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CA No. 5917

UPPER PENINSULA STORMWATER IMPROVEMENTS – EAST REGION

PRELIMINARY ENGINEERING REPORT

Submitted to:
Stormwater Engineering Division
Mobility Department
City of Tampa

W. Fountain Blvd Flooding at Parkland Estates (August 2015)

Contents

EXECUTIVE SUMMARY

UPPER PENINSULA STORMWATER IMPROVEMENTS – EAST REGION

Severe flooding has occurred in the Parkland Estates neighborhood, and in particular near West Fountain Boulevard and Audubon Avenue extending up to Swann Avenue in the City of Tampa (City) for decades. The problems experienced within the project area are created by several issues, not the least of which is that the area is a low-lying portion of the City, basically a bowl, which collects runoff from the surrounding commercial and residential areas. Limited outfall capacity makes the recovery of the area from rainfall events slow, and limited inlet capacity adds overland flow from areas which would normally not contribute runoff to the area. Reducing the depth, duration, and frequency of the flooding within the area without exacerbating problems downstream has been a challenge.

The City has been seeking solutions to this problem for many years, but has continuously struggled to find a feasible and realistic alternative that provides project benefits commensurate with the significant associated costs. The recent discovery of some over 40-year old as-built information has been a revelation for City staff. This as-built information identified existing infrastructure that, while dictating the necessary location of a substantial portion of the recommended alternative, relieved several of the most significant time delays and cost concerns related to all proposed alternatives. More importantly, the size and location of the existing infrastructure discovered allows for the proposed recommendation to not only address the issues that initiated the project but also address other flooding areas along the proposed route. Incorporating other currently planned City improvements and addressing identified deficiencies along the corridor can also be accomplished. The potential for the project to address future drainage requirements and known concerns from the Tampa Hillsborough Expressway Authority (THEA) related to their long-range plans is an additional benefit. All these items further the Transforming Tampa's Tomorrow initiative and provide opportunities that align with Resilient Tampa.

The recommended alternative in this Preliminary Engineering Report (PER) is regional in nature and is expected to qualify for cooperative funding from the Southwest Florida Water Management District. Moreover, the possibility of THEA contributing to the project in order to utilize the new outfall for their future widening projects gives the City the best possible return on their investment, all while meeting the design level of service at the specified problem location.

This report provides background information on the problem and its causes. More importantly, this report details the comprehensive efforts and exhaustive analyses undertaken by the City over many years. Pertinent details from each of the many previous studies are contained herein along with a description of the flooding relief and potential benefits associated with the final selected alternative.

INTRODUCTION

BACKGROUND AND PURPOSE

Flooding occurs in portions of seven different neighborhoods in the watershed, including the Parkland Estates, Palma Ceia Pines, South Howard, New Suburb Beautiful, Historic Hyde Park, Palma Ceia, and Bayshore Gardens, but primarily near West Fountain Boulevard and Audubon Avenue extending up to Swann Avenue in the City of Tampa (City). Limited outfall capacity was identified as the primary cause for this flooding.

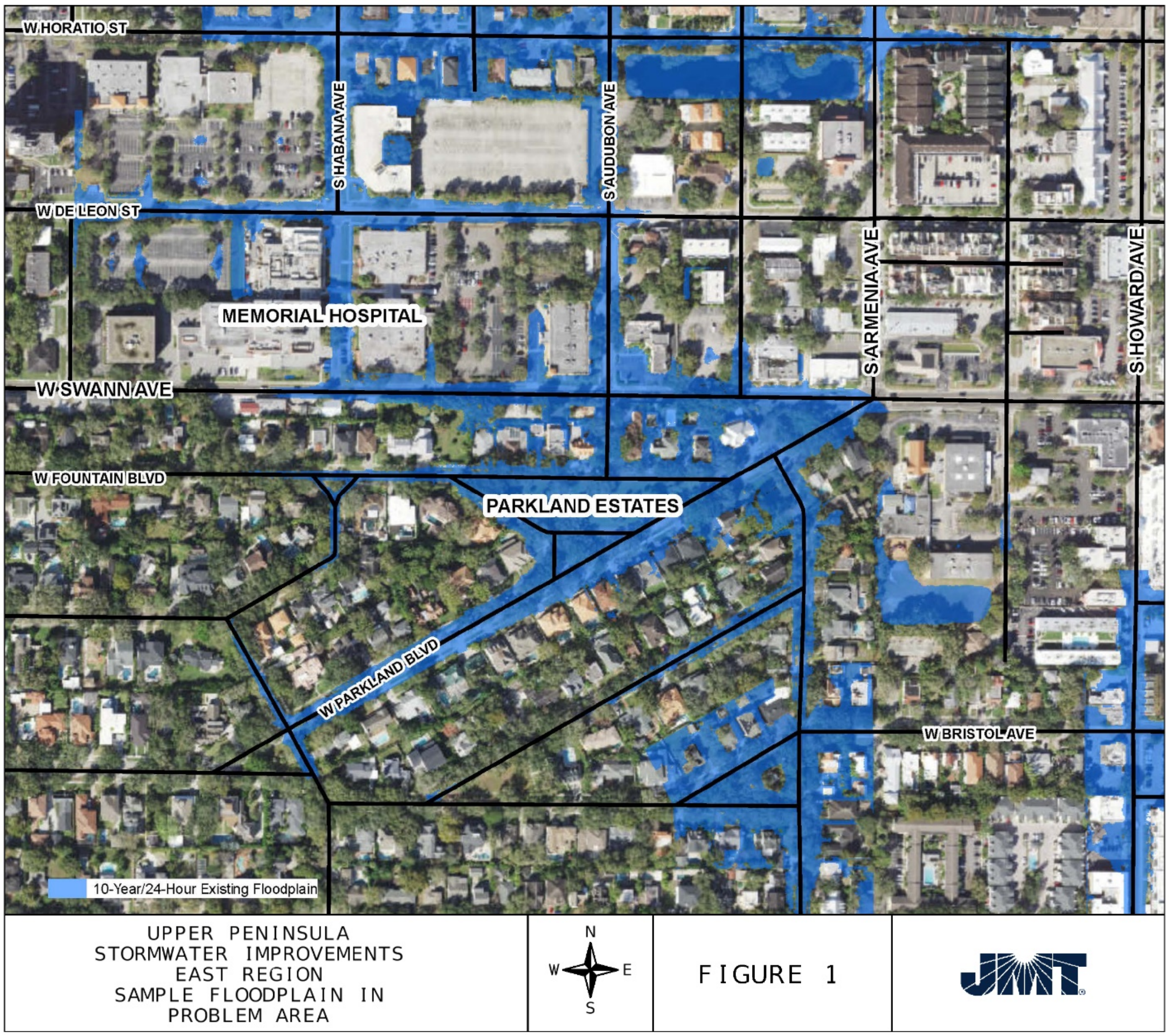
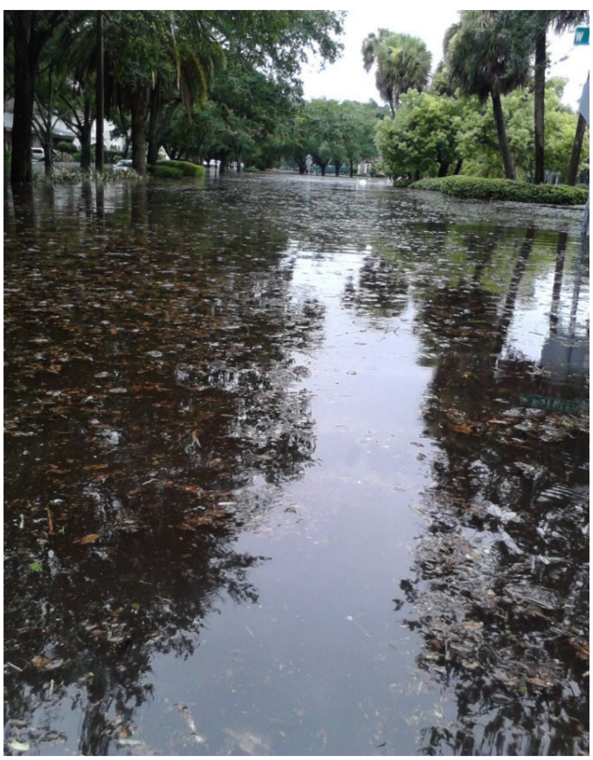


Figure 1: Sample Floodplain in Problem Area

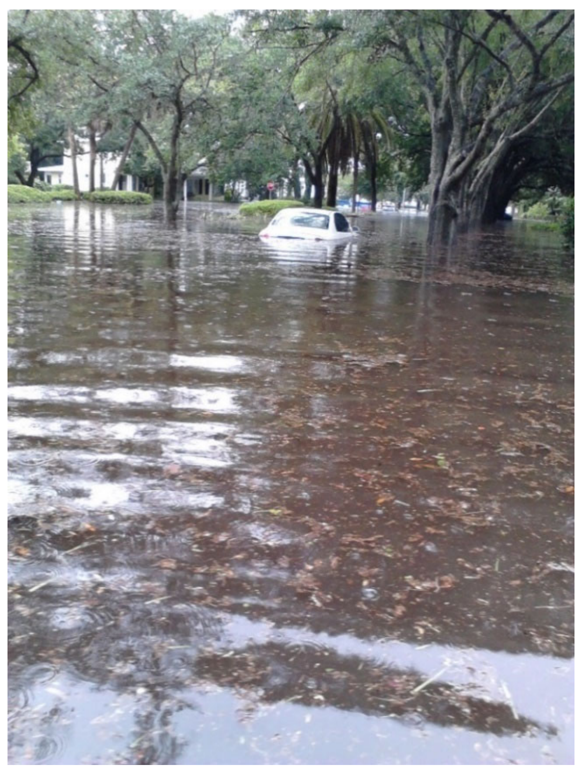
The inadequate capacity of the storm pipe system near West Fountain Boulevard, Audubon Avenue, and Swann Avenue results in frequent flooding of homes and the roadways. Memorial Hospital, location shown in Figure 1, frequently has ambulances and other emergency vehicles stall out in the resulting floodwaters. The next several pages show photographs documenting the problem.

Home on W. Fountain Blvd, Parkland Estates (August 2015)

Water 4' deep at street level, W. Fountain Blvd (August 2015)



W. Fountain Blvd flooding at Parkland Estates (August 2015)



W. Fountain Blvd flooding at Parkland Estates (August 2015)

S. Howard Ave near W. Bristol Ave (September 2016)

W. Fountain Blvd flooding at Parkland Estates (June 2017)

W. Swann Ave near S. Audubon Ave (June 2017)

W. Swann Ave at Memorial Hospital Diagnostic Center (June 2021)

W. Swann Ave at W. Audubon Ave (April 2020)

These photographs provide documentary evidence of the necessity for this project. Residents and businesses in the neighborhoods have only seen the flooding become more severe and frequent over the years.

GENERAL CONDITIONS OF THE PROJECT AREA

Flooding conditions occur within the Parkland Estates, Palma Ceia Pines, South Howard, New Suburb Beautiful, Historic Hyde Park, Palma Ceia, and Bayshore Gardens neighborhoods. The drainage area is primarily residential but also includes commercial and institutional properties and is mostly developed. The drainage area likely to see the most significant benefits from the selected alternative is identified in Figure 2 and is approximately 260 acres. For the purposes of this PER, the focus is on this project drainage area and the runoff which contributes to the low-lying area of Parkland Estates. The project drainage area is roughly bounded by W. Kennedy Boulevard to the north, the Selmon Expressway and S. Howard Avenue to the east, S. MacDill Avenue to the west, and Hillsborough Bay to the south.

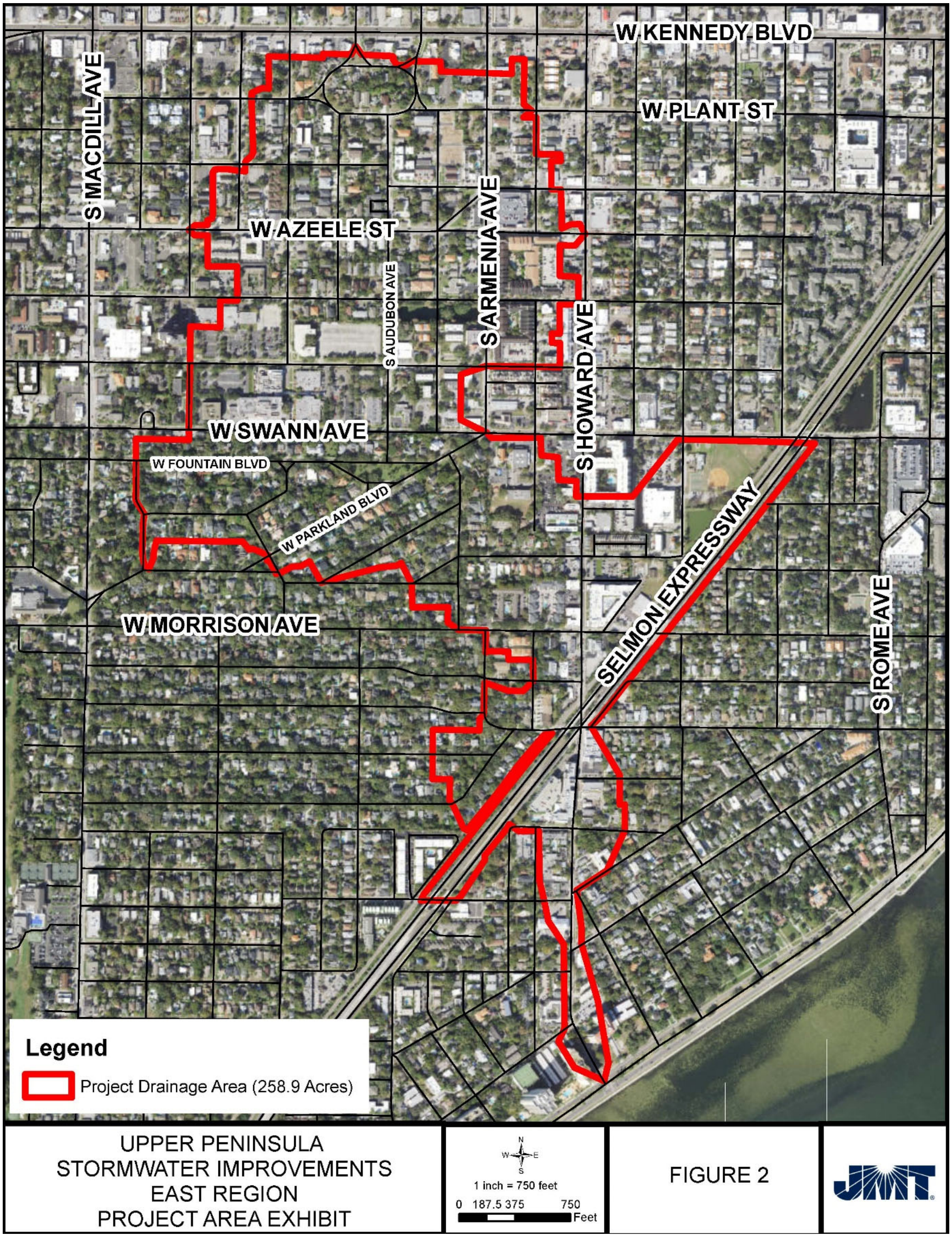


Figure 2: Project Drainage Area

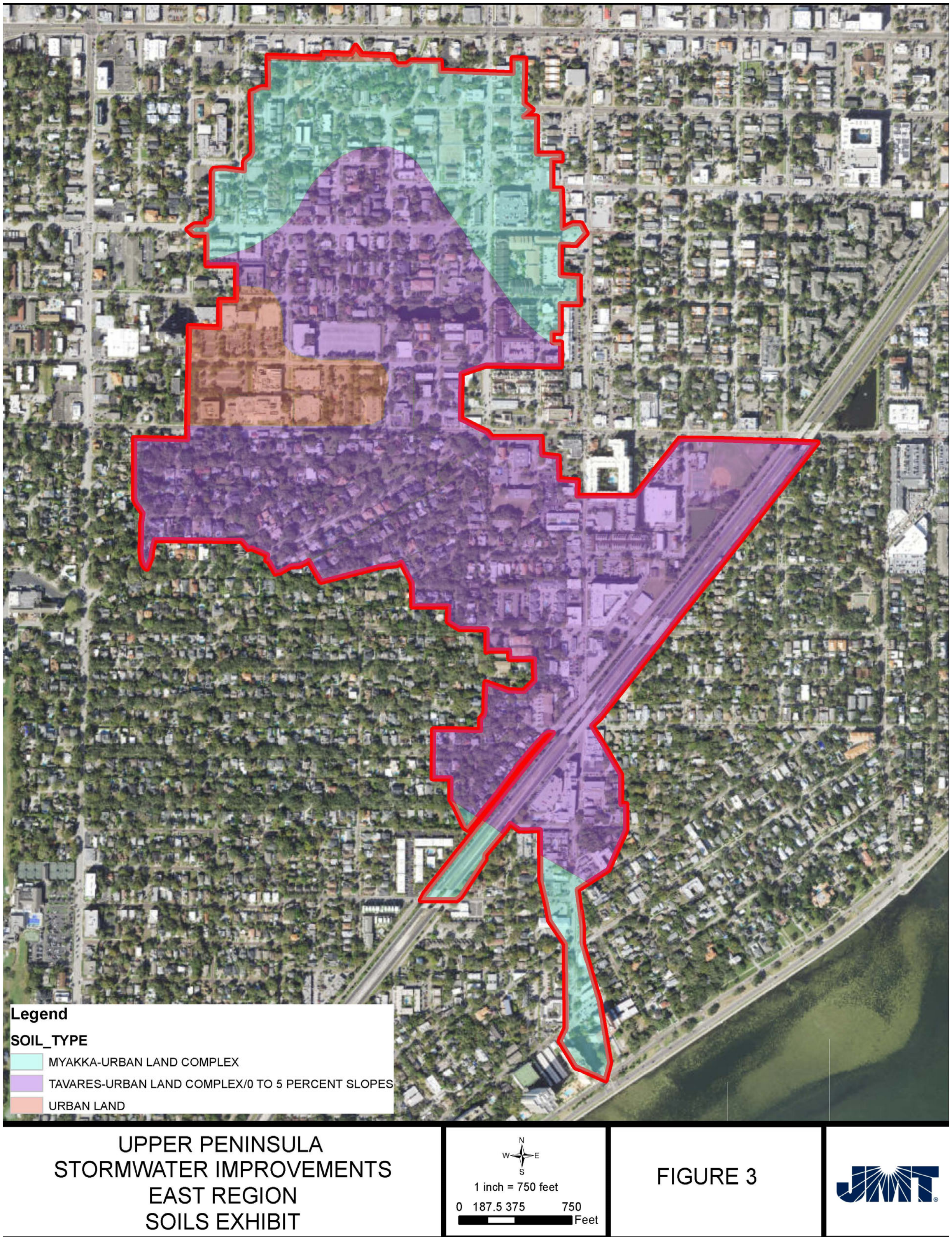


Figure 3: Project Area Soils Map

Figure 3 shows the soils in the project area are 39.3 percent Myakka-Urban land complex (hydrologic soil group A/D), 41.7 percent Tavares-Urban land complex (hydrologic soil group A), and soils in the remaining areas consist of Urban Land (a mixture of soil types with no parent material sometimes referred to as made lands).

There is little topographic relief in the low-lying portions of the project area with most slopes being 0.5 percent or less. Figure 4 depicts a "heat map" based upon 2017 LiDAR data where lighter colors reflect lower elevations. As can be seen in the figure, the flooding near W Fountain Boulevard, S Audubon Avenue, and W Swann Avenue is partly because that area is a low point in the drainage basin. Overland runoff that is not captured by storm sewers throughout the watershed flows to this location.

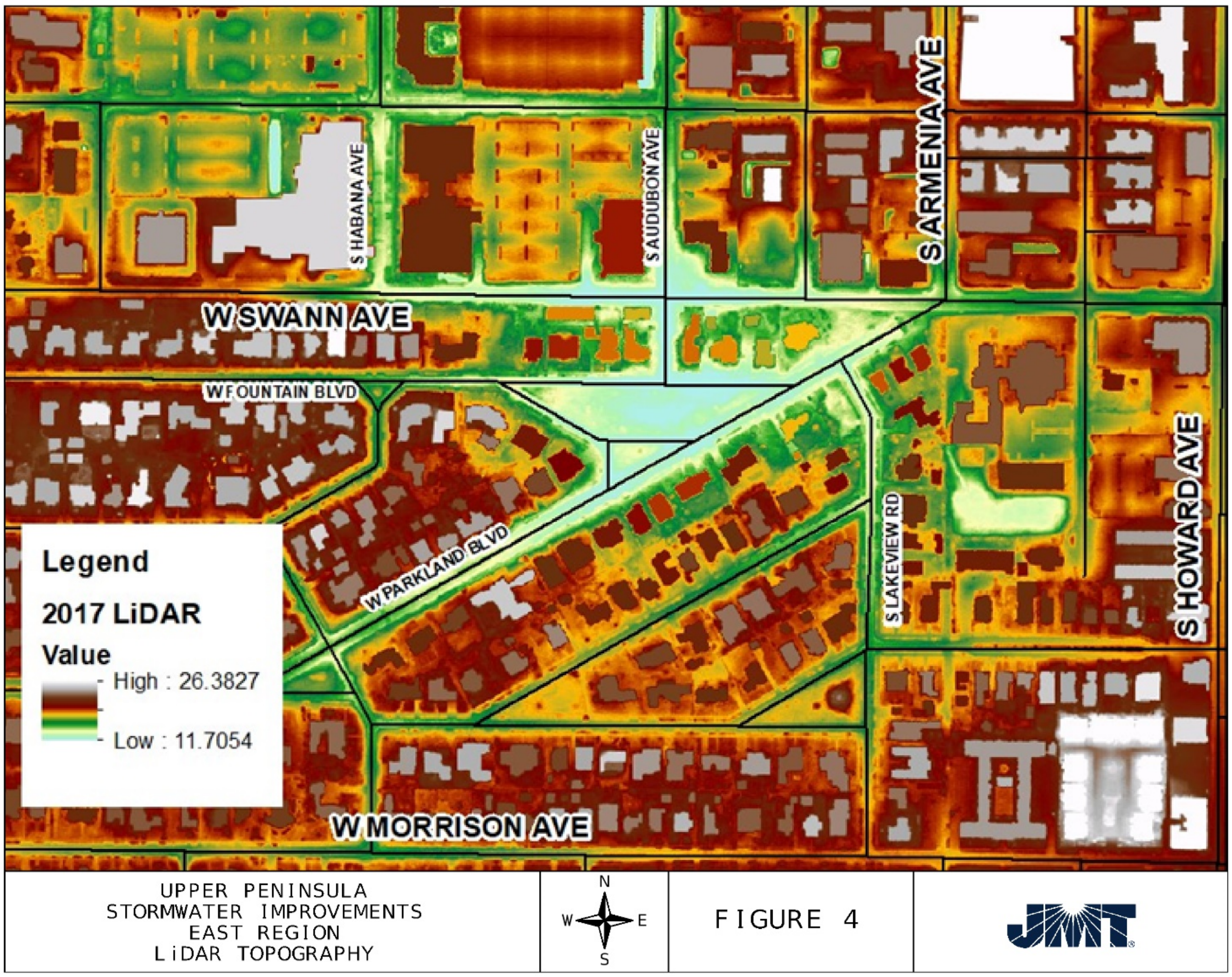


Figure 4: Topography

At W. Fountain Boulevard, inlet throat/rim elevations range from 15.7 feet, North American Vertical Datum of 1988 (NAVD), to 16.2 feet NAVD. Runoff from this area is currently conveyed by a 42-inch reinforced concrete pipe (RCP) to W. Parkland Boulevard where it joins a 36-inch RCP from the northeast and a 48x76-inch elliptical RCP from the southwest. Runoff is then conveyed south under Forest Drive, W.

Morrison Avenue, S. Marti Street, W. Neptune Street, S. Habana Avenue, and eventually to a Hillsborough Bay outlet near Rubideaux Street and the Fred Ball Park. The existing drainage network shown in Figure 5 is inadequate for addressing flooding along Swann Avenue, in Parkland Estates, and generally in the entire 500+ acre basin the system currently serves.

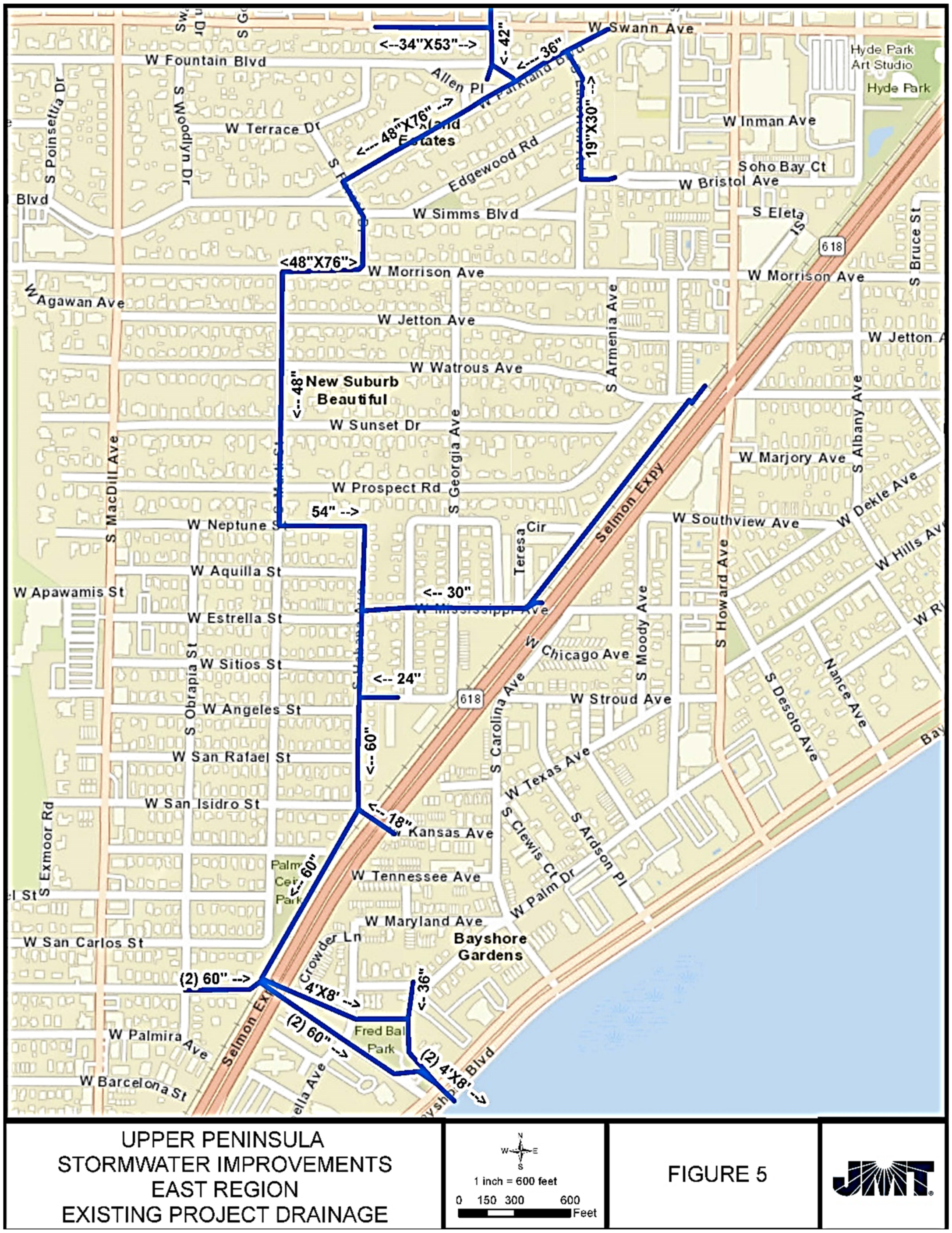


Figure 5: Existing Drainage Network

PRIOR STUDIES

As has been stated, the City has been seeking solutions to the identified flooding problem for many years. The existing primary drainage system connected to the area required analysis in order to explore solutions to the flooding problem. The City developed the Upper Peninsula Watershed Model to assist in this analysis. The Upper Peninsula Model covers a large portion of the City of Tampa and includes the existing outfall for the project area as shown in Figure 6. This existing XP-SWMM modeling was utilized as a starting point for all efforts described below.

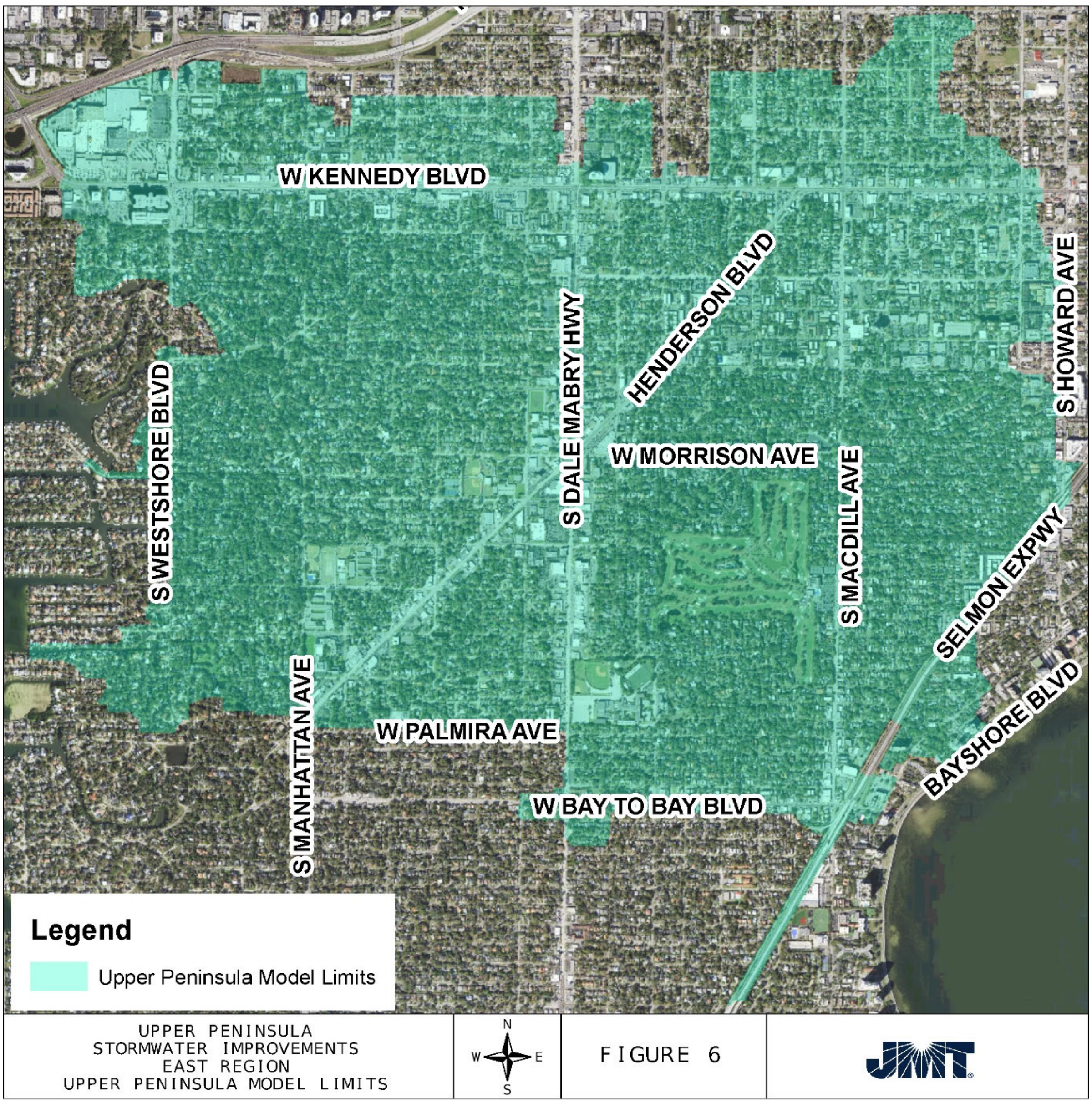


Figure 6: Limits of Upper Peninsula Model

Appendix A contains depictions for most of the various alternative routes described below. Some of the alternatives analyzed internally by the City do not include a specific exhibit, but a description is included.

1 – 2017 PARKLAND ESTATES DRAINAGE IMPROVEMENTS PRELIMINARY ENGINEERING REPORT (JMT – SEPTEMBER 2017)

This study reviewed the City's watershed model and updated it with project area specific field survey data. A total of eight alternatives were analyzed in this study with a target Level of Service (LOS) of no roadway flooding for the 5-year/24-hour design storm event on Swann Avenue, or at Audubon Avenue and W. Fountain Boulevard.

The eight alternatives contained in this study can be described as follows:

- The addition of a stormwater detention facility within the Parkland Estates area;
- Three gravity outfall storm sewer alignments analyzed both with and without a stormwater detention facility (for a total of 6 alternatives); and
- A pumping option.

Each alternative was analyzed for its respective project area benefits. The gravity and pump station solutions were analyzed in an iterative fashion to determine the smallest pipe/pump size which would meet the target LOS. The three alternative routes were evaluated against a set of established factors including costs, environmental factors, safety, constructability, property needs/issues, long range/area planning, and public input. This evaluation resulted in the selection of a preferred gravity alternative and route. (Note: The pump option was similar in cost to the gravity system but was ruled not viable as ongoing operation/maintenance and pump replacement costs would far exceed the maintenance costs for a gravity system.)

The recommended alternative included the addition of a storm sewer collection system along Swann Avenue which has since been constructed. However, implementation of the recommended alternative was not completed as the proposed stormwater system must cross the railroad tracks, the Selmon Expressway and an existing 48" sanitary force main in Bayshore Boulevard. Each of those crossings generate significant time and cost concerns with no definitive expectation of a satisfactory resolution. Considering the significant cost expenditures forecast, the City opted to explore further options and gather more detail on the issues affecting those costs.

2 – PARKLAND ESTATES FEASIBILITY STUDY (DEWBERRY – DECEMBER 2018)

This study modified the existing conditions modeling to include the stormwater improvements on Swann Avenue and further subdivided the model to include the existing stormwater inlets within West Parkland

Boulevard as new nodes to provide additional project-oriented detail. These revisions slightly reduced the predicted existing peak stages from the previous study.

