A. INTRODUCTION

This chapter evaluates the potential for significant adverse impacts on water and sewer infrastructure that could result from the Phased Redevelopment of Governors Island (the Proposed Project). Full development of the Proposed Project would result in a range of new uses on the Island that could include academic space, university housing, a hotel with conference space, retail, and school uses, and would also expand and improve publicly accessible open space. These uses would increase the Island's water demand and sewage generation from current conditions. Therefore, the effect of the Proposed Project on the City's water supply and wastewater conveyance and treatment infrastructure including the Red Hook Wastewater Treatment Plant (WWTP) is assessed in this chapter.

Stormwater infrastructure on the Island is a separate sewer system that is owned and maintained by The Trust for Governors Island (The Trust). The Island's stormwater is conveyed directly into the Harbor without burdening the City's conveyance or treatment infrastructure. Therefore, the effect of the Proposed Project's stormwater flows on the City's conveyance and treatment infrastructure is not assessed in this chapter. However, the impacts associated with stormwater runoff to the receiving water bodies are discussed in this chapter.

B. PRINCIPAL CONCLUSIONS

The improved and expanded open spaces, new development, and retenanted historic structures that would result from the Proposed Project would attract new visitors and introduce new workers and residents to the Island, which could create new demands on the City's water and wastewater sewer infrastructure. An increase in pervious surfaces in the future with the Proposed Project would decrease the total amount of stormwater runoff on the Island.

PHASE 1

As part of Phase 1 of the Proposed Project, one or both of the two proposed new water mains would be constructed to provide potable water to the Island. The proposed 12-inch diameter water main(s) would provide water from Brooklyn under the Buttermilk Channel and would connect into the Island's existing water infrastructure. The Phase 1 open spaces, in and of themselves, are not expected to necessarily materially affect visitation to the Island, but this analysis assumes that the existing water demand on the Island would be a new demand on the City's water system after the installation of the water main(s) because drinking water is currently provided on the Island by means of delivered bottled water.

Phase 1 improvements to the park and public spaces on the Island would include the installation of an irrigation system for approximately 22.94 acres of the Island. The proposed irrigation of approximately 22.94 acres would result in an additional water demand of 131,446 gallons per day (gpd). Therefore, the total water demand for Phase 1 is estimated to be 314,645 gpd, which

includes irrigation plus the water demand for existing uses on the Island. There would be no change in sanitary sewage generated as compared with conditions in the future without the Proposed Project because sanitary sewage generated from the community facility/commercial uses and park visitors would not change and irrigation flows are assumed to not be discharged to the sewer system. In addition, the Phase 1 open space improvements and enhancements would result in a decrease in the amount of impervious surface on the Island, and therefore result in a decrease in the total amount of stormwater runoff. The Trust would also modify the storm sewers, which would result in an overall reduction in the total number of stormwater outfalls. There are currently 132 existing stormwater outfalls serving the island. Many of these outfalls serve small catchment areas less than one acre. The proposed work includes reconstruction of 28 outfalls, construction of one new outfall and abandoning and sealing the remaining seawall outfall penetrations. This improvement, which would be undertaken as part of the seawall rehabilitation, would reduce the total number of outfalls from 132 to 29. Therefore, Phase 1 would not result in any significant adverse impacts on the water supply or wastewater conveyance and treatment infrastructure. Due to the reduction of impervious surfaces and a net decrease of stormwater outfalls, Phase 1 would not result in any significant adverse impacts on the quality of stormwater runoff.

LATER PHASES

The full development of the Proposed Project would result in an increased demand on the City's water supply and the wastewater conveyance and treatment infrastructure.

The water demand for the full development of the Proposed Project would be approximately 1,461,116 gallons per day (gpd). The New York City water supply system delivers 1.1 billion gallons per day (bgd), therefore the Proposed Project would result in a 0.13 percent increase in demand on the system. Furthermore, the water demand includes estimated irrigation flows for the month of peak irrigation demand (July). Irrigation flows would be lower in other months, and it is expected that irrigation would not occur every day; therefore the Proposed Project's water demand would be lower during those times. While full development of the Proposed Project would result in an increase in water demand, the new 12-inch water mains would provide adequate water supply. Therefore, it is expected that there would be adequate water service for the full development of the Proposed Project and there would be no significant adverse impacts on the City's water supply.

The incremental sewage generation by the full development of the Proposed Project, when compared with the future without the Proposed Project would be 616,534 gpd. This incremental volume would be 2.2 percent of the average daily flow at the Red Hook WWTP and would not result in an exceedance of the Red Hook WWTP's capacity, because of the small increase of sanitary flow to the combined sewer system.[1] Based on extensive discussions between The Trust and the New York City Department of Environmental Protection (NYCDEP), the conveyance infrastructure between the force main and WTTP is also sufficient to handle project-generated flows. Therefore, based on the potential development scenarios analyzed below, the incremental sanitary sewage generation would not be expected to create a significant adverse impact on the City's sanitary sewage treatment system.

[1] *City Environmental Quality Review (CEQR) Technical Manual*, May 2010, p.13-16 and p.13-17.

Therefore, based on the potential development scenarios analyzed, the incremental sanitary sewage generation would not be expected to create a significant adverse impact on the City's sanitary sewage treatment system.

