


Appendix A

Selection and Implementation of Alternatives Report for North
Bergen MUA (Woodcliff)

The page features a decorative background with a vertical bar on the left side, divided into a light gray upper section and a teal lower section. A dark gray horizontal bar is positioned at the bottom right of the page.

Selection and Implementation of Alternatives Report

**Township of North Bergen – Woodcliff
Drainage Area**

September 2020

TABLE OF CONTENTS

| | |
|--|----|
| SECTION A - INTRODUCTION | 3 |
| SECTION B - SCREENING OF CSO CONTROL TECHNOLOGIES | 5 |
| SECTION C - EVALUATION OF ALTERNATIVES..... | 6 |
| C.1 DEVELOPMENT AND EVALUATION OF ALTERNATIVES | 6 |
| SECTION D - SELECTION OF RECOMMENDED LTCP | 9 |
| D.1 INTRODUCTION | 9 |
| D.2 SELECTION OF ALTERNATIVES..... | 10 |
| D.2.1 Description..... | 10 |
| D.2.2 Remaining Overflows | 11 |
| D.2.3 Ability to Meet Water Quality Standards | 11 |
| D.2.4 Non-Monetary Factors | 12 |
| D.2.5 Cost Opinion | 13 |
| D.2.6 Selection of Recommended Alternative | 13 |
| SECTION E - FINANCIAL CAPABILITY..... | 14 |
| E.1 Introduction..... | 14 |
| E.2 Baseline Conditions (Without CSO Controls)..... | 15 |
| E.3 Summary & Conclusion..... | 16 |
| E.3.1 Affordability Impacts of the Proposed CSO Controls | 16 |
| E.3.2 Financial Capability Assessment | 18 |
| E.3.3 Implementation Feasibility Implications | 19 |
| E.3.4 Potential Impacts of the COVID-19 Pandemic in Affordability | 20 |
| SECTION F - RECOMMENDED LONG-TERM CONTROL PLAN | 21 |
| F.1 INTRODUCTION | 21 |
| F.2 RECOMMENDED LTCP | 21 |
| F.3 IMPLEMENTATION COST OPINION | 21 |
| F.4 IMPLEMENTATION SCHEDULE..... | 23 |
| F.5 BASES FOR LTCP DEVELOPMENT AND IMPLEMENTATION SCHEDULE..... | 23 |
| F.6 CSO REDUCTION VERSUS TIME..... | 24 |

LIST OF TABLES

Table D-1: Impact of the Woodcliff STP Upgrades on CSOs..... 10
Table E-1: Analysis of the Current Residential Indicator..... 15
Table E-2: North Bergen Projected Residential Indicator in 2041 Without CSO Controls 16
Table E-3: North Bergen’s Selected CSO Controls..... 17
Table E-4: North Bergen’s Projected Residential Indicator Upon Full Implementation of the
Municipal Control Alternative..... 17
Table E-5: Permittee Financial Capability Indicator Benchmarks 18
Table F-1: Construction Schedule for CSO Improvements 23

LIST OF FIGURES

Figure D-1: Hudson River Water Quality at Station 33 12
Figure D-2: Projected CSO Costs for North Bergen Woodcliff Drainage Area..... 13

SECTION A - INTRODUCTION

The Township of North Bergen is a member of the Clean Waters, Healthy Neighborhoods initiative which is a collaboration of the entities who own and operate combined sewer systems within the Passaic Valley Sewerage Commission (PVSC) and North Bergen Municipal Utilities Authority (NBMUA) service areas. This group has decided to prepare a regional long-term control plan for combined sewer overflow (CSO) discharges and aims to keep the public informed of efforts being taken to reduce the water quality impacts of CSO on area receiving waters. Each member of the initiative has received a New Jersey Pollutant Discharge Elimination System (NJPDES) permit for their CSO discharges. The North Bergen permit have required several reports including:

1. Characterization Monitoring and Modeling of the Combined Sewer System
https://www.nj.gov/dep/dwq/pdf/CSO_SystemCharacterization_PVSC_2_20180629.pdf
2. Public Participation Process
https://www.nj.gov/dep/dwq/pdf/CSO_PublicParticipation_PVSC_11_20180703_Report.pdf
3. Consideration of Sensitive Area
https://www.nj.gov/dep/dwq/pdf/CSO_SensitiveAreas_PVSC_21_20180628.pdf
4. Compliance Monitoring Program
https://www.nj.gov/dep/dwq/pdf/CSO_ComplianceMonitoring_Baseline_PVSC_21_20180630.pdf
5. Development and Evaluation of CSO Control Alternatives (DEAR)
https://www.nj.gov/dep/dwq/pdf/CSO_DEAR_WoodcliffRegional_20190628.pdf

Each report has included information leading to the selection of the DEAR for the North Bergen Woodcliff drainage area and Woodcliff Sewage Treatment Plant. Now this report, the Selection and Implementation of Alternatives Report, considers the alternatives and selects the preferred alternative for North Bergen.

The Township of North Bergen is a densely populated town in Hudson County, New Jersey. Guttenberg and the northeast section of North Bergen discharge wastewater to the Woodcliff Sewage Treatment Plant. Plant effluent and CSO is discharged to the Hudson River. The drainage area for the Woodcliff plant is about 180 acres. Approximately 141 acres are serviced by the combined sewer system and 39 acres are serviced by separated sewer system. For North Bergen only one CSO outfall discharges CSO to the Hudson River under NJPDES Permit No. NJ0029084 for Regulator NB004.