The three gravity solutions from the previous report (Study 1), and the pumping option (each without the stormwater detention facility) were re-evaluated to reduce the required culvert sizes and maintain the same LOS as obtained previously. A fourth gravity route was also explored in this study.

Following an evaluation process matching that from Study 1, the preferred gravity alternative route from Study 1 again was chosen. This alternative was then compared in more detail to the pump alternative. Conceptual plans (not intended for construction) were generated to evaluate the potential construction costs, utility conflicts, and overall feasibility of each alternative.

This study looked at transportation impacts, business and residential impacts, utility impacts, and tree impacts associated with each alternative. In addition to the fact that the proposed stormwater system still must cross the railroad tracks, the Selmon Expressway, and the existing 48” sanitary force main in Bayshore Boulevard, this study identified high impacts on existing landscaping and trees along portions of the recommended route. The City again opted to explore other options.

3 – INTERNAL ANALYSES (CITY OF TAMPA – JANUARY 2019 TO AUGUST 2020)

The City, internally, looked at multiple options to provide relief to the Parkland Estates area. Upstream of the project area, the existing weir structure at ‘Zom Pond’ (located on W. Horatio Street between S. Audubon Avenue and S. Armenia Avenue) was analyzed for alteration. Modeling results, however, demonstrated no significant impact on flood stages in the Parkland Estates area. Redirection of some upstream flows into the existing Cleveland Street drainage basin were investigated and discarded due to numerous existing flooding conditions downstream in that system.

Baslee Engineering Services, Inc. (BES) was engaged by the city to prepare conceptual plans for an additional gravity outfall route from Lakeview to Morrison to Georgia to Mississippi to Moody to Stroud to Howard to Hillsborough Bay. These conceptual plans were analyzed by the City similarly to Study 2. Again, the proposed problematic crossings still were necessary, and this route also yielded Grand Tree impacts and generated new construction related concerns due to the narrow right-of-way (ROW) along the corridor.

Upgrades to the existing Parkland Estates system downstream and south of the Morrison/Marti intersection, such as parallel pipes, upsized pipes, and outfall improvements were considered. These options did not yield sufficient relief at Parkland Estates commensurate with the anticipated construction costs. The noted limited ROW, tree, traffic, and utility impacts plus issues crossing the Selmon Expressway were also factors.

A parallel 60-inch pipe along the eastern boundary of the Palma Ceia Park and adjacent to the Selmon Expressway was explored but yielded adverse downstream impacts and limited peak flood stage reduction at Parkland Estates.

Weir adjustments in the junction chamber on the west side of the Selmon Expressway and upstream of the existing Rubideaux outfall were considered. Similar to the parallel 60-inch pipe discussed previously, adverse downstream impacts and limited peak flood stage reduction at Parkland Estates discounted this option.

Pump station options of pumping to the existing system at the Marti/Morrison intersection or pumping to the existing Swann Pond basin on Rome Avenue were also analyzed. Again, adverse downstream impacts discounted these options as well.

4 – CITY ALTERNATIVES REVISITED (JMT – AUGUST 2020)

JMT was re-engaged in August of 2020 to explore further possibilities that could benefit the overall system.

Initial alternative analysis efforts began with a focus on the City's alternative (Study 3) of providing a parallel 60-inch RCP gravity storm sewer system starting at the intersection of S. Marti Street and W. Morrison Avenue heading south to W. Neptune Street, east to S. Habana Avenue, and then south to the Selmon Expressway. Multiple variations on this concept were analyzed, including the addition of a flap gate to eliminate backflow in the existing closed conduit system along W. Parkland Boulevard near S. Forest Drive, changing the parallel systems termination point along the Selmon Expressway to mitigate adverse downstream impacts, and other modifications to the existing system along the route similar to many the City had envisioned with their previous alternatives. Ultimately, as in the City's analysis (Study 3), limited relief at Parkland Estates, unreasonably high costs, limited ROW, tree, traffic, and utility impacts plus the problematic crossings associated with the construction of these systems continued to adversely affect their feasibility. Additionally, attempts to resolve localized flooding concerns along the route(s) served to increase the associated costs and diminish the relief provided in the Parkland Estates area.

5 – STORMWATER PUMPING STATION AND FORCE MAIN (JMT – MARCH 2021)

Following review of the previous studies and discussions with the City, JMT then began an earnest analysis of a pumping alternative with a wet well in the park located immediately south of the flooding area along W. Fountain Boulevard and a force main from there to Hillsborough Bay. While the construction of this force main alternative would still generate many of the same issues plaguing the gravity solutions, doing nothing was simply not an option. The City made the conscious decision at this point to accept the additional operation and maintenance costs associated with the pumping alternative, since the most significant issues associated with the construction would be mitigated by the smaller conduit size and available construction methods. In order not to expend monies evaluating another route, the gravity alternative route for which construction plans had been previously prepared by BES (Study 3), from W. Fountain Boulevard, east to W. Parkland Boulevard, north to S. Lakeview Road, south to W. Morrison Avenue, east to S. Georgia Avenue, south to W. Mississippi Avenue, east to S. Moody Avenue, south to W. Stroud Avenue, east to S. Howard Avenue, and south to Hillsborough Bay was utilized to determine force main length.

The footprint of the Parkland Estates park was reviewed to determine a maximum feasible wet well area of 10,000 square feet, with a depth of 15 feet, and those values were utilized in an iterative process increasing pump flow rates and force main diameters until a 5-Year, 8-Hour Design Storm LOS was achieved at the park. Once the LOS result had been achieved, other variations were explored, such as adding a flap gate on W. Parkland Boulevard, varying pump on/off control elevations, and cutting the wet well area in half and repeating the process. Two alternatives were then presented to the City.

1. 10,000 square foot wet well area, 2-70 cfs pumps and a 42-inch force main and
2. 5,000 square foot wet well area, 2-90 cfs pumps and a 42-inch force main.

A conceptual site plan for the 10,000 square foot wet well and pump house was prepared. To address noise concerns, talks were initiated with Tampa Electric (TECO) to determine the feasibility of obtaining an uninterrupted power supply to the pump station versus having on-site generators. Information on this alternative was compiled into a Technical Memorandum, included in Appendix B.

Mitigating the long-term impacts to the area was a focus of the City. Noise from the pump station equipment, visual impacts from the proposed infrastructure, and significant disruption to the neighborhood and the park during construction were just some of the areas of concern for the City. Discussions even considered an additional City property at the intersection of W. Parkland Boulevard and W. Swann Avenue as a potential location for housing generators or other equipment should it become necessary. Each additional consideration added costs and concerns to a project which would not allow for any incidental flooding benefits along the force main route. Simply speaking, the flooding benefits received would be limited solely to the Parkland Estates area. While this was the intended result for the project, the likelihood of obtaining matching grant funds from other agencies to help defray the increasing costs was minimal.

While attempting to determine the appropriate mitigating actions described above, the City discovered archived as-built information dating as far back as 1972, that identified the existence of a 5'x10' box culvert within the Howard Avenue ROW that crosses the railroad and the Selmon Expressway, and the existence of triple 4'x6' box culverts crossing the 48" sanitary prestressed concrete cylinder pipe (PCCP) force main in Bayshore Boulevard as well. As a direct result of this discovery, the largest hurdles to a feasible gravity solution no longer existed, and JMT was immediately tasked to develop a preferred gravity solution which made use of the existing infrastructure.

CURRENT ANALYSIS EXISTING CONDITIONS

MODEL APPROACH

This assessment expanded the existing model review beyond what had been previously considered (Studies 1 and 2). The City provided additional Geographic Information Systems (GIS) data that were then compared with the model information for consistency prior to further analysis. This comparison identified a discrepancy between the delineated and modeled watershed boundaries of a little over 4 acres. Basin names and the total number of basins also differed between the provided GIS files and the modeled data. Updating the GIS information was not performed as part of this effort, however the modeled acreages were revised and ultimately verified to match the total delineated acreage. Impervious percentages for sub-basins in the immediate vicinity of the project area were updated to better reflect the current existing conditions. Recent as-built storm sewer inlet construction and roadway improvements on Swann Avenue were also incorporated.

Once the existing culverts crossing the primary problem areas were discovered, the main obstacles to a gravity solution were eliminated. In order to utilize the discovered existing culverts, the previously selected route for the gravity alternative from Study 3 needed to be modified to continue east along W. Morrison Avenue to S. Howard Avenue and then proceed south to Hillsborough Bay. As this new route traverses a significant portion of S. Howard Avenue, further investigation in conjunction with the City was warranted and identified several localized flooding issues along the proposed route that could be addressed with the project, such as the potential elimination of the existing pump station located at Bern's Steak House and street flooding issues along W. Eleta Street and W. Bristol Avenue.

Additionally, the existing triangular pond between the CSX Railroad and S. Albany Ave, shown in Figure 7, was constructed with the original Selmon Expressway and receives discharge from a portion of the Selmon Expressway. This pond has no outfall control structure and there exists an inoperable pump station which is assumably the originally intended outfall for the runoff it receives from both the Selmon Expressway and the adjacent grocery store. During site visits, this pond's stage was about one foot below its berm indicating that no storage attenuation is being provided. As runoff enters this pond, discharge can navigate to an existing ditch within the CSX right-of-way and flow north to the Swann Avenue Pond, but in larger storm events, the pond will overflow to S. Albany Avenue and W Bristol Avenue and exacerbate the flooding conditions in this area. For this reason, the area of the Selmon Expressway draining to this existing pond was conservatively assumed to contribute in its entirety to the modeled system.

Figure 7: Bristol-Albany Pond off Selmon Expressway

To allow for pre-post comparisons within the Howard Avenue Corridor, several additional basins were required. These basins shown in Figure 8 were coarsely delineated using old plan sets provided by the City that compared reasonably to the 2017 LiDAR data. Curve numbers were calculated for these basins utilizing the Southwest Florida Water Management District's 2017 Land Use/Land Cover layer and Soil Conservation Service (SCS) soils information from Hillsborough County. Times of Concentration (TC) were set to a minimum 10 minutes for these basins to yield a conservative result, and overland flow conduits were added to the modeling to account for conveyance of runoff within the road rights-of-way.

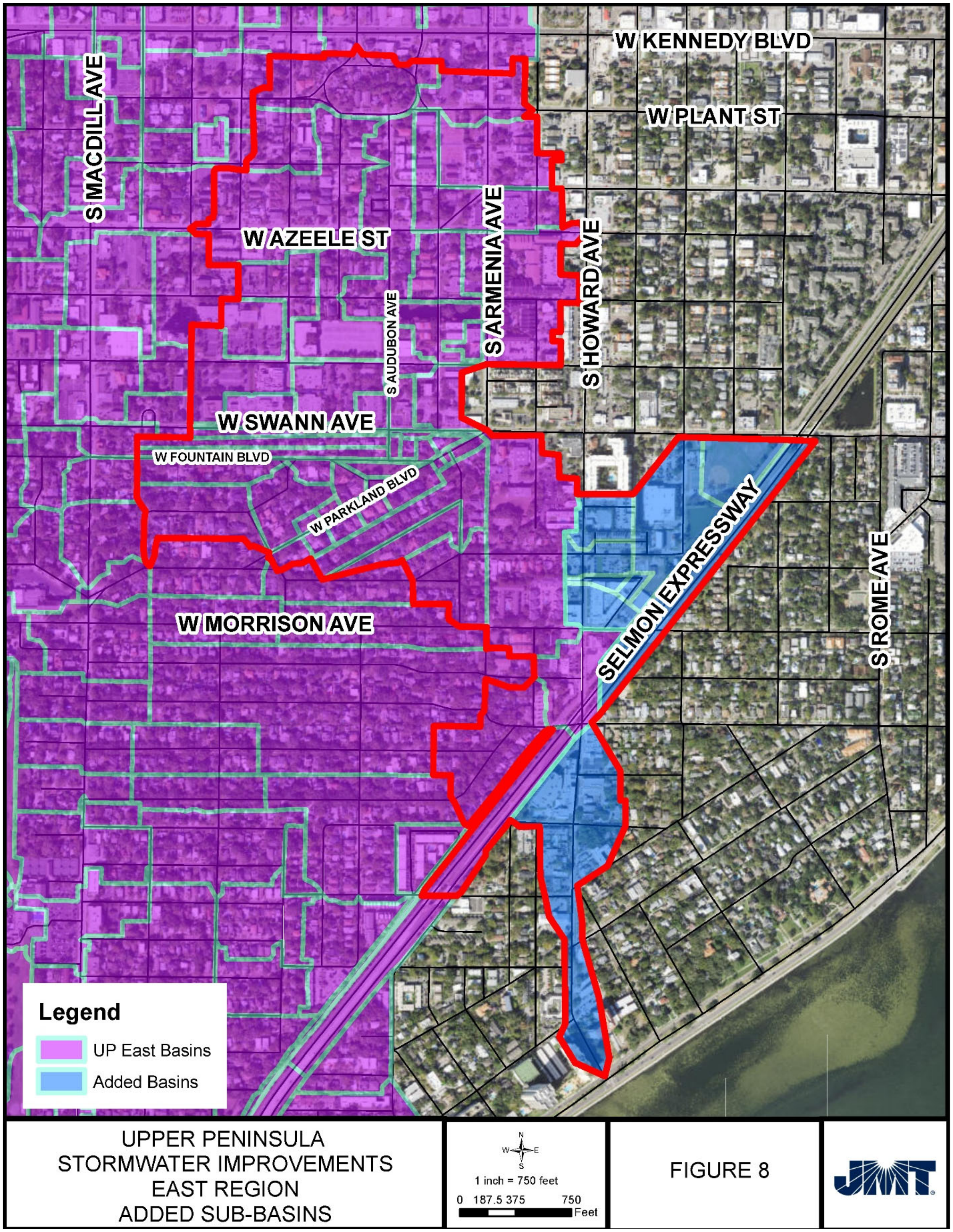


Figure 8: Added Sub-Basins

The model was then rerun to establish baseline conditions for the Mean Annual (2.33-), 5-, 10-, 25-, 50- and 100-year/8-hour and 24-hour storm events.

While the XP-SWMM model predicted flooding in the areas where flooding has been documented, to have a greater confidence in the proposed condition results, the City asked JMT if a simple calibration of the model could be accomplished that demonstrated the system's observed flooding response to frequent small intense storm events. A recent small but intense rain event, on April 20, 2020, of approximately one inch in a 20-minute time period had resulted in flooding of the roadways in Parkland Estates for several hours. The updated XP-SWMM model was executed to simulate this storm event, and the 1D results predicted lower flood elevations than had been observed. Field investigations were conducted that identified numerous inlets in the immediate vicinity of the flooding area for which actual inlet capacities had been severely diminished due to multiple pavement overlays of the roadways without milling. As the XP-SWMM 1D modeling did not take inlet capacities into account, options were investigated to account for the reduced inflow and bypass flows.

The recent Hillsborough County 2017 LiDAR was utilized to generate a 2D surface with a 5' grid size for use in the analysis. Utilization of a 2D surface provides for better definition with respect to overland flow pathways, and a quick graphical view of impacted areas, however the modeling run-times and data storage requirements are significantly increased. It is also important to note that XP-SWMM provides several options for modeling inlet capacities. Each available option has its own benefits and drawbacks. Assuming full capture of runoff at each inlet allows for the worst-case scenario for proposed pipe sizing but does not address actual or reduced inlet capacities. Setting an inlet capacity allows for the user to analyze the individual inlet, but excess runoff (that is not captured by the inlet) can be lost from the simulation. Lastly, 2D inflow capture is the most data intensive, requires all runoff to start in the 2D grid, and is limited in its ability to evaluate inlet-based solutions. The method utilized for this analysis to demonstrate reasonableness of the model results (i.e calibration) was to generate individual inlet capacity rating curves in the flooded area based upon the number and size of the inlets. This method allowed for the short-term prediction of peak stages but has the limitation of not being able to intercept bypass flows (excess runoff). Fortunately, since the selected calibration event was of such a short duration, this limitation minimally affected the predicted peak stages. However, the receding leg of the flow hydrograph was impacted. Thus, a combination of an inlet capacity simulation for peak stage prediction, combined with a full capture simulation to identify timing of the hydrograph resulted in stage predictions and timing which matched reasonably with the observed outcomes.

An added benefit of performing the inlet capacity analysis was the resulting identification of a list of subbasins with inadequate inlets in the vicinity of the problem area for the City as shown in Figure 9. Neglecting to address the inadequacies of the system in the upstream area will negatively affect the performance of any proposed solution.

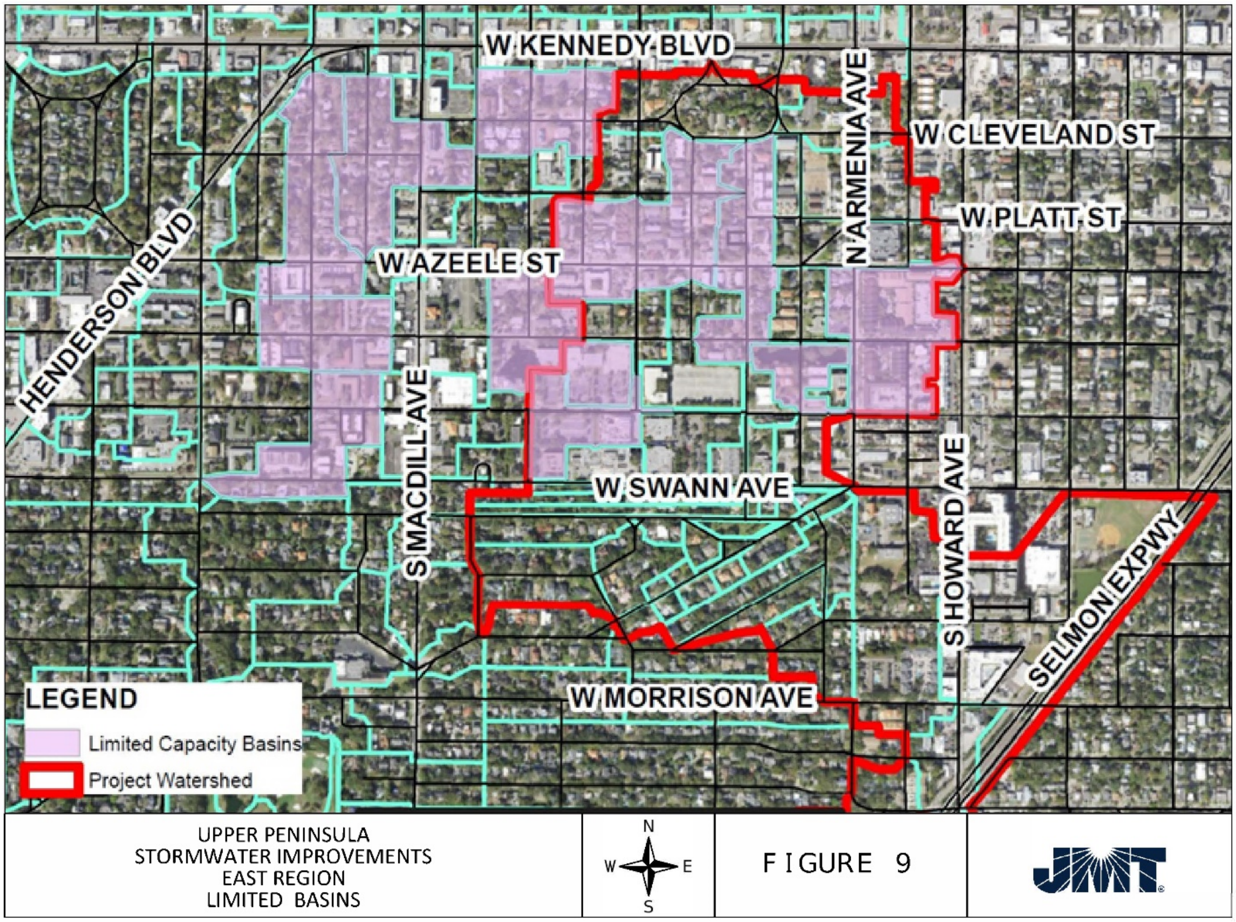


Figure 9: Drainage Sub- Basins with Insufficient Inlets Near Project Area

Following demonstration to the City that the modeled system sufficiently predicted the existing reaction to the frequently occurring short duration high intensity events, design storm and critical storm simulations were then initiated. For efficiency in model run times and alternatives analysis predictions, the existing model was reverted back to 1D for these design simulations as that was the best option for culvert sizing.

A summary of the flooding analysis is presented below and is summarized in Tables 1 and 2 for the 8-hour and 24-hour design storm events respectively.

- During the mean annual storm event, flooding along Audubon Avenue at the Swann Avenue and W. Fountain Boulevard intersections is two feet greater than the highest roadway elevations at these locations.
- Roadway flooding also occurs along Swann Avenue, W. Parkland Boulevard, and S. Lakeview Road during the mean annual storm event.

Figure 10: Reported Nodes

EXISTING CONDITIONS PEAK STAGES (8-HOUR DESIGN STORM)							
LOCATION AND XP-SWMM NODE	**ROAD EOP ELEVATION OR LOWEST INLET THROAT**	**MEAN ANNUAL PEAK STAGE**	**5-YEAR PEAK STAGE**	**10-YEAR PEAK STAGE**	**25-YEAR PEAK STAGE**	**50-YEAR PEAK STAGE**	**100-YEAR PEAK STAGE**
	FEET NAVD						
W Swann Ave and S Audubon Ave (NRU0790)	15.7 to 16.0	18.0	18.4	18.7	19.0	19.2	19.4
W Swann Ave and S Tampania Ave (NRU0810)	16.6 to 17.0	18.0	18.4	18.7	19.0	19.2	19.4
W Swann Ave and S Armenia Ave (NRU1230)	17.3 to 17.8	17.9	18.3	18.6	19.0	19.2	19.4
S Audubon Ave and W Fountain Blvd (NRU0770)	15.7	17.9	18.3	18.6	18.9	19.1	19.4
W Parkland Blvd at park (NRU0750)	16.4	17.7	18.2	18.5	18.9	19.1	19.4
W Parkland Blvd at W Fountain Blvd (NRU1090)	16.5	17.8	18.2	18.6	18.9	19.1	19.4
W Parkland Blvd at S Lakeview Rd (NRU1110)	16.9	17.9	18.3	18.6	19.0	19.2	19.4

Table 1: Mean Annual, 5-, 10-, 25-, 50-, and 100-year/8-hour Storm Event Under Existing Conditions

EXISTING CONDITIONS PEAK STAGES (24-HOUR STORM)							
LOCATION AND XP-SWMM NODE	ROAD EOP ELEVATION OR LOWEST INLET THROAT	MEAN ANNUAL PEAK STAGE	5-YEAR PEAK STAGE	10-YEAR PEAK STAGE	25-YEAR PEAK STAGE	50-YEAR PEAK STAGE	100-YEAR PEAK STAGE
	FEET NAVD						
W Swann Ave and S Audubon Ave (NRU0790)	15.7 to 16.0	17.8	18.1	18.5	18.9	19.2	19.4
W Swann Ave and S Tampania Ave (NRU0810)	16.6 to 17.0	17.8	18.1	18.5	18.9	19.2	19.4
W Swann Ave and S Armenia Ave (NRU1230)	17.3 to 17.8	17.7	18.0	18.5	18.8	19.2	19.4
S Audubon Ave and W Fountain Blvd (NRU0770)	15.7	17.7	18.0	18.4	18.8	19.1	19.3
W Parkland Blvd at park (NRU0750)	16.4	17.6	17.9	18.4	18.7	19.1	19.3
W Parkland Blvd at W Fountain Blvd (NRU1090)	16.5	17.6	18.0	18.4	18.8	19.1	19.3
W Parkland Blvd at S Lakeview Rd (NRU1110)	16.9	17.7	18.0	18.5	18.8	19.2	19.4

Table 2: Mean Annual, 5-, 10-, 25-, 50-, and 100-year/24-hour Storm Event Under Existing Conditions

The existing conditions modeling confirms that the primary drainage system in the vicinity of West Fountain Boulevard, Audubon Avenue, and Swann Avenue does not meet the target flooding criteria for the area of no flooding in the street for the 5-year, 8-hour design storm event.

RECOMMENDED ALTERNATIVE

Figure 11: Recommended Alternative Project Route

MODEL APPROACH

A box culvert traversing the final selected route for the gravity alternative was analyzed and sized to meet a 5-year/8-hour Level of Service at the S. Audubon Avenue and W. Fountain Boulevard intersection. A 5’x10’ box culvert from Parkland Estates connects to the existing 5’x10’ box culvert under the Selmon Expressway and a 4’x15’ box culvert from the Selmon Expressway connects to the existing triple 4’x6’ box culverts under Bayshore Boulevard. To address the previously described localized flooding issues along the proposed route, a proposed pipe system was then extended north from the proposed box culvert at the intersection of S. Howard Avenue and W. Morrison Avenue to slightly north of W. Bristol Avenue, and easterly along W. Bristol Avenue and W. Eleta Street to collect the existing contributing runoff from these areas.

MODELING RESULTS

The resulting proposed system was then analyzed producing the following results.

PROPOSED CONDITIONS PEAK STAGES (8-HOUR STORM)							
LOCATION AND XP-SWMM NODE	ROAD EOP ELEV OR LOW INLET THROAT	MEAN ANNUAL PEAK STAGE	5-YEAR PEAK STAGE	10-YEAR PEAK STAGE	25-YEAR PEAK STAGE	50-YEAR PEAK STAGE	100-YEAR PEAK STAGE
	FEET NAVD						
W Swann Ave and **S** Audubon Ave (NRU0790)	15.7 to 16.0	14.9	16.2	16.9	17.3	17.6	17.9
W Swann Ave and S Tampania Ave (NRU0810)	16.6 to 17.0	17.1	17.1	17.1	17.3	17.6	17.9
W Swann Ave and S Armenia Ave (NRU1230)	17.3 to 17.8	13.2	14.5	15.4	16.0	16.5	17.0
S Audubon Ave and W Fountain Blvd (NRU0770)	15.7	12.9	14.8	15.6	16.2	16.6	17.1
W Parkland Blvd at park (NRU0750)	16.4	13.6	15.2	16.1	16.6	16.9	17.4
W Parkland Blvd at W Fountain Blvd (NRU1090)	16.5	12.6	14.6	15.5	16.1	16.5	17.0
W Parkland Blvd at S Lakeview Rd (NRU1110)	16.9	12.2	14.4	15.3	15.9	16.3	16.8

Table 3: Mean Annual, 5-, 10-, 25-, 50- and 100-year/8-Hour Storm Event under Recommended Alternative

PROPOSED CONDITIONS PEAK STAGES (24-HOUR STORM)							
LOCATION AND XP-SWMM NODE	ROAD EOP ELEVATION OR LOWEST INLET THROAT	MEAN ANNUAL PEAK STAGE	5-YEAR PEAK STAGE	10-YEAR PEAK STAGE	25-YEAR PEAK STAGE	50-YEAR PEAK STAGE	100-YEAR PEAK STAGE
	FEET NAVD						
Swann Ave and Audubon Ave (NRU0790)	15.7 to 16.0	14.6	15.4	16.9	17.4	17.8	18.0
Swann Ave and Tampania Ave (NRU0810)	16.6 to 17.0	17.1	17.1	17.2	17.4	17.8	18.**0**
Swann Ave and Armenia Ave (NRU1230)	17.3 to 17.8	13.2	13.**7**	15.6	16.4	17.0	17.4
Audubon Ave and W. Fountain Blvd (NRU0770)	15.7	12.7	14.0	15.8	16.5	17.1	17.5
W. Parkland Blvd at park (NRU0750)	16.4	13.6	14.5	16.2	16.8	17.4	17.7
W. Parkland Blvd at W. Fountain Blvd (NRU1090)	16.5	12.5	13.8	15.6	16.4	17.0	17.4
W. Parkland Blvd at S. Lakeview Rd (NRU1110)	16.9	12.1	13.6	1546	16.3	16.9	17.3

Table 4: Mean Annual, 5-, 10-, 25-, 50- and 100-year/24-Hour Storm Event under Recommended Alternative

As can be seen in the above tables, some of the reported locations outside of the S. Audubon Avenue and W. Fountain Boulevard intersection do not meet the 5-year, 8-hour Level of Service and many still show flooding conditions in other design storm events. It is important to note however, that substantial benefits are realized across the system. While the peak stages achieved may not provide a "no flooding" result everywhere in the specified design storm event, the flood depths and durations are significantly reduced.

JMT prepared conceptual construction plans for the box culvert. These plans are included in Appendix C and were utilized by the City to prepare an engineer's estimate of cost for the recommended project. That cost estimate is included in Appendix D and resulted in a preliminary project cost of $45,362,600.

To evaluate the cost effectiveness for the project, the methodology set forth by the Southwest Florida Water Management District (SWFWMD) in their Cooperative Funding Initiative (CFI) Application

Stormwater Improvement Flood Protection (SIFP) Benefit Cost Analysis (BCA) Tool was followed and their FY23_CFI_SIFP_BCA_Template spreadsheet was utilized. The results of the BCA analysis conservatively demonstrated an expected Annual Damage Benefit of $3,547,811, which equates to a present value of future benefits over the 30-year assumed project useful life of $44,024,933 for a Benefit/Cost ratio of 0.97. Pertinent portions of the BCA spreadsheet and the assumptions utilized to generate the data are contained in Appendix E.

This achieved ratio of 0.97 is slightly above those which have historically been ranked high enough by the SWFWMD to receive cooperative funding. Considering that all the assumptions and estimates have been conservatively applied, as the ultimate details of the project become fleshed out during the design process, the benefits are anticipated to increase and the costs to potentially decrease thus increasing the ultimate ratio achieved by the proposed project.

ADDITIONAL PROJECT BENEFITS

The methodologies utilized in the BCA result, discussed above, were focused conservatively on only those benefits associated with reductions in flooding conditions. The selected route of the recommended alternative provides many opportunities for additional co-benefits beyond those accounted for in the BCA.

HOWARD AVENUE CORRIDOR

In 2016, the City prepared a Review of Transportation Conditions on South Howard Avenue from Bayshore Boulevard to Kennedy Boulevard. The purpose of this corridor review was to identify current transportation conditions and recommend actions and improvements to address priority problems. The prioritized activities stressed improving the parking shortage, sidewalks and pedestrian safety, pavement utilization, street lighting, intersection modifications, public transportation, and drainage (there is no existing storm sewer system along S. Howard Avenue). Considering the construction of a large box culvert within S. Howard Avenue will generally necessitate a re-construction of the entire ROW, many of the identified issues beyond drainage/flooding can, and should, be addressed with this project thereby eliminating the need to disrupt the corridor for multiple activities.

Howard Avenue corridor Items that should be considered with this project include but are not limited to:

- Pavement utilization options such as:
    - Providing on-street parallel parking
    - Providing options for public transportation
    - Providing wider sidewalks meeting ADA standards with landscaping and pedestrian amenities
    - Converting the corridor back to a brick street
- Improved street lighting
- Underground electric services

- Intersection improvements
  - Include safety improvements currently proposed by the City for S. Howard Avenue and Bayshore Boulevard
  - Five-leg intersection improvements involving Dekle Avenue, Mississippi Avenue, and DeSoto Avenue.

GREEN INFRASTRUCTURE

As the City moves forward with Transforming Tampa's Tomorrow in alignment with Mayor Jane Castor's Resilient Tampa initiative, green infrastructure improvements designed to reduce and treat stormwater at its source are anticipated to be incorporated as part of the design of this project. Nutrient Separating Baffle Boxes (NSBBs) which can include the potential addition of Biological Adsorption Media (BAM) up-filters are a likely Best Management Practice (BMP) to be included at strategic locations along the project route. These systems are designed to capture and store debris. Several units resembling that shown in Figure 11 have been installed on recent City projects.

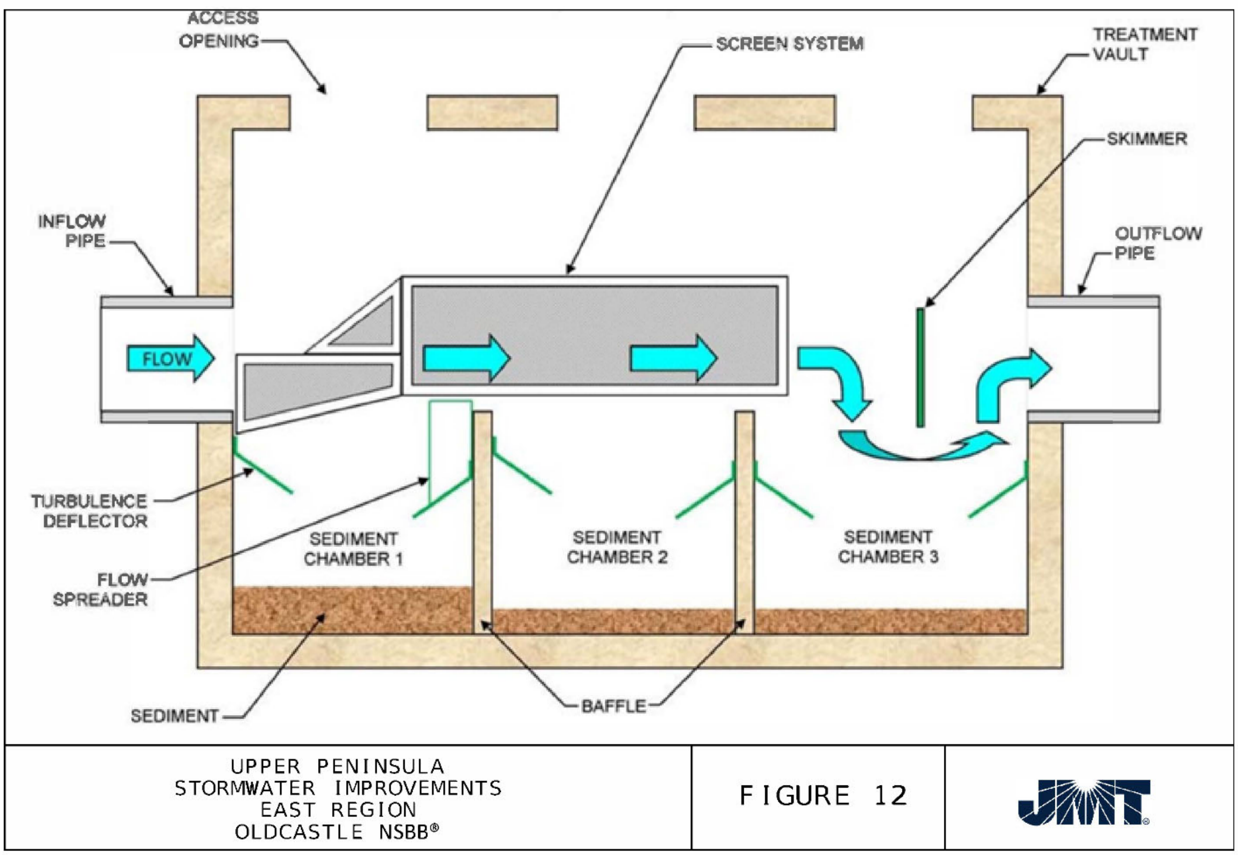


Figure 12: Nutrient Separating Baffle Box (NSBB®)

Where ROW and current tree conditions within the project area permit, bio-swales and tree wells can be implemented in conjunction with road diets, chicanes, and other traffic calming options to provide additional green infrastructure to bolster the proposed nutrient uptake. Available and applicable options to manage the runoff from the contributing drainage area prior to collection within the proposed gravity storm sewer system will be explored with the City and implemented accordingly. Inclusion of green infrastructure into the public facilitation and education components of any design process are also recommended. Some typical green infrastructure examples are shown in Figure 12, and constructed versions can be seen on City Streets such as Scott Street and Zack Street.