The full development of the Proposed Project would result in a decrease in the total amount of impervious surfaces from 52 percent to 41 percent of the 150-acre site. As a result, the full development of the Proposed Project would result in increased infiltration of stormwater and decreased stormwater runoff to the New York Harbor. In addition, in accordance with New York State Department of Environmental Conservation (NYSDEC) State Pollutant Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from Construction Activity (GP-0-10-001), a Stormwater Pollution Prevention Plan (SWPPP) consisting of both temporary erosion and sediment controls and post-construction stormwater management practices would be prepared prior to commencing any construction activities associated with the Later Phases. The erosion and sediment control practices would be implemented during construction activities to minimize the potential for sediment laden runoff into the adjacent water bodies. The project site would incorporate post-construction stormwater control measures that would be designed to meet the requirements of the SWPPP and would improve the quality of stormwater runoff. The implementation of these measures as part of the Proposed Project would result in the overall improvement of stormwater runoff.

At this time, the uses associated with the Later Phases-Island Redevelopment are not specifically proposed, defined, or designed and their operations have not yet been planned. In the future, when the specific uses for the Later Phases-Island Redevelopment are identified and designed, it is anticipated that additional environmental review will be required. At that time, in coordination with NYCDEP, the Trust will commit to creating a best management practices (BMP) Concept Plan that would identify potential BMPs that would achieve an overall stormwater release rate of 0.25 cubic feet per second (cfs) or 10 percent of the allowable flow rate (whichever is greater).

Calculations from the NYCDEP flow volume matrix for the full development of the Proposed Project identified an approximately five- to six-time increase in the amount of sanitary flow discharge to the combined sewer system located in Brooklyn as compared with existing conditions. Full development of the Proposed Project, as a result of the Later Phases-Island Redevelopment component, could result in appreciable increases in sanitary flows to the combined sewer system in Brooklyn. However, the uses associated with the Later Phases-Island Redevelopment are not specifically proposed, defined, or designed and their operations have not yet been planned. When such development has been planned and designed, it is anticipated that it would require zoning and other land use actions that would be subject to CEQR and the associated future environmental review would take into account potential impacts on sanitary and stormwater drainage and management.

C. METHODOLOGY

Governors Island is currently zoned as a low-density residential district R3-2. Pursuant to the 2010 *CEQRs Technical Manual*, a preliminary sewer analysis would be warranted in R3 zoning districts if the proposed development is greater than 25 residential units or 50,000 square feet of commercial development. The size and location of the Proposed Project both warrant a preliminary sewer analysis.

This analysis follows the methodologies set forth in the 2010 *CEQR Technical Manual* and assesses current conditions, conditions in the future without the Proposed Project (No Build), and conditions in the future with the Proposed Project (Build).

Water demand and sewage generation are calculated based on the proposed uses and the generation rates defined in the *CEQR Technical Manual*. The ability of the City's water and sewer infrastructure to handle the anticipated demand is determined by comparing the existing conditions with the future with and future without the Proposed Project. The existing and Build stormwater runoff and sanitary flows were calculated using the NYCDEP Flow Volume Calculation Matrix found in the *CEQR Technical Manual*.

D. EXISTING CONDITIONS

WATER SUPPLY

New York City's water supply system is composed of three watersheds—Croton, Delaware, and Catskill—and extends as far north as the Catskill Mountains. From these watersheds, water is conveyed to the City via a conveyance system made up of reservoirs, controlled lakes, aqueducts, and tunnels. Within the City, a network of underground water pipes distributes water to customers. On average, the New York City water system delivers approximately 1.1 bgd to the five boroughs and upstate communities.

The Croton system supplies an average of 22 million gallons per day (mgd), primarily to users in the lower-elevation portions of Manhattan and the Bronx. The Delaware and Catskill systems supply all five boroughs and deliver approximately 98 percent of the City's drinking water. The Delaware and Catskill water systems collect water from watershed areas in the Catskill Mountains and deliver it to the Kensico Reservoir in Westchester County. From the Kensico Reservoir, water is sent to the Hillview Reservoir in Yonkers, which balances the daily fluctuations in water demand and pressure to the system. From there, water is delivered to the City through three water tunnels, Tunnel Nos. 1, 2, and 3. Tunnel No. 1 carries water through the Bronx and Manhattan to Brooklyn; Tunnel No. 2 travels through the Bronx, Queens, Brooklyn, and then through the Richmond Tunnel to Staten Island; and Tunnel No. 3 goes through the Bronx and Manhattan, terminating in Queens. Tunnel Nos. 1 and 2 serve the northwestern portion of Brooklyn, from which water for the project site is comes.

The water on Governors Island is non-potable and used for the Island's fire suppression system and various greywater uses. Potable water is brought to the Island for public access use purposes, for The Trust and NPS staff and contractors, for artists in Building 110, and for the Urban Assembly New York Harbor School students and staff.

The estimated water consumption calculations for current conditions are represented in **Table 12-1**. The existing water demand is estimated to be 184,654 gpd based on existing uses. Currently, 164 buildings are located on the project site. Twenty-three buildings are used for community facility purposes, three are for mechanical or infrastructure uses, and 138 are vacant. Based on the current uses and *CEQR Technical Manual* usage rates, a conservative estimate of existing demand on the City's water distribution system is approximately 184,654 gpd. The amount of domestic water demand on the Island is estimated to be 107,991 gpd, which includes drinking water and additional non-potable (greywater) uses. As noted above the Island does not currently have a potable water supply, and existing uses on the Island do not rely on the City's water supply system for potable drinking water. Therefore, a portion of the domestic water demand is met with the provision of bottled water, rather than through the City's water distribution system. Non-potable uses, such as toilet flushing, draw from the City's water distribution system. A total of 76,663 gpd of water is estimated to be used for air conditioning.

