Inundation Modeling and Mapping, Dam Break Supplement for Shadow Run Dam at Lake Grady, Riverview, Hillsborough County, Florida

Florida Department of Environmental Protection, Florida
Dam Safety Program, Division of Water Resource Management

NID ID: FL00176 Shadow Run Dam, Riverview, Hillsborough County, Florida

Project No.BS135

REVISED FINAL
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08/19/2022

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Prepared for

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Professional Services Contract No. BS135

08/19/2022

Prepared by COMAK Group, Inc

in association with

Mott MacDonald Florida, LLC

REVISED FINAL

2022

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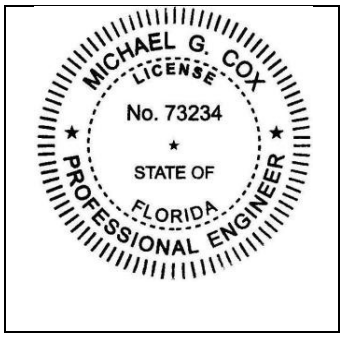
CERTIFICATION
FLORIDA PROFESSIONAL ENGINEER

The engineering services addressed herein, as defined in Section 471.005(6), F.S., have been performed by and under the responsible charge of the professional engineer named below. These engineering services are based upon the named professional engineer's knowledge, information, and belief, and in accordance with commonly accepted procedures consistent with applicable standards of practice. This certification is not a guaranty or warranty, either expressed or implied.

Comak Group, Inc.
Florida Board of Professional Engineers Registry No. 32224

Principal Engineer



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1.0 GENERAL INFORMATION

1.1 Project Location

Shadow Run Dam at Lake Grady, NID ID: FL00176, is in west central Hillsborough County, within the municipal limits of Riverview, Florida, approximately 20 miles southeast of downtown Tampa. It is owned and operated by Shadow Run Dam Corporation, Inc, Riverview, FL. The dam is situated at approximate Latitude 27.8377^0 North, and Longitude 82.2731^0 West. Shadow Run Dam is located on Shadow Run Boulevard and is approximately 1.4 miles south of the Bell Creek crossing of Boyettte Road, which is about 2.9 miles to the east of US Highway 301 S in Riverview, Hillsborough County. The dam impounds Bell Creek and Pelleham Branch which flows through Shadow Run Dam lake outlet works and which is part of the Alafia River Basin. See project vicinity figure on Page 6. The project location map for Shadow Run Dam is shown on Figure 1 in Appendix A.

1.2 Purpose

1) Provide FDEP and the dam owner, with inundation mapping and modeling in the project vicinity and downstream locations, which have or may have collectively the potential for loss of life and loss of property in the event of a dam failure.

2) Conduct hydrologic and hydraulic analysis of the dam for the 100-year, ½ PMP and PMP storm events, and selected dam break conditions including the Sunny Day failure and prepare matching inundation maps based on the results.

3) Prepare customized inundation maps based on the modeling results for the dam site, under dam break conditions.

The FDEP has executed a work delivery order with Mott MacDonald to provide the services in the SOW outlined in Contract No: BS-135,Task Assignment No. 13 for No Dam Break and Dam Break Inundation Modeling and Mapping. The No Dam Break Inundation Modeling and Mapping for Shadow Run Dam was conducted as Task 4, with the final Report dated June 30, 2022, as revised. **This Dam Break Inundation Modeling and Mapping Report for Shadow Run Dam is conducted as Task 5 and is a Supplement to the Task 4 report.** Consequently, some of the data and information in the Engineering analyses for the Task 4, **No Dam Break** condition report are not repeated herein, and the reader should refer to the June 30, 2022, report for additional details and descriptions.

This Task 5 assignment is to prepare the Inundation Mapping Report for the Sunny Day Dam Break, the 100-year storm Dam Break, ½ PMP storm Dam Break and the PMP storm Dam Break scenarios for Shadow Run Dam at Lake Grady. It is a companion document to Task 4 Inundation Modeling Report for the No Dam Break condition 100-year storm, ½ PMP and the PMP storm Dam Break events for Shadow Run Dam at Lake Grady.

1.3 Background Data Information

Background information for this project was obtained from a review of historic record files obtained from the FDEP, University of South Florida, Shadow Run Dam Corporation, Inc., and Esri.

The following maps and aerial imagery were obtained:

- High resolution 0.24 m or 9.4-in Bing Aerial Imagery (1.54 m or 5-foot horizontal accuracy) available on ArcGIS Pro (dated 1/18/2016 and supplied by the State of Florida to Esri et al.[1]).

The following digital elevation data were obtained:

- LIDAR Datasets horizontal resolution 1 m or 3.28-foot (+/- 30.8 cm or 12.12-inches at 95% confidence level), vertical accuracy (+/- 9.6 cm or 3.8-inches at 95% confidence level), and
- National Elevation Dataset (NED) 1/9 arc second Digital Elevation Model (DEM).

1.4 Project Datum

The project maps and elevation data are based on the horizontal coordinate system NAD 1983 2011 UTM Zone 16N projection. Contours on the USGS Quadrangle Maps, Lidar data, and Digital Elevation Model (DEM, used within the project are referenced to the North American Vertical Datum of 1988 (NAVD88).

Pertinent topographic surveying data and bathymetric data were obtained from detailed field methods conducted in January through March 2022. The DEM data developed for Shadow Run Dam at Lake Grady was merged with the detailed Bathymetry data obtained in the field in March 2022 to create a seamless DEM/ BEM referenced to NAVD88 vertical datum elevation. Benchmarks at Shadow Run Dam were used by field surveying conducted in March 2022 to verify and ground truth the DEM / BEM data. An overhead close-up view of Shadow Run Dam Spillway Outlet Works Control Structure at Lake Grady is included as Figure 1a on Page 7.

1.5 Project Description

NID ID: FL 00176. Shadow Run Dam is a rolled earth fill dam approximately 30 feet high and approximately 1015 feet long. The dam forms a 120-acre impoundment with 750-acre feet of storage at normal pool level and has a pool surface area of approximately 275 acres with a storage volume of 3119 - acre feet at the top of dam embankment crest at Shadow Run Blvd. An 8ft wide paved curvilinear concrete walkway runs along the crest of the dam which is about 30 feet wide. The water level in the lake pool is controlled by a winged shaped drop inlet concrete overflow spillway having weir elevations at varying levels, discharging into a 4-barrel concrete culvert outlet conduit; two(2) sized at 13ft wide by 8.3ft high and two (2) sized at 12 ft wide by 8.3ft high. The profile of the top of the impoundment varies and follows the concrete walkway elevations along Shadow Run Blvd which vary from a low of 44.3ft to a high of 45.9 ft. The average low point elevation is approximately 44.5 feet. The dam was

[1] Esri, Digital Globe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, Aero GRID, IGN, and the GIS User Community

originally constructed around 1969 to create a recreational lake and consisted of an earthen embankment built across Bell Creek and Pelleham Branch.

Based on its storage capacity and height, the Shadow Run Dam is in the category of an "Intermediate" dam. The dam is listed in the NID as a **Significant Hazard** Potential Classification impoundment, indicating that "failure or mis-operation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns." The dam hazard potential classification is based on "Federal Guidelines for Dam Safety: Hazard Potential Classification System for Dams" published by the Federal Emergency Management Agency (FEMA)[2]. Refer to the project Vicinity Figure below which illustrates the dam and its surrounding neighborhood. It is noted that no inspection report documenting the Significant Hazard Potential Classification for Shadow Run Dam at Lake Grady was available at the time of this study. The Project Location Map, Figure 1, is shown with an Aerial background setting in Appendix A.

The dam consists of a typical NRCS grassed - lined embankment with a 3-Teir Weir pool level control concrete drop inlet with no defined approach channel and Bell Creek as the defined exit channel. The dam was originally constructed in 1969 without any emergency spillway. In 1983 the upstream side of the dam failed and in 1987 slope problems were encountered due to surface erosion and dam seepage. Subsequently, the dam was repaired, and the current outlet works structure constructed in October 1997. The entire dam embankment crest would function as the emergency overflow spillway if an extreme flood event such as the Probable Maximum Flood (PMF), were to occur.

The dam upstream and downstream embankment slopes are each 2.5:1 (horizontal to vertical). The principal spillway is a winged shaped drop inlet concrete overflow spillway having three(3) Weir control elevations at varying levels, and referred to as Low- Level Weir, Mid-Level Weir and High-Level Weir, all discharging into the 4-barrel concrete culvert outlet conduit. The Low-Level Weir crest is 2 feet wide at elevation 34.61ft, which serves to maintain the Normal pool at Elevation 35.11. The Mid-Level Weir has a total length of 204 feet at crest elevation of 35.61 ft and the High-Level Weir has a length of 57feet at a crest elevation 40.61ft. The spillway outlet works is equipped with a Draw Down drain gate which is a 72-inch diameter gate valve with stem and invert at elevation 25.11 ft, allowing a maximum lake pool drawdown of approximately ten feet. The discharge barrel consists of a 105-foot long four (4) barrel concrete conduits with outlet elevation at approximately 22.61 ft. The 4-barrel culvert discharges to a concrete apron approximately 40feet long, with end of apron at elevation 22.41ft.

[2] FEMA- Federal Guidelines for Dam Safety: Hazard Potential Classification System for Dams, January 2004

Project Vicinity Figure – Shadow Run Dam, Riverview, Hillsborough County, FL

Refer to Figure 1a. which is a close-up overhead view of the dam embankment at the principal Spillway Drop Inlet Outlet Works Control Structure location.

Figure 1a. Overhead View – Shadow Run Dam Outlet Works, Riverview, Hillsborough County, FL

2.0 ENGINEERING ANALYSES

2.1 Hydrology

The delineation of the drainage basin contributing runoff to Shadow Run Dam at the Lake Grady impoundment and the downstream Bell Creek sub-area to the mouth of Bell Creek at the confluence with Alafia River , was performed utilizing ArcGIS Pro's hydrological tools and DEM data obtained from the University of South Florida GIS data files. The contributory Bell Creek drainage area to Shadow Run Dam at Lake Grady is approximately 17.43 mi^2 (or11,155.2 acres). The contributing Bell Creek sub-area from Shadow Run Dam outflow downstream to the Bell Creek Mouth at the confluence with Alafia River , which is the downstream study limit, is 2.52 mi^2 (or 1,612.8 acres) thereby resulting in a total Shadow Run Dam / Bell Creek system catchment area of 19.95 mi^2 or 12,768 acres. The mainstem and upstream Alafia River catchment drainage area above the confluence with Bell Creek mouth, has a combined drainage area of approximately 370 mi^2 and is not included in the hydrologic model analysis, because this catchment area is about 18 times as large as the project drainage area, and reportedly, based on historic events the Alafia River flood peak arrives at the Bell Creek Mouth confluence some 24-36 hours after the peak flows from the Shadow Run Dam at Lake Grady system has receded.

The USACE HEC-HMS model was used to analyze the Shadow Run Dam at Lake Grady impoundment drainage system. HEC-HMS is a hydrologic simulation software developed by the Hydrologic Engineering Center of U.S. Army Corps of Engineers (USACE). The model determined the runoff volume entering the Shadow Run Dam at Lake Grady impoundment system, the discharges from the dam outlet structure and the maximum water level in Lake Grady resulting from the 100-year, ½ PMP and PMP storm events.

2.1.1 Model Setup

The NRCS Curve Number (CN) Method was used in HEC-HMS to develop the runoff hydrographs for the study area. This Task 5 report is a supplement to the Task 4, **No Dam Break** Inundation Modeling and Mapping report, dated June 30, 2022, as revised. Refer to that report for additional descriptions of the hydrologic model set up and runoff network system.

The 100-year 24-hour rainfall depth is 11.1 inches and was taken from the NOAA Atlas 14. The PMP 24-hour value is 47.1 inches and was obtained from Hydrometeorological Report (HMR) 51 rainfall maps. The NRCS Type III (Type II Modified) temporal distribution was used to simulate the rainfall depths in the runoff models. The HEC-HMS was used in conjunction with HEC-RAS for the dam impoundment to account for Lake Grady storage as well as and the Pelleham Branch and Bell Creek inflow stream storage.

Table 1 summarizes the drainage basin Runoff Peak Flow for Shadow Run Dam at Lake Grady and the downstream Bell Creek drainage sub catchment area. Figure 2 in Appendix A shows the delineation of the contributory Bell Creek drainage area to Shadow Run Dam at Lake Grady and the downstream Bell Creek subbasin to Bell Creek mouth at the confluence with Alafia River. Figure 3 in Appendix A is a schematic of the HEC-HMS hydrologic model network developed and used.

Table 1. Shadow Run Dam At Lake Grady - Drainage Basin Runoff Peak Flow Summary - HEC HMS (Table adapted from the Task 4, Shadow Run Dam - No Dam Break Model Report , dated June 30, 2022)

Points of Interest (POI)	Drainage Area (mi^2)	CN	Peak Inflow 100 -yr (CFS)	Peak Inflow ½ PMP (CFS)	Peak Inflow PMP (CFS)
Shadow Run Dam / Shadow Run Blvd			0	0	1458
POI 01 -Shadow Run Dam At Lake Grady Inlet	17.43 (11155.2 ac)	78	4946.0	13917.8	25119.0
POI 02 - Shadow Run Dam At Lake Grady Outlet-d/s toe	17.43 (11155.2 ac)	N/a	4485.0	13290.0	24846.7
POI 03 - Boyette Rd over Bell Creek	19.1 (1068.8 ac)	N/a	5142.0	15874.0	31272.0
POI 04 – Bell Creek Outlet	19.95 (12768 ac)	80	5148.0	15881.0	31268.0

2.2 Hydraulics

2.2.1 HEC-RAS Model Introduction

The HEC-RAS model was used in the analysis of the Shadow Run Dam at Lake Grady impoundment system on Bell Creek and its downstream riverine flood floodplain. HEC-RAS is a hydraulics simulation software developed by the Hydrologic Engineering Center of U.S. Army Corps of Engineers (USACE). It is a steady and unsteady hydrodynamic analysis model based on the solution of Saint Venant Equation using an implicit finite difference method. The HEC-RAS system includes river analysis components for one- and two-dimensional steady and unsteady flow simulation and is applicable in situations where the water surface profile is rapidly varied, such as hydraulic jumps, hydraulics of bridges, as well as dam break and levee breach analysis.

2.2.2 Model Setup

In this model application, the **2D HEC-RAS** model based on available 3.28 ft x 3.28ft terrain data was used for the Bell Creek Shadow Run Dam at Lake Grady impoundment system. HEC-RAS has the capability to provide 1D riverine, detailed 2D channel and floodplain, and hybrid of 1D channel flow with 2D floodplain flow areas simulation modules. The HEC-RAS 2D simulation was used and provides a more realistic depiction of flow throughout a system than a 1D model for the case where flood wave may 'spread' significantly and for urbanized areas, as well as wide floodplains.

Also, the RAS- Mapper in the HEC-RAS 2D module was used to post-process the simulation results and generate inundation maps and graphs.

2.2.3 Simulation Domains

Figure 2 in Appendix A shows the Bell Creek contributory drainage catchment area to Shadow Run Dam and the downstream Bell Creek sub-watershed catchment area. The hydrologic analysis described in Section 2.1 utilized the HEC-HMS model to simulate the runoff inflow to the dam's system. The Shadow Run Dam is listed in the Federal National Inventory of Dams (NID No:00176) as a **Significant Hazard Potential** dam. Typically, the hazard potential classification of a dam is used to select the extreme hydrologic failure event. The PMF is the flood that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are possible in the study area drainage basin. According to FEMA guidance, High Hazard Potential dams are typically evaluated using a full PMF, and Significant and Low-Hazard Potential dams are evaluated on a percentage of the PMF or some more frequent storm event, such as the 100-yr (one percent annual chance exceedance) storm event. The project scope of services requires that the Shadow Run Dam be evaluated for both the PMP and ½ PMP storms as well as the 100-year storm event. Due to the potential for the capacity of the dam to be exceeded during events more frequent than the PMP storm, the 100-year 24-hour storm (11.1 inches), and the half Probable Maximum Precipitation (1/2 PMP) storm (23.55 inches) were analyzed in addition to the PMP (47.1 inches) event. Reservoir flood routing analysis as well as channel flood routing analysis were conducted for the selected downstream points of interest. These flood routing results were then used in HEC-RAS 2D model to perform the **dam break** flood flow analysis for the selected extreme storm events.

Two (2) 2D simulation domains, which include Shadow Run Dam at Lake Grady as well as the downstream Bell Creek floodplain contributing areas, were established in the HEC-RAS model. The potential inundated areas downstream extend from Lake Grady spillway outflow through the Bell Creek subarea floodplain and crossing under Boyette Road Bridge to Bell Creek Mouth at the confluence with Alafia River. The model domain schematic map is illustrated on Figure 4 in Appendix A. It is noted that the project scope of this Task 5 Dam Break Inundation Modeling and Mapping for Shadow Run Dam includes the failure of the dam under the Sunny Day condition, as well as during the 100-yr, ½ PMP and PMP storm events.

2.2.4 Boundary Conditions, Hydraulic Structures and Modeling Analysis Coefficients

For the model domains considered, selected types of boundary conditions were used in HEC-RAS 2D model setup, which are depicted by the red checkered lines on Figure 4. Inflow boundary conditions were used in the water storage domain around the Shadow Run Dam impoundment at Lake Grady. The outflows coming from the principal spillway and discharge barrels, and dam crest overtopping were combined and identified as the lake outflow boundary, which connects to the inflow boundary of the downstream Bell Creek floodplain. To capture the flooding impact from the contributing Bell Creek sub-area downstream of the Shadow Run Dam, a floodplain boundary was applied. For the study limit at the confluence with Alafia River, the 100yr flood water surface elevation established in prior studies was used as the downstream boundary condition, in lieu of the Bell Creek mouth normal depth water surface elevation.

Table 2 summarizes the elevation - area and storage data developed for the dam at Lake Grady. ***(Table adapted from the Task 4, Shadow Run Dam - No Dam Break Model Report , dated June 30, 2022)***

Table 2. Shadow Run Dam at Lake Grady, Elevation-Area- Storage - Discharge Summary

Elevation (ft)	Surface Area (ac)	Storage Volume (ac-ft)	Drawdown Outlet 72"dia. Discharge (cfs)	Drop Inlet Low Weir L=2ft Discharge (cfs)	Drop Inlet Mid Weir L=204ft Discharge (cfs)	Drop Inlet High Weir L=57ft Discharge (cfs)	Dam Crest, L =1015ft Discharge (cfs)	Total Discharge (cfs)	Description
16.43	0.000	0	0	0	0	0	0	0	Lake Bottom (Low Point)
20.00	0.871	1.23	0	0	0	0	0	0	Lake Bottom Average
25.10	8.604	12.22	0	0	0	0	0	0	Drawdown Outlet Invert
29.00	60.404	149.17	0	0	0	0	0	0	Intermediate Stage
33.00	109.717	508.77	304	0	0	0	0	0	Intermediate Stage
34.61	115.927	656.18	347.09	0.00	0	0	0	347.09	Low Weir Crest El
35.11	119.897	750.43	360.19	4.71	0	0	0	364.90	Normal Pool El
35.61	141.134	958.08	372.83	13.32	0.00	0	0	386.15	Mid-Level Weir Crest
36.00	160.082	1056.80	385.06	24.47	241.35	0	0	650.88	Intermediate Stage
38.00	198.294	1418.88	430.51	87.22	2698.41	0	0	3216.14	Intermediate Stage
39.00	218.578	1628.64	451.53	127.15	4469.92	0	0	5048.60	Intermediate Stage
40.00	227.905	1844.79	471.60	171.81	6516.54	0	0	7159.95	Intermediate Stage
40.61	239.321	1989.86	481.33	195.76	7632.25	0.00	0	8309.34	High Level Weir Crest
41.00	246.619	2082.61	490.86	220.74	8805.26	67.11	0	9583.97	Intermediate Stage
42.00	256.397	2326.54	509.39	273.59	11312.75	348.70	0	12095.73	Intermediate Stage
43.00	270.341	2591.62	527.27	330.09	14021.36	750.29	0	15629.01	Intermediate Stage
44.00	272.514	2855.14	544.56	390.02	16917.12	1242.86	0	19094.56	Intermediate Stage
44.50	273.601	2986.90	553.00	421.22	18431.55	1518.48	0.00	20924.25	Top of Dam Overflow El 44.5 (Avg) L=1050ft
45.00	274.687	3118.66	561.30	453.20	19987.99	1811.93	897.14	22814.42	
46.00	276.860	3382.18	577.64	519.45	23226.00	2448.36	4661.70	31433.15	

It is noted that for Shadow Run Dam/Lake Grady impoundment the available top of embankment / roadway profile data within the LiDAR DEM at the dam was confirmed by field survey measurements conducted in March 2022 and supplemented by Lake Bathymetry Elevation data (BEM) obtained in March 2022 and merged with the DEM data to form a seamless DEM/BEM data base, which was utilized in the hydraulic models. All ground elevations refer to NAVD 1988 datum and were cross checked with established Benchmarks at Shadow Run Blvd. All 2D domain and internal boundaries are shown in Figure 4 in Appendix A.

2.2.5 Dam Break Simulation Scenarios

In this Task 5 model study, the following four (4) dam break scenarios were required to be evaluated in the hydraulic analysis. They are:

- Breach Analysis – Sunny Day modeling for Shadow Run Dam (piping)
- Breach Analysis – 100-year storm modeling for Shadow Run Dam (piping)
- Breach Analysis – ½ PMP storm modeling for Shadow Run Dam (piping)
- Breach Analysis – PMP storm modeling for Shadow Run Dam (overtopping)

According to the USACE manual "Using HEC-RAS for Dam Break Analysis," the overtopping and dam breach weir coefficient range from 2.6 to 3.1. A piping pressure flow coefficient of 0.5 was used for Sunny day, 100-year and ½ PMP dam break analysis. Dam breach calculations based on Von Thun and Gillete, and Froehlich methods, were used in the analysis. The dam breach calculation method and parameters are listed in the table below:

Table 3. Dam Breach Calculation Method and Parameters Summary

Description	Shadow Run Dam			
Dam Breach Scenario	**Sunny Day**	**100 - year**	**1/2 PMP**	**PMP**
Final Bottom Width (ft)	82	103	103	144
Final Bottom Elev (ft)	22.0	22.0	22.0	22.0
Left side slope	0.5:1	0.7:1	0.7:1	1:1
Right side slope	0.5:1	0.7:1	0.7:1	1:1
Breach weir Coef	2.6	2.6	2.6	2.6
Breach formation time(hrs)	0.33	1.52	1.52	1.71
Failure mode	Piping	Piping	Piping	Overtopping
Piping Coef	0.5	0.5	0.5	---
Initial Piping Elev (ft)	22.0 Bottom of Dam	22.0 Bottom of Dam	22.0 Bottom of Dam	---
Start WS (ft)	35.10 (normal pool)	42.05 (peak stage)	44.40 (peak stage)	45.20 (peak stage)
Breach method	Von Thun & Gillete	Froehlich (2008)	Froehlich (2008)	Froehlich (2008)

3.0 POINTS OF INTEREST AND CROSS SECTIONS

3.1 Points of Interest and Cross Sections

Points of Interest (POI) were identified at the dam and at downstream locations along the stream corridor, based on review of aerial photography, flood maps, field reconnaissance and hydrologic analysis. Four POIs were carefully chosen and are illustrated on Figure 5 in Appendix A. Shadow Run Dam at Lake Grady representative photographs and top of dam cross sections at selected POIs are shown on Figure 6; and the Boyette Road crossing over Bell Creek representative Photos and road profile from east to west is shown on Figure 7. The cross sections and top of road low point elevations were obtained from the LiDAR/ DEM surface data supplemented by field survey conducted in March 2022.

Table 4. Points of Interest and Representative Photo Summary for Shadow Run Damat Lake Grady

Points of Interest (POI)	Distance from Shadow Run Dam at lake Grady – ft	Representative Photo and Cross Section	Dam /Top of Road Low Point Elevation within DEM-ft NAVD88
POI 01 - Shadow Run dam Spillway Drop Inlet	0.0 (0.00mi)	X	Top of Dam (Crest) Low Point El.44.50
POI 02 - Shadow Run Dam Outlet	145 (0.03mi)	-------	-------
POI 03 - Boyette Road Bridge across Bell Creek	7352 (1.39 mi)	X	Westside Roadway - Low Point El. 27.83
POI 04 – Bell Creek Outlet (Mouth) at Alafia River	12,987 (2.46 mi)	-------	-------

4.0 INUNDATION MAPPING, FLOOD DEPTHS AND TRAVEL TIMES

The four (4) dam failure analyses scenarios identified in Section 2 for Shadow Run Dam at Lake Grady were evaluated for flood inundation **dam break** under Sunny Day, 100-year 24-hour storm, ½ PMP storm and PMP storm event conditions. Based on the HEC-RAS 2D simulation results, the hydraulic features at selected points of interest extending downstream of Shadow Run Dam are summarized on Tables 5,6, 7 and 8. The modeled flood inundation extents, maximum water elevations and maximum water depths, were established for the dam failure scenarios and the resulting flooding inundation illustrated graphically in Appendix A on Figures 8 through 26, using Esri Hybrid Satellite imagery as the background for the Model domain and selected Points of Interest.

4.1 Sunny Day Dam Break

A **Sunny Day** dam break is one that is not associated with a storm or flood wave**.** The break mode assumed is categorized as "Piping" where the break is caused by internal erosion and seepage flows through or underneath the embankment. The process is described as water seeping through the dam at a significant enough rate, such that it is internally eroding material and transporting it out of the dam embankment. As the material is eroded, a larger hole forms and can carry more water and erode more material, until the piping hole becomes large enough, such that the weight of the material above the hole is too great to be maintained and a mass caving of material will occur. This will result in a large rise in the outflow through the breach, which will then accelerate the breaching process and continue to cut down the embankment and widen the breach until the natural channel bed is reached. The hydraulic features of the **Sunny Day** break scenario at the dam are summarized in **Table 5**. The resulting peak reservoir pool elevation would be at approximately 35.10 NAVD88, which is the normal pool level of Lake Grady. The normal pool reservoir stage is predicted to be maintained for 15 minutes after dam piping failure begins.

The Sunny Day dam break flood inundation extent, maximum water surface elevations and maximum water depths are shown on Figures 8, 9 and 10, respectively. The resulting flood inundation extent is also shown Figure 23 Index Map sheet and map Panels -A1 through -A6 illustrating flooded parcels near homes. The impacted homes are in the vicinity of Bell Creek Mouth at the confluence with Alafia River. Eight(8) homes are impacted in this area with flooding depths above ground varying from 1.5ft to 3.3ft for these parcels which are along Carr Road. The normal Sunny (dry weather) day water elevation along Alafia River at Bell Creek mouth is 3.11ft NAVD88. The Sunny Day dam break elevation is 11.3ft NAVD 88 at the Bell Creek confluence with Alafia River. This means that there would be an 8.2ft rise in the water surface elevation at the mouth of Bell Creek if the dam were to fail during dry weather. The 11.3ft NAVD 88 elevation corresponds to elevation 12.19ft. NGVD. Note that the 25-year maximum flood elevation for Bell Creek at the confluence with Alafia River is 12.32ft NGVD, as published in the Alafia River Watershed Management Plan, dated 2002. Therefore, a dry weather failure of the dam would result in a flood level at the mouth of Bell Creek that is equivalent to the 25-year flood event water surface maximum elevation.

It is noted that words "homes" and "structures" are used interchangeably throughout the report and both mean building structures. The criteria for identifying flooding impacts at homes/ structures is inundation depth above ground surface equal to or greater than 0.1 ft at the structure. The impacted homes are highlighted as red rectangles on the Map panel sheets with a pointer call out of the flood depth above ground at the structure.

4.2 100-year Dam Break

The failure mode for the 100-year event Dam Break is "piping". As described in Section 4.1, the piping dam break failure mode involves internal erosion and seepage flow through or underneath the embankment. As the material progressively erodes, a larger hole forms and becomes large enough such that the weight of the material above the hole is too great to be maintained and a mass caving of material occurs. This results in a large rise in the outflow through the breach, which in turn accelerates the breaching process and cuts down the embankment and widens the breach until the natural channel bed is reached. The hydraulic features of the simulated dam break are summarized in Table 6. The dam break flood inundation extent, maximum water surface elevations and maximum water depths are shown on Figures 11,12 and 13, respectively. The flooding inundation extent is also shown in Figure 24 Index Map sheet and Map Panels -A1 through -A6 illustrating flooded parcels near homes and depth of flooding above ground at the structures.

Table 5. Hydraulic Features of Shadow Run Dam system, Sunny Day Dam Break

Point of Interest (POI)	Distance from Shadow Run Dam at Lake Grady (ft)	Peak Velocity (ft/s)	Peak Flood Wave Discharge (cfs)	Peak Flood Depth (ft)	Peak Flood Stage (ft)	Peak Stage Arrival Time (since start of failure)	Remarks
POI 01 - Shadow Run Dam Inlet Works Spillway Structure (Mid Pt)	0	--------	9473	16.13	35.10	00:15:00	Normal Pool El. 35.10ft NAVD88 Dam Breach (Piping)
POI 02 - Shadow Run Dam Outlet (Mid Pt of d/s toe)	145	12.10	9473	7.64	32.30	00:20:00	Dam Breach (Piping)
POI 03 - Boyette Rd Bridge across Bell Creek (Mid Pt of the Upstream face)	7352	3.38	3902	8. 78	21.15	01:30:00	
POI 04 - Bell Creek outlet (Mouth) at Confluence with Alafia River	12987	2.46	2826	10.61	11.3 (8.19ft above no break el.)	02:50:00	Bell Creek Mouth non-rainy day stream El. 3.11 ft, adapted from Alafia River Watershed Management Plan, Hillsborough County, 2002

Flooding impacts downstream include twenty-seven (27) homes on the left bank of Bell Creek, with flood depths above ground varying from 0.1ft to 5.6ft in the vicinity of Boyette Road bridge; eighteen (18) homes in the area adjacent and near to Bell Creek mouth at the confluence with Alafia River, with flooding depths above ground varying from 0.3ft to 8.0ft at the homes in the area; four (4) homes near the right bank downstream of Boyette Road are impacted with flood depths varying from 0.4ft to 3.1ft; and one (1) home on the right bank downstream of Shadow Run Dam near Deepbrook Drive will have a flood depth of 1.0ft above ground. The number of homes and parcels impacted downstream are fifty (50) and one hundred and seventy-nine (179), respectively.

The upstream impacts include five (5) homes along Lake Grady northeast shoreline along Shadow Run Blvd; and two (2) homes on the Pelleham Branch southwest shoreline along Lake Hills Drive.
The number of parcels impacted upstream of the dam are ninety-seven (97).

