Appendix N

Selection and Implementation of Alternatives Report
for City of Paterson

City of Paterson
Combined Sewer System
NJPDES Permit No. NJ0108880

CSO Long Term Control Plan (LTCP)

Selection and Implementation of Alternatives Report

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SECTION A - INTRODUCTION

A.1 DESCRIPTION OF THE CITY

The City of Paterson (City) is an older urban community located within Passaic County, New Jersey. The City is bounded on the west by the Boroughs of West Paterson and Totowa, on the north by the Passaic River and the Boroughs of Haledon and Prospect Park, on the east by the Passaic River and the Boroughs of Elmwood Park and Fairlawn, and the south by the City of Clifton. The City consists of approximately 5,290 acres, and the City's population in 2010 (according to the US Census Bureau) was 146,199 persons. Most of the housing in the City was constructed prior to 1940.

As stated above, the City encompasses approximately 8.26 square miles (5,290 acres). The City's land use is varied, consisting of residential, commercial and industrial areas. It is approximated that eight (8%) percent of the City is commercial, 19% is industrial, 65% is residential, and the remaining eight (8%) percent is considered open space. The main commercial area of the City is the downtown, an area roughly encompassed by Main Street and Memorial Drive and King Boulevard (Broadway) and Market Street. The major industrial areas of the City are along the Passaic River, with most of these industries lying along the northern boundary of the City. There are also additional industrial areas along the Interstate 80 corridor.

A.2 DESCRIPTION OF THE CITY'S COMBINED SEWER SYSTEM

The City of Paterson is the owner and operator of a combined sewer system (CSS) (a system where sewage and storm water are collected and flow within the same conduit) that provides sanitary and storm water conveyance throughout the City. As previously mentioned, the City consists of 5,290 acres, of which approximately 4,760 acres (90%) are serviced by a CSS (refer to Appendix A for maps of the City's CSS, with sub-areas and CSOs labeled).

During dry weather, sewage is conveyed through the City's CSS, into combined sewer overflow (CSO) control facilities (i.e.: regulator chambers) that are owned and operated by the Passaic Valley Sewerage Commissioners (PVSC). From the regulators, the sewage flows to the PVSC's interceptor, which ultimately conveys the sewage to the PVSC Water Pollution Control Facility (WPCF) in Newark for treatment.

During wet weather events, the combined flow in the CSS is too great for the PVSC interceptor to accommodate. Excess flow crests a weir within the PVSC regulators, and sewer overflows occur at discharge points at the Passaic River (refer to Figure 1).

Each of the City's original twenty-eight (28) overflow discharge pipes originate at PVSC regulators, and each of these overflow pipes discharges to the Passaic River. Over time, flow to four (4) of these overflow discharge points (CSO Areas 012, 018, 019 and 020) has been halted, either through the plugging or abandonment of the outfall pipe or the regulator. Another five (5) overflow points (CSO Areas 002, 004, 008, 009, and 011) were recently consolidated with others and/or abandoned as part of the City's Solids/Floatables program. Once this work was completed, only 19 of the City's original 28 overflow discharge points remained in service.

Over the years, the City has constructed relief sewer systems (consisting of weirs, internal overflow chambers (IOCs), and large diameter relief sewers) in order to provide hydraulic relief to the combined sewer system. The relief sewer systems were specifically designed to prevent surcharging of the combined sewer systems and alleviate street flooding. (The relief sewer systems are prevalent in CSO Areas 028, 029, 030 and 031). When it was convenient, storm water inlets along the route of the relief sewers were connected directly to the relief sewer; however, most of the inlets in upstream areas remained connected to the combined sewer system. It should be noted that the relief sewer systems were constructed to provide hydraulic relief and alleviate street flooding; they were not intended to function as separated storm sewer systems.

These new control facilities (weirs and IOCs) divert excess flow from the combined sewer system to the relief sewers, with the ultimate discharge of this excess flow being to the Passaic River. Overall, the relief sewer system contains 24 active internal control facilities, owned and operated by the City, which are tributary to four (4) combined sewer overflow discharge pipes.

A.3 DESCRIPTION OF THE COMBINED SEWER SYSTEM AREAS

As previously discussed, a majority of the sections within the City of Paterson are serviced by combined sewer systems that convey sanitary and storm water in the same conduit. During dry periods, sewage is transported through the City's collection system to a PVSC regulator chamber, to the PVSC interceptor and ultimately to the PVSC WPCF in Newark. However, the interceptor lines have limited hydraulic capacity, and during wet weather the excess combined flow is diverted at the regulator chambers to an outfall pipe which discharges to the Passaic River.

The following is a brief description of each of the City's CSO areas, as reported in the 2007 Schoor DePalma Cost and Performance Analysis Report. It is a discussion of the proposed improvements that have either been constructed or were proposed to be constructed in that Report within each area, in order for the City to comply with the Solids/Floatables Control requirements of its General Permit. Proposed improvements were published in design drawings by CMX, titled "City of Paterson CSO – Solids and Floatables Control Facilities Project," issued for bid on October 1, 2009.

CSO001 - Curtis Place

The Curtis Place PVSC Regulator is located approximately 100 feet west of the intersection of Curtis Place and Broadway. Outfall 001 is a 48" diameter pipe, approximately 30 feet long, which discharges at the southwest comer of the bridge that leads to the parking lot of the Salvation Army Building. It should be noted that the Curtis Place PVSC Regulator is one of the upstream starting points of the PVSC Interceptor (along with the S.U.M. Regulator).

The existing 48" outfall was brick and mortared plugged and partially removed. The overflow from PVSC Regulator 001 is now diverted into a new four (4) net netting chamber. The netting chamber is located two (2) feet downstream of the Regulator and in between the Regulator and the bridge that leads to the parking lot of the Salvation Army Building. The screened overflow discharges into a manmade drainage channel approximately ten (10") in width which flows for about sixty (60') feet until it flows into the Passaic River.

CSO002 - Mulberry Street

The Mulberry Street PVSC Regulator is located in a paved area between (currently abandoned) River Street and the Passaic River, approximately 250 feet southwest of the intersection of River Street and West Broadway. Outfall 002 is a 12" diameter pipe, approximately 20 feet long, which discharges to the north of the regulator, directly into the Passaic River.

This outfall is currently inactive and has been plugged since the implementation of controls proposed to address floatables/solids control.

CSO003 - West Broadway

The West Broadway PVSC Regulator is located within West Broadway, approximately forty (40') feet northwest of the intersection of West Broadway and (currently abandoned) River Street. Outfall 003 is an 18" diameter pipe, approximately 40 feet long, which discharges to the Passaic River through the southeastern foundation wall of the County Bridge over the Passaic River that links the north and south sides of West Broadway.

An in-line netting chamber is proposed to be installed in order to capture solids and floatables of *W'* or greater diameter prior to their discharge to the river. Due to the location of the existing regulator and the outfall pipe (along the centerline of West Broadway), new piping will be installed to re-direct combined overflow to an in-line netting chamber located outside of the West Broadway right-of-way. The combined overflow is conveyed through the new diversion piping, through the netting chamber, discharging to the Passaic River.

With a design flow of six (6) MGD (9.28 cfs) the proposed netting chamber will house two (2) nets. The size of the netting chamber will be 23' x 8'-8". The chamber will be located within a vacant lot directly northeast of the regulator; this lot is currently being redeveloped, but accommodations have been made to provide space for the proposed netting chamber. The netting chamber will be placed approximately fifteen (15') feet east of the existing roadway and approximately 25-30 feet from the bank of the Passaic River.

A new doghouse manhole will be installed along the existing outfall pipe approximately five (5') feet downstream of the regulator to redirect the combined flow 90 degrees in an easterly direction to a new manhole located within the vacant lot. A pipe connection running ten (10') feet will be made to connect this manhole to the proposed netting chamber. A pipe will exit from the opposite side of the netting chamber to connect to another proposed manhole. A check valve will be installed within this manhole to prevent backflow into the netting chamber. A new pipe running approximately thirty (30') feet will exit this manhole and will run through a core-drilled hole in an existing headwall, thus directly discharging the combined flow into the Passaic River.

CSO004 - Bank Street

The Bank Street PVSC Regulator is located in an abandoned roadway approximately 250 feet northwest of the intersection of (currently abandoned) River Street and West Broadway. Mapping shows that Outfall 004 is approximately 150 feet long and is located approximately 240 feet downstream of Outfall 003, but this outfall is buried, and could not be located.

In the area of the PVSC regulator, Bank Street has essentially been abandoned due to realignment of the adjacent roadways. The sewer pipe leading to this regulator will be abandoned in place and filled with grout, and the regulator will also be abandoned in place. The outfall pipe and other

influent and dry weather piping entering and exiting the regulator will also be brick and mortared sealed and abandoned in place.

Sewer separation is proposed in this CSO Area, which will connect the existing catch basins to an existing manhole that connects to the River Street storm sewer system. The proposed storm sewer pipe will be 12" ductile iron, approximately 70 feet in length. The previous connections from the catch basins to the regulator will be brick and mortar plugged.

As of the current LTCP, this sewer separation has been completed and CSO004 has been plugged.

CSO005 - Bridge Street

The Bridge Street PVSC Regulator is located approximately 50 feet northwest of the intersection of River and Bridge Streets. Outfall 005 is approximately twenty-five (25) feet long, and discharges to the Passaic River beneath the southeast foundation of the bridge that links the north and south sides of Bridge Street over the Passaic River.

A two (2) net netting chamber is proposed for CSO005. Overflow is being redirected from the existing PVSC Regulator 005 via 60" RCCP to the adjacent comer lot southwest of the regulator (similar to CSO007's design). Overflow is then screened through a two (2) net in- line netting chamber. Screened flow then is discharged from a new headwall at the end of the netting chamber directly into the Passaic River. A 5' x 4' rectangular hydraulic flap valve is proposed at the outfall. The existing outfall pipe will be sealed and abandoned in place.

CSO006 - Montgomery Street

The Montgomery Street PVSC Regulator is located in a sidewalk area along the northwest edge of River Street at its intersection with Montgomery Street. There is no discharge pipe at Outfall 006; combined sewer discharge to the Passaic River occurs immediately northwest of the regulator.

A four (4) net netting chamber was installed at CSO006. The netting chamber was installed directly at the end of the PVSC Regulator where it discharged into the Passaic River. The screened overflow now discharges directly into the Passaic River like before, except now at the end of the netting chamber. Re-grading was done for the installation of the netting chamber, which is located with the Regulator in a gravel parking lot between River Street and the Passaic River.

CSO007 - Straight Street

The Straight Street PVSC Regulator is located approximately 30 feet northwest of the intersection of Straight Street and River Street. Outfall 007 passes through the southeastern foundation wall of the Straight Street Bridge, and discharges to the Passaic River.

CSO007 is currently under construction. Overflow is being redirected from the existing PVSC Regulator 007 via 60" RCCP to the adjacent comer lot southwest of the regulator. Overflow is then screened through a three (3) net in-line netting chamber. Screened flow then continues approximately fifteen (15) feet to a new outfall with tide flap, which is located on the bank of the Passaic River. The existing outfall pipe will be sealed and abandoned in place.

CSO008 - Franklin Street

The Franklin Street PVSC Regulator is located along the northwest edge of River Street at its intersection with Franklin Street. Outfall 008 is believed to be buried and inactive; its flow was consolidated with the outfall pipe from CSO007.

CSO009 - Keen Street

The Keen Street PVSC Regulator is located approximately 75 feet southwest of the intersection of Keen Street and River Street. Outfall 009 discharges to the Passaic River at the southwest terminus of Keen Street. The outfall pipe from CSO009 is inactive; it was consolidated with the outfall pipe from CSO010.

CSO010 - Warren Street

The Warren Street PVSC Regulator is located on Warren Street approximately 350 feet west of River Street in a truck loading driveway for Halal Meat. Outfall 010 is approximately 50 feet long, and discharges to the Passaic River behind Halal Meat.

A three (3) net netting chamber was installed approximately forty (40) feet downstream of the PVSC Regulator 010. The netting chamber is located on the bank of the Passaic River in between two buildings of Halal Meat and behind a fenced in walkway connecting the two buildings used to move animals to and from the buildings. Screened overflow is directly discharged into the Passaic River.

CSO011 - 6th Avenue

The 6th Avenue PVSC Regulator is located on 6th Avenue, approximately 70 feet west of Shady Street. Outfall 011 is 18" in diameter and runs west from the regulator along 6th Avenue approximately 55 feet through the easterly foundation wall of the 6th Avenue Bridge, where it discharges to the Passaic River. The land use within the 6th Avenue drainage area is primarily industrial.

It was determined that the Area of CSO011 was 100% separated. As such, the regulator outfall pipe, influent pipe and dry weather pipe were brick and mortared sealed and abandoned. The upstream manhole from the regulator located at the intersection of 6th Avenue and Shady Street will be removed, and a new junction chamber approximately 11'-8" x 6'-8" will be installed to allow sewage to flow directly to the PVSC interceptor.

CSO012 - 5th Street and 5th Avenue

The 5th Street and 5th Avenue PVSC Regulator is located at the intersection of 5th Street and 5th Avenue. Previous field studies determined that the sewer drainage basin leading to Regulator 012 is 100% separated, and Outfall 012 has been plugged.

CSO013 - East 11th Street

The East 11th Street PVSC Regulator is located in East 11th Street approximately 450 feet north of 5th Avenue. Outfall 013 discharges to the Passaic River at the north terminus of East 11th Street.

A three (3) net netting chamber was installed approximately thirty (30) feet downstream of the PVSC Regulator 013. The netting chamber is located in the middle of the roadway at the end of 11th Street (a dead end street). Screened overflow flows approximately twenty-five (25) feet via

48" RCP to the existing headwall, where it discharges into a wetland area which is also part of the Passaic River bank.

CSO014 - East 12th Street / 4th Avenue

The East 12th Street / 4th Avenue PVSC Regulator is located at the intersection of East 12th Street and 4th Avenue. Outfall 014 runs north from the regulator and discharges to the Passaic River at the bottom of a steep slope.

A two (2) net end-of-pipe netting chamber was installed at the bottom of a steep slope along the banks of the Passaic River where the previous outfall was located. The PVSC Regulator 014 is located at the top of the slope at the intersection of East 12th Street and 4th Avenue as mentioned above. A 24" RCP outfall pipe leaves the regulator and flows northwest down the slope for approximately forty (40) feet, then bends and flows perpendicular to the Passaic River where it flows into the netting chamber. A new concrete stairway from the regulator to the netting chamber was installed along with a gravel entrance driveway. Screened overflows discharge from the netting facility directly into the Passaic River.

CSO015 - S.U.M. Park

The S.U.M. Park PVSC Regulator is located approximately 200 feet southeast of the southeasterly comer of Hinchcliffe Stadium. Outfall 015 is a 36" diameter pipe, which is located along a steep slope. The outfall discharges to the Passaic River approximately 60 feet southeast of the regulator. It should be noted that the S.U.M. PVSC Regulator is one of the upstream starting points of the PVSC Interceptor (along with the Curtis Place Regulator).

An in-line netting chamber was constructed along the embankment near Outfall 015. Due to the steepness of the embankment, re-grading and structural fill was placed to provide a stable foundation for the netting chamber. Once a stable foundation was achieved, the concrete chamber was installed between the regulator and outfall point (over the existing pipe) in a "doghouse" fashion. The slope was re-graded, and an embankment/retaining wall was installed to secure the netting chamber in place and facilitate servicing. A tide gate was installed at the end of the existing outfall pipe to prevent backflow of flood waters into the netting chamber.

With a design flow of 22 MGD (34.04 cfs) the proposed netting chamber will house two (2) nets. The size of the netting chamber will be 23' x 8'-8". A ten (10) foot wide asphalt access driveway from the park's paved path to the netting facility will be installed in order to access the netting chamber for maintenance.

CSO016 - Northwest Street

The Northwest Street PVSC Regulator is located at the intersection of Broadway and Presidential Boulevard. Outfall 016 is approximately 20 feet long, and discharges to the Passaic River through the north foundation wall of the County Bridge that links the north and south sides of Broadway over the Passaic River.

A Romag (mechanical) screen and netting facility have been installed for the short-term control technology for CSO016. Existing PVSC Regulator 016 was modified to divert overflow via cast-in-place concrete box culvert to the new screening facility. The new screening facility is located at the corner of the park east of the Broadway Avenue Bridge. Overflow flows into the new screening facility where flow is diverted into two channels, each channel having a Romag screen and two

nets. Screened flow is then discharged directly into the Passaic River. The existing outfall pipe was sealed and abandoned in place.

CSO017 - Arch Street

The Arch Street PVSC Regulator is located at the southeast end of Arch Street, approximately 200 feet southeast of Presidential Boulevard. Outfall 017 discharges to the Passaic River underneath the bridge connecting Arch and Bridge Streets.

Prior to the 2007 Schoor DePalma Report, field investigations at this site found that the tide gates within the regulator were forced shut with 2' x 4's, effectively plugging the outfall. The City had reported that there were no overflow issues related to this CSO Area at the time. Therefore, no further work was required at this CSO Area.

Subsequent to the 2007 Report, the Arch Street PVSC Regulator is in service and the overflow is treated with an end-of-pipe netting chamber. The forward flow not relieved by the PVSC regulating chamber then diverts to the CSO032 Hudson Street regulating chamber. Overflow is screened at CSO032 by end-of-pipe netting facilities, and forward flow crosses the river to the PVSC Main Line at Lawrence Street.

CSO018 - Jefferson Street

The Jefferson Street PVSC Regulator is located approximately 40 feet southeast of the intersection of Jefferson Street and Presidential Boulevard. Outfall 018 discharges to the Passaic River approximately 90 feet southeast of Presidential Boulevard. However, the outfall could not be located and is believed to be buried. It is understood that a masonry wall was installed within the regulator to block peak dry weather flows from discharging through the overflow pipe.

As the regulator is blocked, and no dry or wet weather flow can discharge to the Passaic River from this regulator, no further work is required at this CSO Area.

CSO019 - Stout Street

The Stout Street PVSC Regulator is located approximately 40 feet southeast of the intersection of Stout Street and Presidential Boulevard. Outfall 019 discharges to the Passaic River. However, the outfall could not be located and is believed to be buried. It is understood that a masonry wall was installed within the regulator to block peak dry weather flows from discharging through the overflow pipe.

As the regulator is blocked, and no dry or wet weather flow can discharge to the Passaic River from this regulator, no further work is required at this CSO Area.

CSO020 - North Straight Street

The North Straight Street PVSC Regulator is located approximately fifty (50') feet east of the intersection of North Straight Street and Main Street. Outfall 020 runs along the centerline of North Straight Street and discharges to the Passaic River underneath the bridge connecting North Straight Street and Straight Street. It is understood that a masonry wall was installed within the regulator to block peak dry weather flows from discharging through the overflow pipe.

As the regulator is blocked and no dry or wet weather flow can discharge to the Passaic River from this regulator, no further work is required at this CSO Area.

CSO021 - Bergen Street

The Bergen Street PVSC Regulator is located at the eastern terminus of Bergen Street. A short section of 32" x 49" box culvert exits the regulator and discharges to the Passaic River immediately east of the regulator.

The existing solids/floatables control technology for Outfall 021 is an end-of-pipe netting facility. Bergen Street will be extended approximately eighteen feet; a new headwall will be installed to support the street extension and new sidewalls will be installed to support the proposed netting chamber. New piping will be installed beneath the street extension to allow the combined flow to continue to the proposed netting facility. With a design flow of 8.0 MOD (12.38 cfs) the proposed end-of-pipe netting facility will house two (2) nets. Re-grading and placement of fill will be necessary for the street extension and netting facility. Riprap will be installed at the discharge points of both the netting facility and an existing storm line to prevent scouring along the channel bottom.

CSO022 - Short Street

The Short Street PVSC Regulator is located at the eastern terminus of Short Street. Outfall 022 runs approximately 20 feet to the east and discharges to the Passaic River.

A two (2) net netting chamber is proposed for CSO022. The proposed netting chamber is to be located at the end of the PVSC Regulator 022. A new retaining wall is proposed around the netting chamber with a 4' x 4' rectangular hydraulic flap valve. Screened flow then is discharged from a new headwall/retaining wall at the end of the netting chamber onto a new concrete pad then directly into the Passaic River.

CSO023 - 2nd Avenue

The 2nd Avenue PVSC Regulator is located along the eastern shoulder of McLean Boulevard (N.J.S.H. 20) at its intersection with 2nd Avenue. Outfall 023 is approximately 35 feet long and discharges to the Passaic River at a point approximately 220 feet east of the intersection of 2nd Avenue and 25th Street.

An in-line netting chamber is proposed to be installed at Outfall 023. A new access lane (complete with a new retaining wall and associated fill and pavement) will be constructed between the northbound shoulder of McLean Boulevard (N.J.S.H. 20) and the Passaic River in order to install the netting chamber. The access lane will provide safe access to the netting chamber, allowing maintenance trucks to stage off of N.J.S.H. 20 to service the facility. The unit will house two (2) nets. New outfall piping will also be installed to accommodate the orientation of the netting chamber as required to properly maintain the facility.

CSO024 - 3rd Avenue

The 3rd Avenue PVSC Regulator is located at the intersection of McLean Boulevard (N.J.S.H. 20) and 3rd Avenue. (The regulator lies underneath the southbound travel lanes of Route 20.) Outfall 024 is a 42" diameter pipe, approximately 70 feet long, which discharges to the Passaic River at a point approximately 100 feet east of the intersection of 3rd Avenue and McLean Boulevard.

An in-line netting chamber is proposed to be installed at Outfall 024. The proposed location of the chamber is within the shoulder of the northbound lanes of N.J.S.H. 20, and some minor re-grading

will be necessary along the existing slope between N.J.S.H. 20 and the Passaic River. The unit will house two (2) nets that will service a design flow of 35.0 MGD (54.15 cfs). The concrete chamber housing the nets will have (approximate) dimensions of 23' x 8'- 8". The chamber will be installed in the "doghouse" fashion over the existing outfall pipe. The existing headwall will be replaced with a new headwall installed in the same location with a tide gate valve attached to prevent backflow into the netting chamber.

CSO025 - 10th Avenue and 33rd Street

The 10th Avenue and 33rd Street PVSC Regulator is located at the intersection of McLean Boulevard (N.J.S.H. 20) and 33rd Street. Outfall 025 runs along the centerline of 33rd Street for approximately 250 feet and discharges to the Passaic River through the southwest foundation wall of County Bridge #8.

A Romag (mechanical) screen and netting facility were installed to meet the short-term control technology requirements for CSO025. A new junction chamber was installed approximately one hundred and fifty (150) feet downstream of the PVSC Regulator 025. The proposed junction chamber will divert flow from existing 72" RCP outfall pipe to a new 84" PCCP. Overflow will then flow into the screening facility which is proposed to be located in existing parking lot adjacent to the east side of the bridge. Flow inside the facility is diverted into two channels, each channel having a Romag screen and two (2) nets. Screened flow then flows from the facility via a 10' x 10' box culvert to a new headwall/outfall. A coarse bar screen is proposed at the outlet of the headwall and flow is discharged directly into the Passaic River.

CSO026 - 20th Avenue

The 20th Avenue PVSC Regulator is located along the eastern edge of McLean Boulevard (N.J.S.H. 20) and its intersection with 20th Avenue. Outfall 026 is approximately 600 feet long and runs to the east along a warehouse complex access driveway, discharging to the Passaic River.

A two (2) net in-line netting chamber is proposed for the short-term control technology for CSO026. The netting chamber's proposed location is approximately ten (10) feet downstream of the PVSC Regulator 026. It is proposed to cut out an appropriate section of the existing 43" x 56" brick outfall pipe, connecting the chamber and existing pipe with a concrete collar. A 24" tide flap valve is proposed at the outfall.

CSO027 - Market Street

The Market Street PVSC Regulator is located along the western edge of the Market Street exit ramp from McLean Boulevard (N.J.S.H. 20), approximately 240 feet northwest of the intersection of Interstate 80 and McLean Boulevard. Outfall 027 runs beneath Route 20 approximately 400 feet and discharges to the Passaic River through the west foundation wall of the bridge that connects Market Street (Elmwood Park) and McLean Boulevard (Paterson).

A Romag (mechanical) screen and netting facility is proposed for the short-term control technology for CSO027. Due to the existing PVSC Regulator 027 location, the existing regulator is proposed to be modified and a new regulator and screening facility installed upstream. A new junction chamber is proposed at the intersection of Vreeland Street and East 41st Street to divert flow from existing 84" RCP into a proposed 90" PCCP. The new 90" PCCP flows across East 41st Street to an existing parking lot on Market Street between East 41st and East 42nd Streets where

the new regulator and screening facility is proposed to be located. Flow will then enter the new regulator which will divert dry weather flow to via new sanitary sewer to the proposed modified regulator which will discharge all flow into the PVSC interceptor. Overflow at the new regulator will enter the proposed screening facility located next to the new regulator. The screening facility will divert flow into two channels, each channel having a Romag screen and two (2) nets. Screened flow then flows from the facility via a 90" PCCP and ties back into the existing 90" RCP outfall pipe with a new junction chamber located approximately just south of the facility in the middle of Market Street. Screened flow then flows via the existing 90" RCP outfall pipe and discharges directly into the Passaic River. Sanitary lines downstream of the new facility and upstream of the existing regulator will be diverted from entering the outfall pipe and connected into the new sanitary sewer running from the new regulator to the existing regulator.

Subsequent to the baseline modeling work performed in October 2006 for the 2007 Schoor DePalma Report, it was believed that the knife gate at PVSC Regulator 027 was no longer being operated to limit system inflows during wet weather. As a result, overflows at this location drop from 56 annually to 52 (using 1988 JFK rainfall data), and annual CSO volume decreases substantially, dropping from approximately 341 MG annually to 31 MG. This required a major change to the Paterson hydraulic & hydrologic model received from PVSC, which did not reflect this system change when acquired for this LTCP. Furthermore, it has prompted Paterson to request that their baseline design year be set back to 2006, which more accurately represents the initiation of the City's improvements to their CSS. A complete summary of the Paterson model expansion and calibration is detailed later in Section A.

CSO028 - S.U.M. Park 2

Outfall 028 (also known as the S.U.M. Park 2 Overflow) discharges to the Passaic River approximately 250 feet southeast of Hinchcliffe Stadium and approximately 500 feet east of the Great Falls. The 90" to 116" relief sewer was constructed as a bypass for the Molly Ann Brook into which additional storm sewers were constructed and connected. To provide hydraulic relief to the combined sewer system, nine (9) City owned and operated internal overflow chambers (IOCs) were constructed between the combined sewer system and the Molly Ann Brook bypass.

As stated above, CSO Area 028 consists of nine (9) internal overflow chambers (IOC). It was determined that one (1) IOC has been plugged, and five (5) others did not record overflows during wet weather events. The five (5) IOCs will be plugged and abandoned in place, thus leaving three (3) functioning IOCs in this CSO Area. Static bar screens are proposed to be installed within the remaining three (3) roes (A I-3, A I-4, and A I-5). Each static bar screen will be constructed of 1" x 1/2" steel bars at 1/2" maximum spacing between bars. Additional support will be provided from 1/4" x 1/8" steel bars welded perpendicular to the screening bars at 10" center minimum. The bar screens will be angled (when possible) to facilitate manual servicing.

CSO029 - River Road (Loop Road)

Outfall 029 contains six (6) City owned and operated roes which discharge to this outfall. The overflow from Overflow Chamber EF-1 discharges to Outfall 029 just north of River Street; the overflow from Overflow Chambers EF-2 through EF-6 discharge to the outfall along Paterson Avenue between the intersections of Grand Street and Van Houten Street.

An in-line netting chamber is proposed to be installed at Outfall 029. This chamber is proposed to be installed downstream of the existing City owned IOC EF-1, in a cul-de-sac along (currently abandoned) River Road. The concrete chamber will be installed below grade with the access hatches at pavement level. The concrete chamber will house four (4) nets which will service a design flow of 50.0 MGD (77.36 cfs). The chamber will be sized 23' x 15'-8".

Currently dry weather flow enters the IOC and is diverted into a 15" VCP that flows to the PVSC interceptor. In order to make room for the netting chamber, this line will be rerouted. The existing line will still exit the IOC in the same location, but a new manhole will be installed approximately ten (10) feet downstream of the roe in order to reroute the flow through a proposed 18" PVC line. This line will run behind the netting chamber to another proposed manhole and will reconnect at an existing manhole. From this manhole the existing 15" VCP will be replaced with 18" PVC line to convey the flow to the PVSC interceptor.

Currently the wet weather flow that overflows the weir inside the IOC is conveyed through a 48" pipe directly into an existing 108" storm line. A new 48" DIP is proposed that will convey flow through the north wall of the existing IOC chamber into a new manhole. (The existing 48" pipe will be brick and mortared sealed.) The combined sewage will then flow into the proposed netting chamber. The wet weather flow will then exit the netting chamber; continuing through a 48" RCP line to a new outfall, where it will discharge into the Passaic River. A proposed tide gate valve will be installed directly on a new headwall to prevent backflow into the netting chamber.

Additional improvements at this site include a proposed storm line which will connect the existing storm water inlets along River Road and divert this flow into the new wet weather overflow line upstream of the netting chamber.

The remaining internal regulators making up the rest of CSO029 currently collect into a 120" RCP which then splits into two 108" RCPs and discharges to the Passaic River. The EF-1 regulator currently ties into one of the 108" RCP outfall pipes just upstream of the outfall point.

A Romag (mechanical) screen and netting facility are currently being constructed to meet the short-term requirements for CSO029. A new junction chamber is proposed approximately three hundred (300) feet upstream of the existing junction chamber which splits the 120" RCP into two (2) 108" RCP (exiting junction chamber located at the intersection of Memorial Drive and Bridge Street). The proposed junction chamber will divert flow from existing 120" RCP outfall pipe to a new 12' wide by 10' high box culvert. Overflow will then flow into the screening facility which is proposed to be located along the sidewalk of Memorial Drive just north of the intersection of Paterson Street within the existing comer lots. Flow inside the facility is diverted into two channels, each channel having a two (2) Romag screens and three (3) nets. Screened flow then flows from the facility via a 12' x 10' box culvert and ties back into the existing 120" RCP with a new junction chamber located approximately sixty (60) feet upstream of the existing junction mentioned above. Screened flow then flows via the existing two (2) 108" RCP outfall pipes and discharges directly into the Passaic River.