Table 12-1
Estimated Water Consumption: Existing Conditions

Use	Size (Square feet) /Unit	Rate	Consumption (gallons per day)
Community Facility/Commercial			
Domestic	450,960	0.10 gpd/sf	45,096
Air Conditioning	450,960	0.17 gpd/sf	76,663
Park and Open Space Areas			
Domestic	12,579 visitors[1]	5 gpd/visitor[2]	62,895
TOTAL	NA	NA	**184,654**

Notes
[1] Number of visitors on a busy summer weekend day in 2010.
[2] Rate obtained from NYSDEC Design Standards for Wastewater Treatment Works for Intermediate Size Sewage Facilities, last revised 1988.
Source: Rates from 2010 *CEQR Technical Manual.*

The existing park and open space areas are closed in the winter and therefore, less water is brought to the Island during this time.

WASTEWATER AND STORMWATER CONVEYANCE AND TREATMENT

There are two sewer systems on the Island, one for sanitary sewage and one for stormwater.

SANITARY SEWAGE

The sewage generated as a result of domestic water use is ultimately conveyed to the City's sewer system. The estimated amount of daily sanitary sewage currently generated by the existing uses is 107,991 gpd. This estimated amount conservatively includes all water demand except that used by air conditioning, which is typically not discharged into the sewer system.

Sanitary sewage is collected in a network of pipes and manholes throughout the Island, discharging to a pump station located in Building 691 on the South Island. Wastewater is then pumped off the Island through a 14-inch diameter force main under Buttermilk Channel to a 21-inch diameter sewer in Wolcott Street in the Red Hook section of Brooklyn, which is in the drainage area served by the Red Hook WWTP. The flow from the 21-inch diameter sewer in Wolcott Street is conveyed to Regulator 2 located approximately at the intersection of Wolcott Street and Conover Street[2]. At the Red Hook WWTP, wastewater is fully treated by physical and biological processes before it is discharged into New York Harbor. The quality of the treated wastewater (effluent) is regulated by a SPDES permit issued by NYSDEC. A maximum daily capacity for each treatment facility in the City is set to ensure that the quality of effluent is acceptable to discharge into surrounding water bodies; the maximum capacity for the Red Hook WWTP is 60 mgd. The average monthly flow over the past 12 months is 28 mgd, well below the maximum permitted level of 60 mgd.

Unlike the separate sewer system on Governors Island, the majority of the drainage area for Red Hook WWTP has a network of "combined" sewers that convey sanitary sewage and stormwater together to the WWTP. In periods of dry weather, the combined sewers convey only sanitary sewage. During and immediately after wet weather, the sewers can experience a much larger flow. To control

[2] Information obtained from NYCDEP Plant Operations-Red Hook General Location Map

flooding at the Red Hook WWTP, regulators are built into the system to allow only approximately two times the amount of design dry weather flow into the interceptors, which take the flow to the Red Hook WWTP. The excess flow to the regulators is discharged to the nearest waterbody as combined sewer overflow (CSO).

The Trust recently completed improvements to the sanitary sewage conveyance system on the Island. These improvements were the installation of new pumps and lining of the storage tanks.

STORMWATER

The stormwater infrastructure on the Island is owned and maintained by The Trust. The Governors Island storm sewer system consists of a network of catch basins and pipes that collect and convey stormwater to one of 132 stormwater outfalls on the Island.

The project site is approximately 150 acres. It is estimated that approximately 22.79 acres (15 percent) of the site is covered by impermeable building roof, 55.79 acres (37 percent) is paved, and the remaining 71.56 acres (48 percent) are covered by grass or unpaved surface. The project site surface types, areas, and the method of stormwater runoff discharge from the project site are shown in **Table 12-2**.

Table 12-2
Project Site Surface Coverage: Existing Conditions

Surface Type	Surface Areas (sf)	Discharge Method
Building Roofs	992,603	Storm Sewer
Pavement and Roadway	2,430,234	Storm Sewer
Grass, Unpaved	3,117,205	Storm Sewer
Total	**6,540,042**	
Sources: West 8 Team: Pervious and Impervious Surfaces-Phased Development of Governors Island dated April 2011.		

The weighted runoff coefficient of the project site is calculated to be 0.56 based on the NYCDEP Flow Volume Calculation Matrix, which corresponds to the percentage of precipitation that becomes surface runoff.

E. THE FUTURE WITHOUT THE PROPOSED PROJECT

In the future without the Proposed Project, the land usage on the North Island would be expected to remain the same as current conditions—existing buildings and land uses are not expected to substantially change. Existing non-historic buildings on the South Island were approved to be demolished in 2008, leaving this area of the island as primarily open space and vacant land. As described in Chapter 2, "Framework for Analysis," the number of visitors to the Island is expected to increase approximately 40 percent. As a result, water consumption and sanitary sewage generation would be expected to increase from existing conditions while stormwater runoff would remain approximately the same.

WATER SUPPLY

In the future without the Proposed Project, it is estimated that there would be a 40 percent increase in visitors to the Island; therefore, the amount of water brought to the Island daily

would increase. **Table 12-3** calculates the water consumption on the Island in the future without the Proposed Project.

