REQUEST FOR PROPOSALS

Architectural and Engineering Services

Stormwater Management Improvements | Plans and Specifications

December 1, 2022

PROPOSAL SUBMITTAL DEADLINE

Date: January 13, 2023

TIME: 4:00PM

LIST OF ATTACHMENTS:

PROJECT BACKGROUND

STATEMENT OF PURPOSE

The Green-Wood Cemetery (the Cemetery) is soliciting proposals from highly experienced and professional design consulting firms to design multiple stormwater facilities in the historic 478-acre historic cemetery in Brooklyn, NY. The New York State Environmental Facilities Corporation (NYSEFC) has awarded the Cemetery funding for the design and construction of these stormwater improvements. The proposals must identify the necessary tasks and related costs to complete the design and preparation of permitted construction plans and specifications in accordance with New York State Department of Environmental Conservation (NYSDEC) regulations and New York City Department of Environmental Protection (NYCDEP) standards.

BACKGROUND

The proposed project is an integrated stormwater management system to reduce the volume of water discharging to the combined sewer system during large storm events and reduce the volume of potable water used for irrigation.

The project sewershed (the North portion of the Cemetery - discharging to 4th Avenue) is approximately 148 acres (Figure 1). The proposed practice areas will manage runoff across three drainage areas. The designs will be based on the general approach and conceptual designs presented in the Feasibility Study (Attachment A). Underground storage (Practice Area 1) is proposed to manage water across 1.2 impervious acres in the service yard at the northwest corner of the property **and is not included in this scope of work**. Bioretention basins (Practice Area 2) are proposed to manage water from 33 acres (4.3 impervious acres) along the western property boundary. An Opti Continuous Monitoring and Adaptive Control system (Practice Area 3a) is proposed at Sylvan Water to manage the remaining 113 acres (17.2 impervious acres). The Opti system will release water into the combined sewer ahead of a storm event to create additional storage volume within the pond, thereby reducing wet weather flows. A pump and grit filter (Practice Area 3b) are proposed adjacent to the Opti system to extract water from Sylvan Water during dry weather days to irrigate cemetery grounds. These separate management practices will work in conjunction to manage runoff across all 148 acres.

Green-Wood has hired Brightstorm, a technical management consultant, to act at the owner's representative to ensure the successful design and implementation of this project. The selected consultant will work in coordination with the Cemetery, Brightstorm, the contracted engineer for Practice Area 1 (Arcadis), Opti engineering staff for Practice Area 3a, and state agency (EFC) staff administering grant funds for the project.

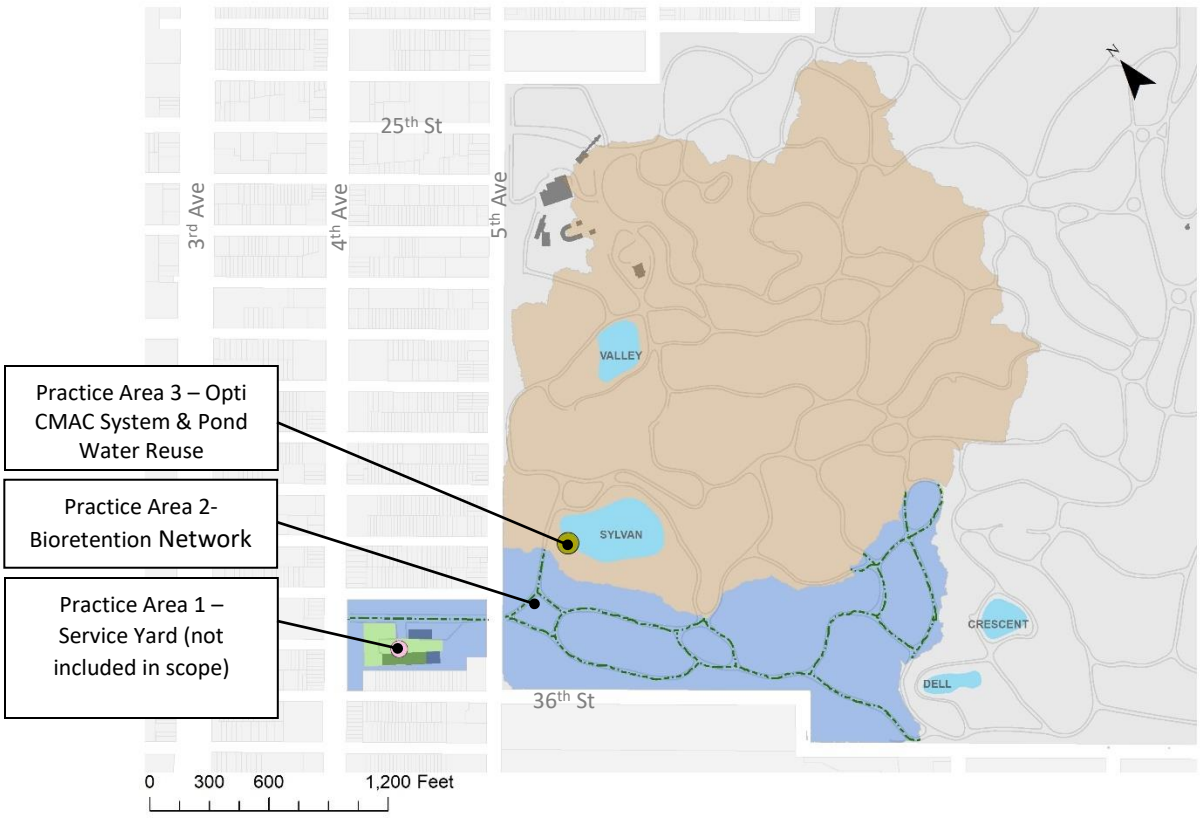

FIGURE 1 – OVERALL SEWERSHED AND DRAINAGE AREA FOR EACH PROJECT PRACTICE AREA

PROJECT GOALS

The design of the proposed practices should be guided by, but not limited to, the following goals:

- Set Green-Wood Cemetery as an example of how public and private practices can work together to construct effective stormwater management practices on private property in NYC.
- Manage and capture the water quality volumes for the 90th percentile rain event (1.5 inches) as summarized in Table 1 below.
- Minimize wet weather outflows to the combined sewer system.
- Minimize potable water used for irrigation.
- Optimize the number of nature-based practices in accordance with budgetary constraints outlined in the Scope of Work.

TABLE 1: TARGET WATER QUALITY VOLUMES FOR PRACTICE AREAS 2 &3A

	Practice 2: Bioretention Network	**Practice 3a: Opti CMAC System**
Total Drainage Area (ac)	33	113
Impervious Area (ac)	4.3	17.2
Target Water Quality Volume (gal)	224,822	856,930

SCOPE OF WORK

All tasks described herein will be funded through a grant provided by NYSEFC. The design consultant, and all related sub-contractors, will be subject to the NYSEFC Terms and Conditions found in Attachment C, and must adhere to all General Design Guidelines detailed in Attachment B.

TASK 1: INITIAL SITE INVESTIGATION AND CONCEPTUAL DESIGN

Practice Area 2: Bioretention Basins

The consultant will perform all required site due diligence, field work, and H&H modeling to ensure project constructability, including:

1. Conduct all topographic and subsurface utility surveys necessary. Topographic Survey and Site Mapping must include the following: topography (1' contour) with spot grades; building footprints, tree locations, property lines, catch basin inverts, utility locations, and right of way. Topographic information must be referenced to the North American Vertical Datum of 1988 (ft US) and EPSG Horizontal Projection 2263 - NAD83 / New York Long Island (ft US).
2. Retain a qualified Geotechnical Engineering Firm to perform a comprehensive soil investigation, the cost of which shall be included in the proposal. Soil borings and infiltration tests shall be conducted at frequencies necessary to ensure an adequate representation of site soil conditions. Infiltration testing shall be done in accordance with any permit required process for facilities using infiltration-based sizing. Comprehensive soil investigation must include classification of soil based on USC system, and contaminant testing to determine appropriate hauling and disposal costs of soil. The Consultant shall also be responsible for relevant underground notification requirements prior to any underground activities.
3. Identify all permits necessary for construction.
4. Provide concept design drawings and memo based on survey, field work, and any H&H modeling the bidder deems necessary to inform construction feasibility. Concept design drawings should include the proposed location(s), footprint, and typical cross-sections in accordance with the Supplemental Budget Information below and General Design Guidelines (Attachment B). The concept memo should complement the drawing to summarize the feasibility and preliminary construction costs of proposed layout based on survey, field work, budgetary and other implications discovered during due diligence.

Practice Area 3a: Opti System

The design consultant will be required to coordinate with Opti on the design of the CMAC system. The bidder should not include add Opti's design budget in their proposal; however, bidders are encouraged to contact Opti at https://optirtc.com/contact to understand the level of site investigation and design effort required to produce construction drawings and preliminary H&H modeling beyond what is listed below. Please refer to the Opti Scope of Work and example details in Attachment E in preparing estimates for level of design effort.

The consultant will perform due diligence and field work to ensure project constructability for Practice Area 3a, including:

1. Provide a bathymetric survey of Sylvan Water, including diameter and invert of all inlet and outlet structures.
2. Visually inspect the condition of the embankment around the perimeter of Sylvan Water.
3. Survey manholes and connection from Sylvan Water outlet structure to the sewer connection. The consultant should consider CCTV inspection.
4. Develop existing conditions SWMM model for design storm performance calculations.
5. Identify all permits necessary for construction.
6. Provide preliminary construction cost estimates

Practice Area 3b: Water Reuse System

A preliminary proposal for the water reuse system has been submitted by Rainwater Management Solutions, which is included in Attachment F. The consultant will perform due diligence and field work to ensure project constructability for Practice Area 3b, including:

1. Coordination with Cemetery staff to site the pump and filter.
2. Develop a use/demand spreadsheet to determine timing and utilization for pump sizing.
3. Identify all permits necessary for construction.
4. Coordinate with RMS (or equivalent rainwater harvesting provider) to refine equipment specification and to provide cost estimates for hardware and hardware installation.

TASK 1 DELIVERABLES:

1. Practice Area 2 - Concept Memo and design layout
2. Practice Area 3a - Concept Memo summarizing Sylvan Water survey and existing conditions, including preliminary H&H modeling of the system with CMAC and estimated wet weather capture and implications on the design and total cost of the system.
3. Practice Area 3b - Concept Memo summarizing conceptual pump system components, sizing and location. Provide estimated costs for the purchase/installation of this practice.

COMMUNICATION:

1. In-person kick-off meeting with the Cemetery Team.
2. Virtual check-in meetings (1-2 hours) every two weeks.
3. Provide written communications on progress between check-in meetings.

TASK 2: PROJECT PLANS AND SPECIFICATIONS

The design consultant will:

1. Develop plans and specifications for constructing the project for each Practice Area. Incorporate feedback and revisions from stakeholders at each stage (30%, 60%, 90%) of the design process.
2. Obtain all permits at the earliest opportunity.
3. Provide detailed line-item level cost estimate revisions at each design point for each Practice Area.

TASK 2 DELIVERABLES:

1. Full plan set and specifications appropriate for each design stage (30-60-90%).

COMMUNICATION:

1. Virtual check-in meetings (1-2 hours) every two weeks.
2. Provide written communications on progress between check-in meetings.
3. Attend one in-person meeting during each design stage (30-60-90%).

TASK 3: LONG-TERM MAINTENANCE PLAN

The design consultant will:

1. Develop a five-year Operations and Maintenance (O&M) Plan. The Cemetery staff will be responsible for implementation of this plan; however, the consultant should summarize maintenance activities and frequencies in a written plan, and budget for maintenance training sessions with the Cemetery staff.

TASK 3 DELIVERABLES:

1. O&M Manual

TASK 4: PRE-CONSTRUCTION SUPPORT & RFI RESPONSE

The consultant is expected to:

1. Hold pre-bid meeting with prospective contractors to outline scope of work and answer questions.
2. Provide bidding assistance.
3. Hold pre-construction meeting with selected contractor and staff.
4. Respond to RFIs and provide support during construction.

SUPPLEMENTAL BUDGET INFORMATION

The total value of the grant funding is $1,775,000, which is inclusive of a 10% local match from Green-Wood Cemetery. The extent of bioretention basins in Practice Area 2 is scalable and is contingent on the total cost of Practices 1, 3a, and 3b as described:

1. NYSEFC funding will be used towards construction overages for the installation of the underground detention system in Practice Area 1. The construction overages are expected to be between $50,000-$150,000; a refined estimated is expected in January/February 2023.
2. The budget presented in the feasibility study for Practice Area 3a assumed replacement of the outfall structure for installation of the Opti CMAC system. If field investigations reveal a need for more extensive repairs or replacement of the existing pipe to the site connection at 4th Ave, construction cost will increase. Bidders should account for this contingency through discussions with Opti.

With these contingencies in mind the bidder should recommend an approach for how they will phase design tasks most efficiently within the schedule.

TABLE 2: COST ESTIMATES AND CONTINGENCIES

	Practice Area 1 **Underground Storage**	**Practice Area 2:** **Bioretention Network**	**Practice Area 3a:** **Sylvan Water -Opti CMAC**	**Practice Area 3b:** **Sylvan Water Reuse Pump/Filter**
Expected Design Budget	N/A	$250,000 - $300,000		
Expected Construction Budget Range	$50,000 - $150,000*	$400,000 - $600,000	$500,000-$700,000	$100,000
Items required for budget reconciliation	Final construction bids following approved design	Final Costs for Practice Area 1, and estimated construction costs for Practice Area 3a	Preliminary Site Investigations and Existing Pond Status	N/A

* This represents the expected overage from the NYCDEP Resilient Partners Program reimbursement that will be covered under the EFC grant and is not representative of the full construction of this practice.

PROPOSAL INSTRUCTIONS & EVALUATION

QUALIFICATIONS AND EXPERIENCE

The Green-Wood Cemetery is seeking a multi-disciplinary consulting team that possesses a combination of technical expertise, creative capacity, and professional experience on similar projects. Professional expertise anticipated for this project includes landscape architectural, civil, structural and geotechnical engineering. Preference will be given to bidders with project experience under federal, state or local grant regulations and experience with continuous monitoring and adaptive control (CMAC) on stormwater projects.

Proposers shall have documented experience in:

- Landscape Architecture
- Civil Engineering
- Geotechnical Engineering
- Grading Design
- Stormwater Management
- Construction Detailing
- Construction Cost Estimating

PROPOSAL INSTRUCTIONS

Submission of Sealed Proposals

Bidders should complete the registration form posted on Green-Wood's website page dedicated to this RFP. Interested Bidders will then receive a link to a data room that contains additional existing property information. One (1) electronic version of the proposal shall be emailed to matt@brightstorm.io. A confirmation of receipt will be sent to all prospective bidders.

Deadline

Proposals will not be considered if received after the date and time indicated on the cover page.

Inquires

Bidders are encouraged to email questions to Matt Rea at matt@brightstorm.io prior to December 16, 2022. Questions will be compiled, and answers issued as an addendum which shall be emailed to all prospective bidders on or before December 30, 2022.

To ensure an ethical evaluation process, all inquiries or other communications regarding this RFP shall be exclusively directed to the authorized RFP contact identified above. Bidders are hereby expressly instructed not to otherwise communicate with the Cemetery's officers or employees regarding this RFP. This prohibition is also applicable to bidder's affiliates, officers, employees, agents, and subcontractors.

PROPOSAL CONTENT

The proposal should contain no more than fifteen (15) pages of written material (excluding transmittal letter, resumes, cost proposal, supplemental question responses and grant required MWBE and certification forms), describing the ability of the Bidder to perform the work requested, as outlined below.

A. Transmittal Letter: Indicate who will be assigned to the project, who will be the project manager, and that the proposal will be valid for ninety (90) days.

B. Approach/Project Work Plan: – Provide a comprehensive, concise work plan presenting all tasks outlined in the Scope of Work. Describe how the work will be done within the given timeframe, dependencies, and budget as outlined in the Scope of Work.

The work plan is not limited to those elements outlined in the Scope of Work; should Bidders wish to recommend other items, they may be added as a separate task or incorporated into tasks identified in the Scope of Work. Define deliverables.

C. Staffing/Project Manager Description: Identify specific personnel assigned to major project tasks, their roles in relation to the work required and any special qualifications they may bring to the project. Include resumes of individuals proposed for this contract. Include the geographic location of each staff member.

D. Experience: Indicate how your firm meets the experience requirements. List projects conducted over the past five years which involved services similar to those requested under this RFP. Please provide at least one example of a project completed under a government grant program (federal/state/local).

E. References: Include at least three (3) references where the same/similar services, as stated in this RFP, have been provided.

F. Cost Proposal and Budget: The estimated value of this contract is between $250,000-$300,000. Bidders are welcome to submit bids above this estimate, provided that detailed time and hourly rate estimates are provided to support the bid. Bidders should submit a separate cost proposal that includes: a budget table with line-item costs as well as estimated hours corresponding to tasks and other activities outlined in the work plan; a summary all staff, their position type, and hour rates, respectively, who are anticipated to work on this project. Bidders may include additional cost justification documentation as necessary.

G. Project Schedule: The Cemetery is seeking an aggressive schedule for this project design. The Cemetery's goal is to have construction break ground in Fall/Winter 2023 with landscaping no later than Spring 2024. Bidders must provide a design schedule as part of this response.

H. Completed EFC Grant Forms: Each bidder is required to complete the MWBE forms and supplemental certifications provided in Attachment C.

Supplemental Questions:

1) Please provide a list of construction contractors in New York City that your firm has a good working relationship with.

EVALUATION CRITERIA

The Cemetery Team will evaluate the proposal submission based on the evaluation point system below. The Cemetery Team will interview the three highest scoring prospective firms prior to making its selection. The interviews will determine the final selection of the winning bidder based on project understanding and competence of the work plan. The Cemetery Team reserves the right to rely on information from sources other than the information provided by the respondents.

The Cemetery Team may seek written clarification on proposal elements to better understand and evaluate the proposal. The process may not be used as an opportunity to submit missing documentation or to make a substantive revision to the original proposal.

The Cemetery Team anticipates initial firm selection will take place within two (2) weeks of receipt of proposals and final firm selection the following week. Selected firm will be notified via email of award.

Evaluation Item	Maximum Points
Design Experience • Experience designing projects similar in scope • Ability to perform work in a timely manner with high quality products and output • Presented project experience displays outside the box thinking to maximize detention/retention capacity • Experience with CMAC design	**25**
Permitting Experience • Experience coordinating with multiple government agencies • Experience permitting projects in New York City • Identified permitting requirements not laid out in RFP	**10**
Schedule • Proposed timeline meets project objectives • Anticipates critical path issues which may cause schedule delays • Availability of designated personnel to complete the work in a timely manner	**20**
Work Plan • Demonstrates an understanding of the Cemetery's goals and vision for the retrofit • Work plan is consistent with the items outlined in the RFP • Work plan clearly explains how team will be able to complete project within the project timeline • Project Manager has experience managing projects of a similar scope/size	**30**
Cost Proposal • Clear presentation of proposed fee by task • Costs are reasonable/within budget laid out by project	**15**
Total Points	**100**

CONTRACT

The contracted firm will be required to sign a contract with the Cemetery relating to the work to be performed (form of contract is included as Attachment D). The contents of submitted proposals will be considered obligations of the selected Bidder. No information should be submitted that is not intended to be incorporated into the proposal and any contract which may result from such proposal. If there is any inconsistency between the terms herein and any of the other contract documents, the terms in the other contract documents shall prevail.

RIGHT OF REJECTION

In its sole discretion, the Cemetery reserves the right to reject any or all proposals received as a result of this request, to waive technicalities and/or immaterial project requirements, to amend this RFP, to re-advertise for proposals, to waive any irregularities in the proposal submission and review process, and to pursue contracting in a manner that is in the Cemetery's best interest provided that it falls within the EFC grant requirements. The Cemetery will not pay for any information contained in any proposals submitted and the Cemetery incurs no obligation or liability whatsoever by reason of issuance of this RFP or action by anyone relative thereto. The Cemetery is not liable for costs incurred by firms prior to issuance of a contract. No contractor shall use the Cemetery's names, logos, images or any data or results arising from any anticipated contract for advertising without the Cemetery's prior written consent.

DISPOSITION OF PROPOSALS

All material submitted in response to this RFP will become the Cemetery's property and may be returned only at the Cemetery's option and at the expense of the proposal submitter. The Cemetery shall not be obligated to detail any of the results of the evaluation of proposals.

ATTACHMENT A

Green-Wood Cemetery Feasibility Study and Concept Plan

GREEN-WOOD CEMETERY STORMWATER MANAGEMENT

July 30, 2021 REVISED June 2, 2022

A COMPREHENSIVE STORMWATER MANAGEMENT STRATEGY FOR A CULTURAL AND HISTORIC LANDMARK

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INTRODUCTION TO THE GREEN-WOOD CEMETERY

Founded in 1838 and now a National Historic Landmark, The Green-Wood Cemetery (the Cemetery) was one of the first rural cemeteries in America. By the early 1860s, it had earned an international reputation for its magnificent beauty and became the prestigious place to be buried, attracting 500,000 visitors a year, second only to Niagara Falls as the nation's greatest tourist attraction. Crowds flocked there to enjoy family outings, carriage rides, and sculpture viewing in the finest of first-generation American landscapes. Green-Wood's popularity helped inspire the creation of public parks, including New York City's Central and Prospect Parks.

At 478 acres, the Cemetery is the largest privately-owned green space in New York City. Its landscape features hills, valleys, glacial ponds, and paths, throughout which exists one of the largest outdoor collections of nineteenth- and twentieth-century statuary and mausoleums. Four seasons of beauty from century-and-a-half-old trees offer a peaceful oasis to visitors, as well as its 570,000 permanent residents, including Leonard Bernstein, Boss Tweed, Charles Ebbets, Jean-Michel Basquiat, Louis Comfort Tiffany, Horace Greeley, Civil War generals, baseball legends, politicians, artists, entertainers, and inventors. Today, the Cemetery is a vibrant cultural institution, hosting a range of events on its grounds and providing a safe environment for the community throughout COVID-19.

EXECUTIVE SUMMARY

The Green-Wood Cemetery is a part of the south-central Brooklyn community and, at 478 acres, is more than half the size of Central Park and nearly the size of Prospect Park. The drainage system for the Cemetery was planned and constructed in 1876, dividing the site into two distinct drainage schemes and thus today has resulted in different drainage and conveyance issues on the north and south sides. After assessing data from previous and ongoing studies and conversations with Cemetery staff, it was determined that the most effective means of managing stormwater at the Cemetery is to focus strategies on the 148 acre sewershed on the north side of the Cemetery.

The proposed project is an integrated stormwater management system comprised of 4 components (Practices 1, 2, 3a, and 3b). Practice 1 consists of an underground detention storage system at the cemetery's service yard, which will be constructed in collaboration with the New York City Department of Environmental Protection (NYC DEP) under the Resilient NYC Partners program. Practice 2 is a proposed treatment network within the right-of-way that incorporates an array of bioretention basins to be located in the watershed south of Sylvan Water. Practice 3a is an Opti Continuous Monitoring and Adaptive Control system at Sylvan Water to manage stormwater discharging to the combined sewer. This system will control the outlet valve at Sylvan Water to drain the water level down ahead of a storm event to increase the available volume in the pond. This practice will significantly reduce the cemetery's contribution to combined sewer overflow events. Finally, Practice 3b consists of a pump and grit filter to be installed adjacent to Sylvan Water, to extract water for irrigation. This will offset approximately 8,100 gallons/day of potable water use during the irrigation season.

Calculations to determine the required water quality treatment volumes were done using guidance from NYS DEC for new development and redevelopment. The proposed project does not trigger these requirements and therefore calculations are used as a reference goal to design the most effective means of managing stormwater at the Cemetery. To this end, the bioretention basins (Practice 2) are scalable and can be increased or reduced for the highest cost to benefit as construction costs of the other practices are more defined after initial designs and site investigations. Practice 1 will be funded through the Resilient NYC Partners Program through the New York City Department of Environmental Protection. The total project cost for the remaining practices is $1,973,733.

The duration of the design phase is expected to last nine months, from October 2022 to June 2023. Procurement and subsequent construction are expected to be completed by March 2024.

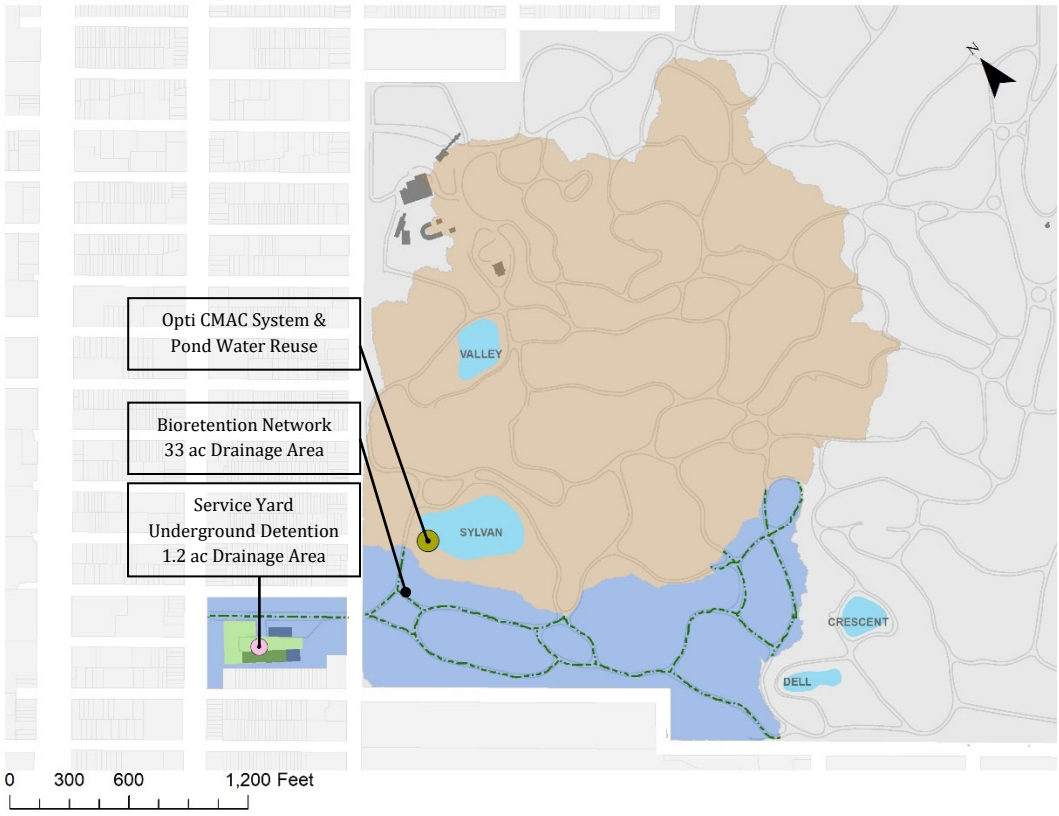


Figure 1: Conceptual Plan of Managed Sewershed

PROJECT OBJECTIVES

The primary goal of this project is to effectively manage stormwater runoff on site at Green-Wood Cemetery to reduce the volume of water that contributes to combined sewer overflow events in New York City. Every year, billions of gallons are discharged into the City's rivers because the sewer system is overwhelmed during rain events. Every piece of green infrastructure and technology used to reduce the peak volumes that the sewer systems experience aid the health of our waterways. The Green-Wood Cemetery is a vast plot of the land in a combined sewer area, which has enormous potential to reduce contributions to combined sewer overflow events.

The secondary goal is to reduce the volume of potable water being used for irrigation. The Cemetery manages irrigation efficiently, however the Cemetery can save the City over 1.7 million gallons over each irrigation season by reusing water that falls on the site.

EXISTING CONDITIONS

DATA SOURCES

The following sources were used to assess the Cemetery and generate informed stormwater management strategies:

- NYC Open Data
- Ongoing conversations with staff members at the Cemetery
- Ongoing conversations with eDesign Dynamics and Opti, two consulting groups working at the Cemetery
- The Cemetery's Cultural Landscape Report, Treatment and Management Section, drafted by AKRF, 2016: report on many components of the existing conditions, summarized below.

OVERVIEW

The Cemetery is hydrologically divided by a ridge line that separates the north and south sides according to the 1876 drainage plan (Figure 3). Stormwater that falls on the north side tracks its way through a series of swales adjacent to the paved roadways, through catch basins and into an underground pipe network before discharging into one of four ponds within the Cemetery. The ponds are entirely supplied by stormwater. Stormwater that falls on the south basin collects in dry wells (also referred to as cesspools) to infiltrate into the subgrade soils. During high intensity storm events, the south basin overflows to piped connections to the NYC Department of Environmental Protection (DEP) sewer system. All City owned sewers connected to the Cemetery's drainage system are combined sewers, carrying both stormwater runoff and sanitary sewer discharge.

Figure 2: Site Map

CONVEYANCE

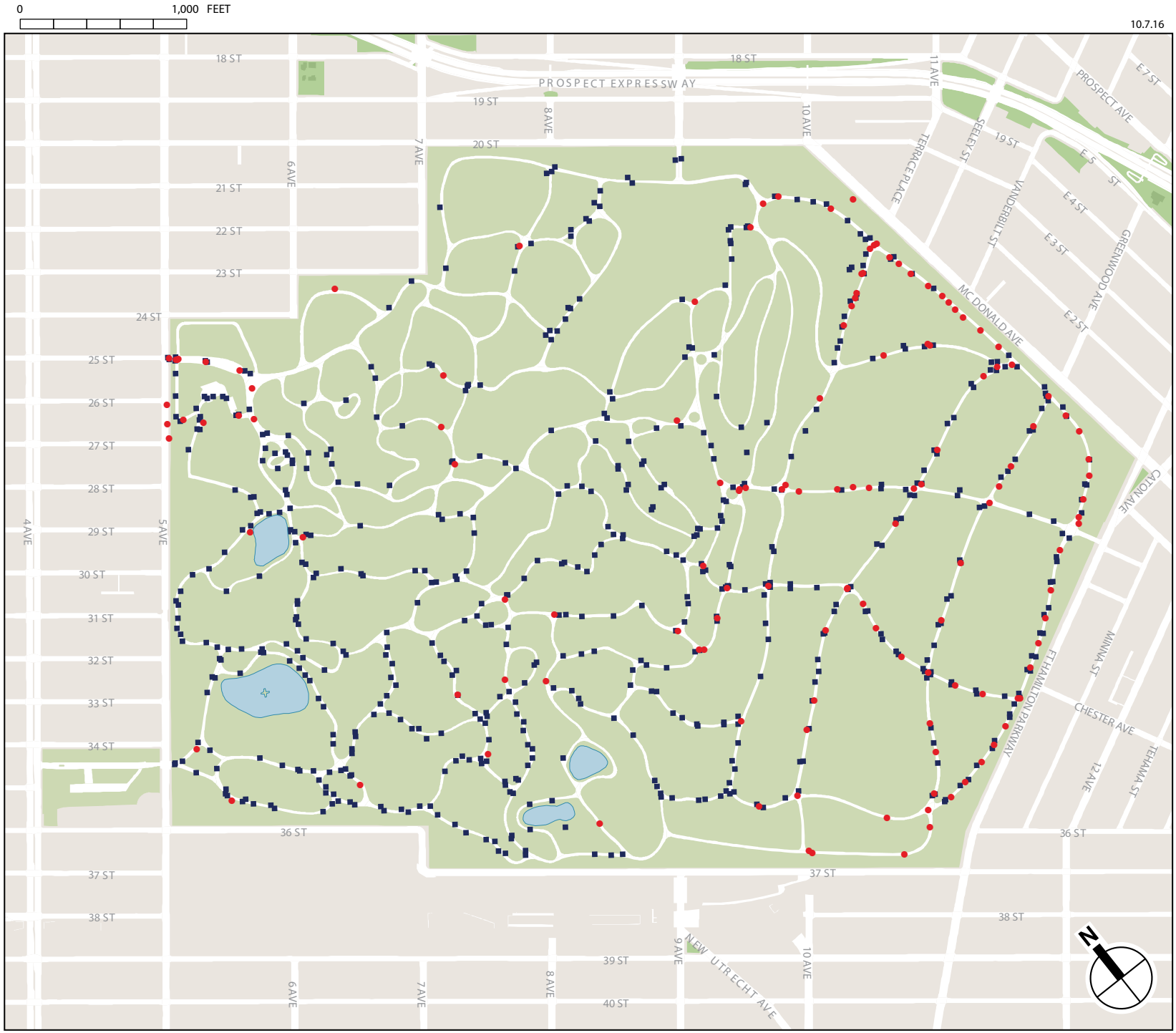
The 1876 drainage plan in Figure 3 shows geographic features and the split between the north side (pink roads) and south side (yellow roads) of the Cemetery. It also shows the two drainage methods of the north and south sides in their original forms. Cesspools dot the south side of the Cemetery, along with their connecting pipes and the discharge points to the combined sewer system. According to Cemetery management, presently there are no apparent drainage problems on the south side. The detention bodies can be seen on the north side (Dale Water, Crescent Water, Dell Water, Meadow Water, Valley Water, & Sylvan Water) along with the conveyance pipes to and between them. Since the creation of this map, Meadow Water and Dale Water have been filled in and replaced with grave sites.

