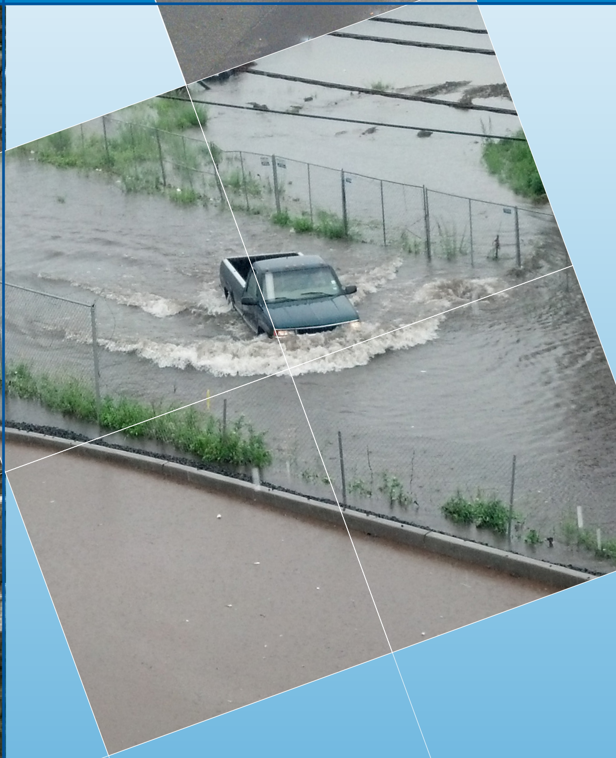
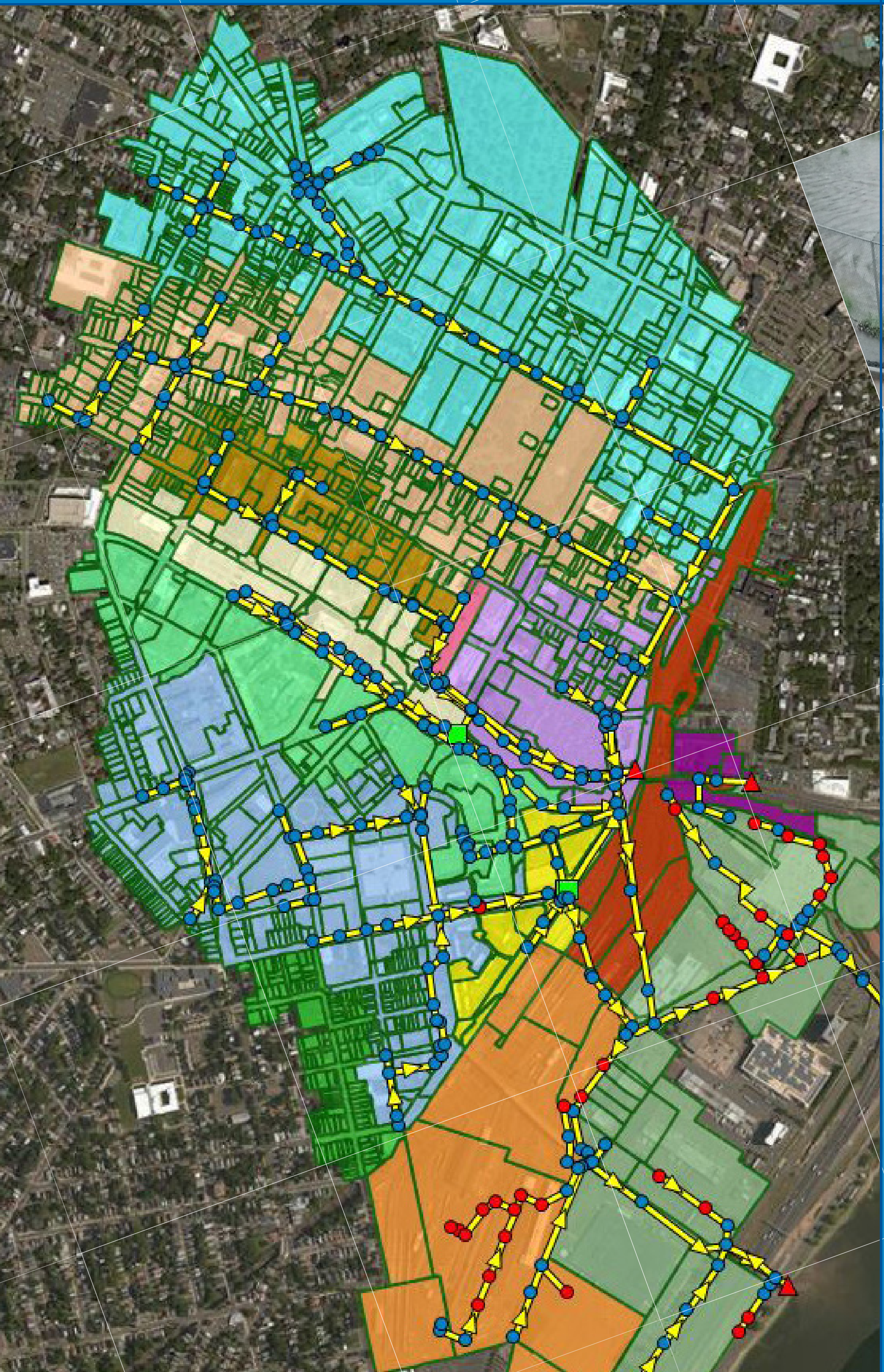
Final Report

City of New Haven, Connecticut





Downtown Stormwater Modeling Project

January 2017

CDM Smith

CDM Smith

75 State Street, Suite 701
Boston, Massachusetts 02109
tel: 617 452-6000

January 16, 2017

Mr. Giovanni Zinn, P. E.
City Engineer
Engineering Department
City of New Haven
200 Orange St, Rm 503
New Haven, Connecticut 06510

Subject: Downtown Stormwater Modeling Project
Final Report

Dear Mr. Zinn:

CDM Smith Inc. (CDM Smith) is pleased to submit the New Haven *Downtown Stormwater Modeling Project* Final Report, incorporating your comments on the Draft Report. This study addresses existing flooding problems, as well as future impacts of sea level rise and increased precipitation intensity associated with climate change. CDM Smith updated New Haven's existing EPA Storm Water Management Model (SWMM), investigated the issues contributing to flooding, and identified cost-effective improvements that significantly reduce flooding and contribute to continued urban revitalization.

The report provides a summary of the results of field investigations, SWMM modeling with drainage and capacity analyses, drainage improvement alternatives and a recommended plan to reduce flooding, including an opinion of probable project costs and permitting requirements.

If you have any questions or comments on this Final Report, please contact us.

Very truly yours,

Virginia Roach

Virginia Roach, P.E.
Vice President
CDM Smith Inc.

cc: Dawn Henning, City of New Haven
Larry Smith, City of New Haven
Paul Schmidt, CDM Smith
Mitch Heineman, CDM Smith

Table of Contents

List of Figures

List of Tables

Appendices

This page intentionally left blank.

Executive Summary

Introduction

Downtown New Haven has experienced repeated flooding during intense rainfall in recent years. This Downtown Stormwater Modeling project addresses existing flooding problems, as well as future impacts of sea level rise and increased precipitation intensity associated with climate change. CDM Smith updated New Haven's existing EPA Storm Water Management Model (SWMM), investigated the issues contributing to flooding, and identified cost-effective improvements that significantly reduce flooding and contribute to continued urban revitalization. The project is funded through a Community Development Block Grant-Disaster Recovery grant (CDBG-DR).

The drainage area to the Downtown flood problem areas shown in Figure ES-1 totals 835 acres, encompassing the Central Business District, New Haven Green, the City Municipal Complex, residential neighborhoods, most of Yale University's main Campus, Yale's Medical Campus, and part of Route 34. Route 34's depressed corridor between the Air Rights Garage and State Street presently creates a barrier between the Hill neighborhood and downtown. The upcoming Downtown Crossing project will convert the limited access roadway to urban boulevards, allowing mixed-use development in the area and enhancements that will reconnect City streets, improve traffic patterns and encourage non-motorized transportation. However, the flooding challenges the City faces affect the areas planned for development. This study presents solutions that will reduce flooding in these areas.

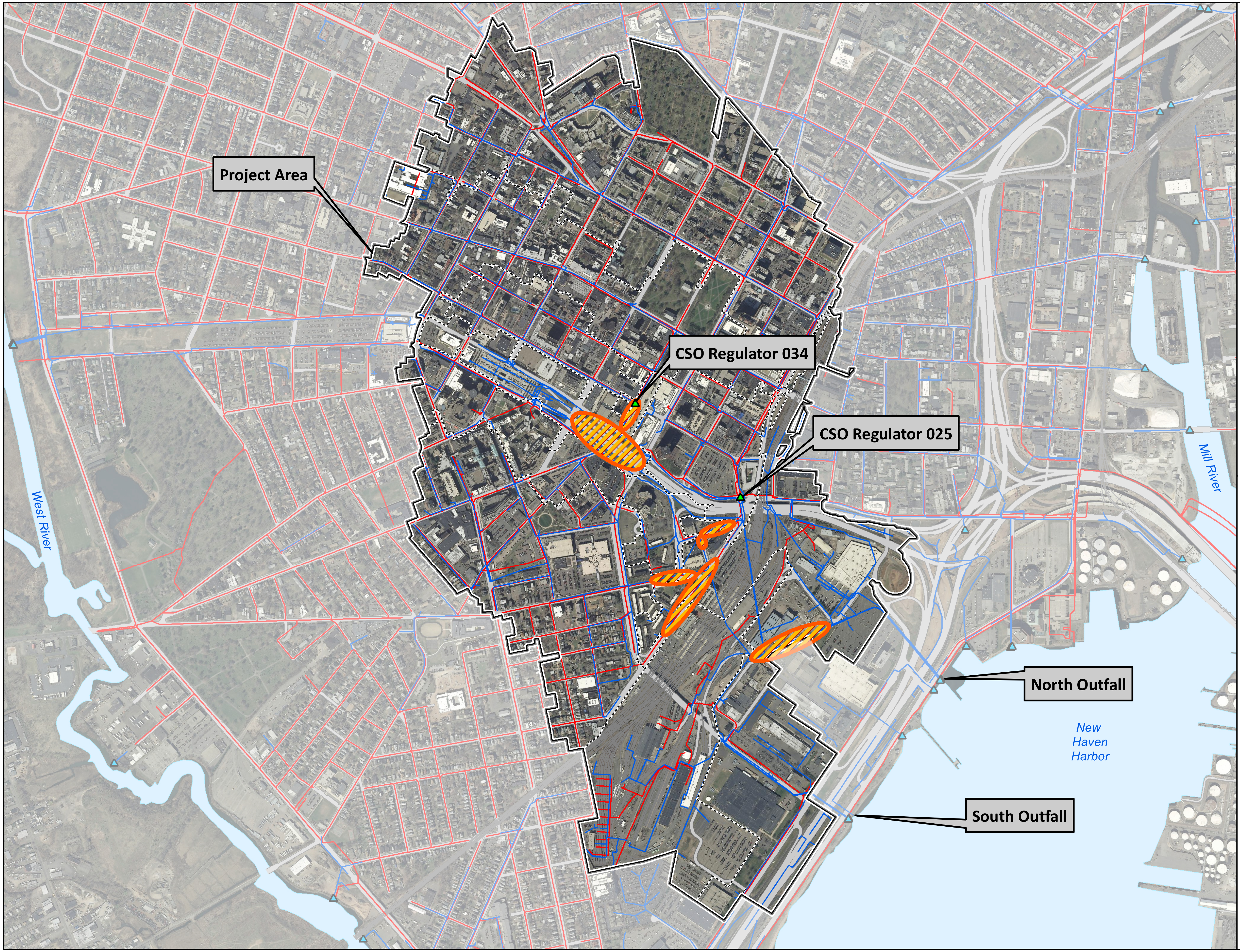
Flooding Problems and Locations

The flood-prone areas, as described by the City, and the contributing watershed are shown in Figure ES-1. Frequent flooding occurs along Route 34, at Temple Street and Union Avenue. The project area is drained by tidally-influenced twin 6-ft by 4-ft box culverts built in 1945 that drain from State Street at Union Avenue into the New Haven Railyard, and a 66-inch arch pipe built in 1873 that extends from Meadow Street into the Railyard. Both conduits cross the Railyard and connect to twin 6-ft by 6-ft box culverts that discharge to New Haven Harbor at Long Wharf. The study area was originally served by a combined sewer system that discharged directly to New Haven Harbor via the 66-inch pipe. Beginning in the 1920s, sewage treatment works were constructed at the present site of the East Shore Water Pollution Abatement Facility, with various combined sewer overflow (CSO) regulators designed into the system for wet-weather relief. While in recent years, the City has installed separate storm drains throughout most of the study area, most roof leaders still connect to the combined sewers. During large storms, runoff into the combined system exceeds its conveyance capacity, and CSO regulators 025 at State Street and 034 at Temple Street overflow into the storm sewer system (Figure ES-1).

New Haven, CT

Downtown Stormwater Modeling Project

Figure ES-1
Areas of Reported Flooding



Legend

- ▨ Areas of Reported Flooding
- ▲ CSO Regulator
- ▲ Outfall
- — Drain
- — Sewer
- ☐ Project Area/Total Tributary Drainage Area Boundary
- ⬚ Subtributary Drainage Area Boundary
- —+— Railroads

N

1 inch = 1,000 feet

Feet
0 500 1,000

PescatoreEC C:\Projects\New_Haven\ProjectWise\Fig_Areas_of_Reported_Flooding.mxd 12/30/2016

Model Development

A hydrologic and hydraulic computer model of New Haven's downtown drainage system was developed using PCSWMM software. PCSWMM provides a comprehensive GIS-based interface that uses the EPA SWMM computational engine; its inputs and output are fully compatible with EPA SWMM. The model was calibrated to observed conditions and used to identify and assess potential flood mitigation measures. The following principal resources were used in model development:

- GNHWPCA geodatabase of drain and sewer system assets;
- City geodatabase with parcel data, roadways, and spot elevations;
- "Drainage Study for Route 34 And Union Avenue" and accompanying SWMM model prepared by Cardinal Engineering Associates in 2012;
- Record drawings from the City, GNHWPCA, and Connecticut DOT;
- City of New Haven planimetric maps;
- US National Land Cover Database 2011 urban imperviousness data accessed at www.mrlc.gov/nlcd11_data.php; and
- NRCS soils data accessed at http://casoilresource.lawr.ucdavis.edu/see/#penwood.

The model was calibrated to fall 2015 and spring 2016 flow metering data, validated against historic storms, adjusted to represent planned baseline conditions, and used to assess potential improvements to mitigate flooding during intense rainfall.

The model incorporates detailed representation of the downtown drainage system. Since the sewer system tributary to CSO regulators 025 and 034 overflows to the drainage system during intense rainfall, the model also incorporates a basic representation of the sewer system tributary to those two CSO regulators.

Baseline Conditions

Following model calibration, system hydrology and hydraulics were adjusted to reflect planned baseline conditions. The baseline conditions incorporate the following system modifications:

- Approximately 200 15-by 5-foot right-of-way bioswales/rain gardens with 2 to 2.5 feet open graded stone, two feet of engineered soil, 4 to 6 inches of depression storage, and a gabion, similar to New York City Department of Environmental Protection right-of-way bioswales shown in Figure 3-3 below;
- Cleaning of principal City drains that traverse Connecticut Department of Transportation's New Haven Railyard;
- Closure of GNHWPCA's CSO regulator 034 at Temple and George Streets, with accompanying sewer separation and relief pipes;

- Relocation of the drain in front of the former Coliseum site (crossing at Orange Street), and pipe size upgrade to 60-inch diameter; and
- Capacity upgrade at GNHWPCA's Union Street pumping station from 22 to 35 million gallons per day.

Capacity Analysis

To assess conveyance capacity and design flows, simulated sediment was removed from pipes, and Manning's n-values were adjusted downward to 0.015 in the Railyard and outfall lines. The future case 1-year through 10-year NRCS design storms were simulated with the future case design tide (year 2066 mean high water at elevation 3.73 NAVD88).

The existing conditions model simulated significant flooding from the Columbus Avenue sewer to Union Avenue for all simulated design storms. For this reason, future case simulations were performed assuming that all wet-weather inflow that currently enters the sewer system will be diverted to the drain system. This assumption slightly underutilizes system capacity, as the Union Street Pumping Station is slated for upgrade to 35-mgd capacity, but the difference is judged insignificant for planning purposes and provides a margin of safety.

The full pipe flow capacity of the Meadow Street drain and twin box culverts through the Railyard and onward to the North outfall is much less than the flow that can be delivered by the upstream collection system, even after assuming clean pipe conditions in the Rail Yard and downstream. These conduits currently convey all drainage and CSOs from the Downtown and Hill drainage areas, and also receive flow from the Railyard and Post Office areas. There is limited hydraulic relief to the west via the Brewery Street overflow to the South outfall system, but that system is also stressed beyond capacity during intense rainfall by local and Railyard drainage.

The simulated 10-year peak discharges are one and one-half to more than twice the full pipe flow capacities of the pipes, and produce flooding across the collection system. There is little capacity for surcharge without causing flooding due to shallow cover along these routes, especially at the intersection of Meadow Street and Union Avenue, as well as further upstream in Route 34. Furthermore, while the pipe calculations assume crown-full flow at the outfall, that level is just above mid-tide under current sea level conditions. Typical high tides reach 3 NAVD 88, while spring tides can be two feet higher; these conditions reduce overall conveyance capacity.

The drainage system model can be used as an effective tool to assess flood control through conveyance and storage improvements (both in-system and constructed storage), supplemented by green infrastructure improvements. While flows in the sewer system are presently only indirectly connected to the drainage system via CSO regulators 034 (which is slated for closure) and 025, these flows must be considered in flood reduction planning, as the sewer system has limited capacity for conveying wet-weather inflow, and sewer system flooding is typically mitigated either via CSOs, or by re-routing inflow directly to the drainage system.

Alternatives Analysis

CDM Smith evaluated drainage improvements needed to reduce flooding in problem areas, namely Route 34 / Downtown Crossing, Temple Street (south of George Street), Union Avenue, and Water Street, taking into account existing conditions and future development plans for the area. Alternative solutions were evaluated using the calibrated SWMM model, designing drainage facilities to control peak rates of runoff at mean high water during a 10-year 24-hour storm under Year 2066 climate change conditions (with a 7.5-percent increases in precipitation and 0.9-foot sea level rise). The analysis also examined the capacity of proposed improvements during historical storms adjusted for year 2066 climate change conditions, as discussed in Section 3. SWMM model results were evaluated in terms of predicted flooding extent and hydraulic grade lines throughout the problem sections of the study area.

The alternatives analysis includes consideration of:

- Flow diversion to a new/supplemental outfall system to New Haven Harbor;
- In-system storage in existing drainage system;
- New subsurface storage systems and other types of green infrastructure; and
- A pumped discharge system.

Recommended Plan

Figure ES-2 illustrates the recommended plan as a phased solution to Downtown New Haven flooding problems:

Phase 1 Improvements

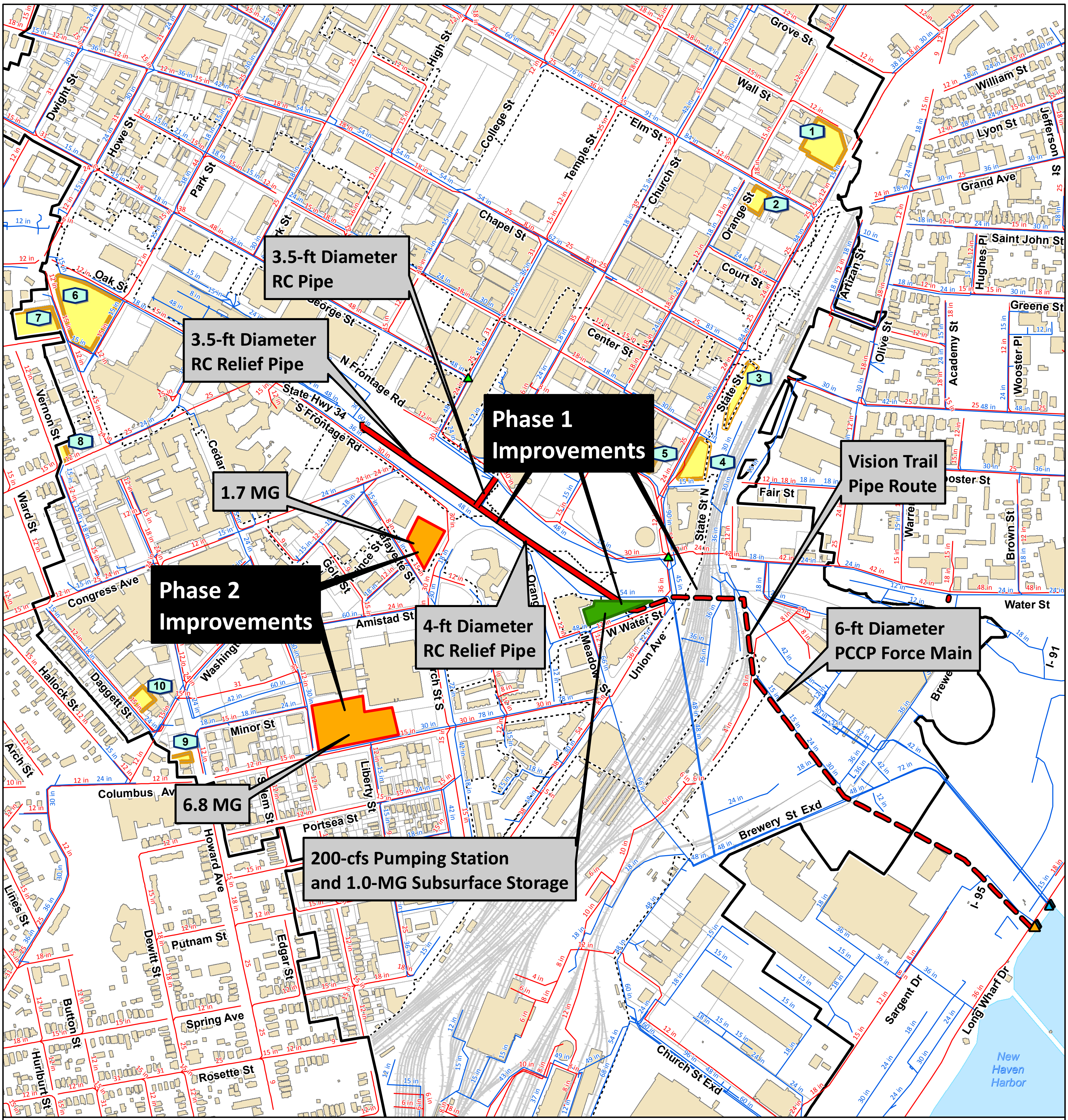
- 200-cfs pumping station
- 1-MG subsurface storage system
- Three 3- to 4.5-foot flap gates
- 3,300 feet of 6-foot diameter prestressed concrete cylinder pipe (PCCP) force main along the Vision Trail route
- 200 feet of 3.5-ft reinforced concrete (RC) pipe across Route 34
- 1,800 feet of 3.5- to 4-ft RC relief pipe along Route 34

Phase 2 Improvements

- 1.7-MG subsurface storage system
- 6.8-MG subsurface storage system

The proposed phased approach to implementing the recommended plan will help stagger costs while still providing significant flood protection during intense storm events.

As discussed in Section 5, three flap gates can be installed to prevent combined sewage from entering the 1.0-MG storage facility and pumping station behind the Police Station at the Knights



Potential Public Sites for Green Infrastructure Practices

1 Children's Museum Parking Lot
4 Wall Street

2 Parking Lot
40 Elm Street

3 N Lot Parking Lot
253 State Street

4 O Lot Parking Lot
221 State Street

5 George and State Street Lot 3
25 George Street

6 Connecticut Mental Health Center
34 Park Street

7 Hospital Parking Lot
914 Howard Ave

8 Greenspace
119 Davenport Avenue

9 Vacant Lot/Greenspace
634 Howard Avenue

10 Wilson Library
303 Washington Avenue

Proposed

- Gravity Pipe
- Force Main
- 🟧 Subsurface Storage
- 🟩 Subsurface Storage and Pumping Station
- ▲ Drain Outfall
- 🟥 Junction Chamber
- 🟨 Public Properties

Existing

- Drain
- Sewer
- ▲ CSO Regulator
- ▲ Outfall
- Total Tributary Drainage Area Boundary
- Subtributary Drainage Area Boundary
- Shoreline
- Railroad
- Buildings

N

1 inch = 600 feet

0 300 600 Feet

New Haven, CT
Downtown Stormwater Modeling Project

Figure ES-2
Recommended Plan

CDM Smith

PescatoreEC C:\Projects\New_Haven\ProjectWise\Recommended_Plan_11x17.mxd 1/12/2017 of Columbus property under Phase 1. However, unless further roof leader disconnections can be constructed, the 6.8-MG storage facility would need to be a higher-cost CSO storage facility in Phase 2 due to backflow of combined sewage from the 66-inch arch drain into the 78-inch drain in Columbus Avenue. If CSOs at regulator 025 were eliminated and flap gates were not needed, the storage needed along Columbus Avenue could be reduced to 5.1 MG due to a higher availability of in-system storage.

The proposed force main route includes 500 feet of microtunneling, pipe jacking, or other trenchless technology across the Connecticut Department of Transportation (CT DOT) Railyard. A more detailed analysis of this Railyard crossing should be performed during detailed design, examining geotechnical data, including groundwater elevations, at the proposed pumping station site and in the Railyard.

Other investigations to be completed under detailed design include:

- Further evaluation of utility conflicts along the proposed force main route from the proposed pumping station to New Haven Harbor.
- Further evaluation of potential pumping methods and types of pumps, and a comparison of the costs and benefits of pumping alternatives. Potential pumping selections include non-clog pumps, axial flow pumps, and Archimedes screw pumps. The non-clog pumps and axial flow pumps (rotodynamic or “centrifugal” pumps) can be either submersible motor type, or dry pit type. As discussed in Section 5, a non-clog type pumping system provides more versatility to adapt to pumping conditions and potential future increasing sea level, by changing just the pumps to provide greater discharge pressure (with a comparable increase in pump horsepower). Axial flow pumps and Archimedes screw pumps require the structure to be built to a specific elevation. If that discharge elevation is exceeded by future sea level rise, the entire structure must be modified. The non-clog pumps will operate at variable discharge pressure as required to discharge the flow through the transmission main. Axial flow pumps and Archimedes screw pumps will operate at a fixed discharge pressure (and power), which may be greater than required by the flow rate and tide elevation.
- Further consideration of the use of redundant pumps during storms larger than the design storm, and the corresponding impact on the force main design.
- Examination of geotechnical data and utilities at the three proposed storage sites to further evaluate the locations and potential volume of storage facilities.
- Cleaning and TV inspection of the twin 6- by 4-foot box drains at the railroad crossing in the Railyard to verify model assumptions about sediment blockage and to improve flow capacity. The 66-inch arch drain at the railroad crossing was lined in recent years and should be in good condition. Flow monitoring did not suggest that there was significant obstruction in the arch; however, conditions can change over time and inspection of the arch would also be beneficial. When the arch is inspected, the current dimensions of the pipe should be verified.

- Temporary and permanent easement plans/permits for proposed drainage facilities on properties not owned by the City. Easements/permits will be needed in the following locations under the recommended plan:

  Phase 1

  - Knights of Columbus site for pumping station and subsurface storage facilities
  - Route 34 for 3.5- to 4-ft RC relief pipes and Route 34 crossing (CT DOT Permit)
  - CT DOT/Amtrak Railyard for force main
  - IKEA property for force main

  Phase 2

  - Yale site on Columbus Avenue for subsurface storage facility
  - Commercial medical office property at 2 Church Street South

Green Infrastructure

The City is planning approximately two hundred right-of-way bioswales/rain gardens within the project area, and these bioswales were included in the modeled baseline conditions, as discussed in Section 3.4. These green infrastructure improvements and the installation of additional green infrastructure practices throughout the project area in planned project developments will help reduce runoff to the Downtown flood problem areas. As demonstrated in Section 5.7, distributed small green infrastructure practices such as right-of-way bioswales are not effective for controlling peak rates of runoff during major storm events; however, they are effective at reducing peak rates of runoff during small storm events, and at reducing stormwater runoff volumes. Higher volumes of runoff can be controlled by using subsurface storage and infiltration systems such as the reinforced concrete system shown in Figure 5-6. Installing green infrastructure practices throughout the project area can further reduce stormwater runoff to drainage systems to help reduce flooding, with the added benefit of improving the water quality of receiving waters and complying with the City's Municipal Separate Storm System (MS4) permit.

The Recommended Plan on Figure ES-2 provides locations of open areas with few trees on public properties where there are opportunities for the City to install green infrastructure practices (shown in Section 5.7) to further reduce stormwater runoff volumes to drainage systems, improve the water quality of receiving waters and comply with the City's Municipal Separate Storm System (MS4) permit. Pursuing the installation of green infrastructure practices on public properties is preferred over private properties because there are fewer administrative hurdles and costs. As discussed in Section 1, the City's Zoning Ordinance requirements for new and redevelopment projects, as well as Greater New Haven Water Pollution Control Authority (GNHWPCA) requirements, promote the installation of green infrastructure by requiring on-site stormwater retention. Over time, the accumulation of runoff volume reduction provided by infiltrating green infrastructure practices throughout the project area will offset a portion of the storage volume needed in the future Phase 2 of the recommended plan.

Opinion of Probable Project Costs

Table 5-2 in Section 5 presents the opinion of probable project costs:

Phase 1 – $39.1 million

- 200-cfs pumping station
- 1-MG subsurface storage system
- Three 3- to 4.5-foot flap gates
- 3,300 feet of 6-foot diameter force main along the Vision Trail route
- 200 feet of 3.5-ft RC pipe across Route 34
- 1,800 feet of 3.5- to 4-ft RC relief pipe along Route 34

Phase 2 - $32.3 million

- 1.7-MG subsurface storage system
- 6.8-MG subsurface storage system

Total Phased Project Costs $71.4 million

Project costs include estimated construction costs, a 30-percent construction contingency, engineering and implementation costs. Construction costs are scaled to an estimated mid-point of construction in May 2019. Costs for land acquisition and easements are not included.

Project cost estimates in this report assume CSO improvements have been made and all proposed storage facilities are separate stormwater storage facilities, similar to the reinforced concrete manufactured subsurface storage and infiltration systems shown in Figure 5-6. Please note that the proposed stormwater storage facilities are watertight and are not designed to infiltrate due to groundwater elevations at the three subsurface storage sites. Following storms, the subsurface storage systems are designed to drain to the drainage system by gravity. If CSO storage facilities are needed in the future, the CSO storage facilities must drain back to the sewer system following storms, odor control, tank cleaning and other appurtenances will be required, and the storage costs should be increased approximately 150 percent. If CSOs at regulator 025 were eliminated and flap gates were not needed in the system, the storage needed along Columbus Avenue could be reduced to 5.1 MG due to a higher availability of in-system storage. This would translate to a Phase 2 cost savings of approximately $6.4 million.

Based on recent bid prices, green infrastructure construction costs in the Northeast vary from about $150,000 per impervious acre treated for rain gardens, right-of-way bioswales, vegetated bioretention areas and subsurface storage and infiltration systems, to about $500,000 per impervious acre treated for porous pavements (when green infrastructure practices are designed for the 90-percent storm, about one inch of runoff). Rooftop solutions such as green roof retrofits are more expensive (about $1.7 million per acre treated) if the roof needs to be replaced and waterproofed. As the City plans and constructs green infrastructure practices throughout the project area, the most cost-effective green infrastructure practices should be prioritized.

Permitting Requirements

Coastal Connecticut projects require permits through the CT Department of Energy & Environmental Protection's (DEEP's) Office of Long Island Sound Programs (OLISP). The permit they issue that is applicable to the proposed project is:

- Structures, Dredging, and Fill Permit: for structures, dredging and fill placed waterward of the Coastal Jurisdiction Line in tidal, coastal or navigable waters of the state, including dredging and the placement of structures or fill material. This permit will be needed to construct the force main outfall below the Coastal Jurisdiction Limit (equal to elevation 4.6 NAVD88). Compliance with Connecticut Stormwater Quality Manual must be shown. 401 Water Quality Certification is made in conjunction with issuance of a state permit under the Structures, Dredging and Fill statutes.

Other permit requirements include:

- Pre-Construction Notification (PCN) under U.S. Army Corps of Engineers (USACE) General Permit #6 for Utility Line Activities which allows for up to 0.5 acre of impact to Waters of the U.S.
- Project Review by the State Historic Preservation Officer (SHPO) and Tribal Historic Preservation Officers (THPO); there are two tribes in this area.
- Project Review by CT DEEP Natural Diversity Data Base (NDDB).
- General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities from CT DEEP.
- CT DOT permit for proposed drains along and across Route 34.
- CT DOT/Amtrak permits/License Agreement for proposed force main in Railyard.

The proposed new force main outfall will also be added to the City's list of drain outfalls under New Haven's Municipal Separate Storm Sewer System (MS4) Permit.

Section 1

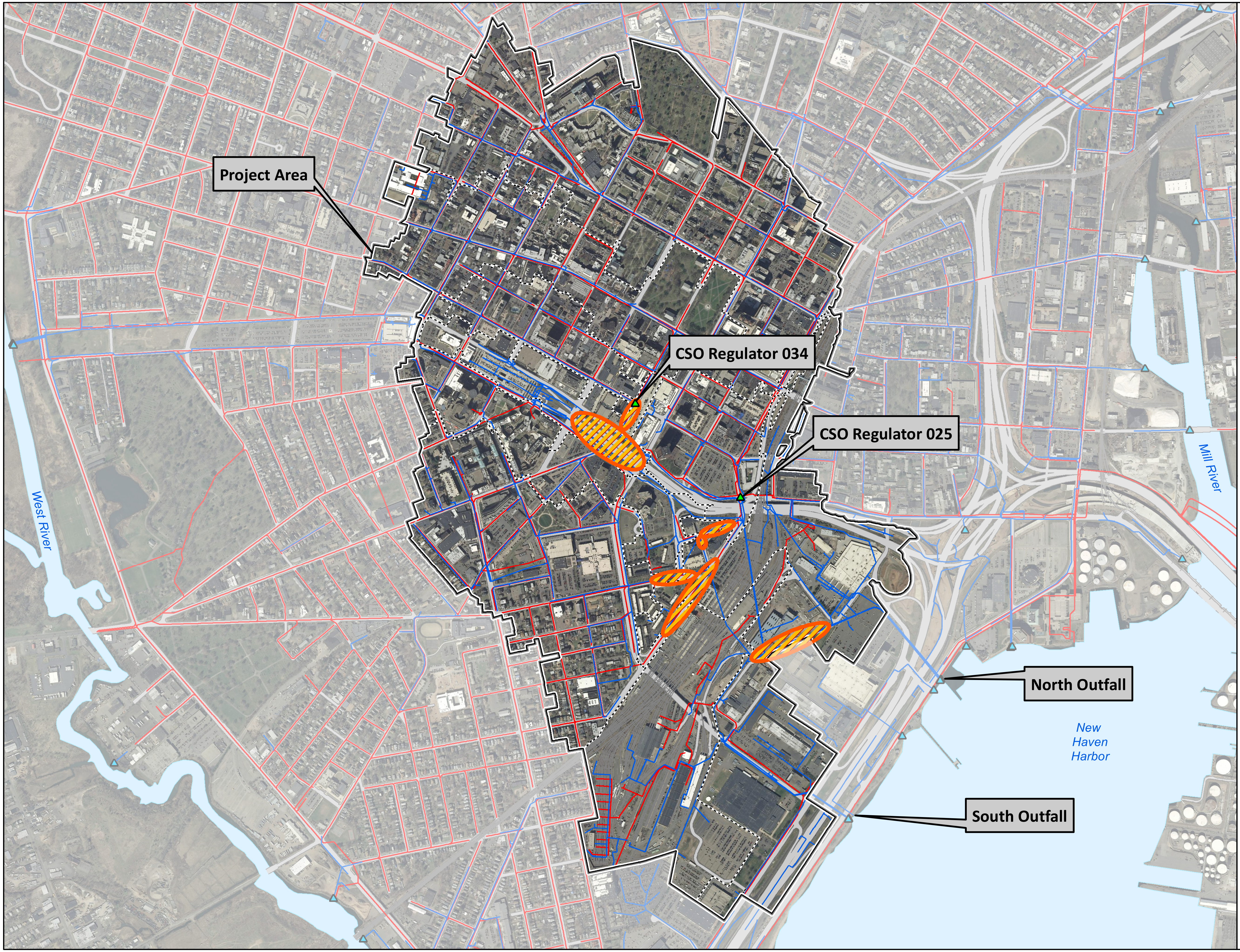
Introduction

Downtown New Haven has experienced repeated flooding during intense rainfall in recent years. This Downtown Stormwater Modeling project addresses existing flooding problems, as well as future impacts of sea level rise and increased precipitation intensity associated with climate change. CDM Smith updated New Haven's existing EPA Storm Water Management Model (SWMM), investigated the issues contributing to flooding, and identified cost-effective improvements that significantly reduce flooding and contribute to continued urban revitalization. The project is funded through a Community Development Block Grant-Disaster Recovery grant (CDBG-DR).

The drainage area to the Downtown flood problem areas shown in Figure 1-1 totals 835 acres, encompassing the Central Business District, New Haven Green, the City Municipal Complex, residential neighborhoods, most of Yale University's main Campus, Yale's Medical Campus, and part of Route 34. Route 34's depressed corridor between the Air Rights Garage and State Street presently creates a barrier between the Hill neighborhood and downtown. The upcoming Downtown Crossing project will convert the limited access roadway to urban boulevards, allowing mixed-use development in the area and enhancements that will reconnect City streets, improve traffic patterns and encourage non-motorized transportation. However, the flooding challenges the City faces affect the areas planned for development. This study presents solutions that will reduce flooding in these areas.

1.1 Flooding Problems and Locations

The flood-prone areas, as described by the City, and the contributing watershed are shown in Figure 1-1. Frequent flooding occurs along Route 34, at Temple Street and Union Avenue. The project area is drained by tidally-influenced twin 6-ft by 4-ft box culverts built in 1945 that drain from State Street at Union Avenue into the New Haven Railyard, and a 66-inch arch pipe built in 1873 that extends from Meadow Street into the Railyard. Both conduits cross the Railyard and connect to twin 6-ft by 6-ft box culverts that discharge to New Haven Harbor at Long Wharf. The study area was originally served by a combined sewer system that discharged directly to New Haven Harbor via the 66-inch pipe. Beginning in the 1920s, sewage treatment works were constructed at the present site of the East Shore Water Pollution Abatement Facility, with various combined sewer overflow (CSO) regulators designed into the system for wet-weather relief. While in recent years, the City has installed separate storm drains throughout most of the study area, most roof leaders still connect to the combined sewers. During large storms, runoff into the combined system exceeds its conveyance capacity, and CSO regulators 025 at State Street and 034 at Temple Street overflow into the storm sewer system (Figure 1-1).



New Haven, CT

Downtown Stormwater
Modeling Project

Figure 1-1
Areas of Reported Flooding

Legend

- ▨ Areas of Reported Flooding
- ▲ CSO Regulator
- ▲ Outfall
- — Drain
- — Sewer
- ☐ Project Area/Total Tributary Drainage Area Boundary
- ⬚ Subtributary Drainage Area Boundary
- ┼ Railroads

N

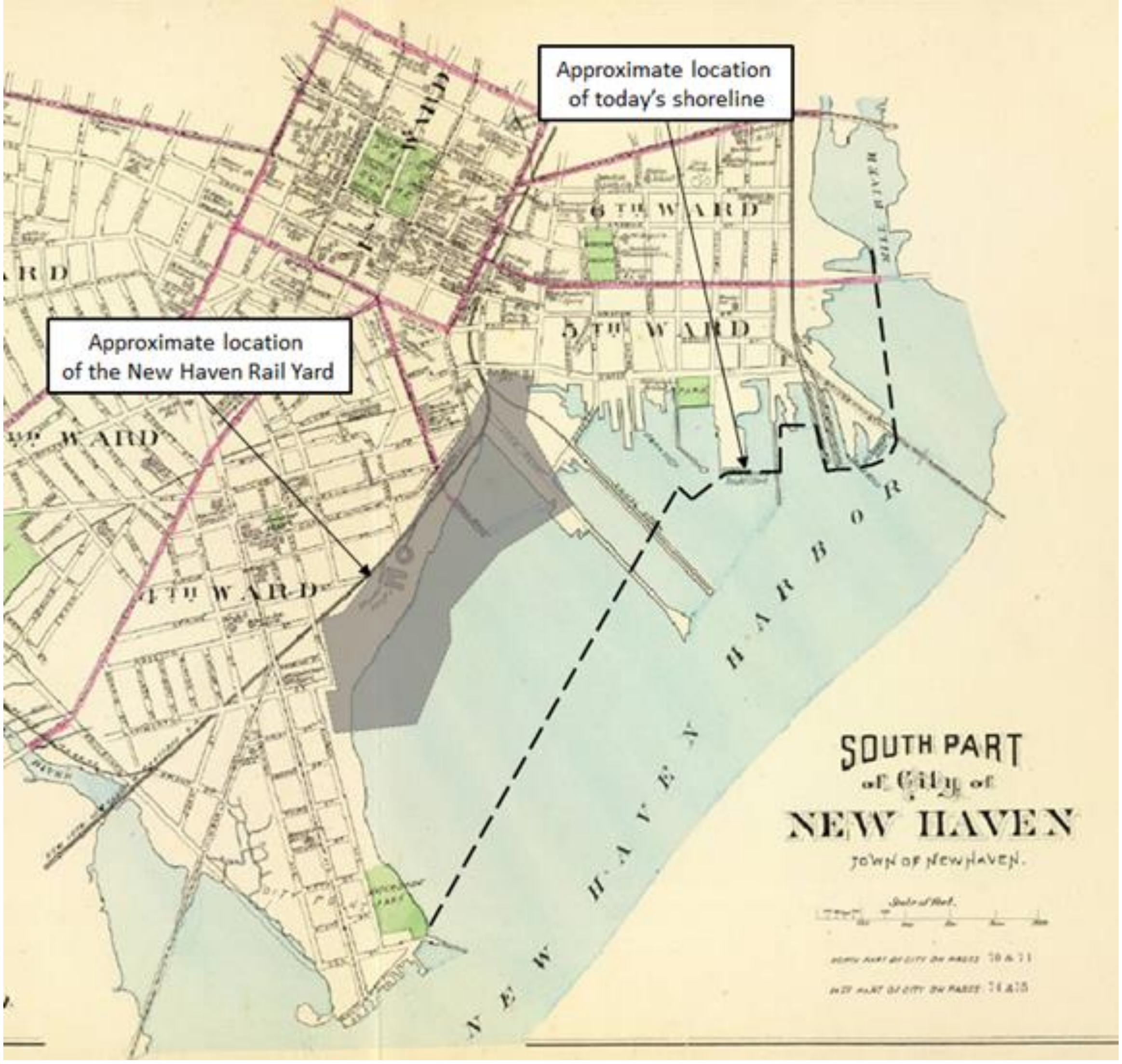
1 inch = 1,000 feet

Feet
0 500 1,000

CDM Smith

PescatoreEC C:\Projects\New_Haven\ProjectWise\Fig_Areas_of_Reported_Flooding.mxd 12/30/2016

Since New Haven was settled in 1638, the shoreline has evolved. As development progressed, shallow areas were filled, and the shoreline was changed significantly. This filled area includes the Railyard, which was not yet filled in when the 1893 map shown in Figure 1-2 was created. While New Haven has naturally well-drained soils, most of the land was covered by impervious roadways and roofs over the course of the last century, greatly increasing stormwater runoff. Today, the storm drain system outfalls run underneath the Railyard, creating significant challenges for accessing these pipes for maintenance and improvements, such as adding conveyance capacity.



Approximate location of today's shoreline

Approximate location of the New Haven Rail Yard

Figure 1-2 - Historic Map of New Haven Harbor (Map: Copyright 1893, D.H. Hurd & Co.)

1.2 Previous and Concurrent Studies

Two recent studies examined the flooding problems in Downtown New Haven and identified potential improvements. These reports are discussed below. Additionally, a concurrent study into climate change impacts on New Haven is being conducted and is described below.

1.2.1 Drainage Study for Route 34 and Union Avenue

In July 2012, a *Drainage Study for Route 34 and Union Avenue* was prepared for the City of New Haven by Cardinal Engineering Associates for a 580-acre drainage area (referred to hereafter as the "Cardinal report"). Cardinal developed SWMM models of the sewer and drain systems to support their analyses.

The Cardinal report identified three floods along Route 34, Temple Street, and Union Avenue in the three preceding years on October 1, 2010, May 18, 2011, and June 23, 2011. They proposed a system-wide upgrade to mitigate flooding. The key conclusions and recommendations in this report include:

- Flooding in the Route 34 area is caused mainly by the trunkline's inadequate capacity and not by tidal backflow.
- The volume of flooding that occurs on Route 34 in the College and Church Street area is approximately 5.5 ac-ft (1.8 MG) during a 10-year storm at high tide.
- The recommended plan consisted of upgrading existing storm drains with larger conduits:
    - 4,400 feet of 5-foot reinforced concrete pipe (RCP) in Route 34/Martin Luther King Drive area,
    - 1,600 feet of 10-ft by 7-ft box culvert in Union Avenue,
    - 4,000 feet of jacked 72-in RCP under the railroad (4- 72-in pipes, 1,000 feet long each), and
    - 5,000 feet of 10-ft by 6-ft box culvert (2- 10-ft by 6-ft box culverts, 2,500 feet each) in the Harbor area.
- The estimated construction cost for Phase 1 improvements was $29 million in 2012 dollars.
- Under future flow conditions when 100% of roof leaders are disconnected, and for peak rates of runoff occurring at a tide elevation greater than mean high water, recommended Phase 2 improvements included a pumping station. The estimated construction cost for the pumping station was $25 to $30 million, bringing the total estimated construction cost to $54 to $59 million in 2012 dollars.

1.2.2 Downtown Crossing Phase 2 – Orange Street Drainage Feasibility Study

The *Downtown Crossing Phase 2 – Orange Street Drainage Feasibility Study* was a follow-up assessment performed by Parsons-Brinckerhoff (PB) in 2014. This study analyzed the cost effectiveness of the Cardinal proposal and used Cardinal's model to investigate additional alternatives for flood reduction.

PB completed a cursory evaluation of discharge to the Quinnipiac River. The required crossing of the rail line and I-91, and the need for installation of significant drainage infrastructure in the downtown area were cited as reasons for dismissal of this option.

PB's primary recommendation was construction of a 120-cfs screw pumping station located at the Air Rights Garage discharging to the West River via the Route 34/MLK Boulevard corridor. This option would convey flow approximately 1,200 feet from the Air Rights Garage to an existing 54- to 84-in diameter drainage system.

PB's additional recommendations included:

- Construction of a relief pond along MLK Boulevard, which would be temporary if future development of Downtown Crossing could accommodate other flooding mitigation solutions.
- Further study of the potential effectiveness of green infrastructure, particularly near Union Station, as the proposed pumping station would not fully mitigate flooding in this area.

The estimated construction cost for the 120-cfs screw pumping station and force main was $25 million in accordance with 2013 CTDOT Cost Estimating Guidelines, escalated to the year 2015. Cost estimates assumed structural modification of the Air Rights Garage would not be required, and costs did not include right-of-way or utility relocation costs.

1.2.3 Long Wharf Flood Protection Study

GZA GeoEnvironmental, Inc. is researching the effects of climate change with respect to coastal flooding along Long Wharf in New Haven. Tide elevation predictions developed in the GZA study informed design tide elevations for this Downtown Stormwater Modeling project.

1.3 Ongoing Development and Green Infrastructure Projects

In addition to the Route 34 Downtown Crossing Project, there are various other City-sponsored projects in the planning, approval, and construction phases that will depend on overall improvements to the storm drainage system within this area. These projects include:

- Reconstruction and improvements to Union Avenue, and a proposed parking garage adjacent to Union Station
- The Hill-to-Downtown Transit-Oriented Development Community Plan, and reconstruction and improvements to Lafayette Street area
- The New Haven Coliseum Site Redevelopment project
- Redevelopment of the former Church Street South housing development
- The completed Alexion Pharmaceuticals facility at 100 College Street

- Ongoing improvements at the New Haven Railyard administered by the Connecticut Department of Transportation.

In addition, a number of other private and non-City public developments and projects along Frontage Road and the Long Wharf/Sargent Drive area are occurring, including the New Haven Register building, the former Gateway Community College building, and other smaller projects. The City's Zoning Ordinance[1] requires that stormwater management systems for new development sites be designed to "collect, retain, and treat the first inch of rain on-site." In combined sewer areas, private development must retain the 2-year, 6-hour storm volume per Greater New Haven Water Pollution Control Authority (GNHWPCA) requirements.

The City is implementing green infrastructure to reduce stormwater runoff and improve the urban environment. Approximately two hundred right-of-way bioswales/rain gardens are planned, as discussed in Section 3.4.

1.4 Scope of Work

Specific tasks completed for this study include:

Task 1. Update Existing Stormwater Management Model (SWMM) based on recent infrastructure upgrades, maintenance practices, planned future developments, green infrastructure projects and other background information.

Task 2. Perform Storm Sewer System Flow Monitoring to calibrate and validate the SWMM model.

Task 3. Perform Analyses of Storm Sewer System Capacity Using SWMM to evaluate the storm sewer system function under a number of hydrologic and development scenarios.

Task 4. Propose Design Solutions for Flood Alleviation in problem areas, namely Route 34 / Downtown Crossing, Temple Street (south of George Street), Union Avenue, and Water Street, taking into account existing conditions and future development plans for the area.

Section 2 describes field investigations and findings that support the SWMM model development and capacity analysis. Section 3 provides the project design criteria and assumptions, while Section 4 summarizes the SWMM modeling. Section 5 presents the drainage improvements alternatives analysis, and Section 6 summarizes the recommended solutions, including an opinion of probable project costs and permitting requirements.

---

[1] www.municode.com/library/ct/new_haven/codes/zoning?nodeId=ZOOR_ARTVIOTDI_S60STMAPL

Section 2

Data Collection

2.1 Data Sources

Development of the SWMM model for this project drew upon the model previously developed by Cardinal Engineering, as well as the City's GIS database, the City's 1970s-era planimetrics maps, and record drawings obtained from the City, the Greater New Haven Water Pollution Control Authority (GNHWPCA), and the Connecticut Department of Transportation. The City's collection system GIS data, developed by the GNHWPCA, identifies manhole inverts and rims and pipe dimensions across the sewer and drain systems. CDM Smith performed field investigations to identify some missing pipe sizes and to verify pipe configurations, discussed in more detail below in Section 2.4. CDM Smith supplemented this information with the City's GIS database, which has spot elevation readings for landscape features and survey points across the city. GNHWPCA sewer inverts and rims are referenced to NAVD 88, while drainage data is primarily referenced to NGVD 29. Work for this study was conducted using NAVD 88. NGVD data were adjusted by applying the conversion NAVD 88 = NGVD29 – 1.05 feet.

The Cardinal model consisted of 42 pipe segments. Discharge hydrographs were developed outside of SWMM using the Rational Method, and input to the model as time series at 16 load points. Model improvements and development are discussed in more detail in Section 4.

2.2 Geotechnical Data

New Haven is generally underlain by very sandy, permeable soils. Elevations in the project area range from 2 to 50 feet NAVD 88. High groundwater levels and elevations just above sea level in some parts of the study area limit opportunities for installation of stormwater infiltration systems in the low-lying areas; however, there are opportunities for infiltration and green infrastructure in higher areas.

Most of downtown is classified as Urban Land by the US Natural Resources Conservation Service (NRCS; formerly SCS), with surrounding areas classified as Penwood-Urban land complex (NRCS map symbols 307 and 235B respectively). Filled areas (Urban Land) vary in percent fines and permeability. Penwood soil is excessively drained, with negligible to very low surface runoff. It is found in sandy glaciofluvial outwash in the Connecticut River Valley[1].

The City provided historical soil borings data for about 110 locations throughout the project area that verified the predominantly sandy, gravelly soils.

---

[1] https://soilseries.sc.egov.usda.gov/OSD_Docs/P/PENWOOD.html

2.3 Flow Monitoring

CSL Services of Pennsauken, New Jersey performed flow metering in the fall of 2015 and spring of 2016 to use for calibrating and validating the SWMM model. This data was supplemented by flow metering data obtained from GNHWPCA for long-term flow monitors in its combined sewers and at CSO regulators.

In the fall, nine area-velocity meters were deployed for six weeks, from November 10 through December 25, 2015. In the spring, ten meters were deployed for eight weeks, from March 19 through May 14, 2016. Figure 2-1 shows the meter locations. A rain gauge was deployed on the roof of the City office building at 200 Orange Street during both monitoring periods. Weekly visits to each metering site were conducted to download five-minute interval data and ensure the meters were working properly.

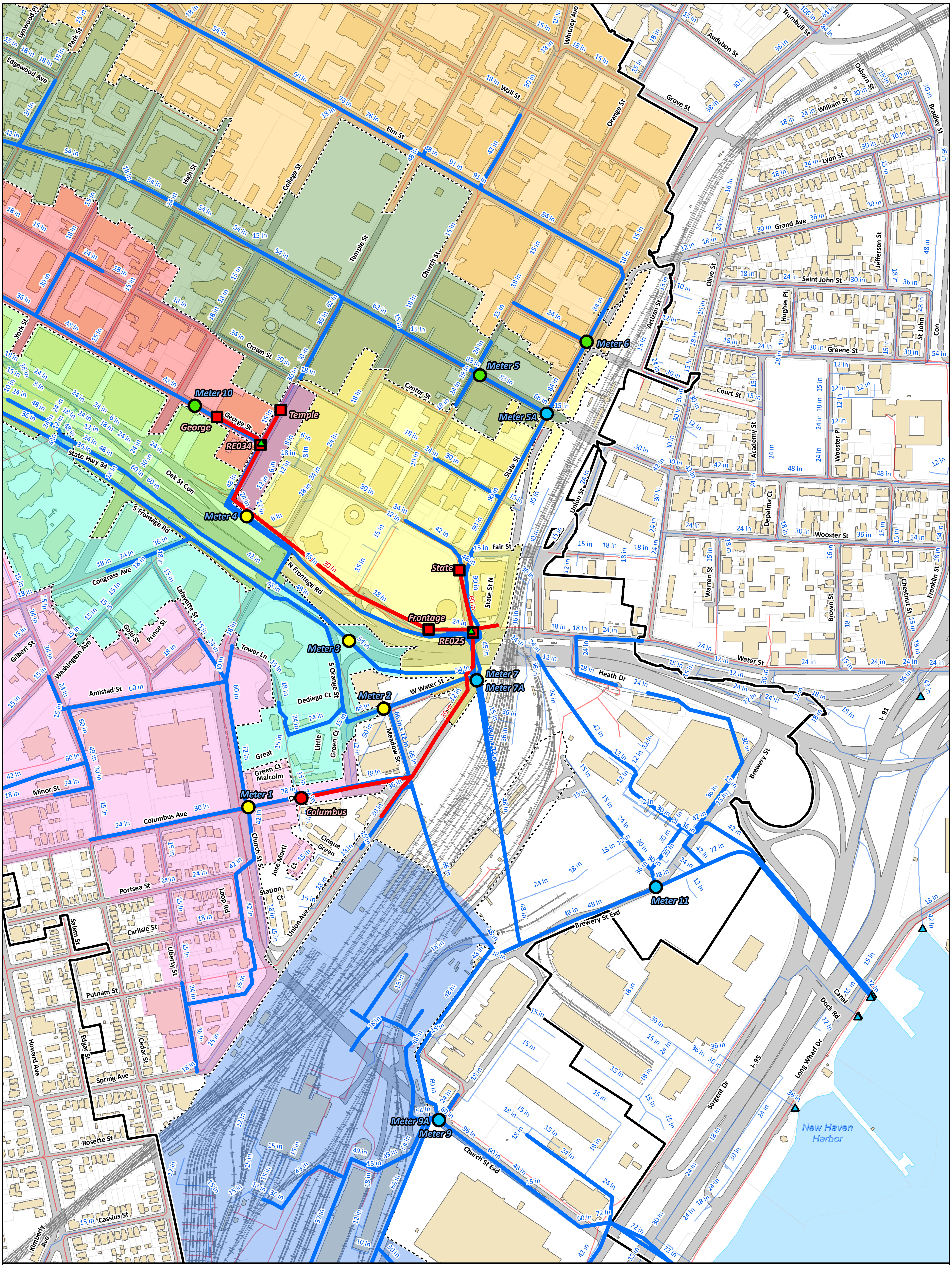
2.3.1 Site Selection and Conditions

Fall metering sites 1 through 6 shown on Figure 2-1 were selected to assess the runoff characteristics of the principal drainage sheds tributary to the two major drains that cross the Railyard. Sites 1 and 2 measured flows tributary to the 66-inch drain, while sites 3 through 6 gauged the principal drains upgradient of the twin box culverts. Meter 7 measured flow in one barrel of the twin box culvert. Site 9 measured flow in the largest pipe fully tributary to the 12-foot wide, 4-ft high Church Street extension drain. Meter 10 was located upgradient of Meter 4 and CSO regulator 034 to allow comparison of flows before and after CSOs enter the drainage system. Meter 8 was originally targeted to measure a 36-inch drain in Union Avenue west of Meadow Street, but field investigations indicated that the best suitable manhole serviced an 18-inch pipe. The site was dropped from the study, and the ID was not used in either fall or spring.

In the spring, the metering program was adjusted based on findings from the fall program. As the fall program provided good characterization of drainage to Meters 5 and 6, the merged flow from the two lines flows was instead measured just downstream at Meter 5A in State Street. Meter 10 was dropped from the program, as its flows differed minimally from Meter 4, and its fall data informed a good understanding of the drainage shed. Three sites were added for the spring program, as shown on Figure 2-1:

- Meter 7A was added in the east barrel of the twin box culvert at Union Avenue to ensure the validity of the assumption that flows were essentially the same in either barrel.
- Meter 9A was added adjacent to Site 9 to measure flow coming from the Brewery Street area into the Church Street extension pipe. This site was not included in the fall program, as it receives both local drainage as well as flow from the 66-inch Railyard pipe when the hydraulic grade line at its terminus in Brewery Street overtops a weir there.
- Meter 11 was added to gauge the hydraulic grade line in Brewery Street between the Railyard and the IKEA site. As the pipe invert at this site is well below mean tide. Velocity and discharge measurements at this site were of poor quality.

Table 2-1 lists the metering program sites, GNHWPCA meters used to assess interaction of the sewer and drain systems, and sediment depths measured during gauge installation.



Legend

▲ CSO Regulator
△ Outfall
— Drain
— Sewer
▨ Shoreline
┼ Railroads
▭ Buildings

Drainage Meter Area
▨ Meter 1
▨ Meter 2
▨ Meter 3
▨ Meter 4
▨ Meter 5
▨ Meter 6
▨ Meter 7
▨ Meter 9
▨ Meter 10

■ Sewer Meter
● Drain Meter, Fall
● Drain Meter, Fall/Spring
● Drain Meter, Spring
☐ Project Area/Total Tributary Drainage Area Boundary
⬚ Subtributary Drainage Area Boundary

N

1 inch = 500 feet

0 250 500 Feet

New Haven, CT
Downtown Stormwater
Modeling Project

Figure 2-1
Meter Locations

CDM Smith

PescatoreEC C:\Projects\New_Haven\ProjectWise\Meter_Location.mxd 1/6/2017

Table 2-1
Metering Locations and Sediment Depths

ID	Description	Fall	Spring	Sediment Depth (inches)
Drain system				
Meter 1	Columbus Avenue 78"	✓	✓	<1
Meter 2	W. Water Street 48"	✓	✓	5
Meter 3	South Frontage Road 54"	✓	✓	2
Meter 4	North Frontage Road 48"	✓	✓	<1
Meter 5	Chapel Street 66"	✓		0
Meter 5A	State & Chapel 90"		✓	0
Meter 6	State Street 84"	✓		0
Meter 7	Union Avenue 72"x48" west barrel	✓	✓	<1
Meter 7A	Union Avenue 72"x48" east barrel		✓	<1
Meter 9	Church Street Ext. 60"x48" west	✓	✓	11
Meter 9A	Church Street Ext. 60"x48" east		✓	9
Meter 10	George Street 48"	✓		<1
Meter 11	Brewery St 72"x48"		✓	3
Sewer system (GNHWPCA)				
George	George Street RE034 36"x48"	✓	✓	
Temple	Temple Street RE034 25x37	✓	✓	
Columbus	Columbus Avenue RE025 30"	✓	✓	
Regulator 034	79" weir at elevation 13.65	✓	✓	
Frontage	Frontage Road RE025 30"	✓	✓	
State	State Street RE025 48"x60"	✓	✓	
Regulator 025	45" weir at elevation 5.35	✓	✓	

Installation reports for meters 1 through 11 are presented in Appendix A.

2.3.2 Rainfall

The fall monitoring program recorded 1-month 24-hour or larger storms on November 19 and December 23 (Section 3 discusses precipitation frequency estimates). The only storm that large in the spring was recorded on April 1. The greatest one-hour rainfall in the fall was 0.45 inches on December 23, a 2-month event. In the spring, 0.56 inches fell in one hour on May 6, but total rainfall that day was only 0.76 inches. The flow metering data were thus satisfactory for characterizing the study area's hydrology and hydraulics.

Ironically, several large storms occurred in mid-winter between the two metering periods. The GNHWPCA rain gauge at Sea Street recorded 0.62 inches in one hour and 1.52 inches in 24 hours on February 3, and 0.70 inches in one hour and 1.79 inches in 24 hours on February 23. The computer model was compared against system performance data for the February 23 storm, as considerable surcharge was recorded for that event at the GNHWPCA flow meters, and CSL meter

3 data were also available, as that site was re-activated early so CSL could assess its performance based on questions raised during the fall metering program.

Table 2-2 summarizes precipitation data collected at the Orange Street and Sea Street sites for November 2015 through May 2016. It also presents event totals for Tweed New Haven Airport. However, the airport data appear to be deficient. This assessment is corroborated by comparison with Sikorsky Memorial Airport in Bridgeport; for 2012-2015, Tweed averaged 30 inches of precipitation annually, while Sikorsky averaged 40 inches. Over the entire period, the greatest rainfall depths recorded were the one-hour depth on February 23, and the 24-hour depth on April 1, both at the Sea Street gauge. These depths correspond with average recurrence intervals of about five months for both events at the respective durations.

Table 2-2

November 10, 2015 to May 14, 2016 New Haven Precipitation

Date	Duration (hours)[1]	Orange Street			Sea Street			Tweed[3]
		1-h	24-h	Event[2]	1-h	24-h	Event[2]	
November 10, 2015	21	0.11	0.50		0.00	0.00		0.29
November 19, 2015	7	0.31	1.12		0.28	0.92		0.94
December 1, 2015	30	0.13	0.47	0.51	0.12	0.39	0.43	0.23
December 14, 2015	8	0.39	0.80		0.36	0.61		0.45
December 17, 2015	15	0.32	0.98		0.30	0.90		0.77
December 22, 2015	6	0.18	0.43		0.14	0.42		0.38
December 23, 2015	14	0.45	1.55		0.38	1.34		0.85
December 29, 2015	6	NA			0.14	0.54		0.35
December 30, 2015	4				0.11	0.25		0.16
January 10, 2016	8				0.47	1.32		1.36
January 16, 2016	8				0.09	0.26		0.27
February 3, 2016	19				0.62	1.52		1.14
February 6, 2016	9				0.11	0.47		0.38
February 16, 2016	8				0.24	0.70		0.24
February 23, 2016	35				0.70	1.79	1.97	1.00
March 1, 2016	9				0.12	0.31		0.23
March 14, 2016	19				0.20	1.21		0.91
March 21, 2016	1	0.27	0.27		0.15	0.15		0.02
March 28, 2016	10	0.20	0.82		0.20	0.80		0.69
April 1, 2016	55	0.35	1.68	1.87	0.48	1.96	2.12	1.40
April 4, 2016	2	0.14	0.20		0.10	0.36		0.42
April 11, 2016	16	0.13	0.33		0.10	0.26		0.19
April 22, 2016	12	0.24	0.51		0.21	0.44		0.20
April 26, 2016	8	0.36	0.54		0.32	0.43		0.42
May 3, 2016	11	0.11	0.66		0.11	0.54		0.52
May 6, 2016	53	0.56	0.76	1.35	0.31	0.54	1.03	0.89

Storms shown measured at least 025 inches in 24 hours at Orange Street or Sea Street gauge

NA: not available

1. Fall and spring storm durations shown are for Orange Street; December 29 – March 14 for Sea Street
2. Event depths only shown for storms exceeding 24-hour duration
3. Tweed data appear to be deficient, as discussed in text

2.3.3 Flow Metering Summary

Tables 2-3 and 2-4 present summary data for the fall and spring metering programs. The spring data also includes the period beginning January 2016 for the GNHWPCA sites, and February 4 through March for Meter 3. When assessing peak flows at the monitoring sites in the context of understanding flood-producing rainfall, it is helpful to consider that the peak fall rainfall of 0.45 inches per hour is one quarter of the 10-year 1-hour rainfall depth of 1.83 inches; peak runoff in a 10-year storm can be expected to be in the vicinity of four times the peak rates shown here.

Table 2-3
Metering Averages

ID	Description	Depth (ft)		Velocity (ft/s)		Flow (ft³/s)	
		Fall	Spring	Fall	Spring	Fall	Spring
Meter 1	Columbus Avenue 78"	0.2	0.2	0.10	0.05	0.2	0.09
Meter 2	West Water Street 48"	0.8	0.7	0.15	0.07	0.3	0.14
Meter 3	South Frontage Road 54"	0.4	0.5	0.4	0.3	0.3	0.3
Meter 4	North Frontage Road 48"	0.14	0.09	0.8	0.3	0.2	0.07
Meter 5	Chapel Street 66"	0.10	NA	0.6	NA	0.2	NA
Meter 5A	State and Chapel 90"	NA	0.10	NA	1.7	NA	0.3
Meter 6	State Street 84"	0.04	NA	0.14	NA	0.2	NA
Meter 7	Union Ave. 72"x48" west barrel	0.4	0.5	0.8	0.7	1.9	2.1
Meter 7A	Union Ave. 72”x48” east barrel	NA	0.5	NA	0.6	NA	1.7
Meter 9	Church St. Ext. 60"x48" east	1.2	1.3	0.04	0.02	0.2	0.14
Meter 9A	Church St. Ext. 60"x48" west	NA	1.2	NA	0.01	NA	0.05
Meter 10	George Street 48"	0.13	NA	0.8	NA	0.2	NA
Meter 11	Brewery St 72"x48" south barrel	NA	1.3	NA	0.01	NA	0.07
George	George Street RE034 36"x48"	0.3	0.3	2.2	2.2	0.6	0.5
Temple	Temple Street RE034 25”x37”	0.7	0.8	1.2	1.2	0.5	0.6
Columbus	Columbus Avenue RE025 30"	0.4	0.3	4.7	4.6	2.0	1.3
Regulator 034	79" weir at elevation 13.65’	0.00	0.00	NA	NA	0.00	0.01
Frontage	Frontage Road RE025 30"	0.8	0.8	1.6	1.4	1.5	1.5
State	State Street RE025 48"x60"	0.3	0.3	2.6	2.4	1.2	0.9
Regulator 025	45" weir at elevation 5.35’	0.6	0.6	NA	NA	0.13	0.3

The metering data primarily served to support calibration of the SWMM model. The data also inform the following observations:

- There was little surcharge over the monitoring period in the drain system, other than the February 23 storm, where depth at Meter 3 exceeded the pipe crown by four feet. Much more severe surcharge occurred during that same storm in the Columbus and Frontage Road sewer system meters, where depths exceeded pipe crown by eight to nine feet.

- Modest base flow is present throughout the drainage system. The lowest flows at meters 7 and 7A indicate dry weather flows near 2 cfs (cubic feet per second), which is comparable with base flow in area streams, which typically averages 1.5 cfs/mi^2 annually.

- Mean and peak flows were generally similar between the two seasons, as total and peak rainfall were comparable.
- Peak flows in the drainage system were larger than those in the sewer system, but peak sewer system flows were well in excess of the current 34 cfs (22 million gallons per day) capacity of the Union Street pumping station to which the listed sewer meters are tributary.
- There may be modest tidal inflow through the south outfall tide gate as water levels consistently rose about one-half foot during flood tide, However, that rise could also be due to dry weather base flow held back by the tide gate.

Table 2-4

Metering Maxima

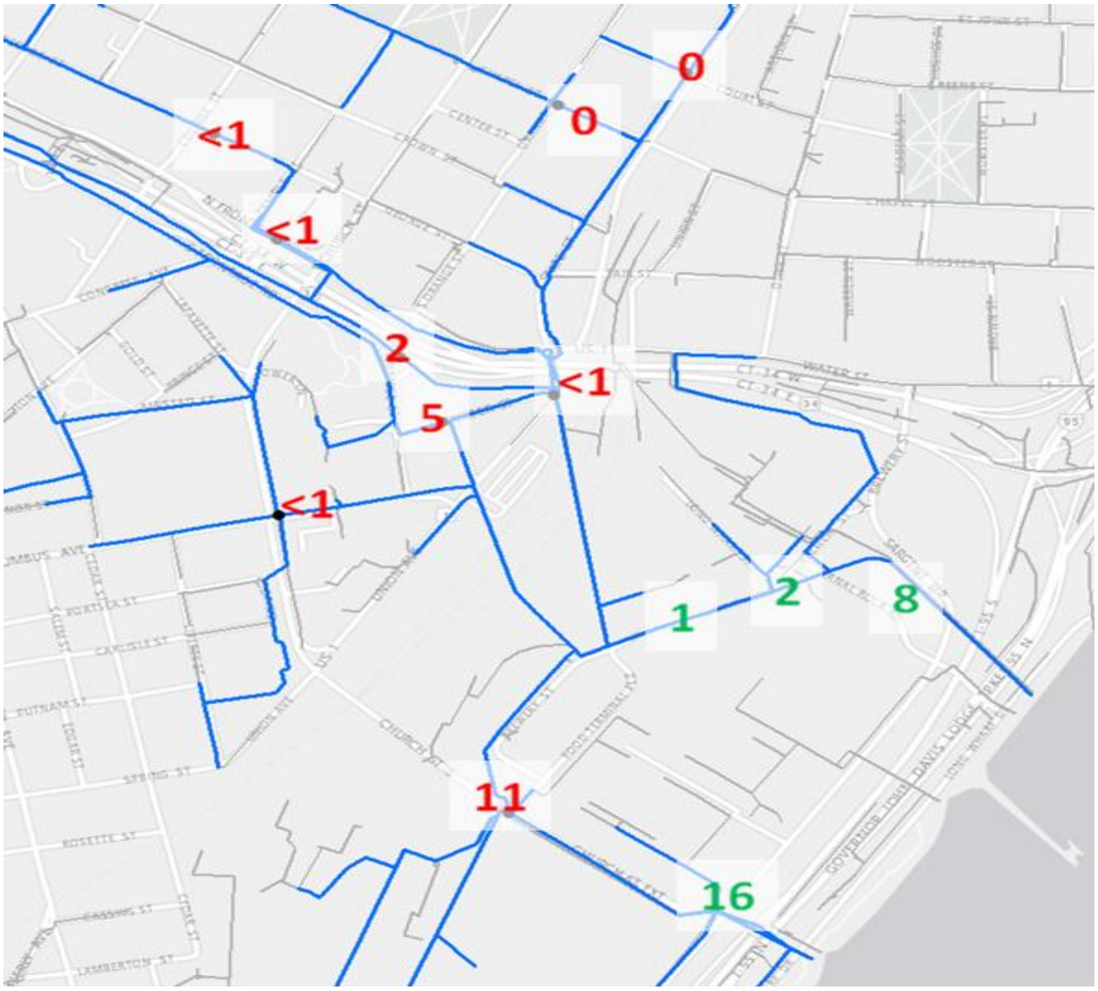
ID	Description	Depth (ft)		Velocity (ft/s)		Flow (ft^3/s)	
		Fall	Spring	Fall	Spring	Fall	Spring
Meter 1	Columbus Avenue 78"	3.4	3.2	1.9	1.7	16	19
Meter 2	West Water Street 48"	4.4	4.0	3.7	2.6	26	14
Meter 3	South Frontage Road 54"	3.6	8.8	3.5	2.9	25	27
Meter 4	North Frontage Road 48"	1.6	1.6	3.6	1.9	12	8
Meter 5	Chapel Street 66"	1.0	NA	4.5	NA	12	NA
Meter 5A	State and Chapel 90"	NA	1.6	NA	6.0	NA	28
Meter 6	State Street 84"	2.2	NA	3.3	NA	23	NA
Meter 7	Union Ave. 72"x48" west barrel	5.2	5.0	2.8	1.9	48	47
Meter 7A	Union Ave. 72"x48" east barrel	NA	4.9	NA	2.5	NA	59
Meter 9	Church St. Ext. 60"x48" east	4.9	4.1	3.9	2.8	29	39
Meter 9A	Church St. Ext. 60"x48" west	NA	4.0	NA	2.2	NA	27
Meter 10	George Street 48"	1.3	NA	3.5	NA	9	NA
Meter 11	Brewery St 72"x48" south barrel	NA	6.4	NA	1.3	NA	25
George	George Street RE034 36"x48"	2.6	4.2	5.0	5.5	12	31
Temple	Temple Street RE034 25"x37"	1.2	4.8	2.2	2.3	3	8
Columbus	Columbus Avenue RE025 30"	10.8	11.3	6.9	7.9	16	31
Regulator 034	79" weir at elevation 13.65'	0.4	3.6	NA	NA	5	140[1]
Frontage	Frontage Road RE025 30"	5.2	10.6	2.8	3.0	13	14
State	State Street RE025 48"x60"	2.3	7.6	5.8	7.9	31	99
Regulator 025	45" weir at elevation 5.35'	4.2	10.7	NA	NA	49	335[1]

1. Flowrates appear unusual, but correspond with greatest flow depths. Highest flow at 025 and 034 recorded 2/25/16 from 1 – 2 AM. Next highest reported flows at 025 and 034 were 179 and 11 cfs respectively on Jan. 10.

2.4 Manhole Inspections

CDM Smith performed manhole inspections to clarify drainage system configurations and to investigate sediment depths. Figure 2-2 shows the depths of sediment found during meter installations and manhole inspections. No inspections were conducted in the Railyard (the City plans to conduct these inspections in the future), but the model calibration (Section 4) suggests that there may be significant hydraulic impairment in the Railyard twin box culverts. CDM Smith recommends that the Railyard pipes be inspected and cleaned if needed.

Downstream of the Railyard, 1 to 8 inches of sediment were encountered in the twin box culverts tributary to the north outfall along Brewery Street and in the IKEA parking lot. Inspection of the 12-foot-wide by 4-foot-high box culvert in Church Street Extension tributary to the south outfall identified 11 to 16 inches of sediment. Cleaning these pipes would improve the system's hydraulic capacity. Minimal sediment was encountered upstream of the Railyard.



Red - CSL meter site
Green – CDM Smith inspection

Figure 2-2 Observed Sediment Depths in Drainage System - Fall 2015 (Inches)

2.5 Sediment Sampling

Fuss & O'Neill performed sediment sampling to identify potential disposal options and reuse alternatives for sediment that could be cleaned from City drains. Sediment samples were collected on May 4, 2016 from four storm drain manholes. Locations are indicated on the map included in the sediment sampling report in Appendix B. Samples were collected using a stainless steel bucket attached to a rod to scoop sediment from the base of the manhole. Each sample was analyzed by York Analytical Laboratories, a Connecticut Department of Public Health Certified Environmental Laboratory.

The sediment has constituent levels similar to what is typically found in street sweepings and catch basin cleanings. If the City has a preferred reuse/disposal location for these materials, it may be possible to manage extracted sediments in a similar manner. Exceedances of the Direct Exposure Criteria and the Pollutant Mobility Criteria, as described in the Connecticut Remediation Standard Regulations, make reuse of the sediment inappropriate where there is the potential for direct exposure, or where it could cause groundwater impacts. It may be possible to use the material under pavement or a building, or with a clean soil “cap” to prevent direct exposure.

This sampling effort was a snapshot in time and location; it may not be representative of sediment throughout the drain system. It is assumed that if the sediment is to be removed, it would be consolidated and tested based on the final volume and potential reuse or disposal alternatives being considered.

Section 3

Design Criteria and Assumptions

3.1 Rainfall Analysis

3.1.1 Frequency Analysis

Precipitation frequency statistics for New Haven are published in National Weather Service publications, and have been developed by other researchers, such as Cornell University's Northeast Regional Climate Center (NRCC). The most recent rainfall frequency statistics for the area were published by NOAA in October 2015 in Atlas 14, Volume 10. This publication formally replaces the 1961 National Weather Bureau TP-40 report, and supersedes the 2013 NRCC atlas. Table 3-1 presents average recurrence interval (ARI) extreme rainfall depths for Tweed New Haven Airport as published in Atlas 14, along with sub-annual estimates based on analysis of local precipitation data using CDM Smith's NetSTORM software. It indicates that, for example, the 10-year 1-day rainfall for New Haven is 5.22 inches. This means that, on average, one storm exceeds this depth over a 24-hour duration in 10 years. The actual number of storms for a specific period can differ from the expected value due to random variation.

Table 3-1

ARI Depth Estimates for Tweed New Haven Airport

ARI*	1-Month	3-Month	6-Month	1-Year	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
5-Minute	0.10	0.20	0.27	0.34	0.41	0.53	0.63	0.76	0.86	0.96
10-Minute	0.15	0.29	0.38	0.49	0.59	0.75	0.89	1.07	1.22	1.36
15-Minute	0.17	0.35	0.47	0.57	0.69	0.88	1.04	1.26	1.44	1.61
30-Minute	0.24	0.45	0.61	0.79	0.95	1.22	1.44	1.74	1.97	2.21
1-Hour	0.34	0.58	0.78	1.00	1.21	1.55	1.83	2.21	2.51	2.81
2-Hour	0.47	0.80	1.05	1.30	1.58	2.03	2.40	2.92	3.32	3.71
3-Hour	0.55	0.94	1.22	1.51	1.83	2.35	2.79	3.39	3.85	4.32
6-Hour	0.71	1.19	1.51	1.92	2.33	2.98	3.53	4.28	4.87	5.45
12-Hour	0.91	1.47	1.88	2.40	2.89	3.69	4.36	5.27	5.98	6.69
1-Day	1.00	1.66	2.20	2.82	3.42	4.40	5.22	6.34	7.20	8.07
2-Day	1.16	1.99	2.62	3.15	3.89	5.09	6.09	7.46	8.52	9.58
3-Day	1.24	2.15	2.81	3.41	4.22	5.54	6.64	8.15	9.32	10.48
4-Day	1.30	2.26	2.93	3.66	4.51	5.91	7.07	8.66	9.89	11.12
7-Day	1.46	2.75	3.65	4.34	5.26	6.78	8.03	9.76	11.09	12.42
10-Day	1.53	3.13	3.97	5.00	5.97	7.55	8.86	10.66	12.05	13.44

While the atlas assumes climatic stationarity, i.e. constancy, it is well recognized that New England's climate has become wetter in recent decades (Horton et al., 2012). It is thus possible that Atlas 14 underestimates current ARI depths, as its statistics are based on data beginning in the 1800s. However, annual series of extreme precipitation for the region do not exhibit significant trends. Figure 3-1 shows annual series of one-day precipitation maxima for New Haven's Tweed Airport. These are the same data used to develop the frequency statistics presented in Atlas 14. Typical annual maximum daily precipitation in New Haven has remained consistent, except for the cluster of very high maxima in the 1870s, with about 10 percent of years exceeding 4.6 inches. As the New Haven data has some gaps, the figure also shows comparable datasets for Bridgeport's Sikorsky Airport, 13 miles to the southwest. Bridgeport has a nearly complete record beginning 1894. The figure also shows data for New York Central Park, which is slightly wetter, but has a complete dataset since the mid-1800s.

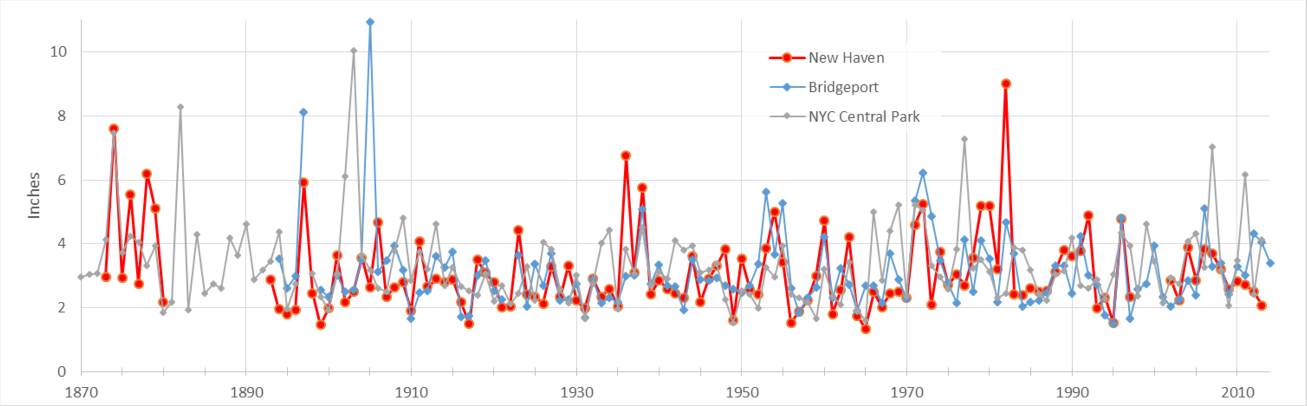


Figure 3-1 Annual Series of One-Day Precipitation Maxima

Figure 3-2 shows analogous hourly datasets for the same stations. While this figure shows record rainfall in Bridgeport in 2012, as well as an extreme event in New Haven that year, there is similarly no evidence of trends in the magnitude, supporting Atlas 14's assumption of stationarity in the historic data.

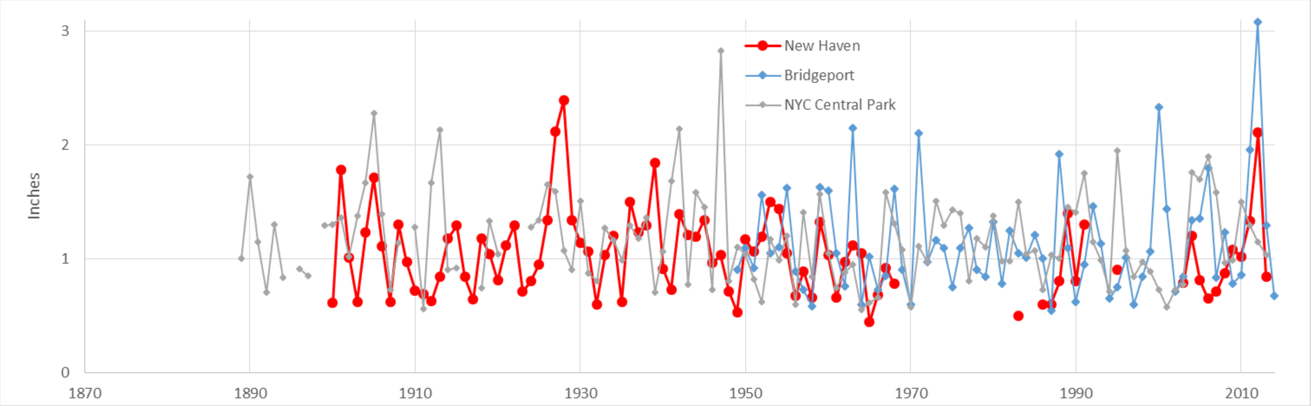


Figure 3-2 Annual Series of Hourly Precipitation Maxima

Atlas 14 makes no projections to account for future climate change. However, EPA has promulgated guidance for estimating changes in extreme rainfall statistics through its CREAT (Climate Resilience Evaluation and Awareness Tool) and SWMM-CAT (Storm Water Management Model Climate Adjustment Tool) software.

Table 3-2 shows projected percent increases in 24-hour New Haven rainfall estimates for the 2045-2074 period for three climate change scenarios. The table shows, for instance, that the 10-year 24-hour rainfall is estimated to increase by 7.5 percent under the Hot/Dry scenario group. Thus, the Atlas 14 10-year 24-hour depth of 5.22 inches is projected to be 5.61 inches by 2060 (the midpoint of the forecast period).

Table 3-2
Projected Percent Increases in 24-Hour Extreme Rainfall Estimates
Under Different Climate Change Scenarios

Scenario	5-Year	10-Year	50-Year
Warm/Wet	10.6	10.4	10.8
Hot/Dry	7.3	7.5	8.3
Median	3.8	4.0	6.1

3.1.2 Recent Flooding

The 2012 report prepared by Cardinal Engineering identified floods along Route 34, Temple Street, and Union Avenue on October 1, 2010, May 18, 2011, and June 23, 2011. Since then, flooding has recurred on August 10, 2012, September 28, 2012, July 14, 2014, August 13, 2014, and possibly other dates. Other parts of the city were flooded on October 29, 2012 due to Hurricane Sandy. While none of these storms had 24-hour rainfall at Tweed New Haven Airport exceeding a 2-year ARI, each had intense short-duration rainfall. Intense short duration rainfall is the principal cause of flooding in New Haven's drainage system, as the time of concentration is well under an hour for most local streets, and about an hour for the complete system. Runoff from intense rainfall can also overwhelm catch basin inlet capacity, and can carry debris that obstructs catch basin inlets. Flow entering the drain system can exceed the conveyance capacity due to inadequately sized infrastructure, or because of local issues such as sediment accumulation. Solutions to mitigate downtown flooding should thus include reduction and conveyance of runoff during short, intense storms.

Table 3-3 lists the storms identified above, as well as all events since 2010 where at least 0.85 inches of rain were recorded in one hour at either the GNHWPCA rain gauge or at Tweed New Haven. The table is color-coded to show each storm's average recurrence interval at various durations. For example, at the GNHWPCA gauge, the July 14, 2014 storm exceeded a 10-year ARI at 15-minute and 1-hour durations, a 5-year ARI at a 3-hour duration, a 2-year ARI at a 6-hour duration, but was less than a 1-year event at a 24-hour duration. The 0.85-inch threshold was chosen to obtain a reasonably sized list; it has no specific relevance to recurrence intervals or flood likelihood. The table shows that 2012 and 2014 both had three 2-year, 1-hour storms. While this is atypical, it is not necessarily indicative of a deficiency in atlas statistics.

Table 3-3
Intense New Haven Rainfall 2010-2016

Date	15-Min	1-Hr	3-Hr	6-Hr	24-Hr	Gauge
August 22, 2010	NA	1.0	1.2	1.7	2.6	Tweed
October 01, 2010	0.3	0.5	0.9	1.0	1.1	Tweed
May 18, 2011	0.6	1.4	1.8	1.8	2.3	Tweed
June 23, 2011	0.5	0.9	1.0	1.4	1.5	Tweed
August 01, 2011	0.7	0.9	0.9	0.9	0.9	Tweed
June 25, 2012	NA	0.9	1.0	1.0	1.1	Tweed
August 10, 2012	1.4	2.2	2.4	2.4	2.9	GNHWPCA
September 18, 2012	0.8	1.3	1.4	1.4	1.4	GNHWPCA
September 28, 2012	0.8	2.0	3.0	3.2	3.4	GNHWPCA
July 11, 2013	0.9	1.0	1.0	1.2	1.4	GNHWPCA
July 23, 2013	0.7	0.9	1.1	1.1	2.0	GNHWPCA
May 16, 2014	0.6	1.1	1.4	1.6	1.6	GNHWPCA
May 27, 2014	0.7	1.3	1.3	1.3	1.4	GNHWPCA
June 13, 2014	0.8	1.6	1.7	1.7	2.1	GNHWPCA
July 14, 2014	1.0	1.8	2.4	2.4	2.5	GNHWPCA
August 13, 2014	0.4	1.1	1.8	2.5	2.7	Tweed
September 21, 2014	0.4	0.9	1.1	1.4	1.4	Tweed
July 01, 2015	0.8	0.9	0.9	0.9	0.9	GNHWPCA
May 30, 2016	0.7	1.1	1.5	1.5	1.5	Tweed
NOAA Atlas 14						
1-Year	0.6	1.0	1.5	1.9	2.8	
2-Year	0.7	1.2	1.8	2.3	3.4	
5-Year	0.9	1.6	2.4	3.0	4.4	
10-Year	1.0	1.8	2.8	3.5	5.2	
25-Year	1.3	2.2	3.4	4.3	6.3	

Notes: Table shows events with at least 0.85 inches in one hour for gauge with larger accumulation. GNHWPCA gauge operational since June 2012; Tweed gauge has deficient hourly and sub-hourly data on many dates. Storms that did not exceed the 0.85 inch in 1-hour threshold are excluded from the table, except known flood event on October 1, 2010.

3.1.3 Design Storm

The design storm for proposed drainage system improvements is a 10-year 24-hour storm using an NRCS Type III synthetic hyetograph, in accordance with standard engineering practices for street drainage system design. The 24-hour rainfall depth for the design storms was selected for a 2066 planning horizon assuming the Hot/Dry climate change scenario identified in EPA SWMM-CAT. The 10-year 2066 event has a 24-hour depth of 5.61 inches, as presented in the discussion accompanying Table 3-2. The NRCS hyetograph was discretized to 5-minute intervals using US Army Corps of Engineers HEC-HMS software.

The largest events recorded at the GNHWPCA gauge in 2012 and 2014 were also simulated to assess system performance under historical storm conditions in conjunction with observed tides. A 7.5 percent scaling factor was applied to the hyetograph of each historic event to simulate the impact of increased extreme storm intensity for the 2066 planning horizon.

3.2 Tide Levels

NOAA maintains a recording tide gauge at the Port of New Haven. Its mean tide range is 6.14 feet, with a great diurnal range of 6.71 feet. Although data for this station is not referenced to the NAVD 88 datum, NAVD estimates can be obtained by subtracting 3.52 feet from observations reported relative to the station's MLLW (mean lower low water) datum. For this study, observed tides were converted from MLLW to NAVD 88 for use in model calibration and for simulation of 2012 and 2014 storms.

For simulation of NRCS design storms, a mean tide condition was simulated with high tide coincident with peak rainfall intensity.

Tides for design simulation conditions were adjusted upward by 0.9 feet to represent an intermediate sea level rise scenario for 2066 conditions, based on estimates obtained from GZA GeoEnvironmental, Inc. for their study of sea level rise impacts on New Haven's shoreline. The current mean high water elevation in New Haven Harbor is elevation 2.84 NAVD88. Adding 0.9 feet to this elevation results in the design mean high water elevation 3.73 NAVD88.

3.3 Level of Service

Use of the 10-year NRCS storm peaking coincident with high tide for design simulations can be expected to yield a level of service exceeding 10 years. This is because while most flooding in the study area is due to brief, intense rainfall, the NRCS hyetograph combines the intense rainfall typical of a summer convective storm with longer-duration depths characteristic of a cyclonic storm such as a hurricane or nor'easter. Additionally, high tide conditions prevail for only about ten percent of the time, so an intense storm is more likely to occur at mid- or low tide. For this reason, design simulations were also performed for the recent floods of 2012 and 2014 to allow realistic assessment of infrastructure improvements needed to attain a satisfactory level of service for the downtown collection system.

Scaling the rainfall and raising the tide level to account for future climate change further increase the expected level of service for present climatic conditions, but provide a reasonable framework for the 2066 planning horizon. Similarly, the effective level of service further into the future would be lower, assuming continued increases in extreme storm intensity (as driven by higher temperatures and other factors) and sea level rise.

Any engineering design specifying a level of service is probabilistic, as well as based on engineering judgement and assumptions. While there were repeated floods in recent years, the next ten years could have zero, one, or multiple 10-year storms. There is also no certainty in the climate projections assumed for this study; actual climate change may be more moderate or more severe.

3.4 Baseline Conditions

The computer model of the drainage system discussed in the next section was initially configured and calibrated to existing conditions. For all design simulations, the model was adjusted to represent planned baseline conditions, i.e. with modifications to the system that are expected to be implemented in the near future independent of infrastructure improvements recommended in this report. The baseline conditions incorporate the following system modifications:

- Approximately 200 15-by 5-foot right-of-way bioswales/rain gardens with 2 to 2.5 feet open graded stone, two feet of engineered soil, 4 to 6 inches of depression storage, and a gabion, similar to New York City Department of Environmental Protection right-of-way bioswales shown in Figure 3-3 below;

- Cleaning of principal City drains that traverse Connecticut Department of Transportation's New Haven Railyard;

- Closure of GNHWPCA's CSO regulator 034 at Temple and George Streets, with accompanying sewer separation and relief pipes;

- Relocation of the drain in front of the former Coliseum site (crossing at Orange Street), and pipe size upgrade to 60-inch diameter; and

- Capacity upgrade at GNHWPCA's Union Street pumping station from 22 to 35 million gallons per day.

Figure 3-3 New York City Department of Environmental Protection Right-of-Way Bioswale

3.5 References

Horton, R., W. Solecki, and C. Rosenzweig, 2012. "Climate Change in the Northeast: A Sourcebook. Draft technical input report prepared for the US National Climate Assessment." http://downloads.globalchange.gov/nca/technical_inputs/nca_ne_full_report_v2.pdf

Section 4

Modeling

4.1 Model Development

A hydrologic and hydraulic computer model of New Haven's downtown drainage system was developed using PCSWMM software. PCSWMM provides a comprehensive GIS-based interface that uses the EPA SWMM computational engine; its inputs and output are fully compatible with EPA SWMM. The model was calibrated to observed conditions and used to identify and assess potential flood mitigation measures. The following principal resources were used in model development:

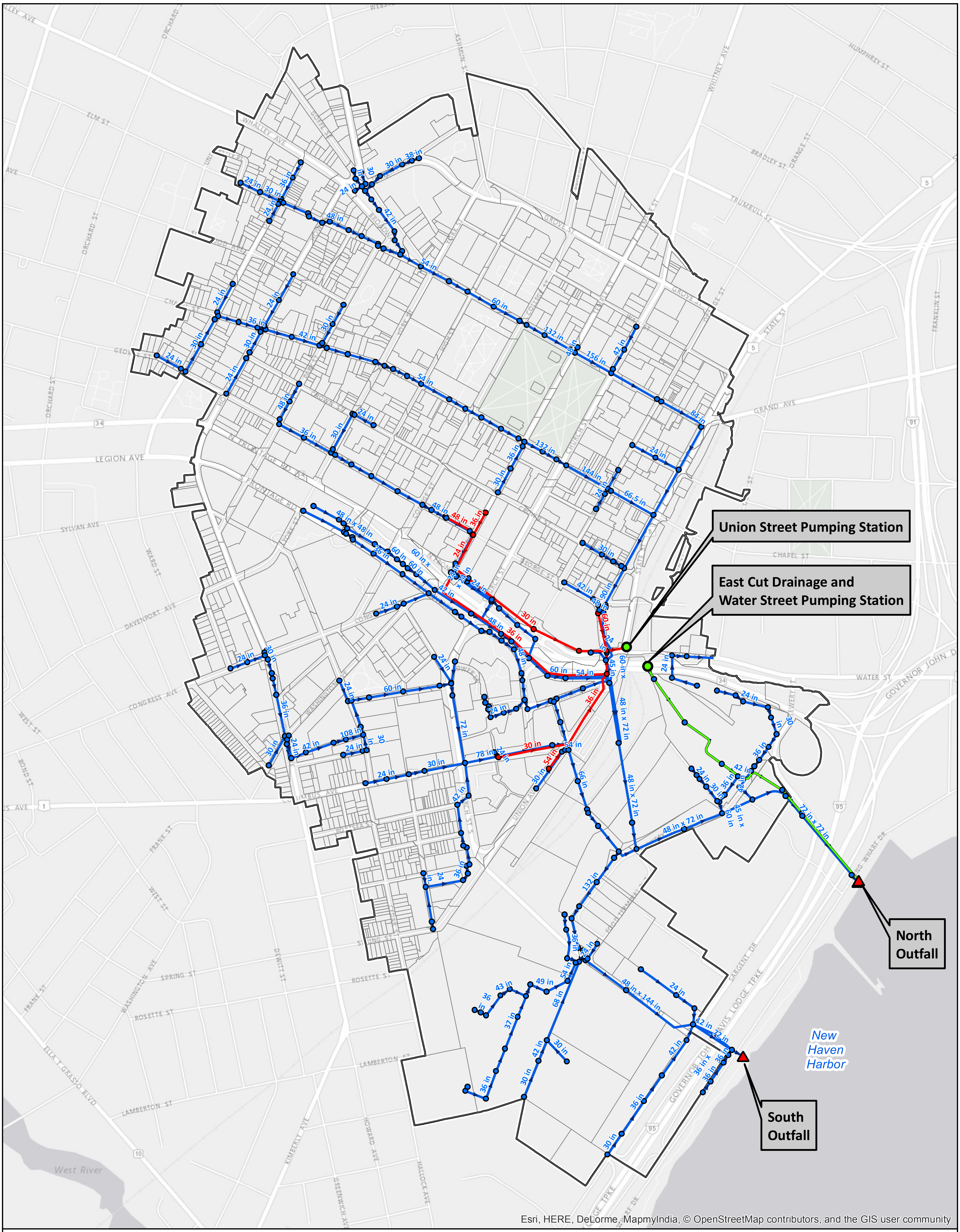
- GNHWPCA geodatabase of drain and sewer system assets;
- City geodatabase with parcel data, roadways, and spot elevations;
- "Drainage Study for Route 34 And Union Avenue" and accompanying SWMM model prepared by Cardinal Engineering Associates in 2012;
- Record drawings from the City, GNHWPCA, and Connecticut DOT;
- City of New Haven planimetric maps;
- US National Land Cover Database 2011 urban imperviousness data accessed at www.mrlc.gov/nlcd11_data.php; and
- NRCS soils data accessed at http://casoilresource.lawr.ucdavis.edu/see/#penwood.

The model was calibrated to fall 2015 and spring 2016 flow metering data, validated against historic storms, adjusted to represent planned baseline conditions, and used to assess potential improvements to mitigate flooding during intense rainfall.

The model incorporates detailed representation of the downtown drainage system. Since the sewer system tributary to CSO regulators 025 and 034 overflows to the drainage system during intense rainfall, the model also incorporates a basic representation of the sewer system tributary to those two CSO regulators.

4.1.1 Drainage Hydraulics

The model incorporates all storm drains with nominal diameters of at least 36 inches in the study area, as well as smaller pipes needed to maintain network connectivity and represent principal drainage sheds (Figure 4-1). As discussed in Section 2, the Cardinal model consisted of 42 pipe segments. This Downtown Stormwater Modeling project enhanced the model by locating nodes geographically and expanding the model to 380 drainage conduits with 10 sewer system links.



Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

Legend

- 🔺 Drain Outfalls
- ● Drain Junction
- ● Sewer Junction
- → Drain Pipe
- → Sewer Pipe
- — Railyard Force Main and Pipes
- ● Pumping Stations
- ☐ Total Project Area/Tributary Drainage Area Boundary
- ☐ Subcatchments

N

1 inch = 800 feet

Feet
0 400 800

New Haven, CT

Downtown Stormwater Modeling Project

Figure 4-1
Baseline Hydraulic Model

CDM Smith

PescatoreEC C:\Projects\New_Haven\ProjectWise\Baseline_Hydro_Model.mxd 1/4/2017

All Railyard drainage is included to provide a comprehensive picture of drainage throughout the areas of interest. Drainage for IKEA and other properties along Sargent Drive is not included in the model; this area is independent of the downtown drainage system and is served by a 36-inch outfall discharging to the Harbor south of the Long Wharf jetty.

The Downtown drainage system drains to the twin box culverts at Union Avenue and State Street and to the 66-inch pipe in Meadow Street. The Union Avenue junction chamber receives flow from a 54-inch pipe in Route 34, a 48-inch pipe in North Frontage Road, and a 90-inch pipe in State Street. The State Street pipe in turn serves a 66-inch pipe in Chapel Street and an 84-inch pipe in Elm Street. The Meadow Street drain serves a 78-inch pipe in Columbus Avenue and a 48-inch drain in South Frontage Road. The Meadow Street and Union Avenue systems are interconnected via a 54-inch drain in West Water Street.

South of the Railyard, both the Meadow Street and Union Avenue drainage systems drain northeast to twin box culverts that run in Brewery Street, and then southeast near Sargent Drive to twin 6-foot by 6-foot outfalls into New Haven Harbor. Additional flow enters the system from the Railyard and Post Office areas. When water levels in Brewery Street exceed 39 inches, flow can discharge southwest to a 76-inch by 48-inch pipe in Brewery Street that connects to a 12-foot by 4-foot box culvert in Church Street Extension, which in turn discharges to New Haven Harbor 1,900 feet south of the north outfall via twin 72-inch circular pipes. The Church Street Extension pipe also receives drainage from the Railyard's West End EMU Storage and Running Repair area via a 54-inch pipe that connects to it from the south near Food Terminal Drive.

While part of the Railyard is served by the Downtown drain system, the mainline tracks lie close to and in places below mean sea level. The Railyard is thus served by the 75 cubic feet per second (cfs) East Cut Drainage and Water Street Pumping Station. The pumping station is located east of the main line tracks beneath the Route 34 overpass. It discharges to a 42-inch force main with an outfall to the Harbor immediately adjacent to the twin box culverts.

Pipe geometry, length, and inverts were initially populated using the GNHWPCA database. Manhole IDs primarily use the "DMH_ID" field from the GIS. These typically use the planimetric sheet ID, the letter "N", and an arbitrary three-digit identifier, such as O18N685. Manholes that did not correspond with named entries in the GIS were named based on streets or other principal geographic features and an arbitrary two or three-digit identifier such as "Chapel109." Key structures were assigned descriptive names such as "UnionAveChamber." Conduit IDs were primarily assigned based on the OBJECTID field in the GIS, as the StormMain_ID field in the existing database was not populated. Some conduit IDs were named to match their upstream manhole ID. Pipes were assigned an initial Manning's n of 0.015; form (minor) losses were not explicitly represented except at key locations such as to represent head loss through the tide gates at the New Haven Harbor outfalls.

The Downtown sewer shed closely overlaps the drainage system. The 18-acre area west of Liberty Street is served by combined sewers; elsewhere the sewer and drain systems are separate, although much private inflow remains connected to the sewer system. The sewer system is served by CSO regulators 034 at Temple and George Streets, and 025 at State Street and Water Street. GNHWPCA has performed sewer separation and hydraulic improvements to limit

CSOs to an average of one CSO in two years. However, during intense rainfall, the CSO regulators still discharge substantial overflows to the drain system.

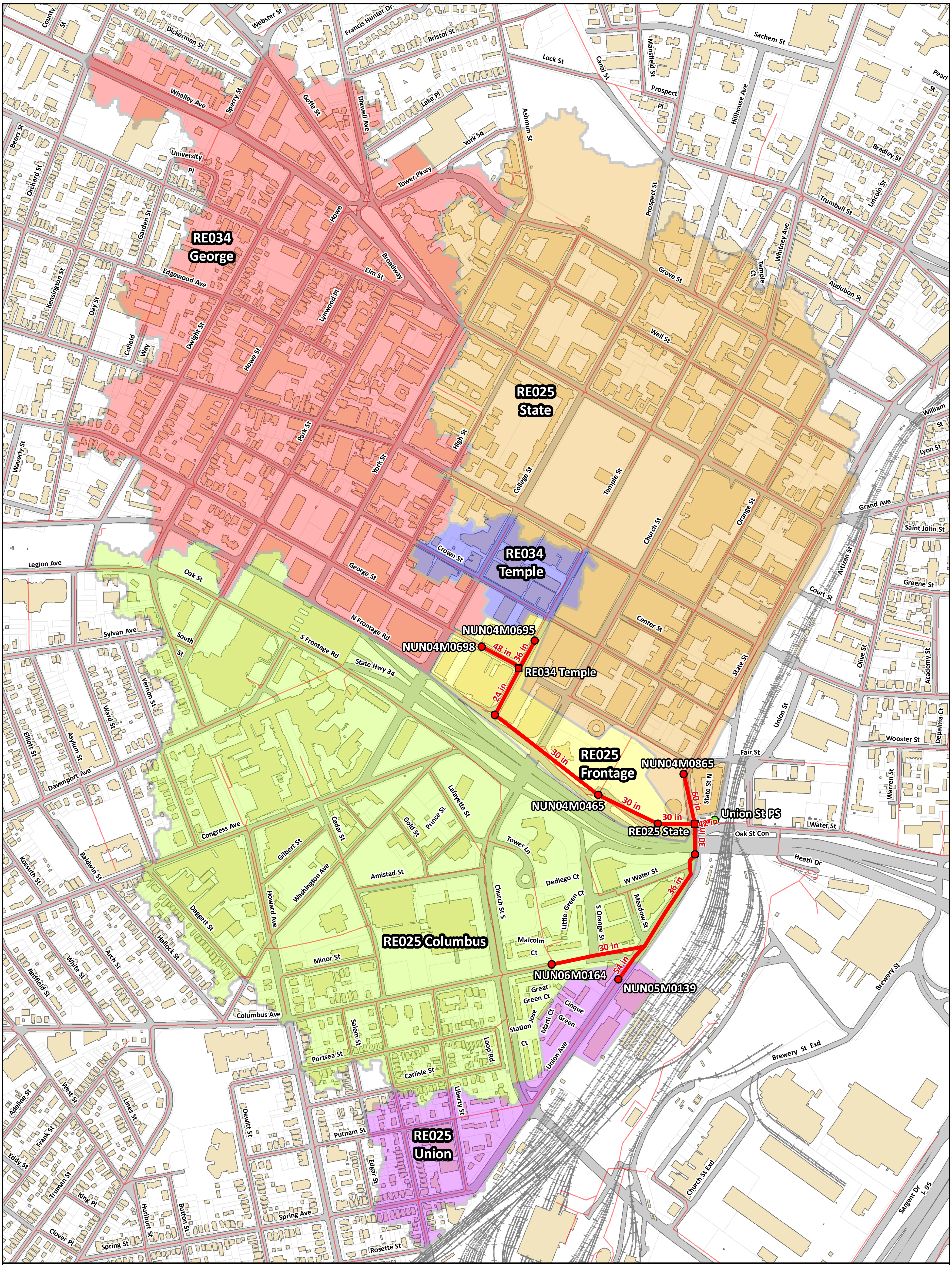
Figure 4-2 shows sewer system components included in the model. The figure shows manhole IDs, principal pipe dimensions, and contributing sewer shed areas, as discussed later in this section. Sewer manhole IDs correspond with the SMH_ID field in the GNHWPCA database.

A 36-inch sewer in Union Avenue, a 30-inch sewer in North Frontage Road, and a 48-inch by 60-inch sewer in George Street drain to regulator 025 at State Street and Water Street. Flow at the regulator is normally conveyed to the Union Street pumping station via a 42-inch pipe. The pumping station conveys 22 mgd toward GNHWPCA's East Shore Water Pollution Abatement Facility. During intense rain, flow can overtop a 45-inch long weir at elevation 4.3 NAVD 88 and discharge to the drainage system. The 30-inch North Frontage Road sewer conveys flow from the 034 regulator. The 034 regulator receives flow from a 48-inch egg-shaped sewer in George Street, and a 36-inch egg-shaped sewer in Temple Street. It overflows to a 48-inch drain in Temple Street via a 78-inch long weir at elevation 12.6 NAVD 88.

Tide conditions at the north and south outfalls are represented using external time series for representation of historic events. Synthetic design storms can be simulated with fixed or time-varying tide levels. As SWMM does not automatically represent head loss at tide gates, these losses were represented by specifying a form loss coefficient (K) of 1.0 at both the north and south outfalls. Setting K=1 yields head loss of 0.25 feet at a flow velocity of 4 ft/s, and a head loss of 1.0 foot at a velocity of 8 ft/s. The model does not consider that under low flow conditions, it typically takes 0.5 feet of hydraulic head to open a tide gate; this phenomenon is not important for assessing hydraulic grade lines during high flow conditions.

Properties of the hydraulic sub-model were assigned as described below

- Most manhole inverts were obtained from the GNHWPCA GIS and adjusted to NAVD 88. Conflicting and missing data were resolved through reference to design drawings and reasonable estimation. Minor discrepancies in inverts are of minimal importance for assessing flooding, as inverts do not affect hydraulic grade lines during surcharge conditions. Under surcharge, only pipe dimensions, friction, and form losses affect head losses.
- Manhole rims were obtained from GIS and interpolation from survey points in the City's geodatabase.
- Surface ponding during flood conditions was specified as 900 ft^2 at most manholes, representing a typical flood area. Surface ponding at three flood-prone locations was specified in detail based on topographic data:
    - Manhole 017N115 at the low point in Route 34 below Church Street was assigned a stage-storage curve similar to that previously used in the Cardinal model.
    - The roadway in front of the Police Station along Union Avenue from Meadow Street to Water Street was allocated equally between drain manhole "MeadowUnionCham" and adjacent sewer manhole "NUN05M0142."



Legend

Sewersheds

- 🟩 RE025 Columbus
- 🟨 RE025 Frontage
- 🟧 RE025 State
- 🟪 RE025 Union
- 🟥 RE034 George
- 🟦 RE034 Temple

Sewer Model Data

- ● Node
- ■ Regulator
- ● Pumping Station
- ▬ Sewer Pipe

Basemap

- — Sewer
- ┼ Railroads
- ▭ Buildings

N

1 inch = 600 feet

Feet
0 300 600

New Haven, CT
Downtown Stormwater
Modeling Project

Figure 4-2
Sewer System Components
Included in SWMM Model

CDM Smith

PescatoreEC C:\Projects\New_Haven\ProjectWise\Sewer_Catchments.mxd 1/6/2017

- Tide at outfalls was obtained from NOAA records for the calibration period and specified as discussed later in this section for design simulations.
- Overflow weirs at the two CSO regulators were assigned typical weir coefficients of 3.3.
- Explicit form losses were only assigned at the harbor outfalls, the Union Street pumping station entrance, the 90-degree turn from the Railyard twin box culverts into Brewery Street, and at the transition from the twin 12x4 box culverts in Church Street Extension to twin 6-foot circular pipes at Sargent Drive. Elsewhere, Manning's coefficient was assumed to adequately represent losses associated with typical bends and transitions. A high form loss factor was also specified for a dummy pipe immediately adjacent to the South outfall to represent leakage through the tide gate noted during calibration.

4.1.2 Hydrology

The hydrologic model was primarily delineated based on parcel data from the City Assessor's database. Additional detail was added to discretize roads, the Railyard, and other large parcels into multiple topography-based sub-catchments. The model consists of 1,393 drainage sub-catchments spanning 835 acres. Most sub-catchments correspond with specific parcels, ranging from 0.001 to 27 acres with a median size of 0.15 acres (6,500 ft^2). The main system covers 797 acres, with the remaining 38 draining to the sewer system or Railyard pumping station. The effective contributing areas to the main system was adjusted to 565 acres based on model calibration to exclude private inflow connections to the sewer system; sewer system inflow is separately modeled using SWMM's unit hydrograph method. Table 4-1 summarizes the tributary areas in the hydrology model.

Flows in the sewer system were represented with average sanitary contributions and inflow modeled using a single unit hydrograph for each principal area. A typical diurnal pattern was applied to all sewage flow. Table 4-2 lists calibrated sanitary flows and "R" factors assigned for each sewershed (calibration is discussed later in this section). The unit hydrograph for each principal area was assigned a response time ("T" factor) of 0.5 hours and a decay ("K") factor of 1.0. The system's composite R factor indicates that 15 percent of rainfall enters the sewers as inflow. The T and K factors describe a triangular hydrograph that takes 0.5 hour to peak and 1.0 hour to decay.

Table 4-1
Tributary Area Summary

System	Drainage Area (acres)	Contributing Area (acres)	Drain To
MAIN SYSTEM			
Storm	780	547	North and South outfalls
Combined	18	18	Union Street Pumping Station via Regulator 025
TOTAL	798	565	
OTHER SYSTEM – Within modeled area but does not drain to main outfalls			
Railyard PS	30	30	Railyard Pumping Station
Railyard	8	8	GNHWPCA sewer
TOTAL	38	38	

Table 4-2
Sewer System Component

Manhole	Principal Sewer	Sewershed Area (acres)	Sanitary Flow		Hydrograph ID	R
			cfs	mgd		
NUN04M0698	George Street 48”	164	0.56	0.36	George Street	0.10
NUN04M0695	Temple Street 36”	50	0.53	0.34		
NUN04M0465	N Frontage Road 30”	30	0.10	0.06		
NUN04M0865	George Street 60”	187	0.96	0.62	Yale Downtown	0.24
NUN06M0164	Columbus Ave. 30”	165	1.60	1.03	Hill	0.14
NUN05M0139	Union Ave. 54”	17	0.19	0.12		
Total		613	3.94	2.53		0.15

Hydrologic parameters were assigned in accordance with best engineering practices. Assignments for each parameter set are discussed below. Parameters that were subsequently adjusted through calibration are identified in bold.

- **Contributing area** was initially specified equal to land area. As the model explicitly represents rooftop runoff to the sewer system, contributing areas were adjusted through calibration to account for surfaces not connected to the drain system.

- **Subcatchment width** affects the time of concentration, and thus controls hydrograph shape. Width was estimated as the length of gutter in the study area. The approximately 800-acre area includes 128,000 linear feet of roadway. As there are two feet of gutter per foot of road, the effective drainage width is 320 feet per acre (128,000 x 2 ÷ 800; analogous to 136 ft of overland flow length). Widths were subsequently adjusted through calibration.

- Imperviousness estimates were obtained from NLCD 2011. Its 30-meter pixel resolution is larger than the smallest sub-catchments, but robustly gauges imperviousness tributary to each major drain.

- The impervious to pervious internal routing model was applied across the model domain, directing a portion of runoff from impervious surfaces onto the pervious component of the same sub-catchment. This is typical of urban runoff conditions, such as where roof leaders drain into grassed yards, or sidewalks drain to adjacent tree lawns.

- The **impervious to pervious routing fraction** was uniformly specified as 100 minus imperviousness. This corresponds with the “mostly disconnected” condition described in Sutherland’s method for estimating effective imperviousness (see e.g. Estimating Change in Impervious Area and Directly Connected Impervious Areas for Massachusetts Small MS4 Permit, EPA Region I, April 2014). CDM Smith has found that the “mostly disconnected” condition yields good initial estimates of runoff in many New England communities. This value was a principal calibration parameter.

- Overland flow slope was uniformly set at 0.4 percent based on an average elevation near 42 ft at the upper end of the watershed and 12 ft at the lower end along a 7,000-foot drainage path. Individual sub-catchment slopes were not differentiated, as SWMM effectively merges sub-catchment width, slope, and roughness into a single parameter, and the width parameter was calibrated.

- Overland Manning's n was uniformly specified as 0.02 for impervious and 0.08 for pervious surfaces, respectively. These are typical values for collection system models. Impervious N is of minor importance because it is lumped with width and slope as noted above. Pervious N is yet less important, as New Haven's sandy soils yield minimal runoff.

- Depression storage was specified as 0.05 and 0.20 inches for impervious and pervious surfaces, respectively, following EPA guidance included with SWMM. These values are of minor importance for assessing flooding. Similarly, the fraction of impervious area without depression storage, which primarily represents sloped roofs, was specified at 25 percent. This is a typical value in SWMM models, and is of little importance for assessing flooding.

- The Green-Ampt method was used to simulate soil processes. Soils across the model were uniformly specified with a suction head of 1.9 inches, hydraulic conductivity of 3.8 inches per hour, and an initial deficit of 34 percent, characteristic of very sandy soils such as the Penwood soil type prevalent in New Haven.

- Evaporation was specified as a constant 0.1 inches per day. Evaporation is of little importance for event-based flood modeling, which was the focus of this study.

- SWMM's groundwater baseflow simulation component was not used for this study due to the minimal importance of baseflow during flood-producing rainfall. Instead, 1.24 cfs/mi^2 of baseflow was allocated across all subcatchments and varied by month, ranging from 0.7 cfs in summer to 2.8 cfs in spring. The system-wide value was obtained from baseflow analysis of USGS Mill River gauge 01196620 in Hamden, with the assumption that baseflow in New Haven's drains is reasonably comparable with baseflow in a natural stream. Baseflow simulation allows the model to function sensibly in dry weather and light rainfall, which is helpful during calibration. Baseflow was assigned by specifying each sub-catchment's acreage in SWMM's "Inflows" data section, and scaling all inflows by a monthly pattern with units of cfs/acre, yielding cfs.

- Existing low-impact development (LID) practices were represented on eight parcels on the Yale campus and Chapel Street totaling 2.5 acres, and the Alexion Pharmaceuticals site at 100 College Street. An infiltration trench was configured to represent the installations at these sites. The model simulates a drywell 12 feet deep with a 1:2 voids to solids ratio, yielding an effective void depth of 4 feet. This was not intended to be a direct representation of an infiltration trench, as these types of green infrastructure practices are generally two to four feet deep. Rather, it represents an appropriate volume for each installation. Each site was assigned LID usage parameters in accordance with its storage volume, ranging from 0.5 to 1.5 inches of site runoff.

4.2 Calibration

4.2.1 Overview

The model was calibrated to conditions observed from November to December 2015 and March through May 2016. Much of the calibration involved investigation into flowrate discrepancies at some metering locations, especially along Route 34, where the GIS did not fully define system connectivity, and downgradient of the Railyard, for which only limited drainage shed data were initially available. Principal parameter adjustments can be classified into three groups:

- Pipe friction and sediment estimates to account for elevated hydraulic grade lines observed at the Union Avenue junction chamber and further upstream
- R factor for sewers. As sewer inflow can vary from less than 1 percent in a strictly sanitary system to above 20 percent in systems with high private inflow, robust model representation can only be attained through calibration
- Contributing area, routing coefficient, and width for drainage sub-catchments. Contributing area was adjusted downward in conjunction with allocation of inflow to corresponding sewer system components based on review of both drain and sewer system metering data. Routing coefficients were adjusted to improve the match between simulated and observed runoff volumes, while width was adjusted to improve hydrograph timing.

Additional minor calibration adjustments were made to mimic leakage into the drain system from the South outfall tide gate, and to replicate observed dry weather flow upstream of Meter 2.

Manning’s n was adjusted upward from its 0.015 setting in 39 pipes to a weighted mean of 0.021 and a maximum value of 0.025. The calibrated system-wide N of 0.016 is typical of an urban collection system, but the high values in the adjusted pipes appear to reflect significant hydraulic deficiencies in the reach from the Railyard to the North and South outfalls. As Manning’s n in concrete pipes should not typically exceed 0.017, these high values may indicate sediment accumulations or other blockages. No blockages were observed in manhole inspections performed for this study, but may be present in the Railyard, which could not be accessed for this project.

Three calibration periods of varying length were selected from both the fall and spring metering programs for detailed hydrograph review as listed in Table 4-3. Scatterplots comparing observed and simulated peak and summary conditions for all storms were also reviewed. The six selected events encompass most of the wet days over the two monitoring seasons. Most span two distinct storms separated by a day or more. The 4.88 inches of rainfall over the three fall events includes most of the 6.05 inches of rain recorded over the fall metering program, while the 5.75 inches over the three spring events includes most of the 7.32 inches measured during that program.

Table 4-4 summarizes the hydrologic calibration. Parameters reduced through calibration are shaded purple; increased values are shaded red. Area was reduced where drain and sewer system flow metering suggested that significant portions of the drainage shed connect directly to the sewer system. Effective drainage area was reduced to less than half of total area for the Hill (Meter 1), Chapel Street (Meter 5), and Elm Street (Meter 6) systems. Effective imperviousness was adjusted slightly downwards for Meters 5 and 6, as the area reductions alone did not adequately reduce simulated flows to observed levels. For Meters 3, 4, 7, and 9, effective imperviousness was set to measured imperviousness (i.e. SWMM’s Outlet routing method was invoked), as measured flows exceeded initial simulated values. Width was modestly adjusted from its initial value of 320 feet per acre to improve hydrograph response times. Width was increased to steepen hydrographs for sub-catchments draining to Meters 5, 6, and 9, while it was decreased to flatten hydrographs for sub-catchments draining to Meter 1 and areas classified in the table as “Other.”

Table 4-3
Calibration Events

Event	Duration (days)	Storms	Rain (inches)		
			1-Hr	24-Hr	Total[1]
Fall 1	0.9	November 19, 2015 18:45	0.31	1.12	1.12
Fall 2	3.3	December 14, 2015 19:30	0.39	0.80	1.78
		December 17, 2015 5:00	0.32	0.98	
Fall 3	2.0	December 22, 2015 10:00	0.18	0.43	1.98
		December 23, 2015 15:30	0.45	1.55	
Fall Total					**4.88**
Spring 1	6.3	March 28, 2016 5:00	0.20	0.82	2.69
		April 1, 2016 0:30	0.35	1.68	
Spring 2	3.8	April 22, 2016 20:00	0.24	0.51	1.05
		April 26, 2016 4:00	0.36	0.54	
Spring 3	4.5	May 3, 2016 2:45	0.11	0.66	2.14
		May 6, 2016 4:30	0.56	0.76	
Spring Total					**5.75**

[1] - Total rainfall spans event duration

The calibrated drain system-wide effective imperviousness is 64 percent. This value is reasonably analogous with the Rational Method runoff coefficient, which can be used to estimate peak runoff. As an example, the projected mid-century 10-year 30-minute rainfall for New Haven is about 1.55 inches. Plugging these values into the Rational Method, one can estimate peak runoff from the Downtown/Hill system (roughly Meters 1 through 7 and 10, a 530-acre catchment) as Q = CiA = 0.64 x 3.1 in/hr x 530 ac. = 1,052 cfs. During an extreme storm, the total flow into the drain system would also include CSOs from the sewer system. Using the R value presented in Table 4-2 to represent sewer inflow, a similar Rational Method calculation yields inflow of Q = 0.15 x 3.1 in/hr x 613 ac. = 285 cfs. Assuming the upgraded Union Street Pumping Station will have approximately 48-cfs wet-weather capacity (allowing for 6-cfs sanitary flow), approximately 237 cfs additional inflow must also be accommodated by the drain system, for a total peak flow of 1,287 cfs (1,052 + 237) without accounting for storage effects. For the comparable 1-year intensity (0.85 in/30 min), corresponding inflows of 577 and 108 cfs are obtained, totaling 685 cfs. These estimates differ from calculations performed in the model, which uses an implementation of Manning's equation for computing surface runoff, and explicitly simulates routing through the collection system. These flowrates exceed the collection system's conveyance capacity through the Railyard. As discussed in Section 4.3 below, the full pipe flow capacity of the drainage system through the Railyard is 235 cfs, while maximum flow conveyed in the 10-year design storm with extensive surcharge is 400 cfs.

Table 4-4
Hydrology Calibration

Meter ID	Drainage Shed	Area (acres)		Imperviousness			Calibrated Width (ft/acre)
					Effective		
		Original	Calibrated	Measured	Original	Calibrated	
1	Columbus Avenue	106	48	76	59	59	282
2	South Frontage Road	53	53	77	61	61	320
3	Route 34	32	32	83	70	83	320
4	George/Temple Streets	3	3	93	86	93	320
5	Chapel Street	109	50	69	52	49	397
6	Elm Street	195	78	72	55	45	416
7/7A	Downtown	44	44	84	72	84	320
9	Railyard West End	86	86	84	71	84	342
10	George Street	32	32	75	58	58	320
Other[1]		139	139	78	61	61	295
North/South outfall system		798	565	76	60	64	334

Blue shading indicates reductions from the initial model based on calibration; red indicates increased values

[1] Other includes areas gauged at spring Meters 9A and 11A, as well as Liberty Street combined sewers.

4.2.2 Meter 7 Detail

Calibration plots were produced comparing time series of depth, velocity, and discharge for each calibration event at each drain and sewer metering site. Figure 4-3 presents results for Meter 7 for Spring event 3. Refer to Figure 2-1 for meter locations. Nearly 300 similar time series plots for all metered sites are presented in Appendix C. This meter (along with 7A in the spring) was given the most weight in making calibration adjustments. While its unique drainage shed is small compared with the other meters, it receives flow from Meters 3 through 6, as well as any overflow from the CSO regulators. Additionally, its hydraulic grade line is influenced by downstream conditions in the Railyard and outfall pipes, and affects levels upstream in the flood-prone areas.

Figure 4-3 shows distinct responses to the May 3 and May 6 storms, a minor storm late on May 4, and several distinct peaks within the May 6 storm. The hydrograph component most critical for assessing the model's value for simulating system capacity is the sharp spike in discharge to 47 cfs on May 7, with an accompanying spike in water level to an observed depth of 5.0 feet, one foot above the pipe crown at 4 feet. During this period, modeled discharge is well-aligned with observed values. Modeled and observed depths exhibit the same shape, rising and falling over a six-hour period. Peak simulated depth is low, at 4.2 feet, but simulates some surcharge. The discrepancy between observed and simulated depth is mirrored in the velocity data, which shows that while the model simulates a peak of 2.8 ft/s, the data indicate a peak of only 1.9 ft/s.

The earlier peaks on May 3rd through the 6th show both similarities and differences with the major peak on the 7th. The model underestimates each minor peak depth observation, and fails to replicate steady upward drift in depth in the hours near midnight on both the 5th and 7th. Modeled discharge closely follows observations on May 6th, but is less consistently aligned with the data at other times. The model underestimates dry weather flowrate, but this is of little importance for assessing wet weather conditions.

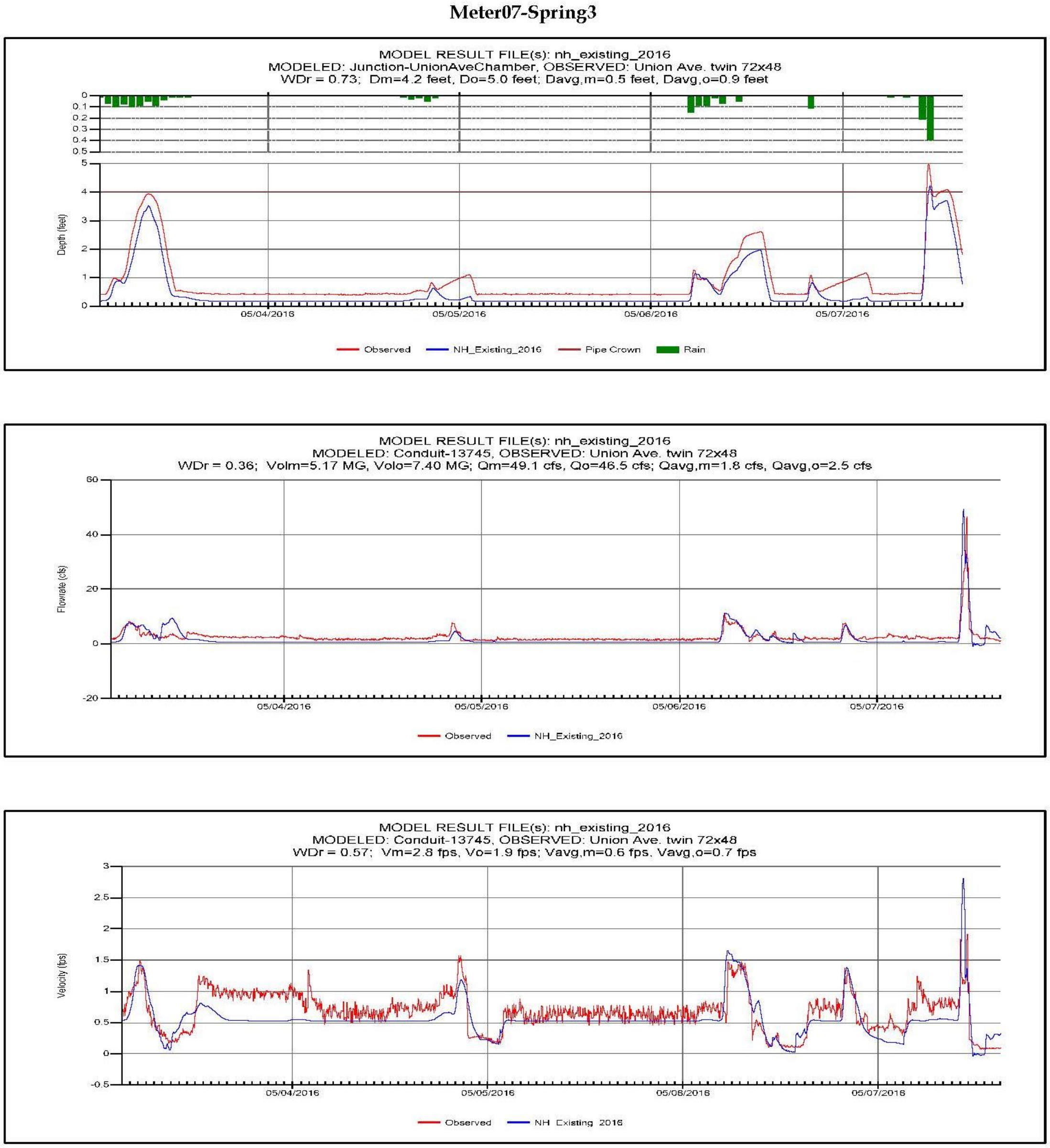


Figure 4-3 Simulated vs Observed Flow at Meter 7 for Spring Event 3

Observed velocity has four distinct peaks near 1.5 ft/s from May 3rd through 6th; three of those are well-matched by the model. Velocity also has distinctive troughs coinciding with high tide conditions; the model replicates these conditions well, matching drops to near-zero velocities corresponding with high tides at 5/3 9 AM, 5/4 10 PM, and 5/6 11 AM, and 5/7 at noon. It is important to note that the invert at the Union Avenue chamber lies at -0.1 NAVD 88, while the highest tide over the spring monitoring period was above 5.2 NAVD 88 near midnight on May 6. During high tide conditions, flow must fill the entire box culvert system downgradient of Meter 7 before it can overcome tidal head and discharge to the Harbor. In this situation, head losses between the meter site and the outfall are cumulative, so any local blockage could potentially control observed water levels.

As simulated flowrates over Event 3 are all reasonable, this dataset suggests that the model underestimates head loss through the pipe system downstream of Meter 7. This discrepancy occurs despite modeled Manning's n in the Railyard box culverts being adjusted to 0.025, higher than anywhere else in the system, and past the limits of expected performance for concrete pipe. As the model performs quite well in some events (for example, on March 28 during Spring Event 1, as shown in the appendix), and a principal recommendation of this study is inspection and cleaning of the Railyard pipes, the calibration was judged adequate as presented here for the purpose of understanding the system and planning improvements.

Figure 4-4 presents summary scatterplots for Meter 7. Each red dot in the graphs compares observed and simulated summary statistics for a storm in Table 2-2. Dots below the lower blue line identify events where the model underestimates observed conditions. The most anomalous dot in the volume plot shows an event where observed volume was over 5 million gallons (MG), while modeled volume was only 2 MG. Dots falling between the two blue lines mark events where simulated results fall within the tolerance limits specified in the commonly used WaPUG guidelines for collection system model calibration (although WaPUG guidelines suggest that a model only need be calibrated to three principal events). Dots falling above the upper blue line indicate events where the model overestimates observed totals or peaks. In the graph showing peak discharge, the model exceeds WaPUG criteria in three events where peak discharges between 20 and 30 cfs were estimated, while observations fell near 10 cfs. The thick black line identifies ideal correspondence; the 47 cfs peak discharge on May 7th falls close to this line. The peak discharge and peak velocity plots show a good deal of scatter, but no obvious bias. The volume plot shows that the model underestimates total volume, but corresponding plots in Appendix C show that upstream volumes at Meters 3 through 6 generally show modeled volumes exceeding measured volumes. As the local loads in the immediate vicinity of Meter 7 (upstream of the twin 6- by 4-foot box culverts) were adjusted up to a reasonable limit, this discrepancy could not be resolved. And, as discussed above, simulated peak depths were consistently low across most storms, despite significant calibration adjustments to modeled head losses downstream of Meter 7.

4.2.3 Other Locations

Appendix C presents 300 time series plots for all meters and calibration events. Appendix D presents 78 scatterplots with summary statistics for all measured storms. A brief discussion of findings from calibration at each metering site is presented below. Refer to Figure 2-1 for meter locations.

Drainage System Meters

- Meter 1 / Columbus – Flow depth in this 78-inch pipe rarely exceeded two feet, with velocities consistently under 2 ft/s and flow never exceeding 20 cfs. Modeled depth was consistently high, and modeled velocity consistently low. The contributing area was adjusted downward in conjunction with specification of a high R factor for the Columbus Avenue sewer to achieve reason able peak discharges and event volumes for Meter 1.

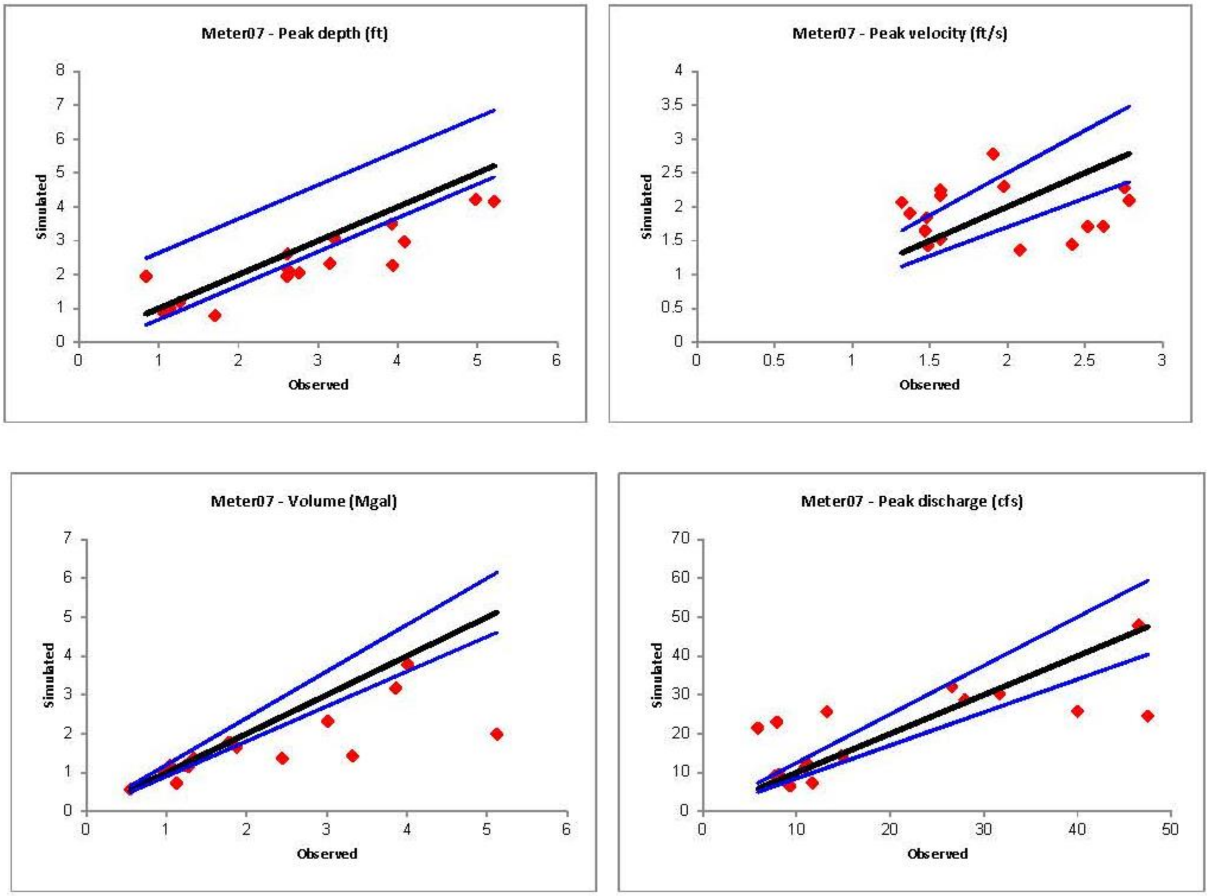


Figure 4-4   Summary Scatterplots for Meter 7

The low simulated depth and high simulated velocities could be improved by reducing downstream conveyance in the 78-inch pipe or the old Meadow Street drain, but such adjustments would be based only on observations in the lower one-third of the pipe's cross-section, and thus might not be representative of its full flow conditions.

- Meter 2/ S. Frontage – Scatterplots for this location show fairly high scatter for volume, peak discharge, and peak velocity, with peak depths biased low. The event hydrographs show good general conformance between model and gauge.

- Meter 3/ Route 34 – Event volumes and peak depths are biased low in the scatterplots. Event hydrographs show strong conformance between modeled and gauged flows and depths for some events, with velocity measurements consistently noisy. The 54-inch pipe did not fill beyond four feet during fall or spring, but the scatterplots incorporate the February 23rd storm, where observed depth reached almost 9 feet.

- Meter 4 / Temple – The model is well-calibrated and performs very well at this location, which was downstream of Meter 10 and RE034. Flow depths in the 48-inch pipe never exceeded 20 inches.

- Meter 5 / Chapel, Meter 6/ Elm, Meter 5A – The model performs well at these locations after drainage areas were adjusted to relocate much of their inflow to the sewer system. Flow depth never exceeded 1 foot in the 66-inch Chapel Street pipe, or 2 feet in the 7-foot Elm Street pipe. These two meters were replaced in the spring by Meter 5A, in the outgoing pipe from the manhole where the two lines meet. Flow volumes were overestimated at 5A, but downward adjustment of flow would have degraded the fit at 5, 6, and 7.

- Meter 7A – Average measured flow was 20 percent lower than at Meter 7 in the adjacent twin-box culvert barrel, but wet-weather flows were very similar between the two pipes.

- Meter 9 / Railyard West - Although the 2014 DOT Maintenance of Way Building Drainage Report (DOT Project 301-0124) shows a 10-year peak discharge of 51 cfs for this pipe, observed flows above 30 cfs were recorded in four events during the fall and spring monitoring programs, with a peak discharge of 39 cfs on May 7th. The contributing area above the meter was reviewed with DOT, and calibration was achieved by specifying outlet routing for the 84 percent impervious area. Steady rise and fall of water levels during dry weather in the absence of significant dry weather flow led to specification of minor leakage through the South outfall tide gate. Manning's n in the 1,700-foot reach from the meter to the South outfall was increased to 0.020 and 11 inches of sediment was specified. Despite these modifications, modeled peak depths remain one to two feet low, and the model never simulated surcharge, which was recorded in several storms.

- Meter 9A / Church St. Ext. – This meter was added to the spring program to improve understanding of the interconnection between the North and South outfall systems. The model did reasonably well simulating hydraulic grade lines, and up to 20 cfs discharging toward the South outfall. It did not replicate up to 10 cfs of reverse flow observed at the beginning of several storms. As reverse flow occurred regardless of hydraulic grade lines, it may simply be that the geometry of the junction structure preferentially directs flow from the Railyard pipe into the Meter 9A pipe when the latter has no incoming flow.

- Meter 10 – Simulated and measured flows matched very well at this site. While modeled depths were lower than observed depths, head losses were not calibrated, as liquid depth never rose above the bottom third of the 48-inch pipe. This site was abandoned for the spring program, as Meter 4, located 900 feet downstream, incorporates its drainage shed.

- Meter 11 – This site was metered in the spring to isolate hydraulic losses in the lower end of the North outfall system. The site was not included in the fall program because it was expected that velocity could not be reliably measured. A velocity meter was deployed for the spring program, but no useful measurements were obtained. The model simulated peak levels well at this site, suggesting that friction losses (N=0.025 in all pipes) and form losses (K=1 at the outfall) in the 1,600 feet between the meter and the outfall are reasonably representative of actual conditions. The regular 2-foot rise and fall of levels in the pipe during dry weather was attributable to its filling with baseflow. The model did a good job mimicking observed dry-weather levels with no leakage through the tide gate.

Sewer System Meters

As discussed above, adjustment of R factors based on flow metering was critical to achieving reasonable calibration in the sewer system. Depths and velocities were considered of peripheral interest, as sewer system conditions only affect the drainage system when its total flow exceeds the 21 mgd (32 cfs) existing capacity of the Union Street Pumping Station.

- Columbus Avenue – The model was well-calibrated and did a good job simulating flows, which peaked between 15 and 20 cfs in larger storms. The 30-inch sewer repeatedly surcharged to depths of 6 to 12 feet. Observed dry-weather velocities averaging near 6 ft/s could not be replicated in the model, but the model satisfactorily represented lower velocities during surcharge.
- Frontage Road - The calibrated model matches observed flows well at this location. The 30-inch pipe surcharged during most significant storms, with depths reaching 6 to 10 feet in the four largest storms.
- George, State, Temple Streets – The model performs well across all events at each of these sites.
- RE034 – The model simulated more events than were observed at this site, but simulated overflow rates never exceeded 5 cfs.
- RE025 – Observed flow rates at this site appear erroneous. The model did a reasonable job simulating overflow duration, but underestimated peak depths. Simulated depths reached 5 feet, while observed depths reached 11 feet.

4.3 Baseline Conditions

Following model calibration, system hydrology and hydraulics were adjusted to reflect planned baseline conditions (Section 3.4). To assess conveyance capacity and design flows, simulated sediment was removed from pipes, and Manning's n-values were adjusted downward to 0.015 in the Railyard and outfall lines. The future case 1-year through 10-year NRCS design storms were simulated with the future case design tide (year 2066 mean high water at elevation 3.73 NAVD88).

The existing conditions model simulated significant flooding from the Columbus Avenue sewer to Union Avenue for all simulated design storms. For this reason, future case simulations were performed assuming that all wet-weather inflow that currently enters the sewer system will be diverted to the drain system. This assumption slightly underutilizes system capacity, as the Union Street Pumping Station is slated for upgrade to 35-mgd capacity, but the difference is judged insignificant for planning purposes and provides a margin of safety.

The full pipe flow capacity of the Meadow Street drain and twin box culverts through the Railyard and onward to the North outfall is much less than the flow that can be delivered by the upstream collection system, even after assuming clean pipe conditions in the Rail Yard and downstream. Table 4-5 estimates full pipe capacity in these key conduits after cleaning and presents simulated peak discharges for the 10-year storm. These conduits currently convey all drainage and CSOs from the Downtown and Hill drainage areas, and also receive flow from the Railyard and Post Office areas. There is limited hydraulic relief to the west via the Brewery Street overflow to the

South outfall system, but that system is also stressed beyond capacity during intense rainfall by local and Railyard drainage.

Table 4-5
Full Pipe Capacity Estimates for Key Pipes

	Railyard		North Outfall U/S	North Outfall D/S
	Meadow at Union to Brewery	Twin Box Culverts from Union to Brewery	6x4 Twin Box Culverts in Brewery	6x6 Twin Box Culverts at Sargent Drive
Upstream crown (ft, NAVD)	4.82	3.95	2.52	1.72
Downstream crown (ft, NAVD)	4.21	2.52	1.72	1.05
Head loss allowance (ft)	0.61	1.43	0.80	0.67
Length (ft)	1,085	1,500	1,120	1,320
Slope	0.06%	0.10%	0.07%	0.05%
Width (ft)	--	6	6	6
Height (ft)	5.5	4	4	6
Barrels	1	2	2	2
Area (ft^2)	23.8	24.0	24.0	36.0
Hydraulic radius (ft)	1.4	1.2	1.2	1.5
Q (cfs per barrel)	69	83	72	105
V (ft/s)	2.9	3.5	3.0	2.9
Total Capacity (cfs)	**69**	**166**	**144**	**211**
Simulated 10-yr Peak Discharge (cfs)	**152**	**252**	**312**	**350**

Notes:

The Railyard pipes both drain to the 6x4 culverts, which in turn drain to the 6x6 culverts. Approximately 100 cfs of Railyard drainage can discharge to the South Outfall via the Brewery Street diversion chamber and the 76x48 drain to South Church Street.

Manning's n of 0.015 in clean pipe assumed; form losses not explicitly considered.

Meadow Street drain is assumed to have a 66-inch circular cross-section. Its actual cross section may differ, as it is a lined arch-shaped brick drain.

The simulated 10-year peak discharges are one and one-half to more than twice the full pipe flow capacities of the pipes, and produce flooding across the collection system. There is little capacity for surcharge without causing flooding due to shallow cover along these routes, especially at the intersection of Meadow Street and Union Avenue, as well as further upstream in Route 34. Furthermore, while the pipe calculations assume crown-full flow at the outfall, that level is just above mid-tide under current sea level conditions. Typical high tides reach 3 NAVD 88, while spring tides can be two feet higher; these conditions reduce overall conveyance capacity.

The drainage system model can be used as an effective tool to assess flood control through conveyance and storage improvements (both in-system and constructed storage), supplemented by green infrastructure improvements. To effectively inform planning needs, Table 4-6 presents baseline conditions peak wet-weather inflows for 1-year to 10-year 24-hour NRCS storms. While flows in the sewer system are presently only indirectly connected to the drainage system via CSO regulators 034 (which is slated for closure) and 025, these flows must be considered in flood reduction planning, as the sewer system has limited capacity for conveying wet-weather inflow, and sewer system flooding is typically mitigated either via CSOs, or by re-routing inflow directly to the drainage system.

Table 4-6

Peak Collection System Flows (cfs)

Pipe	System	Capacity	1-Year	2-Year	5-Year	10-Year
	Hill/South of Route 34					
Columbus Ave. 78"	Drainage	247	53	89	102	142
S. Frontage / W Water 48"	Drainage	67	76	89	89	93
Columbus/Union/Liberty	Sewer	12	34	34	34	35
Hill/South of Rte. 34 Total Drainage[1]		**326**	**129**	**177**	**191**	**235**
	Downtown					
State Street 90"	Drainage	367	153	185	244	338
North Frontage Road 60”[2]	Drainage	123	50	56	74	85
Route 34 54"	Drainage	111	31	39	56	58
Downtown[3]	Sewer	250	90	107	135	160
Downtown Total Drainage[1]		**851**	**233**	**280**	**374**	**481**
Hill/Route 34/Downtown Total[1]		**1,177**	**362**	**457**	**564**	**716**

[1] Maximum unattenuated peak flow rate (timing of peaks may result in lower flow rate)

[2] Planned replacement for existing 48”

[3] Sum of capacity of State and Frontage Road sewers

The remainder of this report identifies flood reduction improvement solutions to meet the City’s Downtown planning objectives.

Section 5

Alternatives Analysis

5.1 Introduction

CDM Smith evaluated drainage improvements needed to reduce flooding in problem areas, namely Route 34 / Downtown Crossing, Temple Street (south of George Street), Union Avenue, and Water Street, taking into account existing conditions and future development plans for the area. Alternative solutions were evaluated using the calibrated SWMM model, designing drainage facilities to control peak rates of runoff at mean high water during a 10-year 24-hour storm under Year 2066 climate change conditions (with a 7.5-percent increases in precipitation and 0.9-foot sea level rise). The analysis also examined the capacity of proposed improvements during historical storms adjusted for year 2066 climate change conditions, as discussed in Section 3. SWMM model results were evaluated in terms of predicted flooding extent and hydraulic grade lines throughout the problem sections of the study area.

The alternatives analysis includes consideration of:

- Flow diversion to a new/supplemental outfall system to New Haven Harbor;
- In-system storage in existing drainage system;
- New subsurface storage systems and other types of green infrastructure; and
- A pumped discharge system.

5.2 Alternative 1 – New Outfall from State and Water Streets

Alternative 1 examined the degree of flood control that could be attained with a new gravity outfall to New Haven Harbor from the intersection of State and Water Streets. A siphon would be needed to cross under the railroad tracks with sufficient pipe cover to construct the crossing by microtunneling, jacking, or other trenchless technology. Forty percent of the total project drainage area (337 acres) drains to the 90-inch diameter drain in State Street. The pipe route with the least impact to the railroad and utilities that could collect separate stormwater flow from the 90-inch drain upstream of CSO regulator 025 is located north of Route 34 along Water Street, then south along the Vision Trail and east to Canal Dock Road (see Figure 5-2 under Alternative 3). The Farmington Canal Greenway was also considered as a potential alternative pipe route; however, the Farmington Canal Greenway is scheduled for construction this Fall, preventing simultaneous construction of a new drainage outfall and the Greenway, and the Vision Trail provides a more direct pipe route to Canal Dock Road.

SWMM modeling of Alternative 1 revealed that diverting only the separate stormwater flow in twin 5-foot diameter drains could control peak rates of runoff from only up to a year 2066 1-year 24-hour storm in flood problem areas. If flow were allowed to back up from Union Avenue to the new Water Street diversion pipe, the ground elevation where Union Avenue flooding occurs is too low to allow the hydraulic grade line (HGL) to rise high enough to provide 10-year 24-hour storm control. Even with new triple 10-foot diameter pipes, only a 5-year 24-hour storm could be controlled and flooding would be controlled only in the Route 34 area. Further roof leader disconnections would also be needed to prevent combined sewage from discharging to the new outfall from combined sewer overflows (CSOs) at regulator 025. Hence, this alternative would not cost-effectively provide the desired level of flood control.

5.3 Alternative 2 – Subsurface Storage Systems

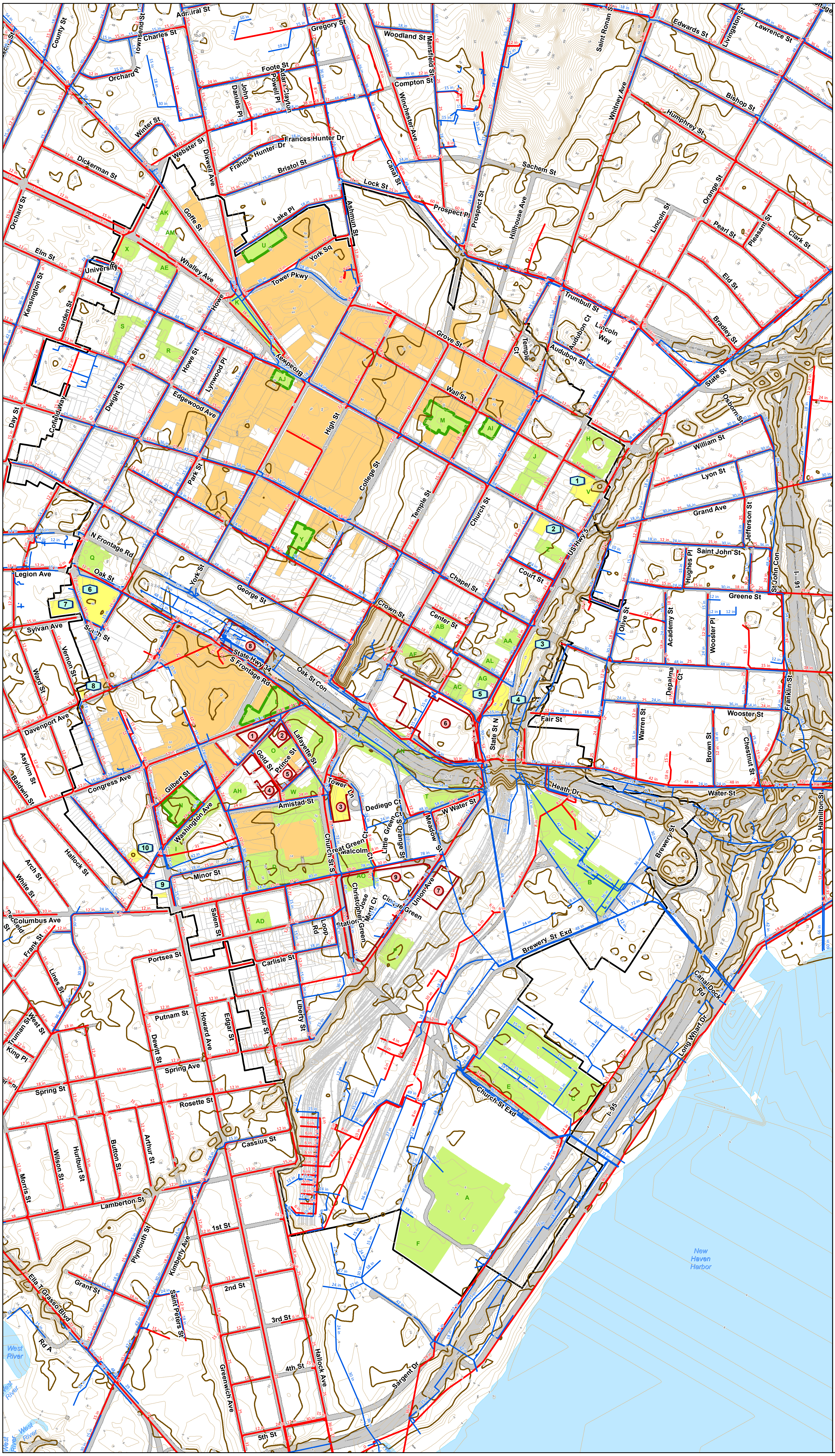
CDM Smith reviewed the amount of subsurface storage alone needed to control year 2066 peak rates and volumes of runoff during a 10-year 24-hour storm at mean high water, as well as the locations where subsurface storage would be possible. Figure 5-1 shows potential sites for subsurface storage and other green infrastructure practices, based on a review of publicly-owned properties and private properties with open lots and minimal tree cover. The figure also shows locations of planned developments in the project area. CDM Smith reviewed historical borings and groundwater data to examine the feasibility of stormwater infiltration, as well as existing pipe inverts to design storage facilities to drain to the existing drainage system following a storm where needed.

It was found that storage alone could not control flooding along Route 34 and Union Avenue during the year 2066 10-year 24-hour design storm. A year 2066 5-year 24-hour storm level of control could be attained with a total of about 12.3 MG of storage, as well as the addition of relief pipes along Route 34 and in Water Street. Hence, similar to Alternative 1, Alternative 2 would not cost-effectively provide the desired level of flood control.

5.4 Alternative 3 – New Outfall and Subsurface Storage

Alternative 3 is a combination of Alternatives 1 and 2, with a new outfall from State and Water Streets and subsurface storage in three private property locations, shown on Figure 5-2. Based on SWMM modeling, twin 8-ft diameter pipes in combination with 8.3 MG of subsurface storage, approximately 1,800 feet of 3.5-ft diameter relief pipe and 950 feet of 4-ft diameter relief pipe along Route 34 would control year 2066 10-year 24-hour storm peak rates of runoff at mean high water. Similar to Alternative 1, a siphon would be needed to cross under the railroad tracks with sufficient pipe cover to construct the crossing by microtunneling, jacking, or other trenchless technology, and the pipe route would follow the Vision Trail to discharge to the harbor at Canal Dock Road.

As shown on Figure 5-2, the proposed 3.5-ft diameter relief pipe would extend from east of College Street to the proposed subsurface storage facility on the Knights of Columbus property behind the Police Station. The relief pipe is needed to supplement flow capacity in the existing 3.5-ft drain along Route 34 between College and Church Streets where the pipe flattens out and flooding occurs at a low point with little pipe cover. The proposed 4-ft diameter relief pipe along the north side of Route 34 is designed to control flooding that occurs at Temple Street and currently ponds in the adjacent parking garage. The 4-foot relief pipe would work in parallel with the existing 4-ft diameter drain in North Frontage Road and connect to the 5-foot diameter Orange Street crossing drain to be constructed under the Downtown Crossing/Route 34 project (included in the model baseline conditions). These relief pipes could also be constructed as part of the ongoing Downtown Crossing / Route 34 project.



New Haven, CT

Downtown Stormwater Modeling Project

Figure 5-1
Potential Subsurface Storage and Green Infrastructure Locations

Legend

- A Private Property Identification
- 🟩 Potential Private Properties
- 🟨 Potential Public Properties
- ▢ Potential Yale Sites
- 🟧 Yale Property
- ▢ Total Tributary Drainage Area Boundary

Potential Public Sites for Subsurface Storage and Green Infrastructure

1 Children's Museum Parking Lot
4 Wall Street

2 Parking Lot
40 Elm Street

3 N Lot Parking Lot
253 State Street

4 O Lot Parking Lot
221 State Street

5 George and State Street Lot 3
25 George Street

6 Connecticut Mental Health Center
34 Park Street

7 Hospital Parking Lot
914 Howard Ave

8 Greenspace
119 Davenport Avenue

9 Vacant Lot/Greenspace
634 Howard Avenue

10 Wilson Library
303 Washington Avenue

Planned Developments

① 216 Congress Avenue
② 222 - 246 Lafayette Street
③ Tower Lane #9
④ 10 - 32 Gold Street
⑤ 49 Prince Street
⑥ New Haven Coliseum Site Redevelopment
⑦ Union Square Parking Garage
⑧ 100 College Street
⑨ Church Street South / Union Square

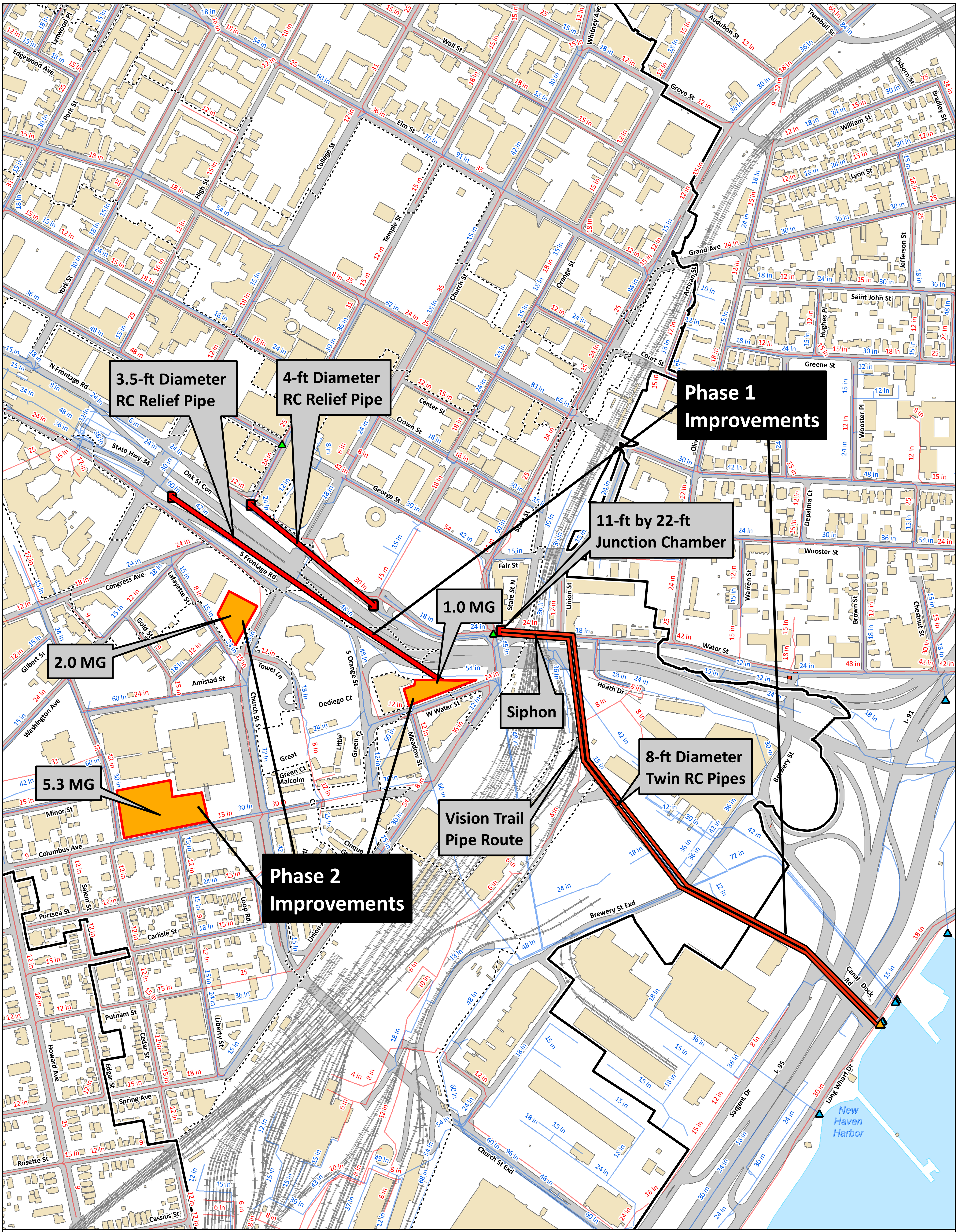
N

1 inch = 550 feet

Feet
0 550 1,100

CDM Smith

PescatoreEC C:\Projects\New_Haven\ProjectWise\Fig_OnsiteGI_24x36.mxd 9/21/2016



Legend

Proposed

- ▲ Drain Outfall
- ▬ Gravity Pipe
- 🟧 Subsurface Storage
- ■ Junction Chamber

Existing

- ▲ CSO Regulator
- ▲ Outfall
- ▢ Total Project Area/Tributary Drainage Area Boundary
- ⬚ Sub-Tributary Drainage Area Boundary
- — Drain
- — Sewer
- ┼ Railroads
- ▢ Buildings
- ▢ Shoreline

N

1 inch = 500 feet

0 250 500 Feet

New Haven, CT
Downtown Stormwater Modeling Project

Figure 5-2
Alternative 3
New Outfall and Subsurface Storage

PescatoreEC C:\Projects\New_Haven\ProjectWise\Alternative_3_Farmington_Canal_Greenway_Large_Pipes_Subsurface_Storage_Final.mxd 1/13/2017

Alternative 3 is a viable option to provide the desired level of flood control; however, further roof leader disconnections would be needed to prevent regulator 025 CSOs from discharging to the new outfall and to some of the storage facilities. Separate stormwater is discharged to the proposed 2.0-MG storage facility at 2 Church Street South. Flap gates can be installed on the existing 54-inch drain along Route 34 on the north side of the proposed 1.0-MG storage facility behind the Police Station at the Knights of Columbus property, on the 54-inch drain in West Water Street on the south side of the site, and on the storage discharge pipe to prevent combined sewage from entering the proposed storage facility. However, capacity is needed in the existing 78-inch drain in Columbus Avenue and in the proposed 5.3-MG storage facility at the Yale site on Columbus Avenue for combined sewage to backflow into the storage instead of flooding the streets. Unless further roof leader disconnection from the sewer system can be constructed or other CSO improvements can be done to eliminate CSOs at regulator 025, the 5.3-MG storage facility would need to be a CSO storage facility. Project cost estimates in this report assume CSO improvements have been made and all proposed storage facilities are separate stormwater storage facilities, similar to the reinforced concrete manufactured subsurface storage and infiltration systems shown in Figure 5-6 below. Please note that the proposed stormwater storage facilities are watertight and are not designed to infiltrate due to groundwater elevations at the three subsurface storage sites. Following storms, the subsurface storage systems are designed to drain by gravity to the drainage system. Pre-treatment devices such as particle separators are recommended upstream of the proposed stormwater storage facilities to reduce sediment and debris and associated clogging of the systems. If CSO storage facilities are needed in the future, the CSO storage facilities must drain back to the sewer system following storms, odor control, tank cleaning and other appurtenances will be required, and the storage costs should be increased approximately 150 percent.

CDM Smith used the SWMM model to examine the performance of Alternative 3 during historical low-volume high intensity storms (adjusted for year 2066 climate change) using a phased approach, constructing the twin 8-foot diameter gravity pipes and the 3.5- to 4-ft relief pipes in Phase 1, then constructing the three subsurface storage facilities in Phase 2. It was found that the Phase 1 drainage improvements reduced flooding during the 5-year 1-hour storm (2.2 inches of rainfall) that occurred June 13, 2014. Adding the three storage facilities in Phase 2 would bring the level of service up to the 10-year 24-hour design storm (5.6 inches of rainfall) with only minor flooding at Temple Street and North Frontage Road (briefly 0.1 foot above manhole rim). Tables summarizing the analysis are in Appendix E.

Table 5-1 summarizes both total and phased probable project costs for Alternative 3. Project costs include estimated construction costs, a 30-percent construction contingency, engineering and implementation costs. Construction costs are scaled to an estimated mid-point of construction in May 2019. Costs for land acquisition and easements are not included. As shown in Table 5-1, the total probable project cost for Alternative 3 drainage improvements is approximately $69 million. Under the phased approach described above, Phase 1 project costs are estimated at $38.7 million and Phase 2 project costs are $33.2 million.