Table 12-3
Estimated Water Consumption: Future Without the Proposed Project

Use	Size (Square feet) /Unit	Rate	Consumption (gallons per day)
Community Facility/Commercial			
Domestic	450,960	0.10 gpd/sf	45,096
Air Conditioning	450,960	0.17 gpd/sf	76,663
Park and Open Space Areas			
Domestic	17,684 visitors[1]	5 gpd/visitor[2]	88,420
TOTAL	NA	NA	**210,179**

Notes:
[1] Project number of visitors on a busy summer weekend day in 2013 and 2030.
[2] Rate obtained from NYSDEC Design Standards for Wastewater Treatment Works for Intermediate Size Sewage Facilities, last revised 1988.
Source: Rates from 2010 *CEQR Technical Manual.*

As in existing conditions, the Island would not have a potable water supply. Therefore, a portion of the domestic water demand will continue to be met with the provision of bottled water, rather than through the City's water distribution system. Non-potable uses, such as toilet flushing, will continue to draw from the City's water distribution system.

WASTEWATER AND STORMWATER CONVEYANCE AND TREATMENT

SANITARY SEWAGE

In the future without the Proposed Project, the amount of sanitary sewage discharged from the site will increase from 107,991 gpd to 133,516 gpd, a 24 percent increase due to the increase in park visitors to the Island.

STORMWATER

Since there will be no change in the impervious surfaces in the future without the Proposed Project on the North Island, stormwater runoff flows are not expected to change. On the South Island, the demolition of existing non-historic buildings will result in a decrease in the weighted runoff coefficient. Therefore, the volume of stormwater runoff will be expected to decrease.

F. PROBABLE IMPACTS OF THE PROPOSED PROJECT

The improved and expanded open spaces, new development, and retenanted historic structures that would result from the Proposed Project would attract new visitors and introduce new workers and residents to the Island. This could create new demands on the City's water and sewer infrastructure.

WATER SUPPLY

PHASE 1

As part of Phase 1 of the Proposed Project, one or both of the proposed new water mains would be constructed to provide potable water to the Island. The 12-inch diameter water main(s) are proposed to provide water from Brooklyn under the Buttermilk Channel and would connect into existing Island water infrastructure (see **Figure 12-1**). The non-potable source would be disconnected from the existing Island water infrastructure.

As described in Chapter 1, "Project Description," overall, the additional and improved open spaces planned for Phase 1, in and of themselves, are not expected to necessarily materially affect visitation to the Island. Therefore, Phase 1 would not result in increased water demand for domestic or air conditioning uses compared to the future without the Proposed Project. However, to provide for a conservative analysis, it is assumed that all water demand after the installation of the water main(s) is new demand on the City's water supply because drinking water is currently provided on the Island by bottled water. Therefore, this analysis assumes that the 210,179 gpd of water demand in the future without the Proposed Project would be a new demand on the City's water supply with the completion of the water main(s) in Phase 1.

In addition, approximately 22.94 acres of land would be irrigated as part of the Phase 1 improvements to open spaces, which would result in a water demand of 131,446 gpd. Therefore, the total water demand in Phase 1 would be 210,179 gpd from community facilities/commercial uses and visitors and 131,446 gpd from irrigation, for a total estimate of 341,645 gpd. It also should be noted that the irrigation flows represent water consumption during the month of peak irrigation demand (July). Irrigation flow would be lower in other months, and it is expected that irrigation would not occur every day; therefore, the Proposed Project's water demand would be lower during those times. With the improvements to the water supply system, it is expected that there would be adequate water service for Phase 1 of the Proposed Project and there would be no significant adverse impacts on the City's water supply.[3]

LATER PHASES

As described in Chapter 2, "Analytical Framework," two potential development scenarios—the University/Research Option (URO) and Mixed-Use Option (MUO)—have been identified for the Later Phases-Island Redevelopment component of the Proposed Project. The projected water consumption for both scenarios (including the Later Phases-Park and Public Spaces) is shown in **Tables 12-4 and 12-5**. The URO would result in a water demand of 1,383,816 gpd. The MUO would generate a higher water demand, and therefore the MUO is considered the reasonable worst-case development scenario for the full development of the Proposed Project for purposes of the water analysis. As shown in Table 12-5, the Later Phases-Park and Public Spaces would require 309,516 gpd, the MUO would require 1,151,600 gpd, and the total water demand for the full development of the Proposed Project would be of 1,461,116 gpd. The water demand generated from the Later Phases-Park and Public Spaces would include 22.94 acres of land that would be irrigated beginning in Phase 1 and an additional 12.15 acres irrigated as a result of the

[3] *CEQR Technical Manual*, May 2010, p.13-8.

PROPOSED PHASED REDEVELOPMENT OF
GOVERNORS ISLAND

Off-Island Existing and Proposed Water Mains
Figure 12-1

Table 12-4
Later Phases Assuming University/Research Option
Projected Water Consumption

Use	Unit	Size (Square feet)	Rate	Consumption (gallons per day)
Residential				
Domestic	3,268 people		100 gpd/person	326,800
Air Conditioning		1,050,000	0.17 gpd/sf	178,500
Retail				
Domestic		75,000	0.24 gpd/sf	18,000
Air Conditioning		75,000	0.17 gpd/sf	12,750
Commercial/ Office/ Community Facility/Conference Center/Maintenance[1]				
Domestic		1,445,000	0.10 gpd/sf	144,500
Air Conditioning		1,445,000	0.17 gpd/sf	245,650
Hotel				
Domestic	350 rooms		120 gpd/rm/occupant[2]	63,000
Air Conditioning		280,000	0.17 gpd/sf	47,600
School				
Domestic	1,200 seats		10 gpd/seat	12,000
Air Conditioning		150,000	0.17 gpd/sf	25,500
Subtotal URO				**1,074,300**
Later Phases - Park and Public Spaces				
Domestic	21,690 visitors[3]		5 gpd/visitor[4]	108,450
Irrigation	35.09 acres		5,730 gpd/acre[5]	**201,066**
TOTAL	NA	3,000,000	NA	**1,383,816**

Notes:
1 There is no rate provided in the 2010 *CEQR Manua*l for community facility, maintenance space and conference space. The commercial/office rates were utilized.
2 Average 1.5 occupants per room
3 Projected number of visitors on a busy summer weekend day in 2030
4 Rate obtained from NYSDEC Design Standards for Wastewater Treatment Works for Intermediate Size Sewage Facilities, last revised 1988.
5 An average water consumption rate for irrigation was calculated based on the preliminary irrigation design for the Island. The irrigation flow rate represents the water demand during the month of peak irrigation demand (July). Irrigation flow rates would be lower during other months, and irrigation would not occur every day.
Source: Rates from 2010 *CEQR Technical Manual;* Northern Design Irrigation Consultants and Designers.