Overall, the Cemetery's storm sewer system is in good condition and functions well, given its age: most of the system was developed between 1875 and 1898, and still functions efficiently and effectively. Approximately 90% of the sewer drains are 6" diameter clay or cast-iron pipes. Most of the remaining drains

are 8" or 12" diameter clay or cast-iron pipes. It is believed that few, if any, other concrete drains still exist. The sewer drains are on average 6' below grade. However, in certain areas such as near the Historic Chapel, where significant fill was added, the system is as deep as 22' below grade and slopes toward outfall connections to the City owned sewers in the surrounding streets. Catch basins across the site are approximately 6' – 7' deep and generally are situated as pairs on each side of the path. On the southern half of the site, pairs of catch basins connect to drywells in the center of the path. Most drywells are 10' or 12' in diameter and are approximately 10'-14' deep. Some drywells in the southern basin are up to 16' deep. See Figure 4 for a map of catch basins and manholes.

The Cemetery discharges to the Owl's Head Wastewater Treatment Plant in southern Brooklyn.

Figure 3: 1876 Drainage Plan



- Catch basin
- Manhole

Figure 4: Catch Basins and Manholes

WATER BODIES

Four detention ponds—Dell Water, Crescent Water, Valley Water, and Sylvan Water—are connected by the storm sewer system on the northern half of the Cemetery. Valley Water flows to Sylvan Water and Crescent Water flows to Dell Water. Sylvan Water is the largest detention pond at 16' – 17' deep at its deepest location. It is situated in the lowest area of the Cemetery and, as a result, is the receiving water body for approximately 25% of the Cemetery. Crescent Water is the highest pond in the Cemetery and has an overflow structure that likely overflows to Dell Water, although that connection is not confirmed. The watershed that contains Dell Water and Crescent water is significantly smaller than the watershed containing Valley Water and Sylvan Water. Dell Water was the subject of a 2014 drainage study by McClaren Engineering and is the subject of an ongoing study by eDesign Dynamics to solve drainage issues locally. Additionally, there is no evidence that the watershed is connected to the sewer system. As such, it is not included in this Feasibility Study. See the Existing Conditions Drawings for watershed boundaries and the location of water bodies.

CONNECTION TO NYC COMBINED SEWER

Stormwater collected by the sewer system on the north side of the Cemetery discharges from the site through connections into the City-owned sewer at six locations. The main outfall is a control device which releases water from Sylvan Water to the record mapped 12" diameter reinforced concrete City-owned sewer at 4th Avenue (See Existing Conditions Drawings). The second outfall on the north side is a 12" diameter combined sewer pipe, which collects stormwater from approximately a dozen catch basins around the Historic Chapel and connects to the record mapped 18" diameter, extra strength vitrified clay, City-owned sewer in 5th Avenue. The third northern outfall is a 12" diameter sewer pipe, which collects stormwater near the Crematory and Main Office, and connects to the record mapped 12" diameter City-owned sewer at 5th Avenue. At one point, Valley Water overflowed through an 18" diameter pipe to 5th Avenue, but it is believed by the Green-Wood's Civil Engineer that this pipe drain is clogged. Three other outfalls on the northern side of the Cemetery collect stormwater from nearby catch basins and exit the site on 23rd Street and 24th Street.

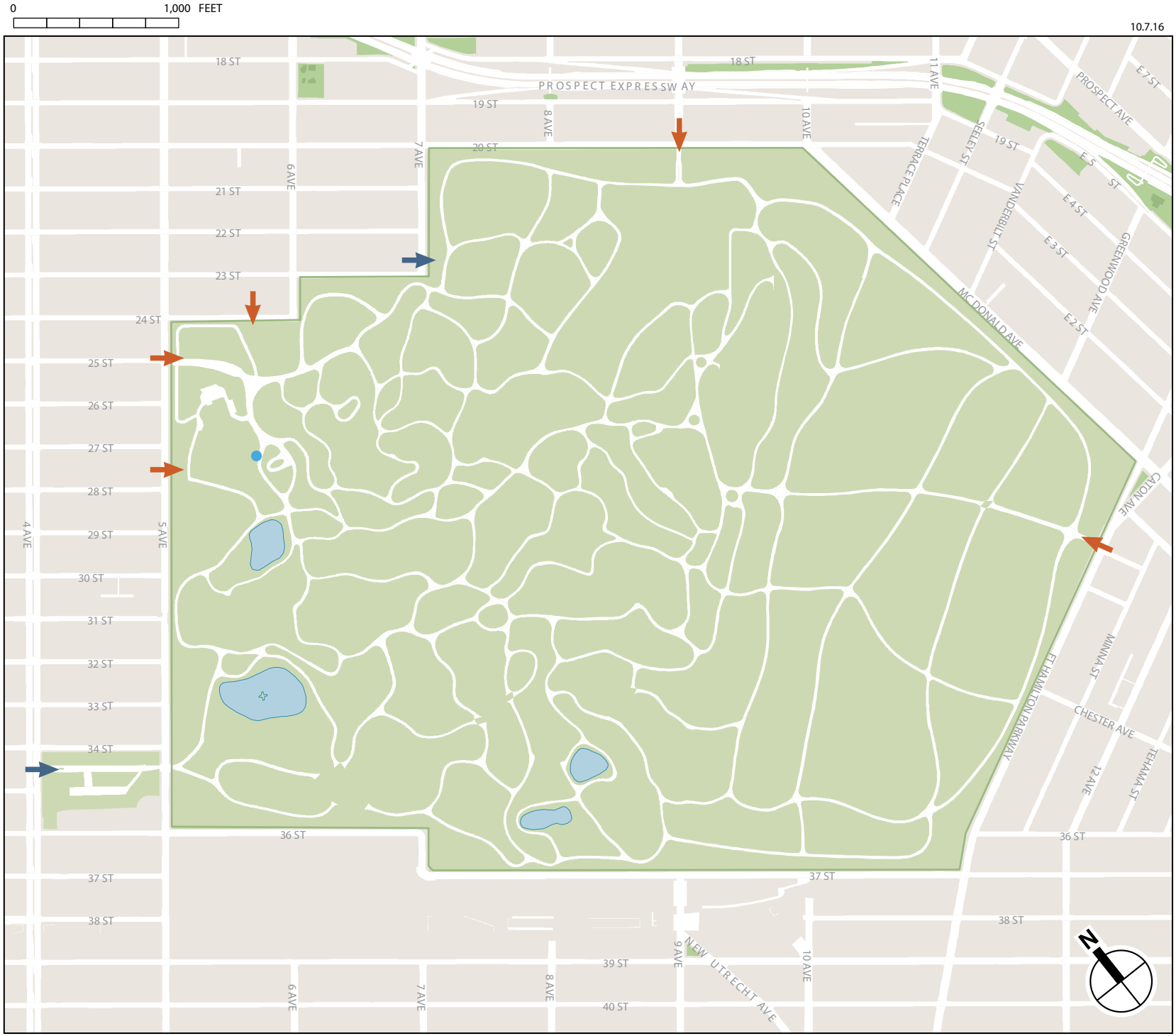
The southern storm sewer and drywell system overflows through two 24" diameter reinforced concrete storm sewer pipes into a 24" diameter on-site storm sewer adjacent to Fort Hamilton Parkway. This on-site storm sewer then discharges into a combined City sewer in Fort Hamilton Parkway. See the Existing Conditions Drawings for the location of outfalls.

WATER SUPPLY & DEMAND

Water is used on site for irrigation and several public restrooms. Water used for drip irrigation of 2.05 acres near the historic chapel is supplied by the 150' deep well on Landscape Avenue near the Historic Chapel that was constructed around 2014. Lawns near the Cemetery's main entrance are irrigated with City water. A pump in the service yard supplies irrigation water to fill the 500-gallon tanker trucks which are used during the 20-week irrigation season. Approximately 8,100 gallons per day are used at the service yard for irrigation during the season, according to water bills.

For supply into on-site buildings, the Cemetery uses the City water supply, which enters the site at a number of locations along 4th Avenue, 5th Avenue, 6th Avenue, 9th Avenue, and Fort Hamilton Parkway. The Cemetery currently has an extraordinarily high water bill associated with the water meter at 9th Avenue and 20th Street, indicating that there are leaks throughout the system. The Cemetery is currently working on a solution to fix the leak.

Figure 5 shows the well and water services. On the north side, two of the connections shown are from Green-Wood Cemetery's Civil Engineer and Records, and three are from NYCDEP Records. On the south side, both connections shown are from NYCDEP records. The only well shown on site is on the north side, near what is now a mausoleum. Figure 5 additionally contains a table of the average daily water use at each of the meters at the Cemetery.



Water Service Per Green-Wood Cemetery Engineer and Records

Water Service Per NYCDEP Records

Well

Figure 5: Water Service Entry Points

SOILS

The soils native to Green Wood Cemetery were investigated using the USDA Web Soil Survey mapping tool and the NRCS & NYC Soil and Water Conservation District Reconnaissance Soil Survey Report. The USDA Soil Survey Map shows the entire Cemetery as Greenbelt-Urban Land of varying slopes. The soil types from USDA are summarized in the table below.

Table 1: Soil Survey

Map Symbol	Name	Area (Acres)	% of Site
GUAw	Greenbelt-Urban land, very deep water table, 0 to 3 percent slopes, Cemetery	94.0	19.92%
GUBw	Greenbelt-Urban land, very deep water table, 3 to 8 percent slopes, Cemetery	165.1	34.99%
GUCw	Greenbelt-Urban land, very deep water table, 8 to 15 percent slopes, Cemetery	81.2	17.21%
GUDw	Greenbelt-Urban land, very deep water table, 15 to 25 percent slopes, Cemetery	88.3	18.71%
GUEw	Greenbelt-Urban land, very deep water table, 25 to 35 percent slopes, Cemetery	40.5	8.58%
W	Water	2.8	0.59%

The Reconnaissance Soil Survey shows the Cemetery soil types are split along the ridge line that separates the north and south drainage areas. Both soil types are composites of different categories specified by the survey.

The north side of the Cemetery has soil designation 244, known as Montauk-Foresthills-Pavement & Buildings Complex. The report describes this designation as: “Nearly level to gently sloping areas of till plains and moraines that have been partially cut and filled, mostly for parks and light residential use; a mixture of gneissic till soils and anthropogenic soils, with more than 15 percent impervious pavement and buildings covering the surface; located from the terminal moraine northward in Brooklyn and Queens.” Soil designation 244 is a composite of hydrologic soil groups B & C. Permeability in the solum is 1.2”/hr and 0.2”/hr in the substratum.

The south side of the Cemetery has soil designation 77, known as Flatbush-Riverhead-Pavement & Buildings Complex. The report describes this designation as: “Nearly level to gently sloping areas of outwash plains that have been partially filled with natural soil materials for athletic fields, cemeteries, and low density residential use; a mixture of anthropogenic soils and gneissic outwash soils, with more than 15 percent impervious pavement and buildings covering the surface; located south of the terminal moraine in Brooklyn and Queens.” Soil designation 77 is of hydrologic soil group B. Permeability in the solum is 1.2”/hr and 20”/hr in the substratum. This difference relative to the north side appears to explain why the drainage concerns are focused on the north.

USDA **Natural Resources Conservation Service**

Web Soil Survey
National Cooperative Soil Survey

2/10/2021

Figure 6: Soil Survey

Figure 6: Soil Survey

EROSION

Figure 7 indicates the extent of erosion on the Cemetery grounds as observed in 2016. The orange/brown hatches show the areas of observed erosion. On the south side, slopes are generally shallow and get steeper as one moves north toward the ridge. On the north side, the distribution of slope ranges has more of a balance. The slope map in Figure 8 shows shallow slopes in green and steep slopes in pink, and a range in between. Locations of significant erosion can be seen in in the Photo Package.

GROUNDWATER

The depth to groundwater within The Green-Wood Cemetery is varied across the site as shown in Figure 9. Sylvan Water (shown in red within the site boundaries) sits less than 11 feet above the groundwater table. The well on site is approximately 150 feet deep, which aligns with the depths shown in the map. There is a direct relationship between the elevation of the site and the depth to water below the land surface. It should be noted that the leak associated with the 9th Avenue water pit is infiltrating 13.2 million gallons per year.

FLOODING

The site is not subject to tidal influence as the lowest elevation of the Cemetery is inland of the FEMA Special Flood Hazard Area at approximately 20 ft NAVD88. The Cemetery has experienced flooding in the Service Yard in the past during significant rain events. Stormwater discharges into the subway station at 4th Avenue and during large storm events, the MTA closes the valve to prevent overflow into the subway station, thereby causing a backup in the service yard. Managing stormwater within the drainage area of this sewer will lessen the severity of flooding in the service area.

LANDMARK STATUS

The site was registered in 2006 as a National Historic Landmark. The proposed plan does not include any disturbances to buildings or graves and therefore there does not trigger the need to coordinate with the Landmarks Commission.

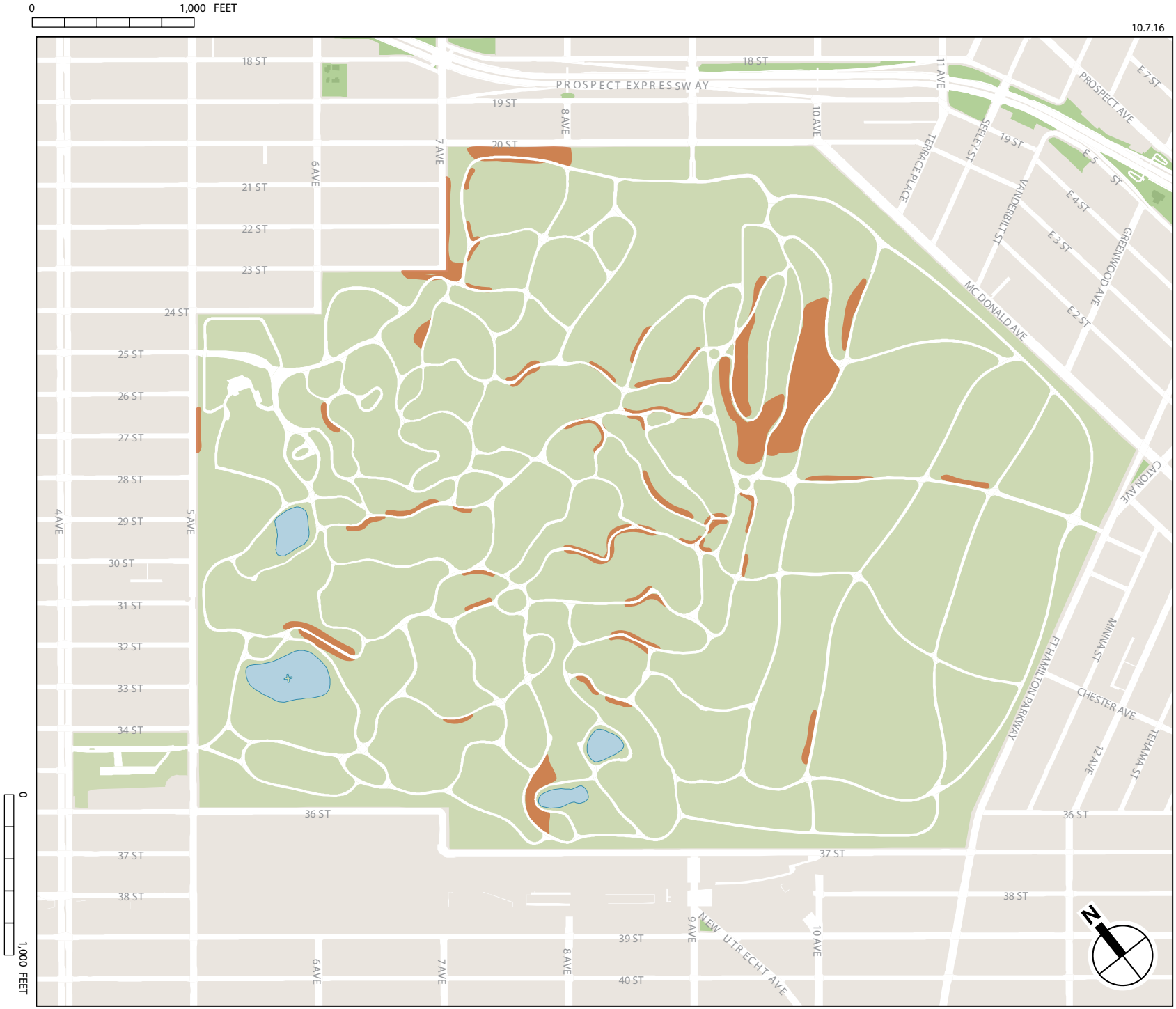


Figure 7: Observed Erosion

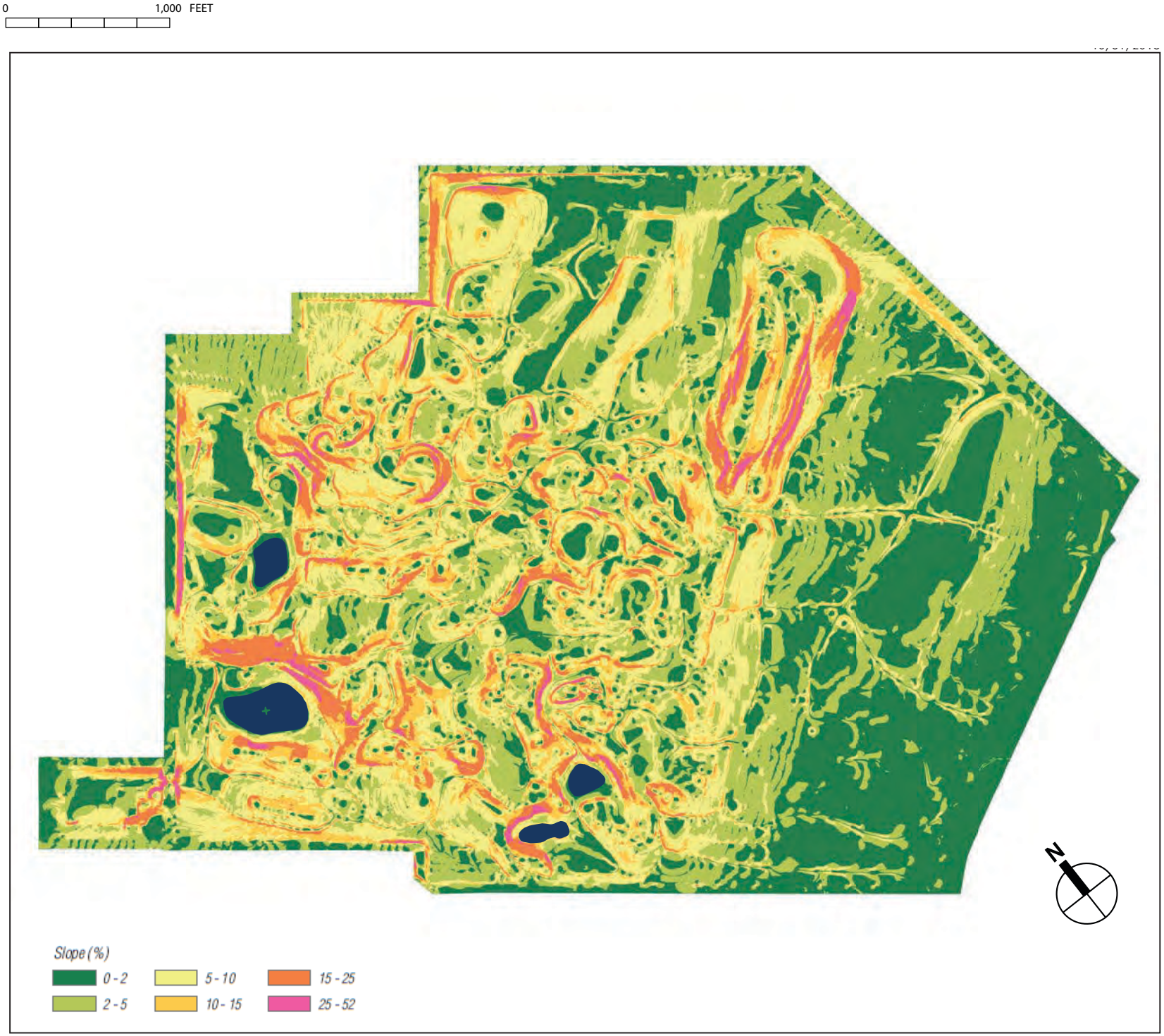
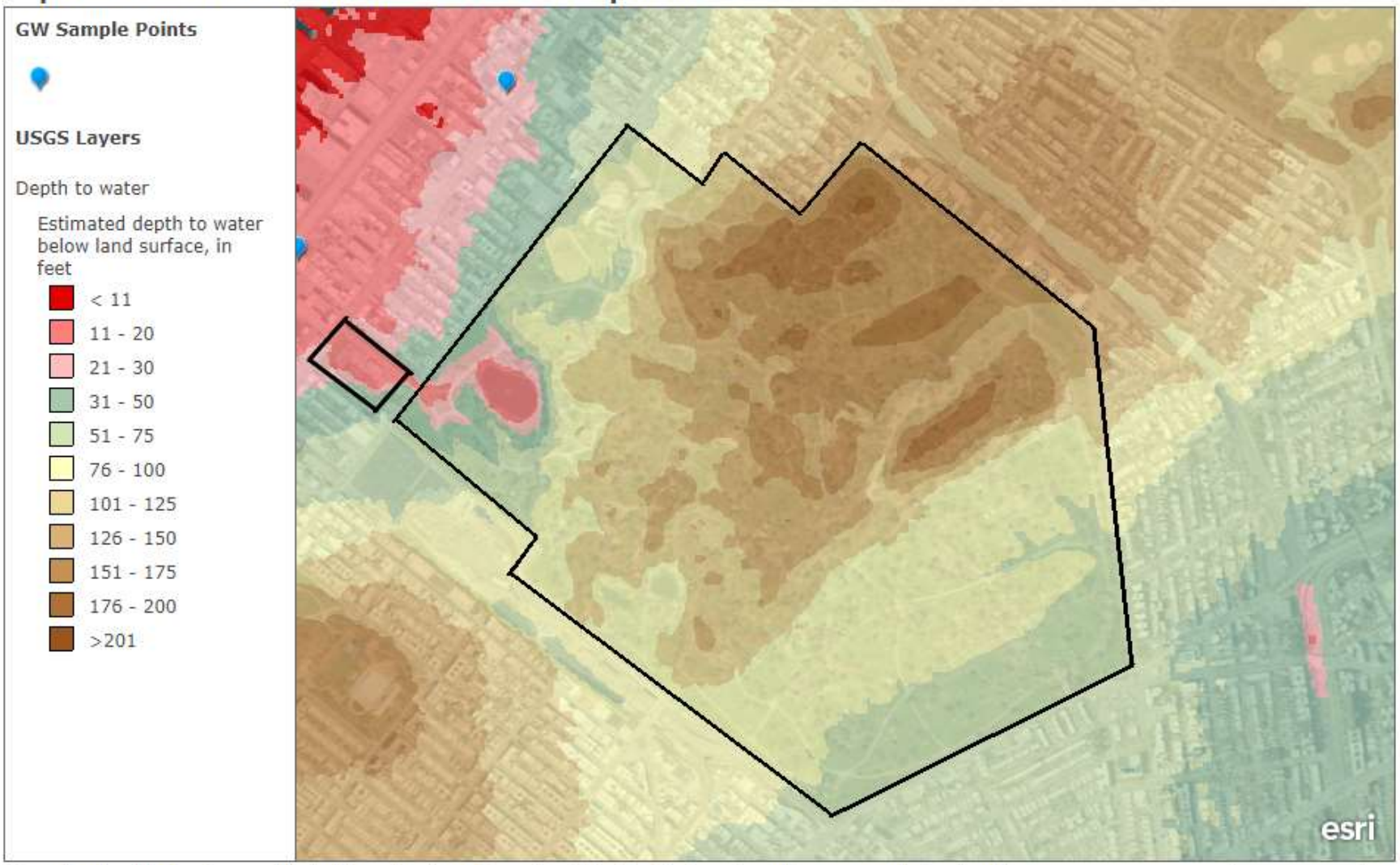


Figure 8: Terrain Map

Depth to Groundwater in the New York Metropolitan Area



Groundwater data has been collected from locations throughout the New York metropolitan area and other locations.

Figure 9: Depth to Groundwater

SUBSURFACE INVESTIGATIONS

The NRCS & NYC Soil and Water Conservation District Reconnaissance Soil Survey Report - Provides additional soil data.

North side of site:

Designation: 244 - Montauk-Foresthills-Pavement & buildings complex, 0-8% slopes.

Depth to Bedrock: >60'

Depth to Groundwater: >40'

Solum: 1.2"/hr

Substratum: 0.2"/hr

Foresthills series
Parent Material: Loamy fill, less than 40 inches deep, over an intact or truncated glacial till soil
Landform: Anthropogenic fill areas on urbanized till plains
Depth to Bedrock: Very deep
Drainage Class: Well drained
Permeability: Moderate; moderately slow where the surface has been compacted
Soil Texture: Silt loam, loam, or sandy loam throughout
Coarse Fragments: 1 to 20 percent throughout; less than 10 percent artifacts
Range in Soil pH: Very strongly acid to slightly acid in the loamy fill; very strongly acid to neutral in the underlying soil
Hydrologic Group: B
Typical Soil Profile:

A	0 to 2 inches – very dark grayish brown (10YR 3/2) loam; weak coarse subangular blocky structure; very friable; 5 percent gravel, 1 percent cobbles, and 1 percent stones; moderately acid.
Bw	2 to 15 inches – 60 percent brown (7.5YR 4/4) silt loam, 25 percent yellowish red (5YR 4/6) loam, and 15 percent black (10YR 2/1) loam; weak coarse subangular blocky structure; friable; 5 percent gravel and 1 percent cobbles; strongly acid.
Ab	15 to 17 inches – black (10YR 2/1) loam; weak medium subangular blocky structure; very friable; 1 percent gravel and 1 percent cobbles; moderately acid.
BAb	17 to 28 inches – brown (7.5YR 4/3) loam; weak medium subangular blocky structure; friable; 5 percent gravel and 1 percent cobbles; strongly acid.
Bwb	28 to 42 inches – reddish brown (5YR 4/4) loam; weak medium subangular blocky structure; friable; 5 percent gravel and 1 percent cobbles; strongly acid.
Cd	42 to 60 inches – yellowish red (5YR 4/6) loam; weak coarse platy structure; firm; 5 percent gravel and 1 percent cobbles; strongly acid.

Montauk series
Parent Material: Glacial till derived mainly from granitic materials
Landform: Till plains and moraines
Depth to Bedrock: Very deep
Drainage Class: Well drained
Permeability: Moderate or moderately rapid in the solum; slow or moderately slow in the substratum
Soil Texture: Silt loam, loam, or sandy loam in the solum; fine sandy loam or coarser in the substratum
Coarse Fragments*:* 3 to 35 percent in the solum; 5 to 50 percent in the substratum
Range in Soil pH*:* Extremely acid to moderately acid
Hydrologic Soil Group*:* C
Typical Soil Profile:

A	0 to 2 inches – brown (10YR 4/3) sandy loam; weak fine granular structure; very friable; strongly acid.
Bw	2 to 27 inches – yellowish brown (10YR 5/6) fine sandy loam; weak medium subangular blocky structure becoming weak medium platy in lower two inches; friable; 5 percent gravel; strongly acid.
2Cd1	27 to 40 inches – brown (7.5YR 4/4) sandy loam; weak thick platy structure; firm and brittle; 10 percent gravel; strongly acid.
3Cd2	40 to 65 inches - reddish brown (5YR 4/4) loamy sand; massive; firm and brittle; 10 percent gravel; strongly acid.

Pavement & buildings consist of those areas in which 80% or more of the surface is covered by asphalt, concrete, buildings or other impervious materials. Substratum phases are added to provide additional information on the type of surficial materials present before development.
The postglacial substratum refers to various types of materials (e.g., beach, stream) deposited since the retreat of the last glacier.
The till substratum phase refers to unsorted and unstratified glacial till deposits.
The outwash substratum phase refers to sorted or stratified glacial meltwater deposits.
The wet substratum and wet subsoil phases refer to areas of tidal marsh, swamp, or water which were filled for development.

South side of site:

Designation: 77 - Flatbush-Riverhead-Pavement & buildings complex, 0-8% slopes.

Depth to Bedrock: >60”

Depth to Groundwater: >40”

Solum: 1.2”/hr

Substratum: 20”/hr

Flatbush series
Parent Material: Loamy fill, less than 40 inches deep, over glacial outwash materials
Landform: Anthropogenic urban fill plains
Depth to Bedrock: Very deep
Drainage Class: Well drained
Permeability: Moderate or moderately slow in the solum; rapid or very rapid in the substratum
Soil Texture: Silt loam, loam, or sandy loam; loamy sand or sand in the substratum
Coarse Fragments: 0 to 35 percent in the solum; 5 to 60 percent in the substratum
Range in Soil pH: Very strongly acid to slightly alkaline
Hydrologic Soil Group: B
Typical Soil Profile:

A	0 to 13 inches – very dark grayish brown (10YR 3/2) fine sandy loam; weak fine subangular blocky structure; friable; 5 percent gravel; slightly acid.
Ab	13 to 21 inches – brown (10YR 4/3) silt loam; moderate fine subangular blocky structure; friable; 1 percent gravel; slightly acid.
Bwb	21 to 50 inches – yellowish brown (10YR 5/6) silt loam; weak medium subangular blocky structure; friable; 1 percent gravel; slightly acid.
2C	50 to 79 inches – dark yellowish brown (10YR 4/6) sand; massive; friable; 10 percent gravel; moderately acid.

Riverhead series
Parent Material: Glacial outwash derived mainly from granitic materials
Landform: Outwash plains
Depth to Bedrock: Very deep
Drainage Class: Well drained
Permeability*:* Moderately rapid in the solum; very rapid in the substratum
Soil Texture: Loam or sandy loam in the surface; sandy loam or loamy sand in the subsoil; loamy sand or coarser in the substratum
Coarse Fragments*:* 0 to 35 percent in the solum; 5 to 40 percent in the substratum
Range in Soil pH*:* Extremely acid to moderately acid
Hydrologic Soil Group*:* B
Typical Soil Profile:

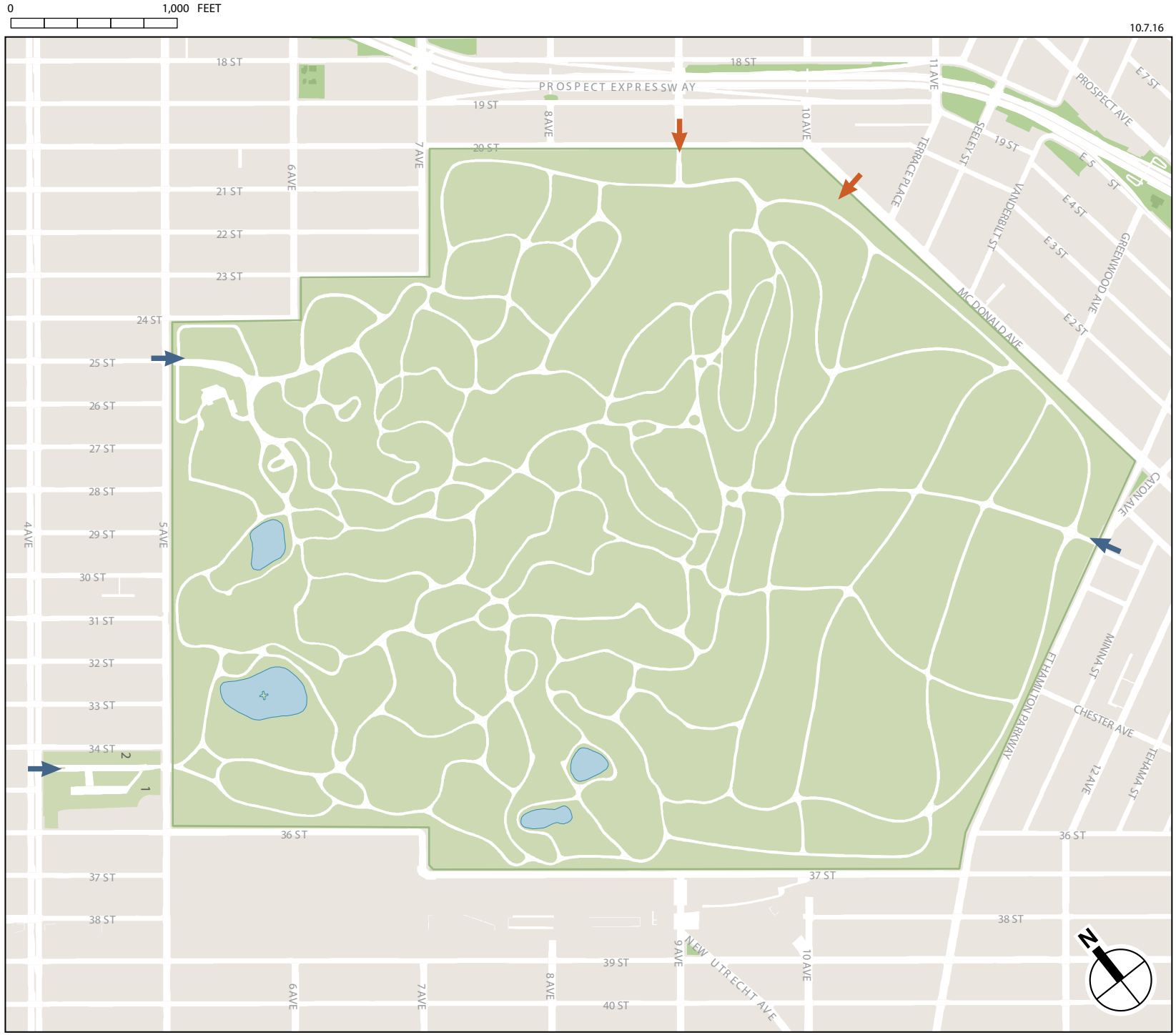
Ap	0 to 12 inches - brown (10YR 4/3) sandy loam; weak fine granular structure; friable; strongly acid; abrupt smooth boundary.
Bw	12 to 27 inches - strong brown (7.5YR 5/6) sandy loam; very weak medium subangular blocky structure parting to weak fine granular; friable; 5 percent gravel; strongly acid.
BC1	27 to 32 inches - yellowish brown (10YR 5/4) loamy sand; very weak fine granular structure; very friable; 10 percent gravel; strongly acid.
2BC2	32 to 35 inches - yellowish brown (10YR 5/4) gravelly loamy sand; massive; friable; 30 percent gravel; strongly acid.
2C1	35 to 40 inches - brown (7.5YR 4/4) sand; single grain; loose; 10 percent gravel; strongly acid; abrupt smooth boundary.
2C2	40 to 65 inches - very pale brown (10YR 7/4) coarse and medium sand stratified with 2-inch layers of gravel, 8 to 24 inches apart; single grain; loose; strongly acid.

