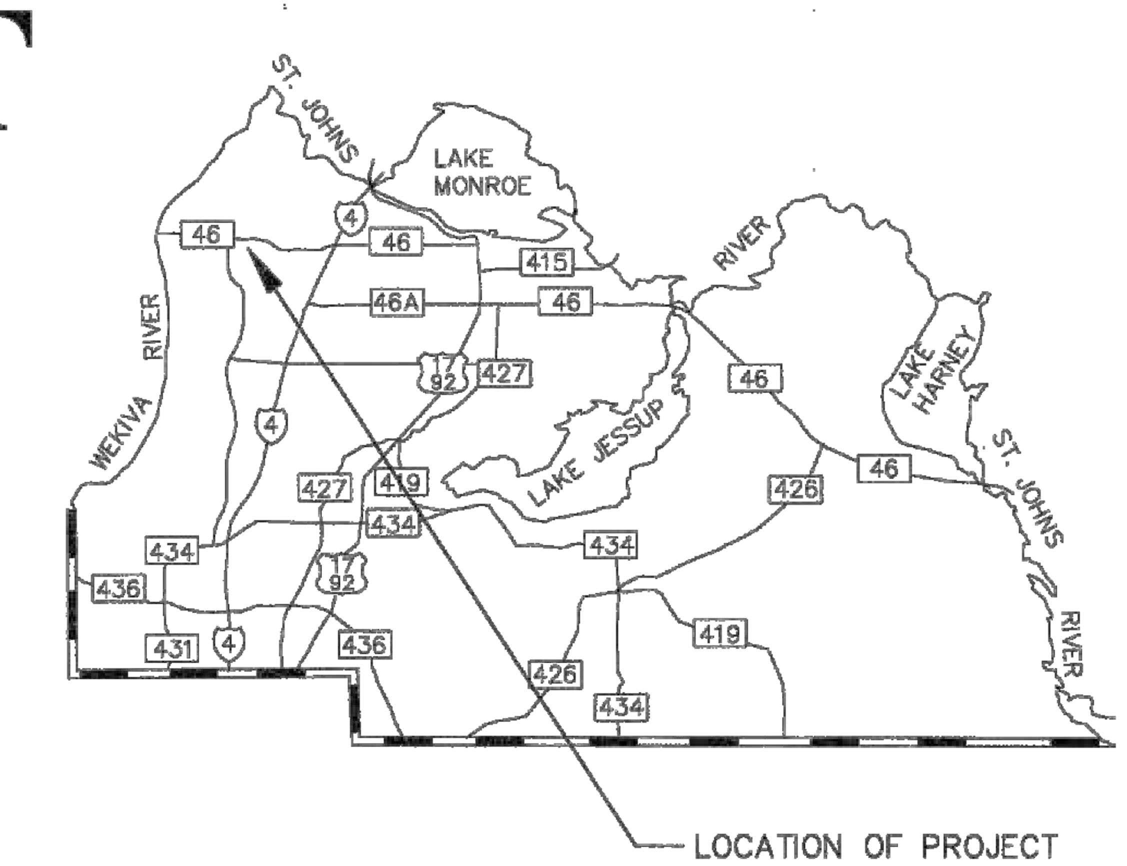
The goal of this effort was to develop a flood mitigation solution to provide an improved positive outfall to Lake Sylvan. This outfall would be operated at a permitted lower elevation than the current lake control elevation. This would provide an opportunity for additional flood storage (freeboard) in the lake over the long term.

Based on the foregoing, Geosyntec recommends moving forward with the permitting in of this proposed project.

