319(H) GRANT (WQR-2019-LHC00130) DESIGN AND IMPLEMENTATION OF FOUR SMALL-SCALE IN-LAKE / WATERSHED PROJECTS

LAKE HOPTCONG, SUSSEX AND MORIS COUNTIES, NEW JERSEY

Funded By:
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EXECUTIVE SUMMARY

Four small-scale projects were designed and implemented between 2022 and 2024 in Lake Hopatcong and its watershed with funding provided by the 319(h) grant program (WQR-2019-LHC00130). One project was implemented in each municipality with the goal of reducing the availability of phosphorus that contribute to harmful algal blooms (HABs) in Lake Hopatcong.

FLOATING WETLAND ISLANDS IN LANDING CHANNEL

In an effort to reduce phosphorus availability in the Landing Channel section of Lake Hopatcong, five floating wetland islands (FWIs) were installed at the southern end. The islands were planted with native wetland plants, and they form associations with microbes that sequester phosphorus from the lake, reducing phosphorus availability for other plants and algae. No monitoring associated with the FWIs was conducted for this study; however, a total removal of approximately 18 lbs of TP is estimated.

SHORELINE STABILIZATION AT MEMORIAL POND

Along the southwestern shoreline of Memorial Pond, approximately 2,800 square feet of shoreline and adjacent bank was planted with native herbaceous and woody plant material. The use of native vegetation not only enhances the ecological value of the site but also reduces the vulnerability of the shoreline to future erosion and invasive species establishment. Additionally, these plants will aid in the collection and treatment of nutrient and sediment loads produced during storm events. The shoreline buffer is estimated to reduce the existing total phosphorus (TP), total nitrogen (TN), and total suspended solids (TSS) loads by 0.17, 1.80, and 39.2 lbs/yr, respectively.

REPLACEMENT OF FILTERRA MEDIA WITH BIOCHAR

Three existing Filterra boxes had the filter media removed and replaced with Biochar and three other boxes received new trees of species more resilient to road salt. Post-installation stormwater monitoring was conducted at each Filterra unit to assess the performance of Biochar relative to the existing media. The Filterras with standard filter media and vegetation performed well in reducing TP and TSS concentrations, with respective removal rates of 44% and 77%. However, there was a slight negative removal rate of -3% for soluble reactive phosphorus (SRP), indicating higher SRP concentrations post-treatment. The Filterra with Biochar performed slightly better than the Filterras with vegetation for all metrics, with mean TP, SRP, and TSS removal rates of 49%, 19%, and 82%, respectively. Based on this data, it's apparent that the Biochar was more effective in reducing dissolved phosphorus concentrations, which is the goal of Biochar in this setting.

SOCKS FOR DOCKS BIOCHAR PROGRAM

A total of 470 pre-made Biochar socks were purchased and distributed to lakefront property owners around Lake Hopatcong. In total, Biochar socks were distributed to over 160 properties. Princeton Hydro also developed a training video that was made available to all participants, with information related to the installation and removal of Biochar as well as the purpose of using Biochar: https://www.youtube.com/watch?v=ZJDnjEZlBgI. Biochar socks were removed from five random locations after three months of installation and analyzed for TP and extractable phosphorus. While the laboratory data is underwhelming (estimated total removal of 0.14 lbs of TP), the observed improvements, particularly in smaller waterbodies or more isolated coves, indicate that the Biochar is having some beneficial impact relative to improving water quality. Princeton Hydro is continuing to develop other methods and approaches to better quantify nutrient removal capabilities of Biochar.

1.0 INTRODUCTION

As part of the larger rehabilitation effort to reduce nutrient loading in Lake Hopatcong, four small-scale projects were designed and implemented between 2022 and 2024 in Lake Hopatcong and its watershed. Grant funds were awarded to the Lake Hopatcong Commission (LHC) through the 319(h) grant program (WQR-2019-LHC00130). One project was implemented in each municipality with the goal of reducing the availability of phosphorus that contribute to harmful algal blooms (HABs) in Lake Hopatcong. The four projects included the instillation of floating wetland islands (FWIs) in Landing Channel, shoreline stabilization via plantings at Memorial Pond, the replacement of the existing filter media with Biochar in Filterra stormwater units, and the Socks for Docks Biochar program. Each of these projects utilized different methods, with the ultimate goal of reducing the nutrient load in Lake Hopatcong. All project locations are identified in the figure in Appendix I.

INSTALLATION OF FWI IN LANDING CHANEL

In an effort to reduce phosphorus availability in the Landing Chanel section of Lake Hopatcong (Township of Roxbury), a series of FWIs were installed at the southern end of Landing Channel. These islands are planted with native wetland plants, and they form associations with microbes that sequester phosphorus from the lake, reducing phosphorus availability for other plants and algae.

SHORELINE STABILIZATION AT MEMORIAL POND

Memorial Pond, located in Memorial Park in the Borough of Mt. Arlington, is a wet pond BMP that removes nutrients, suspended solids and other pollutants. It was noted through some on-site assessments that the southwestern section of the pond would benefit from stabilization via native vegetation. This project reduces pollutants such as nutrients and solids from entering the pond and, in turn, entering Lake Hopatcong.

REPLACEMENT OF FILTERRA MEDIA WITH BIOCHAR

Six stormwater Filterra boxes were installed under SFY2005 and SFY2011 319(h) grants by Jefferson Township with guidance from Princeton Hydro to provide additional stormwater treatment. While this type of Manufactured Treatment Device (MTD) is sound technology, there have been issues with getting the trees to successfully grow. This is most likely due to the impacts of road salt and associated plowing activities. As an alternative approach, three of the Filterra boxes had the existing media removed and replaced with Biochar; the damaged / dead trees were also removed. The other three boxes received new trees of species more resilient to road salt. Post-installation stormwater monitoring was conducted at each Filterra unit to assess the performance of Biochar relative to the existing media.

SOCKS FOR DOCKS BIOCHAR PROGRAM

470 premade Biochar socks were purchased and distributed to lakefront residents. Princeton Hydro also developed a training video that was made available to all participants, with information related to the installation and removal of Biochar as well as the benefits of using Biochar. Biochar socks were removed from select locations after three months of installation and analyzed for total phosphorus (TP) and extractable phosphorus. The resulting data was used to quantify how much phosphorus each Biochar sock removed from the lake.

2.0 INSTALLATION OF FLOATING WETLAND ISLANDS IN LANDING CHANNEL

SUMMARY

FWI activities in Landing Channel were conducted on 8 June 2022 and 18 June 2024. Five islands (7.5' x 12') totaling 450 sq. ft were installed in Landing Channel on 8 June 2022 and planted with a variety of native wetland vegetation. In 2024, the existing FWIs were re-planted and provided with upgraded bird fencing material and then returned to their original location in the channel.

FWIs are primarily used to control nutrient loading in lakes using biological nutrient uptake, a type of bioremediation. These systems provide a natural method to assist in nutrient removal relative to some other techniques, such as chemical nutrient inactivants. FWIs are polymer mats that are anchored to the lakebed. The mats are planted with a variety of native wetland vegetation with the plants rooted in peat or other soil matrix and eventually growing down into the water column where they take up nutrients to support vegetative growth. In addition to the plants, the matrix of these islands is colonized by a variety of naturally-occurring beneficial microbes including bacteria and periphyton in biofilms that also remove nutrients from the water including both nitrogen and phosphorus. The islands are deployed into open waters and have water quality, aesthetic, fishery and wildlife benefits. Specifically, these benefits include:

- Being a net sink (absorption) of nutrients and other pollutants that would otherwise be available for nuisance algae and aquatic plants. The microbial community underneath the island, coupled with the accumulation of terrestrial / wetland plants on the island itself, removes nutrients and other pollutants from the water column.
- Provides structure and habitat for a variety of aquatic organisms including young fish. In turn, larger gamefish will be attracted to the structures.
- Provides potential shoreline stabilization when placed along near shore areas.
- Being an aesthetic amenity for the lake. Attractive annual and perennial vegetation can be planted on the island to function as a scenic "lake-scape."

SCHEDULE AND PLANT LIST

On 8 June 2022, five islands were planted and installed at the southern end of Landing Channel. These islands were planted using a variety of native wetland plants (Table 2.1). After planting, netting was placed around the perimeter of the island to deter bird nesting. The islands were then deployed into the channel, anchored in place, and watered thoroughly.

Table 2.1: List of floating wetland plant species used in the 2022 planting of FWIs in Landing Channel

Landing Channel: Floating Wetland Island Plant List, 2022		
Botanical Name	**Species Name**	**Quantity**
Asclepias incarnata	Swamp Milkweed	150
Eupatorium maculatum	Spotted Joe-pye Weed	100
Eupatorium perfoliatum	Boneset	100
Iris versicolor	Blueflag Iris	150
Lobelia siphilitica	Blue Lobelia	100
Pontederia cordata	Pickerelweed	100
Schoenoplectus tabernaemontanii	Softstem Bullrush	200

On 18 June 2024, the islands were removed from their place in the water and re-planted with native wetland plants (Table 2.2). Due to a combination of the hot and dry summer of 2022 and the failing of the netting, most of the plants did not survive into 2024. However, there were funds in the grant for additional plants, and it was decided to replant all of the FWIs. After planting the bird netting was replaced and the FWIs deployed back into the channel. The netting was reinforced with sturdier stakes to prevent the failing of the nets. Additionally, three layers of twine were wrapped around each island to act as a secondary barrier to prevent waterfowl from landing on the islands. Finally, mylar tape was added to the netting of each island to act as an additional deterrent to waterfowl.

It was reported that geese had knocked down the fencing on one of the replanted islands in September 2024. Princeton Hydro did fix the fencing on this island, but the geese had already destroyed the plants. Additional fencing materials were left with a local volunteer to address these issues moving forward.

Table 2.2: List of floating wetland plant species used in the 2024 planting of FWIs in Landing Channel

Landing Channel: Floating Wetland Island Plant List, 2024		
Botanical Name	**Species Name**	**Quantity**
Asclepias incarnata	Swamp Milkweed	150
Iris versicolor	Blueflag Iris	150
Lobelia siphilitica	Blue Lobelia	100
Pontederia cordata	Pickerelweed	150
Schoenoplectus tabernaemontanii	Softstem Bullrush	200
Carex vulpinoidea	Fox Sedge	50

MAINTENANCE

Maintenance for FWIs that are anchored firmly in place is very simple, especially after the first year. The following is a list of simple maintenance measures that should be followed while the FWIs are deployed:

- During the first few weeks following installation, ensure that the plants receive enough water. If the forecast does not include rain, this could involve splashing the plants with water using a paddle or something similar. The plants will begin to extend their roots through the mat and will eventually be suspended in the water column beneath, allowing for water absorption.
- During the first two years following the installation, periodically check the health of the plants to ensure that they're receiving enough water and continually growing.
- During the first two years following installation while the young plants are still growing, ensure that the protective goose netting remains in place.
- Periodically visually check the FWIs while they remain in the water to ensure that no geese or other animals are eating the plants or nesting on the islands.
- Periodically visually check that the FWIs remain in place where they were installed and that the anchors have not been dislodged.

There have been repeated instances of geese knocking down the fencing on FWIs installed in Lake Hopatcong over the years, even after sturdier materials have been used. Unless there are local volunteers available to monitor and address fencing issues at a high frequency during the first two years post-installation, it is not recommended to install additional FWIs in Lake Hopatcong.

PHOTOS

Photo 2.1: Volunteers and Princeton Hydro planting FWIs in 2022

Photo 2.2: Finished FWIs installed in Landing Channel in 2022

Photo 2.3: FWIs in Landing Channel before replanting in 2024

Photo 2.4: FWIs installed in Landing Channel after the 2024 Replanting

3.0 SHORELINE STABILIZATION THROUGH PLANTINGS AT MEMORIAL POND

SUMMARY

Along the southwestern shoreline of Memorial Pond, approximately 2,800 square feet of shoreline and adjacent bank was planted with native herbaceous and woody plant material. The use of native vegetation not only enhances the ecological value of the site but also reduces the vulnerability of the shoreline to future erosion and invasive species establishment. Additionally, these plants will aid in the collection and treatment of nutrient and sediment loads produced during storm events. The plant palette of this feature focused on aesthetically pleasing native plants as it is an area of moderate traffic and visibility. The stabilization of this shoreline reduces the flow of pollutants and excess nutrients and solids from entering the pond, and in turn, entering Lake Hopatcong.

SCHEDULE OF EVENTS AND MAINTENANCE

The Memorial Pond shoreline was planted on 19 July 2023. An operation and maintenance (O&M) manual was developed following the installation of the plants and submitted to the LHC and the Mt. Arlington Department of Public Works. The O&M Manual is included in Appendix II; the planting plan is included as an appendix to the O&M.

PHOTOS

Photo 3.1: Southwest shoreline of Memorial Pond in July 2023

Photo 3.2: Shoreline of Memorial Pond plantings in July 2023

4.0 REPLACEMENT OF FILTERRA STORMWATER BOXES WITH BIOCHAR

SUMMARY

The third project completed in Lake Hopatcong involved evaluating the nutrient-removal effectiveness of two different stormwater filtering methods. The first method was the installation of Biochar in three of the existing Filterra units, and the second method involved the replanting of trees in the other three units. Stormwater was monitored pre-treatment (before flowing through each Filterra unit) and post-treatment (after flowing through each Filterra unit). Trees were installed in F-1, F-2 and F-6, and Biochar was installed in F-3, F-4 and F-5 (Appendix III). The tree species included one eastern redbud (*Cercis canadensis*) and four tree lilac (*Syringa reticulata*); hardy tree species that were salt tolerant were required.

SCHEDULE OF EVENTS

Table 4.1: Schedule of Filterra activities

Filterra Stormwater Devices: Filter Media Installation and Monitoring	
Date	**Activity**
5/1/2023	Biochar installed in three Filterra units
10/2/2023	Trees Planted in three Filterra units
3/5/2024	1st monitoring event
4/3/2024	2nd monitoring event
11/21/2024	3rd monitoring event

RESULTS AND ANALYSIS

The following section will discuss and objectively assess the results of the stormwater sampling data collected immediately upgradient and down gradient of the structures to determine the effectiveness of Biochar in reducing pollutant concentrations. All discrete data collected as part of the monitoring can be found in full in Appendix IV. The upgradient samples were collected as stormwater drained into the Filterra units from the road and the downgradient samples were collected from the catch basins that the Filterra units discharged to. All samples were analyzed for TP, soluble reactive phosphorus (SRP), and total suspended solids (TSS).

It's important to note that there were issues sampling the downgradient, post-treatment outflow pipe at F-3 and F-4, two of the Filterras that had Biochar, because the discharge pipe was located in submerged water in the catch basin, resulting in the mixing of the filtered discharge water from the Filterra with untreated stormwater that drained directly into the catch basin. The downgradient catch basin may have been partially clogged, resulting in very dirty water that was collected as the post-treatment sample. **Thus, the data from F-3 and F-4 will not be included in the pollutant removal comparison.**

Pollutant removal efficiencies for each sampling event as well as the means for all three events are provided in Table 4.2. Bold positive values indicate lower pollutant concentrations in the post-treatment sample (positive removal rate) while italicized negative values indicate higher pollutant concentrations in the post-treatment sample (negative removal rate). F-1, which had new trees planted, had positive mean pollutant removal rates for all parameters except for SRP, which had a 32% increase in post-treatment samples. F-2 performed significantly better than F-1, with mean TP, SRP, and TSS removal efficiencies of 75%, 5%, and 92%. This data indicates that the Filterra units were functioning well after new trees were planted.

The data from F-3 and F-4 will not be used due to the limitations faced when collecting post-treatment stormwater samples; the post-treatment samples were mixed with a lot of unfiltered water due to the submergence of the

discharge pipe. Additionally, a potentially partially clogged discharge pipe in the receiving catch basin likely increased pollutant concentrations.

F-5 and F-6 are located directly opposite one another; F-5 had Biochar replaced and F-6 had the tree replaced. F-5 had the best pollutant removal efficiencies across all three parameters relative to all other Filterras. F-5 had mean TP, SRP, and TSS removal efficiencies of 49%, 19%, and 82%, respectively. F-6 had negative removal rates for TP and SRP but a positive removal rate for TSS.

Table 4.2: Pollutant Removal Efficiencies

Lake Hopatcong Stormwater Sampling: Pollutant Removal Efficiencies				
Date	**Site**	**TP**	**SRP**	**TSS**
03.05.2024	F-1	**72%**	*-57%*	**93%**
	F-2	**85%**	**3%**	**84%**
	F-3	*-200%*	*-147%*	*-442%*
	F-4	*-24%*	**2%**	*-103%*
	F-5	**63%**	**3%**	**98%**
	F-6	*-36%*	*-183%*	**67%**
04.03.2024	F-1	*-10%*	**4%**	**13%**
	F-2	**82%**	0%	**94%**
	F-3	*-300%*	*-237%*	*-3000%*
	F-4	*-115%*	*-121%*	*-55%*
	F-5	**52%**	**41%**	**56%**
	F-6	*-8%*	*-60%*	**76%**
11.21.2024	F-1	*-36%*	*-42%*	**67%**
	F-2	**57%**	**12%**	**99%**
	F-3	*-100%*	*-197%*	**88%**
	F-4	*-43%*	*-197%*	**90%**
	F-5	**33%**	**12%**	**94%**
	F-6	**20%**	*-233%*	**98%**
Mean	F-1	**9%**	*-32%*	**58%**
	F-2	**75%**	**5%**	**92%**
	F-3	*-200%*	*-194%*	*-1118%*
	F-4	*-61%*	*-105%*	*-23%*
	F-5	**49%**	**19%**	**82%**
	F-6	*-8%*	*-159%*	**80%**

Figures 4.1 – 4.3 present the pre- and post-treatment pollutant concentrations for each sampling event. TP concentrations were elevated pre- and post-treatment during each sampling event; however, the mean removal rates of 75% and 49% at F-2 and F-5 are significant. F-1, which had the trees replaced, had a 9% TP removal rate while F-6 had a slight increase of 8%. Data from F-3 and F-4 will not be analyzed. Overall, TP removal rates were positive at F-1, F-2, F-5, and F-6.

SRP removal rates were poor at most sites; however, the highest removal rate was measured at F-5 (19%). This indicates that Biochar may have the potential to enhance SRP removal rates relative to standard filter media.

TSS removal rates were significant at all sites except for F-3 and F-4, which were the two Filterras that had post-treatment water influenced by unfiltered stormwater. TSS removal rates varied between 58% and 92% at the three Filterras that had the trees replaced, and a removal rate of 82% at F-5, the Filterra with Biochar. Not only were TSS removal rates very high, but the pre-treatment concentrations were often elevated, indicating that all Filterra units, regardless of filter media, were very effective in reducing TSS concentrations.