Pavement & buildings consist of those areas in which 80% or more of the surface is covered by asphalt, concrete, buildings or other impervious materials. Substratum phases are added to provide additional information on the type of surficial materials present before development.
The postglacial substratum refers to various types of materials (e.g., beach, stream) deposited since the retreat of the last glacier.
The till substratum phase refers to unsorted and unstratified glacial till deposits.
The outwash substratum phase refers to sorted or stratified glacial meltwater deposits.
The wet substratum and wet subsoil phases refer to areas of tidal marsh, swamp, or water which were filled for development.

ELECTRICAL SERVICE

Electrical service enters the site at several locations on 4th Avenue, 5th Avenue, Fort Hamilton Parkway, 9th Avenue and McDonald Avenue (See Figure 10). Field observations such as equipment panels and manholes on the Cemetery property line suggest several electrical service points of entry on 5th Avenue (see Photo 14 in the photo package for an electrical equipment panel on 5th Avenue). Green-Wood Cemetery records confirm an electrical duct bank enters the site at the 25th Street entrance that serves the Main Office, Chapel, and Crematory. A 2" diameter conduit carrying electrical cable runs from the Main Office to an electrical box on Landscape Avenue toward the Chapel Field observations indicate electrical conduit runs to both 9th Avenue entrance buildings and the Hillside Mausoleum. These services originate from the 9th Avenue and 20th Street intersection and McDonald Avenue. Field observations also confirmed electrical service to the Fort Hamilton entrance buildings. The Mackay Mausoleum is the only private mausoleum with electrical service. The Mackay Mausoleum electrical service comes from the Fort Hamilton Parkway.

The Con Edison Company of New York (Con Ed) no longer releases their infrastructure record plates documenting existing electrical conduits and sizes in the City streets to consulting engineers or property owners for general purposes. On occasion these plates may be released to an electrical or civil engineer as part of a new service or service upgrade request with an accompanying electrical load letter describing additional electrical needs defined by an electrical engineer. The amount of electricity used annually and the maximum amount of electrical energy available to the Cemetery property were not studied in this report and the GW Engineer did not express any specific concerns over the availability of electrical power on site. However, any plan for future development within the Cemetery requiring new electrical service may include a load letter and service determination submission to Con Ed and they will provide a ruling on whether a service upgrade is warranted for the new development.



Electrical Service Per Green-Wood Cemetery Engineer and Records

Electrical Service Per Field Observations Only

Figure 10: Electrical Service Entry Points

PROJECT DESCRIPTION

PROJECT SUMMARY

The proposed project is an integrated stormwater management system to reduce the volume of water discharging to the DEP combined sewer system and to New York City's water bodies during large storm events. Additionally, the project will reduce the volume of potable water from the City supply that is used for irrigation. Based on extensive research, site visits, and discussions with multiple staff members at the Cemetery, strategies to manage the drainage area associated with the 4th Avenue sewer on the north side of the Cemetery are the most effective to reduce contributions to the combined sewer system.

The sewershed discharging to 4th Avenue is approximately 148 acres. Three proposed practice areas will manage runoff across this subcatchment. Underground storage (Practice 1) is proposed to manage water across 1.2 impervious acres in the service yard at the northwest corner of the property. Bioretention basins (Practice 2) are proposed to manage water from 33 acres (4.3 impervious acres) along the western property boundary. An Opti Continuous Monitoring and Adaptive Control system (Practice 3a) is proposed at Sylvan Water to manage the remaining 113 acres (17.2 impervious acres). The Opti system will release water into the combined sewer ahead of a storm event to create additional storage volume within the pond so that wet weather flows are reduced during rain events. A pump and grit filter (Practice 3b) are proposed adjacent to the Opti system to extract water from Sylvan Water during dry weather days to irrigate the Cemetery. These separate management practices will work in conjunction to manage runoff across all 148 acres. The conceptual plan is described below and can be seen in Figure 11 and the Conceptual Design Drawings.

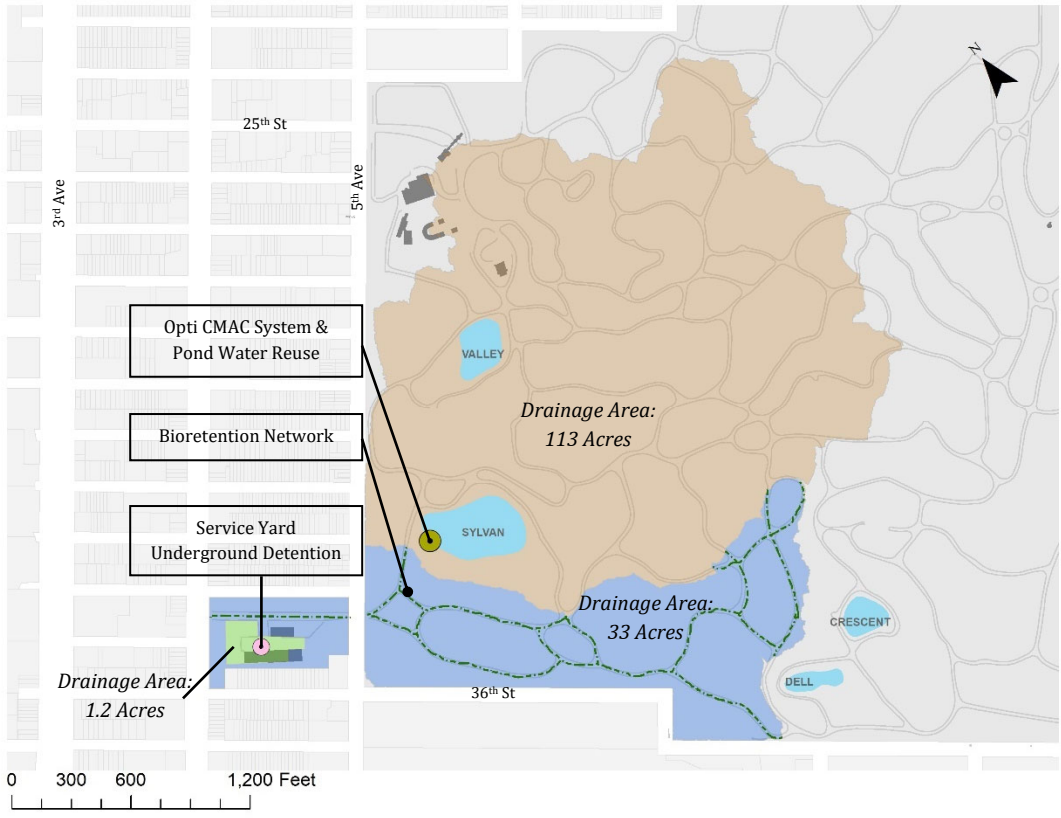


Figure 11: Conceptual Plan

WATER QUALITY VOLUME

Water quality volume calculations for each practice were done using guidance from NYS DEC for new development and redevelopment. The proposed project does not trigger these requirements such that the below calculations are used as a reference to design the most effective means of managing stormwater at the Cemetery.

Table 4.1 New York Stormwater Sizing Criteria1	
Water Quality Volume (WQV) Water Qualility	90% Rule: WQv(acre-feet) = [(P)(Rv)(A)] /12 Rv = 0.05+0.009(I) I = Impervious Cover (Percent) P(inch) = 90% Rainfall Event Number (See Figure 4.1)2 A = site area in acres

The required water quality volume (WQV) to be treated by the proposed condition of a stormwater management improvement project is defined in Table 4.1 of Chapter 4 of the New York State Stormwater Management Design Manual, which outlines the 90% rule. Calculating the WQV with the 90% rule utilizes the following equation:

$$WQV = \frac{P * (0.05 + 0.009 * I) * A}{12}$$

Where:

WQV = the water quality volume in acre-feet.

P = the depth of the 90% rainfall event in inches, which can be found in figure 4.1 of the same manual.

I = impervious cover as a percentage of total area.

A = the site area in acres.

Applying this across the entire project area:

$$WQV = \frac{1.5\ in * (0.05 + 0.009 * 15\%) * 148\ ac}{12} * 43{,}560 * 7.48 = \ \ 1{,}128{,}182\ gallons$$

The water quality volume goal for the entire project watershed is *1.128 million gallons*. The water quality volumes for individual practices can be seen below in Table 2 and calculations can be found in the Appendix.

	Practice 1	***Practice 2***	***Practice 3***
	Service Yard Underground Detention	*Bioretention Network*	*Opti CMAC System*
Total Drainage Area (ac)	**1.2**	**33**	**113**
Impervious Area (ac)	**1.2**	**4.3**	**17.2**
Target Water Quality Volume (gal)	**46,431**	**224,822**	**856,930**
Estimated Water Quality Volume Provided (gal)	**61,908**	**224,822**	**1,055,755**
Estimated Volume Managed Annually (gal)	**1,500,000**	**6,700,000**	**42,700,000**

Table 2: Practice Summary

The estimated volume managed calculations shown in Table 2 are estimates provided during conceptual design development. The bioretention areas will be designed with the goal of achieving this water quality volume target and will be refined through additional site investigations as described in the Practice 2 summary below. The Opti CMAC system treatment volumes were calculated by Opti as part of a technical summary provided to NYC DEP. Details of these calculations are provided in the Practice 3 summary below and in the Appendix.

PRACTICE 1 – SERVICE YARD UNDERGROUND DETENTION

A subsurface detention facility is proposed in the cemetery's service yard, located in the northwest corner of the property. The service yard is nearly 100% impervious cover and includes a 7,400 square foot building (with internal downspouts) and 46,100 square foot parking area, which together attribute to the directly connected impervious acreage. The total drainage area to the proposed practice is 1.2 acres. The proposed practice and drainage area can be seen in Figure 12.

Figure 12: Practice 1 - Service Yard Underground Detention Drainage Area

The proposed retrofit will be funded externally by NYC DEP and will collect runoff from both the building rooftop and existing parking lot into an underground detention system that is sized to manage a minimum WQv of 1.5 inches (an initial target of 2" will be confirmed during design) across the drainage area. See the Conceptual Plan Drawings for BMP details.

Assumptions:

- The proposed project is expected to contribute to Green-Wood Cemetery's Local Match, as required by the GIGP funding.
- Grant funding may be utilized to cover construction overages should they exceed the reimbursement provided by NYC DEP for the delivered greened acreage.

Data Gaps:

- Need to confirm roof downspout connection

PRACTICE 2 –BIORETENTION NETWORK

A network of hydraulically connected bioretention facilities is proposed along the western drainage area adjacent to Sylvan Water. This network will function as a treatment train for managing runoff within the rights-of-way. The practices will be designed and sized to maximize water quality treatment across the 33-acre drainage area. This bioretention network will be designed to optimally attenuate peak flows by managing much of the 4.3-acre impervious area. The impervious area consists of a 5,700 square foot roof and the remainder is pedestrian and vehicular roadways. The drainage area and bioretention network can be seen in Figure 13.

Figure 13: Practice 2 – Bioretention Network Drainage Area

The bioretention network will be designed to be scalable in its implementation, given the design unknowns as described below. It is the intent during the design process to size, locate and implement to the Maximum Extent Practicable this series of bioretention basins within this watershed to maximize the cost/treated volume. It is estimated that approximately $700,000- $900,000 of grant funding may remain after the Opti and reuse projects are completed (each of these projects require additional site investigation and full design prior to understanding fully delivered construction costs); therefore, our design will target the maximum treatment volume within this budget range and given the site constraints determined during site investigations. The design target will be to achieve the minimum water quality volume as shown in the Practice summary in the water quality volume section above; however, the final treated volume may be less than this value once final design is completed. See the Conceptual Plan Drawings for BMP details.

Figure 14 shows a bioretention basin in Mount Olivet Cemetery as an example of the type of basin being proposed. A conceptual drawing of a typical basin can be seen in Figure 15.

Figure 14: Example Roadside Bioretention Basin at Mount Olivet Cemetery– (*The Nature Conservancy*)

Assumptions:

- All bioretention basins will be designed and permitted in accordance with NYS DEC and NYC DEP regulations
- The total area required for bioretention basins will be determined during the design process as soil testing is still required once final locations are selected to determine if underdrains are required due to soil permeability.
- Based on the NYS DEC Green Infrastructure Worksheets from a 1.5" rain event[1] the total required bioretention network footprint is estimated between 17,891 and 51,525 sq ft, depending on soil infiltration rates and underdrain requirements. This is proposed to be accommodated within the roadway ROW in the drainage area.
- Additional treatment may be provided at the service yard. The service yard has approximately 8,500 square feet of usable area for bioretention basins for the area not being managed by Practice 1, and various additional practices will be distributed along the roadways within this drainage area.

Data Gaps:

- Drainage area, impervious area, soil types, topography, and hydrology were all provided by Green-Wood and through desktop research for this analysis and will be confirmed during the design process.
- Prior to detailed engineering design, a field investigation will be completed in the area along the proposed bioretention treatment train. This due diligence will include a detailed site

[1] New York State Department of Environmental Protection Green Infrastructure Worksheet https://www.dec.ny.gov/chemical/8694.html

survey, geotechnical investigation, and infiltration testing within the right-of-way of the proposed BMP footprint (see Conceptual Design Drawings).

- While it is unlikely that any below ground foundations exist within the proposed practice area, it is possible that the current and historic land use of the cemetery could reveal a need for ground penetrating radar to verify the absence of historic subsurface structures.

Figure 15: Bioretention Conceptual Design

PRACTICE 3 – OPTI CMAC SYSTEM & POND WATER REUSE

The combination of an Opti Continuous Monitoring and Adaptive Control (CMAC) and a grit filter and pump are proposed to be installed adjacent to Sylvan Water to control water levels ahead of a significant rain event and utilize excess pond water for irrigation across the site. The drainage area is 113 acres with 17.2 impervious acreage within roadways. The drainage area and practice location can be seen in Figure 16.

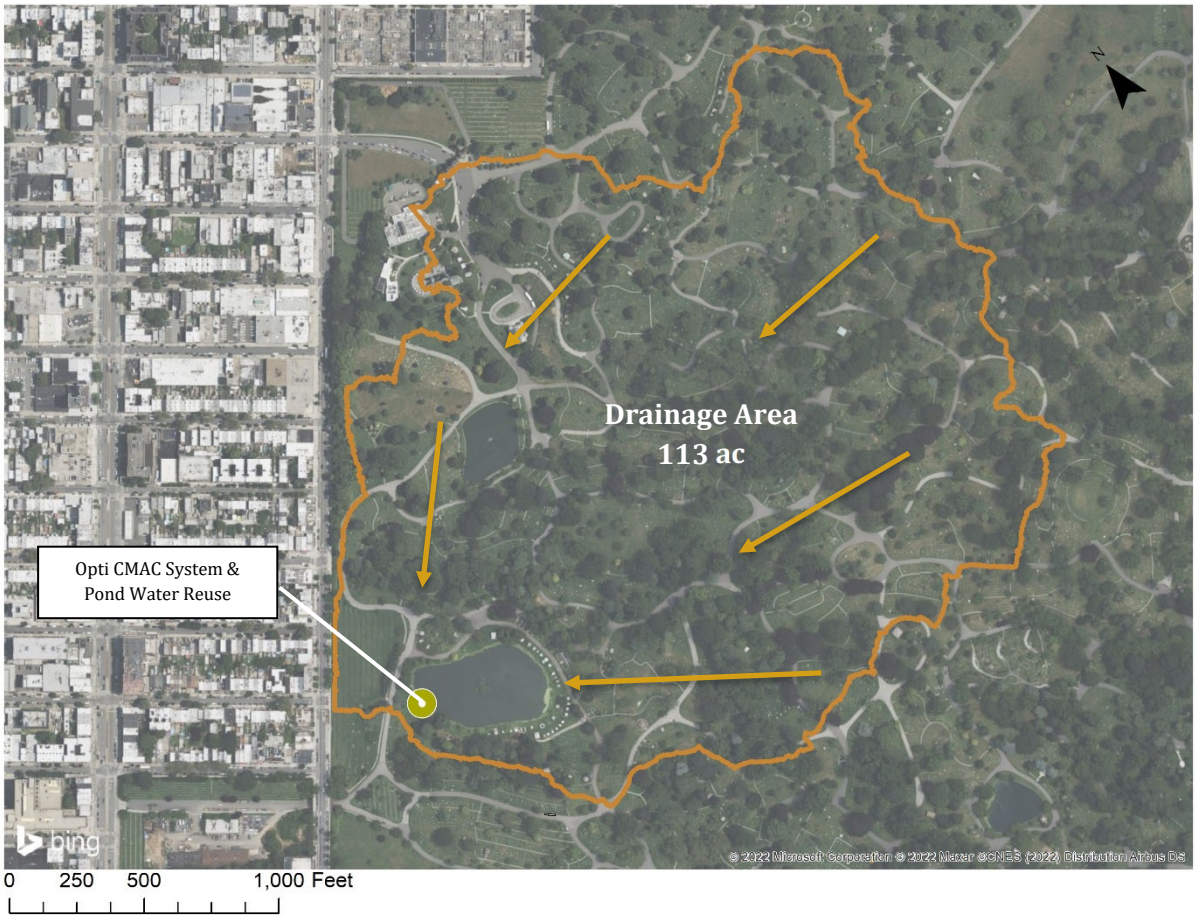


Figure 16: Practice 3 – Opti CMAC System & Pond Water Reuse Drainage Area

PRACTICE 3A – OPTI CMAC SYSTEM

An Opti CMAC system is proposed to be installed at the discharge point of Sylvan Water. There is currently a passive Opti system at the site which acts as a weather station and measures the flow of water discharging to the combined sewer. Results of a study to prove the effectiveness of the system can be found in the Appendix.

The proposed retrofit of Sylvan Water is the installation of Opti Continuous Monitoring and Adaptive Control (CMAC) technology to limit contribution to the combined sewer during wet weather. Opti CMAC technology utilizes the National Weather Service forecast and on-site sensors to make predictive and automated decisions in advance of a storm to control water levels to create storage for incoming runoff (Figure 17). Control logic at Sylvan Water will be developed to determine the start time, duration, and rate of water discharge. Once rainfall begins, discharge from the pond would be controlled to limit outflow to a pre-defined rate to meet project objectives.

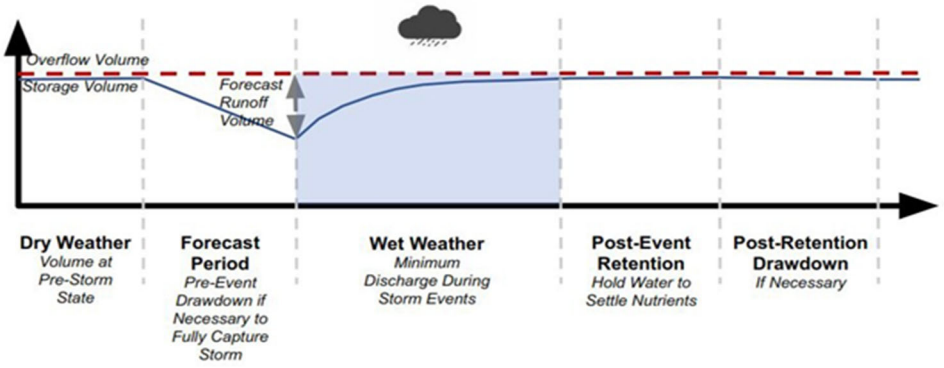


Figure 17: Example Opti CMAC Control logic for Sylvan Water retrofit

The proposed Sylvan Water retrofit using Opti CMAC will increase the water quality benefit and wet weather discharge control of the drainage area. Peak wet weather discharge during the 1.5" and the 10-year rainfall event would be controlled at a rate of 1.67 cfs (0.1 cfs/impervious acre). The water level would be drawdown at Sylvan Water by approximately 1.6-feet and 2.1-feet, 24-hours in advance of the 1.5" and 10-year storm, respectively.

Managing wet weather discharge for the 1.5" design storm at the target rate of 1.67 cfs (0.1 cfs/impervious acre) would allow the pond to be credited as a Type II facility. This would result in approximately 26 greened acres (1.5" x 17.2 impervious acres) from the Sylvan Water retrofit project. In addition to the greened acreage, this project is estimated to result in an approximate reduction of 25.1 million gallons per year from CSO events.

Each Opti CMAC retrofit scenario would require 24-hour pre-event drawdown to achieve the results in Table 1. This would require stored water in the pond to be discharged during dry weather in advance of a rainfall event. The average dry weather discharge rates to achieve the wet weather results from Table 3 are approximately 2.1 cfs and 2.6 cfs for the 1.5" storm and the 10-year storm, respectively. It is assumed that pre-event discharge at these rates will be allowable during dry weather.

Table 3: Runoff Depth Managed through Opti System

Scenario	1.5" Design Storm Overflow		10-year, 58 minute, design storm (1.86") Overflow	
	<= 1.67 cfs	>1.67 cfs	<= 1.67 cfs	>1.67 cfs
Existing (in)	0.27	1.23	0.26	1.60
Opti (in)	1.50	0	1.86	0

Assumptions:

- Target flow rate for greened acre credit is 0.1 cfs /impervious acre. This results in a target rate of 1.67 cfs.
- 10-year storm duration and intensity were determined using 2012 DEP BWSO guidance for detention facility design.

- Greened acre calculation was performed using runoff depth managed over the entire drainage area (1.5”). This was multiplied by the impervious area to obtain greened acres. The total volume managed for the 1.5” rainfall event (179,162 cf) over the impervious area is equivalent to 2.96” per impervious acre. The 1.5” runoff depth was used to be conservative. Initial modeling shows that the system can manage 1.86” (which was used for the provided water quality volume calculations)
- Detention design guidance from DEP/BWSO was used for this analysis. This does not consider any detention/reduction in peak inflow to Sylvan Water that is occurring.
- Reduced peak inflow would decrease the drawdown needed in advance of a storm and reduce the pre-event discharge rate.

Data Gaps:

- Stage-storage information of Sylvan Water is assumed based on best available information. Depth of drawdown may change based on survey and bathymetric data obtained during design phase.
- Drainage area and impervious area was provided by Green-Wood for this analysis and will be confirmed during the design process.
- The condition of the pond discharge pipe to the sewer network is unknown and will require additional investigation to determine if additional measures may be required to replace the outfall structure.

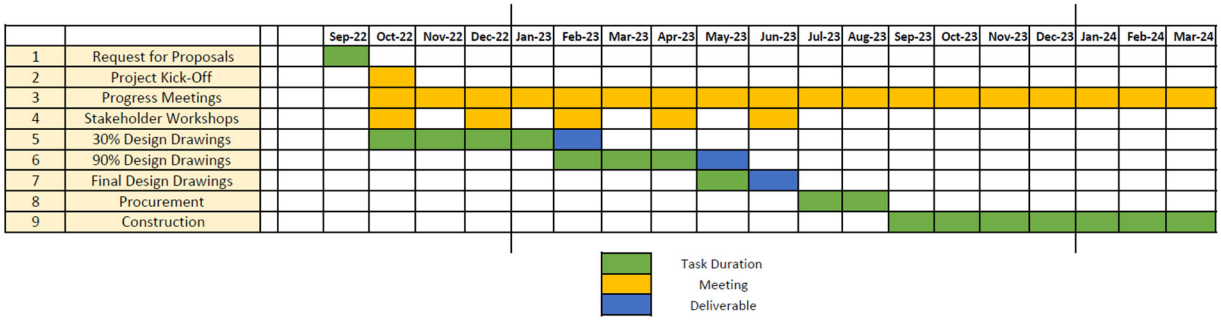
PRACTICE 3B - POND WATER REUSE

Adjacent to the proposed Opti system, a 60psi 50gpm duplex submersible pump and grit filter will be installed below grade to pump water out of Sylvan Water to be used for irrigation across the Cemetery. A hose will run from the pump to the paved pathway, where it will fill a 500-gallon tanker truck. The location of the pump and hose system can be seen in the Conceptual Design Drawings. The pump will use electrical service entering at the Service Yard.

According to DEP water bills at the service yard, the Cemetery utilizes approximately 8,100 gallons per day of water for irrigation during the 7-month irrigation season. The total volume of Sylvan Water is approximately 8.8 million gallons. Extracting this volume from the pond during the irrigation season from April to October creates additional space in the water body for water flow during rain events and reduces the overall potable water demand at the Cemetery.

PROPOSED PROJECT SCHEDULE

The duration of the design phase is expected to last nine months, from October 2022 to June 2023. Procurement follows and construction is expected to be completed in March 2024.



ANTICIPATED REGULATORY APPROVAL AND PERMITS

The proposed project will be constructed on private property. There is not a proposed increase to the impervious areas on site and thus, according to the NYC DEP Guidelines for the Design and Construction of Stormwater Management Systems (2012), the project is not subject to the stormwater performance standards. The proposed project does not include an additional sewer connection and does not include any retrofit or renovation of buildings at the Cemetery. The site discharges to a combined sewer and does not directly discharge to a DEC water body. All required grading, construction and environmental permits will be determined during final design and will be obtained before any construction commences on site.

PROJECT COST ESTIMATE

Table 4: Cost Estimate

Practice	Scope Description	Estimated Cost
#1 Underground Detention	Design/Build Underground Detention System in Service Yard	Funding to be provided by NYCDEP ($490,000 est)
#2 Bioretention Network[1]	2.1 Design and Permitting	$258,400
	2.2 Construction	$569,800
Practice #2 Subtotal		**$828,200**
#3a Opti CMAC System[2]	3a.1 Design and Permitting	$158,000
	3a.2 Hardware and Hardware Commissioning	$60,000
	3a.3 Software Configuration, Optimization and Licensure	$150,000
	3a.4 Basin Retrofit, Outfall Replacement, Equipment Installation[3]	$343,800
Practice #3a Subtotal		**$711,800**
#3b Pump and Grit Filter System	3b.1 Materials (Pump, Wet Well, Piping, Filtration System)	$62,027
	3b.2 Materials Installation	$10,500
	Practice #3b Subtotal	**$72,527**
	Project Subtotal	**$1,612,527**
	Contingency (20%)	**$322,505**
	Agency Review/Inspection (2%)	**$38,701**
	Total Project Request	**$1,973,733**

1. Bioretention cost estimates are extrapolated from final costs of completed bioretention project constructed in 2019 at Sacred Heart Church in Detroit by The Nature Conservancy with a similar design intent.
2. Costs provided by OptiRTC, Inc.
3. Does not include pond dredging, potential conveyance upgrades, or embankment rehabilitation.

LONG-TERM OPERATION AND MAINTENANCE

Table 4-1 in Chapter 4 of the New York City Stormwater Design Manual outlines routine maintenance tasks and frequencies for vegetated bioretention SMPs. The relevant contents of the table are replicated below.

Table 5: Maintenance Schedule

Task	Description	Frequency
Watering	Watering of new plantings during first two years of establishment.	During extended dry periods of no significant precipitation within 7 days, or as needed based on plant condition.
Weeding	Removal of non-native or undesirable vegetation.	Quarterly at minimum during the growing season or more frequently based on inspections.
Mulching	Mulching of planting beds.	Once annually for first two growing seasons or until beds have filled in.
Sediment Removal	Removal of accumulated sediment and debris from infiltration/filtration areas	Twice per year or more frequently if needed based on inspections (note: leaves and other natural materials can be left in place).
Inlet Cleaning	Vacuum cleaning of accumulated sediment and debris within inlets.	Twice per year or more frequently based on inspections if sediment and debris accumulation is rapid.

Maintenance Guidance from the NYS Stormwater Design Manual Chapter 6.4.6:

- Sediment shall be cleaned out of the sedimentation chamber when it accumulates to a depth of more than six inches. Vegetation within the sedimentation chamber shall be limited to a height of 18 inches. The sediment chamber outlet devices shall be cleaned/repaired when drawdown times exceed 36 hours. Trash and debris shall be removed as necessary.
- Silt/sediment shall be removed from the filter bed when the accumulation exceeds one inch. When the filtering capacity of the filter diminishes substantially (i.e., when water ponds on the surface of the filter bed for more than 48 hours), the top few inches of discolored material shall be removed and shall be replaced with fresh material. The removed sediments shall be disposed in an acceptable manner (i.e., landfill).
- A stone drop (pea gravel diaphragm) of at least six inches shall be provided at the inlet of bioretention facilities (F-6). Areas devoid of mulch shall be re-mulched on an annual basis. Dead or diseased plant material shall be replaced.
- Organic filters or surface sand filters that have a grass cover should be mowed a minimum of three times per growing season to maintain maximum grass heights less than 12 inches.

MONITORING

As part of this project, Green-Wood Cemetery is partnering with Temboo to install soil moisture and or water sensors to bioretention basins to track the impact of maintenance efforts, including; pulling weeds that can compete with water and soil nutrients; watering basins during drought periods; aerating soil to reduce compaction and improve water absorption; adding layers of compost and mulch to the basin to prevent compaction, improve soil quality, and installing native plants that attract native pollinators. The sensors will verify and quantify the amount of stormwater offset into the municipal storm drains due to maintenance of bioretention basins only when needed, based on real-time soil moisture data, and be used as a maintenance tracking asset.

Temboo's mission is to empower organizations to improve their environmental impact, one small sensor at a time, using technology, environmental data, and maintenance. With Temboo's innovative code generation tools and intuitive user interfaces that collect and display environmental data in real time, anyone on Green-Wood's team or invited community members can use this information collaboratively to measure, maintain, and quantify the benefits of green infrastructure.

Green-Wood Cemetery and Temboo will also co-create workforce development programs to provide the Groundskeepers staff with upskilling, hands-on training with interactive technology that will reduce maintenance time out in the field and save irrigation costs. The skill set enabled with this partnership will help implement workforce maintenance practices to sustain investments in green infrastructure and allow more time to be dedicated to other departments to further develop sustainability efforts.

APPENDIX

DESIGN CALCULATIONS

PRACTICE 1 - SERVICE YARD UNDERGROUND DETENTION

Target Water Quality Volume:

$$WQV = \frac{P * (0.05 + 0.009I) * A}{12} = \frac{1.5\ in * (0.05 + 0.009 * 100\%) * 1.2\ acre}{12} = 6{,}207\ \text{ft}^3 =$$

$$46{,}431\ gallons$$

Water Quality Volume Practice Estimate:

$$WQV = \frac{P * (0.05 + 0.009I) * A}{12} = \frac{2.0\ in * (0.05 + 0.009 * 100\%) * 1.2\ acre}{12} = 8{,}276\ \text{ft}^3 =$$

$$61{,}908\ gallons$$

- The NYC DEP Wastewater Resiliency Plan[2] was used to find an average of 1 rainfall event per year that exceed 2 inches (figure 2). The annual maxima for daily precipitation was extrapolated at 3.2 inches.
- 3.2 inches not managed by Practice 1
- Using Table 3 from the NYC DEP Wastewater Resiliency Plan and weather data[1] from (1969-2019), the average total rainfall per year was estimated at 50.4 inches of total rainfall.
- 50.4 inches total rainfall – 3.2 inches not managed by underground detention= 47 inches managed
- 47 inches/ year * 1.2 acres = 1.5 million gallons

PRACTICE 2 – BIORETENTION NETWORK

Target Water Quality Volume:

$$WQV = \frac{P * (0.05 + 0.009I) * A}{12} = \frac{1.5\ in * (0.05 + 0.009 * 13\%\%) * 33\ acre}{12} = 30{,}056\ \text{ft}^3 =$$

$$224{,}822\ gallons$$

[2] https://www1.nyc.gov/assets/dep/downloads/pdf/climate-resiliency/climate-chapter-4.pdf

Water Quality Practice Estimate:

$$WQV = \frac{P * (0.05 + 0.009I) * A}{12} = \frac{1.5\ in * (0.05 + \ 0.009 * 13\%\%) \ * \ 33\ acre}{12} = 30{,}056\ \text{ft}^3 =$$

$$224{,}822\ gallons$$

Annual Runoff Reduction:

- The NYC DEP Wastewater Resiliency Plan was used to find an average of 2 rainfall events per year that exceed 1.5 inches (figure 2). The annual maxima for daily precipitation was extrapolated at 3.2 inches.
- Two events at 3.2 inches = 6.4 inches not managed by the proposed bioretention basins
- Using Table 3 from the NYC DEP Wastewater Resiliency Plan and weather data[1] from (1969-2019), the average total rainfall per year was estimated at 50.4 inches of total rainfall.
- 50.4 inches total rainfall – 6.4 inches not managed by bioretention = 44 inches managed
- Annual runoff reduction = (44 inches/ 1.5 inches)* 30,056ft^3 = 881,642 ft^3 for the total rainfall over one year or 6.7 million gallons/yr assuming all proposed bioretention area is installed

PRACTICE 3 – OPTI CMAC SYSTEM

Target Water Quality Volume:

$$WQV = \frac{P * (0.05 + 0.009I) * A}{12} = \frac{1.5\ in * (0.05 + \ 0.009 * 15\%) \ * \ 113\ acre}{12} = 114{,}563\ \text{ft}^3$$

$$856{,}930\ gallons$$

Water Quality Volume Practice Estimate:

$$WQV = \frac{P * (0.05 + 0.009I) * A}{12} = \frac{1.86\ in * (0.05 + \ 0.009 * 15\%) \ * \ 113\ acre}{12} = 141{,}146\ \text{ft}^3 =$$

$$1{,}055{,}775\ gallons$$

Annual Runoff Reduction:

The total volume managed by the Opti System over a year can be calculated as follows:

d = rainfall depth over the watershed in one year, in inches = 50.37 inches (or approximately 4.2 ft)

i = The system can manage up to the 1.86" rain event with this design. NYC considers the 1.5" as the 90% event. Therefore the 1.86" event is approximately the 92% event.

c = The runoff coefficient for the site is assumed to be 0.3 (NYC multiplier used to approximate runoff)

$$dciA = 4.2\ ft * .92 * 0.3 * 113\ acres * \frac{43{,}560 ft^2}{1\ acre} = 5{,}705{,}907\ ft^3\ or\ 42.7\ million\ gallons/\ yr$$

In addition to the above calculations, a 2-ft draw down of Sylvan Water results in an additional storage volume of 1.82 million gallons and therefore the Opti system effectively manages the water quality volume for this watershed.