Table 6. Hydraulic Features of Shadow Run Dam system 100-Year Flood Dam Break

Point of Interest (POI)	Distance from Shadow Run Dam at Lake Grady (ft)	Peak Velocity (ft/s)	Peak Flood Wave Discharge (cfs)	Peak Flood Depth (ft)	Peak Flood Stage (ft)	Peak Stage Arrival Time (since start of rainfall)	Remarks
POI 01 - Shadow Run Dam Inlet Works Spillway Structure (Mid Pt)	0	------	18844	23.01	42.05 (same as no dam break level)	22:35:00	(Top of Dam Low Point El 44.5ft NAVD88) Dam Breach Piping
POI 02 - Shadow Run Dam Outlet (Mid Pt of d/s toe apron)	145	14.28	18844	12.21	35.30	22:40:00	Dam Breach Piping
POI 03 - Boyette Rd Bridge across Bell Creek (Mid Pt of the Upstream face)	7352	4.87	16691	15.21	27.60	23:00:00	Westside Roadway-Low Point El. 27.83
POI 04 - Bell Creek outlet (Mouth) at Confluence with Alafia River	12987	2.62	15695	16.00	16.70 (1.76ft rise over no dam break el.)	23:30:00	Bell Creek Mouth 100-yr flood El. 14.59 ft adapted from Alafia River Watershed Management Plan, Hillsborough County, 2002

4.3 ½ PMP Dam Break

The failure mode for the ½ PMP event Dam Break is "piping." As described in Section 4.1, the piping dam break failure mode involves internal erosion and seepage flow through or underneath the

embankment. As the material progressively erodes, a larger hole forms and becomes large enough such that the weight of the material above the hole is too great to be maintained and a mass caving of material occurs. This results in a large rise in the outflow through the breach, which in turn accelerates the breaching process and cuts down the embankment and widens the breach until the natural channel bed is reached. The hydraulic features of the simulated dam break are summarized in Table 7. The dam break flood inundation extent, maximum water surface elevations and maximum water depths are shown on Figures 15,16 and 17, respectively. The resulting inundation flooding extent is also shown in Figure 25 Index Map sheet and Map Panels -A1 through -A6 illustrating flooded parcels near homes and depth of flooding above ground at the structures.

Bell Creek downstream flooding impacts include twenty (20) homes in the vicinity of Bell Creek near the confluence with Alafia River. Forty- four (44) homes on the upstream left bank side of Boyette Road bridge; and two (2) homes on downstream left bank just north of Boyette Road. Nineteen (19) homes on Waterford Run Drive downstream of Boyette Road on the right bank of Bell Creek are impacted ; one (1) home on the right bank downstream of Shadow Run Dam near Deepbrook Drive will be impacted, as well as one (1) home just downstream of Shadow Run Dam on the left bank of Bell Creek. The number of downstream parcels impacted is two hundred and twelve (212) and the number of downstream homes impacted is eighty-seven (87) .

Table 7. Hydraulic Features of Shadow Run Dam system 1/2 PMP Flood Dam Break

Point of Interest (POI)	Distance from Shadow Run Dam at Lake Grady (ft)	Peak Velocity (ft/s)	Peak Flood Wave Discharge (cfs)	Peak Flood Depth (ft)	Peak Flood Stage (ft)	Peak Stage Arrival Time (since start of rainfall)	Remarks
POI 01 - Shadow Run Dam Inlet Works Spillway Structure (Mid Pt)	0	--------	30332	25.58	44.50 (rise 0.1ft)	19:25:00	Peak stage at Brim of dam. Low Point El.44.5. Dam Break Piping
POI 02 - Shadow Run Dam Outlet (Mid Pt of d/s toe apron)	145	13.30	30332	14.20	38.34	19:30:00	Dam Break Piping. The peak flood stage is the downstream side embankment toe creek pool level.
POI 03 - Boyette Rd Bridge across Bell Creek (Mid Pt of the Upstream face)	7352	5.01	30435	18.56	30.50	19:40:00	Westside Roadway - Low Point El. 27.83
POI 04 - Bell Creek outlet (Mouth) at Confluence with Alafia River	12987	3.70	28738	17.84	18.54 (2.04ft rise over no dam break el.)	20:00:00	Modeled water surface level at Bell Creek mouth.

Upstream impacts include twelve (12) homes along the Lake Grady northeast shoreline adjacent to Shadow Run Blvd; three (3) homes adjacent to the Bell Creek right bank flood pool in the vicinity of Raulerson Road; and two (2) homes on the Pelleham Branch southwest shoreline along Lake Hills Drive. The number of upstream parcels impacted is one hundred and eight (108).

4.4 PMP Dam Break

The failure mode for the PMP storm event Dam Break is "overtopping." The overtopping failure mode involves a head cut erosion process which begins at the downstream side of the dam embankment and progresses by eroding towards the center of the dam and widening over time. When the head cut reaches the upstream side of the dam crest, a mass failure of the upstream crest will occur. The hydraulic features of the simulated dam break are summarized in Table 8 below.

The dam break flood inundation extent, maximum water surface elevations and maximum water depths are shown on Figures 19, 20 and 21, respectively. The resulting inundation flooding extent is also shown in Figure 26 Index Map sheet and Map Panels -A1 through -A6 illustrating flooded parcels near homes and depth of flooding above ground at the structures.

Table 8. Hydraulic Features of Shadow Run Dam system PMP Flood Dam Break

Point of Interest (POI)	Distance from Shadow Run Dam at Lake Grady (ft)	Peak Velocity (ft/s)	Peak Flood Wave Discharge (cfs)	Peak Flood Depth (ft)	Peak Flood Stage (ft)	Peak Stage Arrival Time (since start of rainfall)	Remarks
POI 01 - Shadow Run Dam Inlet Works Spillway Structure (Mid Pt)	0	-------	37000	25.68	44.63 (0.56ft lower than no dam break el.45.19)	16:25:00	Top of Dam Low Point El.44.50. 0.69 ft Overtopping of dam. Dam Breach (Overtopping)
POI 02 - Shadow Run Dam Outlet (Mid Pt of d/s toe apron)	145	12.30	37000	16.75	40.02	16:30:00	The peak flood stage is the downstream side embankment creek pool level.
POI 03 - Boyette Rd Bridge across Bell Creek (Mid Pt of the Upstream face)	7352	5.56	35862	19.59	31.70	17:00.00	Westside Roadway- Low Point El. 27.83
POI 04 - Bell Creek outlet (Mouth) at Confluence with Alafia River	12987	4.07	35722	18.71	19.40	17:20:00	Modeled water surface level at Bell creek mouth.

Bell Creek downstream flooding impacts include twenty-two (22) homes in the vicinity of Bell Creek Mouth at the confluence with Alafia River; twenty(20) homes on the downstream right bank side of Boyette Road Bridge near Waterford Run Drive; two (2) homes on the left bank side just north of Boyette Road; forty-seven (47) homes on the upstream side of Boyette Road on the left bank of Bell Creek; one (1) home on the right bank downstream of Shadow Run Dam near Deepbrook Drive will be impacted, as well as one (1) home just downstream of Shadow Run Dam on the left bank of Bell Creek. The number of downstream parcels impacted is two hundred and thirty (230), and the number of downstream homes impacted is ninety-three (93).

Upstream impacts include fourteen (14) homes along the Lake Grady northeast shoreline adjacent to Shadow Run Blvd; three (3) homes adjacent to the Bell Creek right bank flood pool in the vicinity of Raulerson Road; and three (3) homes on the Pelleham Branch southwest shoreline along Lake Hills Drive. The number of upstream parcels impacted is one hundred and nine (109), and the number of upstream homes impacted is twenty (20).

4.5 Comparison between Dam Break and No Dam Break Flooding Inundation

Based on the results of the simulation scenarios assessed, the Shadow Run Dam Break resulting downstream impacts are compared to the No Dam Break impacts using Maximum Water Elevations at the selected Points of Interest (POI) 1,2,3 and 4. This comparison will reveal if **dam break** conditions for the respective extreme events result in increases in flooding stages over the **no dam break** condition. The comparative extreme events include the 100-year, ½ PMP,PMP and Sunny Day, for conditions with and without dam failure, along the reach of Bell Creek between Shadow Run Dam and the mouth of Bell Creek at the confluence with Alafia River.

- the Flood Inundation Maximum Water Elevations for 100-year Dam Break versus 100-year No Dam Break, see Table 9 below, and refer to Figure14 for flood extent comparison
- the Flood Inundation Maximum Water Elevations for ½ PMP Dam Break versus ½ PMP No Dam Break, see Table 9 below, and refer to Figure 18 for flood extent comparison
- the Flood Inundation Maximum Water Elevations for PMP Dam Break versus PMP No Dam Break, see Table 9 below, and refer to Figure 22 for flood extent comparison
- the Flood Inundation Maximum Water Elevations for Sunny Day Dam Break versus Dry Weather Conditions, see Table 9 below, and refer to Figures 23 -A1 through -A4 Appendix A for flooding extent

Table 9. Shadow Run Dam-Dam Break vs No Dam Break Max. Elevations for Flooding Scenarios

Point of Interest (POI)	100-yr Dam Break El	100-yr No Dam Break El	100-yr Flood Increase (ft)	½ PMP Dam Break El	½ PMP No Dam Break El	½ PMP Flood Increase (ft)	PMP Dam Break El	PMP No Dam Break El	PMP Flood Increase (ft)	Sunny Day Dam Break El	Sunny Day Dry Weather El	Sunny Day Flooding Increase (ft)
POI 1	42.05	42.10	- 0.05	44.5	44.4	- 0.10	44.6	45.2	- 0.60	35.10	35.10	0.00
POI 2	35.30	29.90	+5.40	38.34	34.3	+ 4.04	40.02	37.7	+ 2.32	32.30	24.80	+ 7.50
POI 3	27.60	21.80	+5.80	30.50	26.9	+ 3.60	31.70	30.2	+ 1.50	21.00	12.40	+ 8.60
POI 4	16.70	14.94	+1.76	18.54	16.5	+ 2.04	19.40	18.6	+ 0.80	11.30	3.11	+ 8.19

Notes:
POI 1. Upstream Embankment Face at Shadow Run Dam.
POI 2. Shadow Run Dam Downstream Embankment Toe.
POI 3. Bell Creek at Upstream Side Boyette Road Bridge.

POI 4. Bell Creek Mouth at confluence with Alafia River.

FEMA P-946, *Federal Guidelines for Mapping of Flood Risks Associated with Dam Incidents and Failures, dated July 2013,* identify ***acceptable consequences of failure to be when the incremental effects (depth) of failure on downstream structures are approximately 2 feet or less.*** *Additionally, according to* FEMA 94 *Federal Guidelines For Dam Safety : Selecting and Accommodating Inflow Design Floods for Dams, dated 2004,* the Inflow Design Flood (IDF) at a dam facility is defined as "the flood flow above which the incremental increase in water surface elevation downstream due to failure of a dam is no longer considered to present an unacceptable additional downstream threat". Based on the above Table 9 dam break versus no dam break comparisons the appropriate IDF for Shadow Run Dam should be the ½ PMP flood event, because the ½ PMP as the IDF would meet the criteria where the larger event flows such as the PMP would result in incremental increases, equal to or less than 2 feet (rounding to the nearest whole number), due to dam failure, in downstream elevations at the relevant flooding impact POI locations which are considered as acceptable consequences. Also, the peak ½ PMP flood flow can pass safely though the dam outlet works without overtopping the dam.

The current hazard classification for Shadow Run Dam is Significant Hazard Potential, based on its general rural setting. The concern is whether the dam hazard classification should remain the same based on its general rural setting in conjunction with the ½ PMP being the appropriate IDF, or should the hazard potential rating be increased to the High Hazard Potential Classification, because the project watershed area is experiencing increased residential and commercial development, where the failure or mis-operation of the facility may probably cause loss of human life and major economic and lifeline losses.

For the extreme flooding events evaluated, the inundation boundaries were established for the 2.5-mile downstream reach of Bell Creek and the resulting incremental increased flooding impacts on residential homes and the local roadways due to dam failure were analyzed at the selected POIs locations. The comparative flooding elevations at the POIs are listed on Table 9. For each flooding event considered, a notable increase in flood elevations occur near the downstream dam embankment toe, where the flood wave initial response to the dam failure is the largest. At this location there are no flooding impacts to residences or local roadways. As the flood wave travels downstream, it is attenuated by the available flood plain storage until it arrives at the Boyette Road crossing of Bell Creek, which acts as an obstruction to flood flows during extreme events, and there is a resulting increase water surface elevation.

The 100-year dam break water surface comparison to the no dam break condition revealed:

- at POI 2, the downstream embankment toe location, the relative increase in maximum water surface is about 5.4 feet. No homes or local roads are impacted at this location along Bell Creek.
- at POI 3, the upstream side of the Bell Creek Boyette Road crossing location, the relative increase in maximum water surface is 5.80 feet. Approximately twenty-seven (27) homes are within the dam failure flood plain inundation area, none of which were within the no dam break flood plain inundation area. The flooding depth above ground surface at the homes vary from 0.1feet to 5.6 feet, with approximately fourteen(14) homes having flooding depths greater than 2 feet above ground surface. **This represents an unacceptable consequence of**

dam failure as the homes and the county roadway would be directly impacted, and human lives would be in jeopardy at this location.

- at POI 4, the Bell Creek mouth location, the relative increase in maximum water surface is about 1.8 feet. Approximately eighteen (18) homes are within the dam failure flood plain inundation area, which are the identical eighteen (18) homes situated in the no dam break flood plain inundation area. The incremental increases in flooding depth above ground surface at the homes vary from 0.1feet to 1.7feet with no homes having incremental flooding depth increases greater than 2ft above ground. This represents an acceptable consequence of dam failure.

The ½ PMP dam break water surface comparison to the no dam break condition revealed:

- at POI 2, the downstream embankment toe location, the relative increase in maximum water surface is about 4.04 feet. No homes or local roads are impacted at this location along Bell Creek.
- at POI 3, the upstream side of the Bell Creek Boyette Road crossing location, the relative increase in maximum water surface is 3.60 feet. Approximately forty-four (44) homes are within the dam failure flood plain inundation area, twenty-six (26) of which were in the no dam break flood plain inundation area. The dam failure flooding depth above ground surface at the homes vary from 0.2feet to 8.6 feet. The incremental increases in depth above ground surface at the structures resulting from dam failure versus no dam failure are greater than 2 feet for approximately twenty-five (25) of the homes impacted. **This represents an unacceptable consequence of dam failure, as the homes and the county roadway would be directly impacted, and human lives would be in jeopardy at this location.**
- at POI 4, the Bell Creek mouth location, the relative increase in maximum water surface is about 2.04 feet. Approximately twenty (20) homes are within the dam failure flood plain inundation area, eighteen (18) of which were situated in the no dam break flood plain inundation area. The dam failure flooding depths above ground surface range from 0.1feet to 9.5 feet. However, the dam failure incremental increases in flooding depth above ground surface at the structures over the no dam failure condition varies from 0.1ft to 1.9 feet , with 10 of the homes experiencing a differential increase in depths at the structures ranging from 1.6ft to 2.0ft. This represents an acceptable consequence of dam failure.

The PMP dam break water surface comparison to the no dam break condition revealed:

- at POI 2, the downstream embankment toe location, the relative increase in maximum water surface is about 2.32 feet. No homes or local roads are impacted at this location along Bell Creek.
- at POI 3, the upstream side of the Bell Creek Boyette Road crossing location, the relative increase in maximum water surface is about 1.50 feet. Approximately forty-seven (47) homes are within the dam failure flood plain inundation area, 44 of which were in the no dam break flood plain inundation area. The dam failure flooding depth above ground surface at the homes vary from 0.1feet to 9.7 feet. The incremental increases in depth above ground surface at the structures resulting from dam failure versus no dam failure are less than 2 feet for the homes impacted. This represents an acceptable consequence of dam failure.
- at POI 4, the Bell Creek mouth location, the relative increase in maximum water surface is

about 0.80 feet. Approximately (22) homes are within the dam failure flood plain inundation area, eighteen (18) of which were situated in the no dam break flood plain inundation area. The dam failure flooding depths above ground surface range from 0.1feet to 11.0 feet. However, the dam failure incremental increases in flooding depth above ground surface at the structures over the no dam failure condition varies from 0.1ft to 0.9 feet. This represents an acceptable consequence of dam failure.

The Sunny Day dam break water surface comparison to the Dry Weather Bell Creek channel elevations revealed:

- at POI 2, the downstream embankment toe location, the dam failure relative increase in maximum water surface is 7.50 feet. No homes or local roads are impacted along this part of Bell Creek. The resultant dam break flood wave is contained within the channel banks.
- at POI 3, the upstream side of the Bell Creek Boyette Road crossing location, the relative increase in maximum water surface is 8.60 feet. The resultant dam break flood wave is contained within the channel banks. No homes or local roadway are impacted along this part of Bell Creek. This represents an acceptable consequence of dam failure.
- at POI 4, the Bell Creek mouth location, the relative increase in maximum water surface is 8.19 feet. Approximately eight (8) homes are within the dam failure flood plain inundation area. The dam failure flooding depths above ground surface at the structures range from 1.5feet to 3.3feet. Three of the homes would experience flooding depths at the structures that are greater than 2 feet. **This represents an unacceptable consequence of dam failure and human lives would be in jeopardy at this location.**

In summary, based on the inundation modeling and mapping analyses, and the inundation boundaries computed for the 2.5 -mile downstream reach of Bell Creek, the resulting incremental flooding increased impacts during a Sunny Day dam failure on residential homes situated near the Bell Creek Mouth and Carr Road areas are considered as **unacceptable consequences.** Additionally, the resulting incremental impacts during the 100-year and ½ PMP events at the Boyette Road crossing and adjacent upstream areas to the south represent **unacceptable consequence of dam failure, which indicates that human lives would be in jeopardy at this location.**

If any of these unusual extreme events were to occur causing the failure or mis-operation of the facility, the resulting unacceptable consequences may probably cause loss of human life in conjunction with economic and lifeline losses. Consequently, the current Significant Hazard Potential Classification for Shadow Run Dam should be increased to High Hazard Potential Classification.

5.0 FLOODED PARCELS DURING DAM BREAK EVENTS

5.1 General

Flooded parcels resulting from the Sunny Day dam break, the 100- year dam break, ½ PMP dam break and PMP dam break events were identified and used to further confirm properties and homes adjacent to Shadow Run Dam and the downstream Bell Creek system that will be impacted and may require evacuation of residents ahead of the arrival of the extreme rainfall event. The impacted homes and parcels are shown on Inundation Maps for the various dam break scenarios considered. Refer to Appendix A Figures 23 through 26, Index Maps and Map Panels. Note that the words "homes" and "structures" are used interchangeably, and both refer to building structures.

5.2 Flooded Parcels and Homes

The parcels and homes that will be inundated during the Sunny Day dry weather, 100-year, ½ PMP and PMP rainy day events, assuming the "dam break" conditions at Shadow Run Dam, are illustrated on Figures 8, 11, 15 and 19, respectively; and map panel Figures 23, 24 ,25 and 26, respectively.

Sunny Day Dam Break

The number of parcels with homes downstream of Shadow Run Dam, which are impacted during the Sunny Day (dry weather) failure event is eight (8). The homes are in the area adjacent to the mouth of Bell Creek at the confluence with Alafia River. The flooding depth above ground surface at the structures range from 1.5ft to 3.3ft. Refer to Figure 8 and map panel Figure 23-A1.The number of parcels impacted is one hundred and four (104).

For the lake area upstream of Shadow Run Dam only one home on the northeast shoreline of Lake Grady along Shadow Run Blvd would be impacted. The flooding depth above ground at this location is 0.1ft. Refer to Figure 8 and map panel Figure 23-A4. The number of shoreline parcels impacted is fifty-two (52).

100-year Dam Break

The number of parcels with homes downstream of Shadow Run Dam, which are impacted during the 100-year rainy day failure event is fifty (50). Eighteen (18) of the homes are in the area adjacent to the mouth of Bell Creek at the confluence with Alafia River. The flooding depth above ground surface near the homes at this location range from 0.3ft to 8.3ft. Refer to Figure 11 and map panel Figure 24-A1. Twenty -seven (27) homes on the left bank of Bell Creek just upstream of Boyette Road would be impacted. The Flooding depth above ground at this location range from 0.1 ft to 5.6 ft. Refer to Figure 11 and map panel Figure 24-A1. Four (4) homes on the right bank just downstream of Boyette Road and adjacent to Waterford Run Drive are impacted , and the flooding depths above ground at the structures range from 0.4ft to 3.1 ft. One (1) home just downstream of Shadow Run Dam along the Bell Creek right bank near Deepbrook Drive is impacted, and the flooding depth above ground at the structure is 1.0 ft. The number of parcels impacted is one hundred and seventy-nine (179).

For the lake area upstream of Shadow Run Dam five (5) homes on the northeast shoreline of Lake Grady along Shadow Run Blvd would be impacted. The flooding depth above ground for the impacted homes range from 0.3ft to 5.8 ft. Refer to Figure 11 and map panel Figure 24-A4. Two (2) homes are impacted on the Pelleham Branch southwest shoreline along Lake Hils Dr. The flooding depths above ground are both 0.1ft. The number of parcels impacted is ninety-seven (97).

½ PMP Dam Break

The number of parcels with homes **downstream of Shadow Run Dam**, which are impacted during the ½ PMP rainy day failure event is eighty-seven (87). Twenty (20) of the homes are in the area adjacent to the mouth of Bell Creek at the confluence with Alafia River. Nineteen (19) homes downstream of Boyette Road on the right bank of Bell Creek, and two (2) homes on the left bank just downstream of Boyette Road are impacted. The flooding depth above ground level near the homes downstream of Boyette Road range from 0.1ft to 10.2ft. Refer to Figure 15 and map panel Figure 25-A1. On the left bank of Bell Creek just upstream of Boyette Road forty- four (44) homes are impacted, with flooding depths above ground ranging from 0.2ft to 8.6 ft. Refer to Figure 15 and map panel Figure 25-A1. One (1)home on the left bank of Bell Creek just downstream of Shadow Run Blvd along Donneymoore Drive is impacted with a flooding depth of 1.1ft above ground. Another home approximately 3,000ft downstream on the right bank of Bell Creek along Deepbrook Drive is impacted with the flooding depth above ground at 4.3 ft. Refer to Figure 15 and map panel Figure 25-A3. The number of parcels impacted is two hundred and twelve (212).

For the lake area **upstream of Shadow Run Dam** fourteen (14) homes on the northeast shoreline of Lake Grady along Shadow Run Blvd would be impacted. The flooding depth above ground for the impacted homes range from 0.1ft to 8.3 ft. Refer to Figure 15 and map panel Figure 25-A4. Two (2) homes are impacted on the Pelleham Branch southwest shoreline along Lake Hils Dr. The flooding depths above ground are 2.3ft and 2.6ft. Another three (3) homes situated near the end Raulerson Rd are impacted with flooding depths of 0.9ft to 1.5ft above ground. Refer to map panel Figure 25-A6. The number of parcels impacted is one hundred and eight (108).

PMP Dam Break

The number of parcels with homes downstream of Shadow Run Dam, which are impacted during the PMP rainy day failure event is ninety-three (93). Twenty-two (20) of the homes are in the area near the mouth of Bell Creek at the confluence with Alafia River; and twenty (20) homes downstream of Boyette Road on the right bank of Bell Creek, which includes five homes on the right bank of Alafia River. Two homes on the left bank of Bell Creek just downstream of Boyette Road are impacted, with flooding depths above ground at 1.4ft and 1.7ft The flooding depth above ground level near the homes downstream along Bell Creek between Boyette Road and its mouth range from 0.1ft to 11.0ft. Refer to Figure 19 and map panel Figure 26-A1. On the left bank of Bell Creek upstream of Boyette Road and along Sedgebrook Drive forty-seven (47) homes are impacted, with flooding depths above ground ranging from 0.1ft to 9.7 ft. Refer to Figure 19 and map panel Figures 26-A2,and 26-A3. One (1) home on the left bank of Bell Creek just downstream of Shadow Run Blvd along Donneymoore Drive is impacted with a flooding depth of 2.5ft above

ground. Another home approximately 3,000ft downstream on the right bank of Bell Creek along Deepbrook Drive is impacted with the flooding depth above ground at 5.7 ft. Refer to Figure 19 and map panel Figure 26-A3. The number of parcels impacted is two hundred and thirty (230).

For the lake area upstream of Shadow Run Dam fourteen (14) homes on the northeast shoreline of Lake Grady along Shadow Run Blvd would be impacted. The flooding depth above ground for the impacted homes range from 0.2ft to 8.2 ft. Refer to Figure 19 and map panel Figure 26-A4. Three (2) homes are impacted on the Pelleham Branch southwest shoreline along Lake Hills Dr. The flooding depths above ground are 0.1ft, 2.7ft and 2.4ft. Another three (3) homes situated near the end Raulerson Rd are impacted with flooding depths of 1.0ft to 1.6ft above ground. Refer to map panel Figure 25-A6. The number of parcels impacted is one hundred and nine (109).

The Table below summarizes the number of Impacted Homes and Inundated Parcels for the simulated Dam Break flooding events for areas along Bell Creek at locations upstream and downstream of Shadow Run Dam.

Downstream of Shadow Run Dam	Drawing No.	Dam Break Inundation Event	No of Impacted Homes	No. of Impacted Parcels	Comments
√	Figure 8	Sunny Day	8	104	See Figure 23 A1to A-3
√	Figure 11	100yr	50	179	See Figure 24 A1to A-43
√	Figure 15	½ PMP	87	212	See Figure 25 A1 to A-3
√	Figure 19	PMP	93	230	See Figure 26 A1 to A-3
Upstream of Shadow Run Dam	Drawing No.	Inundation Event	No. of Impacted Homes	No. of Impacted Parcels	Comments
√	Figure 8	Sunny Day	1	52	See Figure 23 A3 to A-6
√	Figure 11	100yr	7	97	See Figure 24 A3 to A-6
√	Figure 15	½ PMP	17	108	See Figure 25 A3 to A-6
√	Figure 19	PMP	20	109	See Figure 26 A3 to A-6

6.0 SUMMARY OF FINDINGS

Based on the hydrologic and hydraulic investigations performed for developing the Inundation Modeling and Mapping associated with extreme storm events for the Shadow Run Dam, owned and operated by Shadow Run Corp, Inc., the following findings are presented.

- Considering the four selected dam break flooding events simulated for flood inundation impacts at four (4) selected points of interest (POI) along Bell Creek at Shadow Run Dam and downstream to its mouth at Alafia River, all locations were identified as having potential flooding consequences. The four dam break events simulated are:
    - Sunny Day – Dam Break
    - 100-year – Dam Break
    - ½ PMP – Dam Break
    - PMP – Dam Break

- **Sunny Day Dam Break -**

  The Sunny Dam Break condition will result in a peak flood wave of 9,473 cfs at the Shadow Run Dam, dam and it occurs 15 minutes after the start of failure. The entire Lake Grady volume at the Shadow Run Dam will discharge into the Bell Creek floodplain downstream. The peak flood outflow wave will be attenuated within the downstream floodplain resulting in a peak discharge of 3,902 cfs at Boyette Road crossing at approximately 1 hour 30 minutes after the start of failure. The peak flood wave discharge will be further attenuated downstream within the flood plain and arrive at the Mouth of Bell Creek 2 hours and 50 minutes after the start of failure. The peak flood wave discharge of 2,826 cfs will arrive at the mouth of Bell Creek, and the peak flood stage will be at an elevation of 11.3 ft NAVD88. This represents a rise of approximately 8.2ft over the normal dry weather Bell Creek water surface elevation of 3.11 ft NAVD88 at its confluence with Alafia River. This peak water surface elevation of 11.3 ft NAVD 88 is equivalent to the 25-year flood peak water surface elevation for Bell Creek at the confluence with the Alafia River.

  Eight (8) parcels with homes in the vicinity of the Bell Creek confluence with the Alafia River will be affected if a failure of the dam were to occur during dry weather. The flooding depths above the ground surface at the homes, which are in the Carr Road area, would range from 1.5ft to 3.3ft. **The consequence of this type of dam failure at the mouth of Bell Creek is considered unacceptable since human lives would be in jeopardy.**

- **100-year Dam Break –**

  Shadow Run Dam at Lake Grady will not be overtopped during the 100-year storm event. The failure mode during this storm event is "piping." The resulting peak flood wave outflow is approximately 18,844 cfs with a corresponding peak flood stage of 42.05 ft NAVD 88. The peak stage corresponds to a lake pool rise of 7 ft over normal pool level at 35.1ft NAVD 88. This flood stage at Lake Grady is approximately 2.45ft below the top of the dam's average low point. The dam failure is anticipated to occur over a period of 1 hour

and 31minutes. The 100- year storm dam breach flood wave will discharge to the Bell Creek and flow towards Boyette Road bridge and then on to the mouth at the confluence with Alafia River. At Boyette Road, the peak discharge is calculated at 16,691 cfs with a corresponding peak stage at elevation 27.60 NAVD 88. As stated in Section 4.5 herein, approximately twenty-seven (27) homes, none of which would be inundated by the 100-year flood under no dam break conditions, would now be in the 100-year flood plain resulting from dam failure. **Fourteen of the homes would have flooding depths greater than 2ft at the structures, which is an unacceptable consequence, and human lives would be in jeopardy.** The peak flow of 15,695 cfs, and the corresponding peak stage at elevation 16.70 ft NAVD 88, will arrive at the Alafia River confluence approximately 2 hours and 26 minutes after the start of the dam failure.

- **½ PMP Dam Break**

  Shadow Run Dam at Lake Grady will not be overtopped during the ½ PMP storm event. The failure mode during this storm event is "piping." The peak flood stage is at Elevation 44.5 ft NAVD88, which is at the top of the dam embankment low point and approximately 9.4 feet above normal pool level, indicating a full reservoir condition. The resulting peak flood wave outflow is approximately 30,332 cfs with a corresponding peak outflow flood stage of 38.34 ft NAVD88 at the toe of the dam embankment. The dam failure is anticipated to occur over a period of 1 hour and 31 minutes. The ½ PMP storm dam breach flood wave will discharge to the Bell Creek and flow towards Boyette Road bridge and then on to the mouth at the confluence with Alafia River. At Boyette Road, the peak discharge is calculated at 30,435 cfs with a corresponding peak stage at elevation 30.50ft NAVD88.

  As stated in Section 4.5 herein, approximately forty-four (44) homes are within the dam failure flood plain area, which is an increase of twenty-eight (28) more homes over the no dam break condition. Twenty-five of these homes will have greater than 2 feet incremental increases in flooding depth above ground at the structures due to dam failure. **This represents an unacceptable consequence as human lives would be in jeopardy.**

  The peak flow of 28,738 cfs, and the corresponding peak stage at elevation 18.5 ft NAVD88, will arrive at Bell Creek mouth at the confluence with Alafia River approximately 2 hours and 6 minutes after the start of the dam failure. At this location, two additional homes would be impacted by dam failure during this storm event. The resulting incremental increases in flooding depth at the structures due to dam failure at the Bell Creek mouth location is equal to or less than 2 feet, which is considered an acceptable consequence outcome.

