PHILMONT (SUMMIT) RESERVOIR
WATER QUALITY IMPROVEMENT

Prepared by

RENEWAGE LLC

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Stormwater Management and Water Quality Improvement for Summit Reservoir

October 12, 2015

Introduction

The Village of Philmont is concerned with water quality deterioration in Summit Reservoir, a vital natural community landmark and critical ecological, economic and recreational resource. The Village seeks innovative green engineering solutions utilizing an economical and ecological BMP solution to halt further deterioration and begin the process of revitalizing the lake. The community has been awarded Brownfield Opportunity Area Program first-phase grant, provided by the New York State Department of Environmental Conservation. The proposed plan outlined herein will be integrated into the overall BOA plan to assist the community restore environmental quality.

Background

The Summit Reservoir is a 48-acre man-made reservoir located in the Village of Philmont and the Town of Claverack. The Reservoir was originally built to provide a reliable supply of water power to the numerous mills, but it was also utilized for swimming, boating, and fishing for generations of local residents and visitors and is still used for recreation today, including a small beach and boat launch.

Current State

The Reservoir has been continuously filling in with siltation and sedimentation, as the Agawamuck Creek picks up sediment from upstream bodies of water. Sedimentation has caused dramatic changes to the Reservoir and gradually filled in several areas. As a result weeds and vegetation have overtaken the area. This change poses a significant risk to residents, economic vitality and recreation. And as the Reservoir fills, the dam at its base becomes more vulnerable to flooding and becomes a potential hazard to residents of the Village and downstream areas.

Below the Philmont Reservoir, the Agawamuck continues downstream to High Falls, a waterfall currently managed by the Columbia Land Conservancy. This area attracts thousands of visitors each year, and is a tremendous asset to the area for hiking and outdoor recreation.

Future State

The Village Board of Trustees, local businesses, residents and neighbors are committed to the Summit Reservoir and the waterfront area. The Reservoir is a critical component to every area of redevelopment for the Village of Philmont and surrounding areas. The desires of most residents and visitors are for walking, bicycle trails, swimming, boating, fishing, and other recreational activities.

Plans for future residential and commercial development on and near the reservoir can be integrated into the proposed BOA and stormwater management plan ensuring growth while ensuring future water quality improvement.

Project Description

The critical first step in the redevelopment and revitalization of the Philmont Reservoir is mitigating the siltation and sedimentation that has taken place for decades as high water carries dirt and gravel into the Reservoir. Modern stormwater and wetland management strategies open up the possibility to manage and capture a large percentage of the sediment from runoff utilizing low-impact and natural techniques that meet and exceed Federal and State standards before it enters the Summit Reservoir.

Further loss of recreational assets at the Summit Reservoir would have a devastating impact on the Village of Philmont and surrounding areas. By addressing the ongoing limitations of the reservoir, we can plan for long-term sustainable growth, preserve open space, reduce the threats of dramatic storms and flooding, and improve the economic vitality and local ecosystem and habitat.

The Village of Philmont is seeking funds to design a stormwater system that will improve the water and environmental condition of the channels leading into the Philmont Reservoir. Through sound stormwater management principles, a redesign of the water flow, and improving filtration of water that enters the reservoir, we can dramatically improve the ecosystem of the reservoir and maintain a long-term and sustainable plan of sustainability.

View of the Reservoir circa 1908

View of Reservoir today

ANNALYSIS OF TREATMENT OPTIONS

Watershed and Sub-watershed Delineation and Runoff Modeling

The first step in the development of a stormwater management plan is an identification and analysis of the watershed and sub-watershed drainage areas. The preliminary drainage boundaries of each significant sub-watershed draining to Summit Resevoir (associated with the 8 points of stormwater discharge) will be delineated using elevation data from 5-foot, LiDAR-derived contours obtained from County Department of Planning if available or from other sources. Follow-up field visits will be made to verify drainage boundaries prior to runoff and pollutant loading analysis.