Table 5-1
Alternative 3 – New Outfall and Subsurface Storage
Opinion of Probable Project Costs

Total Costs

Description	Pipe Size (in)	Quantity	Unit	Unit Cost	Estimated Cost
Microtunnel Siphon at Railroad Tracks (200 lf)	--	1	ea	$5,100,000	$5,100,000
Junction Chamber	--	1	ea	$458,500	$458,500
Twin 8-foot Diameter RCPs (3,200 lf each)	96	6,400	lf	$2,150	$13,760,000
Headwall and Riprap Pad		1	ea	$225,000	$225,000
3.5-Foot Diameter RCP	42	1,800	lf	$800	$1,440,000
4-Foot Diameter RCP	48	950	lf	$850	$807,500
3 to 4.5-Foot Flap Gates	--	3	ea	$25,000	$75,000
Subsurface Storage (4-foot inside depth)	--	5.3	MG	$2,113,396	$11,201,000
Subsurface Storage (4.6-foot inside depth)	--	2.0	MG	$1,978,500	$3,957,000
Subsurface Storage (7.5-foot inside depth)	--	1.0	MG	$1,855,000	$1,855,000
Subtotal					**$38,879,000**
Construction Contingencies (30%)					$11,663,700
Total Construction Costs (May 2016 ENR 10,315)					**$50,542,700**
Construction Cost at Mid-Point of Construction (May 2019)					**$55,229,373**
Engineering and Implementation Costs (25%)					$13,807,343
Opinion of Probable Project Costs (Rounded)					**$69,037,000**

Phased Costs

Description	Pipe Size (in)	Quantity	Unit	Unit Cost	Estimated Cost
Phase 1					
Microtunnel Siphon at Railroad Tracks (200 lf)	--	1	ea	$5,100,000	$5,100,000
Junction Chamber	--	1	ea	$458,500	$458,500
Twin 8-foot Diameter RCPs (3,700 lf each)	96	7,400	lf	$1,859	$13,760,000
Headwall and Riprap Pad		1	ea	$225,000	$225,000
3.5-Foot Diameter RCP	42	1,800	lf	$800	$1,440,000
4-Foot Diameter RCP	48	950	lf	$850	$807,500
Subtotal					**$21,791,000**
Construction Contingencies (30%)					$6,537,300
Total Construction Costs (May 2016 ENR 10,315)					**$28,328,300**
Construction Cost at Mid-Point of Construction (May 2019)					**$30,955,098**
Engineering and Implementation Costs (25%)					$7,738,775
Opinion of Probable Phase 1 Project Costs (Rounded)					**$38,694,000**
Phase 2					
Subsurface Storage (4-foot inside depth)	--	5.3	MG	$2,113,396	$11,201,000
Subsurface Storage (4.6-foot inside depth)	--	2.0	MG	$1,978,500	$3,957,000
Subsurface Storage (7.5-foot inside depth)	--	1.0	MG	$1,855,000	$1,855,000
3- to 4.5-Foot Flap Gates	--	3	ea	$25,000	$75,000
Subtotal					**$17,088,000**
Construction Contingencies (30%)					$5,126,400
Total Construction Costs (May 2016 ENR 10,315)					**$22,214,400**
Construction Cost at Mid-Point of Construction (May 2022)					**$26,525,155**
Engineering and Implementation Costs (25%)					$6,631,289
Opinion of Probable Phase 2 Project Costs (Rounded)					**$33,157,000**
Opinion of Probable Total Project Costs (Rounded)					**$71,851,000**

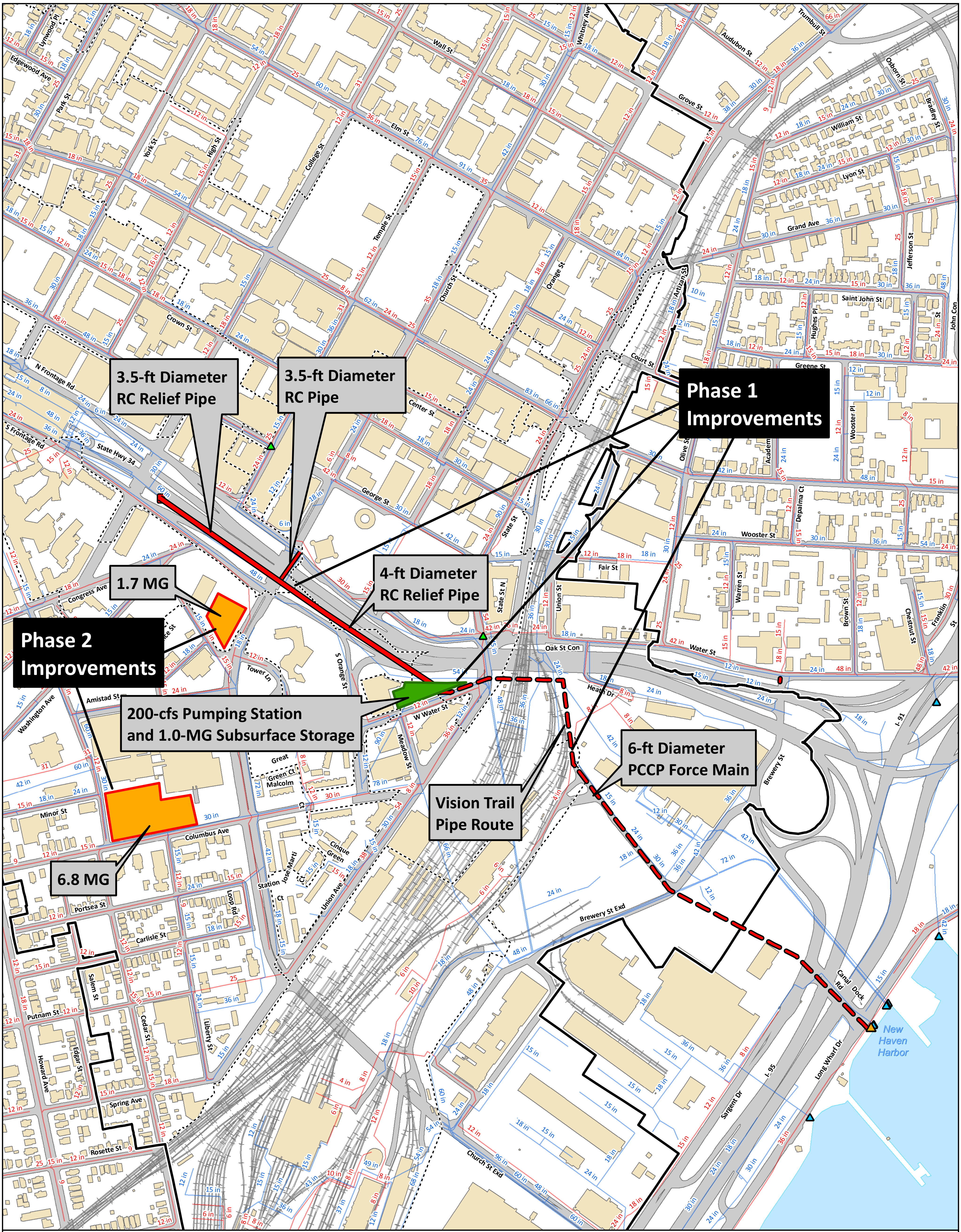
5.5 Alternative 4 – Pumping and Subsurface Storage

CDM Smith also evaluated the combination of pumping and subsurface storage. Based on SWMM modeling, a 200-cfs pumping station, 6-foot diameter prestressed concrete cylinder pipe (PCCP) force main and 9.5 MG of storage at three separate locations would be needed to achieve a Year 2066 10-year 24-hour level of control at mean high water (Figure 5-3). A relatively short length (200 ft) of 3.5-foot diameter pipe is proposed across Route 34 (cross-connecting the two drains at the intersection of Church Street and North Frontage Road and replacing the existing 24-inch drain across Route 34) to control flooding at Temple Street. It will connect to a 3.5- to 4-ft diameter relief pipe proposed along the south side of Route 34, needed to supplement flow capacity in the existing 3.5-ft drain along Route 34 between College and Church Streets where the pipe flattens out and flooding occurs at a low point with little pipe cover. As shown on Figure 5-3, the proposed 3.5- to 4-ft diameter relief pipe would extend from east of College Street to the proposed subsurface storage facility on the Knights of Columbus property behind the Police Station.

Similar to Alternative 3, separate stormwater is discharged to the proposed 1.7-MG storage facility at 2 Church Street South. Three flap gates can be installed to prevent combined sewage from entering the 1.0-MG storage facility and pumping station behind the Police Station at the Knights of Columbus property. However, unless further roof leader disconnections can be constructed, the 6.8-MG storage facility would need to be a CSO storage facility due to backflow of combined sewage from the 66-inch arch drain into the 78-inch drain in Columbus Avenue. If CSOs at regulator 025 were eliminated and flap gates were not needed, the storage needed along Columbus Avenue could be reduced to 5.5 MG due to a higher availability of in-system storage.

CDM Smith considered sliplining a force main in the 66-inch arch drain that runs under the Railyard. However, the maximum force main size may be limited to 54 inches due to past lining of the arch, which would provide only about 111-cfs pumped capacity. This would be a net gain of only 42 cfs over the existing arch pipe capacity (the capacity of the existing 66-inch arch pipe is 69 cfs, as shown in Table 4-5). Hence, sliplining does not appear to be cost-effective.

As discussed in Section 1, Parsons-Brinckerhoff's (PB's) primary recommendation in the 2014 Downtown Crossing Phase 2 – Orange Street Drainage Feasibility Study was construction of a 120-cfs screw pumping station located at the Air Rights Garage discharging to the West River via the Route 34/MLK Boulevard corridor. This option would convey flow approximately 1,200 feet from the Air Rights Garage to an existing 54- to 84-in diameter drainage system. Placing a pumping station at a higher elevation than the flood problem areas mitigates flooding in only some parts of the system. The City and CDM Smith considered pumping flow from the proposed Knights of Columbus site behind the Police Station to the 54- to 84-inch diameter drainage system and the West River.



Legend

Proposed

- 🔺 Drain Outfall
- ▬ Gravity Pipe
- ●- - Force Main
- 🟩 Subsurface Storage and Pumping Station
- 🟧 Subsurface Storage
- ■ Junction Chamber

Existing

- ▲ CSO Regulator
- ▲ Outfall
- ☐ Total Project Area/Tributary Drainage Area Boundary
- ⬚ Subtributary Drainage Area Boundary
- — Drain
- — Sewer
- ┼ Railroads
- ▨ Buildings
- ▨ Shoreline

N

1 inch = 500 feet

0 250 500 Feet

New Haven, CT

Downtown Stormwater Modeling Project

Figure 5-3
Alternative 4
Pumping and Subsurface Storage

CDM Smith

PescatoreEC C:\Projects\New_Haven\ProjectWise\Alternative_4_Subsurface_Storage_and_Pumping_Station_Final.mxd 1/12/2017

However, pumping east to the Vision Trail route and New Haven Harbor has several advantages over this option:

- Both options require similar force main lengths, but there are potentially fewer utility conflicts along the Vision Trail route.
- The Vision Trail route option has a significantly lower total dynamic head (TDH) than the West River option. The lower TDH for the Vision Trail route option translates to lower costs for decreased pump motor horsepower, and decreased rating of the electric power system (plus potentially smaller physical size of the electrical equipment).
- Fewer permitting issues. Sending stormwater flow out of the project drainage area to the West River may require a Water Diversion Permit from the Connecticut Department of Energy & Environmental Protection (DEEP). Adding freshwater to the tidally influenced wetland area in the West River is counter to recent efforts to restore this area to a salt water marsh. There have been invasive species issues, particularly Phragmites, due to flap-style tide gate installations that caused a more freshwater regime. In 2012, three of the flap tide gates were removed and three self-regulating tide gates were installed, allowing salt water to enter the river system when the tide rose above the river. Hence, a proposal to discharge new freshwater flow to the West River from the Downtown drainage area would not be well-received.

Similar to Alternative 3, CDM Smith used the SWMM model to examine the performance of Alternative 4 during historical low-volume high intensity storms using a phased approach. The first phase would be the installation of the pumping station, force main, relief pipes, and the 1.0 MG of subsurface storage co-located at the pumping station location in the parking lot behind the New Haven Police Department. This would control peak rates of runoff during the 5-year 1-hour storm event that occurred June 13, 2014 (2.2 inches of rainfall). Tables summarizing the analysis are in Appendix E.

The second phase would include the 6.8-MG and 1.7-MG subsurface storage locations. The addition of these two subsurface storage locations would bring the level of service up to the year 2066 10-year 24-hour design storm (5.6 inches of rainfall).

The proposed 3.5- to 4-ft relief drains along Route 34 can be constructed as part of the ongoing Downtown Crossing / Route 34 project (the 200-ft 3.5-ft diameter pipe across Route 34 should not be brought online until the proposed pumping station and force main are in place). SWMM modeling was also performed to examine the impact of constructing just these relief pipes prior to other proposed drainage improvements. It was found that installing these pipes lowers the upstream hydraulic grade line, but more improvements are needed downstream to reduce flooding at the Police Station and along Route 34 (see hydraulic profile in Appendix E).

Table 5-2 summarizes both total and phased probable project costs for Alternative 4. As shown in the table, the total probable project cost for Alternative 4 drainage improvements is approximately $68.7 million. Under the phased approach described above, Phase 1 project costs are estimated at $39.1 million and Phase 2 project costs are $32.3 million.

Table 5-2
Alternative 4 – Pumping and Subsurface Storage
Opinion of Probable Project Costs

Total Costs

Description	Pipe Size (in)	Quantity	Unit	Unit Cost	Estimated Cost
200-cfs Pumping Station	--	1	ea	$9,000,000	$9,000,000
Microtunnel Force Main at Railroad Tracks (500 lf)	--	1	ea	$5,000,000	$5,000,000
6-foot Diameter Force Main	72	2,800	lf	$1,550	$4,340,000
Headwall and Riprap Pad		1	ea	$100,000	$100,000
3 to 4.5-Foot Flap Gates	--	3	ea	$25,000	$75,000
3.5-Foot Diameter RCP	42	1,050	lf	$800	$840,000
4-Foot Diameter RCP	48	950	lf	$850	$807,500
Subsurface Storage (6-foot inside depth)	--	6.8	MG	$1,971,176	$13,404,000
Subsurface Storage (5.5-foot inside depth)	--	1.7	MG	$1,919,412	$3,263,000
Subsurface Storage (7.5-foot inside depth)	--	1.0	MG	$1,855,000	$1,855,000
Subtotal					**$38,684,500**
Construction Contingencies (30%)					$11,605,350
Total Construction Costs (May 2016 ENR 10,315)					**$50,289,850**
Construction Cost at Mid-Point of Construction (May 2019)					**$54,953,077**
Engineering and Implementation Costs (25%)					$13,738,269
Opinion of Probable Project Costs (Rounded)					**$68,692,000**

Phased Costs

Description	Pipe Size (in)	Quantity	Unit	Unit Cost	Estimated Cost
Phase 1					
200-cfs Pumping Station	--	1	ea	$9,000,000	$9,000,000
Subsurface Storage (7.5-foot inside depth)	--	1.0	MG	$1,855,000	$1,855,000
Microtunnel Force Main at Railroad Tracks (500 lf)	--	1	ea	$5,000,000	$5,000,000
6-foot Diameter Force Main	72	2,800	lf	$1,550	$4,340,000
Headwall and Riprap Pad		1	ea	$100,000	$100,000
3 to 4.5-Foot Flap Gates	--	3	ea	$25,000	$75,000
3.5-Foot Diameter RCP	42	1,050	lf	$800	$840,000
4-Foot Diameter RCP	48	950	lf	$850	$807,500
Subtotal					**$22,017,500**
Construction Contingencies (30%)					$6,605,250
Total Construction Costs (May 2016 ENR 10,315)					**$28,622,750**
Construction Cost at Mid-Point of Construction (May 2019)					**$31,276,852**
Engineering and Implementation Costs (25%)					$7,819,213
Opinion of Probable Phase 1 Project Costs (Rounded)					**$39,097,000**
Phase 2					
Subsurface Storage (6-foot inside depth)	--	6.8	MG	$1,971,176	$13,404,000
Subsurface Storage (5.5-foot inside depth)	--	1.7	MG	$1,919,412	$3,263,000
Subtotal					**$16,667,000**
Construction Contingencies (30%)					$5,000,100
Total Construction Costs (May 2016 ENR 10,315)					**$21,667,100**
Construction Cost at Mid-Point of Construction (May 2022)					**$25,871,651**
Engineering and Implementation Costs (25%)					$6,467,913
Opinion of Probable Phase 2 Project Costs (Rounded)					**$32,340,000**
Opinion of Probable Total Project Costs (Rounded)					**$71,437,000**

The total project costs for Alternative 4 are slightly lower than the Alternative 3 project costs. As discussed above, if CSOs at regulator 025 were eliminated and flap gates were not needed, the Alternative 4 storage needed along Columbus Avenue could be reduced to 5.1 MG in the future due to a higher availability of in-system storage. This would bring the total project cost down to $62.8 million, which is nine percent ($6.2 million) lower than the total project costs for Alternative 3.

Alternative 4 also has the following advantages over Alternative 3:

- A siphon is required at the railroad pipe crossing for the Alternative 3 gravity pipe system. There is potential for pipe clogging at this crossing due to the relatively low velocities in the gravity pipe system. The proposed pumping station and force main are designed to pump flow at 7 fps. This higher velocity will greatly reduce the potential for pipe clogging at the railroad crossing.

- Large-diameter pipe crossings, such as the 6- by 4-foot pipe crossing in Brewery Street, are easier with a force main. A force main can pass under the large-diameter pipes without the clogging issues associated with a siphon, discussed above.

- There is more versatility with a non-clog-type pumping station to adapt to higher sea level rise. Potential pumping selections include non-clog pumps, axial flow pumps, and Archimedes screw pumps. The non-clog pumps and axial flow pumps (rotodynamic or “centrifugal” pumps) can be either submersible motor type, or dry pit type. A non-clog-type pumping system provides more versatility to adapt to pumping conditions and potential future increasing sea level, by changing just the pumps to provide greater discharge pressure (with a comparable increase in pump horsepower). Axial flow pumps and Archimedes screw pumps must discharge to an open basin located at an elevation such that the flow will discharge through the transmission main by gravity against the maximum tide condition. These types of pumps require the structure to be built to a specific elevation. If that discharge elevation is exceeded by future sea level rise, the entire structure must be modified. Non-clog pumps will discharge through a closed piping system. The pumps develop sufficient pressure to discharge the flow through the transmission main to discharge to the ocean against the selected maximum tide condition. The non-clog pumps will operate at variable discharge pressure as required to discharge the flow through the transmission main. Axial flow pumps and Archimedes screw pumps will operate at a fixed discharge pressure (and power), which may be greater than required by the flow rate and tide elevation.

- Only one 6-foot diameter outfall would discharge at Canal Dock Road under Alternative 4 vs. two 8-foot diameter outfalls under Alternative 3. This smaller outfall would result in lower impacts on New Haven Harbor and the adjacent new Boathouse at Canal Dock, because it would require less dredging, a smaller headwall and smaller riprap pad.

Based on these advantages and potentially significantly lower future total costs for Alternative 4 than Alternative 3, Alternative 4 is the preferred alternative.

5.6 Alternative 5 – New Outfall, Pumping and Subsurface Storage

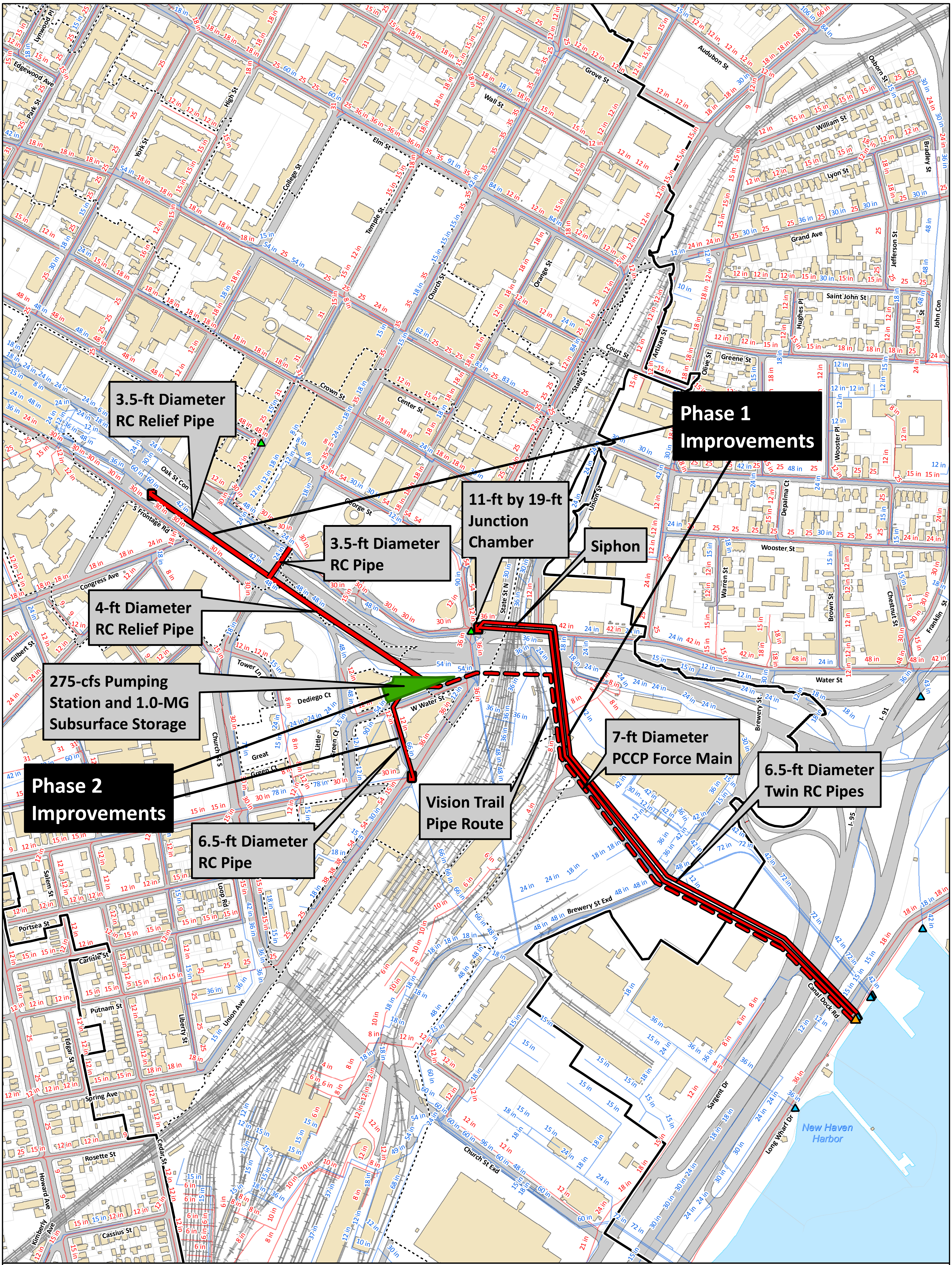
Alternative 5 is the combination of large gravity pipes and a pumping station with a smaller volume of storage than Alternatives 3 and 4, plus the short length of 3.5-ft diameter pipe across Route 34 and 3.5- to 4-ft diameter relief pipes along Route 34 described under Alternative 4, and a 6.5-foot diameter pipe in Meadow Street to convey flow from the existing 78-inch drain in Columbus Avenue to the pumping station (Figure 5-4). Similar to Alternatives 1 and 3, new twin 6.5-foot diameter gravity pipes would collect flow from the 90-inch diameter State Street drain upstream of the 025 regulator at the intersection of State and Water Streets. A siphon would be needed to cross under the railroad tracks with sufficient pipe cover to construct the crossing by microtunneling, jacking, or other trenchless technology. The pipes would follow the Vision Trail route southeast to Canal Dock Road. To control peak rates of runoff during a year 2066 10-year 24-hour storm, a 275-cfs pumping station and 7-foot diameter PCCP force main are also needed along with 1.0 MG of storage co-located at the Knights of Columbus site behind the Police Station. Three flap gates can be installed to prevent combined sewage from entering the storage facility and pumping station.

CDM Smith used the SWMM model to examine the performance of Alternative 5 during historical low-volume high intensity storms using a phased approach. The first phase would be the installation of the twin gravity pipes along the Vision Trail, 3.5-ft diameter pipe across Route 34 and 3.5- to 4-ft diameter relief pipes. Most of the force main for the pumping station would also be constructed during Phase 1 since most of it would be located alongside the twin gravity pipes. Construction of the gravity pipes and relief pipes would control peak rates of runoff during the 10-year 1-hour storm event that occurred July 14, 2014 (2.7 inches).

The second phase would include the 275-cfs pumping station, 1.0-MG subsurface storage and 6.5-foot drain in Meadow Street. The addition of these improvements would bring the level of service up to the year 2066 10-year 24-hour design storm (5.6 inches).

Table 5-3 summarizes both total and phased probable project costs for Alternative 5. As shown in the table, the total probable project cost for Alternative 5 drainage improvements is approximately $72 million, about five percent ($3.3 million) higher than the total project cost for Alternative 4. Under the phased approach described above, Phase 1 project costs are estimated at $37.9 million and Phase 2 project costs are $37.2 million.

As discussed above, if CSOs at regulator 025 were eliminated and flap gates were not needed, the storage needed along Columbus Avenue under Alternative 4 could be reduced to 5.1 MG in the future due to a higher availability of in-system storage. This would bring the total project cost down to $62.8 million, which is approximately 13 percent ($9.2 million) lower than the total project costs for Alternative 5.



Legend

Proposed

- △ Drain Outfall
- ▬ Gravity Pipe
- ▬ ● Force Main
- 🟩 Subsurface Storage and Pumping Station
- 🟥 Junction Chamber

Existing

- △ CSO Regulator
- △ Outfall
- — Drain
- — Sewer
- ☐ Project Area/Total Tributary Drainage Area Boundary
- ⬚ Subtributary Drainage Area Boundary
- ▨ Shoreline
- ┼ Railroads
- ▨ Buildings

N

1 inch = 500 feet

0 250 500 Feet

New Haven, CT
Downtown Stormwater Modeling Project

Figure 5-4
Alternative 5
New Outfall, Pumping and Subsurface Storage

CDM Smith

PescatoreEC C:\Projects\New_Haven\ProjectWise\Alternative_5_Subsurface_ Storage_and_Pumping_Station_Final.mxd 1/12/2017

Table 5-3

Alternative 5 – New Outfall, Pumping and Subsurface Storage

Opinion of Probable Project Costs

Total Costs

Description	Pipe Size (in)	Quantity	Unit	Unit Cost	Estimated Cost
275-cfs Pumping Station	--	1	ea	$11,500,000	$11,500,000
Microtunnel Force Main at Railroad Tracks (500 lf)	--	1	ea	$5,000,000	$5,000,000
Junction Chamber	--	1	ea	$456,500	$456,500
Microtunnel Siphon at Railroad Tracks (200 lf)	--	1	ea	$4,245,000	$4,245,000
Twin 6.5-foot Diameter RCPs (3,200 lf each) and 7-foot Force Main (2,800 lf)	78 and 84	9,200	lf	$1,600	$14,720,000
Headwall and Riprap Pad		1	ea	$300,000	$300,000
3 to 4.5-Foot Flap Gates	--	3	ea	$25,000	$75,000
3.5-Foot Diameter RCP	42	1,050	lf	$800	$840,000
4-Foot Diameter RCP	48	950	lf	$850	$807,500
6.5-foot Diameter RCP	78	450	lf	$1,675	$753,750
Subsurface Storage (7.7-foot inside depth)	--	1.0	MG	$1,855,000	$1,855,000
Subtotal					**$40,552,750**
Construction Contingencies (30%)					$12,165,825
Total Construction Costs (May 2016 ENR 10,315)					**$52,718,575**
Construction Cost at Mid-Point of Construction (May 2019)					**$57,607,010**
Engineering and Implementation Costs (25%)					$14,401,753
Opinion of Probable Project Costs (Rounded)					**$72,009,000**

Phased Costs

Description	Pipe Size (in)	Quantity	Unit	Unit Cost	Estimated Cost
Phase 1					
Junction Chamber	--	1	ea	$456,500	$456,500
Microtunnel Siphon at Railroad Tracks (200 lf)	--	1	ea	$4,245,000	$4,245,000
Twin 6.5-foot Diameter RCPs (3,200 lf each) and 7-foot Force Main (2,800 lf)	78 and 84	9,200	lf	$1,600	$14,720,000
Headwall and Riprap Pad		1	ea	$300,000	$300,000
3.5-Foot Diameter RCP	42	1,050	lf	$800	$840,000
4-Foot Diameter RCP	48	950	lf	$850	$807,500
Subtotal					**$21,369,000**
Construction Contingencies (30%)					$6,410,700
Total Construction Costs (May 2016 ENR 10,315)					**$27,779,700**
Construction Cost at Mid-Point of Construction (May 2019)					**$30,355,628**
Engineering and Implementation Costs (25%)					$7,588,907
Opinion of Probable Phase 1 Project Costs (Rounded)					**$37,945,000**
Phase 2					
275-cfs Pumping Station	--	1	ea	$11,500,000	$11,500,000
Microtunnel Force Main at Railroad Tracks (500 lf)	--	1	ea	$5,000,000	$5,000,000
6.5-foot Diameter RCP	78	450	lf	$1,675	$753,750
3 to 4.5-Foot Flap Gates	--	3	ea	$25,000	$75,000
Subsurface Storage (7.7-foot inside depth)	--	1.0	MG	$1,855,000	$1,855,000
Subtotal					**$19,183,750**
Construction Contingencies (30%)					$5,755,125
Total Construction Costs (May 2016 ENR 10,315)					**$24,938,875**
Construction Cost at Mid-Point of Construction (May 2022)					**$29,778,321**
Engineering and Implementation Costs (25%)					$7,444,580
Opinion of Probable Phase 2 Project Costs (Rounded)					**$37,223,000**
Opinion of Probable Total Project Costs (Rounded)					**$75,168,000**

Alternative 4 also has the following advantages over Alternative 5:

- Similar to Alternative 3, Alternative 5 includes a siphon at the railroad pipe crossing for the gravity pipe system. There is potential for pipe clogging at this crossing due to the relatively low velocities in the gravity pipe system. The proposed pumping station and force main under Alternative 4 are designed to pump flow at 7 fps. This higher velocity will greatly reduce the potential for pipe clogging at the railroad crossing.

- Large-diameter pipe crossings, such as the 6- by 4-foot pipe crossing in Brewery Street, are easier with a force main. A force main can pass under the large-diameter pipes without the clogging issues associated with a siphon, discussed above.

- There is more versatility with a centrifugal-type pumping station in Phase 1 to adapt to higher sea level rise, as discussed above.

- Only one 6-foot diameter outfall would discharge at Canal Dock Road under Alternative 4 vs. three 6.5- to 7-foot diameter outfalls under Alternative 5. This smaller outfall would result in lower impacts on New Haven Harbor and the adjacent new Boathouse at Canal Dock, because it would require less dredging, a smaller headwall and smaller riprap pad.

Based on these advantages and lower total costs for Alternative 4 than Alternative 5, Alternative 4 is the preferred alternative.

5.7 Green Infrastructure

Installing green infrastructure practices throughout the project area can further reduce stormwater runoff to drainage systems to help reduce flooding, with the added benefit of improving the water quality of receiving waters and complying with the City's Municipal Separate Storm System (MS4) permit. New Haven is generally underlain by very sandy, permeable soils, providing opportunities (where groundwater is at least 6 feet deep) to infiltrate stormwater in green infrastructure facilities. Infiltrating green infrastructure practices, shown in Figures 5-5 to 5-7, include vegetated bioretention areas, right-of-way bioswales, rain gardens, subsurface storage and infiltration systems, and porous pavements. The City is planning to install approximately two hundred right-of-way bioswales/rain gardens within the project area, and these bioswales were included in the modeled baseline conditions, as discussed in Section 3.4. As demonstrated below, distributed small green infrastructure practices such as right-of-way bioswales are not effective for controlling peak rates of runoff during major storm events; however, they are effective at reducing peak rates of runoff during small storm events, and at reducing stormwater runoff volumes.

The alternatives evaluation above showed that large volumes of storage are needed to reduce flooding. Reinforced concrete subsurface storage and infiltration systems (Figure 5-6) provide the largest storage volume of the green infrastructure practices shown above. These are the types of storage facilities proposed in the alternatives evaluation in this Section. However, due to groundwater elevations at the sites where subsurface storage is proposed, the stormwater storage facilities are designed to be watertight and not infiltrate. They are designed to drain to the drainage system following a storm event when flow elevations recede.

Figure 5-5 Right-of-Way Bioswales and Rain Gardens

Figure 5-6 Subsurface Storage and Infiltration

Figure 5-7 Porous Pavements

Installation of additional green infrastructure practices throughout the project area in planned project developments will help reduce runoff to the flood problem areas. Figure 5-1 shows the locations of planned developments, as well as other public and private properties with open spaces with little tree cover that provide opportunities for additional green infrastructure practices. Pursuing the installation of green infrastructure practices on public properties is preferred over private properties because there are fewer administrative hurdles and costs. Over time, the accumulation of runoff volume reduction provided by infiltrating green infrastructure practices throughout the project area will offset a portion of the storage volume needed in the future Phase 2 of preferred Alternative 4.

CDM Smith modeled the effectiveness of an example green infrastructure catchment area using the City's current planned right-of-way bioswale design (see Section 3.4 for more detail on New Haven's current plans for installing bioswales). For the test area of a 1.2-acre subcatchment with nine bioswales (e.g. Elm between York and High,) the bioswales remove 26 percent of runoff based on a 2012 to 2014 simulation using GNHWPCA precipitation data. However, there is a negligible impact on the peak rate of runoff in larger storms.

Figure 5-8 and Figure 5-9 below compare peak runoff by storm with and without right-of-way bioswales ("swales"). Figure 5-8 shows the full range of peaks up to 8 cfs (8 cfs is the magnitude of the 8/10/12 storm, which dropped 2.1 inches in 30 minutes in Bridgeport, about a 75-year event according to Atlas 14); little overall difference is apparent, with and without bioswales.

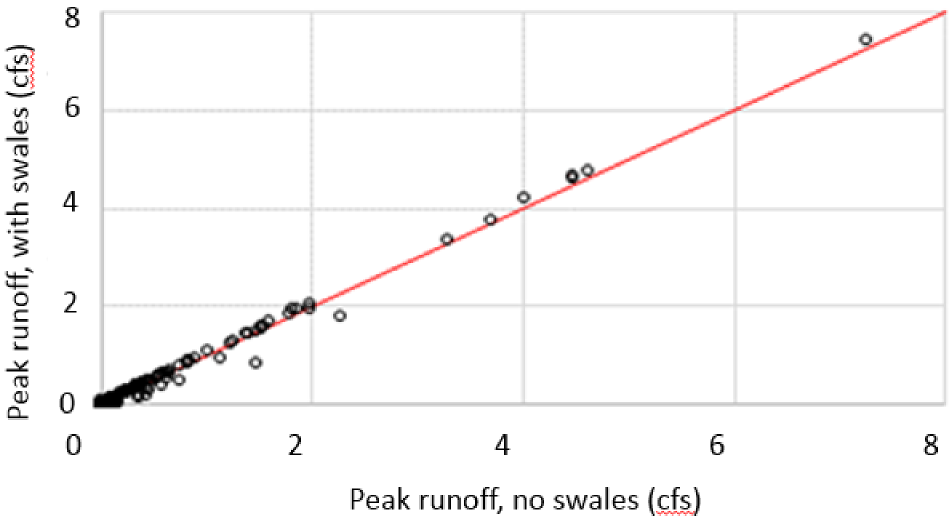


Figure 5-8 Green Infrastructure Peak Runoff Comparison (Up to 8 cfs)

The improvement is more evident in events with peak rates of runoff ≤1 cfs, see Figure 5-9. There are many events with zero runoff with the bioswales added, as well as some events with 50% or greater reduction in peak runoff.

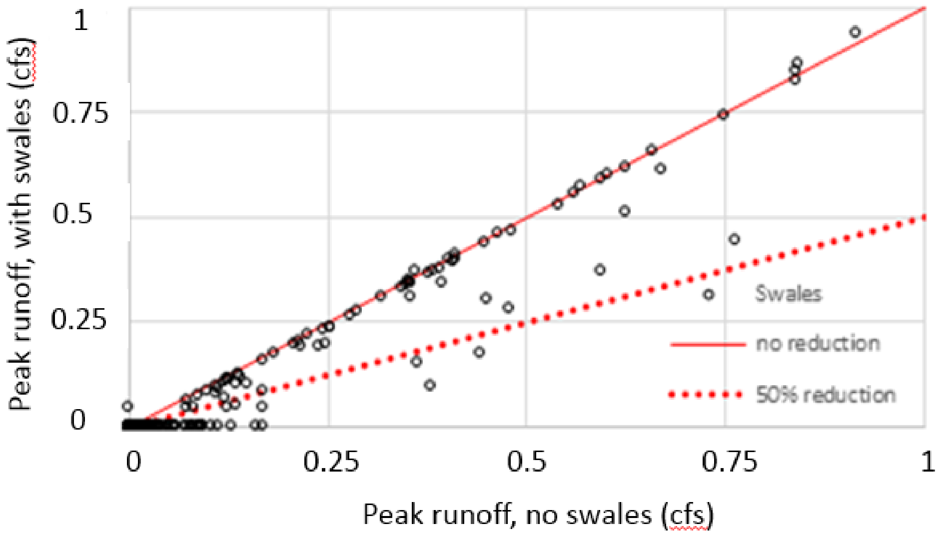


Figure 5-9 Green Infrastructure Peak Runoff Comparison (Up to 1 cfs)

When runoff volume is considered, more benefit is seen with the bioswales, with every storm yielding reduced runoff. The biggest volumetric event is 6/6/13 (21,000 ft^3), when 5 inches of rain fell in over 33 hours, about a 7-year event on a 24-hour basis (4.75 inches). Runoff volume for that event is reduced 10 percent with bioswales added, as shown in Figure 5-10.

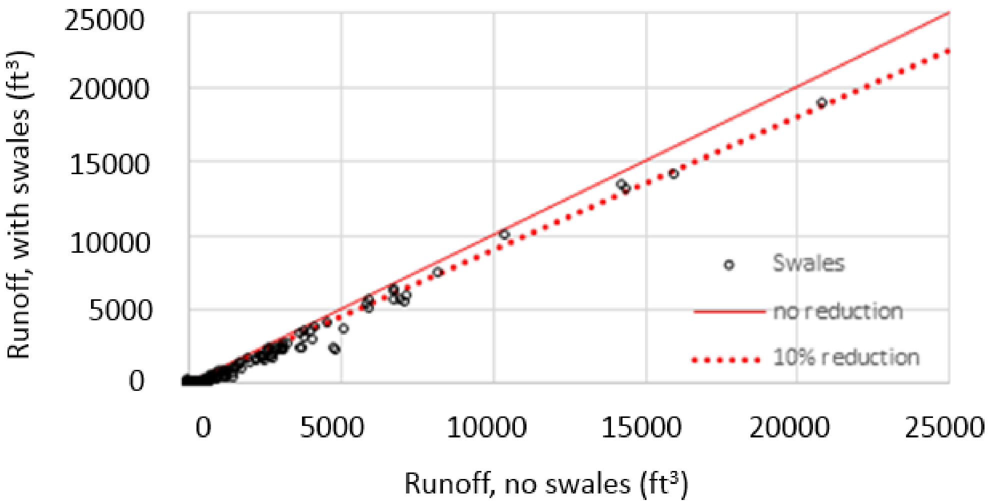


Figure 5-10 Green Infrastructure Volume Comparison, 6/6/13 Storm Event

Section 6

Recommended Plan

6.1 Summary

This section summarizes the recommended Downtown New Haven drainage system improvements plan, including construction phasing, easements, additional cleaning and television inspection needs for final design, and cost estimates.

6.1.1 Pumping Station and Subsurface Storage

Section 5 showed that Alternative 4 provides the most cost-effective flood control improvements addressing predicted sea level rise and increased precipitation due to climate change. Figure 6-1 illustrates the recommended Alternative 4 plan as a phased solution to Downtown New Haven flooding problems:

Phase 1 Improvements

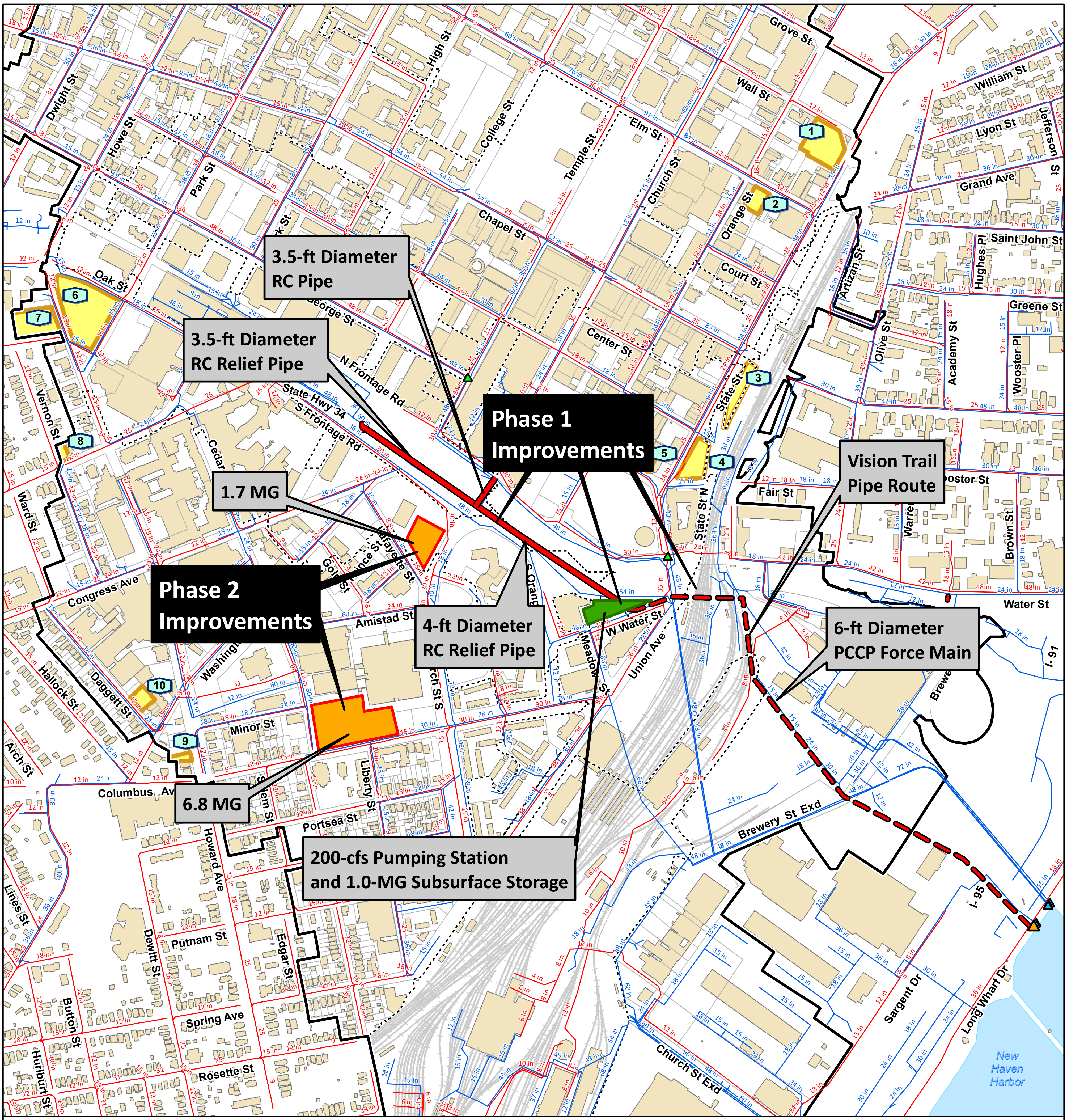
- 200-cfs pumping station
- 1-MG subsurface storage system
- Three 3- to 4.5-foot flap gates
- 3,300 feet of 6-foot diameter prestressed concrete cylinder pipe (PCCP) force main along the Vision Trail route
- 200 feet of 3.5-ft reinforced concrete (RC) pipe across Route 34
- 1,800 feet of 3.5- to 4-ft RC relief pipe along Route 34

Phase 2 Improvements

- 1.7-MG subsurface storage system
- 6.8-MG subsurface storage system

The proposed phased approach to implementing the recommended plan will help stagger costs while still providing significant flood protection during intense storm events.

As discussed in Section 5, three flap gates can be installed to prevent combined sewage from entering the 1.0-MG storage facility and pumping station behind the Police Station at the Knights of Columbus property under Phase 1. However, unless further roof leader disconnections can be constructed, the 6.8-MG storage facility would need to be a higher-cost CSO storage facility in Phase 2 due to backflow of combined sewage from the 66-inch arch drain into the 78-inch drain in Columbus Avenue. If CSOs at regulator 025 were eliminated and flap gates were not needed, the storage needed along Columbus Avenue could be reduced to 5.1 MG due to a higher availability of in-system storage.



Potential Public Sites for Green Infrastructure Practices

1 Children's Museum Parking Lot
4 Wall Street

2 Parking Lot
40 Elm Street

3 N Lot Parking Lot
253 State Street

4 O Lot Parking Lot
221 State Street

5 George and State Street Lot 3
25 George Street

6 Connecticut Mental Health Center
34 Park Street

7 Hospital Parking Lot
914 Howard Ave

8 Greenspace
119 Davenport Avenue

9 Vacant Lot/Greenspace
634 Howard Avenue

10 Wilson Library
303 Washington Avenue

Proposed

- ━ Gravity Pipe
- ╍ Force Main
- 🟧 Subsurface Storage
- 🟩 Subsurface Storage and Pumping Station
- ▲ Drain Outfall
- ■ Junction Chamber
- 🟨 Public Properties

Existing

- ― Drain
- ― Sewer
- ▲ CSO Regulator
- ▲ Outfall
- ☐ Total Tributary Drainage Area Boundary
- ⬚ Subtributary Drainage Area Boundary
- ▭ Shoreline
- ┼ Railroad
- ▭ Buildings

N

1 inch = 600 feet

0 300 600 Feet

New Haven, CT
Downtown Stormwater Modeling Project

Figure 6-1
Recommended Plan

PescatoreEC C:\Projects\New_Haven\ProjectWise\Recommended_Plan_11x17.mxd 1/12/2017

The proposed force main route includes 500 feet of microtunneling, pipe jacking, or other trenchless technology across the Connecticut Department of Transportation (CT DOT) Railyard. A more detailed analysis of this Railyard crossing should be performed during detailed design, examining geotechnical data, including groundwater elevations, at the proposed pumping station site and in the Railyard.

Other investigations to be completed under detailed design include:

- Further evaluation of utility conflicts along the proposed force main route from the proposed pumping station to New Haven Harbor.
- Further evaluation of potential pumping methods and types of pumps, and a comparison of the costs and benefits of pumping alternatives. Potential pumping selections include non-clog pumps, axial flow pumps, and Archimedes screw pumps. The non-clog pumps and axial flow pumps (rotodynamic or "centrifugal" pumps) can be either submersible motor type, or dry pit type. As discussed in Section 5, a non-clog type pumping system provides more versatility to adapt to pumping conditions and potential future increasing sea level, by changing just the pumps to provide greater discharge pressure (with a comparable increase in pump horsepower). Axial flow pumps and Archimedes screw pumps require the structure to be built to a specific elevation. If that discharge elevation is exceeded by future sea level rise, the entire structure must be modified. The non-clog pumps will operate at variable discharge pressure as required to discharge the flow through the transmission main. Axial flow pumps and Archimedes screw pumps will operate at a fixed discharge pressure (and power), which may be greater than required by the flow rate and tide elevation.
- Further consideration of the use of redundant pumps during storms larger than the design storm, and the corresponding impact on the force main design.
- Examination of geotechnical data and utilities at the three proposed storage sites to further evaluate the locations and potential volume of storage facilities.
- Cleaning and TV inspection of the twin 6- by 4-foot box drains at the railroad crossing in the Railyard to verify model assumptions about sediment blockage and to improve flow capacity. The 66-inch arch drain at the railroad crossing was lined in recent years and should be in good condition. Flow monitoring did not suggest that there was significant obstruction in the arch; however, conditions can change over time and inspection of the arch would also be beneficial. When the arch is inspected, the current dimensions of the pipe should be verified.
- Temporary and permanent easement plans/permits for proposed drainage facilities on properties not owned by the City. Easements/permits will be needed in the following locations under the recommended plan:

  Phase 1

  - Knights of Columbus site for pumping station and subsurface storage facilities
  - Route 34 for 3.5- to 4-ft RC relief pipes and Route 34 crossing (CT DOT Permit)

- CT DOT/Amtrak Railyard for force main
- IKEA property for force main

Phase 2

- Yale site on Columbus Avenue for subsurface storage facility
- Commercial medical office property at 2 Church Street South

6.1.2 Green Infrastructure

The City is planning approximately two hundred right-of-way bioswales/rain gardens within the project area, and these bioswales were included in the modeled baseline conditions, as discussed in Section 3.4. These green infrastructure improvements and the installation of additional green infrastructure practices throughout the project area in planned project developments will help reduce runoff to the Downtown flood problem areas. As demonstrated in Section 5.7, distributed small green infrastructure practices such as right-of-way bioswales are not effective for controlling peak rates of runoff during major storm events; however, they are effective at reducing peak rates of runoff during small storm events, and at reducing stormwater runoff volumes. Higher volumes of runoff can be controlled by using subsurface storage and infiltration systems such as the reinforced concrete system shown in Figure 5-6. Installing green infrastructure practices throughout the project area can further reduce stormwater runoff to drainage systems to help reduce flooding, with the added benefit of improving the water quality of receiving waters and complying with the City's Municipal Separate Storm System (MS4) permit.

The Recommended Plan on Figure 6-1 provides locations of open areas with few trees on public properties where there are opportunities for the City to install green infrastructure practices (shown in Section 5.7) to further reduce stormwater runoff volumes to drainage systems, improve the water quality of receiving waters and comply with the City's Municipal Separate Storm System (MS4) permit. Pursuing the installation of green infrastructure practices on public properties is preferred over private properties because there are fewer administrative hurdles and costs. As discussed in Section 1, the City's Zoning Ordinance requirements for new and redevelopment projects, as well as Greater New Haven Water Pollution Control Authority (GNHWPCA) requirements, promote the installation of green infrastructure by requiring on-site stormwater retention. Over time, the accumulation of runoff volume reduction provided by infiltrating green infrastructure practices throughout the project area will offset a portion of the storage volume needed in the future Phase 2 of preferred Alternative 4.

6.2 Opinion of Probable Project Costs

Table 5-2 in Section 5 presents the opinion of probable project costs:

Phase 1 – $39.1 million

- 200-cfs pumping station
- 1-MG subsurface storage system

- Three 3- to 4.5-foot flap gates
- 3,300 feet of 6-foot diameter force main along the Vision Trail route
- 200 feet of 3.5-ft RC pipe across Route 34
- 1,800 feet of 3.5- to 4-ft RC relief pipe along Route 34

Phase 2 - $32.3 million

- 1.7-MG subsurface storage system
- 6.8-MG subsurface storage system

Total Phased Project Costs $71.4 million

Project costs include estimated construction costs, a 30-percent construction contingency, engineering and implementation costs. Construction costs are scaled to an estimated mid-point of construction in May 2019. Costs for land acquisition and easements are not included.

Project cost estimates in this report assume CSO improvements have been made and all proposed storage facilities are separate stormwater storage facilities, similar to the reinforced concrete manufactured subsurface storage and infiltration systems shown in Figure 5-6. Please note that the proposed stormwater storage facilities are watertight and are not designed to infiltrate due to groundwater elevations at the three subsurface storage sites. Following storms, the subsurface storage systems are designed to drain to the drainage system by gravity. If CSO storage facilities are needed in the future, the CSO storage facilities must drain back to the sewer system following storms, odor control, tank cleaning and other appurtenances will be required, and the storage costs should be increased approximately 150 percent. If CSOs at regulator 025 were eliminated and flap gates were not needed in the system, the storage needed along Columbus Avenue could be reduced to 5.1 MG due to a higher availability of in-system storage. This would translate to a Phase 2 cost savings of approximately $6.4 million.

Based on recent bid prices, green infrastructure construction costs in the Northeast vary from about $150,000 per impervious acre treated for rain gardens, right-of-way bioswales, vegetated bioretention areas and subsurface storage and infiltration systems, to about $500,000 per impervious acre treated for porous pavements (when green infrastructure practices are designed for the 90-percent storm, about one inch of runoff). Rooftop solutions such as green roof retrofits are more expensive (about $1.7 million per acre treated) if the roof needs to be replaced and waterproofed. As the City plans and constructs green infrastructure practices throughout the project area, the most cost-effective green infrastructure practices should be prioritized.

6.3 Permitting Requirements

Coastal Connecticut projects require permits through the CT Department of Energy & Environmental Protection's (DEEP's) Office of Long Island Sound Programs (OLISP). The permit they issue that is applicable to the proposed project is:

- Structures, Dredging, and Fill Permit: for structures, dredging and fill placed waterward of the Coastal Jurisdiction Line in tidal, coastal or navigable waters of the state, including dredging and the placement of structures or fill material. This permit will be needed to construct the force main outfall below the Coastal Jurisdiction Limit (equal to elevation 4.6 NAVD88). Compliance with Connecticut Stormwater Quality Manual must be shown. 401 Water Quality Certification is made in conjunction with issuance of a state permit under the Structures, Dredging and Fill statutes.

Other permit requirements include:

- Pre-Construction Notification (PCN) under U.S. Army Corps of Engineers (USACE) General Permit #6 for Utility Line Activities which allows for up to 0.5 acre of impact to Waters of the U.S.
- Project Review by the State Historic Preservation Officer (SHPO) and Tribal Historic Preservation Officers (THPO); there are two tribes in this area.
- Project Review by CT DEEP Natural Diversity Data Base (NDDB).
- General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities from CT DEEP.
- CT DOT permit for proposed drains along and across Route 34.
- CT DOT/Amtrak permits/License Agreement for proposed force main in Railyard.

The proposed new force main outfall will also be added to the City's list of drain outfalls under New Haven's Municipal Separate Storm Sewer System (MS4) Permit.

Appendix A

Installation Reports for Meters

Site Name / Manhole # Meter 1

Investigation Date: 11/4/15 Time: 8:30 Crew Members: KE/MH

Installation Date: 11/4/15 Time: 9:30 Crew Members: KE/MH

Address/Location: Intersection of Columbus Ave. and Church St. (south on Columbus, in the lane)

Latitude: N 41°17.925 Longitude: W 72°55.720

Weather Conditions: Wet [✓ Dry]

Hydraulic Conditions

Influent Flow:

Velocity 0.0 ft/sec **Standing*

Depth 3.25 in

Turbulence Amplitude:

- ☐ [✓ Less than 0.25”]
- ☐ 0.25” to 0.75”
- ☐ 0.75” to 1.5”
- ☐ 1.5” to 3”
- ☐ Greater than 3”

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	72”		78”
Width	72”		78”
Material	RCP		RCP
Shape	Round		Round

Sediment Present:

☐ [✓ Yes] Hard packed: ____________ in. deep

☐ No Soft: 0.25 in. deep

Surcharge / Backwater Influence:

- ☐ [✓ No evidence visible]
- ☐ Remains in pipe
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____________ft from rim

Gas Investigation:

☐ Good 20.9 (condition)

Site Conditions

Site Access:

- ☐ Good (no problems accessing site)
- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ [✓ Traffic Control only (Requires extra traffic control]
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ [✓ No]

Height above ground __

Manhole depth 19’ 5”

Measured from *downstream invert* to *rim*

Pipe Offset Y

Structural Integrity of Manhole:

☐ Good ☐ [✓ Fair] ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_________ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ [✓ Yes] ☐ No ☐ Maybe

Sensor Configuration:

(Please include Serial Numbers when possible)

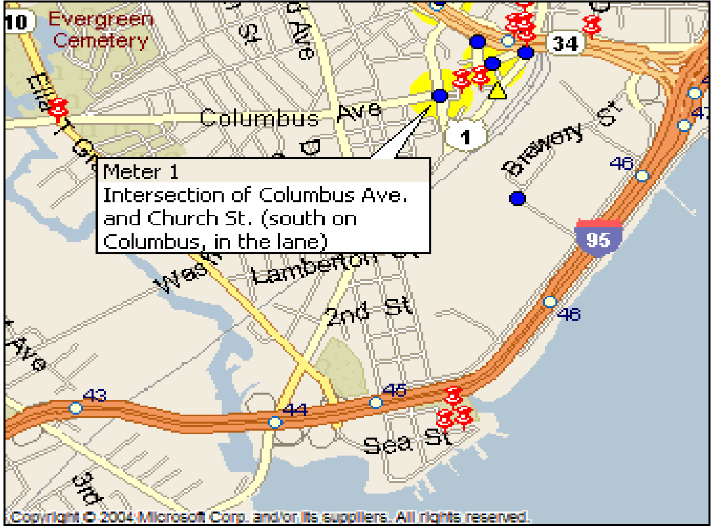
Level	Primary: Flowav
	Redundant: Flowav
Velocity	Primary: Flowav
	Redundant: Flowav
Meter Logger	Telog

Comments: *Sensors are 34” in the DS pipe.*

Sensor #1: 5:00 with 1.14 offset

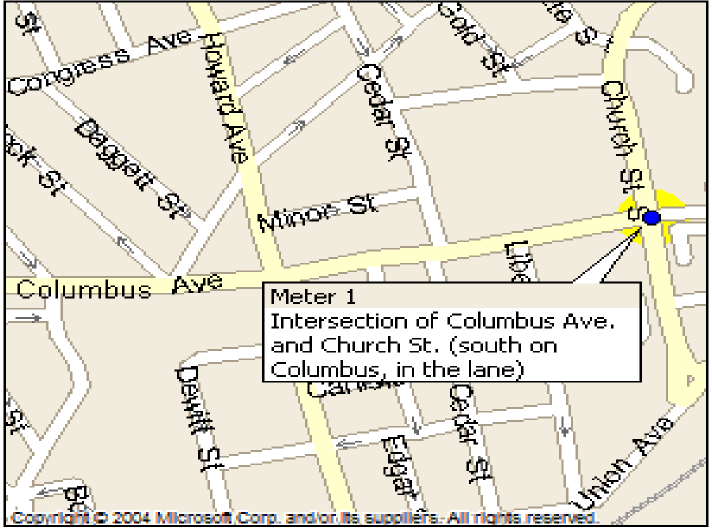
Sensor #2: 4:30

Area Map



Meter 1
Intersection of Columbus Ave. and Church St. (south on Columbus, in the lane)

Detail Map



Meter 1
Intersection of Columbus Ave. and Church St. (south on Columbus, in the lane)

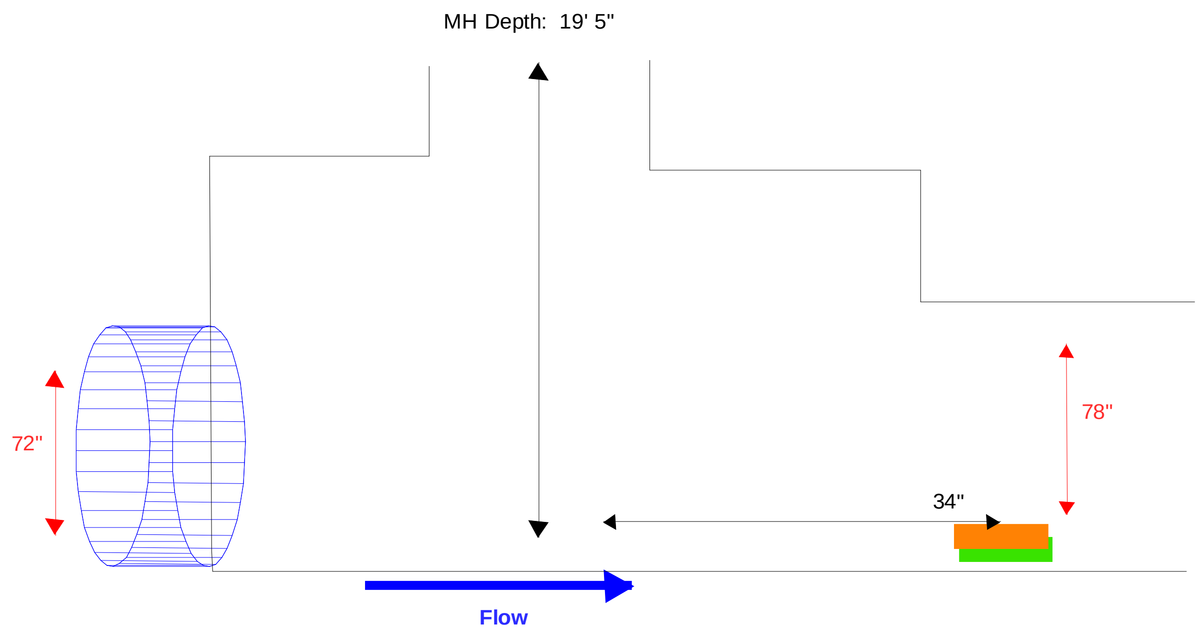
View from top of MH

Site Overview

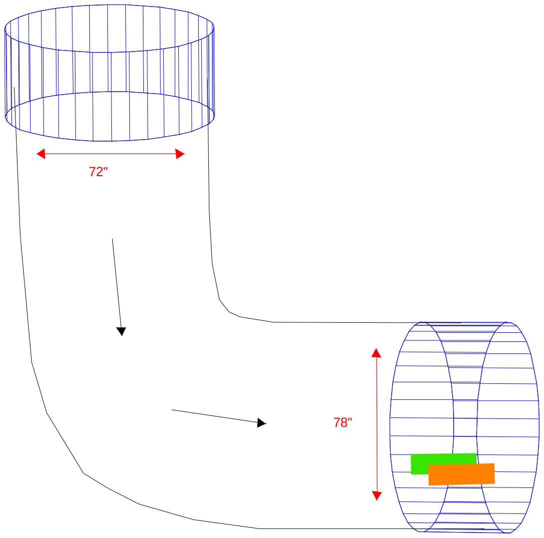
View of flow through influent line

View of flow through effluent line

Dimensional Structure Profile View (profile sketch showing location of sensors)



Plan View



Site Location Plan View

Sketch or plat showing upstream and downstream manholes, connections, and bends.

Site Name / Manhole #   Meter 2

Investigation Date: 11/3/15   Time: 11:34   Crew Members: KE/MH

Installation Date: 11/3/15   Time: 12:30   Crew Members: KE/MH

Address/Location: Intersection of W. Water and Meadow Streets (on W. Water St.)

Latitude: N 41°18.271   Longitude: W 72°55.380

Weather Conditions: Wet   [✓ Dry]

Hydraulic Conditions

Influent Flow:

Velocity 0.0 ft/sec   **Standing*

Depth   8.75 in

Turbulence Amplitude:

- ☐ [✓ Less than 0.25”]
- ☐ 0.25” to 0.75”
- ☐ 0.75” to 1.5”
- ☐ 1.5” to 3”
- ☐ Greater than 3”

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	48”		48”
Width	48”		48”
Material	Brick		Brick
Shape	Round		Round

Sediment Present:

☐ [✓ Yes]   Hard packed: ____________ in. deep

☐ No   Soft: 4.75 in. deep

Surcharge / Backwater Influence:

- ☐ No evidence visible
- ☐ Remains in pipe
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____________ft from rim

Gas Investigation:

☐ Good   20.9 (condition)

Site Conditions

Site Access:

- ☐ Good (no problems accessing site)
- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ [✓ Traffic Control only (Requires extra traffic control]
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes   ☐ [✓ No]

Height above ground   __

Manhole depth   12’

Measured from *downstream invert* to *rim*

Pipe Offset   N

Structural Integrity of Manhole:

☐ Good ☐ [✓ Fair] ☐ Poor

Pipe Bends:

☐ Influent ☐ [✓ Effluent] ☐ Manhole

Approx Distance to bend: 6’

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_________ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ [✓ Yes] ☐ No ☐ Maybe

Sensor Configuration:

(Please include Serial Numbers when possible)

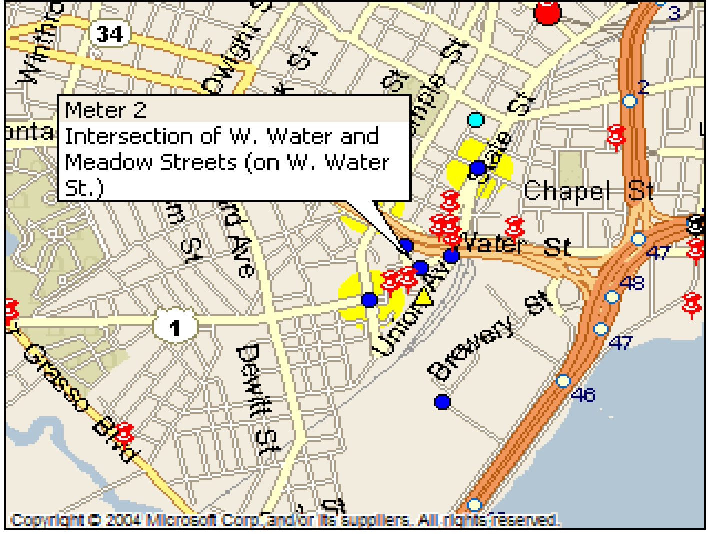
Level	Primary: Flowav
	Redundant: Flowav
Velocity	Primary: Flowav
	Redundant: Flowav
Meter Logger	Telog

Comments: *Sensors are 36” in the US pipe.*

Sensor #1: 5:00, has 7.21 offset

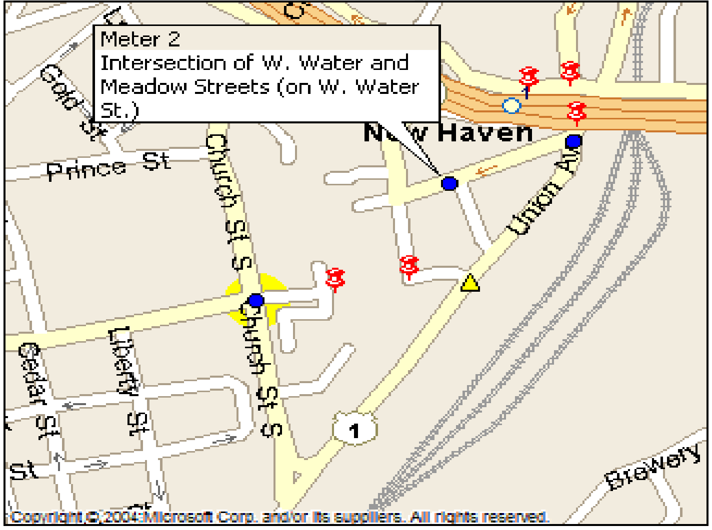
Sensor #2: 4:30 , out of flow

Area Map



Meter 2
Intersection of W. Water and Meadow Streets (on W. Water St.)

Detail Map



Meter 2
Intersection of W. Water and Meadow Streets (on W. Water St.)

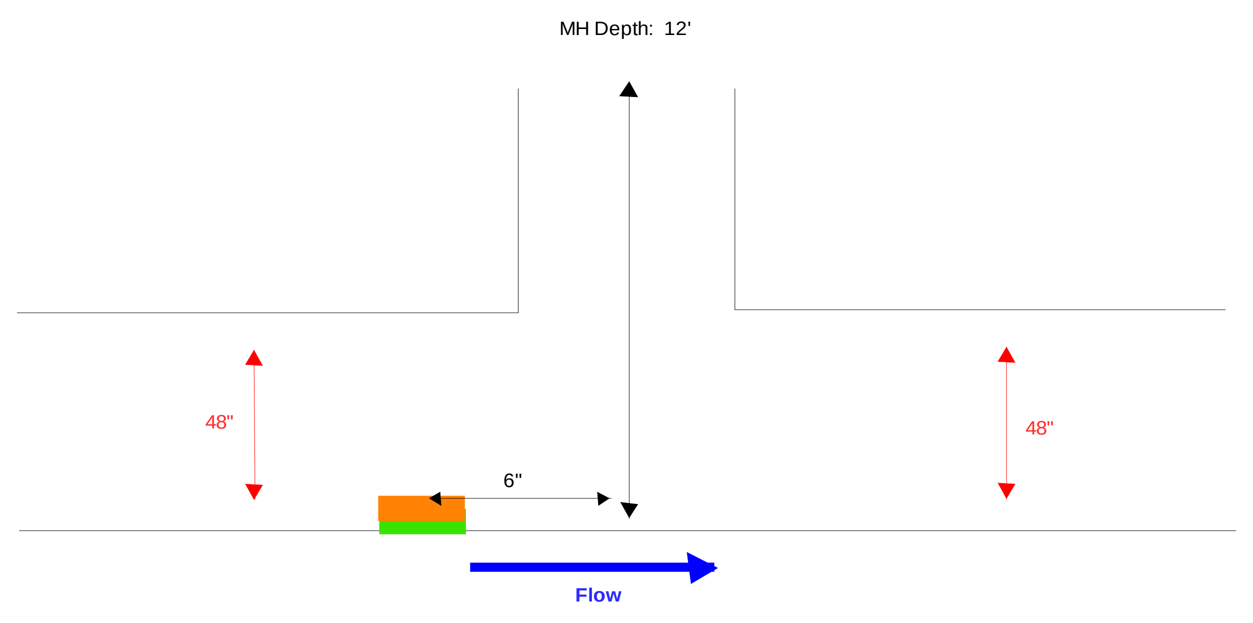
View from top of MH

Site Overview

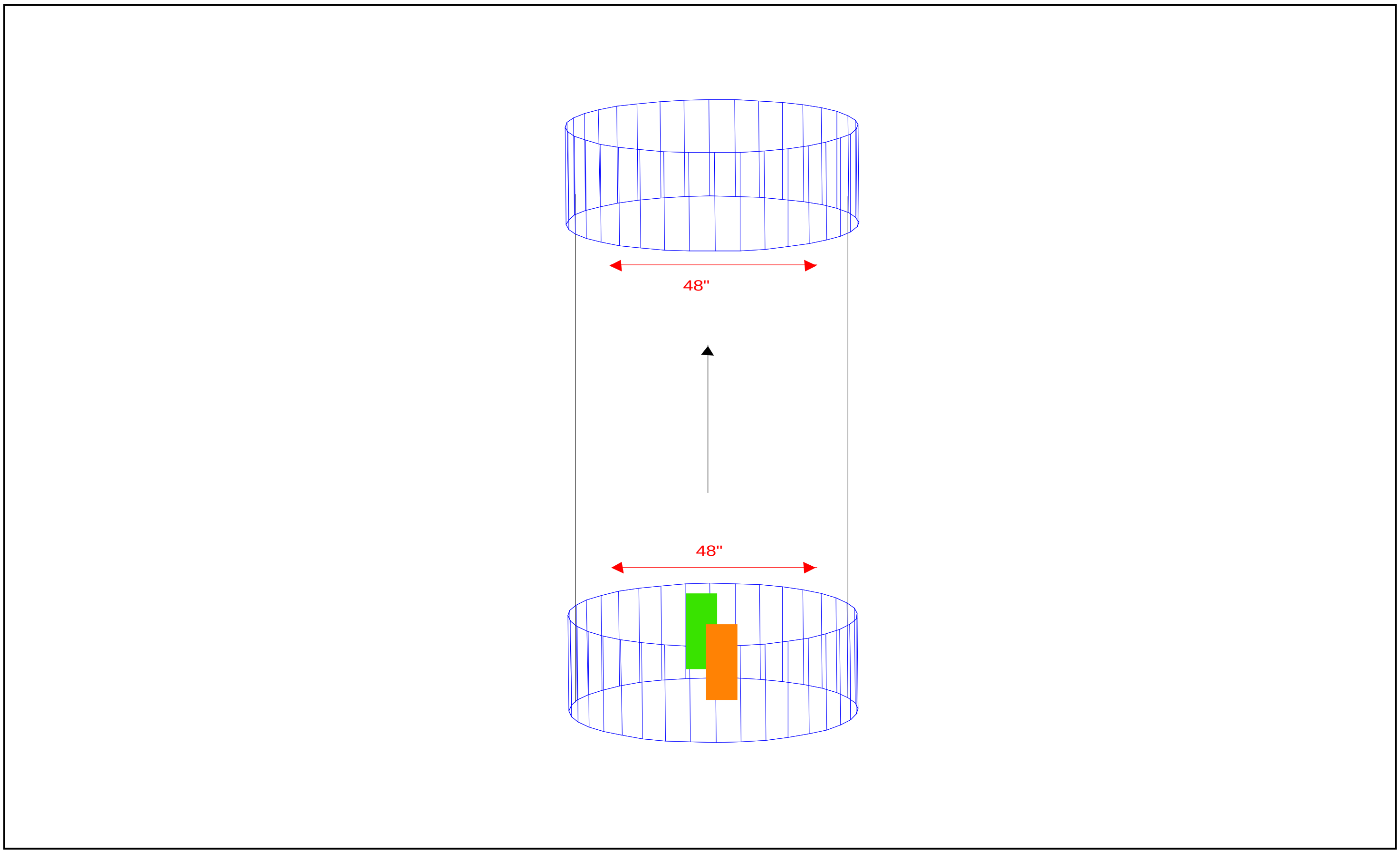
View of flow through influent line

View of flow through effluent line

Dimensional Structure Profile View (profile sketch showing location of sensors)



Plan View



Site Location Plan View

Sketch or plat showing upstream and downstream manholes, connections, and bends.

Source: Esri, DigitalGlobe, GeoEy
Aerogrid, IGN, IGP, swisstopo, and

Site Name / Manhole # Meter 3

Investigation Date: 11/3/15 Time: 15:19 Crew Members: KE/MH

Installation Date: 11/3/15 Time: 16:00 Crew Members: KE/MH

Address/Location: Intersection of S. Frontage Rd. and S. Orange St. (on the triangular grass median)

Latitude: N 41°18.271 Longitude: W 72°55.380

Weather Conditions: Wet [✓ Dry]

Hydraulic Conditions

Influent Flow:

Velocity 0.56 ft/sec

Depth 4.75 in

Turbulence Amplitude:

☐ Less than 0.25”
☑ 0.25” to 0.75”
☐ 0.75” to 1.5”
☐ 1.5” to 3”
☐ Greater than 3”

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	54”		54”
Width	54”		54”
Material	RCP		RCP
Shape	Round		Round

Sediment Present:

☑ Yes Hard packed: ____________ in. deep
☐ No Soft: 1.50 in. deep

Surcharge / Backwater Influence:

☑ No evidence visible
☐ Remains in pipe
☐ _____ft from rim
☐ Reaches Rim (potential meter damage)
☐ Evidence unclear: _____________ft from rim

Gas Investigation:

☐ Good 20.9 (condition)

Site Conditions

Site Access:

☐ Good (no problems accessing site)
☑ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
☐ Traffic Control only (Requires extra traffic control
☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☑ No
Height above ground __
Manhole depth 16’ 4”
Measured from *downstream invert* to *rim*
Pipe Offset N
Structural Integrity of Manhole:
☐ Good ☑ Fair ☐ Poor

Pipe Bends: *None within camera view*
☐ Influent ☐ Effluent ☐ Manhole
Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:
☐ Influent ☐ Effluent ☐ Manhole
Approx Distance to change:_________ft
(detail is comments)

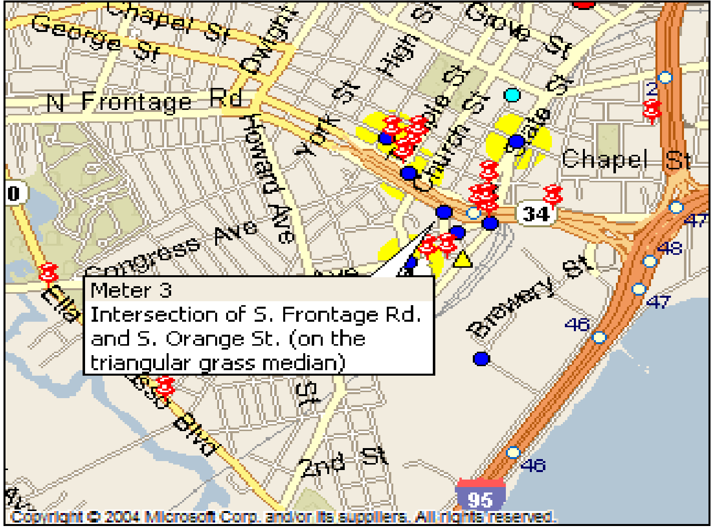
Crew Member: Can you maintain this site?
☑ Yes ☐ No ☐ Maybe

Sensor Configuration:
(Please include Serial Numbers when possible)

Level	Primary: Flowav
	Redundant: Flowav
Velocity	Primary: Flowav
	Redundant: Flowav
Meter Logger	Telog

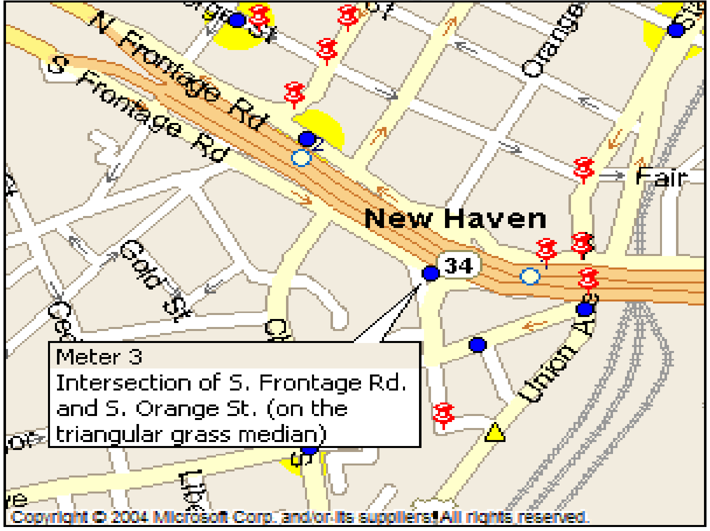
Comments: *Sensors are 36” in the US pipe. Sensor #1: has 3.3 offset*

Area Map



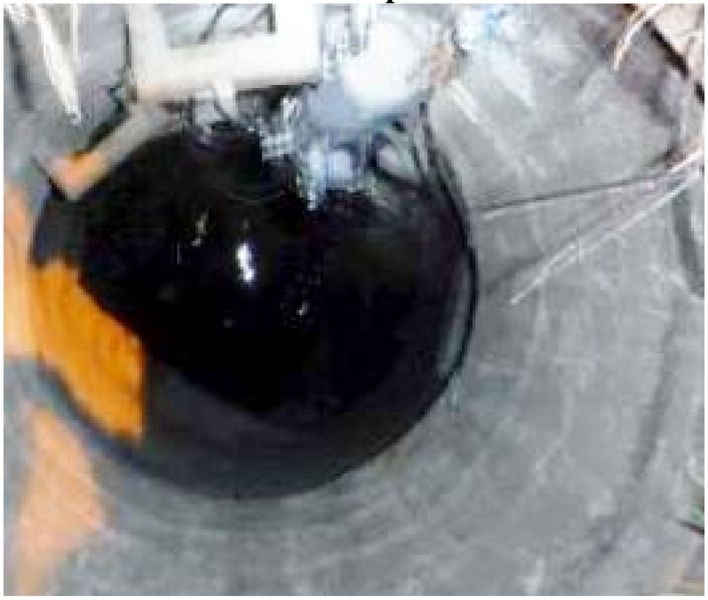
Meter 3
Intersection of S. Frontage Rd. and S. Orange St. (on the triangular grass median)

Detail Map



Meter 3
Intersection of S. Frontage Rd. and S. Orange St. (on the triangular grass median)

View from top of MH

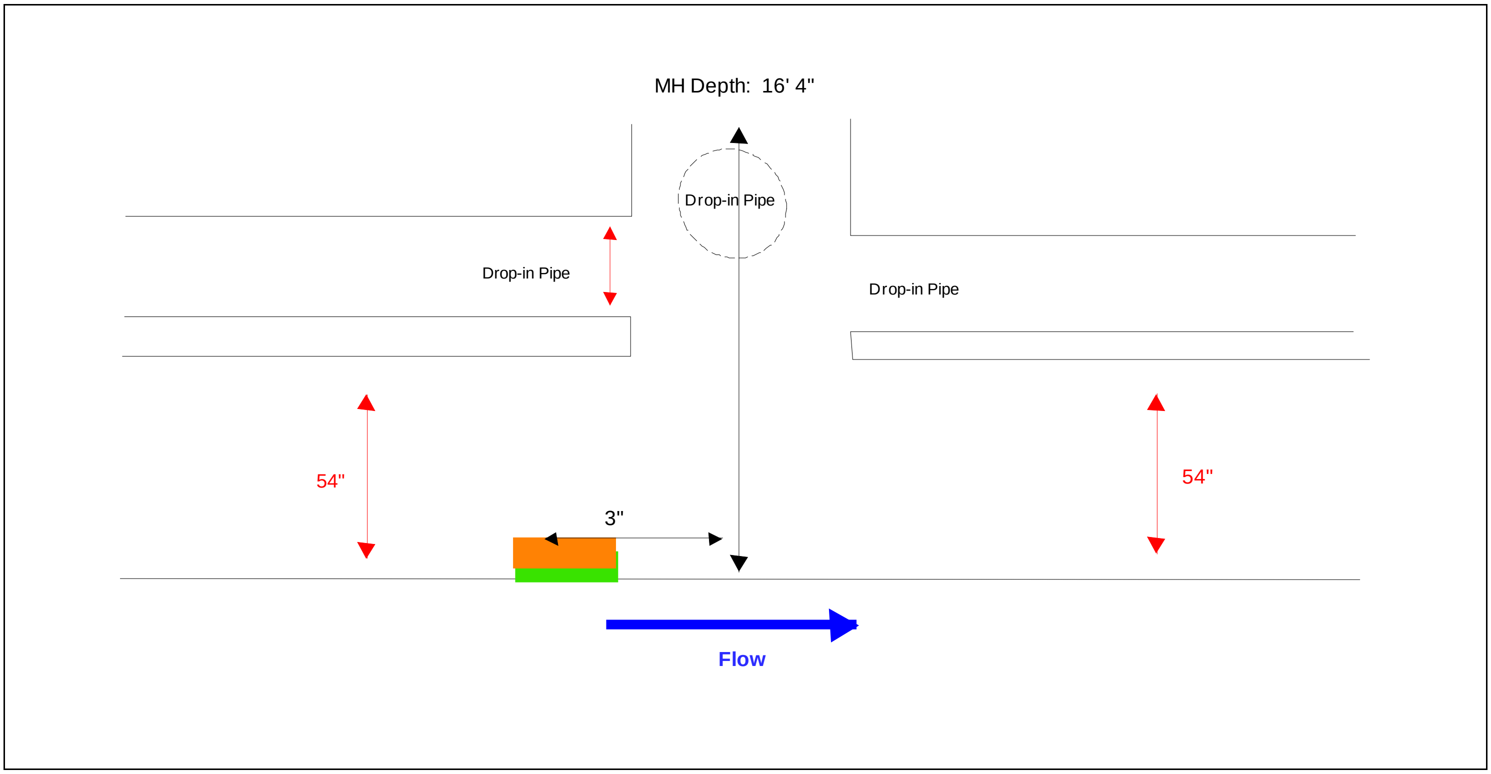


Site Overview

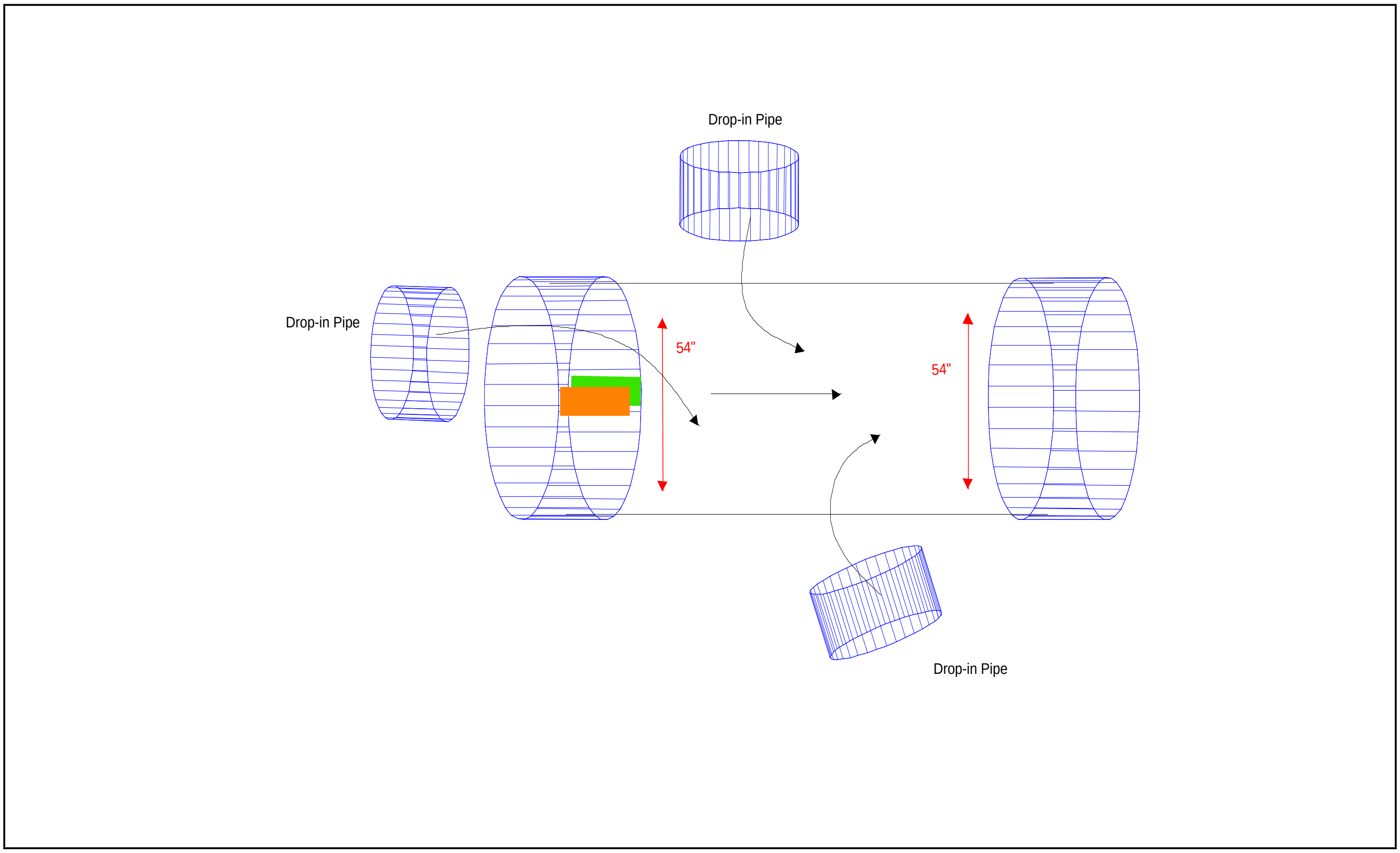
View of flow through influent line

View of flow through effluent line

Dimensional Structure Profile View (profile sketch showing location of sensors)

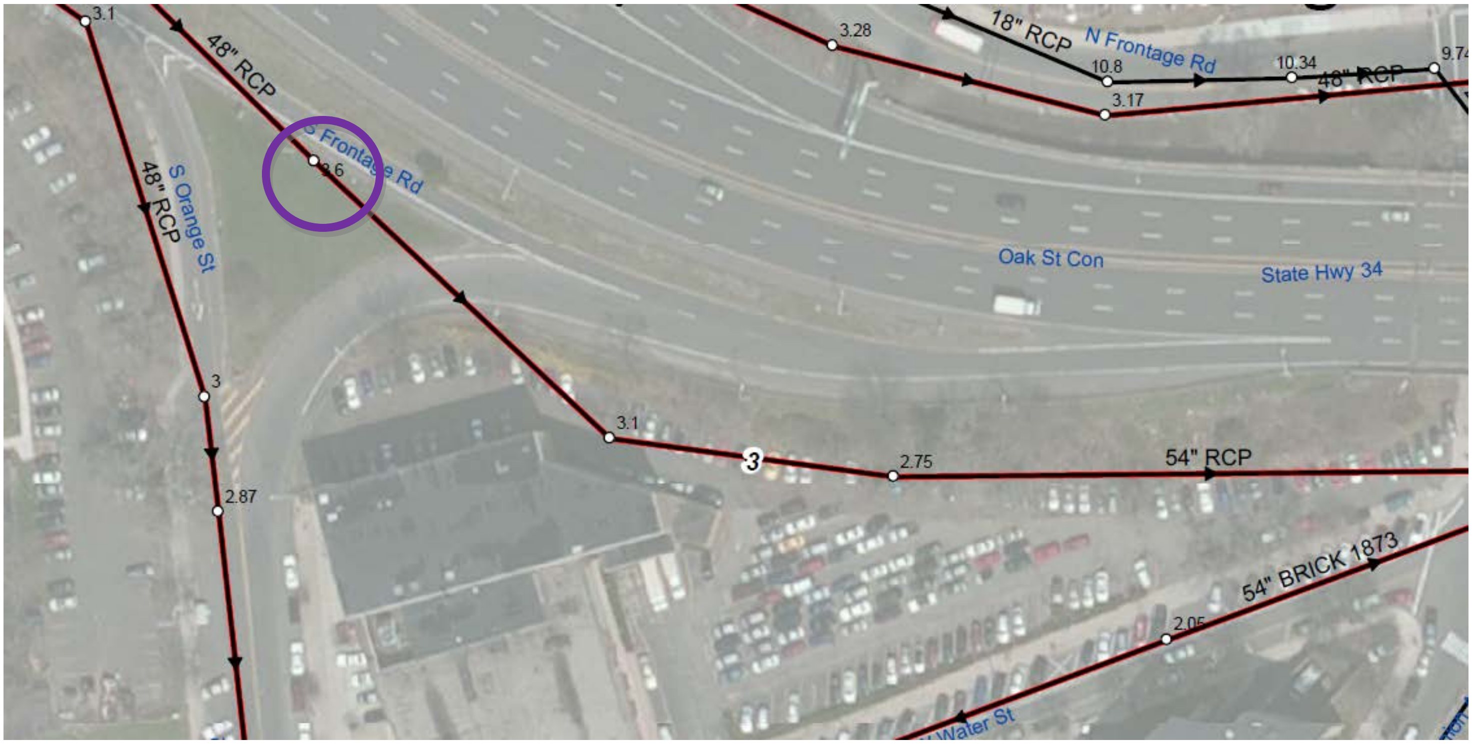


Plan View



Site Location Plan View

Sketch or plat showing upstream and downstream manholes, connections, and bends.



Site Name / Manhole # Meter 4

Investigation Date: 11/5/15 Time: 12:00 Crew Members: KE/MH

Installation Date: 11/5/15 Time: 13:30 Crew Members: KE/MH

Address/Location: N. Frontage Rd., by the entrance of the Temple St. garage (in the bike lane)

Latitude: N 41°18.289 Longitude: W 72°55.784

Weather Conditions: [✓ Wet] Dry

Hydraulic Conditions

Influent Flow:

Velocity 0.50 ft/sec **Visual*

Depth 1.00 in

Turbulence Amplitude:

- ☐ Less than 0.25”
- ☐ [✓ 0.25” to 0.75”]
- ☐ 0.75” to 1.5”
- ☐ 1.5” to 3”
- ☐ Greater than 3”

Sewer Line Characteristics:

	Influent 1	Influent 2	Influent 3	Effluent
Height	48”	15”	18”	48”
Width	48”	15”	18”	48”
Material	RCP	RCP	RCP	RCP
Shape	Round	Round	Round	Round

Sediment Present:

☐ [✓ Yes] Hard packed: ____________ in. deep

☐ No Soft: *Trace to 0.25* in. deep

Surcharge / Backwater Influence:

- ☐ [✓ No evidence visible]
- ☐ Remains in pipe
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____________ft from rim

Gas Investigation:

☐ Good 20.9 (condition)

Site Conditions

Site Access:

- ☐ Good (no problems accessing site)
- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ [✓ Traffic Control only (Requires extra traffic control]
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ [✓ No]

Height above ground __

Manhole depth 13’

Measured from *downstream invert* to *rim*

Pipe Offset N

Structural Integrity of Manhole:

☐ Good ☐ [✓ Fair] ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_________ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ [✓ Yes] ☐ No ☐ Maybe

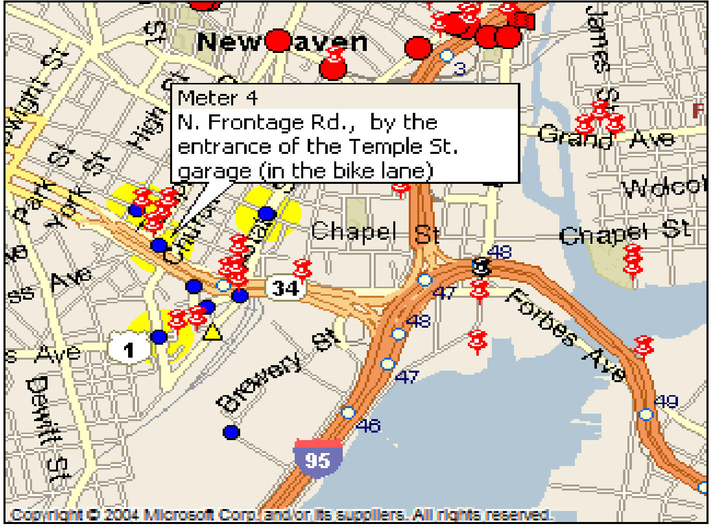
Sensor Configuration:

(Please include Serial Numbers when possible)

Level	Primary: Flowav
	Redundant: Flowav
Velocity	Primary: Flowav
	Redundant: Flowav
Meter Logger	Telog

Comments: *Sensors are 42” in the DS pipe.*
Sensor #1: 6:00 Sensor #2: 5:30

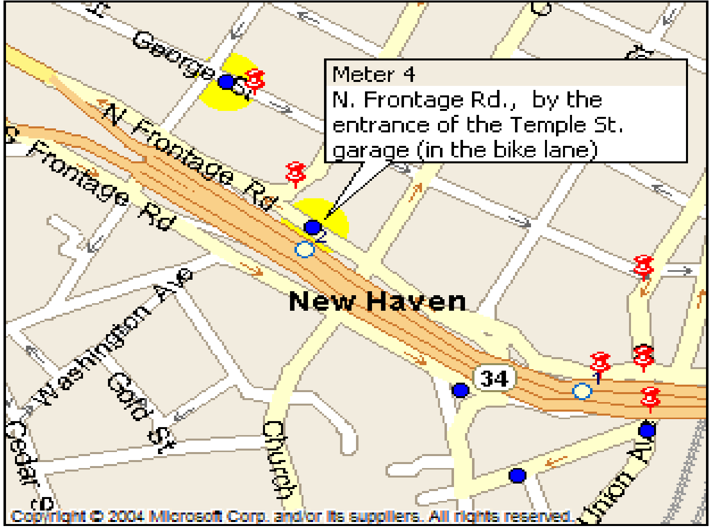
Area Map



Meter 4
N. Frontage Rd., by the entrance of the Temple St. garage (in the bike lane)

Copyright © 2004 Microsoft Corp. and/or its suppliers. All rights reserved.

Detail Map



Meter 4
N. Frontage Rd., by the entrance of the Temple St. garage (in the bike lane)

Copyright © 2004 Microsoft Corp. and/or its suppliers. All rights reserved.

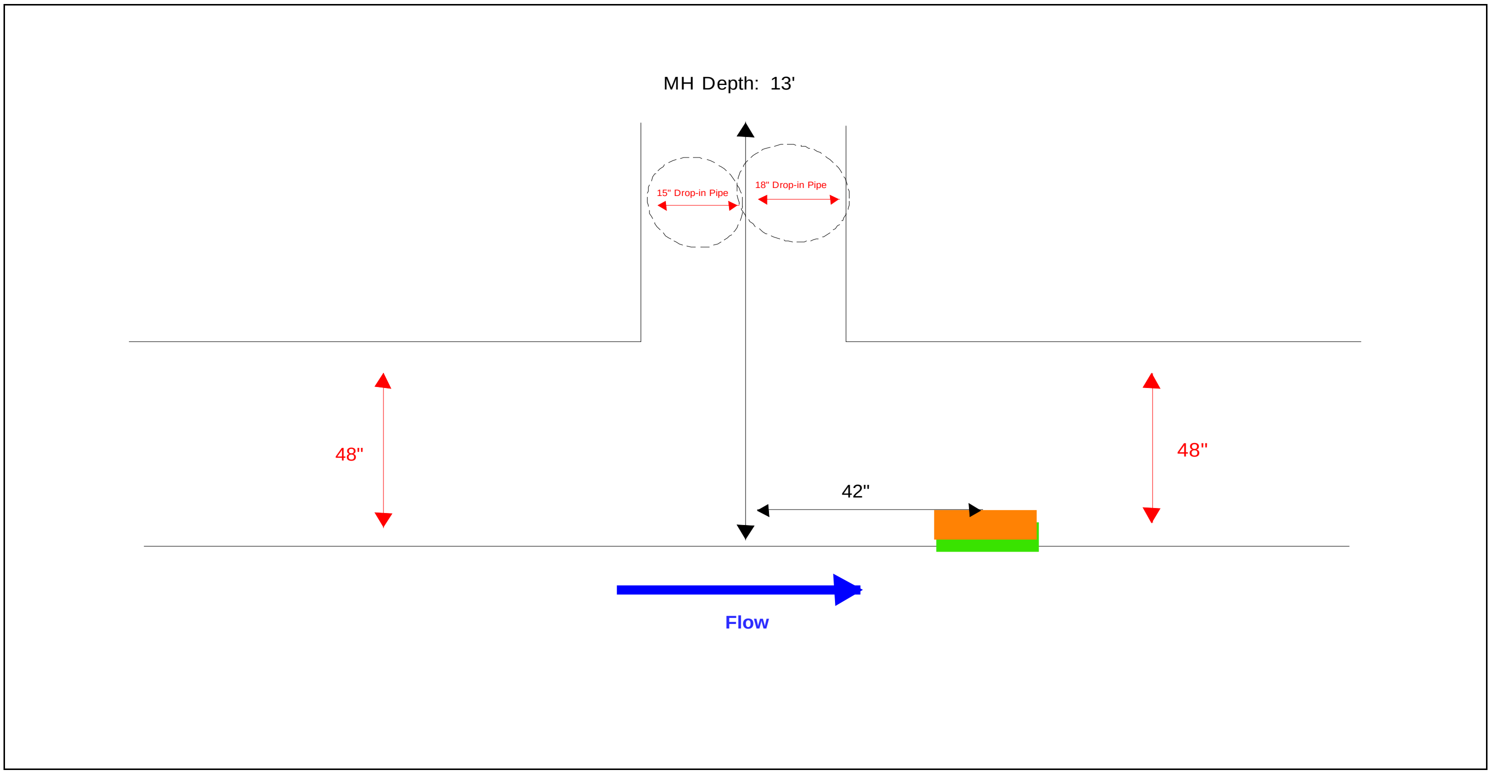
View from top of MH

Site Overview

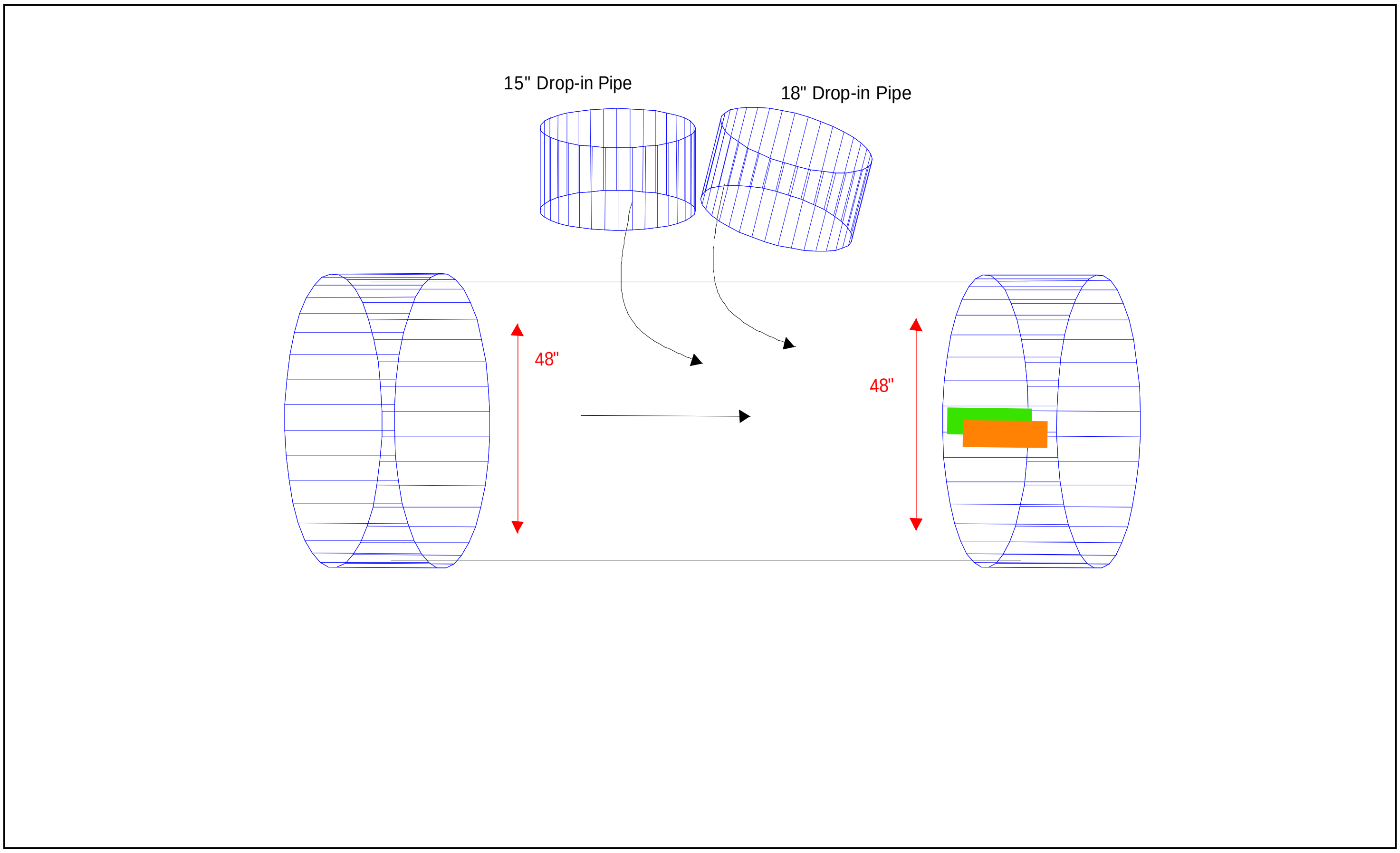
View of flow through influent line

View of flow through effluent line

Dimensional Structure Profile View (profile sketch showing location of sensors)



Plan View



Site Location Plan View

Sketch or plat showing upstream and downstream manholes, connections, and bends.

p

Site Name / Manhole # Meter 5

Investigation Date: 11/3/15 Time: 9:30 Crew Members: KE/MH

Installation Date: 11/6/15 Time: 8:43 Crew Members: KE/MH

Address/Location: In the intersection of Chapel and State (in the right lane of State. St.)

Latitude: N 41°18.290 Longitude: W 72°55.375

Weather Conditions: Wet [✓ Dry]

Hydraulic Conditions

Influent Flow:

Velocity 0.50 ft/sec

Depth 0.50 in

Turbulence Amplitude:

- ☐ Less than 0.25”
- ☐ [✓ 0.25” to 0.75”]
- ☐ 0.75” to 1.5”
- ☐ 1.5” to 3”
- ☐ Greater than 3”

Sewer Line Characteristics:

	Influent 1	Influent 2	Influent 3	Effluent
Height	66.5”	84”	15”	90”
Width	66.5”	84”	15”	90”
Material	RCP	RCP	RCP	RCP
Shape	Round	Round	Round	Round

Sediment Present:

☐ Yes Hard packed: ____________ in. deep

☐ [✓ No] Soft: ____________ in. deep

Surcharge / Backwater Influence:

- ☐ [✓ No evidence visible]
- ☐ Remains in pipe
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____________ft from rim

Gas Investigation:

☐ Good 20.9 (condition)

Site Conditions

Site Access:

- ☐ Good (no problems accessing site)
- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ [✓ Traffic Control only (Requires extra traffic control]
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ [✓ No]

Height above ground __

Manhole depth 14’

Measured from *downstream invert* to *rim*

Pipe Offset Y

Structural Integrity of Manhole:

☐ Good ☐ [✓ Fair] ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

[✓ Pipe Size]/Geometry/Material Change:

☐ [✓ Influent] ☐ Effluent ☐ Manhole

Approx Distance to change:_________ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ [✓ Yes] ☐ No ☐ Maybe

Sensor Configuration:

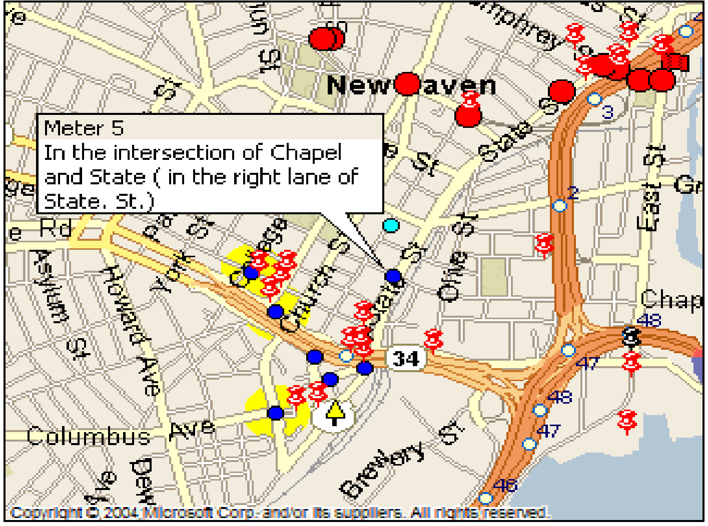
(Please include Serial Numbers when possible)

Level	Primary: Flowav
	Redundant: Flowav
Velocity	Primary: Flowav
	Redundant: Flowav
Meter Logger	Telog

Comments: *Sensors are 36” in the US pipe.*

Sensor #1: 6:00 Sensor #2: 5:30

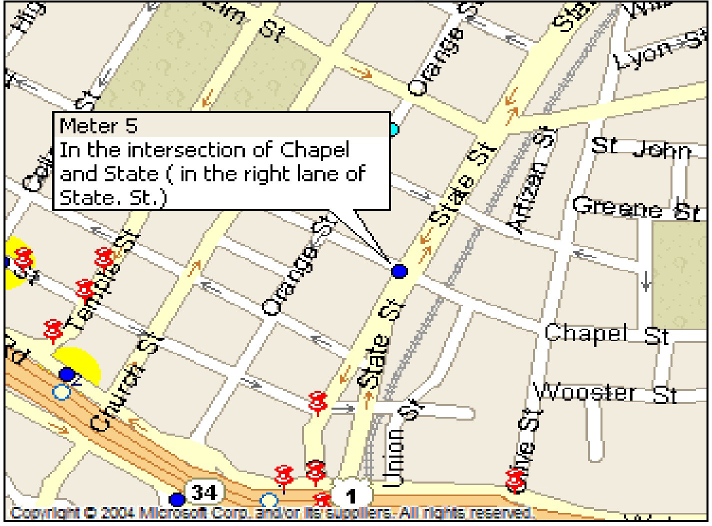
Area Map



Meter 5
In the intersection of Chapel and State (in the right lane of State. St.)

Copyright © 2004 Microsoft Corp. and/or its suppliers. All rights reserved.

Detail Map



Meter 5
In the intersection of Chapel and State (in the right lane of State. St.)

Copyright © 2004 Microsoft Corp. and/or its suppliers. All rights reserved.

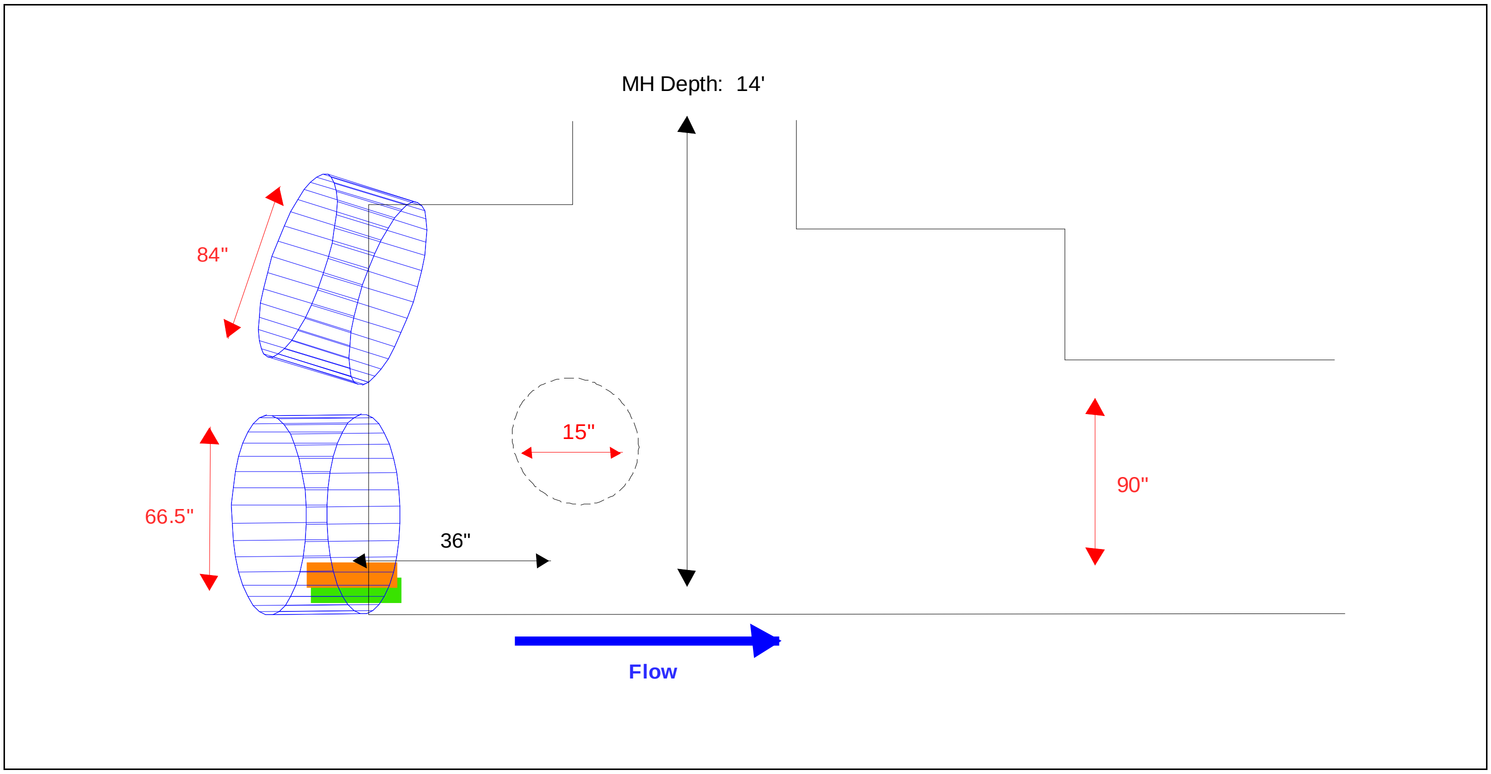
View from top of MH

Site Overview

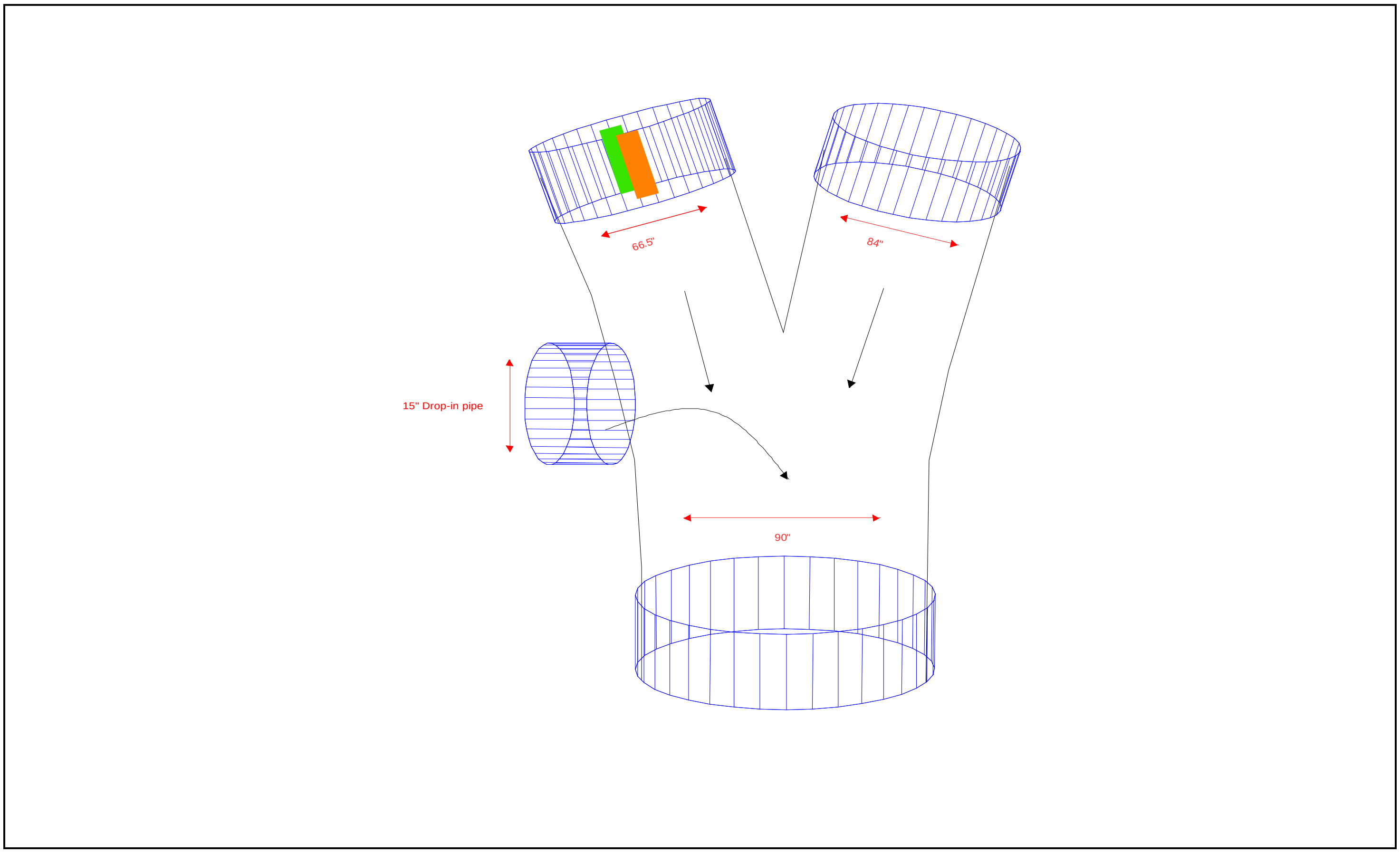
View of flow through influent line

View of flow through effluent line

Dimensional Structure Profile View (profile sketch showing location of sensors)



Plan View



Site Location Plan View

Sketch or plat showing upstream and downstream manholes, connections, and bends.

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, IGP, swisstopo, and the GIS User Community

Site Name / Manhole # Meter 6

Investigation Date: 11/3/15 Time: 9:30 Crew Members: KE/MH

Installation Date: 11/6/15 Time: 11:40 Crew Members: KE/MH

Address/Location: In the intersection of Chapel and State (in the right lane of State. St.)

Latitude: N 41°18.290 Longitude: W 72°55.375

Weather Conditions: Wet [✓ Dry]

Hydraulic Conditions

Influent Flow:

Velocity 0.0 ft/sec *Standing*

Depth 0.25 in

Turbulence Amplitude:

- ☐ [✓ Less than 0.25”]
- ☐ 0.25” to 0.75”
- ☐ 0.75” to 1.5”
- ☐ 1.5” to 3”
- ☐ Greater than 3”

Sewer Line Characteristics:

	Influent 1	Influent 2	Influent 3	Effluent
Height	84”	66.5”	15”	90”
Width	84”	66.5”	15”	90”
Material	RCP	RCP	RCP	RCP
Shape	Round	Round	Round	Round

Sediment Present:

☐ Yes Hard packed: ____________ in. deep

☐ [✓ No] Soft: ____________ in. deep

Surcharge / Backwater Influence:

- ☐ [✓ No evidence visible]
- ☐ Remains in pipe
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____________ft from rim

Gas Investigation:

☐ Good 20.9 (condition)

Site Conditions

Site Access:

- ☐ Good (no problems accessing site)
- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ [✓ Traffic Control only (Requires extra traffic control]
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ [✓ No]

Height above ground __

Manhole depth 14’

Measured from *downstream invert* to *rim*

Pipe Offset Y

Structural Integrity of Manhole:

☐ Good ☐ [✓ Fair] ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

[✓ Pipe Size]/Geometry/Material Change:

☐ [✓ Influent] ☐ Effluent ☐ Manhole

Approx Distance to change:_________ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ [✓ Yes] ☐ No ☐ Maybe

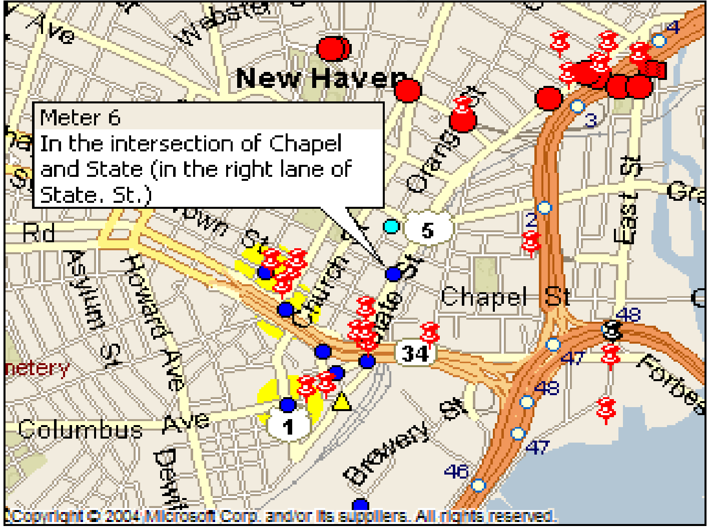
Sensor Configuration:

(Please include Serial Numbers when possible)

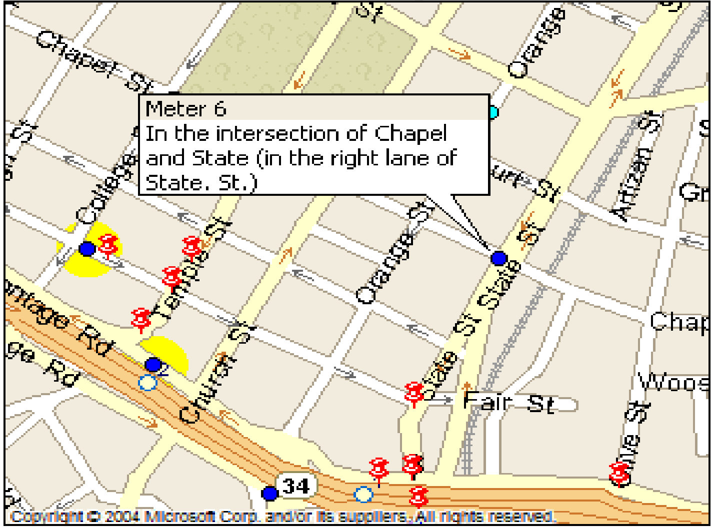
Level	Primary: Flowav
	Redundant: Flowav
Velocity	Primary: Flowav
	Redundant: Flowav
Meter Logger	Telog

Comments: *Sensors are 48” in the US pipe.*
Sensor #1: 6:00 Sensor #2: 5:30

Area Map



Detail Map



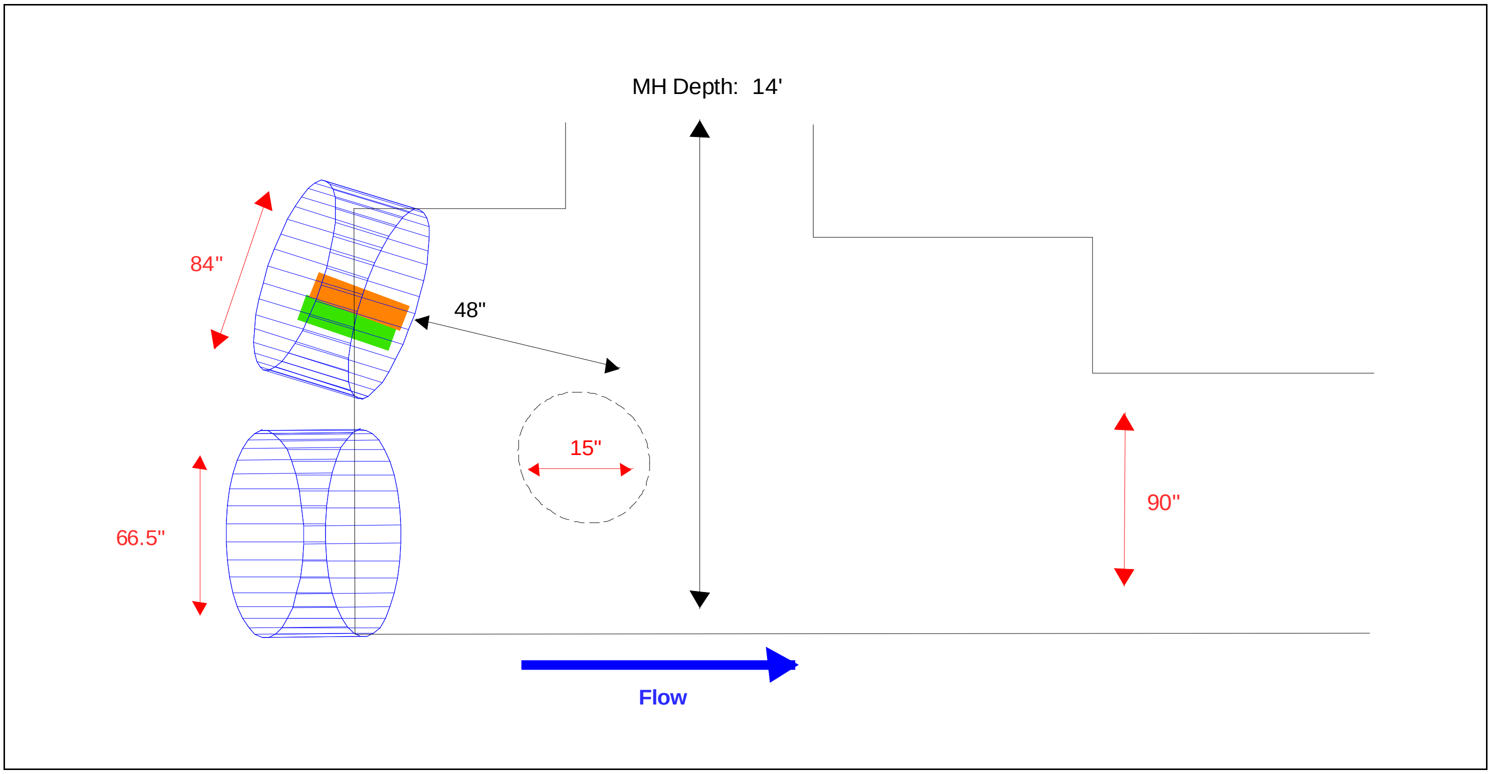
View from top of MH

Site Overview

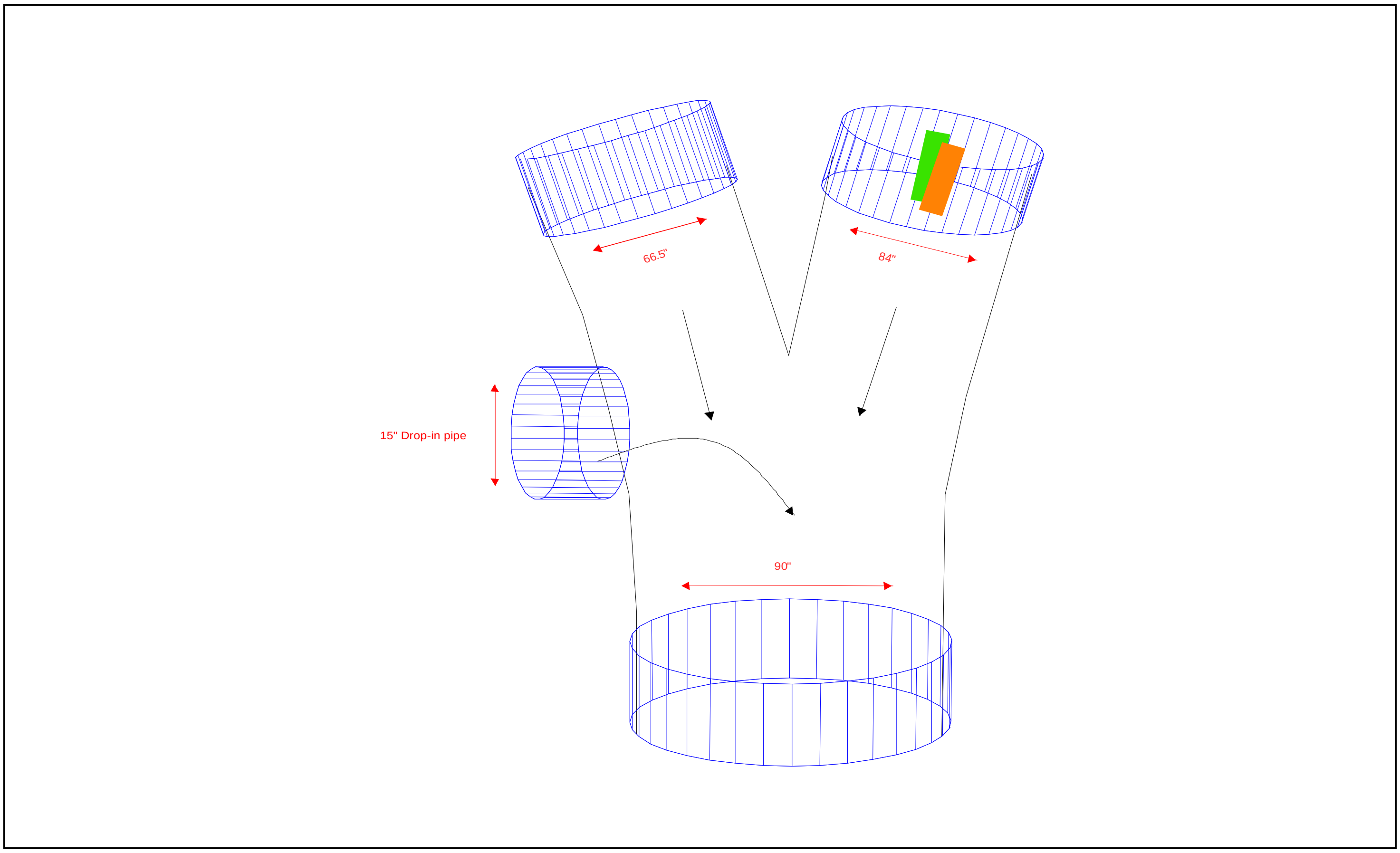
View of flow through influent line

View of flow through effluent line

Dimensional Structure Profile View (profile sketch showing location of sensors)



Plan View



Site Location Plan View

Sketch or plat showing upstream and downstream manholes, connections, and bends.

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Ai
Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Site Name / Manhole # Meter 7

Investigation Date: 11/2/15 Time: 12:50 Crew Members: KE/MH

Installation Date: 11/9/15 Time: 15:13 Crew Members: KE/MH

Address/Location: On Union Avenue, across from W. Water Street

Latitude: N 41°18.049 Longitude: W 72°55.456

Weather Conditions: Wet [✓ Dry]

Hydraulic Conditions

Influent Flow:

Velocity _0_ ft/sec

Depth 4.75 in

Turbulence Amplitude:

☐ [✓ Less than 0.25”]
☐ 0.25” to 0.75”
☐ 0.75” to 1.5”
☐ 1.5” to 3”
☐ Greater than 3”

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	49.5”		49.5”
Width	72.5”		72.5”
Material	Concrete		Concrete
Shape	Rectangle		Rectangle

Sediment Present:

☐ [✓ Yes] Hard packed: ____________ in. deep
☐ No Soft: 0.25 in. deep

Surcharge / Backwater Influence:

☐ No evidence visible
☐ Remains in pipe
☐ [✓ 4 ft from rim]
☐ Reaches Rim (potential meter damage)
☐ Evidence unclear: _____________ft from rim

Gas Investigation:

☐ Good 20.9 (condition)

Site Conditions

Site Access: *Possibility of car parked on lid*

☐ Good (no problems accessing site)
☐ [✓ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)]
☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
☐ Traffic Control only (Requires extra traffic control
☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ [✓ No]
Height above ground __
Manhole depth 11’ 6”
Measured from *downstream invert* to *rim*
Pipe Offset Y
Structural Integrity of Manhole:
☐ Good ☐ [✓ Fair] ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole
Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole
Approx Distance to change:_________ft
(detail is comments)

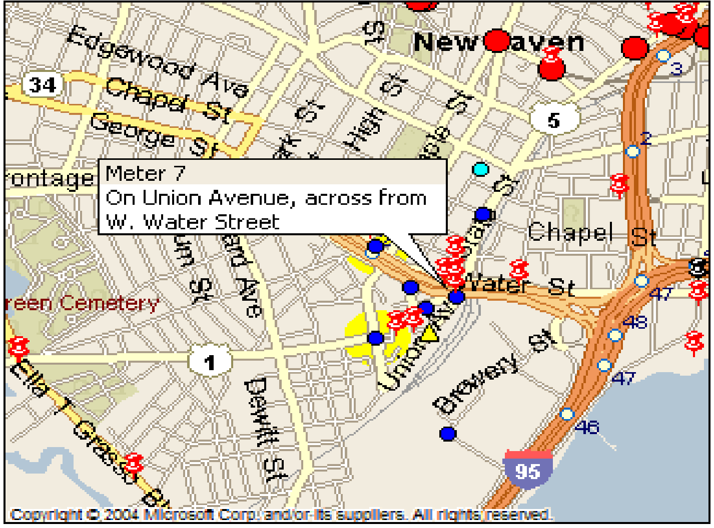
Crew Member: Can you maintain this site?
☐ [✓ Yes] ☐ No ☐ Maybe

Sensor Configuration:
(Please include Serial Numbers when possible)

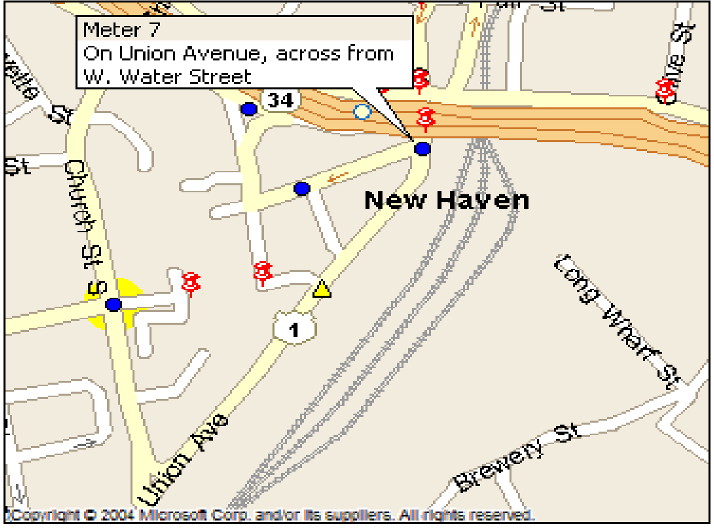
Level	Primary: Flowav
	Redundant: Flowav
Velocity	Primary: Flowav
	Redundant: Flowav
Meter Logger	Telog

Comments: *Sensors are 12” in the left channel US pipe. Sensor #1: 6:00 Sensor #2: 5:30*

Area Map



Detail Map



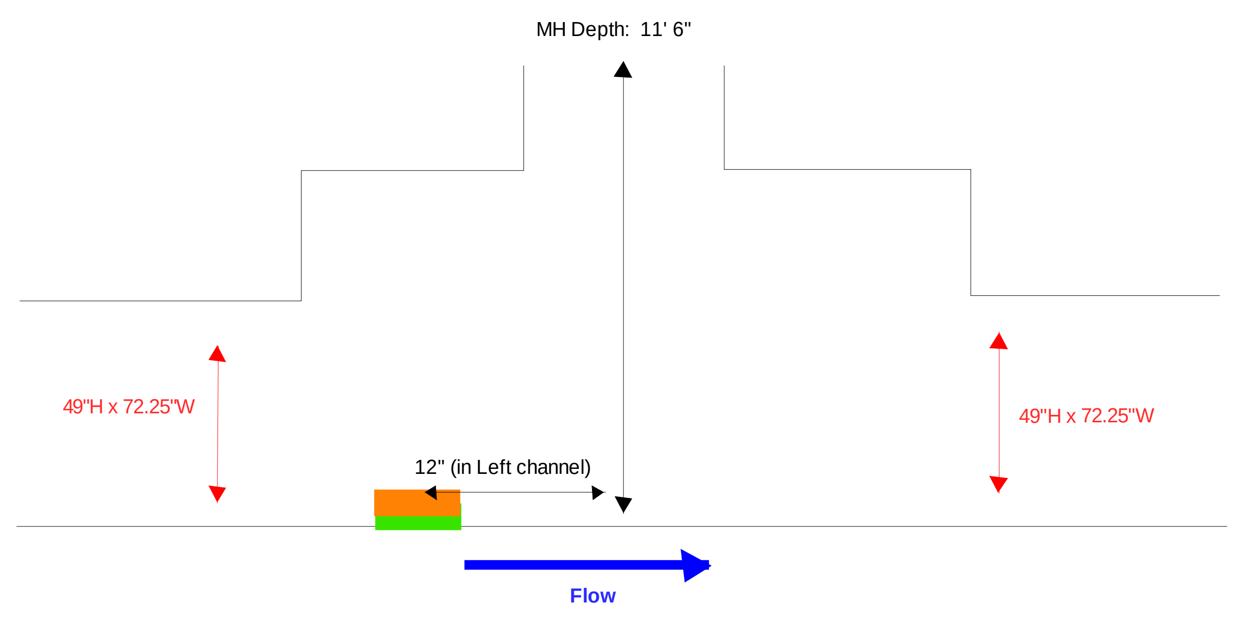
View from top of MH

Site Overview

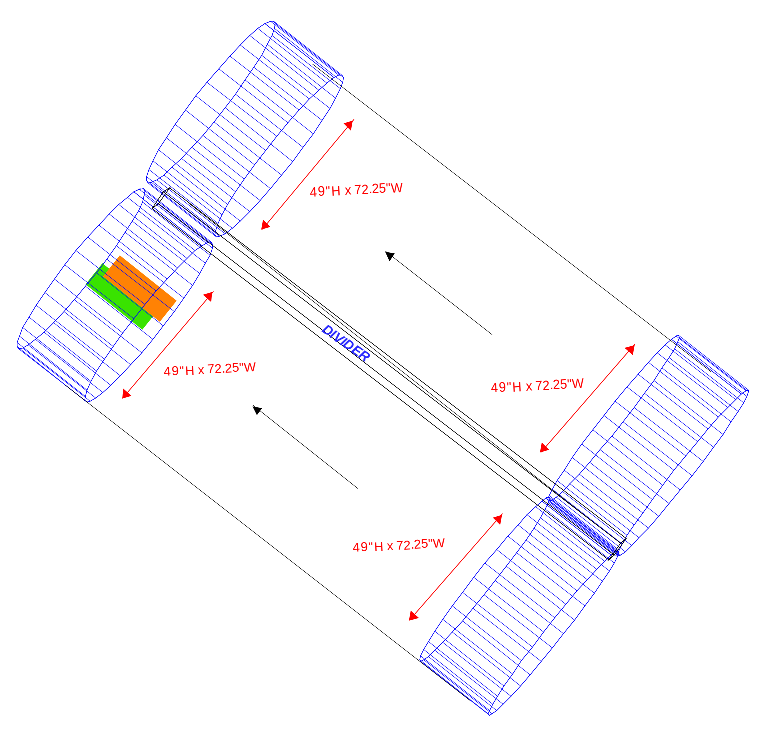
View of flow through influent line

View of flow through effluent line

Dimensional Structure Profile View (profile sketch showing location of sensors)

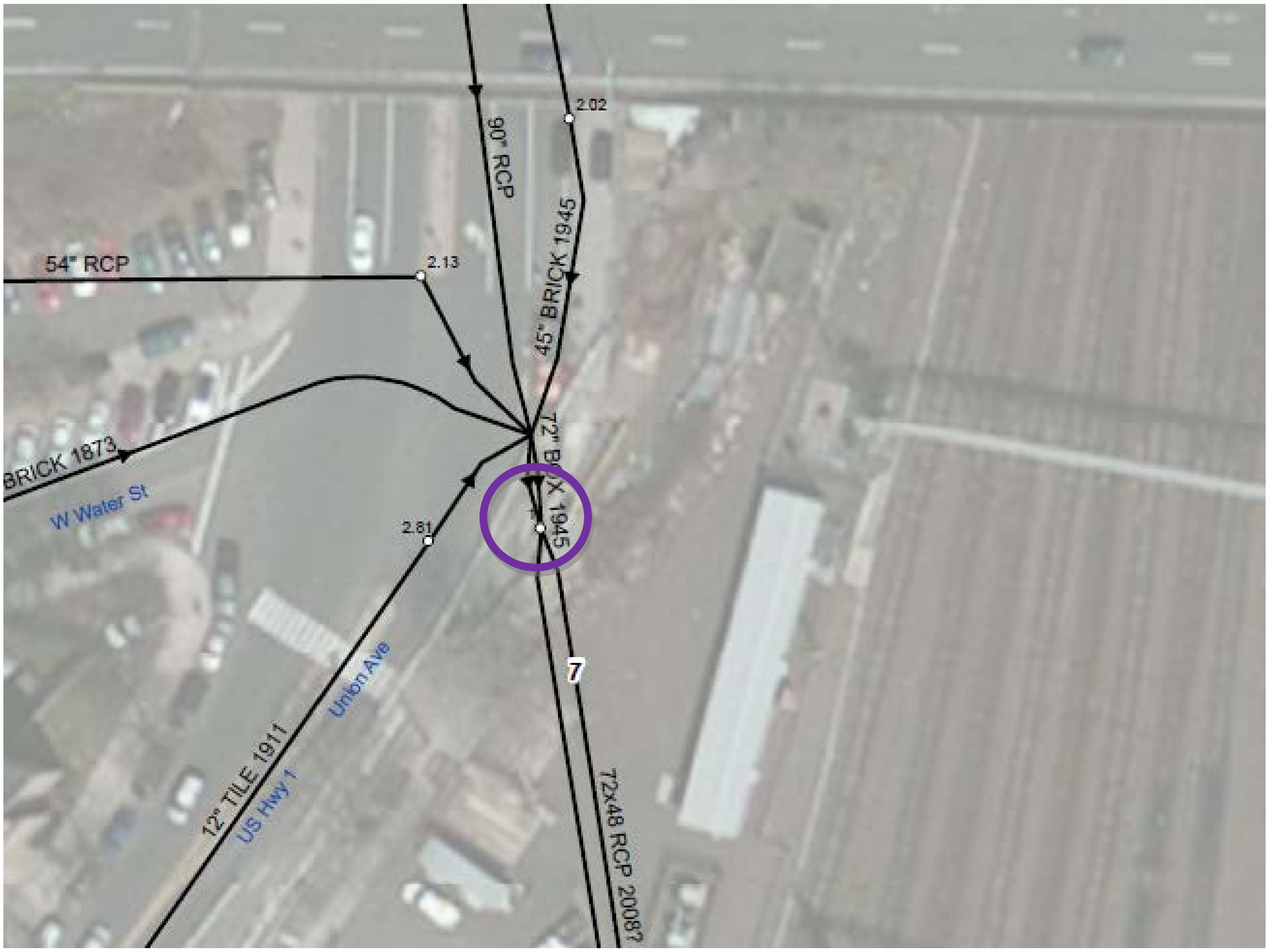


Plan View



Site Location Plan View

Sketch or plat showing upstream and downstream manholes, connections, and bends.



Site Name / Manhole # Meter 9

Investigation Date: 11/2/15 Time: 15:00 Crew Members: KE/MH

Installation Date: 11/9/15 Time: 10:00 Crew Members: KE/MH

Address/Location: At dead end of the Church St. Ext. (Brewery St. & Food Terminal Plaza)

Latitude: N 41°17.647 Longitude: W 72°55.485

Weather Conditions: Wet [✓ Dry]

Hydraulic Conditions

Influent Flow:

Velocity 0.0 ft/sec **Standing flow*

Depth ___ in

Turbulence Amplitude:

- ☐ [✓ Less than 0.25”]
- ☐ 0.25” to 0.75”
- ☐ 0.75” to 1.5”
- ☐ 1.5” to 3”
- ☐ Greater than 3”

Sewer Line Characteristics:

	Influent 1	Influent 2	Influent 3	Effluent
Height	48”	48”	24”	48”
Width	60”	60”	24”	144”
Material	RCP	RCP	RCP	RCP
Shape	Rectangle	Rectangle	Rectangle	Rectangle

Sediment Present:

☐ [✓ Yes] Hard packed: ____________ in. deep

☐ No Soft: 10.75 in. deep

Surcharge / Backwater Influence:

- ☐ [✓ No evidence visible]
- ☐ Remains in pipe
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____________ft from rim

Gas Investigation:

☐ Good 20.9 (condition)

Site Conditions

Site Access: *May be hard to access/possible trailer parked over the site or if there is snow*

- ☐ Good (no problems accessing site)
- ☐ [✓ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)]
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ [✓ No]

Height above ground __

Manhole depth 8 10”

Measured from *downstream invert* to *rim*

Pipe Offset _____

Structural Integrity of Manhole:

☐ Good ☐ [✓ Fair] ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

[✓ Pipe Size]/Geometry/Material Change:

☐ Influent ☐ [✓ Effluent] ☐ Manhole

Approx Distance to change: 10’

(detail is comments)

Crew Member: Can you maintain this site?

☐ [✓ Yes] ☐ No ☐ Maybe

Sensor Configuration:

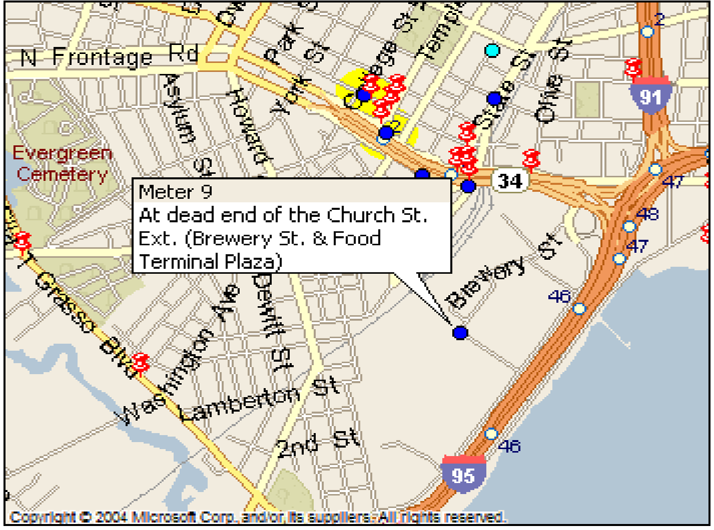
(Please include Serial Numbers when possible)

Level	Primary: Flowav
	Redundant: Flowav
Velocity	Primary: Flowav
	Redundant: Flowav
Meter Logger	Telog

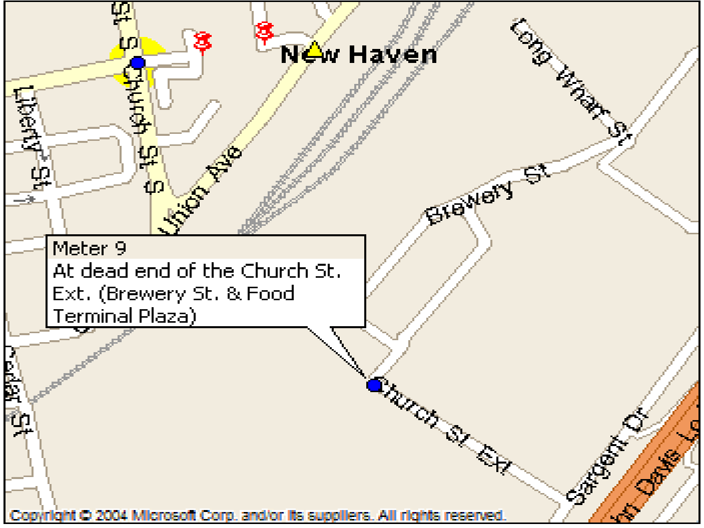
Comments: *Sensors are 38” in the US pipe.*

Sensor #1: 4:20 Sensor #2: 4:00

Area Map



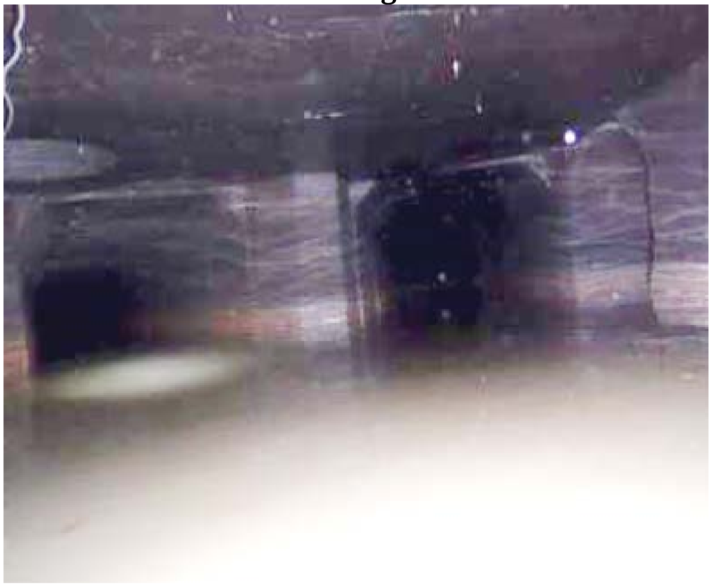
Detail Map



View from top of MH

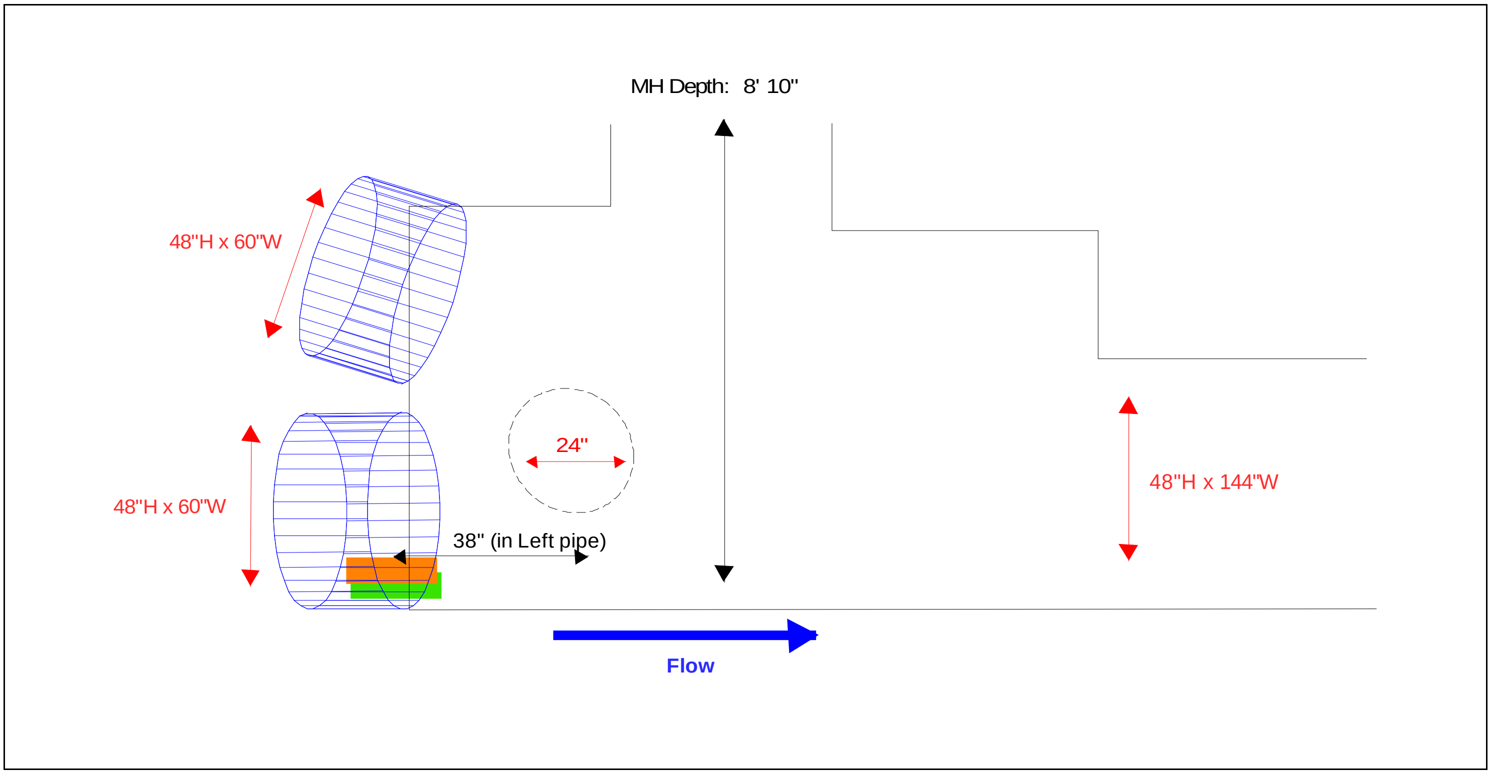
Site Overview

View of flow through influent line

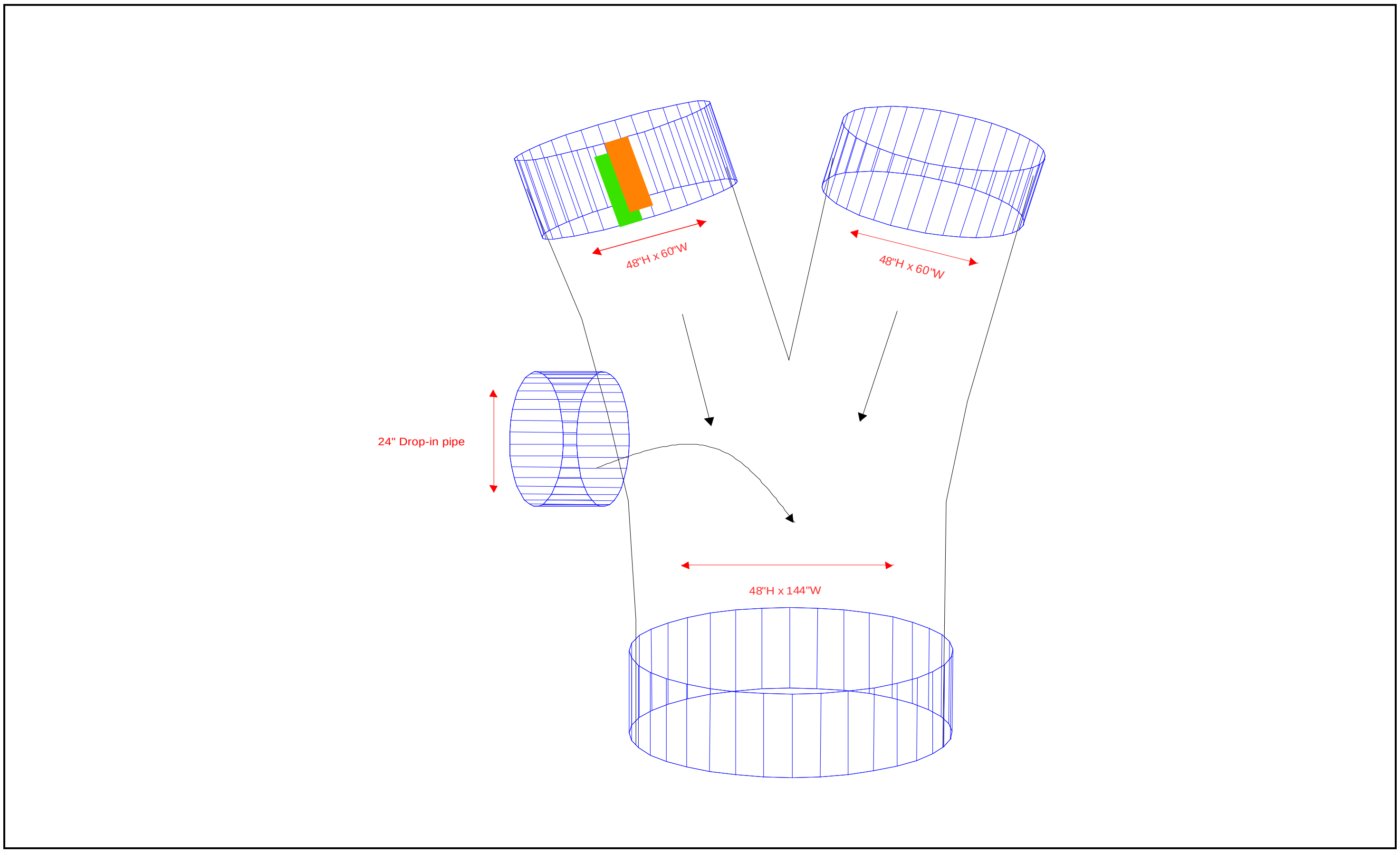


View of flow through effluent line

Dimensional Structure Profile View (profile sketch showing location of sensors)

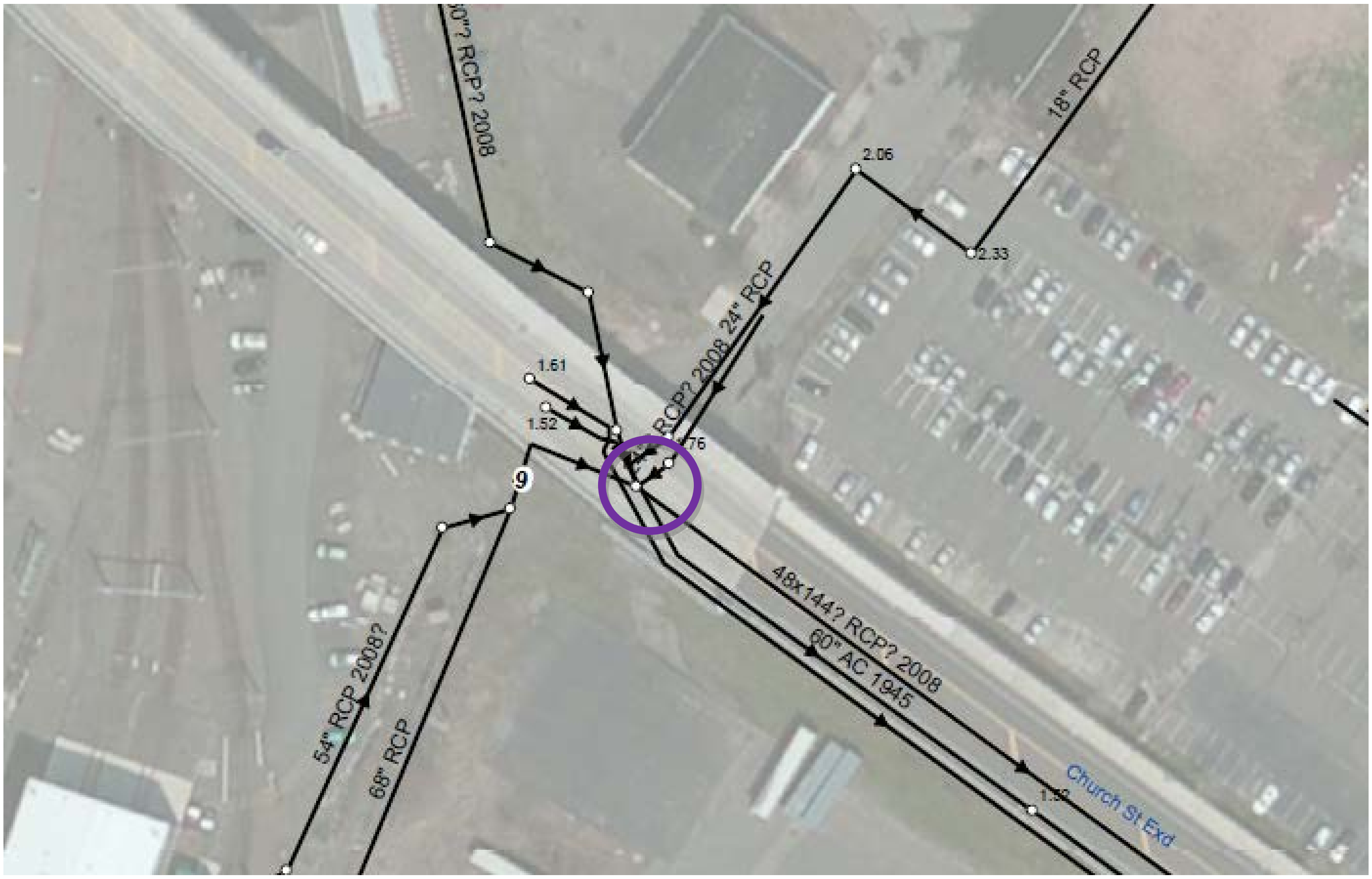


Plan View



Site Location Plan View

Sketch or plat showing upstream and downstream manholes, connections, and bends.



Site Name / Manhole #   Meter 9A

Investigation Date: 3/15/16   Time: 19:05   Crew Members: GW/JB

Installation Date: 3/16/16   Time: 10:05   Crew Members: GM/JB

Address/Location: At dead end of the Church St. Ext. (Brewery St. & Food Terminal Plaza)

Latitude: N 41°17.647   Longitude: W 72°55.485

Weather Conditions: Wet   [✓ Dry]

Hydraulic Conditions

Influent Flow:

Velocity 0.0 ft/sec   **Standing flow*

Depth   22.0 in

Turbulence Amplitude:

- ☐ [✓ Less than 0.25”]
- ☐ 0.25” to 0.75”
- ☐ 0.75” to 1.5”
- ☐ 1.5” to 3”
- ☐ Greater than 3”

Sewer Line Characteristics:

	Influent 1	Influent 2	Influent 3	Effluent
Height	48”	48”	24”	48”
Width	60”	60”	24”	144”
Material	RCP	RCP	RCP	RCP
Shape	Rectangle	Rectangle	Round	Rectangle

Sediment Present:

☐ [✓ Yes]   Hard packed: ____________ in. deep

☐ No   Soft: 9.0 in. deep

Surcharge / Backwater Influence:

- ☐ [✓ No evidence visible]
- ☐ Remains in pipe
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____________ft from rim

Gas Investigation:

☐ Good   20.9 (condition)

Site Conditions

Site Access: *May be hard to access/possible trailer parked over the site or if there is snow*

- ☐ Good (no problems accessing site)
- ☐ [✓ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)]
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes   ☐ [✓ No]

Height above ground __

Manhole depth   8’ 10”

Measured from *downstream invert* to *rim*

Pipe Offset   _____

Structural Integrity of Manhole:

☐ Good ☐ [✓ Fair] ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

[✓ **Pipe Size**]**/Geometry/Material Change:**

☐ Influent ☐ [✓ Effluent] ☐ Manhole

Approx Distance to change: 10’

(detail is comments)

Crew Member: Can you maintain this site?

☐ [✓ Yes] ☐ No ☐ Maybe

Sensor Configuration:

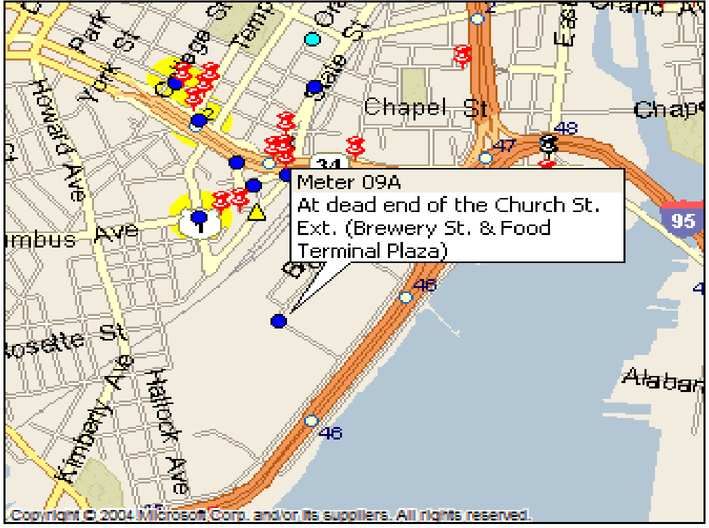
(Please include Serial Numbers when possible)

Level	Primary: Flowav	
	Redundant: FL900	
Velocity	Primary: Flowav	
	Redundant: FL900	
Meter Logger	Telog	

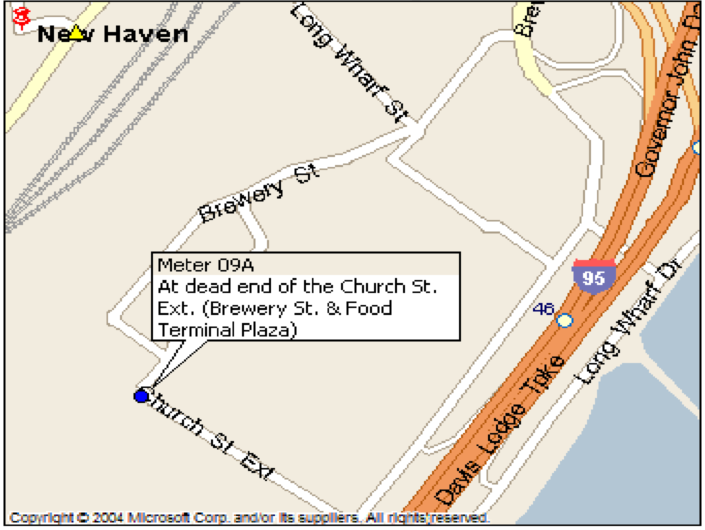
Comments: *Sensors are 38” in the US pipe.*

Sensor #1: 4:20   Sensor #2: 4:00

Area Map



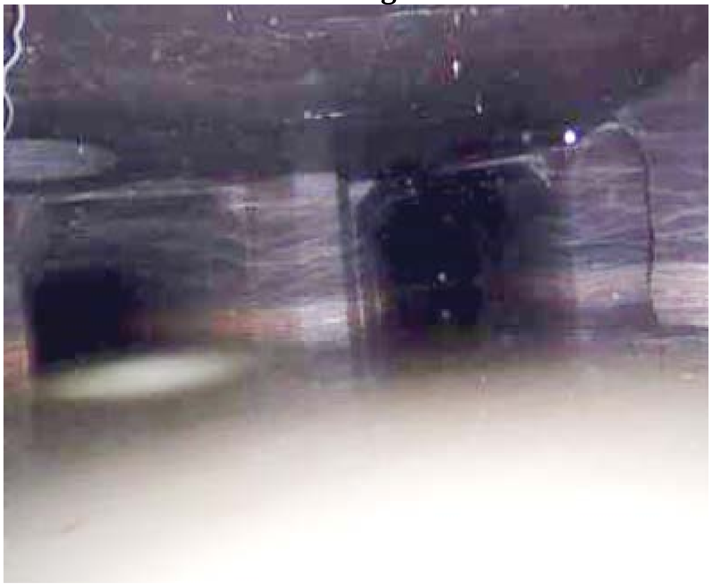
Detail Map



View from top of MH

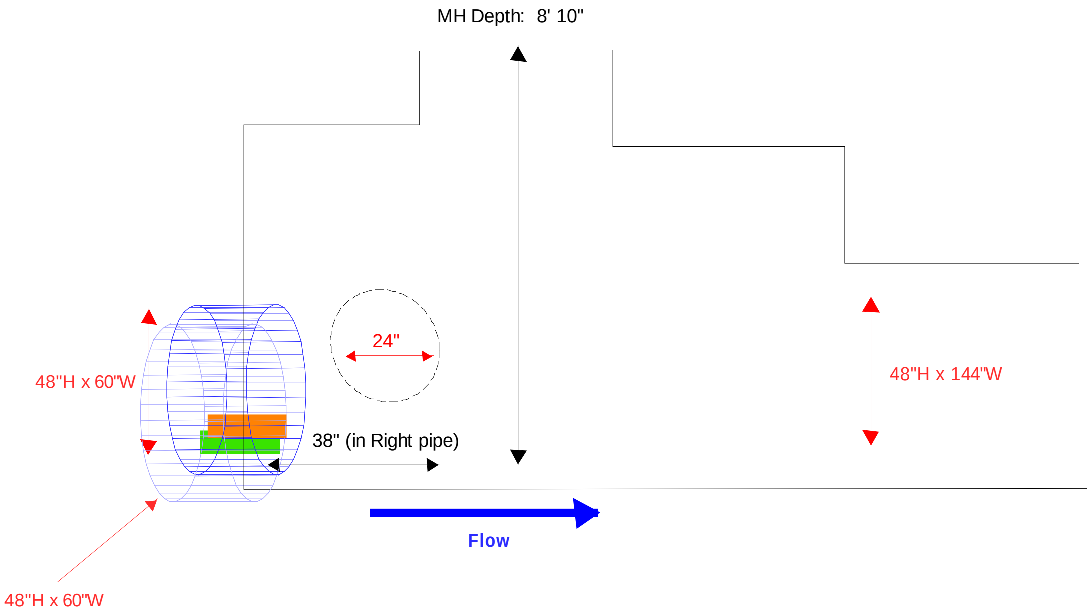
Site Overview

View of flow through influent line

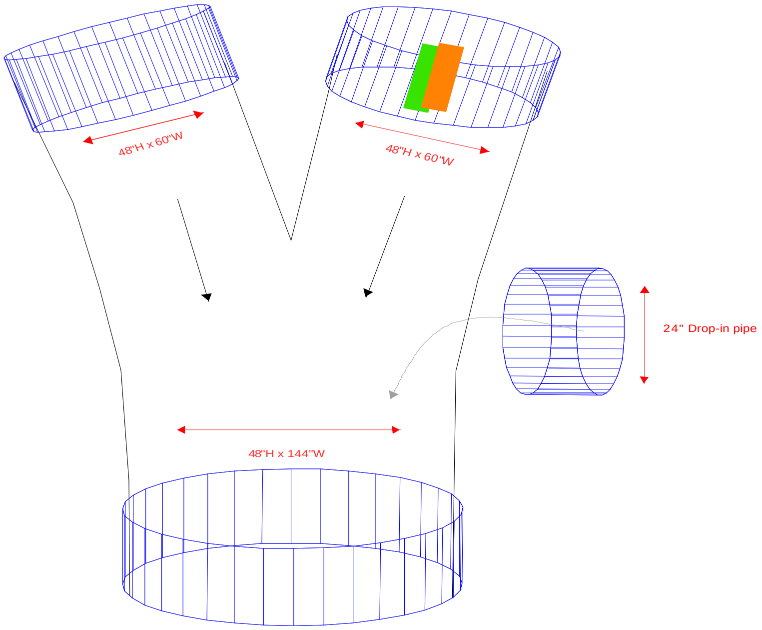


View of flow through effluent line

Dimensional Structure Profile View (profile sketch showing location of sensors)

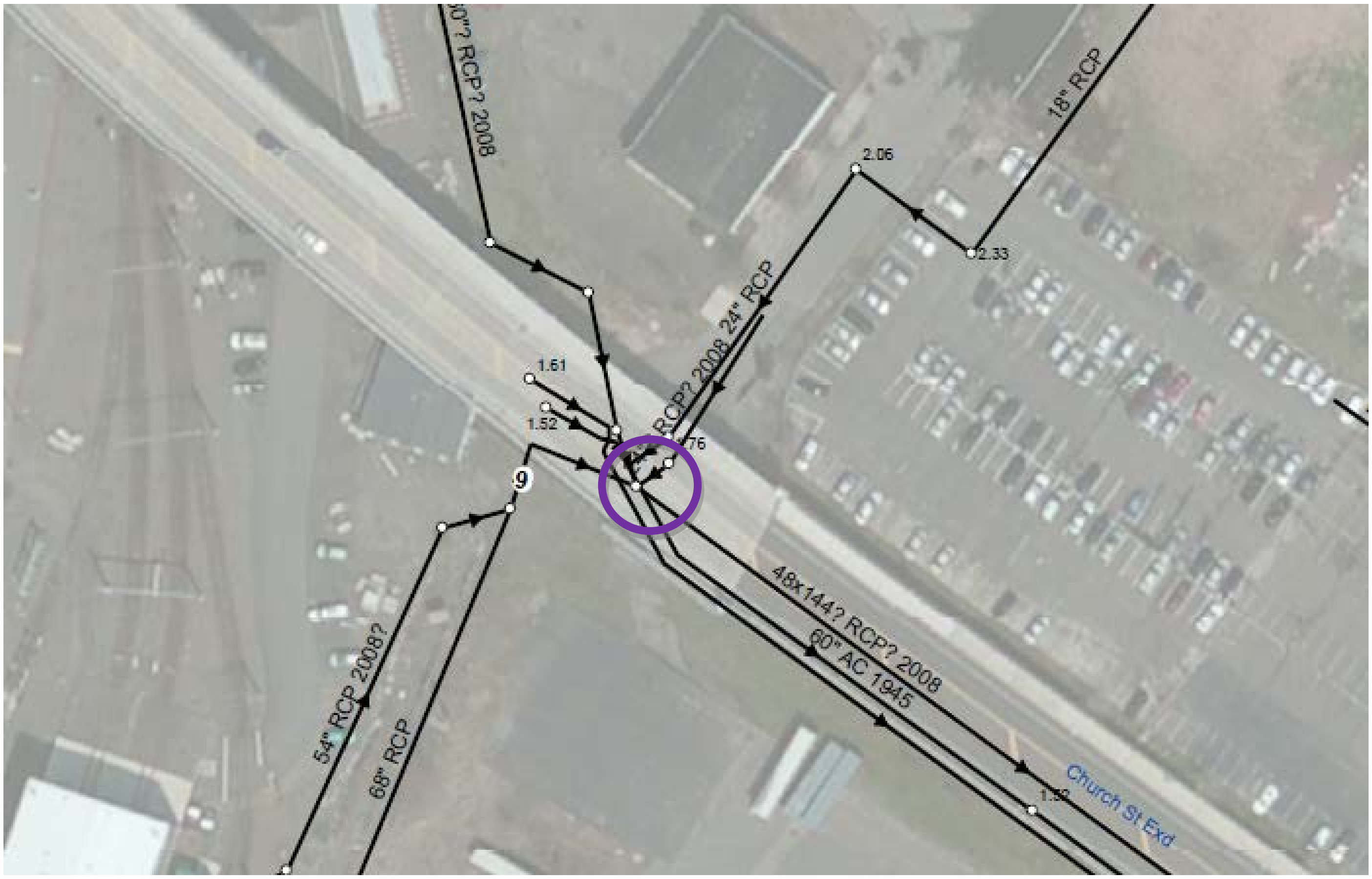


Plan View



Site Location Plan View

Sketch or plat showing upstream and downstream manholes, connections, and bends.