- **PMP Dam Break**

  Shadow Run Dam will be overtopped during the PMP storm event. The sustained overtopping flow for a duration of 4½ hours will likely result in the failure of the dam. The resulting peak flood wave outflow is approximately 37,000 cfs with a corresponding peak flood stage of 44.63ft NAVD88 at the upstream side of the embankment and a peak stage

of 40.02ft NAVD88 at the embankment downstream toe. The dam failure is anticipated to occur approximately 16 hours and 30 minutes after the start of the storm. The resulting overtopping flood wave exiting Lake Grady will arrive at the Boyette Road crossing approximately 2 hours and thirty-three minutes after the start of the dam failure.

The peak stage at Boyette Road will be at approximately 31.70 ft NAVD 88, with a peak flood flow of approximately 35,862 cfs. As explained in Section 4.5 approximately forty-seven (47)homes are inundated, due to dam failure, which is 3 more homes than the no dam break condition at this location. The incremental increases in depth above the ground surface at the structures resulting from dam failure versus no dam failure are less than 2 feet, which is considered an acceptable consequence outcome for the homes impacted.

The peak flow of 35,722 cfs, and the corresponding peak stage at elevation 19.4 ft NAVD 88, will arrive at Bell Creek mouth at the confluence with Alafia River approximately 2 hours and 53 minutes after the start of the dam failure. As per Section 4.5 approximately four(4) more homes are impacted at this location due to dam failure.

Utilizing guidance outlined in the Federal Emergency Management Agency(FEMA) Publication FEMA P-946 " Federal Guidelines for Inundation Mapping of Flood Risks Associated with Dam Incidents and Failures," dated July 2013, which identify ***acceptable consequences of failure to be when the incremental effects (depth) of failure on downstream structures are approximately 2 feet or less;*** in conjunction with the comparative analysis of the Dam Break condition versus the No Dam Break condition for Shadow Run Dam, for the extreme events considered, the technical findings revealed that the consequential Points of Interest locations are:

- **at Boyette Road crossing of Bell Creek** - the incrementally increased flooding depths at the structures are greater than 2 feet during a dam failure resulting from the 100-year, and ½ PMP flood events. **The consequences of dam failure at this location are unacceptable as the adjacent homes and county roadway would be directly impacted and human lives would be in jeopardy in addition to economic and lifeline losses.**

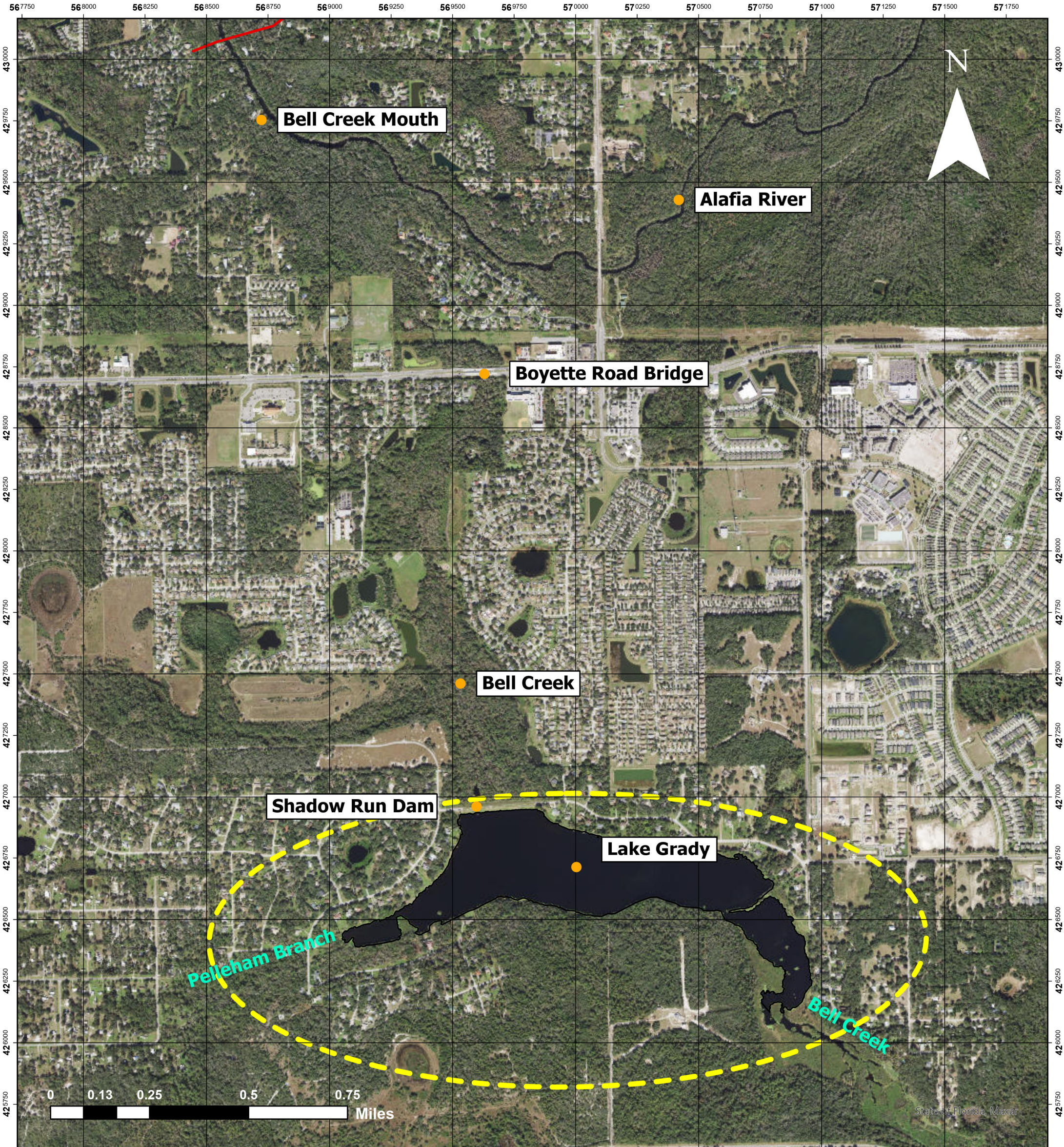
- **at Bell Creek mouth** - the incrementally increased flooding depths at the structures are greater than 2 feet during a dam failure resulting from the Sunny Day dry weather event. **The consequences of a fair-weather dam failure at this location are unacceptable as the adjacent homes would be directly impacted and human lives would be in jeopardy in addition to economic and lifeline losses.** It is noted that the increased flooding depths due to dam failure, versus no dam failure, during the 100-yr, ½ PMP and PMP events are considered acceptable consequences.

Based on the findings of our dam evaluation for the extreme events, and the consequences of dam failure on downstream locations as outlined above, if any of these unusual extreme events were to occur resulting in the failure or mis operation of the facility, **the events with unacceptable consequences at the Boyette Road crossing of Bell Creek and at Bell Creek mouth may probably cause loss of human life in conjunction with economic and lifeline losses.**

Therefore, the current Significant Hazard Potential rating for Shadow Run Dam at Lake Grady, should be increased to High Hazard Potential Classification.

7.0 APPENDIX A – FIGURES

Figure 1 to Figure 26



Project

Inundation Modeling and Mapping for Shadow Run Dam

Project Location- Shadow Run Dam at Lake Grady, Riverview, Hillsborough County, FL

Date	**Drawn**	**Scale**
06.14.22	TC/MC	1:15,000

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 1

Legend

- Study limit
- Received shoreline
- Lake Grady location

Notes

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Division of Water Resource Management

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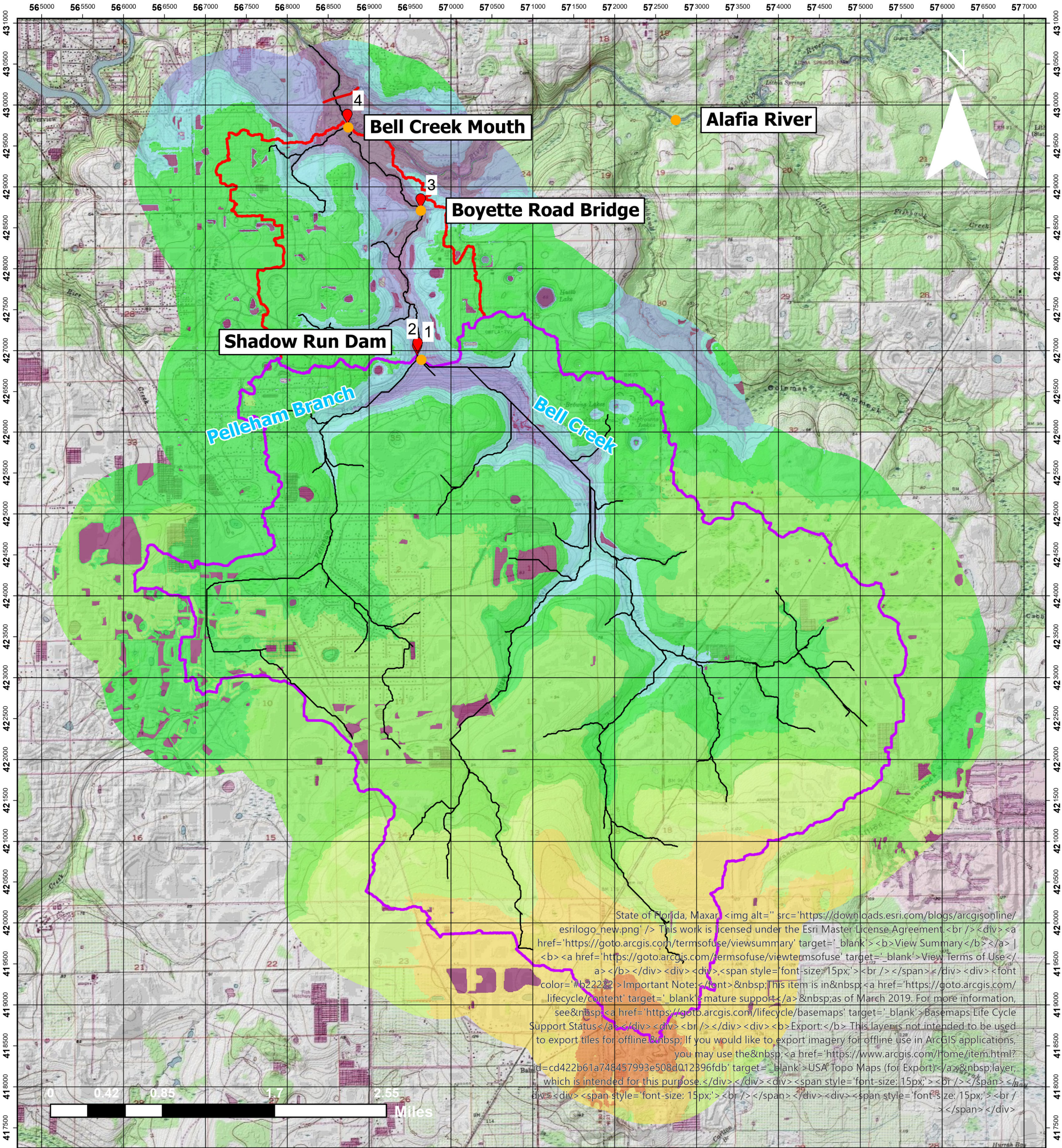

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 View Summary | View Terms of Use
 Important Note: This item is in mature support as of March 2019. For more information, see Basemaps Life Cycle Support Status
 Export: This layer is not intended to be used to export tiles for offline. If you would like to export imagery for offline use in ArcGIS applications, you may use the USA Topo Maps (for Export) layer, which is intended for this purpose.

Project

Inundation Modeling and Mapping for Shadow Run Dam

Shadow Run Dam at Lake Grady – Drainage Catchment Areas

Date	Drawn	Scale
06.14.22	TC/MC	1:45,000

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 2

Legend

- Flood modeling points of interest
- Study limit
- Modeled flow routing (0.090 sq miles contributing area threshold)

Lake Grady watershed area at Carrow Road (19.95 sq miles)

- Bell Creek D/S Subarea (2.52 sq miles)
- Lake Grady Subarea (17.43 sq miles)

Lake Grady watershed (feet)

- -0.999 - 0
- 0.1 to 20.0
- 20.1 to 40.0
- 40.1 to 60.0
- 60.1 to 80.0
- 80.1 to 100.0
- 100.1 to 120.0
- 120.1 to 140.0
- 140.1 to 160.0
- 160.1 to 165.0

Notes

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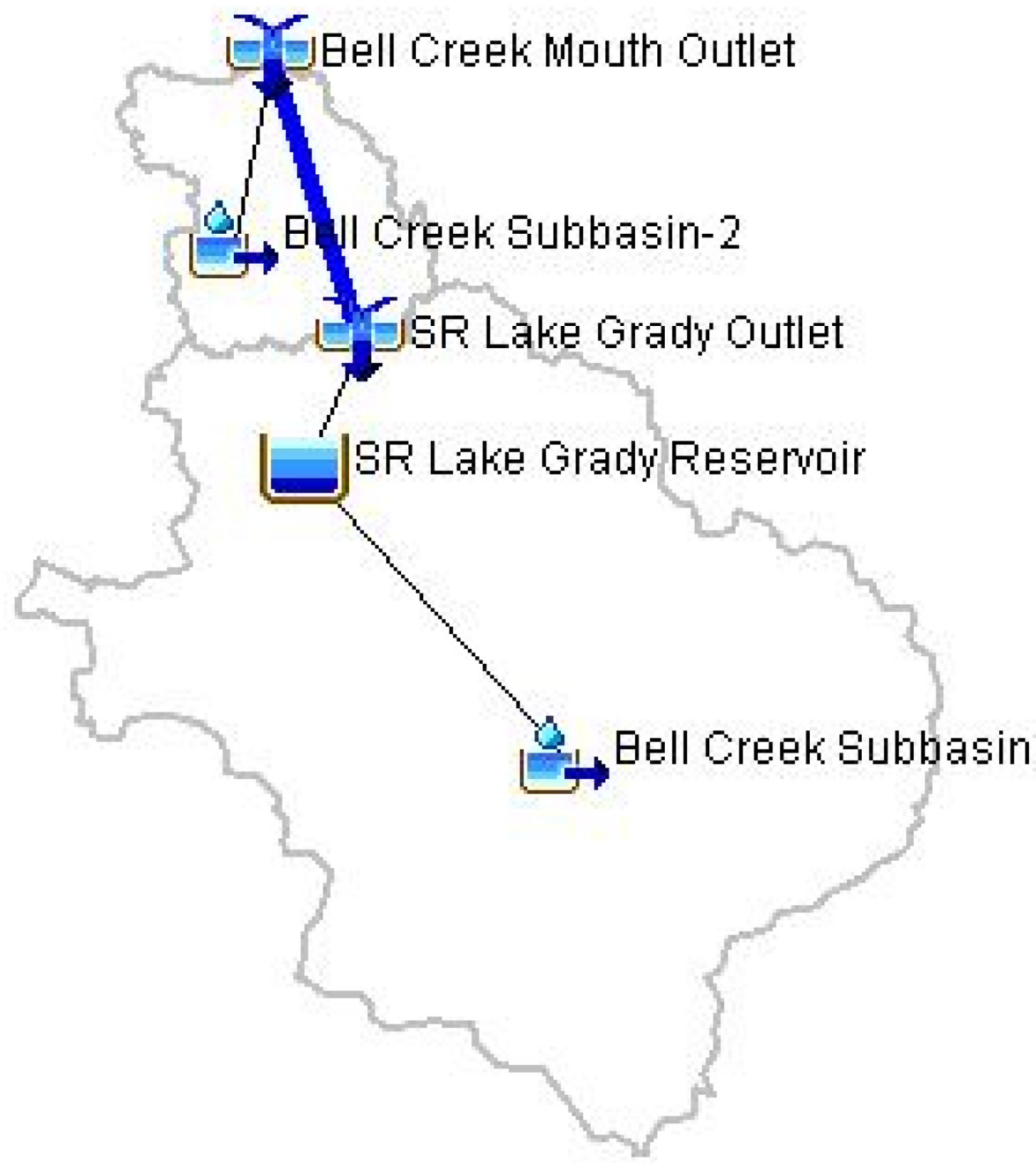

Project

Inundation Modeling and Mapping for Shadow Run Dam

Shadow Run Dam at Lake Grady – HEC-HMS Model Network Schematic

Date	**Drawn**	**Scale**
06.15.22	TC/MC	N/A

Legend

Spatial Reference
N/A

Drawing Ref:
Figure 3

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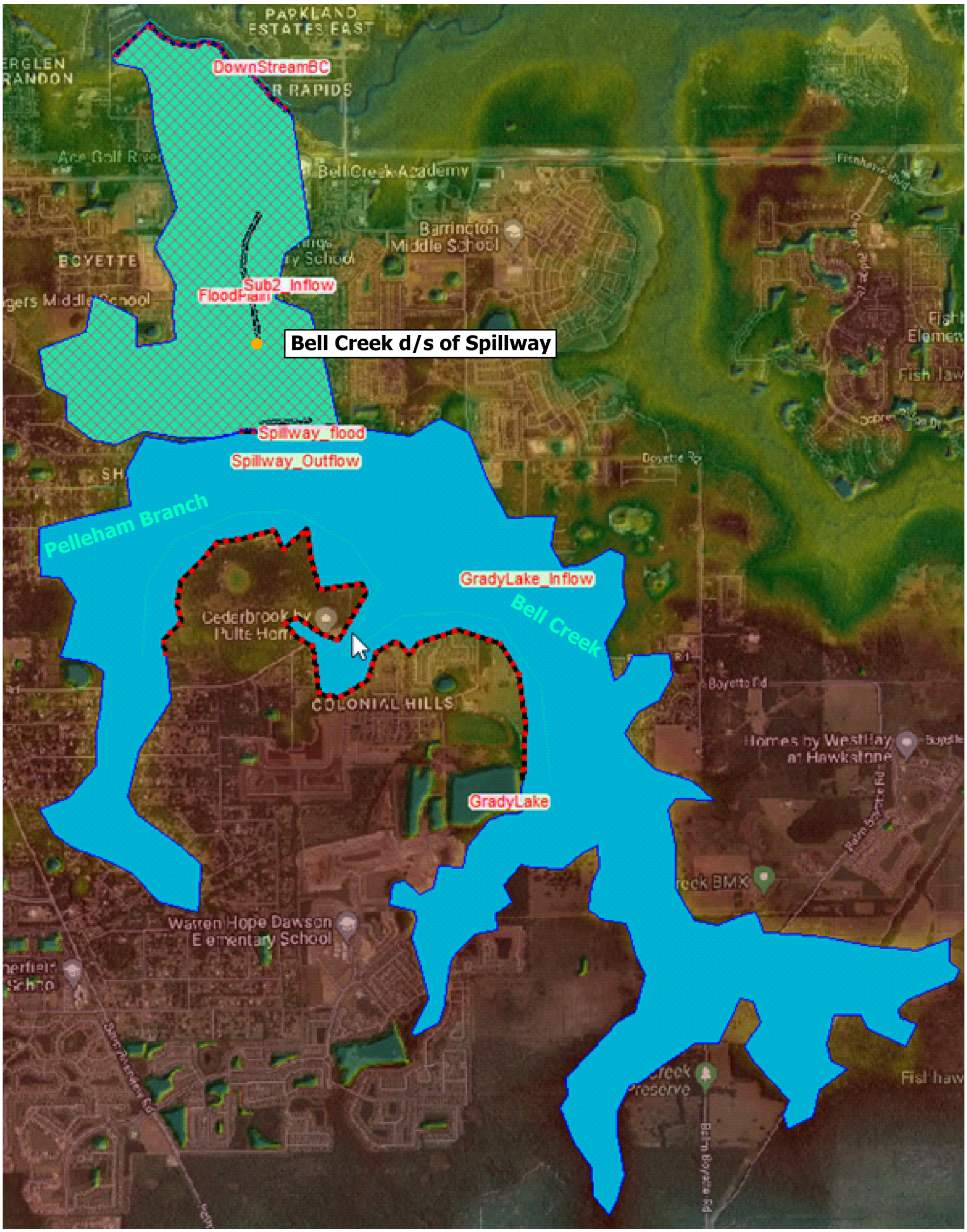
Notes

1) Model Schematic Drawing - not to scale



Project

Inundation Modeling and Mapping for Shadow Run Dam

Shadow Run Dam at Lake Grady – Schematic of HEC-RAS model set up

Date	Drawn	Scale
06.14.22	TC/MC	N/A

Legend

- Model boundary condition divide
- Simulation domain - Bell Creek Floodplain
- Typical simulation domain - Shadow Run Dam Floodplain

Spatial Reference
N/A

Drawing Ref:
Figure 4

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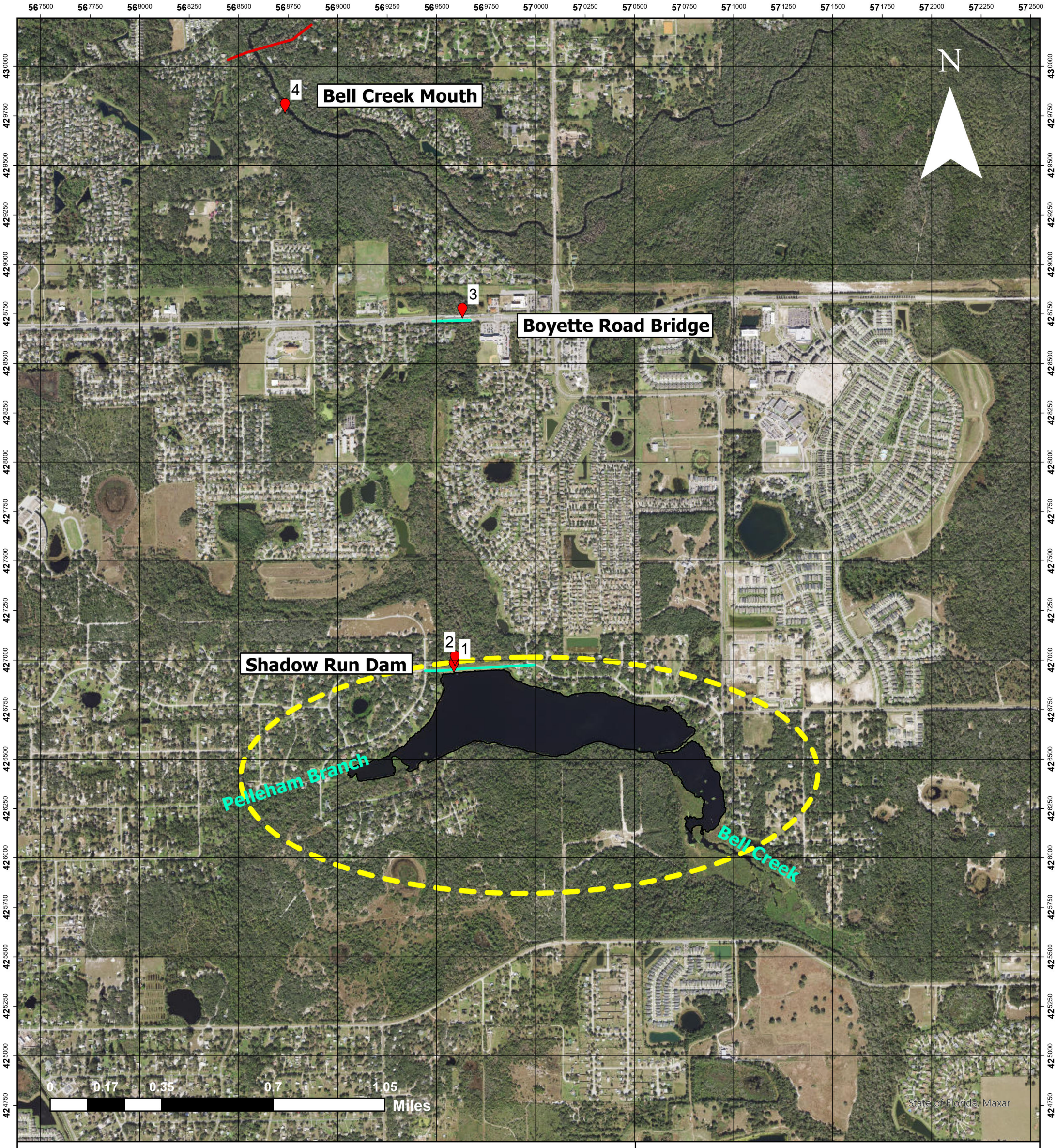
Notes

1) Model Schematic Drawing - not to scale



Project

Inundation Modeling and Mapping for Shadow Run Dam

Shadow Run Dam Location, Points of Interest and Cross Sections

Date	Drawn	Scale
06.14.22	TC/MC	1:18,500

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 5

Legend

- Flood modeling points of interest
- Study limit
- Cross section lines
- Lake Grady location
- Received shoreline

Notes

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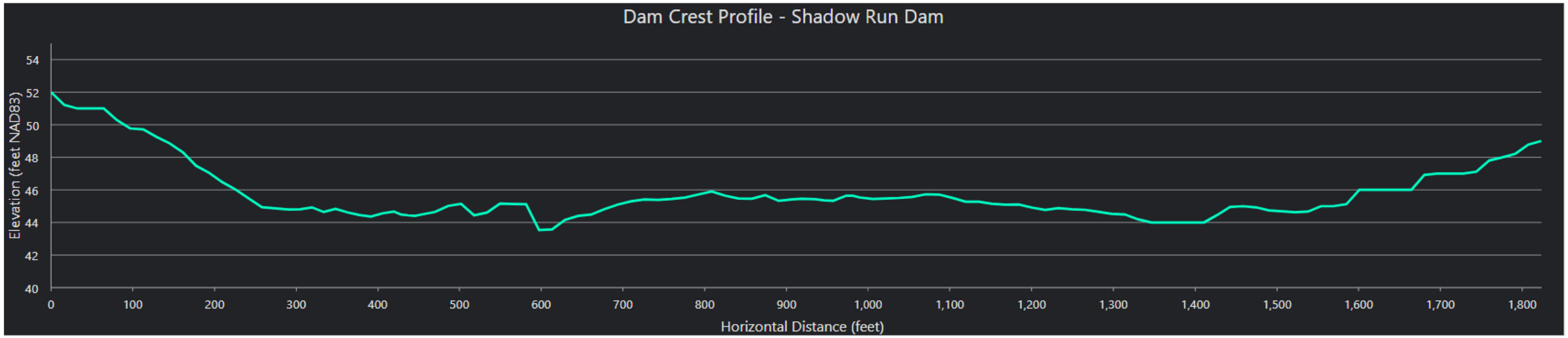

Project

Dam Break Inundation Mapping – Shadow Run Dam

Date	Drawn	Scale
06.15.22	TC/MC	N/A

Shadow Run Dam Representative Photos and Top of Dam Cross section

Shadow Run Dam, Riverview, Hillsborough County, FL

Spatial Reference

N/A

Drawing Ref:

Figure 6

Legend

Notes

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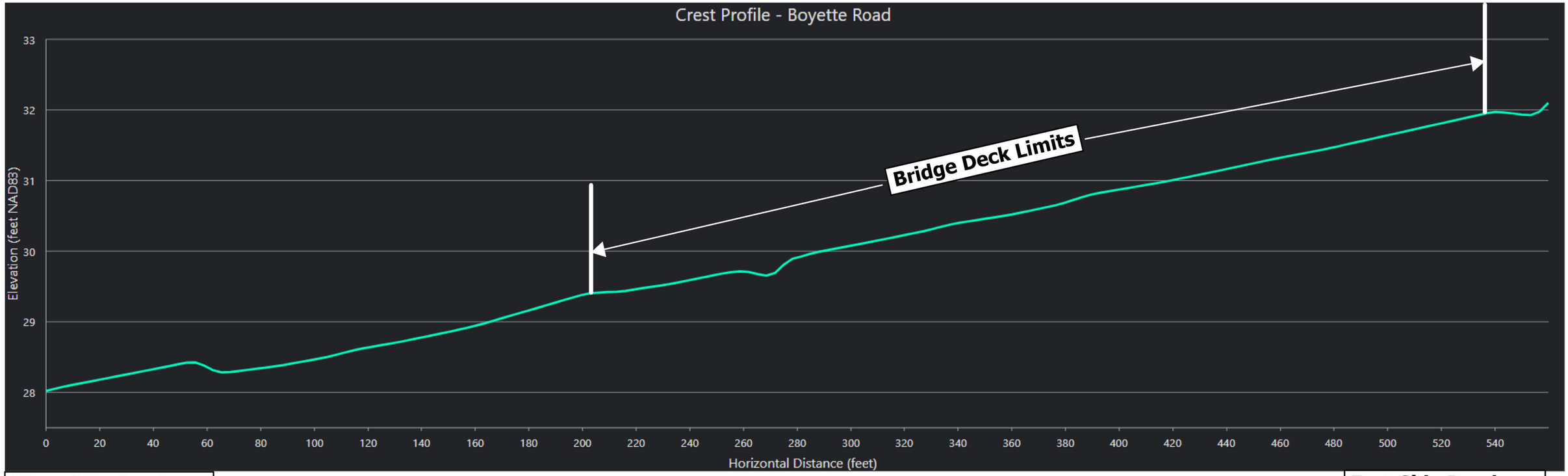
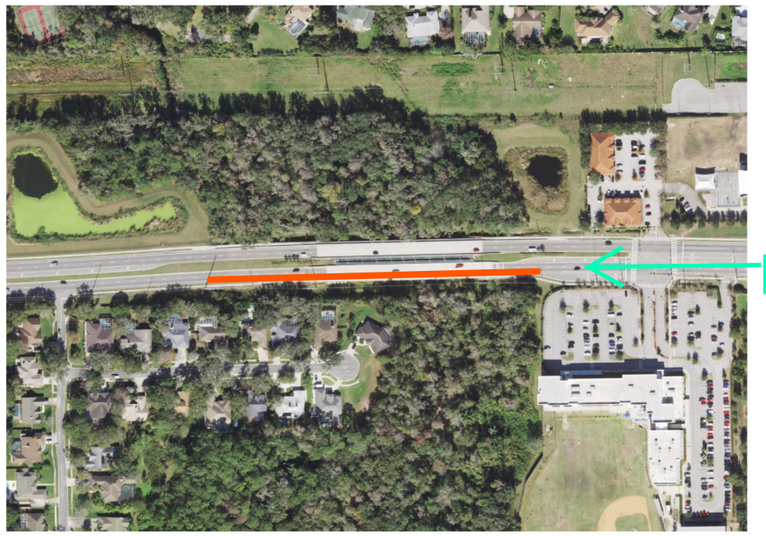


West Side Roadway

East Side Roadway



Project

Dam Break Inundation Mapping – Shadow Run Dam

Date	Drawn	Scale
06.15.22	TC/MC	N/A

Boyette Road Representative Photos and Cross section

Shadow Run Dam, Riverview, Hillsborough County, FL

Spatial Reference

N/A

Drawing Ref:

Figure 7

Legend

Notes

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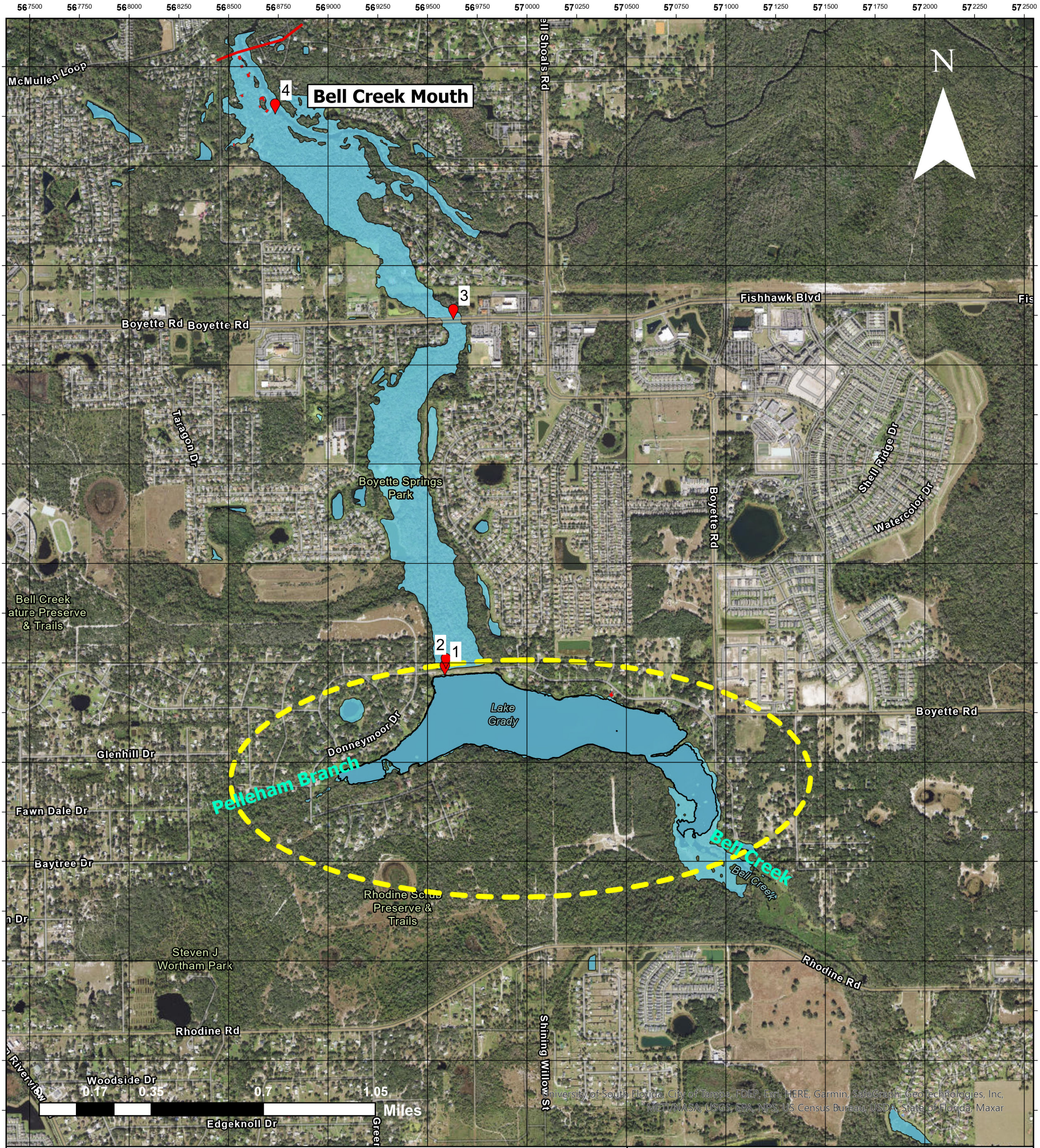

Project

Inundation Modeling and Mapping for Shadow Run Dam

Sunny Day Dam Break Flood Inundation Extent

Date	Drawn	Scale
08.11.22	TC/MC	1:18,500

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 8

Legend

- Flood modeling points of interest
- Study limit
- Lake Grady location
- Received shoreline
- Inundated structures
- Shadow Run Dam Sunny Day event (dam break)

Notes

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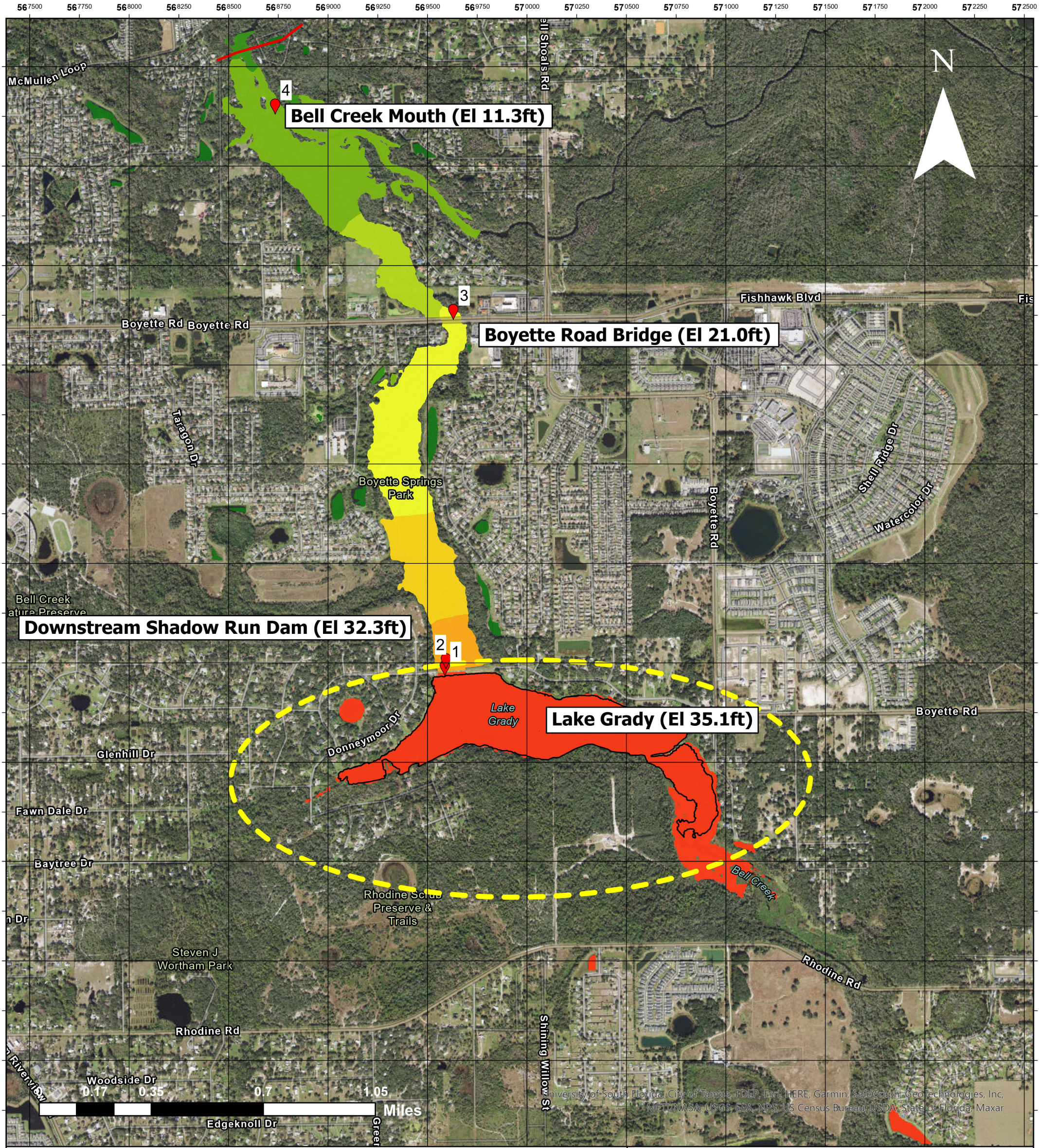

Project

Inundation Modeling and Mapping for Shadow Run Dam

Sunny Day Dam Break Flood Inundation Maximum Water Elevations

Date	Drawn	Scale
08.11.22	TC/MC	1:18,500

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 9

Legend

- Flood modeling points of interest
- Study limit
- Lake Grady location
- Received shoreline

Shadow Run Dam Sunny Day event (dam break - feet)

- 4.9 to 5.0
- 5.1 to 10.0
- 10.1 to 15.0
- 15.1 to 20.0
- 20.1 to 25.0
- 25.1 to 30.0
- 30.1 to 35.0
- 35.1 to 35.1

Notes

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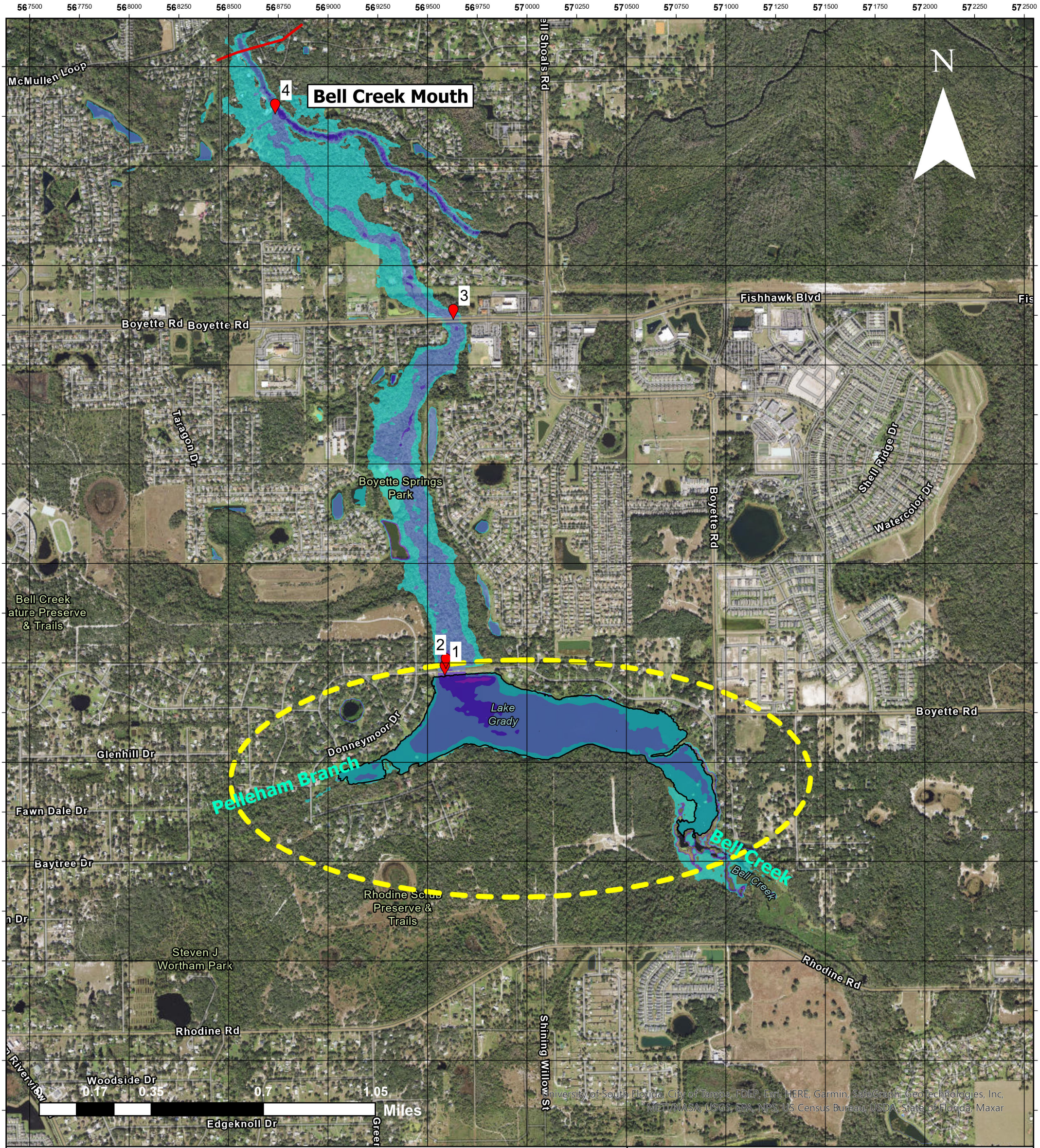

Project

Inundation Modeling and Mapping for Shadow Run Dam

Sunny Day Dam Break Flood Inundation Depths

Date	Drawn	Scale
08.11.22	TC/MC	1:18,500

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 10

Legend

- Flood modeling points of interest
- Study limit
- Lake Grady location
- Received shoreline

Shadow Run Dam Sunny Day event (dam break - feet)

- 0.0 to 5.0
- 5.1 to 10.0
- 10.1 to 15.0
- 15.1 to 18.3
- NoData

Notes

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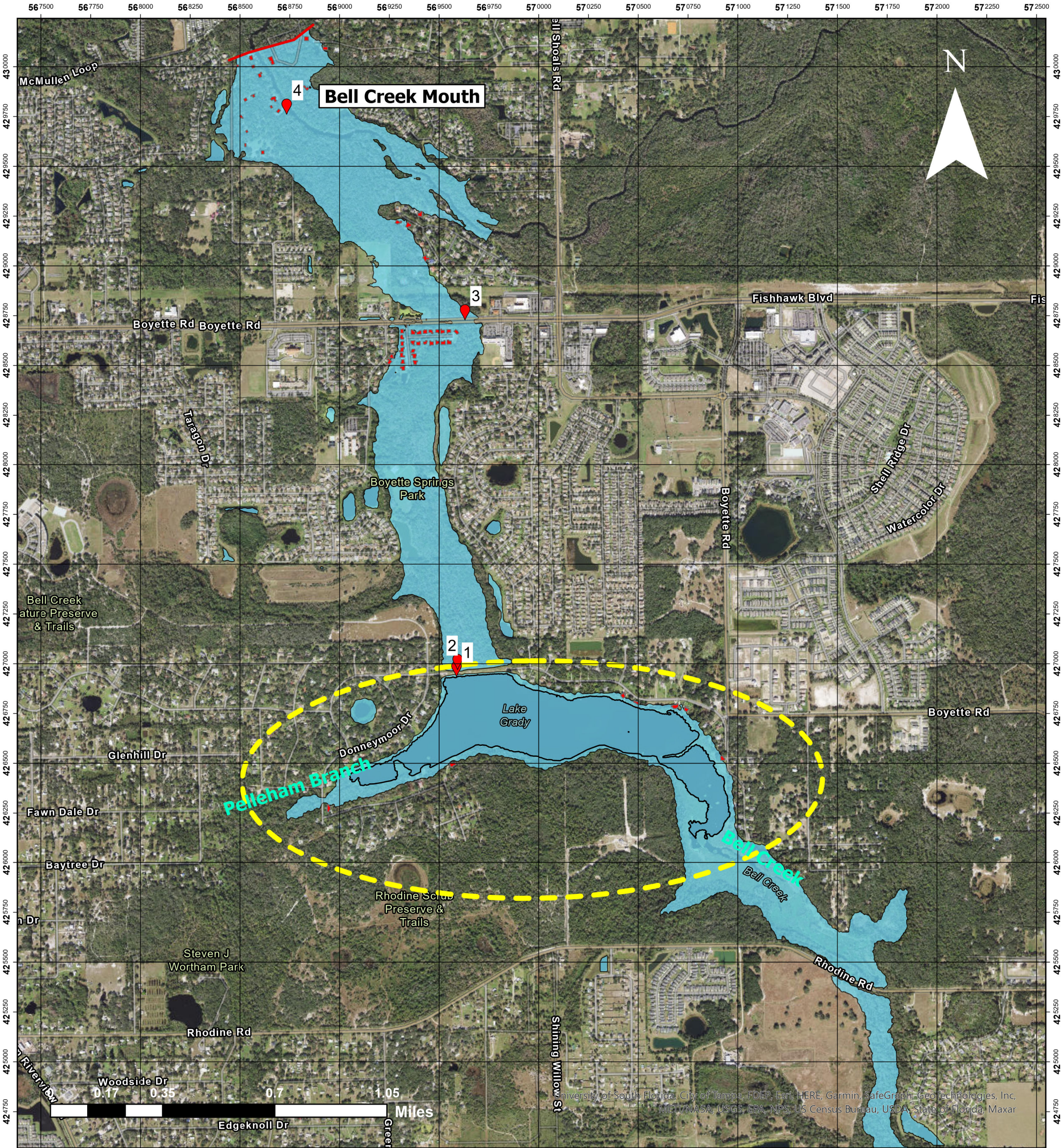

Project

Inundation Modeling and Mapping for Shadow Run Dam

100 Year Dam Break Flood Inundation Extent

Date	Drawn	Scale
08.11.22	TC/MC	1:18,500

Legend

- Flood modeling points of interest
- Study limit
- Lake Grady location
- Received shoreline
- Inundated structures
- Shadow Run Dam 100-year storm (dam break)

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 11

Notes

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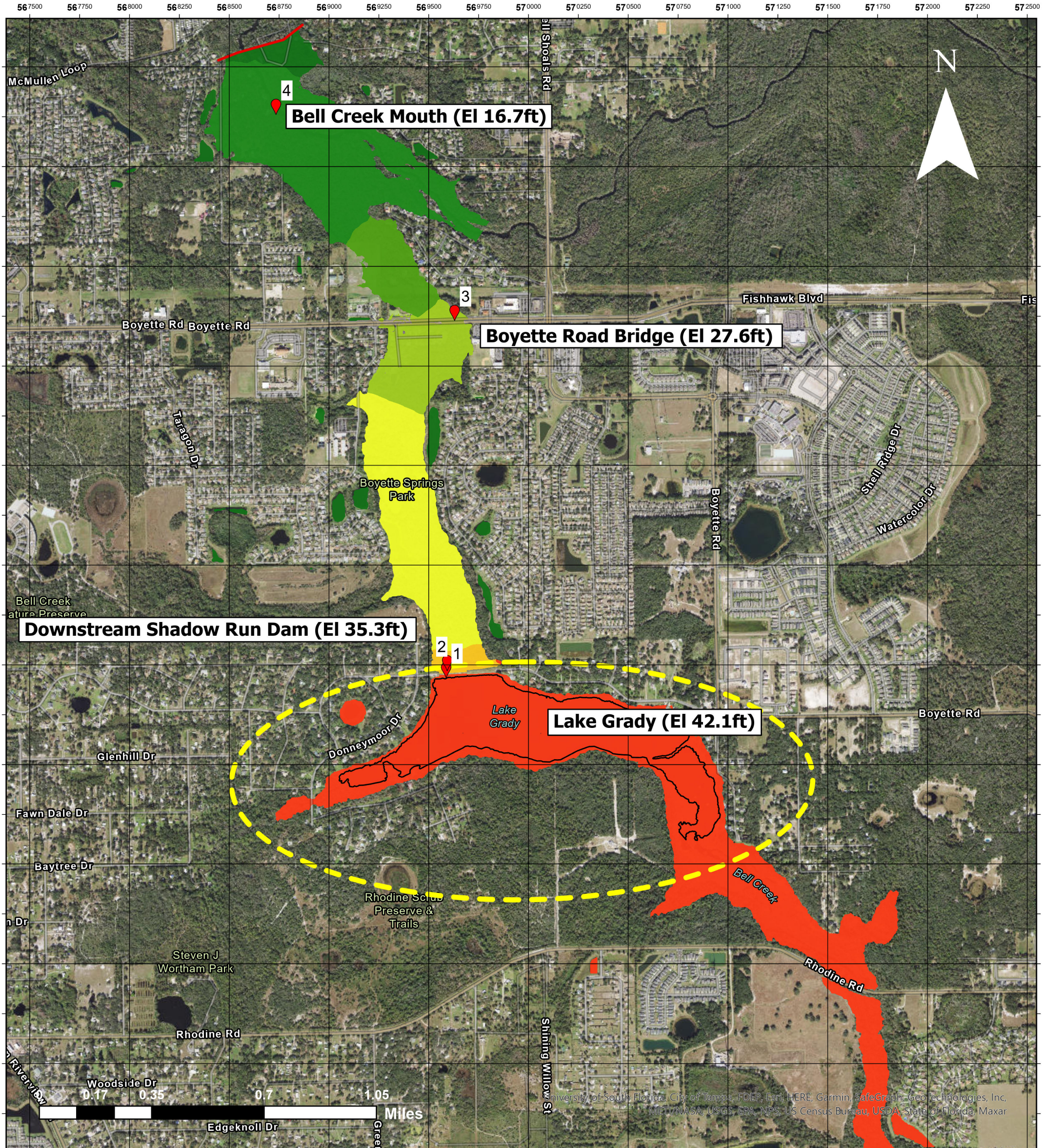

Project

Inundation Modeling and Mapping for Shadow Run Dam

100 Year Dam Break Flood Inundation Maximum Water Elevations

Date	Drawn	Scale
08.11.22	TC/MC	1:18,500

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 12

Legend

- Flood modeling points of interest
- Study limit
- Lake Grady location
- Received shoreline

Shadow Run Dam 100-year event (dam break - feet)

- 14.6 to 15.0
- 15.1 to 20.0
- 20.1 to 25.0
- 25.1 to 30.0
- 30.1 to 35.0
- 35.1 to 40.0
- 40.1 to 42.1

Notes

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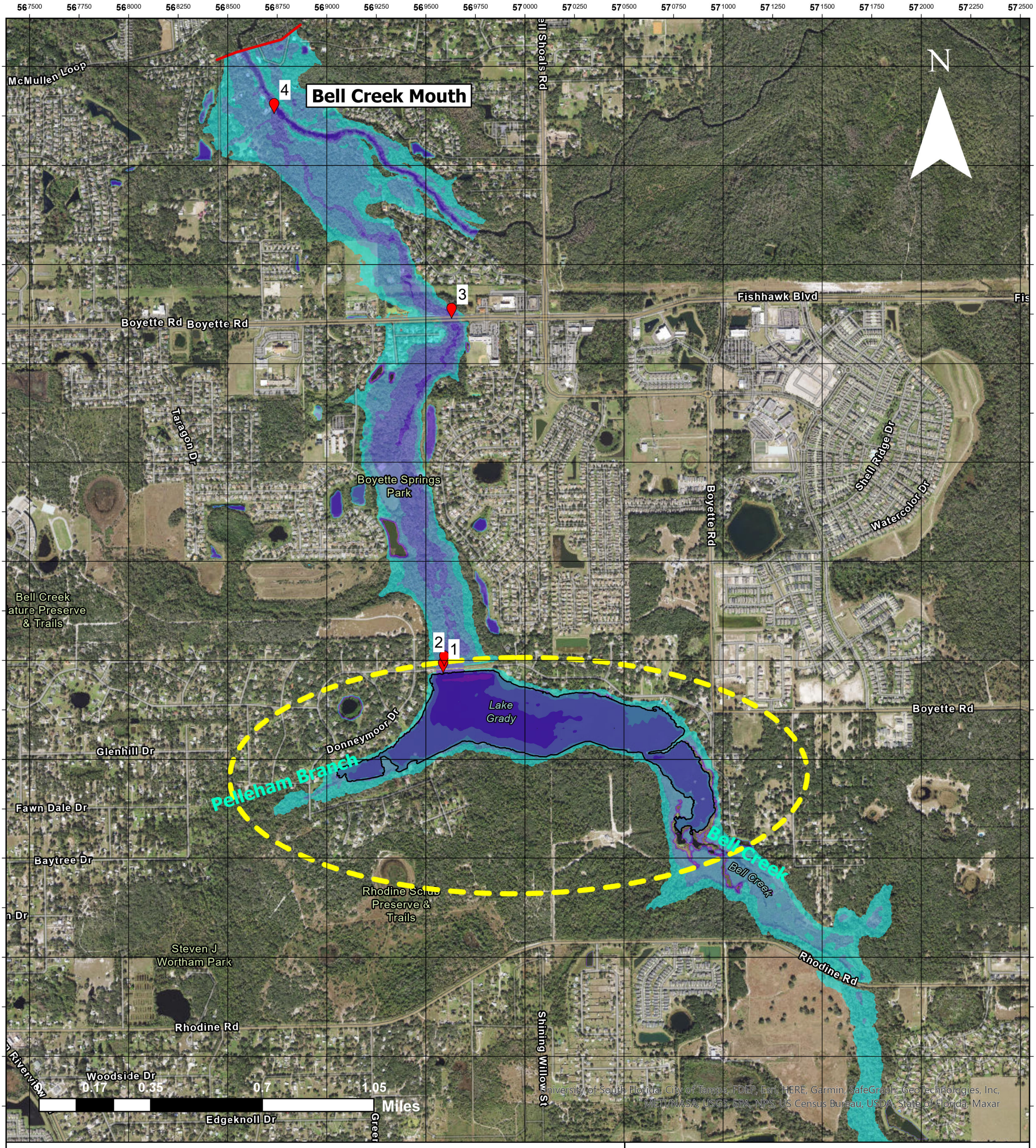

Project

Inundation Modeling and Mapping for Shadow Run Dam

100 Year Dam Break Flood Inundation Depths

Date	Drawn	Scale
08.11.22	TC/MC	1:18,500

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 13

Legend

- Flood modeling points of interest
- Study limit
- Lake Grady location
- Received shoreline

Shadow Run Dam 100-year event (dam break - feet)

- 0.0 to 5.0
- 5.1 to 10.0
- 10.1 to 15.0
- 15.1 to 20.0
- 20.1 to 25.0
- 25.1 to 25.3
- NoData

Notes

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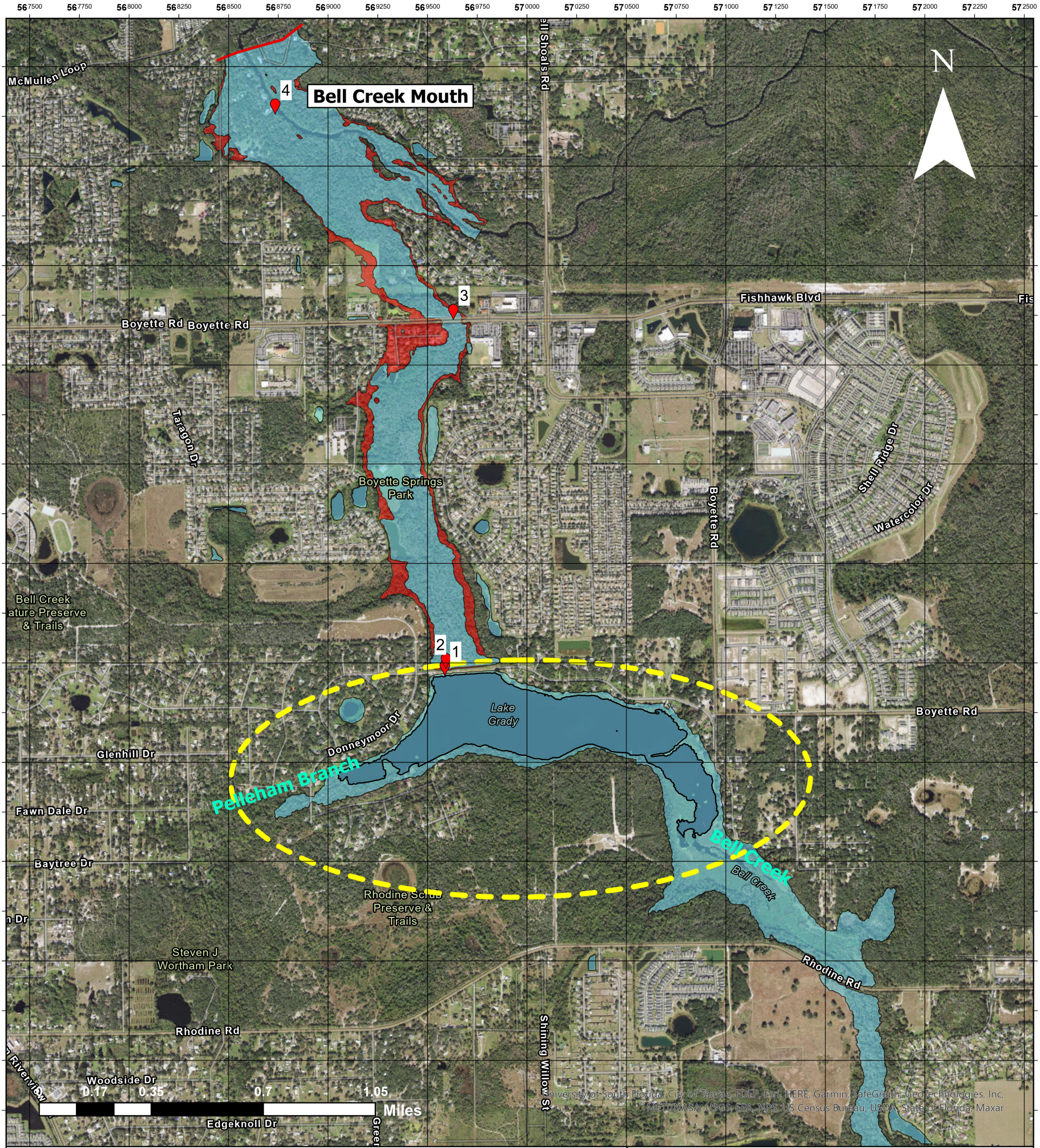

Project

Inundation Modeling and Mapping for Shadow Run Dam

100 Year Comparison Flood Inundation Maximum Water Elevations, Dam Break vs No Dam Break

Date	Drawn	Scale
08.11.22	TC/MC	1:18,500

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 14

Legend

- Flood modeling points of interest
- Study limit
- Lake Grady location
- Received shoreline
- Shadow Run Dam 100-year storm (dam break)
- Shadow Run Dam 100-year storm (no dam break)