In consistency with the 1994 USEPA's CSO Control Policy, the NJPDES permit requires implementation of CSO controls through development of a Long-Term Control Plan (LTCP). The

permit includes requirements to cooperatively develop the LTCP with PVSC and its hydraulically connected CSO permittees. Each permittee is required to develop all necessary information for the portion of the hydraulically connected system they own.

Section D.3.b.v of the NJPDES permit indicates that, as part of the LTCP requirements, a Development and Evaluation of CSO Control Alternatives report (DEAR) be submitted to the NJDEP within 48 months from the effective date (July 1, 2015) of the permit, or July 1, 2019. The DEAR report was submitted by July 1, 2019 and served as a basis for selecting the preferred alternative which is the subject of this report.

As will be discussed later in this report, the Woodcliff Sewage Treatment Plant has a rated capacity of 2.91 MGD with a wet weather capacity of 8 MGD. The plant is being upgraded to replace the secondary Lamella clarifiers with a membrane filtration system. The new membrane system will be sized to a dry weather flow of 3.46 MGD with a wet weather flow of 8 MGD. In addition to this and in consideration of CSO control, the plant will also have a 2 MGD wet weather bypass for a total plant capacity of 10 MGD. This provides the plant with an additional 2 MGD for treating CSOs from the Township of North Bergen and Guttenberg as an interim measure. The Township of North Bergen would like to make this CSO control measure a condition of the LTCP. As will be discussed later in this report, this capacity has been assumed to be a baseline CSO control. The cost of the upgrade is approximately \$23,000,000. Twenty percent of the cost, \$4,600,000, is associated with expanded and improved treatment of CSOs. Membranes will provide a higher degree of treatment of CSO and the bypass will increase the plant's wet weather capacity by 2 MGD.

It should also be noted that North Bergen will also construct other CSO improvements in the Central drainage area (NJPDES Permit No. NJ0108898) as described in the LTCP report entitled Selection and Implementation of Alternatives Report – Township of North Bergen – Central Drainage Area. This will consist of a 5 MG CSO storage tank in the NB003 drainage area and if needed, a 0.8 MG CSO storage tank in the NB008 drainage area. The total cost of these improvements is estimated at over \$38,000,000.

SECTION B - SCREENING OF CSO CONTROL TECHNOLOGIES

A wide variety of CSO control alternatives were reviewed as part of the technology screening process to identify the options that have the greatest potential in the Woodcliff Sewage Treatment Plant to achieve the CSO control goals. Options identified during this screening process were subsequently evaluated for effectiveness and costs, as described in the DEAR report.

As part of the screening process, each CSO control technology was evaluated for its effectiveness to achieve pathogen reduction CSO volume reduction. The other considerations included the ambient receiving water quality goals, the characteristics of the existing sewer system, the characteristics of the wet weather flow (peak flow rate, volume, frequency, and duration), hydraulic and pollutant loading, climate, implementation requirements (land, neighborhood, noise, disruption), and the operational factors. Three CSO controls were selected and are described in the DEAR report and Section C.

SECTION C - EVALUATION OF ALTERNATIVES

CSO control technologies can be grouped generally as Source Control, Collection System Control, Storage or Treatment technologies. The DEAR report discussed the alternatives for each technology.

C.1 DEVELOPMENT AND EVALUATION OF ALTERNATIVES

North Bergen has identified three technologies for CSO control:

- 1 Source Control – Expansion of the North Bergen Woodcliff Sewage Treatment Plant;
- 2 Source Control – Suspended Solids Removal and Disinfection; and
- 3 Source Control - Green Infrastructure.

Under current conditions the Woodcliff Sewage Treatment Plant has a rated capacity of 2.91 MGD with a wet weather capacity of 8 MGD. It accomplished 89.8% CSO capture for the typical year under current conditions. The plant is being upgraded to replace the secondary Lamella clarifiers with a membrane filtration system. The new membrane system will be sized to a dry weather flow of 3.46 MGD and a wet weather flow of 8 MGD. In addition to this, the plant will also have a 2 MGD wet weather bypass for a total plant capacity of 10 MGD. This provides the plant with an additional 2 MGD for treating CSO from the Township of North Bergen and Guttenberg. This improvement will increase CSO capture to 92% based on the PVSC CSO Group methodology (see PVSC's Development and Evaluation of Alternatives – Regional Report – Town of Guttenberg (NJ0108715) and North Bergen (N0029084)). The Township of North Bergen will make this measure the primary CSO control method of the North Bergen LTCP. The benefits of this are:

- 1 Maximizes high degree of CSO treatment.
- 2 Full time coverage with experienced operators at the treatment facility.
- 3 Operation and maintenance procedures compatible with wastewater treatment processes.
- 4 No chemicals are required.

Green Infrastructure (GI) refers to a host of source-control approaches that can reduce and treat rainfall runoff prior to its entry into the CSS. GI approaches typically intercept rainfall runoff with soil media and plants to eliminate or attenuate volumes and pollutants through absorption, infiltration, and evapo-transpiration. Many GI approaches can also deliver ancillary environmental, social, and economic benefits to the community, such as decreasing localized flooding, reducing the heat-island effect, improving air quality, creating job opportunities, and providing needed green spaces for aesthetic purposes.

GI can be used alone or in conjunction with other types of CSO alternatives. Due to their reliance on the physical and biological properties of soil media and plants, some GI approaches are susceptible to seasonally variable performance. GI typically requires widespread implementation to provide significant system-wide CSO-control, particularly in highly urbanized areas like the Township of North Bergen's Woodcliff Sewage Treatment Plant, where they may not be as practical as traditional "gray infrastructure" approaches in providing reliable, stand-alone solutions. Nevertheless, GI approaches are being considered in the CSO LTCP.