Site Name / Manhole # Meter 10

Investigation Date: 11/5/15 Time: 8:30 Crew Members: KE/MH

Installation Date: 11/5/15 Time: 8:40 Crew Members: KE/MH

Address/Location: 257 George Street (in the right lane, past Chase Bank)

Latitude: N 41°18.289 Longitude: W 72°55.784

Weather Conditions: Wet [✓ Dry]

Hydraulic Conditions

Influent Flow:

Velocity 0.0 ft/sec

Depth 1.25 in

Turbulence Amplitude:

- ☐ [✓ Less than 0.25”]
- ☐ 0.25” to 0.75”
- ☐ 0.75” to 1.5”
- ☐ 1.5” to 3”
- ☐ Greater than 3”

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	48”	12”	48”
Width	48”	12”	48”
Material	RCP	RCP	RCP
Shape	Round	Round	Round

Sediment Present:

☐ [✓ Yes] Hard packed: ____________ in. deep

☐ No Soft: 0.25 in. deep

Surcharge / Backwater Influence:

- ☐ [✓ No evidence visible]
- ☐ Remains in pipe
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____________ft from rim

Gas Investigation:

☐ Good 20.9 (condition)

Site Conditions

Site Access:

- ☐ Good (no problems accessing site)
- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ [✓ Traffic Control only (Requires extra traffic control]
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ [✓ No]

Height above ground __

Manhole depth 9’ 4”

Measured from *downstream invert* to *rim*

Pipe Offset Y **can see center*

Structural Integrity of Manhole:

☐ Good ☐ [✓ Fair] ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_________ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ [✓ Yes] ☐ No ☐ Maybe

Sensor Configuration:

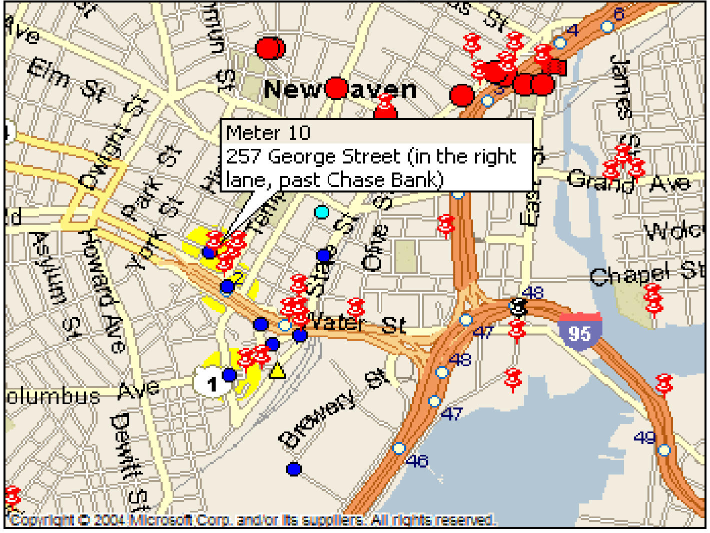
(Please include Serial Numbers when possible)

Level	Primary: Flowav
	Redundant: Flowav
Velocity	Primary: Flowav
	Redundant: Flowav
Meter Logger	Telog

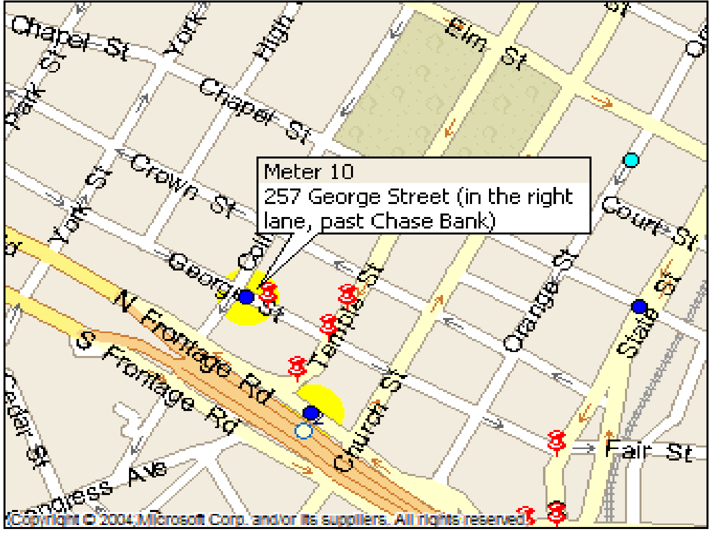
Comments: *Sensors are 21” in the DS pipe.*

Sensor #1: 6:00 Sensor #2: 5:30

Area Map



Detail Map



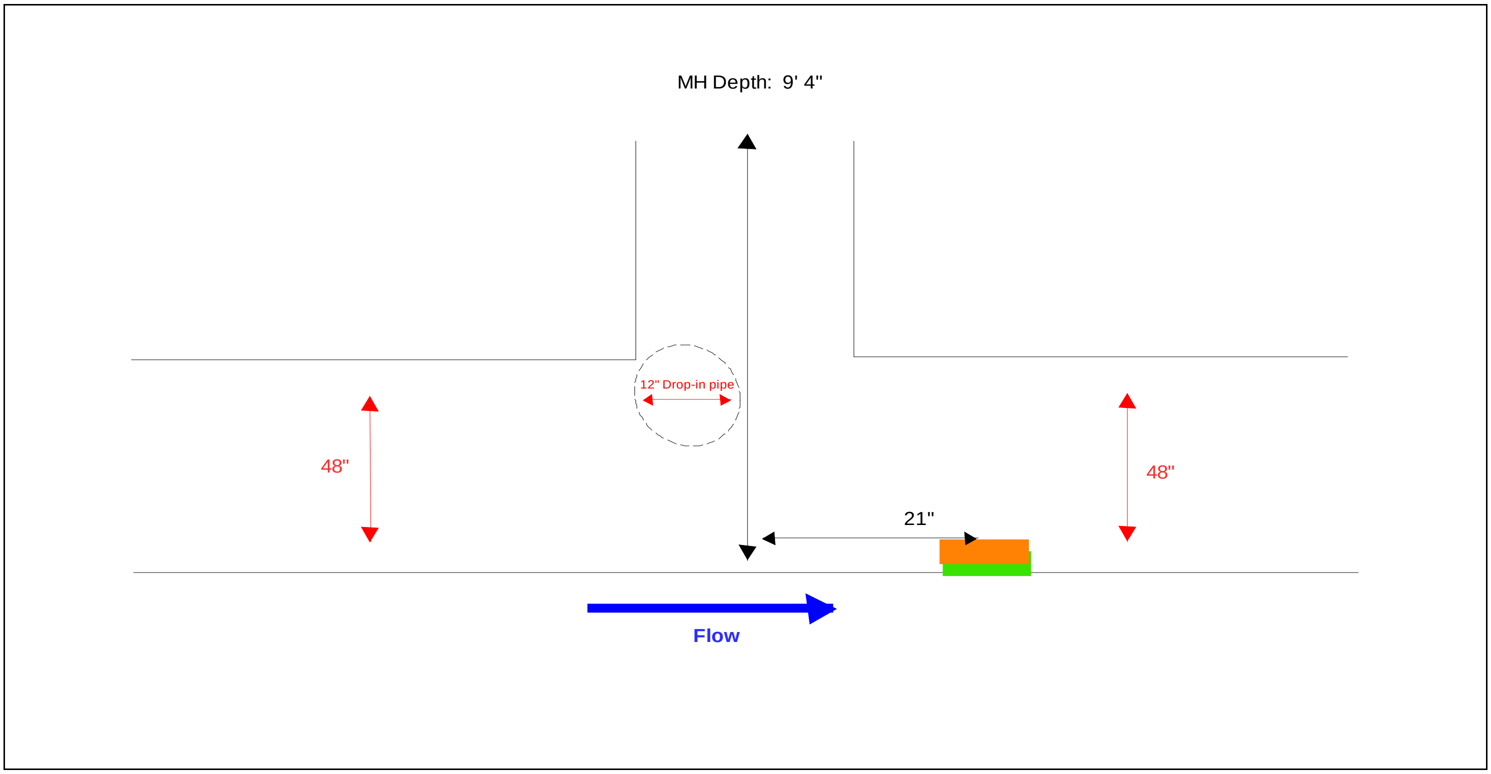
View from top of MH

Site Overview

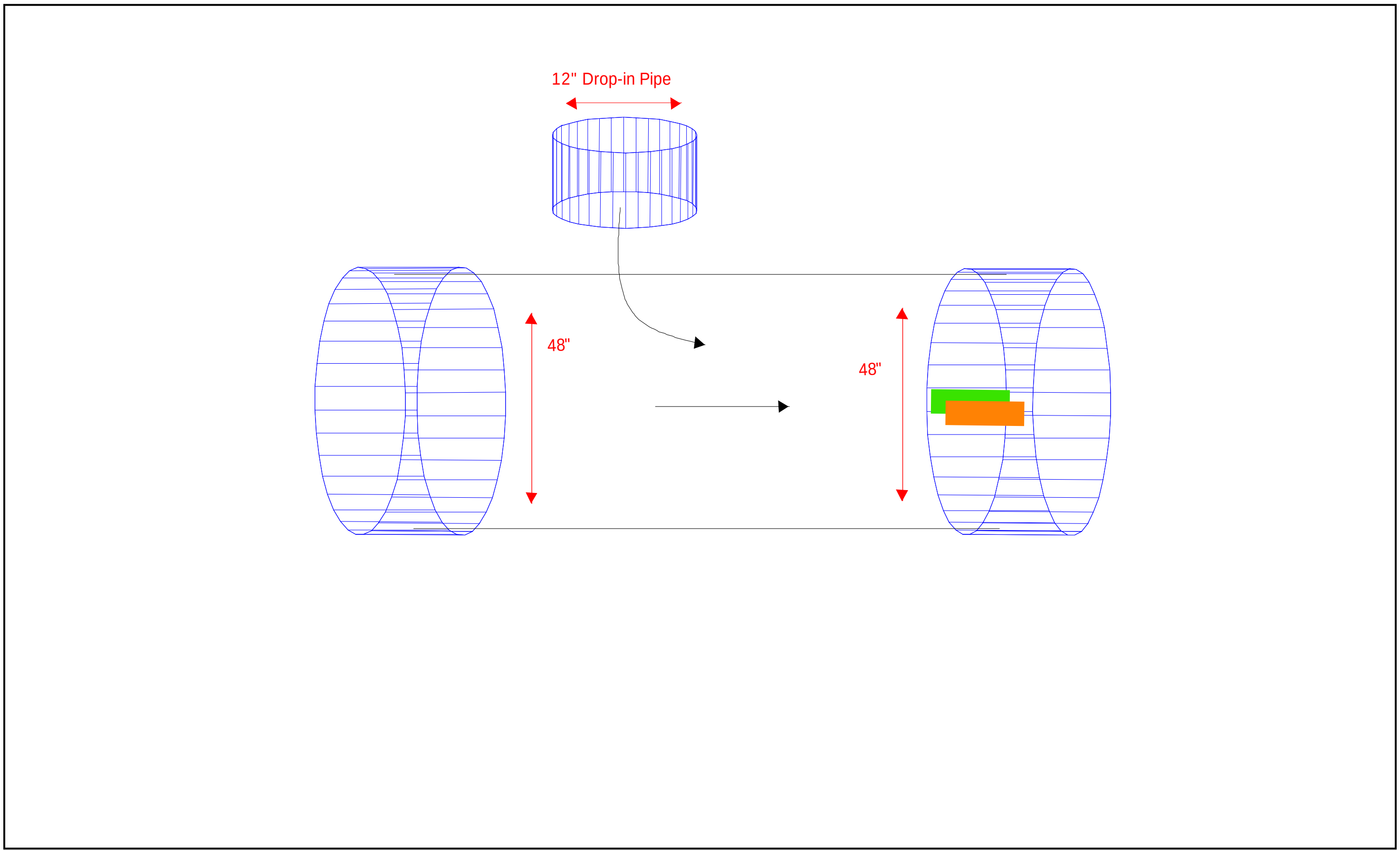
View of flow through influent line

View of flow through effluent line

Dimensional Structure Profile View (profile sketch showing location of sensors)



Plan View



Site Location Plan View

Sketch or plat showing upstream and downstream manholes, connections, and bends.

Site Name / Manhole # Meter 11

Investigation Date: 3/18/16 Time: 13:45 Crew Members: GW/JB

Installation Date: 3/18/16 Time: 13:41 Crew Members: GW/TJW

Address/Location: 1 Brewery Street

Latitude: N 41°17’ 52” Longitude: W 72°55’ 11”

Weather Conditions: Wet [✓ Dry]

Hydraulic Conditions

Influent Flow:

Velocity 0.0 ft/sec

Depth 7.0 in

Turbulence Amplitude:

- ☐ [✓ Less than 0.25”]
- ☐ 0.25” to 0.75”
- ☐ 0.75” to 1.5”
- ☐ 1.5” to 3”
- ☐ Greater than 3”

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	47”		47”
Width	73.5”		73.5”
Material	Cement		Cement
Shape	Rectangle		Rectangle

Sediment Present:

☐ [✓ Yes] Hard packed: ____________ in. deep

☐ No Soft: ____________ in. deep

Surcharge / Backwater Influence:

- ☐ [✓ No evidence visible]
- ☐ Remains in pipe
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____________ft from rim

Gas Investigation:

☐ [✓ Good] ____ (condition)

Site Conditions

Site Access:

- ☐ Good (no problems accessing site)
- ☐ [✓ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)]
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ [✓ No]

Height above ground __

Manhole depth ____

Structural Integrity of Manhole:

☐ Good ☐ [✓ Fair] ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_________ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ [✓ Yes] ☐ No ☐ Maybe

Sensor Configuration:

(Please include Serial Numbers when possible)

Level	Primary: Flowav
	Redundant: FL900
Velocity	Primary: Flowav
	Redundant: FL900
Meter Logger	Telog

Comments: Redundant FL900 AV Sensor

Area Map

Meter 11
1 Brewery Street

Copyright © 2004 Microsoft Corp. and/or its suppliers. All rights reserved.

Detail Map

Meter 11
1 Brewery Street

Copyright © 2004 Microsoft Corp. and/or its suppliers. All rights reserved.

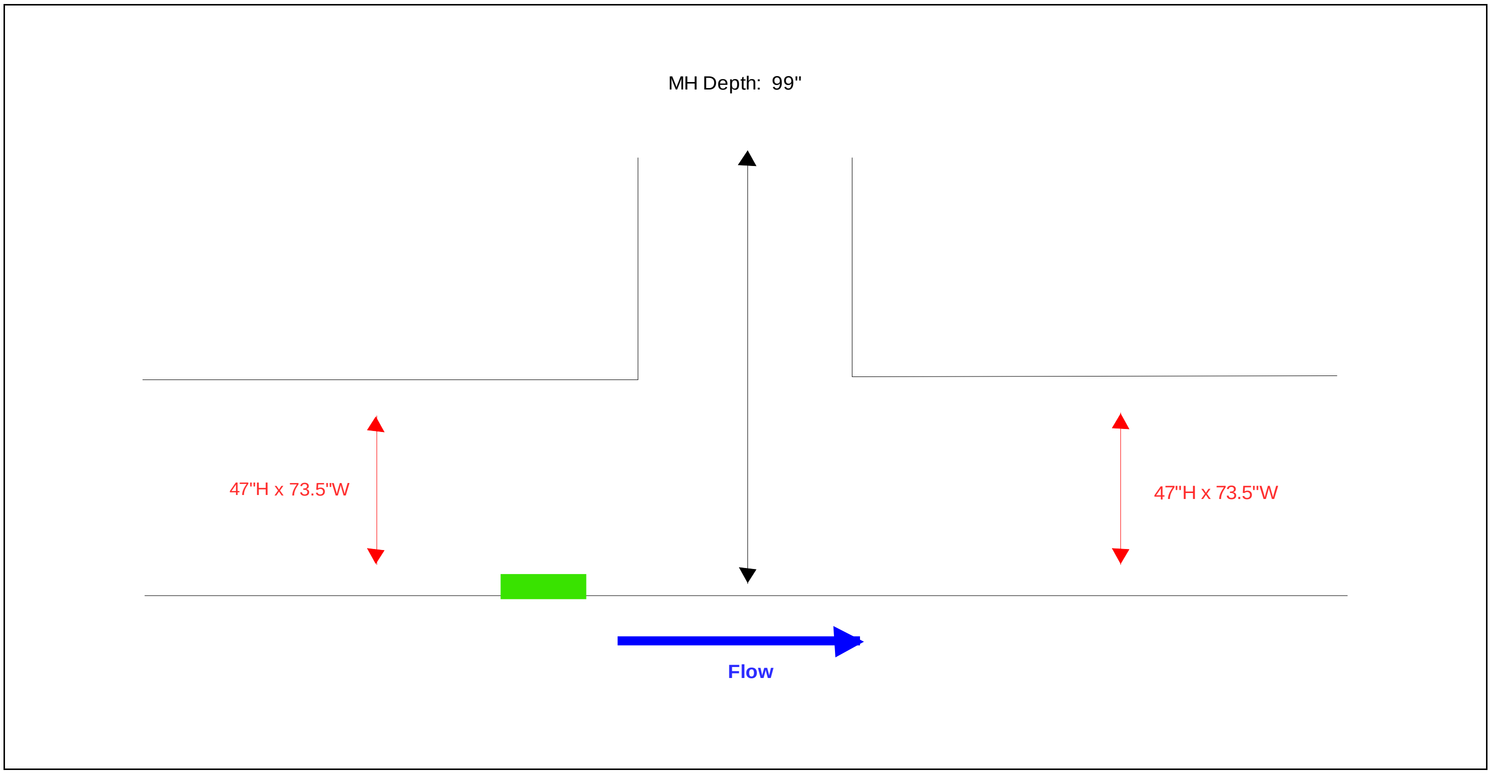
View from top of MH

Site Overview

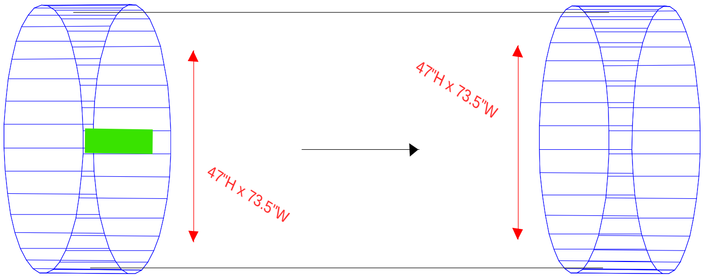
View of flow through influent line

View of flow through effluent line

Dimensional Structure Profile View (profile sketch showing location of sensors)



Plan View



Site Location Plan View

Sketch or plat showing upstream and downstream manholes, connections, and bends.

Appendix B

Sediment Sampling Report

FUSS & O'NEILL

May 26, 2016

Virginia Roach, P.E.
Vice President
CDM Smith
75 State Street, Suite 701
Boston, MA 02109

RE: Stormwater System Sediment Sampling
New Haven, CT
Fuss & O'Neill Reference No. 20130554.A30

Dear Ms. Roach:

Fuss & O'Neill is pleased to provide this report documenting the sediment sampling completed at select locations within the city of New Haven storm sewer system. The sampling was completed to preliminarily identify potential disposal or reuse alternatives for the sediment, which may be removed from the stormwater system as part of the proposed drainage improvement plans currently being developed for downtown New Haven.

Sampling

Sediment samples were collected by Fuss & O'Neill on May 4, 2016 from three storm sewer manholes identified by CDM Smith, and a fourth storm manhole located upstream of a CDM Smith-identified manhole that could not be sampled due to a lack of sediment. Sample locations are indicated on the stormwater system map included in *Attachment A*.

The samples were collected using a stainless steel bucket attached to a rod to scoop sediment from the base of the manhole. The bucket was decontaminated before each use. Sediment thickness in the manholes ranged from approximately 0.25 feet to 3.4 feet. The sediment consisted primarily of medium to coarse sand with some gravel. Coarse-grained materials typically adsorb fewer pollutants than fine-grained material.

Each sample was analyzed by York Analytical Laboratories, a Connecticut Department of Public Health Certified Environmental Laboratory, for the following list of analyses:

- RCRA 8 Metals – Total/TCLP (toxicity characteristic leaching procedure)
- Volatile Organic Compounds (VOCs) – Total/TCLP
- Semi-Volatile Organic Compounds (SVOCs) - Total/TCLP
- Pesticides – Total/ TCLP
- Herbicides – Total/TCLP

56 Quarry Road
Trumbull, CT
06611
t 203.374.3748
800.286.2469
f 203.374.4391

www.fando.com

Connecticut

Massachusetts

Rhode Island

South Carolina

- Polychlorinated Biphenyls (PCBs)
- Cyanide
- Extractable Total Petroleum Hydrocarbons (ETPH)
- Reactivity (cyanide and sulfide)
- pH
- Ignitability
- Paint Filter Test

Regulatory Framework

The Connecticut Remediation Standard Regulations (RSRs) contain numerical criteria that apply to the cleanup of certain sites and, indirectly, to the reuse of soil or sediment. In addition, disposal of polluted sediment may be regulated by the Connecticut Solid Waste Management Regulations. Federal hazardous waste regulations could apply if levels of pollutants exceed federal criteria. The analytical parameter list was generated with all these regulations in mind.

This project is not strictly subject to the RSRs; however, baseline RSR criteria are presented alongside the analytical data as a preliminary evaluative tool for determining the appropriateness of reusing the sediment.

Two sets of RSR criteria apply when remediating soil or managing sediment. These two criteria are the Direct Exposure Criteria and the Pollutant Mobility Criteria.

1. Direct Exposure Criteria are established to protect human health from exposure to contaminants in soil. With some exceptions, these criteria apply to soil located within fifteen feet of the ground surface. Polluted soil must be remediated to a concentration that is consistent with the Residential Direct Exposure Criteria (R DEC), unless the site is used exclusively for industrial or commercial purposes. In such a case, the less stringent Industrial/Commercial Direct Exposure Criteria (I/C DEC) may be used, provided an Environmental Land Use Restriction(ELUR) is recorded to ensure that the site is not used for residential purposes in the future.

2. Pollutant Mobility Criteria are established to prevent the pollution of groundwater caused by soil contamination that is available to migrate into groundwater. The Pollutant Mobility Criteria (PMC) varies depending on the groundwater quality classification of the site – GA PMC for areas with potable groundwater and GB PMC for areas with non-potable groundwater. Much of New Haven and other urban areas are classified as GB areas. GA PMC are more stringent than GB PMC. Default criteria are provided for analysis by total mass testing, and alternative criteria are provided based on leachability testing.

Discussion of Analytical Results

Herbicides and pesticides were not detected in any of the four samples above laboratory reporting limits. In addition, VOCs and SVOCs analyzed by TCLP were also not detected above laboratory reporting limits.

Very low levels of acetone and PCBs were detected in sample SED-04, at concentrations below any RSR criteria. Acetone is a common laboratory contaminant and low level detections are sometimes associated with laboratory contamination. PCBs are persistent in the environment and often are detected at low concentrations in random areas without a direct source.

ETPH was detected in all samples, with the concentration in sample SED-02 exceeding the R DEC and GA PMC. ETPH measures a mid-range of petroleum products, including vehicle oils.

Several SVOC concentrations exceeded the R DEC and I/C DEC and the baseline GB PMC in three samples (SED-02, SED-03, and SED-04). However, SVOC concentrations meet the alternative PMC criteria based on the TCLP analysis. SVOCs are compounds associated with heavy petroleum products used in vehicles and exhaust of vehicles, and are commonly found in street sweepings and catch basin sediments. (Note: SVOCs are also present in coal and partially combusted organic materials, which are often found in an urban environment.)

Total metal concentrations were all below the R DEC; however, barium analyzed by TCLP exceeded the GA PMC in three samples (SED-01, SED-02, and SED-04), and lead analyzed by TCLP exceeded the GB PMC in all four samples. Note that the TCLP test is very aggressive and analysis by the less aggressive but acceptable synthetic precipitation leaching procedure (SPLP) test may show that the material would not exceed the GB PMC.

Analysis for ignitability, pH, cyanide reactivity, and sulfide reactivity all indicated the material is non-hazardous based on those characteristics. TCLP analysis of VOCs, SVOCs, pesticides, herbicides and metals also indicate that the material is non-hazardous in accordance with federal regulations.

Reuse/Disposal Options

Exceedances of both the DEC and PMC present in the sediment samples make reuse of the sediment where there is the potential for direct exposure, or where it could cause groundwater impacts, inappropriate. It may be possible to use the material under pavement or a building, or a clean soil "cap" to prevent direct exposure. As previously noted, testing using the SPLP method will likely prove that the material would comply with the GB PMC (provided the total mass data are similar to the current samples), so an impermeable cap would not be needed.

Additionally, the sediment has constituent levels similar to what is typically found in street sweepings and catch basin cleanings. If the City has a preferred reuse/disposal location for these materials, it may be possible to manage the storm drainage system sediments in a similar manner.

While reuse may be technically feasible, finding suitable reuse locations is often difficult, and material with similar constituent levels is often disposed of at an appropriately permitted landfill.

Based on the characterization data collected, several potential disposal facilities have been identified that may be able to accept the material. These facilities include:

- Manchester Landfill - Manchester, CT
- Phoenix Soils, LLC a Clean Earth Company – Plainville, CT
- Cranston Sanitary Landfill – Cranston, RI
- Ted Ondrick Company, LLC - Chicopee, MA

Transportation and disposal fees can vary based on material quantities, schedule for when it will be disposed, and fuel costs at the time of transportation. Typical transportation and disposal fees for this type of material currently range between $70 and $100 per ton. This cost does not include removal of the sediment from the stormwater drainage system or staging of sediment.

Note that this sampling effort was a snapshot in time and location, and may not be representative of sediment throughout the City's storm drainage system. We assume that if the sediment is to be removed, it would be consolidated and tested based on the final volume and potential reuse or disposal alternatives being considered. We recommend that SPLP testing be conducted along with the testing conducted for this program. A more detailed evaluation of disposal and reuse options could then be undertaken.

Thank you for requesting engineering services from Fuss & O'Neill. Please contact us if you have any questions or require further assistance.

Sincerely,

William Heiple, PE, LEP	Erik Mas, PE
Associate	Vice President

Enclosures: Table 1: Summary of Detected Constituents in Sediment
Attachment A: Sediment Sample Locations
Attachment B: Laboratory Report

FUSS & O'NEILL

Table

Summary of Detected Constituents in Sediment

Table 1
Summary of Detected Constituents in Sediment
New Haven Stormwater System

Sample ID	CTDEEP RSR Pollution Mobility Criteria GB	CTDEEP RSR Pollution Mobility Criteria GA GAA	CTDEEP RSR Direct Exposure Criteria Industrial / Commercial	CTDEEP RSR Direct Exposure Criteria Residential	SED-01	SED-02	SED-03	SED-04
Sample Number					1252160504-01	1252160504-02	1252160504-03	1252160504-04
Sampling Date					5/4/2016	5/4/2016	5/4/2016	5/4/2016
Compound								
Volatile Organics, CT RCP List (mg/kg)								
Acetone	140	14	1000	500	<0.0099	<0.0094	<0.0092	0.01
Volatile Organics, TCLP RCRA List	None Detected Above Laboratory Reporting Limits							
Semi-Volatiles, CT RCP (mg/kg)								
Anthracene	400	40	2500	1000	<0.624	0.784D	<0.617	<0.637
Benzo(a)anthracene	1	1	7.8	1	<0.624	4.73D	2.23D	2.08D
Benzo(a)pyrene	1	1	1	1	<0.624	2.82D	1.67D	1.43D
Benzo(b)fluoranthene	1	1	7.8	1	<0.624	4.17D	2.22D	1.89D
Benzo(g,h,i)perylene	~	~	~	~	<0.624	0.912D	0.68D	<0.637
Benzo(k)fluoranthene	1	1	78	8.4	<0.624	2.01D	1.13D	1.1D
Bis(2-ethylhexyl)phthalate	11	1	410	44	0.625D	0.796D	<0.617	<0.637
Carbazole	~	~	~	~	<0.624	3.8D	1.63D	0.771D
Chrysene	~	~	~	~	<0.624	4.22D	2.03D	1.68D
Fluoranthene	56	5.6	2500	1000	1.29D	11.1D	5.21D	4.34D
Indeno(1,2,3-cd)pyrene	~	~	~	~	<0.624	1D	0.688D	<0.637
Phenanthrene	40	4	2500	1000	<0.624	6.4D	1.78D	1.27D
Pyrene	40	4	2500	1000	1.06D	10D	4.07D	3.32D
Semi-Volatiles, TCLP RCRA Target List	None Detected Above Laboratory Reporting Limits							
Herbicides, CT RCP	None Detected Above Laboratory Reporting Limits							
Herbicides, TCLP Target List	None Detected Above Laboratory Reporting Limits							
Pesticides, CT RCP Target List	None Detected Above Laboratory Reporting Limits							
Pesticides, TCLP RCRA List	None Detected Above Laboratory Reporting Limits							
Polychlorinated Biphenyls (mg/kg)								
Aroclor 1260	~	~	~	~	<0.0312	<0.0313	<0.0308	0.0467
Total PCBs	~	~	10	1	<0.0312	<0.0313	<0.0308	0.0467
Extractable Total Petroleum Hydrocarbons (ETPH) (mg/kg)								
ETPH (Extractable Total Petroleum Hydrocarbons)	2500	500	2500	500	338	796	198	234
Metals, RCRA (mg/kg)								
Arsenic	~	~	10	10	1.37	<1.25	1.35	5.4
Barium	~	~	140000	4700	16.6	11.1	6.97	32
Chromium	~	~	51100	4000	8.99	33.3	16.3	36
Lead	~	~	1000	400	29.5	128	38.7	31.1
Mercury	~	~	10000	340	0.0689	0.557	<0.037	0.209
Selenium	~	~	610	20	<1.25	<1.25	1.38	<1.27
Metals, TCLP RCRA (mg/L)								
Barium	10	1	~	~	1.29	1.37	0.884	1.43
Cadmium	0.05	0.005	~	~	0.005	0.004	<0.003	<0.003
Chromium	0.5	0.05	~	~	0.007	0.008	0.016	0.018
Lead	0.15	0.015	~	~	0.54	0.333	0.155	0.05
Selenium	0.5	0.05	~	~	0.014	<0.011	<0.011	0.015
Cyanide, Total	Not Detected Above Laboratory Reporting Limits							
Ignitability	~	~	~	~	Non-Ignit.	Non-Ignit.	Non-Ignit.	Non-Ignit.
Paint Filter Test	~	~	~	~	No Free Liquid	No Free Liquid	No Free Liquid	No Free Liquid
pH	~	~	~	~	7.40	7.13	7.06	7.12
Reactivity-Cyanide	Not Detected Above Laboratory Reporting Limits							
Reactivity-Sulfide	Not Detected Above Laboratory Reporting Limits							

NOTES:
Exceedences of Connecticut DEEP RSR Criteria are highlighted and bolded.
D=result is from an analysis that required a dilution
< =analyte not detected at or above the laboratory reporting limit indicated
~=no regulatory limit has been established for this analyte

Attachment A

Sediment Sample Locations

New Haven Storm Water System Sediment Sampling Locations

SED-01 – Sargent Drive (IKEA parking lot)

SED-02 - West Water Street/ Meadow Street

SED-03 – Sargent Drive/Church Street Extension

SED-04 - Food Terminal (Below Church Street South)

Attachment B

Laboratory Report

Technical Report

prepared for:

Fuss & ONeill, Inc.
56 Quarry Road
Trumbull CT, 06611
Attention: Gregory Toothill

Report Date: 05/16/2016

Client Project ID: 20130554.A30

Client Project No.: 20130554.A30

York Project (SDG) No.: 16E0136

CT Cert. No. PH-0723	New Jersey Cert. No. CT-005	New York Cert. No. 10854	PA Cert. No. 68-04440

Report Date: 05/16/2016
Client Project ID: 20130554.A30
York Project (SDG) No.: 16E0136

Fuss & ONeill, Inc.
56 Quarry Road
Trumbull CT, 06611
Attention: Gregory Toothill

Purpose and Results

This report contains the analytical data for the sample(s) identified on the attached chain-of-custody received in our laboratory on May 04, 2016 and listed below. The project was identified as your project: **20130554.A30**.

The analyses were conducted utilizing appropriate EPA, Standard Methods, and ASTM methods as detailed in the data summary tables.

All samples were received in proper condition meeting the customary acceptance requirements for environmental samples except those indicated under the Notes section of this report.

All analyses met the method and laboratory standard operating procedure requirements except as indicated by any data flags, the meaning of which are explained in the attachment to this report, and case narrative if applicable.

The results of the analyses, which are all reported on dry weight basis (soils) unless otherwise noted, are detailed in the following pages.

Please contact Client Services at 203.325.1371 with any questions regarding this report.

York Sample ID	Client Sample ID	Matrix	Date Collected	Date Received
16E0136-01	**1252160504-01**	**Sediment**	**05/04/2016**	**05/04/2016**
16E0136-02	**1252160504-02**	**Sediment**	**05/04/2016**	**05/04/2016**
16E0136-03	**1252160504-03**	**Sediment**	**05/04/2016**	**05/04/2016**
16E0136-04	**1252160504-04**	**Sediment**	**05/04/2016**	**05/04/2016**
16E0136-05	**1252160504-05**	**Soil**	**05/04/2016**	**05/04/2016**
16E0136-06	**1252160504-06**	**Soil**	**05/04/2016**	**05/04/2016**

General Notes for York Project (SDG) No.: 16E0136

1. The RLs and MDLs (Reporting Limit and Method Detection Limit respectively) reported are adjusted for any dilution necessary due to the levels of target and/or non-target analytes and matrix interference. The RL(REPORTING LIMIT) is based upon the lowest standard utilized for the calibration where applicable.
2. Samples are retained for a period of thirty days after submittal of report, unless other arrangements are made.
3. York's liability for the above data is limited to the dollar value paid to York for the referenced project.
4. This report shall not be reproduced without the written approval of York Analytical Laboratories, Inc.
5. All samples were received in proper condition for analysis with proper documentation, unless otherwise noted.
6. All analyses conducted met method or Laboratory SOP requirements. See the Qualifiers and/or Narrative sections for further information.
7. It is noted that no analyses reported herein were subcontracted to another laboratory, unless noted in the report.
8. This report reflects results that relate only to the samples submitted on the attached chain-of-custody form(s) received by York.

Approved By:

Date: 05/16/2016

Benjamin Gulizia
Laboratory Director

Sample Information

Client Sample ID: **1252160504-01**

York Sample ID: **16E0136-01**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 8:25 am	05/04/2016

Volatile Organics, CT RCP List

Sample Prepared by Method: EPA 5035A

Log-in Notes:

Sample Notes:

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
630-20-6	1,1,1,2-Tetrachloroethane	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
71-55-6	1,1,1-Trichloroethane	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
79-34-5	1,1,2,2-Tetrachloroethane	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
79-00-5	1,1,2-Trichloroethane	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
75-34-3	1,1-Dichloroethane	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
75-35-4	1,1-Dichloroethylene	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
563-58-6	1,1-Dichloropropylene	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
87-61-6	1,2,3-Trichlorobenzene	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
96-18-4	1,2,3-Trichloropropane	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
120-82-1	1,2,4-Trichlorobenzene	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
95-63-6	1,2,4-Trimethylbenzene	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
96-12-8	1,2-Dibromo-3-chloropropane	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
106-93-4	1,2-Dibromoethane	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
95-50-1	1,2-Dichlorobenzene	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
107-06-2	1,2-Dichloroethane	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
78-87-5	1,2-Dichloropropane	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
108-67-8	1,3,5-Trimethylbenzene	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
541-73-1	1,3-Dichlorobenzene	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
142-28-9	1,3-Dichloropropane	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
106-46-7	1,4-Dichlorobenzene	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
594-20-7	2,2-Dichloropropane	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
78-93-3	2-Butanone	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
95-49-8	2-Chlorotoluene	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
591-78-6	2-Hexanone	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
106-43-4	4-Chlorotoluene	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
108-10-1	4-Methyl-2-pentanone	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
67-64-1	Acetone	ND	SCAL-E	ug/kg dry	9.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
107-13-1	Acrylonitrile	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
71-43-2	Benzene	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
108-86-1	Bromobenzene	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
74-97-5	Bromochloromethane	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
75-27-4	Bromodichloromethane	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
75-25-2	Bromoform	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
74-83-9	Bromomethane	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
75-15-0	Carbon disulfide	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
56-23-5	Carbon tetrachloride	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
108-90-7	Chlorobenzene	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
75-00-3	Chloroethane	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
67-66-3	Chloroform	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
74-87-3	Chloromethane	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK

Sample Information

Client Sample ID: **1252160504-01** **York Sample ID:** **16E0136-01**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 8:25 am	05/04/2016

Volatile Organics, CT RCP List

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
156-59-2	cis-1,2-Dichloroethylene	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
10061-01-5	cis-1,3-Dichloropropylene	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
124-48-1	Dibromochloromethane	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
74-95-3	Dibromomethane	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
75-71-8	Dichlorodifluoromethane	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
100-41-4	Ethyl Benzene	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
87-68-3	Hexachlorobutadiene	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
98-82-8	Isopropylbenzene	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
80-62-6	Methyl Methacrylate	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
1634-04-4	Methyl tert-butyl ether (MTBE)	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
75-09-2	Methylene chloride	ND		ug/kg dry	9.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
91-20-3	Naphthalene	ND		ug/kg dry	9.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
104-51-8	n-Butylbenzene	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
103-65-1	n-Propylbenzene	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
95-47-6	o-Xylene	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
179601-23-1	p- & m- Xylenes	ND		ug/kg dry	9.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
99-87-6	p-Isopropyltoluene	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
135-98-8	sec-Butylbenzene	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
100-42-5	Styrene	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
98-06-6	tert-Butylbenzene	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
127-18-4	Tetrachloroethylene	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
109-99-9	Tetrahydrofuran	ND		ug/kg dry	9.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
108-88-3	Toluene	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
156-60-5	trans-1,2-Dichloroethylene	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
10061-02-6	trans-1,3-Dichloropropylene	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
110-57-6	trans-1,4-dichloro-2-butene	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
79-01-6	Trichloroethylene	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
75-69-4	Trichlorofluoromethane	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK
75-01-4	Vinyl Chloride	ND		ug/kg dry	4.9	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:12	BK

	Surrogate Recoveries	Result	Acceptance Range
17060-07-0	*Surrogate: 1,2-Dichloroethane-d4*	*92.6 %*	*70-130*
2037-26-5	*Surrogate: Toluene-d8*	*98.2 %*	*70-130*
460-00-4	*Surrogate: p-Bromofluorobenzene*	*100 %*	*70-130*

Volatile Organics, TCLP RCRA List

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 5030B/1311

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
75-35-4	1,1-Dichloroethylene	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 00:45	BK
107-06-2	1,2-Dichloroethane	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 00:45	BK
106-46-7	1,4-Dichlorobenzene	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 00:45	BK
78-93-3	2-Butanone	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 00:45	BK
71-43-2	Benzene	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 00:45	BK

Sample Information

Client Sample ID: **1252160504-01** **York Sample ID:** **16E0136-01**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 8:25 am	05/04/2016

Volatile Organics, TCLP RCRA List

Sample Prepared by Method: EPA 5030B/1311

Log-in Notes: **Sample Notes:**

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
56-23-5	Carbon tetrachloride	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 00:45	BK
108-90-7	Chlorobenzene	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 00:45	BK
67-66-3	Chloroform	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 00:45	BK
127-18-4	Tetrachloroethylene	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 00:45	BK
79-01-6	Trichloroethylene	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 00:45	BK
75-01-4	Vinyl Chloride	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 00:45	BK

	Surrogate Recoveries	Result	Acceptance Range
17060-07-0	*Surrogate: 1,2-Dichloroethane-d4*	*97.4 %*	*65-135*
460-00-4	*Surrogate: p-Bromofluorobenzene*	*96.7 %*	*81-114*
2037-26-5	*Surrogate: Toluene-d8*	*97.3 %*	*86-118*

Semi-Volatiles, CT RCP BNA List

Sample Prepared by Method: EPA 3546 SVOA

Log-in Notes: **Sample Notes:**

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
95-94-3	1,2,4,5-Tetrachlorobenzene	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
120-82-1	1,2,4-Trichlorobenzene	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
90-12-0	1-Methylnaphthalene	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
95-95-4	2,4,5-Trichlorophenol	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
88-06-2	2,4,6-Trichlorophenol	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
120-83-2	2,4-Dichlorophenol	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
105-67-9	2,4-Dimethylphenol	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
51-28-5	2,4-Dinitrophenol	ND		ug/kg dry	1250	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
121-14-2	2,4-Dinitrotoluene	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
606-20-2	2,6-Dinitrotoluene	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
91-58-7	2-Chloronaphthalene	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
95-57-8	2-Chlorophenol	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
91-57-6	2-Methylnaphthalene	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
95-48-7	2-Methylphenol	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
88-74-4	2-Nitroaniline	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
88-75-5	2-Nitrophenol	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
65794-96-9	3- & 4-Methylphenols	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
91-94-1	3,3'-Dichlorobenzidine	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
99-09-2	3-Nitroaniline	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
534-52-1	4,6-Dinitro-2-methylphenol	ND		ug/kg dry	1250	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
101-55-3	4-Bromophenyl phenyl ether	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
59-50-7	4-Chloro-3-methylphenol	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
106-47-8	4-Chloroaniline	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
7005-72-3	4-Chlorophenyl phenyl ether	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
100-01-6	4-Nitroaniline	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
100-02-7	4-Nitrophenol	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
83-32-9	Acenaphthene	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
208-96-8	Acenaphthylene	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR

Sample Information

Client Sample ID: **1252160504-01** **York Sample ID:** **16E0136-01**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 8:25 am	05/04/2016

Semi-Volatiles, CT RCP BNA List **Log-in Notes:** **Sample Notes:**

Sample Prepared by Method: EPA 3546 SVOA

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
62-53-3	Aniline	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
120-12-7	Anthracene	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
56-55-3	Benzo(a)anthracene	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
50-32-8	Benzo(a)pyrene	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
205-99-2	Benzo(b)fluoranthene	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
191-24-2	Benzo(g,h,i)perylene	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
207-08-9	Benzo(k)fluoranthene	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
85-68-7	Benzyl butyl phthalate	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
111-91-1	Bis(2-chloroethoxy)methane	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
111-44-4	Bis(2-chloroethyl)ether	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
108-60-1	Bis(2-chloroisopropyl)ether	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
117-81-7	**Bis(2-ethylhexyl)phthalate**	**625**	CCV-E	ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
86-74-8	Carbazole	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
218-01-9	Chrysene	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
53-70-3	Dibenzo(a,h)anthracene	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
132-64-9	Dibenzofuran	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
84-66-2	Diethyl phthalate	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
131-11-3	Dimethyl phthalate	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
84-74-2	Di-n-butyl phthalate	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
117-84-0	Di-n-octyl phthalate	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
206-44-0	**Fluoranthene**	**1290**		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
86-73-7	Fluorene	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
118-74-1	Hexachlorobenzene	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
87-68-3	Hexachlorobutadiene	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
77-47-4	Hexachlorocyclopentadiene	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
67-72-1	Hexachloroethane	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
193-39-5	Indeno(1,2,3-cd)pyrene	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
78-59-1	Isophorone	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
91-20-3	Naphthalene	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
98-95-3	Nitrobenzene	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
621-64-7	N-nitroso-di-n-propylamine	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
86-30-6	N-Nitrosodiphenylamine	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
82-68-8	Pentachloronitrobenzene	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
87-86-5	Pentachlorophenol	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
85-01-8	Phenanthrene	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
108-95-2	Phenol	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
129-00-0	**Pyrene**	**1060**		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR
110-86-1	Pyridine	ND		ug/kg dry	624	2	EPA 8270D	05/09/2016 14:01	05/10/2016 11:34	SR

	Surrogate Recoveries	Result	Acceptance Range
367-12-4	*Surrogate: 2-Fluorophenol*	*40.3 %*	*30-130*
4165-62-2	*Surrogate: Phenol-d5*	*50.7 %*	*30-130*
4165-60-0	*Surrogate: Nitrobenzene-d5*	*50.0 %*	*30-130*

Sample Information

Client Sample ID: **1252160504-01** **York Sample ID:** **16E0136-01**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 8:25 am	05/04/2016

Semi-Volatiles, CT RCP BNA List

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 3546 SVOA

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
321-60-8	*Surrogate: 2-Fluorobiphenyl*	*46.5 %*			*30-130*					
118-79-6	*Surrogate: 2,4,6-Tribromophenol*	*87.6 %*			*30-130*					
1718-51-0	*Surrogate: Terphenyl-d14*	*56.0 %*			*30-130*					

Semi-Volatiles, TCLP RCRA Target List

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 3510C/1311

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
106-46-7	1,4-Dichlorobenzene	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 16:51	KH
95-95-4	2,4,5-Trichlorophenol	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 16:51	KH
88-06-2	2,4,6-Trichlorophenol	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 16:51	KH
121-14-2	2,4-Dinitrotoluene	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 16:51	KH
95-48-7	2-Methylphenol	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 16:51	KH
65794-96-9	3- & 4-Methylphenols	ND		ug/L	20.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 16:51	KH
1319-77-3	Cresols, total	ND		ug/L	30.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 16:51	KH
118-74-1	Hexachlorobenzene	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 16:51	KH
87-68-3	Hexachlorobutadiene	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 16:51	KH
67-72-1	Hexachloroethane	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 16:51	KH
98-95-3	Nitrobenzene	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 16:51	KH
87-86-5	Pentachlorophenol	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 16:51	KH
110-86-1	Pyridine	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 16:51	KH

	Surrogate Recoveries	Result	Acceptance Range
367-12-4	*Surrogate: 2-Fluorophenol*	*33.0 %*	*10-65*
4165-62-2	*Surrogate: Phenol-d5*	*25.5 %*	*10-49*
4165-60-0	*Surrogate: Nitrobenzene-d5*	*67.8 %*	*10-96*
321-60-8	*Surrogate: 2-Fluorobiphenyl*	*61.0 %*	*10-93*
118-79-6	*Surrogate: 2,4,6-Tribromophenol*	*77.7 %*	*10-128*
1718-51-0	*Surrogate: Terphenyl-d14*	*47.3 %*	*10-100*

Pesticides, CT RCP Target List

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 3545A

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
72-54-8	4,4'-DDD	ND		ug/kg dry	3.12	5	EPA 8081B	05/06/2016 14:02	05/10/2016 11:47	AMC
72-55-9	4,4'-DDE	ND		ug/kg dry	3.12	5	EPA 8081B	05/06/2016 14:02	05/10/2016 11:47	AMC
50-29-3	4,4'-DDT	ND		ug/kg dry	3.12	5	EPA 8081B	05/06/2016 14:02	05/10/2016 11:47	AMC
15972-60-8	Alachlor	ND		ug/kg dry	3.12	5	EPA 8081B	05/06/2016 14:02	05/10/2016 11:47	AMC
309-00-2	Aldrin	ND		ug/kg dry	3.12	5	EPA 8081B	05/06/2016 14:02	05/10/2016 11:47	AMC
319-84-6	alpha-BHC	ND		ug/kg dry	3.12	5	EPA 8081B	05/06/2016 14:02	05/10/2016 11:47	AMC
319-85-7	beta-BHC	ND		ug/kg dry	3.12	5	EPA 8081B	05/06/2016 14:02	05/10/2016 11:47	AMC
57-74-9	Chlordane, total	ND		ug/kg dry	12.4	5	EPA 8081B	05/06/2016 14:02	05/10/2016 11:47	AMC
319-86-8	delta-BHC	ND		ug/kg dry	3.12	5	EPA 8081B	05/06/2016 14:02	05/10/2016 11:47	AMC
60-57-1	Dieldrin	ND		ug/kg dry	3.12	5	EPA 8081B	05/06/2016 14:02	05/10/2016 11:47	AMC
959-98-8	Endosulfan I	ND		ug/kg dry	3.12	5	EPA 8081B	05/06/2016 14:02	05/10/2016 11:47	AMC

Sample Information

Client Sample ID: **1252160504-01** **York Sample ID:** **16E0136-01**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 8:25 am	05/04/2016

Pesticides, CT RCP Target List

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 3545A

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
33213-65-9	Endosulfan II	ND		ug/kg dry	3.12	5	EPA 8081B	05/06/2016 14:02	05/10/2016 11:47	AMC
1031-07-8	Endosulfan sulfate	ND		ug/kg dry	3.12	5	EPA 8081B	05/06/2016 14:02	05/10/2016 11:47	AMC
72-20-8	Endrin	ND		ug/kg dry	3.12	5	EPA 8081B	05/06/2016 14:02	05/10/2016 11:47	AMC
7421-93-4	Endrin aldehyde	ND		ug/kg dry	3.12	5	EPA 8081B	05/06/2016 14:02	05/10/2016 11:47	AMC
53494-70-5	Endrin ketone	ND		ug/kg dry	3.12	5	EPA 8081B	05/06/2016 14:02	05/10/2016 11:47	AMC
58-89-9	gamma-BHC (Lindane)	ND		ug/kg dry	3.12	5	EPA 8081B	05/06/2016 14:02	05/10/2016 11:47	AMC
76-44-8	Heptachlor	ND		ug/kg dry	3.12	5	EPA 8081B	05/06/2016 14:02	05/10/2016 11:47	AMC
1024-57-3	Heptachlor epoxide	ND		ug/kg dry	3.12	5	EPA 8081B	05/06/2016 14:02	05/10/2016 11:47	AMC
72-43-5	Methoxychlor	ND		ug/kg dry	3.12	5	EPA 8081B	05/06/2016 14:02	05/10/2016 11:47	AMC
8001-35-2	Toxaphene	ND		ug/kg dry	156	5	EPA 8081B	05/06/2016 14:02	05/10/2016 11:47	AMC

	Surrogate Recoveries	Result	Acceptance Range
2051-24-3	*Surrogate: Decachlorobiphenyl*	*45.1 %*	*30-140*
877-09-8	*Surrogate: Tetrachloro-m-xylene*	*31.9 %*	*30-140*

Pesticides, TCLP RCRA List

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 3510C/1311

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
57-74-9	Chlordane, total	ND		ug/L	0.444	1	EPA 8081B/1311	05/06/2016 14:41	05/09/2016 21:13	AMC
72-20-8	Endrin	ND		ug/L	0.0444	1	EPA 8081B/1311	05/06/2016 14:41	05/09/2016 21:13	AMC
58-89-9	gamma-BHC (Lindane)	ND		ug/L	0.0444	1	EPA 8081B/1311	05/06/2016 14:41	05/09/2016 21:13	AMC
76-44-8	Heptachlor	ND		ug/L	0.0444	1	EPA 8081B/1311	05/06/2016 14:41	05/09/2016 21:13	AMC
1024-57-3	Heptachlor epoxide	ND		ug/L	0.0444	1	EPA 8081B/1311	05/06/2016 14:41	05/09/2016 21:13	AMC
72-43-5	Methoxychlor	ND		ug/L	0.0444	1	EPA 8081B/1311	05/06/2016 14:41	05/09/2016 21:13	AMC
8001-35-2	Toxaphene	ND		ug/L	1.11	1	EPA 8081B/1311	05/06/2016 14:41	05/09/2016 21:13	AMC

	Surrogate Recoveries	Result	Acceptance Range
877-09-8	*Surrogate: Tetrachloro-m-xylene*	*93.3 %*	*30-120*
2051-24-3	*Surrogate: Decachlorobiphenyl*	*106 %*	*30-120*

Polychlorinated Biphenyls (Soxhlet Extraction)

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA SW846-3540C

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
12674-11-2	Aroclor 1016	ND		mg/kg dry	0.0312	1	EPA 8082A	05/10/2016 07:16	05/11/2016 12:37	AMC
11104-28-2	Aroclor 1221	ND		mg/kg dry	0.0312	1	EPA 8082A	05/10/2016 07:16	05/11/2016 12:37	AMC
11141-16-5	Aroclor 1232	ND		mg/kg dry	0.0312	1	EPA 8082A	05/10/2016 07:16	05/11/2016 12:37	AMC
53469-21-9	Aroclor 1242	ND		mg/kg dry	0.0312	1	EPA 8082A	05/10/2016 07:16	05/11/2016 12:37	AMC
12672-29-6	Aroclor 1248	ND		mg/kg dry	0.0312	1	EPA 8082A	05/10/2016 07:16	05/11/2016 12:37	AMC
11097-69-1	Aroclor 1254	ND		mg/kg dry	0.0312	1	EPA 8082A	05/10/2016 07:16	05/11/2016 12:37	AMC
11096-82-5	Aroclor 1260	ND		mg/kg dry	0.0312	1	EPA 8082A	05/10/2016 07:16	05/11/2016 12:37	AMC
37324-23-5	Aroclor 1262	ND		mg/kg dry	0.0312	1	EPA 8082A	05/10/2016 07:16	05/11/2016 12:37	AMC
11100-14-4	Aroclor 1268	ND		mg/kg dry	0.0312	1	EPA 8082A	05/10/2016 07:16	05/11/2016 12:37	AMC
1336-36-3	Total PCBs	ND		mg/kg dry	0.0312	1	EPA 8082A	05/10/2016 07:16	05/11/2016 12:37	AMC

Sample Information

Client Sample ID: 1252160504-01 **York Sample ID:** 16E0136-01

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 8:25 am	05/04/2016

Polychlorinated Biphenyls (Soxhlet Extraction)

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA SW846-3540C

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst

	Surrogate Recoveries	Result	Acceptance Range
877-09-8	*Surrogate: Tetrachloro-m-xylene*	*72.0 %*	*30-140*
2051-24-3	*Surrogate: Decachlorobiphenyl*	*62.5 %*	*30-140*

Herbicides, CT RCP

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 3550B/8151A

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
93-76-5	2,4,5-T	ND		ug/kg dry	25.0	1	EPA 8151A	05/09/2016 07:53	05/10/2016 13:24	AMC
93-72-1	2,4,5-TP (Silvex)	ND		ug/kg dry	25.0	1	EPA 8151A	05/09/2016 07:53	05/10/2016 13:24	AMC
94-75-7	2,4-D	ND		ug/kg dry	25.0	1	EPA 8151A	05/09/2016 07:53	05/10/2016 13:24	AMC
75-99-0	Dalapon	ND		ug/kg dry	25.0	1	EPA 8151A	05/09/2016 07:53	05/10/2016 13:24	AMC
1918-00-9	Dicamba	ND		ug/kg dry	25.0	1	EPA 8151A	05/09/2016 07:53	05/10/2016 13:24	AMC

	Surrogate Recoveries	Result	Acceptance Range
19719-28-9	*Surrogate: 2,4-Dichlorophenylacetic acia*	*67.6 %*	*30-150*

Herbicides, TCLP Target List

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 3535A/1311

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
93-72-1	2,4,5-TP (Silvex)	ND		ug/L	5.00	1	EPA 8151A/1311	05/09/2016 07:50	05/09/2016 14:47	AMC
94-75-7	2,4-D	ND		ug/L	5.00	1	EPA 8151A/1311	05/09/2016 07:50	05/09/2016 14:47	AMC

	Surrogate Recoveries	Result	Acceptance Range
19719-28-9	*Surrogate: 2,4-Dichlorophenylacetic acia*	*84.6 %*	*30-150*

Extractable Total Petroleum Hydrocarbons (ETPH)

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 3545A

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
CT ETPH	**ETPH (Extractable Total Petroleum Hydrocarbons)**	**338**		mg/kg dry	12.5	1	CT DEP ETPH	05/06/2016 07:12	05/07/2016 02:53	AMC

	Surrogate Recoveries	Result	Acceptance Range
3386-33-2	*Surrogate: 1-Chlorooctadecane*	*87.5 %*	*50-150*

Metals, RCRA

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 3050B

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
7440-38-2	**Arsenic**	**1.37**		mg/kg dry	1.25	1	EPA 6010C	05/05/2016 10:13	05/06/2016 04:56	KV
7440-39-3	**Barium**	**16.6**		mg/kg dry	1.25	1	EPA 6010C	05/05/2016 10:13	05/06/2016 04:56	KV
7440-43-9	Cadmium	ND		mg/kg dry	0.374	1	EPA 6010C	05/05/2016 10:13	05/06/2016 04:56	KV
7440-47-3	**Chromium**	**8.99**		mg/kg dry	0.624	1	EPA 6010C	05/05/2016 10:13	05/06/2016 04:56	KV
7439-92-1	**Lead**	**29.5**		mg/kg dry	0.374	1	EPA 6010C	05/05/2016 10:13	05/06/2016 04:56	KV
7782-49-2	Selenium	ND		mg/kg dry	1.25	1	EPA 6010C	05/05/2016 10:13	05/06/2016 04:56	KV

Sample Information

Client Sample ID: **1252160504-01**

York Sample ID: **16E0136-01**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 8:25 am	05/04/2016

Metals, RCRA

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3050B

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
7440-22-4	Silver	ND		mg/kg dry	0.624	1	EPA 6010C	05/05/2016 10:13	05/06/2016 04:56	KV

Metals, TCLP RCRA

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3015A/1311

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
7440-38-2	Arsenic	ND		mg/L	0.004	1	EPA 6010C/1311	05/09/2016 11:24	05/10/2016 03:49	KV
7440-39-3	**Barium**	**1.29**		mg/L	0.011	1	EPA 6010C/1311	05/09/2016 11:24	05/10/2016 03:49	KV
7440-43-9	**Cadmium**	**0.005**		mg/L	0.003	1	EPA 6010C/1311	05/09/2016 11:24	05/10/2016 03:49	KV
7440-47-3	**Chromium**	**0.007**		mg/L	0.006	1	EPA 6010C/1311	05/09/2016 11:24	05/10/2016 03:49	KV
7439-92-1	**Lead**	**0.540**		mg/L	0.003	1	EPA 6010C/1311	05/09/2016 11:24	05/10/2016 03:49	KV
7782-49-2	**Selenium**	**0.014**	M-SeTC	mg/L	0.011	1	EPA 6010C/1311	05/09/2016 11:24	05/10/2016 03:49	KV
7440-22-4	Silver	ND		mg/L	0.006	1	EPA 6010C/1311	05/09/2016 11:24	05/10/2016 03:49	KV

Mercury by 7473

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 7473 soil

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
7439-97-6	**Mercury**	**0.0689**		mg/kg dry	0.0374	1	EPA 7473	05/05/2016 06:04	05/05/2016 17:08	ALD

Mercury TCLP by 7473

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 7473 water

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
7439-97-6	Mercury	ND		mg/L	0.000200	1	EPA 7473/1311	05/06/2016 12:06	05/09/2016 12:26	ALD

Ignitability

Log-in Notes:

Sample Notes:

Sample Prepared by Method: Analysis Preparation

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	Ignitability	Non-Ignit.		-	1	1	EPA 1030P	05/10/2016 01:11	05/10/2016 01:56	AA

Paint Filter Test

Log-in Notes:

Sample Notes:

Sample Prepared by Method: Analysis Preparation

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	Paint Filter Test	No Free Liquid		-	0	1	EPA 9095A	05/10/2016 18:43	05/11/2016 02:31	AA

Total Solids

Log-in Notes:

Sample Notes:

Sample Prepared by Method: % Solids Prep

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
solids	**% Solids**	**80.1**		%	0.100	1	SM 2540G	05/09/2016 11:51	05/10/2016 13:22	TJM

Cyanide, Total

Log-in Notes:

Sample Notes:

Sample Information

Client Sample ID: 1252160504-01 **York Sample ID:** 16E0136-01

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 8:25 am	05/04/2016

Sample Prepared by Method: Analysis Preparation Soil

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
57-12-5	Cyanide, total	ND		mg/kg dry	0.624	1	EPA 9014/9010C	05/10/2016 08:32	05/10/2016 14:43	LAB

pH

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: Analysis Preparation

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	pH	**7.40**		pH units	0.500	1	EPA 9045D	05/10/2016 13:49	05/10/2016 13:49	TJM

Reactivity-Cyanide

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: Analysis Preparation

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	Reactivity - Cyanide	ND		mg/kg	0.250	1	EPA SW-846 Ch.7.3.3	05/11/2016 10:09	05/11/2016 10:11	AD

Reactivity-Sulfide

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: Analysis Preparation

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	Reactivity - Sulfide	ND		mg/kg	15.0	1	EPA SW-846 Ch.7.3.4	05/11/2016 10:10	05/11/2016 10:11	AD

TCLP Extraction for METALS EPA 1311

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA SW 846-1311 TCLP ext. for metals

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	TCLP Extraction	Completed		N/A	1.00	1	EPA 1311	05/04/2016 20:45	05/05/2016 15:26	TJM

TCLP Extraction for SVOCS/PEST/HERB

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA SW 846-1311 TCLP extr. for SVOA/PEST/HERBS

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	TCLP Extraction	Completed		N/A	1.00	1	EPA 1311	05/04/2016 20:47	05/05/2016 15:26	TJM

TCLP Extraction for VOA by EPA 1311 ZHE

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA SW 846-1311 TCLP ZHE for VOA

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	TCLP Extraction	Completed		%	1.00	1	EPA 1311	05/04/2016 20:48	05/05/2016 15:26	TJM

Sample Information

Client Sample ID: 1252160504-02 **York Sample ID:** 16E0136-02

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 10:20 am	05/04/2016

Volatile Organics, CT RCP List

Log-in Notes: **Sample Notes:**

Sample Information

Client Sample ID: **1252160504-02**

York Sample ID: **16E0136-02**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 10:20 am	05/04/2016

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
630-20-6	1,1,1,2-Tetrachloroethane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
71-55-6	1,1,1-Trichloroethane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
79-34-5	1,1,2,2-Tetrachloroethane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
79-00-5	1,1,2-Trichloroethane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
75-34-3	1,1-Dichloroethane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
75-35-4	1,1-Dichloroethylene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
563-58-6	1,1-Dichloropropylene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
87-61-6	1,2,3-Trichlorobenzene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
96-18-4	1,2,3-Trichloropropane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
120-82-1	1,2,4-Trichlorobenzene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
95-63-6	1,2,4-Trimethylbenzene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
96-12-8	1,2-Dibromo-3-chloropropane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
106-93-4	1,2-Dibromoethane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
95-50-1	1,2-Dichlorobenzene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
107-06-2	1,2-Dichloroethane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
78-87-5	1,2-Dichloropropane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
108-67-8	1,3,5-Trimethylbenzene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
541-73-1	1,3-Dichlorobenzene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
142-28-9	1,3-Dichloropropane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
106-46-7	1,4-Dichlorobenzene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
594-20-7	2,2-Dichloropropane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
78-93-3	2-Butanone	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
95-49-8	2-Chlorotoluene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
591-78-6	2-Hexanone	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
106-43-4	4-Chlorotoluene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
108-10-1	4-Methyl-2-pentanone	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
67-64-1	Acetone	ND	SCAL-E	ug/kg dry	9.4	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
107-13-1	Acrylonitrile	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
71-43-2	Benzene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
108-86-1	Bromobenzene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
74-97-5	Bromochloromethane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
75-27-4	Bromodichloromethane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
75-25-2	Bromoform	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
74-83-9	Bromomethane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
75-15-0	Carbon disulfide	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
56-23-5	Carbon tetrachloride	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
108-90-7	Chlorobenzene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
75-00-3	Chloroethane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
67-66-3	Chloroform	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
74-87-3	Chloromethane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
156-59-2	cis-1,2-Dichloroethylene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
10061-01-5	cis-1,3-Dichloropropylene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
124-48-1	Dibromochloromethane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK

Sample Information

Client Sample ID: 1252160504-02 **York Sample ID:** 16E0136-02

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 10:20 am	05/04/2016

Volatile Organics, CT RCP List

Sample Prepared by Method: EPA 5035A

Log-in Notes: **Sample Notes:**

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
74-95-3	Dibromomethane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
75-71-8	Dichlorodifluoromethane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
100-41-4	Ethyl Benzene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
87-68-3	Hexachlorobutadiene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
98-82-8	Isopropylbenzene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
80-62-6	Methyl Methacrylate	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
1634-04-4	Methyl tert-butyl ether (MTBE)	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
75-09-2	Methylene chloride	ND		ug/kg dry	9.4	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
91-20-3	Naphthalene	ND		ug/kg dry	9.4	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
104-51-8	n-Butylbenzene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
103-65-1	n-Propylbenzene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
95-47-6	o-Xylene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
179601-23-1	p- & m- Xylenes	ND		ug/kg dry	9.4	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
99-87-6	p-Isopropyltoluene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
135-98-8	sec-Butylbenzene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
100-42-5	Styrene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
98-06-6	tert-Butylbenzene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
127-18-4	Tetrachloroethylene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
109-99-9	Tetrahydrofuran	ND		ug/kg dry	9.4	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
108-88-3	Toluene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
156-60-5	trans-1,2-Dichloroethylene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
10061-02-6	trans-1,3-Dichloropropylene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
110-57-6	trans-1,4-dichloro-2-butene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
79-01-6	Trichloroethylene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
75-69-4	Trichlorofluoromethane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK
75-01-4	Vinyl Chloride	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 12:42	BK

	Surrogate Recoveries	Result	Acceptance Range
17060-07-0	*Surrogate: 1,2-Dichloroethane-d4*	*90.5 %*	*70-130*
2037-26-5	*Surrogate: Toluene-d8*	*99.5 %*	*70-130*
460-00-4	*Surrogate: p-Bromofluorobenzene*	*98.0 %*	*70-130*

Volatile Organics, TCLP RCRA List

Sample Prepared by Method: EPA 5030B/1311

Log-in Notes: **Sample Notes:**

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
75-35-4	1,1-Dichloroethylene	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 01:26	BK
107-06-2	1,2-Dichloroethane	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 01:26	BK
106-46-7	1,4-Dichlorobenzene	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 01:26	BK
78-93-3	2-Butanone	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 01:26	BK
71-43-2	Benzene	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 01:26	BK
56-23-5	Carbon tetrachloride	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 01:26	BK
108-90-7	Chlorobenzene	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 01:26	BK
67-66-3	Chloroform	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 01:26	BK

Sample Information

Client Sample ID: **1252160504-02** **York Sample ID:** **16E0136-02**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 10:20 am	05/04/2016

Volatile Organics, TCLP RCRA List

Sample Prepared by Method: EPA 5030B/1311

Log-in Notes: **Sample Notes:**

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
127-18-4	Tetrachloroethylene	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 01:26	BK
79-01-6	Trichloroethylene	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 01:26	BK
75-01-4	Vinyl Chloride	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 01:26	BK
	Surrogate Recoveries	**Result**			**Acceptance Range**					
17060-07-0	*Surrogate: 1,2-Dichloroethane-d4*	*94.9 %*			*65-135*					
460-00-4	*Surrogate: p-Bromofluorobenzene*	*96.6 %*			*81-114*					
2037-26-5	*Surrogate: Toluene-d8*	*97.7 %*			*86-118*					

Semi-Volatiles, CT RCP BNA List

Sample Prepared by Method: EPA 3546 SVOA

Log-in Notes: **Sample Notes:**

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
95-94-3	1,2,4,5-Tetrachlorobenzene	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
120-82-1	1,2,4-Trichlorobenzene	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
90-12-0	1-Methylnaphthalene	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
95-95-4	2,4,5-Trichlorophenol	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
88-06-2	2,4,6-Trichlorophenol	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
120-83-2	2,4-Dichlorophenol	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
105-67-9	2,4-Dimethylphenol	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
51-28-5	2,4-Dinitrophenol	ND		ug/kg dry	1250	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
121-14-2	2,4-Dinitrotoluene	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
606-20-2	2,6-Dinitrotoluene	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
91-58-7	2-Chloronaphthalene	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
95-57-8	2-Chlorophenol	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
91-57-6	2-Methylnaphthalene	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
95-48-7	2-Methylphenol	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
88-74-4	2-Nitroaniline	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
88-75-5	2-Nitrophenol	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
65794-96-9	3- & 4-Methylphenols	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
91-94-1	3,3'-Dichlorobenzidine	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
99-09-2	3-Nitroaniline	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
534-52-1	4,6-Dinitro-2-methylphenol	ND		ug/kg dry	1250	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
101-55-3	4-Bromophenyl phenyl ether	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
59-50-7	4-Chloro-3-methylphenol	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
106-47-8	4-Chloroaniline	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
7005-72-3	4-Chlorophenyl phenyl ether	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
100-01-6	4-Nitroaniline	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
100-02-7	4-Nitrophenol	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
83-32-9	Acenaphthene	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
208-96-8	Acenaphthylene	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
62-53-3	Aniline	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
120-12-7	**Anthracene**	**784**		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
56-55-3	**Benzo(a)anthracene**	**4730**		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR

Sample Information

Client Sample ID: **1252160504-02** **York Sample ID:** **16E0136-02**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 10:20 am	05/04/2016

Semi-Volatiles, CT RCP BNA List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546 SVOA

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
50-32-8	**Benzo(a)pyrene**	**2820**		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
205-99-2	**Benzo(b)fluoranthene**	**4170**		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
191-24-2	**Benzo(g,h,i)perylene**	**912**		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
207-08-9	**Benzo(k)fluoranthene**	**2010**		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
85-68-7	Benzyl butyl phthalate	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
111-91-1	Bis(2-chloroethoxy)methane	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
111-44-4	Bis(2-chloroethyl)ether	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
108-60-1	Bis(2-chloroisopropyl)ether	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
117-81-7	**Bis(2-ethylhexyl)phthalate**	**796**	CCV-E	ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
86-74-8	**Carbazole**	**3800**	CCV-E	ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
218-01-9	**Chrysene**	**4220**		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
53-70-3	Dibenzo(a,h)anthracene	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
132-64-9	Dibenzofuran	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
84-66-2	Diethyl phthalate	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
131-11-3	Dimethyl phthalate	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
84-74-2	Di-n-butyl phthalate	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
117-84-0	Di-n-octyl phthalate	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
206-44-0	**Fluoranthene**	**11100**		ug/kg dry	1570	5	EPA 8270D	05/09/2016 14:01	05/11/2016 00:37	SR
86-73-7	Fluorene	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
118-74-1	Hexachlorobenzene	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
87-68-3	Hexachlorobutadiene	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
77-47-4	Hexachlorocyclopentadiene	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
67-72-1	Hexachloroethane	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
193-39-5	**Indeno(1,2,3-cd)pyrene**	**1000**		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
78-59-1	Isophorone	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
91-20-3	Naphthalene	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
98-95-3	Nitrobenzene	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
621-64-7	N-nitroso-di-n-propylamine	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
86-30-6	N-Nitrosodiphenylamine	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
82-68-8	Pentachloronitrobenzene	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
87-86-5	Pentachlorophenol	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
85-01-8	**Phenanthrene**	**6400**		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
108-95-2	Phenol	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
129-00-0	**Pyrene**	**10000**		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR
110-86-1	Pyridine	ND		ug/kg dry	626	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:05	SR

	Surrogate Recoveries	Result	Acceptance Range
367-12-4	*Surrogate: 2-Fluorophenol*	*54.4 %*	*30-130*
4165-62-2	*Surrogate: Phenol-d5*	*60.6 %*	*30-130*
4165-60-0	*Surrogate: Nitrobenzene-d5*	*62.1 %*	*30-130*
321-60-8	*Surrogate: 2-Fluorobiphenyl*	*48.8 %*	*30-130*
118-79-6	*Surrogate: 2,4,6-Tribromophenol*	*97.7 %*	*30-130*
1718-51-0	*Surrogate: Terphenyl-d14*	*59.8 %*	*30-130*

Sample Information

Client Sample ID: **1252160504-02**

York Sample ID: **16E0136-02**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 10:20 am	05/04/2016

Semi-Volatiles, TCLP RCRA Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3510C/1311

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
106-46-7	1,4-Dichlorobenzene	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 17:25	KH
95-95-4	2,4,5-Trichlorophenol	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 17:25	KH
88-06-2	2,4,6-Trichlorophenol	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 17:25	KH
121-14-2	2,4-Dinitrotoluene	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 17:25	KH
95-48-7	2-Methylphenol	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 17:25	KH
65794-96-9	3- & 4-Methylphenols	ND		ug/L	20.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 17:25	KH
1319-77-3	Cresols, total	ND		ug/L	30.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 17:25	KH
118-74-1	Hexachlorobenzene	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 17:25	KH
87-68-3	Hexachlorobutadiene	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 17:25	KH
67-72-1	Hexachloroethane	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 17:25	KH
98-95-3	Nitrobenzene	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 17:25	KH
87-86-5	Pentachlorophenol	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 17:25	KH
110-86-1	Pyridine	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 17:25	KH

	Surrogate Recoveries	Result	Acceptance Range
367-12-4	*Surrogate: 2-Fluorophenol*	*31.9 %*	*10-65*
4165-62-2	*Surrogate: Phenol-d5*	*25.1 %*	*10-49*
4165-60-0	*Surrogate: Nitrobenzene-d5*	*67.0 %*	*10-96*
321-60-8	*Surrogate: 2-Fluorobiphenyl*	*61.2 %*	*10-93*
118-79-6	*Surrogate: 2,4,6-Tribromophenol*	*77.6 %*	*10-128*
1718-51-0	*Surrogate: Terphenyl-d14*	*48.8 %*	*10-100*

Pesticides, CT RCP Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3545A

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
72-54-8	4,4'-DDD	ND		ug/kg dry	3.13	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:02	AMC
72-55-9	4,4'-DDE	ND		ug/kg dry	3.13	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:02	AMC
50-29-3	4,4'-DDT	ND		ug/kg dry	3.13	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:02	AMC
15972-60-8	Alachlor	ND		ug/kg dry	3.13	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:02	AMC
309-00-2	Aldrin	ND		ug/kg dry	3.13	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:02	AMC
319-84-6	alpha-BHC	ND		ug/kg dry	3.13	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:02	AMC
319-85-7	beta-BHC	ND		ug/kg dry	3.13	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:02	AMC
57-74-9	Chlordane, total	ND		ug/kg dry	12.4	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:02	AMC
319-86-8	delta-BHC	ND		ug/kg dry	3.13	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:02	AMC
60-57-1	Dieldrin	ND		ug/kg dry	3.13	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:02	AMC
959-98-8	Endosulfan I	ND		ug/kg dry	3.13	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:02	AMC
33213-65-9	Endosulfan II	ND		ug/kg dry	3.13	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:02	AMC
1031-07-8	Endosulfan sulfate	ND		ug/kg dry	3.13	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:02	AMC
72-20-8	Endrin	ND		ug/kg dry	3.13	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:02	AMC
7421-93-4	Endrin aldehyde	ND		ug/kg dry	3.13	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:02	AMC
53494-70-5	Endrin ketone	ND		ug/kg dry	3.13	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:02	AMC
58-89-9	gamma-BHC (Lindane)	ND		ug/kg dry	3.13	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:02	AMC
76-44-8	Heptachlor	ND		ug/kg dry	3.13	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:02	AMC

Sample Information

Client Sample ID:	**1252160504-02**	**York Sample ID:**	**16E0136-02**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 10:20 am	05/04/2016

Pesticides, CT RCP Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3545A

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
1024-57-3	Heptachlor epoxide	ND		ug/kg dry	3.13	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:02	AMC
72-43-5	Methoxychlor	ND		ug/kg dry	3.13	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:02	AMC
8001-35-2	Toxaphene	ND		ug/kg dry	157	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:02	AMC

	Surrogate Recoveries	Result	Acceptance Range
2051-24-3	*Surrogate: Decachlorobiphenyl*	*40.9 %*	*30-140*
877-09-8	*Surrogate: Tetrachloro-m-xylene*	*36.4 %*	*30-140*

Pesticides, TCLP RCRA List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3510C/1311

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
57-74-9	Chlordane, total	ND		ug/L	0.457	1	EPA 8081B/1311	05/06/2016 14:41	05/09/2016 21:28	AMC
72-20-8	Endrin	ND		ug/L	0.0457	1	EPA 8081B/1311	05/06/2016 14:41	05/09/2016 21:28	AMC
58-89-9	gamma-BHC (Lindane)	ND		ug/L	0.0457	1	EPA 8081B/1311	05/06/2016 14:41	05/09/2016 21:28	AMC
76-44-8	Heptachlor	ND		ug/L	0.0457	1	EPA 8081B/1311	05/06/2016 14:41	05/09/2016 21:28	AMC
1024-57-3	Heptachlor epoxide	ND		ug/L	0.0457	1	EPA 8081B/1311	05/06/2016 14:41	05/09/2016 21:28	AMC
72-43-5	Methoxychlor	ND		ug/L	0.0457	1	EPA 8081B/1311	05/06/2016 14:41	05/09/2016 21:28	AMC
8001-35-2	Toxaphene	ND		ug/L	1.14	1	EPA 8081B/1311	05/06/2016 14:41	05/09/2016 21:28	AMC

	Surrogate Recoveries	Result	Acceptance Range
877-09-8	*Surrogate: Tetrachloro-m-xylene*	*94.0 %*	*30-120*
2051-24-3	*Surrogate: Decachlorobiphenyl*	*83.0 %*	*30-120*

Polychlorinated Biphenyls (Soxhlet Extraction)

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA SW846-3540C

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
12674-11-2	Aroclor 1016	ND		mg/kg dry	0.0313	1	EPA 8082A	05/10/2016 07:16	05/11/2016 12:56	AMC
11104-28-2	Aroclor 1221	ND		mg/kg dry	0.0313	1	EPA 8082A	05/10/2016 07:16	05/11/2016 12:56	AMC
11141-16-5	Aroclor 1232	ND		mg/kg dry	0.0313	1	EPA 8082A	05/10/2016 07:16	05/11/2016 12:56	AMC
53469-21-9	Aroclor 1242	ND		mg/kg dry	0.0313	1	EPA 8082A	05/10/2016 07:16	05/11/2016 12:56	AMC
12672-29-6	Aroclor 1248	ND		mg/kg dry	0.0313	1	EPA 8082A	05/10/2016 07:16	05/11/2016 12:56	AMC
11097-69-1	Aroclor 1254	ND		mg/kg dry	0.0313	1	EPA 8082A	05/10/2016 07:16	05/11/2016 12:56	AMC
11096-82-5	Aroclor 1260	ND		mg/kg dry	0.0313	1	EPA 8082A	05/10/2016 07:16	05/11/2016 12:56	AMC
37324-23-5	Aroclor 1262	ND		mg/kg dry	0.0313	1	EPA 8082A	05/10/2016 07:16	05/11/2016 12:56	AMC
11100-14-4	Aroclor 1268	ND		mg/kg dry	0.0313	1	EPA 8082A	05/10/2016 07:16	05/11/2016 12:56	AMC
1336-36-3	Total PCBs	ND		mg/kg dry	0.0313	1	EPA 8082A	05/10/2016 07:16	05/11/2016 12:56	AMC

	Surrogate Recoveries	Result	Acceptance Range
877-09-8	*Surrogate: Tetrachloro-m-xylene*	*76.0 %*	*30-140*
2051-24-3	*Surrogate: Decachlorobiphenyl*	*72.0 %*	*30-140*

Sample Information

Client Sample ID: **1252160504-02** **York Sample ID:** **16E0136-02**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 10:20 am	05/04/2016

Herbicides, CT RCP

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 3550B/8151A

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
93-76-5	2,4,5-T	ND		ug/kg dry	25.1	1	EPA 8151A	05/09/2016 07:53	05/10/2016 13:37	AMC
93-72-1	2,4,5-TP (Silvex)	ND		ug/kg dry	25.1	1	EPA 8151A	05/09/2016 07:53	05/10/2016 13:37	AMC
94-75-7	2,4-D	ND		ug/kg dry	25.1	1	EPA 8151A	05/09/2016 07:53	05/10/2016 13:37	AMC
75-99-0	Dalapon	ND		ug/kg dry	25.1	1	EPA 8151A	05/09/2016 07:53	05/10/2016 13:37	AMC
1918-00-9	Dicamba	ND		ug/kg dry	25.1	1	EPA 8151A	05/09/2016 07:53	05/10/2016 13:37	AMC

	Surrogate Recoveries	Result	Acceptance Range
19719-28-9	*Surrogate: 2,4-Dichlorophenylacetic acia*	*56.2 %*	*30-150*

Herbicides, TCLP Target List

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 3535A/1311

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
93-72-1	2,4,5-TP (Silvex)	ND		ug/L	5.00	1	EPA 8151A/1311	05/09/2016 07:50	05/09/2016 14:59	AMC
94-75-7	2,4-D	ND		ug/L	5.00	1	EPA 8151A/1311	05/09/2016 07:50	05/09/2016 14:59	AMC

	Surrogate Recoveries	Result	Acceptance Range
19719-28-9	*Surrogate: 2,4-Dichlorophenylacetic acia*	*87.0 %*	*30-150*

Extractable Total Petroleum Hydrocarbons (ETPH)

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 3545A

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
CT ETPH	**ETPH (Extractable Total Petroleum Hydrocarbons)**	**796**		mg/kg dry	12.5	1	CT DEP ETPH	05/06/2016 07:12	05/07/2016 03:25	AMC

	Surrogate Recoveries	Result	Acceptance Range
3386-33-2	*Surrogate: 1-Chlorooctadecane*	*109 %*	*50-150*

Metals, RCRA

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 3050B

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
7440-38-2	Arsenic	ND		mg/kg dry	1.25	1	EPA 6010C	05/05/2016 10:13	05/06/2016 05:26	KV
7440-39-3	**Barium**	**11.1**		mg/kg dry	1.25	1	EPA 6010C	05/05/2016 10:13	05/06/2016 05:26	KV
7440-43-9	Cadmium	ND		mg/kg dry	0.376	1	EPA 6010C	05/05/2016 10:13	05/06/2016 05:26	KV
7440-47-3	**Chromium**	**33.3**		mg/kg dry	0.626	1	EPA 6010C	05/05/2016 10:13	05/06/2016 05:26	KV
7439-92-1	**Lead**	**128**		mg/kg dry	0.376	1	EPA 6010C	05/05/2016 10:13	05/06/2016 05:26	KV
7782-49-2	Selenium	ND		mg/kg dry	1.25	1	EPA 6010C	05/05/2016 10:13	05/06/2016 05:26	KV
7440-22-4	Silver	ND		mg/kg dry	0.626	1	EPA 6010C	05/05/2016 10:13	05/06/2016 05:26	KV

Metals, TCLP RCRA

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 3015A/1311

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
7440-38-2	Arsenic	ND		mg/L	0.004	1	EPA 6010C/1311	05/09/2016 11:24	05/10/2016 04:19	KV
7440-39-3	**Barium**	**1.37**		mg/L	0.011	1	EPA 6010C/1311	05/09/2016 11:24	05/10/2016 04:19	KV
7440-43-9	**Cadmium**	**0.004**		mg/L	0.003	1	EPA 6010C/1311	05/09/2016 11:24	05/10/2016 04:19	KV

Sample Information

Client Sample ID: **1252160504-02** **York Sample ID:** **16E0136-02**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 10:20 am	05/04/2016

Metals, TCLP RCRA

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 3015A/1311

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
7440-47-3	**Chromium**	**0.008**		mg/L	0.006	1	EPA 6010C/1311	05/09/2016 11:24	05/10/2016 04:19	KV
7439-92-1	**Lead**	**0.333**		mg/L	0.003	1	EPA 6010C/1311	05/09/2016 11:24	05/10/2016 04:19	KV
7782-49-2	Selenium	ND	M-SeTC	mg/L	0.011	1	EPA 6010C/1311	05/09/2016 11:24	05/10/2016 04:19	KV
7440-22-4	Silver	ND		mg/L	0.006	1	EPA 6010C/1311	05/09/2016 11:24	05/10/2016 04:19	KV

Mercury by 7473

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 7473 soil

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
7439-97-6	**Mercury**	**0.557**		mg/kg dry	0.0376	1	EPA 7473	05/05/2016 06:04	05/05/2016 17:17	ALD

Mercury TCLP by 7473

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 7473 water

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
7439-97-6	Mercury	ND		mg/L	0.000200	1	EPA 7473/1311	05/06/2016 12:06	05/09/2016 12:26	ALD

Ignitability

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: Analysis Preparation

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	Ignitability	Non-Ignit.		-	1	1	EPA 1030P	05/10/2016 01:11	05/10/2016 01:56	AA

Paint Filter Test

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: Analysis Preparation

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	Paint Filter Test	No Free Liquid		-	0	1	EPA 9095A	05/10/2016 18:43	05/11/2016 02:31	AA

Total Solids

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: % Solids Prep

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
solids	**% Solids**	**79.8**		%	0.100	1	SM 2540G	05/09/2016 11:51	05/10/2016 13:22	TJM

Cyanide, Total

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: Analysis Preparation Soil

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
57-12-5	Cyanide, total	ND		mg/kg dry	0.626	1	EPA 9014/9010C	05/10/2016 08:32	05/10/2016 14:43	LAB

pH

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: Analysis Preparation

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	pH	**7.13**		pH units	0.500	1	EPA 9045D	05/10/2016 13:49	05/10/2016 13:49	TJM

Sample Information

Client Sample ID: **1252160504-02** **York Sample ID:** **16E0136-02**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 10:20 am	05/04/2016

Reactivity-Cyanide

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: Analysis Preparation

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	Reactivity - Cyanide	ND		mg/kg	0.250	1	EPA SW-846 Ch.7.3.3	05/11/2016 10:09	05/11/2016 10:11	AD

Reactivity-Sulfide

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: Analysis Preparation

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	Reactivity - Sulfide	ND		mg/kg	15.0	1	EPA SW-846 Ch.7.3.4	05/11/2016 10:10	05/11/2016 10:11	AD

TCLP Extraction for METALS EPA 1311

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA SW 846-1311 TCLP ext. for metals

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	TCLP Extraction	Completed		N/A	1.00	1	EPA 1311	05/04/2016 20:45	05/05/2016 15:26	TJM

TCLP Extraction for SVOCS/PEST/HERB

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA SW 846-1311 TCLP extr. for SVOA/PEST/HERBS

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	TCLP Extraction	Completed		N/A	1.00	1	EPA 1311	05/04/2016 20:47	05/05/2016 15:26	TJM

TCLP Extraction for VOA by EPA 1311 ZHE

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA SW 846-1311 TCLP ZHE for VOA

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	TCLP Extraction	Completed		%	1.00	1	EPA 1311	05/04/2016 20:48	05/05/2016 15:26	TJM

Sample Information

Client Sample ID: **1252160504-03** **York Sample ID:** **16E0136-03**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 11:00 am	05/04/2016

Volatile Organics, CT RCP List

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
630-20-6	1,1,1,2-Tetrachloroethane	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
71-55-6	1,1,1-Trichloroethane	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
79-34-5	1,1,2,2-Tetrachloroethane	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
79-00-5	1,1,2-Trichloroethane	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
75-34-3	1,1-Dichloroethane	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
75-35-4	1,1-Dichloroethylene	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
563-58-6	1,1-Dichloropropylene	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK

Sample Information

Client Sample ID: **1252160504-03** **York Sample ID:** **16E0136-03**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 11:00 am	05/04/2016

Volatile Organics, CT RCP List **Log-in Notes:** **Sample Notes:**

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
87-61-6	1,2,3-Trichlorobenzene	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
96-18-4	1,2,3-Trichloropropane	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
120-82-1	1,2,4-Trichlorobenzene	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
95-63-6	1,2,4-Trimethylbenzene	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
96-12-8	1,2-Dibromo-3-chloropropane	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
106-93-4	1,2-Dibromoethane	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
95-50-1	1,2-Dichlorobenzene	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
107-06-2	1,2-Dichloroethane	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
78-87-5	1,2-Dichloropropane	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
108-67-8	1,3,5-Trimethylbenzene	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
541-73-1	1,3-Dichlorobenzene	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
142-28-9	1,3-Dichloropropane	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
106-46-7	1,4-Dichlorobenzene	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
594-20-7	2,2-Dichloropropane	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
78-93-3	2-Butanone	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
95-49-8	2-Chlorotoluene	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
591-78-6	2-Hexanone	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
106-43-4	4-Chlorotoluene	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
108-10-1	4-Methyl-2-pentanone	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
67-64-1	Acetone	ND	SCAL-E	ug/kg dry	9.2	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
107-13-1	Acrylonitrile	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
71-43-2	Benzene	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
108-86-1	Bromobenzene	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
74-97-5	Bromochloromethane	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
75-27-4	Bromodichloromethane	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
75-25-2	Bromoform	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
74-83-9	Bromomethane	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
75-15-0	Carbon disulfide	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
56-23-5	Carbon tetrachloride	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
108-90-7	Chlorobenzene	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
75-00-3	Chloroethane	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
67-66-3	Chloroform	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
74-87-3	Chloromethane	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
156-59-2	cis-1,2-Dichloroethylene	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
10061-01-5	cis-1,3-Dichloropropylene	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
124-48-1	Dibromochloromethane	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
74-95-3	Dibromomethane	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
75-71-8	Dichlorodifluoromethane	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
100-41-4	Ethyl Benzene	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
87-68-3	Hexachlorobutadiene	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
98-82-8	Isopropylbenzene	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
80-62-6	Methyl Methacrylate	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
1634-04-4	Methyl tert-butyl ether (MTBE)	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK

Sample Information

Client Sample ID: 1252160504-03 **York Sample ID:** 16E0136-03

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 11:00 am	05/04/2016

Volatile Organics, CT RCP List

Sample Prepared by Method: EPA 5035A

Log-in Notes: **Sample Notes:**

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
75-09-2	Methylene chloride	ND		ug/kg dry	9.2	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
91-20-3	Naphthalene	ND		ug/kg dry	9.2	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
104-51-8	n-Butylbenzene	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
103-65-1	n-Propylbenzene	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
95-47-6	o-Xylene	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
179601-23-1	p- & m- Xylenes	ND		ug/kg dry	9.2	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
99-87-6	p-Isopropyltoluene	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
135-98-8	sec-Butylbenzene	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
100-42-5	Styrene	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
98-06-6	tert-Butylbenzene	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
127-18-4	Tetrachloroethylene	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
109-99-9	Tetrahydrofuran	ND		ug/kg dry	9.2	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
108-88-3	Toluene	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
156-60-5	trans-1,2-Dichloroethylene	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
10061-02-6	trans-1,3-Dichloropropylene	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
110-57-6	trans-1,4-dichloro-2-butene	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
79-01-6	Trichloroethylene	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
75-69-4	Trichlorofluoromethane	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK
75-01-4	Vinyl Chloride	ND		ug/kg dry	4.6	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:12	BK

	Surrogate Recoveries	Result	Acceptance Range
17060-07-0	*Surrogate: 1,2-Dichloroethane-d4*	*94.9 %*	*70-130*
2037-26-5	*Surrogate: Toluene-d8*	*99.2 %*	*70-130*
460-00-4	*Surrogate: p-Bromofluorobenzene*	*98.7 %*	*70-130*

Volatile Organics, TCLP RCRA List

Sample Prepared by Method: EPA 5030B/1311

Log-in Notes: **Sample Notes:**

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
75-35-4	1,1-Dichloroethylene	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 02:07	BK
107-06-2	1,2-Dichloroethane	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 02:07	BK
106-46-7	1,4-Dichlorobenzene	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 02:07	BK
78-93-3	2-Butanone	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 02:07	BK
71-43-2	Benzene	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 02:07	BK
56-23-5	Carbon tetrachloride	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 02:07	BK
108-90-7	Chlorobenzene	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 02:07	BK
67-66-3	Chloroform	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 02:07	BK
127-18-4	Tetrachloroethylene	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 02:07	BK
79-01-6	Trichloroethylene	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 02:07	BK
75-01-4	Vinyl Chloride	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 02:07	BK

	Surrogate Recoveries	Result	Acceptance Range
17060-07-0	*Surrogate: 1,2-Dichloroethane-d4*	*95.4 %*	*65-135*
460-00-4	*Surrogate: p-Bromofluorobenzene*	*92.9 %*	*81-114*
2037-26-5	*Surrogate: Toluene-d8*	*96.8 %*	*86-118*

Sample Information

Client Sample ID: 1252160504-03 **York Sample ID:** 16E0136-03

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 11:00 am	05/04/2016

Semi-Volatiles, CT RCP BNA List

Sample Prepared by Method: EPA 3546 SVOA

Log-in Notes:

Sample Notes:

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
95-94-3	1,2,4,5-Tetrachlorobenzene	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
120-82-1	1,2,4-Trichlorobenzene	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
90-12-0	1-Methylnaphthalene	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
95-95-4	2,4,5-Trichlorophenol	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
88-06-2	2,4,6-Trichlorophenol	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
120-83-2	2,4-Dichlorophenol	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
105-67-9	2,4-Dimethylphenol	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
51-28-5	2,4-Dinitrophenol	ND		ug/kg dry	1230	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
121-14-2	2,4-Dinitrotoluene	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
606-20-2	2,6-Dinitrotoluene	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
91-58-7	2-Chloronaphthalene	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
95-57-8	2-Chlorophenol	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
91-57-6	2-Methylnaphthalene	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
95-48-7	2-Methylphenol	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
88-74-4	2-Nitroaniline	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
88-75-5	2-Nitrophenol	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
65794-96-9	3- & 4-Methylphenols	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
91-94-1	3,3'-Dichlorobenzidine	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
99-09-2	3-Nitroaniline	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
534-52-1	4,6-Dinitro-2-methylphenol	ND		ug/kg dry	1230	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
101-55-3	4-Bromophenyl phenyl ether	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
59-50-7	4-Chloro-3-methylphenol	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
106-47-8	4-Chloroaniline	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
7005-72-3	4-Chlorophenyl phenyl ether	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
100-01-6	4-Nitroaniline	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
100-02-7	4-Nitrophenol	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
83-32-9	Acenaphthene	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
208-96-8	Acenaphthylene	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
62-53-3	Aniline	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
120-12-7	Anthracene	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
56-55-3	**Benzo(a)anthracene**	**2230**		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
50-32-8	**Benzo(a)pyrene**	**1670**		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
205-99-2	**Benzo(b)fluoranthene**	**2220**		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
191-24-2	**Benzo(g,h,i)perylene**	**680**		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
207-08-9	**Benzo(k)fluoranthene**	**1130**		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
85-68-7	Benzyl butyl phthalate	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
111-91-1	Bis(2-chloroethoxy)methane	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
111-44-4	Bis(2-chloroethyl)ether	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
108-60-1	Bis(2-chloroisopropyl)ether	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
117-81-7	Bis(2-ethylhexyl)phthalate	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
86-74-8	**Carbazole**	**1630**	CCV-E	ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
218-01-9	**Chrysene**	**2030**		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR

Sample Information

Client Sample ID: **1252160504-03** **York Sample ID:** **16E0136-03**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 11:00 am	05/04/2016

Semi-Volatiles, CT RCP BNA List

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 3546 SVOA

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
53-70-3	Dibenzo(a,h)anthracene	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
132-64-9	Dibenzofuran	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
84-66-2	Diethyl phthalate	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
131-11-3	Dimethyl phthalate	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
84-74-2	Di-n-butyl phthalate	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
117-84-0	Di-n-octyl phthalate	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
206-44-0	**Fluoranthene**	**5210**		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
86-73-7	Fluorene	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
118-74-1	Hexachlorobenzene	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
87-68-3	Hexachlorobutadiene	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
77-47-4	Hexachlorocyclopentadiene	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
67-72-1	Hexachloroethane	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
193-39-5	**Indeno(1,2,3-cd)pyrene**	**688**		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
78-59-1	Isophorone	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
91-20-3	Naphthalene	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
98-95-3	Nitrobenzene	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
621-64-7	N-nitroso-di-n-propylamine	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
86-30-6	N-Nitrosodiphenylamine	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
82-68-8	Pentachloronitrobenzene	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
87-86-5	Pentachlorophenol	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
85-01-8	**Phenanthrene**	**1780**		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
108-95-2	Phenol	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
129-00-0	**Pyrene**	**4070**		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR
110-86-1	Pyridine	ND		ug/kg dry	617	2	EPA 8270D	05/09/2016 14:01	05/10/2016 12:36	SR

	Surrogate Recoveries	Result	Acceptance Range
367-12-4	*Surrogate: 2-Fluorophenol*	*40.5 %*	*30-130*
4165-62-2	*Surrogate: Phenol-d5*	*45.3 %*	*30-130*
4165-60-0	*Surrogate: Nitrobenzene-d5*	*56.9 %*	*30-130*
321-60-8	*Surrogate: 2-Fluorobiphenyl*	*59.0 %*	*30-130*
118-79-6	*Surrogate: 2,4,6-Tribromophenol*	*92.9 %*	*30-130*
1718-51-0	*Surrogate: Terphenyl-d14*	*58.8 %*	*30-130*

Semi-Volatiles, TCLP RCRA Target List

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 3510C/1311

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
106-46-7	1,4-Dichlorobenzene	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 17:59	KH
95-95-4	2,4,5-Trichlorophenol	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 17:59	KH
88-06-2	2,4,6-Trichlorophenol	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 17:59	KH
121-14-2	2,4-Dinitrotoluene	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 17:59	KH
95-48-7	2-Methylphenol	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 17:59	KH
65794-96-9	3- & 4-Methylphenols	ND		ug/L	20.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 17:59	KH
1319-77-3	Cresols, total	ND		ug/L	30.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 17:59	KH

Sample Information

Client Sample ID: **1252160504-03**

York Sample ID: **16E0136-03**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 11:00 am	05/04/2016

Semi-Volatiles, TCLP RCRA Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3510C/1311

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
118-74-1	Hexachlorobenzene	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 17:59	KH
87-68-3	Hexachlorobutadiene	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 17:59	KH
67-72-1	Hexachloroethane	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 17:59	KH
98-95-3	Nitrobenzene	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 17:59	KH
87-86-5	Pentachlorophenol	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 17:59	KH
110-86-1	Pyridine	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 17:59	KH

	Surrogate Recoveries	Result		Acceptance Range
367-12-4	*Surrogate: 2-Fluorophenol*	*28.6 %*		*10-65*
4165-62-2	*Surrogate: Phenol-d5*	*21.8 %*		*10-49*
4165-60-0	*Surrogate: Nitrobenzene-d5*	*60.0 %*		*10-96*
321-60-8	*Surrogate: 2-Fluorobiphenyl*	*54.9 %*		*10-93*
118-79-6	*Surrogate: 2,4,6-Tribromophenol*	*71.1 %*		*10-128*
1718-51-0	*Surrogate: Terphenyl-d14*	*44.9 %*		*10-100*

Pesticides, CT RCP Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3545A

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
72-54-8	4,4'-DDD	ND		ug/kg dry	3.08	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:32	AMC
72-55-9	4,4'-DDE	ND		ug/kg dry	3.08	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:32	AMC
50-29-3	4,4'-DDT	ND		ug/kg dry	3.08	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:32	AMC
15972-60-8	Alachlor	ND		ug/kg dry	3.08	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:32	AMC
309-00-2	Aldrin	ND		ug/kg dry	3.08	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:32	AMC
319-84-6	alpha-BHC	ND		ug/kg dry	3.08	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:32	AMC
319-85-7	beta-BHC	ND		ug/kg dry	3.08	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:32	AMC
57-74-9	Chlordane, total	ND		ug/kg dry	12.2	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:32	AMC
319-86-8	delta-BHC	ND		ug/kg dry	3.08	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:32	AMC
60-57-1	Dieldrin	ND		ug/kg dry	3.08	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:32	AMC
959-98-8	Endosulfan I	ND		ug/kg dry	3.08	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:32	AMC
33213-65-9	Endosulfan II	ND		ug/kg dry	3.08	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:32	AMC
1031-07-8	Endosulfan sulfate	ND		ug/kg dry	3.08	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:32	AMC
72-20-8	Endrin	ND		ug/kg dry	3.08	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:32	AMC
7421-93-4	Endrin aldehyde	ND		ug/kg dry	3.08	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:32	AMC
53494-70-5	Endrin ketone	ND		ug/kg dry	3.08	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:32	AMC
58-89-9	gamma-BHC (Lindane)	ND		ug/kg dry	3.08	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:32	AMC
76-44-8	Heptachlor	ND		ug/kg dry	3.08	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:32	AMC
1024-57-3	Heptachlor epoxide	ND		ug/kg dry	3.08	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:32	AMC
72-43-5	Methoxychlor	ND		ug/kg dry	3.08	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:32	AMC
8001-35-2	Toxaphene	ND		ug/kg dry	154	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:32	AMC

	Surrogate Recoveries	Result		Acceptance Range
2051-24-3	*Surrogate: Decachlorobiphenyl*	*36.1 %*		*30-140*
877-09-8	*Surrogate: Tetrachloro-m-xylene*	*29.0 %*	GC-Surr	*30-140*

Sample Information

Client Sample ID: **1252160504-03**

York Sample ID: **16E0136-03**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 11:00 am	05/04/2016

Pesticides, TCLP RCRA List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3510C/1311

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
57-74-9	Chlordane, total	ND		ug/L	0.457	1	EPA 8081B/1311	05/06/2016 14:41	05/09/2016 21:44	AMC
72-20-8	Endrin	ND		ug/L	0.0457	1	EPA 8081B/1311	05/06/2016 14:41	05/09/2016 21:44	AMC
58-89-9	gamma-BHC (Lindane)	ND		ug/L	0.0457	1	EPA 8081B/1311	05/06/2016 14:41	05/09/2016 21:44	AMC
76-44-8	Heptachlor	ND		ug/L	0.0457	1	EPA 8081B/1311	05/06/2016 14:41	05/09/2016 21:44	AMC
1024-57-3	Heptachlor epoxide	ND		ug/L	0.0457	1	EPA 8081B/1311	05/06/2016 14:41	05/09/2016 21:44	AMC
72-43-5	Methoxychlor	ND		ug/L	0.0457	1	EPA 8081B/1311	05/06/2016 14:41	05/09/2016 21:44	AMC
8001-35-2	Toxaphene	ND		ug/L	1.14	1	EPA 8081B/1311	05/06/2016 14:41	05/09/2016 21:44	AMC
	Surrogate Recoveries	**Result**			**Acceptance Range**					
877-09-8	*Surrogate: Tetrachloro-m-xylene*	*89.6 %*			*30-120*					
2051-24-3	*Surrogate: Decachlorobiphenyl*	*84.5 %*			*30-120*					

Polychlorinated Biphenyls (Soxhlet Extraction)

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA SW846-3540C

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
12674-11-2	Aroclor 1016	ND		mg/kg dry	0.0308	1	EPA 8082A	05/10/2016 07:16	05/11/2016 13:15	AMC
11104-28-2	Aroclor 1221	ND		mg/kg dry	0.0308	1	EPA 8082A	05/10/2016 07:16	05/11/2016 13:15	AMC
11141-16-5	Aroclor 1232	ND		mg/kg dry	0.0308	1	EPA 8082A	05/10/2016 07:16	05/11/2016 13:15	AMC
53469-21-9	Aroclor 1242	ND		mg/kg dry	0.0308	1	EPA 8082A	05/10/2016 07:16	05/11/2016 13:15	AMC
12672-29-6	Aroclor 1248	ND		mg/kg dry	0.0308	1	EPA 8082A	05/10/2016 07:16	05/11/2016 13:15	AMC
11097-69-1	Aroclor 1254	ND		mg/kg dry	0.0308	1	EPA 8082A	05/10/2016 07:16	05/11/2016 13:15	AMC
11096-82-5	Aroclor 1260	ND		mg/kg dry	0.0308	1	EPA 8082A	05/10/2016 07:16	05/11/2016 13:15	AMC
37324-23-5	Aroclor 1262	ND		mg/kg dry	0.0308	1	EPA 8082A	05/10/2016 07:16	05/11/2016 13:15	AMC
11100-14-4	Aroclor 1268	ND		mg/kg dry	0.0308	1	EPA 8082A	05/10/2016 07:16	05/11/2016 13:15	AMC
1336-36-3	Total PCBs	ND		mg/kg dry	0.0308	1	EPA 8082A	05/10/2016 07:16	05/11/2016 13:15	AMC
	Surrogate Recoveries	**Result**			**Acceptance Range**					
877-09-8	*Surrogate: Tetrachloro-m-xylene*	*85.0 %*			*30-140*					
2051-24-3	*Surrogate: Decachlorobiphenyl*	*79.5 %*			*30-140*					

Herbicides, CT RCP

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3550B/8151A

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
93-76-5	2,4,5-T	ND		ug/kg dry	24.7	1	EPA 8151A	05/09/2016 07:53	05/10/2016 13:51	AMC
93-72-1	2,4,5-TP (Silvex)	ND		ug/kg dry	24.7	1	EPA 8151A	05/09/2016 07:53	05/10/2016 13:51	AMC
94-75-7	2,4-D	ND		ug/kg dry	24.7	1	EPA 8151A	05/09/2016 07:53	05/10/2016 13:51	AMC
75-99-0	Dalapon	ND		ug/kg dry	24.7	1	EPA 8151A	05/09/2016 07:53	05/10/2016 13:51	AMC
1918-00-9	Dicamba	ND		ug/kg dry	24.7	1	EPA 8151A	05/09/2016 07:53	05/10/2016 13:51	AMC
	Surrogate Recoveries	**Result**			**Acceptance Range**					
19719-28-9	*Surrogate: 2,4-Dichlorophenylacetic acia*	*62.6 %*			*30-150*					

Herbicides, TCLP Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3535A/1311

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst

Sample Information

Client Sample ID: 1252160504-03 **York Sample ID:** 16E0136-03

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 11:00 am	05/04/2016

Herbicides, TCLP Target List

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 3535A/1311

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
93-72-1	2,4,5-TP (Silvex)	ND		ug/L	5.00	1	EPA 8151A/1311	05/09/2016 07:50	05/09/2016 15:10	AMC
94-75-7	2,4-D	ND		ug/L	5.00	1	EPA 8151A/1311	05/09/2016 07:50	05/09/2016 15:10	AMC
	Surrogate Recoveries	**Result**			**Acceptance Range**					
19719-28-9	*Surrogate: 2,4-Dichlorophenylacetic acia*	*85.4 %*			*30-150*					

Extractable Total Petroleum Hydrocarbons (ETPH)

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 3545A

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
CT ETPH	**ETPH (Extractable Total Petroleum Hydrocarbons)**	**198**		mg/kg dry	12.3	1	CT DEP ETPH	05/06/2016 07:12	05/07/2016 03:57	AMC
	Surrogate Recoveries	**Result**			**Acceptance Range**					
3386-33-2	*Surrogate: 1-Chlorooctadecane*	*94.9 %*			*50-150*					

Metals, RCRA

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 3050B

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
7440-38-2	**Arsenic**	**1.35**		mg/kg dry	1.23	1	EPA 6010C	05/05/2016 10:13	05/06/2016 05:31	KV
7440-39-3	**Barium**	**6.97**		mg/kg dry	1.23	1	EPA 6010C	05/05/2016 10:13	05/06/2016 05:31	KV
7440-43-9	Cadmium	ND		mg/kg dry	0.370	1	EPA 6010C	05/05/2016 10:13	05/06/2016 05:31	KV
7440-47-3	**Chromium**	**16.3**		mg/kg dry	0.617	1	EPA 6010C	05/05/2016 10:13	05/06/2016 05:31	KV
7439-92-1	**Lead**	**38.7**		mg/kg dry	0.370	1	EPA 6010C	05/05/2016 10:13	05/06/2016 05:31	KV
7782-49-2	**Selenium**	**1.38**		mg/kg dry	1.23	1	EPA 6010C	05/05/2016 10:13	05/06/2016 05:31	KV
7440-22-4	Silver	ND		mg/kg dry	0.617	1	EPA 6010C	05/05/2016 10:13	05/06/2016 05:31	KV

Metals, TCLP RCRA

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 3015A/1311

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
7440-38-2	Arsenic	ND		mg/L	0.004	1	EPA 6010C/1311	05/09/2016 11:24	05/10/2016 04:25	KV
7440-39-3	**Barium**	**0.884**		mg/L	0.011	1	EPA 6010C/1311	05/09/2016 11:24	05/10/2016 04:25	KV
7440-43-9	Cadmium	ND		mg/L	0.003	1	EPA 6010C/1311	05/09/2016 11:24	05/10/2016 04:25	KV
7440-47-3	**Chromium**	**0.016**		mg/L	0.006	1	EPA 6010C/1311	05/09/2016 11:24	05/10/2016 04:25	KV
7439-92-1	**Lead**	**0.155**		mg/L	0.003	1	EPA 6010C/1311	05/09/2016 11:24	05/10/2016 04:25	KV
7782-49-2	Selenium	ND	M-SeTC	mg/L	0.011	1	EPA 6010C/1311	05/09/2016 11:24	05/10/2016 04:25	KV
7440-22-4	Silver	ND		mg/L	0.006	1	EPA 6010C/1311	05/09/2016 11:24	05/10/2016 04:25	KV

Mercury by 7473

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 7473 soil

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
7439-97-6	Mercury	ND		mg/kg dry	0.0370	1	EPA 7473	05/05/2016 06:04	05/05/2016 17:29	ALD

Mercury TCLP by 7473

Log-in Notes: **Sample Notes:**

Sample Information

Client Sample ID:	**1252160504-03**	**York Sample ID:**	**16E0136-03**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 11:00 am	05/04/2016

Sample Prepared by Method: EPA 7473 water

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
7439-97-6	Mercury	ND		mg/L	0.000200	1	EPA 7473/1311	05/06/2016 12:06	05/09/2016 12:26	ALD

Ignitability

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: Analysis Preparation

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	Ignitability	Non-Ignit.		-	1	1	EPA 1030P	05/10/2016 01:11	05/10/2016 01:56	AA

Paint Filter Test

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: Analysis Preparation

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	Paint Filter Test	No Free Liquid		-	0	1	EPA 9095A	05/10/2016 18:43	05/11/2016 02:31	AA

Total Solids

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: % Solids Prep

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
solids	**% Solids**	**81.1**		%	0.100	1	SM 2540G	05/09/2016 11:51	05/10/2016 13:22	TJM

Cyanide, Total

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: Analysis Preparation Soil

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
57-12-5	Cyanide, total	ND		mg/kg dry	0.617	1	EPA 9014/9010C	05/10/2016 08:32	05/10/2016 14:43	LAB

pH

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: Analysis Preparation

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	pH	**7.06**		pH units	0.500	1	EPA 9045D	05/10/2016 13:49	05/10/2016 13:49	TJM

Reactivity-Cyanide

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: Analysis Preparation

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	Reactivity - Cyanide	ND		mg/kg	0.250	1	EPA SW-846 Ch.7.3.3	05/11/2016 10:09	05/11/2016 10:11	AD

Reactivity-Sulfide

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: Analysis Preparation

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	Reactivity - Sulfide	ND		mg/kg	15.0	1	EPA SW-846 Ch.7.3.4	05/11/2016 10:10	05/11/2016 10:11	AD

TCLP Extraction for METALS EPA 1311

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA SW 846-1311 TCLP ext. for metals

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	TCLP Extraction	Completed		N/A	1.00	1	EPA 1311	05/04/2016 20:45	05/05/2016 15:26	TJM

Sample Information

Client Sample ID: 1252160504-03 **York Sample ID:** 16E0136-03

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 11:00 am	05/04/2016

TCLP Extraction for SVOCS/PEST/HERB

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA SW 846-1311 TCLP extr. for SVOA/PEST/HERBS

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	TCLP Extraction	Completed		N/A	1.00	1	EPA 1311	05/04/2016 20:47	05/05/2016 15:26	TJM

TCLP Extraction for VOA by EPA 1311 ZHE

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA SW 846-1311 TCLP ZHE for VOA

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	TCLP Extraction	Completed		%	1.00	1	EPA 1311	05/04/2016 20:48	05/05/2016 15:26	TJM

Sample Information

Client Sample ID: 1252160504-04 **York Sample ID:** 16E0136-04

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 11:45 am	05/04/2016

Volatile Organics, CT RCP List

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
630-20-6	1,1,1,2-Tetrachloroethane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
71-55-6	1,1,1-Trichloroethane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
79-34-5	1,1,2,2-Tetrachloroethane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
79-00-5	1,1,2-Trichloroethane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
75-34-3	1,1-Dichloroethane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
75-35-4	1,1-Dichloroethylene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
563-58-6	1,1-Dichloropropylene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
87-61-6	1,2,3-Trichlorobenzene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
96-18-4	1,2,3-Trichloropropane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
120-82-1	1,2,4-Trichlorobenzene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
95-63-6	1,2,4-Trimethylbenzene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
96-12-8	1,2-Dibromo-3-chloropropane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
106-93-4	1,2-Dibromoethane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
95-50-1	1,2-Dichlorobenzene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
107-06-2	1,2-Dichloroethane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
78-87-5	1,2-Dichloropropane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
108-67-8	1,3,5-Trimethylbenzene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
541-73-1	1,3-Dichlorobenzene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
142-28-9	1,3-Dichloropropane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
106-46-7	1,4-Dichlorobenzene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
594-20-7	2,2-Dichloropropane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
78-93-3	2-Butanone	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
95-49-8	2-Chlorotoluene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK

Sample Information

Client Sample ID: **1252160504-04** **York Sample ID:** **16E0136-04**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 11:45 am	05/04/2016

Volatile Organics, CT RCP List

Sample Prepared by Method: EPA 5035A

Log-in Notes: **Sample Notes:**

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
591-78-6	2-Hexanone	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
106-43-4	4-Chlorotoluene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
108-10-1	4-Methyl-2-pentanone	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
67-64-1	**Acetone**	**10**	SCAL-E	ug/kg dry	9.5	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
107-13-1	Acrylonitrile	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
71-43-2	Benzene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
108-86-1	Bromobenzene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
74-97-5	Bromochloromethane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
75-27-4	Bromodichloromethane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
75-25-2	Bromoform	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
74-83-9	Bromomethane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
75-15-0	Carbon disulfide	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
56-23-5	Carbon tetrachloride	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
108-90-7	Chlorobenzene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
75-00-3	Chloroethane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
67-66-3	Chloroform	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
74-87-3	Chloromethane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
156-59-2	cis-1,2-Dichloroethylene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
10061-01-5	cis-1,3-Dichloropropylene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
124-48-1	Dibromochloromethane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
74-95-3	Dibromomethane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
75-71-8	Dichlorodifluoromethane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
100-41-4	Ethyl Benzene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
87-68-3	Hexachlorobutadiene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
98-82-8	Isopropylbenzene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
80-62-6	Methyl Methacrylate	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
1634-04-4	Methyl tert-butyl ether (MTBE)	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
75-09-2	Methylene chloride	ND		ug/kg dry	9.5	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
91-20-3	Naphthalene	ND		ug/kg dry	9.5	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
104-51-8	n-Butylbenzene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
103-65-1	n-Propylbenzene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
95-47-6	o-Xylene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
179601-23-1	p- & m- Xylenes	ND		ug/kg dry	9.5	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
99-87-6	p-Isopropyltoluene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
135-98-8	sec-Butylbenzene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
100-42-5	Styrene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
98-06-6	tert-Butylbenzene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
127-18-4	Tetrachloroethylene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
109-99-9	Tetrahydrofuran	ND		ug/kg dry	9.5	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
108-88-3	Toluene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
156-60-5	trans-1,2-Dichloroethylene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
10061-02-6	trans-1,3-Dichloropropylene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
110-57-6	trans-1,4-dichloro-2-butene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK

Sample Information

Client Sample ID: **1252160504-04**

York Sample ID: **16E0136-04**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 11:45 am	05/04/2016

Volatile Organics, CT RCP List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
79-01-6	Trichloroethylene	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
75-69-4	Trichlorofluoromethane	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK
75-01-4	Vinyl Chloride	ND		ug/kg dry	4.7	1	EPA 8260C	05/09/2016 08:20	05/09/2016 13:41	BK

	Surrogate Recoveries	Result	Acceptance Range
17060-07-0	*Surrogate: 1,2-Dichloroethane-d4*	*93.6 %*	*70-130*
2037-26-5	*Surrogate: Toluene-d8*	*98.5 %*	*70-130*
460-00-4	*Surrogate: p-Bromofluorobenzene*	*98.0 %*	*70-130*

Volatile Organics, TCLP RCRA List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 5030B/1311

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
75-35-4	1,1-Dichloroethylene	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 02:48	BK
107-06-2	1,2-Dichloroethane	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 02:48	BK
106-46-7	1,4-Dichlorobenzene	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 02:48	BK
78-93-3	2-Butanone	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 02:48	BK
71-43-2	Benzene	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 02:48	BK
56-23-5	Carbon tetrachloride	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 02:48	BK
108-90-7	Chlorobenzene	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 02:48	BK
67-66-3	Chloroform	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 02:48	BK
127-18-4	Tetrachloroethylene	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 02:48	BK
79-01-6	Trichloroethylene	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 02:48	BK
75-01-4	Vinyl Chloride	ND		ug/L	50	10	EPA 8260C/1311	05/06/2016 16:37	05/07/2016 02:48	BK

	Surrogate Recoveries	Result	Acceptance Range
17060-07-0	*Surrogate: 1,2-Dichloroethane-d4*	*97.9 %*	*65-135*
460-00-4	*Surrogate: p-Bromofluorobenzene*	*91.5 %*	*81-114*
2037-26-5	*Surrogate: Toluene-d8*	*99.2 %*	*86-118*

Semi-Volatiles, CT RCP BNA List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546 SVOA

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
95-94-3	1,2,4,5-Tetrachlorobenzene	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
120-82-1	1,2,4-Trichlorobenzene	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
90-12-0	1-Methylnaphthalene	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
95-95-4	2,4,5-Trichlorophenol	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
88-06-2	2,4,6-Trichlorophenol	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
120-83-2	2,4-Dichlorophenol	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
105-67-9	2,4-Dimethylphenol	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
51-28-5	2,4-Dinitrophenol	ND		ug/kg dry	1270	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
121-14-2	2,4-Dinitrotoluene	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
606-20-2	2,6-Dinitrotoluene	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
91-58-7	2-Chloronaphthalene	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
95-57-8	2-Chlorophenol	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR

Sample Information

Client Sample ID: 1252160504-04

York Sample ID: 16E0136-04

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 11:45 am	05/04/2016

Semi-Volatiles, CT RCP BNA List

Sample Prepared by Method: EPA 3546 SVOA

Log-in Notes:

Sample Notes:

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
91-57-6	2-Methylnaphthalene	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
95-48-7	2-Methylphenol	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
88-74-4	2-Nitroaniline	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
88-75-5	2-Nitrophenol	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
65794-96-9	3- & 4-Methylphenols	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
91-94-1	3,3'-Dichlorobenzidine	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
99-09-2	3-Nitroaniline	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
534-52-1	4,6-Dinitro-2-methylphenol	ND		ug/kg dry	1270	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
101-55-3	4-Bromophenyl phenyl ether	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
59-50-7	4-Chloro-3-methylphenol	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
106-47-8	4-Chloroaniline	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
7005-72-3	4-Chlorophenyl phenyl ether	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
100-01-6	4-Nitroaniline	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
100-02-7	4-Nitrophenol	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
83-32-9	Acenaphthene	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
208-96-8	Acenaphthylene	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
62-53-3	Aniline	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
120-12-7	Anthracene	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
56-55-3	**Benzo(a)anthracene**	**2080**		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
50-32-8	**Benzo(a)pyrene**	**1430**		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
205-99-2	**Benzo(b)fluoranthene**	**1890**		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
191-24-2	Benzo(g,h,i)perylene	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
207-08-9	**Benzo(k)fluoranthene**	**1100**		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
85-68-7	Benzyl butyl phthalate	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
111-91-1	Bis(2-chloroethoxy)methane	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
111-44-4	Bis(2-chloroethyl)ether	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
108-60-1	Bis(2-chloroisopropyl)ether	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
117-81-7	Bis(2-ethylhexyl)phthalate	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
86-74-8	**Carbazole**	**771**	CCV-E	ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
218-01-9	**Chrysene**	**1680**		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
53-70-3	Dibenzo(a,h)anthracene	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
132-64-9	Dibenzofuran	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
84-66-2	Diethyl phthalate	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
131-11-3	Dimethyl phthalate	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
84-74-2	Di-n-butyl phthalate	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
117-84-0	Di-n-octyl phthalate	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
206-44-0	**Fluoranthene**	**4340**		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
86-73-7	Fluorene	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
118-74-1	Hexachlorobenzene	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
87-68-3	Hexachlorobutadiene	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
77-47-4	Hexachlorocyclopentadiene	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
67-72-1	Hexachloroethane	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR

Sample Information

Client Sample ID: 1252160504-04 **York Sample ID:** 16E0136-04

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 11:45 am	05/04/2016

Semi-Volatiles, CT RCP BNA List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546 SVOA

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
193-39-5	Indeno(1,2,3-cd)pyrene	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
78-59-1	Isophorone	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
91-20-3	Naphthalene	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
98-95-3	Nitrobenzene	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
621-64-7	N-nitroso-di-n-propylamine	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
86-30-6	N-Nitrosodiphenylamine	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
82-68-8	Pentachloronitrobenzene	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
87-86-5	Pentachlorophenol	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
85-01-8	**Phenanthrene**	**1270**		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
108-95-2	Phenol	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
129-00-0	**Pyrene**	**3320**		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR
110-86-1	Pyridine	ND		ug/kg dry	637	2	EPA 8270D	05/09/2016 14:01	05/10/2016 13:07	SR

	Surrogate Recoveries	Result	Acceptance Range
367-12-4	*Surrogate: 2-Fluorophenol*	*42.7 %*	*30-130*
4165-62-2	*Surrogate: Phenol-d5*	*44.7 %*	*30-130*
4165-60-0	*Surrogate: Nitrobenzene-d5*	*46.8 %*	*30-130*
321-60-8	*Surrogate: 2-Fluorobiphenyl*	*40.6 %*	*30-130*
118-79-6	*Surrogate: 2,4,6-Tribromophenol*	*94.1 %*	*30-130*
1718-51-0	*Surrogate: Terphenyl-d14*	*55.4 %*	*30-130*

Semi-Volatiles, TCLP RCRA Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3510C/1311

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
106-46-7	1,4-Dichlorobenzene	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 18:33	KH
95-95-4	2,4,5-Trichlorophenol	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 18:33	KH
88-06-2	2,4,6-Trichlorophenol	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 18:33	KH
121-14-2	2,4-Dinitrotoluene	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 18:33	KH
95-48-7	2-Methylphenol	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 18:33	KH
65794-96-9	3- & 4-Methylphenols	ND		ug/L	20.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 18:33	KH
1319-77-3	Cresols, total	ND		ug/L	30.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 18:33	KH
118-74-1	Hexachlorobenzene	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 18:33	KH
87-68-3	Hexachlorobutadiene	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 18:33	KH
67-72-1	Hexachloroethane	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 18:33	KH
98-95-3	Nitrobenzene	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 18:33	KH
87-86-5	Pentachlorophenol	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 18:33	KH
110-86-1	Pyridine	ND		ug/L	10.0	1	EPA 8270D/1311	05/06/2016 05:59	05/06/2016 18:33	KH

	Surrogate Recoveries	Result	Acceptance Range
367-12-4	*Surrogate: 2-Fluorophenol*	*31.0 %*	*10-65*
4165-62-2	*Surrogate: Phenol-d5*	*24.5 %*	*10-49*
4165-60-0	*Surrogate: Nitrobenzene-d5*	*64.7 %*	*10-96*
321-60-8	*Surrogate: 2-Fluorobiphenyl*	*58.7 %*	*10-93*
118-79-6	*Surrogate: 2,4,6-Tribromophenol*	*77.0 %*	*10-128*

Sample Information

Client Sample ID: **1252160504-04**

York Sample ID: **16E0136-04**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 11:45 am	05/04/2016

Semi-Volatiles, TCLP RCRA Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3510C/1311

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
1718-51-0	*Surrogate: Terphenyl-d14*	*49.2 %*			*10-100*					

Pesticides, CT RCP Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3545A

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
72-54-8	4,4'-DDD	ND		ug/kg dry	3.18	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:47	AMC
72-55-9	4,4'-DDE	ND		ug/kg dry	3.18	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:47	AMC
50-29-3	4,4'-DDT	ND		ug/kg dry	3.18	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:47	AMC
15972-60-8	Alachlor	ND		ug/kg dry	3.18	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:47	AMC
309-00-2	Aldrin	ND		ug/kg dry	3.18	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:47	AMC
319-84-6	alpha-BHC	ND		ug/kg dry	3.18	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:47	AMC
319-85-7	beta-BHC	ND		ug/kg dry	3.18	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:47	AMC
57-74-9	Chlordane, total	ND		ug/kg dry	12.6	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:47	AMC
319-86-8	delta-BHC	ND		ug/kg dry	3.18	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:47	AMC
60-57-1	Dieldrin	ND		ug/kg dry	3.18	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:47	AMC
959-98-8	Endosulfan I	ND		ug/kg dry	3.18	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:47	AMC
33213-65-9	Endosulfan II	ND		ug/kg dry	3.18	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:47	AMC
1031-07-8	Endosulfan sulfate	ND		ug/kg dry	3.18	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:47	AMC
72-20-8	Endrin	ND		ug/kg dry	3.18	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:47	AMC
7421-93-4	Endrin aldehyde	ND		ug/kg dry	3.18	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:47	AMC
53494-70-5	Endrin ketone	ND		ug/kg dry	3.18	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:47	AMC
58-89-9	gamma-BHC (Lindane)	ND		ug/kg dry	3.18	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:47	AMC
76-44-8	Heptachlor	ND		ug/kg dry	3.18	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:47	AMC
1024-57-3	Heptachlor epoxide	ND		ug/kg dry	3.18	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:47	AMC
72-43-5	Methoxychlor	ND		ug/kg dry	3.18	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:47	AMC
8001-35-2	Toxaphene	ND		ug/kg dry	159	5	EPA 8081B	05/06/2016 14:02	05/10/2016 12:47	AMC
	Surrogate Recoveries	**Result**			**Acceptance Range**					
2051-24-3	*Surrogate: Decachlorobiphenyl*	*46.6 %*			*30-140*					
877-09-8	*Surrogate: Tetrachloro-m-xylene*	*32.2 %*			*30-140*					

Pesticides, TCLP RCRA List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3510C/1311

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
57-74-9	Chlordane, total	ND		ug/L	0.457	1	EPA 8081B/1311	05/06/2016 14:41	05/09/2016 21:59	AMC
72-20-8	Endrin	ND		ug/L	0.0457	1	EPA 8081B/1311	05/06/2016 14:41	05/09/2016 21:59	AMC
58-89-9	gamma-BHC (Lindane)	ND		ug/L	0.0457	1	EPA 8081B/1311	05/06/2016 14:41	05/09/2016 21:59	AMC
76-44-8	Heptachlor	ND		ug/L	0.0457	1	EPA 8081B/1311	05/06/2016 14:41	05/09/2016 21:59	AMC
1024-57-3	Heptachlor epoxide	ND		ug/L	0.0457	1	EPA 8081B/1311	05/06/2016 14:41	05/09/2016 21:59	AMC
72-43-5	Methoxychlor	ND		ug/L	0.0457	1	EPA 8081B/1311	05/06/2016 14:41	05/09/2016 21:59	AMC
8001-35-2	Toxaphene	ND		ug/L	1.14	1	EPA 8081B/1311	05/06/2016 14:41	05/09/2016 21:59	AMC
	Surrogate Recoveries	**Result**			**Acceptance Range**					
877-09-8	*Surrogate: Tetrachloro-m-xylene*	*83.5 %*			*30-120*					

Sample Information

Client Sample ID: **1252160504-04** **York Sample ID:** **16E0136-04**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 11:45 am	05/04/2016

Pesticides, TCLP RCRA List

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 3510C/1311

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
2051-24-3	*Surrogate: Decachlorobiphenyl*	*76.8 %*			*30-120*					

Polychlorinated Biphenyls (Soxhlet Extraction)

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA SW846-3540C

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
12674-11-2	Aroclor 1016	ND		mg/kg dry	0.0318	1	EPA 8082A	05/10/2016 07:16	05/11/2016 13:35	AMC
11104-28-2	Aroclor 1221	ND		mg/kg dry	0.0318	1	EPA 8082A	05/10/2016 07:16	05/11/2016 13:35	AMC
11141-16-5	Aroclor 1232	ND		mg/kg dry	0.0318	1	EPA 8082A	05/10/2016 07:16	05/11/2016 13:35	AMC
53469-21-9	Aroclor 1242	ND		mg/kg dry	0.0318	1	EPA 8082A	05/10/2016 07:16	05/11/2016 13:35	AMC
12672-29-6	Aroclor 1248	ND		mg/kg dry	0.0318	1	EPA 8082A	05/10/2016 07:16	05/11/2016 13:35	AMC
11097-69-1	Aroclor 1254	ND		mg/kg dry	0.0318	1	EPA 8082A	05/10/2016 07:16	05/11/2016 13:35	AMC
11096-82-5	**Aroclor 1260**	**0.0467**		mg/kg dry	0.0318	1	EPA 8082A	05/10/2016 07:16	05/11/2016 13:35	AMC
37324-23-5	Aroclor 1262	ND		mg/kg dry	0.0318	1	EPA 8082A	05/10/2016 07:16	05/11/2016 13:35	AMC
11100-14-4	Aroclor 1268	ND		mg/kg dry	0.0318	1	EPA 8082A	05/10/2016 07:16	05/11/2016 13:35	AMC
1336-36-3	**Total PCBs**	**0.0467**		mg/kg dry	0.0318	1	EPA 8082A	05/10/2016 07:16	05/11/2016 13:35	AMC
	Surrogate Recoveries	**Result**			**Acceptance Range**					
877-09-8	*Surrogate: Tetrachloro-m-xylene*	*83.0 %*			*30-140*					
2051-24-3	*Surrogate: Decachlorobiphenyl*	*81.5 %*			*30-140*					

Herbicides, CT RCP

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 3550B/8151A

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
93-76-5	2,4,5-T	ND		ug/kg dry	25.5	1	EPA 8151A	05/09/2016 07:53	05/10/2016 14:04	AMC
93-72-1	2,4,5-TP (Silvex)	ND		ug/kg dry	25.5	1	EPA 8151A	05/09/2016 07:53	05/10/2016 14:04	AMC
94-75-7	2,4-D	ND		ug/kg dry	25.5	1	EPA 8151A	05/09/2016 07:53	05/10/2016 14:04	AMC
75-99-0	Dalapon	ND		ug/kg dry	25.5	1	EPA 8151A	05/09/2016 07:53	05/10/2016 14:04	AMC
1918-00-9	Dicamba	ND		ug/kg dry	25.5	1	EPA 8151A	05/09/2016 07:53	05/10/2016 14:04	AMC
	Surrogate Recoveries	**Result**			**Acceptance Range**					
19719-28-9	*Surrogate: 2,4-Dichlorophenylacetic acia*	*52.0 %*			*30-150*					

Herbicides, TCLP Target List

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 3535A/1311

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
93-72-1	2,4,5-TP (Silvex)	ND		ug/L	5.00	1	EPA 8151A/1311	05/09/2016 07:50	05/09/2016 15:22	AMC
94-75-7	2,4-D	ND		ug/L	5.00	1	EPA 8151A/1311	05/09/2016 07:50	05/09/2016 15:22	AMC
	Surrogate Recoveries	**Result**			**Acceptance Range**					
19719-28-9	*Surrogate: 2,4-Dichlorophenylacetic acia*	*86.6 %*			*30-150*					

Sample Information

Client Sample ID: **1252160504-04** **York Sample ID:** **16E0136-04**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 11:45 am	05/04/2016

Extractable Total Petroleum Hydrocarbons (ETPH)

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 3545A

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
CT ETPH	**ETPH (Extractable Total Petroleum Hydrocarbons)**	**234**		mg/kg dry	12.7	1	CT DEP ETPH	05/06/2016 07:12	05/07/2016 04:29	AMC
	Surrogate Recoveries	**Result**		**Acceptance Range**						
3386-33-2	*Surrogate: 1-Chlorooctadecane*	*89.7 %*		*50-150*						

Metals, RCRA

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 3050B

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
7440-38-2	**Arsenic**	**5.40**		mg/kg dry	1.27	1	EPA 6010C	05/05/2016 10:13	05/06/2016 05:36	KV
7440-39-3	**Barium**	**32.0**		mg/kg dry	1.27	1	EPA 6010C	05/05/2016 10:13	05/06/2016 05:36	KV
7440-43-9	Cadmium	ND		mg/kg dry	0.382	1	EPA 6010C	05/05/2016 10:13	05/06/2016 05:36	KV
7440-47-3	**Chromium**	**36.0**		mg/kg dry	0.637	1	EPA 6010C	05/05/2016 10:13	05/06/2016 05:36	KV
7439-92-1	**Lead**	**31.1**		mg/kg dry	0.382	1	EPA 6010C	05/05/2016 10:13	05/06/2016 05:36	KV
7782-49-2	Selenium	ND		mg/kg dry	1.27	1	EPA 6010C	05/05/2016 10:13	05/06/2016 05:36	KV
7440-22-4	Silver	ND		mg/kg dry	0.637	1	EPA 6010C	05/05/2016 10:13	05/06/2016 05:36	KV

Metals, TCLP RCRA

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 3015A/1311

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
7440-38-2	Arsenic	ND		mg/L	0.004	1	EPA 6010C/1311	05/09/2016 11:24	05/10/2016 04:30	KV
7440-39-3	**Barium**	**1.43**		mg/L	0.011	1	EPA 6010C/1311	05/09/2016 11:24	05/10/2016 04:30	KV
7440-43-9	Cadmium	ND		mg/L	0.003	1	EPA 6010C/1311	05/09/2016 11:24	05/10/2016 04:30	KV
7440-47-3	**Chromium**	**0.018**		mg/L	0.006	1	EPA 6010C/1311	05/09/2016 11:24	05/10/2016 04:30	KV
7439-92-1	**Lead**	**0.050**		mg/L	0.003	1	EPA 6010C/1311	05/09/2016 11:24	05/10/2016 04:30	KV
7782-49-2	**Selenium**	**0.015**	M-SeTC	mg/L	0.011	1	EPA 6010C/1311	05/09/2016 11:24	05/10/2016 04:30	KV
7440-22-4	Silver	ND		mg/L	0.006	1	EPA 6010C/1311	05/09/2016 11:24	05/10/2016 04:30	KV

Mercury by 7473

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 7473 soil

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
7439-97-6	**Mercury**	**0.209**		mg/kg dry	0.0382	1	EPA 7473	05/05/2016 06:04	05/05/2016 17:38	ALD

Mercury TCLP by 7473

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 7473 water

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
7439-97-6	Mercury	ND		mg/L	0.000200	1	EPA 7473/1311	05/06/2016 12:06	05/09/2016 12:26	ALD

Ignitability

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: Analysis Preparation

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst

Sample Information

Client Sample ID: **1252160504-04** **York Sample ID:** **16E0136-04**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 11:45 am	05/04/2016

Ignitability

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: Analysis Preparation

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	Ignitability	Non-Ignit.		-	1	1	EPA 1030P	05/10/2016 01:11	05/10/2016 01:56	AA

Paint Filter Test

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: Analysis Preparation

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	Paint Filter Test	No Free Liquid		-	0	1	EPA 9095A	05/10/2016 18:43	05/11/2016 02:31	AA

Total Solids

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: % Solids Prep

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
solids	**% Solids**	**78.5**		%	0.100	1	SM 2540G	05/09/2016 11:51	05/10/2016 13:22	TJM

Cyanide, Total

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: Analysis Preparation Soil

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
57-12-5	Cyanide, total	ND		mg/kg dry	0.637	1	EPA 9014/9010C	05/10/2016 08:32	05/10/2016 14:43	LAB

pH

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: Analysis Preparation

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	pH	**7.12**		pH units	0.500	1	EPA 9045D	05/10/2016 13:49	05/10/2016 13:49	TJM

Reactivity-Cyanide

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: Analysis Preparation

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	Reactivity - Cyanide	ND		mg/kg	0.250	1	EPA SW-846 Ch.7.3.3	05/11/2016 10:09	05/11/2016 10:11	AD

Reactivity-Sulfide

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: Analysis Preparation

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	Reactivity - Sulfide	ND		mg/kg	15.0	1	EPA SW-846 Ch.7.3.4	05/11/2016 10:10	05/11/2016 10:11	AD

TCLP Extraction for METALS EPA 1311

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA SW 846-1311 TCLP ext. for metals

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	TCLP Extraction	Completed		N/A	1.00	1	EPA 1311	05/04/2016 20:45	05/05/2016 15:26	TJM

TCLP Extraction for SVOCS/PEST/HERB

Log-in Notes: **Sample Notes:**

Sample Information

Client Sample ID: **1252160504-04**

York Sample ID: **16E0136-04**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Sediment	May 4, 2016 11:45 am	05/04/2016

Sample Prepared by Method: EPA SW 846-1311 TCLP extr. for SVOA/PEST/HERBS

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	TCLP Extraction	Completed		N/A	1.00	1	EPA 1311	05/04/2016 20:47	05/05/2016 15:26	TJM

TCLP Extraction for VOA by EPA 1311 ZHE

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA SW 846-1311 TCLP ZHE for VOA

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	TCLP Extraction	Completed		%	1.00	1	EPA 1311	05/04/2016 20:48	05/05/2016 15:26	TJM

Sample Information

Client Sample ID: **1252160504-05**

York Sample ID: **16E0136-05**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Soil	May 4, 2016 12:00 pm	05/04/2016

Volatile Organics, CT RCP List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
630-20-6	1,1,1,2-Tetrachloroethane	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
71-55-6	1,1,1-Trichloroethane	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
79-34-5	1,1,2,2-Tetrachloroethane	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
79-00-5	1,1,2-Trichloroethane	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
75-34-3	1,1-Dichloroethane	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
75-35-4	1,1-Dichloroethylene	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
563-58-6	1,1-Dichloropropylene	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
87-61-6	1,2,3-Trichlorobenzene	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
96-18-4	1,2,3-Trichloropropane	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
120-82-1	1,2,4-Trichlorobenzene	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
95-63-6	1,2,4-Trimethylbenzene	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
96-12-8	1,2-Dibromo-3-chloropropane	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
106-93-4	1,2-Dibromoethane	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
95-50-1	1,2-Dichlorobenzene	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
107-06-2	1,2-Dichloroethane	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
78-87-5	1,2-Dichloropropane	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
108-67-8	1,3,5-Trimethylbenzene	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
541-73-1	1,3-Dichlorobenzene	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
142-28-9	1,3-Dichloropropane	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
106-46-7	1,4-Dichlorobenzene	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
594-20-7	2,2-Dichloropropane	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
78-93-3	2-Butanone	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
95-49-8	2-Chlorotoluene	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
591-78-6	2-Hexanone	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK

Sample Information

Client Sample ID: 1252160504-05 **York Sample ID:** 16E0136-05

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Soil	May 4, 2016 12:00 pm	05/04/2016

Volatile Organics, CT RCP List

Sample Prepared by Method: EPA 5035A

Log-in Notes:

Sample Notes:

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
106-43-4	4-Chlorotoluene	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
108-10-1	4-Methyl-2-pentanone	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
67-64-1	Acetone	ND		ug/kg wet	1000	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
107-13-1	Acrylonitrile	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
71-43-2	Benzene	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
108-86-1	Bromobenzene	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
74-97-5	Bromochloromethane	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
75-27-4	Bromodichloromethane	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
75-25-2	Bromoform	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
74-83-9	Bromomethane	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
75-15-0	Carbon disulfide	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
56-23-5	Carbon tetrachloride	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
108-90-7	Chlorobenzene	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
75-00-3	Chloroethane	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
67-66-3	Chloroform	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
74-87-3	Chloromethane	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
156-59-2	cis-1,2-Dichloroethylene	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
10061-01-5	cis-1,3-Dichloropropylene	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
124-48-1	Dibromochloromethane	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
74-95-3	Dibromomethane	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
75-71-8	Dichlorodifluoromethane	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
100-41-4	Ethyl Benzene	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
87-68-3	Hexachlorobutadiene	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
98-82-8	Isopropylbenzene	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
80-62-6	Methyl Methacrylate	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
1634-04-4	Methyl tert-butyl ether (MTBE)	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
75-09-2	Methylene chloride	ND		ug/kg wet	1000	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
91-20-3	Naphthalene	ND		ug/kg wet	1000	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
104-51-8	n-Butylbenzene	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
103-65-1	n-Propylbenzene	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
95-47-6	o-Xylene	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
179601-23-1	p- & m- Xylenes	ND		ug/kg wet	1000	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
99-87-6	p-Isopropyltoluene	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
135-98-8	sec-Butylbenzene	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
100-42-5	Styrene	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
98-06-6	tert-Butylbenzene	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
127-18-4	Tetrachloroethylene	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
109-99-9	Tetrahydrofuran	ND		ug/kg wet	1000	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
108-88-3	Toluene	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
156-60-5	trans-1,2-Dichloroethylene	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
10061-02-6	trans-1,3-Dichloropropylene	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
110-57-6	trans-1,4-dichloro-2-butene	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
79-01-6	Trichloroethylene	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK

Sample Information

Client Sample ID: **1252160504-05** **York Sample ID:** **16E0136-05**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Soil	May 4, 2016 12:00 pm	05/04/2016

Volatile Organics, CT RCP List

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
75-69-4	Trichlorofluoromethane	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK
75-01-4	Vinyl Chloride	ND		ug/kg wet	500	100	EPA 8260C	05/09/2016 08:20	05/09/2016 14:11	BK

	Surrogate Recoveries	Result	Acceptance Range
17060-07-0	*Surrogate: 1,2-Dichloroethane-d4*	*94.3 %*	*70-130*
2037-26-5	*Surrogate: Toluene-d8*	*95.1 %*	*70-130*
460-00-4	*Surrogate: p-Bromofluorobenzene*	*95.8 %*	*70-130*

Sample Information

Client Sample ID: **1252160504-06** **York Sample ID:** **16E0136-06**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Soil	May 4, 2016 12:05 pm	05/04/2016

Volatile Organics, CT RCP List

Log-in Notes: **Sample Notes:**

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
630-20-6	1,1,1,2-Tetrachloroethane	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
71-55-6	1,1,1-Trichloroethane	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
79-34-5	1,1,2,2-Tetrachloroethane	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
79-00-5	1,1,2-Trichloroethane	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
75-34-3	1,1-Dichloroethane	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
75-35-4	1,1-Dichloroethylene	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
563-58-6	1,1-Dichloropropylene	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
87-61-6	1,2,3-Trichlorobenzene	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
96-18-4	1,2,3-Trichloropropane	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
120-82-1	1,2,4-Trichlorobenzene	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
95-63-6	1,2,4-Trimethylbenzene	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
96-12-8	1,2-Dibromo-3-chloropropane	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
106-93-4	1,2-Dibromoethane	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
95-50-1	1,2-Dichlorobenzene	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
107-06-2	1,2-Dichloroethane	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
78-87-5	1,2-Dichloropropane	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
108-67-8	1,3,5-Trimethylbenzene	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
541-73-1	1,3-Dichlorobenzene	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
142-28-9	1,3-Dichloropropane	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
106-46-7	1,4-Dichlorobenzene	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
594-20-7	2,2-Dichloropropane	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
78-93-3	2-Butanone	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
95-49-8	2-Chlorotoluene	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK

Sample Information

Client Sample ID:	**1252160504-06**	**York Sample ID:**	**16E0136-06**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Soil	May 4, 2016 12:05 pm	05/04/2016

Volatile Organics, CT RCP List **Log-in Notes:** **Sample Notes:**

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
591-78-6	2-Hexanone	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
106-43-4	4-Chlorotoluene	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
108-10-1	4-Methyl-2-pentanone	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
67-64-1	Acetone	ND	SCAL-E	ug/kg wet	10	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
107-13-1	Acrylonitrile	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
71-43-2	Benzene	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
108-86-1	Bromobenzene	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
74-97-5	Bromochloromethane	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
75-27-4	Bromodichloromethane	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
75-25-2	Bromoform	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
74-83-9	Bromomethane	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
75-15-0	Carbon disulfide	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
56-23-5	Carbon tetrachloride	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
108-90-7	Chlorobenzene	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
75-00-3	Chloroethane	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
67-66-3	Chloroform	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
74-87-3	Chloromethane	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
156-59-2	cis-1,2-Dichloroethylene	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
10061-01-5	cis-1,3-Dichloropropylene	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
124-48-1	Dibromochloromethane	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
74-95-3	Dibromomethane	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
75-71-8	Dichlorodifluoromethane	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
100-41-4	Ethyl Benzene	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
87-68-3	Hexachlorobutadiene	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
98-82-8	Isopropylbenzene	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
80-62-6	Methyl Methacrylate	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
1634-04-4	Methyl tert-butyl ether (MTBE)	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
75-09-2	Methylene chloride	ND		ug/kg wet	10	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
91-20-3	Naphthalene	ND		ug/kg wet	10	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
104-51-8	n-Butylbenzene	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
103-65-1	n-Propylbenzene	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
95-47-6	o-Xylene	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
179601-23-1	p- & m- Xylenes	ND		ug/kg wet	10	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
99-87-6	p-Isopropyltoluene	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
135-98-8	sec-Butylbenzene	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
100-42-5	Styrene	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
98-06-6	tert-Butylbenzene	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
127-18-4	Tetrachloroethylene	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
109-99-9	Tetrahydrofuran	ND		ug/kg wet	10	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
108-88-3	Toluene	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
156-60-5	trans-1,2-Dichloroethylene	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
10061-02-6	trans-1,3-Dichloropropylene	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
110-57-6	trans-1,4-dichloro-2-butene	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK

Sample Information

Client Sample ID: **1252160504-06** | **York Sample ID:** **16E0136-06**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
16E0136	20130554.A30	Soil	May 4, 2016 12:05 pm	05/04/2016

Volatile Organics, CT RCP List

Sample Prepared by Method: EPA 5035A

Log-in Notes:

Sample Notes:

CAS No.	Parameter	Result	Flag	Units	RL	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
79-01-6	Trichloroethylene	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
75-69-4	Trichlorofluoromethane	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK
75-01-4	Vinyl Chloride	ND		ug/kg wet	5.0	1	EPA 8260C	05/09/2016 08:20	05/09/2016 14:41	BK

	Surrogate Recoveries	Result	Acceptance Range
17060-07-0	*Surrogate: 1,2-Dichloroethane-d4*	*95.3 %*	*70-130*
2037-26-5	*Surrogate: Toluene-d8*	*99.2 %*	*70-130*
460-00-4	*Surrogate: p-Bromofluorobenzene*	*95.9 %*	*70-130*

REASONABLE CONFIDENCE PROTOCOL

LABORATORY ANALYSIS QA/QC CERTIFICATION FORM

Laboratory Name: York Analytical Laboratories, Inc.
Client: Fuss & ONeill, Inc.
Project Location: 20130554.A30
Lab Project No.: **16E0136**
Laboratory Sample ID(s): 16E0136-01 - 16E0136-06
Sampling Date(s): 05/04/2016 - 05/04/2016
RCP Methods Used: See Narrative and Method Reference Section of this Technical Report

1	For each analytical method referenced in this laboratory report package, were all specified QA/QC performance criteria followed (including the requirement to explain any criteria falling outside of acceptable guidelines, as specified in the CT DEP RCPs)?	YES
1A	Were the method specified preservation and holding time requirements met?	YES
1B	VPH and EPH Methods only: Was the VPH or EPH method conducted without significant modifications (see Section 11.3 of respective RCP methods)?	NR
2	Were all samples received by the laboratory in a condition consistent with that described on the associated chain-of-custody document(s)?	YES
3	Were samples received at an appropriate temperature (<6°C)?	YES
4	Were all QA/QC performance criteria specified in the CTDEP Reasonable Confidence Protocol documents achieved?	NO
5A	Were reporting limits specified or referenced on the chain-of-custody?	YES
5B	Were these reporting limits met?	YES
6	For each analytical method referenced in this laboratory report package, were results reported for all constituents identified in the method-specific analyte lists presented in the Reasonable Confidence Protocol documents?	NO
7	Are project-specific matrix spikes and laboratory duplicates included in this data set?	NO

Notes: For all questions to which the response was "No" (with the exception of question #7), additional information must be provided in an attached narrative. If the answer to questions #1, #1A, or #1B is "No", the data package does not meet the requirements for "Reasonable Confidence".
This form mav not be altered and all questions must be answered.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete.

Authorized Signature:
Position: Laboratory Director
Printed Name: Benjamin Gulizia
Date: 05/16/2016

YORK

Case Narrative

Client:Fuss & ONeill, Inc.
Client Project ID: 20130554.A30
Prepared for: Gregory Toothill

Introduction

This Case Narrative applies to the following samples submitted to our laboratory on **05/04/2016 13:50**:

Sample Name	Matrix
1252160504-01	**Soil**
1252160504-02	**Soil**
1252160504-03	**Soil**
1252160504-04	**Soil**
1252160504-05	**Soil**
1252160504-06	**Soil**

The 6 sample(s) were received intact in a custody-sealed cooler unless otherwise noted. Upon receipt, cooler temperature(s) was determined using a NIST traceable digital infrared thermometer. The cooler temperature was acceptable (2-6ºC) and documented as:

Cooler	Temp C°
Default Cooler	3.0

Chain-of-custody was maintained from receipt through analysis in the laboratory.

Methodology

Preparation and analysis were conducted according to the SW-846 methods, as detailed in the sample information table, and the requirements of the State of Connecticut Reasonable Confidence Protocols (RCP).

For initial calibrations (ICAL), initial calibration verifications (ICV) and continuing calibration verifications (CCV) for organics determined by GC/MS methods (TO15 volatiles, 8260 volatiles and 8270 semi-volatiles) all method criteria and laboratory SOP criteria were met unless otherwise noted below. Any compounds in the ICAL, ICV or CCV exceeding RCP specified limits are available upon request. This data is not used for Data Quality Assessment or Data Usability Evaluation (assignment of compound bias) which are determined from other lines of evidence. Therefore the data is not detailed in this narrative.

These terms may be used interchangeably. Both are measures of the accuracy of an analysis by measurement of a known material from a source other than that used for calibration. By definition, a **Standard Reference Material (SRM)** is a material containing known levels of analytes used to evaluate the performance of the analytical system with respect to a defined set of acceptance criteria. It is processed exactly as a sample. An **LCS (Laboratory Control Sample)** is second-source standard containing known levels of analyte(s), treated exactly as a sample, run with each analytical batch. Both are metrics used to establish accuracy of the preparation/analysis methods.

Volatile Organics - Total (RCP List)

No problems were encountered with analysis of the samples, other than detailed below. Analysis acceptance criteria were achieved and the reporting requirements as detailed in the RCP protocols for volatiles by method 8260 dated July, 2006, Version 3.0, pages 8 through 11 are included herein.

Calibration

Initial Calibration
In the initial calibration for volatiles quantitation method V2C00373, Acetone, 2-Butanone, Tetrahydrofuran and 2-Hexanone exceeded 15% RSD. All samples were quantitated using this method.

Initial Calibration Verification
In the initial calibration verification for analytical method V2C00373, all target compounds recovered within 80-120% window.

Continuing Calibration Verification
In the continuing calibration verification affecting all samples, all target compounds recovered within 30% difference.

Batch QC

Method Blank
No target compounds were detected at or above the RL in the method blanks.

Laboratory Control Sample (LCS) or Standard Reference Material (SRM)
One LCS/LCS Dup set was run as a batch QC for this project. Please refer to the Quality Control Data attached to this report for bias information.

Matrix Spike, Matrix Spike Duplicate and/or Sample Duplicate
No site specific MS/MSD was run for this work order.

Sample Issues

Dilutions
Sample “1252160504-05” was reported with a 100x dilution factor. The sample was a methanol Trip Blank.

Internal Standards/Surrogates
Internal Standards Issues
No problems were encountered.

Surrogate Issues
No problems were encountered.

Volatile Organics – TCLP (RCRA List)

No problems were encountered with analysis of the samples, other than detailed below. Analysis acceptance criteria were achieved and the reporting requirements as detailed in the RCP protocols for volatiles by method 8260 dated July, 2006, Version 3.0, pages 8 through 11 are included herein.

Calibration

Initial Calibration
In the initial calibration for volatiles quantitation method V3C00259, 2-Butanone, Bromoform, 1,2-Dibromo-3-Chloropropane exceeded 15% RSD. All samples were quantitated using this method.

Initial Calibration Verification
In the initial calibration verification for analytical method V3C00259, all target compounds recovered within 80-120% window.

Continuing Calibration Verification
In the continuing calibration verification affecting all samples, all target compounds recovered within 30% difference.

Batch QC

Method Blank
No target compounds were detected at or above the RL in the method blanks.

Laboratory Control Sample (LCS) or Standard Reference Material (SRM)
One LCS/LCS Dup set was run as a batch QC for this project. Please refer to the Quality Control Data attached to this report for bias information.

Matrix Spike, Matrix Spike Duplicate and/or Sample Duplicate
No site specific MS/MSD was run for this work order.

Sample Issues

Dilutions
No sample dilutions were required.

Internal Standards/Surrogates

Internal Standards Issues
No problems were encountered.

Surrogate Issues
No problems were encountered.

Semi-Volatile Organics – Total (BNA List)

No problems were encountered with analysis of the samples, other than detailed below. Analysis acceptance criteria were achieved and the reporting requirements as detailed in the RCP protocols for volatiles by method 8270 dated July, 2006, Version 3.0. are included herein.

Calibration

Initial Calibration

In the initial calibration for semi-volatiles quantitation method BNA3M227, 2-Nitrophenol, 2,4-Dichlorophenol, Naphthalene, 4-Chloroaniline, Hexachlorobutadiene, 2-Methylnaphthalene, Acenaphthene, 2,4-Dinitrophenol, Dibenzofuran, Fluorene, 4-Chlorophenyl-phenylether, 4-Nitroaniline, 4,6-Dinitro-2-methylphenol, Anthracene, Bis(2-ethylhexyl)phthalate, Benzo(a) anthracene exceeded 15% RSD. All samples were quantitated using this method.

Initial Calibration Verification

In the initial calibration verification for analytical method BNA3M227, all target compounds recovered within the 80-120% window.

Continuing Calibration Verification

In the continuing calibration verification affecting all samples, 4-Nitrophenol, 4-Nitroaniline, Pentachlorophenol, Carbazole, Bis(2-ethylhexyl)phthalate and Di-n-octyl phthalate exceeded 30% difference.

Batch QC

Method Blank

No target compounds were detected at or above the RL.

Laboratory Control Sample (LCS) or Standard Reference Material (SRM)

One LCS/LCS Dup set was run as a batch QC for this project. Please refer to the Quality Control Data attached to this report for bias information.

Matrix Spike, Matrix Spike Duplicate and/or Sample Duplicate

No site specific MS/MSD was run for this work order.

Sample Issues

Dilutions

No sample dilutions were required.

Internal Standards/Surrogates

Internal Standards Issues

No problems were encountered.

Surrogate Issues

No problems were encountered.

Semi-Volatile Organics – TCLP (RCRA List)

No problems were encountered with analysis of the samples, other than detailed below. Analysis acceptance criteria were achieved and the reporting requirements as detailed in the RCP protocols for volatiles by method 8270 dated July, 2006, Version 3.0. are included herein.

Calibration

Initial Calibration

In the initial calibration for semi-volatiles quantitation method BNA4M450, 2,4,6-Trichlorophenol, 2,4-Dinitrotoluene and Pentachlorophenol exceeded 15% RSD. All samples were quantitated using this method.

Initial Calibration Verification

In the initial calibration verification for analytical method BNA4M450, 2,4,6-Trichlorophenol, 2,4-Dinitrotoluene, Hexachlorobutadiene and Pentachlorophenol exceeded the 80-120% window.

Continuing Calibration Verification

In the continuing calibration verification affecting all samples, 2,4-Dinitrotoluene, Hexachlorobutadiene exceeded 30% difference.

Batch QC

Method Blank

No target compounds were detected at or above the RL.

Laboratory Control Sample (LCS) or Standard Reference Material (SRM)

One LCS/LCS Dup set was run as a batch QC for this project. Please refer to the Quality Control Data attached to this report for bias information.

Matrix Spike, Matrix Spike Duplicate and/or Sample Duplicate

No site specific MS/MSD was run for this work order.

Sample Issues

Dilutions

No sample dilutions were required.

Internal Standards/Surrogates

Internal Standards Issues

The internal standard compound Perylene-d12 recovered outside the method acceptance limits in all samples. This is likely due to a sample matrix effect. Sample was rerun to confirm matrix effects. The Internal Standard compound is flagged “IS-06” accordingly.

The internal standard compound Chrysene-d12 recovered outside the method acceptance limits in sample “1252160504-01” The Internal Standard compound is flagged “IS-08” accordingly.

Surrogate Issues

No problems were encountered.

ETPH – Total

No problems were encountered during analysis of the samples, other than detailed below.

Batch QC

Method Blank

No target analyte was detected at or above the RL.

Laboratory Control Sample (LCS) or Standard Reference Material (SRM)

One LCS/LCS Dup set was run as a batch QC for this project. Please refer to the Quality Control Data attached to this report for bias information.

Matrix Spike, Matrix Spike Duplicate and/or Sample Duplicate

No site specific MS/MSD was run for this work order.

Sample Issues

Dilutions

No sample dilutions were required.

Internal Standards and/or Surrogates

Surrogate Issues

No problems were encountered.

<u>Pesticides – Total (RCP List)</u>

No problems were encountered during analysis of the samples, other than detailed below.

Batch QC

Method Blank

No target analyte was detected at or above the RL.

Laboratory Control Sample (LCS) or Standard Reference Material (SRM)

One LCS/LCS Dup set was run as a batch QC for this project. Please refer to the Quality Control Data attached to this report for bias information.

Matrix Spike, Matrix Spike Duplicate and/or Sample Duplicate

The surrogate compounds Tetrachloro-m-xylene recovered outside QC limits for sample “1252160504-03”. The data was accepted based on valid recovery of the alternate surrogate. The surrogate compound is flagged “GC-Surr” accordingly.

Sample Issues

Dilutions

No sample dilutions were required.

Internal Standards and/or Surrogates

Surrogate Issues

No problems were encountered.

<u>Pesticides – TCLP (RCRA List)</u>

No problems were encountered during analysis of the samples, other than detailed below.

Batch QC

Method Blank

No target analyte was detected at or above the RL.

Laboratory Control Sample (LCS) or Standard Reference Material (SRM)
One LCS/LCS Dup set was run as a batch QC for this project. Please refer to the Quality Control Data attached to this report for bias information.

Matrix Spike, Matrix Spike Duplicate and/or Sample Duplicate
No problems were encountered.

Sample Issues
Dilutions
No sample dilutions were required.

Internal Standards and/or Surrogate
Surrogate Issues
No problems were encountered.

PCB – Total (RCP List)

No problems were encountered during analysis of the samples, other than detailed below.

Batch QC
Method Blank
No target analyte was detected at or above the RL.

Laboratory Control Sample (LCS) or Standard Reference Material (SRM)
One LCS/LCS Dup set was run as a batch QC for this project. Please refer to the Quality Control Data attached to this report for bias information.

Matrix Spike, Matrix Spike Duplicate and/or Sample Duplicate
No site specific MS/MSD was run for this work order.

Sample Issues
Dilutions
No sample dilutions were required.

Internal Standards and/or Surrogates
Surrogate Issues
No problems were encountered.

Herbicides – Total (RCP List)

No problems were encountered during analysis of the samples, other than detailed below.

Batch QC
Method Blank
No target analyte was detected at or above the RL.

Laboratory Control Sample (LCS) or Standard Reference Material (SRM)
One LCS/LCS Dup set was run as a batch QC for this project. Please refer to the Quality Control Data attached to this report for bias information.

Matrix Spike, Matrix Spike Duplicate and/or Sample Duplicate
No site specific MS/MSD was run for this work order.

Sample Issues
Dilutions
No sample dilutions were required.

Internal Standards and/or Surrogates
Surrogate Issues
No problems were encountered.

Herbicides – TCLP

No problems were encountered during analysis of the samples, other than detailed below.

Batch QC
Method Blank
No target analyte was detected at or above the RL.

Laboratory Control Sample (LCS) or Standard Reference Material (SRM)
One LCS/LCS Dup set was run as a batch QC for this project. Please refer to the Quality Control Data attached to this report for bias information.

Matrix Spike, Matrix Spike Duplicate and/or Sample Duplicate
No site specific MS/MSD was run for this work order.

Sample Issues
Dilutions
No sample dilutions were required.

Internal Standards and/or Surrogates
Surrogate Issues
No problems were encountered.

Metals – Total (RCRA List, excluding Mercury)

No problems were encountered during analysis of the samples, other than detailed below.

Batch QC
Method Blank
No target analyte was detected at or above the RL.

Laboratory Control Sample (LCS) or Standard Reference Material (SRM)
One Standard Reference Material was run as a batch QC for this project. Please refer to the Quality Control Data attached to this report for bias information.

Matrix Spike, Matrix Spike Duplicate and/or Sample Duplicate
No site specific MS/MSD was run for this work order.

Sample Issues

Dilutions
No sample dilutions were required.

Metals – TCLP (RCRA List, excluding Mercury)

No problems were encountered during analysis of the samples, other than detailed below.

Batch QC

Method Blank
No target analyte was detected at or above the RL.

Laboratory Control Sample (LCS) or Standard Reference Material (SRM)
One Standard Reference Material was run as a batch QC for this project. Please refer to the Quality Control Data attached to this report for bias information.

Matrix Spike, Matrix Spike Duplicate and/or Sample Duplicate
No site specific MS/MSD was run for this work order.

Sample Issues

Dilutions
No sample dilutions were required.

Mercury- Total

No problems were encountered during analysis of the samples, other than detailed below.

Batch QC

Method Blank
No target analyte was detected at or above the RL.

Laboratory Control Sample (LCS) or Standard Reference Material (SRM)
One Standard Reference Material was run as a batch QC for this project. Please refer to the Quality Control Data attached to this report for bias information.

Matrix Spike, Matrix Spike Duplicate and/or Sample Duplicate
No site specific MS/MSD was run for this work order.

Sample Issues

Dilutions
No sample dilutions were required.

Mercury- TCLP

No problems were encountered during analysis of the samples, other than detailed below.

Batch QC

Method Blank
No target analyte was detected at or above the RL.

Laboratory Control Sample (LCS) or Standard Reference Material (SRM)
One Standard Reference Material was run as a batch QC for this project. Please refer to the Quality Control Data attached to this report for bias information.

Matrix Spike, Matrix Spike Duplicate and/or Sample Duplicate
No site specific MS/MSD was run for this work order.

Sample Issues
Dilutions
No sample dilutions were required.

Cyanide- Total

No problems were encountered during analysis of the samples, other than detailed below.

Batch QC
Method Blank
No target analyte was detected at or above the RL.

Laboratory Control Sample (LCS) or Standard Reference Material (SRM)
One Standard Reference Material was run as a batch QC for this project. Please refer to the Quality Control Data attached to this report for bias information.

Matrix Spike, Matrix Spike Duplicate and/or Sample Duplicate
No site specific MS/MSD was run for this work order.

Sample Issues
Dilutions
No sample dilutions were required.