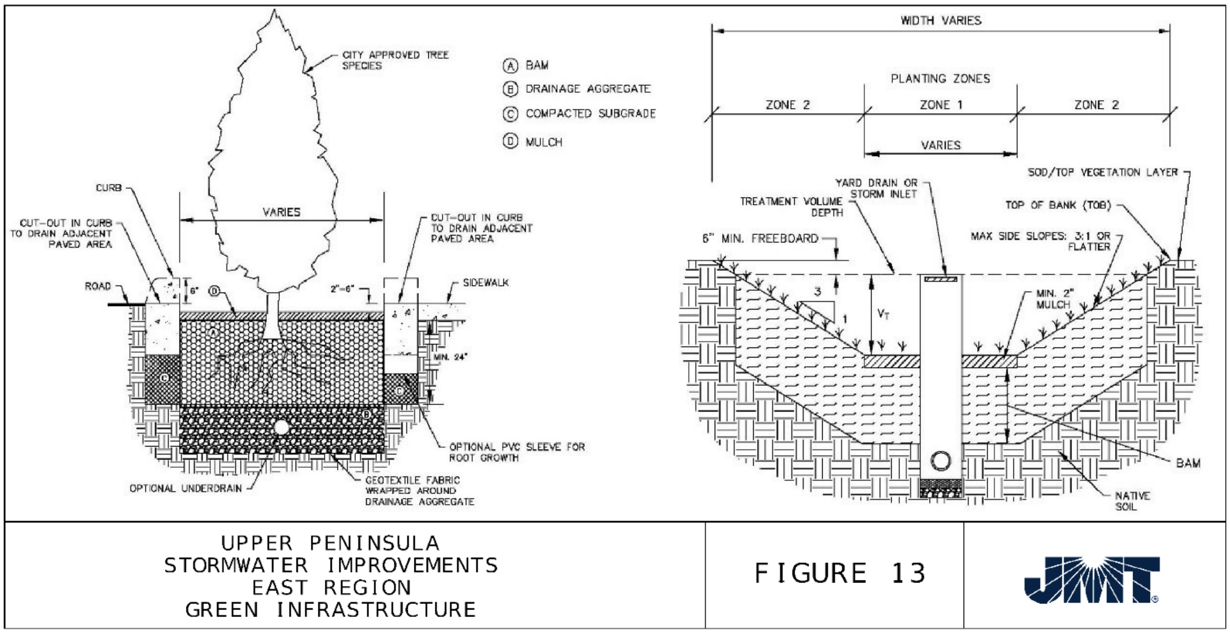


Figure 13: Green Infrastructure Tree Well and Bio-Swale Examples

In summary, the recommended alternative contributes greatly to furthering the City's Transforming Tampa's Tomorrow initiative and contributes to a more resilient Tampa. This alternative was selected for recommendation for numerous reasons. The following provides a list of those deemed most important:

- Utilization of the existing gravity culverts under the railroad, the Selmon Expressway, and the sanitary force main in Bayshore Boulevard eliminated the most significant and costly obstacles to a gravity solution.
- The ability to address localized flooding concerns along the route provided additional benefits above and beyond the intended goal of reducing flooding concerns in Parkland Estates.
- The ability to combine the project with currently planned and recommended transportation and safety improvements in the corridor increases the benefits, saves the City on construction costs, and reduces the total disruption to the community associated with multiple projects.
- Incorporating green infrastructure within the project provides water quality and other community benefits where none currently exist and can expand those benefits in other areas.

- The potential for future drainage connections by the Selmon Expressway expands the Regional nature of the project and provides the potential for obtaining cost sharing.

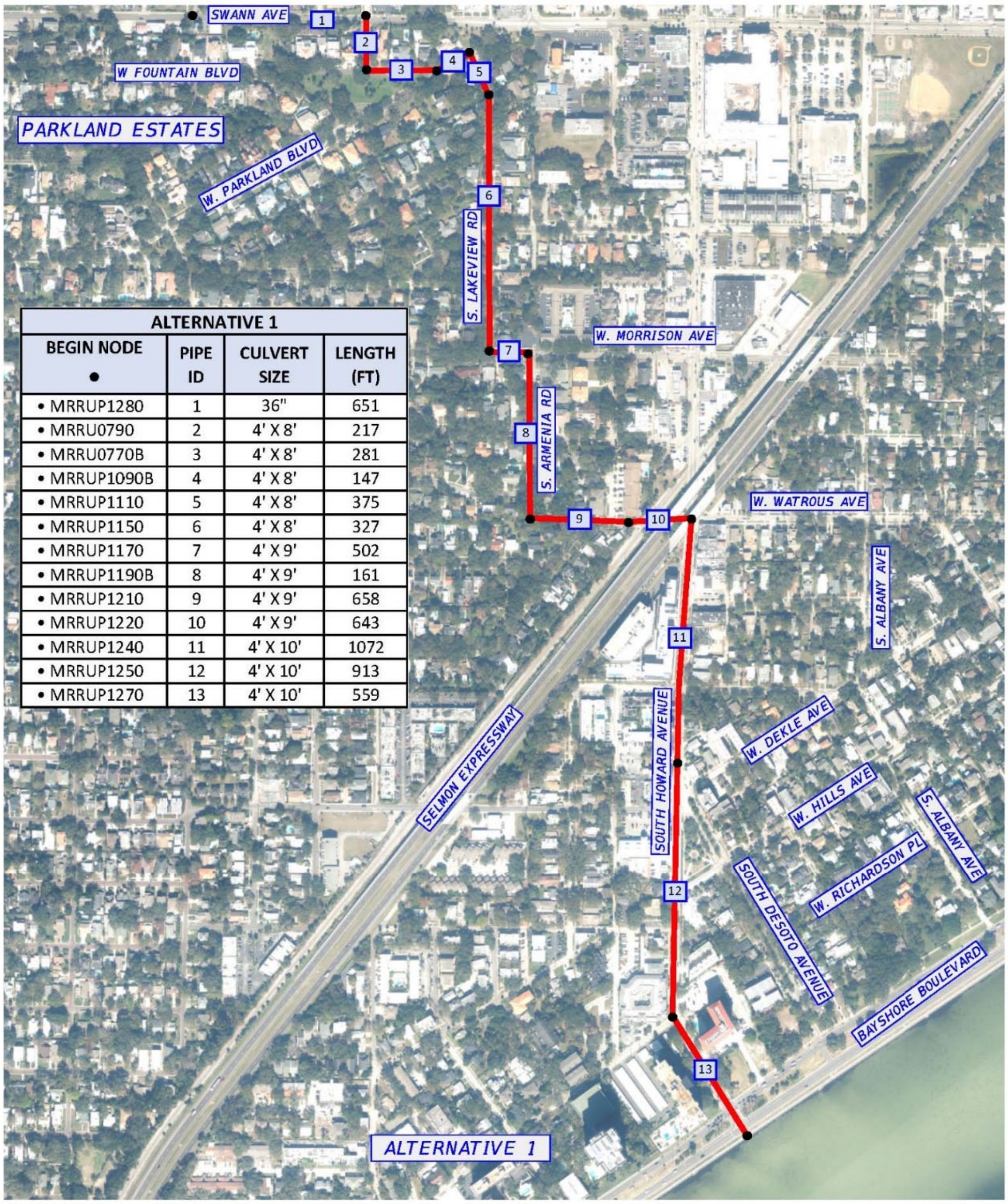
All of these reasons increase the likelihood of obtaining cooperative funding from the Southwest Florida Water Management District thereby providing a maximum return on the City's investment in resilient infrastructure.

APPENDICES

APPENDIX A

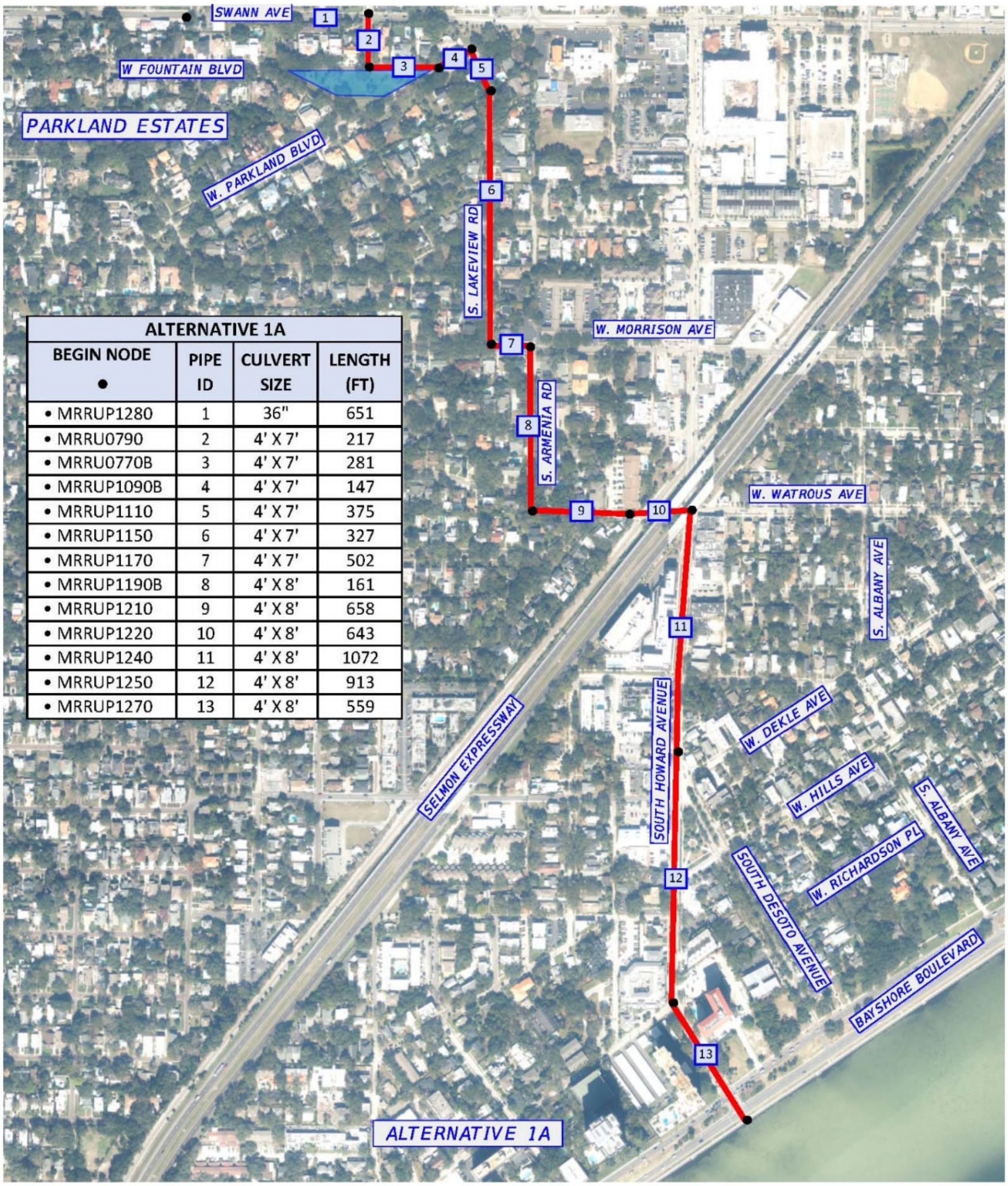
ALTERNATIVE ROUTES CONSIDERED

PARKLAND ESTATES STORMWATER IMPROVEMENTS ANALYSIS				
ALTERNATIVE	**PRIOR STUDY**	**TYPE**	**ROUTE**	**INFEASIBILITY ISSUES**
JMT Alternative 1	1	Gravity	S. Audubon, W. Fountain, W. Parkland, S. Lakeview, W. Morrison, S. Armenia, W. Watrous, S. Howard	Cost, Safety/Constructability Issues, Property Issues
JMT Alternative 1A	1	Gravity	S. Audubon, W. Fountain, W. Parkland, S. Lakeview, W. Morrison, S. Armenia, W. Watrous, S. Howard (with detention pond)	Cost, Safety/Constructability Issues, Property Issues
JMT Alternative 2	1	Gravity	S. Audubon, W. Fountain, W. Parkland, S. Lakeview, W. Morrison, S. Armenia, W. Watrous, S. Howard, S. Desoto	Cost, Time Delays, Permitting, Property Issues
JMT Alternative 2A	1	Gravity	S. Audubon, W. Fountain, W. Parkland, S. Lakeview, W. Morrison, S. Armenia, W. Watrous, S. Howard, S. Desoto (with detention pond)	Cost, Time Delays, Permitting, Property Issues
JMT Alternative 3	1	Gravity	S. Audubon, W. Fountain, W. Parkland, S. Lakeview, W. Morrison, S. Armenia, W. Watrous, S. Albany, W. Hills, S. Albany	Project Costs, Safety/Constructability Issues
JMT Alternative 3A	1	Gravity	S. Audubon, W. Fountain, W. Parkland, S. Lakeview, W. Morrison, S. Armenia, W. Watrous, S. Albany, W. Hills, S. Albany (with pond)	Project Costs, Safety/Constructability Issues
JMT Pump Station	1	Force Main	S. Audubon, W. Fountain, W. Parkland, S. Lakeview, W. Morrison, S. Armenia, W. Watrous, S. Howard, S. Desoto	Operation/Maintenance Costs, 15-Year Pump Replacement Costs
Dewberry Alternative 2	2	Gravity	W. Fountain, W. Parkland, S. Lakeview, W. Morrison, S. Armenia, W. Watrous, S. Howard, S. Desoto	Cost, Depth of Construction, Time Delays, Permitting, Property Issues
Dewberry Pump Alternative	2	Force Main	W. Fountain, W. Parkland, S. Lakeview, W. Morrison, S. Albany, W. Watrous, S. Gunby	Impacts to Trees (Grand Oaks), Narrow Right-of-Way
COT Adjust Zom Pond Weir	3	N/A	W. Horatio between S. Audubon and S. Armenia	No Significant Impact on Flood Stages
COT Redirect Flow	3	N/A	To Existing Cleveland Street Basin	Existing Basin Overtaxed with Numerous Downstream Flooding Issues
COT New Gravity Outfall	3	Gravity	W. Fountain, W. Parkland, S. Lakeview, W. Morrison, S. Georgia, W. Mississippi, S. Moody, W. Stroud, S. Howard	Impacts to Trees (Grand Oaks), Narrow Right-of-Way
BES Concept	3	Gravity	See above	See above
COT Upgrades	3	Gravity	South of Morrison/Marti Intersection	No Significant Impact on Flood Stages with Reasonable Construction Costs
COT Add Parallel 60" Pipe	3	Gravity	Eastern Boundary of Palma Ceia Park Adjacent to Crosstown Expressway	No Significant Impact on Flood Stages, Adverse Downstream Impacts
COT Adjust Weir Elevations	3	Gravity	Junction Chamber West Side of Crosstown Expressway/ Upstream of Rubideaux Outfall	No Significant Impact on Flood Stages, Adverse Downstream Impacts
COT Pump Station	3	Force Main	Parkland Estates Park to Downstream System at Marti/Morrison Intersection	Adverse Downstream Impacts During Larger Storm Events
COT Pump Station	3	Force Main	To Existing Swann Pond Drainage Basin on Rome	Pond Already Overtaxed with Bayshore and Rome Intersection Flooding
JMT Parallel Gravity Outfall	4	Gravity	S. Marti, W. Neptune, S. Habana	No Significant Impact on Flood Stages, Adverse Downstream Impacts
JMT Pump Station	5	Force Main	W. Fountain, W. Parkland, S. Lakeview, W. Morrison, S. Georgia, W. Mississippi, S. Moody, W. Stroud, S. Howard	Benefits Limited to Parkland Estates Only, Operation/Maintenance
JMT Preferred Alternative	Current	Gravity	W. Fountain, W. Parkland, S. Lakeview, W. Morrison, S. Howard	



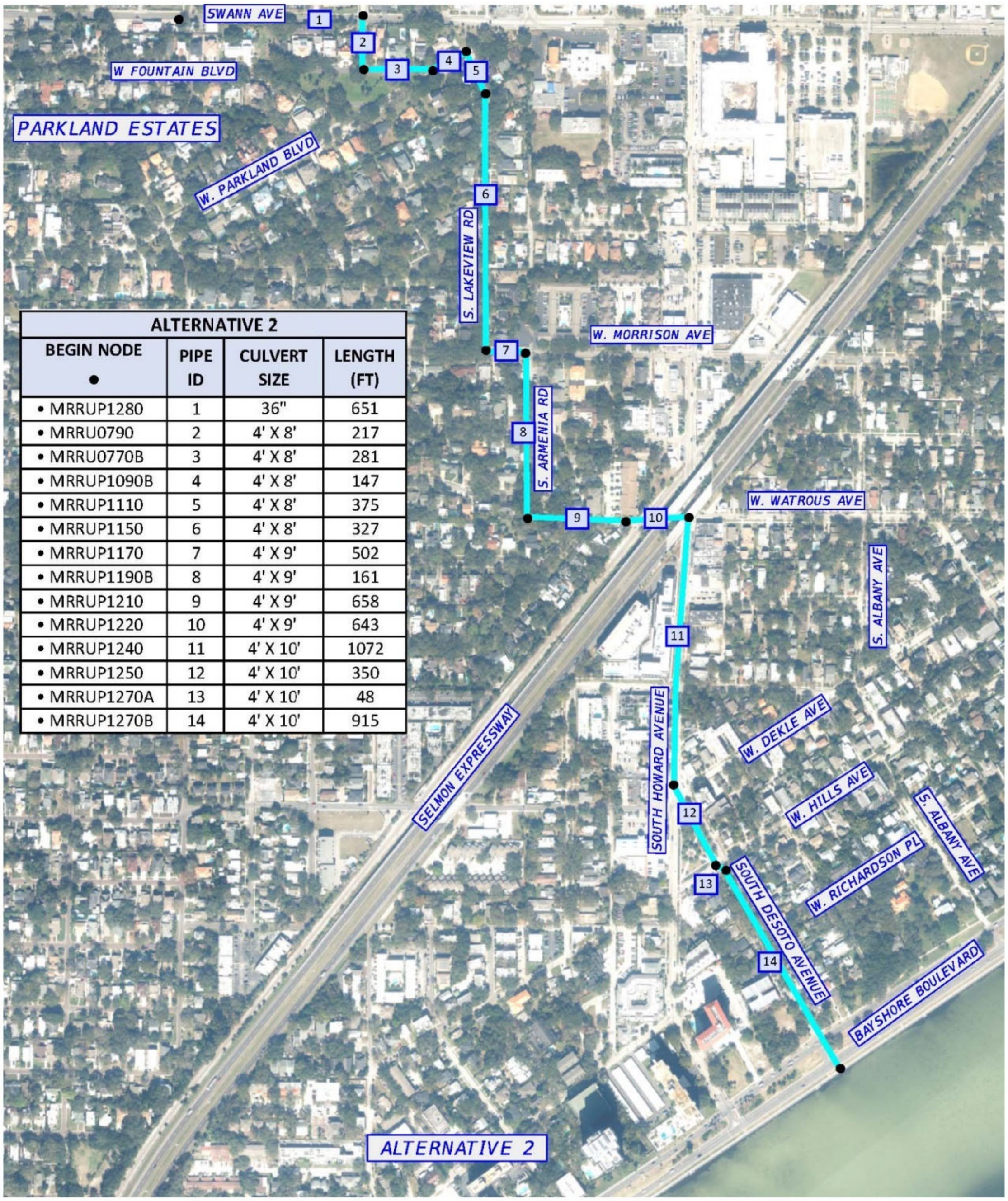
ALTERNATIVE 1			
BEGIN NODE ●	PIPE ID	CULVERT SIZE	LENGTH (FT)
• MRRUP1280	1	36"	651
• MRRU0790	2	4' X 8'	217
• MRRU0770B	3	4' X 8'	281
• MRRUP1090B	4	4' X 8'	147
• MRRUP1110	5	4' X 8'	375
• MRRUP1150	6	4' X 8'	327
• MRRUP1170	7	4' X 9'	502
• MRRUP1190B	8	4' X 9'	161
• MRRUP1210	9	4' X 9'	658
• MRRUP1220	10	4' X 9'	643
• MRRUP1240	11	4' X 10'	1072
• MRRUP1250	12	4' X 10'	913
• MRRUP1270	13	4' X 10'	559

Figure 3 - Alternative 1 Route Diagram



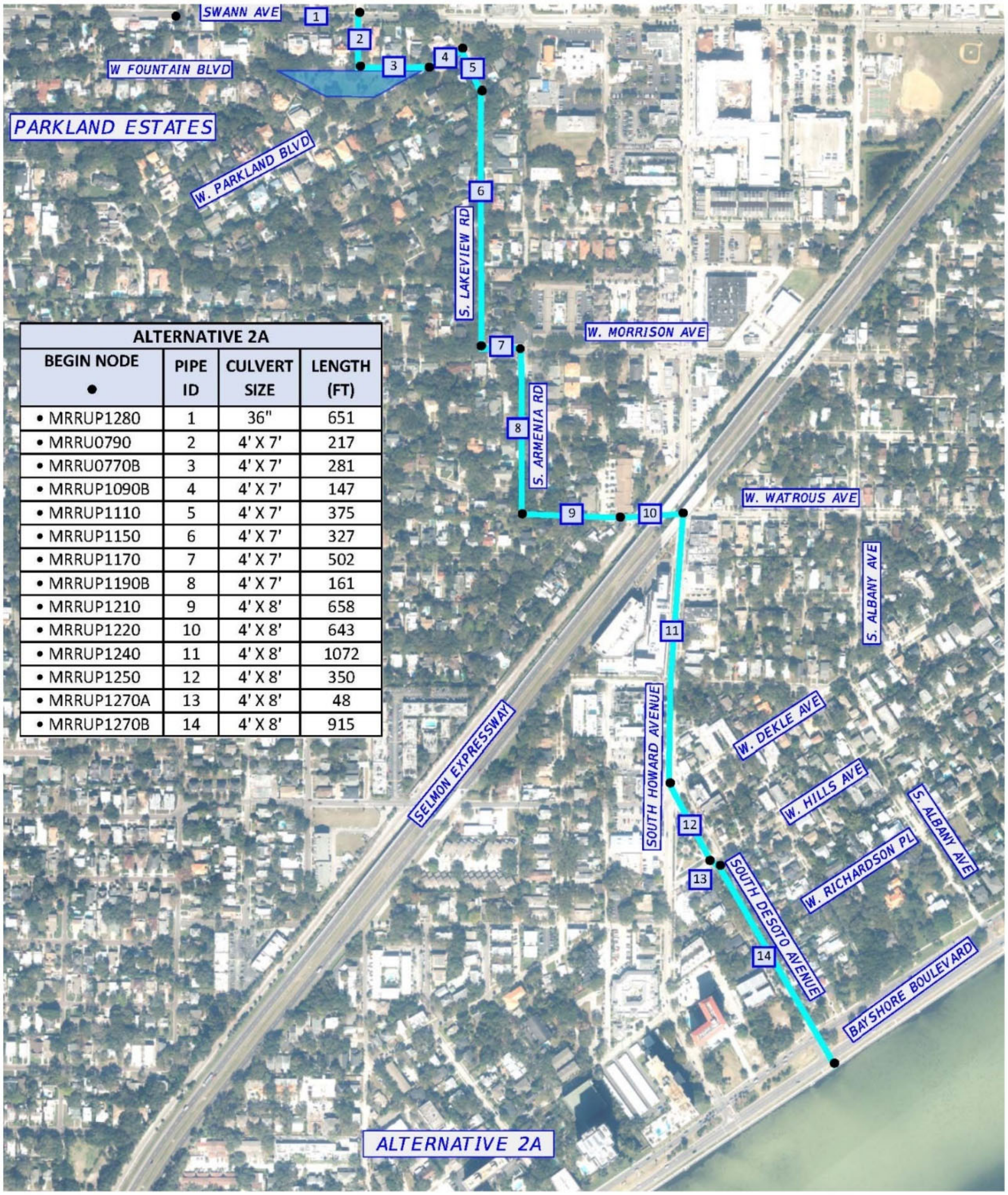
ALTERNATIVE 1A			
BEGIN NODE ●	PIPE ID	CULVERT SIZE	LENGTH (FT)
• MRRUP1280	1	36"	651
• MRRU0790	2	4' X 7'	217
• MRRU0770B	3	4' X 7'	281
• MRRUP1090B	4	4' X 7'	147
• MRRUP1110	5	4' X 7'	375
• MRRUP1150	6	4' X 7'	327
• MRRUP1170	7	4' X 7'	502
• MRRUP1190B	8	4' X 8'	161
• MRRUP1210	9	4' X 8'	658
• MRRUP1220	10	4' X 8'	643
• MRRUP1240	11	4' X 8'	1072
• MRRUP1250	12	4' X 8'	913
• MRRUP1270	13	4' X 8'	559

Figure 4 - Alternative 1A Route Diagram



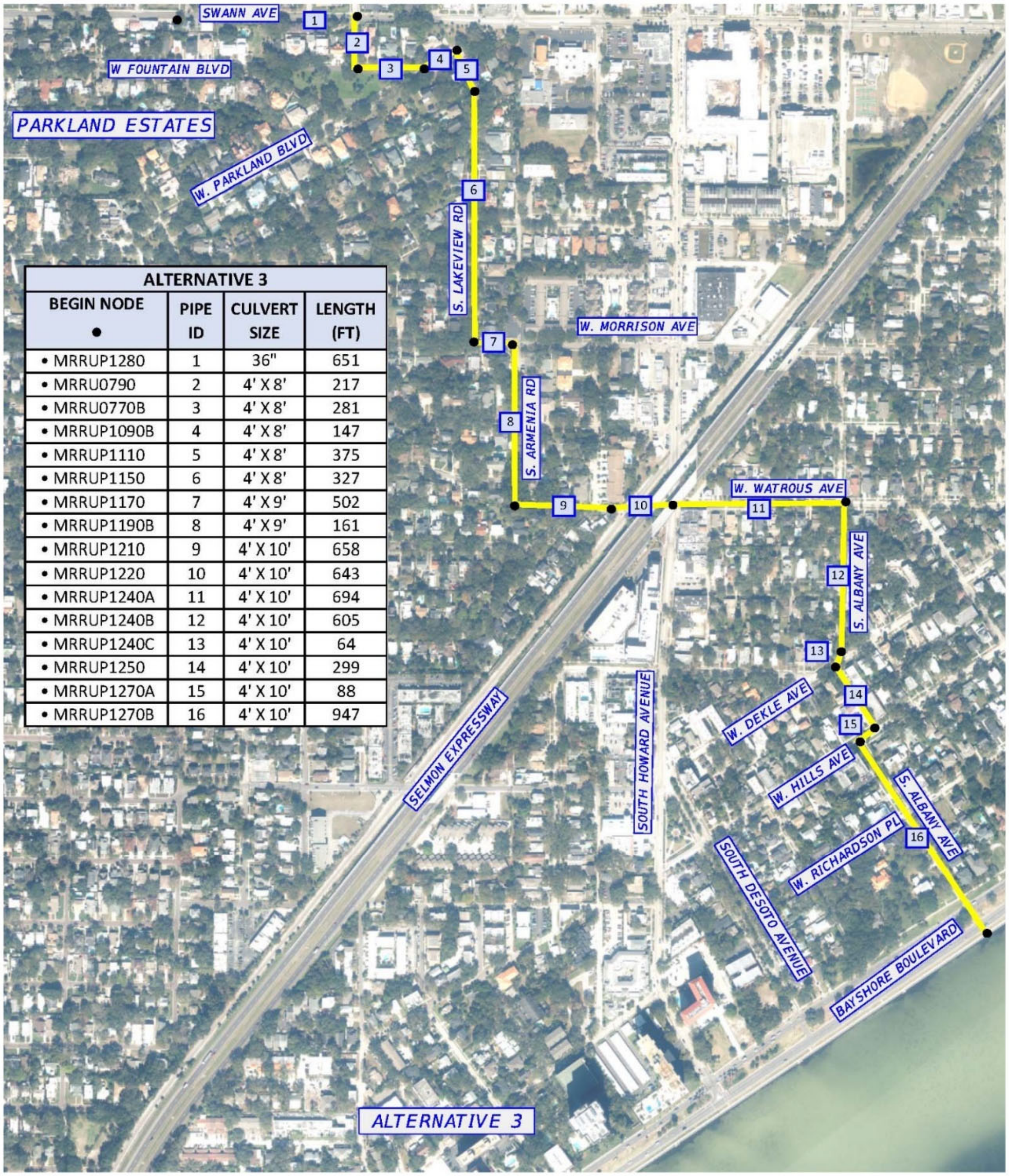
ALTERNATIVE 2			
BEGIN NODE ●	PIPE ID	CULVERT SIZE	LENGTH (FT)
• MRRUP1280	1	36"	651
• MRRU0790	2	4' X 8'	217
• MRRU0770B	3	4' X 8'	281
• MRRUP1090B	4	4' X 8'	147
• MRRUP1110	5	4' X 8'	375
• MRRUP1150	6	4' X 8'	327
• MRRUP1170	7	4' X 9'	502
• MRRUP1190B	8	4' X 9'	161
• MRRUP1210	9	4' X 9'	658
• MRRUP1220	10	4' X 9'	643
• MRRUP1240	11	4' X 10'	1072
• MRRUP1250	12	4' X 10'	350
• MRRUP1270A	13	4' X 10'	48
• MRRUP1270B	14	4' X 10'	915

Figure 5 - Alternative 2 Route Diagram



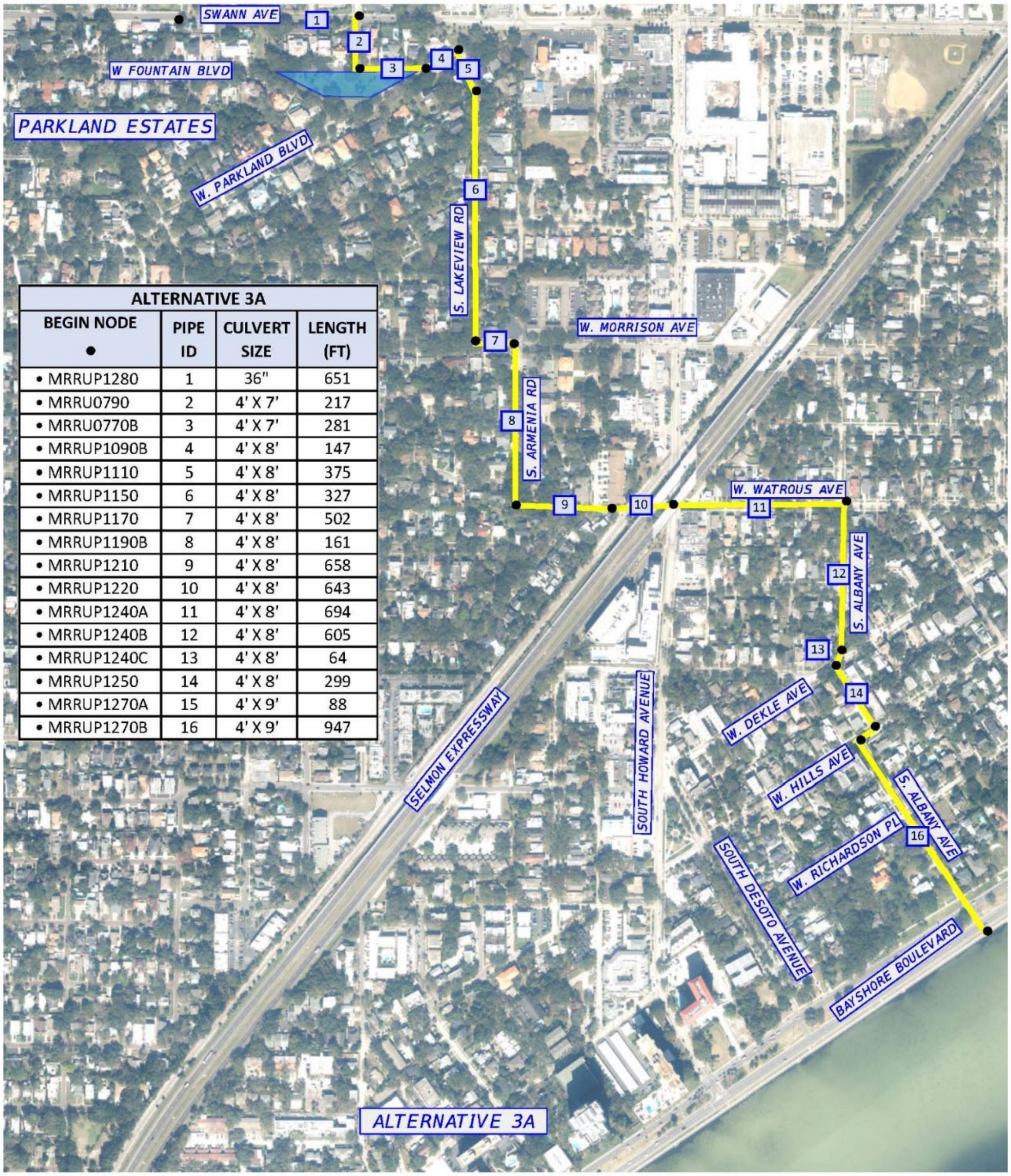
ALTERNATIVE 2A			
BEGIN NODE ●	PIPE ID	CULVERT SIZE	LENGTH (FT)
• MRRUP1280	1	36"	651
• MRRU0790	2	4' X 7'	217
• MRRU0770B	3	4' X 7'	281
• MRRUP1090B	4	4' X 7'	147
• MRRUP1110	5	4' X 7'	375
• MRRUP1150	6	4' X 7'	327
• MRRUP1170	7	4' X 7'	502
• MRRUP1190B	8	4' X 7'	161
• MRRUP1210	9	4' X 8'	658
• MRRUP1220	10	4' X 8'	643
• MRRUP1240	11	4' X 8'	1072
• MRRUP1250	12	4' X 8'	350
• MRRUP1270A	13	4' X 8'	48
• MRRUP1270B	14	4' X 8'	915