Later Phases, which would result in a total of 35.09 acres of irrigated land. However, the irrigation flows represent water consumption during the month of peak irrigation demand (July). Irrigation flow would be lower in other months, and it is expected that irrigation would not occur every day. During those times, the Proposed Project's water demand would be lower.

The water demand created by the full development of the Proposed Project would be provided by new service from the City's water supply from the water mains that would be constructed as part of the Proposed Project. To provide for a conservative analysis, it is assumed that all water demand after the installation of the water mains is new demand on the City's water supply, because drinking water is currently provided on the Island by bottled water. Therefore, the 1,461,116 gpd of total water demand would also be the incremental water demand, which would result in a 0.13 percent increase in demand on the New York City water supply system that

Table 12-5
Later Phases Assuming Mixed-Use Option
Projected Water Consumption

Use	Unit	Size (Square feet)	Rate	Consumption (gallons per day)
Residential				
Domestic	5,091 people		100 gpd/person	509,100
Air Conditioning		2,100,000	0.17 gpd/sf	357,000
Retail				
Domestic		75,000	0.24 gpd/sf	18,000
Air Conditioning		75,000	0.17 gpd/sf	12,750
Commercial/ Office/ Community Facility/Conference Center/Maintenance[1]				
Domestic		395,000	0.10 gpd/sf	39,500
Air Conditioning		395,000	0.17 gpd/sf	67,150
Hotel				
Domestic	350 rooms		120 gpd/rm/occupant[2]	63,000
Air Conditioning		280,000	0.17 gpd/sf	47,600
School				
Domestic	1,200 seats		10 gpd/seat	12,000
Air Conditioning		150,000	0.17 gpd/sf	25,500
Subtotal MUO				**1,151,600**
Later Phases - Park and Public Spaces				
Domestic	21,690 visitors[3]		5 gpd/visitor[4]	108,450
Irrigation	35.09 acres		5,730 gpd/acre[5]	**201,066**
TOTAL	NA	3,000,000	NA	**1,461,116**

Notes:
1 There is no rate provided in the 2010 *CEQR Manual* for community facility, maintenance space and conference space. The commercial/office rates were utilized.
2 Average 1.5 occupants per room
3 Projected number of visitors on a busy summer weekend day in 2030
4 Rate obtained from NYSDEC Design Standards for Wastewater Treatment Works for Intermediate Size Sewage Facilities, last revised 1988.
5 An average water consumption rate for irrigation was calculated based on the preliminary irrigation design for the Island. The irrigation flow rate represents the water demand during the month of peak irrigation demand (July). Irrigation flow rates would be lower during other months, and irrigation would not occur every day.

Source: Rates from 2010 *CEQR Technical Manual;* Northern Design Irrigation Consultants and Designers.

delivers on average 1.1 bgd. While full development of the Proposed Project would result in an increase in water demand, two new 12-inch water mains would be constructed to provide adequate water supply. Therefore, it is expected that there would be adequate water service for the full development of the Proposed Project and there would be no significant adverse impacts on the City's water supply.[4]

[4] *CEQR Technical Manual*, May 2010, p.13-8.

WASTEWATER AND STORMWATER CONVEYANCE AND TREATMENT

PHASE 1

The additional and improved open spaces planned for Phase 1, in and of themselves, are not expected to necessarily materially affect visitation to the Island. Irrigation is assumed to not be discharged to the sewer system; therefore, Phase 1 would not result in any incremental increase in sanitary sewage as compared with conditions in the future without the Proposed Project. Thus, Phase 1 of the Proposed Project would not result in a significant adverse impact on the City's sanitary sewage treatment system.