CSO030 - 19th Avenue

The 19th Avenue IOC is located at the intersection of 19th Avenue and Vreeland Street. Outfall 030 runs east along 19th Avenue and discharges to the Passaic River approximately 500 feet east of McLean Boulevard.

A Romag (mechanical) screen was installed to meet the short-term control requirements for CSO030. The screen facility is located at the end of Vreeland Avenue at the three-way intersection of Vreeland, 19th and East 36th Street. Flow will continue through an 84" RCP, and overflow will be screened and diverted out to existing 90" RCP outfall pipe, which continues down 19th Avenue and discharges directly into the Passaic River.

CSO031 - Route 20 Bypass

Outfall 031 discharges to the Passaic River underneath the entrance ramp to Interstate 80 from Route 20. The combined sewer overflows tributary to this outfall originates from nine (9) City owned and operated IOCs which are located within an 1800' radius from the E. 29th Street Bridge over Interstate 80.

CSO Area 031 consists of nine (9) IOCs (V 1-1, V 1-2, V 1-3, V 1-4, V 1-5, V 1-6, V 1-7, V 1-8, and V 1-9); all nine (9) of these IOCs are scheduled for the installation of static bar screens. Each static bar screen will be constructed of 1" x *W'* steel bars at Y2" maximum spacing between bars. Additional support will be provided from *Yi"* x 1/8" steel bars welded perpendicular to the screening bars at 10" center minimum. The bar screens will be angled (when possible) to facilitate manual servicing.

CSO032 - Hudson Street

The Hudson Street PVSC Regulator is located approximately thirty (30') feet southeast of the intersection of Hudson Street and Presidential Boulevard. Outfall 032 runs approximately (20') feet and discharges to the Passaic River.

The Hudson Street Regulator is located on a branch interceptor of the PVSC system and is used to regulate combined flows from areas upstream of the regulator in which other PVSC Regulators have been plugged (specifically Areas of CSO017, CSO018, CSO019 and CSO020).

A three (3) net end-of-pipe netting chamber is proposed for CSO032. A 48" x 48" flexible hydraulic flap valve on a new concrete headwall is proposed to be located approximately five (5') feet downstream at the end of the PVSC Regulator 032. The netting chamber is proposed to be approximately five (5') feet downstream of the new headwall. Screened flow then is discharged from the netting chamber directly into the Passaic River.

Table A-1, starting on the next page, summarizes the current status of each of the City's outfall structures, regulators and internal overflow chambers (IOCs). This table was also used in the City's Development and Evaluation of Alternatives Report. Further, Figures A-1 and A-2 are maps that provide a geographic reference to the active CSO Outfall structures.

Finally, Appendix B contains summaries of CSO related work dating back to 2015. These summaries were prepared and submitted to the NJDEP on a quarterly basis, per requirements of the City's NJPDES CSO Permit.

Table A-1: City of Paterson CSO Structure Activity

Outfall		Name	Existing Condition	Action Taken	Notes	Since
001		Curtis Pl.	**Active**			
002		Mulberry St.	Inactive	Outfall plugged	Weir inside regulator plugged to divert all flow to the PVSC Interceptor.	Implementation of floatables/solids control (post-2007)
003		W. Broadway	**Active**			
004		Bank St.	Inactive	Regulator plugged & abandoned	100% separation proposed in the implementation of floatables/solids control.	Implementation of floatables/solids control (post-2007)
005		Bridge St.	**Active**			
006		Montgomery St.	**Active**			
007		Straight St.	**Active**			
008		Franklin St.	Inactive	Outfall pipe consolidated with 007		Implementation of floatables/solids control (post-2007)
009		Keen St.	Inactive	Outfall pipe consolidated with 010		Implementation of floatables/solids control (post-2007)
010		Warren St.	**Active**			
011		6th Ave.	Inactive	Regulator abandoned; outfall pipe plugged	CSO area 100% separated. Junction chamber diverts all flow to the PVSC Interceptor.	Pre-2007
012		5th St. & 5th Ave.	Inactive	Outfall plugged	CSO area 100% separated.	Pre-2007
013		E. 11th St.	**Active**			
014		E. 12th St. & 4th Ave.	**Active**			
015		S.U.M. Park	**Active**			
016		Northwest St.	**Active**			
017		Arch St.	**Active**			
018		Jefferson St.	Inactive	Regulator plugged; flow diverted to 032	Masonry wall installed within regulator to block peak dry weather flows from the outfall pipe.	Pre-2007
019		Stout St.	Inactive	Regulator plugged; flow diverted to 032	Masonry wall installed within regulator to block peak dry weather flows from the outfall pipe.	Pre-2007
020		N. Straight St.	Inactive	Regulator plugged; flow diverted to 032	Masonry wall installed within regulator to block peak dry weather	Pre-2007

Outfall		Name	Existing Condition	Action Taken	Notes	Since
					flows from the outfall pipe.	
021		Bergen St.	**Active**			
022		Short St.	**Active**			
023		2nd Ave.	**Active**			
024		3rd Ave.	**Active**			
025		10th Ave. 33rd Ave.	**Active**			
026		20th St.	**Active**			
027		Market St.	**Active**			
028		S.U.M. Park 2	**Active**			
Internal Overflow Chambers (IOCs)	A1-1		Inactive	IOC plugged & abandoned	Plugged after no overflows recorded during wet weather.	Implementation of floatables/solids control (post-2007)
	A1-2		Inactive	IOC plugged & abandoned		Pre-2007
	A1-3		**Active**			
	A1-4		**Active**			
	A1-5		**Active**			
	A1-6		Inactive	IOC plugged & abandoned	Plugged after no overflows recorded during wet weather.	Implementation of floatables/solids control (post-2007)
	A1-7		Inactive	IOC plugged & abandoned	Plugged after no overflows recorded during wet weather.	Implementation of floatables/solids control (post-2007)
	A1-8		Inactive	IOC plugged & abandoned	Plugged after no overflows recorded during wet weather.	Implementation of floatables/solids control (post-2007)
	A1-9		Inactive	IOC plugged & abandoned	Plugged after no overflows recorded during wet weather.	Implementation of floatables/solids control (post-2007)
029		River Rd. (Loop Rd.)	**Active**			
Internal Overflow Chambers (IOCs)	EF-1		**Active**			
	EF-2		**Active**			
	EF-3		**Active**			
	EF-4		**Active**			
	EF-5		**Active**			
	EF-6		**Active**			
030		19th Ave.	**Active**			
(IOC)	V2-1		**Active**			
031		Rt. 20 By-pass	**Active**			
Internal Overflow Chambers (IOCs)	V1-1		**Active**			
	V1-2		**Active**			
	V1-3		**Active**			

Outfall		Name	Existing Condition	Action Taken	Notes	Since
	V1-4		**Active**			
	V1-5		**Active**			
	V1-6		**Active**			
	V1-7		**Active**			
	V1-8		**Active**			
	V1-9		**Active**			
032		Hudson St.	**Active**			

Figure A-1: City of Paterson CSO Outfall Diagram

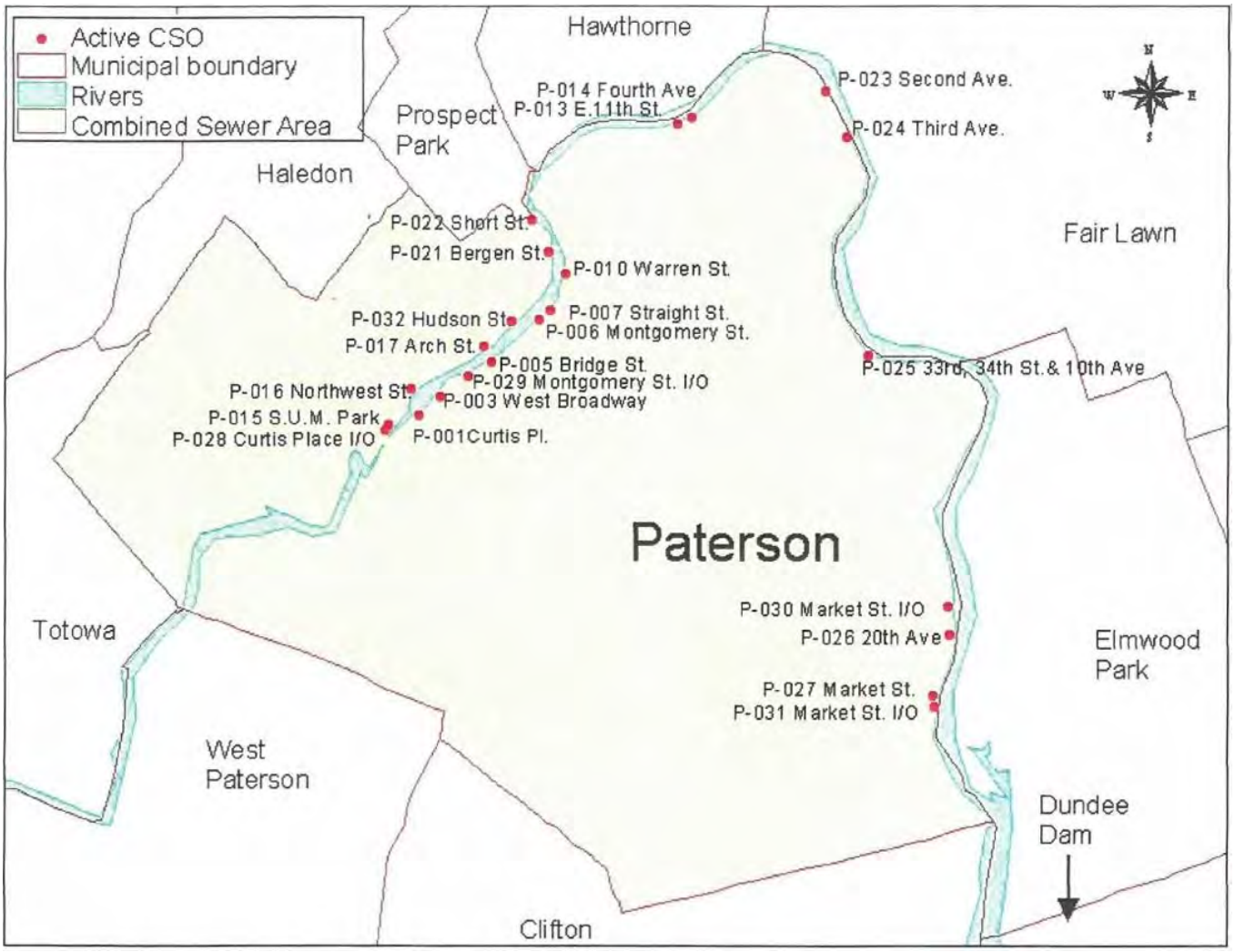
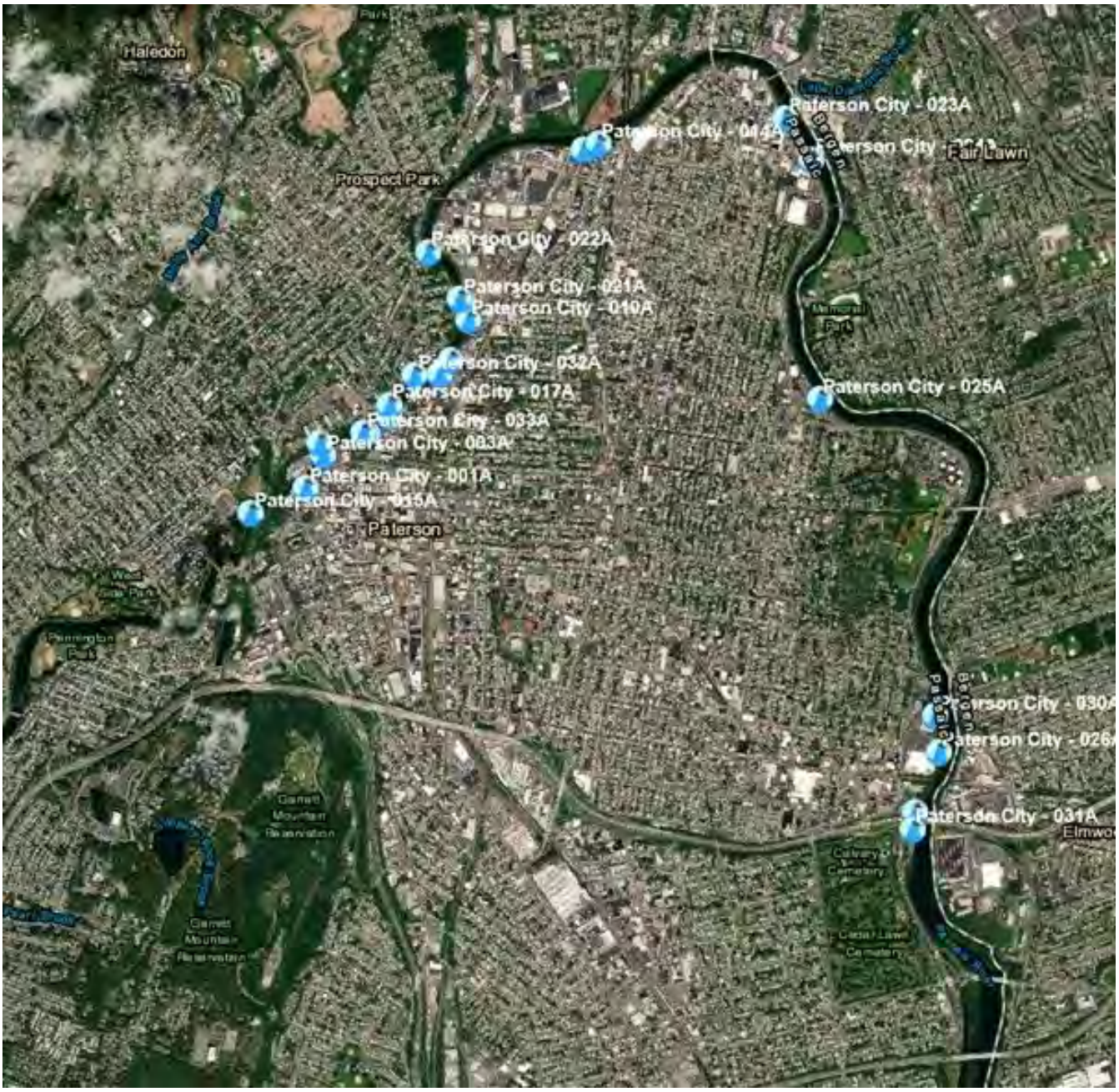


Figure A-2: City of Paterson CSO Outfall Aerial Map



A.4 SEWER SYSTEM MODEL CALIBRATION UPDATE

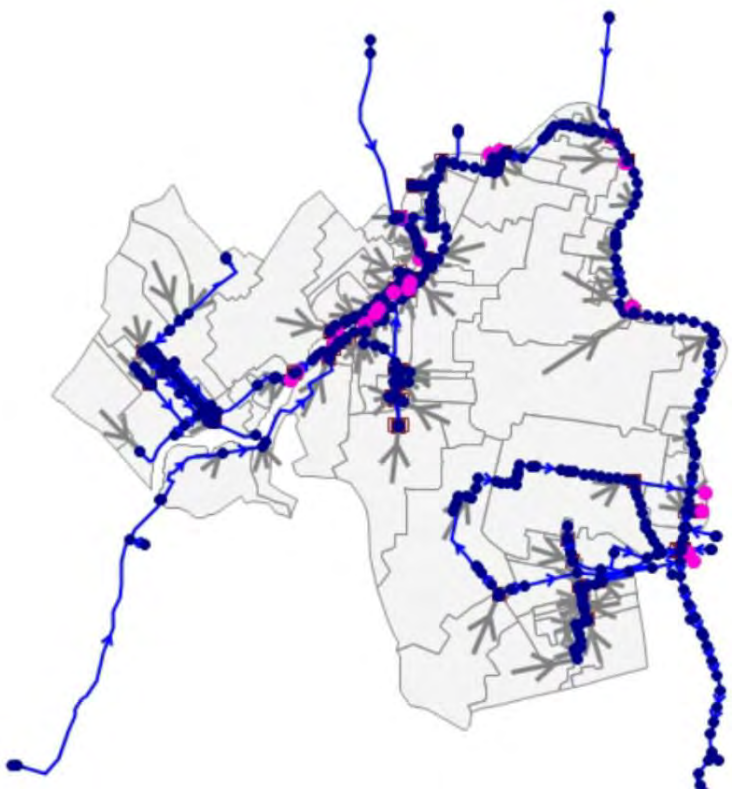
PVSC updated the calibration and validation of the system-wide InfoWorks Integrated Catchment Model (ICM) of the PVSC system based on in-system and overflow monitored in the 2015-2016 period. Monitored data at the permanent metering location at the Paterson Main Line and at temporary locations, including the inflow into Regulator 006A, underflow from 006A to the PVSC interceptor, and the Paterson Interceptor were used to guide the PVSC system-wide ICM update. The City of Paterson obtained this system-wide ICM model for localized calibration updates, as well as use in the development and evaluation of alternatives in the City's Long Term Control Planning (LTCP) effort.

Hydrology parameter selection and runoff generation methodology were maintained, with the major difference being the disaggregation of large outfall-specific drainage areas into smaller subcatchments based on factors specific to the Paterson system. These factors include: (a) connectivity to internal relief points (regulators); (b) representation of potential locations for green infrastructure implementation; and (c) extent of sewer separation already performed by the City historically, and additional areas being considered for sewer separation to primarily address flooding concerns. The majority of differences between the CSO estimates documented in the 2007 Cost and Performance Report and this calibration update were the result of sewer separation efforts undertaken by the City in CSO028 and CSO029 drainage areas. Further changes came from outfall consolidation and additional sewer separation completed by the City since 2006. The PVSC system-wide model did not account for these changes. Thus, the City implemented these changes in the existing conditions ICM model and reviewed the calibration status at the permanent and temporary monitoring locations. Runoff from the separated areas at specific outfalls, including CSO028 and CSO029, is reported on its own to support the water quality modeling. However, it is not accounted for in the alternatives evaluation.

Even with the changes noted above, the modeled combined sewage hydrographs generally showed higher peak flows and volumes during the chosen storm events. Considering that the Paterson system includes 23 outfalls, and the flow monitoring data was available only for a short period of time at fewer locations, the City decided to progress towards the LTCP effort with this conservative ICM model that overestimates the wet weather flow contributions from the City.

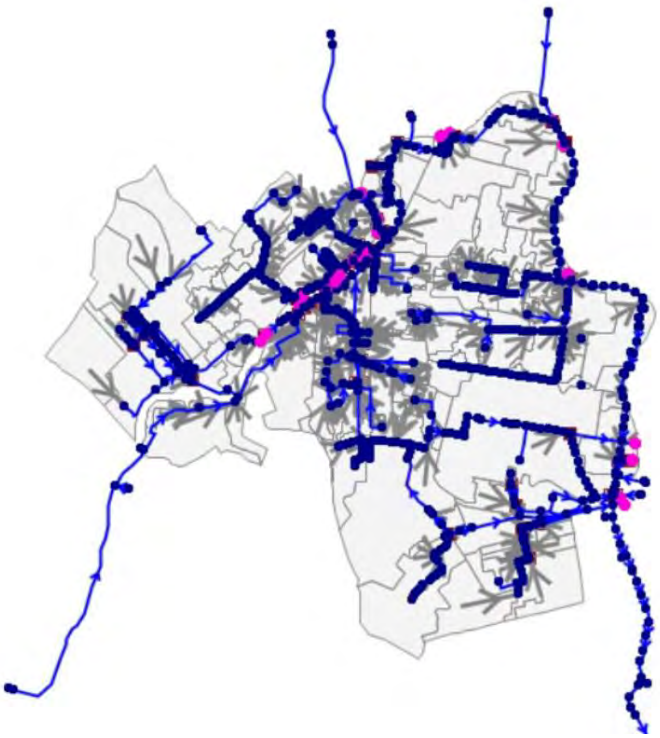
Figures A-3 and A-4 below show the extent of the model calibration updates between what was originally received from PVSC and what was used to begin the City of Paterson's Alternatives Analysis.

Figure A-3: PVSC Infoworks ICM Model – Paterson System (Original)



Subcatchments	**67**
Links	**575**
Conduits	480
Flap Valves	21
Orifice	22
Sluice	10
Weirs	42
Nodes	**568**
Manholes	545
Outfalls	23

Figure A-4: PVSC Infoworks ICM Model – Paterson System (Updated)



Subcatchments	**226**
Links	**922**
Conduits	827
Flap Valves	21
Orifice	22
Sluice	10
Weirs	42
Nodes	**863**
Manholes	840
Outfalls	23

A.5 PURPOSE OF THE LTCP PROJECT

On June 30, 2004, the New Jersey Department of Environmental Protection (NJDEP) revoked the General Permit for Combined Sewer Systems (CSS) (NJPDES No. NJ0105023) to require all municipalities with CSSs to develop a Long Term Control Plan (LTCP) in accordance with the National Combined Sewer Overflow (CSO) Control Policy. This phase of the Program required owners and operators of CSSs to develop and evaluate the feasibility of pathogen control technologies to meet the requirements of the Federal Clean Water Act (CWA). Subsequently, a Combined Sewer System Cost and Performance Analysis for the City of Paterson was prepared by Schoor DePalma, Inc. in conjunction with HydroQual, Inc., and was released in March of 2007.

In accordance with the Combined Sewer Overflow Individual Permit recently issued by the NJDEP to the City of Paterson in 2015, the City is required to prepare its portion of a Long Term Control Plan for implementation into one integrated CSO Plan for the PVSC District service area.

The PVSC NJDEP Permit Part IV.G Section 10 requires that the permittee is responsible for submitting an LTCP that addresses all nine elements in Part IV.G. The nine elements are listed below:

1. Characterization Monitoring and Modeling of the Combined Sewer System
2. Public Participation Process
3. Consideration of Sensitive Area
4. Evaluation of Alternatives
5. Cost/Performance Considerations
6. Operational Plan
7. Maximizing Treatment at the existing STP
8. Implementation Schedule
9. Compliance Monitoring Program

Discussion of elements 1, 2, 3, and 9 above can be found in the Regional Selection and Implementation of Alternatives Report (SIAR), prepared by PVSC. Each of the NJDEP approved reports for elements 1, 2, and 3 can be found in the appendices of the Regional SIAR.

A Development and Evaluation of Alternatives Report (DEAR) on behalf of the City of Paterson was previously submitted to the NJDEP for review on July 1, 2019. It was a high-level overview of the alternative technologies that are required to be evaluated as part of the Combined Sewer Overflow Individual Permit, which are as follows:

- Greenscape Infrastructure (GI)
- Storage Capacity within the existing system
- Additional Storage Capacity in the City and/or at the Treatment Plant
- Reduction of Inflow and Infiltration
- Reduction of Potable Water Use
- Sewer Separation
- Treatment of CSO Discharge

The DEAR for the City of Paterson was submitted as part of a package deliverable, together with a Regional PVSC Report and individual Reports from each of the other PVSC District Permittees. After further review from the NJDEP and various public entities, revisions, and resubmissions, NJDEP conditionally approved the Development and Evaluation of Alternatives Report for the LTCP.

The Report that follows is the Selection and Implementation of Alternatives Report (SIAR) for the City of Paterson. Using the information presented in last year's Regional and Permittee Reports, the SIAR intends to further analyze the alternative technologies presented to this point and offer the most affordable, feasible, long term implementation plan for consideration by the NJDEP. An approvable plan must allow a City the opportunity to meet their flow capture/reduction goals in a logical and feasible manner. Concurrently, the plan must be affordable for the City's residents for the duration of the Plan; sewer costs for ratepayers must not exceed 2.0% of the City's calculated Median Household Income. The City's financial capabilities and overall affordability of the LTCP will be further discussed in Section E of this Report.

SECTION B - SCREENING OF CSO CONTROL TECHNOLOGIES (INTRO TO DEAR)

This section will summarize the City of Paterson's methods of screening potential CSO reduction technologies, as documented in their respective Development and Evaluation of Alternatives Report. The technologies discussed in the Paterson DEAR included:

- Source Control
- Green Infrastructure
- Infiltration & Inflow Control (I/I)
- Sewer System Optimization
- Increased Storage Capacity in the Current Collection System
- Storage (Tanks / Tunnels)
- Expansion / Storage at the STP
- Sewer Separation
- Treatment of CSO Discharge

Many source control measures currently exist within the City of Paterson. Water conservation from low-flow toilets and appliances is part of the City's established building code for new construction. All newly installed parking lots for the past 20 years have infiltration-based practices. Also, a policy of no-net-increase in runoff rate (based on a 2-year and 25-year, 1 hour storm) has been in effect since the late 1990s. Although measures such as these reduce the effective impervious cover and source contribution from new and redevelopment projects, we have not accounted for such projects to be implemented until 2050, as a conservative assumption in Paterson's model.

As part of the NJPDES requirement, the use of green infrastructure (GI) was required to be evaluated. The City of Paterson factored in GI as an early alternative technology to reduce CSO discharges prior to considering grey infrastructure investments, such as storage tanks and/or tunnels. GI assets help to manage rainfall closer to where it falls, in comparison to tanks or tunnels normally built near the outfalls. History has shown that GI is not anticipated to reduce the annual volume/frequency of overflows significantly, unless it is implemented on a widespread level in the right-of-ways and public/private on-site locations. Benefits of GI include opportunities for jobs to clean and maintain applications like rain gardens and bioswales, as well as appealing aesthetics in poorly developed areas. Disadvantages include high life cycle costs, low volume capture, and implementation constraints. The Paterson DEAR presented a scenario that captures 2.5% impervious cover within the City. Initial presentation of this goal was met with criticism that it was not as high as many of the other municipalities' goals (e.g. 5%, 10%). However, this level was selected during LTCP development as the most feasible goal to achieve in terms of balancing necessary costs, volume capture, and implementation factors. We recommend a level of GI in the LTCP that is achievable with the possibility to exceed, as opposed to a level that is too optimistic and beyond what the City can justly afford.

As noted in the DEAR, the City chose not to pursue further I/I control under the LTCP because it currently does not meet the threshold for excessive infiltration of 120 gallons per capita, as per N.J.A.C 7:14A-1.2. There are known I/I contributions coming into the Paterson CSS from adjacent communities—notably the Boroughs of Haledon, Totowa, and West Paterson—but are not directly connected to PVSC interceptors. No rainfall derived inflow and infiltration (RDII) controls were assumed from these separate communities.

An analysis of the City's existing sewer interceptors upstream of each active PVSC regulator to determine the total volume of each pipe was performed during the 2007 Schoor DePalma Cost and Performance Analysis. Most of the existing sewer conduits are of relatively small diameter and/or have lateral house connections, making them unsuitable for in-line storage purposes. There are five locations (CSO001, 005, 015, 016, and 026) where existing upstream sewers are larger than 24" in diameter, and their potential available volume for storage is sufficient to meet at least one of the CSO frequency targets. In all other cases, the CSO frequency target is either already attained, or utilization of in-line storage would be insufficient to provide the required storage. However, the study noted that in-line storage within existing conduits would only remedy specific CSO Areas, for a select few reduction objectives. Thus, in-line storage within existing conduits is not a standalone method of reducing overflows. Similar to GI, it would need to be used in conjunction with other technologies in order to meet the reduction objectives for all of the CSO areas. Not only that, but flooding concerns exist in the City, especially in low lying areas near the Passaic River, where most of the PVSC regulators—and subsequent in-line storage—would be located. Detailed hydraulic evaluation of the existing sewer pipes was not performed as part of the 2007 report. As these computations must be performed, and upstream conditions must be considered before utilizing any existing conduit for in-line storage, storage within the existing infrastructure is less optimal to pursue at this time.

The City evaluated several properties that could potentially hold offline storage tanks, which would be strategically sited and utilize pump systems and conveyance pipelines for regionalization of drainage. Any potential storage tank facility sites near the Passaic River and falling within the 100-year floodplain are required to be entirely below grade. Additionally, in-line storage can be achieved through constructing tunnels deep underground. One likely application of a storage tunnel in Paterson would be near CSO025; an outfall whose drainage area is prone to flooding, lacks available land for a nearby tank, and is currently at the greatest need for greywater storage out of all of Paterson's active outfalls. The sizing of greywater storage is ultimately limited by the facilities' collective "drain down" time. PVSC mandated that the total draining rate from all proposed storage facilities in an individual permittee's drainage area should not be greater than 75% of the permittee's total average dry weather flows. It was further noted that the drainage of the storage facilities to the PVSC interceptor during dry weather should not exceed three (3) days. With these conditions in mind, Paterson's combined sewer system dry weather flow was estimated at 13 MGD, meaning that the City's storage alternatives must be sized to not exceed 10 MG of drainage per day, and be fully emptied within three (3) days.

The City of Paterson is a municipality at the northernmost (upstream) end of the PVSC Combined Sewer System. Given the City's unique geography in relation to the other municipalities in the PVSC District, the City had chosen in the DEAR to not evaluate additional storage at the Treatment Plant further. In recent months, however, a PVSC Treatment Plant Bypass Plan was presented to, and approved by, the NJDEP. As a result, all PVSC District H&H model numbers moving forward should reflect an increased capacity at the WWTP from 400 MGD to 720 MGD.

Sewer separation projects have been ongoing in many parts of the City of Paterson since the early 2000s. The significant sewer separation efforts in the drainage areas to CSO028 and CSO029 are explicitly included in the baseline scenario, since the timeline for this effort has extended over two decades. However, since 2006, the city has undertaken targeted sewer separation efforts in some outfall drainage areas to address either localized flooding concerns or eliminate the need for CSO control. Partial sewer separation was observed in record drawings for the drainage areas serving outfalls 003, 014, 015, 021, and 024, totaling 47.4 acres. These areas were added to the existing baseline separated areas in order to

quantify the estimated CSO reduction benefits that have occurred since 2006. Over the course of the typical year model simulation, these sewer separation projects resulted in a CSO reduction of approximately 10 MG. Furthermore, the City has identified the CSO023 drainage area as a potential site for future sewer separation, totaling 29.8 acres and approximately 9.0 MG of potential CSO volume reduction in the typical year. In total, there are 1058.7 acres of former combined drainage areas that have been separated, or will be in the near future.