GI can be used as a complementary CSO control technology in combination with other alternatives. This alternative was evaluated alone to find out if GI could have a significant impact on CSO volume and frequency reduction. Two different target levels of GI control were evaluated. One of them was to manage 1" of stormwater runoff generated from 5% and 10% of impervious surfaces. On the Woodcliff's North Bergen side, the impervious area is about 100 acres. Table D-3 shows the CSO volume and frequency before and after the implementation of GI comparing with baseline. If GI controlled CSO from 5% of impervious area (about 5 acres) it will reduce CSOs by approximately 2% and the number of CSO events would remain unchanged at 30 events. Because of the relatively small impact achievable with GI, North Bergen has decided to implement GI but on a limited basis.

A previous study, "*Green Infrastructure Feasibility Study, North Bergen,*" prepared by Rutgers University, identified possible locations for GI opportunities in the City. The realistic potentials of GI approaches will be further refined. The following are some considerations:

- 1 North Bergen Public Library - This site is a branch of the North Bergen Free Public Library. The asphalt parking lot is in fair condition and could be repaved with porous asphalt to retain stormwater on site. A strip of porous pavement/sidewalk or stormwater planter may also be used to intercept parking lot runoff before it reaches the street and catch basins. Empty tree pits across the street could be planted with trees and retrofitted with stormwater storage capacity underground.
- 2 James J. Braddock Park - This is a large Hudson County park. There are many opportunities for green infrastructure in Washington Park, including rain gardens, bioswales, buffers, tree pits, and pervious pavement. Rain gardens, bioswales, and landscaped buffers placed adjacent to sidewalks and roadways could intercept stormwater runoff, slow erosion and ponding, and beautify open lawn areas. Most of the pavement in the park is in fair condition, and as older sections are replaced, they could be repaved with pervious pavers or porous asphalt.
- 3 Municipal Parking Lots - Several sites, such as Broadway and 73rd Street, are designated municipal parking lots. They serve as great opportunities for porous asphalt to capture both stormwater runoff and rainwater.

These sites are very visible to the public and would be constant reminders of the importance of controlling stormwater and limiting CSOs.

The third CSO reduction technology that was considered was suspended solids control with disinfection. Pathogens represent the primary pollutant of concern for CSO discharges. Disinfection facilities were sized based on the maximum CSO discharge flow rate for each event to fully treat all but 4, 8, 12, and 20 CSO discharges per year and an 85% CSO reduction. Where full treatment is achieved, disinfection is assumed to remove 99.9% of pathogens (a “3-log kill.”). This preliminary disinfection alternative assumes that PAA disinfection will be implemented at a location between the existing regulator and the existing outfall. Suspended solids removal facilities, such as a FlexFilter, were considered with PAA disinfection. While this technology is not selected at this time, if it is selected in the future, we would request that a pilot study be performed to characterize the solids removal operating conditions and the PAA dose response.

SECTION D - SELECTION OF RECOMMENDED LTCP

D.1 INTRODUCTION

A wide variety of CSO control alternatives were reviewed as part of the technology screening process to identify the options that have the greatest potential in the Woodcliff Sewage Treatment Plant to achieve the CSO control goals. Options identified during this screening process were subsequently evaluated for effectiveness and costs.

As part of the screening process, each CSO control technology was evaluated for its effectiveness to achieve the following goals: 1) Bacteria reduction and 2) Volume reduction. The other considerations included the ambient receiving water quality goals, the characteristics of the existing sewer system, the characteristics of the wet weather flow (peak flow rate, volume, frequency, and duration), hydraulic and pollutant loading, climate, implementation requirements (land, neighborhood, noise, disruption), and the operational factors.

CSO control technologies can be grouped generally as Source Controls, Collection System Controls, Storage or Treatment technologies. Technologies under each group were also reviewed with respect to their potential program-role categories as shown below. These categories provide an indication of how a given technology could fit into the overall LTCP program:

- Primary Technology – High potential of meeting water-quality and CSO control goals;
- Complementary Technology – Some potential to bring positive impacts, but may be limited in effectiveness;
- Program Enhancement Technology – Generally good practices, but likely to have limited impact on water-quality and CSO control goals;
- In place/In-progress Technology – Already implemented or included in near-term plans; and
- Not Recommended Technology – Removed from consideration for various reasons (cost, maintenance, public acceptance, constructability, etc.).

The assessment presented high-level screening and was limited to the consideration of the general capabilities of CSO control technologies. The following sections present the technologies that were deemed viable in terms of effectiveness, cost, feasibility, and public acceptance. Section C.9 of the DEAR report presents details of the screening process and lists technologies retained for further evaluation in the alternative analysis.

The 2004 annual precipitation depth was selected as the typical year for model simulation as described in the System Characterization Report submitted on July 1, 2018. The projected 2045 sanitary flow is used to conservatively reflect conditions in the sewershed at the end of the

anticipated implementation period. The baseline conditions refer to the permittees’ typical year simulations prior to the implementation of CSO improvement technologies. Both the baseline and alternative conditions use the same precipitation and sanitary flow data and only differ with the technologies used in the model simulations. As part of this evaluation, three alternatives were developed.

For the Township of North Bergen, each of the alternatives presented is a combination of controls to manage CSOs in the Woodcliff service area. The CSO control technologies were evaluated for varying levels of control, including up to 0, 4, 8, 12, and 20 overflow events per year. The baseline CSO capture for the Woodcliff Sewage Treatment Plant treating wastewaters from both North Bergen and Guttenberg is 89.8% which is above the USEPA CSO Control Policy criteria of 85%. This indicates compliance with the CSO Control Policy and the goals of the Long Term Control Plan for the Woodcliff STP and North Bergen, however, plant upgrades that are currently underway will improve this CSO capture.

