Stormwater Management Plan Report
Mastic Beach, Smith Point of Shirley
Suffolk County, NY

Issued February 6, 2017

DASNY #3264609999

Governor's Office of Storm Recovery

NEW YORK STATE

DASNY

DORMITORY AUTHORITY STATE OF NEW YORK

H2M architects + engineers

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EXECUTIVE SUMMARY

The Mastic Beach-Smith Point of Shirley Stormwater Management Plan wPeas identified as a proposed project in the Mastic Beach and Smith Point of Shirley – NY Rising Community Reconstruction (NYRCR) Plan dated March 2014. The NYRCR program was established by the Governor's Office of Storm Recovery (GOSR) to provide rebuilding and resiliency assistance to communities severely damaged by Hurricane Irene, Tropical Storm Lee and Superstorm Sandy.

On October 29, 2012, Superstorm Sandy hit Long Island as a Category 1 storm with wind gusts recorded as high as 96 mph. The Village of Mastic Beach and Smith Point of Shirley were two of the hardest hit areas on Long Island with widespread flooding, downed trees, electrical outages and damaged homes. Over 100 emergency rescues were made due to flooding from tidal inundation. It was estimated that between 60 and 80 homes in Mastic Beach and Smith Point of Shirley were deemed either unlivable or condemned due to structural damage. Furthermore, hundreds of homes were damaged to such an extent that residents could not occupy them. In response to this storm, the NYRCR Program was expanded to include the Village of Mastic Beach and Smith Point of Shirley community, which was one of eight NYRCR communities within Suffolk County. A community plan was developed in March 2014, which identified numerous resiliency projects, one of which is the focus of this report.

H2M architects + engineers (H2M) was retained by the Dormitory Authority State of New York (DASNY), under a term contract as a qualified engineering consultant for this project. H2M's project team included Geomaps International Inc., Gayron de Bruin Land Surveying and Engineering, P.C. (GDB) and PETK, Inc. General Contracting (PETK). Geomaps provided aerial topographic mapping of the study area, GDB performed topographic survey mapping of the existing piped drainage systems and PETK assisted our field personnel in providing access to select storm drainage structures which were not accessible due to obstructions (e.g., full of debris, water).

The funding of the project is thru the U.S. Housing and Urban Development (HUD) Community Development Block Grant Disaster Recovery (CDBG-DR) program. This federal grant is being administered by the New York State Housing Trust Fund Corporation (HTFC), a public benefit corporation, as grantee, in which DASNY is an authorized grant subrecipient. Through the NYRCR program, Mastic Beach and Smith Point of Shirley are eligible for up to $3 million in CDBG-DR implementation funds. This specific project as detailed in the NYRCR Community Plan is estimated to cost $1 million, which must be expended for in construction by 2019.

This report details a stormwater drainage plan that identifies and describes specific resiliency measures to mitigate flooding in affected areas from stormwater runoff and back up of seawater into the storm drainage system. A comprehensive inventory and analysis of the storm drainage infrastructure with recommendations and associated cost of improvements which mitigate stormwater impacts throughout the study area are provided. From the recommendations presented, priority projects will be identified, so that the community can evaluate and select projects which will be advanced to engineering design, contract documents, and then construction.

On November 18, 2016, a meeting was held between the Town of Brookhaven, Village of Mastic Beach, DASNY, GOSR, and H2M to review and discuss the Stormwater Management Plan Report for Mastic Beach and Smith Point of Shirley dated October 31, 2106. This report had been issued for review to Town, Village, GOSR and DASNY in early November. H2M made a formal presentation of the report to attendees during this meeting, and addressed comments and questions which followed. A 3-week comment period followed this meeting, which allowed additional time for the Town and Village to submit written comments which were received in the month of December. H2M in collaboration with DASNY, prepared a written response to these comments which were released to all meeting attendees on January 31, 2017.

Enclosed in Appendix G is the November 18, 2016 meeting agenda, meeting sign in sheet, PowerPoint presentation, final meeting minutes dated December 2, 2016 and a response to Town and Village comments dated January 31, 2017.

I. INTRODUCTION

A. Project Description

This project, as detailed in March 2014 Mastic Beach and Smith Point of Shirley NYRCR plan, was referenced and titled "Prepare Stormwater Management Plan and Construct Improvements". For background purposes, we have included a description of the project in Appendix E which provides the basis for this report. The project seeks to reduce risks to public and private property by mitigating stormwater flooding.

The focus of the project, as detailed in the NYRCR plan, was to address flooding due to stormwater runoff and backup of seawater into the stormwater drainage systems. During Hurricane Sandy a number of neighborhoods experienced roadway flooding during the storm, which also impacted private property owners. Many of these same areas continue to flood during high tide and heavy rainfalls.

The project calls for an engineering inventory of the existing drainage system. This includes mapping of storm drain inlets, piping, outfalls and recharge basins. The Village and Town would be solicited for input on areas which experience flooding, so these areas could be identified and evaluated. The information compiled on the existing infrastructure would be evaluated to assess its capacity to convey storm events. Based on this analysis, recommendations would be made to improve the drainage system. Recommendations proposed could include drainage system improvements, green infrastructure and check valves for areas that experience seawater backups. Properties would be identified which could be utilized to increase stormwater storage and recharge, some of which could be considered to serve a dual function as a passive or active park during periods of dry weather.

The plan also estimated the project to cost $1 million. This which would include system inventory, engineering evaluation and design and construction of most critical improvements, with life cycle costs estimated at $1.375 million.

B. Project Location

The Mastic Beach-Smith Point of Shirley study area represents a significant portion of the Incorporated Village of Mastic Beach and Smith Point of Shirley, which are located within the jurisdictional boundaries of the Town of Brookhaven. The study area for this south shore community, as shown in Figure I-1, is approximately 4.48 square miles (2,869 acres). Both communities are located on a peninsula in the southern portion of the Town of Brookhaven within Suffolk County. The communities are surrounded by Bellport Bay, Narrow Bay, Moriches Bay and the Forge River. Pattersqaush Creek and Johns Neck Creek flow into Narrow Bay, and Lons Creek and Home Creek are tributaries of the Forge River. The Smith Point Marina County Park and Smith Point County North Park (undeveloped) are located south of the Smith Point residential neighborhoods and west of the William Floyd Parkway. Johns Neck Creek extends to a New York State Conservation Area, which is located just beyond the southwest corner of the Village boundary. The William Floyd Estate, which is federal property, abuts the southeastern

portion of the study area. Neighboring communities include the hamlets of Mastic and Moriches and a portion of the hamlet of Shirley.

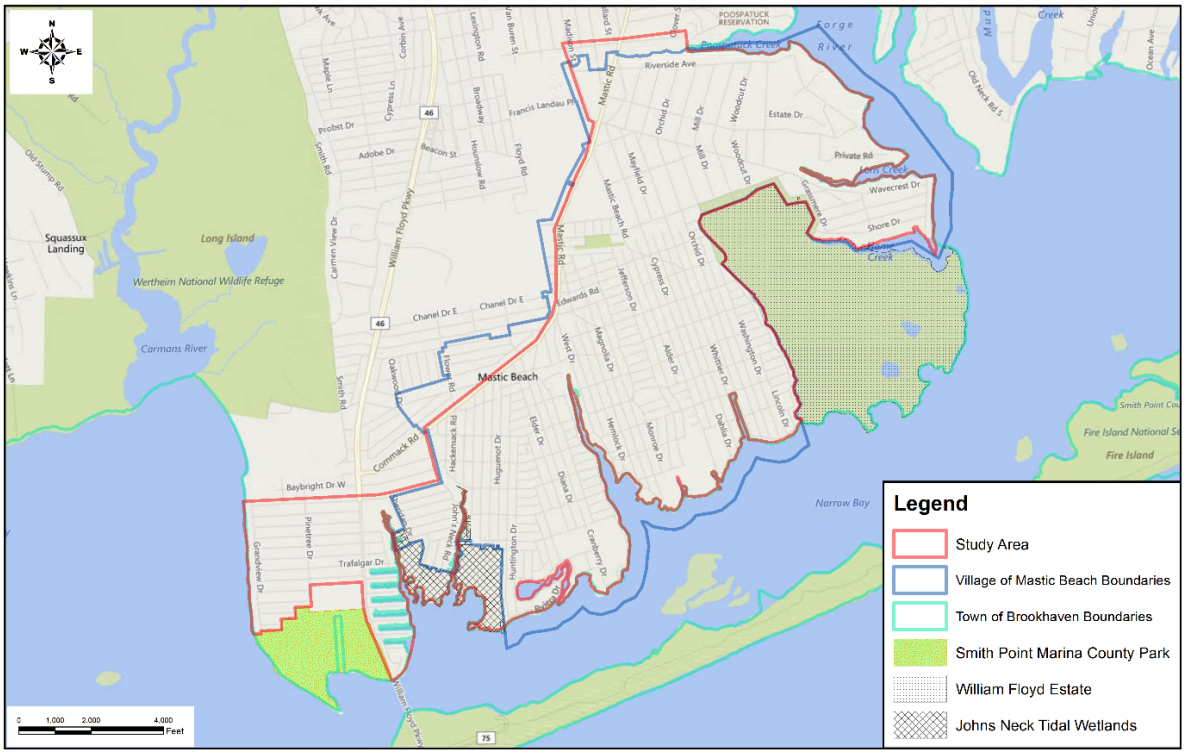

Figure I-1. Study Area Map

The project limits do not include Smith Point County Park North, William Floyd Estate and the Johns Neck Creek tidal wetlands, as these locations are primarily natural and undeveloped and are not known to have drainage systems. The Smith Point Marina County Park, which is developed, was not included as the site has no drainage systems on site.

C. Development History of Area

The Mastic Beach area was originally developed in the 1920s as an affordable summer home community designed for workers from New York City. In the 1930s, the existing pattern of development substantially changed when Walter T. Shirley purchased approximately 10,000 acres of undeveloped land and created large scale subdivisions. From 1945 to 1962, 45 subdivision maps were filed which played a major role in developing the existing road network and pattern of circulation which exists today.

The Village of Mastic Beach was incorporated in November 2010. Prior to incorporation as a Village, Mastic Beach was a hamlet within the Town of Brookhaven. According to the 2010 U.S. Census, there were approximately 12,930 residents in 4,231 households. This data is not coincident with the Village of Mastic boundary and there was no data for Smith Point of Shirley. Land use in the area is

predominately low-density residential with approximately 150 commercial properties. Detached single family homes account for over 90% of the total acreage, which can observed in Figure I-2. The Village of Mastic Beach has a Central Business District on Neighborhood Road. The remaining land includes mixed use, business and waterfront development districts. There are no industrial zoned parcels or uses within the study area. The NYRCR Committee estimates that more than 20% of the housing units are vacant, with the most common reasons being that the property is damaged from the storm, in foreclosure or bank owned, for sale, or is it seasonally used.

Figure I-2. Aerial Map

The natural environment of Mastic Beach and Smith Point of Shirley has been altered by residential development and historic land management measures over the years. Houses were built in the wetlands prior to modern day floodplain and environmental regulations, which makes many residential homes highly vulnerable to storm surge inundation. In addition, residents who have a home near the shoreline or located in low lying areas must contend with high groundwater, which severely impairs drainage on frontage roads and private property.

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II. EXISTING CONDITIONS

A. Topography

The existing ground elevations for the study area were obtained from Suffolk County Department of Information Technology and GeoMaps, which utilized Light Detection and Ranging (LIDAR) data converted to 5-foot and 2-foot elevation contours, respectively. The 5-foot elevation contour data is presented in Figure II-1. Elevations reference the North American Vertical Datum of 1988 (NAVD88). Ground elevations throughout the study area generally slope from approximately 30 feet (ft) at the intersection of Mastic Road and Riverside Avenue (northern portion of study area) to sea level along waterfront boundaries. The typical slope through the study area ranges from 0 to 1% in Smith Point of Shirley and southern half of the Village of Mastic Beach (from William Floyd Parkway to William Floyd Estate). Northern areas in the Village have slopes ranging from 1-4% and Osprey Park averaging 1.1 %. Given the generally flat terrain and slopes in the study area, it is common occurrence to have stormwater ponding along roadways and private property after rainfall events.

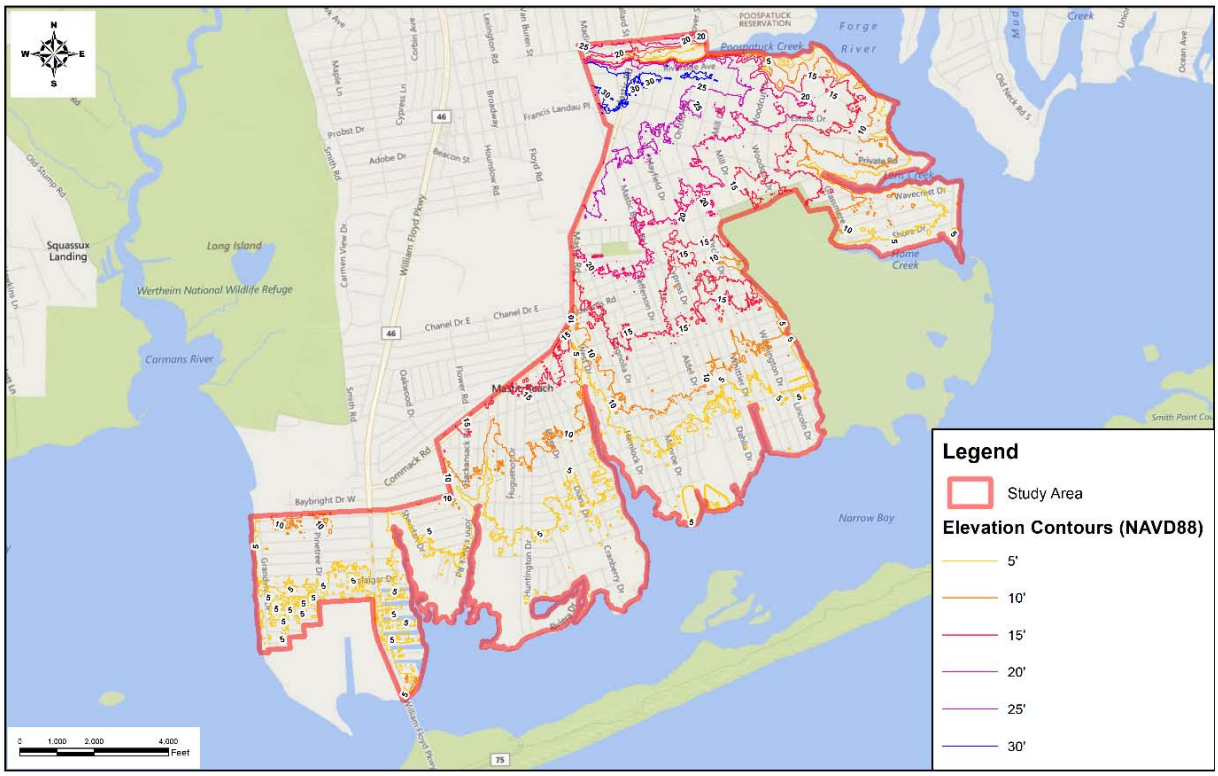

Figure II-1. Topographic Elevation Map

B. Groundwater and Soils

Shallow groundwater exists throughout the area with elevations ranging from 0 to 10 ft (NAVD88), relative to mean sea level. Figure II-3 depicts groundwater water contour elevations. These contours represent the vertical depth of groundwater below the surface grade elevation. The closest USGS well to the study area is located near the intersection of William Floyd Parkway between Ranch and Tipton Drive (Figure II-2). The well monitoring Station No. 404642072520001 is approximately 8,800 ft north and 4,600 ft west of the study area. The groundwater elevation in this area as of September 2016, was 7.76 ft in the National Geodetic Vertical Datum of 1929 (NGVD29). Additional information was collected through a Freedom of Information Law (FOIL) request submitted to the Suffolk County Department of Health Services (SCDHS) for 30 sites. The FOIL request retrieved applications and plans submitted to SCDHS for improvements to onsite individual sewage disposal systems within the last 5 years. Given the shallow groundwater conditions, geotechnical investigations will be conducted as needed prior to the design phase for drainage improvement projects.

These plans provided information on the soil types and approximate depth to groundwater at various locations within the study area. Most of the soils in the area consisted of well-graded clean sand (SW), poorly-graded clean sand (SP), sand with silty fines (SM) or sand with clayey fines (SC) per the Unified Soil Classification System.

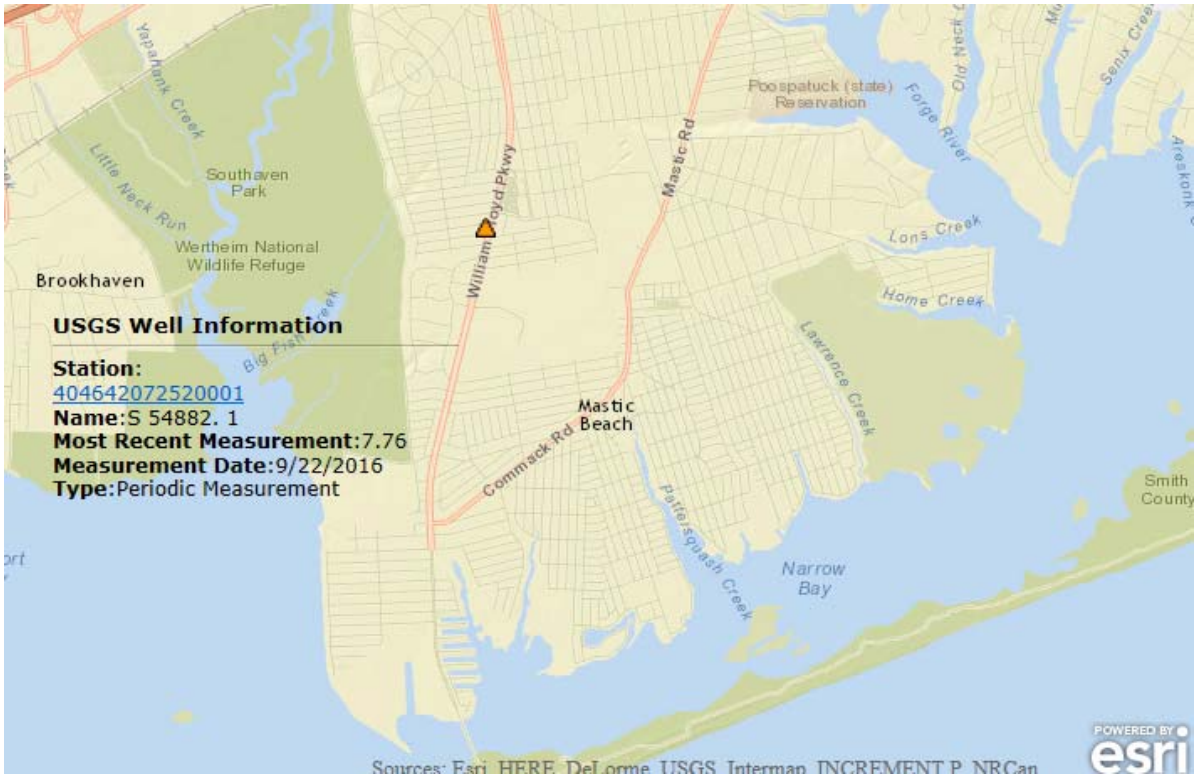

Figure II-2. USGS Well Monitoring Station

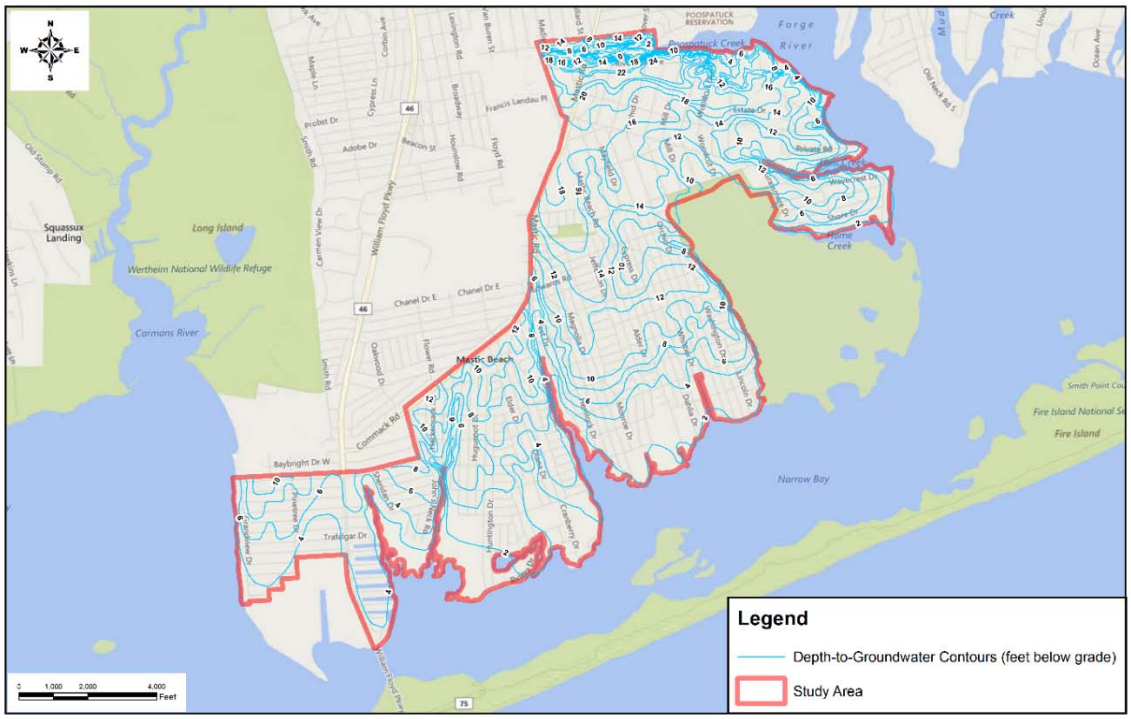

Figure II-3. Depth to Groundwater Map

Figure II-4. Freshwater and Tidal Wetlands Map

C. Wetlands

Tidal and freshwater wetlands (Figure II-4) are prevalent throughout the study area given the proximity to the shoreline, flat terrain and shallow groundwater conditions.

The estimated total area of New York State Department of Environmental Conservation (NYSDEC) regulated freshwater wetlands is approximately 12.6 acres and tidal wetlands is approximately 18.2 acres, most of which are located within the Village of Mastic Beach. These areas do not reflect the regulatory buffer areas which are 300 ft for tidal wetlands and 100 ft for freshwater wetlands. Future drainage improvements proposed which encroach upon these regulatory buffer areas will be subject to state and federal wetlands permitting requirements.

D. Tidal Elevations

The National Oceanographic and Atmospheric Administration (NOAA) has a tide gage station at Smith Point Bridge on the north side of the northeast bridge fender in Narrow Bay. This tide gage station is identified as Station ID 8513825 with a latitude of 40°44.3' N and longitude 72°52.1' W. The time period during which sea level measurements were recorded at this station occurred between February 1990 and January 1991.

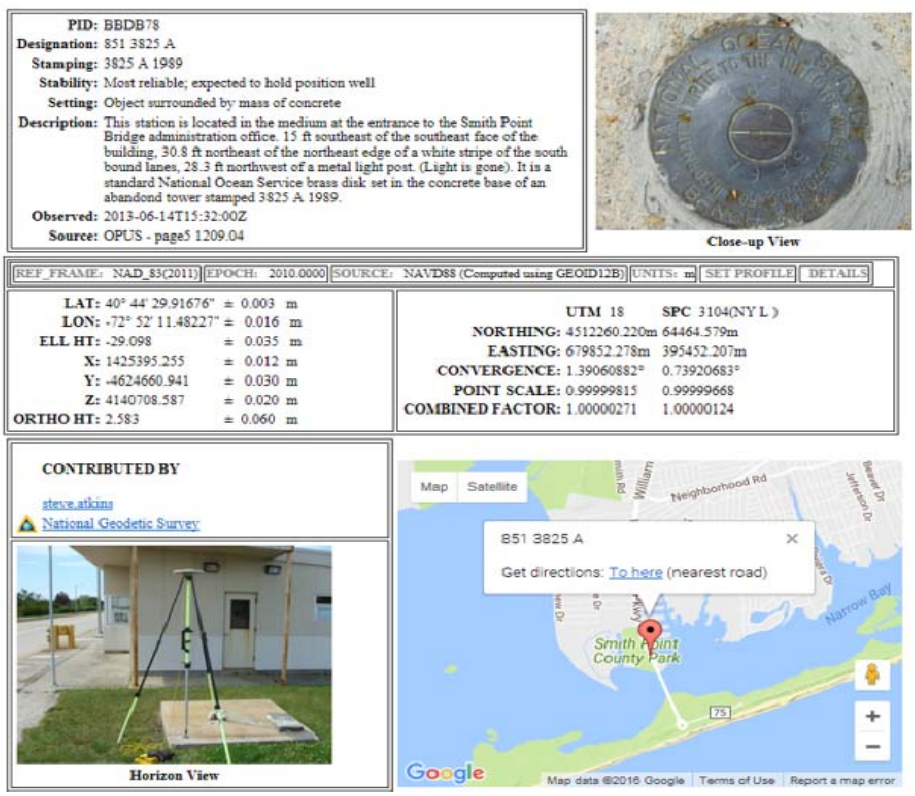

Figure II-5. National Geodetic Survey Benchmark

NOAA references specific tidal elevations at the tide gate station relative to various bench mark stations in the area. For this location, a bench mark station is located just north of the Smith Point Bridge (Figure II-5). The benchmark designation is 3825 A 1989, and is located in the median at the entrance to the Smith Point Bridge administration office.

From this information, the elevations for Mean Lower Low Water (MLLW) and Mean High Water (MHW) were determined relative to the benchmark 3825 A 1989. Adjusting the NOAA station elevations to the NAVD88 benchmark elevation yields the following sea level elevations in Table II-1.

Tide Data for Station 8513825 Smith Point Bridge, Narrow Bay (NAVD88)	
Mean Lower Low Water	-0.73 ft
Mean High Water	+0.57 ft
Mean Higher High Water	**+0.89 ft**

Table II-1. Tide Data for Station 8513825

For purposes of this study, the Mean Higher High Water (MHHW) was used in the stormwater model to establish the downstream tailwater elevations at the pipe outfall. Tailwater refers to waters located immediately downstream from a hydraulic structure such as pipe or culvert. Since the tide gage station recorded data between between February 1990-February 1991, the MHHW of 0.73 ft was calibrated upward by 0.16 feet to reflect estimated sea level rise between 1991 through 2016. It has been estimated that sea level rise has occurred more rapidly over the last several decades, with an average increase of 0.13 inches per year.

E. Floodplain

Based on the National Flood Insurance Program (NFIP) Flood Insurance Rate Map (FIRM) Panel 719 Map 36103C0719H, Panel 738 Map 36103C0738H, Panel 739 Map 36103C0739H, Panel 932 Map 36103C0932H, and Map 951 Panel 36103C0951H, the 100-year flood elevation within the study area ranges from 5 ft to 8 ft (NAVD88 datum), dependent on proximity to shoreline and ground elevation. The 100-yr flood is a flood that has a 1% probability of occurring in any given year. Flood elevations are also as high as 10.0 ft (NAVD88) along several shoreline areas due to wave action. The entire southern half of the study area lies within the 100-year flood zone, which is identified in Figure II-6. This comprises approximately 1000 acres, which is over 34% of the study area.

Figure II-6. Floodplain Map

F. Sea Level Rise

As a result of changing climate, sea level rise is expected to dramatically affect New York's coastal communities this century. Climate change contributes to global sea level rise through higher temperatures which result in an increase in the volume of seawater and thru melting ice caps and glaciers. Sea level rise will continue to increase the risk to developed areas, future development and coastal habitats which are vulnerable to flooding and storm damage. Since 1970, the Northeast has experienced increasing average temperatures by more than 1.5 degrees F. This temperature increase has resulted in heavier and more intense rainfall and storm events, warmer winters and hotter summers. The New York State Sea Level Rise Task Force was created in August 2007, to address sea level rise issues and develop recommendations to protect coastal communities and natural resources from sea level rise.

The outlook for the region is dramatic and will change the coastline. The New York Panel on Climate Change has developed the projections for mean sea level rise in Lower Hudson Valley and Long Island region in Table II-2.

Sea Level Rise Projections in Future Years			
Lower Hudson Valley & Long Island	2020s	2050s	2080s
Sea level rise	2 to 5 in	7 to 12 in	12 to 23 in
Sea level rise with rapid ice-melt scenario	5 to 10 in	19 to 29 in	41 to 55 in

Table II-2. Projected Sea Level Rise in New York

The changes resulting from sea level rise are significant and will have many impacts, such as raising groundwater levels, accelerating saltwater intrusion, and increasing inundation, flooding and storm surge. Proposed stormwater infrastructure resiliency recommendations will be evaluated relative to sea level rise (without rapid ice melt) for Long Island. The midpoint values for sea level rise increases will be utilized for the years 2020 (3.5 inches), 2050 (9.5 inches) and 2080 (17.5 inches). We will evaluate the recommendations relative to groundwater elevations and sea level rise scenarios in an effort to rank priorities. The Mastic Beach-Smith Point of Shirley communities will certainly be challenged with sea level rise scenarios given the extent of its shoreline, which is over 17.2 miles in length.

To illustrate the impact of sea level rise on the study area, Figure II-7 shows the encroachment of a 1-foot and 2-foot sea level rise within the community.

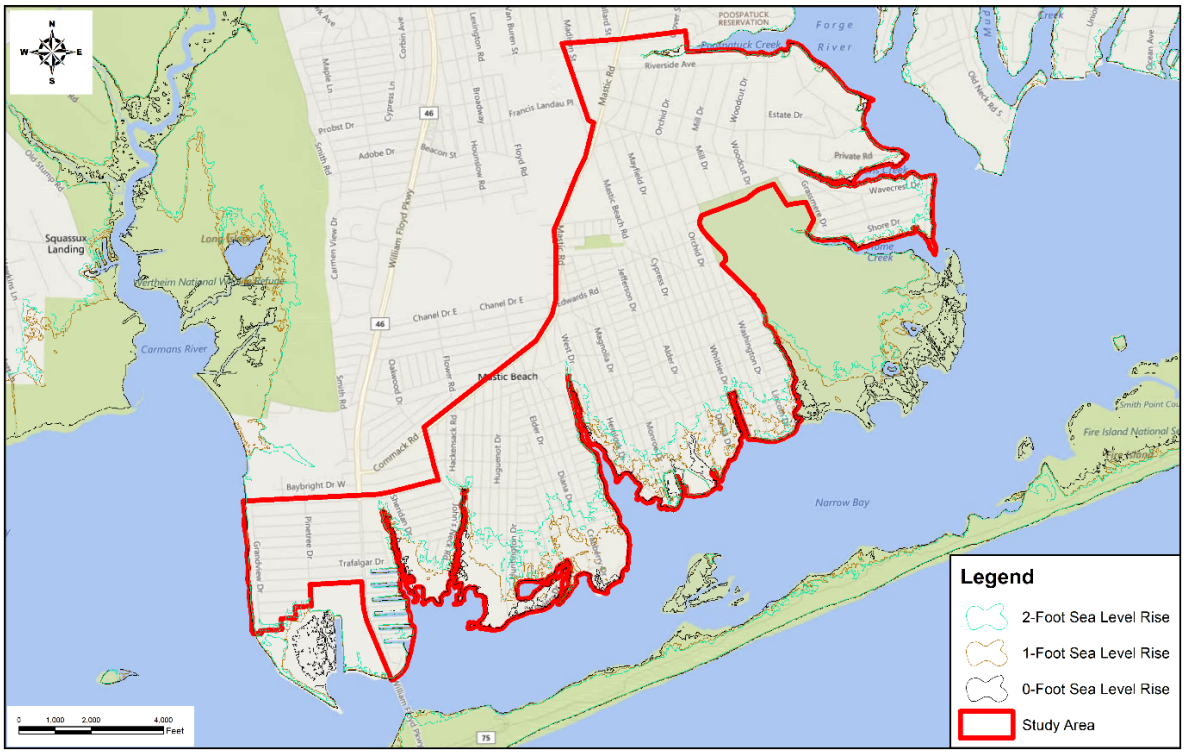

Figure II-7. Sea Level Rise Encroachment Map

The following land area and building encroachments in Table II-3 are estimated based on sea level rise which illustrates the impacts of projected sea level rise in future years.

Sea Level Rise Impact			
Sea Level Rise	Area Effected	Structures Impacted	Percent of Study Area
0 ft	95 acres	21 buildings	3.31%
1 ft	325 acres	98 buildings	11.33%
2 ft	543 acres	553 buildings	18.93%

Table II-3. Sea Level Rise Encroachment Impacts

III. EVALUATION OF EXISTING INFRASTRUCTURE

A. Storm Drainage System Inventory

Prior to survey mapping of the existing drainage system, an inventory of the drainage systems was compiled from various sources of information provided by the Village of Mastic Beach, Town of Brookhaven and Suffolk County. When the Village incorporated in 2010, they had no records which documented the location of the existing storm drainage infrastructure. Since no information was available, Village DPW personnel documented their knowledge of the existing drainage system and prepared a hand marked up map of drainage structures within the study area. The preliminary map prepared by the Village identified approximately 27,000 linear feet of piping, 24,000 linear feet of open ditches, 215 drainage grates, 4 recharge basins and 30 outfalls. According to Village DPW personnel, the Village cleaned and removed debris from all of the drainage structures and pipes which were accessible in 2014. The Village also noted that their existing outfalls did not have check valves to prevent sea water from backing up into the drainage system.

The Town of Brookhaven and Suffolk County provided a Global Information Systems (GIS) database of their existing drainage system. The Town did not have record drawings for roads in the Smith Point of Shirley area, however, they did identify the location of approximately 300 storm structures throughout the study area including locations in the Village of Mastic Beach. The County provided their GIS database of drainage inlets and structures within the William Floyd Parkway right-of-way along with record plans of the Parkway. The drainage system for William Floyd Parkway is a self-contained drainage system and captures stormwater runoff within the existing right-of-way. Given that stormwater runoff is contained by the County system, it was determined that further review of this drainage system was not warranted in this report.

The information compiled from the Village, Town and County sources was utilized in developing two preliminary maps which are included in Appendix A. A summary memorandum, for Phase 1-Data Collection and Review dated December 15, 2015, is also included in this appendix. It details the references and sources of information utilized in compiling both maps and includes an Infrastructure Survey Map dated November 25, 2015 and Infrastructure Inventory Map dated December 14, 2015. The Infrastructure Survey Map shows the approximate location of piped drainage systems and was developed to assist field survey crews in locating and providing detailed topographic mapping of existing drainage systems within the study area. The Infrastructure Inventory Map includes the locations of all drainage structures, piping, outfalls, recharge basins, mosquito ditches, Town and County owned land, and NY Rising buyout program properties.

The topographic mapping of the existing drainage systems located and identified 453 storm drain structures with the study area. In addition, invert elevations and pipe diameters were obtained for approximately 26,000 linear feet of piping. Supplemental investigations were performed on 50 storm structures which were not accessible or were full of debris or water. For these structures, a contractor with a vacuum truck was utilized to remove debris or water, so that information could be obtained on

confirming pipe locations, pipe diameter and invert elevations. Appendix B includes an overall existing drainage system map and location map of specific drainage systems. The maps show the system features with structure number and rim elevation overlaid on aerial maps. The location of the drainage systems has also been mapped in Appendix B. Survey data summary tables are also provided in this appendix which details information collected on existing storm structures and pipes.

In Table III-1, each drainage system location has been assigned an alpha-numeric designation (e.g., DS-1) and the street it is located on. A few systems have been listed as non-applicable (n/a) either because the system could not be field verified or was deemed to be too small (e.g.,single structure,pipe) to model.

Existing Drainage Systems	
Location	Description
DS-01	Grandview Drive from Seymour Drive south
DS-02	Intersection of Grandview Drive and Lombardy Drive
DS-03	Kent Drive to Pinetree Drive
DS-04	Seymour Drive to Pinetree Drive
DS-05	Pinetree Drive (includes 5A,5B & 5C) from Westminster Drive to Lombardy Drive
DS-06	Manor Drive from William Floyd Parkway east
DS-07	Intersection of Abby Lane and Trafalgar Drive
DS-08	Heathcote Court (n/a)
DS-09	Lyndale Court (n/a)
DS-10	Johns Neck Creek (n/a)
DS-11	Intersection of Gooseberry Road and Maywood Drive
DS-12	Maywood Drive (includes 12A & 12B)
DS-13	Hickory Road and Laurelton Drive (includes 13A & 13B)
DS-14	Riviera Drive from Bluepoint Road to Bellport Road
DS-15	Riviera Drive near 706 Riveria Drive
DS-16	Intersection of Riviera Drive and Montauk Drive
DS-17	Intersection of Iris Road and Floral Court
DS-18	Hickory Road between Hempstead Road and Montauk Drive
DS-19	Diana Drive (n/a)
DS-20	Hickory Road from Cranberry Drive to Riveria Drive
DS-21	Intersection of Moriches Drive and Gooseberry Road
DS-22	Forest Road West from Diana Drive to Riveria Drive
DS-23	Intersection of Elm Road West and Hemlock Drive
DS-24	Neighborhood Road from Commack Road to West Drive (includes 24A & 24B)
DS-25	Mastic Road from Commack Rd to Washington Avenue (includes 25A & 25B)
DS-26	Intersection of Queen Road with Woodland Drive and Washington Drive
DS-27	Riviera Drive and Dahlia Drive (n/a)
DS-28	Intersection of Elm Road East and Cypress Drive
DS-29	Riviera Drive from Elm Rd south(includes 29A & 29B)
DS-30	Lincoln Drive and Narcissus Rd (n/a)
DS-31	King Road from Lincoln Drive to Park Drive

DS-32	Oceanview Drive (includes 32A & 32B)

Table III-1. Existing Drainage System Locations

The field survey work also included collecting information on storm system outfalls. A location map for these outfall structures are shown in Appendix C.

B. Known Flooding Locations

Specific locations where flooding occurred in the study area were provided by both the Village of Mastic Beach and Town of Brookhaven during meetings on September 11, 2015, and January 21, 2016, with DASNY and GOSR. A field visit of known flooding locations was conducted with the Village on April 28, 2016. In addition, input was solicited from the NYRCR Mastic Beach-Smith Point of Shirley Committee during the outreach meeting on January 21, 2016. Following this meeting, both the Village and Town were notified that preliminary drainage system maps presented at the outreach meeting were available for inspection and comment by the public and Committee members. Public comments made were transmitted by email to H2M, and reviewed.

Additional site visits were made to the study area on May 6 and July 7, 2016, after heavy rainfall events. On May 6, 2016, site conditions were observed after a 0.68-inch rainfall occurred over a 6-hour period. The area had received 1.23 inches of rainfall over a 5-day period leading up to May 6. On July 7 conditions were observed after a 0.96-inch rainfall had occurred over a 4-hour period. Each of these visits provided an opportunity to document areas where additional flooding had occurred.

Based on the input and observations referenced above, a listing was compiled of specific locations of known flooding in the study area. The locations have been assigned an alpha-numeric designation based on whether the area of flooding was located in the vicinity of Smith Point (e.g.,SP-1) of Shirley or Mastic Beach (e.g.,MB-1). Tables III-2 and III-3 below provide the location identification for areas of known flooding within the study area. The locations where reoccurring flooding occurs have been mapped out in Appendix D.

Smith Point of Shirley Flooding Locations	
Location	Description
SP-1	East side of Grandview Drive at southern end of road
SP-2	East side of Grandview Drive between Peters Drive and Kent Drive
SP-3	41 Kent Drive
SP-4	Intersection of Grandview Drive and Seymour Drive
SP-5	Lombardy Drive near houses #19, #20 and #21
SP-6	Lombardy Drive near house #53
SP-7	Intersection of Lombardy Drive and Pinetree Drive
SP-8	Lombardy Drive near house #108
SP-9	Stretch of St. George Drive West across from house #23
SP-10	Stretch of St. George Drive West near houses #77, #78 and #79

SP-11	Stretch of St. George Drive West between houses #90, #93, #96 and #110

Table III-2. Smith Point of Shirley Known Flooding Locations

Mastic Beach Flooding Locations	
Location	Description
MB-1	South end of Waverly Road
MB-2	South end of Hampton Road
MB-3	Intersection of Neighborhood Road and Commack Road
MB-4	Intersection of Lynbrook Road and Dogwood Road
MB-5	277 Dogwood Road West
MB-6	Intersection of Ducky Lane and Dogwood Road West (n/a)
MB-7	123 Maywood Road
MB-8	Two existing recharge basins on Diana Drive
MB-9	464 Riviera Drive – Intersection of Riviera Drive and Forest Road W.
MB-10	Intersection of Gooseberry Road and Maywood Road
MB-11	Intersection of Hickory Road and Lynbrook Road
MB-12	Laurelton Drive south of Hickory Road
MB-13	Gooseberry Road near house #106
MB-14	115 Hickory Road including Huntington Drive from Hickory Road to Astoria Road
MB-15	105 – 109 Hickory Road
MB-16	17 Bayport Road
MB-17	22 Blue Point Road, north of Riviera Drive
MB-18	17 Bellport Road, north of Bayside Road
MB-19	36 Huntington Drive
MB-20	713 Riviera Drive, between Bellport Road and Manhasset Drive
MB-21	Riviera Drive, between Montauk Drive and Floral Court
MB-22	Intersection of Cranberry Drive and Iris Road
MB-23	7 Gooseberry Road – Intersection of Bayview Drive and Gooseberry Road
MB-24	Quail Road - Intersection of Riviera Drive and Quail Road
MB-25	Intersection of Riviera Drive and Rosewood Road
MB-26	Intersection of Riviera Drive and Hickory Road
MB-27	50 Knapp Road
MB-28	35 Barclay Road
MB-29	Elm Road, between Hemlock Drive and Daisy Drive
MB-30	Southern end of Hemlock Drive
MB-31	Intersection of Dahlia Drive and Riviera Drive
MB-32	Dogwood Road, between Lakeview Drive and Orchid Drive
MB-33	Mastic Road between Riverside Avenue and Meadowmere Avenue
MB-34	Wavecrest Drive, between Houses #12 and #16
MB-35	Oceanview Drive between Wavecrest Drive and Spar Drive

Table III-3. Mastic Beach Known Flooding Locations

A more detailed description of the known flooding conditions along with recommendations is described in Section IV.

C. Methodology

In preparing the hydrologic and hydraulic evaluation for the existing drainage system located, available 2-foot and 5-foot elevation contour data in conjunction with 2013 aerial imagery, was utilized in developing topographic base mapping. This allowed general watershed boundaries to be delineated for the existing drainage systems. Utilizing GPS and conventional surveying techniques, the major portions of the existing drainage infrastructure were mapped and associated attribute data collected into a GIS database. The surveyed drainage pipe network systems within the GIS database were then utilized as the framework to develop various computer models using Bentley's GIS-based SewerGEMS software for the individual watersheds.

The United States Soil Conservation Service (SCS) Method was then utilized to calculate peak runoff rates for various storm frequencies. For this evaluation, a computer model was developed for each drainage system within the study area and used to evaluate the capacity of the existing drainage systems to discharge runoff. Since most of the outfalls within the study area are subject to tidal influences, each system was modeled under MHHW (tailwater) conditions. Our evaluation of the drainage systems is based on data published by the Northeast Regional Climate Center (NRCC) for Nassau County for a 10-year, 24-hour storm event, which is a 5.3-inch rain event.

The tributary area for each watershed modeled in this study was initially determined to encompass that area which would theoretically drain to each of the piped drainage system based on topography. However, in the process of calibrating our models, it was evident based on preliminary runs that smaller tributary areas were draining to these systems, because of the extremely flat topography and soil conditions. It was determined that a considerable amount of surface runoff was being retained in flat and depression storage areas which don't necessarily appear on topographic maps.

Drywell structures were not factored into the stormwater model, as these structures are primarily stand-alone systems which are not connected to the existing piped drainage systems evaluated in this report.

D. Stormwater Mitigation Strategies

Land form uses, characteristics and attributes provide opportunities and constraints which must be considered when developing strategies to mitigate stormwater flooding. Some of these features for the study area include flat topography, shallow groundwater, moderately well drained soils, and frontage along a coastal shoreline. In addition, existing infrastructure and how it functions must also be evaluated to assess what can be done to improve, modify or replace existing stormwater infrastructure to make it more resilient while mitigating flooding.

Given the typical types of flooding problems which occur within the Mastic Beach-Smith Point of Shirley area, the following strategies were considered in Table III-4:

Stormwater Mitigation Strategies		
Strategy	Benefits	Challenges
Utilizing public land for stormwater storage	• Can provide storage for stormwater runoff in areas where high groundwater exists and no available existing drainage infrastructure to connect to • Less utility conflicts than constructing within right of way	• Objections by adjoining property owners of clearing the lot for stormwater management purposes • Obtaining approval to utilize lot by public entity • Determine whether there are covenants and restrictions on the property which restrict stormwater improvements
Install check valves on outfalls	• Protects low-lying inland areas from flooding during high tides	• Periodic maintenance required to prevent fouling of device
Implement drainage reserve areas	• Can provide storage for stormwater runoff in areas where high groundwater exists and no existing drainage infrastructure to connect to	• Land acquisition costs if on private property • Additional lead time to negotiate and obtain permission and easement from private property owner
Modifying existing recharge basin to detention structure	• Can provide additional storage of storm water runoff • Can relieve burden on downstream drainage systems • Provides water quality improvement to downstream waters	• Limited increase in storage capacity due to shallow groundwater
Regrading of roadways	• Can provide additional hydraulic gradient to move water through existing drainage infrastructure • Provides additional protection against water backup up through existing drainage systems during abnormally high tides	• Existing development can limit the amount the road can be raised • Potential for stormwater to back up onto private property without positive overflow within right-of-way • Inconvenience to the public for street access during construction
Install pump stations	• Can potentially evacuate large quantities of storm water runoff and prevent flooding	• High cost to construct • High cost to maintain • Requires standby generator in the event of a power outage, which is likely during a coastal storm
Bioretention	• Remove sediments and contaminants • Natural treatment of stormwater	• Not suitable in shallow groundwater areas • Requires more periodic and skilled maintenance

Stormwater Mitigation Strategies		
Strategy	Benefits	Challenges
Replacing existing pipes which are undersized, set at hydraulically inefficient elevation or are damaged	• Improves pipe conveyance capacity • Reduces head loss in pipe flow which reduces flooding.	• Moderate construction cost, for limited sections of pipe runs, however, cost can be very high if entire systems are replaced
Install drywells	• Can provide small to moderate storage of storm water runoff	• High ground water elevations throughout the study area limit their effectiveness
Install horizontal leaching chambers	• Can provide small to moderate storage of storm water runoff • Can provide similar improvements as drywells but can be installed in areas with shallow groundwater • Can be installed within the existing Town-owned right-of-way	• Existing utilities may limit the quantity of chambers that can be installed
Hydrodynamic separators	• Remove sediments and other pollutants • Small footprint area	• Routine scheduled maintenance required to maintain performance
Vacuum and removal of sediment and debris in pipes and structures which are tidally influenced	• Improves conveyance of stormwater	• Cost associated with disposal of debris to an approved landfill • Maintenance on annual basis or after major storm events
Establish a more targeted maintenance program on mosquito ditches with SCDPW Vector Control	• No cost to Village or Town	• New ditches cannot be created • Maintenance in ditches is limited to hand labor

Table III-4. Stormwater Flooding Mitigation Strategies

Many of these strategies as outlined will be referred to and described in more detail within Section IV. Some of these strategies will be used independently while others will be used in combination depending on the type of flooding issue.

One of the strategies not mentioned was the raising of roads within the study. The evaluation of raising roads was a separate project identified in the Mastic Beach and Smith Point of Shirley – NY Rising Community Reconstruction (NYRCR) Plan dated March 2014. This future project will include an engineering feasibility study analysis of coastal flood projection for the Mastic-Shirley peninsula. The analysis would evaluate costs, potential benefits, challenges and best location for elevated roadway and berms upland of the wetlands to protects homes in the moderate to extreme risk flood areas.

Presently, road raising is being recommended as an alternative for portions of Mastic Beach by the U.S. Army Corps of Engineers (USACE) in the Fire Island to Montauk Point Reformation Study, Draft General Reevaluation Report dated July 2016. Specifically, approximately 10,500 ft (1.98 mi.) of the perimeter

roads along the peninsula between Johns Neck Creek and Pattersquash Creek is an alternative proposed for road raising as shown in Figure III-1. This alternative would also include non-structural improvements to building structures not protected by raised roads. The following roads would be raised:

- Forest Road West from Hackensack Road to Maywood Road
- Maywood Drive from Forest Road to Gooseberry Road
- Gooseberry Road from Maywood Road to Lynbrook Drive
- Lynbrook Drive from Gooseberry Road to Hickory Road
- Hickory Road from Lynbrook Drive to Laurelton Drive
- Laurelton Drive from Hickory Road to Riviera Drive
- Riviera Drive from Laurelton Drive to Floral Court
- Iris Road from Floral Court to Cranberry Drive
- Cranberry Drive from Iris Road to Hickory Road
- Hickory Road from Cranberry Drive to Riviera Drive
- Riviera Drive from Hickory Road to King Road
- Ducky Lane from King Road to Dogwood Road

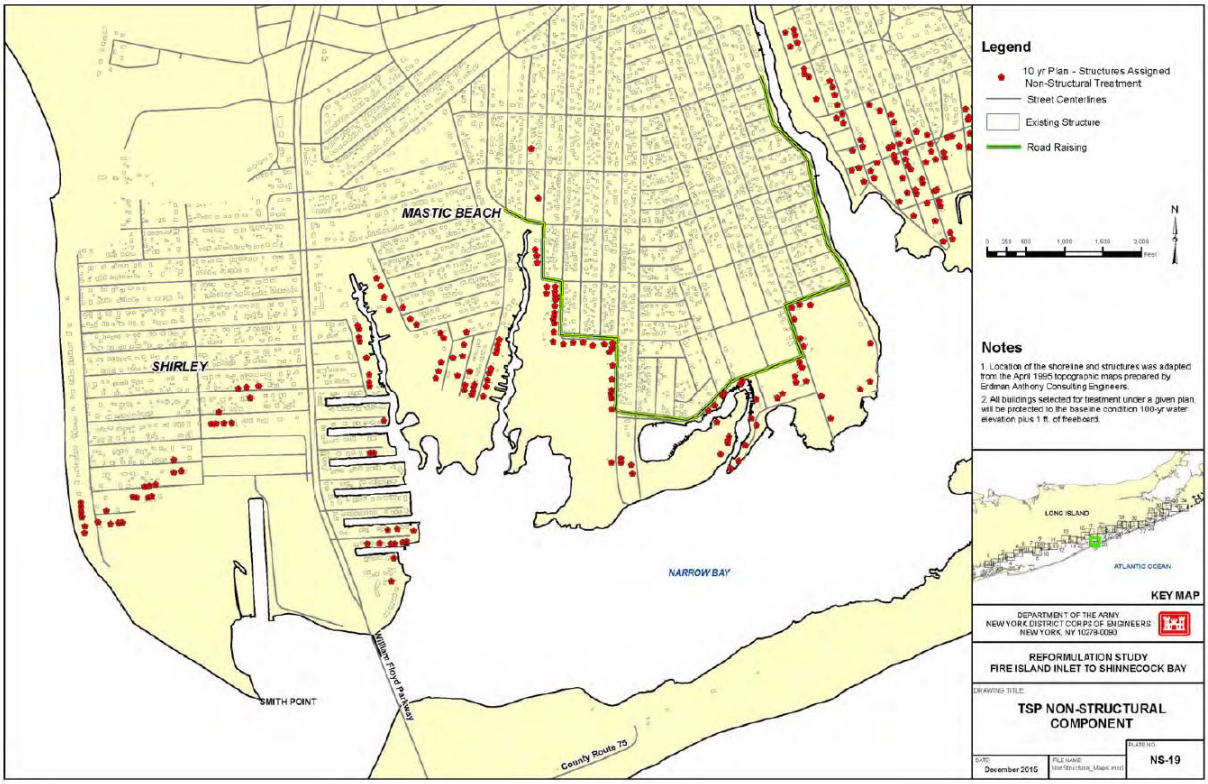

Figure III-1. USACE Proposed Road Raising Alternative in Mastic Beach Location Map

USACE identified 7 foot (NGVD29) as the optimum road crest elevation that would provide protection against still water flooding from the 100-yr storm for 355 structures. The cost for this project, which would include drainage improvements for the roadway and areas upland of the roadway, is estimated

at $3.95 million. The proposed alternative would reduce damage to property and enhance public safety. The projected timeline for this project proposes engineering design and pre-construction between 2018 and 2020, with construction beginning in late 2018.

Recommendations in this report for those areas which might be impacted by a potential USACE road raising project will be identified in the priority ranking of projects. Consideration should be given to deferring projects outlined in this report which would be impacted by the road raising project should it go forward.

E. Green Infrastructure

Green infrastructure (GI) was considered for the study area, and incorporated where feasible in select locations utilizing infiltration measures such as drywells and horizontal leaching chambers. NYSDEC recognizes drywells as an acceptable GI measure that provides infiltration of stormwater and meets the water quality volume treatment objectives as referenced in the State's Stormwater Management Design Manual. However, the vegetative component of GI (bioretention) was not proposed at any locations due to physical constraints and conditions that were unique to the study area. These constraints included extremely flat topography, shallow groundwater levels, flood plain areas and the prevalence of residential on-site sanitary systems located throughout the study area.

When determining whether vegetative GI could be utilized, the following design criteria was considered. The constraint or condition which generally exists within the study area follows the criteria listed.

- Design Criteria: The preferred slopes for vegetative GI are greater than 1% and less than 5%.
    - Site Constraint: Many of the areas which experience flooding within the study area have slopes of 1% or less.
- Design Criteria: The preferred groundwater separation distance for vegetative GI is 1-2 ft.
    - Site Constraint: Many of the locations, where recommendations are proposed, have a very shallow groundwater depth ranging from 1-2 ft. However, when considering the vertical cross section of a bioretention facility, which includes the ponding and filter media depths, the minimum groundwater depth would need to range from 36-48 inches.
- Design Criteria: The preferred location of GI is outside the 100-year floodplain limits.
    - Site Constraint: For this study, approximately 34% of the study area is within the 100-year floodplain limit. The majority of the improvement recommendations are located within the 100-year floodplain limit.
- Design Criteria: The preferred location of GI should be a minimum of 50 ft from an on-site sanitary disposal system.
    - Site Constraint: The study area is predominantly comprised of single-family residences on small lots, which have an on-site sanitary system. There are approximately 6,400 building structures and over 4,200 households in the study area, which translates to a significant number of on-site sewage disposal systems, as no public sewer exists within

the study area. Given the sheer number of these sanitary systems, which are typically located in the front yard of properties, the recommended horizontal distance between GI and the sanitary systems are likely unachievable.

Given the conditions and constraints of the study area relative to the GI design criteria, vegetative GI measures were not incorporated into the drainage infrastructure recommendations presented in Section IV.

F. Environmental Permitting

Several of the stormwater flooding mitigation recommendations outlined in this report may be selected as a project to be funded for design and construction. For those projects selected, environmental permitting will require further review during the design phase to determine if they are required. Given the proximity of the study areas to tidal and freshwater wetlands, the following permits may be required from the NYSDEC, New York Department of State (NYSDOS) and USACE:

Environmental Permitting		
Permit	Coverage Required	Typical Types of Projects
NYSDEC Article 24-Freshwater Wetlands Permit	Improvement work within 100-ft of a regulated wetland adjacent area	Pipe replacement utilizing public land for stormwater storage, regrading of roads, horizontal leaching chambers
NYSDEC Article 25-Tidal Wetlands Permit	Improvement work within 300-ft of a regulated wetland adjacent area	Outfall improvements, check valves, pipe replacement, regrading of roads, pump station, horizontal leaching chambers, hydrodynamic separators
NYSDOS Coastal Consistency	Required when USACE permit required	Outfalls, check valves, pipe replacement
USACE Nationwide Permit	Improvement work within waters of the United States	Outfalls, check valves, pipe replacement

Table III-5. Environmental Permitting

Since a portion of the study area is within the Town of Brookhaven, certain projects may require a Town wetlands permit and coastal erosion management permit application. The Village of Mastic Beach is not known to have a Village wetlands permit, but would require a project applicant to obtain the applicable state and federal permits for work within regulated wetlands areas.

IV. RECOMMENDATIONS FOR DRAINAGE INFRASTRUCTURE PROBLEM AREAS

As identified in Section III, there are numerous locations throughout the study area where there are known flooding conditions based on stakeholder comments from the NYRCR Mastic Beach-Smith Point of Shirley Committee, Village of Mastic Beach, Town of Brookhaven, and the community. Field observations were conducted at these locations and other areas identified by the stakeholders. There were other locations throughout the study area where existing piped drainage systems were determined to have inadequate pipe capacity based on a stormwater modeling analysis which showed that sections of these piped systems were not adequately sized to convey a 10-year storm event.

Section IV describes in more detail localized flooding and existing pipe capacity conveyance problems along with recommendations to mitigate flooding and improve drainage system pipe flow. The sections below have been organized geographically for Smith Point of Shirley and Mastic Beach. The last section covers existing piped drainage systems throughout the entire study area.

For each location presented in Section IV, the existing condition summary narrative and graphics are presented on the left side of the report (even numbered pages) and the recommendation narrative and graphics are show on the right side of the report (odd numbered pages) which improves the overall readability of this section. For locations where narrative extends beyond one page, the narrative continues to pages that follow on the respective side as previously described.

A Locations in Smith Point of Shirley

1. SP-01 – East Side of Grandview Drive at Southern End of Road

Existing Condition:

Grandview Drive runs in a north-south direction along the western edge of the Smith Point section of the study area. This stretch of roadway is relatively flat and ponding occurs in an isolated low area along the east side of the roadway at the southern end of the road. Currently, there are no drainage structures along the east side of the road, but an existing drainage system runs south-to-north along the west side of Grandview Drive at this location (Drainage System DS-01). This system outlets at a structure in the bay across from the intersection of Grandview Drive and Kent Drive.

The elevation at this stretch of roadway is approximately 2.0 feet above sea level.

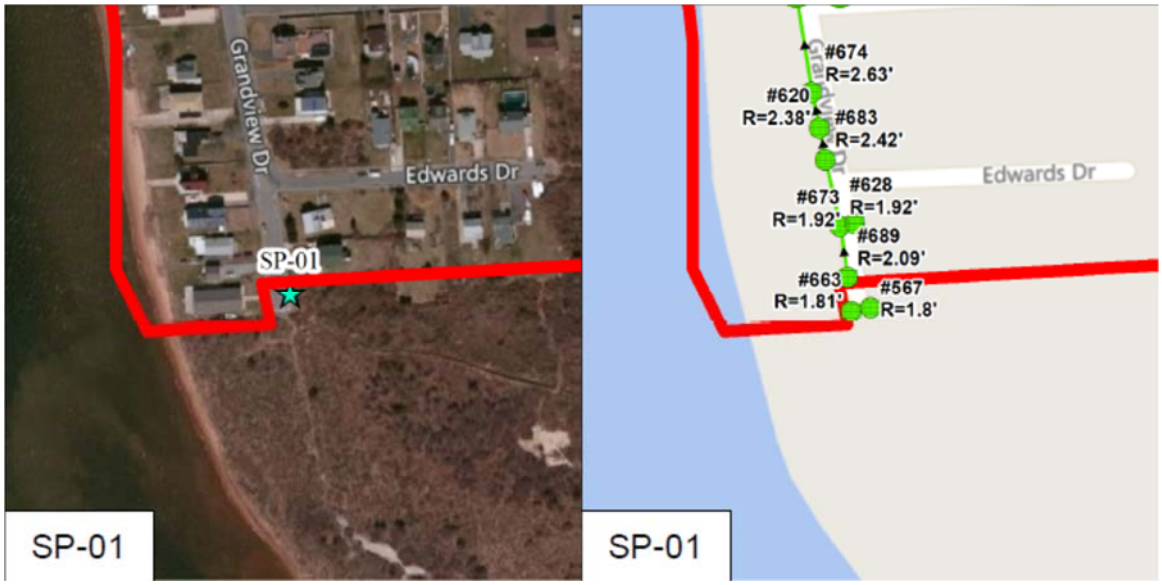

Figure IV-1. Aerial Location Map and Schematic Roadway Map

1. SP-01 – East Side of Grandview Drive at Southern End of Road

Recommended Solution:

The recommended solution is to install one concrete catch basin at the low point on the east side of the roadway, and a 12" diameter cross-pipe connecting the recommended drywell with the nearest Drainage System DS-01 catch basin (#689) located on the west side of Grandview Drive.

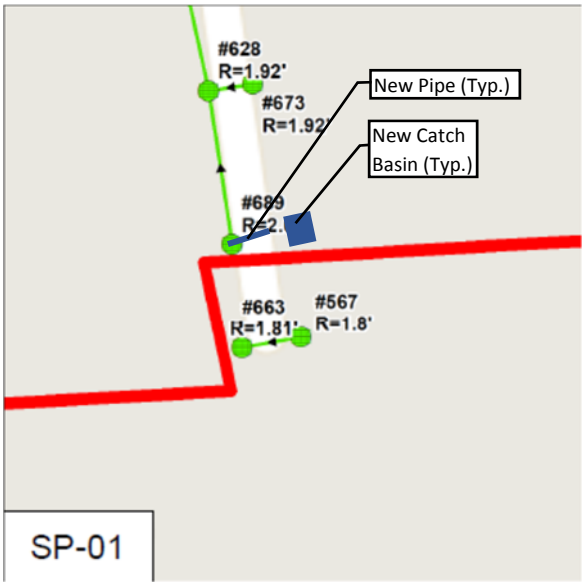

Figure IV-2. Recommended Improvements Map

2. SP-02 – East Side of Grandview Drive between Peters Drive and Kent Drive

Existing Condition:

Grandview Drive runs in a north-south direction along the western edge of the Smith Point section of the study area. This stretch of roadway is relatively flat and minor ponding occurs in an isolated low area along the east side of the roadway. Currently, there are no drainage structures along the east side of the road, but an existing drainage system runs south-to-north along the west side of Grandview Drive at this location (Drainage System DS-01). This system outlets at a structure in the bay across from the intersection of Grandview Drive and Kent Drive.

The elevation at this stretch of roadway is approximately 2.5 feet above sea level.

Figure IV-3. Aerial Location Map and Schematic Roadway Map

2. SP-02 – East Side of Grandview Drive between Peters Drive and Kent Drive

Recommended Solution:

The recommended solution is to install one concrete catch basin at the low point on the east side of the roadway, and a 12" diameter cross-pipe connecting the recommended catch basin with Drainage System DS-01 located on the west side of Grandview Drive. A doghouse manhole should be installed at the connection point to allow future access for maintenance and inspection purposes.

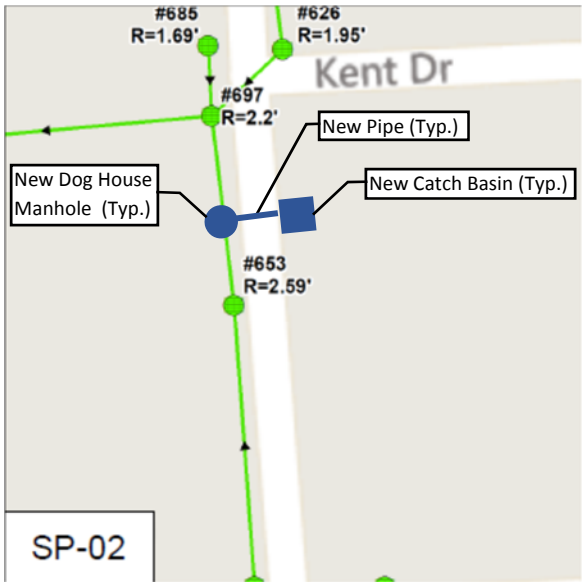

Figure IV-4. Recommended Improvements Map

3. SP-03 – Kent Drive

Existing Condition:

Kent Drive runs in an east-west direction in the southwestern corner of the Smith Point section of the study area, and is bounded by Grandview Drive on the west and Pinetree Drive on the east. This stretch of roadway is relatively flat and ponding occurs along the north side of the road, closest to house #41. Currently, a series of existing drywells are spaced at intervals along the north side of the road, and a conveyance system consisting of drainage structures and pipes runs west-to-east along the south (Drainage System 03). The frame and grate of the drywell nearest to house #41 (structure #546) appears to be in need of repair.

The elevation at this stretch of roadway is approximately 3.0 feet above sea level.

Figure IV-5. Aerial Location Map and Schematic Roadway Map

3. SP-03 – Kent Drive

Recommended Solution:

The existing drainage structure in this area (#546) should be cleaned to remove any debris and sediment that have accumulated over time and inspected to ensure it remains in good working condition. Repairs should be made to the drainage structure, as necessary, and the existing frame and grate should be replaced. Additionally, a 12" diameter cross-pipe is to be installed to connect structure #546 with Drainage System 03 on the south side of Kent Drive. A doghouse manhole should be installed at the connection point to allow future access for maintenance and inspection purposes.

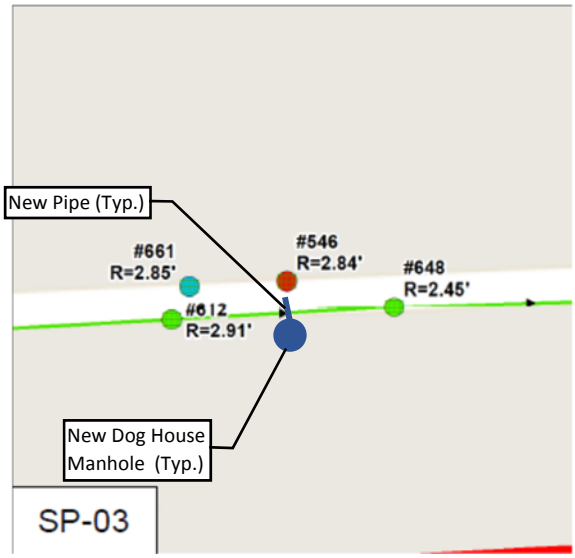

Figure IV-6. Recommended Improvements Map

4. SP-04 – Intersection of Grandview Drive and Seymour Drive

Existing Condition:

Grandview Drive runs in a north-south direction along the western edge of the Smith Point section of the study area, and is intersected by Seymour Drive on the easterly side of the roadway. Although there are existing isolated drainage structures at the northeast and southeast corners of this intersection, ponding has been observed at these locations.

The elevation at this intersection is approximately 2.0 feet above sea level.

Figure IV-7. Aerial Location Map and Schematic Roadway Map

4. SP-04 – Intersection of Grandview Drive and Seymour Drive

Recommended Solution:

The existing drainage structures in this area should be cleaned to remove any debris and sediment that have accumulated over time and inspected to ensure they remain in good working condition. Repairs should be made to the drainage structures, as necessary

The recommended solution is to install a 12" diameter cross-pipe connecting the existing structures at the corners of the intersection (#514 and #670), and a 12" diameter pipe connecting the structure at the southeast corner of the intersection (#670) with the nearest Drainage System DS-01 catch basin (#624) located on the east side of Grandview Drive.

In addition, a 15'-wide section of pavement, centered on the existing drainage structures should be sawcut, removed and replaced to full-depth. The pavement should be sloped to ensure positive drainage to the grates of the existing drainage structures.

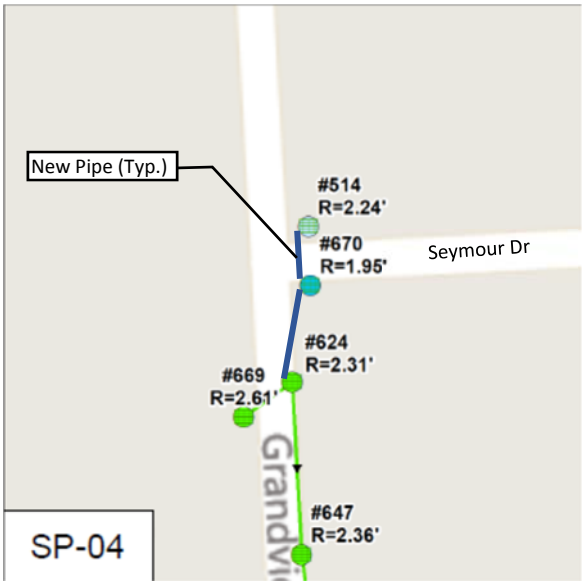

Figure IV-8. Recommended Improvements Map

5. SP-05 – Lombardy Drive near Houses #19, #20 and #21

Existing Condition:

Lombardy Drive runs in an east-west direction in the southwestern corner of the Smith Point section of the study area, and is bounded by Grandview Drive on the west and the William Floyd Parkway on the east. Lombardy Drive is bisected by Pinetree Drive. This stretch of roadway to the west of Pinetree Drive is relatively flat, and ponding occurs over the top of existing drywells along both the north and the south side of the road (one at each location). Ponding occurs in the vicinity of house #19 and house #21 on the north side, and house #20 on the south side of the road. Existing Drainage System DS-02 is located approximately 350 feet to the west of this location, near the intersection of Lombardy Drive and Grandview Drive.

The elevation at this stretch of roadway is approximately 3.0 feet above sea level.

Figure IV-9. Aerial Location Map and Schematic Roadway Map

5. SP-05 – Lombardy Drive near Houses #19, #20 and #21

Recommended Solution:

The existing drainage structures in this area should be cleaned to remove any debris and sediment that have accumulated over time and inspected to ensure they remain in good working condition. Repairs should be made to the drainage structures, as necessary.

The recommendation is to install a 12" diameter cross-pipe connecting the existing drainage structures on the north and south sides of the road with one another. Additionally, 12" diameter pipe should be installed to connect the existing structure on the north side of the street with existing structure #554, which is part of Drainage System DS-02.

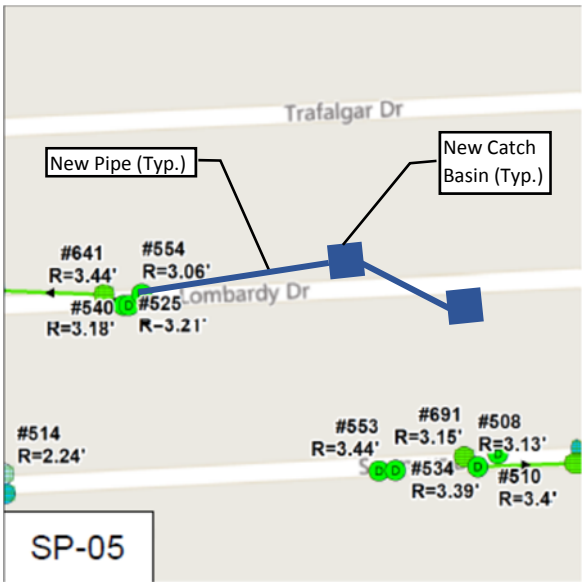

Figure IV-10. Recommended Improvements Map

6. SP-06 – Lombardy Drive near House # 53

Existing Condition:

Lombardy Drive runs in an east-west direction in the southwestern corner of the Smith Point section of the study area, and is bounded by Grandview Drive on the west and the William Floyd Parkway on the east. This stretch of roadway, which is located approximately 75 feet to the west of the intersection with Pinetree Drive is relatively flat and ponding occurs over the top of an existing drywell near house #53 along the north side of the road. It appears that the existing drywell is not positioned at the low point in the roadway. Existing Drainage System DS-05 runs north-south along Pinetree Drive, which is approximately 50 feet east of this location.

The elevation at this stretch of roadway is approximately 4.0 feet above sea level.

Figure IV-11. Aerial Location Map and Schematic Roadway Map

6. SP-06 – Lombardy Drive near House # 53

Recommended Solution:

The existing drainage structures in this area should be cleaned to remove any debris and sediment that have accumulated over time and inspected to ensure they remain in good working condition. Repairs should be made to the drainage structures, as necessary.

The recommended solution is to install one concrete catch basin at the low point of the roadway, as well as a 12" diameter drainage pipe connecting the recommended catch basin with the existing structure #621 within Drainage System DS-05.

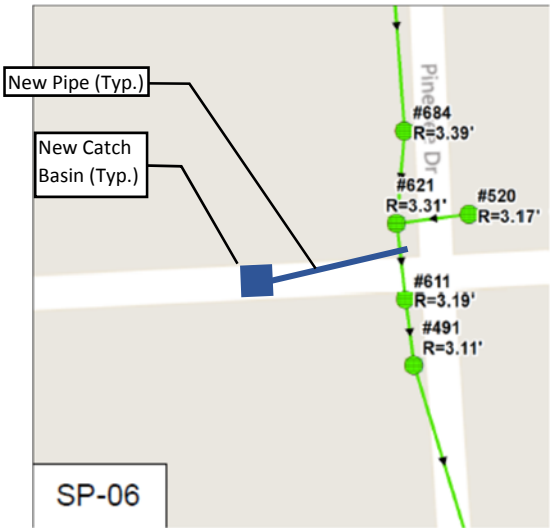

Figure IV-12. Recommended Improvements Map

7. SP-07 – Intersection of Lombardy Drive and Pinetree Drive

Existing Condition:

Lombardy Drive runs in a north-south direction along the central portion of the Smith Point section of the study area, and bisects most of the roads running east-west in this area. Existing drainage structures are present at the northeast, northwest, and southwest corners of this intersection, and are part of a drainage conveyance system, DS-05, that runs in a north-to-south direction and discharges into a shallow channel at the southern end of Pinetree Drive, where it intersects with Kent Drive.

No drainage structure is currently present at the southeast corner of the Lombardy Drive / Pinetree Drive intersection, and ponding as well as pavement deterioration stretching to the south on Pinetree Drive were observed at this location.

The elevation at this intersection is approximately 3.0 feet above sea level.

Figure IV-13. Aerial Location Map and Schematic Roadway Map

7. SP-07 – Intersection of Lombardy Drive and Pinetree Drive

Recommended Solution:

The recommended solution is to install one concrete catch basin at the low point on the southeast corner of the intersection, and a 12" diameter cross-pipe connecting the recommended drainage structure with an existing inlet, structure #611, located on the west side of Pinetree Drive.

In addition, a 15'-wide section of pavement, centered on the recommended drainage structure should be sawcut, removed and replaced to full-depth. The pavement should be sloped to ensure positive drainage to the grates of the existing and new drainage structures.

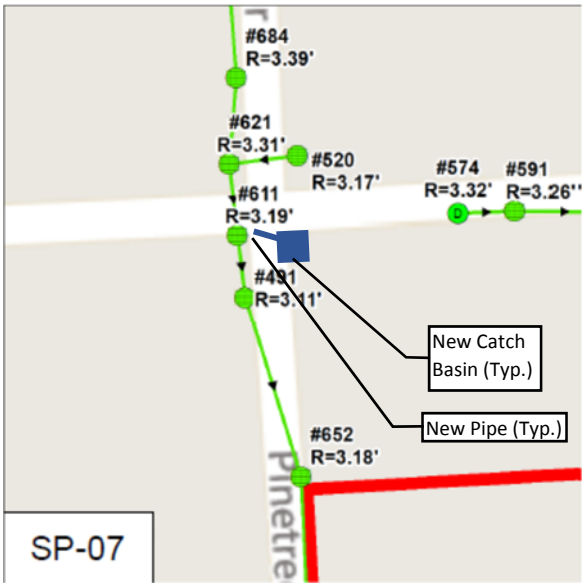

Figure IV-14. Recommended Improvements Map

8. SP-08 – Lombardy Drive near House # 108

Existing Condition:

Lombardy Drive runs in an east-west direction in the southwestern corner of the Smith Point section of the study area, and is bounded by Grandview Drive on the west and the William Floyd Parkway on the east. Lombardy Drive is bisected by Pinetree Drive. This stretch of roadway to the east of Pinetree Drive is relatively flat and ponding occurs along the south side of the road. No drainage structures were observed within this ponding area.

The elevation at this stretch of roadway is approximately 3.5 feet above sea level.

The drainage area tributary to this location is comprised of 2.22 acres of 1/8 to 1/4-acre residential properties, and would generate approximately 6,400 cf of storm runoff during the 90th percentile, 24-hour storm event.

Figure IV-15. Aerial Location Map and Schematic Roadway Map

8. SP-08 – Lombardy Drive near House # 108

Recommended Solution:

The recommended solution is to install new catch basins at existing low points on both the north and south side of the roadway. To help store and infiltrate the storm runoff volume generated by the drainage area tributary to this location, it is recommended that a series of approximately 20 (total) low-profile, underground linear leaching chambers are installed along both the north and south side of the roadway. The leaching chambers should be used to connect the new drainage structures on each side of the roadway, and a 12" diameter cross-pipe should be used to connect the systems.

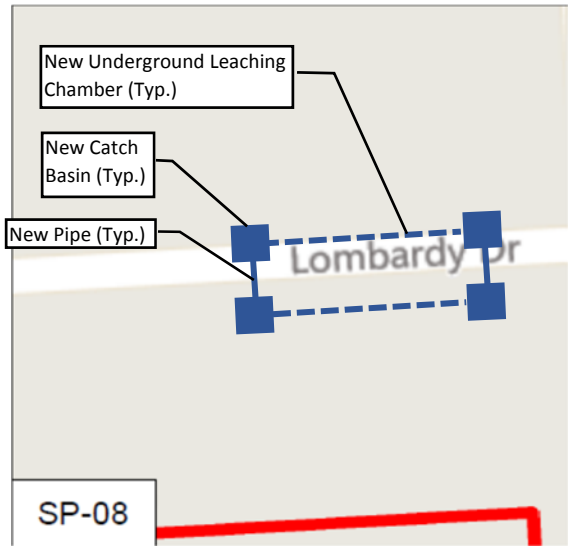

Figure IV-16. Recommended Improvements Map

9. SP-09 – Stretch of St George Drive West across from House # 23

Existing Condition:

St. George Drive West runs in an east-west direction across Smith Point section of the study area. This stretch of roadway is relatively flat and ponding occurs over the top of an existing drainage structure located on the south side of the road across from house # 23.

The elevation at this stretch of roadway is approximately 3.7 feet above sea level.

The drainage area tributary to this location is comprised of 3.20 acres of ¼-acre residential properties, and would generate approximately 9,240 cf of storm runoff during the 90th percentile, 24-hour storm event.

Figure IV-17. Aerial Location Map and Schematic Roadway Map

9. SP-09 – Stretch of St George Drive West across from House # 23

Recommended Solution:

The existing drainage structure in this area should be cleaned to remove any debris and sediment that have accumulated over time, and inspected to ensure it remains in good working condition. Repairs should be made to the drainage structures as necessary.

The recommended solution is to install new catch basins at existing low points on both the north and south side of the roadway. To help store and infiltrate the storm runoff volume generated by the drainage area tributary to this location, it is recommended that a series of approximately 30 (total) low-profile, underground linear leaching chambers are installed along both the north and south side of the roadway. The leaching chambers can be used to connect the new drainage structures to the existing drainage structures at this location.

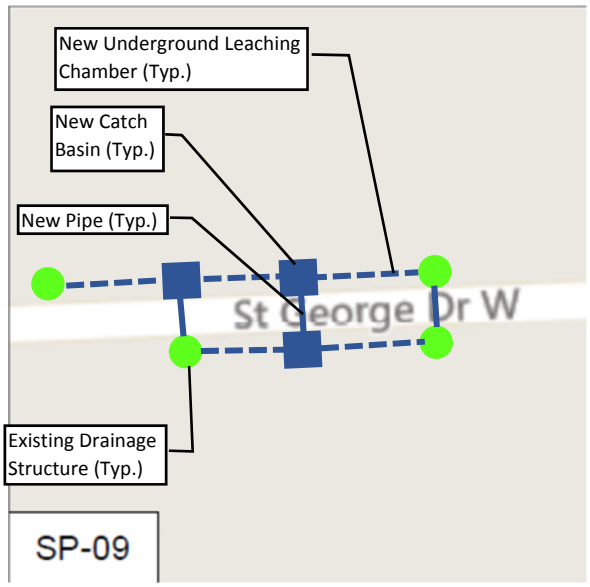

Figure IV-18. Recommended Improvements Map

10. SP-10 – Stretch of St. George Drive West near Houses #77, #78 and #79

Refer to SP-11 summary on pages 46 - 47.

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11. SP-11 – Stretch of St. George Drive West between Houses #90, #93, #96 and #110

Existing Condition:

St. George Drive West runs in an east-west direction across Smith Point section of the study area. This stretch of roadway acts as a local low point in the road and minor ponding occurs over the top of existing drainage structures located on both the north and the south side of the road. Approximately 17 drainage structures were observed on the north side, and 9 drainage structures were observed on the south side of this stretch of roadway.

The elevation at this stretch of roadway is approximately 3.7 feet above sea level.

The drainage area tributary to this location is comprised of 5.38 acres of 1/8 to ¼-acre residential properties, and would generate approximately 15,560 cf of storm runoff during the 90th percentile, 24-hour storm event.

Figure IV-19. Aerial Location Map and Schematic Roadway Map

11. SP-11 – Stretch of St. George Drive West between Houses #90, #93, #96 and #110

Recommended Solution:

The existing drainage structures in this area should be cleaned to remove any debris and sediment that have accumulated over time and inspected to ensure they remain in good working condition. Repairs should be made to the drainage structures as necessary.

To help store and infiltrate the storm runoff volume generated by the drainage area tributary to this location, it is recommended that a series of approximately 50 low-profile, underground linear leaching chambers be installed along the north side of the roadway. The leaching chambers can be used to connect the existing drainage structures on that side of the road, and the remaining existing structures can be tied into the leaching chamber system with 12" diameter drainage pipe.

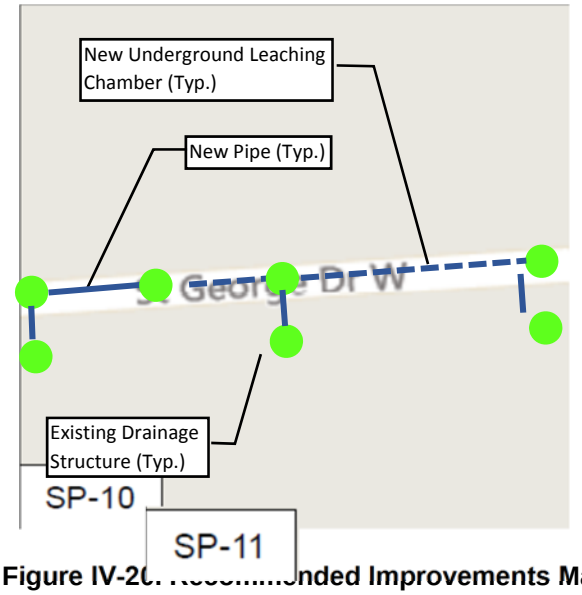

Figure IV-20. Recommended Improvements Map

B Locations in Mastic Beach

1. MB-01 - South End of Waverly Road

Existing Condition:

Waverly Road is located near the southern end of the Mastic Beach portion of the study area, in a low-lying area northeast of the Johns Neck Creek State conservation area. The road is relatively flat, but is sloped to drain in a north-to-south direction. There are currently no drainage structures located along this road, and ponding has been observed near the southern end of the roadway during storm events.