Finally, where available land near outfall structures is limited, or when required storage volume exceeds the maximum size of a potential regional storage tank, the City explored disinfection of CSO discharge. Peracetic acid (PAA) was chosen for further analysis over sodium hypochlorite for several reasons. It has been used as a disinfectant in various industries, including the food and beverage industries and smaller, more confined applications, including hospital settings. PAA is relatively effective, non-toxic and does not produce toxic byproducts. Lower operations & maintenance costs relative to sodium hypochorite, along with a growing list of suppliers, give greater justification to utilizing PAA in the City of Paterson's mostly urban landscape. The Paterson DEAR proposed use of PAA at the same level as gray infrastructure, except at outfalls where tanks or tunnels would be less feasible CSO reduction measures.

The screening of control technologies was completed by the City of Paterson in September of 2018 using the Alternatives Screening Matrix, generated by PVSC for each permittee to exhibit in their DEAR. Each of the control technologies previously discussed in this Section B are listed within this Matrix, shown in Table B-1 on the following pages.

Table B-1: Paterson Alternatives Screening Matrix

Source Control Technologies									
Technology Group	Practice	Primary Goals: Bacteria Reduction	Primary Goals: Volume Reduction	Community Benefit	Implementation & Operation Factors	Consider Combining w/ Other Technologies	Being Implemented	Recommendation for Alternatives Evaluation	Paterson Notes
Stormwater Management	Street/Parking Lot Storage (Catch Basin Control)	Low	Low	- Reduced surface flooding potential	Flow restrictions to the CSS can cause flooding in lots, yards and buildings; potential for freezing in lots; low operational cost. Effective at reducing peak flows during wet weather events but can cause dangerous conditions for the public if pedestrian areas freeze during flooding.	No	Yes	Yes	All newly installed parking lots for the past 20 years have infiltration-based practices.
	Catch Basin Modification (for Floatables Control)	Low	None	- Water quality improvements - Reduced surface flooding potential	Requires periodic catch basin cleaning; requires suitable catch basin configuration, potential for street flooding and increased maintenance efforts. Reduces debris and floatables that can cause operational problems with the mechanical regulators.	No	No	No	Not practical.
	Catch Basin Modification (Leaching)	Low	Low	- Reduced surface flooding potential - Water quality improvements	Can be installed in new developments or used as replacements for existing catch basins. Require similar maintenance as traditional catch basins. Leaching catch basins have minor effects on the primary CSO control goals.	No	No	No	Not practical.
Public Education and Outreach	Water Conservation	None	Low	- Reduced surface flooding potential - Align with goals for a sustainable community	Water purveyor is responsible for the water system and all related programs in the respective City. However, water conservation is a common topic for public education programs. Water conservation can reduce CSO discharge volume, but would have little impact on peak flows.	Yes	Yes	Yes	Code requires low flush units in new construction.
	Catch Basin Stenciling	None	None	- Align with goals for a sustainable community	Inexpensive; easy to implement; public education. Is only as effective as the public's acceptance and understanding of the message. Public outreach programs would have a more effective result.	Yes	Yes	Yes	There are catch basin stenciling projects that we can take credit for.
	Community Cleanup Programs	None	None	- Water quality improvements - Align with goals for a sustainable community	Inexpensive; sense of community ownership; educational BMP; aesthetic enhancement. Community cleanups are inexpensive and build ownership in the city.	Yes	Yes	Yes	
	Public Outreach Programs	Low	None	- Align with goals for a sustainable community	Public education program is ongoing. Permittee should continue its public education program as control measures demonstrate implementation of the NMC.	Yes	Yes	Yes	
	FOG Program	Low	None	- Water quality improvements - Improves collection system efficiency	Requires communication with business owners; Permittee may not have enforcement authority. Reduces buildup and maintains flow capacity. Only as effective as business owner cooperation.	Yes	Yes	No	PVSC is already implementing FOG, but Paterson doesn't see it doing so on its own.
	Garbage Disposal Restriction	Low	None	- Water quality improvements	Permittee may not be responsible for Garbage Disposal. This requires an increased allocation of resources for enforcement while providing very little reduction to wet weather CSO events.	Yes	No	No	This is not common in Paterson.
	Pet Waste Management	Medium	None	- Water quality improvements	Low cost of implementation and little to no maintenance. This is a low cost technology that can significantly reduce bacteria loading in wet weather CSO's.	Yes	Yes	Yes	An ordinance is currently in place.
	Lawn and Garden Maintenance	Low	Low	- Water quality improvements	Requires communication with business and homeowners. Guidelines are already established per USEPA. Educating the public on proper lawn and garden treatment protocols developed by USEPA will reduce waterway contamination. Since this information is already available to the public it is unlikely to have a significant effect on improving water quality.	Yes	No	No	
	Hazardous Waste Collection	Low	None	- Water quality improvements	The N.J.A.C. prohibits the discharge of hazardous waste to the collection system.	Yes	Yes	Yes	
Ordinance Enforcement	Construction Site Erosion & Sediment Control	None	None	- Cost-effective water quality improvements	In building code; reduces sediment and silt loads to waterways; reduces clogging of catch basins; little O&M required; contractor or owner pays for erosion control. A Soil Erosion & Sediment Control Plan Application or 14-day notification (if Permittee covered under permit-by-rule) will be required by NJDEP per the N.J.A.C.	Yes	Yes	Yes	Hudson, Essex and Passaic Soil Conservation Services does the enforcement.
	Illegal Dumping Control	Low	None	- Water quality improvements - Aesthetic benefits	Enforcement of current law requires large number of code enforcement personnel; recycling sites maintained. Local ordinances already in place can be used as needed to address illegal dumping complaints.	Yes	Yes	Yes	
	Pet Waste Control	Medium	None	- Water quality improvements - Reduced surface flooding	Requires resources to enforce pet waste ordinances. Public education and outreach is a more efficient use of resources, but this may also provide an alternative to reducing bacterial loads.	Yes	No	No	
	Litter Control	None	None	- Property value uplift - Water quality improvements - Reduced surface flooding	Aesthetic enhancement; labor intensive; City function. Litter control provides an aesthetic and water quality enhancement. It will require city resources to enforce. Public education and outreach is a more efficient use of resources.	Yes	No	No	There is limited enforcement of litter control.
	Illicit Connection Control	Low	Low	- Water quality improvements - Align with goals for a sustainable community	Site specific; more applicable to separate sanitary system; new storm sewers may be required; interaction with homeowners required. The primary goal of the LTCP is to meet the NJPDES Permit requirements relative to POCs. Illicit connection control is not particularly effective at any of these goals and is not recommended for further evaluation unless separate sewers are in place.	Yes	Yes	Yes	The City funds the cross-connection to stormwater program that applies to sanitary system also.
Good Housekeeping	Street Sweeping/Flushing	Low	None	- Reduced surface flooding potential	Labor intensive; specialized equipment; doesn't address flow or bacteria; City function. Street sweeping and flushing primarily addresses floatables entering the CSS while offering an aesthetic improvement.	Yes	Yes	Yes	Sweeping is performed by the City on a weekly basis (city streets), and flushing by PVWC.
	Leaf Collection	Low	None	- Reduced surface flooding potential - Aesthetic benefits	Requires additional seasonal labor. Leaf collection maximizes flow capacity and removes nutrients from the collection system.	Yes	Yes	Yes	
	Recycling Programs	None	None	- Align with goals for a sustainable community	Most Cities have an ongoing recycling program.	Yes	Yes	Yes	
	Storage/Loading/Unloading Areas	None	None	- Water quality improvements	Requires industrial & commercial facilities designate and use specific areas for loading/unloading operations. There may be few major commercial or industrial users upstream of CSO regulators.	Yes	Yes	Yes	NJDEP requirements, City doesn't have its own. Larger facilities may have SWPPPs that govern this.
	Industrial Spill Control	Low	None	- Protect surface waters - Protect public health	PVSC has established a pretreatment program for industrial users subject to the Federal Categorical Pretreatment Standards 40 CFR 403.1.	Yes	Yes	Yes	

Green Infrastructure Buildings	Green Roofs	None	Medium	- Improved air quality - Reduced carbon emissions - Reduced heat island effect - Property value uplift - Local jobs - Reduced surface flooding - Reduced basement sewage flooding - Align with goals for a sustainable community	Adds modest cost to new construction; not applicable to all retrofits; low operational resource demand; will require the Permittee or private owners to implement; requires regular cleaning of gutters & pipes; upkeep of roof vegetation. Portions of Cities have densely populated areas, but this technology is limited to rooftops. Can be difficult to require on private properties.	Yes	No	Yes	The City does not currently have any green roof projects, but welcomes anyone who wants to do this GI.
	Blue Roofs	None	Medium	- Reduced heat island effect - Property value uplift - Local jobs - Reduced surface flooding - Reduced basement sewage flooding - Align with goals for a sustainable community	Adds modest cost to new construction; not applicable to all retrofits; low operational resource demand; will require the Permittees or private owners to implement; requires regular cleaning of gutters & pipes; upkeep of roof debris. Portions of the Cities have densely populated areas, but this technology is limited to rooftops. Can be difficult to require on private properties.	Yes	Yes	Yes	
	Rainwater Harvesting	None	Medium	- Reduced surface flooding - Reduced basement sewage flooding - Align with goals for a sustainable community - Water Saving	Simple to install and operate; low operational resource demand; will require the Permittees or private owners to implement; requires regular cleaning of gutters & pipes. Portions of the Cities have densely populated areas, but this technology is limited to capturing rooftop drainage. Capture is limited to available storage, which can vary on rainwater use. Can be difficult to require on private properties.	Yes	Yes	Yes	There are rainwater harvesting projects over the last 5 years that we can take credit for.
Green Infrastructure Impervious Areas	Permeable Pavements	Low	Medium	- Improved air quality - Reduced carbon emissions - Reduced heat island effect - Property value uplift - Cost-effective water quality improvements - Reduced surface flooding - Reduced basement sewage flooding - Align with goals for a sustainable community	Not durable and clogs in winter; oil and grease will clog; significant O&M requirements with vacuuming and replacing deteriorated surfaces; can be very effective in parking lots, lanes and sidewalks. Maintenance requirements could be reduced if located in low-traffic areas, and can utilize underground infiltration beds or detention tanks to increase storage.	Yes	No	Yes	
	Planter Boxes	Low	Medium	- Improved air quality - Reduced carbon emissions - Reduced heat island effect - Property value uplift - Reduced surface flooding - Reduced basement sewage flooding - Align with goals for a sustainable community	Site specific; good BMP; minimal vegetation & mulch O&M requirements with regular overflow and underdrain cleaning; effective at containing, infiltration and evapotranspiration of runoff in developed areas. Flexible and can be implemented even on a small-scale to any high-priority drainage areas. Underground infiltration beds or detention tanks can be utilized to increase storage.	Yes	Yes	Yes	
Green Infrastructure Pervious Areas	Bioswales	Low	Low	- Improved air quality - Reduced carbon emissions - Reduced heat island effect - Property value uplift - Local jobs - Passive and active recreational improvements - Reduced surface flooding - Reduced basement sewage flooding - Community aesthetic improvements - Reduced crime - Align with goals for a sustainable community - Increased pedestrian safety through curb retrofits	Site specific; good BMP; minimal vegetation & mulch O&M requirements; not as flexible or infiltrate as much stormwater as planter boxes. Technology requires open space and is primarily a surface conveyance technology with additional storage & infiltration benefits. Can be modified with check dams to slow water flow. Limited open space in most Cities means land can be utilized in more effective ways with the existing infrastructure.	Yes	Yes	Yes	Smaller diameter contracts to cut in bioswales to reduce the sizing of stormwater infrastructure are needed.
	Free-Form Rain Gardens	Low	Medium	- Improved air quality - Reduced carbon emissions - Reduced heat island effect - Property value uplift - Passive and active recreational improvements - Reduced surface flooding - Reduced basement sewage flooding - Community aesthetic improvements - Reduced crime - Align with goals for a sustainable community	Site specific; good BMP; minimal vegetation & mulch O&M requirements with regular overflow and underdrain cleaning; effective at containing, infiltration and evapotranspiration of diverted runoff. Rain Gardens are flexible and can be modified to fit into the previous areas. Underground infiltration beds or detention tanks can be utilized to increase storage.	Yes	Yes	Yes	These are primarily through grants; no city funded initiatives.

Collection System Technologies									
Technology Group	Practice	Primary Goals		Community Benefit	Implementation & Operation Factors	Consider Combining w/ Other Technologies	Being Implemented	Recommendation for Alternatives Evaluation	Paterson Notes
		Bacteria Reduction	Volume Reduction						
Operation and Maintenance	I/I Reduction	Low	Medium	- Water quality improvements - Reduced basement sewage flooding	Requires labor intensive work, changes to the conveyance system require temporary pumping measures; repairs on private property required by homeowners. Reduces the volume of flow and frequency; Provides additional capacity for future growth; House laterals account for 1/2 the sewer system length and significant sources of I/I in the sanitary sewer.	Yes	Yes	Yes	Groundwater comes in through older brick sewers in Paterson and other combined systems. Surrounded on both sides by Passaic River, so combined sewers act as dewatering systems.
	Advanced System Inspection & Maintenance	Low	Low	- Water quality improvements - Reduced basement sewage flooding	Requires additional resources towards regular inspection and maintenance work. Inspection and maintenance programs can provide detailed information about the condition and future performance of infrastructure. Offers relatively small advances towards goals of the LTCP.	Yes	Yes	Yes	
	Combined Sewer Flushing	Low	Low	- Water quality improvements - Reduced basement sewage flooding	Requires inspection after every flush; no changes to the existing conveyance system needed; requires flushing water source. Ongoing: CSO Operational Plan; maximizes existing collection system; reduces first flush effect.	Yes	Yes	Yes	Flushing is performed monthly, primarily in internal structures/screening facilities. Collection system is flushed less frequently, and trunks are done more than laterals. Lots of bricks, sand, and sediment seen in trunk sewers.
	Catch Basin Cleaning	Low	None	- Water quality improvements - Reduced surface flooding	Labor intensive; requires specialized equipment. Catch Basin Cleaning reduces litter and floatables but will have no effect on flow and little effect on bacteria and BOD levels.	Yes	Yes	Yes	Every basin is cleaned every year (goal), but some facilities are cleaned almost weekly to monthly.
Combined Sewer Separation	Roof Leader Disconnection	Low	Low	- Reduced basement sewage flooding	Site specific; Includes area drains and roof leaders; new storm sewers may be required; requires home and business owner participation. The Cities are densely populated and disconnected roof leaders have limited options for discharge to pervious space. Disconnection may be coupled with other GI technologies but is not considered an effective standalone option.	Yes	No	Yes	Hillcrest flow area (A1 in Killam map) - roof leaders are connected originally, but many homeowners have disconnected on their own due to flooding occurrences.
	Sump Pump Disconnection	Low	Low	- Reduced basement sewage flooding	Site specific; more applicable to separate sanitary system; new storm sewers may be required; interaction with homeowners required. The Cities are densely populated and disconnected sump pumps have limited options for discharge to pervious space. Disconnection may be coupled with other GI technologies but is not considered an effective standalone option.	Yes	No	Yes	Same Hillcrest flow area as above.
	Combined Sewer Separation	High	High	- Water quality improvements - Reduced basement sewage flooding - Reduced surface flooding	Very disruptive to affected areas; requires homeowner participation; sewer asset renewal achieved at the same time; labor intensive.	No	Yes	Yes	Area A1 is almost 90% separated. Where sewers are being reconstructed, and if there is opportunity to run storm and sanitary lines in the future, sewer separation may be done in limited areas. Bridge Street outfall area mostly separated already.
Combined Sewer Optimization	Additional Conveyance	High	High	- Water quality improvements - Reduced basement sewage flooding	Additional conveyance can be costly and would require additional maintenance to keep new structures and pipelines operating.	No	Yes	Yes	Extension of the relief sewer to convey the stream coming into the sewers.
	Regulator Modifications	Medium	Medium	- Water quality improvements	Relatively easy to implement with existing regulators; mechanical controls requires O&M. May increase risk of upstream flooding. Permitees have an ongoing O&M program and system wide replacement program for CSO regulators and tide gates.	Yes	Yes	Yes	In the Memorial Drive area, 6 internal structures in downtown. Weirs are adjusted to optimal levels.
	Outfall Consolidation/Relocation	High	High	- Water quality improvements - Passive and active recreational improvements	Lower operational requirements; may reduce permitting/monitoring; can be used in conjunction with storage & treatment technologies. Combining and relocating outfalls may lower operating costs and CSO flows. It can also direct flow away from specific areas.	Yes	Yes	Yes	
	Real Time Control	High	High	- Water quality improvements - Reduced basement sewage flooding	Requires periodic inspection of flow elements; highly automated system; increased potential for sewer backups. RTC is only effective if additional storage capacity is present in the system.	Yes	Yes	Yes	There may be opportunities to look at weirs and optimize their levels to increase the inline storage.

Storage and Treatment Technologies									
Technology Group	Practice	Primary Goals		Community Benefit	Implementation & Operation Factors	Consider Combining w/ Other Technologies	Being Implemented	Recommendation for Alternatives Evaluation	Paterson Notes
		Bacteria Reduction	Volume Reduction						
Linear Storage	Pipeline	High	High	- Water quality improvements - Reduced surface flooding potential - Local jobs	Can only be implemented if in-line storage potential exists in the system; increased potential for basement flooding if not properly designed; maximizes use of existing facilities. Pipe storage for a CSS typically requires large diameter pipes to have a significant effect on reducing CSOs. This typically requires large open trenches and temporary closure of streets to install.	No	Yes	Yes	
	Tunnel	High	High	- Water quality improvements - Reduced surface flooding potential	Requires small area at ground level relative to storage basins; disruptive at shaft locations; increased O&M burden.	No	Yes	Yes	Screening at Loop Road tunnel has lot of capacity that can be utilized for small to medium sized storms. Stormwater diversion tunnel - receives CSOs from A-1 Hillcrest area, a flood diversion tunnel (Mollyanne Brook periodically discharges into it during large storms).
Point Storage	Tank (Above or Below Ground)	High	High	- Water quality improvements - Reduced basement sewage flooding	Storage tanks typically require pumps to return wet weather flow to the system which will require additional O&M; disruptive to affected areas during construction. Several CSO outfalls have space available for tank storage. There may be existing tanks in abandoned commercial and industrial areas to be converted to hold stormwater. Tanks are an effective technology to reduce wet weather CSO's.	No	Yes	Yes	
	Industrial Discharge Detention	Low	Low	- Water quality improvements	Requires cooperation with industrial users; more resources devoted to enforcement; depends on IUs to maintain storage basins. IUs hold stormwater or combined sewage until wet weather flows subside; there may be commercial or industrial users upstream of CSO regulators.	Yes	No	No	Jim DeBlock operates several landfills. This is PVSC's responsibility.
Treatment-CSO Facility	Vortex Separators	None	None	- Water quality improvements	Space required; challenging controls for intermittent and highly variable wet weather flows. Vortex separators would remove floatables and suspended solids when installed. It does not address volume, bacteria or BOD.	Yes	No	Yes	
	Screens and Trash Racks	None	None	- Water quality improvements	Prone to clogging; requires manual maintenance; requires suitable physical configuration; increased O&M burden. Screens and trash racks will only address floatables.	Yes	Yes	Yes	
	Netting	None	None	- Water quality improvements	Easy to implement; labor intensive; potential negative aesthetic impact; requires additional resources for inspection and maintenance. Netting will only address floatables.	Yes	Yes	Yes	
	Contaminant Booms	None	None	- Water quality improvements	Difficult to maintain requiring additional resources. Contaminant booms will only address floatables.	Yes	No	No	
	Baffles	None	None	- Water quality improvements	Very low maintenance; easy to install; requires proper hydraulic configuration; long lifespan. Baffles will only address floatables.	Yes	No	Yes	
	Disinfection & Satellite Treatment	High	High	- Water quality improvements - Reduced basement sewage flooding	Requires additional flow stabilizing measures; requires additional resources for maintenance; requires additional system analysis. Disinfection is an effective control to reduce bacteria and BOD in CSO's.	Yes	No	Yes	
	High Rate Physical/Chemical Treatment (High Rate Clarification Process - ActiFlo)	None	None	- Water quality improvements	Challenging controls for intermittent and highly variable wet weather flows; smaller footprint than conventional methods. This technology primarily focuses on TSS & BOD removal, but does not help reduce the bacteria or CSO discharge volume.	Yes	No	Yes	
	High Rate Physical (Fuzzy Filters)	None	None	- Water quality improvements	Relatively low O&M requirements; smaller footprint than traditional filtration methods. This technology primarily focuses on TSS removal, but does not help reduce the bacteria or CSO discharge volume.	Yes	No	Yes	
Treatment-WRTP	Additional Treatment Capacity	High	High	- Water quality improvements - Reduced surface flooding - Reduced basement sewage flooding	May require additional space; increased O&M burden.	No	No	No	
	Wet Weather Blending	Low	High	- Water quality improvements - Reduced surface flooding - Reduced basement sewage flooding	Requires upgrading the capacity of influent pumping, primary treatment and disinfection processes; increased O&M burden. Wet weather blending does not address bacteria reduction, as it is a secondary treatment bypass for the POTW. Permittee must demonstrate there are no feasible alternatives to the diversion for this to be implemented.	Yes	No	No	
Treatment-Industrial	Industrial Pretreatment Program	Low	Low	- Water quality improvements - Align with goals for a sustainable community	Requires cooperation with Industrial User's; more resources devoted to enforcement; depends on IU's to maintain treatment standards. May require Permits.	Yes	No	No	This is PVSC's program.

SECTION C - EVALUATION OF ALTERNATIVES

C.1 INTRODUCTION

The Development and Evaluation of Alternatives Report (DEAR) for the City aimed to determine which CSO alternative technologies were most applicable for further evaluation in the City. Technologies were weighed based on numerous factors, including potential for percent/volume flow capture, impact on the number of annual CSO events, operations and maintenance challenges, implementation costs and more. To that end, the most feasible technologies were formally organized into Municipal Alternatives that were presented in Section D of the Paterson DEAR. Alternatives were then listed at the end of the Report, each formulated to reach predetermined targets set by the NJDEP.

C.2 DEVELOPMENT AND EVALUATION OF ALTERNATIVES (REF. DEAR)

Prior to 2010, the City of Paterson had been experiencing street and basement flooding issues in the V2 flow area (upstream of CSO030) during rain events upstream of the V2-1 Regulator, which is located at the intersection of Vreeland Avenue and East 36th Street. The most severe flooding typically occurs on 18th Avenue between East 28th Street and East 31st Street; on 19th Avenue between East 32th Street and East 36st Street; on 20th Avenue between East 19th Street and East 22st Street; and around the St. Joseph's University Medical Center. In an effort to reduce these ongoing flood issues, a relief sewer design concept was proposed in 2010 that would be an extension of the combined sewer system in the V2 flow area. The 7700-linear foot relief sewer concept was estimated in 2012 to be an $18-19 Million project. However, while a general route location was discussed, it has not passed the preliminary discussion & design phase. A sketch that was used by the City for discussion purposes only is included in Figure C-2. We have modeled a hypothetical version of this relief sewer in one of the proposed alternative scenarios to analyze its potential impact on the combined sewer system if it was implemented as part of the LTCP.

In addition to this proposed relief sewer, there have been ongoing sewer separation projects in the City. Portions of this separation that were implemented prior to 2006 have been included in the baseline models of the City's sewer system, while more recent projects have been included in the alternatives analysis models of the system. A total of 981.5 acres were separated in the baseline model, which included the partial or complete separation (75-100%) of drainage areas serving Outfalls 028, 029, and 031. A total of 47.4 acres were separated in the alternatives models, spread across the drainage areas serving Outfalls 003, 014, 015, 021, and 024. The City has planned to completely separate the CSO023 drainage area, adding another 29.8 acres of separated area. In total, there are 1058.7 acres of former combined drainage areas that have been separated, or will be in the near future.

Alternatives 4 through 8 build upon the benefits from Alternative 3, using additional greywater storage and/or treatment. The alternatives contained scenarios A, B and C, with each scenario utilizing a different tactic to "capture" the necessary volume to reach a target number of overflow events in the typical year. One tactic is the use of regional storage tanks and/or deep tunnels, plus the necessary conveyance pipes to connect nearby flow areas. Storage tanks were only proposed where implementation was most feasible, otherwise a deep tunnel is costed to hold the required storage volume instead. The zero-overflow target requires additional storage beyond greywater to effectively eliminate the overflows at CSO028, which are present only in this scenario. We solved this by estimating costs for bending weirs at each of

three (3) regulators in the A1 drainage area. Another tactic implements regional peracetic acid (PAA) disinfection facilities at outfall structures, which would reduce the volume of untreated wastewater discharge into receiving waters. The last tactic combines the two technologies, such that depending on the landscape around groups of outfalls, the more feasible, cost-efficient option would be implemented. In costing these scenarios, the all-storage scenario was the most expensive, the disinfection scenario was the least expensive, and the hybrid scenario costs fell in between.

Finally, Alternative 9 was presented as a solution similarly built upon Alternative 3, but only to the level necessary to reach 85% capture within the City. The proposed technology to do this was an appropriately sized deep tunnel located at the largest CSO volume contributor, CSO025.

Table C-1 below shows the City's list of Preliminary Alternatives. The table summarizes information presented within the DEAR that shows how the costs and effectiveness of each alternative vary by level of CSO control. The baseline conditions are listed first for reference, followed by Alternatives 4 through 9.

Table C-1: Summary of Preliminary Alternatives

Alternative	% Capture	Volume Captured (MG)	CSO Events	Cost Range ($ Millions)
Baseline Conditions	82.1	0	53	0
Alt. 4A – 4C: Sewer Separation since 2006 + Planned Sewer Separation + 19th Ave. Relief Sewer + Green Infrastructure (2.5%) + Storage / Treatment required **to reach 0 overflows**	100.0	353.093	0	$ 637 - $ 819
Alt. 5A – 5C: Sewer Separation since 2006 + Planned Sewer Separation + 19th Ave. Relief Sewer + Green Infrastructure (2.5%) + Storage / Treatment required **to reach 4 overflows**	97.9	312.177	4	$ 363 - $ 468
Alt. 6A – 6C: Sewer Separation since 2006 + Planned Sewer Separation + 19th Ave. Relief Sewer + Green Infrastructure (2.5%) + Storage / Treatment required **to reach 8 overflows**	95.7	271.213	8	$ 234 - $ 368
Alt. 7A – 7C: Sewer Separation since 2006 + Planned Sewer Separation + 19th Ave. Relief Sewer + Green Infrastructure (2.5%) + Storage / Treatment required **to reach 12 overflows**	93.8	234.080	12	$ 203 - $ 327
Alt. 8A – 8C: Sewer Separation since 2006 + Planned Sewer Separation + 19th Ave. Relief Sewer + Green Infrastructure (2.5%) + Storage / Treatment required **to reach 20 overflows**	90.1	161.991	20	$ 172 - $ 268
Alt. 9: Sewer Separation since 2006 + Planned Sewer Separation + 19th Ave. Relief Sewer + Green Infrastructure (2.5%) + Storage required to reach **85% system capture within the City**	85.3	69.894	36	$ 78

SECTION D - SELECTION OF RECOMMENDED LTCP

D.1 INTRODUCTION

After the Development and Evaluation of Alternatives Report was submitted in 2019, PVSC and its District Permittees moved towards further determining what would be the most feasible and attainable CSO Alternative Plan for each municipality, both financially and logistically. This Section will describe Paterson's process of selecting its long-term plan, the wet weather capture objective of the plan, and the proposed project schedule that will be followed to achieve this objective.

D.2 LTCP SELECTION PROCESS

Subsequent to the Development and Evaluation of Alternatives Report, PVSC and its District permittee representatives continued to meet twice monthly to discuss various CSO Alternative approaches. As these meetings progressed, more simulations of the PVSC District H&H model were run, and a crucial discovery was made. It became apparent that the permittees fall under one of two categories under the current CSO Policy and Water Quality Standards.

The first category is where a permittee meets water quality in its receiving waters under their current conditions, without any need for further CSO reduction. Several municipalities fit this distinction under the current standards for the Lower Hackensack River (North Bergen, Jersey City) and Newark Bay (Harrison, East Newark, Kearny, Newark, Bayonne). These water quality levels are already attained, and theoretically "doing nothing" will not preclude this attainment.

The City of Paterson and the Upper Passaic River fall into the second category, where water quality in the receiving waters can never be met, even with complete elimination of combined overflows. The same is true for the Lower Passaic River (Paterson, Harrison, East Newark, Kearny, Newark), as well as the Upper Hackensack River. This is due to a high number of background factors, including stormwater, upstream rivers, treatment plants, wildlife & other dry-weather sources. Recent model runs have clearly shown elevated concentrations of pathogens in certain locations during dry weather, driving the pathogen levels to far exceed current Water Quality Standards. Additionally, the Upper Passaic River has the unique distinction of being a Freshwater FW2 criteria water body source for E. Coli, and thus is subject to more stringent standards that must be met for water quality of this pathogen. Model studies for the District also show that if the background was hypothetically removed from the equation, contaminants from combined sewer overflows are far below the established standard pathogen levels for the Upper Passaic River, and do not affect the attainment of water quality.

Following this discovery, the PVSC District progressed with the intention of capturing wastewater volume and reducing overflows at financially attainable levels for each permittee, and achieving water quality where feasible. We believe taking this position satisfies the requirement of the National CSO Policy, where our measures of reducing CSO volume in our proposed LTCP do not preclude the attainment of Water Quality Standards.