The sub-watersheds, and their associated land use/land cover, soils, and topography characteristics, will then be analyzed to estimate volumes and flow rates of the runoff draining into the areas available for treatment. The HydroCAD® rainfall-runoff modeling platform, based upon the Natural Resources Conservation Service (NRCS) TR-20 model and methods (SCS, 1983), will be utilized for the calculation of peak runoff rates and routing to the discharge points for 24-hour storms. The water quality volume (WQv), 1, 10, 25, and 100-year storm data will be obtained from the New York State Stormwater Management Design Manual (NYDEC, 2003) or interpolated from US Weather Bureau Technical Paper No. 40 (Hershfield, 1961) to provide a wide variety of rainfall depths for Warren County. The WQv storm will be analyzed using an alternative approach recommended for storm depths less than 2 inches. This approach recognizes the limitation of the TR20 model in accurately predicting runoff volumes for small storm events (Pitt, 1994).

Pollutant Loading Analysis

The Simple Method, like the name suggests, is fast and effective planning tool which uses several land use inputs and precipitation data to make estimates of annual pollutant and solute loads in urban and urbanizing basins (NYDEC, 2001). Using the sub-watershed boundaries and characteristics from Step 1, the Simple Method will be utilized to estimate annual pollutant loads in each sub-watershed. Detailed land cover/land use mapping will be created in GIS for the entire watershed by “heads up” digitizing with 2009 0.5ft, 4-Band color imagery of Warren County. Impervious surfaces will be estimated based on land cover types and used to calculate the percentage of impervious cover within each sub-watershed. The percent impervious cover in each sub-watershed will be used in Equation 1.0 (see below) to determine the runoff coefficient (Rv). The calculated runoff coefficient will then be used in Equation 2.0 to determine

the annual runoff volumes and loads from the site. Annual precipitation data will be derived from daily statistics as may be available from The County or other sources. Once annual runoff is calculated for each sub-watershed, the Simple Method calculation can be done (Equation 3.0). Final results, which will include tabular and geospatial display of annual pollutant loads by sub-watershed, will be used to prioritize discharge points for treatment (see Step 4 description below).

Prioritization of Treatment Locations

It is expected that regulatory permits will be required for the stormwater improvements developed for this project. These will likely include local, state and federal permits. Local permits are typically limited to building permits. State permits include stormwater discharge and erosion control. Additional state permits may be required depending on the conceptual designs completed in task v. Federal permits may require a review from the Army Corps of Engineers, and the Environmental Protection Agency.

Prioritization of Treatment Locations

During our first site visit to verify the sub-watershed drainage areas, we will review the potential treatment areas at each of the eight (8) stormwater discharge points into the lake. Then, using the results of the runoff modeling and pollutant loading analysis, we will analyze the area available for treatment practices at or near each discharge point against the runoff volumes and pollutant loads. Each discharge point and potential treatment area will be ranked for prioritization based on the relative potential for mitigating the effects stormwater runoff on the lake, the type of stormwater practice appropriate for the site, and the potential for mitigating runoff in the upslope areas prior to reaching the discharge point. For those sub-watersheds that have greater opportunity to mitigate runoff at the source (e.g., disconnection of rooftop runoff, construction of small-scale rain gardens, etc.), recommendations will be made in conjunction with the prioritization scheme to provide treatment in upslope areas.

Conceptual Stormwater Design

A conceptual stormwater design will be developed based on the results of the data analysis conducted in the previous tasks. A site plan will be developed that identifies the proposed locations of stormwater best management practices (BMP). Standard details will be provided that illustrate both the function and resulting aesthetic of each BMP. Low impact design (LID) techniques that incorporate the use of plants, and focus on converting landscapes into functioning elements in the environment will be a focus of the BMP's proposed for this project. Examples of LID stormwater technologies that will be considered include constructed wetlands, bioretention systems and ponds.

