City of Naples

Beach Outfall Management Evaluation

FINAL Technical Memorandum
on
Beach Stormwater Outfall Alternatives Preliminary Assessment

Prepared For
City of Naples

Prepared by:

4415 Metro Parkway Suite 404
Fort Myers, Florida 33916
T 239-278-7996 F 239-278-0913
BPE #8115

April 2013

Table of Contents

List of Figures

List of Tables

List of Appendices

1 INTRODUCTION

1.1 Background

The City of Naples (City) stormwater drainage system consists of a series of catch basins and pipes that collect and convey stormwater to the Gulf of Mexico and other tidal water bodies within the City. The stormwater drainage system is subdivided into 12 Drainage Basins. The study area for this Preliminary Assessment Technical Memorandum (PATM) is located in the City's Stormwater Drainage Basin II, which is one of the main basins serving the City with a contributing area of approximately 920 acres. There are ten (10) stormwater outfalls (numbered 1 through 10) within Basin II discharging to the Gulf of Mexico along Naples Beach. The outfalls are located between the Naples Pier to the south and approximately one-half mile north of the Naples Beach Hotel to the north. Outfall #1 only serves private property and is privately owned and operated; therefore, it is not included in this study. The study area for the remaining nine (9) outfalls has an approximate drainage area of 395 acres. All of the outfall pipes are buried beneath the upland beach profile and become exposed near the water line. Figure 1-1 shows the location of the City's existing beach outfalls.

The Florida Department of Environmental Protection (FDEP) issued to Collier County on January 12, 2005 a Joint Coastal Permit for the Collier County Beach Nourishment project. The specific conditions of the Permit included a requirement to submit a long-range outfall management plan for removal of the beach stormwater outfalls. According to the FDEP, there is an ongoing concern that stormwater runoff discharged to the Gulf of Mexico via the beach outfalls likely affects beach erosion, impacts turtle nesting habitat, interferes with lateral beach access, and degrades water quality. The City has refuted several of these concerns, as discussed below, but is concerned with aesthetics of the beach environment. Naples beaches consist of long expanses of fine white sand, offering spectacular Gulf views and fantastic sunsets, and are a worldwide attraction to seasonal residents and tourists. Preservation and protection of this precious natural resource is critically important to the City.

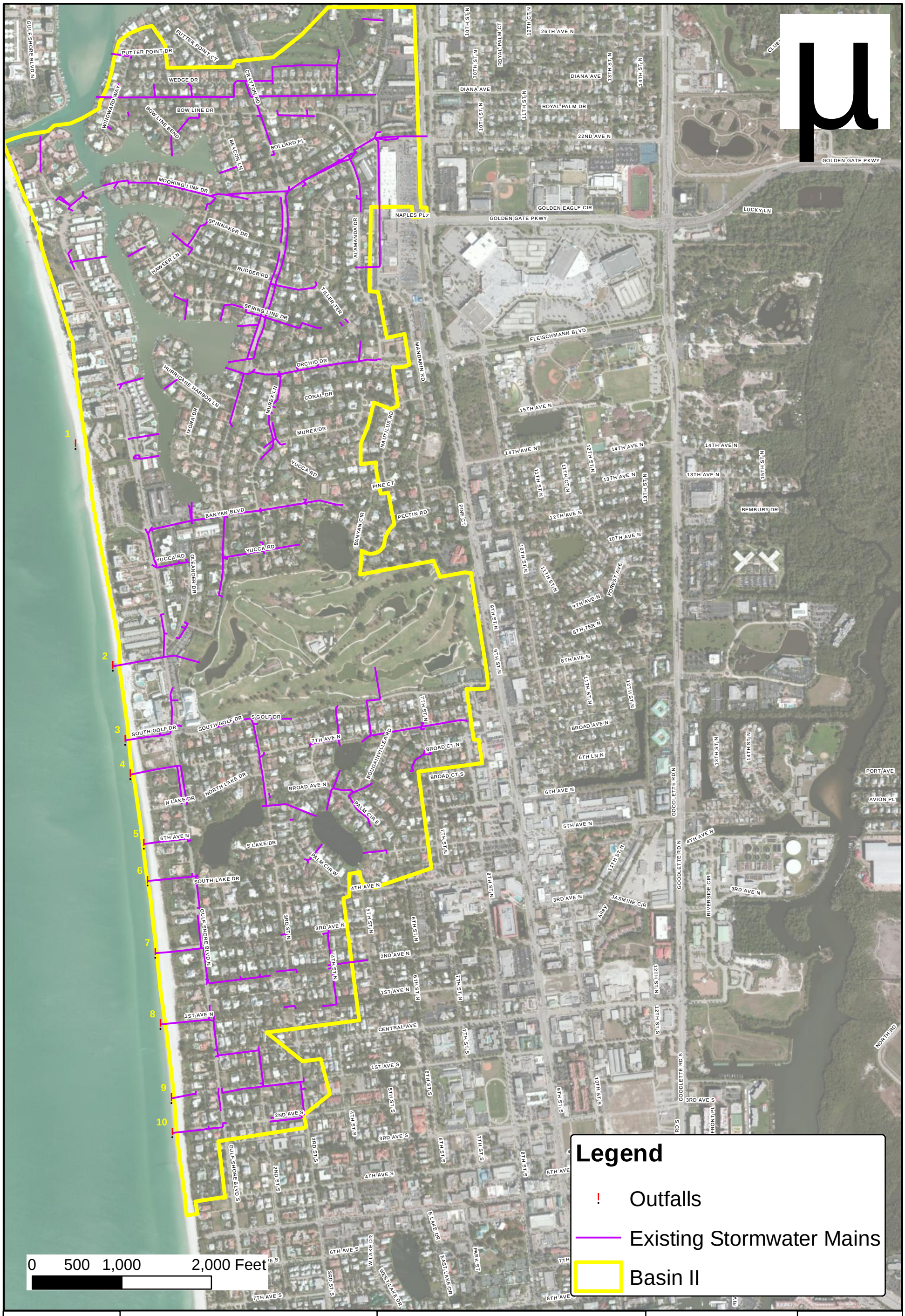
The City has completed a number of studies and investigations related to the beach stormwater outfalls. In February 2010, the City submitted to FDEP a Coastal Impact and Assessment Report, which requested that the permit condition for removal of the outfalls be amended to allow the stormwater outfalls to remain. The Report showed that there was minimal to no impact on turtle nesting, water quality, and beach erosion due to the beach outfalls. Initially, the FDEP did not concur with this recommendation and still required that the permit condition be satisfied. However, in June 2010 the City submitted a letter to FDEP to reaffirm the City's commitment to implement a Stormwater Master Plan, which includes management of stormwater discharged through the beach outfalls, and requested removal of the permit condition. In support of this request the City approved an Ordinance amending the City of Naples Stormwater Master Plan to include policies intended to mitigate impacts of the stormwater outfalls on the beach through technically sound and economically feasible methods that also achieve the City's public safety and flood protection goals. The FDEP reviewed the language of the proposed Ordinance, and agreed that in conjunction with ongoing stormwater treatment efforts by the City, that the

specific condition in the Beach Nourishment Permit related to submission of the long-range outfall management plan is satisfied.

In order to satisfy FDEP concerns regarding the beach outfalls and in accordance with the City's Stormwater Master Plan, the City is investigating alternatives for reducing or eliminating stormwater discharge flows from the outfalls. This PATM documents the work related to Task 5 – Development of Alternatives and Preliminary Assessment Technical Memorandum for the City's Beach Stormwater Outfall Management Evaluation project. This task identifies a series of alternatives that will consider measures within the drainage basin to reduce the impacts of the outfalls on the beach while maintaining the same level of service as compared to the existing conditions.

1.2 Objectives

The objective of the PATM is to identify and evaluate potential options for the beach outfalls in City's stormwater drainage Basin II. The PATM summarizes existing conditions and recognized constraints, identifies economically feasible and permitable alternatives that are available for the City, and provides initial concepts of the potential alternatives. The initial concepts for alternatives include conceptual maps showing location of the facilities, preliminary infrastructure sizing, relative planning level costs, listing of potential benefits and burdens, and description of the extent to which the alternatives achieve identified goals and objectives.



User: thummadir
Date: January 2013
County: Collier

City of Naples
Beach Stormwater Outfall Management Evaluation

Existing Beach Outfall Locations

AECOM
4415 Metro Parkway
Suite 404
Fort Myers, Florida 33916
T 239-278-7996
F 239-278-0913

Figure

1-1

2 DEVELOPMENT OF ALTERNATIVES

2.1 Introduction

The alternatives for the City's nine (9) beach outfalls (Outfall #2 through Outfall #10) were developed in order to address the FDEP concerns and poor aesthetics. The selection of alternatives and concepts involved input from City staff. The selected alternatives were developed based on maintaining the same level of service in Basin II as the existing condition. The following are general assumptions that were made in developing the alternatives:

- The City's Stormwater Drainage Basin II existing system hydraulic model described in "City of Naples Beach Outfall Management Evaluation Final Technical Memorandum on Beach Stormwater Outfalls Hydrologic and Hydraulic Modeling for Existing Conditions – November 2012" developed under Task 4 of this project was used as the "Base Model" or existing conditions model to evaluate the selected alternatives and to determine the preliminary infrastructure sizing.
- The alternatives were evaluated using the 5 year – 24 hour storm event. The maximum stages for each alternative were compared to the maximum stages obtained for the Base Model using the 5 year – 24 hour storm event. Larger storm events would require upsizing of the system.
- It is assumed/recommended that existing Outfalls #9 and #10 be removed and the corresponding flows be redirected to the City's Drainage Basin III (located South of Drainage Basin II) through an upgraded stormwater piping system. The City's stormwater piping along Gulf Shore Boulevard from 6th Avenue South has been upgraded to convey additional flow from Outfalls #9 and #10 to Basin III. The record drawings that show the pipe improvements in Basin III are provided in Appendix A of this report. The proposed pipe in Basin II that will convey the runoff generated from Outfalls #9 and #10 was preliminarily sized using the Base Model. About 2,050 feet of 36 inches reinforced concrete pipe (RCP) is required to carry the total flow (from Outfalls #9 and #10) to Basin III. The proposed pipe will tie into existing 36 inches RCP, at the intersection of Gulf Shore Boulevard and 6th Avenue South in Basin III.
- As indicated in Section 1, Outfall #1 only serves private property and is privately owned and operated; therefore, it is not included in this study.

The following are the five (5) beach stormwater outfall alternatives that are proposed to reduce the impacts of the outfalls on the beach while maintaining the same, or slightly greater level of service as compared to the existing conditions.

1. Alternative 1: Integration of beach outfalls with planned beach re-nourishment project
2. Alternative 2: Integration of beach outfalls with Aquifer Storage and Recovery (ASR) system
3. Alternative 3: Consolidation of beach outfall pipes
4. Alternative 4: Redirection of beach outfall flows via pump station to alternate location

5. Alternative 5: Consolidation and extension of beach outfalls deeper and further into Gulf of Mexico (Sub-aqueous Outfalls)

The above beach outfall alternatives, as well as the preliminary infrastructure improvements and recommended sizing for each alternative are described in more detail in the following sub-sections. Each alternative was evaluated using the Base Model. However, the detailed description of the Base Model evaluation for the alternatives is presented in Section 3.1 of this PATM.

2.2 Alternative 1 – Integration of Beach Outfalls with Planned Beach Re-Nourishment Project

2.2.1. Background

Collier County (County) initiated and completed a beach re-nourishment project in 2006. The County is currently developing the next beach re-nourishment project (2013-14), which includes the feasibility of modifying the existing coastal structures in the City to determine if the project's beach performance could be improved. This process includes an analysis of the existing beach outfalls. A preliminary study identified the need for outfall improvements, but also considered minimal changes to the outfall system. Based upon beach re-nourishment with a 6-year project life, as approved by the County, only a few of the outfalls will need to be extended. As an economy measure, gaps have been left in the fill plan, which are regions where no extension through the new fill is needed. At other locations, the initial fill plan is even with the existing pipeline length, which allows some judgment by the City on whether a temporary or permanent extension is needed. Profile and plan views of the 10 outfall locations are included in Appendix B, along with examples of more durable outfall details. The County is still considering modifications to the 2013-14 beach nourishment project.

The locations of the 10 outfalls in plan and profile views compared to the proposed nourishment project are illustrated in the drawings included in Appendix B. The profile drawings show the construction template, the equilibrated template (EPM), future shoreline locations and the pipeline location compared to the beach project baseline. The baseline is shown in red on the plan view drawings. The baseline is defined in Bathymetric Map included in Appendix C of this report.

The beach is constructed with a 1:10 slope that quickly (a few months to a year) equilibrates to a natural slope. Using the drawing for Outfall #2, it can be seen that the outfall invert extends 156 feet from the red baseline on the plan view drawing. The fill placement will extend 11 feet seaward of the outfalls current extent. Equilibration will bring the natural prolife slope tangent to the bottom of the outfall pipeline. The recommended extension for the outfall pipeline is 36 feet, which is 25 feet from the construction template. For a 10-year project life, the beach width will be 20 feet wider, which will not bury the recommended extension. The alternative with a 10-year design is not included in Appendix B, but they will only be wider by the distance shown in Table 2-1 and the current extension should suffice.

Table 2-1: Improvements in Accordance with Beach Re-nourishment

Outfall No.	Perpendicular Distance of Outfall Invert from #			Approximate Extra Width of 10-Year Project Life	Comment
	Baseline	Construction Template	Equilibrium Profile (EPM)		
1	144	13.0	0.6	0	Private - Consider temporary extension
2	156	10.8	0.0	20	Extension 36 feet
3	156	1.9	-10.4	10	Extension 27 feet
4	168	-36.0	-36.4	0	Taper - Small Fill & No extension needed
5	151	*	*	0	Gap -No Fill
6	159	*	*	0	Gap -No Fill
7	182	*	*	0	Gap -No Fill
8	221	*	*	0	Gap -No Fill
9	158	No Intercept	-61.9	0	Taper - Small Fill, No extension needed, and outfall diversion recommended
10	170	-31.7	-19.5	0	Taper - Small Fill, No extension needed, and outfall diversion recommended
Notes	* No construction at this cross-section				
	# Gulfward Distance is positive				
	Design Baseline is defined in Bathymetric Map included in Appendix C.				

2.2.2. Proposed Alternative

City's Beach outfall Alternative 1 involves integration with the County's planned beach re-nourishment project, and consists of extending the existing Outfalls where needed, further into the Gulf of Mexico. It is recommended that selected beach outfalls be extended about 25 feet from the construction template shoreline in order to accommodate the County's planned beach re-nourishment construction. Only Outfalls #2 and #3 are recommended for extension. The Base Model was modified to extend these outfalls further into the Gulf of Mexico. Outfalls # 4,

#9, and #10 are taper section with small fill densities, and have sufficient length. Outfalls #5 through #8 are in gaps where no nourishment is needed, and the existing outfall length is sufficient.

The durability of the existing outfalls has been fair to poor as reported by the City. The durability can be improved by special design and construction methods. The following two photographs (Figure 2-1) illustrate methods used in New Jersey to increase durability. The photograph 2 was taken in December 2012, shortly after Hurricane Sandy passed through the area. The extension structures must be built to withstand higher wave attacks facilitated by higher storm water levels. Larger storms are accompanied with increase surge levels, which bodes well for outfall structures that are submerged during the storm, thus diminishing the strength of the wave forces breaking on the outfalls. Outfalls built with less bulk provide less surface area for wave forces. A thinner and lower structure is more resilient during storms.

Figure 2-1: Photographs to Illustrate Methods to Increase Durability

Photograph 1: Elevated outfall discharge in Avalon NY - in April 2011 - weather moderate storms and does not interrupt alongshore transport like a groin.

Photograph 2: Outfall at Long Branch, New Jersey on December 24, 2012 – months after Super storm Sandy. Structure is low and high surge may have carried waves over the top and not thru the structure.

Plans developed for the Panama City Beach, Florida nourishment project are included in Appendix D. These plan sheets provide example details that support a more resilient outfall design. In the example shown, the most significant features are a stronger foundation, the use of concrete pipeline and stronger connections and fasteners. The cost for reinforcement of the outfalls is included in the recommended improvements for this alternative.

Two options are considered under this alternative:

Option 1A: Integration with the County's planned beach re-nourishment project, which involves extending the existing Outfalls #2 and #3 about 25 feet further into the Gulf of Mexico. Reinforcement of all the existing outfalls to improve durability.

Option 1B: Integration with the County's planned beach re-nourishment project, which involves extending the existing Outfalls #2 and #3 about 25 feet further into the Gulf of Mexico. Removal

of Outfalls #9 and #10 and the runoff generated by the sub-basins currently discharging into these outfalls to be redirected to Basin III. Reinforcement of Outfalls #2 through #8 to improve durability.

2.2.3. Proposed Infrastructure Improvements

A conceptual map of Alternative 1 is presented in Figure 2-2. Tables 2-2 and 2-3 presents the proposed infrastructure improvements required for implementation of Alternative 1.

Table 2-2: Proposed Infrastructure Requirements – Alternative 1 (Option 1A)

No.	Infrastructure Improvements	Quantity	Comments
1	30 inches diameter PVC pipe	25 feet	Outfall #2 extension (Pipe 1)
		25 feet	Outfall #2 extension (Pipe 2)
2	18 inches diameter PVC pipe	25 feet	Outfall #3 extension
3	Reinforcement of Outfalls #2 through #10	9	Reinforcement of existing outfalls to improve durability

Notes:

- Reference: Collier County Beach Re-nourishment Project Plans and Drawings
- Outfalls #2 and #6 have twin pipes while the remainder of the outfalls consist of a single pipe.
- Proposed piping includes required joints, fittings, and supports as needed

The proposed improvements under Alternative 1A are consistent with the County's current and future Beach Re-nourishment Projects.

Table 2-3: Proposed Infrastructure Requirements – Alternative 1 (Option 1B)

No.	Infrastructure Improvements	Quantity	Comments
1	30 inches diameter PVC pipe	25 feet	Outfall #2 extension (Pipe 1)
		25 feet	Outfall #2 extension (Pipe 2)
2	18 inches diameter PVC pipe	25 feet	Outfall #3 extension
3	Reinforcement of Outfalls #2 through #8	7	Reinforcement of existing outfalls to improve durability
4	Removal of Outfalls #9 and #10	2	Outfalls #9 and #10 to be redirected to Basin III
5	36 inches diameter RCP pipe	2,050 feet	From Outfalls #9 and #10 to Basin III

Notes:

- Outfalls #2 and #6 have twin pipes while the remainder of the outfalls consist of a single pipe.
- Proposed piping includes required joints, fittings, and supports as needed

Extend existing outfalls #2 & #3 by 25'

Flow from Outfalls #9 & #10 recommended to be re-directed to Basin III (1B)

Re-direction of outfalls #9 and #10 is part of Alternative 1B

Outfalls #9 & #10 recommended to be removed (1B)

36"

Legend

- Outfall Location
- Existing Stormwater Main
- Gravity Stormwater Main
- Basin II
- Demolition

0 500 1,000 2,000 Feet

User: thummadir
Date: February 2013
County: Collier

City of Naples
Beach Outfall
Management Evaluation

Alternative 1
Integration of Beach Outfalls with
Planned Beach Re-nourishment Project

AECOM
4415 Metro Parkway
Suite 404
Fort Myers, Florida 33916
T 239-278-7996
F 239-278-0913

Figure

2-2

2.3 Alternative 2 – Integration of Beach Outfalls with Aquifer Storage and Recovery (ASR) System

2.3.1. Background

The City's ASR system is permitted via the well construction permit (Permit No. 261821-003-006-UC/5X) issued by FDEP on August 23rd, 2010. A copy of the permit is included in Appendix E of this report. The permit includes the construction of four (4) Class V, Group 3, Upper Suwannee Formation ASR injection wells below the base of the Underground Source of Drinking Water (USDW), with one storage zone monitoring well within the same formation and two overlying aquifer monitoring wells within the Lower Hawthorne Aquifer, with 670 feet of production casing and an open hole interval to 740 feet below land surface. The ASR wells were designed to inject at a maximum rate of 1 million gallons per day (mgd) per well. Two (2) of the permitted four (4) wells were constructed at the City's Wastewater Treatment Plant (WWTP) at 380 Riverside Circle, Naples, Florida, 34102. The other two wells are planned to be constructed during fiscal year 2013 and 2014 at the same location.

The City could take advantage of the remaining permitted capacity (2 mgd) to manage storm water runoff currently being discharged through the beach outfalls. However, this capacity is very low as compared to the peak flows expected during large storm events. Table 2-4 compares the available ASR capacity (2 mgd) with the peak flow of the 5-year, 24-hour storm event. A considerable storage area would be needed in order to make this alternative more feasible. However, there is no additional infrastructure within the basin to provide the required storage.

Table 2-4: Available ASR capacity and 5-year 24-hour Storm event Peak flow Comparison

*Model Maximum Flow for Outfalls #2 to #10 (Cubic Feet Per Second (cfs))	**Model Maximum Flow for Outfalls #2 to #8 (cfs)	ASR Capacity (cfs)
201.1	170.5	3.1

* Peak flows shown from alternative 5A (same as alternative 2 without the ASR).

**Outfalls 9 and 10 will be re-directed to Basin III.

The flood control level of service benefits derived from a pumping capacity of 2 mgd are minimal. However, assuming that maximum salinity levels for the irrigation system can be met, pumping storm water runoff to an ASR system can accumulate a large volume over a long period of time. The long term continuous simulation needed to establish these benefits was not performed in this study. The following calculation provides a range of the annual volume that could be stored in the ASR, if this alternative is implemented.

- Average annual rainfall (1952 to 2008) in Naples: 52 inches
- Portion of the rainfall converted to runoff: 15 percent to 25 percent
- Annual runoff: 7.8 inches to 12.9 inches

- Total annual runoff volume for a 395-acre drainage basin: 83 to 139 Million Gallons (MG)

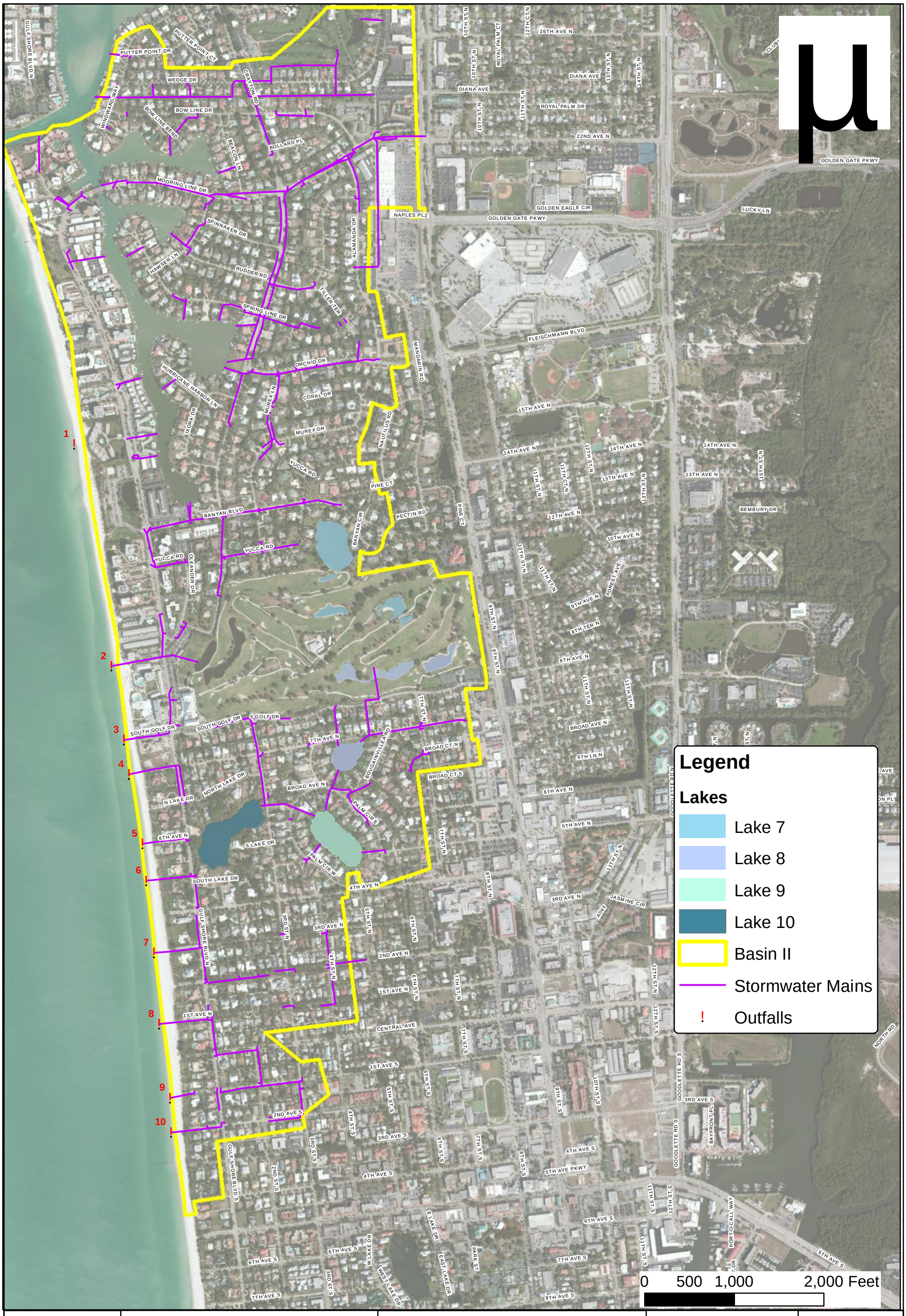
The calculations shown above assume that all the runoff produced by rainfall events in the Basin could be re-directed to the ASR system. Since the re-direction system (in this case a pump station) will be limited by its capacity and by the available capacity of the ASR system, it will not be possible to re-direct large portions of significant rainfall events. It might also not be feasible to re-direct runoff produced by small rainfall events, since they will not produce the volume required to reduce salinity concentrations in the receiving water bodies. Additionally, the feasibility of this alternative is subject to satisfactory ASR system test results that are currently underway at the City. The City's WWTP ASR system is currently undergoing Cycle 2 operational testing for the first two wells. The operational testing data reviewed as part of this effort indicates that the full capacity of the existing ASR system is being used to store reclaimed water and surface water from the Golden Gate Canal. Additional ASR capacity would be required to store water from this project.

2.3.1.1. *Summary of Water Quality Data*

The City has been collecting water quality data from lakes and/or stormwater conveyances since 2008. The City's ten (10) beach outfalls (Outfall #1 to Outfall #10) that discharge into the Gulf of Mexico carry effluent from four (4) wet detention stormwater lakes (Lakes 7 to 10). These lakes are connected in series, with Lake 10 being the last detention area before the outfalls discharge into the Gulf of Mexico. Figure 2-3 shows the location of lakes 7 to 10. Discharges from this location have particularly high mean concentrations of total suspended solids (TSS), indicating that the stormwater lakes do not provide adequate TSS reduction. Data for the outfall at Lake 10 is provided in Table 2-5.

Water recovered from the ASR system can be blended with reclaimed water without the need for additional disinfection and filtration. However, it should be noted that native ASR ground water contains elevated concentrations of dissolved solids and inorganic constituents. ASR recovery efficiency may be difficult to predict, as it is not certain when the levels of dissolved solids and inorganic constituents will increase during the recovery phase. Elevated concentrations of dissolved solids and salts may harm sensitive vegetation and may decrease the hydraulic capacity of reuse and land application sites.

The conductivity data shown in Table 2-5 indicates high salinity levels are present in the Lake 10 samples (estimated greater than excess of 10,000 ppm). The lake where the samples were taken is part of the collection system needed to concentrate the storm water in a single outfall. Based on this high salinity concentration of water from the lakes, it does not appear that water withdrawn directly from the lake will be compatible with the irrigation water supply. Therefore, if an ASR system is to be implemented, the storm water runoff being injected into the ASR must be collected and segregated from the lake water to avoid its high salinity concentrations.



User: thummadir
Date: January 2013
County: Collier

City of Naples
Beach Outfall
Management Evaluation

Basin II Stormwater Lakes

AECOM
4415 Metro Parkway
Suite 404
Fort Myers, Florida 33916
T 239-278-7996
F 239-278-0913

Figure

2- 3

Table 2-5: Water Quality Results for Lake 10

Parameter	Units	12/7/2010	3/18/2011	6/22/2011	9/20/2011
Nitrogen, Kjeldahl	mg/L	0.97	0.7	1.1	0.97
Nitrate, Nitrite as N	mg/L	0.5*	0.10*	0.10*	0.1*
Nitrogen, Total	mg/L	0.97	0.7	1.1	0.97
Phosphorus, Total	mg/L	0.042	0.056	0.043	0.055
Total Suspended Solids (TSS)	mg/L	10**	26	22	13
Copper, Total	µg/L	2.5*	7.8	0.82	1
Fecal Coliform	MF	40	40	40	36
Enterococcus	MPN	166	2420	100	437
Dissolved Oxygen (DO)	mg/L	11.39	8.22	5.4	-
Conductivity	µS/cm	34412	23660	34518	-
Temp	C	18.88	26.42	32.93	-
pH	s.u.	-	-	8.17	-
*Compound was analyzed for but not detected					
** Estimated value; value may not be accurate. Spike recovery or RPD outside of criteria					

Stormwater diverted from Basin 2 will require pretreatment prior to introduction to the ASR system. The treatment of the Stormwater would be similar to what has been developed for the water diverted from the Golden Gate Canal pump station. The treatment would include filtration and disinfection. The existing WWTP has a capacity of 18 mgd for filtration and 24 mgd for disinfection. The proposed integration of a stormwater system with an existing ASR system will also require sampling and testing for Cryptosporidium and Giardia at one time during each two-year period. Samples will need to be taken at a point after treatment as per FDEP's Florida Administrative Code (F.A.C) 62-610.472(3)(d). A consumptive use permit for the use of surface water to supplement the reclaimed water supply may also be required prior to using ground water or surface water to supplement the reclaimed water supply.

Reclaimed water from ASR will need to meet specific conditions regardless of whether surface water is added to the system. Safe limits of dissolved solids and salts that protect vegetation, soils and ground water quality must be established. Recovered water must be monitored for arsenic concentration (< 10 ug/L), specific conductance, fecal coliform, TSS (< 5mg/L), CBOD5 (Carbonaceous Biochemical Oxygen Demand) and chlorine residual (1 mg/L minimum).