The elevation at this stretch of roadway falls within the range of 2.0 - 3.0 feet above sea level.

Figure IV-21. Aerial Location Map and Schematic Roadway Map

1. MB-01 - South End of Waverly Road

Recommended Solution:

The recommended solution is to regrade and re-pave Waverly Road, incorporating a crown and sloping the road at approximately 0.5% from its intersection with Livingston Drive to its southern end. Low-profile concrete curb and gutter can be installed along both sides of the roadway to convey runoff, and the right-of-way beyond southern end of the roadway can be cleared and re-graded to allow runoff to drain into a small drainage reserve area.

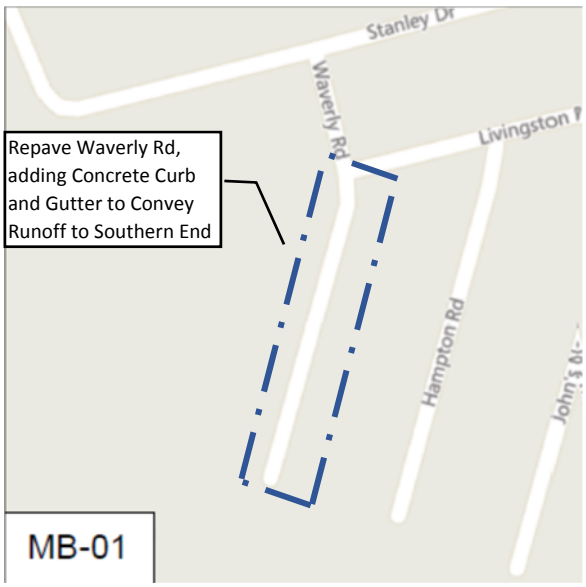

Figure IV-22. Recommended Improvements Map

2. MB-02 - South End of Hampton Road

Existing Condition:

Hampton Road is located near the southern end of the Mastic Beach portion of the study area, in a low-lying area northeast of the Johns Neck Creek State conservation area. The road is relatively flat, but is sloped to drain in a north-to-south direction. There are currently no drainage structures located along this road, and ponding has been observed near the southern end of the roadway during storm events.

The elevation at this stretch of roadway falls within the range of 2.5 - 4.5 feet above sea level.

Figure IV-23. Aerial Location Map and Schematic Roadway Map

2. MB-02 - South End of Hampton Road

Recommended Solution:

The recommended solution is to regrade and re-pave Hampton Road, incorporating a crown and sloping the road at approximately 0.5% from its intersection with Livingston Drive to its southern end. Low-profile concrete curb and gutter can be installed along both sides of the roadway to convey runoff, and the right-of-way beyond southern end of the roadway can be cleared and re-graded to allow runoff to drain into a small drainage reserve area.

Figure IV-24. Recommended Improvements Map

3. MB-03 – Intersection of Neighborhood Road and Commack Road

Existing Condition:

This area of ponding occurs at the northeast corner of the intersection of Neighborhood Road and Commack Road in the north-central region of the study area. This stretch of roadway is relatively flat and minor ponding occurs over the top of the existing catch basin at this location. Village personnel have indicated that an outlet pipe connecting to the south side of this structure may be collapsed, but this information could not be verified via survey.

The elevation at this stretch of roadway is approximately 14.0 feet above sea level.

Figure IV-25. Aerial Location Map and Schematic Roadway Map

3. MB-03 – Intersection of Neighborhood Road and Commack Road

Recommended Solution:

A televised inspection of the outlet pipe is recommended to determine if a drainage pipe connects the existing catch basin with another drainage system located near the curb line south of Neighborhood Road. This inspection would indicate the extent of damage within the existing pipe, and if a repair is possible or if the pipe should be replaced.

In addition, the existing drainage structure and downstream pipe should be cleaned to remove any debris and sediment that have accumulated over time, and inspected to ensure it remains in good working condition. Repairs should be made to the drainage structure as necessary.

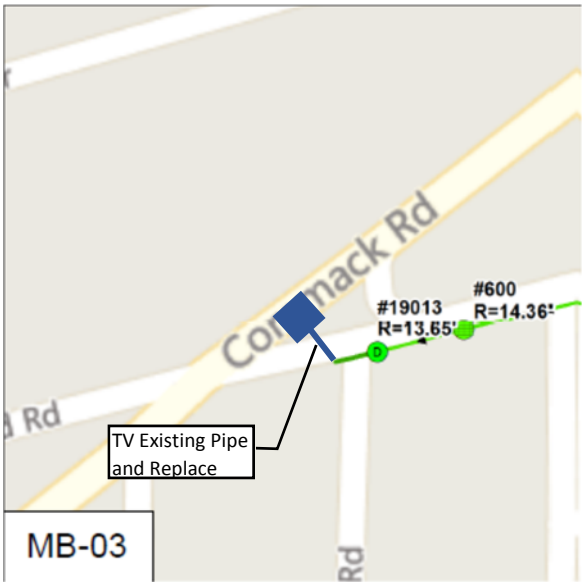

Figure IV-26. Recommended Improvements Map

4. MB-04 – Intersection of Lynbrook Road and Dogwood Road

Existing Condition:

Minor ponding occurs at the southeast corner of the intersection of Lynbrook Road and Dogwood Road in the central region of the study area. This intersection is located within a low point of the local drainage watershed, and minor ponding occurs over the top of the existing drainage structures located at the corners, which are part of a larger drainage system.

The elevation at this stretch of roadway is approximately 8.0 feet above sea level.

Figure IV-27. Aerial Location Map and Schematic Roadway Map

4. MB-04 – Intersection of Lynbrook Road and Dogwood Road

Recommended Solution:

The recommended solution is to install one 5'-deep, 10'-diameter concrete drainage drywell at the southeast corner of the intersection.

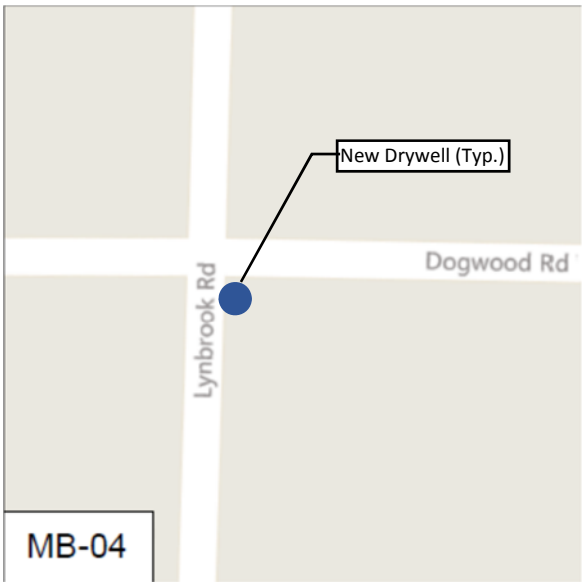

Figure IV-28. Recommended Improvements Map

5. MB-05 – 277 Dogwood Road West

Existing Condition:

Dogwood Road West runs in an east-west direction across the central portion of the study area and is bound by Johns Neck Road on the west and Ducky Lane/Riviera Drive on the west. This drainage issue was observed near house #277, at the northwestern corner of the intersection with Riviera Drive. This stretch of roadway is relatively flat and a low point has developed along the road's edge where a residential driveway and the adjacent road shoulder have deteriorated on the north side of the road. An existing drainage structure was observed in the vicinity, but appears to not be located at the low point

The elevation at this location is approximately 3.0 feet above sea level.

Figure IV-29. Aerial Location Map and Schematic Roadway Map

5. MB-05 – 277 Dogwood Road West

Recommended Solution:

The existing drainage structure in this area should be cleaned to remove any debris and sediment that have accumulated over time, and inspected to ensure it remains in good working condition. Repairs should be made to the drainage structure as necessary.

To effectively remove the low spot within the right-of-way, it is recommended that a 20'-long by 14'-wide section of pavement (approximately half the width of the roadway), along the property frontage should be sawcut, removed and replaced to full-depth. The pavement should be sloped to ensure positive drainage to the existing drainage structure.

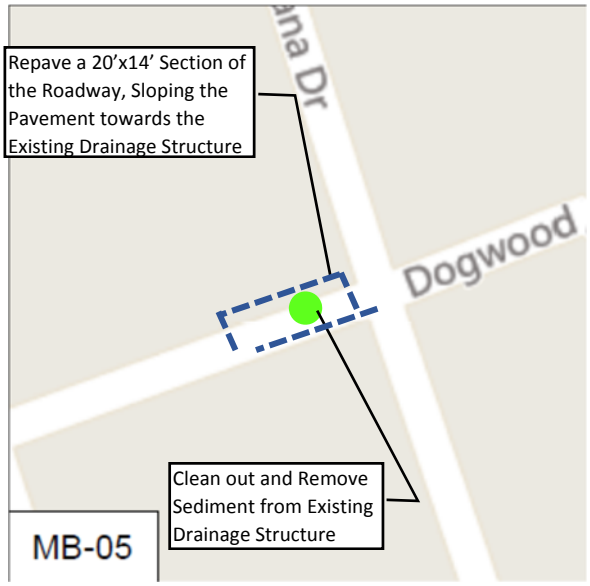

Figure IV-30. Recommended Improvements Map

6. MB-07 – 123 Maywood Road

Existing Condition:

Ponding occurs along the east side of Maywood Road, adjacent to house #123 near the midway point between Forest Road W and Elm Road West. A timber curb, possibly constructed by the homeowner, separates the roadway from the catch basin at the low point of the right-of-way and prevents runoff from properly draining.

The elevation at this stretch of roadway is approximately 3.1 feet above sea level.

Figure IV-31. Aerial Location Map and Schematic Roadway Map

6. MB-07 – 123 Maywood Road

Recommended Solution:

Modify the existing timber curb to re-establish a route for runoff to leave the roadway and enter the drainage structure via overland flow.

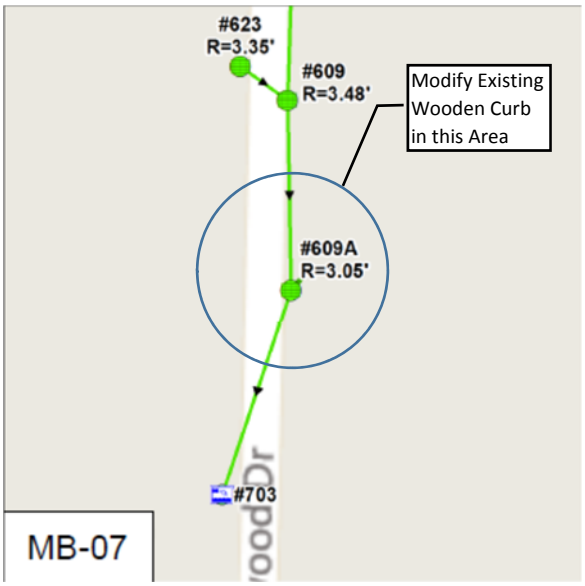

Figure IV-32. Recommended Improvements Map

7. MB-08 - Two Existing Recharge Basins on Diana Drive

Existing Condition:

Two recharge basins are located on the west side of Diana Drive in the Mastic Beach portion of the study area. One basin is located at the northwest corner of the Diana Drive / Forest Road West intersection (South Basin), and the other basin is situated on a vacant lot approximately 350 feet to the north (North Basin). Both basins are overgrown with brush, and ponding at the Diana Drive / Forest Road West intersection has been observed during storm events.

The recharge basins are intended to serve as overflow storage for the existing drainage system located in Diana Drive and Forest Road (Drainage System DS-22) by providing additional capacity and opportunity for infiltration during storm events. DS-22 runs predominantly in a west-to-east direction along Forest Road West, beginning at the intersection with Diana Drive and discharges into Pattersquash Creek. A pipe connecting the South Basin to Structure #313 serves as the overflow pipe from System 22. Although the overflow pipe could not be located in the field, a similar overflow pipe connects DS-22 to the North Basin.

The elevation at this stretch of roadway falls within the range of 2.5 - 4.5 feet above sea level.

Figure IV-33. Aerial Location Map and Schematic Roadway Map

7. MB-08 - Two Existing Recharge Basins on Diana Drive

Recommended Solution:

A televised inspection of the drainage system is recommended where the above-referenced pipe connections could not be established to verify the condition of the pipe, and if repairs should be made or new pipe connections should be established.

It is recommended that the brush is cleared and removed from both basins, and that the basins are re-graded to increase storage capacity. The structures and pipes of Drainage System DS-22 should be cleaned to remove any debris and sediment that have accumulated over time, and inspected to ensure it remains in good working condition. Repairs should be made to the drainage system as necessary.

For the North Basin, a televised inspection of the existing pipe system is recommended. The inspection should investigate the pipes connecting the basin with adjacent drainage structures, as well as of the drainage pipe connecting the North Basin to structure # 089 (of DS-22) to verify the condition of the system and to determine if pipes should be repaired or replaced. Pipes should be pitched to drain into the recharge basin so that it fills to capacity before overflowing back into the downstream pipe system. If necessary, new drainage pipe should be installed to ensure that the outfall from the North Basin is connected to structure #089.

For the South Basin, the recommended solution is to create an additional overflow into the basin by installing a pair of catch basins on opposite sides of the road on Diana Drive, near the intersection with Forest Road. The new catch basin on the west side of Diana Drive should be installed in line with the existing pipe system. Install a new 12" diameter cross-pipe between the new inlets, and a new 12" diameter pipe connecting the system to the South Basin. Pipes should be pitched to drain into the recharge basin so that it fills to capacity before overflowing back into the downstream pipe system.

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7. MB-08 - Two Existing Recharge Basins on Diana Drive (cont.)

Recommended Solution:

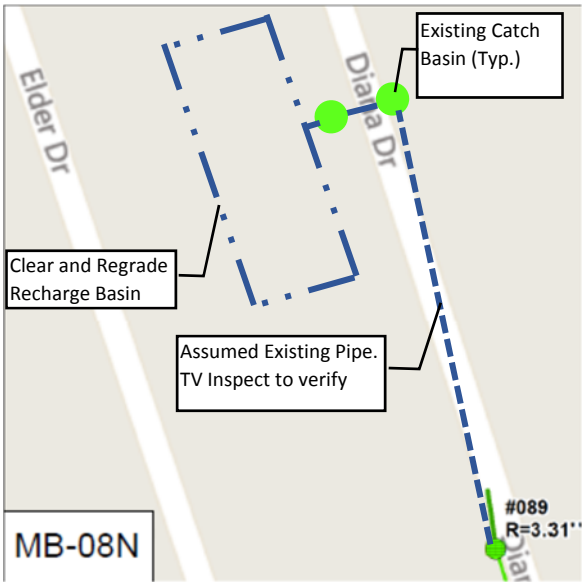

Figure IV-34A. Recommended Improvements Map (North Basin)

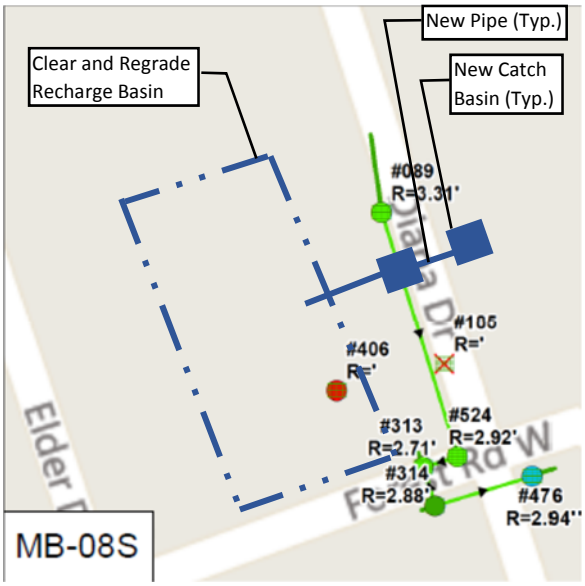

Figure IV-34B. Recommended Improvements Map (South Basin)

8. MB-09 – 464 Riviera Drive – Intersection of Riviera Drive and Forest Road W.

Existing Condition:

Riviera Drive runs in an east-west direction within the north-central portion of the study area. This stretch of roadway is relatively flat and a low point has developed within the right of way where a residential driveway and the adjacent road shoulder have deteriorated on the north side of the road. An existing drainage structure is located approximately 10 feet northeast, but up-gradient, of the ponding area.

Due to its relatively flat longitudinal slope, shallow depth to groundwater, and close proximity to Pattersquash Creek, Riviera Drive is frequently subject to flooding during both storm and tidal events. In addition to the intersection with Forest Road, drainage issues were observed where Riviera Drive intersects each of the following roads: Quail Road (MB-24); Rosewood Road (MB-25); and Hickory Road (MB-26).

The elevation at this stretch of roadway is approximately 2.0 feet above sea level.

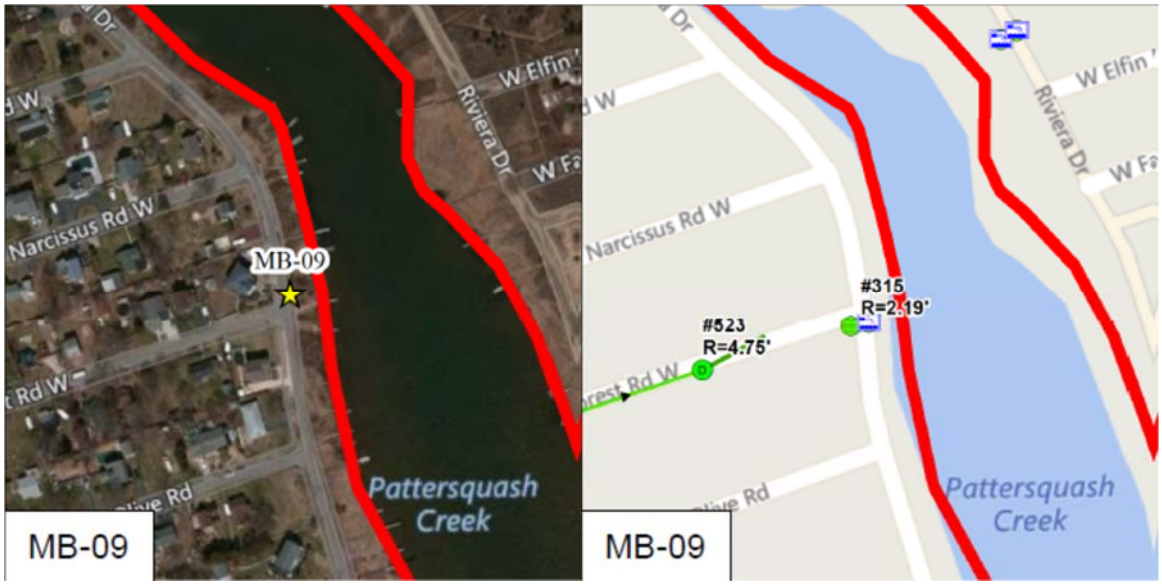

Figure IV-35. Aerial Location Map and Schematic Roadway Map

8. MB-09 – 464 Riviera Drive – Intersection of Riviera Drive and Forest Road W.

Recommended Solution:

Due to the shallow depth to groundwater and the close proximity of Riviera Drive to Pattersquash Creek, it would be difficult to completely eliminate the potential for flooding or ponding in the area without raising the roadway. See Section III.D regarding additional information on other road raising projects. It is possible to minimize the length of time that water remains on the roadway, however, by re-grading the roadway and incorporating additional drainage structures. To do so, it is recommended that drainage structures be installed where Riviera Drive intersects with adjacent roadways. These new drainage structures should be connected to the existing systems located along Forest Road or Hickory Road via drainage pipe. The stretch of Riviera Drive between Forest Road and Hickory Road should regraded to drain to existing and proposed drainage structures, and a crown should be incorporated along the centerline. These improvements would help reduce the length of time that flooding is present along Riviera Drive and where it intersects Forest Road (MB-09), Quail Road (MB-24), Rosewood Road (MB-25) and Hickory Road (MB-26).

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8. MB-09 – 464 Riviera Drive – Intersection of Riviera Drive and Forest Road W. (cont.)

Recommended Solution:

Figure IV-36. Recommended Improvements Map

9. MB-10 – Intersection of Gooseberry Road and Maywood Road

Existing Condition:

Extensive ponding occurs at the northeast and southeast corners of the intersection of Gooseberry Road and Maywood Road in the central region of the study area. This intersection is located within a low point of the local drainage watershed, and minor ponding occurs over the top of the existing drainage structures located at the corners, which are part of a larger drainage system (DS-11). Village personnel have indicated that an outlet pipe running west from the drainage structure at the southeast corner of the intersection may have collapsed and no longer serves as an effective outfall for the system, but this information could not be verified via field survey.

The elevation at this stretch of roadway is approximately 2.3 feet above sea level.

Figure IV-37. Aerial Location Map and Schematic Roadway Map

9. MB-10 – Intersection of Gooseberry Road and Maywood Road

Recommended Solution:

A televised inspection of the outlet pipe is recommended to verify the condition of the outlet pipe, and if it should be repaired or replaced.

It is recommended that the existing drainage system is cleaned to remove any debris and sediment that have accumulated over time, and inspected to ensure it remains in good working condition. Repairs should be made to the drainage system as necessary.

A drainage analysis of existing drainage system DS-11 indicates that the system is currently undersized. Increasing the size of the pipes within this system would serve to improve its conveyance capacity and effectively reduce the potential for flooding in this area. Refer to the DS-11, intersection of Gooseberry Road and Maywood Drive section of the report for additional information.

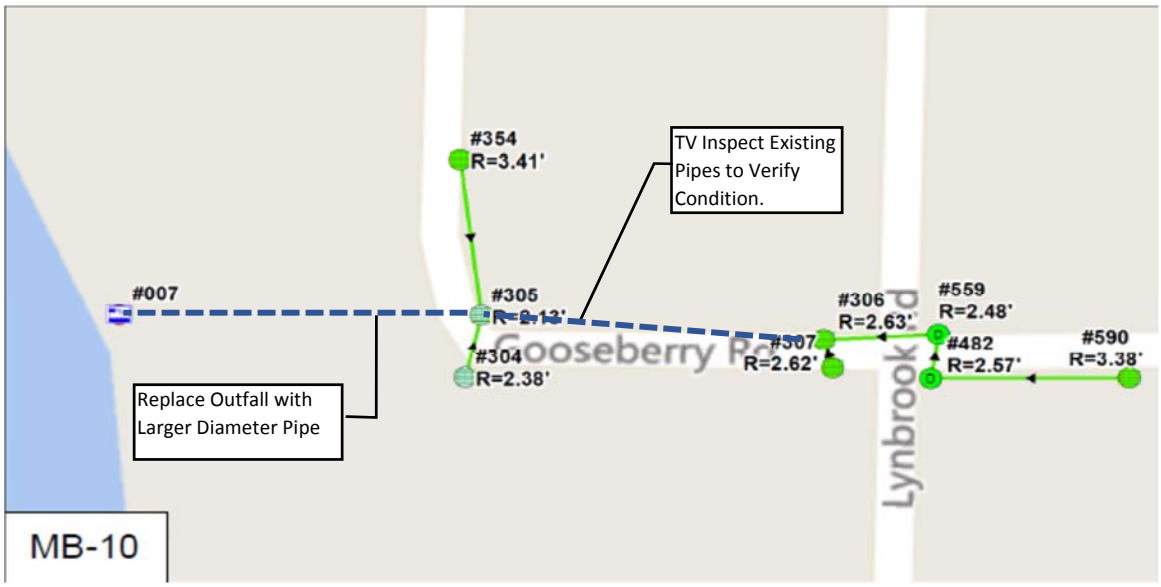

Figure IV-38. Recommended Improvements Map

10. MB-11 – Intersection of Hickory Road and Lynbrook Road

Existing Condition:

Extensive ponding occurs at the intersection of Hickory Road and Lynbrook Road in the central region of the study area. Ponding stretches across the entire width of the low-lying roadway on both the north and south sides of the intersection. No drainage structures were observed at the intersection, although one isolated drywell was located on the west side of the roadway to the north of the intersection and the upstream end of an existing drainage system is located at the intersection of Hickory Road and Woodside Road (DS-13).

The elevation at this stretch of roadway is approximately 2.5 feet above sea level.

Figure IV-39. Aerial Location Map and Schematic Roadway Map

10. MB-11 – Intersection of Hickory Road and Lynbrook Road

Recommended Solution:

The recommended solution is to install catch basins and drainage pipe at the intersection and northward on Lynbrook Road, and connect the series of new catch basins to existing structure #366 of downstream drainage system DS-13.

Since the shallow depth to groundwater in this area minimizes the effectiveness of underground linear leaching chamber systems, it is recommended that a series of catch basins are installed at low points and intersections in this area, and are connected via drainage pipe to the existing drainage system located along Hickory Road (DS-13). Refer to the DS-13, Hickory Road and Laurelton Drive section of the report for additional recommendations to mitigate roadway ponding in this portion of the study area.

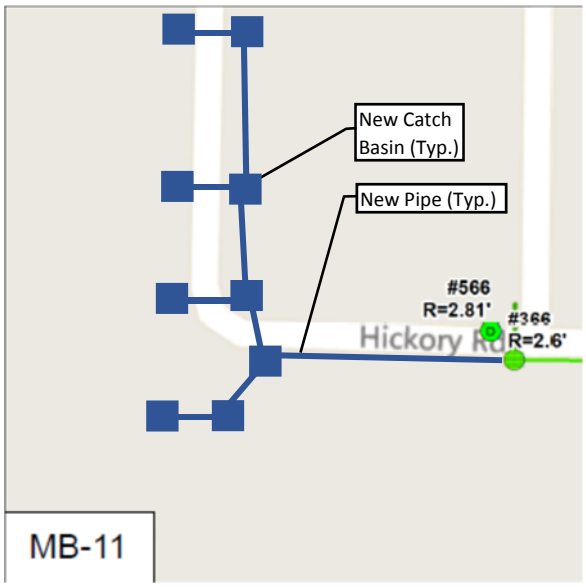

Figure IV-40. Recommended Improvements Map

11. MB-12 – Laurelton Drive South of Hickory Road

Existing Condition:

Minor ponding was observed on both the east and west sides of Laurelton Drive, stretching from Hickory Road south toward Riviera Drive. Existing drainage structures along the roadway do not appear to be located at low points. Widespread alligator cracking and potholes exist near the edge of pavement along this stretch of the roadway.

The elevation at this stretch of roadway is approximately 2.0 feet above sea level.

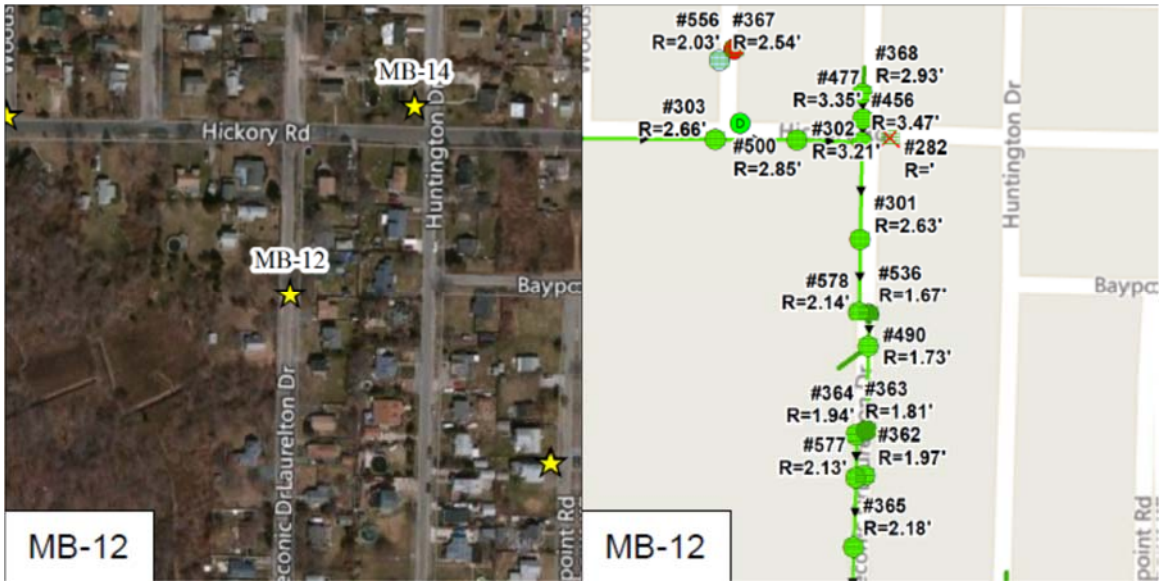

Figure IV-41. Aerial Location Map and Schematic Roadway Map

11. MB-12 – Laurelton Drive South of Hickory Road

Recommended Solution:

It is recommended that the entire length of Laurelton Drive from Hickory Road to Riviera Drive is removed and replaced to full-depth. The pavement should be sloped to ensure positive drainage to the grates of the existing drainage system.

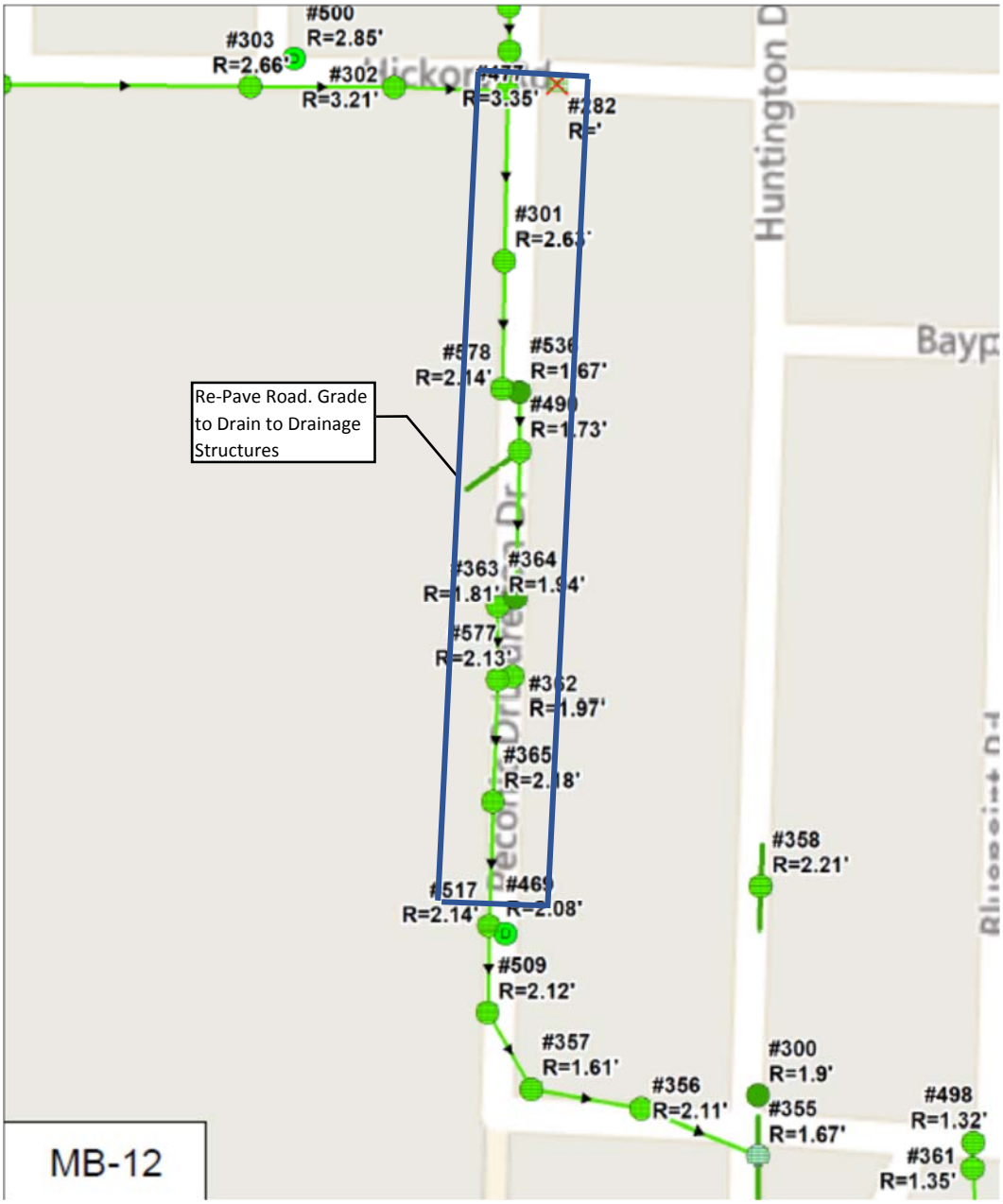

Figure IV-42. Recommended Improvements Map

12. MB-13 – Gooseberry Road near House # 106

Existing Condition:

Minor ponding occurs on Gooseberry Road, near house #106 approximately at the midway point between Laurelton Drive and Huntington Drive. The area of ponding is estimated to be approximately 20 feet in length and stretches across the width of the entire roadway. No drainage structures were observed to be in the area.

The elevation at this stretch of roadway is approximately 4.0 feet above sea level.

The drainage area tributary to this location is comprised of 0.77 acres of ¼-acre residential properties, and would generate approximately 2,200 cf of storm runoff during the 90th percentile, 24-hour storm event.

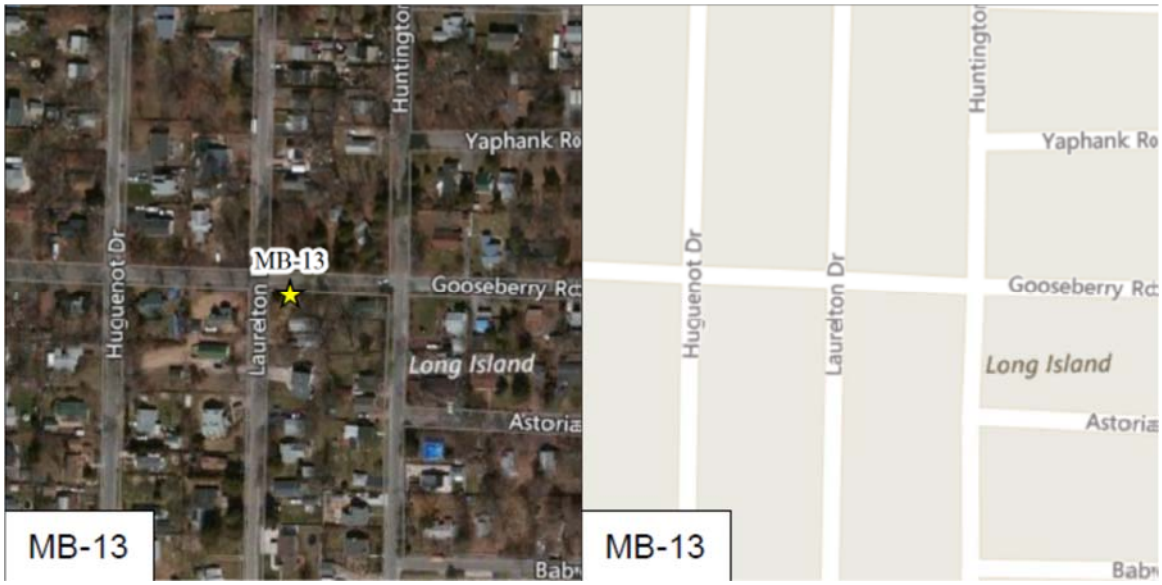

Figure IV-43. Aerial Location Map and Schematic Roadway Map

12. MB-13 – Gooseberry Road near House # 106

Recommended Solution:

The recommended solution is to install new catch basins at existing low points on both the north and south side of the roadway. To help store and infiltrate the storm runoff volume generated by the drainage area tributary to this location, it is recommended that a series of approximately 8 (total) low-profile, underground linear leaching chambers are installed along between catch basins. A 12" diameter cross-pipe should be installed to connect the drainage systems on opposite sides of the road.

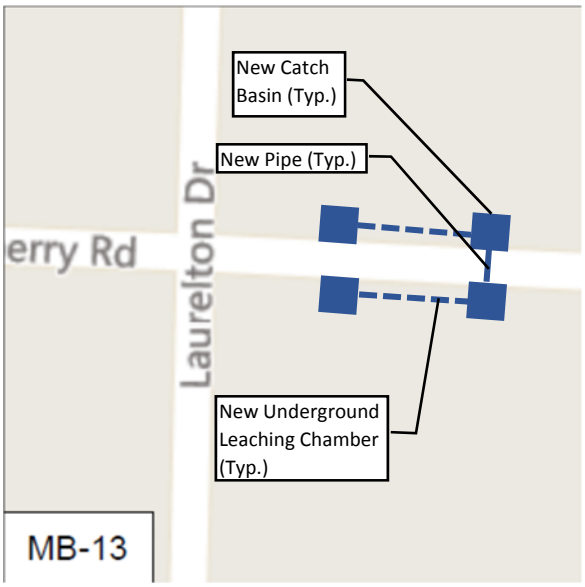

Figure IV-44. Recommended Improvements Map

13. MB-14 – 115 Hickory Road including Huntington Drive from Hickory Road to Astoria Road

Existing Condition:

Extensive ponding was observed along the western side of Huntington Drive, extending approximately 300 feet northward from the intersection with Hickory Road in the central Mastic Beach section of the study area. Two drainage structures located on the west side of Huntington Drive were observed to be inundated with water in this area.

In addition, ponding occurs at both the northeast and southeast corners of the intersection of Astoria Road and Huntington Drive. Water was observed overtopping the existing drainage structure at the northeast corner of the intersection. No other drainage structures were located at this intersection.

The elevation at this stretch of roadway is approximately 3.0 – 4.0 feet above sea level.

The drainage area tributary to this location is comprised of 2.22 acres of 1/8 to ¼-acre residential properties, and would generate approximately 6,400 cf of storm runoff during the 90th percentile, 24-hour storm event.

Figure IV-45. Aerial Location Map and Schematic Roadway Map

13. MB-14 – 115 Hickory Road including Huntington Drive from Hickory Road to Astoria Road

Recommended Solution:

The recommended solution is to install a series of catch basins at low points along the east side of Huntington Drive, as well as at the intersections with Hickory Road, Babylon Road, and Astoria Road. To help store and infiltrate the storm runoff volume generated by the drainage area tributary to this location, it is recommended that a series of approximately 22 (total) low-profile, underground linear leaching chambers are installed to connect new catch basins with existing drainage structures along the east side of Huntington Drive between Hickory Road and Babylon Road. 12" diameter drainage pipe can be used to tie in other new catch basins to the underground linear leaching chamber system.

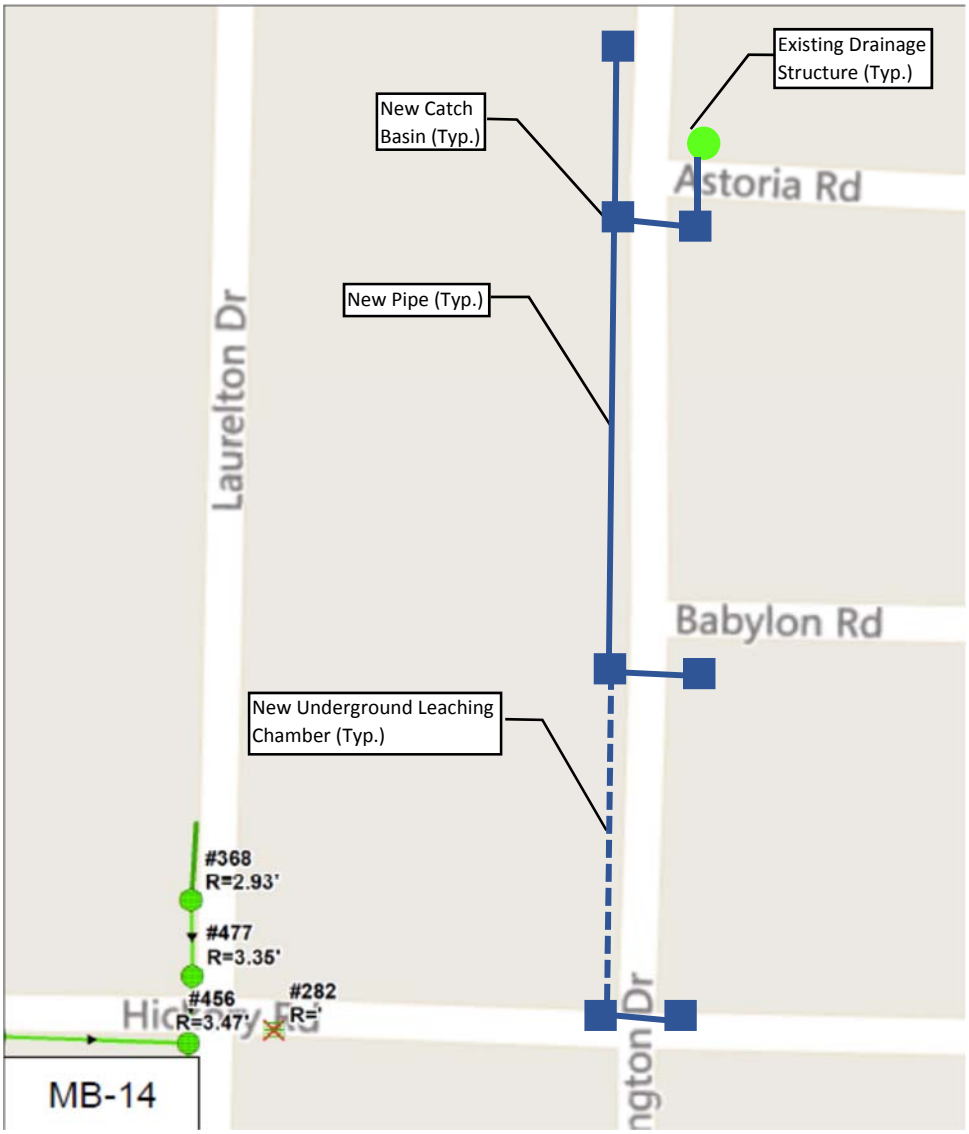

Figure IV-46. Recommended Improvements Map

14. MB-15 – 105 – 109 Hickory Road

Existing Condition:

Hickory Road runs in an east-west direction in the central region of the study area. This stretch of roadway between houses #105 and #109 is relatively flat and minor ponding occurs on the north side of the road. No drainage structures were observed on the north side of the road, but an existing drainage system runs along the south side.

The elevation at this stretch of roadway is approximately 2.0 feet above sea level.

Figure IV-47. Aerial Location Map and Schematic Roadway Map

14. MB-15 – 105 – 109 Hickory Road

Recommended Solution:

It is recommended that the existing drainage system on the south side of Hickory Road is cleaned to remove any debris and sediment that have accumulated over time, and inspected to ensure it remains in good working condition. Repairs should be made to the drainage system as necessary.

The recommended solution is to install two catch basins at low points on the north side of the roadway, as well as a 12"-diameter cross-pipe connecting the recommended catch basin with the existing catch basin located on the south side of the roadway.

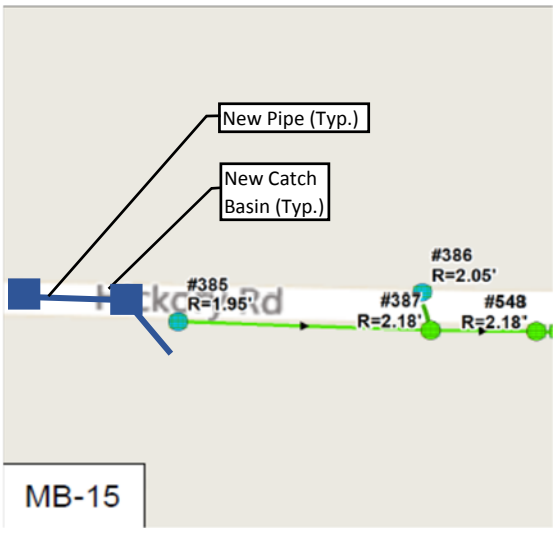

Figure IV-48. Recommended Improvements Map

15. MB-16 – 17 Bayport Road

Existing Condition:

Bayport Road runs in an east-west direction in the central region of the study area. This stretch of roadway between Bellport Road and Bluepoint Road is relatively flat and minor ponding occurs along both the north and south sides of the road as well as at the west side of the intersection of Bellport Road and Bayport Road. No drainage structures were observed in the vicinity.

A vacant lot, which appears to be owned by Suffolk County, could potentially be utilized for stormwater management purposes, is located on the north side of Bayport Road, midway between Bellport Road and Bluepoint Road.

The elevation at this stretch of roadway is approximately 1.8 feet above sea level.

Figure IV-49. Aerial Location Map and Schematic Roadway Map

15. MB-16 – 17 Bayport Road

Recommended Solution:

Due to the low-lying nature of this stretch of roadway and the fact that there are no existing drainage systems in the immediate vicinity, it is suggested that the grass shoulders in the right-of-way of the roadway be re-graded to create shallow depressions that will temporarily store runoff following storm events and help keep it from accumulating on the roadway itself. The vacant lot on the north side of Bayport Road can be cleared and graded to create a shallow drainage reserve area. This area can serve as an overflow location to temporarily store runoff during storm events. An easement with Suffolk County would need to be secured for proposed work on this lot.

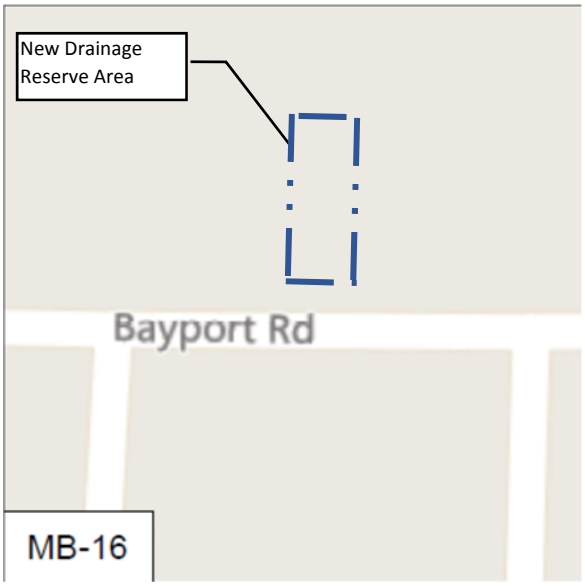

Figure IV-50. Recommended Improvements Map

16. MB-17 – 22 Blue Point Road, North of Riviera Drive

Existing Condition:

Blue Point Road runs in a north-south direction in the central region of the study area. This length of roadway, stretching 450 feet north from the Blue Point Road intersection with Riviera Drive, is relatively flat and extensive ponding occurs along its east side, adjacent to a low-lying wetland area. Areas of isolated ponding occur on the west side of the road, as well. The closest drainage system is drainage structure #498, part of drainage system DS-14, located at the northwest corner of the intersection of Blue Point Road and Riviera Drive.

The elevation at this stretch of roadway is approximately 2.0 feet above sea level.

Figure IV-51. Aerial Location Map and Schematic Roadway Map

16. MB-17 – 22 Blue Point Road, North of Riviera Drive

Recommended Solution:

The recommended solution is to install new catch basins at low points along both the east and west sides of Bluepoint Road, as well as new 12" drainage pipe to connect the new inlets to structure #498 at the intersection with Riviera Drive. Refer to the system DS-14 section for additional information on recommended improvements to that drainage system.

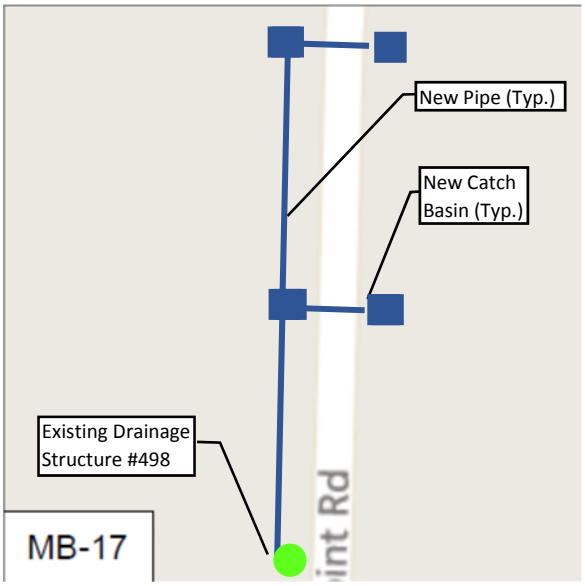

Figure IV-52. Recommended Improvements Map

17. MB-18 – 17 Bellport Road, North of Bayside Road

Existing Condition:

Bellport Road runs in a north-south direction in the central region of the study area. This length of roadway, stretching 170 feet north from the Bellport Road intersection with Bayside Road, is relatively flat and extensive ponding occurs along its east side, adjacent to a vacant lot. Areas of isolated ponding occur on the west side of the road, as well. The closest drainage system is a catch basin located at the northwest corner of the intersection of Bellport Road and Riviera Drive.

A vacant lot, which appears to be owned by Suffolk County, which could potentially be utilized for stormwater management purposes, is located on the west side of Bellport Road, midway between Riviera Drive and Bayport Road.

The elevation at this stretch of roadway is approximately 2.0 feet above sea level.

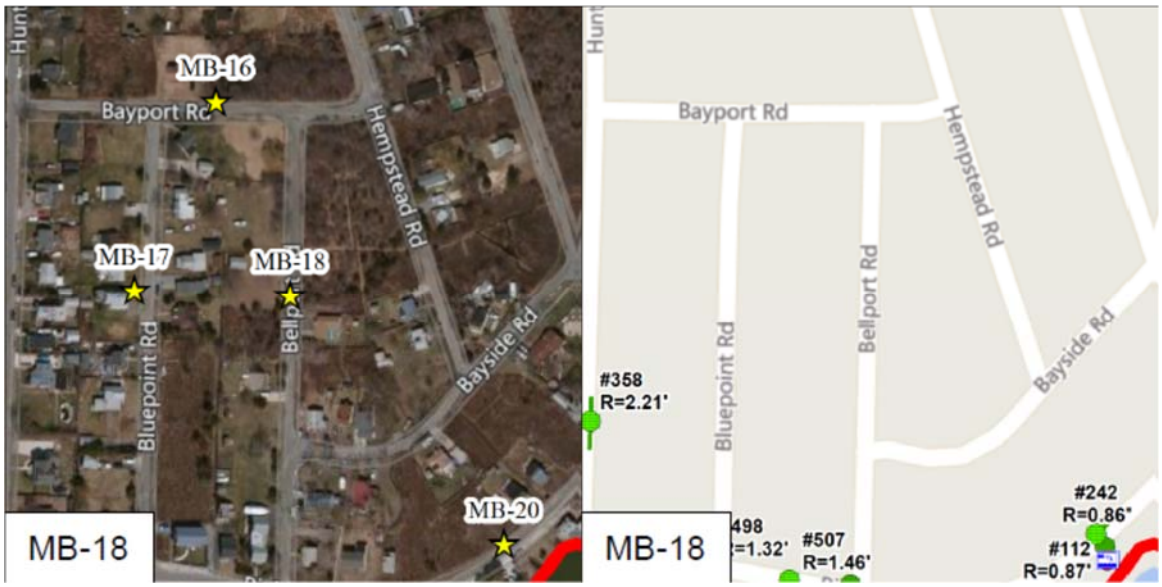

Figure IV-53. Aerial Location Map and Schematic Roadway Map

17. MB-18 – 17 Bellport Road, North of Bayside Road

Recommended Solution:

The recommended solution is to conduct a full-depth replacement of Bellport Road from the intersection with Bayside Road to the intersection with Bayport Road. Due to the low-lying nature of this stretch of roadway and the fact that there are no existing drainage systems in the immediate vicinity, it is suggested that the grass shoulders in the eastern right-of-way of the roadway be re-graded to slope away from the roadway to help keep runoff from accumulating on the roadway itself during storm events.

In addition, it is recommended that the existing vacant lot be cleared and re-graded to create a shallow drainage reserve area to temporarily store overflow runoff. An easement with Suffolk County would need to be secured for proposed work on this lot. Runoff from the roadway should be directed to this location.

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17. MB-18 – 17 Bellport Road, North of Bayside Road (cont.)

Recommended Solution:

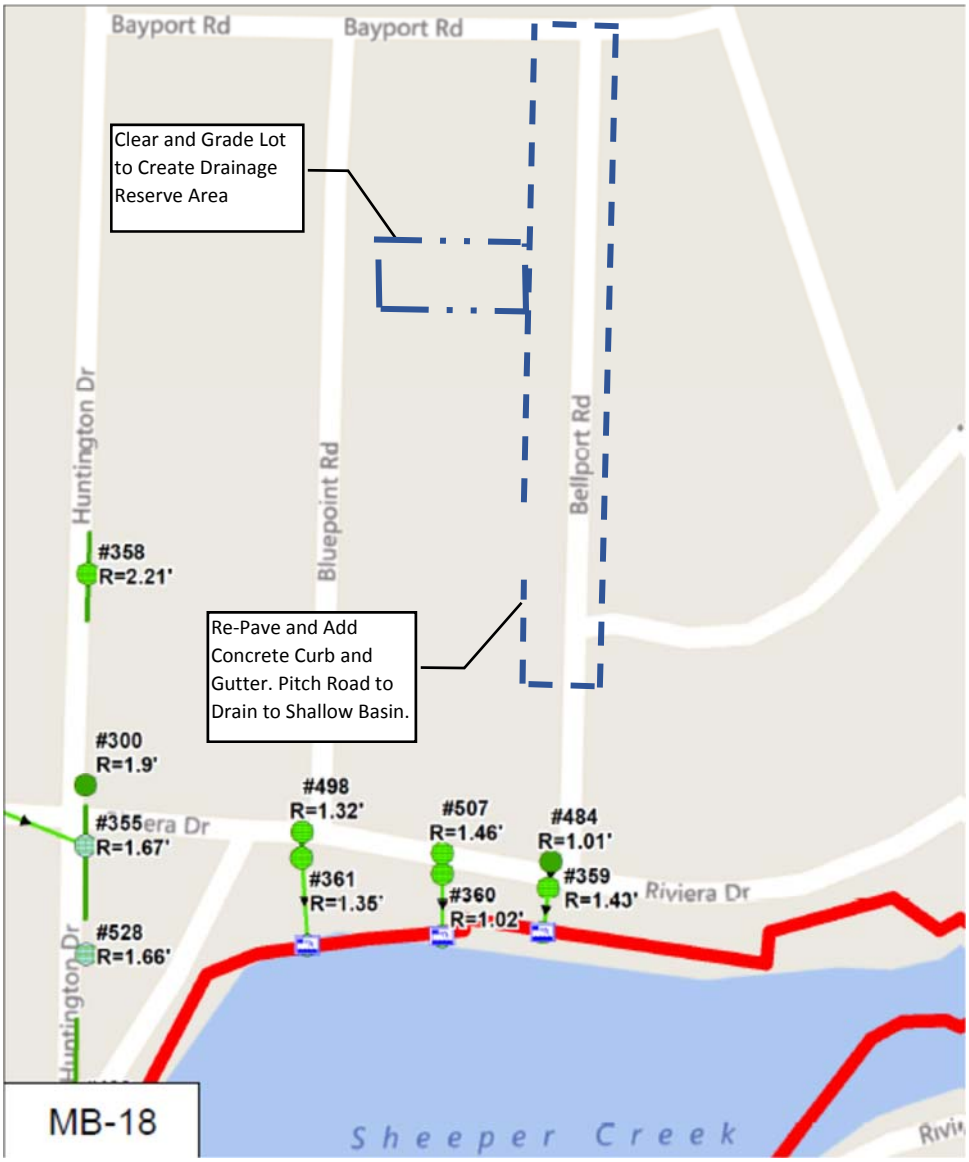

Figure IV-54. Recommended Improvements Map

18. MB-19 – 36 Huntington Drive

Existing Condition:

Huntington Drive runs in a north-south direction in the central region of the study area. This stretch of roadway located south of Riviera Drive is relatively flat and extensive ponding occurs in this area. Several existing drainage structures are located south of Riviera Drive and the system is believed to discharge to an outfall structure in the adjacent Sheeper Creek section of Narrow Bay. Village personnel have indicated that a length of pipe running south from drainage structure #528 (of drainage system DS-13) has collapsed.

The elevation at this stretch of roadway is approximately 1.5 feet above sea level.

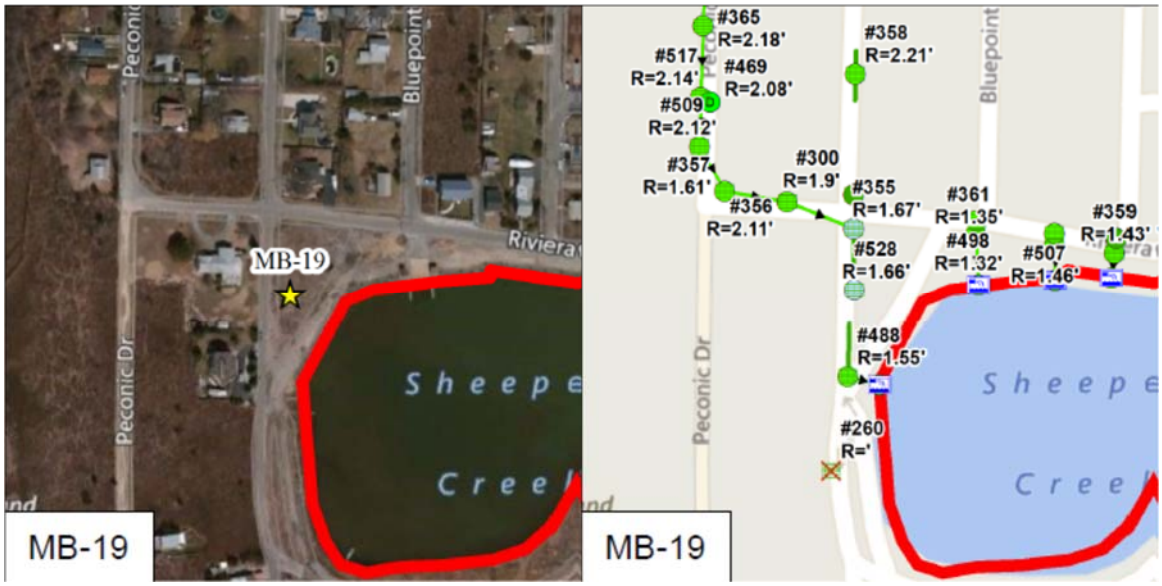

Figure IV-55. Aerial Location Map and Schematic Roadway Map

18. MB-19 – 36 Huntington Drive

Recommended Solution:

Additional investigation is warranted at this location. A televised inspection of the pipe systems connected to structure #528 is recommended. This inspection would indicate the extent of damage within the existing pipe, and if it repair is possible or if the pipe should be replaced. For the purposes of developing a cost estimate, it is assumed that both pipes connecting to structure #528 are damaged beyond repair and should be removed and replaced.

To help minimize tidal influence at this location, the drainage structure immediately upstream of the outfall pipe for system DS-13 should be removed and replaced with a 4' x 4' concrete catch basin, and one in-line check valve should be installed within the outlet pipe.

Refer to the analysis provided under DS-13 – Hickory Road and Laurelton Drive for additional recommendations for this location.

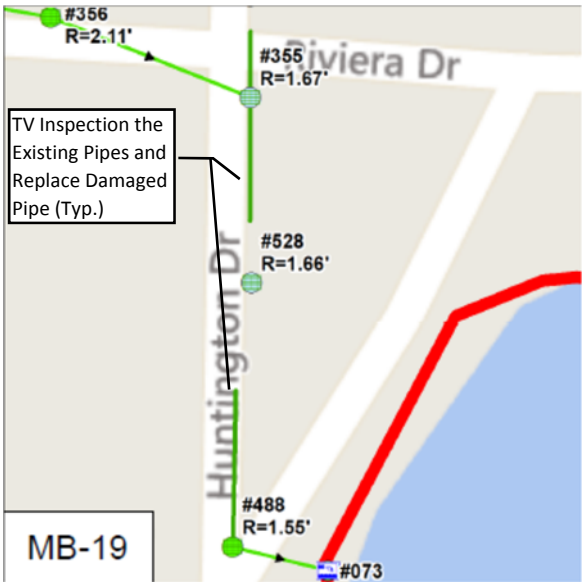

Figure IV-56. Recommended Improvements Map

19. MB-20 – 713 Riviera Drive, between Bellport Road and Manhasset Drive

Existing Condition:

Widespread ponding was observed during storm events along the section of Riviera Drive located between Blue Point Road and Montauk Drive in the central region of the Mastic Beach study area. Ponding stretched across the roadway in some instances, inundating the four separate series of existing culvert pipes located along this section of Rivera Drive. The existing culvert pipes are part of system

The elevation at this stretch of roadway is approximately 1.0 feet above sea level.

Figure IV-57. Aerial Location Map and Schematic Roadway Map

19. MB-20 – 713 Riviera Drive, between Bellport Road and Manhasset Drive

Recommended Solution:

Refer to the analyses of systems DS-14 – Riviera Drive from Bluepoint Road to Bellport Road, and DS-15 – Riviera Drive near 706 Riviera Drive for recommended improvements at this location.

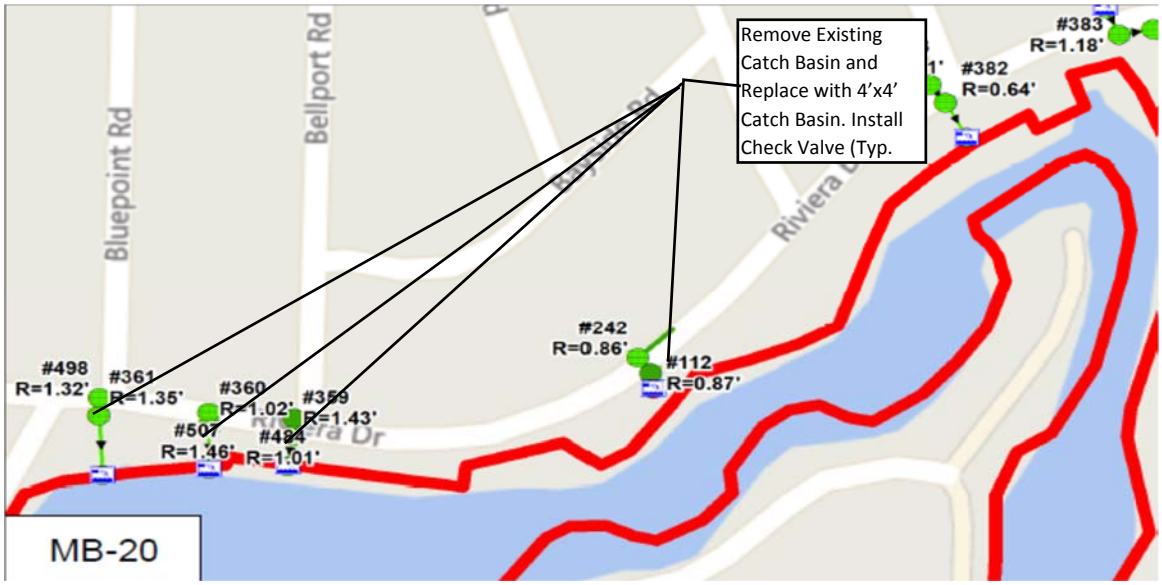

Figure IV-58. Recommended Improvements Map

20. MB-21 – Riviera Drive, between Montauk Drive and Floral Court

Existing Condition:

Minor ponding was observed at a section of Riviera Drive located between Montauk Drive and Floral Court in the central region of the study area. Ponding stretched across the roadway and existing drainage structures in the vicinity did not appear to be located at low points.

The elevation at this stretch of roadway is approximately 1.1 feet above sea level.

Figure IV-59. Aerial Location Map and Schematic Roadway Map

20. MB-21 – Riviera Drive, between Montauk Drive and Floral Court

Recommended Solution:

The recommended solution is to install a new catch basin on both the north and south side of the roadway, at the low point of each. New 12"-diameter drainage pipe should be installed to connect the recommended catch basins to the existing drainage system on the south side of Riviera Drive.

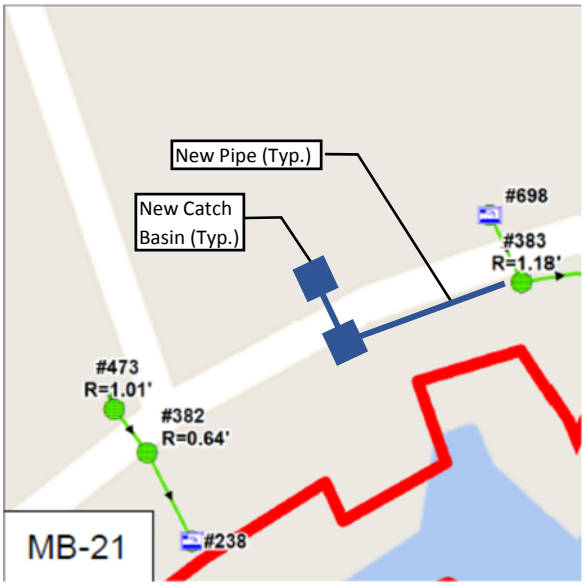

Figure IV-60. Recommended Improvements Map

21. MB-22 – Intersection of Cranberry Drive and Iris Road

Existing Condition:

Ponding occurs at both the northeast and southeast corners of the intersection of Cranberry Drive and Iris Road in the central region of the study area. No drainage structures were observed at the southeast corner of the intersection.

A parcel acquired through the New York Rising program, which could potentially be utilized for stormwater management purposes. This parcel is located on the southwest quadrant of the intersection of Iris Road and Cranberry Drive.

The elevation at this stretch of roadway is approximately 1.5 feet above sea level.

Figure IV-61. Aerial Location Map and Schematic Roadway Map

21. MB-22 – Intersection of Cranberry Drive and Iris Road

Recommended Solution:

Due to the low-lying nature of this section of the study area and the fact that there are no existing drainage systems in the immediate vicinity, it is suggested that the grass shoulders in the right-of-way adjacent to each corner of the intersection be re-graded to slope away from the roadway to help keep runoff from accumulating on the roadway itself during storm events.

In addition, it is recommended that, if the lot has been acquired by the State, that a portion be cleared and re-graded to create a shallow drainage reserve area to temporarily store overflow runoff. Runoff from the roadway should be directed to this location. An easement from the property owner will need to be secured for proposed work on this lot.

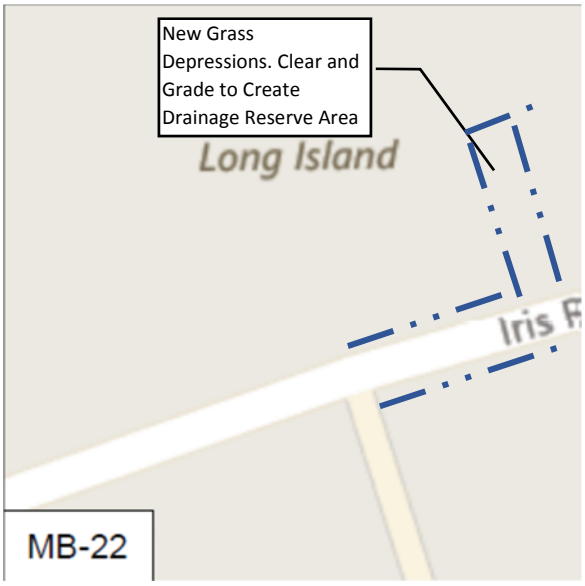

Figure IV-62. Recommended Improvements Map

22. MB-23 – 7 Gooseberry Road – Intersection of Bayview Drive and Gooseberry Road

Existing Condition:

Gooseberry Road runs in an east-west direction across the central portion of the study area and is bound by Maywood Road on the west and Riviera Drive on the west. This area is located near house #7 at the eastern end of the road, approximately 300 feet from the intersection with Riviera Drive. This stretch of roadway is relatively flat and ponding occurs in isolated low areas along the north side of the roadway. Additionally, ponding water was observed at the intersection of Gooseberry Road and Bayview Drive, directly west of 7 Gooseberry Road. Currently, there are no drainage structures in the vicinity.

The elevation at this stretch of roadway is approximately 3.0 feet above sea level.

The drainage area tributary to this location is comprised of 1.46 acres of ¼-acre residential properties, and would generate approximately 4,220 cf of storm runoff during the 90th percentile, 24-hour storm event.

Figure IV-63. Aerial Location Map and Schematic Roadway Map

22. MB-23 – 7 Gooseberry Road – Intersection of Bayview Drive and Gooseberry Road

Recommended Solution:

The recommended solution is to install catch basins at low points on the north and south sides of Gooseberry Road, as well as at the corners of the intersection of Gooseberry Road and Bayview Drive. To help store and infiltrate the storm runoff volume generated by the drainage area tributary to this location, it is recommended that a series of approximately 14 (total) low-profile, underground linear leaching chambers are installed to connect new catch basins in Gooseberry Road. 12" diameter drainage pipe can be used to tie in other new catch basins to the underground linear leaching chamber system.

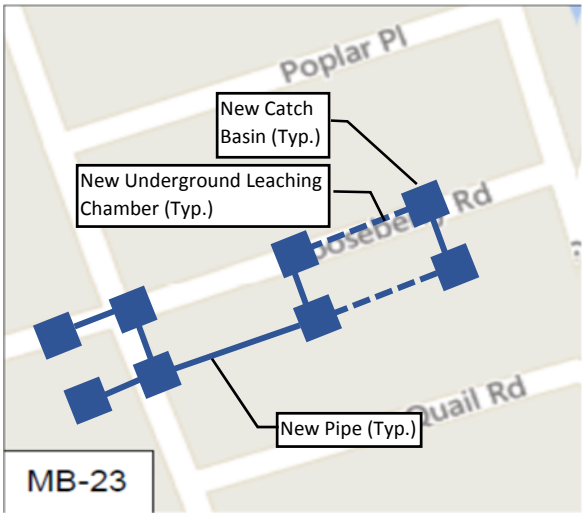

Figure IV-64. Recommended Improvements Map

23. MB-24 – Quail Road – Intersection of Riviera Drive and Quail Road

Existing Condition:

Quail Road runs in an east-west direction in the central region of the study area. Extensive ponding was observed just north of the intersection of Quail Road and Riviera Drive, adjacent to Pattersquash Creek. No drainage structures were observed in this area.

The elevation at this stretch of roadway is approximately 2.0 feet above sea level.

Figure IV-65. Aerial Location Map and Schematic Roadway Map

23. MB-24 – Quail Road – Intersection of Riviera Drive and Quail Road

Recommended Solution:

Refer to the recommended solution provided under MB-09 – 464 Riviera Drive – Intersection of Riviera Drive and Forest Road W.

24. MB-25 – Intersection of Riviera Drive and Rosewood Road

Existing Condition:

Rosewood Road runs in an east-west direction in the central region of the study area. Extensive ponding was observed just north of the intersection of Rosewood Road and Riviera Drive, adjacent to Pattersquash Creek. No drainage structures were observed in this area.

The elevation at this stretch of roadway is approximately 2.0 feet above sea level.

Figure IV-66. Aerial Location Map and Schematic Roadway Map

24. MB-25 – Intersection of Riviera Drive and Rosewood Road

Recommended Solution:

Refer to the recommended solution provided under MB-09 – 464 Riviera Drive – Intersection of Riviera Drive and Forest Road W.

25. MB-26 – Intersection of Riviera Drive and Hickory Road

Existing Condition:

Hickory Road runs in an east-west direction in the central region of the study area. Extensive ponding was observed just north of the intersection of Hickory Road and Riviera Drive, adjacent to Pattersquash Creek. Although no drainage structures were observed to the north of the intersection, where ponding occurs, an existing drainage system runs along the south side of Hickory Road and discharges into the adjacent Narrow Bay.

The elevation at this stretch of roadway is approximately 2.0 feet above sea level.

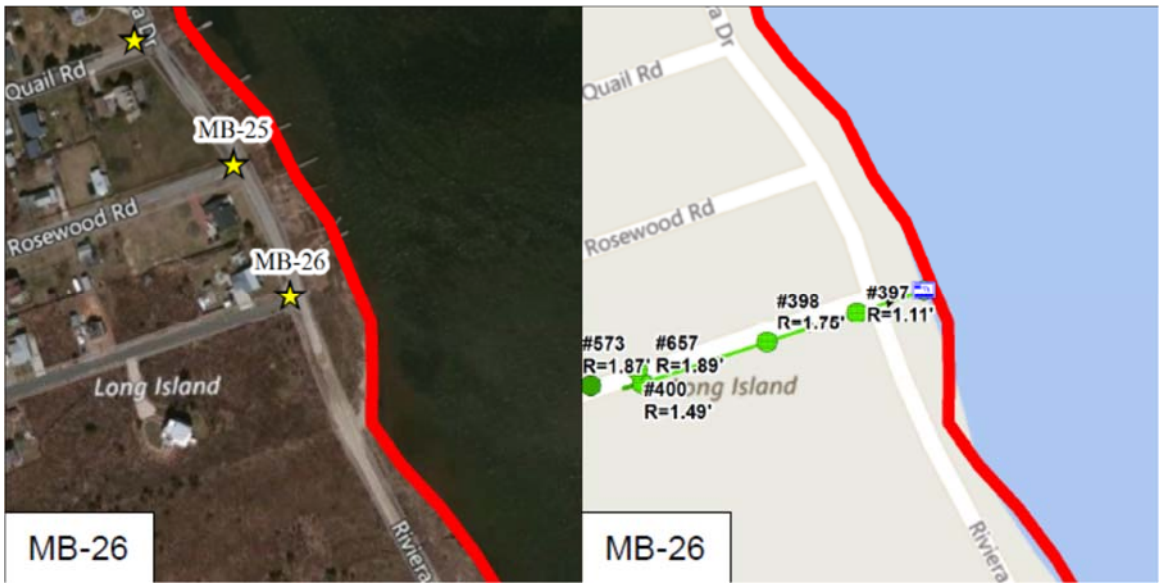

Figure IV-67. Aerial Location Map and Schematic Roadway Map

25. MB-26 – Intersection of Riviera Drive and Hickory Road

Recommended Solution:

Refer to the recommended solution provided under MB-09 – 464 Riviera Drive – Intersection of Riviera Drive and Forest Road W.

26. MB-27 – 50 Knapp Road

Existing Condition:

Knapp Road runs in a north-south direction within the north-central portion of the study area. This stretch of roadway is relatively flat and a low point has been created against a wooden curb installed at the residence.

The elevation at this stretch of roadway is approximately 15.0 feet above sea level.

Figure IV-68. Aerial Location Map and Schematic Roadway Map

26. MB-27 – 50 Knapp Road

Recommended Solution:

To effectively remove the low spot within the right-of-way, it is recommended that the pavement be swept to remove all debris that has accumulated against the wooden curb. In addition, a 25'-long by 14'-wide section of pavement (approximately half the width of the roadway), along the property frontage should be sawcut, removed and replaced to full-depth. In addition, one 8'-deep, 8'-diameter concrete drainage drywell should be installed at a low point down-gradient of the driveway. The pavement should be sloped to ensure positive drainage to the new drywell.

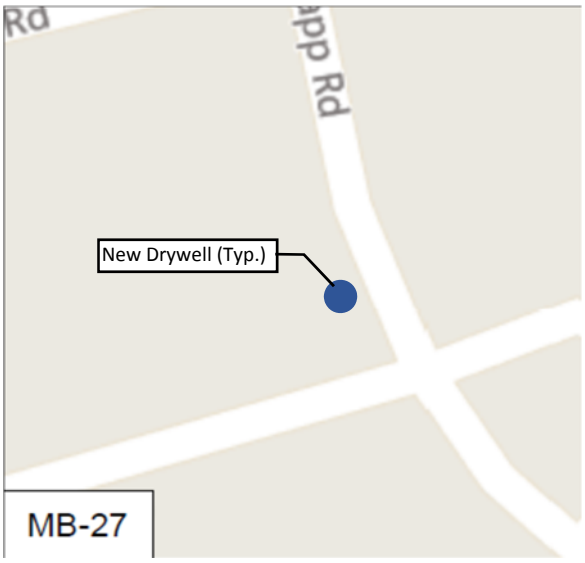

Figure IV-69. Recommended Improvements Map

27. MB-28 – 35 Barclay Road

Existing Condition:

Barclay Road runs in an east-west direction within the north-central portion of the study area. This stretch of roadway is relatively flat and a low point has developed within the right of way where a residential driveway and the adjacent road shoulder have deteriorated on the north side of the road. An existing drainage structure is located approximately 10 feet northeast, but up-gradient, of the ponding area.

The elevation at this stretch of roadway is approximately 15.0 feet above sea level.

Figure IV-70. Aerial Location Map and Schematic Roadway Map

27. MB-28 – 35 Barclay Road

Recommended Solution:

To effectively remove the low spot within the right-of-way, it is recommended that the existing driveway apron be restored and the adjacent pavement be removed and replaced to full-depth. In addition, one 8'-deep, 8'-diameter concrete drainage drywell should be installed at a low point down-gradient (west) of the driveway.

Figure IV-71. Recommended Improvements Map

28. MB-29 – Elm Road, between Hemlock Drive and Daisy Drive

Existing Condition:

Elm Road runs in an east-west direction in the central region of the study area. This length of roadway, stretching between Hemlock Drive and Daisy Drive, is relatively flat and extensive ponding occurs in this area. Runoff is collected and conveyed by a drainage ditch that runs parallel to the roadway within the southern right-of-way, which connects to an existing drainage system (DS-23) beginning at the eastern side of the intersection of Hemlock Drive and Elm Road and running west toward Overlook Drive. This length of roadway is in need of repair.

The elevation at this location is approximately 1.5 to 3.0 feet above sea level.

Figure IV-72. Aerial Location Map and Schematic Roadway Map

28. MB-29 – Elm Road, between Hemlock Drive and Daisy Drive

Recommended Solution:

It is recommended that the entire width of pavement along Elm Road from Hemlock Drive to Daisy Drive be removed and replaced to full-depth. The pavement should be crowned and sloped to ensure positive drainage toward new drainage structures. New catch basins should be installed at low points along the north and south sides of Elm Road. New catch basins should be connected to drainage system DS-23 using 12" diameter pipe.

In addition, the existing drainage system DS-23 should be cleaned to remove any debris and sediment that have accumulated over time, and inspected to ensure it remains in good working condition. Repairs should be made to the drainage structure as necessary.

A mosquito ditch exists in close proximity to the intersection of Overlook Drive and Elm Road, where structure #16011 is located. The connection of this ditch with this outfall structure should be confirmed with the Vector Control Department Suffolk County of Department of Public Works (SCDPW), as the area is significantly overgrown.

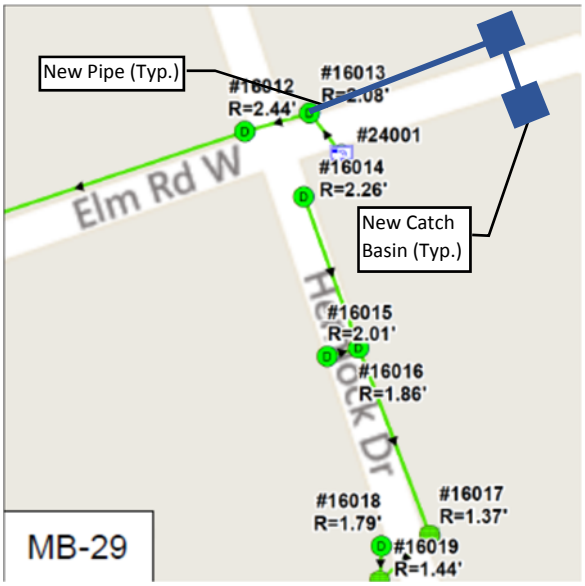

Figure IV-73. Recommended Improvements Map

29. MB-30 – Southern End of Hemlock Drive

Existing Condition:

Hemlock Drive runs in a north-south direction in the central region of the study area. Extensive ponding was observed at the southern end of the road, near the intersection with the unimproved portion of Riviera Drive. No drainage structures were observed in this area.

The elevation at this stretch of roadway is approximately 1.5 feet above sea level.

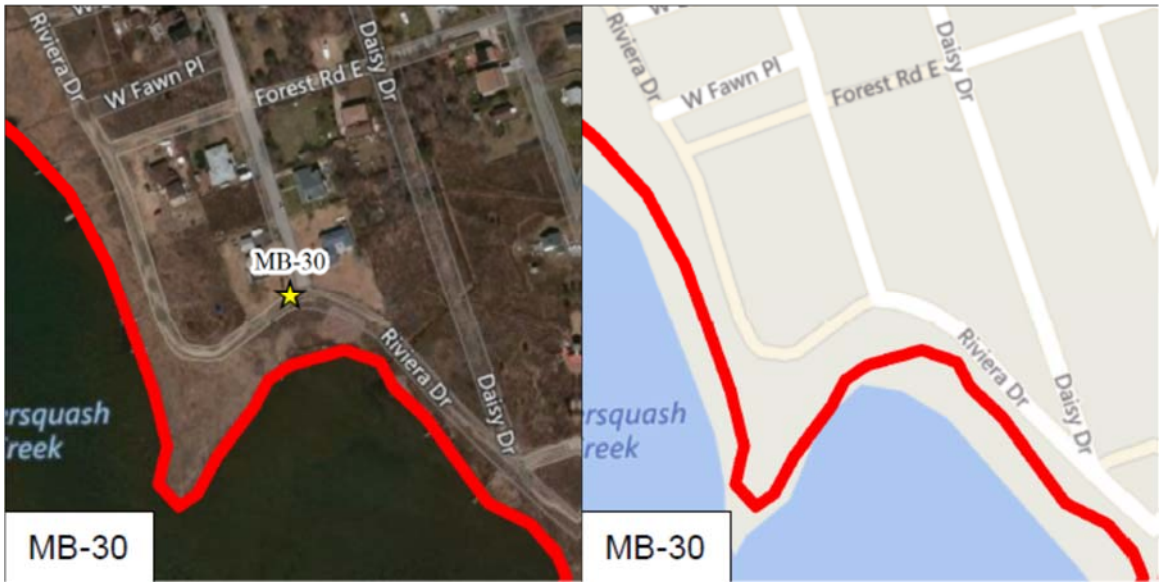

Figure IV-74. Aerial Location Map and Schematic Roadway Map

29. MB-30 – Southern End of Hemlock Drive

Recommended Solution:

Due to the low-lying nature of this section of roadway and the fact that there are no existing drainage systems in the immediate vicinity, it is suggested that the grass right-of-way in the northwest and northeast corners or the Riviera Drive/Hemlock Drive intersection be re-graded to slope away from the roadway to prevent runoff from accumulating on the roadway itself during storm events.