Outline Community Responsibilities

The success of this project lies in its integration of The Brownfield Opportunity Area Program Grant for the Village. The water quality improvement plan will meet the program's goals of restoring environmental quality. Renewage will coordinate with the other consultants on the project.

The success of the project will require the support and involvement of the surrounding community that these improvements will serve. An engineer's cost opinion will be provided for the conceptual stormwater design that will be used for planning purposes by the community to determine how to proceed with the project. It is anticipated that the engineering report developed for this project will be used to apply for grant funding and permitting approvals.

RENEWAGE
STATEMENT OF QUALIFICATIONS

Renewage is an ecological water treatment consultant, offering a wide variety of innovative “bio-mimicry” wastewater treatment solutions and stormwater practices that provide water quality improvement and hazard mitigation.

Renewage services de-centralized residential, commercial, industrial and agricultural businesses and communities. Renewage LLC was founded in 2009 and has offices in Bridgehampton New York, Hoboken New Jersey and Renewage Canada Ltd in Toronto.

Renewage and it's team partners have designed, built, installed and manage numerous projects in many areas of the United States, Canada and around the world.

Renewage is a network of innovative, leading engineers, environmental scientists, planners, academics, architects, and builders whose objective is to provide low impact designed sustainable, economical and ecological storemwater and wastewater treatments solutions.

Renewage uses Best Management Practices that have low operational costs and unlimited life cycles. These technologies support new “smart growth” development, and "green" remediation of older wastewater treatment infrastructure.

Renewage technologies provide a positive cost / benefit and return to end users.

Renewage provides unique bio-regenerative wetland mimicry technologies treat large and small flow domestic and industrial waste-waters.

Renewage is the exclusive distributor of Busse Green Technology in New York and elsewhere
Renewage uses Best Management Practices that have low operational costs and unlimited life cycles.

Steven Gruber (Project Team Leader)

Mr. Gruber is a leading ecological wastewater and stormwater treatment consultant in Canada and The US. Mr Gruber has over 25 years background in green building and land development, with a unique expertise in large-scale projects planning and management that utilize sustainable design and bio-mimicry technologies. His projects are residential industrial and commercial. Recognizing the importance and value of "green infrastructure" water and wastewater treatment in de-centralized communities, he has built a team of experts in the field , including leading engineers to architects, environmental scientists, . Mr. Gruber has developed practical and innovative ways of bringing sustainable technology and ethical enterprise together. Today Mr Gruber is one of the foremost authorities on its application for both residential and commercial uses.

David H. Whitney – Civil and Environmental Engineer

David Whitney – Lead Engineer
The lead engineer and founder of EcoSolutions, a world leader in environmental and ecological design, and the principal engineer of Renewage. Mr. Whitney has installed many Engineered Wetlands in the North Eastern US for private and public uses, and abroad for the State Dept. at US embassies in Africa and elsewhere. An engineering / consulting / designer specializing in the application of ecological design principles to wastewater, stormwater and site-planning projects, Mr. Whitney designs, builds, operates and maintains all its innovative projects. Mr. Whitney has a Master's in Environmental Engineering at the University of Vermont, where he helped develop an interdisciplinary wetland research collaborative. His vision is integrated design that combines function and aesthetics by matching infrastructure to the landscape.David Whitney provides integrated solutions for low impact development, waste and storm water treatment.

Mark O. Liner, PE – Senior Engineer

Mark O. Liner, P.E. is a senior engineer at Renewage LLC. Over his 20-year career in wastewater treatment, he has worked as a regulator at the U.S. Environmental Protection Agency in Washington, D.C., as a process and equipment supplier for wastewater treatment systems, and as a design-build project manager for a large sewage plant in Venezuela. He now specializes in the design and construction of natural treatment systems for industrial facilities. Mark. Liner is a wastewater engineer specializing in the design of treatment systems for industrial facilities. He has designed some of the largest natural treatment systems in the world including a 350,000 m3/d aerated lagoon for an oil production facility in Colombia, a 4,500 kgBOD/d wetland treatment system at Buffalo Airport in NY, and a 7,600 m3/d cyanide treatment system for a Gold Mine in Suriname. He has worked as project manager for large design/build plants as well as lead designer for large facilities employing "first in the ground" innovative technologies. With a broad international experience and deep expertise in various wastewater technologies, Mr. Liner provides senior leadership for the engineering team..