2.3.2. Proposed Alternative

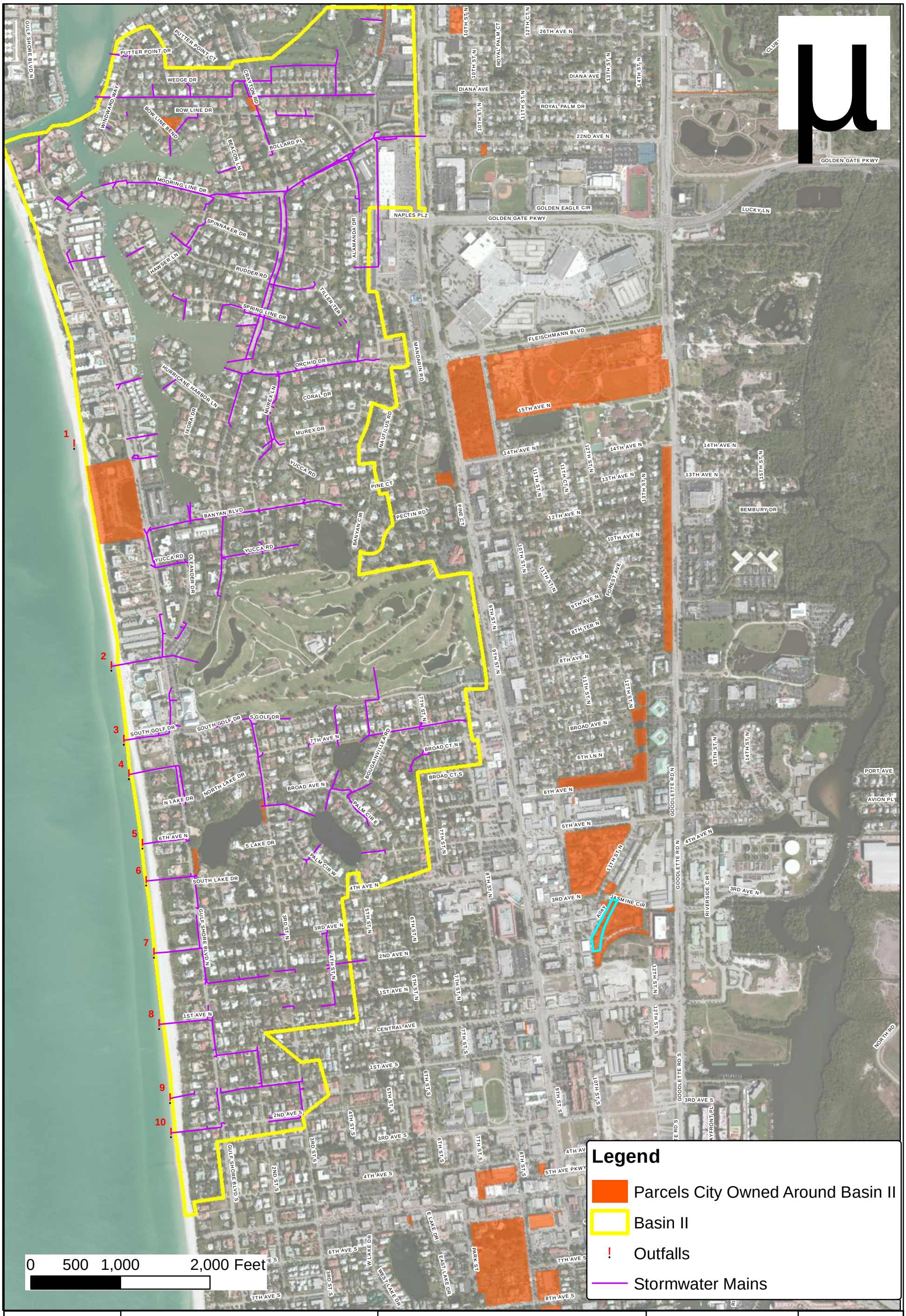
The Beach Outfall Alternative 2 involves integration with the City's existing reclaimed water ASR system as an alternative to divert stormwater discharges that are currently going to the beach outfalls. It should be noted that only a portion of the flow (base flow of about 2 mgd as described in the above Section) from Outfalls #2 through #8 would be captured prior to discharge to the lake system and pumped to the City's ASR system while the rest of the flow will be pumped to a consolidated outfall. The existing discharge Outfalls #2 through #8 will be removed. Outfalls #9 and #10 are recommended to be removed and the runoff generated by the sub-basins currently discharging into Outfalls # 9 and #10 to be re-directed to Basin III (as indicated in Section 2.1).

As part of this effort, AECOM examined a site map showing City owned property within Basin 2 (Figure 2-4). Based on past regulatory efforts and property needed to develop an ASR system, only two potential locations were identified; the City's waste water treatment plant and the golf course.

The potential location for the consolidated pumped ocean outfall was identified based on findings from LiDAR data related to this project and is recommended to be at Outfall #6. Outfall #6 is recommended to be upgraded to a larger size pipe and the discharge location to be extended further into the Gulf of Mexico from the current location. The evaluation of this alternative using the Base Model recommended a 60 inches force main extending about 1,210 feet from Gulf Shore Boulevard for the consolidated outfall at Outfall #6 location. The recommended invert elevation for the consolidated outfall discharge location is approximately -12.5 feet with respect to National Geodetic Vertical Datum (NGVD) 1929. Details on the design considerations for consolidated outfalls are presented under Alternative 3 (Section 2.4).

A pump station will be required to pump flows from Outfalls #2 through #8 to the proposed consolidated outfall and to the ASR system. The system required to pump storm water to the ASR system should keep the storm water separated from the water in the lake to avoid the high salinity concentrations in the lake. The potential location for the pump station is recommended to be City owned property at Alligator Lake. In order to maintain the existing level of service, three (3) pumps with a design capacity of 50 cubic feet per second (cfs) are required at the proposed pump station. A fourth pump with the same design capacity is recommended to serve as a stand-by pump. The proposed pump station would receive stormwater from Outfalls #2 through #8 via gravity flow and then pump water at the required head for the proposed consolidated beach outfall at Outfall #6.

A designated set of pumps at the proposed pump station would pump flow through a new force main that would carry flow to an existing gravity pipe that conveys flow to the City's existing Public Works Pump Station. A new force main is also required to pump flow from the City's existing Public Works Pump Station to the City's WWTP ASR. The diameter of the proposed force main is recommended to be 8 inches in diameter and approximately 5,400 feet in length. The length of the force main was determined based on a conceptual path that was assumed to be practical to carry flows from the proposed pump station to the ASR system. It should be noted that the length of the force main could change depending on the route chosen during final design of the force main.



User: thummadir Date: January 2013 County: Collier		**City of Naples** **Beach Stormwater Outfall Management Evaluation**	AECOM 4415 Metro Parkway Suite 404 Fort Myers, Florida 33916 T 239-278-7996 F 239-278-0913	Figure
		City Owned Parcels Around Basin II		2-4

An alternative for the City's reclaimed water ASR system is to build a new ASR system at the Golf Course located in Basin II. The force main that could carry flow from the proposed pump station to the ASR system at the Golf Course is recommended to be 8 inches in diameter and approximately 5,300 feet in length. As indicated earlier, the length of the force main could change depending on the route chosen during final design of the force main. This location would need to be evaluated further because of its proximity to the City's Coastal Ridge Wellfield.

2.3.3. Proposed Infrastructure Improvements

A conceptual map of Alternative 2 is presented in Figure 2-5. Figure 2-5 presents the two (2) options proposed for this alternative, as described below.

1. Option 2A: About 2 mgd of flow from Outfalls #2 through #8 is pumped via a proposed pump station to the City's WWTP ASR system and the remainder of the flow is pumped to a consolidated outfall at Outfall #6 location.
2. Option 2B: About 2 mgd of flow from Outfalls #2 through #8 is pumped via a proposed pump station to a new ASR system at the Golf Course in the City's stormwater Basin II and the remainder of the flow is pumped to a consolidated outfall at Outfall #6 location.

Table 2-6 and Table 2-7 present the proposed infrastructure improvements required for implementation of Options 2A and 2B of Alternative 2.

Table 2-6: Proposed Infrastructure Requirements – Alternative 2 (Option 2A)

No.	Infrastructure Improvements	Quantity	Comments
1	Pump station with 4 pumps at design capacity of 50 cfs	1	Proposed pump station
2	60 inches diameter RCP pipe	1,210 feet	Consolidated outfall (force main) at Outfall #6 location
		200 feet	From Outfalls #2, #3, #4, #5 to proposed pump station
3	54 inches diameter RCP pipe	820 feet	From Outfalls #2, #3, and #4 to Outfall #5
4	48 inches diameter RCP pipe	390 feet	From Outfalls #2 and #3 to Outfall #4
5	42 inches diameter RCP pipe	860 feet	From Outfall #2 to Outfall #3
		1,020 feet	From Outfalls #6, #7, and #8 to proposed pump station
6	36 inches diameter RCP pipe	800 feet	From Outfalls #8 to Outfall #7
		2,050 feet	From Outfalls #9 and #10 to Basin III
7	8 inches diameter PVC pipe	5,400 feet	New force main from proposed pump station to City's WWTP ASR
8	Removal of Outfalls #2 through #10	NA	• Outfalls #2 through #8 to be sent to ASR and the rest of the flow to be discharged to the ocean via consolidated outfall at Outfall #6 location • Outfalls #9 and #10 to be redirected to Basin III
9	New ASR wells and required appurtenances	2	Additional ASR wells at City's WWTP

Notes:

- Proposed piping includes required joints, fittings, and supports as needed

Table 2-7*:* Proposed Infrastructure Requirements – Alternative 2 (Option 2B)

No.	Infrastructure Improvements	Quantity	Comments
1	Pump station with 4 pumps at design capacity of 50 cfs	1	Proposed pump station
2	60 inches diameter RCP pipe	1,210 feet	Consolidated outfall (force main) at Outfall #6 location
		200 feet	From Outfalls #2, #3, #4, #5 to proposed pump station
3	54 inches diameter RCP pipe	820 feet	From Outfalls #2, #3, and #4 to Outfall #5
4	48 inches diameter RCP pipe	390 feet	From Outfalls #2 and #3 to Outfall #4
5	42 inches diameter RCP pipe	860 feet	From Outfall #2 to Outfall #3
		1,020 feet	From Outfalls #6, #7, and #8 to proposed pump station
6	36 inches diameter RCP pipe	800 feet	From Outfalls #8 to Outfall #7
		2,050 feet	From Outfalls #9 and #10 to Basin III
7	8 inches diameter PVC pipe	5,300 feet	New force main from proposed pump station to proposed ASR at Golf Course in Basin II
8	Removal of Outfalls #2 through #10	NA	• Outfalls #2 through #8 to be sent to ASR and the rest of the flow to be discharged to the ocean via consolidated outfall at Outfall #6 location • Outfalls #9 and #10 to be redirected to Basin III
9	New ASR wells and required appurtenances	2	New ASR system at Golf Course in City's stormwater Basin II
10	Water Treatment: Filtration and disinfection		Filtration and disinfection of stormwater prior to injecting into ASR wells

Notes:

- Proposed piping includes required joints, fittings, and supports as needed

User: thummadir
Date: January 2013
County: Collier

City of Naples
Beach Outfall
Management Evaluation

Alternative 2
Integration of Beach Outfalls with ASR System

AECOM
4415 Metro Parkway
Suite 404
Fort Myers, Florida 33916
T 239-278-7996
F 239-278-0913

Figure

2-5

2.4 Alternative 3 - Consolidation of Beach Outfall Pipes

2.4.1. Background

Alternative 3 includes eliminating the individual outfalls and consolidating them into submerged outfalls. Considerations in the design of such submerged consolidated outfalls are presented below:

2.4.1.1. *Outfall Diameter*

The outfall diameter of the consolidated submerged outfalls must be sufficiently large to minimize head losses, which could increase flooding upstream of the outfall. The outfall diameter should also be small enough to create velocities that will keep the outfall clean of sediments, including sediment from stormwater as well as sediment transported into the outfall by waves. A velocity on the order of 5 feet per second (fps) for the 1 year storm for at least 1 hour is considered to be adequate. Sediment intrusion can be avoided by the addition of duck-bill valves at the end of the outfall, however, they could add to the cost and produce additional head losses, and therefore are not recommended at this time for the project.

2.4.1.2. *Outfall Depth*

The submerged outfall crown, in sections where it is above the sea floor, should be sufficiently deep to avoid interference with boat traffic. This consideration drives towards a deeper outfall, which would be longer unless an adverse slope is selected towards the end. The latter, however, is not favored here as sediment accumulation during the relatively long dry season might be difficult to dislodge during the wet season. The water column for clearance of sub-aqueous structures was assumed to be 6 feet below Mean Lower Low Water (MLLW) level. This assumption should be confirmed with the United States Army Corps of Engineers (USACE) prior to detailed design.

2.4.1.3. *Navigation Markers*

In order to reduce the potential for boat interference, signaling the location of the submerged outfall with navigation markers is recommended.

2.4.1.4. *Outfall Length*

Since the cost of an outfall is strongly correlated with its length, the consolidated outfall length should be minimized, while still satisfying the other design considerations.

2.4.1.5. *Hydrostatic Head*

The density difference between the stormwater, which is essentially fresh, and the seawater, which is saline, causes an increase in head upstream of the outfall. This hydrostatic head is equal to the relative density difference (approximately 0.025) multiplied by the discharge centerline depth. Thus for a discharge centerline 10 feet below Mean Sea Level (MSL), the water depth during high-high tide would be on the order of 14 feet and the hydrostatic head is 0.35 feet, which is small, but not negligible relative to flooding.

2.4.1.6. *Structural Stability*

Structural stability is a paramount consideration, particularly in an area prone to hurricanes during which large waves can cause high forces on submerged objects and significant sediment transport. Structural stability can be achieved through one of the following means:

- Placing the outfall in a trench filled back to the original sea floor level: For an outfall discharging horizontally above the sea floor, part of the outfall will be above the sea floor and needs to be secured through other means. The outfall can be in a trench all the way to its terminus, but requires one or more vertical risers from the outfall to the sea floor. As mentioned above, this is not preferred, as sediment may deposit in the outfall and be difficult to remove. Also, during large storms, sea floor sediment is re-suspended and may deposit in the outfall unless there is a strong outflow.
- Covering the outfall with large stones or riprap: This approach has the disadvantage of raising the height of the outfall and exacerbating the risk of navigation interference.
- Attaching the outfall to piles sunk in the sea floor: This approach typically involves piles sunk on each side of the outfall conduit with horizontal cross bars above and below the outfall conduit to secure it in place.
- Collaring the outfall with heavy concrete blocks resting on the sea floor or partially buried into it: A typical risk with this approach is that the supporting blocks may sink into the sand during large storms.

2.4.1.7. *Outfall Buoyancy*

If the outfall material has a density less than that of seawater, sections of outfall above the sea floor must be weighed down by concrete collars or secured to piles to prevent the outfall from floating, or the outfall must be attached to the sea floor (when that is possible).

2.4.1.8. *Sea Floor Movement*

The proposed outfall layout must account for seafloor elevation changes due to storm-related sediment transport. Sea bottom profiling along several transects between November 2005 and July 2009 show that beyond the submerged alongshore bar, which lies approximately 200 feet offshore, the bottom is relatively stable.

2.4.1.9. *Stormwater Dilution*

Stormwater drainage systems convey the flow of stormwater discharges to the Gulf and concentrate the discharges at a small number of points, with the potential for environmental impacts. Submerged outfalls provide an opportunity for the stormwater to mix rapidly with ambient water, and because of its buoyancy, the effluent rises in the receiving water and has limited interaction with the sea floor. The effluent undergoes a relatively rapid dilution near the discharge point in the buoyant jet generated by the discharge. This initial dilution is greater with greater water depths. Initial dilution can also be increased by distributing the discharge among several points using a multiport diffuser.

Such a structure, however, is not warranted for a stormwater discharge containing limited levels of contamination.

2.4.1.10. *Bio-fouling*

Structures built in the marine environment run the risk of becoming covered by attached marine growth, particularly shellfish. In the case of submerged pipes such as intakes or outfalls, marine growth can result in a decrease of flow capacity and eventually in blockage. The risk is higher for outfalls, such as the ones considered here, that discharge episodically such that the outfalls are filled with seawater much of the time. Outfalls continuously discharging fresh water, such as treated wastewater outfalls, have a lesser risk of internal marine growth that would impede performance. Along the Florida Gulf Coast south of Tampa, green mussels, an invasive species from Asia, have recently been observed to grow in large quantities and to cause costly problems to coastal industries. These mussels can form dense layers that can clog water intakes, weigh down navigation buoys and foul the hulls and engines of boats.

Attached marine growth inside submerged pipes is difficult to clean and should be avoided as much as possible. Therefore, the sub-aqueous outfalls considered in this Alternative, as well as in Alternative 2 and 5, should probably be equipped with rubber duck-bill valves to prevent entry of seawater during dry weather conditions. Although duck-bill valves are available in large sizes, using twin pipes would permit using smaller valves that would not extend as high in the water column. For large flows, the valves open fully and do not cause significant head loss compared to an open pipe.

2.4.2. Proposed Alternative

The Beach Outfall Alternative 3 involves consolidation of existing beach outfalls. The consolidated outfalls will be buried deeper and extend further into the Gulf of Mexico.

Flow from Outfalls #2 through #8 is recommended to be consolidated to two (2) beach outfalls. Different locations could be selected for the consolidated beach outfalls. However, this alternative was based on the assumption that flows are conveyed to the largest outfalls. The LiDAR data related to this project was also considered in the selection of location for consolidated outfalls. Outfall #2 and #6 locations are recommended for consolidated outfalls under this alternative. Outfalls #2 and #6 have twin pipes while the rest of the outfalls have a single pipe.

Flow from Outfalls #3 and #4 will be directed to Outfall #2 location. Flow from Outfalls # 5, #7, and #8 will be directed to Outfall #6 location. The existing discharge Outfalls #2 through #10 will be removed. The runoff generated by the sub-basins currently discharging into Outfalls #9 and #10 is to be re-directed to Basin III (as indicated in Section 2.1). Outfalls #2 and #6 will be replaced with a larger pipe that is buried deeper and extended further into the Gulf of Mexico. Concept profiles that were developed using the cross-sections from LiDAR data related to this project for Outfalls #2 and #6 are shown in Figures 2-6 and 2-7.

Figure 2-6: Outfall #2 Profile (Alternative 3)

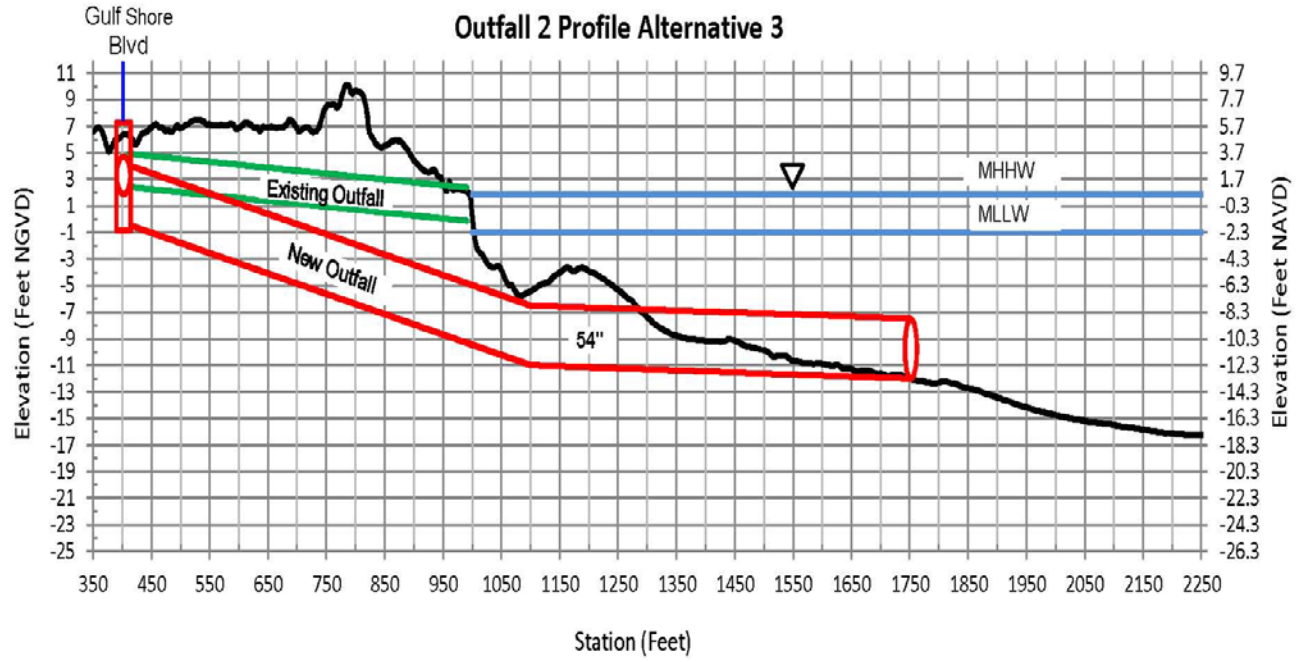
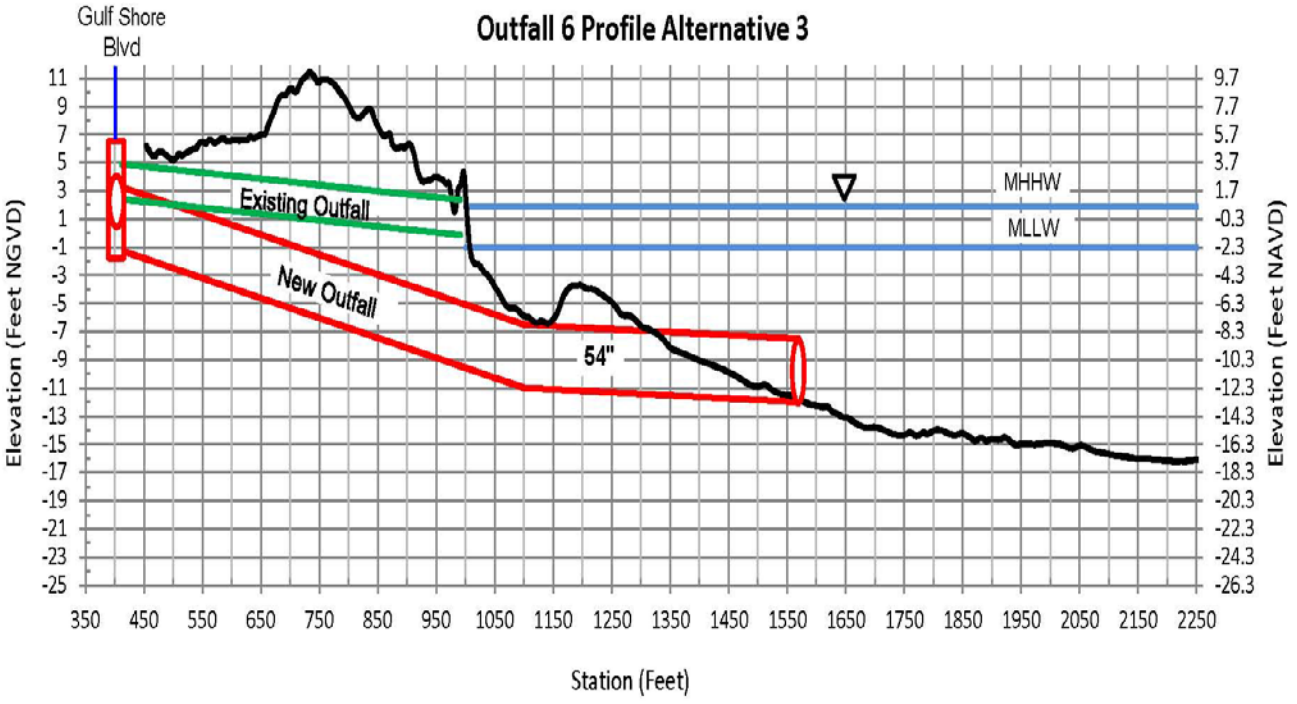


Figure 2-7: Outfall #6 Profile (Alternative 3)



All gravity flow with a single outfall could also be considered as another option for this alternative. However, a single gravity outfall will not maintain the same level of service as the existing condition; and therefore a single gravity outfall is not considered a viable option.

For Outfall #2, a 54 inches diameter conduit is recommended or, alternatively, two (2) 42-inch conduits could be used. With the single 54 inches conduit, the concept design has the outfall extending approximately 750 feet offshore, with the last 450 feet only partially buried. The outfall invert at its terminus is at an elevation of -12 feet NGVD, which leaves a minimum clearance of 6.49 feet at Mean Lower Low Water (MLLW), not accounting for any rip-rap, support or collar that would extend above the conduit. If this elevation can be raised by 1 foot, by using two 42 inches conduits, the outfall length could be reduced by about 120 feet.

Similarly, for Outfall #6, a 54 inches diameter conduit is recommended or, alternatively, two (2) 42-inch conduits could be used. With the single 54 inches conduit, the concept design has the outfall extending approximately 570 feet offshore, with the last 250 feet only partially buried. The outfall invert at its terminus is at an elevation of -12 feet NGVD, which leaves a minimum clearance of 6.49 feet at MLLW, not accounting for any rip-rap, support or collar that would extend above the conduit. If this elevation can be raised by 1 foot, by using two 42 inches conduits, the outfall length could be reduced by about 50 feet.

2.4.3. Proposed Infrastructure Improvements

The conceptual map of Alternative 3 is presented in Figure 2-8. Figure 2-8 presents two (2) options proposed for this alternative as described below:

1. Option 3A: City's beach Outfalls #2 through #8 will be consolidated to two (2) outfalls, consolidated Outfalls #2 and #6, which include single conduits with a diameter of 54 inches.
2. Option 3B: City's beach Outfalls #2 through #8 will be consolidated to two (2) outfalls, consolidated Outfalls #2 and #6, which include two (2) conduits each with a diameter of 42 inches.

Table 2-8 and Table 2-9 present the proposed infrastructure improvements required for the implementation of Options 3A and 3B of Alternative 3.

Table 2-8: Proposed Infrastructure Requirements – Alternative 3 (Option 3A)

No.	Infrastructure Improvements	Quantity	Comments
1	54 inches diameter RCP pipe	1,335 feet	Consolidated outfall at Outfall #2 location
		1,155 feet	Consolidated outfall at Outfall #6 location
2	42 inches diameter RCP pipe	820 feet	From Outfalls #7 and #8 to consolidated Outfall #6
3	36 inches diameter RCP pipe	800 feet	From Outfall #8 to Outfall #7
		2,050 feet	From Outfalls #9 and #10 to Basin III
4	30 inches diameter RCP pipe	860 feet	From Outfalls #3 and #4 to consolidated Outfall #2
5	24 inches diameter RCP pipe	400 feet	From Outfall #5 to consolidated Outfall #6
		390 feet	From Outfall #4 to Outfall #3
6	Removal of Outfalls #2 through #10	NA	• Outfalls #2 through #8 to be consolidated to two (2) Outfalls at Outfall #2 and #6 locations • Outfalls #9 and #10 to be redirected to Basin III

Notes:

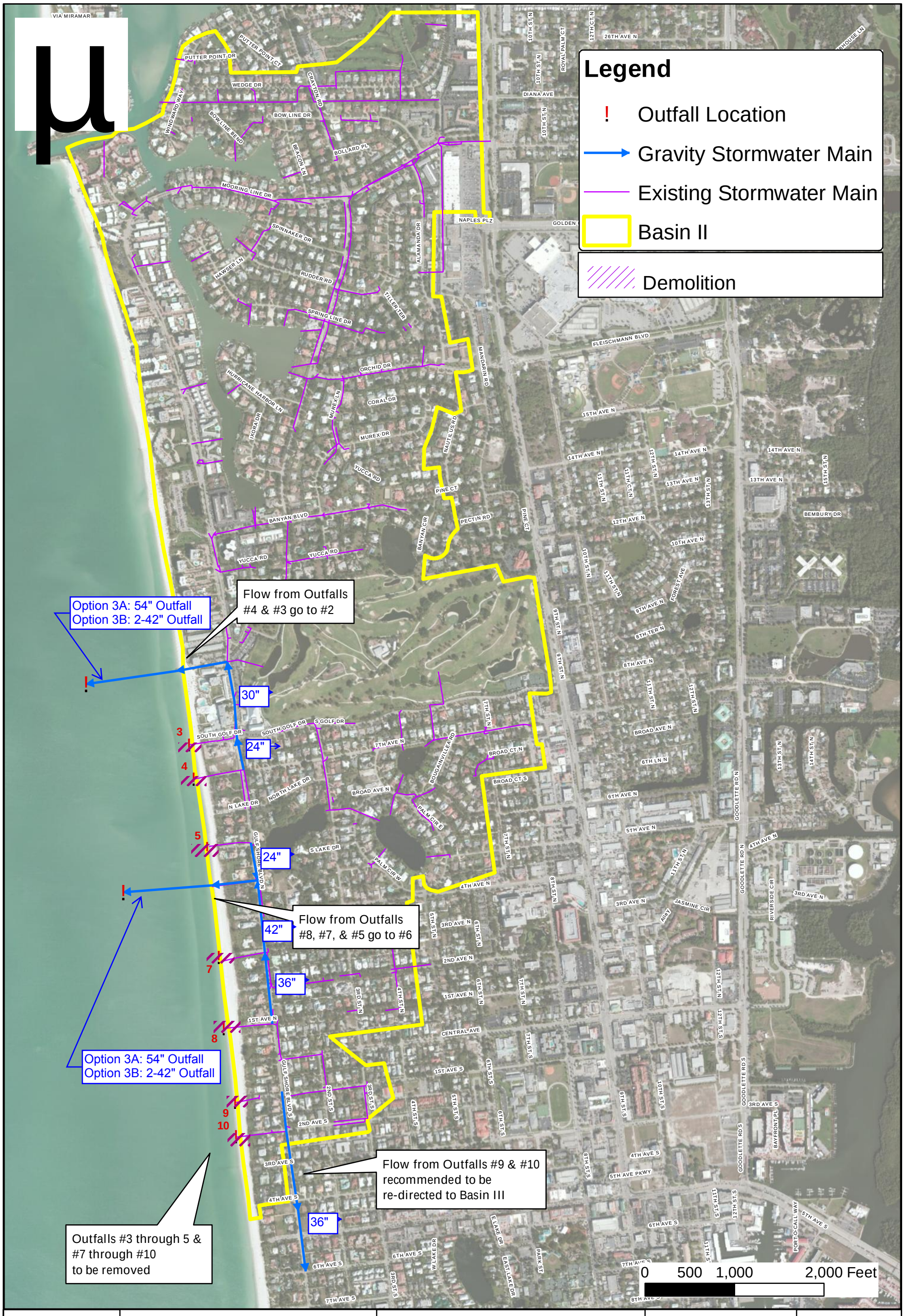
- Proposed piping includes required joints, fittings, and supports as needed

Table 2-9: Proposed Infrastructure Requirements – Alternative 3 (Option 3B)

No.	Infrastructure Improvements	Quantity	Comments
1	42 inches diameter RCP pipe	1,215 feet	Consolidated outfall at Outfall #2 location (Pipe 1)
		1,215 feet	Consolidated outfall at Outfall #2 location (Pipe 2)
		1,105 feet	Consolidated outfall at Outfall #6 location (Pipe 1)
		1,105 feet	Consolidated outfall at Outfall #6 location (Pipe 2)
		820 feet	Flow from Outfalls #7 and #8 to consolidated Outfall #6
2	36 inches diameter RCP pipe	800 feet	From Outfall #8 to Outfall #7
		2,050 feet	From Outfalls #9 and #10 to Basin III
3	30 inches diameter RCP pipe	860 feet	From Outfalls #3 and #4 to consolidated Outfall #2
4	24 inches diameter RCP pipe	400 feet	From Outfall #5 to consolidated Outfall #6
		390 feet	From Outfall #4 to Outfall #3
5	Removal of Outfalls #2 through #10	NA	• Outfalls #2 through #8 to be consolidated to 2 Outfalls at Outfall #2 and #6 locations • Outfalls #9 and #10 to be redirected to Basin III

Notes:

- Proposed piping includes required joints, fittings, and supports as needed



User: thummadir
Date: January 2013
County: Collier

City of Naples
Beach Outfall
Management Evaluation

Alternative 3
Consolidation of Beach Outfall Pipes

AECOM
4415 Metro Parkway
Suite 404
Fort Myers, Florida 33916
T 239-278-7996
F 239-278-0913

Figure
2-8

2.5 Alternative 4 – Re-direction of Beach Outfall Flows via Pump Station to Alternate Location

2.5.1. Background

An alternative for eliminating the City's stormwater beach discharge flows is to re-direct those flows to an alternate location such as Moorings Bay or to Naples Bay. However, conveyance to Naples Bay may have adverse environmental impacts, since it already receives an excess amount of fresh water flow from the Golden Gate Canal. Consequently, it is not considered to be a viable option.

2.5.2. Proposed Alternative

The Beach Outfall Alternative 4 involves re-direction of flow from beach outfalls #2 through #8 to Moorings Bay via a pump station. The runoff generated by the sub-basins currently discharging into Outfalls #9 and #10 would be re-directed to Basin III (as indicated in Section 2.1). The existing beach Outfalls #2 through #10 would be eliminated.