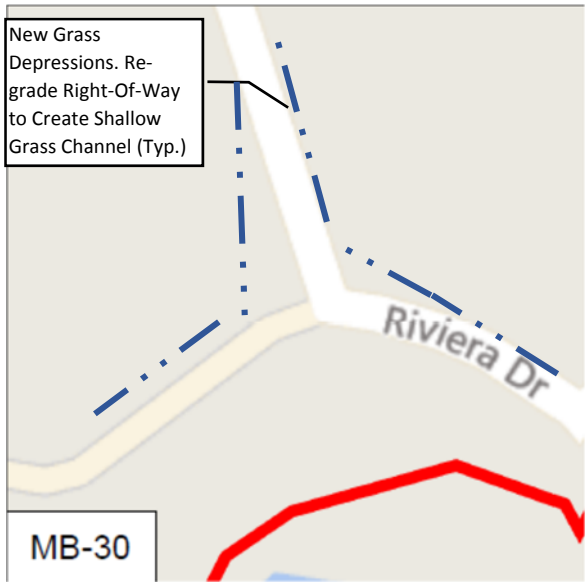

Figure IV-75. Recommended Improvements Map

30. MB-31 - Intersection of Dahlia Drive and Riviera Drive

Existing Condition:

Dahlia Drive runs in a north-south direction in the central Mastic Beach portion of the study area and intersects Riviera Drive at its south end, along the coast of Narrow Bay. Ponding was observed along both sides of this low-lying area, extending approximately 100 feet northward from the intersection. And the existing drainage structure at the east corner of the intersection was filled with water. Field survey indicated that two 8" diameter pipes convey runoff under Dahlia Drive from the existing drainage structure to a shallow channel at the opposite corner of the intersection. The pavement at the intersection is deteriorated and in need of repair.

The elevation at this stretch of roadway falls within the range of 1.0 – 1.5 feet above sea level.

Figure IV-76. Aerial Location Map and Schematic Roadway Map

30. MB-31 - Intersection of Dahlia Drive and Riviera Drive

Recommended Solution:

The recommended solution is to install catch basins at low points along both sides of Dahila Drive, as well as new drainage pipes to connect the catch basins to the existing structure at the corner of the intersection. The 8" diameter culvert pipe should be replaced with a larger diameter pipe to prevent clogging. In addition, this section of Dahlia Drive should be repaved to full-depth and pavement should be pitched to drain to catch basin locations.

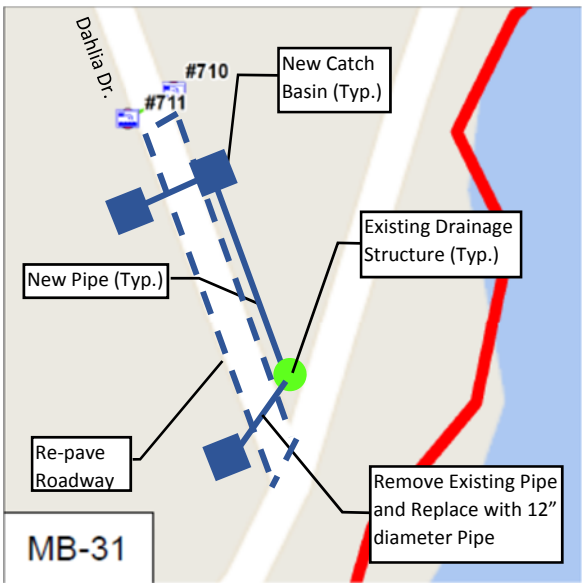

Figure IV-77. Recommended Improvements Map

31. MB-32 – Dogwood Road, between Lakeview Drive and Orchid Drive

Existing Condition:

Dogwood Road runs in an east-west direction in the central region of the Mastic Beach portion of the study area. Ponding has been observed on both sides of a relatively flat length of Dogwood Road between Lakeview Drive and Orchid Drive, as well as at the corners of the intersections of these roadways. No existing drainage structures were observed in this area, and this section of roadway appears to be in a deteriorated condition and is in need of repair.

The elevation at this stretch of roadway is approximately 5.0 feet above sea level.

The drainage area tributary to this location is comprised of 2.16 acres of ¼-acre residential properties, and would generate approximately 6,250 cf of storm runoff during the 90th percentile, 24-hour storm event.

Figure IV-78. Aerial Location Map and Schematic Roadway Map

31. MB-32 – Dogwood Road, between Lakeview Drive and Orchid Drive

Recommended Solution:

The recommended solution is to install catch basins at low points along both the north and south sides of Dogwood Road and at the intersection of Dogwood Road and Lakeview Drive. To help store and infiltrate the storm runoff volume generated by the drainage area tributary to this location, it is recommended that a series of approximately 20 (total) low-profile, underground linear leaching chambers are installed to connect new catch basins on Dogwood Road. 12" diameter drainage pipe can be used to tie in other new catch basins to the underground linear leaching chamber system.

Additionally, it is recommended that the entire width of Dogwood Road from Lakeview Drive to Orchid Drive is removed and replaced to full-depth. The pavement should be crowned and sloped to ensure positive drainage toward new drainage structures.

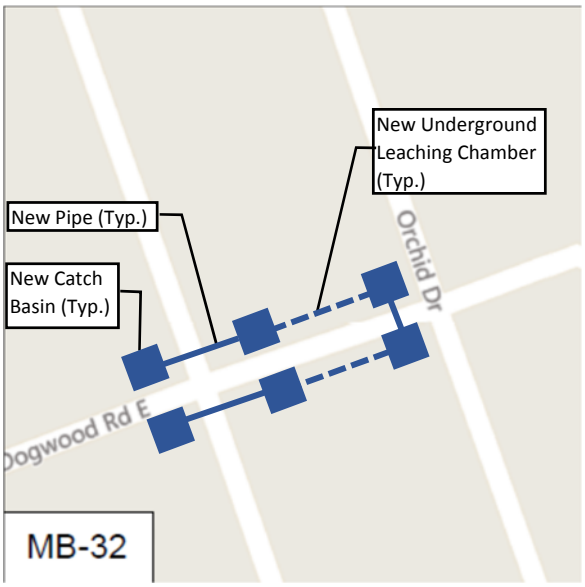

Figure IV-79. Recommended Improvements Map

32. MB-33 - Mastic Road between Riverside Avenue and Meadowmere Avenue

Existing Condition:

Mastic Road runs in a north-south direction through the north-central Mastic Beach portion of the study area. Extensive ponding has been observed at a low point Mastic Road located between Riverside Avenue and Meadowmere Avenue. Although several catch basins, as well as a culvert pipe underneath the road and outfall pipe discharging on the east side of Mastic Road are located at this low point, ponding is reported to overtop these drainage structures during storm events. Village personnel indicated that the outfall pipe may be damaged or collapsed, and catch basins may be clogged with debirs.

The elevation at the low point of the roadway is approximately 14.0 feet above sea level.

Figure IV-80. Aerial Location Map and Schematic Roadway Map

32. MB-33 - Mastic Road between Riverside Avenue and Meadowmere Avenue

Recommended Solution:

Based on the information provided by the Village, it is recommended that the existing drainage system is cleaned to remove any debris and sediment that have accumulated over time, and inspected to ensure it remains in good working condition. Repairs should be made to the drainage system as necessary.

A televised inspection of the pipe system is recommended to verify the condition of the system, and to determine if pipes should be repaired or replaced. Based on the delineated drainage area tributary to this location (approximately 8.24 acres), a 24 inch diameter pipe set at a slope of approximately 2% would be required to adequately convey storm runoff to the discharge location, should a replacement of the outfall pipe prove to be warranted.

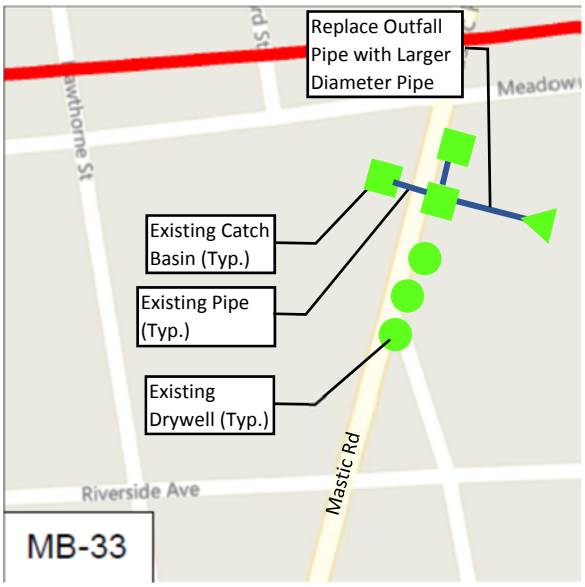

Figure IV-81. Recommended Improvements Map

33. MB-34 – Wavecrest Drive, between Houses #12 and #16

Existing Condition:

Wavecrest Drive runs in an east-west direction in the northeast region of the study area. This length of roadway, stretching between house #12 and #16, is relatively flat and extensive ponding occurs on both the north and south sides of the road in this area. A high point in Wavecrest Drive was observed approximately 1,000 feet to the west of the intersection of Oceanview Drive. No drainage structures were observed along Wavecrest Drive.

The elevation at this stretch of roadway is approximately 2.5 - 3.5 feet above sea level.

Figure IV-82. Aerial Location Map and Schematic Roadway Map

33. MB-34 – Wavecrest Drive, between Houses #12 and #16

Recommended Solution:

The recommended solution is to install new catch basins on both the north and south side of the roadway, at the existing low points of each. To help store and infiltrate the storm runoff volume generated by the drainage area tributary to this location, it is recommended that a series of approximately 30 (total) low-profile, underground linear leaching chambers are installed along both the north and south side of the roadway. The leaching chambers can be used to connect the new drainage structures.

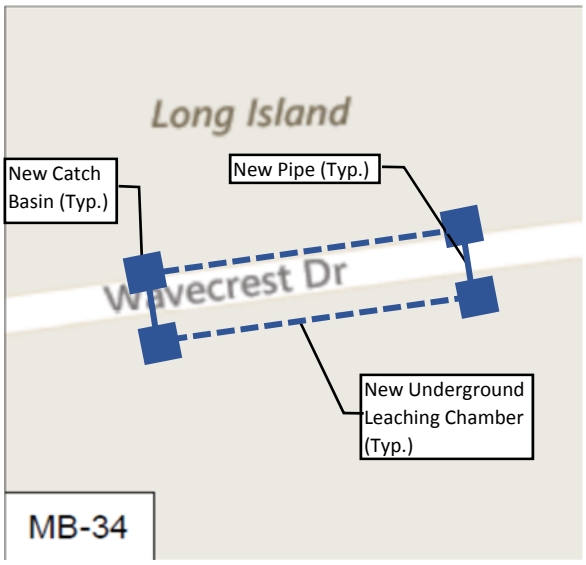

Figure IV-83. Recommended Improvements Map

34. MB-35 –Oceanview Drive, between Wavecrest Drive and Spar Drive

Existing Condition:

Oceanview Drive runs in a north-south direction in the northeast region of the study area. This length of roadway, stretching between Wavecrest Drive and Spar Drive, is relatively flat and extensive ponding occurs in this area. Although existing drainage structures at the northwest and southwest corners of each intersection discharge to a drainage system running south (DS-32), these drainage structures were observed to be inundated during storm events. A vacant lot owned by the Town of Brookhaven, which could potentially be utilized for stormwater management purposes, is located at the southwest corner of the Wavecrest/Oceanview intersection.

The elevation at this stretch of roadway is approximately 1.5 feet above sea level.

Figure IV-84. Aerial Location Map and Schematic Roadway Map

34. MB-35 –Oceanview Drive, between Wavecrest Drive and Spar Drive

Recommended Solution:

The recommended solution is to clear and re-grade the vacant lot to create a shallow drainage reserve area to collect and temporarily store overflow from the existing Oceanview Drive drainage system. An easement would need to be secured from the property owner of this lot before proposed work could be undertaken. Construct low-flow concrete channels from structures #451 and #353 to convey overflow from the street and into the drainage reserve area.

In addition, the existing Oceanview Drive drainage system should be cleaned to remove any debris and sediment that have accumulated over time, and inspected to ensure it remains in good working condition. Repairs should be made to the drainage structure as necessary. Refer to analysis of drainage system DS-32 for additional information.

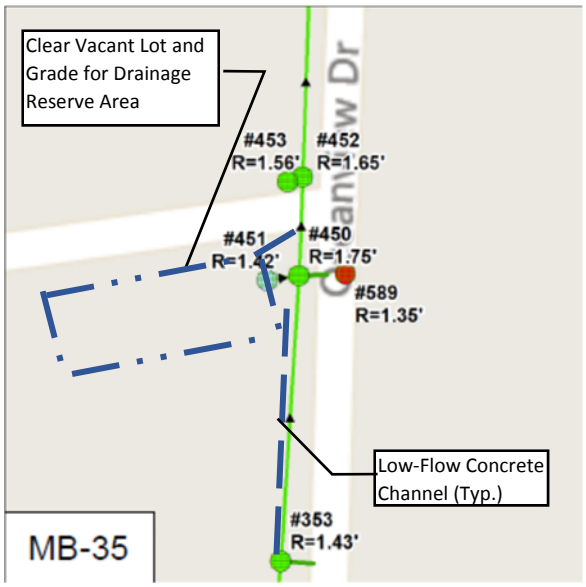

Figure IV-85. Recommended Improvements Map

C Existing Drainage Systems

1. DS-01 – Grandview Drive from Seymour Drive south

Existing Condition:

Drainage System DS-01 runs in a north-south direction along Grandview Avenue at the western edge of the Smith Point of Shirley section of the study area. The drainage system consists of catch basins, drywells and drainage pipe, and consists of two branches that run from the intersection with Seymour Drive to the southern end of Grandview. The north and south branches of this system meet at structure #697, near the Grandview Drive / Kent Drive intersection. An outfall pipe from structure #697 conveys storm runoff to the west and into the Great South Bay.

The ground elevation of this system is approximately 2.0 feet above sea level.

Figure IV-86. Aerial Location Map – DS-01

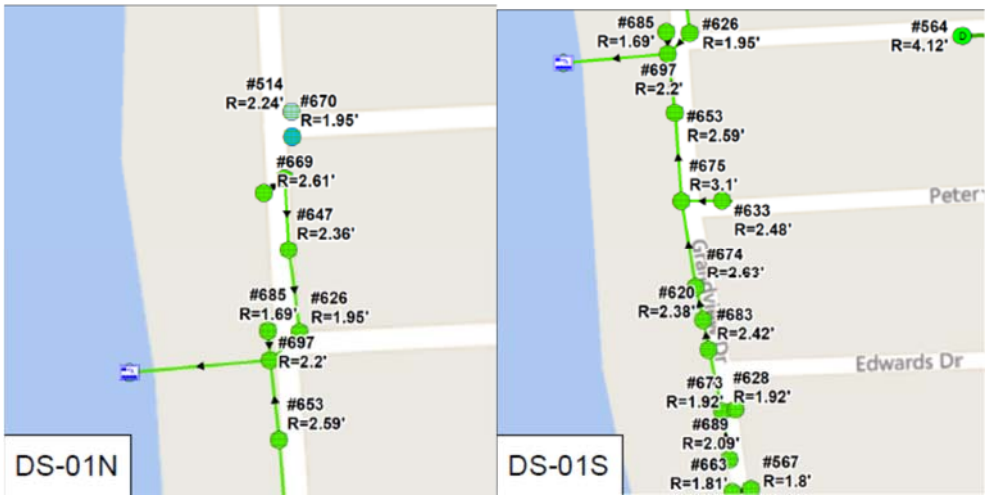

Figure IV-87. Schematic Roadway Map – DS-01N (left) and DS-01S (right)

1. DS-01 – Grandview Drive from Seymour Drive south

Recommended Solution:

For the north branch of the system, by replacing pipes between structure #624 and the system outfall with larger diameter pipe, as well as adjusting pipe invert elevations, the hydraulics of the system can be improved and the potential for roadway flooding can be reduced during the 10-year storm event. Refer to the figure below.

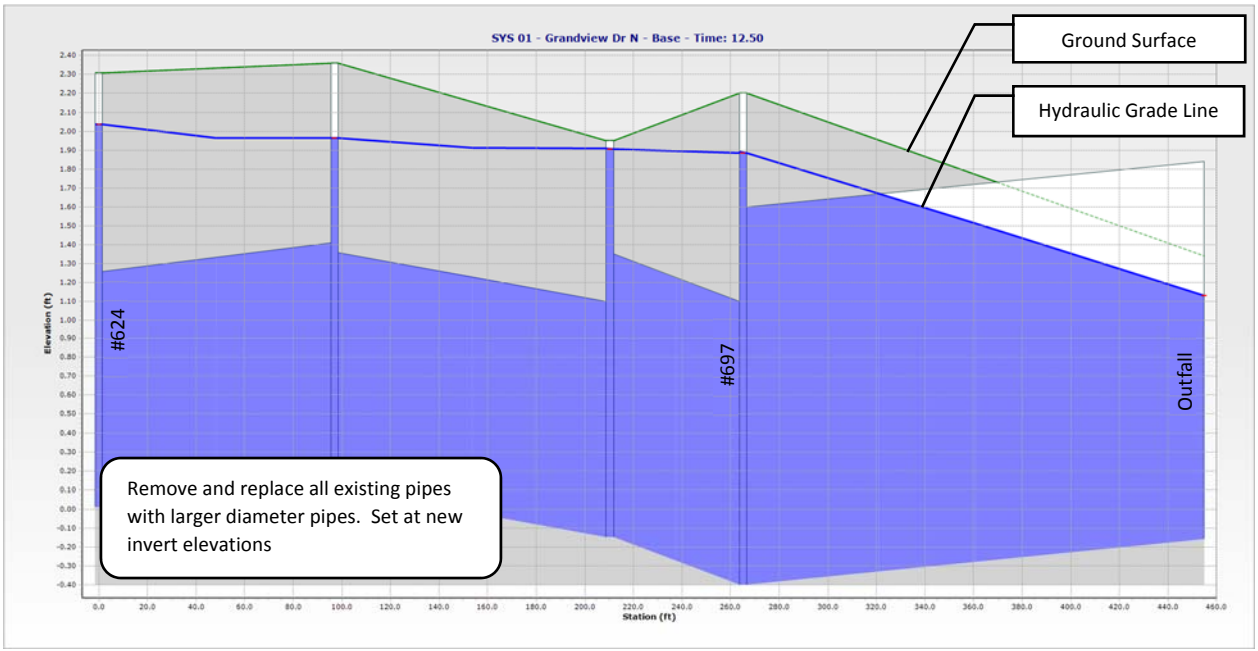

Figure IV-90. Recommended Improvements - DS-01 - North

For the south branch of the system, by replacing pipes between structures #689 and #697 with larger diameter pipe, as well as adjusting pipe invert elevations, the hydraulics of the system can be improved and the potential for roadway flooding can be reduced during the 10-year storm event.

1. DS-01 – Grandview Drive from Seymour Drive south (cont.)

Analysis of Existing System:

The drainage area tributary to this intersection is comprised of approximately 14.45 acres of 1/8-acre – 1/4-acre residential properties. Based on the design analysis, the existing drainage system does not have the capacity to adequately convey the runoff generated during a 10-year storm event. The non-linear vertical layout of the overall drainage system, the undersized nature of the conveyance pipes, and the generally flat nature of the study area all contribute to the system's lack of conveyance capacity. As illustrated in the profile below, the drainage model indicates flooding occurs at the following drainage structures: #624, #626, #689, #628, #683, #620, #674 and #653.

Figure IV-88. Existing Hydraulic Profile of DS-01 – North

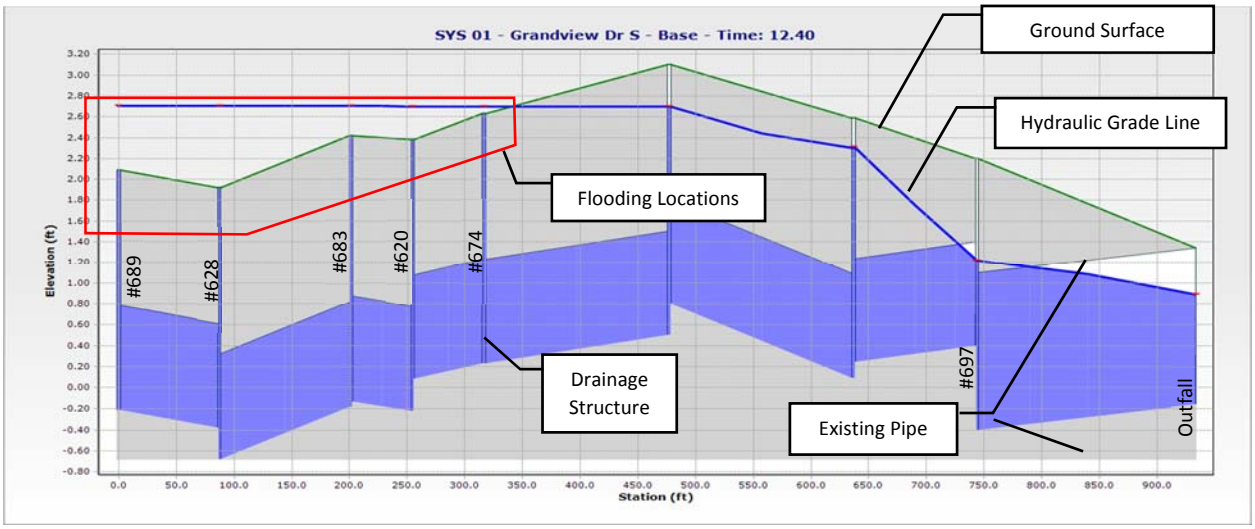

Figure IV-89. Existing Hydraulic Profile of DS-01 – South

1. DS-01 – Grandview Drive from Seymour Drive south (cont.)

Recommended Solution:

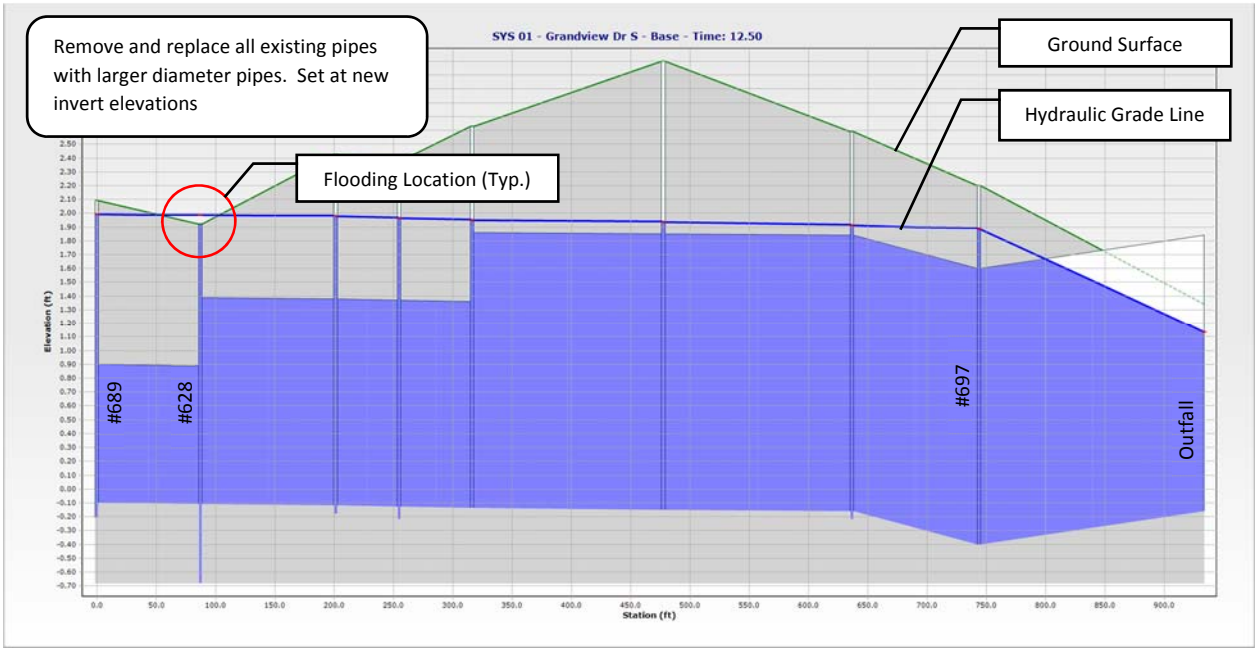

Figure IV-91. Recommended Improvements - DS-01 - South

Even after incorporating the recommended improvements into the south branch of DS-01, the model still indicates the potential for flooding at structure #628 during the 10-year storm event. Refer to the analysis of Locations SP-02 and SP-04 in Section IV for additional recommendations that could impact system DS-01 and reduce the potential for flooding at this location.

2. DS-02 – Intersection of Grandview Drive and Lombardy Drive

Existing Condition:

Drainage System DS-02 is located at the intersection of Grandview Drive and Lombardy Drive along the western edge of the Smith Point section of the study area. The drainage system consists of catch basins, drywells and drainage pipe, and discharges storm runoff into the Great South Bay through an outfall pipe located across from the Grandview / Lombardy Drive intersection.

The ground elevation of this system is approximately 2.0 feet above sea level.

Figure IV-92. Aerial Location Map and Schematic Roadway Map – DS-02

2. DS-02 – Intersection of Grandview Drive and Lombardy Drive

Recommended Solution:

A televised inspection of the pipe system is recommended where pipe connections could not be established to verify the condition of the system, and to determine if pipes should be repaired or replaced.

By replacing pipes between structure #641 and #604 with larger diameter pipe and adjusting pipe invert elevations, the hydraulics of the system can be improved and the potential for roadway flooding can be reduced during the 10-year storm event.

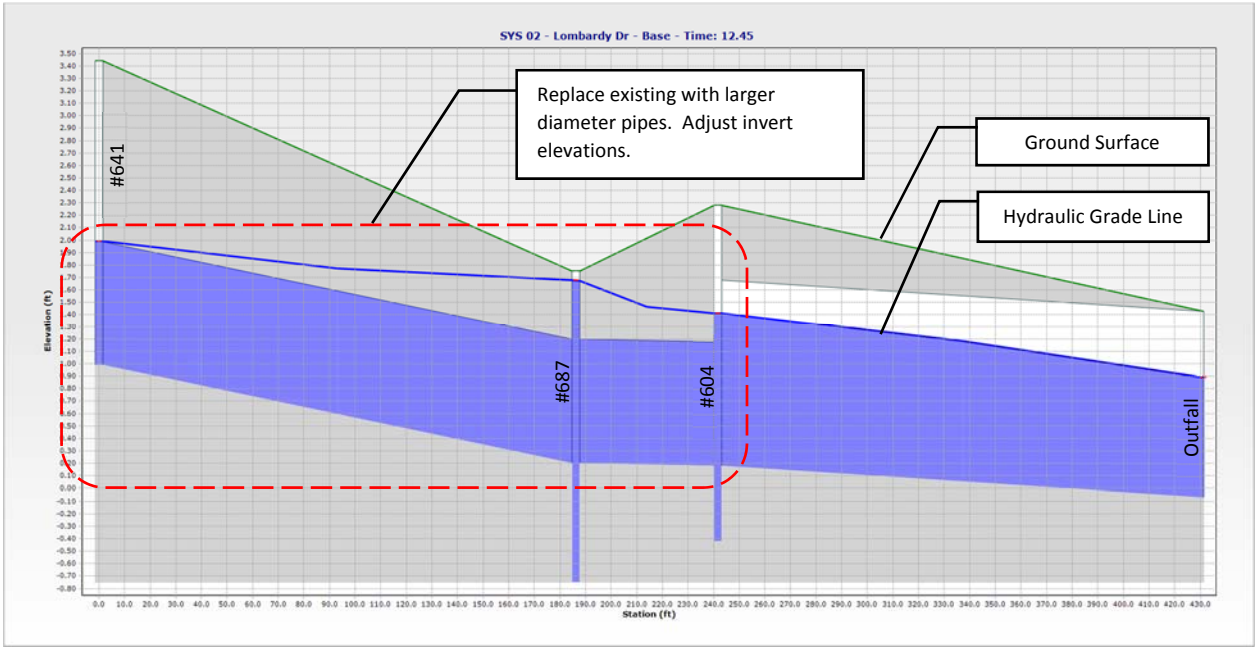

Figure IV-94. Recommended Improvements - DS-02

2. DS-02 – Intersection of Grandview Drive and Lombardy Drive (cont.)

Analysis of Existing System:

Pipe connections between the following structures could not be definitively established, but were assumed to exist or to have existed for stormwater modeling purposes based on record information and field investigation:

#641 to #687

#687 to #604

The drainage area tributary to this intersection is comprised of approximately 5.66 acres of 1/8-acre – 1/4-acre residential properties. Based on the design analysis, the existing drainage system does not have the capacity to adequately convey the runoff generated during a 10-year storm event. The non-linear vertical layout of the overall drainage system, the undersized nature of the conveyance pipes, and the generally flat nature of the study area all contribute to the system's lack of conveyance capacity. As illustrated in the profile below, the drainage model indicates flooding occurs at the following drainage structures: #687.

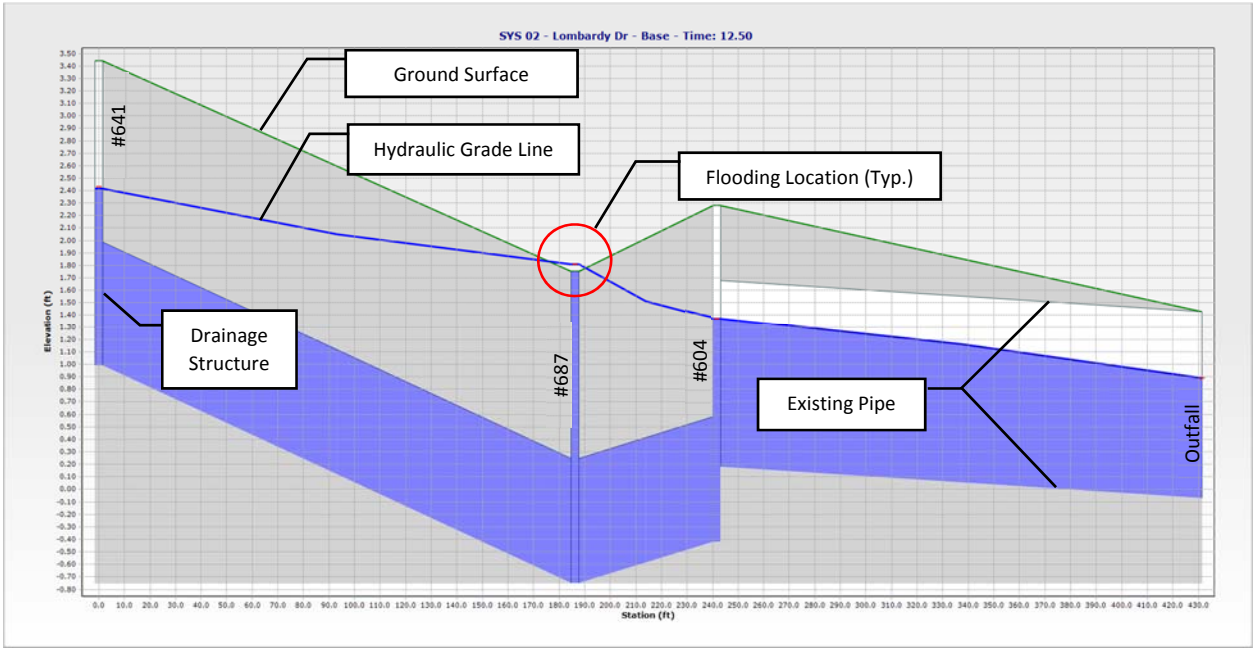

Figure IV-93. Existing Hydraulic Profile of DS-02

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3. DS-03 – Kent Drive to Pinetree Drive

Existing Condition:

Drainage System DS-03 is located along Kent Drive in the southwestern corner of the Smith Point section of the study area. The drainage system consists of catch basins, drywells and drainage pipe, and discharges storm runoff into an existing channel at the eastern end of Kent Drive, near the intersection with Pinetree Drive. DS-03 combines with Drainage System DS-04 at structure #17002, at the Kent Drive / Pinetree Drive intersection.

The ground elevation of this system ranges from 2.1 to 4.1 feet above sea level.

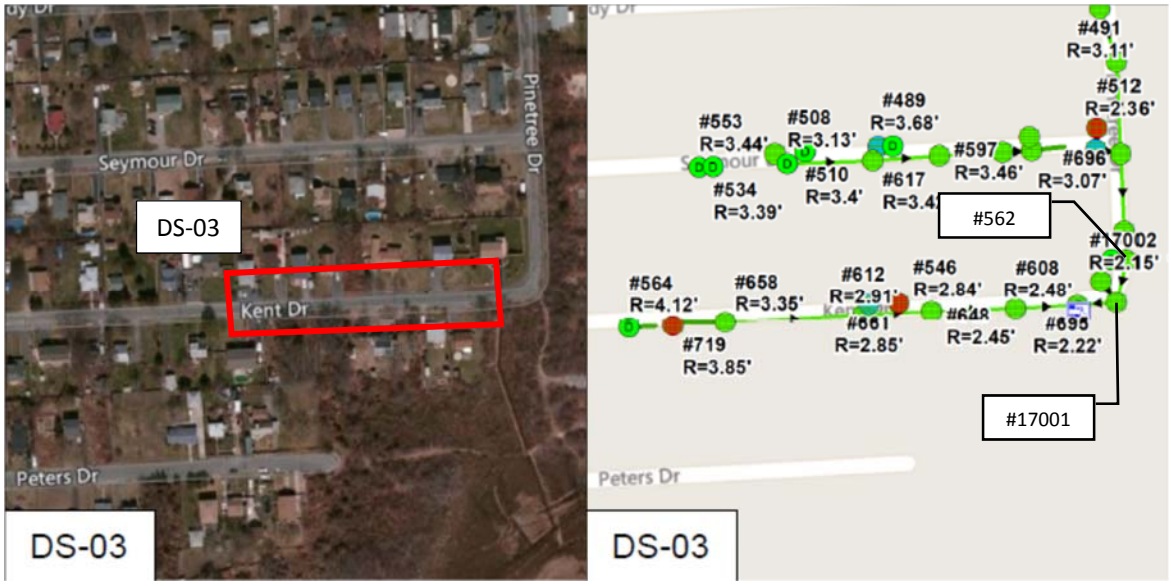

Figure IV-95. Aerial Location Map and Schematic Roadway Map – DS-03

3. DS-03 – Kent Drive to Pinetree Drive

Recommended Solution:

By replacing pipes between structure #612 and the system outfall with larger diameter pipe, as well as adjusting pipe invert elevations at structures #648, #608, #695 and the outfall location, the hydraulics of the system can be improved and the potential for roadway flooding can be reduced during the 10-year storm event.

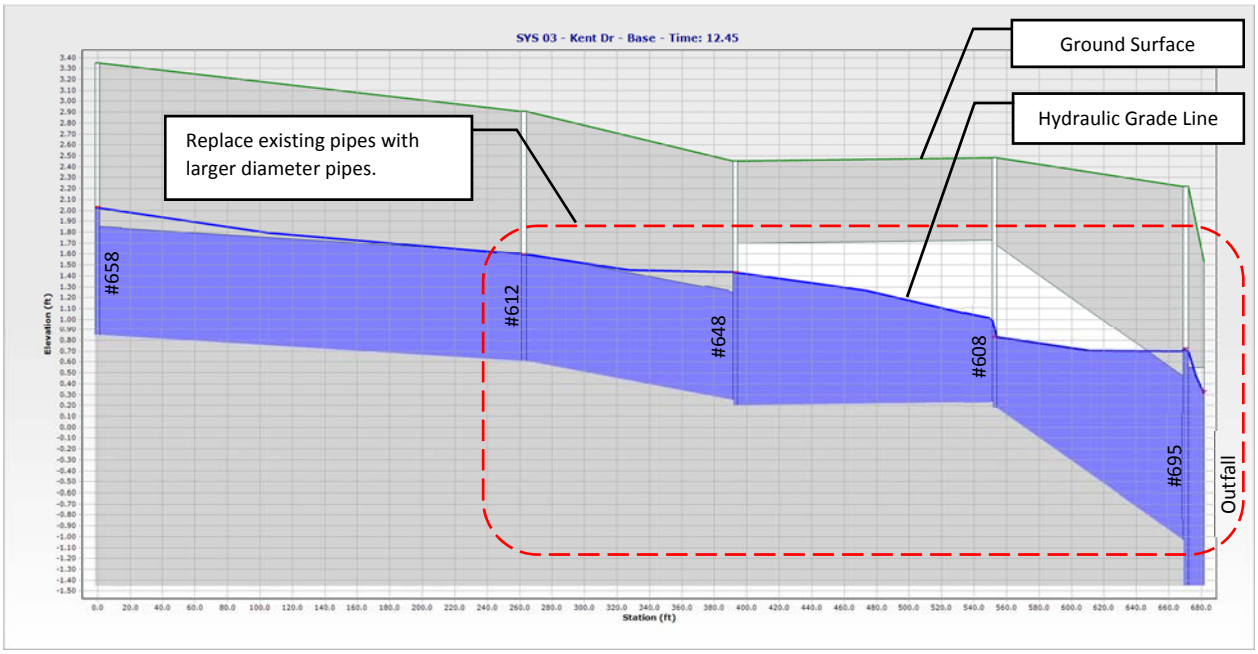

Figure IV-97. Recommended Improvements - DS-03

Refer to the analysis of location SP-03 in Section IV of this report for additional recommendations that could impact system DS-03.

3. DS-03 – Kent Drive to Pinetree Drive (cont.)

Analysis of Existing System:

Pipe connections between the following structures could not be definitively established, but were assumed to exist or to have existed for stormwater modeling purposes based on record information and field investigations:

#562 to #17001

The drainage area tributary to this intersection is comprised of approximately 6.25 acres of 1/8-acre – 1/4-acre residential properties. Based on the design analysis, the existing drainage system does not have the capacity to adequately convey the runoff generated during a 10-year storm event. The non-linear vertical layout of the overall drainage system, the undersized nature of the conveyance pipes, and the generally flat nature of the study area all contribute to the system's lack of conveyance capacity. As illustrated in the profile below, the drainage model indicates flooding occurs at the following drainage structures: #648.

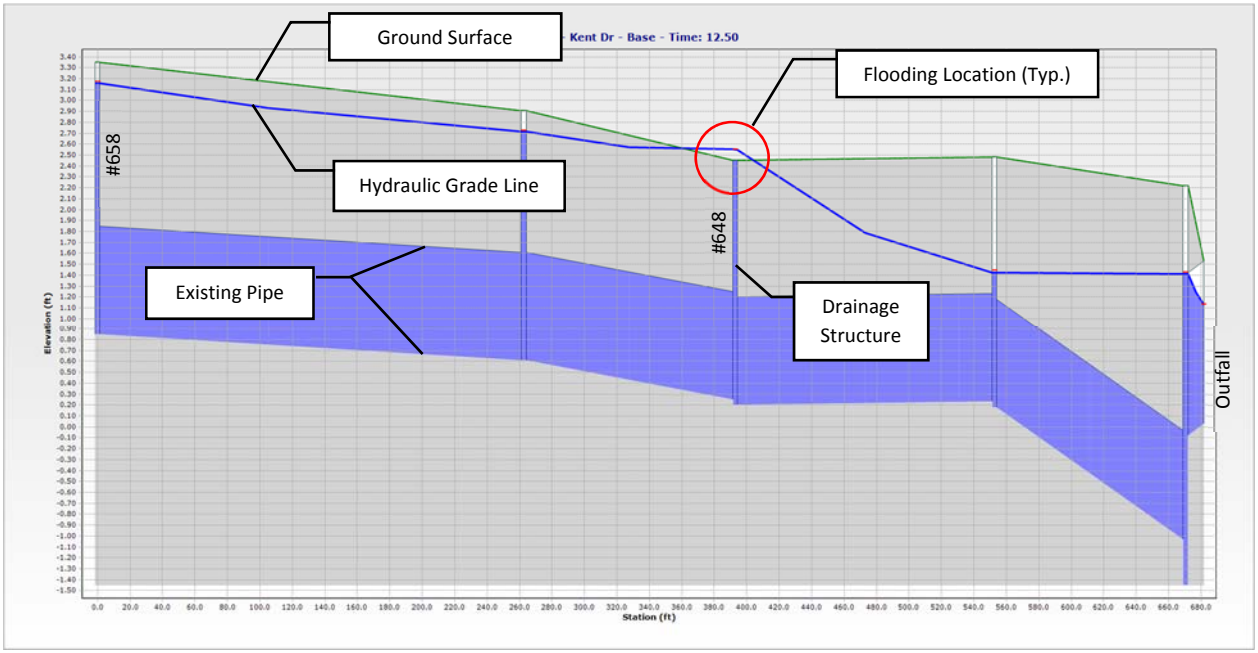

Figure IV-96. Existing Hydraulic Profile of DS-03

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4. DS-04 – Seymour Drive to Pinetree Drive

Existing Condition:

Drainage System DS-04 runs predominantly in a west-to-east direction within Seymour Drive in the Smith Point section of the study area. This drainage system consists of catch basins, drywells and drainage pipe and combines with Drainage System DS-03 at structure #17002, at the Kent Drive / Pinetree Drive intersection.

The ground elevation of this system ranges from 2.4 to 3.4 feet above sea level.

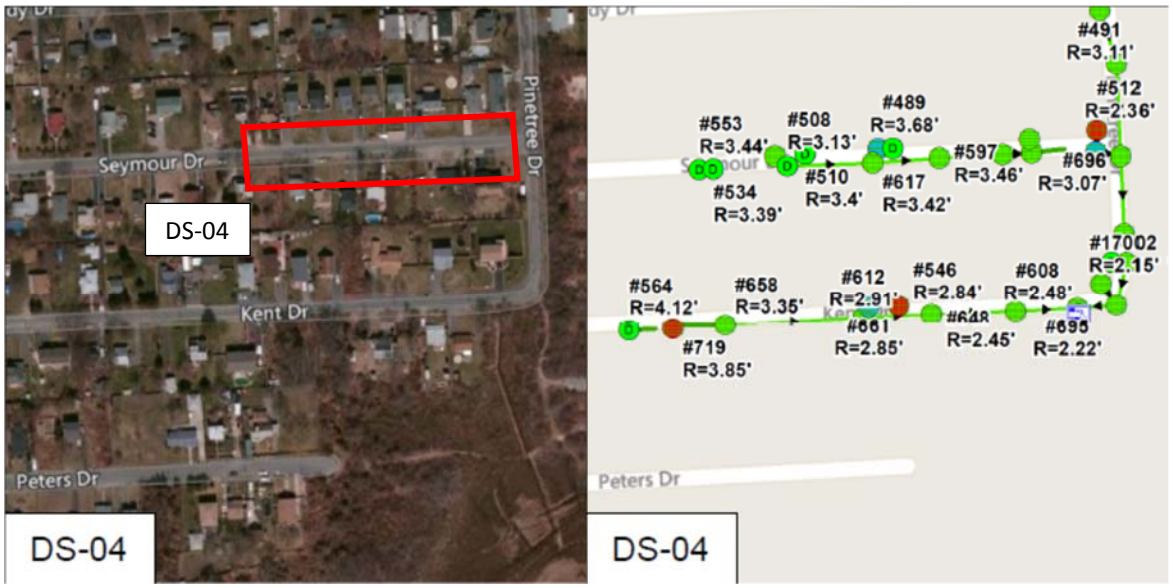

Figure IV-98. Aerial Location Map and Schematic Roadway Map – DS-04

4. DS-04 – Seymour Drive to Pinetree Drive

Recommended Solution:

By replacing pipes between structure #691 and #696 with larger diameter pipe and adjusting pipe invert elevations, as depicted in Figure IV-100, the hydraulics of the system can be improved and the potential for roadway flooding can be reduced during the 10-year storm event. Despite these adjustments, however, the computer model indicates that the potential for minor flooding will remain at structure #640. For the purposes of developing the opinion of probable cost, it was assumed that the entire pipe system would be replaced, and pipe inverts adjusted to improve the hydraulic capacity to the greatest extent allowed by the site constraints.

A televised inspection of the pipe system is recommended where pipe connections could not be established to verify the condition of the system, and to determine if pipes should be repaired or replaced.

Incorporating stormwater storage and infiltration measures in the upstream portions of the drainage area tributary to DS-04 would serve to eliminate runoff before it reaches the system, thereby reducing the potential for flooding/ponding due to the systems inability to adequately convey runoff to the outfall location. These upstream improvements are not included in the opinion of probable cost.

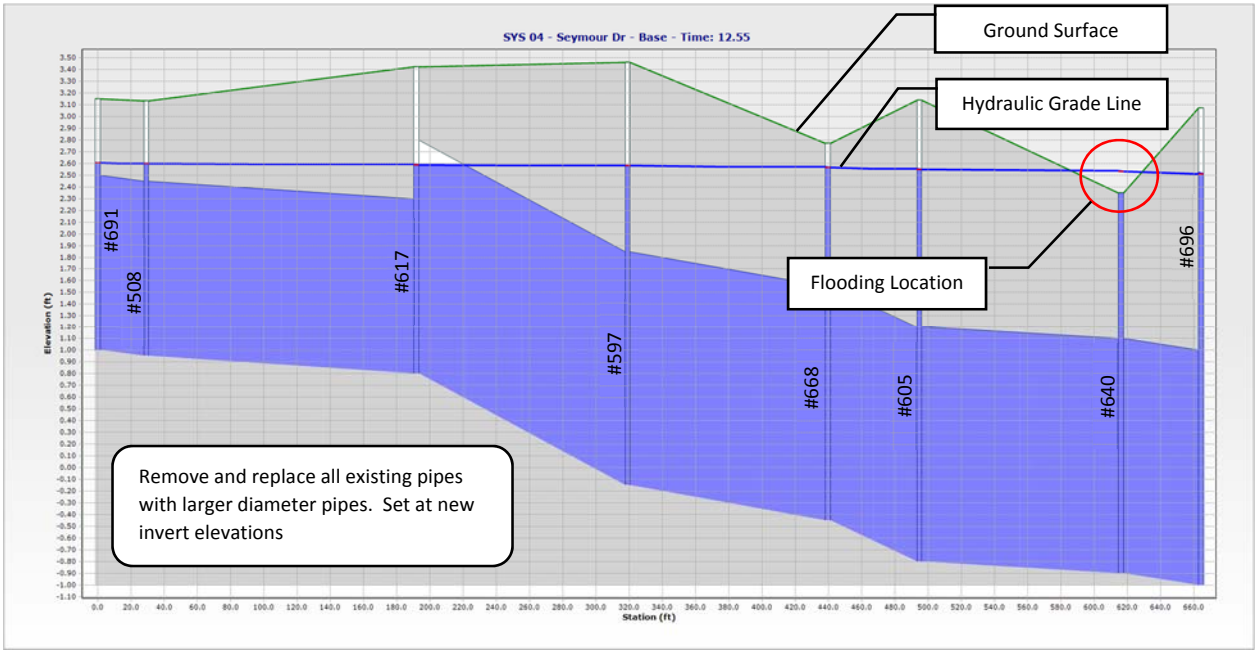

Figure IV-100. Recommended Improvements - DS-04

4. DS-04 – Seymour Drive to Pinetree Drive (cont.)

Analysis of Existing System:

Pipe connections between the following structures could not be definitively established, but were assumed to exist or to have existed for stormwater modeling purposes based on record information and field investigations:

#605 to #640

#640 to #696

#614 to #562

The drainage area tributary to this intersection is comprised of approximately 7.99 acres of 1/8-acre – 1/4-acre residential properties. Based on the design analysis, the existing drainage system does not have the capacity to adequately convey the runoff generated during a 10-year storm event. The non-linear vertical layout of the overall drainage system, the undersized nature of the conveyance pipes, and the generally flat nature of the study area all contribute to the system's lack of conveyance capacity. As illustrated in the profile, the drainage model indicates flooding occurs at the following drainage structures: #691, #508, #668, and #640.

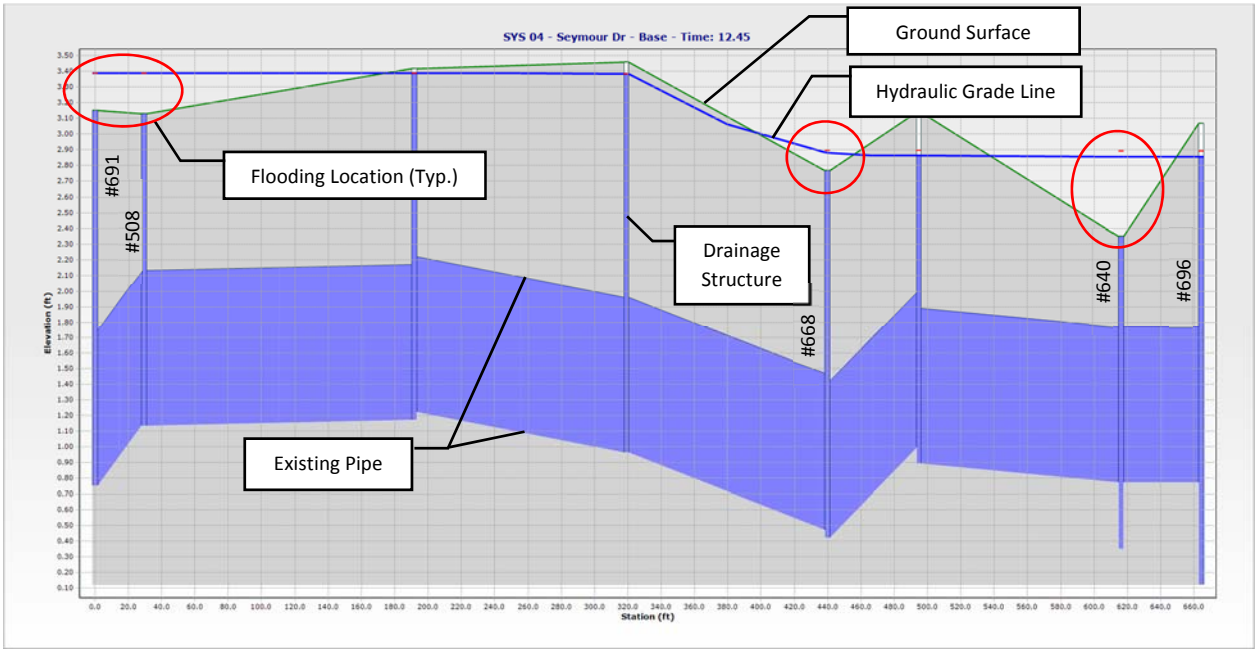

Figure IV-99. Existing Hydraulic Profile of DS-04

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5. DS-05 – Pinetree Drive (includes 5A and 5B) from Westminster Drive to Lombardy Drive

Existing Condition:

Drainage System DS-05 runs in a north-to-south direction along Pinetree Drive in the Smith Point section of the study area. The drainage system consists of catch basins, drywells and drainage pipe, and runs from the intersection with Westminster Drive on the north to Seymour Drive on the south end, where it ties into Drainage System DS-04 at structure #652.

The ground elevation of this system ranges from 2.4 to 3.4 feet above sea level.

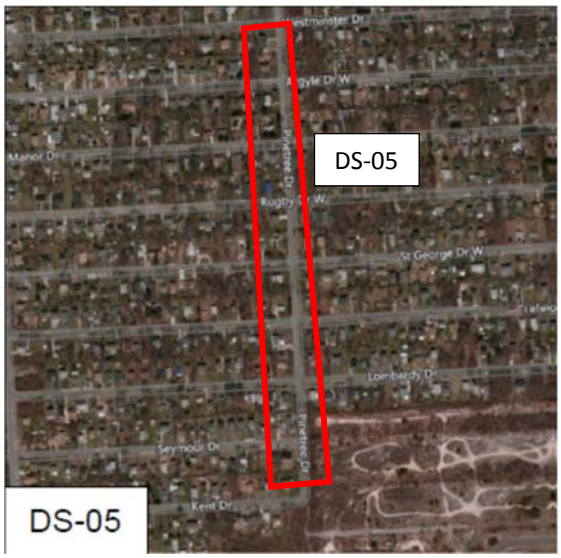

Figure IV-101. Aerial Location Map – DS-05

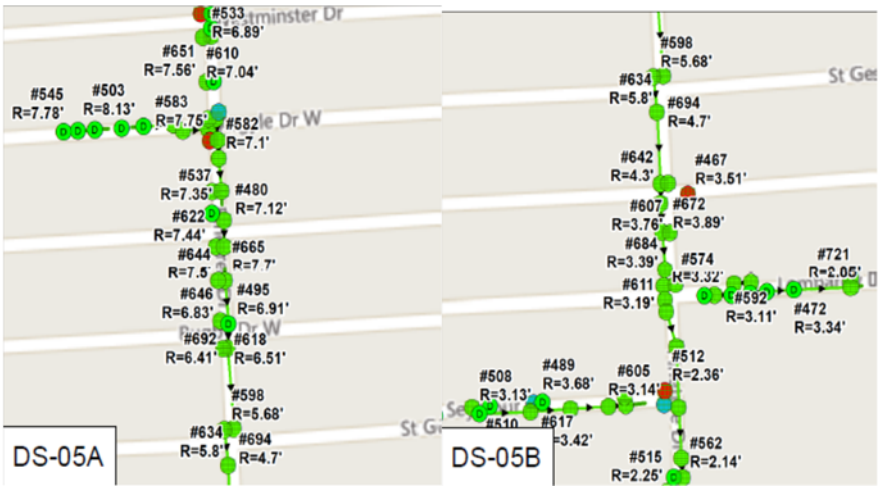

Figure IV-102. Schematic Roadway Map – DS-05A (left) and DS-05B (right)

5. DS-05 – Pinetree Drive (includes 5A and 5B) from Westminster Drive to Lombardy Drive

Recommended Solution:

A televised inspection of the pipe system is recommended where pipe connections could not be established to verify the condition of the system, and to determine if pipes should be repaired or replaced.

By replacing pipes between structure #533 and #652 with larger diameter pipe and adjusting pipe inverts, as depicted in the figure below, the hydraulics of the system can be improved and the potential for roadway flooding can be reduced during the 10-year storm event.

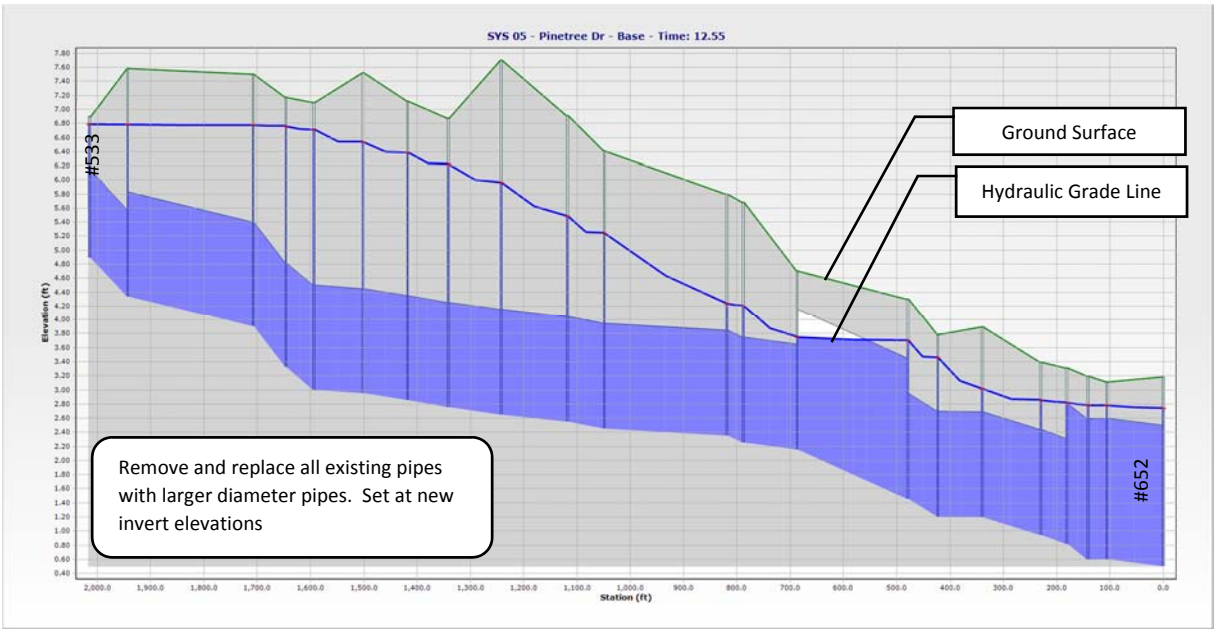

Figure IV-104. Recommended Improvements - DS-05

5. DS-05 – Pinetree Drive (includes 5A and 5B) from Westminster Drive to Lombardy Drive (cont.)

Analysis of Existing System:

Pipe connections between the following structures could not be definitively established, but were assumed to exist or to have existed for stormwater modeling purposes based on record information and field investigations:

#586 to #665

#654 to #480

#682 to #572

#565 to #660

#627 to #565

#588 to #627

The drainage area tributary to this intersection is comprised of approximately 13.59 acres of 1/8-acre – 1/4-acre residential properties. Based on the design analysis, the existing drainage system does not have the capacity to adequately convey the runoff generated during a 10-year storm event. The non-linear vertical layout of the overall drainage system, the undersized nature of the conveyance pipes, and the generally flat nature of the study area all contribute to the system's lack of conveyance capacity. As illustrated in the profile below, the drainage model indicates flooding occurs at the following drainage structures: #533, #572, #582, #586, #643, #672, #684, #621, #611, #491, and #652.

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5. DS-05 – Pinetree Drive (includes 5A and 5B) from Westminster Drive to Lombardy Drive (cont.)

Analysis of Existing System:

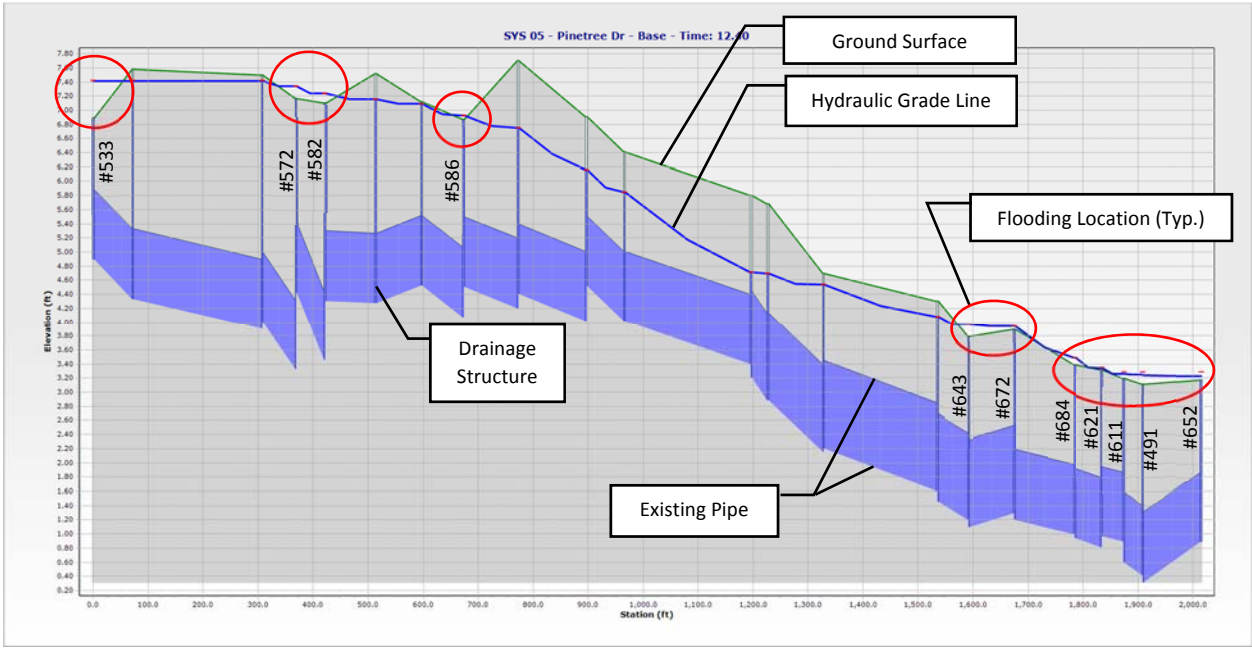

Figure IV-103. Existing Hydraulic Profile of DS-05

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6. DS-05C – Lombardy Drive from Pinetree Drive east

Existing Condition:

Consisting of catch basins and drainage pipe, Drainage System DS-5C is located in the western side of the Smith Point portion of the study area. The system begins just east of the intersection of Pinetree Drive and Lombardy Drive, runs eastward along the south side of Lombardy Drive, and discharges into a shallow channel located on the south side of the roadway.

The ground elevation of this system ranges from 2.5 to 3.5 feet above sea level.

6. DS-05C – Lombardy Drive from Pinetree Drive east

Recommended Solution:

Based on the design analysis, the existing drainage system appears to have the capacity to adequately convey the runoff generated during a 10-year storm event. As such, no improvements are suggested at this location.

6. DS-05C – Lombardy Drive from Pinetree Drive east (cont.)

Analysis of Existing System:

The drainage area tributary to this intersection is comprised of approximately 2.79 acres of 1/8-acre – 1/4-acre residential properties. Based on the design analysis, the existing drainage system appears to have the capacity to adequately convey the runoff generated during a 10-year storm event.

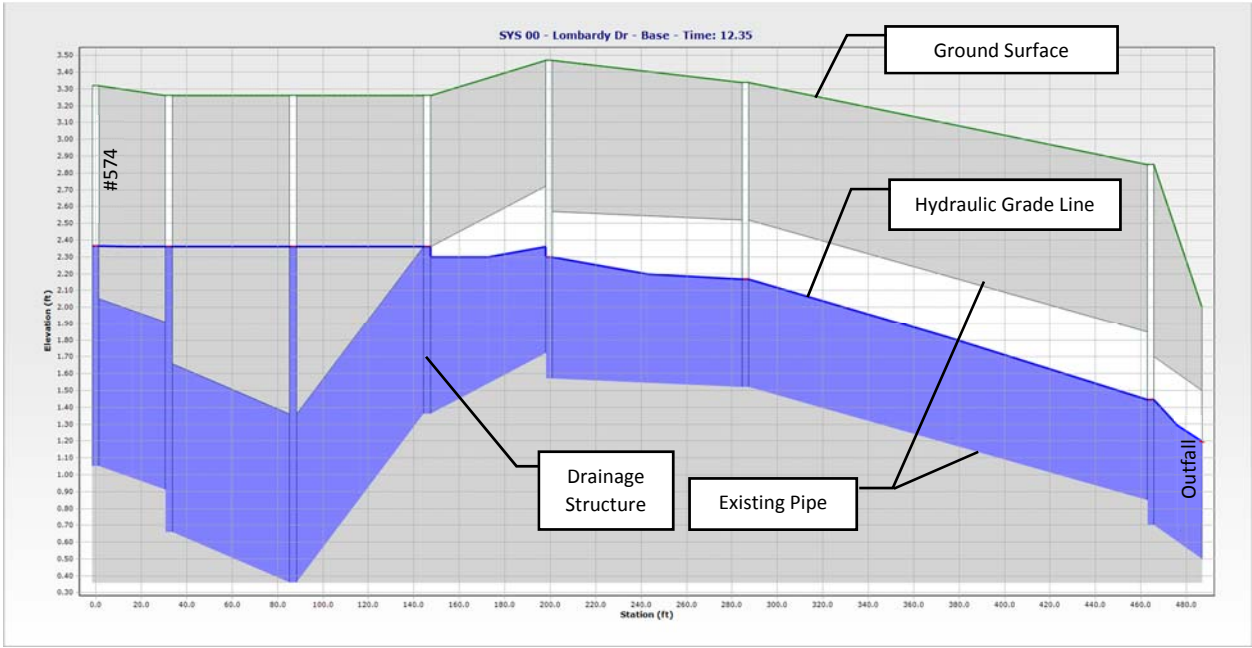

Figure IV-105. Existing Hydraulic Profile of DS-05C

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7. DS-06 – Manor Drive from William Floyd Parkway east

Existing Condition:

Drainage System DS-06 runs in the west-to-east direction within Manor Drive in the Smith Point section of the study area. This drainage system consists of catch basins and drainage pipe and runs from the intersection with the William Floyd Parkway to the discharge outfall located on a creek which leads to Narrow Bay.

The ground elevation of this system ranges from 5.3 to 6.5 feet above sea level.

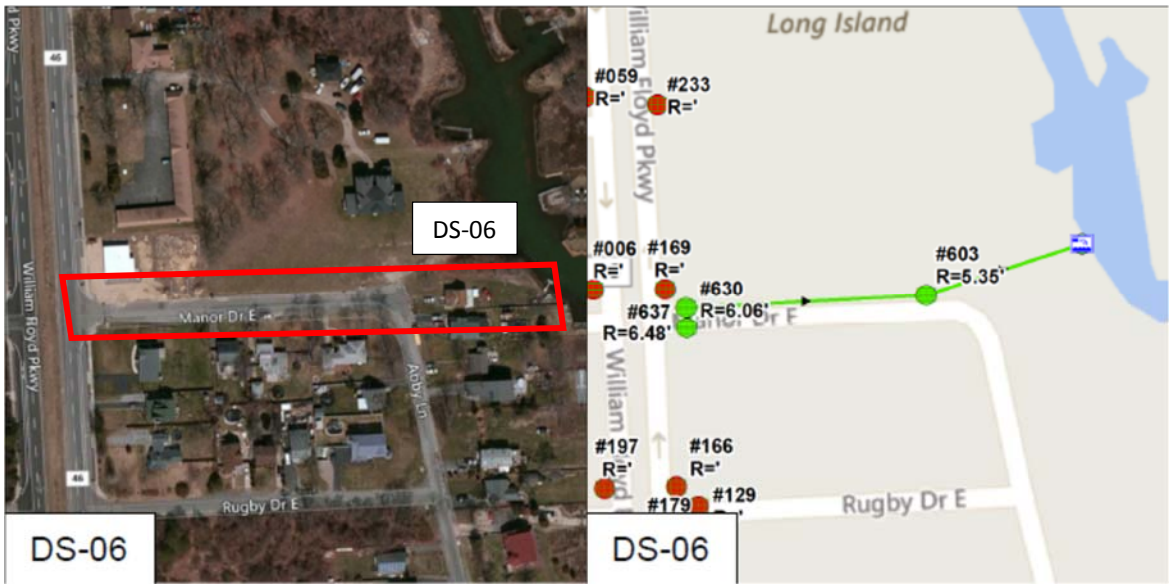

Figure IV-106. Aerial Location Map and Schematic Roadway Map – DS-06

7. DS-06 – Manor Drive from William Floyd Parkway east

Recommended Solution:

Based on the design analysis, the existing drainage system appears to have the capacity to adequately convey the runoff generated during a 10-year storm event. As such, no improvements suggested at this location.

7. DS-06 – Manor Drive from William Floyd Parkway east (cont.)

Analysis of Existing System:

The drainage area tributary to this intersection is comprised of approximately 3.72 acres of 1/8-acre – 1/4-acre residential properties. Based on the design analysis, the existing drainage system appears to have the capacity to adequately convey the runoff generated during a 10-year storm event. This system serves as a stormwater outfall to the William Floyd Parkway and has been appropriately sized to accommodate its stormwater runoff.

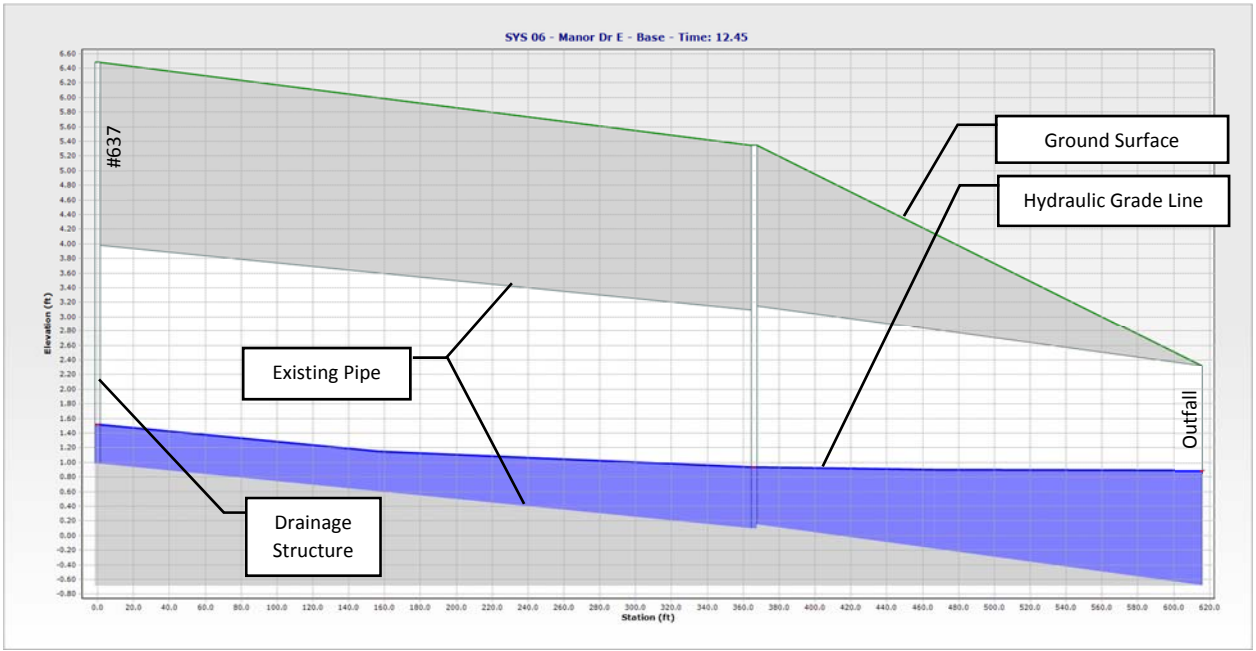

Figure IV-107. Existing Hydraulic Profile of DS-06

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8. DS-07 – Intersection of Abby Lane and Trafalgar Drive

Existing Condition:

Drainage System DS-07 is located at the intersection of Trafalgar Drive and Abby Lane in the Smith Point section of the study area. This drainage system consists of a single catch basin and a length of drainage pipe, which discharges at the southern end of Abby Lane into a canal which leads to Narrow Bay.

The ground elevation of this system ranges from 2.5 to 3.5 feet above sea level.

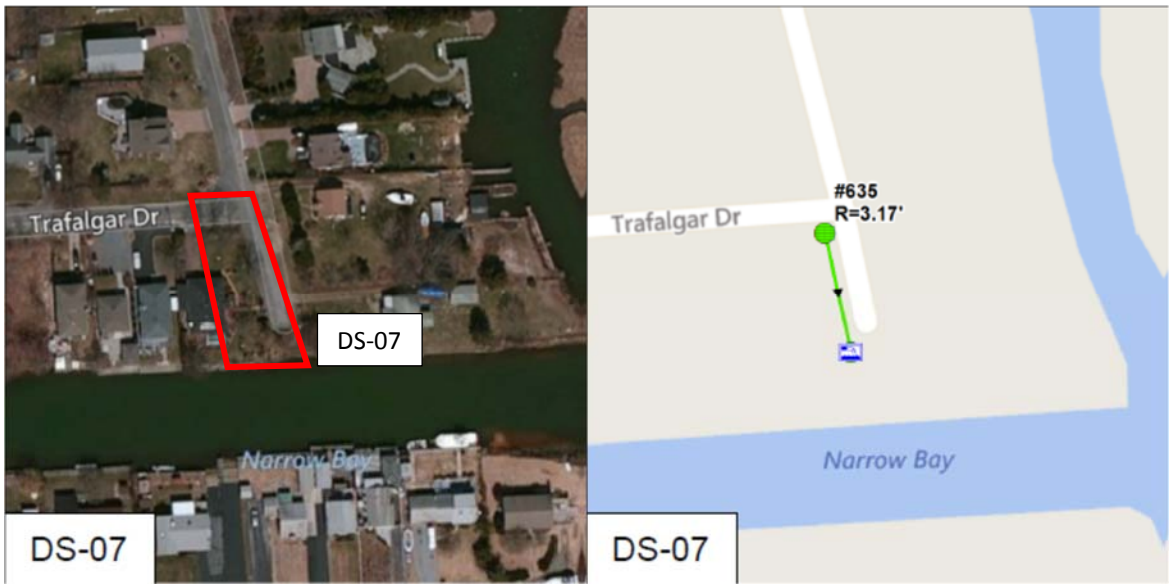

Figure IV-108. Aerial Location Map and Schematic Roadway Map – DS-07

8. DS-07 – Intersection of Abby Lane and Trafalgar Drive

Recommended Solution:

Based on the design analysis, the existing drainage system appears to have the capacity to adequately convey the runoff generated during a 10-year storm event. As such, no improvements are suggested at this location.

8. DS-07 – Intersection of Abby Lane and Trafalgar Drive (cont.)

Analysis of Existing System:

The drainage area tributary to this intersection is comprised of approximately 2.62 acres of 1/8-acre – 1/4-acre residential properties. Based on the design analysis, the existing drainage system appears to have the capacity to adequately convey the runoff generated during a 10-year storm event.

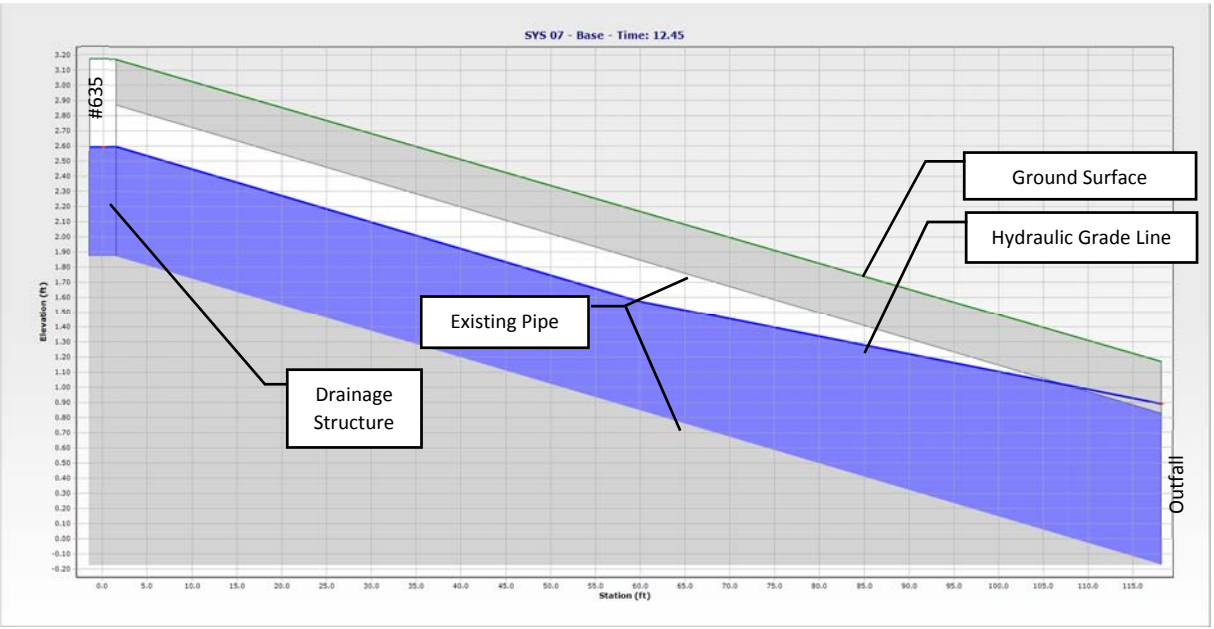

Figure IV-109. Existing Hydraulic Profile of DS-07

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9. DS-11 – Intersection of Gooseberry Road and Maywood Drive

Existing Condition:

Drainage System DS-11 is located at the intersection of Trafalgar Drive and Abby Lane on the western side of the Mastic Beach portion of the study area. This drainage system consists of catch basins, drywells and drainage pipe and runs along Gooseberry Road from its intersection with Woodside Road to the intersection with Maywood Drive, and extends approximately 100 feet northward on Maywood Drive. The Maywood and Gooseberry branches of the system connect at structure #305.

Village of Mastic Beach records indicate that the system discharges via drainage pipe from structure #305 into the nearby creek tributary to the Johns Neck Creek, which is located to the west of the system. Although records point to the existence of an outfall pipe, field observations indicate the pipe to be either collapsed or buried. Extensive ponding occurs at the intersection of Maywood Drive and Gooseberry Road during storm events.

The ground elevation of this system ranges from 2.4 to 3.4 feet above sea level.

Figure IV-110. Aerial Location Map and Schematic Roadway Map – DS-11

9. DS-11 – Intersection of Gooseberry Road and Maywood Drive

Recommended Solution:

A televised inspection of the pipe system is recommended where pipe connections could not be established to verify the condition of the system, and to determine if pipes should be repaired or replaced.

By replacing pipes between structure #590 and the outfall with larger diameter pipe, as well as adjusting the pipe invert elevations, the hydraulics of the system can be improved and the potential for roadway flooding can be reduced during the 10-year storm event.

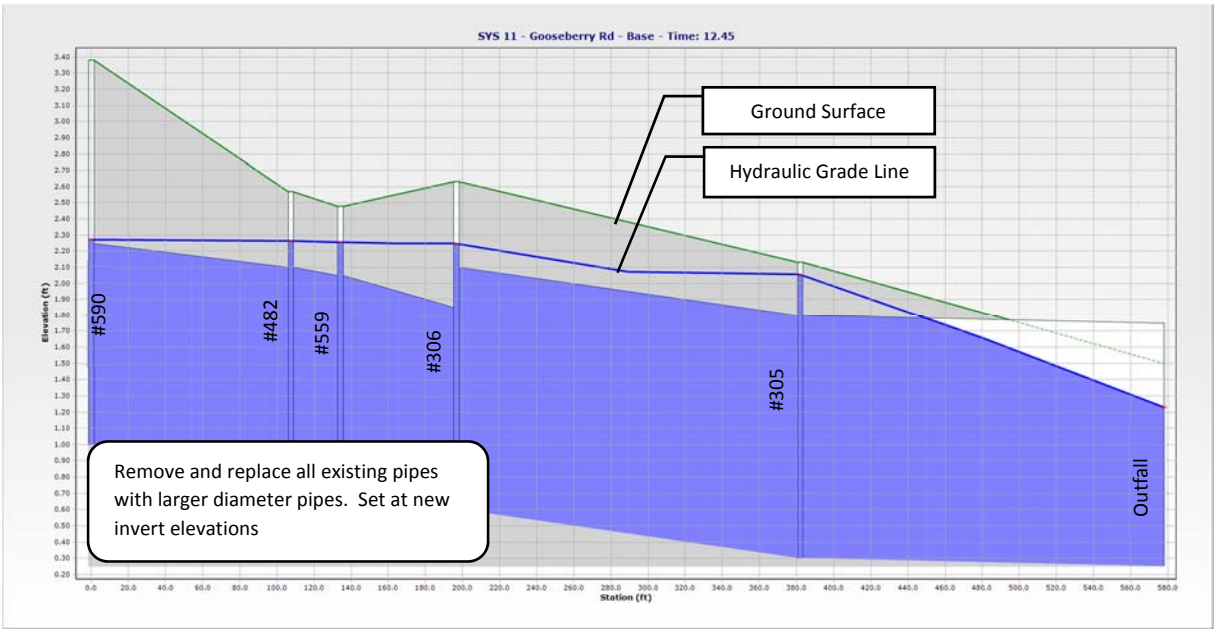

Figure IV-113. Recommended Improvements - DS-11 – Gooseberry Road

9. DS-11 – Intersection of Gooseberry Road and Maywood Drive (cont.)

Analysis of Existing System:

Pipe connections between the following structures could not be definitively established, but were assumed to exist or to have existed for stormwater modeling purposes based on record information and field investigations:

#306 to #305

#354 to #305

#305 to Outfall (#007)

The drainage area tributary to this intersection is comprised of approximately 7.34 acres of 1/8-acre – 1/4-acre residential properties. Based on the design analysis, the existing drainage system does not have the capacity to adequately convey the runoff generated during a 10-year storm event. The non-linear vertical layout of the overall drainage system, the undersized nature of the conveyance pipes, and the generally flat nature of the study area all contribute to the system's lack of conveyance capacity. As illustrated in the profile, the drainage model indicates that flooding occurs at the following drainage structures: #590, #482, #559, #306, and #305.

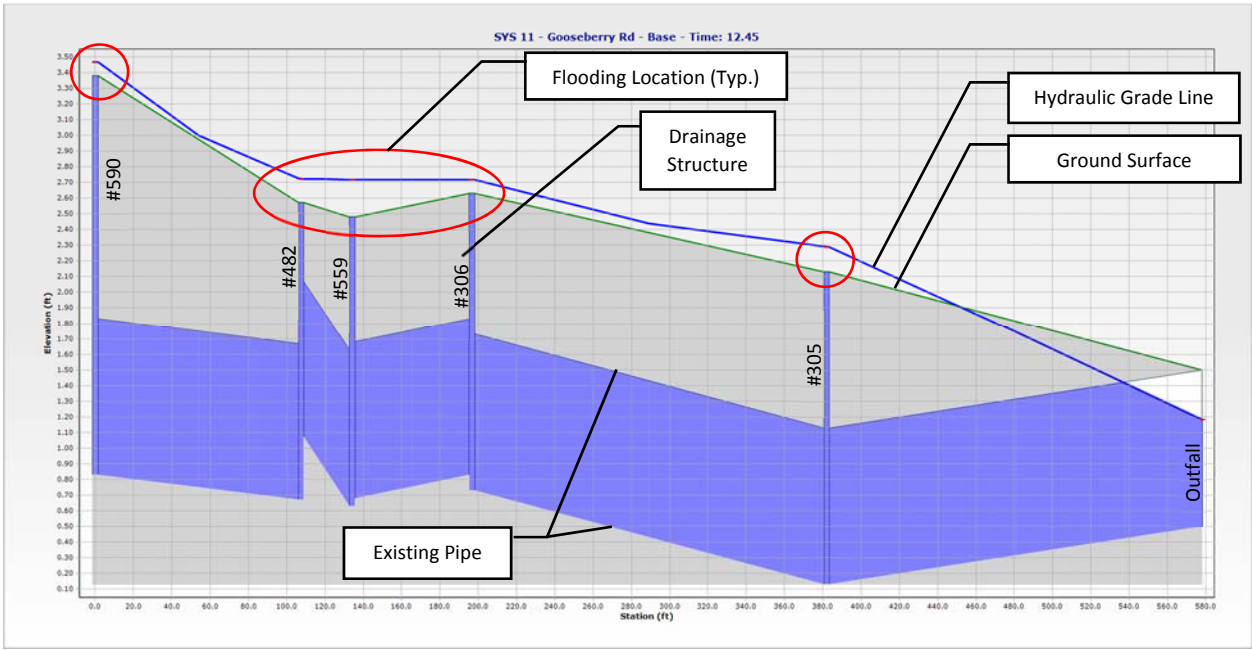

Figure IV-111. Existing Hydraulic Profile of DS-11 – Gooseberry Rd

9. DS-11 – Intersection of Gooseberry Road and Maywood Drive (cont.)

Recommended Solution:

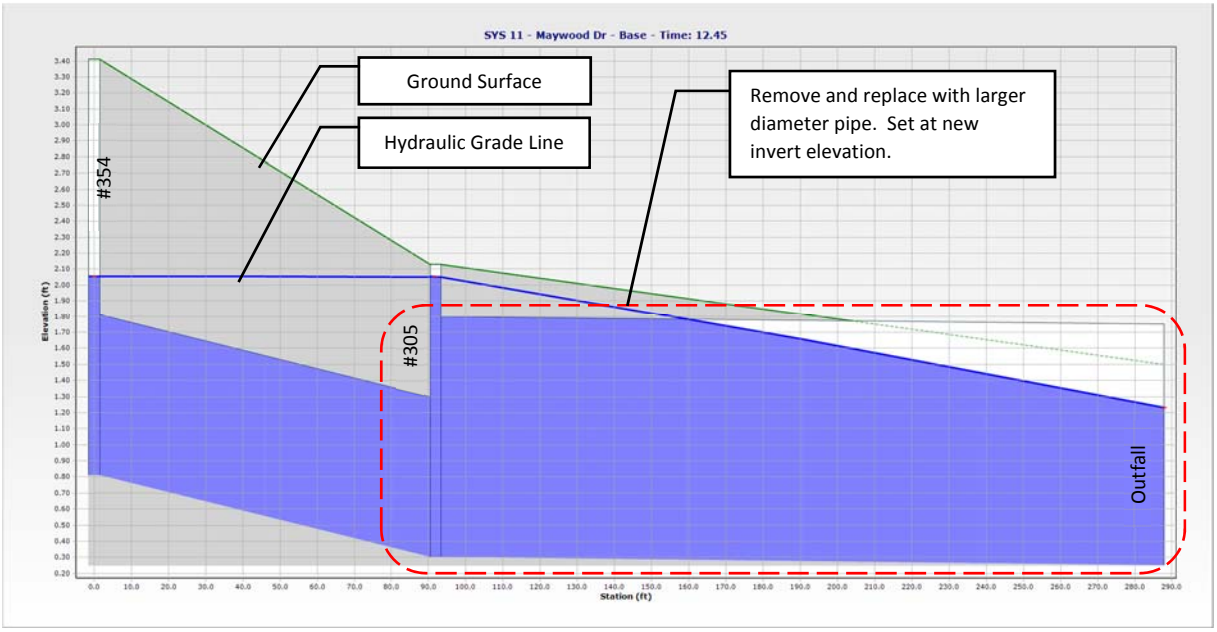

Figure IV-114. Recommended Improvements - DS-11 – Maywood Drive

Refer to the analysis of Locations MB-10 in Section IV of this report for additional recommendations that could impact system DS-11.