Attachment
Lake Sylvan Outfall As-Built Plans

JOB FILE #	SHEET No.
6116-92650	G-1

SEMINOLE COUNTY
PUBLIC WORKS DEPARTMENT



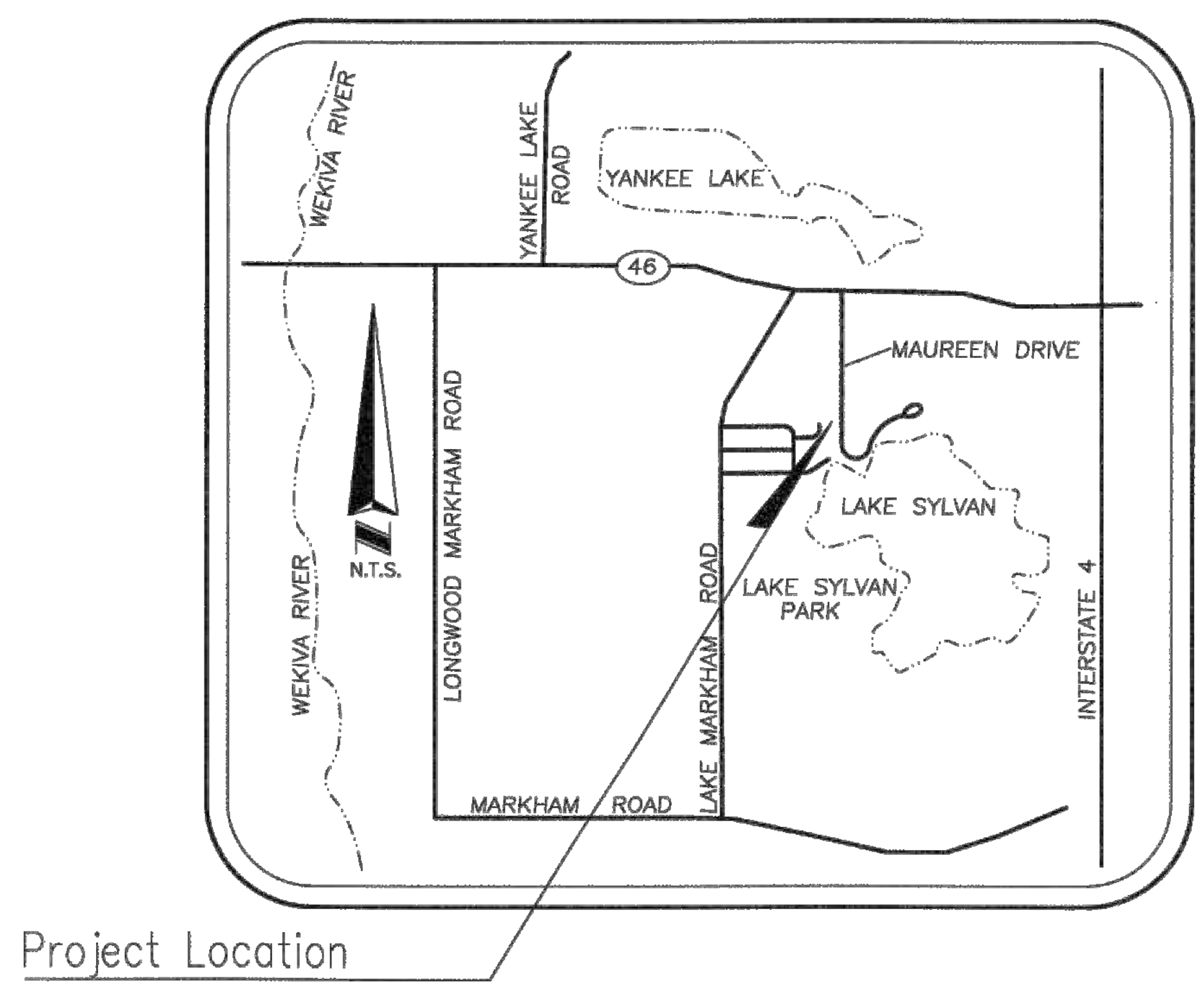
SEMINOLE COUNTY
FLORIDA'S NATURAL CHOICE

INDEX OF PLANS

SHEET NO.	SHEET DESCRIPTION
G-1	COVER SHEET
~~G-2~~	~~GENERAL NOTES AND SUMMARY OF PAY ITEMS~~
~~G-3~~	~~KEY PLAN AND SOIL BORING LOCATIONS~~
~~G-4~~	~~EXISTING CONDITIONS~~
~~G-5~~	~~EXISTING CONDITIONS~~
~~G-6~~	~~EXISTING CONDITIONS~~
~~C-1~~	~~HORIZONTAL CONTROL PLAN~~
C-2	PLAN & PROFILE
C-3	PLAN & PROFILE
~~C-4~~	~~EROSION CONTROL PLAN~~
~~C-5~~	~~CROSS SECTIONS~~
~~CD-1~~	~~MISCELLANEOUS DETAILS~~
~~CD-2~~	~~MISCELLANEOUS DETAILS~~
~~S-1~~	~~STANDARD NOTES~~
~~S-2~~	~~CONCRETE CHANNEL PLANS, SECTIONS AND DETAILS~~

THESE PLANS HAVE BEEN PREPARED IN ACCORDANCE WITH AND ARE GOVERNED BY THE STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION DESIGN STANDARDS (2010 EDITION)

AS-BUILT SURVEY
LAKE SYLVAN OUTFALL IMPROVEMENTS



LOCATION MAP
SEC. 26 TWP. 19 South RNG. 29 East

Seminole County Project Manager:
Robert Walter, P.E.