Notes

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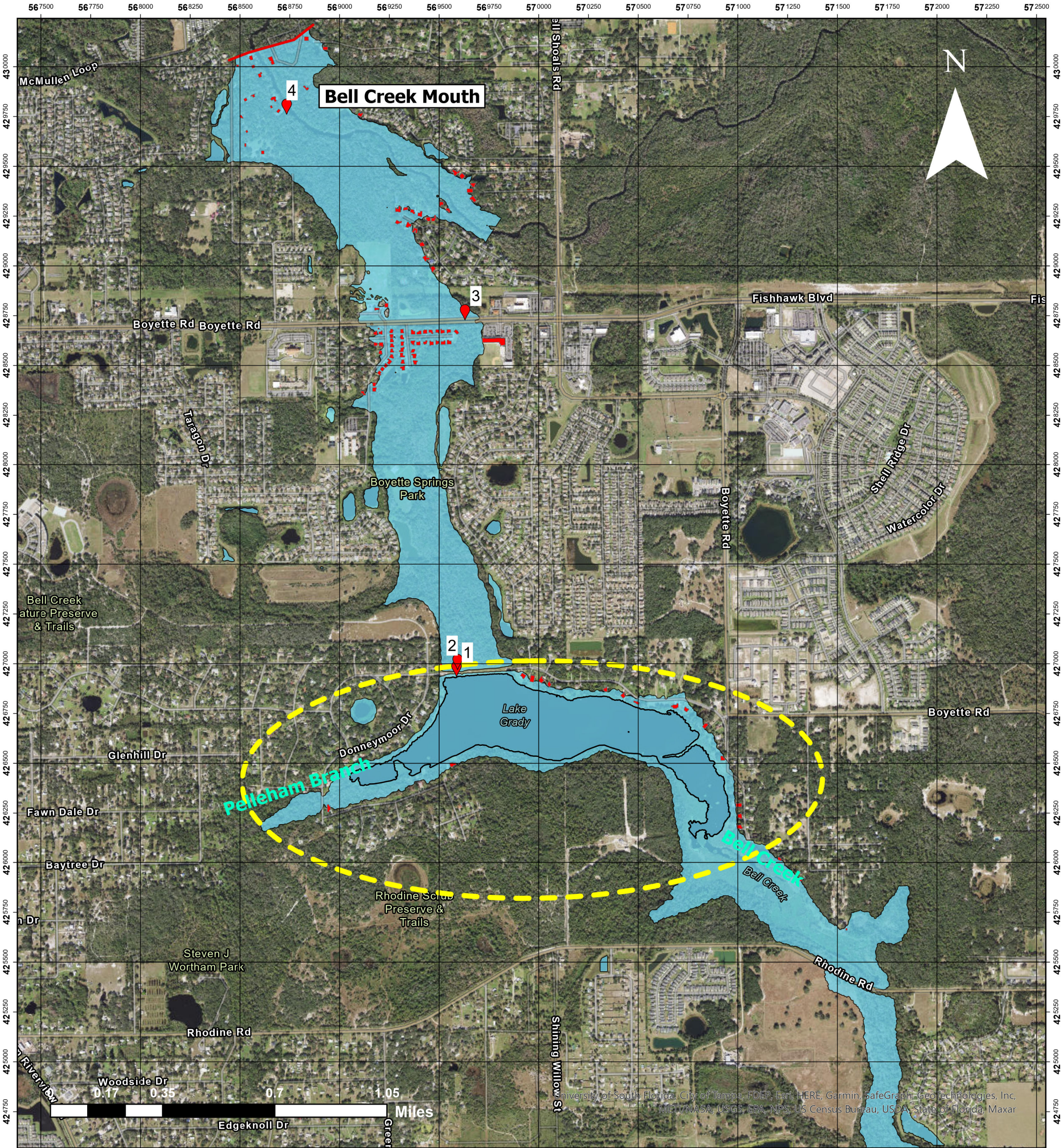

Project

Inundation Modeling and Mapping for Shadow Run Dam

½ PMP Dam Break Flood Inundation Extent

Date	Drawn	Scale
08.11.22	TC/MC	1:18,500

Legend

- Flood modeling points of interest
- Study limit
- Lake Grady location
- Received shoreline
- Inundated structures
- Shadow Run Dam half PMP event (dam break)

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 15

Notes

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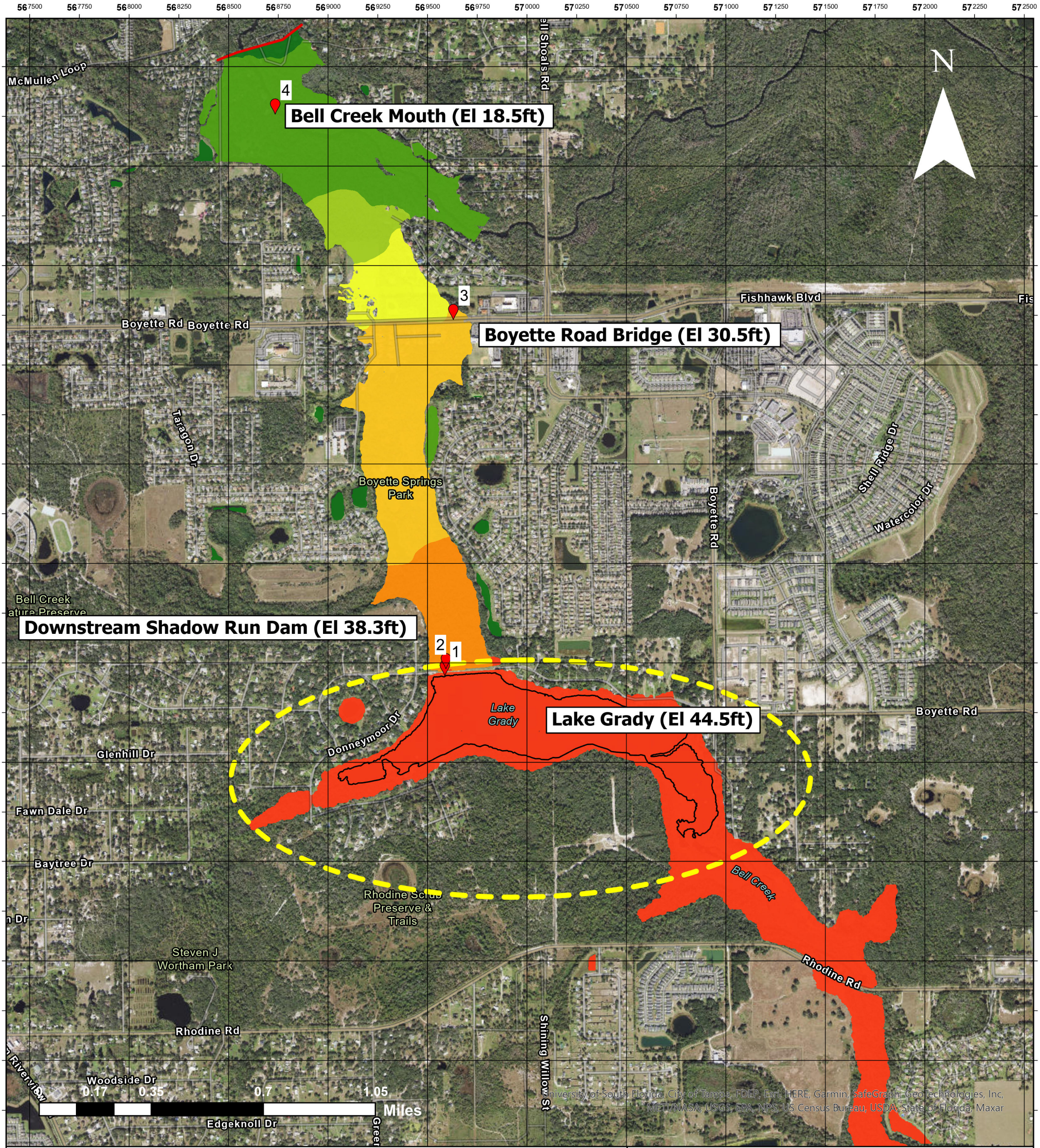

Project

Inundation Modeling and Mapping for Shadow Run Dam

½ PMP Dam Break Flood Inundation Maximum Water Elevations

Date	Drawn	Scale
08.11.22	TC/MC	1:18,500

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 16

Legend

- Flood modeling points of interest
- Study limit
- Lake Grady location
- Received shoreline

Shadow Run Dam half PMP event (dam break - feet)

- 14.6 to 15.0
- 15.1 to 20.0
- 20.1 to 25.0
- 25.1 to 30.0
- 30.1 to 35.0
- 35.1 to 40.0
- 40.1 to 44.5

Notes

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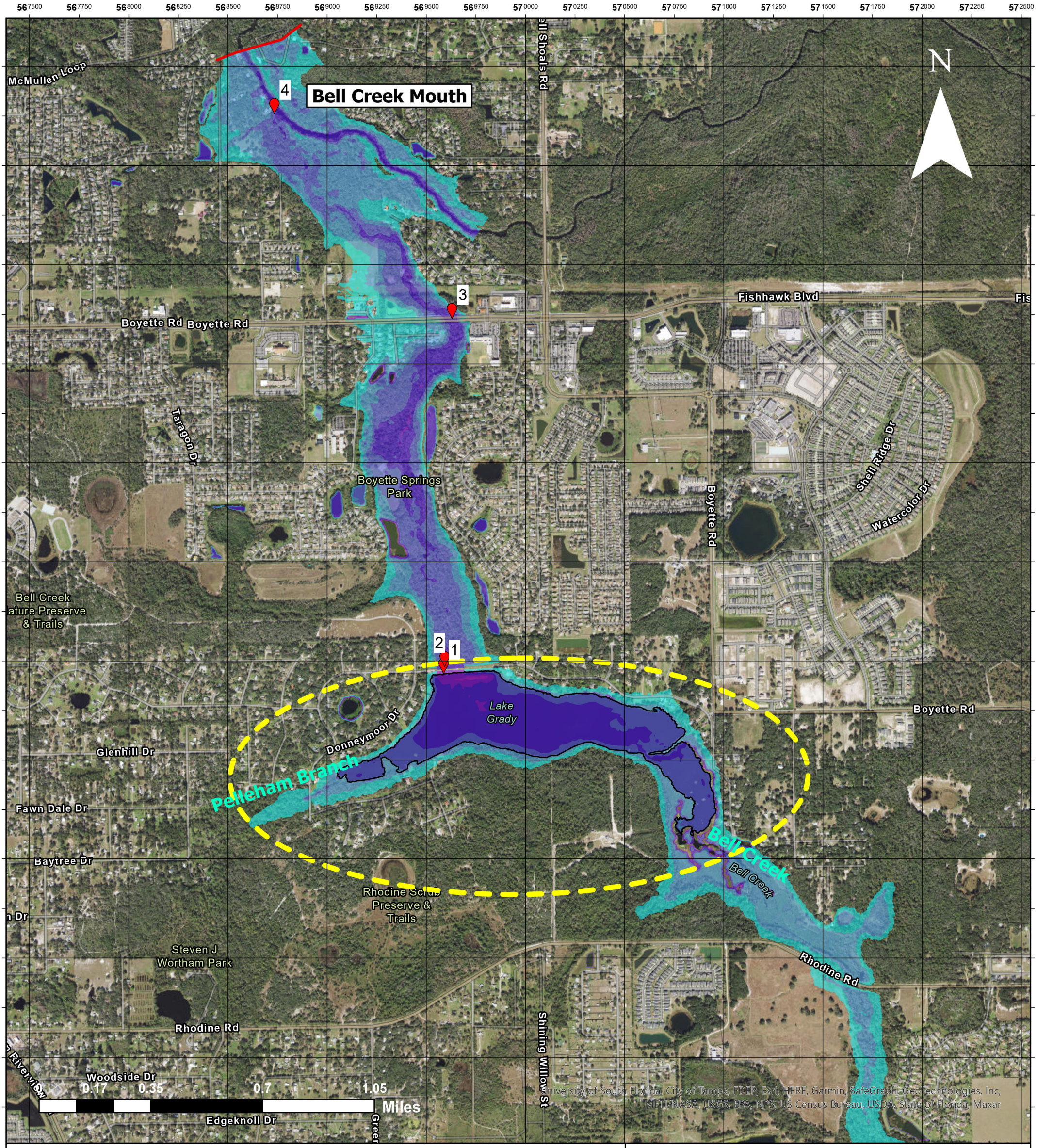

Project

Inundation Modeling and Mapping for Shadow Run Dam

½ PMP Dam Break Flood Inundation Depths

Date	Drawn	Scale
08.11.22	TC/MC	1:18,500

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 17

Legend

- Flood modeling points of interest
- Study limit
- Lake Grady location
- Received shoreline

Shadow Run Dam half PMP event (dam break - feet)

- 0.0 to 5.0
- 5.1 to 10.0
- 10.1 to 15.0
- 15.1 to 20.0
- 20.1 to 25.0
- 25.1 to 27.6
- NoData

Notes

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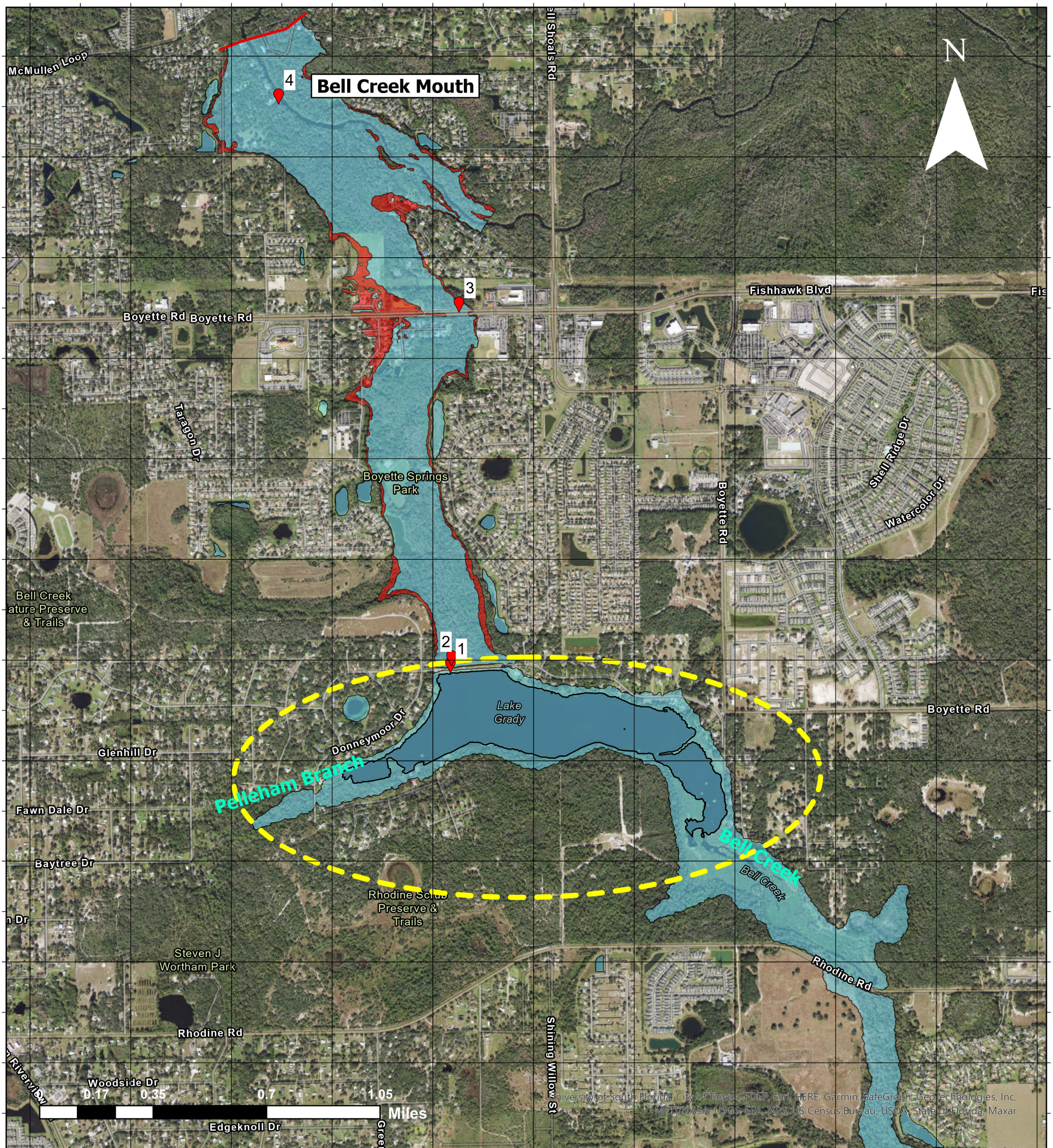

Project

Inundation Modeling and Mapping for Shadow Run Dam

½ PMP Comparison Flood Inundation Maximum Water Elevations, Dam Break vs No Dam Break

Date	Drawn	Scale
08.11.22	TC/MC	1:18,500

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 18

Legend

- Flood modeling points of interest
- Study limit
- Lake Grady location
- Received shoreline
- Shadow Run Dam half-PMP event (no dam break)
- Shadow Run Dam half-PMP event (dam break)

Notes

Florida Department of Environmental Protection

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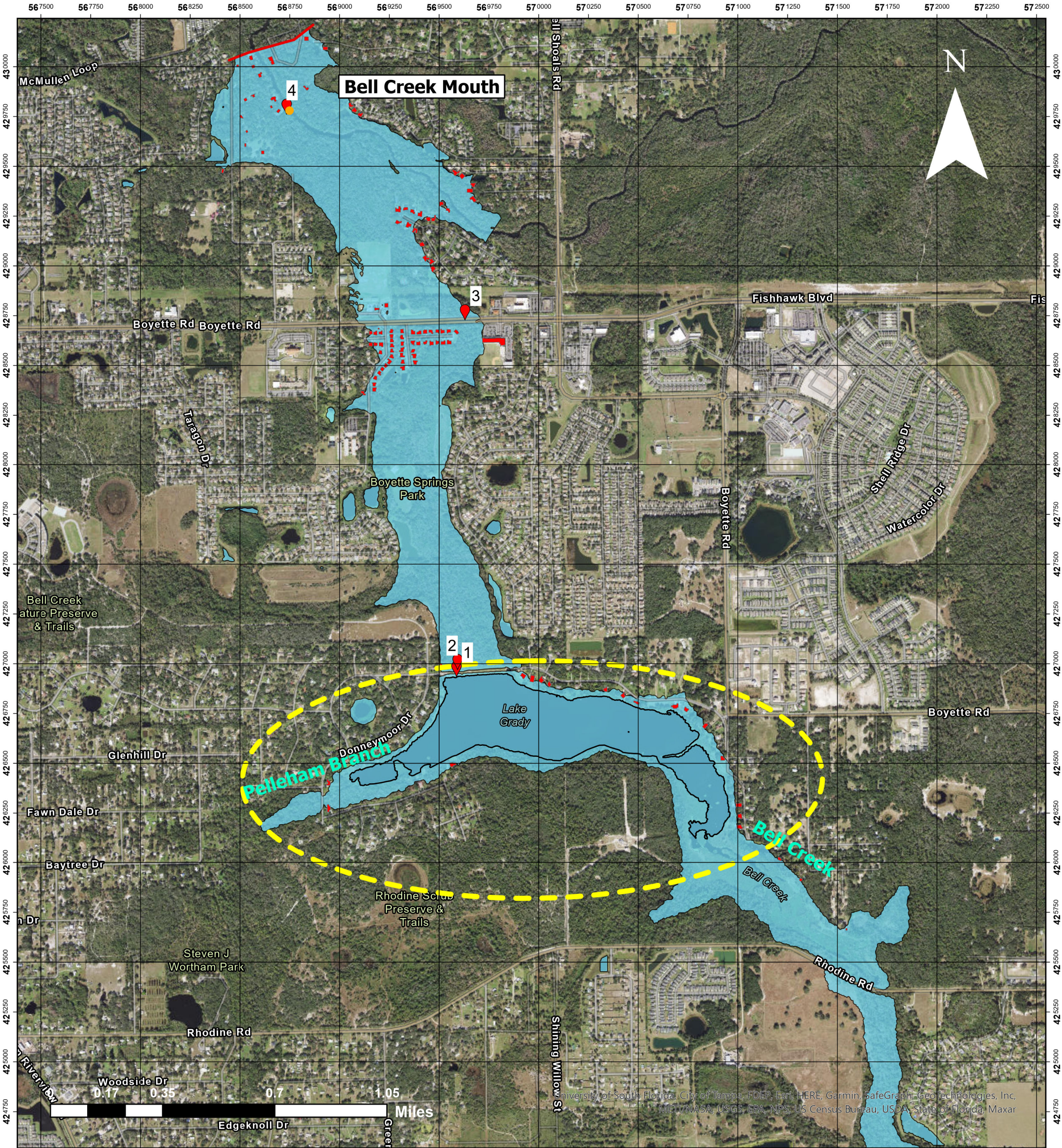

Project

Inundation Modeling and Mapping for Shadow Run Dam

PMP Dam Break Flood Inundation Extent

Date	Drawn	Scale
08.11.22	TC/MC	1:18,500

Legend

- Flood modeling points of interest
- Study limit
- Lake Grady location
- Received shoreline
- Inundated structures
- Shadow Run Dam PMP event (dam break)

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 19

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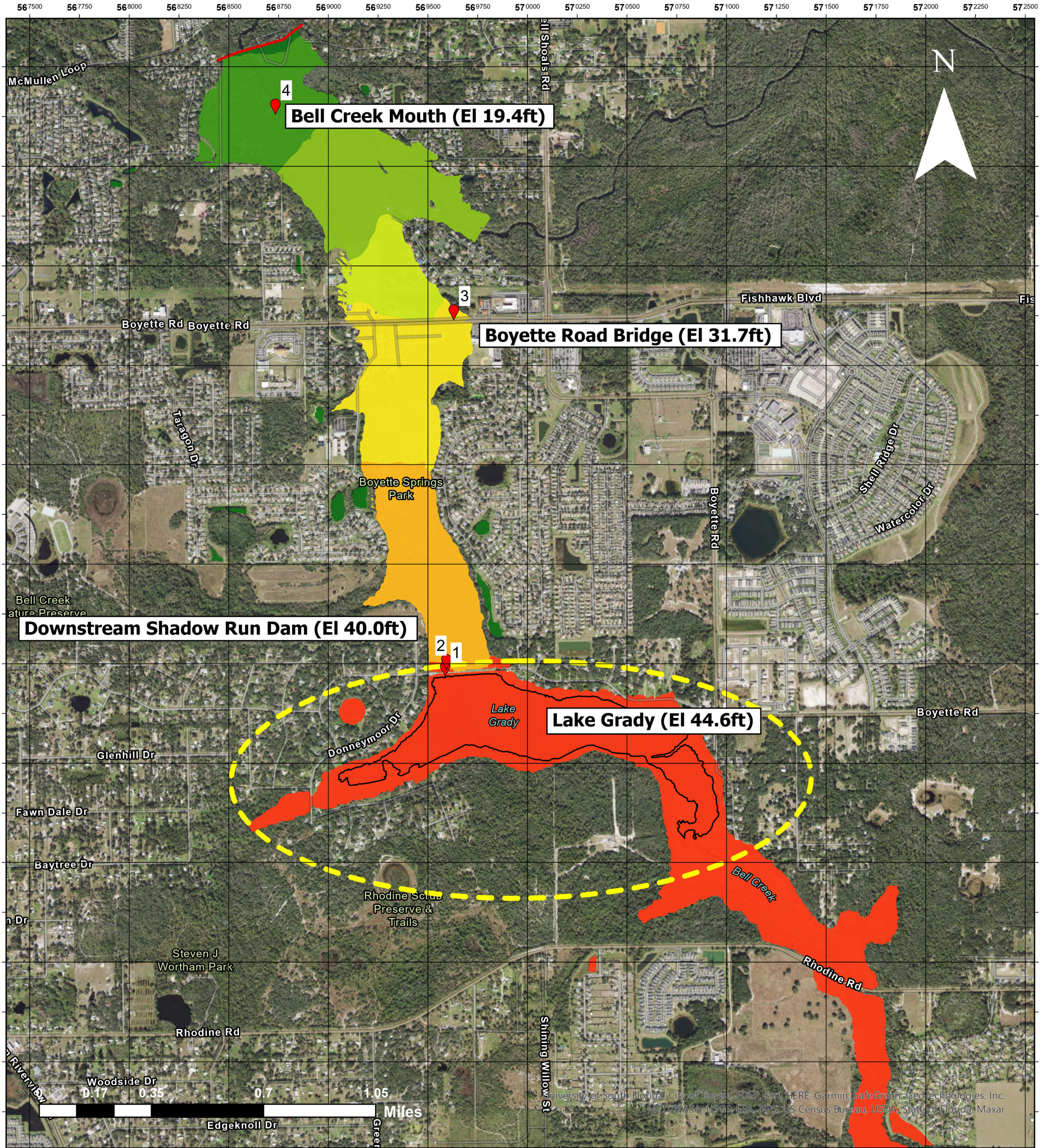
Notes



Project

Inundation Modeling and Mapping for Shadow Run Dam

PMP Dam Break Flood Inundation Maximum Water Elevations

Date	Drawn	Scale
08.11.22	TC/MC	1:18,500

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 20

Legend

- Flood modeling points of interest
- Study limit
- Lake Grady location
- Received shoreline

Shadow Run Dam PMP event (dam break - feet)

- 14.6 to 15.0
- 15.1 to 20.0
- 20.1 to 25.0
- 25.1 to 30.0
- 30.1 to 35.0
- 35.1 to 40.0
- 40.1 to 44.6

Notes

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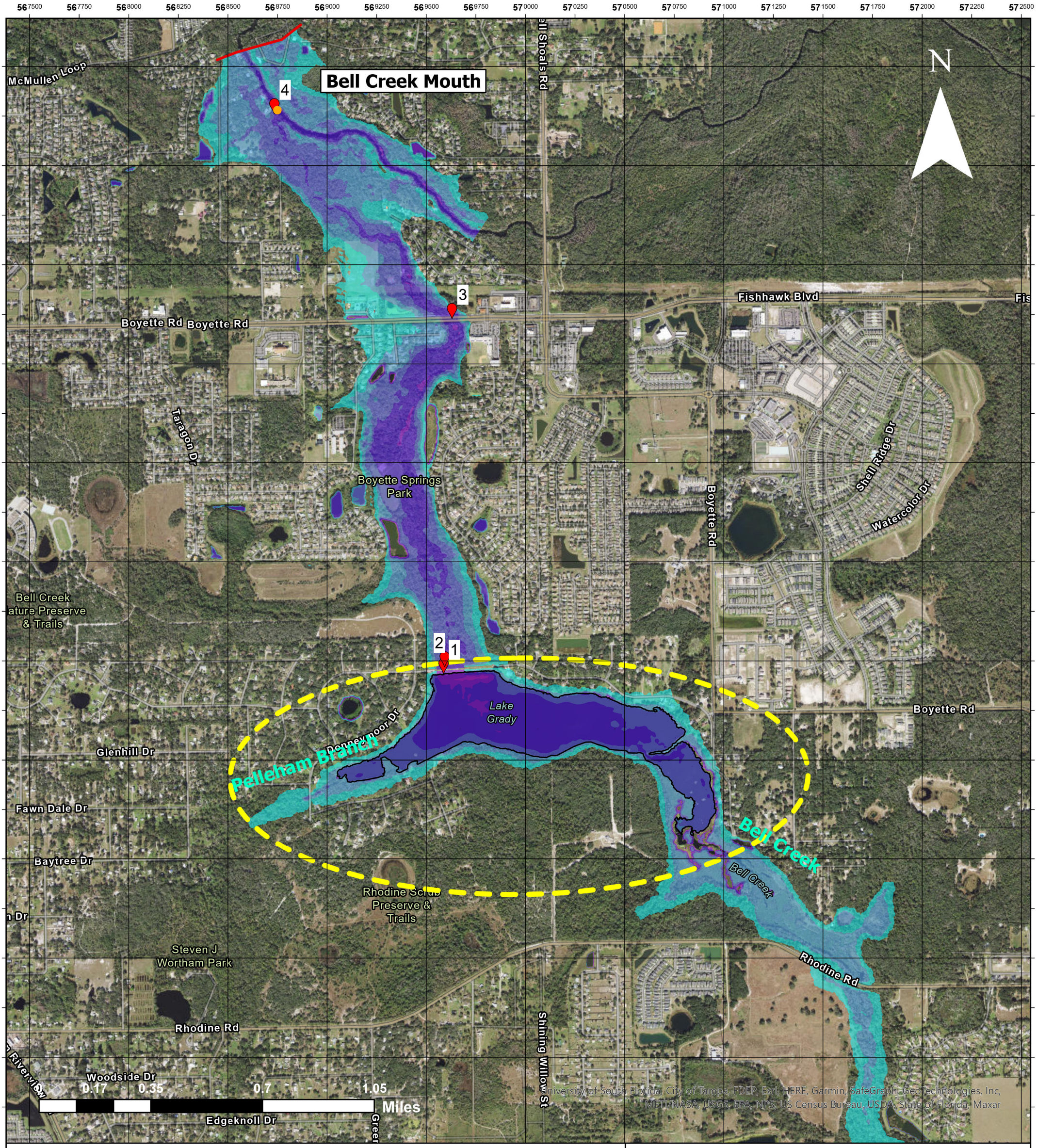

Project

Inundation Modeling and Mapping for Shadow Run Dam

PMP Dam Break Flood Inundation Depths

Date	Drawn	Scale
08.11.22	TC/MC	1:18,500

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 21

Legend

- Flood modeling points of interest
- Study limit
- Lake Grady location
- Received shoreline

Shadow Run Dam PMP event (dam break - feet)

- 0.0 to 5.0
- 5.1 to 10.0
- 10.1 to 15.0
- 15.1 to 20.0
- 20.1 to 25.0
- 25.1 to 27.9
- NoData

Notes

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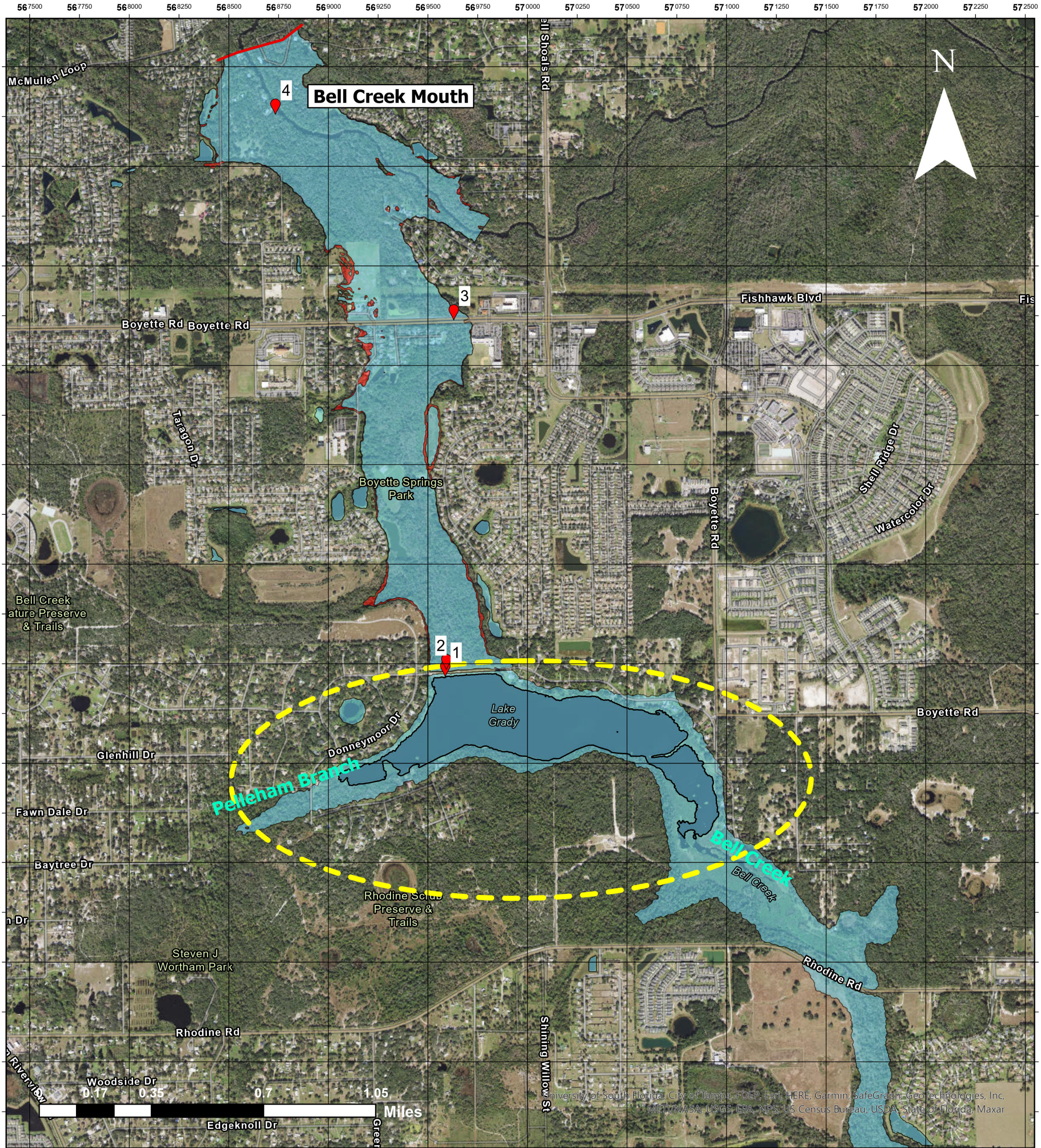