Bioretention Worksheet

(For use on HSG C or D Soils with underdrains)

Af=WQv*(df)/[k*(hf+df)(tf)]

Af	Required Surface Area (ft2)
WQv	Water Quality Volume (ft3)
df	Depth of the Soil Medium (feet)
hf	Average height of water above the planter bed
tf	Volume Through the Filter Media (days)

k — The hydraulic conductivity [ft/day], can be varied depending on the properties of the soil media. Some reported conductivity values are: ***Sand*** - 3.5 ft/day (City of Austin 1988); ***Peat*** - 2.0 ft/day (Galli 1990); ***Leaf Compost*** - 8.7 ft/day (Claytor and Schueler, 1996); ***Bioretention Soil*** (0.5 ft/day (Claytor &

Design Point:	

Enter Site Data For Drainage Area to be Treated by Practice							
Catchment Number	**Total Area** *(Acres)*	**Impervious Area** *(Acres)*	**Percent Impervious** *%*	**Rv**	**WQv** *(ft^3)*	**Precipitation** *(in)*	**Description**
1	33.00	4.30	0.13	0.17	30056.40	1.50	
Enter Impervious Area Reduced by Disconnection of Rooftops			13%	0.17	30,056	<<WQv after adjusting for Disconnected Rooftops	
Enter the portion of the WQv that is not reduced for all practices routed to this practice.						*ft^3*	

Soil Information			
Soil Group	C		
Soil Infiltration Rate	0.45	*in/hour*	*Okay*
Using Underdrains?	Yes	*Okay*	

Calculate the Minimum Filter Area				
		Value	Units	Notes
WQv		30,056	*ft^3*	
Enter Depth of Soil Media	*df*	3	*ft*	*2.5-4 ft*
Enter Hydraulic Conductivity	*k*	0.5	*ft/day*	
Enter Average Height of Ponding	*hf*	0.5	*ft*	*6 inches max.*
Enter Filter Time	*tf*	1	*days*	
Required Filter Area	***Af***	**51525**	***ft^2***	

Infiltrating Bioretention Worksheet

(For use on HSG A or B Soils without underdrains)

WQv ≤ VSM + VDL + (DP x ARG)

VSM = ARG x DSM x nSM

VDL (optional) = ARG x DDL x nDL

Design Point:							
Enter Site Data For Drainage Area to be Treated by Practice							
Catchment Number	**Total Area** *(Acres)*	**Impervious Area** *(Acres)*	**Percent Impervious** *%*	**Rv**	**WQv** *(ft^3)*	**Precipitation** *(in)*	**Description**
1	33.00	4.30	0.13	0.17	30056.40	1.50	
Enter Impervious Area Reduced by Disconnection of Rooftops		0.00	13%	0.17	30,056	<<WQv after adjusting for Disconnected Rooftops	
Enter the portion of the WQv that is not reduced for all practices routed to this practice.					0	*ft^3*	

Infiltrating Bioretention Parameters				
Treatment Volume	WQv	30,056	*ft^3*	
Enter depth of soil Media	DSM	3.00	*ft*	*2.5 - 4 ft*
Enter depth of drainage	DDL	0.70	*ft*	*≥ 0.5 ft*
Enter ponding depth above surface	DP	0.5	*ft*	*≤ 0.5*
Enter porosity of Soil Media	nSM	0.30		*≥20%*
Enter porosity of Drainage	nDL	0.40		*≥ 40%*
Required Bioretention Area	ARG	17891	*sf*	
Bioretention Area Provided		22753	*ft2*	
Native Soil Infiltration Rate		1.20	*in/hr*	*Okay*
Are you using underdrains?		No		
Total Volume Provided		38,225	*ft^3*	*Sum of storage Volume Provided in each layer*

Determine Runoff Reduction			
Runoff Reduction	**30,056**	***ft^3***	***This is 80% of storage volume provided or WQv whichever is less***
Volume Treated	0	*ft^3*	*This is the portion of the WQv that is not reduced in the practice*
Sizing √	*OK*		*Check to be sure Area provided ≥ Af*

National Stormwater Calculator Report

Results

Green-Wood Cemetery

Parameter	Current Scenario
Site Characteristics	
Site Area (acres)	12
Hydrologic Soil Group	B
Hydraulic Conductivity (in/hr)	0.4
Surface Slope (%)	5
Precip. Data Source	NEW YORK LA GUARDIA AP
Evap. Data Source	NEW YORK LA GUARDIA AP
Climate Change Scenario	None
Land Cover	
% Forest	0
% Meadow	0
% Lawn	84
% Desert	0
% Impervious	16
LID Controls	
% Disconnection	0
% Rain Harvesting	0
% Rain Gardens	0
% Green Roofs	0
% Street Planters	100 / 15
% Infiltration Basins	0
% Permeable Pavement	0
Analysis Options	
Years Analyzed	20
Ignore Consecutive Wet Days	False
Wet Day Threshold (inches)	0.1

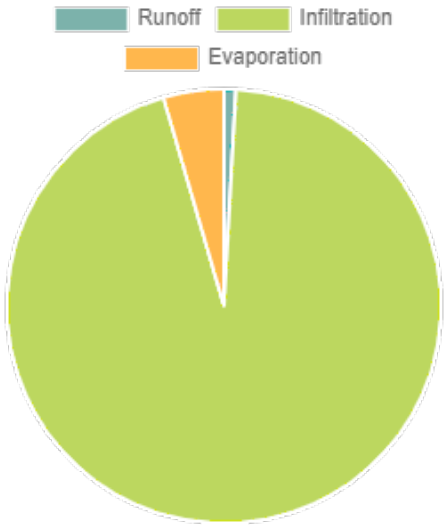
National Stormwater Calculator Report

Results

Site Summary

Current Scenario

Annual Rainfall: 43.82 in.

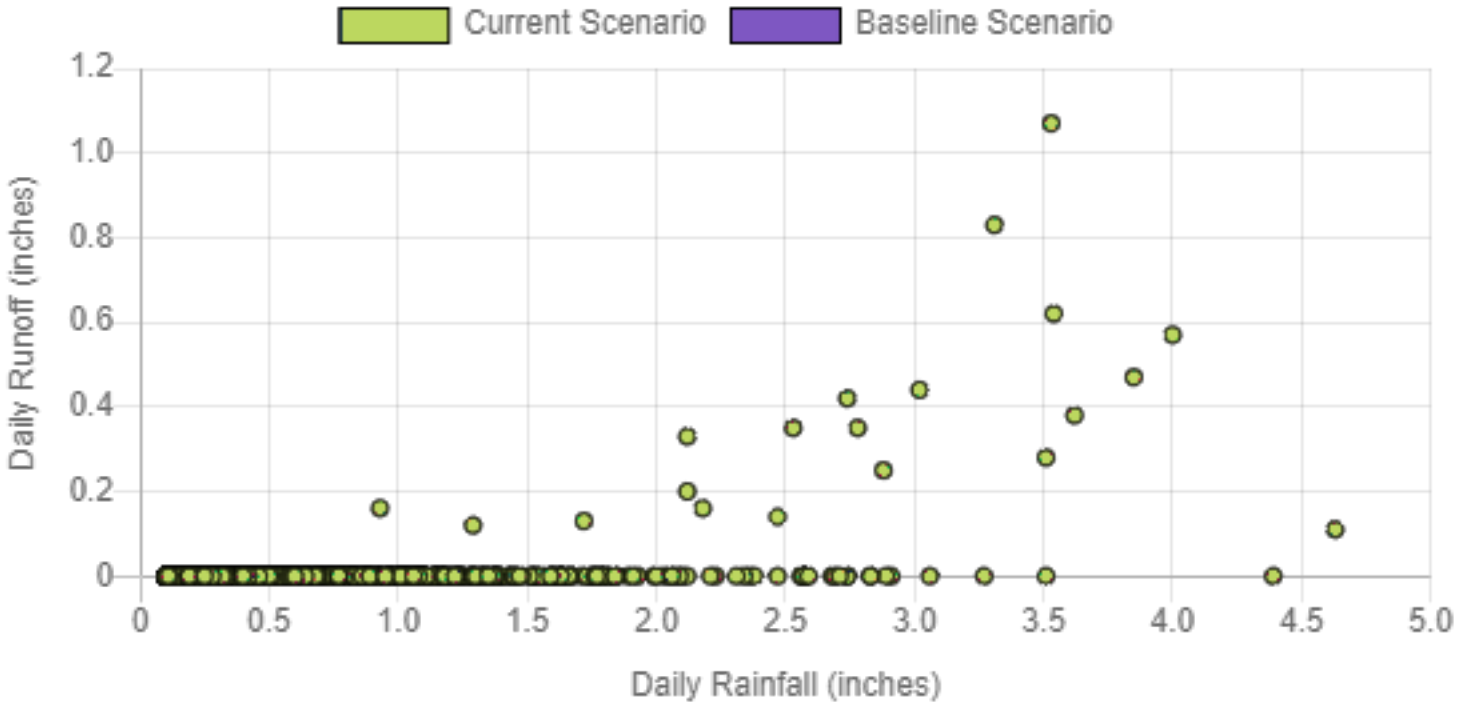


Statisic	Current Scenario
Average Annual Rainfall (inches)	43.82
Average Annual Runoff (inches)	0.38
Days per Year with Rainfall	73.30
Days per Year with Runoff	1.00
Percent of Wet Days Retained	98.64
Smallest Rainfall w/ Runoff (inches)	0.93
Largest Rainfall w/o Runoff (inches)	4.39
Max Rainfall Retained (inches)	4.52

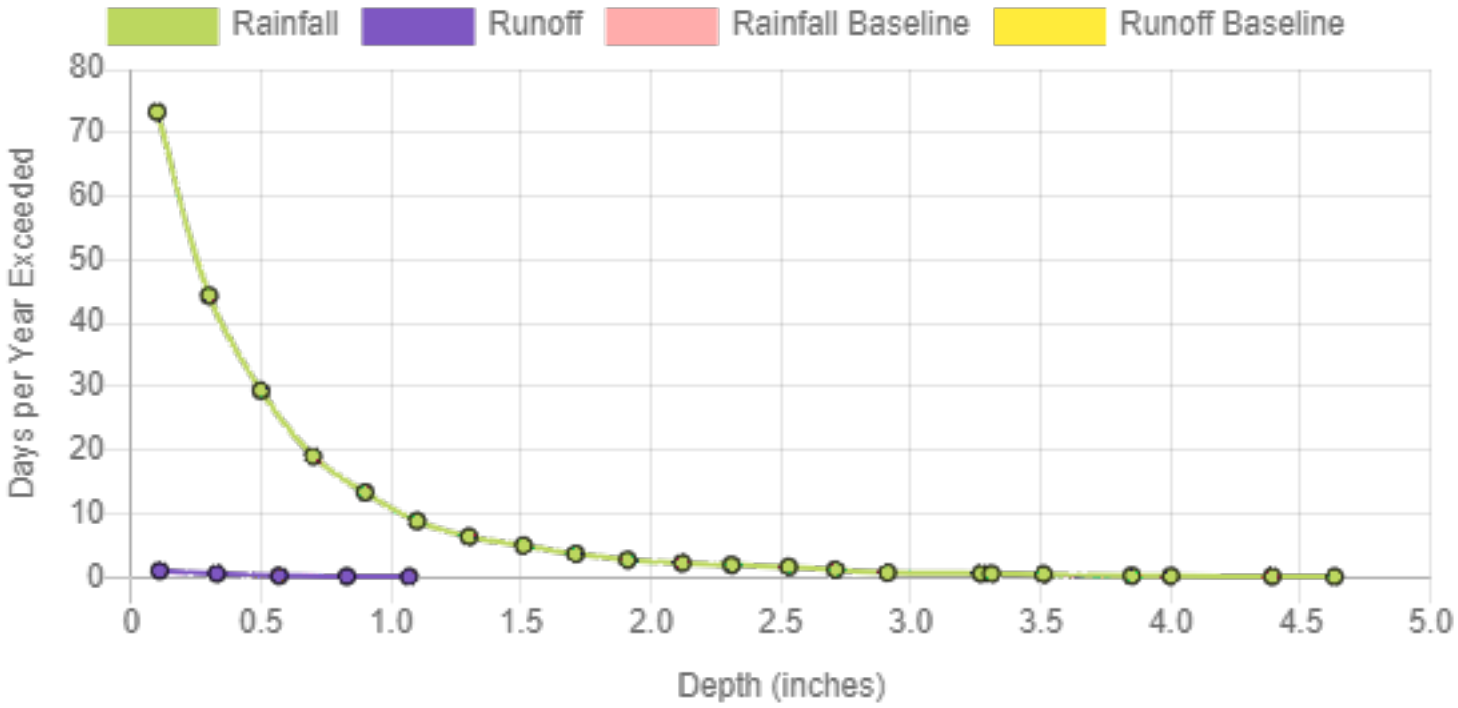
National Stormwater Calculator Report

Results

Rainfall / Runoff Events



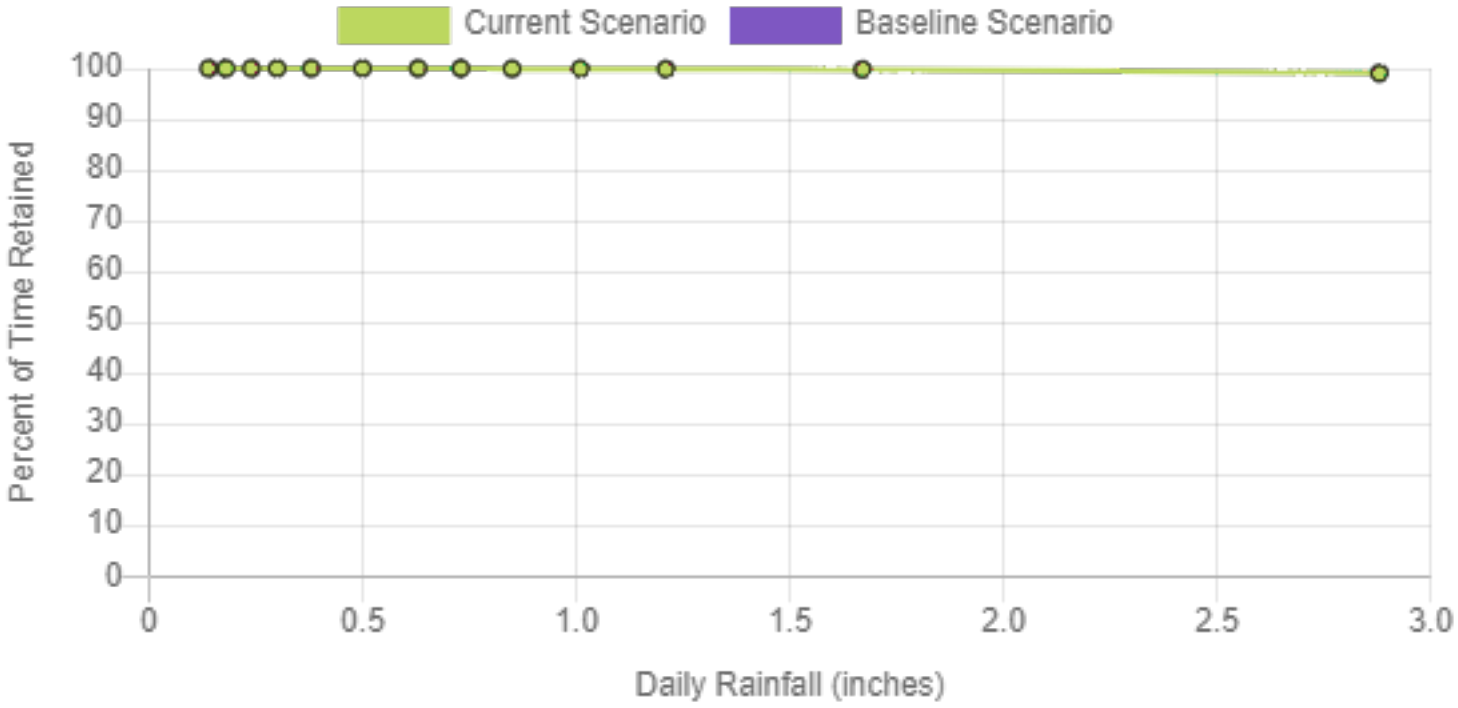
Rainfall / Runoff Exceedance Frequency



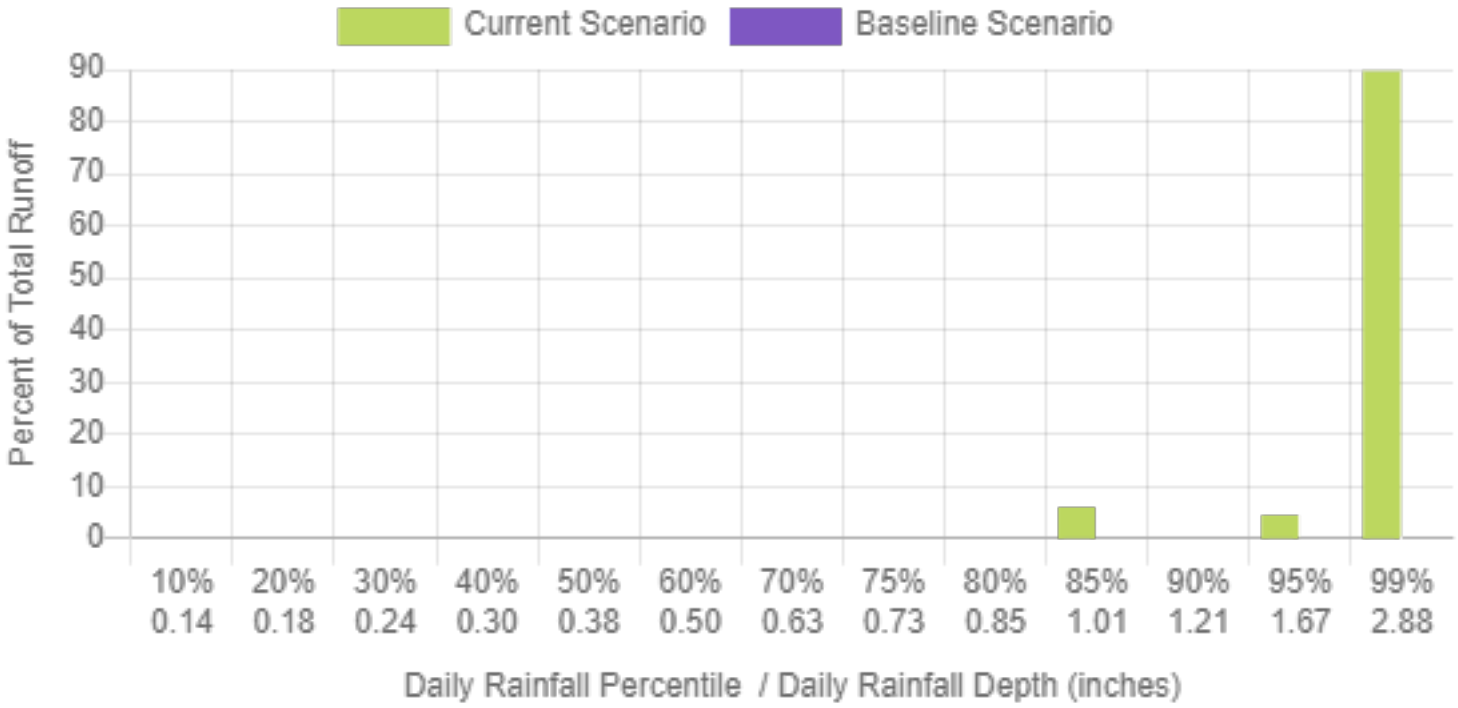
National Stormwater Calculator Report

Results

Rainfall Retention Frequency



Runoff Contribution by Rainfall Percentile

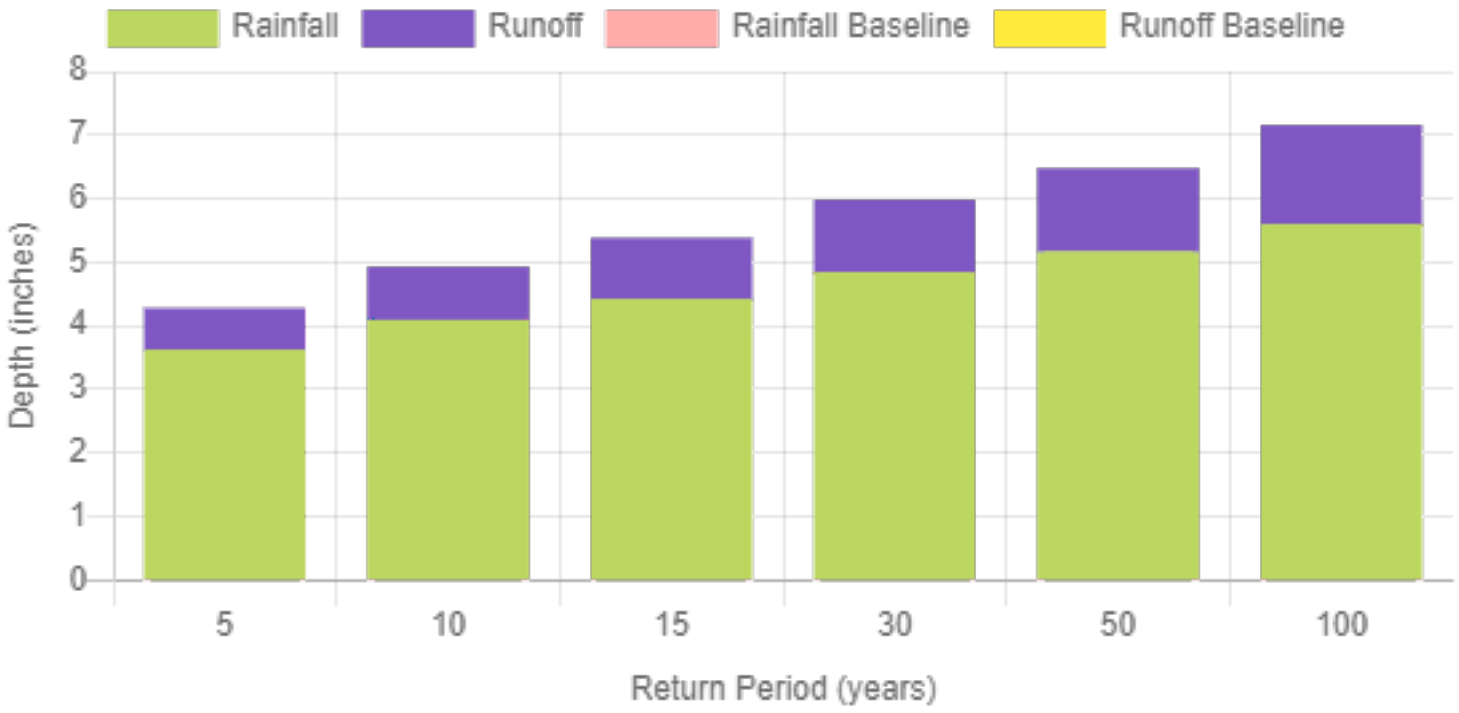


National Stormwater Calculator Report

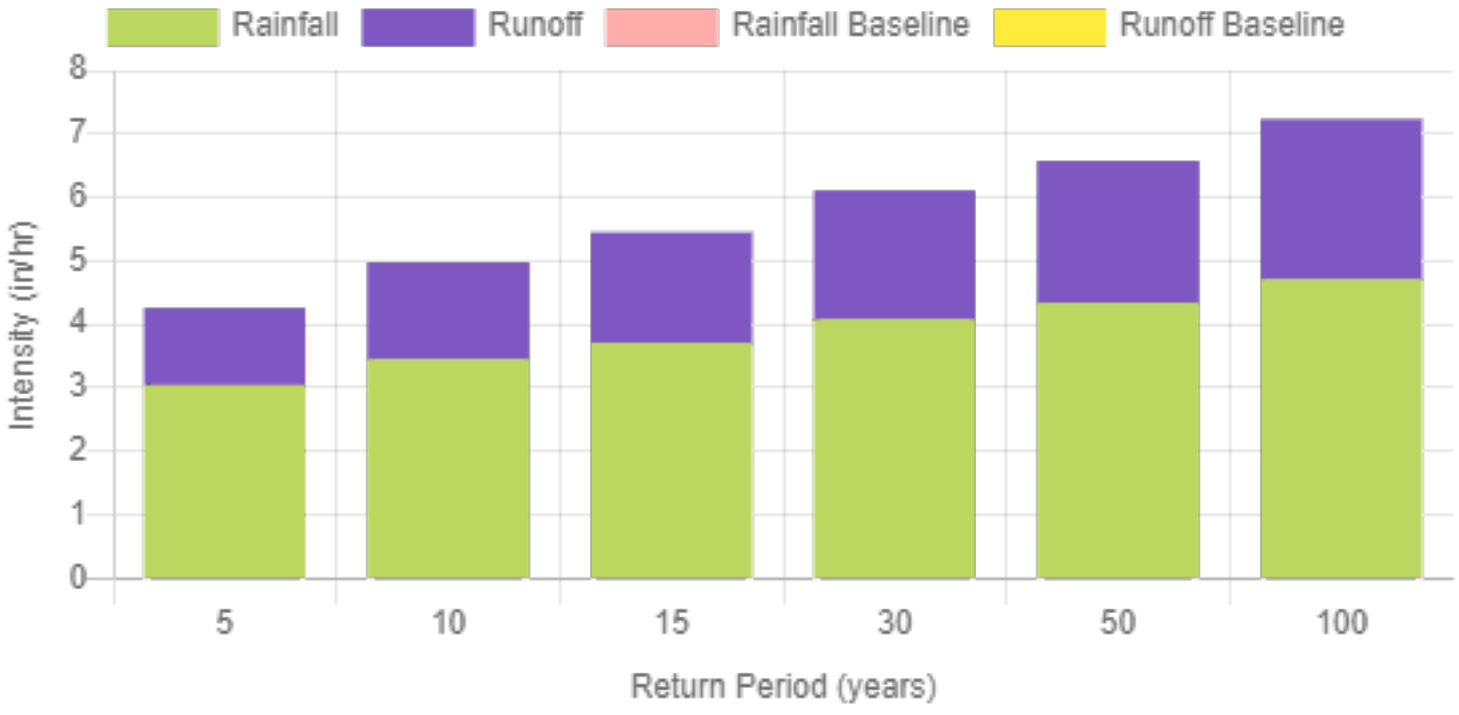
Results

Extreme Event Rainfall / Runoff

Extreme Event Rainfall / Runoff Depth



Extreme Event Peak Rainfall / Runoff



National Stormwater Calculator Report

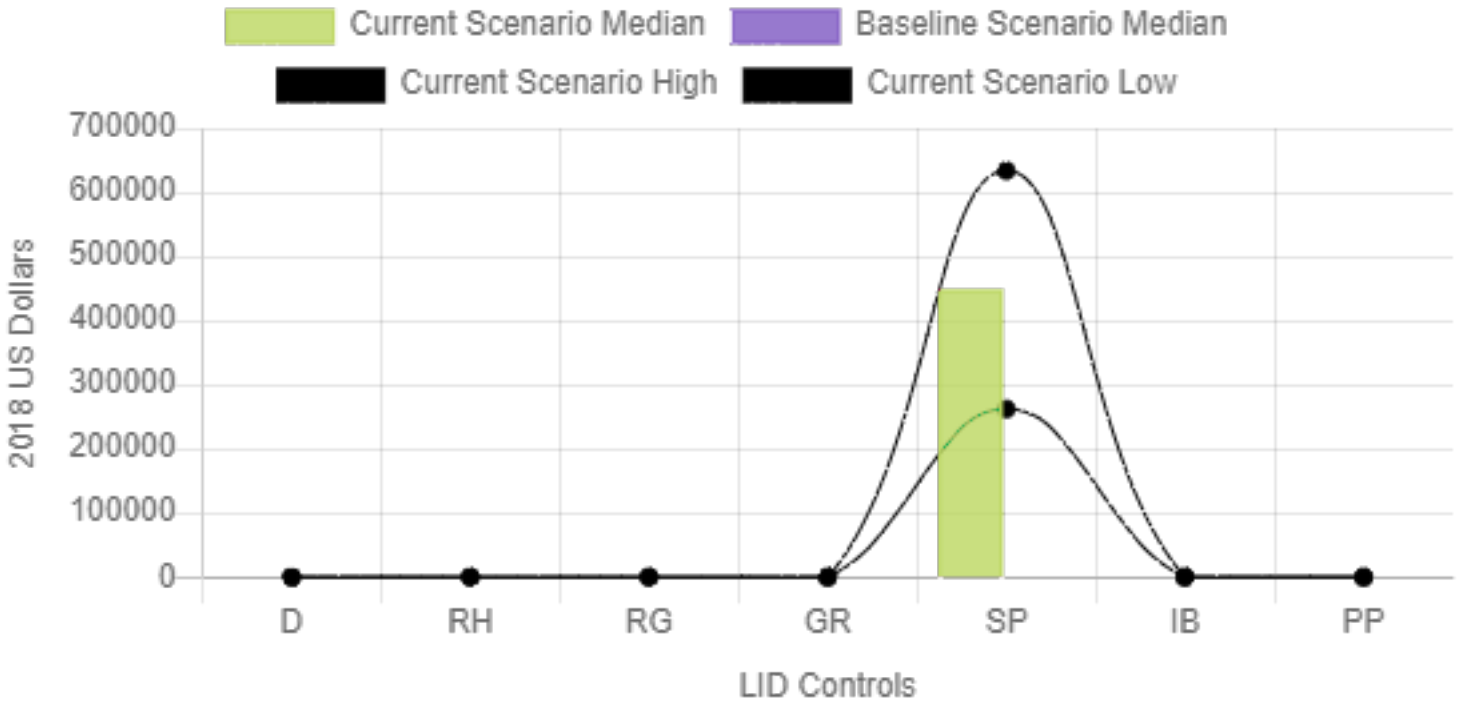
Results

Cost Summary

Estimate of Probable Capital Costs (estimates in 2018 US.$)

	Drainage Area %	Has Pre-Treatment?	Area Treated (C)	Area Treated (B)	Difference (C-B)
D	0 (C)	NA	$0.00 - $0.00	NA / NA	
RH	0 (C)	NA	$0.00 - $0.00	NA / NA	
RG	0 (C)	NA	$0.00 - $0.00	NA / NA	
GR	0 (C)	NA	$0.00 - $0.00	NA / NA	
SP	100 (C)	NA	$261931.17 - $633651.64	NA / NA	
IB	0 (C)	NA	$0.00 - $0.00	NA / NA	
PP	0 (C)	NA	$0.00 - $0.00	NA / NA	

Key	LID Control
D	Disconnection
RH	Rain Harvesting
RG	Rain Gardens
GR	Green Roofs
SP	Street Planters
IB	Infiltration Basins
PP	Permeable Pavement



National Stormwater Calculator Report

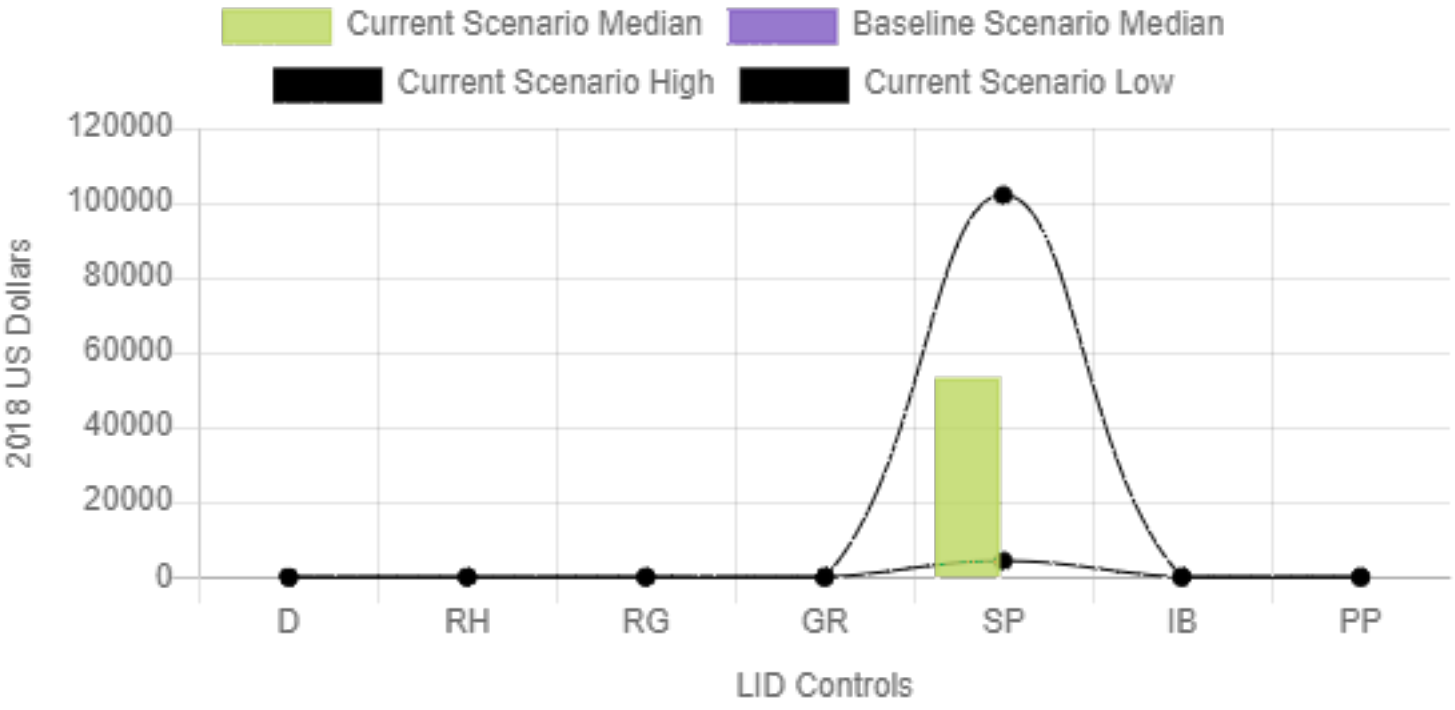
Results

Cost Summary

Estimate of Annual Probable Maintenance Costs

	Drainage Area %	Has Pre-Treatment?	Area Treated (C)	Area Treated (B)	Difference (C-B)
D	0 (C)	NA	$0.00 - $0.00	NA / NA	
RH	0 (C)	NA	$0.00 - $0.00	NA / NA	
RG	0 (C)	NA	$0.00 - $0.00	NA / NA	
GR	0 (C)	NA	$0.00 - $0.00	NA / NA	
SP	100 (C)	NA	$4293.31 - $102056.71	NA / NA	
IB	0 (C)	NA	$0.00 - $0.00	NA / NA	
PP	0 (C)	NA	$0.00 - $0.00	NA / NA	

Key	LID Control
D	Disconnection
RH	Rain Harvesting
RG	Rain Gardens
GR	Green Roofs
SP	Street Planters
IB	Infiltration Basins
PP	Permeable Pavement



Opti Modeling Report
2019

Opti
active intelligence | clean water

Green-Wood Cemetery

Sylvan Water Report

Results

Using measured stage and rainfall data from the Opti monitoring station at Sylvan Water, a calibrated SWMM model was developed of the pond to be used for modelling system performance when enhanced with active controls. Results indicate that by using forecast-driven controls, the pond could provide the following benefits over the existing condition:

- 67.7% reduction in wet weather flows to the combined sewer
- 177,125 ft^3 controllable volume, available for reuse during dry weather
- Increased infrastructure visibility from real-time monitoring

For summarizing performance of the passive and active scenarios during wet weather, a storm event definition of 0.1 inches of rainfall with a 4 hour inter-event period was used. Performance based on the active and passive scenarios are shown for the reporting period in Figure 1 and Table 1. For a full discussion of modeling methodology and control rules refer pages 4-5.