Figure 6 - Alternative 2A Route Diagram



ALTERNATIVE 3			
BEGIN NODE •	PIPE ID	CULVERT SIZE	LENGTH (FT)
• MRRUP1280	1	36"	651
• MRRU0790	2	4' X 8'	217
• MRRU0770B	3	4' X 8'	281
• MRRUP1090B	4	4' X 8'	147
• MRRUP1110	5	4' X 8'	375
• MRRUP1150	6	4' X 8'	327
• MRRUP1170	7	4' X 9'	502
• MRRUP1190B	8	4' X 9'	161
• MRRUP1210	9	4' X 10'	658
• MRRUP1220	10	4' X 10'	643
• MRRUP1240A	11	4' X 10'	694
• MRRUP1240B	12	4' X 10'	605
• MRRUP1240C	13	4' X 10'	64
• MRRUP1250	14	4' X 10'	299
• MRRUP1270A	15	4' X 10'	88
• MRRUP1270B	16	4' X 10'	947

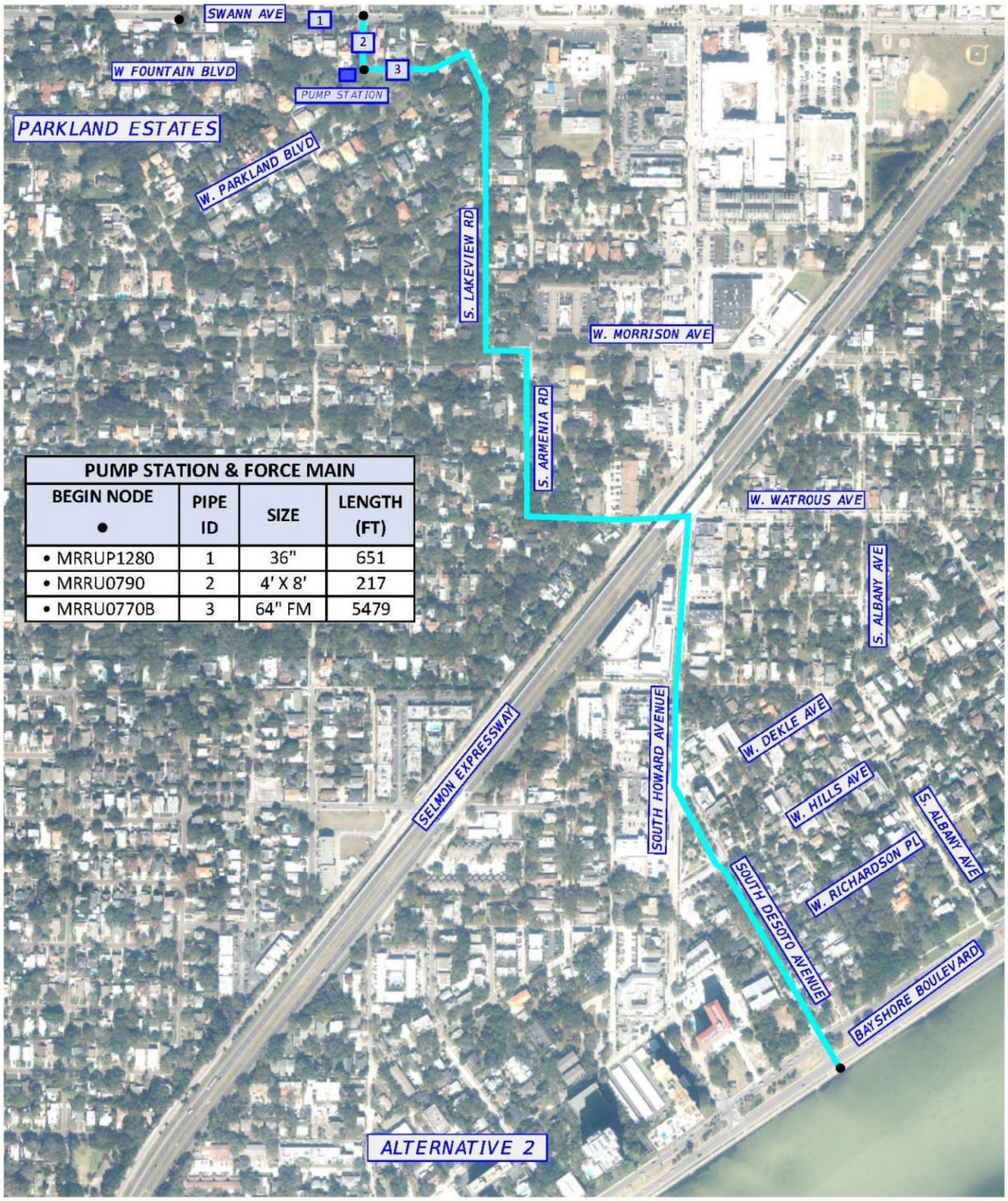
Figure 7 - Alternative 3 Route Diagram



ALTERNATIVE 3A			
BEGIN NODE ●	PIPE ID	CULVERT SIZE	LENGTH (FT)
• MRRUP1280	1	36"	651
• MRRU0790	2	4' X 7'	217
• MRRU0770B	3	4' X 7'	281
• MRRUP1090B	4	4' X 8'	147
• MRRUP1110	5	4' X 8'	375
• MRRUP1150	6	4' X 8'	327
• MRRUP1170	7	4' X 8'	502
• MRRUP1190B	8	4' X 8'	161
• MRRUP1210	9	4' X 8'	658
• MRRUP1220	10	4' X 8'	643
• MRRUP1240A	11	4' X 8'	694
• MRRUP1240B	12	4' X 8'	605
• MRRUP1240C	13	4' X 8'	64
• MRRUP1250	14	4' X 8'	299
• MRRUP1270A	15	4' X 9'	88
• MRRUP1270B	16	4' X 9'	947

Figure 8 - Alternative 3A Route Diagram

PARKLAND ESTATES DRAINAGE IMPROVEMENTS
Preliminary Engineering Report
25



PUMP STATION & FORCE MAIN			
BEGIN NODE ●	PIPE ID	SIZE	LENGTH (FT)
• MRRUP1280	1	36"	651
• MRRU0790	2	4' X 8'	217
• MRRU0770B	3	64" FM	5479

Figure 9 – Pump Station and Force Main Route Diagram

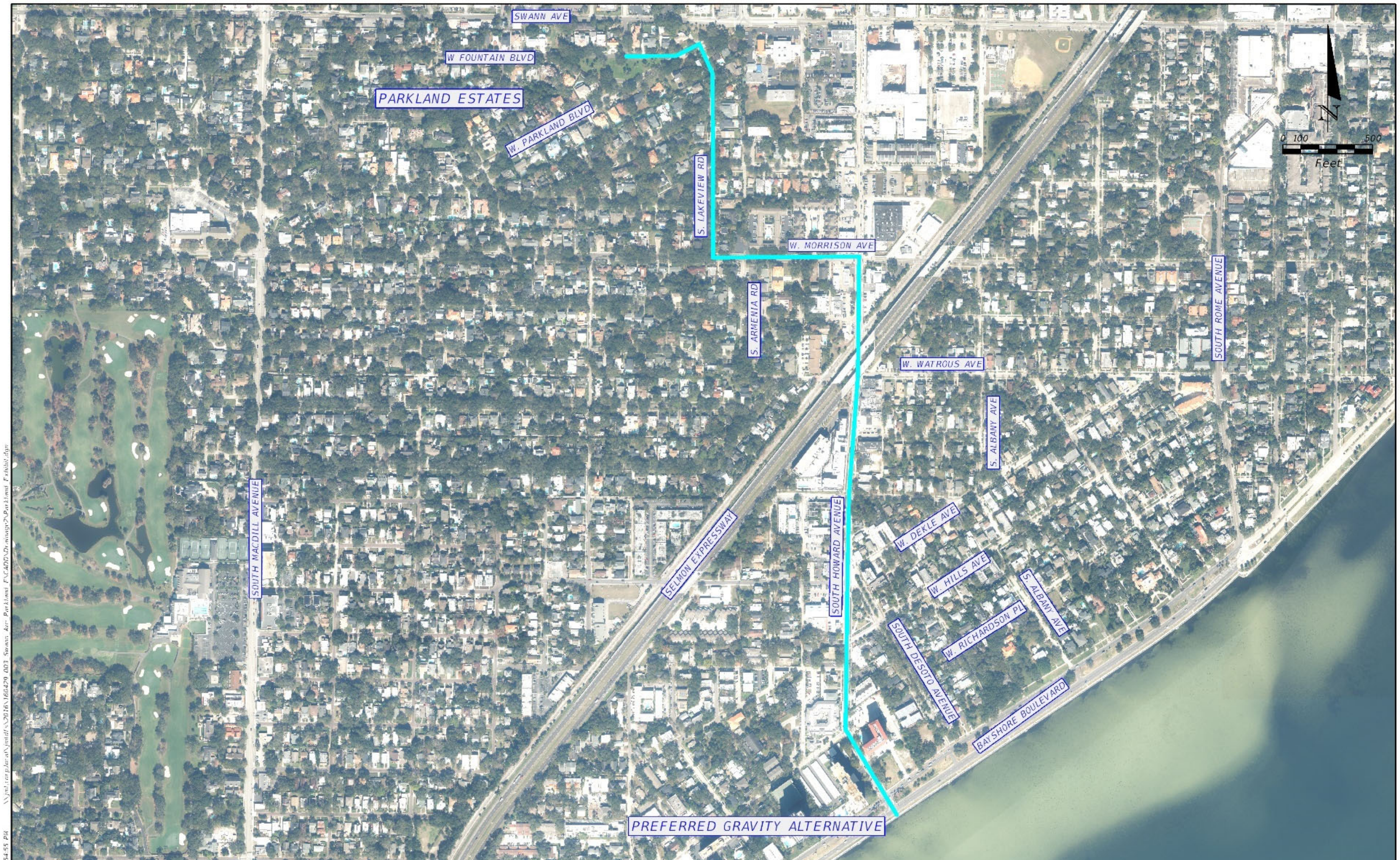
City of Tampa | Stormwater Division

FIGURE 13. Alternative 2 Impacts to Access

FIGURE 14. Pump Alternative Impacts to Access

PARKLAND ESTATES STORMWATER IMPROVEMENTS	
BES CONCEPT ROUTE	


N
E
S
W
Proposed Pump Station
Proposed Force Main
Tie Into Existing System
CITY OF TAMPA PUMP STATION
W Horatio St
W De Leon St
W De Leon St
Victoria Gardens Ln
Kensington Gardens Ln
W Swann Ave
W Fountain Blvd
Allen Pl
W Simms Blvd
W Morrison Ave
W Jetton Ave
W Jetton Ave
W Watrous Ave
W Sunset Dr
W Marjory Ave
W Prospect Rd
W Neptune St
Teresa Cir
W Southview Ave
W Hills Ave
W Dekle Ave
W Richardson Pl
W Mississippi Ave
W Chicago Ave
W Stroud Ave
W Stroud Ave
W Texas Ave
W Texas Ave
Bayshore Blvd
Selmon Expy W
Selmon Expy E
S Arrawana Ave
S Tampania Ave
S Audubon Ave
Tampania Ave
S Armenia Ave
S Moody Ave
S Westland Ave
S Albany Ave
S Melville Ave
S Fremont Ave
S Rome Ave
S Gunby Ave
S Georgia Ave
S Carolina Ave
S Howard Ave
S Alabama Ave
S De Soto Ave
Nance Ave
S Bay Villa Pl
Glen Ave



REVISIONS						
DATE	DESCRIPTION	DATE	DESCRIPTION	Robert Dvorak, P.E. P.E. No. 40962 Johnson, Mirmiran & Thompson, Inc. 1104 E. Twiggs Street, Suite 100 Tampa, FL 33602-3103 Certificate of Authorization No. 5917	CITY OF TAMPA	PARKLAND ESTATES STORMWATER IMPROVEMENTS OUTFALL ALTERNATIVES	SHEET

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APPENDIX B

TECHNICAL MEMORANDUM

JMT 50 YEARS
Turning Visions into Realities

TECHNICAL MEMORANDUM

To: City of Tampa

From: Aaron Mickiewicz, PE
Michael Luning, PE

Date: March 4, 2021

File: 19-03630-001

Subject: Proposed Stormwater Pumping Station – Parkland Estates
Preliminary Basis of Design and Opinion of Probable Cost

BACKGROUND

Flooding occurs near West Fountain Boulevard and Audubon Avenue in the Parkland Estates neighborhood extending up to Swann Avenue in the City of Tampa. Limited outfall capacity is the primary cause for this flooding. The existing drainage system does not have adequate capacity leading to long periods of time where stormwater runoff remains within roadways. Residents are unable to commute to and from their homes within these flood prone areas and in many cases will have to wait hours until the flood waters subside, even during lesser design storm events such as the mean annual or 5-year storms.

JMT reviewed the City's existing XPSWMM watershed model covering the area and updated it with collected survey data. The model was run to establish baseline conditions for the mean annual, 5- and 10-year/24-hour storm events. New outfall routes for the placement of a large box culvert were assessed, both with and without storage in the park, in order to determine the most cost-effective solution. The City subsequently made additional modifications to the XPSWMM modeling and requested JMT to review and calibrate the XPSWMM model to a shorter intense rainfall event such as an inch of rainfall in 20 minutes as those frequent events cause the repetitive flooding issues in the area. The use of the short term storm event revealed that a lack of inlet capacity was an additional concern for flooding in the area. The City then requested JMT to analyze options for a stormwater pumping station and forcemain utilizing the previously established gravity storm route. Multiple options were analyzed and presented to the City resulting in a selection of a preferred alternative. JMT was then requested to assist in providing an opinion of probable cost of a preliminary basis of design for a new stormwater pumping station which will substantially minimizes flooding within the Parkland Estates neighborhood.

2000 E. 11th Avenue, Suite 300 Tampa, FL 33605 (813) 314-0314 www.jmt.com

HYDRAULIC ANALYSIS

JMT was asked to prepare a budget level opinion of construction cost to build completely a new pumping station, discharge force main and separated collection wet well stormwater detention facility. This opinion is based on the following criteria.

CRITERIA

1. Predicted/Required maximum pumping capacity of 70 CFS (31,420 GPM).
2. 3-pump station with 2-pump FIRM rate in operation and 1-pump on standby. Pumps will alternate between cycles.
3. Velocity Range 2 – 8 FPS required for 36-inch diameter station piping and 42-inch diameter force main.
4. Assumed poor soils requiring a deep foundation design.
5. Permits are obtainable.
6. Land cost are not included.
7. High level of architectural detail.
8. Limited site layout area.
9. Discharge location established near the Bayshore Blvd. And S. Howard Ave. intersection into Hillsborough Bay.
10. Medium voltage power, step down transformer, and service conduit to meter by others and thereby excluded from this technical memorandum.
11. Previously determined force main corridor and pumping station location.

PUMP PERFORMANCE REQUIREMENTS

For estimating purposes JMT has selected a pump configuration meeting the criteria and is described as follows:

1. Total Dynamic Head (TDH)
    a. Hazen-Williams formula utilized for friction pipe losses. Coefficient, C = 140.
    b. Static heads using station's pump off elevations.
    c. Free outfall discharge, tailwater elevation = 3.0
    d. Force main system high point elevation = 19.0
    e. No Residual Pressures proposed within current system head characteristics.
2. Allowable Pumping Rates
    a. 70 CFS (31,420 GPM) maximum FIRM pumping rate for a 2-pump in parallel operation.

Pump size, speed, and impeller diameter influence the pump's operating range. Variable Frequency Drives (VFD) are proposed allowing Operations Personnel to adjust pump range as needed for efficient performance against the TDH characteristics resulting in the following.

REQUIRED PUMP PERFORMANCE		
	1-Pump Running	2-Pumps in Parallel Running Each Pump
Operating Points:		
Maximum System Head	19,750 gpm @ 21.5 ft.	15,900 gpm @ 34 ft.
Minimum System Head	20,400 gpm @ 19.1 ft.	16,500 gpm @ 32 ft.

PUMP SELECTION

The City desires Flygt pumps as another existing stormwater pumping station is in operation utilizing these non-clog submersible pumps with quick connect guide rail systems; therefore, the Flygt CP3501 20-inch non clog submersible pump is recommended. The recommended pump is similar to the Donut Pond stormwater pumping station allowing for more convenient maintenance and operation. The Flygt CP3501 20-inch pump is a centerline discharge submersible pump that can accommodate the above operating conditions. Pump information are as follows:

FLYGT CP3501 20-INCH		
	Total Dynamic Head Low Condition, 1-pump Running	Total Dynamic Head High Condition, 2-pumps Running
Operating Point:	20,400 gpm @ 19.1 ft.	15,900 gpm @ 34 ft.
Pump Characteristics:		
Pump Size (inches)	20	20
Impeller Size (inches)	23.03	23.03
Pump Speed (rpm)	595	595
Pump Efficiency (%)	62	83
Frequency (Hz)	60	60
Motor Size (hp)	215	215

Manufacturer's pump curves with high and low system head curves are shown in Appendix A.

POWER REQUIREMENTS

A 1,600-amp service is recommended to supply power to the proposed stormwater pumping station consisting of (3) 215HP pumps and miscellaneous building loads. The preferred design consists of two separate utility feeds through an automatic transfer switch. Variable Frequency Drives with soft start bypasses are recommended for pump control.

It is our understanding a permanent generator is not desired, and a dual feed service is recommended. However, a City standard "quick-connect" setup to allow for portable generator connection for use is anticipated and considered herein.

CONCLUSIONS & RECOMMENDATION

JMT concludes that based on the described criteria a station can be constructed on the chosen site in the estimated amount of $20,859,064.00. The station will be equipped with the following appurtenances which define the opinion of cost to construct.

- (3) 20-inch non clog solids handling submersible pumps with 215 HP motors at 15,900 GPM @ 34-feet TDH.
- Pumps powered by 3-phase 480-volt service.
- Station will have SCADA system for offsite monitoring and controls.
- Pumps will run on Variable Frequency Drives (VFD) with backup soft starters.
- Station will have a low-profile cast-in-place reinforced concrete pump sump with attached valve vault substructure (top slab elevation 6-inches above finished grade) and detached adjoining brick faced block and mortar superstructure building on a reinforced concrete foundation.
- Site layout to accommodate boom truck or crane access for pump removal or other appurtenance service needs requiring removal.
- New 10,000 sq-ft underground concrete stormwater detention and collection system with 4-foot operating range.
- Consideration will be given to designing the controls building to match local architectural theme.

See Appendices for detailed preliminary hydraulic calculations, proposed pump station site layout schematic and detailed opinion of probable cost estimate.

After your review, please advise if you would like to schedule a meeting to discuss this technical memorandum and any questions you may have.

JOHNSON, MIRMIRAN & THOMPSON, INC.

Derek L. Doughty, PE, CFM, ENV SP, D.WRE
Senior Associate

Aaron Mickiewicz, P.E.
Senior Associate

Attachments:
Appendix A: Preliminary Hydraulic Calculations
Appendix B: Site Layout Schematic
Appendix C: Opinion of Probable Cost

Appendix A

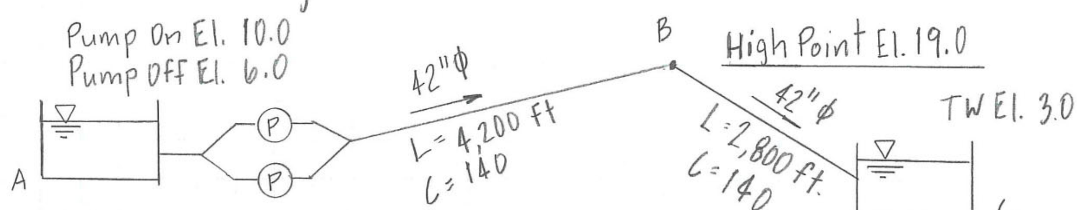
Preliminary Hydraulic Calculations

Project: Parkland Estates
Subject: Stormwater Pumping Station Preliminary Hydraulic Calculation
Job No. 19-03630-001
Sheet No. 1 of 4
Computed By: RAM Date: 1/7/21 Checked By: ____ Date: ____

This calculation is to determine system head characteristics and a basis of design pump performance requirements.

Given Information:

Ground Elev. @ Proposed Pump Station: 16.0
Proposed Pump Station Pump On Elev.: 10.0
Proposed Pump Station Pump Off Elev.: 6.0
Wet Well Area: 10,000 ft²
Required Pump Rate = 70 cfs = 31,420 gpm, Say (2) pumps = 31,420 gpm
∴ (1) pump FIRM = 15,710 gpm
Force Main Diameter: 42-inch
Force Main Material: Plastic, PVC/HDPE
Force Main Length: 7,000 L.F.
Force Main High Point Ground Elev: 22.0, Assume 3' min Cover
Force Main Discharge Invert: (-)3.0 ∴ HP = 22.0 - 3 = 19.0
Force Main Discharge Tailwater Elev: 3.0



SYSTEM HEAD

TDH = Static Head + Friction Loss + Residual Head, where Residual Head = 0.0

Friction Loss, $h_{F42"} = \dfrac{10.44\, L_{Ft}\, Q_{gpm}^{1.85}}{C^{1.85}\, d_{in}^{4.87}}$, Hazen-Williams Formula.

Static Head: $E_C - E_A = 3 - 6 = (-)3$ & $3 - 10 = (-)7$
$E_B - E_A = 19 - 6 = 13$ & $19 - 10 = 9$ ∴ Good $E_B - E_A$

— Include 2,800 LF of Friction Loss thereby conservative. —

Q (gpm)	$h_{F42"}$ (Ft)	High Static (Ft)	Low Static (Ft)	High TDH (Ft)	Low TDH (Ft)
0	–	13	9	13	9
10,000	2.4	↓	↓	15.4	11.4
20,000	8.8	↓	↓	21.8	17.8
30,000	18.7	↓	↓	31.7	27.7
40,000	31.8	↓	↓	44.8	40.8

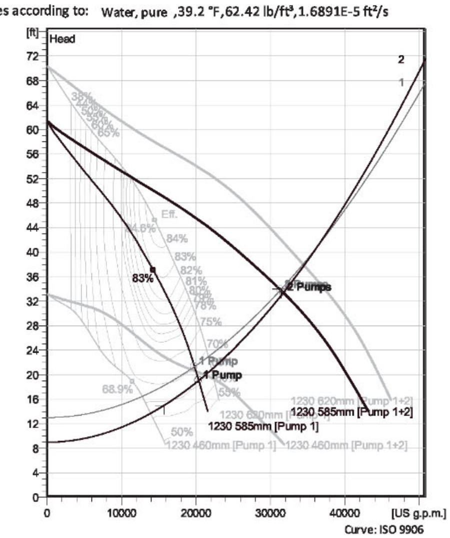
CP 3501/836 3~ 1230

Shrouded single or multi-channel impeller pumps with large throughlets and single volute pump casing for liquids containing solids and fibres. Cast iron design with double sealing technology. Some models available as stainless steel versions.

FLYGT
a xylem brand

Technical specification

Curves according to: Water, pure ,39.2 °F,62.42 lb/ft³,1.6891E-5 ft²/s



Configuration

Motor number
C0836.000 54-52-12ID-W
215hp

Installation type
P - Semi permanent, Wet

Impeller diameter
585 mm

Discharge diameter
20 inch

Pump information

Impeller diameter
585 mm

Discharge diameter
20 inch

Inlet diameter
800 mm

Maximum operating speed
595 rpm

Number of blades
3

Throughlet diameter
4 5/16 inch

Max. fluid temperature
40 °C

Materials

Impeller
Grey cast iron

Project		**Created by**	Ethan Willats	**Last update**	2/3/2021
Block		**Created on**	2/3/2021		

CP 3501/836 3~ 1230

Technical specification

FLYGT a xylem brand

Motor - General

Motor number C0836.000 54-52-12ID-W 215hp	**Phases** 3~	**Rated speed** 595 rpm	**Rated power** 215 hp
ATEX approved No	**Number of poles** 12	**Rated current** 340 A	**Stator variant** 1
Frequency 60 Hz	**Rated voltage** 460 V	**Insulation class** H	**Type of Duty**
Version code 000			

Motor - Technical

Power factor - 1/1 Load 0.63	**Motor efficiency - 1/1 Load** 94.0 %	**Total moment of inertia** 332 lb ft²	**Starts per hour max.** 0
Power factor - 3/4 Load 0.55	**Motor efficiency - 3/4 Load** 93.9 %	**Starting current, direct starting** 1570 A	
Power factor - 1/2 Load 0.43	**Motor efficiency - 1/2 Load** 92.7 %	**Starting current, star-delta** 524 A	

Project		**Created by**	Ethan Willats	**Last update**	2/3/2021
Block		**Created on**	2/3/2021		

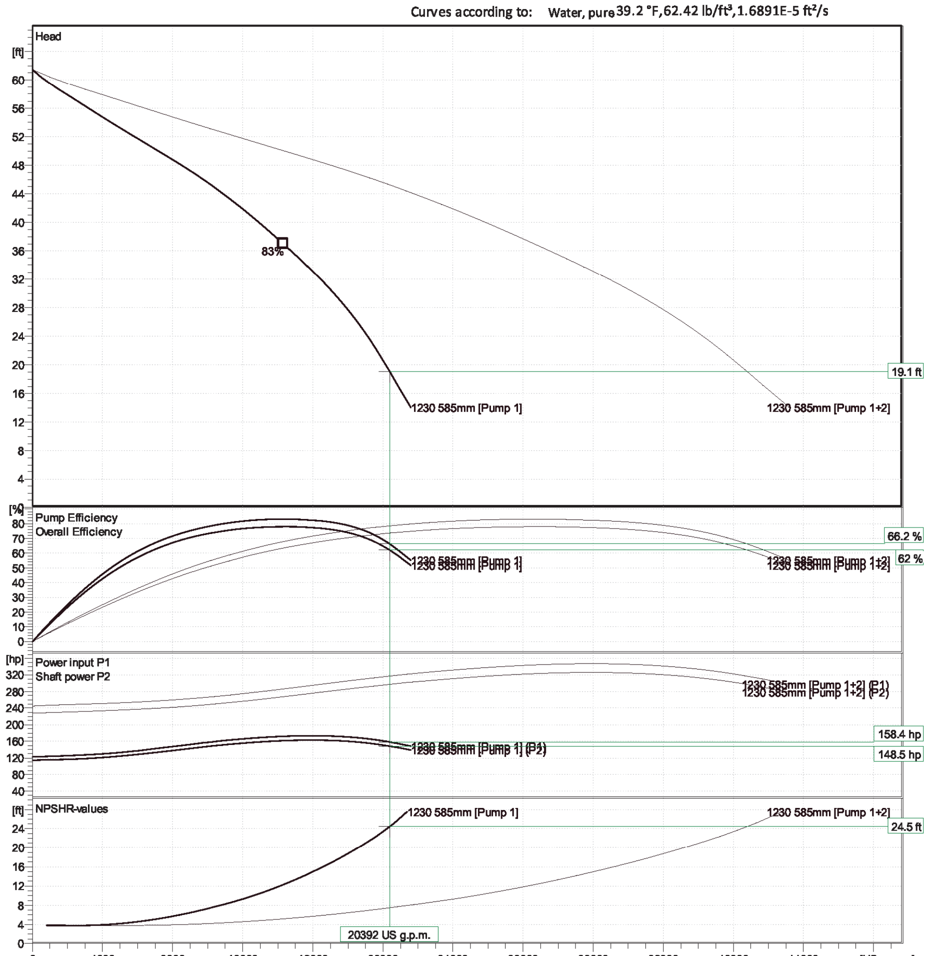
CP 3501/836 3~ 1230

Performance curve

Duty point

Flow	Head
10200 US g.p.m.	19.1 ft

Curves according to: Water, pure 39.2 °F, 62.42 lb/ft³, 1.6891E-5 ft²/s



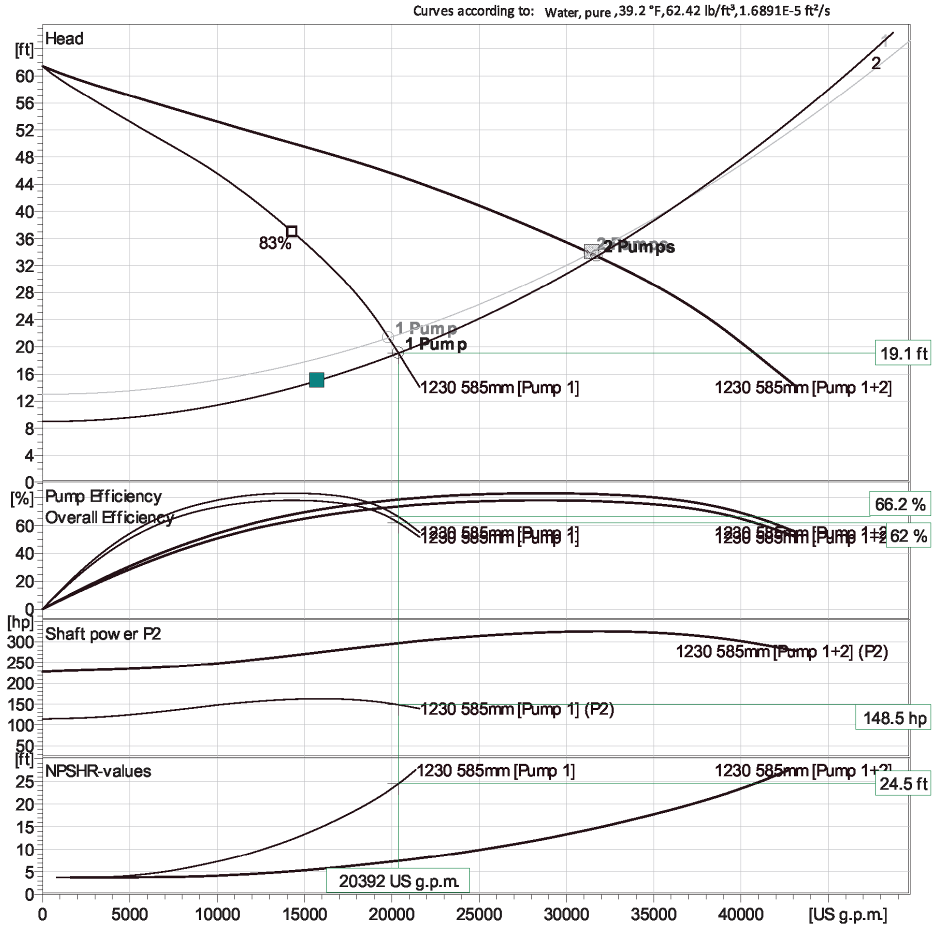
Curve: ISO 9906

Project		Created by	Ethan Willats	Last update	2/3/2021
Block		Created on	2/3/2021		

CP 3501/836 3~ 1230

Duty Analysis

Curves according to: Water, pure ,39.2 °F,62.42 lb/ft³,1.6891E-5 ft²/s



Operating characteristics

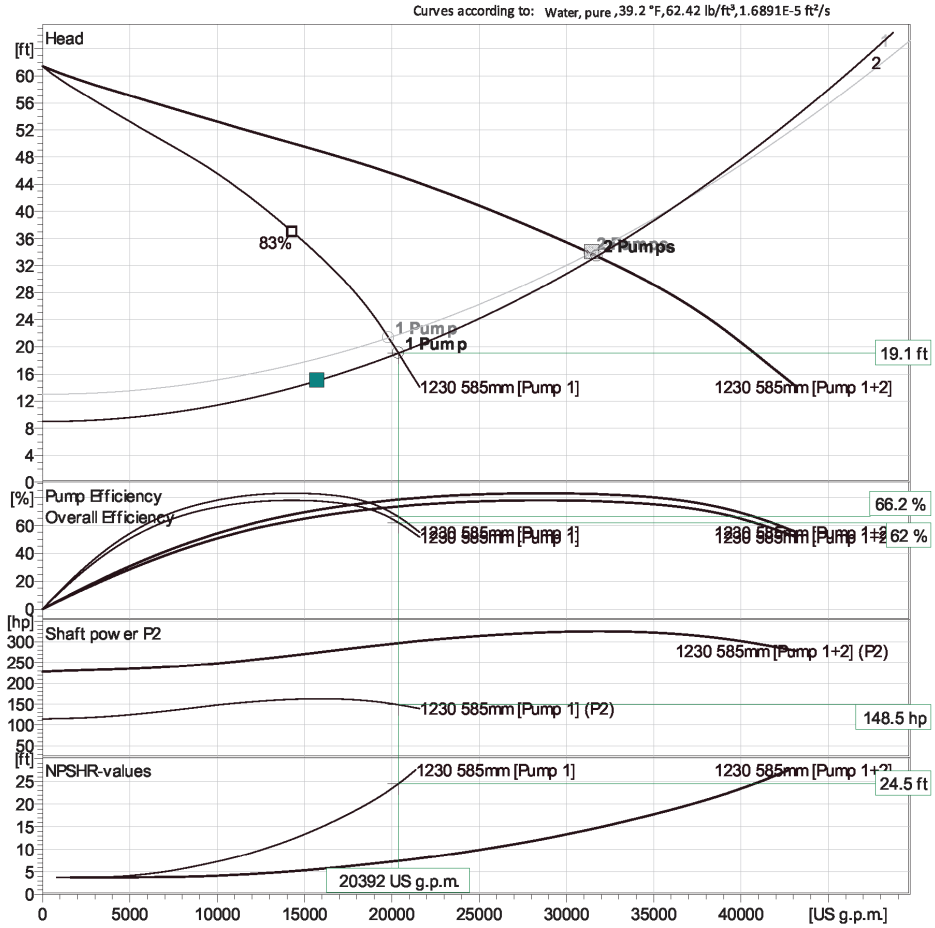
Pumps / Systems	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific Energy	NPSHre
2 / 2	15900 US g.p.m	33.4 ft	163 hp	31800 US g.p.m	33.4 ft	326 hp	82.4 %	136 kWh/US M(	14.8 ft