Project

Inundation Modeling and Mapping for Shadow Run Dam

PMP Comparison Flood Inundation Maximum Water Elevations, Dam Break vs No Dam Break

Date	Drawn	Scale
08.11.22	TC/MC	1:18,500

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 22

Legend

- Flood modeling points of interest
- Study limit
- Lake Grady location
- Received shoreline
- Shadow Run Dam PMP event (dam break)
- Shadow Run Dam PMP event (no dam break)

Notes

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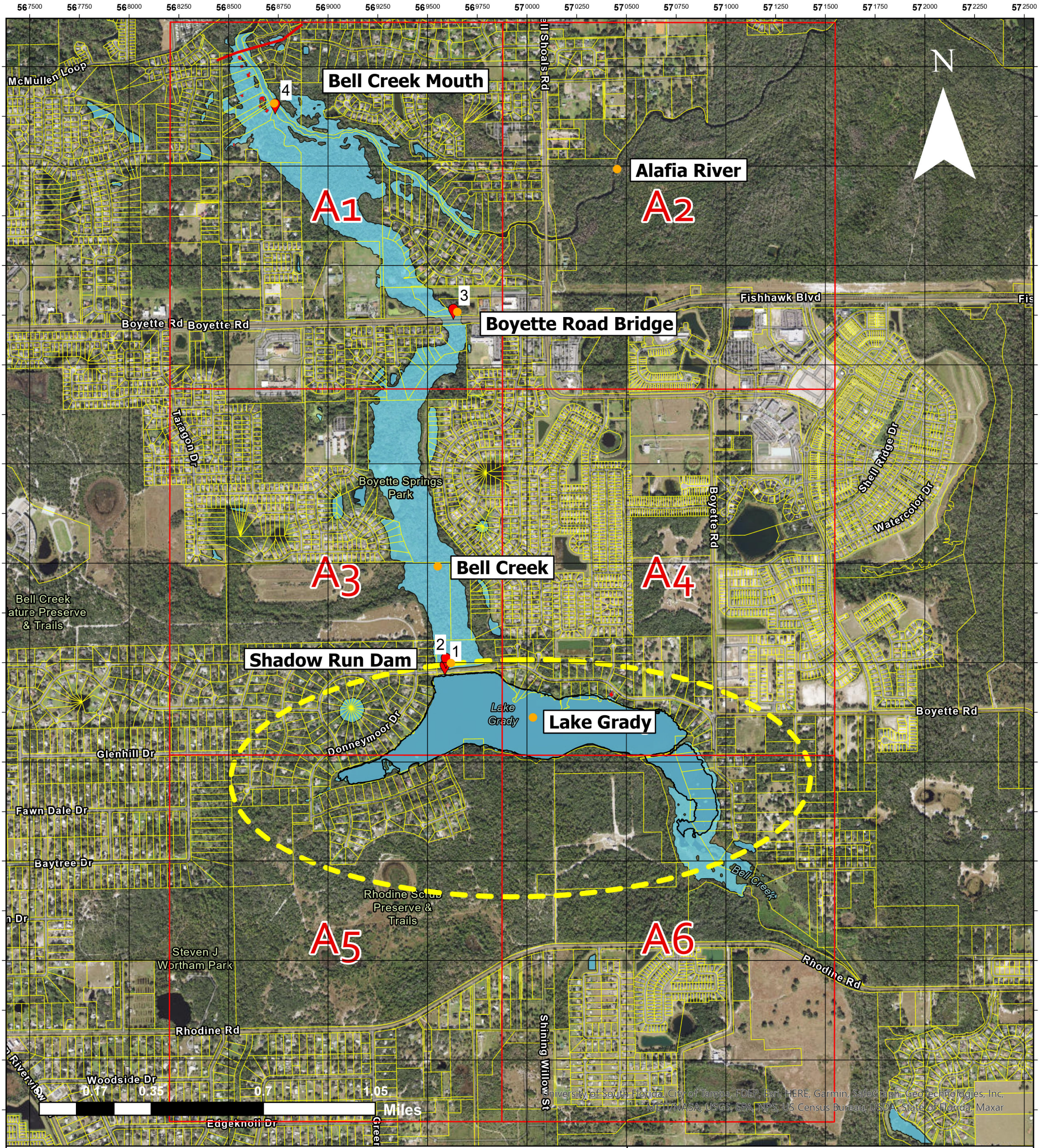

Project

Inundation Modeling and Mapping for Shadow Run Dam

Flooded Parcels near Homes During the Sunny Day Dam Break

Date	Drawn	Scale
08.11.22	TC/MC	1:18,500

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 23

Legend

- Flood modeling points of interest
- Study limit
- Panel Index
- Lake Grady location
- Received shoreline
- Inundated structures
- Hillsborough County Parcels
- Shadow Run Dam Sunny Day event (dam break)

Notes

Florida Department of Environmental Protection

Division of Water Resource Management

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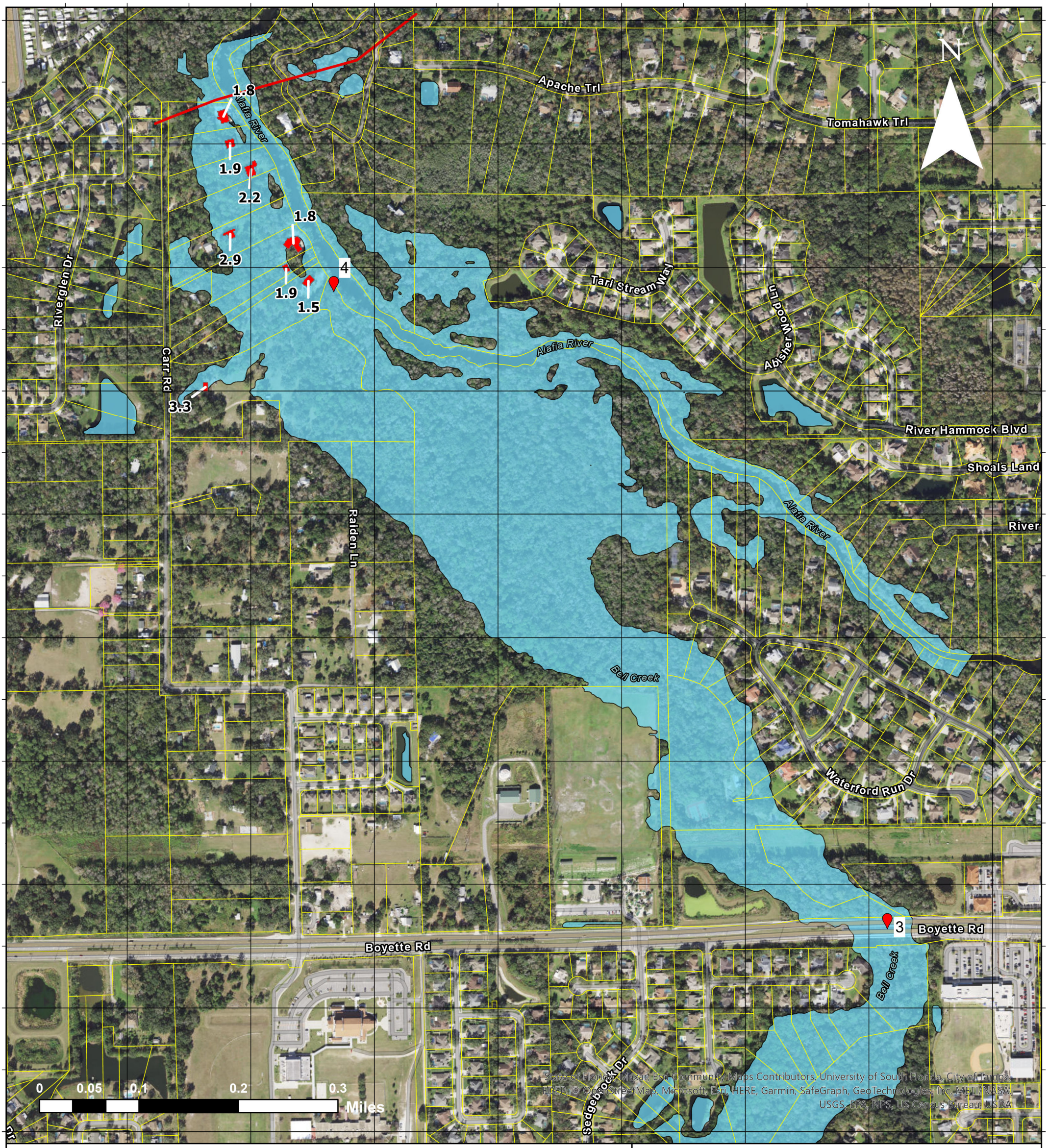

Project

Inundation Modeling and Mapping for Shadow Run Dam

Flooded Parcels near Homes During the Sunny Day Dam Break

Date	Drawn	Scale
08.11.22	TC/MC	1:6,000

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 23 - A1

Legend

- Flood modeling points of interest
- Study limit
- Inundated structures
- Hillsborough County Parcels
- Shadow Run Dam Sunny Day event (dam break)
- 1.5 (typical) - flood depth in feet above ground at structures.

Notes

Florida Department of Environmental Protection

Division of Water Resource Management

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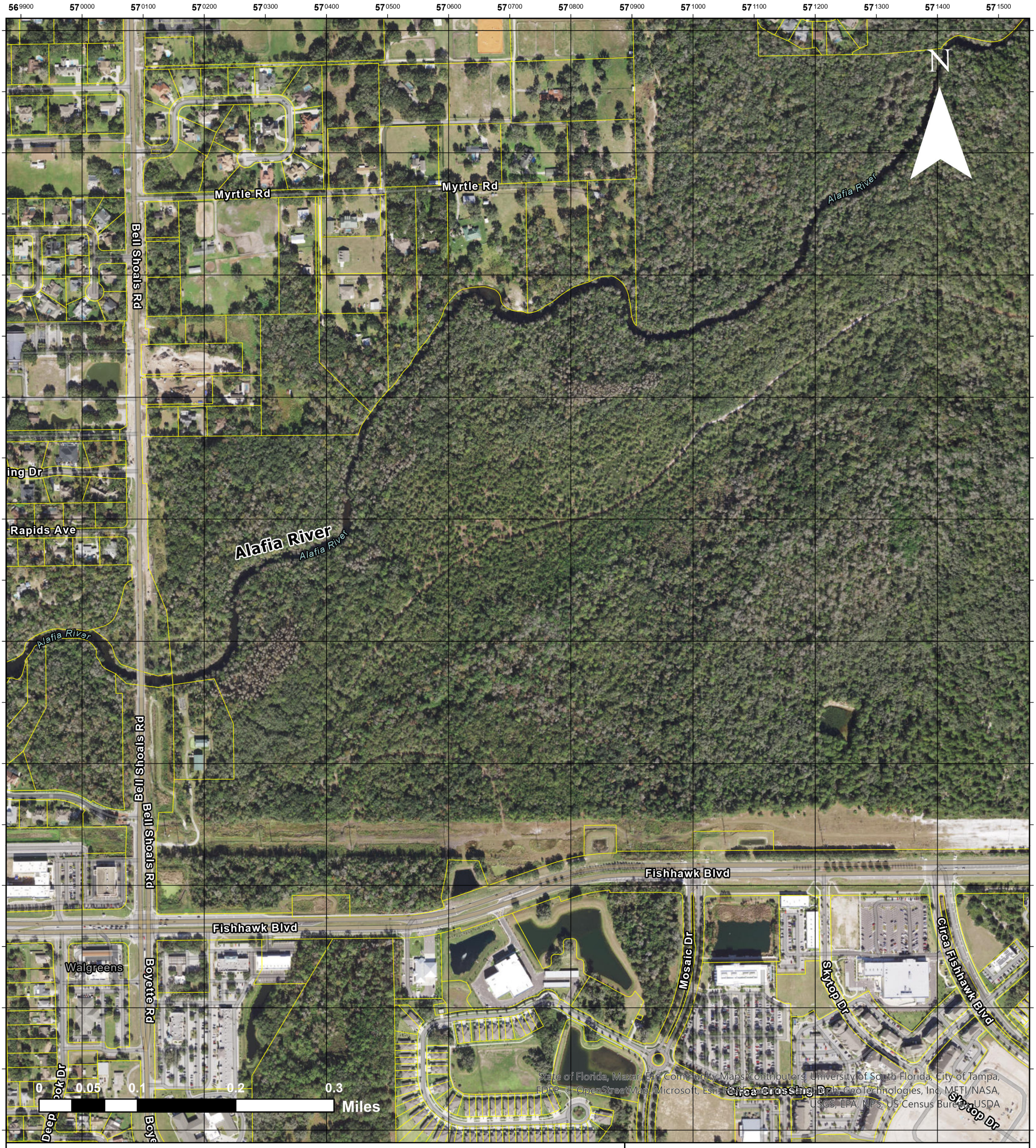

Project

Inundation Modeling and Mapping for Shadow Run Dam

Flooded Parcels near Homes During the Sunny Day Dam Break

Date	Drawn	Scale
08.11.22	TC/MC	1:6,000

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 23 - A2

Legend

- Hillsborough County Parcels
- 1.5 (typical) - flood depth in feet above ground at structures.

Notes

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Division of Water Resource Management

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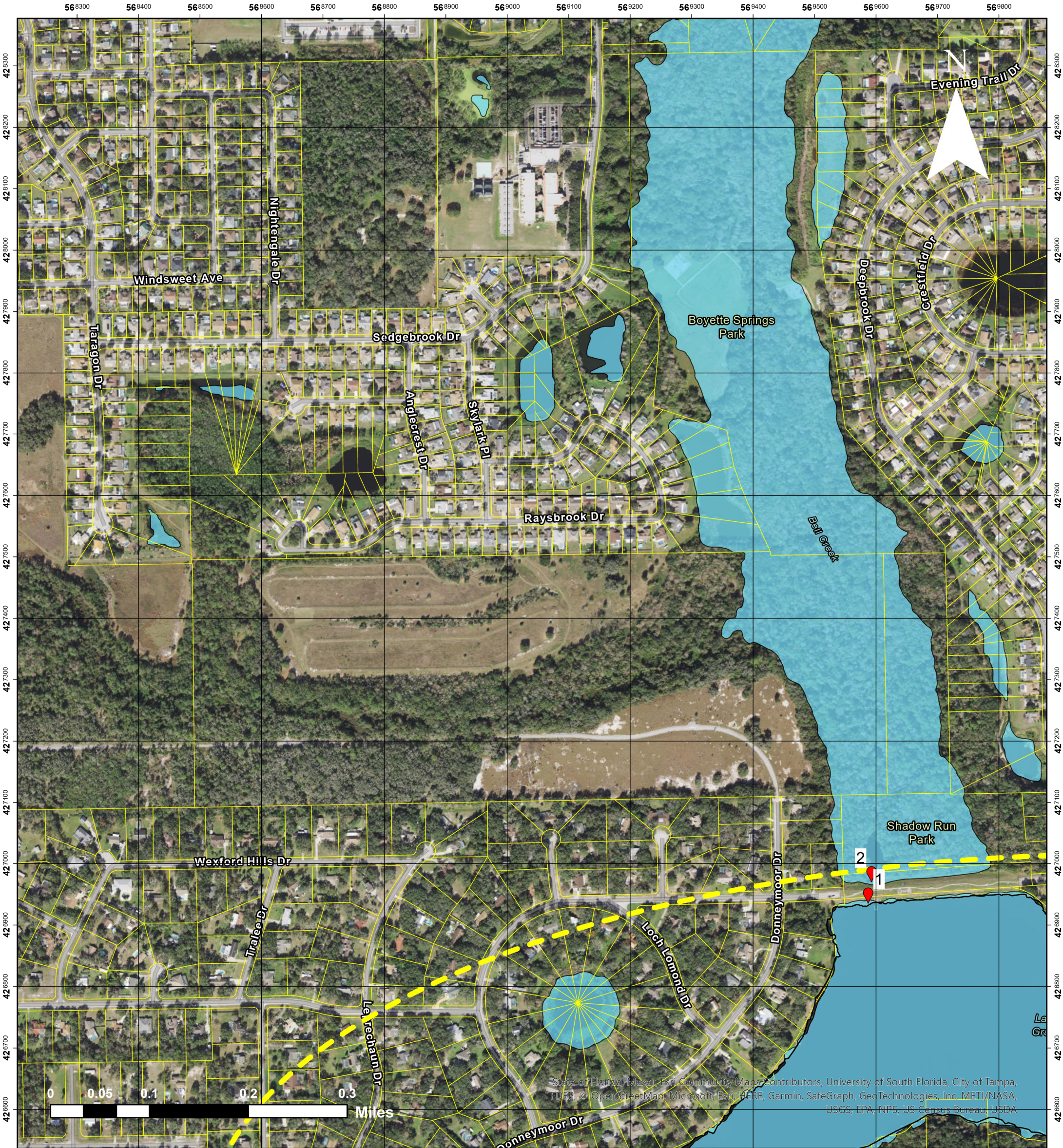

Project

Inundation Modeling and Mapping for Shadow Run Dam

Flooded Parcels near Homes During the Sunny Day Dam Break

Date	Drawn	Scale
08.11.22	TC/MC	1:6,000

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 23 - A3

Legend

- Flood modeling points of interest
- Lake Grady location
- Received shoreline
- Hillsborough County Parcels
- Shadow Run Dam Sunny Day event (dam break)
- 1.5 (typical) - flood depth in feet above ground at structures.

Notes

Florida Department of Environmental Protection

Division of Water Resource Management

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Inundation Modeling and Mapping for Shadow Run Dam

Flooded Parcels near Homes During the Sunny Day Dam Break

Date	Drawn	Scale
08.11.22	TC/MC	1:6,000

Legend

- Lake Grady location
- Received shoreline
- Inundated structures
- Hillsborough County Parcels
- Shadow Run Dam Sunny Day event (dam break)
- 1.5 (typical) - flood depth in feet above ground at structures.

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 23 - A4

Notes

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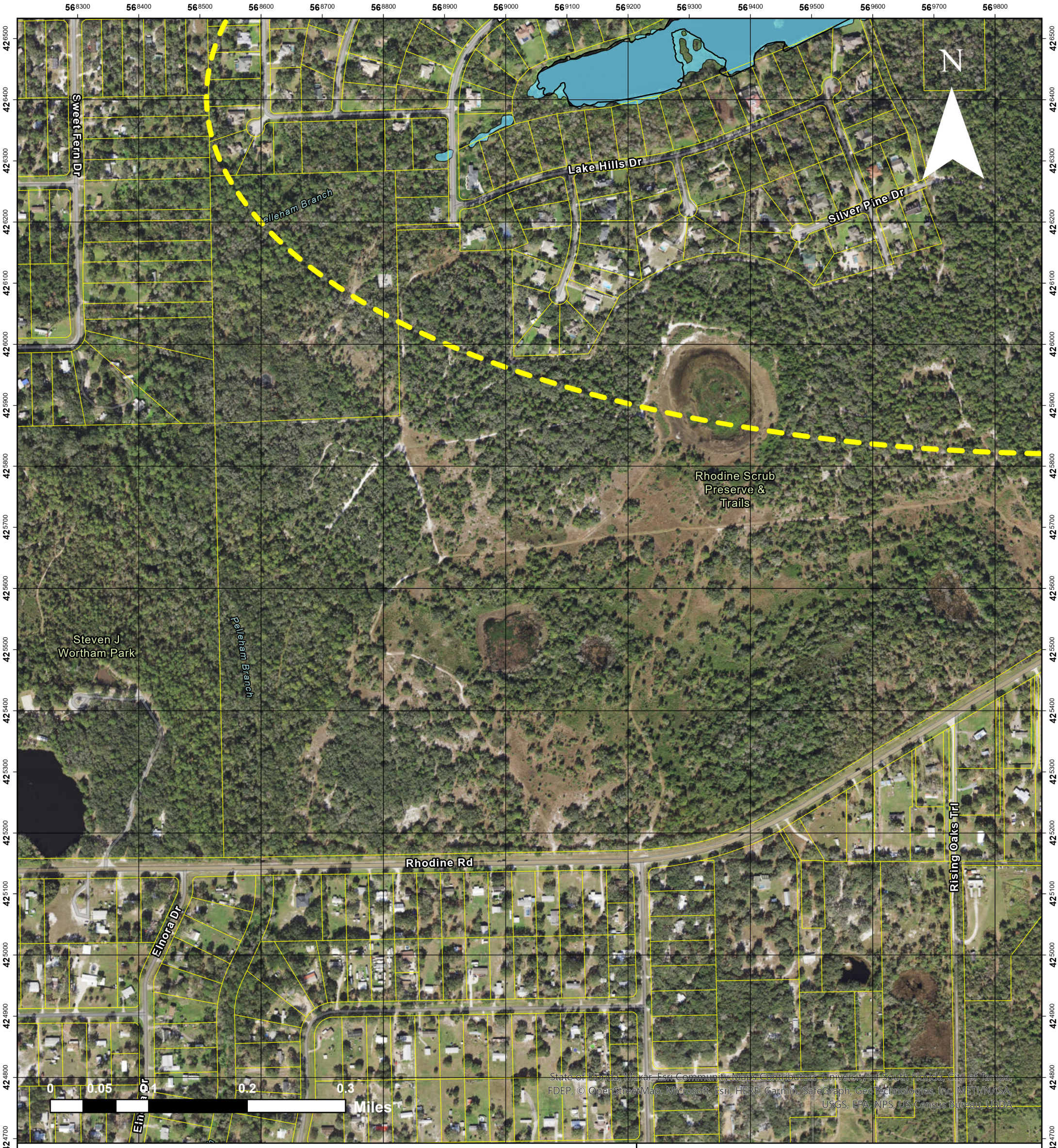

Project

Inundation Modeling and Mapping for Shadow Run Dam

Flooded Parcels near Homes During the Sunny Day Dam Break

Date	Drawn	Scale
08.11.22	TC/MC	1:6,000

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 23 - A5

Legend

- Lake Grady location
- Received shoreline
- Hillsborough County Parcels
- Shadow Run Dam Sunny Day event (dam break)
- 1.5 (typical) - flood depth in feet above ground at structures.

Notes

Florida Department of Environmental Protection

Division of Water Resource Management

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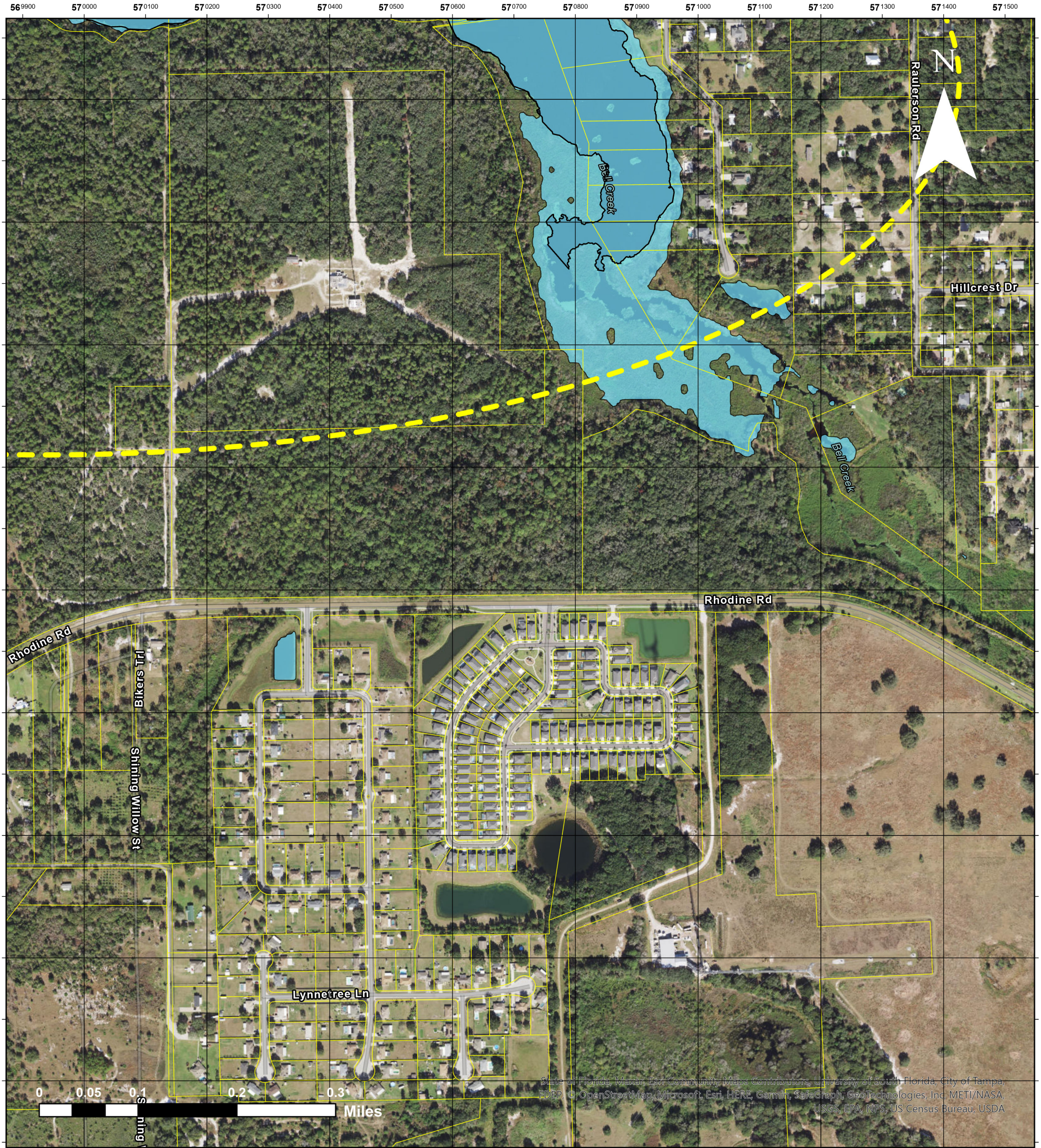

Project

Inundation Modeling and Mapping for Shadow Run Dam

Flooded Parcels near Homes During the Sunny Day Dam Break

Date	Drawn	Scale
08.11.22	TC/MC	1:6,000

Legend

- Lake Grady location
- Received shoreline
- Hillsborough County Parcels
- Shadow Run Dam Sunny Day event (dam break)
- 1.5 (typical) - flood depth in feet above ground at structures.