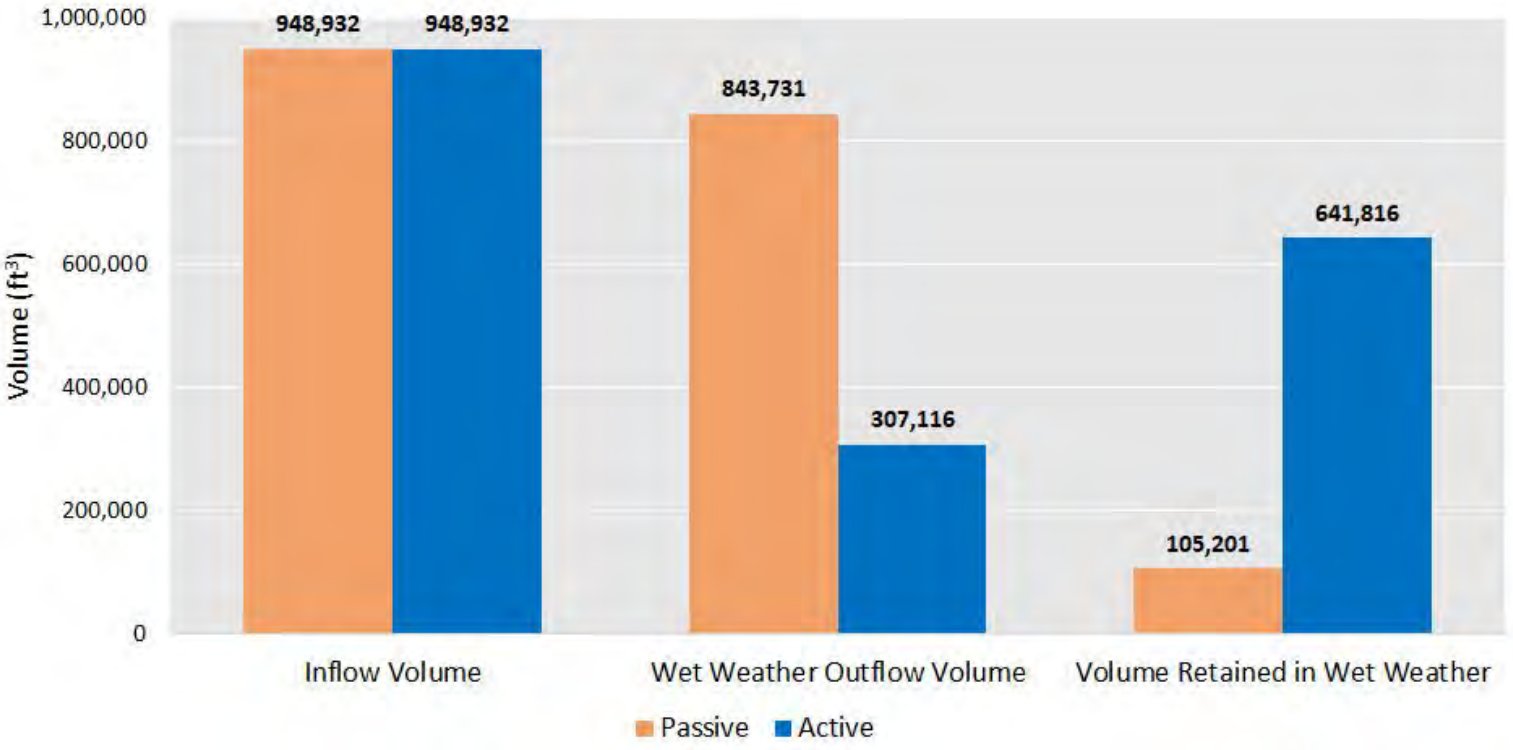


Figure 1: Wet Weather Flow Volumes for Modeled Active and Passive Scenarios

Table 1: Summary Results for Reporting Period

	Passive	Active
Total Rainfall *(in)*	19.23	
Percent Volume Retained in Wet Weather	11.1%	67.6%
Controllable Storage *(ft^3)*	NA	177,125

Sample Event

On 6/21/2019, a storm event with a rainfall volume of 0.78 inches and peak intensity of 2.28 in/hr fell over Sylvan Water. Runoff to the pond occurred quickly, with a fast peaking inflow hydrograph and a peak rate of 19.5 cfs. In the modeled active condition, the pond began to draw down storage prior to the event in order to create sufficient capacity to capture predicted runoff volume. During the storm event the outlet valve in the active condition stayed largely closed, capturing the majority of inflow from the event.

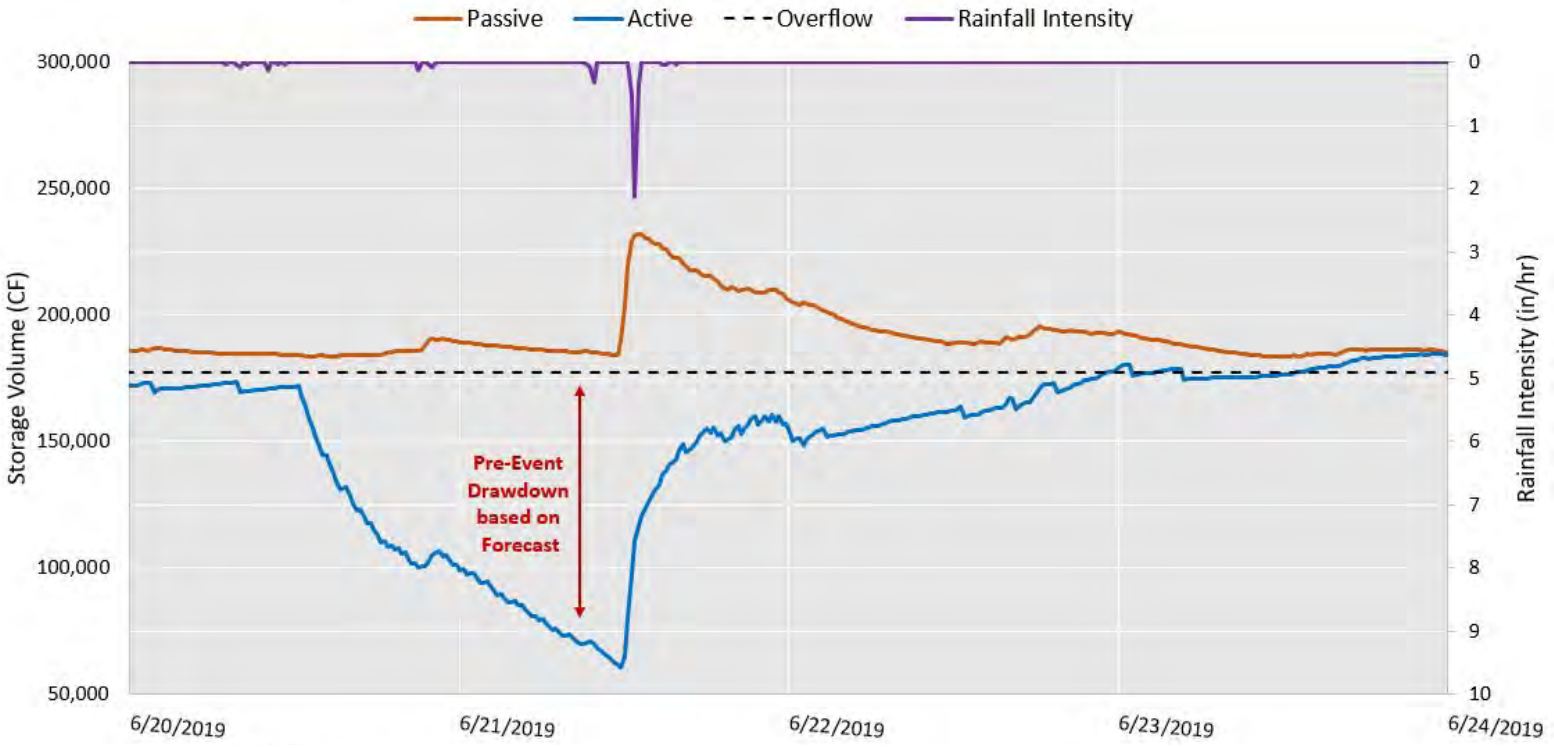


Figure 2: Time Series Comparison of Modeled Active and Passive Storm Response, 6/21/2019

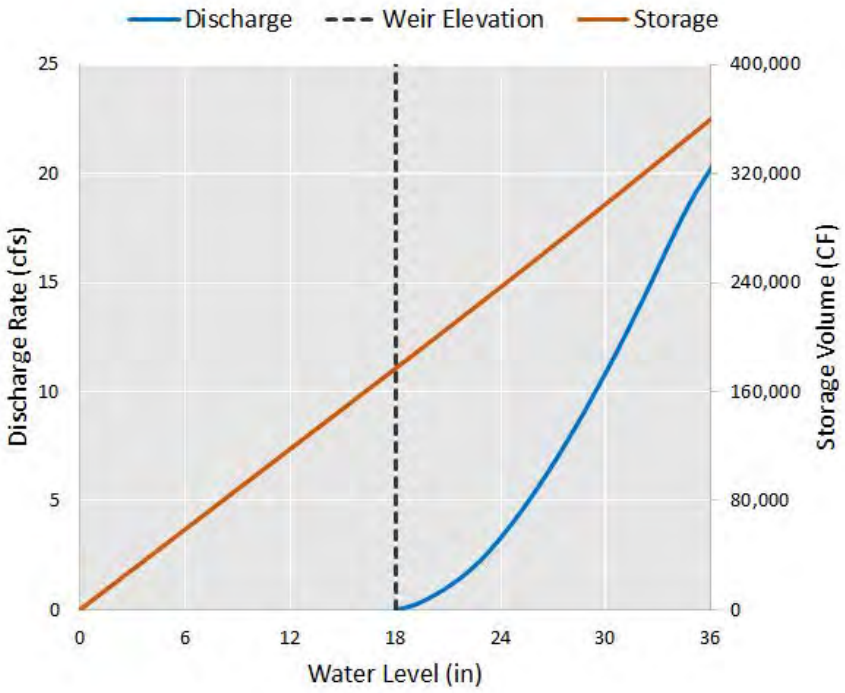
While the observed condition showed some flow attenuation, with 27.5% of flow shifted outside of the wet weather window (defined using a 4 hour buffer), the active condition showed a substantial increase in capture with 75.9% of flows shifted outside the wet weather window.

Table 2: Summary Results for Storm Event 6/21/2019

	Passive	Active
Rainfall *(in)*	0.89	
Inflow *(ft^3)*	112,360	
Wet Weather Outflow *(ft^3)*	81,514	27,100
Percent Flow Retained in Wet Weather	27.5%	75.9%

Methodology - Model Calibration

The monitoring station at Sylvan Water collects level, temperature, and rainfall data on a 5 minute basis, reporting measured data back to the Opti dashboard. Stage (water level) is used to calculate both discharge from the pond and storage volume as shown in Figure 3.



Using a mass balance approach, inflow to the pond was calculated based on change in volume and discharge measured on site. The inflow was then applied to an EPA SWMM model of the pond using the inflow time series as the upstream boundary condition. Resulting stage and discharge were compared to the measured conditions to provide validation of the SWMM model. Results indicate a strong correlation between the measured and modeled data with a Nash-Sutcliffe Efficiency of 0.79 (Figure 4). By comparing the calculated inflow volume to measured rainfall per storm event, an approximate contributing impervious area was found to be 21.1 acres.

Figure 3: Stage-Storage (top 18") and Stage Discharge Curve for Sylvan Water

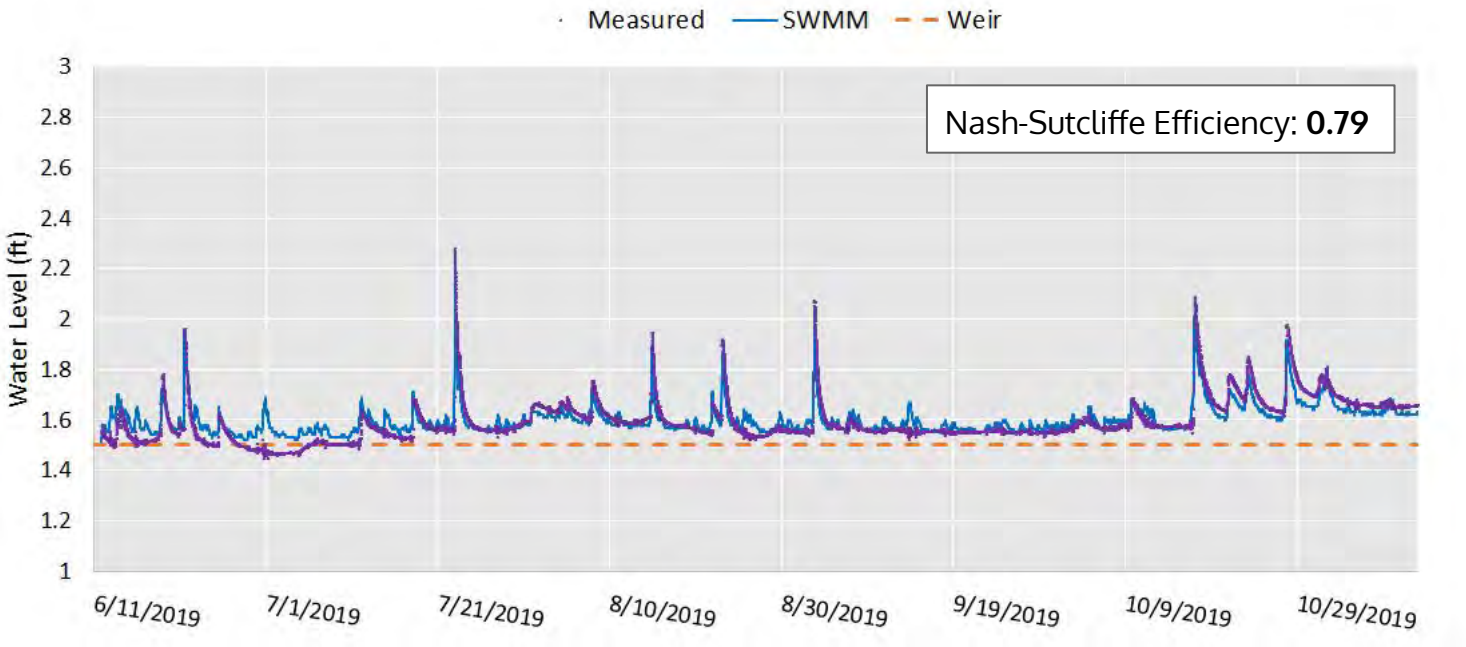
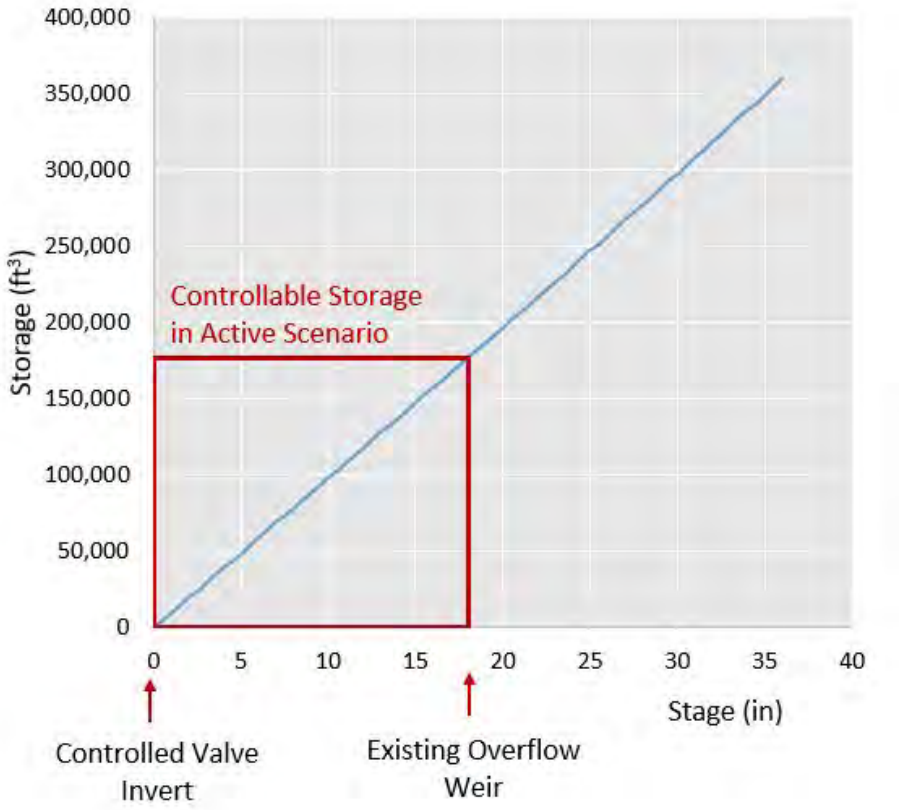


Figure 4: Calibration of SWMM Model - Modeled and Measured Storage Depths

Methodology - Control Scenario

Using the calibrated SWMM model of Sylvan Water, the proposed behavior of an active, controlled system was modeled for the same reporting period. The outlet structure was modeled to include a 14 inch valve located 18 inches below the weir. A 14 inch outlet was chosen so that the system would be able to drain fully within 24 hours, the typical duration over which rainfall forecasts are used to control flows from the pond. Figure 5 shows the stage-storage curve for the active scenario with the volume available for control highlighted.



For the active scenario, controls were applied to the outlet valve based on a forecast and current storage in the pond at each time step. For every time step, the expected runoff over the drainage area was compared to the current available storage in the controllable range. If forecast volumes exceeded the available storage in dry weather, the outlet valve was set to open to prepare for the forecasted storm (Figure 6). Over the back calculated watershed area, the controllable storage available represents 1.9 inches of storage volume.

Figure 5 (above): Stage-Storage Curve for Active Model Scenario

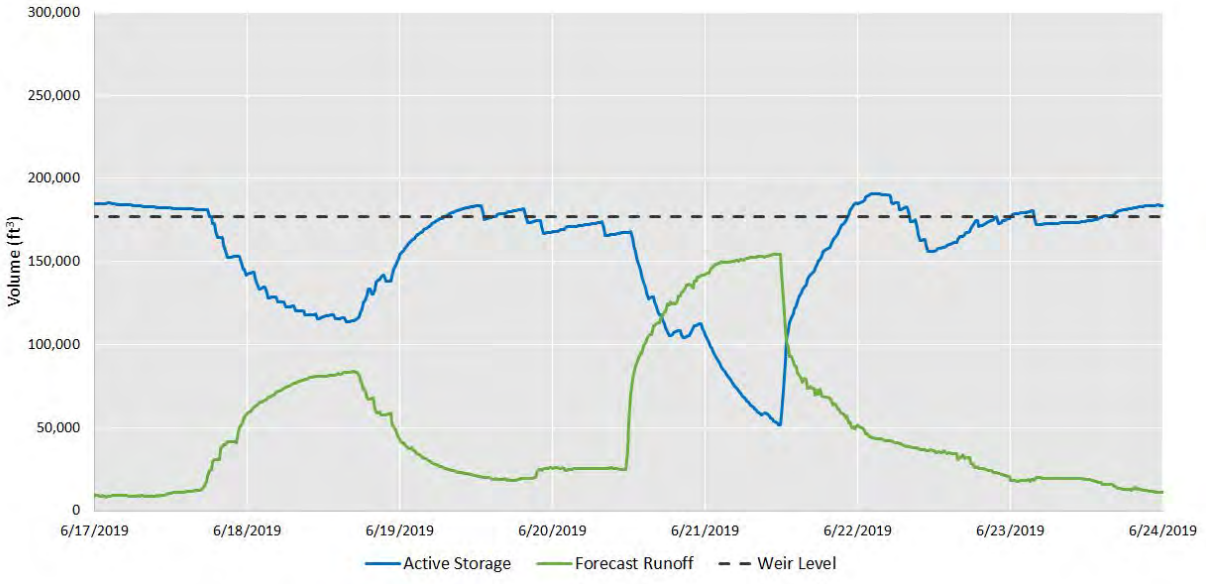


Figure 6 (right): Dynamic of Forecast-Driven Controls in Time Series Format

NYS Stormwater Management Design Manual
Appendix H: Bioretention

H.2 Bioretention

Planting Soil Bed Characteristics

The characteristics of the soil for the bioretention facility are perhaps as important as the facility location, size, and treatment volume. The soil must be permeable enough to allow runoff to filter through the media, while having characteristics suitable to promote and sustain a robust vegetative cover crop. In addition, much of the nutrient pollutant uptake (nitrogen and phosphorus) is accomplished through adsorption and microbial activity within the soil profile. Therefore, the soils must balance soil chemistry and physical properties to support biotic communities above and below ground.

The planting soil should be a sandy loam, loamy sand, loam (USDA), or a loam/sand mix (should contain a minimum 35 to 60% sand, by volume). The clay content for these soils should by less than 25% by volume. Soils should fall within the SM, or ML classifications of the Unified Soil Classification System (USCS). A permeability of at least 1.0 feet per day (0.5"/hr) is required (a conservative value of 0.5 feet per day is used for design). The soil should be free of stones, stumps, roots, or other woody material over 1" in diameter. Brush or seeds from noxious weeds. Placement of the planting soil should be in lifts of 12 to 18", loosely compacted (tamped lightly with a dozer or backhoe bucket). The specific characteristics are presented in Table H.2.

Table H.2 Planting Soil Characteristics

	Value
	5.2 to 7.00
	1.5 to 4.0%
	35 lbs. per acre, minimum
	75 lbs. per acre, minimum
	85 lbs. per acre, minimum
	500 ppm
	10 to 25%
	30 to 55%
	35 to 60%

Mulch Layer

The mulch layer plays an important role in the performance of the bioretention system. The mulch layer helps maintain soil moisture and avoid surface sealing which reduces permeability. Mulch helps prevent erosion, and provides a micro-environment suitable for soil biota at the mulch/soil interface. It also serves as a pretreatment layer, trapping the finer sediments which remain suspended after the primary pretreatment.

The mulch layer should be standard landscape style, single or double, shredded hardwood mulch or chips. The mulch layer should be well aged (stockpiled or stored for at least 12 months), uniform in color, and free of other materials, such as weed seeds, soil, roots, etc. The mulch should be applied to a maximum depth of three inches. Grass clippings should not be used as a mulch material.

Planting Plan Guidance

Plant material selection should be based on the goal of simulating a terrestrial forested community of native species. Bioretention simulates an ecosystem consisting of an upland-oriented community dominated by trees, but having a distinct community, or sub-canopy, of understory trees, shrubs and herbaceous materials. The intent is to establish a diverse, dense plant cover to treat stormwater runoff and withstand urban stresses from insect and disease infestations, drought, temperature, wind, and exposure.

The proper selection and installation of plant materials is key to a successful system. There are essentially three zones within a bioretention facility (Figure H.1). The lowest elevation supports plant species adapted to standing and fluctuating water levels. The middle elevation supports a slightly drier group of plants, but still tolerates fluctuating water levels. The outer edge is the highest elevation and generally supports plants adapted to dryer conditions. When using Table A.5 to identify species, use the following guideline:

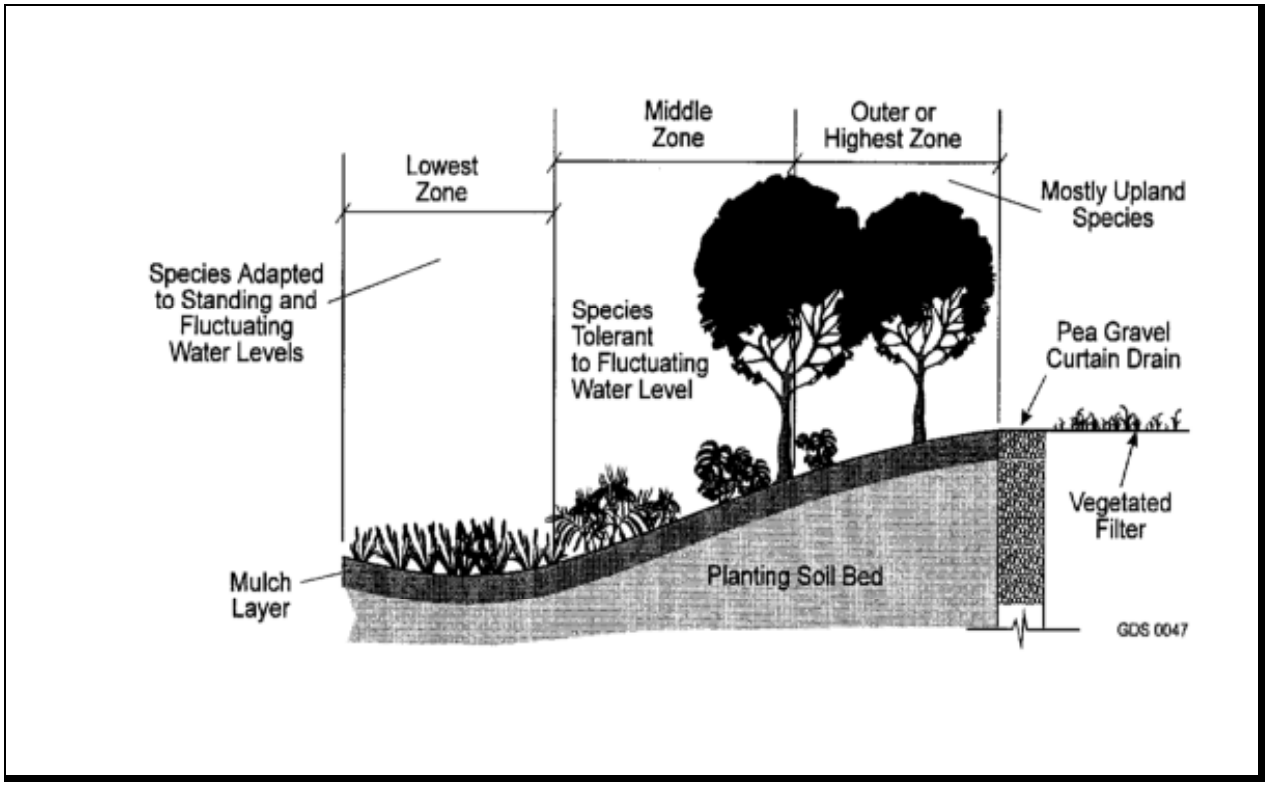
Lowest Zone: Zones 2-3

Middle Zone: Zones 3-4

Outer Zone: Zones 5-6

The layout of plant material should be flexible, but should follow the general principals described in Table H.3. The objective is to have a system which resembles a random and natural plant layout, while maintaining optimal conditions for plant establishment and growth.

Figure H.1 Planting Zones for Bioretention Facilities



Native plant species should be specified over exotic or foreign species.
Appropriate vegetation should be selected based on the zone of hydric tolerance (see Figure H.1).
Species layout should generally be random and natural.
A canopy should be established with an understory of shrubs and herbaceous materials.
Woody vegetation should not be specified in the vicinity of inflow locations.
Trees should be planted primarily along the perimeter of the bioretention area.
Urban stressors (e.g., wind, sun, exposure, insect and disease infestation, drought) should be considered when laying out the planting plan.
Noxious weeds should not be specified.
Aesthetics and visual characteristics should be a prime consideration.
Traffic and safety issues must be considered.
Existing and proposed utilities must be identified and considered.

Plant Material Guidance

Plant materials should conform to the American Standard Nursery Stock, published by the American Association of Nurserymen, and should be selected from certified, reputable nurseries. Planting specifications should be prepared by the designer and should include a sequence of construction, a description of the contractor's responsibilities, a planting schedule and installation specifications, initial maintenance, and a warranty period and expectations of plant survival. Table H.4 presents some typical issues for planting specifications.

	Elements
	Describe site preparation activities, soil amendments, etc.; address erosion and sediment control procedures; specify step-by-step procedure for plant installation through site clean-up.
	Specify the contractors responsibilities, such as watering, care of plant material during transport, timeliness of installation, repairs due to vandalism, etc.
	Specify the materials to be installed, the type of materials (e.g., B&B, bare root, containerized); time of year of installations, sequence of installation of types of plants; fertilization, stabilization seeding, if required; watering and general care.
	Specify inspection periods; mulching frequency (annual mulching is most common); removal and replacement of dead and diseased vegetation; treatment of diseased trees; watering schedule after initial installation (once per day for 14 days is common); repair and replacement of staking and wires.
	Specify the warranty period, the required survival rate, and expected condition of plant species at the end of the warranty period.