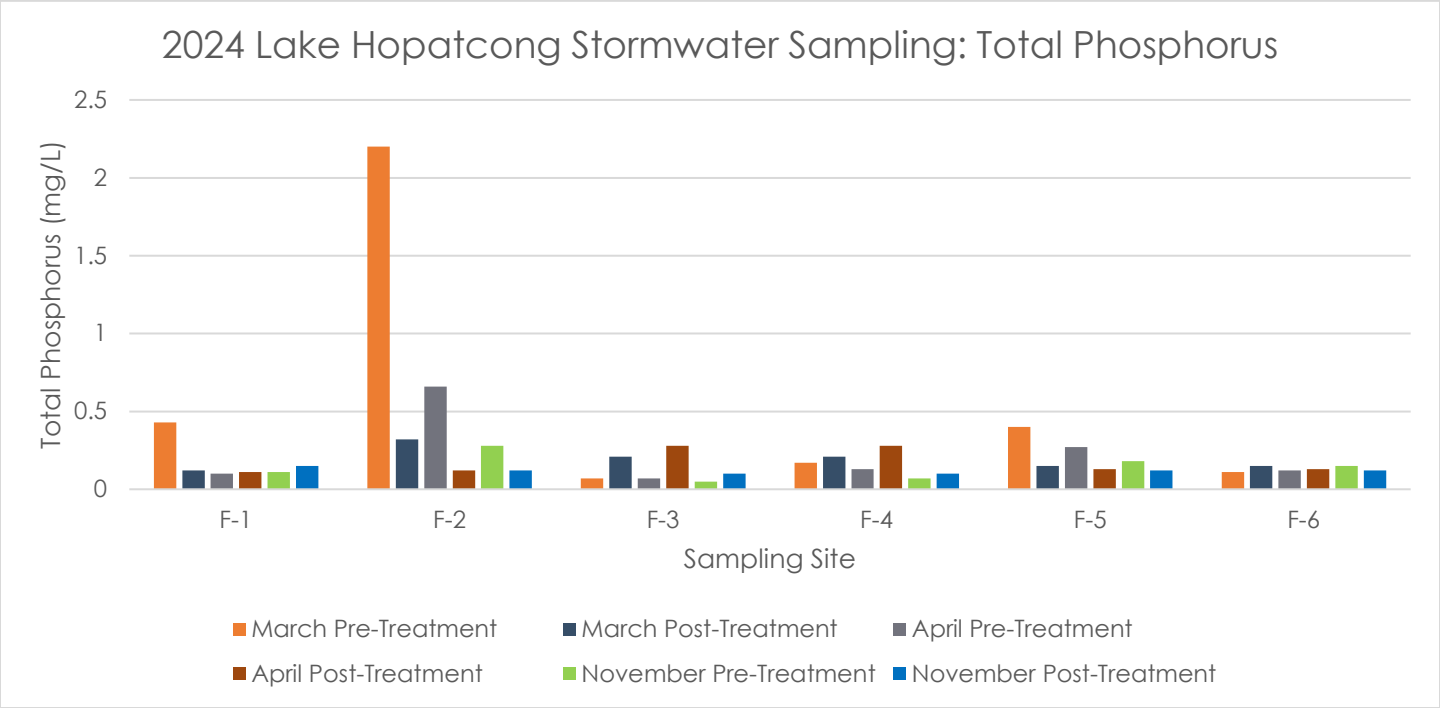


Figure 4.1: TP concentrations pre and post-treatment during the 2024 storm events

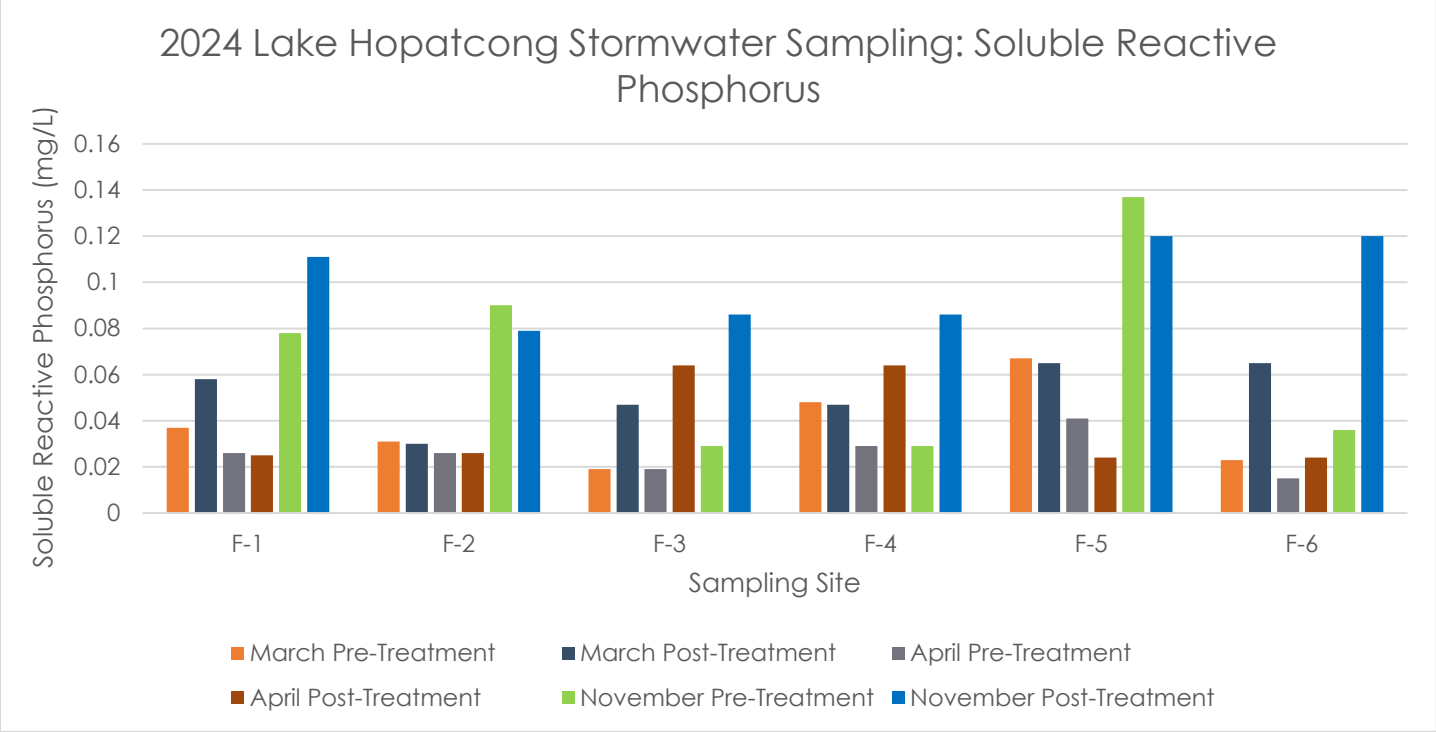


Figure 4.2: SRP concentrations pre and post-treatment during the 2024 storm events

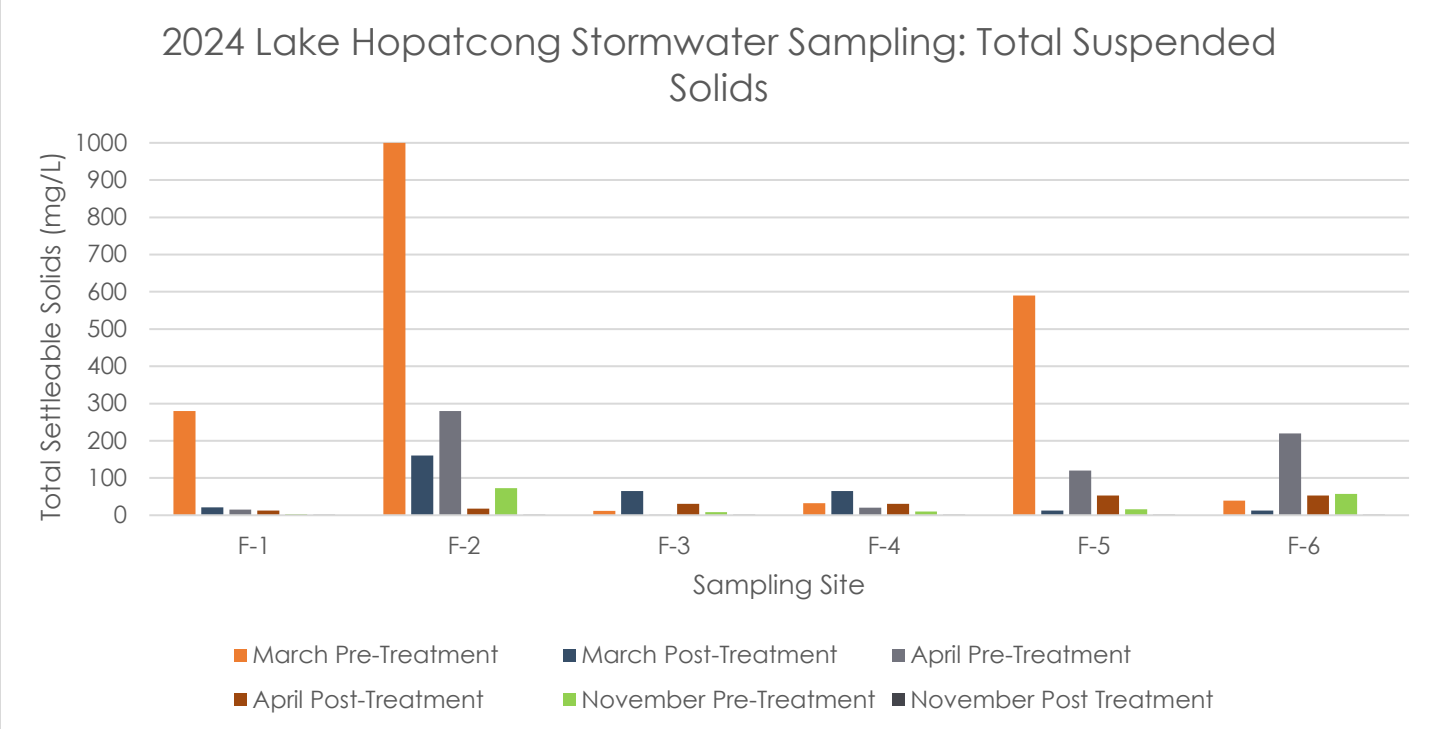


Figure 4.3: TSS concentrations pre and post-treatment during the 2024 storm events

SUMMARY

Table 4.3 presents the mean pollutant removal rates for the two types of filter media: standard Filterra media with vegetation and Biochar. The mean pollutant removal rates for the Filterras with vegetation was calculated using the mean pollutant removals from the three Filterra units with vegetation: F-1, F-2, and F-6. However, only the mean pollutant removal rates for F-5 were used for Biochar due to the difficulties sampling the post-treatment water at F-3 and F-4.

The Filterras with standard filter media and vegetation performed well in reducing TP and TSS concentrations, with respective removal rates of 44% and 77%. However, there was a slight negative removal rate of -3% for SRP, indicating higher SRP concentrations post-treatment.

The Filterra with Biochar performed slightly better than the Filterras with vegetation for all metrics, with mean TP, SRP, and TSS removal rates of 49%, 19%, and 82%, respectively. Based on this data, it's apparent that the Biochar was more effective in reducing dissolved phosphorus concentrations, which is the goal of Biochar in this setting. Biochar is not expected to have an impact on TSS removal relative to the standard media with vegetation, and the data supports that both filter materials were effective in reducing TSS concentrations. Thus, based on this data, Biochar was more effective in reducing dissolved, inorganic phosphorus concentrations (SRP) in the Filterras.

Table 4.3: Pollutant Removal Comparison

Comparison of Pollutant Removal Efficiencies: Vegetation and Biochar			
Site	**TP**	**SRP**	**TSS**
Vegetation	**44%**	*-3%*	**77%**
Biochar	**49%**	**19%**	**82%**

The stormwater data was used to calculate the pollutant loads removed on an annual basis with each of the filter medias. The average pollutant load entering the Filterras was calculated using the volume of stormwater per the drainage area of each Filterra unit based on 2024 rainfall records from March through November at the Jefferson Twp 4.4 SW weather station. The removal efficiencies listed in Table 4.3 were applied to the inflow pollutant loads. The total drainage area for the Filterras with vegetation is approximately 0.90 acres and the total drainage area for the Filterras with Biochar is approximately 1.50 acres.

The estimated annual TP load reduction provided by the Filterras with vegetation is 0.90 lbs (estimated to generate approximately 990 lbs of wet algae biomass), while the estimated annual TP load reduction provided by the Filterras with Biochar is 1.70 lbs (approximately 1,870 lbs of wet algae biomass). Together, the estimated annual TP load reduction is 2.6 lbs (approximately 2,860 lbs of wet algae biomass).

The estimated annual SRP load reduction provided by the Filterras with Biochar is 0.20 lbs; there was a negative SRP removal rate for the Filterras with vegetation.

The estimated annual TSS load reduction provided by the Filterras with vegetation is 970 lbs, while the estimated annual TSS load reduction provided by the Filterras with Biochar is 1,936 lbs. Together, the estimated annual TSS load reduction is 2,906 lbs. It's evident that the Filterras are removing a significant amount of suspended sediment and the regular maintenance of the Filterras is necessary to maintain efficiency.

Between the two treatment strategies (tree with standard filter media vs. Biochar), both removed a comparable amount of TP and TSS; however, the Biochar had a net removal of SRP, the form of phosphorus that is easily assimilated and utilized by algae and cyanobacteria. It should be noted that stormwater sampling occurred in

the spring and fall and the Filterra units with trees may have had higher removal rates over the late spring through early fall season, when plant growth tends to attain their highest rates. Additionally, the trees provide the added benefit of evapotranspiration, which contributes toward reducing the volume of stormwater, where the Biochar does not. With that said, from a pollutant removal perspective, the Biochar appears to be better than the trees with the standard filter media. Comparing the Filterra units plus Biochar with Three-Chambered Baffle Boxes (CBBs), the TP and TSS removal rates were similar; for the CBBs TP and TSS removal rates are typically between 30-40% and 70-80%, respectively. However, while the CBBs have a negligible amount of SRP removal, the Filterra units plus Biochar had an SRP removal rate of nearly 20%.

In conclusion, Princeton Hydro recommends the continued use of Biochar in stormwater structures for the phosphorus removal capability that it offers. The added value of the Biochar is that it can remove measurable amounts of SRP, which is the dissolved form of phosphorus that is easily assimilated by algae and cyanobacteria. However, Princeton Hydro also recommends installing Biochar socks in stormwater structures rather than loose Biochar, as loose Biochar can be transported out of the devices during flooding events. Additionally, the Biochar socks are easier to install and remove than loose Biochar.

MAINTENANCE

The original maintenance manuals developed by Princeton Hydro under the SFY2005 and SFY2011 319 grants for the six Filterra units are provided in Appendix V. Additional maintenance information relative to the replacement of Biochar is provided here. Please note that the Key Individual responsible for overall maintenance of the Filterra units is currently John Schultz, Superintendent of Roads, Jefferson Township Department of Public Works.

REPLACEMENT OF BIOCHAR

The original maintenance manuals for the Filterra units should be consulted for general preventative and corrective maintenance (Appendix V). The following steps should be taken to replace Biochar:

- Princeton Hydro recommends only installing Biochar socks in the Filterra units moving forward. The loose Biochar that was installed in the Filterra units as part of this grant will need to be removed using a vac truck, Township operation protocols.
- Old Biochar can be disposed of in the same manner as the original filter media. Disposal locations are provided in the maintenance manuals in Appendix V.
- When installing new Biochar socks, first lay down a porous filter fabric over the porous underdrain pipe.
- Neatly lay the Biochar socks in the Filterra unit. Leave at least 3" of separation between the top of the Biochar socks and the curb opening.
- Inspect the Biochar at least four times per year, and after every rain event over 2.0 inches.
- Replace the Biochar at least once per year.

EQUIPMENT AND SUPPLIES

- Gloves
- Face mask / cover
- Crowbar for opening grate
- Vac truck if removing loose Biochar
- Truck for transport of old socks
- Replacement socks
- Staples and/or zip ties
- Broom
- Cones for traffic control

PHOTOS

Photo 4.1: Completed biochar installation in a Filterra unit in May 2023

Photo 4.2: Completed tree planting in a Filterra unit in October 2023

5.0 SOCKS FOR DOCKS BIOCHAR PROGRAM

The Socks for Docks Biochar program was the approved replacement project Objective 2, Task 4 (Replanting of a Wetland Stormwater Basin). There was an unforeseen regulatory conflict regarding the treatment of the invasive purple loosestrife in the wetland basin, and the NJDEP approved the Socks for Docks Biochar project as a replacement.

SUMMARY

A total of 470 pre-made Biochar socks were purchased and distributed to lakefront property owners around Lake Hopatcong. This program was originally made available only to the residents of the Borough of Hopatcong because this was replacing a project in the Borough. However, the program was eventually made available to lakefront residents in all four municipalities due to the number of Biochar socks that were still available. In total, Biochar socks were distributed to over 160 properties. Princeton Hydro also developed a training video that was made available to all participants, with information related to the installation and removal of Biochar as well as the purpose of using Biochar: https://www.youtube.com/watch?v=ZJDnjEZlBgI

Biochar socks were removed from five random locations after three months of installation and analyzed for TP and extractable phosphorus. The resulting data were used to quantify how much phosphorus each Biochar sock removed from the lake.

SCHEDULE OF EVENTS AND METHODOLOGY

The Biochar socks were distributed to residents at Hopatcong State Park on 23 May and 30 May 2024. Each resident received at least two Biochar socks, two pieces of rope, and two carabiners to affix the Biochar socks to their docks. Residents were advised to leave the Biochar socks in the lake until at least September.

Princeton Hydro retrieved Biochar socks from five randomly selected residents on 29 August, approximately three months post-installation. Each Biochar sock was cut open, dumped into a clean container, thoroughly mixed, and sub-samples were prepared for the laboratories. In addition to the five Biochar socks that were removed from the lake, one control sample from the same order of Biochar socks was analyzed for the same parameters. To quantify the pollutant removal, the results from the control sock were subtracted from the results from each of the five socks that were deployed in the lake.

The socks were analyzed for TP using analytical method ISO 16967. The socks were analyzed for extractable phosphorus using ASTM D3987 to produce the leachate, followed by ASTM 4500-P B5+E-11 to quantify as total phosphorus.

The TP metric was analyzed to quantify the total amount of phosphorus that each sock removed from the water column while the extractable phosphorus metric was analyzed to determine the amount of phosphorus that could potentially be released back into the environment. However, it should be noted that this sampling program did not directly measure or quantify the actual adsorption (total phosphorus) or de-adsorption (extractable phosphorus) from the Biochar. The data was used to assess the potential for such processes.

RESULTS

The laboratory results are provided in Figures 5.1 and 5.2 below.

The control sock had a TP concentration of 122 mg/kg and an extractable phosphorus concentration of 160 µg/L. For context, it was known that the control sock would have measurable concentrations of phosphorus because it is comprised of organic material. The average TP concentration in the Biochar socks that were deployed in Lake Hopatcong is 147 mg/kg. Thus, the Biochar socks that were deployed in the lake removed approximately 25 mg/kg TP, relative to the control sock. When accounting for the total mass of each of the 470 Biochar socks, the lab data indicates that approximately 0.14 lbs of phosphorus were removed from the lake.

All of the socks that were deployed in the lake had a higher extractable phosphorus concentration than the control sock; however, the increases in socks SD-1, SD-2, SD-4, and SD-5 were minimal, averaging only 35 µg/L higher. When considering the TP concentration in each stock, the amount of extractable phosphorus is extremely low. SD-3 had an extractable phosphorus concentration 384 µg/L higher than the control sock, but even this is very low relative to the TP concentration.