GOVERNING SPECIFICATIONS: STATE OF FLORIDA, DEPARTMENT OF TRANSPORTATION, STANDARD SPECIFICATIONS (2010 EDITION) AND SUPPLEMENTS THERETO IF NOTED IN THE SPECIAL TECHNICAL PROVISIONS FOR THIS PROJECT.

ATTENTION IS DIRECTED TO THE FACT THAT THESE PLANS MAY HAVE BEEN CHANGED IN SIZE BY REPRODUCTION. THIS MUST BE CONSIDERED WHEN OBTAINING SCALED DATA.

AS-BUILT SURVEY PERFORMED BY:
LAYOUT SERVICES, INC.
3380 S PARK AVE STE 7 (321) 759-2779
TITUSVILLE, FL. 32780 (321) 264-9748 (FAX)

CONSTRUCTION COMPLETION DATE ____________

FIELD VERIFIED BY ____________

REVISIONS		
BY	DATE	DESCRIPTION

AS-BUILT ABBREVIATIONS AND LEGEND

E	EAST
EL	ELEVATION
ERCP	ELLIPTICAL REINFORCED CONCRETE PIPE
EXIST	EXISTING
INV	INVERT
LF	LINEAR FEET
LT	LEFT
N	NORTH
RT	RIGHT
S	SOUTH
STA	STATION
TYP	TYPICAL
W	WEST
W/	WITH
x45.0	SPOT ELEVATION

AS-BUILT SURVEYOR'S NOTES:

1. THE PURPOSE OF THIS SURVEY IS TO SHOW THE IMPROVEMENTS FOR THE LAKE SYLVAN OUTFALL IMPROVEMENTS PROJECT AS INSTALLED BY THE CONTRACTOR.
2. ELEVATIONS BASED ON BENCHMARKS SHOWN ON CONSTRUCTION PLANS AND ARE REPRESENTED BY SURVEYOR ON SAID PLANS AND ARE REFERENCED TO THE NATIONAL GEODETIC VERTICAL DATUM OF 1929.
3. ALL UTILITIES SHOWN, WERE NOT LOCATED BY THIS SURVEY AND ARE ON THE DRAWING PREVIOUSLY LOCATED BY ANOTHER SURVEY.
4. AS-BUILT DRAWINGS WERE FIELD VERIFIED AND ARE A TRUE REPRESENTATION OF IMPROVEMENTS.
5. AS-BUILT DATA SHOWN AS BOLD.
6. DATE OF FIELD WORK: 4/13/15

SCALE: 1"=20' HZ.
1"=2' VT.

DATE:
JANE M. WILLIAMS
P.E NO. 64088

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY:
DRAWN BY: RT
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE: APRIL 17, 2015

I hereby certify that the survey shown hereon is true and correct to the best of my knowledge and belief, based on actual measurements taken in the field. This survey meets the Standards of Practice as set forth by the Florida Board of Professional Land Surveyors in Chapter 5J-17, Florida Administrative Code, pursuant to Section 472.027, Florida Statutes.

UNLESS IT BEARS THE SIGNATURE AND ORIGINAL RAISED SEAL OF A FLORIDA LICENSED SURVEYOR AND MAPPER THIS DRAWING SKETCH, PLAT OR MAP IS FOR INFORMATIONAL PURPOSES ONLY AND IS NOT VALID.

James Zimmerman
Professional Land Surveyor No. 6545
State of Florida

LAYOUT SERVICES, INC.
LAND SURVEYING & MAPPING
3380 S PARK AVE STE 7
TITUSVILLE, FL. 32780
(321) 759-2779
(321) 264-9748 (FAX)

SEMINOLE COUNTY, FLORIDA

LAKE SYLVAN OUTFALL IMPROVEMENTS

PLAN AND PROFILE AS-BUILT SURVEY

PROJECT NO. 6116-92650
FILE NAME: C002PLPR AS-BUILT

SHEET NO.
C-2

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY:
DRAWN BY: RT
SHEET CHK'D BY:
CROSS CHK'D BY:
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SEMINOLE COUNTY, FLORIDA

LAKE SYLVAN OUTFALL IMPROVEMENTS

PLAN AND PROFILE AS-BUILT SURVEY

DATE:
JANE M. WILLIAMS
P.E NO. 64088

PROJECT NO. 6116-92650
FILE NAME: C003PLPR AS-BUILT

SHEET NO.
C-3

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