9. DS-11 – Intersection of Gooseberry Road and Maywood Drive (cont.)

Analysis of Existing System:

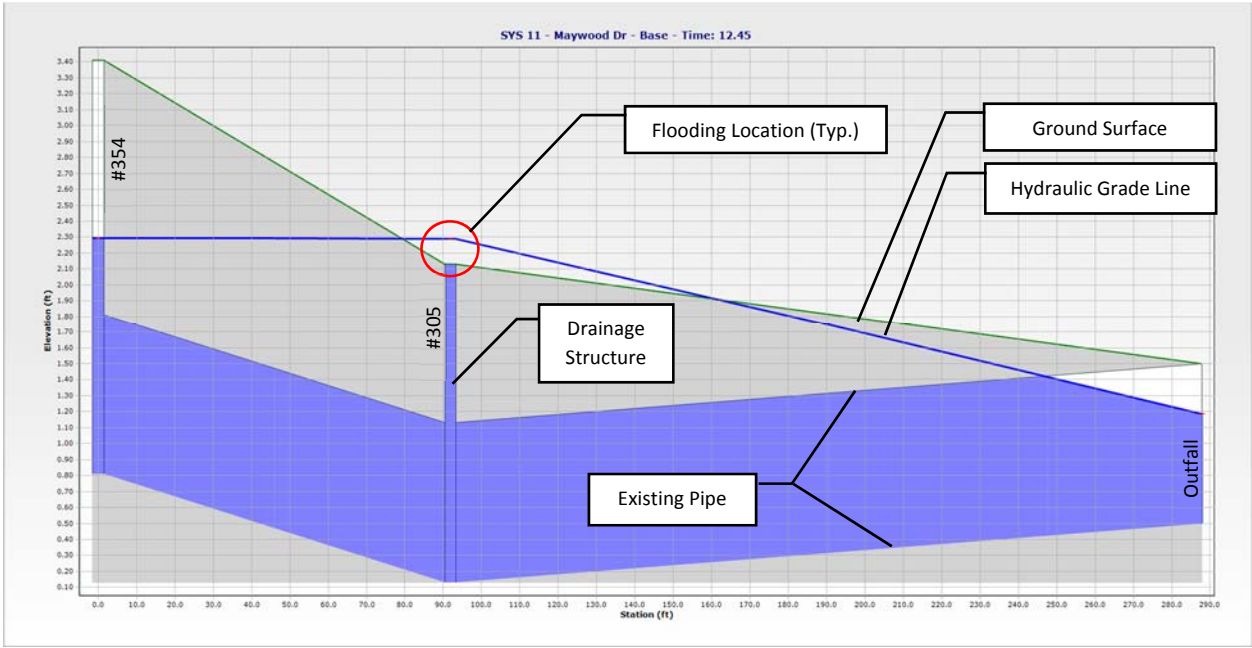

Figure IV-112. Existing Hydraulic Profile of DS-11 – Maywood Drive

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10. DS-12 – Maywood Drive (includes 12A & 12B)

Existing Condition:

Drainage System DS-12 runs north-to-south along Maywood Drive on the western side of the Mastic Beach portion of the study area. This drainage system consists of catch basins, drywells and drainage pipe and runs along Maywood Drive from near its intersection with Dogwood Road to the intersection with Forest Road, and extends approximately 100 feet northward on Maywood Drive. The system discharges via drainage pipe into a channel on the west side of Maywood Drive, at a location approximately 280 feet north of the intersection with Forest Road.

The ground elevation of this system ranges from 3.0 to 6.0 feet above sea level.

Figure IV-115. Aerial Location Map and Schematic Roadway Map – DS-12

10. DS-12 – Maywood Drive (includes 12A & 12B)

Recommended Solution:

By replacing pipes between structure #625 and the system outfall with larger diameter pipe and adjusting pipe inverts, as depicted in the figure below, the hydraulics of the system can be improved and the potential for roadway flooding can be reduced during the 10-year storm event.

A televised inspection of the pipe system is recommended where pipe connections could not be established to verify the condition of the system, and to determine if pipes should be repaired or replaced.

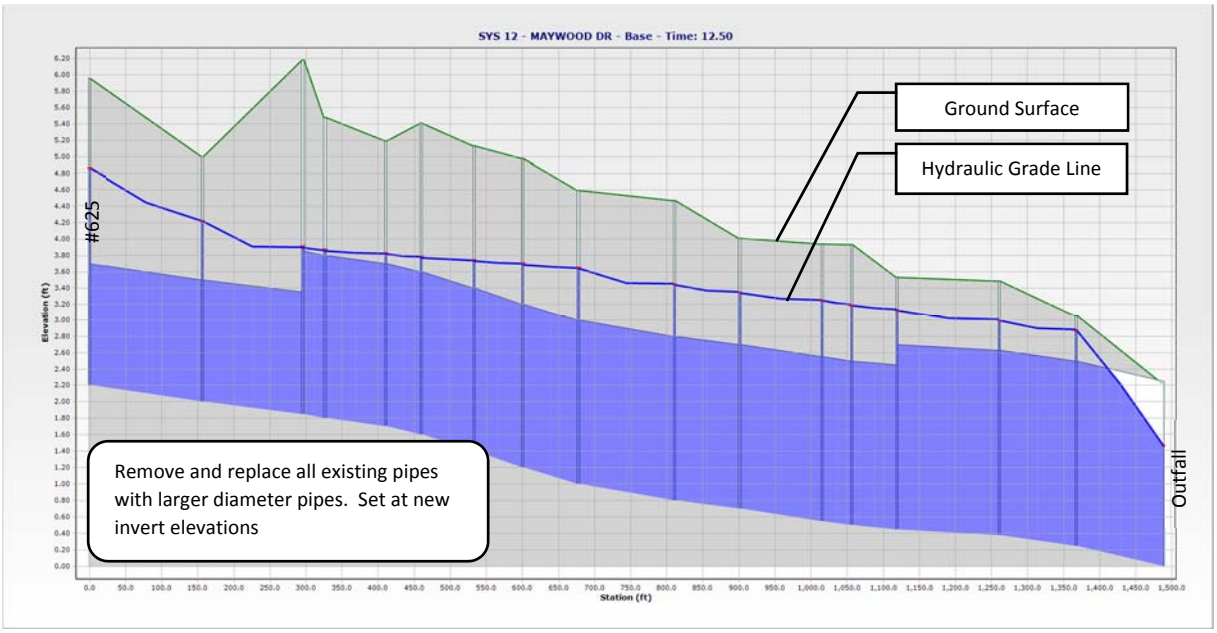

Figure IV-116B. Recommended Improvements - DS-12

10. DS-12 – Maywood Drive (includes 12A & 12B) (cont.)

Analysis of Existing System:

The drainage area tributary to this intersection is comprised of approximately 21.52 acres of 1/8-acre – 1/4-acre residential properties. Based on the design analysis, the existing drainage system does not have the capacity to adequately convey the runoff generated during a 10-year storm event. The non-linear vertical layout of the overall drainage system, the undersized nature of the conveyance pipes, and the generally flat nature of the study area all contribute to the system's lack of conveyance capacity. As illustrated in the profile below, the drainage model indicates flooding occurs at the following drainage structures: #625, #595, #593, #560, #688, #690, #659, #638, #681, #693, #656, and #609.

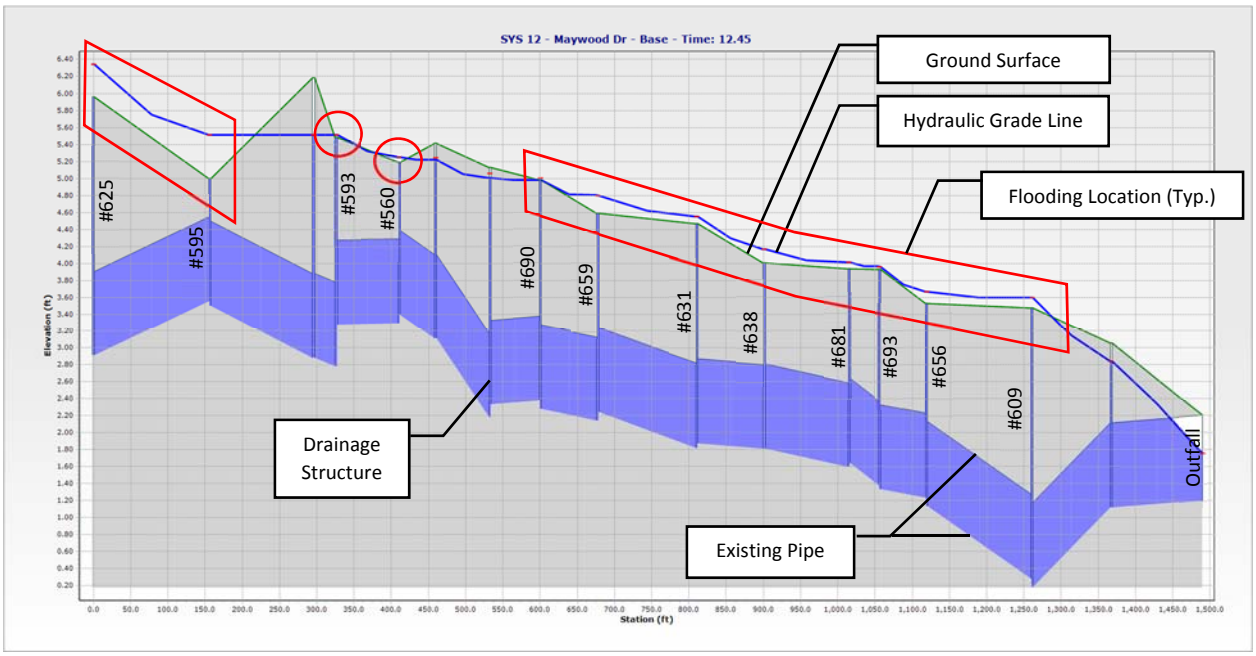

Figure IV-116A. Existing Hydraulic Profile of DS-12

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11. DS-13 – Hickory Road and Laurelton Drive (includes 13A & 13B)

Existing Condition:

Consisting of a series of catch basins, drywells and drainage pipe, Drainage System DS-13 begins at the corner of Woodside Road and Hickory Road on the southern side of the Mastic Beach portion of the study area. From that point, it runs east down Hickory Road and south on Laurelton Drive to the intersection with Riviera Drive. The system bears east on Riviera and then south onto Huntington Drive, before discharging into Sheeper Creek.

The ground elevation of this system ranges from 1.5 to 3.5 feet above sea level.

Figure IV-117. Aerial Location Map and Schematic Roadway Map – DS-13

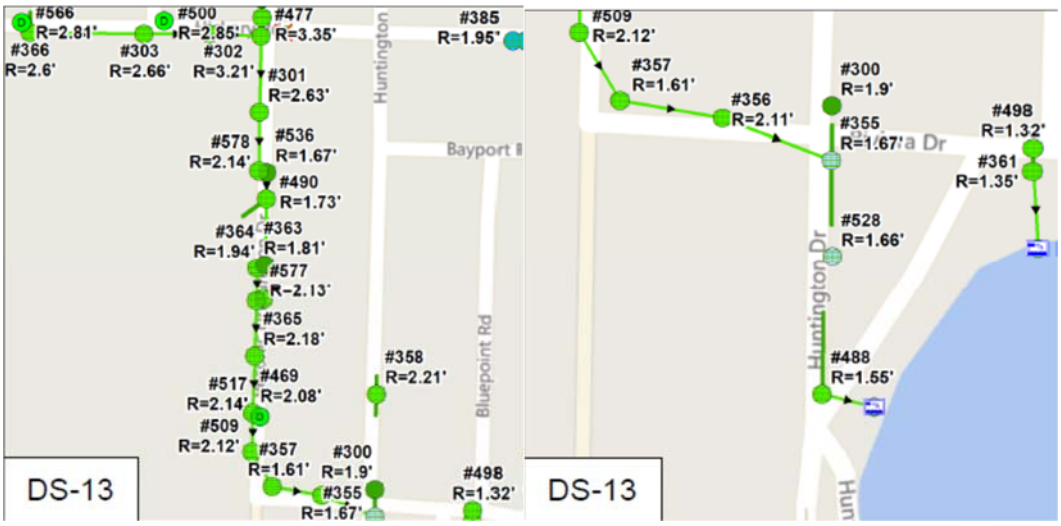

Figure IV-118. Schematic Roadway Map – DS-13

11. DS-13 – Hickory Road and Laurelton Drive (includes 13A & 13B)

Recommended Solution:

Even when increasing pipe diameters and adjusting pipe inverts in an attempt to improve the hydraulics of the system, the computer models continue to indicate flooding will occur at existing drainage structures throughout DS-13 during the 10-year storm event. For the purposes of developing the opinion of probable cost, it was assumed that the entire pipe system would be replaced, and pipe inverts adjusted to improve the hydraulic capacity to the greatest extent allowed by the site constraints.

A televised inspection of each of the pipe system is recommended where pipe connections could not be established to verify the condition of the system, and if it should be repaired or replaced.

Incorporating stormwater storage and infiltration measures in the upstream portions of the drainage area tributary to DS-13 would serve to eliminate runoff before it reaches the system, thereby reducing the potential for flooding/ponding due to the systems inability to adequately convey runoff to the outfall location. These upstream improvements are not included in the opinion of probable cost.

Refer to the analysis of Locations MB-11, MB-12, and MB-19 in Section IV of this report for additional recommendations that could impact system DS-13.

11. DS-13 – Hickory Road and Laurelton Drive (includes 13A & 13B) (cont.)

Analysis of Existing System:

Pipe connections between the following structures could not be definitively established, but were assumed to exist or to have existed for stormwater modeling purposes based on record information and field investigation:

#536 to #490

#490 to #363

#357 to #356

#358 to #300

#300 to #355

#355 to #528 (pipe may be collapsed based on Village comments)

#528 to #488 (pipe may be collapsed based on Village comments)

The drainage area tributary to this intersection is comprised of approximately19.54 acres of 1/8-acre – 1/4-acre residential properties. Based on the design analysis, the existing drainage system does not have the capacity to adequately convey the runoff generated during a 10-year storm event. The non-linear vertical layout of the overall drainage system, the undersized nature of the conveyance pipes, and the generally flat nature of the study area all contribute to the system's lack of conveyance capacity. As illustrated in the profile below, the drainage model indicates flooding occurs at the following drainage structures: #366, #303, #368, #578, #536, #490, #363, #364, #577, #365, #517, #509, #357, #355, #358, #300, and #355.

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11. DS-13 – Hickory Road and Laurelton Drive (includes 13A & 13B) (cont.)

Analysis of Existing System:

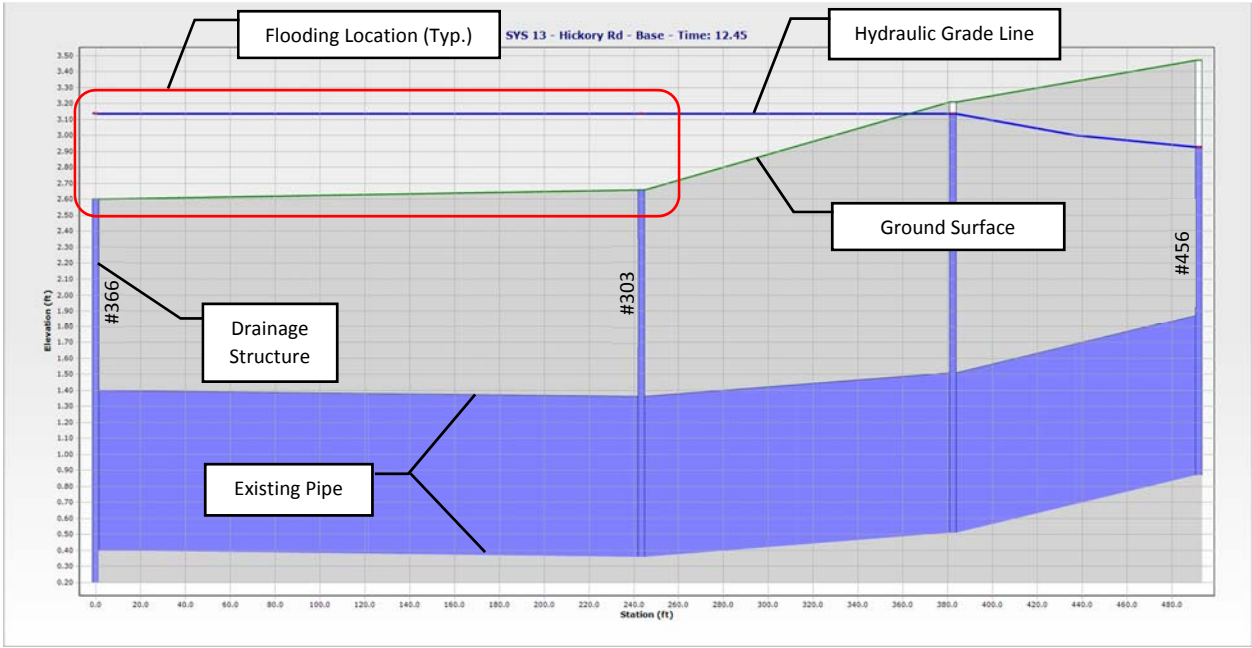

Figure IV-119. Existing Hydraulic Profile of DS-13 – Hickory Road

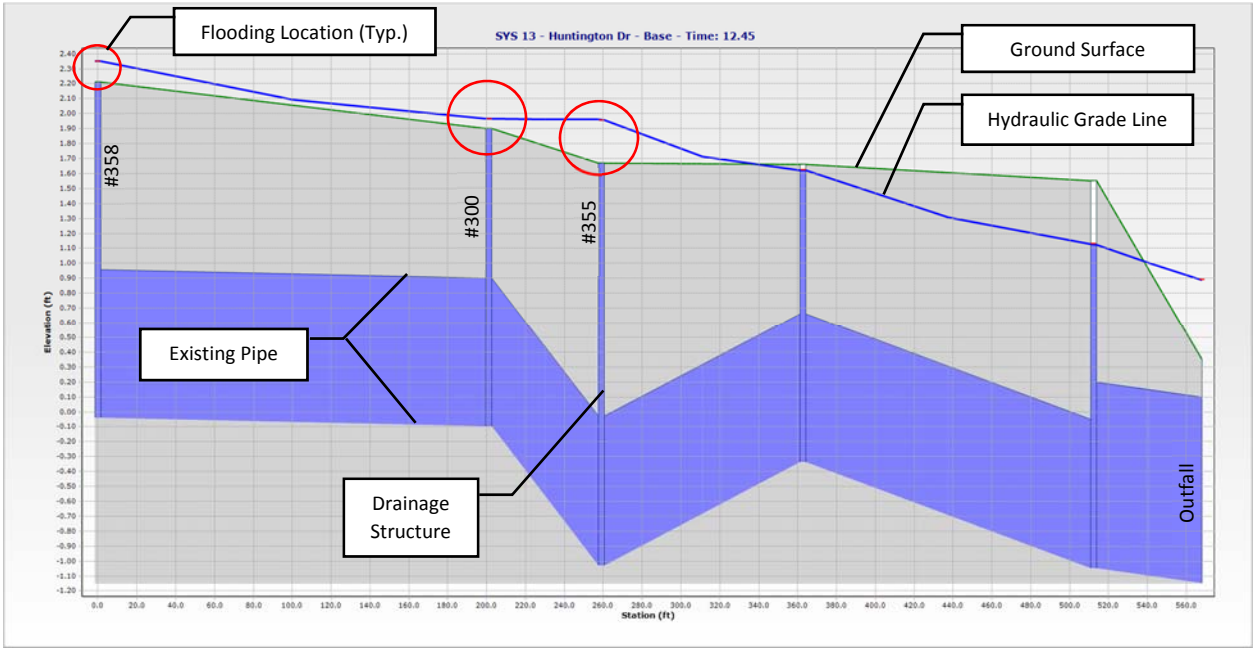

Figure IV-120. Existing Hydraulic Profile of DS-13 – Huntington Drive

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11. DS-13 – Hickory Road and Laurelton Drive (includes 13A & 13B) (cont.)

Analysis of Existing System:

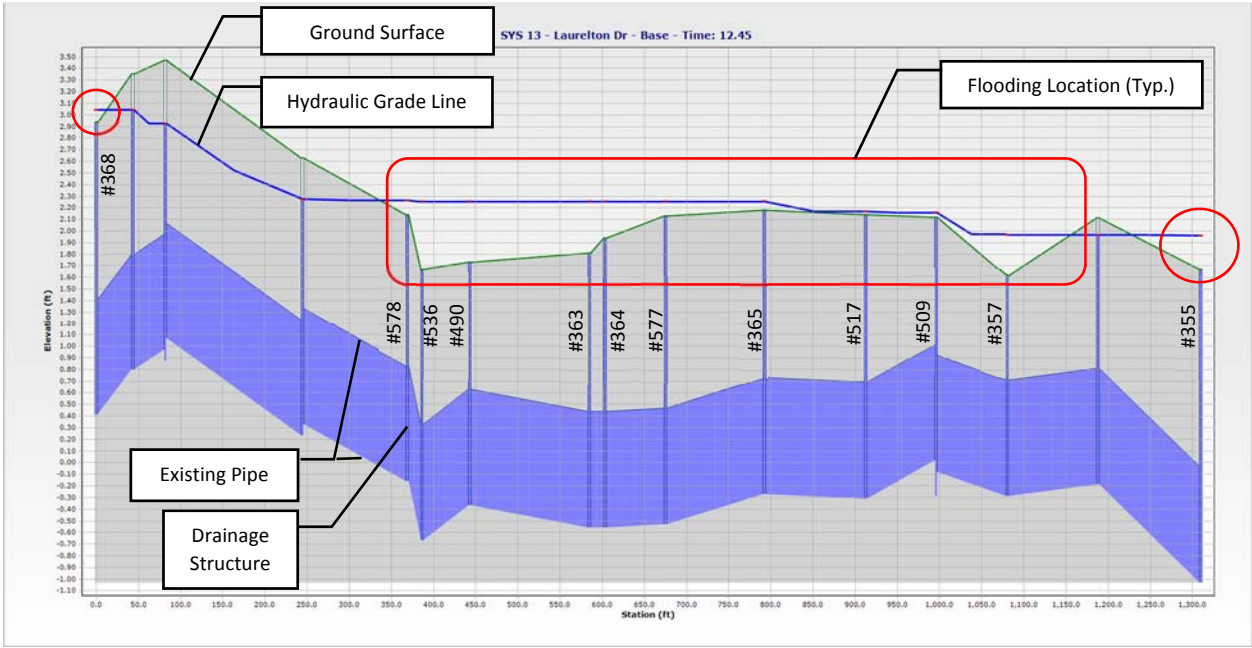

Figure IV-121. Existing Hydraulic Profile of DS-13 – Laurelton Drive

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12. DS-14 - Riviera Drive from Bluepoint Road to Bellport Road

Existing Condition:

Drainage System DS-14 consists of three separate culvert pipes running underneath Riviera Drive and discharging into Sheeper Creek on the western side of the Mastic Beach portion of the study area. The culvert pipes are located in a stretch of Riviera Drive, between the intersections of Bluepoint Road and Bellport Road. In an east-to-west direction, the systems are labeled DS-14A, DS-14B, and DS-14C. The systems are not currently equipped with check valves, and ponding has been observed over the catch basins in Riviera Drive during combination high tide and storm events.

The ground elevation of this system is approximately 1.3 feet above sea level.

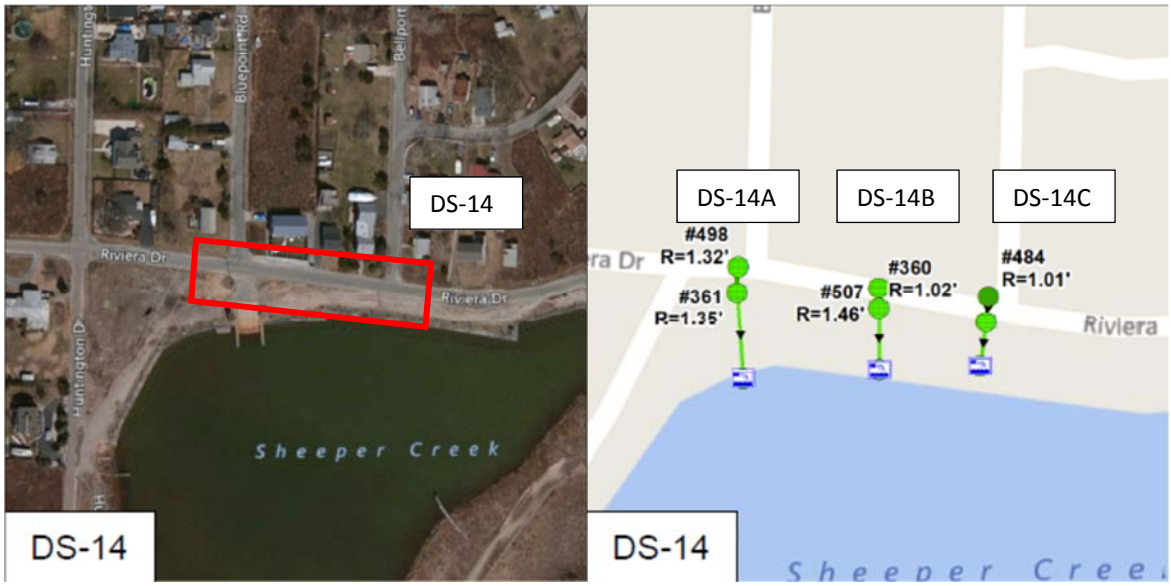

Figure IV-122. Aerial Location Map and Schematic Roadway Map – DS-14

12. DS-14 - Riviera Drive from Bluepoint Road to Bellport Road

Recommended Solution:

A televised inspection of the pipe system is recommended where pipe connections could not be established to verify the condition of the system, and to determine if pipes should be repaired or replaced.

For system DS-14A, by removing existing pipe between #498 and #361 and replacing it with a larger diameter pipe as depicted in the figure below, the hydraulics of the system can be improved and the potential for roadway flooding can be reduced during the 10-year storm event.

Figure IV-126. Recommended Improvements - DS-14 - A

In addition, structures #361 (DS-14A), #360 (DS-14B), and #359 (DS-14C) should be removed and replaced with 4' x 4' concrete catch basins. Also, one in-line check valve should be installed within the outlet pipe (three check valves total).

12. DS-14 - Riviera Drive from Bluepoint Road to Bellport Road (cont.)

Analysis of Existing System:

Pipe connections between the following structures could not be definitively established, but were assumed to exist or to have existed for stormwater modeling purposes based on record information and field investigations:

#498 to #361 (DS-14A)

#507 to #360 (DS-14B)

#360 to Outfall (DS-14B)

#484 to #359 (DS-14C)

The respective drainage areas tributary to each of these systems are comprised of 1/8-acre – 1/4-acre residential properties, and are approximately sized as follows:

DS 14A Drainage Area = 4.83 acres

DS 14B Drainage Area = 0.24 acres

DS 14C Drainage Area = 1.33 acres

Based on the design analysis, only system DS-14A appears to not have the capacity to adequately convey the runoff generated during a 10-year storm event, while DS-14B and DS-14C appear to have adequate capacity. As illustrated in the profile below, the drainage model indicates flooding occurs at the following drainage structures in DS-14A: #498.

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12. DS-14 - Riviera Drive from Bluepoint Road to Bellport Road (cont.)

Analysis of Existing System:

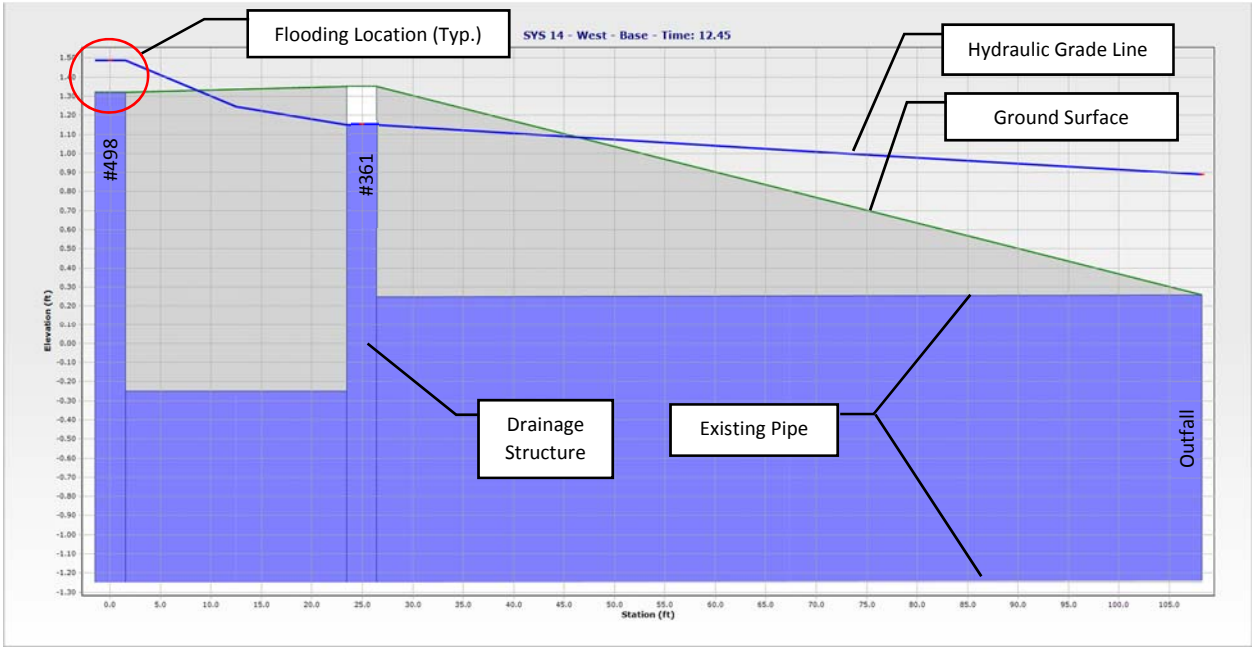

Figure IV-123. Existing Hydraulic Profile of DS-14 - A

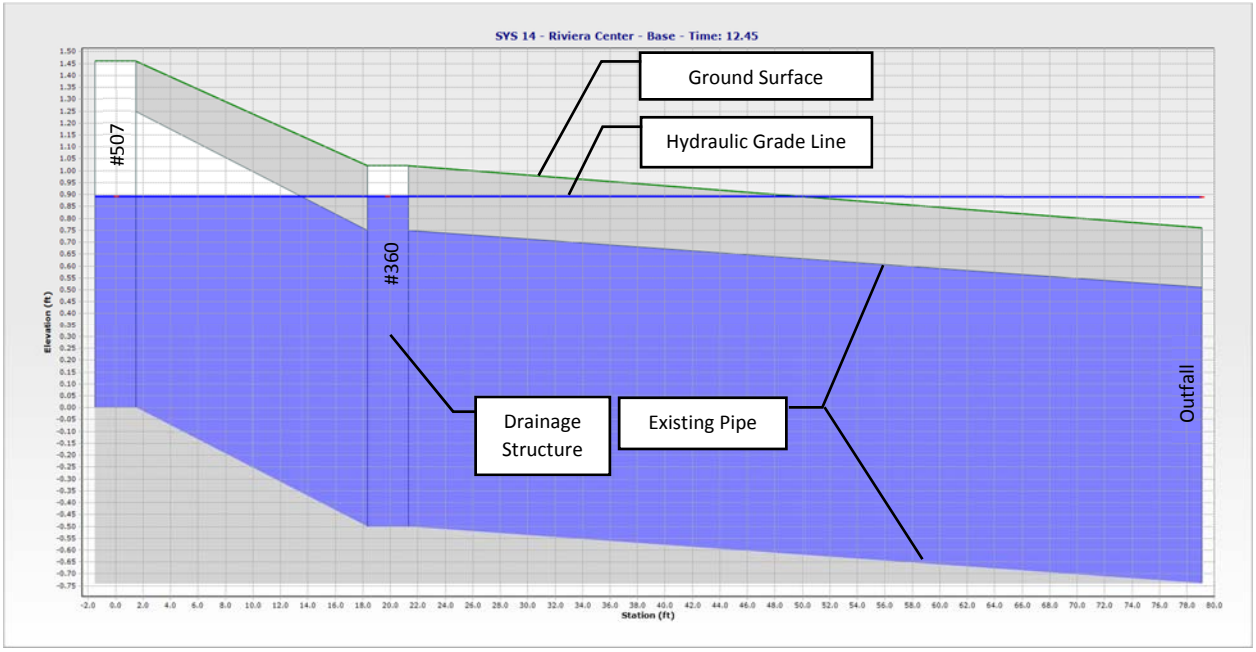

Figure IV-124. Existing Hydraulic Profile of DS-14 – B

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12. DS-14 - Riviera Drive from Bluepoint Road to Bellport Road (cont.)

Analysis of Existing System:

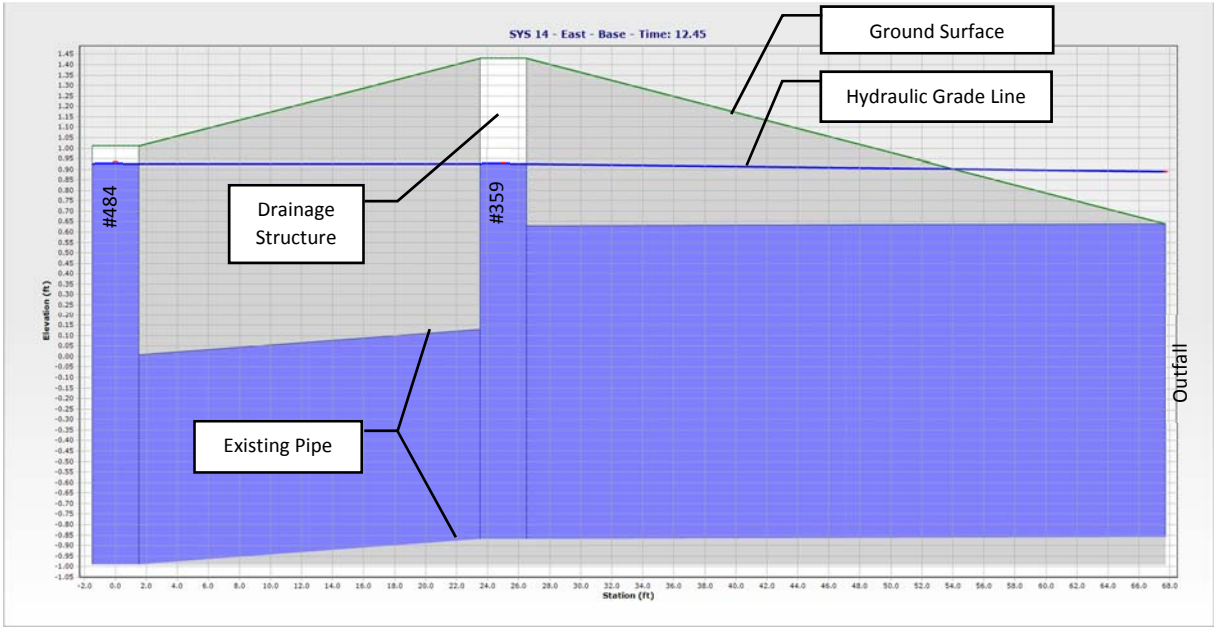

Figure IV-125. Existing Hydraulic Profile of DS-14 - C

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13. DS-15 – Riviera Drive near 706 Riviera Drive

Existing Condition:

Drainage System DS-15 consists of a culvert pipe system running underneath Riviera Drive and discharging into Sheeper Creek on the southern side of the Mastic Beach portion of the study area. The culvert pipe is located between the intersections of Bellport Road and Manhasset Drive. The system is not currently equipped with a check valve, and ponding occurs over the catch basins in Riviera Drive during high tide and storm events.

The ground elevation of this system is approximately 0.9 feet above sea level.

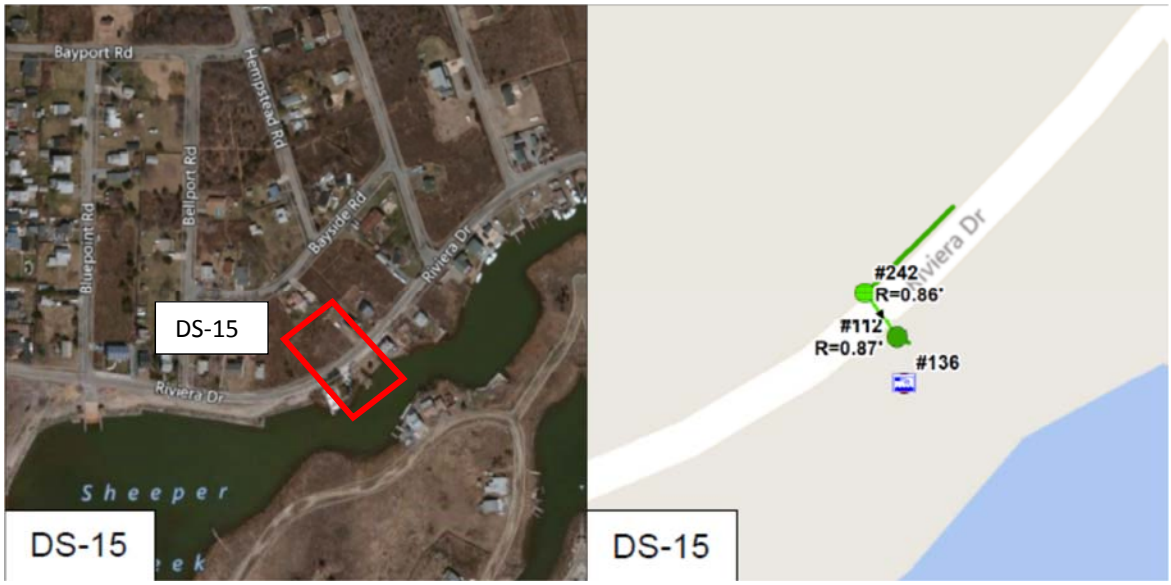

Figure IV-127. Aerial Location Map and Schematic Roadway Map – DS-15

13. DS-15 – Riviera Drive near 706 Riviera Drive

Recommended Solution:

Even when increasing pipe diameters and adjusting pipe inverts in an attempt to improve the hydraulics of the system, the computer models continue to indicate flooding will occur at existing drainage structures throughout DS-15 during the 10-year storm event. For the purposes of developing the opinion of probable cost, it was assumed that the pipe between structures #242 and #112 will be replaced with a larger diameter pipe.

A televised inspection of the pipe system is recommended where pipe connections could not be established to verify the condition of the system, and to determine if pipes should be repaired or replaced.

In addition, structure #112 should be removed and replaced with a 4' x 4' concrete catch basin, and one in-line check valve should be installed within the outlet pipe.

13. DS-15 – Riviera Drive near 706 Riviera Drive (cont.)

Analysis of Existing System:

Pipe connections between the following structures could not be definitively established, but were assumed to exist or to have existed for stormwater modeling purposes based on record information and field investigation:

#242 to #112 (pipe appears to be collapsed)

#112 to #136

The drainage area tributary to this intersection is comprised of approximately 1.55 acres of 1/8-acre – 1/4-acre residential properties. Based on the design analysis, the existing drainage system does not have the capacity to adequately convey the runoff generated during a 10-year storm event. The non-linear vertical layout of the overall drainage system, the undersized nature of the conveyance pipes, and the generally flat nature of the study area all contribute to the system's lack of conveyance capacity. As illustrated in the profile, the drainage model indicates flooding occurs at the following drainage structures: #242.

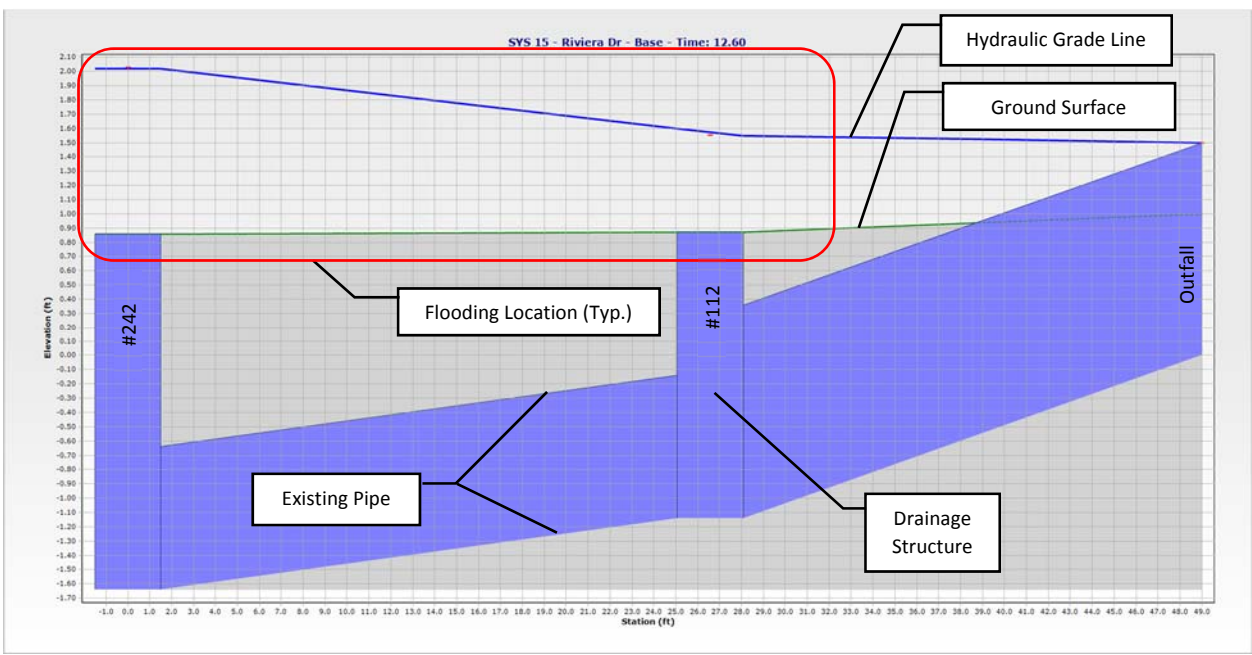

Figure IV-128. Existing Hydraulic Profile of DS-15

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14. DS-16 – Riviera Drive Culvert Pipe

Existing Condition:

Drainage System DS-16 consists of a culvert pipe system running underneath Riviera Drive and discharging into Sheeper Creek in the western side of the Mastic Beach portion of the study area. The culvert pipe is located near the intersection of Riviera Drive and Montauk Drive. The system is not currently equipped with a check valve, and ponding occurs over the catch basins in Riviera Drive during high tide and storm events.

The ground elevation of this system is approximately 1.0 feet above sea level.

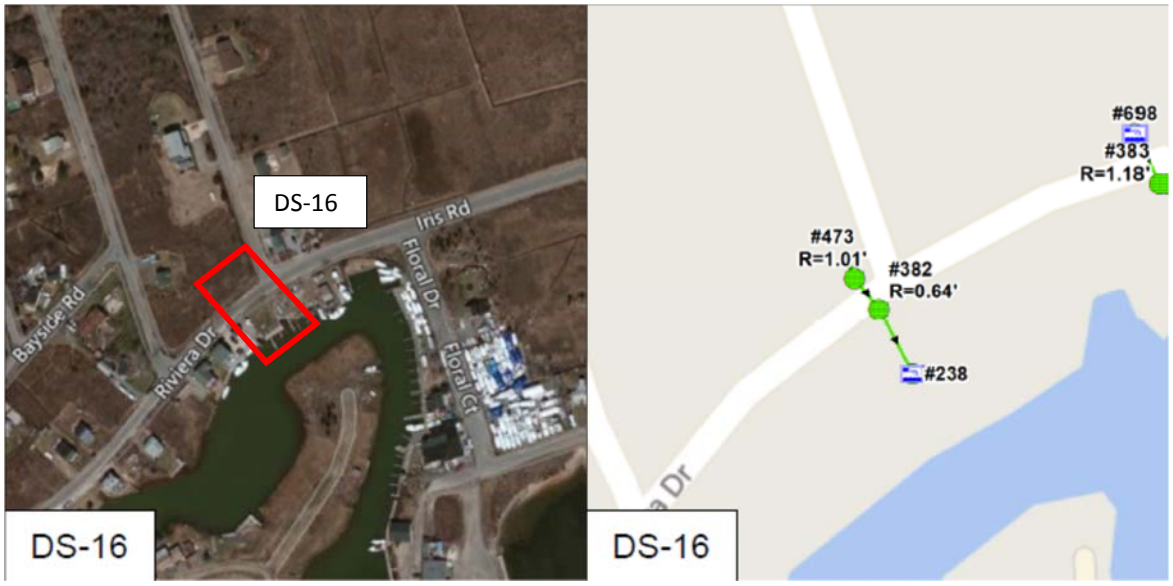

Figure IV-129. Aerial Location Map and Schematic Roadway Map – DS-16

14. DS-16 – Riviera Drive Culvert Pipe

Recommended Solution:

Even when increasing pipe diameters and adjusting pipe inverts in an attempt to improve the hydraulics of the system, the computer models continue to indicate flooding will occur at existing drainage structures throughout DS-16 during the 10-year storm event. For the purposes of developing the opinion of probable cost, it was assumed that the pipe between structures #473 and #382 will be replaced with a larger diameter pipe.

A televised inspection of the pipe system is recommended where pipe connections could not be established to verify the condition of the system, and to determine if pipes should be repaired or replaced.

In addition, structure #382 should be removed and replaced with a 4' x 4' concrete catch basin, and one in-line check valve should be installed within the outlet pipe.

14. DS-16 – Riviera Drive Culvert Pipe (cont.)

Analysis of Existing System:

Pipe connections between the following structures could not be definitively established, but were assumed to exist or to have existed for stormwater modeling purposes based on record information and field investigation:

#473 to #382 (pipe appears to be collapsed)

The drainage area tributary to this intersection is comprised of approximately 4.59 acres of 1/8-acre – ¼-acre residential properties. Based on the design analysis, the existing drainage system does not have the capacity to adequately convey the runoff generated during a 10-year storm event. The non-linear vertical layout of the overall drainage system, the undersized nature of the conveyance pipes, and the generally flat nature of the study area all contribute to the system's lack of conveyance capacity. As illustrated in the profile below, the drainage model indicates flooding occurs at the following drainage structures: #382.

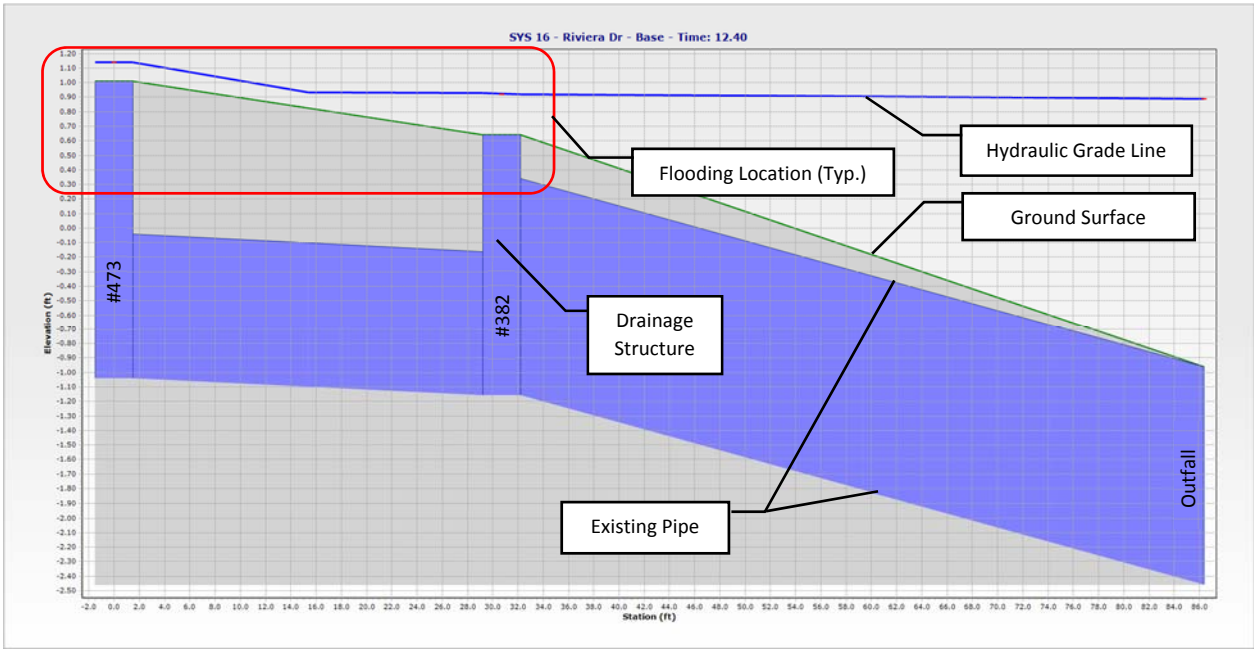

Figure IV-130. Existing Hydraulic Profile of DS-16

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15. DS-17 – Intersection of Iris Road and Floral Court

Existing Condition:

Consisting of catch basins and drainage pipe, Drainage System DS-17 is located on the southern side of the Mastic Beach portion of the study area. The upstream end of the system begins at the intersection of Rivera Drive and Floral Court, runs southward along the west side of Floral Court, and discharges via pipe into adjacent Sheeper Creek. The system is not currently equipped with a check valve.

The ground elevation of this system ranges from 1.0 to 1.5 feet above sea level.

Figure IV-131. Aerial Location Map and Schematic Roadway Map – DS-17

15. DS-17 – Intersection of Iris Road and Floral Court

Recommended Solution:

Based on the design analysis, the existing drainage system appears to have the capacity to adequately convey the runoff generated during a 10-year storm event and no modifications to pipe sizes are recommended. However, it is recommended that the existing drainage system is cleaned to remove any debris and sediment that have accumulated over time at low points within the pipes, and inspected to ensure it remains in good working condition. Repairs should be made to the drainage system as necessary.

In addition, structure #568 should be removed and replaced with a 4' x 4' concrete catch basin, and one in-line check valve should be installed within the outlet pipe.

15. DS-17 – Intersection of Iris Road and Floral Court (cont.)

Analysis of Existing System:

The drainage area tributary to this intersection is comprised of approximately 8.36 acres of 1/8-acre – 1/4-acre residential properties. Based on the design analysis, the existing drainage system appears to have the capacity to adequately convey the runoff generated during a 10-year storm event.

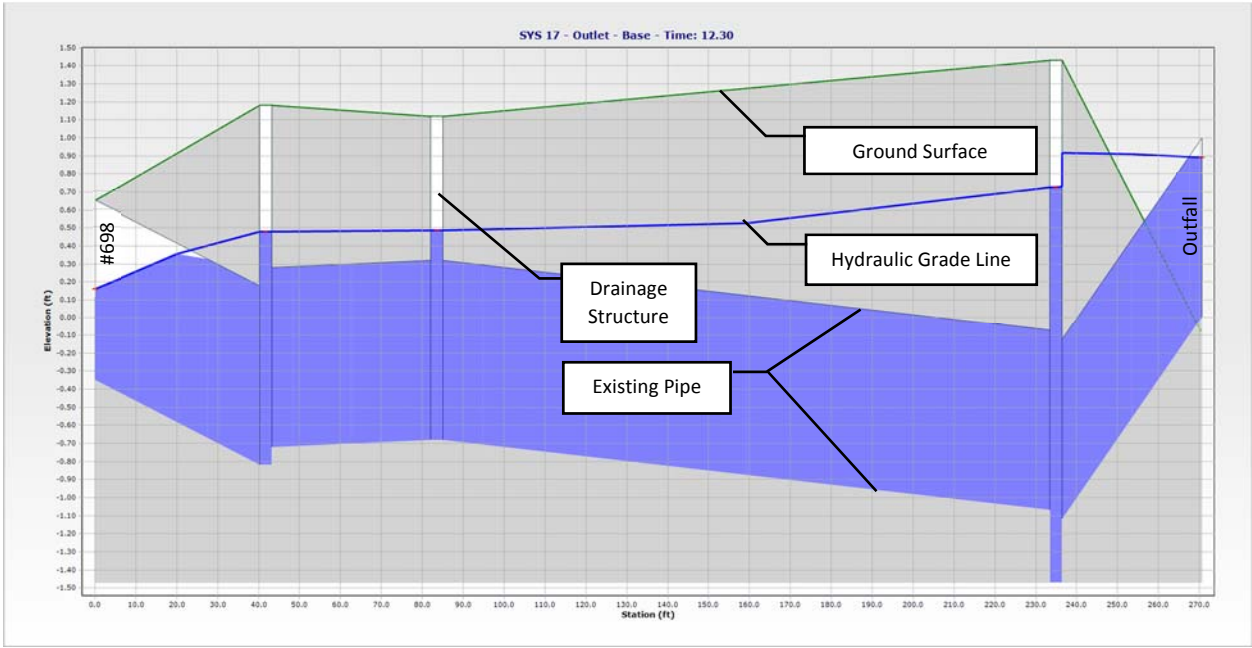

Figure IV-132. Existing Hydraulic Profile of DS-17

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16. DS-18 – Hickory Road between Hempstead Road and Montauk Drive

Existing Condition:

Consisting of catch basins and drainage pipe, Drainage System DS-18 is located on the southern side of the Mastic Beach portion of the study area. The system runs predominantly in an east-west direction along Hickory Drive, and discharges via pipe into a shallow channel at the southwest corner of the Hickory Road / Montauk Drive intersection. Two branches of system DS-18 – one to the west of the outfall structure, and one to the east – meet at structure #392.

The ground elevation of this system ranges from 1.8 to 2.5 feet above sea level.

Figure IV-133. Aerial Location Map and Schematic Roadway Map – DS-18

16. DS-18 – Hickory Road between Hempstead Road and Montauk Drive

Recommended Solution:

By replacing pipes between structures #387 and #392 with larger diameter pipe on the west branch, and replacing pipes between structures #394 and #392 on the east branch, as well as adjusting pipe inverts, the hydraulics of the system can be improved and the potential for roadway flooding can be reduced during the 10-year storm event.

A televised inspection of the pipe system is recommended where pipe connections could not be established to verify the condition of the system, and to determine if pipes should be repaired or replaced.

Refer to the analysis of location MB-15 in Section IV of this report for additional recommendations that could impact system DS-18.

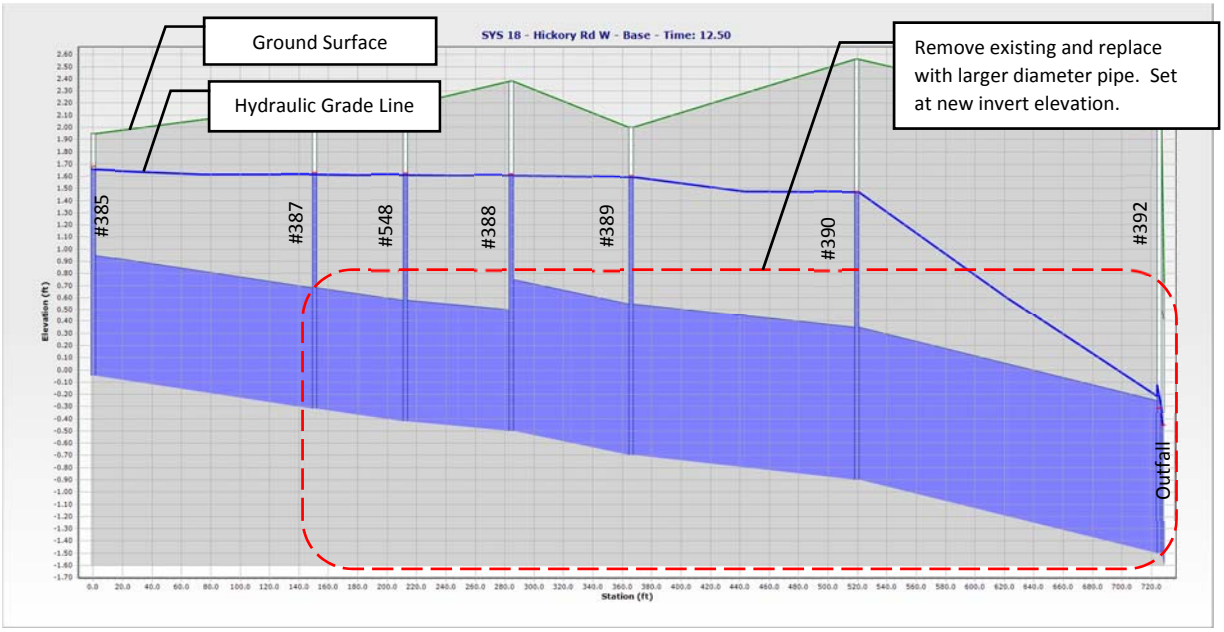

Figure IV-136. Recommended Improvements - DS-18 – West

16. DS-18 – Hickory Road between Hempstead Road and Montauk Drive (cont.)

Analysis of Existing System:

Pipe connections between the following structures could not be definitively established, but were assumed to exist or to have existed for stormwater modeling purposes based on record information and field investigation:

#385 to #387 (DS-18 West)

#394 to #393 (DS-18 East)

The drainage area tributary to this system is comprised of approximately 18.94 acres of 1/8-acre – 1/4-acre residential properties. Based on the design analysis, the existing drainage system does not have the capacity to adequately convey the runoff generated during a 10-year storm event. The non-linear vertical layout of the overall drainage system, the undersized nature of the conveyance pipes, and the generally flat nature of the study area all contribute to the system's lack of conveyance capacity. As illustrated in the profile below, the drainage model indicates flooding occurs at the following drainage structures: #394, #393, #385, #387, #548, and #389.

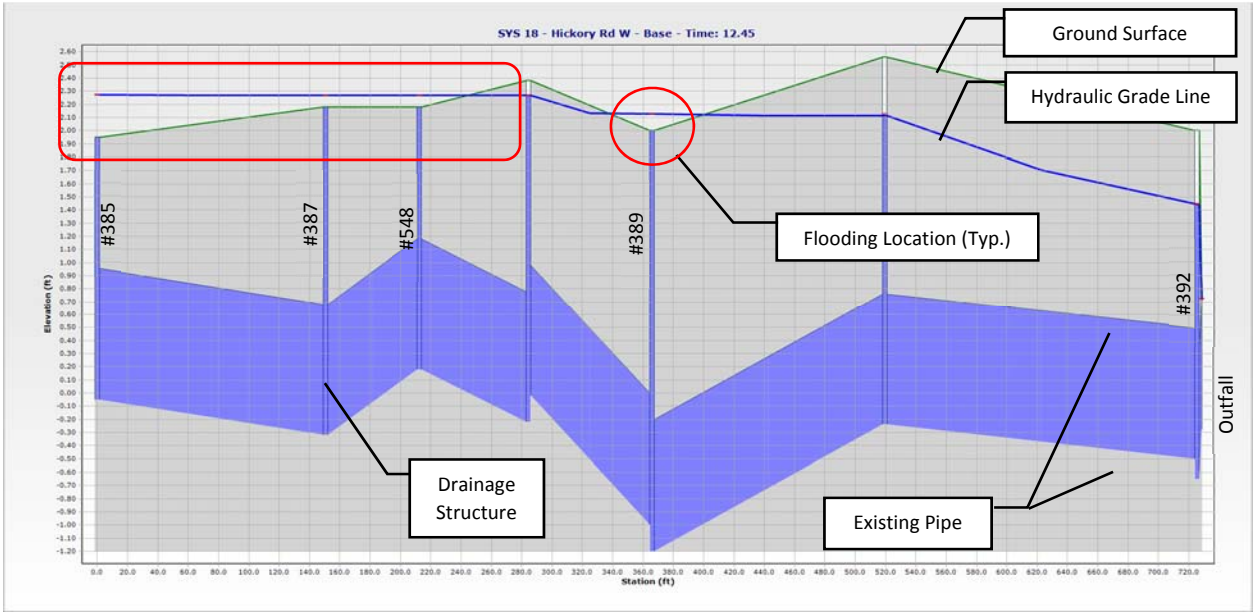

Figure IV-134. Existing Hydraulic Profile of DS-18 – West

16. DS-18 – Hickory Road between Hempstead Road and Montauk Drive (cont.)

Recommended Solution:

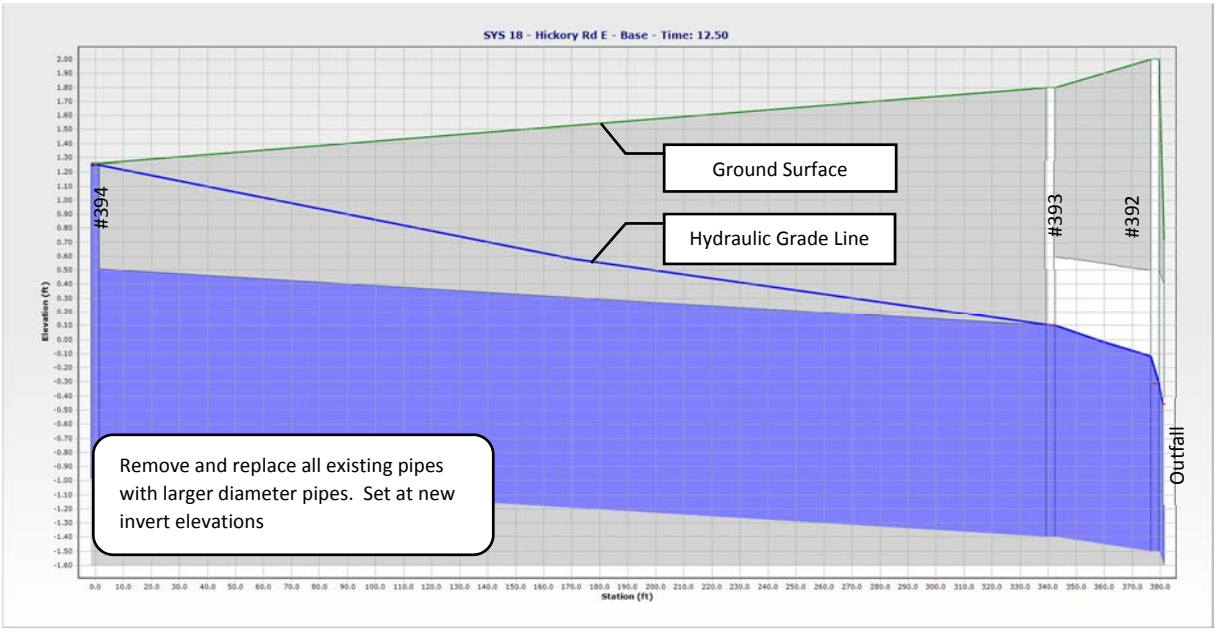

Figure IV-137. Recommended Improvements - DS-18 - East

16. DS-18 – Hickory Road between Hempstead Road and Montauk Drive (cont.)

Analysis of Existing System:

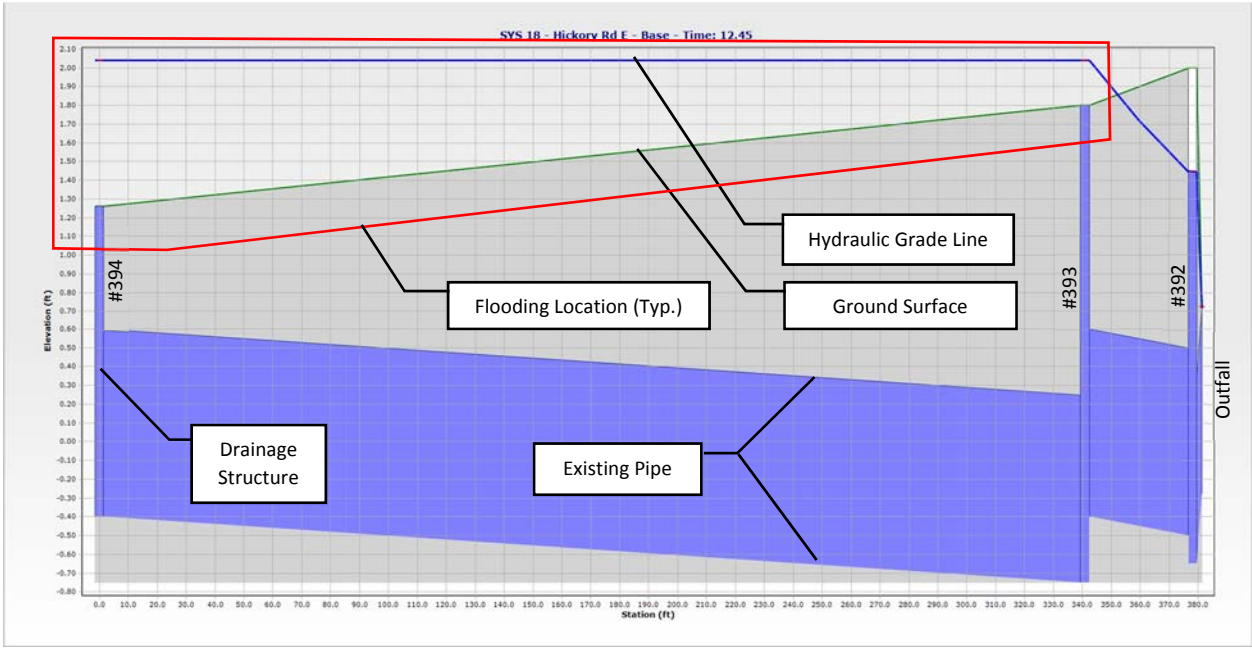

Figure IV-135. Existing Hydraulic Profile of DS-18 – East

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17. DS-20 – Hickory Road from Cranberry Drive to Riviera Drive

Existing Condition:

Consisting of catch basins and drainage pipe, Drainage System DS-20 is located on the southern side of the Mastic Beach portion of the study area. The system runs predominantly in a west-to-east direction along Hickory Drive, beginning at the intersection with Cranberry Drive and discharging via pipe into Pattersquash Creek.

The ground elevation of this system ranges from 1.0 to 2.0 feet above sea level.

Figure IV-138. Aerial Location Map and Schematic Roadway Map – DS-20

17. DS-20 – Hickory Road from Cranberry Drive to Riviera Drive

Recommended Solution:

Even when increasing pipe diameters and adjusting pipe inverts in an attempt to improve the hydraulics of the system, the computer models continue to indicate flooding will occur at existing drainage structures throughout DS-20 during the 10-year storm event. For the purposes of developing the opinion of probable cost, it was assumed that the entire pipe system would be replaced, and pipe inverts adjusted to improve the hydraulic capacity to the greatest extent allowed by the site constraints.

A televised inspection of the pipe system is recommended where pipe connections could not be established to verify the condition of the system, and to determine if pipes should be repaired or replaced.

Incorporating stormwater storage and infiltration measures in the upstream portions of the drainage area tributary to DS-20 would serve to eliminate runoff before it reaches the system, thereby reducing the potential for flooding/ponding due to the systems inability to adequately convey runoff to the outfall location. These upstream improvements are not included in the opinion of probable cost.

17. DS-20 – Hickory Road from Cranberry Drive to Riviera Drive (cont.)

Analysis of Existing System:

Pipe connections between the following structures could not be definitively established, but were assumed to exist or to have existed for stormwater modeling purposes based on record information and field investigation:

#538 to #403

#403 to #399

#399 to #357

The drainage area tributary to this intersection is comprised of approximately 10.18 acres of 1/8-acre – 1/4-acre residential properties. Based on the design analysis, the existing drainage system does not have the capacity to adequately convey the runoff generated during a 10-year storm event. The non-linear vertical layout of the overall drainage system, the undersized nature of the conveyance pipes, and the generally flat nature of the study area all contribute to the system's lack of conveyance capacity. As illustrated in the profile below, the drainage model indicates flooding occurs at the following drainage structures: #538, #403, and #397.

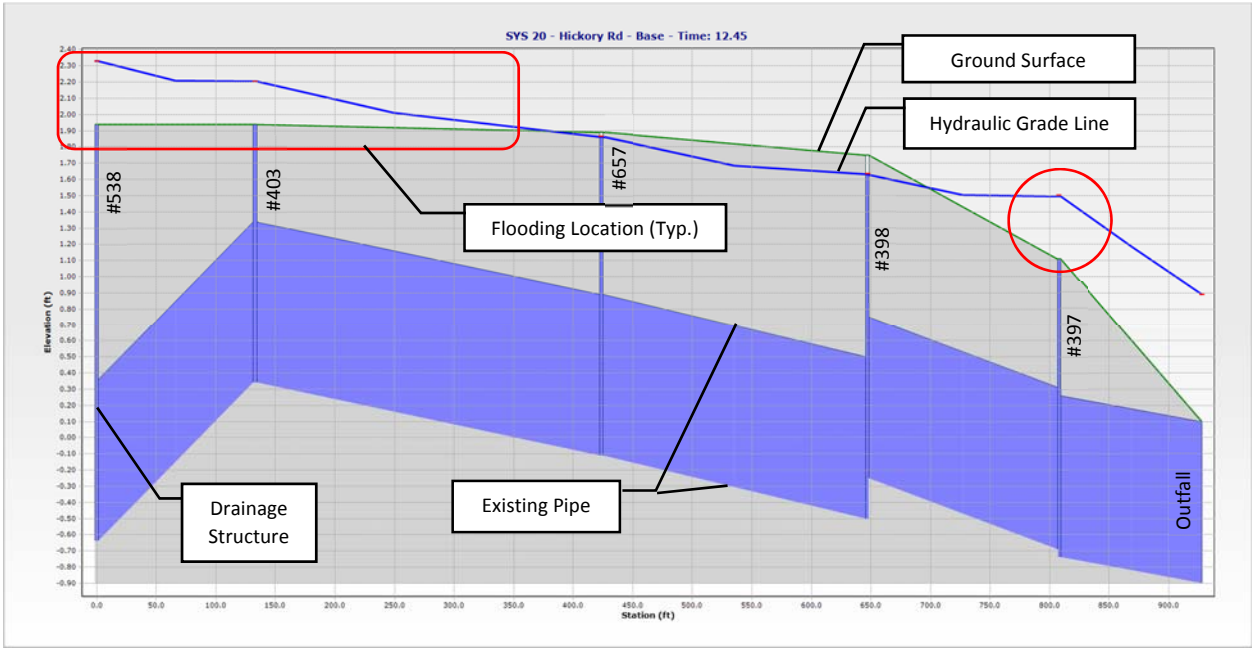

Figure IV-139. Existing Hydraulic Profile of DS-20

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18. DS-21 – Intersection of Moriches Drive and Gooseberry Road

Existing Condition:

Consisting of catch basins and drainage pipe, Drainage System DS-21 is located on the southern side of the Mastic Beach portion of the study area. The system runs predominantly in a north-to-south direction along Moriches Drive, and discharges into a shallow channel on the south side of Gooseberry Road, near the intersection with Moriches Drive. The Moriches Drive branch of the system meets with the Gooseberry Road branch of the system at structure #310.

The ground elevation of this system ranges from 2.0 to 2.5 feet above sea level.

Figure IV-140. Aerial Location Map and Schematic Roadway Map – DS-21

18. DS-21 – Intersection of Moriches Drive and Gooseberry Road

Recommended Solution:

A televised inspection of the pipe system is recommended where pipe connections could not be established to verify the condition of the system, and to determine if pipes should be repaired or replaced.

Within the Moriches Drive branch of the system, by replacing pipes between structures #396 and #308 and between structures #309 and #310 with larger diameter pipe, as well as adjusting pipe inverts, the hydraulics of the system can be improved and the potential for roadway flooding can be reduced during the 10-year storm event.

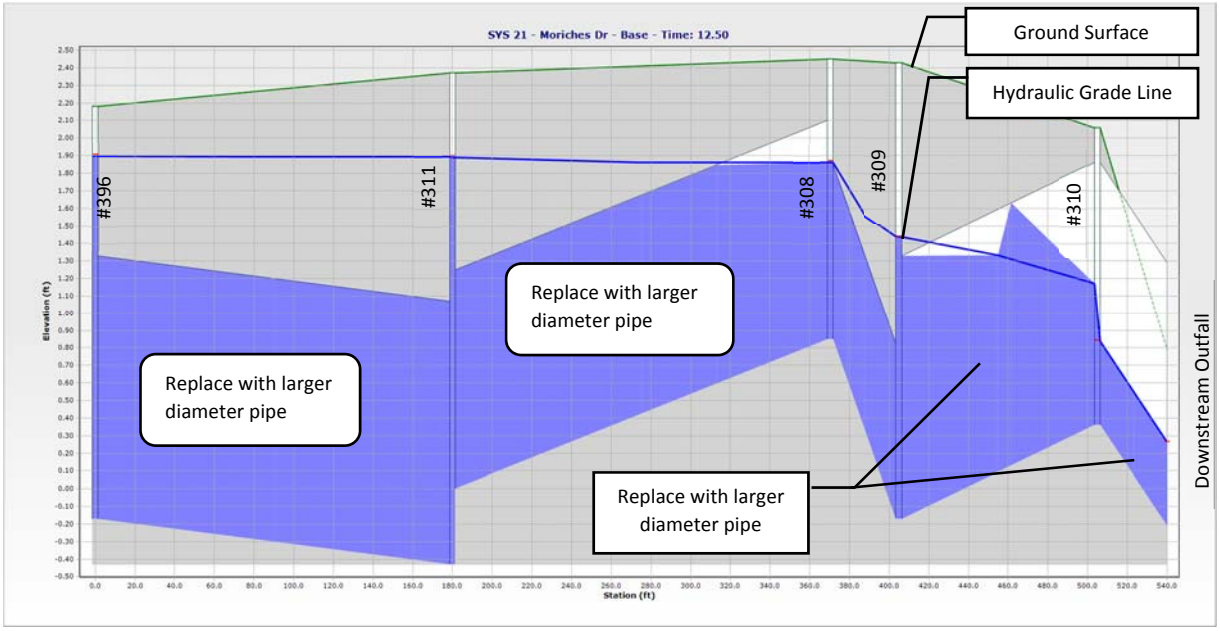

Figure IV-143. Recommended Improvements - DS-21 – Moriches Drive

Within the Gooseberry Road branch of the system, by replacing pipes between structure #310 and the system outfall, as well as adjusting pipe inverts, the hydraulics of the system can be improved and the potential for roadway flooding can be reduced during the 10-year storm event.

18. DS-21 – Intersection of Moriches Drive and Gooseberry Road (cont.)

Analysis of Existing System:

Pipe connections between the following structures could not be definitively established, but were assumed to exist or to have existed for stormwater modeling purposes based on record information and field investigation:

#309 to #310

The drainage area tributary to this intersection is comprised of approximately 4.76 acres of 1/8-acre – 1/4-acre residential properties. Based on the design analysis, the existing drainage system does not have the capacity to adequately convey the runoff generated during a 10-year storm event. The non-linear vertical layout of the overall drainage system, the undersized nature of the conveyance pipes, and the generally flat nature of the study area all contribute to the system's lack of conveyance capacity. As illustrated in the profile below, the drainage model indicates flooding occurs at the following drainage structures: #311 and #396.

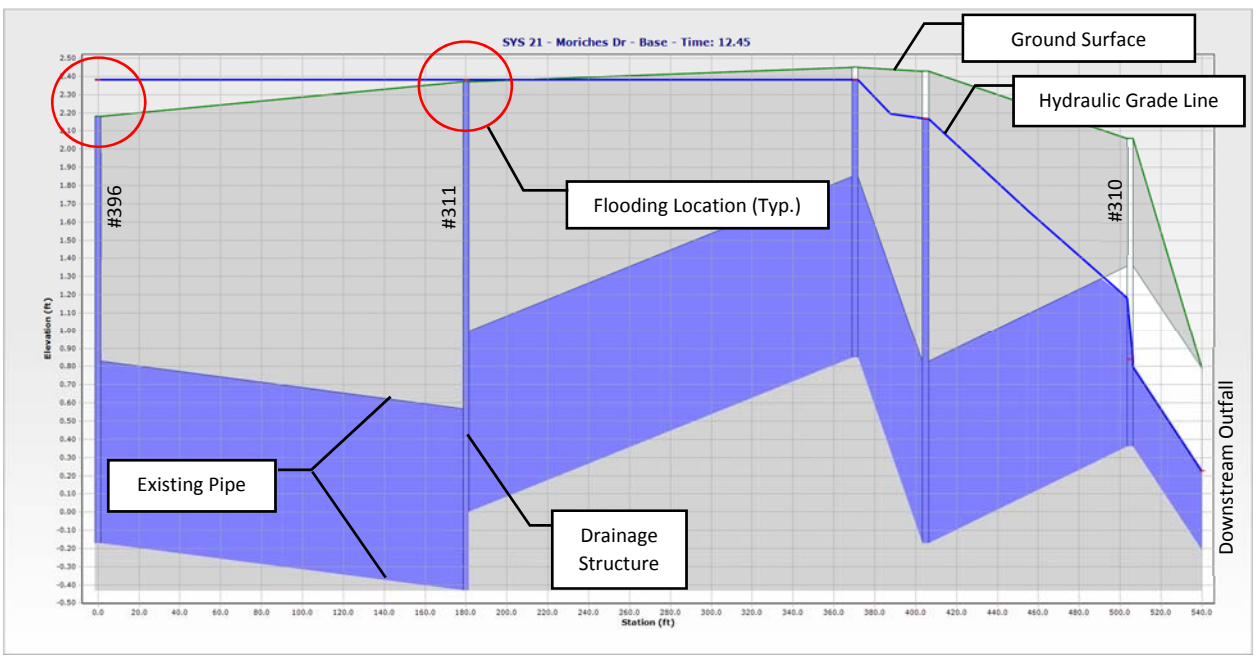

Figure IV-141. Existing Hydraulic Profile of DS-21 – Moriches Drive

18. DS-21 – Intersection of Moriches Drive and Gooseberry Road (cont.)

Recommended Solution:

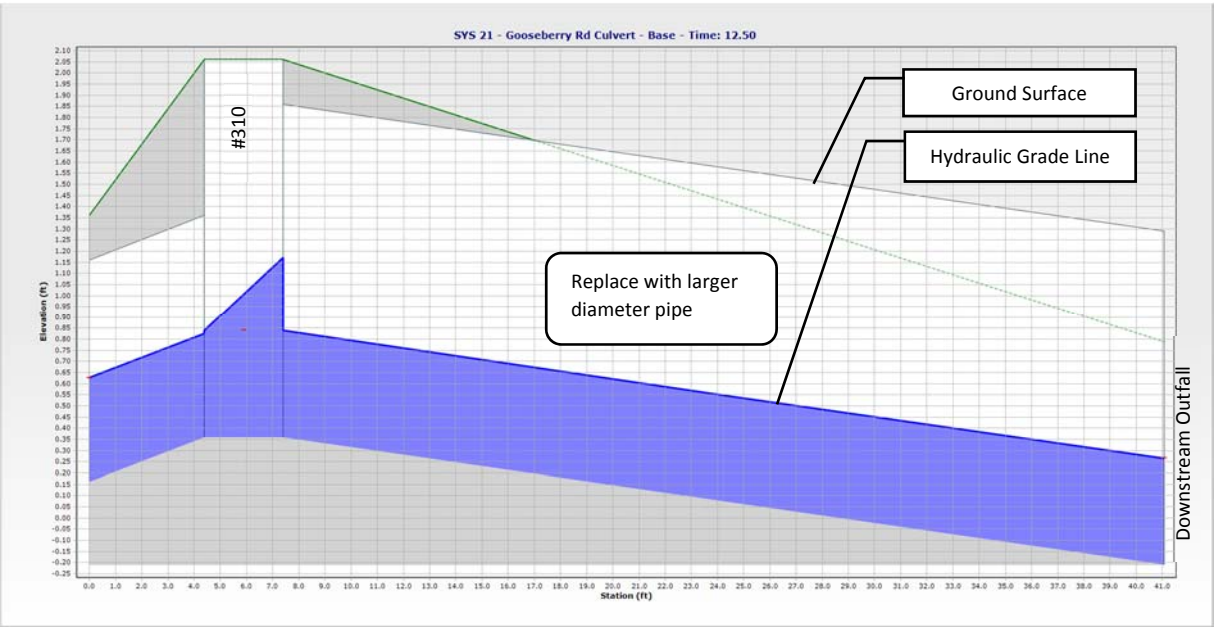

Figure IV-144. Recommended Improvements - DS-21 – Gooseberry Road

18. DS-21 – Intersection of Moriches Drive and Gooseberry Road (cont.)

Analysis of Existing System:

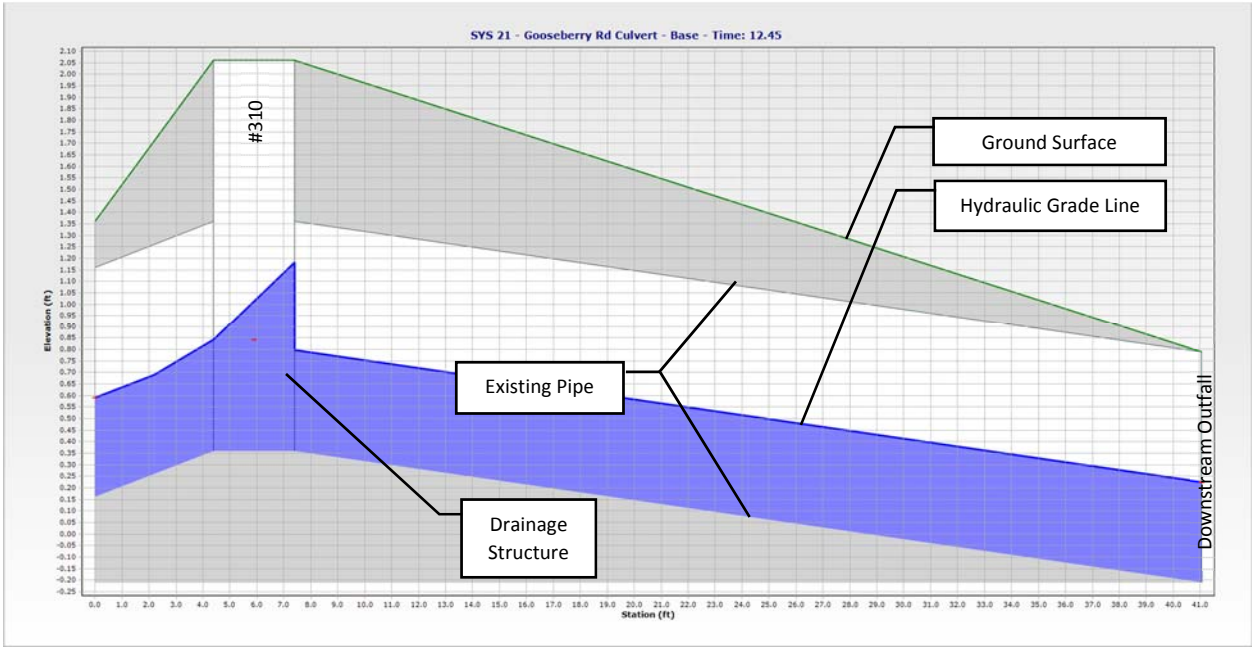

Figure IV-142. Existing Hydraulic Profile of DS-21 – Gooseberry Road

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19. DS-22 – Forest Road West from Diana Drive to Riviera Drive

Existing Condition:

Consisting of catch basins and drainage pipe, Drainage System DS-22 is located on the southern side of the Mastic Beach portion of the study area. The system runs predominantly in a west-to-east direction along Forest Road West, beginning at the intersection with Diana Drive and discharging into Pattersquash Creek.