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 23 - A6

Notes

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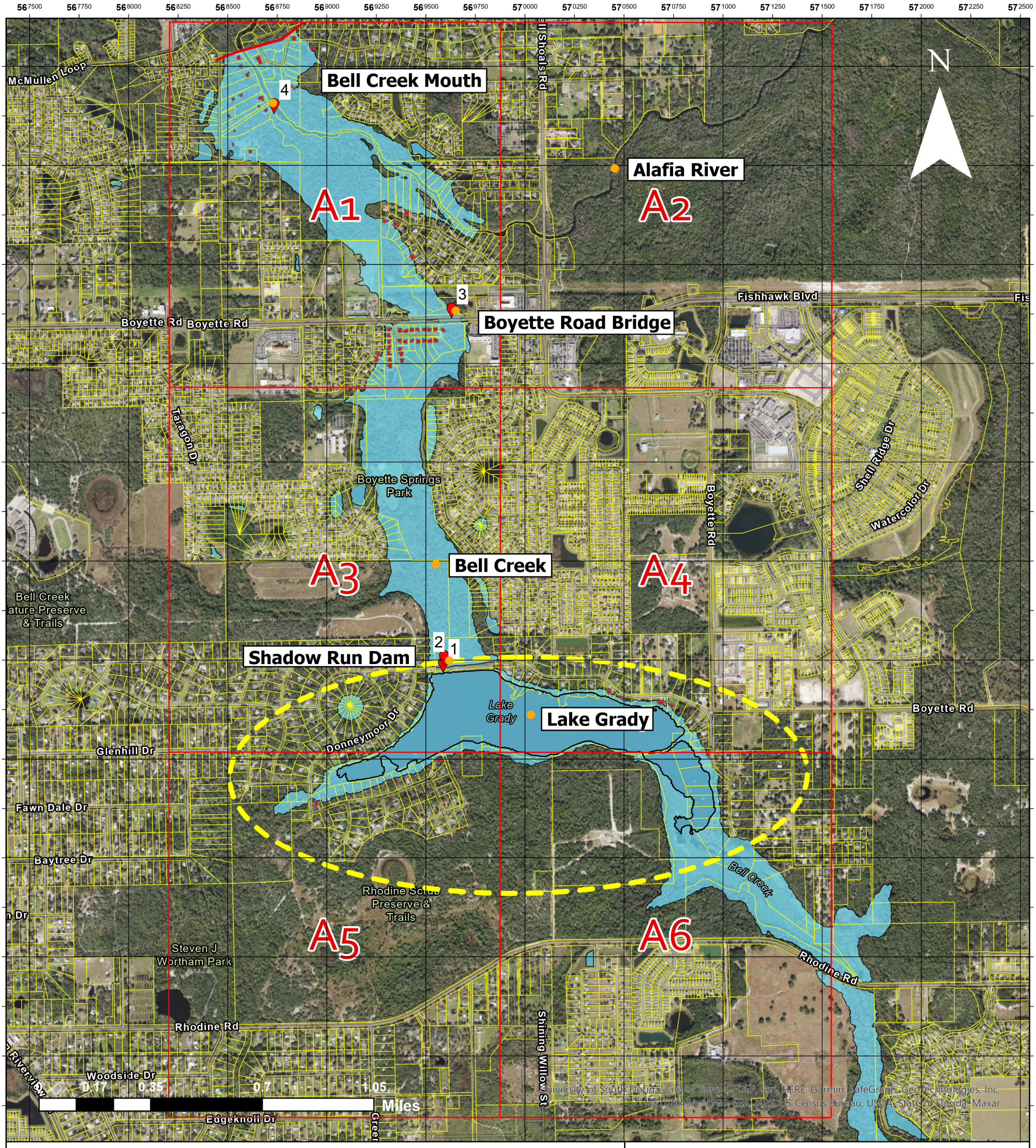

Project

Inundation Modeling and Mapping for Shadow Run Dam

Flooded Parcels near Homes During 100 year Dam Break

Date	Drawn	Scale
08.11.22	TC/MC	1:18,500

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 24

Legend

- Flood modeling points of interest
- Study limit
- Panel Index
- Lake Grady location
- Received shoreline
- Inundated structures
- Hillsborough County Parcels
- Shadow Run Dam 100-year storm (dam break)

Notes

Florida Department of Environmental Protection

Division of Water Resource Management

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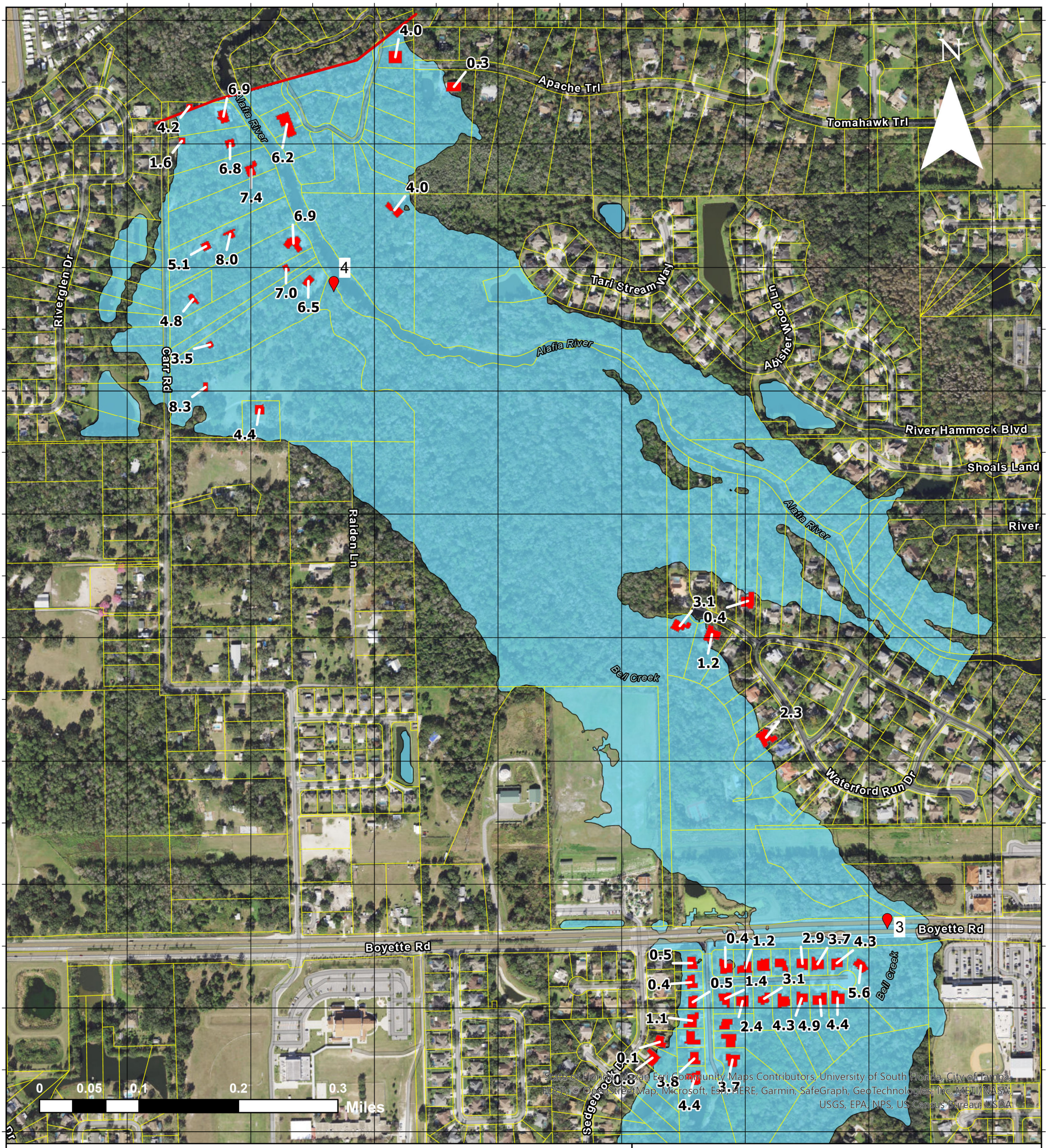

Project

Inundation Modeling and Mapping for Shadow Run Dam

Flooded Parcels near Homes During 100 year Dam Break

Date	Drawn	Scale
08.11.22	TC/MC	1:6,000

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 24 - A1

Legend

- Flood modeling points of interest
- Study limit
- Inundated structures
- Hillsborough County Parcels
- Shadow Run Dam 100-year storm (dam break)
- 1.5 (typical) - flood depth in feet above ground at structures.

Notes

Florida Department of Environmental Protection

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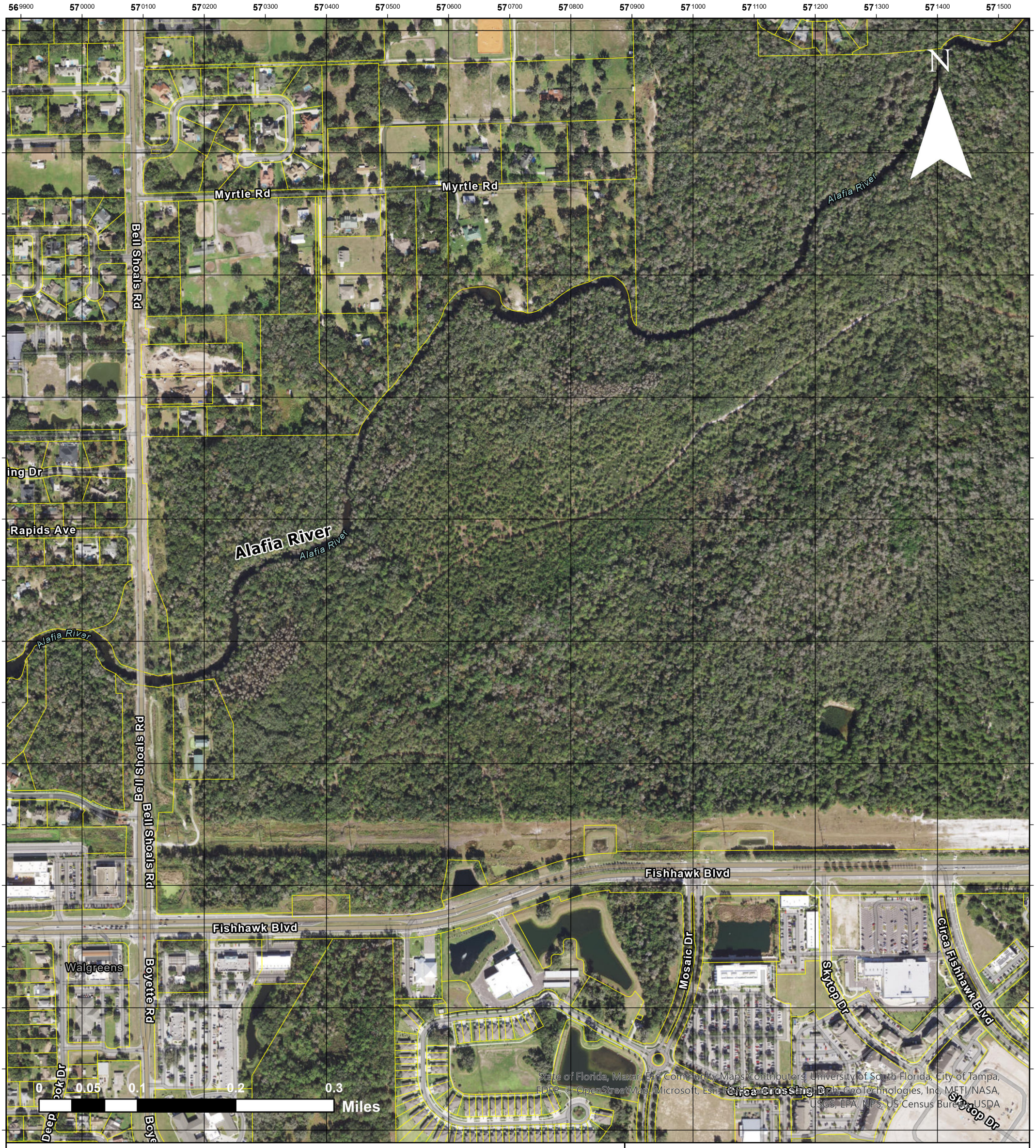

Project

Inundation Modeling and Mapping for Shadow Run Dam

Flooded Parcels near Homes During 100 year Dam Break

Date	Drawn	Scale
08.11.22	TC/MC	1:6,000

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 24 - A2

Legend

- Hillsborough County Parcels
- 1.5 (typical) - flood depth in feet above ground at structures.

Notes

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Inundation Modeling and Mapping for Shadow Run Dam

Flooded Parcels near Homes During 100 year Dam Break

Date	Drawn	Scale
08.11.22	TC/MC	1:6,000

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 24 - A3

Legend

- Flood modeling points of interest
- Lake Grady location
- Received shoreline
- Inundated structures
- Hillsborough County Parcels
- Shadow Run Dam 100-year storm (dam break)
- 1.5 (typical) - flood depth in feet above ground at structures.

Notes

Florida Department of Environmental Protection

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Inundation Modeling and Mapping for Shadow Run Dam

Flooded Parcels near Homes During 100 year Dam Break

Date	Drawn	Scale
08.11.22	TC/MC	1:6,000

Legend

- Lake Grady location
- Received shoreline
- Inundated structures
- Hillsborough County Parcels
- Shadow Run Dam 100-year storm (dam break)
- 1.5 (typical) - flood depth in feet above ground at structures.

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 24 - A4

Notes

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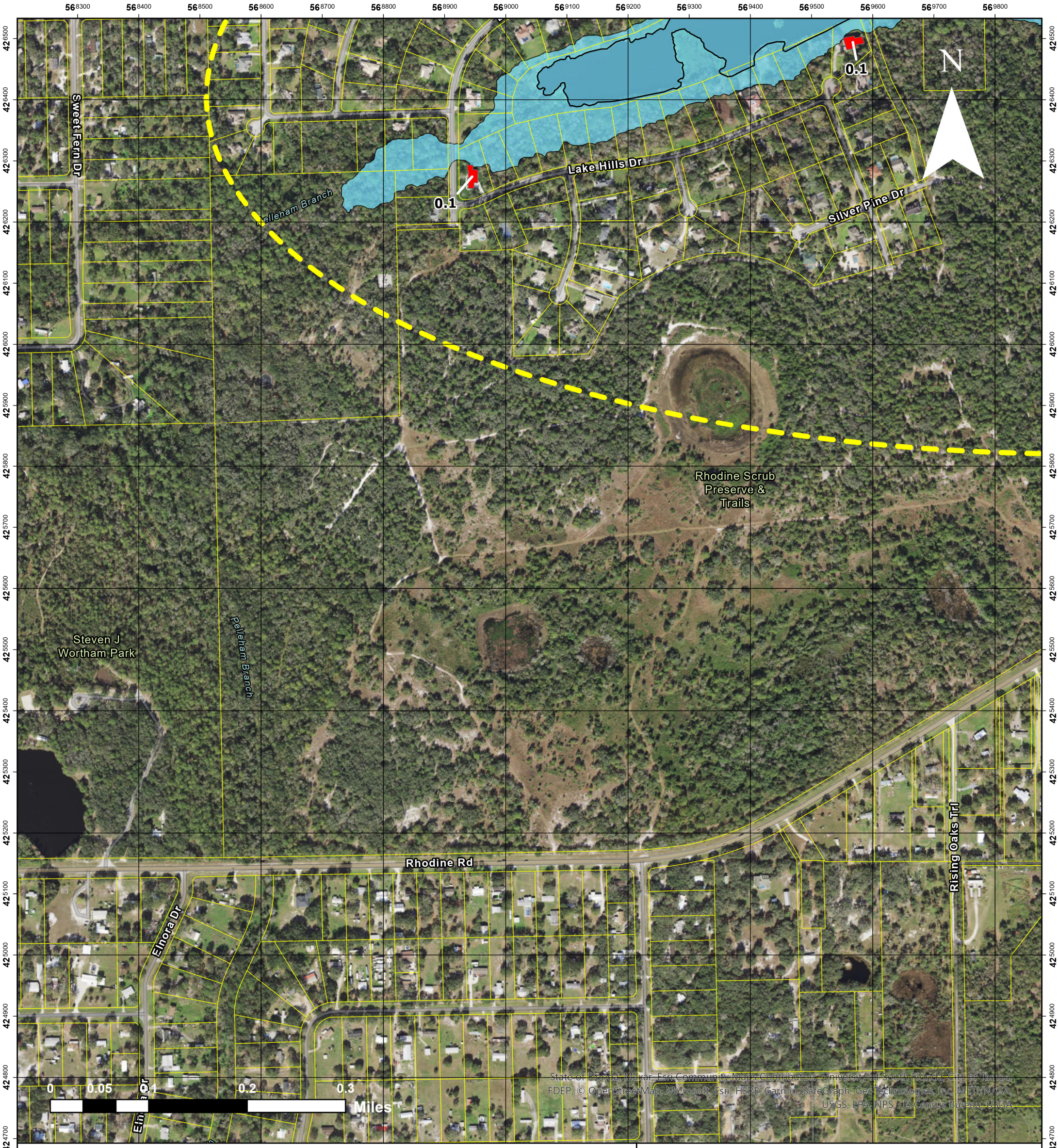

Project

Inundation Modeling and Mapping for Shadow Run Dam

Flooded Parcels near Homes During 100 year Dam Break

Date	Drawn	Scale
08.11.22	TC/MC	1:6,000

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 24 - A5

Legend

- Lake Grady location
- Received shoreline
- Inundated structures
- Hillsborough County Parcels
- Shadow Run Dam 100-year storm (dam break)
- 1.5 (typical) - flood depth in feet above ground at structures.

Notes

Florida Department of Environmental Protection

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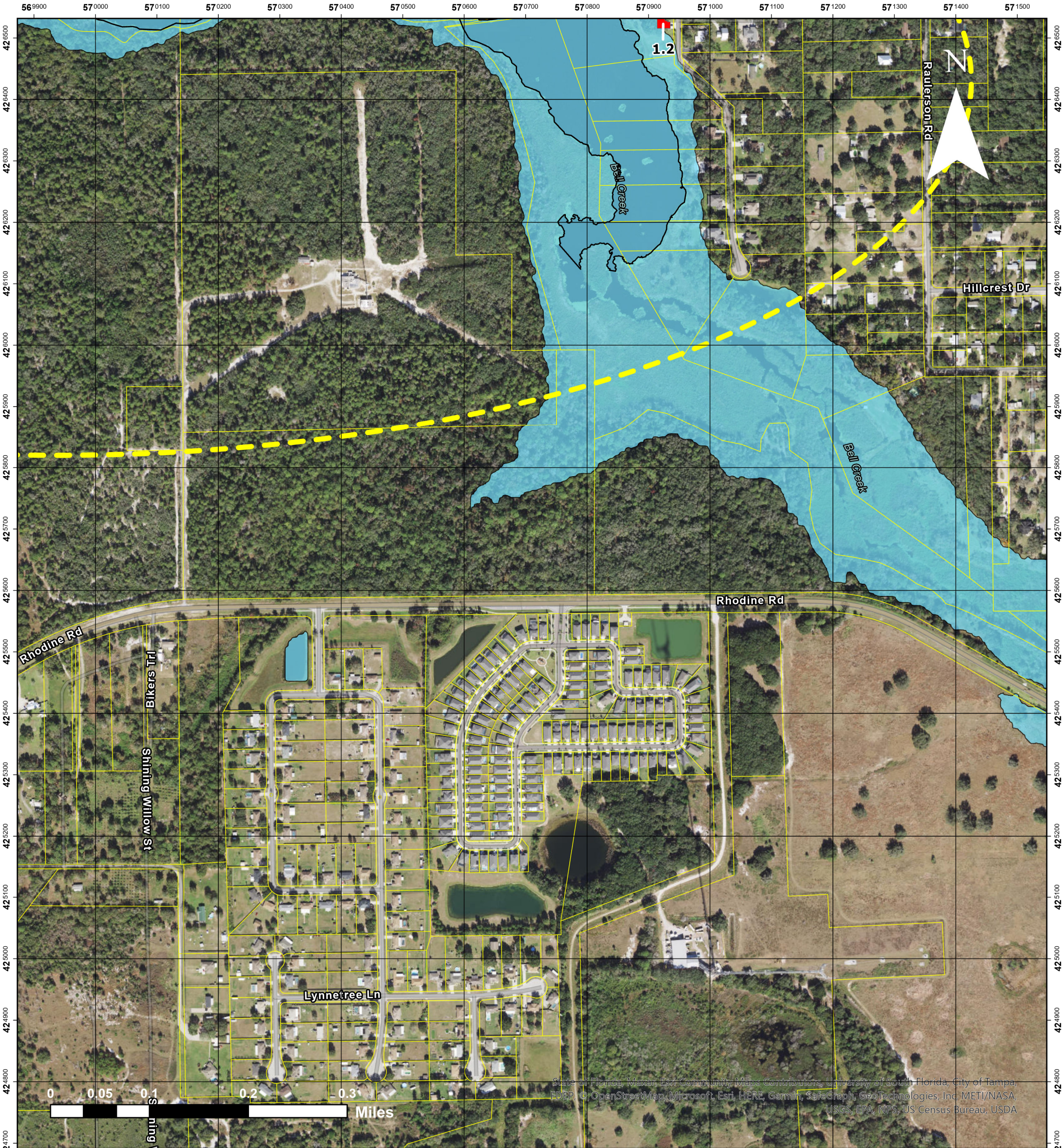

Project

Inundation Modeling and Mapping for Shadow Run Dam

Flooded Parcels near Homes During 100 year Dam Break

Date	Drawn	Scale
08.11.22	TC/MC	1:6,000

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 24 - A6

Legend

- Lake Grady location
- Received shoreline
- Inundated structures
- Hillsborough County Parcels
- Shadow Run Dam 100-year storm (dam break)
- 1.5 (typical) - flood depth in feet above ground at structures.

Notes

Florida Department of Environmental Protection

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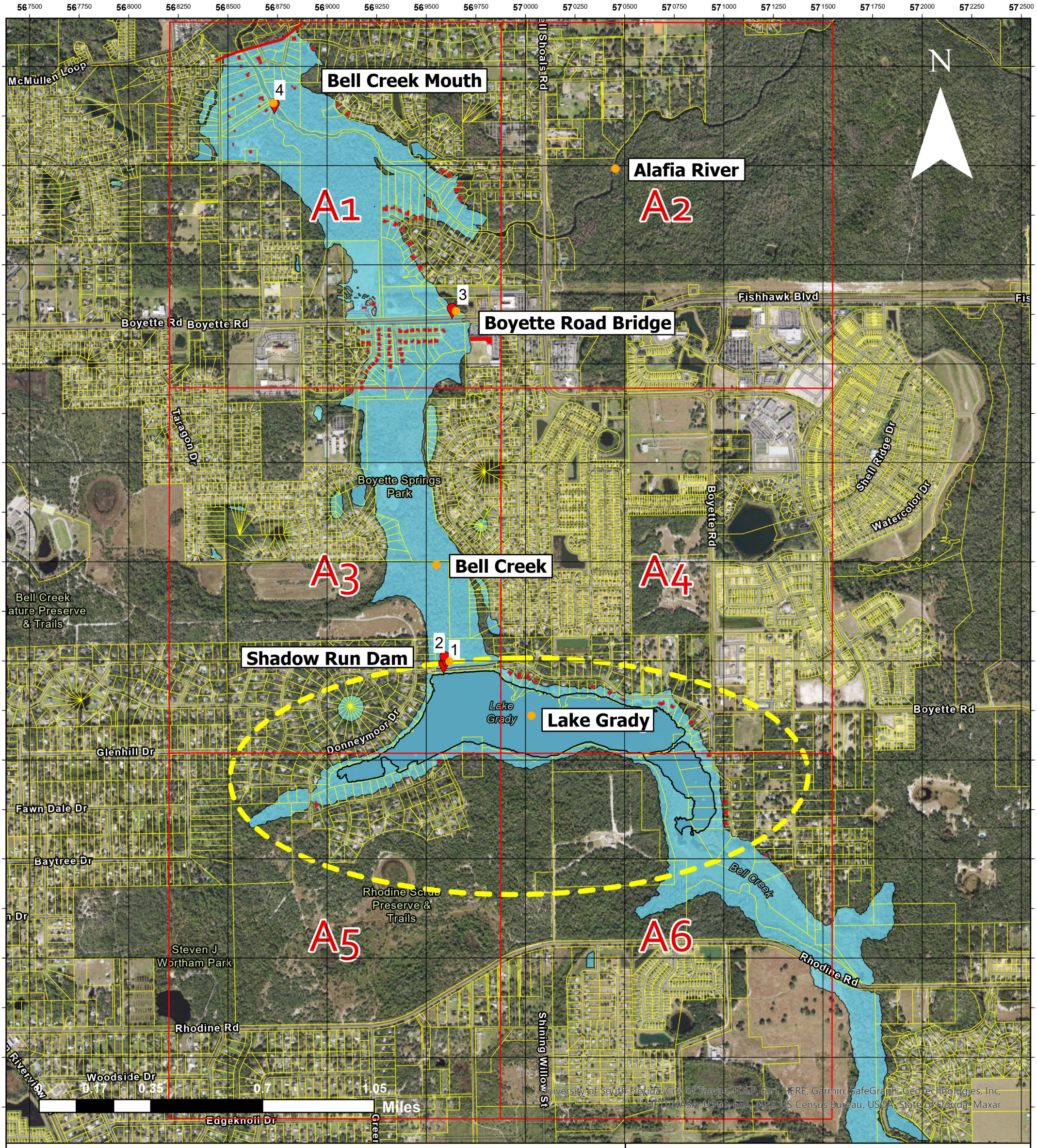

Project

Inundation Modeling and Mapping for Shadow Run Dam

Flooded Parcels near Homes During ½ PMP Dam Break

Date	Drawn	Scale
08.11.22	TC/MC	1:18,500

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 25

Legend

- Flood modeling points of interest
- Study limit
- Panel Index
- Lake Grady location
- Received shoreline
- Inundated structures
- Hillsborough County Parcels
- Shadow Run Dam half-PMP event (dam break)

Notes

Florida Department of Environmental Protection

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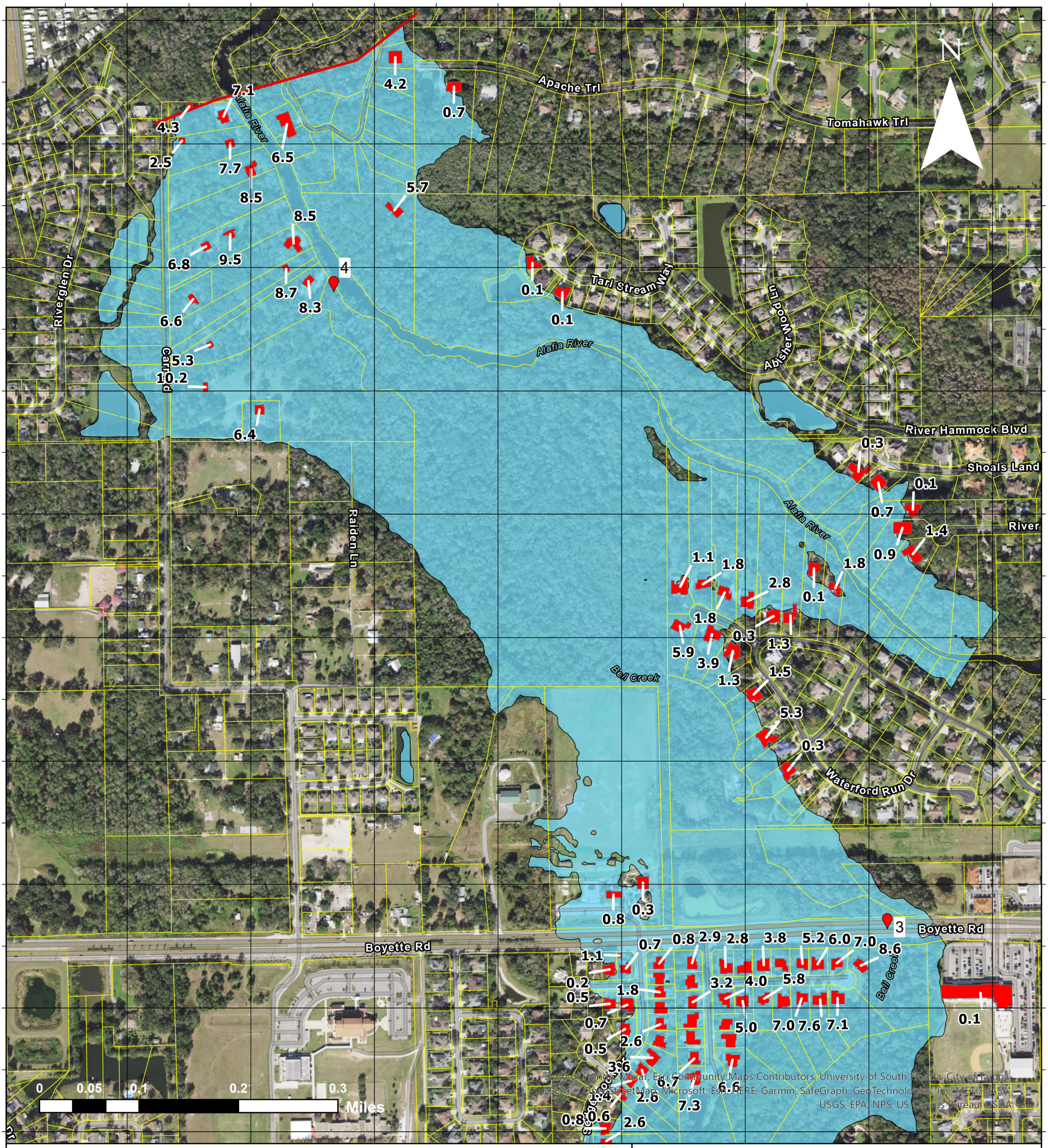

Project

Inundation Modeling and Mapping for Shadow Run Dam

Flooded Parcels near Homes During ½ PMP Dam Break

Date	Drawn	Scale
08.11.22	TC/MC	1:6,000

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 25 - A1

Legend

- Flood modeling points of interest
- Study limit
- Inundated structures
- Hillsborough County Parcels
- Shadow Run Dam half PMP event (dam break)
- 1.5 (typical) - flood depth in feet above ground at structures.

Notes

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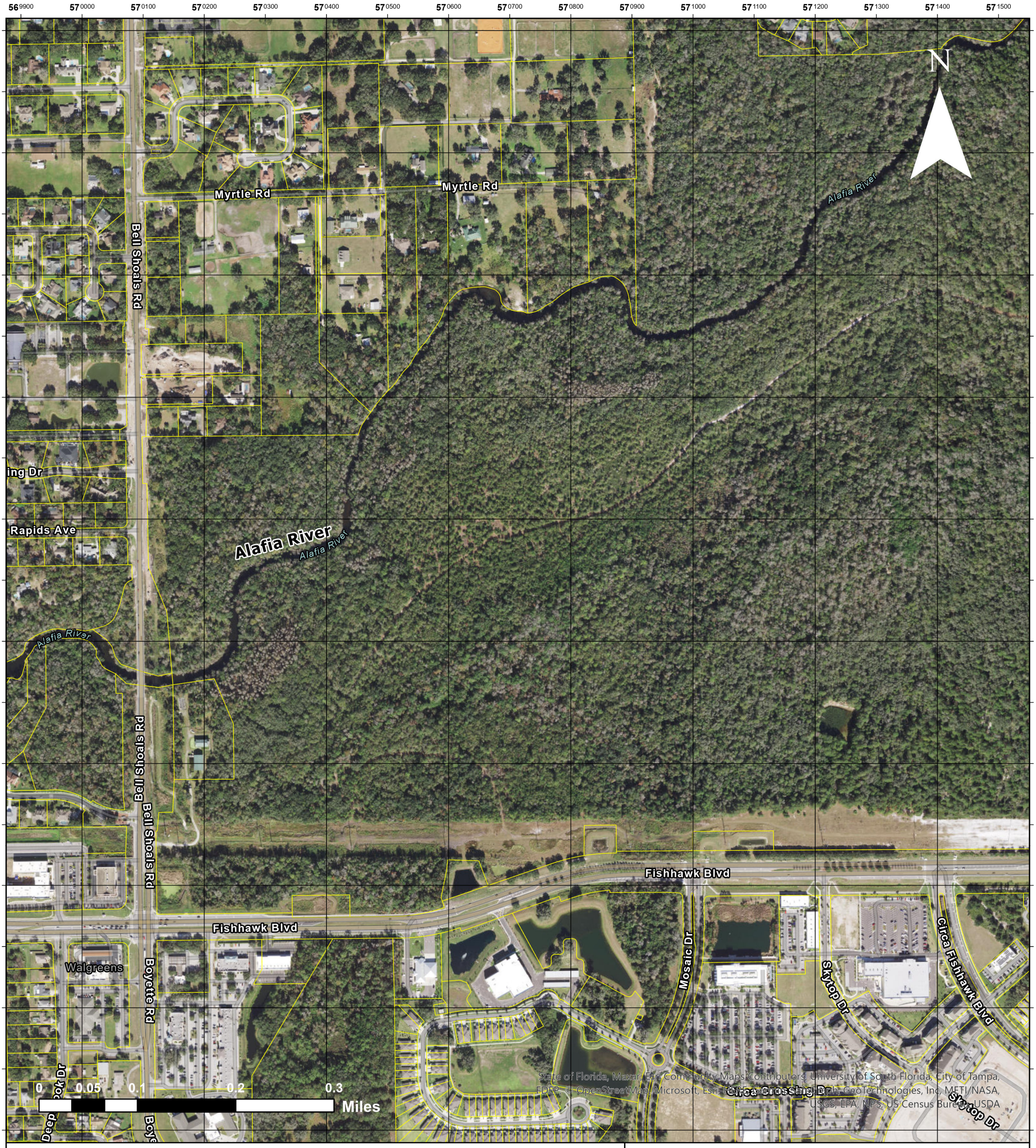

Project

Inundation Modeling and Mapping for Shadow Run Dam

Flooded Parcels near Homes During ½ PMP Dam Break

Date	Drawn	Scale
08.11.22	TC/MC	1:6,000

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 25 - A2

Legend

- Hillsborough County Parcels
- 1.5 (typical) - flood depth in feet above ground at structures.

Notes

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Inundation Modeling and Mapping for Shadow Run Dam

Flooded Parcels near Homes During ½ PMP Dam Break

Date	Drawn	Scale
08.11.22	TC/MC	1:6,000

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 25 - A3

Legend

- Flood modeling points of interest
- Lake Grady location
- Received shoreline
- Inundated structures
- Hillsborough County Parcels
- Shadow Run Dam half PMP event (dam break)
- 1.5 (typical) - flood depth in feet above ground at structures.