Plant Name	Zone	Form	Available	Inundation Tolerance	Wildlife Value	Notes
Trees and Shrubs						
American Elm *(Ulmus americana)*	4,5,6	Dec. Tree	yes	Irregular-seasonal saturation	High. Food (seeds,browsing), cover, nesting for birds & mammals	Susceptible to diesease (short-lived). Sun to full shade, tolerates drought and wind/ice damage.
Arrowwood Viburrium *(Viburrium dentatum)*	3,4	Dec. Shrub	yes	yes	High. Songbirds and mammals	Grows best in sun to partial shade
Bald Cypress *(Taxodium distichum)*	3,4	Dec. Tree	yes	yes	Little food value, but good perching site for waterfowl	Forested Coastal Plain. North of normal range. Tolerates drought.
Bayberry *(Myrica pensylvanica)*	4,5,6	Dec. Shrub	yes	yes	High. Nesting, food, cover. Berries last into winter	Coastal Plain only. Roots fix N_2 Tolerates slightly acidic soils.
Black Ash *(Fraxinus nigra)*	3,4,5	Dec. Tree	yes	Irregular-seasonal saturation	High. Food (seeds, sap), cover, nesting for birds & mammals. Fruit persists in winter	Rapid growth. Requires full sun. Susceptible to wind/ice damage & disease. Tolerates drought and infrequent flooding by salt water.
Black Cherry *(Prunus serotina)*	5,6	Dec. Tree	yes	no	High. Food	Moist soils or wet bottomland areas
Blackgum or Sourgum *(Nyssa sylvatica)*	4,5,6	Dec. Tree	yes	yes	High. Songbirds, egrets, herons, raccoons, owls	Can be difficult to transplant. Prefers sun to partial shade
Black Willow *(Salix nigra)*	3,4,5	Dec. Tree	yes	yes	High. Browsing and cavity nesters.	Rapid growth, stabilizes stream-banks. Full sun
Buttonbush *(Cepahlanthus occidentalis)*	2,3,4,5	Dec. Shrub	yes	yes	High. Ducks and shorebirds. Seeds, nectar and nesting.	Full sun to partial shade. Will grow in dry areas.
Common Spice Bush *(Lindera benzoin)*	3,4,5	Dec. Shrub	yes	yes	Very high. Songbirds	Shade and rich soils. Tolerates acidic soils. Good understory species

Plant Name	Zone	Form	Available	Inundation Tolerance	Wildlife Value	Notes
Eastern Cottonwood *(Populus deltoides)*	4,5	Dec. Tree	yes	yes	Moderate. Cover, food.	Shallow rooted, subject to windthrow. Invasive roots. Rapid growth.
Eastern Hemlock *(Tsuga canadensis)*	5,6	Conif. Tree	yes	yes	Moderate. Mostly cover and some food	Tolerates all sun/shade conditions. Tolerates acidic soil.
Eastern Red Cedar *(Juniperus virginiana)*	4,5,6	Conif. Tree	yes	no	High. Fruit for birds. Some cover.	Full sun to partial shade. Common in wetlands, shrub bogs and edge of stream
Elderberry *(Sambucus canadensis)*	3,4,5,6	Dec. Shrub	yes	yes	Extremely high. Food and cover, birds and mammals.	Full sun to partial shade.
Green Ash, Red Ash *(Fraxinus pennsylvania)*	4,5	Dec. Tree	yes	yes	Moderate. Songbirds.	Rapid growing streambank stabilizer. Full sun to partial shade.
Hackenberry *(Celtis occidentalis)*	5,6	Dec. Tree	yes	some	High. Food and cover	Full sun to partial shade.
Larch, Tamarack *(Larix latricina)*	3,4	Conif. Tree	no	yes	Low. Nest tree and seeds.	Rapid initial growth. Full sun, acidic boggy soil.
Pin Oak *(Quercus palustris)*	3,4,5,6	Dec. Tree	yes	yes	High. Tolerates acidic soil	Gypsy moth target. Prefers well drained, sandy soils.
Red Choke Berry *(Pyrus arbutifolia)*	3,4,5	Dec. Shrub	no	yes	Moderate. Songbirds.	Bank stabilizer. Partial sun.
Red Maple *(Acer rubrum)*	3,4,5,6	Dec. Tree	yes	yes	High seeds and browse. Tolerates acidic soil.	Rapid growth.
River Birch *(Betula nigra)*	3,4,5	Dec. Tree	yes	yes	Low. Good for cavity nesters.	Bank erosion control. Full sun.
Shadowbush, Serviceberry *(Amelanchier*	4,5,6	Dec. Shrub	yes	yes	High. Nesting, cover, food. Birds and	Prefers partial shade. Common in forested

Plant Name	Zone	Form	Available	Inundation Tolerance	Wildlife Value	Notes
canadensis)					mammals.	wetlands and upland woods.
Silky Dogwood *(Cornus amomium)*	3,4,5	Dec. Shrub	yes	yes	High. Songbirds, mammals.	Shade and drought tolerant. Good bank stabilizer.
Slippery Elm *(Ulnus rubra)*	3,4,5	Dec. Tree	rare	yes	High. Food (seeds, buds) for birds & mammals (browse). Nesting	Rapid growth, no salinity tolerance. Tolerant to shade and drought.
Smooth Alder *(Alnus serrulata)*	3,4,5	Dec. Tree	no	yes	High. Food, cover.	Rapid growth. Stabilizes streambanks.
Speckled Alder *(Alnus rugosa)*	3,4	Dec. Shrub	yes	yes	High. Cover, browse for deer, seeds for bird.	
Swamp White Oak *(Quercus bicolor)*	3,4,5	Dec. Tree	yes	yes	High. Mast	Full sun to partial shade. Good bottomland tree.
Swamp Rose *(Rosa Palustrus)*	3,4	Dec. Shrub		Irregular, seasonal, or regularly saturated	High. Food (hips) for birds including turkey, ruffed grouse and mammals. Fox cover.	Prefers full sun. Easy to establish. Low salt tolerance.
Sweetgum *(Liquidambar styraciflua)*	4,5,6	Dec. Tree	yes	yes	Moderate. Songbirds	Tolerates acid or clay soils. Sun to partial shade.
Sycamore *(Platanus occidentalis)*	4,5,6,	Dec. Tree	yes	yes	Low. Food, cavities for nesting.	Rapid growth. Common in floodplains and alluvial woodlands.
Tulip Tree *(Liriodendron tulipifera)*	5,6	Dec. Tree	yes	no	Moderate. Seeds and nest sites	Full sun to partial shade. Well drained soils. Rapid growth.
Tupelo *(Nyssa sylvatica vari biflora)*	3,4,5	Dec. Tree	yes	yes	High. Seeds and nest sites	Ornamental

Plant Name	Zone	Form	Available	Inundation Tolerance	Wildlife Value	Notes
White Ash *(Fraxinus americana)*	5,6	Dec. Tree	yes	no	High. Food	All sunlight conditions. Well drained soils.
Winterberry *(Ilex verticillata)*	3,4,5	Dec. Shrub	yes	yes	High. Cover and fruit for birds. Holds berries into winter.	Full sun to partial shade. Seasonally flooded areas.
Witch Hazel *(Hamamelis virginiana)*	4,5	Dec. Shrub	yes	no	Low. Food for squirrels, deer, and ruffed grouse.	Prefers shade. Ornamental.
Herbaceous Plants						
Arrow arum *(Peltandra virginica)*	2,3	Emergent	yes	up to 1 ft.	High. Berries are eaten by wood ducks.	Full sun to partial shade.
Arrowhead, Duck Potato *(Saggitaria latifolia)*	2,3	Emergent	yes	up to 1 ft.	Moderate. Tubers and seeds eaten by ducks.	Aggressive colonizer.
Big Bluestem (*Andropogon gerardi*)	4,5	Perimeter	yes	Irregular or seasonal inundation.	High. Seeds for songbirds. Food for deer	Requires full sun.
Birdfoot deervetch (*Lotus Corniculatus*)	4,5,6	Perimeter	yes	Infrequent inundation	High. Food for birds.	Full sun. Nitrogen fixer.
Blue Flag Iris *(Iris versicolor)*	2,3	Emergent	yes	Regular or permanently, up to ½ ft or saturated	Moderate. Food muskrat and wildfowl. Cover, marshbirds	Slow growth. Full sun to partial shade. Tolerates clay. Fresh to moderately brackish water.
Blue Joint (*Calamagrotis canadensis*)	2,3,4	Emergent	yes	Regular or permanent inundation up to 0.5 ft.	Moderate. Food for game birds and moose.	Tolerates partial shade
Broomsedge *(Andropogon virginicus)*	2,3	Perimeter	yes	up to 3 in.	High. Songbirds and browsers. Winter food and cover.	Tolerant of fluctuation water levels & partial shade.
Bushy Beardgrass *(Andropogon glomeratus)*	2,3	Emergent	yes	up to 1 ft.		Requires full sun.
Cardinal flower (*Lobelia cardinalis*)	4,5,6	Perimeter	yes	Some. Tolerates saturation up to 100% of season.	High. Nectar for hummingbird, oriole, butterflies.	Tolerates partial shade

Plant Name	Zone	Form	Available	Inundation Tolerance	Wildlife Value	Notes
Cattail *(Typha sp.)*	2,3	Emergent	yes	up to 1 ft.	Low. Except as cover	Aggressive. May eliminate other species. Volunteer. High pollutant treatment
Coontail *(Ceratophyllum demersum)*	1	Submergent	no	yes	Low food value. Good habitat and shelter for fish and invertebrates.	Free floating SAV. Shade tolerant. Rapid growth.
Common Three-Square *(Scirpus pungens)*	2	Emergent	yes	up to 6 in.	High. Seeds, cover. Waterfowl and fish.	High metal removal.
Duckweed *(Lemma sp.)*	1,2	Submergent/ Emergent	yes	yes	High. Food for waterfowl and fish.	High metal removal.
Fowl mannagrass (*Glyceria striata*)	4,5	Perimeter	yes	Irregular or seasonal inundation	High. Food for waterfowl, muskrat, and deer.	Partial to full shade.
Hardstem Bulrush *(Scirpus acutus)*	2	Emergent	yes	up to 3 ft.	High. Cover, food (achenes, rhizomes) ducks, geese, muskrat, fish. Nesting for bluegill and bass.	Quick to establish, fresh to brackish. Good for sediment stabilization and erosion control.
Giant Burreed *(Sparganium eurycarpum)*	2,3	Emergent	rare	Regular to permanently inundated. up to 1 ft.	High. Food (seeds, plant) waterfowl, beaver & other mammals. Cover for marshbirds, waterfowl.	Rapid spreading . Tolerates partial sun. Good for shoreline stabilization.. Salinity <0.5 ppt
Lizard's Tail *(Saururus cernuus)*	2	Emergent	yes	up to 1 ft.	Low, except wood ducks.	Rapid growth. Shade tolerant
Long-leaved Pond Weed *(Potamogeton nodosus)*	1,2	Rooted submerged aquatic	yes	up to 1-6 ft. depending on turbidity	High. Food (seeds, roots) waterfowl, aquatic fur-bearers, deer, moose. Habitat for fish	Rapid spread. Salinity <0.5 ppt. Flowers float on surface, Aug.-Sept.

Plant Name	Zone	Form	Available	Inundation Tolerance	Wildlife Value	Notes
Marsh Hibiscus *(Hibiscus moscheutos)*	2,3	Emergent	yes	up to 3 in.	Low. Nectar.	Full sun. Can tolerate periodic dryness.
Pickerelweed *(Pontederia cordata)*	2,3	Emergent	yes	up to 1 ft.	Moderate. Ducks. Nectar for butterflies.	Full sun to partial shade.
Pond Weed, Sago *(Potamogeton pectinatus*	1	Submergent	yes	yes	Extremely high. Waterfowl, marsh and shorebirds.	Removes heavy metals.
Redtop (*Agrostis alba*)	3,4,5	Perimeter	yes	Up to 25% of season	Moderate. Rabbits and some birds.	Quickly established but not highly competitive.
Rice Cutgrass *(Leersia oryzoides)*	2,3	Emergent	yes	up to 3 in.	High. Food and cover.	Full sun although tolerant of shade. Shoreline stabilization.
Sedges *(Carex spp.)*	2,3	Emergent	yes	up to 3 in.	High waterfowl, songbirds.	Many wetland and upland species.
Tufted Hairgrass (*Deschampsia caespitosa*)	3,4,5	Perimeter	yes	Regular to irregular inundation.	High.	Full sun. May become invasive.
Soft-stem Bulrush *(Scirpus validus)*	2,3	Emergent	yes	up to 1 ft.	Moderate. Good cover and food.	Full sun. Aggressive colonizer. High pollutant removal.
Smartweed *(Polygonum spp.)*	2,3,4	Emergent	yes	up to 1 ft.	High. Waterfowl, songbirds. Seeds and cover.	Fast colonizer. Avoid weedy aliens such as *P. perfoliatum.*
Soft Rush *(Juncus effusus)*	2,3,4	Emergent	yes	up to 3 in.	Moderate.	Tolerates wet or dry conditions.
Spatterdock *(Nuphar luteum)*	2	Emergent	yes	up to 3 ft.	Moderate for food but high for cover.	Fast colonizer. Tolerant of fluctuating water levels.
Switchgrass *(Panicum virgatum)*	2,3,4,5,6	Perimeter	yes	up to 3 in.	High. Seeds, cover for waterfowl, songbirds.	Tolerates wet/dry conditions.

Plant Name	Zone	Form	Available	Inundation Tolerance	Wildlife Value	Notes
Sweet Flag *(Acorus calamus)*	2,3	Herbaceous	yes	up to 3 in.	Low.	Tolerant of dry periods. Not a rapid colonizer. Tolerates acidic conditions.
Waterweed *(Elodea canadensis)*	1	Submergent	yes	yes	Low.	Good water oxygenator. High nutrient, copper, manganese and chromium removal.
Wild Celery *(Valisneria americana)*	1	Submergent	yes	yes	High. Food for waterfowl. Habitat for fish and invertebrates.	Tolerant of murkey water and high nutrient loads.
Wild Rice *(Zizania aquatica)*	2	Emergent	yes	up to 1 ft.	High. Food for birds.	Prefers full sun
Wool Grass *(Scirpus cyperinus)*	2,3	Emergent	yes	Irregularly to seasonally indundated	Moderate. Cover, Food.	Requires full sun. Can tolerate acidic soils, drought. Colonizes disturbed areas, moderate growth.

ATTACHMENT B

GENERAL DESIGN GUIDELINES

1. All improvements shall be designed in accordance with the applicable NYDEC and NYCDEP standards, ADA Accessibility Standards, and any other relevant standards. The Consultant, and each of its subcontractors, shall be required to comply with all local, state, and federal laws and regulations, including but not limited to licensing requirements, environmental, safety, and labor requirements, anti-discrimination laws, and any legally mandated prevailing or minimum wages. Please see Attachment C for NYSEFC Terms and Conditions.
2. Consultant shall prepare design drawings that include – at a minimum – overall site plan with existing grades (maximum 1 ft intervals) and utilities, rough and final grading, profiles, details, show tie ins to existing utilities, conceptual and final landscaping, and any other information necessary to receive all required permits for this project; as appropriate for the given project stage.
3. In general, the Consultant shall prepare and submit to the Client, both electronic and hardcopy plan and profile sheets (hardcopy plans only required upon direct request), at a maximum horizontal scale of 1" = 10' and 1" = 2' vertical scale for all work. Other plans, such as traffic control drawings, typical sections, details, etc. shall be drawn at scales necessary for permit and approvals of drawings from the relevant permitting authorities.
4. All plans must be signed and sealed by a New York Licensed Professional Engineer (PE). Consultant will provide electronic copies of the design drawings and memos in PDF format, and as-builts in AutoCAD 2010 or later and PDF Format.
5. The underground detention system in Practice Area 1 will be designed and constructed under a separate contract in collaboration with NYCDEP under the Resilient NYC Partners program. For this Practice Area, bidders should include time in their bids for design review to ensure that designs for Practice Areas 2 and 3 will not negatively impact the drainage volumes and treatment provided in Practice 1. Practice Area 1 is limited to the service yard footprint, and it is not expected that there will be any conflicts.
6. Designs should not propose removal of internal cemetery roadways.
7. Consideration should be given to phasing construction to minimize operational impacts to the cemetery, particularly during the spring planting season.
8. Facility will meet NYCDEP and NYDEC design criteria. Where the two conflict, NYCDEP requirements shall be used.

ATTACHMENT C

NYSEFC Terms and Conditions

NEW YORK STATE OF OPPORTUNITY. Environmental Facilities Corporation

KATHY HOCHUL
Governor

MAUREEN A. COLEMAN
President & CEO

Mandatory State Revolving Fund Terms and Conditions

for Contracts Funded with the NYS Clean Water State Revolving Fund or Drinking Water State Revolving Fund

Effective November 1, 2021

New York State Environmental Facilities Corporation
625 Broadway, Albany, NY 12207-2997
P: (518) 402-6924 F: (518) 402-7456
www.efc.ny.gov

REQUIRED CONTRACT LANGUAGE

Recipient to Identify Contract Type:

☐ Construction

☐ Treatment Works and Drinking Water Projects

☐ Non-Treatment Works

☐ Non-Construction

Contents

COMMONLY USED TERMS

The following commonly used terms are defined herein as follows:

"Contract" means an agreement between a Recipient and a Contractor.

"Contractor" means all bidders, prime contractors, Service Providers, and consultants as hereinafter defined, unless specifically referred to otherwise.

"Service Provider" means any individual or business enterprise that provides one or more of the following: legal, engineering, financial advisory, technical, or other professional services, supplies, commodities, equipment, materials, or travel.

"Subcontract" means an agreement between a Contractor and a Subcontractor.

"Subcontractor" means any individual or business enterprise that has an agreement, purchase order, or any other contractual arrangement with a Contractor.

"Recipient" means the party, other than EFC, to a grant agreement or a project finance agreement with EFC through which funds for the payment of amounts due thereunder are being paid in whole or in part.

"State" means the State of New York.

"Treatment Works" is defined in Clean Water Act (CWA) Section 212.

"Nonpoint Source Projects" and **"Green Infrastructure Projects"** are defined in CWA Section 319.

"Estuary Management Program Project" is defined in CWA Section 320.

I. SECTION 1 REQUIREMENTS AND PROCEDURES FOR BUSINESS PARTICIPATION OPPORTUNITIES FOR NEW YORK STATE CERTIFIED MINORITY- AND WOMEN-OWNED BUSINESS ENTERPRISES AND EQUAL EMPLOYMENT OPPORTUNITIES FOR MINORITY GROUP MEMBERS AND WOMEN

For purposes of this section:

"Non-Construction" shall mean Contracts for labor, services (including, but not limited to, legal, financial, and other professional services), supplies, equipment, materials, or any combination of the foregoing.

"Contracts Meeting Article 15-A Thresholds" shall mean Contracts or Subcontracts meeting the thresholds under New York State Executive Law Article 15-A as follows:
(a) Non-Construction Contracts greater than $25,000;
(b) Non-Construction Contracts, that are initially under $25,000 but subsequent change orders or contract amendments increase the Contract value to above $25,000;
(c) Construction Contracts greater than $100,000; and,
(d) Construction Contracts that are initially under $100,000 but subsequent change orders or contract amendments increase the Contract value to above $100,000.

The Equal Employment Opportunities requirements of this section apply to all Contracts and Subcontracts, with the exception of:
(1) the requirements under Title VII of the Civil Rights Act of 1964 and 41 CFR Part 60-1 Subpart A which apply only to construction Contracts and Subcontracts;
(2) the Federal Affirmative Action Regulations requirements which apply only to construction Contracts and Subcontracts greater than $10,000.
The Minority- and Women- Owned Business Enterprises ("MWBE") participation requirements of this section apply to the Contracts Meeting Article 15-A Thresholds.

Disregard this section if it does not apply to this Contract or Subcontract.

II. General Provisions

A. Contractors and Subcontractors are required to comply with the following provisions:

1. New York State Executive Law Article 15-A and 5 NYCRR Parts 140-145 ("MWBE Regulations") for all State Contracts as defined therein, with a value (1) in excess of $25,000 for labor, services (including, but not limited to, legal, financial, and other professional services), supplies, equipment, materials, or any combination of the foregoing, or (2) in excess of $100,000 for the acquisition, construction, demolition, replacement, major repair or renovation of real property and improvements thereon.
2. Title VI of the Civil Rights Act of 1964 and 40 CFR Part 7 ("Title VI") for any program or activity receiving federal financial assistance, as those terms are defined therein.
3. Title VII of the Civil Rights Act of 1964 and 41 CFR Part 60-1 Subpart A ("Title VII") for construction Contracts related to any government programs providing federal financial assistance, as those terms are defined therein.
4. 41 CFR Part 60-4 ("Federal Affirmative Action Regulations") for federal or federally assisted construction Contracts in excess of $10,000, as those terms are defined therein.
5. Section 504 of the Rehabilitation Act of 1973 ("Section 504") for any program or activity receiving federal financial assistance, as those terms are defined therein.
6. The Age Discrimination Act of 1975 ("Age Discrimination Act") for any program or activity receiving federal financial assistance, as those terms are defined therein.
7. Section 13 of the Federal Water Pollution Control Act ("Clean Water Act") Amendments of 1972 ("Section 13") for any program or activity receiving federal financial assistance under the Clean Water Act, as those terms are defined therein.

B. Failure to comply with all of the requirements herein may result in a finding by the Recipient that the Contractor is non-responsive, non-responsible, and/or has breached the Contract, leading to the withholding of funds or such other actions, liquidated damages pursuant to subsection III(F) of this section, or enforcement proceedings as allowed by the Contract.

C. If any terms or provisions herein conflict with Executive Law Article 15-A, the MWBE Regulations, Title VI, Title VII, or Federal Affirmative Action Regulations, such law and regulations shall supersede these requirements.

D. Upon request from the Recipient's Minority Business Officer ("MBO") and/or EFC, Contractor will provide complete responses to inquiries and all MWBE and EEO records available within a reasonable time. For purposes of this section, MBO means the duly authorized representative of the SRF Recipient for MWBE and EEO purposes.

III. Equal Employment Opportunities (EEO)

Applicable to all Contracts and Subcontracts unless otherwise noted

A. Each Contractor and Subcontractor performing work on the Contract shall undertake or continue existing EEO programs to ensure that minority group members and women are afforded equal employment opportunities without discrimination because of race, creed, color, national origin, sex, age, disability or marital status. For these purposes, EEO shall apply in the areas of recruitment, employment, job assignment, promotion, upgrading, demotion, transfer, layoff, or termination and rates of pay or other forms of compensation.

B. The Contractor shall comply with the provisions of the Human Rights Law (Executive Law Article 15), Title VI, Title VII, the Federal Affirmative Action Regulations, Section 504, Age Discrimination Act, Section 13, and all other State and Federal statutory and constitutional non-discrimination provisions. The Contractor and Subcontractors shall not discriminate against any employee or applicant for employment because of race, creed (religion), color, sex, national origin, sexual orientation, military status, age, disability, predisposing genetic characteristic, marital status or domestic violence victim status, and shall also follow the requirements of the Human Rights Law with regard to non-discrimination on the basis of prior criminal conviction and prior arrest.

C. Contractors and Subcontractors shall have instituted grievance procedures to assure the prompt and fair resolution of complaints when a violation of Title VI of the Civil Rights Act of 1964 or Title 40 CFR Part 7 is alleged.

D. Pursuant to 40 CFR § 7.95, the Contractor shall display a copy of the EEO notice at the project site in a visible location. The notice shall accommodate individuals with impaired vision or hearing and should be provided in languages other than English where appropriate. The notice must also identify the employee responsible for its EEO compliance. A copy of the EEO notice ("EEO Poster") can be found at: https://www.dol.gov/ofccp/regs/compliance/posters/pdf/eeopost.pdf .

The Contractor will include the provisions of Subdivisions II(A) and II(C) in every Subcontract in such a manner that the requirements of these subdivisions will be binding upon each Subcontractor as to work in connection with the Contract.

Applicable to all construction Contracts

E. The Contractor and Subcontractor will comply with the requirements of 41 CFR § 60-1.4(b) and (c), and such provisions are hereby incorporated by reference. These provisions require, in part, that the Contractor and Subcontractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity, or national origin. The Contractor and Subcontractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, sexual orientation, gender identity, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship.

Applicable to construction Contracts greater than $10,000

F. The Contractor and Subcontractor will comply with the Affirmative Action Regulations and such provisions are hereby incorporated by reference. These provisions require, in part, that the Contractor and Subcontractor place affirmative action goals on Contracts and Subcontracts, as established by the United States Department of Labor. Affirmative action goals for minorities and women by geographic region can be found here: https://www.dol.gov/sites/dolgov/files/ofccp/ParticipationGoals.pdf .

G. Required EEO Forms

Pursuant to 41 CFR Section 60-1.7 for federally assisted construction Contracts, Contractor and Subcontractor will annually file an EEO-1 Report with the Joint Reporting Committee for the Office of Federal Contract Compliance Programs (OFCCP) and the Equal Employment Opportunity Commission (EEOC) according to the instructions provided at https://www.eeoc.gov/employers/eeo-1-survey/eeo-1-instruction-booklet , if Contractor or Subcontractor:

1. Is not exempt from compliance pursuant to 41 CFR § 60-1.5;
2. Has 50 or more employees;
3. Is a prime Contractor or first tier Subcontractor; or Subcontractor below the first tier which performs construction work at the site of construction; and
4. Has a Contract, Subcontract, or purchase order amounting to $50,000 or more.

IV. Business Participation Opportunities for MWBEs

Applicable to Contracts Meeting Article 15-A Thresholds

A. Contract Goals

1. For purposes of this Contract, EFC establishes the following goals for New York State certified MWBE participation based on the current availability of qualified MBEs and WBEs.

Program	MWBE Contract Goal*
CWSRF, DWSRF, & Green Innovation Grant Program	20%
NYS Water Infrastructure Improvement Act Grants (also receiving EFC loan)	Clean Water project 20% Drinking Water project 20%
NYS Intermunicipal Grants (also receiving EFC loan)	Clean Water project 20% Drinking Water project 20%

*May be any combination of MBE and/or WBE participation

2. For purposes of providing meaningful participation by MWBEs on the Contract and achieving the MWBE Contract Goals established in Section III-A hereof, the Contractor should reference the directory of New York State Certified MWBEs found at the following internet address: https://ny.newnycontracts.com .
3. The Contractor understands that only sums paid to MWBEs for the performance of a commercially useful function, as that term is defined in 5 NYCRR § 140.1, may be applied towards achievement of applicable MWBE participation goals.
   a. For construction and construction-related services Contracts or Subcontracts, the portion of the Contract or Subcontract with an MWBE serving as a supplier, and so designated in ESD's Directory, that shall be deemed to represent the commercially useful function performed by the MWBE shall be 60% of the total value of the Contract or Subcontract. The portion of a Contract or Subcontract with an MWBE serving as a broker, as denoted by NAICS code 425120, that shall be deemed to represent the commercially useful function performed by the MWBE shall be the monetary value for fees, or the markup percentage, charged by the MWBE.
   b. For non-construction Contracts or Subcontracts, the portion of a Contract or Subcontract with an MWBE serving as a broker that shall be deemed to represent the commercially useful function performed by the MWBE shall be 25% of the total value of the contract
4. Where MWBE Contract Goals have been established herein, pursuant to 5 NYCRR § 142.8, the Contractor must document "good faith efforts" to provide meaningful participation by MWBEs as Subcontractors or suppliers in the performance of the Contract.
5. In accordance with Section 316-a of Article 15-A and 5 NYCRR § 142.13, the Contractor acknowledges that if it is found to have willfully and intentionally failed to comply with the MWBE participation goals set forth in the Contract, such a finding constitutes a breach of Contract and the Contractor shall be liable to the Recipient for liquidated or other appropriate damages, as set forth herein.

B. MWBE Utilization Plan

1. The Contractor represents and warrants that Contractor has submitted an MWBE Utilization Plan to the Recipient prior to the execution of this Contract.
2. The Contractor agrees to use such MWBE Utilization Plan for the performance of MWBEs on the Contract pursuant to the prescribed MWBE goals set forth in Section III-A of this section.

3. The Contractor further agrees that a failure to submit and/or use such MWBE Utilization Plan shall constitute a material breach of the terms of the Contract. Upon the occurrence of such a material breach, the Recipient shall be entitled to any remedy provided herein, including but not limited to, a finding that the Contractor is not responsive.
4. Contractor must report any changes to the Utilization Plan after Contract award and during the term of the Contract to the Recipient's MBO. Contractor shall indicate the changes to the MBO in the next Monthly MWBE Contractor Compliance Report after the changes occurred. At EFC's discretion, an updated MWBE Utilization Plan form and good faith effort documentation may be required to be submitted. When a Utilization Plan is revised due to execution of a change order, the change order should be submitted to the MBO with the Monthly MWBE Contractor Compliance Report or revised Utilization Plan.
5. The Contractor shall submit copies of all fully executed Subcontracts, agreements, and purchase orders that are referred to in the MWBE Utilization Plan to the MBO within 30 days of their execution.

C. Requests for Waiver

1. If the Contractor, after making good faith efforts, is unable to comply with MWBE goals, the Contractor may submit a Request for Waiver to the Recipient documenting good faith efforts by the Contractor to meet such goals. If the documentation included with the waiver request is complete, the Recipient shall forward the request to EFC for evaluation, and EFC will issue a written notice of acceptance or denial within twenty (20) days of receipt.
2. If the Recipient, upon review of the MWBE Utilization Plan and updated Quarterly MWBE Contractor Compliance Reports determines that the Contractor is failing or refusing to comply with the MWBE Contract Goals and no waiver has been issued in regards to such non-compliance, the Recipient may issue a notice of deficiency to the Contractor. The Contractor must respond to the notice of deficiency within seven (7) business days of receipt. Such response may include a request for partial or total waiver of MWBE Contract Goals.

D. Monthly MWBE Contractor Compliance Report ("Monthly MWBE Report")

The Contractor agrees to submit a report to the Recipient by the third business day following the end of each month over the term of this Contract documenting the payments made and the progress towards achievement of the MWBE goals of the Contract. The Monthly MWBE Report must be supplemented with proof of payment by the Contractor to its Subcontractors (e.g., copies of both sides of a cancelled check) and proof that Subcontractors have been paid within 30 days of receipt of payment from the Recipient. The final Monthly MWBE Report must reflect all Utilization Plan revisions and change orders.

E. Liquidated Damages - MWBE Participation

In accordance with Section 316-a of Article 15-A and 5 NYCRR §142.13, if it has been determined by the Recipient or EFC that the Contractor has willfully and intentionally failed to comply with the MWBE participation goals, the Contractor shall be obligated to pay to Recipient liquidated damages or other appropriate damages, as specified herein and as determined by the Recipient or EFC.

Liquidated damages shall be calculated as an amount not to exceed the difference between:

1. All sums identified for payment to MWBEs had the Contractor achieved the approved MWBE participation goals; and,
2. All sums actually paid to MWBEs for work performed or materials supplied under this Contract.

The Recipient and EFC reserve the right to impose a lesser amount of liquidated damages than the amount calculated above based on the circumstances surrounding the Contractor's non-compliance.

In the event a determination has been made by the Recipient or EFC which requires the payment of damages identified herein and such identified sums have not been withheld, Contractor shall pay such damages to the Recipient within sixty (60) days after they are assessed unless prior to the expiration of such sixtieth day, the Contractor has filed a complaint with the Empire State Development Corporation – Division of Minority and Women's Business Development ("ESD") pursuant to Subdivision 8 of Section 313 of the Executive Law in which event the damages shall be payable if the Director of ESD renders a decision in favor of the Recipient.

V. SECTION 2 PARTICIPATION OPPORTUNITIES FOR NEW YORK STATE CERTIFIED SERVICE-DISABLED VETERAN-OWNED BUSINESSES

New York State Executive Law Article 17-B and 9 NYCRR Part 252 provide for more meaningful participation in public procurement by certified Service-Disabled Veteran-Owned Businesses ("SDVOBs"), thereby further integrating such businesses into New York State's economy. EFC recognizes the need to promote the employment of service-disabled veterans and to ensure that certified service-disabled veteran-owned businesses have opportunities for maximum feasible participation in the performance of EFC Contracts.

In recognition of the service and sacrifices made by service-disabled veterans and in recognition of their economic activity in doing business in New York State, Contractors are strongly encouraged and expected to consider SDVOBs in the fulfillment of the requirements of the Contract. Such participation may be as Subcontractors or suppliers, as protégés, or in other partnering or supporting roles.

Contractor is encouraged to make good faith efforts to promote and assist in the participation of SDVOBs on the Contract for the provision of services and materials. The directory of New York State Certified SDVOBs can be viewed at: http://ogs.ny.gov/Core/SDVOBA.asp .

Contractor is encouraged to contact the Office of General Services' Division of Service-Disabled Veteran's Business Development at 518-474-2015 or VeteransDevelopment@ogs.ny.gov to discuss methods of maximizing participation by SDVOBs on the Contract.

VI. SECTION 3 AMERICAN IRON AND STEEL (AIS) REQUIREMENT

The requirements of this section apply to (1) all construction Contracts and Subcontracts for DWSRF projects and CWSRF treatment works projects and (2) all Contracts for the purchase of iron and steel products for a DWSRF project or CWSRF treatment works project. Disregard this section if it does not apply to this Contract or Subcontract.

The Contractor acknowledges to and for the benefit of the Recipient of the Clean Water State Revolving Fund ("CWSRF") or the Drinking Water State Revolving Fund ("DWSRF") financial assistance that the Contractor understands the goods and services under this Agreement are being funded with monies made available by the New York State Environmental Facilities Corporation ("EFC") through the CWSRF or the DWSRF and that such funding is subject to certain statutory restrictions requiring that certain iron and steel products used in the project be produced in the United States ("American Iron and Steel Requirement") including iron and steel products provided by the Contractor pursuant to this Agreement.

The Contractor hereby represents and warrants that:

(a) the Contractor has reviewed and understands the American Iron and Steel Requirement,
(b) all of the iron and steel products covered by the American Iron and Steel Requirement used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and
(c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Recipient.

Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Recipient to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Recipient resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the EFC or any damages owed to the EFC by the Recipient). While the Contractor has no direct contractual privity with the EFC, as a lender to the Recipient for the funding of this project, the Recipient and the Contractor agree that the EFC is a third-party beneficiary and neither this paragraph, nor any other provision of this Agreement necessary to give this paragraph force or effect, shall be amended or waived without the prior written consent of the EFC.

VII. SECTION 4 DAVIS-BACON (DB) PREVAILING WAGE REQUIREMENTS

The requirements of this section apply to all construction Contracts and Subcontracts greater than $2,000 for either DWSRF projects or CWSRF treatment works projects. Disregard this section if it does not apply to this Contract or Subcontract.

For Contracts in Excess of $2,000:

1. Minimum Wages

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis–Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein provided that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (1)(ii) of this section) and the Davis–Bacon poster (WH–1321) shall be posted at all times by the Contractor and its Subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers. The Davis-Bacon poster (WH-1321) can be found at https://www.dol.gov/whd/regs/compliance/posters/davis.htm . Wage determinations may be obtained from the US Department of Labor's website, https://beta.sam.gov/ .