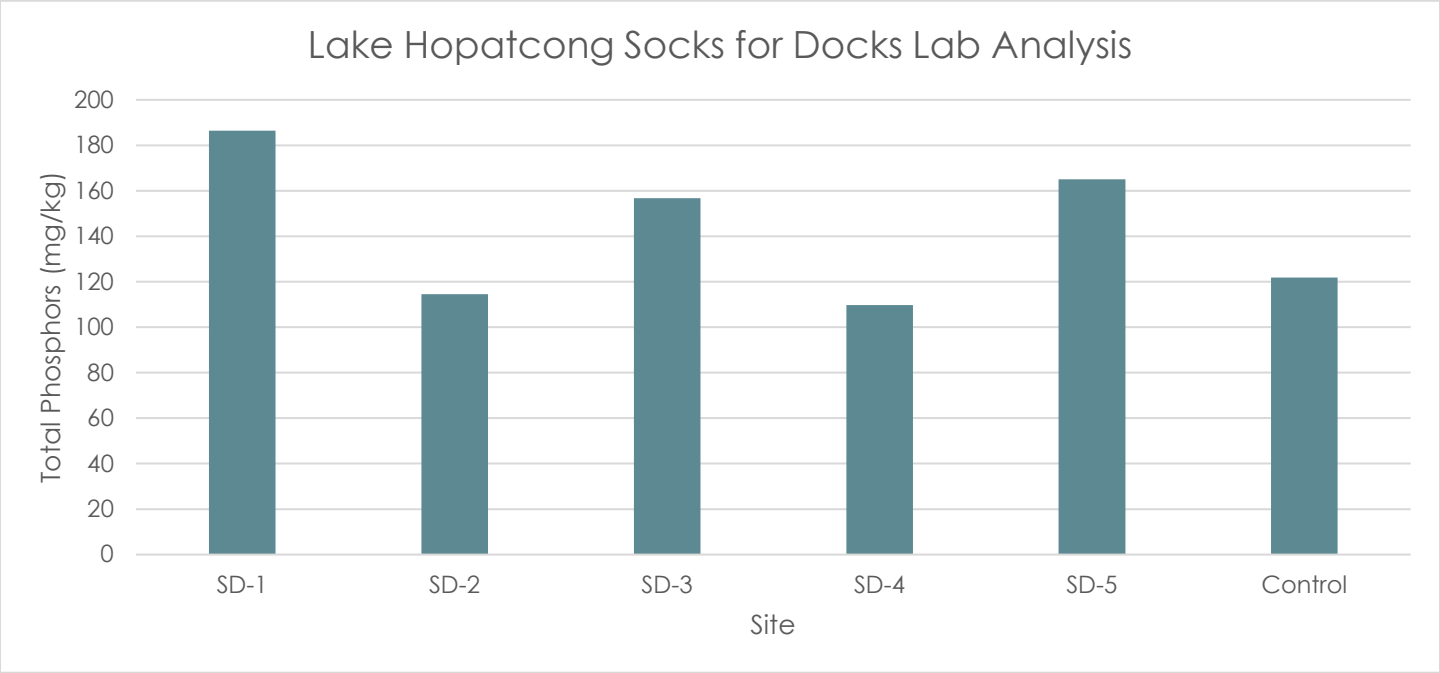


Figure 5.1: Total phosphorus concentrations in Biochar

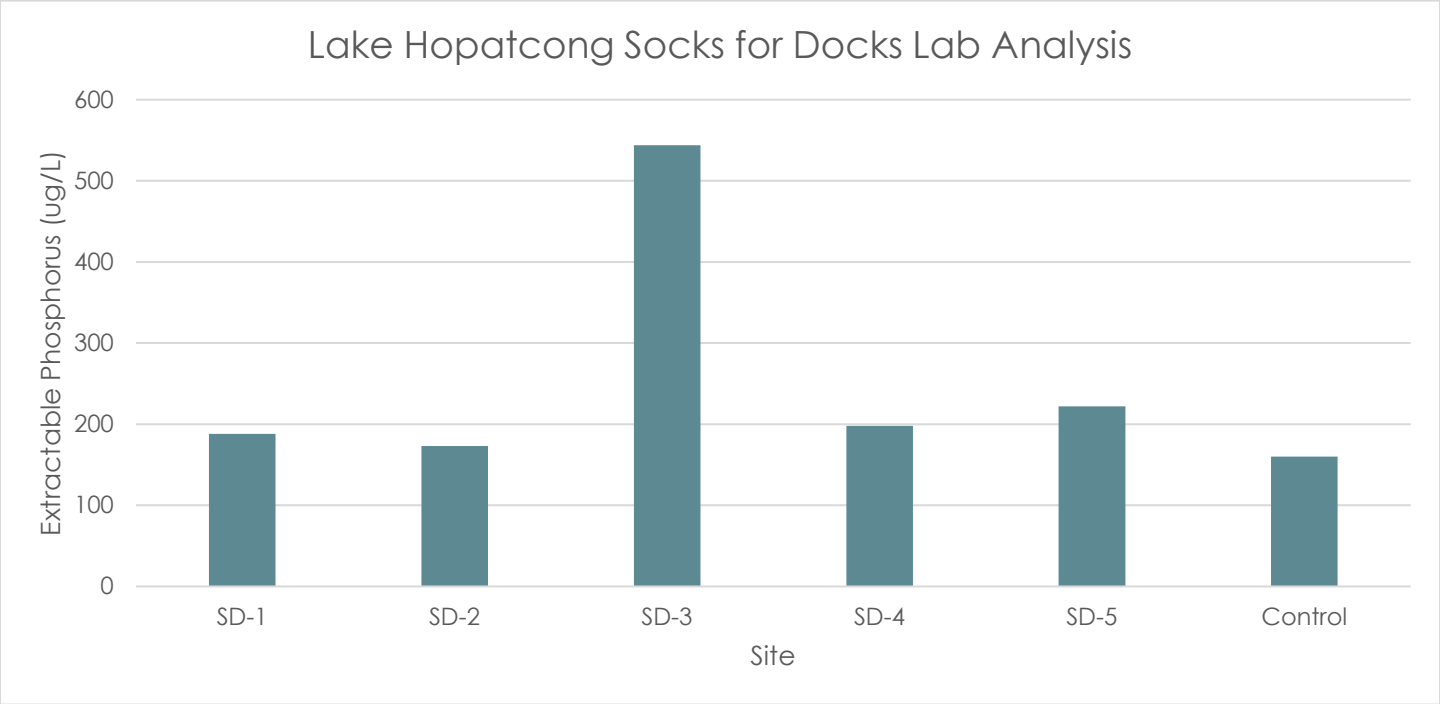


Figure 5.2: Extractable phosphorus concentrations in Biochar

DISCUSSION

Princeton Hydro has been using Biochar since 2020 as an in-lake tool to improve water quality conditions. These Biochar projects have been conducted in New Jersey (including stormwater wet ponds within the Lake Hopatcong watershed), Pennsylvania and New York and the measured improvements have included a percent reduction in phosphorus concentrations, improved water clarity and reductions in the amount of planktonic algae in the water column. Princeton Hydro has also been working toward directly quantifying the removal of phosphorus (in lbs or kg) per Biochar sleeve. Such a direct quantification would be useful in evaluating Biochar as an in-lake BMP, similar to FWIs or weed harvesting. However, the results of these studies have been underwhelming (lower amounts of removed phosphorus than expected) and can't explain why we observe improvements in water quality when Biochar is installed. This may have something to do with the chemical / biological nature of the Biochar. Mechanisms such as the active removal of nitrogen or the transfer of the phosphorus into the microbial food web which in turn is grazed on or sluffs off the Biochar may account for these observed conditions. It's also possible that the laboratory methods that have been utilized are not appropriate for truly assessing the net nutrient uptake of the Biochar, as this is still a relatively new tool for nutrient management.

While the laboratory data from the Socks for Docks program is underwhelming, the observed improvements, particularly in smaller waterbodies or more isolated coves, indicate that the Biochar is having some beneficial impact relative to improving water quality. Over the last few years, Princeton Hydro has documented such water quality improvements in stormwater wet ponds in the Lake Hopatcong watershed, a pond at the Duke Farms Ecological Preserve in Hillsborough, NJ, a number of smaller lakes and ponds in the Pocono region of Pennsylvania, and in one of the ponds in Central Park, NYC. Thus, Princeton Hydro is continuing to develop other methods and approaches to better quantify nutrient removal capabilities of Biochar.

RECOMMENDATIONS

Based on Biochar results obtained through this 319-project, the following recommendations are being made:

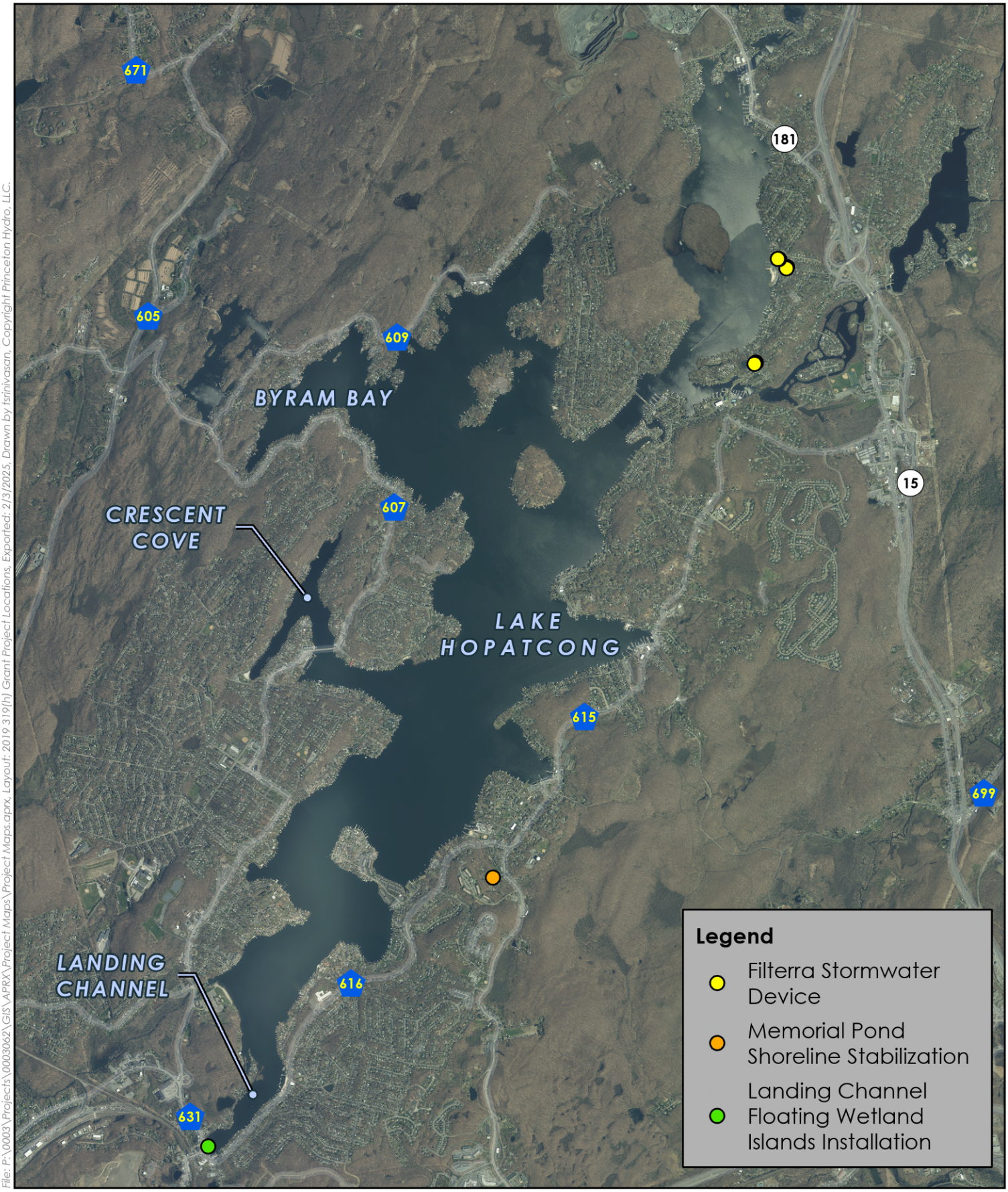
1. While the results of the phosphorus analyses were underwhelming, observed water quality improvements with the installation of Biochar have been routinely documented in a number of waterbodies throughout the Mid-Atlantic region of the United States. Thus, more than likely some chemical / biological processes or mechanisms are not being considered or understood in the application of Biochar in nutrient mitigation in aquatic ecosystems. Given the documented benefits that have been observed in specific aspects of water quality, it is recommended that the stakeholders of the Lake Hopatcong watershed continue to use Biochar in an effort to reduce nutrient availability and improve water quality, as per the objectives identified in the 319-project.

2. Additionally, based on past studies at Lake Hopatcong, the percent reduction of phosphorus in standing waters was relatively high between 3 and 6 months. After 6 months the efficiency of reductions declined. Thus, it is recommended that any installed Biochar remain in the lake for 3 to 6 months. After 6 months the Biochar can be removed and disposed of.

3. The Commission may want to conduct some additional water quality sampling on installed Biochar in 2025 but instead of removing and processing the used Biochar, collect interstitial water directly from the Biochar while they are still in the lake. Additionally, these samples could then be analyzed for species of phosphorus and nitrogen, to identify the accumulation of these nutrients in the Biochar. Samples could also be examined for the identification of algae, bacteria and other microbial life that may be contributing toward the removal of nutrients. For example, high densities of microflagellates, large protozoa, and rotifers may indicate that the nutrients are being removed and shunted into the microbial food web. Thus, it is recommended that the Commission conduct some additional but limited testing for these chemical and biological constituents. The collection of these samples could be conducted during Princeton Hydro's standard monitoring program to minimize costs. Additionally, the chemical and biological analyses could possibly be conducted under the existing Lake Restoration grant.

4. Finally, Princeton Hydro will continue to investigate how Biochar operates to improve water quality conditions. For example, Princeton Hydro is looking into possibly teaming with other organizations (i.e. Biochar companies, academic institutions) to conduct more detailed scientific studies in how Biochar produces more favorable water quality conditions. However, it should be noted that at this point no such investigations are scheduled for the immediate future. With that said, any such future studies could provide the Commission with valuable information on the specific mechanisms associated with how Biochar contributes toward improving water quality conditions.

APPENDIX I: PROJECT LOCATIONS



NOTES:
1. Project locations are approximate.
2. 2020 orthoimagery and roads obtained from the New Jersey Geographic Information Network.

0 1,750 3,500 Feet

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

2019 319(H) GRANT PROJECT LOCATIONS

LAKE HOPATCONG COMMISSION
MORRIS AND SUSSEX COUNTIES
NEW JERSEY

PRINCETON HYDRO
SCIENCE DESIGN ENGINEERING
www.PrincetonHydro.com

APPENDIX II: MEMORIAL POND O&M MANUAL

MAINTENANCE PLAN FOR MEMORIAL POND SHORELINE STABLIZATION PROJECT

MT ARLINGTON, MORRIS COUNTY, NEW JERSEY

AUGUST 2023

PREPARED FOR:
LAKE HOPATCONG COMMISSION
P.O. BOX 8519
LANDING, NJ 07850

PREPARED BY:
PRINCETON HYDRO
35 CLARK STREET, SUITE 200
TRENTON, NJ 08611
908-237-5660

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Appendices

INTRODUCTION

The Lake Hopatcong Commission (LHC) contracted Princeton Hydro, LLC (Princeton Hydro) to design and implement a small-scale shoreline stabilization project at Memorial Pond to reduce pollutants such as nitrogen, phosphorus, and solids from entering the pond and, in turn, reduce the loading and availability in Lake Hopatcong. One stormwater management and water quality feature was designed for this project.

1. Memorial Pond Shoreline Stabilization

The site is located at the intersection of S. Glen Ave. and Mountainview Ave. in Mount Arlington, NJ and is owned by the Borough of Mount Arlington. The project was sponsored by the LHC, with funding through NJDEP's 319(h)-grant program. This report serves as the maintenance plan for the installed shoreline stabilization features.

LOCATION OF STORMWATER MANAGEMENT FEATURES

DESCRIPTIONS OF SHORELINE STABLIZATION FEATURES

ESTABLISHMENT OF NATIVE VEGETATION

Along the southwestern shoreline of Memorial Pond, roughly 2,800 square feet of shoreline and adjacent bank was planted with native herbaceous and woody plant material. The use of native vegetation not only enhances the ecological value of the site, but also reduces the vulnerability of the shoreline to future erosion and invasive species establishment. Additionally, these plants will aid in the collection and treatment of nutrient and sediment loads produced during storm events. The plant palette of this feature focused on aesthetically pleasing native plants as it is an area of moderate traffic and visibility.

COMPREHENSIVE STORMWATER MANAGEMENT FACILITIES MAINTENANCE PROGRAM

A comprehensive Stormwater Management Facilities Maintenance Program is comprised of several related requirements. They include:

- Providing adequate funding, staffing, equipment, and materials.
- Performing routine maintenance procedures on a regularly scheduled basis.
- Performing emergency maintenance procedures and repairs in a timely manner.
- Conducting stormwater management facilities inspections to determine both the need for and effectiveness of maintenance work.
- Providing training and instruction to maintenance personnel and inspectors.
- Conducting periodic program reviews and evaluations to determine the overall effectiveness of the maintenance program, and the need for revised or additional maintenance procedures, personnel, or equipment.
- Instilling pride of workmanship and a commitment to excellence in program personnel.

Adequate funding is achieved by planning for staffing, equipment, and material needs as well as facilities for storage of materials. Additionally, maintenance, storage and replacement of equipment must be considered. Training costs, administrative costs, disposal costs, and permit fees must also be included. Seasonal effects and long-term capital improvements should also be considered. Finally, a method of securing emergency appropriations to deal with unforeseen problems should be developed.

Functional maintenance, which is required to ensure the safe and effective operation of a stormwater management facility, and aesthetic maintenance, which is necessary to maintain the visual appeal and aesthetic quality of the facility, are both required aspects of any stormwater maintenance program. Further, functional maintenance can be divided into two types: preventative and corrective.

Preventative maintenance is routine maintenance and corrective maintenance is emergency maintenance. Aesthetic maintenance is the maintenance required to enhance or maintain the visual appeal of a facility. To be effective, preventative maintenance must be performed on a regularly scheduled basis and includes such routine procedures as vegetation trimming, silt and debris removal, and upkeep of moving parts. Corrective maintenance must be performed on an as-needed or emergency basis and includes structural repairs, mosquito control, and restoration of vegetated linings. Aesthetic maintenance can easily be incorporated into a preventative maintenance schedule. When performed regularly, aesthetic maintenance can reduce the required amount of preventative and corrective maintenance at the facility and will help maintain the visual appeal and allow it to reflect positively on the maintenance staff, owner, and community.

Maintenance and inspection logs should be reviewed periodically to determine the effectiveness of the overall maintenance program. A review of the records can help to identify maintenance problems that may require system modification early. Additionally, a review of the records can determine if the maintenance program requires any additional personnel, equipment, or materials.

A successful stormwater management facility maintenance program will include comprehensive training of maintenance personnel in the areas to guarantee that they are best suited for the tasks they complete. A training program will include maintenance and inspection techniques, proper record keeping, permit and other legal requirements, and stormwater management fundamentals.

KEY INFORMATION FOR PROPER MAINTENANCE OF STORMWATER MANAGEMENT FEATURES

In order to properly maintain the stormwater management feature, it is necessary to utilize the following information as part of the overall maintenance procedures:

RAINFALL DATA

Proper inspection and maintenance rely on understanding when large storm events (defined here as greater than one (1) inch of rainfall in a 24-hour period) have occurred. Local rainfall data can be obtained from any of the following sources; however, this list should be reviewed and updated as this listing is subject to change:

Lake Hopatcong USGS rain gage located in Moris County, NJ (Latitude 40°55'02", Longitude 74°39'56"):
https://waterdata.usgs.gov/nwis/inventory?agency_code=USGS&site_no=405502074395601

Weather Underground (search for Mount Arlington 07856):
https://www.wunderground.com/weather/us/nj/mount-arlington/KNJMOUNT43

APPROVED DISPOSAL FACILITIES

Though no sediment accumulation is anticipated given the type of stormwater management feature installed, proper maintenance of the shoreline stabilization project relies on knowing what facilities in the immediate vicinity of the Borough of Mount Arlington can accept sediment from the site. In the event the Township facilities are not able to provide adequate disposal, the following is a potential disposal facility for sediment removed from the project site. This should be regularly reviewed and updated as this listing is subject to change.

Facility: Bayshore Recycling
DEP ID: 132397
Phone: (732) 738-600
Zip: 08832
Location: 75 Crows Mill Rd.
County: Middlesex
Municipality: Woodbridge Township

RESPONSIBLE PARTY DESIGNATION

It is Princeton Hydro's understanding that the Borough of Mount Arlington, as the owner of the property, will take full responsibility for the preventative and corrective maintenance of the feature described in this manual.

The Key Individual responsible for the overall maintenance program of these facilities at the site is as follows:

Name: Tom Quillinan, Assistant Director, Public Works
Address: 1 Altenbrand Ave, Mount Arlington, NJ 07856
Phone Number: 862-397-2759

All maintenance logs, reports, and inspections of the shoreline stabilization project must be coordinated directly with the individual identified above. At any time, the key individual identified above may make changes to this manual to reflect changes in maintenance procedures. These may include, but are not limited to, developing maintenance budgets, inspecting features, and scheduling and performing actual maintenance work on both a routine and emergency basis.

The key individual identified above is responsible for establishing a system for field personnel to provide feedback to supervisory personnel on a routine and priority basis as the need arises. The procedure includes proper record keeping to provide verification of work actually completed and to assist in preparing future maintenance budgets.

PREVENTATIVE MAINTENANCE REQUIREMENTS

Safety of maintenance personnel is essential. Non-technical staff can carry out some tasks quite effectively; however, all programs should carefully ensure the safety of anyone carrying out maintenance tasks. When tasks are beyond the capabilities of in-house staff, a professional should be hired to conduct the work. When needed, professional judgment should be solicited regularly to ensure that all needs of the installation are met. Even though non-professionals can routinely perform some maintenance tasks, there are many problems that are not obvious to the untrained eye. Detailed preventative maintenance information is provided below for the shoreline stabilization project. All preventative maintenance tasks identified to be completed on a regular basis should be completed at least four (4) times per year.

Detailed preventative maintenance checklists are provided in Appendix B and should be used as needed to complete these tasks for the facilities.

ROUTINE INSPECTION REQUIREMENTS

The shoreline planting should be inspected at least **four (4) times per year** and after all storm events resulting in more than one (1) inch of rainfall in a 24-hour period. The following is a general list of the requirements for inspection. Detailed inspection checklists for the facilities can be found in Appendix B. Preventative and corrective maintenance logs for the facilities can be found in Appendix C.

- Vegetated areas must be inspected for erosion and scouring.
- Vegetated areas must be inspected for unwanted growth, such as weeds and invasive species which should be removed with minimum disruption to the planting soil bed and remaining vegetation.
- The installed, native, vegetated cover should be maintained at a minimum of 85 percent of the total planted area. In other words, a maximum of 15% of the vegetation mass within the project area should be material other than what was planted.