As indicated under Alternative 2 (Section 2.3), a potential location for the proposed pump station is recommended to be City owned property at Alligator Lake. The proposed pump station would receive stormwater from Outfalls #2 through #8 via gravity flow. A wet well will be integrated with storage in Alligator Lake. The pump station is assumed to be sized to maintain the existing level of service during the design storm event (5 year – 24 hour storm event) with no overflow. Flows above the design storm event would result in street flooding. In order to maintain the existing or improved level of service, three (3) pumps with a design capacity of 50 cfs are required at the proposed pump station. A fourth pump with the same design capacity is recommended to serve as a stand-by pump.

A new force main is required to carry flow from the proposed pump station to Mooring's Bay and is recommended to be 60 inches in diameter and approximately 4,600 feet in length. The length of the force main was determined based on a conceptual path that was assumed to be practical to carry flow from proposed pump station to Mooring's Bay. It should be noted that the length of the force main might change depending on the route chosen during final design of the force main. Two options were considered for sizing of the proposed force main discharging into Moorings Bay - single 60 inches force main or two (2) 42 inches force mains.

2.5.3. Proposed Infrastructure Improvements

A conceptual map of Alternative 4 is presented in Figure 2-9. Figure 2-9 presents the two (2) options proposed for this alternative as describe below:

3. Option 4A: Flow from City's beach Outfalls #2 through #8 will be re-directed via a pump station to Moorings Bay through a single force main with a diameter of 60 inches.
4. Option 4B: Flow from City's beach Outfalls #2 through #8 will be re-directed via a pump station to Moorings Bay through two (2) force mains each with diameter of 42 inches.

Table 2-10 and Table 2-11 present the proposed infrastructure improvements required for implementation of Options 4A and 4B of Alternative 4.

Table 2-10: Proposed Infrastructure Requirements – Alternative 4 (Option 4A)

No.	Infrastructure Improvements	Quantity	Comments
1	Pump station with 4 pumps at design capacity of 50 cfs	1	Proposed pump station to re-direct beach outfall flows to Mooring's Bay
2	60 inches diameter RCP for main pipe	4,600 feet	Force main from proposed pump station to Mooring's Bay
		200 feet	From Outfalls #2, #3, #4, and #5 to proposed pump station
3	54 inches diameter RCP pipe	820 feet	From Outfalls #2, #3, and #4 to Outfall #5
4	48 inches diameter RCP pipe	390 feet	From Outfalls #2 and #3 to Outfall #4
5	42 inches diameter RCP pipe	860 feet	From Outfall #2 to Outfall #3
		1,020 feet	From Outfalls #6, #7 and #8 to proposed pump station
6	36 inches diameter RCP pipe	800 feet	From Outfall #8 to Outfall #7
		2,050 feet	From Outfalls #9 and #10 to Basin III
7	Demolition of Outfalls #2 through #10	NA	• Outfalls #2 through #8 to be re-directed to Mooring's Bay • Outfalls #9 and #10 to be redirected to Basin III

Notes:

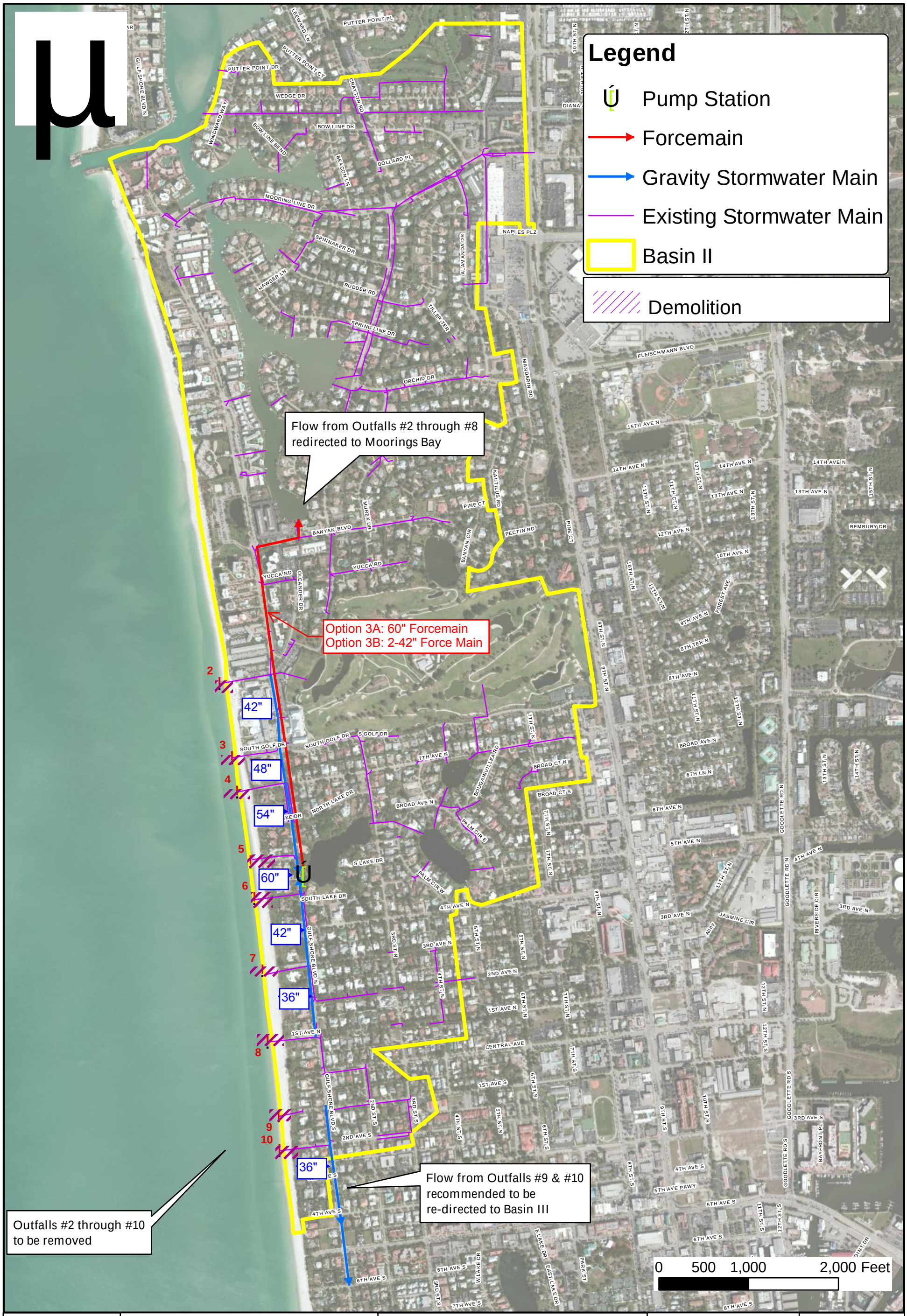
- Proposed piping includes required joints, fittings, and supports as needed

Table 2-11: Proposed Infrastructure Requirements – Alternative 4 (Option 4B)

No.	Infrastructure Improvements	Quantity	Comments
1	Pump station with 4 pumps at design capacity of 50 cfs	1	Proposed pump station to re-direct beach outfall flows to Mooring's Bay
2	60 inches diameter RCP pipe (with required joints and fittings)	200 feet	Flow from Outfalls #2, #3, #4, #5 to proposed pump station
3	54 inches diameter RCP pipe (with required joints and fittings)	820 feet	Flow from Outfalls #2, #3, and #4 to Outfall #5
4	48 inches diameter RCP pipe (with required joints and fittings)	390 feet	Flow from Outfalls #2 and #3 to Outfall #4
5	42 inches diameter RCP force main pipe (with required joints and fittings)	9,200 feet	Twin 42 inches Force main from proposed pump station to Mooring's Bay
		860	Flow from Outfall #2 to Outfall #3
		1,020 feet	Flow from Outfalls #6, #7, and #8 to proposed pump station
6	36 inches diameter RCP pipe (with required joints and fittings)	800 feet	Flow from Outfalls #8 to Outfall #7
		2,050 feet	Flow from Outfalls #9 and #10 to Basin III
7	Demolition of Outfalls #2 through #10	NA	• Flow from Outfalls #2 through #8 to be re-directed to Mooring's Bay • Flow from Outfalls #9 and #10 to be redirected to Basin III

Notes:

- Proposed piping includes required joints, fittings, and supports as needed



User: thummadir
Date: January 2013
County: Collier

City of Naples
Beach Outfall
Management Evaluation

Alternative 4
Re-direction of Flows via
Pump Station to Mooring's Bay

AECOM
4415 Metro Parkway
Suite 404
Fort Myers, Florida 33916
T 239-278-7996
F 239-278-0913

Figure

2-9

2.6 Alternative 5 – Consolidation of Beach Outfalls into Single Outfall Buried Deeper and Further Into Gulf of Mexico (Subaqueous Outfall)

2.6.1. Background

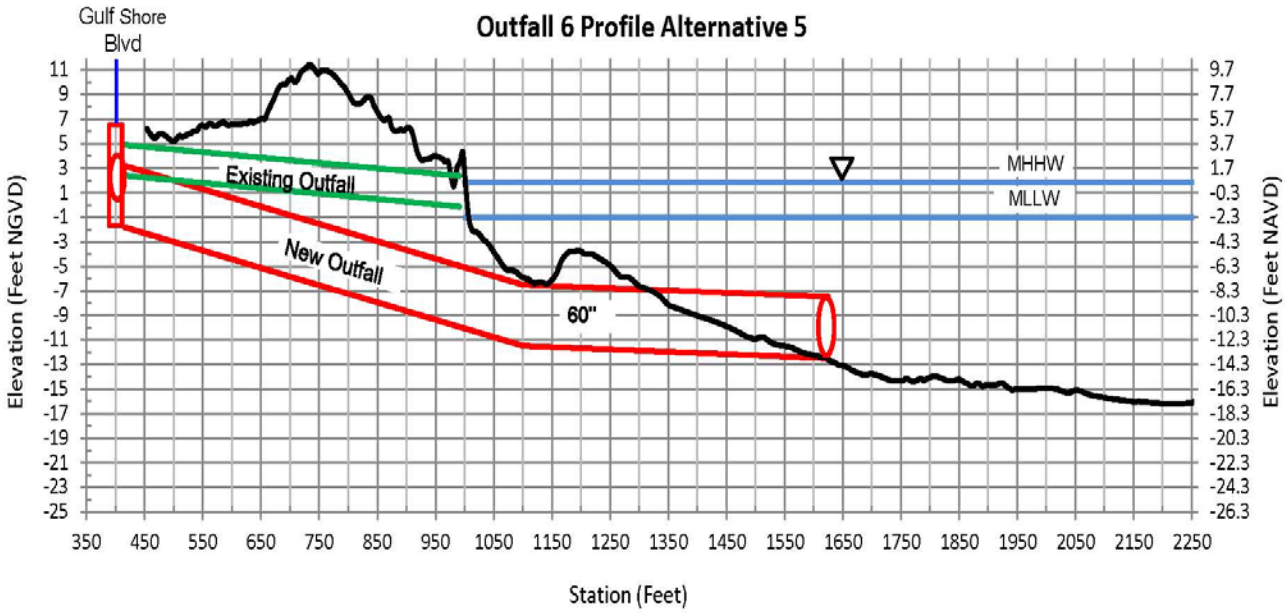
An alternative for eliminating the City's stormwater beach discharge flows is to re-direct those flows into a single ocean outfall that is buried deeper and further into the Gulf of Mexico. Considerations in the design of such submerged consolidated outfalls are presented under Alternative 3 (Section 2.4.1).

2.6.2. Proposed Alternative

The Beach Outfall Alternative 5 involves consolidation of existing beach outfalls into one outfall. The consolidated outfall will be buried deeper and extended further into the Gulf of Mexico.

Flow from Outfalls #2 through #8 is recommended to be consolidated to one (1) beach outfall. Different locations could be selected for the consolidated beach outfall. The LiDAR data related to this project was considered in the selection of location of the consolidated outfall. The Outfall #6 location is recommended for the consolidated outfall under this alternative. Flow from Outfalls #2 through #5 will be directed to the proposed pump station as well as flow from Outfalls #7 and #8. The existing discharge Outfalls #2 through #10 will be removed. The runoff generated by the sub-basins currently discharging into Outfalls #9 and #10 to be re-directed to Basin III (as indicated in Section 2.1). Outfalls #6 will be removed and replaced with a larger pipe that is buried deeper and extended further into the Gulf of Mexico. The concept profile for Outfall #6 is shown in Figure 2-10.

Figure 2-10: Outfall #6 Profile (Alternative 5)



A pump station is recommended to pump flows from Outfalls #2 through #8 to the proposed consolidated outfall at Outfall #6 location. The potential location for the pump station is

recommended to be City owned property at Alligator Lake. In order to maintain the existing or improved level of service, three (3) pumps with a design capacity of 50 cfs are required at the proposed pump station. A fourth pump with the same design capacity is recommended to serve as a stand-by pump. The proposed pump station would receive stormwater runoff from Outfalls #2 through #8 via gravity flow and then pump into the Gulf of Mexico.

Two options are considered under this alternative:

1. Option 5A: City's beach Outfalls #2 through #8 will be consolidated to one (1) outfall at Outfall #6 location, which consists of a 60 inches force main discharge outfall, with a similar profile as the outfall under Alternative 3. The proposed pump station will pump water to the beach through the proposed force main (consolidated outfall).
2. Option 5B: City's beach Outfalls #2 through #8 will be consolidated to one (1) outfall at Outfall #6 location, which consists of two (2) 60 inches gravity discharge outfalls. The proposed pump station will pump water to the required elevation for the proposed consolidated gravity outfall.

2.6.3. Proposed Infrastructure Improvements

A conceptual map of Alternative 5 is presented in Figures 2-11. The figure shows the consolidated outfall as a force main (Option 5A). Tables 2-12 and 2-13 present the proposed infrastructure improvements required for the implementation of Options 5A and 5B of Alternative 5.

Table 2-12: Proposed Infrastructure Requirements – Alternative 5 (Option 5A)

No.	Infrastructure Improvements	Quantity	Comments
1	Pump station with 4 pumps at design capacity of 50 cfs	1	Proposed pump station to pump to consolidated Outfall
2	60 inches diameter RCP force main pipe	1,210 feet	Consolidated outfall (force main) at Outfall #6 location
		200 feet	From outfalls #2 through #5 to proposed pump station
3	54 inches diameter RCP pipe	820 feet	From Outfalls #2 through #4 to Outfall #5
4	48 inches diameter RCP pipe	390 feet	From Outfalls #2 and #3 to Outfall #4
5	42 inches diameter RCP pipe	860 feet	From Outfall #2 to Outfall #3
		1,020 feet	From Outfalls #7 and #8 to proposed pump station
6	36 inches diameter RCP pipe	800 feet	From Outfall #8 to Outfall #7
		2,050 feet	From Outfalls #9 and #10 to Basin III
7	Demolition of Outfalls #2 through #10	NA	• Flow from Outfalls #2 through #8 to be consolidated to one outfall at the location of Outfall #6 • Flow from Outfalls #9 and #10 to be redirected to Basin III

Notes:

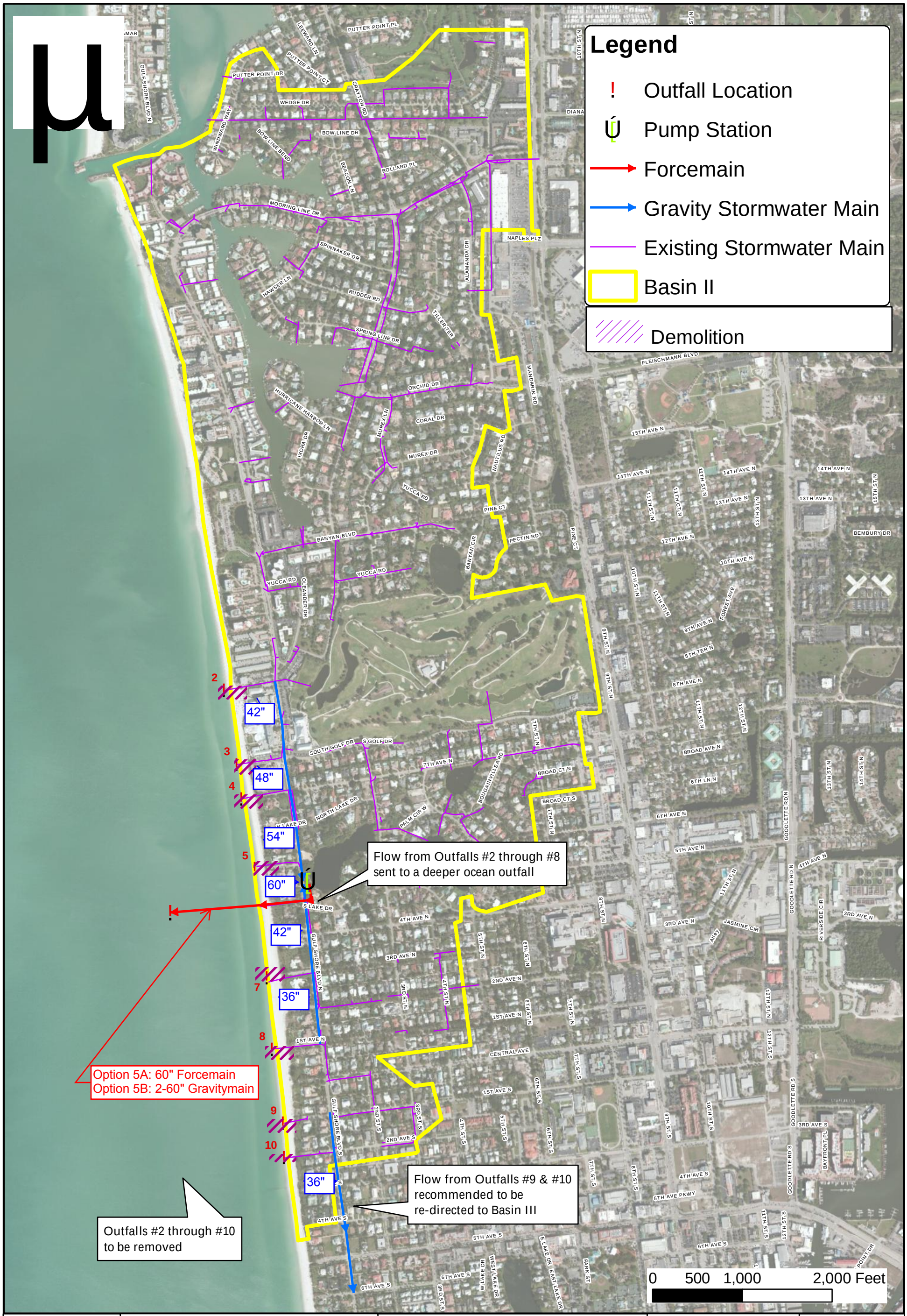
- Proposed piping includes required joints, fittings, and supports as needed

Table 2-13: Proposed Infrastructure Requirements – Alternative 5 (Option 5B)

No.	Infrastructure Improvements	Quantity	Comments
1	Pump station with 4 pumps at design capacity of 50 cfs	1	Proposed pump station to pump to consolidated Outfall
2	60 inches diameter RCP pipe	2,420 feet	Consolidated outfall (gravity main) at Outfall #6 location (twin 60 inches)
		200 feet	From outfalls #2 through #5 to proposed pump station
3	54 inches diameter RCP pipe	820 feet	From Outfalls #2 through #4 to Outfall #5
4	48 inches diameter RCP pipe	390 feet	From Outfalls #2 and #3 to Outfall #4
5	42 inches diameter RCP pipe	860 feet	From Outfall #2 to Outfall #3
		1,020 feet	From Outfalls #7 and #8 to proposed pump station
6	36 inches diameter RCP pipe	800 feet	From Outfall #8 to Outfall #7
		2,050 feet	From Outfalls #9 and #10 to Basin III
7	Demolition of Outfalls #2 through #10	NA	• Flow from Outfalls #2 through #8 to be consolidated to one outfall at the location of Outfall #6 • Flow from Outfalls #9 and #10 to be redirected to Basin III

Notes:

- Proposed piping includes required joints, fittings, and supports as needed



User: thummadir
Date: January 2013
County: Collier

City of Naples
Beach Outfall
Management Evaluation

Alternative 5
Consolidation & Extension of Beach Outfalls
Deeper & Further into Gulf of Mexico

AECOM
4415 Metro Parkway
Suite 404
Fort Myers, Florida 33916
T 239-278-7996
F 239-278-0913

Figure

2-11

2.7 References:

- Tetra Tech, 2007: City of Naples Stormwater Master Plan Update
- Gulf Shore Engineering, 2009: Conceptual Stormwater Management Analysis – Naples Beach Outfalls [Report prepared for Collier County]
- Humiston & Moore, 2010: City of Naples Outfall System – Coastal Impact Assessment and Management [Report prepared for the City of Naples]
- FDEP, 2010: Letter to Ronald A. Wallace, Director of Streets and Stormwater, City of Naples

3 EVALUATION OF ALTERNATIVES

3.1 Stormwater Hydraulic Modeling

The beach outfall alternatives were analyzed and evaluated using the City's existing stormwater system hydraulic model that was prepared under Task 4 of this project as the Base Model. The objective of this evaluation was to define conceptual level improvements needed for each alternative under the premise of maintaining or slightly improving the existing level of service in the existing system. The infrastructure improvements for each alternative that were determined using the hydraulic model are presented in Section 2 of this document. The details on the hydraulic modeling analysis and the assumptions used are presented in "City of Naples Beach Outfall Management Evaluation Final Technical Memorandum on Beach Stormwater Outfalls Hydrologic and Hydraulic Modeling for Existing Conditions – November 2012" that was developed under Task 4 of this project.

The proposed beach outfall alternatives were incorporated into the Base model, and several simulations were performed using the 5 year – 24 hour storm event for each alternative. The elements of each alternative were sized in an iterative process. The storm water model was used for each iteration to evaluate the effects of the alternative on the peak stages for the selected storm event. The criteria used as the "pass or fail" in this process was that the stages under the proposed alternative could be within 2 inches of the stages in the existing conditions model in order to be deemed acceptable. This criterion applies to the sub-basins with peak stages above their minimum grade elevation. For the sub-basins with peak stages under the minimum grade elevation (meaning that no street flooding is caused by the 5 year – 24 hour storm), the 2 inches threshold was not applied, the alternative was considered acceptable if the peak stages at those sub-basins was also under the minimum grade elevation.

Table 3-1 presents a comparison of the Base Model (existing conditions) peak stages for the design storm and the alternatives modeled. Table 3-2 presents a comparison of the maximum beach outfall discharges of the Base Model and the alternatives modeled.

Table 3-1: Existing Conditions and Proposed Alternatives Peak Stage Comparison

Node Name	**Main Road Elevation (Feet NGVD)	5 Year - 24 Hour Maximum Water Elevation (Feet NGVD)							
		Base Model	Alternative 1	Alternative 3 Option 3A	Alternative 3 Option 3B	Alternative 4 Option 4A	Alternative 4 Option 4B	Alternative 5 Option 5A	Alternative 5 Option 5B
10_1	Golf Shore Blvd varies 4.5 – 5.0	5.00	4.26	4.27	4.28	4.25	4.36	4.34	4.26
9_1	Golf Shore Blvd varies 4.5 – 5.0	5.00	4.70	4.74	4.74	4.61	4.71	4.66	4.62
8_2	Golf Shore Blvd varies 4.5 – 5.0	4.96	4.89	5.03	5.04	5.05	5.05	5.03	5.05
8_1	Golf Shore Blvd varies 4.5 – 5.0	4.93	4.86	5.03	5.04	5.05	5.05	5.03	5.05
7_2	Golf Shore Blvd varies 4.5 – 5.0	4.94	4.89	5.03	5.04	5.05	5.05	5.03	5.05
7_1	Golf Shore Blvd varies 4.0 – 4.5	4.49	4.49	4.44	4.45	4.48	4.48	4.38	4.49
11_1	3rd street N varies 8.5-9.0	8.64	8.63	8.64	8.64	8.63	8.64	8.63	8.64
11_0	outfall	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
6_10	7th Ave N varies 8.5 – 10.5	8.55	8.55	8.55	8.55	8.55	8.55	8.55	8.55
6_8	3rd Street N varies 7.5 – 8.5	6.90	6.90	6.90	6.90	6.89	6.89	6.90	6.90
6_6	Palm Circle E varies 7.5 – 9.0	7.04	7.04	7.04	7.04	7.03	7.03	7.04	7.04
6_7	7th Ave N varies 7.0 – 8.5	6.12	6.12	6.12	6.12	6.11	6.10	6.11	6.12
6_4	NA Lake	5.01	5.01	5.03	5.03	4.96	4.95	4.97	4.97
6_3	Palm Circle W varies 7.0 – 8.5	7.88	7.88	7.88	7.88	7.88	7.88	7.88	7.88
6_2	South Lake Dr varies 4.5 – 8.0	3.70	3.70	3.86	3.85	3.50	3.50	3.50	3.50
6_5	5th Avenue N varies 8.5 – 9.0	8.48	8.48	8.48	8.48	8.48	8.48	8.48	8.48
6_1	Golf Shore Blvd varies 4.0 – 4.5	3.50	3.51	3.82	3.83	3.50	3.50	3.50	3.50
4_1	Golf Shore Blvd varies 4.5 – 5.0	4.54	4.54	4.52	4.52	3.50	3.50	3.55	3.50
3_1	Golf Shore Blvd varies 4.5 – 5.5	4.60	4.59	4.02	4.01	3.50	3.50	3.58	3.50
2_3	NA Golf Course	9.40	9.40	9.40	9.40	9.40	9.40	9.40	9.40
2_1	Golf Shore Blvd varies 4.5 – 5.0	3.66	3.66	4.02	4.02	3.50	3.50	3.60	3.50
6_9	South Golf Dr. varies 7.5 – 12.0	6.13	6.13	6.13	6.13	6.12	6.12	6.12	6.13
5_1	Golf Shore Blvd varies 4.0 – 4.5	4.27	4.25	3.82	3.83	3.50	3.50	3.50	3.50
10_2	NA residential, no roads within basin	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60
2_2	NA Golf Course	5.63	5.63	5.63	5.63	5.63	5.62	5.63	5.63
8_3	1st Avenue S varies 6.5 – 8.5	6.04	6.04	6.04	6.04	6.06	6.10	6.07	6.06
8_4	1st Avenue S varies 9.0 – 9.5	6.04	6.04	6.04	6.04	6.06	6.10	6.07	6.06
8_5	2nd Avenue S varies 8.0 – 9.5	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56
2_4	NA Golf Course	4.83	4.83	4.83	4.83	4.83	4.83	4.83	4.83
6-4a	NA Lake	5.79	5.79	5.79	5.79	5.78	5.78	5.78	5.79
6_11a	NA Golf Course	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
6_4b	NA Lake	4.16	4.16	4.20	4.19	4.09	4.09	4.10	4.10
2_1a	Golf Shore Blvd varies 4.5 – 5.5	3.66	3.66	4.02	4.02	3.50	3.50	3.60	3.50
6_11	NA Golf Course	6.47	6.47	6.47	6.47	6.47	6.47	6.47	6.47
6_12	NA Golf Course	6.81	6.81	6.81	6.81	6.80	6.80	6.81	6.81
11_1a	3rd street N varies 8.5 – 9.0	8.55	8.55	8.55	8.55	8.55	8.55	8.55	8.55

** The range of elevations in the main road does not necessarily represent the lowest elevation of the sub-basin.

The results for Alternative 2 are same as Alternative 5A.

Shaded cells represent maximum stages that exceed the existing maximum stage by more than 2 inches, but are below the minimum road elevation.

Table 3-2: Existing Conditions and Proposed Alternatives Peak Beach Outfall Discharges

Outfall	5 Year - 24 Hour Maximum Flow (cfs)							
	Base Model	Alternative 1	Alternative 3 Option 3A	Alternative 3 Option 3B	Alternative 4 Option 4A	Alternative 4 Option 4B	Alternative 5 Option 5A	Alternative 5 Option 5B
2	18.26	19.47	43.96	45.44	0.00	0.00	0.00	0.00
3	9.31	9.53	0.00	0.00	0.00	0.00	0.00	0.00
4	9.24	8.87	0.00	0.00	0.00	0.00	0.00	0.00
5	5.33	5.51	0.00	0.00	0.00	0.00	0.00	0.00
6	27.20	35.01	71.50	73.48	0.00	0.00	175.07	165.19
7	17.95	17.12	0.00	0.00	0.00	0.00	0.00	0.00
8	31.15	31.26	0.00	0.00	0.00	0.00	0.00	0.00
9	7.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	9.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**135.34**	**126.77**	**115.46**	**118.92**	*** 0.00**	*** 0.00**	**175.07**	**165.19**

The results for Alternative 2 are same as Alternative 5A.

* Alternative 4 discharges to Mooring Bay

It is important to note that in most cases, the peak stages for the alternative simulations are due to the difference in hydrostatic head imposed by the fresh water – salt water density difference. This head increases considerably when the outfalls are deepened. Differences in peak stages created by the hydrostatic head difference are not dependent on the dimensions of the proposed infrastructure.

Cells highlighted in yellow in Table 3-1 represents the maximum stages that exceeds the existing maximum stage by more than 2 inches, but are below the minimum road elevation (water within the catch basins). However the peak stage elevations reported are below the minimum road elevation.

Specifically, Table 3-1 shows that at node 6_1 the maximum stages for Alternative 3 are slightly higher than the results obtained with the Existing Conditions (Base Model). These exceedances were considered acceptable taken into consideration that the improvement of the alternative configuration required to reduce them would require much larger diameter pipes, which would have made the alternative economically unviable. The same applies to nodes 2_1 and 2_1a.

Table 3-2 shows that for alternative 5, the total peak flow is greater than the existing conditions total peak flows, however the total peak flow is not indicative of larger discharges because the reported maximum flow reflects the pumping cycles and pumping capacity. Total runoff volume discharged in all alternatives is less than the existing conditions since the runoff from outfalls 9 and 10 are being re-directed to Basin III.

3.2 Cost Estimates

The following Preliminary Opinion of Probable Construction Cost is based on preliminary price quotes from equipment vendors. Any Opinion of the Probable Construction Cost prepared by AECOM represents its judgment as a design professional and is supplied for the general guidance of the City. Since AECOM has no control over the cost of labor and material, or over competitive bidding or market conditions, AECOM does not guarantee the accuracy of such opinions as compared to contractor bids or actual cost to the County. The assumptions that were made during conceptual cost estimating are listed below:

- Estimates were compiled using available 2012 cost data.
- Labor estimates were compiled based on consultation with marine contractors.
- Installations on land assume multiple crews performing work sections in parallel.
- Work in work is based on a 150 ton barge crane with mudhog pumps for jetting pipe into place.
- A spud barge for materials is included as a staging platform.
- Work less than 100 feet from shore is assumed to be performed using sheeting and a land based crane.
- Marine work estimates can vary significantly from actual costs if severe weather impacts construction efforts.

The following Tables provide the preliminary opinion of probable construction cost.