Analytical Batch Summary

Batch ID: BE60194 **General Method:** Wet Chemistry Parameters
Prep Method: EPA SW 846-1311 TCLP ext. for metals

YORK Sample ID	Client Sample ID	Preparation Date	Prepared By
16E0136-01	1252160504-01	05/04/16	TJM
16E0136-02	1252160504-02	05/04/16	TJM
16E0136-03	1252160504-03	05/04/16	TJM
16E0136-04	1252160504-04	05/04/16	TJM
BE60194-BLK1	Blank	05/04/16	TJM

Batch ID: BE60195 **General Method:** Wet Chemistry Parameters
Prep Method: EPA SW 846-1311 TCLP extr. for SVOA/PEST/HERBS

YORK Sample ID	Client Sample ID	Preparation Date	Prepared By
16E0136-01	1252160504-01	05/04/16	TJM
16E0136-02	1252160504-02	05/04/16	TJM
16E0136-03	1252160504-03	05/04/16	TJM
16E0136-04	1252160504-04	05/04/16	TJM
BE60195-BLK1	Blank	05/04/16	TJM

Batch ID: BE60196 **General Method:** Wet Chemistry Parameters
Prep Method: EPA SW 846-1311 TCLP ZHE for VOA

YORK Sample ID	Client Sample ID	Preparation Date	Prepared By
16E0136-01	1252160504-01	05/04/16	TJM
16E0136-02	1252160504-02	05/04/16	TJM
16E0136-03	1252160504-03	05/04/16	TJM
16E0136-04	1252160504-04	05/04/16	TJM
BE60196-BLK1	Blank	05/04/16	TJM

Batch ID: BE60207 **General Method:** Mercury by EPA 7000/200 Series Methods
Prep Method: EPA 7473 soil

YORK Sample ID	Client Sample ID	Preparation Date	Prepared By
16E0136-01	1252160504-01	05/05/16	ALD
16E0136-02	1252160504-02	05/05/16	ALD
16E0136-03	1252160504-03	05/05/16	ALD
16E0136-04	1252160504-04	05/05/16	ALD
BE60207-BLK1	Blank	05/05/16	ALD
BE60207-SRM1	Reference	05/05/16	ALD

Batch ID: BE60233 **General Method:** Metals by ICP
Prep Method: EPA 3050B

YORK Sample ID	Client Sample ID	Preparation Date	Prepared By
16E0136-01	1252160504-01	05/05/16	ALD
16E0136-02	1252160504-02	05/05/16	ALD
16E0136-03	1252160504-03	05/05/16	ALD
16E0136-04	1252160504-04	05/05/16	ALD
BE60233-BLK1	Blank	05/05/16	ALD
BE60233-SRM1	Reference	05/05/16	ALD

Batch ID: BE60279 **General Method:** Semivolatile Organic Compounds by GC/MS
Prep Method: EPA 3510C/1311

YORK Sample ID	Client Sample ID	Preparation Date	Prepared By
16E0136-01	1252160504-01	05/06/16	TFD
16E0136-02	1252160504-02	05/06/16	TFD
16E0136-03	1252160504-03	05/06/16	TFD
16E0136-04	1252160504-04	05/06/16	TFD
BE60279-BLK1	Blank	05/06/16	TFD
BE60279-BS1	LCS	05/06/16	TFD
BE60279-BSD1	LCS Dup	05/06/16	TFD

Batch ID: BE60287 **General Method:** Gas Chromatography/Flame Ionization Detector
Prep Method: EPA 3545A

YORK Sample ID	Client Sample ID	Preparation Date	Prepared By
16E0136-01	1252160504-01	05/06/16	KNN
16E0136-02	1252160504-02	05/06/16	KNN
16E0136-03	1252160504-03	05/06/16	KNN
16E0136-04	1252160504-04	05/06/16	KNN
BE60287-BLK1	Blank	05/06/16	KNN
BE60287-BS1	LCS	05/06/16	KNN
BE60287-BSD1	LCS Dup	05/06/16	KNN

Batch ID: BE60322 **General Method:** Mercury by EPA 7000/200 Series Methods
Prep Method: EPA 7473 water

YORK Sample ID	Client Sample ID	Preparation Date	Prepared By
16E0136-01	1252160504-01	05/06/16	ALD
16E0136-02	1252160504-02	05/06/16	ALD
16E0136-03	1252160504-03	05/06/16	ALD
16E0136-04	1252160504-04	05/06/16	ALD
BE60322-BLK1	Blank	05/06/16	ALD
BE60322-SRM1	Reference	05/06/16	ALD

Batch ID: BE60329 **General Method:** Organochlorine Pesticides by GC/ECD
Prep Method: EPA 3545A

YORK Sample ID	Client Sample ID	Preparation Date	Prepared By
16E0136-01	1252160504-01	05/06/16	MGL
16E0136-02	1252160504-02	05/06/16	MGL
16E0136-03	1252160504-03	05/06/16	MGL
16E0136-04	1252160504-04	05/06/16	MGL
BE60329-BLK1	Blank	05/06/16	MGL
BE60329-BS1	LCS	05/06/16	MGL
BE60329-BSD1	LCS Dup	05/06/16	MGL

Batch ID: BE60331 **General Method:** Organochlorine Pesticides by GC/ECD
Prep Method: EPA 3510C/1311

YORK Sample ID	Client Sample ID	Preparation Date	Prepared By
16E0136-01	1252160504-01	05/06/16	RDS
16E0136-02	1252160504-02	05/06/16	RDS
16E0136-03	1252160504-03	05/06/16	RDS
16E0136-04	1252160504-04	05/06/16	RDS
BE60331-BLK1	Blank	05/06/16	RDS
BE60331-BS1	LCS	05/06/16	RDS
BE60331-BSD1	LCS Dup	05/06/16	RDS

Batch ID: BE60336 **General Method:** Volatile Organic Compounds by GC/MS
Prep Method: EPA 5030B/1311

YORK Sample ID	Client Sample ID	Preparation Date	Prepared By
16E0136-01	1252160504-01	05/06/16	OW
16E0136-02	1252160504-02	05/06/16	OW
16E0136-03	1252160504-03	05/06/16	OW
16E0136-04	1252160504-04	05/06/16	OW
BE60336-BLK1	Blank	05/06/16	OW
BE60336-BLK2	Blank	05/06/16	OW
BE60336-BS1	LCS	05/06/16	OW
BE60336-BSD1	LCS Dup	05/06/16	OW

Batch ID: BE60360 **General Method:** Chlorinated Herbicides by GC/ECD
Prep Method: EPA 3535A/1311

YORK Sample ID	Client Sample ID	Preparation Date	Prepared By
16E0136-01	1252160504-01	05/09/16	CM
16E0136-02	1252160504-02	05/09/16	CM
16E0136-03	1252160504-03	05/09/16	CM
16E0136-04	1252160504-04	05/09/16	CM
BE60360-BLK1	Blank	05/09/16	CM
BE60360-BS1	LCS	05/09/16	CM
BE60360-BSD1	LCS Dup	05/09/16	CM

Batch ID: BE60361 **General Method:** Chlorinated Herbicides by GC/ECD
Prep Method: EPA 3550B/8151A

YORK Sample ID	Client Sample ID	Preparation Date	Prepared By
16E0136-01	1252160504-01	05/09/16	CM
16E0136-02	1252160504-02	05/09/16	CM
16E0136-03	1252160504-03	05/09/16	CM
16E0136-04	1252160504-04	05/09/16	CM
BE60361-BLK1	Blank	05/09/16	CM
BE60361-BS1	LCS	05/09/16	CM
BE60361-BSD1	LCS Dup	05/09/16	CM

Batch ID: BE60368 **General Method:** Volatile Organic Compounds by GC/MS
Prep Method: EPA 5035A

YORK Sample ID	Client Sample ID	Preparation Date	Prepared By
16E0136-01	1252160504-01	05/09/16	BGS
16E0136-02	1252160504-02	05/09/16	BGS
16E0136-03	1252160504-03	05/09/16	BGS
16E0136-04	1252160504-04	05/09/16	BGS
16E0136-05	1252160504-05	05/09/16	BGS
16E0136-06	1252160504-06	05/09/16	BGS
BE60368-BLK1	Blank	05/09/16	BGS
BE60368-BLK2	Blank	05/09/16	BGS
BE60368-BS1	LCS	05/09/16	BGS
BE60368-BSD1	LCS Dup	05/09/16	BGS

Batch ID: BE60388 **General Method:** Metals by ICP
Prep Method: EPA 3015A/1311

YORK Sample ID	Client Sample ID	Preparation Date	Prepared By
16E0136-01	1252160504-01	05/09/16	ALD
16E0136-02	1252160504-02	05/09/16	ALD
16E0136-03	1252160504-03	05/09/16	ALD
16E0136-04	1252160504-04	05/09/16	ALD
BE60388-BLK1	Blank	05/09/16	ALD
BE60388-BLK2	Blank	05/09/16	ALD
BE60388-SRM1	Reference	05/09/16	ALD

Batch ID: BE60397 **General Method:** Miscellaneous Physical Parameters
Prep Method: % Solids Prep

YORK Sample ID	Client Sample ID	Preparation Date	Prepared By
16E0136-01	1252160504-01	05/09/16	TJM
16E0136-02	1252160504-02	05/09/16	TJM
16E0136-03	1252160504-03	05/09/16	TJM
16E0136-04	1252160504-04	05/09/16	TJM

Batch ID: BE60405 **General Method:** Semivolatile Organic Compounds by GC/MS
Prep Method: EPA 3546 SVOA

YORK Sample ID	Client Sample ID	Preparation Date	Prepared By
16E0136-01	1252160504-01	05/09/16	MGL
16E0136-02	1252160504-02	05/09/16	MGL
16E0136-03	1252160504-03	05/09/16	MGL
16E0136-04	1252160504-04	05/09/16	MGL
BE60405-BLK1	Blank	05/09/16	MGL
BE60405-BS1	LCS	05/09/16	MGL
BE60405-BSD1	LCS Dup	05/09/16	MGL

Batch ID: BE60433 **General Method:** Miscellaneous Physical Parameters
Prep Method: Analysis Preparation

YORK Sample ID	Client Sample ID	Preparation Date	Prepared By
16E0136-01	1252160504-01	05/10/16	AA
16E0136-02	1252160504-02	05/10/16	AA
16E0136-03	1252160504-03	05/10/16	AA
16E0136-04	1252160504-04	05/10/16	AA

Batch ID: BE60441 **General Method:** Polychlorinated Biphenyls by GC/ECD
Prep Method: EPA SW846-3540C

YORK Sample ID	Client Sample ID	Preparation Date	Prepared By
16E0136-01	1252160504-01	05/10/16	KNN
16E0136-02	1252160504-02	05/10/16	KNN
16E0136-03	1252160504-03	05/10/16	KNN
16E0136-04	1252160504-04	05/10/16	KNN
BE60441-BLK1	Blank	05/10/16	KNN
BE60441-BS1	LCS	05/10/16	KNN
BE60441-BSD1	LCS Dup	05/10/16	KNN

Batch ID: BE60454 **General Method:** Wet Chemistry Parameters
Prep Method: Analysis Preparation Soil

YORK Sample ID	Client Sample ID	Preparation Date	Prepared By
16E0136-01	1252160504-01	05/10/16	LAB
16E0136-02	1252160504-02	05/10/16	LAB
16E0136-03	1252160504-03	05/10/16	LAB
16E0136-04	1252160504-04	05/10/16	LAB
BE60454-BLK1	Blank	05/10/16	LAB
BE60454-SRM1	Reference	05/10/16	LAB

Batch ID: BE60477 **General Method:** Wet Chemistry Parameters
Prep Method: Analysis Preparation

YORK Sample ID	Client Sample ID	Preparation Date	Prepared By
16E0136-01	1252160504-01	05/10/16	TJM
16E0136-02	1252160504-02	05/10/16	TJM
16E0136-03	1252160504-03	05/10/16	TJM
16E0136-04	1252160504-04	05/10/16	TJM

Batch ID: BE60498 **General Method:** Miscellaneous Physical Parameters
Prep Method: Analysis Preparation

YORK Sample ID	Client Sample ID	Preparation Date	Prepared By
16E0136-01	1252160504-01	05/10/16	AA
16E0136-02	1252160504-02	05/10/16	AA
16E0136-03	1252160504-03	05/10/16	AA
16E0136-04	1252160504-04	05/10/16	AA

Batch ID: BE60535 **General Method:** Wet Chemistry Parameters
Prep Method: Analysis Preparation

YORK Sample ID	Client Sample ID	Preparation Date	Prepared By
16E0136-01	1252160504-01	05/11/16	AD
16E0136-02	1252160504-02	05/11/16	AD
16E0136-03	1252160504-03	05/11/16	AD
16E0136-04	1252160504-04	05/11/16	AD

Batch ID: BE60536 **General Method:** Wet Chemistry Parameters
Prep Method: Analysis Preparation

YORK Sample ID	Client Sample ID	Preparation Date	Prepared By
16E0136-01	1252160504-01	05/11/16	AD
16E0136-02	1252160504-02	05/11/16	AD
16E0136-03	1252160504-03	05/11/16	AD
16E0136-04	1252160504-04	05/11/16	AD

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BE60336 - EPA 5030B/1311											
Blank (BE60336-BLK1)							Prepared & Analyzed: 05/06/2016				
1,1-Dichloroethylene	ND	5.0	ug/L								
1,2-Dichloroethane	ND	5.0	"								
1,4-Dichlorobenzene	ND	5.0	"								
2-Butanone	ND	5.0	"								
Benzene	ND	5.0	"								
Carbon tetrachloride	ND	5.0	"								
Chlorobenzene	ND	5.0	"								
Chloroform	ND	5.0	"								
Tetrachloroethylene	ND	5.0	"								
Trichloroethylene	ND	5.0	"								
Vinyl Chloride	ND	5.0	"								
Surrogate: 1,2-Dichloroethane-d4	*49.3*		*"*	*50.0*		*98.5*	*65-135*				
Surrogate: p-Bromofluorobenzene	*46.8*		*"*	*50.0*		*93.6*	*81-114*				
Surrogate: Toluene-d8	*48.1*		*"*	*50.0*		*96.2*	*86-118*				
Blank (BE60336-BLK2)							Prepared: 05/06/2016 Analyzed: 05/07/2016				
1,1-Dichloroethylene	ND	50	ug/L								
1,2-Dichloroethane	ND	50	"								
1,4-Dichlorobenzene	ND	50	"								
2-Butanone	ND	50	"								
Benzene	ND	50	"								
Carbon tetrachloride	ND	50	"								
Chlorobenzene	ND	50	"								
Chloroform	ND	50	"								
Tetrachloroethylene	ND	50	"								
Trichloroethylene	ND	50	"								
Vinyl Chloride	ND	50	"								
Surrogate: 1,2-Dichloroethane-d4	*48.5*		*"*	*50.0*		*97.0*	*65-135*				
Surrogate: p-Bromofluorobenzene	*47.9*		*"*	*50.0*		*95.9*	*81-114*				
Surrogate: Toluene-d8	*49.7*		*"*	*50.0*		*99.4*	*86-118*				

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BE60336 - EPA 5030B/1311											
LCS (BE60336-BS1)							Prepared & Analyzed: 05/06/2016				
1,1-Dichloroethylene	56		ug/L	50.0		111	68-134				
1,2-Dichloroethane	53		"	50.0		106	69-133				
1,4-Dichlorobenzene	49		"	50.0		97.1	82-124				
2-Butanone	59		"	50.0		117	44-169				
Benzene	57		"	50.0		114	72-134				
Carbon tetrachloride	58		"	50.0		116	62-145				
Chlorobenzene	50		"	50.0		99.8	85-119				
Chloroform	57		"	50.0		114	74-131				
Tetrachloroethylene	55		"	50.0		109	78-133				
Trichloroethylene	51		"	50.0		103	81-125				
Vinyl Chloride	56		"	50.0		112	42-136				
Surrogate: 1,2-Dichloroethane-d4	*48.7*		*"*	*50.0*		*97.5*	*65-135*				
Surrogate: p-Bromofluorobenzene	*49.3*		*"*	*50.0*		*98.6*	*81-114*				
Surrogate: Toluene-d8	*48.5*		*"*	*50.0*		*97.1*	*86-118*				
LCS Dup (BE60336-BSD1)							Prepared & Analyzed: 05/06/2016				
1,1-Dichloroethylene	59		ug/L	50.0		119	68-134		6.48	30	
1,2-Dichloroethane	55		"	50.0		110	69-133		3.84	30	
1,4-Dichlorobenzene	50		"	50.0		99.9	82-124		2.86	30	
2-Butanone	62		"	50.0		125	44-169		6.00	30	
Benzene	58		"	50.0		115	72-134		1.07	30	
Carbon tetrachloride	62		"	50.0		125	62-145		6.83	30	
Chlorobenzene	51		"	50.0		101	85-119		1.45	30	
Chloroform	59		"	50.0		119	74-131		4.59	30	
Tetrachloroethylene	56		"	50.0		113	78-133		3.14	30	
Trichloroethylene	54		"	50.0		108	81-125		4.70	30	
Vinyl Chloride	59		"	50.0		118	42-136		5.35	30	
Surrogate: 1,2-Dichloroethane-d4	*47.3*		*"*	*50.0*		*94.6*	*65-135*				
Surrogate: p-Bromofluorobenzene	*49.4*		*"*	*50.0*		*98.8*	*81-114*				
Surrogate: Toluene-d8	*47.6*		*"*	*50.0*		*95.3*	*86-118*				

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag

Batch BE60368 - EPA 5035A

Blank (BE60368-BLK1) Prepared & Analyzed: 05/09/2016

1,1,1,2-Tetrachloroethane	ND	5.0	ug/kg wet
1,1,1-Trichloroethane	ND	5.0	"
1,1,2,2-Tetrachloroethane	ND	5.0	"
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	ND	5.0	"
1,1,2-Trichloroethane	ND	5.0	"
1,1-Dichloroethane	ND	5.0	"
1,1-Dichloroethylene	ND	5.0	"
1,1-Dichloropropylene	ND	5.0	"
1,2,3-Trichlorobenzene	ND	5.0	"
1,2,3-Trichloropropane	ND	5.0	"
1,2,4-Trichlorobenzene	ND	5.0	"
1,2,4-Trimethylbenzene	ND	5.0	"
1,2-Dibromo-3-chloropropane	ND	5.0	"
1,2-Dibromoethane	ND	5.0	"
1,2-Dichlorobenzene	ND	5.0	"
1,2-Dichloroethane	ND	5.0	"
1,2-Dichloropropane	ND	5.0	"
1,3,5-Trimethylbenzene	ND	5.0	"
1,3-Dichlorobenzene	ND	5.0	"
1,3-Dichloropropane	ND	5.0	"
1,4-Dichlorobenzene	ND	5.0	"
2,2-Dichloropropane	ND	5.0	"
2-Butanone	ND	5.0	"
2-Chlorotoluene	ND	5.0	"
2-Hexanone	ND	5.0	"
4-Chlorotoluene	ND	5.0	"
4-Methyl-2-pentanone	ND	5.0	"
Acetone	ND	10	"
Acrylonitrile	ND	5.0	"
Benzene	ND	5.0	"
Bromobenzene	ND	5.0	"
Bromochloromethane	ND	5.0	"
Bromodichloromethane	ND	5.0	"
Bromoform	ND	5.0	"
Bromomethane	ND	5.0	"
Carbon disulfide	ND	5.0	"
Carbon tetrachloride	ND	5.0	"
Chlorobenzene	ND	5.0	"
Chloroethane	ND	5.0	"
Chloroform	ND	5.0	"
Chloromethane	ND	5.0	"
cis-1,2-Dichloroethylene	ND	5.0	"
cis-1,3-Dichloropropylene	ND	5.0	"
Dibromochloromethane	ND	5.0	"
Dibromomethane	ND	5.0	"
Dichlorodifluoromethane	ND	5.0	"
Ethyl Benzene	ND	5.0	"
Hexachlorobutadiene	ND	5.0	"
Isopropylbenzene	ND	5.0	"
Methyl Methacrylate	ND	5.0	"
Methyl tert-butyl ether (MTBE)	ND	5.0	"

Batch BE60368 - EPA 5035A

Blank (BE60368-BLK1)

Prepared & Analyzed: 05/09/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Methylene chloride	ND	10	ug/kg wet								
Naphthalene	ND	10	"								
n-Butylbenzene	ND	5.0	"								
n-Propylbenzene	ND	5.0	"								
o-Xylene	ND	5.0	"								
p- & m- Xylenes	ND	10	"								
p-Isopropyltoluene	ND	5.0	"								
sec-Butylbenzene	ND	5.0	"								
Styrene	ND	5.0	"								
tert-Butylbenzene	ND	5.0	"								
Tetrachloroethylene	ND	5.0	"								
Tetrahydrofuran	ND	10	"								
Toluene	ND	5.0	"								
trans-1,2-Dichloroethylene	ND	5.0	"								
trans-1,3-Dichloropropylene	ND	5.0	"								
trans-1,4-dichloro-2-butene	ND	5.0	"								
Trichloroethylene	ND	5.0	"								
Trichlorofluoromethane	ND	5.0	"								
Vinyl Chloride	ND	5.0	"								
Surrogate: 1,2-Dichloroethane-d4	*46.6*		*ug/L*	*50.0*		*93.2*	*70-130*				
Surrogate: Toluene-d8	*49.6*		*"*	*50.0*		*99.1*	*70-130*				
Surrogate: p-Bromofluorobenzene	*47.8*		*"*	*50.0*		*95.6*	*70-130*				

Blank (BE60368-BLK2)

Prepared & Analyzed: 05/09/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
1,1,1,2-Tetrachloroethane	ND	5.0	ug/kg wet								
1,1,1-Trichloroethane	ND	5.0	"								
1,1,2,2-Tetrachloroethane	ND	5.0	"								
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113	ND	5.0	"								
1,1,2-Trichloroethane	ND	5.0	"								
1,1-Dichloroethane	ND	5.0	"								
1,1-Dichloroethylene	ND	5.0	"								
1,1-Dichloropropylene	ND	5.0	"								
1,2,3-Trichlorobenzene	ND	5.0	"								
1,2,3-Trichloropropane	ND	5.0	"								
1,2,4-Trichlorobenzene	ND	5.0	"								
1,2,4-Trimethylbenzene	ND	5.0	"								
1,2-Dibromo-3-chloropropane	ND	5.0	"								
1,2-Dibromoethane	ND	5.0	"								
1,2-Dichlorobenzene	ND	5.0	"								
1,2-Dichloroethane	ND	5.0	"								
1,2-Dichloropropane	ND	5.0	"								
1,3,5-Trimethylbenzene	ND	5.0	"								
1,3-Dichlorobenzene	ND	5.0	"								
1,3-Dichloropropane	ND	5.0	"								
1,4-Dichlorobenzene	ND	5.0	"								
2,2-Dichloropropane	ND	5.0	"								
2-Butanone	ND	5.0	"								
2-Chlorotoluene	ND	5.0	"								
2-Hexanone	ND	5.0	"								
4-Chlorotoluene	ND	5.0	"								
4-Methyl-2-pentanone	ND	5.0	"								

Batch BE60368 - EPA 5035A

Blank (BE60368-BLK2) Prepared & Analyzed: 05/09/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Acetone	ND	10	ug/kg wet								
Acrylonitrile	ND	5.0	"								
Benzene	ND	5.0	"								
Bromobenzene	ND	5.0	"								
Bromochloromethane	ND	5.0	"								
Bromodichloromethane	ND	5.0	"								
Bromoform	ND	5.0	"								
Bromomethane	ND	5.0	"								
Carbon disulfide	ND	5.0	"								
Carbon tetrachloride	ND	5.0	"								
Chlorobenzene	ND	5.0	"								
Chloroethane	ND	5.0	"								
Chloroform	ND	5.0	"								
Chloromethane	ND	5.0	"								
cis-1,2-Dichloroethylene	ND	5.0	"								
cis-1,3-Dichloropropylene	ND	5.0	"								
Dibromochloromethane	ND	5.0	"								
Dibromomethane	ND	5.0	"								
Dichlorodifluoromethane	ND	5.0	"								
Ethyl Benzene	ND	5.0	"								
Hexachlorobutadiene	ND	5.0	"								
Isopropylbenzene	ND	5.0	"								
Methyl Methacrylate	ND	5.0	"								
Methyl tert-butyl ether (MTBE)	ND	5.0	"								
Methylene chloride	ND	10	"								
Naphthalene	ND	10	"								
n-Butylbenzene	ND	5.0	"								
n-Propylbenzene	ND	5.0	"								
o-Xylene	ND	5.0	"								
p- & m- Xylenes	ND	10	"								
p-Isopropyltoluene	ND	5.0	"								
sec-Butylbenzene	ND	5.0	"								
Styrene	ND	5.0	"								
tert-Butylbenzene	ND	5.0	"								
Tetrachloroethylene	ND	5.0	"								
Tetrahydrofuran	ND	10	"								
Toluene	ND	5.0	"								
trans-1,2-Dichloroethylene	ND	5.0	"								
trans-1,3-Dichloropropylene	ND	5.0	"								
trans-1,4-dichloro-2-butene	ND	5.0	"								
Trichloroethylene	ND	5.0	"								
Trichlorofluoromethane	ND	5.0	"								
Vinyl Chloride	ND	5.0	"								
Surrogate: 1,2-Dichloroethane-d4	*46.9*		*ug/L*	*50.0*		*93.7*	*70-130*				
Surrogate: Toluene-d8	*48.6*		*"*	*50.0*		*97.2*	*70-130*				
Surrogate: p-Bromofluorobenzene	*47.2*		*"*	*50.0*		*94.5*	*70-130*				

Volatile Organic Compounds by GC/MS - Quality Control Data

York Analytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BE60368 - EPA 5035A											
LCS (BE60368-BS1)											
Prepared & Analyzed: 05/09/2016											
1,1,1,2-Tetrachloroethane	54.7		ug/L	50.0		109	70-130				
1,1,1-Trichloroethane	55.8		"	50.0		112	70-130				
1,1,2,2-Tetrachloroethane	49.8		"	50.0		99.6	70-130				
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113	53.2		"	50.0		106	70-130				
1,1,2-Trichloroethane	51.1		"	50.0		102	70-130				
1,1-Dichloroethane	55.8		"	50.0		112	70-130				
1,1-Dichloroethylene	54.3		"	50.0		109	70-130				
1,1-Dichloropropylene	54.6		"	50.0		109	70-130				
1,2,3-Trichlorobenzene	59.6		"	50.0		119	70-130				
1,2,3-Trichloropropane	47.8		"	50.0		95.5	70-130				
1,2,4-Trichlorobenzene	62.0		"	50.0		124	70-130				
1,2,4-Trimethylbenzene	51.3		"	50.0		103	70-130				
1,2-Dibromo-3-chloropropane	43.3		"	50.0		86.6	70-130				
1,2-Dibromoethane	54.7		"	50.0		109	70-130				
1,2-Dichlorobenzene	55.6		"	50.0		111	70-130				
1,2-Dichloroethane	51.9		"	50.0		104	70-130				
1,2-Dichloropropane	52.6		"	50.0		105	70-130				
1,3,5-Trimethylbenzene	52.0		"	50.0		104	70-130				
1,3-Dichlorobenzene	56.4		"	50.0		113	70-130				
1,3-Dichloropropane	50.6		"	50.0		101	70-130				
1,4-Dichlorobenzene	54.4		"	50.0		109	70-130				
2,2-Dichloropropane	55.4		"	50.0		111	70-130				
2-Butanone	51.3		"	50.0		103	70-130				
2-Chlorotoluene	49.3		"	50.0		98.6	70-130				
2-Hexanone	44.4		"	50.0		88.7	70-130				
4-Chlorotoluene	47.5		"	50.0		95.0	70-130				
4-Methyl-2-pentanone	42.7		"	50.0		85.4	70-130				
Acetone	44.8		"	50.0		89.6	70-130				
Acrylonitrile	54.5		"	50.0		109	70-130				
Benzene	58.6		"	50.0		117	70-130				
Bromobenzene	53.1		"	50.0		106	70-130				
Bromochloromethane	54.9		"	50.0		110	70-130				
Bromodichloromethane	52.2		"	50.0		104	70-130				
Bromoform	55.2		"	50.0		110	70-130				
Bromomethane	56.3		"	50.0		113	70-130				
Carbon disulfide	59.5		"	50.0		119	70-130				
Carbon tetrachloride	53.8		"	50.0		108	70-130				
Chlorobenzene	55.0		"	50.0		110	70-130				
Chloroethane	58.0		"	50.0		116	70-130				
Chloroform	55.4		"	50.0		111	70-130				
Chloromethane	57.9		"	50.0		116	70-130				
cis-1,2-Dichloroethylene	60.1		"	50.0		120	70-130				
cis-1,3-Dichloropropylene	54.0		"	50.0		108	70-130				
Dibromochloromethane	51.3		"	50.0		103	70-130				
Dibromomethane	54.7		"	50.0		109	70-130				
Dichlorodifluoromethane	62.0		"	50.0		124	70-130				
Ethyl Benzene	52.2		"	50.0		104	70-130				
Hexachlorobutadiene	58.6		"	50.0		117	70-130				
Isopropylbenzene	50.8		"	50.0		102	70-130				
Methyl Methacrylate	47.6		"	50.0		95.2	70-130				
Methyl tert-butyl ether (MTBE)	52.8		"	50.0		106	70-130				

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BE60368 - EPA 5035A											
LCS (BE60368-BS1)							Prepared & Analyzed: 05/09/2016				
Methylene chloride	50.5		ug/L	50.0		101	70-130				
Naphthalene	52.9		"	50.0		106	70-130				
n-Butylbenzene	49.5		"	50.0		98.9	70-130				
n-Propylbenzene	49.7		"	50.0		99.5	70-130				
o-Xylene	50.2		"	50.0		100	70-130				
p- & m- Xylenes	97.2		"	100		97.2	70-130				
p-Isopropyltoluene	53.8		"	50.0		108	70-130				
sec-Butylbenzene	48.8		"	50.0		97.5	70-130				
Styrene	57.7		"	50.0		115	70-130				
tert-Butylbenzene	55.1		"	50.0		110	70-130				
Tetrachloroethylene	57.3		"	50.0		115	70-130				
Tetrahydrofuran	41.8		"	50.0		83.6	70-130				
Toluene	55.3		"	50.0		111	70-130				
trans-1,2-Dichloroethylene	54.1		"	50.0		108	70-130				
trans-1,3-Dichloropropylene	51.8		"	50.0		104	70-130				
trans-1,4-dichloro-2-butene	50.0		"	50.0		100	70-130				
Trichloroethylene	53.3		"	50.0		107	70-130				
Trichlorofluoromethane	50.0		"	50.0		99.9	70-130				
Vinyl Chloride	55.7		"	50.0		111	70-130				
Surrogate: 1,2-Dichloroethane-d4	*46.3*		*"*	*50.0*		*92.7*	*70-130*				
Surrogate: Toluene-d8	*49.8*		*"*	*50.0*		*99.5*	*70-130*				
Surrogate: p-Bromofluorobenzene	*53.9*		*"*	*50.0*		*108*	*70-130*				
LCS Dup (BE60368-BSD1)							Prepared & Analyzed: 05/09/2016				
1,1,1,2-Tetrachloroethane	52.6		ug/L	50.0		105	70-130		3.93	30	
1,1,1-Trichloroethane	53.8		"	50.0		108	70-130		3.65	30	
1,1,2,2-Tetrachloroethane	46.7		"	50.0		93.4	70-130		6.49	30	
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113	50.8		"	50.0		102	70-130		4.73	30	
1,1,2-Trichloroethane	49.3		"	50.0		98.6	70-130		3.65	30	
1,1-Dichloroethane	55.6		"	50.0		111	70-130		0.287	30	
1,1-Dichloroethylene	50.4		"	50.0		101	70-130		7.37	30	
1,1-Dichloropropylene	53.6		"	50.0		107	70-130		1.98	30	
1,2,3-Trichlorobenzene	57.6		"	50.0		115	70-130		3.40	30	
1,2,3-Trichloropropane	43.7		"	50.0		87.5	70-130		8.81	30	
1,2,4-Trichlorobenzene	59.2		"	50.0		118	70-130		4.69	30	
1,2,4-Trimethylbenzene	50.2		"	50.0		100	70-130		2.09	30	
1,2-Dibromo-3-chloropropane	38.8		"	50.0		77.6	70-130		11.0	30	
1,2-Dibromoethane	51.7		"	50.0		103	70-130		5.71	30	
1,2-Dichlorobenzene	53.4		"	50.0		107	70-130		4.02	30	
1,2-Dichloroethane	48.5		"	50.0		97.0	70-130		6.85	30	
1,2-Dichloropropane	51.4		"	50.0		103	70-130		2.25	30	
1,3,5-Trimethylbenzene	49.5		"	50.0		99.0	70-130		4.93	30	
1,3-Dichlorobenzene	54.4		"	50.0		109	70-130		3.61	30	
1,3-Dichloropropane	49.7		"	50.0		99.3	70-130		1.93	30	
1,4-Dichlorobenzene	52.6		"	50.0		105	70-130		3.51	30	
2,2-Dichloropropane	52.8		"	50.0		106	70-130		4.75	30	
2-Butanone	44.9		"	50.0		89.9	70-130		13.2	30	
2-Chlorotoluene	46.3		"	50.0		92.5	70-130		6.38	30	
2-Hexanone	40.6		"	50.0		81.2	70-130		8.80	30	
4-Chlorotoluene	45.1		"	50.0		90.2	70-130		5.18	30	
4-Methyl-2-pentanone	39.8		"	50.0		79.6	70-130		7.00	30	

Batch BE60368 - EPA 5035A

LCS Dup (BE60368-BSD1)

Prepared & Analyzed: 05/09/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Acetone	44.2		ug/L	50.0		88.4	70-130		1.28	30	
Acrylonitrile	48.2		"	50.0		96.4	70-130		12.3	30	
Benzene	56.0		"	50.0		112	70-130		4.53	30	
Bromobenzene	49.3		"	50.0		98.5	70-130		7.50	30	
Bromochloromethane	52.1		"	50.0		104	70-130		5.24	30	
Bromodichloromethane	49.8		"	50.0		99.6	70-130		4.67	30	
Bromoform	51.0		"	50.0		102	70-130		7.91	30	
Bromomethane	49.2		"	50.0		98.4	70-130		13.5	30	
Carbon disulfide	55.1		"	50.0		110	70-130		7.80	30	
Carbon tetrachloride	51.2		"	50.0		102	70-130		4.86	30	
Chlorobenzene	53.5		"	50.0		107	70-130		2.89	30	
Chloroethane	53.9		"	50.0		108	70-130		7.27	30	
Chloroform	53.3		"	50.0		107	70-130		3.81	30	
Chloromethane	54.4		"	50.0		109	70-130		6.32	30	
cis-1,2-Dichloroethylene	57.7		"	50.0		115	70-130		4.13	30	
cis-1,3-Dichloropropylene	53.5		"	50.0		107	70-130		0.967	30	
Dibromochloromethane	51.1		"	50.0		102	70-130		0.313	30	
Dibromomethane	50.4		"	50.0		101	70-130		8.03	30	
Dichlorodifluoromethane	59.2		"	50.0		118	70-130		4.57	30	
Ethyl Benzene	50.4		"	50.0		101	70-130		3.61	30	
Hexachlorobutadiene	55.6		"	50.0		111	70-130		5.27	30	
Isopropylbenzene	48.0		"	50.0		95.9	70-130		5.79	30	
Methyl Methacrylate	45.2		"	50.0		90.4	70-130		5.19	30	
Methyl tert-butyl ether (MTBE)	48.2		"	50.0		96.4	70-130		9.03	30	
Methylene chloride	48.7		"	50.0		97.4	70-130		3.71	30	
Naphthalene	51.8		"	50.0		104	70-130		2.10	30	
n-Butylbenzene	47.1		"	50.0		94.1	70-130		4.95	30	
n-Propylbenzene	46.8		"	50.0		93.6	70-130		6.07	30	
o-Xylene	47.4		"	50.0		94.8	70-130		5.74	30	
p- & m- Xylenes	96.4		"	100		96.4	70-130		0.889	30	
p-Isopropyltoluene	50.5		"	50.0		101	70-130		6.40	30	
sec-Butylbenzene	46.7		"	50.0		93.4	70-130		4.38	30	
Styrene	55.7		"	50.0		111	70-130		3.56	30	
tert-Butylbenzene	52.1		"	50.0		104	70-130		5.65	30	
Tetrachloroethylene	56.6		"	50.0		113	70-130		1.30	30	
Tetrahydrofuran	42.3		"	50.0		84.6	70-130		1.14	30	
Toluene	53.8		"	50.0		108	70-130		2.79	30	
trans-1,2-Dichloroethylene	51.4		"	50.0		103	70-130		5.27	30	
trans-1,3-Dichloropropylene	49.2		"	50.0		98.3	70-130		5.15	30	
trans-1,4-dichloro-2-butene	46.9		"	50.0		93.8	70-130		6.46	30	
Trichloroethylene	54.0		"	50.0		108	70-130		1.27	30	
Trichlorofluoromethane	47.2		"	50.0		94.5	70-130		5.60	30	
Vinyl Chloride	53.6		"	50.0		107	70-130		3.97	30	
Surrogate: 1,2-Dichloroethane-d4	*45.6*		*"*	*50.0*		*91.1*	*70-130*				
Surrogate: Toluene-d8	*50.0*		*"*	*50.0*		*99.9*	*70-130*				
Surrogate: p-Bromofluorobenzene	*54.1*		*"*	*50.0*		*108*	*70-130*				

Batch BE60279 - EPA 3510C/1311

Blank (BE60279-BLK1)

Prepared & Analyzed: 05/06/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
1,4-Dichlorobenzene	ND	10.0	ug/L								
2,4,5-Trichlorophenol	ND	10.0	"								
2,4,6-Trichlorophenol	ND	10.0	"								
2,4-Dinitrotoluene	ND	10.0	"								
2-Methylphenol	ND	10.0	"								
3- & 4-Methylphenols	ND	20.0	"								
Cresols, total	ND	30.0	"								
Hexachlorobenzene	ND	10.0	"								
Hexachlorobutadiene	ND	10.0	"								
Hexachloroethane	ND	10.0	"								
Nitrobenzene	ND	10.0	"								
Pentachlorophenol	ND	10.0	"								
Pyridine	ND	10.0	"								
Surrogate: 2-Fluorophenol	*49.4*		*"*	*151*		*32.8*	*10-65*				
Surrogate: Phenol-d5	*38.6*		*"*	*151*		*25.6*	*10-49*				
Surrogate: Nitrobenzene-d5	*62.5*		*"*	*101*		*62.2*	*10-96*				
Surrogate: 2-Fluorobiphenyl	*56.0*		*"*	*100*		*56.0*	*10-93*				
Surrogate: 2,4,6-Tribromophenol	*109*		*"*	*151*		*72.1*	*10-128*				
Surrogate: Terphenyl-d14	*49.7*		*"*	*101*		*49.4*	*10-100*				

LCS (BE60279-BS1)

Prepared & Analyzed: 05/06/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
1,4-Dichlorobenzene	55.2	10.5	ug/L	105		52.4	42-82				
2,4,5-Trichlorophenol	77.1	10.5	"	105		73.3	36-112				
2,4,6-Trichlorophenol	81.0	10.5	"	105		77.0	41-107				
2,4-Dinitrotoluene	107	10.5	"	105		102	41-114				
2-Methylphenol	51.5	10.5	"	105		48.9	10-90				
3- & 4-Methylphenols	44.9	21.1	"	105		42.7	10-101				
Cresols, total	96.4	31.6	"	211		45.8	30-130				
Hexachlorobenzene	63.0	10.5	"	105		59.9	27-120				
Hexachlorobutadiene	80.8	10.5	"	105		76.7	25-106				
Hexachloroethane	55.7	10.5	"	105		52.9	33-84				
Nitrobenzene	72.1	10.5	"	105		68.5	32-113				
Pentachlorophenol	89.1	10.5	"	105		84.7	19-127				
Pyridine	29.7	10.5	"	105		28.2	10-46				
Surrogate: 2-Fluorophenol	*55.8*		*"*	*159*		*35.2*	*10-65*				
Surrogate: Phenol-d5	*44.5*		*"*	*159*		*28.0*	*10-49*				
Surrogate: Nitrobenzene-d5	*67.7*		*"*	*106*		*63.9*	*10-96*				
Surrogate: 2-Fluorobiphenyl	*64.2*		*"*	*105*		*61.0*	*10-93*				
Surrogate: 2,4,6-Tribromophenol	*114*		*"*	*159*		*72.1*	*10-128*				
Surrogate: Terphenyl-d14	*50.7*		*"*	*106*		*47.8*	*10-100*				

Batch BE60279 - EPA 3510C/1311

LCS Dup (BE60279-BSD1)

Prepared & Analyzed: 05/06/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
1,4-Dichlorobenzene	55.3	10.5	ug/L	105		52.5	42-82		0.267	20	
2,4,5-Trichlorophenol	78.4	10.5	"	105		74.4	36-112		1.57	20	
2,4,6-Trichlorophenol	79.4	10.5	"	105		75.4	41-107		2.02	20	
2,4-Dinitrotoluene	104	10.5	"	105		99.0	41-114		2.89	20	
2-Methylphenol	52.2	10.5	"	105		49.6	10-90		1.30	20	
3- & 4-Methylphenols	46.5	21.1	"	105		44.1	10-101		3.41	20	
Cresols, total	98.7	31.6	"	211		46.9	30-130		2.29	20	
Hexachlorobenzene	61.5	10.5	"	105		58.4	27-120		2.47	20	
Hexachlorobutadiene	80.4	10.5	"	105		76.3	25-106		0.523	20	
Hexachloroethane	55.2	10.5	"	105		52.4	33-84		0.912	20	
Nitrobenzene	72.2	10.5	"	105		68.6	32-113		0.204	20	
Pentachlorophenol	88.4	10.5	"	105		84.0	19-127		0.782	20	
Pyridine	27.8	10.5	"	105		26.4	10-46		6.44	20	
Surrogate: 2-Fluorophenol	*57.1*		"	*159*		*35.9*	*10-65*				
Surrogate: Phenol-d5	*46.0*		"	*159*		*29.0*	*10-49*				
Surrogate: Nitrobenzene-d5	*66.5*		"	*106*		*62.8*	*10-96*				
Surrogate: 2-Fluorobiphenyl	*64.0*		"	*105*		*60.8*	*10-93*				
Surrogate: 2,4,6-Tribromophenol	*112*		"	*159*		*70.5*	*10-128*				
Surrogate: Terphenyl-d14	*48.3*		"	*106*		*45.6*	*10-100*				

Batch BE60405 - EPA 3546 SVOA

Blank (BE60405-BLK1)

Prepared: 05/09/2016 Analyzed: 05/10/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
1,2,4,5-Tetrachlorobenzene	ND	250	ug/kg wet								
1,2,4-Trichlorobenzene	ND	250	"								
1-Methylnaphthalene	ND	250	"								
2,4,5-Trichlorophenol	ND	250	"								
2,4,6-Trichlorophenol	ND	250	"								
2,4-Dichlorophenol	ND	250	"								
2,4-Dimethylphenol	ND	250	"								
2,4-Dinitrophenol	ND	500	"								
2,4-Dinitrotoluene	ND	250	"								
2,6-Dinitrotoluene	ND	250	"								
2-Chloronaphthalene	ND	250	"								
2-Chlorophenol	ND	250	"								
2-Methylnaphthalene	ND	250	"								
2-Methylphenol	ND	250	"								
2-Nitroaniline	ND	250	"								
2-Nitrophenol	ND	250	"								
3- & 4-Methylphenols	ND	250	"								
3,3'-Dichlorobenzidine	ND	250	"								
3-Nitroaniline	ND	250	"								
4,6-Dinitro-2-methylphenol	ND	500	"								
4-Bromophenyl phenyl ether	ND	250	"								
4-Chloro-3-methylphenol	ND	250	"								
4-Chloroaniline	ND	250	"								
4-Chlorophenyl phenyl ether	ND	250	"								
4-Nitroaniline	ND	250	"								
4-Nitrophenol	ND	250	"								
Acenaphthene	ND	250	"								
Acenaphthylene	ND	250	"								
Aniline	ND	250	"								

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BE60405 - EPA 3546 SVOA											
Blank (BE60405-BLK1)								Prepared: 05/09/2016 Analyzed: 05/10/2016			
Anthracene	ND	250	ug/kg wet								
Benzo(a)anthracene	ND	250	"								
Benzo(a)pyrene	ND	250	"								
Benzo(b)fluoranthene	ND	250	"								
Benzo(g,h,i)perylene	ND	250	"								
Benzo(k)fluoranthene	ND	250	"								
Benzyl butyl phthalate	ND	250	"								
Bis(2-chloroethoxy)methane	ND	250	"								
Bis(2-chloroethyl)ether	ND	250	"								
Bis(2-chloroisopropyl)ether	ND	250	"								
Bis(2-ethylhexyl)phthalate	ND	250	"								
Carbazole	ND	250	"								
Chrysene	ND	250	"								
Dibenzo(a,h)anthracene	ND	250	"								
Dibenzofuran	ND	250	"								
Diethyl phthalate	ND	250	"								
Dimethyl phthalate	ND	250	"								
Di-n-butyl phthalate	ND	250	"								
Di-n-octyl phthalate	ND	250	"								
Fluoranthene	ND	250	"								
Fluorene	ND	250	"								
Hexachlorobenzene	ND	250	"								
Hexachlorobutadiene	ND	250	"								
Hexachlorocyclopentadiene	ND	250	"								
Hexachloroethane	ND	250	"								
Indeno(1,2,3-cd)pyrene	ND	250	"								
Isophorone	ND	250	"								
Naphthalene	ND	250	"								
Nitrobenzene	ND	250	"								
N-nitroso-di-n-propylamine	ND	250	"								
N-Nitrosodiphenylamine	ND	250	"								
Pentachloronitrobenzene	ND	250	"								
Pentachlorophenol	ND	250	"								
Phenanthrene	ND	250	"								
Phenol	ND	250	"								
Pyrene	ND	250	"								
Pyridine	ND	250	"								
Surrogate: 2-Fluorophenol	*2460*		*"*	*3770*		*65.1*	*30-130*				
Surrogate: Phenol-d5	*2650*		*"*	*3770*		*70.4*	*30-130*				
Surrogate: Nitrobenzene-d5	*1810*		*"*	*2520*		*72.1*	*30-130*				
Surrogate: 2-Fluorobiphenyl	*1700*		*"*	*2500*		*68.1*	*30-130*				
Surrogate: 2,4,6-Tribromophenol	*3700*		*"*	*3770*		*98.2*	*30-130*				
Surrogate: Terphenyl-d14	*1740*		*"*	*2520*		*69.1*	*30-130*				

Batch BE60405 - EPA 3546 SVOA

LCS (BE60405-BS1) Prepared: 05/09/2016 Analyzed: 05/10/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
1,2,4,5-Tetrachlorobenzene	2620	250	ug/kg wet	2500		105	40-140				
1,2,4-Trichlorobenzene	2230	250	"	2500		89.3	40-140				
1-Methylnaphthalene	1810	250	"	2500		72.5	40-140				
2,4,5-Trichlorophenol	1490	250	"	2500		59.7	30-130				
2,4,6-Trichlorophenol	1390	250	"	2500		55.5	30-130				
2,4-Dichlorophenol	1920	250	"	2500		77.0	30-130				
2,4-Dimethylphenol	1900	250	"	2500		75.9	30-130				
2,4-Dinitrophenol	1740	500	"	2500		69.5	30-130				
2,4-Dinitrotoluene	1900	250	"	2500		76.1	40-140				
2,6-Dinitrotoluene	2040	250	"	2500		81.5	30-130				
2-Chloronaphthalene	1590	250	"	2500		63.5	40-140				
2-Chlorophenol	1660	250	"	2500		66.3	30-130				
2-Methylnaphthalene	2070	250	"	2500		83.0	40-140				
2-Methylphenol	1660	250	"	2500		66.4	30-130				
2-Nitroaniline	1930	250	"	2500		77.3	40-140				
2-Nitrophenol	1670	250	"	2500		66.7	30-130				
3- & 4-Methylphenols	1420	250	"	2500		56.9	30-130				
3,3'-Dichlorobenzidine	2750	250	"	2500		110	40-140				
3-Nitroaniline	1940	250	"	2500		77.5	40-140				
4,6-Dinitro-2-methylphenol	2130	500	"	2500		85.1	40-140				
4-Bromophenyl phenyl ether	2220	250	"	2500		88.7	40-140				
4-Chloro-3-methylphenol	2010	250	"	2500		80.5	30-130				
4-Chloroaniline	1270	250	"	2500		50.8	40-140				
4-Chlorophenyl phenyl ether	1830	250	"	2500		73.1	40-140				
4-Nitroaniline	ND	250	"	2500			40-140	Low Bias			
4-Nitrophenol	1160	250	"	2500		46.6	30-130				
Acenaphthene	1800	250	"	2500		71.9	40-140				
Acenaphthylene	1700	250	"	2500		68.2	40-140				
Aniline	1580	250	"	2500		63.0	40-140				
Anthracene	1860	250	"	2500		74.3	40-140				
Benzo(a)anthracene	1890	250	"	2500		75.8	40-140				
Benzo(a)pyrene	2210	250	"	2500		88.4	40-140				
Benzo(b)fluoranthene	1810	250	"	2500		72.3	40-140				
Benzo(g,h,i)perylene	2140	250	"	2500		85.4	40-140				
Benzo(k)fluoranthene	2420	250	"	2500		96.7	40-140				
Benzyl butyl phthalate	1400	250	"	2500		56.0	40-140				
Bis(2-chloroethoxy)methane	1790	250	"	2500		71.7	40-140				
Bis(2-chloroethyl)ether	1510	250	"	2500		60.4	40-140				
Bis(2-chloroisopropyl)ether	1850	250	"	2500		74.0	40-140				
Bis(2-ethylhexyl)phthalate	1280	250	"	2500		51.0	40-140				
Carbazole	12200	250	"	2500		488	40-140	High Bias			
Chrysene	1780	250	"	2500		71.0	40-140				
Dibenzo(a,h)anthracene	1970	250	"	2500		78.8	40-140				
Dibenzofuran	1760	250	"	2500		70.5	40-140				
Diethyl phthalate	1760	250	"	2500		70.3	40-140				
Dimethyl phthalate	1900	250	"	2500		76.0	40-140				
Di-n-butyl phthalate	1580	250	"	2500		63.2	40-140				
Di-n-octyl phthalate	1410	250	"	2500		56.2	40-140				
Fluoranthene	2070	250	"	2500		82.8	40-140				
Fluorene	1760	250	"	2500		70.5	40-140				
Hexachlorobenzene	1700	250	"	2500		68.2	40-140				

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BE60405 - EPA 3546 SVOA											
LCS (BE60405-BS1)								Prepared: 05/09/2016 Analyzed: 05/10/2016			
Hexachlorobutadiene	2820	250	ug/kg wet	2500		113	40-140				
Hexachlorocyclopentadiene	384	250	"	2500		15.4	40-140	Low Bias			
Hexachloroethane	1820	250	"	2500		73.0	40-140				
Indeno(1,2,3-cd)pyrene	2050	250	"	2500		82.1	40-140				
Isophorone	1660	250	"	2500		66.3	40-140				
Naphthalene	1760	250	"	2500		70.5	40-140				
Nitrobenzene	1620	250	"	2500		64.8	40-140				
N-nitroso-di-n-propylamine	1680	250	"	2500		67.3	40-140				
N-Nitrosodiphenylamine	2770	250	"	2500		111	40-140				
Pentachloronitrobenzene	2290	250	"	2500		91.5	40-140				
Pentachlorophenol	1250	250	"	2500		49.9	30-130				
Phenanthrene	1900	250	"	2500		76.1	40-140				
Phenol	1630	250	"	2500		65.2	30-130				
Pyrene	2030	250	"	2500		81.2	40-140				
Pyridine	948	250	"	2500		37.9	40-140	Low Bias			
Surrogate: 2-Fluorophenol	*2020*		*"*	*3770*		*53.6*	*30-130*				
Surrogate: Phenol-d5	*2580*		*"*	*3770*		*68.5*	*30-130*				
Surrogate: Nitrobenzene-d5	*1560*		*"*	*2520*		*62.1*	*30-130*				
Surrogate: 2-Fluorobiphenyl	*1320*		*"*	*2500*		*52.9*	*30-130*				
Surrogate: 2,4,6-Tribromophenol	*3410*		*"*	*3770*		*90.5*	*30-130*				
Surrogate: Terphenyl-d14	*1510*		*"*	*2520*		*60.1*	*30-130*				
LCS Dup (BE60405-BSD1)								Prepared: 05/09/2016 Analyzed: 05/10/2016			
1,2,4,5-Tetrachlorobenzene	2630	250	ug/kg wet	2500		105	40-140		0.476	30	
1,2,4-Trichlorobenzene	2220	250	"	2500		89.0	40-140		0.337	30	
1-Methylnaphthalene	1780	250	"	2500		71.2	40-140		1.78	30	
2,4,5-Trichlorophenol	1640	250	"	2500		65.7	30-130		9.57	30	
2,4,6-Trichlorophenol	1580	250	"	2500		63.3	30-130		13.2	30	
2,4-Dichlorophenol	1930	250	"	2500		77.3	30-130		0.441	30	
2,4-Dimethylphenol	1830	250	"	2500		73.0	30-130		3.84	30	
2,4-Dinitrophenol	1480	500	"	2500		59.1	30-130		16.2	30	
2,4-Dinitrotoluene	1830	250	"	2500		73.2	40-140		3.91	30	
2,6-Dinitrotoluene	1940	250	"	2500		77.5	30-130		5.11	30	
2-Chloronaphthalene	1680	250	"	2500		67.2	40-140		5.66	30	
2-Chlorophenol	1630	250	"	2500		65.1	30-130		1.83	30	
2-Methylnaphthalene	2010	250	"	2500		80.5	40-140		2.99	30	
2-Methylphenol	1610	250	"	2500		64.4	30-130		3.03	30	
2-Nitroaniline	1680	250	"	2500		67.0	40-140		14.3	30	
2-Nitrophenol	1630	250	"	2500		65.0	30-130		2.52	30	
3- & 4-Methylphenols	1460	250	"	2500		58.5	30-130		2.84	30	
3,3'-Dichlorobenzidine	2710	250	"	2500		108	40-140		1.59	30	
3-Nitroaniline	1680	250	"	2500		67.1	40-140		14.3	30	
4,6-Dinitro-2-methylphenol	2030	500	"	2500		81.1	40-140		4.89	30	
4-Bromophenyl phenyl ether	2160	250	"	2500		86.4	40-140		2.72	30	
4-Chloro-3-methylphenol	1860	250	"	2500		74.6	30-130		7.66	30	
4-Chloroaniline	1510	250	"	2500		60.6	40-140		17.5	30	
4-Chlorophenyl phenyl ether	1940	250	"	2500		77.6	40-140		6.00	30	
4-Nitroaniline	ND	250	"	2500			40-140	Low Bias		30	
4-Nitrophenol	1130	250	"	2500		45.4	30-130		2.61	30	
Acenaphthene	1700	250	"	2500		68.1	40-140		5.40	30	
Acenaphthylene	1590	250	"	2500		63.8	40-140		6.70	30	

Batch BE60405 - EPA 3546 SVOA

LCS Dup (BE60405-BSD1)

Prepared: 05/09/2016 Analyzed: 05/10/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Aniline	1630	250	ug/kg wet	2500		65.0	40-140		3.19	30	
Anthracene	1760	250	"	2500		70.6	40-140		5.11	30	
Benzo(a)anthracene	1780	250	"	2500		71.1	40-140		6.32	30	
Benzo(a)pyrene	2130	250	"	2500		85.3	40-140		3.57	30	
Benzo(b)fluoranthene	1710	250	"	2500		68.4	40-140		5.54	30	
Benzo(g,h,i)perylene	2000	250	"	2500		80.1	40-140		6.45	30	
Benzo(k)fluoranthene	2380	250	"	2500		95.0	40-140		1.79	30	
Benzyl butyl phthalate	1390	250	"	2500		55.7	40-140		0.537	30	
Bis(2-chloroethoxy)methane	1760	250	"	2500		70.5	40-140		1.72	30	
Bis(2-chloroethyl)ether	1580	250	"	2500		63.2	40-140		4.50	30	
Bis(2-chloroisopropyl)ether	2020	250	"	2500		80.8	40-140		8.78	30	
Bis(2-ethylhexyl)phthalate	1180	250	"	2500		47.2	40-140		7.78	30	
Carbazole	11400	250	"	2500		455	40-140	High Bias	6.94	30	
Chrysene	1720	250	"	2500		68.9	40-140		3.03	30	
Dibenzo(a,h)anthracene	1930	250	"	2500		77.2	40-140		2.03	30	
Dibenzofuran	1740	250	"	2500		69.4	40-140		1.60	30	
Diethyl phthalate	1780	250	"	2500		71.4	40-140		1.47	30	
Dimethyl phthalate	1830	250	"	2500		73.1	40-140		3.94	30	
Di-n-butyl phthalate	1500	250	"	2500		59.9	40-140		5.26	30	
Di-n-octyl phthalate	1340	250	"	2500		53.4	40-140		5.15	30	
Fluoranthene	1970	250	"	2500		78.8	40-140		4.97	30	
Fluorene	1830	250	"	2500		73.3	40-140		3.90	30	
Hexachlorobenzene	1650	250	"	2500		66.0	40-140		3.19	30	
Hexachlorobutadiene	2790	250	"	2500		111	40-140		1.11	30	
Hexachlorocyclopentadiene	284	250	"	2500		11.3	40-140	Low Bias	30.2	30	Non-dir.
Hexachloroethane	1950	250	"	2500		78.2	40-140		6.88	30	
Indeno(1,2,3-cd)pyrene	2000	250	"	2500		80.0	40-140		2.52	30	
Isophorone	1720	250	"	2500		68.8	40-140		3.58	30	
Naphthalene	1690	250	"	2500		67.4	40-140		4.38	30	
Nitrobenzene	1750	250	"	2500		69.9	40-140		7.57	30	
N-nitroso-di-n-propylamine	1930	250	"	2500		77.1	40-140		13.5	30	
N-Nitrosodiphenylamine	2900	250	"	2500		116	40-140		4.44	30	
Pentachloronitrobenzene	2180	250	"	2500		87.3	40-140		4.70	30	
Pentachlorophenol	784	250	"	2500		31.3	30-130		45.7	30	Non-dir.
Phenanthrene	1820	250	"	2500		72.8	40-140		4.38	30	
Phenol	1650	250	"	2500		65.9	30-130		1.13	30	
Pyrene	1930	250	"	2500		77.4	40-140		4.89	30	
Pyridine	1000	250	"	2500		40.0	40-140		5.24	30	
Surrogate: 2-Fluorophenol	*2360*		*"*	*3770*		*62.6*	*30-130*				
Surrogate: Phenol-d5	*2800*		*"*	*3770*		*74.3*	*30-130*				
Surrogate: Nitrobenzene-d5	*1800*		*"*	*2520*		*71.7*	*30-130*				
Surrogate: 2-Fluorobiphenyl	*1650*		*"*	*2500*		*66.0*	*30-130*				
Surrogate: 2,4,6-Tribromophenol	*3520*		*"*	*3770*		*93.5*	*30-130*				
Surrogate: Terphenyl-d14	*1560*		*"*	*2520*		*62.1*	*30-130*				

Organochlorine Pesticides by GC/ECD - Quality Control Data

York Analytical Laboratories, Inc.

Batch BE60329 - EPA 3545A

Blank (BE60329-BLK1) Prepared: 05/06/2016 Analyzed: 05/09/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
4,4'-DDD	ND	0.500	ug/kg wet								
4,4'-DDE	ND	0.500	"								
4,4'-DDT	ND	0.500	"								
Alachlor	ND	0.500	"								
Aldrin	ND	0.500	"								
alpha-BHC	ND	0.500	"								
beta-BHC	ND	0.500	"								
Chlordane, total	ND	1.98	"								
delta-BHC	ND	0.500	"								
Dieldrin	ND	0.500	"								
Endosulfan I	ND	0.500	"								
Endosulfan II	ND	0.500	"								
Endosulfan sulfate	ND	0.500	"								
Endrin	ND	0.500	"								
Endrin aldehyde	ND	0.500	"								
Endrin ketone	ND	0.500	"								
gamma-BHC (Lindane)	ND	0.500	"								
Heptachlor	ND	0.500	"								
Heptachlor epoxide	ND	0.500	"								
Methoxychlor	ND	0.500	"								
Toxaphene	ND	25.0	"								
Surrogate: Decachlorobiphenyl	*107*		*"*	*100*		*107*	*30-140*				
Surrogate: Tetrachloro-m-xylene	*88.7*		*"*	*100*		*88.7*	*30-140*				

LCS (BE60329-BS1) Prepared: 05/06/2016 Analyzed: 05/09/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
4,4'-DDD	41.7	0.500	ug/kg wet	50.0		83.4	40-140				
4,4'-DDE	47.5	0.500	"	50.0		95.0	40-140				
4,4'-DDT	38.5	0.500	"	50.0		77.0	40-140				
Alachlor	33.7	0.500	"	50.0		67.5	40-140				
Aldrin	41.6	0.500	"	50.0		83.2	40-140				
alpha-BHC	43.5	0.500	"	50.0		87.0	40-140				
beta-BHC	39.9	0.500	"	50.0		79.8	40-140				
delta-BHC	43.2	0.500	"	50.0		86.4	40-140				
Dieldrin	40.1	0.500	"	50.0		80.2	40-140				
Endosulfan I	39.5	0.500	"	50.0		79.0	40-140				
Endosulfan II	39.9	0.500	"	50.0		79.8	40-140				
Endosulfan sulfate	32.6	0.500	"	50.0		65.2	40-140				
Endrin	38.1	0.500	"	50.0		76.2	40-140				
Endrin aldehyde	37.5	0.500	"	50.0		75.0	40-140				
Endrin ketone	44.6	0.500	"	50.0		89.2	40-140				
gamma-BHC (Lindane)	42.7	0.500	"	50.0		85.4	40-140				
Heptachlor	35.8	0.500	"	50.0		71.5	40-140				
Heptachlor epoxide	39.5	0.500	"	50.0		79.0	40-140				
Methoxychlor	43.2	0.500	"	50.0		86.4	40-140				
Surrogate: Decachlorobiphenyl	*69.0*		*"*	*100*		*69.0*	*30-140*				
Surrogate: Tetrachloro-m-xylene	*64.9*		*"*	*100*		*64.9*	*30-140*				

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag

Batch BE60329 - EPA 3545A

LCS Dup (BE60329-BSD1) Prepared: 05/06/2016 Analyzed: 05/09/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
4,4'-DDD	40.4	0.500	ug/kg wet	50.0		80.9	40-140		3.03	30	
4,4'-DDE	41.5	0.500	"	50.0		83.0	40-140		13.5	30	
4,4'-DDT	32.3	0.500	"	50.0		64.6	40-140		17.6	30	
Alachlor	30.5	0.500	"	50.0		61.0	40-140		10.1	30	
Aldrin	36.7	0.500	"	50.0		73.4	40-140		12.6	30	
alpha-BHC	39.0	0.500	"	50.0		78.1	40-140		10.8	30	
beta-BHC	35.5	0.500	"	50.0		70.9	40-140		11.7	30	
delta-BHC	38.2	0.500	"	50.0		76.3	40-140		12.4	30	
Dieldrin	36.0	0.500	"	50.0		72.0	40-140		10.7	30	
Endosulfan I	34.2	0.500	"	50.0		68.5	40-140		14.2	30	
Endosulfan II	35.9	0.500	"	50.0		71.9	40-140		10.5	30	
Endosulfan sulfate	31.3	0.500	"	50.0		62.6	40-140		4.15	30	
Endrin	36.2	0.500	"	50.0		72.4	40-140		5.18	30	
Endrin aldehyde	32.5	0.500	"	50.0		65.0	40-140		14.3	30	
Endrin ketone	38.9	0.500	"	50.0		77.9	40-140		13.6	30	
gamma-BHC (Lindane)	37.9	0.500	"	50.0		75.8	40-140		11.8	30	
Heptachlor	31.6	0.500	"	50.0		63.1	40-140		12.5	30	
Heptachlor epoxide	35.1	0.500	"	50.0		70.1	40-140		11.9	30	
Methoxychlor	36.8	0.500	"	50.0		73.5	40-140		16.1	30	
Surrogate: Decachlorobiphenyl	*58.6*		*"*	*100*		*58.6*	*30-140*				
Surrogate: Tetrachloro-m-xylene	*62.6*		*"*	*100*		*62.6*	*30-140*				

Batch BE60331 - EPA 3510C/1311

Blank (BE60331-BLK1) Prepared: 05/06/2016 Analyzed: 05/09/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Chlordane, total	ND	0.800	ug/L								
Endrin	ND	0.0800	"								
gamma-BHC (Lindane)	ND	0.0800	"								
Heptachlor	ND	0.0800	"								
Heptachlor epoxide	ND	0.0800	"								
Methoxychlor	ND	0.0800	"								
Toxaphene	ND	2.00	"								
Surrogate: Tetrachloro-m-xylene	*3.78*		*"*	*4.00*		*94.6*	*30-120*				
Surrogate: Decachlorobiphenyl	*3.27*		*"*	*4.00*		*81.7*	*30-120*				

Organochlorine Pesticides by GC/ECD - Quality Control Data

York Analytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BE60331 - EPA 3510C/1311											
LCS (BE60331-BS1)							Prepared: 05/06/2016 Analyzed: 05/09/2016				
Endrin	2.27	0.0800	ug/L	2.00		114	40-120				
gamma-BHC (Lindane)	2.27	0.0800	"	2.00		113	40-120				
Heptachlor	1.89	0.0800	"	2.00		94.4	40-120				
Heptachlor epoxide	2.03	0.0800	"	2.00		101	40-120				
Methoxychlor	2.26	0.0800	"	2.00		113	40-120				
Surrogate: Tetrachloro-m-xylene	*4.13*		*"*	*4.00*		*103*	*30-120*				
Surrogate: Decachlorobiphenyl	*3.81*		*"*	*4.00*		*95.2*	*30-120*				
LCS Dup (BE60331-BSD1)							Prepared: 05/06/2016 Analyzed: 05/09/2016				
Endrin	2.14	0.0800	ug/L	2.00		107	40-120		5.97	30	
gamma-BHC (Lindane)	2.14	0.0800	"	2.00		107	40-120		5.91	30	
Heptachlor	1.75	0.0800	"	2.00		87.4	40-120		7.74	30	
Heptachlor epoxide	1.91	0.0800	"	2.00		95.5	40-120		5.97	30	
Methoxychlor	2.17	0.0800	"	2.00		109	40-120		3.80	30	
Surrogate: Tetrachloro-m-xylene	*3.82*		*"*	*4.00*		*95.6*	*30-120*				
Surrogate: Decachlorobiphenyl	*3.62*		*"*	*4.00*		*90.5*	*30-120*				

Batch BE60441 - EPA SW846-3540C

Blank (BE60441-BLK1)

Prepared: 05/10/2016 Analyzed: 05/11/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Aroclor 1016	ND	0.0250	mg/kg wet								
Aroclor 1221	ND	0.0250	"								
Aroclor 1232	ND	0.0250	"								
Aroclor 1242	ND	0.0250	"								
Aroclor 1248	ND	0.0250	"								
Aroclor 1254	ND	0.0250	"								
Aroclor 1260	ND	0.0250	"								
Aroclor 1262	ND	0.0250	"								
Aroclor 1268	ND	0.0250	"								
Total PCBs	ND	0.0250	"								
Surrogate: Tetrachloro-m-xylene	*0.0765*		*"*	*0.100*		*76.5*	*30-140*				
Surrogate: Decachlorobiphenyl	*0.118*		*"*	*0.100*		*118*	*30-140*				

LCS (BE60441-BS1)

Prepared: 05/10/2016 Analyzed: 05/11/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Aroclor 1016	0.552	0.0250	mg/kg wet	0.500		110	40-130				
Aroclor 1260	0.521	0.0250	"	0.500		104	40-130				
Surrogate: Tetrachloro-m-xylene	*0.0815*		*"*	*0.100*		*81.5*	*30-140*				
Surrogate: Decachlorobiphenyl	*0.106*		*"*	*0.100*		*106*	*30-140*				

LCS Dup (BE60441-BSD1)

Prepared: 05/10/2016 Analyzed: 05/11/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Aroclor 1016	0.517	0.0250	mg/kg wet	0.500		103	40-130		6.56	25	
Aroclor 1260	0.516	0.0250	"	0.500		103	40-130		0.925	25	
Surrogate: Tetrachloro-m-xylene	*0.0775*		*"*	*0.100*		*77.5*	*30-140*				
Surrogate: Decachlorobiphenyl	*0.108*		*"*	*0.100*		*108*	*30-140*				

Batch BE60360 - EPA 3535A/1311

Blank (BE60360-BLK1)

Prepared & Analyzed: 05/09/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
2,4,5-TP (Silvex)	ND	5.00	ug/L								
2,4-D	ND	5.00	"								
Surrogate: 2,4-Dichlorophenylacetic acid (DCAA)	*89.8*		*"*	*125*		*71.8*	*30-150*				

LCS (BE60360-BS1)

Prepared & Analyzed: 05/09/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
2,4,5-TP (Silvex)	34.5	5.00	ug/L	40.0		86.2	40-140				
2,4-D	30.8	5.00	"	40.0		76.9	40-140				
Surrogate: 2,4-Dichlorophenylacetic acid (DCAA)	*93.5*		*"*	*125*		*74.8*	*30-150*				

LCS Dup (BE60360-BSD1)

Prepared & Analyzed: 05/09/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
2,4,5-TP (Silvex)	30.8	5.00	ug/L	40.0		76.9	40-140		11.5	30	
2,4-D	28.2	5.00	"	40.0		70.6	40-140		8.47	30	
Surrogate: 2,4-Dichlorophenylacetic acid (DCAA)	*82.0*		*"*	*125*		*65.6*	*30-150*				

Batch BE60361 - EPA 3550B/8151A

Blank (BE60361-BLK1)

Prepared: 05/09/2016 Analyzed: 05/10/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
2,4,5-T	ND	20.0	ug/kg wet								
2,4,5-TP (Silvex)	ND	20.0	"								
2,4-D	ND	20.0	"								
Dalapon	ND	20.0	"								
Dicamba	ND	20.0	"								
Surrogate: 2,4-Dichlorophenylacetic acid (DCAA)	*496*		*"*	*500*		*99.2*	*30-150*				

LCS (BE60361-BS1)

Prepared: 05/09/2016 Analyzed: 05/10/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
2,4,5-T	134	20.0	ug/kg wet	160		83.8	40-140				
2,4,5-TP (Silvex)	133	20.0	"	160		83.1	40-140				
2,4-D	123	20.0	"	160		76.9	40-140				
Dalapon	137	20.0	"	160		85.6	40-140				
Dicamba	124	20.0	"	160		77.5	40-140				
Surrogate: 2,4-Dichlorophenylacetic acid (DCAA)	*377*		*"*	*500*		*75.4*	*30-150*				

Batch BE60361 - EPA 3550B/8151A

LCS Dup (BE60361-BSD1) Prepared: 05/09/2016 Analyzed: 05/10/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
2,4,5-T	128	20.0	ug/kg wet	160		80.0	40-140		4.58	30	
2,4,5-TP (Silvex)	130	20.0	"	160		81.2	40-140		2.28	30	
2,4-D	118	20.0	"	160		73.8	40-140		4.15	30	
Dalapon	127	20.0	"	160		79.4	40-140		7.58	30	
Dicamba	120	20.0	"	160		75.0	40-140		3.28	30	
Surrogate: 2,4-Dichlorophenylacetic acid (DCAA)	*361*		*"*	*500*		*72.2*	*30-150*				

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BE60287 - EPA 3545A											
Blank (BE60287-BLK1)							Prepared & Analyzed: 05/06/2016				
ETPH (Extractable Total Petroleum Hydrocarbo	ND	10.0	mg/kg wet								
Surrogate: 1-Chlorooctadecane	*7.31*		*"*	*10.0*		*73.1*	*50-150*				
LCS (BE60287-BS1)							Prepared & Analyzed: 05/06/2016				
ETPH (Extractable Total Petroleum Hydrocarbo	61.4	10.0	mg/kg wet	75.0		81.9	60-120				
Surrogate: 1-Chlorooctadecane	*7.60*		*"*	*10.0*		*76.0*	*50-150*				
LCS Dup (BE60287-BSD1)							Prepared & Analyzed: 05/06/2016				
ETPH (Extractable Total Petroleum Hydrocarbo	64.7	10.0	mg/kg wet	75.0		86.3	60-120		5.22	30	
Surrogate: 1-Chlorooctadecane	*8.10*		*"*	*10.0*		*81.0*	*50-150*				

Batch BE60233 - EPA 3050B

Blank (BE60233-BLK1)

Prepared: 05/05/2016 Analyzed: 05/06/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Arsenic	ND	1.00	mg/kg wet								
Barium	ND	1.00	"								
Cadmium	ND	0.300	"								
Chromium	ND	0.500	"								
Lead	ND	0.300	"								
Selenium	ND	1.00	"								
Silver	ND	0.500	"								

Reference (BE60233-SRM1)

Prepared: 05/05/2016 Analyzed: 05/06/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Arsenic	112	1.00	mg/kg wet	113		99.5	69.7-142.5				
Barium	157	1.00	"	155		101	72.9-127.1				
Cadmium	67.9	0.300	"	67.5		101	73.2-126.8				
Chromium	161	0.500	"	164		98.3	70.7-129.9				
Lead	86.8	0.300	"	90.1		96.3	70.1-129.9				
Selenium	159	1.00	"	156		102	67.3-132.1				
Silver	48.5	0.500	"	52.6		92.2	66.7-133.5				

Batch BE60388 - EPA 3015A/1311

Blank (BE60388-BLK1)

Prepared: 05/09/2016 Analyzed: 05/10/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Arsenic	ND	0.004	mg/L								
Barium	ND	0.010	"								
Cadmium	ND	0.003	"								
Chromium	ND	0.005	"								
Lead	ND	0.003	"								
Selenium	ND	0.010	"								
Silver	ND	0.005	"								

Batch BE60388 - EPA 3015A/1311

Blank (BE60388-BLK2) Prepared: 05/09/2016 Analyzed: 05/10/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Arsenic	ND	0.004	mg/L								
Barium	ND	0.010	"								
Cadmium	ND	0.003	"								
Chromium	ND	0.005	"								
Lead	ND	0.003	"								
Selenium	ND	0.010	"								
Silver	ND	0.005	"								

Reference (BE60388-SRM1) Prepared: 05/09/2016 Analyzed: 05/10/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Arsenic	0.696		ug/mL	0.720		96.7	84.5-114.1				
Barium	0.378		"	0.400		94.5	85-115				
Cadmium	0.414		"	0.440		94.1	85-115				
Chromium	0.216		"	0.220		98.2	85-115				
Lead	0.811		"	0.840		96.5	85-115				
Selenium	0.683		"	0.720		94.9	85-115				
Silver	0.760		"	0.829		91.6	85-114.9				

Mercury by EPA 7000/200 Series Methods - Quality Control Data

York Analytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BE60207 - EPA 7473 soil											
Blank (BE60207-BLK1)							Prepared & Analyzed: 05/05/2016				
Mercury	ND	0.0300	mg/kg wet								
Reference (BE60207-SRM1)							Prepared & Analyzed: 05/05/2016				
Mercury	6.3459		mg/kg	5.76		110	71.2-129				
Batch BE60322 - EPA 7473 water											
Blank (BE60322-BLK1)							Prepared: 05/06/2016 Analyzed: 05/09/2016				
Mercury	ND	0.000200	mg/L								
Reference (BE60322-SRM1)							Prepared: 05/06/2016 Analyzed: 05/09/2016				
Mercury	0.00245		mg/L	0.00230		106	61.3-135				

Batch BE60194 - EPA SW 846-1311 TCLP ext. for metals

Blank (BE60194-BLK1) Prepared: 05/04/2016 Analyzed: 05/05/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
TCLP Extraction	Completed	1.00	N/A								

Batch BE60195 - EPA SW 846-1311 TCLP extr. for SVOA/PEST/HERBS

Blank (BE60195-BLK1) Prepared: 05/04/2016 Analyzed: 05/05/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
TCLP Extraction	Completed	1.00	N/A								

Batch BE60196 - EPA SW 846-1311 TCLP ZHE for VOA

Blank (BE60196-BLK1) Prepared: 05/04/2016 Analyzed: 05/05/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
TCLP Extraction	Completed	1.00	%								

Batch BE60454 - Analysis Preparation Soil

Blank (BE60454-BLK1) Prepared & Analyzed: 05/10/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Cyanide, total	ND	0.500	mg/kg wet								

Reference (BE60454-SRM1) Prepared & Analyzed: 05/10/2016

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Cyanide, total	53.6		ug/mL	53.9		99.4	37.5-163.7				

DATA QUALITY ASSESSMENT WORKSHEET - VOLATILES

Laboratory Name:	York Analytical Laboratories, Inc.	*Client:*	Fuss & ONeill, Inc.
Project Location:	20130554.A30	*Lab Project No.:*	**16E0136**
Laboratory Sample ID(s):	16E0136-01 - 16E0136-06	*Sampling Date(s):*	05/04/2016 - 05/04/2016

Describe the intended use of the data:

The intended use of this data is determined by the project conceptual site model.

Data Quality Assessment Elements	Data Quality Assessment Nonconformances
STANDARD RCP DELIVERABLES	NONE
Data Package Inspection	NONE
Reasonable Confidence Evaluation	NONE
Chain of Custody Evaluation	NONE
Sample Result Evaluation	NONE
Sample Preservation and Holding Time Evaluation	NONE
Continuing Calibration Verification Evaluation	
Method Blank Evaluation	NONE
Laboratory Control Samples Recovery Evaluation	NONE
Laboratory Control Samples Precision Evaluation	NONE
Surrogate Recovery Evaluation	NONE
Site Specific Matrix Spike Recovery Evaluation	NOT APPLICABLE
Site Specific Matrix Spike Precision Evaluation	NOT APPLICABLE
Tentatively Identified Compounds	NONE

DATA QUALITY ASSESSMENT WORKSHEET - SEMI-VOLATILES

Laboratory Name:	York Analytical Laboratories, Inc.	*Client:*	Fuss & ONeill, Inc.
Project Location:	20130554.A30	*Lab Project No.:*	**16E0136**
Laboratory Sample ID(s):	16E0136-01 - 16E0136-06	*Sampling Date(s):*	05/04/2016 - 05/04/2016

Describe the intended use of the data:

The intended use of this data is determined by the project conceptual site model.

Data Quality Assessment Elements	Data Quality Assessment Nonconformances
STANDARD RCP DELIVERABLES	NONE
Data Package Inspection	NONE
Reasonable Confidence Evaluation	NONE
Chain of Custody Evaluation	NONE
Sample Result Evaluation	NONE
Sample Preservation and Holding Time Evaluation	NONE
Continuing Calibration Verification Evaluation	
Method Blank Evaluation	NONE

DATA QUALITY ASSESSMENT WORKSHEET - SEMI-VOLATILES

Laboratory Name:	York Analytical Laboratories, Inc.	*Client:*	Fuss & ONeill, Inc.
Project Location:	20130554.A30	*Lab Project No.:*	**16E0136**
Laboratory Sample ID(s):	16E0136-01 - 16E0136-06	*Sampling Date(s):*	05/04/2016 - 05/04/2016

Describe the intended use of the data:
The intended use of this data is determined by the project conceptual site model.

Data Quality Assessment Elements	Data Quality Assessment Nonconformances
Laboratory Control Samples Recovery Evaluation	LCS Recovery for Carbazole (488%) was outside acceptance limits (40-140) in BE60405-BS1 for Semi-Volatiles, CT RCP BNA List - This LCS analyte is outside Laboratory Recovery limits due the analyte behavior using the referenced method. The reference method has certain limitations with respect to analytes of this nature. LCS Recovery for Hexachlorocyclopentadiene (15.4%) was outside acceptance limits (40-140) in BE60405-BS1 for Semi-Volatiles, CT RCP BNA List - This LCS analyte is outside Laboratory Recovery limits due the analyte behavior using the referenced method. The reference method has certain limitations with respect to analytes of this nature. LCS Recovery for Pyridine (37.9%) was outside acceptance limits (40-140) in BE60405-BS1 for Semi-Volatiles, CT RCP BNA List - This LCS analyte is outside Laboratory Recovery limits due the analyte behavior using the referenced method. The reference method has certain limitations with respect to analytes of this nature. LCS Recovery for Carbazole (455%) was outside acceptance limits (40-140) in BE60405-BSD1 for Semi-Volatiles, CT RCP BNA List - This LCS analyte is outside Laboratory Recovery limits due the analyte behavior using the referenced method. The reference method has certain limitations with respect to analytes of this nature. LCS Recovery for Hexachlorocyclopentadiene (11.3%) was outside acceptance limits (40-140) in BE60405-BSD1 for Semi-Volatiles, CT RCP BNA List - This LCS analyte is outside Laboratory Recovery limits due the analyte behavior using the referenced method. The reference method has certain limitations with respect to analytes of this nature.

DATA QUALITY ASSESSMENT WORKSHEET - PESTICIDES

Laboratory Name:	York Analytical Laboratories, Inc.	*Client:*	Fuss & ONeill, Inc.
Project Location:	20130554.A30	*Lab Project No.:*	**16E0136**
Laboratory Sample ID(s):	16E0136-01 - 16E0136-06	*Sampling Date(s):*	05/04/2016 - 05/04/2016

Describe the intended use of the data:
The intended use of this data is determined by the project conceptual site model.

Data Quality Assessment Elements	Data Quality Assessment Nonconformances
STANDARD RCP DELIVERABLES	NONE
Data Package Inspection	NONE
Reasonable Confidence Evaluation	NONE
Chain of Custody Evaluation	NONE
Sample Result Evaluation	NONE
Sample Preservation and Holding Time Evaluation	NONE
Method Blank Evaluation	NONE
Laboratory Control Samples Recovery Evaluation	NONE
Laboratory Control Samples Precision Evaluation	NONE
Surrogate Recovery Evaluation	Surrogate Recovery for Tetrachloro-m-xylene (29.0%) was outside acceptance limits (30-140) in 16E0136-03 for Pesticides, CT RCP Target List - Surrogate recovery outside of control limits. The data was accepted based on valid recovery of the alternate surrogate.
Site Specific Matrix Spike Recovery Evaluation	NOT APPLICABLE
Site Specific Matrix Spike Precision Evaluation	NOT APPLICABLE
Tentatively Identified Compounds	NONE

DATA QUALITY ASSESSMENT WORKSHEET - PCBs

Laboratory Name:	York Analytical Laboratories, Inc.	*Client:*	Fuss & ONeill, Inc.
Project Location:	20130554.A30	*Lab Project No.:*	**16E0136**
Laboratory Sample ID(s):	16E0136-01 - 16E0136-06	*Sampling Date(s):*	05/04/2016 - 05/04/2016

Describe the intended use of the data:

The intended use of this data is determined by the project conceptual site model.

Data Quality Assessment Elements	Data Quality Assessment Nonconformances
STANDARD RCP DELIVERABLES	NONE
Data Package Inspection	NONE
Reasonable Confidence Evaluation	NONE
Chain 0f Custody Evaluation	NONE
Sample Result Evaluation	NONE
Sample Preservation and Holding Time Evaluation	NONE
Method Blank Evaluation	NONE
Laboratory Control Samples Recovery Evaluation	NONE
Laboratory Control Samples Precision Evaluation	NONE
Surrogate Recovery Evaluation	NONE
Site Specific Matrix Spike Recovery Evaluation	NONE
Site Specific Matrix Spike Precision Evaluation	NOT APPLICABLE
Tentatively Identified Compounds	NONE

DATA QUALITY ASSESSMENT WORKSHEET - HERBICIDES

Laboratory Name:	York Analytical Laboratories, Inc.	*Client:*	Fuss & ONeill, Inc.
Project Location:	20130554.A30	*Lab Project No.:*	**16E0136**
Laboratory Sample ID(s):	16E0136-01 - 16E0136-06	*Sampling Date(s):*	05/04/2016 - 05/04/2016

Describe the intended use of the data:

The intended use of this data is determined by the project conceptual site model.

Data Quality Assessment Elements	Data Quality Assessment Nonconformances
STANDARD RCP DELIVERABLES	NONE
Data Package Inspection	NONE
Reasonable Confidence Evaluation	NONE
Chain of Custody Evaluation	NONE
Sample Result Evaluation	NONE
Sample Preservation and Holding Time Evaluation	NONE
Method Blank Evaluation	NONE
Laboratory Control Samples Recovery Evaluation	NONE
Laboratory Control Samples Precision Evaluation	NONE
Surrogate Recovery Evaluation	NONE
Site Specific Matrix Spike Recovery Evaluation	NONE
Site Specific Matrix Spike Precision Evaluation	NOT APPLICABLE
Tentatively Identified Compounds	NONE

DATA QUALITY ASSESSMENT WORKSHEET - ETPH

Laboratory Name:	York Analytical Laboratories, Inc.	*Client:*	Fuss & ONeill, Inc.
Project Location:	20130554.A30	*Lab Project No.:*	**16E0136**
Laboratory Sample ID(s):	16E0136-01 - 16E0136-06	*Sampling Date(s):*	05/04/2016 - 05/04/2016

Describe the intended use of the data:

The intended use of this data is determined by the project conceptual site model.

Data Quality Assessment Elements	Data Quality Assessment Nonconformances
STANDARD RCP DELIVERABLES	NONE
Data Package Inspection	NONE
Reasonable Confidence Evaluation	NONE
Chain of Custody Evaluation	NONE
Sample Result Evaluation	NONE
Sample Preservation and Holding Time Evaluation	NONE
Method Blank Evaluation	NONE
Laboratory Control Samples Recovery Evaluation	NONE
Laboratory Control Samples Precision Evaluation	NONE
Surrogate Recovery Evaluation	NONE
Site Specific Matrix Spike Recovery Evaluation	NONE
Site Specific Matrix Spike Precision Evaluation	NOT APPLICABLE
Tentatively Identified Compounds	NONE

DATA QUALITY ASSESSMENT WORKSHEET - METALS

Laboratory Name:	York Analytical Laboratories, Inc.	*Client:*	Fuss & ONeill, Inc.
Project Location:	20130554.A30	*Lab Project No.:*	**16E0136**
Laboratory Sample ID(s):	16E0136-01 - 16E0136-06	*Sampling Date(s):*	05/04/2016 - 05/04/2016

Describe the intended use of the data:

The intended use of this data is determined by the project conceptual site model.

Data Quality Assessment Elements	Data Quality Assessment Nonconformances
STANDARD RCP DELIVERABLES	NONE
Data Package Inspection	NONE
Reasonable Confidence Evaluation	NONE
Chain of Custody Evaluation	NONE
Sample Result Evaluation	NONE
Sample Preservation and Holding Time Evaluation	NONE
Method Blank Evaluation	NONE
Laboratory Control Samples Recovery Evaluation	NOT APPLICABLE
Laboratory Control Samples Precision Evaluation	NOT APPLICABLE
Standard Reference Material Recovery Evaluation	NONE
Site Specific Matrix Spike Recovery Evaluation	NONE
Site Specific Matrix Spike Precision Evaluation	NOT APPLICABLE
Duplicate Precision Evaluation	NONE

DATA QUALITY ASSESSMENT WORKSHEET - MERCURY

Laboratory Name:	York Analytical Laboratories, Inc.	*Client:*	Fuss & ONeill, Inc.
Project Location:	20130554.A30	*Lab Project No.:*	**16E0136**
Laboratory Sample ID(s):	16E0136-01 - 16E0136-06	*Sampling Date(s):*	05/04/2016 - 05/04/2016

Describe the intended use of the data:
The intended use of this data is determined by the project conceptual site model.

Data Quality Assessment Elements	Data Quality Assessment Nonconformances
STANDARD RCP DELIVERABLES	NONE
Data Package Inspection	NONE
Reasonable Confidence Evaluation	NONE
Chain of Custody Evaluation	NONE
Sample Result Evaluation	NONE
Sample Preservation and Holding Time Evaluation	NONE
Method Blank Evaluation	NONE
Laboratory Control Samples Recovery Evaluation	NOT APPLICABLE
Laboratory Control Samples Precision Evaluation	NOT APPLICABLE
Standard Reference Material Recovery Evaluation	NONE
Site Specific Matrix Spike Recovery Evaluation	NONE
Site Specific Matrix Spike Precision Evaluation	NOT APPLICABLE
Duplicate Precision Evaluation	NONE

DATA QUALITY ASSESSMENT SUMMARY

Laboratory:	York Analytical Laboratories, Inc.	Client:	Fuss & ONeill, Inc.
Project:	20130554.A30	Lab Project No:	16E0136
Laboratory Sample ID(s):	16E0136-01 - 16E0136-06	Sampling Date(s):	05/04/2016 - 05/04/2016
Review Date(s):	12/30/1899 - 05/13/2016	Laboratory Reviewer(s):	MS

QC Sample Nonconformances

Batch ID: BE60405

QC Sample ID	Analyte	Result	Type of QC Nonconformance	%REC	%REC Limits	Bias	RPD	RPD Limit	Bias	Comments
BE60405-BS1	Carbazole	12200 ug/kg w	LCS	488	40-140	High Bias				This LCS analyte is outside Laboratory Recovery limits due the analyte behavior using the referenced method. The reference method has certain limitations with respect to analytes of this nature.
BE60405-BS1	Hexachlorocyclopentadiene	384 ug/kg wet	LCS	15.4	40-140	Low Bias				This LCS analyte is outside Laboratory Recovery limits due the analyte behavior using the referenced method. The reference method has certain limitations with respect to analytes of this nature.
BE60405-BS1	Pyridine	948 ug/kg wet	LCS	37.9	40-140	Low Bias				This LCS analyte is outside Laboratory Recovery limits due the analyte behavior using the referenced method. The reference method has certain limitations with respect to analytes of this nature.
BE60405-BSD1	Carbazole	11400 ug/kg w	LCS Dup	455	40-140	High Bias	6.94	30		This LCS analyte is outside Laboratory Recovery limits due the analyte behavior using the referenced method. The reference method has certain limitations with respect to analytes of this nature.
BE60405-BSD1	Hexachlorocyclopentadiene	284 ug/kg wet	LCS Dup	11.3	40-140	Low Bias	30.2	30	Non-dir.	This LCS analyte is outside Laboratory Recovery limits due the analyte behavior using the referenced method. The reference method has certain limitations with respect to analytes of this nature.

Batch ID: BE60405

QC Sample ID	Analyte	Result	Type of QC Nonconformance	%REC	%REC Limits	Bias	RPD	RPD Limit	Bias	Comments
BE60405-BSD1	Pentachlorophenol	784 ug/kg wet	LCS Dup	31.3	30-130		45.7	30	Non-dir.	This LCS analyte is outside Laboratory Recovery limits due the analyte behavior using the referenced method. The reference method has certain limitations with respect to analytes of this nature.
BE60405-BSD1	Pyridine	1000 ug/kg we	LCS Dup	40.0	40-140	Low Bias	5.24	30		

Batch Summary

Batch ID: BE60405 **General Method:** Semivolatile Organic Compounds by GC/MS

YORK Sample ID	Client Sample ID
16E0136-01	1252160504-01
16E0136-02	1252160504-02
16E0136-03	1252160504-03
16E0136-04	1252160504-04
BE60405-BLK1	Blank
BE60405-BS1	LCS
BE60405-BSD1	LCS Dup

Laboratory:	York Analytical Laboratories, Inc.	Client:	Fuss & ONeill, Inc.
Project:	20130554.A30	Lab Project No:	16E0136
Laboratory Sample ID(s):	16E0136-01 - 16E0136-06	Sampling Date(s):	05/04/2016 - 05/04/2016
Review Date(s):	12/30/1899 - 05/13/2016	Laboratory Reviewer(s):	MS

Sample Nonconformances

Sample ID	Analyte	Result	Type of QC Nonconformance	%REC	%REC Limits	Bias	RPD	RPD Limit	Bias	Comments
16E0136-03 (1252160504-03)	Surrogate: Tetrachloro-m-xylene	35.7 ug/kg dry	Surrogate	29.0	30-140	Low Bias				Surrogate recovery outside of control limits. The data was accepted based on valid recovery of the alternate surrogate.

Notes: Other RCP nonconformances, if any, are detailed in the Data Quality Assessment worksheets.

For multiple surrogate analyses such as semi-volatiles, volatiles, etc, single surrogate excursions do not necessarily indicate a bias in the sample. Samples with multiple surrogate excursions may exhibit a bias in the results.

Definitions:
LCS - Laboratory Control Sample
LCS dup - Laboratory Control Sample Duplicate
MS - Matrix Spike
MSD - Matrix Spike Duplicate
BS - Blank Spike also called LCS
BSD - Blank Spike Duplicate also called LCS dup
SRM - Standard Reference Material
DUP - Duplicate

Notes and Definitions

SCAL-E	The value reported is ESTIMATED. The value is estimated due to its behavior during initial calibration (average Rf>20%).
QL-02	This LCS analyte is outside Laboratory Recovery limits due the analyte behavior using the referenced method. The reference method has certain limitations with respect to analytes of this nature.
PF-01	No Free Liquid
M-SeTC	It is noted that a known interference with selenium at the analytical line for analysis by ICP is caused by carbon emission from the TCLP or high organics matrix. The data user may subtract the matrix blank value from the data if needed.
IGN-01	Non-Ignit.
GC-Surr	Surrogate recovery outside of control limits. The data was accepted based on valid recovery of the alternate surrogate.
EXT-COMP	Completed
CCV-E	The value reported is ESTIMATED. The value is estimated due to its behavior during continuing calibration verification (>20% Difference for average Rf or >20% Drift for quadratic fit).
-	The reporting limits have been elevated due to a reduction in the amount of sample used during preparation.

---

*	Analyte is not certified or the state of the samples origination does not offer certification for the Analyte.
ND	NOT DETECTED - the analyte is not detected at the Reported to level (LOQ/RL or LOD/MDL)
RL	REPORTING LIMIT - the minimum reportable value based upon the lowest point in the analyte calibration curve.
LOQ	LIMIT OF QUANTITATION - the minimum concentration of a target analyte that can be reported within a specified degree of confidence. This is the lowest point in an analyte calibration curve that has been subjected to all steps of the processing/analysis and verified to meet defined criteria. This is based upon NELAC 2009 Standards and applies to all analyses.
LOD	LIMIT OF DETECTION - a verified estimate of the minimum concentration of a substance in a given matrix that an analytical process can reliably detect. This is based upon NELAC 2009 Standards and applies to all analyses conducted under the auspices of EPA SW-846.
MDL	METHOD DETECTION LIMIT - a statistically derived estimate of the minimum amount of a substance an analytical system can reliably detect with a 99% confidence that the concentration of the substance is greater than zero. This is based upon 40 CFR Part 136 Appendix B and applies only to EPA 600 and 200 series methods.
Reported to	This indicates that the data for a particular analysis is reported to either the LOD/MDL, or the LOQ/RL. In cases where the "Reported to" is located above the LOD/MDL, any value between this and the LOQ represents an estimated value which is "J" flagged accordingly. This applies to volatile and semi-volatile target compounds only.
NR	Not reported
RPD	Relative Percent Difference
Wet	The data has been reported on an as-received (wet weight) basis
Low Bias	Low Bias flag indicates that the recovery of the flagged analyte is below the laboratory or regulatory lower control limit. The data user should take note that this analyte may be biased low but should evaluate multiple lines of evidence including the LCS and site-specific MS/MSD data to draw bias conclusions. In cases where no site-specific MS/MSD was requested, only the LCS data can be used to evaluate such bias.
High Bias	High Bias flag indicates that the recovery of the flagged analyte is above the laboratory or regulatory upper control limit. The data user should take note that this analyte may be biased high but should evaluate multiple lines of evidence including the LCS and site-specific MS/MSD data to draw bias conclusions. In cases where no site-specific MS/MSD was requested, only the LCS data can be used to evaluate such bias.
Non-Dir.	Non-dir. flag (Non-Directional Bias) indicates that the Relative Percent Difference (RPD) (a measure of precision) among the MS and MSD data is outside the laboratory or regulatory control limit. This alerts the data user where the MS and MSD are from site-specific samples that the RPD is high due to either non-homogeneous distribution of target analyte between the MS/MSD or indicates poor reproducibility for other reasons.

If EPA SW-846 method 8270 is included herein it is noted that the target compound N-nitrosodiphenylamine (NDPA) decomposes in the gas chromatographic inlet and cannot be separated from diphenylamine (DPA). These results could actually represent 100% DPA, 100% NDPA or some combination of the two.
For this reason, York reports the combined result for n-nitrosodiphenylamine and diphenylamine for either of these compounds as a combined concentration as Diphenylamine.

If Total PCBs are detected and the target aroclors reported are "Not detected", the Total PCB value is reported due to the presence of either or both Aroclors 1262 and 1268 which are non-target aroclors for some regulatory lists.

2-chloroethylvinyl ether readily breaks down under acidic conditions. Samples that are acid preserved, including standards will exhibit breakdown. The data user should take note.

Certification for pH is no longer offered by NYDOH ELAP.

Semi-Volatile and Volatile analyses are reported down to the LOD/MDL, with values between the LOD/MDL and the LOQ being "J" flagged as estimated results.

For analyses by EPA SW-846-8270D, the Limit of Quantitation (LOQ) reported for benzidine is based upon the lowest standard used for calibration and is not a verified LOQ due to this compound's propensity for oxidative losses during extraction/concentration procedures and non-reproducible chromatographic performance.

FUSS & O'NEILL
(860) 646-2469 • www.FandO.com

☐ 146 Hartford Road, Manchester, CT 06040
☒ 56 Quarry Road, Trumbull, CT 06611
☐ 1419 Richland Street, Columbia, SC 29201
☐ 78 Interstate Drive, West Springfield, MA 01089
☐ 317 Iron Horse Way, Suite 204, Providence, RI 02908
☐ 80 Washington Street, Suite 301, Poughkeepsie, NY
☐ Other 16E0136

CHAIN-OF-CUSTODY RECORD 32256

Turnaround
☐ 24-Hour* ☐ 48-Hour* ☐ 72-Hour* ☒ Standard (5-7 days) ☐ Other ______ (days)
*Surcharge Applies

PROJECT NAME: Stormwater Sediment
PROJECT LOCATION: New Haven, CT
PROJECT NUMBER: 20130554-A30
LABORATORY: York

REPORT TO: Gregory Toothill (FIO)
INVOICE TO: Same
P.O. NO.: 20130554.A30
Sampler's Signature:
Date: 5/4/16

Source Codes:
MW=Monitoring Well PW=Potable Water T=Treatment Facility S=Soil B=Sediment
SW=Surface Water ST=Stormwater W=Waste A=Air C=Concrete
X=Other Trip Blank

Analysis Request

Containers

Item No.	Transfer Check 1	2	3	4	Sample Number	Source Code	Date Sampled	Time Sampled	RCRA 8 Metals - Total & TCLP	VOCs - Total & TCLP (8260)	SVOCs - Total & TCLP (8270)	Pesticides - Total & TCLP	Herbicides - Total & TCLP	ETPH (CT Method); PCBs (8082) (soxhlet)	Reactivity (cyanide & sulfide); pH	Cyanide; Ignitability; Paint Filter Test	Soil VOA Vial, ☒ methanol	Soil VOA Vial, ☒ water	Glass Soil Container (8) oz	Other: Glass Soil Container 16oz	Other:	Water VOA Vial, ☐ As is ☐ HCl	Glass Amber ( ) ml, ☐ As is ☐ H₂SO₄	Plastic - As is, ☐ 250 ml ☐ 500 ☐ 1000 ml	Plastic - H₂SO₄, ☐ 250 ml ☐ 500 ml	Plastic - HNO₃, 250 ml ☐ Filtered ☐ 0.45µ ☐ 10µ	Plastic - NaOH, 250 ml	Comments
01					1252160504-01	B	5/4/16	0825	X	X	X	X	X	X	X	X	1	2	1	1								
02					↓ -02	↓	↓	1020	X	X	X	X	X	X	X	X	↓	↓	↓	↓								
03					-03			1100	X	X	X	X	X	X	X	X												
04					-04			1145	X	X	X	X	X	X	X	X												
05					-05	X		1200		X							1											High TB
06					↓ -06	↓	↓	1205		X								2										Low TB

Transfer Number	Relinquished By	Accepted By	Date	Time
1			5/4/16	1350
2				
3			5/4/16	1350
4				

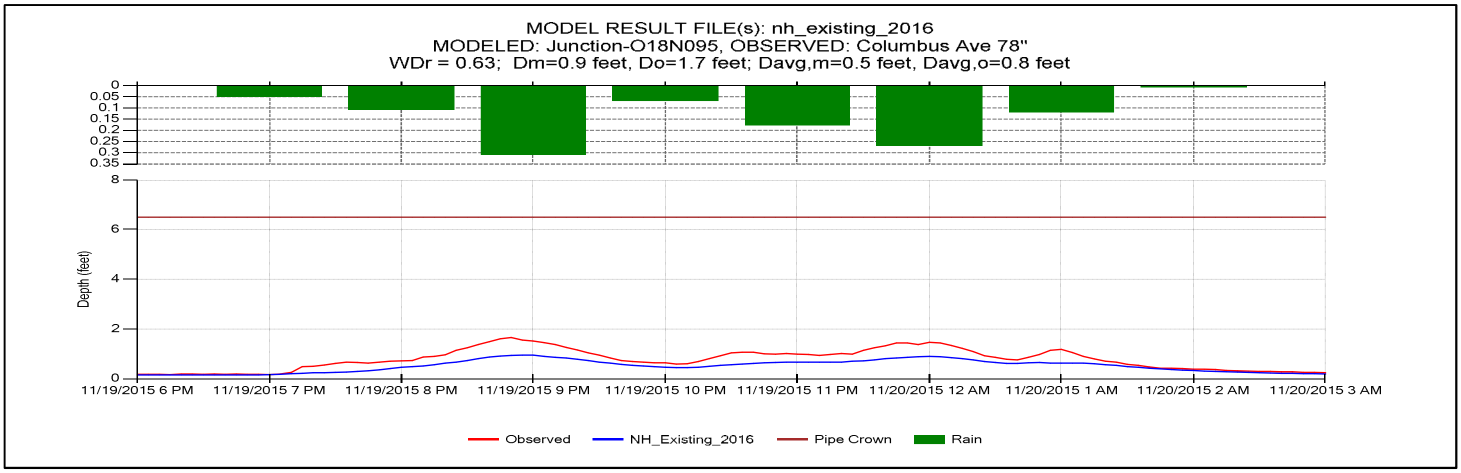
Charge Exceptions: ☒ CT Tax Exempt ☒ QA/QC ☐ Other ______
ø Duplicates 2 Blanks (Item Nos: See Comments)
Reporting and Detection Limit Requirements: ☒ RCP Deliverables ☐ MCP CAM Cert.
Res DEC, GA PMC
Additional Comments: Tax Exempt City of New Haven
3.0°

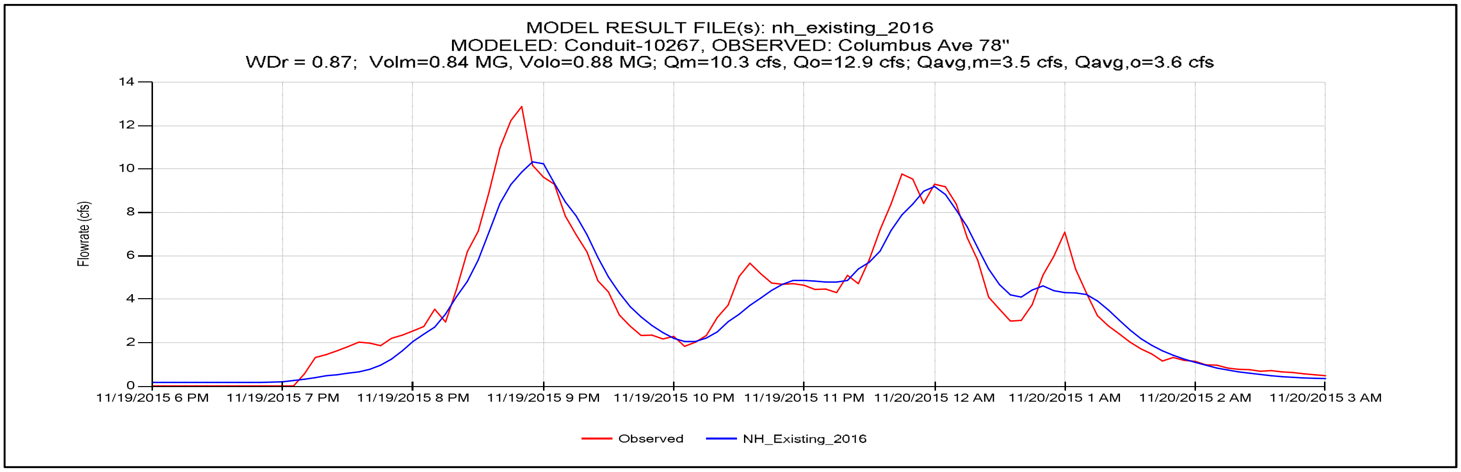
Appendix C

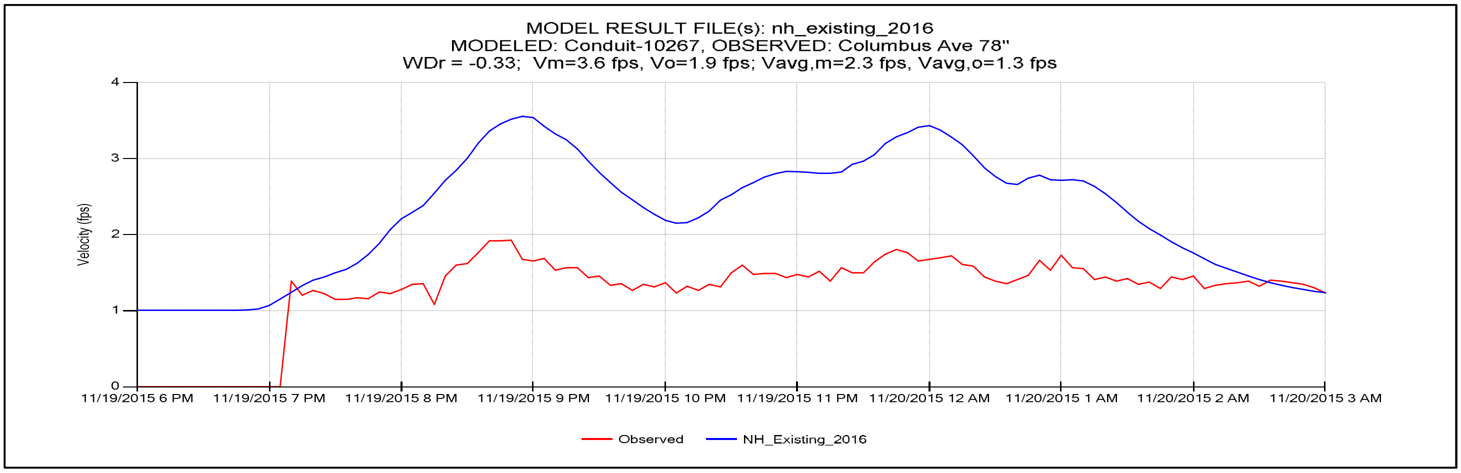
SWMM Model Calibration Plots

Simulated Versus Observed Flow at Flow Meter Sites

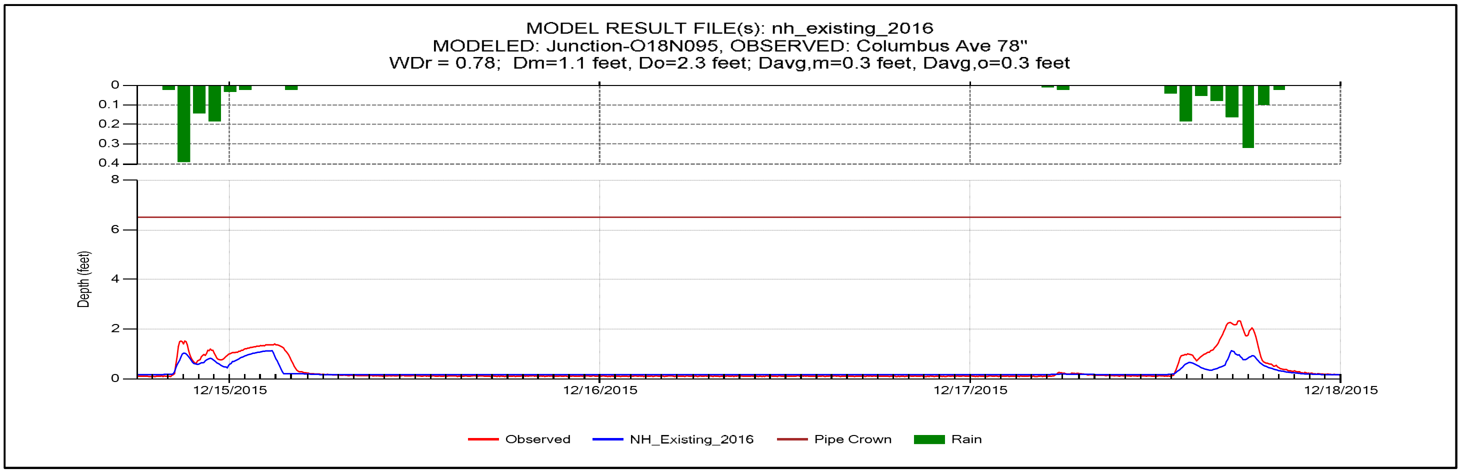
Meter01-Fall1

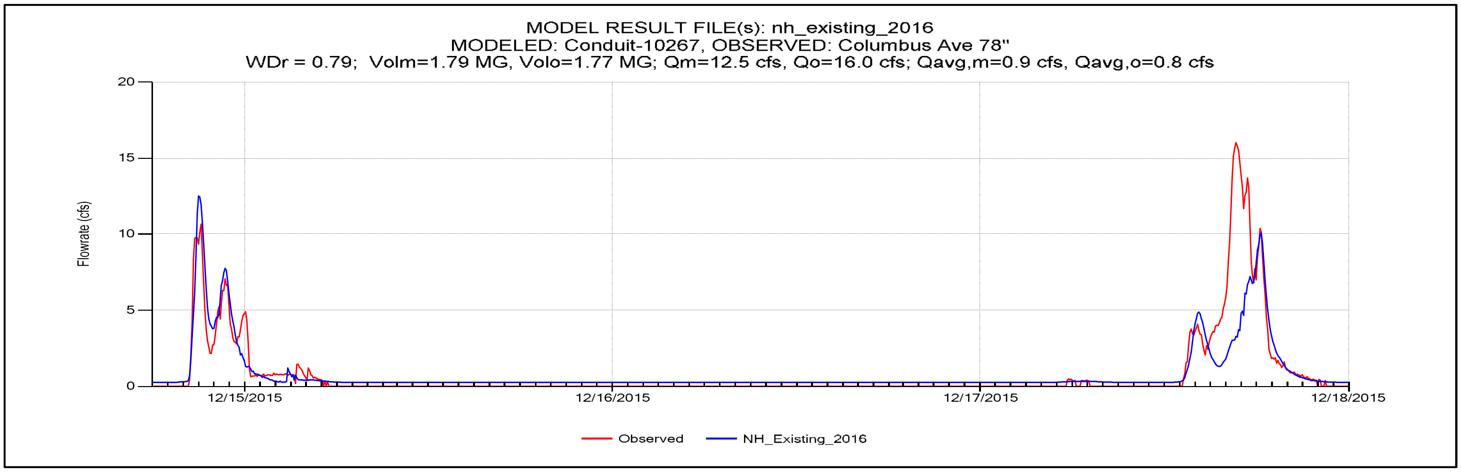


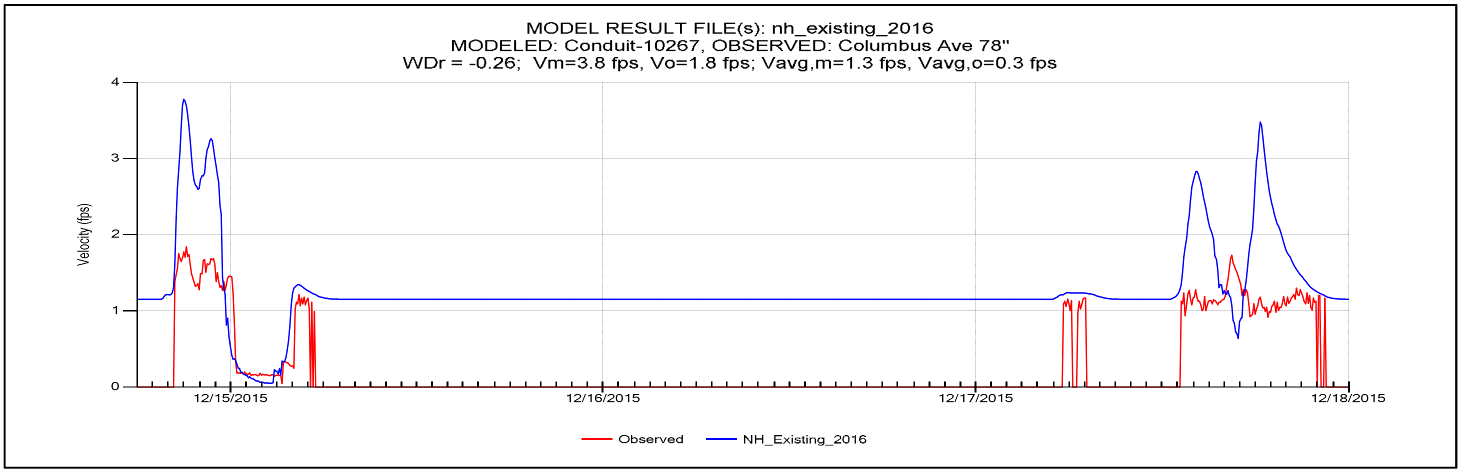




Meter01-Fall2

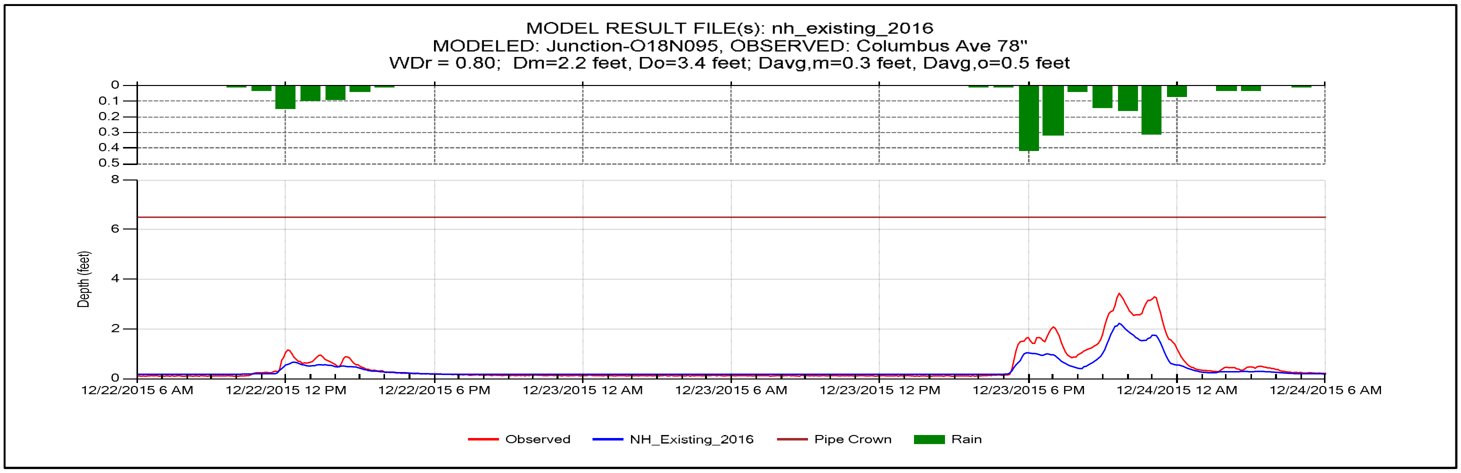


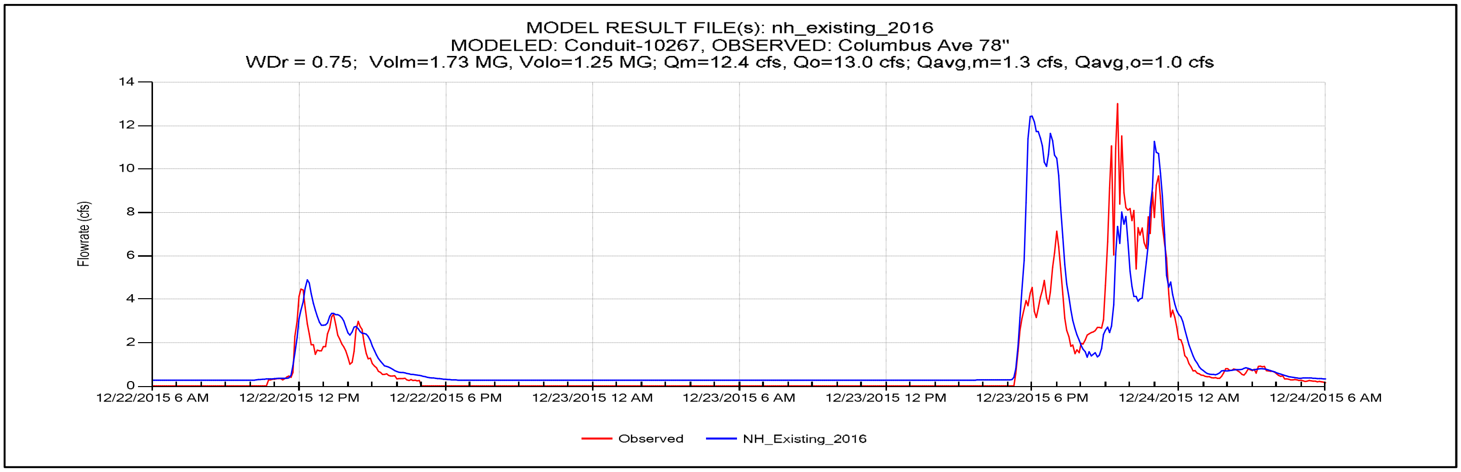


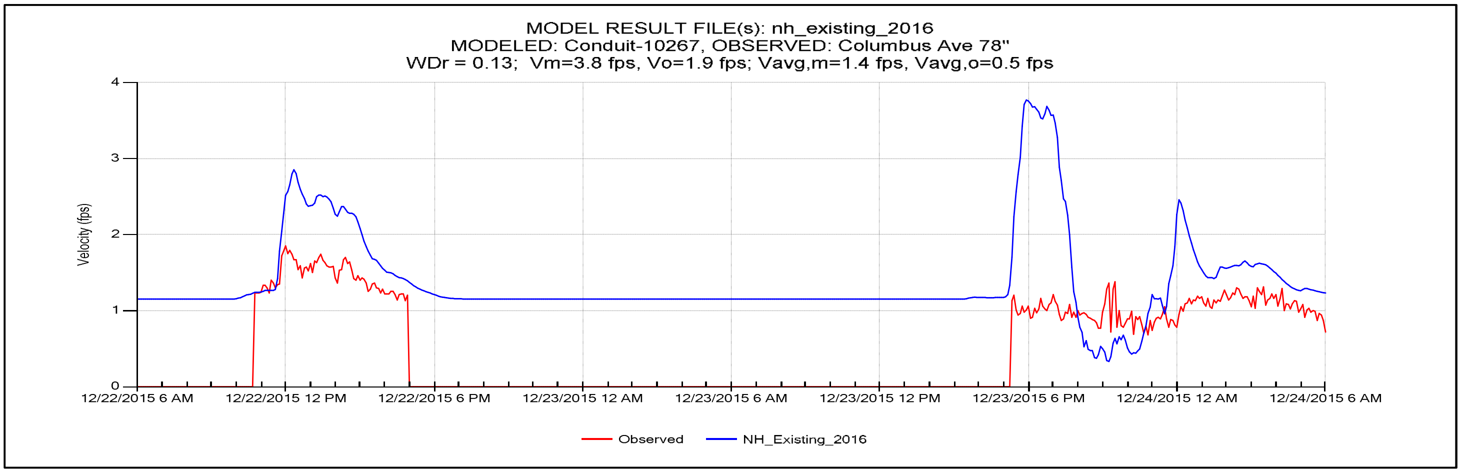


Simulated Versus Observed Flow at Flow Meter Sites

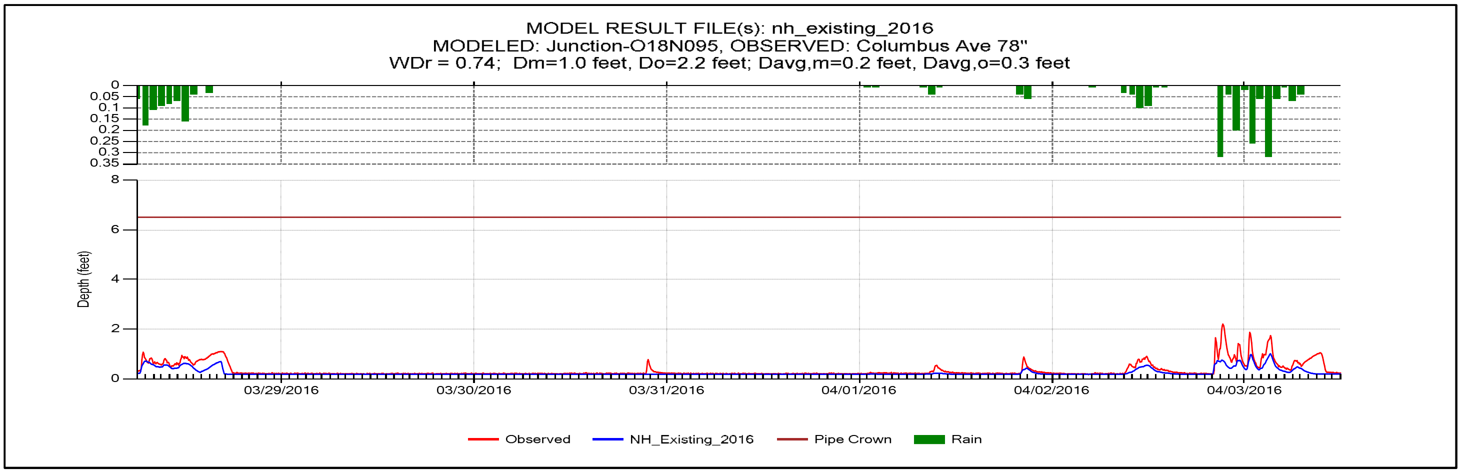
Meter01-Fall3

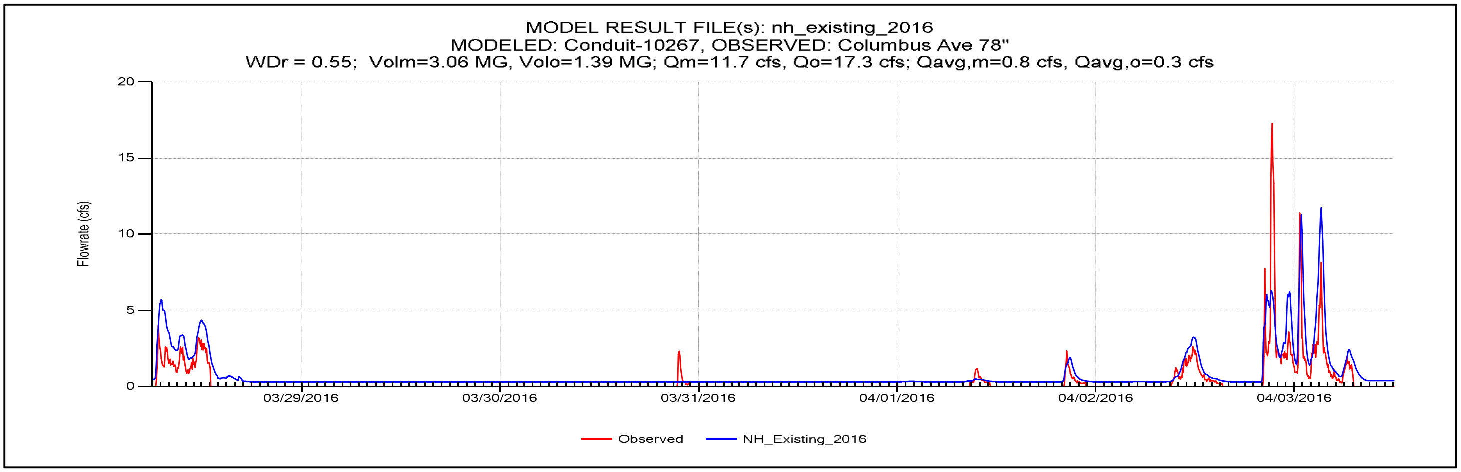


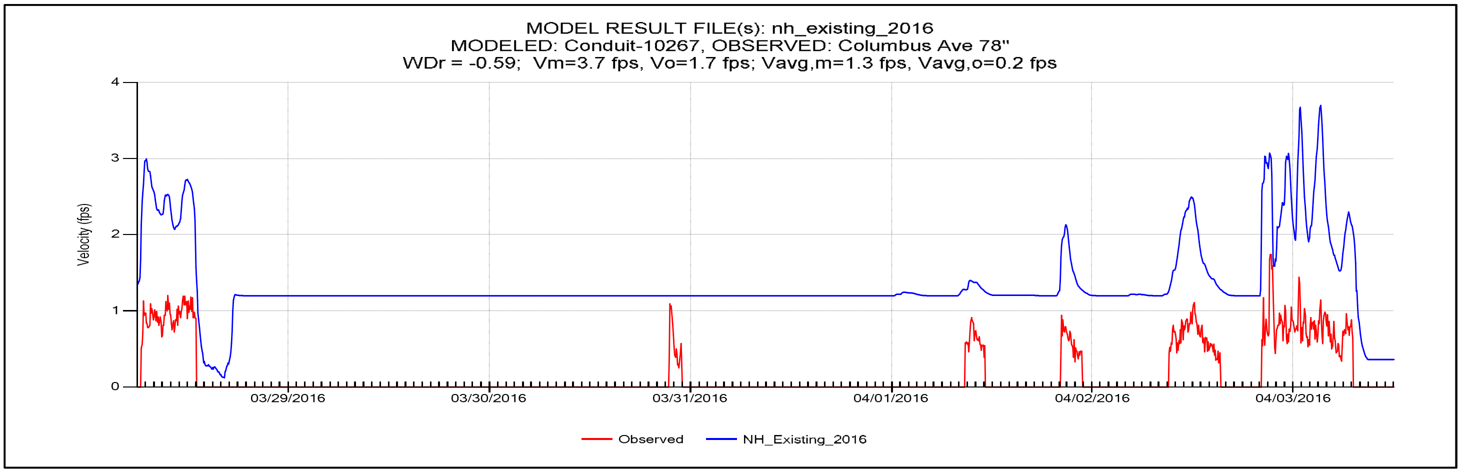




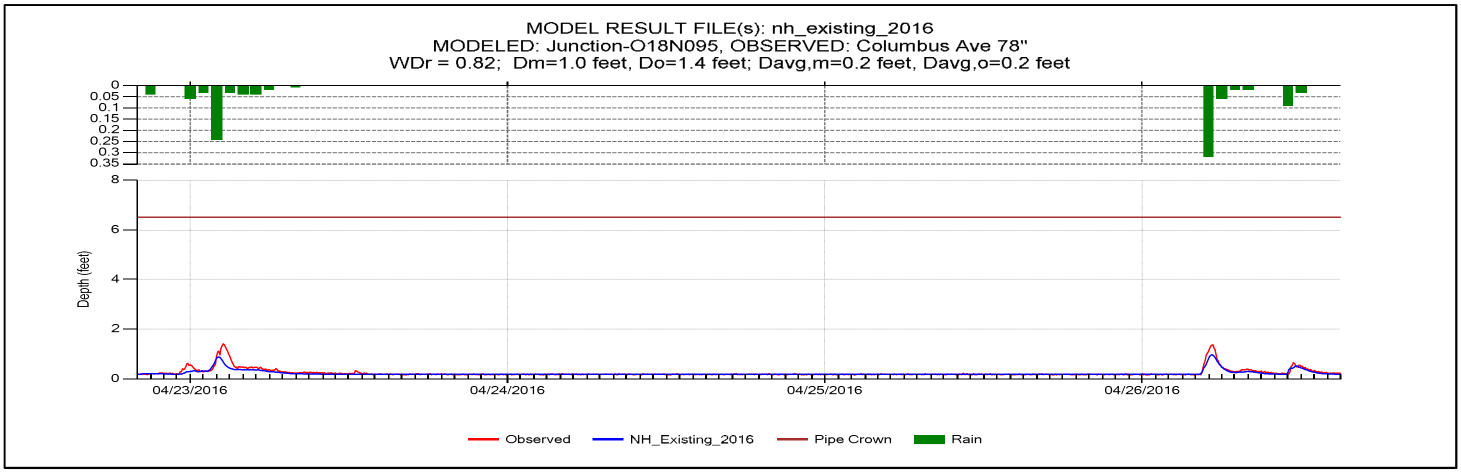
Meter01-Spring1

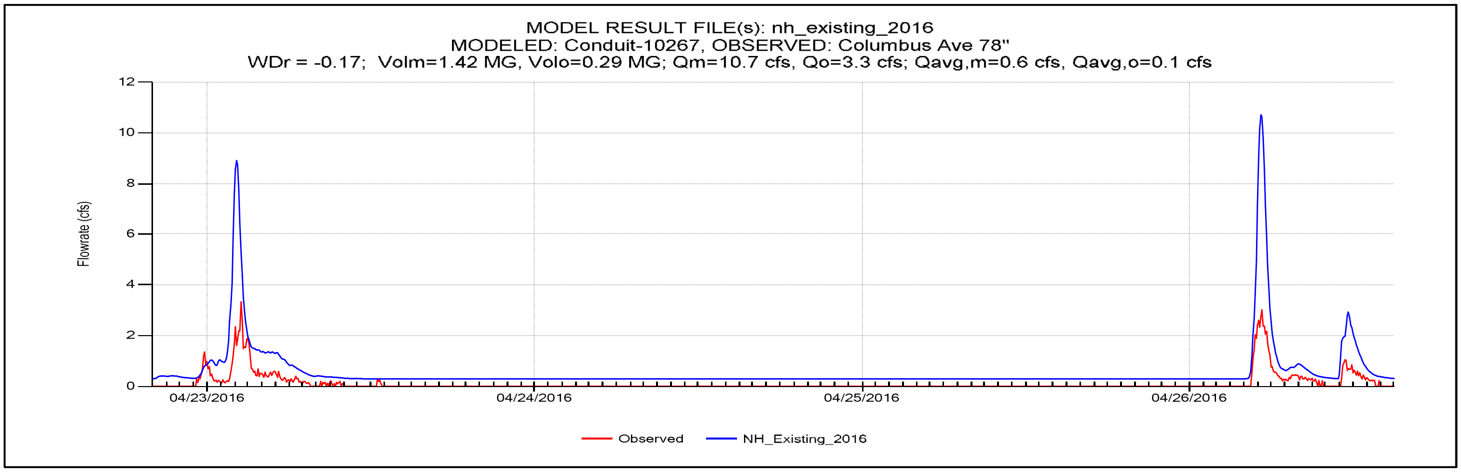


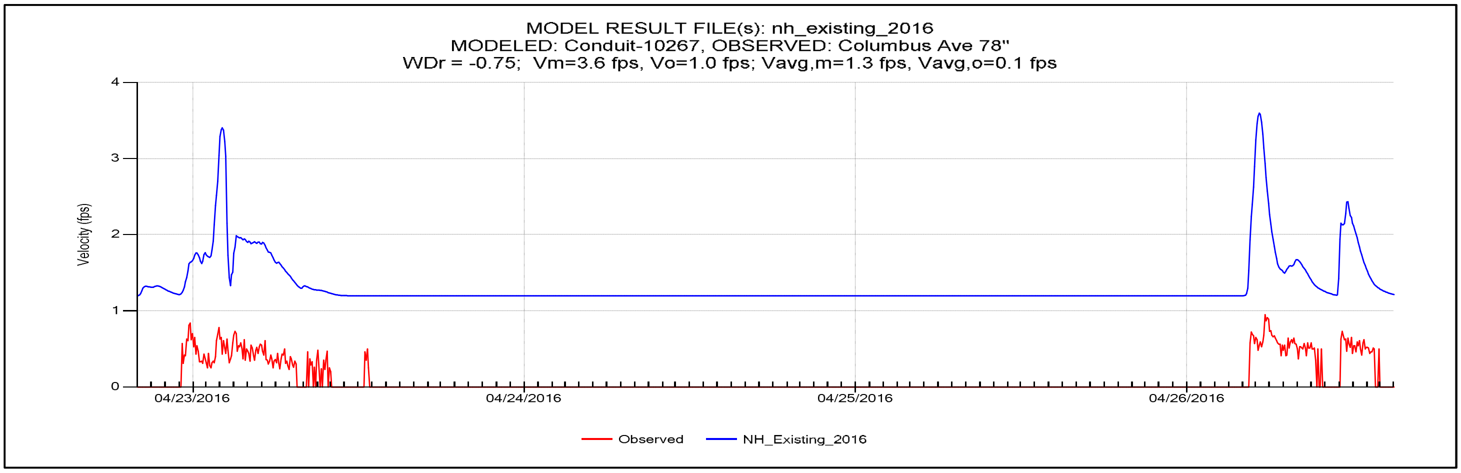




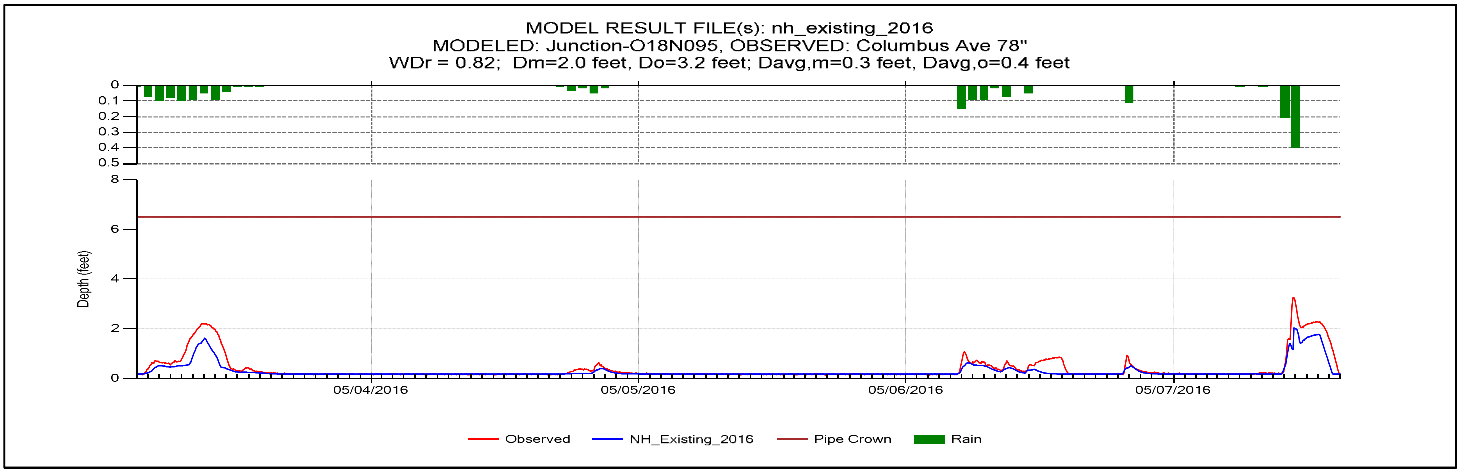
Meter01-Spring2



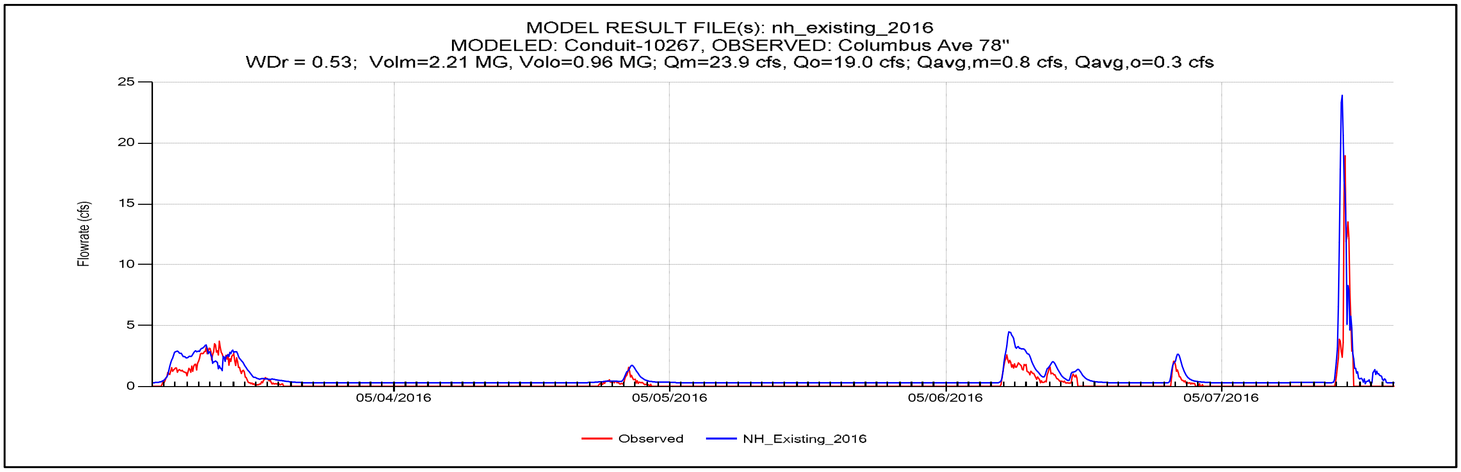




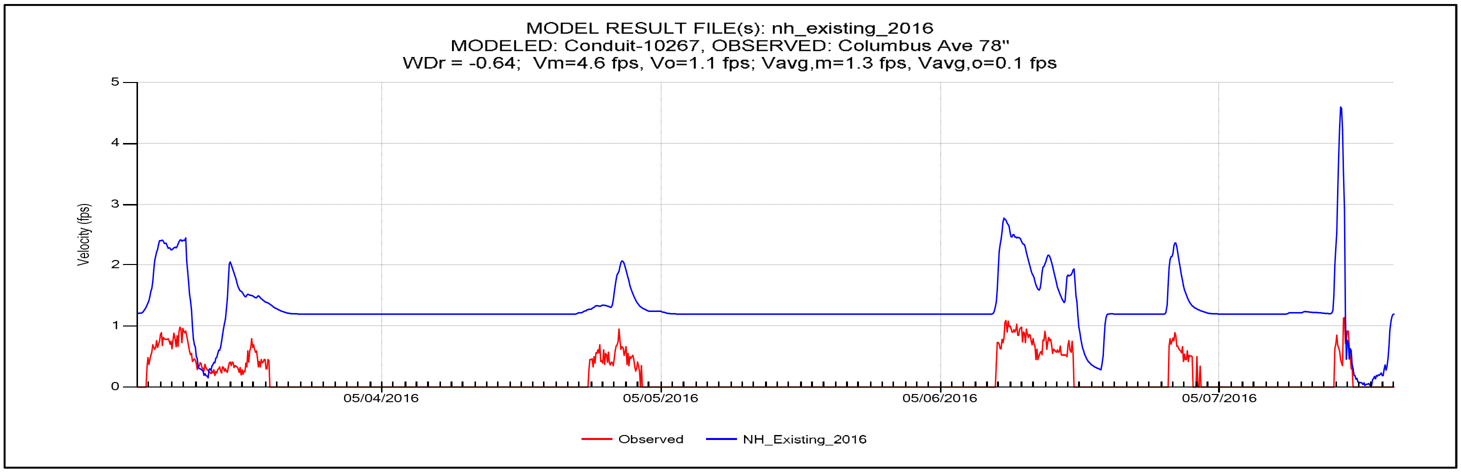
Meter01-Spring3



MODEL RESULT FILE(s): nh_existing_2016
MODELED: Junction-O18N095, OBSERVED: Columbus Ave 78"
WDr = 0.82; Dm=2.0 feet, Do=3.2 feet; Davg,m=0.3 feet, Davg,o=0.4 feet

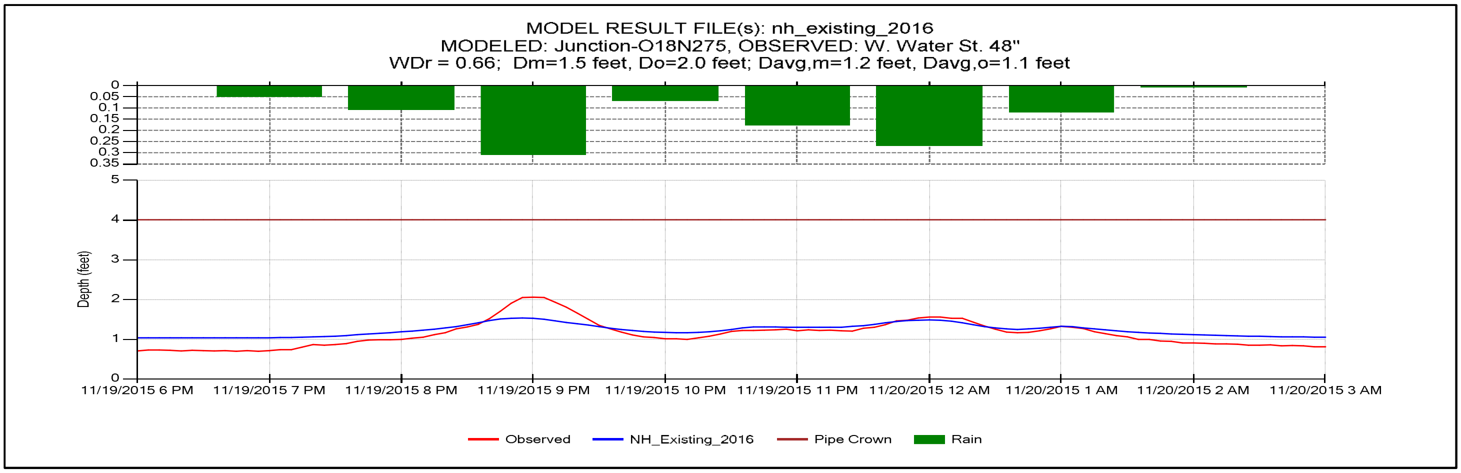


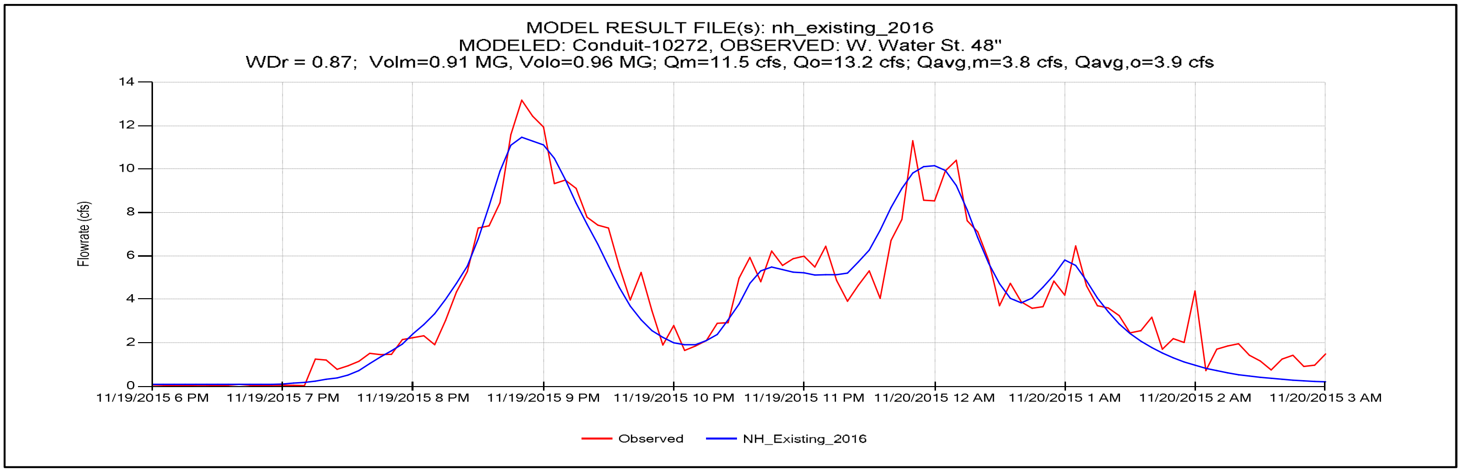
MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-10267, OBSERVED: Columbus Ave 78"
WDr = 0.53; Volm=2.21 MG, Volo=0.96 MG; Qm=23.9 cfs, Qo=19.0 cfs; Qavg,m=0.8 cfs, Qavg,o=0.3 cfs

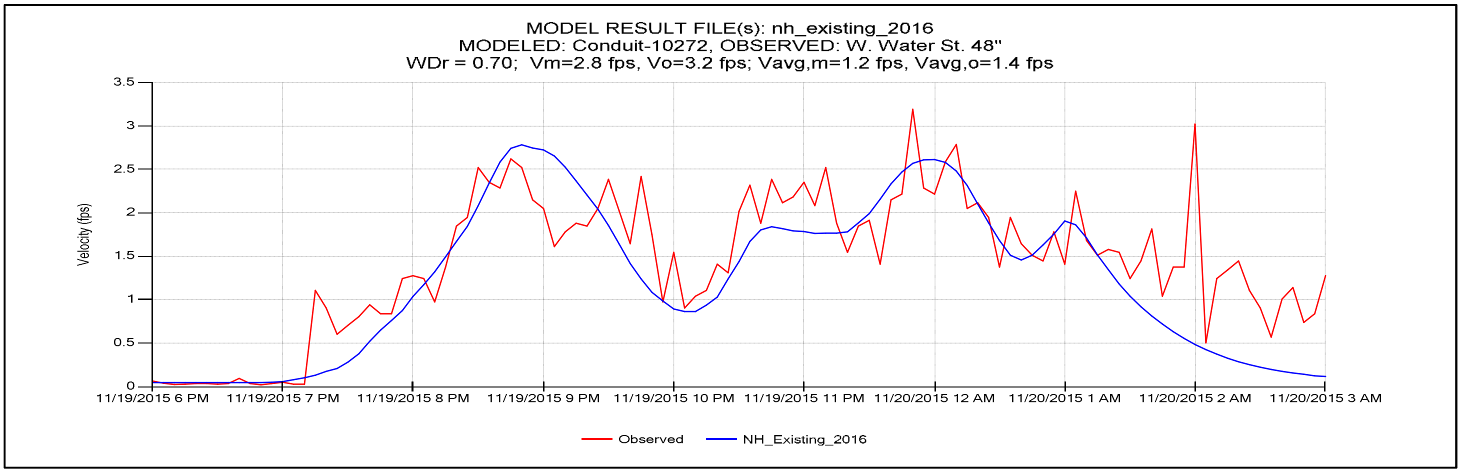


MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-10267, OBSERVED: Columbus Ave 78"
WDr = -0.64; Vm=4.6 fps, Vo=1.1 fps; Vavg,m=1.3 fps, Vavg,o=0.1 fps