Evan Fitzgerald, M.S. – Environmental/Watershed Scientist
Evan Fitzgerald is an environmental scientist that specializes in applied watershed science and ecology. Evan Fitzgerald is dedicated to providing design services that protect water quality through the use of innovative low impact development (LID) principles. Evan has extensive experience using rainfall-runoff modeling techniques (NRCS TR55 and TR20 methods) for the design of stormwater treatment practices (STP) following VTANR regulations. Evan recently developed a tool using Stella modeling software that incorporates the TR55 platform into a simulation model, which evaluates the cost-effectiveness of LID designs. Evan employs various runoff modeling techniques, and Stella modeling tools, along with other GIS applications, in the evaluation of alternative STP designs for project sites.

David J. Maciolek, P.E. – Senior Engineer
Mr. Maciolek has over 20 years of full-time engineering experience primarily related to water and wastewater management, including treatment systems for municipal, commercial/ industrial and small scale wastewater and stormwater flows. He is recognized as a co-developer and the lead engineer of the Living Machine® Systems, advanced wetland systems for wastewater and stormwater treatment. Mr. Maciolek has overseen or had significant involvement in the design, construction and commissioning of over twenty–three systems for wastewater and stormwater treatment since 1998.
Mr. Maciolek is a registered professional engineer in twelve states.

renewage Sustainable Water Treatment Solutions

Ecological Storm-water Management

Water Quality Improvement and Hazard Mitigation
Gravel Filter Wetland Treatment System

Village of Wappingers Falls NY

October 2014

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ECOLOGICAL STORMWATER WETLAND TREATMENT AND MANAGEMENT
CASE STUDY: A NEW APPROACH IN WAPPINGERS FALLS NY

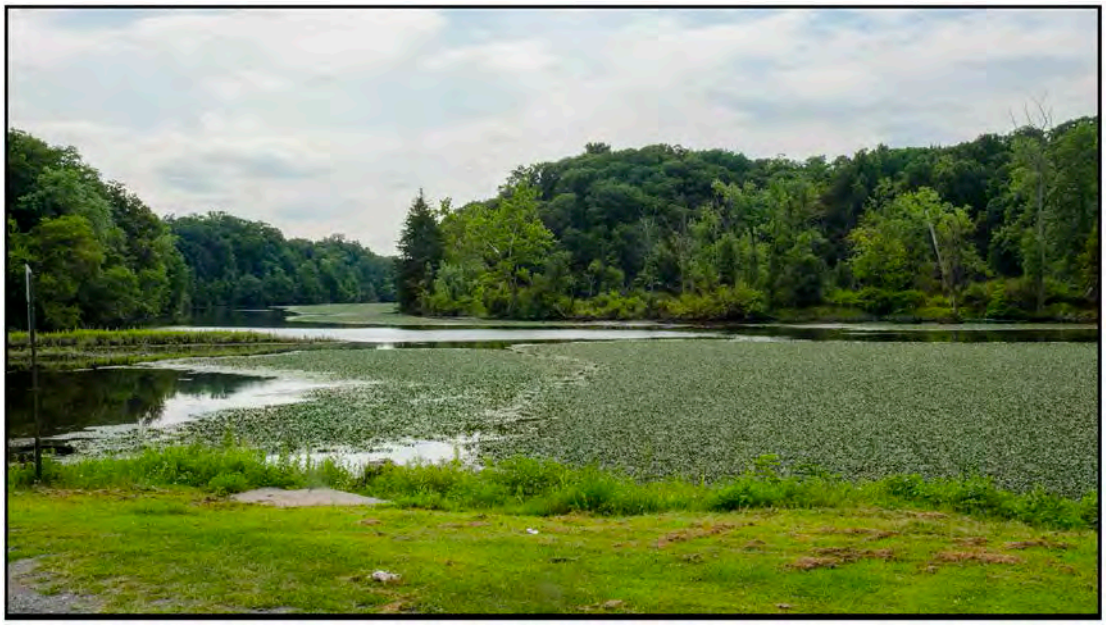
The Village of Wappingers Falls and other communities in the Wappinger Creek Watershed, (the largest in Dutchess County NY), have been concerned for many years with the deterioration of water quality throughout the watershed. Wappinger Lake is a man-made reservoir formed on Wappinger Creek. It is a community landmark that serves as a significant source of groundwater recharge for the Village's drinking water wells, recreation and wildlife habitat. The water depth and quality have been decreasing steadily in recent years, primarily due to sediment deposition and associated nutrient loading.