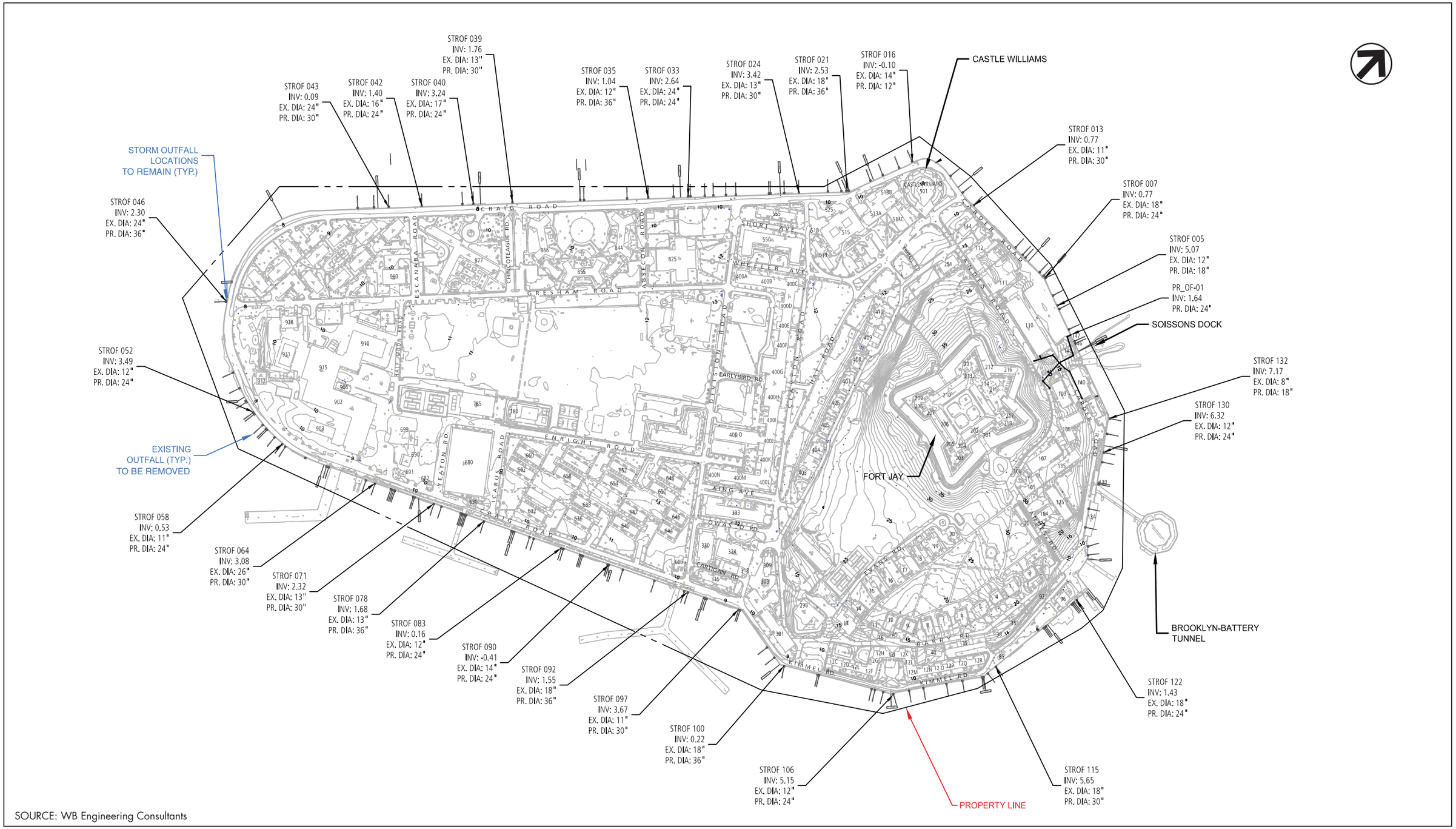
Phase 1 of the Proposed Project would improve existing open spaces on the Island and open new areas to public access. The Phase 1 open space improvements and enhancements would result in a decrease of 6.1% impervious surface on the Island, and therefore result in a decrease in the total amount of stormwater runoff.

Additionally, The Trust would upgrade the storm sewers, which would result in an overall reduction in the total number of stormwater outfalls. There are currently 132 existing stormwater outfalls serving the island. Many of these outfalls serve catchment areas of less than one acre. The proposed work includes reconstruction of 28 stormwater outfalls, construction of one new stormwater outfall and abandoning and sealing the remaining seawall outfall penetrations. This improvement, which would be undertaken as part of the seawall rehabilitation, would reduce the total number of outfalls from 132 to 29.

The proposed improvements also call for selected sections of seawall to be removed and replaced with a rip-rap revetment. Outfalls selected to be abandoned in place in these sections would be cut back to a proposed cast-in-place head wall, capped at the face of the wall and at the inlet, then grouted and sealed with concrete. Outfalls selected to be abandoned in place and located in sections where the seawall is proposed to be rebuilt, rehabilitated, or repointed would first be capped at the face of the seawall and inlet and then be grouted and sealed with concrete. Other remaining outfalls or sections of outfall piping that cannot feasibly be abandoned would be excavated and removed. The seawall rehabilitation and stormwater outfall reconstruction activities would require authorization from the U.S. Army Corps of Engineers (USACE) under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899, and from NYSDEC under Articles 25 and 15 of the Environmental Conservation Law, and Section 401 Water Quality Certification. Erosion and sediment control practices would be designed to mitigate soil disturbance and construction activities as part of this permitting.

The stormwater conveyance network and contributing drainage areas would be modified to address the capped stormwater outfalls. In most cases the modified outfall contributing drainage area will increase in size, therefore the stormwater outfall diameter will increase in most instances. While there would be an increase in flow at these consolidated outfalls, there would be an overall decrease in the stormwater runoff volume due to the net decrease in impervious surfaces. As shown in **Table 12-6**, the size of the stormwater outfall diameters will generally increase to accommodate the change in the contributory drainage areas. See **Figure 12-2** for proposed outfall locations.

This increase in outfall diameter will result in an increase in capacity. However, each outfall will be designed and constructed to address the impacts associated from the increase in flow. See Chapter 10, "Natural Resources", for further discussion on impacts to the waterbody.