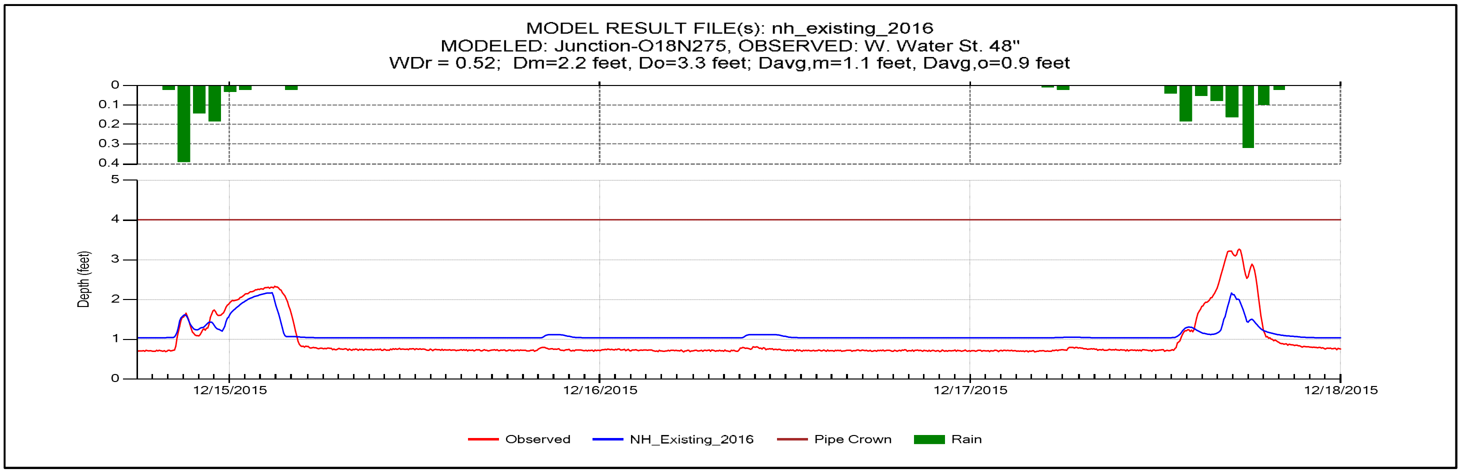
Meter02-Fall1

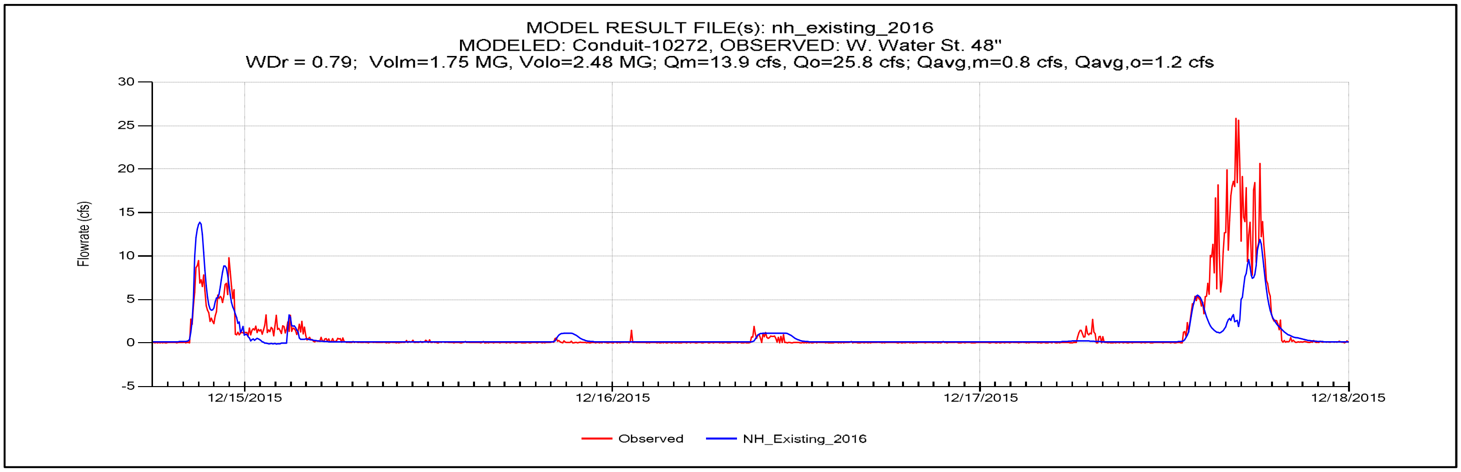


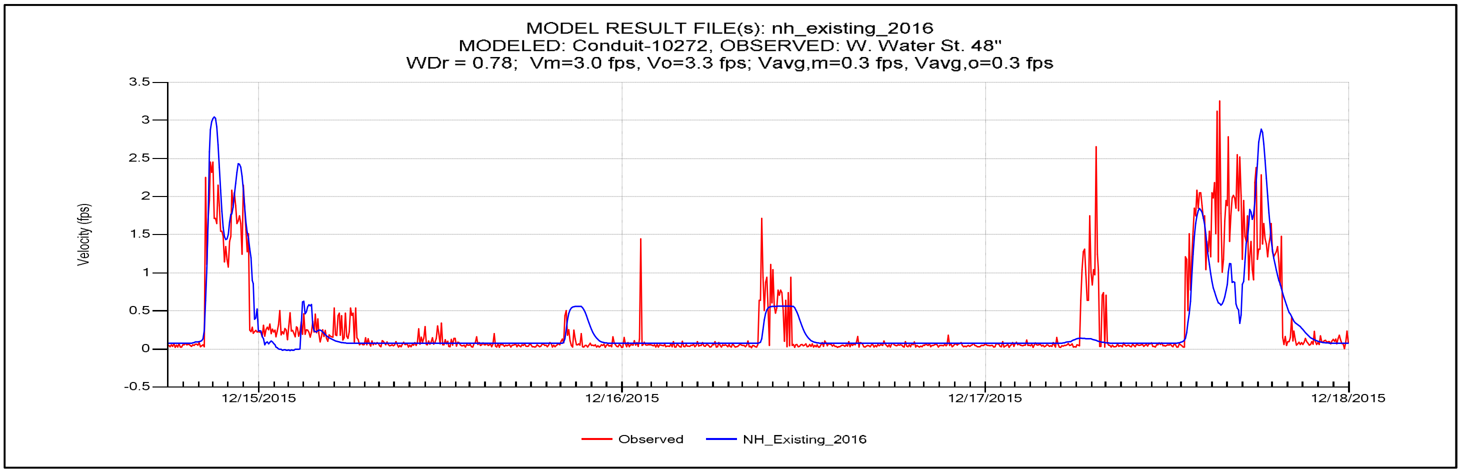




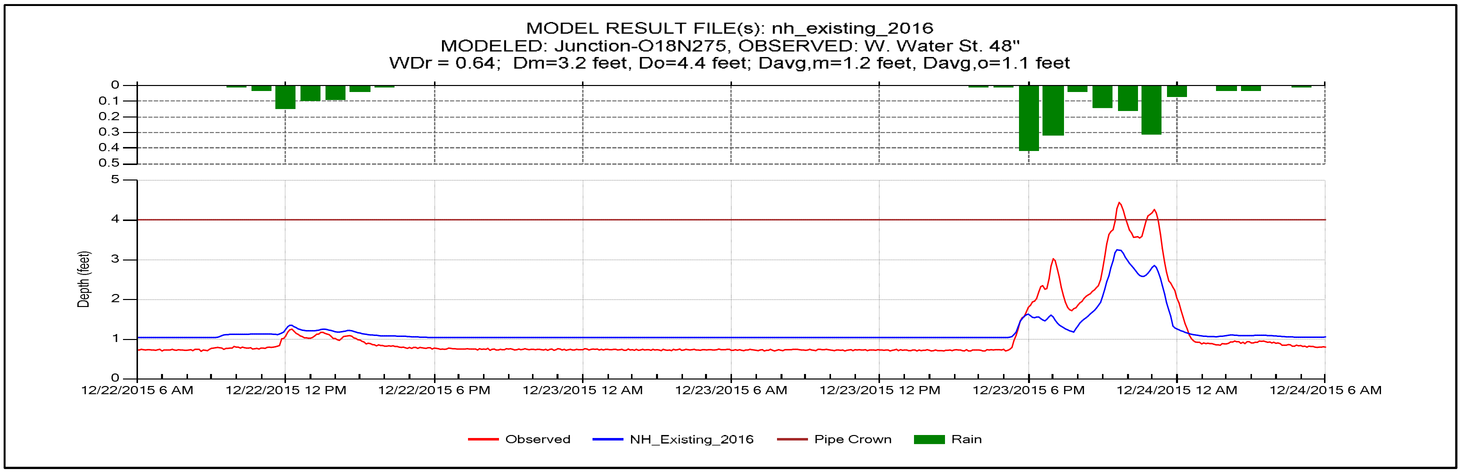
Meter02-Fall2

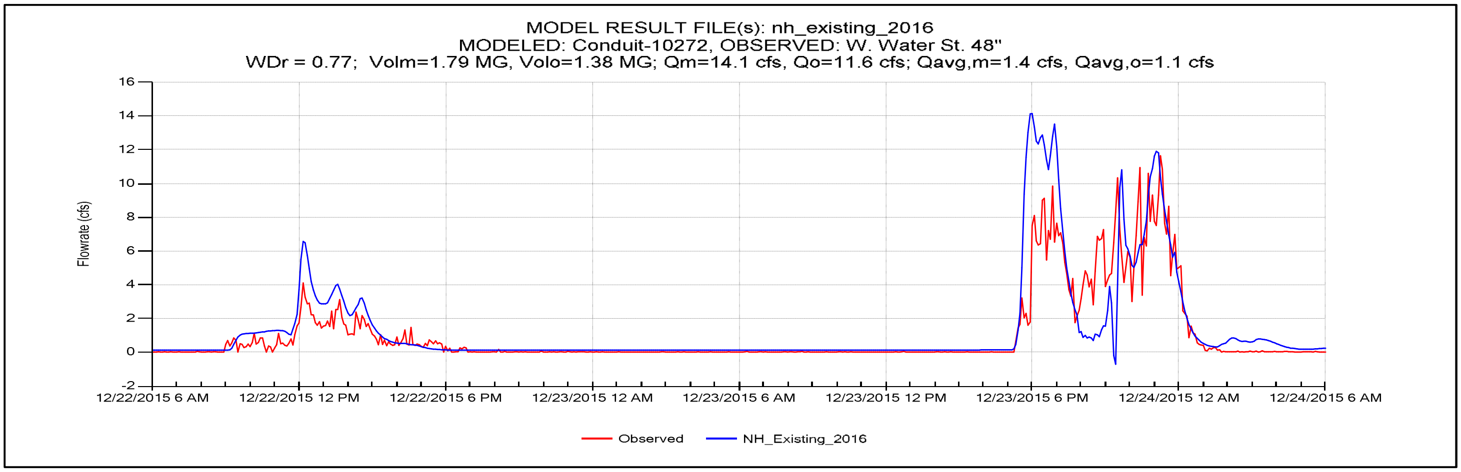


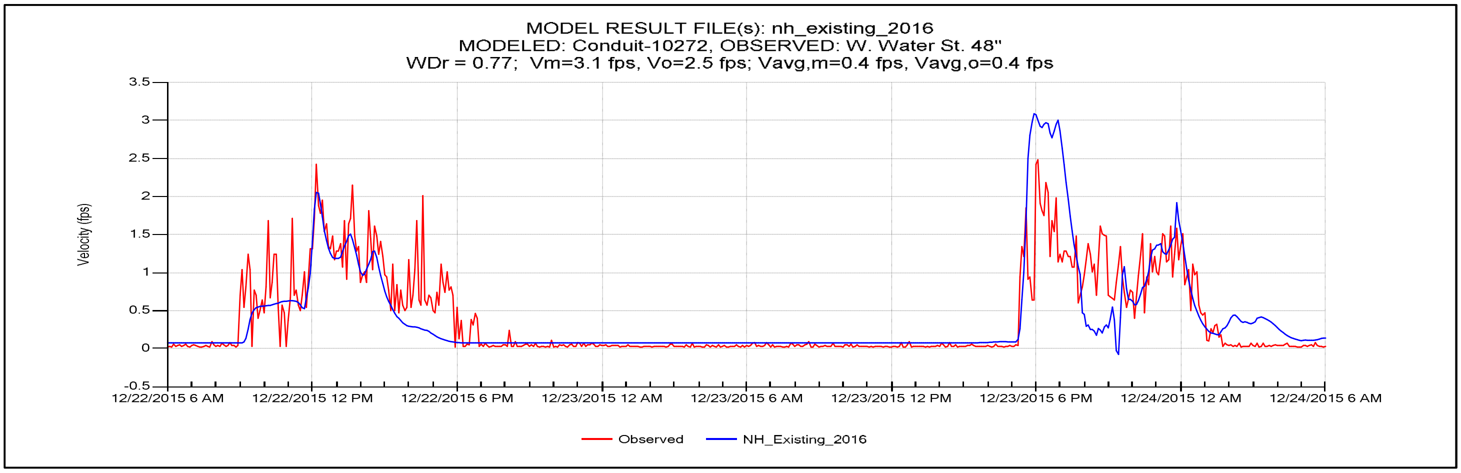




Meter02-Fall3

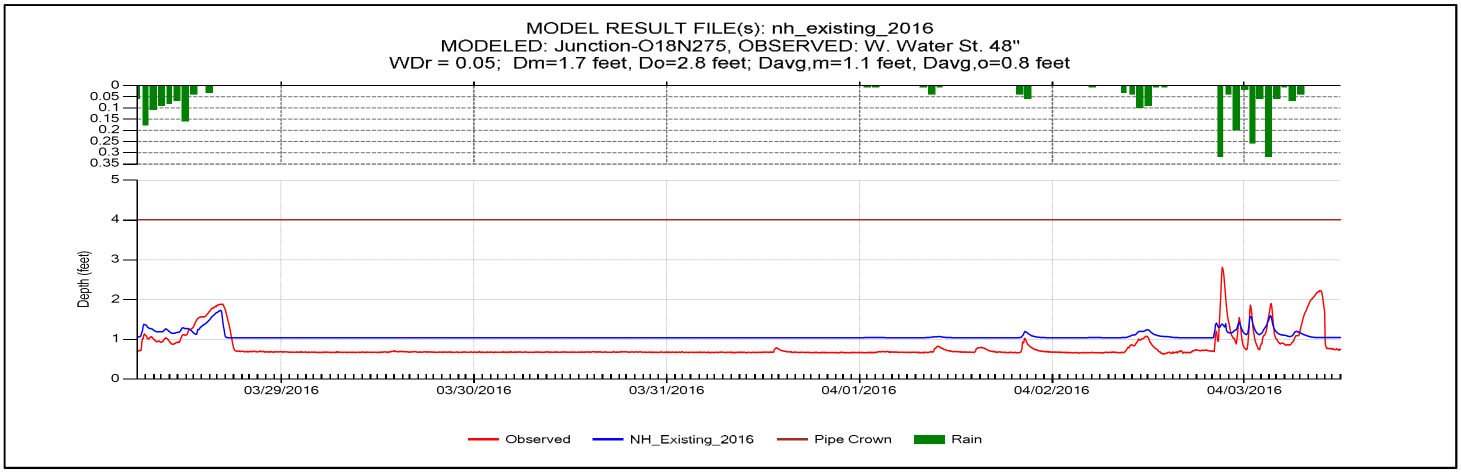


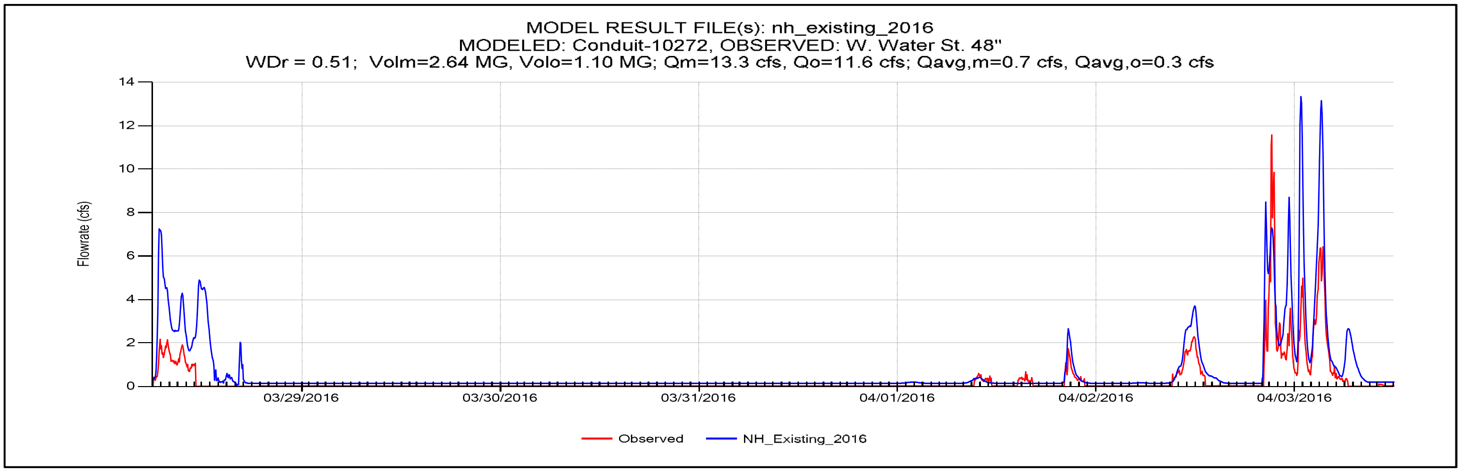


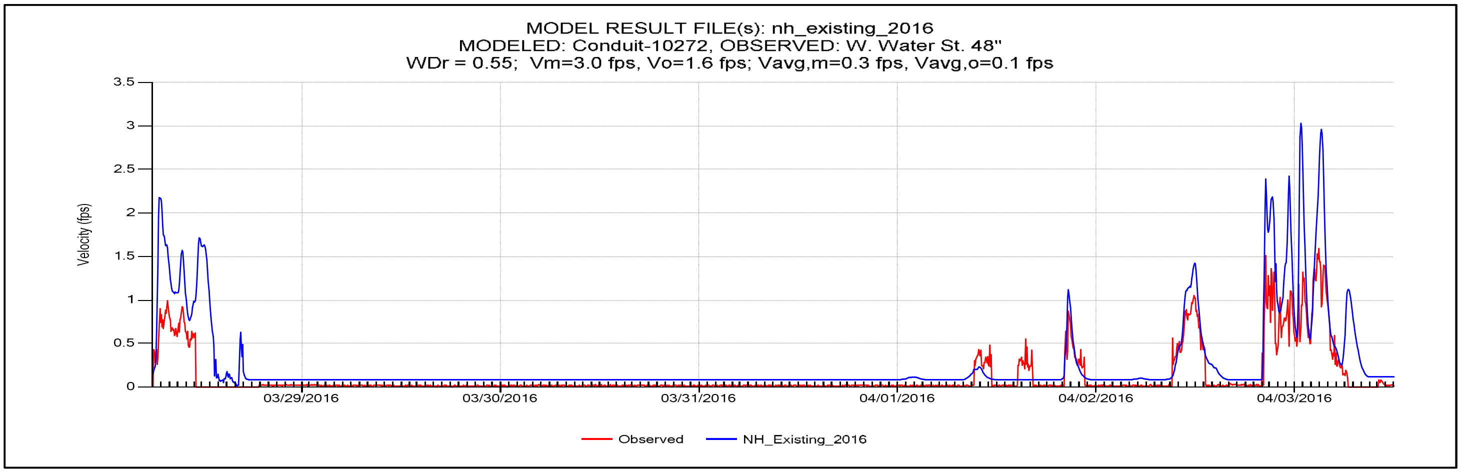


Simulated Versus Observed Flow at Flow Meter Sites

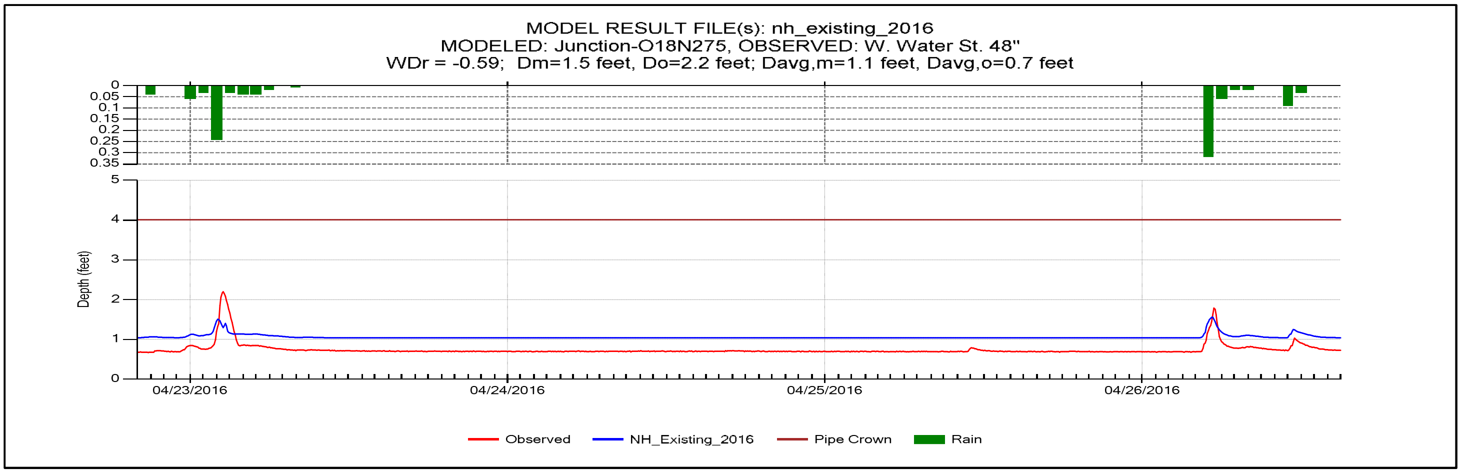
Meter02-Spring1

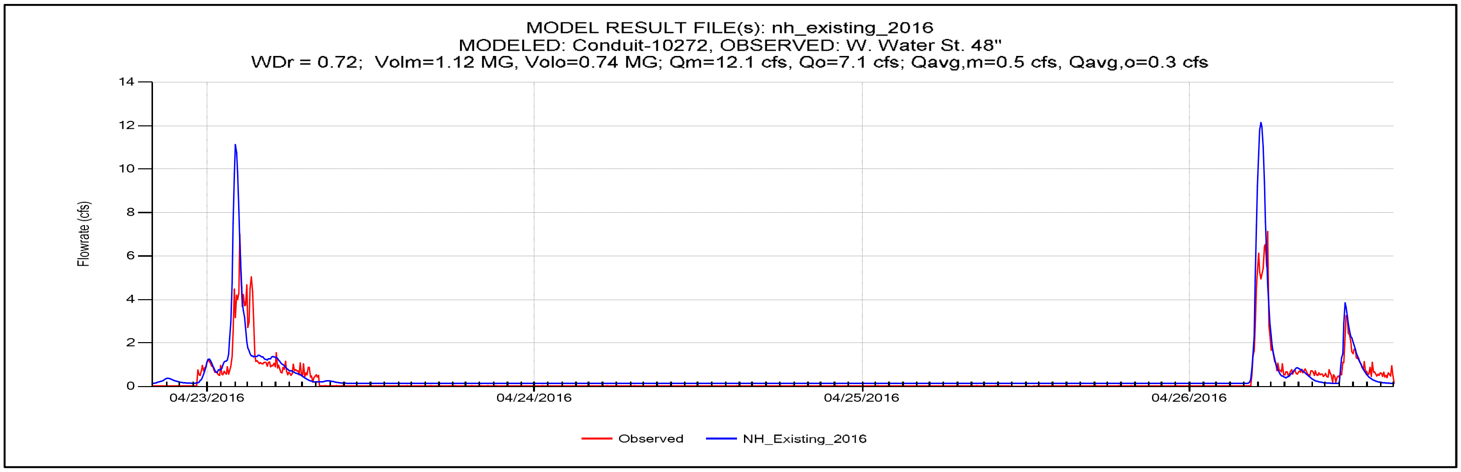


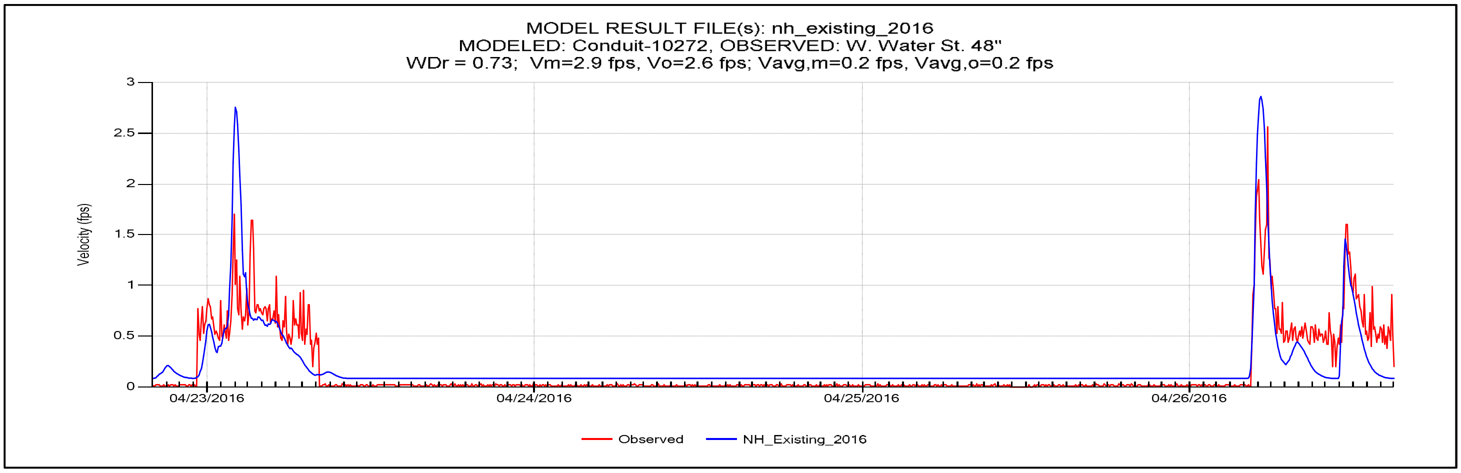




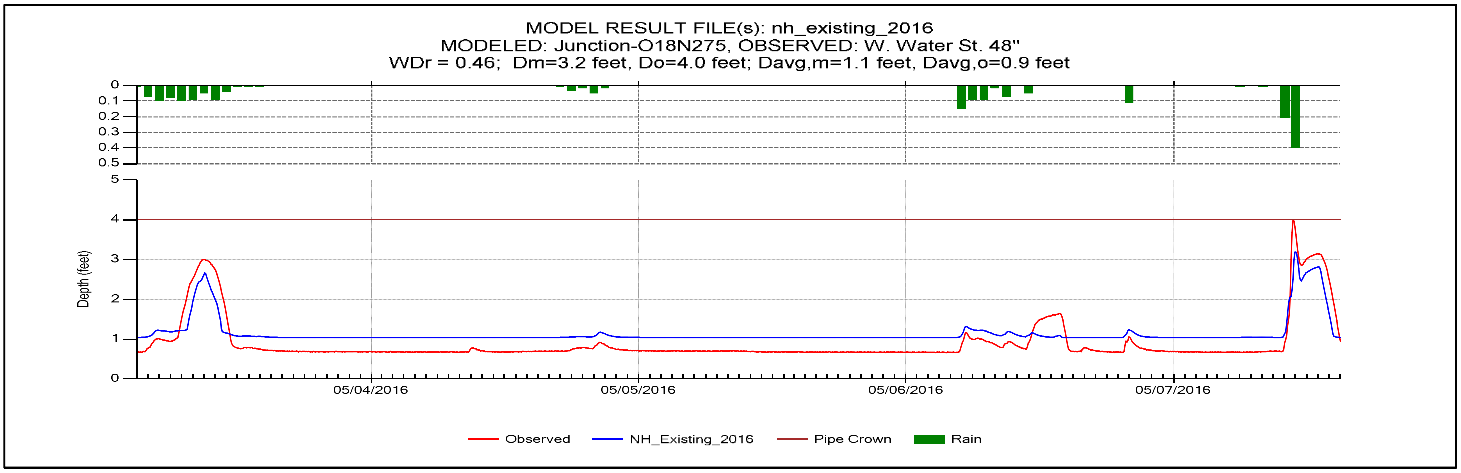
Meter02-Spring2

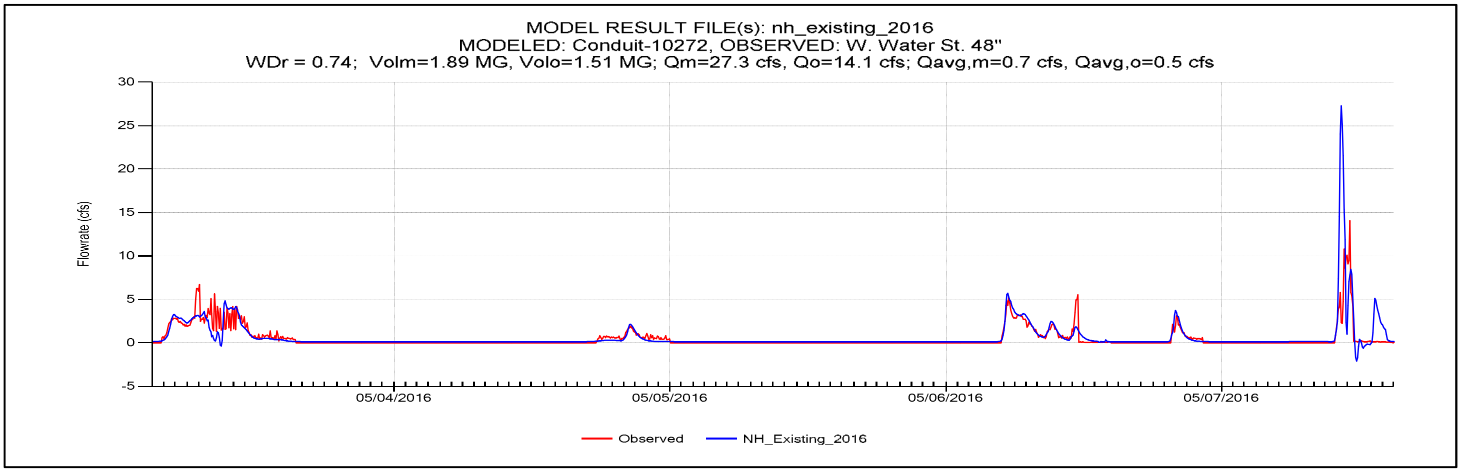


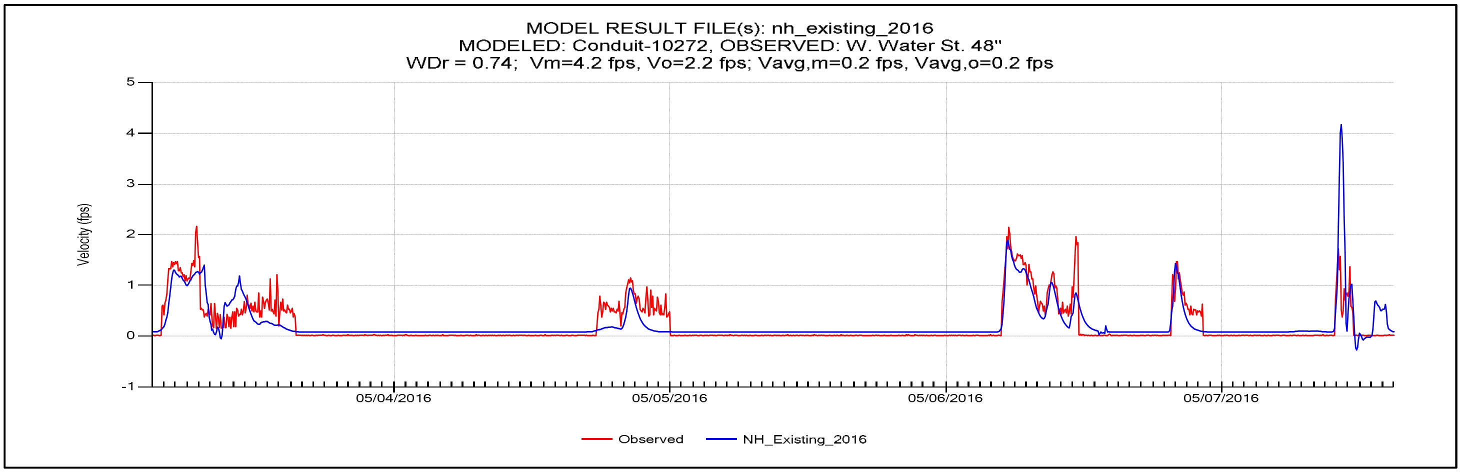




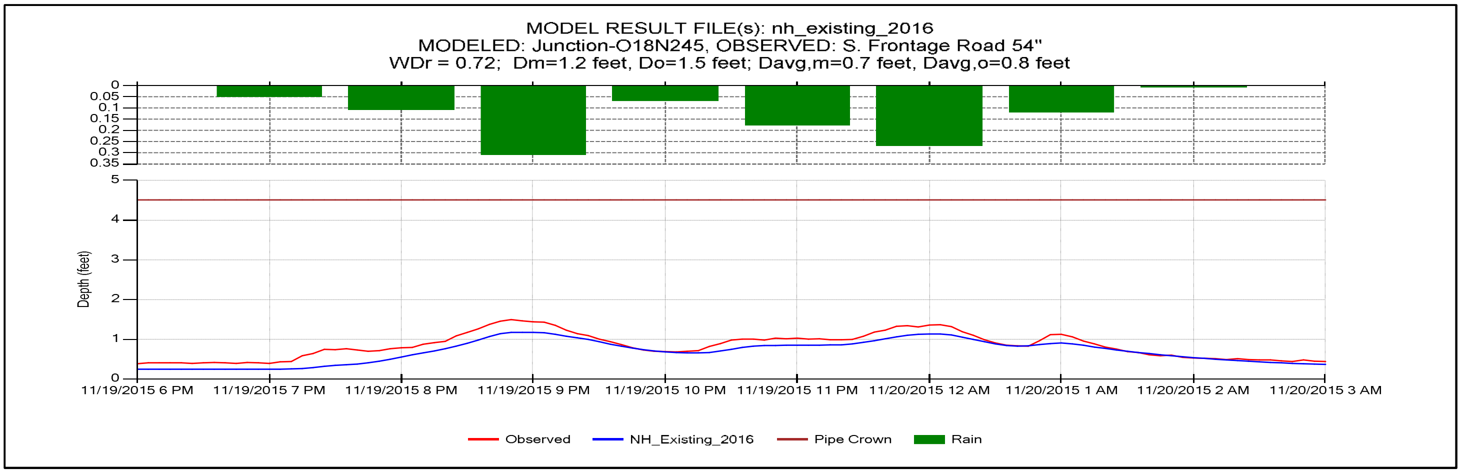
Meter02-Spring3

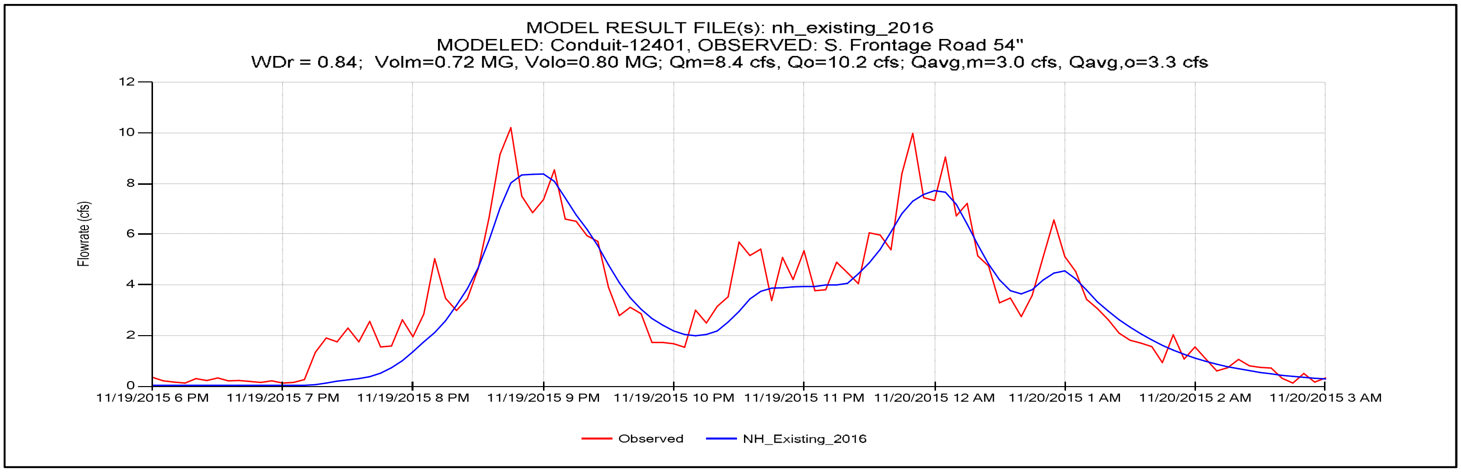


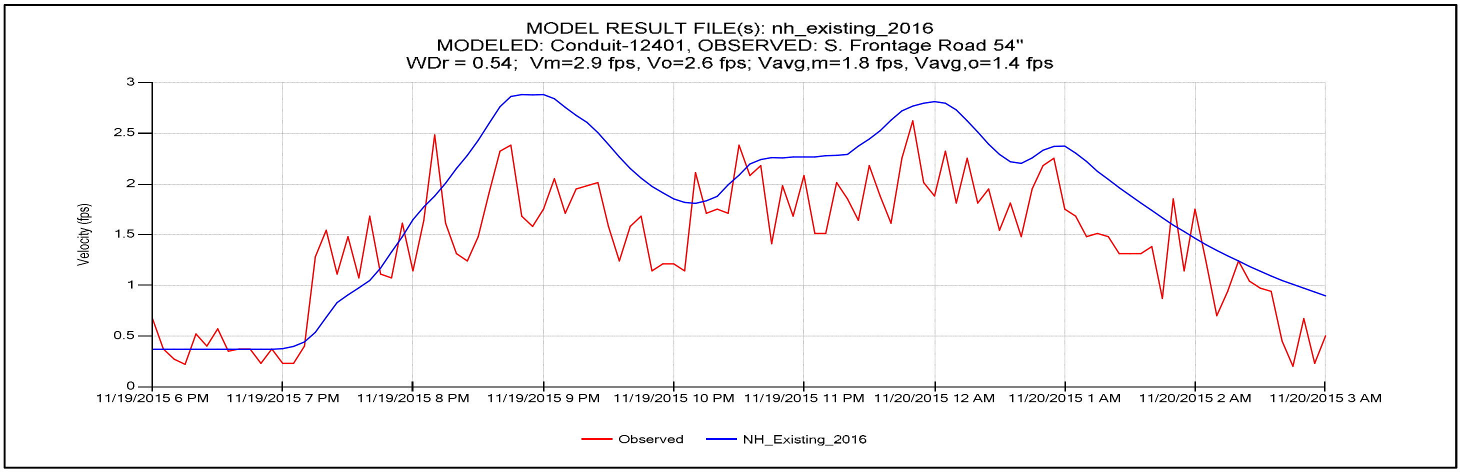




Meter03-Fall1

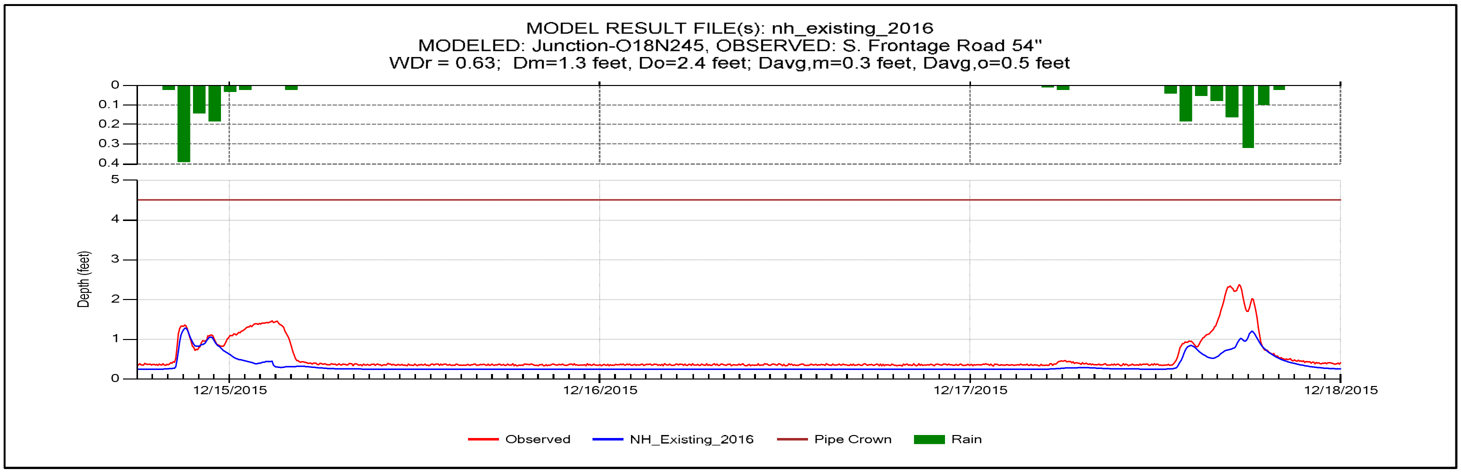


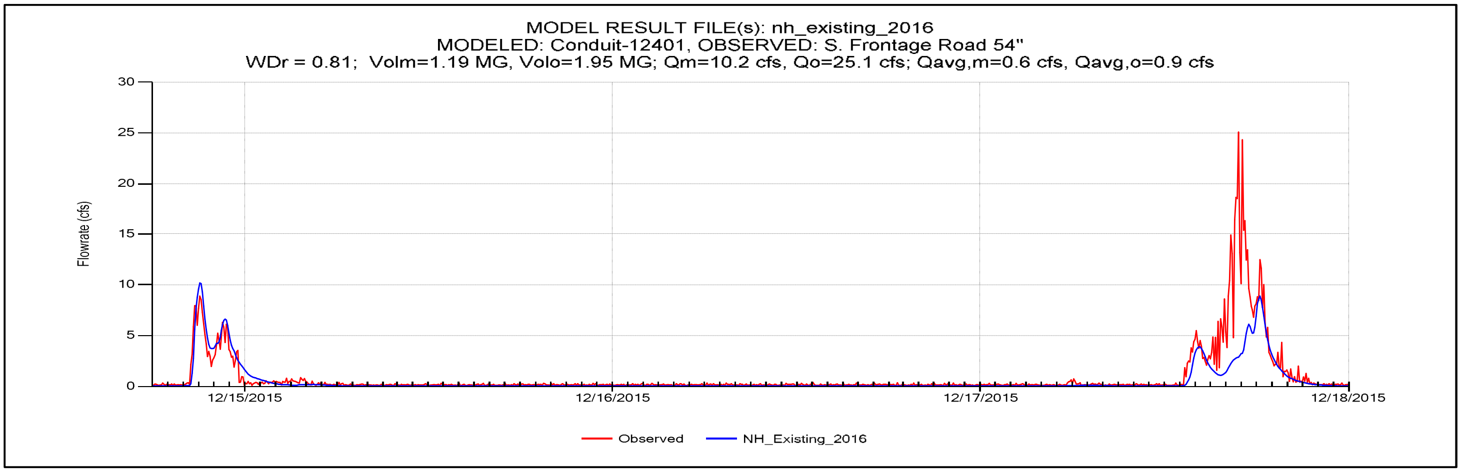


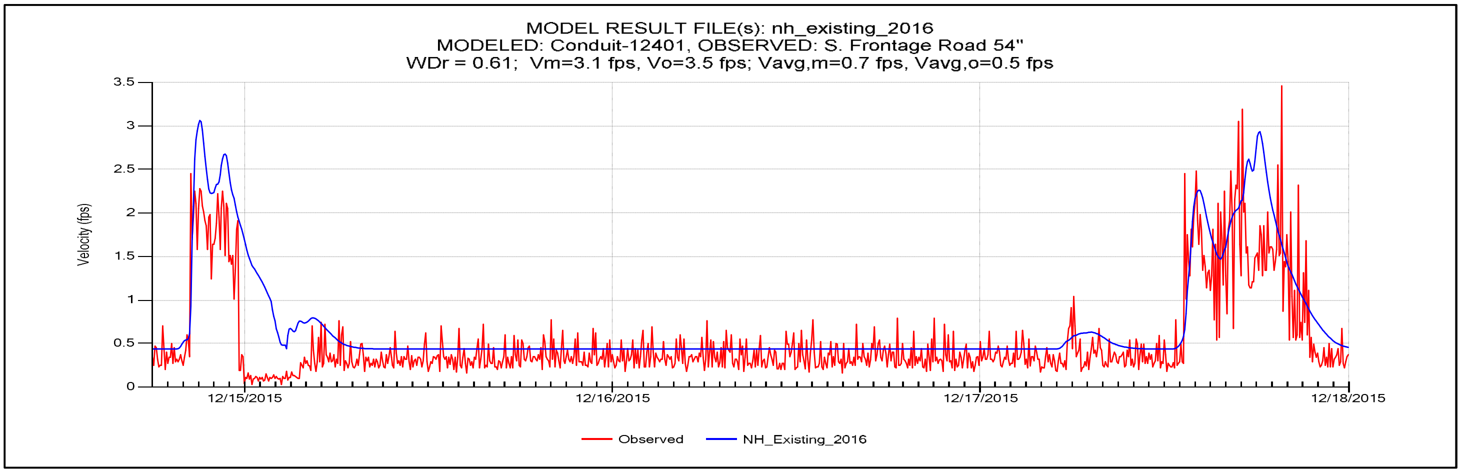


Simulated Versus Observed Flow at Flow Meter Sites

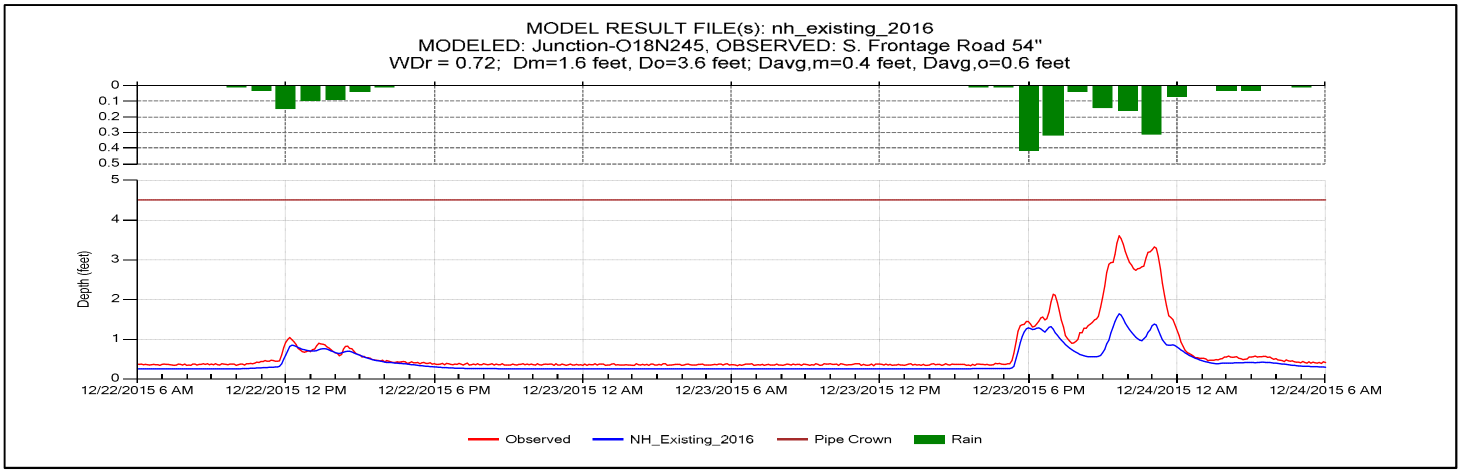
Meter03-Fall2

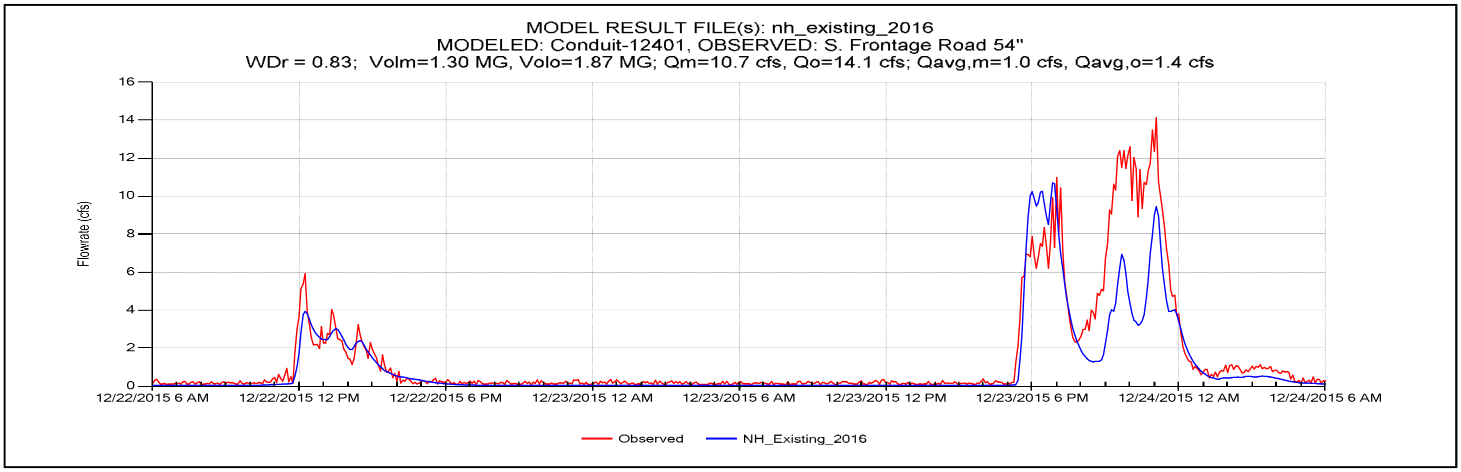

MODEL RESULT FILE(s): nh_existing_2016
MODELED: Junction-O18N245, OBSERVED: S. Frontage Road 54"
WDr = 0.63; Dm=1.3 feet, Do=2.4 feet; Davg,m=0.3 feet, Davg,o=0.5 feet

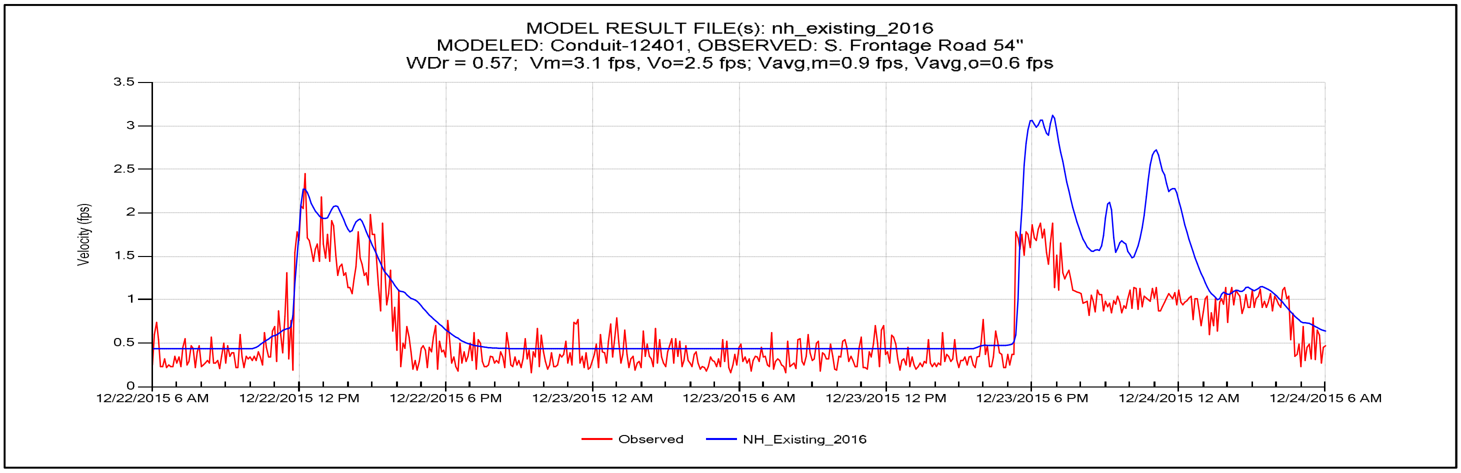

MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-12401, OBSERVED: S. Frontage Road 54"
WDr = 0.81; Volm=1.19 MG, Volo=1.95 MG; Qm=10.2 cfs, Qo=25.1 cfs; Qavg,m=0.6 cfs, Qavg,o=0.9 cfs


MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-12401, OBSERVED: S. Frontage Road 54"
WDr = 0.61; Vm=3.1 fps, Vo=3.5 fps; Vavg,m=0.7 fps, Vavg,o=0.5 fps

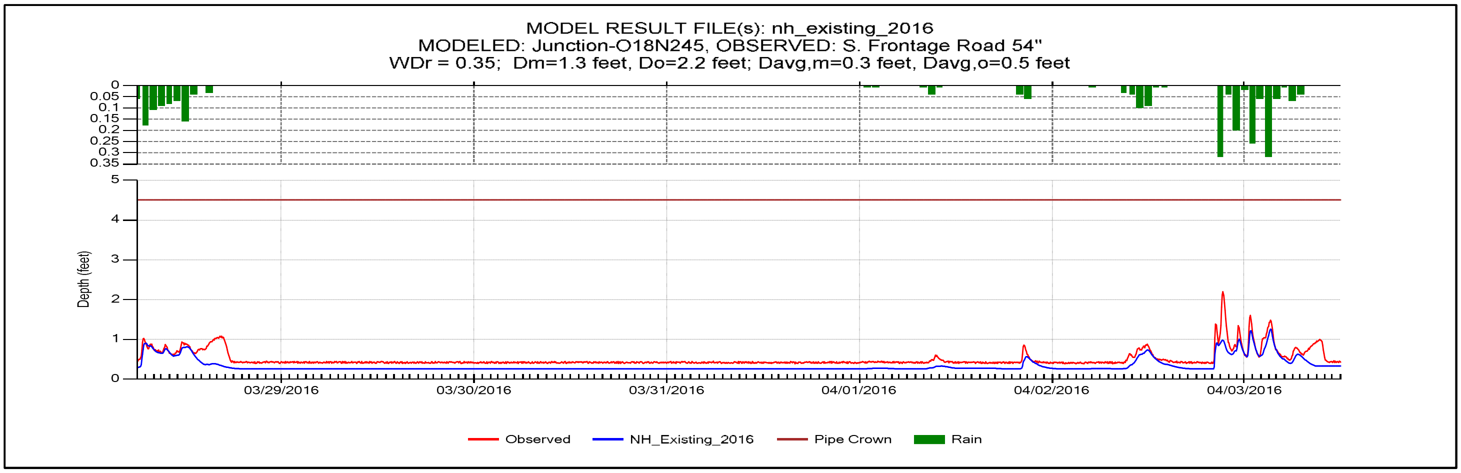
Meter03-Fall3



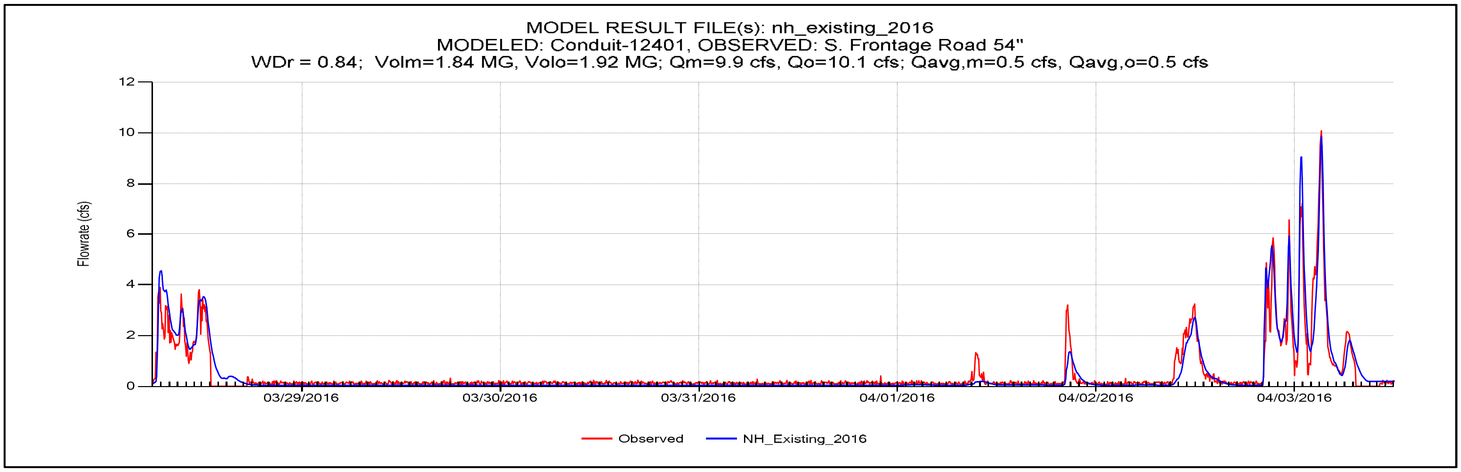




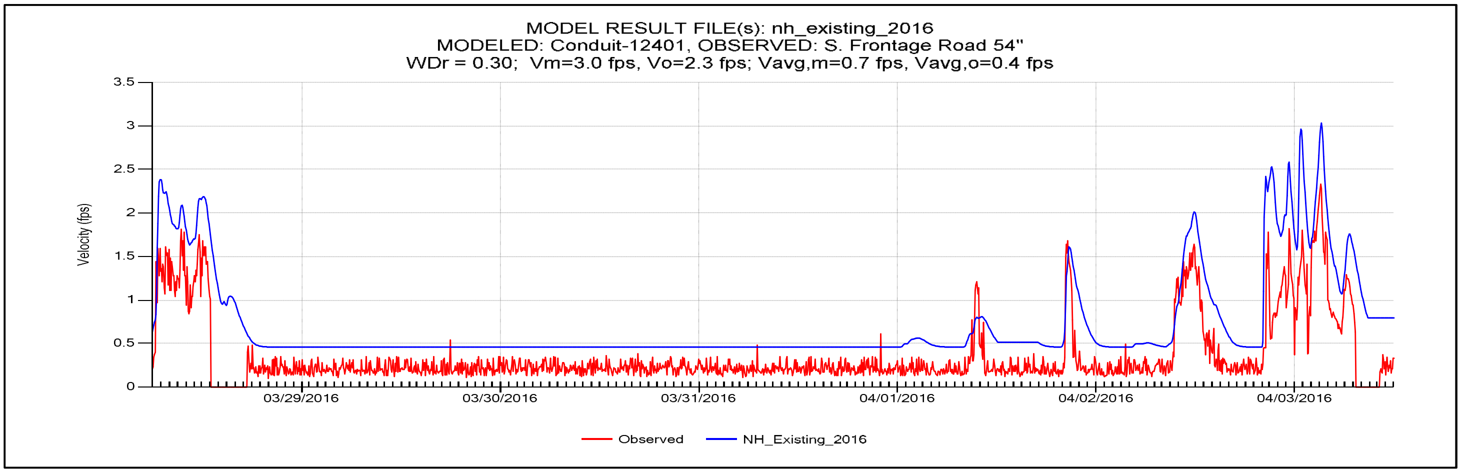
Meter03-Spring1



MODEL RESULT FILE(s): nh_existing_2016
MODELED: Junction-O18N245, OBSERVED: S. Frontage Road 54"
WDr = 0.35; Dm=1.3 feet, Do=2.2 feet; Davg,m=0.3 feet, Davg,o=0.5 feet

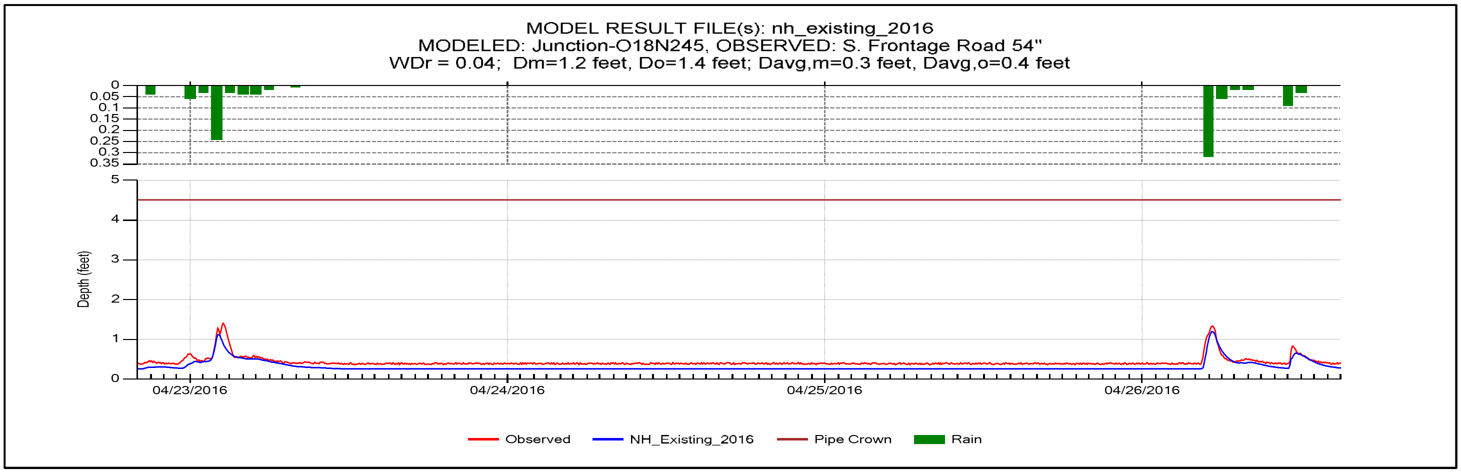


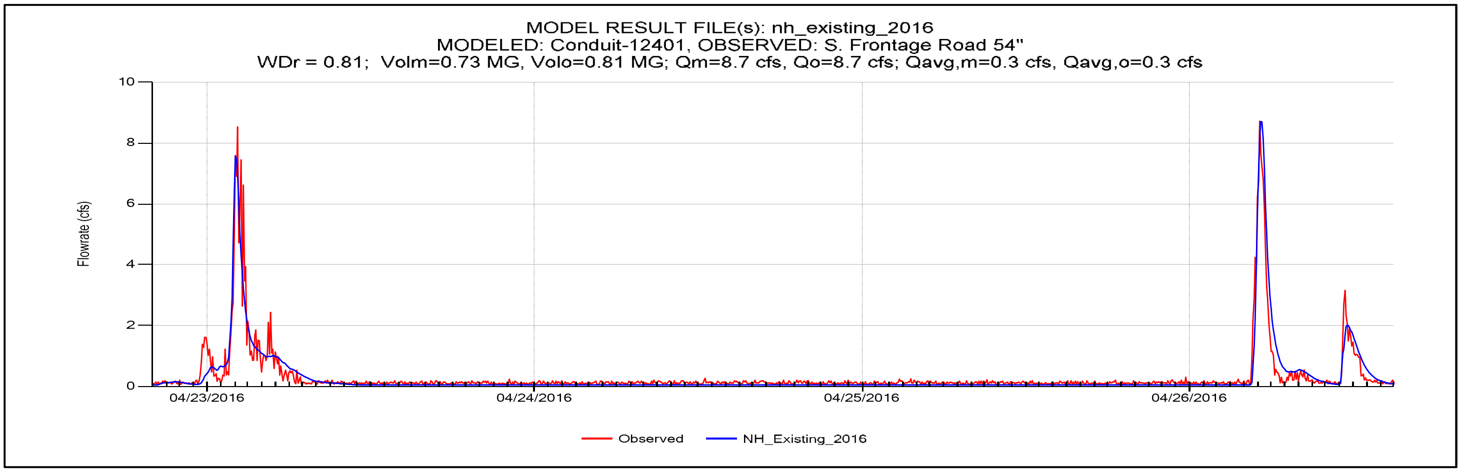
MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-12401, OBSERVED: S. Frontage Road 54"
WDr = 0.84; Volm=1.84 MG, Volo=1.92 MG; Qm=9.9 cfs, Qo=10.1 cfs; Qavg,m=0.5 cfs, Qavg,o=0.5 cfs

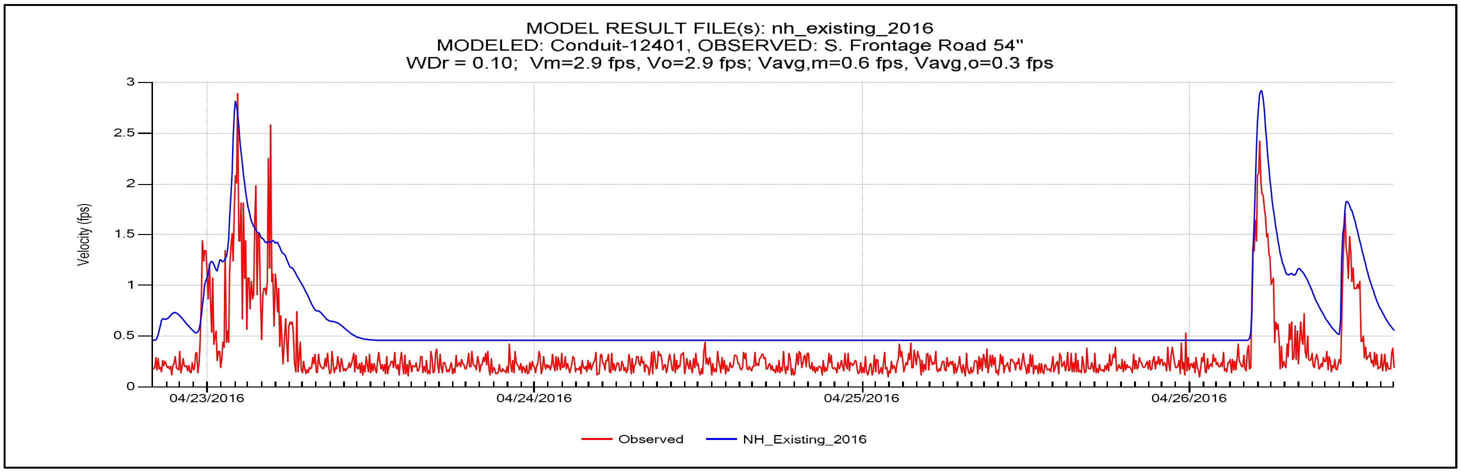


MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-12401, OBSERVED: S. Frontage Road 54"
WDr = 0.30; Vm=3.0 fps, Vo=2.3 fps; Vavg,m=0.7 fps, Vavg,o=0.4 fps

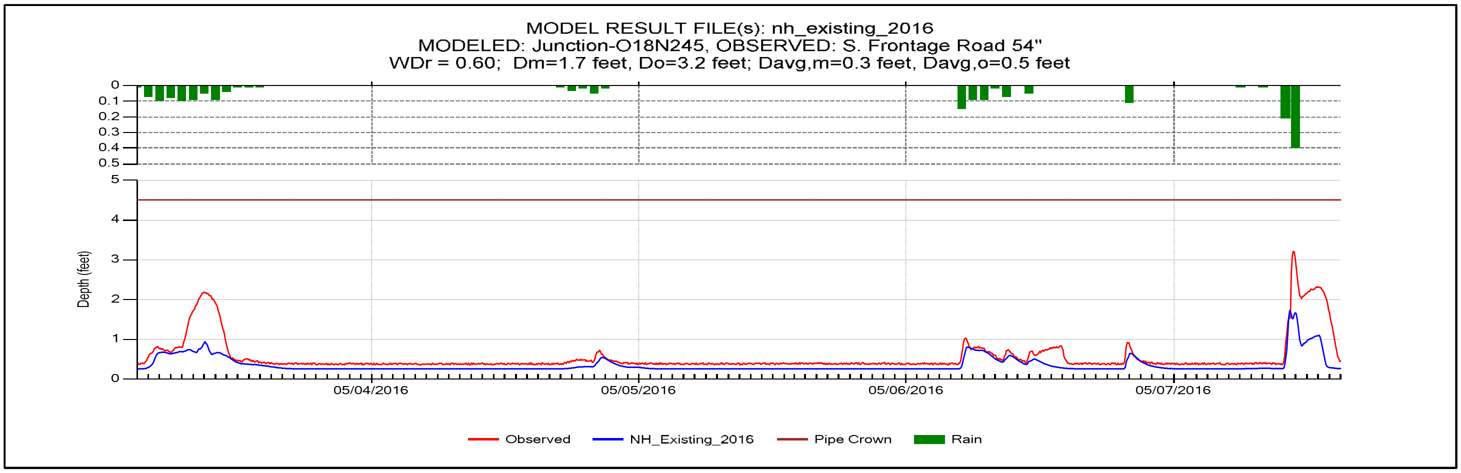
Meter03-Spring2

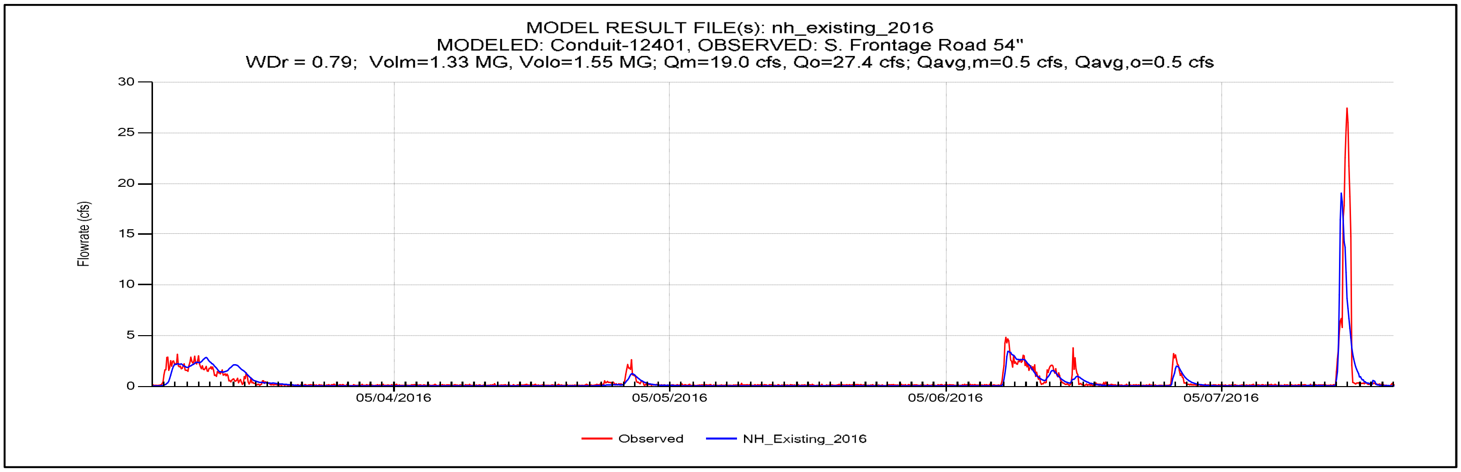


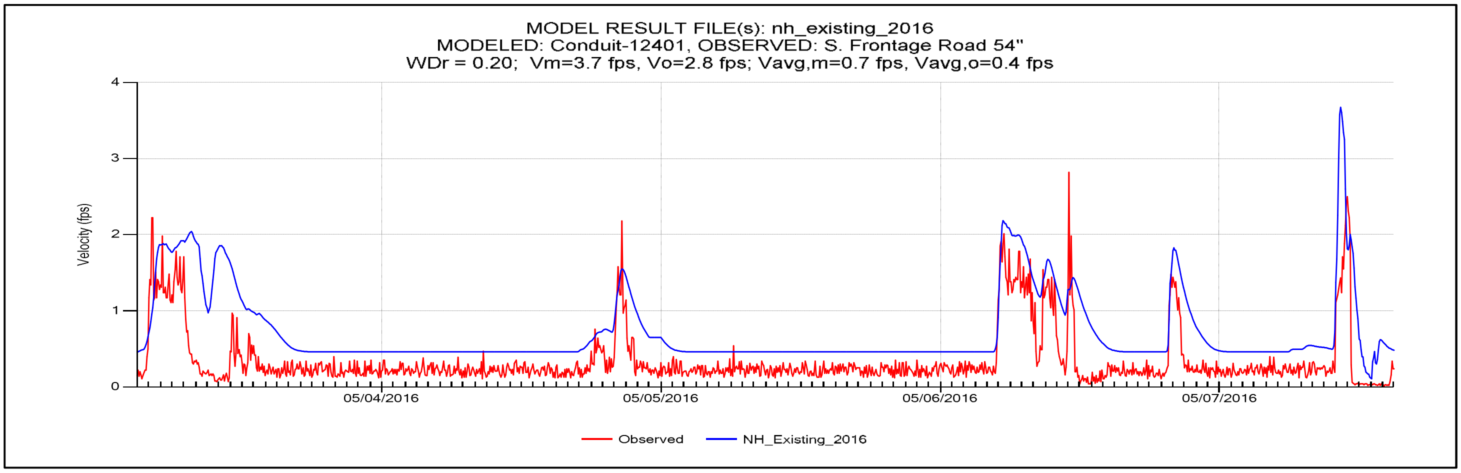




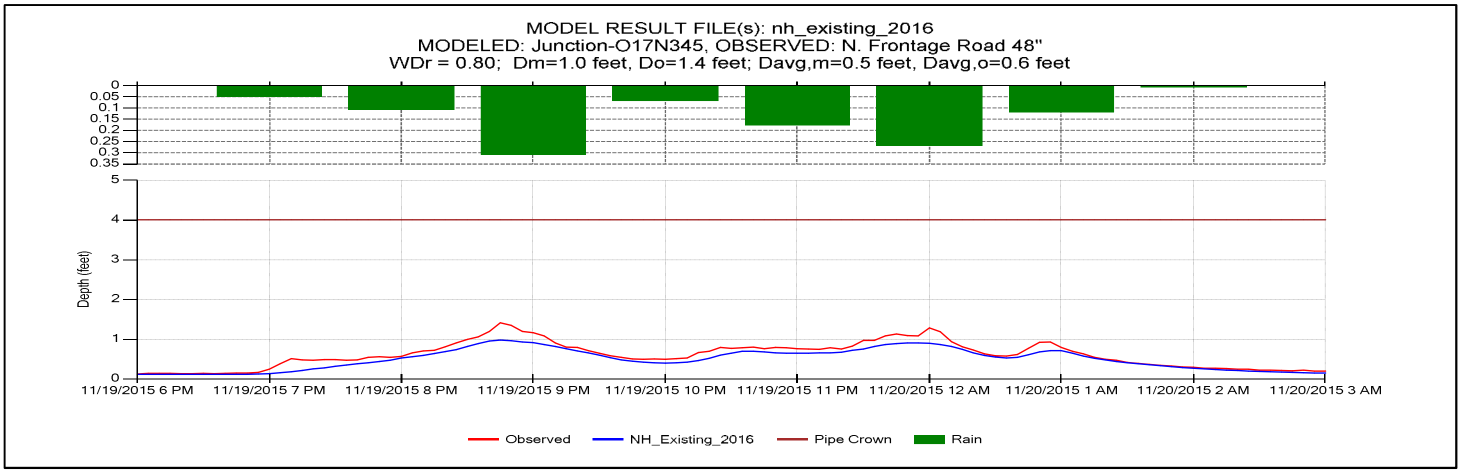
Meter03-Spring3

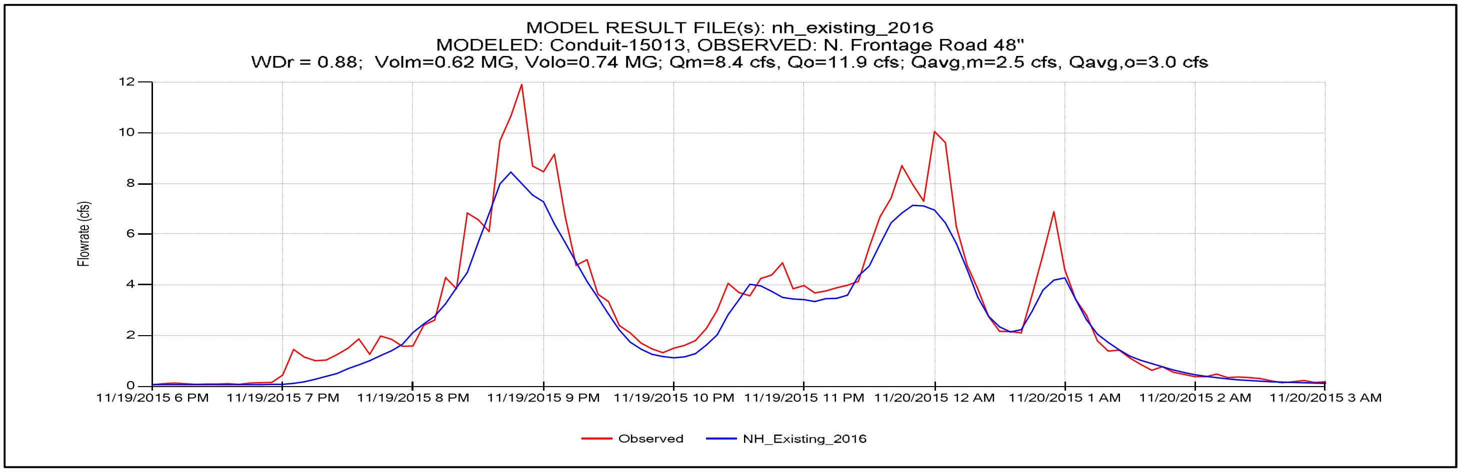


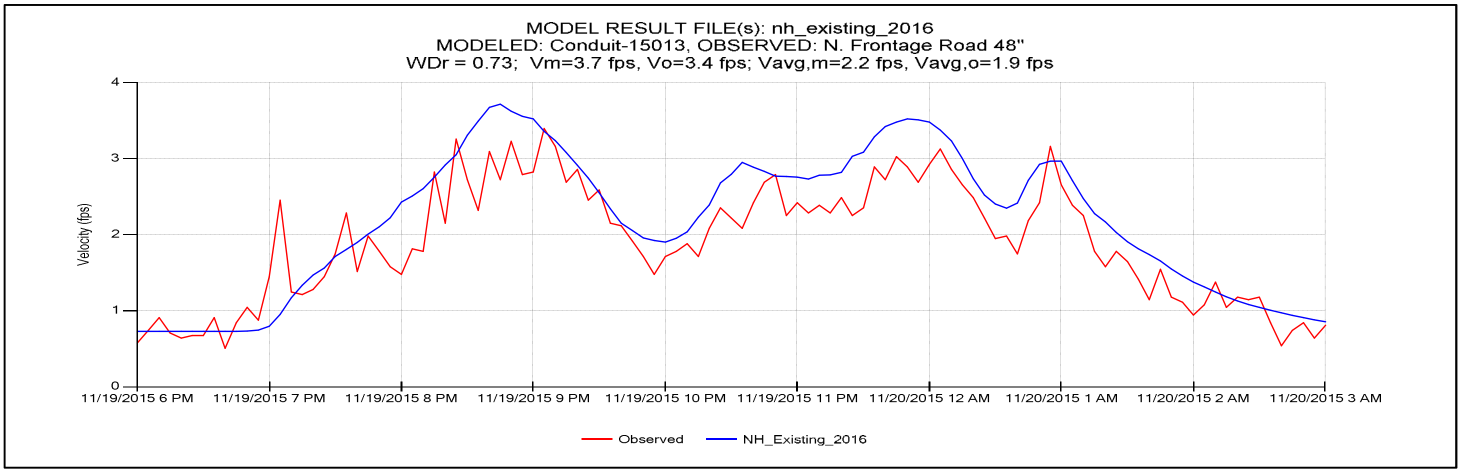




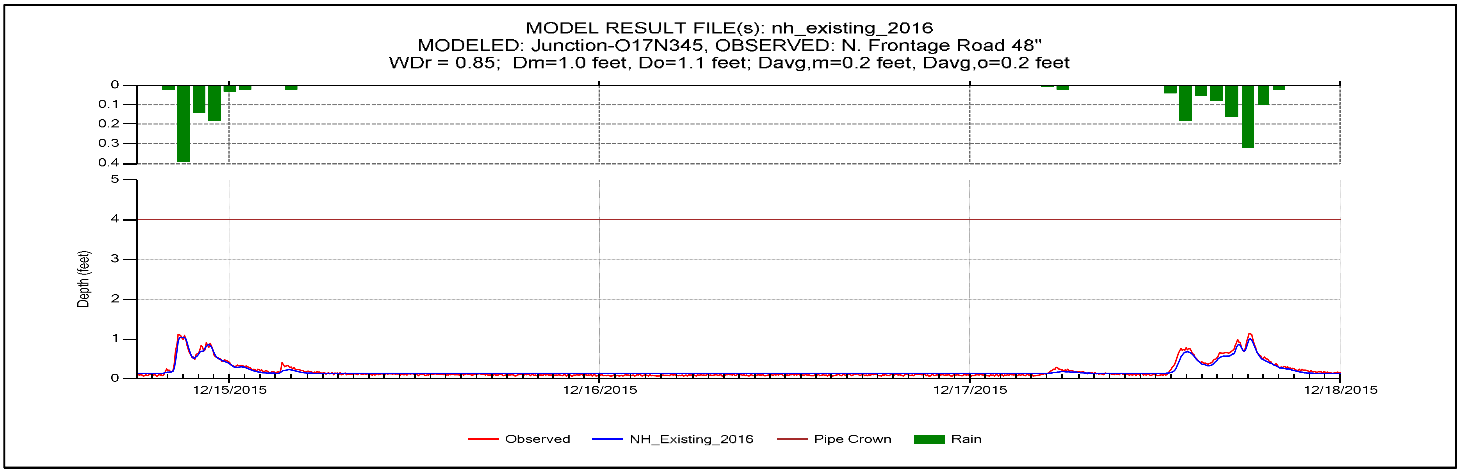
Meter04-Fall1

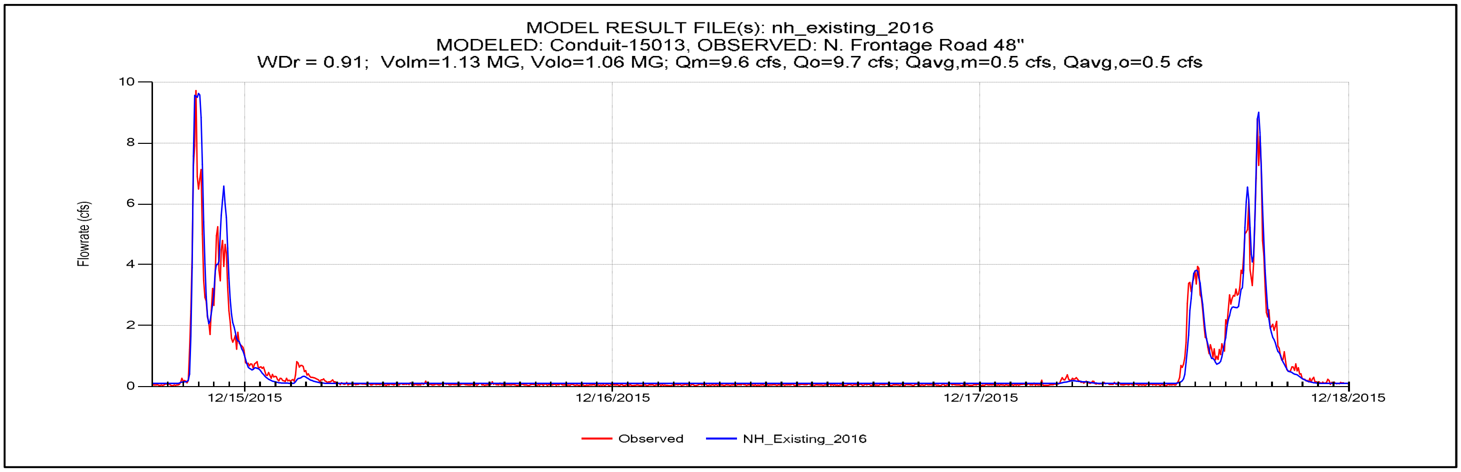


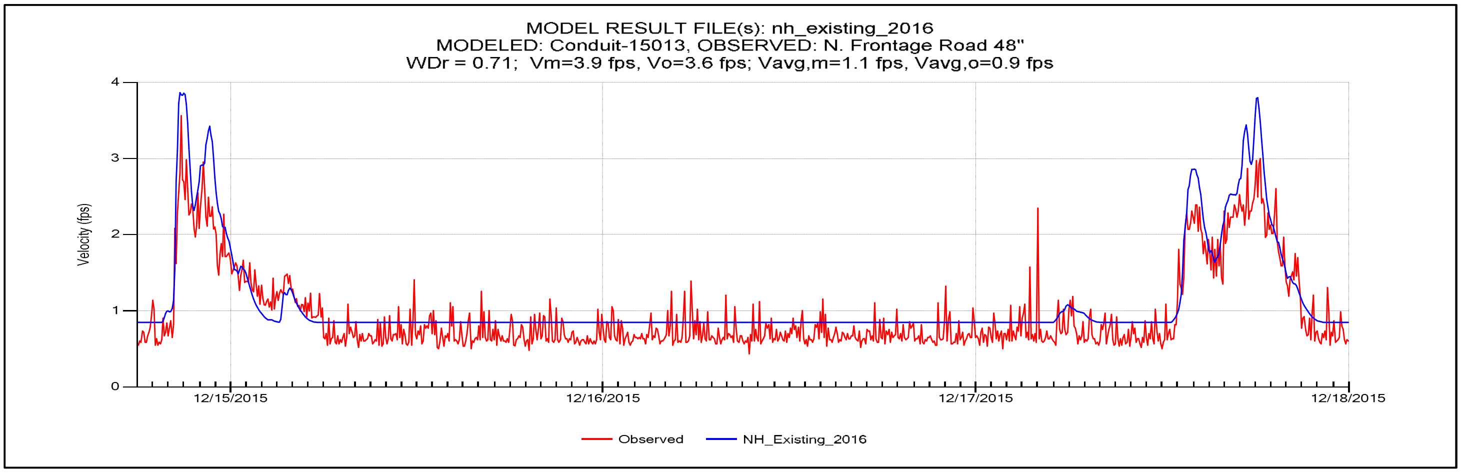




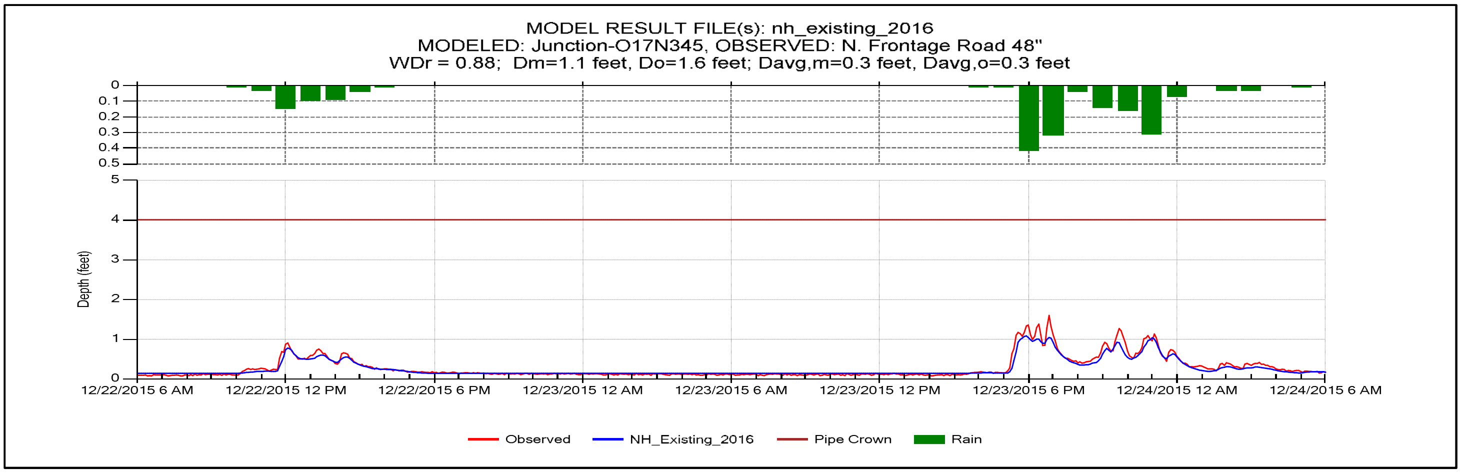
Meter04-Fall2

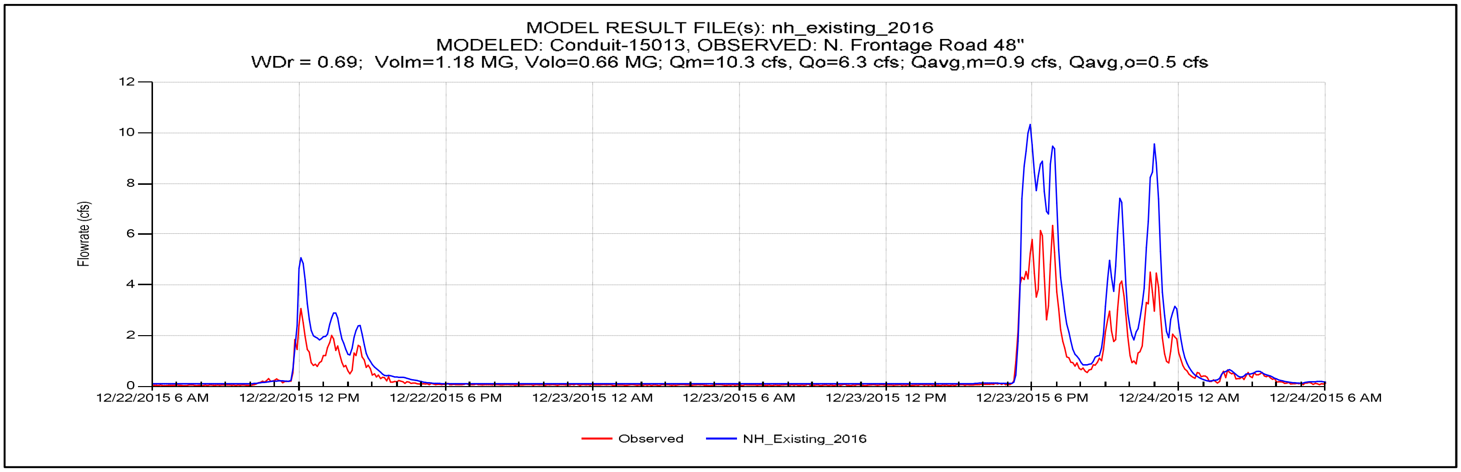


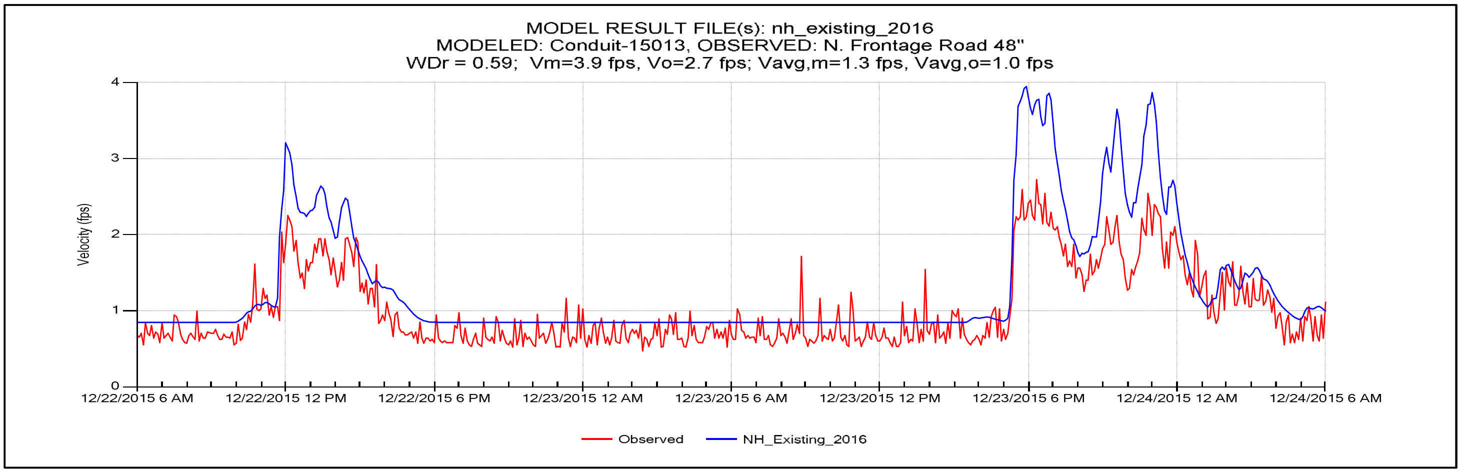




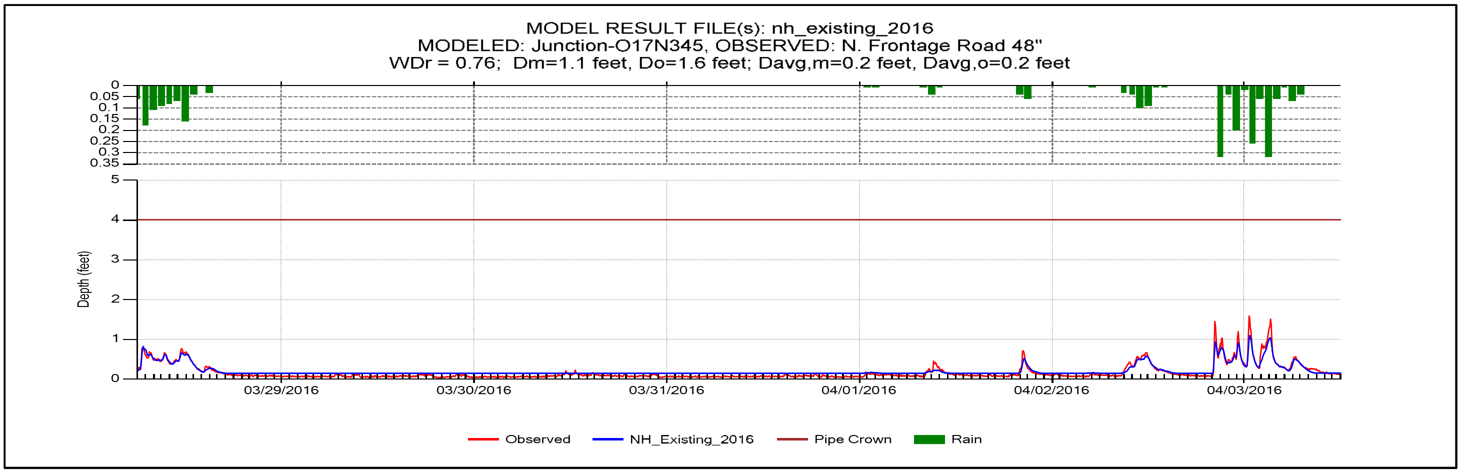
Meter04-Fall3



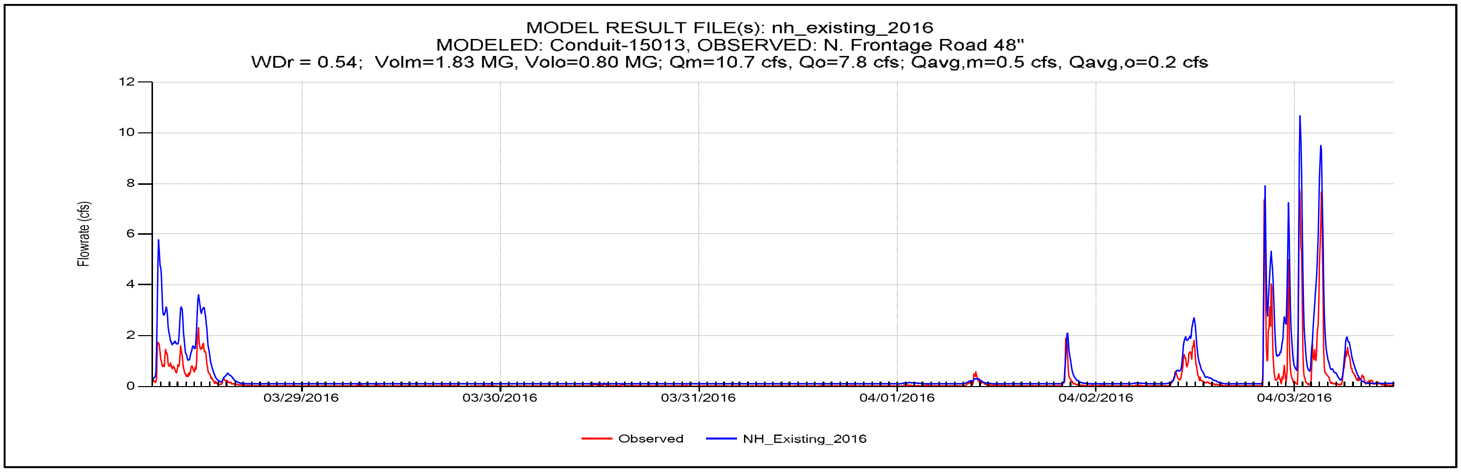




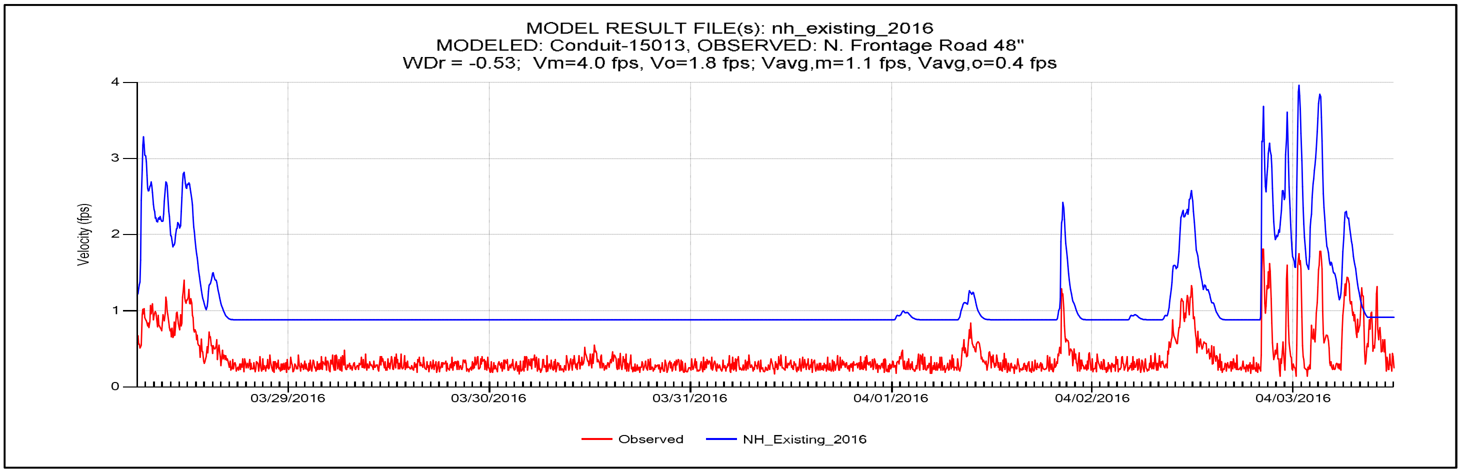
Meter04-Spring1



MODEL RESULT FILE(s): nh_existing_2016
MODELED: Junction-O17N345, OBSERVED: N. Frontage Road 48"
WDr = 0.76; Dm=1.1 feet, Do=1.6 feet; Davg,m=0.2 feet, Davg,o=0.2 feet

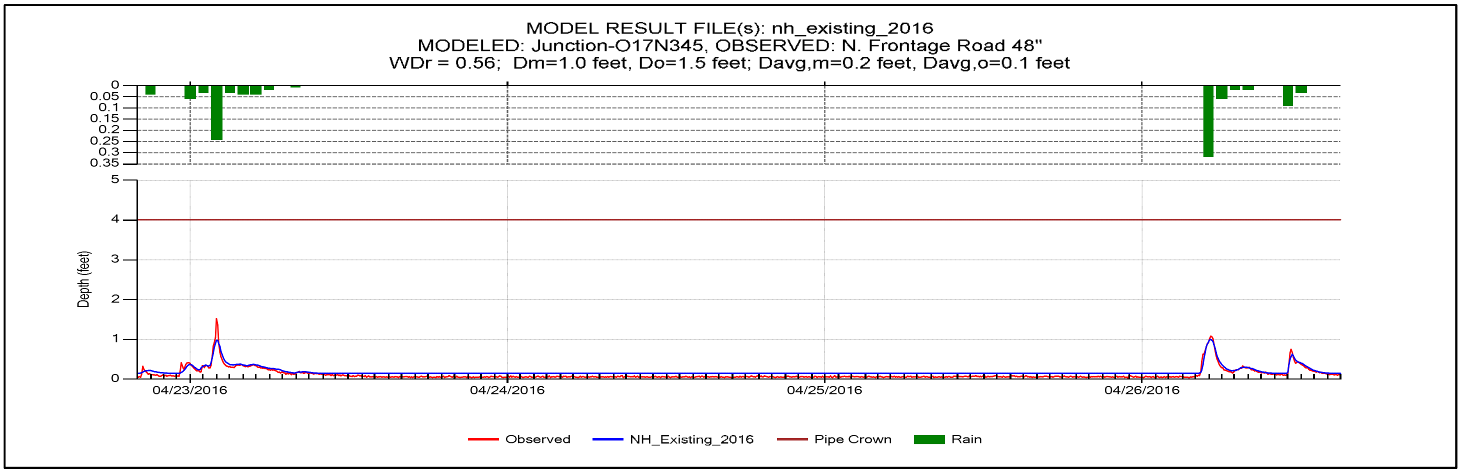


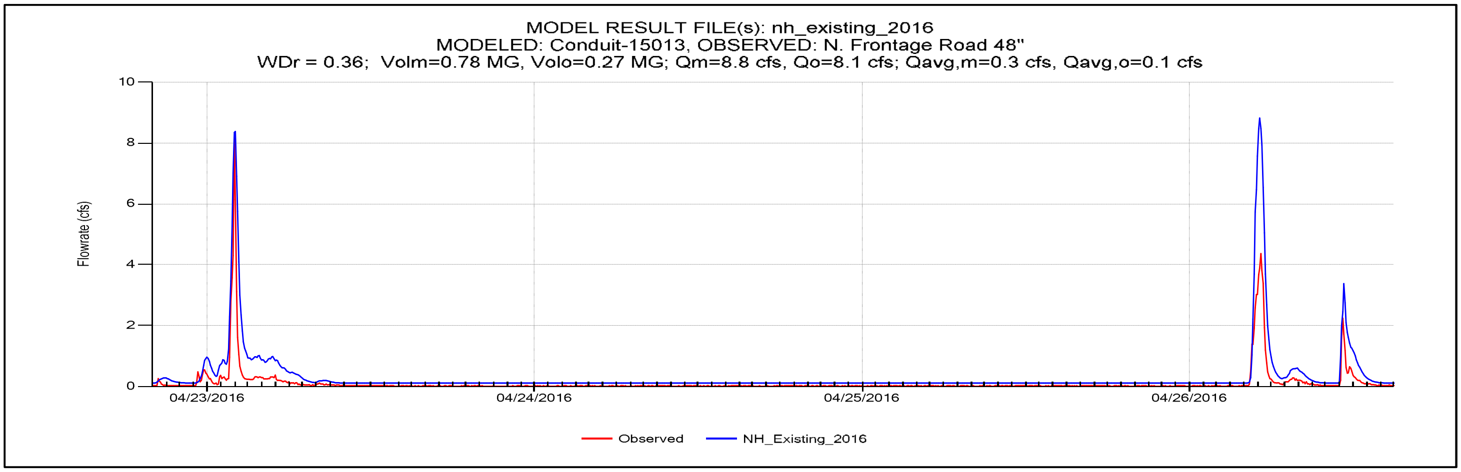
MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-15013, OBSERVED: N. Frontage Road 48"
WDr = 0.54; Volm=1.83 MG, Volo=0.80 MG; Qm=10.7 cfs, Qo=7.8 cfs; Qavg,m=0.5 cfs, Qavg,o=0.2 cfs

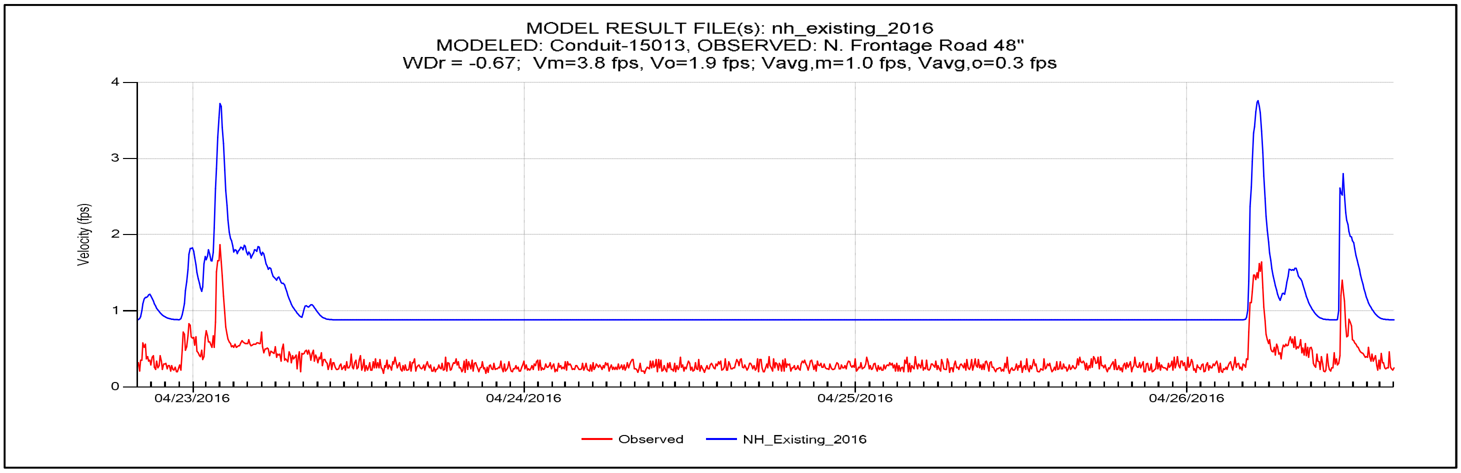


MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-15013, OBSERVED: N. Frontage Road 48"
WDr = -0.53; Vm=4.0 fps, Vo=1.8 fps; Vavg,m=1.1 fps, Vavg,o=0.4 fps

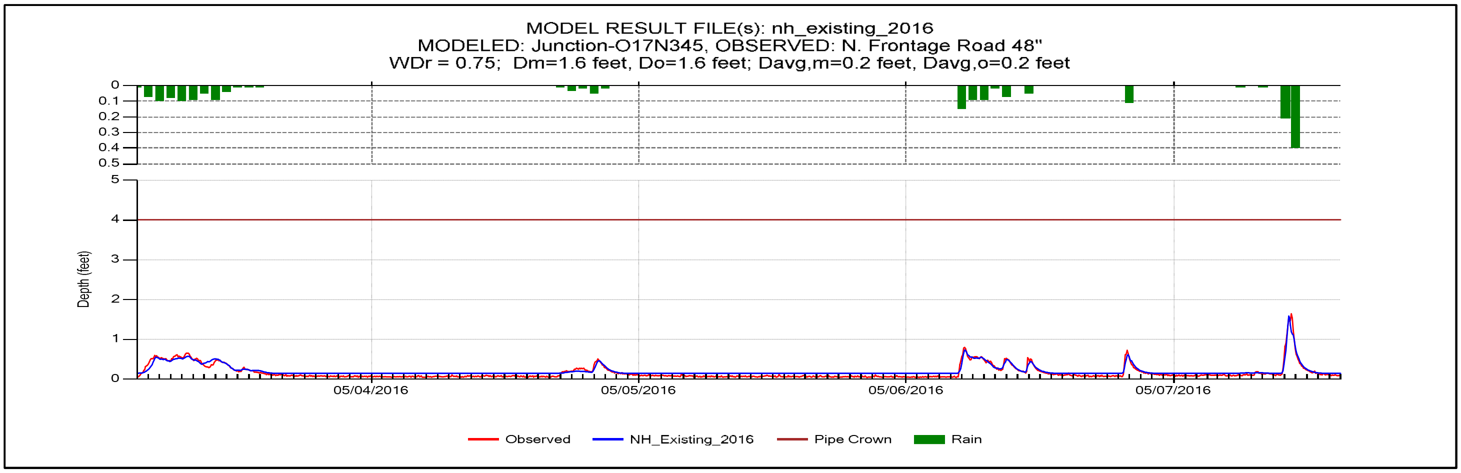
Meter04-Spring2



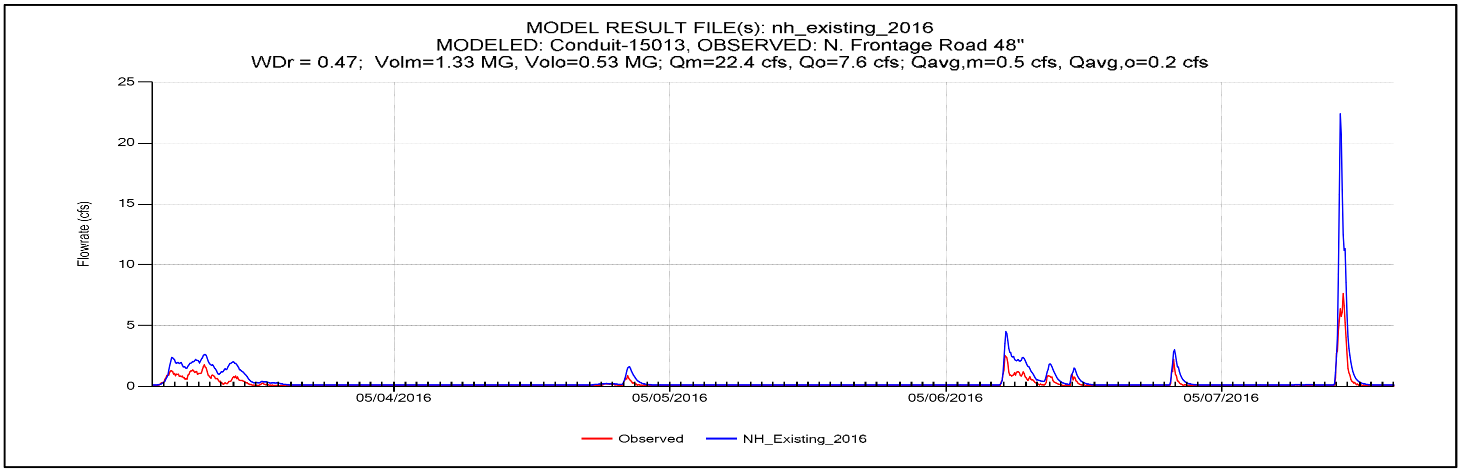




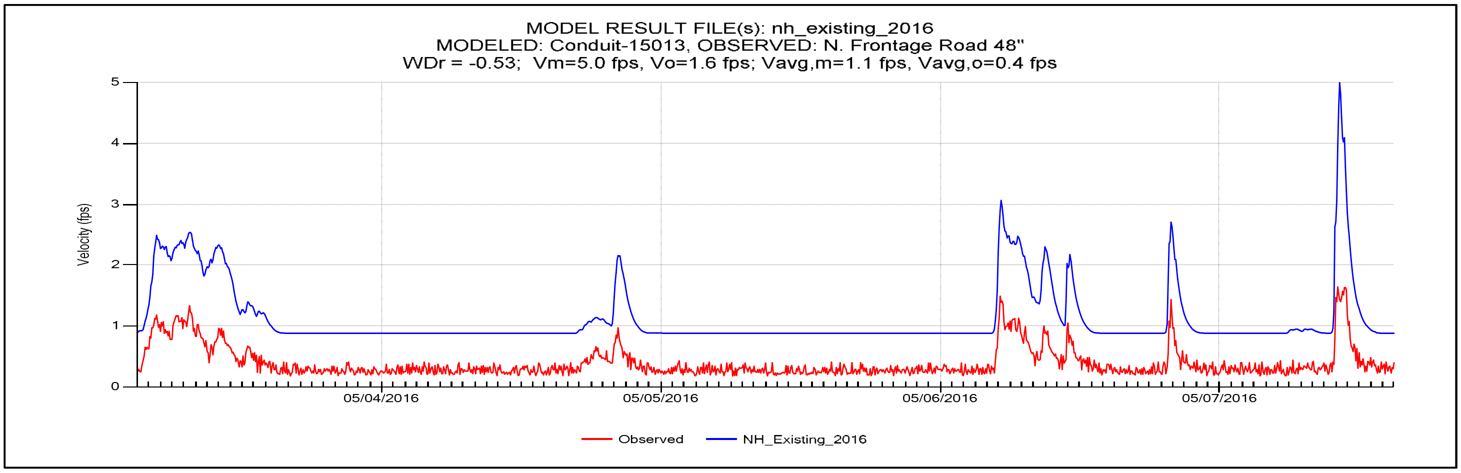
Meter04-Spring3



MODEL RESULT FILE(s): nh_existing_2016
MODELED: Junction-O17N345, OBSERVED: N. Frontage Road 48"
WDr = 0.75; Dm=1.6 feet, Do=1.6 feet; Davg,m=0.2 feet, Davg,o=0.2 feet

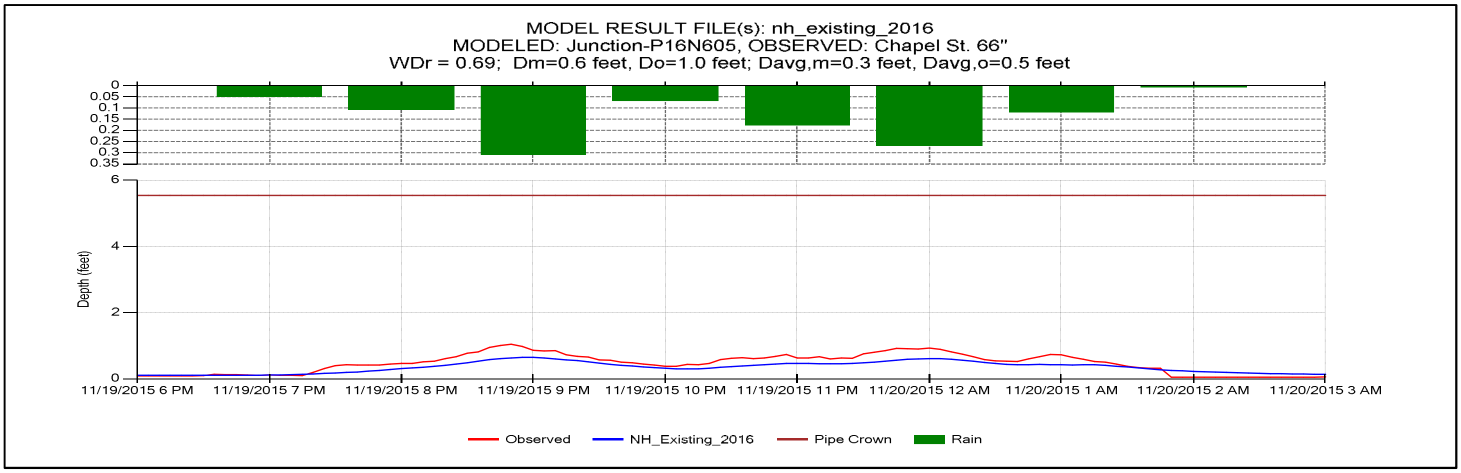


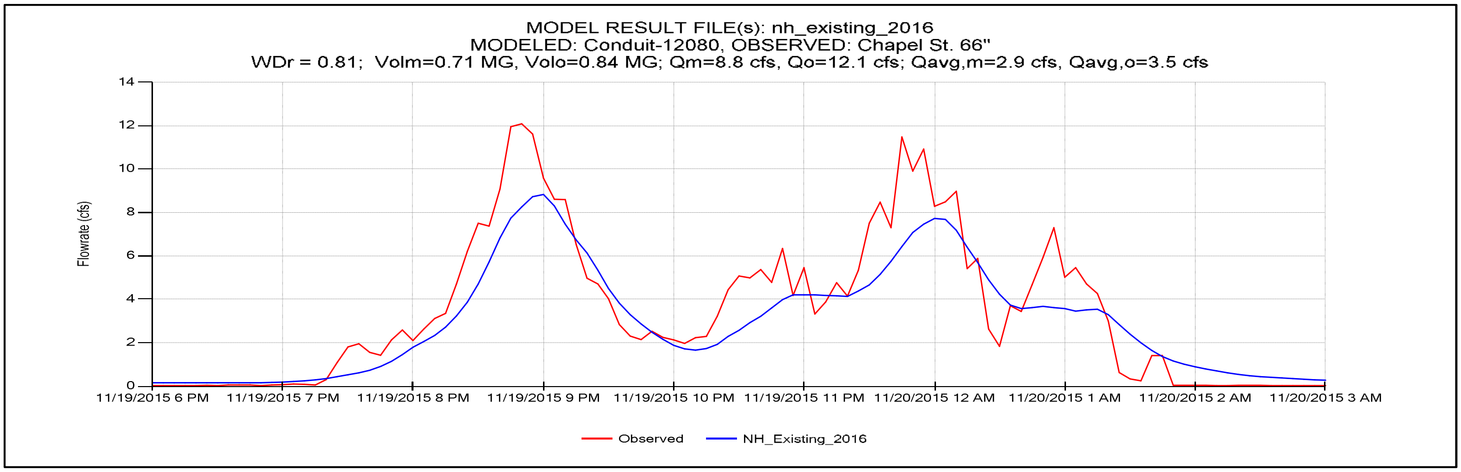
MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-15013, OBSERVED: N. Frontage Road 48"
WDr = 0.47; Volm=1.33 MG, Volo=0.53 MG; Qm=22.4 cfs, Qo=7.6 cfs; Qavg,m=0.5 cfs, Qavg,o=0.2 cfs

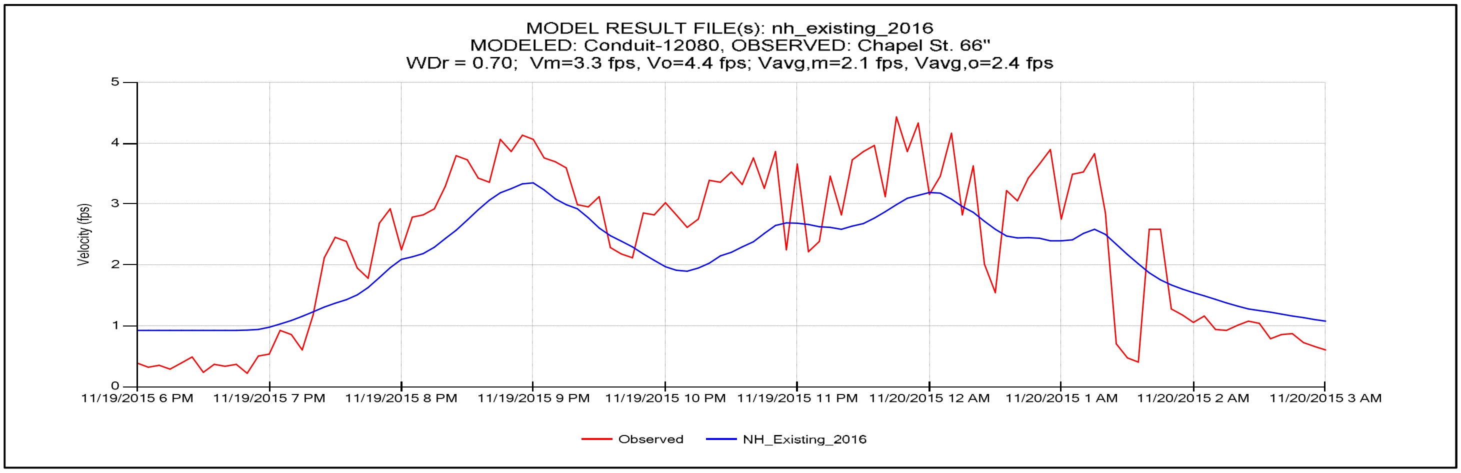


MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-15013, OBSERVED: N. Frontage Road 48"
WDr = -0.53; Vm=5.0 fps, Vo=1.6 fps; Vavg,m=1.1 fps, Vavg,o=0.4 fps

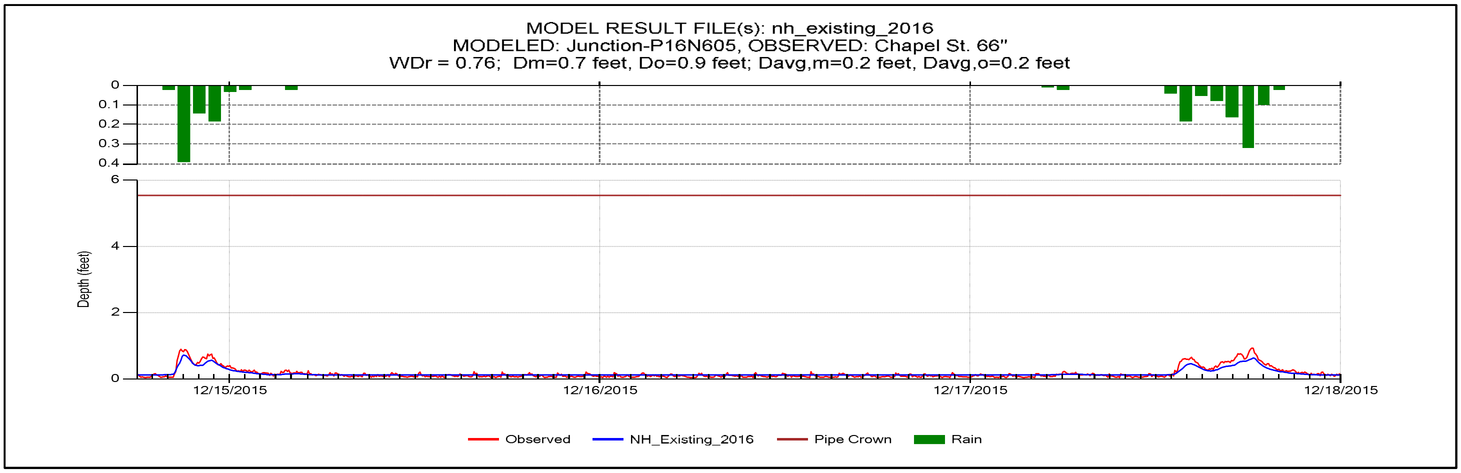
Meter05-Fall1

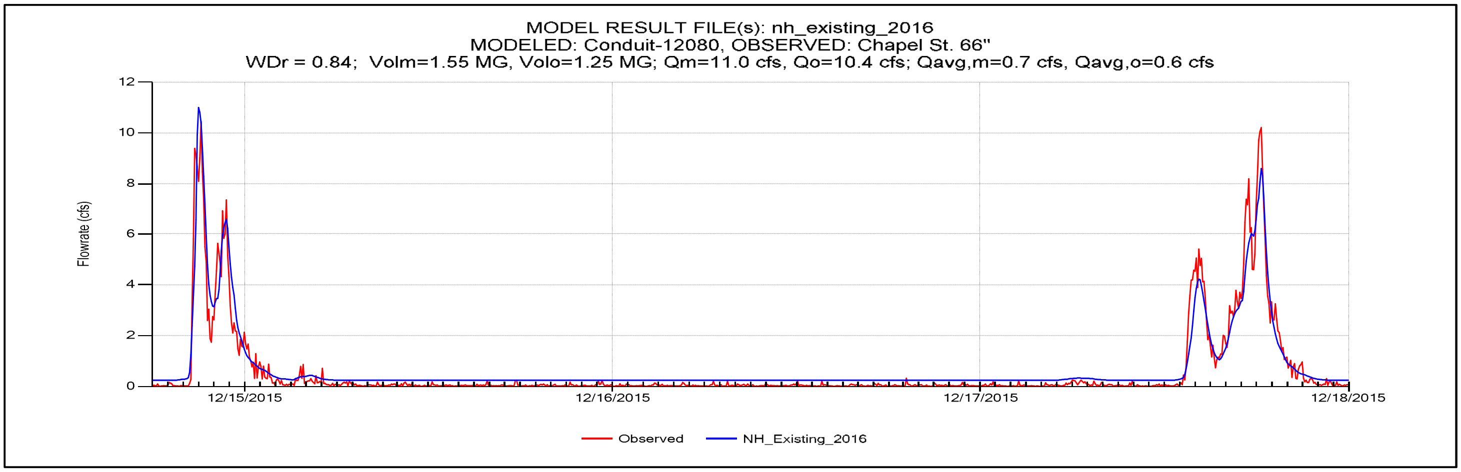


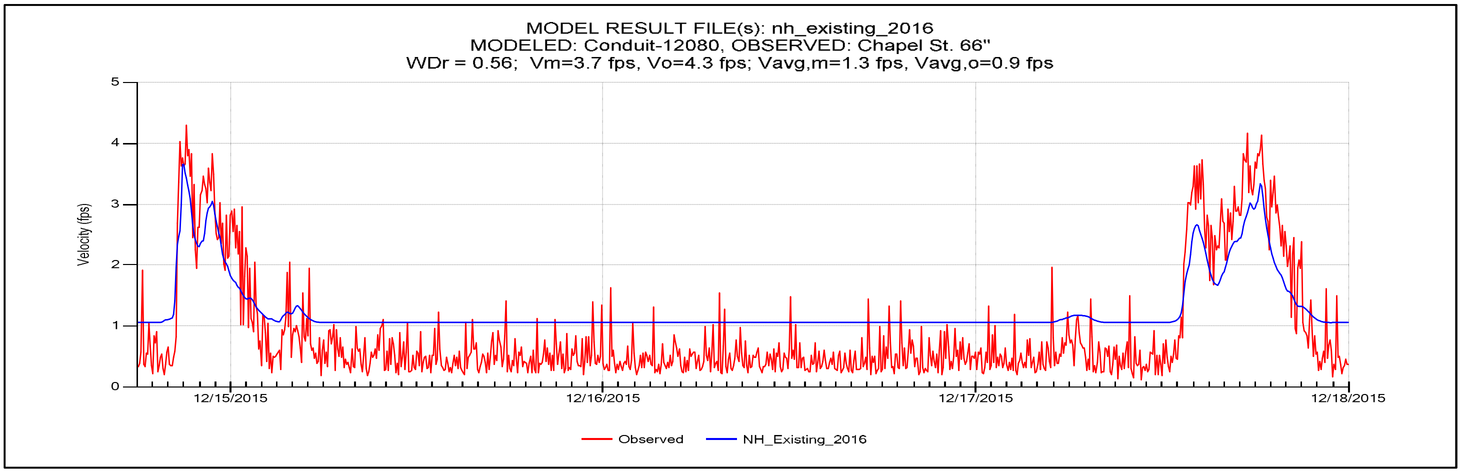




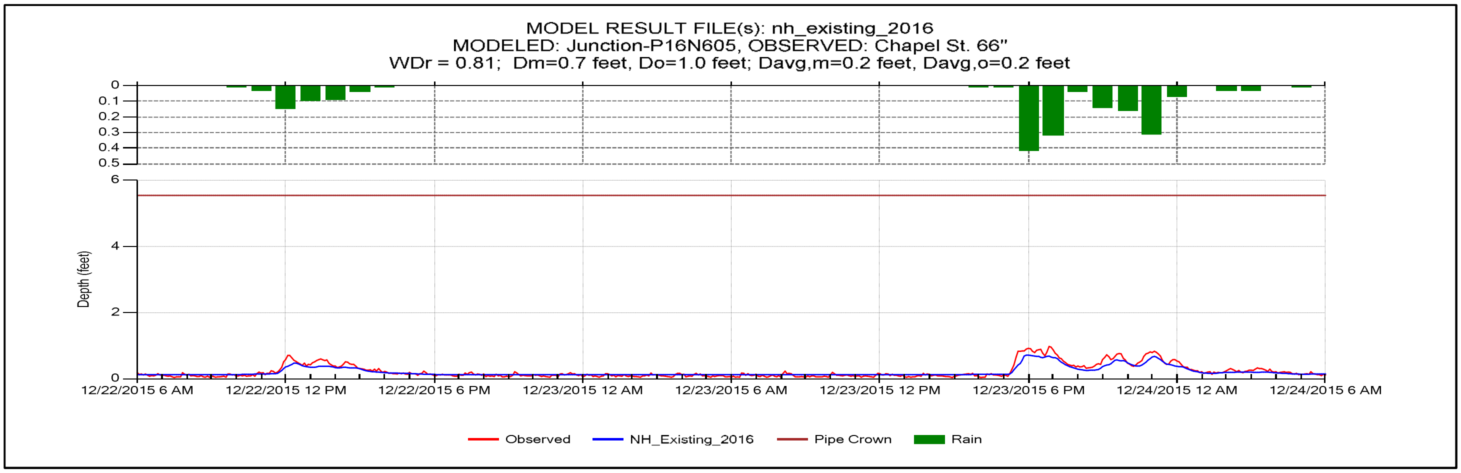
Meter05-Fall2

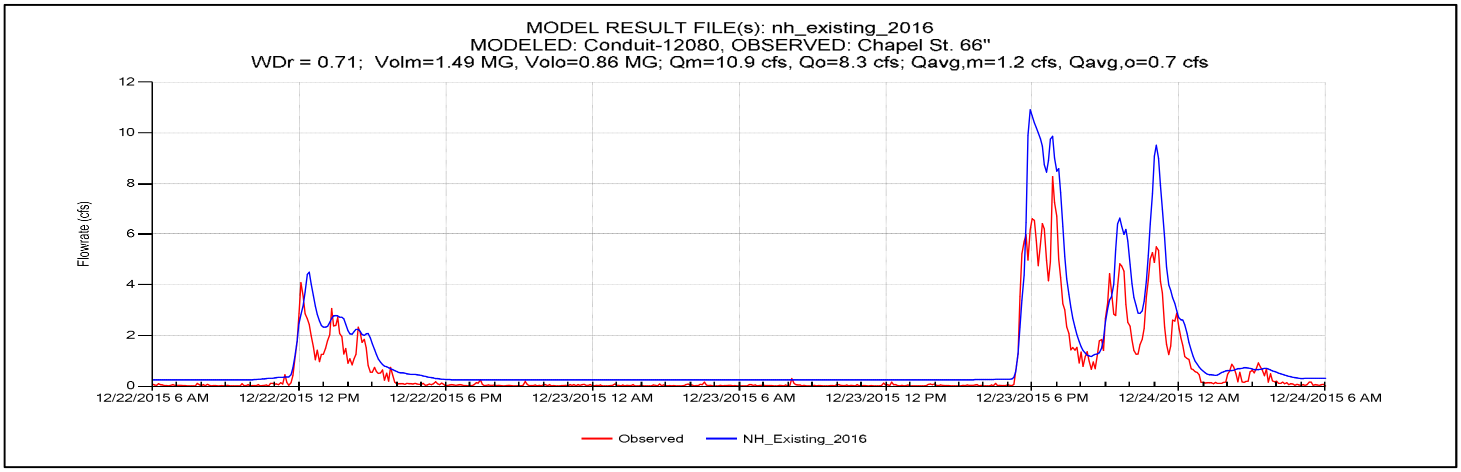


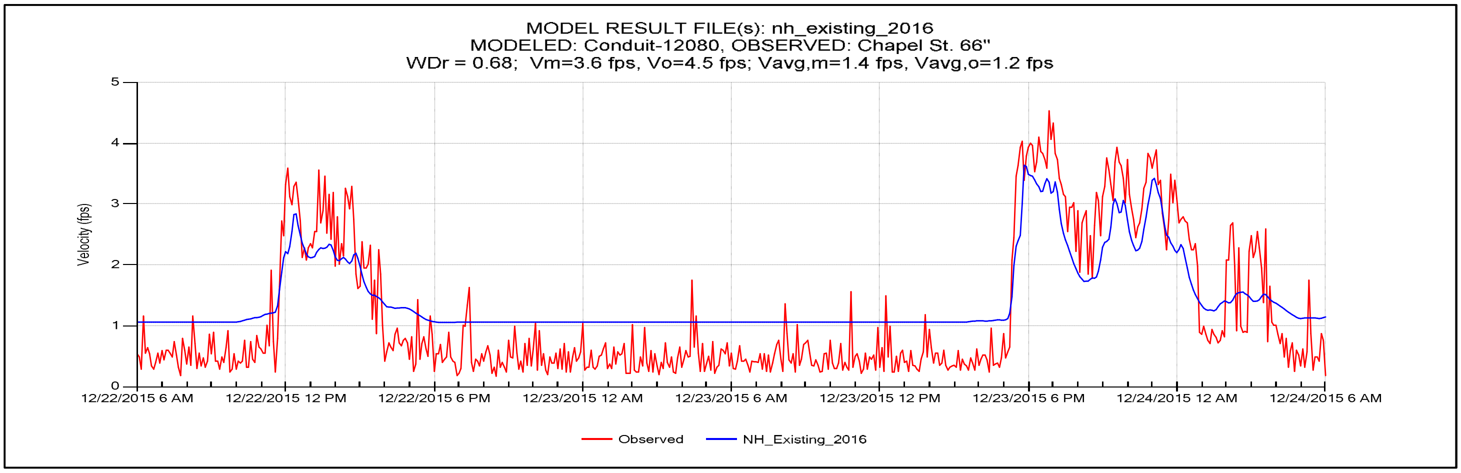




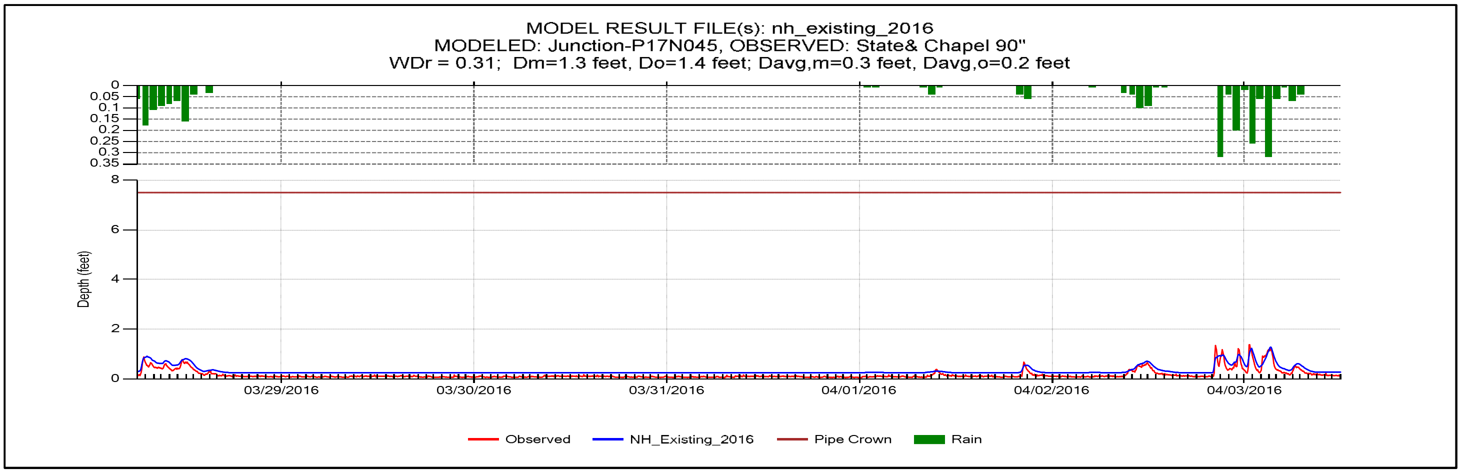
Meter05-Fall3

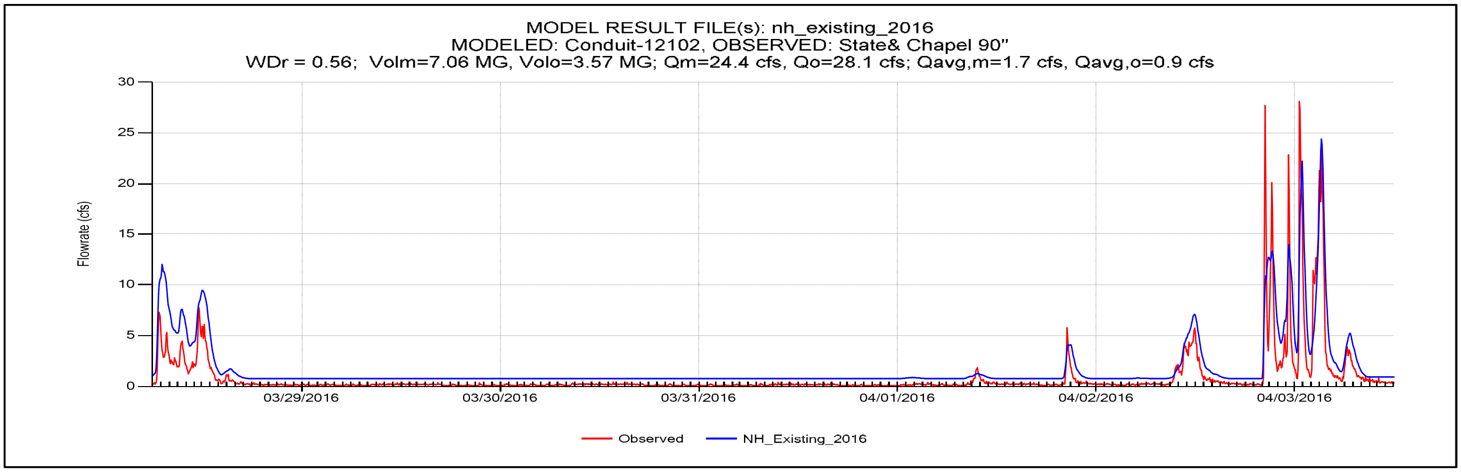


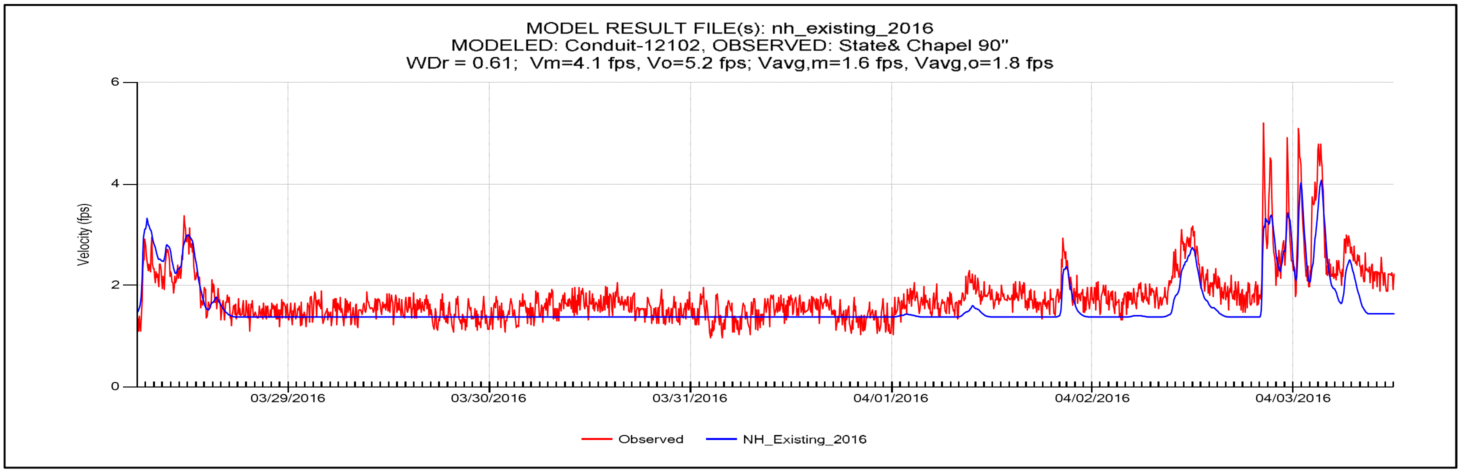




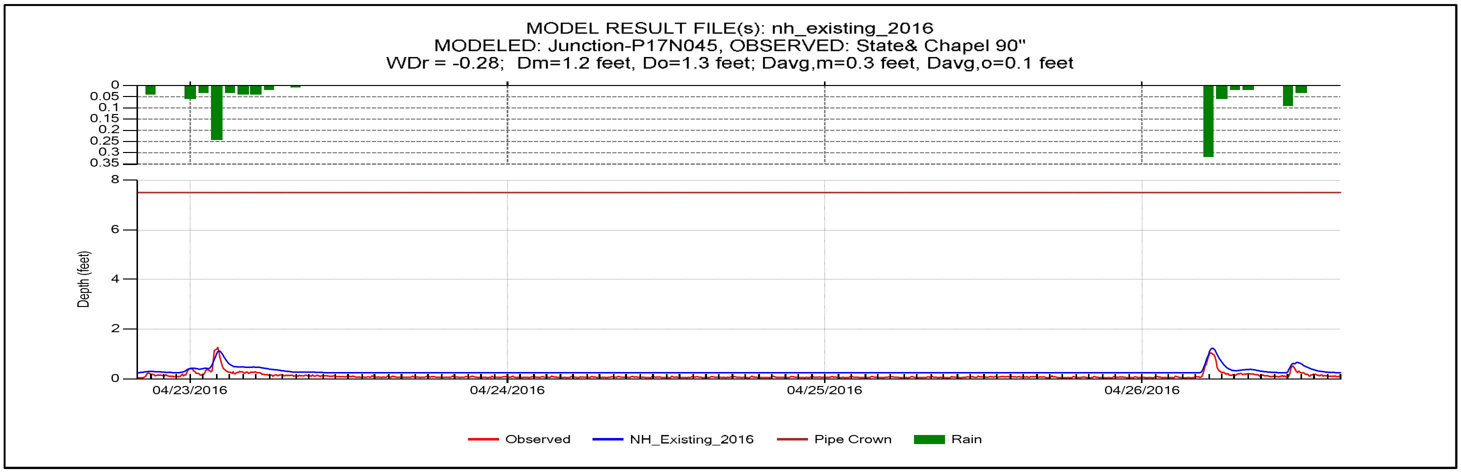
Meter05A-Spring1

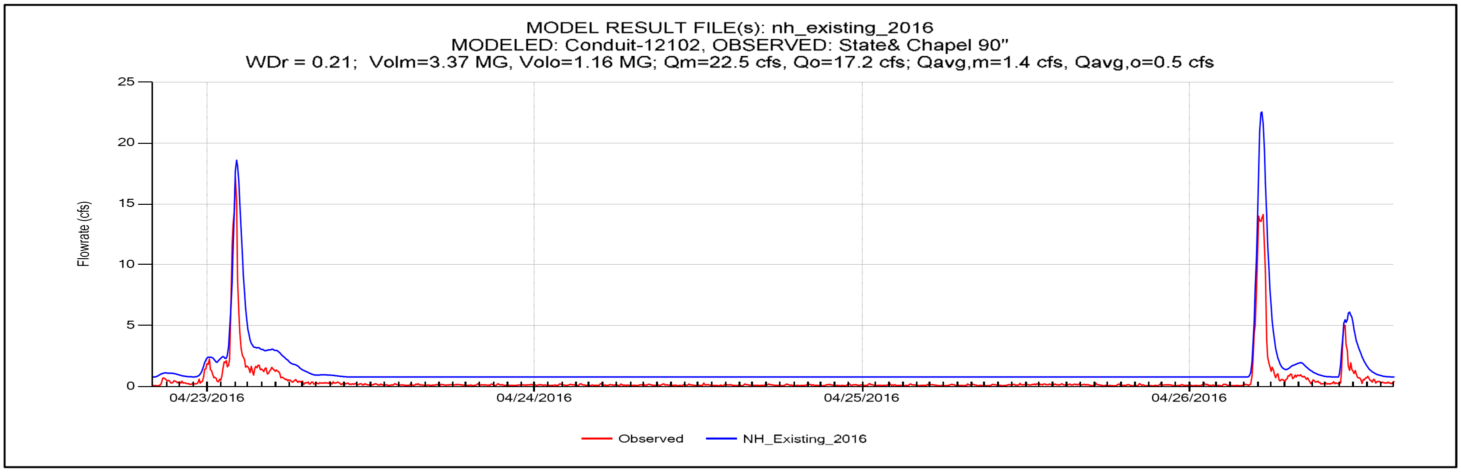


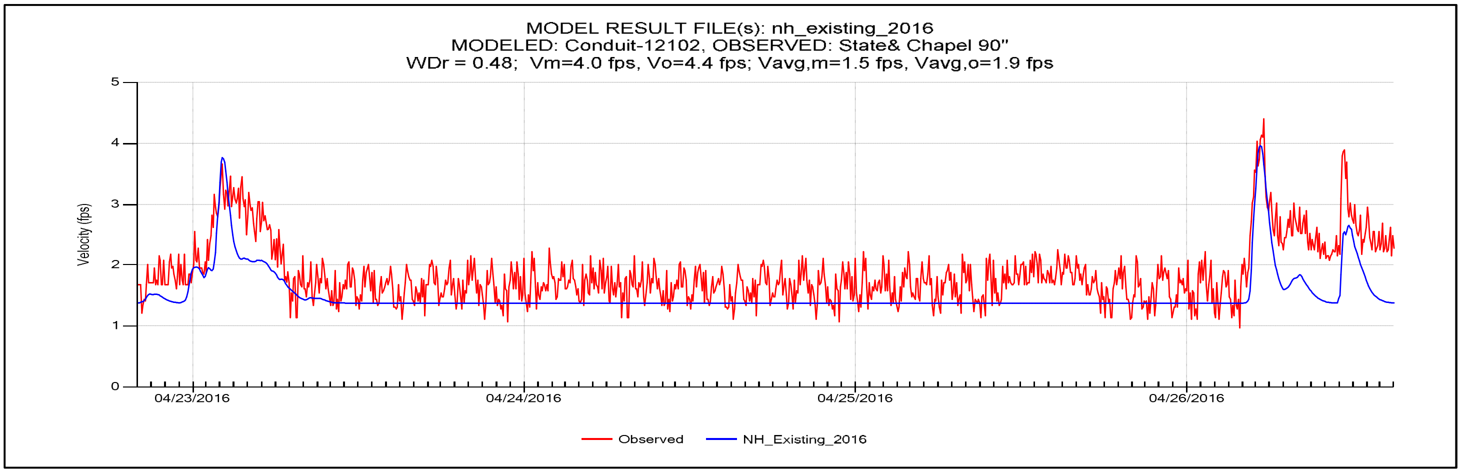




Meter05A-Spring2

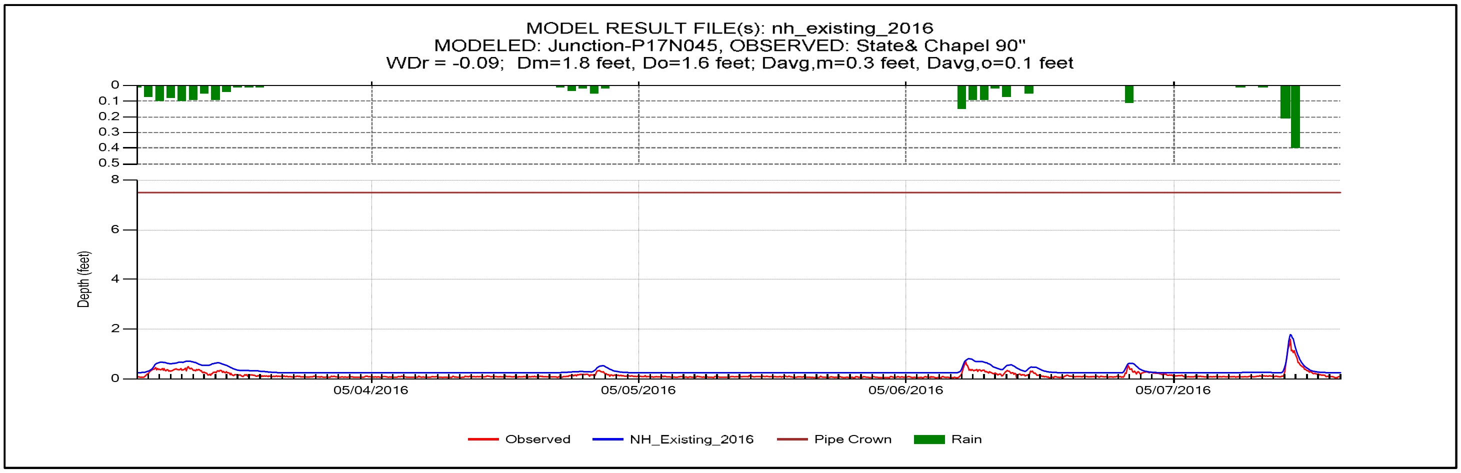

MODEL RESULT FILE(s): nh_existing_2016
MODELED: Junction-P17N045, OBSERVED: State& Chapel 90"
WDr = -0.28; Dm=1.2 feet, Do=1.3 feet; Davg,m=0.3 feet, Davg,o=0.1 feet

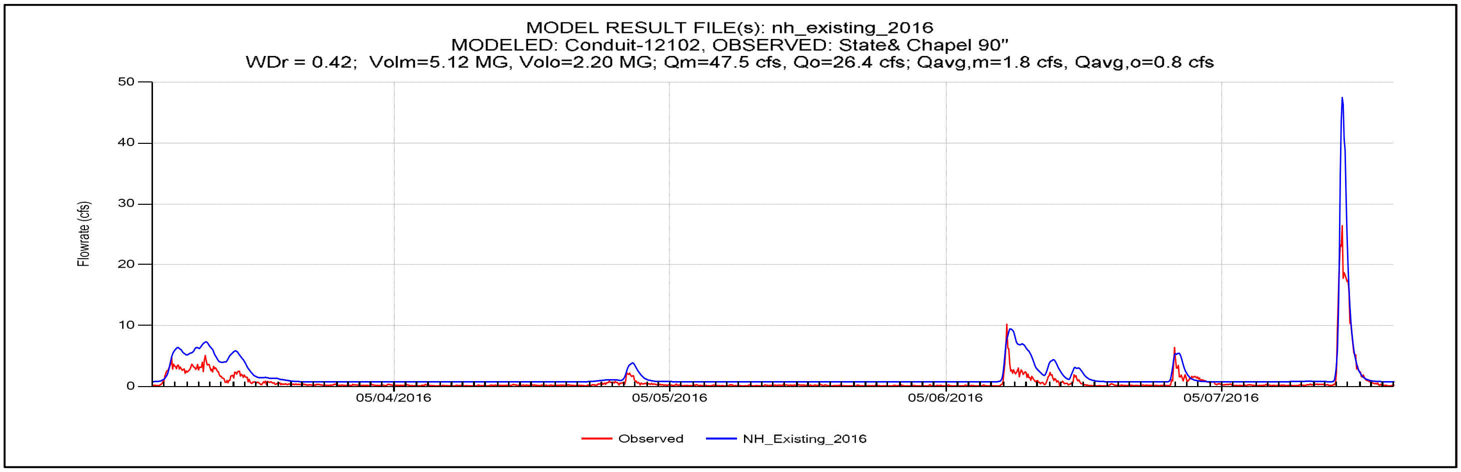

MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-12102, OBSERVED: State& Chapel 90"
WDr = 0.21; Volm=3.37 MG, Volo=1.16 MG; Qm=22.5 cfs, Qo=17.2 cfs; Qavg,m=1.4 cfs, Qavg,o=0.5 cfs

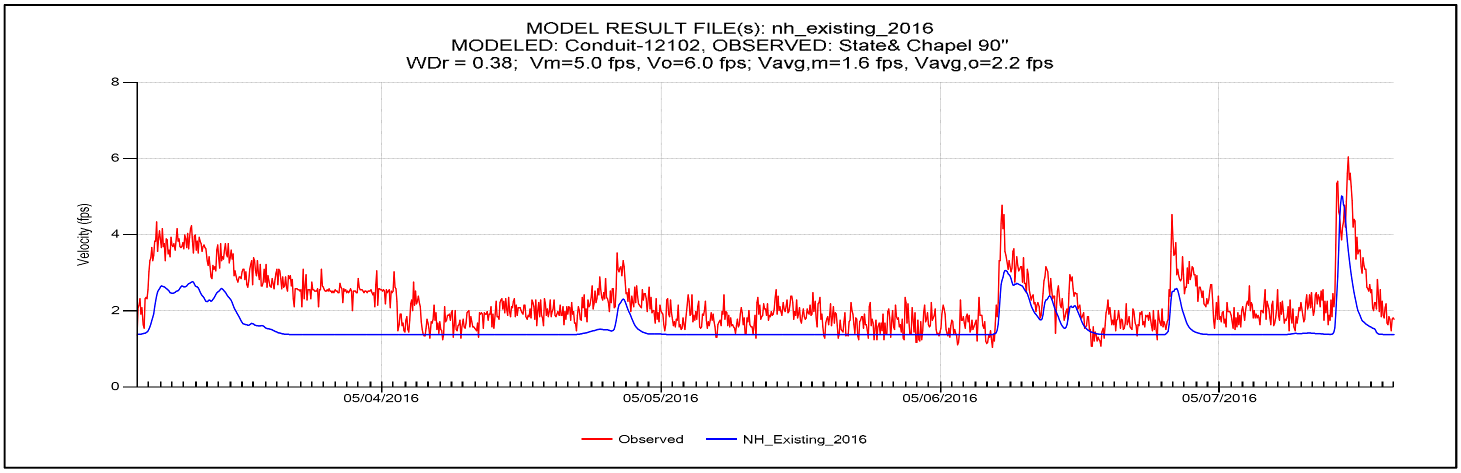

MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-12102, OBSERVED: State& Chapel 90"
WDr = 0.48; Vm=4.0 fps, Vo=4.4 fps; Vavg,m=1.5 fps, Vavg,o=1.9 fps

Simulated Versus Observed Flow at Flow Meter Sites

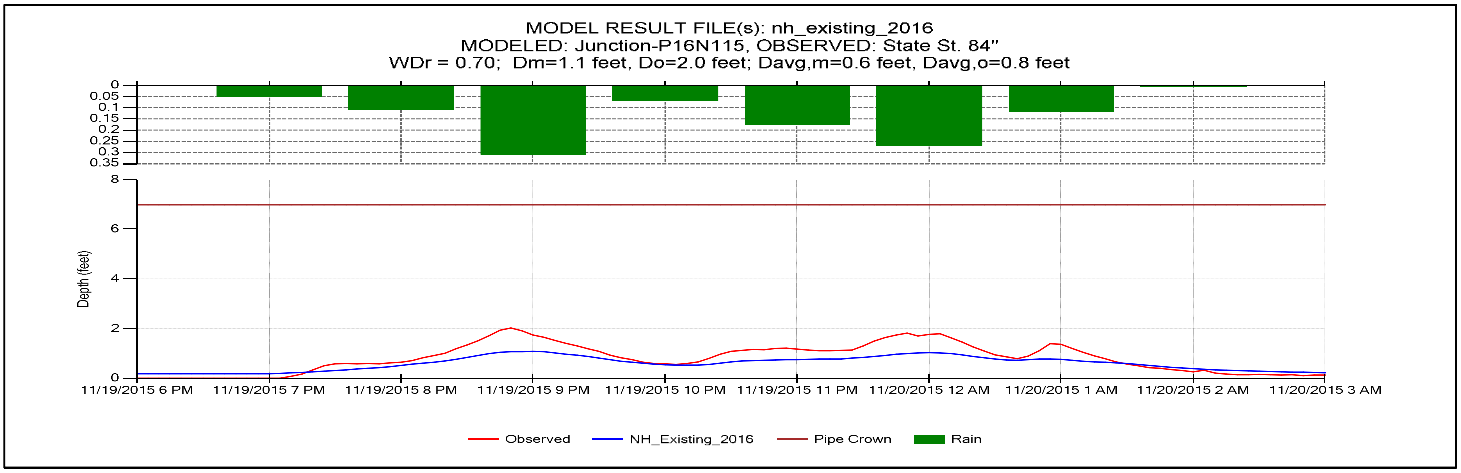
Meter05A-Spring3

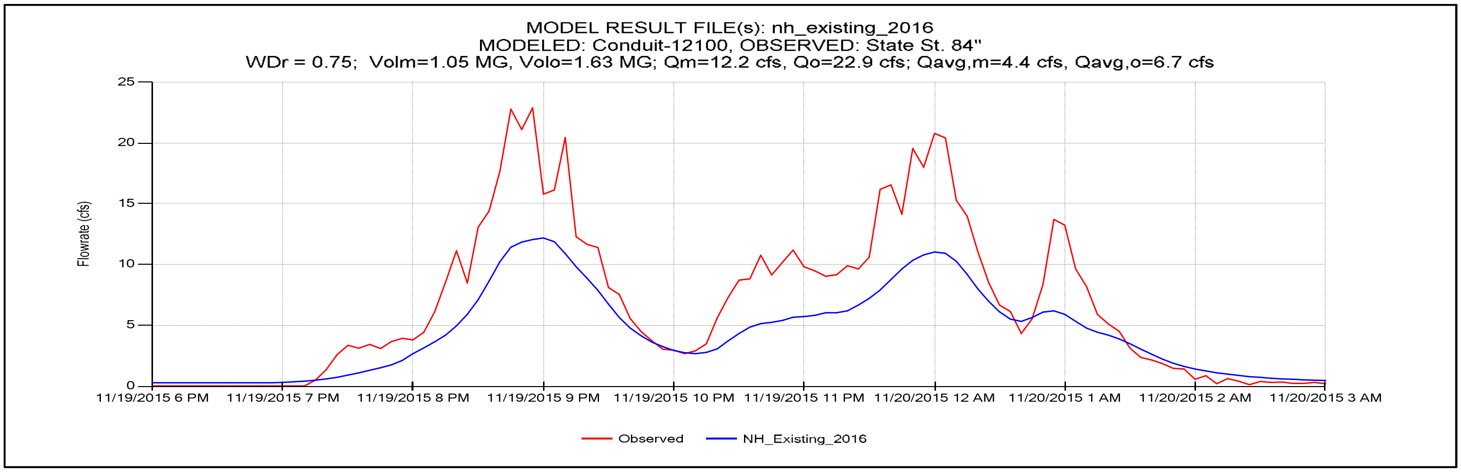

MODEL RESULT FILE(s): nh_existing_2016
MODELED: Junction-P17N045, OBSERVED: State& Chapel 90"
WDr = -0.09; Dm=1.8 feet, Do=1.6 feet; Davg,m=0.3 feet, Davg,o=0.1 feet

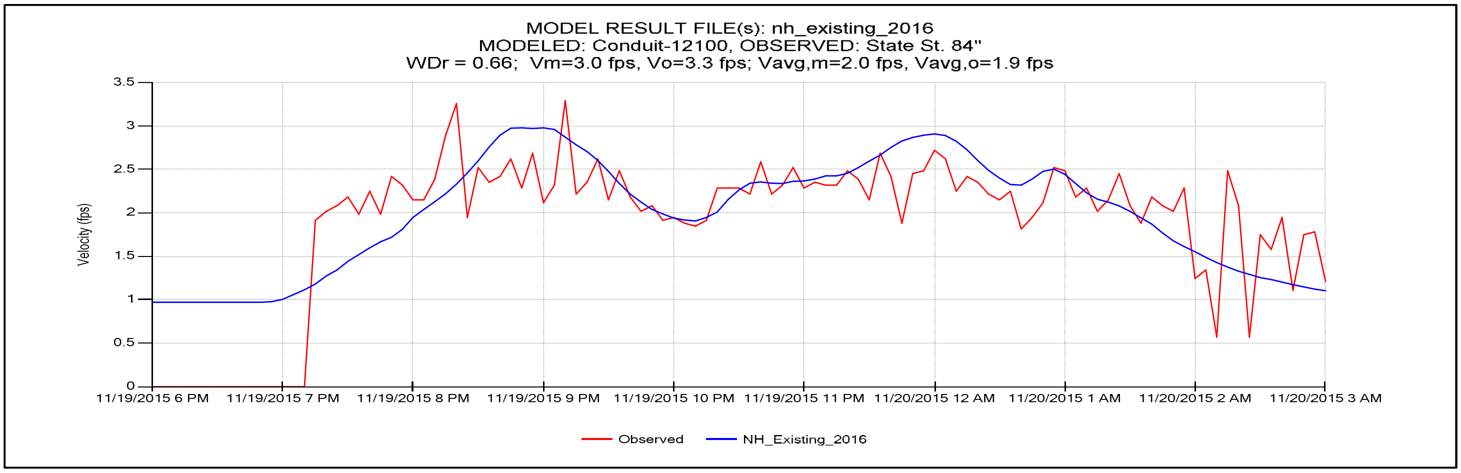

MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-12102, OBSERVED: State& Chapel 90"
WDr = 0.42; Volm=5.12 MG, Volo=2.20 MG; Qm=47.5 cfs, Qo=26.4 cfs; Qavg,m=1.8 cfs, Qavg,o=0.8 cfs


MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-12102, OBSERVED: State& Chapel 90"
WDr = 0.38; Vm=5.0 fps, Vo=6.0 fps; Vavg,m=1.6 fps, Vavg,o=2.2 fps

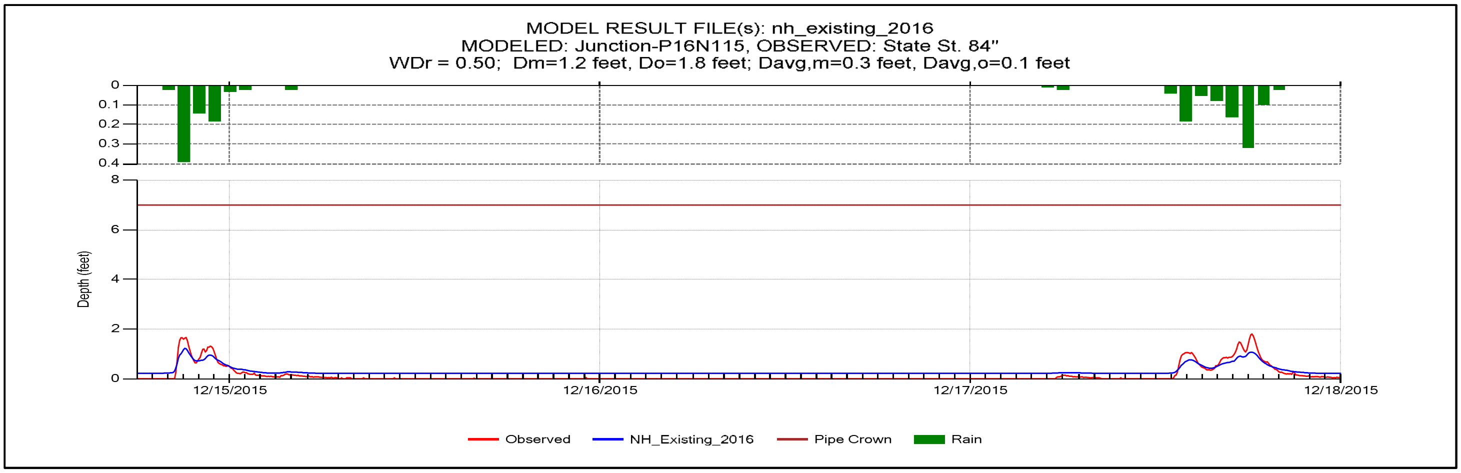
Meter06-Fall1

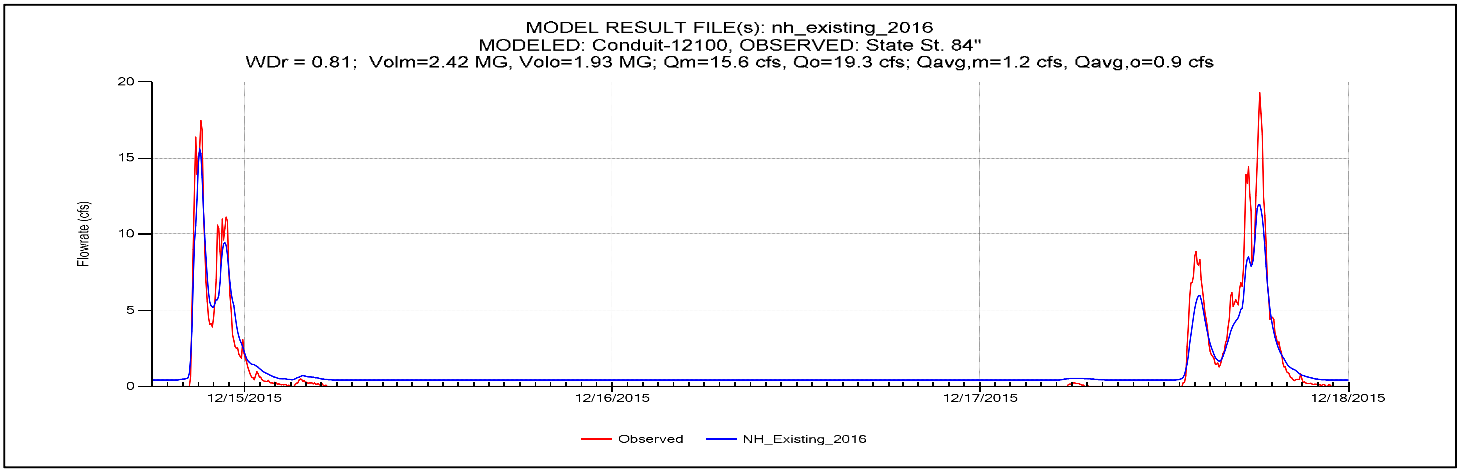


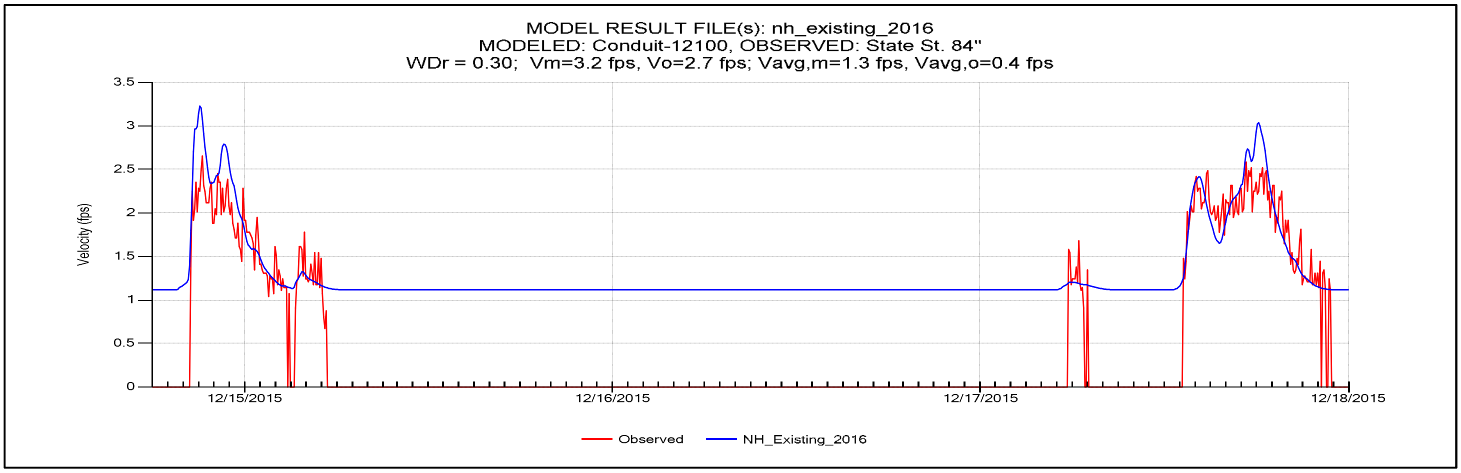




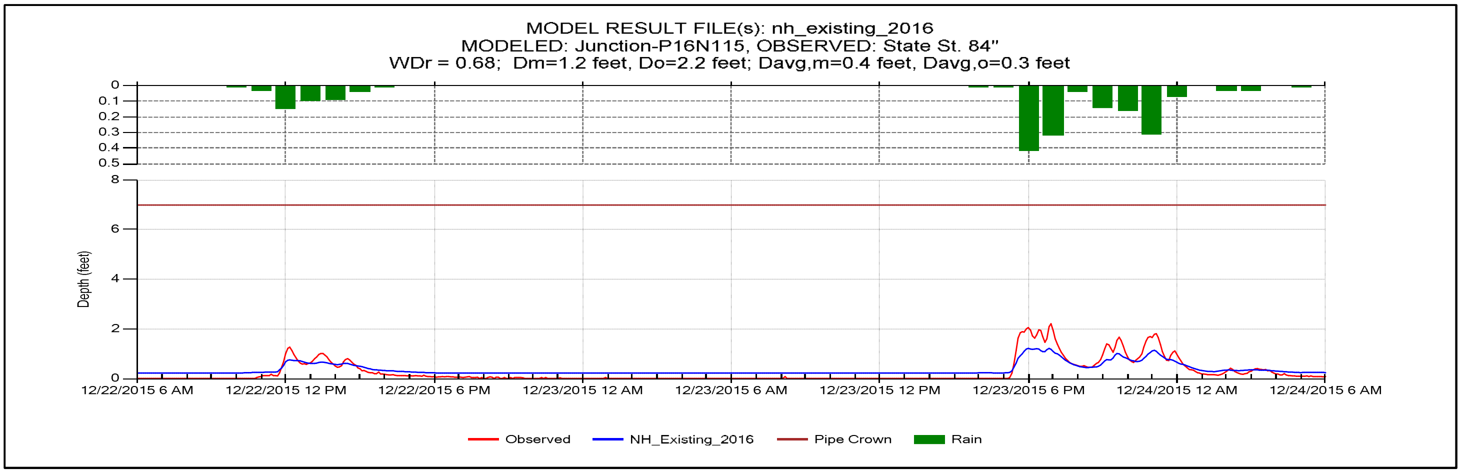
Meter06-Fall2

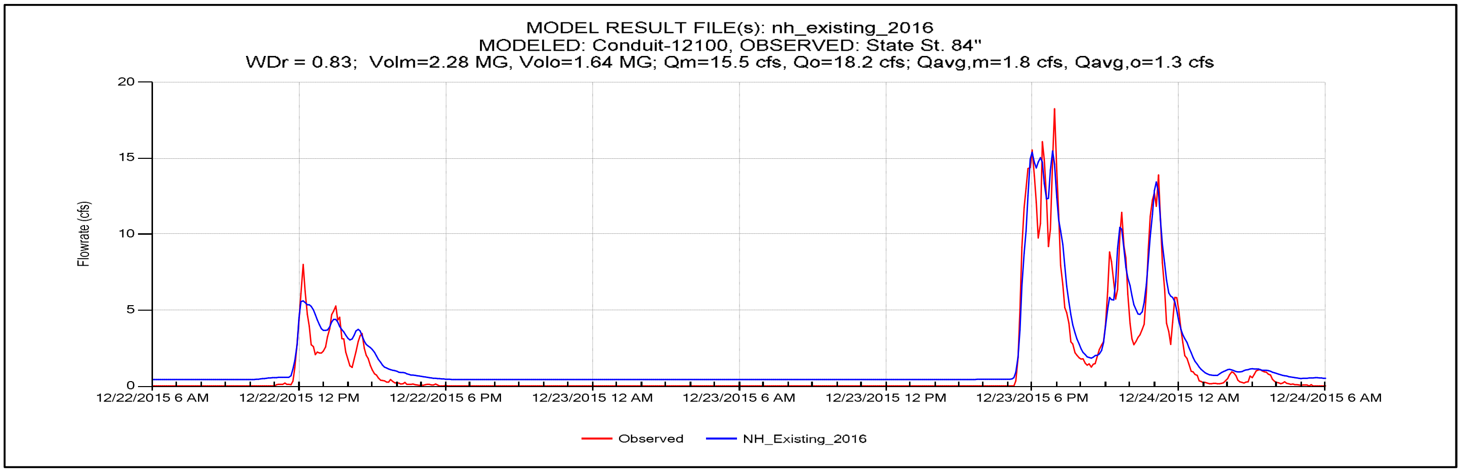


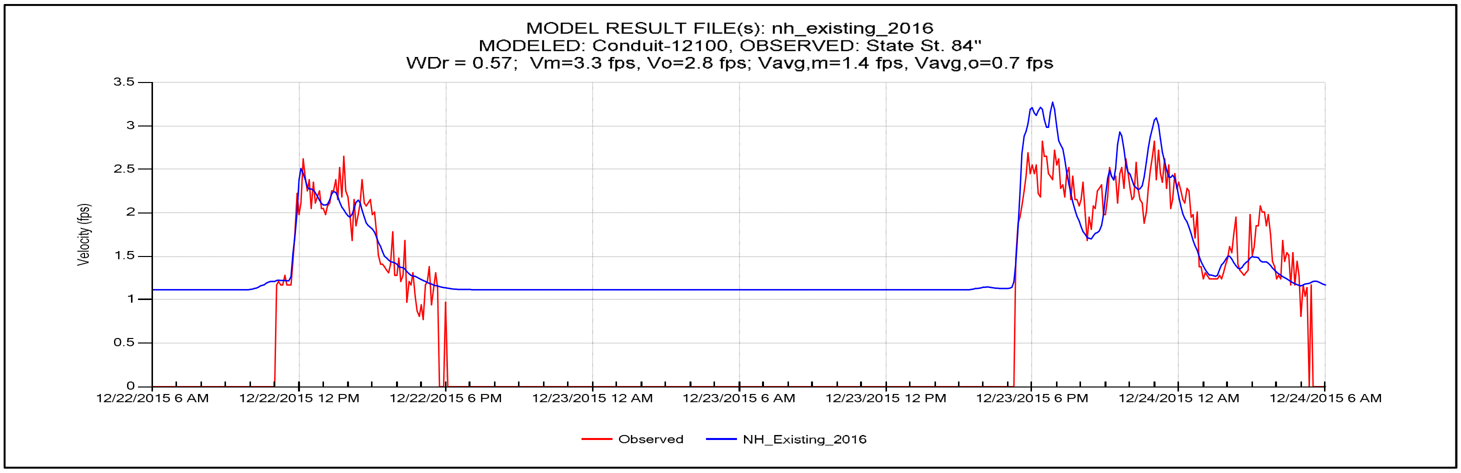




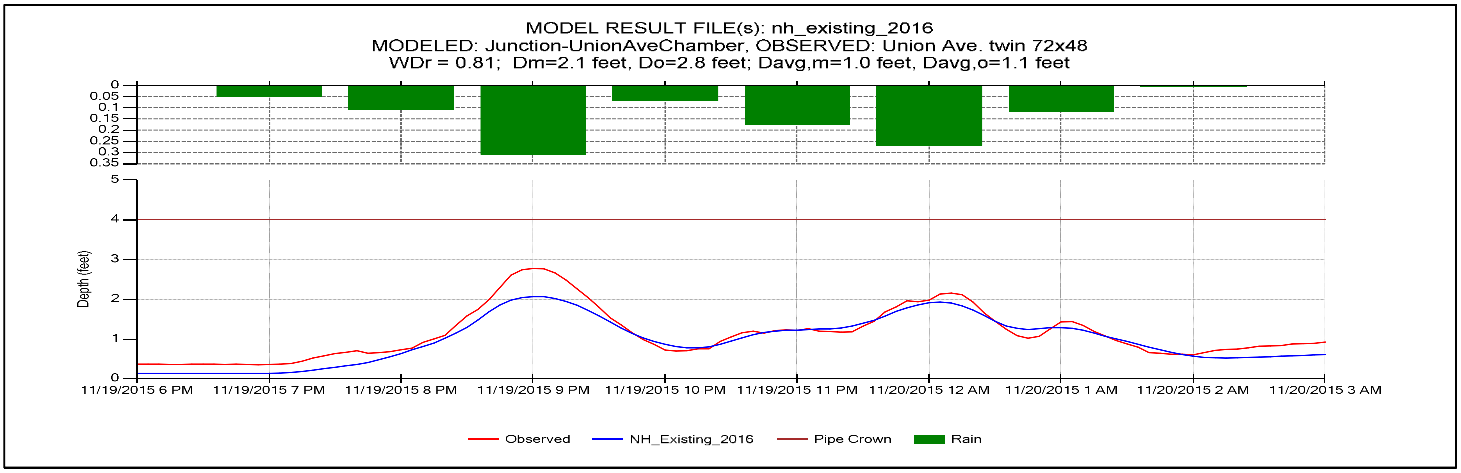
Meter06-Fall3

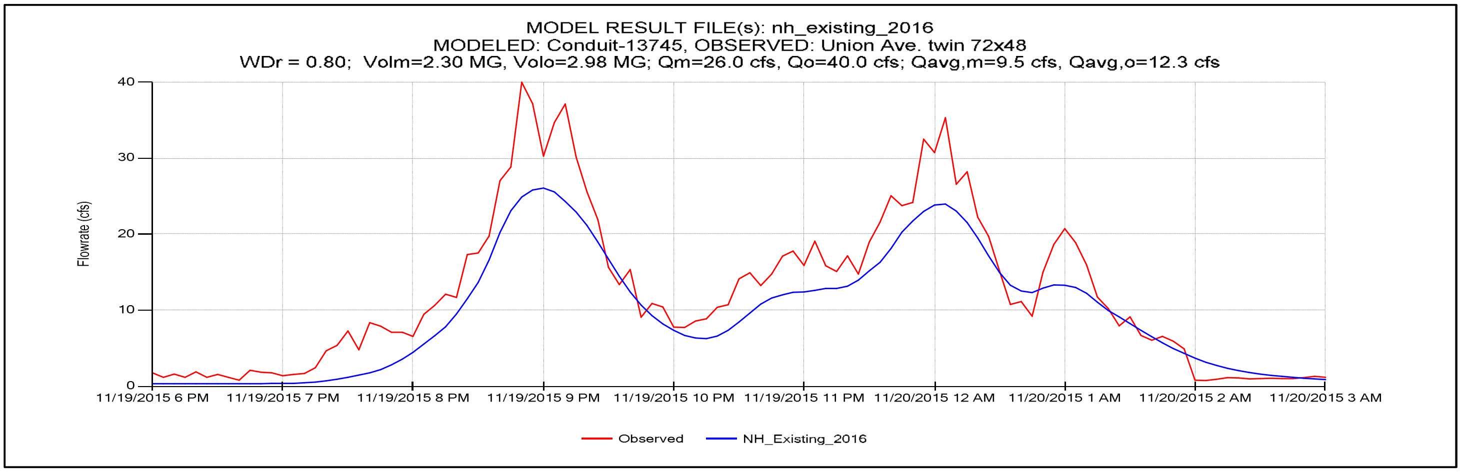


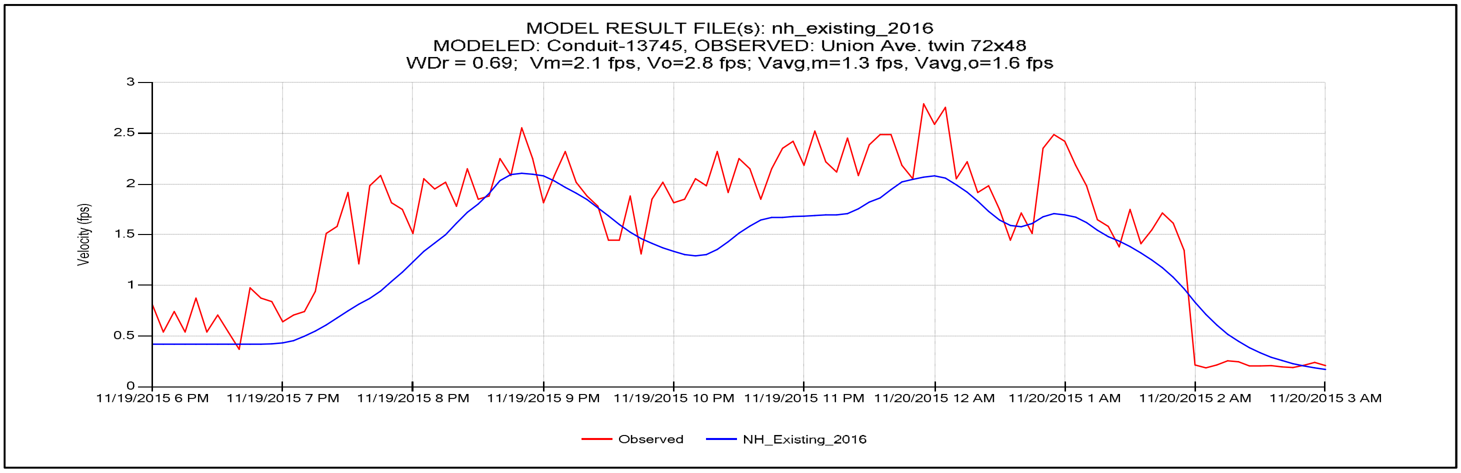




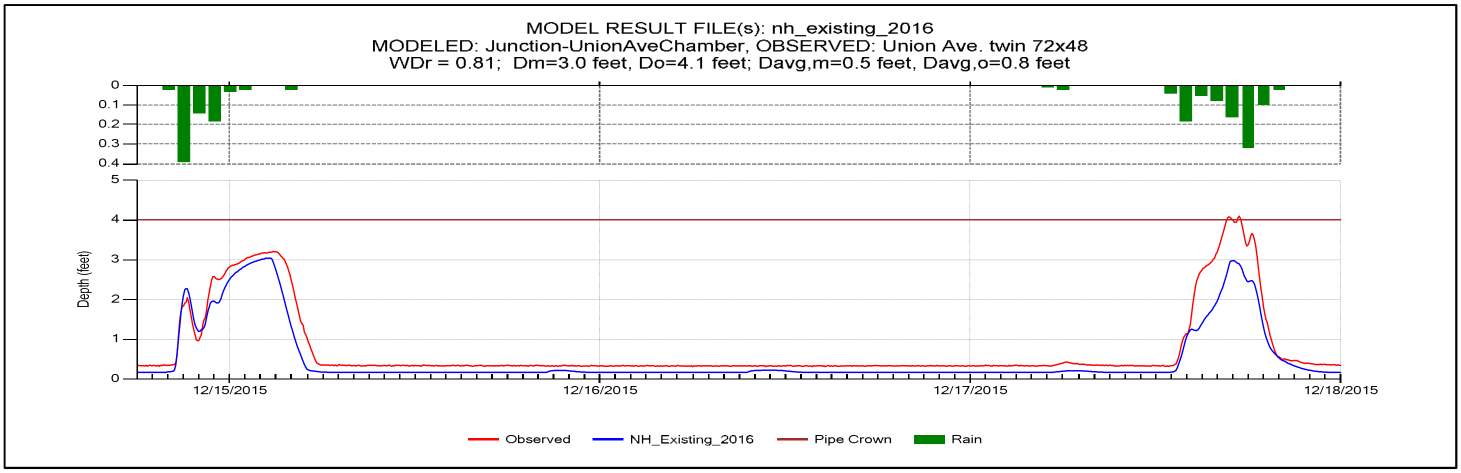
Meter07-Fall1

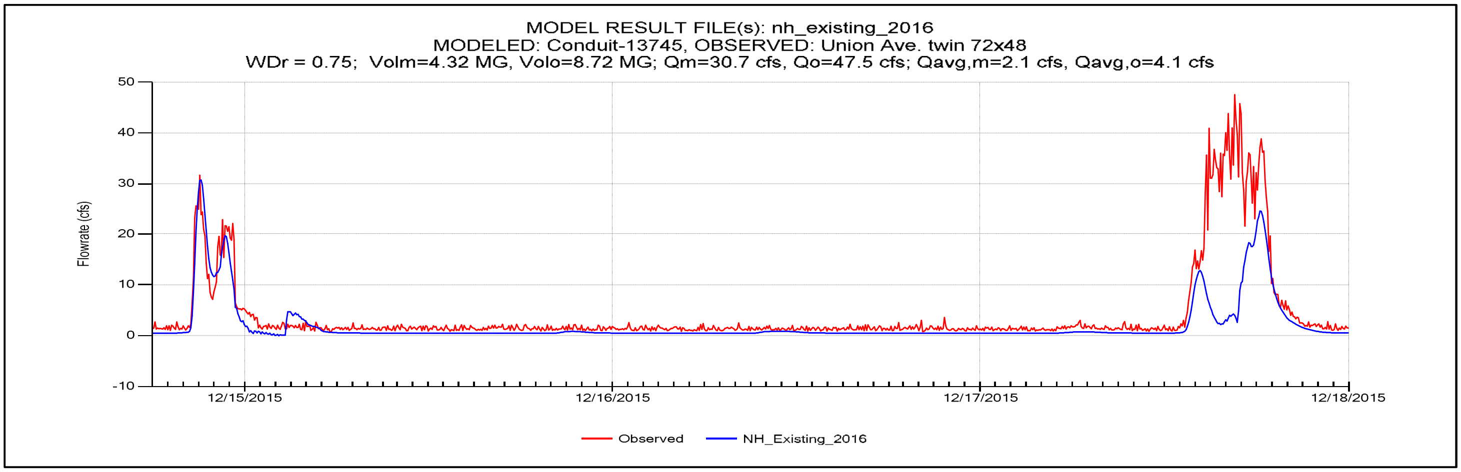

MODEL RESULT FILE(s): nh_existing_2016
MODELED: Junction-UnionAveChamber, OBSERVED: Union Ave. twin 72x48
WDr = 0.81; Dm=2.1 feet, Do=2.8 feet; Davg,m=1.0 feet, Davg,o=1.1 feet

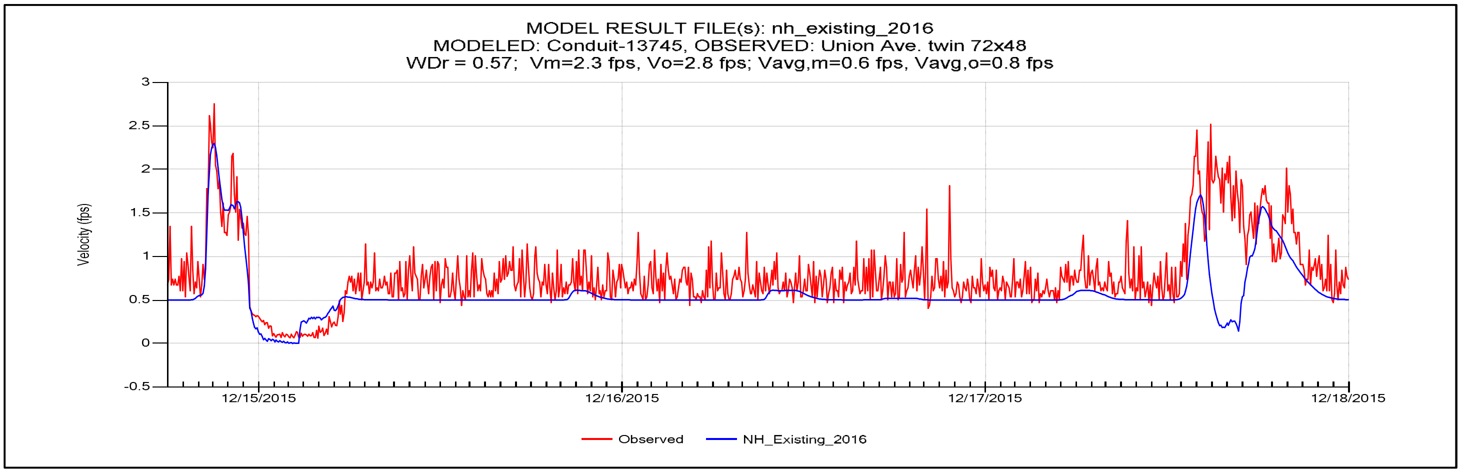

MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-13745, OBSERVED: Union Ave. twin 72x48
WDr = 0.80; Volm=2.30 MG, Volo=2.98 MG; Qm=26.0 cfs, Qo=40.0 cfs; Qavg,m=9.5 cfs, Qavg,o=12.3 cfs


MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-13745, OBSERVED: Union Ave. twin 72x48
WDr = 0.69; Vm=2.1 fps, Vo=2.8 fps; Vavg,m=1.3 fps, Vavg,o=1.6 fps