D.2 SELECTION OF ALTERNATIVES

D.2.1 Description

The Woodcliff STP is already providing 89.8% CSO capture for the design year of 2004. In addition to this the plant is being upgraded to replace the secondary Lamella clarifiers with a membrane filtration system. The new membrane system will be sized to a dry weather flow of 3.46 MGD with a wet weather flow of 8 MGD. In addition to this, the plant has applied for a modification to its permit which will allow for a 2 MGD wet weather bypass for a total wet weather capacity of 10 MGD. This increase in wet weather capacity will be granted after successful testing of the membranes. If approved by NJDEP the increased wet weather capacity of 10 MGD will improve CSO capture to 92% as shown in Table D-1.

Table D-1: Impact of the Woodcliff STP Upgrades on CSOs

| Attributes | Current Wet Weather Capacity of 8 MGD | Future Wet Weather Capacity of 10 MGD |
|-------------------------------------|---------------------------------------|---------------------------------------|
| Capacity (MGD) | 8 | 10 |
| Average Annual Overflow Volume (MG) | 14.3 | 13.2 |
| Annual CSO Number of Events | 31 | 30 |
| Annual Volume Reduction (MG) | - | 1.1 |
| Percent CSO Reduction | 89.8% | 92.0% |

In addition to the Woodcliff STP expansion, Green Infrastructure projects may be selected for CSO control. Many sources are promoting green infrastructure as a CSO solution; however, this technology has limited capacity to reduce CSOs. It can only control small amounts of CSO (0.1 to 1%) in densely developed areas like North Bergen which is why it will be included in the LTCP as a minor technology in the Woodcliff (NJPDES Permit No. NJ0029084) and Central (NJPDES Permit No. NJ0108898) drainage areas of North Bergen. North Bergen has committed to building Green Infrastructure projects in the Township at a cost of \$435,000. No credit will be taken for CSO control by this technology because the Woodcliff STP is already above the EPA control target of 85%. However, assessment of the project's performance and operation and maintenance costs will be done to help characterize the process.

D.2.2 Remaining Overflows

The remaining annual CSO overflows for the 2004 typical year condition with a wastewater treatment wet weather capacity of 10 MGD will be 13.2 MG per year. These flows will be discharged to the Hudson River which flows at an average of 14,000 MGD (21,900 CFS). On average this is less than 0.01% of the average river flow. However, river flows will be much higher and North Bergen's contribution will be much lower during wet weather.

D.2.3 Ability to Meet Water Quality Standards

CSOs from North Bergen will not adversely affect the water quality of the Hudson River. The Hudson River already meets water quality standards during dry and wet weather. Figure D-1 presents an example of water compliance with the SE2 water quality parameter of 770 CFU/100 mL. This is typical of the water quality of the Hudson River