GENERAL MAINTENANCE REQUIREMENTS

1. *Maintaining cover*

   Maintaining vegetated coverage within the shoreline planting areas is an important maintenance requirement that must be followed to ensure the overall project success. Make sure the root zones of the vegetation do not get too wet or too dry.

   If the vegetated area has greater than 50% damage from any cause, the area should be reseeded and/or replanted depending on the final planting plan of that individual system. The design professional should be contacted to assist in assessing the causes and selecting a replanting strategy.

2. *Watering*

   Upon installation, the establishment of a watering regimen is crucial to the overall success of the planting. Immediately after planting, all plant material should be watered thoroughly. Ideally, for the first 2 weeks after planting, the top 6 inches of soil should be checked for soil moisture at least 3 times per week. During the first two years after the planting, this check can be reduced to once per week when possible. Be cautious not to overwater; upon watering, the water should soak in quickly and the plants should never sit in a puddle of water for an extended period of time. Make sure to monitor your local weather and familiarize yourself with the existing soil conditions and water accordingly.

   Generally, watering can be seasonally stopped on or around October 1st and resumed again on or around April 1st.

3. *Removal of trash and debris*

   Accumulated trash and debris should be removed from the shoreline stabilization area. This can be achieved by hand and should be completed on a regular basis (or after all large storm events).

4. *Trimming/Mowing/Pruning*

   The herbaceous material installed as a part of this project should be left to spread, fill in, and develop as much as possible and/or desired. To allow the native plants to thrive, all herbaceous material not installed as a part of this project should be trimmed as needed which may require multiple mowing events each year. Monitor and take note of growth rates to establish a mowing regime.

   Care should be taken not to mow, weed whack or otherwise damage the roots of existing trees or other planted woody material while performing maintenance.

   Pruning is another important maintenance requirement to maintain plant health. Woody material should be inspected for dead, diseased, or damaged branches. If found, remove this material by cutting into healthy wood below the affected areas. Thinning out overly dense shrubs will help to promote air circulation and reduce incidences of disease.

   Generally pruning of woody material should be conducted in the dormant season between December and February.

5. *Elimination of invasive/undesirable species*

   Hand removal of invasive species or undesirable species within the shoreline stabilization areas should be completed frequently during the growing season with special attention given during the first few years until the plant material has adequately established itself. The monitoring and removal if invasive and undesirable species should continue indefinitely.

6. *Maintaining the herbivory fence*

   The posts and fence that surround the project area should be inspected and repaired at least once a week. Due to the presence of deer and geese, the plants must be protected from herbivory damage for at least two years.

   Following the two-year establishment period, the fence can be removed or remain in place at the discretion of the DPW. The more time the plants have to establish free from herbivory damage, the better chance they have for long-term survival.

GENERAL MAINTENANCE EQUIPMENT NEEDS

The following is a list of equipment that may be necessary to conduct the above referenced maintenance tasks:

1. *Maintenance:*
   - Gas-powered trimmers
   - Hedge trimmers
   - Pruning shears

2. *Clean-up*:
   - Gloves
   - Picks
   - Rakes
   - Grass clipping and leaf collection equipment
   - Garbage cans

3. *Revegetation*:
   - Wheel barrows
   - Shovels
   - Seed/Plant stock
   - Straw mulch or equal for soil stabilization

CORRECTIVE MAINTENANCE REQUIREMENTS

Corrective maintenance is required on an emergency or non-routine basis to correct problems or malfunctions and to restore the intended operation and safe condition of a stormwater management feature. Each of the potential problems described below are not considered routine and should not be considered all-inclusive of problems that may occur at the site. They are listed simply as an offering of what might occur with the Shoreline Stabilization at Memorial Pond. Detailed corrective maintenance logs are provided in Appendix C.

The following potential problems and some potential solutions are identified for the Memorial Pond Shoreline; however, they are not all-inclusive and other problems may occur. Should problems not specifically identified below occur onsite, the responsible party should exercise sound judgment in determining the severity of the problem.

Problem #1: *Loss of More than 15% of Vegetative Cover*

Solution:

Vegetation should be restored to its original specifications. All plant lists are provided in Appendix D of this plan. Upon replanting/reseeding, biweekly inspections of vegetative health should be performed throughout the entire first growing season. All use of fertilizers, mechanical treatments, pesticides and other means to assure optimum vegetation health should not compromise the intended purpose of the facility. All vegetation deficiencies should be addressed without the use of fertilizers and pesticides whenever possible.

Problem #2: *Erosion*

Solution:

If erosion is identified, (i.e. missing vegetation, ruts in the soil) the problem area should be closely monitored. If mulch has washed away, stone may be used in its place. Bare areas should be reseeded/replanted and stabilized to the original specifications as quickly as possible to avoid soil erosion and clogging of the facility.

After reseeding/replanting, the vegetation or stone should be closely monitored. Should the problem persist, an engineer or other professional should be consulted for recommendations.

Problem #3: Animal Burrows

Solution:

Animals, such as groundhogs, may dig out burrows that could damage vegetation. Burrows can present a safety hazard for maintenance personnel. Voids and burrows should be plugged by filling with material similar to the existing material, and capped just below grade with stone, concrete or other material. If plugging the burrows does not discourage the animals from returning, further measures should be taken to either remove the animal population or make critical areas of the facility unattractive to them.

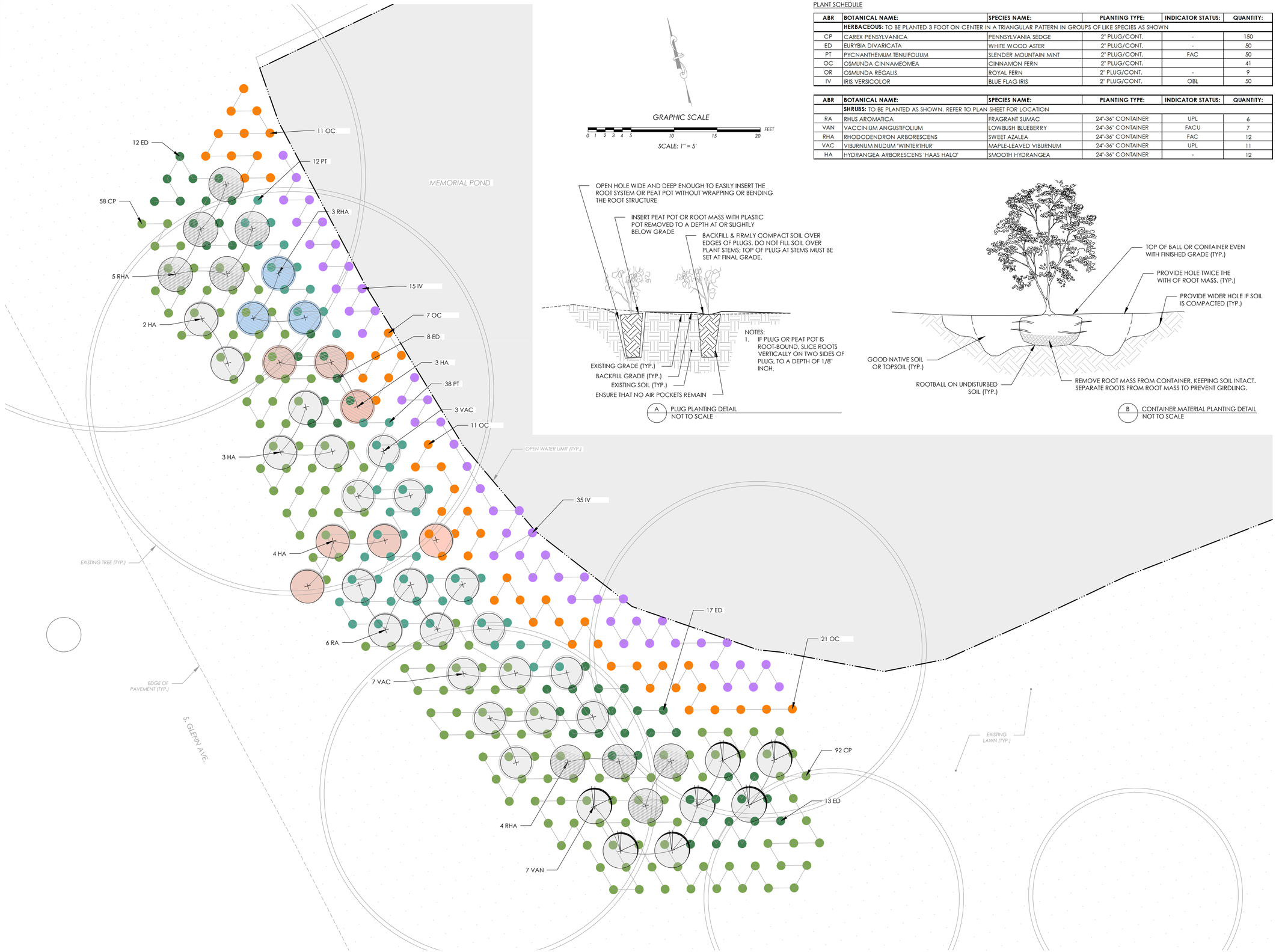
Problem #4: Netting Structure Failure

Solution:

Should the netting structure fail prior to full vegetative establishment, replace with goose/deer exclusion fencing and secure with zip-ties to existing stakes. Broken, damaged, or fallen stakes should be replaced with stakes of equal or greater standards. Once plants are established netting structures and stakes may be removed.

APPENDIX A

DESIGN PLANS



GRAPHIC SCALE

0 1 2 3 4 5 10 15 20 FEET

SCALE: 1" = 5'

PLANT SCHEDULE

ABR	BOTANICAL NAME:	SPECIES NAME:	PLANTING TYPE:	INDICATOR STATUS:	QUANTITY:
	HERBACEOUS: TO BE PLANTED 3 FOOT ON CENTER IN A TRIANGULAR PATTERN IN GROUPS OF LIKE SPECIES AS SHOWN				
CP	CAREX PENSYLVANICA	PENNSYLVANIA SEDGE	2" PLUG/CONT.	-	150
ED	EURYBIA DIVARICATA	WHITE WOOD ASTER	2" PLUG/CONT.	-	50
PT	PYCNANTHEMUM TENUIFOLIUM	SLENDER MOUNTAIN MINT	2" PLUG/CONT.	FAC	50
OC	OSMUNDA CINNAMEOMEA	CINNAMON FERN	2" PLUG/CONT.		41
OR	OSMUNDA REGALIS	ROYAL FERN	2" PLUG/CONT.	-	9
IV	IRIS VERSICOLOR	BLUE FLAG IRIS	2" PLUG/CONT.	OBL	50

ABR	BOTANICAL NAME:	SPECIES NAME:	PLANTING TYPE:	INDICATOR STATUS:	QUANTITY:
	SHRUBS: TO BE PLANTED AS SHOWN. REFER TO PLAN SHEET FOR LOCATION				
RA	RHUS AROMATICA	FRAGRANT SUMAC	24"-36" CONTAINER	UPL	6
VAN	VACCINIUM ANGUSTIFOLIUM	LOWBUSH BLUEBERRY	24"-36" CONTAINER	FACU	7
RHA	RHODODENDRON ARBORESCENS	SWEET AZALEA	24"-36" CONTAINER	FAC	12
VAC	VIBURNUM NUDUM 'WINTERTHUR'	MAPLE-LEAVED VIBURNUM	24"-36" CONTAINER	UPL	11
HA	HYDRANGEA ARBORESCENS 'HAAS HALO'	SMOOTH HYDRANGEA	24"-36" CONTAINER	-	12

A PLUG PLANTING DETAIL
NOT TO SCALE

B CONTAINER MATERIAL PLANTING DETAIL
NOT TO SCALE

CALL BEFORE YOU DIG!
NEW JERSEY LAW REQUIRES
3 WORKING DAYS NOTICE FOR
CONSTRUCTION PHASE AND 10 WORKING
DAYS IN DESIGN STAGE - STOP CALL
NEW JERSEY ONE CALL SYSTEM, INC.
REFERENCE NEW JERSEY TITLE 48, CHPT. 2, ARTICLE 9
1-800-272-1000

PROJECT NOTES

1. ALL EXISTING FEATURES ARE APPROXIMATE AND SHOULD BE FIELD VERIFIED.

DATE	DESCRIPTION

REVISIONS

STATE OF NEW JERSEY CERTIFICATE OF AUTHORIZATION NO.: 24GA27976800

DATE

PRINCETON HYDRO
SCIENCE ENGINEERING DESIGN
35 CLARK STREET, SUITE 200
TRENTON, NEW JERSEY 08611
PHONE: 908.237.5660
PRINCETONHYDRO.COM

PROJECT NAME/LOCATION:

SHORELINE PLANTING
MEMORIAL PARK
MOUNTAINVIEW AVE.
MT ARLINGTON, NJ, 07856

DRAWING NAME:

PLANTING PLAN
AS BUILT

DATE:	8/23/2023
PROJECT NO.:	0003.062
SCALE:	AS SHOWN
DRAWN BY:	CAS
CHECKED BY:	FL, PR

SHEET NO.

1 OF 1

APPENDIX B

INSPECTION AND MAINTENANCE CHECKLIST

Inspection Checklist

Memorial Pond Shoreline Planting

Mt Arlington, Morris County, NJ 07856

Date: _____ **Crew:** _____

Time: _____ **Equipment:** _____

Weather: _____

Shoreline Stabilization

1. General

	O.K.[1]	Routine[2]	Urgent[3]	Comments[4]
A. Vegetation				
B. Erosion				
C. Settlement				
D. Sloughing				
E. Trash and Debris				
F. Sediment				
G. Aesthetics				
H. Other				

2. Miscellaneous

A. Effectiveness of Existing Maint. Prg.				
B. Potential Mosquito Habitats				
C.				
D.				
E.				
F.				

1 The item checked is in good condition, and the maintenance program is adequate

2 The item checked requires attention, but does not present an immediate threat to the facility function or other facility components

3 The item checked requires immediate attention to keep the facility operational or to prevent damage to other facility components

4 Possible explanation and details if columns 2 or 3 are checked

Preventative Maintenance Checklist

Memorial Pond Shoreline Planting

Mt Arlington, Morris County, NJ 07856

Date: _____ **Crew:** _____

Time: _____ **Equipment:** _____

Weather: _____

Shoreline Stabilization

	Items Required	Items Completed	Comments and Special Instructions
1. Maintaining Vegetative Cover			
A. Re-planting			
B. Pruning			
C. Pest Control			
D. Other:			
2. Elimination of Invasive/Undesirable Species			
A. Other:			
3. Removal of Trash and Debris			
A. Bottom			
B. Perimeter Areas			
C. Other:			
4. Other Preventative Maintenance			
A.			
B.			
C.			

Corrective Maintenance Checklist

Memorial Pond Shoreline Planting

Mt Arlington, Morris County, NJ 07856

Date: _____ **Crew:** _____

Time: _____ **Equipment:** _____

Weather: _____

Shoreline Stabilization

	Items Required	Items Completed	Comments and Special Instructions
1. Vegetation Replacement			
2. Erosion Repair			
3. Control of Mosquitoes			
4. Elimination of Animal Burrows			
5. Other Corrective Maintenance			

APPENDIX C

PREVENTATIVE AND CORRECTIVE MAINTENANCE LOG

Preventative Maintenance Log

Memorial Pond Shoreline Planting

Mt Arlington, Morris County, NJ 07856

Date: _____ **Crew:** _____

Time: _____ **Equipment:** _____

Weather: _____

Shoreline Stabilization

	Date						
1. Maintaining Vegetative Cover	**(X) Completed**						
A. Re-planting							
B. Pruning							
C. Pest Control							
D. Other:							
2. Elimination of Invasive/Undesirable Species							
3. Removal of Trash and Debris							
A. Bottom							
B. Perimeter Areas							
4. Other Preventative Maintenance							
A.							
B.							
C.							

Corrective Maintenance Log

Memorial Pond Shoreline Planting

Mt Arlington, Morris County, NJ 07856

Date: _____ **Crew:** _____

Time: _____ **Equipment:** _____

Weather: _____

Shoreline Stabilization

	Date						
	(X) Completed						
1. Vegetation Replacement							
2. Erosion Repair							
3. Control of Mosquitoes							
4. Elimination of Animal Burrows							
5. Other Corrective Maintenance							

APPENDIX D

PLANT LIST

Memorial Pond Shoreline Stabilization Plant List

ABR	BOTANICAL NAME:	SPECIES NAME:	PLANTING TYPE:	INDICATOR STATUS:	QUANTITY:
	HERBACEOUS: TO BE PLANTED 3 FOOT ON CENTER IN A TRIANGULAR PATTERN IN GROUPS OF LIKE SPECIES AS SHOWN				
CP	CAREX PENSYLVANICA	PENNSYLVANIA SEDGE	2" PLUG/CONT.	-	150
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OR	OSMUNDA REGALIS	ROYAL FERN	2" PLUG/CONT.	-	9
IV	IRIS VERSICOLOR	BLUE FLAG IRIS	2" PLUG/CONT.	OBL	50

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VAC	VIBURNUM NUDUM 'WINTERTHUR'	MAPLE-LEAVED VIBURNUM	24"-36" CONTAINER	UPL	11
HA	HYDRANGEA ARBORESCENS 'HAAS HALO'	SMOOTH HYDRANGEA	24"-36" CONTAINER	-	12

APPENDIX III: FILTERRA LOCATIONS

File: P:\0003\Projects\0003062\GIS\APRX\Project Maps\Project Maps.aprx, Layout: 2019 319(h) Grant Filterra Locations, Exported: 2/3/2025, Drawn by tsrinivasan, Copyright Princeton Hydro, LLC.

NOTES:
1. Filterra locations are approximate.
2. 2020 orthoimagery and roads obtained from the New Jersey Geographic Information Network.

0 165 330 Feet

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

2019 319(H) GRANT FILTERRA LOCATIONS

LAKE HOPATCONG COMMISSION
MORRIS AND SUSSEX COUNTIES
NEW JERSEY

PRINCETON HYDRO
SCIENCE DESIGN ENGINEERING
www.PrincetonHydro.com

APPENDIX IV: STORMWATER DATA

Lake Hopatcong Filterra Stormwater Sampling

Date	Site	Treatment	TP (mg/L)	SRP (mg/L)	TSS (mg/L)
03.05.2024	F-1	Pre-Treatment	0.43	0.037	280
		Post-Treatment	0.12	0.058	21
	F-2	Pre-Treatment	2.20	0.031	1000
		Post-Treatment	0.32	0.030	160
	F-3	Pre-Treatment	0.07	0.019	12
		Post-Treatment	0.21	0.047	65
	F-4	Pre-Treatment	0.17	0.048	32
		Post-Treatment	0.21	0.047	65
	F-5	Pre-Treatment	0.40	0.067	590
		Post-Treatment	0.15	0.065	13
	F-6	Pre-Treatment	0.11	0.023	39
		Post-Treatment	0.15	0.065	13
04.03.2024	F-1	Pre-Treatment	0.10	0.026	15
		Post-Treatment	0.11	0.025	13
	F-2	Pre-Treatment	0.66	0.026	280
		Post-Treatment	0.12	0.026	18
	F-3	Pre-Treatment	0.07	0.019	1
		Post-Treatment	0.28	0.064	31
	F-4	Pre-Treatment	0.13	0.029	20
		Post-Treatment	0.28	0.064	31
	F-5	Pre-Treatment	0.27	0.041	120
		Post-Treatment	0.13	0.024	53
	F-6	Pre-Treatment	0.12	0.015	220
		Post-Treatment	0.13	0.024	53
11.21.2024	F-1	Pre-Treatment	0.11	0.078	3
		Post-Treatment	0.15	0.111	1
	F-2	Pre-Treatment	0.28	0.090	73
		Post-Treatment	0.12	0.079	1
	F-3	Pre-Treatment	0.05	0.029	8
		Post-Treatment	0.10	0.086	1
	F-4	Pre-Treatment	0.07	0.029	10
		Post-Treatment	0.10	0.086	1
	F-5	Pre-Treatment	0.18	0.137	16
		Post-Treatment	0.12	0.120	1
	F-6	Pre-Treatment	0.15	0.036	57
		Post-Treatment	0.12	0.120	1

APPENDIX V: FILTERRA MAINTENANCE MANUALS

STORMWATER MANAGEMENT MAINTENANCE PLAN

FOR

TWO (2) FILTERRA UNITS
LOCATED ON YACHT CLUB DRIVE

Jefferson Township
Morris County, New Jersey

PREPARED FOR:

Jefferson Township
1033 Weldon Road
Lake Hopatcong, NJ 07849

PREPARED BY:

Princeton Hydro, LLC
1108 Old York Road, Suite 1
P.O. Box 720
Ringoes, New Jersey 08551
(P) 908.237.5660 • (F) 908.237.5666
email • info@princetonhydro.com

November 2012
Princeton Hydro, LLC Project No. 0003.030

Table of Contents

1.0 Introduction

The Lake Hopatcong Commission contracted Princeton Hydro, LLC (Princeton Hydro) to conduct stormwater quality design services for Yacht Club Drive in Jefferson Township, Morris County, New Jersey (herein referred to as "the site"). This project was funded through SFY2005 Section 319(H) Grant Agreement #RP05-080 between the Lake Hopatcong Commission and the New Jersey Department of Environmental Protection. This report was prepared to present the maintenance plan for the proposed stormwater management features in accordance with the New Jersey Stormwater Management Rules (N.J.A.C.7:8).