The ground elevation of this system ranges from 2.0 to 2.5 feet above sea level.

Figure IV-145. Aerial Location Map and Schematic Roadway Map – DS-22

19. DS-22 – Forest Road West from Diana Drive to Riviera Drive

Recommended Solution:

A televised inspection of the pipe system is recommended where pipe connections could not be established to verify the condition of the system, and to determine if pipes should be repaired or replaced.

By replacing pipes between structure #89 and the system outfall with larger diameter pipe, and adjusting pipe inverts, the hydraulics of the system can be improved and the potential for roadway flooding can be reduced during the 10-year storm event.

Refer to the analysis of location MB-08 in Section IV of this report for additional recommendations that can impact system DS-22.

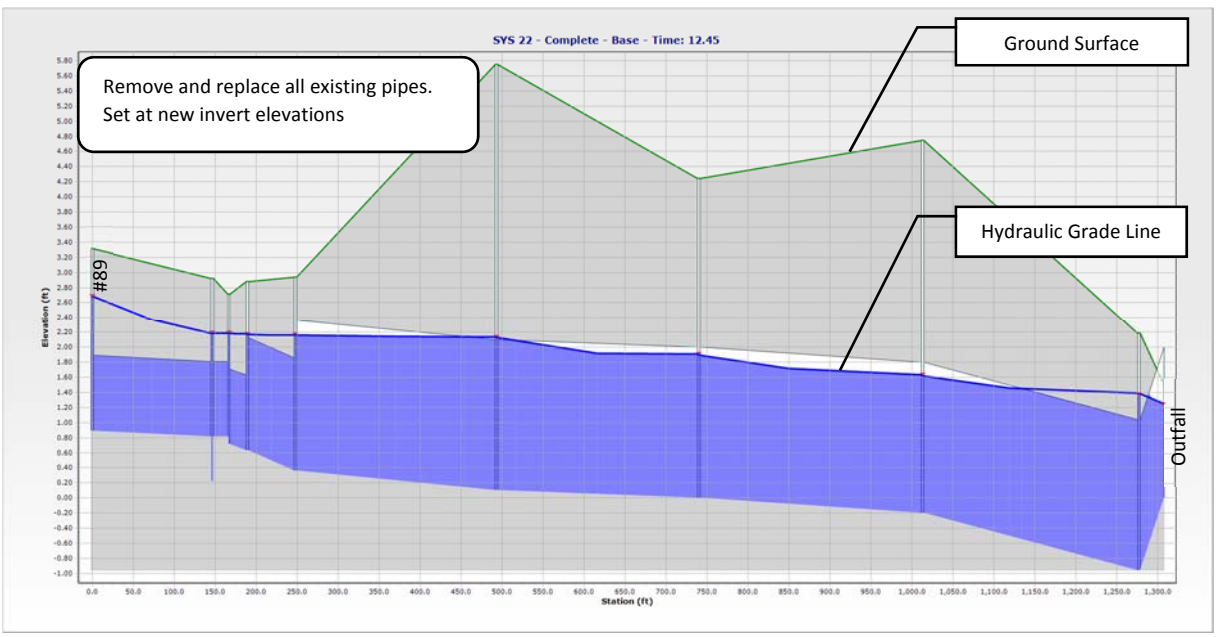

Figure IV-147. Recommended Improvements - DS-22

19. DS-22 – Forest Road West from Diana Drive to Riviera Drive (cont.)

Analysis of Existing System:

Pipe connections between the following structures could not be definitively established, but were assumed to exist or to have existed for stormwater modeling purposes based on record information and field investigation:

#314 to #476

#476 to #405

#523 to #315

#315 to #208

The drainage area tributary to this intersection is comprised of approximately 14.47 acres of 1/8-acre – 1/4-acre residential properties. Based on the design analysis, the existing drainage system does not have the capacity to adequately convey the runoff generated during a 10-year storm event. The non-linear vertical layout of the overall drainage system, the undersized nature of the conveyance pipes, and the generally flat nature of the study area all contribute to the system's lack of conveyance capacity. As illustrated in the profile below, the drainage model indicates flooding occurs at the following drainage structures: #89, #524, #313, #314, and #476.

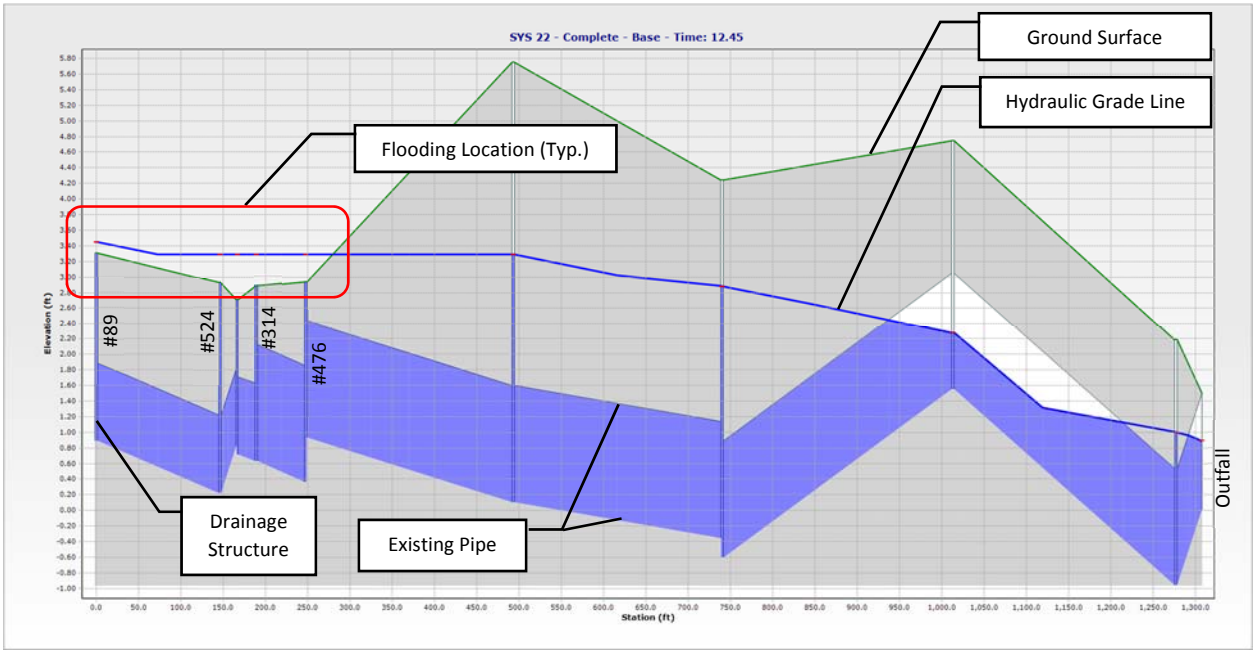

Figure IV-146. Existing Hydraulic Profile of DS-22

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20. DS-23 – Intersection of Elm Road and Hemlock Drive

Existing Condition:

Drainage System DS-23 is comprised of two separate systems in the western side of the Mastic Beach portion of the study area – one running in the east-to-west direction along Elm Road, and the other running in the north-to-south direction along Hemlock Drive. Consisting of catch basins, drywells and drainage pipe, each system originates near the intersection of Hemlock Drive and Elm Road.

The ground elevation of this system ranges from 1.5 to 2.0 feet above sea level.

Figure IV-148. Aerial Location Map and Schematic Roadway Map – DS-23

20. DS-23 – Intersection of Elm Road and Hemlock Drive

Recommended Solution:

A televised inspection of the section of pipe between structure #16011 and the system outfall location within the Elm Road section of DS-23 is recommended to verify the condition of the pipe, and if it should be repaired, replaced or abandoned in place.

It is recommended that the existing drainage system is cleaned to remove any debris and sediment that have accumulated over time, and inspected to ensure it remains in good working condition. Repairs should be made to the drainage system as necessary.

For the Hemlock Drive section of DS-23: even when increasing pipe diameters and adjusting pipe inverts in an attempt to improve the hydraulics of the system, the computer models continue to indicate the potential for flooding at existing drainage structures throughout DS-23 during the 10-year storm event. For the purposes of developing the opinion of probable cost, it was assumed that the entire pipe system within the Hemlock Drive section would be replaced, and pipe inverts adjusted to improve the hydraulic capacity to the greatest extent allowed by the site constraints.

Incorporating stormwater storage and infiltration measures in the upstream portions of the drainage area tributary to DS-23 would serve to eliminate runoff before it reaches the system, thereby reducing the potential for flooding/ponding due to the systems inability to adequately convey runoff to the outfall location. These upstream improvements are not included in the opinion of probable cost.

Refer to the analysis for location MB-29 in Section IV of this report for additional recommendations in this area.

20. DS-23 – Intersection of Elm Road and Hemlock Drive (cont.)

Analysis of Existing System:

Pipe connections between the following structures could not be definitively established, but were assumed to exist or to have existed for stormwater modeling purposes based on record information and field investigations:

#16011 to the perceived outlet located on the west side of Overlook Drive (DS-23 Elm Road system)

The drainage area tributary to this intersection is comprised of approximately 3.97 acres of 1/8-acre – 1/4-acre residential properties. Based on the design analysis, it appears that the existing drainage system on Elm Road is sufficiently sized, but the system along Hemlock Drive does not have the capacity to adequately convey the runoff generated during a 10-year storm event. The non-linear vertical layout of the Hemlock Drive portion of DS-23 drainage system, the undersized nature of its conveyance pipes, and the generally flat nature of the study area all contribute to the system's lack of conveyance capacity. As illustrated in the profile below, the drainage model indicates flooding occurs at the following drainage structures: #16016, #16017 and #16019.

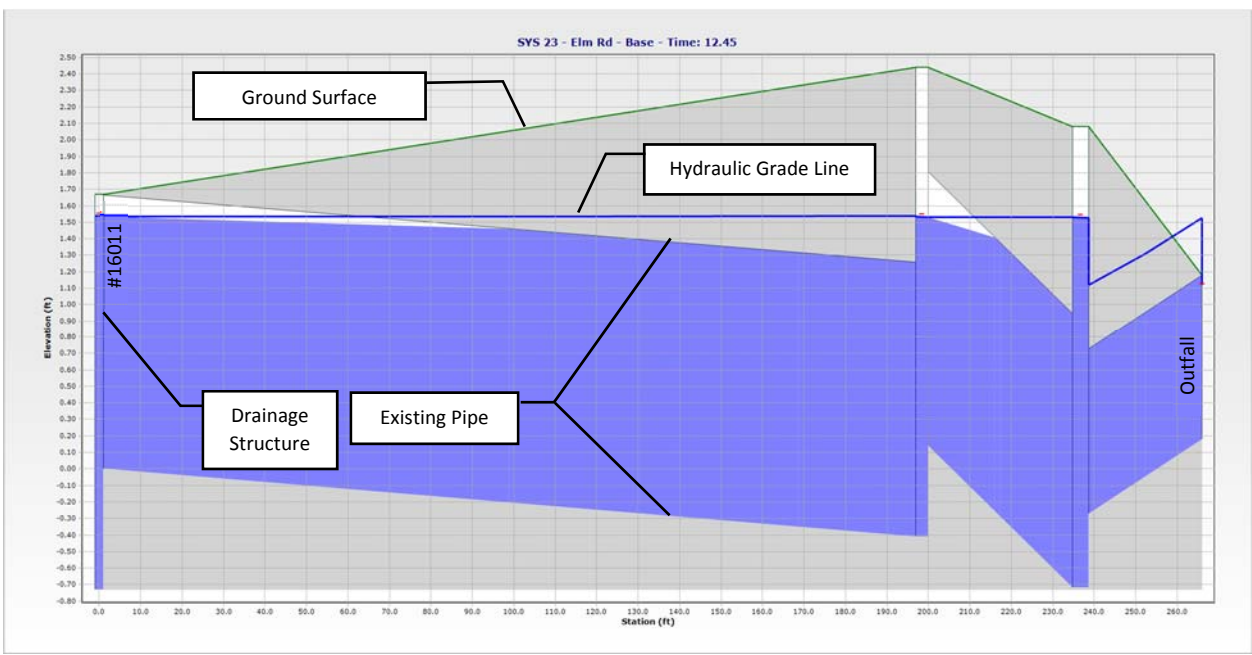

Figure IV-149. Existing Hydraulic Profile of DS-23 – Elm Road

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20. DS-23 – Intersection of Elm Road and Hemlock Drive (cont.)

Analysis of Existing System:

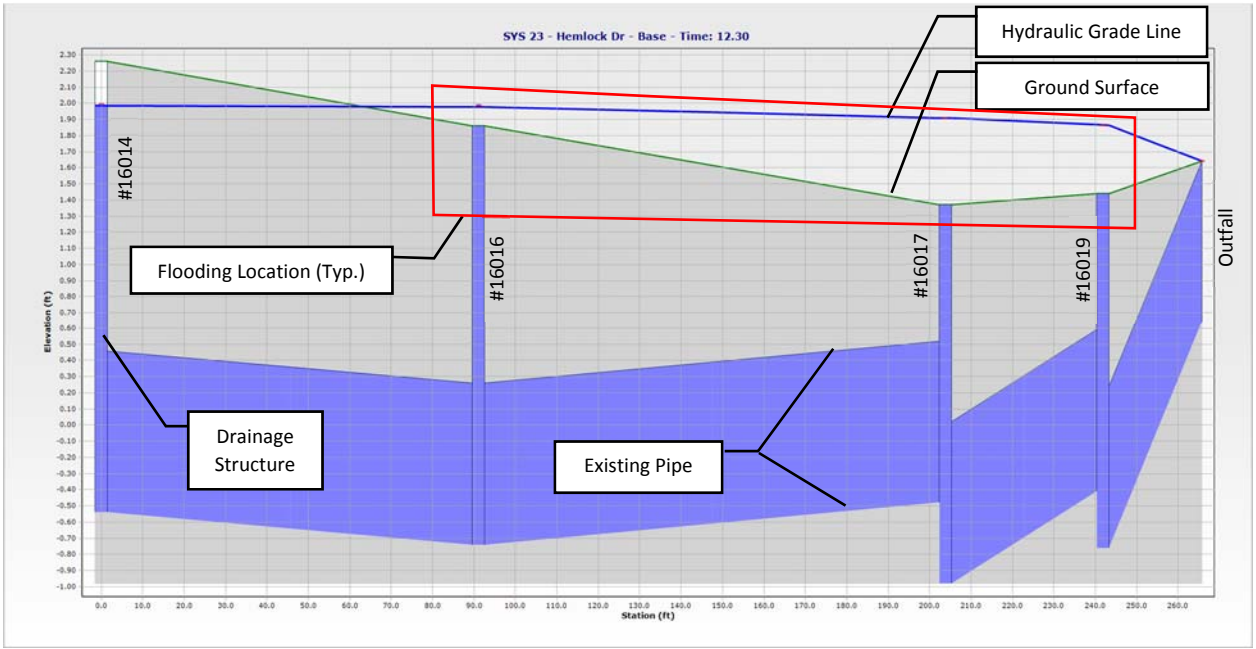

Figure IV-150. Existing Hydraulic Profile of DS-23 – Hemlock Drive

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21. DS-24 – Neighborhood Road from Commack Road to West Drive (includes 24A & 24B)

Existing Condition:

Consisting of catch basins, drywells and drainage pipe, Drainage System DS-24 is located in the central Mastic Beach portion of the study area. The system runs predominantly in a west-to-east direction along Neighborhood Road, beginning at the intersection with Elder Drive and discharging into a shallow channel on the south side of Neighborhood Road, approximately 150 feet east of the intersection with Clearview Drive.

The ground elevation of this system ranges from 6.0 to 15.0 feet above sea level.

Figure IV-151. Aerial Location Map – DS-24

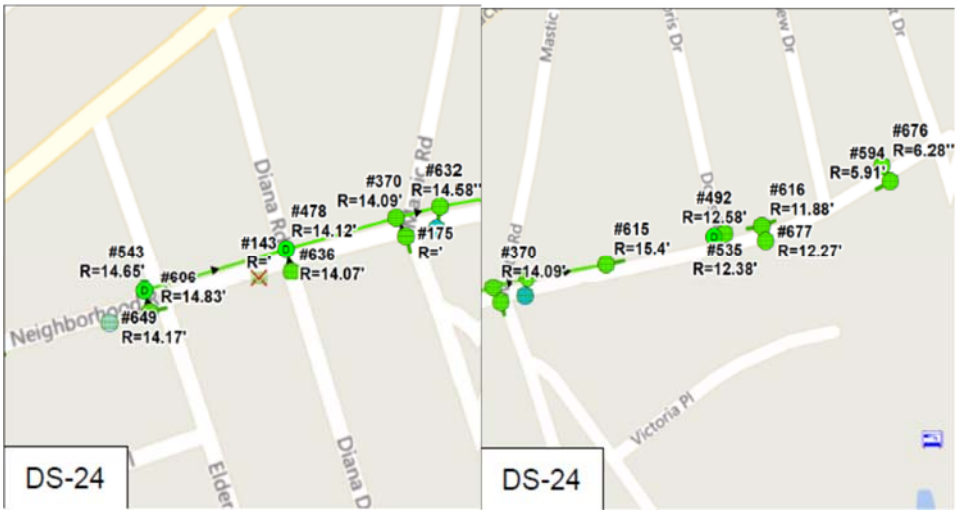

Figure IV-152. Schematic Roadway Map – DS-24W (left) and DS-24E (right)

21. DS-24 – Neighborhood Road from Commack Road to West Drive (includes 24A & 24B)

Recommended Solution:

A televised inspection of the pipe system is recommended where pipe connections could not be established to verify the condition of the system, and to determine if pipes should be repaired or replaced.

By replacing pipes between structure #478 and #616 with larger diameter pipe and adjusting pipe inverts at structure #370, the hydraulics of the system can be improved and the potential for roadway flooding can be reduced during the 10-year storm event.

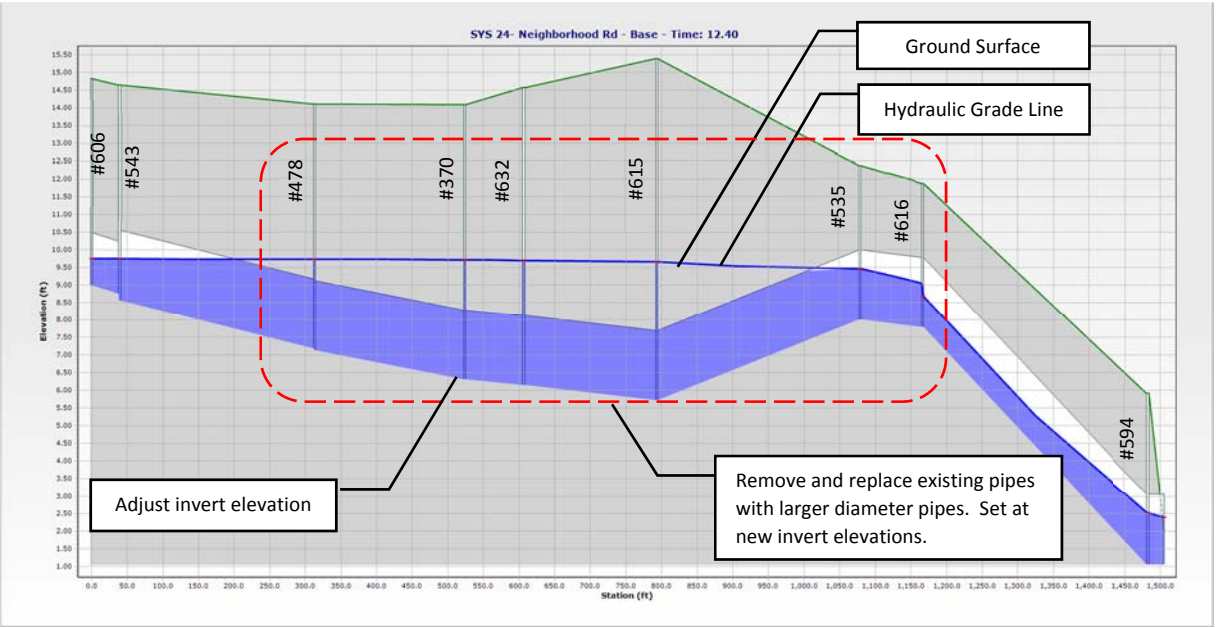

Figure IV-154. Recommended Improvements - DS-24

Since the outfall pipe from system DS-24 discharges to the headwaters of Pattersquash Creek, it is recommended that hydrodynamic separators are incorporated within the system. Hydrodynamic separators will serve to improve water quality by removing debris, sediments and other pollutants from the water prior to discharge. Based on the size of the drainage area tributary to system DS-24, it is recommended that two separators are incorporated.

21. DS-24 – Neighborhood Road from Commack Road to West Drive (includes 24A & 24B) (cont.)

Analysis of Existing System:

Pipe connections between the following structures could not be definitively established, but were assumed to exist or to have existed for stormwater modeling purposes based on record information and field investigation:

#615 to #535

#535 to #616

#616 to #594

#594 to outfall

The drainage area tributary to this intersection is comprised of approximately 15.83 acres of 1/8-acre – 1/4-acre residential properties. Based on the design analysis, the existing drainage system does not have the capacity to adequately convey the runoff generated during a 10-year storm event. The non-linear vertical layout of the overall drainage system, the undersized nature of the conveyance pipes, and the generally flat nature of the study area all contribute to the system's lack of conveyance capacity. As illustrated in the profile below, the drainage model indicates flooding occurs at the following drainage structures: #478, #370, and #535.

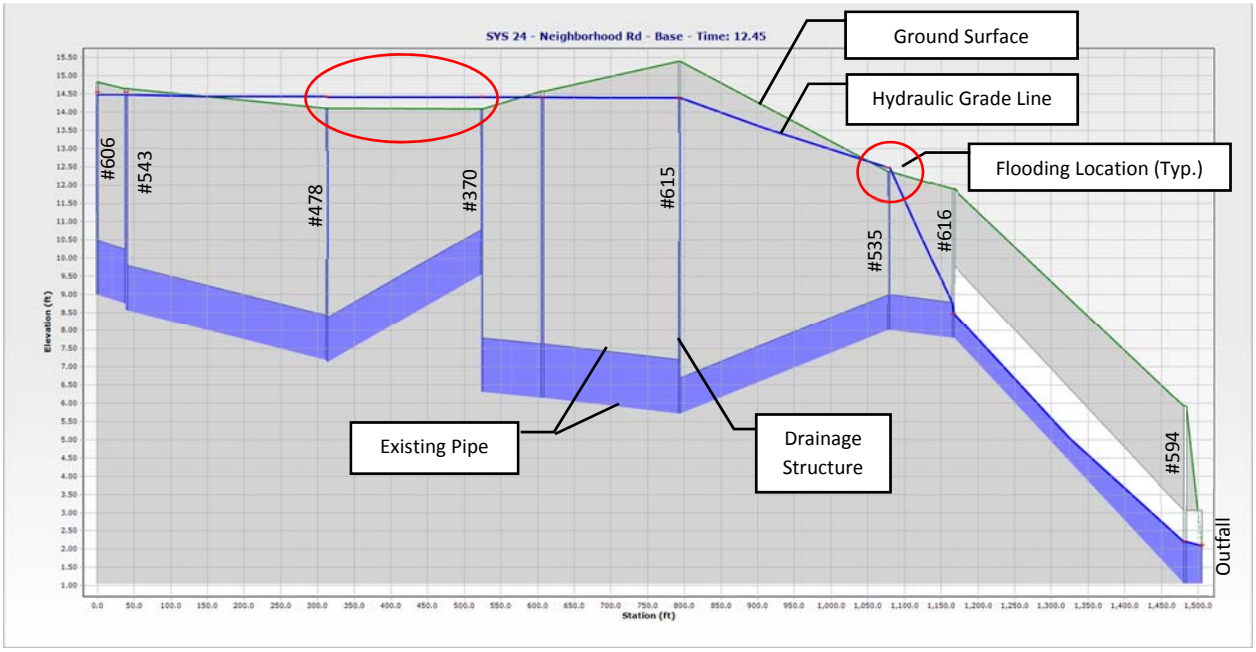

Figure IV-153. Existing Hydraulic Profile of DS-24

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22. DS-25 – Mastic Road from Commack Road to Washington Avenue (includes 25A & 25B)

Existing Condition:

Consisting of catch basins, drywells and drainage pipe, Drainage System DS-25 is located in the central Mastic Beach portion of the study area. The system runs predominantly in a north-to-south direction along Mastic Road, beginning at the intersection with Washington Avenue and discharging into a shallow channel located approximately 300 feet south of the intersection with Barclay Road.

The ground elevation of this system ranges from 6.5 to 20.5 feet above sea level.

Figure IV-155. Aerial Location Map – DS-25

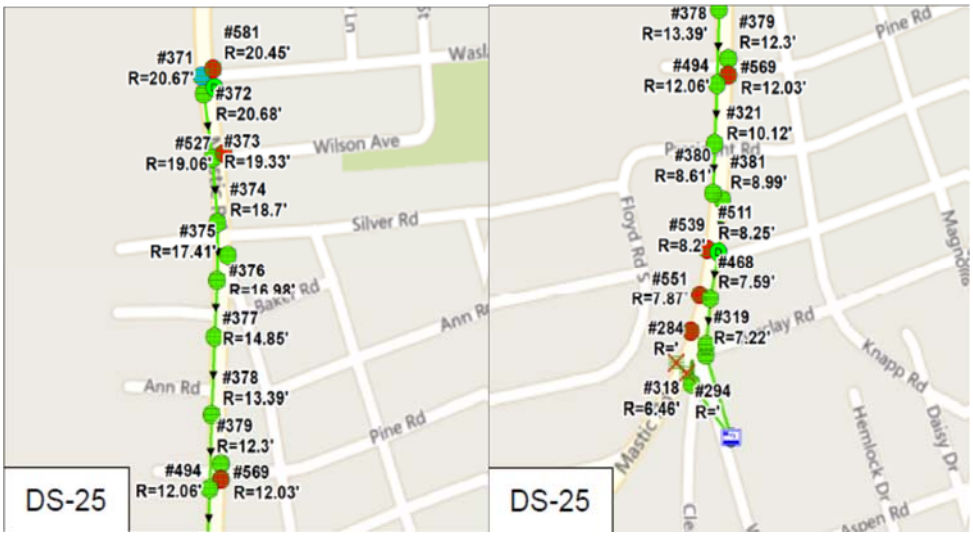

Figure IV-156. Schematic Roadway Map – DS-25N (left) and DS-25S (right)

22. DS-25 – Mastic Road from Commack Road to Washington Avenue (includes 25A & 25B)

Recommended Solution:

By replacing pipes between structure #371 and the system outfall with larger diameter pipe, and adjusting pipe inverts at structures #380 and #381, the hydraulics of the system can be improved and the potential for roadway flooding can be reduced during the 10-year storm event.

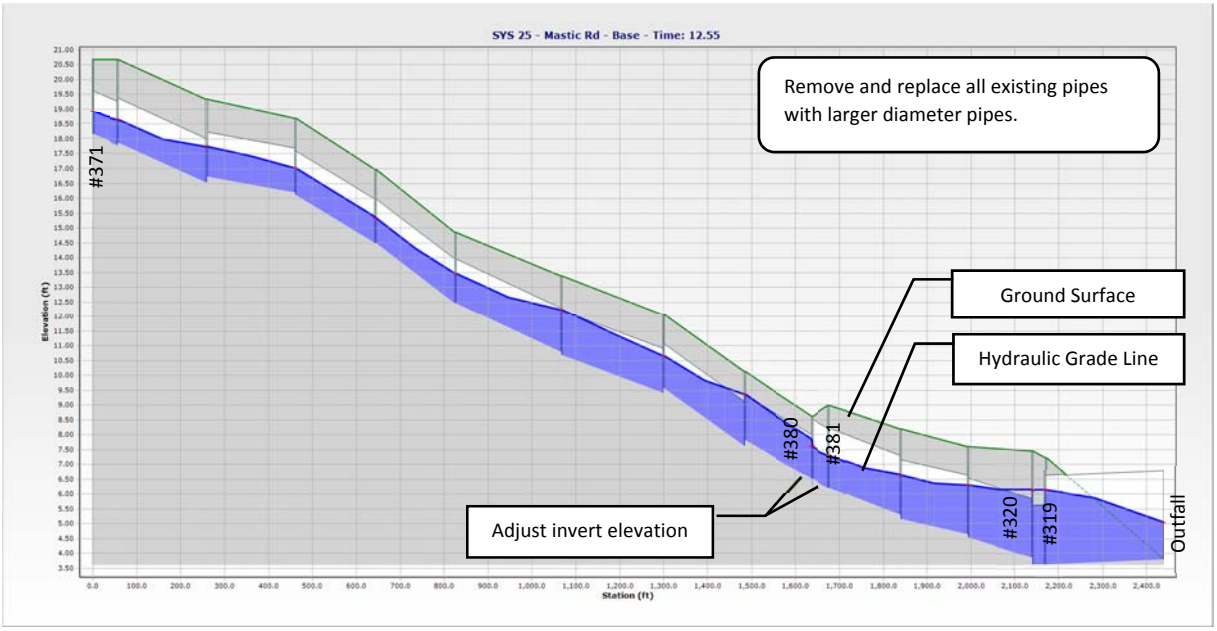

Figure IV-158. Recommended Improvements - DS-25

Since the outfall pipe from system DS-25 discharges to the headwaters of Pattersquash Creek, it is recommended that hydrodynamic separators are incorporated within the system. Hydrodynamic separators will serve to improve water quality by removing debris, sediments and other pollutants from the water prior to discharge. Based on the size of the drainage area tributary to system DS-24, it is recommended that one separator is incorporated.

22. DS-25 – Mastic Road from Commack Road to Washington Avenue (includes 25A & 25B) (cont.)

Analysis of Existing System:

The drainage area tributary to this intersection is comprised of approximately 20.45 acres of 1/8-acre – 1/4-acre residential properties. Based on the design analysis, the existing drainage system does not have the capacity to adequately convey the runoff generated during a 10-year storm event. The undersized nature of the pipes contribute to the system's lack of conveyance capacity. As illustrated in the profile below, the drainage model indicates that minor flooding occurs at the following drainage structures: #371, #373, #374, #377, #378, #494, #321, #380, #539, and #468.

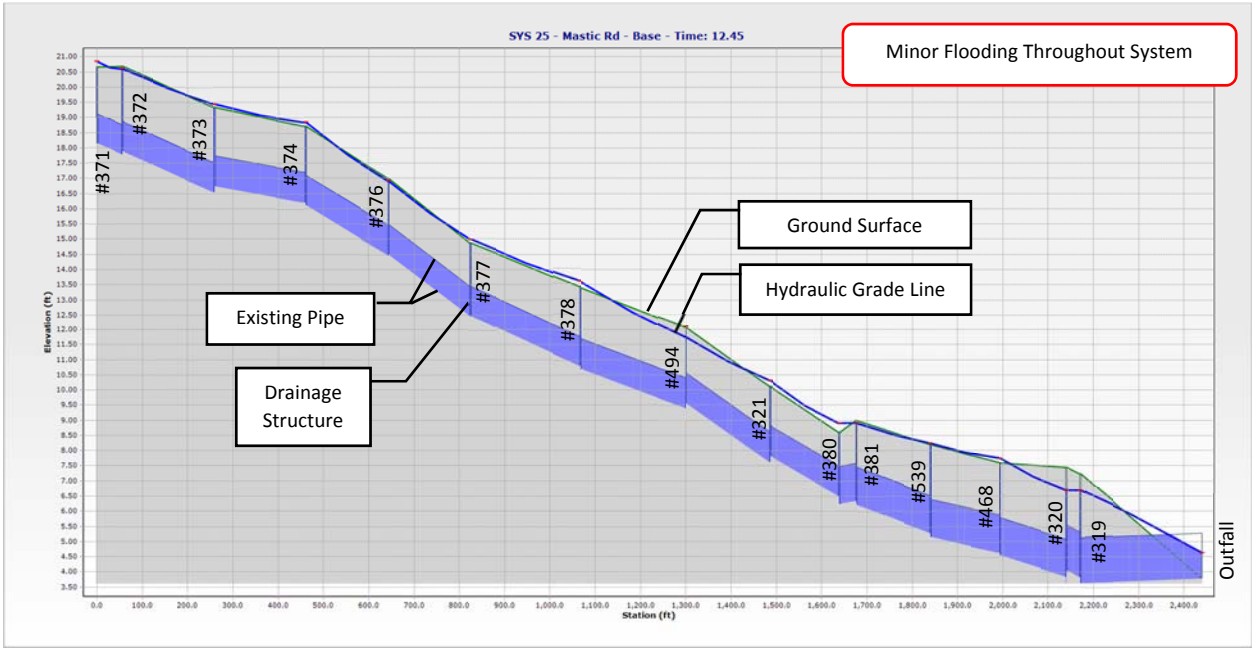

Figure IV-157. Existing Hydraulic Profile of DS-25

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23. DS-26 – Intersection of Queen Road with Woodland Drive and Washington Drive

Existing Condition:

Consisting of catch basins, drywells and drainage pipe, Drainage System DS-26 is located in the central Mastic Beach portion of the study area. The system picks up runoff from Woodland Drive and Washington Drive and conveys it to a discharge location within the William Floyd Estate, just east of the intersection of Queen Road and Washington Drive.

The ground elevation of this system ranges from 8.0 to 11.5 feet above sea level.

Figure IV-159. Aerial Location Map and Schematic Roadway Map – DS-26

23. DS-26 – Intersection of Queen Road with Woodland Drive and Washington Drive

Recommended Solution:

For the Queen Road section of the system, by replacing pipes between structure #331 and the system outfall with larger diameter pipe, as well as adjusting pipe inverts, the hydraulics of the system can be improved and the potential for roadway flooding can be reduced during the 10-year storm event.

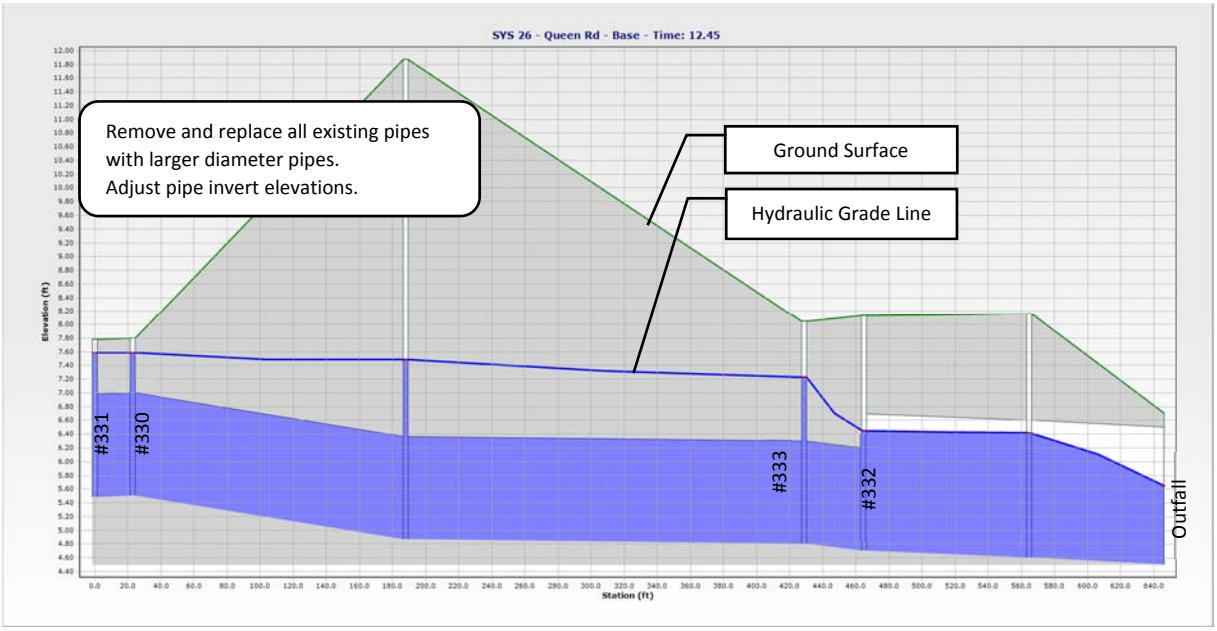

Figure IV-162. Recommended Improvements - DS-26 – Queen Road

For the Washington Drive section of the system, by replacing pipes between structure #333 and the system outfall with larger diameter pipe, as well as adjusting pipe inverts, the hydraulics of the system can be improved and the potential for roadway flooding can be reduced during the 10-year storm event.

23. DS-26 – Intersection of Queen Road with Woodland Drive and Washington Drive (cont.)

Analysis of Existing System:

The drainage area tributary to this intersection is comprised of approximately 14.64 acres of 1/8-acre – 1/4-acre residential properties. Based on the design analysis, the existing drainage system does not have the capacity to adequately convey the runoff generated during a 10-year storm event. The non-linear vertical system layout as well as the undersized nature of the pipes contribute to the system's lack of conveyance capacity. As illustrated in the profile below, the drainage model indicates flooding occurs at the following drainage structures: #331, #330, #333, #332, #335, #408, #334, #333, and #332.

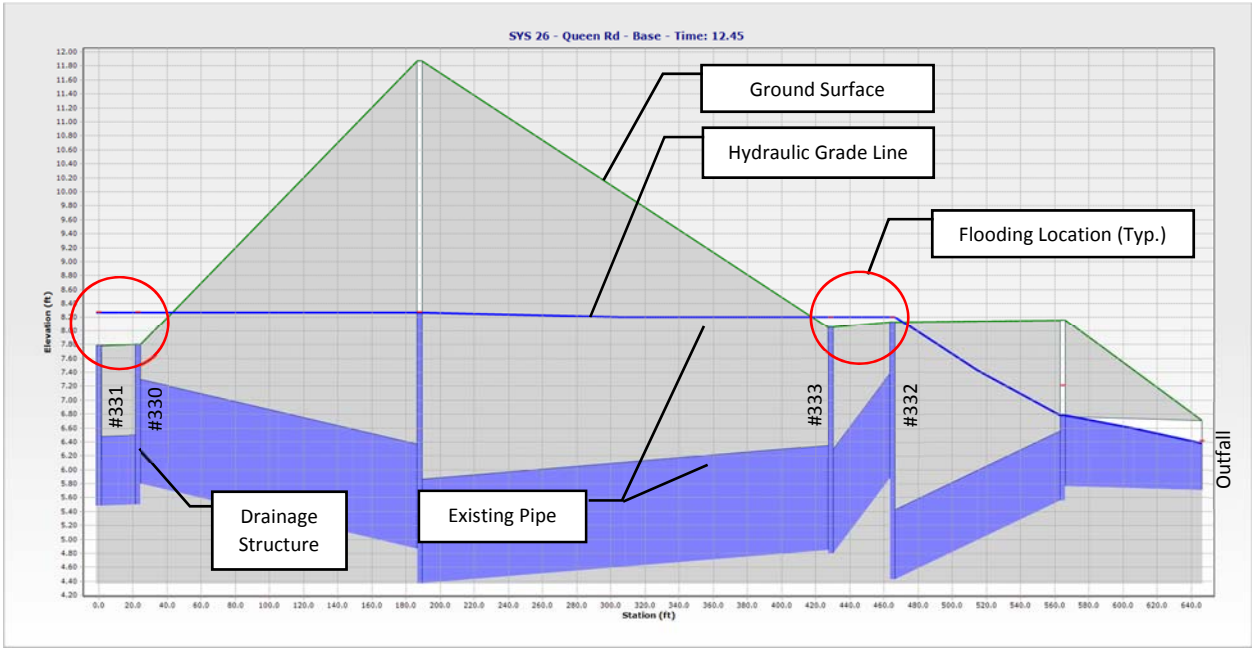

Figure IV-160. Existing Hydraulic Profile of DS-26 – Queen Road

23. DS-26 – Intersection of Queen Road with Woodland Drive and Washington Drive (cont.)

Recommended Solution:

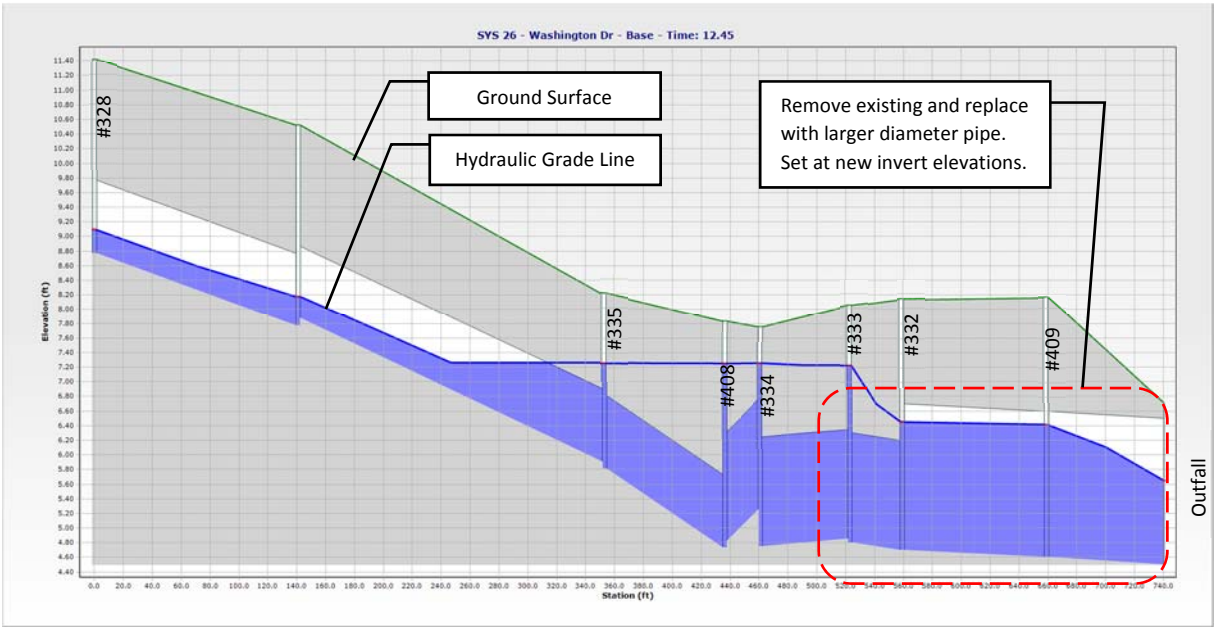

Figure IV-163. Recommended Improvements - DS-26 – Washington Drive

23. DS-26 – Intersection of Queen Road with Woodland Drive and Washington Drive (cont.)

Analysis of Existing System:

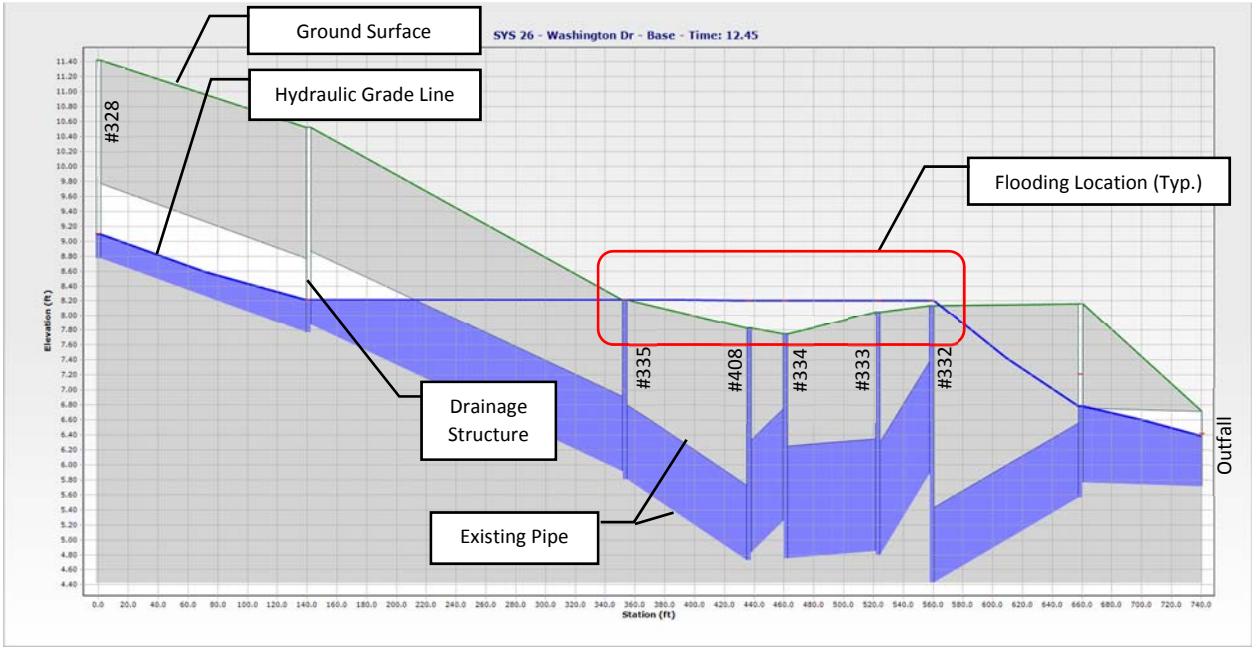

Figure IV-161. Existing Hydraulic Profile of DS-26 – Washington Drive

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24. DS-28 – Intersection of Elm Road East and Cypress Drive

Existing Condition:

Consisting of catch basins, drywells and drainage pipe, Drainage System DS-28 is located in the southern central Mastic Beach portion of the study area. The system picks up runoff in the vicinity of the intersection of Elm Road and Cypress Drive and conveys it to a discharge location on the west side of Cypress Drive, approximately 100 feet south of the intersection.

The ground elevation of this system ranges from 2.9 to 3.3 feet above sea level.

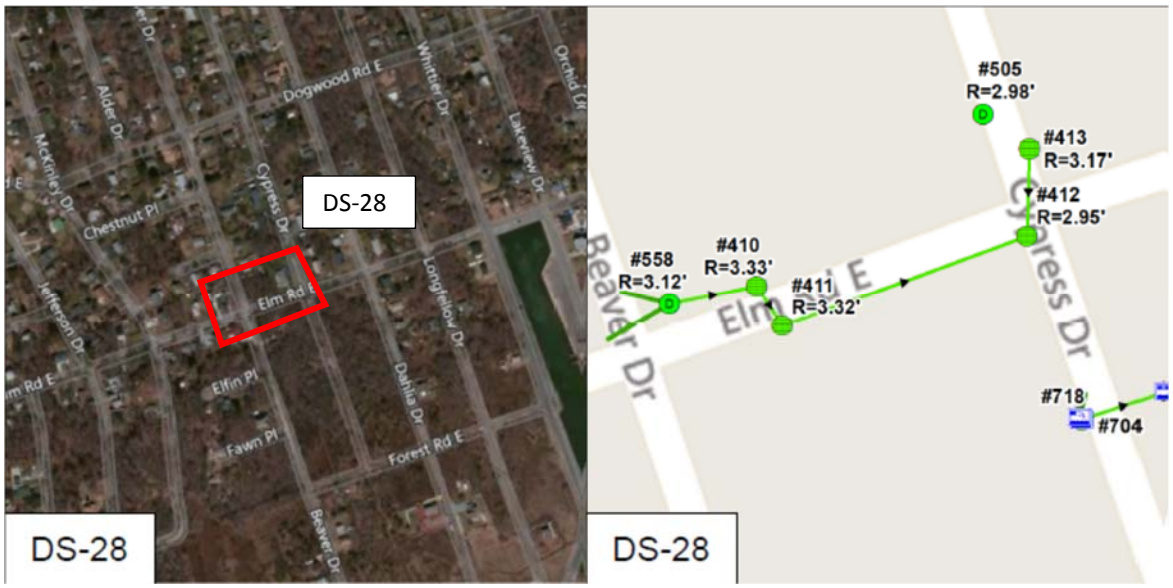

Figure IV-164. Aerial Location Map and Schematic Roadway Map – DS-28

24. DS-28 – Intersection of Elm Road East and Cypress Drive

Recommended Solution:

A televised inspection of the pipe system from structure #412 to the system outfall is recommended to verify the condition of the system, and to determine if pipes should be repaired or replaced.

For the Elm Road section of the system, by replacing pipes between structure #410 and the system outfall with larger diameter pipe, the hydraulics of the system can be improved and the potential for roadway flooding can be reduced during the 10-year storm event. Refer to the figure below.

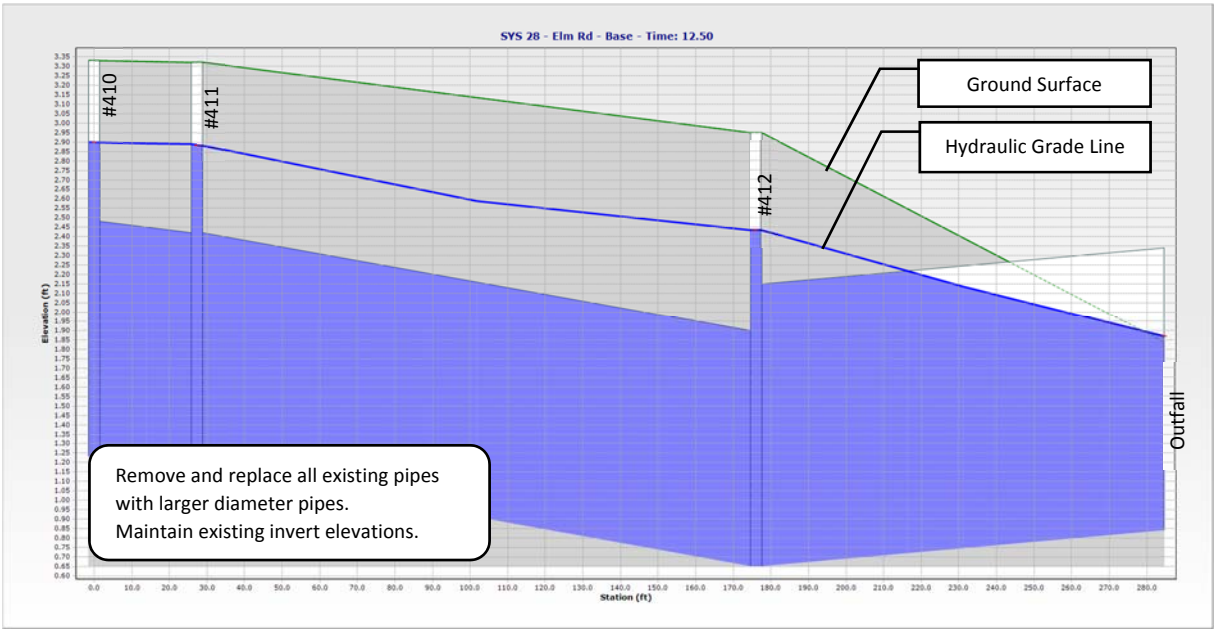

Figure IV-167. Recommended Improvements - DS-28 – Elm Road

For the Cypress Drive section of the system, by replacing pipes between structure #413 and the system outfall with larger diameter pipe, the hydraulics of the system can be improved and the potential for roadway flooding can be reduced during the 10-year storm event. Refer to the figure below.

24. DS-28 – Intersection of Elm Road East and Cypress Drive (cont.)

Analysis of Existing System:

Pipe connections between the following structures could not be definitively established, but were assumed to exist or to have existed for stormwater modeling purposes based on record information and field investigations:

#412 to Outfall

The drainage area tributary to this intersection is comprised of approximately 7.84 acres of 1/8-acre – 1/4-acre residential properties. Based on the design analysis, the existing drainage system does not have the capacity to adequately convey the runoff generated during a 10-year storm event. The non-linear vertical system layout as well as the undersized nature of the pipes contribute to the system's lack of conveyance capacity. As illustrated in the profile below, the drainage model indicates flooding occurs at the following drainage structures: #413 and #412.

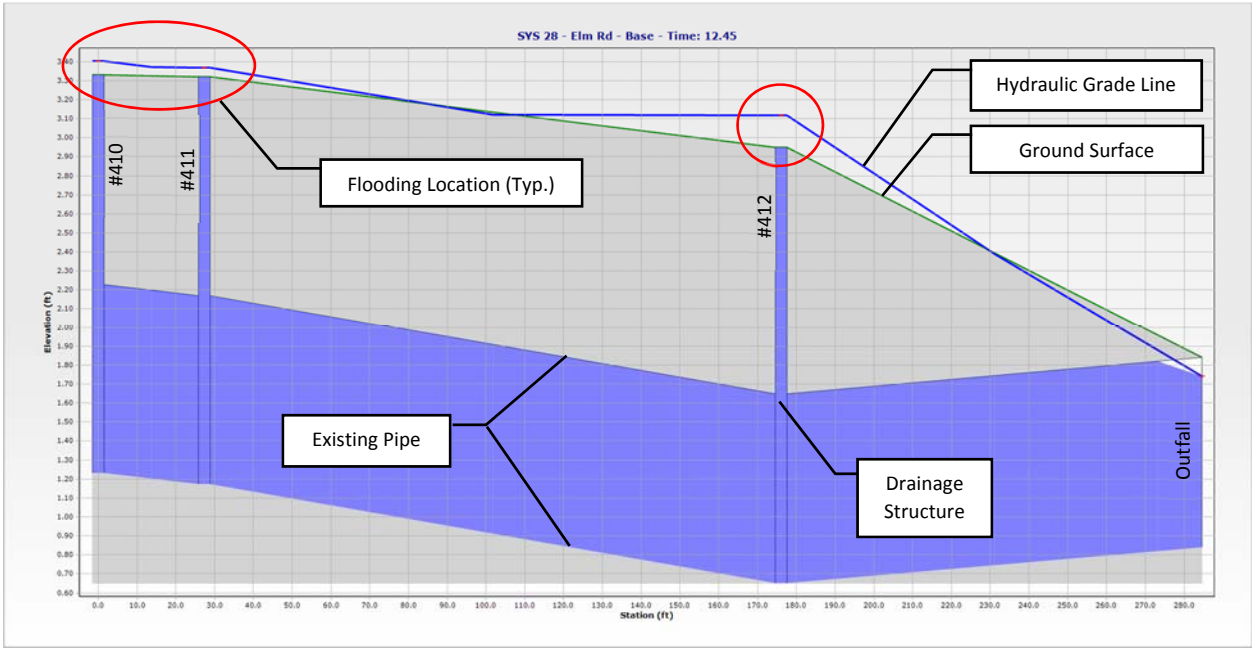

Figure IV-165. Existing Hydraulic Profile of DS-28 – Elm Road

24. DS-28 – Intersection of Elm Road East and Cypress Drive (cont.)

Recommended Solution:

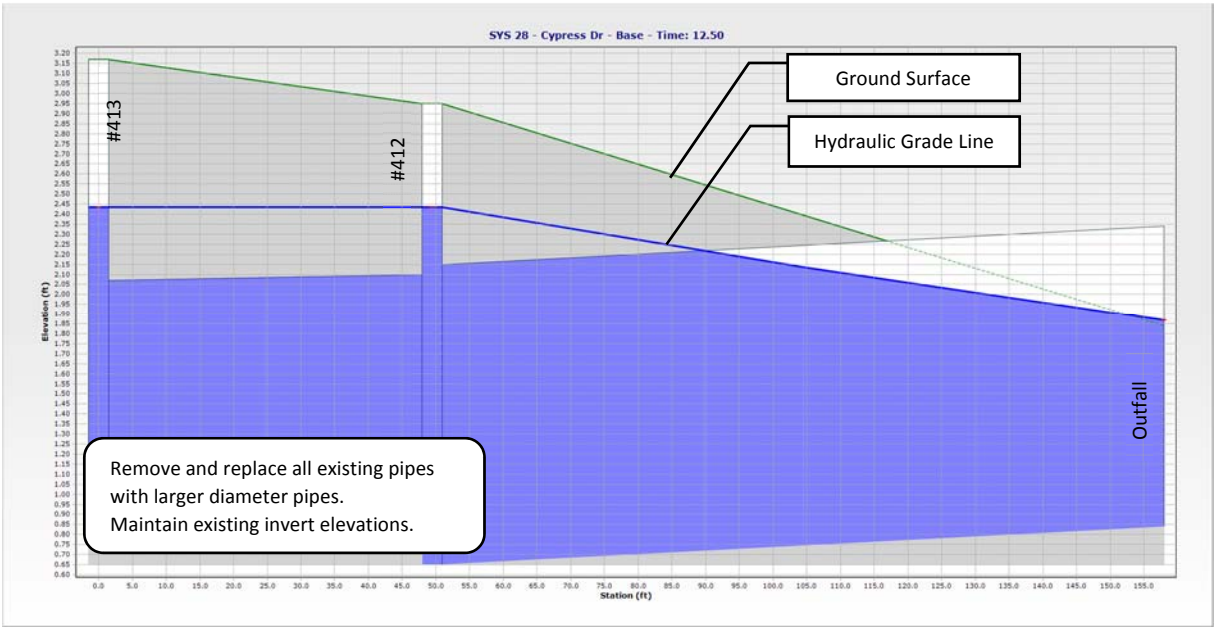

Figure IV-168. Recommended Improvements - DS-28 – Cypress Drive

24. DS-28 – Intersection of Elm Road East and Cypress Drive (cont.)

Analysis of Existing System:

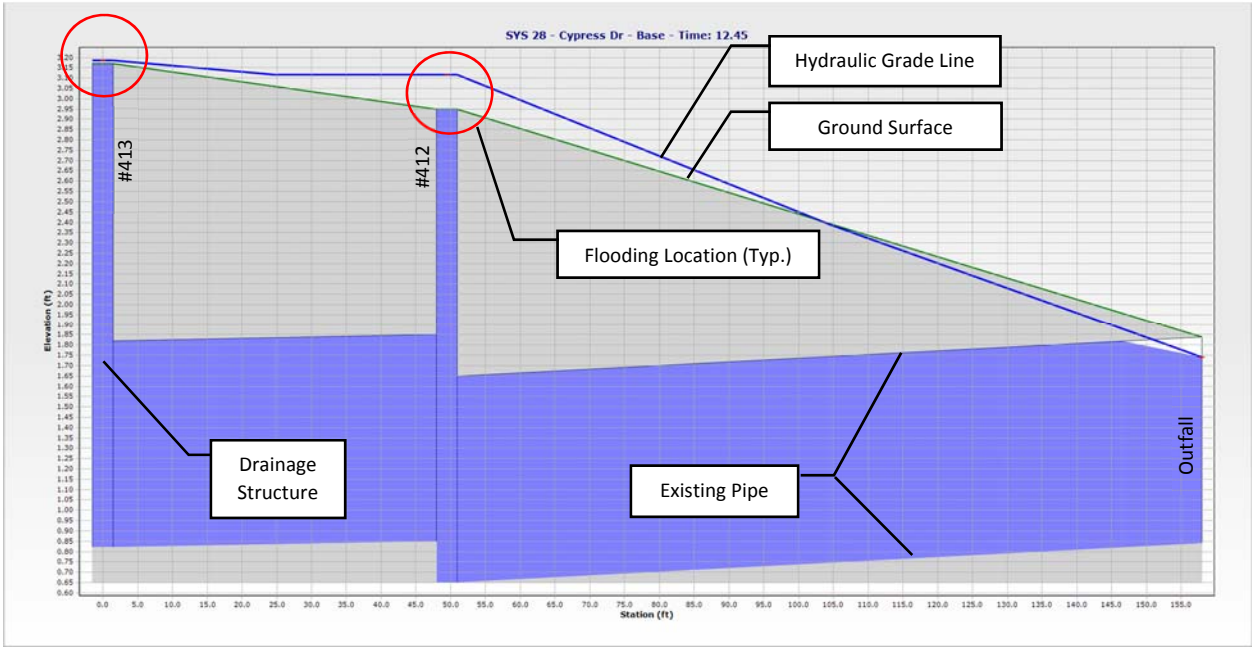

Figure IV-166. Existing Hydraulic Profile of DS-28 – Cypress Drive

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25. DS-29 – Riviera Drive from Elm Road south (includes 29A & 29B)

Existing Condition:

Consisting of catch basins and drainage pipe, Drainage System DS-29 is located in the central Mastic Beach portion of the study area and is comprised of four pipe systems. The Elm Road system picks up runoff along Elm Road and conveys it to the nearby marina. Another system collects runoff from Lakeview Drive and connects with the Elm Road system at structure #580. Two additional isolated systems collect and convey runoff along Riviera Drive, one at the north end and the other at the south end, and discharge into the adjacent inlet at the marina.

The ground elevation of this system ranges from 0.4 to 1.4 feet above sea level along the southern portion of the system, and ranges from 1.5 to 2.5 feet across the northern leg.

Figure IV-169. Aerial Location Map – DS-29

25. DS-29 – Riviera Drive from Elm Road south (includes 29A & 29B)

Recommended Solution:

It is recommended that the existing drainage system is cleaned to remove any debris and sediment that have accumulated over time, and inspected to ensure it remains in good working condition. Repairs should be made to the drainage system as necessary.

For the Elm Road section of the system, by replacing pipes between structure #434 and the system outfall with larger diameter pipe, the hydraulics of the system can be improved and the potential for roadway flooding can be reduced during the 10-year storm event.

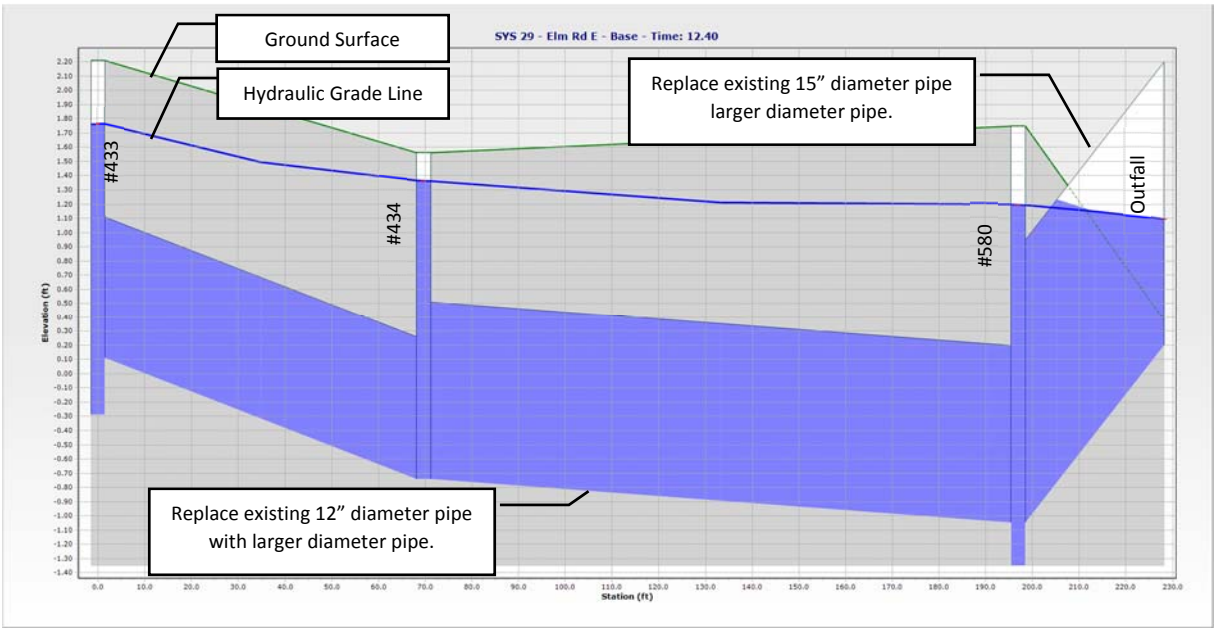

Figure IV-176. Recommended Improvements - DS-29 – Elm Road

For the Lakeview Drive section of the system, by replacing pipes between structure #580 and the system outfall with larger diameter pipe, the hydraulics of the system can be improved and the potential for roadway flooding can be reduced during the 10-year storm event.

25. DS-29 – Riviera Drive from Elm Road south (includes 29A & 29B) (cont.)

Existing Condition:

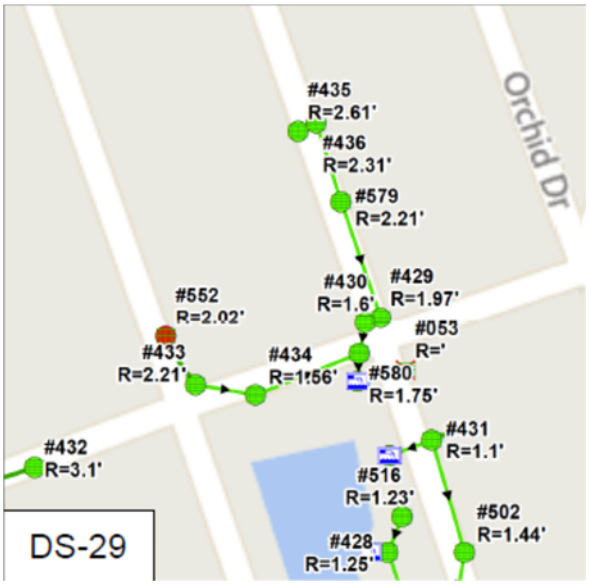

Figure IV-170. Schematic Roadway Map – DS-29 Elm Rd and Lakeview Dr

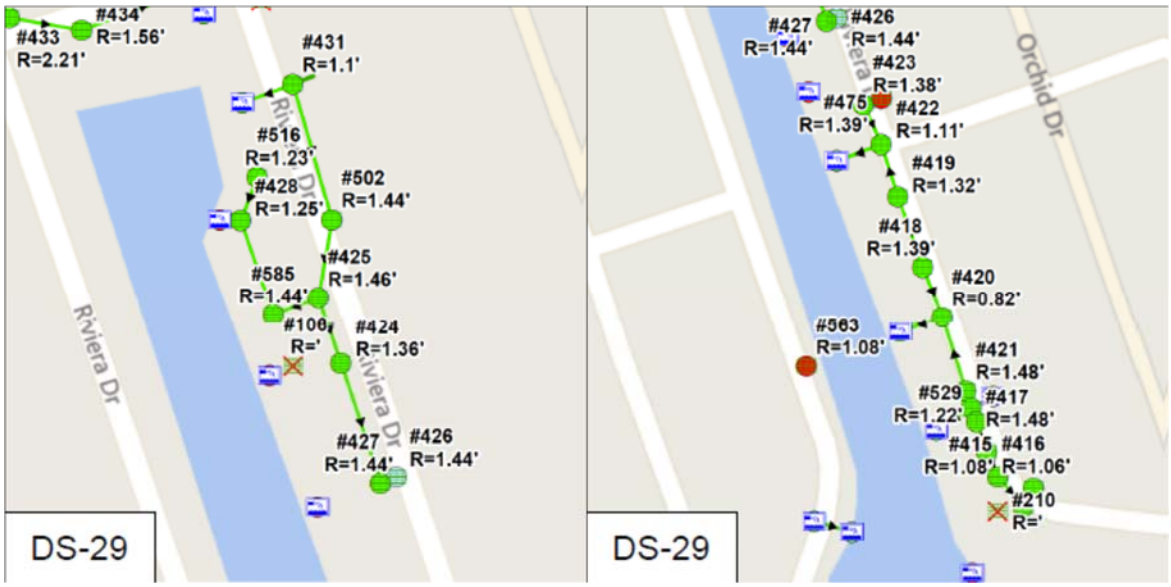

Figure IV-171. Schematic Roadway Map – DS-29N (left) and DS-29S (right)

25. DS-29 – Riviera Drive from Elm Road south (includes 29A & 29B) (cont.)

Recommended Solution:

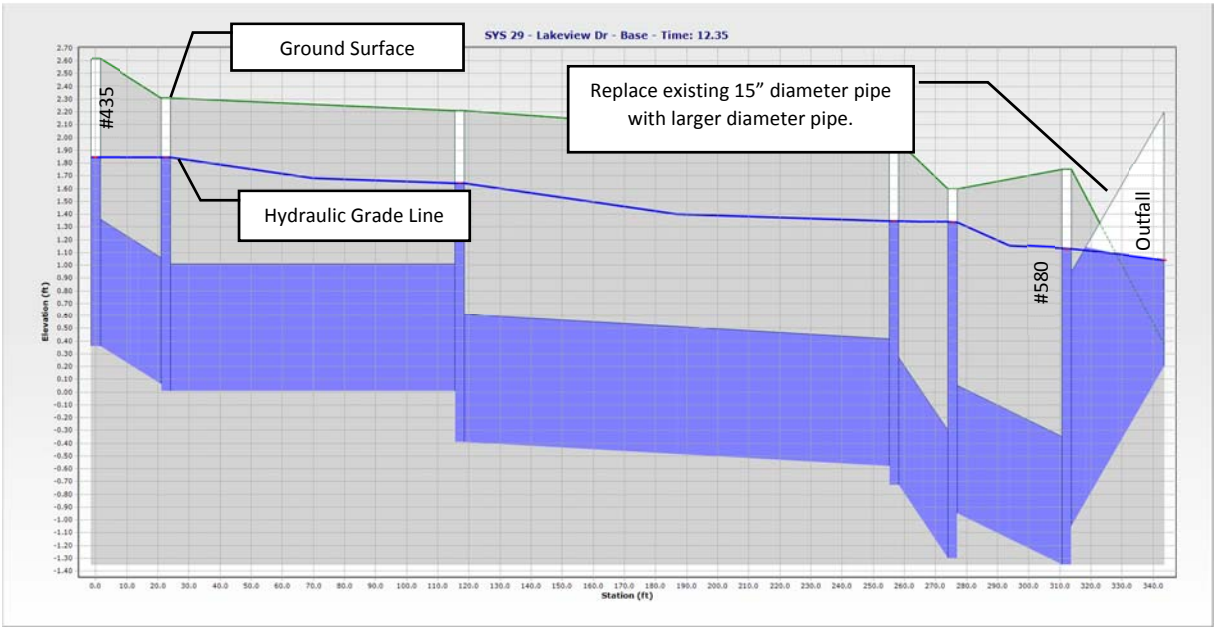

Figure IV-177. Recommended Improvements - DS-29 – Lakeview Drive

For the Riviera Drive sections of DS-29: even when increasing pipe diameters and adjusting pipe inverts in an attempt to improve the hydraulics of the system, the computer models continue to indicate the potential for flooding at several drainage structures during the 10-year storm event. This situation occurs due to the low-lying nature of Riviera Drive and the relatively shallow depth to groundwater. For the purposes of developing the opinion of probable cost, it was assumed that the entire pipe system would be replaced, and pipe inverts adjusted to improve the hydraulic capacity to the greatest extent allowed by the site constraints.

25. DS-29 – Riviera Drive from Elm Road south (includes 29A & 29B) (cont.)

Analysis of Existing System:

The respective drainage areas tributary to each of these systems are comprised of 1/8-acre – 1/4-acre residential properties, and are approximately sized as follows:

DS-29 - Elm Road Drainage Area = 3.32 acres

DS-29 - Lakeview Drive Drainage Area = 3.43 acres

DS-29 - Northern Riviera Drive Drainage Area = 1.85 acres

DS-29 - Southern Riviera Drive Drainage Area = 3.05 acres

Based on the design analysis, the DS-29 existing drainage systems do not have the capacity to adequately convey the runoff generated during a 10-year storm event. The non-linear vertical system layout as well as the undersized nature of the pipes and flat, low-lying nature of the drainage area contribute to the system's lack of conveyance capacity. As illustrated in the profile below, the drainage model indicates flooding occurs at the following drainage structures: #433, #434, #430, #422, and #420.

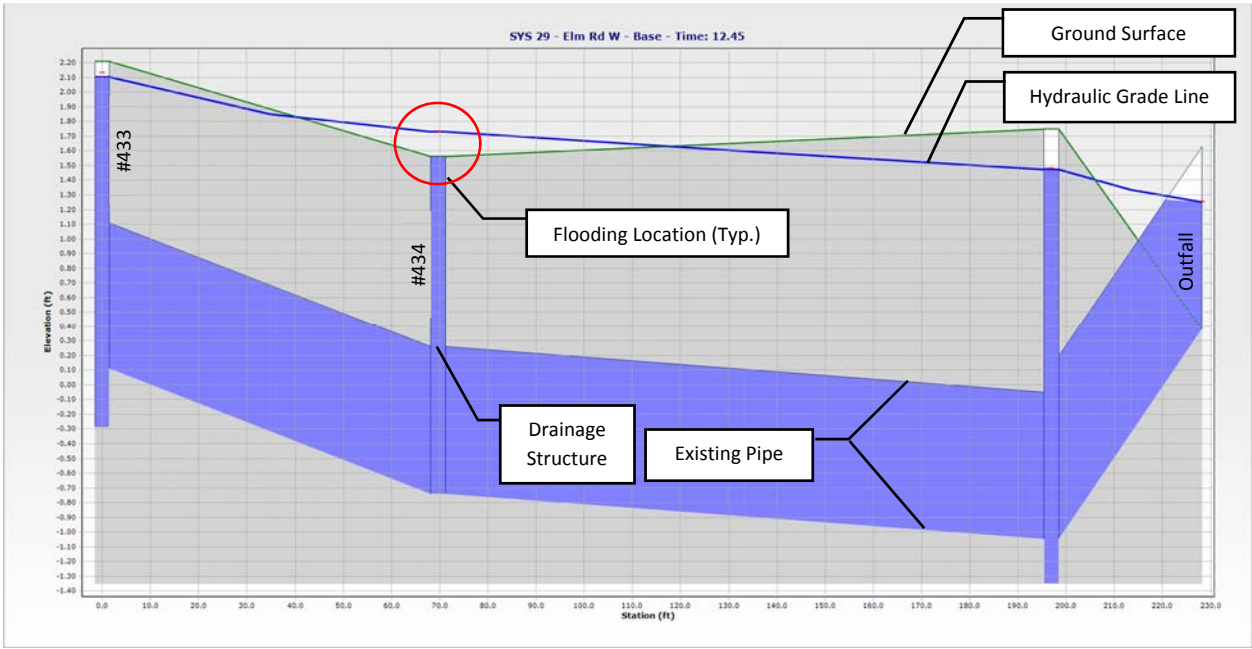

Figure IV-172. Existing Hydraulic Profile of DS-29 – Elm Road

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25. DS-29 – Riviera Drive from Elm Road south (includes 29A & 29B) (cont.)

Analysis of Existing System:

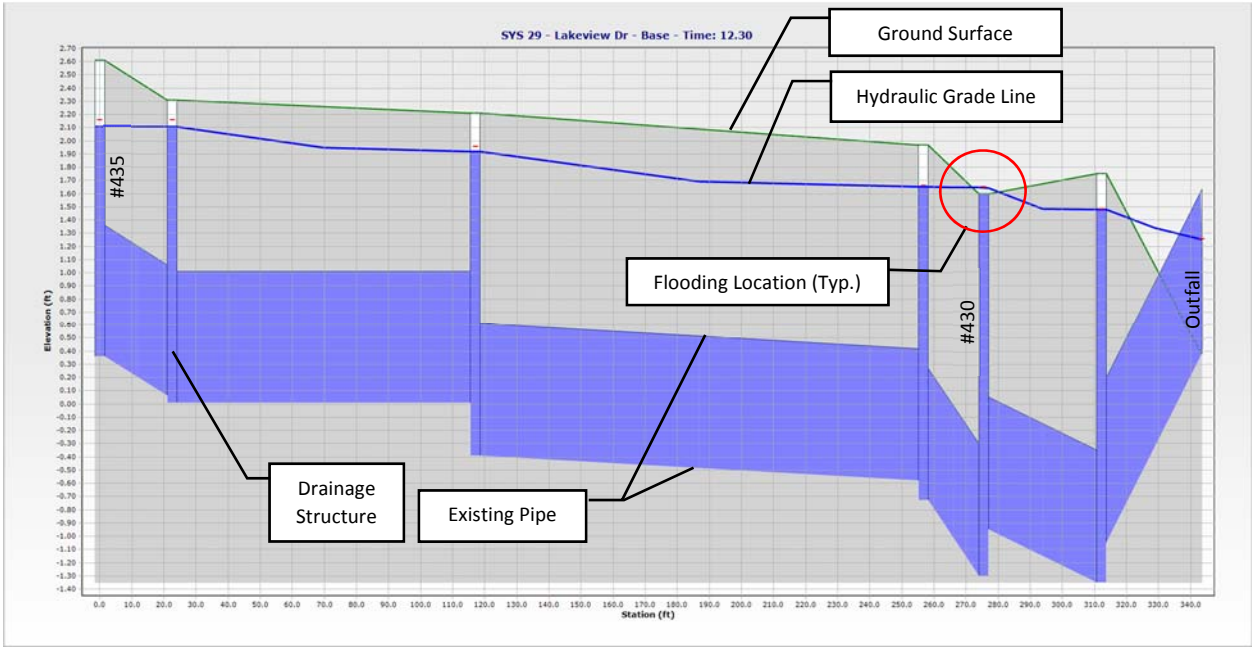

Figure IV-173. Existing Hydraulic Profile of DS-29 – Lakeview Drive

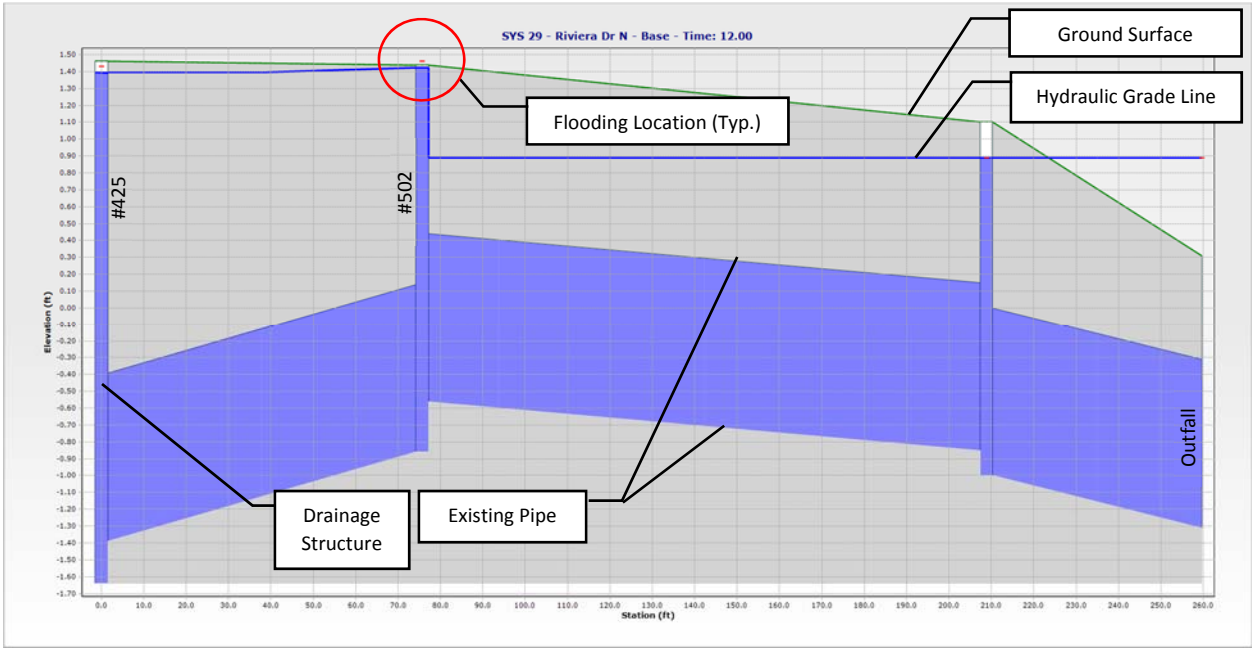

Figure IV-174. Existing Hydraulic Profile of DS-29 – Riviera Drive North

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25. DS-29 – Riviera Drive from Elm Road south (includes 29A & 29B) (cont.)