D.2.4 Non-Monetary Factors

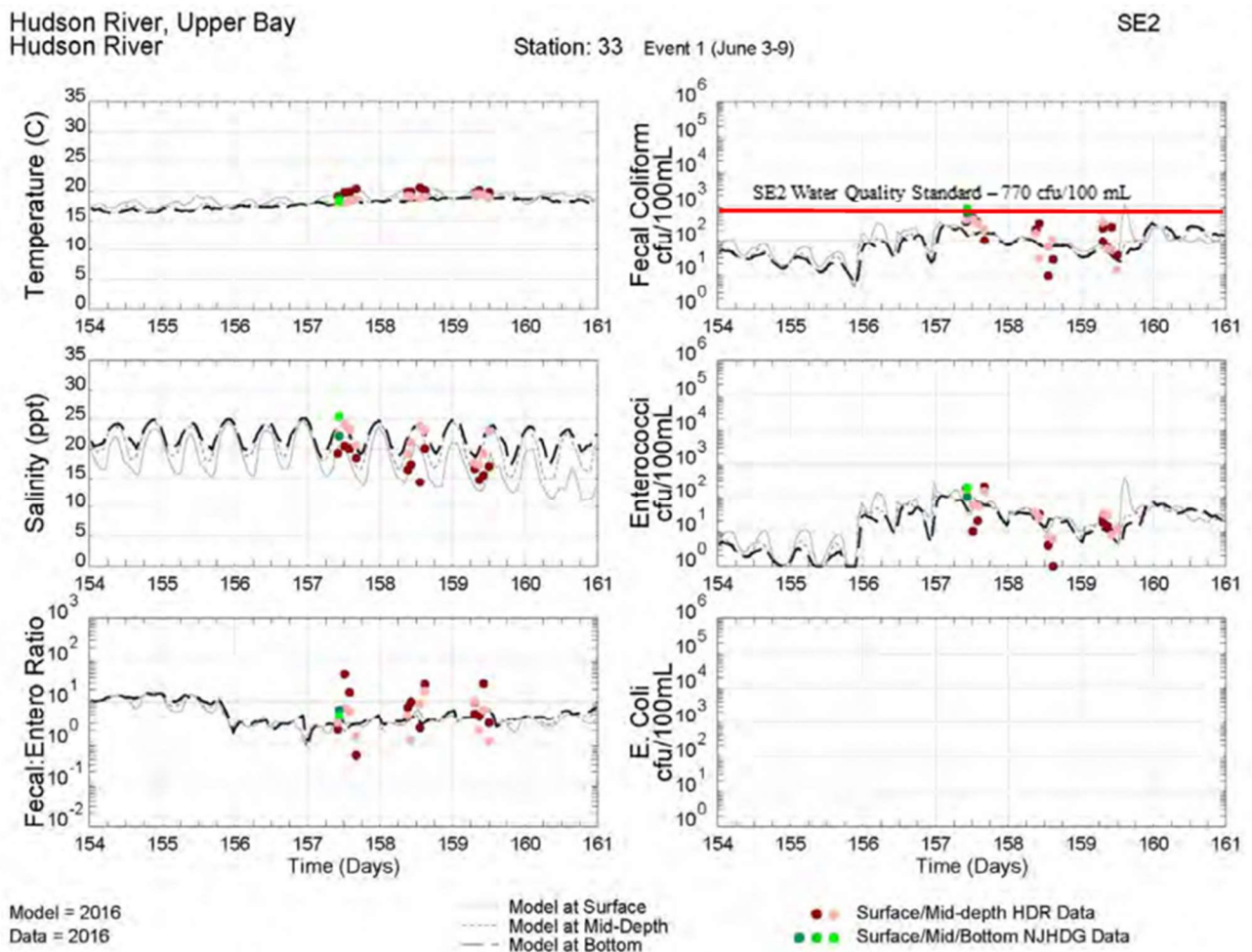


Figure D-1: Hudson River Water Quality at Station 33

The improvements at the Woodcliff STP will be done to ensure compliance with its discharge permit and also because it will have no impact on residents. The construction will be limited to the wastewater treatment plant site which has restricted access. Other CSO technologies such as storage tanks, and separate sewers are often constructed in the public right of way which adversely impacts residents during the construction period.

D.2.5 Cost Opinion

The cost of the LTCP is shown in Table D-2. North Bergen will share in the cost of the upgrade to the Woodcliff STP with Guttenberg. The total improvement will cost approximately \$23,000,000 and wet weather improvements will cost approximately \$4,600,000. North Bergen’s share the wet weather improvements will be approximately 58% or \$2,668,000. In addition to this Green Infrastructure projects will cost \$435,000. In total North Bergen will spend \$3,103,000. In addition to this North Bergen will spend approximately \$200,000 per year maintaining wet weather facilities at the wastewater treatment plant.

Figure D-2: Projected CSO Costs for North Bergen Woodcliff Drainage Area

| Alternative | CSO Capture % | CSO Volume MGD | Volume Captured MG | Annual CSO Events | Cost (x \$0 ⁶) |
|------------------------------------|---------------|----------------|--------------------|-------------------|----------------------------|
| Woodcliff STP Plant Upgrade | | | | | |
| Woodcliff plant upgrade - 10 MGD | 92% | 13.2 | 1.1 | 30 | \$23,000,000 |
| Cost Sharing of Upgrade | | | | | |
| North Bergen | 92 | 13.2 | 1.1 | 30 | \$13,340,000 |
| Guttenberg | | | | | \$9,660,000 |
| North Bergen CSO Costs | | | | | |
| Woodcliff plant upgrade - 10 MGD | 92% | 13.2 | 1.1 | 30 | \$2,668,000 |
| Green Infrastructure | 0% | 14.3 | 0 | 30 | \$435,000 |
| Total | 92% | 13.2 | 1.1 | 30 | \$3,103,000 |

Note: 20% if the upgrade costs are associated with CSO control.

D.2.6 Selection of Recommended Alternative

The recommended alternatives for CSO reductions by North Bergen will be wastewater treatment plant improvements and green infrastructure. The wastewater treatment improvements have already been constructed and are being tested before North Bergen accepts them. It is very likely that the improvements will become part of the plants operating procedures in the next two to three years. When this is done the wet weather capacity of the plant will be upgraded which will allow the plant to go from 89.8 % CSO capture to 92% capture. This improvement will be the primary improvement for CSO capture. Green infrastructure improvements will also be made; however, no credit is being taken for CSO reductions. Rather, the impact of the green infrastructure improvements will be determined by flow metering. If they are successful reducing CSOs, credit will be taken based on the flow monitoring.

SECTION E - FINANCIAL CAPABILITY

E.1 INTRODUCTION

This section of North Bergen's Selection and Implementation of Alternatives Report (SIAR) for the Woodcliff Sewage Treatment Plant quantifies the projected affordability impacts of North Bergen's proposed long term CSO controls for the North Bergen combined sewer system (CSS). This analysis is premised on three assumptions:

- The North Bergen MUA has and will continue to have the same rate structure for the portion of the Township sending wastewater to PVSC as those utilizing NBMUA's Woodcliff Wastewater Treatment Plant;
- The primary CSO controls for the portion of North Bergen in the Woodcliff STP service area is the expansion of the plant's capacity. This work is in progress; and
- The capital costs of the Woodcliff Sewage Treatment Plant (STP) expansion have been financed and are already reflected in NBMUA's budget and therefore will not have future impacts on the Township-wide affordability of wastewater services.

This section is excerpted from a memorandum prepared by the Passaic Valley Sewerage Commission (PVSC) which is incorporated as Appendix I of the Woodcliff STP'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 Woodcliff STP service area and Permittees can be found in the Regional Report and a detailed analysis of North Bergen's FCA can be found in the FCA

Memorandum applicable to the portion of North Bergen served by the Woodcliff STP attached as part of Appendix I of the Regional Report.

E.2 BASELINE CONDITIONS (WITHOUT CSO CONTROLS)

Premised on uniform rates throughout North Bergen, the estimated annual cost for wastewater services for a typical single-family residential user for 2019 is \$557. This estimate is based on typical residential potable water usage is 4,500 gallons monthly. Based on the estimated MHI of \$59,600 the Residential Indicator was approximately 0.9% in 2019, or at the border between what the EPA guidance defines as a low burden and a medium burden. By definition, the current residential indicator for one half of the households is greater than the 0.9%.