SOURCE: WB Engineering Consultants

0 400 800 FEET
SCALE

Proposed Outfall Map
Figure 12-2

Table 12-6
Proposed Outfall Reconstruction

Drainage Area	Outfall ID	Existing Diameter (in)	Existing Capacity (cfs)	Proposed Diameter (in)	Invert Elevation	Proposed Capacity (cfs)
1	PR_OF-01	NA	NA	24	1.64	24.73
2	STROF 005	12	2.74	18	5.07	8.06
3	STROF 007	18	8.06	24	0.77	17.37
4	STROF 013	11	2.19	30	0.77	31.49
5	STROF 016	14	4.16	12	-0.10	2.74
6	STROF 021	18	8.06	36	2.53	51.20
7	STROF 024	13	3.36	30	3.42	31.49
8	STROF 092	18	8.06	36	1.55	51.20
9	STROF 097	11	2.19	30	3.67	31.49
10	STROF 100	18	8.06	36	0.22	51.20
11	STROF 106	12	2.74	24	5.15	17.37
12	STROF 115	18	8.06	30	5.65	31.49
13	STROF 122	18	8.06	24	1.43	17.37
14	STROF 130	12	2.74	24	6.32	17.37
15	STROF 033	24	17.37	24	2.64	17.37
16	STROF 035	12	3.04	36	1.04	51.20
17	STROF 039	13	3.36	30	1.76	31.49
18	STROF 040	17	6.97	24	3.24	17.37
19	STROF 042	16	5.85	24	1.40	17.37
20	STROF 043	24	17.37	30	0.09	31.49
21	STROF 046	24	17.37	36	2.30	51.20
22	STROF 052	12	2.74	24	3.49	17.37
23	STROF 058	11	2.19	24	0.53	17.37
24	STROF 064	26	21.59	30	3.08	31.49
25	STROF 071	13	3.36	30	2.32	31.49
26	STROF 078	13	3.36	36	1.68	51.20
27	STROF 083	12	2.74	24	0.16	17.37
28	STROF 090	14	0.02	24	-0.41	17.37
29	STROF 132	8	4.16	18	7.17	8.06

Notes:
1. Capacities are calculated using the Manning equation. : Q= 1/n*A*R^(2/3)*S^(1/2).
2. Culvert slope is assumed to be 0.50%, except PR_OF-01 which is a designed 1.00% slope.
3. Culvert material is assumed to be DIP (n=0.012)
4. Calculations assume pipe flowing full without resistance from tailwater pressures.
5. Drainage Area 1 proposed discharge is equal to 11.34 cfs during a 10-year storm event.
6.in=inches, cfs=cubic feet per second
Source: WB Engineers and Consultants, September 2011

Stormwater runoff from the Island discharges to tidal waters, therefore per the New York State Stormwater Management Design Manual, stream channel protection, overbank flood control or extreme flood analysis is not required. A SWPPP consisting of both temporary erosion and sediment controls and post-construction stormwater management practices would be prepared in accordance with NYSDEC SPDES General Permit for Stormwater Discharges from Construction Activity (GP-0-10-001) prior to commencing any construction activities associated with Phase 1. The water quality of stormwater runoff would improve due to the decrease in impervious surface and implementation of post construction practices.

Although the flow capacity at each outfall may increase, the overall stormwater runoff peak flows from the Island would decrease because of the total decrease in impervious surfaces.

Therefore, due the decrease in stormwater runoff on the Island and the proposed upgrades to the stormwater outfalls, Phase 1 would not result in significant adverse stormwater impacts.

LATER PHASES

Similar to water demand, the MUO for the Later Phases-Island Redevelopment would be the reasonable worst-case development scenario for the full development of the Proposed Project for purposes of the sewage analysis. The Later Phases-Park and Public Spaces would generate 108,450 gpd and the MUO option would generate 641,600 gpd of sanitary sewage. The total sewage generation for the full development of the Proposed Project would be 750,050 gpd and the incremental sewage generation, when compared with the future without the Proposed Project, would be 616,534 gpd. This estimated amount conservatively includes all water demand except that used by air conditioning and irrigation, which is not discharged into the sewer system.

The sanitary sewage generated by the full development of the Proposed Project would be conveyed via a 14-inch force main to the City's combined sewer system at Wolcott Street and treated at the Red Hook WWTP. The incremental volume of sanitary sewage generated by the full development of the Proposed Project would be 2.2 percent of the average daily flow of 28 mgd at the Red Hook WWTP and would not result in an exceedance of the Red Hook WWTP's capacity, because of the small increase of sanitary flow to the combined sewer system.[5] Based on extensive discussions between The Trust and NYCDEP, the conveyance infrastructure between the force main and WTTP is sufficient to handle project-generated flows. Therefore, based on the potential development scenarios analyzed, the incremental sanitary sewage generation would not be expected to create a significant adverse impact on the City's sanitary sewage treatment system.

There is no site plan for the Later Phases-Island Redevelopment component of the Proposed Project. However, for the purposes of this analysis, it was assumed that the existing amount of roof surfaces, pavement, and pervious surfaces in the development zones would remain the same in the future with the Proposed Project. Based on that assumption and the amount of pervious surface from the full completion of the park and open space areas, it was assumed that with the full development of the Proposed Project, 12 percent (18.24 acres) of the site would be roof surfaces, 29 percent (42.79 acres) of the site would be occupied by asphalt pavement and concrete walkways, and the remaining 59 percent (89.09 acres) of the site would be pervious area such as lawn, wetlands gardens, and groundcover. Based on this information, the weighted runoff coefficient was calculated to be 0.48, a decrease from the existing condition of 0.56. Overall, decreasing the amount of impervious surfaces on the project site from the full development of the Proposed Project would result in a decrease in stormwater runoff to the New York Harbor. As noted above, Governors Island does not convey stormwater runoff to the Red Hook WWTP drainage area combined sewer system.