A Presumptive Approach of 85% wet weather capture was chosen in Paterson, both under its proposed Municipal and Regional Alternative Plans. Under the Regional Alternative, the CSO controls implemented under Paterson's share of the LTCP are designed to help the PVSC District Permittees attain 85% wet

weather capture as one hydraulically connected sewer system. Conversely, the Municipal Alternative is designed to attain 85% wet weather capture within the city independently. The technologies to be installed would be implemented over a proposed 40-year plan in Paterson. Functions of these technologies will be monitored post-construction in yearly intervals to verify that CSO volume capture and overflow reductions are occurring as expected, and to ensure adequate funding for the LTCP still exists. The fundamental nature of a Presumptive Approach is that it must be measured regularly to demonstrate that the presumed level of wet weather capture is on pace for attainment by the end of the proposed LTCP schedule.

Additionally, each project will be optimized using adaptive management as the LTCP implementation proceeds. To that end, included in the plan is adaptive management, which provides an opportunity for Paterson to conduct post construction monitoring, after partially implementing strategic projects of the plan to re-assess the implementation schedule. These projects will be monitored to determine whether they are operating as intended, and to verify that 85% percent capture is still an attainable goal. The City of Paterson is committed to the projects as necessary to achieve the goals set forth in the NJPDES Permit. However, if this post construction monitoring indicates a modification to the investment or actions are needed, those investments and actions will be evaluated, and a supplemental control plan, or adaptive management plan, will be developed for review and approval by the NJDEP for the next NJPDES CSO Permit cycle, which occurs every five (5) years. If necessary, this adaptive management plan will also incorporate any new technologies or group similar projects to reduce costs, pending regulatory approval and other anticipated factors. Minimizing community impacts is one of the cornerstones and key benefits of the selected CSO Control Plan. However, these instances will likely require some re-purposing of public land, a need for rights of way, and a potential need for land that has changed in private or public ownership.

D.3 SELECTION OF ALTERNATIVES

D.3.1 Description

The City of Paterson has been making strides to improve its combined sewer system; it has been diligently separating sewers, lining damaged sewers, and implementing solids control measures, to name a few. However, to reach compliance with the terms of the NJPDES CSO Permit a significant investment must be made on the part of the City with its Long Term Control Plan. The Alternative scenarios that were proposed in Paterson's DEAR, and the CSO control technologies therein, will now be analyzed further in the succeeding sections of this Selection Report.

D.3.2 Remaining Overflows

Beginning with our expanded baseline model, we establish that within the Paterson CSS, our wet weather results in a total CSO volume of about 353 MG, as well as 82.1% wet weather capture. The alternative technologies listed in this Report aim to reduce this volume of CSO flow and increase capture to varying degrees. The alternative scenario that is ultimately selected for Paterson is dependent on the affordability of the system improvements to the City, as well as the overall level of improvement that the PVSC District hopes to achieve after a knee-of-the-curve cost analysis.

The following Tables D-1 and D-2 compare the baseline conditions to the remaining overflows at each outfall, or group of outfalls if they are in close proximity, after implementation of Paterson's Preliminary Alternatives.

Table D-1: Frequency of CSO Discharges in Paterson by Level of Control

Frequency of Discharges by Level of Control							
Paterson CSO Outfall	Alternative 4C 0 Events	Alternative 5C 4 Events	Alternative 6C 8 Events	Alternative 7C 12 Events	Alternative 8C 20 Events	Alternative 9 85% Capture	Baseline
001, 003, 029	0	3	7	8	15	29	30
002	0	0	0	0	0	0	8
004	0	0	0	0	0	0	9
005	0	3	7	7	14	17	20
006	0	3	7	11	20	25	27
007, 010	0	3	7	11	15	28	32
012	0	0	0	0	0	0	13
013	0	3	7	7	17	33	33
014	0	1	3	3	5	5	5
015	0	1	2	4	10	19	21
016	0	4	7	7	14	29	32
017	0	2	7	11	20	26	27
021, 022, 032	0	2	2	11	13	30	30
023	0	0	0	0	0	0	24
024	0	4	6	11	20	29	30
025	0	4	8	11	19	23	53
026, 027, 030	0	3	7	7	14	34	37
028	0	2	5	5	5	5	5
031	0	1	4	4	10	24	25
Total	**0**	**4**	**8**	**12**	**20**	**36**	**53**

Table D-2: CSO Volume in Paterson by Level of Control

CSO Volume by Level of Control (MG/yr)							
Paterson	Alternative 4c	Alternative 5c	Alternative 6c	Alternative 7c	Alternative 8c	Alternative 9	Baseline
CSO Outfall	0 Events	4 Events	8 Events	12 Events	20 Events	85% Capture	
001, 003, 029	0	2.8	7.2	9.2	17.9	24.6	26.4
002	0	0	0	0	0	0	0.2
004	0	0	0	0	0	0	0.2
005	0	0.2	1.1	1.2	2.0	2.0	2.3
006	0	3.3	6.0	12.4	17.4	24.4	25.2
007, 010	0	4.2	7.1	14.3	19.8	37.0	38.6
012	0	0	0	0	0	0	1.6
013	0	1.5	4.5	4.5	8.4	10.3	10.1
014	0	0.1	0.1	0.1	0.2	0.2	0.2
015	0	0.2	0.1	0.1	0.2	0.2	0.6
016	0	1.6	3.3	3.3	7.4	11.9	12.6
017	0	1	1.3	2.7	4.4	6.4	6.9
021, 022, 032	0	4.7	5.2	14.0	18.1	42.0	45.1
023	0	0	0	0	0	0	9.4
024	0	2.2	3.6	7.6	11.0	13.5	16.5
025	0	12.7	25.6	32.6	54.2	56.6	96.8
026, 027, 030	0	5.8	15.2	15.2	27.2	48.0	52.4
028	0	0	0.1	0.1	0.1	0.1	0.1
031	0	0.7	1.4	1.4	3.2	6.1	8.0
Total	**0**	**41.0**	**81.8**	**118.7**	**191.5**	**283.3**	**353.2**

D.3.3 Ability to Meet Water Quality Standards

The City of Paterson has the unique distinction of being further north than any of the other PVSC District municipalities, which brings unique challenges. As previously stated in Section D.2 of this Report, the Upper Passaic River is classified as a Freshwater FW2 water body source for measuring E. Coli. As a result, more stringent standards must be met to reach water quality there. The NJ Pathogen Criteria established for E. Coli in this FW2 receiving water body is currently set at 126 CFU/100 mL (Colony Forming Units per 100 milliliters).

Meanwhile, the standards for Fecal Coliform are already attainable. The Upper Passaic River is classified as an SE2 water body source for measuring Fecal Coliform, and NJ Pathogen Criteria is currently set at 770 CFU/100 mL. These standards of Fecal Coliform in the Upper Passaic far exceed the levels currently measured in these receiving waters, with NJ CSOs being one of the smallest contributors.

D.3.4 Non-Monetary Factors

Some non-monetary factors that influenced the selection process in Paterson included, but were not limited to:

- Public Participation
- Regulatory requirements (EPA, NJPDES)
- Ease of application/development
- Minimizing disruptions and safety hazards

The availability of existing shelved concept plans for scheduled improvements to the combined sewer system provided the LTCP team with direction on where CSO controls could best serve the City. Preliminary construction costs that were already attached to each concept were further developed and included into LTCP alternative scenarios, giving the concepts justification to be selected for implementation.

Another important non-monetary factor of the selection process was community benefits. As public participation was maintained in Paterson throughout the development and selection processes, the public was eager to keep Green Infrastructure as a featured CSO control technology. While not capable of capturing wet weather runoff in larger volumes like most other control technologies, the City acknowledges the other benefits of GI apart from improved water quality. These can include enhanced community aesthetics, improved air quality from reconfigured landscapes, additional jobs to help operate and maintain implemented rain gardens and bioswales, and an effective means to eliminate overflow events at select CSO Outfall structures in the City prior to considering greywater technologies. As a result, the City sought to implement a scenario that captures 2.5% of impervious cover, which was determined to be the most achievable in terms of balancing necessary costs, volume capture, and implementation factors.

Ultimately, while each of the screened CSO technologies chosen for further analysis have a level of implementation, they must also be accepted by the public. All of the technologies that become part of the LTCP will have to function for not only the improvement of the City's combined sewer flows, but also for the best interest of the city's residents. This includes minimizing safety hazards and disruptions to

normal traffic flow during all phases of construction for each proposed technology, and improving quality of life within the City as a result.

D.3.5 Cost Opinion

In an effort to provide consistency in cost estimating CSO controls throughout the municipalities that discharge wastewater to the PVSC Interceptor, PVSC released the "Updated Guidance on Costing for LTCP CSO Planning" memo to all PVSC District Permittees in April 2020. The memo provides updated guidance on costing CSO control technologies, with a goal of establishing standardized unit pricing for improved consistency and ability to evaluate short-listed alternatives. For calculating the life cycle cost, PVSC provided a Present Worth Factor (PWF) of 15.227 to all Permittees.

The City of Paterson used this memo to re-evaluate the projected capital, O&M and life-cycle costs for their short-listed alternative technologies, which include sewer separations, relief sewers, green infrastructure, and greywater storage.

Historical information on sewer separation in CSO communities in the Northeastern U.S. shows the cost of completing separation can range from $200,000 to $500,000 per acre. Many factors impact per acre separation costs, including the age of existing infrastructure, population density and land use, utility pipe density, number of private inflow connections and site-specific factors such as soil conditions, the presence of rock, etc. For the purposes of standardizing around a specific planning level estimate that is consistent between CSO municipalities, it was recommended that a $300,000 per acre unit cost be applied for sewer separation. This cost includes contractor overhead and profit, contingencies and allowances for engineering and implementation. This cost does not include land acquisition and traffic management costs. There is no additional O&M cost assigned for sewer separation as this work should not lead to an increase in O&M efforts associated with maintaining the sewer system, which presumably is maintained today.

Green infrastructure costs can also vary widely in unit costs. The NJDEP guidance manual titled "CSO Guidance Evaluating Green Infrastructure A CSO Control Alternative for LTCPs" (2018) recommends using capital costs within the range of $299,000 and $449,000 per acre of impervious cover managed with green infrastructure. For our LTCP, a standard unit price of $390,000 per acre of impervious cover managed with green infrastructure was recommended. This cost includes contractor overhead and profit, contingencies and allowances for engineering and implementation. Since the cost of green infrastructure can vary between green infrastructure technologies, it is assumed that bioretention systems will be installed. O&M costs for Green Infrastructure technologies vary based on the type of technology that is installed. To remain consistent with the assumption for the construction cost of green infrastructure facilities, it was assumed that bioretention systems will be installed. The NJDEP guidance manual recommends using an O&M cost of $2,250 per year per acre of impervious cover managed with green infrastructure for bioretention systems.

Unit prices for relief sewer pipe projects were generated in the memo based on cost estimates and bid costs for sewer pipeline projects in the northeast. Costs for 72-inch pipe and larger assume trenchless technologies are applied, which can allow for comparable unit costs between pipe sizes. The costs are based on pipe burial depths ranging from 8 ft to 18 ft. The costs per linear foot for various diameters include contractor overhead and profit, contingencies and allowances for engineering and implementation. This cost does not include land acquisition and traffic management costs. Paterson has

proposed a relief sewer that is elliptical in shape and has two unique sizes (5 ft x 3 ft-6 in and 5 ft-11 in x 7 ft-1 in) over its 7,700 linear foot span. As such, the larger dimension of each elliptical pipe size was used in calculating unit price (5 ft and 7 ft). The standardized cost of 5 ft diameter pipe is $6,100 per linear foot, and the cost of 7 ft diameter pipe is $6,800 per linear foot. O&M costs for proposed relief pipelines are expected to be absorbed within existing O&M budgets as the pipe that will be implemented is new and should require less maintenance than other parts of the system. Therefore, no new O&M costs are included for relief pipe.

It was recommended that costs for storage facilities be based on the capital cost curve in Figure 1 of the Cost Guidance Memo. These costs are based on the 1993 U.S. Environmental Protection Agency (EPA) guidance cost manual "Combined Sewer Overflows Control" and other bid/constructed project costs obtained from projects around the country. For uniformity in costing, it was recommended that these updated costs for storage facilities be applied wherever local storage is proposed as part of an alternative regardless of assumed configuration (i.e. storage tanks, local storage conduits/tunnels, storage drop shafts, etc.). These costs include contractor overhead and profit, contingencies (50%), engineering (20%), and ancillary equipment and piping, but do not include land acquisition, unstable subsurface conditions, rock excavation, soil remediation, the cost of the diversion structure for the tank and other unforeseen or unanticipated or site-specific conditions. It is assumed that storage facilities will require coarse screens at the upstream end, odor control, flushing systems and dewatering pumps sized to drain the tanks following storm events over two days. Based on the fact that the cost curves were developed from actual costs from built projects, it is assumed these factors are included in the curves and additional allowances for these items are not necessary.

The equation for the storage cost curve is as follows:

- Storage Cost (Updated EPA Cost Curve) = (3.637*(Vol^0.826))*(Current ENR/4800)*(Newark NJ Cost Works Location Factor/100) *1.5 (for contingency) *1.2 (for engineering)

The 20-City Average ENR for March 2020 is 11397. (It is presumed the EPA cost data is based on 20-City average ENR). The 2019 Cost Works (RS Means) Location Factor for Newark, NJ is 116.8. This factor can be used to convert EPA cost data, which is presumed to be national average to the New Jersey area.

When these factors are inserted in the equation, it is reduced to the following:

- Storage Cost = 18.155*(Vol^0.826)
- $/Gallon Unit Costs = 18.155*(Vol^-0.174)

O&M costs for storage facilities are not provided in the 1993 EPA guidance document. Therefore, annual O&M costs for satellite storage were developed based on assumptions associated with cleaning and maintenance efforts that would be required for such facilities. It was assumed that storage facilities would require a visit by a crew following each storm event for flushing, cleaning and overall maintenance and that there would be 60 storm events per year. The cleaning cost per day is assumed to be $1,500, which includes the cost of a water truck, a jet vac truck and two operators. In order to establish a curve that requires less time for smaller tanks and more time for larger, the following assumptions were made:

- 0.5 MG tanks would require a ½ day of cleaning
- 1 MG tanks would require ¾ of a day
- 3 MG tanks would require a full day
- 6 MG tanks would require 1.5 crew days
- 10 MG tanks would require 2 crew days
- 18 MG tanks would require 2.5 crew days

To account for non-staff resources such as electricity, pumps, etc., a 10% allowance was added to the above curve assumptions. The resultant curve equation for storage O&M costs is:

- Storage O&M Cost = 0.0688*(Vol^0.4387)

D.3.6 Selection of Recommended Alternative

The City has chosen to move forward with one alternative scenario derived from the list of Preliminary Alternatives (Table C-1) that reaches the minimum 85% wet weather capture target as established by the National CSO Policy. Table D-3 shows the selected Alternative's characteristics and cost as reported in the DEAR, using cost opinions from the City Engineer and available cost guidance curves for greywater storage. With the aforementioned costs factors in mind from Section D.3.5, the capital costs for CSO control technologies proposed were revised in April 2020 to a standardized, more conservative estimate. Table D-4 shows the costs for the CSO control technologies under the standardized cost guidance.

Table D-3: Selection of Recommended Alternative from DEAR

Alternative	% Capture	Volume Captured (MG)	CSO Events	Cost ($ Millions)
Alt. 9: Sewer Separation since 2006 + Planned Sewer Separation + 19th Ave. Relief Sewer + Green Infrastructure (2.5%) + Storage required to reach **85% system capture within the City**	85.3	69.894	36	$ 78

Table D-4: Recommended Alternative Technologies with Standardized Costs

CSO Control Technology	Quantity / Size	Units	Updated Capital Cost Total ($M)	Updated O&M Cost Total ($M)	Updated Life Cycle Cost (CC + Present Worth of Annual O&M Cost) ($M)
Sewer Separation Projects Completed Since 2006	47.5	Acres	N/A	N/A	N/A
Planned Sewer Separation for CSO 023	29.8	Acres	$ 8.9 M	$ 0.00 M	$ 9 M
19th Ave. Relief Sewer for CSO 030	7700	LF	$ 49.9 M	$ 0.00 M	$ 50 M
2.5% Green Infrastructure	75.0	Acres	$ 29.3 M	$ 0.17 M	$ 32 M
15' Dia. 1600 LF Storage Tunnel at CSO 025 (towards 85% Capture)	2.1	MG	$ 33.7 M	$ 0.10 M	$ 35 M
		Total	**$ 121.8 M**	**$ 0.26 M**	**$ 126 M**

D.4 DESCRIPTION OF RECOMMENDED LTCP

The selected alternative scenario is currently the most affordable option for the for the City of Paterson to pursue under the LTCP. Its affordability and scheduling will be discussed in greater length in Section E of this Report, but this alternative achieves the minimum percent capture requirements of the NJPDES CSO Permit using technologies that aim to best serve the City as a whole.

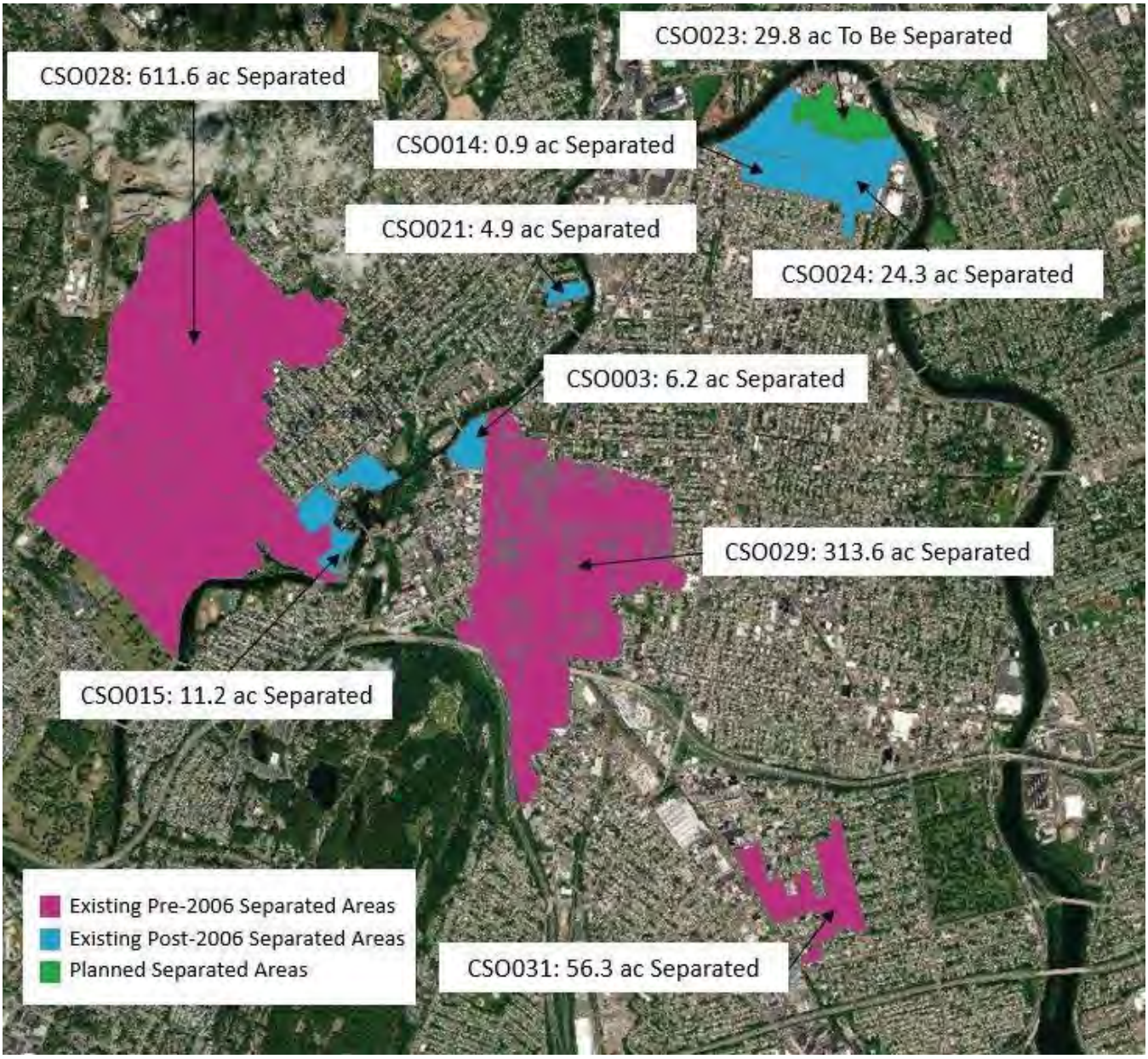
D.4.1 Sewer Separation Projects Completed Since 2006

As previously mentioned in Section B of this Report, sewer separation projects have been ongoing in many parts of Paterson since the early 2000s. The significant sewer separation efforts in the drainage areas to CSO028 and CSO029 are explicitly included in the baseline scenario, since the timeline for this effort has extended over two decades. However, since 2006, the city has undertaken targeted sewer separation efforts in some outfall drainage areas to address either localized flooding concerns or eliminate the need for CSO control. Partial sewer separation was observed in record drawings for the drainage areas serving Outfalls 003, 014, 015, 021, and 024, totaling 47.4 acres. These areas were added to the existing baseline separated areas in order to quantify the estimated CSO reduction benefits that have occurred since 2006. Over the course of the typical year model simulation, these sewer separation projects resulted in a CSO reduction of approximately 10 MG. Furthermore, the City has identified the CSO023 drainage area as a potential site for future sewer separation, totaling 29.8 acres and approximately 9.0 MG of potential CSO volume reduction in the typical year. In total, there are 1058.7 acres of former combined drainage areas that have been separated, or will be in the near future.

With these projects completed or already underway, Paterson may take credit for these CSO control benefits that currently exist within their combined sewer system.

Working from the City of Paterson's 2006 baseline year model, the City Engineer has reported that sewer separation projects completed since that time have totaled about $5 Million. This estimate, plus projected lifecycle maintenance costs, had served as the cost for Paterson's Alternative 1 scenario. However, since these separation projects are categorized as existing improvements made to the City's CSS that can be taken credit for under this LTCP, the costs are not factored into the financing of this LTCP.

Figure D-1: Summary of Partial or Complete Sewer Separation



D.4.2 Planned Sewer Separation for CSO023

Paterson's Alternative 2 scenario is a proposed separation/in-line storage scenario that brings together the benefits of two planned projects aimed to reduce overflows and mitigate known flooding issues in the City. The first project aims to fully separate the storm and sanitary flows in the collection area of CSO023. The City Engineer has projected the cost of implementing this sewer separation project to be about $2.5-3 Million. Updated cost guidance revised the cost to a conservative estimate closer to $9 Million, based on a standardized price per linear foot for new sewer separation projects.

D.4.3 19th Avenue Relief Sewer for CSO030

The second part of Paterson's Alternative 2 scenario is a concept plan for a relief sewer in the V2 flow area, towards CSO030 and primarily along 19th Avenue. This concept has been discussed since 2010, but has been unable to pass the preliminary discussion & design phase. The 7,700-linear foot relief sewer concept was estimated in 2012 by the City Engineer to be an $18-19 Million project to relieve substantial street and basement flooding that occurs through one of the busiest and most densely populated regions of the City.

Together, the construction costs of the planned projects in Paterson's Alternative 2 totaled to an estimated $22 Million in the DEAR. Factoring in their respective 20-year lifecycle projected maintenance costs, as well as the costs of the existing improvements from Alternative 1, Alternative 2 were projected to cost approximately $36 Million to implement. Updated cost guidance revised the incremental costs of the alternatives to this point to a conservative estimate of about $59 Million, based on a standardized price per linear foot for new sewer separation and relief sewer projects.

Sewer separation costs across Paterson's Alternative scenarios 1 and 2 are summarized below in Table D-5.

Table D-5: Cost of Completed Sewer Separation & Planned Projects (from DEAR)

Projects	Construction Cost	Annual Maintenance Cost	Present O&M Value (20-yr Lifespan)	TOTAL 20-yr Lifespan Cost
Sewer Separation Projects Completed in Paterson Since 2006	$5,000,000	$100,000	$1,522,700	$6,522,700
Including Baseline Conditions (Alternative 1):				$6,522,700
Planned Sewer Separation for CSO023 Service Area	$3,000,000	$60,000	$913,620	$3,913,620
Planned 19th Avenue Relief Sewer for V2 Area (CSO030)	$19,000,000	$380,000	$5,786,260	$24,786,260
Cost of Planned Projects:				$28,699,880
Including Alternative 1 System Changes (Alternative 2):				$35,222,580

The following Figures D-2 through D-5 are conceptual maps and designs that capture the scale and scope of the planned sewer separation and relief sewer projects.