(ii)(A) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the Contract shall be classified in conformance with the wage determination. The contracting officer shall approve a request for an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

1. The work to be performed by the classification requested is not performed by a classification in the wage determination;
2. The classification is utilized in the area by the construction industry; and,
3. The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), documentation of the action taken and the request, including the local wage determination shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210 and to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification request within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30–day period that additional time is necessary.

(C) In the event the Contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the request and the local wage determination, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The request shall be sent to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt of the request and so advise the contracting officer or will notify the contracting officer within the 30–day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (1) (ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this Contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the Contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the Contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program *provided* that the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis–Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

2. Withholding. The Recipient shall upon its own action or upon written request of the EPA Award Official or an authorized representative of the Department of Labor withhold or cause to be withheld from the Contractor under this Contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis–Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the Contractor or any Subcontractor the full amount of wages required by the Contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the Contract, the Recipient may, after written notice to the Contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

3. Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis–Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR § 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis–Bacon Act, the Contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The Contractor shall submit weekly for each week in which any Contract work is performed a copy of all payrolls to the Recipient. Such documentation shall be available on request of EFC or EPA. As to each payroll copy received, the Recipient shall provide written confirmation in a form satisfactory to EFC indicating whether or not the project is in compliance with the requirements of 29 CFR § 5.5(a)(1) based on the most recent payroll copies for the specified week. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR § 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH–347 is available for this purpose from the Wage and Hour Division Web site at https://www.dol.gov/agencies/whd/government-contracts/construction/forms or its successor site. The prime Contractor is responsible for the submission of copies of payrolls by all Subcontractors. Contractors and Subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the Recipient, for transmission to EFC, EPA if requested by EPA, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime Contractor to require a Subcontractor to provide addresses and social security numbers to the prime Contractor for its own records, without weekly submission to the Recipient (or the applicant, sponsor, or owner).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the Contractor or Subcontractor or his or her agent who pays or supervises the payment of the persons employed under the Contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under 29 CFR § 5.5(a)(3)(ii), the appropriate information is being maintained under 29 CFR § 5.5 (a)(3)(i), and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the Contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the Contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH–347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the Contractor or Subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The Contractor or Subcontractor shall make the records required under paragraph (3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the Recipient, EFC, EPA, or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the Contractor or Subcontractor fails to submit the required records or to make them available, the Recipient, EFC, or EPA may, after written notice to the Contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR § 5.12.

4. Apprentices and trainees.

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the Contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a Contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the Contractor's or Subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the Contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR § 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does

not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the Contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

5. Compliance with Copeland Act Requirements. The Contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this Contract.

6. Subcontracts. The Contractor or Subcontractor shall insert in any Subcontracts the clauses contained in 29 CFR § 5.5(a)(1) through (10) and such other clauses as the Recipient may by appropriate instructions require, and also a clause requiring the Subcontractors to include these clauses in any lower tier Subcontracts. The prime Contractor shall be responsible for the compliance by any Subcontractor or lower tier subcontractor with all the Contract clauses in 29 CFR § 5.5.

7. Contract Termination: Debarment. A breach of the contract clauses in 29 CFR § 5.5 may be grounds for termination of the Contract, and for debarment as a Contractor and a Subcontractor as provided in 29 CFR § 5.12.

8. Compliance with Davis–Bacon and Related Act requirements. All rulings and interpretations of the Davis–Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this Contract.

9. Disputes Concerning Labor Standards. Disputes arising out of the labor standards provisions of this Contract shall not be subject to the general disputes clause of this Contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the Contractor (or any of its Subcontractors) and the Recipient, the U.S. Department of Labor, or the employees or their representatives.

10. Certification of eligibility.

(i) By entering into this Contract, the Contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the Contractor's firm is a person or firm ineligible to be awarded Government Contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this Contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. § 1001.

For Contracts in Excess of $100,000:

1. Overtime requirements. No Contractor or Subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

2. Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (1) of this section the Contractor and any Subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such Contractor and Subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1) of this section, in the sum of $25 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (1) of this section.

3. Withholding for unpaid wages and liquidated damages. The Recipient shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any monies payable on account of work performed by the Contractor or Subcontractor under any such Contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such Contractor or Subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2) of this section.

4. Subcontracts. The Contractor or Subcontractor shall insert in any Subcontracts the clauses set forth in paragraphs (1) through (4) of this section and also a clause requiring the Subcontractors to include these clauses in any lower tier Subcontracts. The prime Contractor shall be responsible for compliance by any Subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1) through (4) of this section.

5. In any Contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR § 5.1, the Contractor or Subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the Contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the records to be maintained under this paragraph shall be made available by the Contractor or Subcontractor for inspection, copying, or transcription by authorized representatives of the Recipient and the Department of Labor, and the Contractor or Subcontractor will permit such representatives to interview employees during working hours on the job.

VIII.SECTION 5 REQUIREMENTS REGARDING SUSPENSION AND DEBARMENT

The requirements of this section apply to all Contracts and Subcontracts.

Contractor and any Subcontractors shall comply with, Subpart C of 2 CFR Part 180 as implemented and supplemented by 2 CFR Part 1532. The Contractor is not a debarred or suspended party under 2 CFR Part 180 or 2 CFR Part 1532, or 29 CFR § 5.12. Neither the Contractor nor any of its Subcontractors have contracted with, or will contract with, any debarred or suspended party under the foregoing regulations.

The Contractor and any Subcontractor have not been debarred from or deemed ineligible for Government Contracts or federally assisted construction Contracts pursuant to Executive Order 11246.

The Contractor and any Subcontractors have not been deemed ineligible to submit a bid on or be awarded a public contract or subcontract pursuant to Article 8 of the State Labor Law, specifically Labor Law § 220-b. In addition, neither the Contractor nor any Subcontractors have contracted with, or will contract with, any party that has been deemed ineligible to submit a bid on or be awarded a public contract or subcontract under Labor Law § 220-b.

In addition, the Contractor and any Subcontractors have not been deemed ineligible to submit a bid and have not contracted with and will not contract with any party that has been deemed ineligible to submit a bid under Executive Law § 316.

IX. SECTION 6 RESTRICTIONS ON LOBBYING

The requirements of this section apply to all Contracts and Subcontracts greater than $100,000. Disregard this section if it does not apply to this Contract or Subcontract.

The Contractor and any Subcontractor executing a Contract or Subcontract in excess of $100,000 agree to provide to the Recipient an executed Certification Regarding Lobbying pursuant to 40 CFR Part 34 ("Lobbying Certification") in the form attached hereto as Attachment 9, consistent with the prescribed form provided in Appendix A to 40 CFR Part 34.

ATTACHMENT D

Contract Template

Template Green-Wood Cemetery Consultant Agreement
[Green-wood Letterhead]

[Form of Agreement]

[Date]

Re: The Green-Wood Cemetery -- Consulting Agreement for Design Services for Stormwater Management Improvements Project

Dear _____:

The Green-Wood Cemetery ("**Green-Wood**" or "**Owner**") desires to retain Arcadis of New York, Inc., a corporation formed under the laws of the State of New York ("**Consultant**") to provide design services for Stormwater Management Improvements (the "**Project**") in accordance with the terms of this letter agreement and the following Exhibit[s] (together, "**this Agreement**"):

Exhibit A –Scope of Work
Exhibit B – Schedule

In the event of any conflict between this Agreement and any Exhibit, the terms of this Agreement shall control.

1. **Scope of Work and Staffing**

The Consultant shall perform the services set forth in Exhibit A.

Consultant shall perform the services at the level of care and skill ordinarily exercised by members of the same profession currently practicing in the State of New York, on projects of similar size and complexity at the same time and conditions in which the services are performed ("**Standard of Care**").

[List any other consultants with whom Consultant is to coordinate its work.]

Consultant shall use the following employees for performance of its services, and may not alter such staffing (including the replacement of any such employee who leaves Consultant's employment) without the prior consent of Owner:

[list key staff members and titles]

2. **Schedule**

The schedule for Consultant's services under this Agreement is as follows:

[Set forth here or as Exhibit B, including deliverables dates, and length of design phases where applicable.]

Consultant shall not be entitled to additional compensation in the event its services, through no fault of Consultant, extend longer than as set forth in the Schedule.

3. Additional Services

Owner may, from time to time, change the scope of Consultant's services or request additional services by written notice to the Consultant specifying the change. Consultant shall promptly provide Owner with a proposal to provide such a change in services, specifying where applicable the changes in proposed compensation, personnel and effect on the Schedule. Any additional services authorized by Owner following receipt of Consultant's proposal shall be compensated at the hourly rates set forth below unless a fixed sum or other method of compensation is agreed in writing. Consultant shall not perform any additional services unless it has received written authorization from Owner.

[_____]

[list hourly rates preferably by individual name; or alternatively by title]

These hourly rates shall apply through December 31, 2024, and may be revised thereafter by Consultant no more than 3% annually upon written notice to Owner 30 days prior to any adjustment.

4. Subconsultants

[Consultant shall retain and coordinate the services of the following Subconsultants, each of whom shall provide the same insurance coverage (unless otherwise agreed) as Consultant:]

[_____]

Consultant may not retain other Subconsultants for services on the Project without Owner's prior written approval of the Subconsultant, form of subconsultant agreement and insurance requirements. The terms of this Agreement, including but not limited to insurance and indemnification, shall be incorporated in any Subconsultant Agreement, and the form of Consultant's Subconsultant Agreements shall be subject to Owner's prior approval.

5. Compensation and Terms

Owner shall pay Consultant compensation as follows:

[*include details of how payment is to be made – hourly, any NTX maximum, % of design phase, etc.]*

Reimbursable expenses shall be reimbursed at actual cost (except for any owned vehicle use, which shall be billed at IRS rates then in effect) and include vehicle usage, outside printing, out-of-town travel (subject to Owner's prior written approval) a and overnight delivery costs. Any reimbursable expense in excess of [$100] shall require Owner's prior approval.

Billing and payment procedures shall be as follows:

- Consultant shall submit monthly invoices by the 10th day of each month in such detail as Owner shall reasonably require. Each invoice shall reflect the [percentage of services provided by category during the previous month][the amount of time spent by identified personnel, dates of service and location. Owner shall pay all approved invoices submitted by the 10th of the month within 30 days thereafter.

- Owner shall not be deemed in default for failure to pay any portion of an invoice as to which a good faith dispute exists. Notice of the reason for any non-payment shall be given by Owner within 30 days after receipt of such invoice. No interest shall be payable on amounts as to which there exists a good faith dispute between Owner and Consultant. Consultant shall continue services during the pendency of any dispute provided that Owner pays all amounts not subject to a good faith dispute.

6. Suspension and Termination

Owner may terminate Consultant's services, with or without cause, without further obligation, except for payment for services satisfactorily rendered prior to the effective date of termination, and reimbursable expenses.

Consultant may suspend or terminate its services, subject to 10 days' written notice to Owner and an opportunity to cure, if payment of an invoice (except for any amount identified as subject to a good faith dispute as described above) is not received within 45 days.

7. Notices

Routine communications may be sent by e-mail.

All communications affecting legal rights under this Agreement ("**Notices**") shall be in writing delivered by hand or overnight courier service (in each case with written receipt) to the addresses for the parties set forth herein, or at such other address as may later be specified by Notice to the other party, with email copies to Joseph Charap, Director of Horticulture and Curator, jcharap@green-wood.com, and to Richard Moylan, President, rmoylan@green-wood.com, and to [*Consultant contact and email*].

8. Insurance

Consultant and all Subconsultants, unless otherwise agreed by the Owner in writing, shall maintain the following insurance:

a. Worker's Compensation and Employer's Liability in the amounts required by law;

b. Commercial General Liability (which may include umbrella coverage) with a combined single limit of not less than $1,000,000 per occurrence/$2,000,000 annual aggregate for personal injury, including bodily injury or death or property damage, [and umbrella liability of $5,000,000 per occurrence/annual aggregate]. Such insurance shall include operations-premises liability, products-completed operations liability, personal and advertising injury, independent contractor's liability, and contractual liability. This coverage shall be maintained without interruption during the entire term of this Agreement.

c. Comprehensive automobile liability, including contractual liability, covering all owned and non-owned and hired vehicles with a combined single limit of not less than $1,000,000.

d. Professional liability insurance (errors and omissions), in an amount not less than $2,000,000 per occurrence/annual aggregate.

CGL, Umbrella and auto insurance shall name as Additional Insureds: The Green-Wood Cemetery and The Green-Wood Historic Fund, Inc., and their respective officers, directors, and employees; shall obligate the insurer to provide and pay the costs of the defense of the Additional Insureds and shall be provided on a primary basis without regard to any other insurance available to the Additional Insureds.

All insurance except Professional Liability shall be issued on an occurrence basis, by companies licensed to do business in the State of New York, with a Best's Insurance rating of no less than A-, and approved by Owner. Professional Liability coverage may be on a claims-made basis and shall be carried for no less than six years following the conclusion of Consultant's services. Consultant shall not cancel (or permit any lapse under) any policy of insurance. Each policy of insurance required hereunder shall include a provision requiring the insurance company to give Owner at least 30 days prior written notice of any modification or cancellation. Consultant and all subconsultants shall deliver to Owner a certificate of insurance evidencing the above insurance coverage prior to commencement of services and upon each renewal thereof while this Agreement remains in effect.

9. **Miscellaneous.**

(a) Access to Site. Consultant shall have access to the Project Site upon reasonable notice and coordination with the Owner for the performance of Consultant's services and those of its subconsultants. Consultant shall take reasonable precautions to minimize any damage resulting

from its activities but shall not be responsible for the costs caused by such damage except to the extent caused by its negligence or willful misconduct.

(b) Legal Requirements. Consultant shall comply with all legal requirements applicable to its services, and shall be responsible for all losses and expense, including but not limited to attorneys' fees, arising out of failure to so comply. Consultant represents that it possesses any licenses or other governmental or professional society certification required or customarily possessed by firms undertaking Consultant's services In the City of New York.

(c) Site Regulations. If any services are performed at the Project Site in New York, Consultant and its subconsultants shall comply with any regulations applicable in effect from time to time, including, without limitation, those governing security, safety, health, personal conduct, use of motor vehicles and hours of deliveries.

(d) Documents and Work Product. All work product prepared by Consultant or its subconsultants in connection with the services hereunder shall be the property of Owner and may not be used by others without Owner's written consent. Documents generated by Consultant pursuant to this Agreement are not intended or represented to be suitable for reuse by Owner or others on any other project, or for purposes other than that for which the same were created. In the event that Owner uses or modifies any work product prepared by Consultant for any purpose other than the Project without retaining Consultant in connection therewith, Owner shall indemnify Consultant against any loss, damage, cost or liability resulting therefrom.

(e) Consultant's Property. Consultant shall be solely responsible for the safekeeping of and insurance coverage for Consultant's tools, equipment and other property.

(f) Signage. Consultant shall not without Owner's prior written consent, which may be granted or withheld in Owner's sole discretion, display on or about the Project any sign, trademark or advertising materials.

(g) Assignment. This Agreement may not be assigned by Consultant without the prior written consent of Owner.

(h) Indemnification. To the fullest extent permitted by law, Consultant agrees to defend, indemnify and hold harmless Owner and all Additional Insureds from damages, liabilities or costs (including attorney's fees), which any of them may suffer (or which may be asserted against any of them) by reason of Consultant's breach of this Agreement or any negligent or intentionally wrongful act or omission of Consultant and its subconsultants, and any of their employees, agents and/or subconsultants; provided, however, that Consultant's obligation to defend shall not extend to claims of professional liability. Owner may, at its expense, participate in such defense by counsel of its choice, and Consultant agrees to cooperate with such counsel. Consultant's indemnity obligations shall survive termination of this Agreement. Consultant's defense obligation shall not extend to claims to which its professional liability insurance policy is applicable.

(i) Independent Contractor. Consultant acknowledges and agrees that Consultant is

and shall be an independent contractor for all purposes of this Agreement and shall not be the agent or employee of Owner but only a consultant to Owner.

(j) Disputes; New York Law; Jurisdiction. This Agreement shall be governed by and construed in accordance with the laws of the State of New York. The exclusive jurisdiction of any action will lie in State or Federal Courts located in Kings County, New York, and the parties submit to said jurisdiction and consent to the venue thereof. Consultant consents to service of process by registered mail at the address set forth in this Agreement.

(k) No Waiver; Severability; Entire Agreement. No action, delay, partial exercise of right or course of dealing by either party shall constitute a waiver by such party of compliance by the other party with any provision of this Agreement. The invalidity of any term or provision of this Agreement shall not affect the validity of other portions of this Agreement. This Agreement constitutes the sole and entire understanding of the parties, superseding all prior communications, whether written or oral, and may not be modified except in writing signed by Owner and Consultant.

(l) No Consequential Damages. Neither party shall be liable to the other for consequential, incidental, indirect, punitive or special damages hereunder.

(m) Hazardous Materials. Consultant shall have no responsibility for the discovery, presence, handling, removal, disposal or exposure of persons to hazardous materials in any form. If it discovers what it believes to be hazardous materials in the course of its materials, it shall promptly notify the Owner.

(n) Hidden Conditions. Consultant shall not be responsible for hidden conditions not evident without destructive investigation. In the event it discovers any hidden conditions not reasonably anticipated that may affect its services, it shall stop work and notify Owner promptly.

(o) Confidentiality and Publicity. Consultant shall keep confidential all non-public information concerning the Project or its services except as necessary in the performance of its services or as otherwise required by law. If Consultant believes that it is legally required to disclose any such information due to receipt of a subpoena, governmental inquiry or otherwise, it shall notify Owner of such circumstances as soon as practicable before any such disclosure to allow Owner to raise any legal objection prior to disclosure. After completion of the Project, Consultant may identify its services on the Project on its website and in Consultant's other business development materials unless otherwise directed by Owner.

THE GREEN-WOOD CEMETERY **[CONSULTANT]**

By _____ By_____
Richard Moylan Name:
President Title:
Date _____ Date. _____

Exhibit A
Scope of Services

[*may be excerpted from Consultant's Proposal or separate]*

Exhibit B
Schedule

ATTACHMENT E

Opti Scope of Work for Practice 3a

PO Box 170118
Boston, MA 02117
1-844-OPTIRTC
www.optirtc.com

This Scope of Work is applicable to the following sites:

- Practice area 3a - Sylvan Water, GreenWood Cemetery

The following parties are referred to as:

- TBD "Design Team"
- Green Wood Cemetery "Company" (i.e. Customer)

1.0: PROJECT COORDINATION AND MEETINGS

Opti has budgeted for ten (10) 1 hr meetings with the Design Team for the duration of the project and one (1) field visit.

2.0: SOLUTION DESIGN & ANALYSIS

Opti will provide solution design and analysis support of the Opti procured hardware and software to the Design Team. Task 1.0 includes the following components and deliverables:

- Site retrofit feasibility analysis
- Opti Certified Hardware design details
- Opti Continuous Monitoring and Adaptive Control (CMAC) construction specifications (as needed)
- Software Configuration (i.e. control objectives and settings)
- Hydrologic and hydraulic (H&H) modeling support
- Opti Certified Hardware submittal package

Site Retrofit Feasibility

Opti will support the Design Team with a review of existing conditions and development of the CMAC hardware layout and approach.

Opti Certified Hardware Design Details

Opti will provide the Design Team with the following to be included as part of the site planset or construction submittals in .dwg or PDF format:

- Standard installation details of Opti's Certified Hardware, including mounting methods, supports, and full specifications for all associated hardware to be included in the site plans or submittals;
- Electrical connection schedule (one-line diagram and terminal block guide for Opti control panel as) to be included in the site plans;
- Bill of Materials

Opti CMAC Construction Specifications

Opti will provide CMAC construction specifications and requirements, including a general description of work, submittals, quality assurance, product overview, installation and commissioning, and software and platform.

Draft Software Configuration

Opti will provide the Design Team with a draft Software Configuration report to confirm site functionality and behavior prior to final design. Opti will translate performance objectives into standard Opti software configuration settings. Example performance objectives include: flood mitigation, water quality improvements, hydromodification, water conservation and aesthetic preservation. Prior to the delivery of the Configuration Report, Opti will:

- Validate that parameter settings are compatible with the Opti Platform
- Simulate site configuration to confirm behavior of the site is consistent with Site Goals as defined by the Opti Control Configuration Builder.
- Provide single site simulation report, Draft Software Configuration, and passive SWMM model (as needed).

H&H Modeling Support

Opti will work with the Design Team to verify the following H&H requirements:

- Safe conveyance under failsafe conditions
- Drawdown time
- Regulatory requirements

This assumes that the Design Team will define storm event scenarios and provide H&H SWMM model with site characteristics as defined by the Opti Control Configuration Builder (e.g. site location, watershed area, land use and runoff coefficients, stage-storage curves, and key elevations).

Opti Certified Hardware Submittal Package

Opti will provide the Design Team or with a full certified hardware submittals package including:

- Manufacturer specifications
- Wiring diagrams
- User installation and O&M manuals

As part of Task 1.0, Opti assumes the the following will be completed by the Design Team:

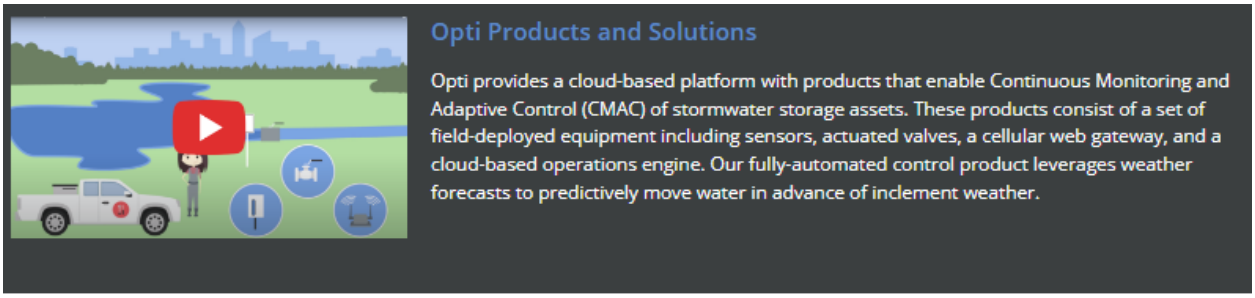
- Site civil plansets
- Regulatory permits
- Locations of all Opti specified hardware indicated on the site plans.
- Outlet structure design
- H&H modeling with all known facility and watershed information as available (e.g. as-built plans or stormwater management reports, coordinates, watershed area, land use and runoff coefficients, stage-storage curves and key elevations);

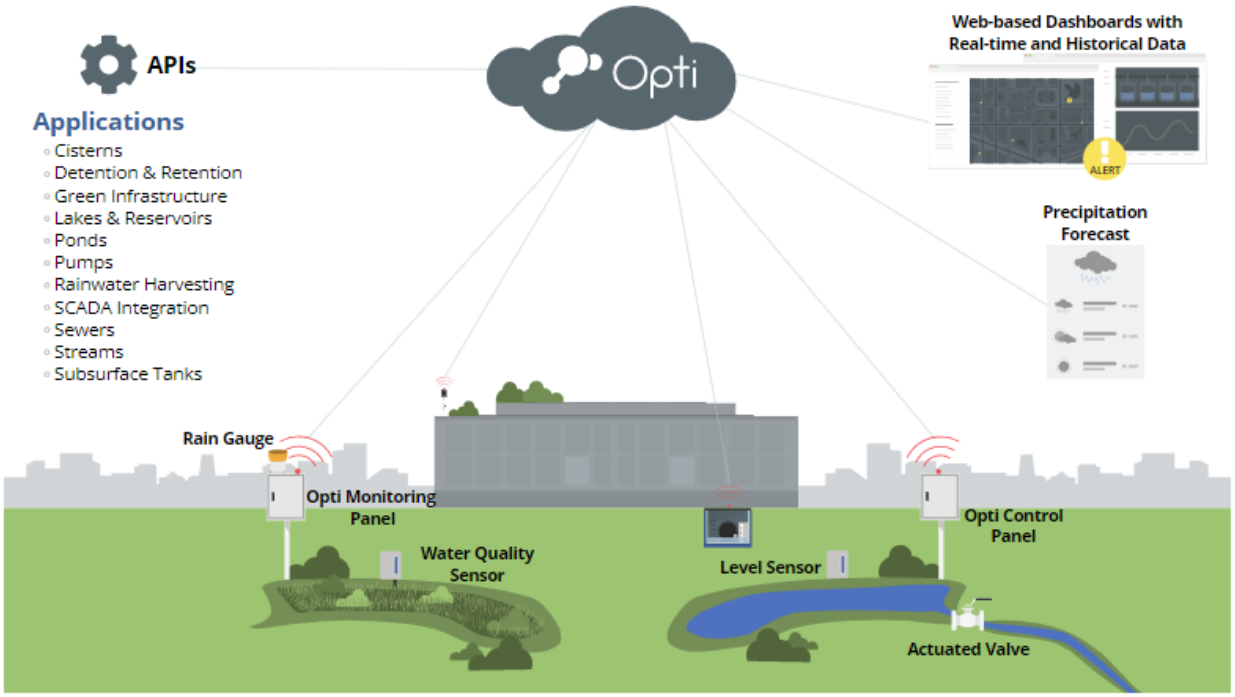
Final designs and specifications of the Opti solution must be provided to Opti for review and approval prior to construction and product implementation. Opti has budgeted for one round of reviews during conceptual design, 30%, 60%, 90% and final design. **Opti reserves the right to decline work if not given the opportunity to review the final design and specifications.**

Summary of Task 1.0 Deliverables

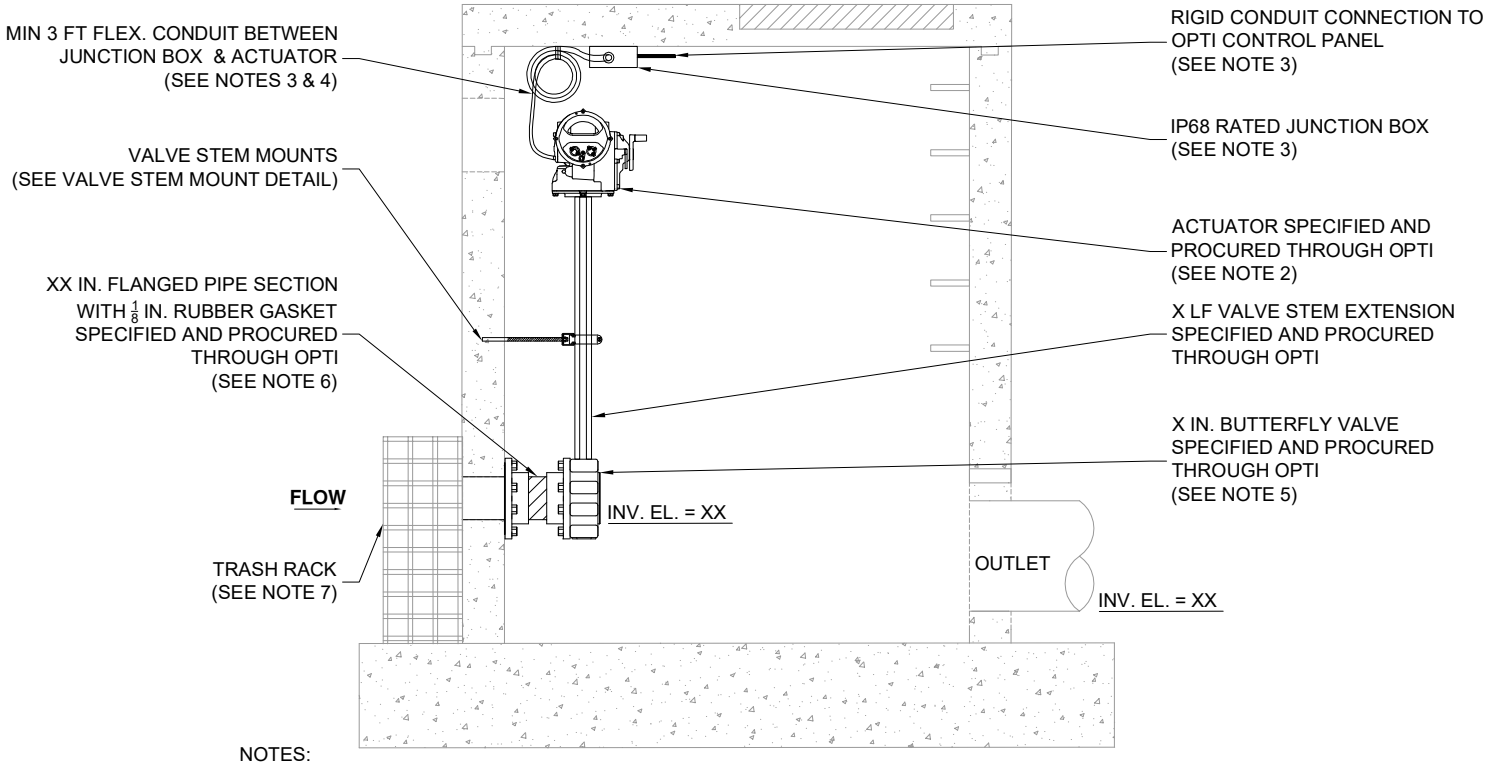
- Opti Certified Hardware design details and bill of materials
- Opti Continuous Monitoring and Adaptive Control (CMAC) construction specifications (as needed)
- Draft Software Configuration Report (i.e. control logic and settings)
- Opti Certified Hardware submittal package

CMAC Overview





Reference Design Details



NOTES:

1. OPTI SPECIFIED EQUIPMENT (TO BE PROCURED THROUGH OPTI):
   1.1. ACTUATOR, BUTTERFLY VALVE, AND VALVE STEM EXTENSION (DELIVERED PRE-ASSEMBLED ON PALLET)
   1.2. FLANGED PIPE SECTION AND RUBBER GASKET
   1.3. POLYWATER FOAM DUCT SEALANT (SENT WITH OPTI CONTROL PANEL)

   ALL OTHER EQUIPMENT TO BE PROCURED BY INSTALLATION CONTRACTOR.

2. ACTUATOR TO BE ORIENTED WITH WHEEL FACING AWAY FROM WALL. VALVES SHALL REST ON ONE OF THE FOLLOWING: POURED CONCRETE PAD (4000 PSI), APPROVED CONCRETE BLOCKS, OR APPROVED STRUCTURE FIT TO BEAR 600LB LOAD.

3. FLEXIBLE CONDUIT SHALL RUN FROM ACTUATOR TO JUNCTION BOX LOCATED IN OUTLET STRUCTURE. ALL CONDUIT ALONG WALL TO BE SECURED WITH #304 SS CLIPS (3' SPACING MAXIMUM). IP68 CORD GRIP REQUIRED FOR CONNECTION BETWEEN CONDUIT AND JUNCTION BOX. ALL CONDUIT CONNECTIONS TO BE IP68 RATED AND SEALED WITH POLYWATER FOAM DUCT SEALANT.

4. CONDUIT TO BE SIZED BY CONTRACTOR. ACTUATOR CONDUIT PORT IS 3/4 IN. INTERNAL THREADED, DOWNSIZE CONDUIT IF NEEDED. SEE ELECTRICAL DIAGRAM.

5. FLANGE TO VALVE CONNECTION: XX UNC FLANGE CONNECTOR BOLTS SHALL BE TIGHTENED TO XX LB-FT TORQUE. ALL HARDWARE TO BE #304 SS.

6. FLANGE TO WALL CONNECTION: BOLT CAVITIES TO BE CLEANED OF DEBRIS USING AUTO CLEANING DRILL BIT OR COMPRESSED AIR PRIOR TO ANCHORING. BOLT CAVITIES TO BE FILLED WITH INJECTABLE ADHESIVE ANCHOR (HILTI HIT SERIES EPOXY #2123401 OR EQUIVALENT). BOLTS TO BE EMBEDDED TO MINIMUM DEPTH SPECIFIED BY MANUFACTURER, 1 IN. CLEARANCE FROM REBAR.

7. TRASH RACK SPECIFIED BY THE ENGINEER OF RECORD (OR OTHERS) TO BE PROCURED BY CONTRACTOR. TRASH RACKS ARE REQUIRED PRIOR TO OPERATION OF THE OPTI ACTUATED VALVE AND SOFTWARE.