In North Bergen, 15.8% of the population was living below the poverty line. This exceeds the national average poverty rate 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 between 2.6% and 10.6%.

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 | 1,887 | 1,887 | \$5,000 | 10.57% |
| \$10,000 to \$14,999 | 1,050 | 2,937 | \$12,500 | 4.23% |
| \$15,000 to \$24,999 | 2,117 | 5,054 | \$20,000 | 2.64% |
| \$25,000 to \$34,999 | 2,004 | 7,058 | \$30,000 | 1.76% |
| \$35,000 to \$49,999 | 2,623 | 9,681 | \$42,500 | 1.24% |
| \$50,000 to \$74,999 | 4,171 | 13,852 | \$62,500 | 0.85% |
| \$75,000 to \$99,999 | 2,859 | 16,711 | \$87,500 | 0.60% |
| \$100,000 to \$149,999 | 3,290 | 20,001 | \$125,000 | 0.42% |
| \$150,000 to \$199,999 | 1,007 | 21,008 | \$175,000 | 0.30% |
| \$200,000 or more | 924 | 21,932 | \$200,000 | 0.26% |
| Total | 21,932 | | | |

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. The costs are projected to the year 2041 based on the LTCP implementation schedule for North Bergen’s Municipal Control Alternative in Section F of this SIAR report which targets the completion of capital improvements through 2040.

Assuming inflation, the projected cost per typical single-family residential user are projected to increase from \$557 in 2019 to \$1,231 in 2041.

Table E-2: North Bergen Projected Residential Indicator in 2041 Without CSO Controls

| Metric | Baseline (2019) | Cost per Typical Residential Wastewater User in 2041 |
|-----------|-----------------|--|
| RI | 0.9% | 1.3% |
| Annual \$ | \$557 | \$1,231 |

E.3 SUMMARY & CONCLUSION

E.3.1 Affordability Impacts of the Proposed CSO Controls

North Bergen has identified long term Municipal Control Alternatives for both the Woodcliff STP and PVSC service areas that will achieve 85% capture of wet weather flows during the typical year utilizing controls within and implemented by North Bergen.

Woodcliff STP Service Area

The Woodcliff Sewage Treatment Plant has a rated capacity of 2.91 MGD with a wet weather capacity of 8 MGD. The plant is being upgraded to a dry weather flow capacity of 3.46 MGD with a wet weather flow of 8 MGD. In addition, for purposes of CSO control, the plant will also have a 2 MGD wet weather bypass for a total plant capacity of 10 MGD. The cost of the upgrade is approximately \$23,000,000. As noted above, the plant expansion work is ongoing and the capital financing required has been incorporated into NBMUA’s budget and rate structure.

PVSC Service Area

The Municipal Control Alternative for the PVSC Service Area includes wet weather storage, the closure of a combined sewer outfall and green stormwater infrastructure totaling \$38 million in capital costs. This figure includes \$3.0 million for improvements to the Woodcliff STP that have already been completed. The estimated costs are summarized on Table E-3.

Table E-3: North Bergen’s Selected CSO Controls

| Wet Weather Control Types | Municipal Control Alternative | |
|---|-------------------------------|--|
| | Capital Costs (\$ millions) | Incremental Annual O&M Costs (\$ millions) |
| Recent Improvement to the Woodcliff STP | \$3.0 | N/A |
| Storage Tank at NB003 (5.0 MG) | \$26.5 | \$0.14 |
| Storage Tank at NB008 (0.8 MG) | \$8.0 | \$0.06 |
| Closure of outfall NB014 | \$0.1 | \$0.0 |
| Green infrastructure (1.0 ac) | \$0.4 | \$0.0 |
| Totals | \$38.0 | \$0.20 |

The costs of these improvements would be allocated across all North Bergen users per the unified rate structure. Implementation of the remaining \$35 million North Bergen Municipal Control Alternative results in projected annual costs per typical single-family user of \$701 (without inflation) and a residential indicator of 1.2% in 2041, the first year after the projected full implementation of the controls ending in 2040. Accounting for inflation, annual costs would grow to \$1,280 with a residential indicator of 1.4% in 2041 as shown in Table E-4.

Table E-4: North Bergen’s Projected Residential Indicator Upon Full Implementation of the Municipal Control Alternative

| Metric | Baseline (2019) | Cost per Typical Residential Wastewater User in 2041 | | | |
|--------|-----------------|--|-------------------|---------------------------------------|-------------------|
| | | No LTCP | | LTCP Implementation Completed in 2040 | |
| | | With Inflation | Without Inflation | With Inflation | Without Inflation |
| RI | 0.9% | 1.3% | 1.1% | 1.4% | 1.2% |

| | | | | | |
|-----------|-------|---------|-------|---------|-------|
| Annual \$ | \$557 | \$1,231 | \$654 | \$1,280 | \$701 |
|-----------|-------|---------|-------|---------|-------|

All of these figures include the projected debt service payments for North Bergen’s 58% share of the ongoing \$23 million upgrade and expansion of the Woodcliff STP. This analysis does not reflect the current and lingering financial impacts as a result of the COVID -19 pandemic and should be revisited upon memorializing the LTCP implementation schedule in North Bergen’s next NJPDES Permit.

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; and
- 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 2.0 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 next NJPDES Permit.