Figure D-2: Concept Plan for Sewer Separation at CSO023

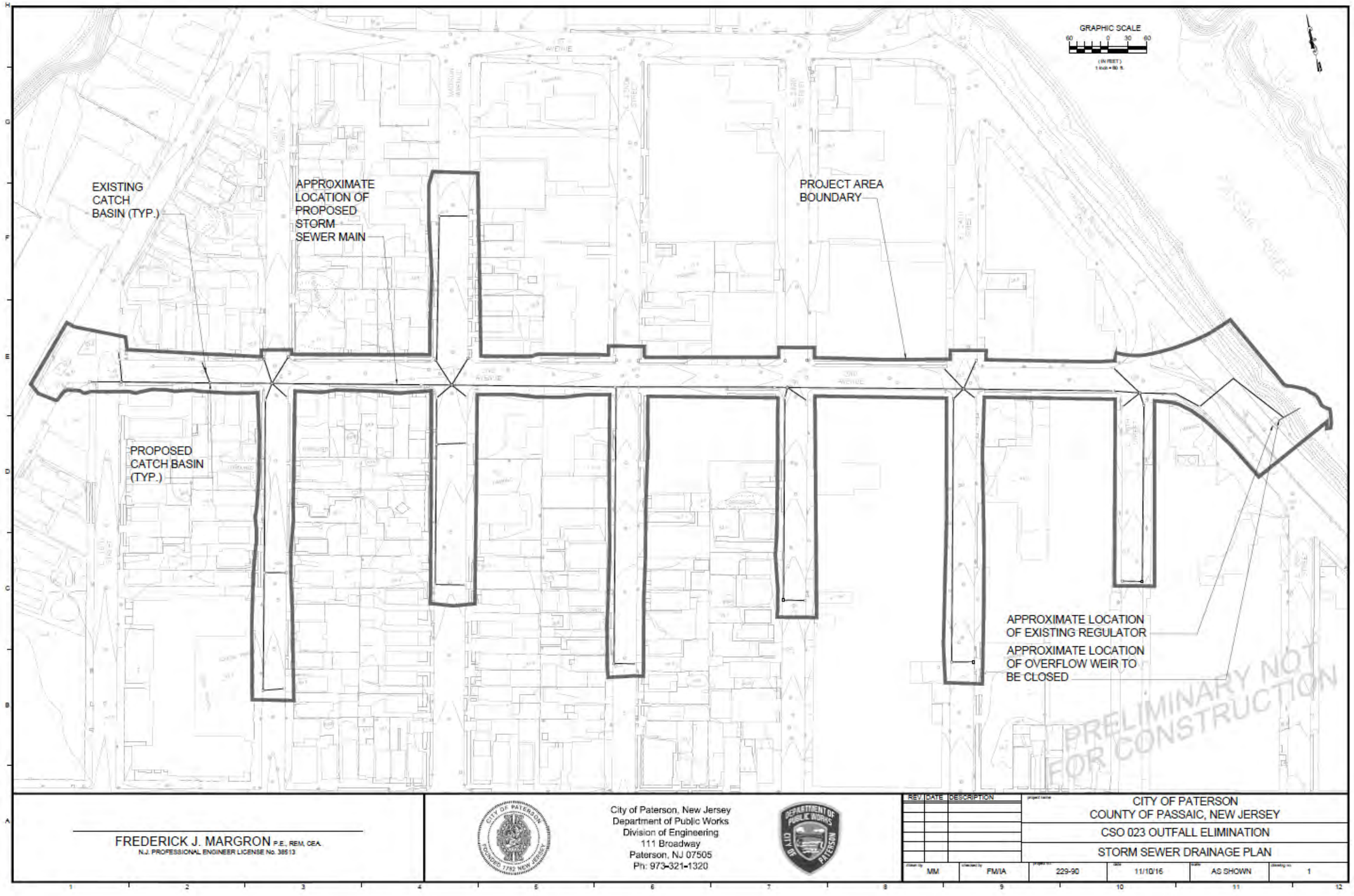


Figure D-3: Proposed 19th Avenue Relief Sewer Route for CSO030 – Aerial

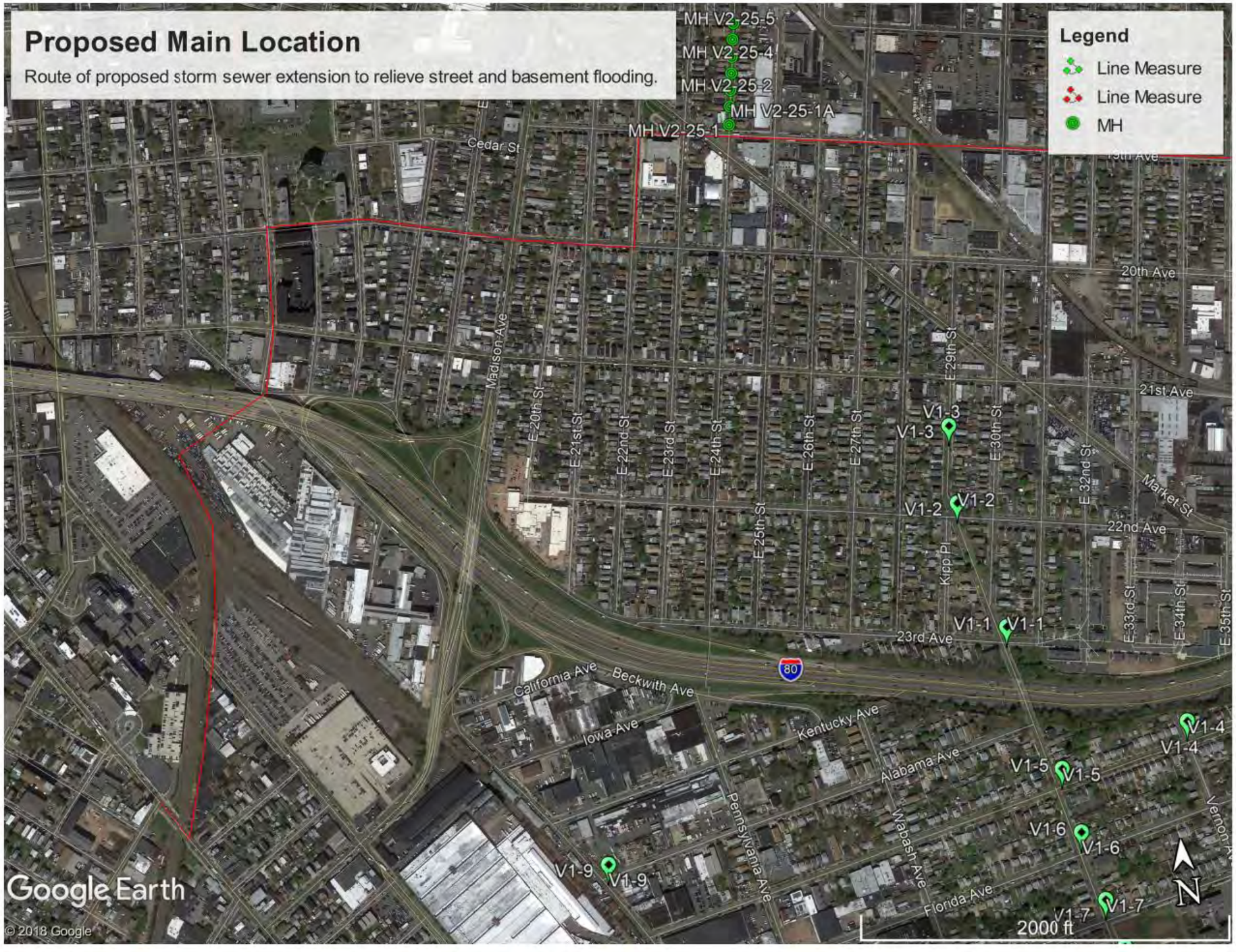


Figure D-4: Proposed 19th Avenue Relief Sewer Route for CSO030 – Sewer Map

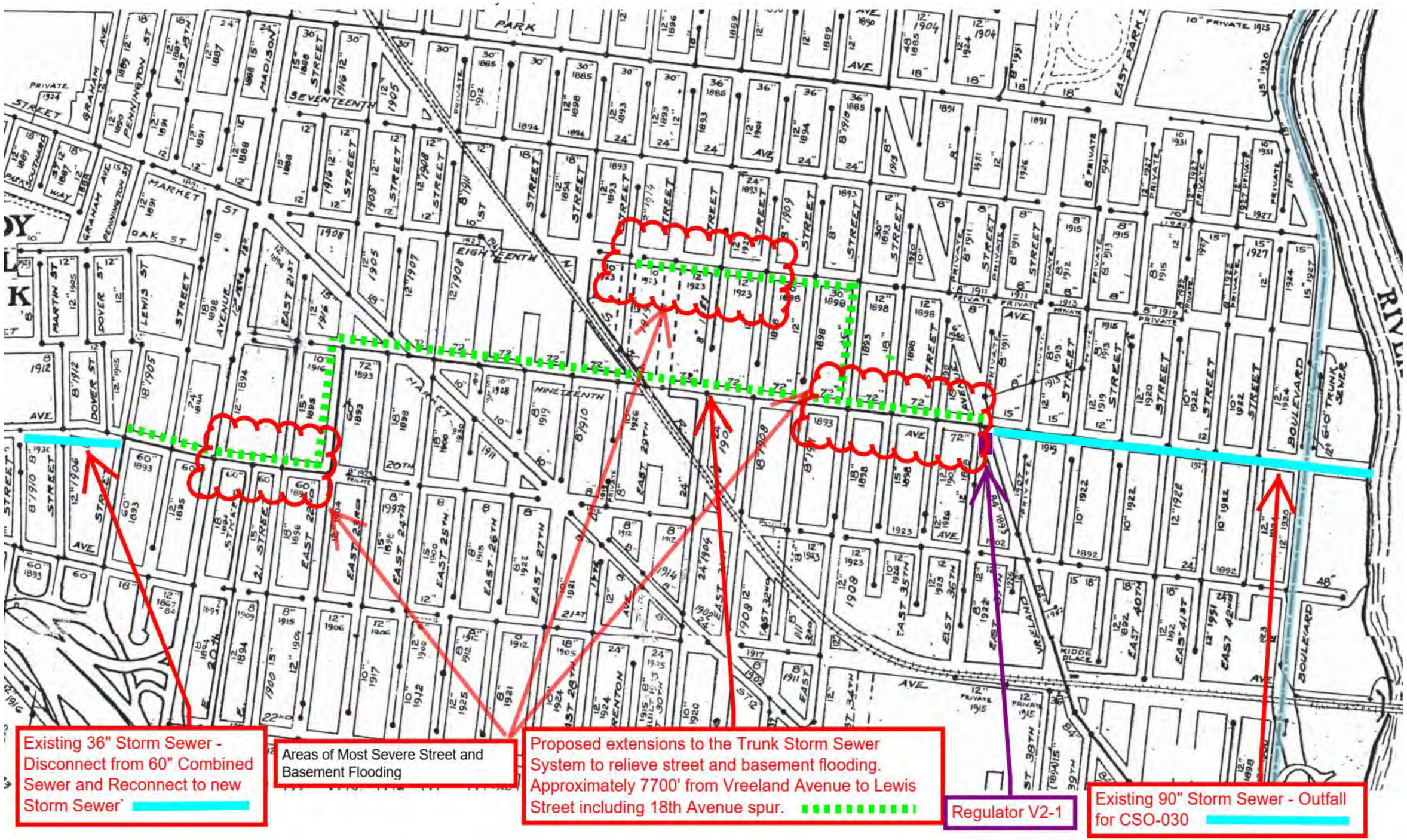
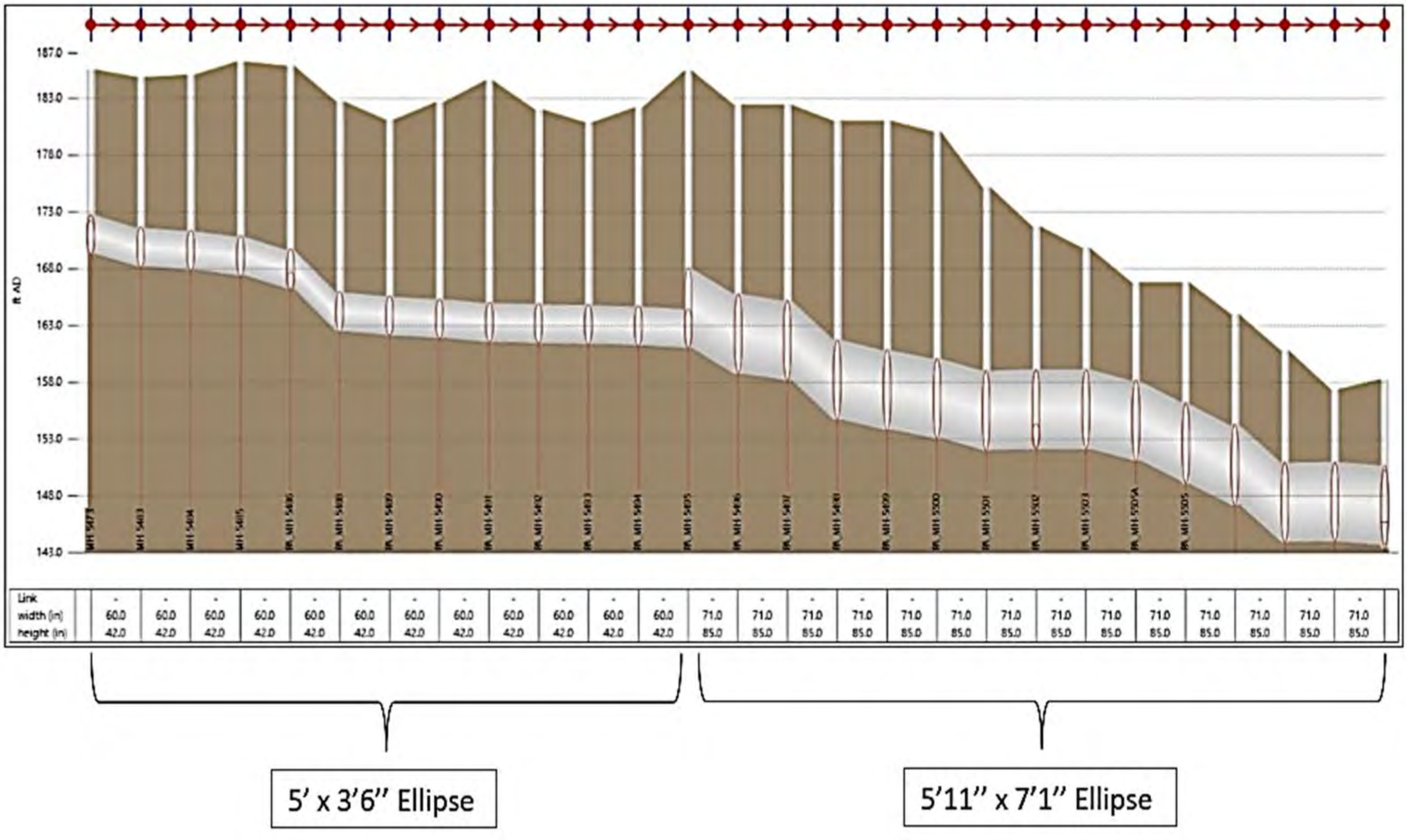


Figure D-5: Proposed 19th Avenue Relief Sewer Route for CSO030 – Profile



D.4.4 Green Infrastructure

The use of green infrastructure (GI) was required to be evaluated in the DEAR as part of the NJPDES requirement. The City of Paterson factored in GI as an early alternative technology to reduce CSO discharges prior to considering implications of greywater infrastructure investments. GI assets help to manage rainfall closer to where it falls, in comparison to tanks or tunnels normally built near the outfalls. The Paterson DEAR presented a scenario that captures 2.5% impervious cover within the City. Initial presentation of this goal was met with criticism that it was not as high as many of the other municipalities' goals (e.g. 5%, 10%). However, this level was selected during LTCP development as the most feasible goal to achieve in terms of balancing necessary costs, volume capture, and implementation factors. We recommend a level of GI in the LTCP that is achievable with the possibility to exceed, as opposed to a level that is too optimistic and beyond what the City can justly afford.

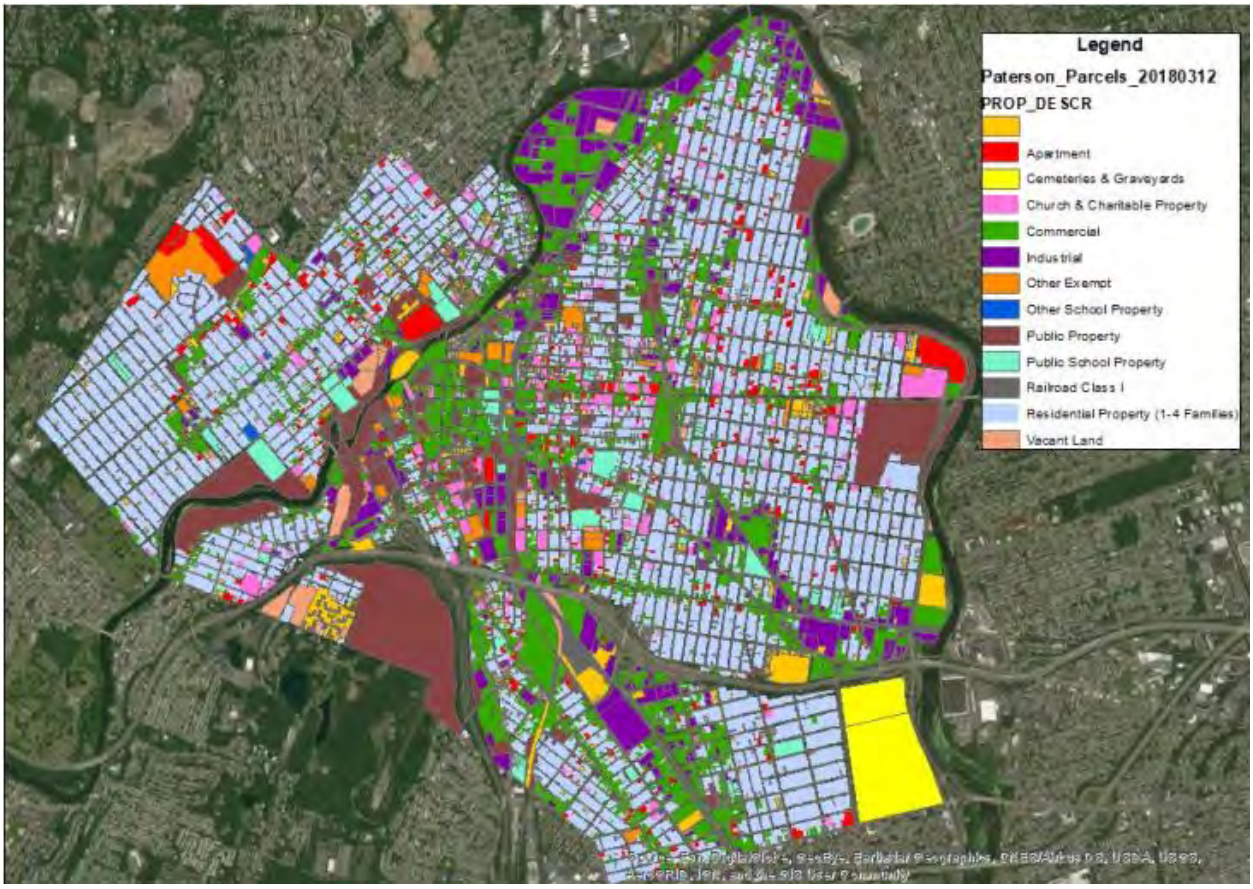
An initial "top-down" approach implemented GI in every outfall at 3% and 6% levels uniformly to quantify their benefits on an outfall-by-outfall basis. Existing drainage areas were split into managed and unmanaged portions. Managed portions were modeled such that they only generated runoff when the cumulative rainfall in a given event exceeded 1.25 inches. This rainfall depth threshold was based on the standard NJDEP water quality storm of 1.25 inches over 2 hours. Generally, for the 3-6% GI implementation rate, we observed between 4 to 7% reduction in total annual CSO volumes on a citywide scale, with frequencies essentially remaining the same. Volume reductions varied between different outfalls based on the extent of impervious cover and routing within the collection systems of these outfall drainage areas.

In dense urban centers similar to Paterson, there are several major constraints to GI implementation, including: limited infiltration potential; high groundwater table; bedrocks; utilities; smaller lots; and narrow sidewalks. Therefore, we evaluated GI from the key consideration of ownership and anticipated water quality benefits (i.e., CSO reduction). In most cases, where larger and more frequent CSOs are estimated, the prioritization will be on grey infrastructure. Similarly, the GI is prioritized on low volume/less frequently overflowing outfalls, with the intent of making as significant of a difference in water quality outcomes as possible. In order to achieve this objective, we analyzed the types of properties and the potential areas available for possible GI implementation based on the right-of-way and property classification and ownership. We began with a suite of GI tools that would be implementable in a dense urban setting, as shown in Figure D-6 below.

Figure D-6: Classification of Property Types for GI

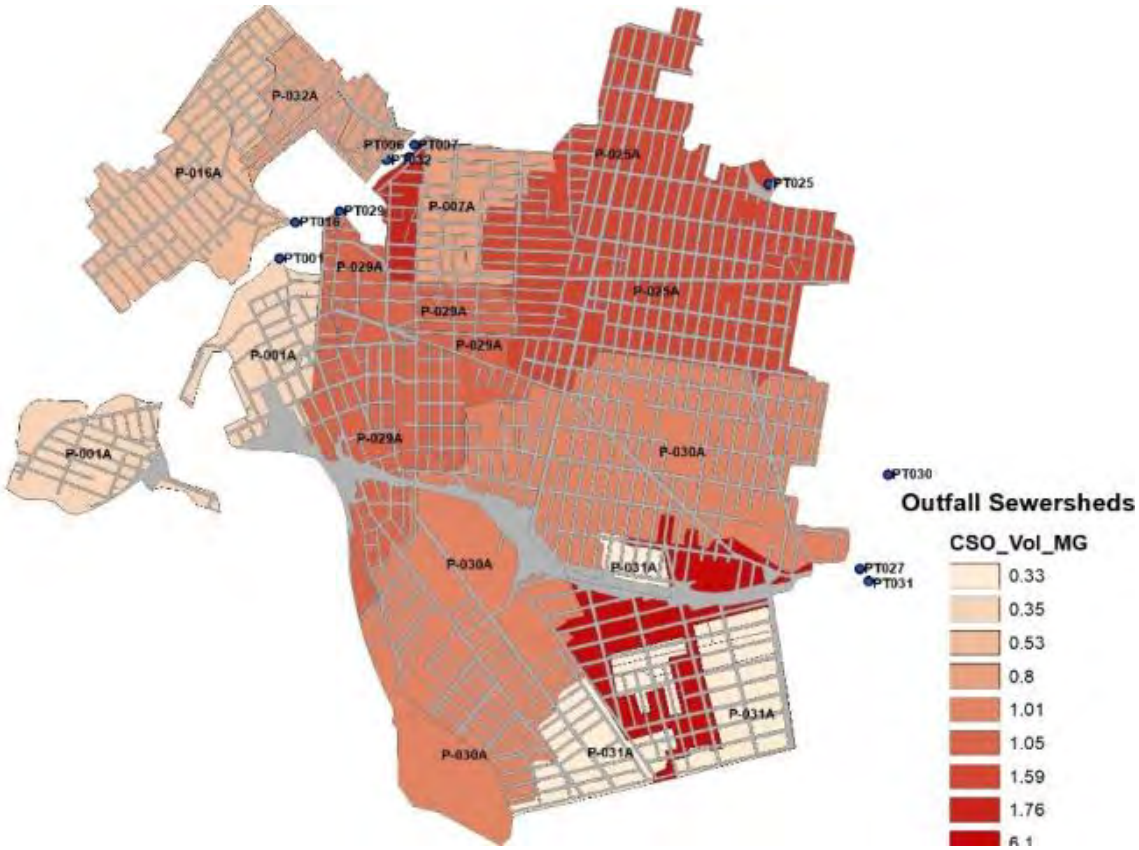
Based on the "top-down" GI modeling results and lessons learned from other CSO municipalities in the region, we established a target GI implementation rate to manage approximately 2.5% of the impervious cover in the combined sewer drainage area within Paterson (in which the first 1.25 inches of rainfall was managed). After this goal was established, a "bottom-up" approach was undertaken to characterize the different land use types and potential opportunities available in the various outfall drainage areas, both within existing properties (on-site) and within the city, county, state and federal right-of-way. Figure D-7 below shows the land use types within the city considered in the initial screening.

Figure D-7: Classification of Property Types for GI



ROW constitutes a major fraction of impervious cover directly connected to sewer systems in urban areas. Roofs, patios, and driveways may drain directly to sewers or runoff of adjacent pervious areas and then eventually connect to the sewers. ROW GI projects can include a variety of design topologies, including bio-swales, continuous tree trenches, green sidewalks, and others. Paterson encompasses the Interstate Route 80 corridor, NJ State 20 and 19 corridors, Passaic County arteries/major roads, and city-owned local roads. With federal, state and county ROW being significant and potential opportunities for grants to fund GI projects and reduce their component impacts on Paterson's sewer system, our GI planning focused entirely on these ROW types. There were approximately 160 acres of available federal, state, and county ROW within the city's combined drainage areas (excluding areas with any level of sewer separation); GI can be implemented on 50 acres of this space. Figure D-8 below shows the ROW in various outfall drainage areas identified in this analysis.

Figure D-8: Right-of-Way GI Opportunities



A careful screening of property types was then conducted to determine what opportunities may exist for on-site retrofits within the City. Based on available parcel data maintained by Passaic County, a multi-tiered property analysis was conducted to identify which properties fell under one of four classifications (tiers): (1) City-Owned; (2) School District-Owned; (3) Other (federal, state and county) Government-owned; and (4) Tax-exempt (non-profit) properties. Although these are not in any priority order, the chances of applying for and obtaining grants to fund the GI projects generally are better with Tier 1 than the Tier 4 properties. In addition, the ownership of parcels plays a major role in terms of obtaining permits for GI construction and operating and maintaining over lifetime; Tier 1 offers the most feasibility to Tier 4 offering the least feasibility. Figures D-9 through D-12 below show the identified GI opportunities in each of the four tiers. A total of 25 managed impervious acres can be spread evenly between parcels in combined sewer drainage areas (excluding areas with any level of sewer separation). Both ROW and on-site GI were included in the Paterson InfoWorks model to assess the incremental benefit of GI.

Figure D-9: City-Owned Parcels (GI Tier 1)

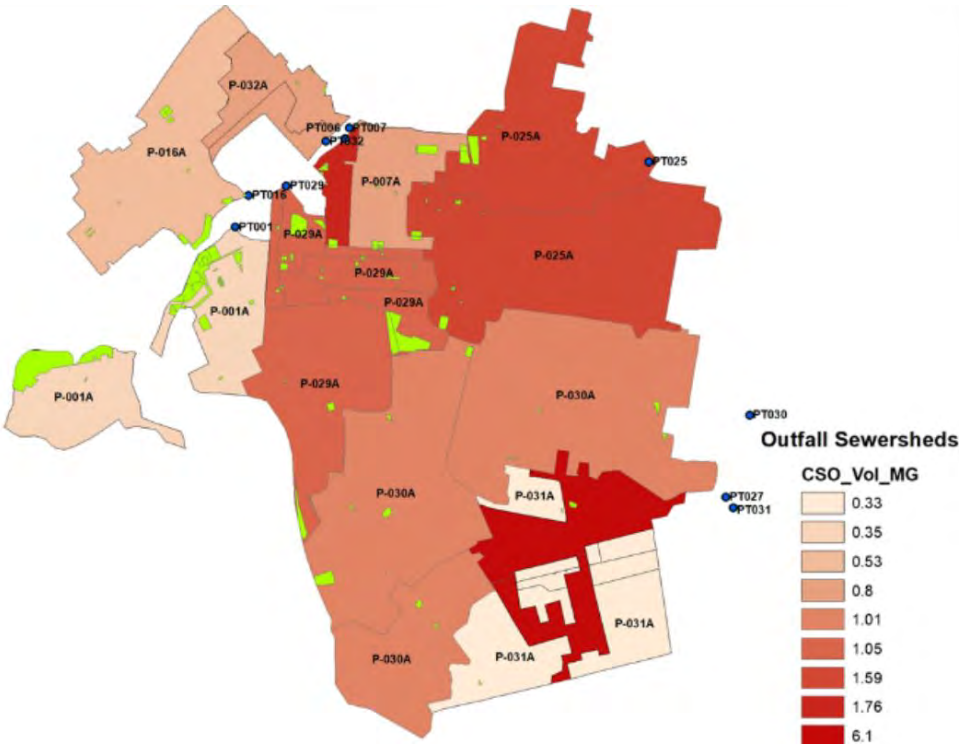


Figure D-10: School District-Owned Parcels (GI Tier 2)

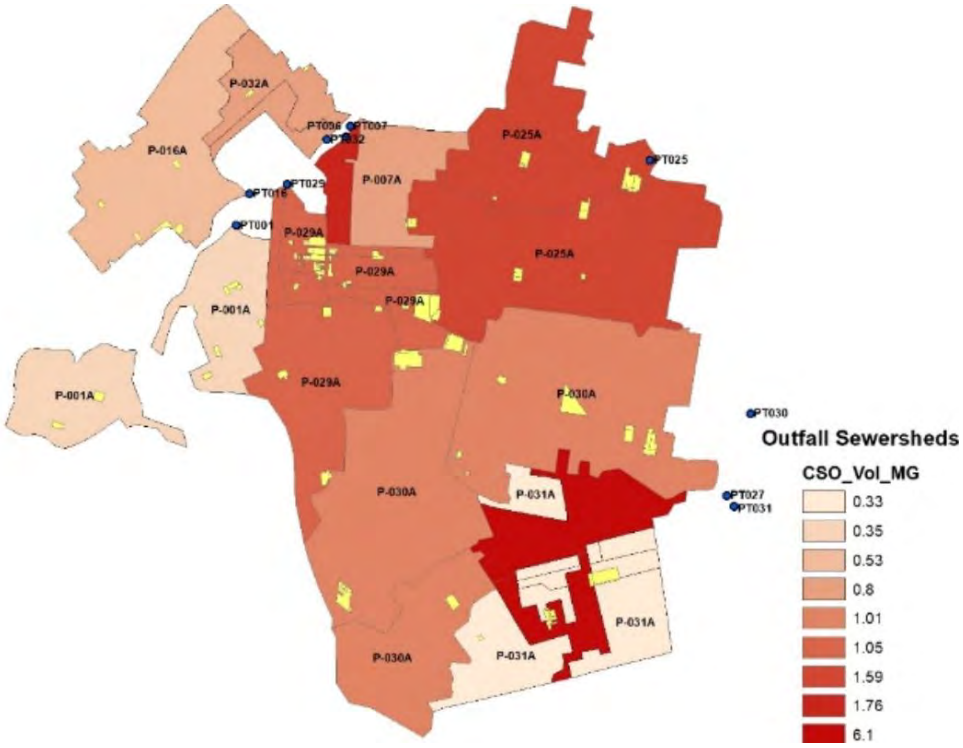


Figure D-11: Other Government-Owned Parcels (GI Tier 3)

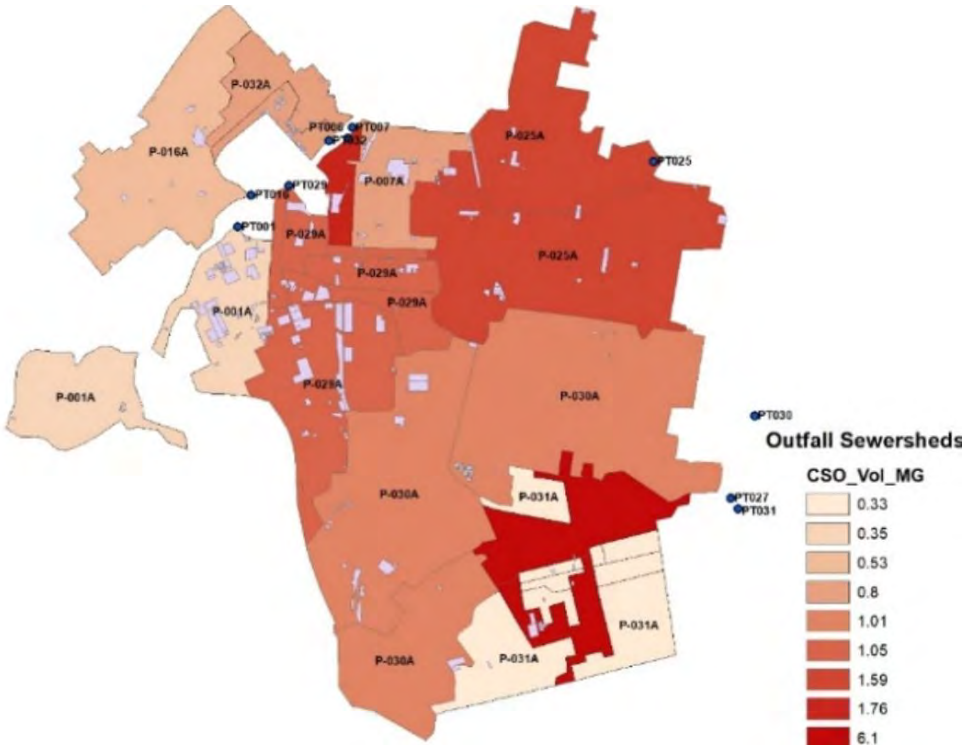
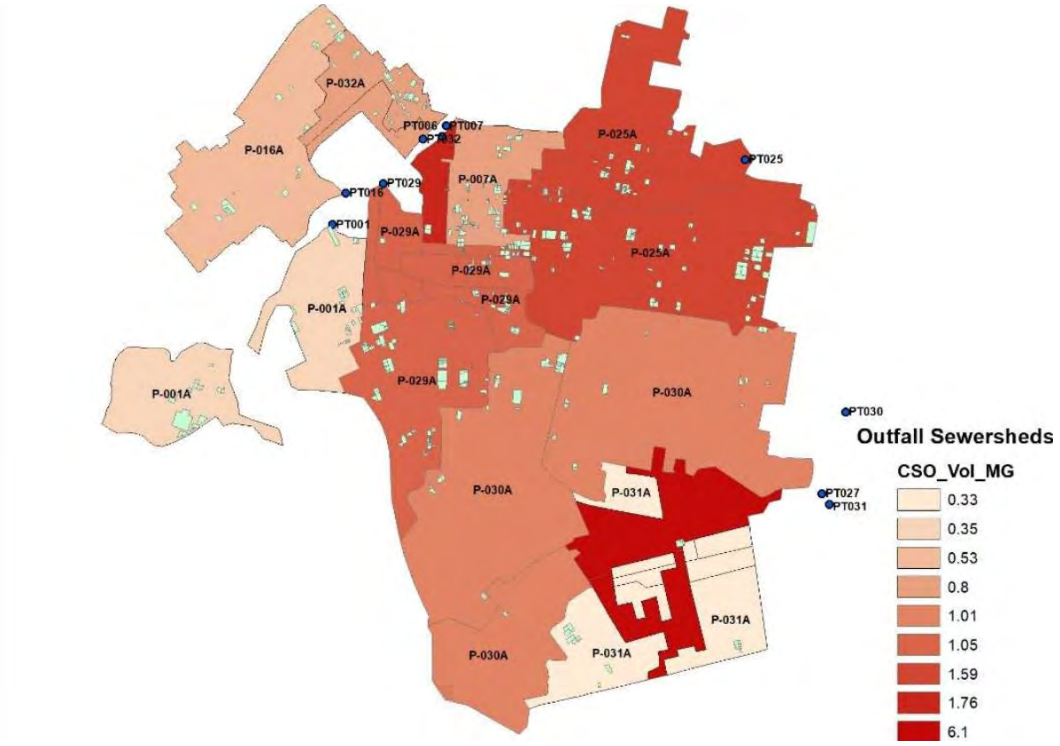


Figure D-12: Tax-Exempt (Non-Profit) Parcels (GI Tier 4)



Alternative 3 proposes to add green infrastructure technologies. For budget purposes, an estimate to manage the water quality-based storm event (1.25 inches over 2 hours) for approximately 2.5% of land area was conducted (seen below in Table D-23).