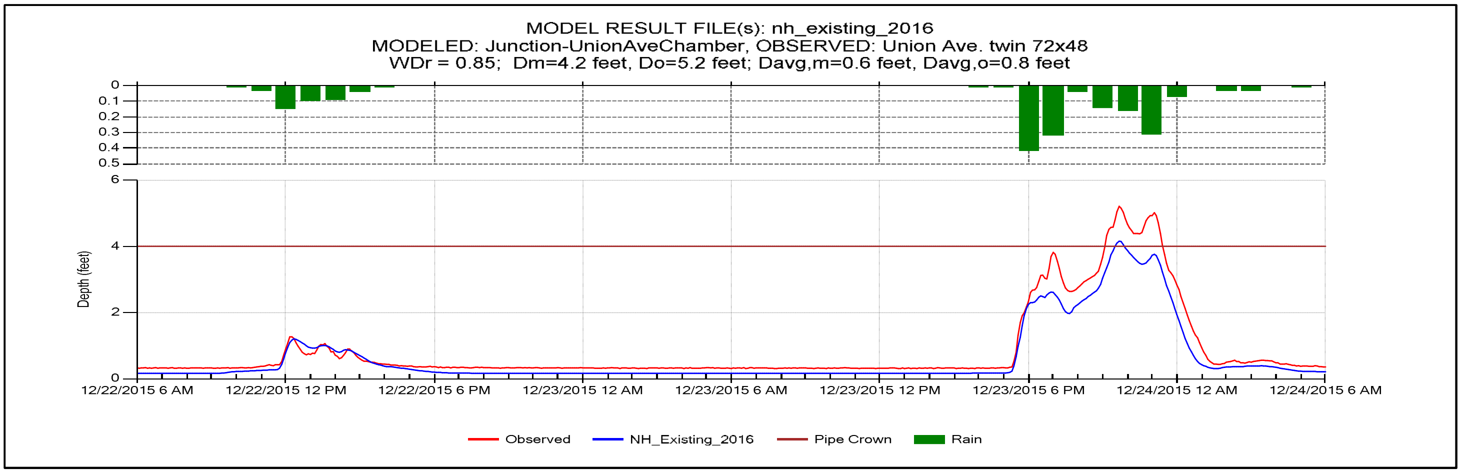
Meter07-Fall2

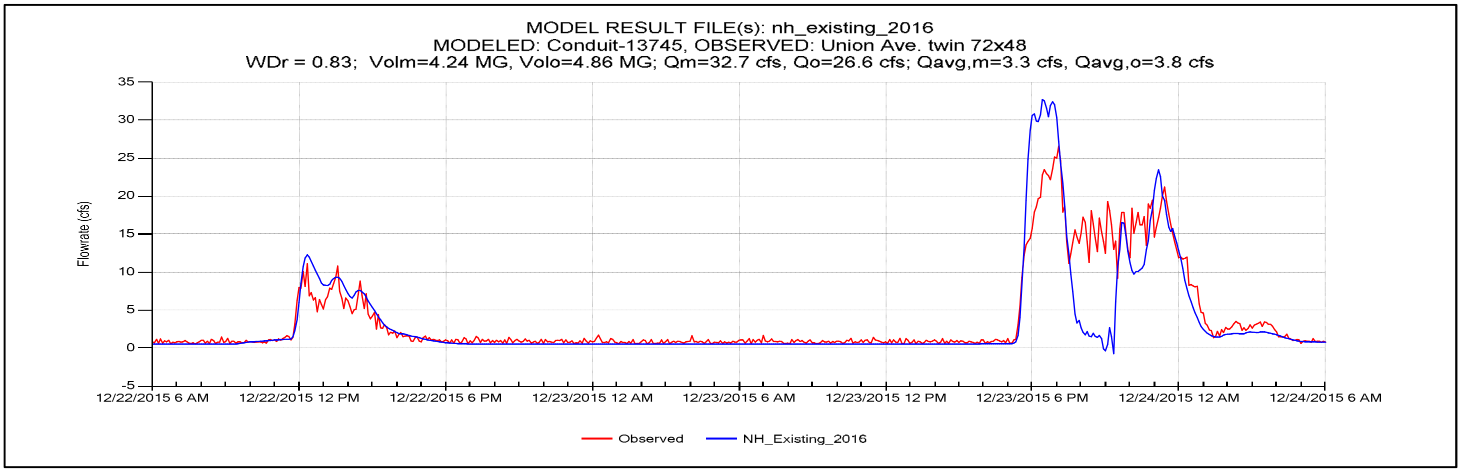


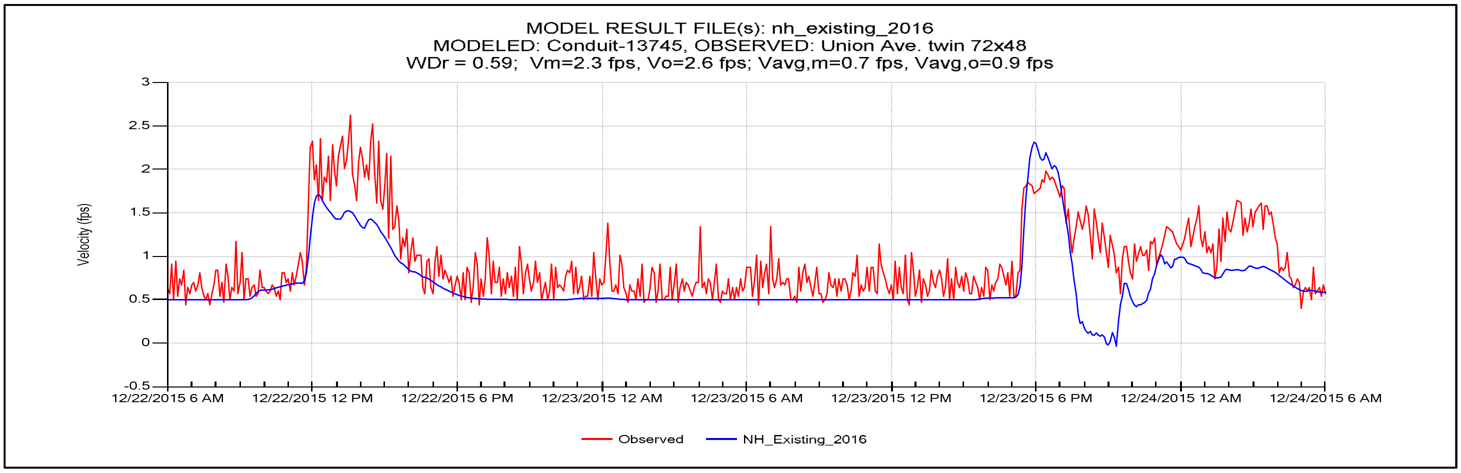




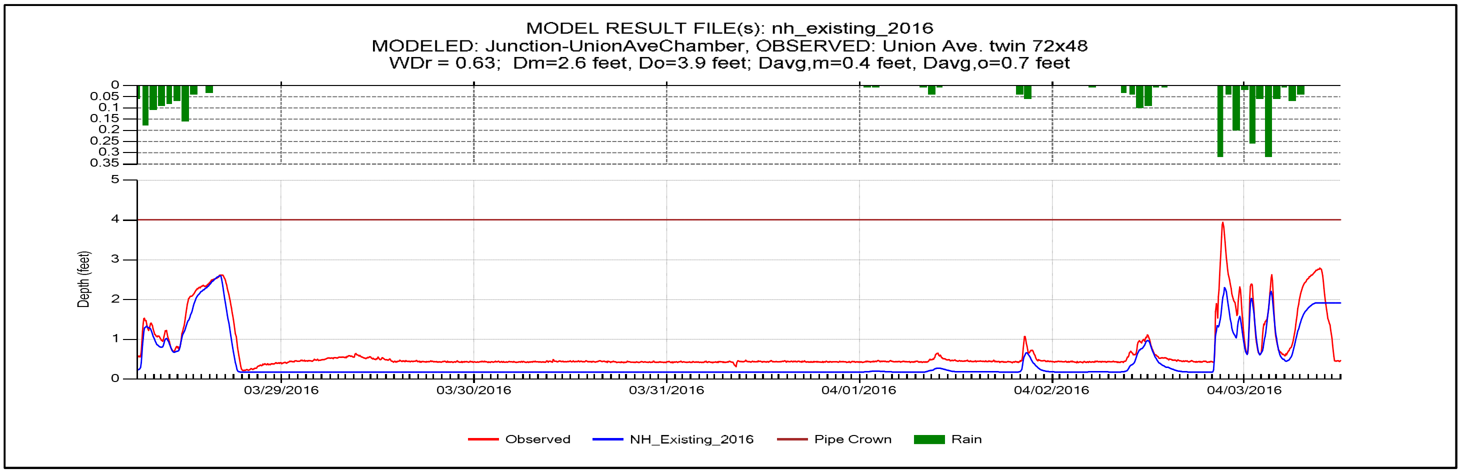
Meter07-Fall3

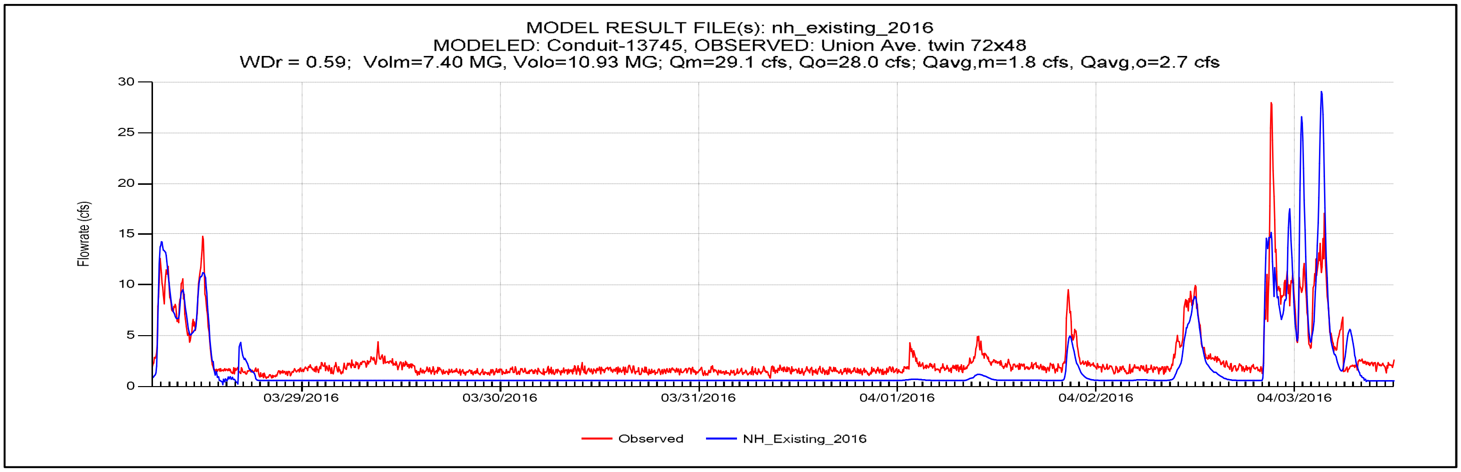


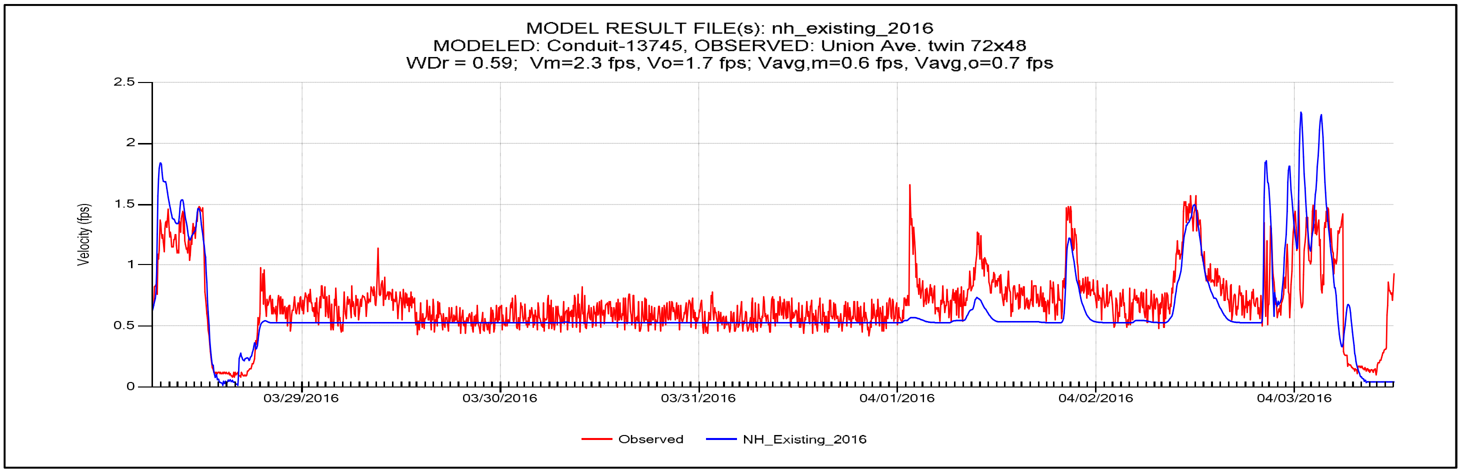




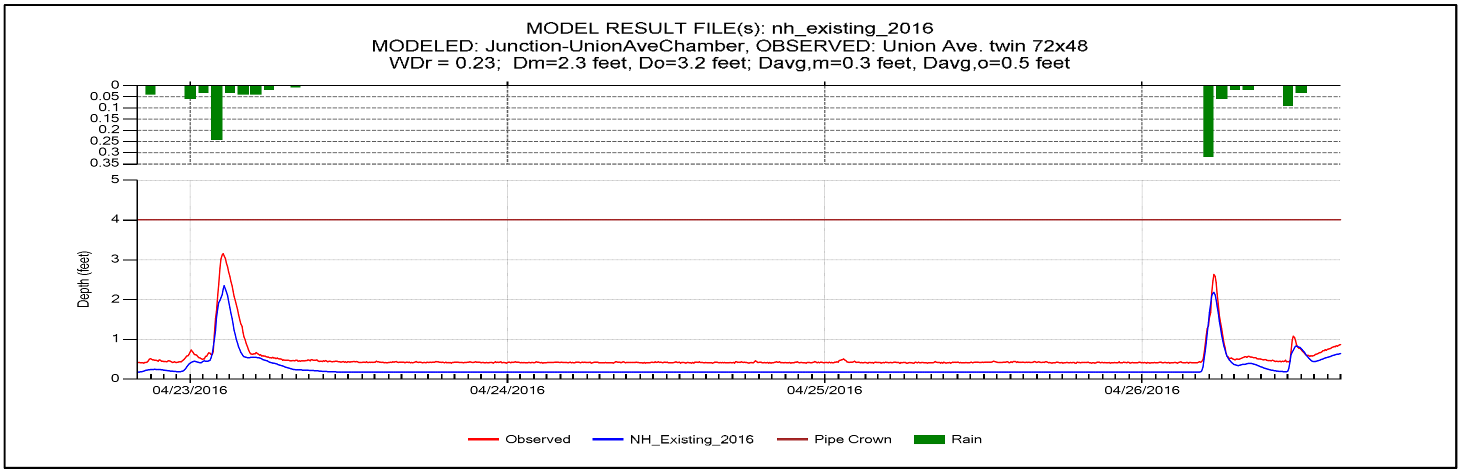
Meter07-Spring1

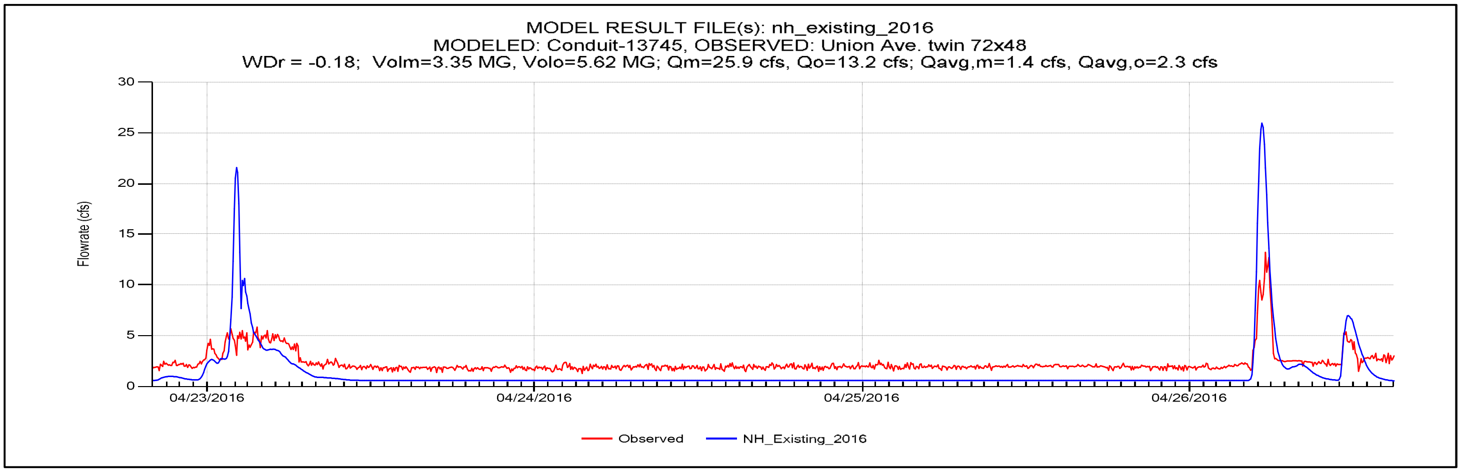


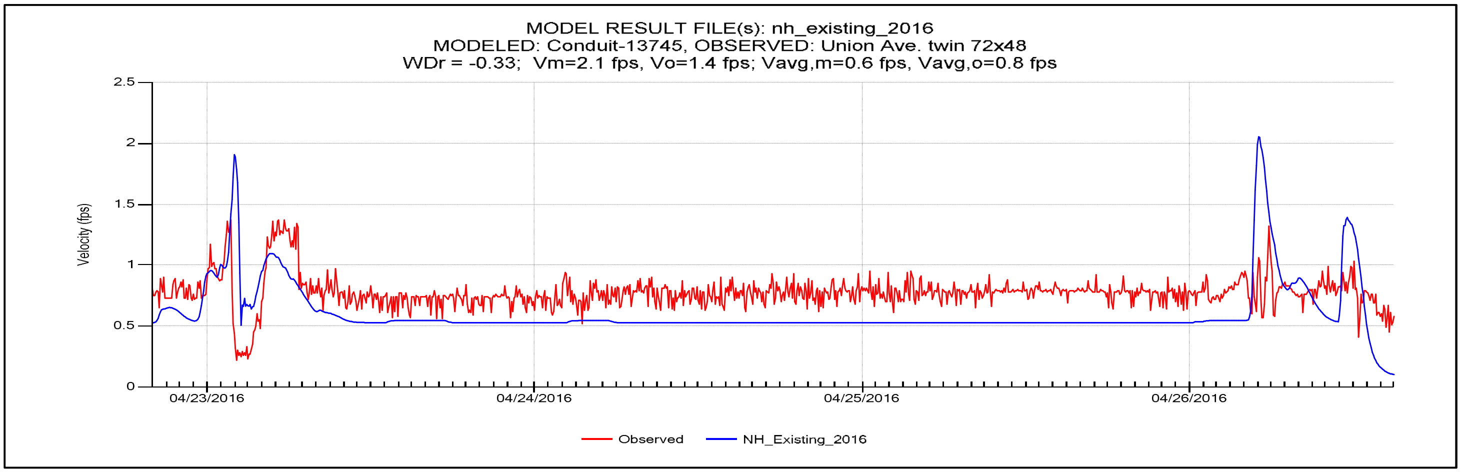




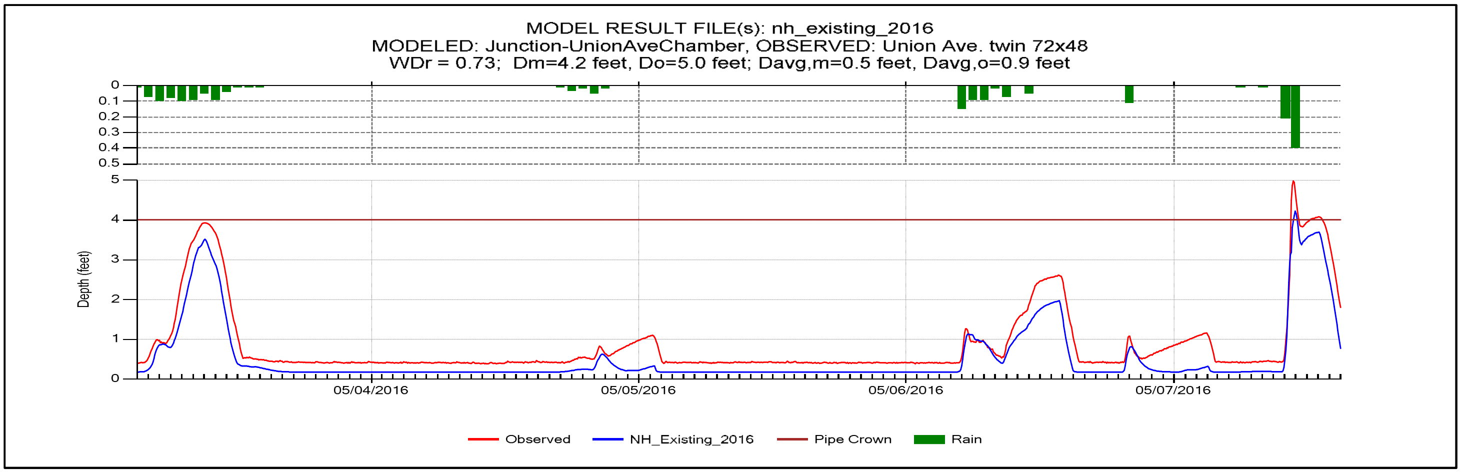
Meter07-Spring2

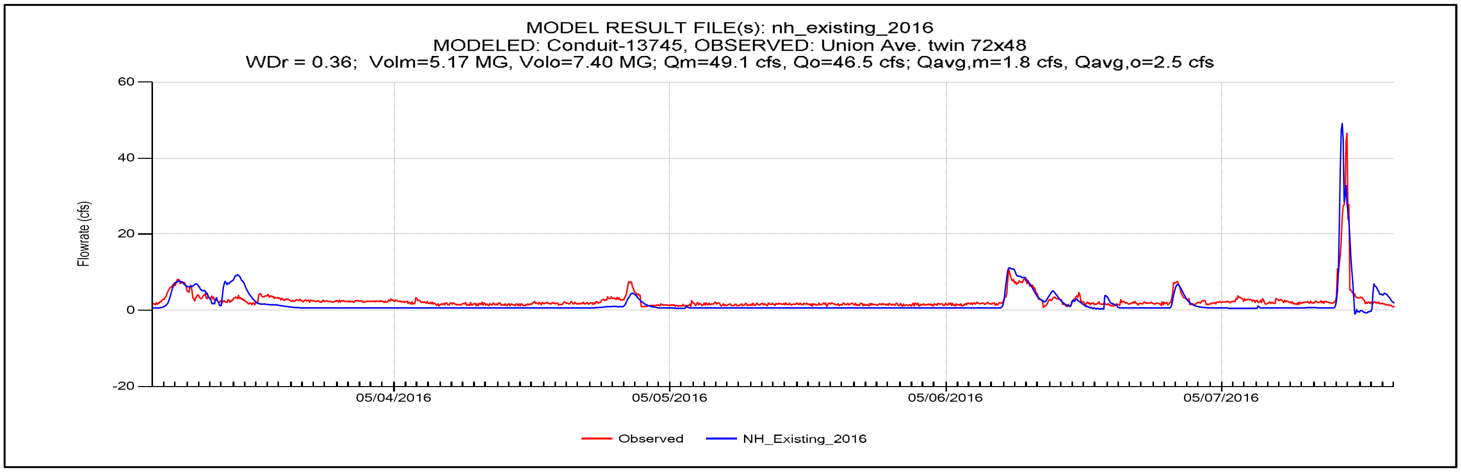


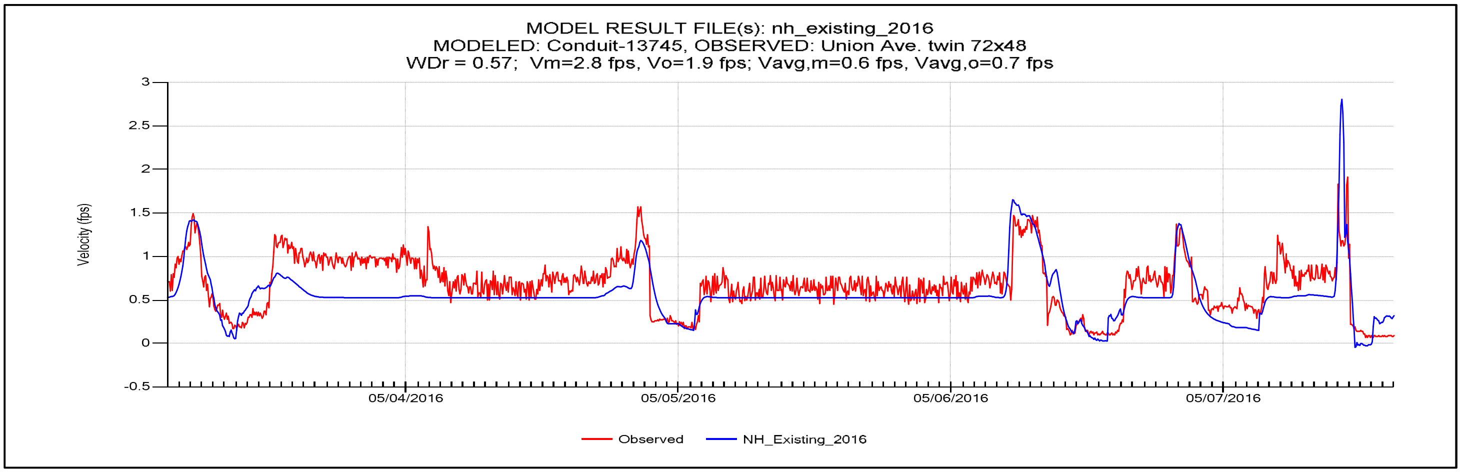




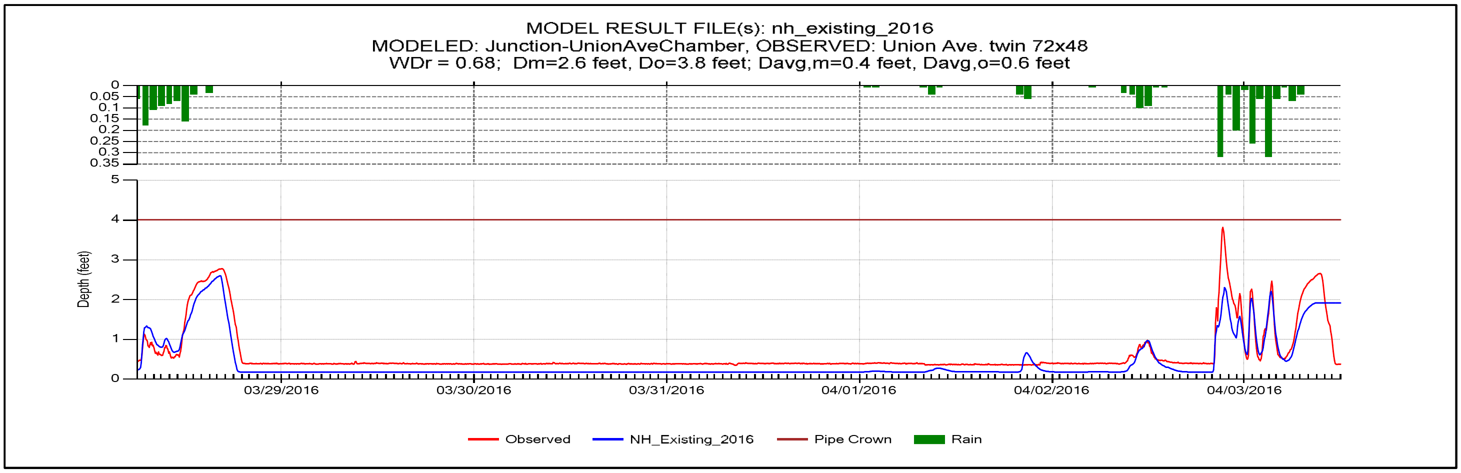
Meter07-Spring3

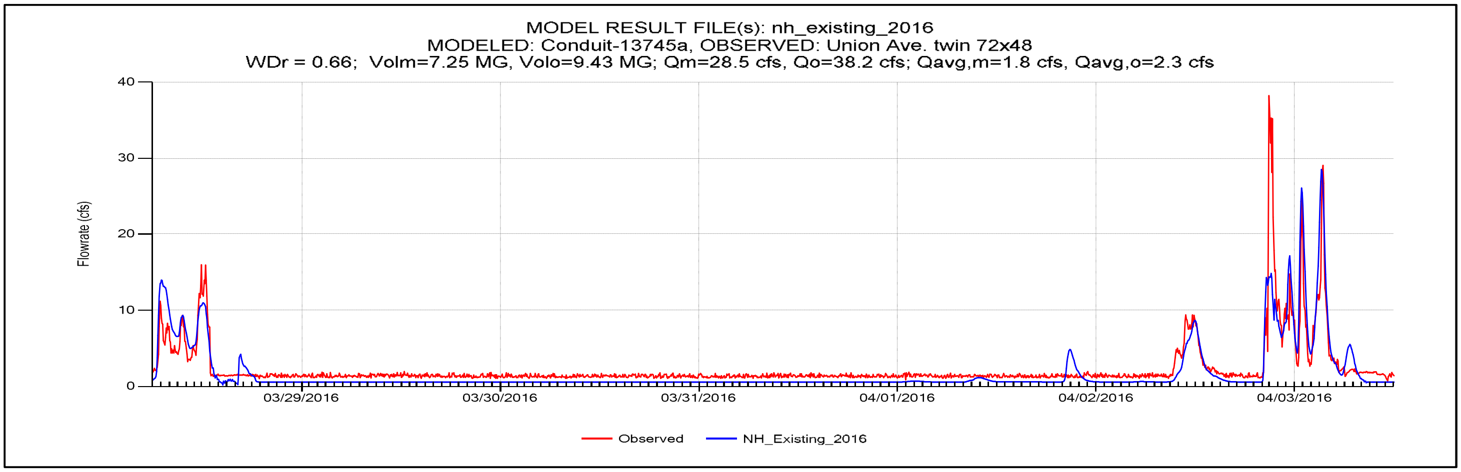


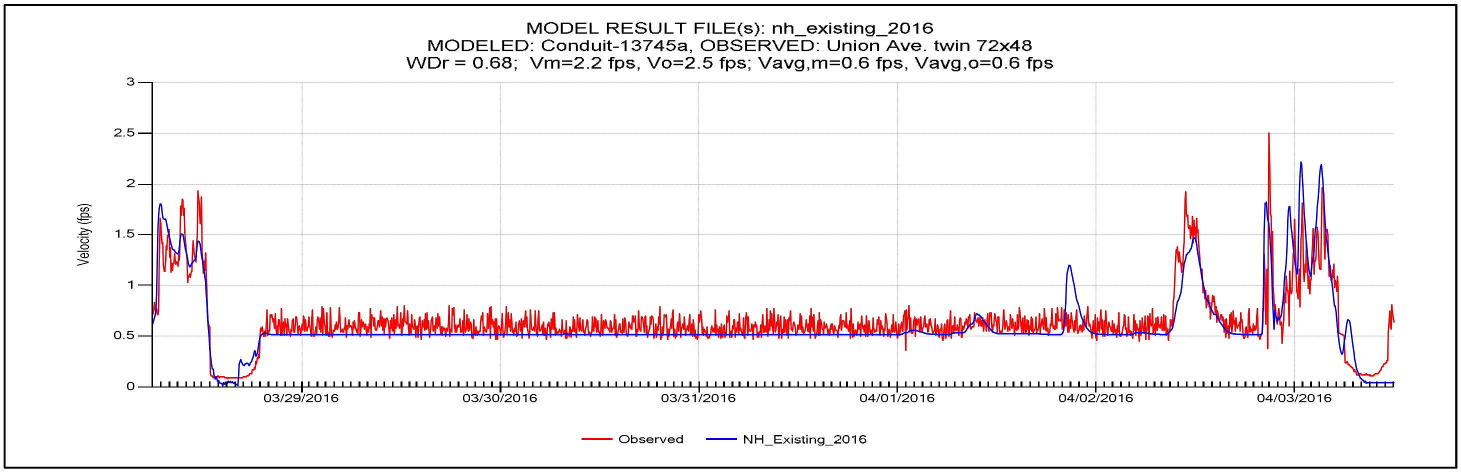




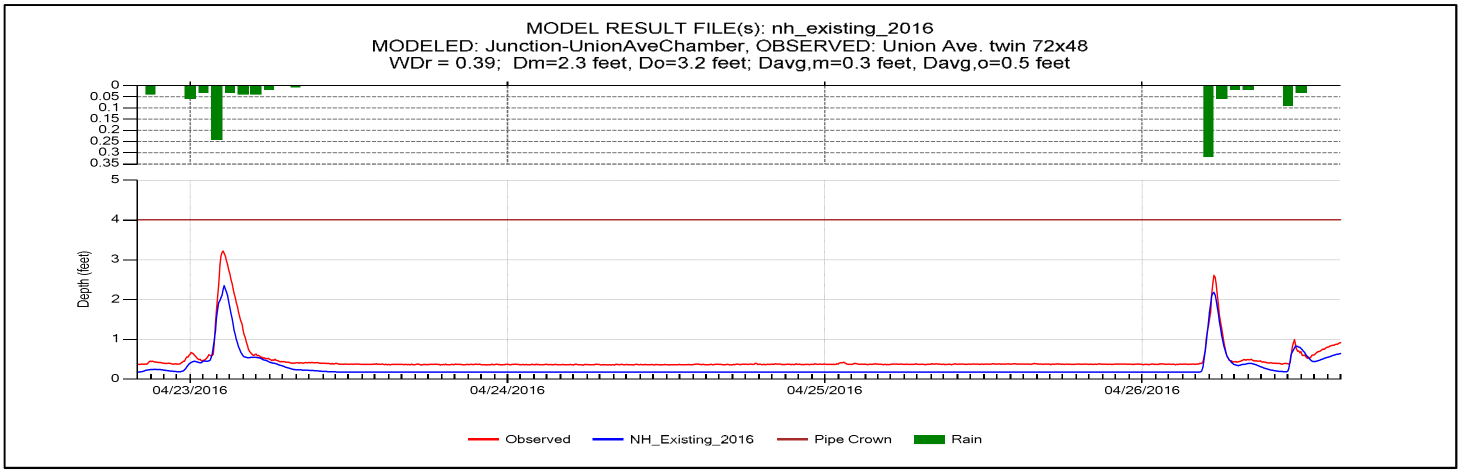
Meter07A-Spring1

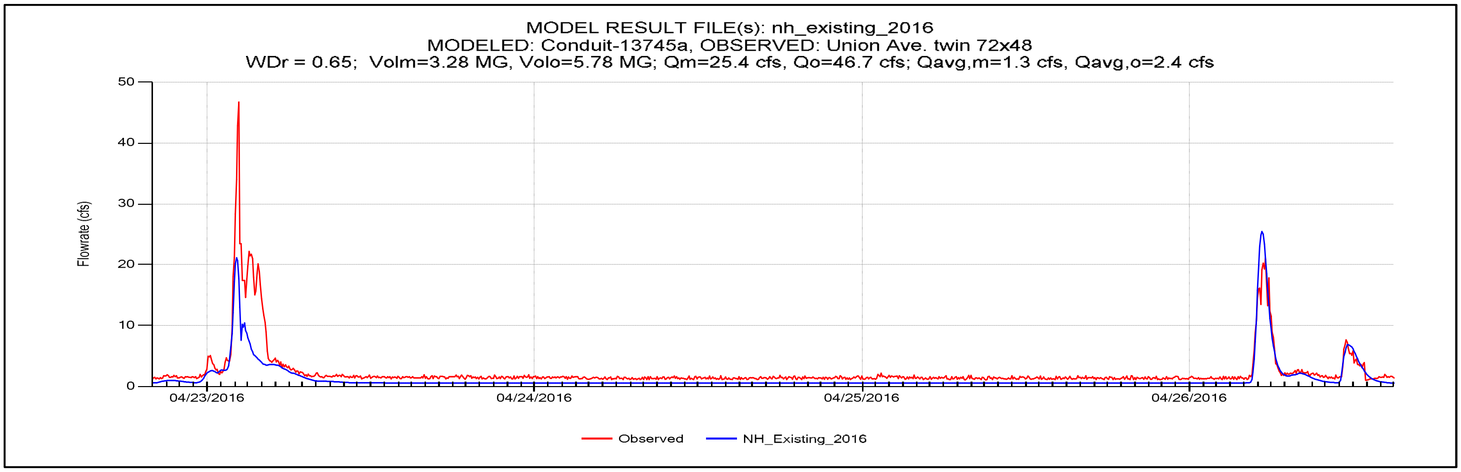


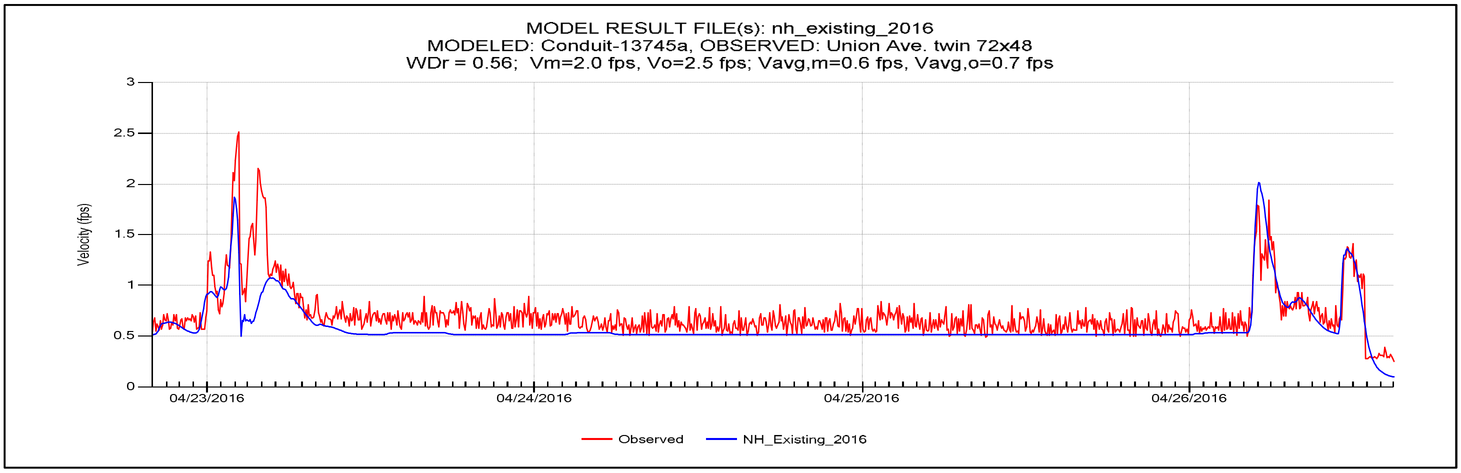




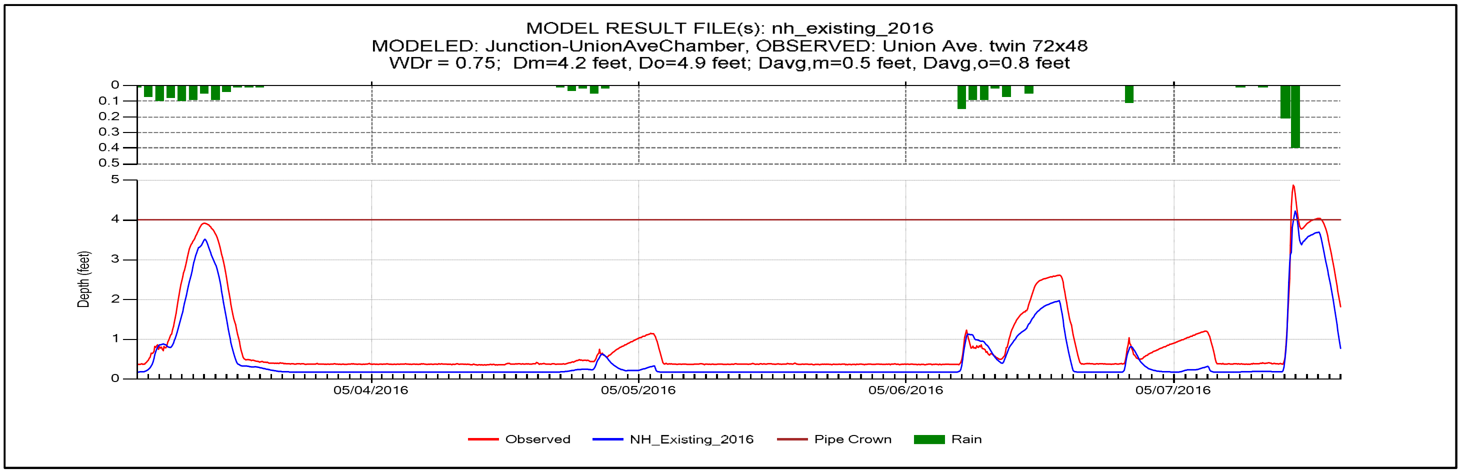
Meter07A-Spring2

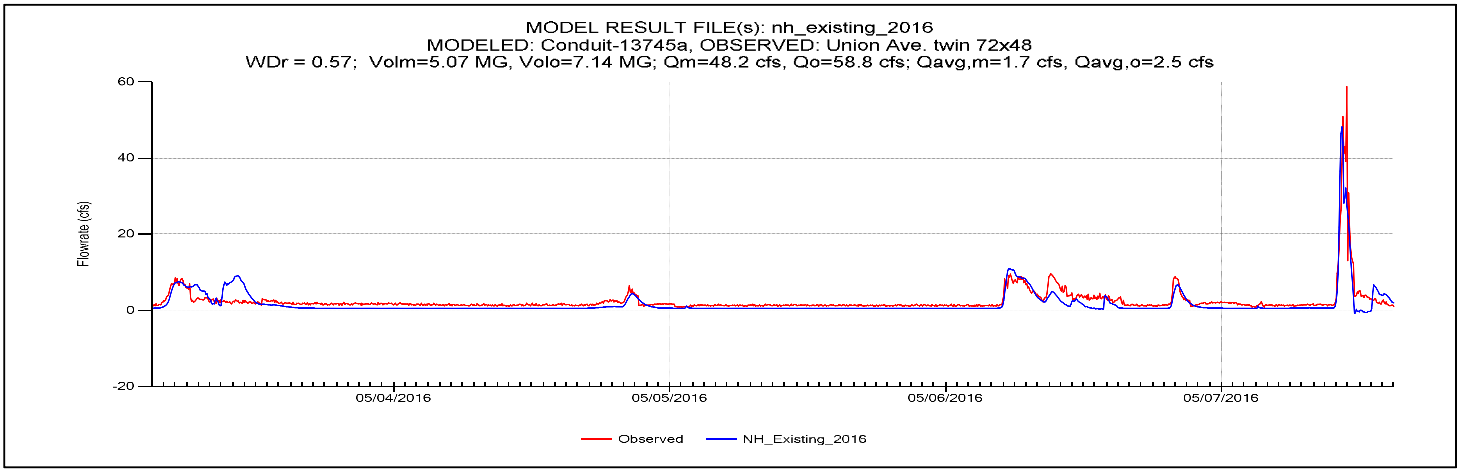


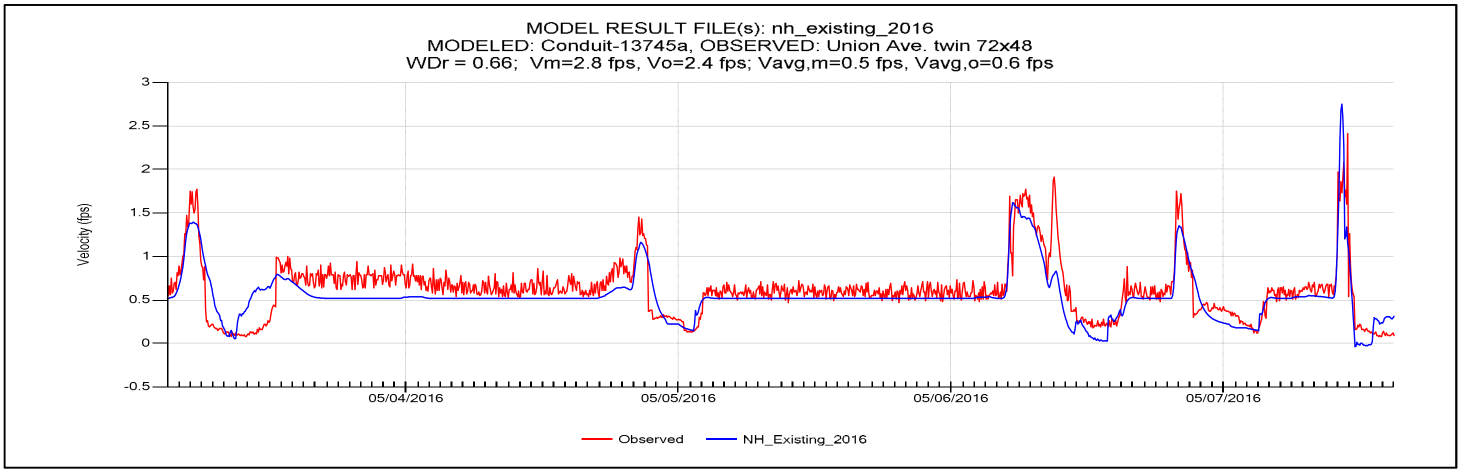




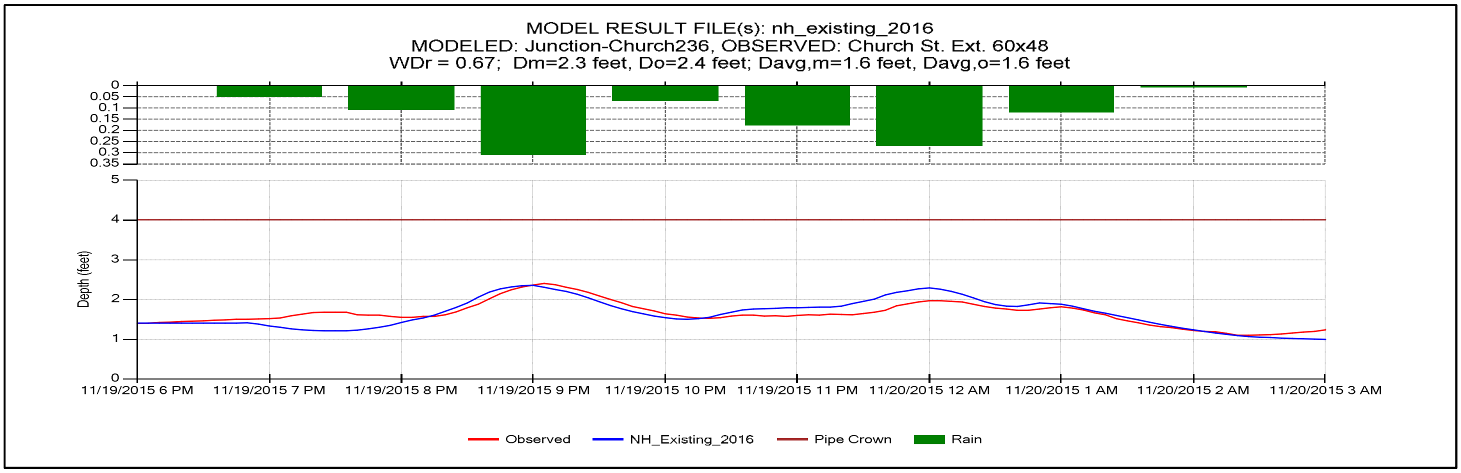
Meter07A-Spring3

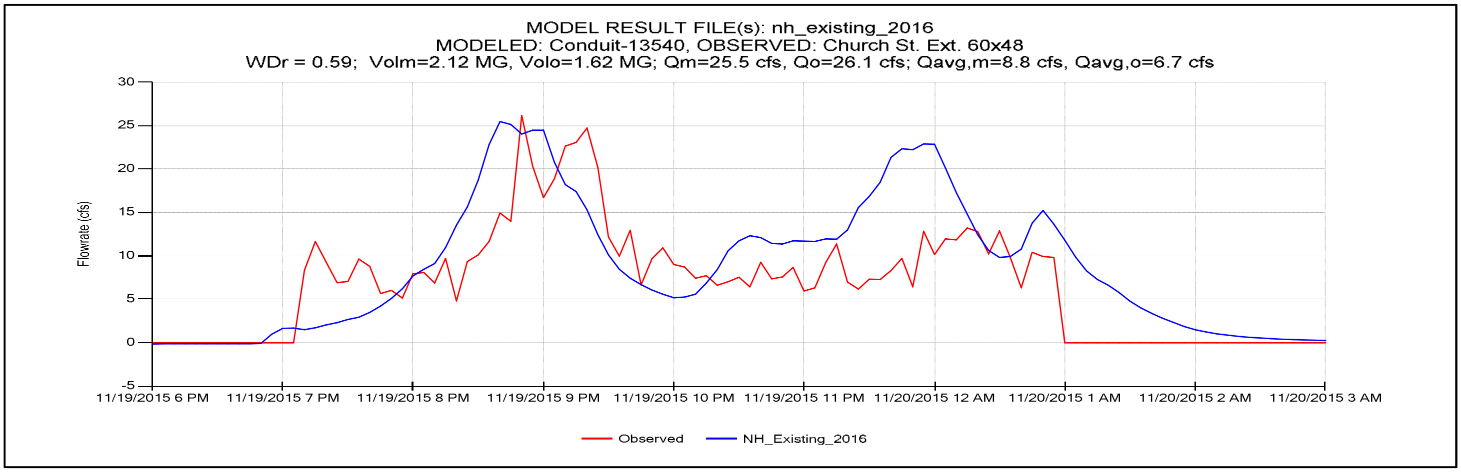


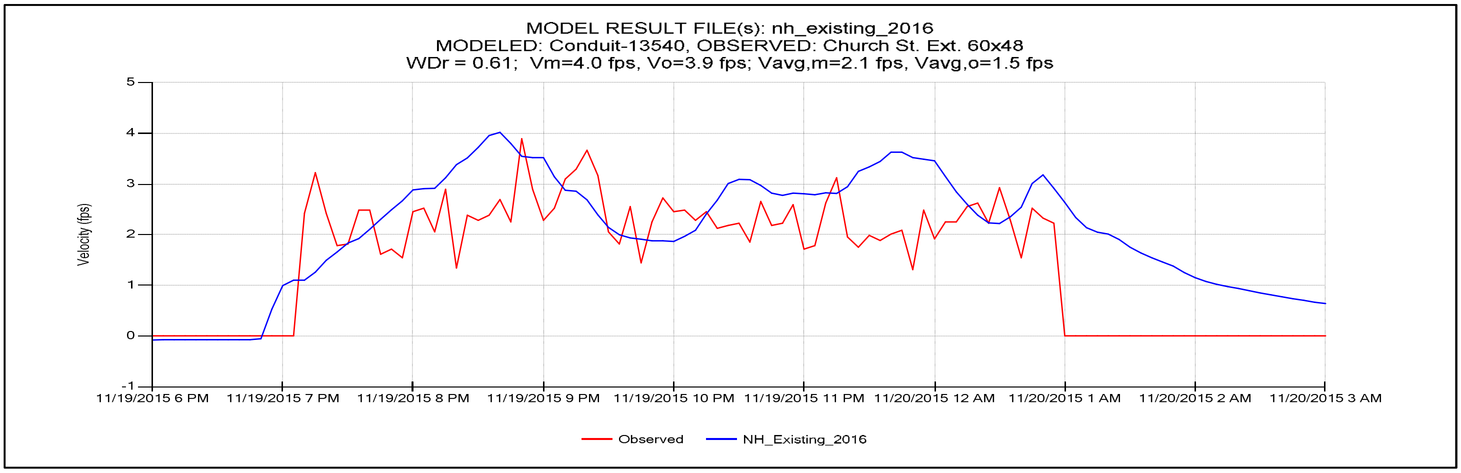




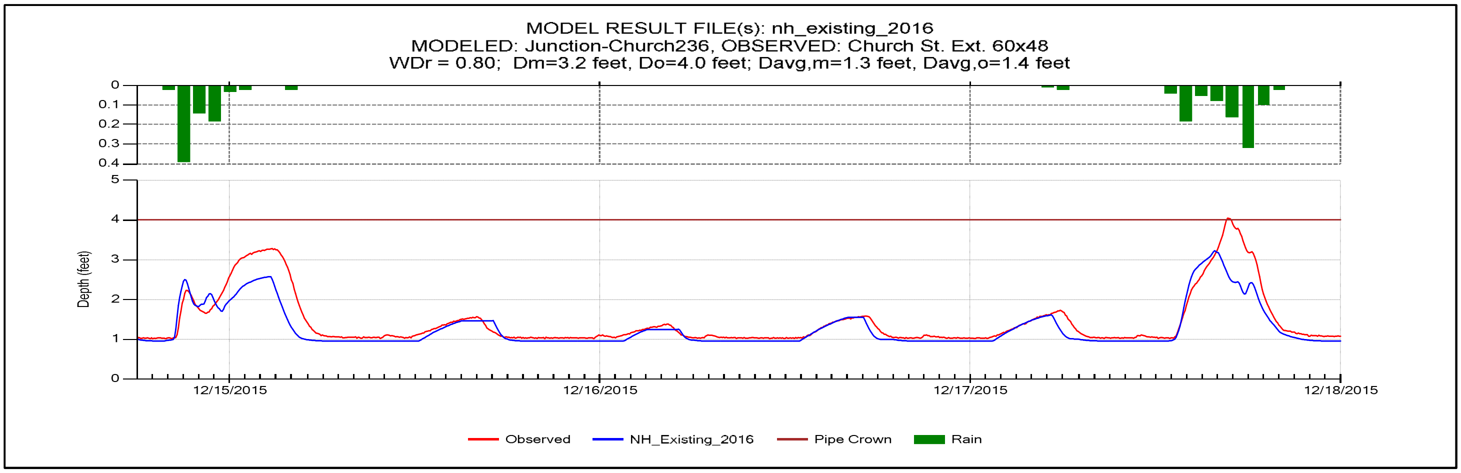
Meter09-Fall1

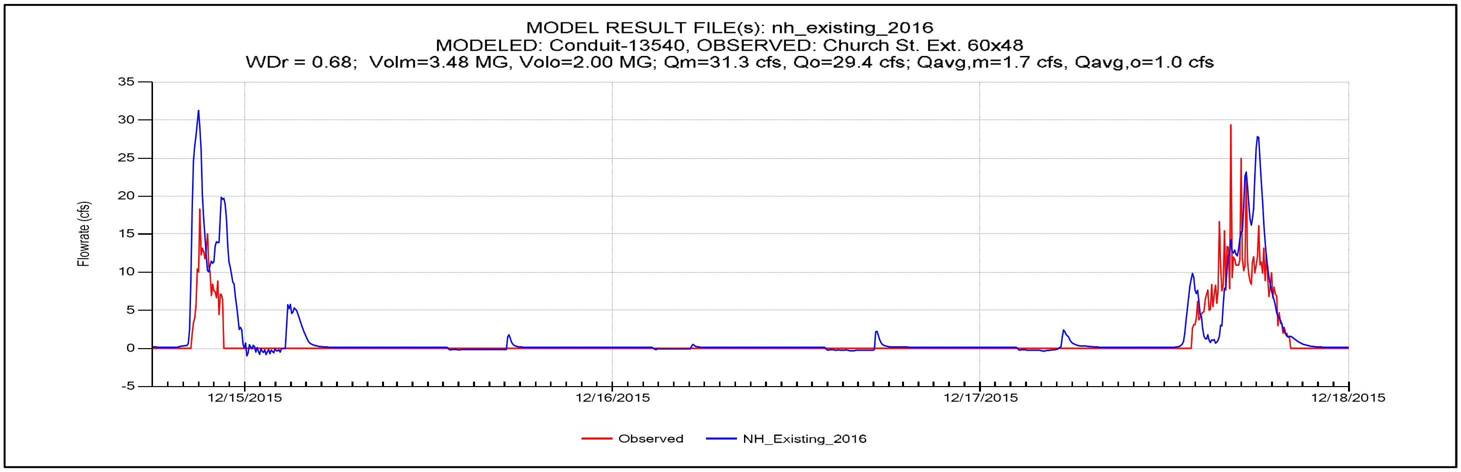


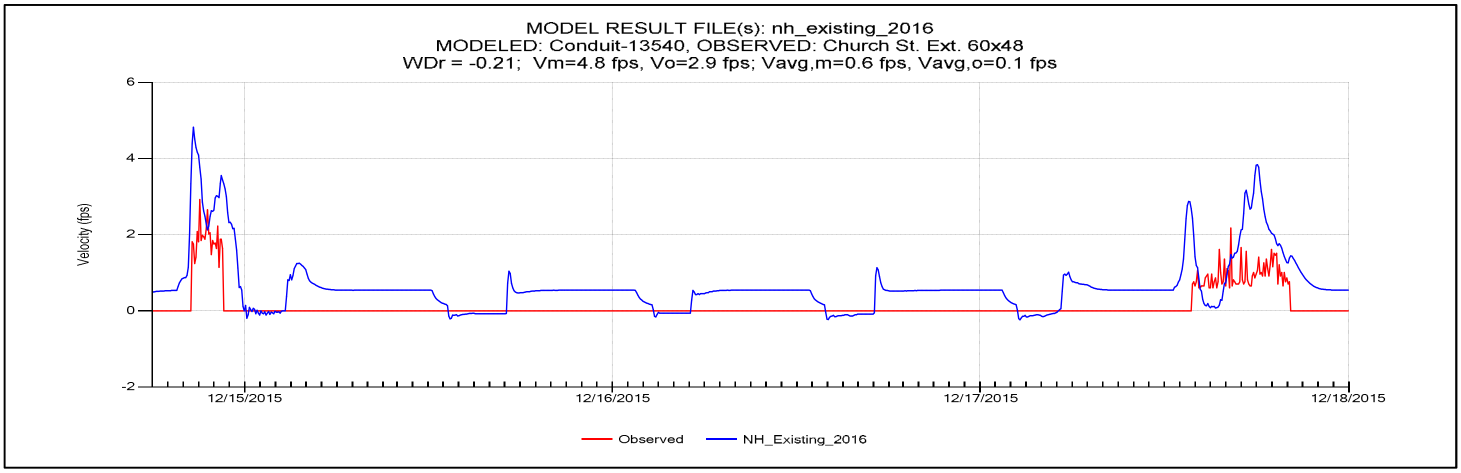




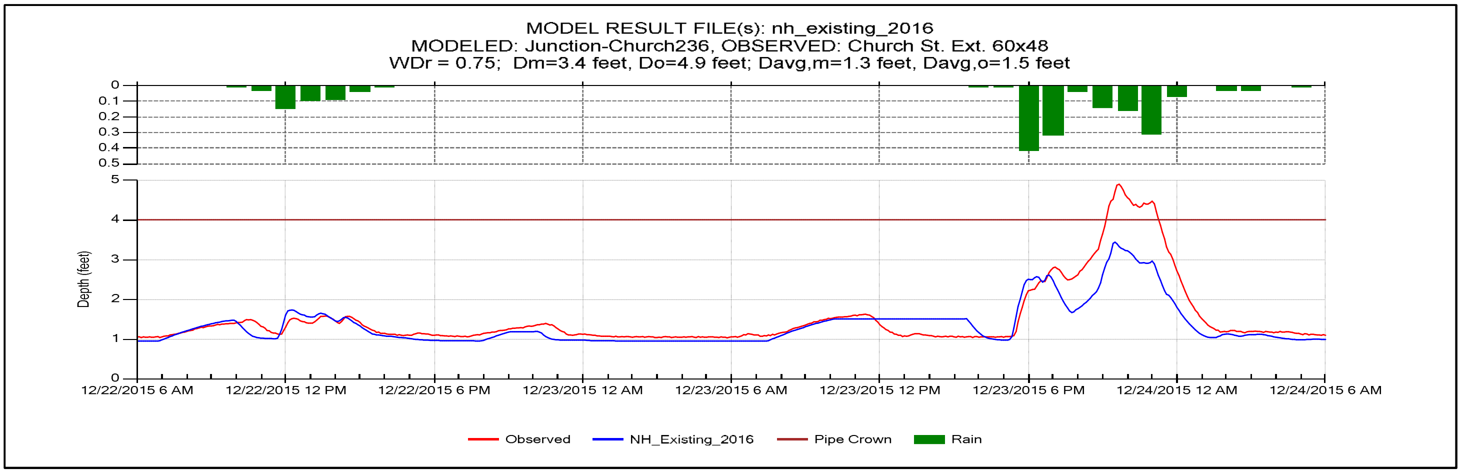
Meter09-Fall2

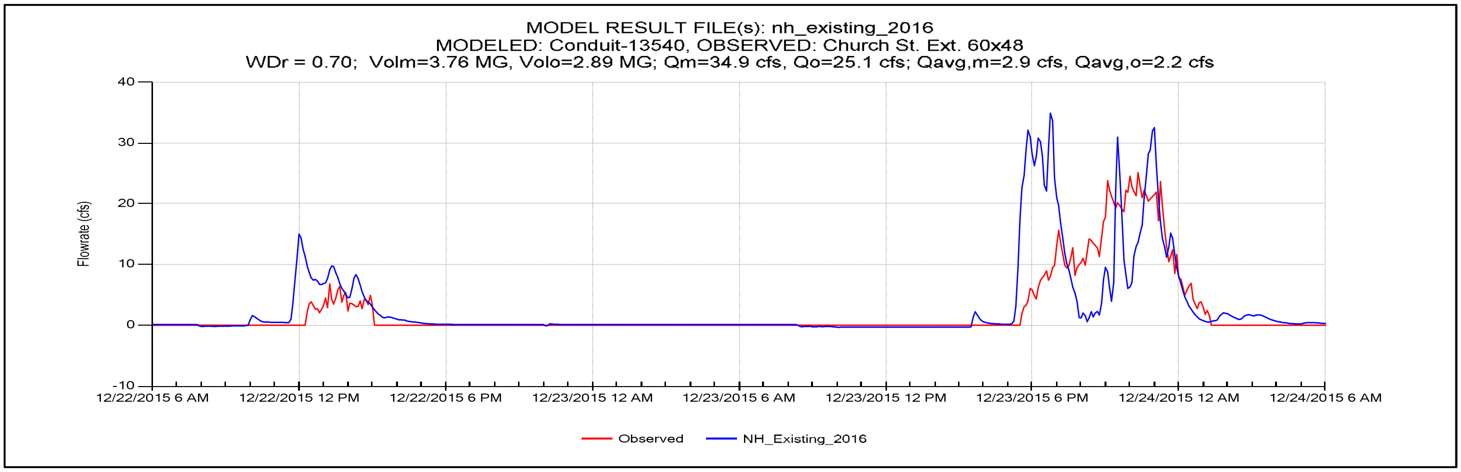


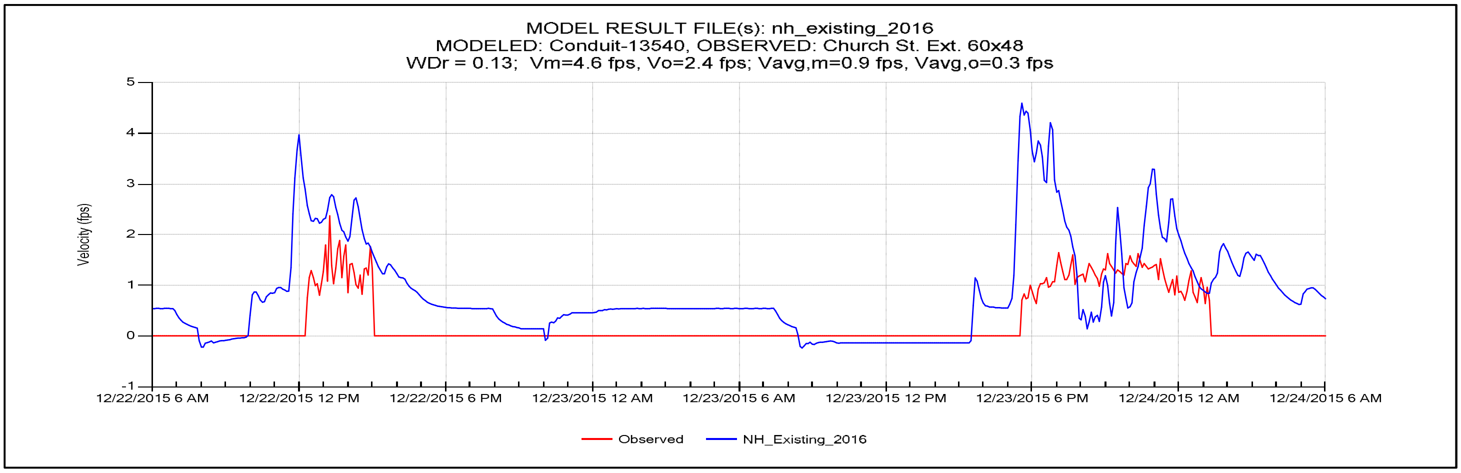




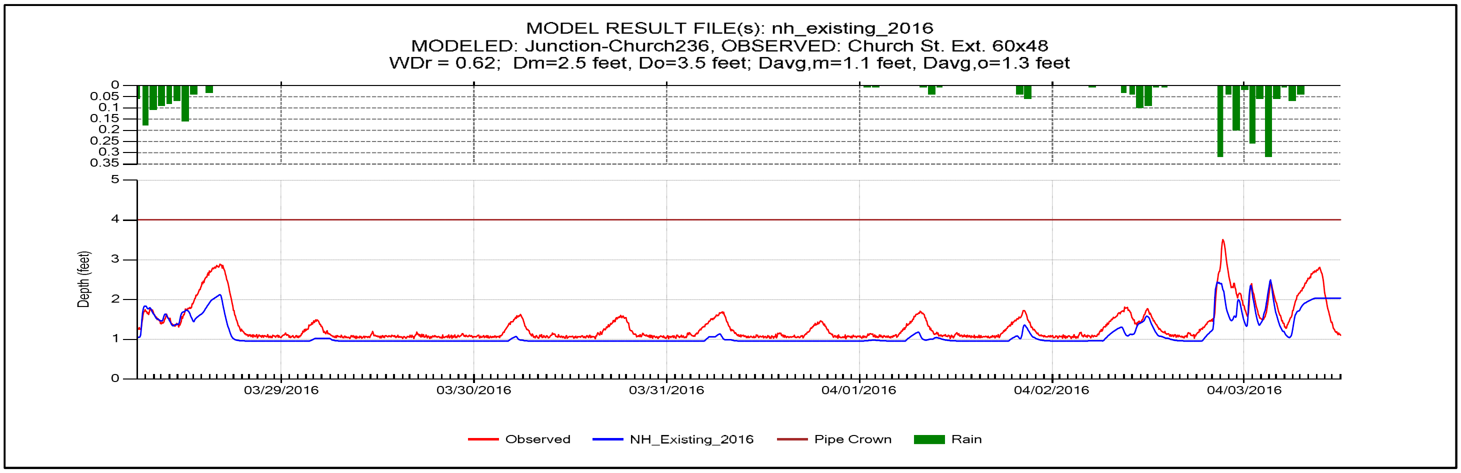
Meter09-Fall3

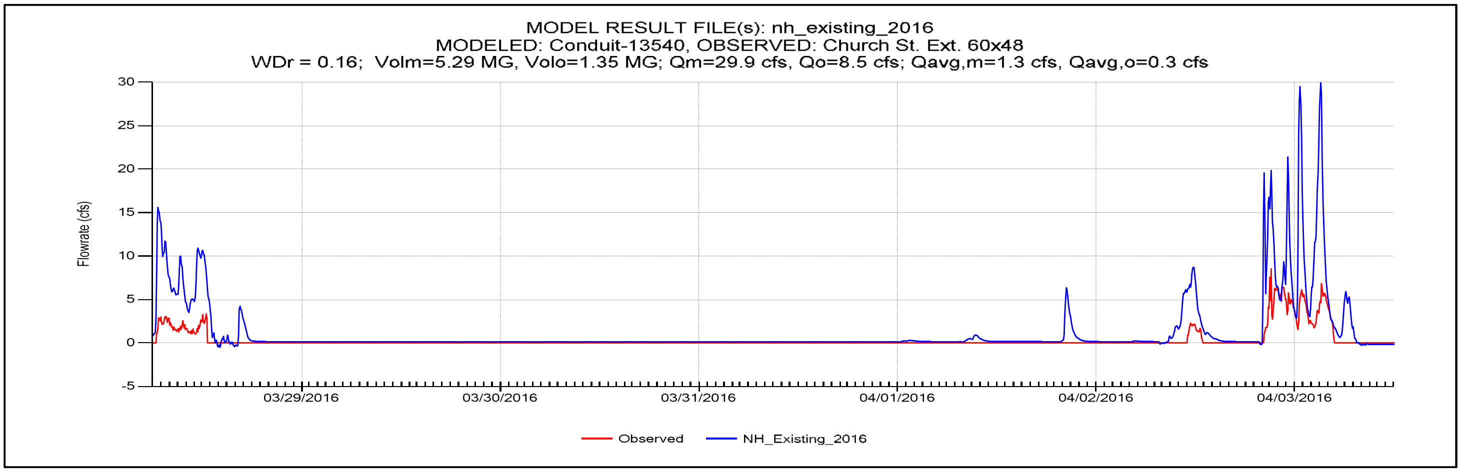


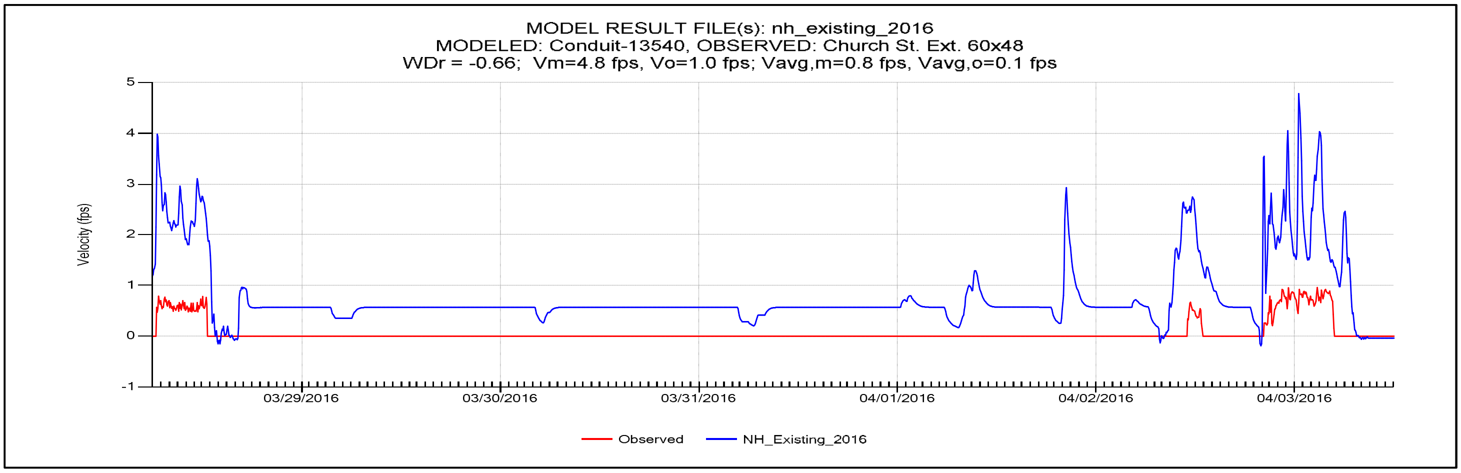




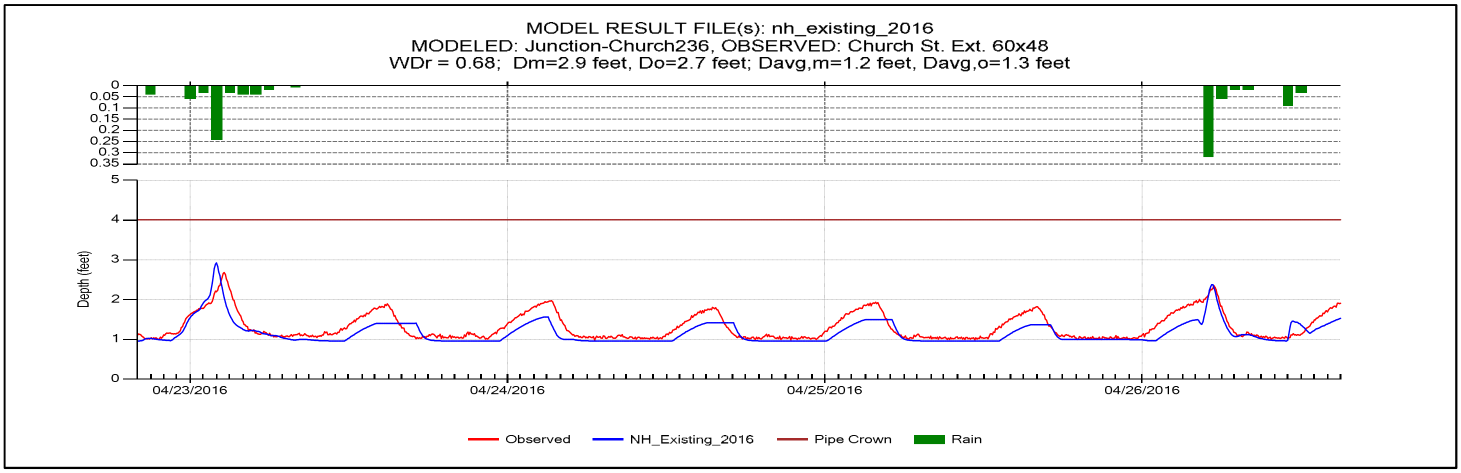
Meter09-Spring1

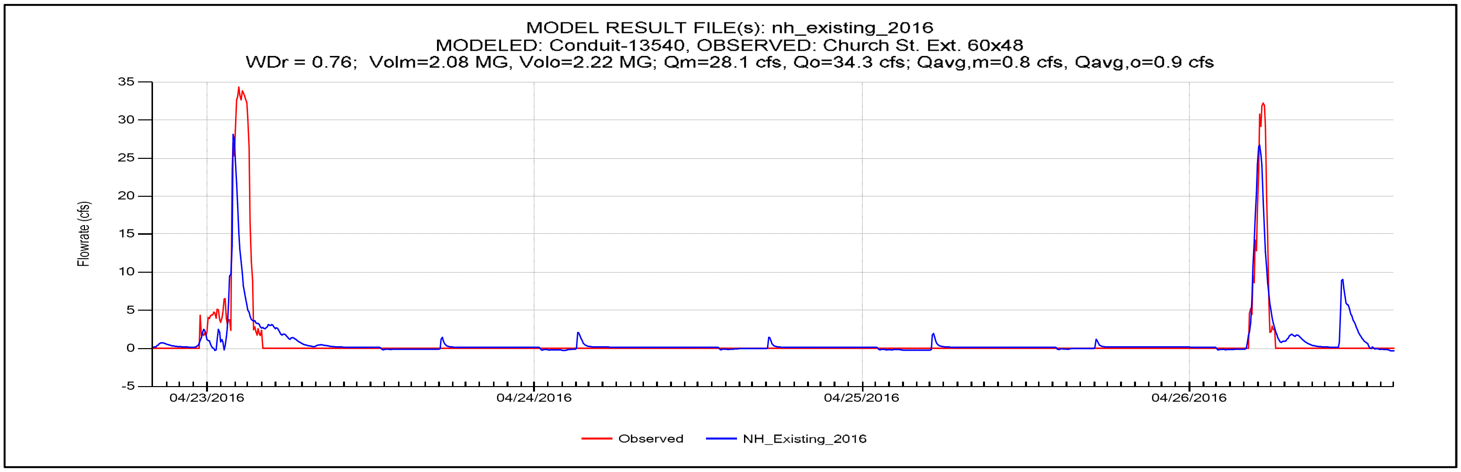


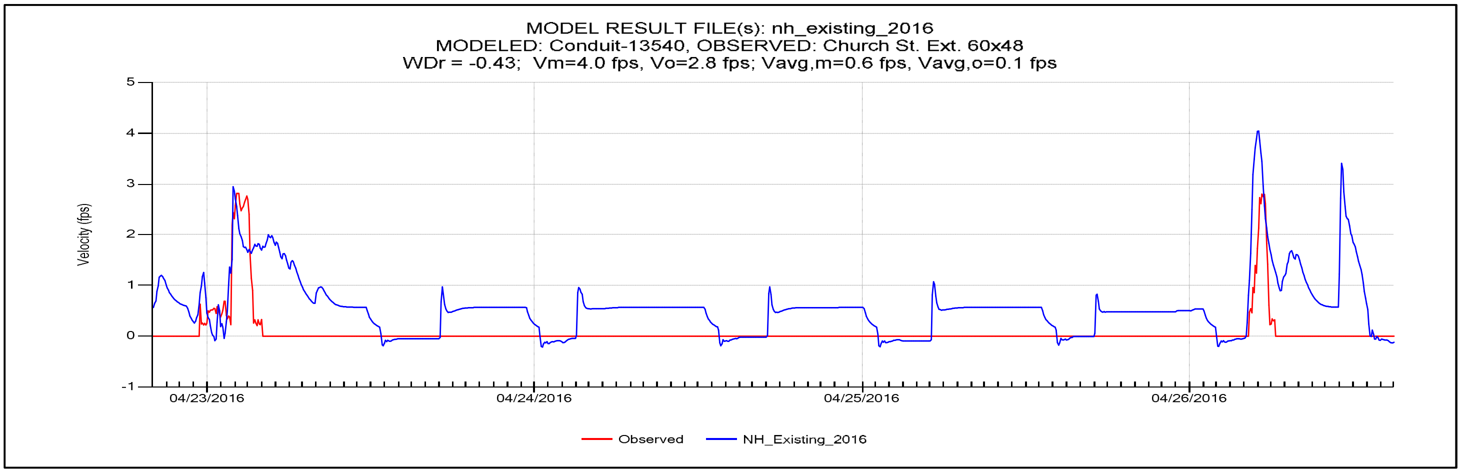




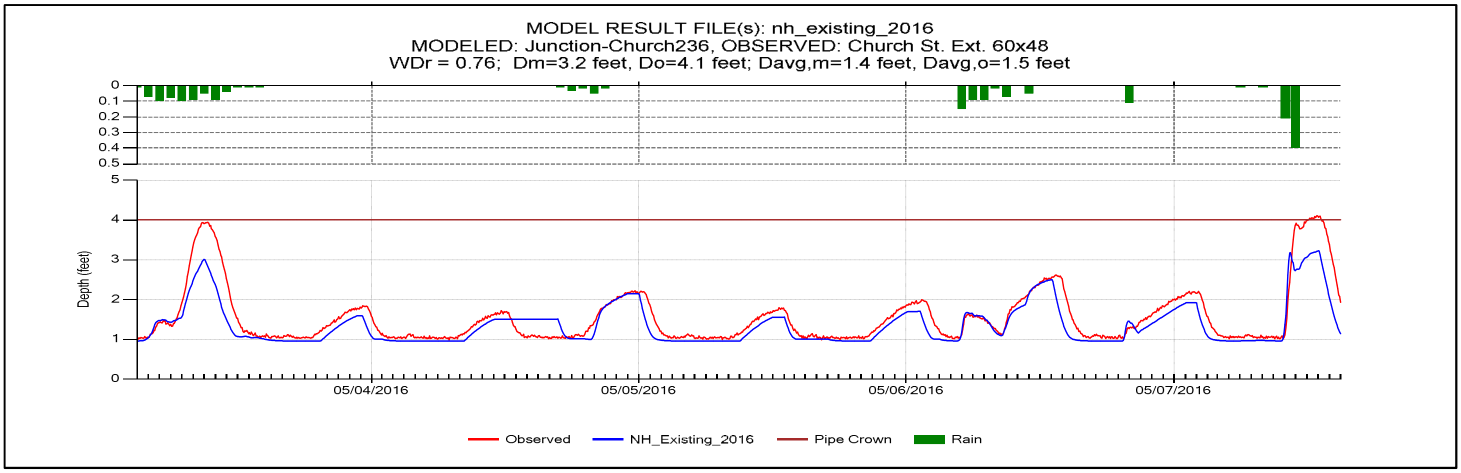
Meter09-Spring2

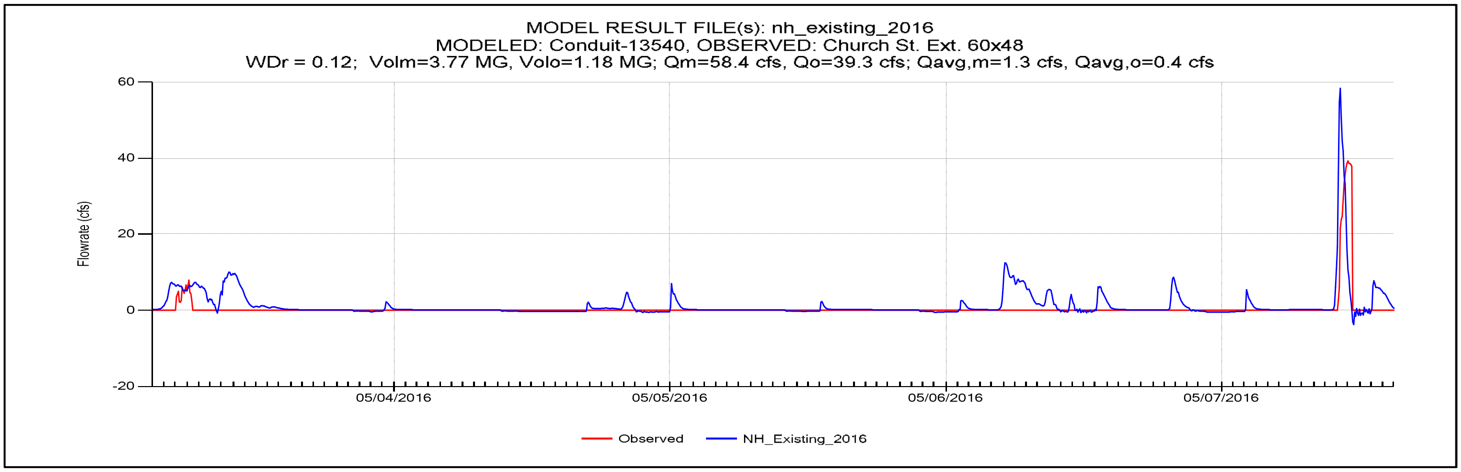


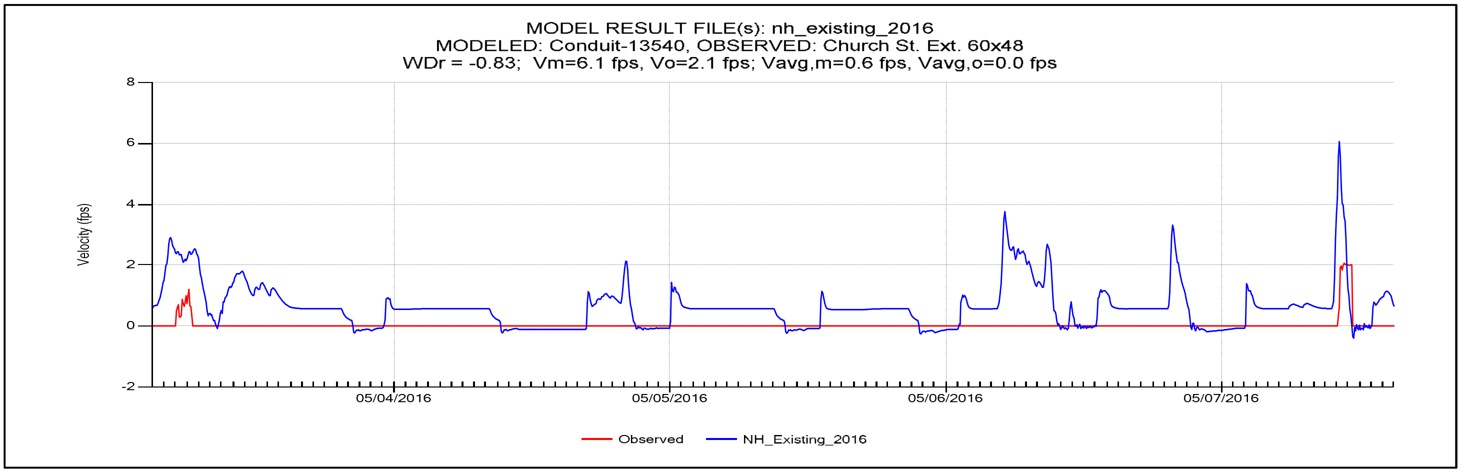




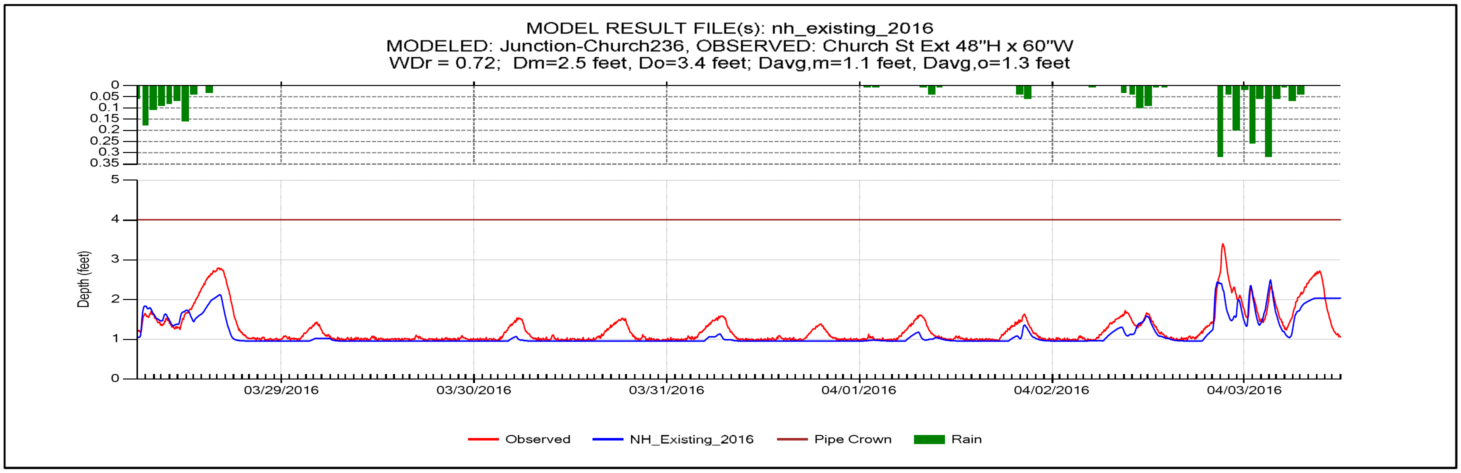
Meter09-Spring3

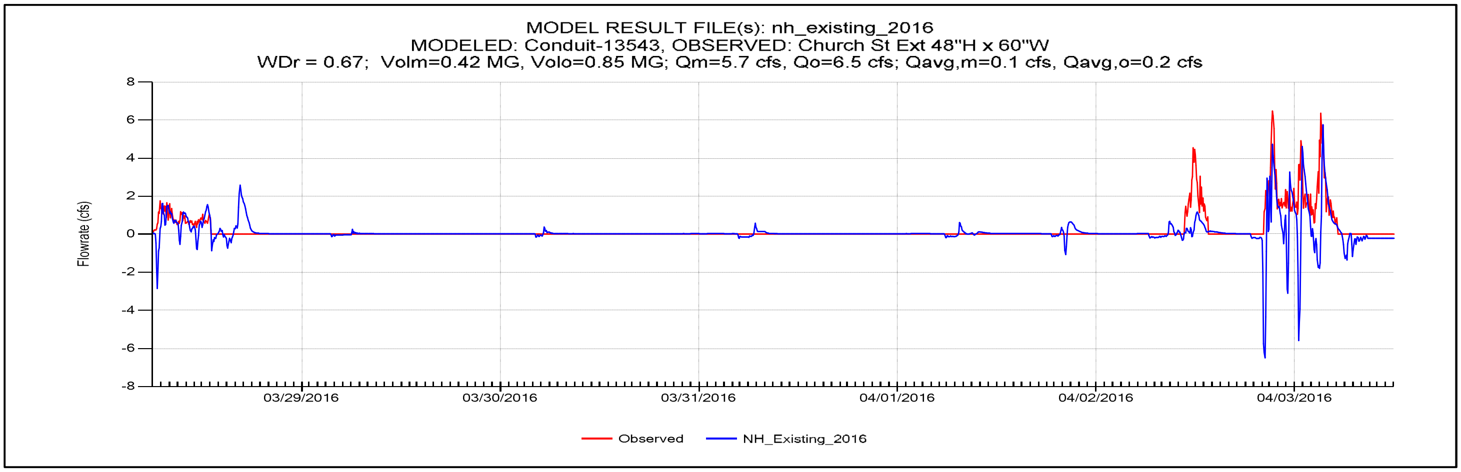


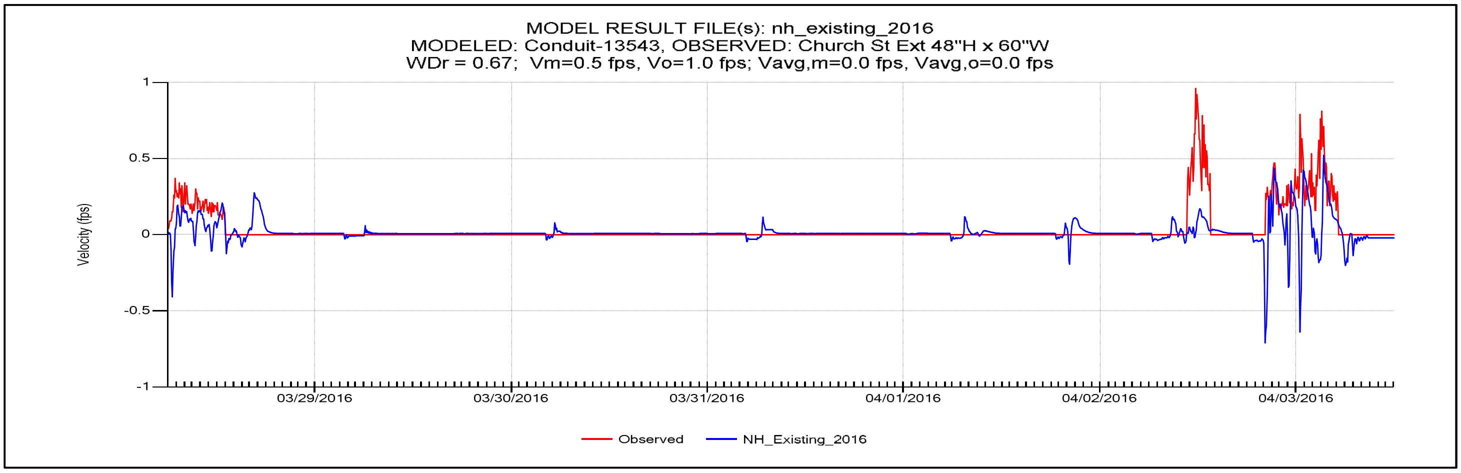




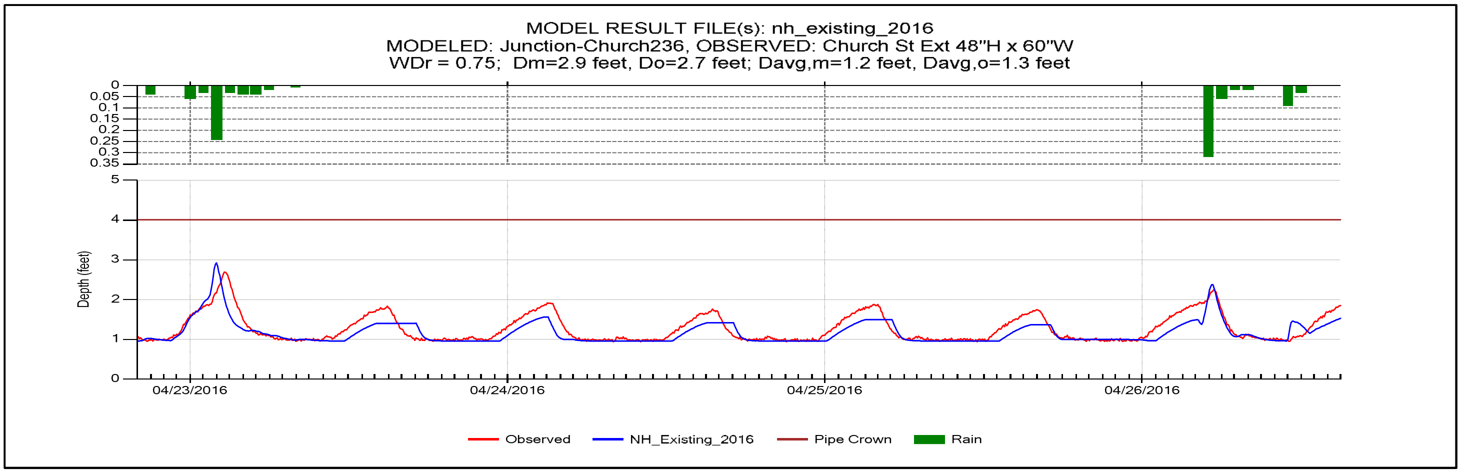
Meter09A-Spring1

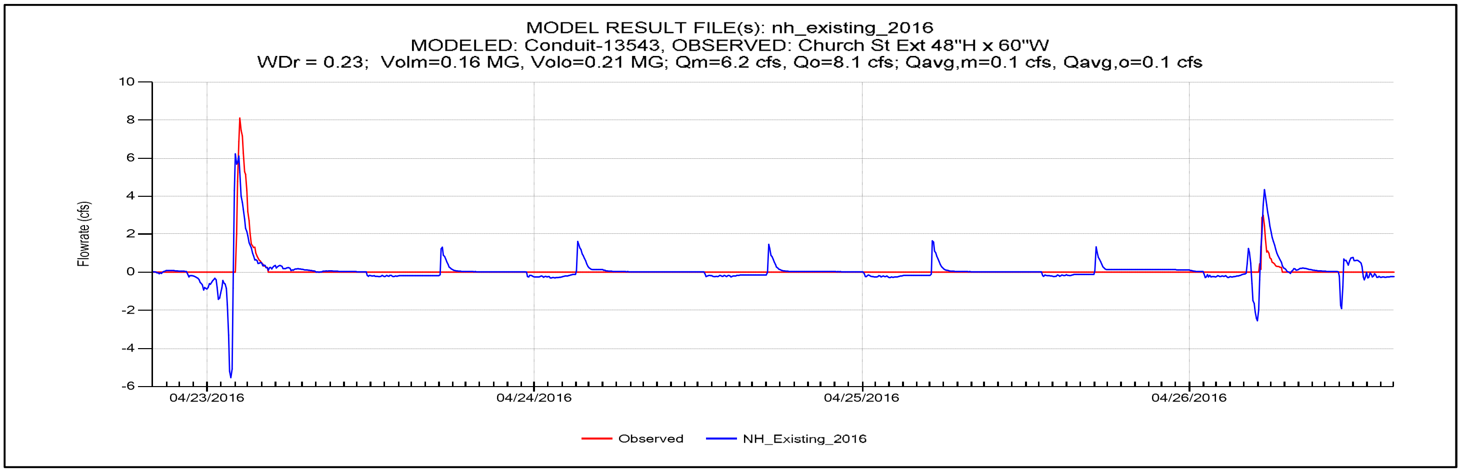


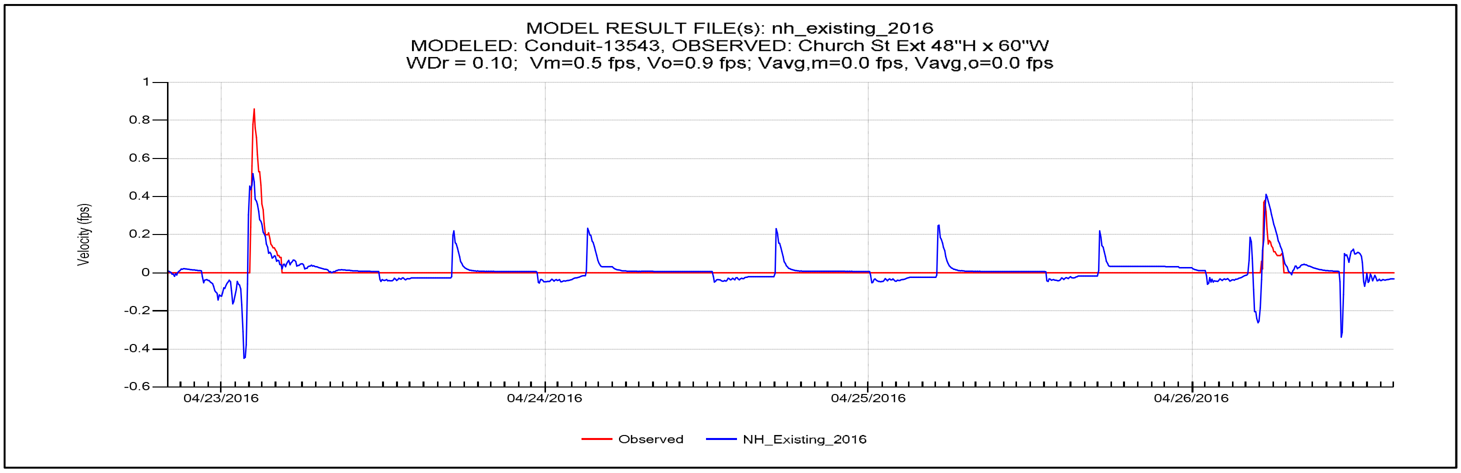




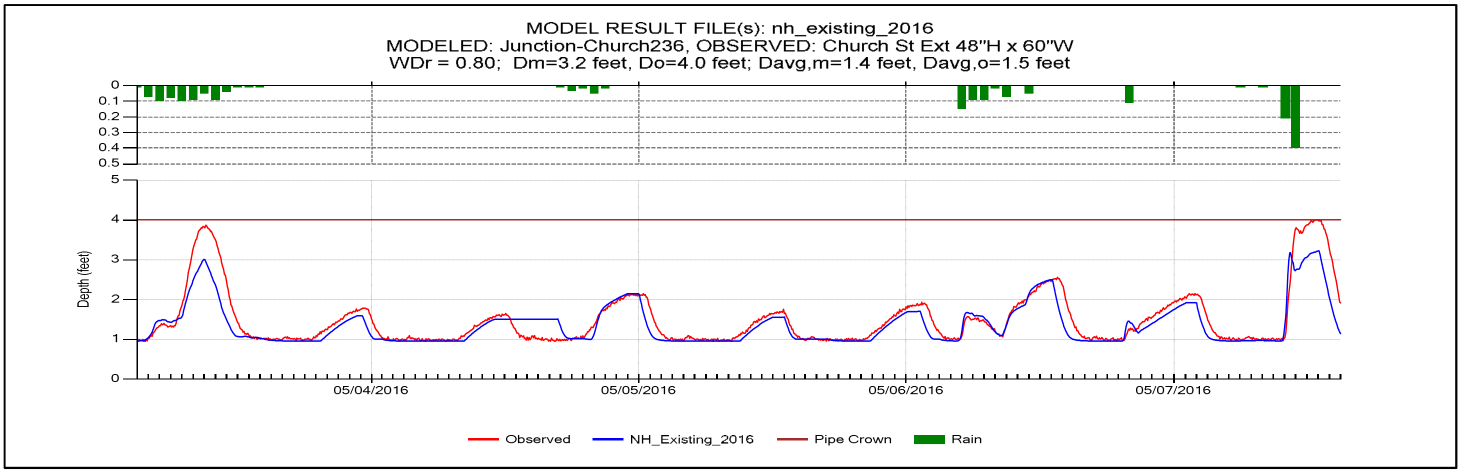
Meter09A-Spring2

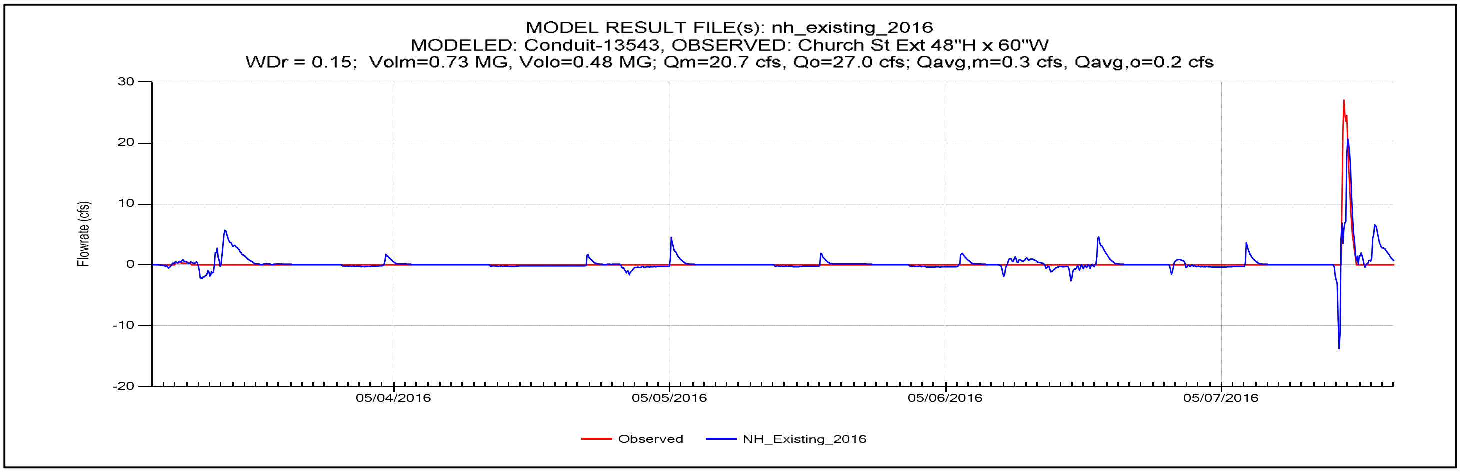


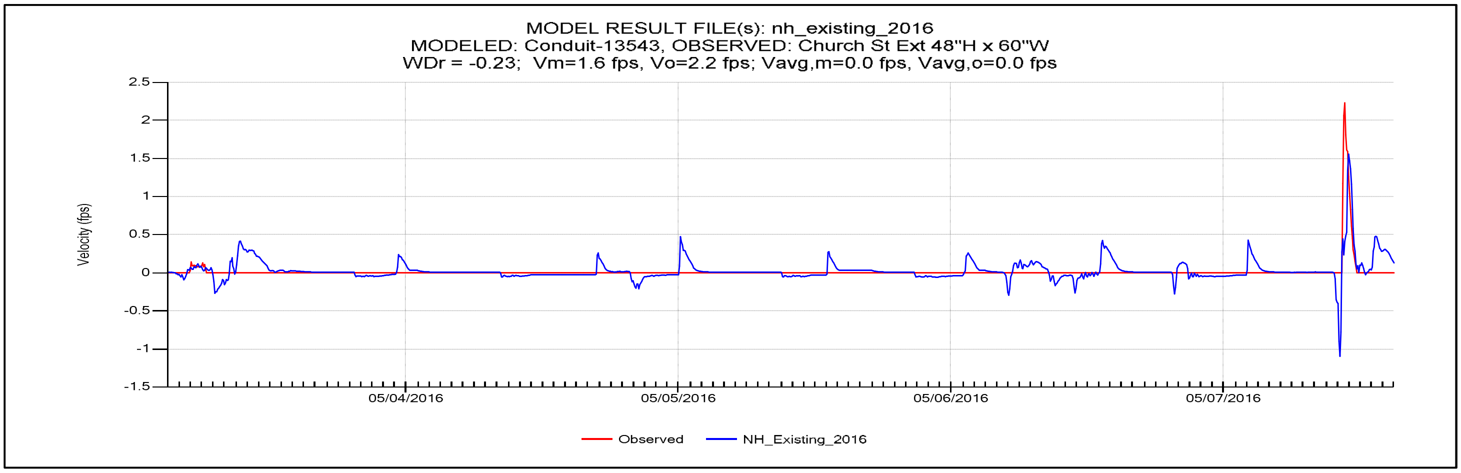




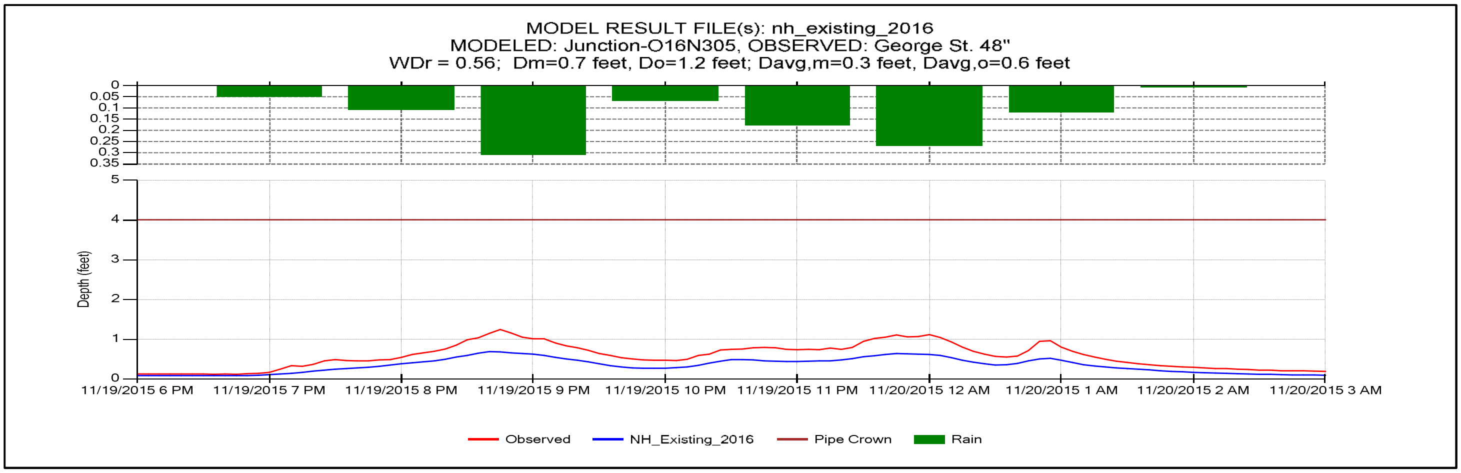
Meter09A-Spring3

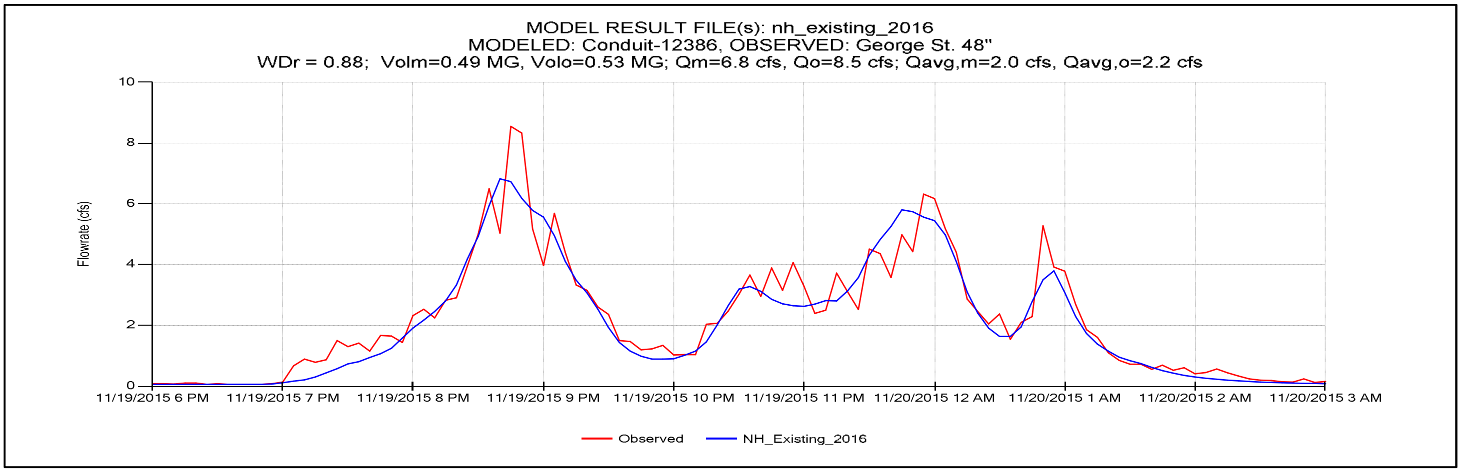


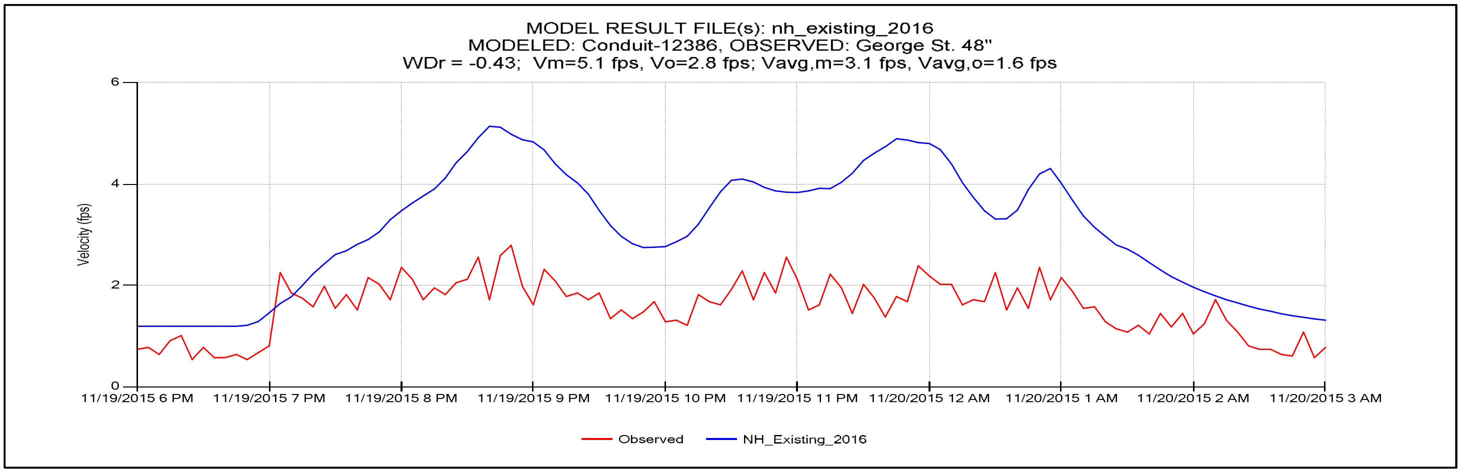




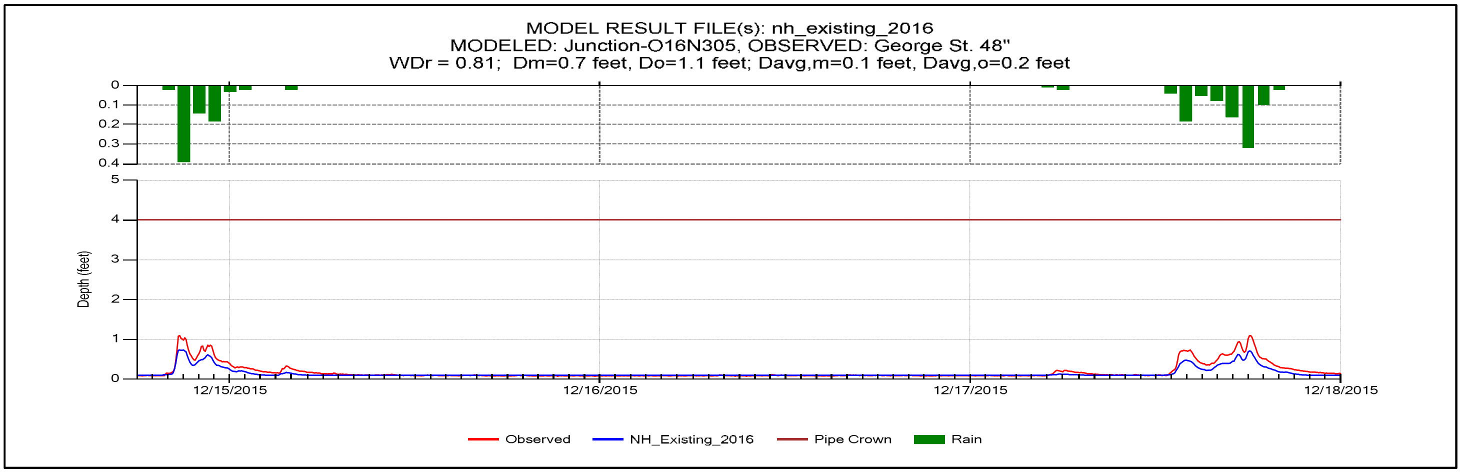
Meter10-Fall1

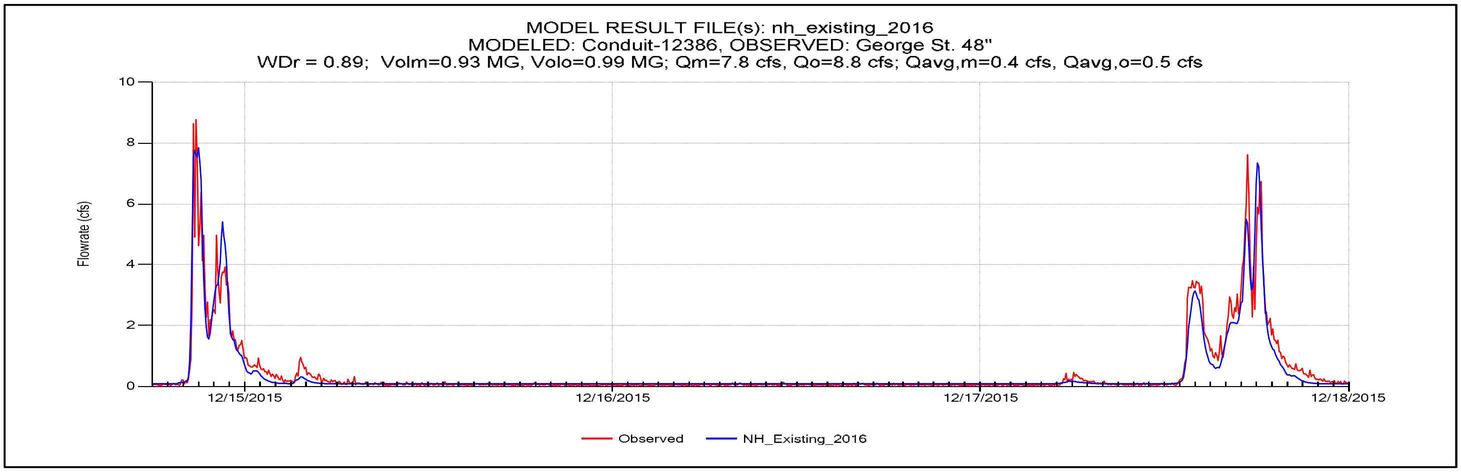


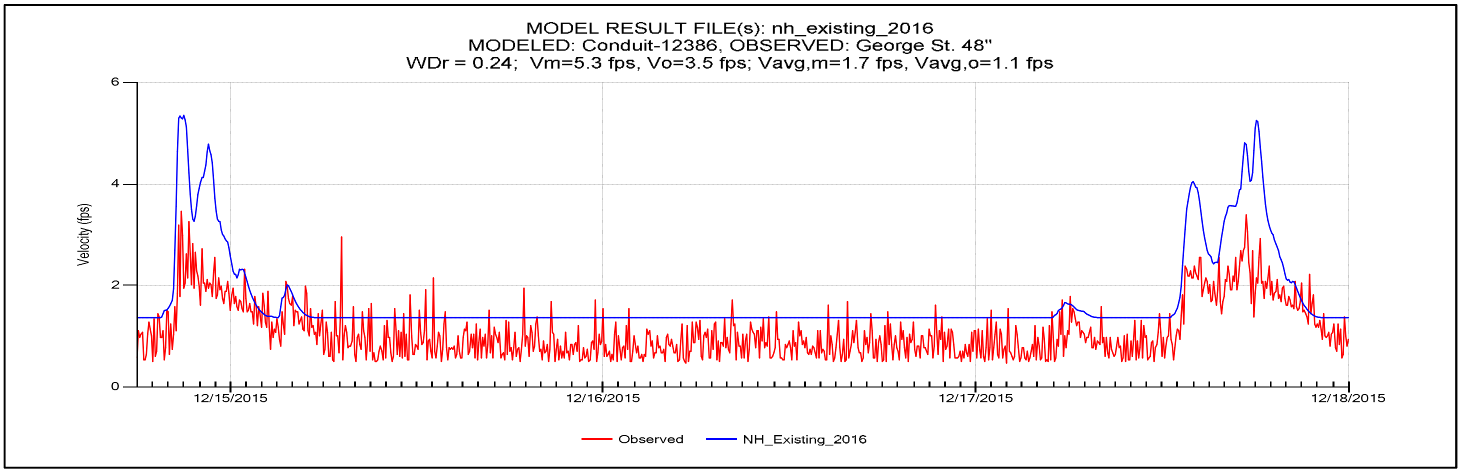




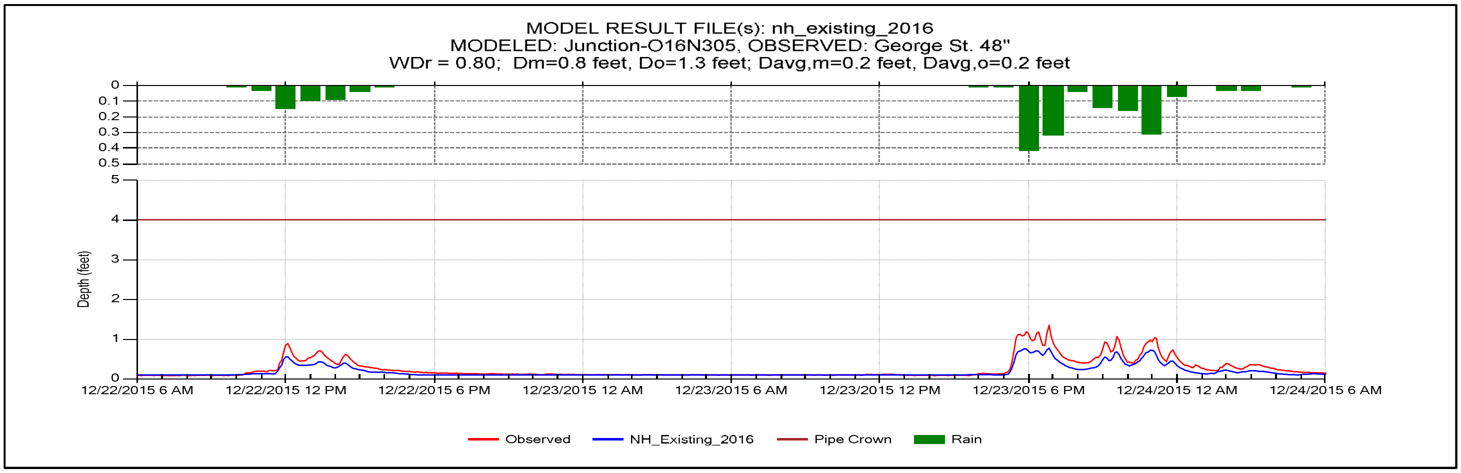
Meter10-Fall2

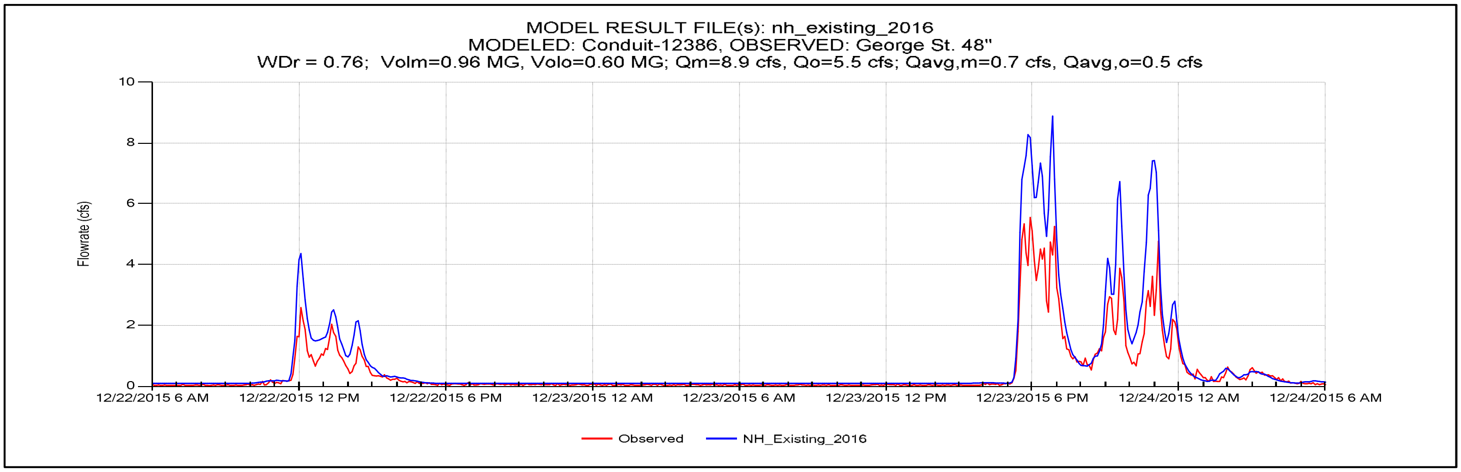


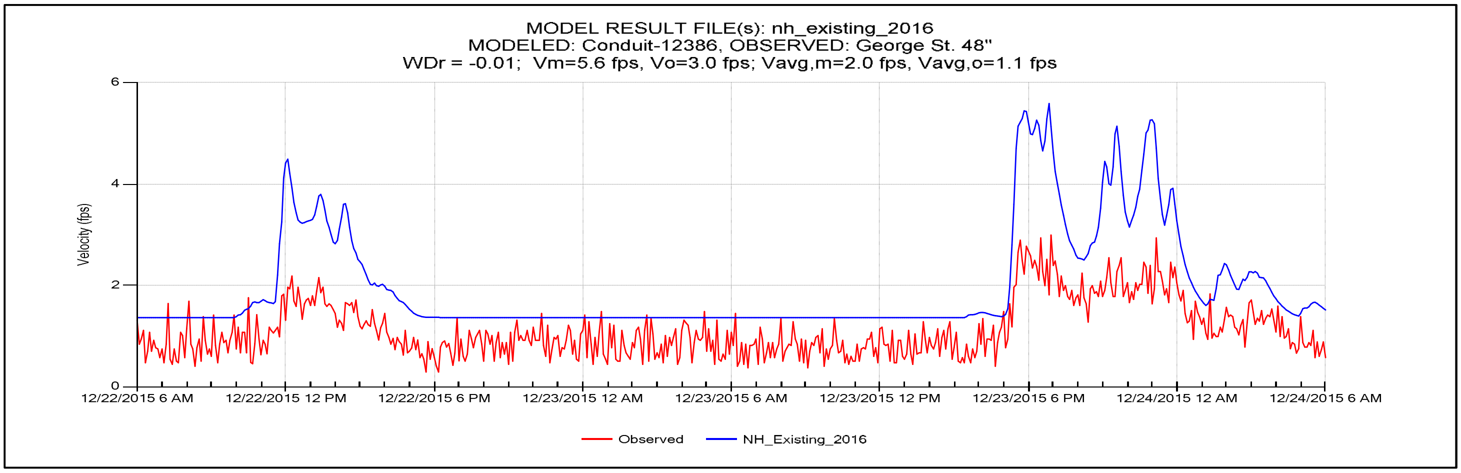




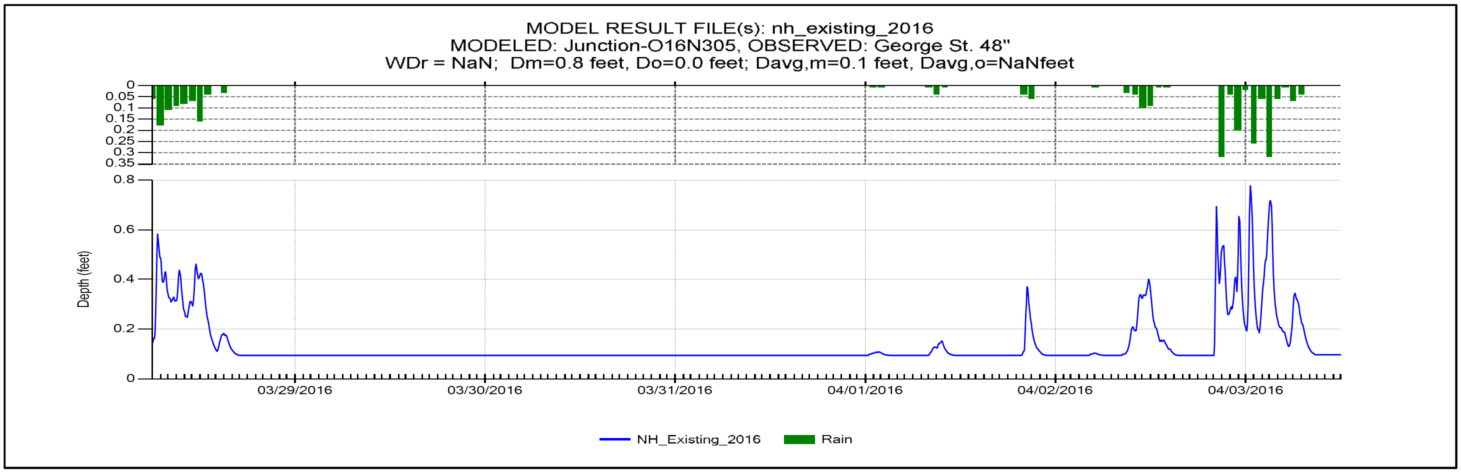
Meter10-Fall3

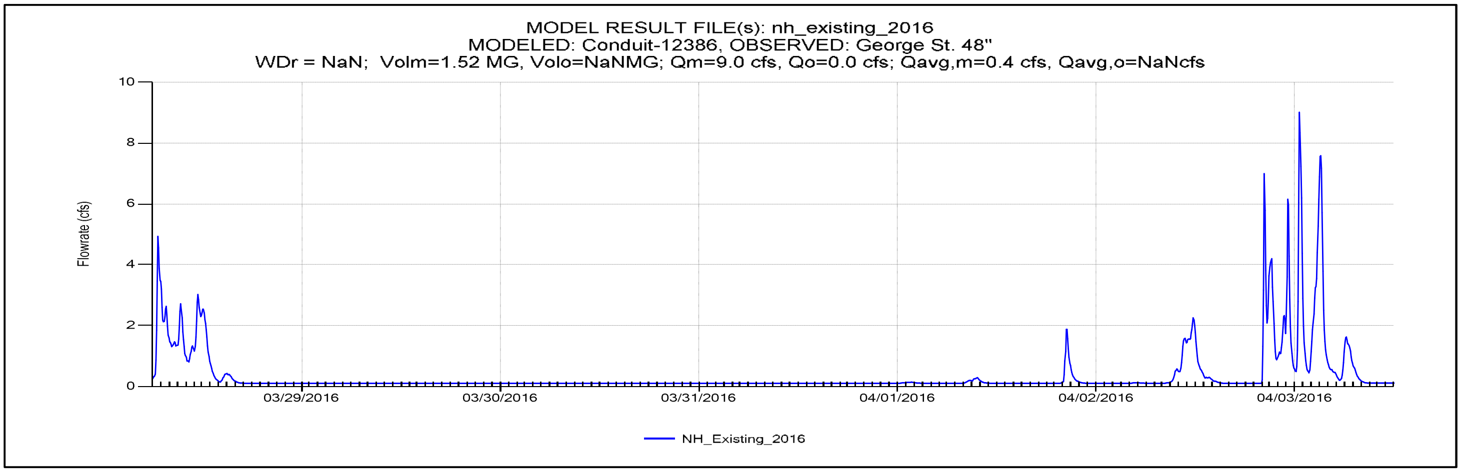


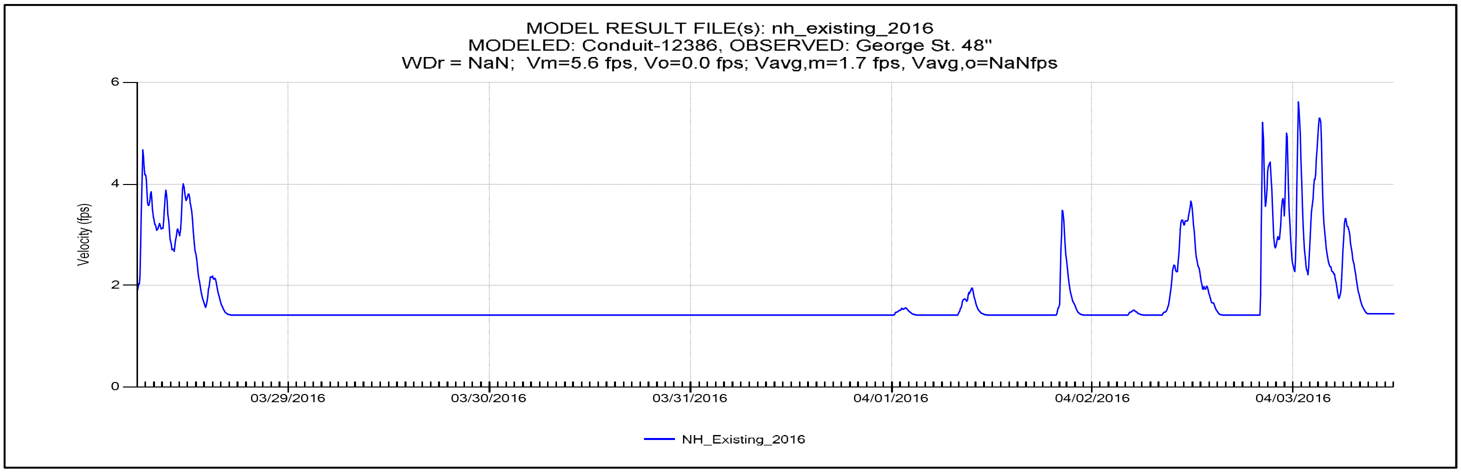




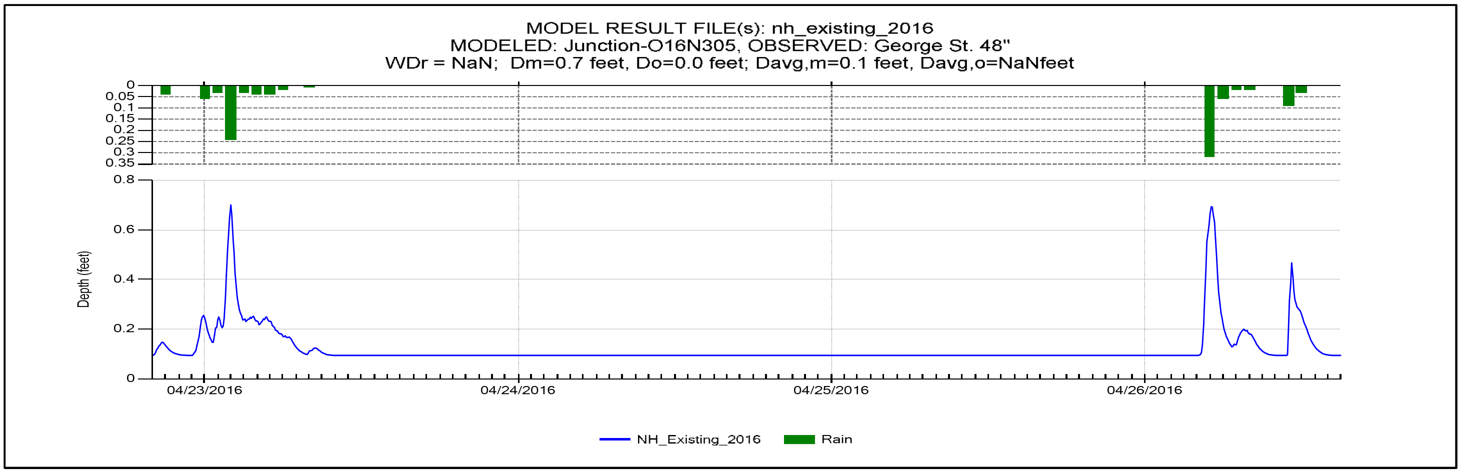
Meter10-Spring1

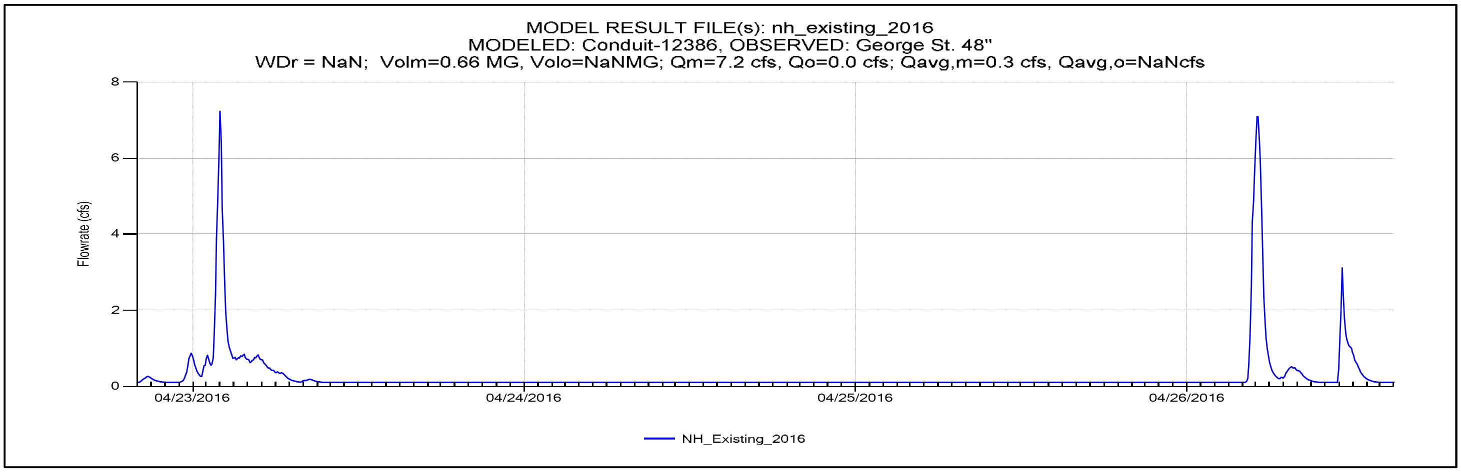


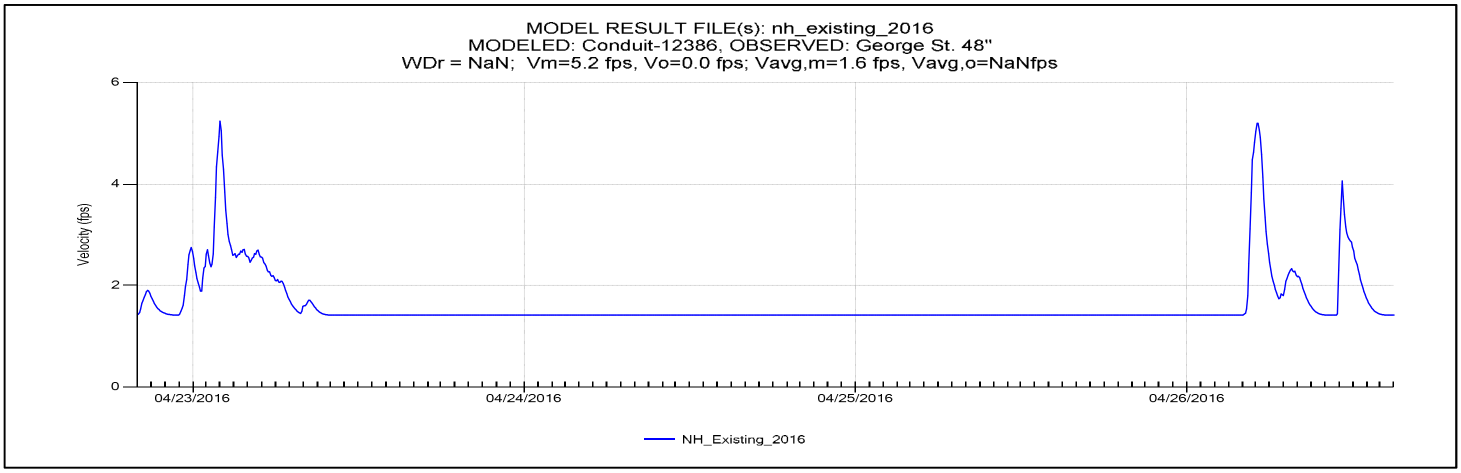




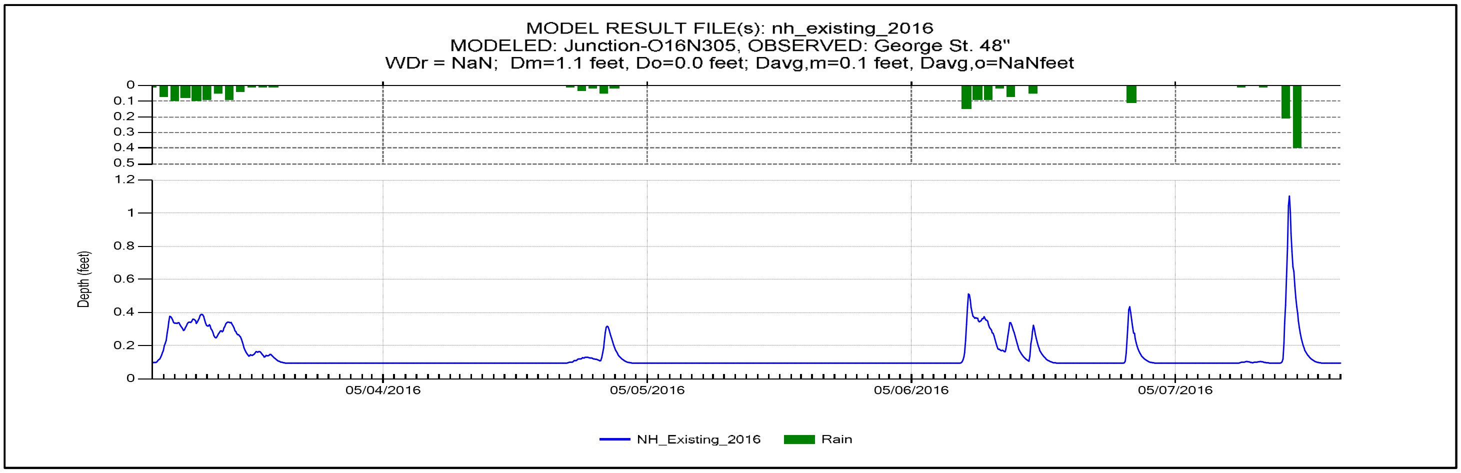
Meter10-Spring2

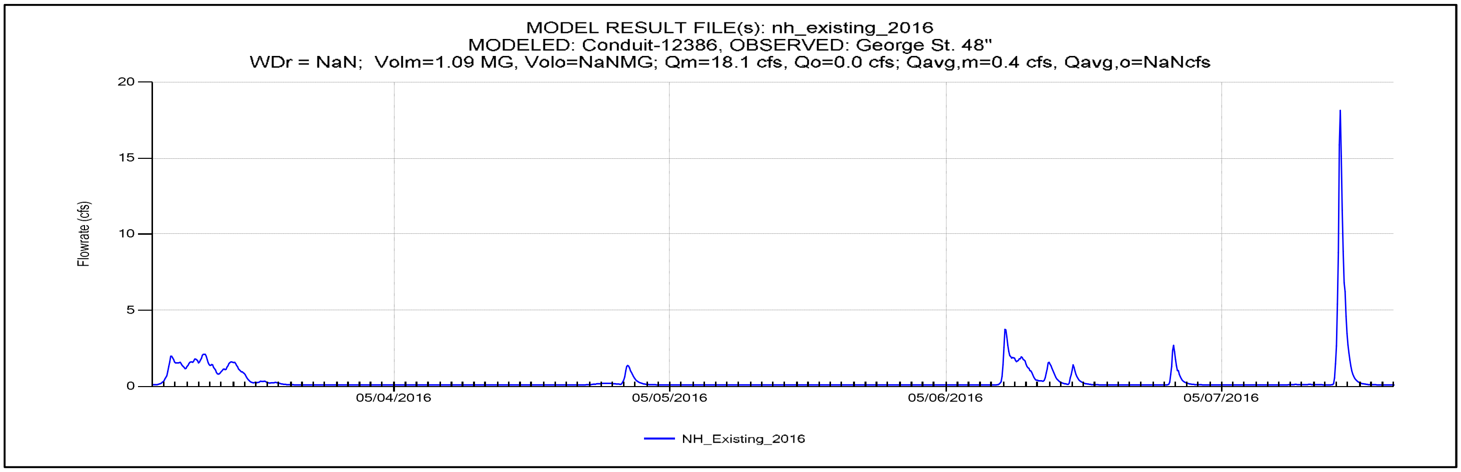


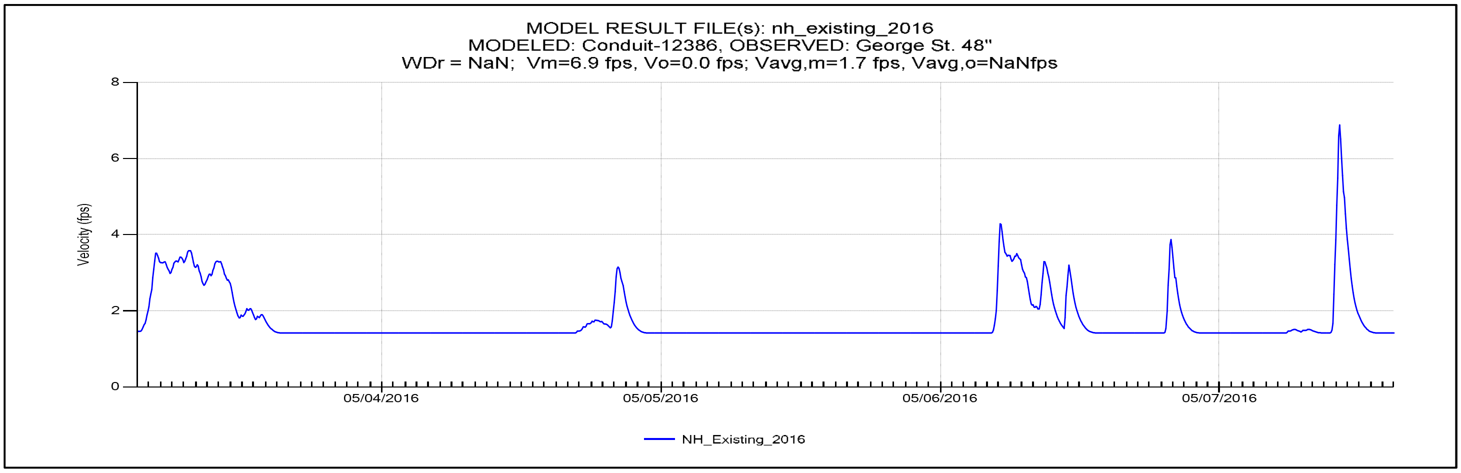




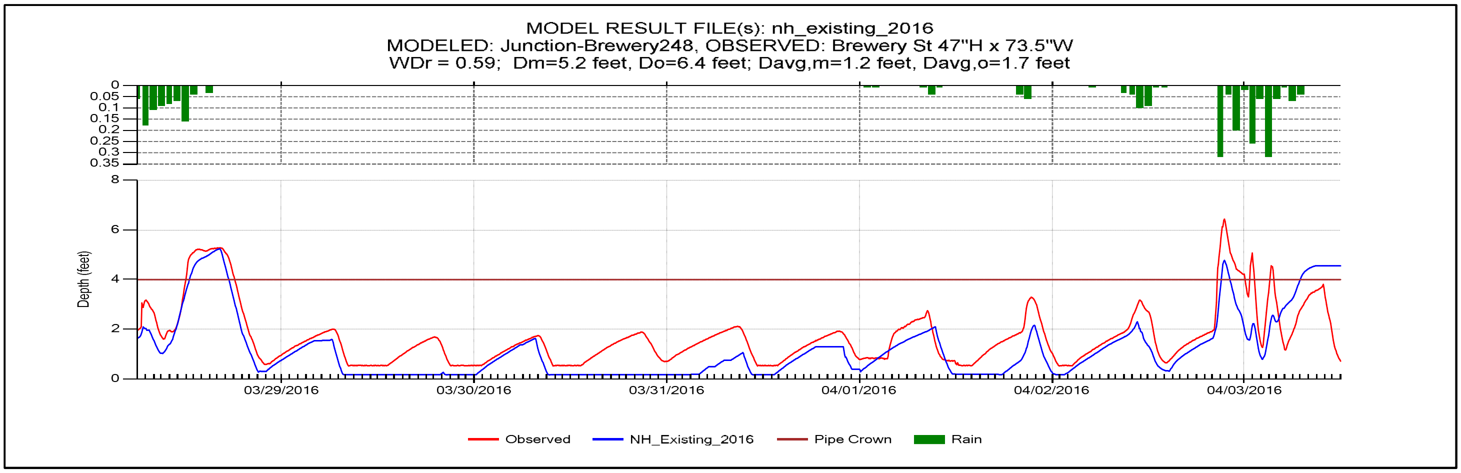
Meter10-Spring3

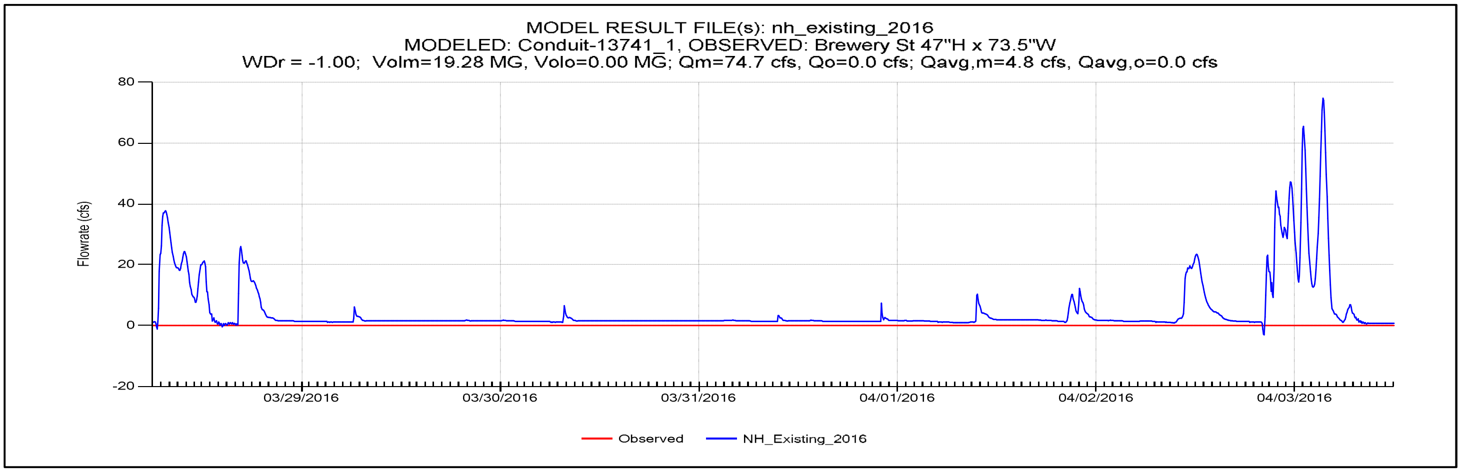


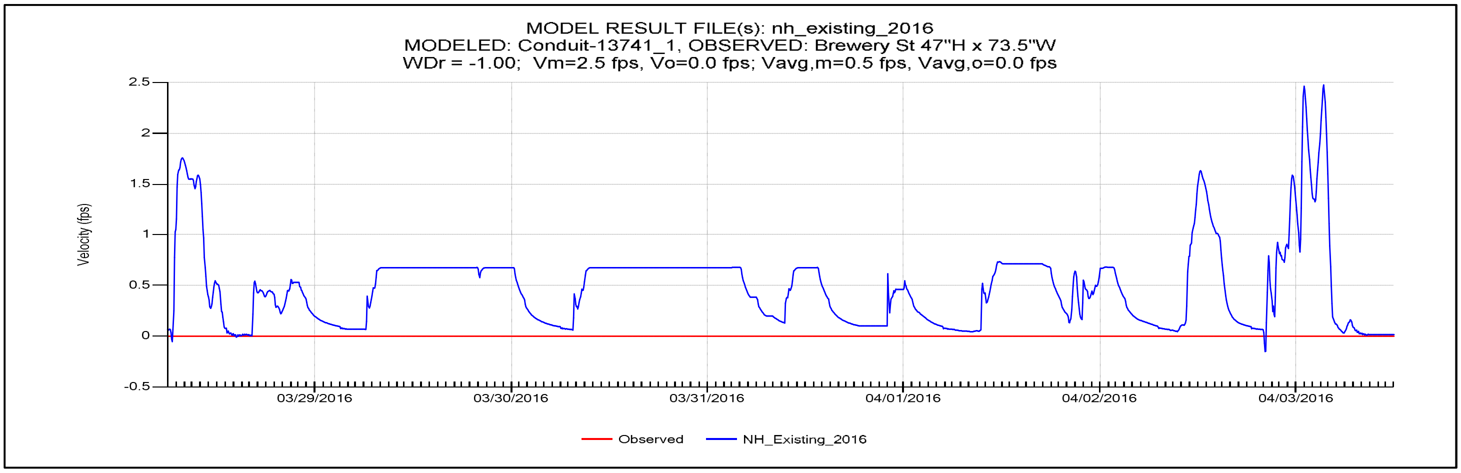




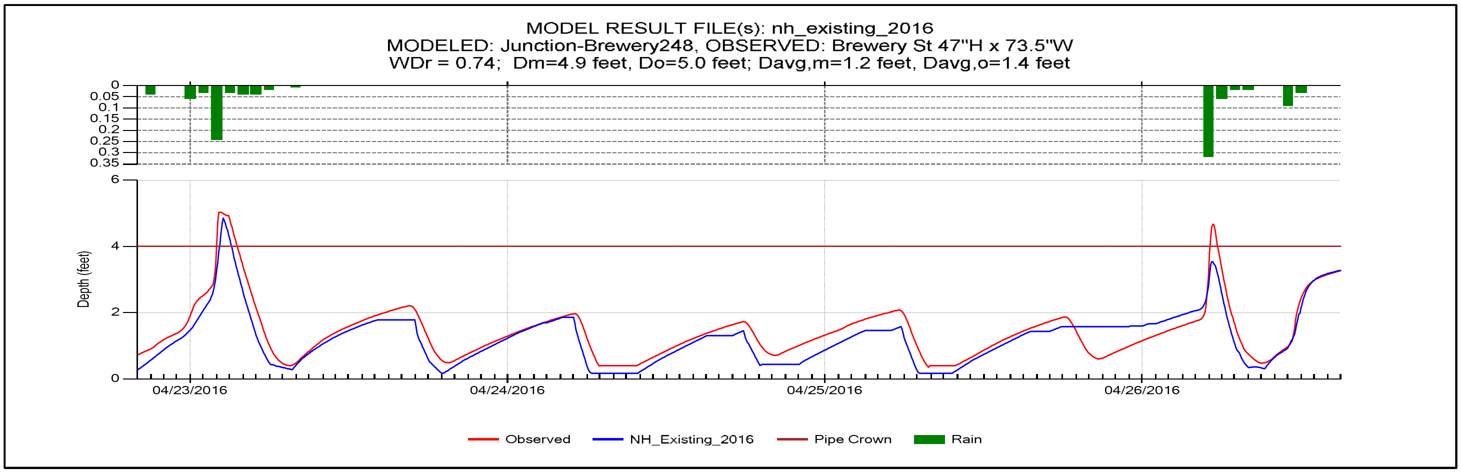
Meter11-Spring1

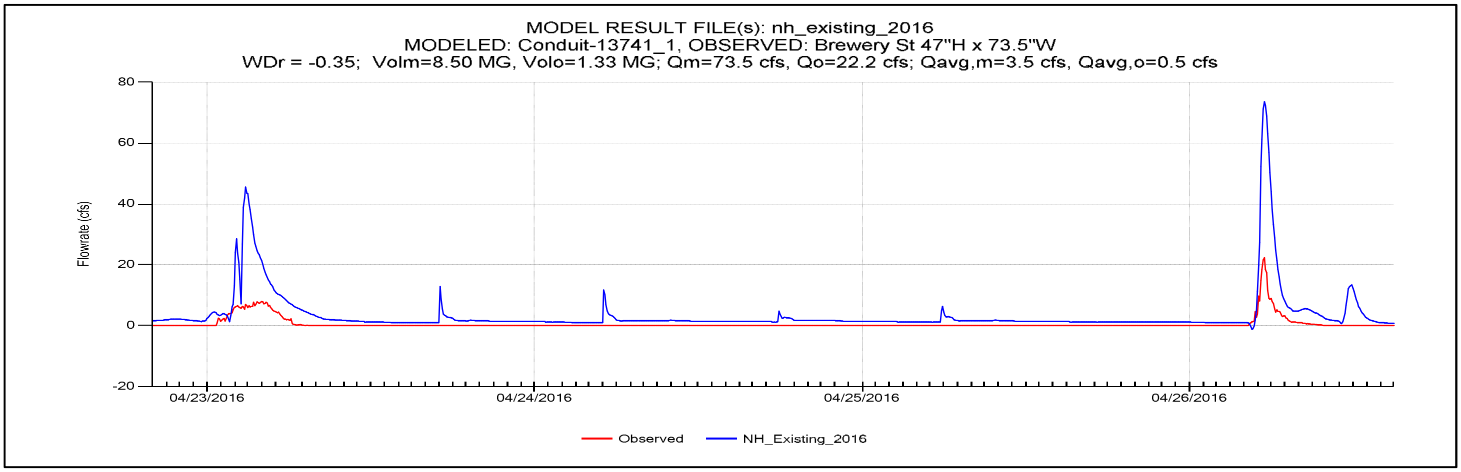


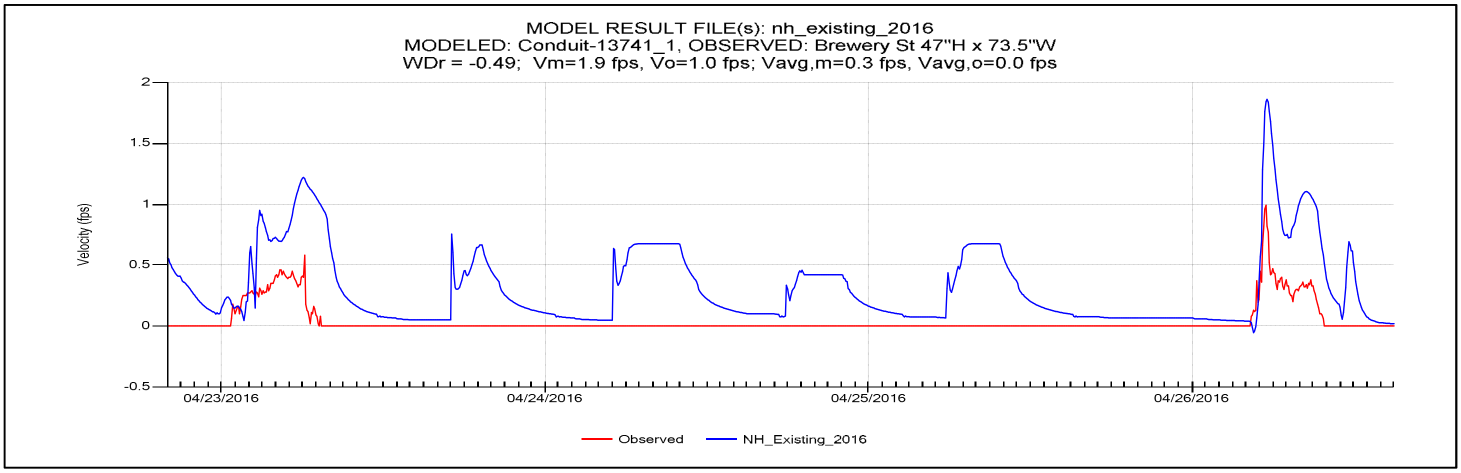




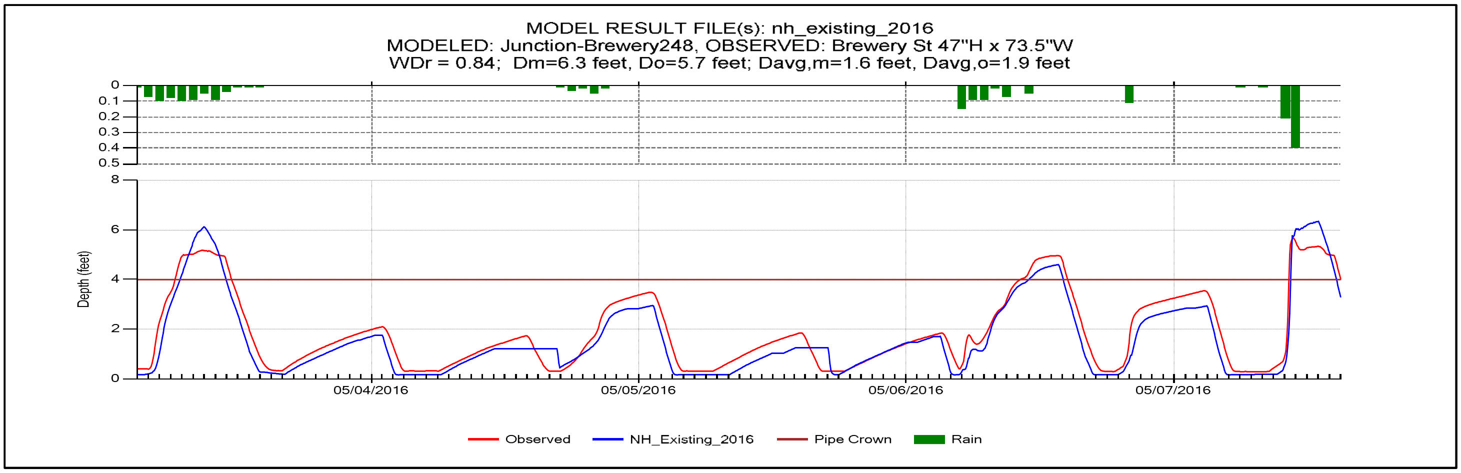
Meter11-Spring2

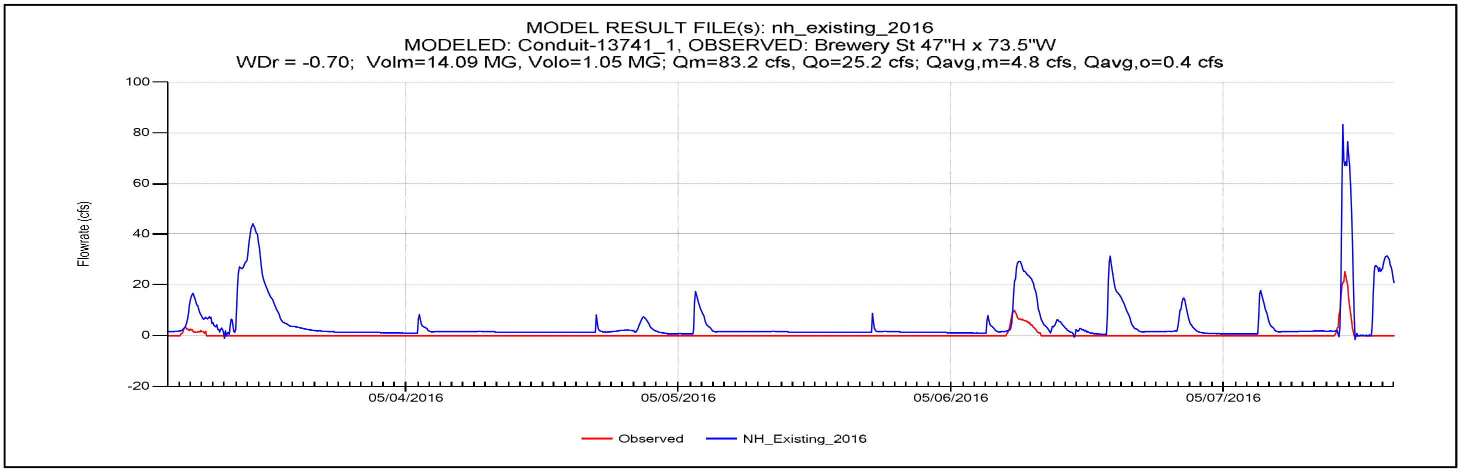


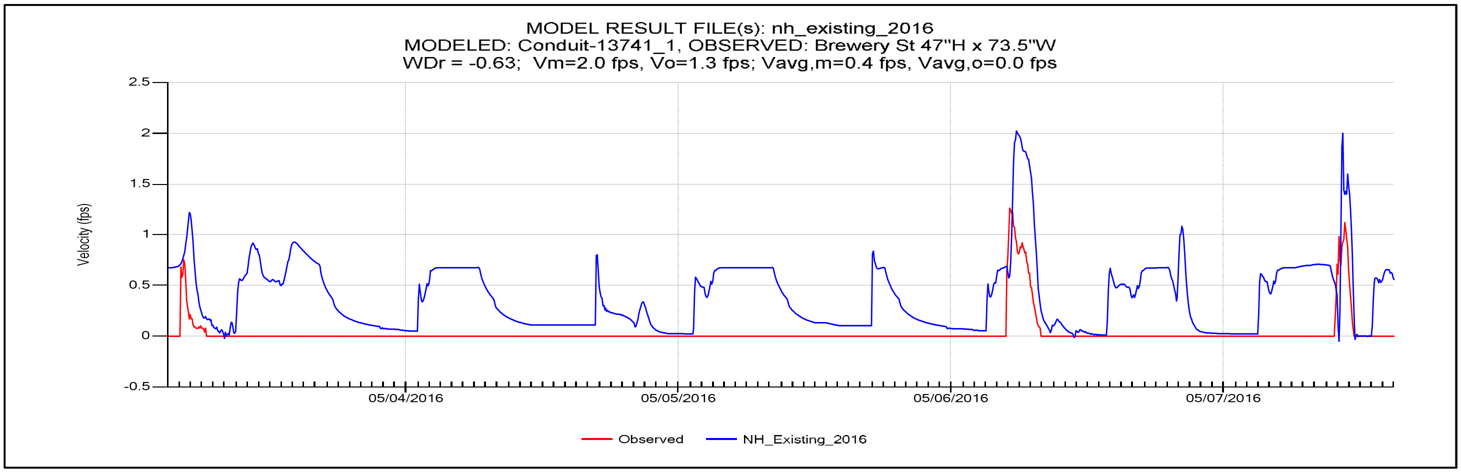




Meter11-Spring3

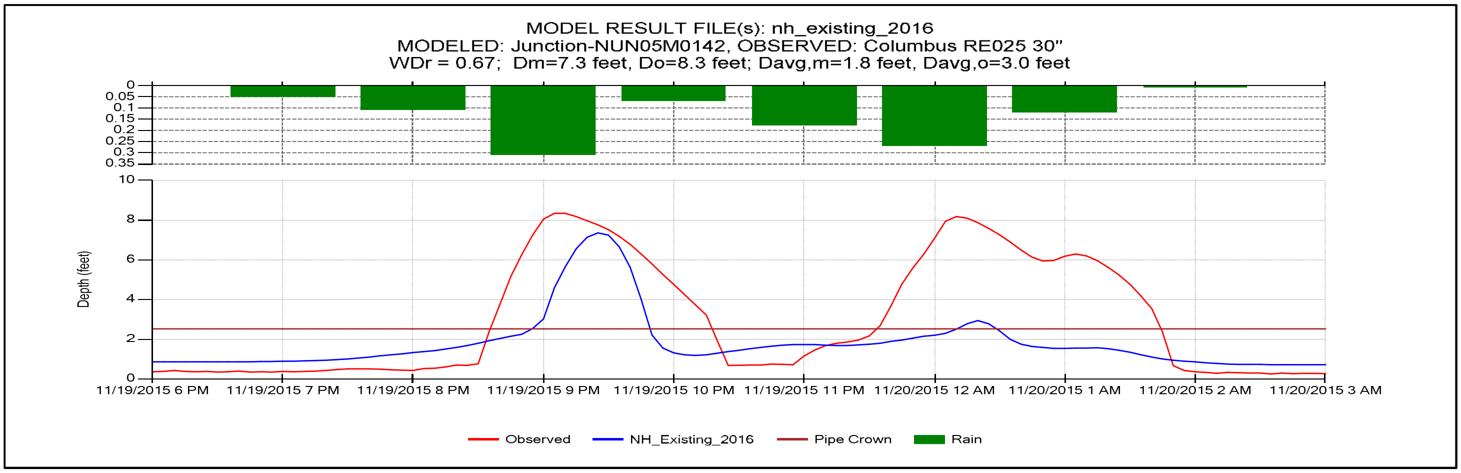


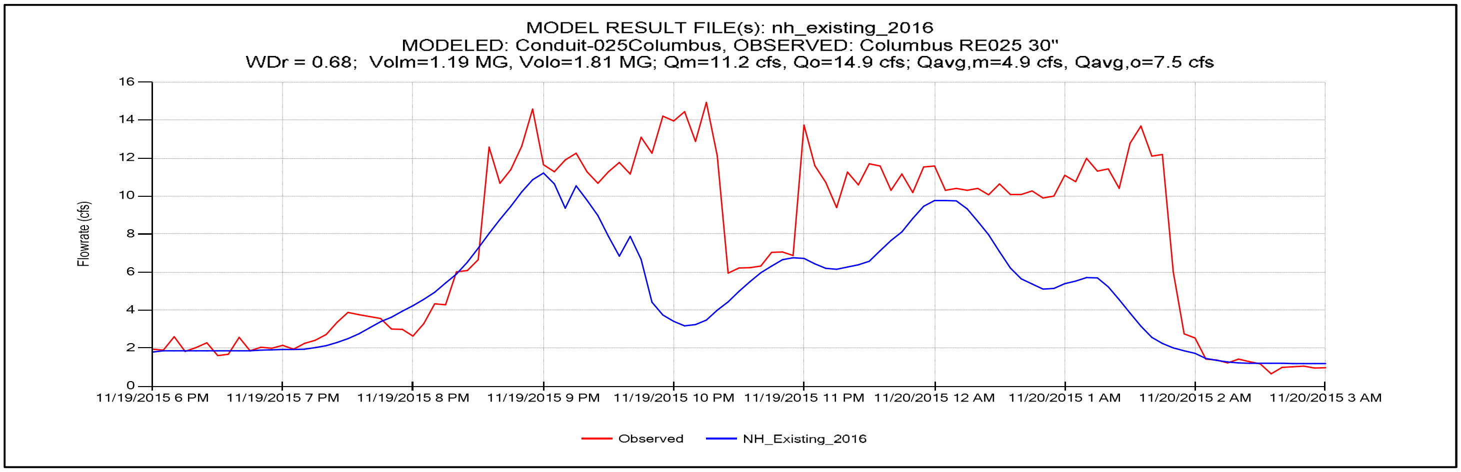


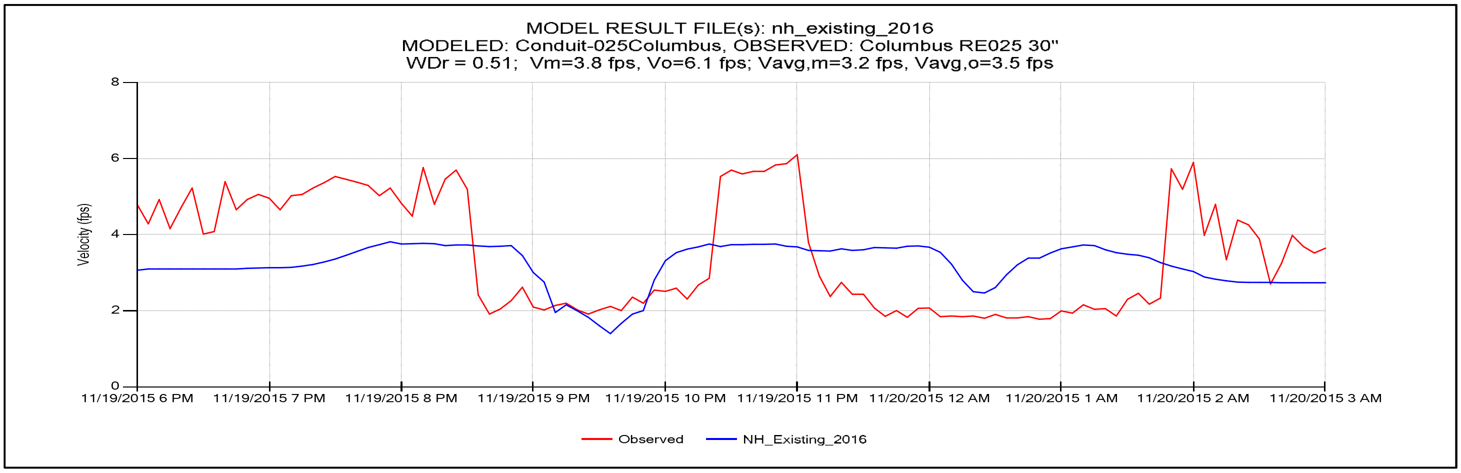


Simulated Versus Observed Flow at Flow Meter Sites

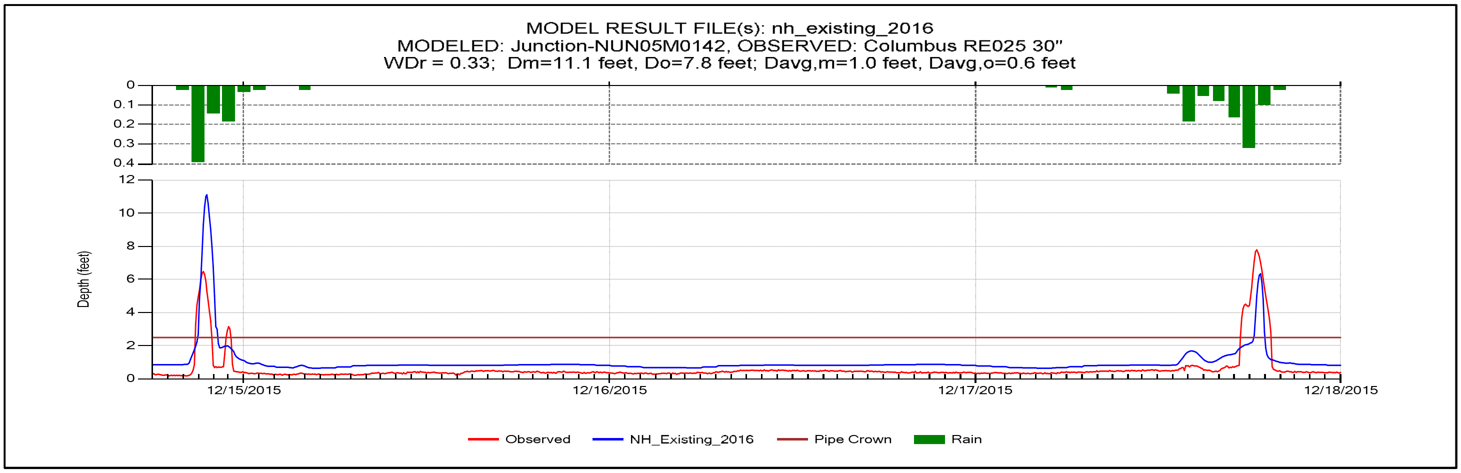
SwrColumbus-Fall1

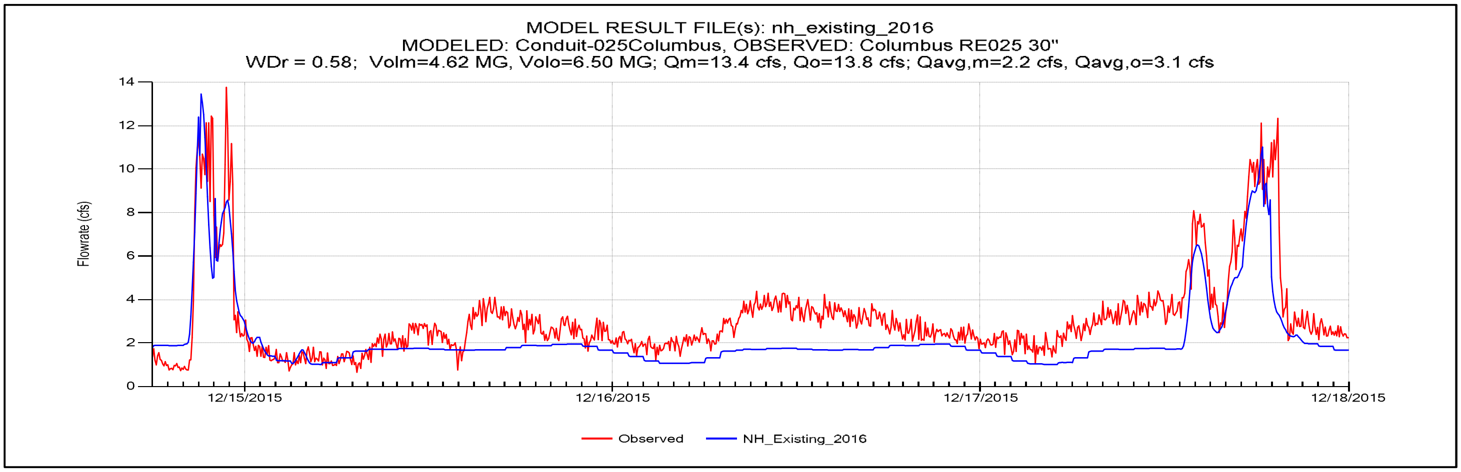

MODEL RESULT FILE(s): nh_existing_2016
MODELED: Junction-NUN05M0142, OBSERVED: Columbus RE025 30"
WDr = 0.67; Dm=7.3 feet, Do=8.3 feet; Davg,m=1.8 feet, Davg,o=3.0 feet