1/1 ACTUATED VALVE DETAIL
VALVE IN OUTLET STRUCTURE

OPTIRTC, INC.
356 BOYLSTON STREET
2ND FLOOR

BOSTON, MA 02116
(844) 678-4782

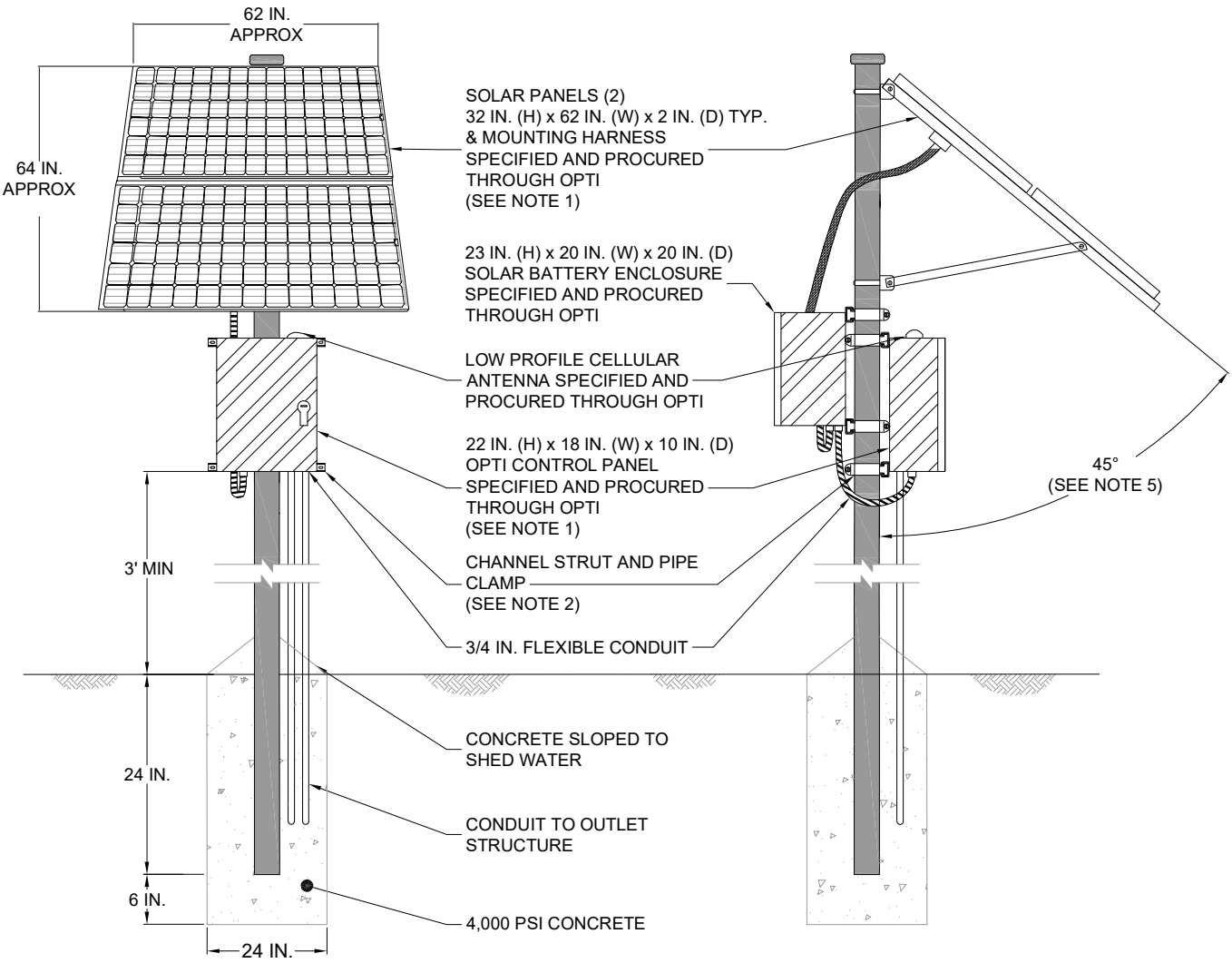
TITLE: ACTUATED VALVE - OCS WALL MOUNT

NOT FOR CONSTRUCTION
REFERENCE USE ONLY
NOT TO SCALE

DRAWN: 12/3/2020

DRAWING NUMBER:

_____ OF _____



NOTES:

1. OPTI SPECIFIED EQUIPMENT (TO BE PROCURED THROUGH OPTI):
   - 1.1. 22 IN. X 18 IN. X 10 IN. NEMA 4X CABINET WITH CELLULAR ANTENNA AND CHANNEL STRUT MOUNTING CLIPS
   - 1.2. SOLAR PANEL KIT AND MOUNTING HARNESS
   - 1.3. POLYWATER FOAM DUCT SEALANT (SENT WITH OPTI CONTROL PANEL)
2. GALVANIZED STEEL CHANNEL STRUT TO BE BOLTED TO SUPPORT POLE USING GALVANIZED STEEL CHANNEL STRUT PIPE CLAMPS. CONTROL PANEL TO BE BOLTED TO CHANNEL STRUT (CHANNEL STRUT MOUNTING CLIP SHIPPED WITH CONTROL PANEL). PANEL TO BE MOUNTED MINIMUM 3 FT. FROM GROUND.
3. ALL CONDUIT PENETRATIONS ARE TO BE IP68 RATED AND SEALED WITH POLYWATER FOAM DUCT SEALANT. SEE ELECTRICAL DIAGRAM FOR CABLE AND CONDUIT SPECIFICATION.
4. ALL EQUIPMENT TO BE GROUNDED TO CONTROL PANEL GROUNDING LUGS. OPTI CONTROL PANEL TO BE GROUNDED TO A GROUNDING ROD, GALVANIZED STEEL POLE, OR CONCRETE-ENCASED GROUNDING ELECTRODE. (SEE ELECTRICAL DIAGRAM AND GROUNDING ROD DETAIL).
5. SOLAR PANELS TO BE MOUNTED FACING SOUTH AT 45° FROM THE MOUNTING POLE.

2/1 OPTI CONTROL PANEL DETAIL
POLE MOUNTED (SOLAR POWER)

OPTIRTC, INC.
356 BOYLSTON STREET
2ND FLOOR

BOSTON, MA 02116
(844) 678-4782

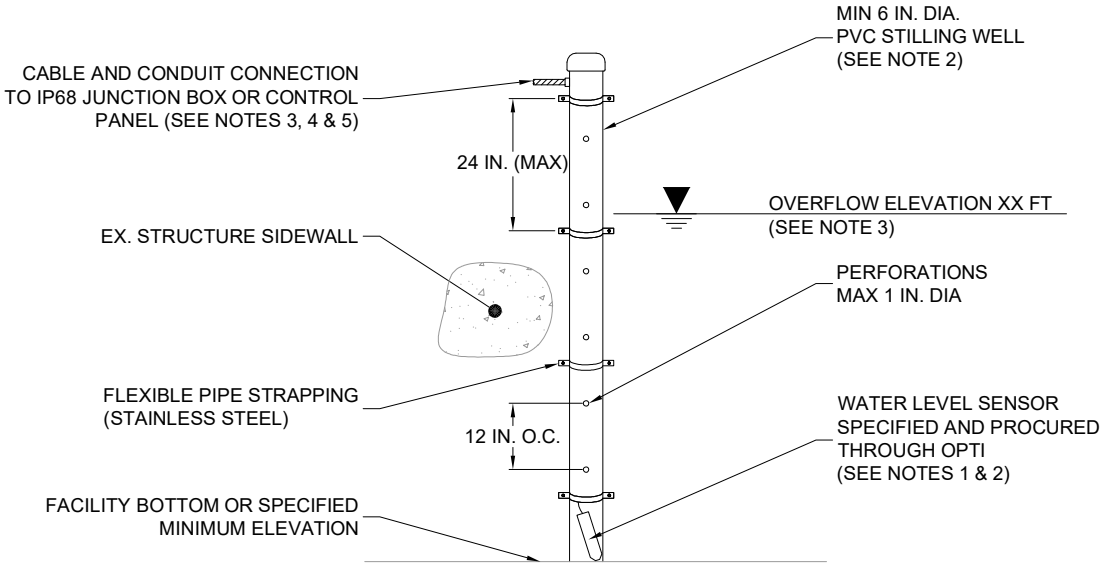
TITLE: CONTROL PANEL - SOLAR POWER

NOT FOR CONSTRUCTION
REFERENCE USE ONLY
NOT TO SCALE

DRAWN: 12/3/2020

DRAWING NUMBER:

_____ OF _____



NOTES:

1. OPTI SPECIFIED EQUIPMENT (TO BE PROCURED THROUGH OPTI):
   - 1.1. WATER LEVEL SENSOR
   - 1.2. POLYWATER FOAM DUCT SEALANT (SENT WITH OPTI CONTROL PANEL)

   ALL OTHER EQUIPMENT TO BE PROCURED BY INSTALLATION CONTRACTOR.
2. WATER LEVEL SENSOR TO REST WITHIN PVC STILLING WELL. SENSOR TO REST AT BOTTOM OF FACILITY OR AT SPECIFIED MINIMUM ELEVATION.
3. OPTI-SPECIFIED JUNCTION BOX REQUIRED IF CABLE LENGTH EXCEEDS 100 FT. JUNCTION BOX LOCATION TO BE SPECIFIED BY OPTI. BOTTOM OF JUNCTION BOX TO BE MOUNTED AT LEAST 4 IN. ABOVE OVERFLOW ELEVATION.
4. PENETRATIONS INTO ALL EQUIPMENT AND CONNECTIONS WITHIN JUNCTION BOXES SHALL BE IP68 RATED AND SEALED WITH POLYWATER FOAM DUCT SEALANT. SEE ELECTRICAL DIAGRAM FOR CABLE AND CONDUIT SPECIFICATION.
5. CONDUIT SECURED ON WALL WITH STAINLESS STEEL CLIPS (3' MAX SPACING). PVC STILLING WELL TO BE SECURED WITH STAINLESS STEEL PIPE STRAPPING (24 IN. MAX SPACING).
6. PRESSURE REFERENCE DEVICE TO BE LOCATED IN OPTI CONTROL PANEL. DO NOT SPLICE WATER LEVEL SENSOR CABLE.
7. MINIMUM 1 FOOT SPARE CABLING TO BE NEATLY COILED IN CONTROL PANEL FOR FUTURE MAINTENANCE OR SYSTEM MODIFICATIONS.

1/1 WATER LEVEL SENSOR DETAIL (PRESSURE TRANSDUCER)
WALL-MOUNTED WATER LEVEL SENSOR

OPTIRTC, INC.
356 BOYLSTON STREET
2ND FLOOR

BOSTON, MA 02116
(844) 678-4782

TITLE: WATER LEVEL SENSOR

NOT FOR CONSTRUCTION
REFERENCE USE ONLY
NOT TO SCALE

DRAWN: 12/3/2020

DRAWING NUMBER:

_____ OF _____

ATTACHMENT F

Practice Area #3b Rainwater Harvesting Conceptual Proposal

November 10, 2022 Estimate No. 1008-8417

Matt Rea / Opti RC
Greenwood Acres
Bronx, New York

Rainwater Management Solutions, Inc. (RMS) Proposal

Rainwater Harvesting System: Major Components

The information provided below is for cost estimating purposes only and should not be construed as a formal estimate or a quote for equipment and/or services until such time as equipment and design are approved by the engineer of record. The equipment noted below appears to fulfill the requirements of the proposed system based preliminary conversations with Opti RC and the client and information provided in Project Memorandum Entitled Green-Wood Stormwater Upgrades Project Memorandum. No formal design was provided, and the estimate is for purposes of applying for a grant of $250,000.

The system consists of a 50 GPM submersible pump housed on an aluminum removeable sled (water dog) to transfer water from the stormwater pond. The sled is configured with floating intake filters, a back flushable filter and housed in a manufacturer approved cooling jacket. The pump is enabled based on a float switch provided with the sled and disabled based on floats in a 3,000-gallon day tank. Water is pushed from the pond through a 50 GPM treatment skid that houses a 100 micron back flushable filter, 5-micron filter, carbon filter and UV light prior to being stored in the day tank. An integrated 100 GPM booster pump will be used to fill the trucks to feed irrigation or other approved end uses. Treatment and booster pump skids are quoted skid mounted and in seasonal enclosures for placement either indoors or outdoors. Water treatment is sufficient for most regulations for non-potable indoor or outdoor spray irrigation. Local regulations and permitting will be the responsibility of the engineer of record. Design assistance, schematic drawings, submitals and O&M manuals are included in this proposal.

The estimate has been updated to 2022 pricing and format.

Shipping amounts included are estimations only. Actual freight charges will be invoiced at time of shipping.

Contact Rainwater Management Solutions, Inc., Dave Stark or Gordon Plocher for additional information.

The following is a general breakdown of the inclusions RMS will be providing.

Quantity	**Components**
	POND PUMPING SYSTEM
One (1)	RMS 5HP Submersible Pump and Motor housed in a pre-fabricated Cooling Jacket with 25' chord. Capable of transfer at 50 GPM at 65 PSI at point of connection. 230V/3P/60Hz. Change in design flow rate and pressure will require updated quote. *Note: Typical pump used for commercial operation transferring water through process treatment and held in storage tank and then distributed to end use applications with a booster pumps.*
Two (2)	RMS 2" Coarse Floating Filters with 7' of suction hose and male thread fitting 1,200 microns. *Note: Draws cleanest water from below the surface.*
One (1)	Normally open float switch without plug and 70' of cord. *Note: Provides low level pump protection in down position and enables pump start in up position. Process controls will stop transfer via floats in day tank.*
One (1)	Pump starter in control box.
One (1)	2" Check valve on discharge of submersible pump.
One (1)	Water dog aluminum sled to house submersible pump package for placement and removal in stormwater pond. Includes: -Aluminum construction - Sure-Flo Self Cleaning Filter with backflush and solenoid valve operation. -150 ft. wire with splice connections -Four removal line connection points for easy install and removal -Bracket for cooling jacket -Camlock 2" Stainless Steel Male Thread input
	WATER TREATMENT SYSTEM
One (1)	Made to Order Rainwater Filtration Skid 50gpm at max pressure 125psi with Domestic Backup Includes: -100 Micron Backwash Filter – DEPENDENT ON PRETREATMENT OF STORMWATER -5 Micron Bag Filter with Stainless Steel Housing -Carbon Filter with Stainless Steel Housing -UV Light -2.0" Flange Rainwater Inlet -2.0" Flange Domestic Inlet -2.0" Flange System Outlet -1" Flange Drain Line -2.0" Flow Meter -2.0" RPZ -2.0" Domestic Motorized Valve -RMS 200 Controller - PLC Touchscreen U.L. Listed Control System -Single Point Power Disconnect Panel and Transformer -Pre-Plumbed in Copper Pro Press -Pre-Wired -Skid Mounted on Painted Blue Steel Skid -Enclosed in Seasonal Enclosure with Fan Approximate Skid Dimensions of 72" L x 32" W x 72" H
	DAY TANK SYSTEM AND ASSESSORIES
One (1)	3,000 Gallon Poly Tank Black 96" Diameter x 109" Height, wt 390 lbs
One (1)	RMS Float Tree consists of 7-foot 2/16 PC chain, two 1/4' SPAS (top fastener for float tree), three 3/16' S/S wire rope clamps, one anchor 10 pounds *Note: Stainless steel chain to attach floats and level sensor. Allows adjustment without entering the tank.*
Three (3)	Normally open float switches without plug *Note: Provides low level pump protection for booster pump and start and stop functions on submersible pond pump.*
Two (2)	Additional 2" Bulkhead Fittings for Submersible Inlet and Air Vent
One (1)	Level sensor for day tank with 36' cable and 4-20 ma output
One (1)	2" PVC Smoothing Inlet
	BOOSTER PUMP PACKAGE TO FILL TRUCKS
One (1)	Made to order booster pump package skid mounted in enclosure. BTCB-10000-S-E 100gpm @ 150tdh Includes: -7.5HP S-Group Goulds Pump 230/3/60 -VFD Kit (pressure sensor, conduit kit, and cable for pressure sensor) -33.4 Gallon Pressure Tank Tank Tee Package (tee, relief valve, boiler drain, and gauge) -2.0" Suction Rainwater Inlet -1.5" Discharge Outlet -Pre-Plumbed in Copper Pro Press -Pre-Wired

	Skid Dimensions TBD – Can be built as two separate or one combined skid depending on final layout and configuration.
One (1)	One day of onsite assistance for system startup and owner training. Not to exceed 8 hours.
	Design Assistance, Submittals, O&M and Schematic Design Drafting for Use By the Engineer of Record in CD's, Rep brokerage Fees Included

UPDATED BUDGETARY PRICING – ROM – PRE-DESIGN *$138,000*

Benefits and Added Value of Working with RMS:

In addition to RMS supplying both the design and components for your needs, the following highlight some summary additional benefits and value-added elements that RMS can provide you in conjunction with this project.

- RMS provides a U.L. Listed Single Point Power Source for the rainwater harvesting system. The electrician lands power feed in one panel for the entire system and the power to remote cistern pumps and other devices is wired from this panel.
- RMS assists your contractor in determining the size and quantity of electrical and control cables necessary. RMS provides your contractor a detailed wiring schematic of the overall system as well as specific schematics for the system controller and single point power source.
- A "rapid connection" wiring schematic can be provided with every system that makes it simple to understand where electrical and control wiring is to be landed and connected.
- Pumps are ready for rapid installation into the tank. RMS provides instructions to your contractor how to install pumps in the cistern.
- All skid mounted equipment provided by RMS is tested prior to the leaving the fabrication facility.
- RMS builds its own controllers and electrical panels in its U.L. Listed panel shop. Controllers are tested to confirm that they operate appropriately with all skid mounted and field installed equipment.
- RMS has designed its system for integration of the controller with the equipment it provides.

Technical Support:

The above proposed project and pricing is for the system and related components. Additional technical support and assistance is also available as outlined below:

One day of onsite technical support for system start-up and training is included in this proposal. Additional support can be scheduled upon request and will be based on the following data.

- Onsite technical support is $1,800.00 per day per RMS person and is includes for up to six hours on a single day, plus travel costs.
- The system can be function tested and the installing contractor can be trained on the operation and maintenance requirements.
- Within 30 days of the training/start-up completion a written report will be provided by RMS.

The trip to start-up the system is to be scheduled after the installing contractor has completed the system installation and has returned the Installation Checklist. Failure to accurately represent the completeness of the installation may result in an unsuccessful start-up trip and additional fees for a return trip. Additional trips to the project will be billed at same daily rate note above.

During the initial start-up visit, the system can be tested to simulate the systems ultimate demand created by the end use as best as possible. If the project site's end use is not complete or capable of accurately representing the system's ultimate demand, then it may be necessary for a return trip to make adjustments after the building is complete or occupied. RMS is not responsible for the costs of return trips to the site if any further technical support, such as system adjustments, are necessary and therefore additional charges may be billed for any additional trips.

Not all installation problems/errors can be located during on-site installation verification. It is critical that the installation contractor follows all instructions including protection of the system/equipment from construction debris. Damage due to construction debris entering the system will not be covered under warranty by RMS.

Specific Exclusions:

The following are specific exclusions from the above RMS scope of work and deliverables.

- Pipe, fittings, manual valves or check valves for required connections between any system, equipment or component of the rainwater harvesting system.
- Electrical and control wiring and conduit required for or between any system, equipment or component of the rainwater harvesting system.
- Electrical grounding of the system.
- Foundation design or construction for any equipment/components related to the rainwater harvesting system.
- Seismic analysis or buoyancy calculations.
- Permits, Inspections, Waivers or Professional Engineering Requirements.
- Water sample testing or any additional testing services.
- Lifting equipment as required for off-loading the system/equipment from the mode of delivery and setting in place.

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Important Information regarding the systems/equipment proposed for this project:
Rainwater Management Solutions commercial rainwater harvesting systems/equipment is for NON-POTABLE water applications only. The customer is solely responsible for determining the suitability of the system/equipment for the intended application. RMS and its representative companies assume no risk or liability in connection therewith, regardless of RMS's knowledge of the system's/equipment's intended use and regardless of any suggestions or statements made by RMS.

Indoor installations of any system/equipment must include an appropriately sized drain system to prevent flooding. This is the customer's responsibility and as such, RMS will not be responsible for damage caused by flooding regardless of why or how it occurs.

This proposal is based upon review of the information provided to RMS at the time that a proposal was requested. **It is the customer's responsibility to review this proposal and to determine whether the systems/equipment contained within it is suitable for the project.** Systems/equipment and labor not specifically addressed under "Materials and Services Provided" are not included in this proposal.

Materials and Services Provided:
Connections between components using pipe, high and low voltage electrical wiring, and other connections between components, are provided and installed by others. Check valves and manual valves are not included. This proposal includes only the components and/or services listed below.

Notes:
All proposals and orders will be subject to RMS's standard terms and conditions, which if not attached to this correspondence are available upon request. Any deviations from those standard terms and conditions are noted in the following:

- *Pricing includes only listed equipment/services and quantities as noted above*
- *F.O.B Shipper – Prepay & Add -SHIPPING IS ESTIMATED – ACTUAL SHIPPING CHARGED AT THE TIME OF MATERIAL READINESS*
- *Packaging and crating fees are based on time and materials and invoiced with freight charges.*
- *Freight costs for tanks may change*
- *50% upfront deposit required for tank purchases and to place skids into productions*
- *Applicable taxes are not included unless noted above*
- *Multiple invoices will be created with separate billing dates if system/equipment is delivered in multiple shipments. All invoices are to be paid in full within 30 days.*

The cost of the materials and services included in this proposal is valid for 15 days from the date of this proposal.

If this proposal is agreeable to you, please indicate your acceptance by signing in the space provided below and return one copy to us for our file. Please attach this document to applicable purchase order.

_____ _____
Signature Date

_____
Company

_____
Title

November 10, 2022 Estimate No. 1008-8417

TERMS AND CONDITIONS

1. **GENERAL**. This set of terms and conditions ("Terms and Conditions") pursuant to which the purchaser identified on the front page hereof ("Purchaser") will purchase and Rainwater Management Solutions, Inc., a Virginia corporation, ("Seller"), will sell the product, and any accessories and attachments (collectively, the "Product") described on the front page of the Purchase Order. These Terms and Conditions shall govern and apply to the sale of the Product to Purchaser, regardless of any terms and conditions appearing on any purchase order from Purchaser or other forms submitted by Purchaser to Seller. Any terms in the Seller's estimate or proposal that may be attached hereto and to the Purchase Order shall govern over the specific related terms herein.

2. **CANCELLATION**. This Purchase Order can be cancelled by either party, subject to the following restrictions: (1) the Products sold hereunder are specially manufactured, or nonstandard goods, then this contract be cancelled by Purchaser unless agreed upon by a signed agreement between the parties; and (2) in the event that the Purchaser cancels this Purchase Order, it agrees to reimburse Seller in an amount equal to either (a) 10% of the Purchase Order if Purchaser cancels at a time after this Purchase Order is executed, but prior to shipment of Products sold hereunder.

3. PRICE. All prices set forth in this Purchase Order are F.O.B. Seller's place of business, unless otherwise agreed in writing. All prices are exclusive of any and all taxes, including, but not limited to, excise, sales, use, property or transportation taxes related to the sale or use of the Product, now or hereafter imposed, together with all penalties and expenses. Purchaser shall be responsible for collecting and/or paying any and all such taxes, whether or not they are stated in any invoice for the Product. Purchaser shall indemnify and hold Seller free and harmless from and against the imposition and payment of such taxes. Seller, at its option, may at any time separately bill the Purchaser for any taxes not included in Seller's invoice and Purchaser shall pay said taxes, or in lieu thereof, shall provide Seller with a tax exemption certificate acceptable to taxing authorities. Unless otherwise specified herein, all prices are exclusive of inland transportation, freight, insurance and other costs and expenses relating to the shipment of the Product from the F.O.B. point to Purchaser's facility. Any prepayment by Seller of freight insurance and other costs shall be for the account of Purchaser and shall be repaid to Seller.

4. PAYMENT, DELINQUENCY CHARGE. Payment shall be made in accordance with the terms of this Purchase Order, unless otherwise agreed in writing: (1) Purchaser shall pay Seller that percentage of the Purchase Price stated on the Purchase Order and in U.S. Dollars upon execution of this Purchase Order; and (2) the remaining percentage of the Purchase Price is due 30 days after shipment. Seller reserves the right to charge interest at the rate of 1.5% per month (but not more than the maximum percentage permitted by law) on all balances not paid by Purchaser within the designated net terms. Seller reserves the right at any time to revoke any credit extended to Purchaser because of Purchaser's failure to pay for any goods when due or for any other reason deemed to be good and sufficient by Seller. Seller shall have no obligation to make sale or shipment of any products to Purchaser, in any manner, if at any time the Seller has reason to believe that the financial responsibility of Purchaser is impaired or unsatisfactory to Seller, or if at the time of such sale or shipment, Purchaser is delinquent in the payment of any account to Seller. In the event Purchaser shall be in default of any terms and conditions hereof, or becomes insolvent or proceedings are instituted to declare Purchaser bankrupt, or a receiver is appointed for Purchaser in any court, Seller may at its option terminate this Purchase Order and/or declare any and all claims or demands against Purchaser held by Seller immediately due and payable, together with any and all attorneys' fees and costs incurred by Seller in enforcing its rights hereunder, all of which Seller may sue for and recover from Purchaser.

5. DELIVERY. Seller shall exert reasonable efforts to cause the Product to be shipped and delivered in accordance with the terms and provisions of this Purchase Order. Risk of Loss shall pass at the F.O.B. point designated on this Purchase Order. Notwithstanding the provisions contained in this Purchase Order to the contrary, Seller shall not be responsible or liable for any loss or damage whatsoever, including loss of income and/or profits, incidental, special or consequential damages resulting from Seller's delayed performance in shipment and delivery of the Product for any reason whatsoever. All risk of damage or loss to the Product at any time after arrival at the F.O.B. point set forth on the front page hereof is assumed by Purchaser and such damage or loss shall not operate in any way to release Purchaser from any of its obligations hereunder or otherwise.

6. INSTALLATION. Unless otherwise stated herein, Purchaser, at its sole cost and expense, shall furnish such materials, labor and equipment as may be necessary for the prompt erection, assembly and installation of the Product. In this regard, Purchaser shall: (a) provide all transportation and necessary rigging services; (b) uncrate the Product and deliver it to the floor of the plant; (c) provide all utilities required for assembly to the Product; and (d) provide such other services as may be required to allow Seller to place electric leads into the Product.

7. WARRANTY. Seller warrants that the Products sold hereunder will be free from defects in material and workmanship for a period of one year from the date of delivery unless otherwise specified on the front page of this document. SELLER'S WARRANTY HEREIN IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES OF SELLER AND THE MANUFACTURER OF THE PRODUCT (COLLECTIVELY, "MANUFACTURING AND SELLING PARTIES"), WHETHER EXPRESS, IMPLIED, STATUTORY, OR OTHERWISE CREATED UNDER APPLICABLE LAW, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTY OF MERCHANTABILITY AND ANY WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE OR USE. IN NO EVENT SHALL SELLER OR THE MANUFACTURING AND SELLING PARTIES BE LIABLE FOR SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING LOSS OF PROFITS, WHETHER OR NOT CAUSED BY OR RESULTING FROM THE NEGLIGENCE OF SELLER AND/OR THE MANUFACTURING AND SELLING COMPANIES, UNLESS SPECIFICALLY PROVIDED HEREIN. IN ADDITION, THIS WARRANTY SHALL NOT APPLY TO ANY PRODUCT OR PORTIONS THEREOF WHICH HAVE BEEN SUBJECTED TO ABUSE, MISUSE, IMPROPER INSTALLATION, MAINTENANCE OR OPERATION, ELECTRICAL FAILURE OR ABNORMAL CONDITIONS, AND TO PRODUCT WHICH HAS BEEN TAMPERED WITH, ALTERED,

MODIFIED, REPAIRED, OR REWORKED BY ANYONE NOT APPROVED BY SELLER. PURCHASER'S SOLE AND EXCLUSIVE REMEDIES UNDER THIS WARRANTY SHALL BE LIMITED, AT SELLER'S EXCLUSIVE DISCRETION, TO: (1) REPLACEMENT OF ANY DEFECTIVE PRODUCT OR PART THEREOF; (2) REPAIR OF ANY DEFECTIVE PRODUCT OR PART THEREOF; OR (3) RETURN OF THE PURCHASE PRICE IN EXCHANGE FOR RETURN OF THE PRODUCT. No agent, employee or representative of Seller has the authority to bind Seller to any affirmation, representation or warranty concerning the Product sold hereunder, and unless such affirmation, representation or warranty made by an agent, employee or representative is specifically included in this Purchase Order, it will not form a part of the basis of this Purchase Order and shall in no way be binding upon the Seller or enforceable by Purchaser. This warranty is not assignable or otherwise transferable to any subsequent purchaser or user of the Product and any sale or other transfer of the Product or any such attempted assignment and transfer of this warranty shall void Seller's warranty and Seller shall thereafter have no further obligation or liability with regard thereto.

8. SECURITY INTEREST. Purchaser hereby grants to Seller and Seller hereby retains a continuing purchase money security interest in the Product and all of the equipment sold and delivered by Seller to Purchaser, whether presently in the possession of Purchaser or hereafter acquired, and all spare parts and components therefor, together with any and all proceeds of sale or other disposition of the Product, including, but not limited to, cash, accounts, contract rights and chattel paper. As a condition to the sale of the product, upon request of Seller, Purchaser shall join with Seller in executing one or more financing statements pursuant to the Uniform Commercial Code in force in Purchaser's state or province of business in a form satisfactory to Seller to evidence Seller's security interest in the Product. Purchaser shall keep the Product free from any adverse lien, security interest or encumbrance. In the event Purchaser shall be in default under this Purchase Order, Seller shall have the remedies of a secured party under the Uniform Commercial Code in force in the state or province where the Product is located, and Seller may enter the Purchaser's premises and remove the Product.

9. RETURNED GOODS. Purchaser shall not return the Product sold hereunder unless it first obtains a returned goods authorization number from Seller. Seller does not guarantee that it will accept returned goods. Purchaser shall bear all return shipping costs and risk of loss up to Seller's place of business.

10. CONFIDENTIALITY. All drawings, designs, specifications, pricing, manuals and programs furnished to Purchaser by Seller shall remain the confidential and proprietary property of Seller. All such information, except as may be found in the public domain, shall be held in strict confidence by Purchaser and shall not be reproduced nor disclosed by Purchaser to any third parties. Copyright in all materials made available by Seller shall remain in Seller at all times.

11. SAFETY PRECAUTIONS. Purchaser shall require employees to use all safety devices, guards, and proper safe operating procedures as set forth in manuals and instructions furnished by Seller or as required by law. Purchaser shall not remove or modify any such devices, guards, instructions, or signs. It is the Purchaser's responsibility to provide all the means that may be necessary to effectively protect all employees from serious bodily injury, which otherwise may result from the method of particular use, operation or set-up or service of the Product. If Purchaser fails to comply with such provisions of this paragraph or the applicable standards or regulations aforementioned, Purchaser shall indemnify and save Seller harmless from and against any and all claims, losses or damages arising therefrom.

12. FORCE MAJEURE. Seller's obligations hereunder are subject to, and Seller shall not be held responsible for, any delay or failure to make delivery of all or any part of the Product due to labor difficulties, fires, casualties, accidents, acts of the elements, acts of God, transportation difficulties, delays by a common carrier, inability to obtain Product, materials or components or qualified labor sufficient to timely perform part of or all of this Purchase Order, governmental regulations or actions, strikes, damage to or destruction in whole or part of manufacturing plant, riots, civil commotions, pandemics, warlike conditions, flood, tidal waves, typhoon, hurricane, earthquake, lightning, explosion, difficulties arising from the IT problems, or any other causes, contingencies, or circumstances within or outside the United States not subject to the Seller's control which prevent or hinder the manufacture or delivery of the Product. In the event of the occurrence of any of the foregoing, at the option of Seller, Seller shall be excused from the performance of this Purchase Order, or the time performance for Seller's shall be extended.

13. GOVERNING LAW, JURISDICTION, VENUE AND WAIVER. This Purchase Order will be binding and effective only when signed by a duly authorized representative of Seller. Except for the perfection of any security interest or lien in any other state, and except as otherwise provided herein, this Purchase Order will be governed and construed in all respects by the internal laws and decisions, other than any conflict of laws provisions, of the Commonwealth of Virginia, including, without limitation, all matters of construction, validity, enforceability, and performance. PURCHASER (I) CONSENTS AT SELLER'S ELECTION AND WITHOUT LIMITING SELLER'S RIGHT TO COMMENCE AN ACTION IN ANY OTHER JURISDICTION, TO THE EXCLUSIVE JURISDICTION AND VENUE OF ANY COURT (FEDERAL, or STATE) SITUATED IN THE CITY OF ROANOKE, VIRGINIA; (II) WAIVES ANY OBJECTION TO IMPROPER VENUE AND FORUM NON-CONVENIENS; AND (III) CONSENTS TO SERVICE OF PROCESS BY CERTIFIED MAIL, POSTAGE PREPAID, ADDRESSED TO PURCHASER AT ITS ADDRESS AS SET FORTH HEREIN. PURCHASER HEREBY WAIVES TRIAL BY JURY. Purchaser shall bring any action arising out of this PURCHASE ORDER only in the federal or state courts in the City of Roanoke, Virginia. In the event Purchaser institutes any action in any court other than a court located in the City of Roanoke, Virginia, Purchaser shall assume all of Seller's costs in transferring said proceeding to a court located in the State of Illinois, including, without limitation, reasonable attorneys' fees.

14. MISCELLANEOUS PROVISIONS.

(a) This Purchase Order constitutes the entire agreement between Seller and Purchaser as it relates to this transaction and the liability of the Manufacturing and Selling Parties and supersedes any and all prior oral or written agreements, correspondence, quotations or understandings heretofore in force between the parties relating to the subject matter hereof. There are no agreements between Seller and Purchaser with respect to the Product herein except those specifically set forth in and made part of this Purchase Order. Any additional terms, conditions and/or prices are rejected by Seller.

(b) If any term or condition or part of this Purchase Order is held invalid, the remaining terms and conditions of this Purchase Order shall not be affected thereby.

(c) This Purchase Order may be modified, canceled or rescinded only by a written agreement of both parties executed by their duly authorized agents.

(d) No claim arising out of any breach of this Purchase Order may be discharged in whole or in part by waiver or renunciation of such claim unless such waiver or renunciation is in writing and signed by the parties hereto.

(e) All rights available to Seller under the Uniform Commercial Code except as specifically limited or excluded herein (even though not specifically enumerated), are reserved to Seller as remedies available in the event of default of Purchase.