Table E-5: Permittee Financial Capability Indicator Benchmarks

| Indicator | Rating | Numeric Score |
|---|--------|---------------|
| Bond Rating | Strong | 3 |
| Overall Net Debt as a Percent of Full Market Property Value | Strong | 3 |

| Indicator | Rating | Numeric Score |
|---|----------|---------------|
| 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 | Strong | 3 |
| Total | | 14 |
| Overall Indicator Score: (numeric score / number of applicable indicators) | | 2.3 |
| 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.¹

The affordability analysis detailed above has documented that the \$35 million (current dollars) in capital expenditures under North Bergen’s Municipal Control Alternative along with related operation and maintenance costs would result in a Residential Indicator of 1.4% which is within the EPA “medium burden” range.

Additional economic factors are presented in the North Bergen FCA Memorandum presented in Appendix I 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 North Bergen’s financial capability.

While the affordability analysis detailed above has documented that the selected \$35 million (current dollars) Municipal Control Alternative along with related operation and maintenance costs would result in a Residential Indicator of “medium impact” under EPA’s criteria; the reality of the high poverty rates, low effective household incomes compared to the rest of New Jersey and nationally and the high costs of living in North Bergen argue strongly that the EPA metric understates the impacts of the CSO control costs on the residents of North Bergen. North Bergen is and is likely to remain financially distressed due to structural economic factors beyond its direct

¹ Combined Sewer Overflows – Guidance for Financial Capability Assessment and Schedule Development, EPA 832-B-97-004, Page 46.

control and its ability to afford and finance future CSO control facilities is restricted. As evidenced by its New Jersey Municipal Revitalization Index score in the top86th percentile, North Bergen's capacity for additional CSO controls, beyond those proposed in the SIAR, is limited.

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 North Bergen and North Bergen's financial capability to finance the CSO control program are premised on the baseline financial conditions of North Bergen 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, North Bergen 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. As detailed in Section F of North Bergen's SIAR, these provisions could include scheduling the implementation of specific CSO control measures to occur during the five-year NJPDES permit cycles. 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

The Woodcliff STP which includes the North Bergen Central and Guttenberg drainage areas has already considered CSO reductions in the plant modifications that are already underway. The plant, as it is currently configured, already accomplishes a CSO of 89.8% which is in compliance with the EPA CSO reduction policy of 85% reduction. The plant modification that are currently being constructed will increase the CSO reduction to 92% when North Bergen and NJDEP accepts them. In addition, North Bergen is going to construct two Green Infrastructure projects on public property or rights of way. These projects will likely be pervious pavers, tree pits or bioswales. No CSO reduction has been assumed for these Green Infrastructure alternatives. Instead, flows will be monitored and reductions will be determined.

F.2 RECOMMENDED LTCP

The Woodcliff STP is already providing 89.8% CSO capture for the design year of 2004. In addition to this the plant is being upgraded to replace the secondary Lamella clarifiers with a membrane filtration system. The new membrane system will be sized to a dry weather flow of 3.46 MGD with a wet weather flow of 8 MGD. In addition to this, the plant has applied for a modification to its permit which will allow for a 2 MGD wet weather bypass for a total wet weather capacity of 10 MGD. This increase in wet weather capacity will be granted after successful testing of the membranes. If approved by NJDEP the increased wet weather capacity of 10 MGD will improve CSO capture to 92%.

In addition to the Woodcliff STP expansion, Green Infrastructure projects may be selected for CSO control. Many sources are promoting green infrastructure as a CSO solution; however, this technology has limited capacity to reduce CSOs. It can only control small amounts of CSO (0.1 to 1%) in densely developed areas like North Bergen which is why it will be included in the LTCP as a minor technology in the Woodcliff (NJPDES Permit No. NJ0029084) and Central (NJPDES Permit No. NJ0108898) drainage areas of North Bergen.

F.3 IMPLEMENTATION COST OPINION

North Bergen will share in the cost of the upgrade to the Woodcliff STP with Guttenberg. The total improvement will cost approximately \$23,000,000 and wet weather improvements will cost approximately \$4,600,000. North Bergen's share the wet weather improvements will be approximately 58% or \$2,668,000. The balance will be paid by Guttenberg.

North Bergen, in both drainage areas (Woodcliff NJPDES Permit No. NJ0029084 and Central (NJPDES Permit No. NJ0108898), has also committed to building Green Infrastructure projects in the Township at a cost of \$435,000. No credit will be taken for CSO control by this technology

because the Woodcliff STP is already above the EPA control target of 85%. However, assessment of the project’s performance and operation and maintenance costs will be done to help characterize the process.

In total North Bergen, as shown in Figure F-1, will spend \$3,103,000 for improving CSO controls. The improvement to the Woodcliff STP is nearing completion of construction. The wet weather portion of the \$23,000,000 construction cost is \$2,668,000. In addition to this North Bergen will spend approximately \$200,000 per year maintaining wet weather facilities at the wastewater treatment plant.