Analysis of Existing System:

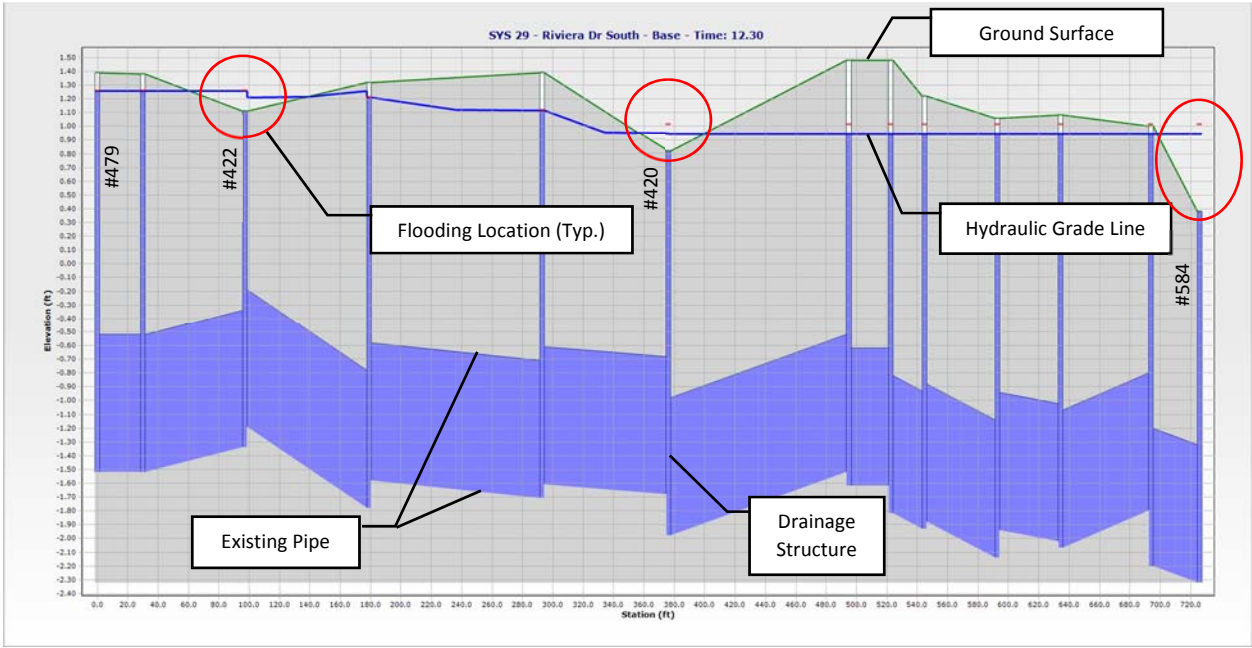

Figure IV-175. Existing Hydraulic Profile of DS-29 – Riviera Drive South

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26. DS-31 – King Road from Lincoln Drive to Park Drive

Existing Condition:

Consisting of catch basins, drywells and drainage pipe, Drainage System DS-31 is located in the eastern Mastic Beach portion of the study area. The system runs in the west-to-east direction along King Road East and discharges into nearby Lawrence Creek, east of the intersection with Park Drive.

The ground elevation of this system ranges from 4.5 to 6.0 feet above sea level.

Figure IV-178. Aerial Location Map and Schematic Roadway Map – DS-31

26. DS-31 – King Road from Lincoln Drive to Park Drive

Recommended Solution:

Based on the design analysis, the existing drainage system appears to have the capacity to adequately convey the runoff generated during a 10-year storm event. As such, no improvements recommended at this location.

26. DS-31 – King Road from Lincoln Drive to Park Drive (cont.)

Analysis of Existing System:

The drainage area tributary to this intersection is comprised of approximately 4.01 acres of 1/8-acre – 1/4-acre residential properties. Based on the design analysis, the existing drainage system appears to have the capacity to adequately convey the runoff generated during a 10-year storm event.

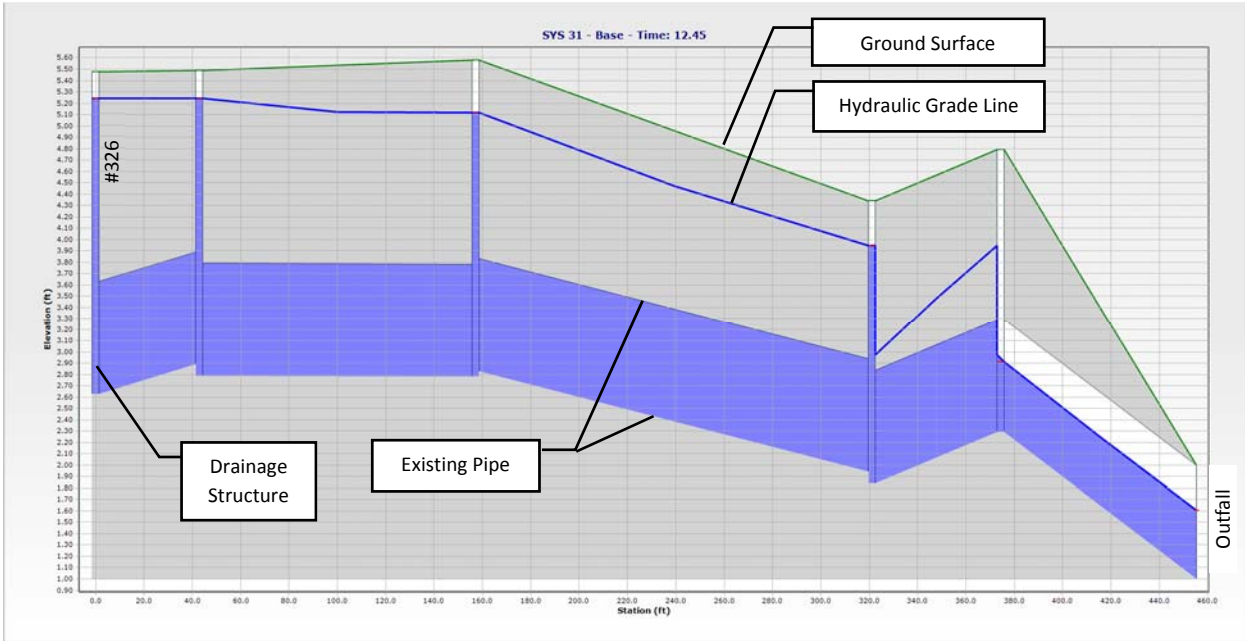

Figure IV-179. Existing Hydraulic Profile of DS-31

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27. DS-32 – Oceanview Drive (includes 32A & 32B)

Existing Condition:

Consisting of catch basins and drainage pipe, Drainage System DS-32 is located in the northeast Mastic Beach portion of the study area. Separate legs of the system pick up runoff along Edgewater Drive and Shore Drive and convey it eastward to the main trunk line of the system, which runs in the north-to-south direction along Oceanview Drive before discharging into Home Creek at the south end of Oceanview Drive.

The ground elevation of this system ranges from 1.5 to 3.0 feet above sea level along the main trunk line in Oceanview Drive, 2.0 – 3.0 feet along the Shore Road Branch, and 3.0 – 6.0 feet along the Edgewater Drive Branch.

Figure IV-180. Aerial Location Map – DS-32

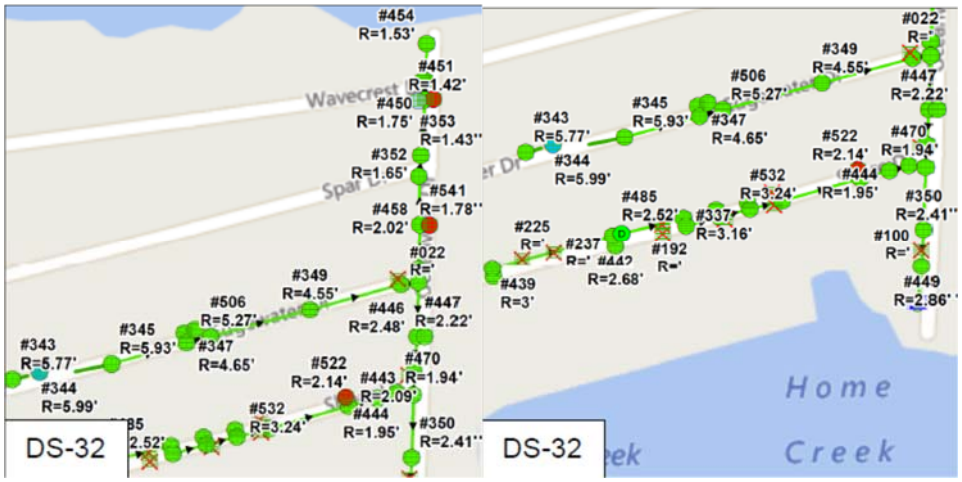

Figure IV-181. Schematic Roadway Map – DS-32N (left) and DS-32S (right)

27. DS-32 – Oceanview Drive (includes 32A & 32B)

Recommended Solution:

For the Edgewater Drive section of the system, by replacing pipes between structures #345 and #662 with larger diameter pipe, as well as adjusting pipe inverts at structures #347, #506, #349, #448 and #662, the hydraulics of the system can be improved and the potential for roadway flooding can be reduced during the 10-year storm event.

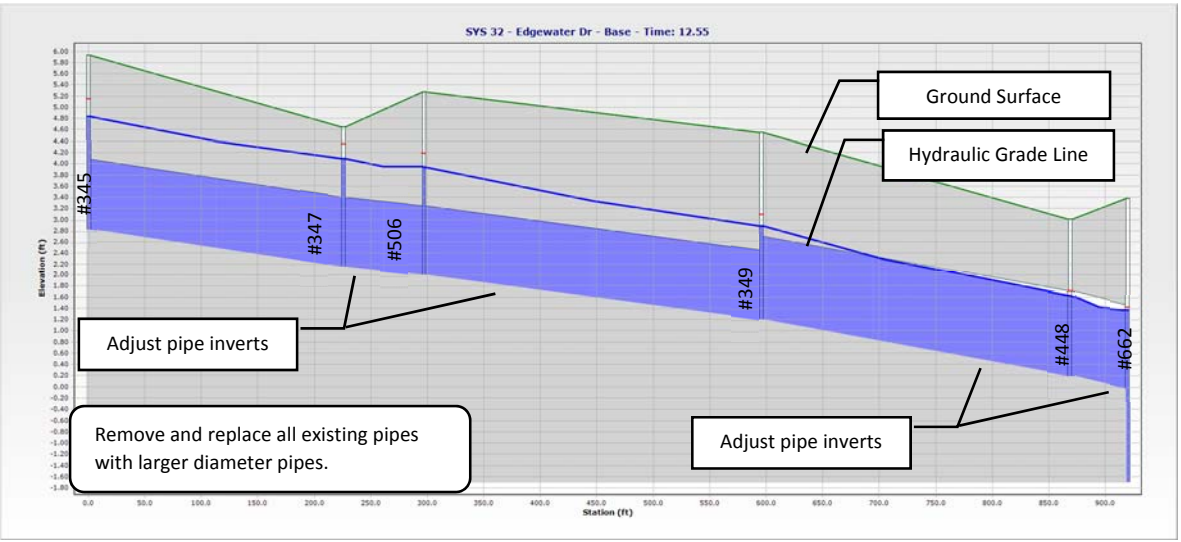

Figure IV-185. Recommended Improvements - DS-32 – Edgewater Drive

For the Edgewater Drive section of the system, by replacing pipes between structures #439 and #445 with larger diameter pipe, as well as adjusting pipe inverts, the hydraulics of the system can be improved and the potential for roadway flooding can be reduced during the 10-year storm event.

27. DS-32 – Oceanview Drive (includes 32A & 32B) (cont.)

Analysis of Existing System:

The drainage area tributary to this intersection is comprised of approximately 32.84 acres of 1/8-acre – 1/4-acre residential properties. Based on the design analysis, the existing drainage system does not have the capacity to adequately convey the runoff generated during a 10-year storm event. The non-linear vertical system layout as well as the undersized nature of the pipes contribute to the system's lack of conveyance capacity. As illustrated in the profile below, the drainage model indicates flooding occurs at the following drainage structures: #345, #347, #349, #448, #662, #454, #452, #450, #353, #352, #458, #351, #662, #446, #599, #445, #350, #449, #440, #439, #441, #485, #342, #443, #444, #470, and #445.

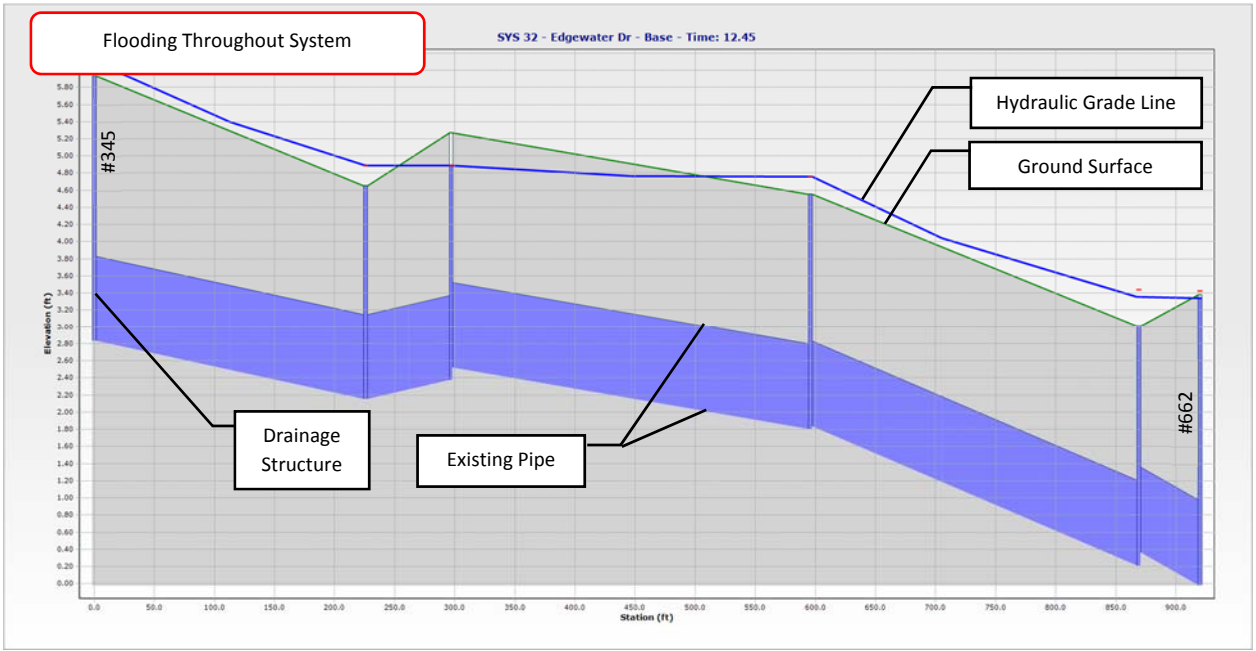

Figure IV-182. Existing Hydraulic Profile of DS-32 – Edgewater Drive

27. DS-32 – Oceanview Drive (includes 32A & 32B) (cont.)

Recommended Solution:

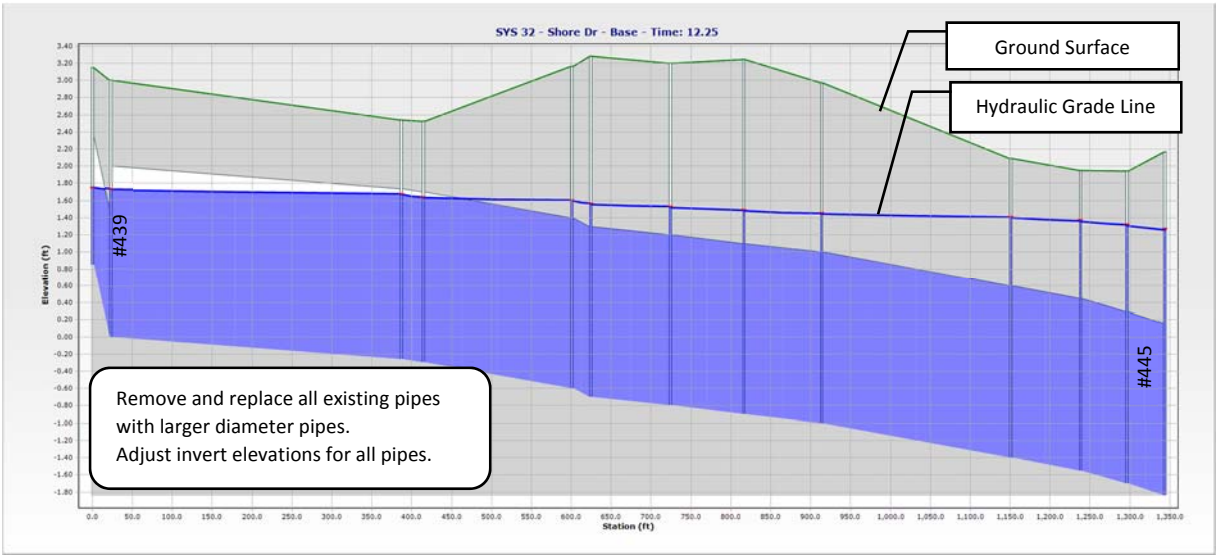

Figure IV-186. Recommended Improvements - DS-32 – Shore Drive

For the Oceanview Drive section of the system, by replacing pipes between structure #454 and the system outfall with larger diameter pipe, as well as adjusting pipe inverts, the hydraulics of the system can be improved and the potential for roadway flooding can be reduced during the 10-year storm event.

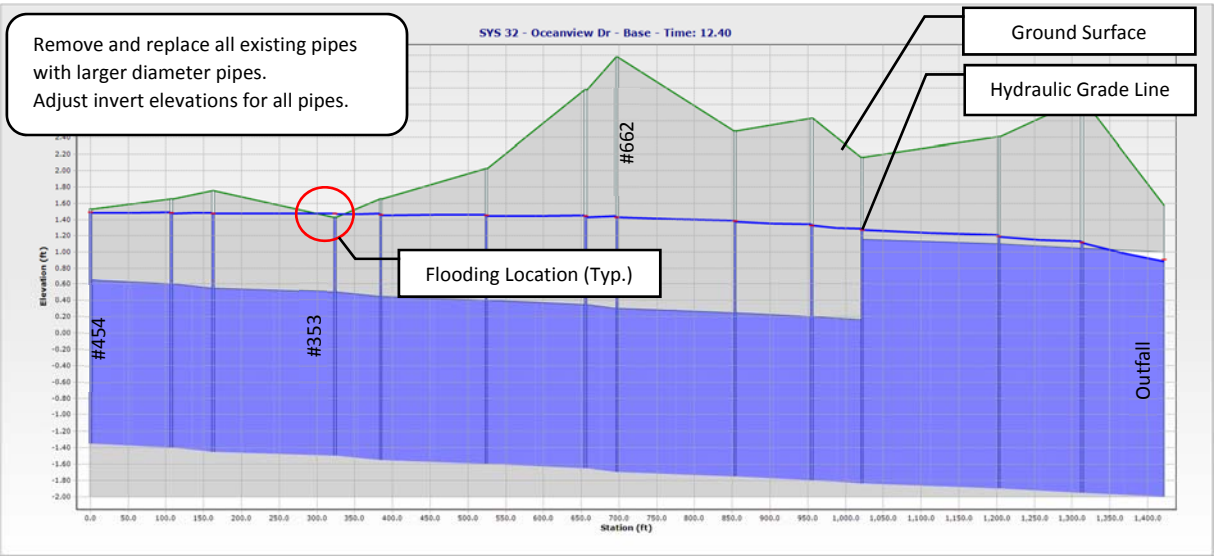

Figure IV-187. Recommended Improvements - DS-32 – Oceanview Drive

27. DS-32 – Oceanview Drive (includes 32A & 32B) (cont.)

Analysis of Existing System:

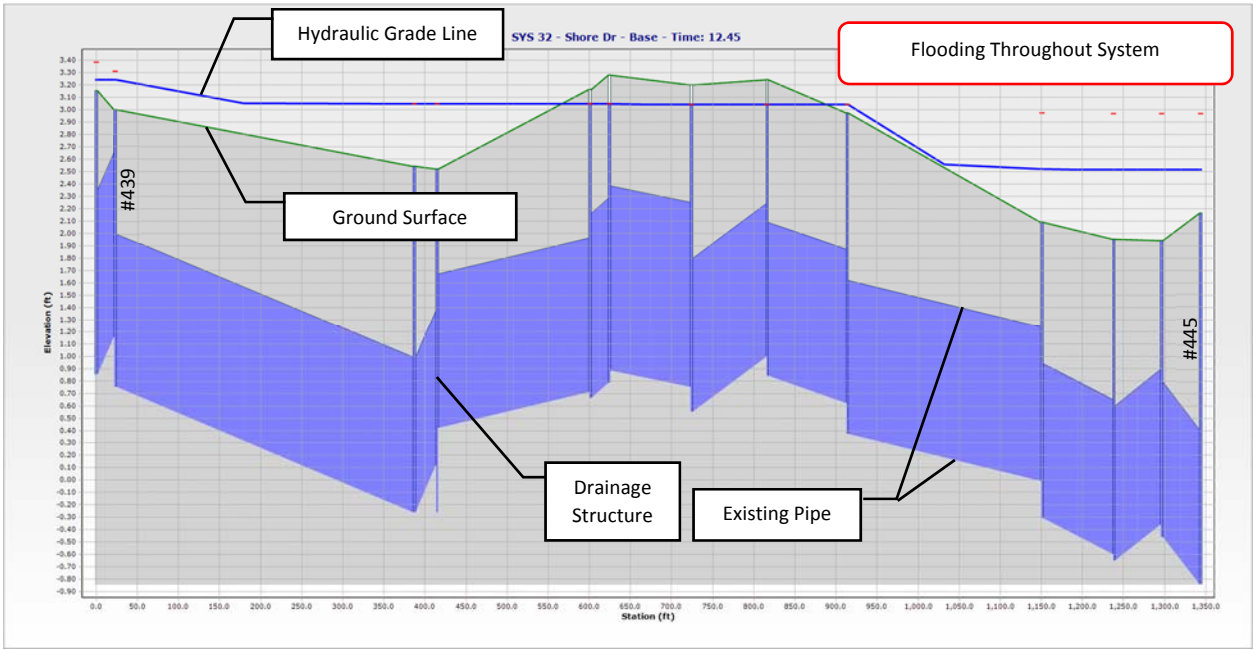

Figure IV-183. Existing Hydraulic Profile of DS-32 – Shore Drive

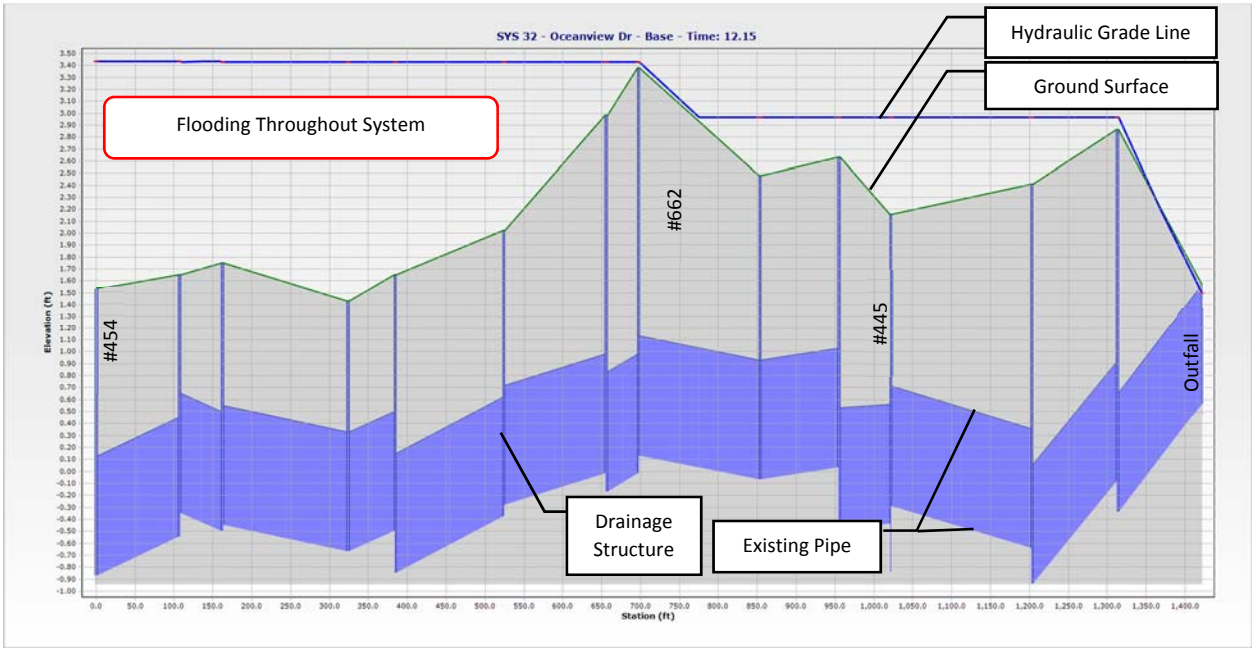

Figure IV-184. Existing Hydraulic Profile of DS-32 – Oceanview Drive

27. DS-32 – Oceanview Drive (includes 32A & 32B) (cont.)

Recommended Solution:

Even after incorporating the recommended improvements into the Oceanview Drive section of DS-32, the model still indicates the potential for flooding at structure #353 during the 10-year storm event.

To prevent the tidal influence of Home Creek from eliminating potential storage capacity provided by the drainage system, it is recommended that structures #449 should be removed and replaced with a 4' x 4' concrete catch basins, and one in-line check valve should be installed within the outlet pipe.

Refer to the analysis of locations MB-34 and MB-35 in Section IV of this report for additional recommendations that could impact system DS-32 and reduce the potential for flooding at this location.

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V. OPINION OF PROBABLE COSTS & PRIORITIZATION OF PROJECTS

An opinion of probable costs has been developed for the recommendations outlined in Section IV and are sorted by location number (e.g., DS-1, MB-1, SP-1) which are presented in Table V-2. In addition, recommendations for the various locations have been prioritized based on several criteria which include impacts on major road routes, the extent of property flooding at a location, level of maintenance associated with mitigation improvements, sea level rise impacts, potential USACE road raising project and environmental permitting. The scoring methodology and ranking criteria are provide in Table V-1.

Project Ranking		
Ranking Categories	Scoring Range	Scoring Criteria
Major Road Routes	0-2 points	0=Not a major Route 2=Major Route
Shallow Groundwater and Low Lying Area	0-2 points	0=Along shoreline area and wetlands, and shallow groundwater impacts 2=Upland and min. shallow groundwater impacts
Extent of Property Flooding	0-2 points	0=Minor property flooding 2=Substantial property flooding
Level of Maintenance	0-2 points	0=High maintenance 2=Low maintenance
Sea Level Rise	0-2 points	0=Substantial sea level rise impacts 2=Minimal sea level rise impacts
USACE Road Raising	0-2 points	0=Impacted by road raising 2=Not impacted by road raising
Environmental Permitting	0-2 points	0=Multiple permits required 2=No permits required

Table V-1. Project Ranking and Scoring Criteria

The ranking and scoring criteria were developed with the intention of providing an objective means to assess the importance, value, and need of a project given the limited funding available. Table V-3 sorts projects by their ranking score. Projects with higher scores would be considered a higher priority project and vice-versa. However, it is recognized there may be other factors which will need to be considered by the NYRCR Mastic Beach-Smith Point of Shirley Committee. The intent of the rankings is to assist the Committee in their discussions as they deliberate, prioritize the select the projects for the next phase.

The opinion of probable costs provided in this report are based on the current information available and have been prepared without the benefit of a detailed design that defines the exact scope of the constructed project. The cost estimates are based on assumptions relating to subsurface conditions. The existence of suitable soils, location of groundwater and the anticipated need for and extent of dewatering operations, and the location of underground utilities can significantly impact the project cost and schedule. The cost opinions reflect the project as identified and described in this report, which may change during design

based on client preferences for materials of construction, systems, and unanticipated conditions. The cost estimating process has considered the following elements:

- Construction difficulty;
- Anticipated means and methods of qualified and competent contractors who have the prerequisite experience with the size and complexity of the project;
- Surveying, utility subsurface markout and engineering is included;
- Insurance and cost of obtaining bonds and warranties are in accordance with industry standards;
- Estimated quantities and projected unit prices for items that will be incorporated into the project;
- Direct costs for contractor general requirements, which includes such items as project management and coordination, quality control, temporary facilities and controls, cleaning and waste management;
- Reasonable and customary indirect costs for profit, overhead and contractor contingencies are used by the bidder;
- An adequate contingency based on the degree of assumptions and unknowns involved with implementing the construction;
- Excluded are costs associated with the preparation of regulatory permitting plans and applications, wetland delineations, boundary surveys, and easement maps;
- Permitting fees, easement acquisition and property acquisition costs are excluded.

Mastic Beach-Smith Point of Shirley Stormwater Management Plan Report
Opinion of Probable Cost and Ranking Matrix (By Location)

Location	Major Routes	Shallow Groundwater & Low Lying Area	Extent of Property Flooding	Level of Maintenance	Sea Level Rise	USACE Road Raising	Environmental Permitting	Project Ranking	Opinion of Probable Cost
DS-01	0	0	1	1	1	2	0	5	$458,500.00
DS-02	0	0	1	1	1	2	0	5	$126,700.00
DS-03	0	1	1	1	1	2	0	6	$195,500.00
DS-04	0	1	1	1	1	2	2	8	$226,800.00
DS-05	1	1	1	1	1	2	2	9	$752,000.00
DS-05C	0	1	0	1	1	2	2	7	$0.00
DS-06	0	1	0	1	1	2	1	6	$0.00
DS-07	0	1	0	1	1	2	1	6	$0.00
DS-11	0	0	2	1	0	0	0	3	$269,600.00
DS-12	0	1	1	1	1	2	1	7	$613,300.00
DS-13	0	0	1	1	0	0	0	2	$810,300.00
DS-14	0	0	2	0	0	0	1	3	$93,400.00
DS-15	0	0	2	0	0	0	1	3	$60,800.00
DS-16	0	0	2	0	0	0	1	3	$67,000.00
DS-17	0	0	2	0	0	0	1	3	$62,600.00
DS-18	0	0	1	1	0	2	1	5	$281,100.00
DS-20	0	0	1	1	0	0	2	4	$339,600.00
DS-21	0	0	1	1	0	2	2	6	$181,700.00
DS-22	0	1	1	1	1	0	0	4	$391,700.00
DS-23	2	0	2	1	1	2	1	9	$149,900.00
DS-24	2	2	0	0	2	2	2	10	$395,900.00
DS-25	2	2	0	0	2	2	0	8	$949,500.00
DS-26	0	2	0	1	2	2	0	7	$270,600.00
DS-28	0	1	1	1	1	2	0	6	$154,800.00
DS-29	0	0	2	0	1	2	0	5	$340,100.00
DS-31	0	1	0	1	1	2	1	6	$0.00
DS-32	0	0	2	0	0	2	0	4	$1,165,900.00

Table V-2.Opinion of Probable Cost Priority Ranking Matrix

Mastic Beach-Smith Point of Shirley Stormwater Management Plan Report
Opinion of Probable Cost and Ranking Matrix (By Location)

Location	Major Routes	Shallow Groundwater & Low Lying Area	Extent of Property Flooding	Level of Maintenance	Sea Level Rise	USACE Road Raising	Environmental Permitting	Project Ranking	Opinion of Probable Cost
MB-01	0	0	1	1	0	2	0	4	$214,800.00
MB-02	0	0	1	1	0	2	0	4	$272,700.00
MB-03	0	2	1	1	2	2	2	10	$81,000.00
MB-04	0	2	1	2	2	2	2	11	$61,200.00
MB-05	0	2	1	2	2	2	2	11	$49,600.00
MB-07	0	0	1	1	1	2	1	6	$36,800.00
MB-08	0	1	1	0	1	2	2	7	$278,300.00
MB-09	0	0	2	0	0	0	0	2	$241,700.00
MB-10	0	0	2	1	0	0	0	3	see DS-11
MB-11	0	0	2	1	0	0	1	4	$388,900.00
MB-12	0	0	1	1	0	0	1	3	see DS-13
MB-13	0	1	1	1	1	2	2	8	$113,300.00
MB-14	0	0	2	1	1	1	2	7	$366,500.00
MB-15	0	0	1	1	0	0	2	4	$89,700.00
MB-16	0	0	1	1	0	0	2	4	$148,000.00
MB-17	0	0	1	1	0	0	1	3	$313,300.00
MB-18	0	0	1	1	0	0	2	4	$369,400.00
MB-19	0	0	2	0	0	0	1	3	$79,000.00
MB-20	0	0	2	0	0	0	1	3	see DS-14,15
MB-21	0	0	2	0	0	0	1	3	$72,800.00
MB-22	0	0	2	1	0	0	0	3	$403,500.00
MB-23	0	0	2	1	0	0	2	5	$352,400.00
MB-24	0	0	2	0	0	0	0	2	see MB-09
MB-25	0	0	2	0	0	0	0	2	see MB-09
MB-26	0	0	2	0	0	0	0	2	see MB-09
MB-27	0	2	0	2	2	2	2	10	$79,400.00
MB-28	0	2	0	2	2	2	2	10	$79,400.00

Table V-2.Opinion of Probable Cost Priority Ranking Matrix

Mastic Beach-Smith Point of Shirley Stormwater Management Plan Report
Opinion of Probable Cost and Ranking Matrix (By Location)

Location	Major Routes	Shallow Groundwater & Low Lying Area	Extent of Property Flooding	Level of Maintenance	Sea Level Rise	USACE Road Raising	Environmental Permitting	Project Ranking	Opinion of Probable Cost
MB-29	0	0	2	1	0	2	0	5	$169,100.00
MB-30	0	0	2	0	0	2	0	4	$65,500.00
MB-31	0	1	2	0	0	2	0	5	$137,500.00
MB-32	0	1	2	1	2	2	1	9	$327,300.00
MB-33	2	1	2	2	2	2	0	11	$179,000.00
MB-34	0	0	2	1	0	2	1	6	$150,600.00
MB-35	0	0	2	1	0	2	0	5	$257,700.00
SP-01	0	0	2	1	0	2	1	6	$70,300.00
SP-02	0	0	2	1	0	2	1	6	$66,600.00
SP-03	0	0	1	1	0	2	2	6	$72,500.00
SP-04	0	0	1	1	0	2	1	5	$68,600.00
SP-05	0	1	1	1	2	2	2	9	$161,500.00
SP-06	0	1	1	1	2	2	2	9	$82,500.00
SP-07	0	1	1	1	1	2	2	8	$69,000.00
SP-08	0	1	1	1	2	2	2	9	$258,600.00
SP-09	0	1	1	1	2	2	2	9	$264,700.00
SP-10	0	1	1	1	2	2	2	9	$147,200.00
SP-11	0	1	1	1	2	2	2	9	$147,200.00

Table V-2.Opinion of Probable Cost Priority Ranking Matrix

Mastic Beach-Smith Point of Shirley Stormwater Management Plan Report
Opinion of Probable Cost and Ranking Matrix (By Ranking)

Location	Major Routes	Shallow Groundwater & Low Lying Area	Extent of Property Flooding	Level of Maintenance	Sea Level Rise	USACE Road Raising	Environmental Permitting	Project Ranking	Opinion of Probable Cost
MB-05	0	2	1	2	2	2	2	11	$49,600.00
MB-04	0	2	1	2	2	2	2	11	$61,200.00
MB-33	2	1	2	2	2	2	0	11	$179,000.00
MB-27	0	2	0	2	2	2	2	10	$79,400.00
MB-28	0	2	0	2	2	2	2	10	$79,400.00
MB-03	0	2	1	1	2	2	2	10	$81,000.00
DS-24	2	2	0	0	2	2	2	10	$395,900.00
SP-06	0	1	1	1	2	2	2	9	$82,500.00
SP-10	0	1	1	1	2	2	2	9	$147,200.00
SP-11	0	1	1	1	2	2	2	9	$147,200.00
DS-23	2	0	2	1	1	2	1	9	$149,900.00
SP-05	0	1	1	1	2	2	2	9	$161,500.00
SP-08	0	1	1	1	2	2	2	9	$258,600.00
SP-09	0	1	1	1	2	2	2	9	$264,700.00
MB-32	0	1	2	1	2	2	1	9	$327,300.00
DS-05	1	1	1	1	1	2	2	9	$752,000.00
SP-07	0	1	1	1	1	2	2	8	$69,000.00
MB-13	0	1	1	1	1	2	2	8	$113,300.00
DS-04	0	1	1	1	1	2	2	8	$226,800.00
DS-25	2	2	0	0	2	2	0	8	$949,500.00
DS-05C	0	1	0	1	1	2	2	7	$0.00
DS-26	0	2	0	1	2	2	0	7	$270,600.00
MB-08	0	1	1	0	1	2	2	7	$278,300.00
MB-14	0	0	2	1	1	1	2	7	$366,500.00
DS-12	0	1	1	1	1	2	1	7	$613,300.00
DS-06	0	1	0	1	1	2	1	6	$0.00
DS-07	0	1	0	1	1	2	1	6	$0.00

Table V-3.Opinion of Probable Cost Priority Ranking Matrix

Mastic Beach-Smith Point of Shirley Stormwater Management Plan Report
Opinion of Probable Cost and Ranking Matrix (By Ranking)

Location	Major Routes	Shallow Groundwater & Low Lying Area	Extent of Property Flooding	Level of Maintenance	Sea Level Rise	USACE Road Raising	Environmental Permitting	Project Ranking	Opinion of Probable Cost
DS-31	0	1	0	1	1	2	1	6	$0.00
MB-07	0	0	1	1	1	2	1	6	$36,800.00
SP-02	0	0	2	1	0	2	1	6	$66,600.00
SP-01	0	0	2	1	0	2	1	6	$70,300.00
SP-03	0	0	1	1	0	2	2	6	$72,500.00
MB-34	0	0	2	1	0	2	1	6	$150,600.00
DS-28	0	1	1	1	1	2	0	6	$154,800.00
DS-21	0	0	1	1	0	2	2	6	$181,700.00
DS-03	0	1	1	1	1	2	0	6	$195,500.00
SP-04	0	0	1	1	0	2	1	5	$68,600.00
DS-02	0	0	1	1	1	2	0	5	$126,700.00
MB-31	0	1	2	0	0	2	0	5	$137,500.00
MB-29	0	0	2	1	0	2	0	5	$169,100.00
MB-35	0	0	2	1	0	2	0	5	$257,700.00
DS-18	0	0	1	1	0	2	1	5	$281,100.00
DS-29	0	0	2	0	1	2	0	5	$340,100.00
MB-23	0	0	2	1	0	0	2	5	$352,400.00
DS-01	0	0	1	1	1	2	0	5	$458,500.00
MB-30	0	0	2	0	0	2	0	4	$65,500.00
MB-15	0	0	1	1	0	0	2	4	$89,700.00
MB-16	0	0	1	1	0	0	2	4	$148,000.00
MB-01	0	0	1	1	0	2	0	4	$214,800.00
MB-02	0	0	1	1	0	2	0	4	$272,700.00
DS-20	0	0	1	1	0	0	2	4	$339,600.00
MB-18	0	0	1	1	0	0	2	4	$369,400.00
MB-11	0	0	2	1	0	0	1	4	$388,900.00
DS-22	0	1	1	1	1	0	0	4	$391,700.00

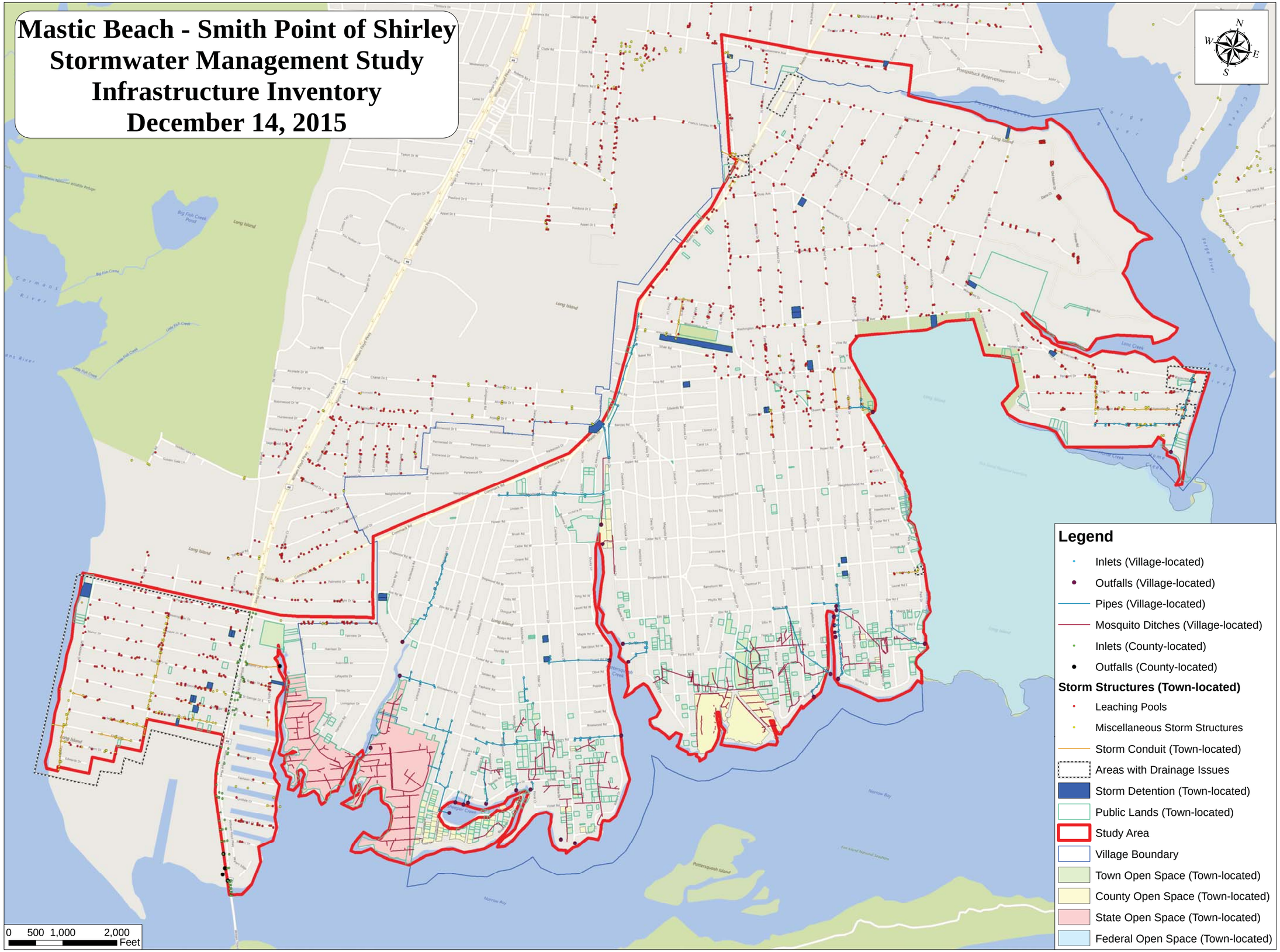
Table V-3.Opinion of Probable Cost Priority Ranking Matrix

Mastic Beach-Smith Point of Shirley Stormwater Management Plan Report
Opinion of Probable Cost and Ranking Matrix (By Ranking)

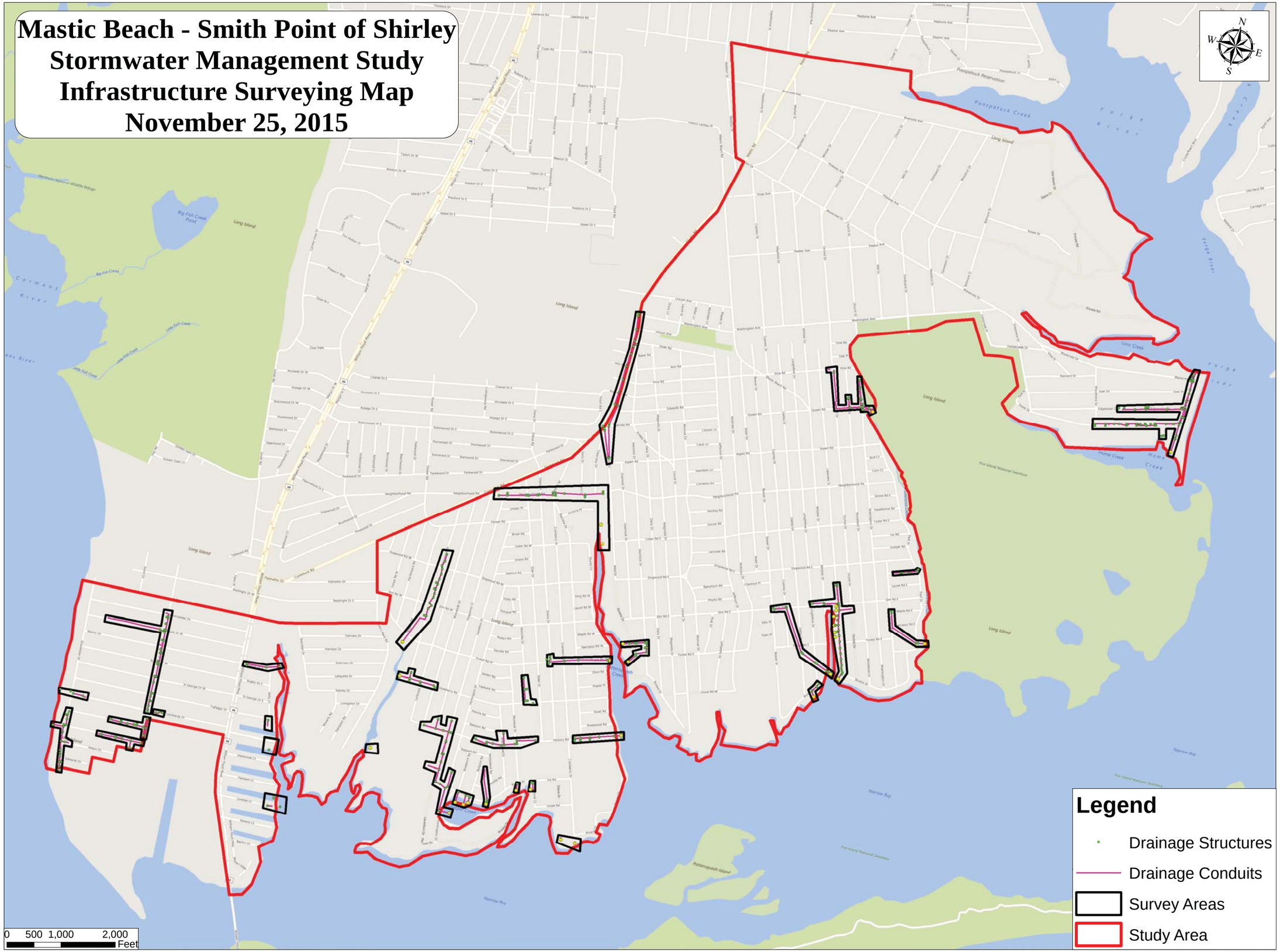
Location	Major Routes	Shallow Groundwater & Low Lying Area	Extent of Property Flooding	Level of Maintenance	Sea Level Rise	USACE Road Raising	Environmental Permitting	Project Ranking	Opinion of Probable Cost
DS-32	0	0	2	0	0	2	0	4	$1,165,900.00
DS-15	0	0	2	0	0	0	1	3	$60,800.00
DS-17	0	0	2	0	0	0	1	3	$62,600.00
DS-16	0	0	2	0	0	0	1	3	$67,000.00
MB-21	0	0	2	0	0	0	1	3	$72,800.00
MB-19	0	0	2	0	0	0	1	3	$79,000.00
DS-14	0	0	2	0	0	0	1	3	$93,400.00
DS-11	0	0	2	1	0	0	0	3	$269,600.00
MB-17	0	0	1	1	0	0	1	3	$313,300.00
MB-22	0	0	2	1	0	0	0	3	$403,500.00
MB-10	0	0	2	1	0	0	0	3	see DS-11
MB-12	0	0	1	1	0	0	1	3	see DS-13
MB-20	0	0	2	0	0	0	1	3	see DS-14,15
MB-09	0	0	2	0	0	0	0	2	$241,700.00
DS-13	0	0	1	1	0	0	0	2	$810,300.00
MB-24	0	0	2	0	0	0	0	2	see MB-09
MB-25	0	0	2	0	0	0	0	2	see MB-09
MB-26	0	0	2	0	0	0	0	2	see MB-09

Table V-3.Opinion of Probable Cost Priority Ranking Matrix

Mastic Beach - Smith Point of Shirley Stormwater Management Study Infrastructure Inventory December 14, 2015



Mastic Beach - Smith Point of Shirley Stormwater Management Study Infrastructure Surveying Map November 25, 2015



MEMORANDUM

DECEMBER 15, 2015

TO: LARRY PALLESCHI, P.E.
DASNY

FROM: MICHAEL KEFFER, P.E.
H2M

PROJECT: MASTIC BEACH-SMITH POINT OF SHIRLEY STORMWATER MANAGEMENT PLAN
H2M PROJECT NO.: DASN1515

BACKGROUND

Phase 1 of the Mastic Beach-Smith Point of Shirley Stormwater Management Plan study involves data collection and field review of the existing gravity stormwater drainage system throughout the study area. During this phase, H2M coordinated with and obtained information from the Village of Mastic Beach, Town of Brookhaven and Suffolk County.

The Village of Mastic Beach provided H2M with a freehand map drawing showing the location of known gravity drainage systems within the Village area study limits. The freehand drawing was prepared and updated by a long-time employee of the Village and Town (prior to the incorporation of the Village of Mastic Beach). H2M also contacted the Suffolk County Department of Public Works and the Town of Brookhaven to obtain available plans for County and Town roads within the study area. The County provided their GIS database and record drainage plans for William Floyd Parkway. The Town was unable to provide record drawings for roads within the Town limits, however, they provided GIS information for the existing drainage system within the study area.

The information compiled from the Village, Town and County sources was utilized in developing an overall map worksheet. H2M utilized the map worksheet as a roadmap to visually inspect the locations of the various catch basins, manholes and mosquito ditches within the study area to confirm the accuracy of drawings, GIS data and record plans provided. Several minor discrepancies were noted during the field review and incorporated into the overall preliminary map of the study area.

As part of our field review, H2M met separately with representatives from the Village of Mastic Beach Department of Public Works and the Town of Brookhaven Highway Department to review the existing drainage infrastructure within the study area. Both representatives identified specific components of individual drainage systems and locations of known flooding.

The final deliverable for Phase 1 is a summary of data and information collected from the Village, Town and County. In addition, preliminary maps were prepared which depicts a portion of the information collected and the approximate location of gravity drainage systems within the study area.

DATA SET SUMMARY

Outlined below are the various mapping sources and references which were acquired during Phase 1 of the project. The sources referenced below were selectively compiled into two maps which are enclosed and include the Infrastructure Inventory Map and the Infrastructure Survey Map.

<u>Base Maps</u>
Various base maps were used as a background for the Preliminary Map. The primary source for the base maps were from Environmental Systems Research Institute (ESRI) and Microsoft Bing Maps.

These include street, topography, and aerial imagery maps. Additional aerial imagery was provided through the NYS GIS Orthoimagery Program.

Village Boundary
This data set delineates the municipal boundary of the Incorporated Village of Mastic Beach. The data was provided by the Suffolk County Department of Information Technology and is dated 2010.

Study Area Boundary
This data set delineates the boundary of the stormwater management plan drainage study area. The area includes the Village of Mastic Beach and Smith Point of Shirley, but does not include certain areas such as Smith Point Park and William Floyd Estate. These locations were previously identified in meetings between DASNY, GOSR and H2M.

Outfalls
The approximate outfall locations were provided by the Village and County. The first data set was provided by the Incorporated Village of Mastic Beach personnel in the form of a marked up paper map which showed the location of all known drainage outfalls within the Village. The pipe locations were approximately digitized on the infrastructure inventory maps prepared.

The second data set was provided by the Suffolk County Department of Public Works. This data was developed by the County to assist them in meeting their MS4 program requirements for illicit discharge detection and elimination. This data set was developed in conjunction with the Cornell Cooperative Extension of Suffolk County and includes attribute information about each outfall such as the receiving water body name, whether that water body is impaired, the date it was located, as well as the type, material and size of the outfall.

Mosquito Ditches
The Incorporated Village of Mastic Beach provided a marked up paper map indicating all of their known locations of mosquito ditches within the Village. After reviewing this map and correlating it with aerial imagery, since the mosquito ditches are visible from aerial imagery, we discovered that the provided information was mostly inaccurate.

A map of the mosquito ditches was subsequently obtained from Suffolk County Department of Public Works. This map which was prepared in 1978 was more comparable to the aerial imagery, but did have some minor discrepancies. Using the map from SCDPW in conjunction with the latest aerial imagery, the mosquito ditches were approximately digitized and a new data set was created.

Storm Inlets
Approximate drainage inlet locations were provided by both the Village and Suffolk County. The first data set was provided by the Incorporated Village of Mastic Beach in the form of a marked up paper map indicating all of their known inlets within the village. There were a total of 214 points identified and digitized using this data source. The storm inlet locations were approximately digitized on the infrastructure inventory maps prepared.

The second set of inlets were provided by Suffolk County. This data includes County stormwater inlets along William Floyd Parkway. It was developed based on a set of record plans from 1973 for the drainage system along the Parkway. There were a total of 538 inlets in the entire data set, but only approximately 80 are within the study area. The attribute data for these structures included the type of drainage inlet. It was later determined using the record drawings from Suffolk County that all of these inlets were part of a self-contained drainage system for the Parkway, and were not known to be connected to existing drainage systems located in the Village and Town.

Drainage Pipes
Approximate drainage pipe locations were provided by the Village and Town. The first data set was provided by the Incorporated Village of Mastic Beach in the form of a marked up paper map indicating all of their known pipes that interconnected with inlets and outfalls previously described within the Village. The pipe locations were approximately digitized on the infrastructure inventory maps prepared.

The second set of data was obtained through the Town of Brookhaven. This data includes pipes interconnected with the inlets and outfalls previously described at various locations within the study area. The attribute information includes the diameter, material, and condition. No information was provided on how this data set was developed.

Recharge Basins
The Town of Brookhaven provided a data set of the stormwater recharge basins within the study area. A total of 63 basins are within the data set and the attribute information includes the tax map number, address, acreage, and generalized dimensions.

Street Centerlines
Street centerlines were provided by both the Town of Brookhaven and the Suffolk County Real Property Tax Service. This data set is for reference information only.

Public Lands
The Town of Brookhaven provided a data set of what it determined to be "public lands", which is approximately 573 parcels in the vicinity of the study area. The attribute information provides the tax map number as well as which entity owns the land, either Fire Districts, LIPA/LILCO, USPS, Town, County, State or Federal as well as separate categories for "Nonprofit Conservation", "Nonprofit educational" and "Affirmative Easement".

Open Space
Open space parcels were identified by the Suffolk County Department of Economic Development and Planning, Division of Planning & Environment and collected in a data set. The data set was clipped to the study area and the ownership is broken down by Town, County, State and Federal entities. There are 48, 61, 17, 1 properties respectively in each data set. The attribute information only includes tax map number and acreage.

Survey Areas
Certain areas which contained existing stormwater infrastructure within the study area were highlighted as detailed topographic information will be needed in order to develop the hydrologic and hydraulic stormwater model. This area delineation data set was provided to the land surveyor to streamline the deployment of field surveying crews. A separate map referenced as the Infrastructure Surveying Map was prepared to assist the land surveying field crews.

Problematic Drainage Areas
Based on input from Village and Town representatives, several areas were identified with known drainage issues and include the three peninsular areas.

ENCLOSURES Infrastructure Inventory Map
Infrastructure Survey Map

Legend

Structures

Structure Type

- Drainage Manhole
- Catch Basin/Inlet
- Outfall

Structures - Investigation Layer

Investigationstatus

- Out of Scope
- Investigation Complete
- Full of Debris
- Full of Water
- Pipes
- Pipe Ends
- Survey Areas
- Study Area

Surveyed Drainage Infrastructure Map
DS-01

APPENDIX: B-01

DATE: OCT 2016

H2M architects + engineers

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Legend

Structures

Structure Type

- Drainage Manhole
- Catch Basin/Inlet
- Outfall

Structures - Investigation Layer

Investigationstatus

- Out of Scope
- Investigation Complete
- Full of Debris
- Pipes
- Pipe Ends
- Survey Areas
- Study Area

Surveyed Drainage Infrastructure Map
DS-02

APPENDIX: B-02

DATE: OCT 2016

H2M architects + engineers

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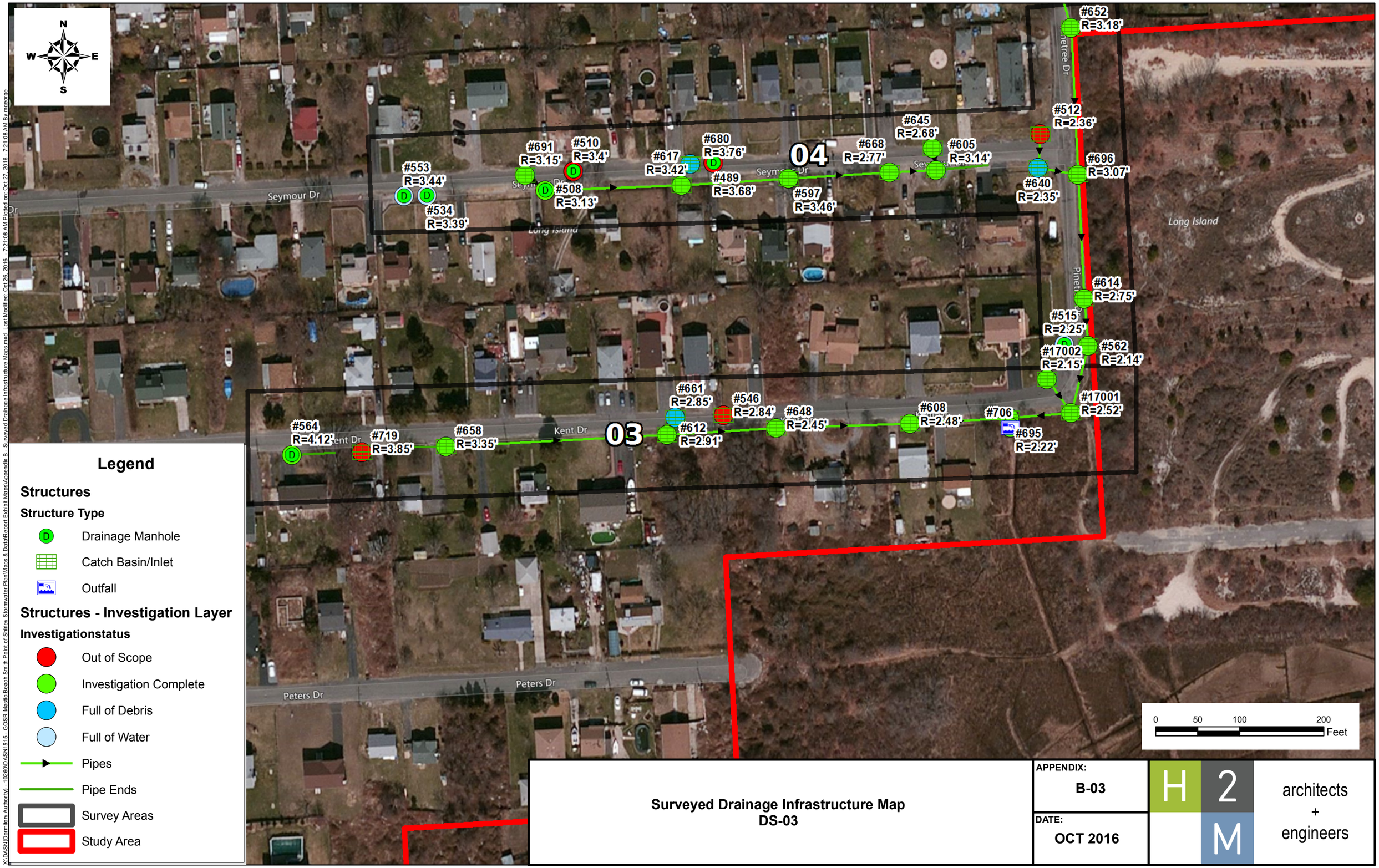

Legend

Structures

Structure Type

- Drainage Manhole
- Catch Basin/Inlet
- Outfall

Structures - Investigation Layer

Investigationstatus

- Out of Scope
- Investigation Complete
- Full of Debris
- Full of Water
- Pipes
- Pipe Ends
- Survey Areas
- Study Area

Surveyed Drainage Infrastructure Map
DS-03

APPENDIX: B-03

DATE: OCT 2016

H2M architects + engineers

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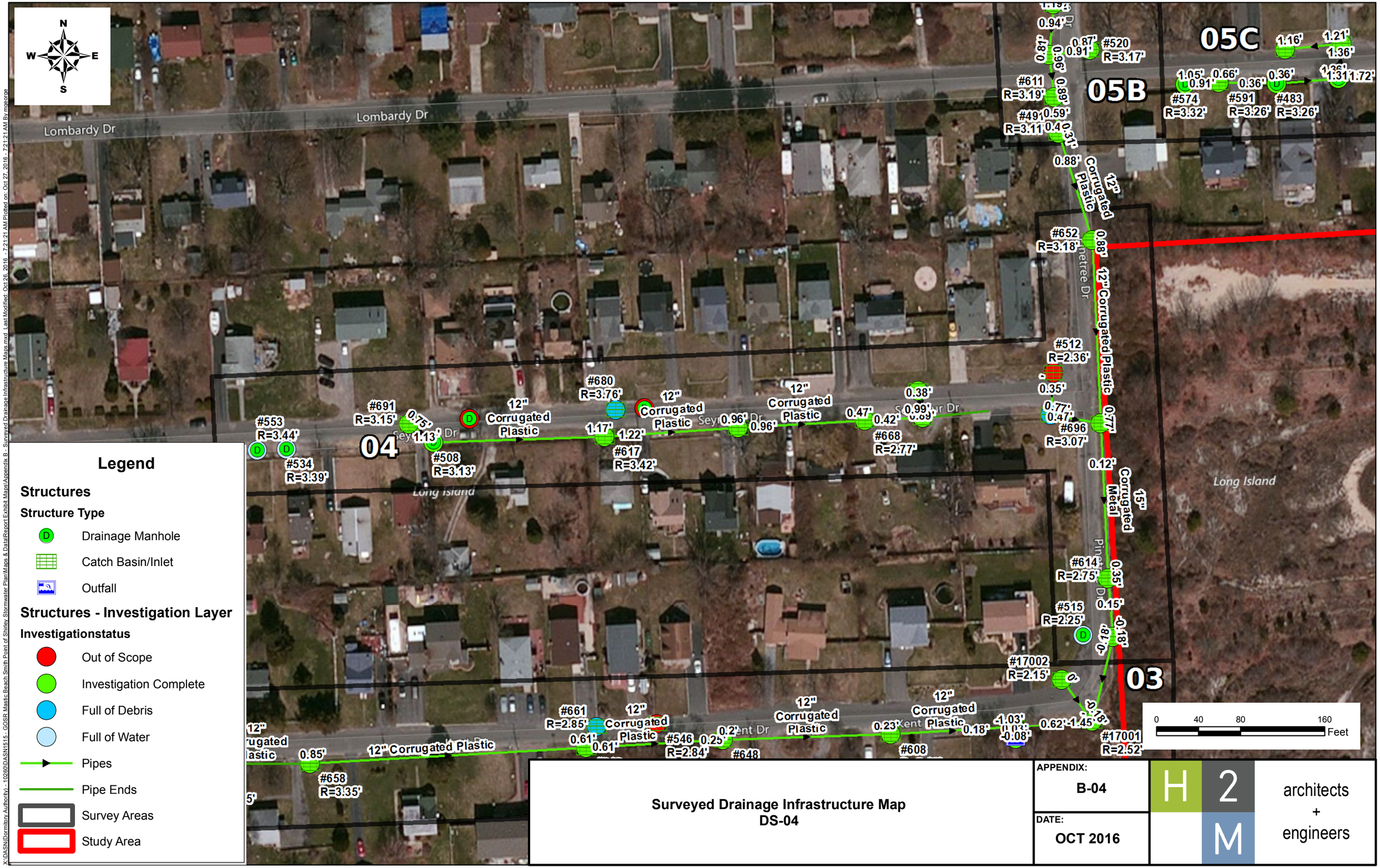

Legend

Structures

Structure Type

- Drainage Manhole
- Catch Basin/Inlet
- Outfall

Structures - Investigation Layer

Investigationstatus

- Out of Scope
- Investigation Complete
- Full of Debris
- Full of Water
- Pipes
- Pipe Ends
- Survey Areas
- Study Area

Surveyed Drainage Infrastructure Map
DS-04

APPENDIX: B-04

DATE: OCT 2016

H2M architects + engineers

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Legend

Structures

Structure Type

- Drainage Manhole
- Catch Basin/Inlet

Structures - Investigation Layer

Investigationstatus

- Out of Scope
- Investigation Complete
- Full of Debris
- Pipes
- Pipe Ends
- Survey Areas
- Study Area

Surveyed Drainage Infrastructure Map
DS-05A

APPENDIX: B-05A

DATE: OCT 2016

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Surveyed Drainage Infrastructure Map
DS-05B

APPENDIX: B-05B

DATE: OCT 2016

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Surveyed Drainage Infrastructure Map
DS-05C

APPENDIX: B-05C

DATE: OCT 2016

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Surveyed Drainage Infrastructure Map
DS-06

APPENDIX: B-06

DATE: OCT 2016

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Surveyed Drainage Infrastructure Map
DS-07

APPENDIX: B-07

DATE: OCT 2016

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Legend

Structures

Structure Type

Catch Basin/Inlet

Structures - Investigation Layer

Investigationstatus

Investigation Complete

Survey Areas

Study Area

Surveyed Drainage Infrastructure Map
DS-08

APPENDIX:
B-08

DATE:
OCT 2016

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Legend

Structures

Structure Type

- Drainage Manhole
- Catch Basin/Inlet

Structures - Investigation Layer

Investigationstatus

- Out of Scope
- Investigation Complete
- Pipes
- Survey Areas
- Study Area

Surveyed Drainage Infrastructure Map
DS-09

APPENDIX: B-09

DATE: OCT 2016

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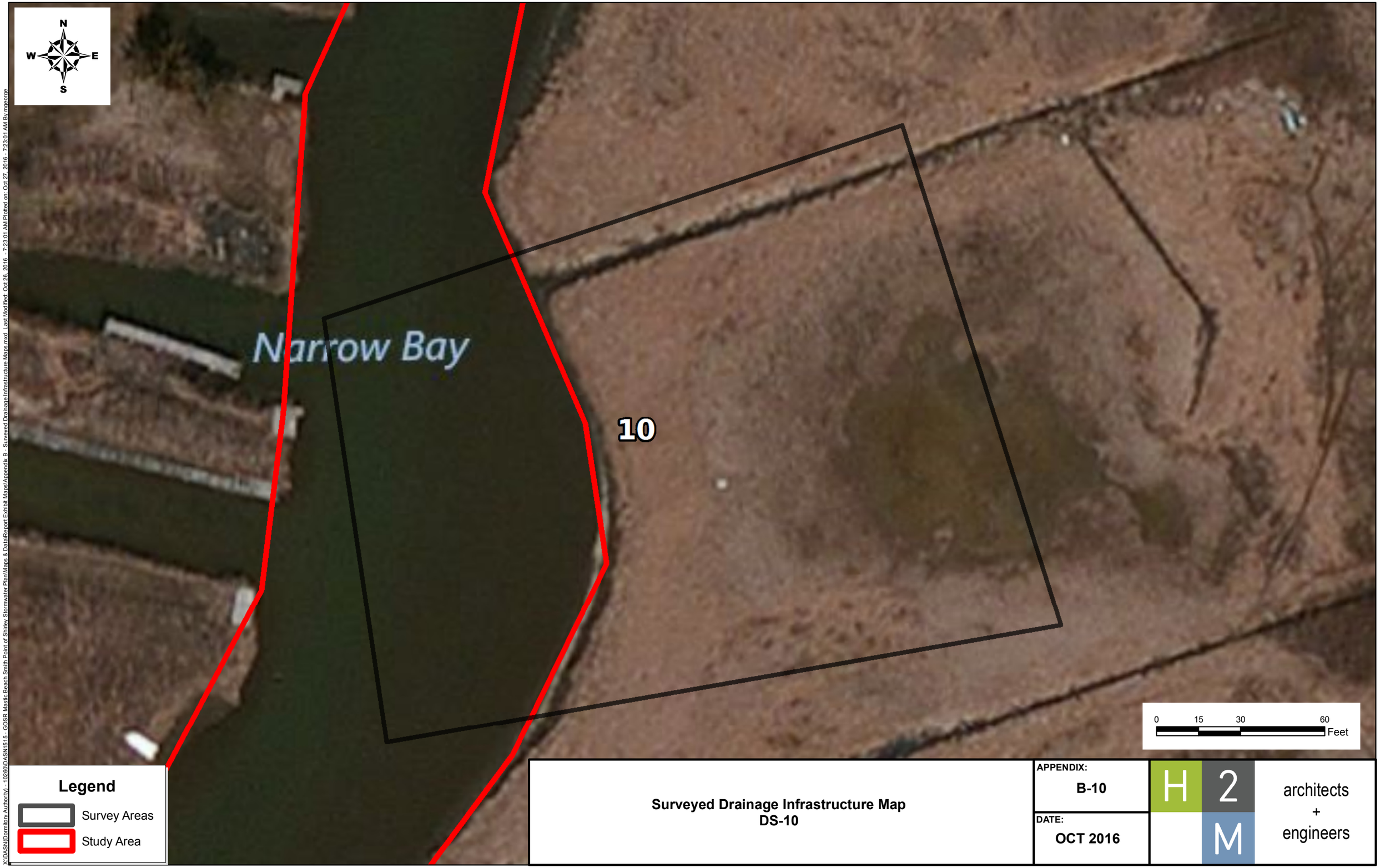

Surveyed Drainage Infrastructure Map
DS-10

APPENDIX: B-10

DATE: OCT 2016

H2M architects + engineers

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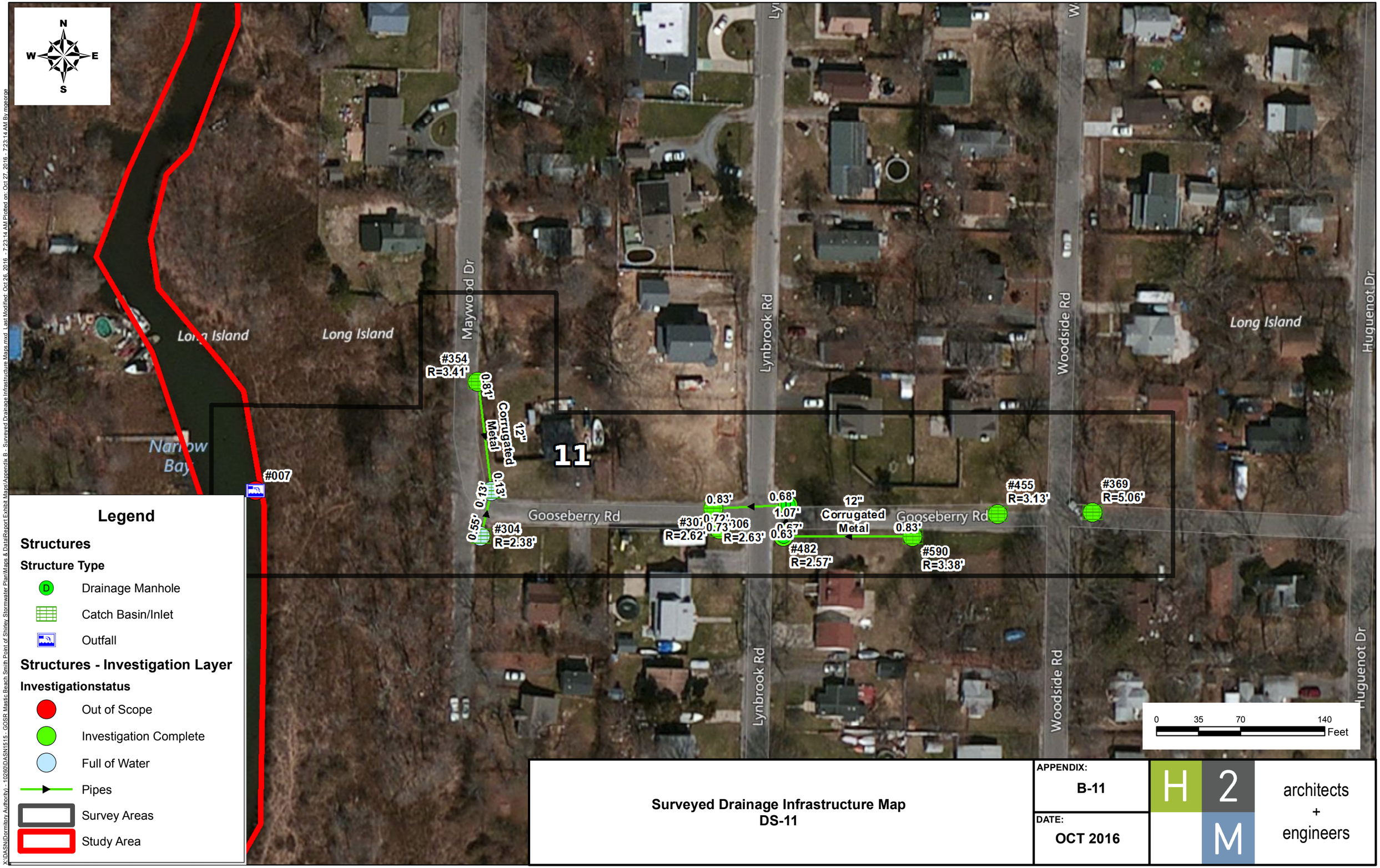

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Surveyed Drainage Infrastructure Map
DS-11

APPENDIX: B-11

DATE: OCT 2016

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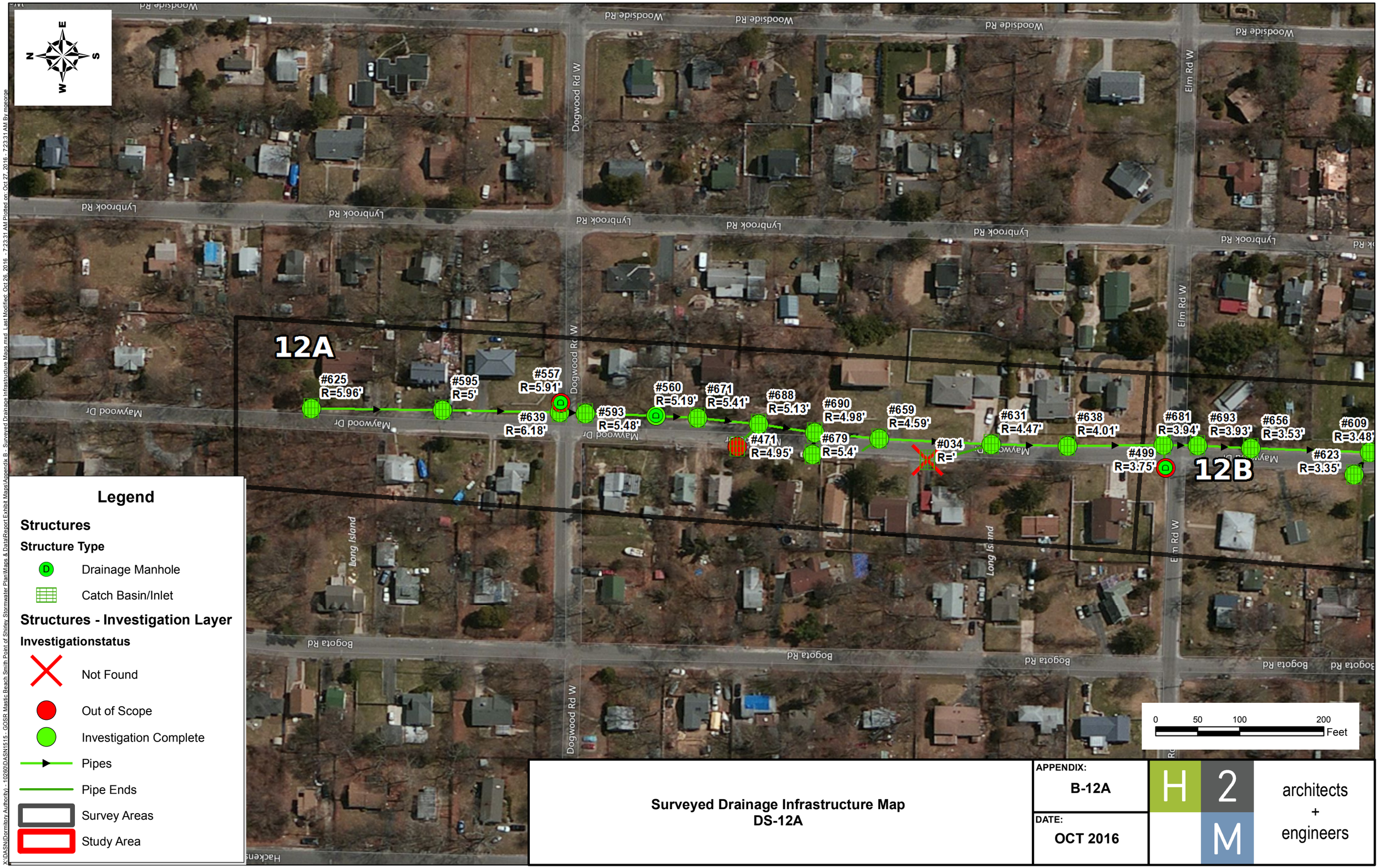

Surveyed Drainage Infrastructure Map
DS-12A

APPENDIX: B-12A

DATE: OCT 2016

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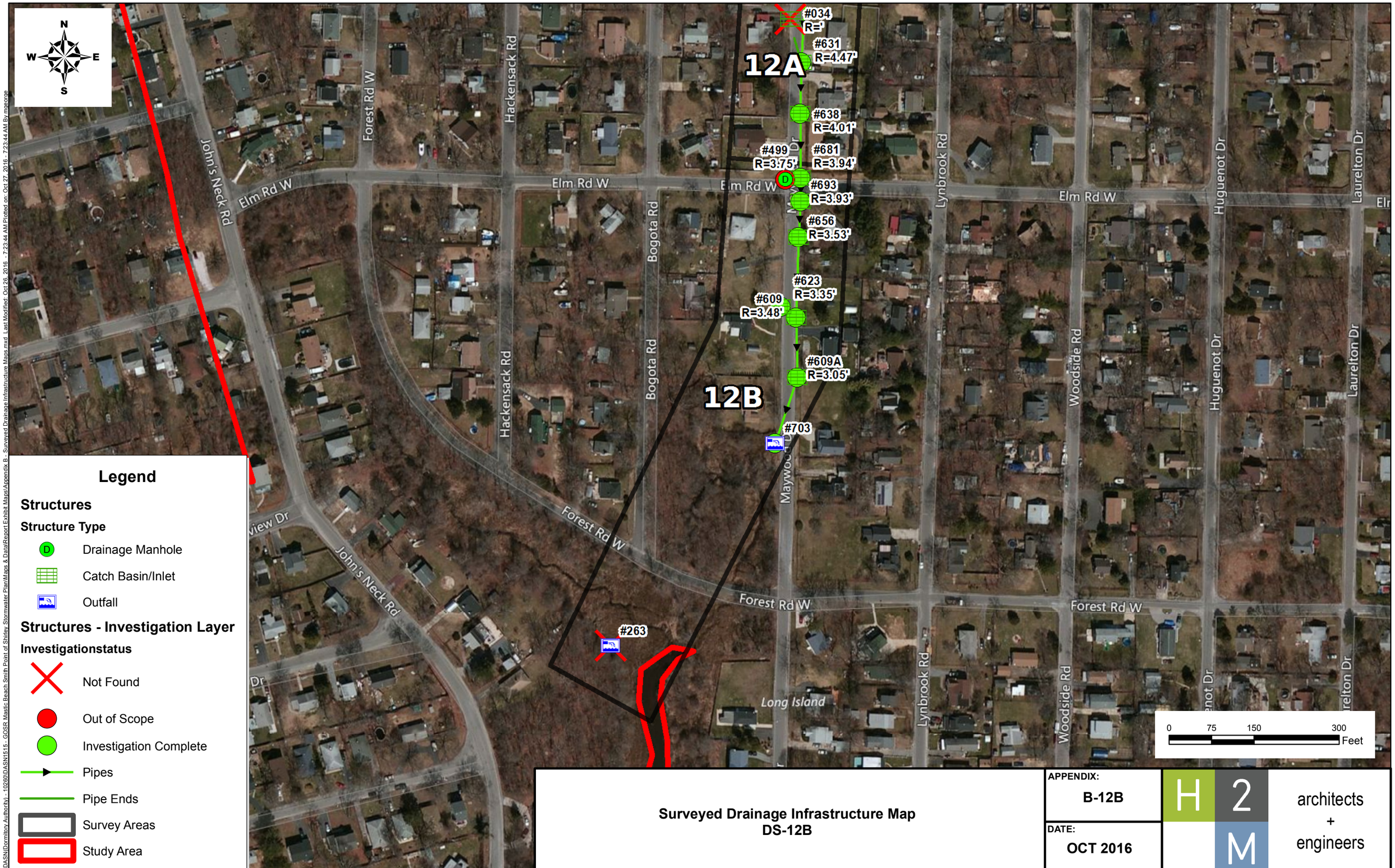

Legend

Structures

Structure Type

- Drainage Manhole
- Catch Basin/Inlet
- Outfall

Structures - Investigation Layer

Investigationstatus

- Not Found
- Out of Scope
- Investigation Complete
- Pipes
- Pipe Ends
- Survey Areas
- Study Area