Project		Created by	Ethan Willats	Last update	2/3/2021
Block		Created on	2/3/2021		

CP 3501/836 3~ 1230

Duty Analysis

Curves according to: Water, pure ,39.2 °F,62.42 lb/ft³,1.6891E-5 ft²/s



Operating characteristics

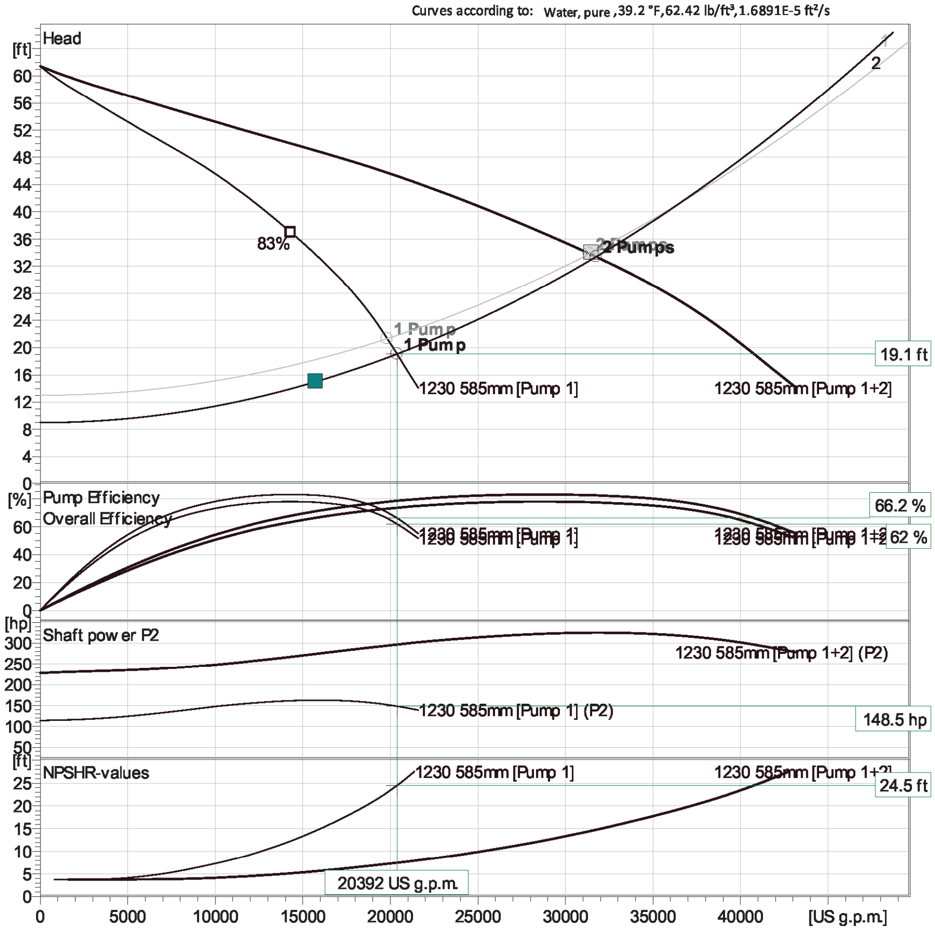
Pumps / Systems	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific Energy	NPSHre
1 / 2	20400 US g.p.m	19.1 ft	148 hp	20400 US g.p.m	19.1 ft	148 hp	66.2 %	96.6 kWh/US M	24.5 ft

Project		Created by	Ethan Willats	Last update	2/3/2021
Block		Created on	2/3/2021		

CP 3501/836 3~ 1230

Duty Analysis

Curves according to: Water, pure ,39.2 °F,62.42 lb/ft³,1.6891E-5 ft²/s



Operating characteristics

Pumps / Systems	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific Energy	NPSHre
2 / 1	15700 US g.p.m	33.8 ft	163 hp	31400 US g.p.m	33.8 ft	325 hp	82.5 %	137 kWh/US M(	14.5 ft

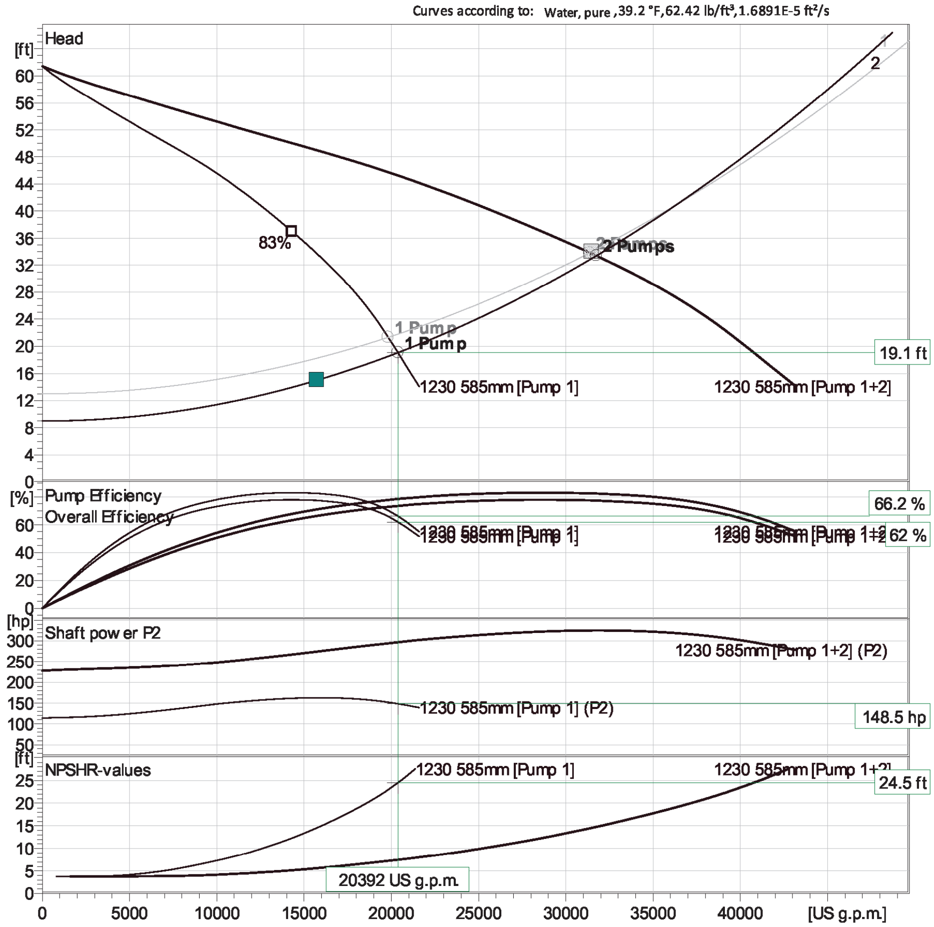
Project		Created by	Ethan Willats	Last update	2/3/2021
Block		Created on	2/3/2021		

CP 3501/836 3~ 1230

Duty Analysis

FLYGT a xylem brand

Curves according to: Water, pure ,39.2 °F,62.42 lb/ft³,1.6891E-5 ft²/s



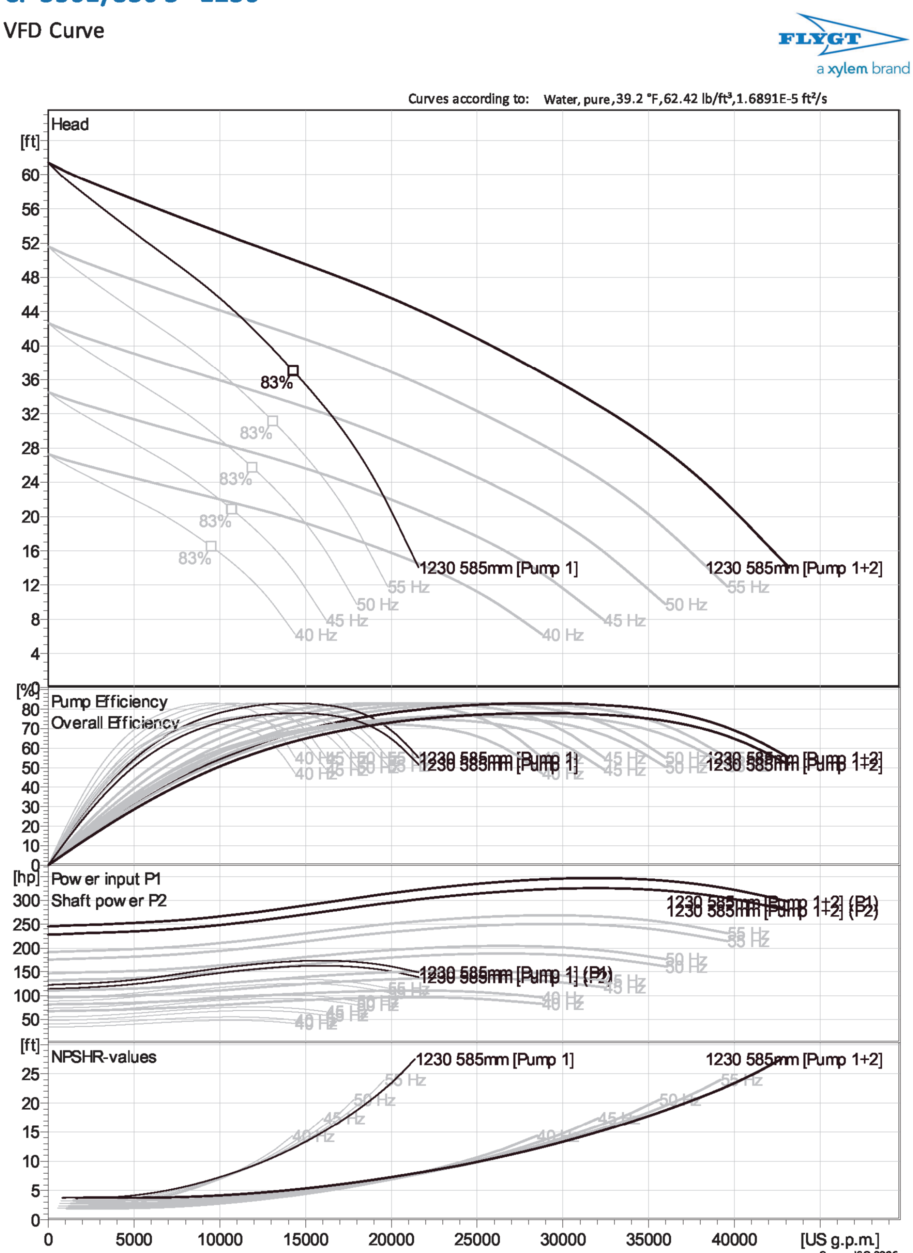
Operating characteristics

Pumps / Systems	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific Energy	NPSHre
1 / 1	19800 US g.p.m	21.3 ft	152 hp	19800 US g.p.m	21.3 ft	152 hp	70.3 %	102 kWh/US M(	23 ft

Project		Created by	Ethan Willats	Last update	2/3/2021
Block		Created on	2/3/2021		

CP 3501/836 3~ 1230

VFD Curve

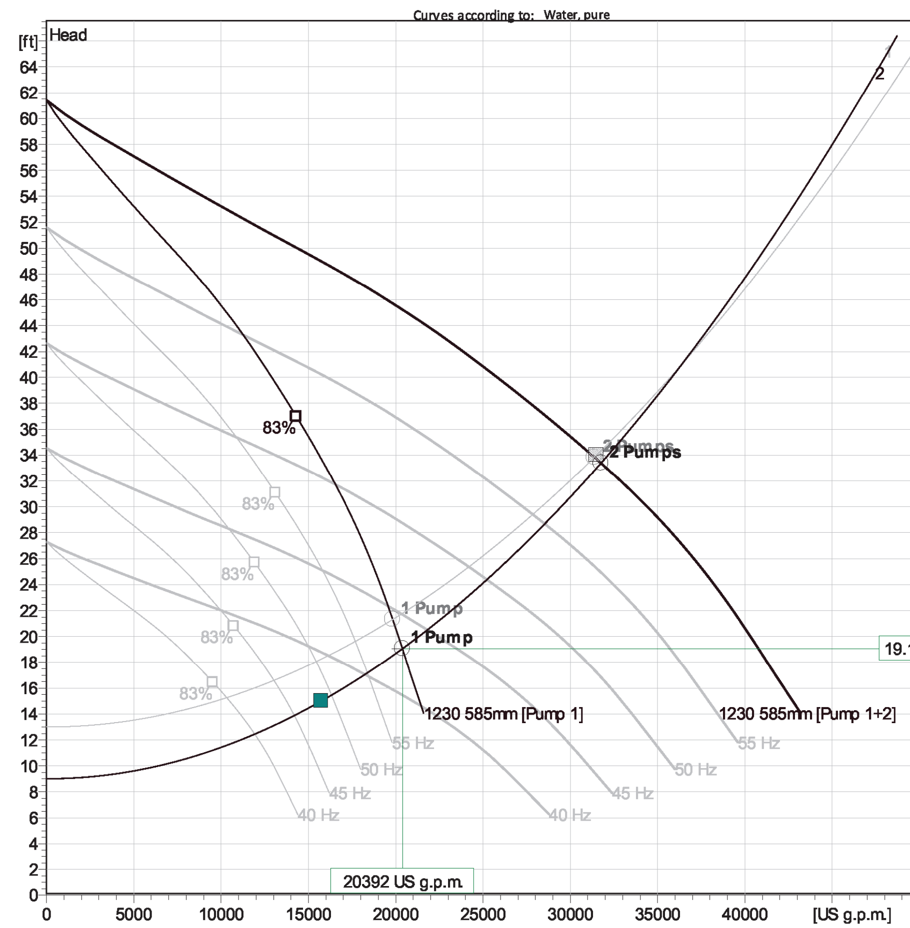


Project		Created by	Ethan Willats	Last update	2/3/2021
Block		Created on	2/3/2021		

CP 3501/836 3~ 1230

VFD Analysis

FLYGT a xylem brand



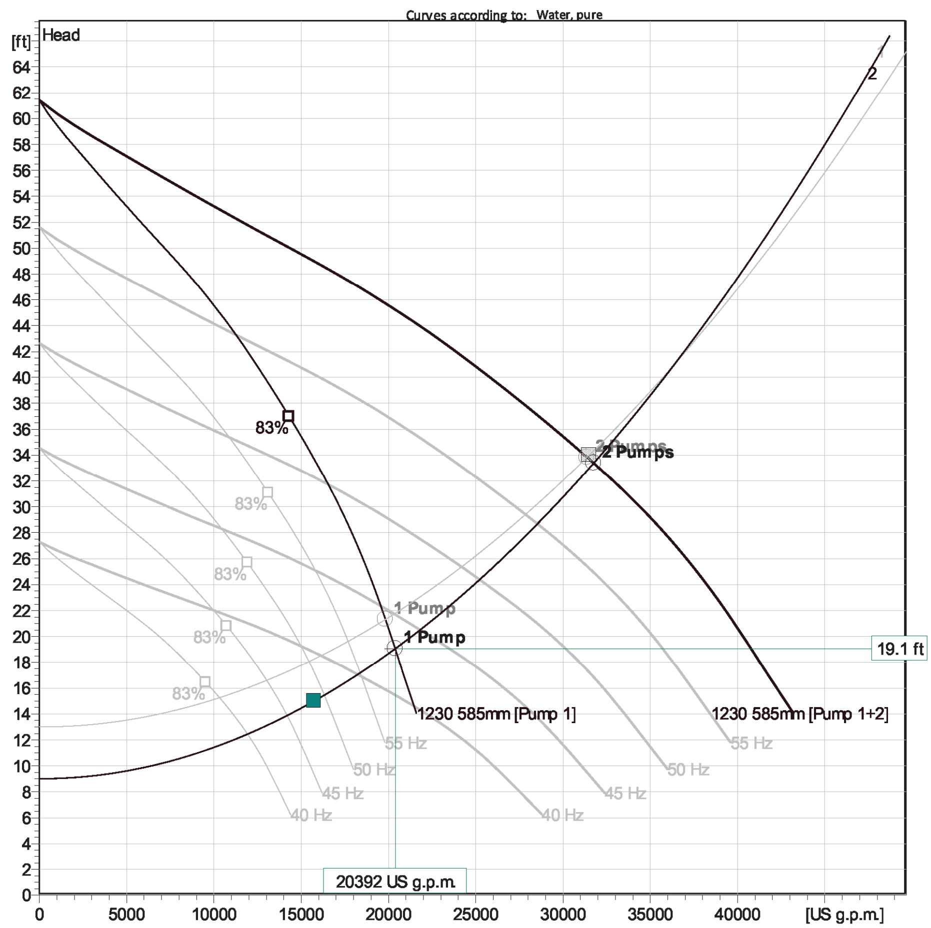
Operating characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific Energy	NPSHre
2 / 2	60 Hz	15900 US g.p.n	33.4 ft	163 hp	31800 US g.p.n	33.4 ft	326 hp	82.4 %	136 kWh/US M	14.8 ft
2 / 2	55 Hz	14300 US g.p.n	28.7 ft	125 hp	28500 US g.p.n	28.7 ft	251 hp	82.6 %	117 kWh/US M	12.4 ft
2 / 2	50 Hz	12600 US g.p.n	24.4 ft	94 hp	25200 US g.p.n	24.4 ft	188 hp	82.8 %	100 kWh/US M	10.1 ft
2 / 2	45 Hz	10900 US g.p.n	20.5 ft	68.2 hp	21800 US g.p.n	20.5 ft	136 hp	83 %	86.2 kWh/US M	7.98 ft
2 / 2	40 Hz	9120 US g.p.m	17.1 ft	47.5 hp	18200 US g.p.n	17.1 ft	94.9 hp	82.9 %	74.3 kWh/US M	5.96 ft
1 / 2	60 Hz	20400 US g.p.n	19.1 ft	148 hp	20400 US g.p.n	19.1 ft	148 hp	66.2 %	96.6 kWh/US M	24.5 ft

Project		Created by	Ethan Willats	Last update	2/3/2021
Block		Created on	2/3/2021		

CP 3501/836 3~ 1230

VFD Analysis



Operating characteristics

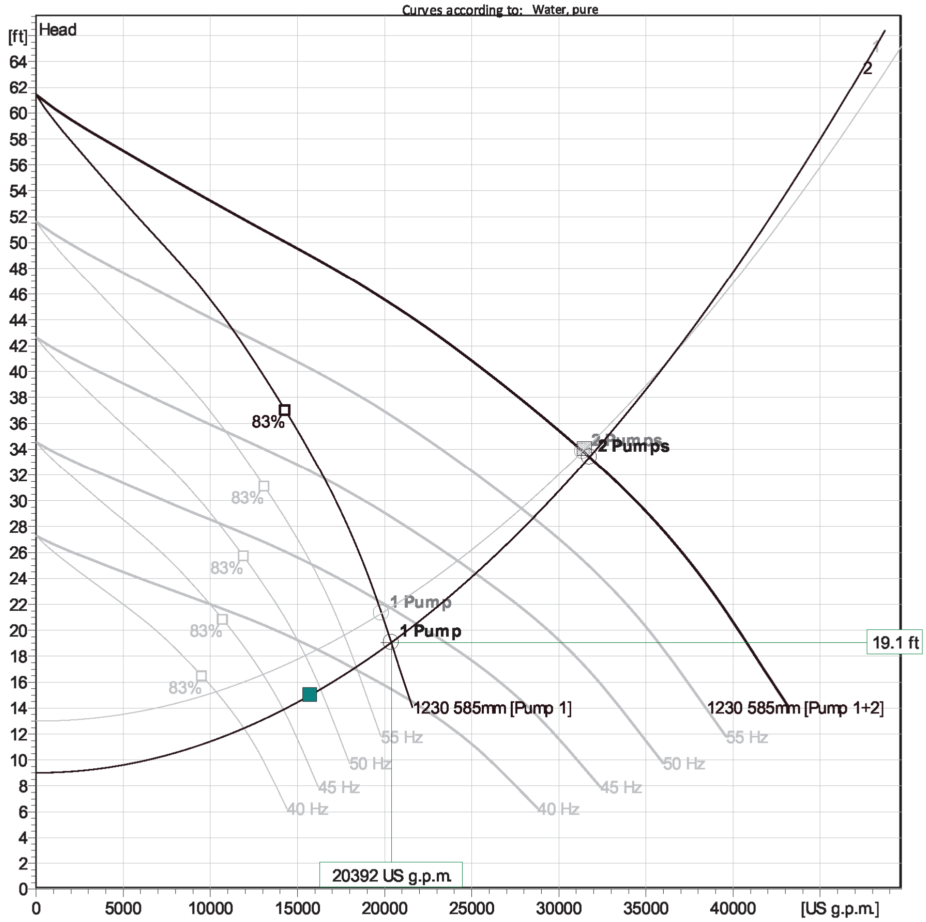
Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific Energy	NPSHre
1 / 2	55 Hz	18400 US g.p.n	17.2 ft	116 hp	18400 US g.p.n	17.2 ft	116 hp	68.8 %	84.4 kWh/US M	20.5 ft
1 / 2	50 Hz	16300 US g.p.n	15.4 ft	88.9 hp	16300 US g.p.n	15.4 ft	88.9 hp	71.8 %	73.6 kWh/US M	16.7 ft
1 / 2	45 Hz	14200 US g.p.n	13.9 ft	66.2 hp	14200 US g.p.n	13.9 ft	66.2 hp	75.3 %	64.4 kWh/US M	13.1 ft
1 / 2	40 Hz	11900 US g.p.n	12.4 ft	47.6 hp	11900 US g.p.n	12.4 ft	47.6 hp	79 %	56.9 kWh/US M	9.71 ft
2 / 1	60 Hz	15700 US g.p.n	33.8 ft	163 hp	31400 US g.p.n	33.8 ft	325 hp	82.5 %	137 kWh/US M	14.5 ft
2 / 1	55 Hz	13900 US g.p.n	29.4 ft	125 hp	27800 US g.p.n	29.4 ft	250 hp	82.8 %	120 kWh/US M	11.9 ft

Project		Created by	Ethan Willats	Last update	2/3/2021
Block		Created on	2/3/2021		

CP 3501/836 3~ 1230

VFD Analysis

Curves according to: Water, pure



Operating characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific Energy	NPSHre
2 / 1	50 Hz	12100 US g.p.n	25.4 ft	93.6 hp	24200 US g.p.n	25.4 ft	187 hp	83 %	104 kWh/US M	9.41 ft
2 / 1	45 Hz	10200 US g.p.n	21.7 ft	67.5 hp	20300 US g.p.n	21.7 ft	135 hp	82.9 %	91.6 kWh/US M	7.09 ft
2 / 1	40 Hz	8070 US g.p.m	18.5 ft	46.2 hp	16100 US g.p.n	18.5 ft	92.4 hp	81.8 %	82.1 kWh/US M	4.93 ft
1 / 1	60 Hz	19800 US g.p.n	21.3 ft	152 hp	19800 US g.p.n	21.3 ft	152 hp	70.3 %	102 kWh/US M	23 ft
1 / 1	55 Hz	17700 US g.p.n	19.6 ft	119 hp	17700 US g.p.n	19.6 ft	119 hp	73.5 %	90.1 kWh/US M	18.8 ft
1 / 1	50 Hz	15500 US g.p.n	18.1 ft	91.7 hp	15500 US g.p.n	18.1 ft	91.7 hp	76.9 %	80.2 kWh/US M	14.9 ft

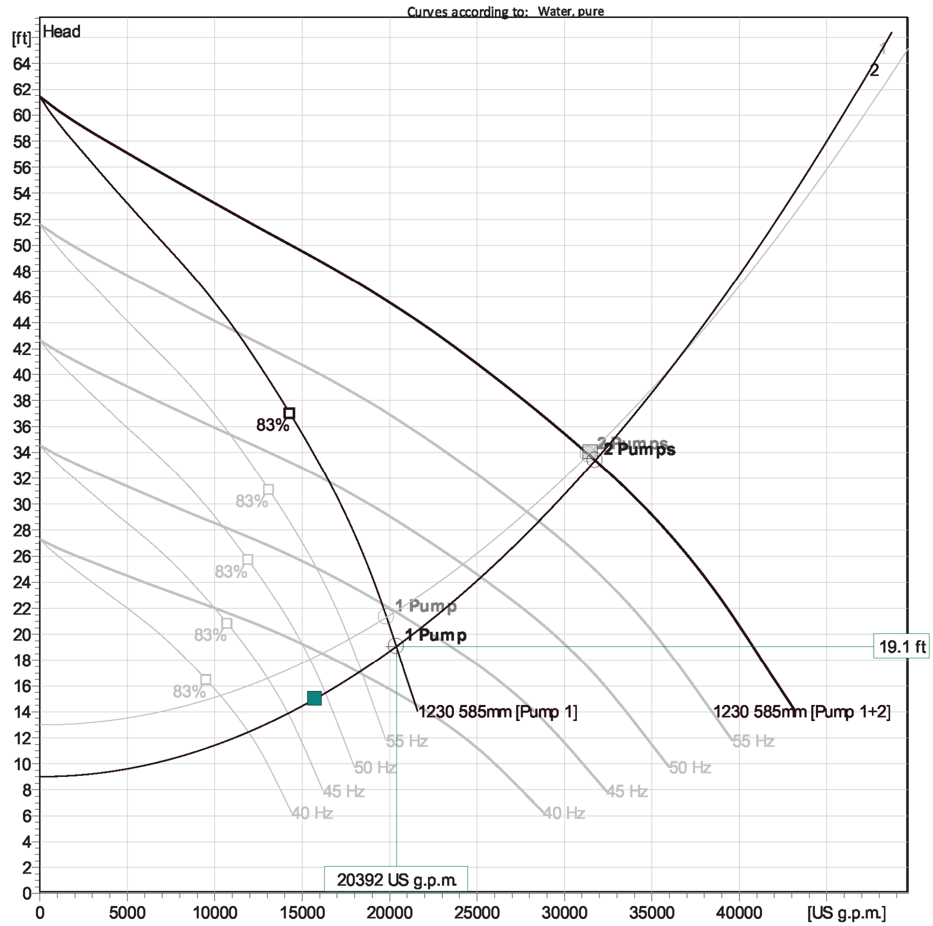
Project		Created by	Ethan Willats	Last update	2/3/2021
Block		Created on	2/3/2021		

CP 3501/836 3~ 1230

VFD Analysis

FLYGT a xylem brand

Curves according to: Water, pure



Operating characteristics

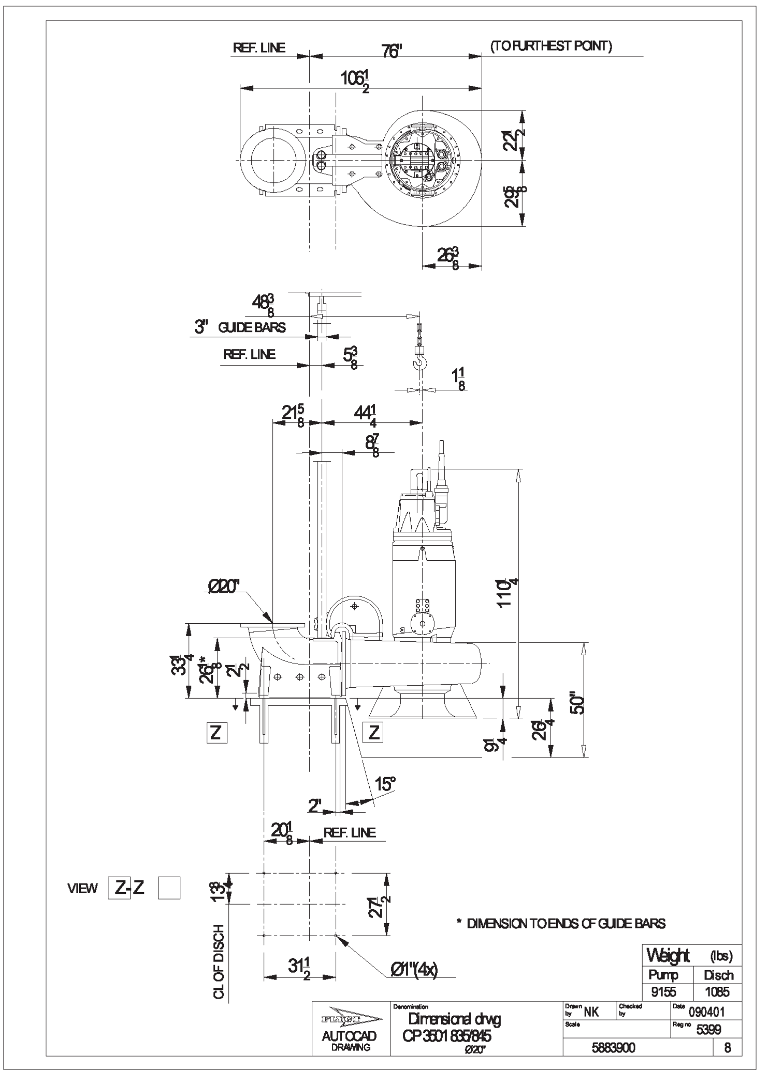
Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific Energy	NPSHre
1 / 1	45 Hz	13000 US g.p.n	16.6 ft	68.2 hp	13000 US g.p.n	16.6 ft	68.2 hp	80.3 %	72.1 kWh/US M	11.1 ft
1 / 1	40 Hz	10300 US g.p.n	15.3 ft	48.2 hp	10300 US g.p.n	15.3 ft	48.2 hp	82.7 %	66.6 kWh/US M	7.38 ft

Project		Created by	Ethan Willats	Last update	2/3/2021
Block		Created on	2/3/2021		