Table D-6: Cost of Green Infrastructure (from DEAR)

GI Asset	Total Volume (CF)	Construction Cost	Annual Maintenance Cost	Present O&M Value (20-yr Lifespan)	TOTAL 20-yr Lifespan Cost
On-Site (Raingarden)	113,437	$2,382,187	$19,284	$293,640	$2,675,828
ROW (Bioswales)	226,875	$10,209,375	$54,450	$829,107	$11,038,482
				Cost of Green Infrastructure:	$13,714,310
				Including Alternative 2 System Changes (Alternative 3):	$48,936,890

The dichotomy considered was management of approximately two-thirds of the runoff volume with ROW BMPs (bioswales). The remaining third of this volume is proposed for management in on-site areas (rain gardens). In addition, an estimated maintenance cost is also documented for operational considerations for a 20-year lifecycle. The original cost of green infrastructure itself was proposed in the DEAR as about $13.7 Million to implement. Updated cost guidance revised these costs to a conservative estimate of about $32 Million (including life cycle O&M costs), based on a standardized price per acre for implementation of green infrastructure.

D.4.5 Storage Tunnel at CSO025

It should be restated that the City of Paterson had taken the approach of structuring their DEAR study into two levels. Alternatives 1 through 3 used existing and proposed sewer separation technologies along with potential green infrastructure to improve the PVSC District's connected system efforts towards attaining 85% system-wide capture. These scenarios were not intended as means to reach that same level of percent capture in the City of Paterson. Instead, Alternative scenarios 4 through 9 explored the additional storage and/or treatment of flow required to achieve the percent capture and overflow targets of the Permit within Paterson's CSS, whilst including the cumulative benefits of the technologies present in Alternative 3.

The final technology evaluated for feasible implementation in Paterson was in-line storage; more specifically, that which can be achieved through constructing large diameter tunnels deep underground. These can serve to connect the flow area of one CSO to another as regional alternative technologies are implemented. As with storage tanks, tunnels pump back wet weather flow into the system when the PVSC interceptor returns to dry weather conditions.

The most feasible application of a storage tunnel in Paterson is near CSO025. This is an outfall whose drainage area is prone to flooding, lacks available land for a nearby tank, and is currently at the greatest need for greywater storage out of all of Paterson's active outfalls.

The sizing of greywater storage under the LTCP is ultimately limited by the facilities' collective "drain down" time. PVSC mandated to each of the permittees that the total draining rate from all proposed storage facilities in an individual permittee's drainage area should not be greater than 75% of the permittee's total average dry weather flows. It was further noted that the drainage of the storage facilities to the PVSC interceptor during dry weather should not exceed three (3) days. With these conditions in mind, Paterson's combined sewer system dry weather flow was estimated at 13 MGD, meaning that the City's storage alternatives needed to be sized to not exceed 10 MG of drainage per day, and be fully emptied within three (3) days.

The storage capacity required to achieve 85% capture in Paterson after implementation of the aforementioned CSO control technologies that make up Paterson's Alternative 3 scenario is summarized in Figure D-13 below, and the calculations developed during the evaluation of the tunnel are summarized in Figure D-14 below. The tunnel is currently planned as 15 feet in diameter and 1,600 feet in length, which would flow south-to-north along East 33rd Street towards CSO025. About 2.1 million gallons of storage would be achieved with a depth likely over 100 feet below grade, dependent on the soil conditions and depth to bedrock, with dropshafts along the route for pumping operations.

The costs to implement a tunnel of this scale were reported in the DEAR as about $28.2 Million, without taking into account annual operations & maintenance. Updated cost guidance revised these costs to a conservative estimate of about $33.7 Million ($35 Million including life cycle O&M costs), based on standardized formulas taken from cost curves found in the Cost Guidance Memo.

Figure D-13: Storage Capacity Required to Achieve 85% Capture in Paterson

Volume Not Captured after Alternative 3 (including Sewer Separation, Relief Sewer + GI)							
GROUP	Outfall ID	Storage Required for 0 overflow events (MG)	Storage Required for 4 overflow events (MG)	Storage Required for 8 overflow events (MG)	Storage Required for 12 overflow events (MG)	Storage Required for 20 overflow events (MG)	Storage Required for 85% Capture in Paterson (MG)
A	031	2.396	1.257	0.554	0.553	0.095	
B	015	0.111	0.026	0.017	0.016	0.003	
	016	1.628	0.905	0.631	0.626	0.237	
	028	0.080					
C	026, 027, 030	8.885	3.837	2.019	1.986	1.040	
D	001, 003, 029	4.208	2.273	1.389	1.124	0.275	
E	005	0.325	0.229	0.089	0.071	0.008	
F	006	4.289	1.760	1.262	0.629	0.312	
G	007, 010	6.561	2.588	1.909	1.185	0.770	
H	013	1.562	0.884	0.369	0.361	0.076	
	014	0.114	0.025	0.018	0.018		
I	017	1.184	0.389	0.324	0.185	0.083	
J	021, 022, 032	6.977	2.871	2.627	1.514	1.158	
K	025	13.890	5.624	3.675	3.020	1.527	1.500
L	024	2.659	0.954	0.708	0.302	0.087	
	Systemwide	**54.869**	**23.622**	**15.591**	**11.590**	**5.671**	**1.500**

Storage Required (MG)	GROUP	Active Outfalls in Group	Storage Option	Storage Option Cost	Conveyance Pipe Cost	Pump System Cost	Acquisition/ Clearing Costs	Contaminated Soils	TOTAL Alternative Cost
	A								
	B								
	C								
	D								
	E								
	F								
	G								
	H								
	I								
	J								
1.500	K	025	Tunnel	$23,854,802		$645,529		$3,750,000	$28,250,331
	L								
1.500				$23,854,802	$0	$645,529	$0	$3,750,000	$28,250,331
								Storage by group, 85% capture:	**$28,250,331**
								Including Alternative 3 System Changes (Alternative 9):	**$77,250,331**

Figure D-14: Storage Calculations for 85% Capture in Paterson

	Group K	
	CSO Location	025 10th Ave & E. 33rd St
	Proposed Tank(s)	Eastside Park (small); school ballfield (large)
1	Property Owner	NEW JERSEY SCHOOLS DEVELOPMENT AUTH
	Block	8208
	Lot	2
	Available space	425' x 175'
	Land Acquisition	$0
	Land Clearing	$50,000
2	Property Owner	CITY OF PATERSON (PARKS DEPT)
	Block	8101
	Lot	1
	Available space	225' x 150'
	Land Acquisition	$0
	Land Clearing	$200,000

Storage Tank(s)	$42,467,941
Tunnel (15' diam.)	$24,500,331

Capture Target	Target Storage (MG)	Tank Diam. (ft)	Tank Height (ft)	Capacity (MG)	Meets Target Storage Volume?	Tank Construction Cost	Annual Tank Operation Cost	Annual Tank Maintenance Cost	Present O&M Value (20-yr Lifespan)	TOTAL 20-yr Lifespan Cost
85%	1.500	140	14	1.612	YES	$13,518,183	$235,000	$405,545	$9,753,586	$23,271,769

Capture Target	Target Storage (MG)	Tunnel Diam. (ft)	Length (ft)	Capacity (MG)	Meets Target Storage Volume?	Tunnel Construction Cost	Annual Tunnel Operation Cost*	Annual Tunnel Maintenance Cost	Present O&M Value (20-yr Lifespan)	TOTAL 20-yr Lifespan Cost
85%	1.500	30	400	2.115	YES	$6,000,000	$470,000	$120,000	$8,983,930	$14,983,930
85%	1.500	15	1600	2.115	YES	$12,800,000	$470,000	$256,000	$11,054,802	$23,854,802
85%	1.500	12	2500	2.115	YES	$17,500,000	$470,000	$350,000	$12,486,140	$29,986,140

* Pump station operation for tunnels included.

Pipe Type	Pipe Diameter (in)	Conveyance Pipe Needed (LF)	Conveyance Pipe Construction Cost	Annual Conv. Pipe Maintenance Cost	Present O&M Value (20-yr Lifespan)	TOTAL 20-yr Lifespan Cost
RCP	54	2200	$1,870,000	$37,400	$569,490	$2,439,490

Pumping from	Expected CSO Flow (MGD)*	Pump Station Construction Cost	Annual Pump Sta. Operation Cost	Annual Pump Sta. Maintenance Cost	Present O&M Value (20-yr Lifespan)	TOTAL 20-yr Lifespan Cost
025	34.820	$6,801,935	$235,000	$136,039	$5,649,806	$12,451,742
Tank	0.806	$403,664	$235,000	$8,073	$3,701,277	$4,104,941
Tunnel	1.057	$494,833	$0	$9,897	$150,696	$645,529

* Assume 2-day dewatering period for greywater storage.

Figure D-15: Proposed Route for Storage Tunnel to CSO 025

* Image shown on right is for informational purposes only, intended to show scale of a storage tunnel access dropshaft.

SECTION E - FINANCIAL CAPABILITY

E.1 INTRODUCTION

This section of the City of Paterson Selection and Implementation of Alternatives Report (SIAR) quantifies the projected affordability impacts of Paterson's proposed long term CSO controls for their combined sewer system (CSS). This section is excerpted from a memorandum prepared by the Passaic Valley Sewerage Commission (PVSC) which is incorporated as Appendix P of PVSC's SELECTION AND IMPLEMENTATION OF ALTERNATIVES FOR LONG TERM CONTROL PLANNING FOR COMBINED SEWER SYSTEMS - REGIONAL REPORT (Regional Report).

The Financial Capability assessment is a two-step process including *Affordability*, which evaluates the impact of the CSO control program on the residential ratepayers, and *Financial Capability*, which examines a Permittee's ability to finance the program. Affordability is measured in terms of the Residential Indicator (RI) which is the percentage of median household income spent on wastewater services. Total wastewater services exceeding 2.0% of the median household income are considered to impose a high burden by USEPA. The financial capability analysis uses metrics similar to the municipal bond rating agencies.

USEPA encourages the use of additional information and metrics to more accurately capture the impacts of the proposed CSO controls on the Permittee and its residents. Therefore, this FCA includes information on the impacts of future costs among lower income residents and within the context of local costs of living.

Detailed discussion of the FCA for the PVSC service area and Permittees can be found in the Regional Report and a detailed analysis of the City of Paterson's FCA can be found in the FCA Memorandum specifically written for Paterson attached as part of Appendix P of the Regional Report.

E.2 BASELINE CONDITIONS (WITHOUT CSO CONTROLS)

The estimated annual cost for wastewater services for a typical single-family residential user for 2019 is $460. This estimate is based on typical residential potable water usage is 4,500 gallons monthly. Based on the estimated 2019 MHI of $40,000 the Residential Indicator was approximately 1.% in 2019, or what the EPA guidance defines as a medium burden. By definition the current residential indicator for one half of the households is greater than the 1.1%.

In 2017, 29% of the population was living below the poverty line, over two times the national average of 14.6%. The total Census households are broken out by income brackets on Table E-1 below, along with the respective current Residential Indicators by income bracket. The RI for each bracket was calculated from the mid-point income within the bracket. At the lowest income levels, the current RI is already at or over 2.3%.

Table E-1: Analysis of the Current Residential Indicator

Income Bracket	Households		Bracket Average Income	Bracket RI at Typical Cost per Household
	Number	Cumulative		
Less than $10,000	6,379	6,379	$5,000	9.2%
$10,000 to $14,999	3,445	9,824	$12,500	3.7%
$15,000 to $24,999	6,340	16,164	$20,000	2.3%
$25,000 to $34,999	5,096	21,260	$30,000	1.5%
$35,000 to $49,999	6,526	27,786	$42,500	1.1%
$50,000 to $74,999	6,335	34,121	$62,500	0.7%
$75,000 to $99,999	4,307	38,428	$87,500	0.5%
$100,000 to $149,999	3,723	42,151	$125,000	0.4%
$150,000 to $199,999	837	42,988	$175,000	0.3%
$200,000 or more	798	43,786	$200,000	0.2%
Total	43,786			

PVSC has developed a time-based model that calculates annual costs and revenue requirements based on assumed program costs, schedules and economic variables such as interest and inflation rates. The residential indicator is calculated for each year based upon the costs per typical residential users which changes annually based on the annual system revenue requirements. The estimated inflationary impacts on wastewater costs per typical single family residential user without additional CSO control costs are shown on Table E-2. Assuming inflation, the projected cost per typical single family residential user are projected to increase from $460 in 2019 to $1,257 in 2061 due to inflation.

The regional alternative would result in lowered overall costs for the control of CSOs within the PVSC service area. Under this approach both the costs of the regional facilities such as a relief interceptor and the resultant savings would be allocated amongst the PVSC municipalities with combined sewer systems. As the basis of this allocation remains under discussion as of the writing of this SIAR, the FCA focuses on implementation of the Municipal Control Alternative. Should the permittees come to agreement on the cost allocation for the Regional Control Plan, the FCA will be revisited to reassess the affordability and schedule for implementation of the LTCP.

Table E-2: Paterson Projected Residential Indicator in 2061 Without CSO Controls

Metric	Baseline (2019 unless noted)	Cost per Typical Residential Wastewater User in 2061
RI	1.3%	1.5%
Annual $	$463	$1,257

E.3 SUMMARY AND CONCLUSION

E.3.1 Affordability Impacts of the Proposed CSO Controls

Paterson has identified a long term CSO control strategy that will achieve 85% capture of wet weather flows during the typical year. These controls are summarized on Table E-3.

Table E-3: Paterson's Selected CSO Controls

Wet Weather Control Types	Capital Costs ($ Millions)	Incremental Annual O&M Costs ($ Millions)
Sewer Separation for CSO 023	$9.00	$0.00
19th Ave. Relief Sewer for CSO 030	$50.00	$0.00
2.5% Green Infrastructure	$32.00	$0.17
15' Diameter 1,600 LF Storage Tunnel @ CSO 025	$35.00	$0.10
Total	$126	$0.27

Implementation of the $122 Million Municipal Control Alternative results in projected annual costs per typical single family user of $633 (without inflation) and a residential indicator of 1.6% in 2061, the first year after the projected full implementation of the controls ending in 2060. Accounting for inflation, annual costs would grow to $1,683 with a residential indicator of 2.0% in 2061 as shown in Table E-4.

Table E-4: Permittee Projected Residential Indicator Upon Full Implementation of the Municipal Control Alternative in 2061

Metric	Baseline (2019)	Cost per Typical Residential Wastewater User in 2061			
		No LTCP		LTCP Implementation Completed in 2060	
		With Inflation	Without Inflation	With Inflation	Without Inflation
RI	1.1%	1.5%	1.1%	2.0%	1.6%
Annual $	$460	$1,257	$460	$1,683	$633

E.3.2 Financial Capability Assessment

The second part of the financial capability assessment - calculation of the financial capability indicator for the permittee - includes six items that fall into three general categories of debt, socioeconomic, and financial management indicators. The six items are:

- Bond rating
- Total net debt as a percentage of full market real estate value
- Unemployment rate
- Median household income
- Property tax revenues as a percentage of full market property value
- Property tax revenue collection rate

Each item is given a score of three, two, or one, corresponding to ratings of strong, mid-range, or weak, according to EPA-suggested standards. The overall financial capability indicator is then derived by taking a simple average of the ratings. This value is then entered into the financial capability matrix to be compared with the residential indicator for an overall capability assessment).

As shown on Table E-5, the overall score for the financial indicators is 1.8 yielding an EPA Qualitative Score of "midrange". As each of the financial indicators are generally based upon publicly available data from 2017 or earlier, this analysis does not reflect the current and lingering impacts of the COVID -19 pandemic and should be revisited upon memorializing the LTCP implementation schedule in the City's next NJPDES Permit.

Table E-5: Permittee Financial Capability Indicator Benchmarks

Indicator	Rating	Numeric Score
Bond Rating	Midrange	2
Overall Net Debt as a Percent of Full Market Property Value	Strong	3
Unemployment Rate	Weak	1
Median Household Income	Midrange	2
Property Tax as a Percent of Full Market Property Value	Midrange	2
Property Tax Collection Rate	Weak	1
	Total	10
Overall Indicator Score: (numeric score / number of applicable indicators)		1.8
	EPA Qualitative Score	Midrange

E.3.3 Implementation Feasibility Implications

The 1997 EPA guidance indicates that ratepayers and permittees who are highly burdened future expenditures added to their current wastewater treatment, conveyance, and collection costs can be allowed 15 years to complete capital projects to handle CSOs. In extreme cases, the guidance suggested a 20-year compliance schedule might be negotiated. Paterson is proposing a 40-year implementation schedule.

The affordability analysis detailed above has documented that the $122 Million (current dollars) Municipal Control Alternative along with related operation and maintenance costs would result in a Residential Indicator of 2.0% in 2061, at the EPA "high burden" trigger. Moreover, the reality of the high poverty rates, low household incomes compared to the rest of New Jersey and nationally and the high costs of living in Paterson strongly support that the EPA metric understates the impacts of the CSO control costs on the residents of Paterson. As evidenced by its New Jersey Municipal Revitalization Index score in the top 99th percentile Paterson's capacity to implement the CSO controls proposed in the SIAR is limited without considerable scheduling flexibility and external funding assistance.

Additional economic factors are presented in the Paterson FCA Memorandum found in Appendix P of the SELECTION AND IMPLEMENTATION OF ALTERNATIVES FOR LONG TERM CONTROL PLANNING FOR COMBINED SEWER SYSTEMS - REGIONAL REPORT, enforcing the limits to the affordability of CSO controls and the City's financial capability.

E.3.4 Potential Impacts of the COVID-19 Pandemic in Affordability

The projections and conclusions concerning the affordability of the Municipal Control Alternative proposed in this SIAR by Paterson and Paterson's financial capability to finance the CSO control program are premised on the baseline financial conditions of 2017 - 2019 as well as the economic conditions in New Jersey and the United States generally at the time that work on this SIAR commenced. While the impacts of the pandemic on the long-term affordability of the CSO LTCP are obviously still unknown, it is reasonable to expect that there will be potentially significant impacts. There are several dimensions to these potential impacts, including reduced utility revenues and household incomes.

Given the current and likely continuing uncertainties as to the New Jersey and national economic conditions, Paterson will be reticent to commit to long term capital expenditures for CSO controls without the incorporation of adaptive management provisions, including provisions to revise and reschedule the long term CSO controls proposed in this SIAR based on emergent economic conditions beyond the permittees' control. A revised affordability assessment should be performed during review of the next NJPDES permit to identify controls that are financially feasible during that next permit period.

SECTION F - RECOMMENDED LONG-TERM CONTROL PLAN

F.1 INTRODUCTION

This Section of the Selection and Implementation of Alternative Report contains the City of Paterson's Municipal Alternative. As previously described in Section D.2, a Presumptive Approach with an 85% wet weather capture goal was selected as the most achievable, cost-effective means of satisfying the requirements of the National CSO Policy, NJDEP and EPA.

Under the Presumptive Approach, the CSO controls shall be measured regularly after implementation to demonstrate that the presumed level of wet weather capture is on pace for attainment by the end of the proposed LTCP schedule.

F.2 RECOMMENDED LTCP

As thoroughly detailed in Sections D.3 and D.4 of this Report and their sub-sections, Paterson has selected its Alternative 9 scenario from its Development and Evaluation of Alternatives Report as its Municipal Alternative. This scenario is designed to achieve 85% wet weather capture within the limits of the City upon complete implementation of its proposed CSO control technologies.

The Paterson Municipal Alternative and PVSC Regional Alternative (refer to PVSC Regional SIAR) contain the same CSO control technologies in Paterson, and both are designed to attain the minimum required 85% wet weather capture as required by the NJPDES CSO Permit at the end of its proposed implementation schedule.

As previously mentioned in Section D.2 of this Report, the PVSC District Permittees and NJDEP have mutually agreed to the terms of adaptive management for Municipal and Regional Alternatives. There shall be triggering conditions for reopening the requirements of this LTCP in coordination with NJDEP, which are defined as follows:

- Events beyond permittee (or NJDEP) control such as pandemics, natural disasters, etc.
- Emergent regulatory requirements or water quality standards.
- Innovative and alternative technologies that could enhance controls and/or reduce costs.
- Emergent developments, economic or otherwise, that could materially affect affordability and abilities to finance the CSO controls.
- An implemented technology does not perform as expected, such that new project(s) must be added to the plan.

Under this SIAR, the City of Paterson is obliged to inform NJDEP, and provide an analysis of, any adaptive management implications as they occur and a proposed plan of action. If a CSO control proposed under this SIAR proves to be less beneficial than expected after implementation, or a more affordable CSO Control emerges that was not previously considered, the City of Paterson will reconsider and reevaluate the existing LTCP for the next NJPDES CSO Permit cycle, so that a more efficient technology may be used in its place or as a supplement. NJPDES CSO Permit cycles occur every five (5) years, with the next cycle between years 2021 and 2025. Any replacement technology shall have the necessary plans and calculations to support its addition or substitution as a CSO alternative if necessary.

Furthermore, Section F.3 of this SIAR for the City of Paterson contains a recommended list of CSO control technologies for its combined sewer system, their anticipated capital and life cycle costs, and a proposed schedule to implement them. However, the intention of this SIAR is only to commit to achieving the 85 percent level of capture target, as established by the National CSO Policy. The City is not committing to the projects themselves that have been listed as means to achieve this target.

F.3 IMPLEMENTATION COST OPINION

Table F-1: Proposed Municipal Alternative Implementation Costs

Project Name/Benchmark	Capital Cost Opinion (Standardized)
Sewer Separation at CSO 023	$8,940,000
19th Ave. Relief Sewer for CSO 030	$49,872,308
Green Infrastructure (75 acres)	$29,250,000
15' Diam. 1,600 LF Storage Tunnel at CSO 025	$33,705,643
Total	**$121,767,951**

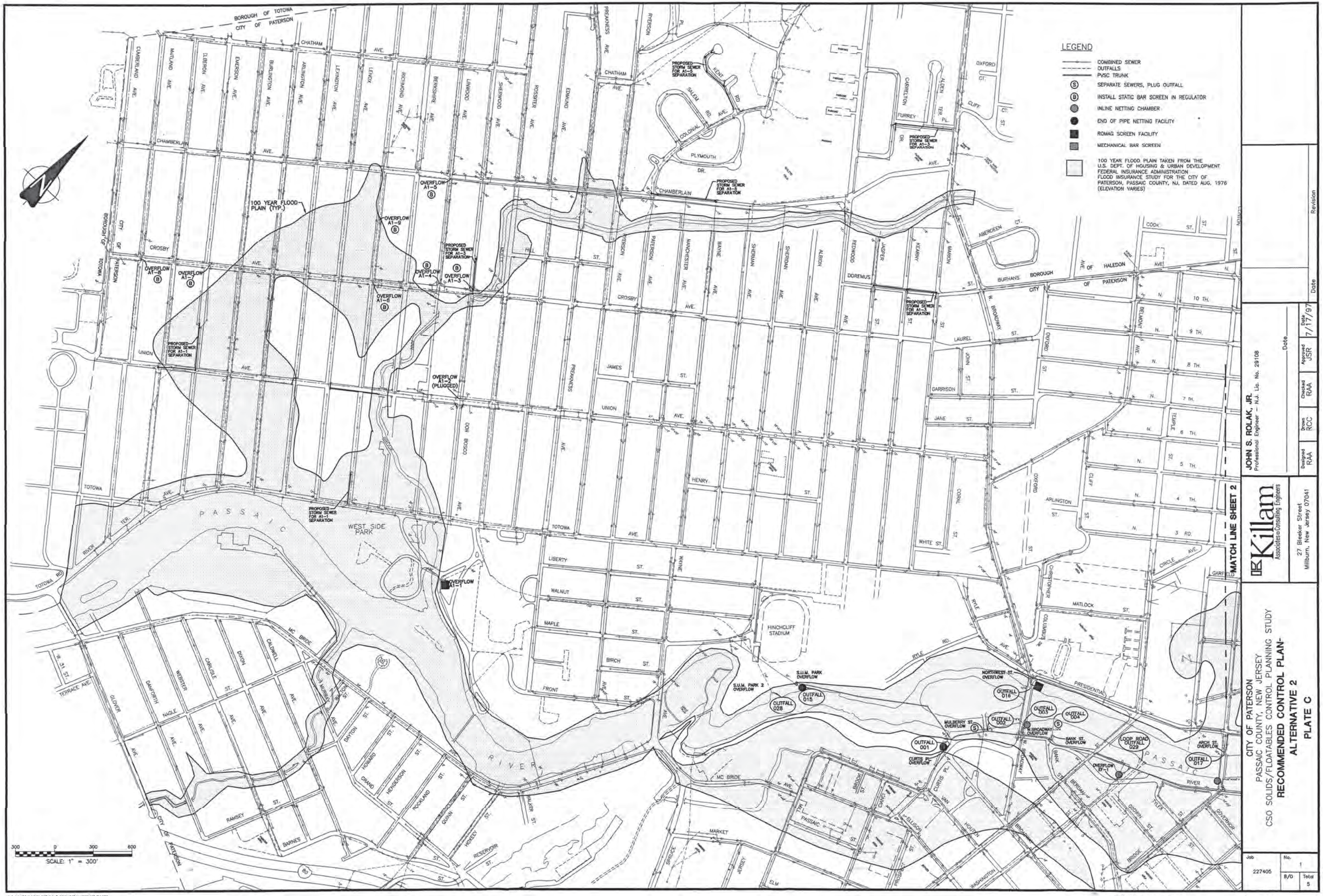
F.4 IMPLEMENTATION SCHEDULE

Table F-2: Proposed 40-Year Municipal Alternative Implementation Schedule

Project Name/Benchmark	Year [1]	Capital Cost Opinion (Standardized)
Green Infrastructure - Pilot Study	2021	[2] N/A
Two (2) additional Sewer Separation projects (in vicinity of CSO 027 + at West Railway Avenue)	2022	[3] $4,000,000
Sewer Separation at CSO 023	2023	$8,940,000
Green Infrastructure: +2 acres (2/75 ac. Total)	2024	$780,000
Green Infrastructure: +3 acres (5/75 ac. Total)	2025	$1,170,000
Green Infrastructure: +10 acres (15/75 ac. Total)	2030	$3,900,000
Green Infrastructure: +10 acres (25/75 ac. Total)	2035	$3,900,000
19th Ave. Relief Sewer for CSO 030	2040	$49,872,308
Green Infrastructure: +15 acres (40/75 ac. Total)	2045	$5,850,000
Green Infrastructure: +15 acres (55/75 ac. Total)	2050	$5,850,000
15' Diam. 1,600 LF Storage Tunnel at CSO 025	2055	$33,705,643
Green Infrastructure: +20 acres (75/75 ac. Total)	2060	$7,800,000
	Total	**$121,767,951**
Note 1: Projects are to be implemented and operational by the end of the listed year.		
Note 2: The pilot study project is a joint venture with PVSC and is funded by PVSC.		
Note 3: These projects are currently under an EPA consent order to be completed by the end of 2022. They have not been evaluated or priced under this LTCP. However, they are listed in this implementation schedule for the record as a means of taking credit for wet weather capture under a future cycle of the NJPDES CSO Permit. Cost guidance was given by the City Engineer.		

APPENDIX A

Paterson Sewer System Killam Maps



JOHN S. ROLAK, JR.
Professional Engineer – N.J. Lic. No. 29108
Date

Designed	Drawn	Checked	Approved	Date
RAA	RCC	RAA	JSR	7/17/97

Revision

Killam Associates Consulting Engineers
27 Bleeker Street
Millburn, New Jersey 07041

CITY OF PATERSON
PASSAIC COUNTY, NEW JERSEY
CSO SOLIDS/FLOATABLES CONTROL PLANNING STUDY

RECOMMENDED CONTROL PLAN-ALTERNATIVE 2 PLATE C

Job	No.	
227405	B/O	Total 5

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Killam Associates

Contract No.

MATCH LINE SHEET 1

MATCH LINE SHEET 3

LEGEND

- COMBINED SEWER
- OUTFALLS
- PVSC TRUNK
- (S) SEPARATE SEWERS, PLUG OUTFALL
- (B) INSTALL STATIC BAR SCREEN IN REGULATOR
- INLINE NETTING CHAMBER
- END OF PIPE NETTING FACILITY
- ROMAG SCREEN FACILITY
- MECHANICAL BAR SCREEN
- 100 YEAR FLOOD PLAIN TAKEN FROM THE U.S. DEPT. OF HOUSING & URBAN DEVELOPMENT FEDERAL INSURANCE ADMINISTRATION FLOOD INSURANCE STUDY FOR THE CITY OF PATERSON, PASSAIC COUNTY, NJ, DATED AUG. 1976. (ELEVATION VARIES)

300 0 300 600

SCALE: 1" = 300'

JOHN S. ROLAK, JR.
Professional Engineer — N.J. Lic. No. 29108

Designed	Drawn	Checked	Approved	Date	Revision
RAA	RCC	RAA	JSR	7/17/97	Date

Killam Associates
27 Bleeker Street
Millburn, New Jersey 07041

CITY OF PATERSON
PASSAIC COUNTY, NEW JERSEY
CSO SOLIDS/FLOATABLES CONTROL PLANNING STUDY

RECOMMENDED CONTROL PLAN- ALTERNATIVE 2

PLATE C

Job	No.	
227405	2	
	B/O	Total 5

Killam Associates

Contract No.