Table 3-3: Conceptual Costs - Alternative 1A

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	18 inches diameter PVC pipe	LF	25	$ 672.28	$ 16,807.00
2	30 inches diameter PVC pipe	LF	50	$ 766.02	$ 38,301.00
3	Reinforcement of Outfalls #2 through #10	EA	9	$ 29,450.00	$ 265,050.00
				SUBTOTAL	$ 338,355.00
	Miscellaneous (25%)				$ 84588.75
	General Requirements (15%)				$ 50,755.25
	Contractor Overhead & Profit (20%)				$ 67,671.00
	Contingency (10%)				$ 33,835.50
				TOTAL	$ 575,203.50

Table 3-4: Conceptual Costs - Alternative 1B

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	18 inches diameter PVC pipe	LF	25	$ 672.28	$ 16,807.00
2	30 inches diameter PVC pipe	LF	50	$ 766.02	$ 38,301.00
3	36 inches diameter RCP pipe	LF	2,050	$ 247.34	$ 507,050.96
4	Reinforcement of Outfalls #2 through #8	EA	7	$ 29,450.00	$ 206,150.00
				SUBTOTAL	$ 768,308.96
	Miscellaneous (25%)				$ 192,077.24
	General Requirements (15%)				$ 115,246.34
	Contractor Overhead & Profit (20%)				$ 153,661.79
	Contingency (10%)				$ 76,830.90
				TOTAL	$ 1,306,125.23

Table 3-5: Conceptual Costs - Alternative 2A

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Pump station with 4 pumps at design capacity of 50 cfs each	EA	1	$ 2,680,190.40	$ 2,680,190.40
2	8 inches diameter PVC pipe	LF	5,400	$ 50.46	$ 272,494.80
3	36 inches diameter RCP pipe	LF	2,850	$ 173.69	$ 495,011.38
4	42 inches diameter RCP pipe	LF	1,880	$ 218.74	$ 411,234.58
5	48 inches diameter RCP pipe	LF	390	$ 266.57	$ 103,962.69
6	54 inches diameter RCP pipe	LF	820	$ 325.81	$ 267,163.38
7	60 inches diameter RCP pipe	LF	1,410	$ 473.22	$ 667,239.28
8	Removal of Outfalls #2 through #10	EA	9	$ 7,554.67	$ 67,992.06
9	New ASR wells	EA	2	$ 844,690.00	$ 1,689,380.00
				SUBTOTAL	$ 6,654,668.57
	Miscellaneous (25%)				$ 1,663,667.14
	General Requirements (15%)				$ 998,200.29
	Contractor Overhead & Profit (20%)				$ 1,330,933.71
	Contingency (10%)				$ 665,466.86
				TOTAL	$ 11,312,936.57

Table 3-6: Conceptual Costs - Alternative 2B

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Pump station with 4 pumps at design capacity of 50 cfs each	EA	1	$ 2,746,132.37	$ 2,746,132.37
2	8 inches diameter RCP pipe	LF	5,300	$ 51.70	$ 274,028.76
3	36 inches diameter RCP pipe	LF	2,850	$ 177.96	$ 507,190.37
4	42 inches diameter RCP pipe	LF	1,880	$ 224.12	$ 421,352.38
5	48 inches diameter RCP pipe	LF	390	$ 273.13	$ 106,520.53
6	54 inches diameter RCP pipe	LF	820	$ 333.83	$ 273,736.52
7	60 inches diameter RCP pipe	LF	1,410	$ 484.86	$ 683,655.68
8	Removal of Outfalls #2 through #10	EA	8	$ 8,708.11	$ 69,664.90
9	New ASR wells (and required appurtenances)	EA	2	$ 865,472.30	$ 1,730,944.60
10	Water Treatment: Filtration and disinfection	EA	1	$ 483,315.70	$ 483,315.70
				SUBTOTAL	$ 7,296,541.82
	Miscellaneous (25%)				$ 1,824,135.45
	General Requirements (15%)				$ 1,094,481.27
	Contractor Overhead & Profit (20%)				$ 1,459,308.36
	Contingency (10%)				$ 729,654.18
				TOTAL	$ 12,404,121.09

Table 3-7: Conceptual Costs - Alternative 3A

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	24 inches diameter RCP pipe	LF	790	$ 92.41	$ 73,001.14
2	30 inches diameter RCP pipe	LF	860	$ 159.30	$ 137,001.10
3	36 inches diameter RCP pipe	LF	2,850	$ 206.07	$ 587,290.16
4	42 inches diameter RCP pipe	LF	820	$ 259.52	$ 212,805.66
5	54 inches diameter RCP pipe	LF	2,490	$ 502.38	$ 1,250,923.71
6	Removal of Outfalls #2 through #10	EA	9	$ 8,963.00	$ 80,666.97
				SUBTOTAL	$ 2,341,688.73
	Miscellaneous (25%)				$ 585,422.18
	General Requirements (15%)				$ 351,253.31
	Contractor Overhead & Profit (20%)				$ 468,337.75
	Contingency (10%)				$ 234,168.87
				TOTAL	$ 3,980,870.85

Table 3-8: Conceptual Costs - Alternative 3B

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	24 inches diameter RCP pipe	LF	790	$ 88.52	$ 69,927.40
2	30 inches diameter RCP pipe	LF	860	$ 152.60	$ 131,232.63
3	36 inches diameter RCP pipe	LF	2,850	$ 197.39	$ 562,562.15
4	42 inches diameter RCP pipe	LF	4,355	$ 438.65	$ 1,910,328.38
5	Removal of Outfalls #2 through #10	EA	9	$ 8,585.61	$ 77,270.47
				SUBTOTAL	$ 2,751,321.04
	Miscellaneous (25%)				$ 687,830.26
	General Requirements (15%)				$ 412,698.16
	Contractor Overhead & Profit (20%)				$ 550,264.21
	Contingency (10%)				$ 275,132.10
				TOTAL	$ 4,677,245.76

Table 3-9: Conceptual Costs - Alternative 4A

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Pump station with 4 pumps at design capacity of 50 cfs each	EA	1	$ 2,761,793.28	$ 2,761,793.28
2	36 inches diameter RCP pipe	LF	2,850	$ 178.98	$ 510,082.83
3	42 inches diameter RCP pipe	LF	1,880	$ 225.40	$ 423,755.31
4	48 inches diameter RCP pipe	LF	390	$ 274.69	$ 107,128.01
5	54 inches diameter RCP pipe	LF	820	$ 335.73	$ 275,297.62
6	60 inches diameter RCP pipe	LF	4,800	$ 427.29	$ 2,050,997.76
7	Removal of Outfalls #2 through #10	EA	9	$ 7,784.69	$ 70,062.19
				SUBTOTAL	$ 6,199,116.99
	Miscellaneous (25%)				$ 1,549,779.25
	General Requirements (15%)				$ 929,867.55
	Contractor Overhead & Profit (20%)				$ 1,239,823.40
	Contingency (10%)				$ 619,911.70
				TOTAL	$ 10,538,498.89

Table 3-10: Conceptual Costs - Alternative 4B

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Pump station with 4 pumps at design capacity of 50 cfs each	EA	1	$ 2,756,418.24	$ 2,756,418.24
2	36 inches diameter RCP pipe	LF	2,850	$ 178.63	$ 509,090.10
3	42 inches diameter RCP pipe	LF	11,080	$ 224.96	$ 2,492,590.93
4	48 inches diameter RCP pipe	LF	390	$ 274.15	$ 106,919.51
5	54 inches diameter RCP pipe	LF	820	$ 335.08	$ 274,761.83
6	60 inches diameter RCP pipe	LF	200	$ 400.51	$ 80,102.20
7	Removal of Outfalls #2 through #10	EA	9	$ 7,769.54	$ 69,925.84
				SUBTOTAL	$ 6,289,808.64
	Miscellaneous (25%)				$ 1,572,452.16
	General Requirements (15%)				$ 943,471.30
	Contractor Overhead & Profit (20%)				$ 1,257,961.73
	Contingency (10%)				$ 628,980.86
				TOTAL	$ 10,692,674.69

Table 3-11: Conceptual Costs - Alternative 5A

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Pump station with 4 pumps at design capacity of 50 cfs each	EA	1	$ 2,864,407.68	$ 2,864,407.68
2	36 inches diameter RCP pipe	LF	2,850	$ 185.63	$ 529,034.95
3	42 inches diameter RCP pipe	LF	1,880	$ 233.78	$ 439,499.93
4	48 inches diameter RCP pipe	LF	390	$ 284.89	$ 111,108.35
5	54 inches diameter RCP pipe	LF	820	$ 348.20	$ 285,526.30
6	60 inches diameter RCP pipe	LF	1,410	$ 510.78	$ 720,193.60
7	Removal of Outfalls #2 through #10	EA	9	$ 8,073.93	$ 72,665.35
				SUBTOTAL	$ 5,022,436.15
	Miscellaneous (25%)				$ 1,255,609.04
	General Requirements (15%)				$ 753,365.42
	Contractor Overhead & Profit (20%)				$ 1,004,487.23
	Contingency (10%)				$ 502,243.62
				TOTAL	$ 8,538,141.46

Table 3-12: Conceptual Costs - Alternative 5B

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Pump station with 4 pumps at design capacity of 50 cfs each	EA	1	$ 2,800,395.84	$ 2,800,395.84
2	36 inches diameter RCP pipe	LF	2,850	$ 181.48	$ 517,212.43
3	42 inches diameter RCP pipe	LF	1,880	$ 228.55	$ 429,678.29
4	48 inches diameter RCP pipe	LF	390	$ 278.53	$ 108,625.37
5	54 inches diameter RCP pipe	LF	820	$ 340.42	$ 279,145.55
6	60 inches diameter RCP pipe	LF	2,620	$ 533.95	$ 1,398,937.10
7	Removal of Outfalls #2 through #10	EA	9	$ 7,893.50	$ 71,041.48
				SUBTOTAL	$ 5,605,036.06
	Miscellaneous (25%)				$ 1,401,259.01
	General Requirements (15%)				$ 840,755.41
	Contractor Overhead & Profit (20%)				$ 1,121,007.21
	Contingency (10%)				$ 560,503.61
				TOTAL	$ 9,528,561.30

Table 3-13: Summary of Costs for Proposed Alternatives

Alternative #	Description	Total Estimated Cost
1A	Integration of beach outfalls with County's planned beach re-nourishment project	$575,204
1B	Integration of beach outfalls with County's planned beach re-nourishment project (Flows from Outfalls #9 and #10 re-directed to Basin III)	$1,306,125
2A	Integration of beach outfalls with ASR system at WWTP	$11,312,937
2B	Integration of beach outfalls with ASR system at Golf Course	$12,404,121
3A	Consolidation of beach outfalls into 2 outfalls with a single conduit with a diameter of 54 inches	$3,980,871
3B	Consolidation of beach outfalls into 2 outfalls with two (2) conduit each with a diameter of 42 inches	$4,677,246
4A	Redirection of beach outfall flows via pump station to Mooring's Bay through a single force main with a diameter of 60 inches	$10,538,499
4B	Redirection of beach outfall flows via pump station to Mooring's Bay through two (2) force mains each with a diameter of 42 inches	$10,692,675
5A	Consolidation and extension of beach outfalls deeper and further into Gulf of Mexico (Subaqueous Outfalls) with 60 inches force main discharge outfall.	$8,538,141
5B	Consolidation and extension of beach outfalls deeper and further into Gulf of Mexico (Subaqueous Outfalls) with two (2) 60 inches gravity discharge outfalls.	$9,528,561

3.3 Benefit and Burden Analysis

As indicated in Section 1 of this report, the stormwater beach outfall alternatives were developed to address the FDEP concerns and improve aesthetics. The goals and objectives for the development of alternatives include the following:

1 Reduce beach erosion

2 Reduce impacts to turtle nesting habitat

3 Provide lateral beach access

4 Reduce impacts to water quality

5 Improve aesthetics

The proposed five (5) alternatives were further analyzed to determine the extent to which the alternatives achieve identified goals and objectives. Table 3-14 presents such analysis of the proposed beach outfall alternatives. The table also lists potential benefits and burdens associated with each alternative.

Table 3-14*:* Evaluation of Proposed Alternatives

Alternatives	Goals & Objectives	Benefits	Burdens
Alternative 1: Integration of beach outfalls with County's planned beach re-nourishment project	☐ Reduce beach erosion ☐ Reduce impacts to turtle nesting habitat ☐ Provide lateral beach access ☐ Reduce impacts to water quality ☐ Improve aesthetics	• Implementation of this alternative is easy and requires less capital investments when compared to other alternatives. • The City will be in compliance with County's beach re-nourishment project. • Meets or improves existing level of service	• Only partially satisfies FDEP concerns. • Does not meet all the City's goals and objectives. • Bigger storm events (bigger than 5 year – 24 hour storm event) still could result in street flooding.
Alternative 2: Integration of beach outfalls with Aquifer Storage and Recovery (ASR) system	☒ Reduce beach erosion ☒ Reduce impacts to turtle nesting habitat ☒ Provide lateral beach access ☒ Reduce impacts to water quality ☒ Improve aesthetics	• Satisfies FDEP concerns and meets City's goals and objectives to some extent. • 2 mgd of permitted capacity is available with City's ASR system. • Improves level of service of the system.	• Uncertainties related to operational testing results. • Only 2 mgd of beach outfall flow (very low capacity compared to the 5-year, 24-hour storm peak flow) could be sent to ASR and the rest of the flow will be discharged to ocean. • Construction of force main and ASR wells includes significant capital costs. • Installation of force mains through public roads might pose a challenge. • Construction of a pump station in residential neighborhood and operation and maintenance of pump station is an added burden. • Operation and maintenance of pump station in private golf course is a burden.

Alternatives	Goals & Objectives	Benefits	Burdens
Alternative 3: Consolidation of beach outfall pipes	☒ Reduce beach erosion ☒ Reduce impacts to turtle nesting habitat ☒ Provide lateral beach access ☒ Reduce impacts to water quality ☒ Improve aesthetics	• Satisfies FDEP concerns and meets City's goals and objectives to reasonable extent. • Operation and maintenance of two outfalls is easy compared to nine beach outfalls.	• Compromises level of service to certain extent. • Installation of big diameter pipes might pose a challenge. • Bigger storm events (bigger than 5 year – 24 hour storm event) could result in street flooding. • Uncertainties related to operation and maintenance of deep ocean outfalls.
Alternative 4: Redirection of beach outfall flows via pump station to Mooring's Bay	☒ Reduce beach erosion ☒ Reduce impacts to turtle nesting habitat ☒ Provide lateral beach access ☒ Reduce impacts to water quality ☒ Improve aesthetics	• Satisfies FDEP concerns and meets City's goals and objectives to greater extent. • Stormwater discharges to ocean can be eliminated completely. • Flushing and oxygenation of Mooring's Bay. • Improves level of service of the system.	• Installation of force mains through public roads might pose a challenge. • Bigger storm events (bigger than 5 year – 24 hour storm event) could result in street flooding. • Construction of a pump station in residential neighborhood and operation and maintenance of pump station is an added burden. • Permitting challenges • Impacts Moorings bay pollutant loading.

Alternatives	Goals & Objectives	Benefits	Burdens
Alternative 5: Consolidation and extension of beach outfalls deeper and further into Gulf of Mexico (Subaqueous Outfalls)	☒ Reduce beach erosion ☒ Reduce impacts to turtle nesting habitat ☒ Provide lateral beach access ☒ Reduce impacts to water quality ☒ Improve aesthetics	• Satisfies FDEP concerns and meets City's goals and objectives to reasonable extent. • Operation and maintenance of one outfall is easy compared to nine beach outfalls. • Pump station option improves level of service of the system.	• Compromises level of service to certain extent with gravity main option. • Bigger storm events (bigger than 5 year – 24 hour storm event) could result in street flooding. • Construction of a pump station in residential neighborhood and operation and maintenance of pump station is an added burden. • Uncertainties related to operation and maintenance of deep ocean outfalls.

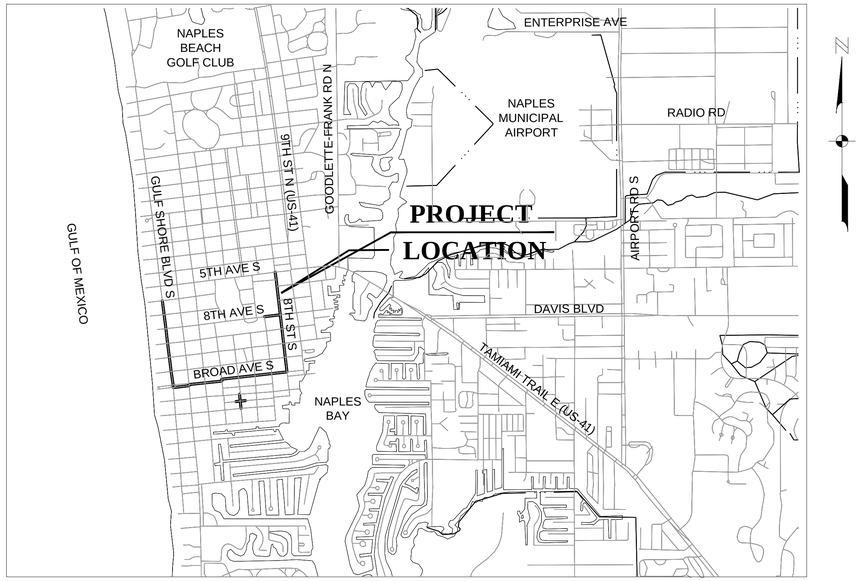
APPENDICES

Appendix A

Record Drawings – City's Stormwater Pipe Improvements in Basin III

AS-BUILT SURVEY
FOR
BASIN III PHASE 2
STORMWATER IMPROVEMENTS
SECTIONS 3, 4, 9 AND 10 TOWNSHIP 50 SOUTH, RANGE 25 EAST
CITY OF NAPLES, COLLIER COUNTY, FLORIDA

AS BUILT STRUCTURE COORDINATES			
FLORIDA ZONE EAST, NAD 83(90 ADJ), NGVD 29			
STRUCTURE	NORTHING	EASTING	ELEVATION
CS-1	655161.90	395248.76	2.41
S-1	655182.06	395246.48	3.28
S-2	654892.59	392565.69	7.38
S-3	654841.11	392146.20	6.43
S-4	654839.02	392122.59	6.48
S-5	655151.32	394414.18	4.24
S-6	655076.96	394446.23	1.96
S-7	655084.91	394843.39	4.27
S-8	655094.76	394899.42	2.94
S-9	655027.95	394358.46	2.81
S-10	655027.92	394379.79	3.98
S-11	655038.26	394445.79	3.21
S-14	654992.60	393895.80	6.38
S-15	654999.95	393969.49	5.37
S-16	655072.98	394807.18	2.96
S-17	654981.11	393466.51	7.62
S-21	654975.05	393611.54	7.05
S-22	654940.93	393635.78	7.22
S-23	654956.80	393834.68	6.61
S-25	654950.43	393035.87	6.49
S-26	655003.50	393994.88	3.12
S-27	655021.94	392102.99	5.78
S-28	655415.64	392054.34	5.33
S-29	655210.98	392077.59	5.29
S-30	655591.23	392030.52	5.31
S-31	655998.25	391978.05	5.24
S-32	656440.34	391927.45	4.61
S-33	656857.76	391875.36	5.36
S-34	657181.28	391836.81	5.14
S-36	655823.03	392002.52	5.40
S-45	654898.50	393048.96	6.44
S-46	654930.18	393051.95	6.29
S-48	657208.55	391832.39	5.14
S-51	656217.92	391955.35	4.73
S-52	656612.84	391905.35	4.88
S-53	657210.89	391847.27	4.88
S-58	657015.18	391857.11	5.52
S-71	654956.94	393249.70	6.88



VICINITY MAP

NOTES:

1. FIELD WORK INFORMATION WAS PROVIDED ON MARCH 1, 2012 BY QUALITY ENTERPRISES USA, INC.
2. THERE ARE NO APPARENT PHYSICAL USES OTHER THAN THOSE SHOWN.
3. SUBSTANTIAL VISIBLE IMPROVEMENTS OTHER THAN THOSE SHOWN, NOT LOCATED.
4. THIS SURVEY IS SUBJECT TO ANY FACTS THAT MAY BE DISCLOSED BY A FULL AND ACCURATE TITLE SEARCH.
5. THIS SURVEY DOES NOT MAKE ANY REPRESENTATION AS TO ZONING OR DEVELOPMENT RESTRICTIONS ON THE SUBJECT PARCEL.
6. ELEVATIONS SHOWN HEREON ARE IN FEET AND IN THE NATIONAL GEODETIC VERTICAL DATUM OF 1929.
7. NO ENVIRONMENTAL ASSESSMENT OR AUDIT WAS PERFORMED ON THE SURVEYED PARCEL BY THIS FIRM.
8. ADDITIONS OR DELETIONS TO THIS SURVEY MAP OR REPORT BY OTHER THAN THE SIGNING PARTY IS PROHIBITED WITHOUT THE WRITTEN CONSENT OF THE SIGNING PARTY.
9. THE FOUNDATIONS BENEATH THE SURFACE WERE NOT LOCATED UNLESS OTHERWISE NOTED.
10. THE PURPOSE OF THIS SURVEY IS TO SHOW THE AS-BUILT ELEVATIONS AND LOCATIONS, AS SHOWN IN RED, AS PROVIDED BY QUALITY ENTERPRISES USA, INC. OF DRAINAGE PIPES AND STRUCTURES.
11. AS-BUILT ELEVATIONS AND LOCATIONS AS AS PROVIDED BY QUALITY ENTERPRISES USA WERE NOT FIELD LOCATED BY THIS FIRM AND HAVE NOT BEEN VERIFIED.
12. DRAINAGE STRUCTURES AND IMPROVEMENTS, AS SHOWN IN BLACK, ARE PROPOSED FROM THE CONSTRUCTION PLANS BY THIS FIRM, PROJECT NUMBER 20098079, DATED JANUARY 2011.

SHEET INDEX

THIS SURVEY IS ONLY FOR THE BENEFIT OF:

CITY OF NAPLES

NO OTHER PERSON OR ENTITY MAY RELY ON THIS SURVEY.

IN MY PROFESSIONAL OPINION, AS A LICENSED FLORIDA PROFESSIONAL SURVEYOR AND MAPPER, THIS PLAT IS A TRUE AND CORRECT REPRESENTATION OF A SURVEY MADE AND PLATTED UNDER MY DIRECTION, DATED AS SHOWN IN NOTE 1 ABOVE AND MADE IN ACCORDANCE WITH CHAPTER 472.027, FLORIDA STATUTES.

_____
BARRY E. SYREN (FOR THE FIRM L.B. 642)
PROFESSIONAL SURVEYOR AND MAPPER
FLORIDA CERTIFICATE NO. 5365

DATE SIGNED: _____
NOT VALID WITHOUT THE SIGNATURE AND THE ORIGINAL RAISED SEAL OF A FLORIDA LICENSED SURVEYOR AND MAPPER. THIS CERTIFICATION IS TO THE DATE OF LAST FIELD WORK AS SHOWN AND NOT THE SIGNATURE DATE.

JOHNSON ENGINEERING
2350 STANFORD COURT
NAPLES, FLORIDA 34112
PHONE (239) 434-0333
FAX (239) 434-9320
E.B. #642

BASIN III PHASE 2
STORMWATER IMPROVEMENTS
SECTIONS 3, 4, 9 AND 10 TOWNSHIP 50 SOUTH, RANGE 25 EAST
CITY OF NAPLES, COLLIER COUNTY, FLORIDA

REVISIONS

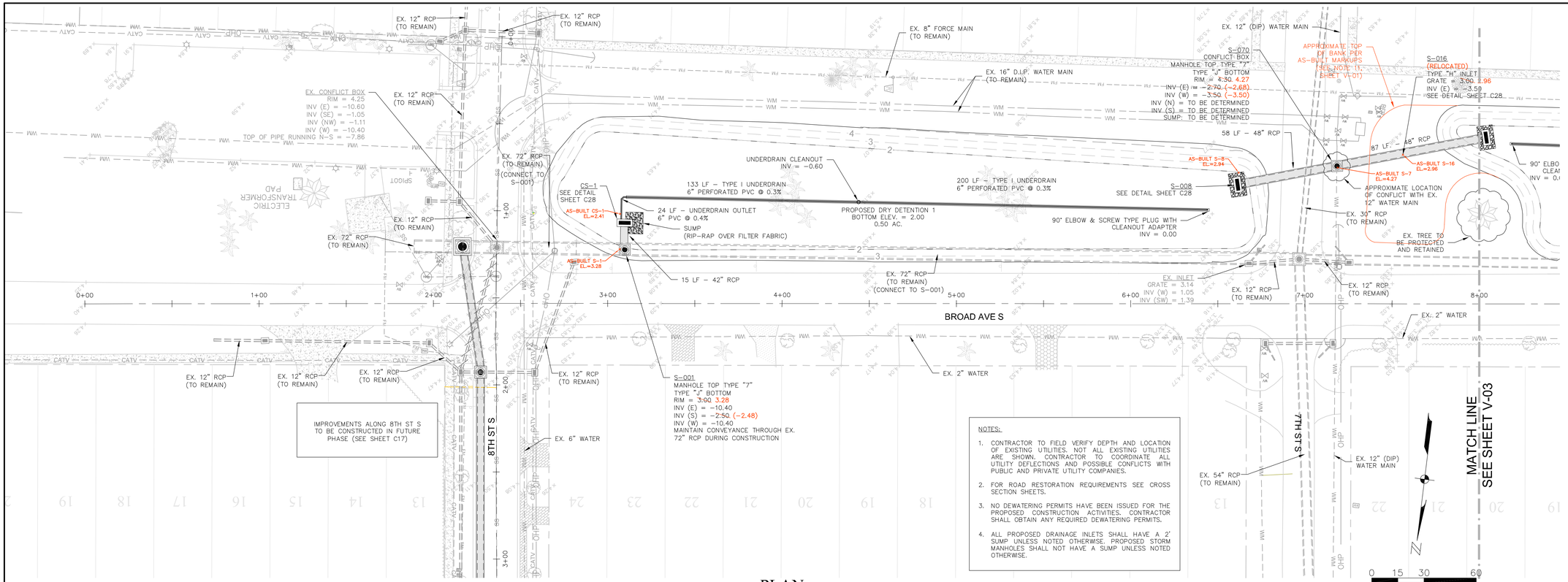
DESCRIPTION	DATE

DATE:	03/08/12
PROJECT NO.	20128983
FILE NO.	03-50-25
SCALE:	1"=30'

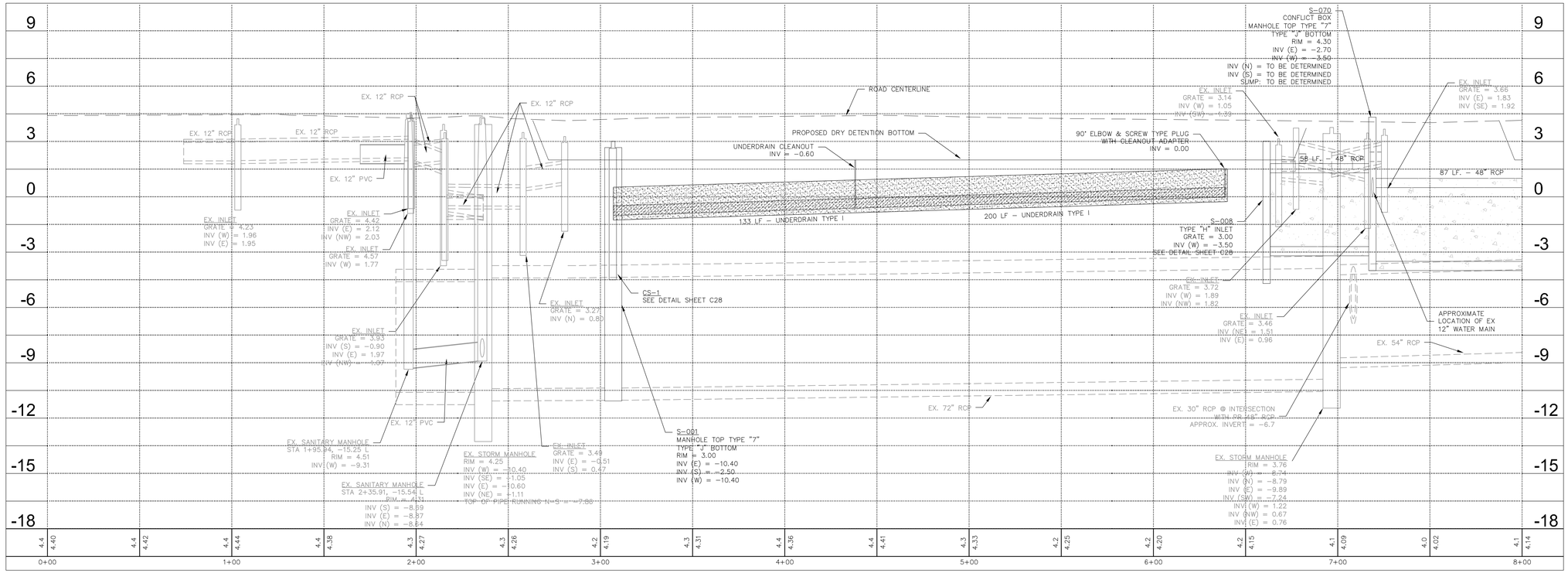
AS-BUILT SURVEY

SHEET NUMBER

V-01



PLAN
SCALE: HORIZ. 1" = 30'



PROFILE
SCALE: HORIZ. 1" = 30'
VERT. 1" = 3'

NOTE:
ALL ELEVATIONS SHOWN ARE N.G.V.D. 1929

W:\20128983\Surveying\20128983 - As Built Survey Broad Ave.dwg (Sheet 2) tjd Mar 09, 2012 - 2:12pm

JOHNSON ENGINEERING
2350 STANFORD COURT
NAPLES, FLORIDA 34112
PHONE (239) 434-0333
FAX (239) 434-9320
E.B. #642

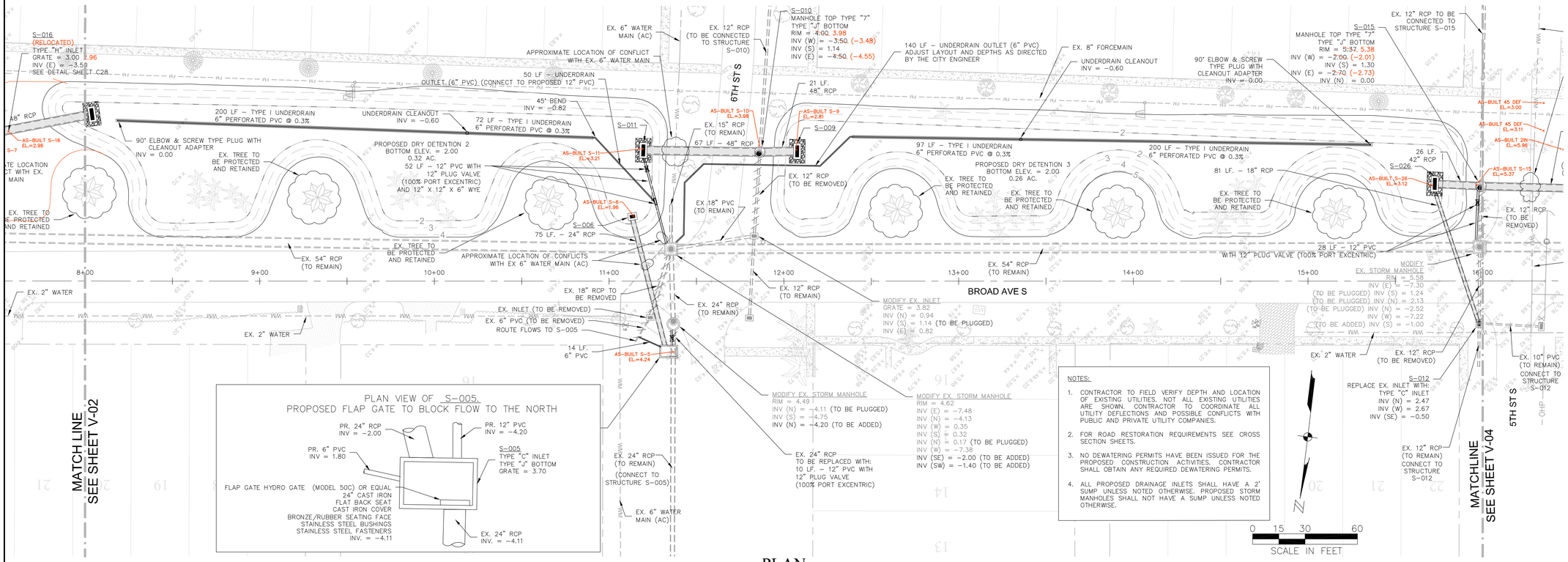
BASIN III PHASE 2
STORMWATER IMPROVEMENTS
SECTIONS 3, 4, 9 AND 10 TOWNSHIP 50 SOUTH, RANGE 25 EAST
CITY OF NAPLES, COLLIER COUNTY, FLORIDA