Surveyed Drainage Infrastructure Map
DS-12B

APPENDIX: B-12B

DATE: OCT 2016

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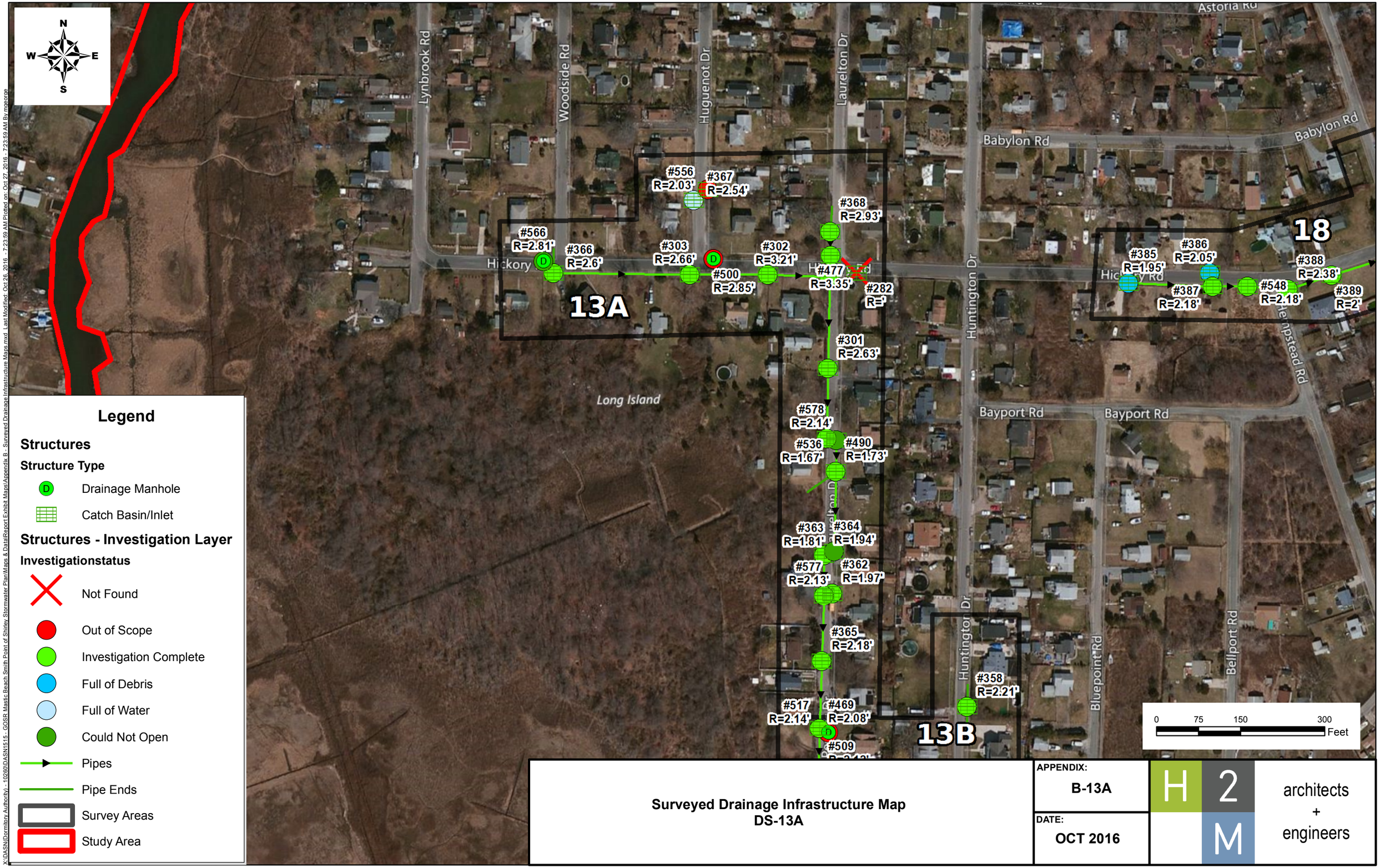

Legend

Structures

Structure Type

- Drainage Manhole
- Catch Basin/Inlet

Structures - Investigation Layer

Investigationstatus

- Not Found
- Out of Scope
- Investigation Complete
- Full of Debris
- Full of Water
- Could Not Open
- Pipes
- Pipe Ends
- Survey Areas
- Study Area

Surveyed Drainage Infrastructure Map
DS-13A

APPENDIX: B-13A

DATE: OCT 2016

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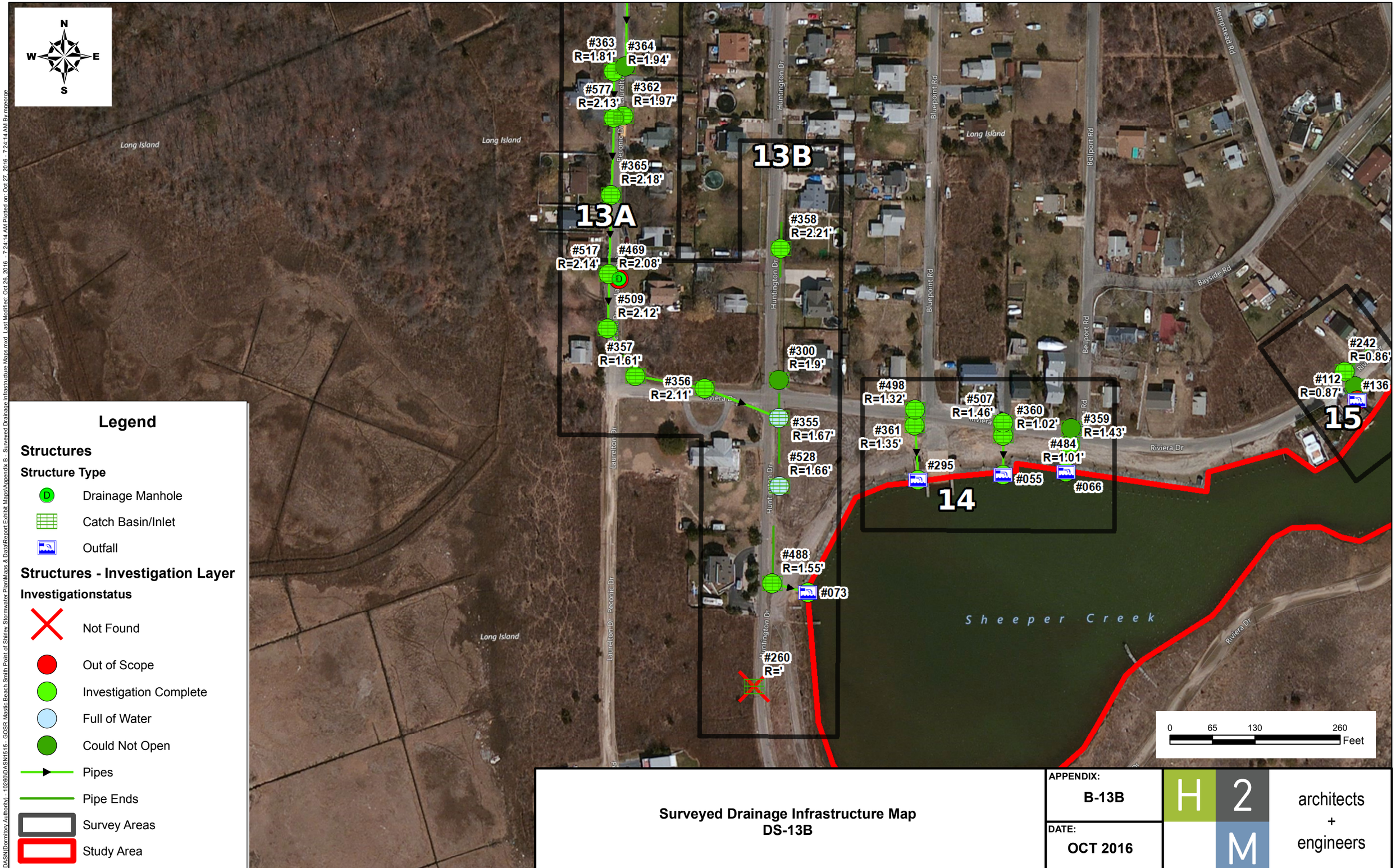

Legend

Structures

Structure Type

- Drainage Manhole
- Catch Basin/Inlet
- Outfall

Structures - Investigation Layer

Investigationstatus

- Not Found
- Out of Scope
- Investigation Complete
- Full of Water
- Could Not Open
- Pipes
- Pipe Ends
- Survey Areas
- Study Area

Surveyed Drainage Infrastructure Map
DS-13B

APPENDIX: B-13B

DATE: OCT 2016

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Legend

Structures

Structure Type

- Catch Basin/Inlet
- Outfall

Structures - Investigation Layer

Investigationstatus

- Investigation Complete
- Full of Water
- Could Not Open
- Pipes
- Pipe Ends
- Survey Areas
- Study Area

Surveyed Drainage Infrastructure Map
DS-14

APPENDIX: B-14

DATE: OCT 2016

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Legend

Structures

Structure Type

- Catch Basin/Inlet
- Outfall

Structures - Investigation Layer

Investigationstatus

- Out of Scope
- Investigation Complete
- Could Not Open
- Pipes
- Pipe Ends
- Survey Areas
- Study Area

Surveyed Drainage Infrastructure Map
DS-15

APPENDIX: B-15

DATE: OCT 2016

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Surveyed Drainage Infrastructure Map
DS-16

APPENDIX: B-16

DATE: OCT 2016

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Surveyed Drainage Infrastructure Map
DS-17

APPENDIX: B-17

DATE: OCT 2016

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Legend

Structures

Structure Type

- Catch Basin/Inlet
- Outfall

Structures - Investigation Layer

Investigationstatus

- Not Found
- Investigation Complete
- Full of Debris
- Pipes
- Pipe Ends
- Survey Areas
- Study Area

Surveyed Drainage Infrastructure Map
DS-18

APPENDIX: B-18

DATE: OCT 2016

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Legend

Structures

Structure Type

Outfall

Structures - Investigation Layer

Investigationstatus

Not Found

Investigation Complete

Survey Areas

Study Area

Surveyed Drainage Infrastructure Map
DS-19

APPENDIX: **B-19**

DATE: **OCT 2016**

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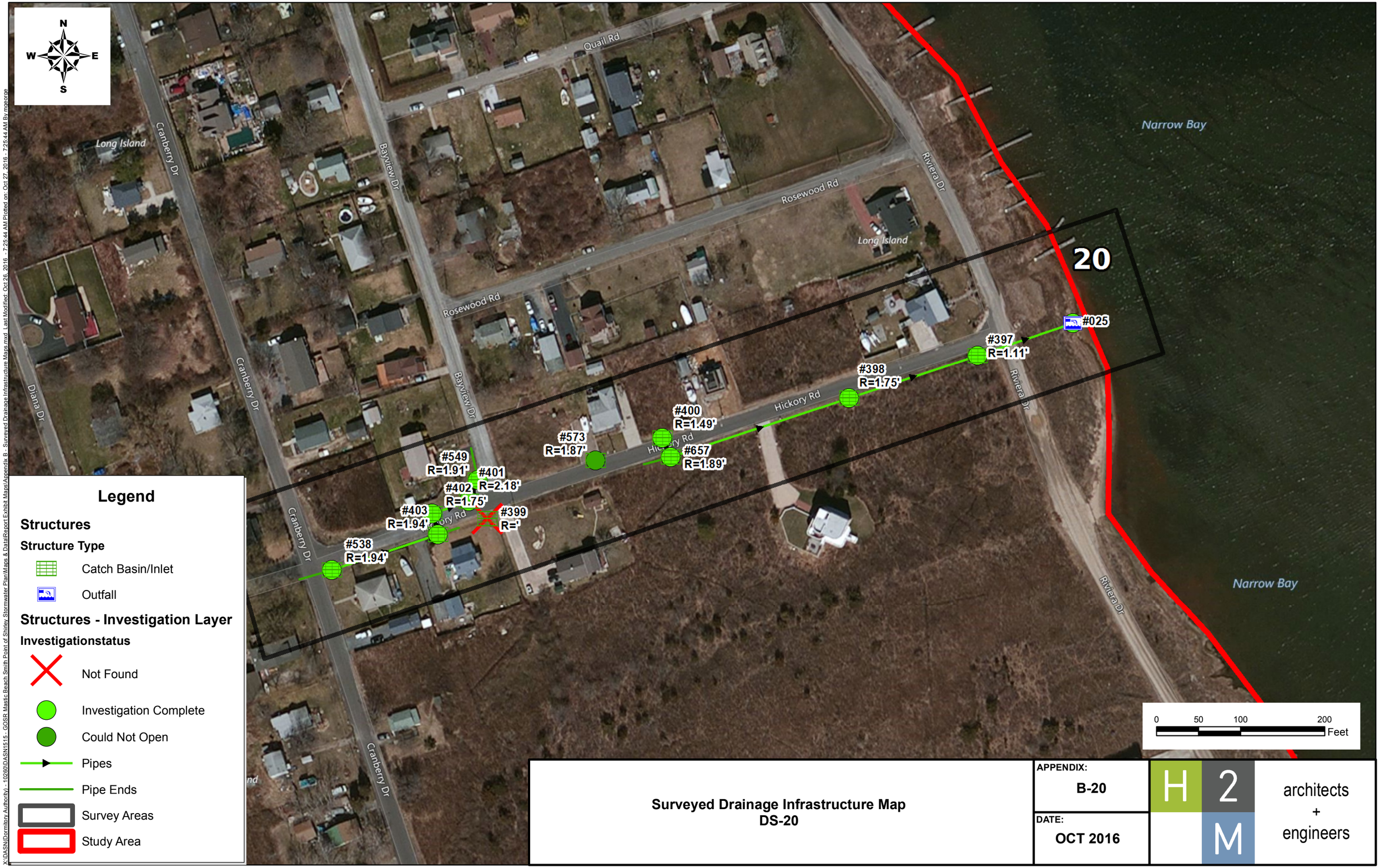

Legend

Structures

Structure Type

- Catch Basin/Inlet
- Outfall

Structures - Investigation Layer

Investigationstatus

- Not Found
- Investigation Complete
- Could Not Open
- Pipes
- Pipe Ends
- Survey Areas
- Study Area

Surveyed Drainage Infrastructure Map
DS-20

APPENDIX: B-20

DATE: OCT 2016

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Legend

Structures

Structure Type

- Catch Basin/Inlet
- Outfall

Structures - Investigation Layer

Investigationstatus

- Out of Scope
- Investigation Complete
- Full of Water
- Pipes
- Pipe Ends
- Survey Areas
- Study Area

Surveyed Drainage Infrastructure Map
DS-21

APPENDIX: B-21

DATE: OCT 2016

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Legend

Structures

Structure Type

- Drainage Manhole
- Catch Basin/Inlet
- Outfall

Structures - Investigation Layer

Investigationstatus

- Not Found
- Out of Scope
- Investigation Complete
- Full of Debris
- Could Not Open
- Pipes
- Pipe Ends
- Survey Areas
- Study Area

Surveyed Drainage Infrastructure Map
DS-22

APPENDIX: B-22

DATE: OCT 2016

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Legend

Structures

Structure Type

- Drainage Manhole
- Catch Basin/Inlet
- Outfall

Structures - Investigation Layer

Investigationstatus

- Investigation Complete
- Full of Water
- Pipes
- Pipe Ends
- Survey Areas
- Study Area

Surveyed Drainage Infrastructure Map
DS-23

APPENDIX: B-23

DATE: OCT 2016

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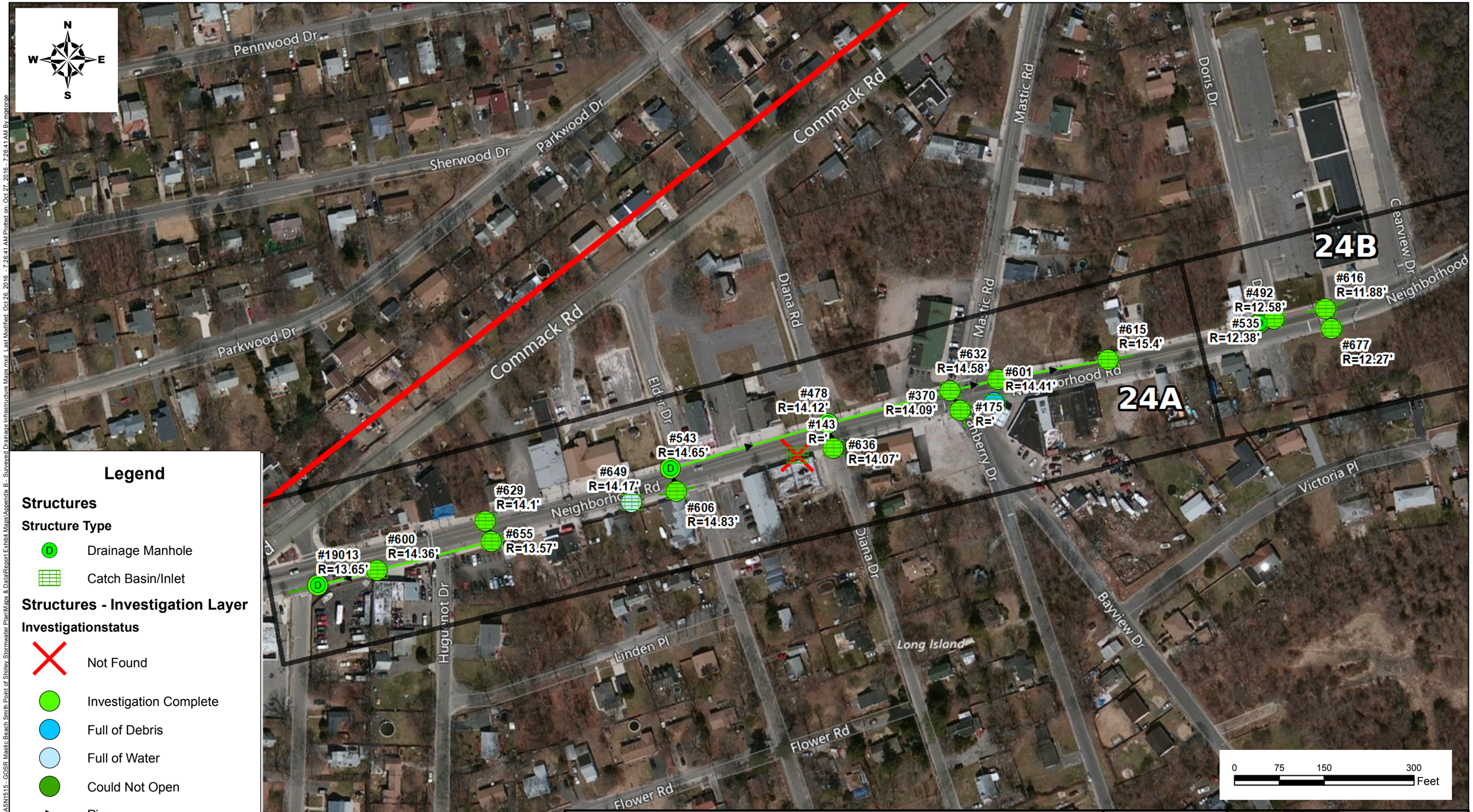

Legend

Structures

Structure Type

- Drainage Manhole
- Catch Basin/Inlet

Structures - Investigation Layer

Investigationstatus

- Not Found
- Investigation Complete
- Full of Debris
- Full of Water
- Could Not Open
- Pipes
- Pipe Ends
- Survey Areas
- Study Area

Surveyed Drainage Infrastructure Map
DS-24A

APPENDIX: B-24A

DATE: OCT 2016

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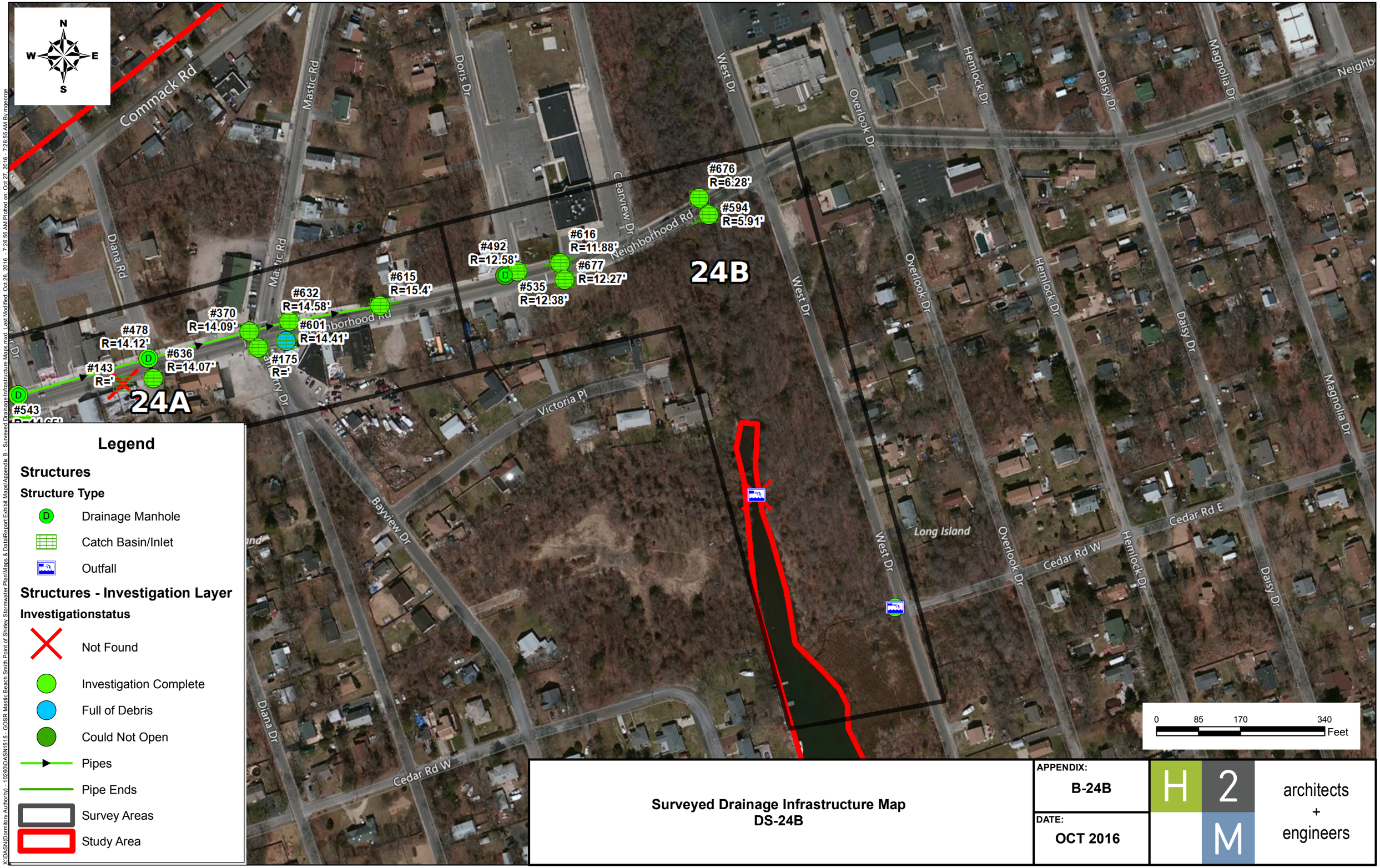

Legend

Structures

Structure Type

- Drainage Manhole
- Catch Basin/Inlet
- Outfall

Structures - Investigation Layer

Investigationstatus

- Not Found
- Investigation Complete
- Full of Debris
- Could Not Open
- Pipes
- Pipe Ends
- Survey Areas
- Study Area

Surveyed Drainage Infrastructure Map
DS-24B

APPENDIX: B-24B

DATE: OCT 2016

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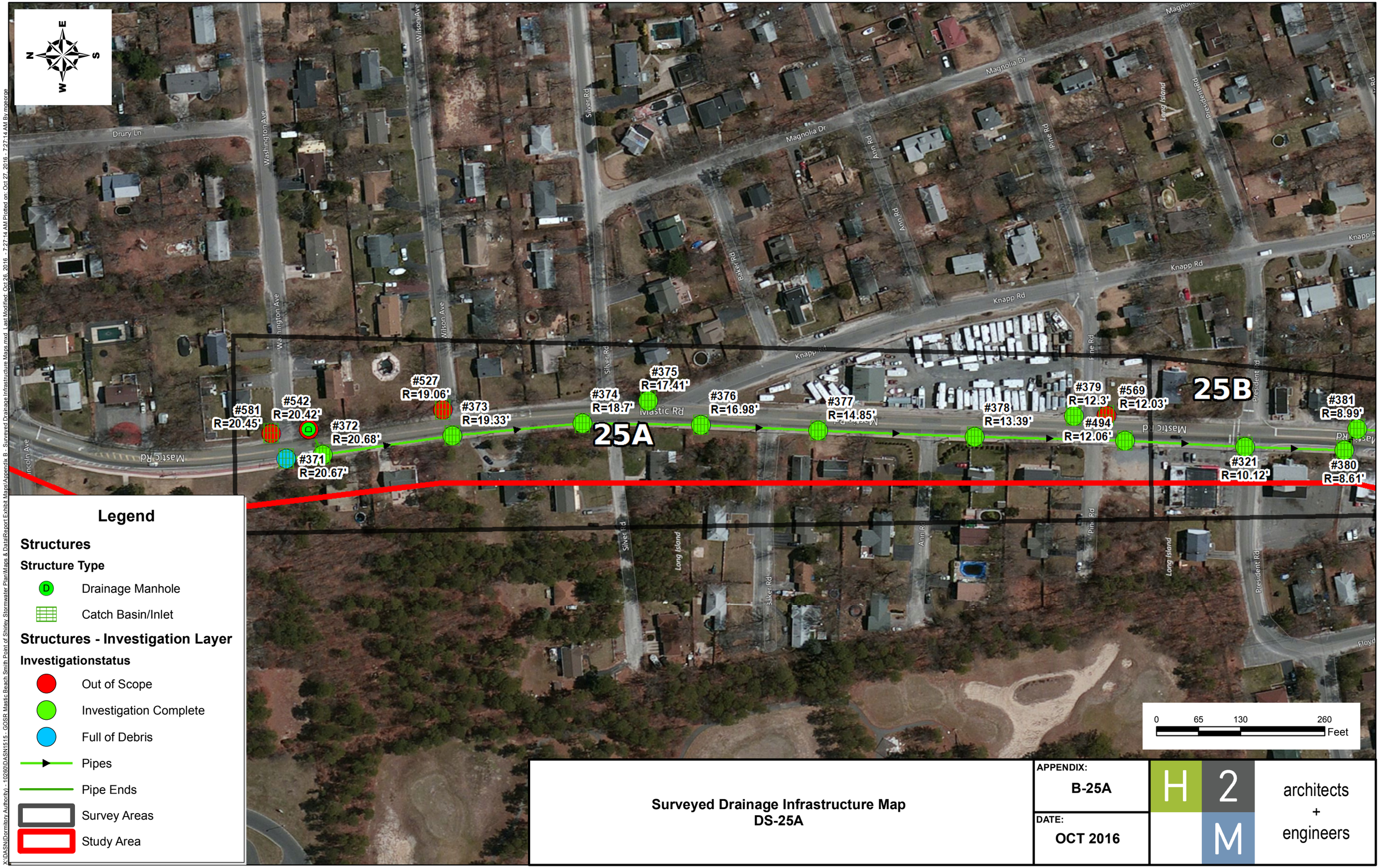

Legend

Structures

Structure Type

- Drainage Manhole
- Catch Basin/Inlet

Structures - Investigation Layer

Investigationstatus

- Out of Scope
- Investigation Complete
- Full of Debris
- Pipes
- Pipe Ends
- Survey Areas
- Study Area

Surveyed Drainage Infrastructure Map
DS-25A

APPENDIX: B-25A

DATE: OCT 2016

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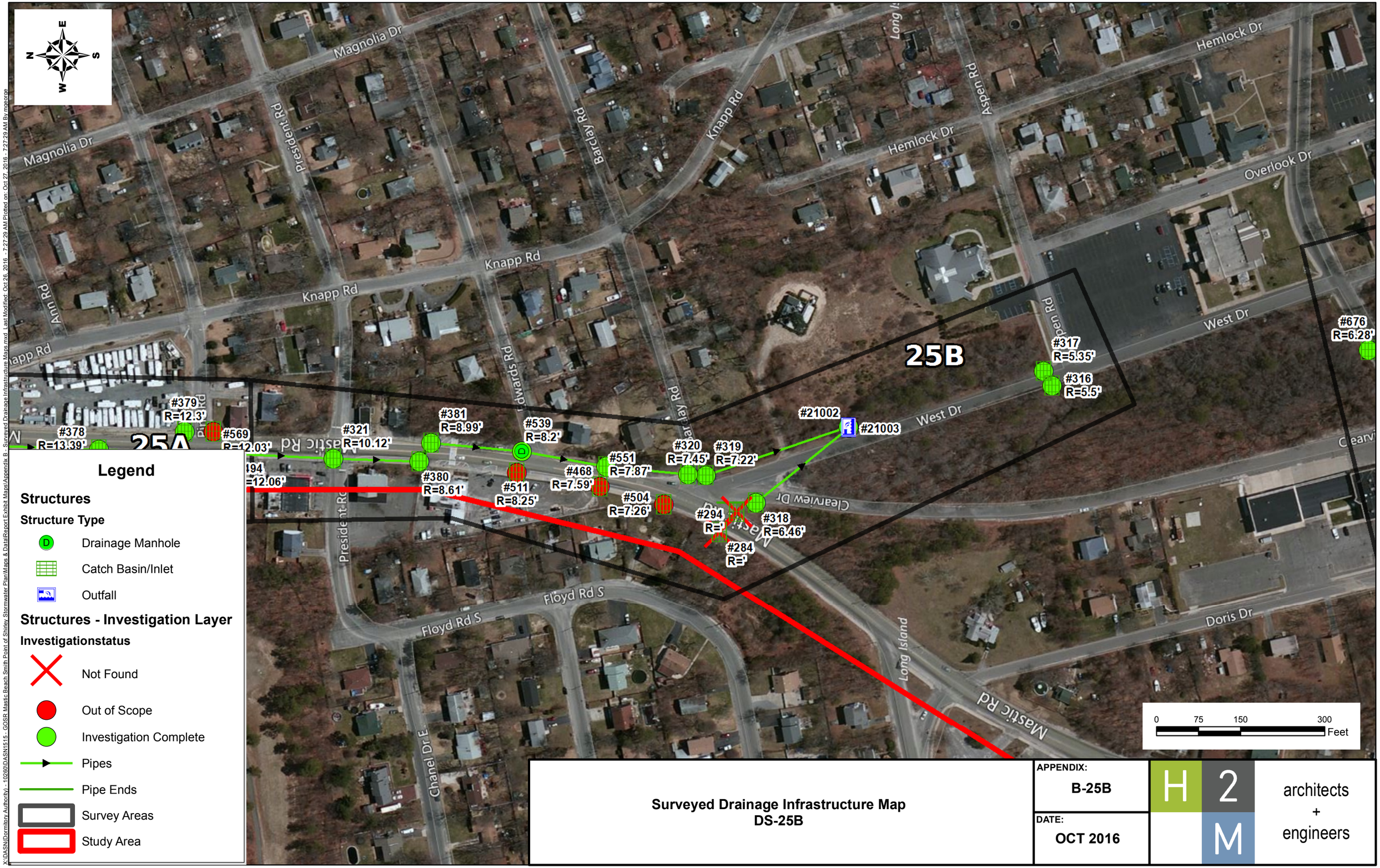

Legend

Structures

Structure Type

- Drainage Manhole
- Catch Basin/Inlet
- Outfall

Structures - Investigation Layer

Investigationstatus

- Not Found
- Out of Scope
- Investigation Complete
- Pipes
- Pipe Ends
- Survey Areas
- Study Area

Surveyed Drainage Infrastructure Map
DS-25B

APPENDIX: B-25B

DATE: OCT 2016

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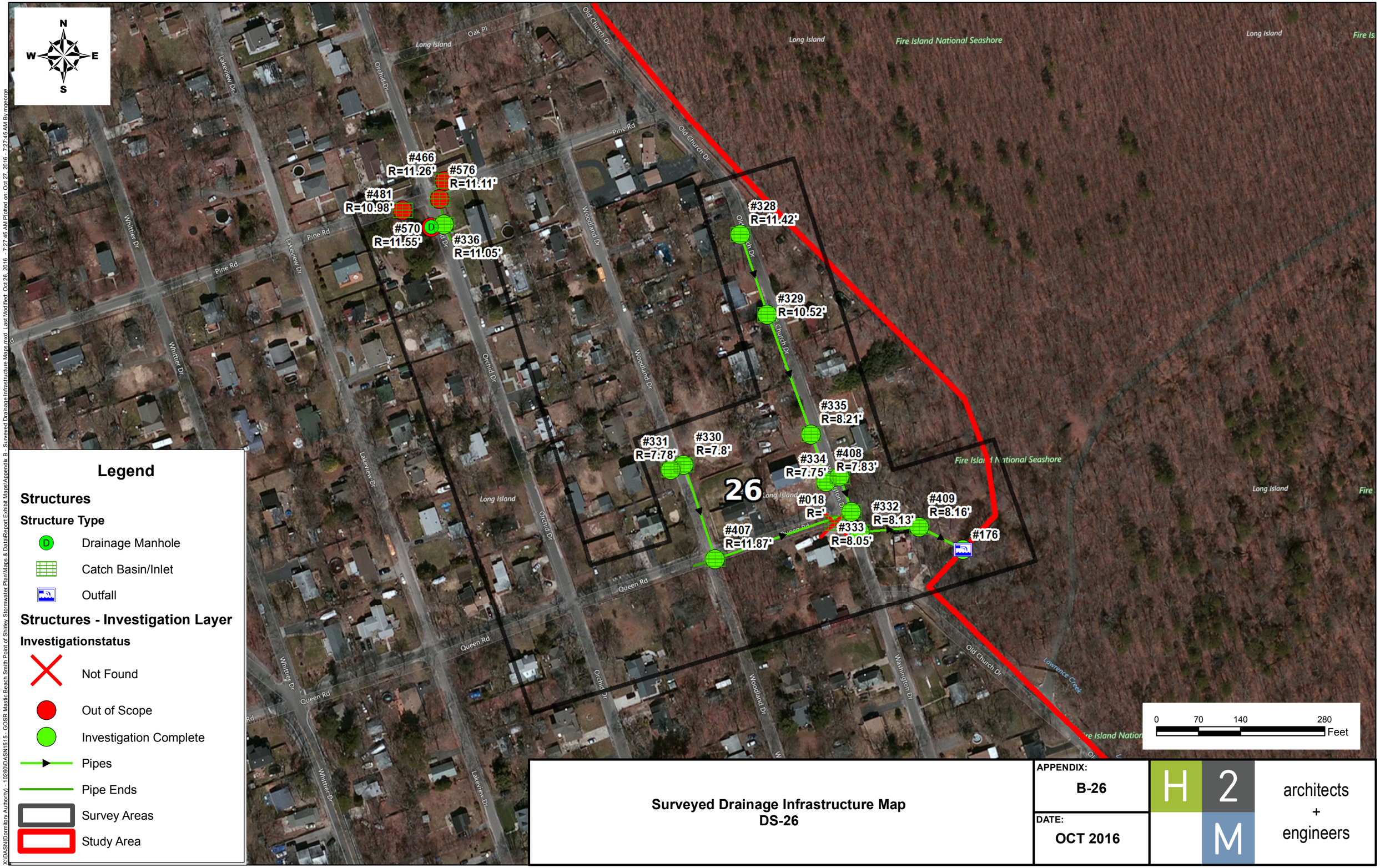

Legend

Structures

Structure Type

- Drainage Manhole
- Catch Basin/Inlet
- Outfall

Structures - Investigation Layer

Investigationstatus

- Not Found
- Out of Scope
- Investigation Complete
- Pipes
- Pipe Ends
- Survey Areas
- Study Area

Surveyed Drainage Infrastructure Map
DS-26

APPENDIX: B-26

DATE: OCT 2016

H 2 M architects + engineers

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Surveyed Drainage Infrastructure Map
DS-27

APPENDIX: B-27

DATE: OCT 2016

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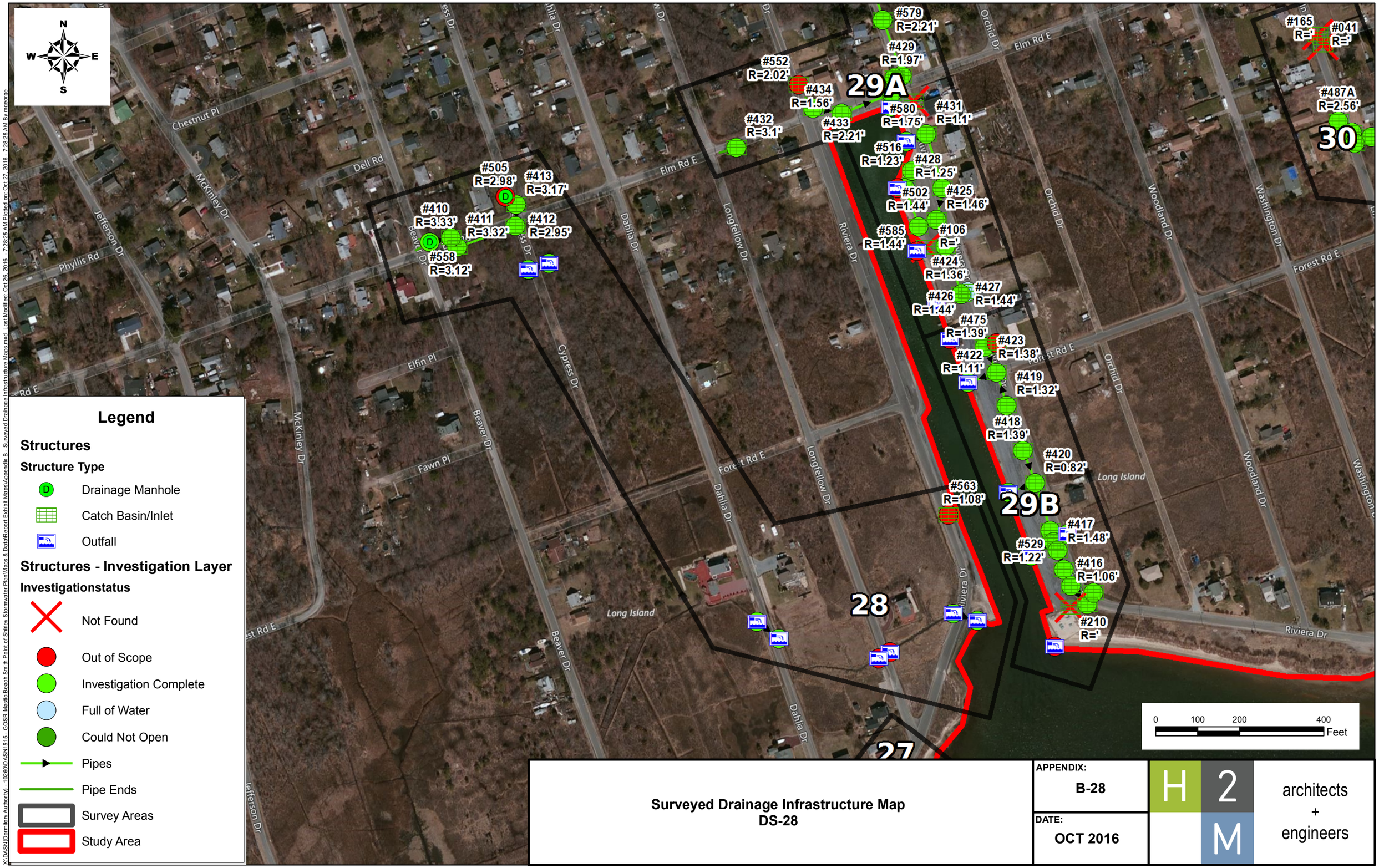

Legend

Structures

Structure Type

- Drainage Manhole
- Catch Basin/Inlet
- Outfall

Structures - Investigation Layer

Investigationstatus

- Not Found
- Out of Scope
- Investigation Complete
- Full of Water
- Could Not Open
- Pipes
- Pipe Ends
- Survey Areas
- Study Area

Surveyed Drainage Infrastructure Map
DS-28

APPENDIX: B-28

DATE: OCT 2016

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Legend

Structures

Structure Type

- Drainage Manhole
- Catch Basin/Inlet
- Outfall

Structures - Investigation Layer

Investigationstatus

- Not Found
- Out of Scope
- Investigation Complete
- Full of Water
- Pipes
- Pipe Ends
- Survey Areas
- Study Area

Surveyed Drainage Infrastructure Map
DS-29A

APPENDIX: B-29A

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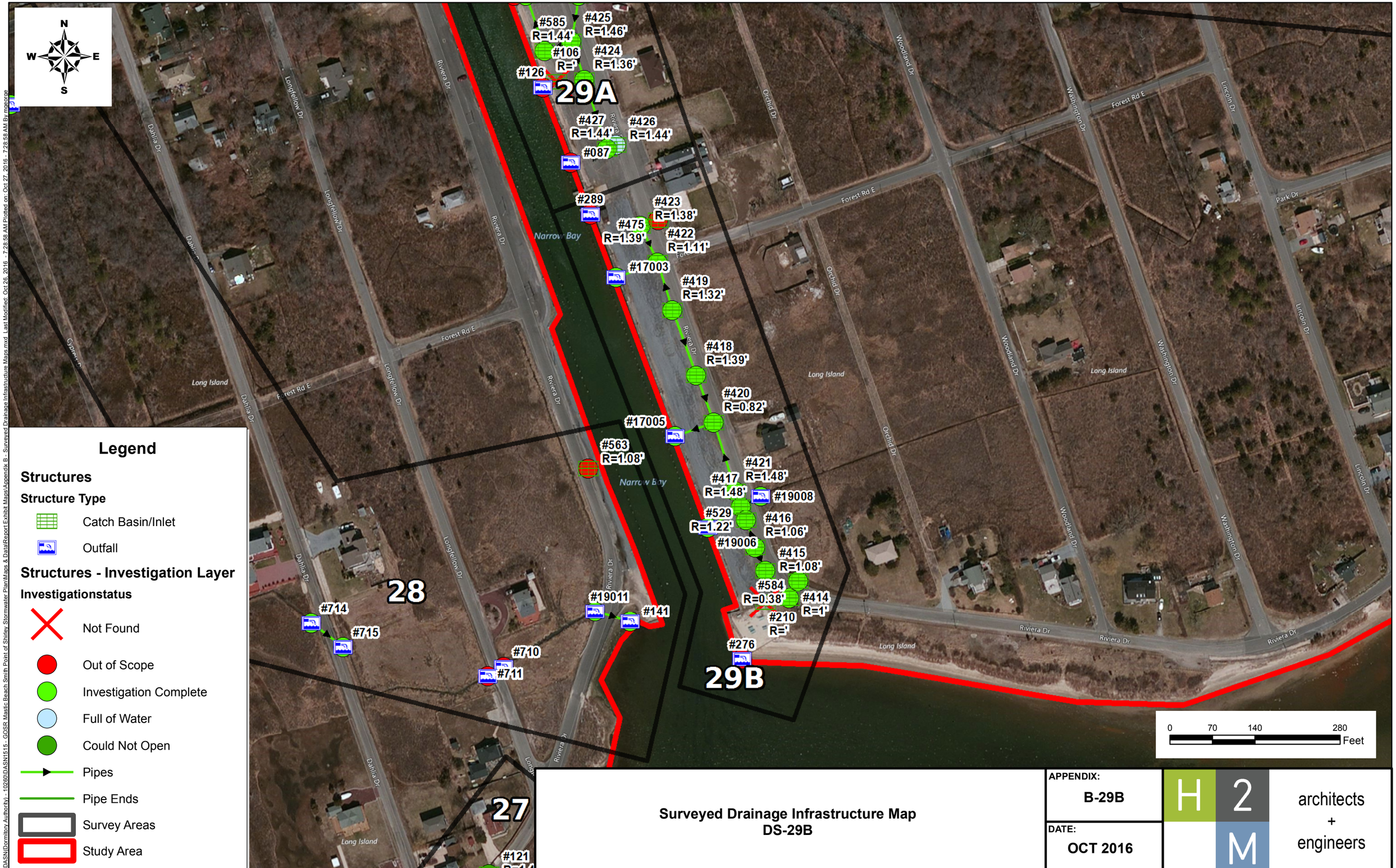

Legend

Structures

Structure Type

- Catch Basin/Inlet
- Outfall

Structures - Investigation Layer

Investigationstatus

- Not Found
- Out of Scope
- Investigation Complete
- Full of Water
- Could Not Open
- Pipes
- Pipe Ends
- Survey Areas
- Study Area

Surveyed Drainage Infrastructure Map
DS-29B

APPENDIX: B-29B

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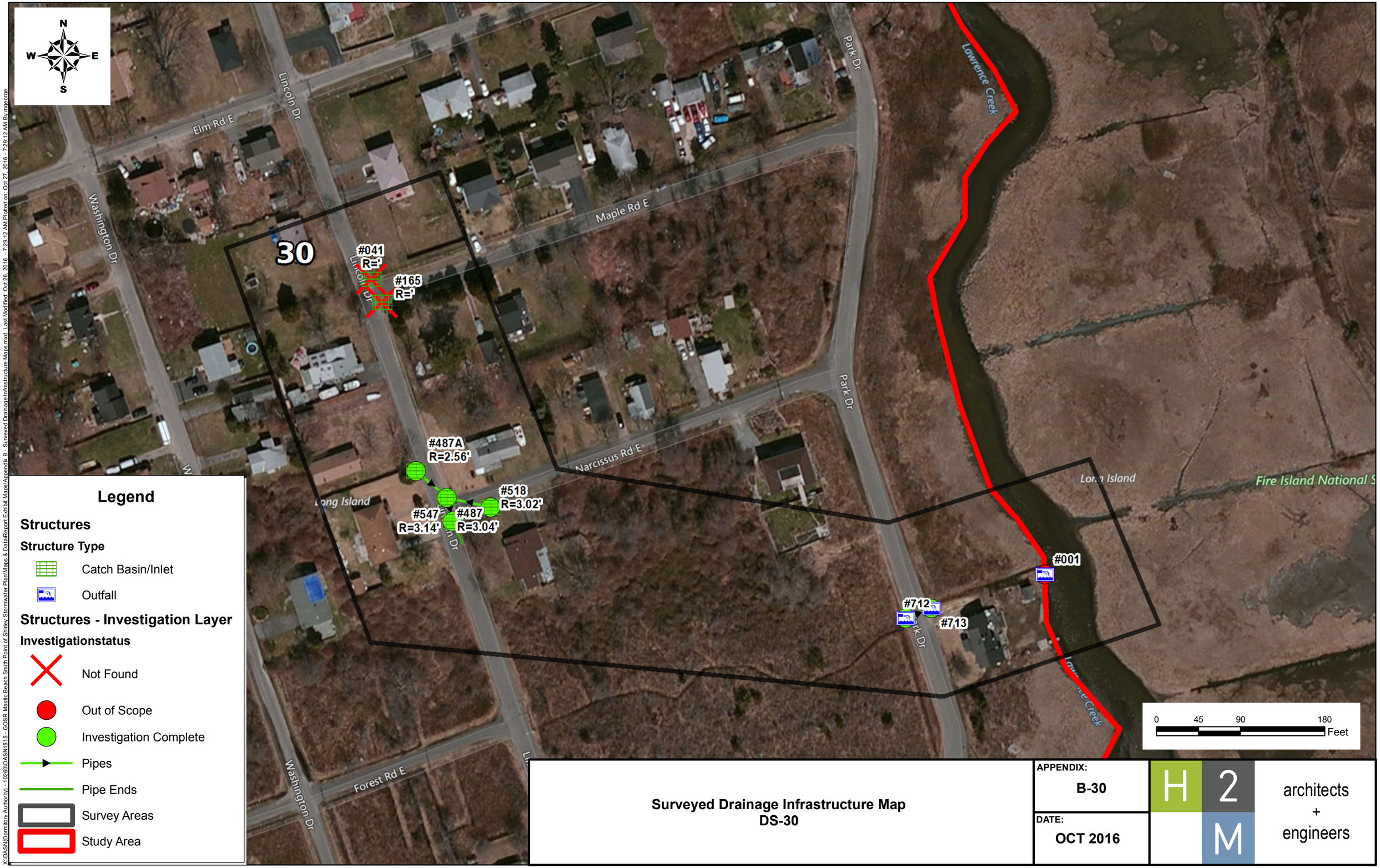

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Surveyed Drainage Infrastructure Map
DS-30

APPENDIX: B-30

DATE: OCT 2016

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Legend

Structures

Structure Type

- Drainage Manhole
- Catch Basin/Inlet

Structures - Investigation Layer

Investigationstatus

- Out of Scope
- Investigation Complete
- Pipes
- Pipe Ends
- Survey Areas
- Study Area

Surveyed Drainage Infrastructure Map
DS-31

APPENDIX: B-31

DATE: OCT 2016

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Legend

Structures

Structure Type

- Drainage Manhole
- Catch Basin/Inlet
- Outfall

Structures - Investigation Layer

Investigationstatus

- Not Found
- Out of Scope
- Investigation Complete
- Full of Debris
- Full of Water
- Pipes
- Pipe Ends
- Survey Areas
- Study Area

Surveyed Drainage Infrastructure Map
DS-32A

APPENDIX: B-32A

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Legend

Structures

Structure Type

- Drainage Manhole
- Catch Basin/Inlet
- Outfall

Structures - Investigation Layer

Investigationstatus

- Not Found
- Out of Scope
- Investigation Complete
- Full of Debris
- Pipes
- Pipe Ends
- Survey Areas
- Study Area

Surveyed Drainage Infrastructure Map
DS-32B

APPENDIX: B-32B

DATE: OCT 2016

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Surveyed Drainage Infrastructure Map

APPENDIX: B

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Structure Survey Data

Structure Number	Structure Type	Structure Elevation (feet, NAVD88)	Investigation Status
1	Outfall		Out of Scope
2	Catch Basin/Inlet		Out of Scope
4	Outfall	-1.31	Investigation Complete
7	Outfall		Out of Scope
16	Outfall	0.38	Investigation Complete
18	Catch Basin/Inlet		Not Found
22	Catch Basin/Inlet		Not Found
23	Outfall	2.32	Investigation Complete
25	Outfall	0.1	Investigation Complete
34	Catch Basin/Inlet		Not Found
41	Catch Basin/Inlet		Not Found
53	Catch Basin/Inlet		Not Found
55	Outfall	0.76	Investigation Complete
66	Outfall	0.64	Investigation Complete
67	Outfall		Investigation Complete
71	Catch Basin/Inlet		Not Found
73	Outfall	0.35	Investigation Complete
87	Outfall		Out of Scope
89	Catch Basin/Inlet	3.31	Investigation Complete
100	Catch Basin/Inlet		Not Found
101	Catch Basin/Inlet		Not Found
106	Catch Basin/Inlet		Not Found
112	Catch Basin/Inlet	0.87	Could Not Open
113	Catch Basin/Inlet		Not Found
121	Catch Basin/Inlet	1.43	Could Not Open
126	Outfall		Out of Scope
127	Catch Basin/Inlet		Not Found
136	Outfall		Out of Scope
141	Outfall	-0.25	Investigation Complete
143	Catch Basin/Inlet		Not Found
155	Outfall		Out of Scope
160	Catch Basin/Inlet		Out of Scope
165	Catch Basin/Inlet		Not Found
168	Catch Basin/Inlet		Not Found
175	Catch Basin/Inlet		Investigation Complete
176	Outfall	6.71	Investigation Complete
184	Outfall	1.71	Investigation Complete
185	Catch Basin/Inlet		Not Found
192	Catch Basin/Inlet		Not Found
208	Outfall		Investigation Complete
210	Catch Basin/Inlet		Not Found
222	Outfall		Not Found
225	Catch Basin/Inlet		Not Found
231	Outfall	1.57	Investigation Complete
235	Catch Basin/Inlet		Investigation Complete
237	Catch Basin/Inlet		Not Found
238	Outfall	-0.96	Investigation Complete
242	Catch Basin/Inlet	0.86	Investigation Complete
249	Outfall	-0.09	Investigation Complete
257	Outfall		Not Found
260	Catch Basin/Inlet		Not Found
263	Outfall		Not Found

Structure Survey Data

Structure Number	Structure Type	Structure Elevation (feet, NAVD88)	Investigation Status
276	Outfall		Out of Scope
282	Catch Basin/Inlet		Not Found
284	Catch Basin/Inlet		Not Found
289	Outfall		Out of Scope
294	Catch Basin/Inlet		Not Found
295	Outfall	0.26	Investigation Complete
300	Catch Basin/Inlet	1.9	Could Not Open
301	Catch Basin/Inlet	2.63	Investigation Complete
302	Catch Basin/Inlet	3.21	Investigation Complete
303	Catch Basin/Inlet	2.66	Investigation Complete
304	Catch Basin/Inlet	2.38	Full of Water
305	Catch Basin/Inlet	2.13	Full of Water
306	Catch Basin/Inlet	2.63	Investigation Complete
307	Catch Basin/Inlet	2.62	Investigation Complete
308	Catch Basin/Inlet	2.45	Investigation Complete
309	Catch Basin/Inlet	2.43	Investigation Complete
310	Catch Basin/Inlet	2.06	Full of Water
311	Catch Basin/Inlet	2.37	Investigation Complete
312	Catch Basin/Inlet	2.28	Investigation Complete
313	Catch Basin/Inlet	2.71	Investigation Complete
314	Catch Basin/Inlet	2.88	Could Not Open
315	Catch Basin/Inlet	2.19	Investigation Complete
316	Catch Basin/Inlet	5.5	Investigation Complete
317	Catch Basin/Inlet	5.35	Investigation Complete
318	Catch Basin/Inlet	6.46	Investigation Complete
319	Catch Basin/Inlet	7.22	Investigation Complete
320	Catch Basin/Inlet	7.45	Investigation Complete
321	Catch Basin/Inlet	10.12	Investigation Complete
322	Catch Basin/Inlet	4.79	Investigation Complete
323	Catch Basin/Inlet	4.34	Investigation Complete
324	Catch Basin/Inlet	5.58	Investigation Complete
325	Catch Basin/Inlet	5.59	Investigation Complete
326	Catch Basin/Inlet	5.48	Investigation Complete
327	Catch Basin/Inlet	5.49	Investigation Complete
328	Catch Basin/Inlet	11.42	Investigation Complete
329	Catch Basin/Inlet	10.52	Investigation Complete
330	Catch Basin/Inlet	7.8	Investigation Complete
331	Catch Basin/Inlet	7.78	Investigation Complete
332	Catch Basin/Inlet	8.13	Investigation Complete
333	Catch Basin/Inlet	8.05	Investigation Complete
334	Catch Basin/Inlet	7.75	Investigation Complete
335	Catch Basin/Inlet	8.21	Investigation Complete
336	Catch Basin/Inlet	11.05	Investigation Complete
337	Catch Basin/Inlet	3.16	Investigation Complete
338	Catch Basin/Inlet	3.28	Investigation Complete
339	Catch Basin/Inlet	3.07	Investigation Complete
340	Catch Basin/Inlet	3.2	Investigation Complete
341	Catch Basin/Inlet	3.23	Investigation Complete
342	Catch Basin/Inlet	2.97	Investigation Complete
343	Catch Basin/Inlet	5.77	Investigation Complete
344	Catch Basin/Inlet	5.99	Full of Debris
345	Catch Basin/Inlet	5.93	Investigation Complete

Structure Survey Data

Structure Number	Structure Type	Structure Elevation (feet, NAVD88)	Investigation Status
346	Catch Basin/Inlet	4.61	Investigation Complete
347	Catch Basin/Inlet	4.65	Investigation Complete
348	Catch Basin/Inlet	5.01	Investigation Complete
349	Catch Basin/Inlet	4.55	Investigation Complete
350	Catch Basin/Inlet	2.41	Investigation Complete
351	Catch Basin/Inlet	2.98	Investigation Complete
352	Catch Basin/Inlet	1.65	Investigation Complete
353	Catch Basin/Inlet	1.43	Investigation Complete
354	Catch Basin/Inlet	3.41	Investigation Complete
355	Catch Basin/Inlet	1.67	Full of Water
356	Catch Basin/Inlet	2.11	Investigation Complete
357	Catch Basin/Inlet	1.61	Investigation Complete
358	Catch Basin/Inlet	2.21	Investigation Complete
359	Catch Basin/Inlet	1.43	Investigation Complete
360	Catch Basin/Inlet	1.02	Investigation Complete
361	Catch Basin/Inlet	1.35	Investigation Complete
362	Catch Basin/Inlet	1.97	Investigation Complete
363	Catch Basin/Inlet	1.81	Could Not Open
364	Catch Basin/Inlet	1.94	Investigation Complete
365	Catch Basin/Inlet	2.18	Investigation Complete
366	Catch Basin/Inlet	2.6	Investigation Complete
367	Catch Basin/Inlet	2.54	Full of Water
368	Catch Basin/Inlet	2.93	Investigation Complete
369	Catch Basin/Inlet	5.06	Investigation Complete
370	Catch Basin/Inlet	14.09	Investigation Complete
371	Catch Basin/Inlet	20.67	Full of Debris
372	Catch Basin/Inlet	20.68	Investigation Complete
373	Catch Basin/Inlet	19.33	Investigation Complete
374	Catch Basin/Inlet	18.7	Investigation Complete
375	Catch Basin/Inlet	17.41	Investigation Complete
376	Catch Basin/Inlet	16.98	Investigation Complete
377	Catch Basin/Inlet	14.85	Investigation Complete
378	Catch Basin/Inlet	13.39	Investigation Complete
379	Catch Basin/Inlet	12.3	Investigation Complete
380	Catch Basin/Inlet	8.61	Investigation Complete
381	Catch Basin/Inlet	8.99	Investigation Complete
382	Catch Basin/Inlet	0.64	Investigation Complete
383	Catch Basin/Inlet	1.18	Investigation Complete
384	Catch Basin/Inlet	1.12	Investigation Complete
385	Catch Basin/Inlet	1.95	Full of Debris
386	Catch Basin/Inlet	2.05	Full of Debris
387	Catch Basin/Inlet	2.18	Investigation Complete
388	Catch Basin/Inlet	2.38	Investigation Complete
389	Catch Basin/Inlet	2	Investigation Complete
390	Catch Basin/Inlet	2.56	Investigation Complete
391	Catch Basin/Inlet	1.83	Investigation Complete
392	Catch Basin/Inlet	2	Investigation Complete
393	Catch Basin/Inlet	1.8	Investigation Complete
394	Catch Basin/Inlet	1.26	Full of Debris
395	Catch Basin/Inlet		Not Found
396	Catch Basin/Inlet	2.18	Investigation Complete
397	Catch Basin/Inlet	1.11	Investigation Complete

Structure Survey Data

Structure Number	Structure Type	Structure Elevation (feet, NAVD88)	Investigation Status
398	Catch Basin/Inlet	1.75	Investigation Complete
399	Catch Basin/Inlet		Not Found
400	Catch Basin/Inlet	1.49	Investigation Complete
401	Catch Basin/Inlet	2.18	Investigation Complete
402	Catch Basin/Inlet	1.75	Investigation Complete
403	Catch Basin/Inlet	1.94	Investigation Complete
404	Catch Basin/Inlet	4.24	Investigation Complete
405	Catch Basin/Inlet	5.75	Investigation Complete
406	Catch Basin/Inlet		Out of Scope
407	Catch Basin/Inlet	11.87	Investigation Complete
408	Catch Basin/Inlet	7.83	Investigation Complete
409	Catch Basin/Inlet	8.16	Investigation Complete
410	Catch Basin/Inlet	3.33	Investigation Complete
411	Catch Basin/Inlet	3.32	Investigation Complete
412	Catch Basin/Inlet	2.95	Investigation Complete
413	Catch Basin/Inlet	3.17	Investigation Complete
414	Catch Basin/Inlet	1	Investigation Complete
415	Catch Basin/Inlet	1.08	Investigation Complete
416	Catch Basin/Inlet	1.06	Investigation Complete
417	Catch Basin/Inlet	1.48	Investigation Complete
418	Catch Basin/Inlet	1.39	Investigation Complete
419	Catch Basin/Inlet	1.32	Investigation Complete
420	Catch Basin/Inlet	0.82	Investigation Complete
421	Catch Basin/Inlet	1.48	Investigation Complete
422	Catch Basin/Inlet	1.11	Investigation Complete
423	Catch Basin/Inlet	1.38	Investigation Complete
424	Catch Basin/Inlet	1.36	Investigation Complete
425	Catch Basin/Inlet	1.46	Investigation Complete
426	Catch Basin/Inlet	1.44	Full of Water
427	Catch Basin/Inlet	1.44	Investigation Complete
428	Catch Basin/Inlet	1.25	Investigation Complete
429	Catch Basin/Inlet	1.97	Investigation Complete
430	Catch Basin/Inlet	1.6	Investigation Complete
431	Catch Basin/Inlet	1.1	Investigation Complete
432	Catch Basin/Inlet	3.1	Investigation Complete
433	Catch Basin/Inlet	2.21	Investigation Complete
434	Catch Basin/Inlet	1.56	Investigation Complete
435	Catch Basin/Inlet	2.61	Investigation Complete
436	Catch Basin/Inlet	2.31	Investigation Complete
437	Catch Basin/Inlet	4.31	Investigation Complete
438	Catch Basin/Inlet	4.01	Investigation Complete
439	Catch Basin/Inlet	3	Investigation Complete
440	Catch Basin/Inlet	3.15	Investigation Complete
441	Catch Basin/Inlet	2.54	Investigation Complete
442	Catch Basin/Inlet	2.68	Investigation Complete
443	Catch Basin/Inlet	2.09	Investigation Complete
444	Catch Basin/Inlet	1.95	Investigation Complete
445	Catch Basin/Inlet	2.16	Investigation Complete
446	Catch Basin/Inlet	2.48	Investigation Complete
447	Catch Basin/Inlet	2.22	Investigation Complete
448	Catch Basin/Inlet	3.01	Investigation Complete
449	Catch Basin/Inlet	2.86	Investigation Complete

Structure Survey Data

Structure Number	Structure Type	Structure Elevation (feet, NAVD88)	Investigation Status
450	Catch Basin/Inlet	1.75	Investigation Complete
451	Catch Basin/Inlet	1.42	Full of Water
452	Catch Basin/Inlet	1.65	Investigation Complete
453	Catch Basin/Inlet	1.56	Investigation Complete
454	Catch Basin/Inlet	1.53	Investigation Complete
455	Catch Basin/Inlet	3.13	Investigation Complete
456	Catch Basin/Inlet	3.47	Investigation Complete
458	Catch Basin/Inlet	2.02	Investigation Complete
466	Catch Basin/Inlet	11.26	Out of Scope
467	Catch Basin/Inlet	3.51	Out of Scope
468	Catch Basin/Inlet	7.59	Investigation Complete
469	Drainage Manhole	2.08	Out of Scope
470	Catch Basin/Inlet	1.94	Investigation Complete
471	Catch Basin/Inlet	4.95	Out of Scope
472	Drainage Manhole	3.34	Investigation Complete
473	Catch Basin/Inlet	1.01	Investigation Complete
474	Drainage Manhole	7.63	Investigation Complete
475	Catch Basin/Inlet	1.39	Out of Scope
476	Catch Basin/Inlet	2.94	Full of Debris
477	Catch Basin/Inlet	3.35	Investigation Complete
478	Drainage Manhole	14.12	Investigation Complete
479	Catch Basin/Inlet	7.32	Full of Debris
480	Catch Basin/Inlet	7.12	Investigation Complete
481	Catch Basin/Inlet	10.98	Out of Scope
482	Drainage Manhole	2.57	Investigation Complete
483	Drainage Manhole	3.26	Investigation Complete
484	Catch Basin/Inlet	1.01	Could Not Open
485	Drainage Manhole	2.52	Investigation Complete
486	Drainage Manhole	7.46	Out of Scope
487	Catch Basin/Inlet	3.04	Investigation Complete
487A	Catch Basin/Inlet	2.56	Investigation Complete
488	Catch Basin/Inlet	1.55	Investigation Complete
489	Drainage Manhole	3.68	Out of Scope
490	Catch Basin/Inlet	1.73	Investigation Complete
491	Catch Basin/Inlet	3.11	Investigation Complete
492	Drainage Manhole	12.58	Could Not Open
494	Catch Basin/Inlet	12.06	Investigation Complete
495	Drainage Manhole	6.91	Investigation Complete
496	Drainage Manhole	3.47	Investigation Complete
497	Catch Basin/Inlet	5.24	Investigation Complete
498	Catch Basin/Inlet	1.32	Investigation Complete
499	Drainage Manhole	3.75	Out of Scope
500	Drainage Manhole	2.85	Out of Scope
501	Drainage Manhole	0.96	Full of Water
502	Catch Basin/Inlet	1.44	Investigation Complete
503	Drainage Manhole	8.13	Out of Scope
504	Catch Basin/Inlet	7.26	Out of Scope
505	Drainage Manhole	2.98	Out of Scope
506	Catch Basin/Inlet	5.27	Investigation Complete
507	Catch Basin/Inlet	1.46	Investigation Complete
508	Drainage Manhole	3.13	Investigation Complete
509	Catch Basin/Inlet	2.12	Investigation Complete

Structure Survey Data

Structure Number	Structure Type	Structure Elevation (feet, NAVD88)	Investigation Status
510	Drainage Manhole	3.4	Out of Scope
511	Catch Basin/Inlet	8.25	Out of Scope
512	Catch Basin/Inlet	2.36	Out of Scope
513	Drainage Manhole	7.91	Investigation Complete
514	Catch Basin/Inlet	2.24	Full of Water
515	Drainage Manhole	2.25	Full of Water
516	Catch Basin/Inlet	1.23	Investigation Complete
517	Catch Basin/Inlet	2.14	Investigation Complete
518	Catch Basin/Inlet	3.02	Investigation Complete
519	Drainage Manhole	3.41	Investigation Complete
520	Catch Basin/Inlet	3.17	Investigation Complete
521	Drainage Manhole	4.99	Out of Scope
522	Catch Basin/Inlet	2.14	Out of Scope
523	Drainage Manhole	4.75	Investigation Complete
524	Catch Basin/Inlet	2.92	Investigation Complete
525	Drainage Manhole	3.21	Investigation Complete
526	Catch Basin/Inlet	7.41	Out of Scope
527	Catch Basin/Inlet	19.06	Out of Scope
528	Catch Basin/Inlet	1.66	Full of Water
529	Catch Basin/Inlet	1.22	Investigation Complete
530	Drainage Manhole	3.26	Investigation Complete
531	Catch Basin/Inlet	2.59	Out of Scope
532	Catch Basin/Inlet	3.24	Investigation Complete
533	Catch Basin/Inlet	6.89	Out of Scope
534	Drainage Manhole	3.39	Full of Water
535	Catch Basin/Inlet	12.38	Investigation Complete
536	Catch Basin/Inlet	1.67	Could Not Open
537	Drainage Manhole	7.35	Out of Scope
538	Catch Basin/Inlet	1.94	Investigation Complete
539	Drainage Manhole	8.2	Investigation Complete
540	Drainage Manhole	3.18	Out of Scope
541	Catch Basin/Inlet	1.78	Out of Scope
542	Drainage Manhole	20.42	Out of Scope
543	Drainage Manhole	14.65	Investigation Complete
544	Catch Basin/Inlet	7.68	Out of Scope
545	Drainage Manhole	7.78	Investigation Complete
546	Catch Basin/Inlet	2.84	Out of Scope
547	Catch Basin/Inlet	3.14	Investigation Complete
548	Catch Basin/Inlet	2.18	Investigation Complete
549	Catch Basin/Inlet	1.91	Investigation Complete
550	Catch Basin/Inlet	1.05	Could Not Open
551	Catch Basin/Inlet	7.87	Out of Scope
552	Catch Basin/Inlet	2.02	Out of Scope
553	Drainage Manhole	3.44	Full of Water
554	Drainage Manhole	3.06	Investigation Complete
555	Drainage Manhole	7.43	Investigation Complete
556	Catch Basin/Inlet	2.03	Out of Scope
557	Drainage Manhole	5.91	Out of Scope
558	Drainage Manhole	3.12	Investigation Complete
559	Drainage Manhole	2.48	Investigation Complete
560	Drainage Manhole	5.19	Investigation Complete
561	Drainage Manhole	7.44	Investigation Complete

Structure Survey Data

Structure Number	Structure Type	Structure Elevation (feet, NAVD88)	Investigation Status
562	Catch Basin/Inlet	2.14	Investigation Complete
563	Catch Basin/Inlet	1.08	Out of Scope
564	Drainage Manhole	4.12	Investigation Complete
565	Drainage Manhole	8.31	Full of Debris
566	Drainage Manhole	2.81	Could Not Open
567	Catch Basin/Inlet	1.8	Investigation Complete
568	Catch Basin/Inlet	1.43	Investigation Complete
568A	Catch Basin/Inlet	1.1	Investigation Complete
569	Catch Basin/Inlet	12.03	Out of Scope
570	Drainage Manhole	11.55	Out of Scope
571	Catch Basin/Inlet	7.55	Investigation Complete
572	Catch Basin/Inlet	7.17	Investigation Complete
573	Catch Basin/Inlet	1.87	Could Not Open
574	Drainage Manhole	3.32	Investigation Complete
575	Drainage Manhole	7.73	Out of Scope
576	Catch Basin/Inlet	11.11	Out of Scope
577	Catch Basin/Inlet	2.13	Investigation Complete
578	Catch Basin/Inlet	2.14	Investigation Complete
579	Catch Basin/Inlet	2.21	Investigation Complete
580	Catch Basin/Inlet	1.75	Investigation Complete
581	Catch Basin/Inlet	20.45	Out of Scope
582	Catch Basin/Inlet	7.1	Investigation Complete
583	Drainage Manhole	7.75	Investigation Complete
584	Catch Basin/Inlet	0.38	Investigation Complete
585	Catch Basin/Inlet	1.44	Investigation Complete
586	Catch Basin/Inlet	6.87	Investigation Complete
587	Catch Basin/Inlet	4.53	Out of Scope
588	Drainage Manhole	7.88	Out of Scope
589	Catch Basin/Inlet	1.35	Out of Scope
590	Catch Basin/Inlet	3.38	Investigation Complete
591	Catch Basin/Inlet	3.26	Investigation Complete
592	Catch Basin/Inlet	3.11	Investigation Complete
593	Catch Basin/Inlet	5.48	Investigation Complete
594	Catch Basin/Inlet	5.91	Investigation Complete
595	Catch Basin/Inlet	5	Investigation Complete
596	Outfall	1.34	Investigation Complete
597	Catch Basin/Inlet	3.46	Investigation Complete
598	Catch Basin/Inlet	5.68	Investigation Complete
599	Catch Basin/Inlet	2.63	Investigation Complete
600	Catch Basin/Inlet	14.36	Investigation Complete
601	Catch Basin/Inlet	14.41	Full of Debris
602	Outfall	1.43	Investigation Complete
603	Catch Basin/Inlet	5.35	Investigation Complete
604	Catch Basin/Inlet	2.28	Investigation Complete
605	Catch Basin/Inlet	3.14	Investigation Complete
606	Catch Basin/Inlet	14.83	Investigation Complete
607	Catch Basin/Inlet	3.76	Investigation Complete
608	Catch Basin/Inlet	2.48	Investigation Complete
609	Catch Basin/Inlet	3.48	Investigation Complete
609A	Catch Basin/Inlet	3.05	Investigation Complete
610	Catch Basin/Inlet	7.04	Investigation Complete
611	Catch Basin/Inlet	3.19	Investigation Complete

Structure Survey Data

Structure Number	Structure Type	Structure Elevation (feet, NAVD88)	Investigation Status
612	Catch Basin/Inlet	2.91	Investigation Complete
613	Catch Basin/Inlet	3.31	Investigation Complete
614	Catch Basin/Inlet	2.75	Investigation Complete
615	Catch Basin/Inlet	15.4	Investigation Complete
616	Catch Basin/Inlet	11.88	Investigation Complete
617	Catch Basin/Inlet	3.42	Investigation Complete
618	Catch Basin/Inlet	6.51	Investigation Complete
619	Catch Basin/Inlet	6.79	Out of Scope
620	Catch Basin/Inlet	2.38	Investigation Complete
621	Catch Basin/Inlet	3.31	Investigation Complete
622	Catch Basin/Inlet	7.44	Investigation Complete
623	Catch Basin/Inlet	3.35	Investigation Complete
624	Catch Basin/Inlet	2.31	Investigation Complete
625	Catch Basin/Inlet	5.96	Investigation Complete
626	Catch Basin/Inlet	1.95	Investigation Complete
627	Catch Basin/Inlet	7.58	Investigation Complete
628	Catch Basin/Inlet	1.92	Investigation Complete
629	Catch Basin/Inlet	14.1	Investigation Complete
630	Catch Basin/Inlet	6.06	Investigation Complete
631	Catch Basin/Inlet	4.47	Investigation Complete
632	Catch Basin/Inlet	14.58	Investigation Complete
633	Catch Basin/Inlet	2.48	Investigation Complete
634	Catch Basin/Inlet	5.8	Investigation Complete
635	Catch Basin/Inlet	3.17	Investigation Complete
636	Catch Basin/Inlet	14.07	Investigation Complete
637	Catch Basin/Inlet	6.48	Investigation Complete
638	Catch Basin/Inlet	4.01	Investigation Complete
639	Catch Basin/Inlet	6.18	Investigation Complete
640	Catch Basin/Inlet	2.35	Full of Debris
641	Catch Basin/Inlet	3.44	Investigation Complete
642	Catch Basin/Inlet	4.3	Investigation Complete
643	Catch Basin/Inlet	3.79	Investigation Complete
644	Catch Basin/Inlet	7.5	Investigation Complete
645	Catch Basin/Inlet	2.68	Investigation Complete
646	Catch Basin/Inlet	6.83	Investigation Complete
647	Catch Basin/Inlet	2.36	Investigation Complete
648	Catch Basin/Inlet	2.45	Investigation Complete
649	Catch Basin/Inlet	14.17	Full of Water
650	Catch Basin/Inlet	7.94	Investigation Complete
651	Catch Basin/Inlet	7.56	Investigation Complete
652	Catch Basin/Inlet	3.18	Investigation Complete
653	Catch Basin/Inlet	2.59	Investigation Complete
654	Catch Basin/Inlet	7.52	Investigation Complete
655	Catch Basin/Inlet	13.57	Investigation Complete
656	Catch Basin/Inlet	3.53	Investigation Complete
657	Catch Basin/Inlet	1.89	Investigation Complete
658	Catch Basin/Inlet	3.35	Investigation Complete
659	Catch Basin/Inlet	4.59	Investigation Complete
660	Catch Basin/Inlet	7.5	Investigation Complete
661	Catch Basin/Inlet	2.85	Full of Debris
662	Catch Basin/Inlet	3.38	Investigation Complete
663	Catch Basin/Inlet	1.81	Investigation Complete

Structure Survey Data

Structure Number	Structure Type	Structure Elevation (feet, NAVD88)	Investigation Status
664	Catch Basin/Inlet	2.8	Investigation Complete
665	Catch Basin/Inlet	7.7	Investigation Complete
666	Catch Basin/Inlet	6.7	Investigation Complete
667	Catch Basin/Inlet	4.07	Investigation Complete
668	Catch Basin/Inlet	2.77	Investigation Complete
669	Catch Basin/Inlet	2.61	Investigation Complete
670	Catch Basin/Inlet	1.95	Full of Debris
671	Catch Basin/Inlet	5.41	Investigation Complete
672	Catch Basin/Inlet	3.89	Investigation Complete
673	Catch Basin/Inlet	1.92	Investigation Complete
674	Catch Basin/Inlet	2.63	Investigation Complete
675	Catch Basin/Inlet	3.1	Investigation Complete
676	Catch Basin/Inlet	6.28	Investigation Complete
677	Catch Basin/Inlet	12.27	Investigation Complete
678	Catch Basin/Inlet	8.03	Investigation Complete
679	Catch Basin/Inlet	5.4	Investigation Complete
680	Catch Basin/Inlet	3.76	Full of Debris
681	Catch Basin/Inlet	3.94	Investigation Complete
682	Catch Basin/Inlet	7.77	Investigation Complete
683	Catch Basin/Inlet	2.42	Investigation Complete
684	Catch Basin/Inlet	3.39	Investigation Complete
685	Catch Basin/Inlet	1.69	Investigation Complete
686	Catch Basin/Inlet	7.28	Investigation Complete
687	Catch Basin/Inlet	1.75	Full of Debris
688	Catch Basin/Inlet	5.13	Investigation Complete
689	Catch Basin/Inlet	2.09	Investigation Complete
690	Catch Basin/Inlet	4.98	Investigation Complete
691	Catch Basin/Inlet	3.15	Investigation Complete
692	Catch Basin/Inlet	6.41	Investigation Complete
693	Catch Basin/Inlet	3.93	Investigation Complete
694	Catch Basin/Inlet	4.7	Investigation Complete
695	Catch Basin/Inlet	2.22	Investigation Complete
696	Catch Basin/Inlet	3.07	Investigation Complete
697	Catch Basin/Inlet	2.2	Investigation Complete
698	Outfall	0.65	Investigation Complete
699	Outfall	1.36	Investigation Complete
700	Outfall	0.79	Investigation Complete
701	Outfall	0.35	Investigation Complete
702	Outfall	0.72	Investigation Complete
703	Outfall	2.2	Investigation Complete
704	Outfall	1.77	Investigation Complete
705	Outfall	1.66	Investigation Complete
706	Outfall	1.53	Investigation Complete
707	Outfall	1.64	Investigation Complete
708	Outfall	0.4	Investigation Complete
709	Outfall	0.6	Investigation Complete
710	Outfall	0.09	Out of Scope
711	Outfall	0.09	Out of Scope
712	Outfall	0.82	Investigation Complete
713	Outfall	0.45	Investigation Complete
714	Outfall	0.25	Investigation Complete
715	Outfall	-0.03	Investigation Complete

Structure Survey Data

Structure Number	Structure Type	Structure Elevation (feet, NAVD88)	Investigation Status
716	Outfall	-0.28	Investigation Complete
717	Outfall	-0.5	Investigation Complete
718	Outfall	1.84	Investigation Complete
719	Catch Basin/Inlet	3.85	Out of Scope
720	Catch Basin/Inlet	2.8662	Investigation Complete
721	Catch Basin/Inlet	2.85	Investigation Complete
16011	Drainage Manhole	1.67	Investigation Complete
16012	Drainage Manhole	2.44	Investigation Complete
16013	Drainage Manhole	2.08	Investigation Complete
16014	Drainage Manhole	2.26	Investigation Complete
16015	Drainage Manhole	2.01	Investigation Complete
16016	Drainage Manhole	1.86	Full of Water
16017	Catch Basin/Inlet	1.37	Investigation Complete
16018	Drainage Manhole	1.79	Investigation Complete
16019	Catch Basin/Inlet	1.44	Investigation Complete
17001	Catch Basin/Inlet	2.52	Investigation Complete
17002	Catch Basin/Inlet	2.15	Investigation Complete
17003	Outfall	0.11	Investigation Complete
17005	Outfall	-0.17	Investigation Complete
17005	Outfall	-0.96	Investigation Complete
17006	Outfall	-0.14	Investigation Complete
19006	Outfall	-1.1	Investigation Complete
19008	Outfall	-0.8	Investigation Complete
19011	Outfall	-0.28	Investigation Complete
19013	Drainage Manhole	13.65	Investigation Complete
21002	Outfall	3.72	Investigation Complete
21003	Outfall	3.78	Investigation Complete
24001	Outfall	1.18	Investigation Complete

Pipe Survey Data

From Structure Number	To Structure Number	Pipe Diameter (inches)	Pipe Material	From Invert (feet, NAVD88)	To Invert (feet, NAVD88)	Pipe Length (feet)
89	524	12	Corrugated Plastic	0.89	0.27	146.26
175	370	12	Concrete		6.44	37.22
301	578	12	Corrugated Plastic	0.33	-0.16	124.30
302	456	12	Corrugated Metal	0.51	0.87	109.58
303	302	12	Corrugated Metal	0.36	0.51	139.04
307	306	12	Corrugated Metal	0.72	0.73	17.62
308	309	12	Corrugated Plastic	0.85	-0.17	34.47
310	700	12	Corrugated Metal		-0.21	35.16
311	308	12	Corrugated Metal		0.85	190.20
312	311	12	Corrugated Metal	-0.32	-0.43	18.94
314	313	12	Corrugated Metal	0.63	0.71	22.76
316	317	24	Corrugated Metal	2.2	2.25	29.86
318	21002	18	Concrete	2.66	3.72	214.03
319	21003	18	Corrugated Plastic	3.62	3.78	267.93
320	319	18	Corrugated Metal	4.05	3.82	32.62
321	380	12	Corrugated Plastic	7.82	6.51	153.27
322	323	12	Corrugated Metal	2.29	1.84	53.17
324	323	12	Corrugated Metal	2.83	1.94	163.99
325	324	12	Corrugated Metal	2.34	2.93	11.34
326	327	12	Corrugated Metal	2.63	2.89	42.89
327	324	12	Corrugated Metal	2.79	2.78	114.26
328	329	12	Corrugated Plastic	8.77	7.77	140.82
329	335	12	Corrugated Plastic	7.87	5.91	212.27
330	407	18	Corrugated Metal	5.8	4.87	165.20
331	330	12	Corrugated Plastic	5.48	5.5	22.75
332	409	12	Corrugated Metal	4.43	5.56	99.90
333	332	18	Corrugated Metal	4.8	5.88	36.16
334	333	18	Corrugated Metal	4.75	4.85	62.05
335	408	12	Corrugated Plastic	5.81	4.73	83.23
337	338	18	Corrugated Metal	0.66	0.78	23.46
338	340	18	Corrugated Metal	0.88	0.75	100.08
339	340	18	Corrugated Metal	0.52	0.55	21.78
340	532	15	Corrugated Metal	0.55	0.99	91.92
342	443	15	Corrugated Metal	0.37	-0.01	236.96
345	347	12	Corrugated Plastic	2.83	2.15	225.86
346	347	12	Corrugated Plastic	1.81	2.25	29.59
347	506	12	Corrugated Plastic	2.15	2.37	71.13
348	346	12	Corrugated Plastic	2.41	1.91	32.31
349	448	12	Corrugated Plastic	1.83	0.21	273.30
350	449	12	Corrugated Plastic	-0.94	-0.09	110.08
351	458	12	Corrugated Plastic	-0.02	-0.28	131.38
352	353	12	Corrugated Plastic	-0.5	-0.67	60.82
353	450	12	Corrugated Plastic	-0.67	-0.45	161.21
356	355	12	Corrugated Plastic	-0.19	-1.03	121.66
359	66	18	Corrugated Plastic	-0.87	-0.86	42.70
361	295	18	Corrugated Plastic	-1.25	-1.24	83.30
364	577	12	Corrugated Plastic	-0.56		71.46
365	517	12	Corrugated Plastic	-0.27	-0.31	120.52
366	303	12	Corrugated Metal	0.4	0.36	243.26
368	477	12	Corrugated Metal	0.41	0.8	43.14
370	632	18	Concrete	6.29	6.13	82.92