Print Date

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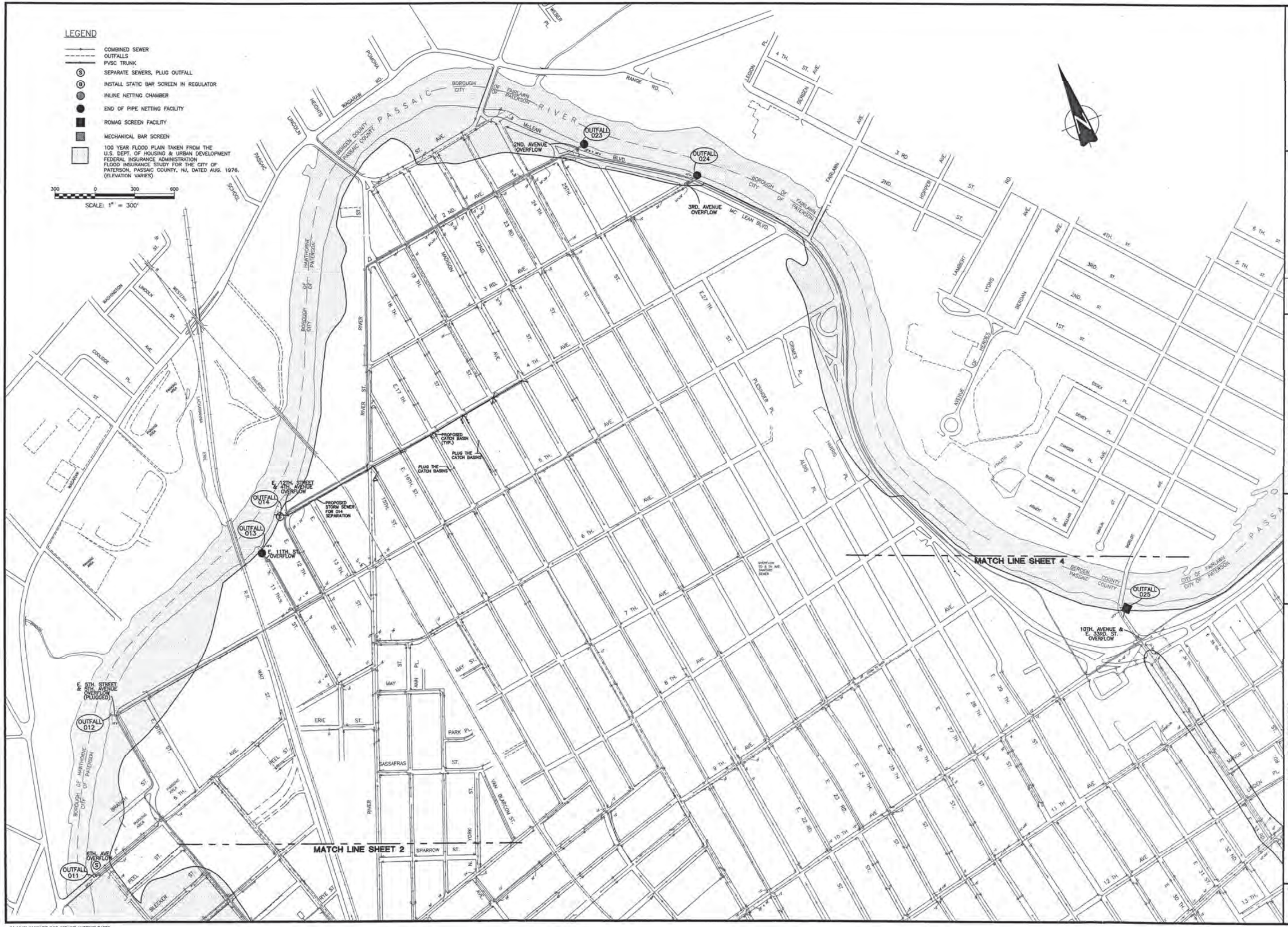

JOHN S. ROLAK, JR.
Professional Engineer – N.J. Lic. No. 29108

Date

Revision	Date

Designed	Drawn	Checked	Approved	Date
RAA	RCC	RAA	JSR	7/17/97

Killam Associates Consulting Engineers
27 Bleeker Street
Millburn, New Jersey 07041

CITY OF PATERSON
PASSAIC COUNTY, NEW JERSEY
CSO SOLIDS/FLOATABLES CONTROL PLANNING STUDY

RECOMMENDED CONTROL PLAN-
ALTERNATIVE 2
PLATE C

Job	No.	
227405	3	
	B/D	Total
		5

Print Date

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Killam Associates

Contract No.

MATCH LINE SHEET 3

MATCH LINE SHEET 5

EAST SIDE PARK

OUTFALL 029

10TH AVENUE & E. 33RD. STREET OVERFLOW

PROPOSED STORM SEWER FOR P-028 SEPARATION

OUTFALL 030

PASSAIC RIVER

LEGEND

- COMBINED SEWER
- OUTFALLS
- PVSC TRUNK
- (S) SEPARATE SEWERS, PLUG OUTFALL
- (B) INSTALL STATIC BAR SCREEN IN REGULATOR
- INLINE NETTING CHAMBER
- END OF PIPE NETTING FACILITY
- ROMAG SCREEN FACILITY
- MECHANICAL BAR SCREEN
- 100 YEAR FLOOD PLAIN TAKEN FROM THE U.S. DEPT. OF HOUSING & URBAN DEVELOPMENT FEDERAL INSURANCE ADMINISTRATION FLOOD INSURANCE STUDY FOR THE CITY OF PATERSON, PASSAIC COUNTY, NJ. DATED AUG. 1978. (ELEVATION VARIES)

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SCALE: 1" = 300'

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Date

Designed	Drawn	Checked	Approved	Date
RAA	RCC	RAA	JSR	7/17/97

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CITY OF PATERSON
PASSAIC COUNTY, NEW JERSEY
CSO SOLIDS/FLOATABLES CONTROL PLANNING STUDY

RECOMMENDED CONTROL PLAN- ALTERNATIVE 2

PLATE C

Job	No.	Revision	Date
227405	4		
	B/O Total 5		

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Contract No.

Print Date

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Professional Engineer - N.J. Lic. No. 29108

Date

Designed	Drawn	Checked	Approved	Date
RAA	RCC	RAA	JSR	7/17/97

Revision

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Millburn, New Jersey 07041

CITY OF PATERSON
PASSAIC COUNTY, NEW JERSEY
CSO SOLIDS/FLOATABLES CONTROL PLANNING STUDY

RECOMMENDED CONTROL PLAN-
ALTERNATIVE 2
PLATE C

Job	No.	
227405	5	
	B/O	Total
		5

Killam Associates

Contract No.

SHEET-1

SHEET-2

SHEET-3

SHEET-4

SHEET-5

PASSAIC VALLEY SEWERAGE COMMISSIONERS

NEWARK, NEW JERSEY

SEWER SYSTEM EVALUATION SURVEY

PHASE II-B RESULTS

INTERNAL INSPECTION AND SMOKE TESTING

PLATE U

CITY OF PATERSON

PASSAIC COUNTY, NEW JERSEY

NOVEMBER, 1984

Elson T. Killam Associates, Inc.
Environmental and Hydraulic Engineers

LEGEND

- Municipal Boundary
- Cleaned and Inspected, 2008 to Present
- CIPP, 2000 to Present
- Spot Repaired if required, Ready for Lining, 2000 to Present
- New, Rebuilt or Inspected and Found to be Satisfactory Main, 1990 to Present
- Gunited Sewer Mains
- SANITARY SEWER WITH DESIGNATED MANHOLE NUMBERING
- PIPE END NOT DETERMINED
- MUNICIPAL/SUB AREA INTERCEPTOR WITH DESIGNATED MANHOLE NUMBERING
- PUMPING STATION WITH FORCE MAIN
- PVSC MAIN OR BRANCH INTERCEPTOR SEWER (MANHOLES ARE NOT NUMBERED)
- SUB AREA LIMIT
- SUB AREA INDENTIFICATION
- MINI SYSTEM LIMIT
- MINI SYSTEM NUMBER
- SANITARY SEWERS RECOMMENDED FOR REHABILITATION
- SANITARY SEWERS ENTIRELY OR PARTIALLY DELETED
- SANITARY SEWERS INTERNALLY INSPECTED: NON COST-EFFECTIVE FOR REHABILITATION BUT HAVING STRUCTURAL DAMAGE
- SANITARY SEWERS INTERNALLY INSPECTED BUT NON COST-EFFECTIVE FOR REHABILITATION
- MANHOLES RECOMMENDED FOR INFILTRATION REHABILITATION
- SANITARY SEWERS CONTAINING INFLOW SOURCES
- MANHOLES RECOMMENDED FOR INFLOW REHABILITATION

NOTES:

1. COMBINED SEWERS ARE BASED UPON STUDY MAPS DEVELOPED FOR PHASE I ANALYSIS. MAPS HAVE BEEN MODIFIED TO REFLECT FIELD INFORMATION FOR AREAS INCLUDED IN THE SURVEY ONLY.
2. BASE MAP DEVELOPED BY AERO SERVICE IN 1974.
3. PLAN GRID IS BASED ON NEW JERSEY STATE PLANE COORDINATE SYSTEM AND IS DRAWN 2000 FEET BETWEEN GRIDS.
4. ALL SANITARY SEWERS SHOWN ARE 8"ø UNLESS OTHERWISE NOTED.
5. "TEE" CONNECTIONS ARE NUMBERED THE SAME AS THE DOWNSTREAM MANHOLE AND DESIGNATED WITH THE LETTER "T". WHERE MORE THAN ONE "TEE" CONNECTION EXISTS WITHIN THE MANHOLE REACH, CONNECTIONS ARE NUMBERED IN AN UPSTREAM SEQUENCE (T1, T2, T3, ETC.).

   EXAMPLE: 4 4T 5 5T1 5T2 6
6. SPECIAL CONDITIONS:
   SUB-AREA, OR SECTIONS THEREOF, HAVE BEEN INDICATED AS CONSISTING OF SEPARATE SANITARY SEWERS.

1

600 400 200 0 600 1200

MINI-SYSTEMS 15, 16, 33, AND 34 OR PARTS THEREOF, FLOW FROM THE BOROUGH OF HALEDON

FLOW FROM BOROUGH OF HALEDON

HALEDON METER

FORCE MAIN FROM HARMON COLOR WORKS

Need to determine how homes on North 4th Street are connected.

Need to determine how homes on Inglis Place are connected to North 4th Street.

PROSPECT PARK METER

FLOW FROM BOROUGH OF PROSPECT PARK

Abandoned - Prior to 1970

A1

B1

B2

B3

B4

C1

D1

E1

CSO-003

CSO-004

CSO-005

CSO-017

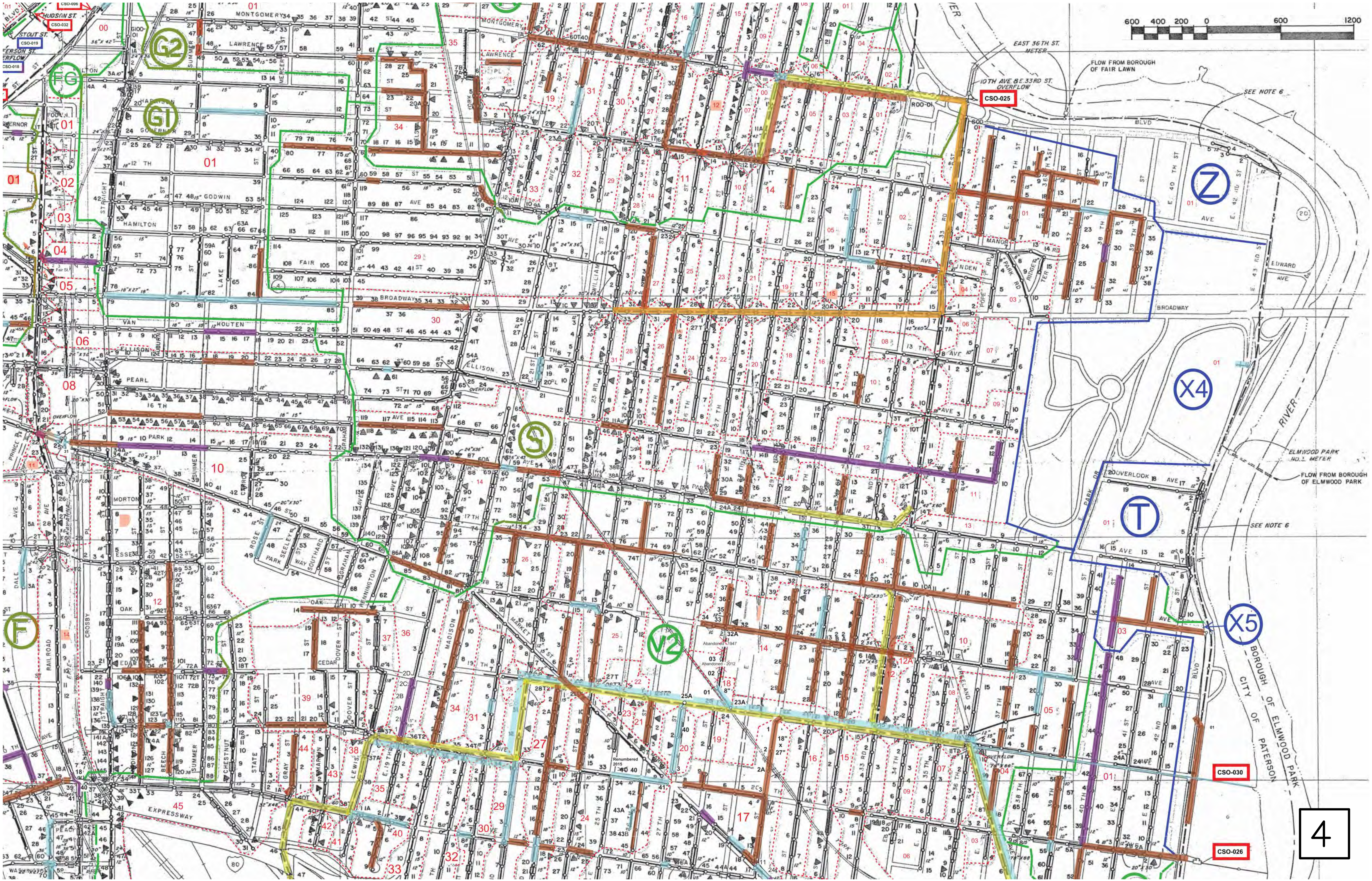
CSO-018

CSO-029

CSO-033


CSO-016
NORTHWEST ST. OVERFLOW
CSO-002
MULBERRY ST.
CSO-001
CURTISS PL. OVERFLOW
CSO-015
SUM. PARK OVERFLOW
CSO-028
Flow redirected to Totowa Boro, sewer abandoned, prior to 2008.
Furman St. vacated, sewer abandoned, prior to 2000.
Birch St. vacated, sewer abandoned, prior to 2000.
Pine St. vacated, sewer abandoned, prior to 2000.
Sewer Reconstructed from MH #7 to MH #27 - 1990, 15" PVC, Sewer slightly realigned and one MH removed.
CITY OF PATERSON
BOROUGH OF TOTOWA
BOROUGH OF WEST PATERSON
600 400 200 0 600 1200
2


PASSAIC RIVER
FORCE MAIN FROM FAIR LAWN INDUSTRIES
FORCE MAIN, FROM BOROUGH OF GLEN ROCK
FLOW FROM BOROUGH OF FAIR LAWN
2 ND. AVENUE METER
FLOW FROM BOROUGH OF HAWTHORNE
HAWTHORNE METER
BOROUGH OF HAWTHORNE
CSO-011
CSO-012
CSO-013
CSO-014
CSO-021
CSO-022
CSO-023
CSO-024
Abandoned Prior to 2002
12" Abandoned 2013
20" Prepared for CIP
Abandoned 2011
E. 12TH & 4TH AVE. OVERFLOW
E. 11TH ST. OVERFLOW
SHORT ST. OVERFLOW
BERGEN ST. OVERFLOW
WARREN ST. OVERFLOW
KEEN ST. OVERFLOW
STRAIGHT ST. OVERFLOW
CC-12. (Former Keen St 01)
SEE NOTE 6
CITY OF PATERSON
BOROUGH OF FAIR LAWN
RIVERSIDE
PASSAIC
MC LEAN BLVD
EAST 36TH ST. METER
600 400 200 0 600 1200



CSO-025
10TH AVE & E 33RD ST. OVERFLOW
EAST 36TH ST. METER
FLOW FROM BOROUGH OF FAIR LAWN
SEE NOTE 6
ELMWOOD PARK NO.1 METER
FLOW FROM BOROUGH OF ELMWOOD PARK
CSO-030
CSO-026
BOROUGH OF ELMWOOD PARK
CITY OF PATERSON
RIVER
BROADWAY
EXPRESSWAY
600 400 200 0 600 1200
Z
X4
T
X5
G1
G2
FG
F
S
V2

4


CSO-026
CSO-027
CSO-031
FLOW FROM MARCAL PAPER CO.
FLOW FROM BOROUGH OF ELMWOOD PARK
PASSAIC
BERGEN COUNTY
PASSAIC COUNTY
PATERSON MAIN LINE METER
V0-00
U
V1
V2
BERGEN-PASSAIC EXPRESSWAY
SUSQUEHANNA
ALABAMA
CALIFORNIA AVE
IOWA AVE
KENTUCKY
MARYLAND
FLORIDA
ILLINOIS
MICHIGAN
DELAWARE AVE
BUFFALO
DUNDEE
KNICKERBOCKER
GENESEE
GROVE
CROOKS
CITY OF PATERSON
CITY OF CLIFTON
FLOW FROM CITY OF CLIFTON
MINI-SYSTEMS 67, 69, 71, AND 73 OR PARTS THEREOF FLOW FROM THE CITY OF CLIFTON
N 780,000
E 2,146,000
600 400 200 0 600 1200

5

APPENDIX B

City of Paterson CSO Construction Related Activities
(2015-Present)

City of Paterson, 4th Quarter 2015 Report

NJPDES Number: NJ0108880

Summary of construction related activities in this municipal system

ATTACHMENT A

City of Paterson:

- **Solids and Floatables Control Projects**
  - **CSO-029A Screening Facility, Memorial Drive at Paterson Street**
    - **Contractor has mobilized and commenced activities at the site**

- **In-House Major Projects**
  - **East 27th Street (19th Avenue - Market Street) – Replace 590 L.F. of 8" concrete sewer with 590 L.F. of 8" PVC sewer. (Complete)**
  - **Union Avenue (Ryerson Avenue to Manchester Avenue) - Replace 268 L.F. of 18" concrete sewer with 268 L.F. of 18" PVC sewer and 40 L.F. of 15" concrete branch sewer with 40 L.F. of 15" PVC sewer. (Complete)**
  - **Summer Street (Montgomery Street - Lawrence Street) - Replace 369 L.F. of 18" concrete sewer with 369 L.F. of 18" PVC sewer and rehabilitate 257 L.F. of 18" concrete sewer with 257 L.F. of CIPP liner. (Complete)**
  - **6th Avenue (East 7th Street - Wait Street) – Spot repairs of 12" concrete pipe using 12" PVC sewer followed by installation of 684 L.F. of 12" CIPP liner. (Complete)**
  - **Market Street (East 31st Street - East 32nd Street) - Replace 195 L.F. of 12" concrete sewer with 195 L.F. of 12" PVC sewer, spot repairs of 12" concrete pipe using 12" PVC sewer followed by installation of 350 L.F. of 12" CIPP liner. (Complete)**
  - **Trenton Avenue, (Alabama Avenue - Maryland Avenue) – Replace 13 L.F. of 15" concrete sewer with 15 L.F. of 15" PVC sewer and rehabilitate 236 L.F. of 15" concrete sewer with 236 L.F. of CIPP liner. (Complete)**
  - **East 30th Street (20th Avenue – 19th Avenue beneath NYS&W RR) - Spot repairs of 27"x18" Egg-Shaped concrete pipe followed by installation of 690 L.F. 27"x18" Egg-Shaped CIPP liner. (In Progress)**
  - **East 19th Street (20th Avenue - Cedar Street) - Spot repairs of lateral connection to an 18" x 24" Brick Egg-Shaped sewer followed by installation of 528 L.F. of 18" x 24" CIPP liner. (In Progress)**
  - **East 5th Street (5th Avenue - Branch Street) Replace 102 L.F. of 24" VCP sewer with 102 L.F. of 24" PVC sewer and rehabilitate 346 L.F. of 18" and 24" VCP sewer with 346 L.F. of CIPP liner. (In Progress)**

City of Paterson, 1st Quarter 2016 Report

NJPDES Number: NJ0108880

Summary of construction related activities in this municipal system

ATTACHMENT A

City of Paterson:

- **Solids and Floatables Control Projects**
    - **CSO-029A Screening Facility, Memorial Drive at Paterson Street**
        - **Contractor has mobilized and commenced activities at the site**

- **In-House Major Projects**
    - **Lyon Street (North York Street – Van Blarcom Street) – Replace 118 L.F. of 18" concrete sewer with 118 L.F. of 18" PVC sewer. (Complete)**
    - **Putnam Street (East of Intersection of Rosa Parks Avenue) - Abandon 270 L.F. of 18" concrete sewer redirecting flow into parallel 36" sewer. (Complete)**
    - **East 5th Street (5th Avenue - Branch Street) Rehabilitate 194 L.F. of 18" VCP and 154 L.F. of 24" VCP with CIPP liner. (Complete)**
    - **East 30th Street (20th Avenue – 19th Avenue beneath NYS&W RR) - Spot repairs of 27"x18" Egg-Shaped concrete pipe followed by installation of 685 L.F. 27"x18" Egg-Shaped CIPP liner. (Complete)**
    - **East 19th Street (20th Avenue - Cedar Street) - Spot repairs of lateral connection to an 18" x 24" Brick Egg-Shaped sewer followed by installation of 527 L.F. of 18" x 27" CIPP liner. (Complete)**
    - **21st Avenue, (Madison Avenue – Lewis Street) – Rehabilitate 290 L.F. of 12" concrete sewer and 118 L.F. of 18" Concrete and VCP sewer main with CIPP liner. (Complete)**
    - **Renewal or replacement of 14 service laterals from main to curb.**

City of Paterson, 2nd Quarter 2016 Report

NJPDES Number: NJ0108880

Summary of construction related activities in this municipal system

ATTACHMENT A

City of Paterson:

- **Solids and Floatables Control Projects, Outside Consultant**
    - **Construction of new CSO-029A Screening Facility, Memorial Drive at Paterson Street (In Progress)**
        - **Contractor has mobilized and commenced activities at the site**
        - **Closed sheeting has been installed preparatory to excavation work**

- **In-House Managed Main and Lateral Repair Projects**
    - **Buffalo Avenue (Multiple spot repairs of main and laterals to mitigate against main surcharging) – Replace 127 L.F. of 8" VCP sewer with PVC sewer and repair 17 lateral points of connection with tees and 84 L.F. of 6" PVC sewer lateral. (Complete)**
    - **New storm water inlets (2) constructed at East 20th Street and 22nd Avenue to receive excess flow from onsite stormwater retention system at New School 16. (Complete)**
    - **Three defective storm water inlets replaced at the following locations, (Complete);**
        - **Intersection of Jefferson Street and Garfield Street**
        - **599 East 30th Street**
        - **Levine Street at intersection of Sussex Street**
    - **New City Yard, Easement to Jelsma Street, redirect Lawrence to Montgomery to remove flow in main from under privately owned building by constructing 298 LF of 12" PVC sewer, included replacement of 4 defective inlets. (Complete)**
    - **Wayne Avenue (Union Avenue - James Street) – Replace 269 L.F. of 15" concrete sewer with 269 L.F. of 15" PVC sewer, included the replacement of 1 defective inlet. (Complete)**
    - **Renewal or replacement of 9 service laterals. (Complete)**
    - **River Street (4th Avenue – 5th Avenue) – Replace or renew 405 L.F. of 12" and 15" concrete sewer including CIPP where appropriate. (In Progress)**
    - **Lower Main Street (Memorial Drive – Passaic River Bridge) – Replace or renew 125 L.F. of 24" storm sewer including separation of stormwater inlets from combined sewer system and lateral repairs. (In Progress)**
    - **CSO-027 Outfall (PVSC Market Street Regulating Chamber – Passaic River) – Rehabilitate 325 L.F. of defective 80" outfall sewer. (In Progress)**

City of Paterson, 2nd Quarter 2016 Report

NJPDES Number: NJ0108880

Summary of construction related activities in this municipal system

ATTACHMENT A

- **In-House Managed Projects, Other;**
    - **Factory rehabilitation of V2-1, V1-8 and V1-9 Mechanical Screen Rake Arms. (In Progress)**
        - **Rake arms removed and sent to manufacturer for factory rehabilitation.**
        - **Arms have been returned and await reinstallation by contractor.**

City of Paterson, 3rd Quarter 2016 Report

NJPDES Number: NJ0108880

Summary of construction related activities in this municipal system

ATTACHMENT A

City of Paterson:

- **Solids and Floatables Control Projects, Outside Consultant**
    - **Construction of new CSO-029A Screening Facility, Memorial Drive at Paterson Street (In Progress)**
        - **Contractor has mobilized and commenced activities at the site**
        - **Closed sheeting has been installed preparatory to excavation work**
        - **Excavation work has commenced**

- **In-House Managed Main and Lateral Repair Projects**
    - **Straight Street, between 16th Avenue and Pearl Street, Replace 160 LF of 18" sewer main. Multiple spot repairs of branch basin laterals and manhole replacement. (Complete)**
    - **Three defective storm water inlets replaced and basin laterals renewed at the following locations, (Complete);**
        - **(2) at 114 North Main Street 599 East 30th Street**
        - **(1) at 11 John Street**
    - **Renewal or replacement of 7 service laterals. (Complete)**
    - **River Street (4th Avenue – 5th Avenue) – Replace or renew 405 L.F. of 12" and 15" concrete sewer including CIPP where appropriate. (Complete)**
    - **Lower Main Street (Memorial Drive – Passaic River Bridge) – Replace or renew 125 L.F. of 24" storm sewer including separation of stormwater inlets from combined sewer system and lateral repairs. (Complete)**
    - **River Street, between Bridge Street & Tyler Street Replace – Slip line 537 L.F. of defective 30" brick main with 16" HDPE pipe. Replace collapsed and defective manholes and the replacement of 1 defective inlet. (Complete)**
    - **CSO-027 Outfall (PVSC Market Street Regulating Chamber – Passaic River) – Rehabilitate 325 L.F. of defective 80" outfall sewer by means of slip lining. (In Progress)**
    - **A-1 Trunk Sewer from Totowa Avenue to Passaic River Crossing in Westside Park - Replace approximately 937 L.F. of 30" and 36" sewer main. (In Progress)**
    - **Wayne Avenue (Totowa Avenue – Liberty Street) – Replace approximately 386 L.F. of 15" concrete sewer with 386 L.F. of 8" PVC sewer and 390 L.F. of 18" stormwater main including the replacement of 6 defective inlets and basin laterals. (In Progress)**
    - **East 23rd Street, between Market Street and 20th Avenue – Replace or renewal by means of CIPP lining 665 L.F. of 18" concrete sewer main, including the replacement of 1 defective inlet and basin lateral. (In Progress)**

City of Paterson, 3rd Quarter 2016 Report

NJPDES Number: NJ0108880

Summary of construction related activities in this municipal system

ATTACHMENT A

- **In-House Managed Projects, Other;**
    - **Factory rehabilitation of V2-1, V1-8 and V1-9 Mechanical Screen Rake Arms. (Complete)**

City of Paterson, 4th Quarter 2016 Report

NJPDES Number: NJ0108880

Summary of construction related activities in this municipal system ATTACHMENT A

City of Paterson:

- **Solids and Floatables Control Projects, Outside Consultant**
    - **Construction of new CSO-029A Screening Facility, Memorial Drive at Paterson Street (In Progress)**
        - **Excavation work has been completed.**
        - **Form work and reinforcing steel being placed.**

- **In-House Managed Main and Lateral Repair Projects**
    - **Madison Avenue, between Market Street and 19th Avenue, - Replace approximately 103 L.F. of 15" sewer main, construct a receiver manhole and repair/reconnect defective stormwater laterals. (Complete)**
    - **Renewal or replacement of 4 service laterals. (Complete)**
    - **CSO-027 Outfall (PVSC Market Street Regulating Chamber – Passaic River) – Rehabilitate 325 L.F. of defective 80" outfall sewer by means of slip lining. (In Progress)**
    - **A-1 Trunk Sewer from Totowa Avenue to Passaic River Crossing in Westside Park - Replace approximately 937 L.F. of 30" and 36" sewer main. (In Progress)**
    - **Wayne Avenue (Totowa Avenue – Liberty Street) – Replace approximately 386 L.F. of 15" concrete sewer with 386 L.F. of 8" PVC sewer and 390 L.F. of 18" stormwater main including the replacement of 6 defective inlets and basin laterals. (Complete)**
    - **East 23rd Street, between Market Street and 20th Avenue – Replace or renewal by means of CIPP lining 665 L.F. of 18" concrete sewer main, including the replacement of 1 defective inlet and basin lateral. Pipe laying operations are complete, final reach to 19th Avenue interceptor awaits CIPP lining. (In Progress)**

- **In-House Managed Projects, Other;**
    - **Rehabilitation of CSO-016 Mechanical Screening System in design.**

Combined Sewer Overflow (CSO) Construction Related Activities Reported to PVSC for the 1st Quarter 2017

Paterson – as reported by the City of Paterson

- Solids and Floatables Control Projects, Outside Consultant
  - Construction of new CSO-029A Screening Facility, Memorial Drive at Paterson Street (In Progress)
    - Excavation work has been completed.
    - Form work and reinforcing steel being placed.
    - Below grade cast in place structure has been poured.
    - Work on precast diversion tunnels has begun

- In-House Managed Main and Lateral Repair Projects
  - Renewal or replacement of 7 service laterals. (Complete)
  - CSO-027 Outfall (PVSC Market Street Regulating Chamber – Passaic River) – Rehabilitate 325 L.F. of defective 80" outfall sewer by means of slip lining. (In Progress)
  - A-1 Trunk Sewer from Totowa Avenue to Passaic River Crossing in Westside Park - Replace approximately 937 L.F. of 30" and 36" sewer main. (Completed)
  - East 23rd Street, between Market Street and 20th Avenue – Replace or renewal by means of CIPP lining 665 L.F. of 18" concrete sewer main, including the replacement of 1 defective inlet and basin lateral. Pipe laying operations are complete, final reach to 19th Avenue interceptor awaits CIPP lining. (In Progress)
  - Rehabilitation of 20 manholes by means of epoxy lining on River Street and Straight Street (in Progress)

- In-House Managed Projects, Other;
  - Rehabilitation of CSO-016 Mechanical Screening System in design.