REVISIONS
DESCRIPTION
DATE

DATE:	03/08/12
PROJECT NO.	20128983
FILE NO.	03-50-25
SCALE:	1"=30'

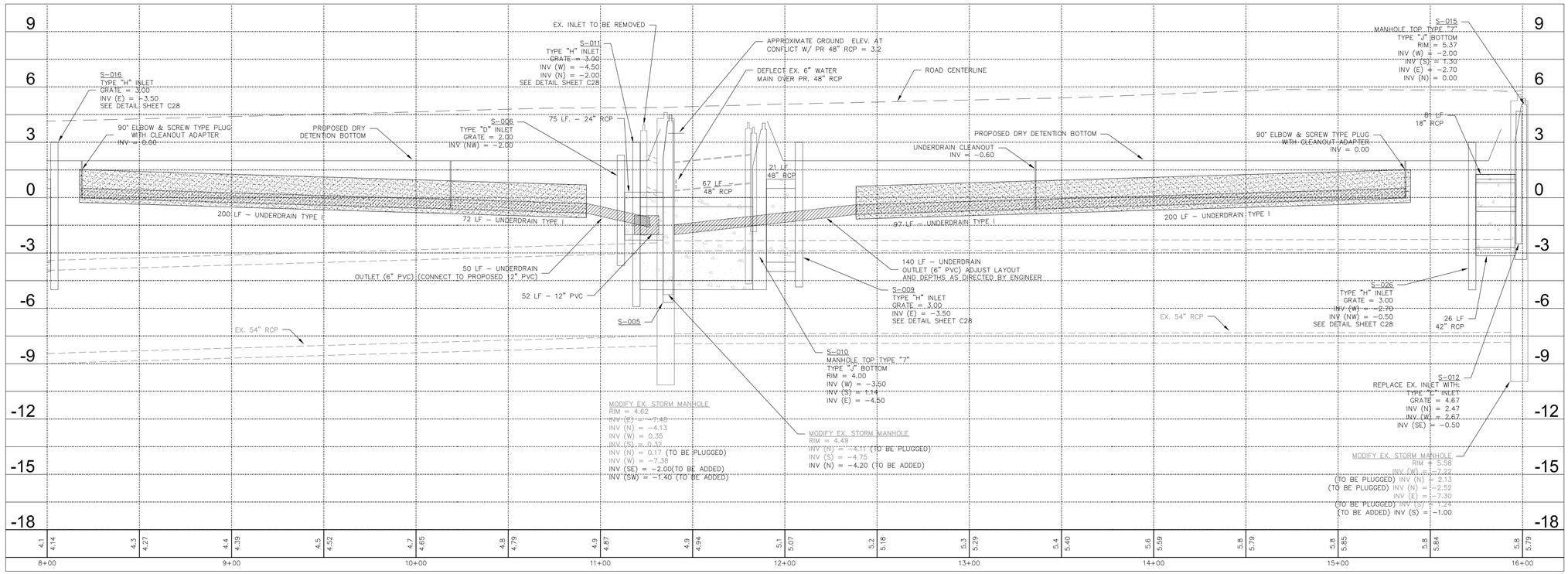
AS-BUILT SURVEY

SHEET NUMBER
V-02



PLAN

SCALE: HORIZ. 1" = 30'



PROFILE

SCALE: HORIZ. 1" = 30'
VERT. 1" = 3'

W:\20128983\Surveying\20128983 – As Built Survey Broad Ave.dwg (Sheet 3) tjd Mar 09, 2012 – 2:13pm

JOHNSON ENGINEERING
2350 STANFORD COURT
NAPLES, FLORIDA 34112
PHONE (239) 434-0333
FAX (239) 434-9320
E.B. #642

BASIN III PHASE 2
STORMWATER IMPROVEMENTS
SECTIONS 3, 4, 9 AND 10 TOWNSHIP 50 SOUTH, RANGE 25 EAST
CITY OF NAPLES, COLLIER COUNTY, FLORIDA

REVISIONS

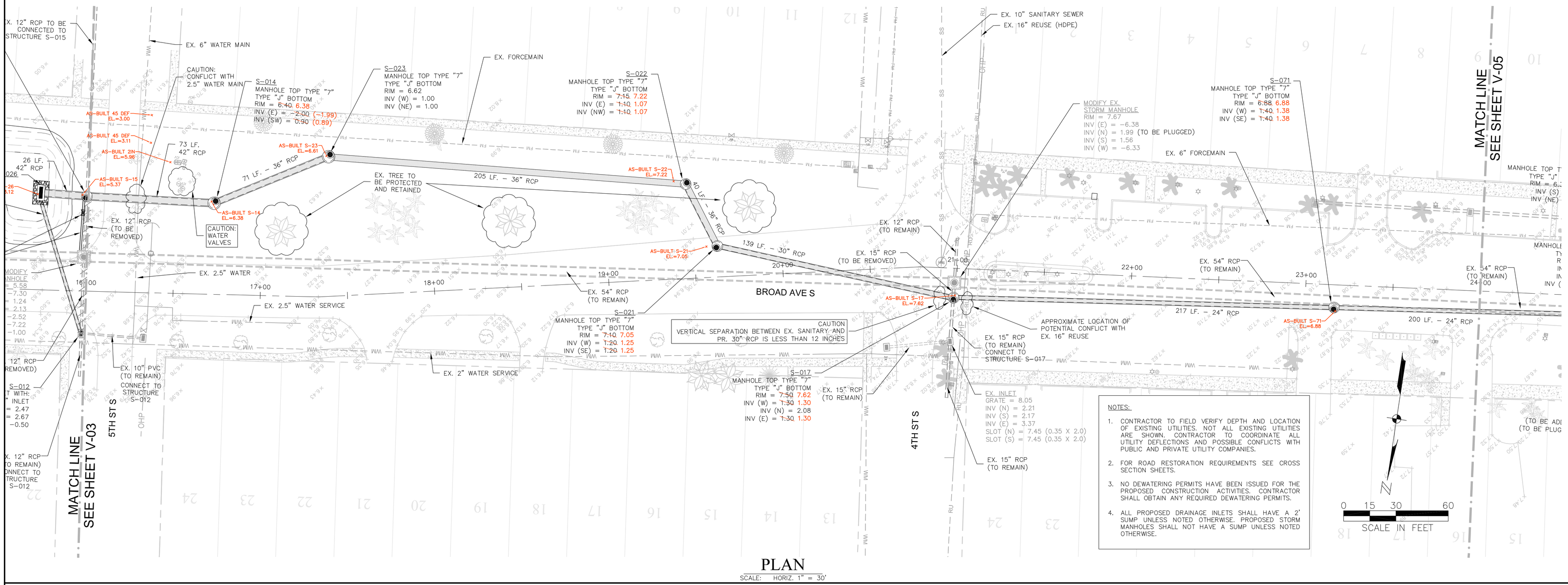
DESCRIPTION	DATE

DATE:	03/08/12
PROJECT NO.	20128983
FILE NO.	03-50-25
SCALE:	1"=30'

AS-BUILT SURVEY

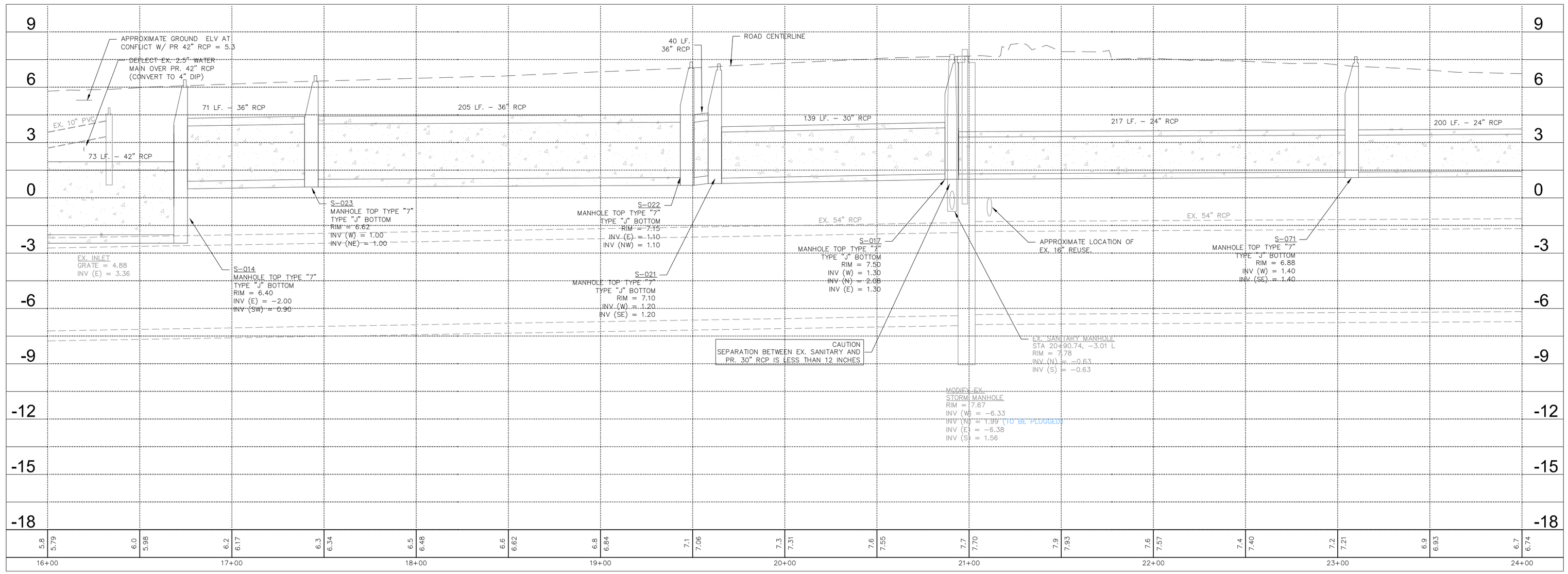
SHEET NUMBER

V-03



PLAN

SCALE: HORIZ. 1" = 30'



PROFILE

SCALE: HORIZ. 1" = 30'
VERT. 1" = 3'

W:\20128983\Surveying\20128983 – As Built Survey Broad Ave.dwg (Sheet 4) tjd Mar 09, 2012 – 2:15pm

JOHNSON ENGINEERING
2350 STANFORD COURT
NAPLES, FLORIDA 34112
PHONE (239) 434-0333
FAX (239) 434-9320
E.B. #642

BASIN III PHASE 2
STORMWATER IMPROVEMENTS
SECTIONS 3, 4, 9 AND 10 TOWNSHIP 50 SOUTH, RANGE 25 EAST
CITY OF NAPLES, COLLIER COUNTY, FLORIDA

REVISIONS

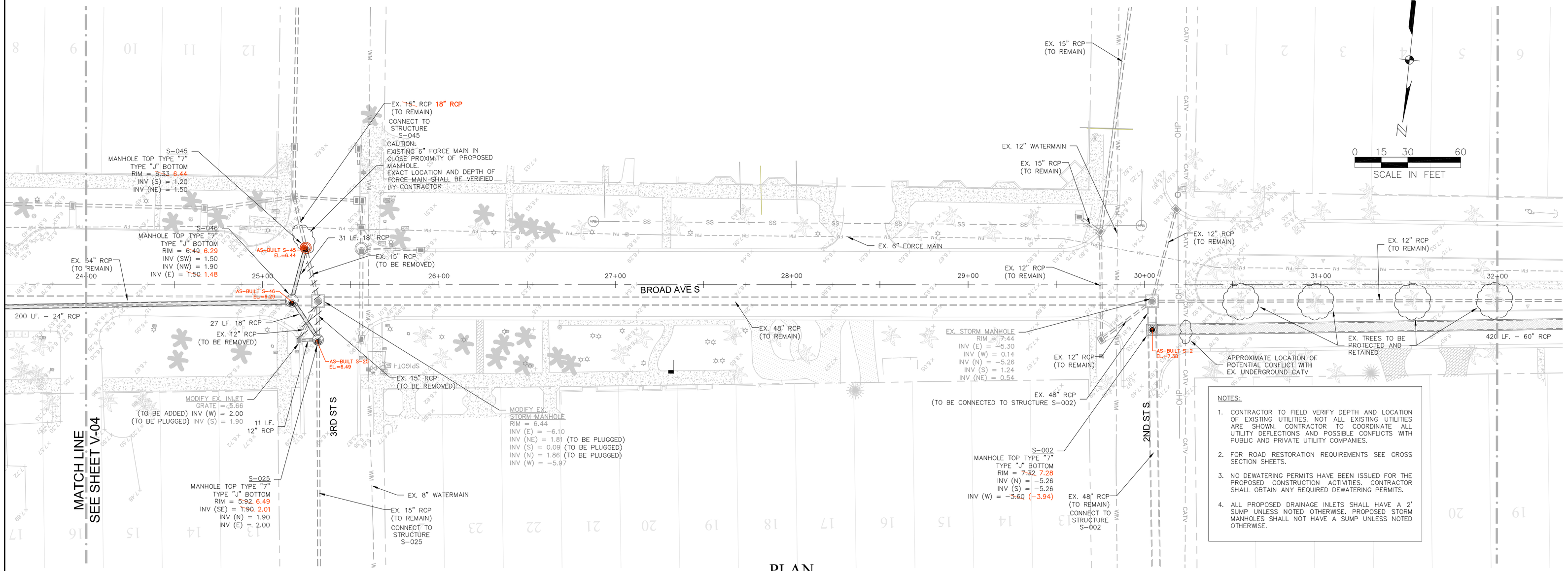
DESCRIPTION	DATE

DATE:	03/08/12
PROJECT NO.	20128983
FILE NO.	03-50-25
SCALE:	1"=30'

AS-BUILT SURVEY

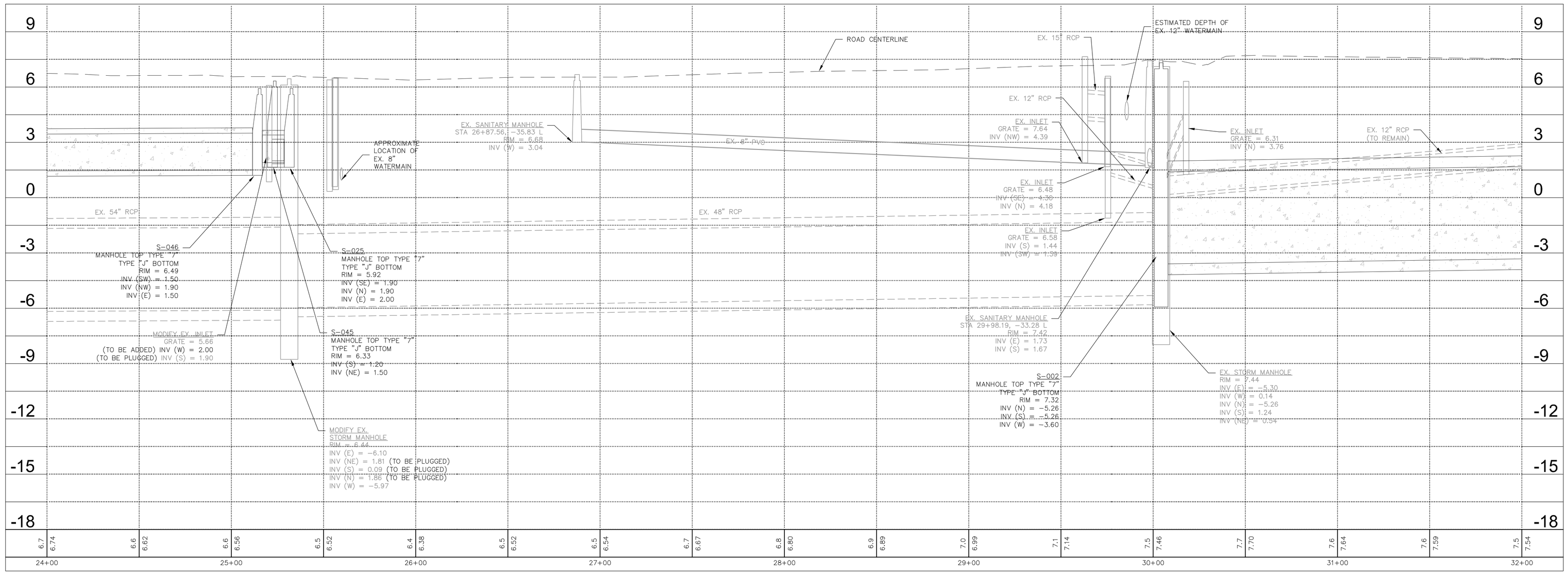
SHEET NUMBER

V-04



PLAN

SCALE: HORIZ. 1" = 30'



PROFILE

SCALE: HORIZ. 1" = 30'
VERT. 1" = 3'

W:\20128983\Surveying\20128983 - As Built Survey Broad Ave.dwg (Sheet 5) tjd Mar 09, 2012 - 2:16pm

JOHNSON ENGINEERING
2350 STANFORD COURT
NAPLES, FLORIDA 34112
PHONE (239) 434-0333
FAX (239) 434-9320
E.B. #642

BASIN III PHASE 2
STORMWATER IMPROVEMENTS
SECTIONS 3, 4, 9 AND 10 TOWNSHIP 50 SOUTH, RANGE 25 EAST
CITY OF NAPLES, COLLIER COUNTY, FLORIDA

NOTES:

1. CONTRACTOR TO FIELD VERIFY DEPTH AND LOCATION OF EXISTING UTILITIES. NOT ALL EXISTING UTILITIES ARE SHOWN. CONTRACTOR TO COORDINATE ALL UTILITY DEFLECTIONS AND POSSIBLE CONFLICTS WITH PUBLIC AND PRIVATE UTILITY COMPANIES.
2. FOR ROAD RESTORATION REQUIREMENTS SEE CROSS SECTION SHEETS.
3. NO DEWATERING PERMITS HAVE BEEN ISSUED FOR THE PROPOSED CONSTRUCTION ACTIVITIES. CONTRACTOR SHALL OBTAIN ANY REQUIRED DEWATERING PERMITS.
4. ALL PROPOSED DRAINAGE INLETS SHALL HAVE A 2' SUMP UNLESS NOTED OTHERWISE. PROPOSED STORM MANHOLES SHALL NOT HAVE A SUMP UNLESS NOTED OTHERWISE.

REVISIONS

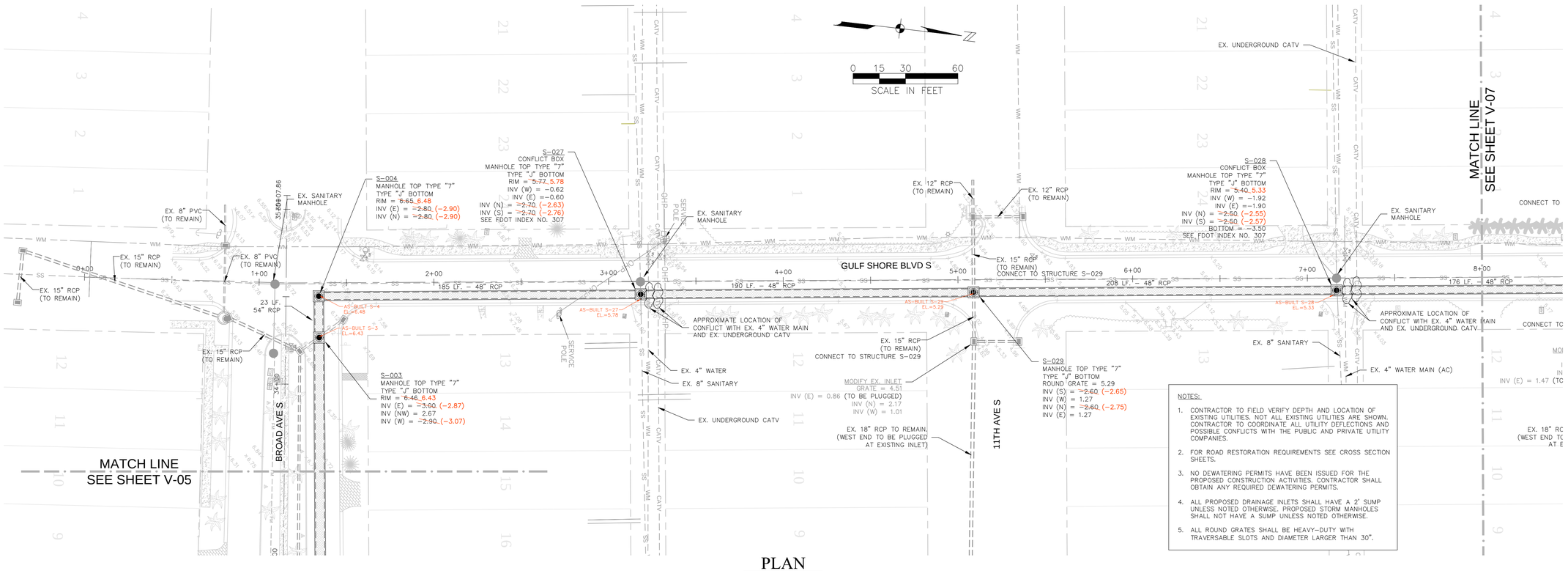
DESCRIPTION	DATE

DATE:	03/08/12
PROJECT NO.	20128983
FILE NO.	03-50-25
SCALE:	1"=30'

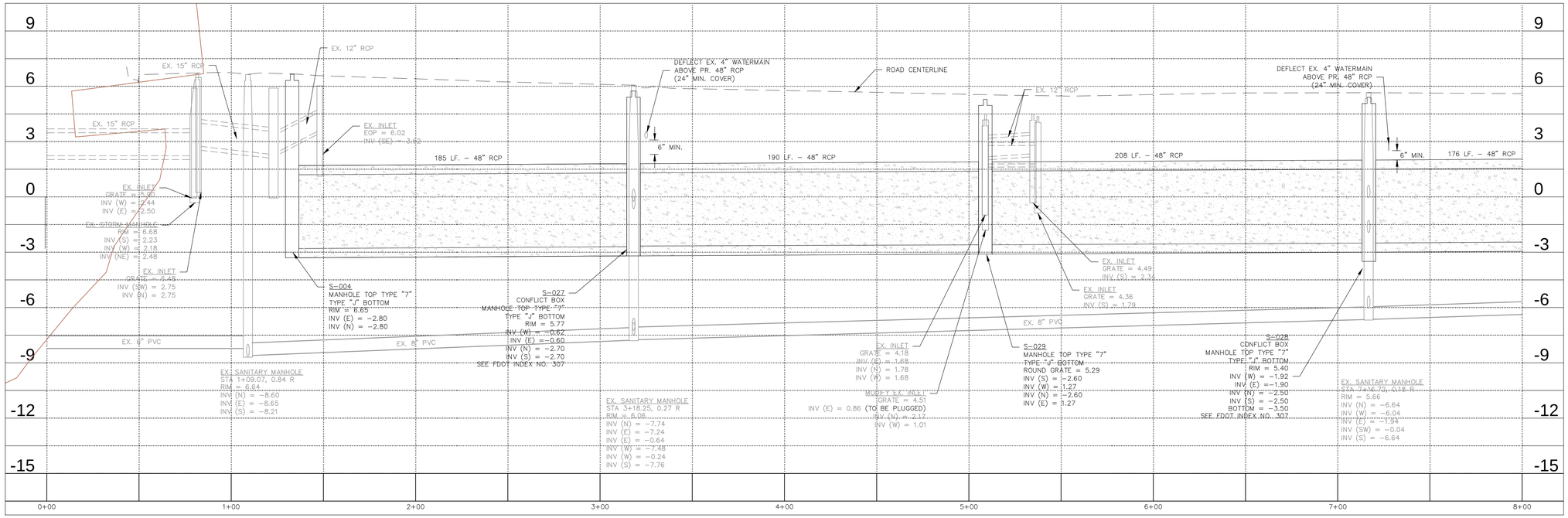
AS-BUILT SURVEY

SHEET NUMBER

V-05



PLAN
SCALE: HORIZ. 1" = 30'



PROFILE
SCALE: HORIZ. 1" = 30'
VERT. 1" = 3'

NOTE:
ALL ELEVATIONS SHOWN ARE N.G.V.D. 1929

W:\20128983\Surveying\20128983 - As Built Survey GulfShore Blvd.dwg (Sheet 6) tjd Mar 09, 2012 - 9:28am

JOHNSON ENGINEERING
2350 STANFORD COURT
NAPLES, FLORIDA 34112
PHONE (239) 434-0333
FAX (239) 434-9320
E.B. #642 & L.B. #642

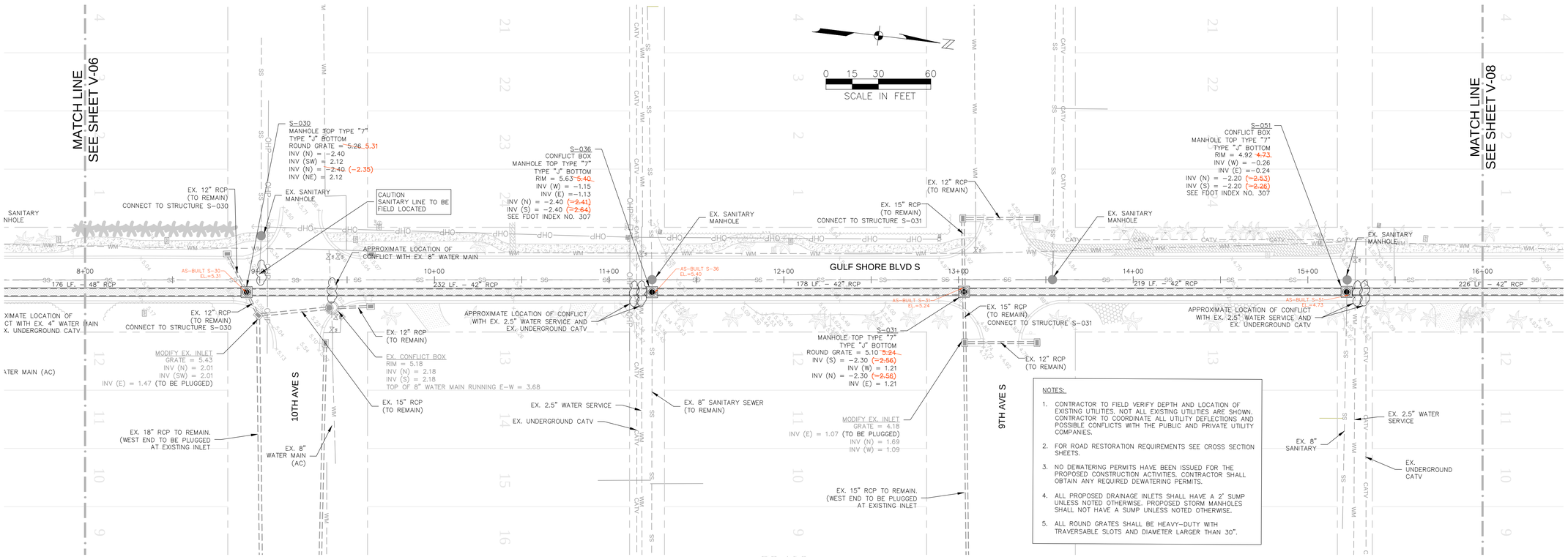
BASIN III PHASE 2
STORMWATER IMPROVEMENTS
SECTIONS 3, 4, 9 AND 10 TOWNSHIP 50 SOUTH, RANGE 25 EAST
CITY OF NAPLES, COLLIER COUNTY, FLORIDA

REVISIONS
DESCRIPTION
DATE

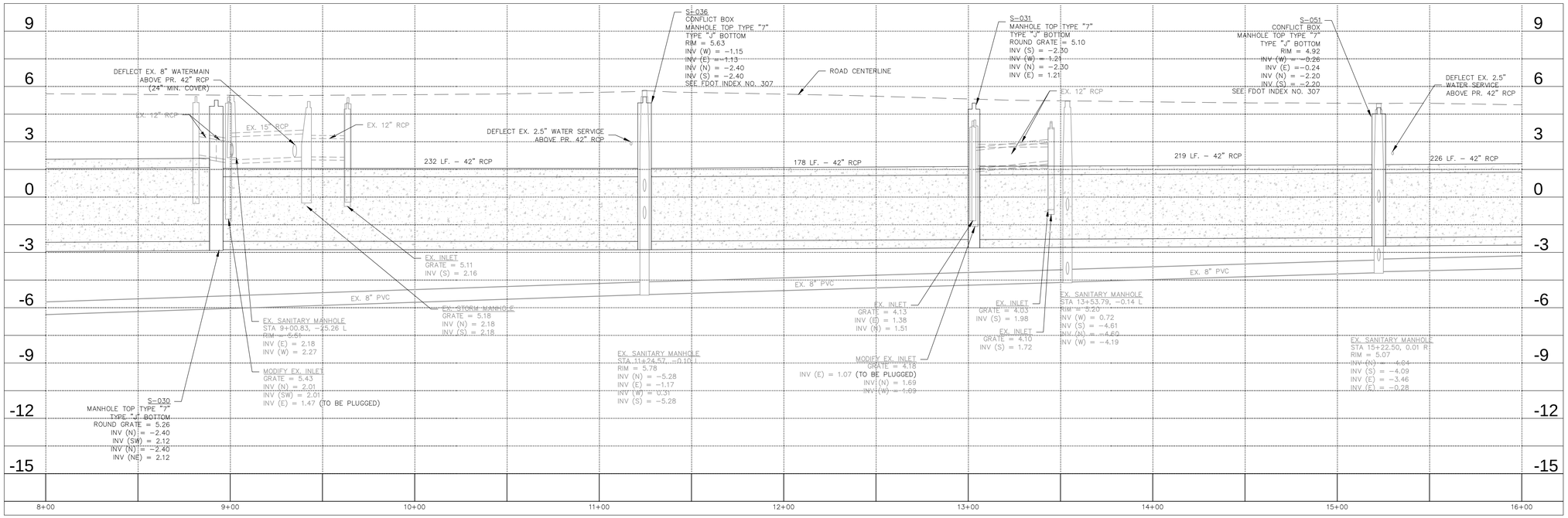
DATE:	03/08/12
PROJECT NO.	20128983
FILE NO.	03-50-25
SCALE:	1"=30'

AS-BUILT SURVEY

SHEET NUMBER
V-06



PLAN
SCALE: HORIZ. 1" = 30'



PROFILE
SCALE: HORIZ. 1" = 30'
VERT. 1" = 3'

NOTE:
ALL ELEVATIONS SHOWN ARE N.G.V.D. 1929

W:\20128983\Surveying\20128983 – As Built Survey GulfShore Blvd.dwg (Sheet 7) tjd Mar 09, 2012 – 9:50am

JOHNSON ENGINEERING
2350 STANFORD COURT
NAPLES, FLORIDA 34112
PHONE (239) 434-0333
FAX (239) 434-9320
E.B. #642 & L.B. #642