1.1 General Description of Stormwater Quality Features

The stormwater quality features include two (2) Filterra units, located on either side of Yacht Club Drive (identified on the Project Location map found in Appendix 1). The site is mainly located within the Township right-of-way. A small portion of one of the filterra units encroaches on the property of the Lake Forest Yacht Club, located at 35 Yacht Club Drive. A permanent maintenance easement has been obtained by Jefferson Township.

The two (2) Filterra units are different sizes, based on the size of the area draining to each unit. The unit on the lake side of Yacht Club Drive has a footprint of four (4) feet by six (6) feet, while the other unit is larger with a size of six (6) feet by ten (10) feet. Stormwater enters the inlets where oil, trash and vegetative debris are captured. The stormwater is filtered by the filterra unit, removing total suspended solids and phosphorous.

1.2 Comprehensive Maintenance Program

A comprehensive Maintenance Program is comprised of several related requirements. They include:

- Providing adequate funding, staffing, equipment, and materials.
- Performing routine maintenance procedures on a regularly scheduled basis.

- Performing emergency maintenance procedures and repairs in a timely manner.
- Conducting inspections to determine both the need for and effectiveness of maintenance work.
- Providing training and instruction to maintenance personnel and inspectors.
- Conducting periodic program reviews and evaluations to determine the overall effectiveness of the maintenance program and the need for revised or additional maintenance procedures, personnel, or equipment.
- Instilling pride of workmanship and a commitment to excellence in program personnel.

Adequate funding is achieved by planning for staffing, equipment, and material needs as well as facilities for storage of materials. Additionally, maintenance storage and replacement of equipment must be considered. Training costs, administrative costs, disposal costs, and permit fees must also be included. Seasonal effects and long term capital improvements should also be considered. Finally, a method of securing emergency appropriations to deal with unforeseen problems should be developed.

Functional maintenance, which is required to ensure the safe and effective operation of a Stormwater Quality Facility, and aesthetic maintenance, which is necessary to maintain the visual appeal and aesthetic quality of the facility are both required aspects of any stormwater maintenance program. Furthermore, functional maintenance can be divided into two types: Preventative and Corrective. Preventative maintenance is routine maintenance and corrective maintenance is emergency maintenance. Aesthetic maintenance is the maintenance required to enhance or maintain the visual appeal of a facility. To be effective, preventative maintenance must be performed on a regularly scheduled basis and includes such routine procedures as vegetation trimming, silt and debris removal, and upkeep of moving parts. Corrective maintenance must be performed on an as-needed or emergency basis and includes structural repairs and restoration of vegetation. Aesthetic maintenance can easily be incorporated into a preventative maintenance schedule. When performed regularly, aesthetic maintenance can reduce the required amount of preventative and corrective maintenance at the facility and will help maintain the visual appeal, allowing it to reflect positively on the maintenance staff, owner, and community.

Maintenance and inspection logs should be reviewed periodically to determine the effectiveness of the overall maintenance program. A review of the records can help identify maintenance problems that are the result of poor planning, design, or construction. Additionally, a review of the records can determine if the maintenance program requires any additional personnel, equipment, or materials.

A successful stormwater quality facility maintenance program will include comprehensive training of maintenance personnel in the areas to guarantee that they are best suited for the tasks they complete. A training program will include maintenance and inspection techniques, proper record keeping, permit and other legal requirements, and stormwater management fundamentals.

1.3 Key Information for Proper Maintenance of Stormwater Quality Features

In order to properly maintain the Filterra units, it is necessary to utilize the following information as part of the overall maintenance procedures:

Approved Disposal Facilities

Proper maintenance of the stormwater management features relies on knowing what facilities in the immediate vicinity of Jefferson Township can accept sediment from the site. The following is a potential disposal facility for sediment and debris removed from the Filterra Units. This should be regularly reviewed and updated as this listing is subject to change.

Facility : Tilcon of New York
DEP ID : 133631
Phone: 973-366-7741
City : Wharton
Zip : 07885
Location : 625 Mt. Hope Rd.
County : Morris
Municipality : Rockaway Twp

2.0 Responsible Party Designation

It is our understanding that Jefferson Township, will take full responsibility for the preventative and corrective maintenance of the stormwater quality features described in this manual.

The Key Individual responsible for the overall maintenance program at Jefferson Township is as follows:

Name: Head of Department of Maintenance

Address: 1033 Weldon Rd., Lake Hopatcong, NJ 07849

Phone Number: (973) 697-1500

All maintenance logs, reports, and inspections of the stormwater quality facilities must be coordinated directly with the individual identified above. At any time, the key individual identified above may make changes to this manual to reflect changes in maintenance procedures at the Township. These may include, but are not limited to, developing maintenance budgets, inspecting facilities, and scheduling and performing actual maintenance work on both a routine and emergency basis.

The key individual identified above is responsible for establishing a system for field personnel to provide feedback to supervisory personnel on a routine and priority basis as the need arises. The procedure includes proper record keeping to provide verification of work actually completed and to assist in preparing future maintenance budgets.

3.0 Preventative Maintenance Requirements

Safety of maintenance personnel is essential. Non-technical staff can carry out some tasks quite effectively; however, all programs should carefully ensure the safety of anyone carrying out maintenance tasks. Often, a professional should be hired to conduct the work. Confined spaces should never be entered without proper training and permits from occupational and safety regulatory agencies. Additionally, professional judgment should be solicited regularly to ensure that all needs of the facility are met. Even though non-professionals can routinely perform some maintenance tasks, there are many problems that are not obvious to the untrained eye. Below, detailed preventative maintenance information is provided for the stormwater management facilities.

The Filterra units must be inspected and serviced at least **two (2) times per year**. A detailed preventative maintenance and inspection checklist, titled "Filterra Structure Maintenance Report" is provided in Appendix 2 and should be used to complete these tasks for the above mentioned facility.

Routine Inspection Requirements

The Filterra units must be inspected at least **two (2) times per year**. Frequency of maintenance will depend upon the pollutant load of the surrounding area. A newly installed device should be inspected every few months to determine service frequency. The following is a general list of the requirements for inspection. A detailed inspection checklist for the device can be found in Appendix 2.

- All device components expected to receive and/or trap debris and sediment must be inspected for clogging and excessive debris and sediment accumulation.
- All structural components must be inspected for cracking, subsidence, spalling, erosion, and deterioration.

General Maintenance Requirements

General maintenance shall be as follows:

A. Each unit is to be maintained by the manufacturer, or a manufacturer approved contractor (Garden State Pre-Cast) for a period of one year. The cost of this service is to be included in the price of each unit.
B. Annual maintenance consists of two scheduled visits. The visits are scheduled seasonally; the spring visit aims to clean up after winter loads including salts and sands. The fall visit helps the system by removing excess leaf litter.

C. Each maintenance visit consists of the following tasks:
    a. Unit inspection.
    b. Foreign debris, silt, mulch and trash removal.
    c. Plant health evaluation and pruning or replacement as necessary.
    d. Replacement of mulch.
    e. Disposal of all maintenance refuse items at an approved facility.
    f. Maintenance records updated and stored (reports available upon request).

D. The beginning and ending date of contractor's obligation to maintain the installed system shall be determined by Jefferson Township at the time the system is activated. Jefferson Township must promptly notify the contractor of any damage to the trees, which constitutes an integral part of the bioretention technology.

For specific step-by-step instructions on Filterra maintenance, refer to the Filterra Maintenance Manual included in Appendix 3.

General Maintenance Equipment Needs

The following is a list of equipment that may be necessary to conduct the above referenced maintenance tasks:

- Mulch
- Pruning Shears
- Shovel
- Broom
- Short Handled Rake
- Empty 5 Gallon Buckets*
- Tape Measure
- Filterra Structure Maintenance Report Worksheet
- Digital Camera
- Safety Equipment (traffic cones, safety vest, impervious gloves, steel toe boots, etc.)

*A vacuum truck may be used instead of buckets.

4.0 Corrective Maintenance Requirements

Corrective maintenance is required on an emergency or non-routine basis to correct problems or malfunctions and to restore the intended operation and safe condition of a stormwater management facility. Each of the potential problems described below are not considered routine and should not be considered all-inclusive of problems that may occur at the site. They are listed simply as an offering of what might occur at the Jefferson Township facilities.

The following problems and some potential solutions are identified for the filterras, however, they are not all-inclusive and other problems may occur. Should problems not specifically identified below occur onsite, the responsible party should exercise sound judgment in determining the severity of the problem.

Problem #1: Tree is damaged or missing.

Solution: Trees should be restored to its original specifications. The specified tree species is Almelanchier canadensis (Servicberry) at 6-7 feet in height. Upon replanting, biweekly inspections of vegetative health should be performed throughout the entire first growing season. The use of pesticides and fertilizers containing phosphorous is prohibited in Jefferson Township.

Problem #1: Clogged outlet pipes

Solution: Should clogs be noted at the outlet pipes that are impeding flow, a vacuum truck or other machinery may be used remove the debris. Debris removed must be taken to one of the suitable disposal/recycling sites identified in Section 1.3 above.

Problem #2: Cracking, breaking, spalling, or deteriorating structures

Solution: Should cracking, breaking, spalling, or deterioration of any structural elements within the device be discovered, the damage should be closely inspected. Equipment, materials, and personnel must be available to perform these repairs on short notice. The immediacy of the repairs will depend upon the nature of the damage and its effects on the safety and operation of the device. If the condition worsens or the condition is severe or dangerous, a licensed civil engineer should be consulted for repair planning. In some cases, the structures may need to be replaced if too heavily damaged for repair.

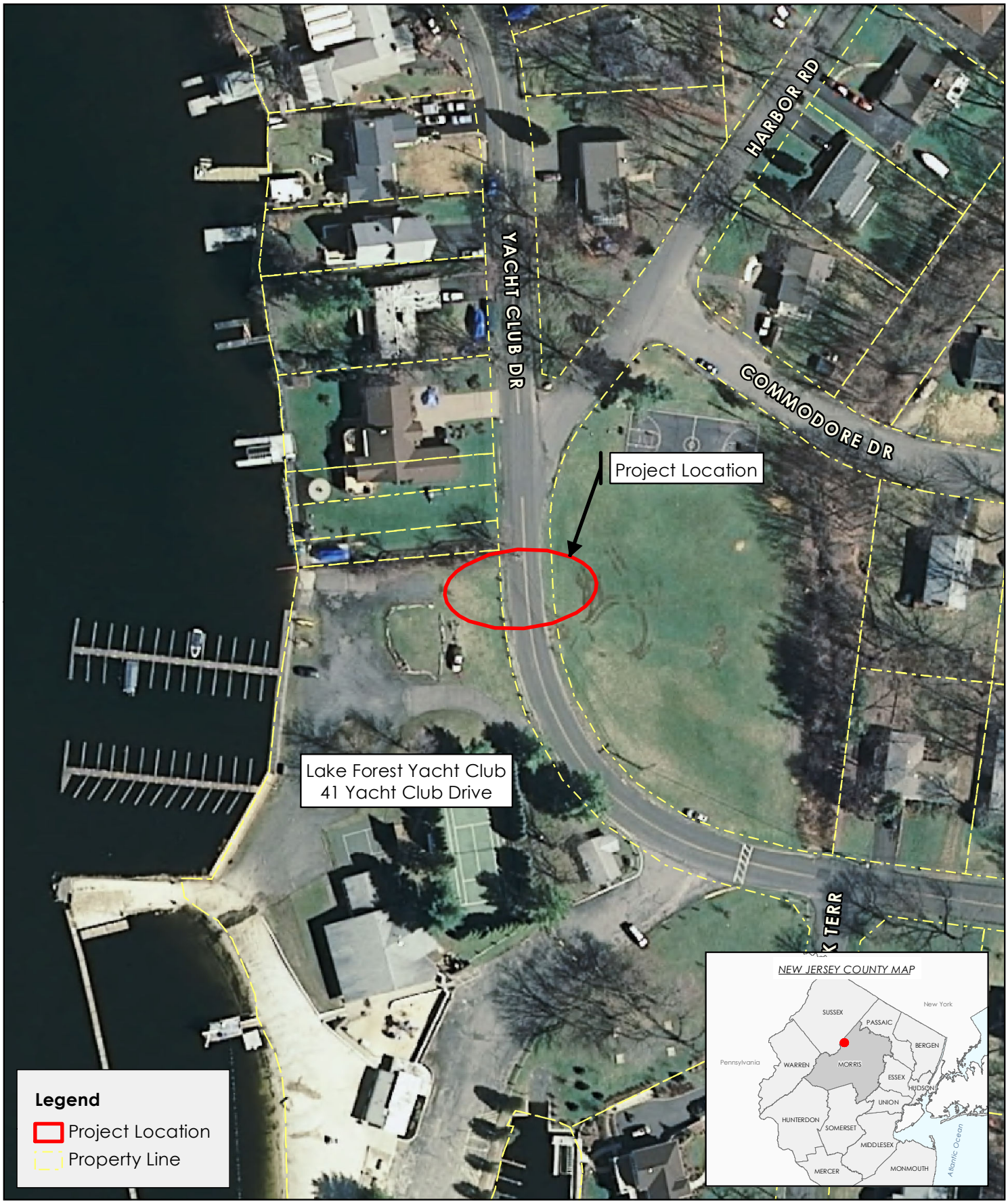
Problem #3: Replacement of Filterra media

Solution: The Filterra media should be replaced if it begins to fail. The manufacturer, Filterra, Inc. should be contacted for the replacement parts and installation instructions. A copy of the Filterra Maintenance Manual is included in Appendix 3.

APPENDICES

APPENDIX 1: Location Map of Stormwater Management Facilities
APPENDIX 2: Filterra Structure Maintenance Report
APPENDIX 3: Filterra Maintenance Manual

APPENDIX 1: Location Map of Stormwater Management Features



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PROJECT LOCATION

LAKE HOPATCONG BMP RETROFIT PROJECT
41 YACHT CLUB DRIVE
JEFFERSON TOWNSHIP
MORRIS COUNTY, NJ

PRINCETON HYDRO, LLC.
1108 OLD YORK ROAD
P.O. BOX 720
RINGOES, NJ 08551
*with offices in NJ, PA and CT

NOTES:
1.New Jersey 2007 High Resolution Orthophotography obtained from the NJGIN Information Warehouse.
2. Project location is approximate.
3. Property lines obtained from Morris County, 2010.

0 50 100 Feet

Map Projection: NAD 1983 StatePlane New Jersey FIPS 2900 Feet

APPENDIX 2: Filterra Structure Maintenance Report

Filterra® Structure Maintenance Report

Project		**Structure Number**	
Plant Type		**Structure Size**	
Date		**GPS**	
		Pre Mtce Photo #	

Initial Observations

Standing Water	Y	N	Damage to Grate	Y	N
IF Yes, STOP NOW & call 804-798-6068			Is Bypass Clear	Y	N
			Notes		
Damage to Box Structure	Y	N			
If YES to any observation take close up photo					

Waste

Silt / Clay	Y	N	Buckets Removed (# of)	
Cups/Bags	Y	N	Notes	
Leaves	Y	N		
Other				

Media

Distance to Bottom of Top Slab (in.)		Notes	
Buckets of Media Added (# of)			

Mulch

Netting Replaced	Y	N	Bags of Mulch Added (# of)	
Stones Replaced	Y	N	Notes	

Plant	#1	(#2)		#1	(#2)
Height above Grate (ft., in.)			Plant Replaced	Y / N	Y / N
Stem diameter/Caliper (in.)					
Width at Widest Point (ft., in.)			Notes		
Health	Alive/Dead	Alive/Dead			
Damage to Plant	Y / N	Y / N			
If YES to plant damage take close up photo					

Other Notes

(use back if necessary)

APPENDIX 3: Filterra Maintenance Manual

Introduction and Scope of this Document

At federal, state and local levels, stormwater management is increasingly important. Filterra® units can help developers comply with NPDES (National Pollutant Discharge Elimination System) legislation by removing pollutants, using a small efficient natural system that is both cost-effective and reliable. Routine maintenance services are required to ensure each installed unit continues to operate effectively.

Purpose:
Stormwater BMP maintenance is quickly becoming an enforceable entity from local governments and all property owners now find themselves having to deal with this topic. Once Filterra has completed the included 1-year maintenance contract; it is solely the property owner's responsibility to ensure each system is routinely serviced. This program has been created to instruct individuals or companies on the proper steps to perform extended maintenance services on a Filterra® Bioretention System in accordance to our Standard Operating Procedures (SOP). It is our intention to provide an authorized training course to help property owners with the selection of personnel who understand the procedure of Filterra BMP Maintenance to ensure the units work as designed

What you will learn:

- Extended Maintenance Procedure
- Filterra Maintenance Paperwork
- Proper Tree Care
- Possible Troubleshooting Procedures for Filterra® Units

What is Extended Maintenance?
While only Filterra® or an authorized representative can perform the activation (open the units up after installation) and maintenance service during the first year of operation, it is the owner of the system's responsibility to ensure routine maintenance is performed thereafter. This extended maintenance service is contracted and managed through the owner or authorized owner's representative for a specific site or sites.

Table of Contents

Section A

Filterra Maintenance SOP

Toll Free: (866) 349-3458
Fax: (804) 798-8400
maintenance@filterra.com

Tools and Equipment

- Mulch
- Pruning Shears
- Shovel
- Broom
- Short Handled Rake
- Empty 5 Gallon Bucket
- Tape Measure
- Filterra Maintenance Worksheet
- Digital Camera
- Safety Equipment (traffic cones, safety vest, impervious gloves, steel toe boots, etc)

Maintenance – Step 1

Set Up

Ensure your work area is safe and secure by setting traffic cones around the work area.

Workers should wear high visibility vest or jackets, impermeable gloves and other safety equipment required at each job site.

Maintenance – Step 2
Inspection of Filterra

Each unit should be inspected to confirm that:

a) the structure size matches the paper work
b) there is no standing water in the unit
c) there is no damage to the tree grate or grates
d) there is no damage to the top slab
e) the downstream bypass structure or opening is clear

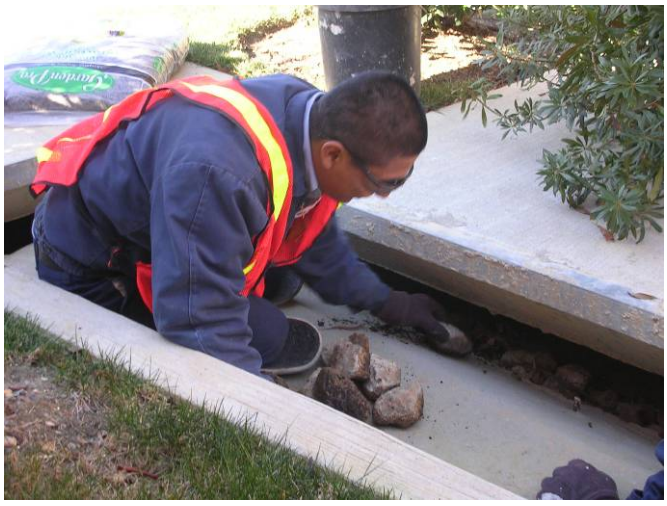
Maintenance – Step 3

Removal of Tree Grate and Erosion Control Stones

Carefully remove each half of tree grate and place to one side.

Lift grates safely and appropriately as each half may weight up to 155 pounds (Cast Iron Grates).

In the throat of each unit there are numerous fist sized erosion control stones. These need to be removed before the maintenance and they are to be placed to the side. If no stones are present, please install as they are necessary to disperse the incoming flows.



Maintenance – Step 4
Debris, Trash and Mulch Removal

Take extra care when removing waste, there may be sharp items contained in the unit.

Enter the unit with your modified, short handle rake and pull back from all corners and edges, the collected debris, trash and mulch along with any sediment. Be careful not to remove the engineered media.

The number of 5 gallon buckets removed and the type of waste should be recorded on your Maintenance Paperwork.

All waste should be disposed in compliance to local waste disposal regulations.