In addition, in accordance with NYSDEC SPDES General Permit for Stormwater Discharges from Construction Activity (GP-0-10-001), a SWPPP consisting of both temporary erosion and sediment controls and post-construction stormwater management practices would be prepared prior to commencing any construction activities associated with the Later Phases. Furthermore, the stormwater control measures associated with the Later Phases-Island Redevelopment

[5] *CEQR Technical Manual*, May 2010, p.13-16 and p.13-17.

component of the Proposed Project would be designed to meet the requirements of the NYSDEC design criteria and treat stormwater runoff and prevent transport into the New York Harbor.

At this time, the uses associated with the Later Phases-Island Redevelopment are not specifically proposed, defined, or designed and their operations have not yet been planned. In the future, when the specific uses for the Later Phases-Island Redevelopment are identified and designed, it is anticipated that additional environmental review will be required. At that time, in coordination with NYCDEP, the Trust will commit to creating a BMP Concept Plan that would identify potential BMPs that would achieve an overall stormwater release rate of 0.25 cfs, or 10 percent of the allowable flow rate (whichever is greater). However, please note that stormwater is a separate system and is not conveyed to DEP infrastructure. As examples of potential BMPs for the types of uses currently assumed for the Later Phases-Island Redevelopment component of the Proposed Project, green and blue roofs could be employed for retaining or releasing stormwater with slowed discharge rates to control peak runoff rates. In addition, onsite rain gardens, infiltration swales, and stormwater detention may be possible within paved area and landscaped areas of the site. Subsurface vaults/tanks, stone beds, stormwater chambers, and perforated pipes could allow stormwater to seep into the ground, where site conditions allow, and could store water for gradual release during rain events, thereby freeing up capacity in The Trust's storm sewer system. Walkways, courtyards, and other paved areas onsite could be constructed with permeable concrete or porous asphalt. BMPs that would reduce sanitary sewage volumes such as gray water reuse and low-flow fixtures would also be required in the Concept Plan.

Using the existing and proposed site data, the NYCDEP Volume Calculation Matrix was completed for the existing and Build conditions. The summary tables, taken from the NYCDEP Flow Volume Matrix, are included in **Table 12-7**.

Table 12-7
NYCDEP Flow Volume Matrix–Existing and Build Volume Comparison

		Existing				Build			
		6,540,042 sf / 150 Acres				6,540,042 sf / 150 Acres			
Rainfall Volume (in.)	Rainfall Duration (hr.)	Runoff Volume Direct Drainage (MG)	Runoff Volume To CSS (MG)	Sanitary Volume To CSS (MG)	Total Volume To CSS (MG)	Runoff Volume Direct Drainage (MG)	Runoff Volume To CSS (MG)	Sanitary Volume To CSS (MG)	Total Volume To CSS (MG)
0.00	3.80	0.00	0.00	0.02	0.02	0.00	0.00	0.12	0.12
0.40	3.80	0.92	0.00	0.02	0.02	0.79	0.00	0.12	0.12
1.20	11.30	2.75	0.00	0.05	0.05	2.36	0.00	0.35	0.35
2.50	19.50	5.73	0.00	0.09	0.09	4.91	0.00	0.61	0.61

Notes: CSS = Combined Sewer System; MG = Million Gallons

The calculations from the flow volume matrix help to determine the change in wastewater volumes to the combined sewer system from existing conditions to the Build condition. Runoff volumes were calculated for four rainfall volume scenarios with varying durations. The overall increase in sanitary sewer discharge from the project site for the above rainfall volume-duration scenarios would be 0.10 MG, 0.10 MG, 0.30 MG, and 0.49 MG, respectively. As a result of the full development of the Proposed Project, there would be approximately five to six times the amount of sanitary flow over the existing condition.

When the specific uses for the Later Phases-Island Redevelopment are proposed, defined, and designed in the future, it is anticipated that the analysis shown in Table 12-6 will be revised for the additional environmental review process. Based on the capacity of the wastewater

conveyance and treatment system at that time, a detailed analysis may be required to assess how increased sanitary or storm discharges resulting from the Later Phases-Island Redevelopment component of the Proposed Project may impact capacity in the existing sewer system, exacerbate CSO volumes and/or frequencies, or contribute greater pollutant loading in stormwater discharged to receiving waterbodies. The need for and methodology associated with a detailed analysis will be based on consultation with NYCDEP at that time.

The *CEQR Technical Manual* provides the following examples of potential impacts on sanitary and stormwater drainage and management:

- Appreciable increases in sanitary and/or stormwater flows to a combined or separate sewer system that would exceed capacity in the sewer system or exacerbate current conditions related to street flooding or surcharging sewers downstream;
- Appreciable increases in sanitary and/or stormwater flows to a combined sewer system that would exacerbate current conditions related to CSOs (i.e., frequency or volumes); and
- Appreciable increases in combined or separate storm sewer flows that result in increased pollutant loadings or standards that would exacerbate water quality, ecological integrity, or public use and enjoyment of receiving waterbodies pursuant to 6 NYCRR Part 800. Under this program, the State Water Pollution Control Board adopts and assigns classifications and standards on the basis of the existing or expected best usage of the state's waters.

Full development of the Proposed Project, as a result of the Later Phases-Island Redevelopment component, could result in appreciable increases in sanitary flows to the combined sewer system in Brooklyn resulting in the examples above. However, the uses associated with the Later Phases-Island Redevelopment are not specifically proposed, defined, or designed and their operations have not yet been planned. When such development has been planned and designed, it is anticipated that it would require zoning and other land use actions that would be subject to CEQR and the associated future environmental review would take into account potential impacts on sanitary and stormwater drainage and management.

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