Combined Sewer Overflow (CSO) Construction Related Activities Reported to PVSC for the 2nd Quarter 2017

Paterson – as reported by the City of Paterson

- Solids and Floatables Control Projects, Outside Consultant
    - Construction of new CSO-029A Screening Facility, Memorial Drive at Paterson Street (In Progress)
        - Excavation work has been completed.
        - Below grade cast in place structure is complete.
        - Precast diversion tunnels have been completed.
        - Awaiting delivery of mechanical screening equipment and controls.

- In-House Managed Main and Lateral Repair Projects
    - Renewal or replacement of 8 service laterals. (Completed)
    - CSO-027 Outfall (PVSC Market Street Regulating Chamber – Passaic River) – Rehabilitate 325 L.F. of defective 80" outfall sewer by means of slip lining. (In Progress)
    - 16th Avenue from Straight Street to Madison Avenue, project is as follows:
        - Completed 98 spot repairs of various size sewer mains, (8" thru 18"), totaling 105 LF of main and including replacement of 4 defective manholes.
        - A total of 48 point of connection lateral repairs to prepare the main line for CIPP lining.
        - Renewal of 4 laterals from main to curb with new cleanouts.
        - Replacement of 4 collapsed inlets
        - Replacement of 187 LF of inlet laterals, (8" and 10"), 14 inlet lateral repairs in total.
        - CIPP lining of approximately 3225 LF of mainline sewer is scheduled for completion by September 1.
    - East 23rd Street, between Market Street and 20th Avenue – Replace or renewal by means of CIPP lining 665 L.F. of 18" concrete sewer main, including the replacement of 1 defective inlet and basin lateral. Pipe laying operations are complete, final reach to 19th Avenue interceptor CIPP lining. (Completed)

- Rehabilitation of 20 manholes by means of epoxy lining on River Street and Straight Street (Completed)

- Jersey Street replacement of 2 inlets and inlet laterals. (Completed)

- Replacement of 2 defective manhole frames and covers. (Completed)

- East 42nd Street between 18th and 19th Avenue, replacement of 134 LF of 12" defective sewer main and 33 LF of defective 10" storm drain. (Completed)

- Replacement of 5 LF of defective 8" sewer main and a defective manhole at Redwood Avenue. (Completed)

- In-House Managed Projects, Other;

    - Rehabilitation of CSO-016 Mechanical Screening System in design. (In Progress)

City of Paterson, 3rd Quarter 2017 Report

NJPDES Number: NJ0108880

Summary of construction related activities in this municipal system

ATTACHMENT A

City of Paterson:

- **Solids and Floatables Control Projects, Outside Consultant**
    - **Construction of new CSO-029A Screening Facility, Memorial Drive at Paterson Street (In Progress)**
        - **Excavation work has been completed.**
        - **Below grade cast in place structure is complete.**
        - **Precast diversion tunnels have been completed.**
        - **Mechanical screening equipment and controls have been received and are presently being installed.**

- **In-House Managed Main and Lateral Repair Projects**
    - **Renewal or replacement of 11 service laterals. (Completed)**
    - **Installation of approximately 120 LF of 12" stormwater main to relieve a drainage issue at 129 Temple Street (Completed)**
    - **23rd Avenue between East 24th and East 25th Street, replacement of 204 LF of defective 8" sewer main. (Completed)**
    - **Paterson Avenue between Union Avenue and James Street, replacement of 250 LF of defective 12" sewer main. (Completed)**
    - **16th Avenue from Straight Street to Madison Avenue, project is as follows:**
        - **CIPP lining of approximately 2677 LF of mainline sewer. (Completed)**
        - **Repairs to existing manholes. (Completed)**
        - **Epoxy coating of manholes is scheduled for completion by December 1st. (In Progress)**
    - **East 12th Street between 5th Avenue and Dead End, replacement of 406 LF of defective 12" sewer main. (In Progress)**
    - **East 24th Street between 18th Avenue and 19th Avenue, spot repairs and renewal or replacement service laterals in advance of installation of approximately 642 LF of 12" CIPP. (In Progress)**
    - **Straight Street between Park Avenue and Essex Street, spot repairs and renewal or replacement service laterals in advance of installation of approximately 800 LF of 12" & 18" CIPP. (In Progress)**
    - **CSO-027 Outfall (PVSC Market Street Regulating Chamber – Passaic River) – Rehabilitate 325 L.F. of defective 80" outfall sewer by means of slip lining. (In Progress)**

- **In-House Managed Projects, Other;**
    - **Rehabilitation of CSO-016 Mechanical Screening System in design. (In Progress)**

City of Paterson, 4th Quarter 2017 Report

NJPDES Number: NJ0108880

Summary of construction related activities in this municipal system

ATTACHMENT A

City of Paterson:

- **Solids and Floatables Control Projects, Outside Consultant**
    - **Construction of new CSO-029A Screening Facility, Memorial Drive at Paterson Street (In Progress)**
        - **Excavation work has been completed.**
        - **Below grade cast in place structure is complete.**
        - **Precast diversion tunnels have been completed.**
        - **Mechanical screening equipment and controls have been received and are presently being installed.**
        - **Project has been delayed by unresolved utility conflicts. Engineer is addressing possible change orders.**

- **In-House Managed Main and Lateral Repair Projects**
    - **Renewal or replacement of 4 service laterals. (Completed)**
    - **Linwood Avenue at the intersection of Union Avenue**
        - **Replaced 49 LF of defective 18" sewer main.**
        - **Replaced 15 LF of defective 15" basin lateral.**
    - **16th Avenue from Straight Street to Madison Avenue, project is as follows:**
        - **Epoxy coating of manholes is scheduled for completion by December 1st. (Completed)**
    - **Eagle Avenue at Knickerbocker Avenue**
        - **Excavate and spot repair of manhole and approaching inlet piping followed by full manhole rehabilitation from the interior including epoxy coating.**
    - **Carbon Street between North 9th Street & Burhans Avenue**
        - **Replace collapsed manhole and reinstate approach piping, renew a collapsed lateral and install a cleanout**
    - **Presidential Blvd. between Piercy Street and Hudson Street**
        - **Spot repair of 12 LF of 8" collapsed main.**
    - **East 19th Street between Market Street and Park Avenue. (Completed)**
        - **Replace 815 LF of 15" sewer main**
    - **East 24th Street between 18th Avenue and 19th Avenue**
        - **Spot repairs of defective main, repair or replacement of defective manholes and repair or replacement of 25 concrete laterals, including 17 cleanouts, in preparation for CIPP lining of approximately 600 LF of 12" concrete sewer main. (Completed).**
        - **CIPP scheduled for 2018.**

City of Paterson: Continued

- East 38th St. between Market Street and 21st Avenue
  - Replace 97 LF of defective 15" sewer main.
  - Renew two service laterals.

Park Avenue at the Intersection of East 21st Street

  - Replacement of collapsed mainline tee and lateral.

- Straight Street between Park Avenue and Essex Street, spot repairs and renewal or replacement service laterals in advance of installation of approximately 800 LF of 12" & 18" CIPP. (In Progress, project will be completed in Spring)

- CSO-027 Outfall (PVSC Market Street Regulating Chamber – Passaic River) – Rehabilitate 325 L.F. of defective 80" outfall sewer by means of slip lining. (In Progress)

- **In-House Managed Projects, Other;**

  - Rehabilitation of CSO-016 Mechanical Screening System in design. (In Progress)

City of Paterson, 1st Quarter 2018 Report

NJPDES Number: NJ0108880

Summary of construction related activities in this municipal system

ATTACHMENT A

City of Paterson:

- **Solids and Floatables Control Projects, Outside Consultant**
    - **The City has issued an Request for Proposals for the redesign and permitting of CSO-025A Screening Facility. Proposals are due on May 8, 2018.**
    - **Construction of new CSO-029A Screening Facility, Memorial Drive at Paterson Street (In Progress)**
        - **Excavation work has been completed.**
        - **Below grade cast in place structure is complete.**
        - **Precast diversion tunnels have been completed, except inlet tunnel that requires modifications to accommodate conflicting utilities.**
        - **Mechanical screening equipment and controls have been received and are presently being installed.**
        - **Project is progressing but has been slowed by utility conflicts and contaminated soils. Engineer is addressing a proposed change order to resolve the utility conflicts to move the project to completion.**

- **In-House Managed Main and Lateral Repair Projects**
    - **Renewal or replacement of 4 service laterals. (Completed)**
    - **Linwood Avenue between Union Avenue and Molly Ann's Brook (In Progress)**
        - **Spot repairs of 890 LF of 15" sewer main in advance of CIPP lining.**
    - **Broadway between Curtis Place and West Broadway (In Progress)**
        - **Replaced 12 LF of defective 8". 10" & 12" sewer main.**
        - **Replaced 2 defective manholes.**
    - **River Street between 3rd and 4th Avenues (Completed)**
        - **Replaced 668 LF of defective 15" sewer main.**
        - **Replaced 7.5 LF of defective 8" sewer main.**
        - **Replaced 4 defective manholes.**
        - **Replaced 33 LF of defective 8" basin lateral.**
        - **Replaced 20 LF of defective 6" service laterals.**
        - **Replaced one collapsed stormwater inlet.**
    - **Prince Street between Slater Street and Green Street (In Progress)**
        - **Began replacement of 208 LF of defective 18" sewer main.**
        - **Three (3) defective manholes.**
        - **Prepped for CIPP lining of 190 LF of defective 18" sewer main for CIPP. Scheduled for 2nd quarter.**
    - **Cumberland Avenue, between Union Avenue and Totowa Border (In Progress)**
        - **Replaced approximately 2360 LF of defective 8" and 10" sewer main.**

- Straight Street between Park Avenue and Essex Street, spot repairs and renewal or replacement service laterals in advance of installation of approximately 800 LF of 12" & 18" CIPP. (In Progress, project will restart in April)

- CSO-027 Outfall (PVSC Market Street Regulating Chamber – Passaic River) – Rehabilitate 325 L.F. of defective 80" outfall sewer by means of slip lining. (In Progress)

- In-House Managed Projects, Other;

    - Rehabilitation of CSO-016 Mechanical Screening System in design. (In Progress)
    - Repairs to the V1-4 and V1-7 Internal Regulators and Screening Facilities (In Progress)

City of Paterson, 2nd Quarter 2018 Report

NJPDES Number: NJ0108880

Summary of construction related activities in this municipal system

ATTACHMENT A

City of Paterson:

- **Solids and Floatables Control Projects, Outside Consultant**
    - **The City issued a Request for Proposals for the redesign and permitting of CSO-025A Screening Facility. Proposals were received on May 8, 2018. Contract documents are being finalized to award the redesign to Mott McDonald.**
    - **Construction of new CSO-029A Screening Facility, Memorial Drive at Paterson Street (In Progress)**
        - **Excavation work has been completed.**
        - **Below grade cast in place structure is complete.**
        - **Precast diversion tunnels have been completed, except inlet tunnel that requires modifications to accommodate conflicting utilities.**
        - **Mechanical screening equipment and controls have been received and are presently being installed.**
        - **Project is progressing but has been slowed by utility conflicts and contaminated soils. Engineer is addressing a proposed change order to resolve the utility conflicts to move the project to completion. A redesign is being finalized and the work should move forward during the 3rd Quarter.**

- **In-House Managed Main and Lateral Repair Projects**
    - **Renewal or replacement of 8 service laterals. (Completed)**
    - **Linwood Avenue between Union Avenue and Molly Ann's Brook (Project Completed)**
        - **Spot repairs of 15 LF of 12" sewer main.**
    - **Broadway between Curtis Place and West Broadway (Project Completed)**
        - **Replaced 12 LF of defective 8". 10" & 12" sewer main.**
        - **Replaced 2 defective manholes.**
    - **Prince Street between Slater Street and Green Street (Project Completed)**
        - **Completed replacement of 208 LF of defective 18" sewer main.**
        - **Completed replacement of three (3) defective manholes.**
        - **Completed CIPP lining of 190 LF of defective 18" sewer main for CIPP.**
    - **Cumberland Avenue, between Union Avenue and Totowa Border (Project Completed)**
        - **Replaced 2293 LF of defective 8" sewer main.**
        - **Replaced 6 defective manholes.**
        - **Reconnected 39 service laterals.**
        - **Replaced one storm water inlet.**
    - **Burlington Avenue, Chamberlain to Chatham**
        - **Replacement of 413 LF of 18" Storm Sewer.**
        - **Replacement of 65 LF of 12" basin lateral and 5 catch basins.**
        - **Replacement of 165 LF of 12" sanitary sewer.**
        - **CIPP lining of approximately 1600 LF of 10" and 12" sanitary sewer.**

- Straight Street between Park Avenue and Essex Street, spot repairs and renewal or replacement service laterals in advance of installation of approximately 800 LF of 12" & 18" CIPP. (In Progress, project will restart in April)

- CSO-027 Outfall (PVSC Market Street Regulating Chamber – Passaic River) – Rehabilitate 325 L.F. of defective 80" outfall sewer by means of slip lining. Pipe scheduled for delivery the week of July 23rd. (In Progress)

- **In-House Managed Projects, Other;**

    - Rehabilitation of CSO-016 Mechanical Screening System in design. (In Progress)
    - Repairs to the V1-4 and V1-7 Internal Regulators and Screening Facilities (In Progress)

City of Paterson, 3rd Quarter 2018 Report

NJPDES Number: NJ0108880

Summary of construction related activities in this municipal system

ATTACHMENT A

City of Paterson:

- **Solids and Floatables Control Projects, Outside Consultant**
    - **The City issued a Request for Proposals for the redesign and permitting of CSO-025A Screening Facility. Proposals were received on May 8, 2018. The contract was awarded for the redesign to Mott McDonald. Design work has commenced and the City is currently in the process of resolving easement issues.**
    - **Construction of new CSO-029A Screening Facility, Memorial Drive at Paterson Street (In Progress)**
        - **Below grade cast in place structure is complete.**
        - **Mechanical screening equipment and controls have been received and are presently being installed.**
        - **Precast diversion tunnels have been completed, except inlet tunnel that requires modifications to accommodate conflicting utilities.**
        - **Project is progressing but has been slowed by utility conflicts and excessive quantities of contaminated soils. Engineer has completed the modifications to one of the chambers required due to utility conflicts. The Contractor is preparing a change order to construct the modified chamber and address the contaminated soil disposal. This will be processed through the municipal council when received and move the project to completion.**

- **In-House Managed Main and Lateral Repair Projects**
    - **Burlington Avenue, Chamberlain to Chatham (Project Completed)**
        - **Replacement of 413 LF of 18" Storm Sewer.**
        - **Replacement of 65 LF of 12" basin lateral and 5 catch basins.**
        - **Replacement of 165 LF of 12" sanitary sewer.**
        - **CIPP lining of approximately 1600 LF of 10" and 12" sanitary sewer.**
    - **Renewal or replacement of 14 service laterals. (Completed)**
    - **Danforth between McBride and Nagle (Project Completed)**
        - **Replaced 18.33 LF of 8" sewer main.**
    - **Frame and Cover Replacements (Projects Completed)**
        - **103 North Main Street**
        - **Main and Lee Streets**
        - **Governor and Straight Streets**
    - **186 Jackson Street; replace collapsed basin and lateral (Projects Completed)**
    - **4th Avenue at East 16th Street (Projects Completed)**
        - **Rehabilitation of a brick manhole over a brick main.**
        - **Manhole lining**
    - **Paterson Ave Between Crosby and Molly Ann Brook (Project Completed)**
        - **Spot repairs of 14.43 LF of defective 8" sewer main.**
        - **Replaced 19.5 LF of 6" laterals. City of Paterson, 2nd Quarter 2018 Report - Continued**

- **In-House Managed Main and Lateral Repair Projects Continued**

  - **East 18th Street between Ellison Street and Pearl Street (Project Completed)**
    - **Completed replacement of 11.50 LF of defective 15" sewer main.**

  - **Paterson Ave Between Chamberlain Avenue and Molly Ann Brook (Project Completed)**
    - **Replacement of 128 LF of defective 12" sewer main.**
    - **Replaced 19.5 LF of 6" laterals.**

  - **Paterson Ave at Molly Ann Brook Crossing (Project Completed)**
    - **Rehabilitation and relining of syphon chambers and approach manholes.**

  - **10th Avenue between East 26th Street and East 27th Street (Project Completed)**
    - **Replaced 8.5 LF of defective 8" sewer main.**
    - **Replaced 4.17 LF of 6" laterals.**

  - **Straight Street between Park Avenue and Essex Street (Project Completed)**
    - **Spot repairs of 662 LF of 12" and 18".**
    - **CIPP lining of 723 LF of 12" and 18" combined sewer.**
    - **Rehabilitation of all manholes**

  - **East 18th Street between Ellison Street and Pearl Street (Project Completed)**
    - **Spot repairs of 662 LF of 12" and 18".**
    - **CIPP lining of 723 LF of 12" and 18" combined sewer.**

  - **East 12th Street between 4th and 5th Avenues (In Progress)**
    - **Replace approximately 500 LF of 12" concrete sewer main**

  - **Linwood Avenue, between Molly Ann Brook and Totowa Avenue, work includes renewal of the 18" Brook crossing, (In Progress)**
    - **Replace approximately 175 LF of defective 18" sewer main**
    - **CIPP lining of the brook crossing and rehabilitation of the associated manholes**

  - **Totowa Avenue, between Ryerson Avenue and Sheraton Avenue (In Progress)**
    - **Replace approximately 450 LF of defective 8" sewer main**
    - **CIPP lining of approximately 475 LF of defective 8" sewer main**

  - **CSO-027 Outfall (PVSC Market Street Regulating Chamber – Passaic River) – Rehabilitate 325 L.F. of defective 80" outfall sewer by means of slip lining. Pipe has been received and is scheduled for installation the week of October 22, 2018. (In Progress)**

City of Paterson, 1st Quarter 2019 Report

NJPDES Number: NJ0108880

Summary of construction related activities in this municipal system

ATTACHMENT A

City of Paterson:

- **Solids and Floatables Control Projects, Outside Consultant**
    - **The City issued a Request for Proposals for the redesign and permitting of CSO-025A Screening Facility. Proposals were received on May 8, 2018. The contract was awarded for the redesign to Mott McDonald. Design work has commenced and the City is currently in the process of resolving easement issues.**
    - **Construction of new CSO-029A Screening Facility, Memorial Drive at Paterson Street (In Progress)**
        - **Below grade cast in place structure is complete.**
        - **Mechanical screening equipment and controls have been received and are presently being installed.**
        - **Precast diversion tunnels have been completed, except inlet tunnel that requires modifications to accommodate conflicting utilities.**
        - **Project is progressing but has been slowed by utility conflicts and excessive quantities of contaminated soils. Engineer has completed the modifications to one of the chambers required due to utility conflicts. The Contractor has prepared a change order to construct the modified chamber and address the contaminated soil disposal. This proposal is being processed through the municipal council and should move forward during the 2nd Quarter.**

- **In-House Managed Main and Lateral Repair Projects**
    - **Holsman Avenue, between Jefferson Street and Stout Street, Sewer Main Repair (In Progress)**
        - **Replaced 55 LF of defective 12" & 8" sewer main**
        - **Replacement of 1 Defective Manhole**
        - **Repair and reconnect three building laterals**
    - **Renewal or replacement of 6 service laterals. (Completed)**
    - **Beech Street between 20th & 21st Avenues, replace defective manhole (Project Completed)**
        - **Replaced 8 LF of 12" sewer main.**
        - **Replacement of 1 Defective Manhole**
        - **Repair and reconnect two building laterals**

City of Paterson, 2nd Quarter 2019 Report

NJPDES Number: NJ0108880

Summary of construction related activities in this municipal system

ATTACHMENT A

City of Paterson:

- **Solids and Floatables Control Projects, Outside Consultant**
    - **The City issued a Request for Proposals for the redesign and permitting of CSO-025A Screening Facility. Proposals were received on May 8, 2018. The contract was awarded for the redesign to Mott McDonald. Design work has commenced and the City is currently in the process of resolving easement issues.**
    - **Construction of new CSO-029A Screening Facility, Memorial Drive at Paterson Street (In Progress)**
        - **Below grade cast in place structure is complete.**
        - **Mechanical screening equipment and controls have been received and are presently being installed.**
        - **Precast diversion tunnels have been completed, except inlet tunnel that requires modifications to accommodate conflicting utilities.**
        - **Project is progressing but has been slowed by utility conflicts and excessive quantities of contaminated soils. Engineer has completed the modifications to one of the chambers required due to utility conflicts. The Contractor has prepared a change order to construct the modified chamber and address the contaminated soil disposal. This proposal has been approved by the municipal council and we are working with the State to address the funding. The project should move forward during the 3rd Quarter.**

- **In-House Managed Main and Lateral Repair Projects**
    - **Finalized repairs to the Jefferson Street Sewer Main**
    - **Ryerson Avenue, between Union Avenue and James Street, Sewer Main Repair (Project Completed)**
        - **Replaced 114 LF of 8” sewer main.**
        - **Repair and reconnect four building laterals**
    - **First Avenue at the Intersection of River Street, replace defective main (Project Completed)**
        - **Replaced 99 LF of defective 8" sewer main**
        - **Replaced 2 LF of defective 12" sewer main**
        - **Replaced 86 LF of defective 18" sewer main**
        - **Replaced 6 LF of defective 24" sewer main**
        - **Replaced 31 LF of defective 8" basin lateral**
        - **Replacement of 1 building lateral, main to curb**
    - **Renewal or replacement of 4 service laterals. (Completed)**
    - **North Main Street (Completed)**
        - **Replace defective MH frame and cover and two defective stormwater inlet frames and grates.**
    - **6th Avenue at East 11th Street**
        - **Repair defective manhole**
        - **Replace 10 LF of 10” basin lateral.**

City of Paterson, 3rd Quarter 2019 Report

NJPDES Number: NJ0108880

Summary of construction related activities in this municipal system

ATTACHMENT A

City of Paterson, Outsourced Construction Projects:

- **Solids and Floatables Control Projects, Outside Consultant**
    - **The City issued a Request for Proposals for the redesign and permitting of CSO-025A Screening Facility. Proposals were received on May 8, 2018. The contract was awarded for the redesign to Mott McDonald. Design work has commenced and the City is currently in the process of resolving easement issues.**
    - **Construction of new CSO-029A Screening Facility, Memorial Drive at Paterson Street (In Progress)**
        - **Below grade cast in place structure is complete.**
        - **Mechanical screening equipment and controls have been received and are presently being installed.**
        - **Precast diversion tunnels have been completed, except inlet tunnel that requires modifications to accommodate conflicting utilities.**
        - **Project is progressing but has been slowed by utility conflicts and excessive quantities of contaminated soils. Engineer has completed the modifications to one of the chambers required due to utility conflicts. The Contractor has prepared a change order to construct the modified chamber and address the contaminated soil disposal. This proposal has been approved by the municipal council. We have successfully coordinated with the NJDEP and the NJIB to secure the required funding and approvals; and the contractor remobilized to the site on October 15, 2019. Completion is expected within the next 4-6 months.**

- **In-House Managed Main and Lateral Repair Projects**
    - **Governor Street between Rosa Parks & Carroll Street, Sewer Main Repair (Project Completed)**
        - **Replaced 117 LF of 12" sewer main.**
        - **Replaced 1 defective manhole.**
        - **Repair and reconnect 2 building laterals**
    - **Summer Street at the Intersection of Montgomery Street, replace defective main (Project Completed)**
        - **Replaced 97 LF of defective 18" sewer main**
        - **Replaced 1 defective manhole.**
        - **Repair and reconnect 3 building laterals.**
        - **Replaced 27 LF of 12" basin laterals.**
        - **Replaced 2 stormwater basins.**
    - **Renewal or replacement of 12 service laterals. (Completed)**
    - **Summer Street Intersection of Essex Street (Completed)**
        - **Spot-repair replace 2 LF of 12" main.**
    - **Replace 2 defective MH frames and covers.**

- **Lewis Street, between Cedar Street & Oak Street, Sewer Main Repair (Project Completed)**
  - **Replaced 174 LF of 12" sewer main.**
  - **Repair and reconnect 6 building laterals**

- **East 20th Street, near house number 84**
  - **Replace 1 defective basin.**
  - **Replaced 10 LF of 12" basin lateral.**

- **East 16th Street between 4th Avenue and River Street, Sewer Main Repair (Project Completed)**
  - **Replaced 386 LF of 10" sewer main.**
  - **Replaced 86 LF of 12" sewer main.**
  - **Replaced 78 LF of 15" sewer main.**
  - **Replaced 4 defective manholes.**
  - **Repair and reconnect 10 building laterals**
- **Madison Street, near house number 76**
  - **Replace 1 defective basin.**
  - **Replaced 4 LF of 10" basin lateral.**

- **Beckwith Avenue between State Street & Chestnut Street, Sewer Main Repair (Project Completed)**
  - **Replaced 105 LF of 12" sewer main.**
  - **Replaced 1 defective manhole.**
  - **Repair and reconnect 1 building laterals**

- **Sherwood Avenue between Totowa Avenue Parks & Chamberlain Avenue, Sewer Main Repair (In Progress)**
  - **Replaced 1,301 LF of 30" sewer main.**
  - **Repair and reconnect 5 building laterals**

City of Paterson, 4th Quarter 2019 Report

NJPDES Number: NJ0108880

Summary of construction related activities in this municipal system

ATTACHMENT A

City of Paterson, Outsourced Construction Projects:

- **Solids and Floatables Control Projects, Outside Consultant**
    - **The City issued a Request for Proposals for the redesign and permitting of CSO-025A Screening Facility. Proposals were received on May 8, 2018. The contract was awarded for the redesign to Mott McDonald. Design work has commenced and the City is currently in the process of resolving easement issues.**
    - **Construction of new CSO-029A Screening Facility, Memorial Drive at Paterson Street (In Progress)**
        - **Below grade cast in place structure is complete.**
        - **Mechanical screening equipment and controls have been received and are presently being installed.**
        - **Precast diversion tunnels have been completed, except inlet tunnel that requires modifications to accommodate conflicting utilities.**
        - **Project is progressing but has been slowed by utility conflicts and excessive quantities of contaminated soils. Engineer has completed the modifications to one of the chambers required due to utility conflicts. The Contractor has prepared a change order to construct the modified chamber and address the contaminated soil disposal. This proposal has been approved by the municipal council. We have successfully coordinated with the NJDEP and the NJIB to secure the required funding and approvals; and the contractor remobilized to the site on October 15, 2019. Completion is expected by April 30, 2020.**

- **In-House Managed Main and Lateral Repair Projects**
    - **Katz Avenue, between Redwood Avenue & Dead End, Sewer Main Repair (Project Completed)**
        - **Replaced 9 LF of 10” sewer main.**
    - **Sherwood Avenue, renewal and replacement project: (Project In Progress)**
        - **Replaced 148 LF of defective 30" sewer main**
    - **Renewal or replacement of 3 service laterals. (Completed)**
    - **Summer Street Intersection of Essex Street (Completed)**
        - **Spot-repair replace 2 LF of 12” main.**
    - **Replace 2 defective MH frames and covers.**

City of Paterson, 1st Quarter 2020 Report

NJPDES Number: NJ0108880

Summary of construction related activities in this municipal system

ATTACHMENT A

City of Paterson, Outsourced Construction Projects:

- **Solids and Floatables Control Projects, Outside Consultant**
    - **The City issued a Request for Proposals for the redesign and permitting of CSO-025A Screening Facility. Proposals were received on May 8, 2018. The contract was awarded for the redesign to Mott McDonald. Design work has commenced and the City is currently in the process of resolving easement issues.**
    - **Construction of new CSO-029A Screening Facility, Memorial Drive at Paterson Street (In Progress)**
        - **Below grade cast in place structure is complete.**
        - **Mechanical screening equipment and controls have been received and are presently being installed.**
        - **Precast diversion tunnels have been completed, except inlet tunnel that requires modifications to accommodate conflicting utilities.**
        - **Project is progressing but has been slowed by utility conflicts and excessive quantities of contaminated soils. Engineer has completed the modifications to one of the chambers required due to utility conflicts. The Contractor has prepared a change order to construct the modified chamber and address the contaminated soil disposal. This proposal has been approved by the municipal council. We have successfully coordinated with the NJDEP and the NJIB to secure the required funding and approvals; and the contractor remobilized to the site on October 15, 2019. Completion is expected by July 30, 2020.**

- **In-House Managed Main and Lateral Repair Projects**
    - **East 21st Street, between 17th Avenue & Park Avenue, Sewer Main Repair (Project Completed)**
        - **Replaced 358 LF of 12" sewer main.**
        - **Internally inspected and reconnected 13 laterals that were found to be in satisfactory condition.**
    - **Ellison Street, between Church Street and City Hall Plaza, Sewer Main Repair, (Project Completed)**
        - **Replaced 283 LF of defective 8" and 12"" sewer main**
    - **Pennington Street, between 17th Avenue and Market Street (Project Completed)**
        - **Replaced 12 LF of defective 12"" sewer main**
    - **Renewal or replacement of 8 service laterals. (Completed)**