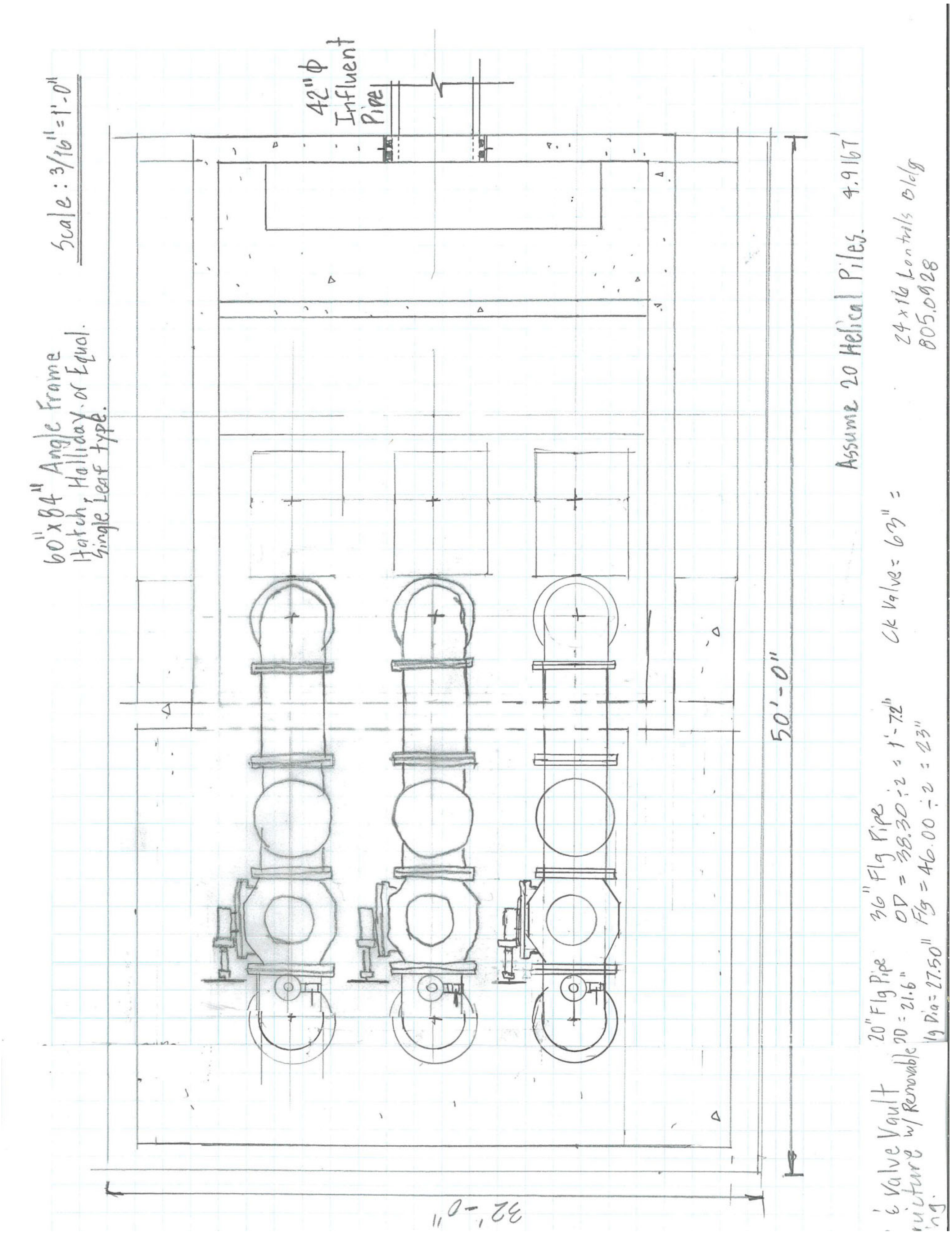
CP 3501/836 3~ 1230

Dimensional drawing

FLYGT
a xylem brand

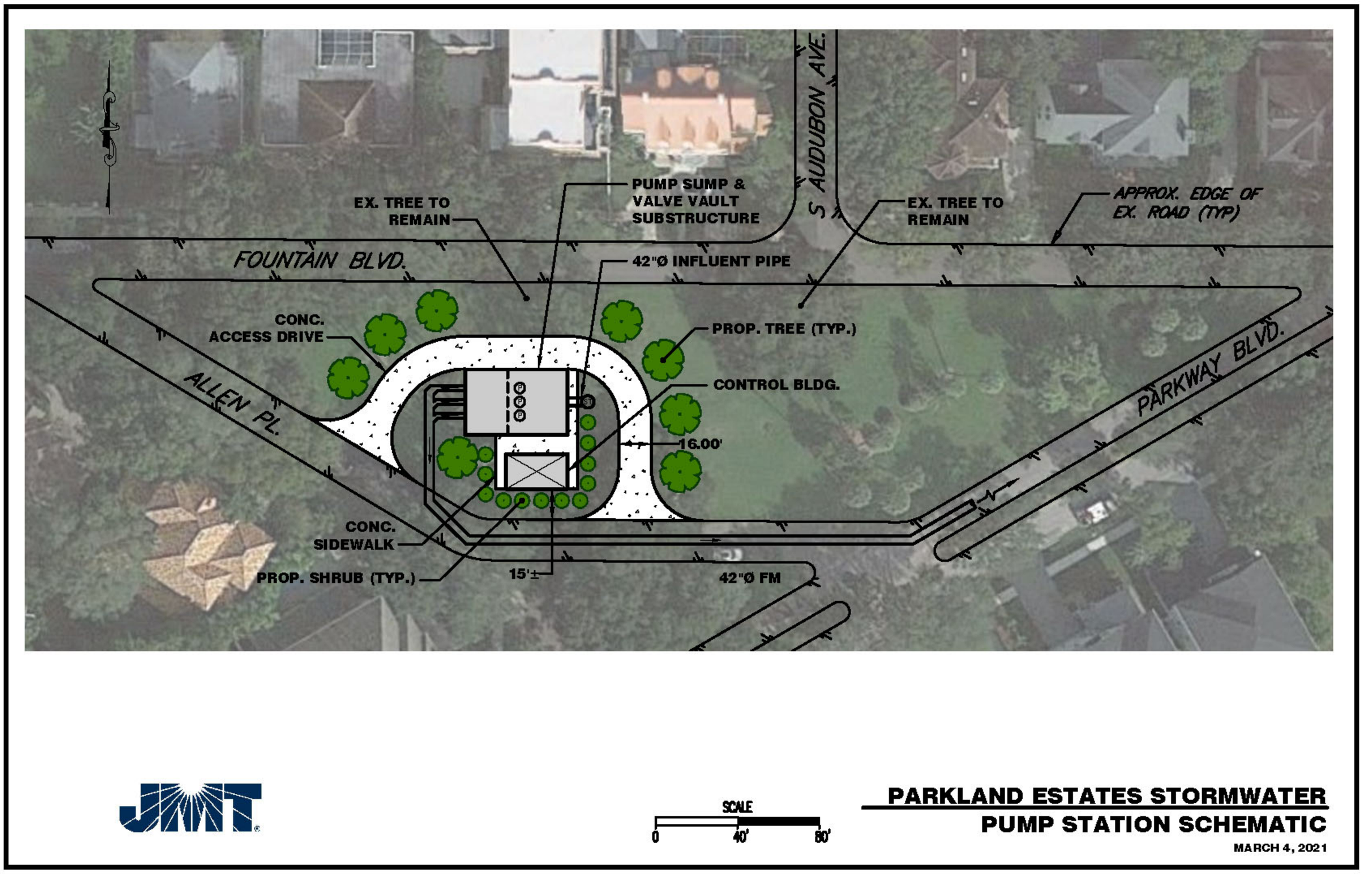


Project		**Created by**	Ethan Willats	**Last update**	2/3/2021
Block		**Created on**	2/3/2021		


Scale: 3/16" = 1'-0"
42" Φ Influent Pipe
60" x 84" Angle Frame Hatch, Halliday or Equal. Single Leaf type.
Assume 20 Helical Piles. 4.9167'
24 x 16 Controls Bldg
805.0928
Ck Valve = 63" =
50'-0"
32'-0"
36" Flg Pipe
OD = 38.30 ÷ 2 = 1'-7.2"
Flg = 46.00 ÷ 2 = 23"
20" Flg Pipe
OD = 21.6"
Flg Dia = 27.50"
Valve Vault
w/ Removable

Appendix B

Proposed Pump Station Site Layout Schematic


PUMP SUMP &
VALVE VAULT
SUBSTRUCTURE
EX. TREE TO
REMAIN
S AUDUBON AVE.
EX. TREE TO
REMAIN
APPROX. EDGE OF
EX. ROAD (TYP)
FOUNTAIN BLVD.
42"Ø INFLUENT PIPE
CONC.
ACCESS DRIVE
PROP. TREE (TYP.)
ALLEN PL.
CONTROL BLDG.
PARKWAY BLVD.
16.00'
CONC.
SIDEWALK
PROP. SHRUB (TYP.)
15'±
42"Ø FM
SCALE
0
40'
80'
PARKLAND ESTATES STORMWATER
PUMP STATION SCHEMATIC
MARCH 4, 2021

Appendix C

Opinion of Probable Cost

Project: Parkland Estates
Subject: Construction Cost Est.
Computed By: RAM Date: 3/03/20
Job No. 19-03630-001
Sheet No. 1 of 2
Checked By: MPL Date: 3/04/21

Parkland Estates Stormwater Pumping Station Opinion of Probable Cost

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL ITEM PRICE
1	General Requirements (Management and Coordination, Documention, Third Party Testing and Inspection Services, Temporary Controls and Barriers, Storage and Staging, and Field Engineering.	1	LS	$ 386,750.00	$ 386,750.00
2	Mobilization, includes Insurance, Bond, and Erosion and Sediment Control	1	LS	$1,260,000.00	$ 1,260,000.00
3	Electrical Equipment; includes 2-enclosed Circuit breakers (one for each service), automatic transfer switch, Distribution Switchboard, VFDs with Soft Start Bypasses for each pump and miscellaneous Controls Building equipment (HVAC).	1	LS	$ 800,000.00	$ 800,000.00
4	20-inch Non-Clog Submersible Pumps with 215 HP Motor including 3-inch S.S. Guide Rail Quick Connect System, Base Elbow, and Pump Controls (HOA, Transducer, Stilling Wells, and Backup Floats and Telemetry)	3	LS	$ 475,000.00	$ 1,425,000.00
5	32' x 50' Pump Sump and Valve Vault Substructure Cast in Place Reinforced Concrete including Excavation, Dewatering, Structrual Shoring and Sheeting, Vibration Monitoring, Helical Piles, Special Inspections, Testing, Appurtenances, Startup and Commissioning, O&M Manuals, Demonstrations, and Warranties	1	LS	$3,750,000.00	$ 3,750,000.00
6	Brick Controls Building Superstructure and Foundation, 30' x 16'	1	LS	$ 85,000.00	$ 85,000.00
7	36" Diameter Flanged Ductile Iron Station Piping with Interior Cement Lining and Exterior Epoxy Coating.	90	LF	$ 850.00	$ 76,500.00
8	36" Diameter Flanged Ductile Iron Station Fittings with Interior Cement Lining and Exterior Fusion Bonded Epoxy Coating.	9	EA	$ 1,000.00	$ 9,000.00
9	42" Diameter Ductile Iron Header Mechanical Joint Piping with Interior Cement Lining and Exterior Fusion Bonded Epoxy Coating	40	LF	$ 1,500.00	$ 60,000.00

Parkland Estates_Construction Cost Estimate.xlsx

Project: Parkland Estates
Subject: Construction Cost Est.
Computed By: RAM Date: 3/03/20

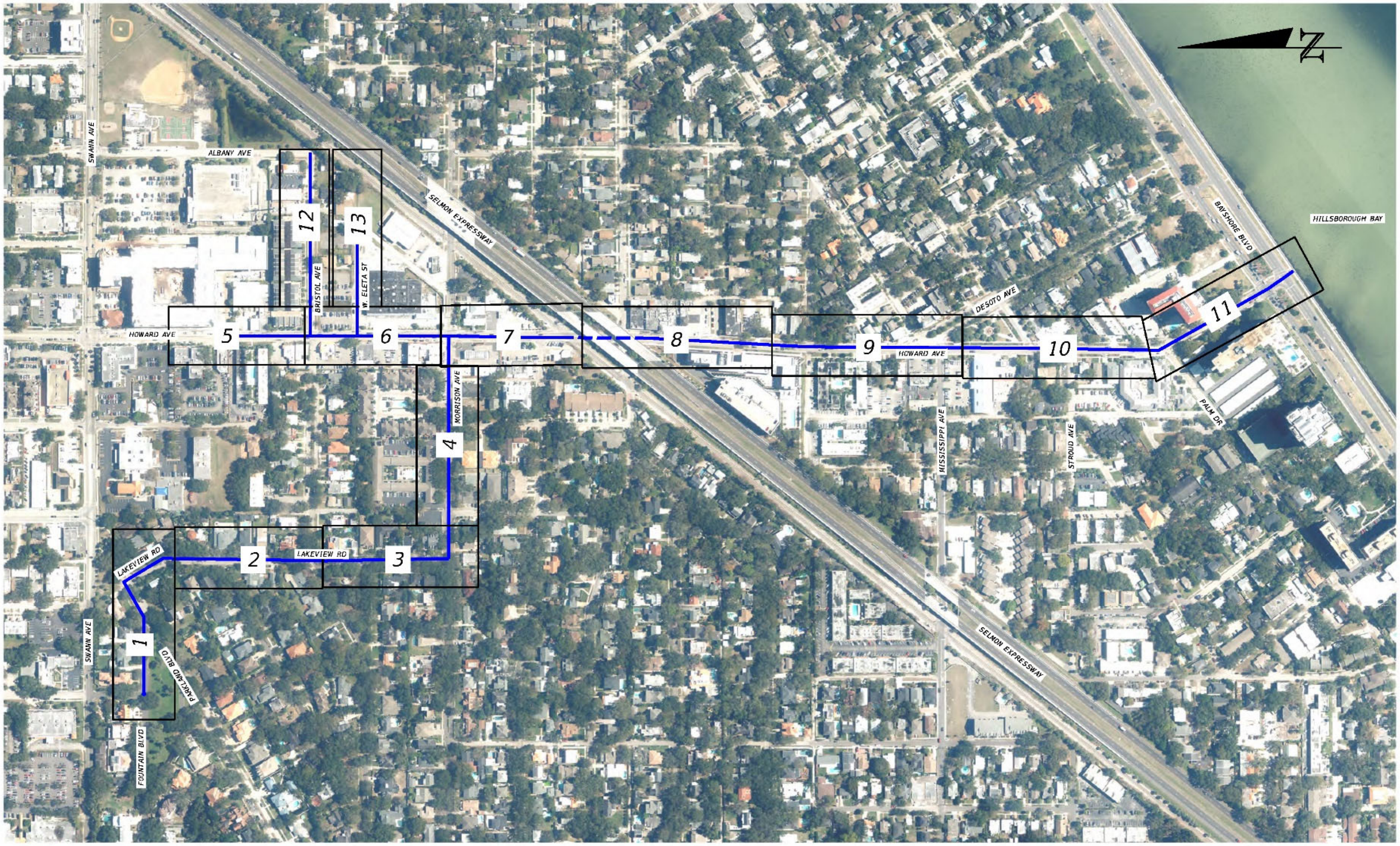
Job No. 19-03630-001
Sheet No. 2 of 2
Checked By: MPL Date: 3/04/21

Parkland Estates Stormwater Pumping Station Opinion of Probable Cost					
ITEM NO.	**ITEM DESCRIPTION**	**QUANTITY**	**UNIT**	**UNIT PRICE**	**TOTAL ITEM PRICE**
10	Station Automatic Combination Air Vents including S.S. Ball Valve and S.S. Piping	3	EA	$ 6,000.00	$ 18,000.00
11	36" Check Valve with Fusion Bonded Epoxy Coating	3	EA	$ 58,750.00	$ 176,250.00
12	36" 100% Port Plug Valve with Fusion Bonded Epoxy Coating, Worm Gear and Handwheel.	3	EA	$ 63,850.00	$ 191,550.00
13	Substructure Single Leaf Angle Frame Hatches, Access Ladders and Removeable Grating, Pipe Supports, and S.S. Hardware	1	LS	$ 80,000.00	$ 80,000.00
14	Pump Station Site Work; includes grading, concrete access drive, Stormwater BMP, and Landscaping.	1	LS	$ 70,000.00	$ 70,000.00
15	42" Diameter PVC C905 Force Main including pipe fittings (Zinc Coated D.I. with Restrained Followers) excavation, bedding, select backfill, compaction, pavement/Curb and Gutter/Conc.Walk/ Landscaping Restoration, dewatering, Inspection and Testing, and Test Holes	7,000	LF	$ 900.00	$ 6,300,000.00
16	3" Combination Air Vent Manhole including excavation, bedding, select backfill, compaction, dewatering, Inspection and Testing	6	EA	$ 12,000.00	$ 72,000.00
17	42" Diameter Force Main Discharge including Energy Dissipation, Coastline Restoration, Backflow Prevention	1	EA	$ 100,000.00	$ 100,000.00
18	Underground Reinforced Concrete Detention Facility (10,000 Sq.Ft x 4-ft Depth for Storage)	1	LS	$1,500,000.00	$ 1,500,000.00
	Subtotal				$ 16,360,050.00
	Engineering Design and Construction Phase Services @ 2.5%				$ 409,001.25
	Design Contingency @ 25%				$ 4,090,012.50
	TOTAL				**$20,859,063.75**

Parkland Estates_Construction Cost Estimate.xlsx

APPENDIX C

JMT CONCEPTUAL BOX CULVERT PLANS



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City of Tampa Florida

PARKLAND ESTATES STORMWATER IMPROVEMENTS

PROJECT LAYOUT

SHEET

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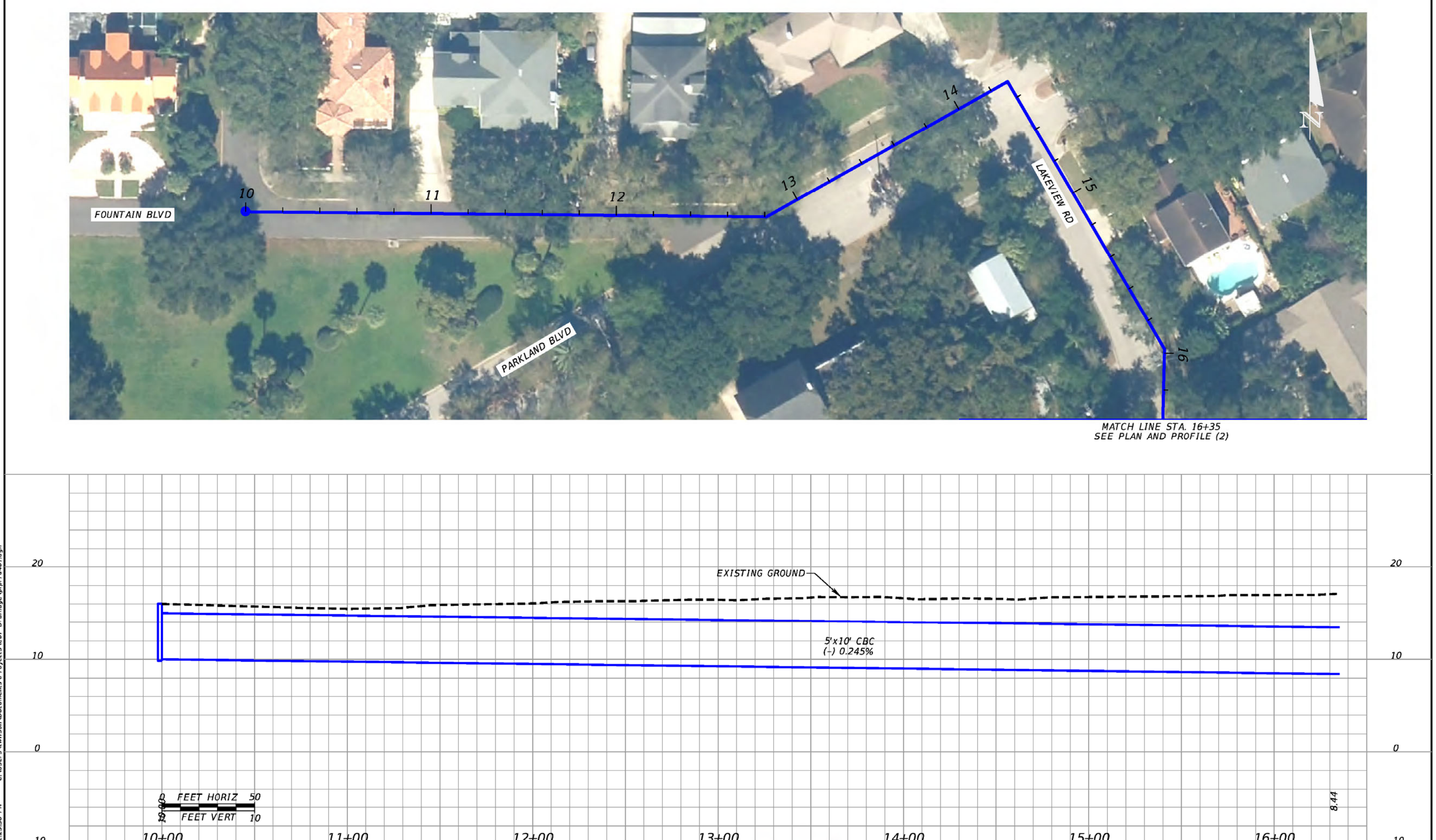

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PARKLAND ESTATES STORMWATER IMPROVEMENTS

PLAN AND PROFILE (1)

SHEET E-1

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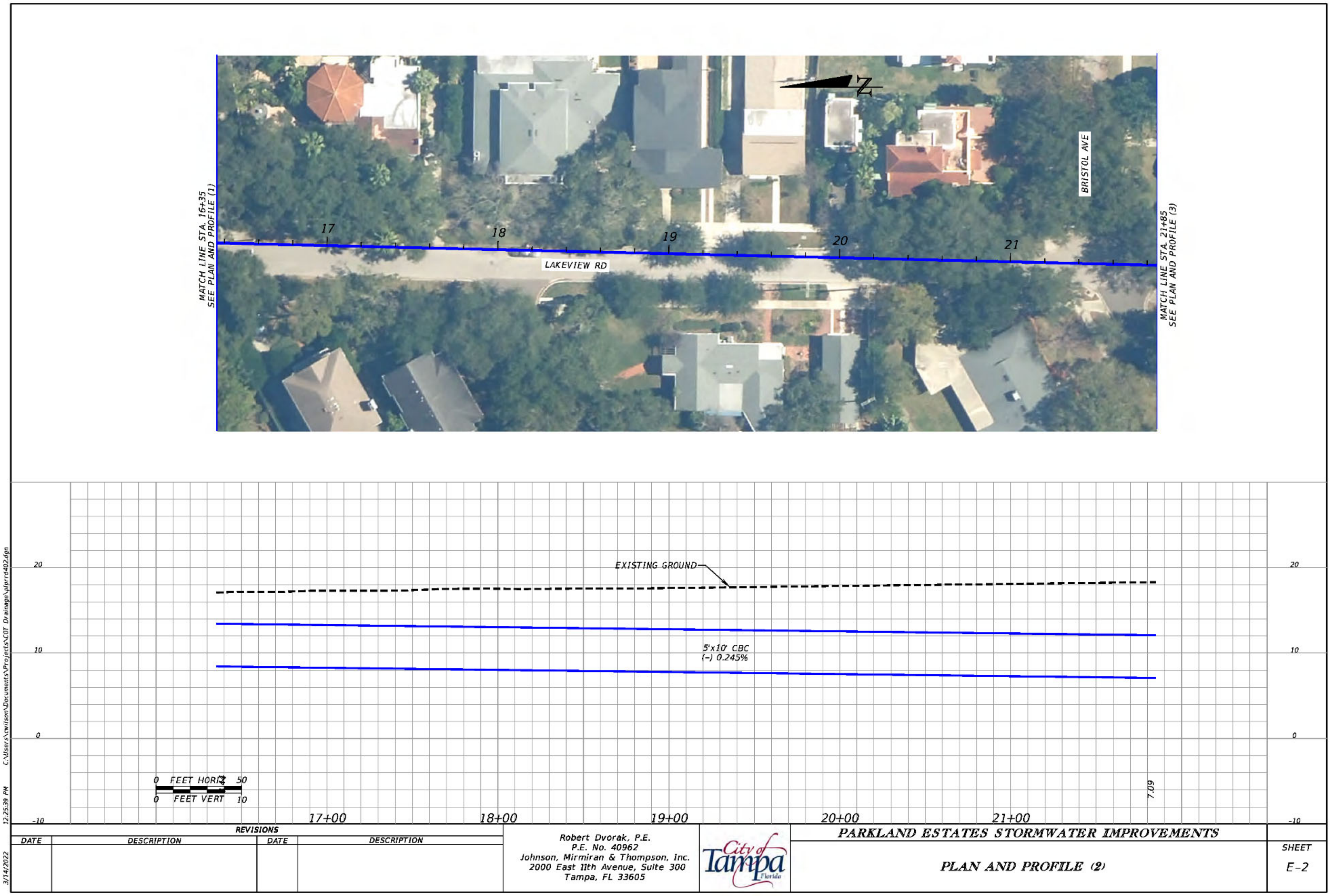
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SEE PLAN AND PROFILE (1)
17
18
19
20
21
LAKEVIEW RD
BRISTOL AVE
MATCH LINE STA. 21+85
SEE PLAN AND PROFILE (3)
EXISTING GROUND
5'x10' CBC
(-) 0.245%
0 FEET HORIZ 50
0 FEET VERT 10
7.09
17+00
18+00
19+00
20+00
21+00
20
10
0
-10
REVISIONS
DATE
DESCRIPTION
DATE
DESCRIPTION
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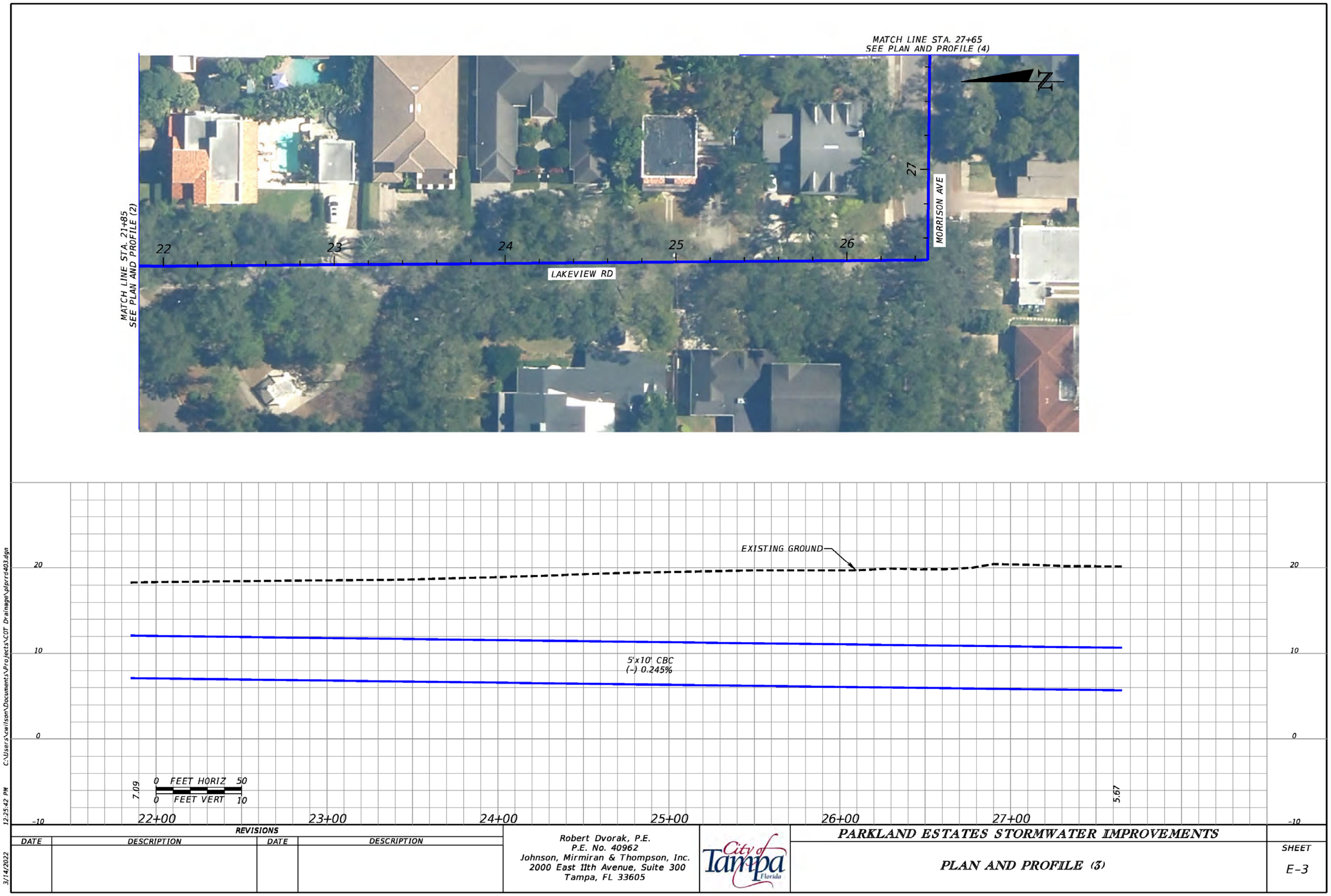
City of Tampa Florida
PARKLAND ESTATES STORMWATER IMPROVEMENTS
PLAN AND PROFILE (2)
SHEET
E-2