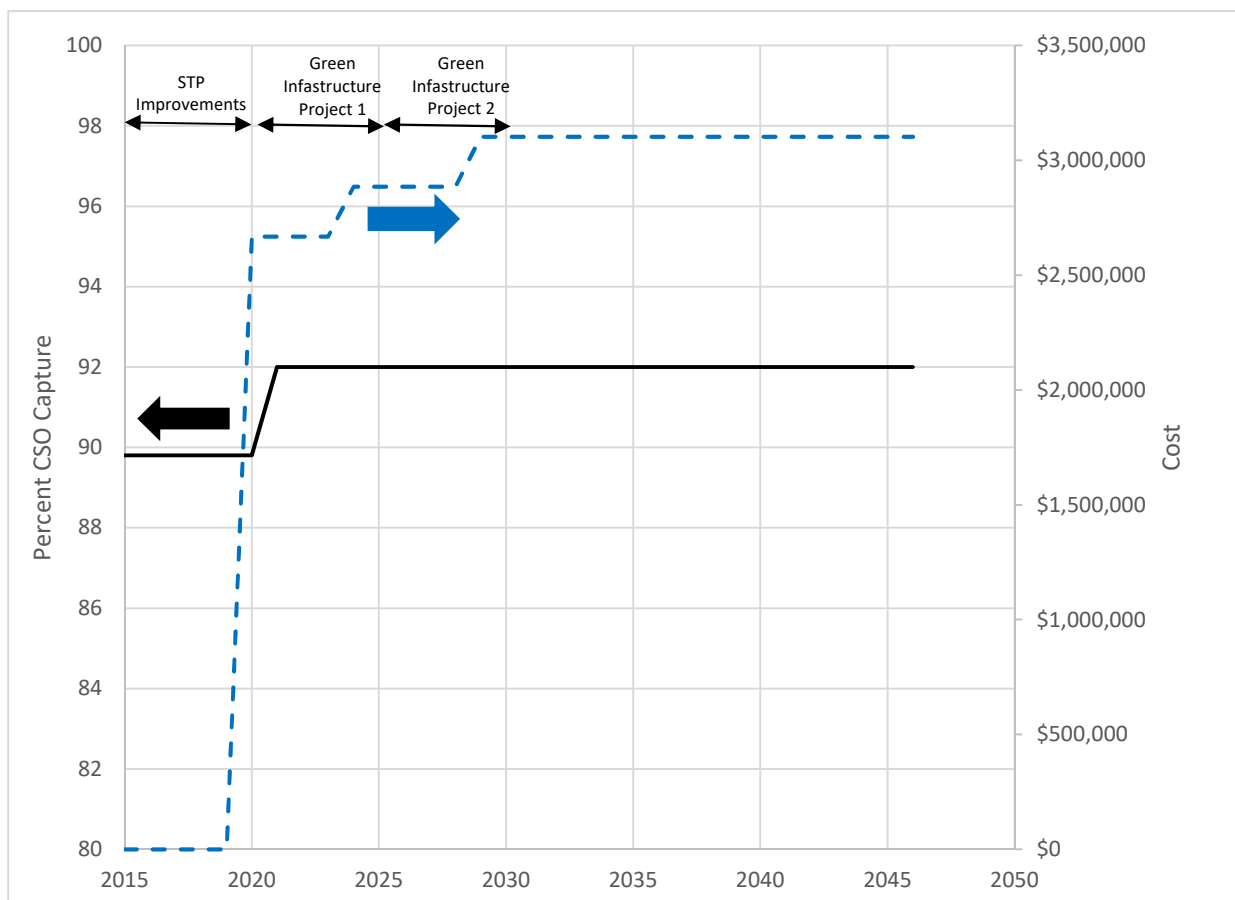


Figure F-1 Sequencing of CSO Construction Activities and Costs on CSO Capture

North Bergen will also construct other CSO improvements in the Central drainage area (NJPDES Permit No. NJ0108898) as described in the LTCP report entitled Selection and Implementation of Alternatives Report – Township of North Bergen – Central Drainage Area. This will consist of a 5MG CSO storage tank in the NB003 drainage area and if needed, a 0.8 MG CSO storage tank in

the NB008 drainage area. Cost of the 5 MG tanks is \$28,800,000 and, if needed, the storage tank for NB008 is \$9,400,000. In total North Bergen may spend over \$40,000,000 for CSO controls.

F.4 IMPLEMENTATION SCHEDULE

The improvements to CSO reductions at the Woodcliff STP are almost constructed. Testing is underway to accept the improvements. Once accepted by North Bergen data will be provided to NJDEP for accepting the improvements. When accepted by NJDEP the wet weather capacity of the plant will be upgraded which will allow the plant to go from 89.8 % CSO capture to 92% capture. It is very likely that the improvements will become part of the plants operating procedures in the next two to three years. Also, during the next permit cycle of five years one Green Infrastructure project will be built and the second one will be constructed within five years of the first project.

F.5 BASES FOR LTCP DEVELOPMENT AND IMPLEMENTATION SCHEDULE

The Woodcliff STP improvements have been funded and a construction schedule has been provided to NJDEP for the project. The wastewater treatment plant is currently under construction with an expectation that the improvements will be accepted by North Bergen and NJDEP in 2021. During the next permit cycle of five years one Green Infrastructure project will be built and the second one will be constructed within five years of the first project. This schedule is shown in Table F-1 and Figure F-1.

Table F-1: Construction Schedule for CSO Improvements

| CSO Improvement Projects | Construction Period |
|--------------------------------|---------------------|
| Woodcliff STP Improvements | 2016 to 2021 |
| Green Infrastructure Project 1 | 2021 to 2026 |
| Green Infrastructure Project 2 | 2026 to 2031 |

North Bergen will also construct other CSO improvements in the Central drainage area (NJPDES Permit No. NJ0108898) as described in the LTCP report entitled Selection and Implementation of Alternatives Report – Township of North Bergen – Central Drainage Area. This will consist of a 5MG CSO storage tank in the NB003 drainage area and if needed, a 0.8 MG CSO storage tank in the NB008 drainage area. Cost of the 5 MG tanks is \$28,800,000 and, if needed, the storage tank for NB008 is \$9,400,000. In total North Bergen may spend over \$40,000,000 for CSO controls.

F.6 CSO REDUCTION VERSUS TIME

The current CSO reduction is 89.8% which is compliance with the EPA CSO Reduction Policy, however, the current plant improvements that are underway will improve this efficiency to 92%. This will likely occur in 2021 and be one of the first CSO projects completed in the PVSC drainage area. Figure F-1 presents a display of the CSO projects and the change in CSO capture.