Once all mulch is removed you should see 9” (plus or minus one inch) below the bottom of the top slab; measure and record this distance. If more media is needed or if the media appears clogged with sediment please contact the Filterra office

Maintenance – Step 5

Replacing the Mulch

Shredded hardwood mulch should be spread evenly to a depth of 3” within the unit. Place the mulch through the throat and the tree grate opening for simple installation

Measure the distance from the bottom of the top slab to the mulch. This should be 6” (plus or minus one inch)

Box Length	Box Width	Filter Surface Area (ft2)	Volume @ 3" (ft3)	# of 2 ft3 Mulch Bags
6	4	24	6	3
8	4	32	8	4
6	6	36	9	5
8	6	48	12	6
10	6	60	15	8
12	6	72	18	9
13	7	91	23	12

Maintenance – Step 6

Install Erosion Control Stones and Clean Up

Tap the stones to remove sediment and re-install cleaned stones back through the throat. These should cover the mulch at least 6” back. The stones should be replaced low enough so that trash items may enter the throat without obstruction.

Re-install the tree grates, taking care not to damage the plant and ensuring that the Filterra plate can be easily seen.

Clean the top slab and throat of all debris

Add a minimum of 5 gallons of water to plant.

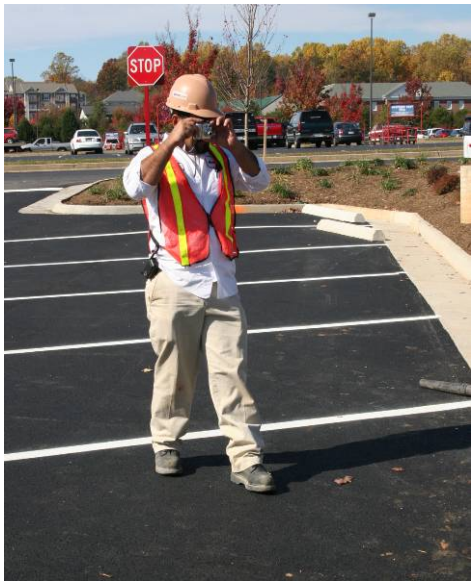
Maintenance – Step 7

Final Paperwork and Photograph

Measure and record (in feet and inches) the plant height above the grate and the width at its widest point. Record any additional notes of interest about the unit or its surrounding environment (oil/chemical spill, dead landscape vegetation, construction within the drainage area, etc.)

Take a dated photograph of every unit after the maintenance is complete. Make sure you capture the entire plant and unit in your photo.

Ensure all Maintenance paperwork is completed, dated and signed.



Filterra® Project Maintenance Order

Project	
Address	
Directions	
Project Owner Owner Notified of Mtce on (date)	
Filterra Units on this Order	_____
Total Units on this Project	_____
Date of Maintenance	
Arrival Time	
Departure Time	
# of Workers	
Notes on Project	
Maintenance Supervisor	_____

Filterra® Structure Maintenance Report

Project		**Structure Number**	
Plant Type		**Structure Size**	
Date		**GPS**	
		Pre Mtce Photo #	

Initial Observations

Standing Water	Y	N	Damage to Grate	Y	N
IF Yes, STOP NOW & call 804-798-6068			Is Bypass Clear	Y	N
			Notes		
Damage to Box Structure	Y	N			
If YES to any observation take close up photo					

Waste

Silt / Clay	Y	N	Buckets Removed (# of)	
Cups/Bags	Y	N	Notes	
Leaves	Y	N		
Other				

Media

Distance to Bottom of Top Slab (in.)		Notes	
Buckets of Media Added (# of)			

Mulch

Netting Replaced	Y	N	Bags of Mulch Added (# of)	
Stones Replaced	Y	N	Notes	

Plant	#1	(#2)		#1	(#2)
Height above Grate (ft., in.)			Plant Replaced	Y / N	Y / N
Stem diameter/Caliper (in.)					
Width at Widest Point (ft., in.)			Notes		
Health	Alive/Dead	Alive/Dead			
Damage to Plant	Y / N	Y / N			
If YES to plant damage take close up photo					

Other Notes

(use back if necessary)

Section B

Tree/Shrub Care

Trees, grasses, and shrubs do more than make the Filterra system attractive; they also enhance pollutant removal. Above ground, the system's plants add beauty and value to the urban landscape. Underground, nature's complex physical, chemical and biological processes are hard at work removing a wide range of non-point source pollutants from stormwater runoff. Pollutants are decomposed, volatilized and incorporated into the biomass of the Filterra's micro/macro fauna and flora

Tree/Shrub Care

Visual Inspection

Visually examine the plant for any signs of disease or damage. Pay close attention to deterioration of leaves or broken stems

Pruning as necessary

Remove or prune excess foliage to create a more upright position. When possible, multi-stemmed trees should be trimmed down to only a single stem protruding from the 12” opening in the tree grate. Tree branches should not touch the inside ring of the grate.

Before

After

Tree/Shrub Care

Water/ Irrigation

Under drought conditions, the plant in the Filterra unit may need irrigation as necessary based on the selected plant's needs.

Plant Replacement

The plant should live to its life expectancy. If you find yourself needing to replace the plant within the Filterra unit, take the following into consideration:

- The Filterra standard sized box accommodates a 5 to 15 gallon root zone. Larger trees will require deeper boxes.
- The species listed on our approved list are drought tolerant and have applicability to bioretention due to shallow root zones.
- Approved planting types and species can be found on our website at http://www.filterra.com/index.php/product/plants/
- Use only single stem trees in the Filterra system
- Install new tree/plant in the center of the grate opening
- Replacement plant should be sufficient height above the tree grate

DO NOT FERTILIZE. Filterra units receive adequate nutrients from stormwater runoff to maintain plant growth and survival and therefore do not require fertilization.

Section C

Troubleshooting a Neglected Filterra

This picture shows the inside of a unit that has been neglected for several years. Filterra units are like all other stormwater BMP's and require regular maintenance to ensure they continue to operate efficiently.

Unfortunately, there are units installed throughout the country that have been neglected after the standard 1-year maintenance period, in which Filterra provides, has expired. Depending on existing site conditions, these units may not be operating to full potential. Some units may simply need a standard maintenance session to bring it back to full operation while other may require additional attention. This section is designed to assist you in addressing a neglected Filterra unit. If you have any questions, please call our office for assistance

Troubleshooting

Missing or Broken Plant

1. Select the appropriate plant from Filterra approved plant list
2. Install newly selected plant per guidelines
3. Record new plant type and measurements on worksheet for records

Missing or Broken Tree Grates

Replacement Tree Grates can either be ordered from Filterra or another supplier. Each Filterra supplied Cast Iron Grate (36” or 48” Square) should be 1½” in height.

Dead Plant

Some plants may lose their leaves during dormant periods (typically in the fall or winter months). Plant death can be determined by scraping back the bark and exposing the flesh. If the flesh is green then the plant is alive.

If the plant is no longer alive due to natural causes or lack of irrigation, please replace and install a new plant as per Filterra guidelines.

If the plant is no longer alive because it has been submerged in standing water inside the unit, please ensure the problem has been corrected before replacing the plant.

Troubleshooting

Standing Water

1. Check to see if there is standing water located inside the internal stand pipe.
    a. If water is present inside the stand pipe, the unit is saturated and not draining properly. (*This should not be checked until 48 hours after a heavy rainfall to ensure any downstream devices have an adequate time period to drain*) To ensure the internal underdrain pipe has not become clogged, simply remove the clean out cap and run a plumbing snake through the pipe until it exits the Filterra vault.

    b. If water is not present in the stand pipe, the unit is most likely clogged within the top portion of the media layer which will require additional investigation.

2. To ensure the media layer has not become occluded, simply scrape away the 3" mulch layer and the standing water should flow through the media layer. If the water level is not reduced, continue to dig down into the media layer until the water passes. The occluded media layer will need to be replaced.

Water in Unit?	**Water in Cleanout?**	**Water in Bypass**	**Conclusion**
YES	YES	YES	Clogged downstream, check bypass structure(s)
YES	YES	NO	Pipe may be clogged between Filterra and bypass
YES	NO	NO	Filterra media occluded

Stormwater Maintenance Plan
For Filterra Installation 319 –Grant (SFY-2010)

Jefferson Township, Morris County, New Jersey

Prepared for:

The Township of Jefferson
1033 Weldon Rd.
Lake Hopatcong, NJ 07849

Prepared by:

Princeton Hydro, LLC
1108 York Road, Suite 1
P.O. Box 720
Ringoes, New Jersey 08551
(P) 908.237.5660
(F) 908.237.5666
www.princetonhydro.com
Offices in New Jersey, Pennsylvania, Connecticut and Maryland

October 2016

Contents

APPENDICES:

1 Introduction

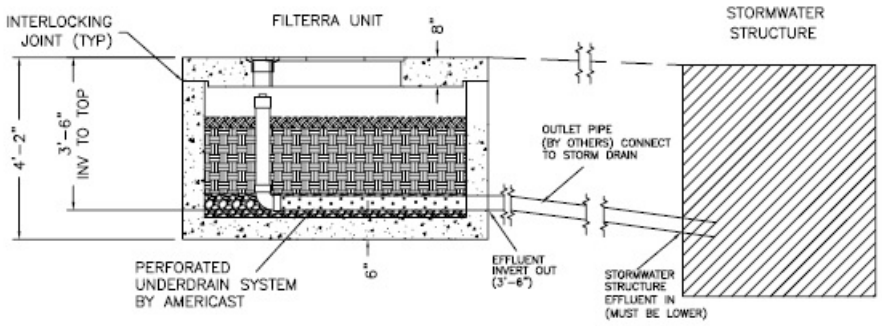
The Lake Hopatcong Commission care of the Lake Hopatcong Foundation contracted Princeton Hydro, LLC (Princeton Hydro) to conduct stormwater management design services at the Yacht Club Drive property and the Ashley Cover property (see Design Plans found in Appendix A). Two stormwater management facilities were designed for each property for this project.

1. Yacht Club Drive –North (YCD-N) – Filterra System
2. Yacht Club Drive –South (YCD-S) – Filterra System
3. Ashley Cove – North (AC-N) – Filterra System
4. Ashley Cove – East (AC-E) – Filterra System

The sites are located within the Right-of-Way of the township owned roads. Jefferson Township installed the units and will be responsible for the maintenance of all four (4) structures. The projects were funded through SFY2010 Section 319(H) Grant Agreement between the Lake Hopatcong Commission and the New Jersey Department of Environmental Protection managed by the Lake Hopatcong Foundation. This manual was prepared to present the maintenance plan for the stormwater management features in accordance with the New Jersey Stormwater Management Rules (N.J.A.C.7:8).

1.1 Descriptions of Stormwater Management Features

A manufactured treatment device known as a Filterra unit manufactured by Contech was installed at each of the four (4) locations. The device was installed offline with a connection to the existing storm sewer network running within the adjacent roads prior to its eventual discharge into Lake Hopatcong. Stormwater enters the Filterra where it is filtered through the filter media, reducing sediment and phosphorous loads in the stormwater leaving the unit. Litter and other debris are also captured in the mulch layer above the filter media. One or two small street trees/shrubs, depending on the size of the unit, are also planted in the unit to provide additional benefits. See below for schematic of system:



CROSS SECTION

1.1.1 Yacht Club Drive North-(YCD-N)– Filterra System

A 6 x 8 Filterra™ Unit (Unit) is installed off of Yacht Club Drive, across the street from Springbrook Terrace. The Unit captures and treats the water flowing along the northern side of Yacht Club Drive. Overflow from the Unit will exit the Unit via a 4 inch diameter smooth-walled, non-perforated PVC pipe tied to the existing downstream catch basin or continue to curb flow to the downstream catch basin. One Northern Bayberry (*Morella pensylvanica*) was installed in the Unit.

1.1.2 Yacht Club Drive –South (YCD-S) – Filterra System

A 7 x13 Filterra™ Unit (Unit) is installed off of Yacht Club Drive, at the intersection of Yacht Club Drive and Springbrook Terrace. The Unit captures and treats the water flowing along the southern side of Yacht Club Drive. Overflow from the Unit will either exit the Unit via a 6 inch diameter smooth-walled, non-perforated PVC pipe tied to the existing catch basin or the existing catch basin. Two Northern Bayberry (*Morella pensylvanica*) were installed in the Unit.

1.1.3 Ashley Cove – North (AC-N) – Filterra System

A 7 x 13 Filterra™ Unit (Unit) was installed along the norther curb of Ripplewood Drive at the intersection with Espanong Road. The Unit captures and treats the water flowing along Espanong Road. Overflow from the Unit will exit the Unit via a 6 inch diameter smooth-walled, non-perforated PVC pipe tied to the existing downstream catch basin and via curbflow to the existing downstream catch basin. Two Northern Bayberry (*Morella pensylvanica*) were installed in the Unit. In addition to the unit, the downstream inlet box was replaced and a junction box was installed on an existing stormwater pipe adjacent to the

1.1.4 Ashley Cove –East (AC-E) – Filterra System

A7 x 13 Filterra™ Unit (Unit) was installed along the curb of the eastern side of Ripplewood Drive at the intersection with Espanong Drive. The Unit captures and treats the water flowing along the east side of Ripplewood Drive and some flow from Espanong Road. Overflow from the Unit will exit the Unit via a 6 inch diameter smooth-walled, non-perforated PVC pipe tied to the existing downstream manhole or to

the existing downstream catch basin. Two Northern Bayberry (*Morella pensylvanica*) were installed in the Unit.

The design plans are provided in Appendix A, for reference.

1.2 Comprehensive Stormwater Management Facilities Maintenance Program

A comprehensive Stormwater Management Facilities Maintenance Program is comprised of several related requirements. They include:

- Providing adequate funding, staffing, equipment, and materials.
- Performing routine maintenance procedures on a regularly scheduled basis.
- Performing emergency maintenance procedures and repairs in a timely manner.
- Conducting stormwater management facilities inspections to determine both the need for and effectiveness of maintenance work.
- Providing training and instruction to maintenance personnel and inspectors.
- Conducting periodic program reviews and evaluations to determine the overall effectiveness of the maintenance program and the need for revised or additional maintenance procedures, personnel, or equipment.
- Instilling pride of workmanship and a commitment to excellence in program personnel.

Adequate funding is achieved by planning for staffing, equipment, and material needs as well as facilities for storage of materials. Additionally maintenance storage and replacement of equipment must be considered. Training costs, administrative costs, disposal costs, and permit fees must also be included. Seasonal effects and long term capital improvements should also be considered. Finally, a method of securing emergency appropriations to deal with unforeseen problems should be developed.

Functional maintenance, which is required to ensure the safe and effective operation of a stormwater management facility, and aesthetic maintenance, which is necessary to maintain the visual appeal and aesthetic quality of the facility are both required aspects of any stormwater maintenance program. Further, functional maintenance can be divided into two types: Preventative and Corrective. Preventative maintenance is routine maintenance and corrective maintenance is emergency maintenance. Aesthetic maintenance is the maintenance required to enhance or maintain the visual appeal of a facility. To be effective, preventative maintenance must be performed on a regularly scheduled basis and includes such routine procedures as vegetation trimming, silt and debris removal, and upkeep of moving parts. Corrective maintenance must be performed on an as-needed or emergency basis and includes structural repairs, mosquito control, and restoration of vegetated linings. Aesthetic maintenance can easily be incorporated into a preventative maintenance schedule. When performed regularly, aesthetic maintenance can reduce the required amount of preventative and corrective maintenance at the facility and will help maintain the visual appeal and allow it to reflect positively on the maintenance staff, owner, and community.

Maintenance and inspection logs should be reviewed periodically to determine the effectiveness of the overall maintenance program. A review of the records can help identify maintenance problems that are the result of poor planning, design, or construction. Additionally, a review of the records can determine if the maintenance program requires any additional personnel, equipment, or materials.

A successful stormwater management facility maintenance program will include comprehensive training of maintenance personnel in the areas to guarantee that they are best suited for the tasks they complete. A training program will include maintenance and inspection techniques, proper record keeping, permit and other legal requirements, and stormwater management fundamentals.

1.3 Key Information for Proper Maintenance of Stormwater Management Features

In order to properly maintain the stormwater management features, it is necessary to utilize the following information as part of the overall maintenance procedures:

1.3.1 Rainfall Data

Proper inspection and maintenance relies on understanding when one (1) inch rainfall events have occurred. Local rainfall data can be obtained from any of the following sources; however, this list should be reviewed and updated as this listing is subject to change:

USGS rain gage located in Lake Hopatcong NJ:

http://waterdata.usgs.gov/nj/nwis/uv?site_no=01455500

Weather Underground (search for Lake Hopatcong, NJ):

http://www.wunderground.com/history/

1.3.2 Approved Disposal Facilities

Proper maintenance of the stormwater management features relies on knowing what facilities in the immediate vicinity of Lake Hopatcong that can accept sediment from the site. The following is a potential disposal facility for sediment removed from the facilities. This should be regularly reviewed and updated as this listing is subject to change.

Facility :	Tilcon of New York
DEP ID :	133631
Phone:	973-366-7741
City :	Wharton
Zip :	7885
Location :	625 Mt. Hope Rd.
County :	Morris
Municipality :	Rockaway Twp

2 Responsible Party Designation

It is our understanding that Jefferson Township, as the property owner of the project, will take full responsibility for the preventative and corrective maintenance of the stormwater management features described in this manual.

The Key Individual responsible for the overall maintenance program of these facilities at the site is as follows:

Name: Edward Haack, Jefferson Township Engineer

Address: 1033 Weldon Road, Lake Hopatcong, New Jersey 07849

Phone Number: (973) 697 - 2522

All maintenance logs, reports, and inspections of the stormwater management facilities must be coordinated directly with the individual identified above. At any time, the key individual identified above may make changes to this manual to reflect changes in maintenance procedures at the Township. These may include, but are not limited to, developing maintenance budgets, inspecting facilities, and scheduling and performing actual maintenance work on both a routine and emergency basis.

The key individual identified above is responsible for establishing a system for field personnel to provide feedback to supervisory personnel on a routine and priority basis as the need arises. The procedure includes proper record keeping to provide verification of work actually completed and to assist in preparing future maintenance budgets.

3 Preventative Maintenance Requirements

Safety of maintenance personnel is essential. Non-technical staff can carry out some tasks quite effectively; however, all programs should carefully ensure the safety of anyone carrying out maintenance tasks. Often, a professional should be hired to conduct the work. Confined spaces should never be entered without proper training and permits from occupational and safety regulatory agencies. Additionally, professional judgment should be solicited regularly to ensure that all needs of the facility are met. Even though non-professionals can routinely perform some maintenance tasks, there are many problems that are not obvious to the untrained eye. Detailed preventative maintenance information is provided below for the stormwater management facilities. All preventative maintenance tasks identified to be completed on a regular basis should be completed at least four (4) times per year.

Detailed preventative maintenance and inspection checklists are provided in Appendix B and should be used as needed to complete these tasks for the facilities.

Routine Inspection Requirements

The Filterra should be inspected at least **two (2) times per year**. Frequency of maintenance will depend upon the pollutant load of the surrounding area. A newly installed device should be inspected every few

months to determine service frequency. The following is a general list of the requirements for inspection. Detailed inspection checklists for the device can be found in Appendix B.

1. All device components expected to receive and/or trap debris and sediment must be inspected for clogging and excessive debris and sediment accumulation.
2. All structural components must be inspected for cracking, subsidence, spalling, erosion, and deterioration.
3. All vegetation shall be inspected for dead or diseased branches and foliage.
4. All vegetation shall be inspected for vegetation growth into travelways and sidewalks.

General Maintenance Requirements

General maintenance shall be as follows:

A. Each unit is to be maintained by the manufacturer, or a manufacturer approved contractor (Contech) for a period of one year. The cost of this service is to be included in the price of each unit.
B. Annual maintenance consists of two scheduled visits. The visits are scheduled seasonally; the spring visit aims to clean up after winter loads including salts and sands. The fall visit helps the system by removing excess leaf litter.
C. Each maintenance visit consists of the following tasks:
    a. Unit inspection.
    b. Foreign debris, silt, mulch and trash removal.
    c. Plant health evaluation and pruning or replacement as necessary.
    d. Replacement of mulch.
    e. Disposal of all maintenance refuse items at an approved facility.
    f. Maintenance records updated and stored (reports available upon request).
D. The beginning and ending date of contractor's obligation to maintain the installed system shall be determined at the time the system is activated. Jefferson Township must promptly notify the manufacturer of any damage to the shrub, which constitutes an integral part of the bioretention technology.

For specific step-by-step instructions on Filterra maintenance, refer to the Filterra Maintenance Manual included in Appendix F.