MATCH LINE STA. 27+65
SEE PLAN AND PROFILE (4)
MATCH LINE STA. 21+85
SEE PLAN AND PROFILE (2)
22
23
24
25
26
27
LAKEVIEW RD
MORRISON AVE
EXISTING GROUND
5'x10' CBC
(-) 0.245%
20
10
0
-10
0 FEET HORIZ 50
0 FEET VERT 10
7.09
5.67
22+00
23+00
24+00
25+00
26+00
27+00
REVISIONS
DATE
DESCRIPTION
DATE
DESCRIPTION
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City of Tampa Florida
PARKLAND ESTATES STORMWATER IMPROVEMENTS
PLAN AND PROFILE (3)
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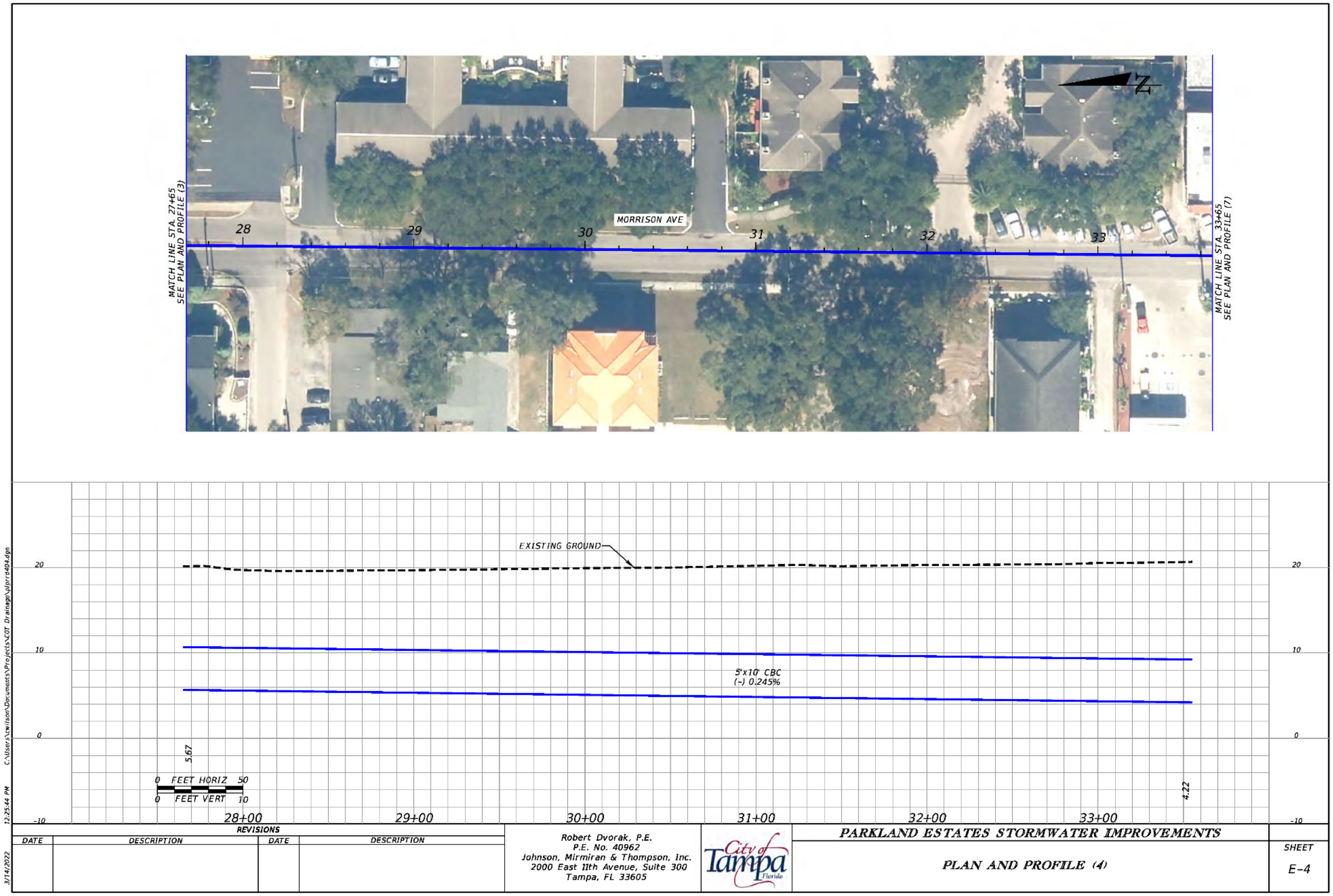
MATCH LINE STA. 27+65
SEE PLAN AND PROFILE (3)
MORRISON AVE
28
29
30
31
32
33
MATCH LINE STA. 33+65
SEE PLAN AND PROFILE (7)
EXISTING GROUND
5'x10' CBC
(-) 0.245%
5.67
4.22
0 FEET HORIZ 50
0 FEET VERT 10
20
10
0
-10
28+00
29+00
30+00
31+00
32+00
33+00
REVISIONS
DATE
DESCRIPTION
DATE
DESCRIPTION
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PARKLAND ESTATES STORMWATER IMPROVEMENTS
PLAN AND PROFILE (4)
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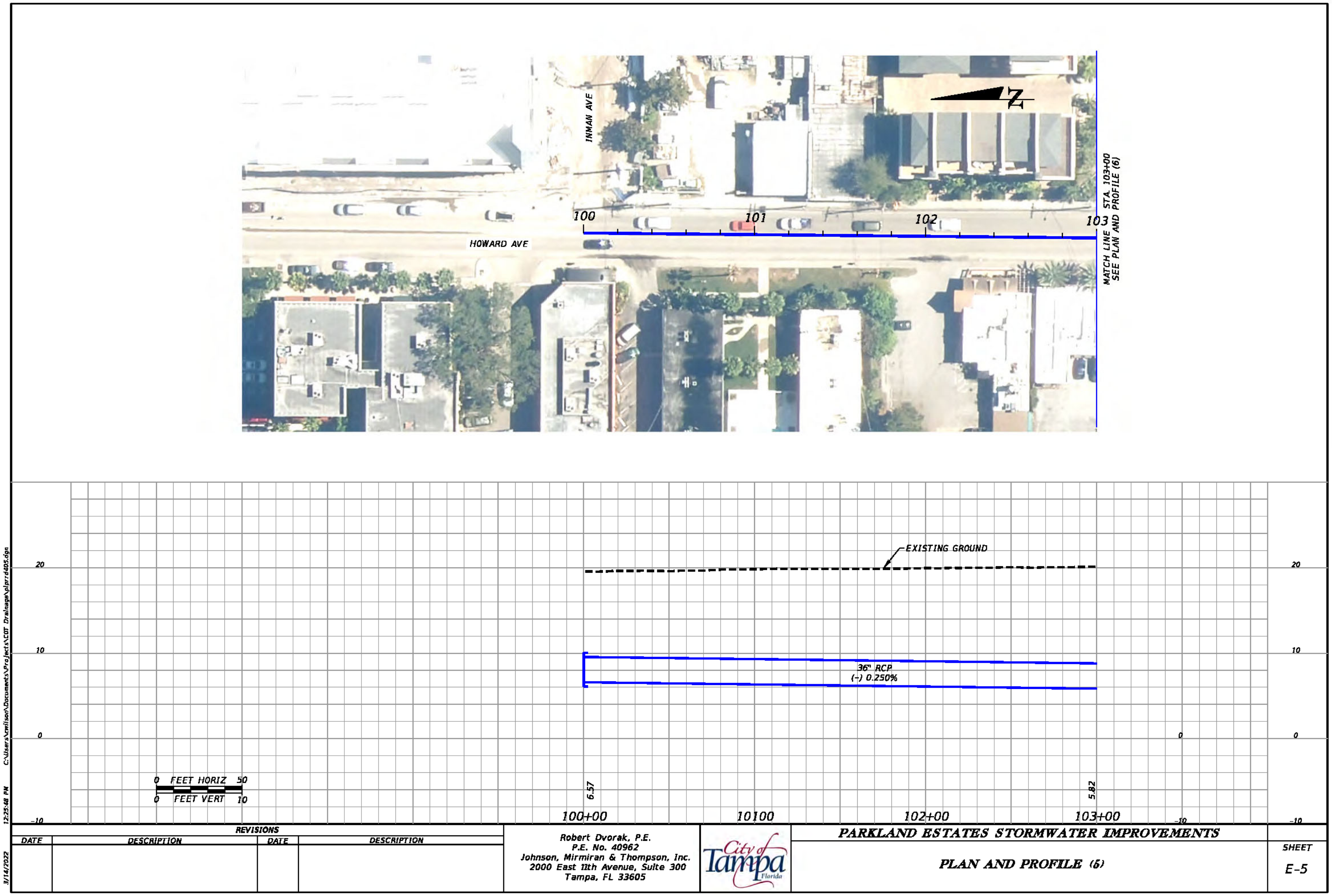
INMAN AVE
HOWARD AVE
100
101
102
103
MATCH LINE STA. 103+00
SEE PLAN AND PROFILE (6)
EXISTING GROUND
36" RCP
(-) 0.250%
20
10
0
-10
0 FEET HORIZ 50
0 FEET VERT 10
6.57
5.82
100+00
10100
102+00
103+00
REVISIONS
DATE
DESCRIPTION
DATE
DESCRIPTION
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PARKLAND ESTATES STORMWATER IMPROVEMENTS
PLAN AND PROFILE (6)
SHEET
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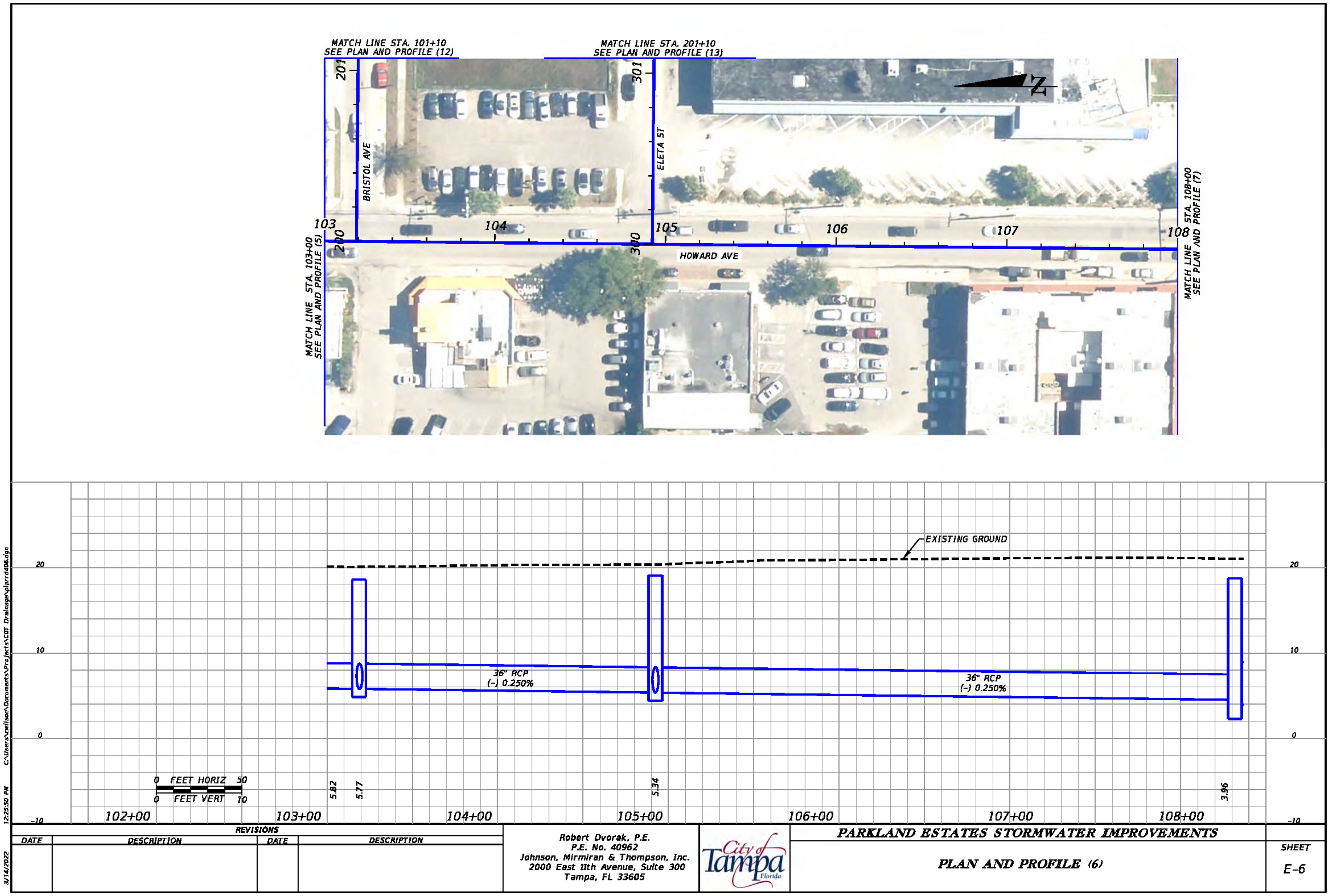
MATCH LINE STA. 101+10
SEE PLAN AND PROFILE (12)
MATCH LINE STA. 201+10
SEE PLAN AND PROFILE (13)
BRISTOL AVE
ELETA ST
HOWARD AVE
MATCH LINE STA. 103+00
SEE PLAN AND PROFILE (5)
MATCH LINE STA. 108+00
SEE PLAN AND PROFILE (7)
EXISTING GROUND
36" RCP
(-) 0.250%
36" RCP
(-) 0.250%
FEET HORIZ
FEET VERT
102+00
103+00
104+00
105+00
106+00
107+00
108+00
REVISIONS
DATE
DESCRIPTION
DATE
DESCRIPTION
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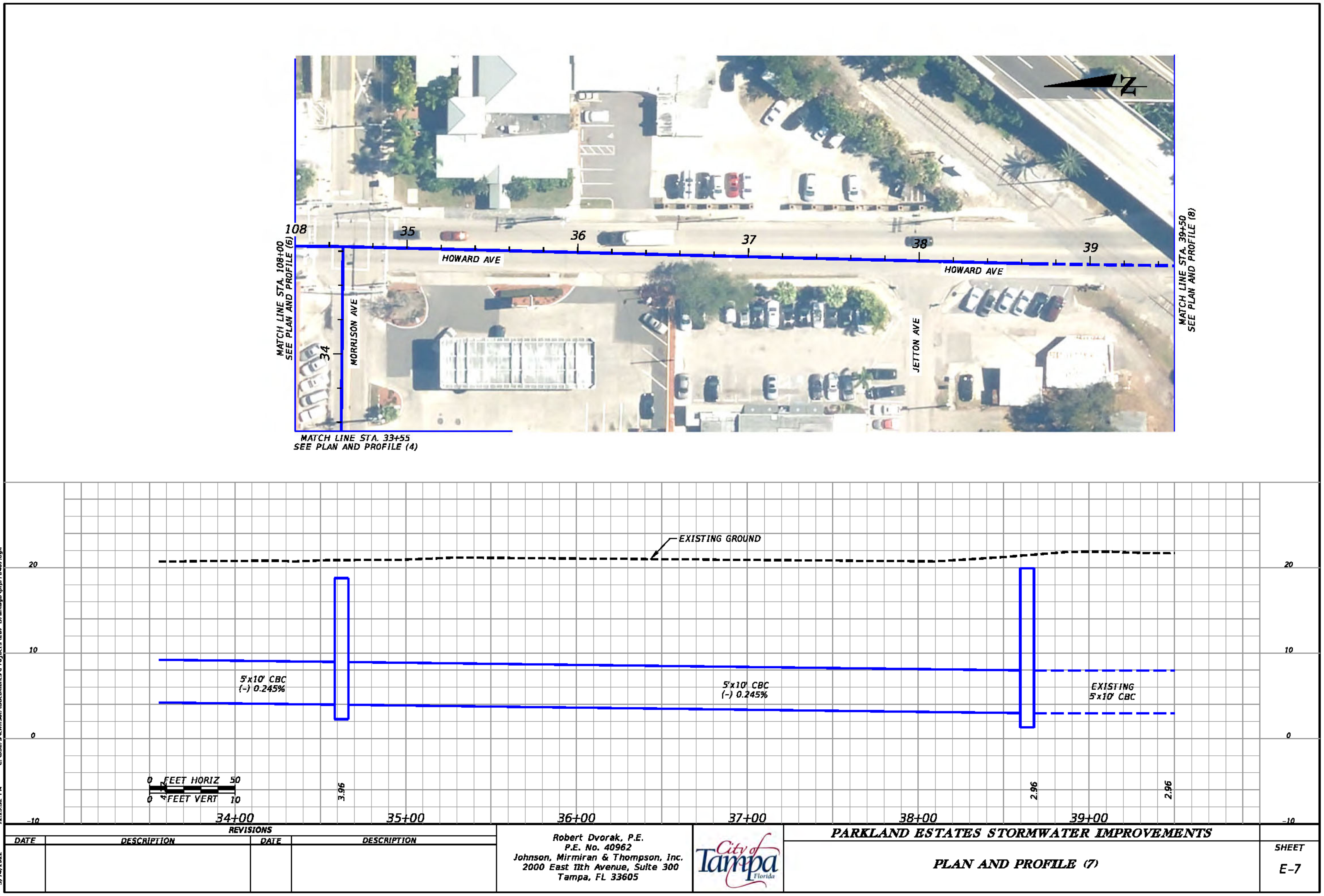
City of Tampa Florida
PARKLAND ESTATES STORMWATER IMPROVEMENTS
PLAN AND PROFILE (6)
SHEET
E-6


108
35
36
37
38
39
34
HOWARD AVE
MORRISON AVE
JETTON AVE
MATCH LINE STA. 108+00 SEE PLAN AND PROFILE (6)
MATCH LINE STA. 33+55 SEE PLAN AND PROFILE (4)
MATCH LINE STA. 39+50 SEE PLAN AND PROFILE (8)
EXISTING GROUND
5'x10' CBC (-) 0.245%
5'x10' CBC (-) 0.245%
EXISTING 5'x10' CBC
20
10
0
-10
FEET HORIZ 50
FEET VERT 10
3.96
2.96
2.96
34+00
35+00
36+00
37+00
38+00
39+00
REVISIONS
DATE
DESCRIPTION
DATE
DESCRIPTION
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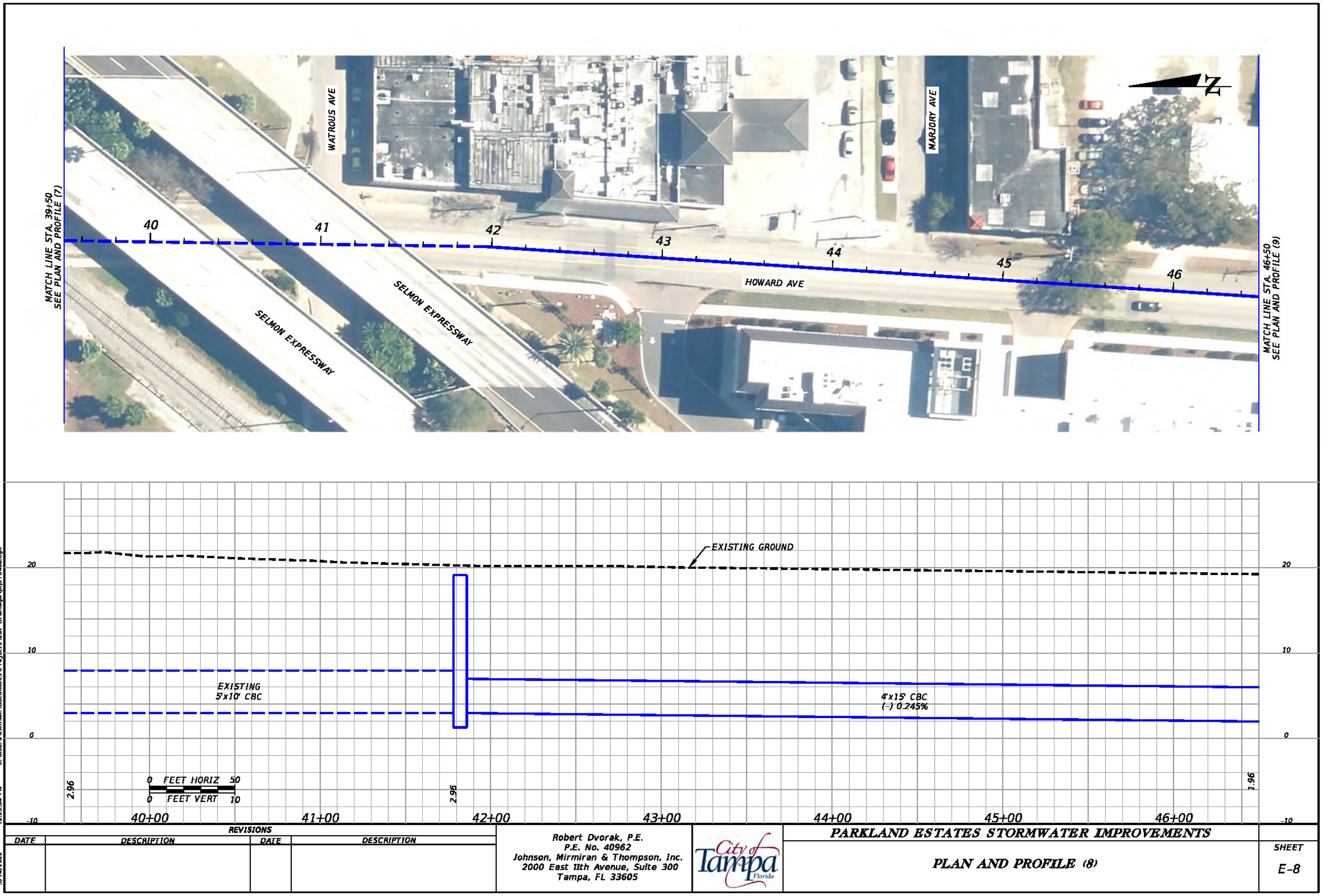
City of Tampa Florida
PARKLAND ESTATES STORMWATER IMPROVEMENTS
PLAN AND PROFILE (7)
SHEET
E-7
3/14/2022


WATROUS AVE
MARJORY AVE
SELMON EXPRESSWAY
SELMON EXPRESSWAY
HOWARD AVE
MATCH LINE STA. 39+50 SEE PLAN AND PROFILE (7)
MATCH LINE STA. 46+50 SEE PLAN AND PROFILE (9)
EXISTING GROUND
EXISTING 5'x10' CBC
4'x15' CBC (-) 0.245%
0 FEET HORIZ 50
0 FEET VERT 10
40+00
41+00
42+00
43+00
44+00
45+00
46+00
REVISIONS
DATE
DESCRIPTION
DATE
DESCRIPTION
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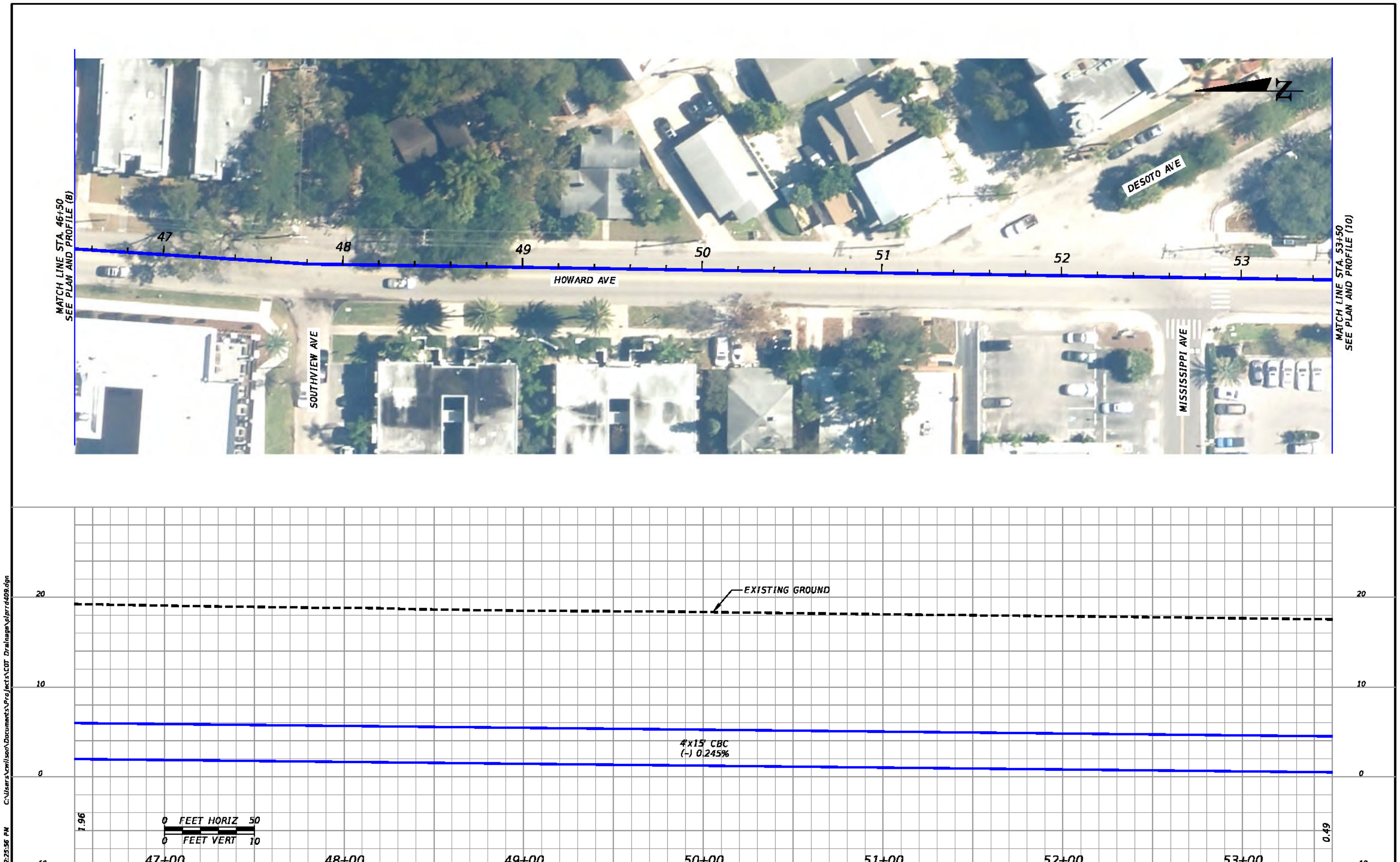
PARKLAND ESTATES STORMWATER IMPROVEMENTS
PLAN AND PROFILE (8)
SHEET
E-8



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PARKLAND ESTATES STORMWATER IMPROVEMENTS

PLAN AND PROFILE (9)

SHEET
E-9

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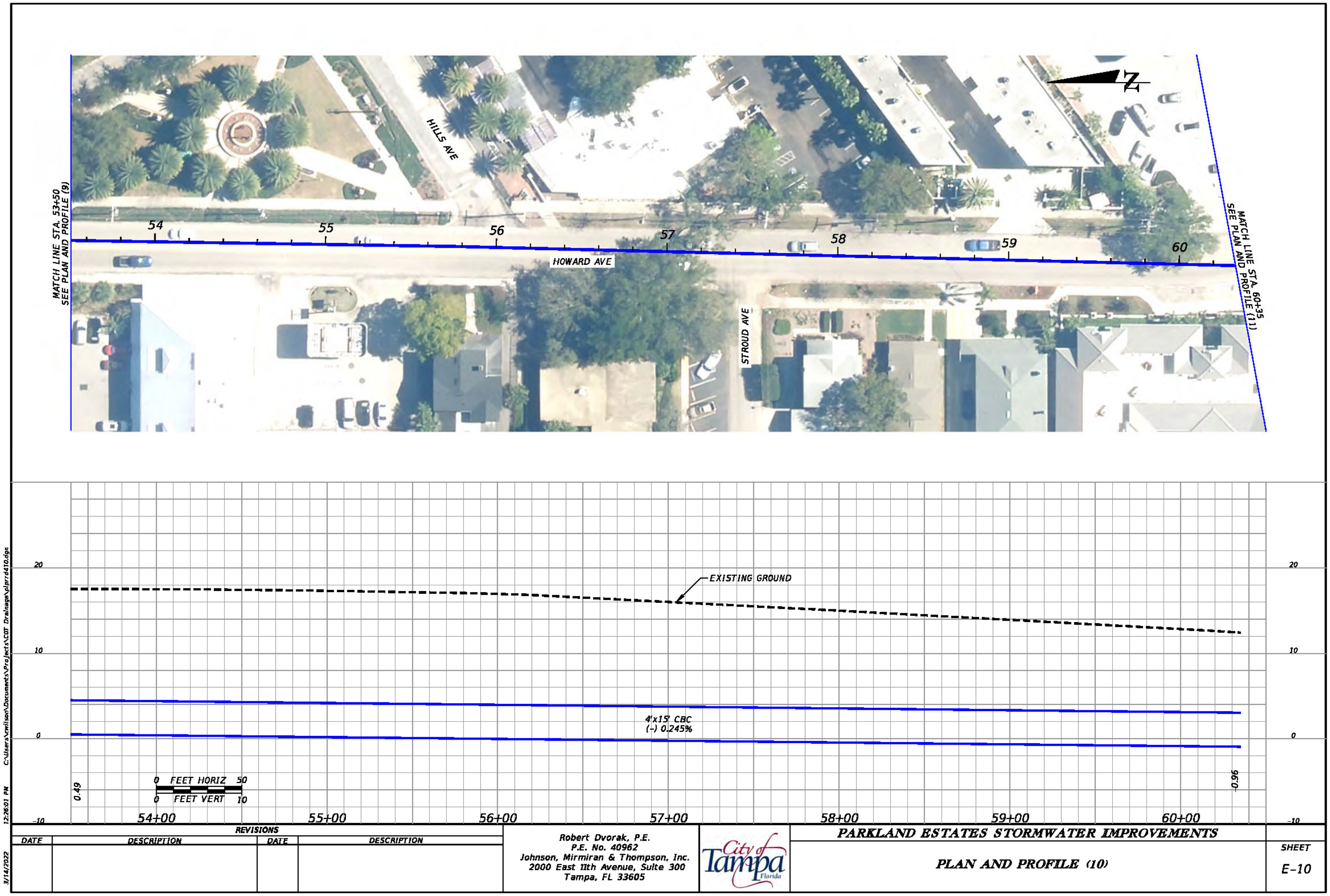
MATCH LINE STA. 53+50 SEE PLAN AND PROFILE (9)
HILLS AVE
HOWARD AVE
STROUD AVE
MATCH LINE STA. 60+35 SEE PLAN AND PROFILE (11)
54
55
56
57
58
59
60
EXISTING GROUND
4'x15' CBC
(-) 0.245%
0 FEET HORIZ 50
0 FEET VERT 10
0.49
-0.96
54+00
55+00
56+00
57+00
58+00
59+00
60+00
20
10
0
-10
REVISIONS
DATE
DESCRIPTION
DATE
DESCRIPTION
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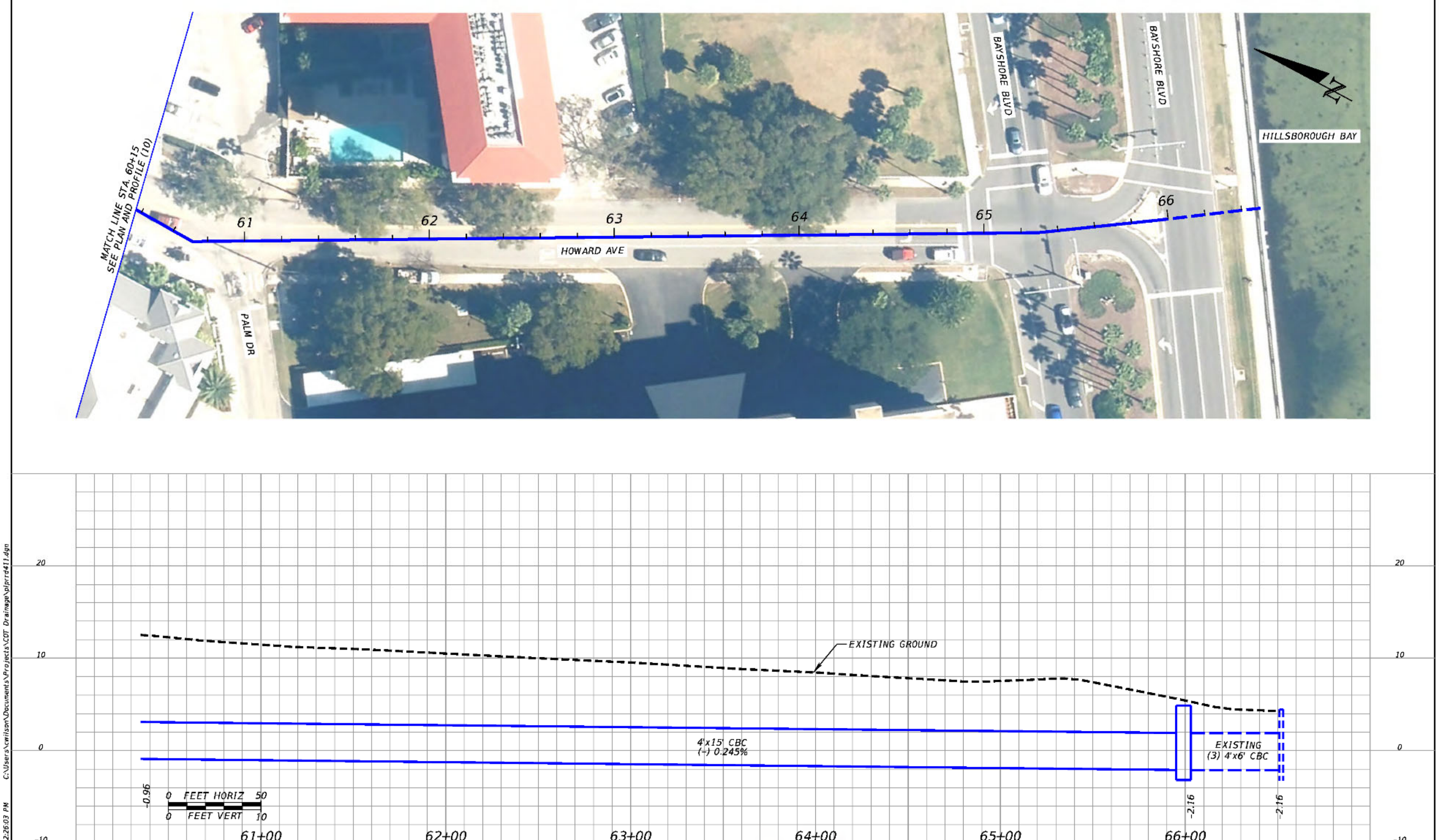
PARKLAND ESTATES STORMWATER IMPROVEMENTS
PLAN AND PROFILE (10)
SHEET
E-10



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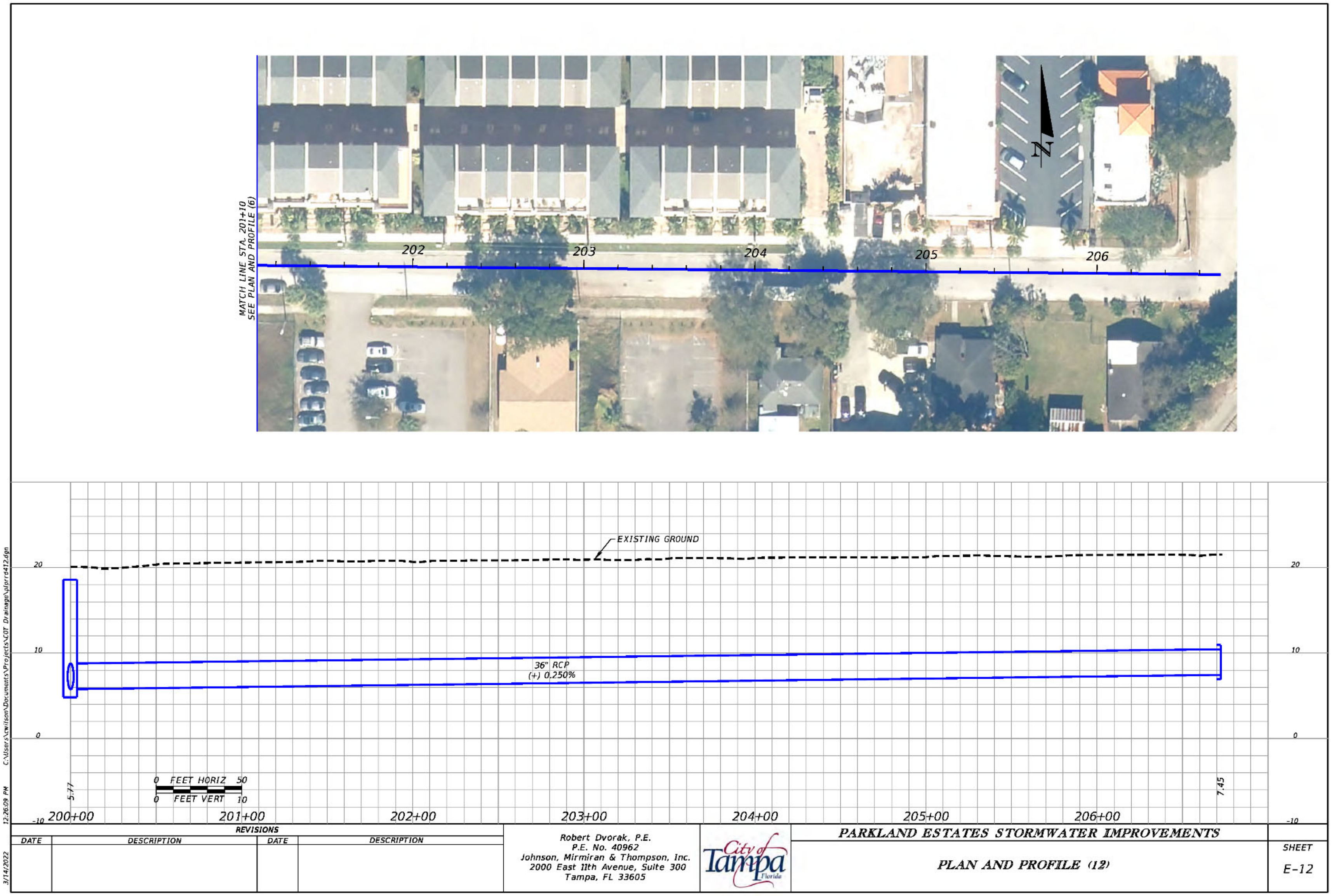
PARKLAND ESTATES STORMWATER IMPROVEMENTS

PLAN AND PROFILE (11)

SHEET
E-11


MATCH LINE STA. 201+10
SEE PLAN AND PROFILE (6)
202
203
204
205
206
N
EXISTING GROUND
36" RCP
(+) 0.250%
20
10
0
-10
5.77
7.45
0 FEET HORIZ 50
0 FEET VERT 10
200+00
201+00
202+00
203+00
204+00
205+00
206+00
REVISIONS
DATE
DESCRIPTION
DATE
DESCRIPTION
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City of Tampa Florida
PARKLAND ESTATES STORMWATER IMPROVEMENTS
PLAN AND PROFILE (12)
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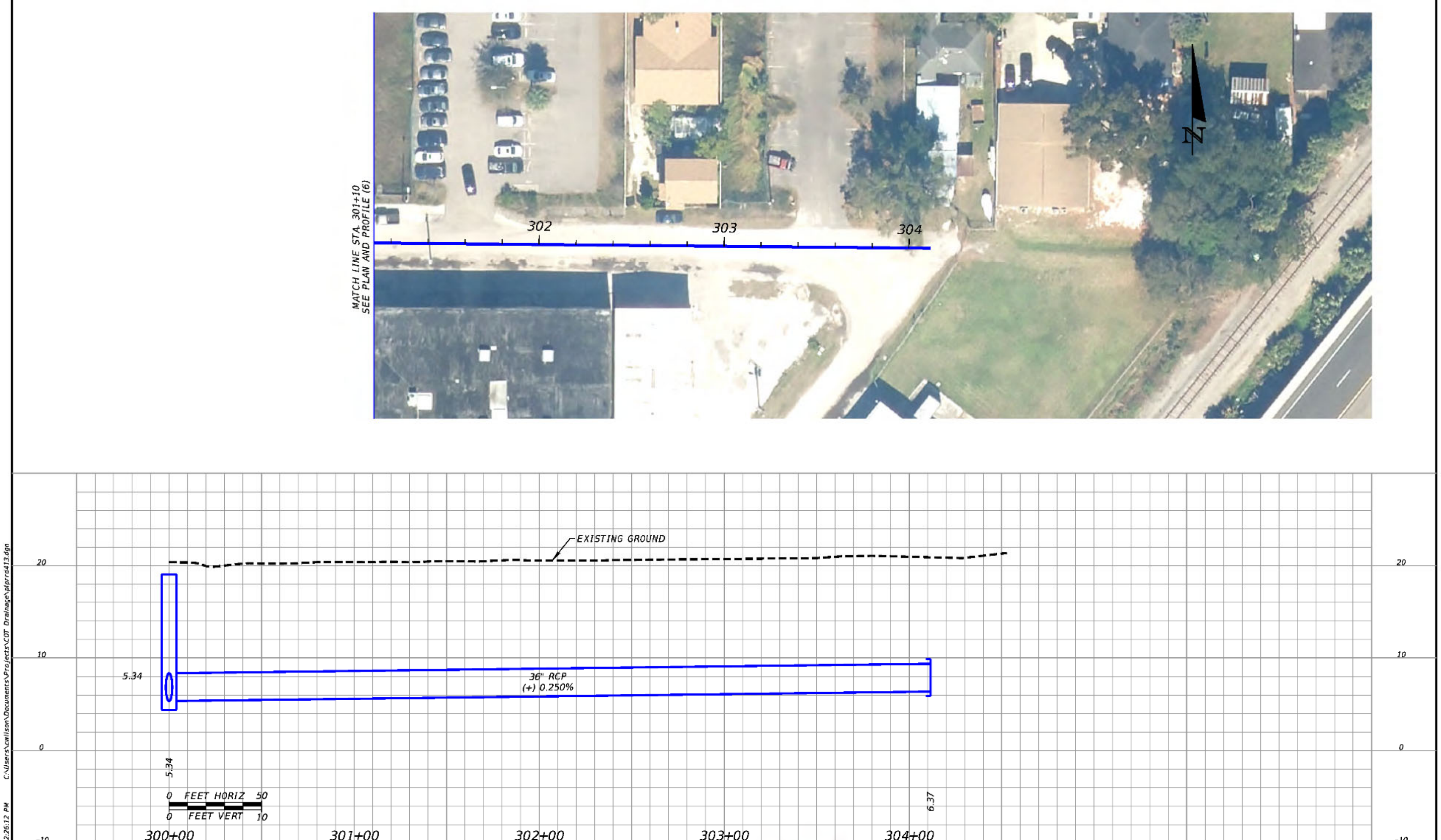

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PARKLAND ESTATES STORMWATER IMPROVEMENTS

PLAN AND PROFILE (13)

SHEET
E-13

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3/14/2022

APPENDIX D

COST ESTIMATE

Upper Peninsula - East -- Flood Relief Project

Preliminary Opinion of Probable Construction & Total Project Costs

9/23/2021

Item #	Item Description	Quantity / Units	Unit Price	Amount
1	Mobilization/Demobilization	1 LS	$ 200,000	$ 200,000
2	Performance and Payment Bond/Insurance	1 LS	$ 600,000	$ 600,000
3	General Conditions	1 LS	$ 4,200,000	$ 4,200,000
4	Construction Stakeout/As-builts	1 LS	$ 500,000	$ 500,000
5	Construction Engineering and Inspection	1 LS	$ 1,600,000	$ 1,600,000
6	Maintenance of Traffic	1 LS	$ 800,000	$ 800,000
7	Materials Testing	1 LS	$ 400,000	$ 400,000
8	Permitting	1 LS	$ 40,000	$ 40,000
9	Utility Coordination	1 LS	$ 280,000	$ 280,000
10	Public Outreach	1 LS	$ 200,000	$ 200,000
11	Temporary driveway and road repairs	1 LS	$ 760,000	$ 760,000
12	Citizen Accommodations	1 LS	$ 200,000	$ 200,000
13	Sedimentation and Erosion Control	1 LS	$ 200,000	$ 200,000
14	Demolish & Remove Existing Infrastructure	1 LS	$ 200,000	$ 200,000
15	Concrete Box Culvert, 5x12	2450 LF	$ 1,950	$ 4,777,500
16	Concrete Box Culvert, 5x10	2950 LF	$ 1,850	$ 5,457,500
17	Reinforced Concrete Pipe, 54"	500 LF	$ 450	$ 225,000
18	Reinforced Concrete Pipe, 48"	650 LF	$ 360	$ 234,000
19	Reinforced Concrete Pipe, 36"	425 LF	$ 260	$ 110,500
20	Reinforced Concrete Pipe, 15"-30""	4500 LF	$ 180	$ 810,000
21	Cast-in-place RC Junction Box	4 EA	$ 200,000	$ 800,000
22	Pre-cast Storm Sewer Structures	125 EA	$ 6,500	$ 812,500
23	Access Manholes	12 EA	$ 3,800	$ 45,600
24	Sanitary sewer relocation	1 LS	$ 3,800,000	$ 3,800,000
25	Potable water relocation	1 LS	$ 2,400,000	$ 2,400,000
26	Right-of-way Restoration	1 LS	$ 5,200,000	$ 5,200,000
Subtotal				**$ 34,852,600**
	Contingency @ 15%		$ 5,230,000	$ 5,230,000
	Design Build fee @ 8%		$ 2,790,000	$ 2,790,000
	Total Preliminary Construction Cost			**$ 42,872,600**
	Engineering Design & Pre-Design Services @ 7%		$ 2,440,000	$ 2,440,000
	Third Party Review Fee @ 0.15%		$ 50,000	$ 50,000
	Total Preliminary Project Cost			**$ 45,362,600**

APPENDIX E

BENEFIT/COST ANALYSIS WITH BMPTRAINS REPORT AND EXHIBIT

Project Useful Life: 30 Years (SWFWMD standard value)

Discount Rate: 7 percent (SWFWMD standard Value)

Maximum Driveable Depth: 6" (SWFWMD standard value) Roadway lines were sampled from DEM to produce Crown elevation utilized in Peak Stage graph tabs and Roadway Innundation Tab for each roadway segment. The lowest elevation sampled from the DEM was utilized. In areas with less detailed hydraulics, and/or no underground closed conduit system, these roadway crowns produced results significantly lower than the selected nodes predicted stages. In these cases, the invert of the overland weir modeled was utilized as the roadway crown as a compromise for pre/post comparisons for all segments applied to the same node.