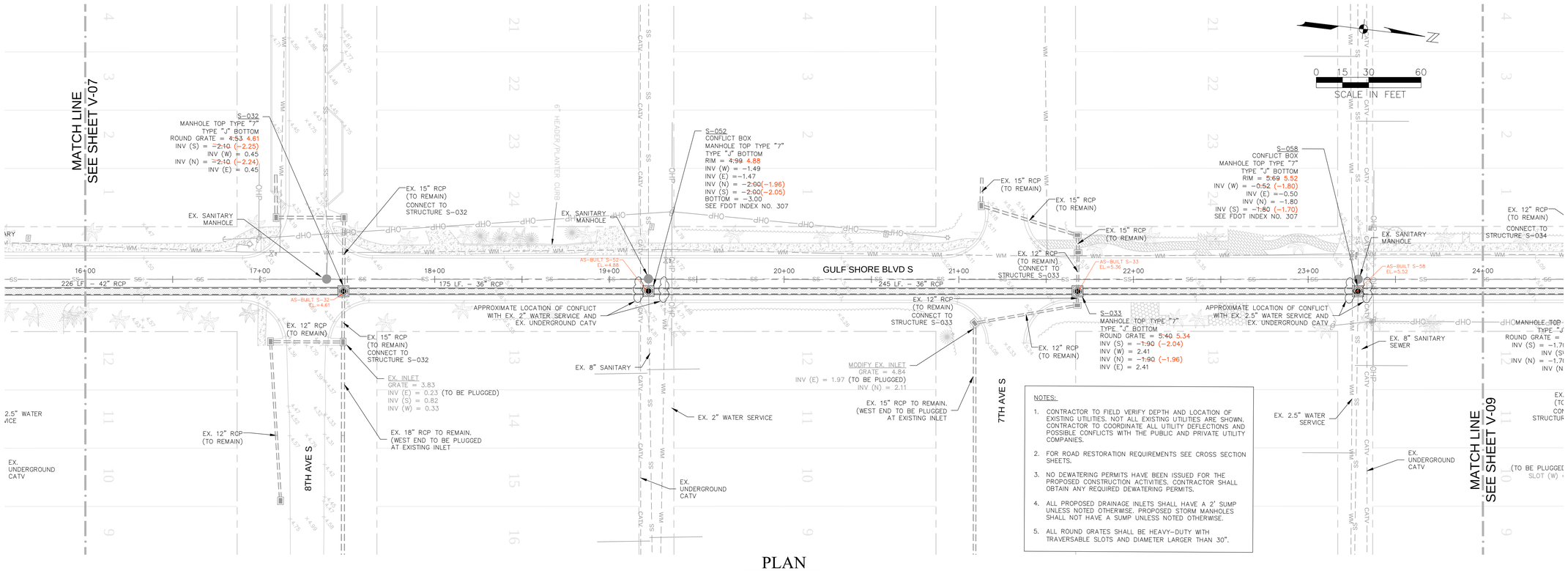
BASIN III PHASE 2
STORMWATER IMPROVEMENTS
SECTIONS 3, 4, 9 AND 10 TOWNSHIP 50 SOUTH, RANGE 25 EAST
CITY OF NAPLES, COLLIER COUNTY, FLORIDA

REVISIONS
DESCRIPTION
DATE

DATE:	03/08/12
PROJECT NO.	20128983
FILE NO.	03-50-25
SCALE:	1"=30'

AS-BUILT SURVEY

SHEET NUMBER
V-07

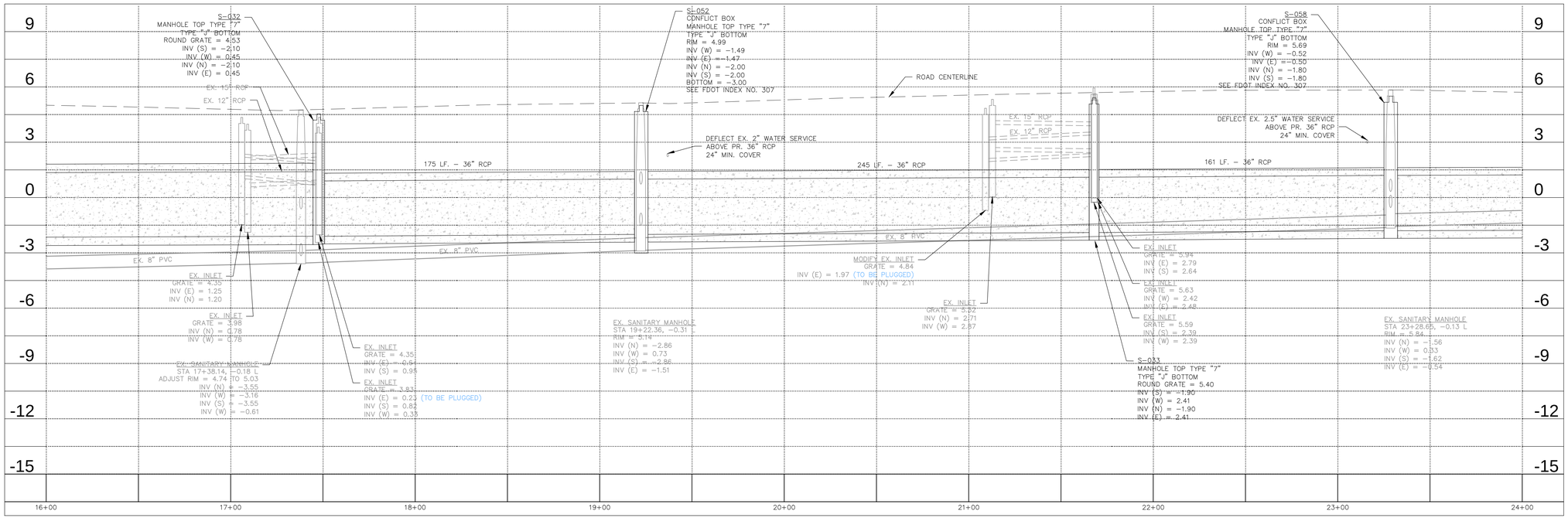


NOTES:

1. CONTRACTOR TO FIELD VERIFY DEPTH AND LOCATION OF EXISTING UTILITIES. NOT ALL EXISTING UTILITIES ARE SHOWN. CONTRACTOR TO COORDINATE ALL UTILITY DEFLECTIONS AND POSSIBLE CONFLICTS WITH THE PUBLIC AND PRIVATE UTILITY COMPANIES.
2. FOR ROAD RESTORATION REQUIREMENTS SEE CROSS SECTION SHEETS.
3. NO DEWATERING PERMITS HAVE BEEN ISSUED FOR THE PROPOSED CONSTRUCTION ACTIVITIES. CONTRACTOR SHALL OBTAIN ANY REQUIRED DEWATERING PERMITS.
4. ALL PROPOSED DRAINAGE INLETS SHALL HAVE A 2' SUMP UNLESS NOTED OTHERWISE. PROPOSED STORM MANHOLES SHALL NOT HAVE A SUMP UNLESS NOTED OTHERWISE.
5. ALL ROUND GRATES SHALL BE HEAVY-DUTY WITH TRAVERSABLE SLOTS AND DIAMETER LARGER THAN 30".

PLAN

SCALE: HORIZ. 1" = 30'



PROFILE

SCALE: HORIZ. 1" = 30'
VERT. 1" = 3'

NOTE:
ALL ELEVATIONS SHOWN ARE N.G.V.D. 1929

W:\20128983\Surveying\20128983 - As Built Survey GulfShore Blvd.dwg (Sheet 8) tjd Mar 09, 2012 - 9:55am

JOHNSON ENGINEERING
2350 STANFORD COURT
NAPLES, FLORIDA 34112
PHONE (239) 434-0333
FAX (239) 434-9320
E.B. #642 & L.B. #642

BASIN III PHASE 2 STORMWATER IMPROVEMENTS

SECTIONS 3, 4, 9 AND 10 TOWNSHIP 50 SOUTH, RANGE 25 EAST
CITY OF NAPLES, COLLIER COUNTY, FLORIDA

REVISIONS

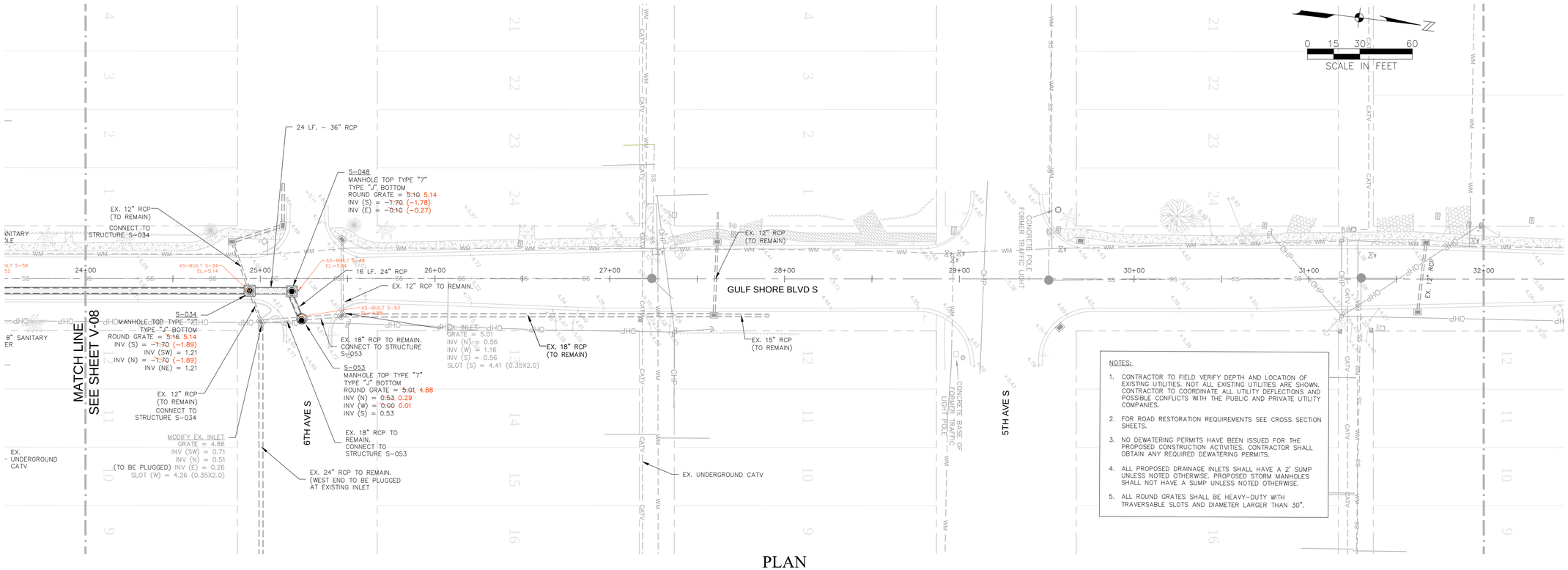
DESCRIPTION	DATE

DATE:	03/08/12
PROJECT NO.	20128983
FILE NO.	03-50-25
SCALE:	1"=30'

AS-BUILT SURVEY

SHEET NUMBER

V-08

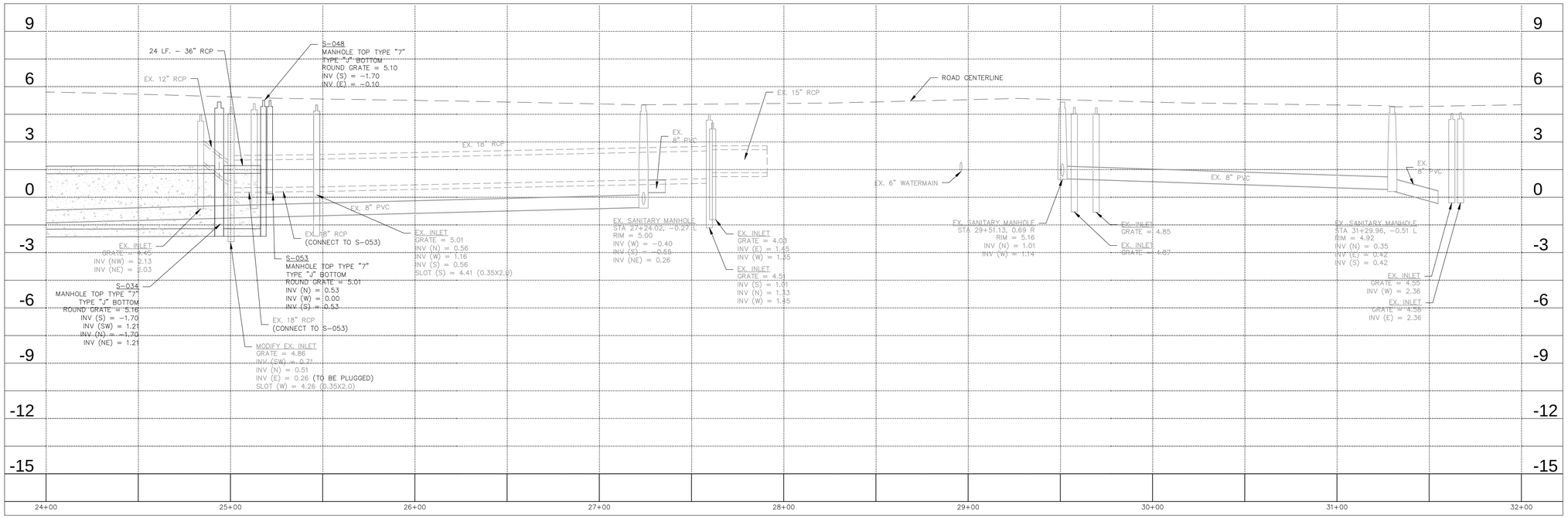


NOTES:

1. CONTRACTOR TO FIELD VERIFY DEPTH AND LOCATION OF EXISTING UTILITIES. NOT ALL EXISTING UTILITIES ARE SHOWN. CONTRACTOR TO COORDINATE ALL UTILITY DEFLECTIONS AND POSSIBLE CONFLICTS WITH THE PUBLIC AND PRIVATE UTILITY COMPANIES.
2. FOR ROAD RESTORATION REQUIREMENTS SEE CROSS SECTION SHEETS.
3. NO DEWATERING PERMITS HAVE BEEN ISSUED FOR THE PROPOSED CONSTRUCTION ACTIVITIES. CONTRACTOR SHALL OBTAIN ANY REQUIRED DEWATERING PERMITS.
4. ALL PROPOSED DRAINAGE INLETS SHALL HAVE A 2' SUMP UNLESS NOTED OTHERWISE. PROPOSED STORM MANHOLES SHALL NOT HAVE A SUMP UNLESS NOTED OTHERWISE.
5. ALL ROUND GRATES SHALL BE HEAVY-DUTY WITH TRAVERSABLE SLOTS AND DIAMETER LARGER THAN 30".

PLAN

SCALE: HORIZ. 1" = 30'



PROFILE

SCALE: HORIZ. 1" = 30'
VERT. 1" = 3'

NOTE:
ALL ELEVATIONS SHOWN ARE N.G.V.D. 1929

W:\20128983\Surveying\20128983 – As Built Survey GulfShore Blvd.dwg (Sheet 9) tjd Mar 09, 2012 – 10:02am

JOHNSON ENGINEERING
2350 STANFORD COURT
NAPLES, FLORIDA 34112
PHONE (239) 434-0333
FAX (239) 434-9320
E.B. #642 & L.B. #642

BASIN III PHASE 2 STORMWATER IMPROVEMENTS

SECTIONS 3, 4, 9 AND 10 TOWNSHIP 50 SOUTH, RANGE 25 EAST
CITY OF NAPLES, COLLIER COUNTY, FLORIDA

REVISIONS

DESCRIPTION	DATE

DATE:	03/08/12
PROJECT NO.	20128983
FILE NO.	03-50-25
SCALE:	1"=30'

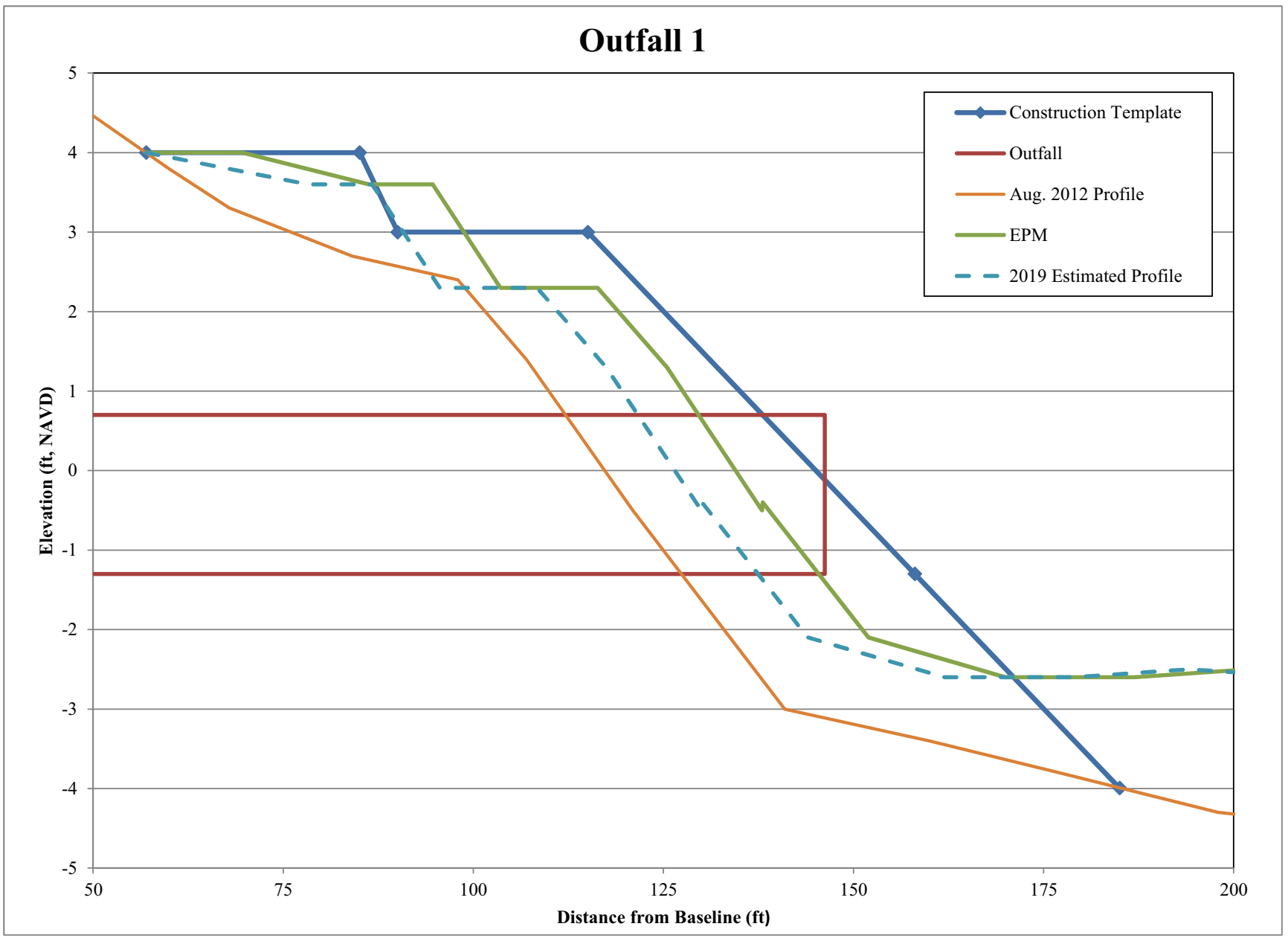
AS-BUILT SURVEY

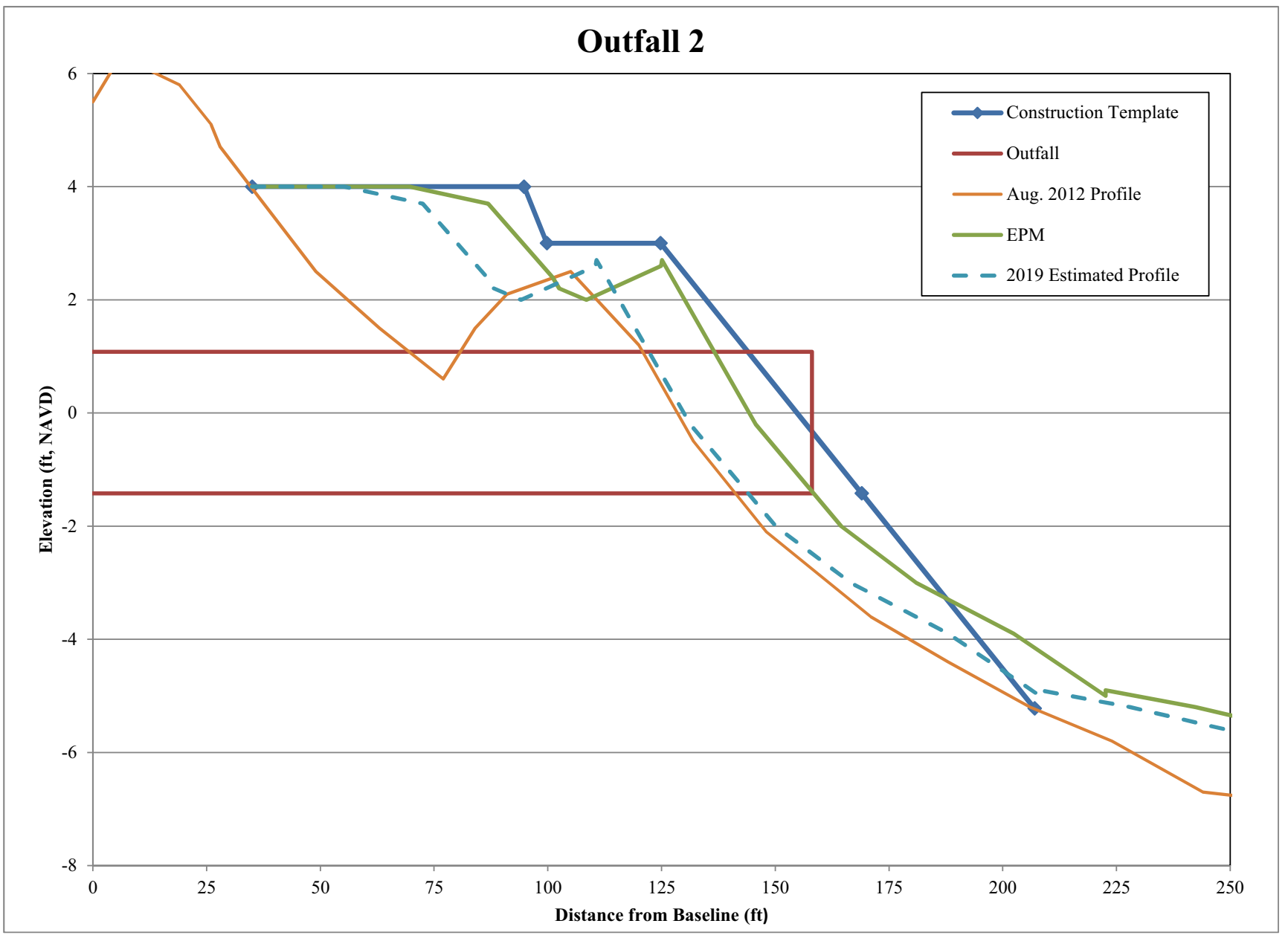
SHEET NUMBER

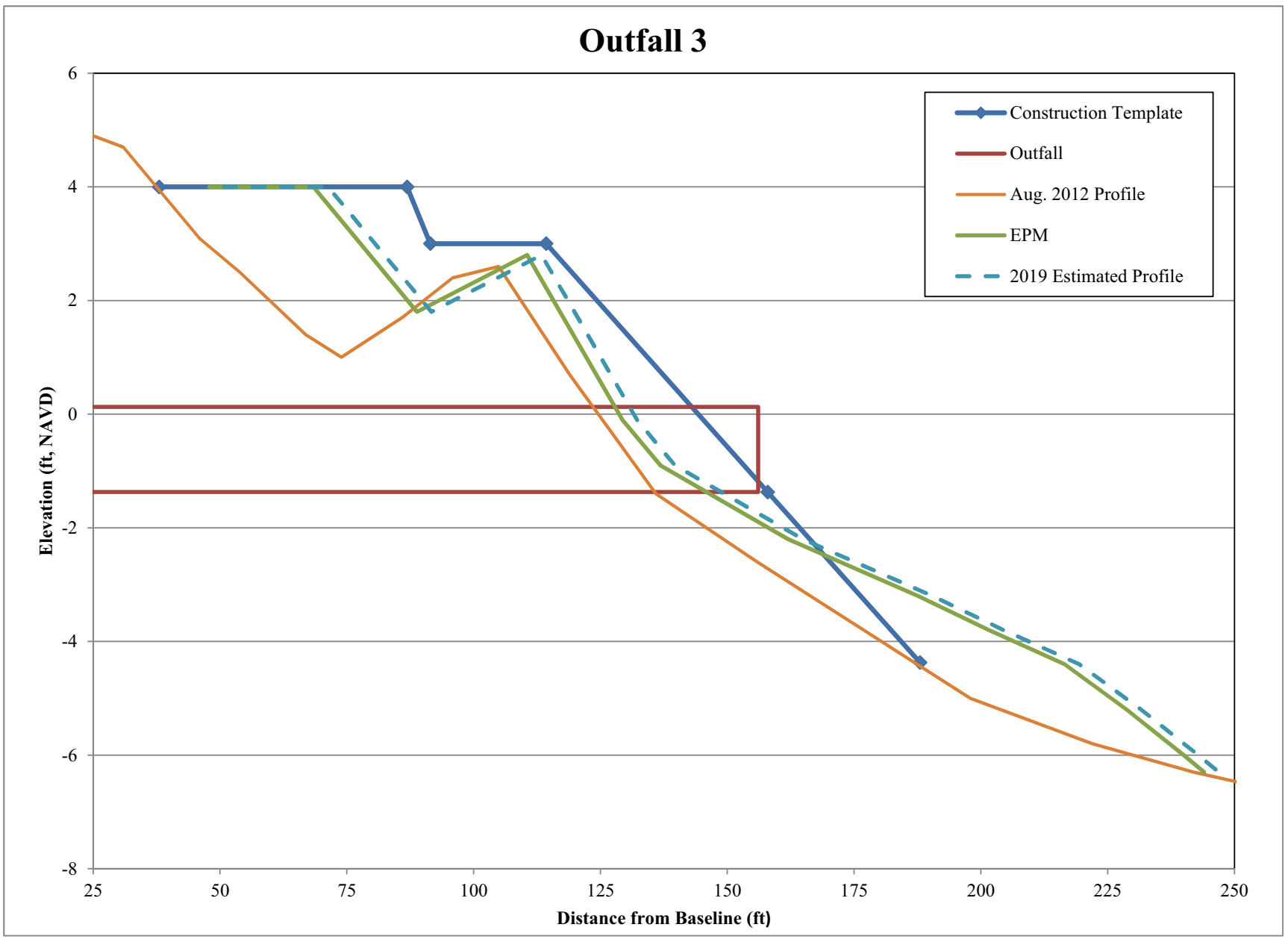
V-09

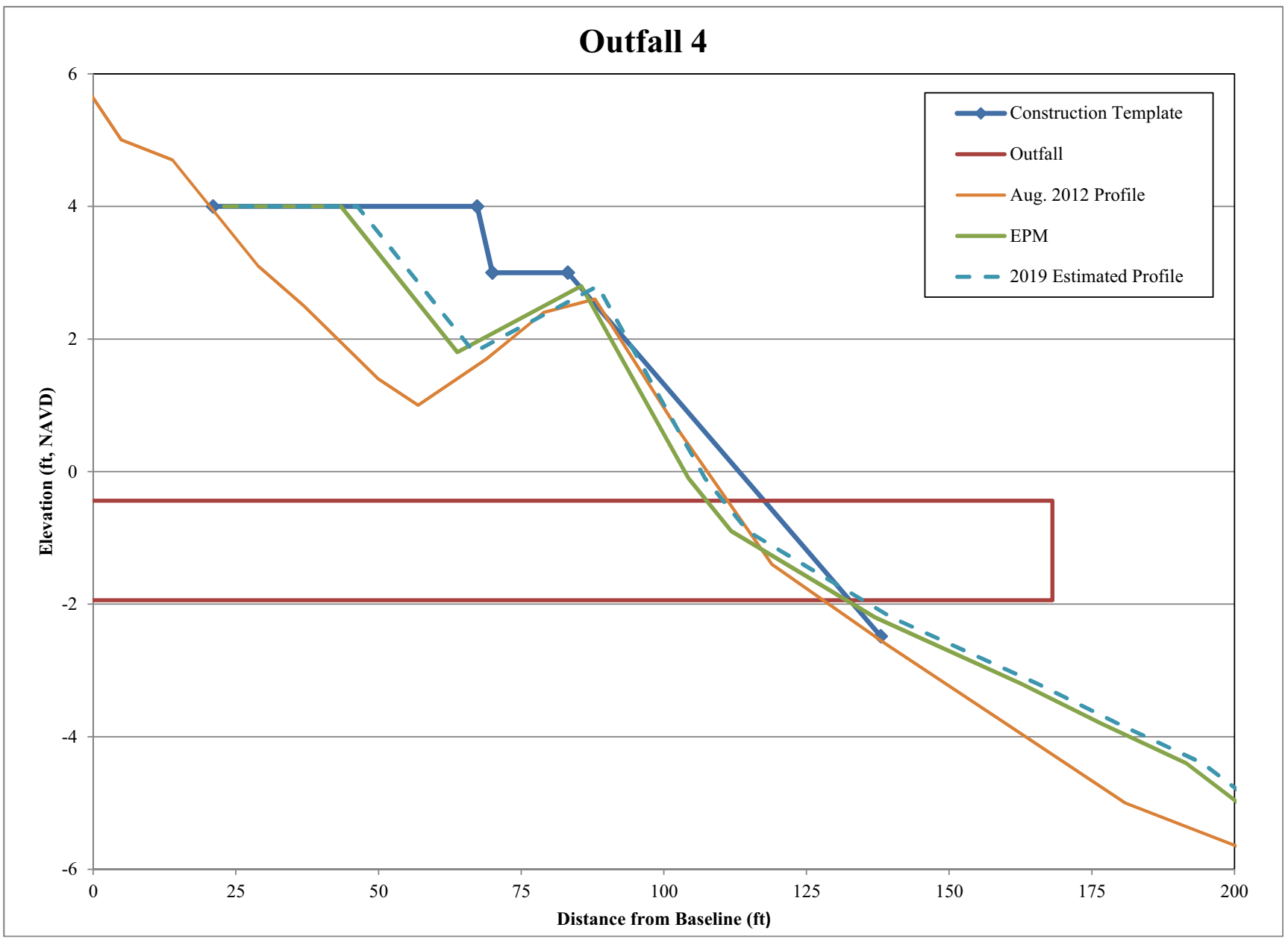
Appendix B

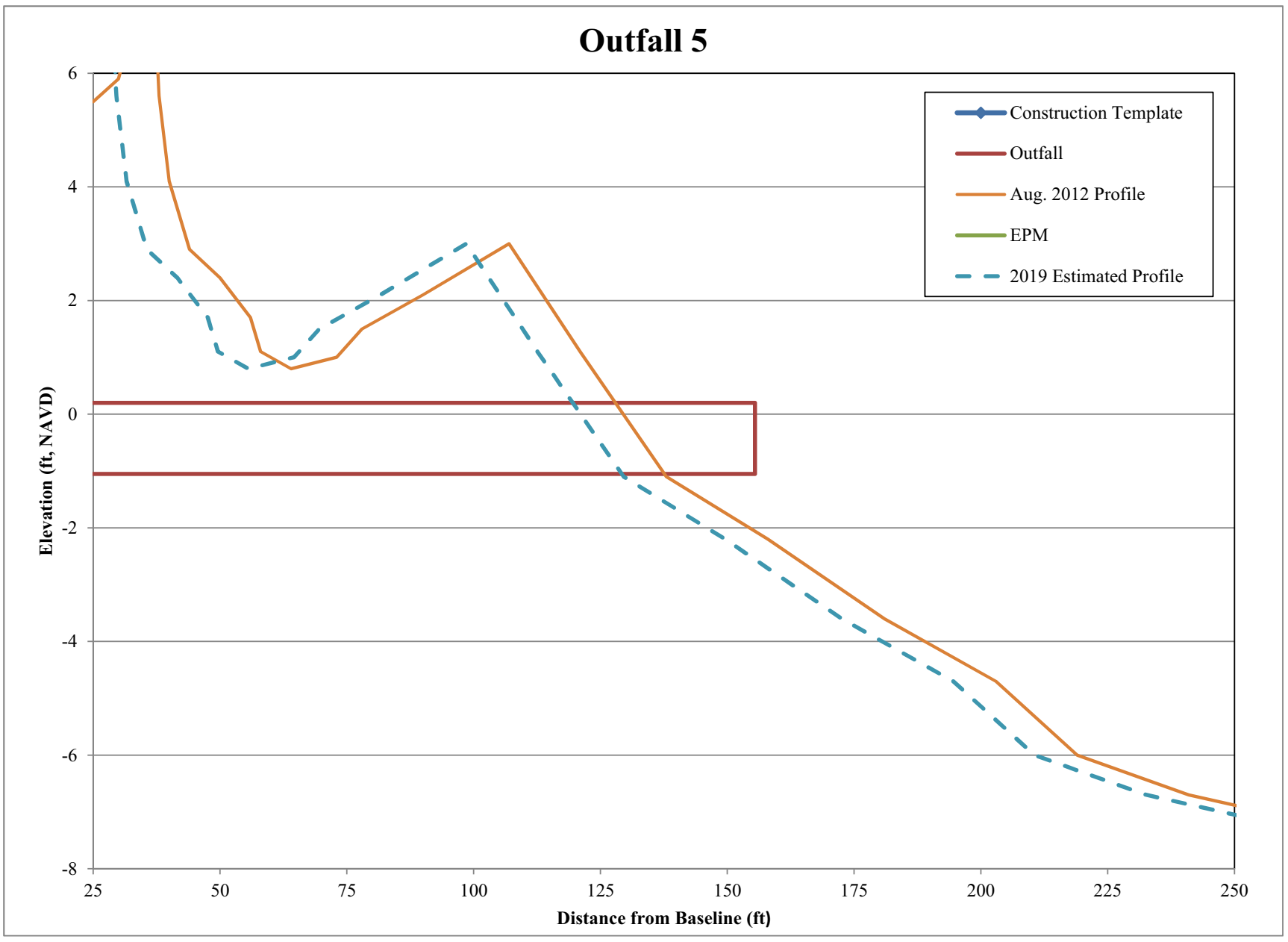
Proposed Beach Outfall Profiles in accordance with County's Beach Re-Nourishment Project