General Maintenance Equipment Needs

The following is a list of equipment that may be necessary to conduct the above referenced maintenance tasks:

- Mulch
- Pruners
- Shovel

- Broom
- Short Handled Rake
- Empty 5 Gallon Buckets*
- Tape Measure
- Filterra Structure Maintenance Report Worksheet
- Digital Camera
- Safety Equipment (traffic cones, safety vest, impervious gloves, steel toe boots, etc.)

*A vacuum truck may be used instead of buckets.

4 Corrective Maintenance Requirements

Corrective maintenance is required on an emergency or non-routine basis to correct problems or malfunctions and to restore the intended operation and safe condition of a stormwater management facility. Each of the potential problems described below are not considered routine and should not be considered all-inclusive of problems that may occur at the site. They are listed simply as an offering of what might occur at the Yacht Club Drive and Ashley Cove locations. Detailed corrective and preventive maintenance logs are provided in the Appendices.

The following potential problems and some potential solutions are identified for the MTD, however, they are not all-inclusive and other problems may occur. Should problems not specifically identified below occur onsite, the responsible party should exercise sound judgment in determining the severity of the problem.

Problem #1: Tree is damaged or missing.

Solution: Trees should be restored to its original specifications. The specified tree species is Northern Bayberry (*Morella pensylvanica*) at 24-36 inches in height. Upon replanting, biweekly inspections of vegetative health should be performed throughout the entire first growing season. The use of pesticides and fertilizers containing phosphorous is prohibited.

Problem #2: Clogged outlet pipes

Solution: Should clogs be noted at the outlet pipes that are impeding flow, a vacuum truck or other machinery may be used remove the debris. Debris removed must be taken to one of the suitable disposal/recycling sites identified in Section 1.3 above.

Problem #3: Cracking, breaking, spalling, or deteriorating structures

Solution: Should cracking, breaking, spalling, or deterioration of any structural elements within the device be discovered, the damage should be closely inspected. Equipment, materials, and personnel must be available to perform these repairs on short notice. The immediacy of the repairs will depend upon the nature of the damage and its effects on the safety and operation of the device. If the condition worsens or the condition is severe or dangerous, a licensed civil engineer should be consulted for repair planning. In some cases, the structures may need to be replaced if too heavily damaged for repair.

Problem #4: Clogging Filterra media

Solution: The Filterra media should be replaced if it begins to fail. The manufacturer, Filterra, Inc. should be contacted for the replacement parts and installation instructions. A copy of the Filterra Maintenance Manual is included in Appendix F.

APPENDICES

APPENDIX A: Design Plans

APPENDIX B: Inspection and Maintenance Checklists

APPENDIX C: Preventative and Corrective Maintenance Logs

APPENDIX D: Plant Lists

APPENDIX E: Activation Letter

APPENDIX F: Filterra Maintenance

APPENDIX A: Design Plans

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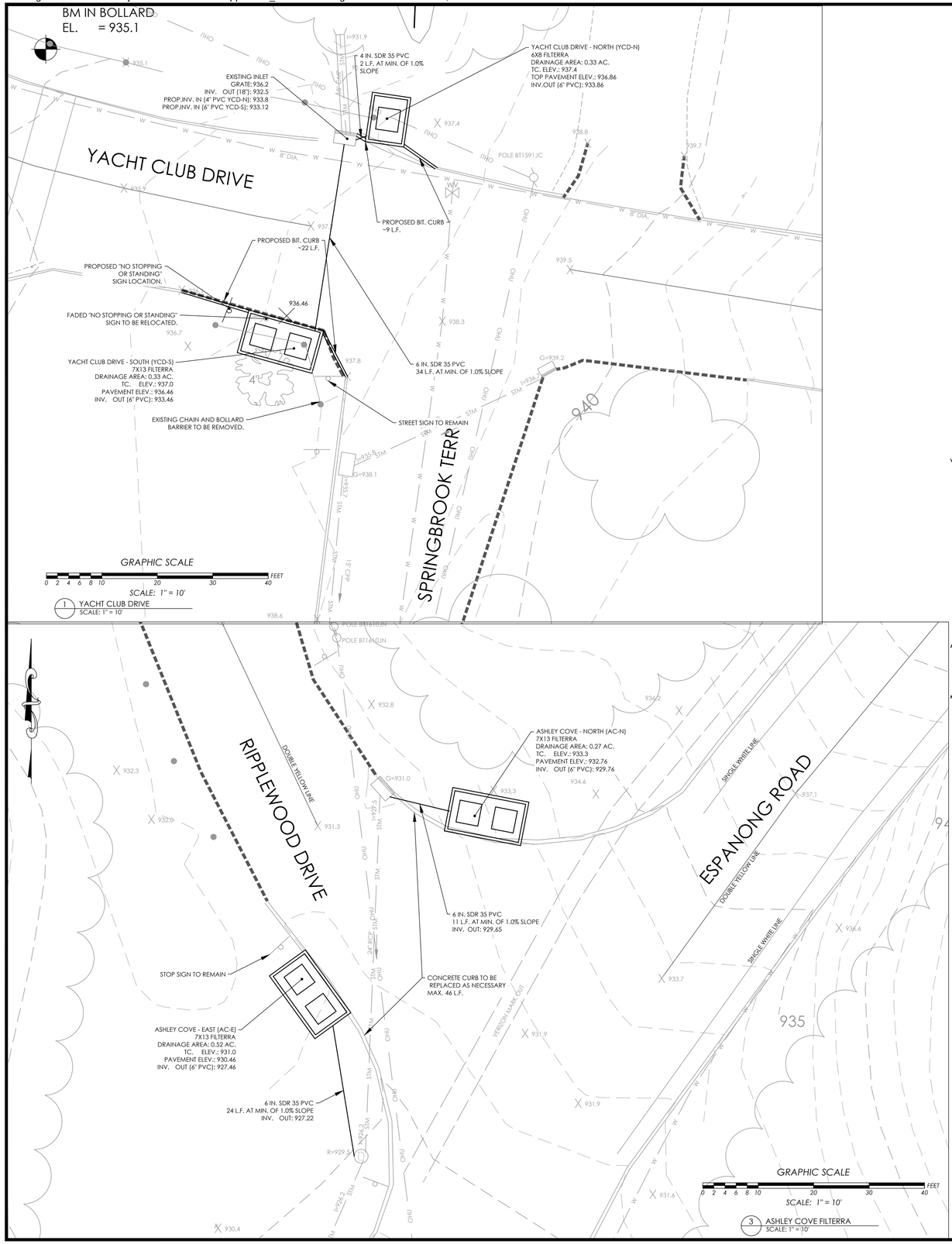


LEGEND

- LIMIT OF DISTURBANCE
- PROPERTY BOUNDARY
- ROW — RIGHT OF WAY
- EXISTING EDGE OF PAVEMENT
- PROPOSED EDGE OF PAVEMENT
- EXISTING STRUCTURE
- PROPOSED STRUCTURE
- EXISTING CONTOUR - MAJOR
- EXISTING CONTOUR - MINOR
- STATE OPEN WATER
- X — X — EXISTING FENCE
- STM — EXISTING STORM SEWER LINE
- STM — PROPOSED STORM SEWER LINE
- SAN — EXISTING SANITARY SEWER LINE
- W — W — EXISTING WATER LINE
- G — EXISTING GAS LINE
- EXISTING TREELINE
- X 931.6 — EXISTING SPOT ELEVATION
- BOLLARD-CHAIN FENCE

VEGETATED INLET CONSTRUCTION & INSTALLATION

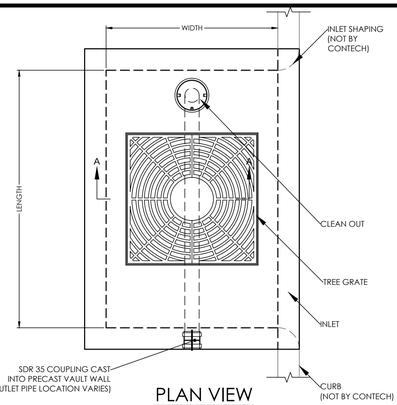
A. EACH UNIT SHALL BE CONSTRUCTED AT THE LOCATIONS AND ELEVATIONS ACCORDING TO THE SIZES SHOWN ON APPROVED SHOP DRAWINGS. ANY MODIFICATIONS TO THE ELEVATION OR LOCATION SHALL BE AT THE DIRECTION OF AND APPROVED BY THE ENGINEER.
B. IF THE UNIT IS STORED BEFORE INSTALLATION, THE TOP SLAB MUST BE PLACED ON THE BOX USING THE 2X4 WOOD PROVIDED, TO PREVENT ANY CONTAMINATION FROM THE SITE. ALL INTERNAL FITTINGS SUPPLIED (IF ANY), MUST BE LEFT IN PLACE AS PER THE DELIVERY.
C. THE UNIT SHALL BE PLACED ON A COMPACTED SUB-GRADE WITH A MINIMUM 12-INCH GRAVEL BASE MATCHING THE FINAL GRADE OF THE CURB LINE IN THE AREA OF THE UNIT. THE UNIT TO BE PLACED SUCH THAT THE UNIT AND TOP SLAB MATCH THE GRADE OF THE CURB IN THE AREA OF THE UNIT. COMPACT UNDISTURBED SUB-GRADE MATERIALS TO 95% OF MAXIMUM DENSITY AT +1- 2% OF OPTIMUM MOISTURE. UNSUITABLE MATERIAL BELOW SUB-GRADE SHALL BE REPLACED TO THE SITE ENGINEER'S APPROVAL.
D. BACKFILLING SHOULD BE PERFORMED IN A CAREFUL MANNER, BRINGING THE APPROPRIATE FILL MATERIAL UP IN 6" LIFTS ON ALL SIDES.
E. PRECAST SECTIONS SHALL BE SET IN A MANNER THAT WILL RESULT IN A WATERTIGHT JOINT. IN ALL INSTANCES, INSTALLATION OF THE UNIT SHALL CONFORM TO ASTM SPECIFICATION C891 "STANDARD PRACTICE FOR INSTALLATION OF UNDERGROUND PRECAST UTILITY STRUCTURES", UNLESS DIRECTED OTHERWISE IN CONTRACT DOCUMENTS.
F. OUTLET CONNECTIONS SHALL BE ALIGNED AND SEALED TO MEET THE APPROVED DRAWINGS WITH MODIFICATIONS NECESSARY TO MEET SITE CONDITIONS AND LOCAL REGULATIONS.
G. ONCE THE UNIT IS SET, ALL INTERNAL FORMS AND PROTECTIVE COVERS MUST BE LEFT INTACT. THE TOP LID SHOULD BE SEALED ONTO THE BOX SECTION BEFORE BACKFILLING, USING A NONSHRINK GROUT, BUTYL RUBBER OR SIMILAR WATERPROOF SEAL. ALL OTHER PROTECTIVE COVERS AND FORMS SHALL BE REMOVED BY THE SUPPLIER AT THE TIME OF ACTIVATION.
H. CURB AND GUTTER CONSTRUCTION (WHERE PRESENT) SHALL ENSURE THAT THE FLOW-LINE OF THE THE UNIT IS AT A GREATER ELEVATION THAN THE FLOW-LINE OF THE BYPASS STRUCTURE OR RELIEF (DROP INLET, CURB CUT OR SIMILAR). FAILURE TO COMPLY WITH THIS GUIDELINE MAY CAUSE FAILURE AND/OR DAMAGE TO THE ENVIRONMENTAL DEVICE.
I. EACH UNIT MUST RECEIVE ADEQUATE IRRIGATION TO ENSURE SURVIVAL OF THE LIVING SYSTEM DURING PERIODS OF DRIER WEATHER. THIS MAY BE ACHIEVED THROUGH GUTTER FLOW OR THROUGH THE TREE GRATE.

ACTIVATION

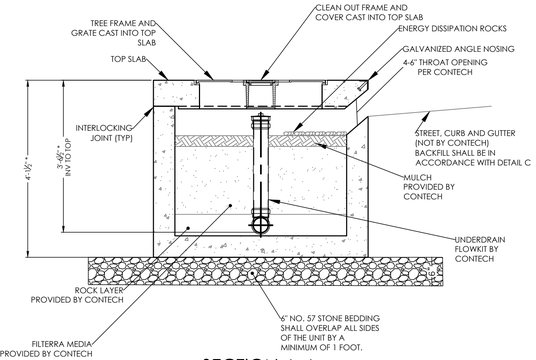
A. ACTIVATION OF THE UNIT IS PERFORMED ONLY BY THE MANUFACTURER. CONTRACTOR IS RESPONSIBLE FOR INLET PROTECTION AND SUBSEQUENT CLEAN OUT COST. THIS PROCESS CANNOT COMMENCE UNTIL THE PROJECT SITE IS FULLY STABILIZED AND CLEANED (FULL LANDSCAPING, GRASS COVER, FINAL PAVING AND STREET SWEEPING COMPLETED), NEGATING THE CHANCE OF CONSTRUCTION MATERIALS CONTAMINATING THE SYSTEM. CARE SHALL BE TAKEN DURING CONSTRUCTION NOT TO DAMAGE THE PROTECTIVE THROAT AND TOP PLATES.
B. ACTIVATION INCLUDES INSTALLATION OF PLANT(S) AND MULCH LAYERS AS NECESSARY.

MAINTENANCE

A. EACH CORRECTLY INSTALLED UNIT IS TO BE MAINTAINED BY THE MANUFACTURER, OR A MANUFACTURER APPROVED CONTRACTOR FOR A MINIMUM PERIOD OF 1 YEAR. THE COST OF THIS SERVICE IS TO BE INCLUDED IN THE PRICE OF EACH UNIT.
B. ANNUAL MAINTENANCE CONSISTS OF A MAXIMUM OF (2) SCHEDULED VISITS. THE VISITS ARE SCHEDULED SEASONALLY; THE SPRING VISIT AIMS TO CLEAN UP AFTER WINTER LOADS INCLUDING SALTS AND SANDS, THE FALL VISIT HELPS THE SYSTEM BY REMOVING EXCESSIVE LEAF LITTER.
C. EACH MAINTENANCE VISIT CONSISTS OF THE FOLLOWING TASKS.
1. UNIT INSPECTION
2. FOREIGN DEBRIS, SILT, MULCH & TRASH REMOVAL
3. FILTER MEDIA EVALUATION AND RECHARGE AS NECESSARY
4. PLANT HEALTH EVALUATION AND PRUNING OR REPLACEMENT AS NECESSARY
5. REPLACEMENT OF MULCH
6. DISPOSAL OF ALL MAINTENANCE REFUSE ITEMS
7. MAINTENANCE RECORDS UPDATED AND STORED (REPORTS AVAILABLE UPON REQUEST)
D. THE BEGINNING AND ENDING DATE OF CONTRACTOR'S OBLIGATION TO MAINTAIN THE INSTALLED SYSTEM SHALL BE DETERMINED BY THE TOWNSHIP AT THE TIME THE SYSTEM IS ACTIVATED. THE TOWNSHIP MUST PROMPTLY NOTIFY THE CONTRACTOR OF ANY DAMAGE TO THE PLANT(S), WHICH CONSTITUTE(S) AN INTEGRAL PART OF THE BIORETENTION TECHNOLOGY.



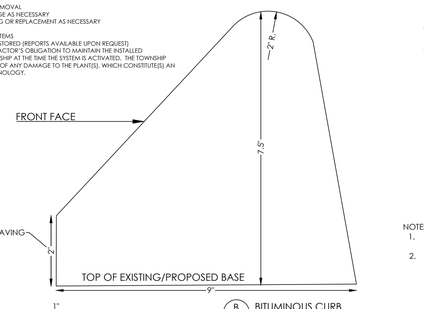
PLAN VIEW



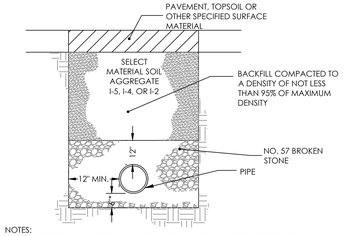
SECTION A-A

PLANT AS SUPPLIED BY CONTECH (NOT SHOWN FOR CLARITY)

FILTERRA LOCATION	ID	UNIT SIZE	TOP OF CURB ELEV.	PAVEMENT INV.	INV. OUT	PIPE DIA.	PIPE LEGNTH	PLANT SPICIES - QUANTITY
ASHLEY COVE - NORTH	AC-N	7 X 13	933.3	932.76	929.76	6" PVC	9	AMELANCHIER CANADENSIS (SERVICE BERRY) - 2
ASHLEY COVE - EAST	AC-E	7 X 13	931	930.46	927.46	6" PVC	24	AMELANCHIER CANADENSIS (SERVICE BERRY) - 2
YACHT CLUB DRIVE - NORTH	YCD-N	6 X 8	937.4	936.86	933.86	4" PVC	2	AMELANCHIER CANADENSIS (SERVICE BERRY) - 1
YACHT CLUB DRIVE - SOUTH	YCD-S	7 X 13	937	936.46	933.46	6" PVC	34	AMELANCHIER CANADENSIS (SERVICE BERRY) - 2

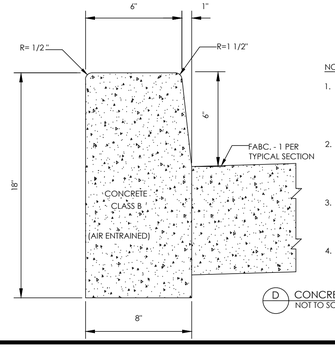


B BITUMINOUS CURB
NOT TO SCALE



NOTES:
1. WHERE TRENCH BOTTOM IS IN ROCK EXCAVATION, INCREASE BEDDING DEPTH UNDER PIPE TO 12".
2. FOUNDATION MATERIAL CONSISTING OF NO. 57 BROKEN STONE SHALL BE PLACED TO A DEPTH OF 24" BELOW BEDDING MATERIAL WHERE UNSUITABLE FOUNDATION EXISTS, AS DETERMINED BY ENGINEER.

C TRENCH AND BEDDING DETAIL
WITHIN ROAD/STREET R.O.W.
NOT TO SCALE



NOTES:
1. CONCRETE TO HAVE A COMPRESSIVE STRENGTH OF 3,000 PSI AFTER 28 DAYS AND SHALL BE CLASS B CONCRETE IN ACCORDANCE WITH NEW JERSEY HIGHWAY SPECIFICATIONS.
2. MINIMUM LENGTH OF BLOCK SHALL BE 10 FEET WITH A PREFORMED BITUMINOUS EXPANSION JOINT, COMPLYING WITH AASHTO M-213, FILLED ½" THICK AND INSTALLED EVERY 20 FEET
3. ANY EXCAVATION BELOW DESIRED GRADE DUE TO OVER EXCAVATION OR WET SOIL SHALL BE BACKFILLED WITH 3/4" CRUSHED STONE.
4. CONSTRUCTION JOINTS SHALL BE INSTALLED MIDWAY BETWEEN EXPANSION JOINTS.

D CONCRETE CURB
NOT TO SCALE

ALL DISTURBED AREAS NOT STABILIZED WITH PAVEMENT SHALL BE SEEDED AND STRAW MULCHED IN ACCORDANCE WITH THE NJ SOIL EROSION AND SEDIMENT CONTROL STANDARDS.

TEMPORARY SEEDING:
TEMPORARY SEEDING IS TO BE USED ON ALL DISTURBED AREAS WHERE PERMANENT STABILIZATION WILL NOT BE ACCOMPLISHED FOR A PERIOD OF UP TO 6 MONTHS.

PRODUCT	RATE	RECOMMENDED OPTIMUM SEEDING DATES
PERENNIAL RYEGRASS	100 LBS. PER ACRE	3/15-5/15 & 8/15-10/1
SPRING OATS	86 LBS. PER ACRE	3/15-6/1 & 8/1-10/1
WINTER CEREAL RYE	112 LBS. PER ACRE	8/1-11/15
WINTER BARLEY	96 LBS. PER ACRE	8/15-10/1
PEARL MILLET	20 LBS. PER ACRE	5/15-8/15
GERMAN OR HUNGARIAN MILLET	30 LBS. PER ACRE	5/15-8/15

PERMANENT SEEDING:
SEEDING MIXTURE FOR GENERAL SEEDING:
40% TURF-TYPE TALL FESCUE
10% CREEPING RED FESCUE
10% CHEWING FESCUE
10% KENTUCKY BLUEGRASS
30% TURF-TYPE PERENNIAL RYEGRASS

E SITE STABLIZATION
NOT TO SCALE

CALL BEFORE YOU DIG!
NEW JERSEY LAW REQUIRES
3 WORKING DAYS NOTICE FOR CONSTRUCTION PHASE AND 10 WORKING DAYS IN DESIGN STAGE - STOP CALL
NEW JERSEY ONE CALL SYSTEM, INC.
REFERENCE NEW JERSEY TITLE 48, CHPT. 2, ARTICLE 9
1-800-272-1000

PROJECT NOTES

NOTES:
1. NEW JERSEY STATE PLANE COORDINATE SYSTEM (NAP-83/2011). VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 1988 (NAVD-88). COMPUTED USING GEOID12B.
2. SITE SPECIFIC SURVEY CONDUCTED BY GARDELL LAND SURVEYING, LLC OF ROCKAWAY, NEW JERSEY ON OCTOBER 27, 2015.
3. ADDITIONAL SITE INFORMATION OBTAINED FROM JEFFERSON TOWNSHIP.
4. RIGHT-OF-WAY (ROW) WIDTHS PROVIDED BY JEFFERSON TOWNSHIP ON NOVEMBER 20, 2015. ROW LIMITS WERE APPROXIMATED IN PLAN VIEW BY PRINCETON HYDRO.