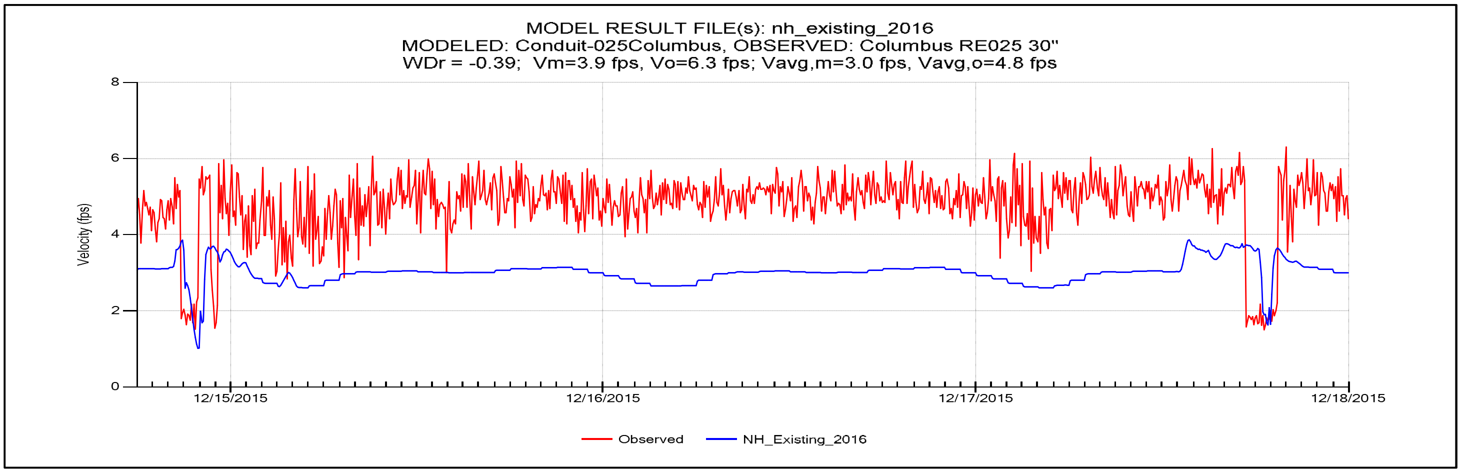

MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-025Columbus, OBSERVED: Columbus RE025 30"
WDr = 0.68; Volm=1.19 MG, Volo=1.81 MG; Qm=11.2 cfs, Qo=14.9 cfs; Qavg,m=4.9 cfs, Qavg,o=7.5 cfs


MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-025Columbus, OBSERVED: Columbus RE025 30"
WDr = 0.51; Vm=3.8 fps, Vo=6.1 fps; Vavg,m=3.2 fps, Vavg,o=3.5 fps

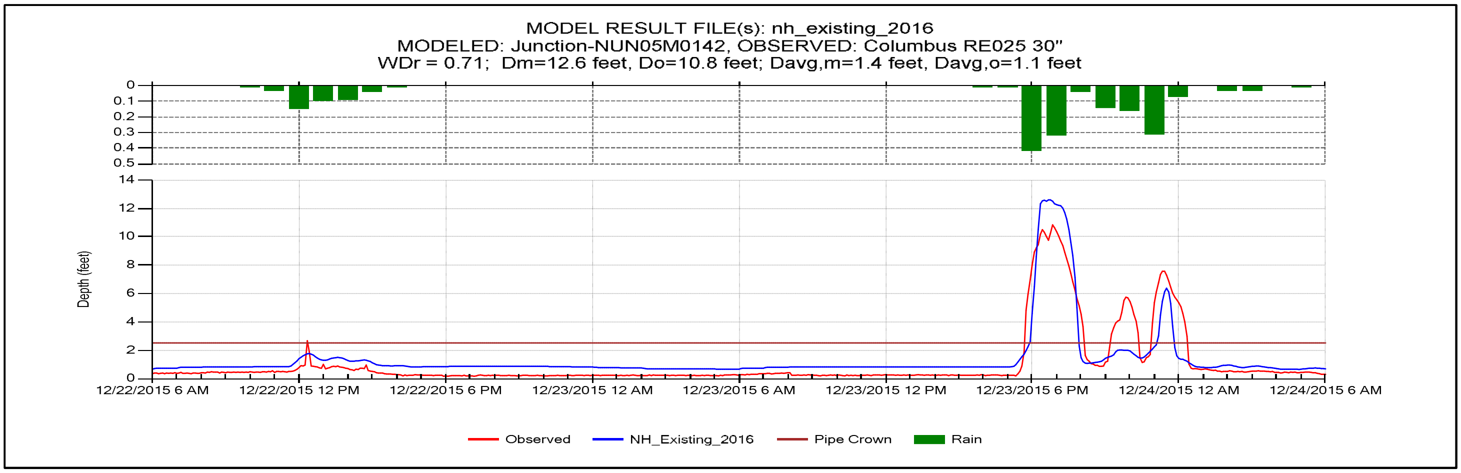
SwrColumbus-Fall2

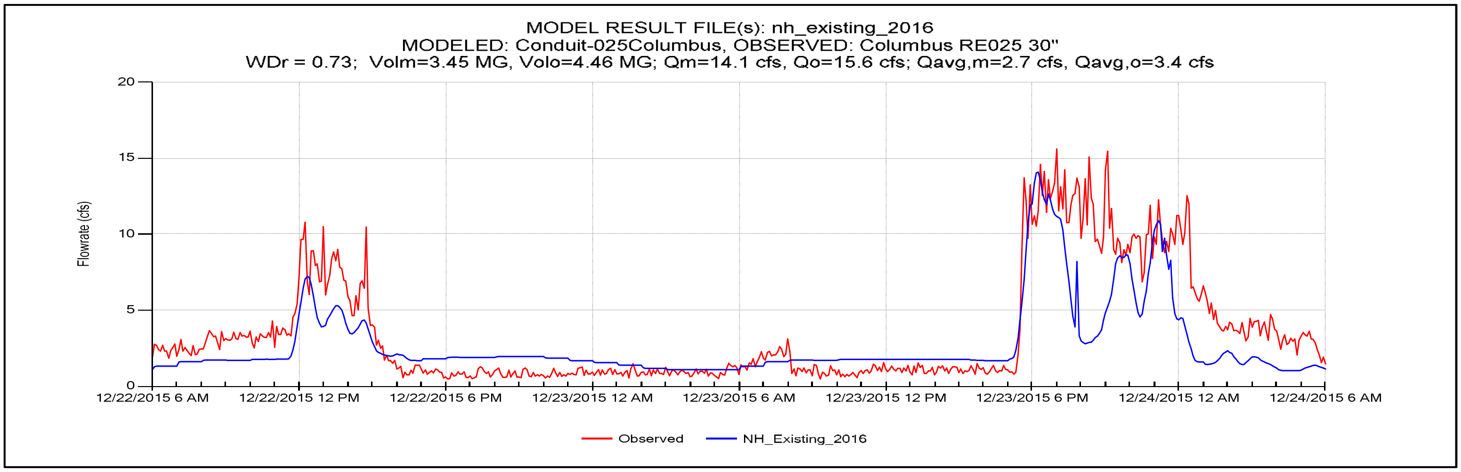


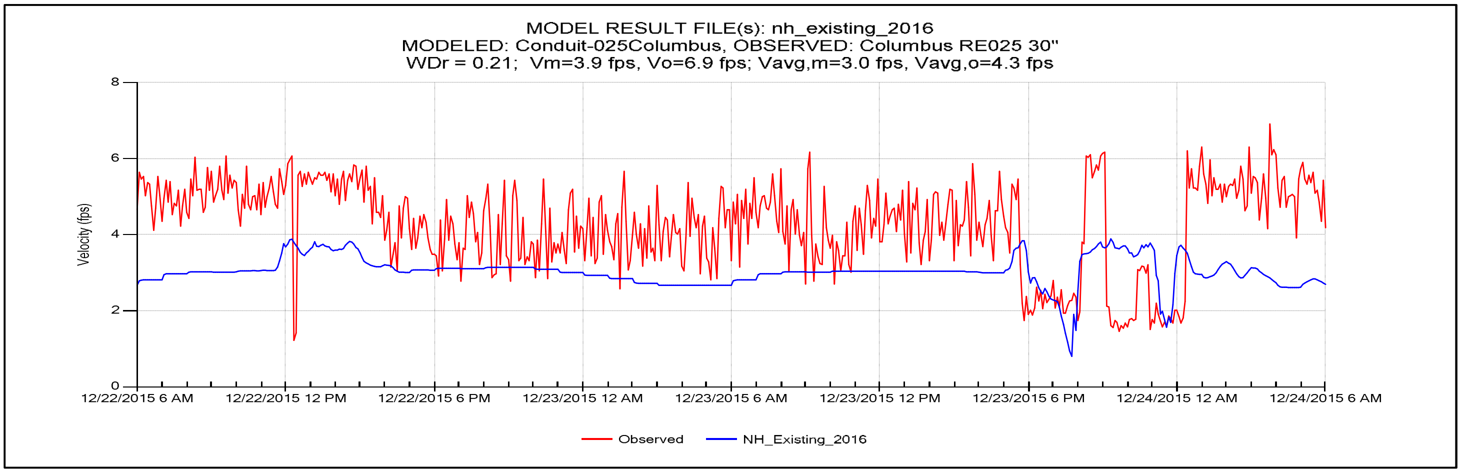




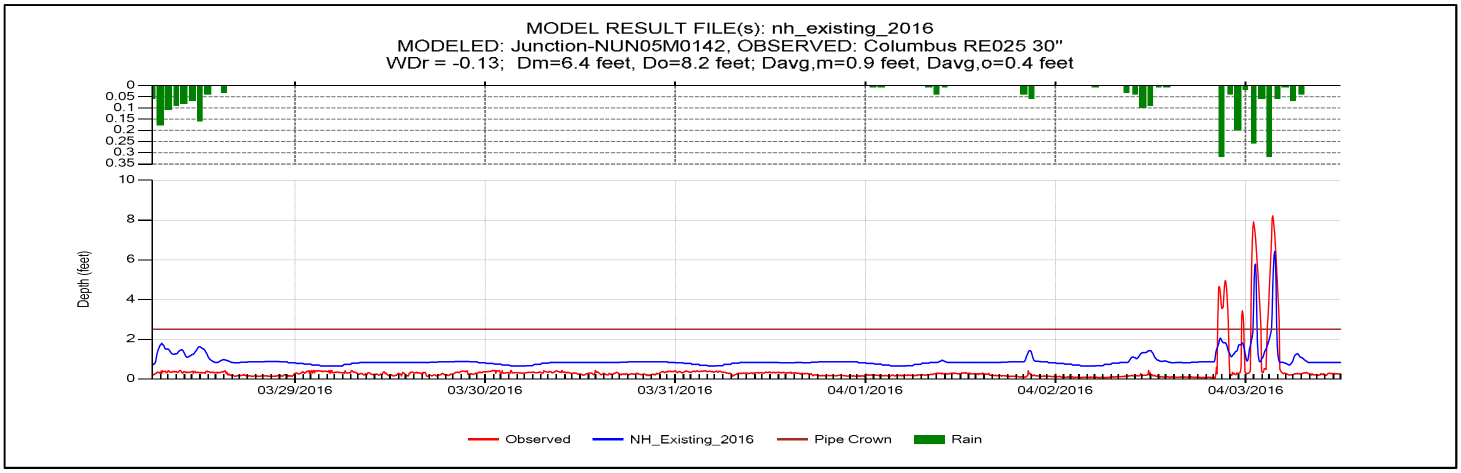
SwrColumbus-Fall3

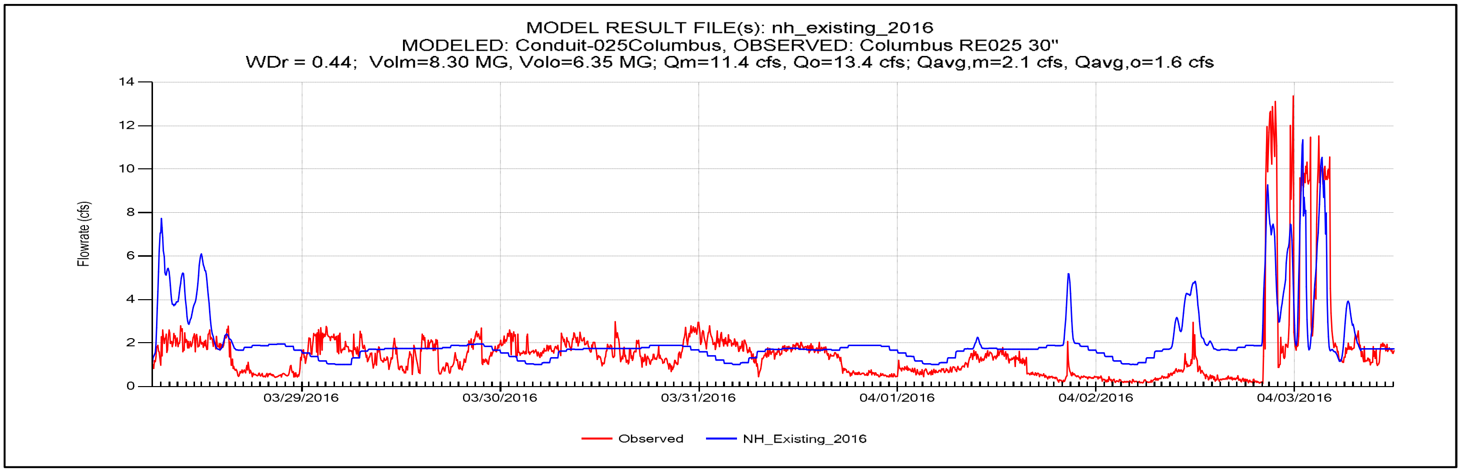


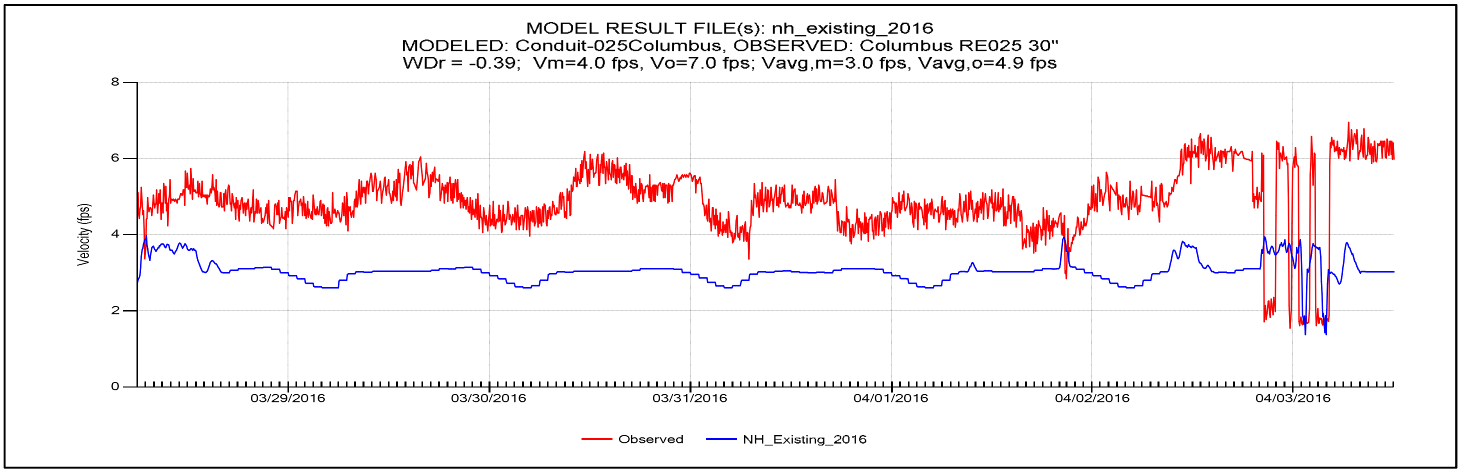




SwrColumbus-Spring1

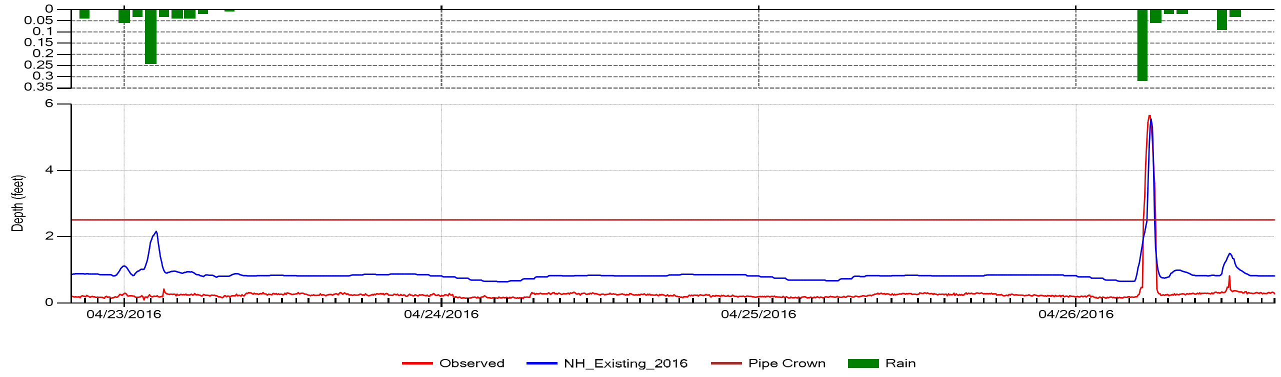




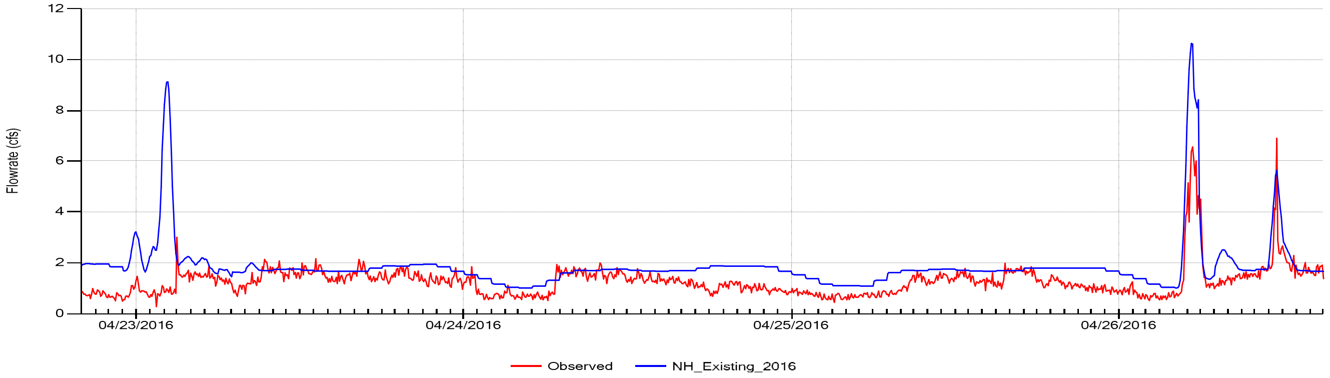


SwrColumbus-Spring2

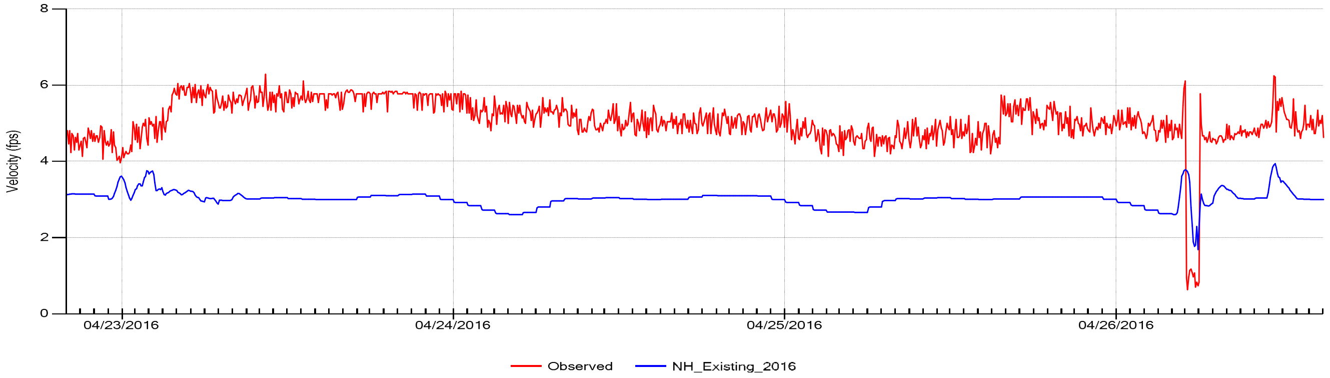
MODEL RESULT FILE(s): nh_existing_2016
MODELED: Junction-NUN05M0142, OBSERVED: Columbus RE025 30"
WDr = -0.67; Dm=5.5 feet, Do=5.7 feet; Davg,m=0.9 feet, Davg,o=0.3 feet



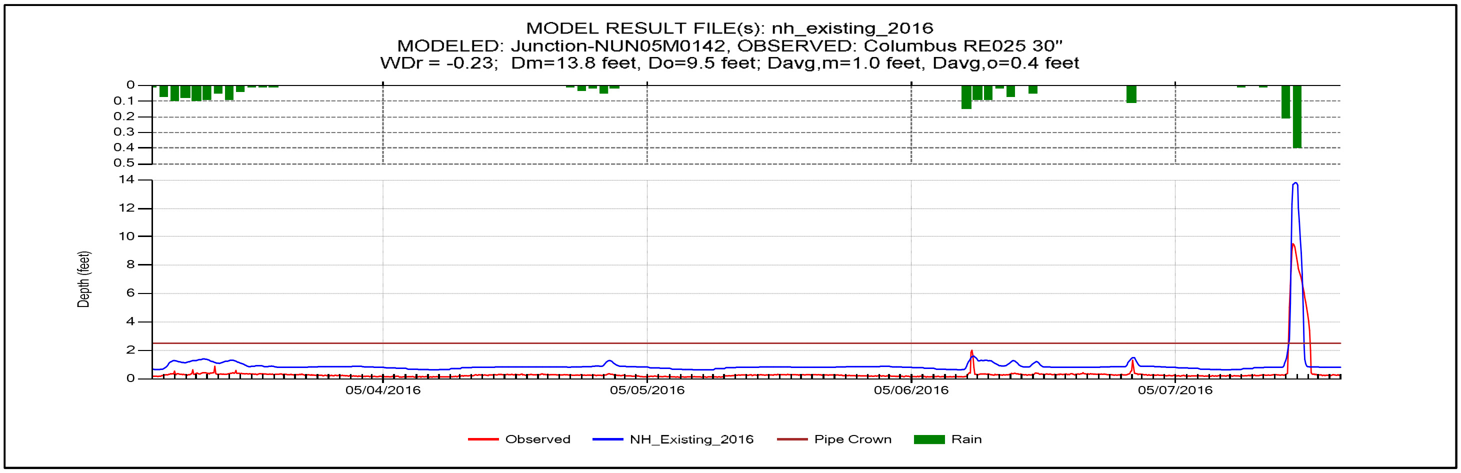
MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-025Columbus, OBSERVED: Columbus RE025 30"
WDr = 0.21; Volm=4.56 MG, Volo=3.12 MG; Qm=10.6 cfs, Qo=6.9 cfs; Qavg,m=1.9 cfs, Qavg,o=1.3 cfs

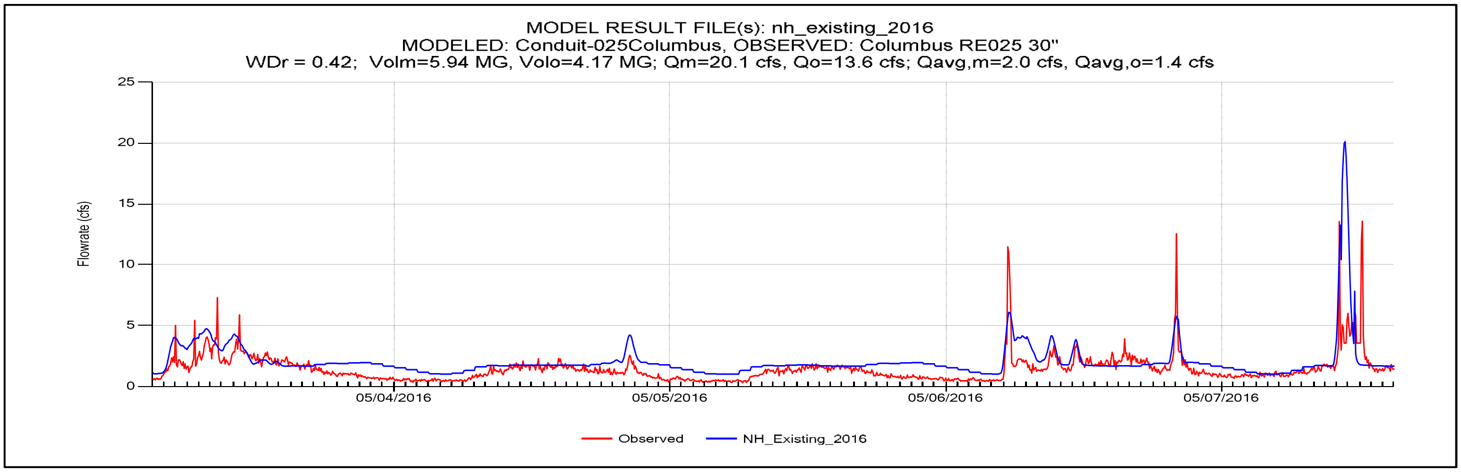


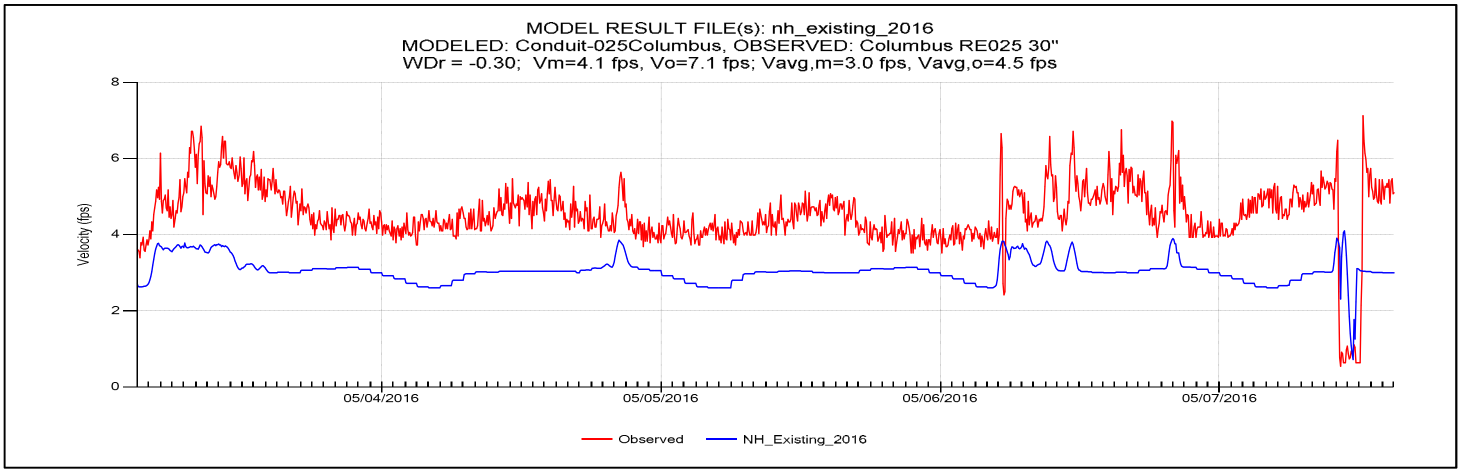
MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-025Columbus, OBSERVED: Columbus RE025 30"
WDr = -0.60; Vm=3.9 fps, Vo=6.3 fps; Vavg,m=3.0 fps, Vavg,o=5.1 fps



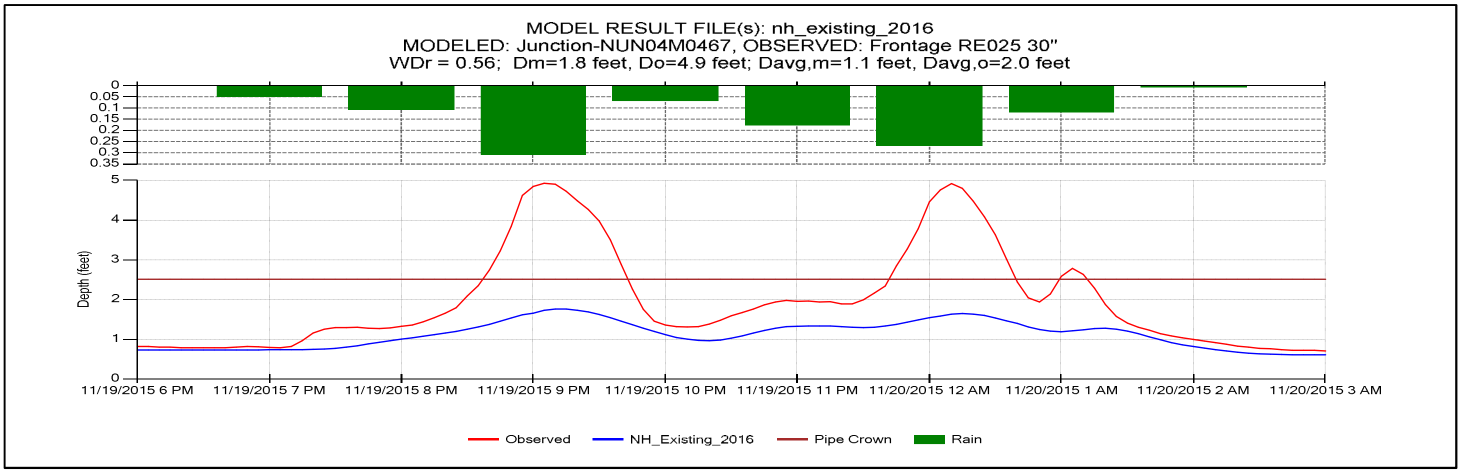
SwrColumbus-Spring3

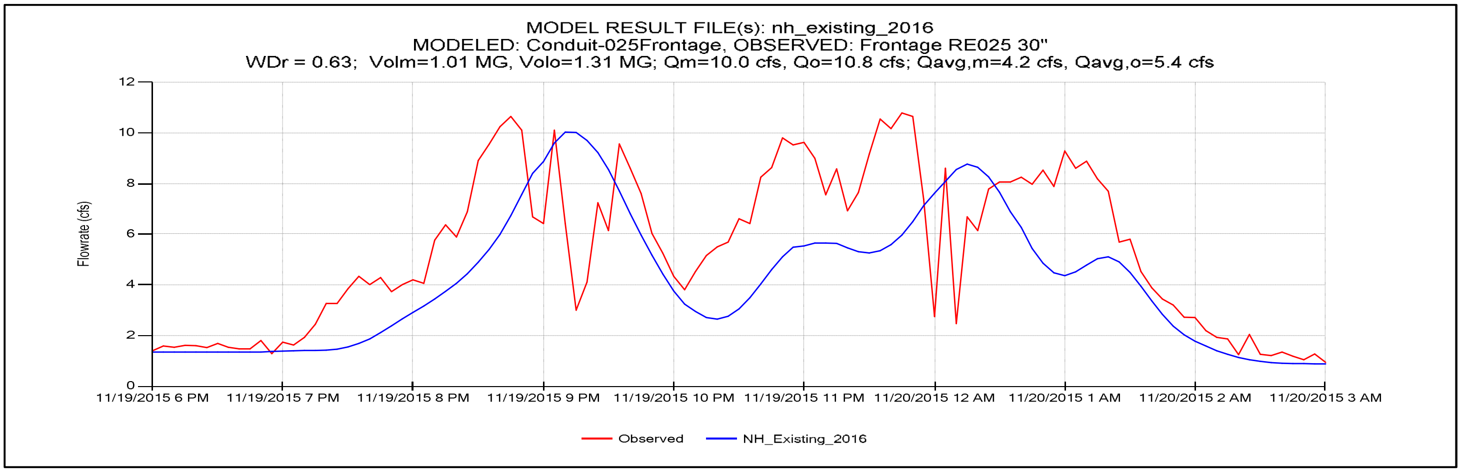


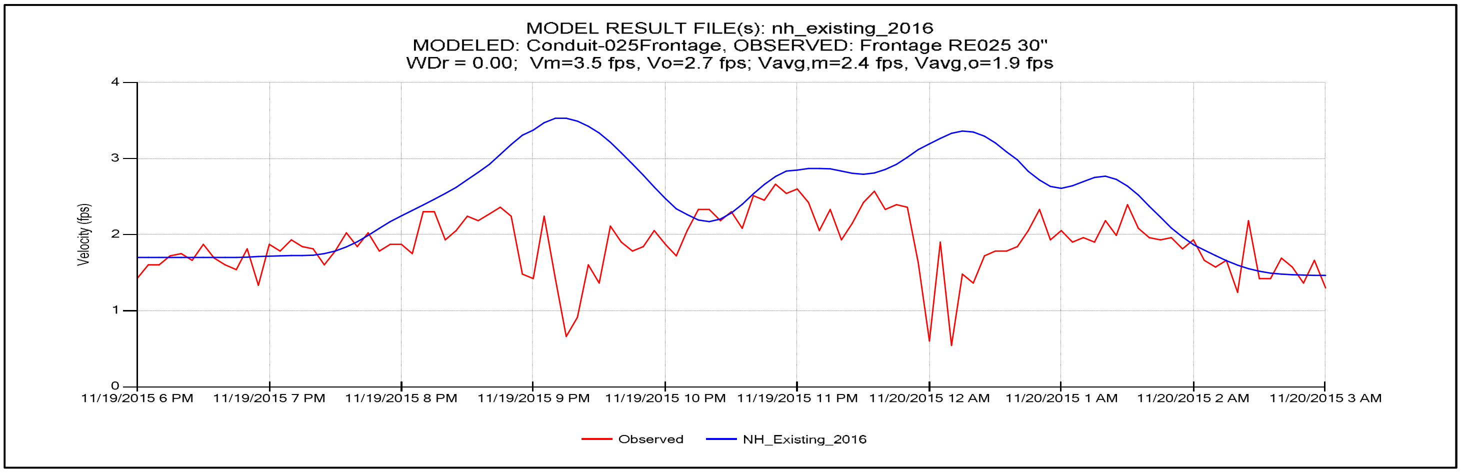




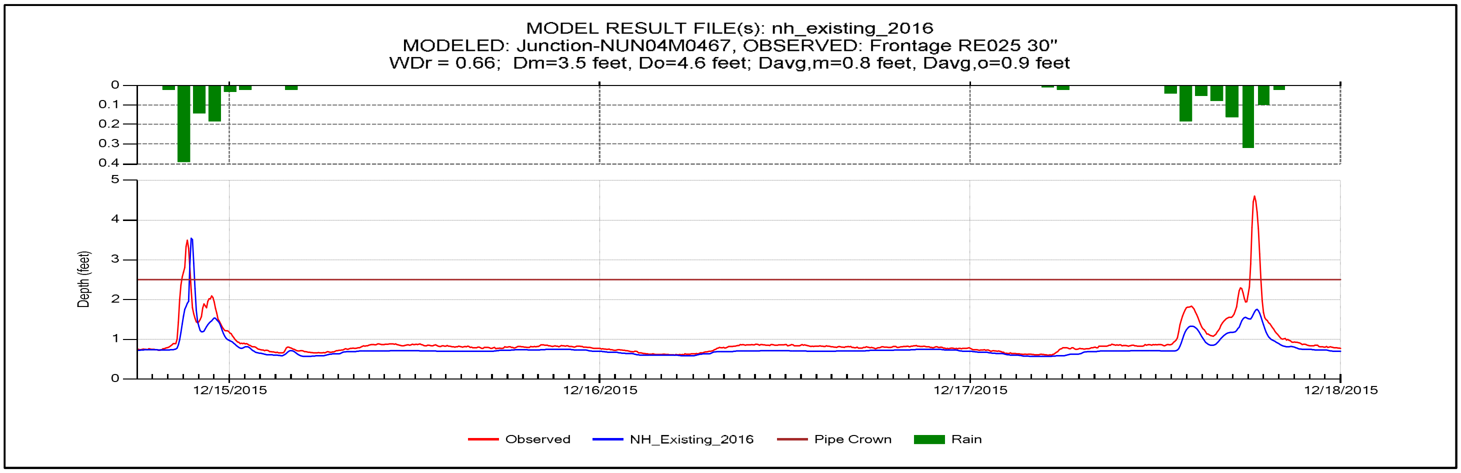
SwrFrontage-Fall1



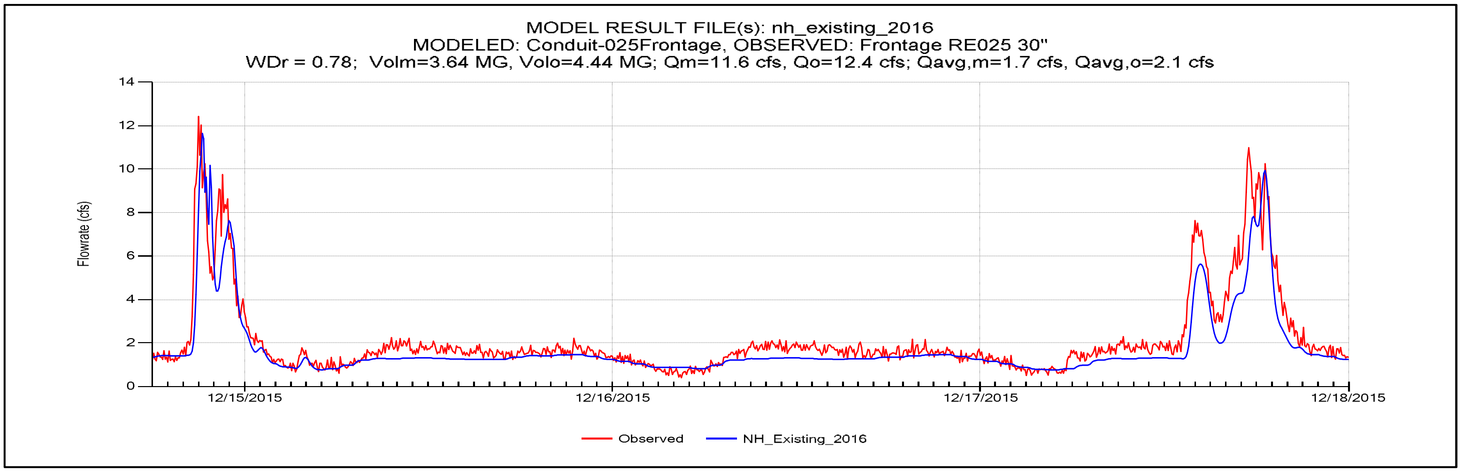




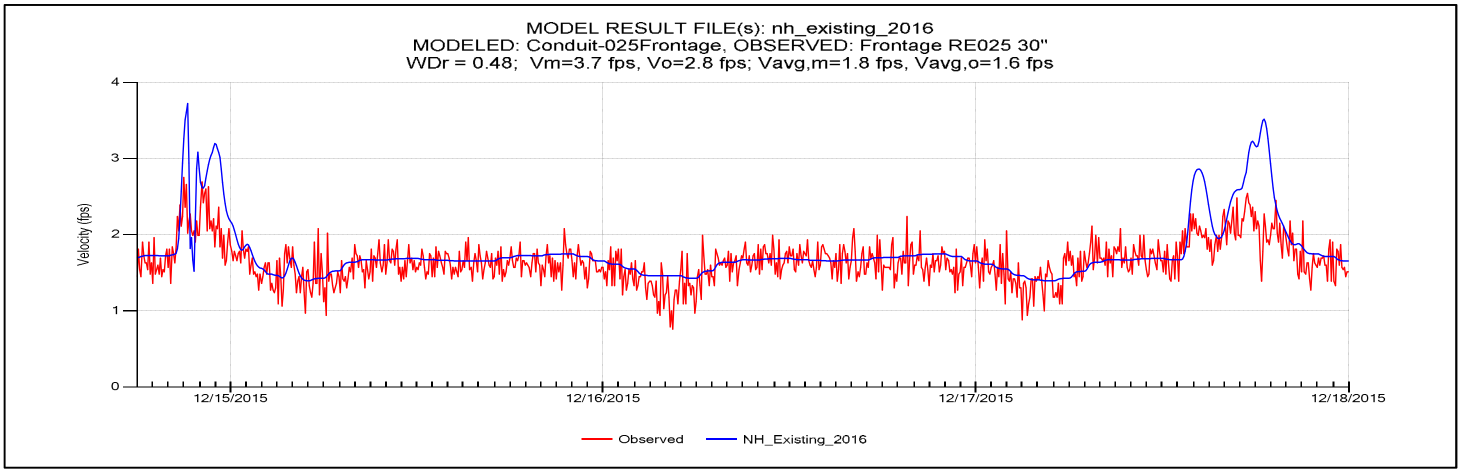
SwrFrontage-Fall2



MODEL RESULT FILE(s): nh_existing_2016
MODELED: Junction-NUN04M0467, OBSERVED: Frontage RE025 30"
WDr = 0.66; Dm=3.5 feet, Do=4.6 feet; Davg,m=0.8 feet, Davg,o=0.9 feet

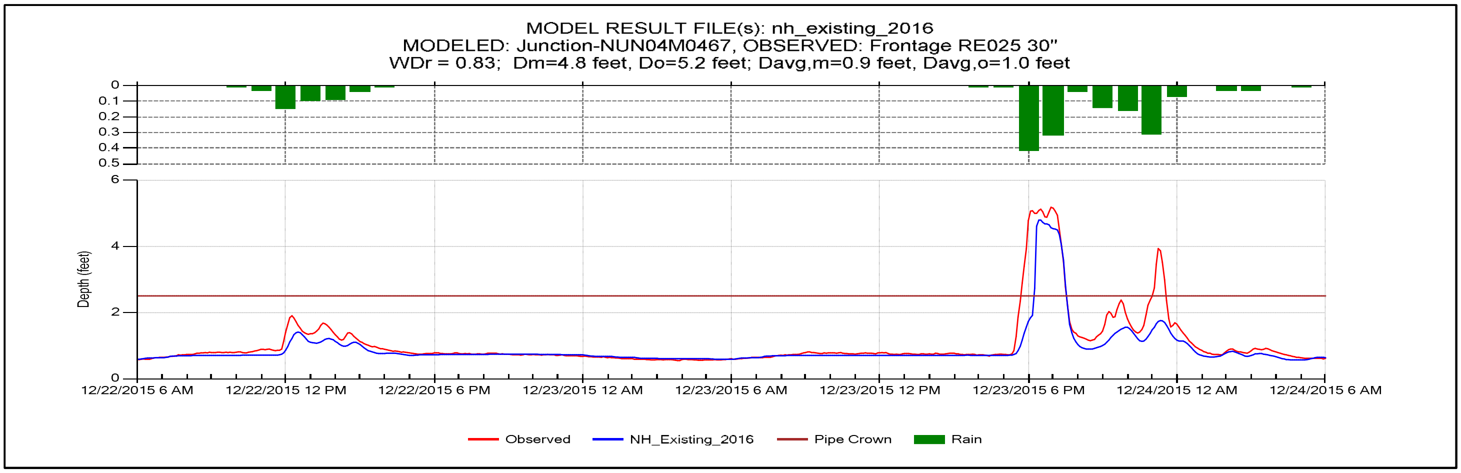


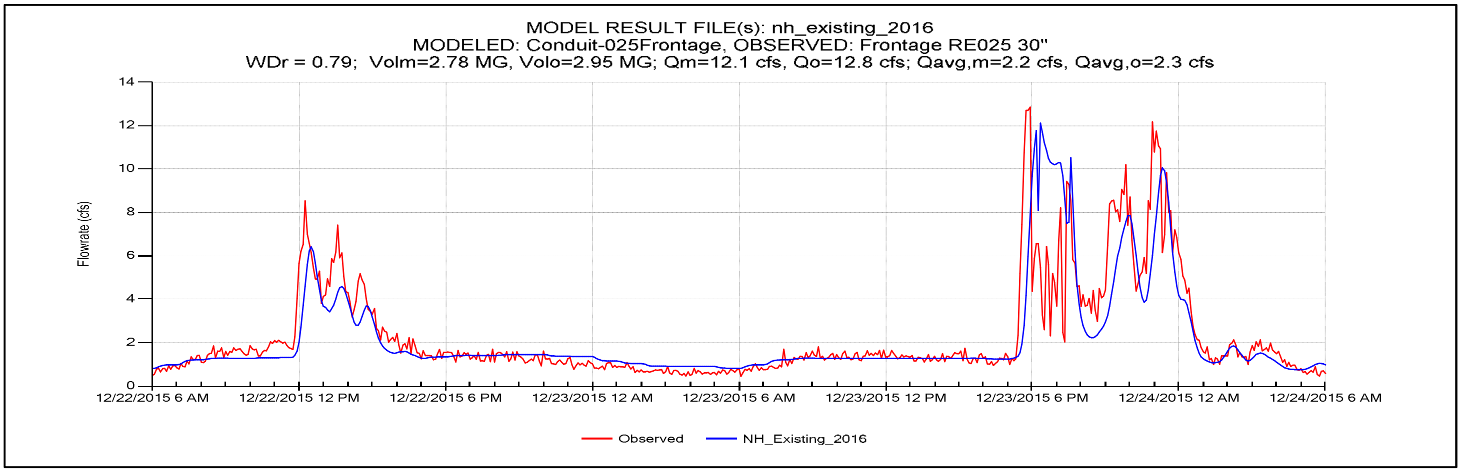
MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-025Frontage, OBSERVED: Frontage RE025 30"
WDr = 0.78; Volm=3.64 MG, Volo=4.44 MG; Qm=11.6 cfs, Qo=12.4 cfs; Qavg,m=1.7 cfs, Qavg,o=2.1 cfs

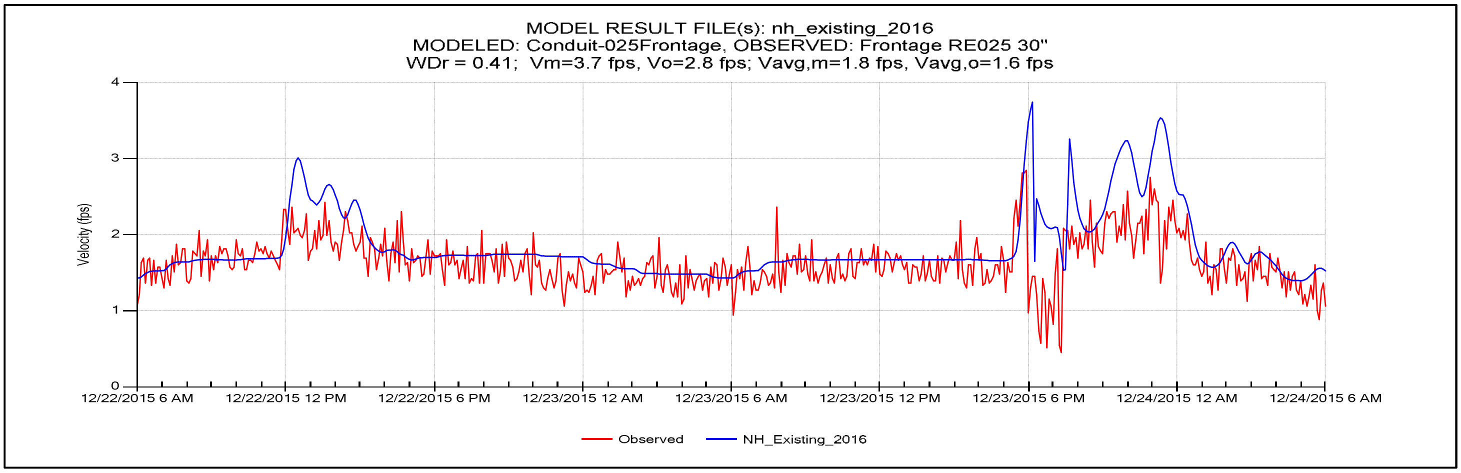


MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-025Frontage, OBSERVED: Frontage RE025 30"
WDr = 0.48; Vm=3.7 fps, Vo=2.8 fps; Vavg,m=1.8 fps, Vavg,o=1.6 fps

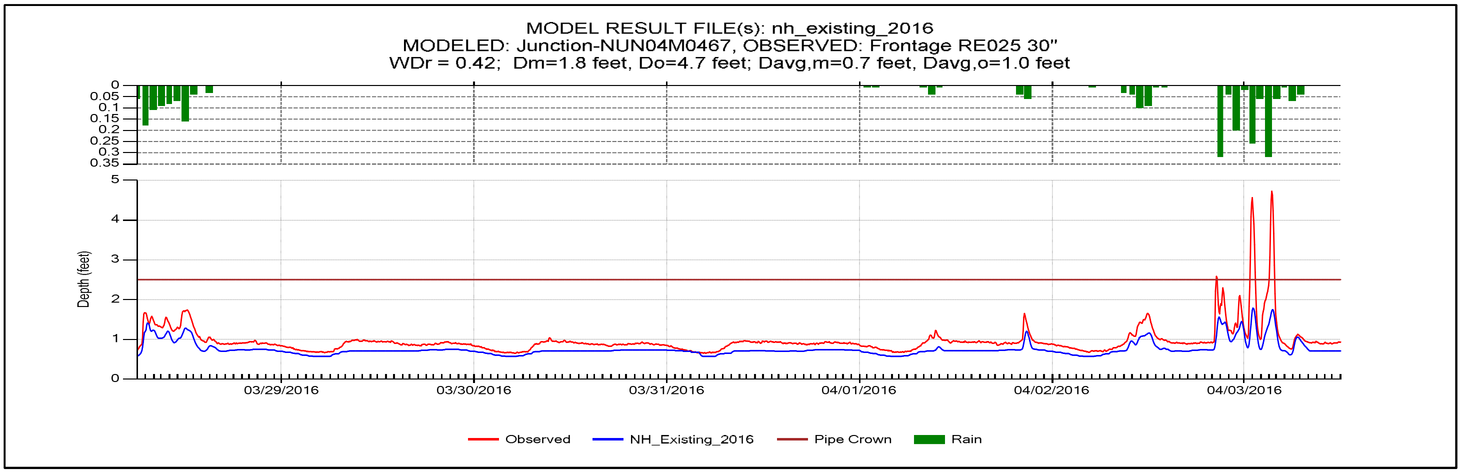
SwrFrontage-Fall3



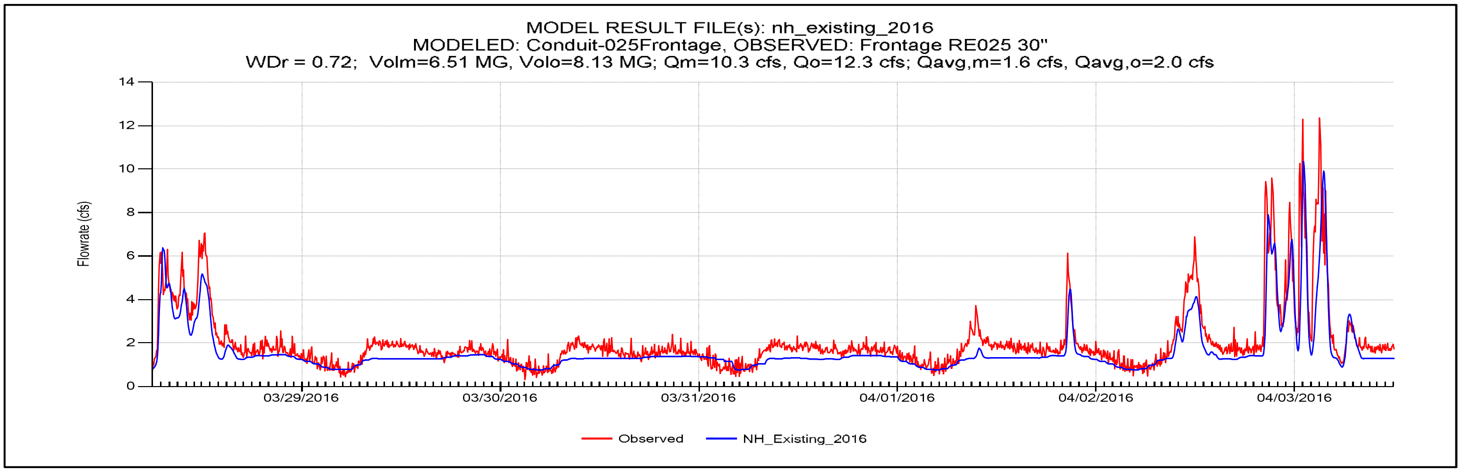




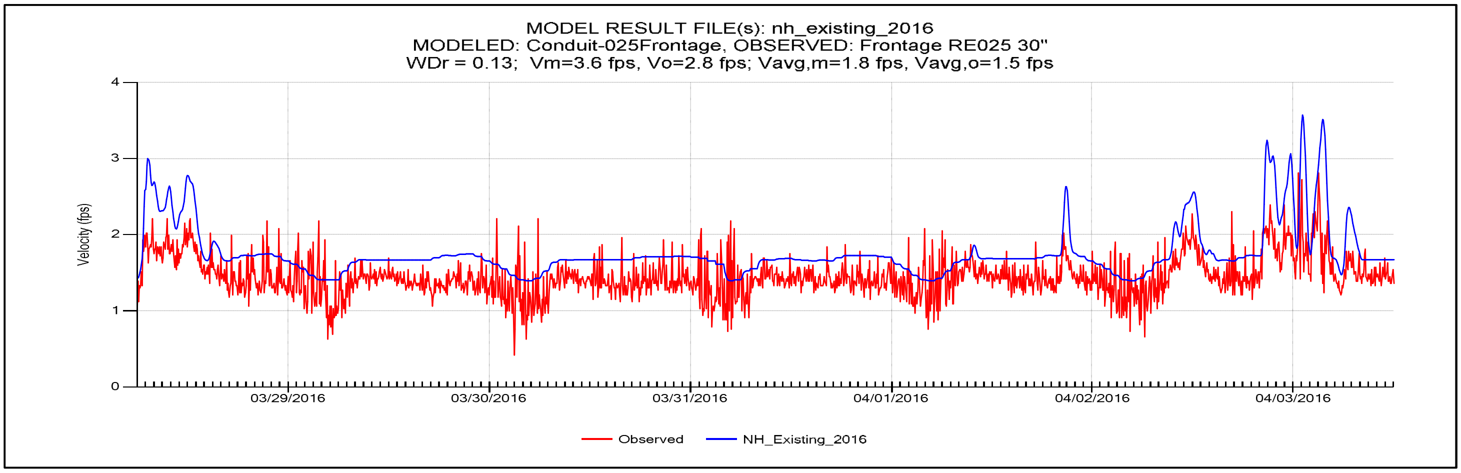
SwrFrontage-Spring1



MODEL RESULT FILE(s): nh_existing_2016
MODELED: Junction-NUN04M0467, OBSERVED: Frontage RE025 30"
WDr = 0.42; Dm=1.8 feet, Do=4.7 feet; Davg,m=0.7 feet, Davg,o=1.0 feet

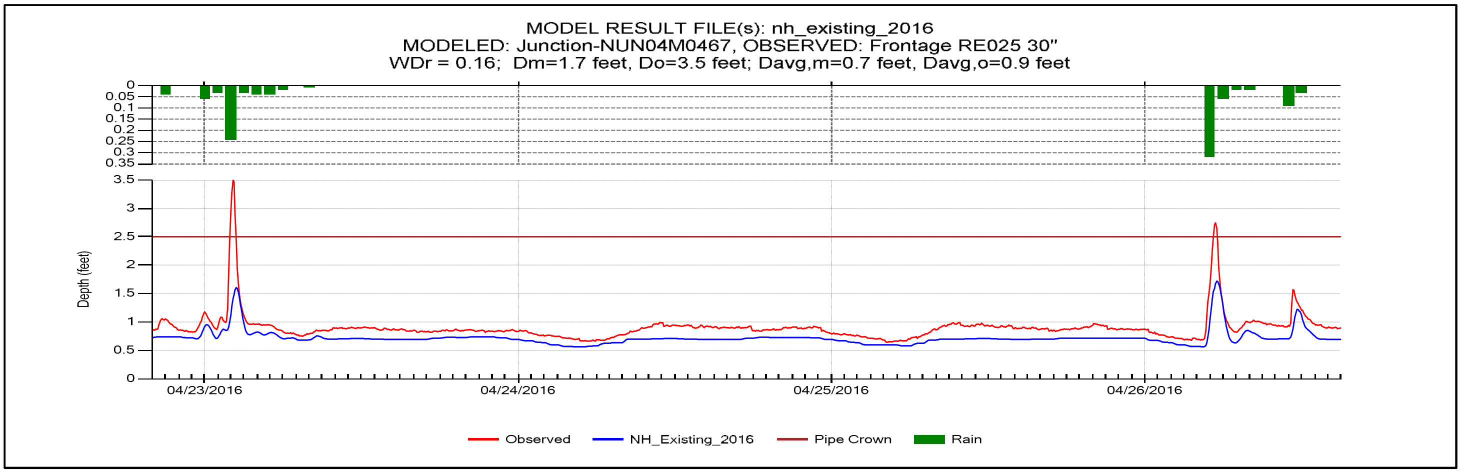


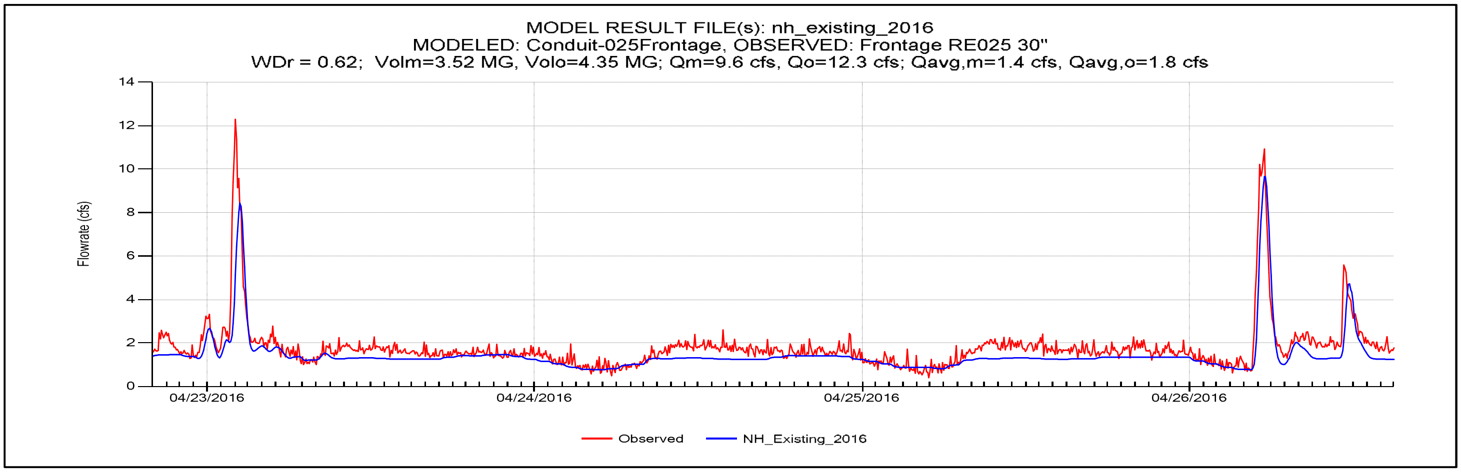
MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-025Frontage, OBSERVED: Frontage RE025 30"
WDr = 0.72; Volm=6.51 MG, Volo=8.13 MG; Qm=10.3 cfs, Qo=12.3 cfs; Qavg,m=1.6 cfs, Qavg,o=2.0 cfs

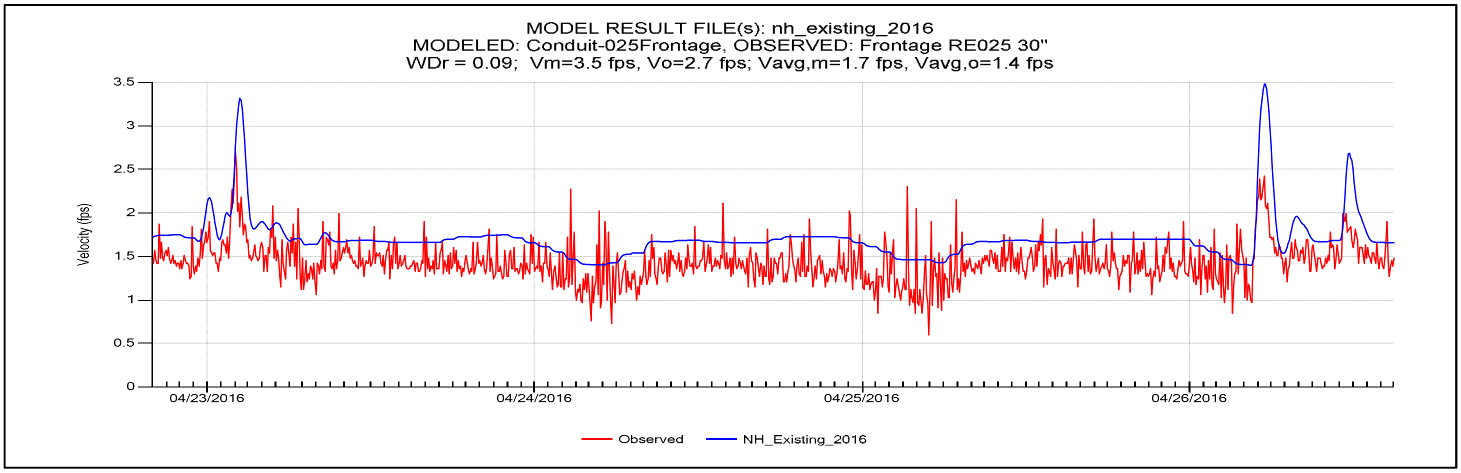


MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-025Frontage, OBSERVED: Frontage RE025 30"
WDr = 0.13; Vm=3.6 fps, Vo=2.8 fps; Vavg,m=1.8 fps, Vavg,o=1.5 fps

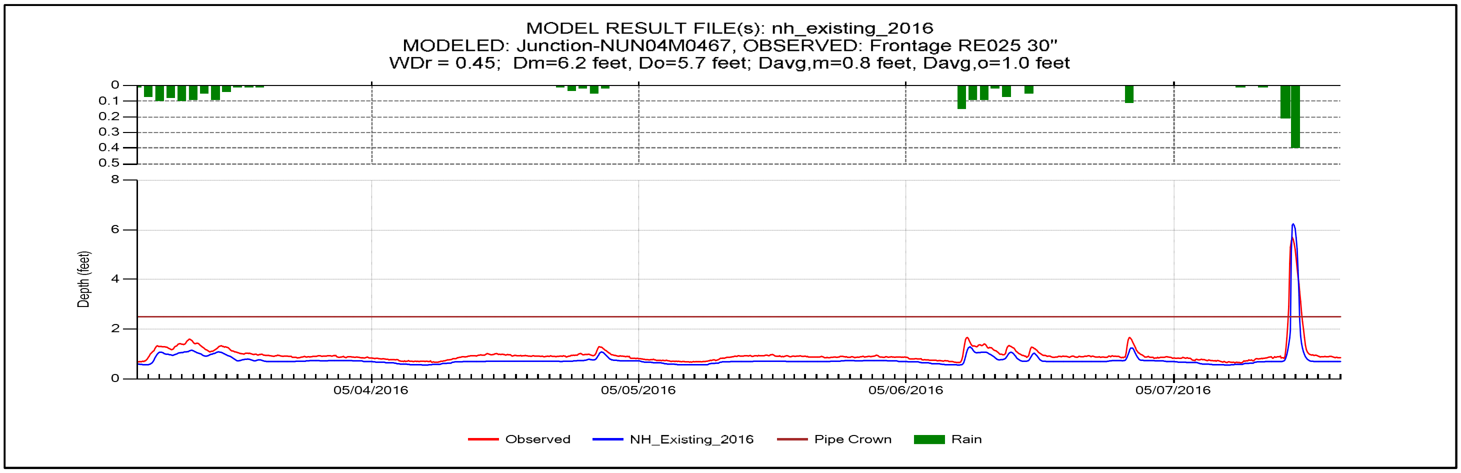
SwrFrontage-Spring2

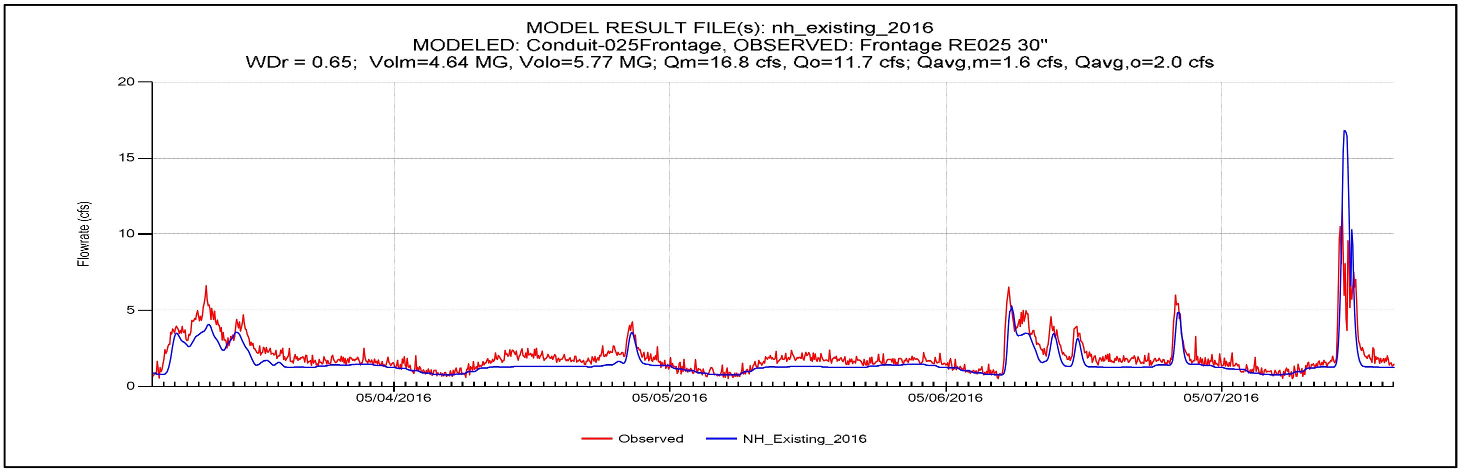


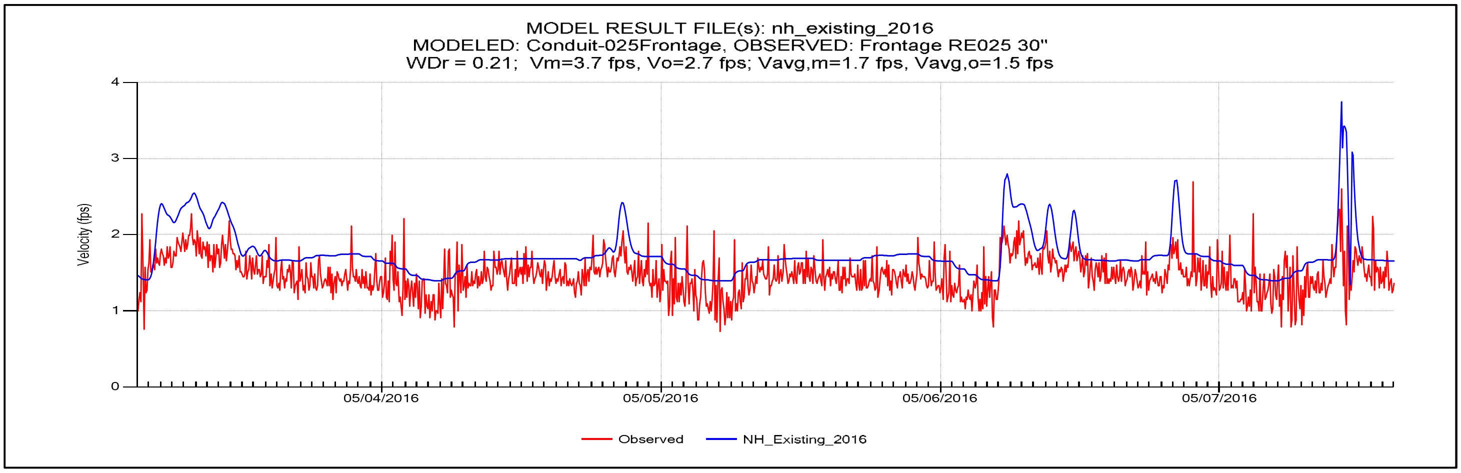




SwrFrontage-Spring3

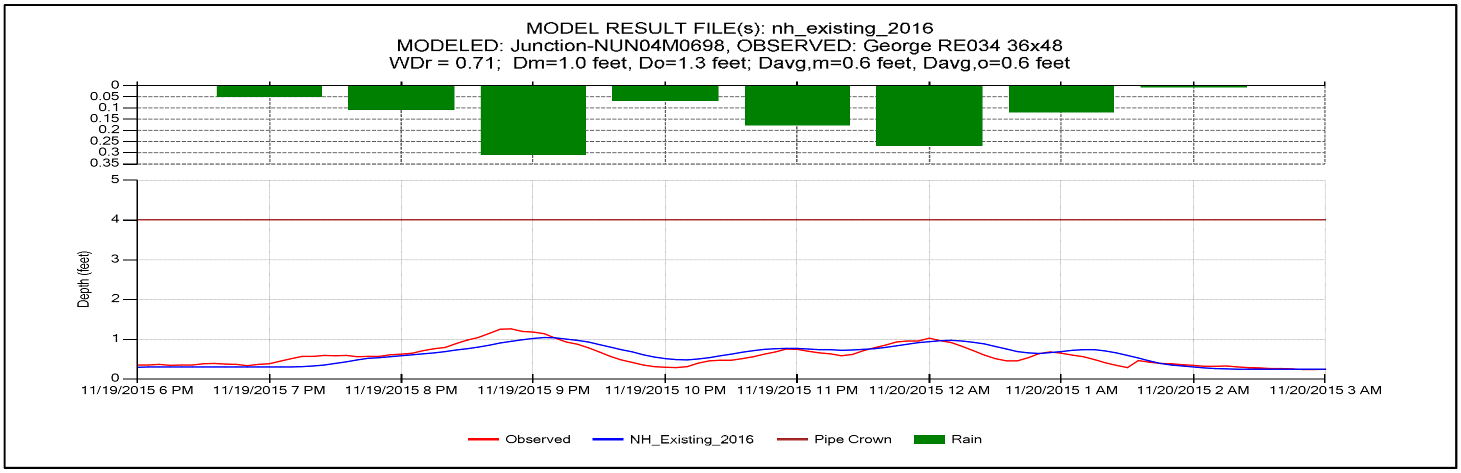


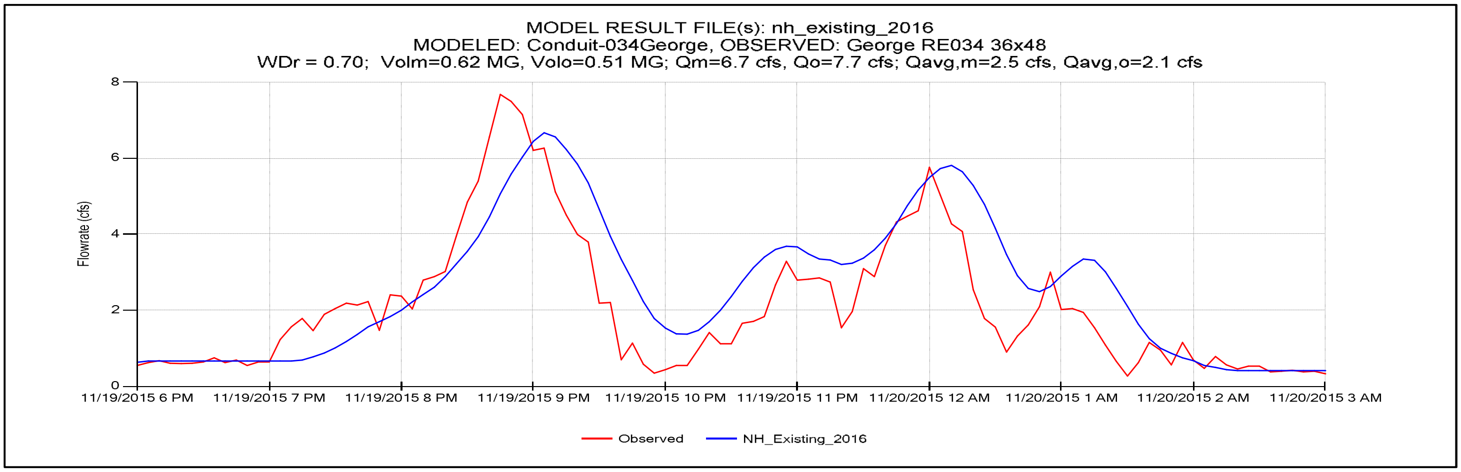


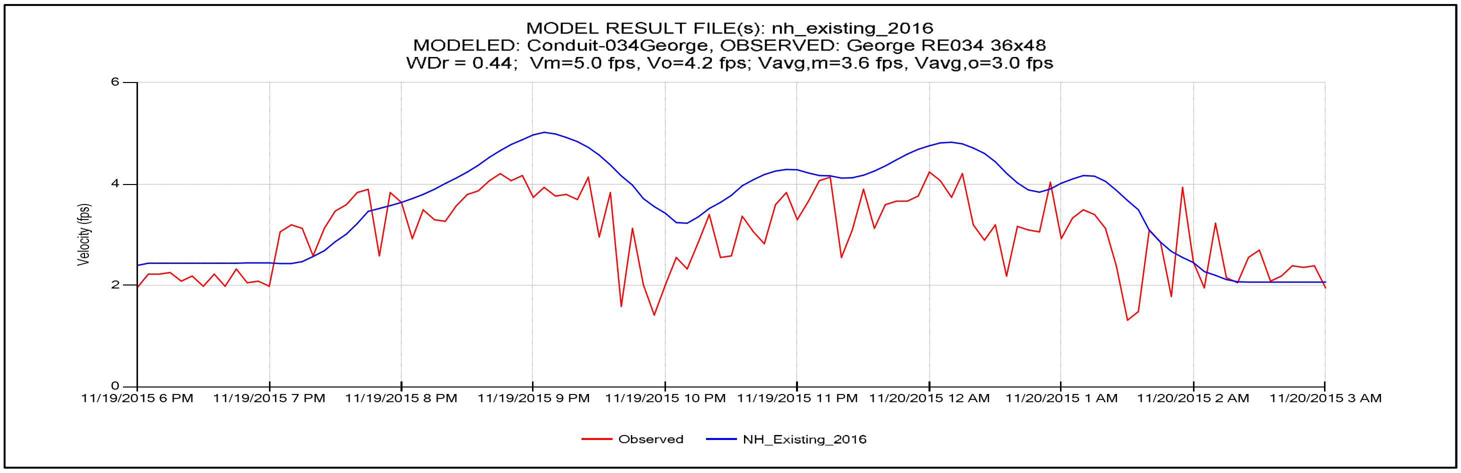


Simulated Versus Observed Flow at Flow Meter Sites

SwrGeorge-Fall1

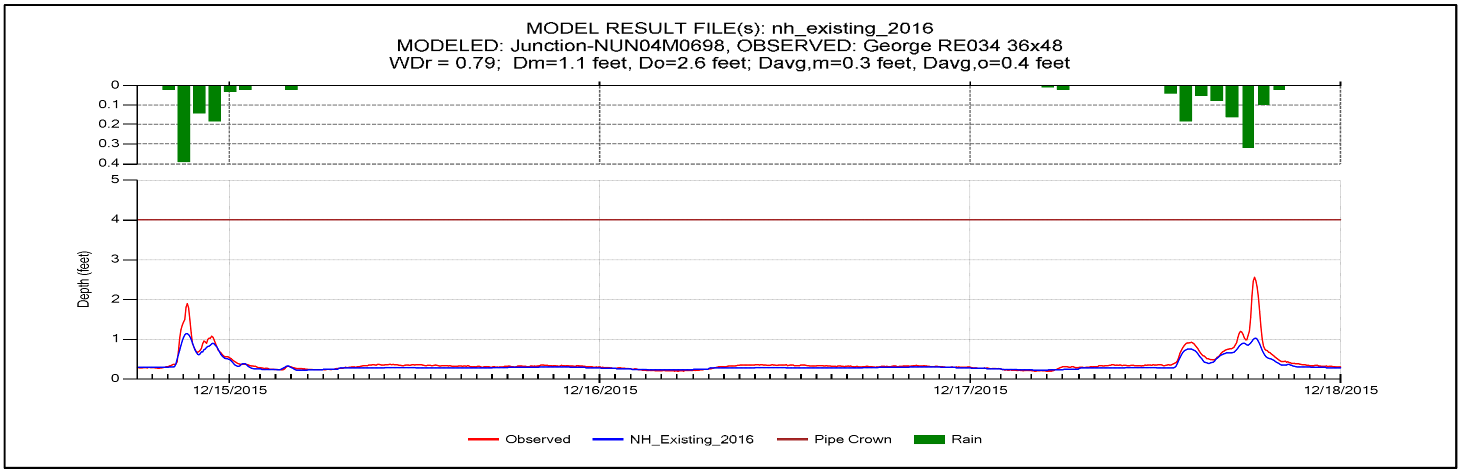


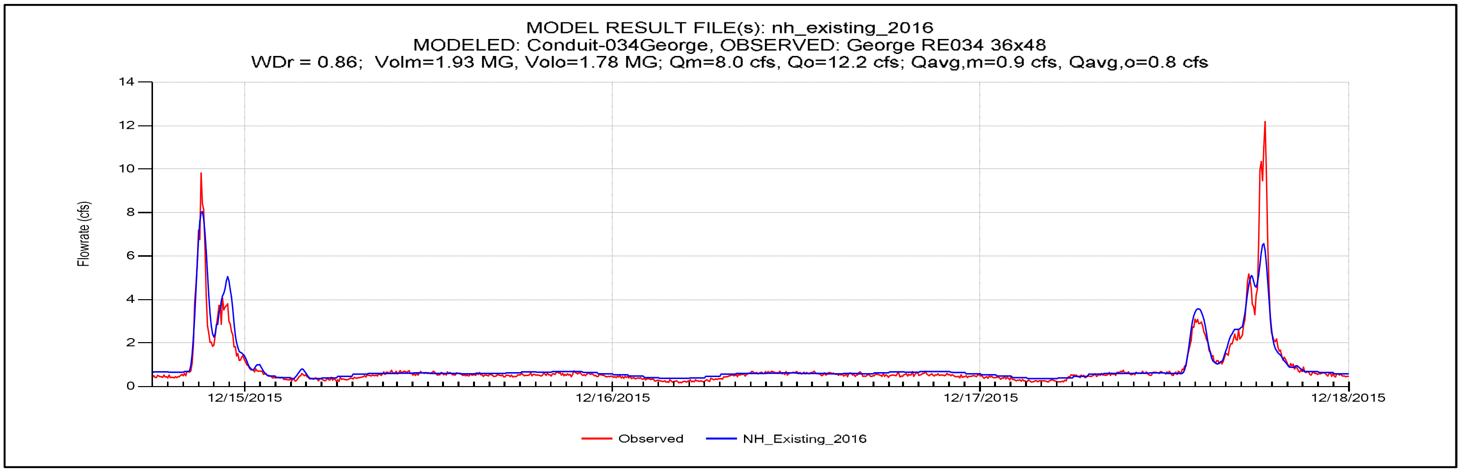


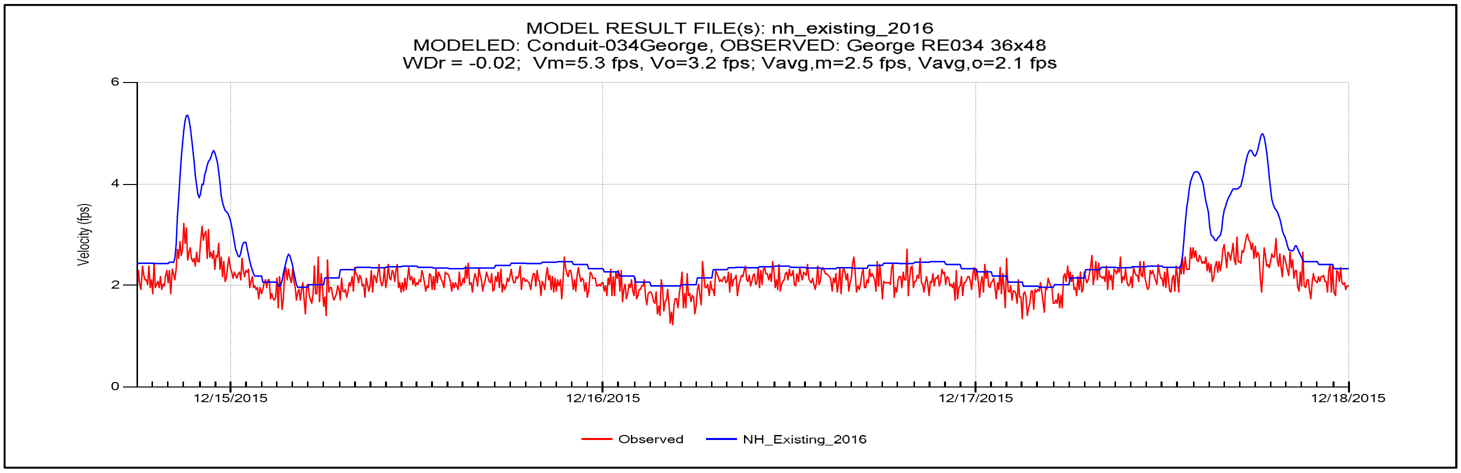


Simulated Versus Observed Flow at Flow Meter Sites

SwrGeorge-Fall2

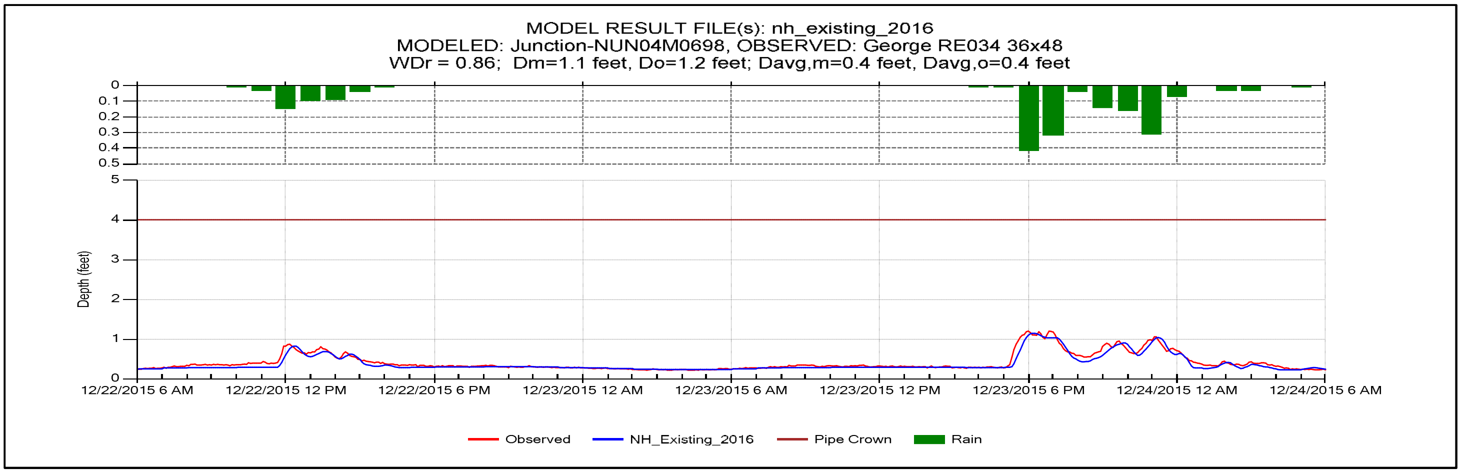


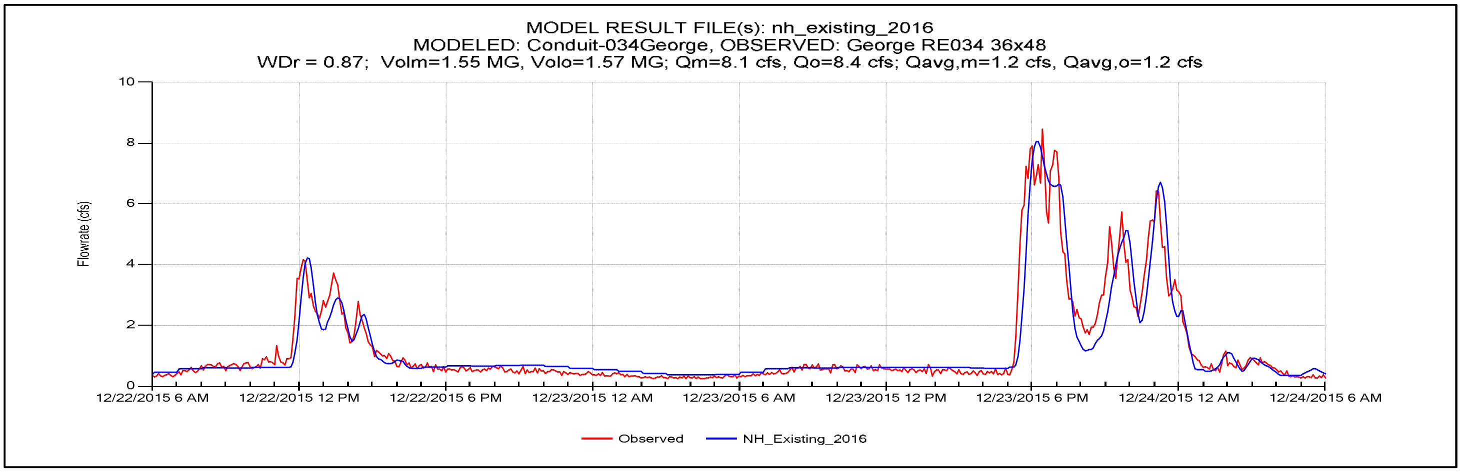


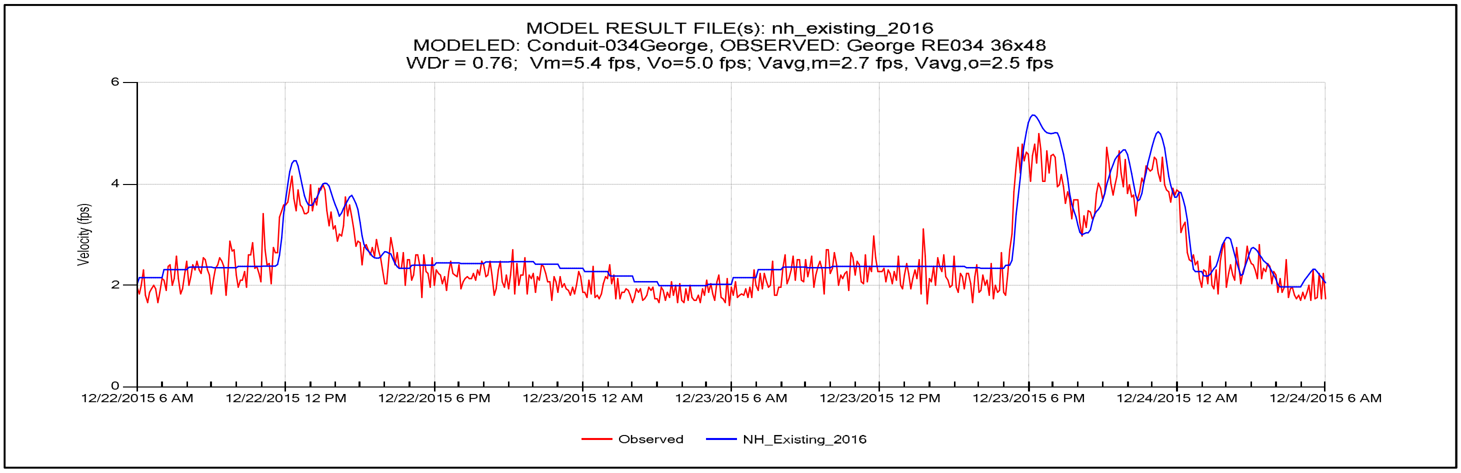


Simulated Versus Observed Flow at Flow Meter Sites

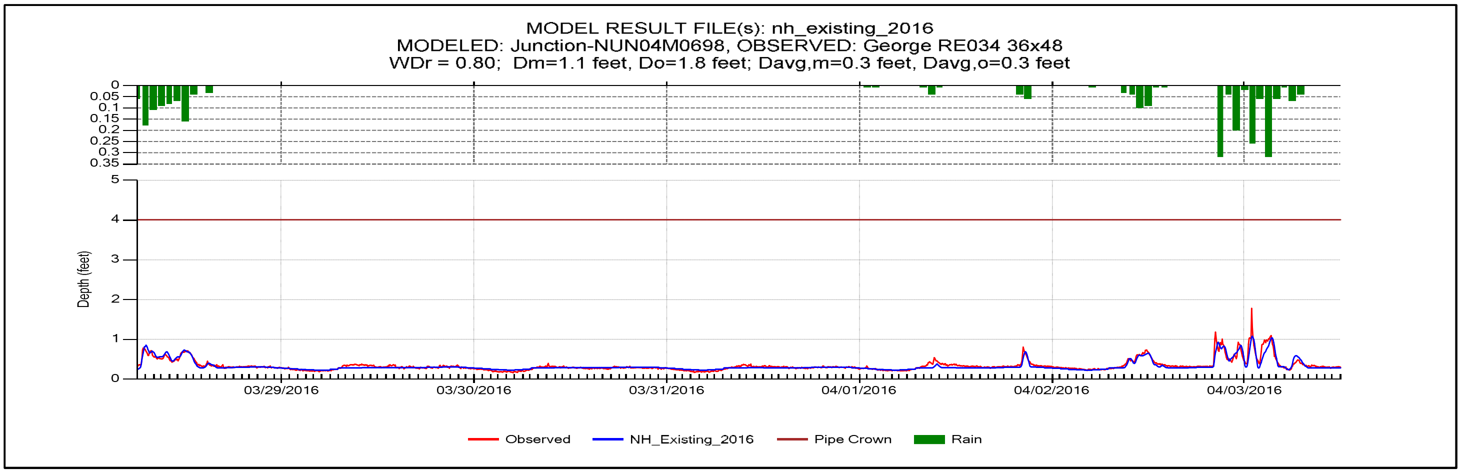
SwrGeorge-Fall3

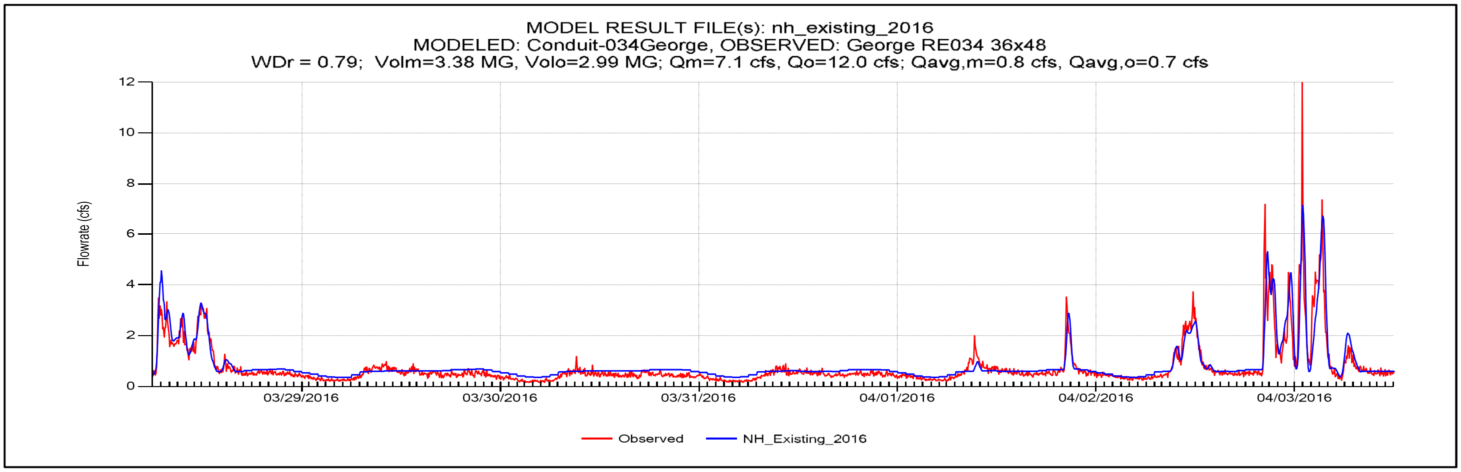


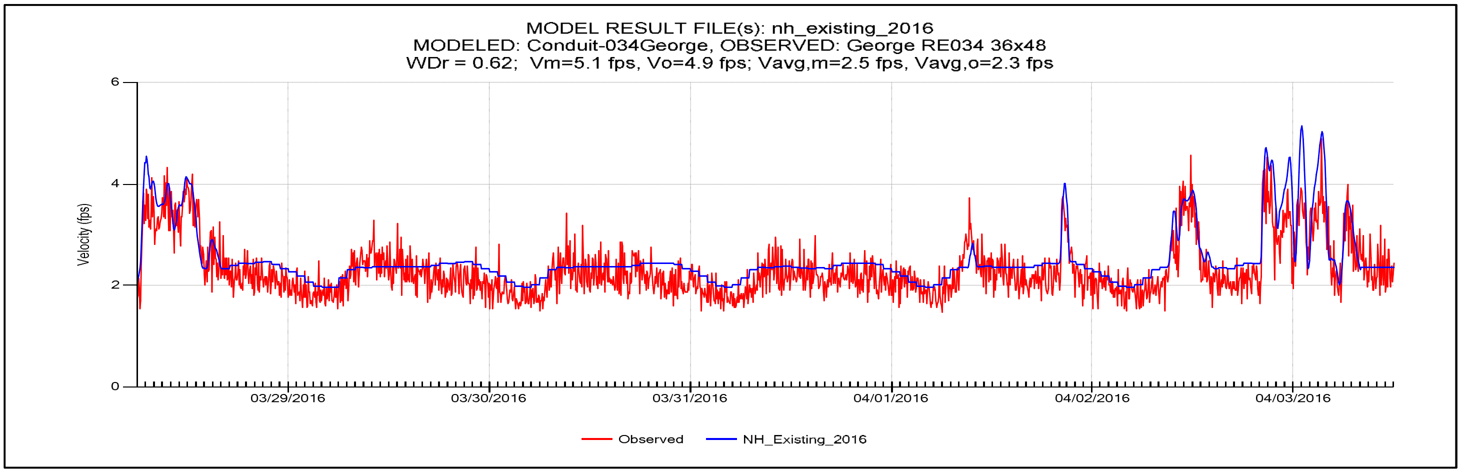




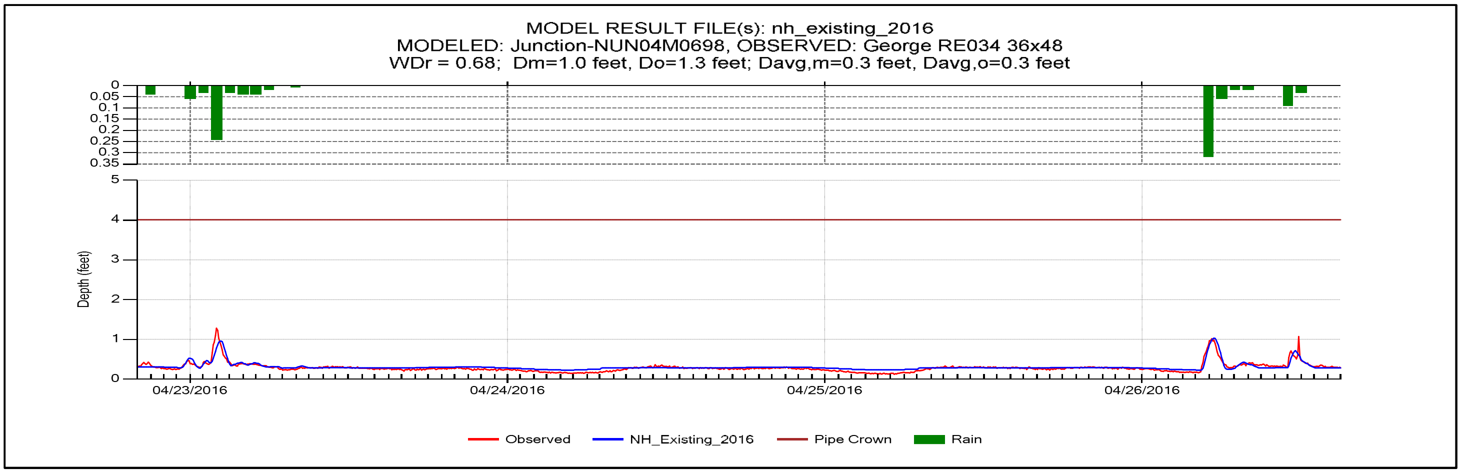
SwrGeorge-Spring1

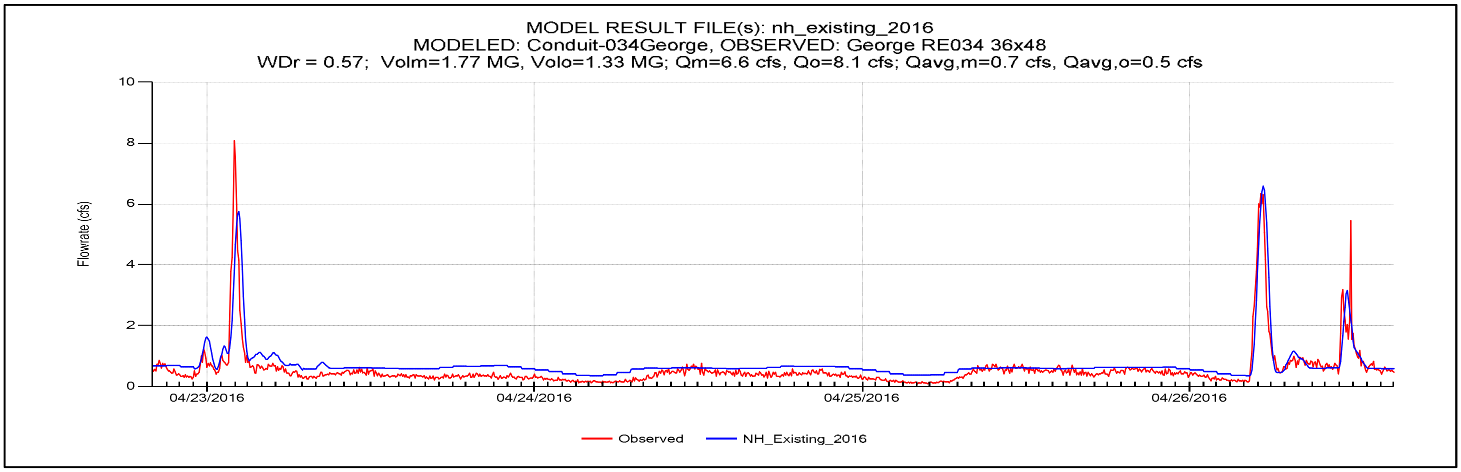

MODEL RESULT FILE(s): nh_existing_2016
MODELED: Junction-NUN04M0698, OBSERVED: George RE034 36x48
WDr = 0.80; Dm=1.1 feet, Do=1.8 feet; Davg,m=0.3 feet, Davg,o=0.3 feet

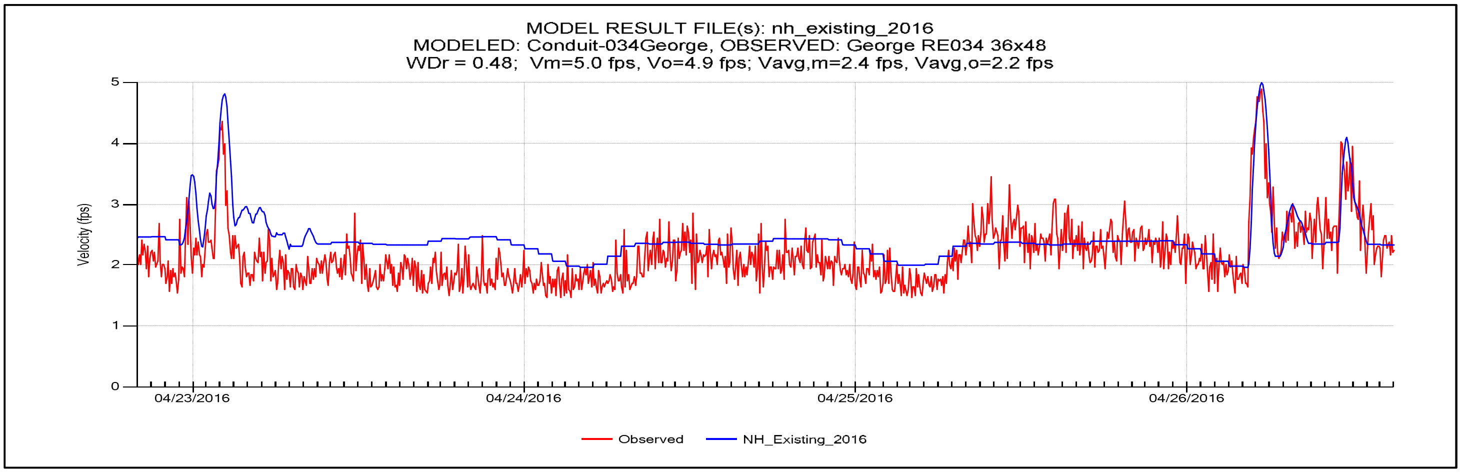

MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-034George, OBSERVED: George RE034 36x48
WDr = 0.79; Volm=3.38 MG, Volo=2.99 MG; Qm=7.1 cfs, Qo=12.0 cfs; Qavg,m=0.8 cfs, Qavg,o=0.7 cfs


MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-034George, OBSERVED: George RE034 36x48
WDr = 0.62; Vm=5.1 fps, Vo=4.9 fps; Vavg,m=2.5 fps, Vavg,o=2.3 fps

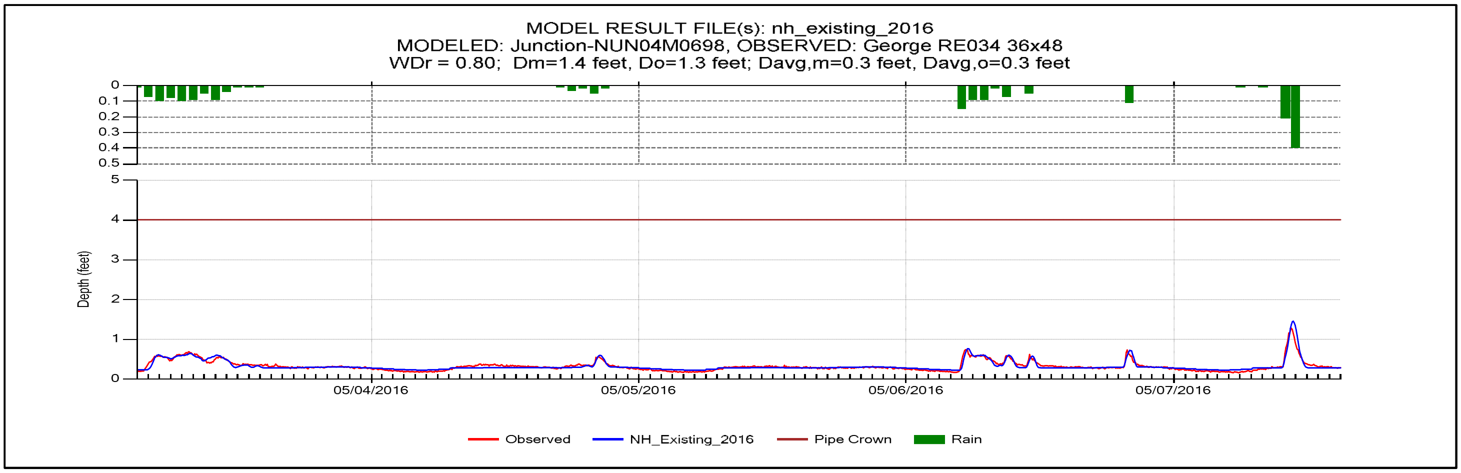
SwrGeorge-Spring2

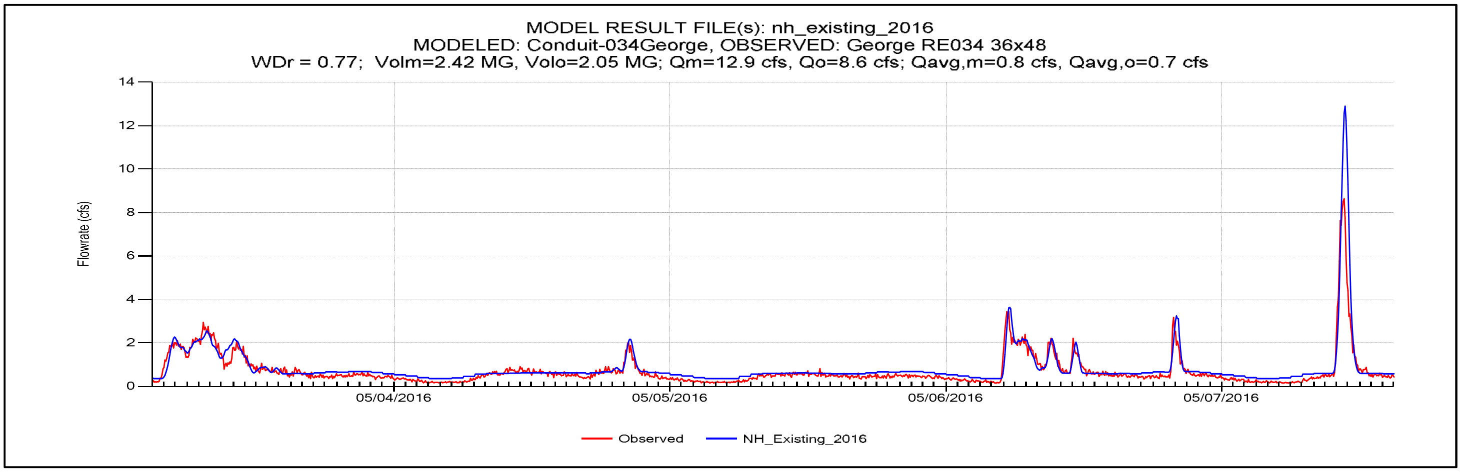


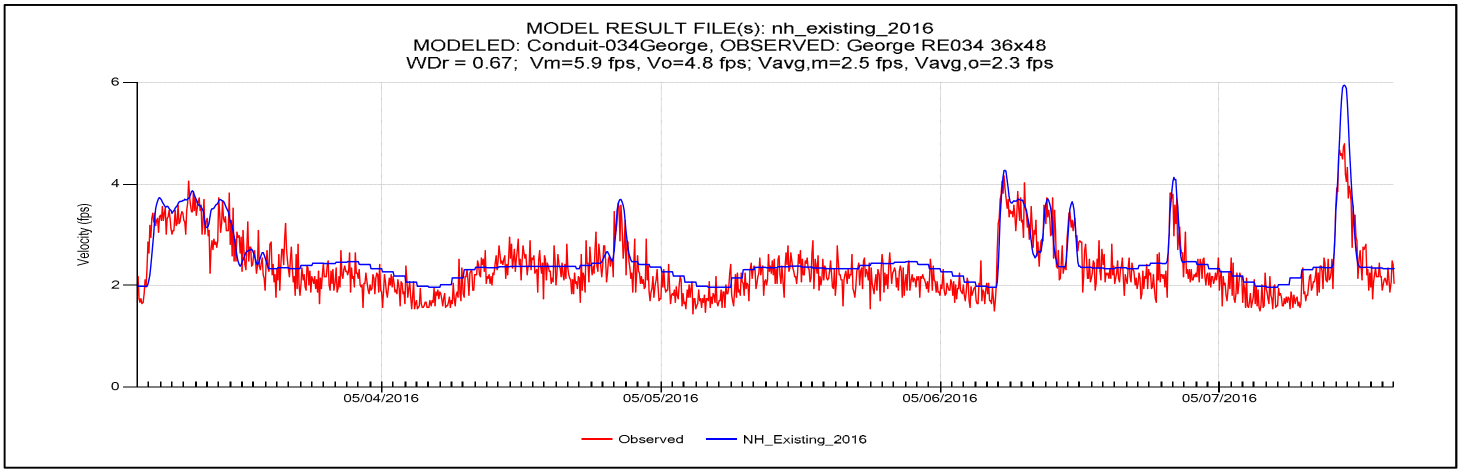




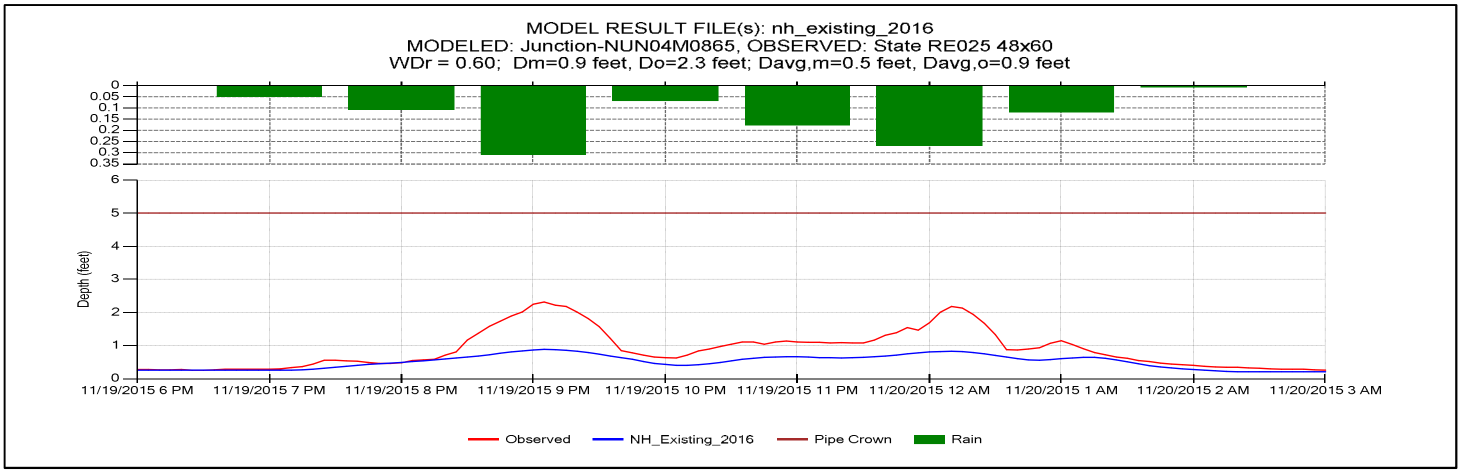
SwrGeorge-Spring3

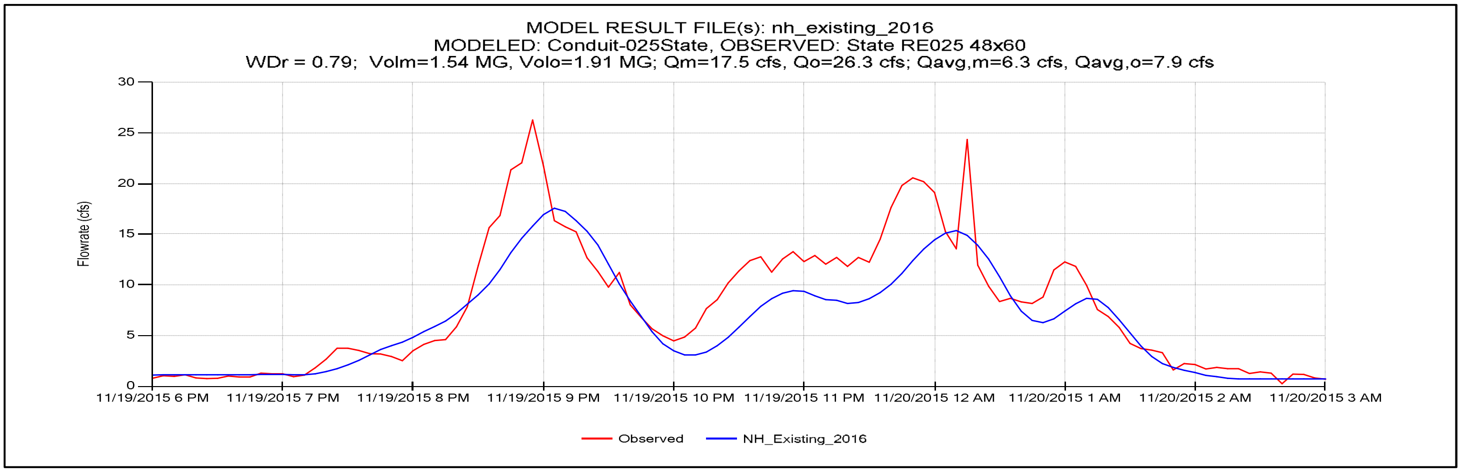


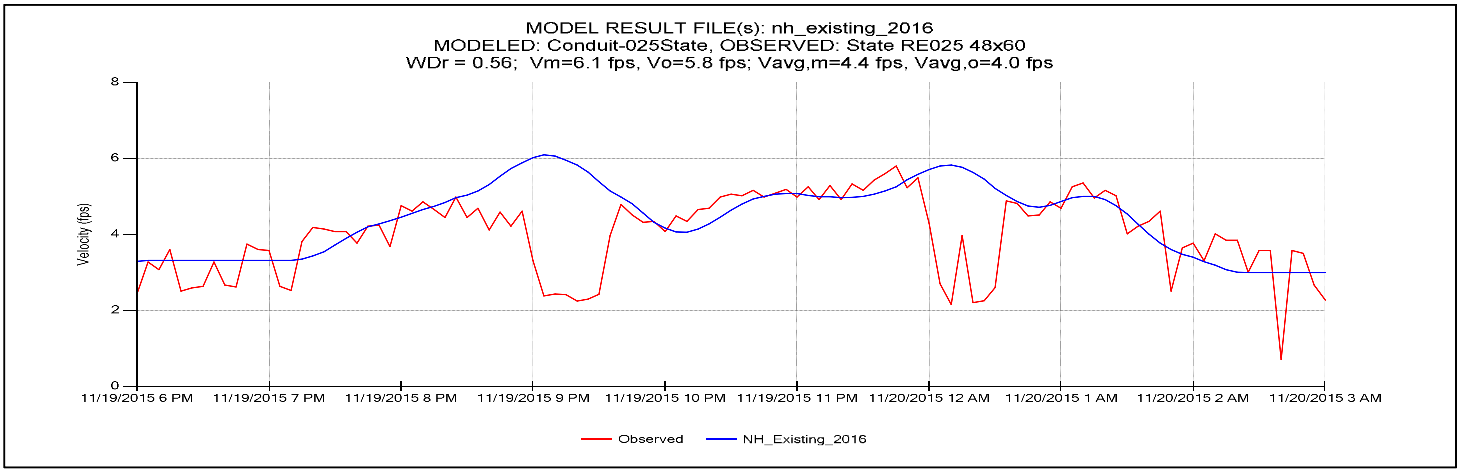




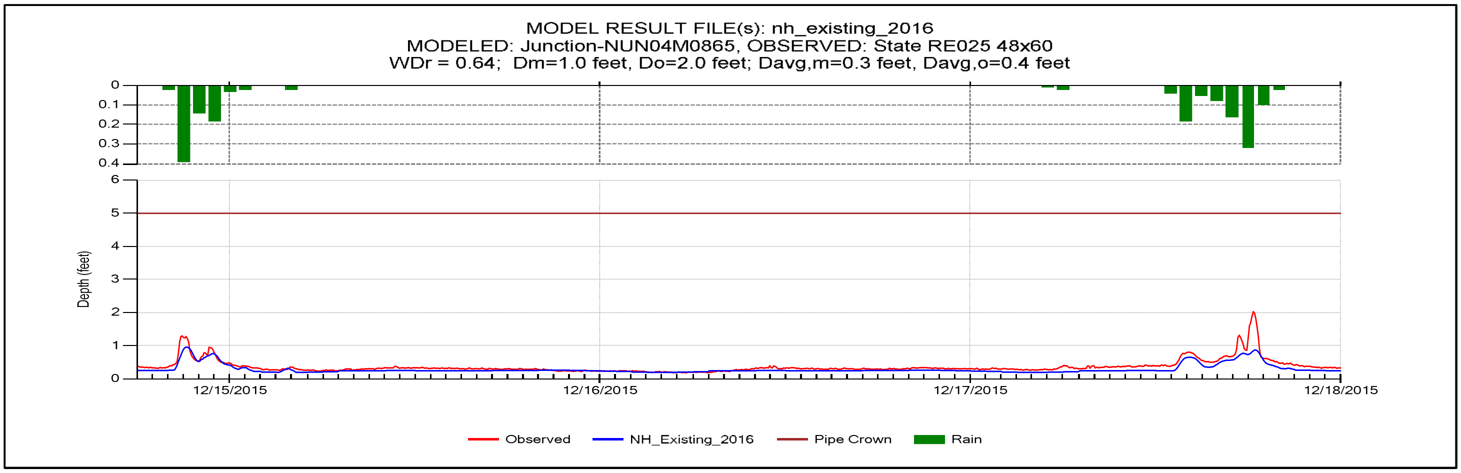
SwrState-Fall1

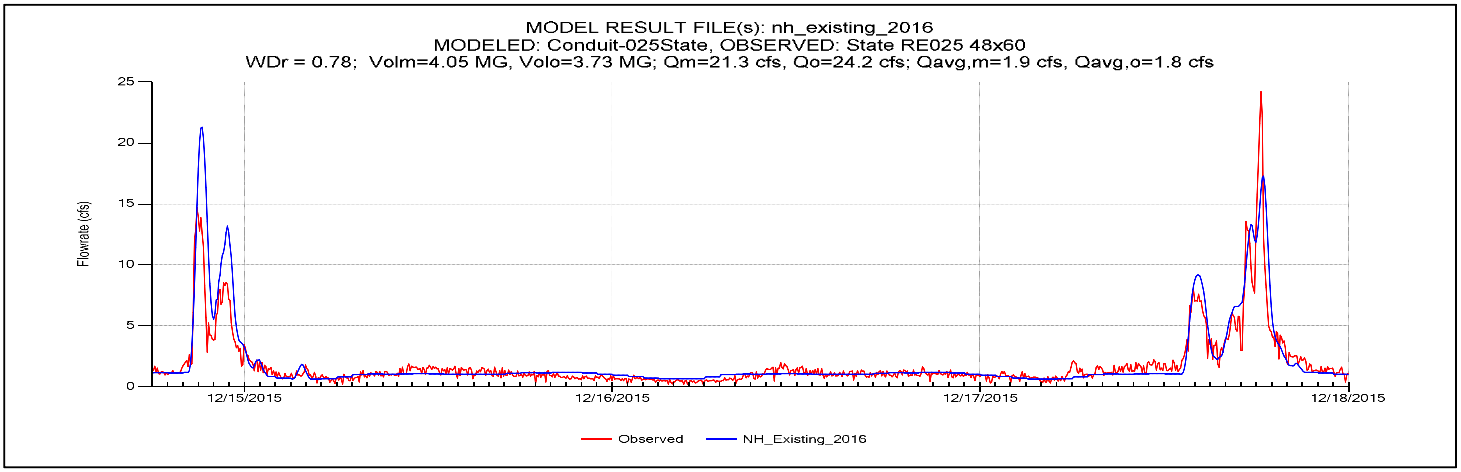


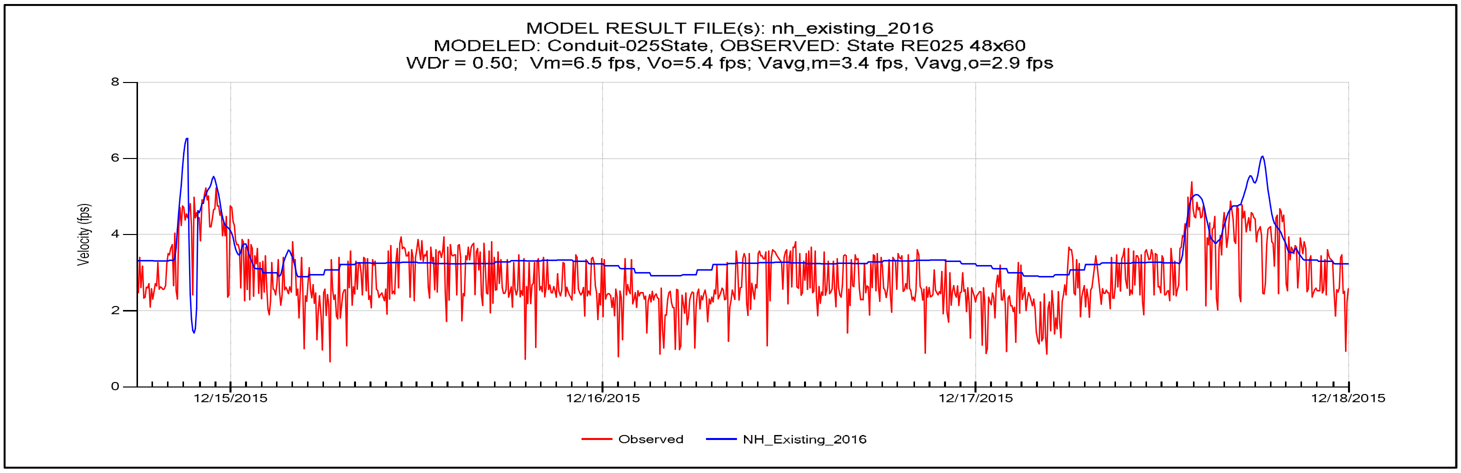




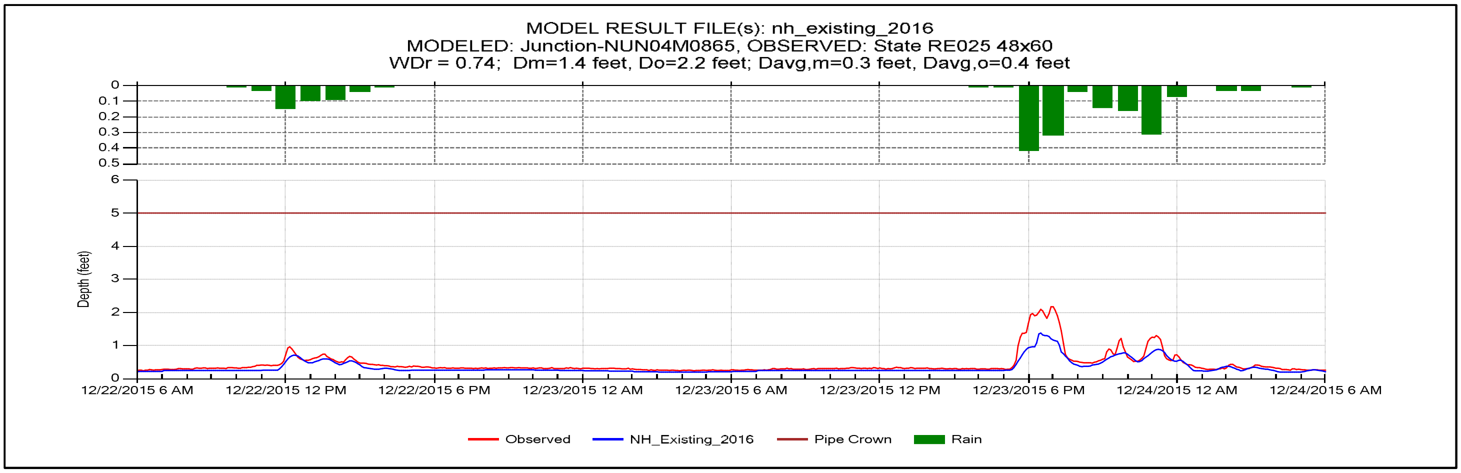
SwrState-Fall2

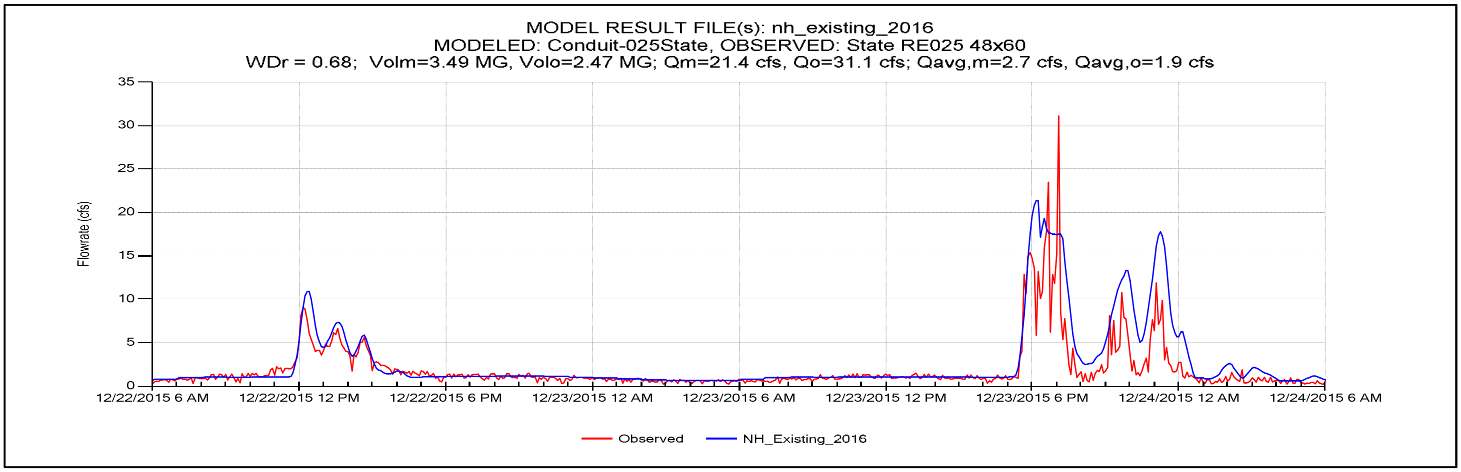


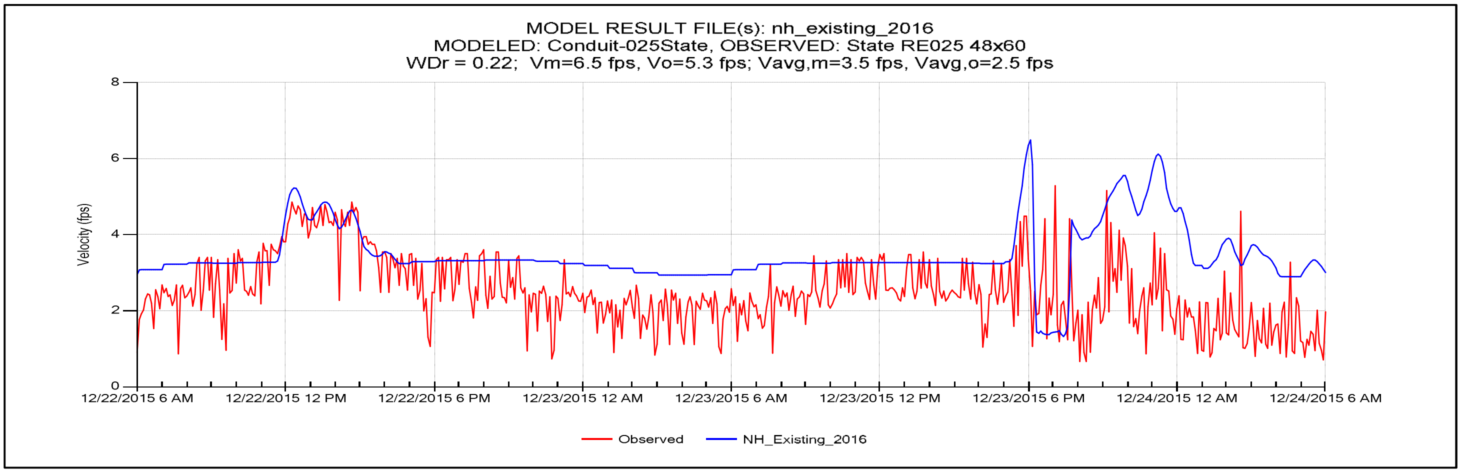




SwrState-Fall3

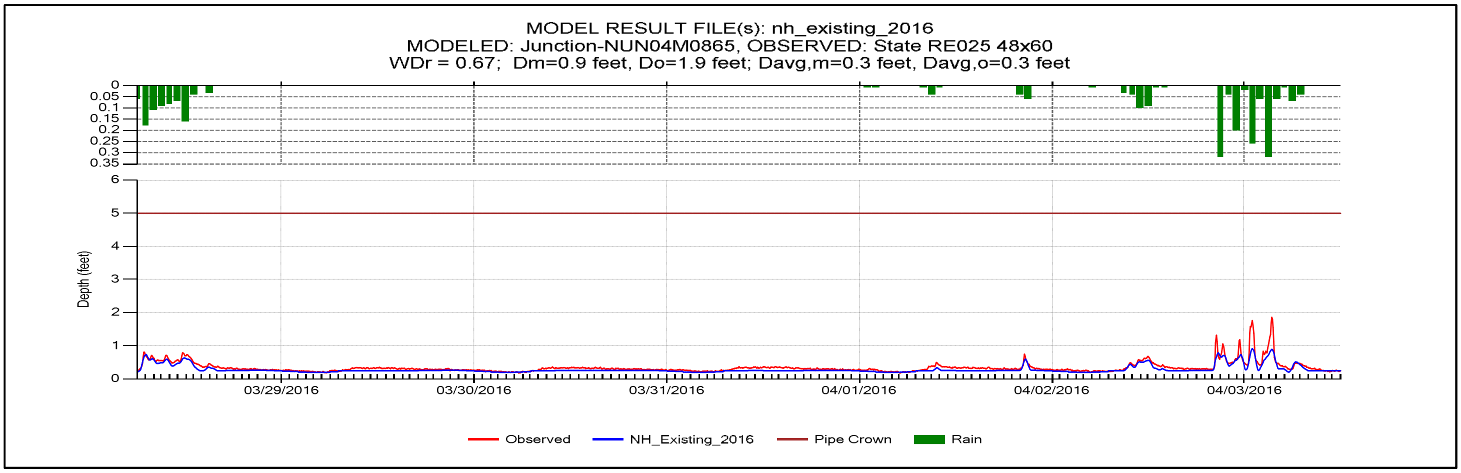


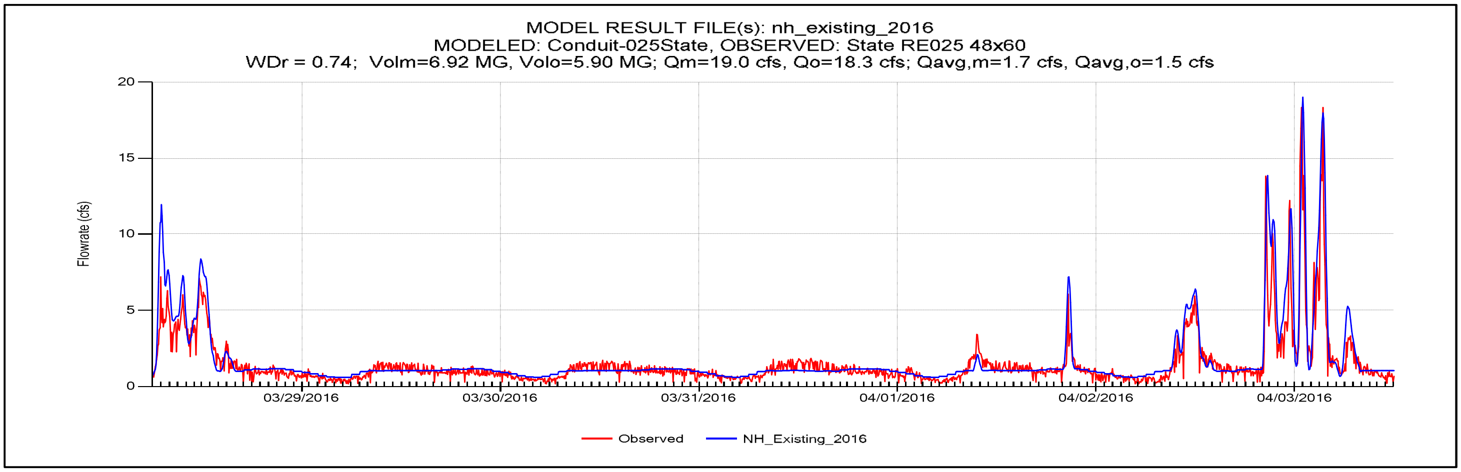


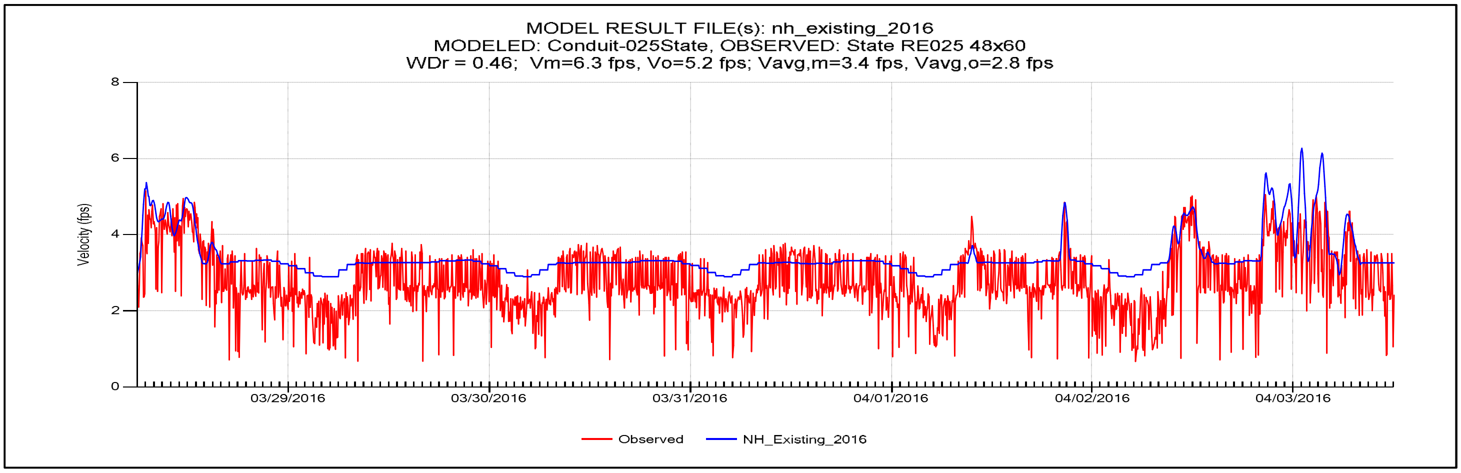


Simulated Versus Observed Flow at Flow Meter Sites

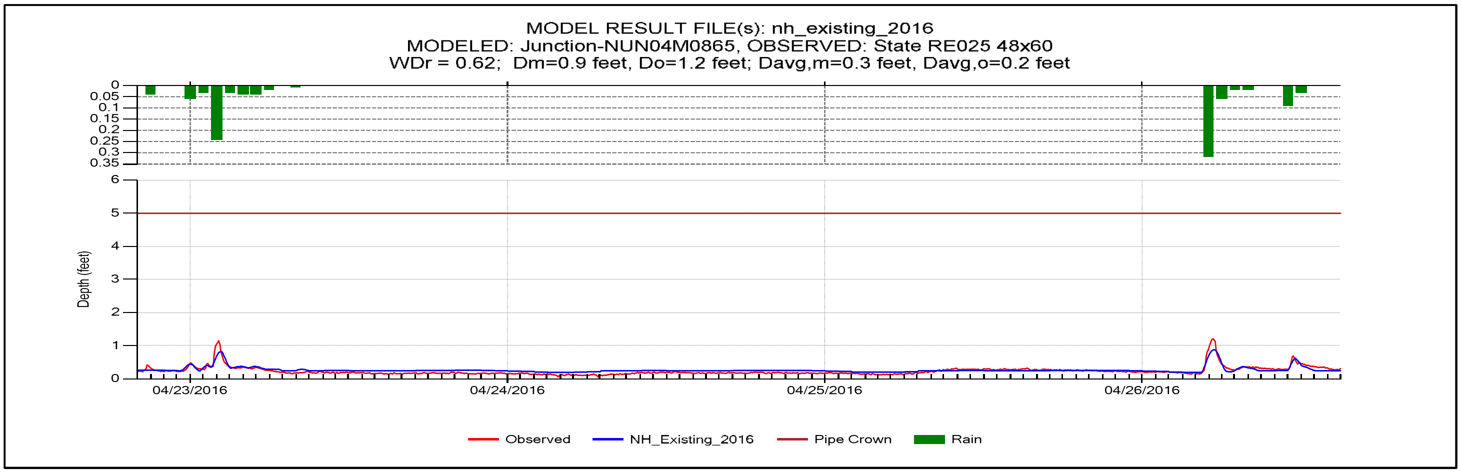
SwrState-Spring1



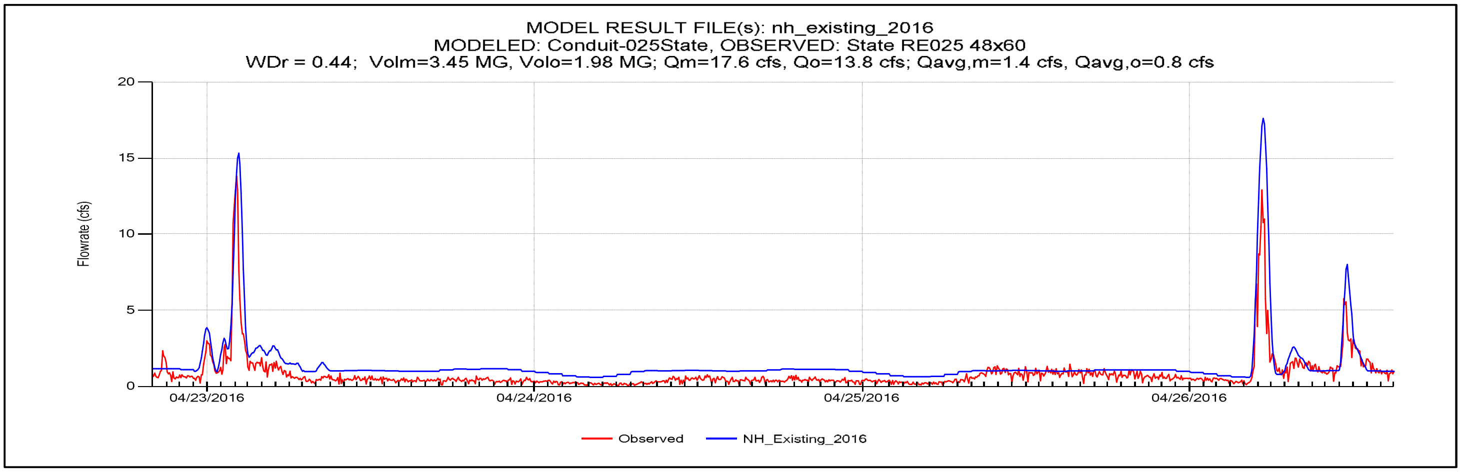




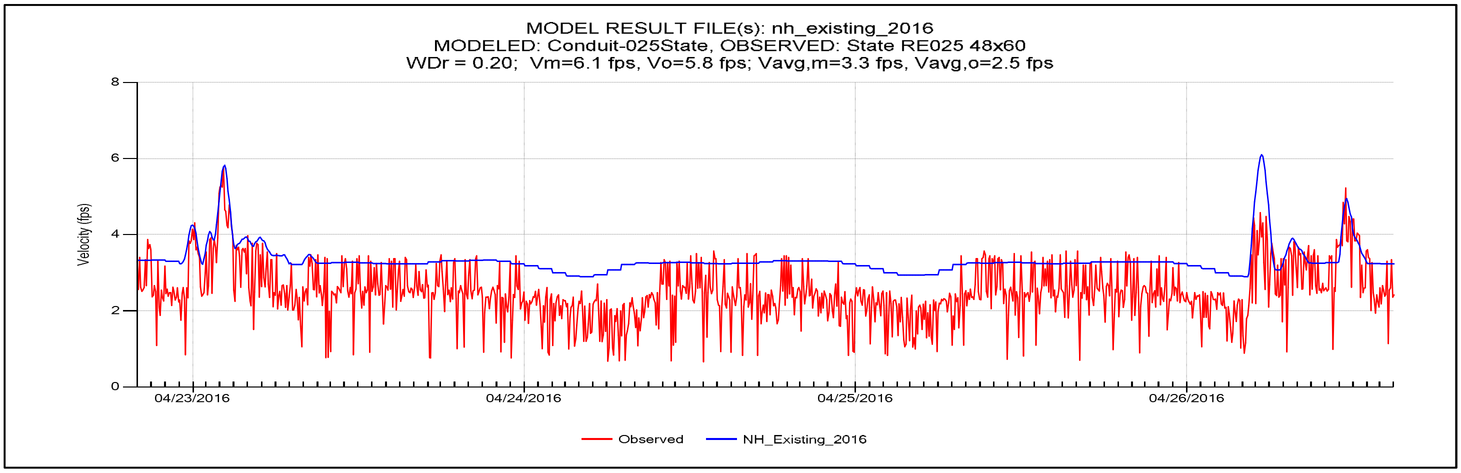
SwrState-Spring2



MODEL RESULT FILE(s): nh_existing_2016
MODELED: Junction-NUN04M0865, OBSERVED: State RE025 48x60
WDr = 0.62; Dm=0.9 feet, Do=1.2 feet; Davg,m=0.3 feet, Davg,o=0.2 feet

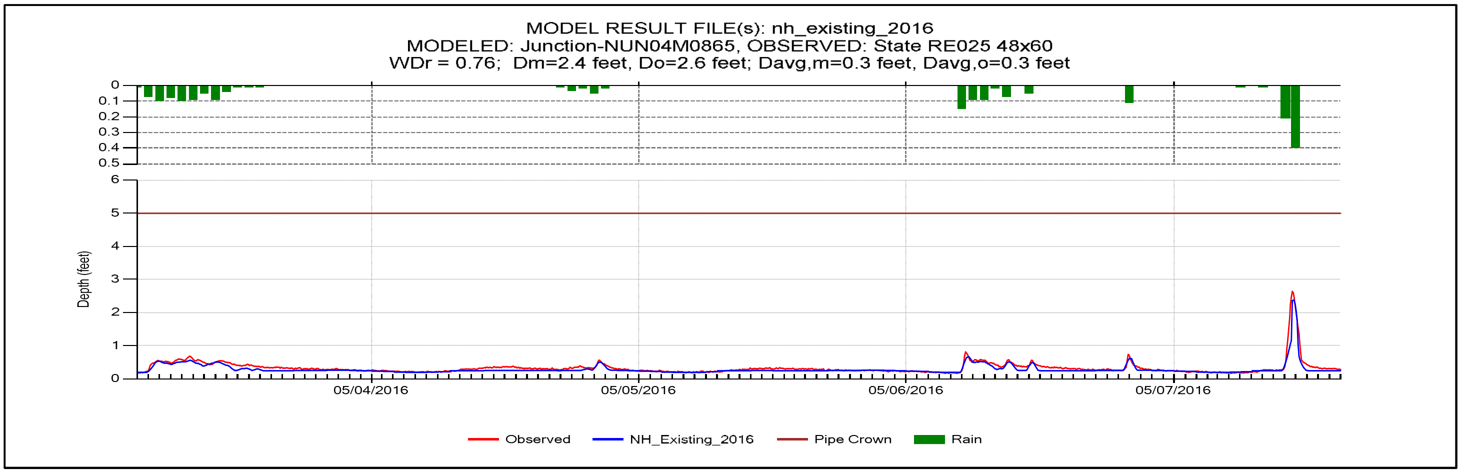


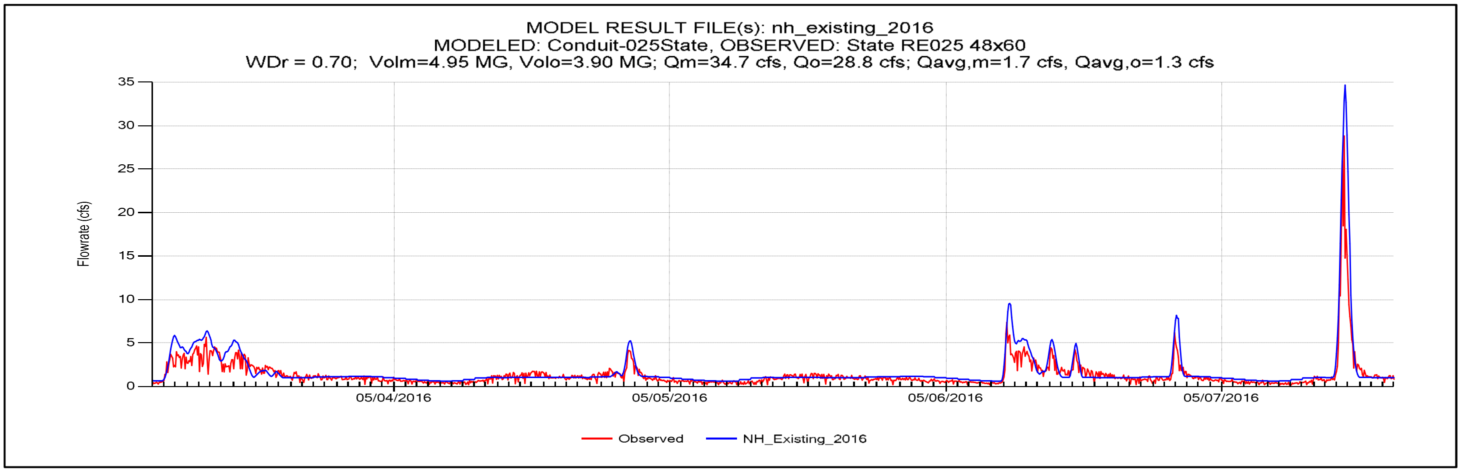
MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-025State, OBSERVED: State RE025 48x60
WDr = 0.44; Volm=3.45 MG, Volo=1.98 MG; Qm=17.6 cfs, Qo=13.8 cfs; Qavg,m=1.4 cfs, Qavg,o=0.8 cfs

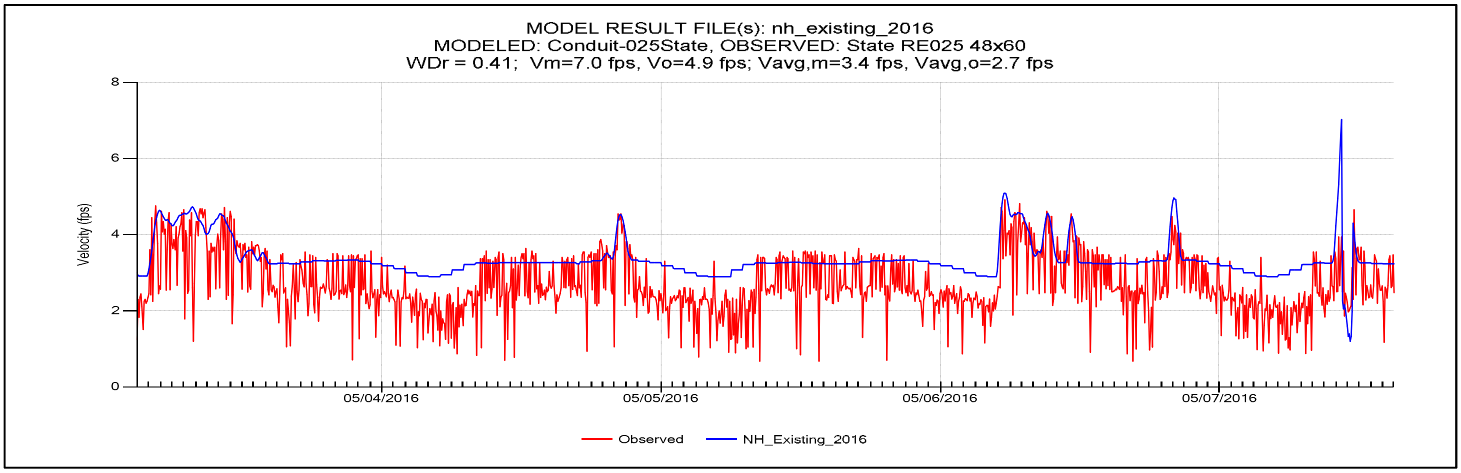


MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-025State, OBSERVED: State RE025 48x60
WDr = 0.20; Vm=6.1 fps, Vo=5.8 fps; Vavg,m=3.3 fps, Vavg,o=2.5 fps

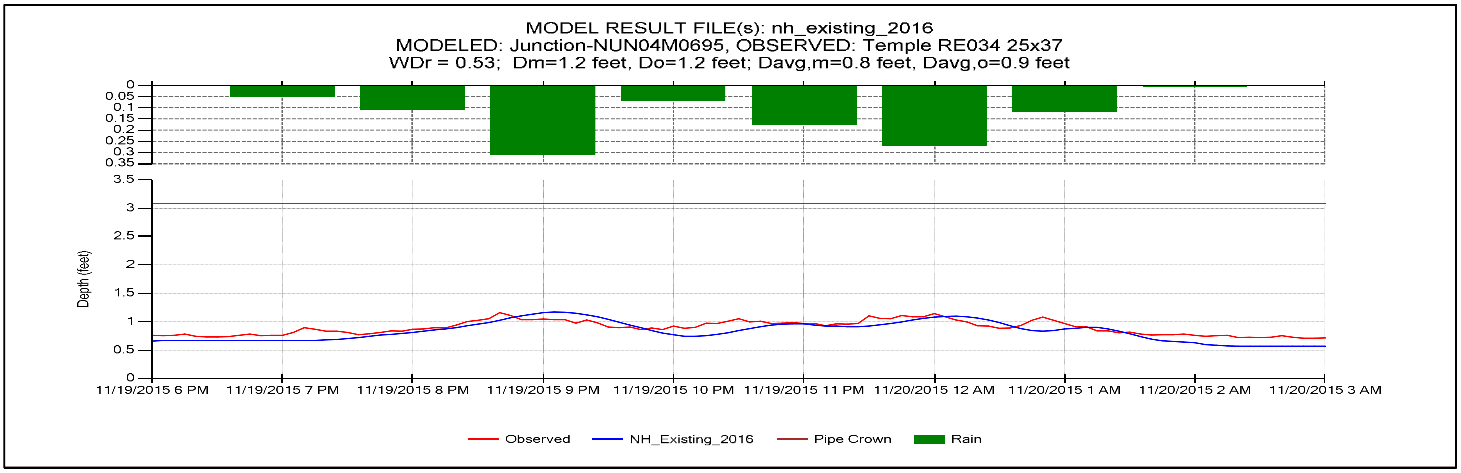
SwrState-Spring3



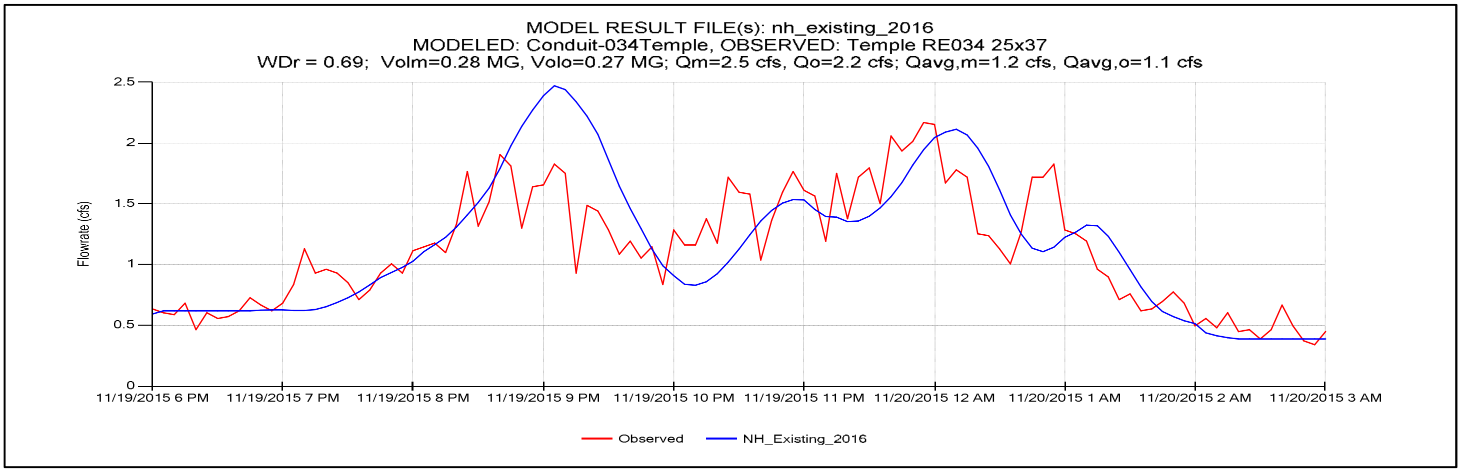




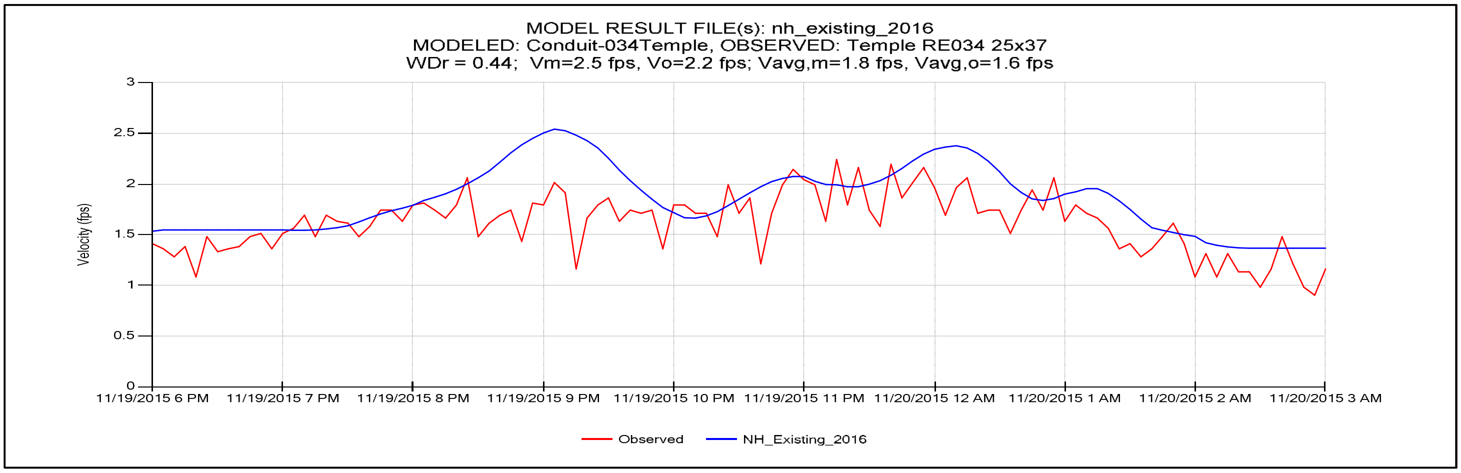
SwrTemple-Fall1



MODEL RESULT FILE(s): nh_existing_2016
MODELED: Junction-NUN04M0695, OBSERVED: Temple RE034 25x37
WDr = 0.53; Dm=1.2 feet, Do=1.2 feet; Davg,m=0.8 feet, Davg,o=0.9 feet

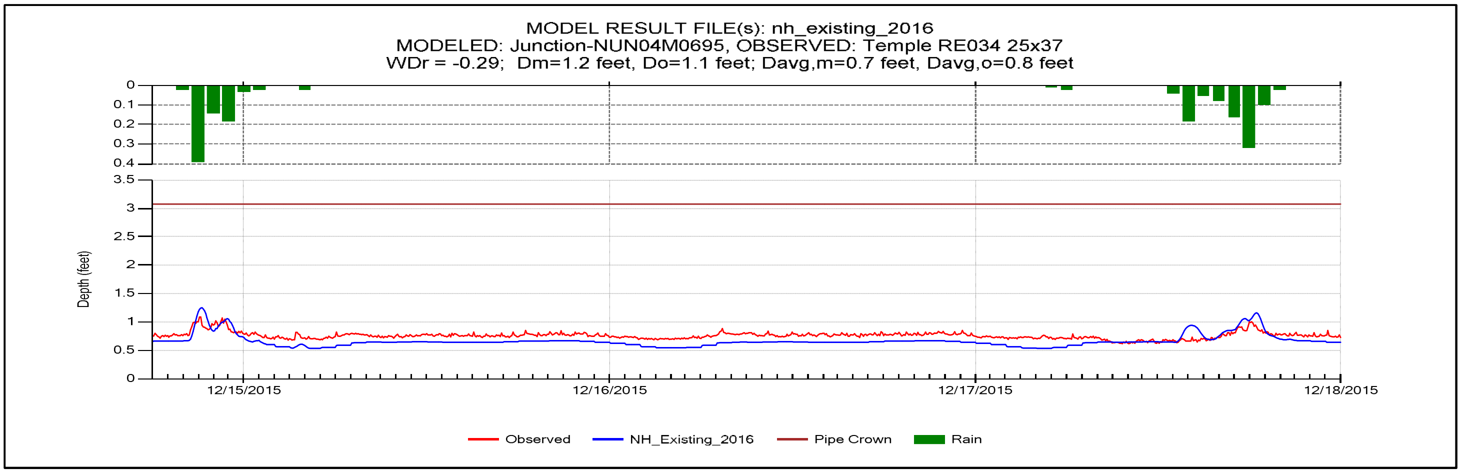


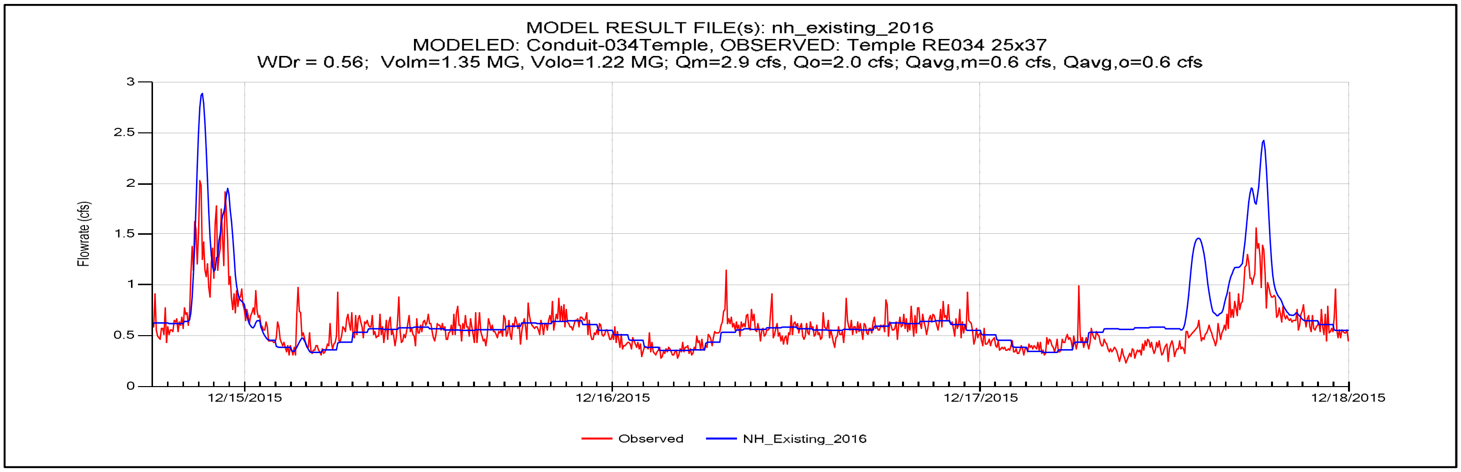
MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-034Temple, OBSERVED: Temple RE034 25x37
WDr = 0.69; Volm=0.28 MG, Volo=0.27 MG; Qm=2.5 cfs, Qo=2.2 cfs; Qavg,m=1.2 cfs, Qavg,o=1.1 cfs

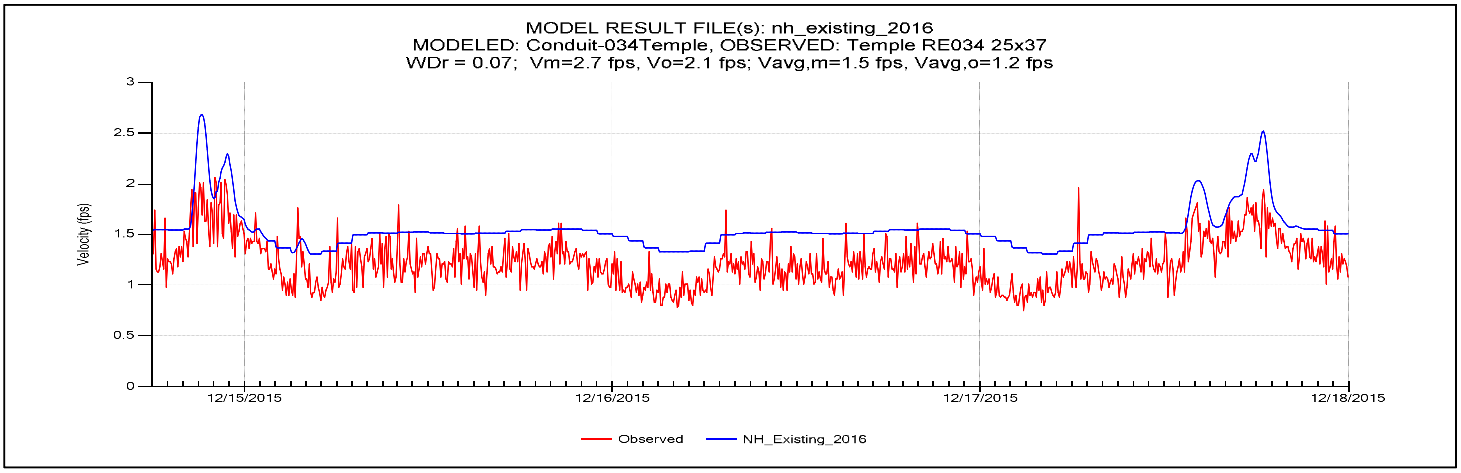


MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-034Temple, OBSERVED: Temple RE034 25x37
WDr = 0.44; Vm=2.5 fps, Vo=2.2 fps; Vavg,m=1.8 fps, Vavg,o=1.6 fps