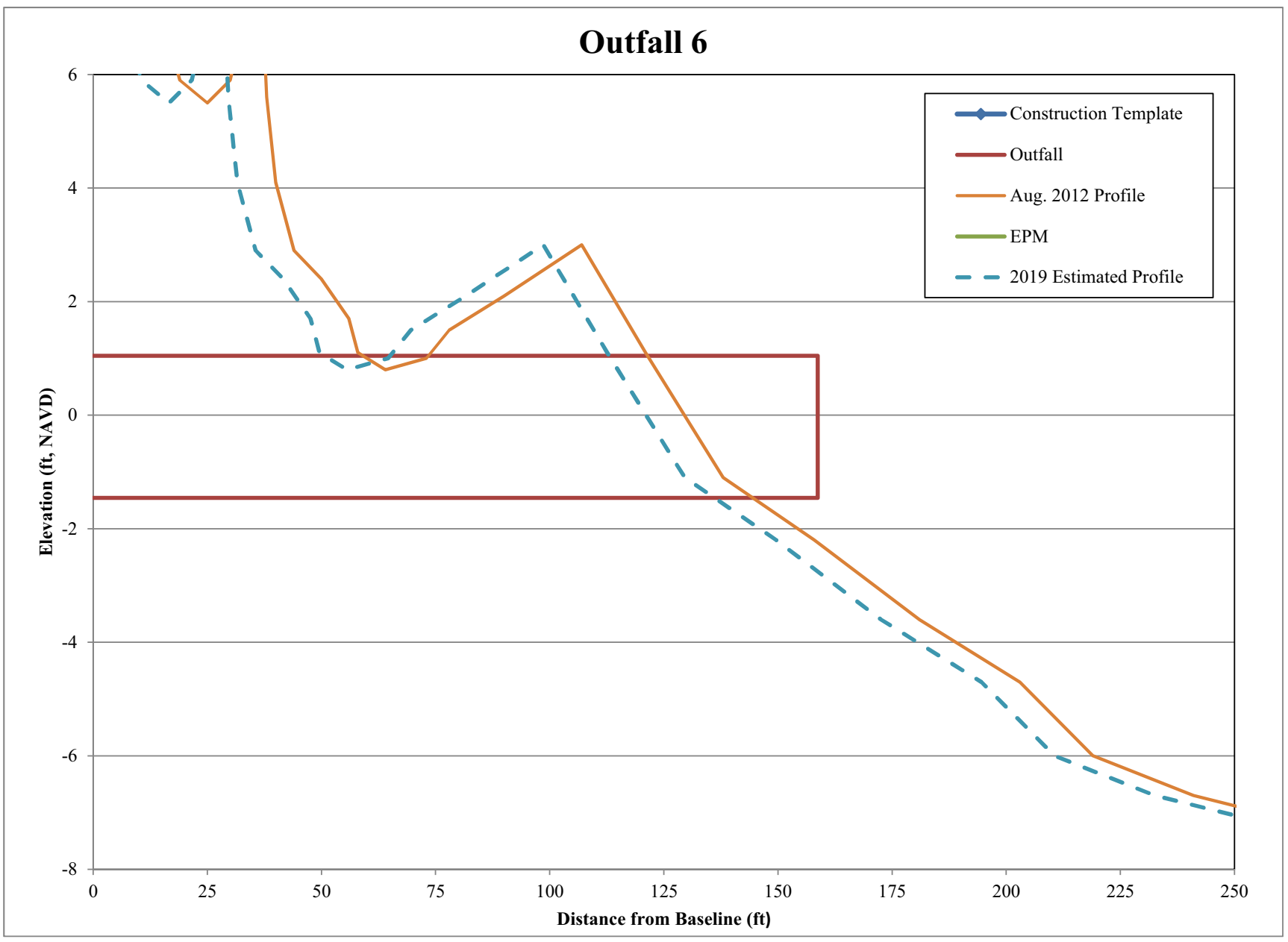

Outfall 1
Construction Template
Outfall
Aug. 2012 Profile
EPM
2019 Estimated Profile
Elevation (ft, NAVD)
5
4
3
2
1
0
-1
-2
-3
-4
-5
50
75
100
125
150
175
200
Distance from Baseline (ft)

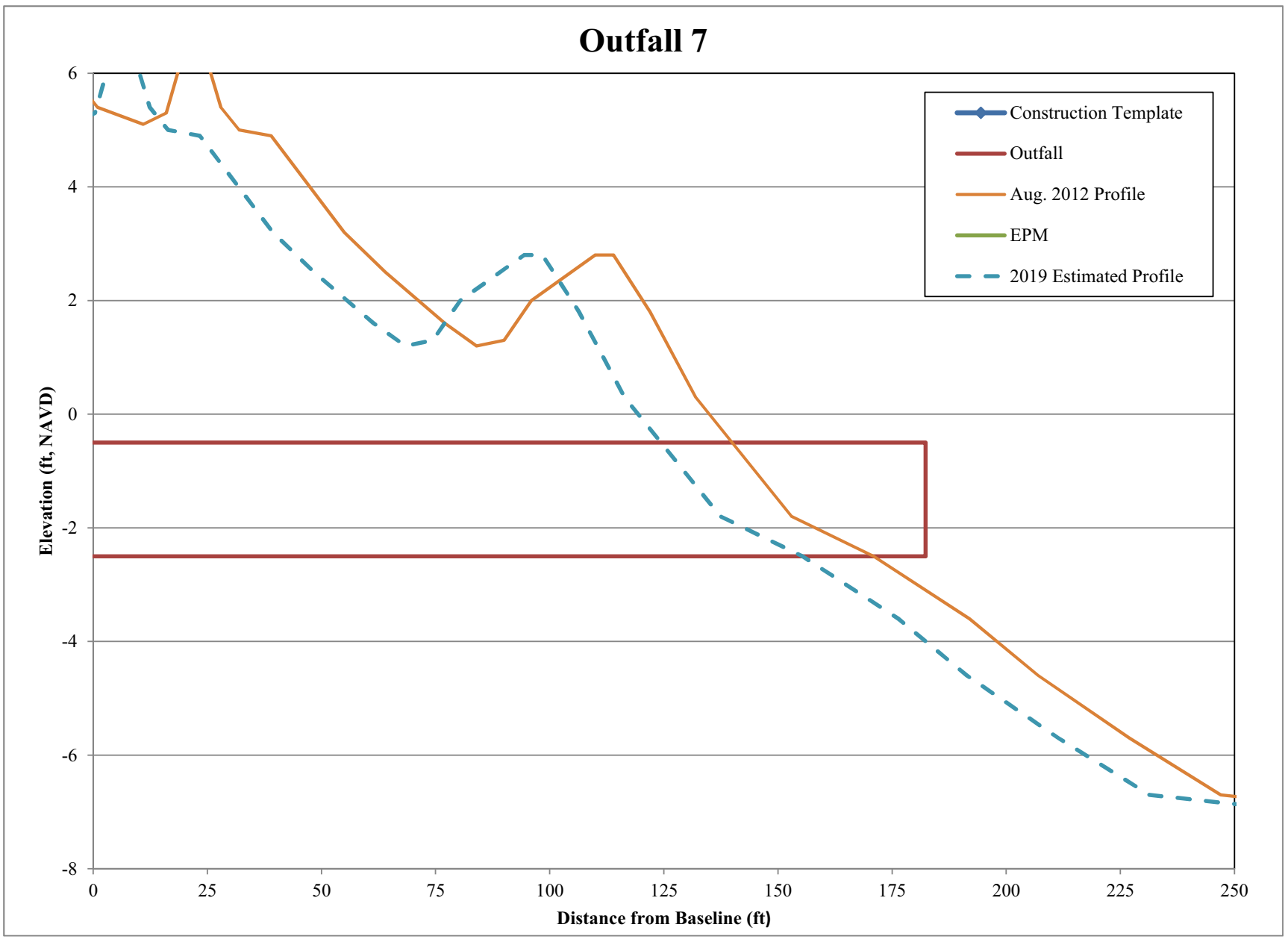

Outfall 2
Construction Template
Outfall
Aug. 2012 Profile
EPM
2019 Estimated Profile
Elevation (ft, NAVD)
6
4
2
0
-2
-4
-6
-8
0
25
50
75
100
125
150
175
200
225
250
Distance from Baseline (ft)

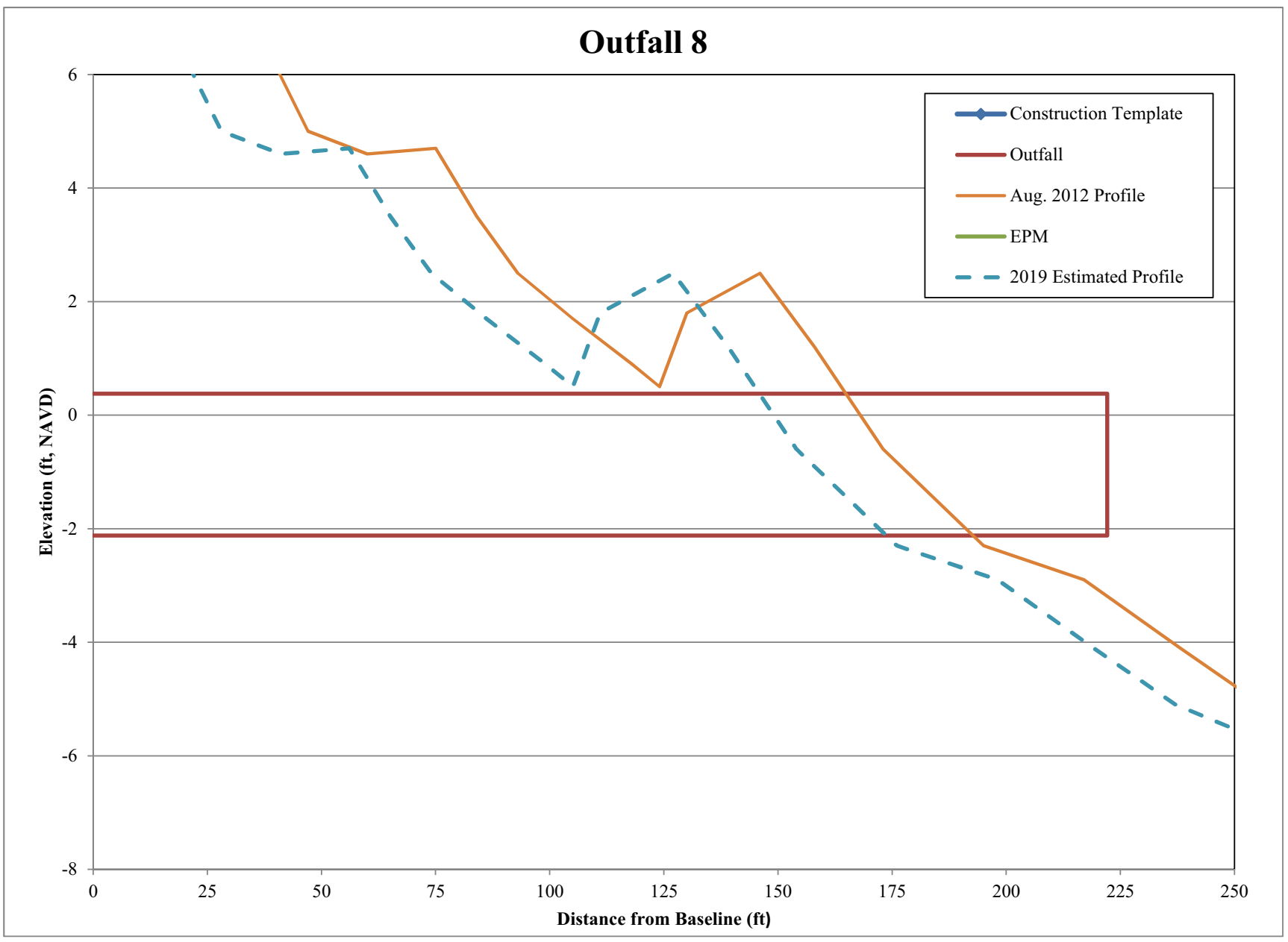

Outfall 3
Construction Template
Outfall
Aug. 2012 Profile
EPM
2019 Estimated Profile
Elevation (ft, NAVD)
6
4
2
0
-2
-4
-6
-8
25
50
75
100
125
150
175
200
225
250
Distance from Baseline (ft)

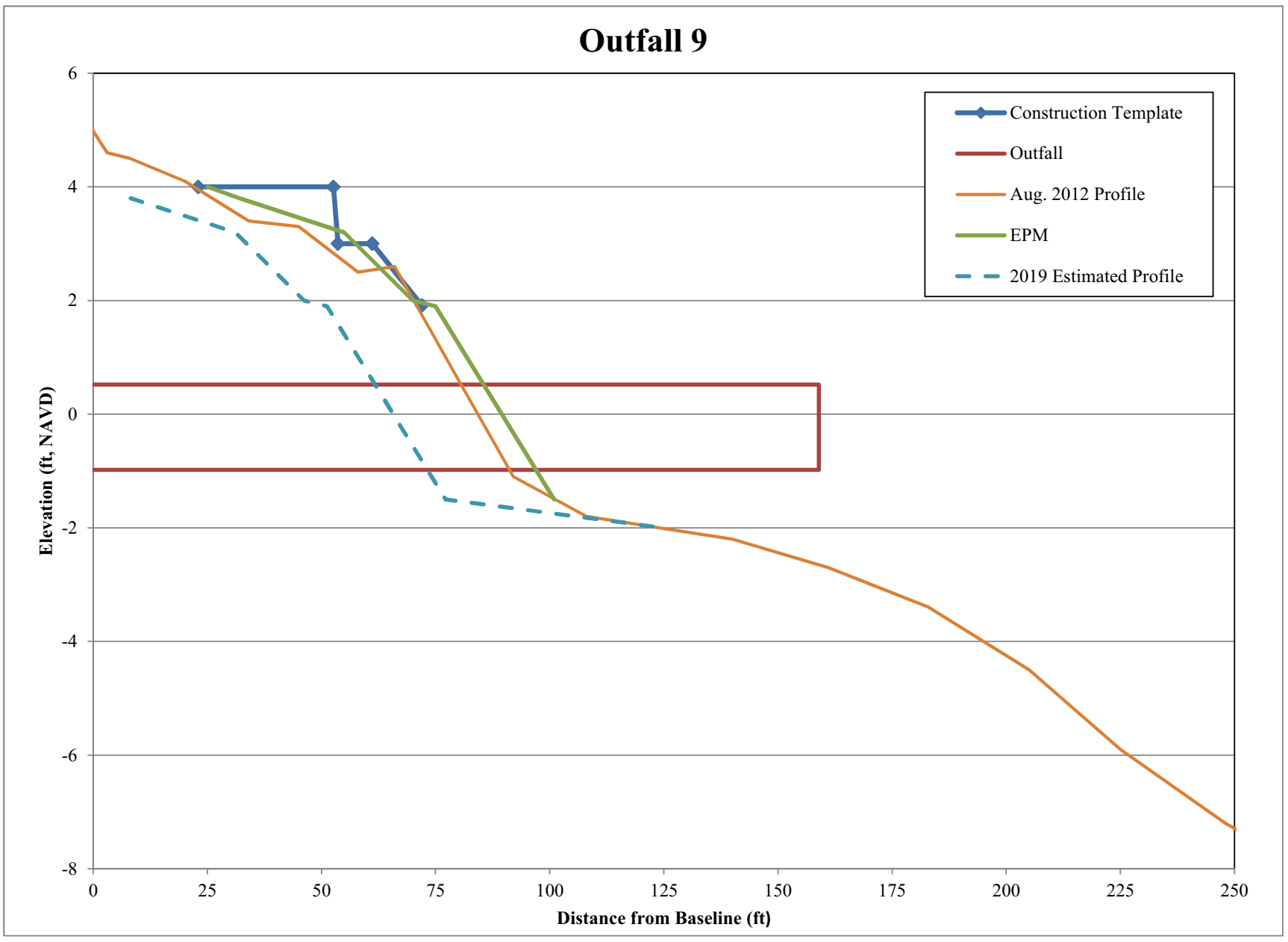

Outfall 4
Construction Template
Outfall
Aug. 2012 Profile
EPM
2019 Estimated Profile
Elevation (ft, NAVD)
6
4
2
0
-2
-4
-6
0
25
50
75
100
125
150
175
200
Distance from Baseline (ft)

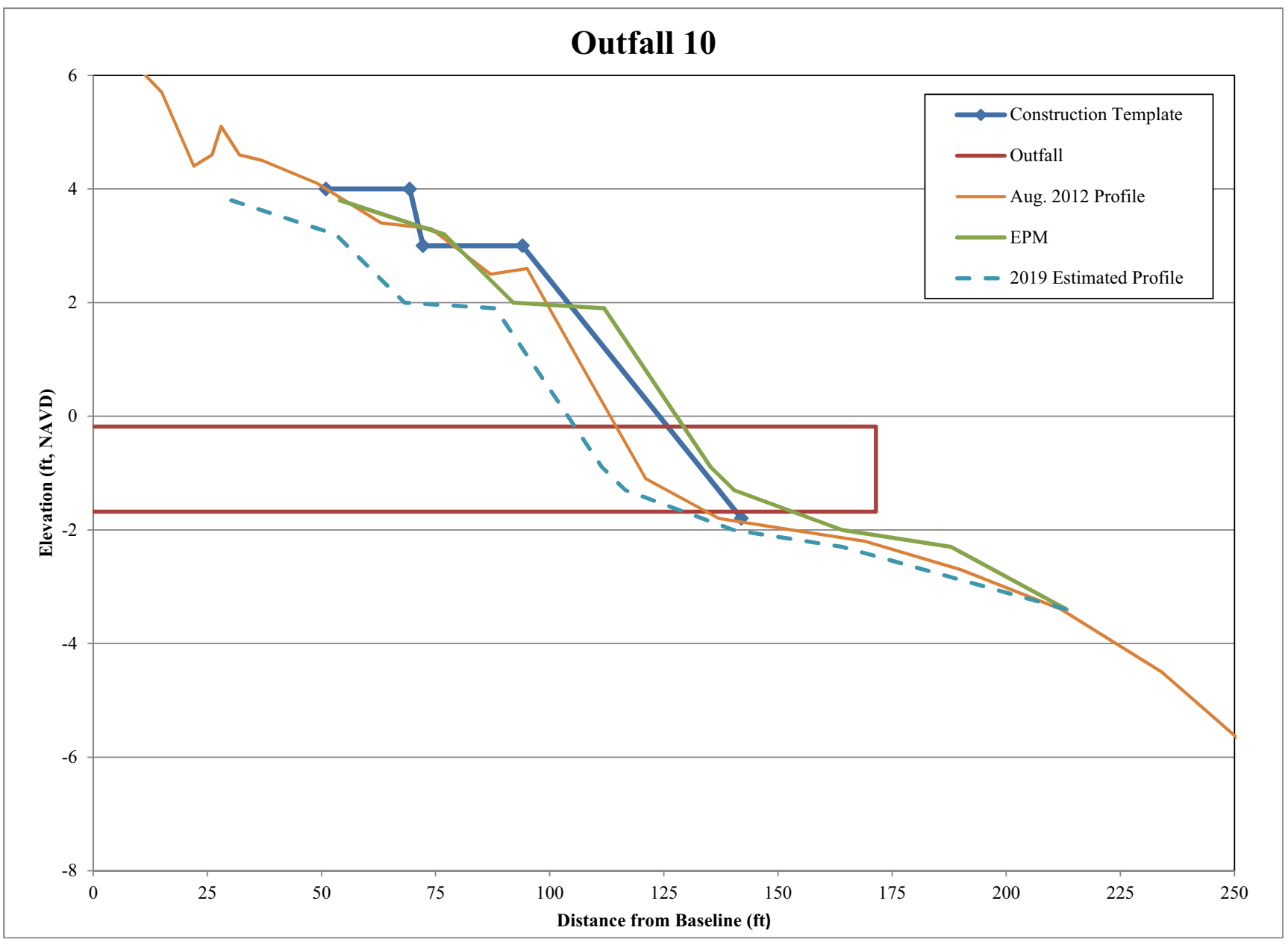

Outfall 5
Construction Template
Outfall
Aug. 2012 Profile
EPM
2019 Estimated Profile
Elevation (ft, NAVD)
6
4
2
0
-2
-4
-6
-8
25
50
75
100
125
150
175
200
225
250
Distance from Baseline (ft)


Outfall 6
Construction Template
Outfall
Aug. 2012 Profile
EPM
2019 Estimated Profile
Elevation (ft, NAVD)
6
4
2
0
-2
-4
-6
-8
0
25
50
75
100
125
150
175
200
225
250
Distance from Baseline (ft)


Outfall 7
Construction Template
Outfall
Aug. 2012 Profile
EPM
2019 Estimated Profile
Elevation (ft, NAVD)
6
4
2
0
-2
-4
-6
-8
0
25
50
75
100
125
150
175
200
225
250
Distance from Baseline (ft)


Outfall 8
Construction Template
Outfall
Aug. 2012 Profile
EPM
2019 Estimated Profile
Elevation (ft, NAVD)
6
4
2
0
-2
-4
-6
-8
0
25
50
75
100
125
150
175
200
225
250
Distance from Baseline (ft)


Outfall 9
Construction Template
Outfall
Aug. 2012 Profile
EPM
2019 Estimated Profile
Elevation (ft, NAVD)
6
4
2
0
-2
-4
-6
-8
0
25
50
75
100
125
150
175
200
225
250
Distance from Baseline (ft)


Outfall 10
Construction Template
Outfall
Aug. 2012 Profile
EPM
2019 Estimated Profile
Elevation (ft, NAVD)
6
4
2
0
-2
-4
-6
-8
0
25
50
75
100
125
150
175
200
225
250
Distance from Baseline (ft)

Appendix C

Bathymetric Map and Outfall Locations

Source: Coastal Planning and Engineering

Bathymetric Map & Outfall Locations Naples, Florida

N

Feet
0 250 500

1 inch = 500 feet

BANYAN BLVD
CRAYTON RD
8th Ave
N 4th AVE
N 2nd AVE
CENTRAL AVE
S 1st AVE
GULF SHORE BLVD

LANDWARD LIMIT OF FILL
LOWER BERM CREST
CONSTRUCTION TOE OF FILL
ROCK PILE
ROCK GROIN

R-61 R-63 R-64 R-66 R-67 R-68
T-62 T-65 T-69

4ft 0ft

(1) SINGLE 24" PIPE OUTFALL @ -1.3' NAVD
(2) DOUBLE 30" PIPE OUTFALL @ -1.4' NAVD
(3) SINGLE 18" PIPE OUTFALL @ -1.4' NAVD
(4) SINGLE 18" PIPE OUTFALL @ -1.9' NAVD
(5) SINGLE 15" PIPE OUTFALL @ -1.0' NAVD
(6) DOUBLE 30" PIPE OUTFALL @ -1.5' NAVD
(7) SINGLE 24" PIPE OUTFALL @-2.5' NAVD
(8) SINGLE 30" PIPE OUTFALL @-2.1' NAVD
(9) SINGLE 18" PIPE OUTFALL @-1.0' NAVD
(10) SINGLE 18" PIPE OUTFALL @ -1.7 NAVD

G:\Gillen\146892\mxd\Outfalls.mxd

Notes:

1. Aerial photography credits: ESRI, USDA, USFS, AEX, GeoEye, Geomapping, Aerogrid, IGN and the GIS user community.
2. All outfall elevations represent approximate invert elevations in NAVD88 feet.
3. Hardbottom shown only represents the most landward edge of hardbottom surveyed; it is not representative of all habitats delineated by the survey.
4. Bathymetric surface generated from LiDAR data flown in 2010.
5. Contour elevations are NAVD88 feet.

Legend

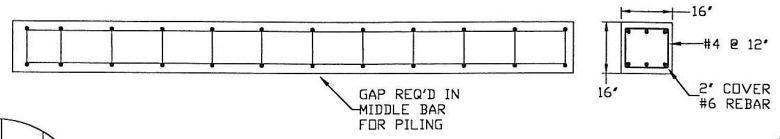
- Proposed Equilibrium Toe of Fill
- 2013 Proposed Construction Template
- Aug. 2009 Landward Hardbottom Edge
- Nov. 2008 Landward Hardbottom Edge
- May 2006 Landward Hardbottom Edge
- July 2005 Landward Hardbottom Edge
- Pipeline Corridor
- 1995 Erosion Control Line
- FDEP Range Monuments
- 2010 4ft and 0ft Bathymetric Contours
- Approx. Zero Intercept
- Design Baseline

Appendix D

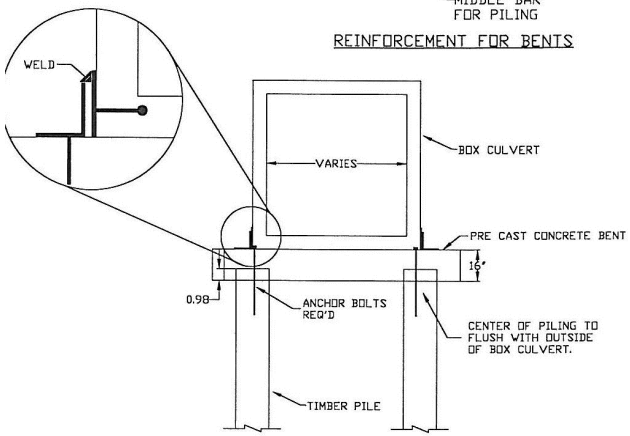
Plans for Panama City Beach Erosion Control and Stormwater Damage Protection Project

Prepared by Panhandle Engineering, Inc. 1998.

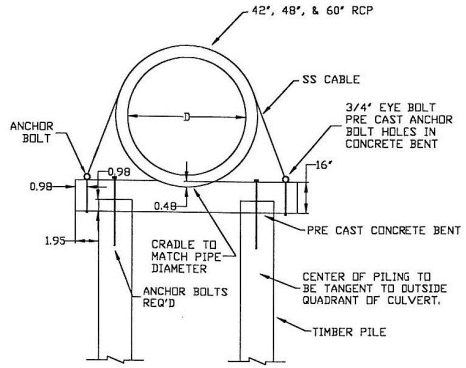
Prepared for Coastal Planning & Engineering Inc.