CONSTRUCTION NOTES:
1. ALL ELEVATIONS AND QUANTITIES ARE BASED ON IN-SITU CONDITIONS. ONCE DISTURBED, MATERIAL CONDITIONS CAN VARY SIGNIFICANTLY.
2. THE APPROVAL AND USE OF THESE PLANS ARE FOR THE PROJECT APPLICANT AS DEPICTED ON THIS SHEET. THIS PLAN IS NOT TO BE UTILIZED IN THE PREPARATION OF ANY OTHER PROJECTS.
3. AS FIELD CONDITIONS MAY REQUIRE MODIFICATIONS TO PROPOSED TOPOGRAPHIC ELEVATIONS AND FACILITY LOCATIONS, THESE PLANS ARE NOT TO BE UTILIZED AS AS-BUILTS.
4. CONTRACTOR TO USE AREAS WITHIN THE LIMIT OF DISTURBANCE ONLY.
5. SOILS AND/OR OTHER MATERIALS TO BE UTILIZED FOR FILLING OR BACKFILLING SHALL BE APPROVED BY A QUALIFIED GEOTECHNICAL ENGINEER AND BE FREE OF DEBRIS AND DELETERIOUS MATERIALS.
6. ALL MATERIALS SHALL CONFORM TO THEIR RESPECTIVE LATEST AMERICAN STANDARDS FOR TESTING AND MATERIALS SPECIFICATIONS (ASTM).
7. ALL UTILITIES KNOWN AND UNKNOWN WITHIN THE PROJECT LIMIT OF DISTURBANCE SHALL BE LOCATED BY THE CONTRACTOR PRIOR TO CONSTRUCTION.
8. NECESSARY PRECAUTIONS SHALL BE TAKEN BY THE CONTRACTOR TO PROTECT EXISTING SERVICES, MAINS AND SITE IMPROVEMENTS AND INFRASTRUCTURE. ANY DAMAGE TO EXISTING SERVICES OR MAINS SHALL BE REPAIRED IMMEDIATELY AT THE CONTRACTOR'S OWN EXPENSE AND THE RESPECTIVE UTILITY COMPANY SHALL BE NOTIFIED IMMEDIATELY.
9. THE CONTRACTOR SHALL NOTE THAT IN THE CASE OF A DISCREPANCY BETWEEN THE SCALED AND THE FIGURED DIMENSIONS SHOWN ON THESE PLANS, THE FIGURED DIMENSIONS SHALL APPLY.
10. IT SHALL BE DISTINCTLY UNDERSTOOD THAT FAILURE TO MENTION SPECIFICALLY ANY WORK THAT WOULD NORMALLY BE REQUIRED TO COMPLETE THE PROJECT, SHALL NOT RELIEVE THE CONTRACTORS RESPONSIBILITY TO PERFORM THAT WORK.
11. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE REPAIR AND REPLACEMENT OF FENCES, SIGNS, STRUCTURES, VEGETATION, IRRIGATION, LANDSCAPING COMPONENTS, AND ANY OTHER PROPERTY ITEMS THAT ARE REMOVED OR DAMAGED FOR THE PURPOSES OF THE PROJECT LOGISTICS AND/OR ACCIDENTS WHICH MAY OCCUR.
12. THE CONTRACTOR IS RESPONSIBLE FOR THE REMOVAL AND PROPER DISPOSAL OF ALL STOCK-PILED SOIL, TRASH, CONSTRUCTION MATERIALS AND DEBRIS AFTER THE COMPLETION OF CONSTRUCTION. ALL DISPOSAL SHALL BE PERFORMED IN ACCORDANCE WITH APPLICABLE MUNICIPAL, COUNTY, AND STATE REGULATIONS.
13. THE CONTRACTOR IS RESPONSIBLE TO RESTORE ALL GRASSY AREAS, DRIVEWAYS AND CURBING DISTURBED DURING CONSTRUCTION TO THEIR PRE-CONSTRUCTION CONDITION AFTER COMPLETION OF CONSTRUCTION AND PRIOR TO FINAL ACCEPTANCE OF THE PROJECT.

CONSTRUCTION SAFETY AND SECURITY:
1. ALL CONSTRUCTION SHALL ADHERE TO OSHA STANDARDS AND REGULATIONS.

DATE	DESCRIPTION

REVISIONS

STATE OF NEW JERSEY CERTIFICATE OF AUTHORIZATION NO.: 24GA27976800

MARY L. PAIST-GOLDMAN
Professional Engineer
NJ Lic. No. GE-45798

DATE

PRINCETON HYDRO, LLC
SCIENTISTS AND ENGINEERS
1108 OLD YORK ROAD, SUITE 1
P.O. BOX 720
RINGOES, NEW JERSEY 08551
PHONE. 908.237.5660
FAX. 908.237.5666
WWW.PRINCETONHYDRO.COM

PROJECT NAME/LOCATION:
FILTERRA INSTALLATION
319-GRANT (SFY-2010)
JEFFERSON TOWNSHIP
MORRIS COUNTY, NEW JERSEY

DRAWING NAME:
FILTERRA INSTALLATION AT ASHLEY COVE AND YACHT CLUB DR.
DESIGN PLAN

DATE:	11/05/2015
PROJECT NO.:	0003.048
SCALE:	1" = 10'
DRAWN BY:	AEM
CHECKED BY:	MPG

SHEET NO.
1 OF 1

APPENDIX B: Inspection and Maintenance Checklists

Inspection Checklist

Lake Hopatcong BMP Retrofits
Jefferson Township
Morris County, New Jersey

Date: _____ **Crew:** _____

Time: _____ **Equipment:** _____

Weather: _____

Ashley Cove - South (AC-S) - Filterra

	O.K.[1]	Routine[2]	Urgent[3]	Comments[4]
1. Filterra				
A. Trash and Debris				
B. Sediment				
C. Other				
2. Inlet Structure				
A. Condition of Structure				
B. Trash and Debris				
C. Sediment				
D. Other				
3. Outlet Structure				
A. Condition of Structure				
B. Trash and Debris				
C. Sediment				
D. Other				
4. Miscellaneous				
A. Effectiveness of Existing Maintenance Program				
B.				
C.				
D.				
E.				

1 The item checked is in good condition, and the maintenance program is adequate.
2 The item checked requires attention, but does not present an immediate threat to the facility function or other facility components.
3 The item checked requires immediate attention to keep the facility operational or to prevent damage to other facility components.
4 Possible explanation and details if columns 2 or 3 are checked.

Inspection Checklist

Lake Hopatcong BMP Retrofits
Jefferson Township
Morris County, New Jersey

Date: _____ **Crew:** _____

Time: _____ **Equipment:** _____

Weather: _____

Ashley Cove - North (AC-N) - Filterra

	O.K.[1]	Routine[2]	Urgent[3]	Comments[4]
1. Filterra				
A. Trash and Debris				
B. Sediment				
C. Other				
2. Inlet Structure				
A. Condition of Structure				
B. Trash and Debris				
C. Sediment				
D. Other				
3. Outlet Structure				
A. Condition of Structure				
B. Trash and Debris				
C. Sediment				
D. Other				
4. Miscellaneous				
A. Effectiveness of Existing Maintenance Program				
B.				
C.				
D.				
E.				

1 The item checked is in good condition, and the maintenance program is adequate.
2 The item checked requires attention, but does not present an immediate threat to the facility function or other facility components.
3 The item checked requires immediate attention to keep the facility operational or to prevent damage to other facility components.
4 Possible explanation and details if columns 2 or 3 are checked.

Inspection Checklist

Lake Hopatcong BMP Retrofits
Jefferson Township
Morris County, New Jersey

Date: _____ **Crew:** _____

Time: _____ **Equipment:** _____

Weather: _____

Yacht Club Drive - South (YCD-S) - Filterra

	O.K.[1]	Routine[2]	Urgent[3]	Comments[4]
1. Filterra				
A. Trash and Debris				
B. Sediment				
C. Other				
2. Inlet Structure				
A. Condition of Structure				
B. Trash and Debris				
C. Sediment				
D. Other				
3. Outlet Structure				
A. Condition of Structure				
B. Trash and Debris				
C. Sediment				
D. Other				
4. Miscellaneous				
A. Effectiveness of Existing Maintenance Program				
B.				
C.				
D.				
E.				

1 The item checked is in good condition, and the maintenance program is adequate.
2 The item checked requires attention, but does not present an immediate threat to the facility function or other facility components.
3 The item checked requires immediate attention to keep the facility operational or to prevent damage to other facility components.
4 Possible explanation and details if columns 2 or 3 are checked.

Inspection Checklist

Lake Hopatcong BMP Retrofits
Jefferson Township
Morris County, New Jersey

Date: _____ **Crew:** _____

Time: _____ **Equipment:** _____

Weather: _____

Yacht Club Drive - North (YCD-N) - Filterra

	O.K.[1]	Routine[2]	Urgent[3]	Comments[4]
1. Filterra				
A. Trash and Debris				
B. Sediment				
C. Other				
2. Inlet Structure				
A. Condition of Structure				
B. Trash and Debris				
C. Sediment				
D. Other				
3. Outlet Structure				
A. Condition of Structure				
B. Trash and Debris				
C. Sediment				
D. Other				
4. Miscellaneous				
A. Effectiveness of Existing Maintenance Program				
B.				
C.				
D.				
E.				

1 The item checked is in good condition, and the maintenance program is adequate.
2 The item checked requires attention, but does not present an immediate threat to the facility function or other facility components.
3 The item checked requires immediate attention to keep the facility operational or to prevent damage to other facility components.
4 Possible explanation and details if columns 2 or 3 are checked.

Preventative Maintenance Checklist

Lake Hopatcong BMP Retrofits
Jefferson Township
Morris County, New Jersey

Date: _____ **Crew:** _____

Time: _____ **Equipment:** _____

Weather: _____

Yacht Club Drive - South (YCD-S) - Filterra

	Items Required	Items Completed	Comments and Special Instructions
1. Removal of Trash and Debris			
A. Inside Device			
B. Inlets			
C. Outlets			
D. Other:			
2. Removal of Sediment and Disposal			
A. Inlets			
B. Inside Device			
C. Outlets			
D. Other:			
3. Other Preventative Maintenance			
A.			
B.			
C.			

Preventative Maintenance Checklist

Lake Hopatcong BMP Retrofits
Jefferson Township
Morris County, New Jersey

Date: _____ **Crew:** _____

Time: _____ **Equipment:** _____

Weather: _____

Yacht Club Drive - North (YCD-N) - Filterra

	Items Required	Items Completed	Comments and Special Instructions
1. Removal of Trash and Debris			
A. Inside Device			
B. Inlets			
C. Outlets			
D. Other:			
2. Removal of Sediment and Disposal			
A. Inlets			
B. Inside Device			
C. Outlets			
D. Other:			
3. Other Preventative Maintenance			
A.			
B.			
C.			

Preventative Maintenance Checklist

Lake Hopatcong BMP Retrofits
Jefferson Township
Morris County, New Jersey

Date: _____ **Crew:** _____

Time: _____ **Equipment:** _____

Weather: _____

Ashley Cove - North (AC-N) - Filterra

1. Removal of Trash and Debris

	Items Required	Items Completed	Comments and Special Instructions
A. Inside Device			
B. Inlets			
C. Outlets			
D. Other:			

2. Removal of Sediment and Disposal

A. Inlets			
B. Inside Device			
C. Outlets			
D. Other:			

3. Other Preventative Maintenance

A.			
B.			
C.			

Preventative Maintenance Checklist

Lake Hopatcong BMP Retrofits
Jefferson Township
Morris County, New Jersey

Date: _____ **Crew:** _____

Time: _____ **Equipment:** _____

Weather: _____

Ashley Cove - East (AC-E) - Filterra

	Items Required	Items Completed	Comments and Special Instructions
1. Removal of Trash and Debris			
A. Inside Device			
B. Inlets			
C. Outlets			
D. Other:			
2. Removal of Sediment and Disposal			
A. Inlets			
B. Inside Device			
C. Outlets			
D. Other:			
3. Other Preventative Maintenance			
A.			
B.			
C.			

Corrective Maintenance Checklist

Lake Hopatcong BMP Retrofits
Jefferson Township
Morris County, New Jersey

Date: _____ **Crew:** _____

Time: _____ **Equipment:** _____

Weather: _____

Ashley Cove - East (AC-E) - Filterra

	Items Required	Items Completed	Comments and Special Instructions
1. Structural Repair			
2. Dewatering			
3. Unclogged Outlet Pipe			
4. Other Corrective Maintenance			

Corrective Maintenance Checklist

Lake Hopatcong BMP Retrofits
Jefferson Township
Morris County, New Jersey

Date: _____ **Crew:** _____

Time: _____ **Equipment:** _____

Weather: _____

Ashley Cove - North (AC-N) - Filterra

	Items Required	Items Completed	Comments and Special Instructions
1. Structural Repair			
2. Dewatering			
3. Unclogged Outlet Pipe			
4. Other Corrective Maintenance			

Corrective Maintenance Checklist

Lake Hopatcong BMP Retrofits
Jefferson Township
Morris County, New Jersey

Date: _____ **Crew:** _____

Time: _____ **Equipment:** _____

Weather: _____

Yacht Club Drive - South (YCD-S) - Filterra

	Items Required	Items Completed	Comments and Special Instructions
1. Structural Repair			
2. Dewatering			
3. Unclogged Outlet Pipe			
4. Other Corrective Maintenance			

Corrective Maintenance Checklist

Lake Hopatcong BMP Retrofits
Jefferson Township
Morris County, New Jersey

Date: _____ **Crew:** _____

Time: _____ **Equipment:** _____

Weather: _____

Yacht Club Drive - North (YCD-N) - Filterra

	Items Required	Items Completed	Comments and Special Instructions
1. Structural Repair			
2. Dewatering			
3. Unclogged Outlet Pipe			
4. Other Corrective Maintenance			

APPENDIX C: Preventative and Corrective Maintenance Logs

Preventative Maintenance Log

Lake Hopatcong BMP Retrofits
Jefferson Township
Morris County, New Jersey

Date: _____ **Crew:** _____

Time: _____ **Equipment:** _____

Weather: _____

Ashley Cove - South (AC-E) - Filterra

(X) Completed

	Date											
1. Removal of Trash and Debris												
A. Inside Device												
B. Inlets												
C. Outlets												
D. Other:												
2. Removal of Sediment and Disposal												
A. Inlets												
B. Inside Device												
C. Outlets												
D. Other:												
3. Other Preventative Maintenance												
A.												
B.												
C.												

Preventative Maintenance Log

Lake Hopatcong BMP Retrofits
Jefferson Township
Morris County, New Jersey

Date: _____ **Crew:** _____

Time: _____ **Equipment:** _____

Weather: _____

Ashley Cove - North (AC-N) - Filterra

	Date											
	(X) Completed											
1. Removal of Trash and Debris												
A. Inside Device												
B. Inlets												
C. Outlets												
D. Other:												
2. Removal of Sediment and Disposal												
A. Inlets												
B. Inside Device												
C. Outlets												
D. Other:												
3. Other Preventative Maintenance												
A.												
B.												
C.												

Preventative Maintenance Log

Lake Hopatcong BMP Retrofits
Jefferson Township
Morris County, New Jersey

Date: _____ **Crew:** _____

Time: _____ **Equipment:** _____

Weather: _____

Yacht Club Drive - South (YCD-S) - Filterra

(X) Completed

	Date											
1. Removal of Trash and Debris												
A. Inside Device												
B. Inlets												
C. Outlets												
D. Other:												
2. Removal of Sediment and Disposal												
A. Inlets												
B. Inside Device												
C. Outlets												
D. Other:												
3. Other Preventative Maintenance												
A.												
B.												
C.												

Preventative Maintenance Log

Lake Hopatcong BMP Retrofits
Jefferson Township
Morris County, New Jersey

Date: _____ **Crew:** _____

Time: _____ **Equipment:** _____

Weather: _____

Yacht Club Drive - North (YCD-N) - Filterra

	Date											
	(X) Completed											
1. Removal of Trash and Debris												
A. Inside Device												
B. Inlets												
C. Outlets												
D. Other:												
2. Removal of Sediment and Disposal												
A. Inlets												
B. Inside Device												
C. Outlets												
D. Other:												
3. Other Preventative Maintenance												
A.												
B.												
C.												

Corrective Maintenance Log

Lake Hopatcong BMP Retrofits
Jefferson Township
Morris County, New Jersey

Date: _____ **Crew:** _____

Time: _____ **Equipment:** _____

Weather: _____

Yacht Club Drive - North (YCD-N) - Filterra

	(X) Completed	Date										
1. Structural Repair												
2. Dewatering												
3. Unclogged Outlet Pipe												
4. Other Corrective Maintenance												

Corrective Maintenance Log

Lake Hopatcong BMP Retrofits
Jefferson Township
Morris County, New Jersey

Date: _____ **Crew:** _____

Time: _____ **Equipment:** _____

Weather: _____

Ashley Cove - East (AC-E) - Filterra

	(X) Completed	Date										
1. Structural Repair												
2. Dewatering												
3. Unclogged Outlet Pipe												
4. Other Corrective Maintenance												

Corrective Maintenance Log

Lake Hopatcong BMP Retrofits
Jefferson Township
Morris County, New Jersey

Date: _____ **Crew:** _____

Time: _____ **Equipment:** _____

Weather: _____

Ashley Cove - North (AC-N) - Filterra

	Date											
	(X) Completed											
1. Structural Repair												
2. Dewatering												
3. Unclogged Outlet Pipe												
4. Other Corrective Maintenance												

APPENDIX D: Plant Lists

FILTERRA UNIT

BOTANICAL NAME:	**SPECIES NAME:**
MORELLA PENSYLVANICA	NORTHERN BAYBERRY

APPENDIX E: Activation Letter

Contech Engineered Solutions LLC
9025 Centre Pointe Drive, Suite 400
West Chester, OH 45069
Phone: (513) 645-7000
www.ContechES.com

Contech Activation Letter - Filterra

Lake Hopatcong Commision
Attn: Amy McNamara
117 Lakeside Blvd
Landing, NJ 07850

September 1, 2016

Project Name: 319 - Grant (SFY-2010)
Project Jurisdiction: Jefferson Township, NJ

Mrs. McNamara,

This 2 page letter should be used as official notification to your local jurisdiction with regard to the activation of your Filterra Systems.

Please be advised that after installation (not by Contech), the Filterra stormwater treatment units were activated on 08/31/2016. Activation refers to bringing the unit into operation by removing the protective boards as well as installing the plant and mulch layer.

The 1 year maintenance agreement included with the purchase of this product is currently in effect and will expire on 08/31/2017.

The second page of this letter contains a list of each Filterra unit that is covered by this activation letter.

Please feel free to contact me if any additional information is needed.

Sincerely,

Don Personett
Activation and Maintenance Coordinator
Contech Engineered Solutions, LLC

Contech Engineered Solutions LLC
9025 Centre Pointe Drive, Suite 400
West Chester, OH 45069
Phone: (513) 645-7000
www.ContechES.com

Contech Activation Letter - Filterra

Contech hereby confirms that the following units were supplied to the subject project as per the approved plans:

Unit # YCD-N FT 13x7
Unit # YCD-S FT 13x7
Unit # AC-E FT 13x7
Unit # AC-N FT 8x6

APPENDIX F: Filterra Maintenance

CONTECH® ENGINEERED SOLUTIONS

filterra® Bioretention Systems
A Growing Idea in Stormwater Filtration

Filterra® Maintenance Steps

1. Inspection of Filterra and surrounding area

2. Removal of tree grate and erosion control stones

3. Removal of debris, trash and mulch

4. Mulch replacement

5. Clean area around Filterra

6. Complete paperwork and record plant height and width

Contech has created a network of Certified Maintenance Providers (CCMP's) to provide maintenance on Filterra systems. To find a CCMP in your area please visit www.conteches.com/maintenance