Vehicles per Household: 1.6 (SWFWMD standard value)

Estimated Values for Vehicles: No change (SWFWMD standard values)

Estimated Road Repair Cost: (SWFWMD standard values). It appears "Unknown/Other" road repair cost was inadvertently changed to 150, but no roads were categorized as such.

# of Lanes: 2 lanes used for all roadways

Est # of Daily Vehicles Affected: Published Hillsborough County Traffic Counts were utilized for Swann Avenue. Local Roadways were calculated utilizing the ITE Trip Generation Manual and conservatively assuming a limit of 40 homes accessing each road, i.e. no significant through traffic.

Detour Time per Vehicle: 0.25 hr used for local roads, 0.5 hr used for collectors

Finished Floor Elevation (FFE): The highest adjacent grade (HAG) at each structure was estimated by utilizing an automated process requiring LiDAR and building footprint data. Elevations within the building footprints were sampled from the LiDAR and the highest value was applied to assign a minimum value to each structure. Considering most structures in the evaluation area are slab-on-grade, an additional 6 inches was added to each HAG elevation to simulate the thickness of a standard slab.

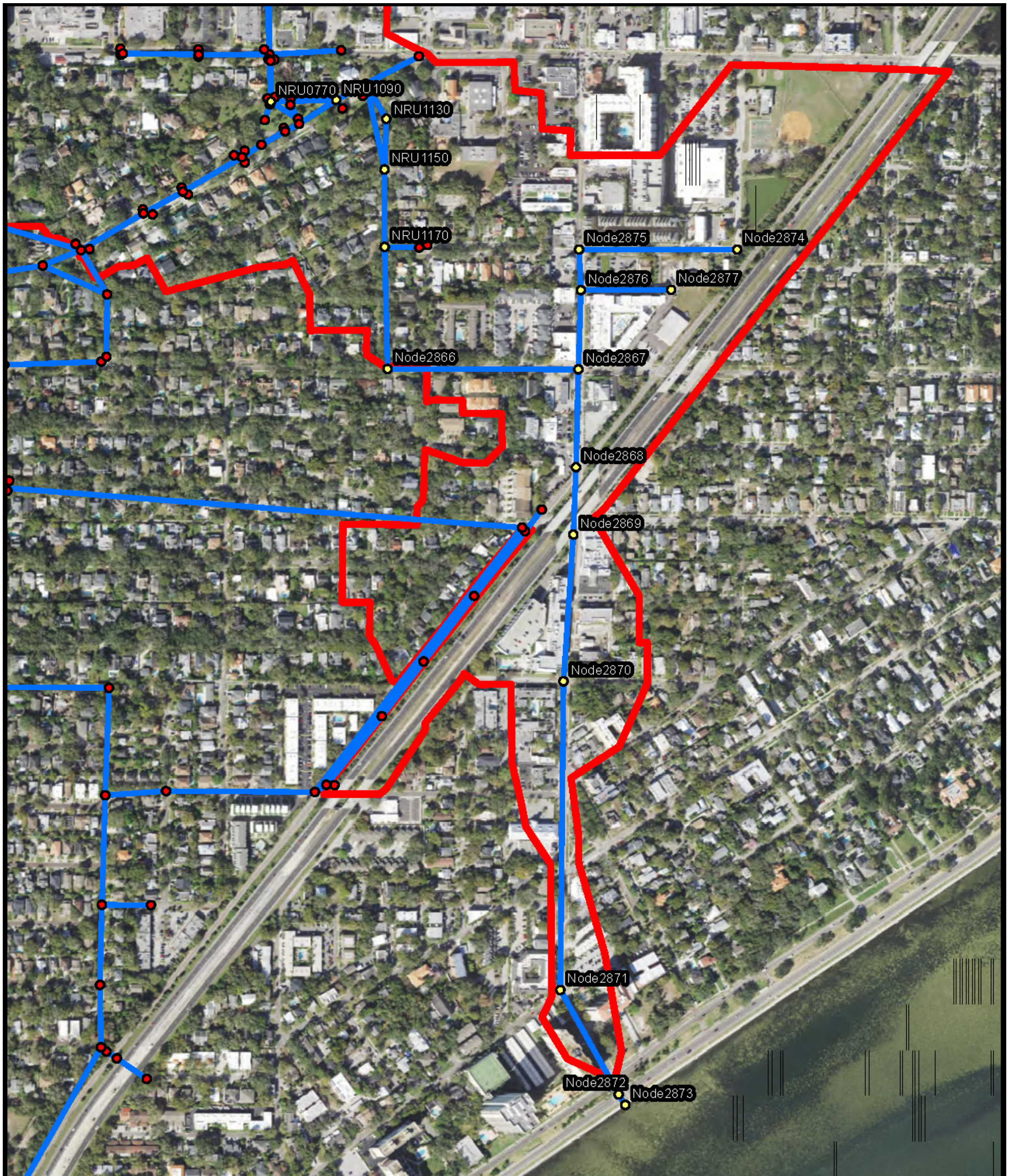
Driveway Elevation: The lowest adjacent grade (LAG) at each structure was estimated by utilizing an automated process requiring LiDAR and building footprint data. Elevations within the building footprints were sampled from the LiDAR and the lowest value was applied to assign a value to each structure. Considering structures are elevated above the adjacent roadways, an additional 6 inches was deducted from each LAG elevation for the Driveway Minimum Elevation.

Building Type: Only residential structures were included. All building types set to One Story, No Basement to be conservative.

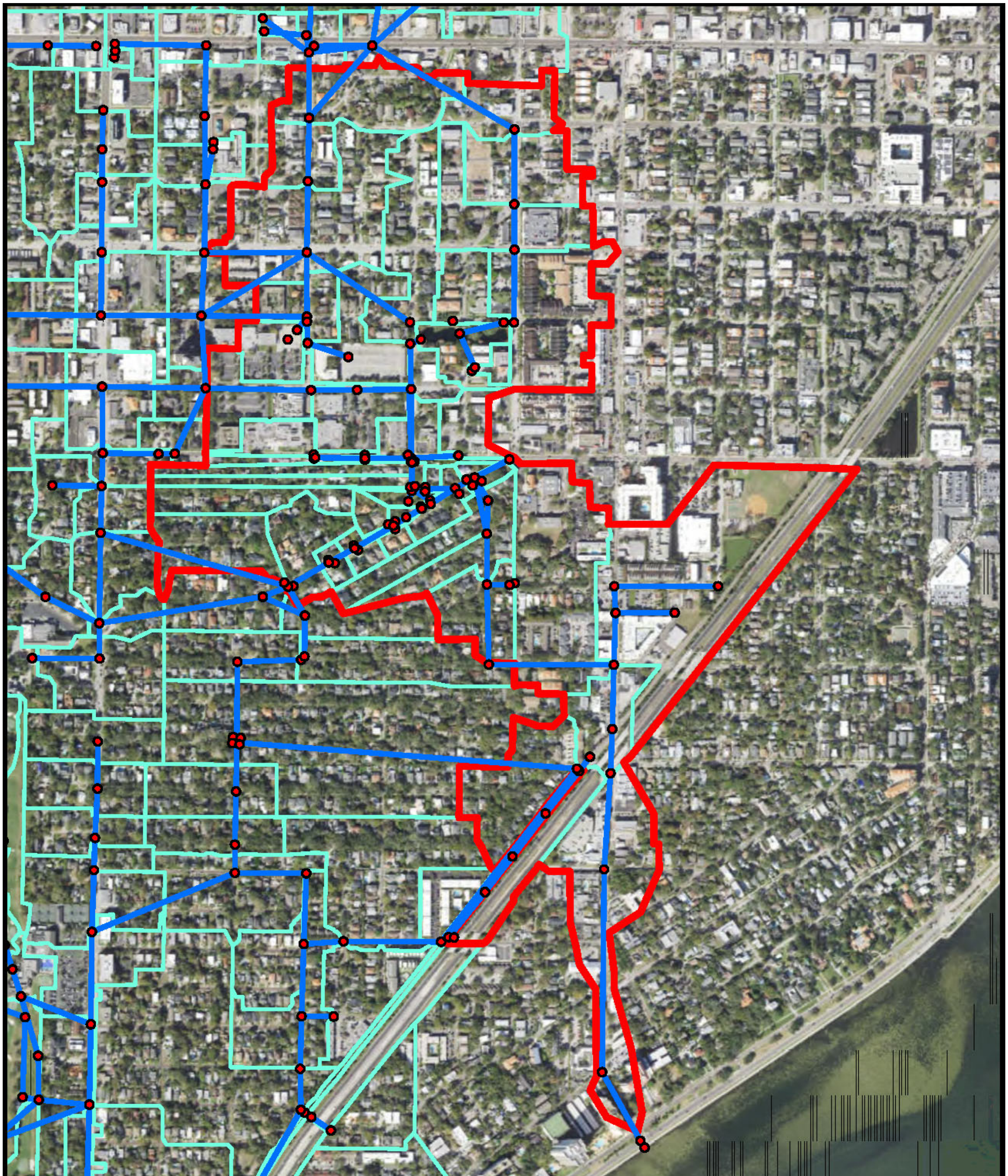
Building Square Footage: Obtained from City of Tampa

Building Value: Obtained from City of Tampa. "Just Value" for each evaluated structure utilized as a proxy for building replacement value.

Design Storms: The mean annual, 5-year, 10-year, 25-year, 50-year and 100-year; 24-hour storm events as defined by the SWFWMD were utilized for this BCA.



UPPER PENINSULA STORMWATER IMPROVEMENTS EAST REGION PROPOSED CONNECTIVITY	N W E S 1 inch = 500 feet 0 125 250 500 Feet	BCA Watershed Nodes Links	JMT

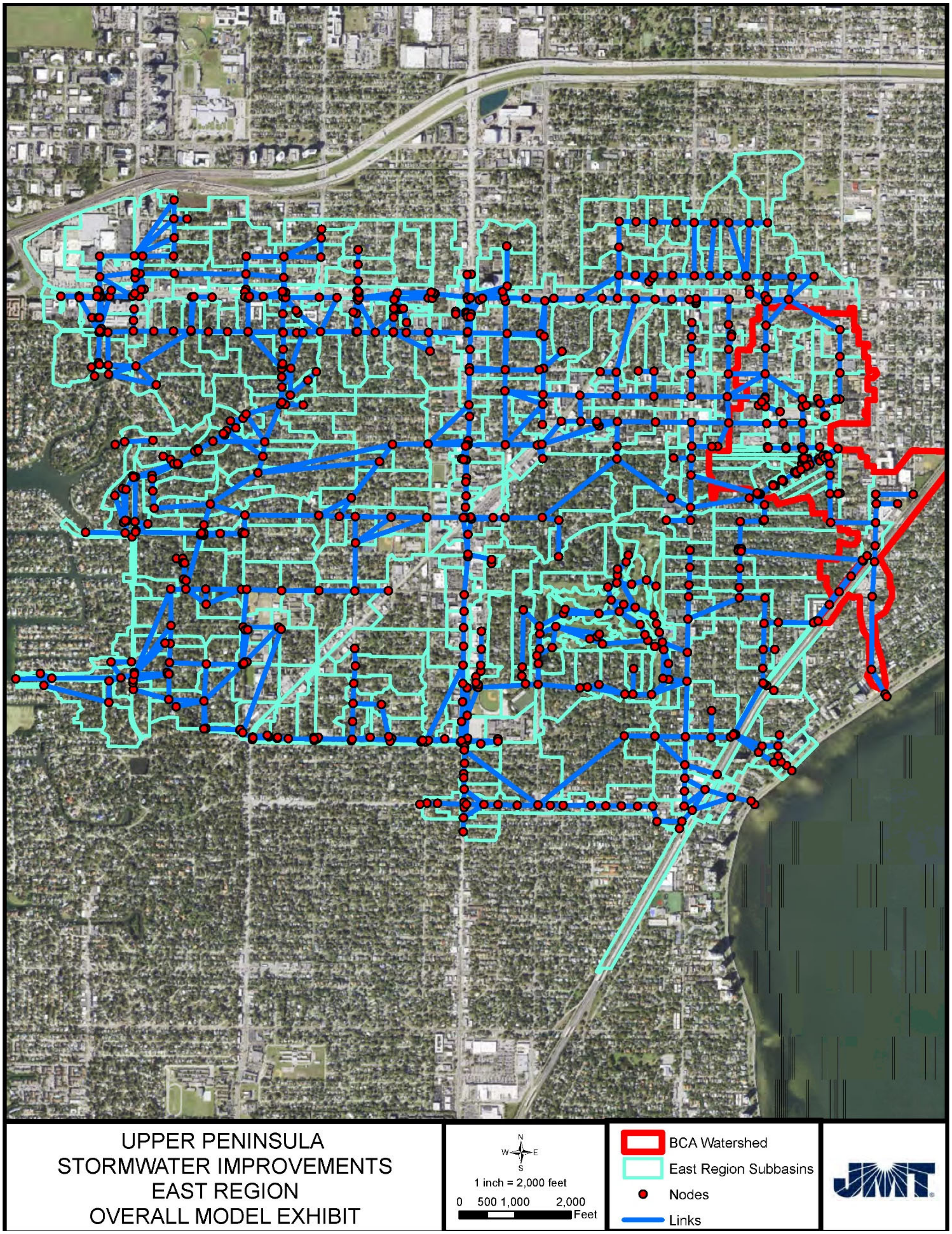


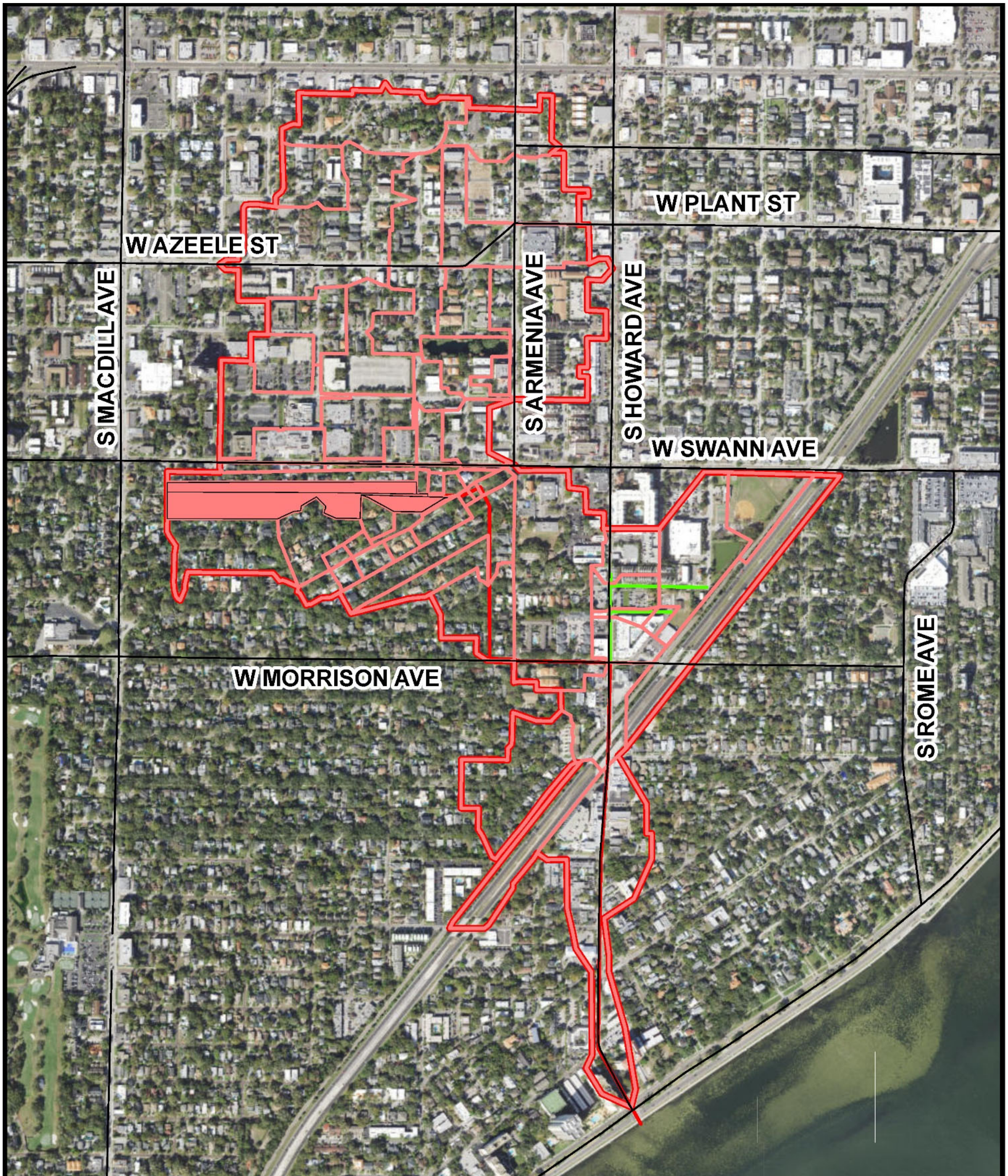
UPPER PENINSULA
STORMWATER IMPROVEMENTS
EAST REGION
BCA MODEL EXHIBIT

1 inch = 762 feet

0 190 380 760 Feet

BCA Watershed
East Region Subbasins
Nodes
Links


UPPER PENINSULA
STORMWATER IMPROVEMENTS
EAST REGION
OVERALL MODEL EXHIBIT
N
W
E
S
1 inch = 2,000 feet
0 500 1,000 2,000
Feet
BCA Watershed
East Region Subbasins
Nodes
Links



UPPER PENINSULA
STORMWATER IMPROVEMENTS
EAST REGION
BMPTRAINS EXHIBIT

1 inch = 800 feet
0 200 400 800 Feet

BMPTrains Basins
Route Type
Box Culvert
RCP

Complete Report (not including cost) Ver 4.3.3

Project: Upper Peninsula East/Parkland
Date: 9/30/2021 1:51:36 PM

Site and Catchment Information

Analysis: BMP Analysis

Catchment Name	Basin 643	Node 646	Node 647
Rainfall Zone	Florida Zone 4	Florida Zone 4	Florida Zone 4
Annual Mean Rainfall	51.00	51.00	51.00

Post-Condition Landuse Information

Landuse	Rangeland/Parkland: TN=1.150 TP=0.055	Single-Family: TN=2.070 TP=0.327	Single-Family: TN=2.070 TP=0.327
Area (acres)	0.90	4.91	5.68
Rational Coefficient (0-1)	0.01	0.39	0.35
Non DCIA Curve Number	39.00	39.00	39.00
DCIA Percent (0-100)	0.00	47.10	41.60
Wet Pond Area (ac)	0.00	0.00	0.00
Nitrogen EMC (mg/l)	1.150	2.070	2.070
Phosphorus EMC (mg/l)	0.055	0.327	0.327
Runoff Volume (ac-ft/yr)	0.039	8.197	8.407
Groundwater N (kg/yr)	0.000	0.000	0.000
Groundwater P (kg/yr)	0.000	0.000	0.000
Nitrogen Loading (kg/yr)	0.055	20.922	21.458

Phosphorus Loading (kg/yr)	0.003	3.305	3.390

Catchment Number: 1 Name: Basin 643

Project: Upper Peninsula East/Parkland
Date: 9/30/2021

User Defined BMP Design

Contributing Catchment Area (acres)	0.900
Provided Nitrogen Treatment Efficiency (%)	10
Provided Phosphorus Treatment Efficiency (%)	10

Watershed Characteristics

Catchment Area (acres)	0.90
Contributing Area (acres)	0.900
Non-DCIA Curve Number	39.00
DCIA Percent	0.00
Rainfall Zone	Florida Zone 4
Rainfall (in)	51.00

Surface Water Discharge

Required TN Treatment Efficiency (%)	
Provided TN Treatment Efficiency (%)	10
Required TP Treatment Efficiency (%)	
Provided TP Treatment Efficiency (%)	10

Media Mix Information

Type of Media Mix	Not Specified
Media N Reduction (%)	
Media P Reduction (%)	

Groundwater Discharge (Stand-Alone)

Treatment Rate (MG/yr)	0.000
TN Mass Load (kg/yr)	0.000
TN Concentration (mg/L)	0.000
TP Mass Load (kg/yr)	0.000
TP Concentration (mg/L)	0.000

Load Diagram for User Defined BMP (stand-alone)

Load		Treatment		Surface Discharge
N: 0.06 kg/yr	→	N: 10 %	→	N: 0.05 kg/yr
P: 0.00 kg/yr		P: 10 %		P: 0.00 kg/yr

↓

Mass Reduction
N: 0.01 kg/yr
P: 0.00 kg/yr

Load Diagram for User Defined BMP (As Used In Routing)

Upstream Nodes	Load		Treatment		Mass Discharged
Node: 2	N: 42.43 kg/yr	→	N: 10.0 %	→	N: 38.19 kg/yr
Node: 3	P: 6.70 kg/yr		P: 10.0 %		P: 6.03 kg/yr
	Q: 16.64 ac-ft				Q: 16.64 ac-ft

↓

Mass Removed
N: 4.24 kg/yr
P: 0.67 kg/yr

Catchment Number: 2 Name: Node 646

Project: Upper Peninsula East/Parkland
Date: 9/30/2021

None Design

Watershed Characteristics

Catchment Area (acres)	4.91
Contributing Area (acres)	4.910
Non-DCIA Curve Number	39.00
DCIA Percent	47.10

Rainfall Zone	Florida Zone 4
Rainfall (in)	51.00

Surface Water Discharge

Required TN Treatment Efficiency (%)

Provided TN Treatment Efficiency (%)

Required TP Treatment Efficiency (%)

Provided TP Treatment Efficiency (%)

Media Mix Information

Type of Media Mix	Not Specified
Media N Reduction (%)	0.000
Media P Reduction (%)	0.000

Groundwater Discharge (Stand-Alone)

Treatment Rate (MG/yr)	0.000
TN Mass Load (kg/yr)	0.000
TN Concentration (mg/L)	0.000
TP Mass Load (kg/yr)	0.000
TP Concentration (mg/L)	0.000

Load Diagram for None (stand-alone)

Load
N: 20.92 kg/yr →
P: 3.31 kg/yr

Treatment
N: %
P: %

→ Surface Discharge
N: 20.92 kg/yr
P: 3.31 kg/yr

↓

Mass Reduction
N: 0.00 kg/yr
P: 0.00 kg/yr

Load Diagram for None (As Used In Routing)

Upstream Nodes
None

Load
N: 20.92 kg/yr
P: 3.31 kg/yr →
Q: 8.20 ac-ft

Treatment
N: 0.0 %
P: 0.0 %

→ Mass Discharged
N: 20.92 kg/yr
P: 3.31 kg/yr
Q: 8.20 ac-ft

↓

Mass Removed
N: 0.00 kg/yr
P: 0.00 kg/yr

Catchment Number: 3 Name: Node 647

Project: Upper Peninsula East/Parkland
Date: 9/30/2021

None Design

Watershed Characteristics

Catchment Area (acres)	5.68
Contributing Area (acres)	5.680
Non-DCIA Curve Number	39.00
DCIA Percent	41.60
Rainfall Zone	Florida Zone 4

Rainfall (in) 51.00

Surface Water Discharge

Required TN Treatment Efficiency (%)
Provided TN Treatment Efficiency (%)
Required TP Treatment Efficiency (%)
Provided TP Treatment Efficiency (%)

Media Mix Information

Type of Media Mix	Not Specified
Media N Reduction (%)	0.000
Media P Reduction (%)	0.000

Groundwater Discharge (Stand-Alone)

Treatment Rate (MG/yr)	0.000
TN Mass Load (kg/yr)	0.000
TN Concentration (mg/L)	0.000
TP Mass Load (kg/yr)	0.000
TP Concentration (mg/L)	0.000

Load Diagram for None (stand-alone)

Load		Treatment		Surface Discharge
N: 21.46 kg/yr	→	N: %	→	N: 21.46 kg/yr
P: 3.39 kg/yr		P: %		P: 3.39 kg/yr

↓

Mass Reduction
N: 0.00 kg/yr
P: 0.00 kg/yr

Load Diagram for None (As Used In Routing)

Upstream Nodes
None

Load
N: 21.46 kg/yr
P: 3.39 kg/yr
Q: 8.41 ac-ft

→

Treatment
N: 0.0 %
P: 0.0 %

→

Mass Discharged
N: 21.46 kg/yr
P: 3.39 kg/yr
Q: 8.41 ac-ft

↓

Mass Removed
N: 0.00 kg/yr
P: 0.00 kg/yr

Summary Treatment Report Version: 4.3.3

Project: Upper Peninsula
East/Parkland

Date:9/30/2021

Analysis Type: BMP Analysis
BMP Types:
Catchment 1 - (Basin 643)
User Defined BMP
Catchment 2 - (Node 646)
None
Catchment 3 - (Node 647)
None
Based on % removal values to the nearest percent

Routing Summary
Catchment 1 Routed to Outlet
Catchment 2 Routed to Catchment 1
Catchment 3 Routed to Catchment 1

Summary Report

Nitrogen

Surface Water Discharge

Total N post load	42.43 kg/yr	
Percent N load reduction	10 %	
Provided N discharge load	38.19 kg/yr	84.21 lb/yr
Provided N load removed	4.24 kg/yr	9.36 lb/yr

Phosphorus

Surface Water Discharge		
Total P post load	6.697 kg/yr	
Percent P load reduction	10 %	
Provided P discharge load	6.028 kg/yr	13.29 lb/yr
Provided P load removed	.67 kg/yr	1.477 lb/yr

FY23 Cooperative Funding Initiative Application
Stormwater Improvement Flood Protection (SIFP) Benefit Cost Analysis Tool
Version 1.1, July 2021

Southwest Florida Water Management District
WATERMATTERS.ORG · 1-800-423-1476

Cooperator/Applicant: City of Tampa

Project Number/Name: (????) Upper Peninsula Stormwater Improvements - East Region

Cooperator/Applicant to insert a short narrative about the project including anticipated benefit(s): *Flooding problem near West Fountain Boulevard and Audubon Avenue extending up to Swann Avenue is severe with respect to both frequency of occurence and depth of inundation. This proposed project is to construct a new gravity outfall from the natural low point in the basin to ultimate discharge to Tampa Bay at the intersection of Howard Avenue and Bayshore Boulevard. It is anticipated that street flooding for the 5-year/8-hr storm event will be elinated within Parkland Estates once this project is implemented. In addition, localized flooding problems along the route will be addressed as the system is being proposed in an area with no defined conveyance system. Capacity is being considered for anticipated Selmon Expressway Improvements. Water quality treatment BMP's are likely where no water quality treatment exists and several planned Vision Zero traffic/transportation impovement projects along the route will be included. The proposed route reduces overall construction costs by taking advantage of existing dry box culvert crossings of the railroad tracks and the large sanitary force main in Bayshore Boulevard.*

Table A - Benefit Cost Information

Benefit Category	Is this benefit addressed by the proposed project? (Yes/No or N/A)	Can you provide B:C information for the CFI application? (Yes and B:C ratio, No, or N/A)	If you answered "No" in column "C", do you need assistance to be able to provide B:C information? (Yes or N/A)	Additional Comments
Flood Protection	Yes	Yes, 1.0	N/A	
Water Quality Improvement	N/A	N/A	N/A	
Additional Benefit 1	N/A	N/A	N/A	
Additional Benefit 2	N/A	N/A	N/A	
Additional Benefit 3	N/A	N/A	N/A	

Table B - Project Cost

		(a)	(c)	(d)	(e)	(f)
Cost Category		Cooperator Share	District Share	Other Funding Sources	Total	% District Funding Match
(a)	Direct Project Administration Costs				$0	#DIV/0!
(b)	Land Purchase/Easement				$0	#DIV/0!
(c)	Planning/Design/Engineering/Environmental Documentation				$0	#DIV/0!
(d)	Construction/Implementation				$0	#DIV/0!
(e)	Construction/Implementation Contingency				$0	#DIV/0!
(f)	Environmental Compliance/Mitigation/Enhancement				$0	#DIV/0!
(g)	Construction Administration				$0	#DIV/0!
(h)	Other Costs (e.g. O&M)				$0	#DIV/0!
(i)	**Grand Total (Sum rows (a) through (h) for each column)**	$0	$0	$0	$0	#DIV/0!
Notes:						

Table C - Project Benefit Summary

Check all project benefits that are applicable. If you choose to enter a benefit not listed below, please provide a detailed description.

Benefit Considered	Benefit Detail
[x]	Reduced physical damage (buildings, contents, infrastructure, landscaping, vehicles, equipment, crops, ecosystems)
[x]	Reduced loss of functions (net loss of business income, net loss of rental income, net loss of wages, net loss of public services, net loss of utility services, displacement costs of temporary quarters, transportation system disruptions)
[x]	Reduced emergency response costs (evacuation and rescue costs, security costs, dewatering flood management system repairs, humanitarian assistance)
[x]	Reduced public safety and health impacts (population at risk, casualties, displacement/shelter needs, critical facilities)

For benefits that could not be quantified in physical terms, please provide a description below. The description should include a description of economic factors that may affect or qualify the amount of economic benefits to be realized. The description should also include any uncertainty (such as model parameterization) that might affect the level of benefits received.

Description of Qualitative Benefits :

Table D - Benefit Cost Analysis

(a)	Expected Annual Damage Without Project [1]	$4,327,908
(b)	Expected Annual Damage With Project [1]	$780,097
(c)	Expected Annual Damage Benefit (a) – (b)	$3,547,811
(d)	Discount Rate	7.0%
(e)	Project Useful Life (# years)	30
(f)	Total Present Value of Future Benefits	$44,024,933
(g)	Total Project Cost	$45,362,600
(h)	Benefit/Cost Ratio	**0.97**

[1] This tool assumes no population growth thus EAD will be constant over analysis period.