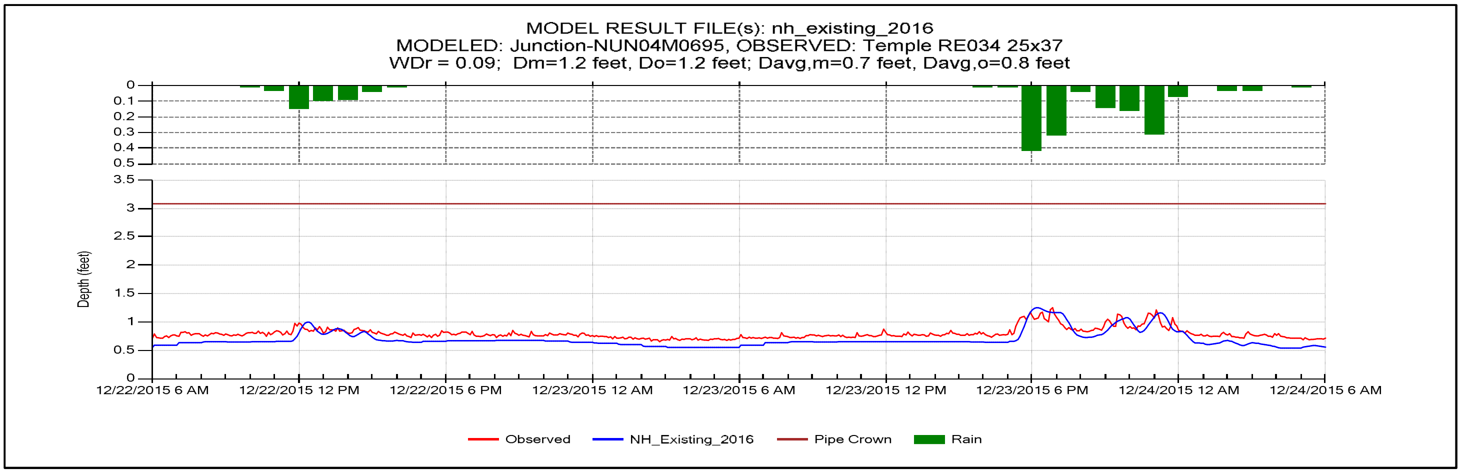
SwrTemple-Fall2

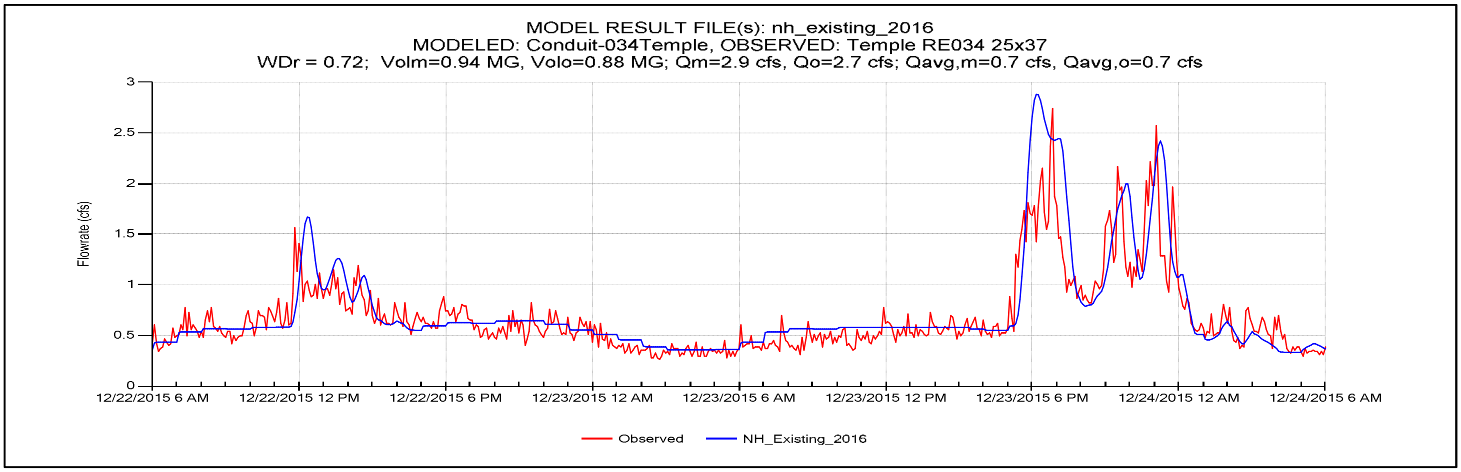


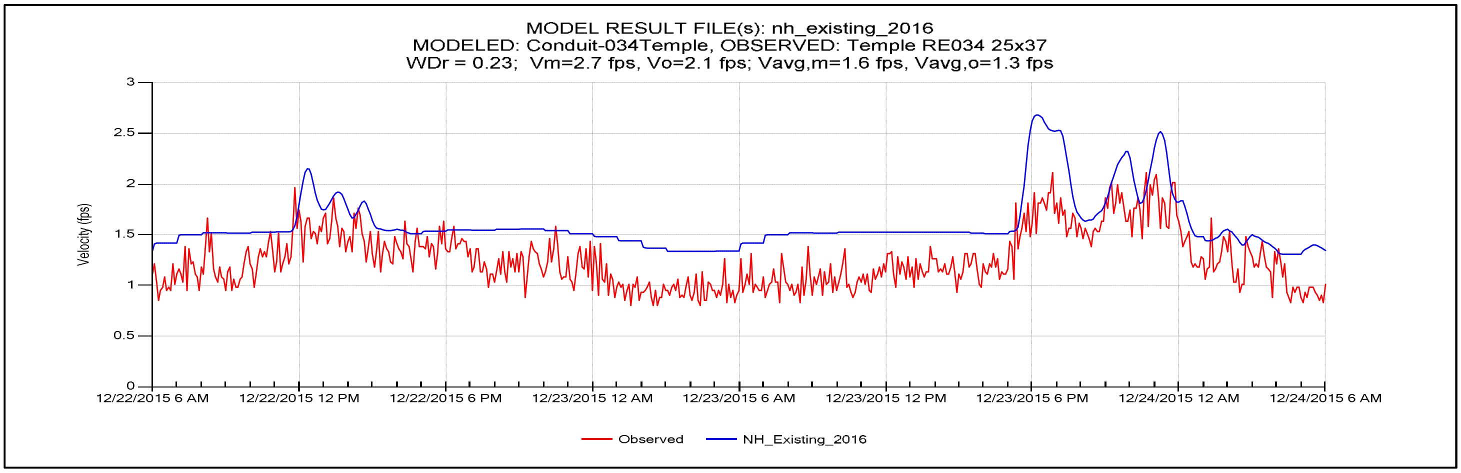




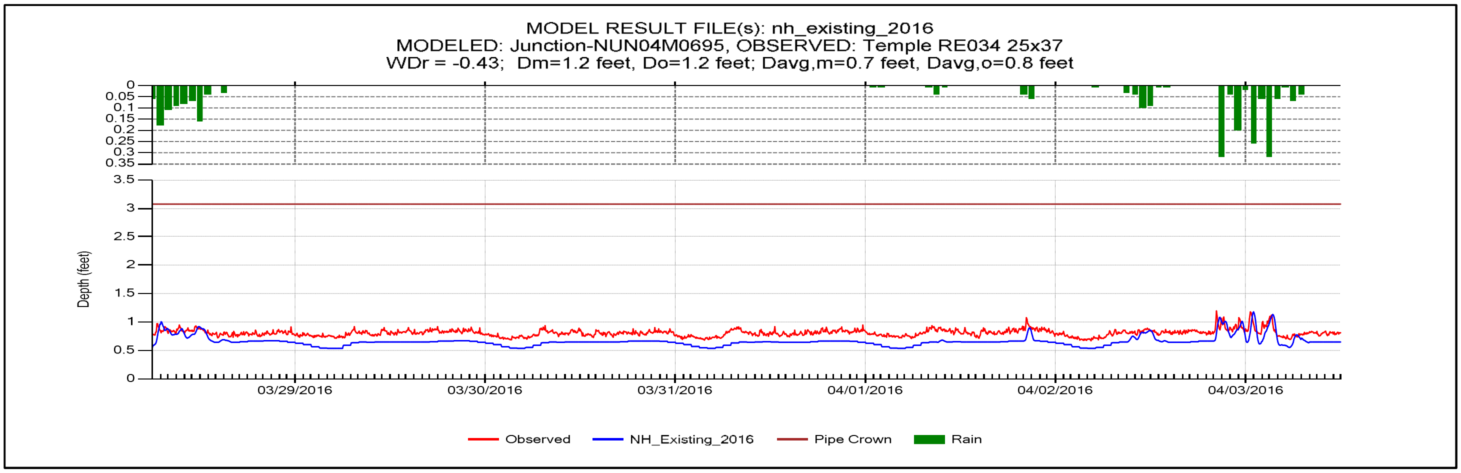
SwrTemple-Fall3

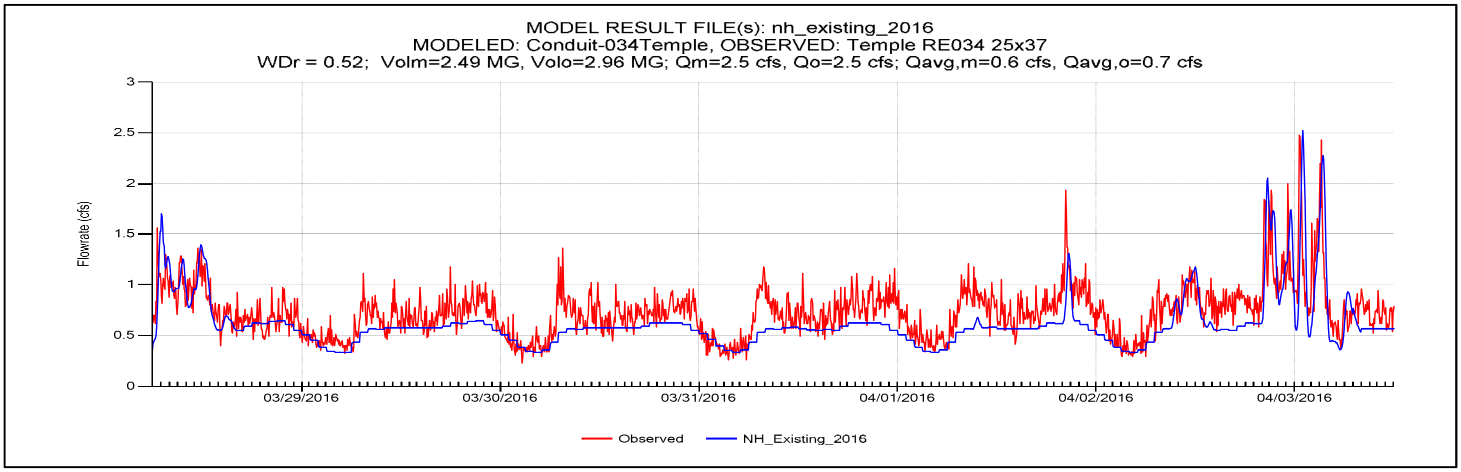


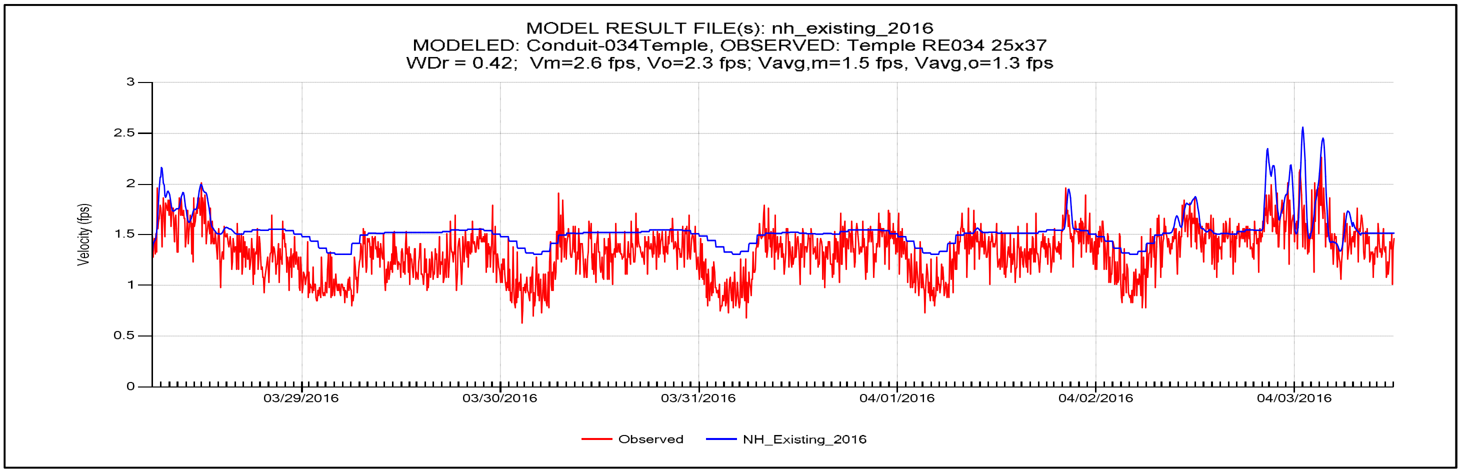




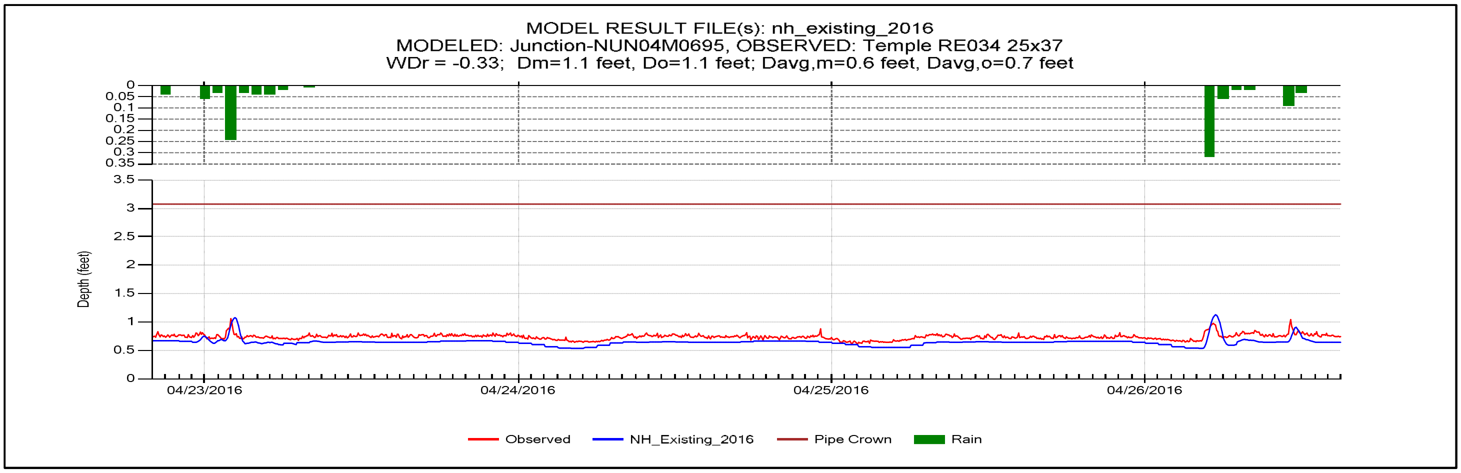
SwrTemple-Spring1

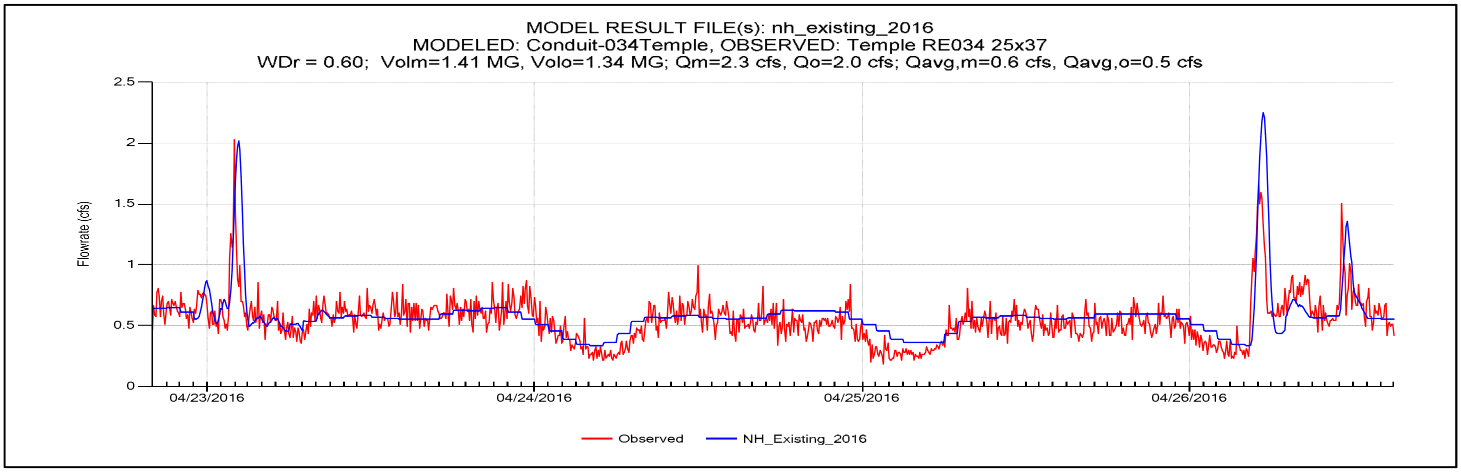


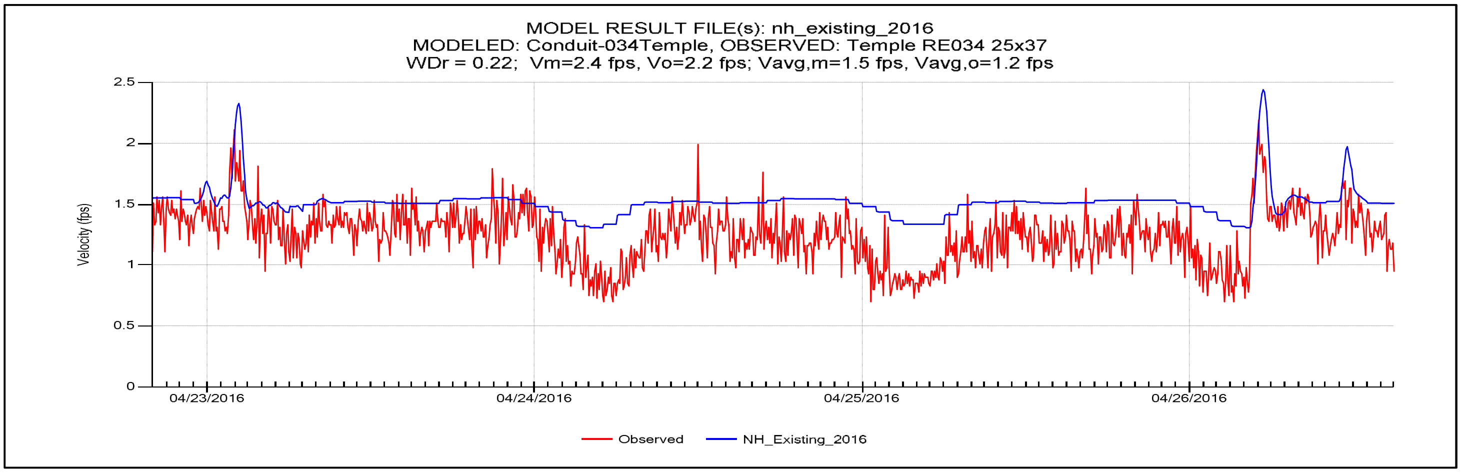




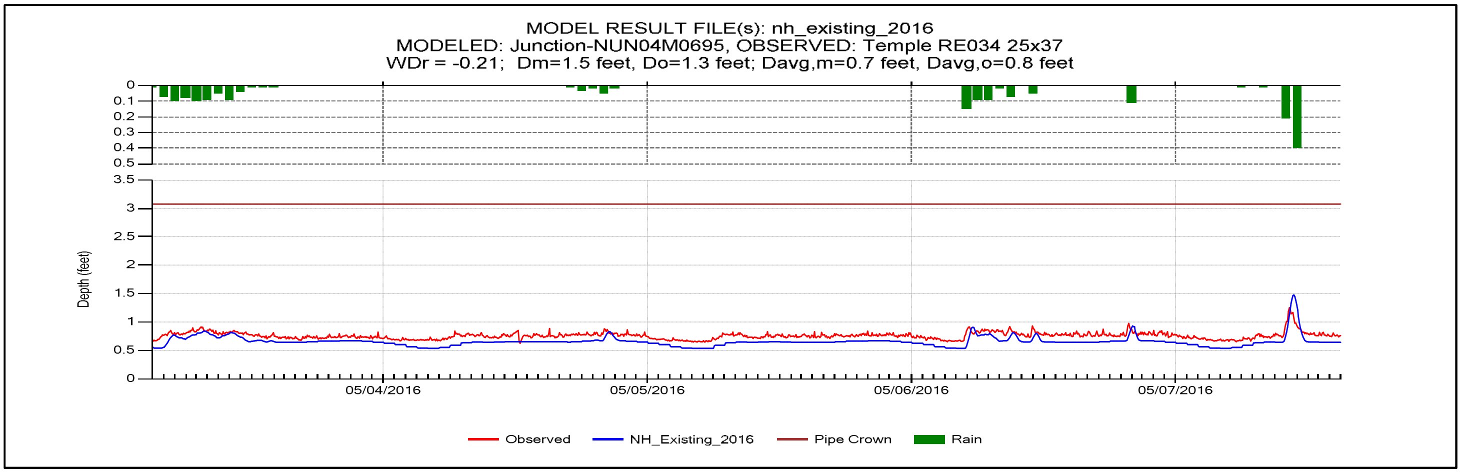
SwrTemple-Spring2

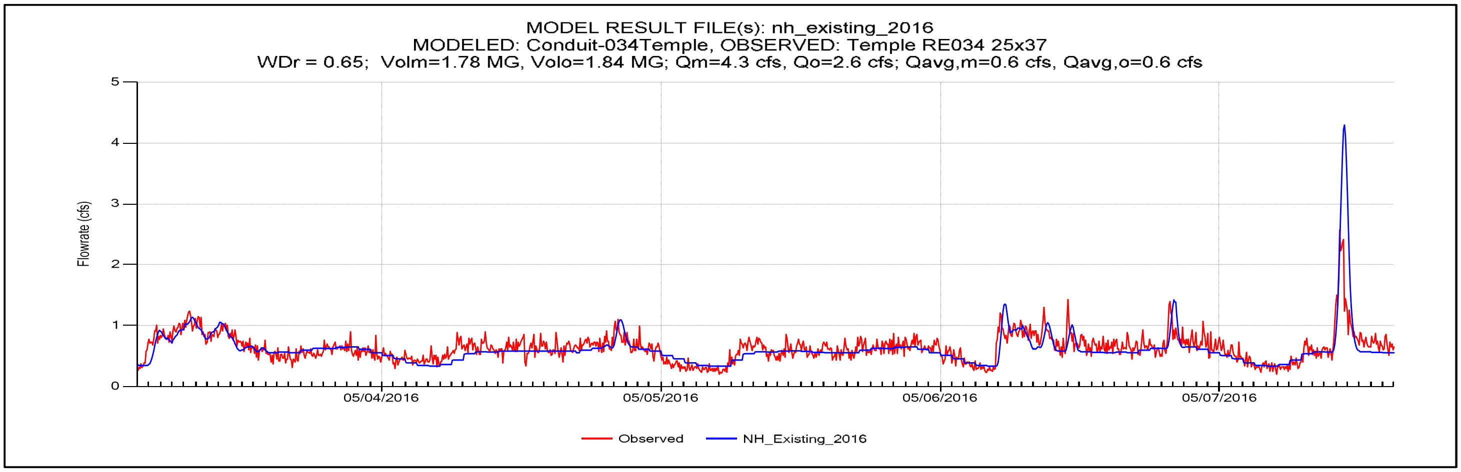


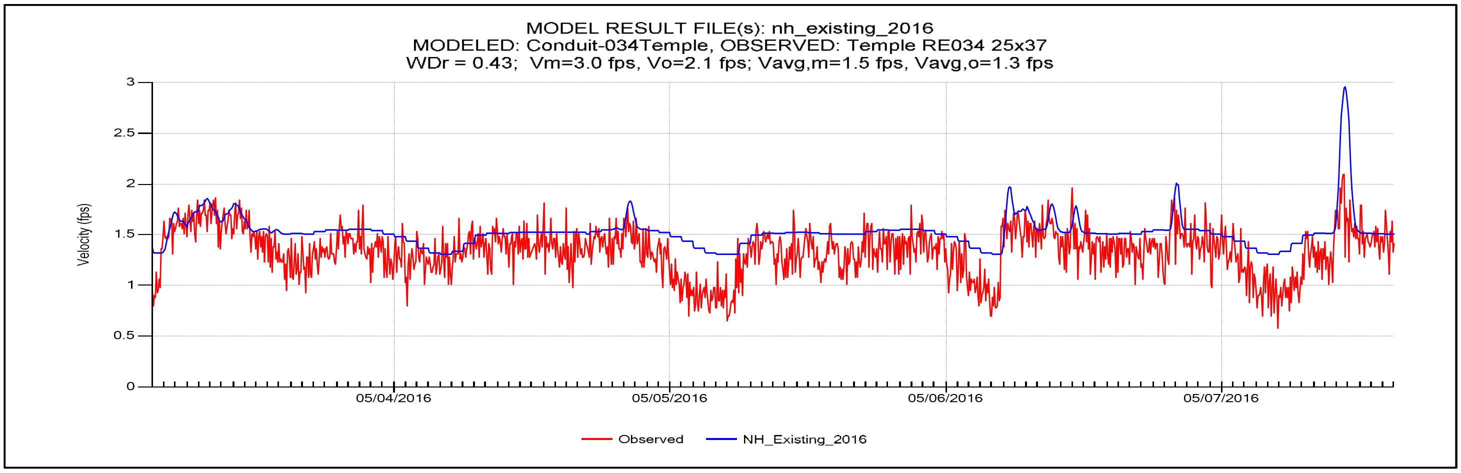




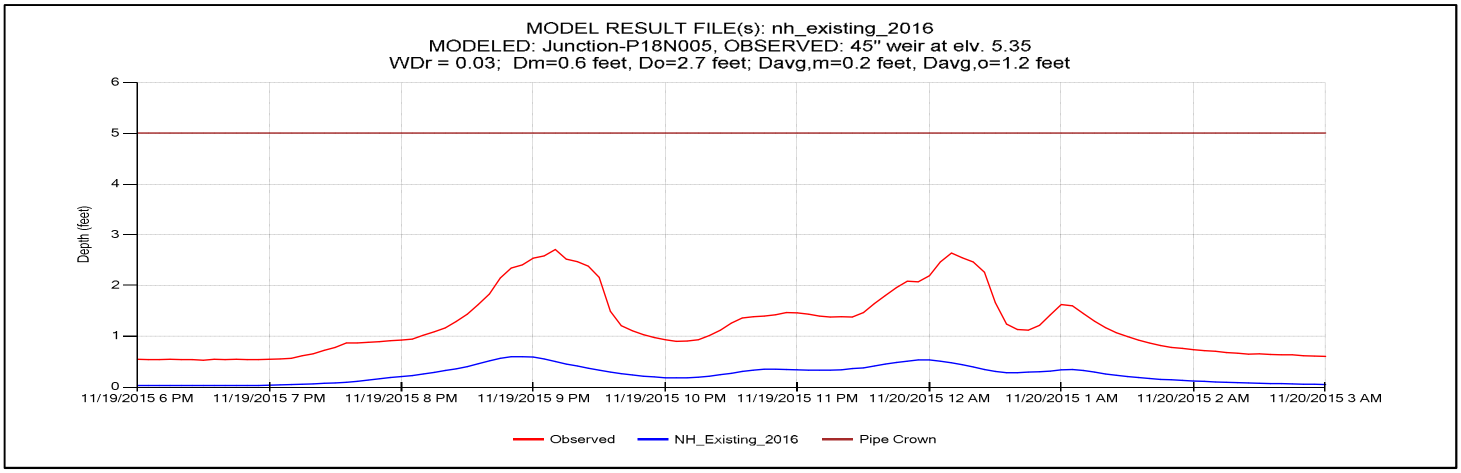
SwrTemple-Spring3

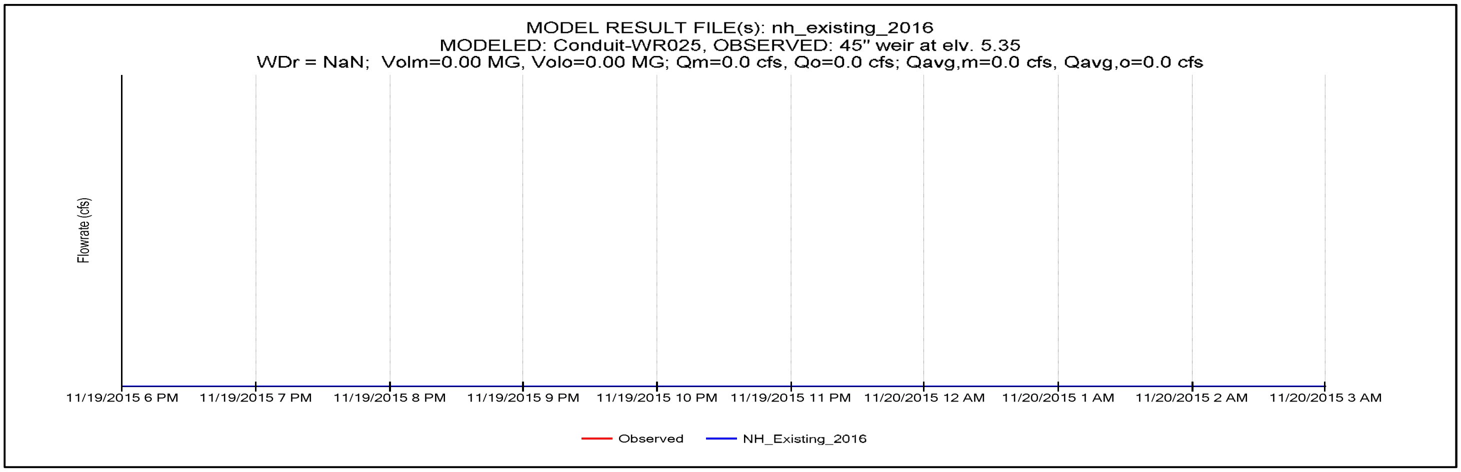


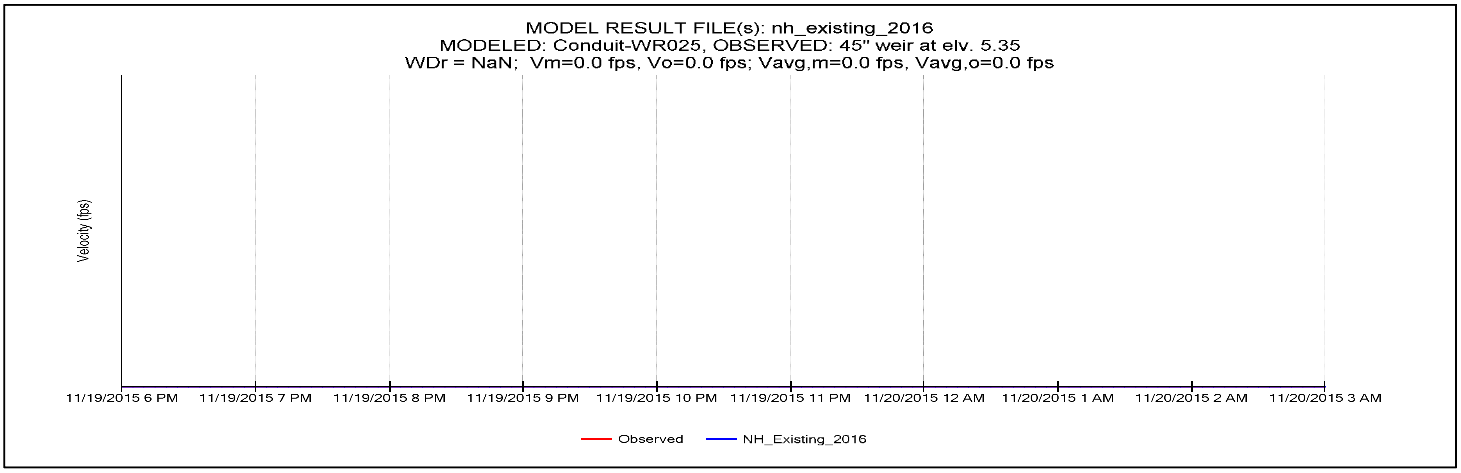




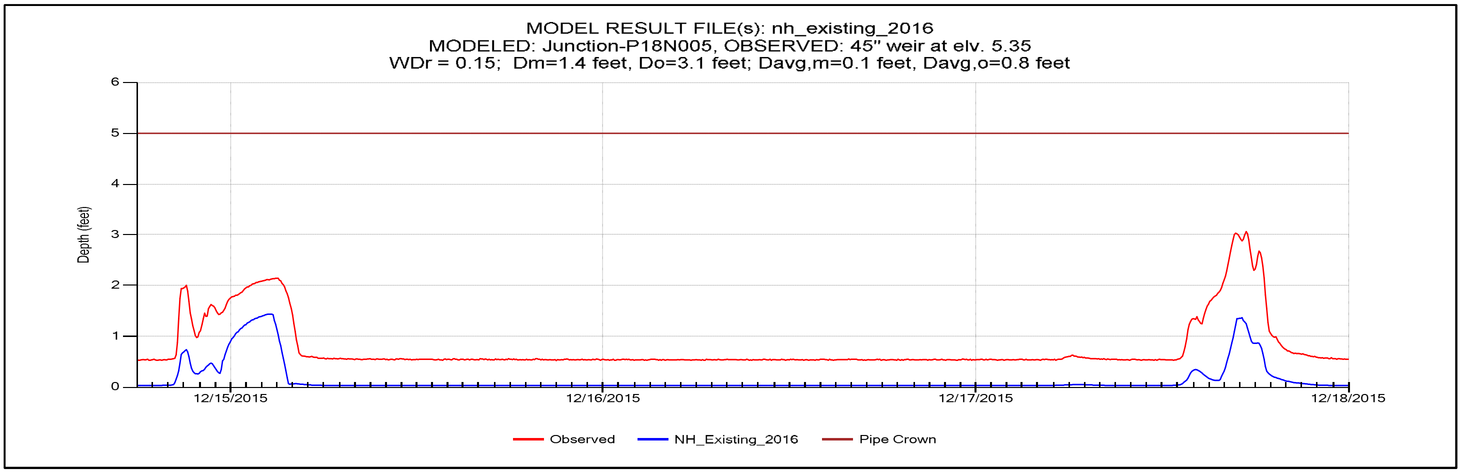
Weir25-Fall1

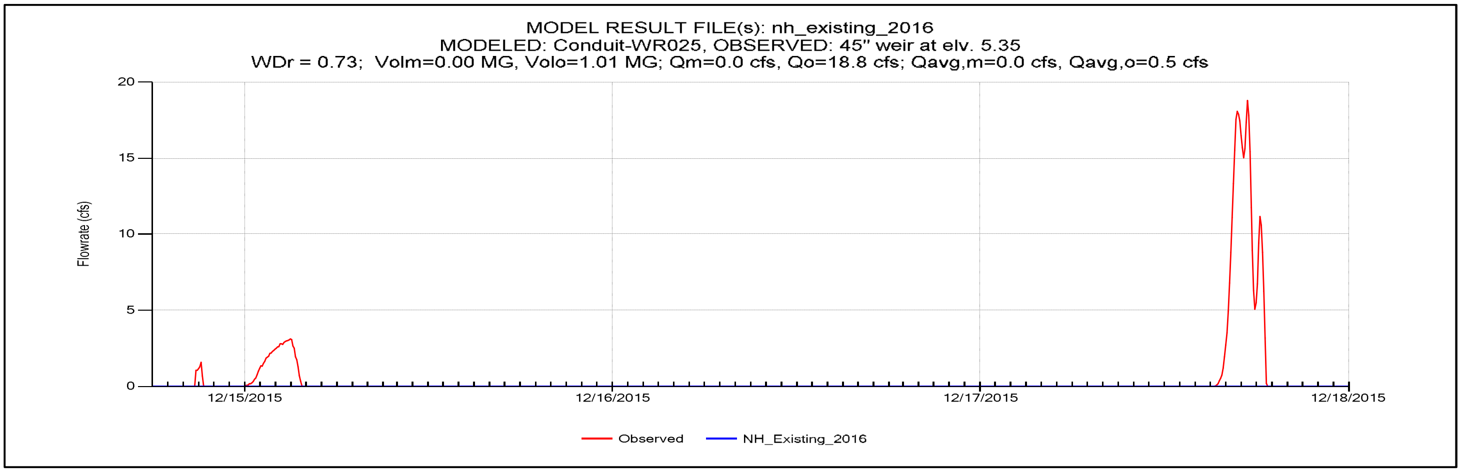


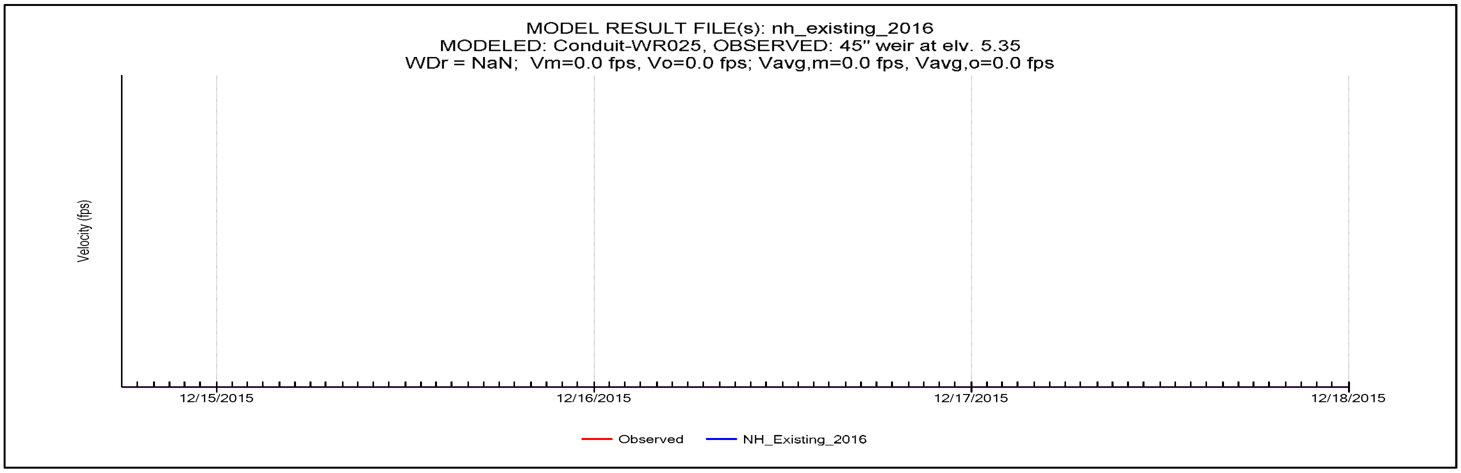




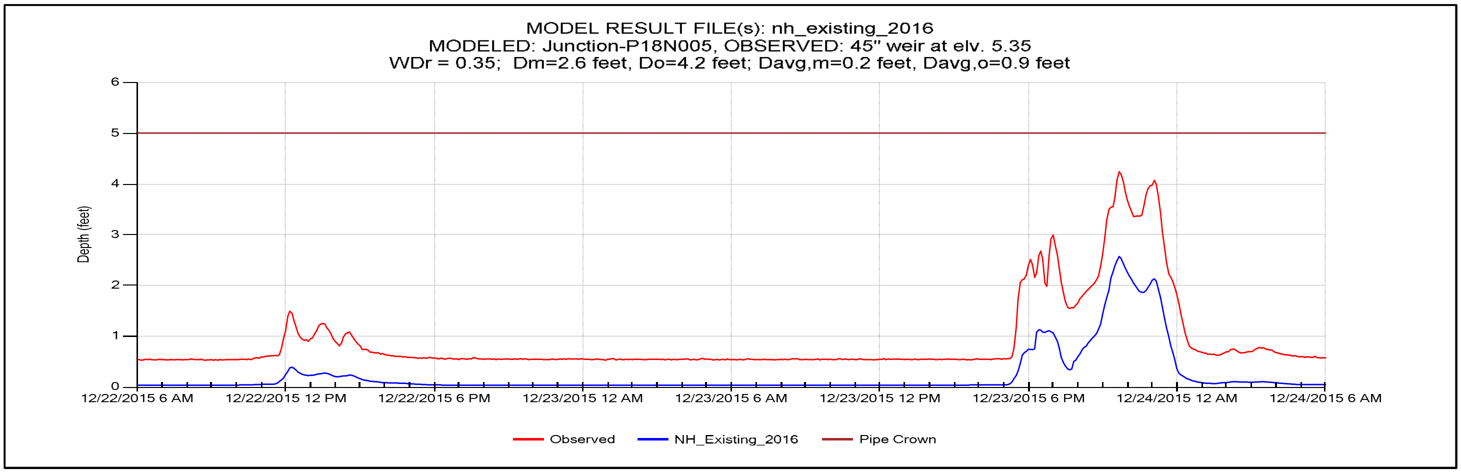
Weir25-Fall2

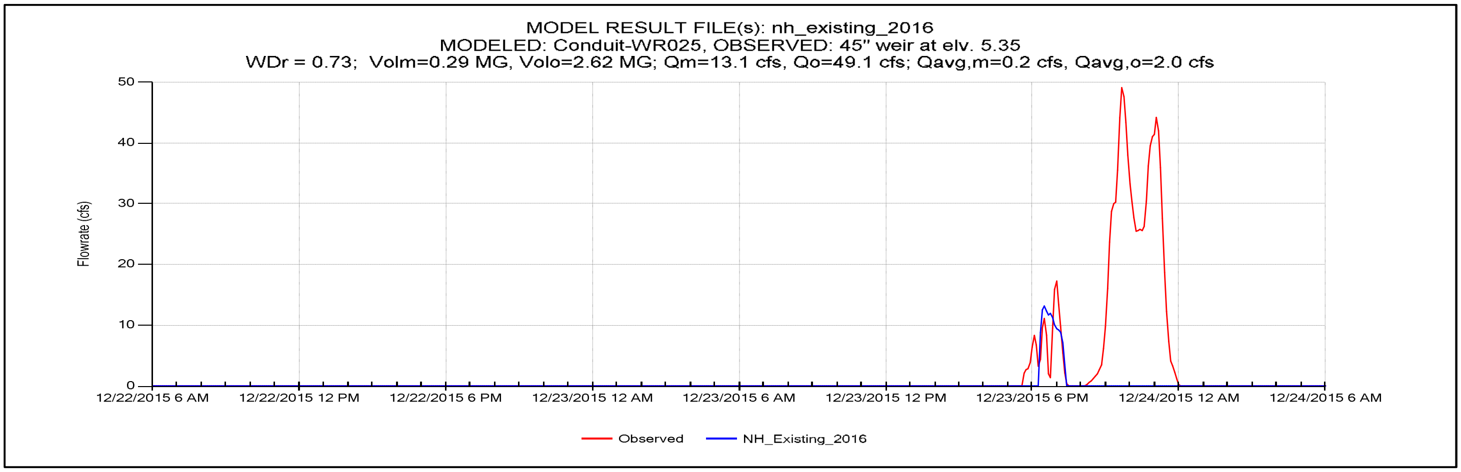

MODEL RESULT FILE(s): nh_existing_2016
MODELED: Junction-P18N005, OBSERVED: 45" weir at elv. 5.35
WDr = 0.15; Dm=1.4 feet, Do=3.1 feet; Davg,m=0.1 feet, Davg,o=0.8 feet

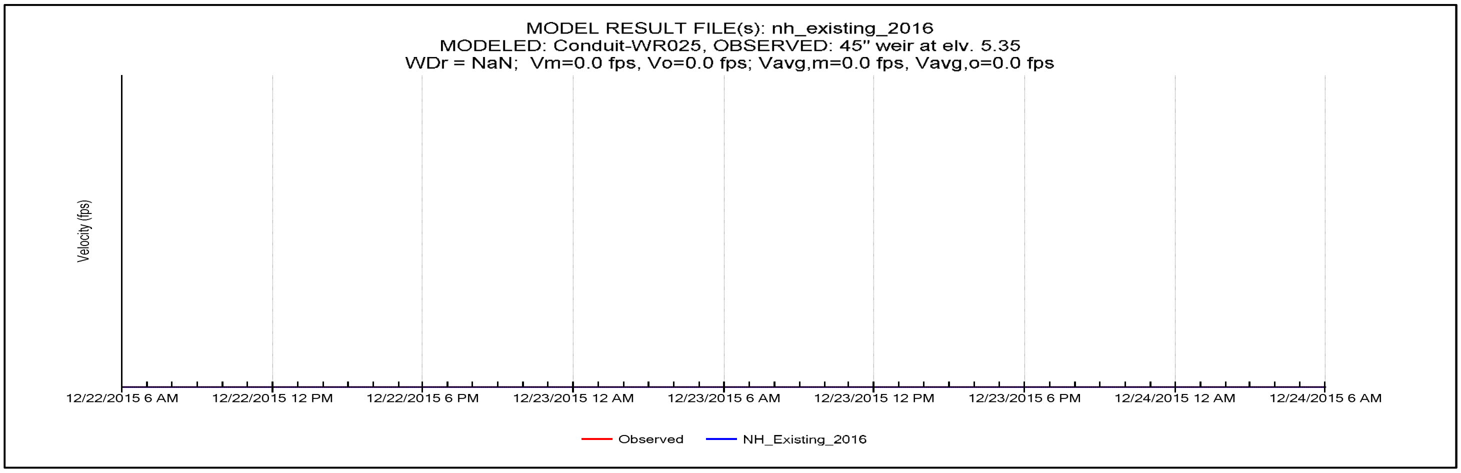

MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-WR025, OBSERVED: 45" weir at elv. 5.35
WDr = 0.73; Volm=0.00 MG, Volo=1.01 MG; Qm=0.0 cfs, Qo=18.8 cfs; Qavg,m=0.0 cfs, Qavg,o=0.5 cfs


MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-WR025, OBSERVED: 45" weir at elv. 5.35
WDr = NaN; Vm=0.0 fps, Vo=0.0 fps; Vavg,m=0.0 fps, Vavg,o=0.0 fps

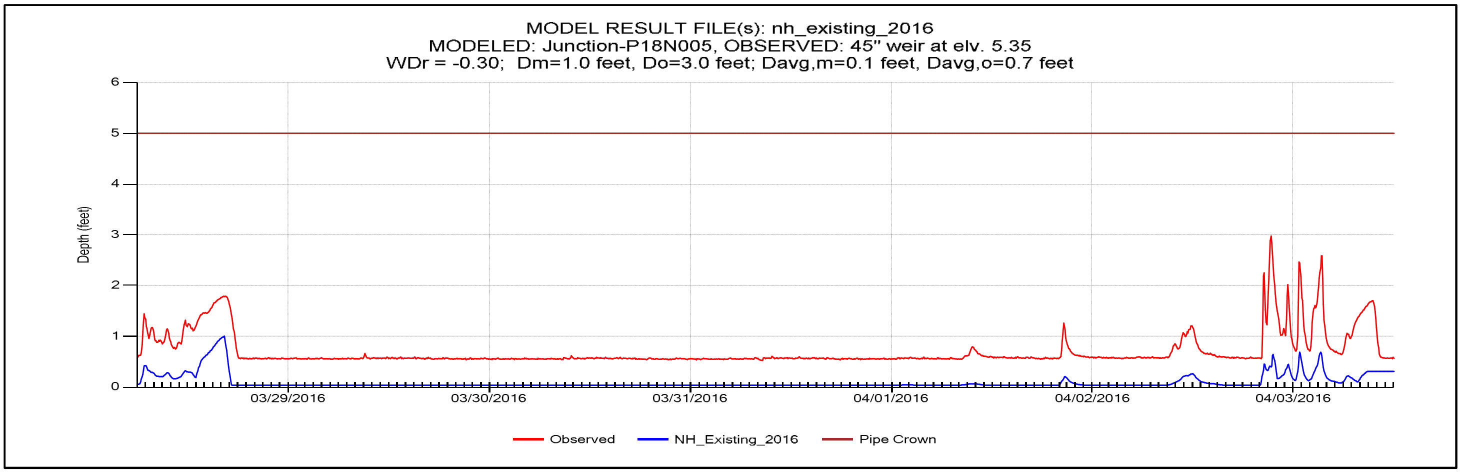
Weir25-Fall3


MODEL RESULT FILE(s): nh_existing_2016
MODELED: Junction-P18N005, OBSERVED: 45" weir at elv. 5.35
WDr = 0.35; Dm=2.6 feet, Do=4.2 feet; Davg,m=0.2 feet, Davg,o=0.9 feet

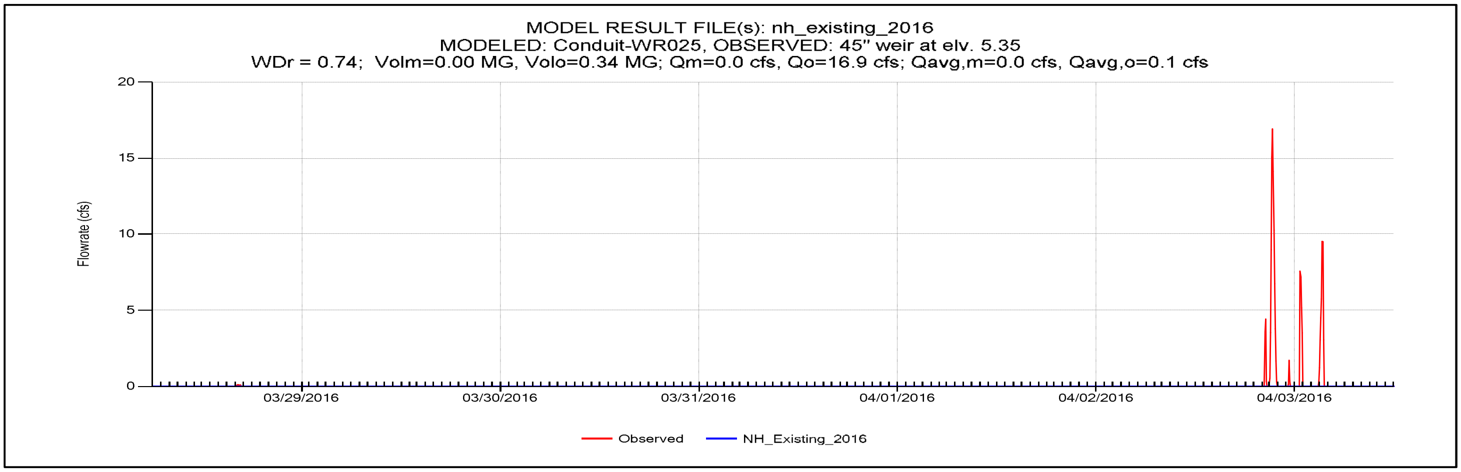

MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-WR025, OBSERVED: 45" weir at elv. 5.35
WDr = 0.73; Volm=0.29 MG, Volo=2.62 MG; Qm=13.1 cfs, Qo=49.1 cfs; Qavg,m=0.2 cfs, Qavg,o=2.0 cfs


MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-WR025, OBSERVED: 45" weir at elv. 5.35
WDr = NaN; Vm=0.0 fps, Vo=0.0 fps; Vavg,m=0.0 fps, Vavg,o=0.0 fps

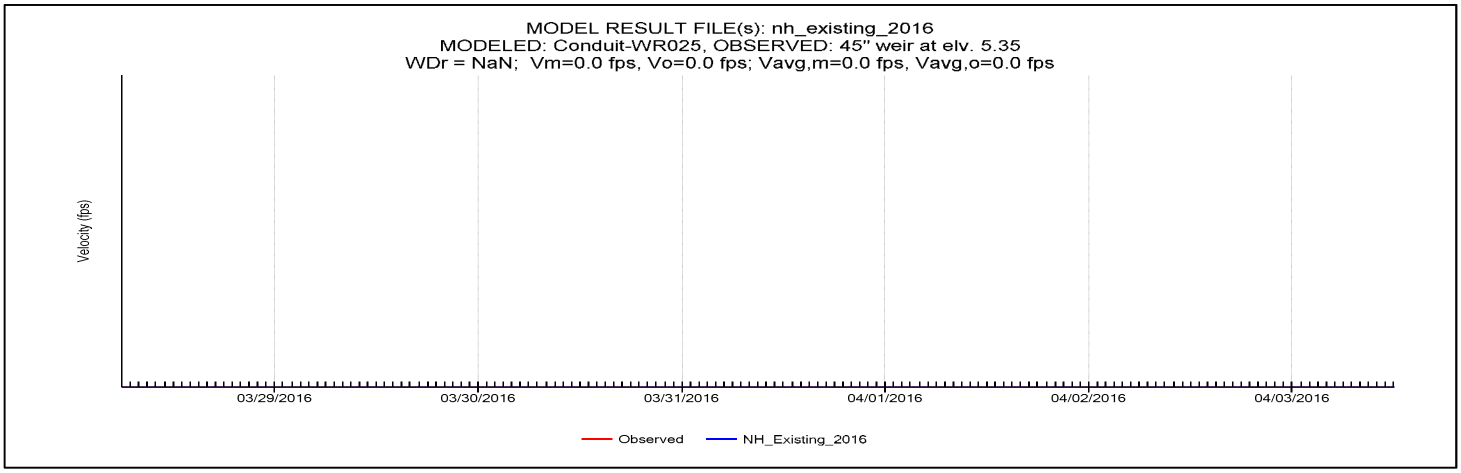
Weir25-Spring1



MODEL RESULT FILE(s): nh_existing_2016
MODELED: Junction-P18N005, OBSERVED: 45" weir at elv. 5.35
WDr = -0.30; Dm=1.0 feet, Do=3.0 feet; Davg,m=0.1 feet, Davg,o=0.7 feet

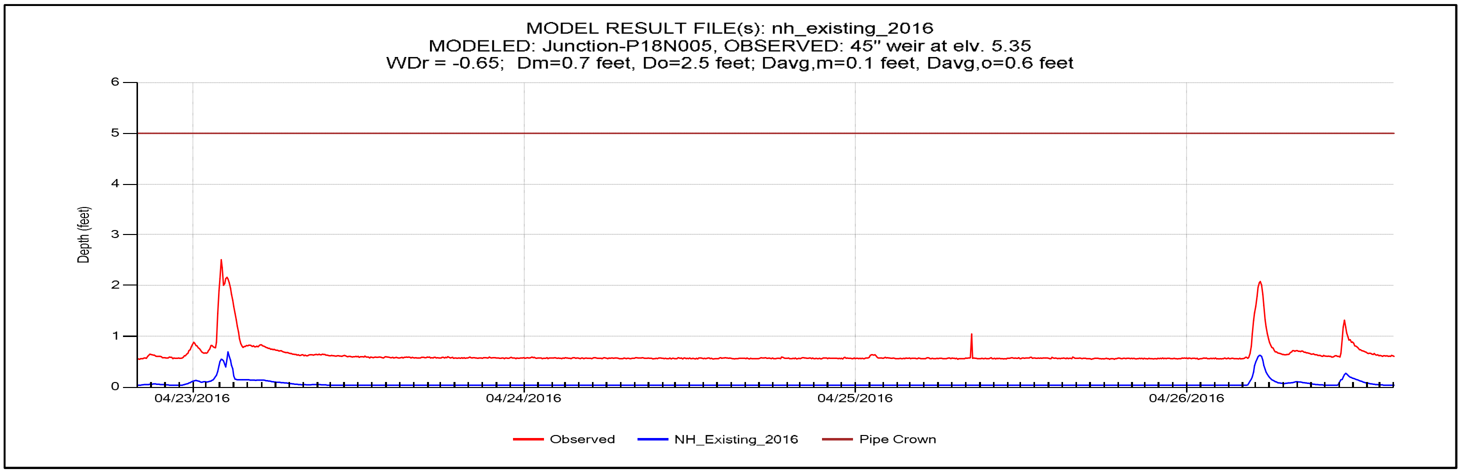


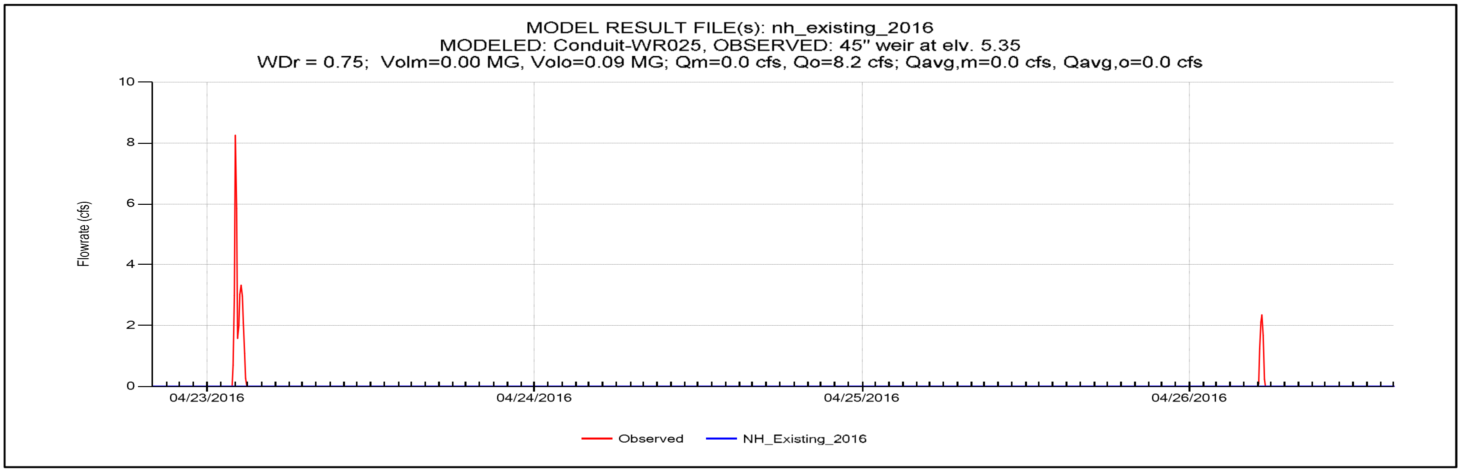
MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-WR025, OBSERVED: 45" weir at elv. 5.35
WDr = 0.74; Volm=0.00 MG, Volo=0.34 MG; Qm=0.0 cfs, Qo=16.9 cfs; Qavg,m=0.0 cfs, Qavg,o=0.1 cfs

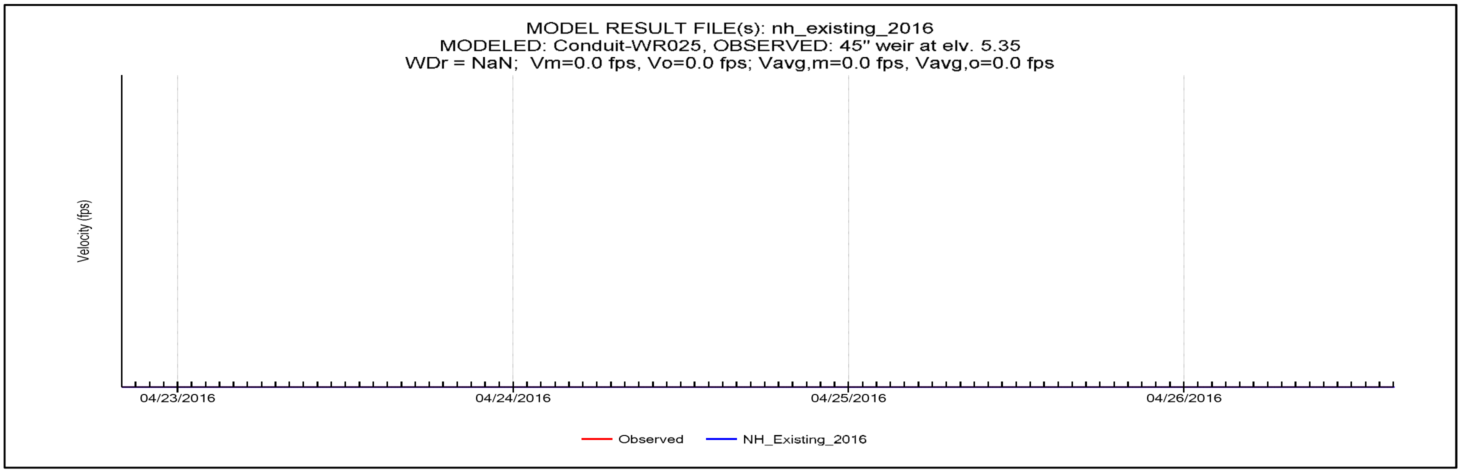


MODEL RESULT FILE(s): nh_existing_2016
MODELED: Conduit-WR025, OBSERVED: 45" weir at elv. 5.35
WDr = NaN; Vm=0.0 fps, Vo=0.0 fps; Vavg,m=0.0 fps, Vavg,o=0.0 fps

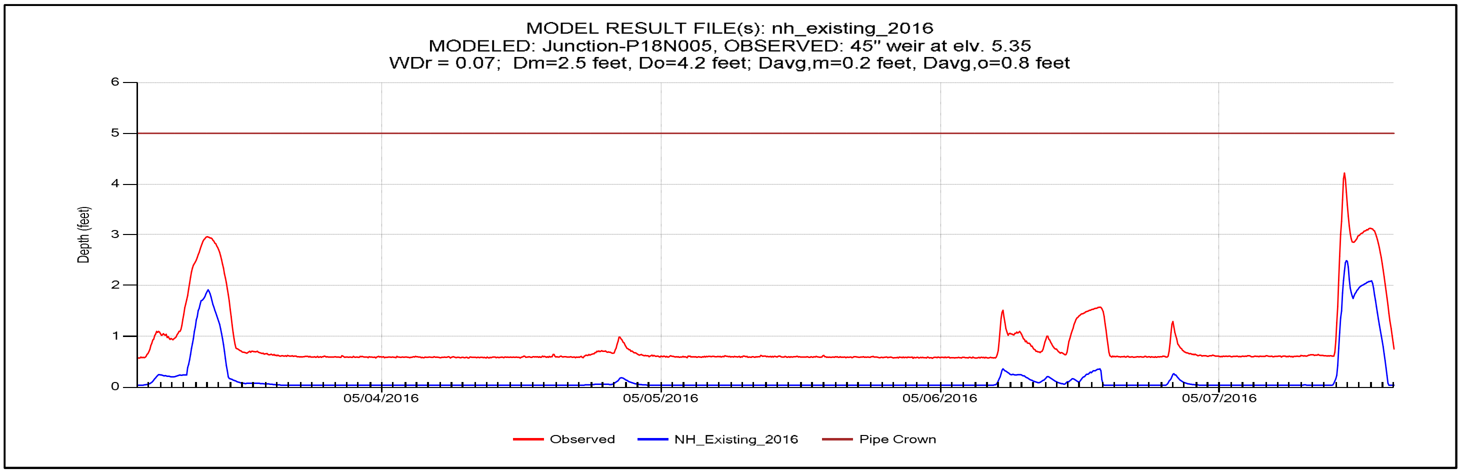
Weir25-Spring2

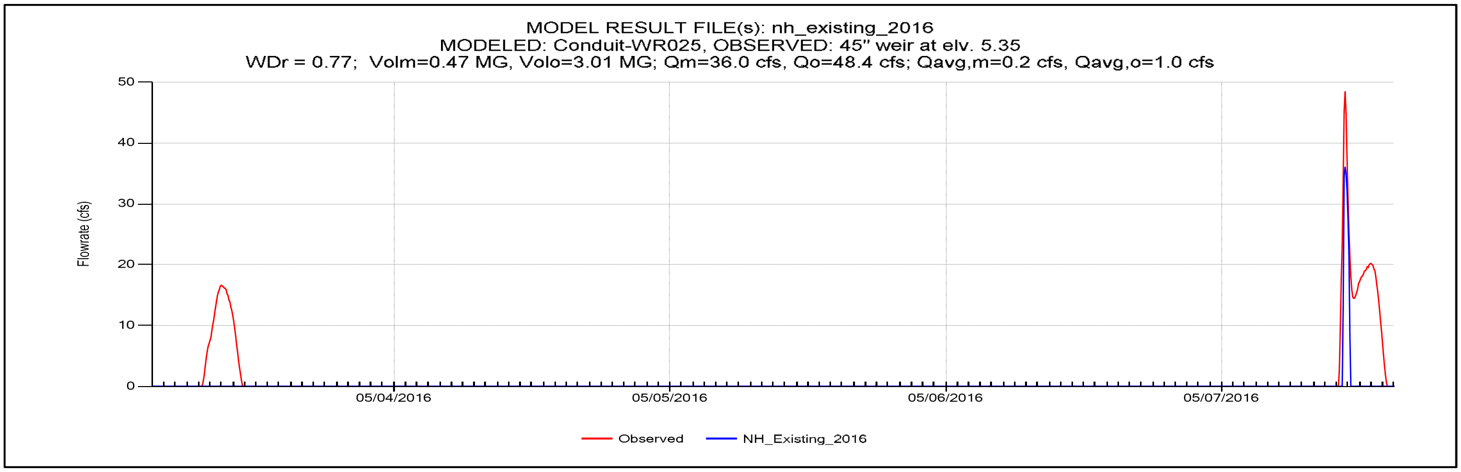


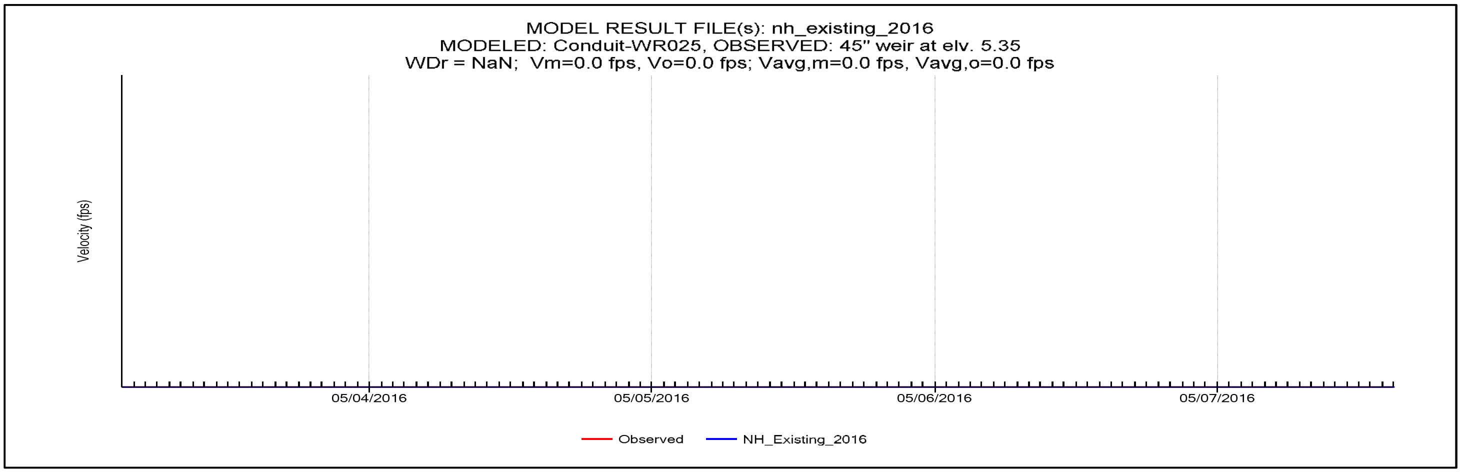




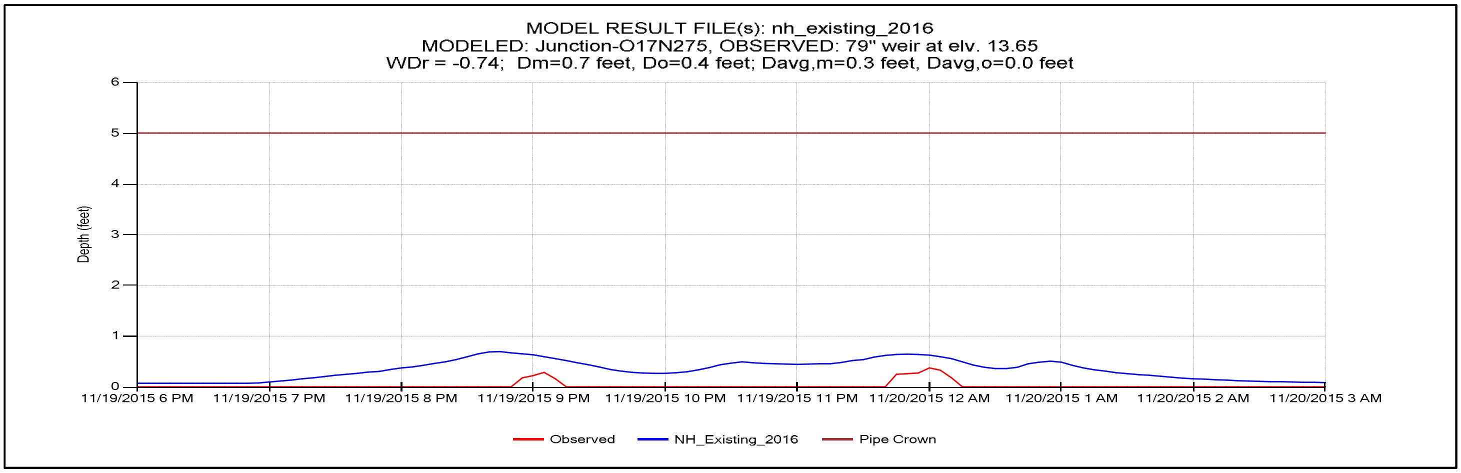
Weir25-Spring3

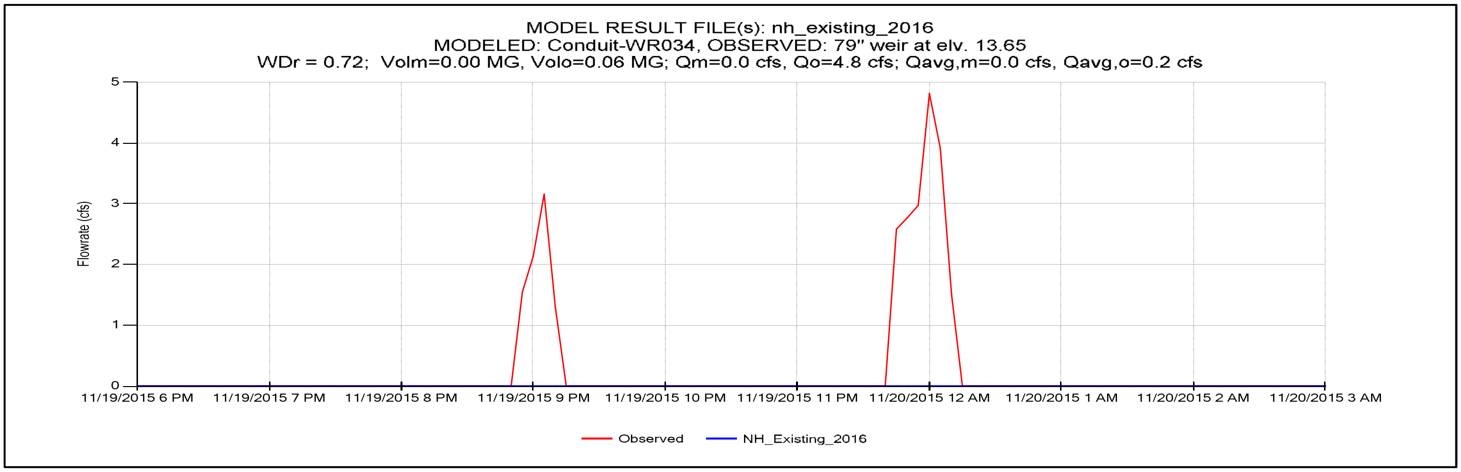


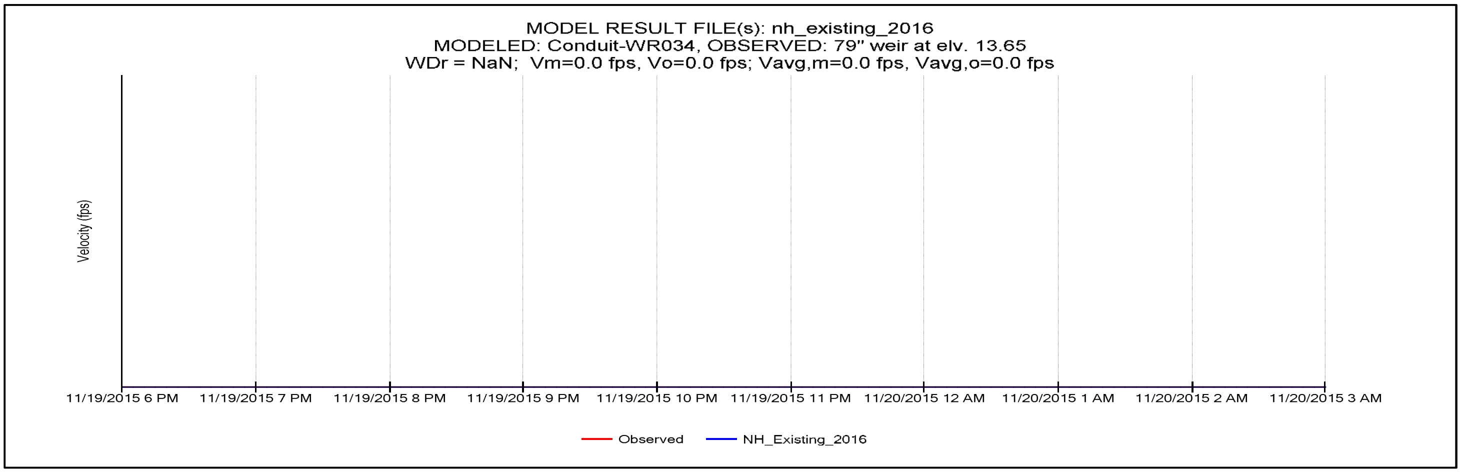




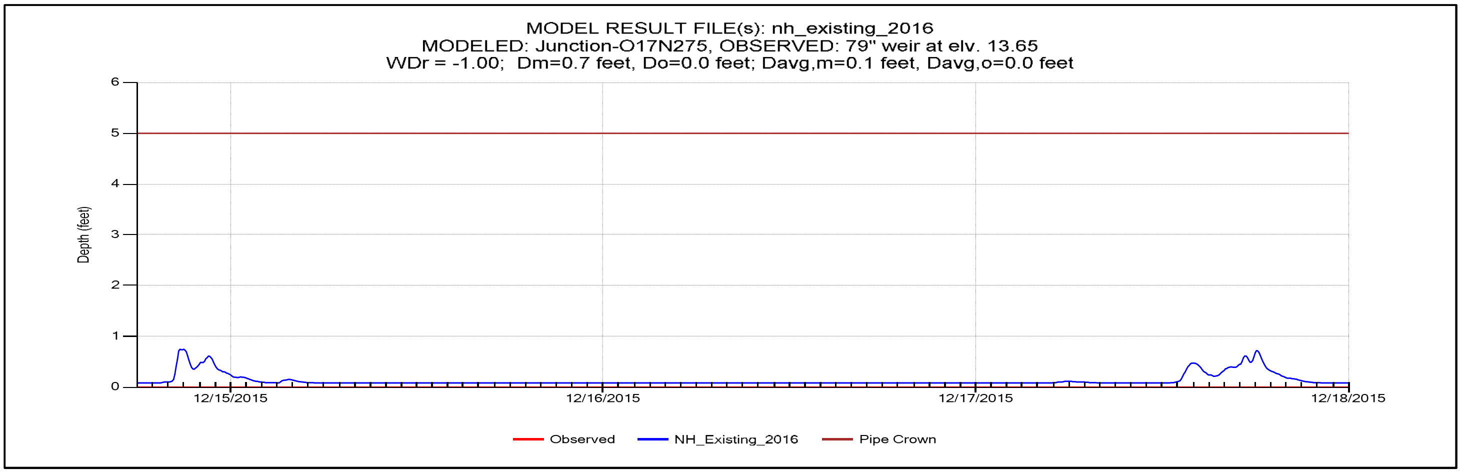
Weir34-Fall1

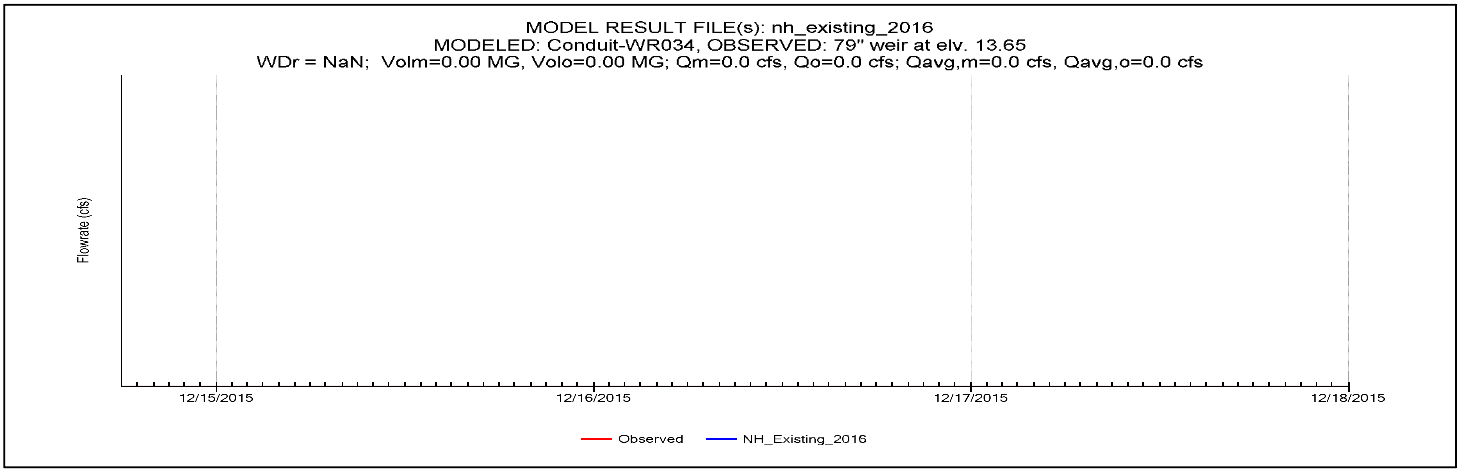


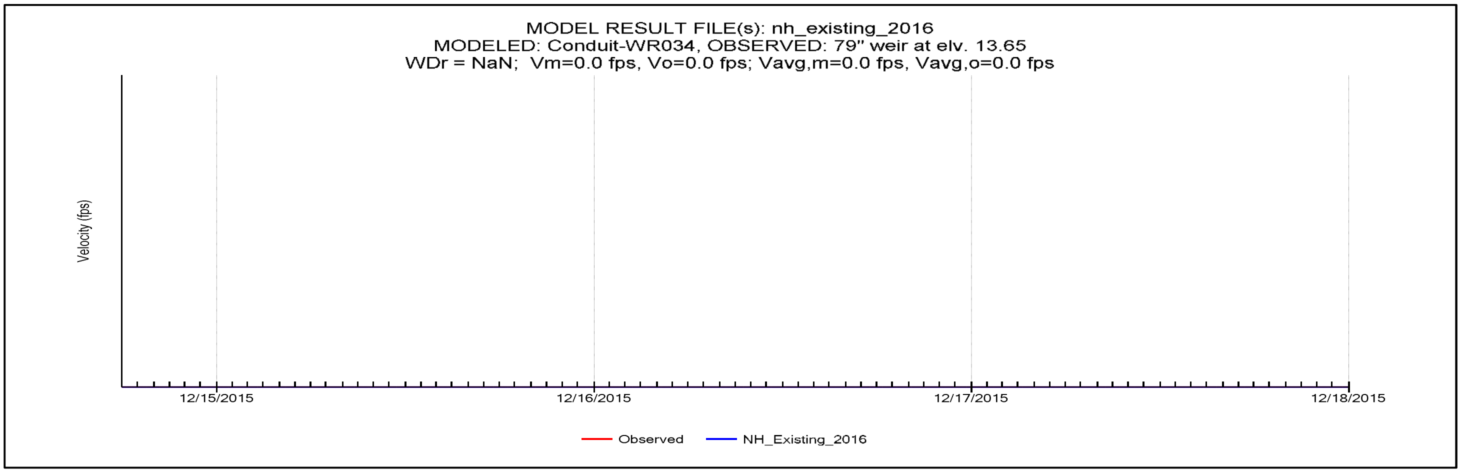




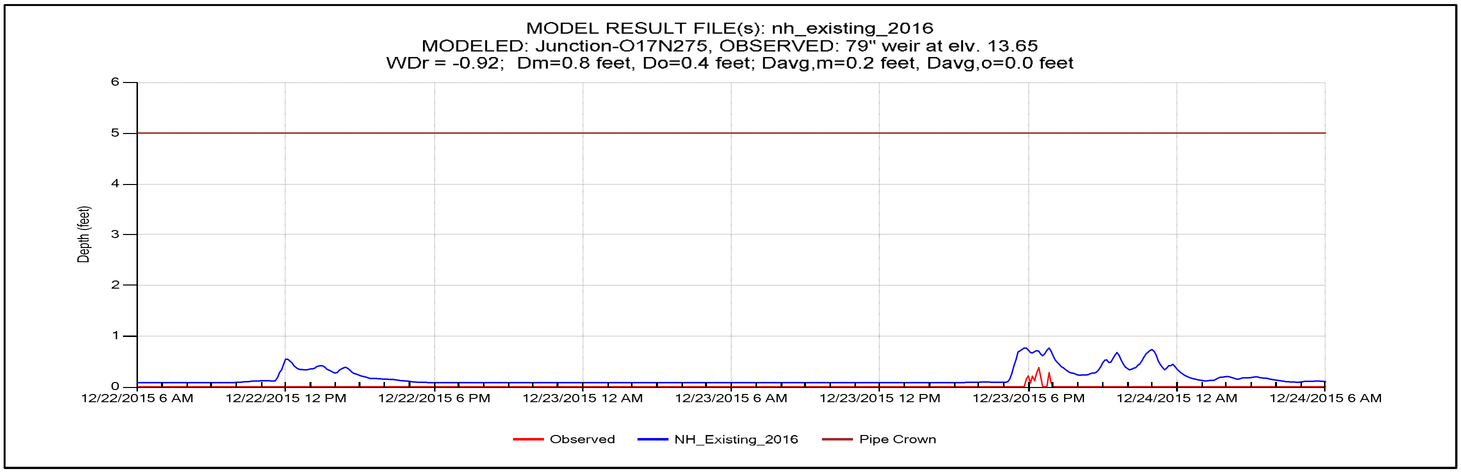
Weir34-Fall2

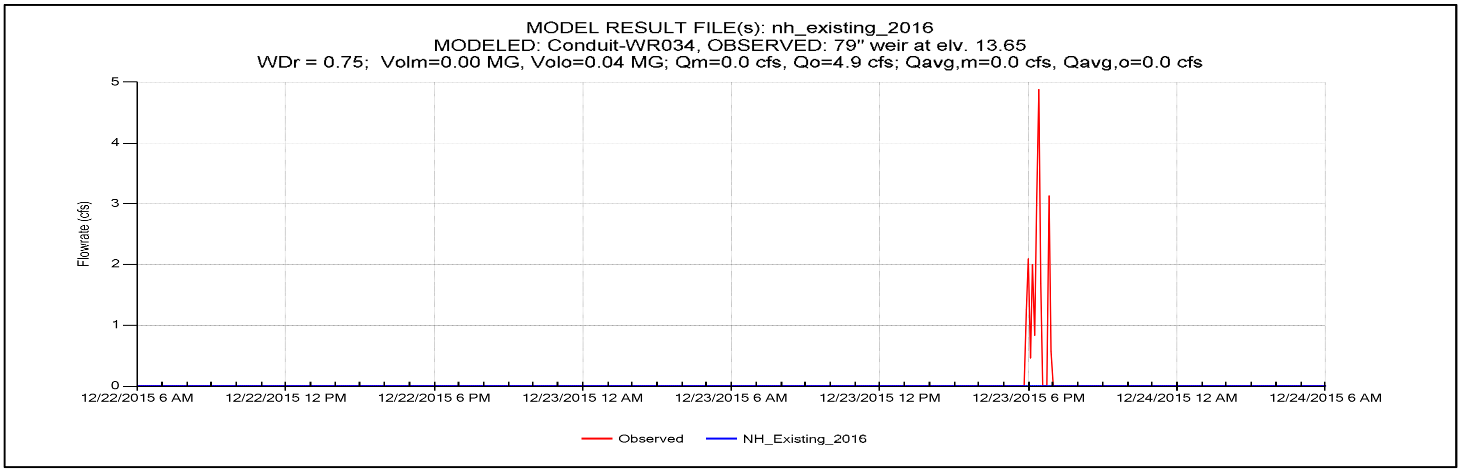


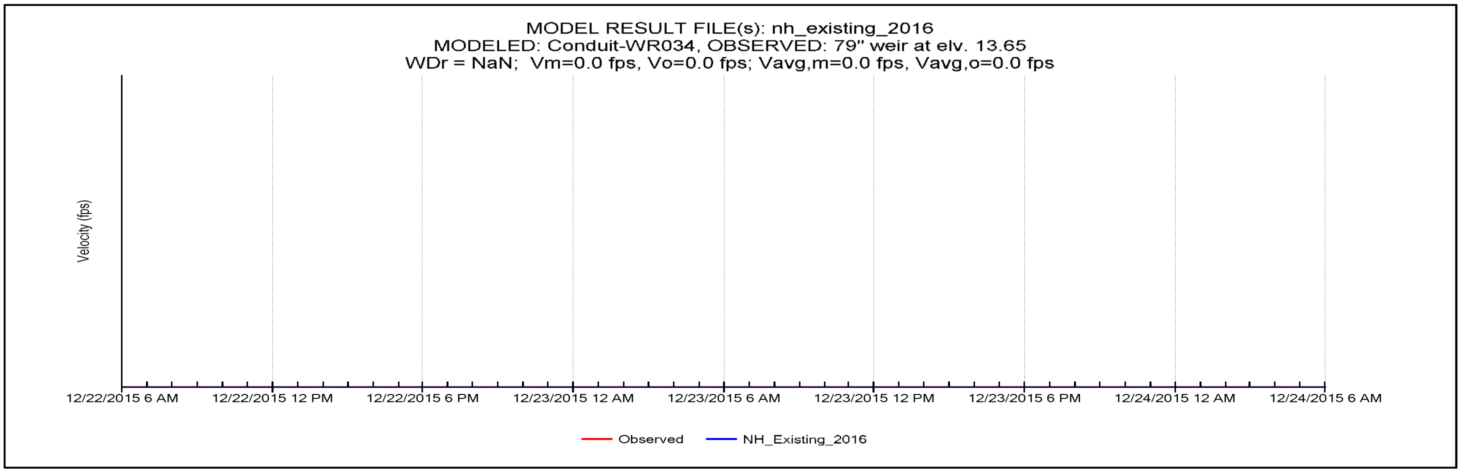




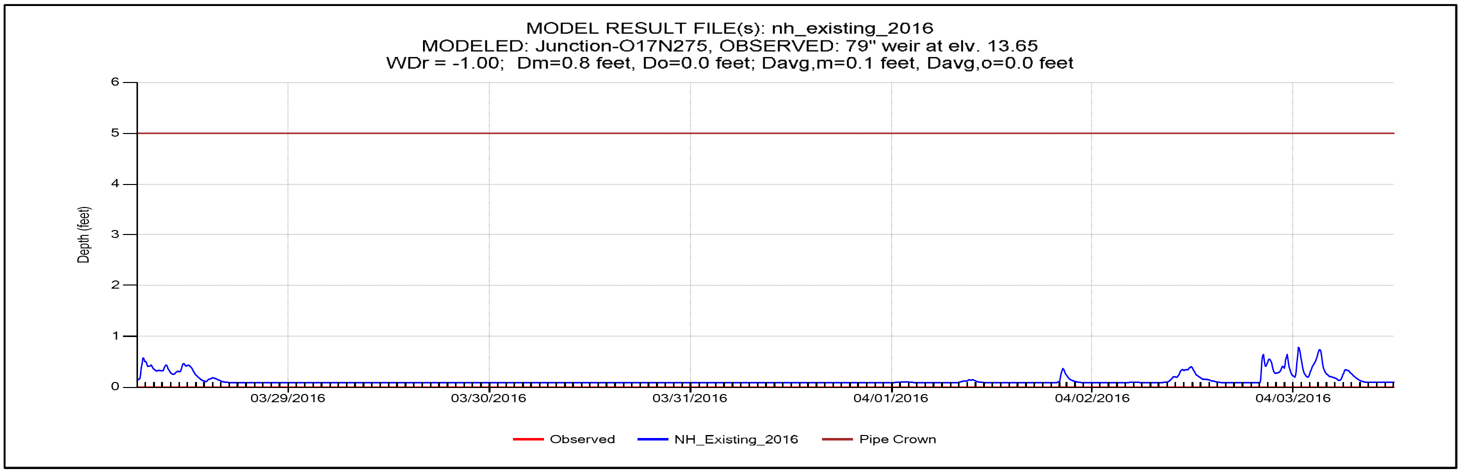
Weir34-Fall3

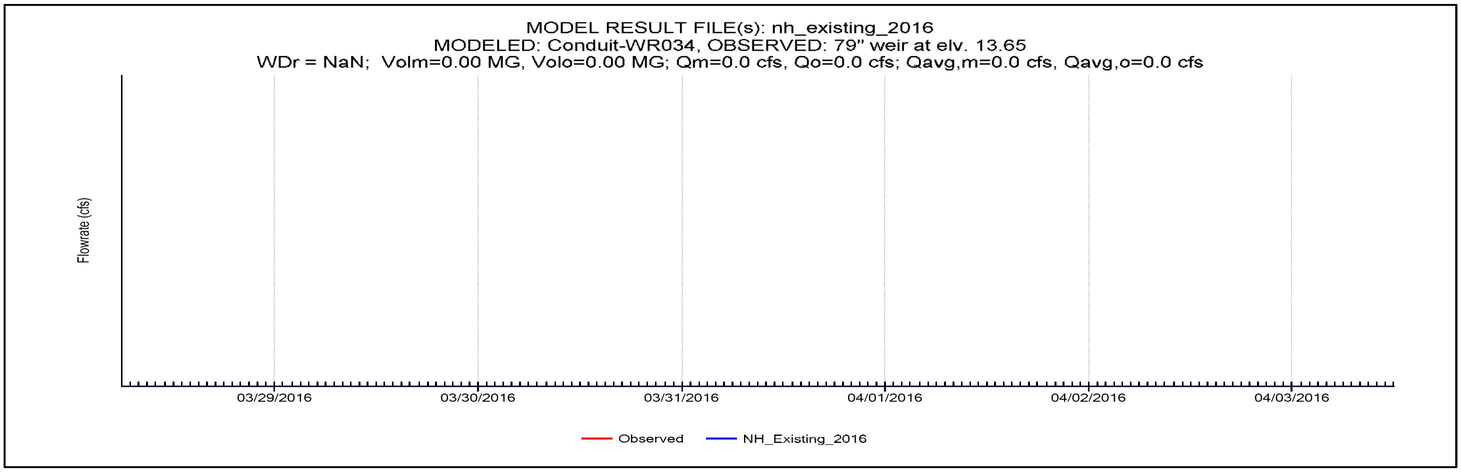


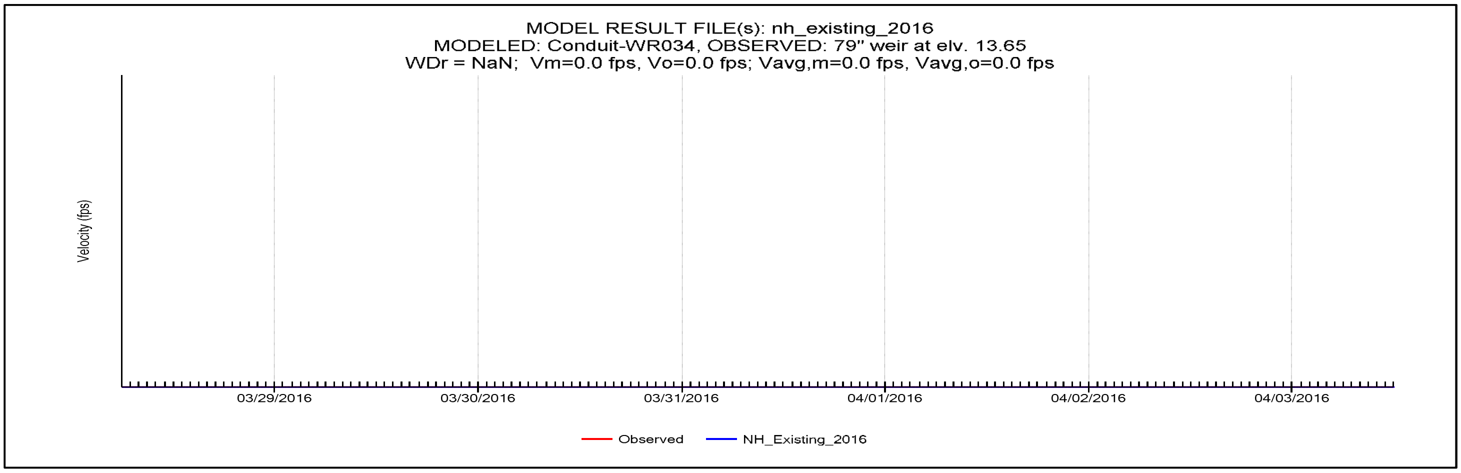




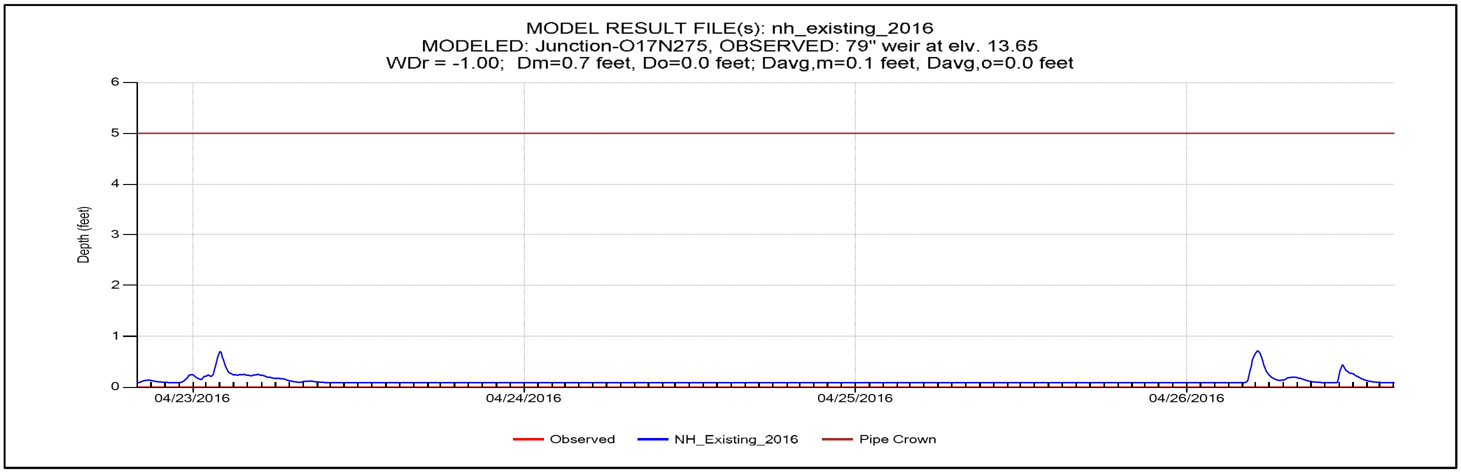
Weir34-Spring1

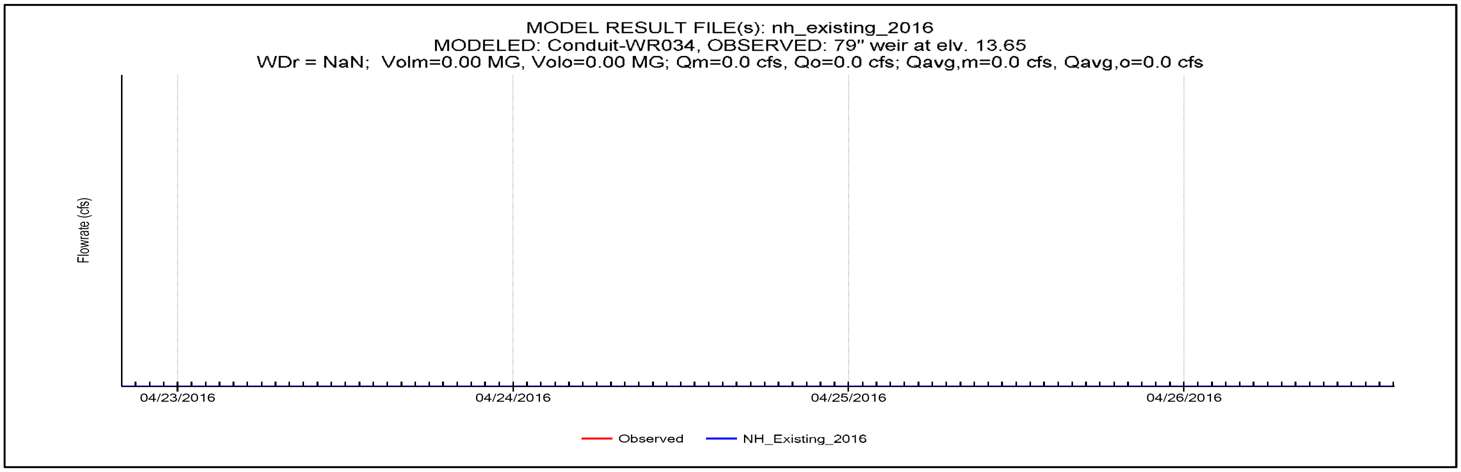


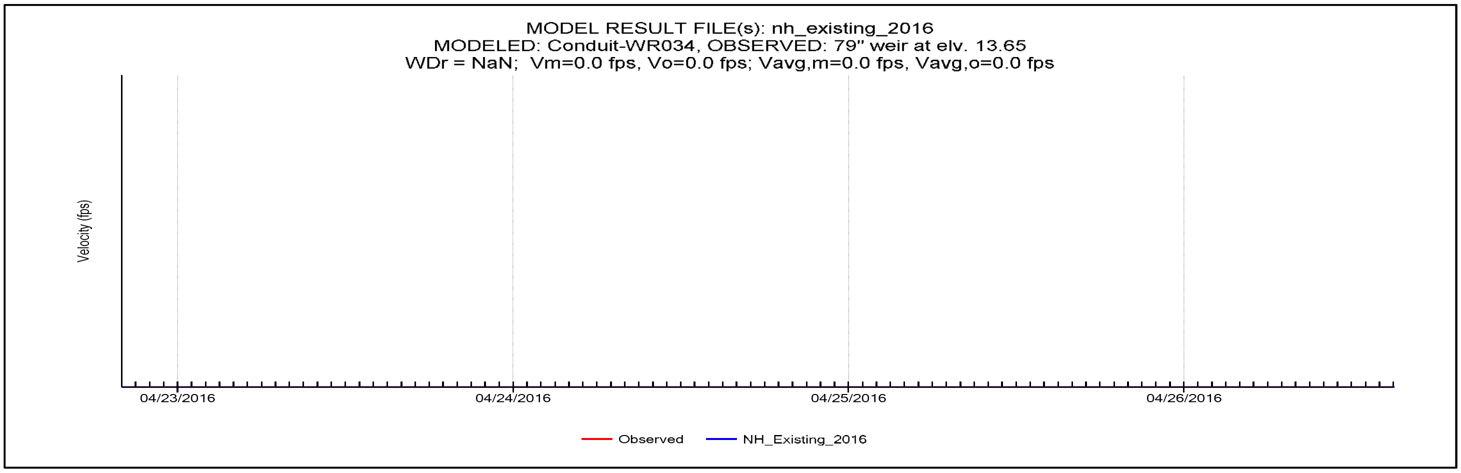




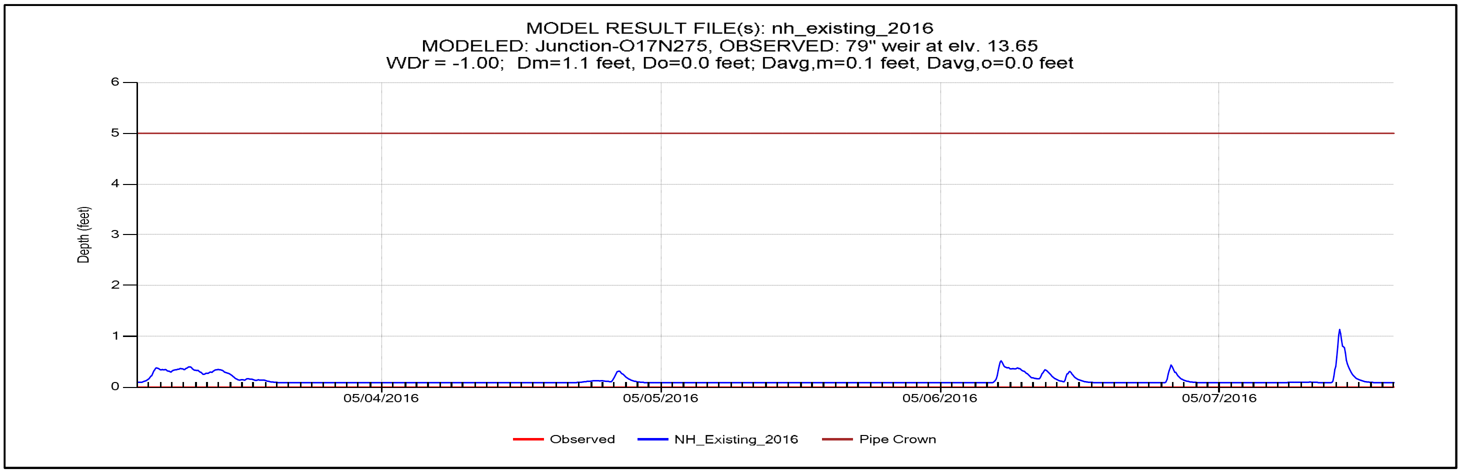
Weir34-Spring2

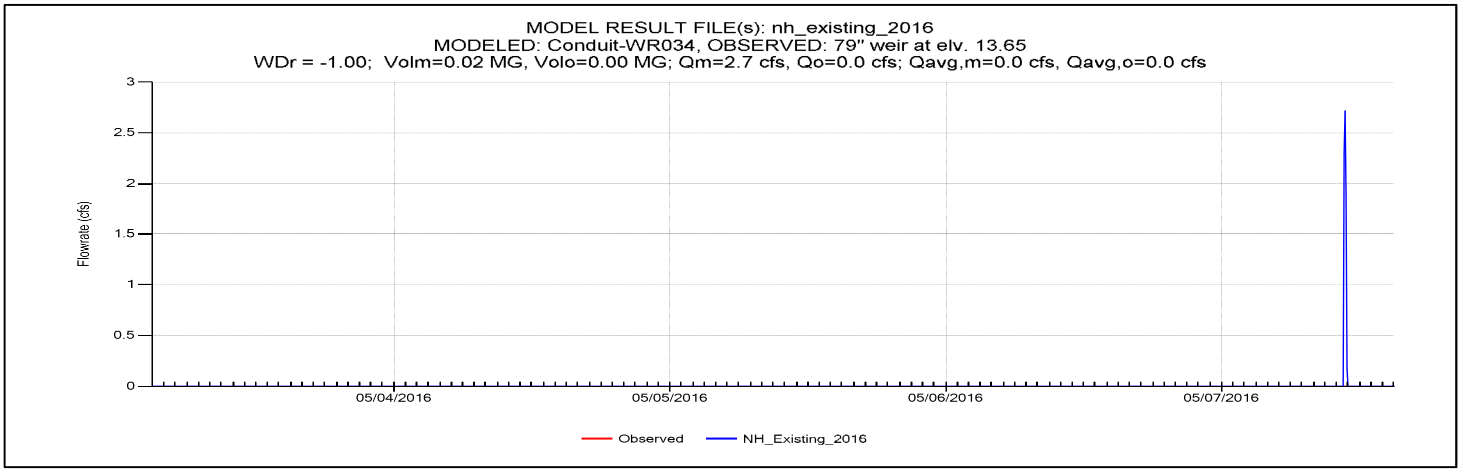


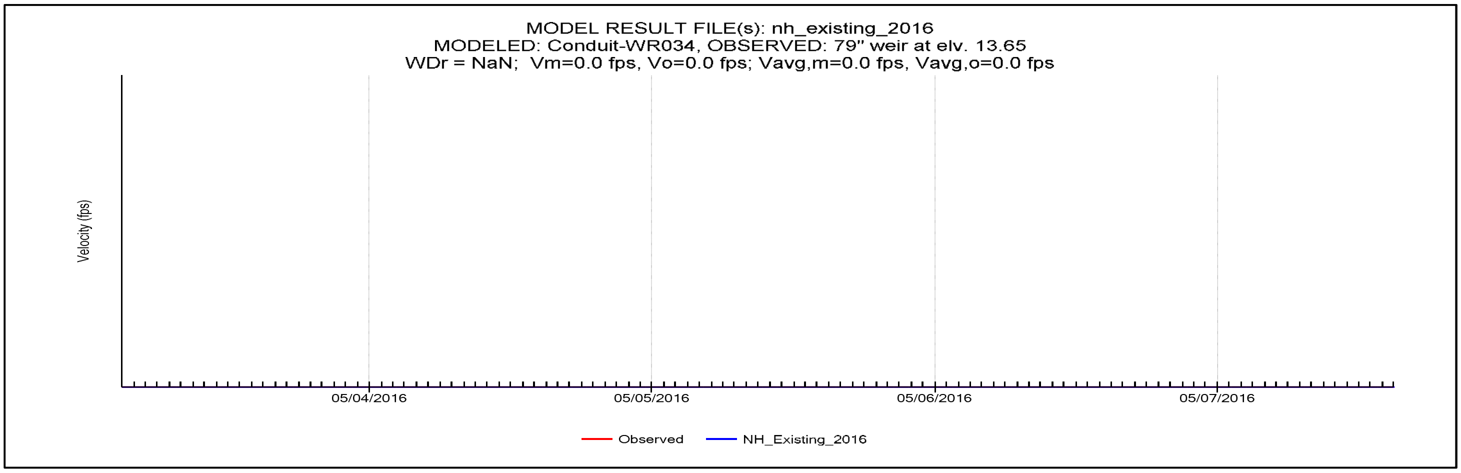




Weir34-Spring3



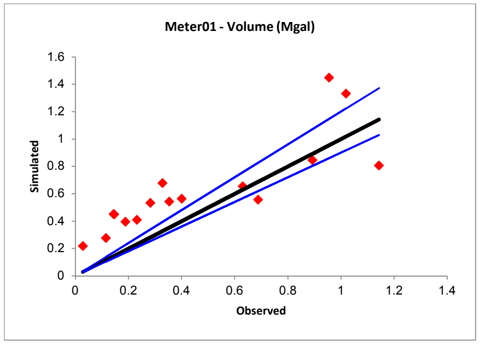


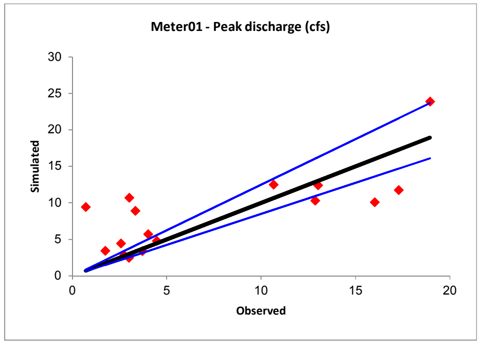


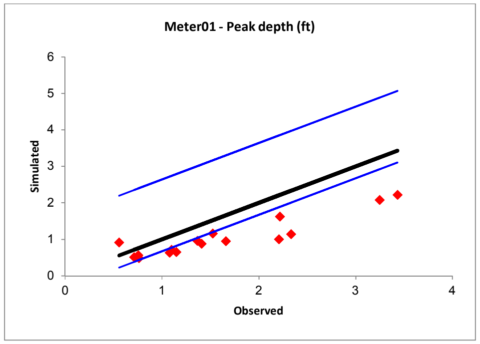
Appendix D

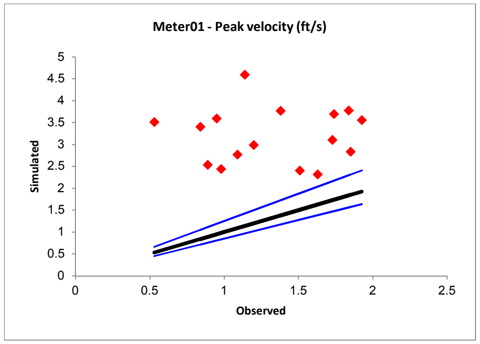
SWMM Model Scatterplots with Summary Statistics

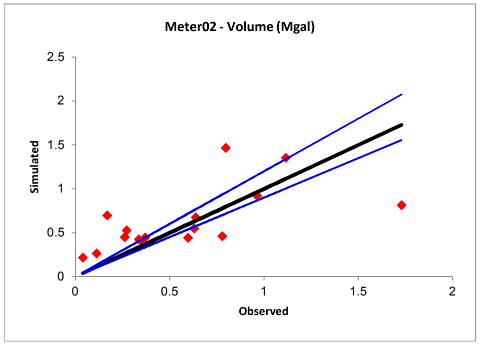
Simulated Versus Observed Flow at Flow Meter Sites

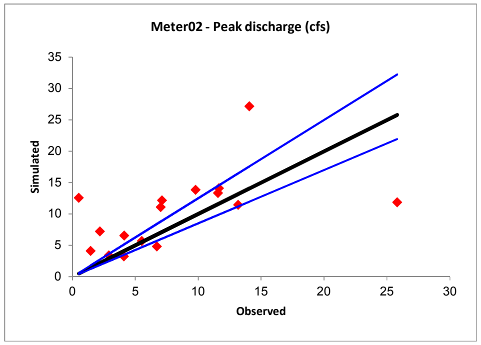


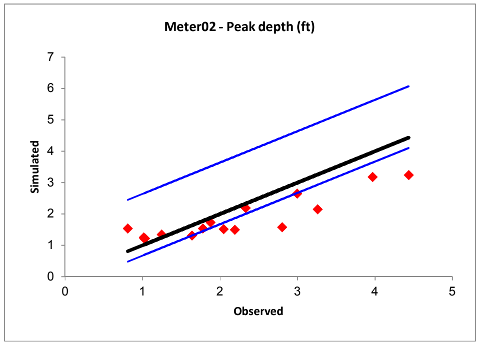


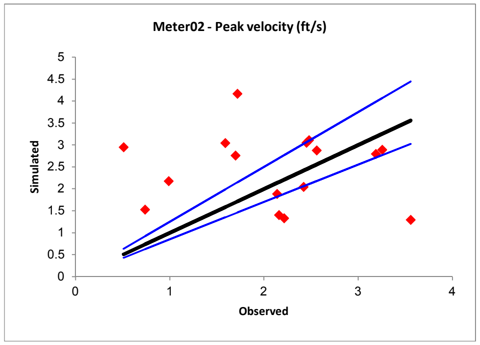


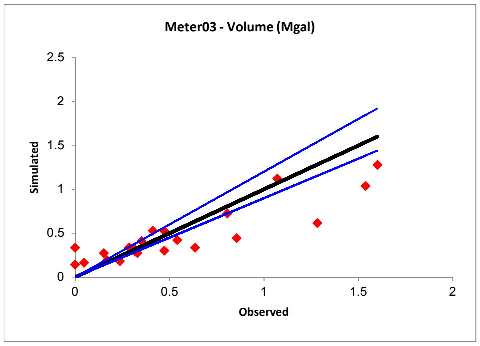


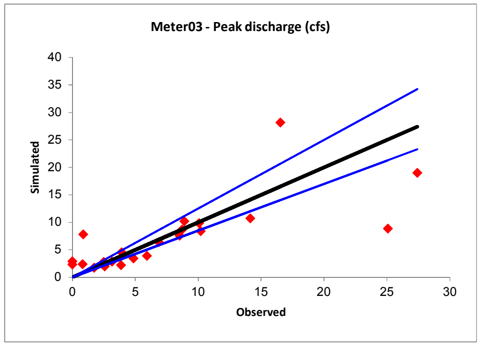


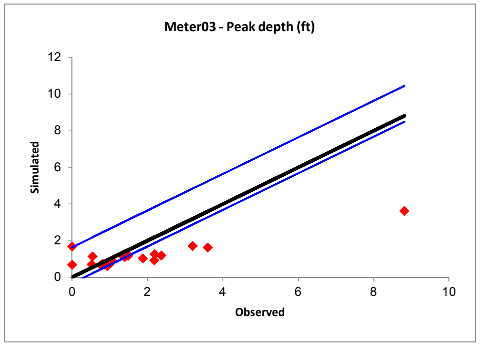


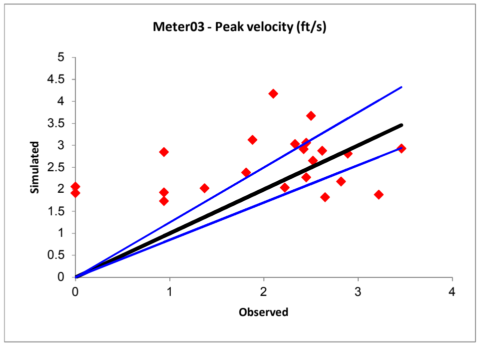




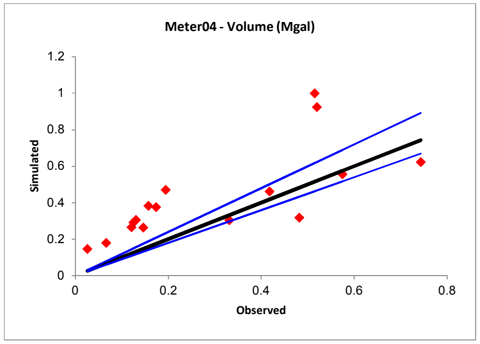


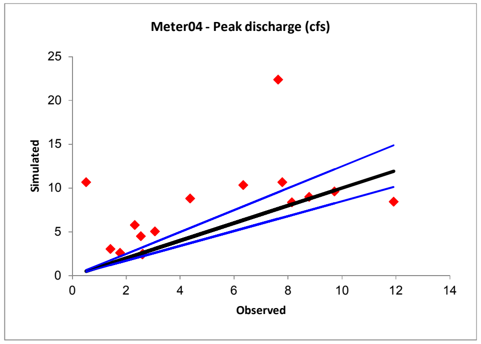


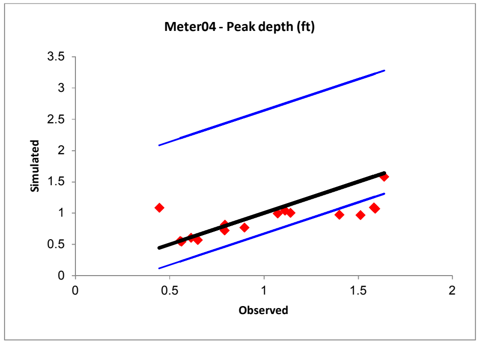


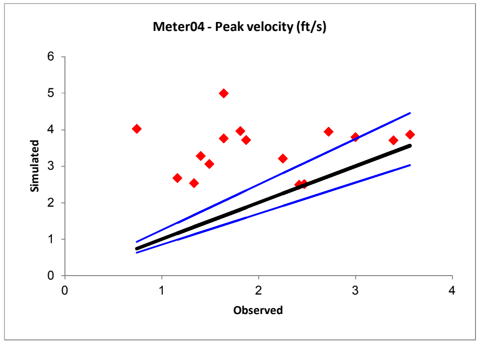


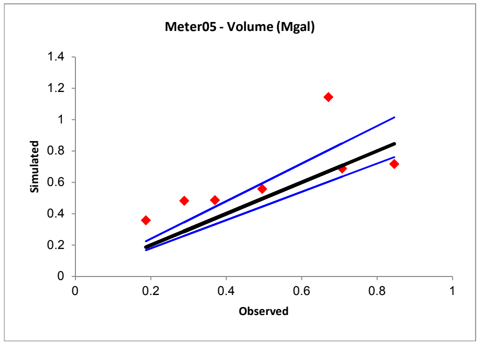
Simulated Versus Observed Flow at Flow Meter Sites

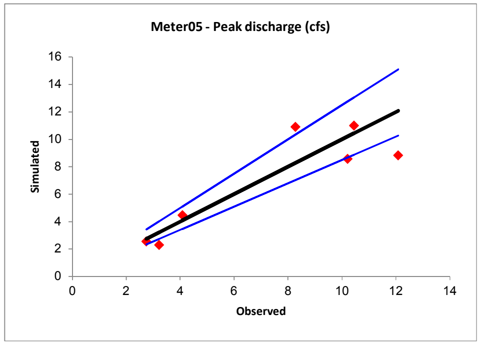

Meter04 - Volume (Mgal)

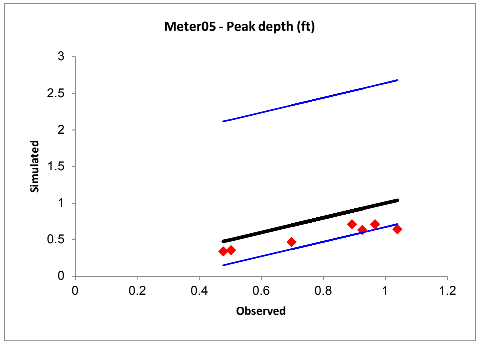

Meter04 - Peak discharge (cfs)

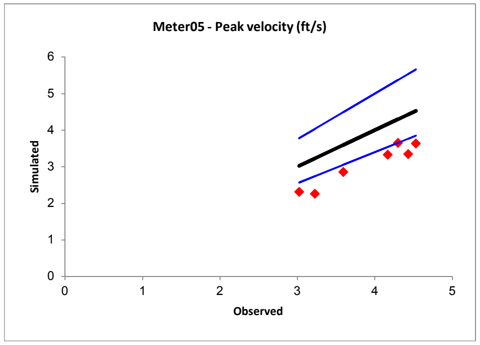

Meter04 - Peak depth (ft)

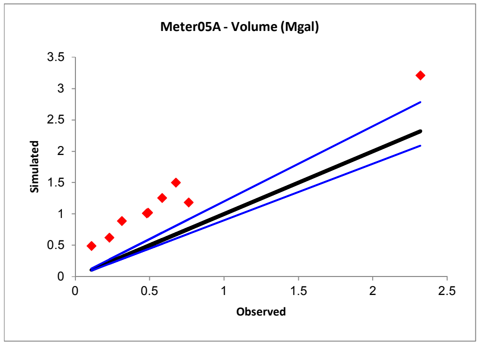

Meter04 - Peak velocity (ft/s)

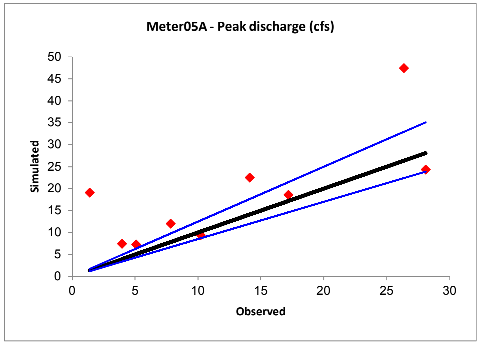

Meter05 - Volume (Mgal)

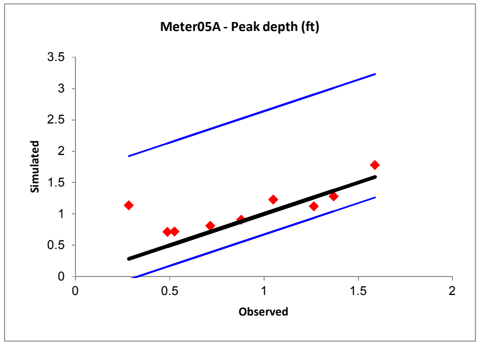

Meter05 - Peak discharge (cfs)

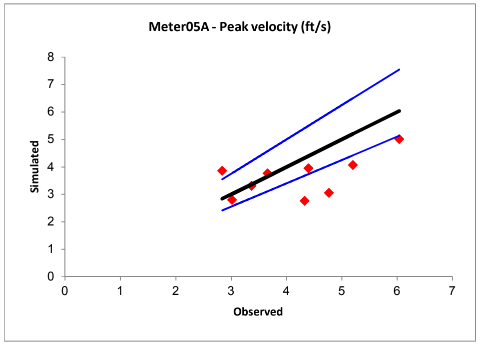

Meter05 - Peak depth (ft)


Meter05 - Peak velocity (ft/s)

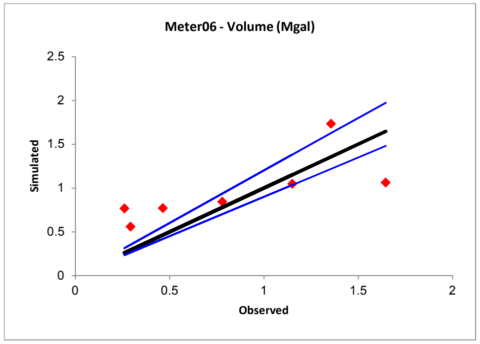

Meter05A - Volume (Mgal)

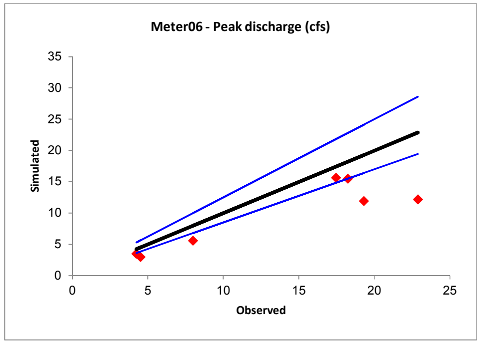

Meter05A - Peak discharge (cfs)

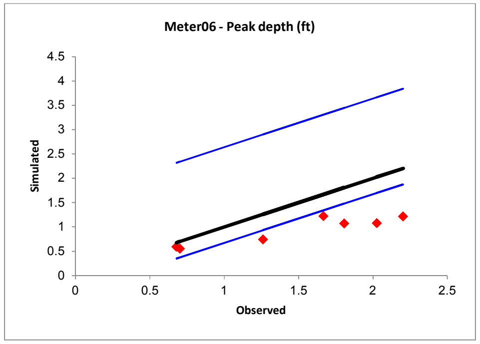

Meter05A - Peak depth (ft)

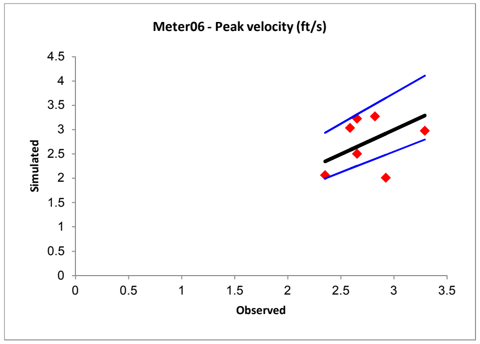

Meter05A - Peak velocity (ft/s)

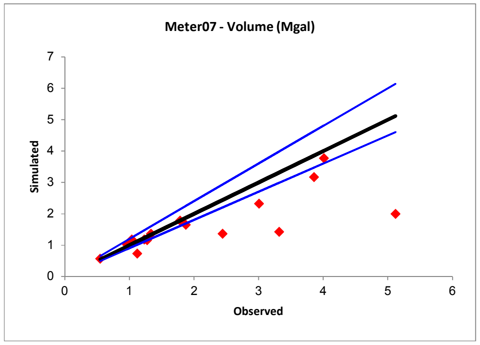
Simulated Versus Observed Flow at Flow Meter Sites

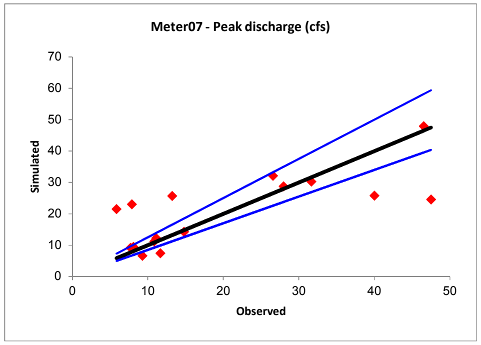

Meter06 - Volume (Mgal)

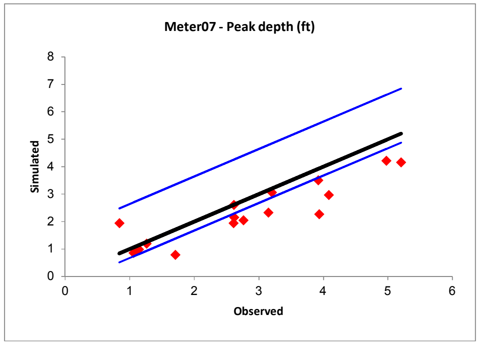

Meter06 - Peak discharge (cfs)

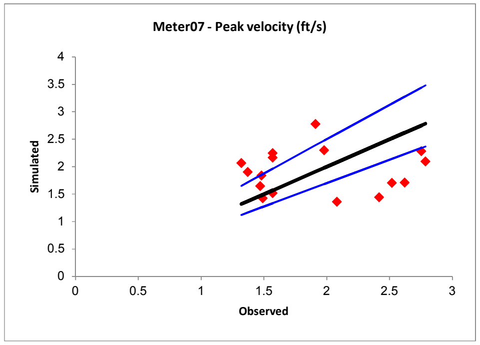

Meter06 - Peak depth (ft)

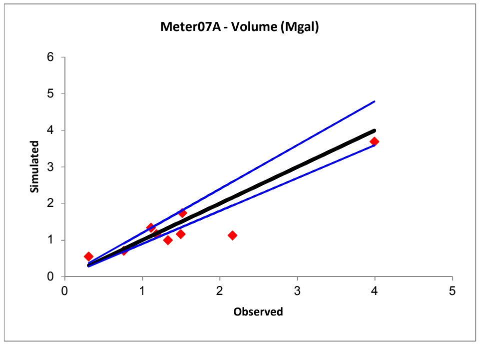

Meter06 - Peak velocity (ft/s)

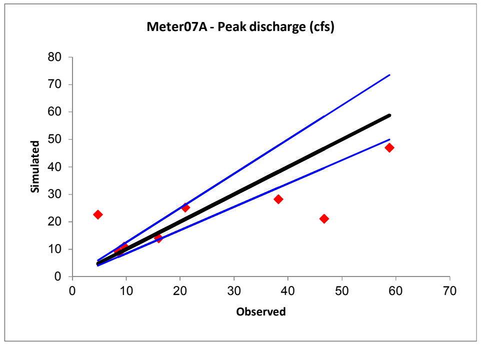

Meter07 - Volume (Mgal)

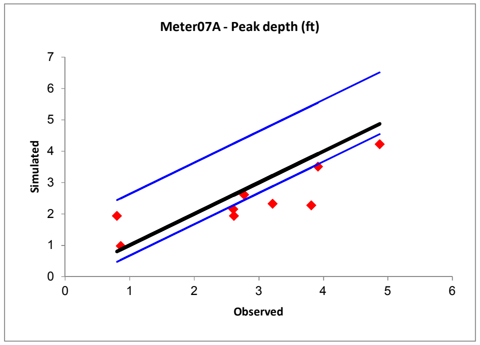

Meter07 - Peak discharge (cfs)

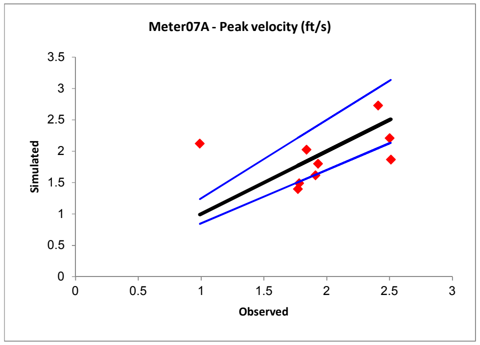

Meter07 - Peak depth (ft)


Meter07 - Peak velocity (ft/s)

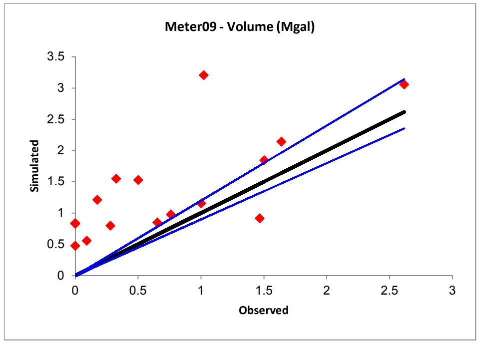

Meter07A - Volume (Mgal)

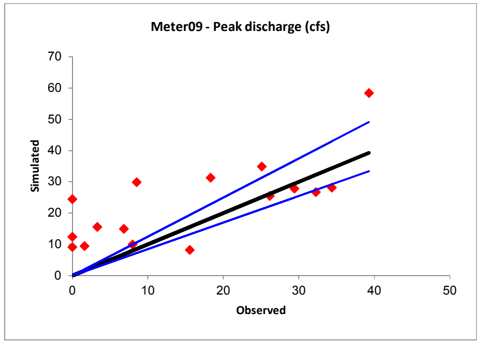

Meter07A - Peak discharge (cfs)

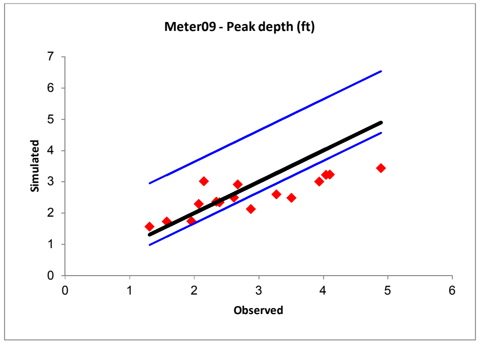

Meter07A - Peak depth (ft)

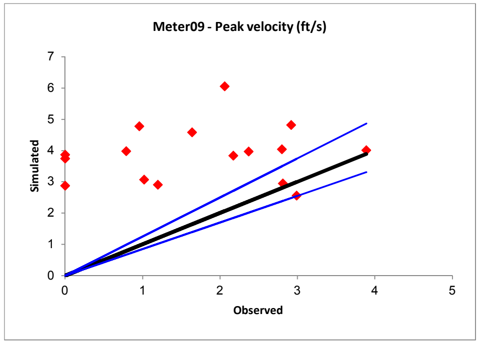

Meter07A - Peak velocity (ft/s)

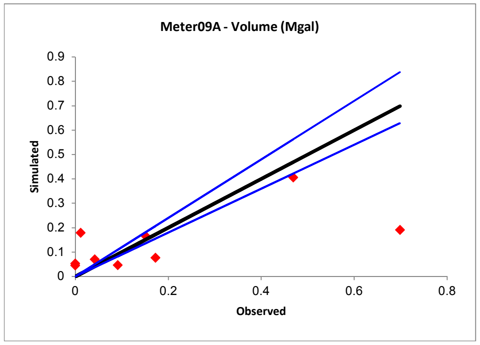
Simulated Versus Observed Flow at Flow Meter Sites

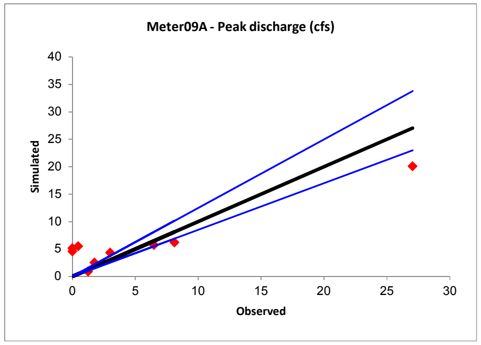

Meter09 - Volume (Mgal)

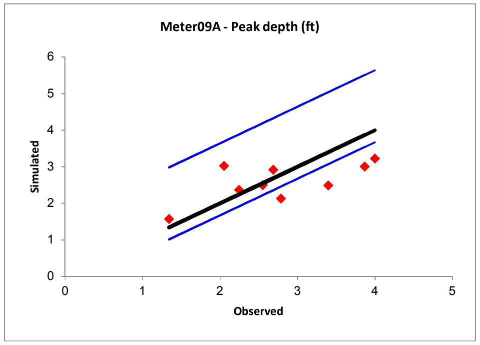

Meter09 - Peak discharge (cfs)

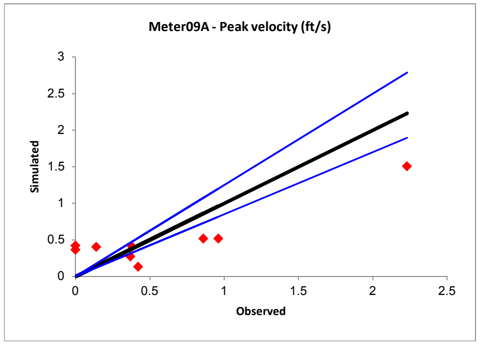

Meter09 - Peak depth (ft)

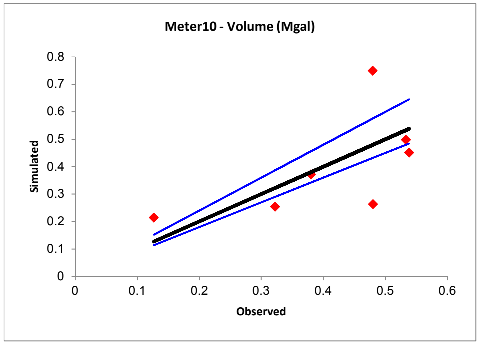

Meter09 - Peak velocity (ft/s)

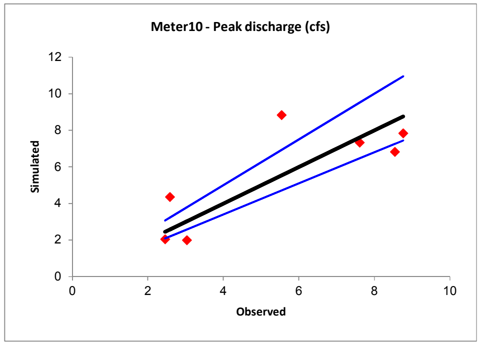

Meter09A - Volume (Mgal)

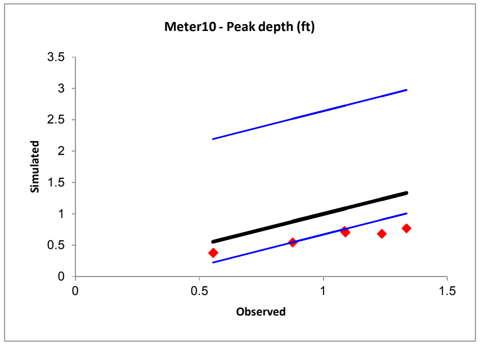

Meter09A - Peak discharge (cfs)

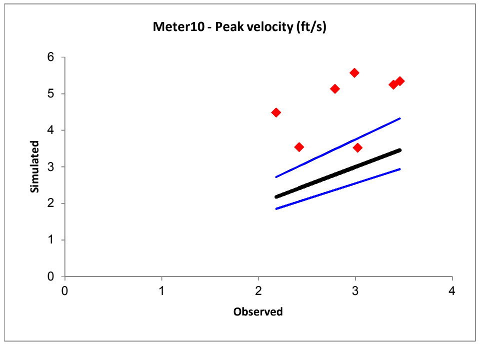

Meter09A - Peak depth (ft)


Meter09A - Peak velocity (ft/s)

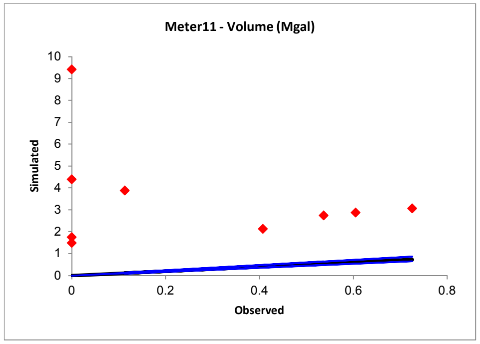

Meter10 - Volume (Mgal)

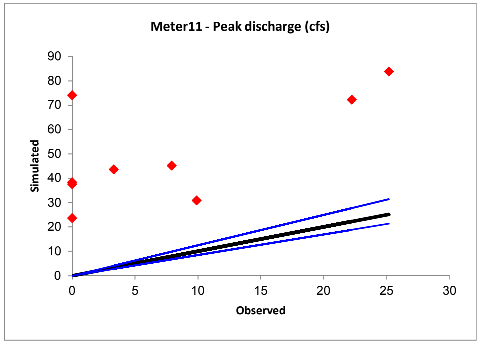

Meter10 - Peak discharge (cfs)

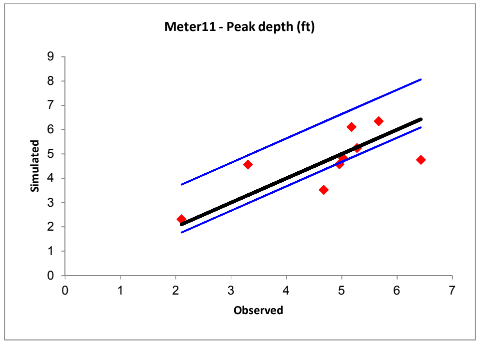

Meter10 - Peak depth (ft)

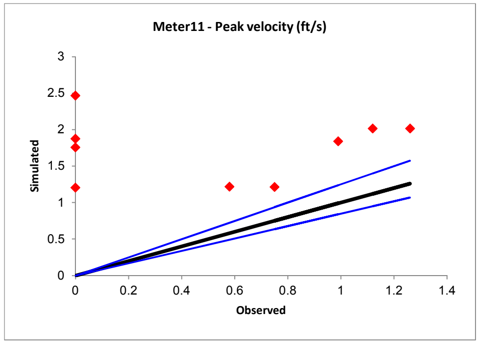

Meter10 - Peak velocity (ft/s)

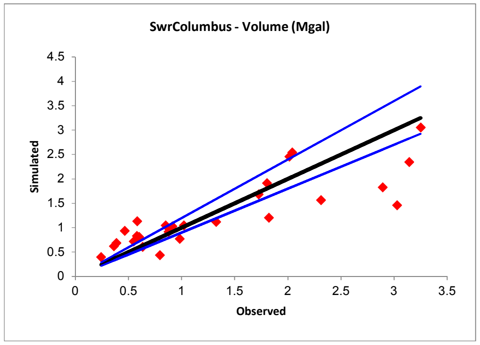
Simulated Versus Observed Flow at Flow Meter Sites

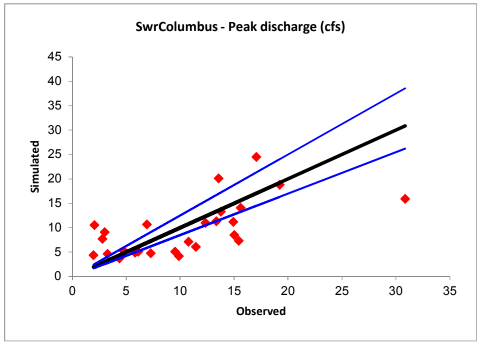


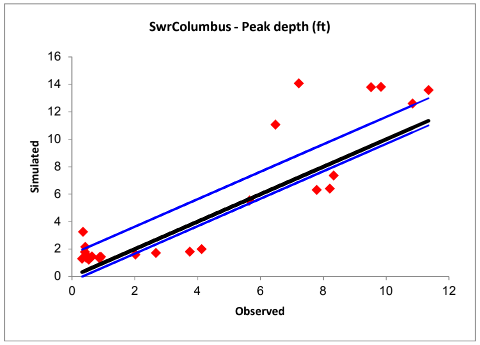


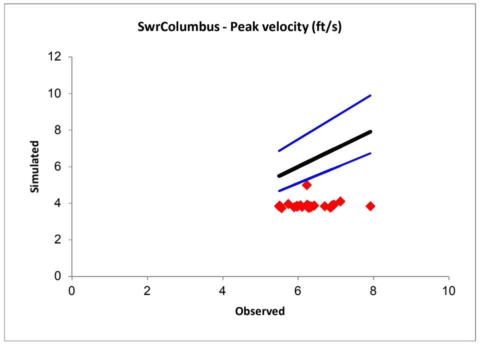


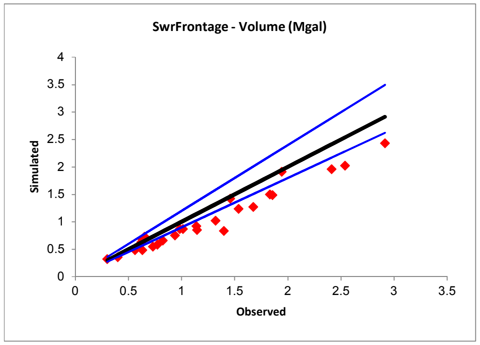


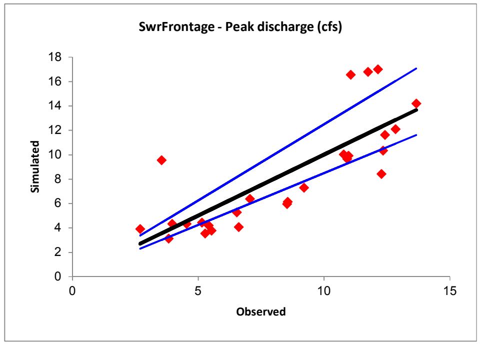


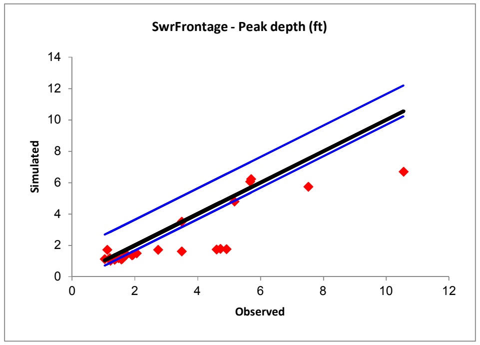


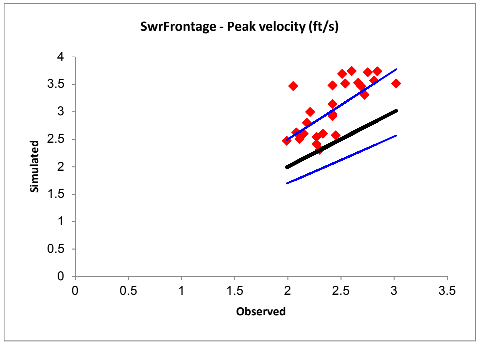




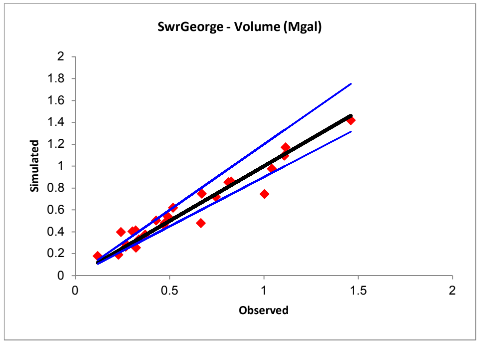


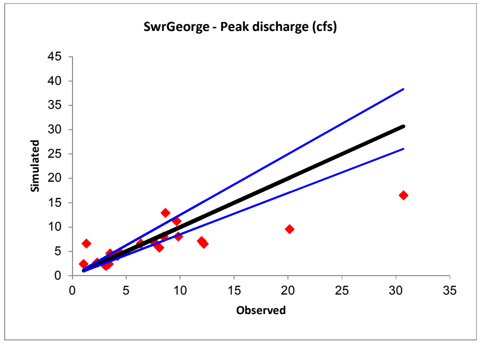


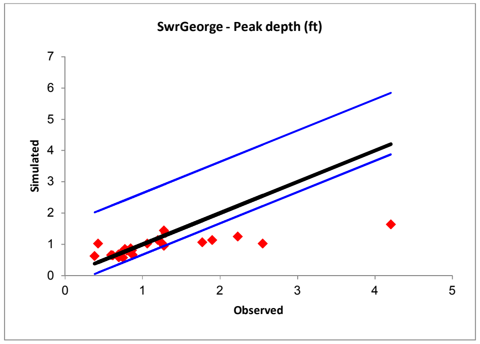


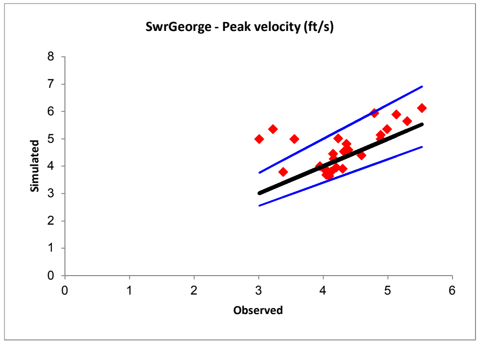


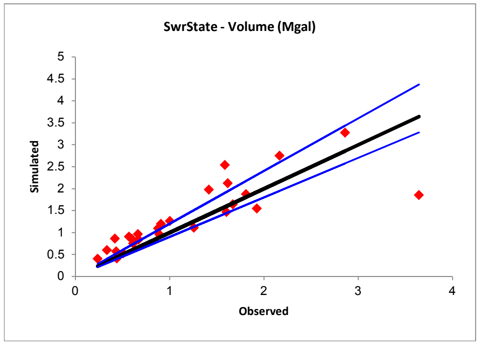
Simulated Versus Observed Flow at Flow Meter Sites

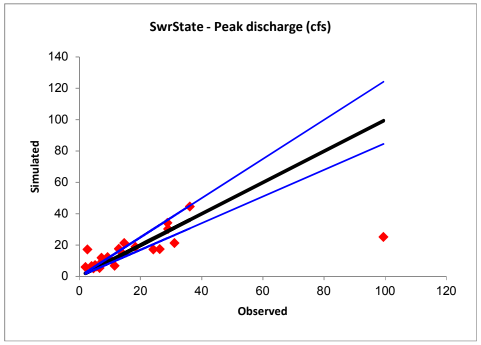


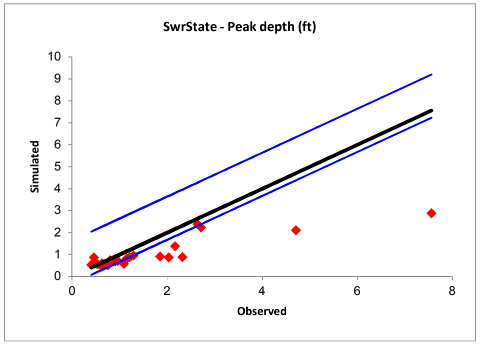


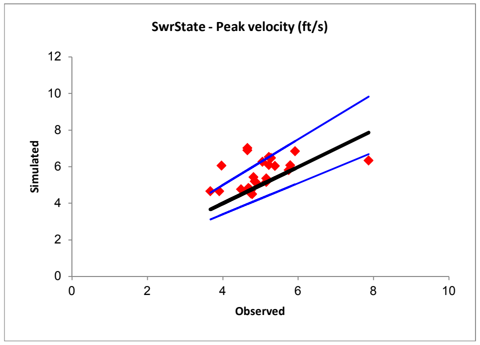


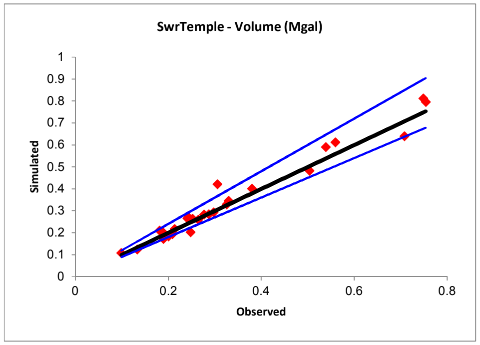


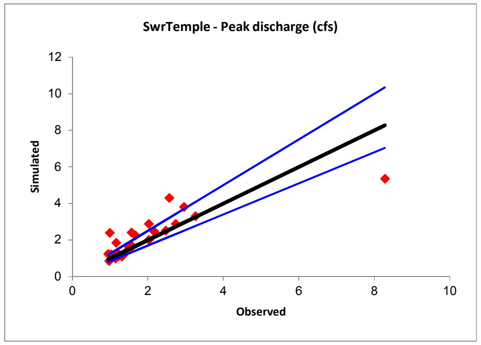


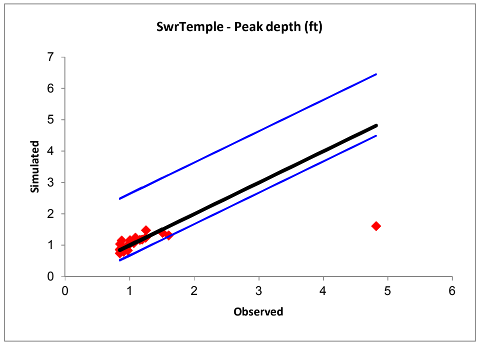


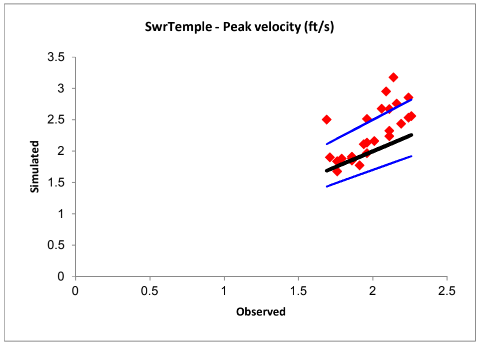




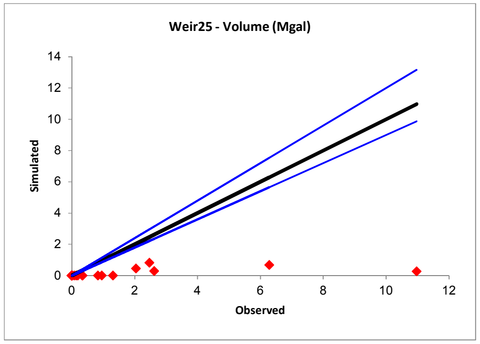


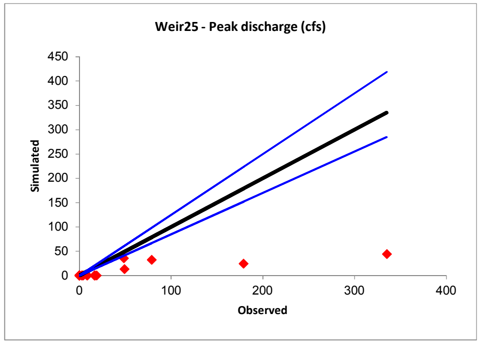


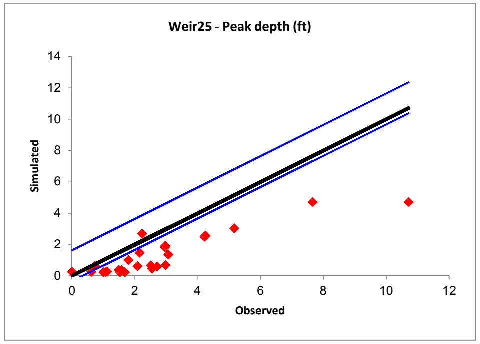


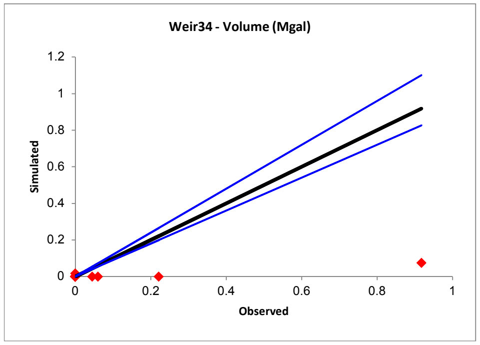


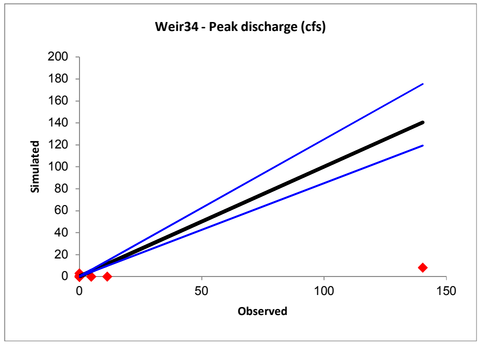
Simulated Versus Observed Flow at Flow Meter Sites

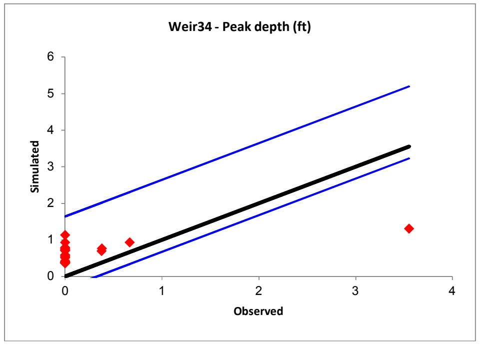










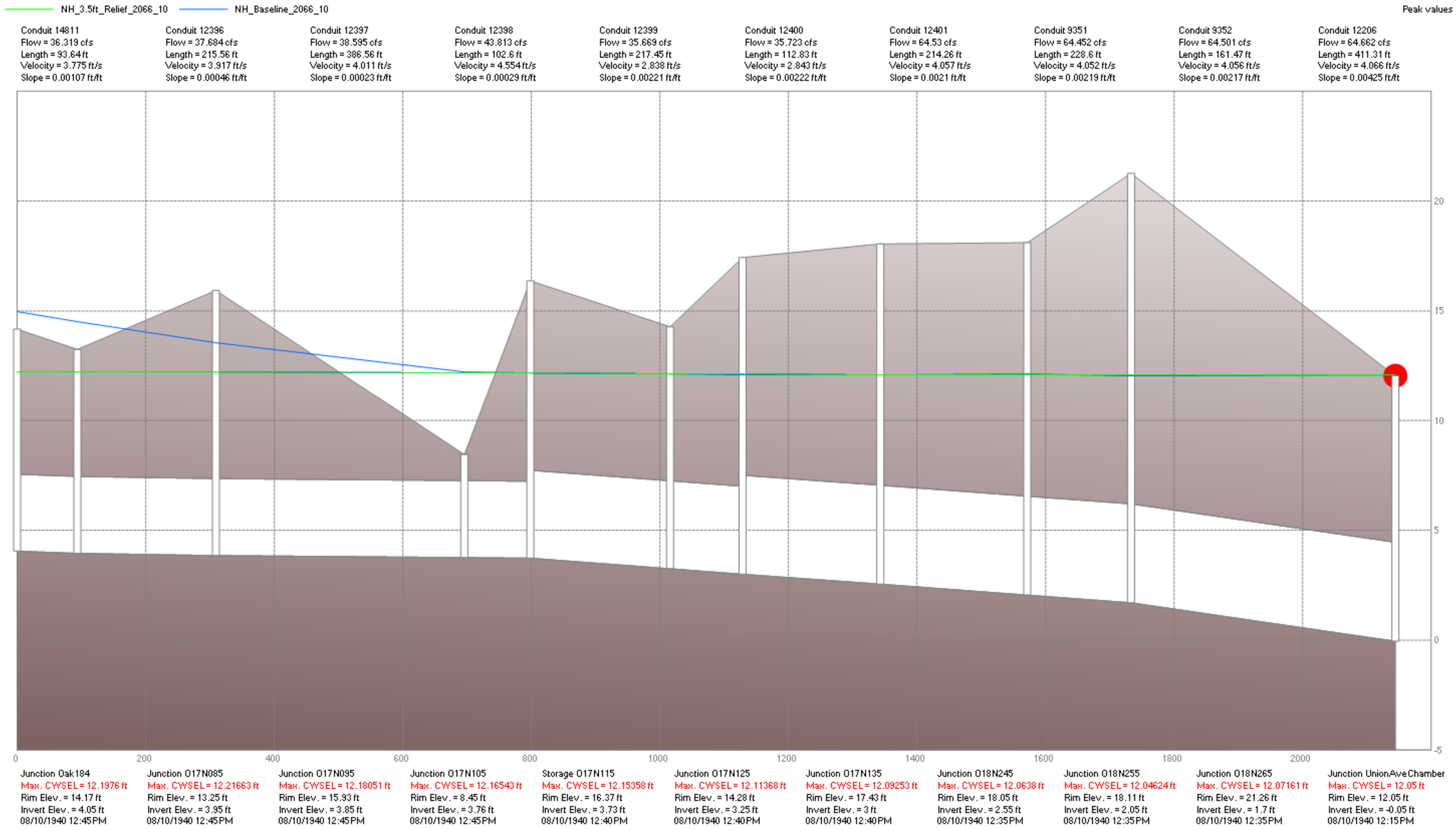


Appendix E

Alternatives Analysis – Hydraulic Grade Lines

Baseline + 3.5-ft Relief Pipe

10YR 24HR Storm Event



NEW HAVEN DOWNTOWN STORMWATER MODELING PROJECT

BASELINE CONDITIONS

Hydraulic Grade Line (ft)

Location	Route 34		Police Station		Temple/Frontage	Storm	
Rim Elev (ft)	8.5		8.0		13.6	Avg Return Year	24-Hr Rain Depth (in)
Phase	O17N105	O17N115	O18N225	MeadowUnionCham	O17N285		
NRCS Storm	**12.2**	**12.2**	**10.3**	**10.3**	**18.0**	10-Yr 24-Hr	5.6
8/10/2012	**12.3**	**12.2**	**10.1**	**10.1**	**20.4**	50-Yr 15-Min 25-Yr 1-Hr	3.1
9/28/2012	**11.0**	**10.8**	**9.2**	**9.2**	**15.0**	15-Yr 3-Hr	3.7
5/16/2014	8.0	8.0	**8.1**	**8.1**	8.6	1-Yr 1-Hr	1.7
6/13/2014	**10.2**	**10.0**	**8.8**	**8.8**	11.7	5-Yr 1-Hr	2.2
7/14/2014	**11.0**	**11.0**	**9.3**	**9.3**	**16.8**	10-Yr 1-Hr	2.7

Notes: 2066 tide level conditions used for all storm events

7.5% adjustment added to rainfall events

NEW HAVEN DOWNTOWN STORMWATER MODELING PROJECT

ALTERNATIVE 3 -VISION TRAIL GRAVITY PIPES + STORAGE

Phase 1 - Construct gravity pipes and relief pipe.

Hydraulic Grade Line

Location	Route 34		Police Station		Temple/Frontage	Storm	
Rim Elev (ft)	8.5		8.0		13.6	Avg Return Year	24-Hr Rain Depth (in)
Phase	O17N105	O17N115	O18N225	MeadowUnionCham	O17N285		
NRCS Storm	**10.5**	**10.5**	**9.8**	**9.7**	**15.7**	10-Yr 24-Hr	5.6
8/10/2012	**10.7**	**10.6**	**9.8**	**9.6**	**16.1**	50-Yr 15-Min	3.1
9/28/2012	7.5	7.5	**8.2**	**8.1**	8.5	15-Yr 3-Hr	3.7
5/16/2014	5.9	5.9	6.1	6.2	6.5	1-Yr 1-Hr	1.7
6/13/2014	6.7	6.7	6.9	6.8	6.9	5-Yr 1-Hr	2.2
7/14/2014	8.5	8.3	**8.6**	**8.6**	12.9	10-Yr 1-Hr	2.7

Notes: 2066 tide level conditions used for all storm events

7.5% adjustment added to rainfall events

NEW HAVEN DOWNTOWN STORMWATER MODELING PROJECT

ALTERNATIVE 3 -VISION TRAIL GRAVITY PIPES + STORAGE

Phase 2 - Construct storage and flap gates.

Hydraulic Grade Line

Location	Route 34		Police Station		Temple/Frontage	Storm	
Rim Elev (ft)	**8.5**		**8.0**		**13.6**	**Avg Return Year**	**24-Hr Rain Depth (in)**
Phase	**O17N105**	**O17N115**	**O18N225**	**MeadowUnionCham**	**O17N285**		
NRCS Storm	7.7	7.6	6.1	6.1	**13.7**	10-Yr 24-Hr	5.6
8/10/2012	8.1	7.6	6.0	6.0	**14.5**	50-Yr 15-Min	3.1
9/28/2012	6.4	6.1	3.7	3.7	7.0	15-Yr 3-Hr	3.7
5/16/2014	5.8	5.6	3.7	3.7	6.5	1-Yr 1-Hr	1.7
6/13/2014	6.0	5.8	4.1	4.1	6.9	5-Yr 1-Hr	2.2
7/14/2014	6.7	6.4	3.8	3.8	8.1	10-Yr 1-Hr	2.7

Notes: 2066 tide level conditions used for all storm events

7.5% adjustment added to rainfall events

Peak Storage Volume (MG)

Name	10YR_2066	8/10/2012	9/28/2012	5/16/2014	6/13/2014	7/14/2014
SU_D	5.3	3.0	1.6	1.4	1.3	1.3
SU_G	2.0	1.8	1.5	0.6	0.9	1.1
SU_T	1.0	0.8	0.4	0.4	0.4	0.4
Total Vol	8.3	5.6	3.5	2.5	2.7	2.9

NEW HAVEN DOWNTOWN STORMWATER MODELING PROJECT

ALTERNATIVE 4 - PUMPING STATION + STORAGE

Phase 1 - Construct pumping station and storage, flap gates and relief pipe.

Hydraulic Grade Line

Location	**Route 34**		**Police Station**		**Temple/Frontage**	**Storm**	
Rim Elev (ft)	**8.5**		**8.0**		**13.6**	**Avg Return Year**	**24-Hr Rain Depth (in)**
Phase	**O17N105**	**O17N115**	**O18N225**	**MeadowUnionCham**	**O17N285**		
NRCS Storm	**9.7**	**9.7**	**9.9**	**9.9**	**15.7**	10-Yr 24-Hr	5.6
8/10/2012	**10.2**	**10.2**	**9.8**	**9.7**	**16.6**	50-Yr 15-Min	3.1
9/28/2012	7.2	7.1	**8.5**	**8.4**	11.8	15-Yr 3-Hr	3.7
5/16/2014	5.9	5.8	7.0	7.2	7.4	1-Yr 1-Hr	1.7
6/13/2014	6.4	6.4	8.0	7.7	8.2	5-Yr 1-Hr	2.2
7/14/2014	8.2	7.5	**8.8**	**8.7**	13.6	10-Yr 1-Hr	2.7

Notes: 2066 tide level conditions used for all storm events

7.5% adjustment added to rainfall events

Peak Storage Volume (MG)

Name	**10YR_2066**	**8/10/2012**	**9/28/2012**	**5/16/2014**	**6/13/2014**	**7/14/2014**
SU_T	1.0	1.1	0.6	0.5	0.5	0.7

NEW HAVEN DOWNTOWN STORMWATER MODELING PROJECT

ALTERNATIVE 4 - PUMPING STATION + STORAGE

Phase 2 - Construct remainder of storage.

Hydraulic Grade Line

Location	Route 34		Police Station		Temple/Frontage	Storm	
Rim Elev (ft)	**8.5**		**8.0**		**13.6**	**Avg Return Year**	**24-Hr Rain Depth (in)**
Phase	**O17N105**	**O17N115**	**O18N225**	**MeadowUnionCham**	**O17N285**		
NRCS Storm	8.1	8.0	7.3	7.4	13.6	10-Yr 24-Hr	5.6
8/10/2012	**9.7**	**9.5**	**8.6**	7.5	**16.3**	50-Yr 15-Min	3.1
9/28/2012	6.8	6.7	5.0	5.0	9.5	15-Yr 3-Hr	3.7
5/16/2014	5.9	5.7	5.1	5.2	7.4	1-Yr 1-Hr	1.7
6/13/2014	6.2	6.1	5.2	5.2	8.2	5-Yr 1-Hr	2.2
7/14/2014	7.2	7.1	5.7	5.7	11.4	10-Yr 1-Hr	2.7

Notes: 2066 tide level conditions used for all storm events
7.5% adjustment added to rainfall events

Peak Storage Volume (MG)

Name	10YR_2066	8/10/2012	9/28/2012	5/16/2014	6/13/2014	7/14/2014
SU_D	6.8	4.1	2.7	2.2	2.1	2.1
SU_G	1.7	1.7	1.5	0.6	0.9	1.1
SU_T	0.5	0.7	0.5	0.5	0.5	0.5
Total Vol	9.0	6.5	4.7	3.3	3.6	3.7

NEW HAVEN DOWNTOWN STORMWATER MODELING PROJECT

ALTERNATIVE 5 - VISION TRAIL GRAVITY PIPES + PUMPING STATION

Phase 1 - Construct gravity pipes, force main and relief pipe.

Hydraulic Grade Line (ft)

Location	**Route 34**		**Police Station**		**Temple/Frontage**	**Storm**	
Rim Elev (ft)	**8.5**		**8.0**		**13.6**	**Avg Return Year**	**24-Hr Rain Depth (in)**
Phase	**O17N105**	**O17N115**	**O18N225**	**MeadowUnionCham**	**O17N285**		
NRCS Storm	**10.9**	**10.9**	**8.8**	**8.7**	**15.7**	10-Yr 24-Hr	5.6
8/10/2012	**11.0**	**11.0**	**9.1**	**8.8**	**16.2**	50-Yr 15-Min	3.1
9/28/2012	8.1	7.9	**8.2**	**8.1**	10.0	15-Yr 3-Hr	3.7
5/16/2014	6.0	6.0	6.9	6.0	7.5	1-Yr 1-Hr	1.7
6/13/2014	6.7	6.7	6.8	6.7	8.4	5-Yr 1-Hr	2.2
7/14/2014	6.7	6.7	6.8	6.7	8.4	10-Yr 1-Hr	2.7

Notes: 2066 tide level conditions used for all storm events

7.5% adjustment added to rainfall events

NEW HAVEN DOWNTOWN STORMWATER MODELING PROJECT

ALTERNATIVE 5 - VISION TRAIL GRAVITY PIPES + PUMPING STATION

Phase 2 - Construct pumping station, storage and flap gates.

Hydraulic Grade Line (ft)

Location	**Route 34**		**Police Station**		**Temple/Frontage**	**Storm**	
Rim Elev (ft)	**8.5**		**8.0**		**13.6**	**Avg Return Year**	**24-Hr Rain Depth (in)**
Phase	**O17N105**	**O17N115**	**O18N225**	**MeadowUnionCham**	**O17N285**		
NRCS Storm	7.5	7.3	6.4	6.3	13.6	10-Yr 24-Hr	5.6
8/10/2012	**9.0**	**8.6**	7.8	6.8	**14.9**	50-Yr 15-Min	3.1
9/28/2012	6.6	6.4	3.8	3.6	8.8	15-Yr 3-Hr	3.7
5/16/2014	5.9	5.8	3.3	3.3	7.5	1-Yr 1-Hr	1.7
6/13/2014	6.2	6.1	3.8	3.8	8.3	5-Yr 1-Hr	2.2
7/14/2014	6.7	6.4	4.4	4.4	13.6	10-Yr 1-Hr	2.7

Notes: 2066 tide level conditions used for all storm events
7.5% adjustment added to rainfall events

Peak Storage Volume (MG)

Name	**10YR_2066**	**8/10/2012**	**9/28/2012**	**5/16/2014**	**6/13/2014**	**7/14/2014**
SU_T	1.0	1.1	0.2	0.2	0.2	0.2