REINFORCEMENT FOR BENTS



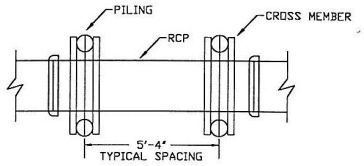
SINGLE BOX CULVERT SUPPORT



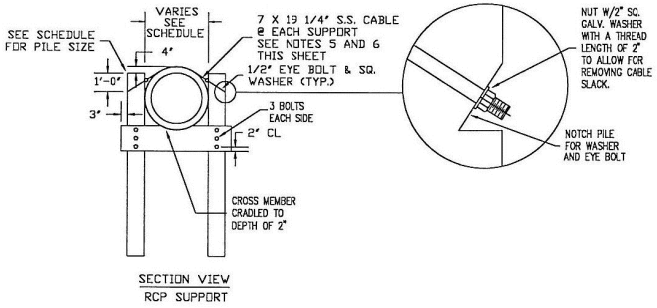
LARGE DIAMETER
RCP SUPPORT

PILE & SUPPORT SCHEDULE			
PIPE SIZE	CROSS MEMBER SIZE	CROSS MEMBER BOLT SIZE	PILE SIZE*
2-4x10	BENT	——	12"ø X 15'
6'X6'	BENT	——	12"ø X 15'
5'X5'	BENT	——	12"ø X 15'
4'X4'	BENT	——	12"ø X 15'
60"	BENT	——	12"ø X 15'
48"	BENT	3/4 X 18	12"ø X 15'
42"	BENT	3/4 X 16	12"ø X 14'
36"	4 X 12	3/4 X 16	12"ø X 13'
30"	3 X 12	3/4 X 16	12"ø X 12'
24"	3 X 12	3/4 X 16	12"ø X 12'
INLET	PILE CAP	——	12"ø X 14'

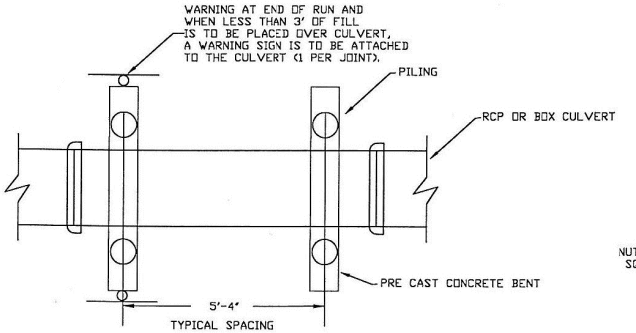
* PILE DIAMETER REFERS TO THE BUTT OF THE PILE



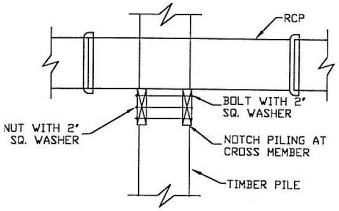
PLAN VIEW
INTERMITTENT FLOW



SECTION VIEW
RCP SUPPORT



PLAN VIEW
CONTINUOUS FLOW

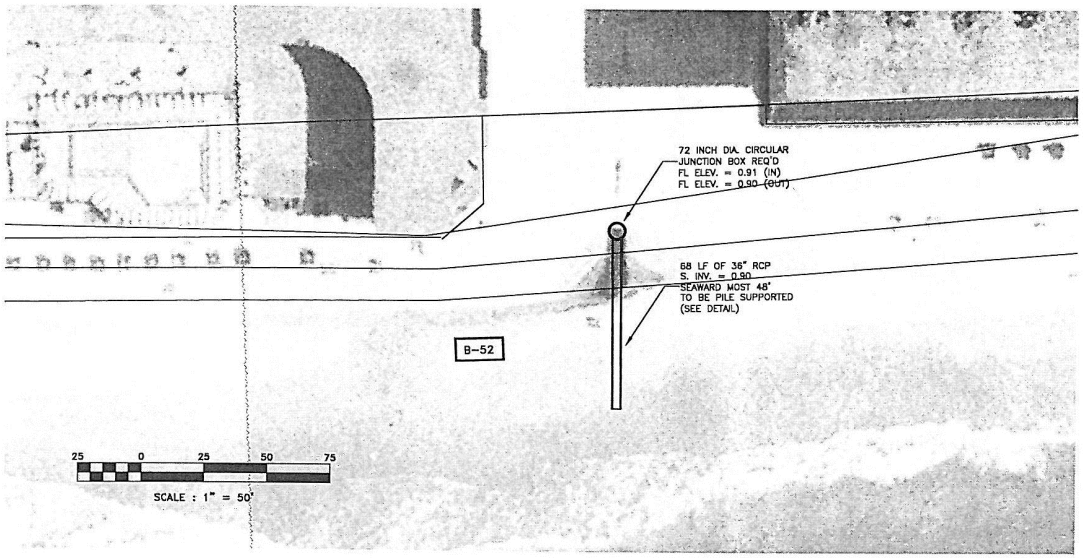


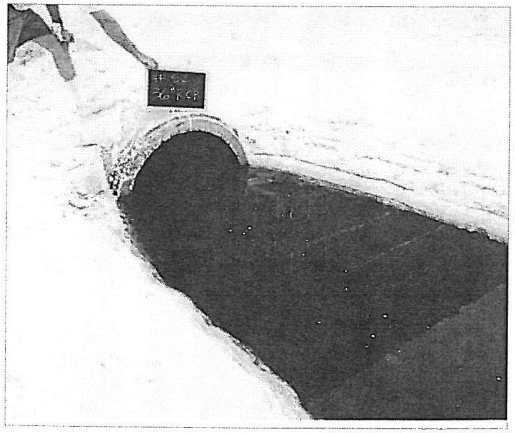
SIDE VIEW

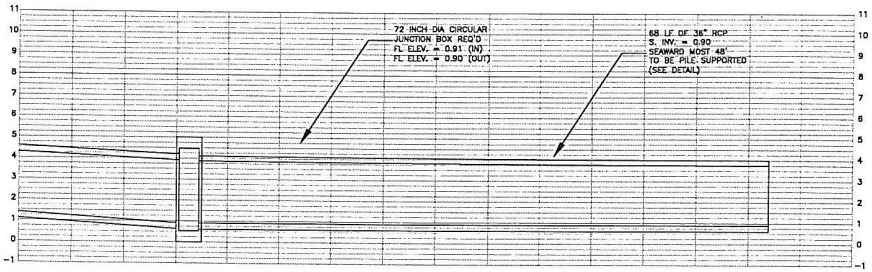
GENERAL NOTES:

1. PERMANENT OR TEMPORARY EASEMENTS FOR STORMWATER IMPROVEMENTS ARE NOT SHOWN AND WILL BE PROVIDED BY OTHERS IF REQUIRED.
2. LOCATION OF SEVEN FOOT CONTOUR AND OTHER FILL CHARACTERISTICS PER COASTAL PLANNING AND ENGINEERING, INC. CONSTRUCTION PLAN.
3. DUE TO CORROSION AND TRANSIENT NATURE OF BEACHFILL AN ONGOING MONITORING AND MAINTENANCE SHOULD BE UNDERTAKEN BY OWNER.
4. ALL MATERIAL TO BE IN COMPLIANCE WITH F.D.O.T. STANDARD SPECIFICATIONS FOR ROADS AND BRIDGES (1991).
5. CONTRACTOR TO PROVIDE COMPLETE AS-BUILT DRAWINGS FROM UPSTREAM POINT OF CONNECTION TO SEAWARD EXTENT OF CONSTRUCTION. AS-BUILT DRAWING TO BE PREPARED AND SEALED BY REGISTERED LAND SURVEYOR AND INCLUDE HORIZONTAL AND VERTICAL CONTROL.
6. REPORT CHANGES IN EXISTING CONDITIONS TO ENGINEER.
7. IF SEA TURTLE ACTIVITY HAS BEEN OBSERVED, CONSTRUCTION SHALL STRICTLY FOLLOW THE SPECIFICATIONS OUTLINED IN SECTION 7.2.2 OF GENERAL BID SPECS.
8. CONSTRUCTION FENCING TO BE PLACED AS PER TECHINICAL SPECS, SECTION 33 GENERAL BID SPECIFICATIONS.

MATERIAL	QUANTITY
36" RCP	68 LF
24" RCP SLOTTED	
24" N-12	
24" END CAPS/HOLES	
24" END CAP/NO HOLES	
N-12 FAB. WYES	
N-12 FAB. REDUCING WYES	
N-12 FAB. 45° BENDS	
6" END CAP/NO HOLES	
NUM OF PILINGS	24
NUM OF BENTS	12







PROFILE VIEW OF OUTFALL STRUCTURE 52

Appendix E

City's WWTP ASR Permit

Florida Department of Environmental Protection

South District
P.O. Box 2549
Fort Myers, Florida 33902-2549

BY ELECTRONIC MAIL:

August 23, 2010

In the Matter of an
Application for Permit by:

Mr. Robert Middleton, Director of Utilities
City of Naples
380 Riverside Circle,
Naples, Florida 34102
Email: bmiddleton@naplesgov.com

Collier County - UIC
File Number: 261821-003-006-UC/5X
ASR-1-4, Class V, Group 3,
Aquifer Storage and Recovery Wellfield

NOTICE OF PERMIT

Enclosed are Permit Numbers 261821-003-006-UC/5X authorizing construction of four, (4), Class V, Group Three, Aquifer Storage and Recovery, (ASR), injection wells and associated monitor wells, issued pursuant to Section(s) 403.087, Florida Statutes.

Any party to this Order (permit) has the right to seek judicial review of the permit pursuant to Section 120.68, Florida Statutes, by the filing of a Notice of Appeal pursuant to Rule 9.110, Florida Rules of Appellate Procedure, with the Clerk of the Department in the Office of General Counsel, 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000; and by filing a copy of the Notice of appeal accompanied by the applicable filing fees with the appropriate District Court of Appeal. The Notice of Appeal must be filed within 30 days from the date this Notice is filed with the Clerk of the Department.

Executed in Lee County, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

for

Jon M. Iglehart
Director of
District Management

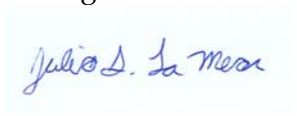
CERTIFICATE OF SERVICE

The undersigned duly designated deputy clerk hereby certifies that this **NOTICE OF PERMIT** and all copies were mailed before the close of business on August 23, 2010 to the listed persons.

Clerk Stamp

FILING AND ACKNOWLEDGMENT

FILED, on this date, pursuant to Section 120.52, Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.



8/23/10

Clerk Date

JMI/DR/jl

Enclosures

cc Nancy Marsh, EPA (marsh.nancy@epa.gov)
Noah Kulger, SFWMD (nkugler@sfwmd.gov)
Joe Haberfeld, FDEP (joe.haberfeld@dep.state.fl.us)
James Alexander, FDEP (james.alexander@dep.state.fl.us)
Albert Muniz, Hazen and Sawyer, (amuniz@hazenandsawyer.com)

Florida Department of Environmental Protection

South District
P.O. Box 2549
Fort Myers, Florida 33902-2549

Charlie Crist
Governor

Jeff Kottkamp
Lt. Governor

Michael W. Sole
Secretary

BY ELECTRONIC MAIL:

PERMIT

PERMITTEE:
Mr. Robert Middleton, Director of Utilities
City of Naples
380 Riverside Circle
Naples, Florida 34102
Email: bmiddleton@naplesgov.com

Collier County UIC
Permit/Cert. No: 261821-003-006-UC/5X
Date of Issue: **August 23, 2010**
Expiration Date: **August 22, 2015**
Latitude: Multiple N
Longitude: Multiple W
Class V, Group 3, Non-USDW ASR Well Construction

This permit is issued under the provisions of Chapter 403 of the Florida Statutes (F.S.) and rules 62-4, 62-520, 62-528, and 62-550 of the Florida Administrative Code. The above named permittee is hereby authorized to perform the work or operate the facility shown on the application and approved drawing(s), plans, and other documents, attached hereto or on file with the Department and made a part hereof and specifically described as follows:

Construct and operationally test in accordance with the Department approved cycle testing plan, four, (4), Class V, Group 3, Upper Suwannee Formation Aquifer Storage and Recovery, ASR, injection wells, (ASR-1-4) below the base of the Underground Source of Drinking Water, (USDW), with (1) storage zone monitoring well, MW-1 constructed within the same formation and two, (2), overlying aquifer monitor wells MW-2 and MW-3 within the Lower Hawthorn Aquifer, with 670 feet of production casing and an open hole interval to 740 feet below land surface. The proposed well construction consists of a 34-inch steel surface casing set to approximately 450 feet below land surface and a 24 –inch I.D., 0.05-inch wall thickness, steel production casing set to approximately 1080 feet bls with a 24 – inch open hole interval from approximately 1080 to 1350 feet bls. The monitoring system consists of one, (1) storage zone monitor well constructed to the same dimensions, casing and open hole depth as the ASR well. Additional overlying aquifer monitor wells MW -2 and MW-3 will be constructed with a sixteen-inch, (16") steel casing set to approximately 335 feet bls and a 6.625 – inch (6 5/8") O.D. 0.58-inch wall thickness, FRP, casing set to approximately 670 feet bls with an open hole interval from 670 to 740 feet bls. This permit authorizes a workover procedure for ASR-1 and ASR-2 with respect to an identified geological feature existing approximately 1150 to 1160 feet below land surface.

The purpose is to store, in the Arcadia/Upper Suwannee Formation aquifer systems, reclaimed water from the City of Naples Water Reclamation Facility, (WRF), and partially treated surface water from the Golden Gate Canal to meet the seasonal irrigation water demands within the City of Naples. The ASR wells are designed to inject at a maximum rate of 1 MGD (million gallons per day) per well. This project is depicted on the May 12, 2010 application and associated documents submitted in support of the application. The project is located at 380 Riverside Circle, Naples, Florida, 34102.

Subject to Specific Conditions 1-17.

SPECIFIC CONDITIONS:

1. **General Criteria:**

a. The terms, conditions, requirements, limitations and restrictions set forth in this permit are "permit conditions" and are binding and enforceable pursuant to section 403.141, F.S.

b. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviation from the approved drawings, exhibits, specifications, or conditions of this permit may constitute grounds for revocation and enforcement action.

c. As provided in subsection 403.087(7), F.S., the issuance of this permit does not convey any vested rights or exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor infringement of federal, state, or local laws or regulations. This permit is not a waiver of or approval of any other Department permit that may be required for other aspects of the total project which are not addressed in this permit.

d. This permit conveys no title to land, water, does not constitute State recognition or acknowledgment of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the State. Only the Trustees of the Internal Improvement Trust Fund may express State opinion as to title.

e. This permit does not relieve the permittee from liability for harm to human health or welfare, animal, or plant life, or property caused by the construction or operation of this permitted source, or from penalties therefrom; nor does it allow the permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department.

f. The permittee shall properly operate and maintain the facility and systems of treatment and control (and related appurtenances) that are installed and used by the permittee to achieve compliance with the conditions of this permit, or are required by Department rules. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to achieve compliance with the conditions of the permit and when required by Department rules.

g. The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, upon presentation of credentials or other documents as may be required by law and at reasonable times, access to the premises where the permitted activity is located or conducted to:

(1) Have access to and copy any records that must be kept under conditions of this permit;

SPECIFIC CONDITIONS:

(2) Inspect the facility, equipment, practices, or operations regulated or required under this permit; and

(3) Sample or monitor any substances or parameters at any location reasonably necessary to assure compliance with this permit or Department rules.

(4) Reasonable time will depend on the nature of the concern being investigated.

h. If, for any reason, the permittee does not comply with or will be unable to comply with any condition or limitation specified in this permit, the permittee should immediately provide the Department with the following information:

(1) A description of and cause of noncompliance; and

(2) The period of noncompliance, including dates and times; or, if not corrected the anticipated time the noncompliance is expected to continue, and steps being taken to reduce, eliminate, and prevent the recurrence of the noncompliance. The permittee shall be responsible for any and all damages that may result and may be subject to enforcement action by the Department for penalties or for revocation of this permit.

i. In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data and other information relating to the construction or operation of this permitted source which are submitted to the Department may be used by the Department as evidence in any enforcement case involving the permitted source arising under the Florida Statutes or Department rules, except where such use is proscribed by sections 403.111 and 403.73, F.S. Such evidence shall only be used to the extent it is consistent with the Florida Rules of Civil Procedure and appropriate evidentiary rules.

j. The permittee agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance; provided, however, the permittee does not waive any other rights granted by Florida Statutes or Department rules.

k. This permit is transferable only upon Department approval in accordance with rules 62-4.120 and 62-528.350, F.A.C. The permittee shall be liable for any non-compliance of the permitted activity until the transfer is approved by the Department.

l. This permit or a copy thereof shall be kept at the work site of the permitted activity.

m. The permittee shall comply with the following;

(1) Upon request, the permittee shall furnish all records and plans required under Department rules. During enforcement actions, the retention period for all

records shall be extended automatically unless the Department determines that the records are no longer required.

(2) The permittee shall hold at the facility or other location designated by this permit records of all monitoring information (including calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation) required by the permit, copies of all reports required by this permit, and records of all data used to complete the application for this permit. These materials shall be retained at least three years from the date of the sample, measurement, report, or application unless otherwise specified by Department rule.

(3) Records of monitoring information shall include:

(a) the date, exact place, and time of sampling or measurements;

(b) the person responsible for performing the sampling or measurements;

(c) the dates analyses were performed;

(d) the person responsible for performing the analyses;

(e) the analytical techniques or methods used;

(f) the results of such analyses.

(4) The permittee shall furnish to the Department, within the time requested in writing, any information which the Department requests to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit.

(5) If the permittee becomes aware that relevant facts were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be corrected promptly.

n. All applications, reports, or information required by the Department shall be certified as being true, accurate, and complete

o. Reports of compliance or noncompliance with, or any progress reports on, requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each scheduled date

p. Any permit noncompliance constitutes a violation of the Safe Drinking Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application

SPECIFIC CONDITIONS:

q. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit

r. The permittee shall take all reasonable steps to minimize or correct any adverse impact on the environment resulting from noncompliance with this permit.

s. This permit may be modified, revoked and reissued, or terminated for cause, as provided in 40 C.F.R. sections 144.39(a), 144.40(a), and 144.41 (1998). The filing of a request by the permittee for a permit modification, revocation or reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition

t. The permittee shall retain all records of all monitoring information concerning the nature and composition of injected fluid until five years after completion of any plugging and abandonment procedures specified under rule 62-528.435, F.A.C. The permittee shall deliver the records to the Department office that issued the permit at the conclusion of the retention period unless the permittee elects to continue retention of the records.

u. The permittee shall notify the Department as soon as possible of any planned physical alterations or additions to the permitted facility. In addition, prior approval is required for activities described in rule 62-528.410(1)(h).

v. The permittee shall give advance notice to the Department of any planned changes in the permitted facility or injection activity that may result in noncompliance with permit requirements.

w. The permittee shall report any noncompliance which may endanger health or the environment including:

(1) Any monitoring or other information which indicates that any contaminant may cause an endangerment to an underground source of drinking water; or

(2) Any noncompliance with a permit condition or malfunction of the injection system that may cause fluid migration into or between underground sources of drinking water.

(3) Any information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause, the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time

it is expected to continue; and the steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

x. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures.

y. No underground injection is allowed that causes or allows movement of fluid into an underground source of drinking water if such fluid movement may cause a violation of any primary drinking water standard or may otherwise adversely affect the health of persons.

2. Signatories and Certification Requirements.

a. All reports and other submittals required to comply with this permit shall be signed by a person authorized under Rules 62-528.340(1) or (2), F.A.C.

In accordance with Rule 62-528.340(4), F.A.C., all reports shall contain the following certification:

> "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based upon my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

3. Drawings, plans, documents or specifications submitted by the Permittee, not attached hereto, but retained on file at the South Florida District Office, are made a part hereof. Any changes, except as provided elsewhere in this permit, must be approved by the Department before implementation.

4. The injection and monitor wells at the site shall be abandoned when posing a potential threat to the quality of the waters of the State. In the event a well must be plugged or abandoned, the permittee shall obtain a permit from the Department as required by Chapter 62-528, F.A.C. The permittee shall notify the Department and obtain approval prior to any well work or modification.

5. The permittee shall notify the Department in the event that any of the conditions of the permit cannot be met, including an emergency discharge, due to breakdown of equipment, power outages or damages by hazard of fires, wind or other causes in accordance with the following:

SPECIFIC CONDITIONS:

a. Notification shall be made in person, email, or by telephone within 24 hours of the event.

b. A written report shall be submitted within 5 days which describes the nature and cause of the breakdown or malfunction, the steps being taken to correct the problem and prevent its recurrence, emergency procedures in use pending correction of the problem and the time when the facility will again be operating in compliance with permit conditions.

6. Prior to the commencement of any work, the name of the Florida-registered driller(s) supervising the drilling operations and the driller's registration number shall be submitted to the Department. The permittee or the engineer of record shall provide the Department with copies of all required federal, state or local permits prior to spudding the wells.

7. The permittee shall retain the engineer of record or obtain the services of any professional engineer registered in the State of Florida for the inspection of the construction of this project. Upon completion the engineer shall inspect for conformity to construction permit applications and associated documents. The Department shall be notified immediately of any change of engineer.

8. The specifications for a temporary containment structure around the borehole during the drilling of the ASR well and storage zone monitor wells shall be submitted to and approved by the Department prior to those wells being constructed.

9. Pumping fluids other than the treated and disinfected reclaimed water from the City of Naples WRF and partially treated surface water from the Golden Gate Canal into the injection well will constitute a violation of this permit and shall constitute cause for revocation.

10. Operational (Cycle) Testing

a. Prior to operational, (cycle), testing:

(1) The permittee shall submit the following information to each member of the TAC:

(a) A draft well completion report with certification of well construction completion by the Professional Engineer of Record;

(b) Geophysical logs;

(c) Water Quality data;

(d) Mechanical integrity test data;

SPECIFIC CONDITIONS:

(e) Confining zone data;

(f) Natural background ground water quality samples shall be obtained from the ASR test well and each monitor well for primary and secondary standards (Chapter 62-550.310 and .320, F.A.C.), excluding dioxin, asbestos, acrylamide and epichlorohydrin. The analysis shall also include dissolved oxygen, total uranium, total iron, total and fecal coliform, E. coli, enterococci, Giardia and Cryptosporidium. "Natural background" means the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department (Rule 62-520.200(12), F.A.C.). The samples shall be taken after final completion and clearance of drilling fluids from each well, and prior to the initiation of any injection tests.

(g) Source Water Fluid Analysis

a. Reclaimed Water from the City of Naples WRF and partially treated surface water from the Golden Gate Canal

(1) Prior to injection, the reclaimed water and surface water analyses shall include:

(A) Primary and Secondary drinking water standards established in Chapter 62-550, Part III, F.A.C., (excluding asbestos, acrylamide, epichlorohydrin, and dioxin);

(B) Giardia lamblia and cryptosporidium, fecal coliform, E. coli, and enterococci; ammonia, total Kjeldahl nitrogen (TKN), total nitrogen, total phosphorus, orthophosphate, dissolved oxygen, and total uranium.

(2) Six evenly spaced samples shall be collected from the WRF and the Golden Gate Canal. The sample results shall be completed and submitted to the Department prior to operational (cycle) testing.

(3) After the initiation of operational, (cycle), testing one sample from the WRF reclaimed source water and one sample from the partially treated Golden Gate Canal surface water shall be taken annually for all parameters listed in specific condition 10.a.(1) (g) a.(1) above. The permittee shall submit the results of source water analysis to the Department no later than 60 days following the sample date. The results shall be submitted to .the Department of Environmental Protection, P.O. Box 2549, Fort Myers, FL 33902-2549. A copy of the reports shall also be sent to the Department of Environmental Protection, Underground Injection Control Program, Mail Station 3530, 2600 Blair Stone Road, Tallahassee, FL 32399-2400.

SPECIFIC CONDITIONS:

The source water analysis may be submitted in digital (*i.e.*,electronic) format—*via* direct Internet electronic mail (e-mail); CD ROM, or DVD. The file format to be utilized should be in Excel™ format or comma delimited text (a.k.a. "CSV"). Data files shall be electronically mailed via the internet simultaneously to both of the following addresses: david.rhodes@dep.state.fl.us and joe.haberfeld@dep.state.fl.us. The signatory pages, the laboratory data sheets and diskettes shall still be mailed to the Department pursuant to the previous paragraph.

(h) As-built well construction specifications

(i) Other data obtained during well construction

(j) The permittee shall provide an updated well inventory and physically verify all wells deeper than 300 feet below land surface that are within a 0.50-mile radius of the ASR test well. Operational status, existing use, depth of final casing, and total depth of the well shall be determined and submitted with the above-mentioned information.

(k) An updated cycle testing and well workover plan shall be submitted to and approved by the Department prior to the permittee requesting authorization of operational testing. In the event the construction results in a well constructed within the USDW the permittee shall obtain a major permit modification and Administrative Order prior to conducting cycle testing

b. Written authorization shall be obtained from the Department prior to cycle testing or operational testing.

c. Operational, (Cycle), Testing Conditions – ASR Well

ASR-1

Well Number	Casing Diameter (ID) and Type	Cased and Total Depths (bls)	Open Hole (bls)
ASR – 1	24" Steel	1080'/1350'	1080'-1350'
ASR – 2	24" Steel	1080'/1350'	1080'-1350'
ASR – 3	24" Steel	1080'/1350'	1080'-1350'
ASR – 4	24" Steel	1080'/1350'	1080'-1350'

The injection well system shall be monitored in accordance with rule 62-528.615, F.A.C. The following injection well performance data shall be recorded and reported from the injection well instrumentation in the Monthly Operating Report as indicated below during each recharge and recovery cycle, (not during storage). Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.

SPECIFIC CONDITIONS:

Water Quality Parameters	*Sampling Frequency*
Maximum Injection Pressure (psi)	Daily/Monthly
Minimum Injection Pressure (psi)	Daily/Monthly
Average Injection Pressure (psi)	Monthly
Maximum Flow Rate	Daily/Monthly
Minimum Flow Rate	Daily/Monthly
Average Flow Rate	Monthly
Total Volume Recharged (Gals)	Daily/Monthly
Total Volume Recovered (Gals)	Daily/Monthly
Net Storage Volume and Cumulative Storage Volume (MG)	Monthly
Gross Alpha (pCi/L)	*(see below)
Cryptosporidium and Giardia lamblia	Monthly (Injectate only)
E. coli and Enterococci	Monthly (Injectate only)
Total Trihalomethanes (mg/L)	Weekly
Dissolved Oxygen (mg/L)	Weekly
Total Iron (mg/L)	Weekly
Arsenic (µg/L)	Weekly**
Total Dissolved Solids (mg/L)	Weekly
Specific Conductivity (µmhos/cm)	Weekly
Total Alkalinity (mg/L)	Weekly
pH (SU)	Weekly
Chloride (mg/L)	Weekly
Sulfate (mg/L)	Weekly
Field Temperature (°C)	Weekly
Color (color units)	Weekly
Odor (TON)	Weekly
Fecal Coliform (# per 100 ml)	Weekly
Total Coliform (# per 100 ml)	Weekly
Oxidation-Reduction Potential	Weekly
Primary and Secondary Drinking Water Standards (Injectate, (Recharge), Water Only - each WRF)	Annually***

*Beginning of recharge cycle and the beginning and end of each recovery cycle.

**Twice weekly during recovery; once weekly during injection.

***Plus giardia lamblia, cryptosporidium parvum, dissolved oxygen, total iron, total uranium, ammonia, total Kjeldahl nitrogen (TKN), total nitrogen, total phosphorus, orthophosphate fecal coliform, E. coli, and enteroccoci (asbestos, acrylamide, epichlorohydrin, and dioxin are excluded).

SPECIFIC CONDITIONS:

d. Operational Testing Conditions - Monitor Well System Monitor Wells

Monitor Wells

Well Number	Casing Diameter (ID)	Depth (bls) Cased/Total	Group or Formation	Monitoring Interval (bls)
MW-2 and MW-3	6 5/8" FRP	670'/740'	Lower Hawthorn Aquifer	670'-740'
MW-1	16 " Steel	1050'/1400'	Arcadia/U. Suwannee Aquifer	1050'-1400'

All monitor wells shall be monitored in accordance with rule 62-528.615, F.A.C. The following monitor well performance data shall be recorded and reported from the monitor well instrumentation in the Monthly Operating Report as indicated below during all recharge, storage and recovery cycles of the injection/production wells. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.During extended storage periods (greater than 30 days), the monitor well water quality parameters listed below may be sampled and analyzed monthly.

Water Quality Parameters	*Sampling Frequency*
Maximum Water Level or Pressure (feet NAVD or psi)	Daily/Monthly
Minimum Water Level or Pressure (feet NAVD or psi)	Daily/Monthly
Average Water Level or Pressure (feet NAVD or psi)	Monthly
Gross Alpha (pCi/L)	(SZMW only)*
Total Trihalomethanes (mg/L)	Weekly
Dissolved Oxygen (mg/L)	Weekly
Total Iron (mg/L)	Weekly
Arsenic (µg/L)	Weekly**
Total Dissolved Solids (mg/L)	Weekly
Specific Conductivity (µmhos/cm)	Weekly
Total Alkalinity (mg/L)	Weekly
pH (SU)	Weekly
Chloride (mg/L)	Weekly
Sulfate (mg/L)	Weekly
Field Temperature (°C)	Weekly
Color (color units)	Weekly
Odor (TON)	Weekly
Fecal Coliform (# per 100 ml)	Weekly
Total Coliform (# per 100 ml)	Weekly
Oxidation-Reduction Potential	Weekly

*Beginning and end of each recovery cycle. ** Twice weekly during recovery for SZMW-1.

SPECIFIC CONDITIONS:

e. A qualified representative of the Engineer of Record must be present for the start-up operations and the Department must be notified in writing of the date operational testing began for the subject wells.

f. Before authorizing operational testing the Department shall conduct an inspection of the facility to determine if the conditions of the permit have been met.

g. The permittee shall calibrate all pressure gauge(s), flow meter(s), chart recorder(s), and other related equipment associated with the injection well system on a semi-annual basis. The permittee shall maintain all monitoring equipment and shall ensure that the monitoring equipment is calibrated and in proper operating condition at all times. Laboratory equipment, methods, and quality control will follow EPA guidelines as expressed in Standard Methods for the Examination of Water and Wastewater. The pressure gauge(s), flow meter(s), and chart recorder(s) shall be calibrated using standard engineering methods.

h. The permittee shall submit monthly to the Department the results of all injection well and monitor well data required by this permit no later than the last day of the month immediately following the month of record. The results shall be sent to the Department of Environmental Protection, P.O. Box 2549, Fort Myers, Florida 33902-A copy of this report shall also be sent to the Department of Environmental Protection, Underground Injection Control Program, MS 3530, 2600 Blair Stone Road, Tallahassee, Florida 32399-2400.

i. If injection is to continue beyond the expiration date of this permit, the permittee shall apply for and obtain an operation permit. If necessary to complete the operational testing period, the permittee shall apply for renewal of the construction permit at least 60 days prior to the expiration date of this permit.

11. Prior to commencement of operational,(cycle), testing of the ASR well, the permittee shall obtain from the Department a Water Quality Exemption for any and all necessary parameters pursuant to Rule 62-520.500, F.A.C.

12. This project will be monitored by the Department with the assistance of the U.S. Environmental Protection Agency (USEPA), Region 4, and the Technical Advisory Committee (TAC) that consists of representatives of the following agencies whose addresses are included below:

a. Department of Environmental Protection - Fort Myers
b. Department of Environmental Protection – Tallahassee
c. Southwest Florida Water Management District – Brooksville

Florida Department of Environmental Protection	Florida Department of Environmental Protection	Southwest Florida Water Management District
South District Office	Bureau of Water Facilities	Well Construction

SPECIFIC CONDITIONS:

	Regulation	Permitting
P.O. Box 2549	UIC Program, Mail Station 3530	2379 Broad Street
2295 Victoria Avenue, Ste 364	2600 Blair Stone Rd.	Brooksville, Florida 34604-6899
Fort Myers, FL 33902-2549	Tallahassee, FL 32399-2400	

13. The permittee shall provide copies of all construction-related correspondence relative to this permit to each member of the TAC listed in specific condition 12.a. through d. above. Such correspondence includes but is not limited to reports, schedules, analyses and geophysical logs required by the Department under the terms of this permit. The permittee is not required to provide specific correspondence to any TAC member who submits to the permittee a written request to be omitted as a recipient of specific correspondence.

14. During the construction period allowed by this permit, daily progress reports shall be submitted to the Department and the Technical Advisory Committee (not the USEPA) each week. The reporting period shall run for seven (7) days and reports shall be mailed or electronically mailed within 48 hours of the last day of the reporting period. The report shall include, but is not limited to the following:

a. Description of daily footage drilled by diameter of bit or size of hole opener or reamer being used;

b. Description of work during installation and cementing of casing, including amounts of casing and cement used;

c. Description of formation and depth encountered;

d. Lithological description of drill cuttings collected every ten feet or at every formation change;

e. Description of work and type of testing accomplished including geophysical logging and pumping tests;

f. Description of any construction problems that develop and their status;

g. Copies of the driller's logs; and

h. Accurate records of the amount and type of any material used during construction to kill the flow of the wells.

15. No drilling operations shall begin without an approved disposal site for drill cuttings, fluids or waste. It shall be the Drilling Contractor's responsibility to obtain any necessary Department and local agency approval for disposal prior to the start of construction.

SPECIFIC CONDITIONS:

16. After completion of construction and testing, a final report shall be submitted to the Department and the TAC., with only the cover letter sent to USEPA. The Department and TAC addresses are as follows:

Underground Injection Control Program
Bureau of Water Facilities Regulation
Department of Environmental Protection
2600 Blair Stone Road, Mail Station #3530
Tallahassee, FL 32399-2400

Underground Injection Control Program
Department of Environmental Protection
South District Office
2295 Victoria Avenue, Ste 364
Ft Myers, FL 33902-2549

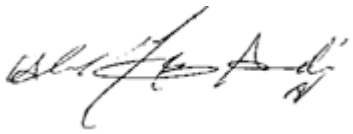
The report shall include, but not be limited to, all information and data collected under Sections 62-528.605, 62-528.610, 62-528.615 and 62-528.620, F.A.C., with appropriate interpretations. Mill certificates for the casing(s) shall be included in this report. The report shall be certified by a P.E. and P.G.

17. The permittee is reminded of the necessity to comply with the pertinent regulations of any other regulatory agency, as well as any county, municipal, and federal regulations applicable to the project. These regulations may include, but are not limited to, those of the Federal Emergency Management Agency in implementing flood control measures. This permit should not be construed to imply compliance with the rules and regulations of other regulatory agencies.

Note: In the event of an emergency the permittee shall contact the Department by calling Ph. (800) 320-0519. During normal business hours, the permittee shall call (239) 332-6975.

Issued this 23rd. day of August, 2010.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION



for

_____

Jon M. Iglehart
Director of
District Management

JMI/DR/JL