Notes

Florida Department of Environmental Protection

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Project

Inundation Modeling and Mapping for Shadow Run Dam

Flooded Parcels near Homes During ½ PMP Dam Break

Date	Drawn	Scale
08.11.22	TC/MC	1:6,000

Legend

- Lake Grady location
- Received shoreline
- Inundated structures
- Hillsborough County Parcels
- Shadow Run Dam half PMP event (dam break)
- 1.5 (typical) - flood depth in feet above ground at structures.

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 25 - A4

Notes

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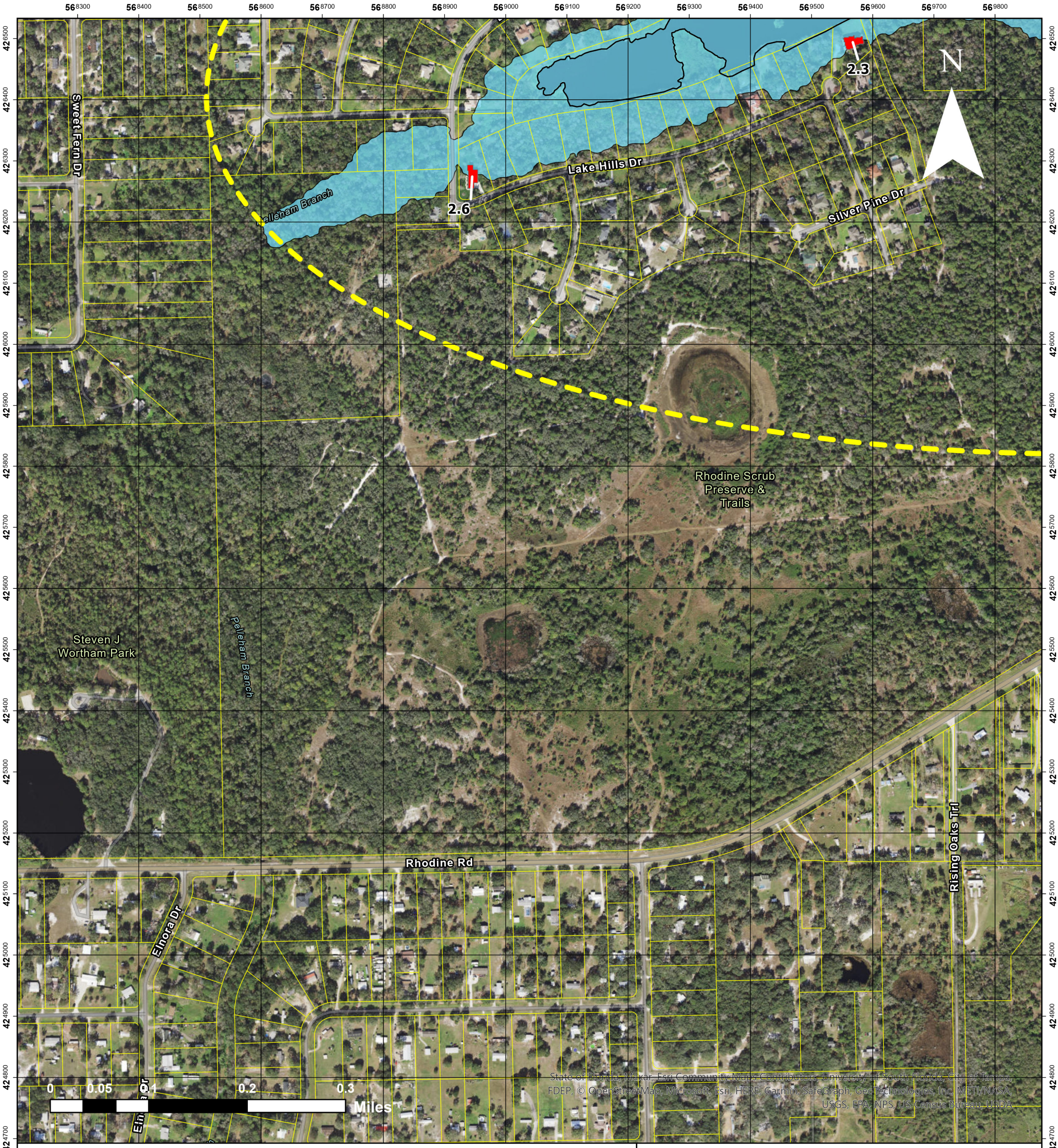

Project

Inundation Modeling and Mapping for Shadow Run Dam

Flooded Parcels near Homes During ½ PMP Dam Break

Date	Drawn	Scale
08.11.22	TC/MC	1:6,000

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 25 - A5

Legend

- Lake Grady location
- Received shoreline
- Inundated structures
- Hillsborough County Parcels
- Shadow Run Dam half PMP event (dam break)
- 1.5 (typical) - flood depth in feet above ground at structures.

Notes

Florida Department of Environmental Protection

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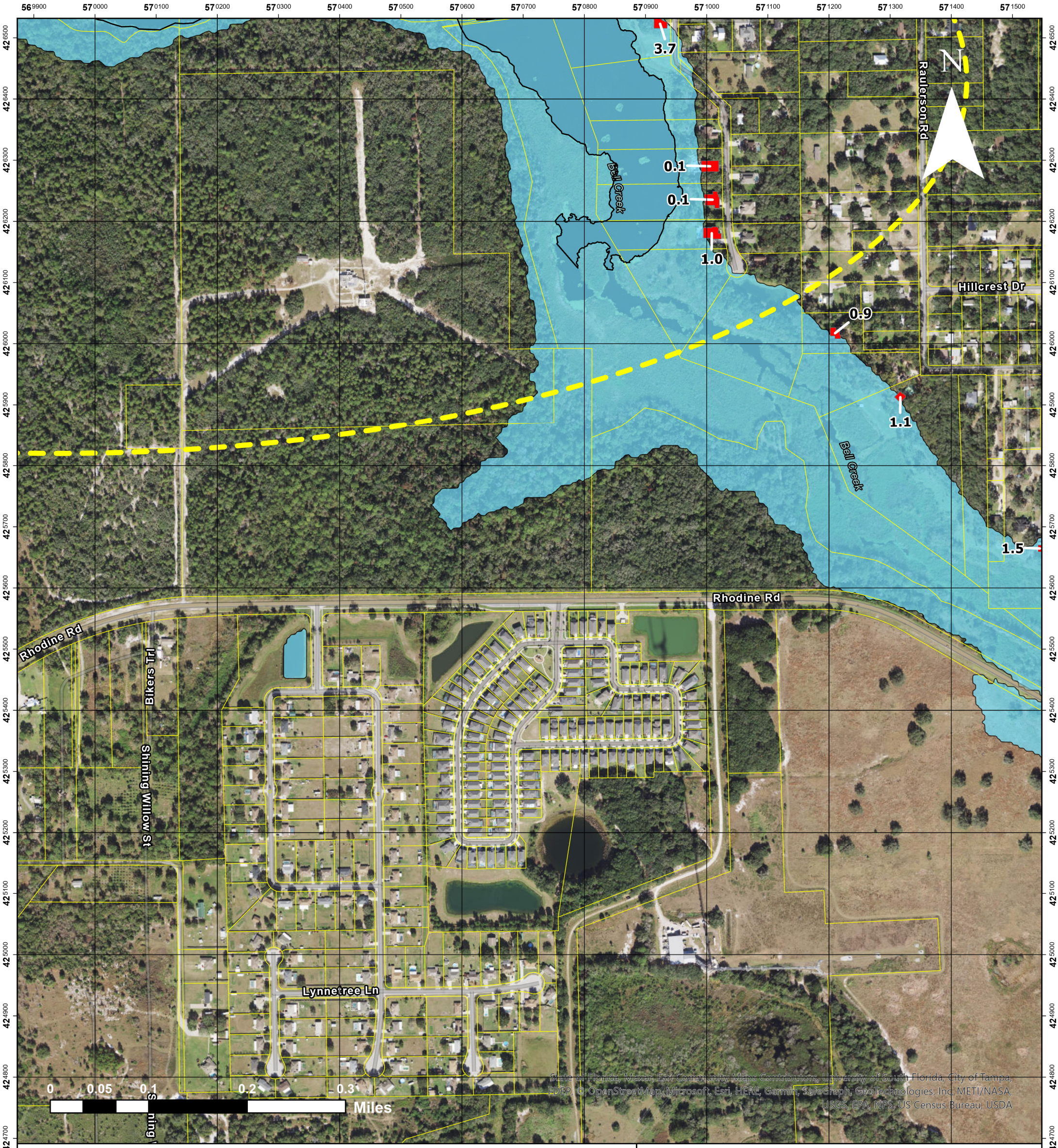

Project

Inundation Modeling and Mapping for Shadow Run Dam

Flooded Parcels near Homes During ½ PMP Dam Break

Date	Drawn	Scale
08.11.22	TC/MC	1:6,000

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 25 - A6

Legend

- Lake Grady location
- Received shoreline
- Inundated structures
- Hillsborough County Parcels
- Shadow Run Dam half PMP event (dam break)
- 1.5 (typical) - flood depth in feet above ground at structures.

Notes

Florida Department of Environmental Protection

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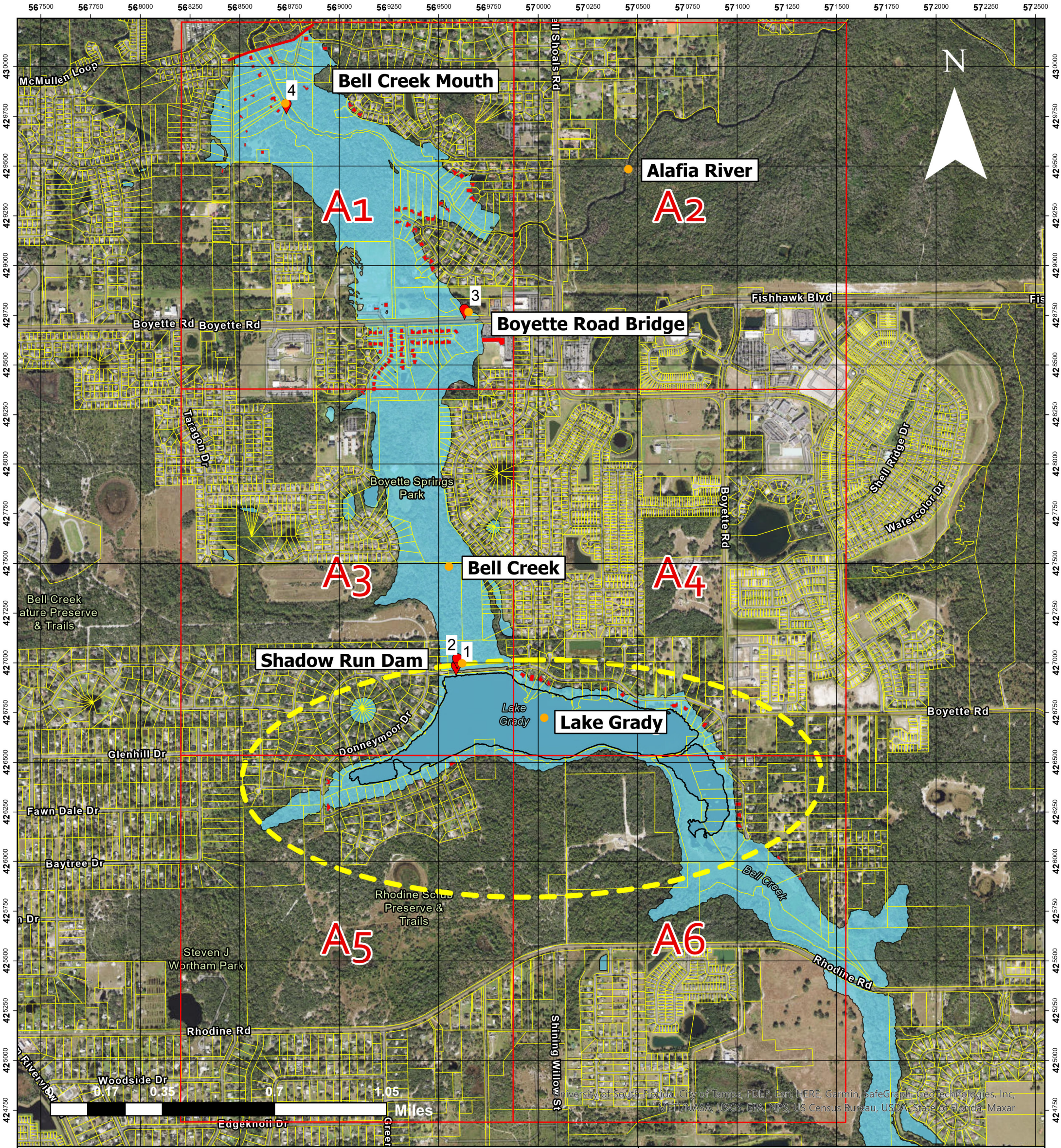

Project

Inundation Modeling and Mapping for Shadow Run Dam

Flooded Parcels near Homes During PMP Dam Break

Date	Drawn	Scale
08.11.22	TC/MC	1:18,500

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 26

Legend

- Flood modeling points of interest
- Study limit
- Panel Index
- Lake Grady location
- Received shoreline
- Inundated structures
- Hillsborough County Parcels
- Shadow Run Dam PMP event (dam break)

Notes

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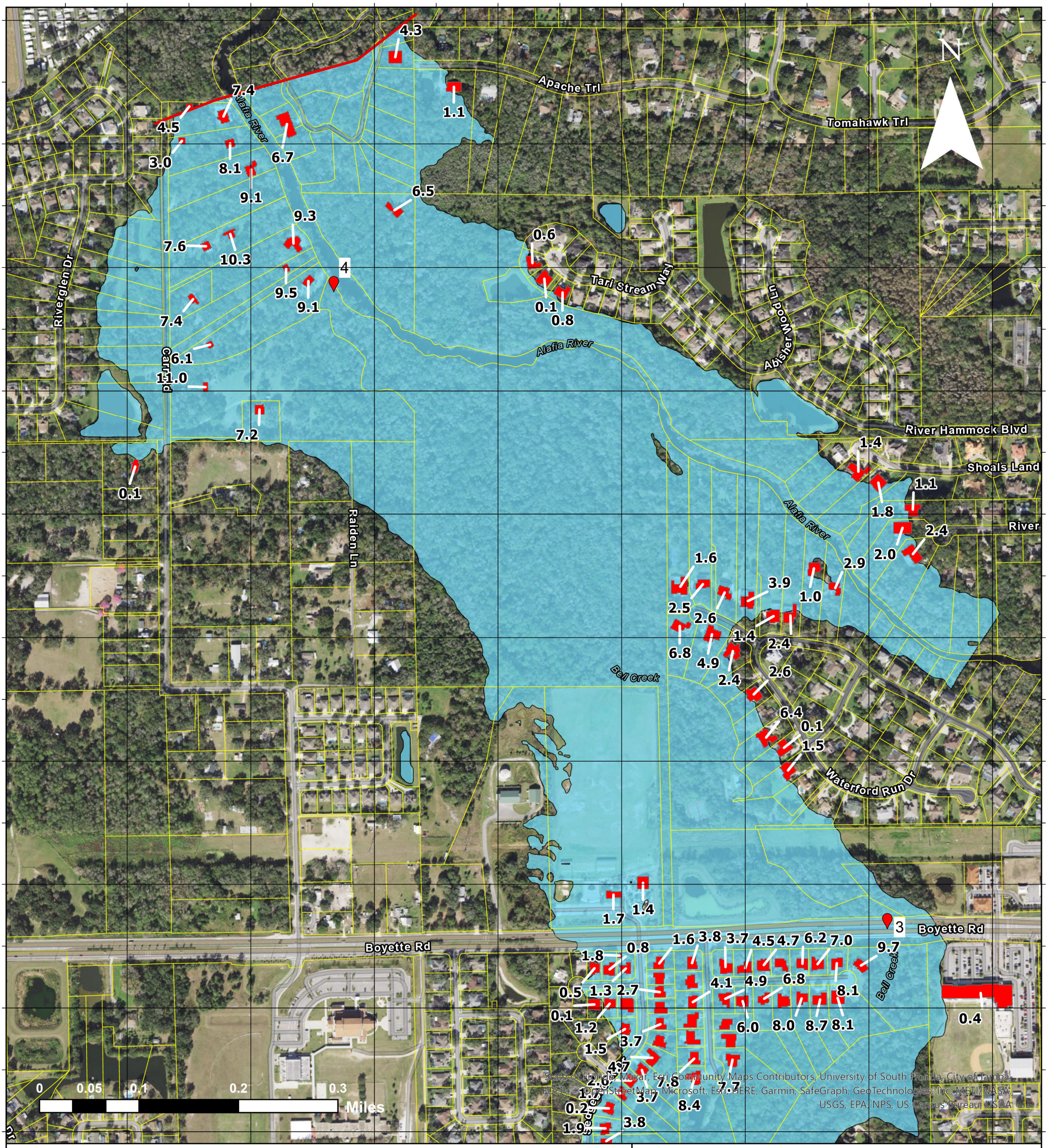

Project

Inundation Modeling and Mapping for Shadow Run Dam

Flooded Parcels near Homes During PMP Dam Break

Date	Drawn	Scale
08.11.22	TC/MC	1:6,000

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 26 - A1

Legend

- Flood modeling points of interest
- Study limit
- Inundated structures
- Hillsborough County Parcels
- Shadow Run Dam PMP event (dam break)
- 1.5 (typical) - flood depth in feet above ground at structures.

Notes

Florida Department of Environmental Protection

Division of Water Resource Management

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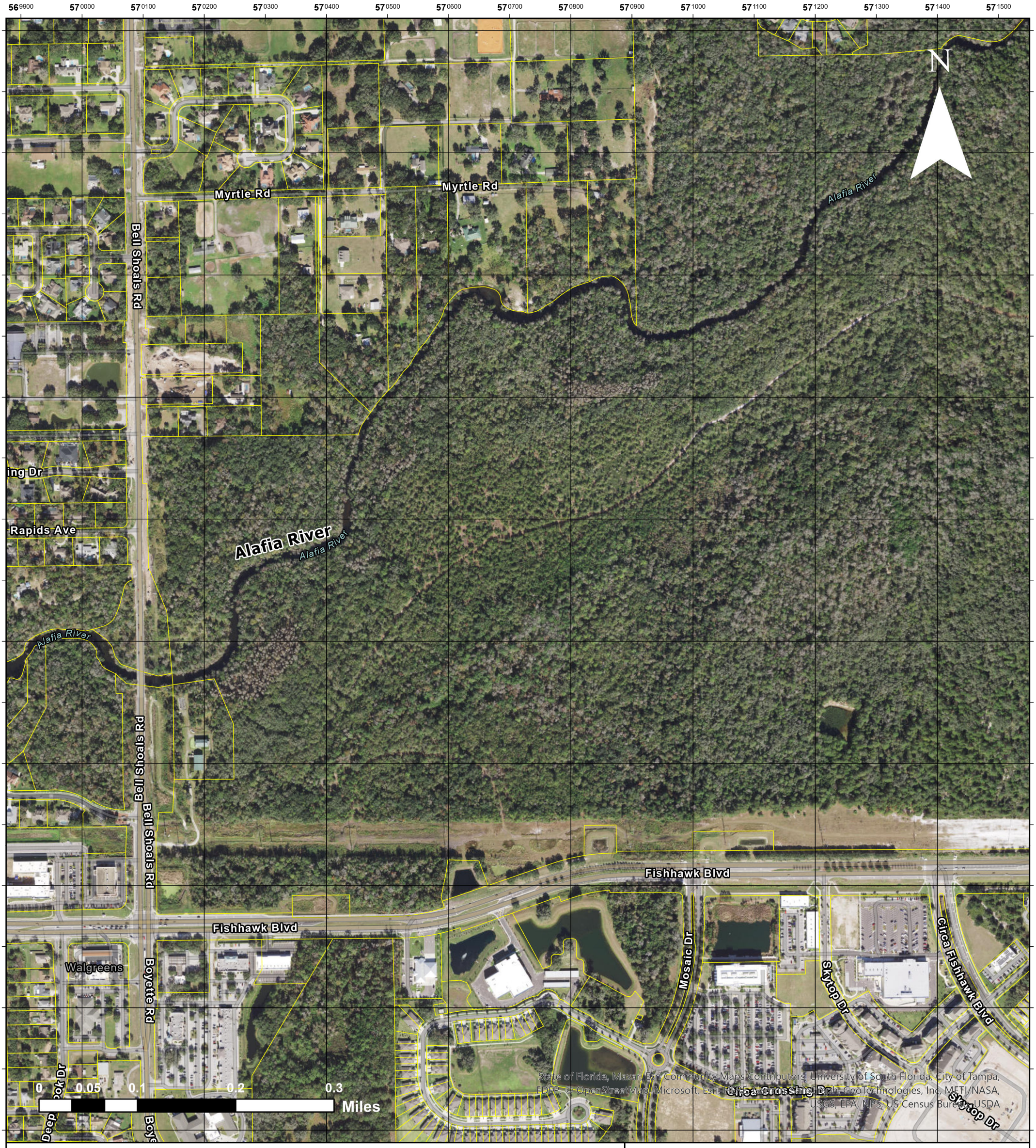

Project

Inundation Modeling and Mapping for Shadow Run Dam

Flooded Parcels near Homes During PMP Dam Break

Date	Drawn	Scale
08.11.22	TC/MC	1:6,000

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 26 - A2

Legend

- Hillsborough County Parcels
- 1.5 (typical) - flood depth in feet above ground at structures.

Notes

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Project

Inundation Modeling and Mapping for Shadow Run Dam

Flooded Parcels near Homes During PMP Dam Break

Date	Drawn	Scale
08.11.22	TC/MC	1:6,000

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 26 - A3

Legend

- Flood modeling points of interest
- Lake Grady location
- Received shoreline
- Inundated structures
- Hillsborough County Parcels
- Shadow Run Dam PMP event (dam break)
- 1.5 (typical) - flood depth in feet above ground at structures.

Notes

Florida Department of Environmental Protection

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Project

Inundation Modeling and Mapping for Shadow Run Dam

Flooded Parcels near Homes During PMP Dam Break

Date	Drawn	Scale
08.11.22	TC/MC	1:6,000

Legend

- Lake Grady location
- Received shoreline
- Inundated structures
- Hillsborough County Parcels
- Shadow Run Dam PMP event (dam break)
- 1.5 (typical) - flood depth in feet above ground at structures.

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 26 - A4

Notes

Florida Department of Environmental Protection

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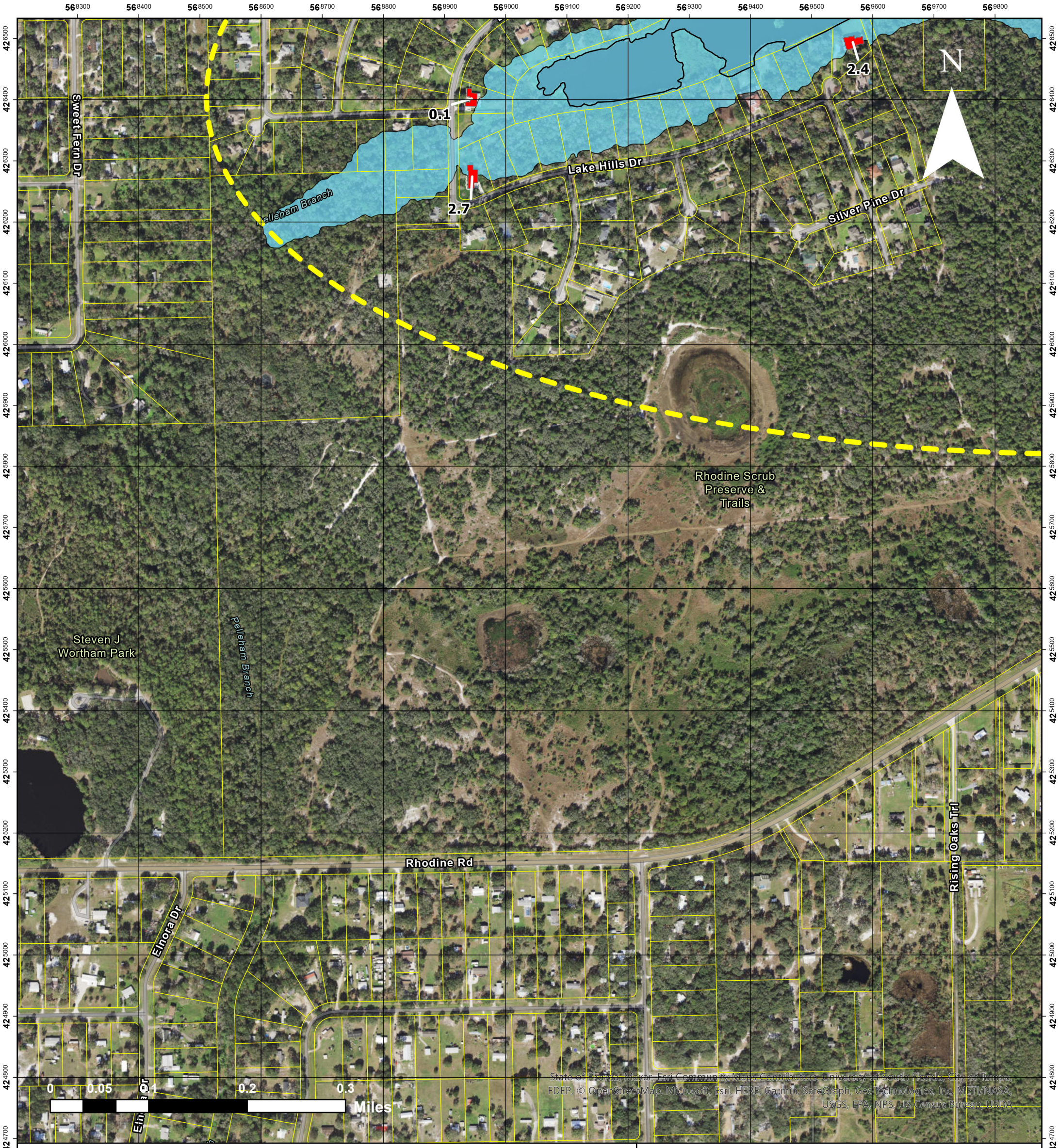

Project

Inundation Modeling and Mapping for Shadow Run Dam

Flooded Parcels near Homes During PMP Dam Break

Date	Drawn	Scale
08.11.22	TC/MC	1:6,000

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 26 - A5

Legend

- Lake Grady location
- Received shoreline
- Inundated structures
- Hillsborough County Parcels
- Shadow Run Dam PMP event (dam break)
- 1.5 (typical) - flood depth in feet above ground at structures.

Notes

Florida Department of Environmental Protection

Division of Water Resource Management

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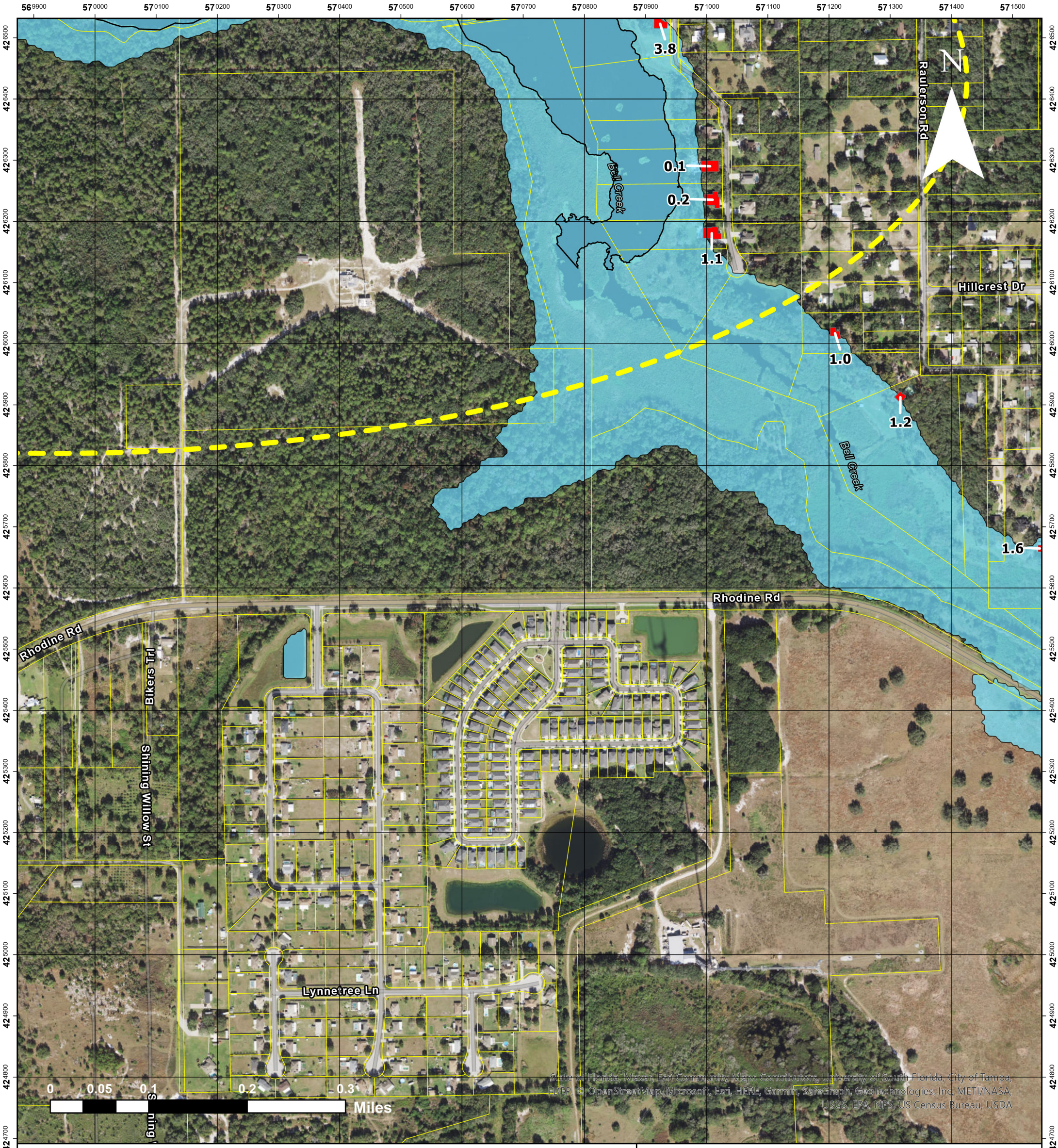

Project

Inundation Modeling and Mapping for Shadow Run Dam

Flooded Parcels near Homes During PMP Dam Break

Date	Drawn	Scale
08.11.22	TC/MC	1:6,000

Spatial Reference

Name: Albers Conical Equal Area
[Florida Geographic Data Library]

Drawing Ref:

Figure 26 - A6

Legend

- Lake Grady location
- Received shoreline
- Inundated structures
- Hillsborough County Parcels
- Shadow Run Dam PMP event (dam break)
- 1.5 (typical) - flood depth in feet above ground at structures.

Notes

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