Pipe Survey Data

From Structure Number	To Structure Number	Pipe Diameter (inches)	Pipe Material	From Invert (feet, NAVD88)	To Invert (feet, NAVD88)	Pipe Length (feet)
371	372	12	Corrugated Plastic	18.12	17.78	56.53
372	373	12	Corrugated Plastic	17.88	16.53	202.58
373	374	12	Corrugated Plastic	16.73	16.2	201.96
374	376	12	Corrugated Plastic	16.1	14.48	182.40
376	377	12	Corrugated Plastic	14.48	12.45	181.52
377	378	12	Corrugated Plastic	12.45	10.79	242.04
378	494	12	Corrugated Plastic	10.69	9.41	232.36
380	381	15	Corrugated Metal	6.24	6.32	38.72
381	539	15	Corrugated Metal	6.22	5.3	162.68
382	238	18	Corrugated Plastic	-1.16	-2.46	55.63
383	384	12	Corrugated Plastic	-0.72	-0.68	41.93
384	568	12	Corrugated Metal	-0.68	-1.07	151.25
387	548	12	Corrugated Plastic	-0.32	0.18	62.00
388	389	12	Corrugated Plastic	-0.02	-1	81.82
389	390	12	Corrugated Plastic	-1.2	-0.24	153.38
390	392	12	Corrugated Plastic	-0.24	-0.5	205.92
391	390	12	Corrugated Plastic	-0.17	0.06	117.11
392	702	12	Corrugated Metal	-0.7	-0.28	3.28
393	392	12	Corrugated Plastic	-0.4	-0.5	37.18
396	311	12	Corrugated Plastic	-0.17	-0.43	180.09
397	25	12	Corrugated Plastic	-0.74	-0.9	119.90
398	397	12	Corrugated Plastic	-0.25	-0.69	160.97
400	657	12	Corrugated Plastic	-0.11	-0.81	24.55
401	549	12	Corrugated Plastic	0.98	0.16	27.15
402	401	12	Corrugated Metal	0.05	0.68	45.85
403	402	12	Corrugated Metal	0.44	0.35	25.56
404	523	18	Corrugated Metal	-0.61	1.55	273.22
405	404	18	Corrugated Metal	0.1	-0.36	247.27
407	333	18	Corrugated Metal	4.37	4.85	240.79
408	334	18	Corrugated Plastic	4.83	5.25	24.60
409	176	12	Corrugated Plastic	5.76	5.71	81.45
410	411	12	Corrugated Plastic	1.23	1.17	27.42
411	412	12	Corrugated Plastic	1.17	0.65	148.67
413	412	12	Corrugated Plastic	0.82	0.85	49.45
415	414	12	Corrugated Plastic	-2.07	-1.8	59.35
416	415	12	Corrugated Plastic	-1.94	-2.02	41.76
416	529	12	Corrugated Plastic	-2.14	-1.88	47.93
417	19006	12	Corrugated Plastic	-1.62	-1.1	62.93
418	420	12	Corrugated Plastic	-1.61	-1.68	82.86
419	418	12	Corrugated Plastic	-1.58	-1.71	113.98
419	422	12	Corrugated Plastic	-1.78	-1.19	82.00
420	17005	12	Corrugated Metal	-1.73	-0.96	68.23
421	417	12	Corrugated Plastic	-1.62	-1.62	27.51
421	420	12	Corrugated Plastic	-1.52	-1.98	119.02
422	17003	12	Corrugated Metal	-1.34	-0.89	71.87
423	422	12	Corrugated Plastic	-1.52	-1.34	66.97
424	427	12	Corrugated Plastic	-1.34	-1.46	119.65
425	424	12	Corrugated Plastic	-1.54	-1.54	67.31
425	585	12	Corrugated Plastic	-1.64	-1.01	46.21
429	430	12	Corrugated Plastic	-0.73	-1.3	18.80
430	580	12	Corrugated Plastic	-0.95	-1.35	36.82

Pipe Survey Data

From Structure Number	To Structure Number	Pipe Diameter (inches)	Pipe Material	From Invert (feet, NAVD88)	To Invert (feet, NAVD88)	Pipe Length (feet)
431	4	12	Corrugated Plastic	-1	-1.31	50.86
431	502	12	Corrugated Metal	-0.85	-0.56	133.15
433	434	12	Corrugated Plastic	0.11	-0.74	69.68
434	580	12	Corrugated Plastic	-0.74	-1.05	127.24
435	436	12	Corrugated Plastic	0.36	0.06	22.53
436	579	12	Corrugated Plastic	0.01	0.01	94.47
437	438	18	Corrugated Metal	0.91	0.71	49.51
439	440	18	Corrugated Metal	1.15	0.85	23.18
439	441	15	Corrugated Metal	0.75	-0.26	363.56
441	485	15	Corrugated Metal	-0.26	0.12	27.71
442	441	18	Corrugated Metal	-0.42	-0.16	32.85
443	444	15	Corrugated Metal	-0.31	-0.6	87.44
444	470	15	Corrugated Metal	-0.65	-0.36	58.20
445	350	12	Corrugated Plastic	-0.29	-0.64	181.31
446	599	12	Corrugated Metal	-0.07	0.03	101.69
447	446	15	Corrugated Metal	-0.48	-0.22	22.85
448	662	12	Corrugated Plastic	0.36	-0.02	51.04
449	231	12	Corrugated Plastic	-0.34	0.57	108.70
450	452	12	Corrugated Plastic	-0.5	-0.35	55.43
451	450	12	Corrugated Plastic	-0.53	-0.7	17.99
452	454	12	Corrugated Plastic	-0.55	-0.87	107.06
453	452	12	Corrugated Plastic	-1.04	-1.25	8.71
456	301	12	Corrugated Plastic	1.07	0.23	162.99
458	352	12	Corrugated Plastic	-0.38	-0.85	139.63
468	320	15	Corrugated Metal	4.54	3.85	146.60
470	445	15	Corrugated Metal	-0.46	-0.84	47.56
472	721	12	Corrugated Plastic	1.52	0.85	178.30
473	382	12	Corrugated Plastic	-1.04	-1.16	30.72
477	456	12	Corrugated Metal	0.8	0.97	38.61
478	370	15	Concrete	7.12	9.54	211.23
480	586	12	Corrugated Plastic	4.52	4.07	76.51
482	559	12	Corrugated Metal	1.07	0.63	26.77
485	337	15	Corrugated Metal	0.42	0.71	186.37
487	547	12	Corrugated Metal	0.89	0.74	25.83
487A	487	12	Corrugated Metal	0.86	0.94	43.68
488	73	15	Corrugated Plastic	-1.05	-1.15	55.83
491	652	12	Corrugated Plastic	0.31	0.88	105.87
494	321	12	Corrugated Plastic	9.56	7.62	185.69
495	692	12	Corrugated Plastic	4.51	4.01	69.00
496	472	12	Corrugated Plastic	1.57	1.54	86.41
497	326	12	Corrugated Metal	2.84	2.73	102.88
502	425	12	Corrugated Plastic	-0.86	-1.39	75.66
506	349	12	Corrugated Plastic	2.52	1.8	298.80
508	617	12	Corrugated Plastic		1.17	162.47
509	357	12	Corrugated Plastic	-0.08	-0.29	84.74
516	428	12	Corrugated Plastic	-1.62	-1.1	43.90
517	509	12	Corrugated Plastic	-0.31	0.02	83.03
518	487	12	Corrugated Metal	0.87	0.94	47.72
520	621	12	Corrugated Plastic	0.87	0.91	38.95
524	313	12	Corrugated Plastic	0.22	0.81	20.45
525	641		Corrugated Plastic	0.61	1.04	37.03

Pipe Survey Data

From Structure Number	To Structure Number	Pipe Diameter (inches)	Pipe Material	From Invert (feet, NAVD88)	To Invert (feet, NAVD88)	Pipe Length (feet)
529	417	12	Corrugated Plastic	-1.93	-1.82	22.22
530	496	12	Corrugated Plastic		1.72	53.65
530	592	12	Corrugated Plastic	1.36	1.31	32.87
532	342	15	Corrugated Metal	0.84	0.62	97.42
538	403	12	Corrugated Plastic	-0.64	0.34	132.73
539	468	15	Corrugated Metal	5.15	4.64	152.74
543	478	15	Concrete	8.55	7.17	273.30
548	388	12	Corrugated Plastic	0.18	-0.22	71.85
558	410	12	Corrugated Plastic		1.43	50.73
559	306	12	Corrugated Plastic	0.68	0.83	62.36
560	671	12	Corrugated Metal	3.39	3.11	49.29
567	663	12	Corrugated Plastic	-0.3	-0.29	33.80
568	249	12	Concrete	-1.12		35.76
568A	568	15	Corrugated Plastic	-0.2	-1.47	34.00
572	582	12	Corrugated Plastic	4.42	3.45	52.47
574	591	12	Corrugated Plastic	1.05	0.91	32.10
577	365	12	Corrugated Plastic			117.31
579	429	12	Corrugated Plastic	-0.39	-0.58	139.67
580	16	15	Corrugated Plastic		0.38	31.24
582	654	12	Corrugated Plastic	4.3	4.27	92.29
583	678	12	Corrugated Plastic	5.36	5.43	94.60
584	414	12	Corrugated Plastic	-2.32	-2.2	32.30
585	428	12	Corrugated Plastic	-1.41	-1.25	95.67
590	482	12	Corrugated Metal	0.83	0.67	107.56
591	483	12	Corrugated Plastic	0.66	0.36	54.76
592	613	15	Corrugated Plastic	1.21	1.16	53.88
593	560	12	Corrugated Metal	3.28	3.29	84.02
595	639	12	Corrugated Metal	3.5	2.88	139.65
597	668	12	Corrugated Plastic	0.96	0.47	120.61
598	694	15	Corrugated Plastic	2.88	2.15	101.36
599	445	12	Corrugated Metal	-0.47	-0.44	66.29
600	19013	18	Corrugated Metal	8.56	8.95	102.11
603	23	36	Corrugated Metal	0.15	-0.68	249.73
604	602	18	Corrugated Plastic	0.18	-0.07	189.80
606	543	18	Corrugated Metal	8.98	8.75	39.15
607	672	15	Corrugated Plastic	1.49	1.19	24.39
608	695	12	Corrugated Plastic	0.18	-1.03	117.82
609	609A	12	Corrugated Metal	0.18	0.85	106.61
609A	703	12	Corrugated Metal	1.12	1.2	121.83
610	627	12	Corrugated Plastic	5.14	4.48	26.20
611	491	12	Corrugated Plastic	0.59	0.41	34.96
612	648	12	Corrugated Plastic	0.61	0.25	130.23
617	597	12	Corrugated Plastic	1.22	0.96	127.23
618	692	12	Corrugated Plastic	4.51	3.66	15.21
620	674	12	Corrugated Plastic	0.08	0.23	61.39
621	611	12	Corrugated Plastic	0.96	0.89	40.39
622	586	12	Corrugated Plastic	5.04	4.07	25.15
623	609	12	Corrugated Plastic	0.6	0.38	32.87
624	647	8	Corrugated Plastic	0.01	0.16	96.92
625	595	12	Corrugated Metal	2.91	3.55	156.00
626	697	18	Corrugated Metal	-0.15	0	54.83

Pipe Survey Data

From Structure Number	To Structure Number	Pipe Diameter (inches)	Pipe Material	From Invert (feet, NAVD88)	To Invert (feet, NAVD88)	Pipe Length (feet)
628	683	12	Corrugated Plastic	-0.68	-0.18	113.90
629	655	12	Corrugated Metal	10.1	9.57	35.20
630	637	15	Corrugated Metal	2.41		31.50
631	638	12	Corrugated Metal	1.87	1.81	90.56
632	615	18	Concrete	6.13	5.7	186.50
633	675	12	Corrugated Plastic	0.58	0.55	73.89
634	598	15	Corrugated Plastic	3.2	2.88	30.42
635	17005	12	Corrugated Metal	1.87	-0.17	118.13
636	478	15	Corrugated Metal	11.17	10.67	41.87
637	603	36	Corrugated Metal	0.98	0.1	366.03
638	681	12	Corrugated Metal	1.81	1.59	113.92
639	593	12	Corrugated Metal	2.88	2.78	30.62
642	643	15	Corrugated Plastic	1.45	1.19	55.59
643	672	15	Corrugated Metal	1.09	1.29	83.46
644	665	12	Corrugated Plastic	4.9	4.2	20.81
645	605	12	Corrugated Plastic	0.38	0.89	25.89
646	495	12	Corrugated Plastic	4.28	4.01	27.15
647	626	12	Corrugated Plastic	0.11	0.25	113.36
648	608	12	Corrugated Plastic	0.2	0.23	159.75
650	682	12	Corrugated Plastic	5.59	5.17	80.02
652	696	12	Corrugated Plastic	0.88	0.77	174.79
653	697	12	Corrugated Plastic	0.24	0.4	107.13
655	600	18	Corrugated Metal	8.82	8.56	197.05
656	609	12	Corrugated Plastic	1.13	0.28	141.55
657	398	12	Corrugated Plastic	-0.11	-0.5	223.40
658	612	12	Corrugated Plastic	0.85	0.61	262.64
659	631	12	Corrugated Metal	2.24	1.82	133.41
660	572	12	Corrugated Plastic	4	3.32	61.30
662	351	12	Corrugated Plastic	-0.02	-0.17	41.61
662	446	12	Corrugated Metal	0.13	-0.07	156.52
664	519	12	Corrugated Metal	1.55	0.71	100.66
665	495	12	Corrugated Plastic	4.4		124.36
666	654	12	Corrugated Plastic	4.25	4.82	27.34
667	642	15	Corrugated Plastic	2.07	1.6	24.82
668	605	12	Corrugated Plastic	0.42	0.99	54.99
669	624	12	Corrugated Plastic	0.06	0.21	33.82
671	688	12	Corrugated Metal	3.11	2.18	73.22
672	684	12	Corrugated Plastic	1.19	0.99	110.22
673	628	12	Corrugated Plastic	-0.43	-0.28	25.24
674	675	12	Corrugated Plastic	0.23	0.5	161.14
675	653	12	Corrugated Plastic	0.8	0.09	159.23
676	594	18	Concrete	0.98	1.06	38.23
677	616	12	Concrete	8.67	7.78	34.88
678	650	12	Corrugated Plastic	5.63	5.44	34.03
679	690	12	Corrugated Plastic	2.7	2.38	26.06
681	693	12	Corrugated Metal	1.64	1.38	41.03
683	620	12	Corrugated Plastic	-0.13	-0.22	53.78
684	621	12	Corrugated Plastic	0.94	0.81	48.48
685	697	18	Corrugated Metal	-0.26	-0.4	39.25
688	690	12	Corrugated Plastic	2.33	2.38	67.36
689	628	12	Corrugated Plastic	-0.21	-0.38	87.19

Pipe Survey Data

From Structure Number	To Structure Number	Pipe Diameter (inches)	Pipe Material	From Invert (feet, NAVD88)	To Invert (feet, NAVD88)	Pipe Length (feet)
690	659	12	Corrugated Plastic	2.28	2.14	77.10
691	508	12	Corrugated Plastic	0.75	1.13	29.35
692	634	12	Corrugated Plastic	4.01	3.4	230.02
693	656	12	Corrugated Metal	1.33	1.23	63.14
694	642	15	Corrugated Plastic	2.2	1.6	207.93
695	706	18	Corrugated Metal	-0.08	0.03	11.20
696	614	15	Corrugated Metal	0.12	0.35	147.35
697	596	18	Corrugated Metal	-0.4	-0.16	189.66
698	383	12	Corrugated Metal	-0.35	-0.82	41.67
699	310	12	Corrugated Metal	0.36	0.16	5.90
701	392	12	Corrugated Metal	-0.65	-0.6	34.09
704	705	12	Corrugated Metal	1.77	1.66	50.39
709	708	12	Corrugated Metal	-0.4	-0.6	50.02
711	710	12	Corrugated Metal	-0.91	-0.91	29.89
712	713	18	Corrugated Metal	-0.68	-1.05	29.31
714	715	12	Corrugated Metal	-0.75	-1.03	66.02
717	716	12	Corrugated Metal	-0.5	-0.28	30.44
720	721	12	Corrugated Plastic	1.07	0.7	28.04
16012	16011	20	Corrugated Metal	-0.41		198.43
16013	16012	20	Corrugated Metal	-0.72	0.14	38.35
16014	16016	12	Corrugated Plastic	-0.54		91.13
16015	16016	12	Corrugated Plastic	-0.74		18.43
16016	16017	12	Corrugated Plastic		-0.48	112.65
16017	16019	12	Corrugated Plastic	-0.98	-0.41	38.09
16018	16019	12	Corrugated Plastic	-0.56	-0.51	19.42
16019	707	12	Corrugated Metal	-0.76	0.64	23.88
17001	695	15	Corrugated Metal	0.62	-1.45	73.87
17002	17001	15	Corrugated Metal		-0.18	49.28
19008	417	12	Corrugated Metal	-0.8	-1.52	37.94
19011	141	12	Corrugated Metal	-0.28	-1.25	60.07
24001	16013	12	Corrugated Plastic	0.18	-0.27	29.33

Pipe End Survey Data

Structure Number	Pipe Diameter (inches)	Pipe Material	Invert (feet, NAVD 88)	Pipe Length (feet)
55	18	Corrugated Plastic	-0.74	32.07
89	12	Corrugated Plastic	0.93	44.65
175	12	Corrugated Metal		27.79
184	15	Corrugated Plastic	1.71	13.81
242	12	Corrugated Plastic	-1.39	58.65
242	12	Corrugated Plastic	-1.54	12.97
309	12	Corrugated Plastic	0.03	50.05
312	12	Corrugated Plastic	-0.22	32.05
313	18	Corrugated Metal	0.96	8.71
315	18	Corrugated Metal	-0.96	18.29
316	24	Corrugated Metal	2.2	7.40
317	24	Corrugated Metal	2.25	7.39
318	12	Corrugated Metal	3.11	68.86
327	12	Corrugated Metal	2.74	8.61
336	18	Corrugated Metal	8.15	12.85
336	18	Corrugated Metal	7.85	26.57
336	18	Corrugated Metal	7.85	26.89
341	15	Corrugated Metal	1.13	10.87
343	12	Corrugated Plastic	3.17	44.59
345	12	Corrugated Plastic	2.23	106.78
353	12	Corrugated Plastic	-1.42	18.45
354	12	Corrugated Plastic	0.81	51.20
355	12	Corrugated Plastic		69.13
355	12	Corrugated Plastic	-0.93	37.12
356	12	Corrugated Plastic	-0.19	51.88
358	12	Corrugated Plastic	-0.09	39.81
358	12	Corrugated Plastic	-0.04	43.56
359	12	Corrugated Plastic	-0.77	19.27
360	12	Corrugated Plastic	-0.68	14.20
361	12	Corrugated Metal	-1.25	20.78
362	12	Corrugated Plastic	-0.53	10.71
364	12	Corrugated Plastic	-0.46	11.42
366	12	Corrugated Metal	0.2	43.32
368	12	Corrugated Metal	0.43	44.30
372	12	Corrugated Plastic	17.78	25.72
387	12	Corrugated Plastic	-0.02	15.73
387	12	Corrugated Plastic	0.08	78.24
391	12	Corrugated Plastic	-0.27	70.78
393	12	Corrugated Plastic	-0.75	76.74
403	12	Corrugated Plastic	0.44	25.77
405	18	Corrugated Metal	0.1	43.16
407	18	Corrugated Metal	4.87	37.77
423	12	Corrugated Plastic	-1.72	17.05
427	12	Corrugated Plastic	-1.66	9.44
428	12	Corrugated Plastic	-1.1	15.89
431	12	Corrugated Plastic	-1.15	20.76
432	12	Corrugated Plastic	0.75	42.58
433	12	Corrugated Plastic	-0.29	32.71
443	15	Corrugated Metal	-0.31	11.28
450	12	Corrugated Plastic	-0.95	15.73
458	12	Corrugated Metal	-0.63	14.04

Pipe End Survey Data

Structure Number	Pipe Diameter (inches)	Pipe Material	Invert (feet, NAVD 88)	Pipe Length (feet)
473	12	Corrugated Plastic	-0.94	10.10
488	12	Corrugated Plastic	-1.05	87.44
490	12	Corrugated Plastic	-0.07	30.85
490	12	Corrugated Plastic	-0.37	58.06
490	12	Corrugated Plastic	-0.17	62.87
497	12	Corrugated Metal	2.64	15.57
501				23.47
513	12	Corrugated Plastic	5.52	31.37
513	12	Corrugated Plastic	5.53	42.25
517	12	Corrugated Plastic	0.14	14.02
523	18	Corrugated Metal	1.55	117.48
525	12	Corrugated Plastic	0.63	5.10
530	12	Corrugated Plastic		30.37
532	15	Corrugated Metal	0.89	7.98
535	12	Corrugated Plastic	9.73	12.13
538	12	Corrugated Plastic	-0.24	41.26
545	12	Corrugated Plastic	5.45	22.55
547	12	Corrugated Plastic	0.84	26.28
549	12	Corrugated Plastic	-0.11	38.93
554	12	Corrugated Plastic	1.06	17.56
558				28.52
558	12	Corrugated Plastic	1.07	41.04
564	12	Corrugated Plastic	1.61	50.09
572	12	Corrugated Plastic	4.02	16.09
578	12	Corrugated Plastic	0.34	12.39
583	12	Corrugated Plastic	5.46	38.85
594	24	Concrete	0.91	6.69
594	18	Concrete	0.91	36.89
604	12	Corrugated Plastic	-0.42	30.95
605	12	Corrugated Plastic	0.89	62.06
606	12	Corrugated Metal	9.08	29.51
606	18	Corrugated Metal	9.03	30.06
609A	12	Corrugated Metal	1	17.57
614	15	Corrugated Metal	0.15	31.92
615	24	Concrete	5.85	40.33
616	24	Concrete	3.03	34.51
616	24	Concrete	3.03	31.09
627	12	Corrugated Plastic	4.33	10.95
627	12	Corrugated Plastic	4.38	13.72
631	12	Corrugated Plastic	2.47	44.46
632	18	Concrete	9.23	25.81
633	12	Corrugated Plastic	-0.02	15.74
637	36	Corrugated Metal	1.08	12.43
639	12	Corrugated Metal	2.98	6.95
641	12	Corrugated Plastic	0.99	69.70
651	12	Corrugated Plastic	5.56	11.83
654	12	Corrugated Plastic	4.97	39.38
655	12	Corrugated Metal	10.07	40.65
657	12	Corrugated Plastic	0.09	33.28
658	12	Corrugated Plastic	0.95	83.18
659	12	Corrugated Plastic	2.19	24.39

Pipe End Survey Data

Structure Number	Pipe Diameter (inches)	Pipe Material	Invert (feet, NAVD 88)	Pipe Length (feet)
660	12	Corrugated Plastic	3.9	16.91
665	12	Corrugated Plastic	4.45	35.00
676	18	Concrete	0.98	8.78
681	12	Corrugated Metal	1.59	17.43
681	12	Corrugated Metal	1.54	16.19
686	12	Corrugated Plastic	4.88	12.64
688	12	Corrugated Plastic	2.43	22.42
696	15	Corrugated Metal	0.47	22.62
718		Corrugated Plastic	1.84	13.76
721	12	Corrugated Plastic	0.75	33.70
721	12	Corrugated Plastic	1.7	4.27
16011	20	Unknown	-0.73	19.72
16011	20	Unknown		13.51
17006	18	Unknown	-1.64	5.46
19013	18	Corrugated Metal	8.8	50.16

0 1,000 2,000 4,000 Feet

Legend

- Structures
- Study Area

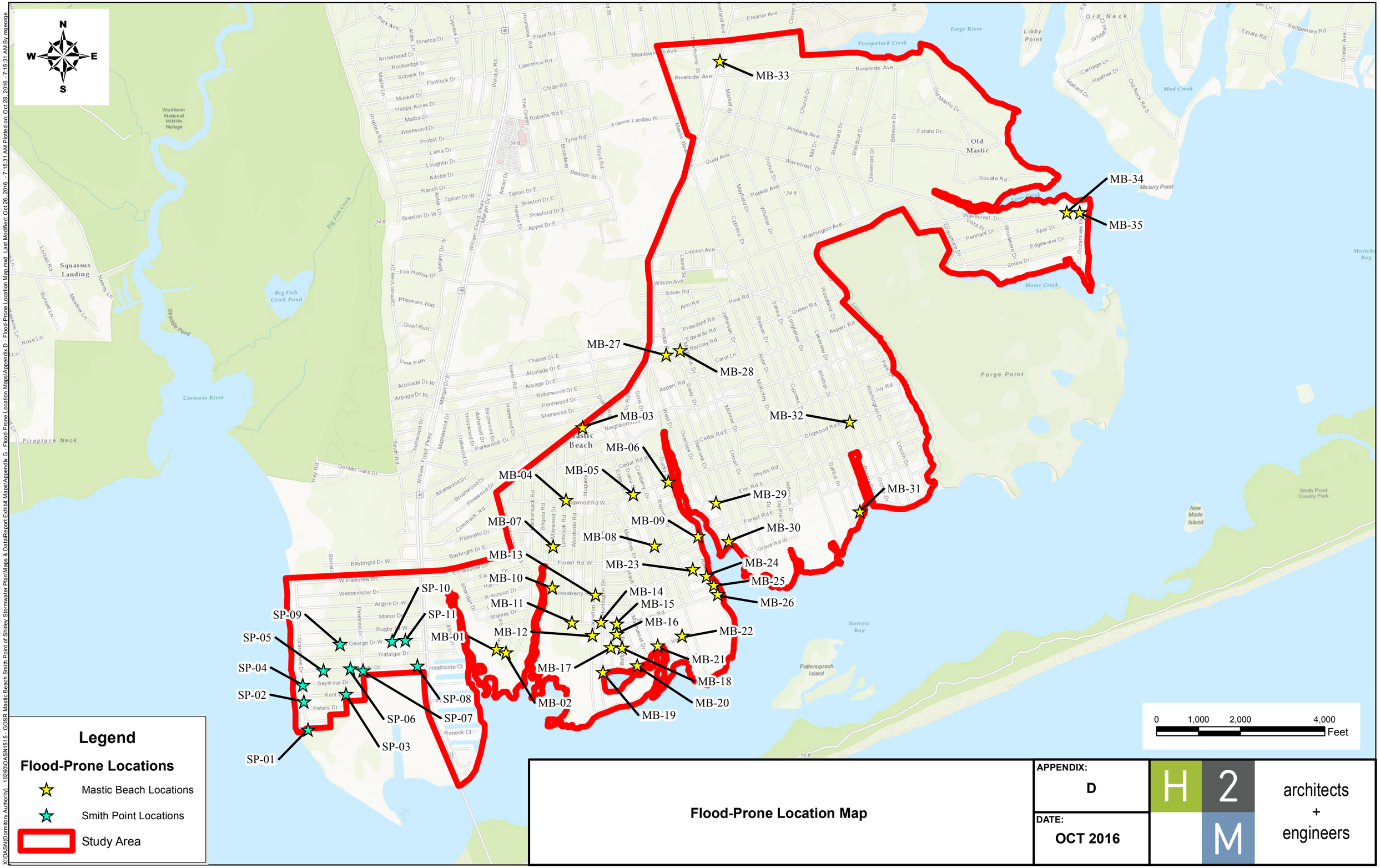
Outfall Location Map

APPENDIX: C

DATE: JULY 2016

H2M architects + engineers

X:\DASN\Dormitory Authority\ - 10260\DASN1515 - GOSR Mastic Beach Smith Point of Shirley Stormwater Plan\Maps & Data\Report Exhibit Maps\Appendix C - Outfall Location Map.mxd Last Modified: Jul 07, 2016 - 12:36:17 PM Plotted on: Jul 07, 2016 - 12:36:17 PM By: mgeorge



Legend

Flood-Prone Locations

- Mastic Beach Locations
- Smith Point Locations
- Study Area

Flood-Prone Location Map

APPENDIX: D

DATE: OCT 2016

H2M architects + engineers

X:\DASN\Dormitory Authority\ - 10260\DASN1515 - GOSR Mastic Beach Smith Point of Shirley Stormwater Plan\Maps & Data\Report Exhibit Maps\Appendix G - Flood-Prone Location Map.mxd Last Modified: Oct 26, 2016 - 7:15:31 AM Plotted on: Oct 28, 2016 - 7:15:31 AM By mgeorge

PROPOSED PROJECT: Prepare Stormwater Management Plan and Construct Improvements

Project Description

Like most Long Island south shore communities, NYRCR Mastic Beach and Smith Point of Shirley experienced flooding due to stormwater runoff and backup of seawater into stormwater drainage systems. A number of the neighborhoods experienced roadway flooding during the storm that extended onto private properties. Some of these areas continue to flood at higher high tides and during heavy rainfalls. Many of the recharge basins are ineffective due to the high groundwater elevation.

The project would begin with an engineering inventory of existing drainage collection and recharge components and would locate via GPS the catch basins, collection piping, recharge basins, and receiving water outfalls. Locations that experience flooding would be solicited from the Village and Town and included in the inventory. The adequacy of the system to accommodate storm events would be evaluated and recommendations made for improvements. Green infrastructure (*e.g.*, bioretention areas, vegetated swales, treatment wetlands, rain gardens) would be utilized for stormwater improvements wherever possible. Outfalls subject to seawater backups would be outfitted with one-way valves. Properties would be identified and acquired where possible to increase stormwater storage and recharge. Some properties could serve a dual function as passive or active parks or playgrounds during dry weather.

PREPARE STORMWATER MANAGEMENT PLAN AND CONSTRUCT IMPROVEMENTS

Recovery Support Functions: Infrastructure, Natural and Cultural Resources

Estimated Cost: $1,000,000

Assets Made More Resilient:

Stormwater collection system

Risk Reduction & Benefits:

Reduced flooding from stormwater runoff

Green stormwater treatment & recharge & protected wetlands

Estimated Project Costs

The project is estimated to cost $1 million including system inventory, engineering evaluation and design and construction of the most critical improvements. Total life cycle costs are estimated at $1,375,000.

Project Benefits

Risk Reduction

A properly engineered stormwater management system can eliminate flooding from stormwater runoff in all but the most severe storm events. Risk to public and private assets can be reduced accordingly.

Economic Resilience

The value of public and private properties is preserved or even enhanced when flooding is no longer a concern. The project could be expanded to include a greater number of improvements. It will create 13 FTE jobs[xi].

Environmental Protection

Green infrastructure techniques are supported by the U.S. Environmental Protection Agency as the preferred approach to stormwater collection and treatment as they protect the environment by providing more "natural" and effective methods of treating stormwater runoff.

Cost Benefit Analysis

Long-term benefits will be derived from the system inventory and recommended and constructed improvements. The project will make it possible for the Village and the Town to address long standing flooding issues that will only become worse as the climate changes. The management plan will generate a number of specific engineered designs that will be constructed and others that will be "shovel ready."

Risk Reduction Analysis

Improved stormwater collection and recharge will eliminate flooding from stormwater runoff in all but the most severe storm events. The associated risk to public and private assets will be reduced and roadways utilized for evacuation made passable and safer.

Superstorm Sandy flooding[i]

General Timeframe for Implementation

Design and construction of numerous stormwater projects can be completed within one to three years of the start of project implementation.

Regulatory Requirements Related to Project

Projects that are located in or adjacent to existing wetlands will require a permit from the NYS DEC and the Town of Brookhaven (if outside the incorporated Village of Mastic Beach.) Acquisition of properties for stormwater storage and recharge will require the consent of the property owner, which could be Suffolk County, as it owns numerous properties in the Village.

Jurisdiction

Most of the area will come under the jurisdiction of the Village of Mastic Beach. Some areas will be the responsibility of the Town of Brookhaven.

Mapping Information Source Summary and References

Maps throughout this report were created using ArcGIS® software by Esri. ArcGIS® and ArcMap™ are the intellectual property of Esri and are used herein under license. Copyright © Esri. All rights reserved. For more information about Esri® software, please visit www.esri.com.

[1] Basemaps

The primary source of basemaps was Microsoft Virtual Earth, also known as Bing Maps. These include street, topography, and aerial imagery maps.

Microsoft Virtual Earth [computer map]. Scale As Shown. Redmond, WA: Microsoft Corporation, 2016. www.microsoft.com/maps/. (Date Viewed As Shown).

[2] Village Boundary

This data set delineates the municipal boundary of the Incorporated Village of Mastic Beach. The data was provided by Suffolk County Department of Information Technology.

Suffolk County Village Boundaries [computer map]. Scale As Shown. Hauppauge, NY: Suffolk County Department of Information Technology, 2010.

[3] Study Area Boundary

This data set delineates the boundary of the drainage study area. The area includes the Village of Mastic Beach and Smith Point of Shirley, but does not include certain areas such as Smith Point Park, Johns Neck Wetlands and William Floyd Estate. It was created based on plan information provided by GOSR and the boundary of the Incorporated Village of Mastic Beach.

[4] Outfalls

Approximate outfall locations were provided by two different agencies. The first data set was provided by the Incorporated Village of Mastic Beach personnel in the form of a marked-up paper map indicating all of their known outfalls within the village. The second set of outfalls were provided by Suffolk County Department of Public Works. This data was developed to aid in illicit discharge detection and elimination from Suffolk County's MS4 as well as the eventual storm sewer system mapping of all County-owned stormwater structures. This data set was developed in conjunction with the Cornell Cooperative Extension of Suffolk County. The data set includes attribute information about each outfall such as the receiving water body name, whether that water body is impaired, the date it was located, as well as the type, material and size of the outfall.

[5] Mosquito Ditches

The Incorporated Village of Mastic Beach personnel provided a marked up paper map indicating all of their known locations of mosquito ditches within the village. After review in correlation with aerial imagery, since the mosquito ditches are visible from aerial imagery, we discovered that the provided information was mostly inaccurate. A map of the mosquito ditches was subsequently obtained from Suffolk County Department of Public Works. This map was more comparable to the aerial imagery, but since it was made in 1978, had some minor discrepancies. Using the map from SCDPW in conjunction with the aerial imagery, the mosquito ditches were approximately digitized and a new data set was created.

[6] Inlets

Approximate drainage inlet locations were provided by two different agencies. The first data set was provided by the Incorporated Village of Mastic Beach personnel in the form of a marked up paper map indicating all of their known inlets within the village. There were a total of 214 points identified and digitized using this data source. The second set of inlets were provided by Suffolk County Department of Public Works. This data includes County stormwater inlets along William Floyd Parkway. It was developed based on a set of record plans from 1973 for the drainage system along the Parkway. There was a total of 538 inlets in the entire data set, but only approximately 80 are within the study area. The attribute data included the type of inlet. It was later determined using the record drawings from Suffolk County that all of these inlets were part of a self-contained drainage system jfor the Parkway, and is not connected to any other drainage system.

[7] Pipes

Approximate drainage pipe locations were provided by two different agencies. The first data set was provided by the Incorporated Village of Mastic Beach personnel in the form of a marked up paper map indicating all of their known pipes that interconnected with inlets and outfalls previously described within the village. The pipes were approximately digitized. The second set of pipes was obtained through the Town of Brookhaven. This data includes pipes interconnected with the inlets and outfalls previously described at various locations in the vicinity of the study area. The attribute information includes the diameter, material, and condition. No information was provided on how this data set was developed.

[8] Storm Detention Areas

The Town of Brookhaven provided a data set of the storm detention basins in the vicinity of the study area. A total of 63 are within the data set and the attribute information includes the tax map number, address, acreage, and generalized dimensions. Based on field review, most of the sites described as detention basins do not exist.

Storm Detention Areas [computer map]. Scale As Shown. Farmingville, NY: Town of Brookhaven Planning and Environment Department, 2015.

[9] Street Centerlines

Street centerlines were provided by the Suffolk County Real Property Tax Service. This data set is for reference information only.

Suffolk County Street Centerlines [computer map]. Scale As Shown. Riverhead, NY: Suffolk County Real Property Tax Service Agency, November 2015.

[10] Public Lands

The Town of Brookhaven provided a data set of what it determined to be "public lands". Approximately 573 exist in the vicinity of the study area. The attribute information provides the tax map number as well as which entity owns the land, either Fire Districts, LIPA/LILCO, USPS, Town, County, State or Federal as well as separate categories for "Nonprofit Conservation", "Nonprofit educational" and "Affirmative Easement". No information is available on how this data set was developed or if any of the properties are in a process of being acquired.

Public Lands [computer map]. Scale As Shown. Farmingville, NY: Town of Brookhaven Planning and Environment Department, 2015.

[11] Open Space

Open space parcels were identified by the Suffolk County Department of Economic Development and Planning, Division of Planning & Environment and collected in a data set. The data set was clipped to the study area and ownership is identified by Town, County, State and Federal entities. There are 1, 48, 61, and 17 properties in each data set, respectively. The attribute information only includes tax map number and acreage.

Suffolk County Open Space [computer map]. Scale As Shown. Hauppauge, NY: Suffolk County Department of Economic Development and Planning, Division of Planning & Environment, 2015.

[12] Survey Areas

Using engineering judgement, H2M highlighted certain areas for the purposes of further investigation and survey for the development of a stormwater drainage model for this study. This area delineation data set was provided to the subcontractor surveyor to streamline the deployment of field surveying crews.

[13] Subsurface Drainage Infrastructure

H2M's subcontractor, Gayron deBruin, performed surveying of the drainage infrastructure in the areas delineated by the "Survey Areas" map. The survey generated GIS data files for drainage structures (manholes, catch basins/inlets, and outfalls), pipes (connecting between structures), and "pipe ends" (pipes confirmed to be connected to one structure, but no other). The attribute data included rim and invert elevations.

[14] 15 Houses Acquired by NY Rising (sold to Brookhaven and TNC)

Locations provided by The Nature Conservancy.

Village of Mastic Beach, 23 NY Rising Buyout Parcels + 15 NY Rising Acquisition parcels sold to Town of Brookhaven and TNC. Arlington, VA: The Nature Conservancy. 2015.

[15] NY Rising Buy-Out Program Parcels (Closed by 1/1/16)

Locations provided by The Nature Conservancy.

Village of Mastic Beach, 23 NY Rising Buyout Parcels + 15 NY Rising Acquisition parcels sold to Town of Brookhaven and TNC. Arlington, VA: The Nature Conservancy. 2015.

[16] 62 Acquisition Parcels

A list of 62 parcels that are proposed for open space acquisition in a partnership with NRCS and Suffolk County was provided by the Suffolk County Department of Economic Development and Planning.

[17] National Wetlands Inventory

The US Fish & Wildlife Service developed a GIS layer compiling and delineating all wetland areas in the entire country.

U.S. Fish and Wildlife Service. July 2016. National Wetlands Inventory website. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. http://www.fws.gov/wetlands/. July 2016.

[18] NYS Freshwater Wetlands
NYSDEC has established certain waterbodies and the lands nearby as freshwater wetlands and all construction occurring within 300 feet must be permitted. A GIS layer is available delineating these areas.

NYSDEC Division of Fish, Wildlife and Marine Resources, Regulatory Freshwater Wetlands, Albany, NY: New York State Department of Environmental Conservation. http://www.dec.ny.gov/lands/5124.html*. January 1999.*

[19] NYS Tidal - Coastal Wetlands
NYSDEC has established all coastal and tidal areas to be considered wetlands and all construction occurring within 300 feet must be permitted. A GIS layer is available delineating these areas.

NYSDEC Division of Fish, Wildlife and Marine Resources, Tidal Wetlands, Albany, NY: New York State Department of Environmental Conservation. http://www.dec.ny.gov/lands/4940.html. November 2005.

[20] Groundwater Contours
The U.S. Geological Survey (USGS), in cooperation with State and local agencies, systematically collects groundwater data at varying measurement frequencies to monitor the hydrologic conditions on Long Island, New York. Each year during April and May, the USGS conducts a synoptic survey of water levels to define the spatial distribution of the water table and potentiometric surfaces within the three main water-bearing units underlying Long Island -- the upper glacial, Magothy, and Lloyd aquifers (Smolensky and others, 1989) -- and the hydraulically connected Jameco (Soren, 1971) and North Shore aquifers (Stumm, 2001). These data and the maps constructed from them are commonly used in studies of Long Island's hydrology and are utilized by water managers and suppliers for aquifer management and planning purposes.

Como, M.D., Noll, M.L., Finkelstein, J.S., Monti, Jack, Jr., and Busciolano, Ronald, 2015, Water-table and potentiometric-surface altitudes in the Upper Glacial, Magothy, and Lloyd aquifers of Long Island, New York, April-May 2013: U.S. Geological Survey Scientific Investigations Map 3326, 4 sheets, scale 1:125,000, 6-p. text, http://dx.doi.org/10.3133/sim3326

[21] Elevation Contours
2-foot elevation contours for the study area generated by H2M's subconsultant, GeoMaps.

[22] Drainage Complaints
This layer comprises locations which are known to experience flooding or ponding conditions. It was developed based on input from the Village, Town, and public comments. In addition, locations were also identified by H2M during site visits.

[23] Sea Level Rise
Data sets were created by the NOAA Office for Coastal Management to determine areas that will be inundated as a result of sea level rise in increments of 1-foot up to 6 feet.

NOAA Office for Coastal Management, Sea Level Rise and Coastal Flooding Impacts, National Oceanic and Atmospheric Administration. Sea Level Rise. https://coast.noaa.gov/slr/. December 2015.

[24] Building Footprints
GIS file prepared by the Suffolk County Department of Information Technology outlining most of the above grade structure footprints in the county.

Suffolk County Building Footprints [computer map]. Scale As Shown. Hauppauge, NY: Suffolk County Department of Information Technology, 2015.

[25] Soil Survey
The NRCS soil survey provides generalized soil data and information for more than 95% of the country's counties. Soil surveys are intended for general, large-scale analyses.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. http://websoilsurvey.nrcs.usda.gov/. July 2016.

[26] National Flood Hazard Layer
This FEMA dataset represents the current effective flood data for the country, where maps have been modernized. It is a compilation of effective Flood Insurance Rate Map (FIRM) databases and Letters of Map Change (LOMCs). The NFHL is updates as studies go effective.

National Flood Hazard Layer [computer map]. Scale As Shown. Washington, D.C.: Federal Emergency Management Agency, 2016. http://hazards.fema.gov/gis/nfhl/rest/services/public/NFHL/MapServer. *(Date Viewed As Shown).*

[27] Address Points
GIS file of address points for all of Suffolk County, prepared by Suffolk County Department of Information Technology.

Suffolk County Address Points [computer map]. Scale As Shown. Hauppauge, NY: Suffolk County Department of Information Technology, 2015.

Mastic Beach/Smith Point of Shirley - Stormwater Management Plan
Village/Town Officials Meeting
November 18, 2016

Agenda

1. Welcome / Introductions
2. Project Overview
    a. Purpose and Goals
    b. Study Area/Extents
    c. Public Input Summary
    d. Inventory of Existing Infrastructure
3. Assessment / Evaluation
    a. Characteristics of Study Area
        i. Sea level rise consideration
    b. Methodology
    c. Mitigation Strategies
4. Recommendations
    a. Project Rankings
    b. Probable Costs
5. Questions?
6. Next Steps
    a. Finalize Report
    b. Selection of Projects/Areas
    c. PMA

GOSR Mastic Beach / Smith Point of Shirley

Stormwater Management Plan Report

DASNY Project No. 3264609999

Name	Company / position	Telephone No.	Email Address	Signature
1.) PETER WRENN	DASNY Design	(518) 257 3230	pwrenn@dasny.org	PDW
2.) BILL SPITZ	HGA w/GOSR	631 806 4264	bspitz@hga-llc.com	
3.) VALERIE SCOPAZ	GOSR	646 463 1622		VS
4.) MIKE KEFFER	HZM	631 756-8000	mkeffer@hzm.com	
5.) SEAN CALLAHAN	HZM	631 756 8000	SCALLAHAN@HZM.com	
6.) Gregg Kelsey	Town of Brookhaven	631 451 6490	gkelsey@brookhaven.org	
7.) Thomas Kalosh	Town of Brookhaven	631-451-6562	tkalosh@brookhaven	
8.) Kaitlin Giannakos	GOSR		Kaitlin.Giannakos@stormrecovery.ny.gove	
9.) ~~Michael Kocher~~	~~Brookhaven Highway~~	—		
10.) Michael Kocher	Brookhaven Highway	631-767-9282	mkocher@brookhaven.org	
11.) Bonnie LAfont	HGA / SME	985-432-0334	blafont@hga-llc.com	
12.) Steve Tricarico	TOB	631-451-9242	stricarico@brookhaven	
13.) Kevin Geiger	TOB	631-451-9200	kgeiger@brookhave	
14.) Maureen Sperry	Village of Mastic Beach	631.281.2326	M.sperry@masticbeachvillageny.gov	
15.)	Village Mastic Beach	772 1252		
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Mastic Beach-Smith Point of Shirley Stormwater Management Plan Report Review

Village & Town Officials Meeting

November 18, 2016

Purpose & Need for Study

Prepare a stormwater management plan which identifies and describes specific resiliency measures to mitigate flooding in effected areas from stormwater runoff and high tide conditions.

Project Goals

- Provide a comprehensive analysis of the existing stormwater drainage infrastructure and make recommendations for improvements.
- Install check valves on outfalls in tidal areas to minimize tidal flooding of low lying areas.
- Improve pipe capacities and inlet capacities.
- Implementation of green infrastructure.
- Identify properties for stormwater storage and recharge.

Public Input Summary

- Meetings with Town and Village on 9/11/15 & 1/21/16
- Committee Meeting on 1/21/16
- Public comments transmitted by email
- Mapping available for public review and input after 1/21/16 (from 1/26-2/9)

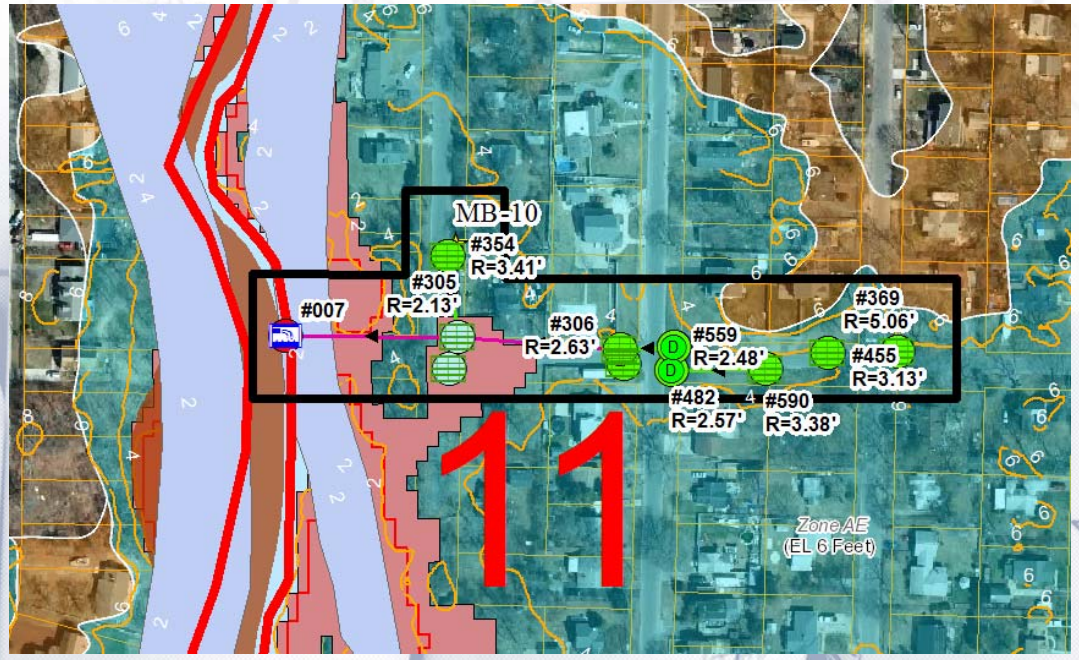
Inventory of Existing Infrastructure

- Storm Drainage Inventory
  - 453 drainage structures
  - 26,000 linear feet of piping

- Supplemental Investigations

Characteristics of Study Area

- Topography
- Groundwater and soils
- Wetlands
- Floodplain
- Sea level rise



Groundwater & Soils

- Groundwater depths 0-10 ft
- Soil profiles for 30 properties
- Well and poorly graded sand, sand with silty fines and sand with clayey fines

Wetlands

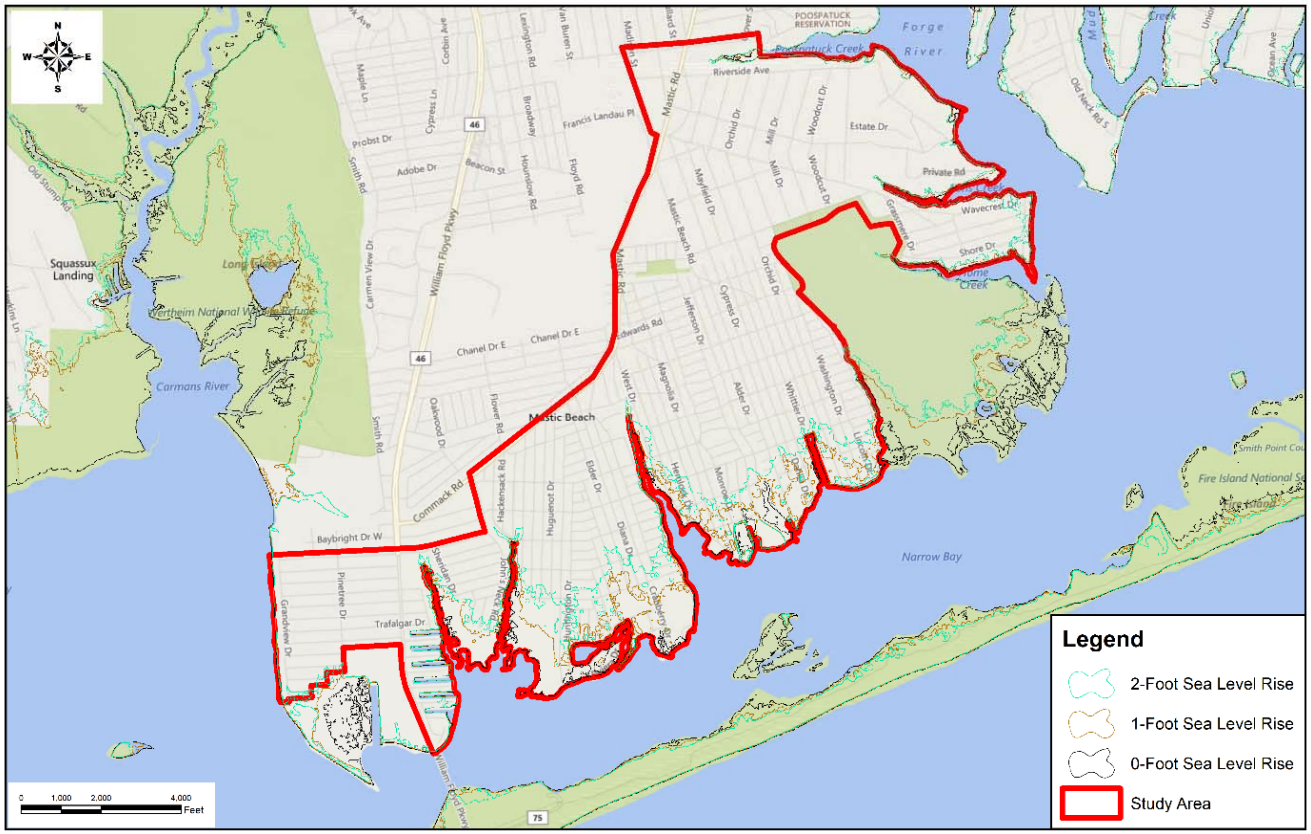
N
W
E
S
Legend
Study Area
NYS Freshwater Wetlands
Tidal - Coastal Wetlands
0 1,000 2,000 4,000
Feet

Floodplain

- 100-yr flood zone: 1000 acres/34% of study area
- Flood elevations range up to 8 ft & 10 ft due to wave action

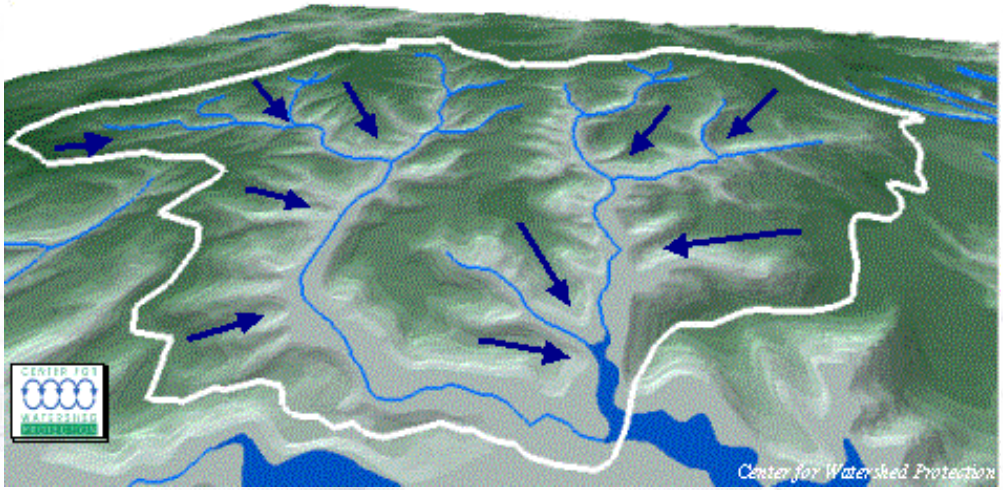
Sea Level Rise

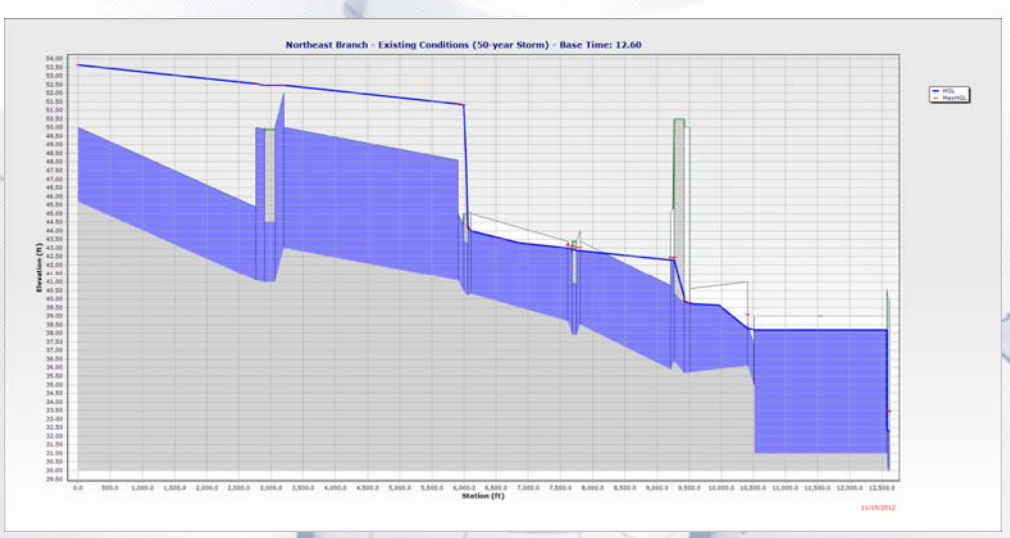
Sea Level Rise Impact			
Sea Level Rise	Area Effected	Structures Impacted	Percent of Study Area
0 ft	95 acres	21 buildings	3.31%
1 ft	325 acres	98 buildings	11.33%
2 ft	543 acres	553 buildings	18.93%



Methodology

- Identify tributary watersheds
- Evaluate land uses
- Develop computer models
- Analyze pipe networks and capacities





Mitigation Strategies

- 13 strategies considered
- 11 utilized

Stormwater Mitigation Strategies		
Strategy	Benefits	Challenges
Replacing existing pipes which are undersized, set at hydraulically inefficient elevation or are damaged	• Improves pipe conveyance capacity • Reduces head loss in pipe flow which reduces flooding.	• Moderate construction cost, for limited sections of pipe runs, however, cost can be very high if entire systems are replaced
Install drywells	• Can provide small to moderate storage of storm water runoff	• High ground water elevations throughout the study area limit their effectiveness
Install horizontal leaching chambers	• Can provide small to moderate storage of storm water runoff • Can provide similar improvements as drywells but can be installed in areas with shallow groundwater • Can be installed within the existing Town-owned right-of-way	• Existing utilities may limit the quantity of chambers that can be installed
Hydrodynamic separators	• Remove sediments and other pollutants • Small footprint area	• Routine scheduled maintenance required to maintain performance
Vacuum and removal of sediment and debris in pipes and structures which are tidally influenced	• Improves conveyance of stormwater	• Cost associated with disposal of debris to an approved landfill • Maintenance on annual basis or after major storm events
Establish a more targeted maintenance program on mosquito ditches with SCDPW Vector Control	• No cost to Village or Town	• New ditches cannot be created • Maintenance in ditches is limited to hand labor

Recommendations

- Existing drainage systems (28)
- Flooding locations in Mastic Beach (35) and Smith Point of Shirley (11)
- Summary
  - Existing conditions
  - Analysis of system (hydraulic grade line and flooding location)
  - Recommended solution

Project Rankings & Probable Cost

- Major road routes
- Shallow groundwater
- Extent of property flooding
- Level of maintenance
- Sea level rise
- USACE road raising
- Environmental permitting

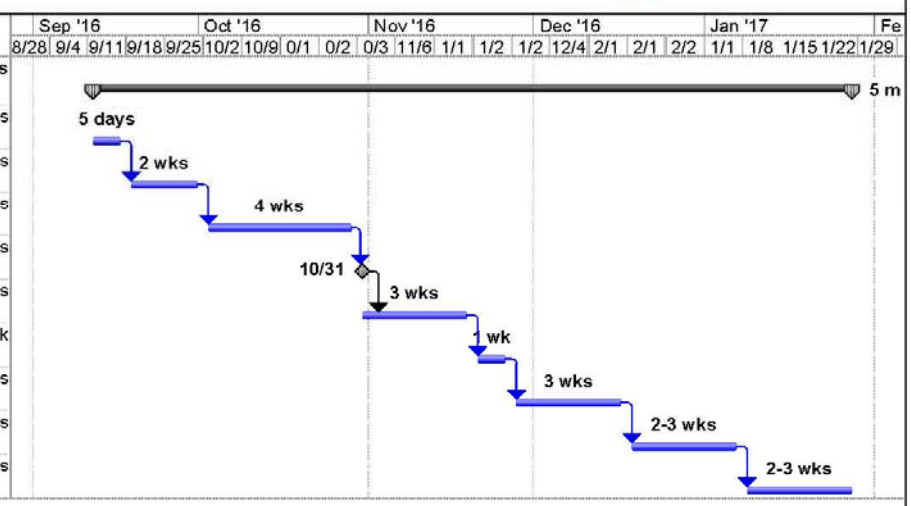
Project Timeline

Mastic Beach - Smith Point of Shirley
Comprehensive Drainage Study

Project Timeline

architects + engineers

ID	Task Name	Duration
1	PROJECT TIMELINE	5 months
2	SUPPLEMENTAL INVESTIGATIONS	5 days
3	STORMWATER MODELING	2 wks
4	DEVELOPMENT OF RECOMMENDATIONS	4 wks
5	ISSUE OF DRAFT REPORT (OCT 31)	0 days
6	STAKEHOLDER REVIEW OF DRAFT REPORT (est.)	3 wks
7	STAKEHOLDER PROGRESS REVIEW MEETING (est.)	1 wk
8	ISSUANCE OF FINAL REPORT (est.)	3 wks
9	IDENTIFICATION OF PROJECTS SELECTED (est.)	3 wks
10	DEVELOP PROJECT SCOPE, SCHEDULE & BUDGET (est.)	3 wks



Mastic Beach - Smith Point of Shirley Comprehensive Drainage Study
Date: 09/26/2016
File Name: Mastic Beach-Smith Point of Shirley

Task
Split
Progress
Milestone
Summary
Project Summary
External Tasks
External Milestone
Deadline

thank you

Governor's Office of Storm Recovery

DASNY
DORMITORY AUTHORITY STATE OF NEW YORK

MEETING MINUTES

Project: Mastic Beach-Smith Point of Shirley Stormwater Plan Report Presentation

Date and Location: November 18, 2016
Mastic Beach Village Hall

Minutes Date: December 2, 2016 – Final

Present	Name	Telephone	E-Mail
Y	Maura P. Spery, Mayor, Mastic Beach Village (MS)	631-432-5668	m.spery@masticbeachvillageny.gov
Y	Frank Perrino, Mastic Beach Village (FP)	631-772-1252	N/A
Y	Steve Tricarico, Deputy Supt., TOB (ST)	631-451-9242	stricarico@brookhaven.org
Y	Patricia Kaloski, Legislative Aide, TOB (Panico) (PK)	631-451-6502	pkaloski@brookhaven.org
Y	Gregg Kelsey, Assistant Town Engineer, TOB (GK)	631-451-6490	gkelsey@brookhaven.org
Y	Michael Kochen, Hwy Construction Super, TOB (MK2)	631-767-9282	mkochen@brookhaven.org
Y	Kevin Geiger, Deputy Superintendent TOB (KG2)	631-451-9200	kgeiger@brookhaven.org
Y	Valerie M. Scopaz, Community Planner, GOSR (VS)	646-463-1622	valerie.scopaz@stormrecovery.ny.gov
Y	Kaitlin Giannakos, Sr. Project Manager GOSR (KG)	631-396-0431	kaitlin.giannakos@stormrecovery.ny.gov
Y	Bill Spitz, Sr. Project Manager, HGA w/ GOSR (BS)	631-806-4264	bspitz@hga-llc.com
Y	Bonnie Lafont, Subject Matter Expert, HGA (BL)	985-438-0336	blafont@hga-llc.com
Y	Peter Wrenn, Engineer/DPM, DASNY (PW)	518-257-3230	pwrenn@dasny.org
Y	Sean Callahan, PE, Senior Engineer, H2M (SC)	631-756-8000	scallahan@h2m.com
Y	Michael Keffer, Deputy Division Director, H2M (MK)	631-756-8000	mkeffer@h2m.com

Comments prior to H2M Presentation

- Introductions were made by everyone in attendance and a sign in sheet was circulated.
- MS stated that the Town should become fully engaged on the project, given the recent vote by the community to dissolve the Village on November 16. MS noted that the Village is targeting to dissolve in April 2017.
- PW stated that DASNY will oversee design and construction of the projects which will be identified and selected by the Town and Village.
- PW commented that the project funding is disbursed through a reimbursement process which flows through DASNY. HGA/GOSR review requests and DASNY distributes funds.
- Contract procurement goes through DASNY.
- A Project Management Agreement (PMA) will need to be in place between DASNY/GOSR and beneficiaries, before the next phase of work commences.
- The Town will take over projects from an operations and a maintenance perspective upon completion of the project.
- PW stated that the Village can remain a stakeholder in the project until it officially dissolves.

Questions and Comments during H2M Presentation

- MK and SC presented a PowerPoint presentation to the group. H2M will provide a copy of the PowerPoint presentation to attendees via email.
- MS stated she understood that the USACE road raising alternative is off the table based on her recent discussions with USACE.

- MS commented that NYSDEC may be considering a revision to their policy regarding discharging storm runoff into wetlands.
- Town of Brookhaven questioned the high probable cost estimates provided in the Report. MK/SC explained that mobilization, maintenance of traffic, survey, subsurface utility mark-out and engineering design were built into the probable cost estimates. Land acquisition and easement costs are not included. Also, MK noted that at this time the probable costs should be viewed as an order of magnitude estimate.
- MS asked what the total costs of all projects are as presented in the report. MK stated that the approximate cost for all of the projects is $15 million.
- VS stated that approximately $2.6 million is potentially available to fund survey, design and construction of projects.
- MS stated that her community would like to see a portion of the overall funds used on beach and wetland projects. She felt there would be disappointment in the community if all of the funds were expended on drainage improvements. The community would like to enjoy and benefit from other projects as well.
- BL stated that CDBG funds must be used for both design and construction. Funds cannot be used exclusively for design engineering. The community is responsible for selecting the projects. Procurement of these services is handled through DASNY.
- MS commented that the report identifies existing storm systems in the area, community identified localized flooding areas, and associated problems/issues with recommendations.

Green Infrastructure (GI)

- In response to a question of why no green infrastructure was incorporated into design, MK explained that, although the vegetative component was not present in GI solutions presented, the GI element will still be accomplished through the use of leaching chambers and drywells. These structures are recognized by NYSDEC as GI. Constraints preventing vegetative GI from being incorporated into the design include extremely flat topography, high groundwater, floodplain location, and proximity to on-site sanitary systems.
- BS suggested that MK's explanation be incorporated into the H2M report, as the use of GI in the project must be evaluated due to federal funding requirements. The report must address GI in order to clear the required environmental review.
- BS and MK commented that Village and Town staff should be consulted on the stormwater model findings to determine how accurate and how dire flooding situations are, and that the project ranking could be adjusted if necessary. BS referred to this action as "ground truthing."
- BS also suggested that a 1-yr storm event be modeled for projects selected as part of the ground truthing exercise.

Suggestions re: Report Recommendations

- Town of Brookhaven representatives stated that in low-lying areas of Smith Point of Shirley a high water table (approximately 2 ft below the surface) prohibits the installation of catch basins. Once the hardpan layer is broken, groundwater swells onto the roadway during tidal events.
- PW asked if the ranking categories identified in the Report were acceptable and complete. If so, the projects could be ranked in tiers for further evaluation by the Town and Village.

- GK suggested installing separate drainage structures/manholes to house tideflex check valves.
- PW stated that the Town/Village should review the recommendations and bring all potential issues to the table, so H2M can adjust the recommendations and planning strategy in the report as necessary.
- BS stated that the report is currently considered a Draft Report so H2M can make changes or additions if they feel they need to in response to comments they receive. There does not need to be 100% agreement by stakeholders on every recommendation in the report for it to be deemed complete. Municipal officials can decide how they want to utilize the report as a guidance document in future years.
- BS commented that the finished report will be considered an Advisory Document containing engineering recommendations to be either accepted or rejected by the Town. Recommendations in the report are not necessarily "adopted" by the Town. Completion of the report does not mean that the report has been adopted.
- GK suggested it might be a good idea to modify project rankings that impact the largest part of the community (e.g. repairing systems in heavily traveled roadways). BS countered that this approach may not be the appropriate way to go. BS shared his experience from other communities where projects with the lowest cost but largest impact are typically pursued. He suggested not weighting projects based on size, impact or cost. It should be left to the Town to consider these variables as well as political impacts and select projects to construct accordingly.
- FP with Mastic Beach DPW stated that most of the existing drainage pipes are galvanized steel and are failing due to age. He suggested that pipe replacements be plastic pipe as they have a longer lifespan.
- Comment was made that projects in the report which are constructed should be implemented in such a way that they do not have to be demolished and/or reconstructed should the Town come in to make future improvements.
- MS shared updated maps from USACE which showed homes identified for non-structural improvements since USACE reportedly will not be pursuing a road raising project.
- MS stated that roads should be removed from the Village where there are no residential homes, which would allow more wetlands to be constructed. She envisions areas near the shoreline which may one day be served by boardwalks and not roadways due to sea level rise. She questioned how much funding should be spent in low lying areas given the encroachments from future sea level rise.
- MS discussed that she would like to see the Village become a biodiversity community lab, so the future of the community can be properly planned.
- PW stated that the project cannot be funded with a mix of funds from DASNY and the Town.
- BS stated that the Town may be able to do many of the projects cheaper given the requirements associated with federal funding.

Schedule

- MS stated that the final draft report will be used as a guidance document in identifying select projects going forward.
- There is a time constraint on the funding, in that project construction must be completed by 2019.
- PW commented that the target for finalizing the report is mid-late December.

- H2M will distribute the PowerPoint presentation on Monday 11/21. Meeting minutes will be issued before Thanksgiving.
- Attendees will review the report and provide comments to H2M within 3 weeks of the November 18 meeting date. PW will send out an email notifying participants of the review period and when comments are due back to DASNY/H2M.

These meeting minutes were prepared by H2M and represent an overview of the matters discussed. If there are any errors, omissions, discrepancies, inaccuracies, or required changes to these minutes, please notify Michael Keffer within five business days of receipt of the draft meeting minutes at mkeffer@h2m.com. After five business days from receipt, these meeting minutes shall be considered correct and final.

Respectfully submitted,

H2M architects + engineers

Michael W. Keffer, P.E., LEED AP
Assistant Vice President
Deputy Director of Civil Engineering

Enclosure: Attendance Sign In Sheet

Distribution: All Attendees

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GOSR Mastic Beach / Smith Point of Shirley

Stormwater Management Plan Report

DASNY Project No. 3264609999

Name	Company / position	Telephone No.	Email Address	Signature
1.) PETER WRENN	DASNY Design	(518) 257 3230	pwrenn@dasny.org	PDW
2.) BILL SPITZ	HGA w/GOSR	631 806 4264	bspitz@hga-llc.com	
3.) VALERIE SCOPAZ	GOSR	646 463 1622		VS
4.) MIKE KEFFER	HZM	631 756-8000	mkeffer@hzm.com	
5.) SEAN CALLAHAN	HZM	631 756 8000	SCALLAHAN@HZM.com	
6.) Gregg Kelsey	Town of Brookhaven	631 451 6490	gkelsey@brookhaven.org	
7.) Thomas Kalosh	Town of Brookhaven	631-451-6562	tkalosh@brookhaven	
8.) Kaitlin Giannakos	GOSR		Kaitlin.Giannakos@stormrecovery.ny.gove	
9.) ~~Michael Kocher~~	~~Brookhaven Highway~~	—		
10.) Michael Kocher	Brookhaven Highway	631-767-9282	mkocher@brookhaven.org	
11.) Bonnie LAfont	HGA / SME	985-432-0334	blafont@hga-llc.com	
12.) Steve Tricarico	TOB	631-451-9242	stricarico@brookhaven	
13.) Kevin Geiger	TOB	631-451-9200	kgeiger@brookhave	
14.) Maureen Sperry	Village of Mastic Beach	631.281.2326	M.sperry@masticbeachvillageny.gov	
15.)	Village Mastic Beach	772 1252		
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Mastic Beach/Smith Point of Shirley - Stormwater Management Plan Report
(Issued for Review and Comment)
January 31, 2017

On November 18, 2016, H2M presented the Mastic Beach/Smith Point of Shirley - Stormwater Management Plan Report (dated October 31, 2016) to the Town of Brookhaven, Village of Mastic Beach, GOSR and DASNY. During the presentation, the Town and the Village were invited to submit comments on the report which are summarized with a respective response below:

Name of Reviewer: Gregg G Kelsey, P.E.
Organization/Position: Town of Brookhaven Highway Department / Assistant Town Engineer

<u>Comment(s)</u>

1. Road raising alternative map, Figure III-1, should be modified to show any new information, or be noted that at this time, additional non-structural treatments are being proposed by USACE.

Response: At this time, the information as shown in Figure III-1 is the latest information available as presented by the Army Corps of Engineers in its Fire Island to Montauk Point Reformulation Study (Draft Hurricane Sandy General Reevaluation Report, dated July 2016).

2. Stormwater discharge to wetlands, as being discussed with NYSDEC, if deemed acceptable, should be encouraged where the location provides the opportunity to discharge to Town, County or NY Rising properties.

Response: At this time, we are not aware of any NYSDEC draft regulatory/policy changes that would expressly allow stormwater discharges into regulated wetlands. However, discharges to regulated wetlands are not currently prohibited, but are subject to the various Federal and State tidal and freshwater permitting requirements. Depending on the project location one or more of the following permits may be required at locations identified in the report: NYSDEC Article 24 permit, NYSDEC Article 25 permit, U.S. Army Corps of Engineers (USACE) Section 404 permit, USACE Section 10 permit, and/or USACE Nationwide Permit. Although stormwater discharge to regulated wetlands may be an option, the extent and difficulty of obtaining the permit(s) could be challenging given site specific conditions and the improvement proposed. Given these unknowns, wetland permitting was factored into the rankings matrix as a consideration.

3. The Town would like the southern section of Cranberry Drive, south of Iris Road, to be reviewed for flooding and drainage impacts during a storm event. Access to the waterfront facility at the south end is a priority. A road raising with storm water shedding

to the existing shoulders and adjoining Town, County or NY Rising property could provide a solution.

Response: The flooding in this area is tidally influenced as it is a very, low-lying area surrounded by wetlands and no drainage infrastructure exists in the area. Since this is not a stormwater drainage issue, this location and flooding problem are outside of the scope of the current project.

4. In section 4 of the report, can the existing conditions of each project location appear on the left side of the page, with the associated aerial/map and the proposed recommendations and solution appear on the right side of the page? It would be easier to follow and review each project and recommendation if they were presented in this fashion.

Response: H2M evaluated the suggested format change; however, the suggested format made the report difficult to read. As an alternative to this suggestion, the report will be modified with the existing condition summary narrative and graphics placed on the left side of the report (even numbered pages) and the recommendation narrative and graphics placed on the right side of the report (odd numbered pages) which improves the overall readability of Section 4.

5. Are the balance of the homes on Cranberry Drive, south of Iris Road being acquired by NY Rising?

Response: The New York Rising Buyout and Acquisition Program is no longer accepting applications. Remaining properties that do not have an active application with the program may not be acquired.

6. High tide in this area is about 1.6 feet above sea level. Is this accurate or is there a known correct high tide elevation established here, in the project area, or at various points on the shoreline?

Response: High tide is an elevation which fluctuates daily due to numerous conditions. When performing the engineering analysis and modeling of stormwater pipes, the high tide elevation was not utilized. Instead, Mean Higher High Water (MHHW) was used, which is based on historical tide level data from the National Oceanographic and Atmospheric Administration (NOAA) tide gauge station located at Smith Point Bridge. Refer to pages 8-9 of the report which discusses the Mean Higher High Water elevation for the project which was used in the analysis.

7. Highway just recently reviewed all Village roads for status of pavement. From this review we have identified a few desired locations for future road resurfacing. We would like to give projects in these areas a higher ranking to reflect how Highway can follow the DASNY project with a Town paving project, possibly saving funds but certainly providing a final product with little to no pavement maintenance.

Response: We will provide the Ranking Matrix from Section 5 in a Microsoft Excel spreadsheet (.xls) file format and insert an additional column titled "Roadway Resurfacing". The Town will then assign a ranking score to each project listed based on prior resurfacing improvements or future roadway resurfacing schedule. H2M will provide a suggested ranking scale with descriptions to assist the Town in scoring the projects based on past and future resurfacing projects which overlap with the project location.*

8. Contrary to the above statement, we have identified many roads that would not see road resurfacing for many years, as they were recently paved. We would like to give projects in these areas a lower ranking to reflect how Highway would propose projects in these areas near the end of the pavement cycle, to coordinate the drainage projects with the pavement resurfacing projects.

Response: See response to Comment 7 above.

9. At this moment we will not comment on any projects in the Smith Point area of the report as funding for construction in this area will not be part of the DASNY project. We certainly will use this information for other Town or Grant projects in the future.

Response: It is our understanding that the Town and Village are in agreement that the implementation phase of the project will be solely within the jurisdictional boundaries of the Village of Mastic Beach and not Smith Point of Shirley.

10. Here is a list of projects that are in areas where new pavement is identified: MB-01, MB-02.

Response: See response to Comment 7 above.

11. Projects that improve access to resident's sole source of access to schools, shopping, etc. should be given a higher priority.

Response: The suggested purpose of introducing additional ranking categories is to refine the project rankings. The categories identified by the Town are considered very subjective, such as described in the Comment 11. While the intent of the Town's request is understood, these proposed categories to the Ranking Matrix are outside the project scope. H2M will

provide the Ranking Matrix from Section 5 in an Excel (spreadsheet) file format to the Town if they desire to add more ranking categories to assist in their final assessment and prioritization of prospective projects.

12. Projects that do not improve to resident's sole source of access, but improve a secondary access that can be avoided in a storm or coastal event, should be given a lower priority.

Response: See response to Comment 11 above.

13. A desired goal of this report should be to identify and reach a road rising effort to meet the estimated 2050 sea level rising criteria as a minimum, approximately 9". All outfall pipes in the project area should be equipped with check valves or be able to be low cost retrofitted in 20 to 30 years.

Response: This report acknowledges sea level rise in Section II.F which is projected to range from 2" to 23" without rapid ice melt between the periods of 2020 and 2080. Should sea level rise occur to the extent projected, many of the roadways in low-lying areas along the shoreline will be impacted as depicted in Figure II-7 of the report. We understand the Town's intent to raise roads near shoreline areas which would be subject to tidal influences and sea level rise. However, the evaluation of raising roads was a separate project identified in the Mastic Beach/Smith Point of Shirley NYRCR Plan, dated March 2014, and is outside this project's scope. Refer to page 116 of the report which references the road raising project in the Mastic Beach/Smith Point of Shirley NYRCR Plan.

In an effort to develop cost-effective drainage solutions, the report proposes to only install check valves in outfall pipes where the elevation of existing upstream catch basins is lower than the immediately surrounding area, effectively creating an isolated basin with no real overflow path during high tide conditions at these locations. The report identifies nine (9) outfalls where this occurs. The Town may desire to add more checkvalves to the remainder of the outfalls, but we do not see the benefit of these prospective installations.

14. We hope the Village has comments on the major drainage problems and those in the high traffic areas, as the Town has not overseen the roads for 6 years.

Response: During meetings attended by the Village on September 11, 2015 and January 21, 2016, flood locations within the Village were discussed. Also, H2M conducted a field visit with the Village Mayor and DPW personnel on May 6, 2016 where flooding locations were identified. These locations have been documented within the report.

15. One location of high traffic is MB-33. This project has recently had some improvements, but needs attention and be of a higher priority due to its high volume use and a major thoroughfare for the peninsula.

Response: H2M agrees that this location needs attention, even though recent work has been completed within the cited area. It should be noted that the tributary watersheds for this location are located in both the Village and Town, which may result in prospective improvements located in both jurisdictions.

16. The ranking system should reflect the problems including visibility, traffic volume or use, and if the roadway is vital to the neighborhood for access.

Response: See response to Comment 11 above.

17. Prioritize existing outfall pipes that are metal pipes, which still need to be videoed for functionality, condition, etc. and would benefit from being converted to non-corrosive plastic pipes.

Response: The material type for existing outfall pipes are provided in Appendix B, in the Table titled "Structure Survey Data". GOSR authorized a limited amount of supplemental investigation work which was necessary to complete the engineering analysis. The supplemental investigations included additional field survey of existing drainage structures and vacuum removal of water/debris from storm structures, so that field measurements could be obtained for the stormwater model. Given there was over 5-miles of piping within the study limits, it was cost prohibitive to provide pipe condition assessments utilizing CCTV inspections. Once projects are selected for implementation, CCTV can be used effectively, when required, during the design phase to provide information regarding overall pipe conditions. For projects which involve replacement of outfall pipes, we will recommend that these pipes be replaced with non-corrosive plastic pipes.

18. The priority list should include and identify the top selected projects, at this point in the report, and include additional projects in order of importance should the bid awards come in under the engineers estimate and provide additional opportunities to complete additional projects. Another way might be to design and acquire permitting for additional projects, beyond the current identified budget limit and list the additional projects as contingency projects and only award those additional projects should the budget exist.

Response: The Ranking Matrix in Section 5 was developed to assist the Town in selecting the top projects for implementation. The ranking and scoring criteria were developed with the intention of providing an objective means to assess the importance, value and need for a project given the limited funding available. The Town (with Village input) will need to take the next step in identifying, selecting and prioritizing projects for implementation and

deciding which projects should be implemented by DASNY and those which the Town will handle on their own.

19. Maps presented in the report, upon the development of the Final Report, should be provided in full size for future planning, discussion and management.

Response: The maps presented in the report are general, graphic illustrations based primarily on publicly available GIS information. Providing the illustrations at full size is not recommended given their generality and inherent inaccuracies. H2M would make available for distribution the GIS mapping created in this report, provided a hold-harmless agreement form is signed by the requesting entity.

20. After the draft report is complete, the Town would like the opportunity to visit each site to further access the ranking of each project.

Response: We encourage the Town to visit the site as it will be helpful in their final assessment of projects and aid in their decision making, selection and prioritization of projects.

21. The goal should be to prioritize the more complicated and more involved projects for DASNY to perform the design, permitting, construction, and inspection to reach the budget limit. The ranking system needs to change to reflect this and other comments made in these comments. Some elements of the scoring might need to be modified or eliminated to reflect these new concepts. Or there needs to be 2 scoring systems, one for major projects, and another for minor projects. The major ones would be for DASNY to start and design, the minor one for the Town to handle with staff. It might be advantageous to prepare a list of projects the Town could perform, with no permitting, then a list with permitting, and rate them according to major roads, etc. Then a second list for the remainder of the projects for DASNY to construct initially.

Response: See response to Comment 11 above.

22. Regarding the ranking system, many high ranked projects are simple leaching pool installs in upland areas. Most if not all of these types of projects can be addressed with highway staff, highway requirements contracts at significantly less cost as there is little to no overhead, design, bid, etc. The scope of these un –complicated projects should be to put them on the low priority scale, unless a significant impact is observed multiple times a year (i.e., flooding across road during typical storms).

Response: See response to Comment 11 above.

Name of Reviewer: Maura Spery
Organization/ Position: Village of Mastic Beach, Mayor

23. As I have stated before I do not think that ALL $3 million of the CRZ money should all be spent on Stormwater projects. There were many other projects that the committee designated as higher priorities that would make a big difference to the community as a whole. Also if we use all $3 million for Stormwater Projects there is still a $12million deficit as far as completing the other projects.

Response: This comment is directed at GOSR and not the project team. GOSR will respond directly to the Village on this comment.

24. Please correct the Development History of Area on page 3. Mastic Beach was developed by Arthur and Warren Smadbeck as the Home Guardian Company. They started to develop Mastic Beach in June of 1926 and completed the Ten Sections of Mastic Beach in 1941.

Response: The development history as described on page 3 of the report was referenced from the Mastic Beach/Smith Point of Shirley NYRCR Plan, dated March 2014. This memo, which will be incorporated into the final report will acknowledge this correction.

25. I believe that the Army Corp of Engineers is no longer looking to make a raised road (Berm/Dike) solution in Mastic Beach but instead will be elevating and buying out homes instead. Will this have an impact on any of these projects?

Response: The engineering analysis performed in this report was based on the latest information presented in the U.S. Army Corps of Engineers 'Fire Island to Montauk Point Reformulation Study'. This Draft shows an alternative for raising roads within the Village. Should it be formally resolved on a later date that this alternative is not being pursued by the Army Corps of Engineers, the Ranking Matrix can be modified showing the elimination of this category. As mentioned previously, the Ranking Matrix from Section 5 will be provided to the Town and Village in an .xls (spreadsheet) file format, which will allow them to update and modify the matrix should Army Corps of Engineers parameters change in the future.

26. I am surprised that many of the recommendations call for a Televised inspection of the storm drain pipes. Should this not have been done as part of this report?

Response: GOSR authorized a limited amount of supplemental investigation work which was necessary to complete the engineering analysis. The supplemental investigations included additional field survey of existing drainage structures and vacuum removal of water/debris from storm structures, so that field measurements could be obtained for the

stormwater model. Given there was over 5-miles of piping within the study limits, it was cost prohibitive to provide pipe condition assessments utilizing CCTV inspections. Once projects are selected for implementation, CCTV can be used effectively when required during the design phase to provide information regarding overall pipe conditions.

27. Have we looked at removing any roads (that NYRising bought the homes and there are no longer homes on the roads) so that they can be re-established as wetlands and absorb floodwaters? Can we look at replacing some of the dirt roads with raised boardwalks? This would allow wetlands to re-establish and absorb stormwater more efficiently. There are many roads that resident have access on side streets and the road could be removed. Is there any way to look at these as options?

Response: The retreatment of roads and homes was not specifically evaluated given that the project was focused on the engineering analysis of existing stormwater infrastructure. In our opinion, road removal within an existing community where property owners reside has multiple issues associated with it, many of which extend beyond an engineering solution and would warrant a separate study of its own.

***** End of Review Comment/Response Section *****