Some of the key problems include:

- **Flooding –** minimal flood mitigation resilience practices
- **Rising Cost of Disaster Prevention and Clean Up –** ineffective solutions, old-practices and short-term fixes
- **Declining Groundwater Quality** - Reduced quality and increased contamination of hazardous substances
- **Deterioration of Drinking Water –** Increased remediation costs, raised risk of poor health and well-being of residents
- **Destruction of the Eco-system** - Lost recreational assets and damaged aquatic community
- **Stagnant Economic Growth** - declining property values, reduced municipal tax base

Wappinger Lake

The Village of Wappingers Falls contributes only a small percentage of sediment into the watershed, however proportionally it contributes a significantly higher concentration of sediment per square mile.



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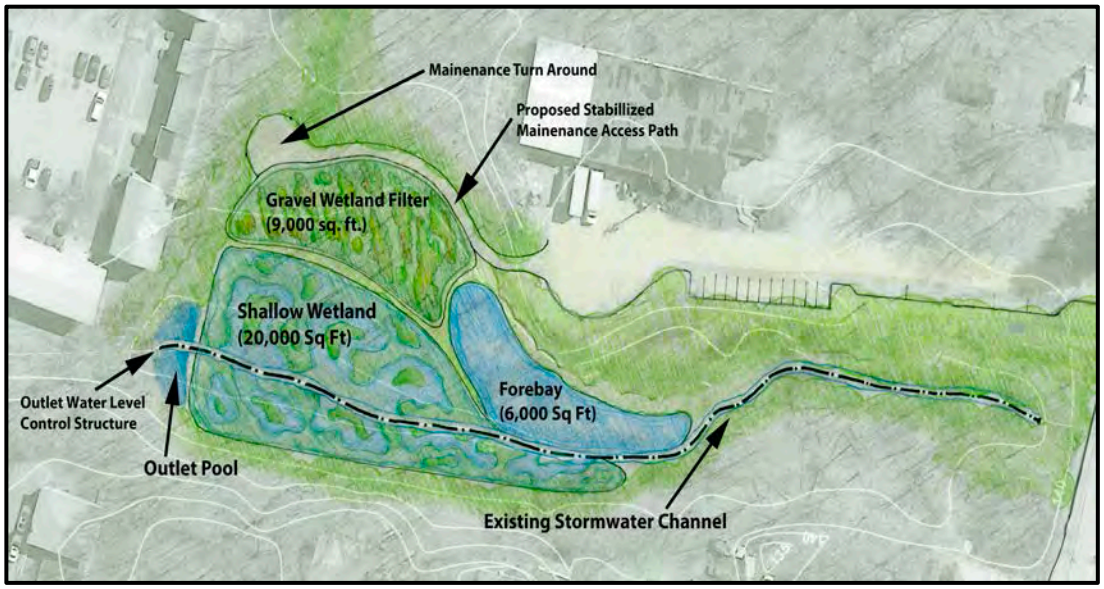
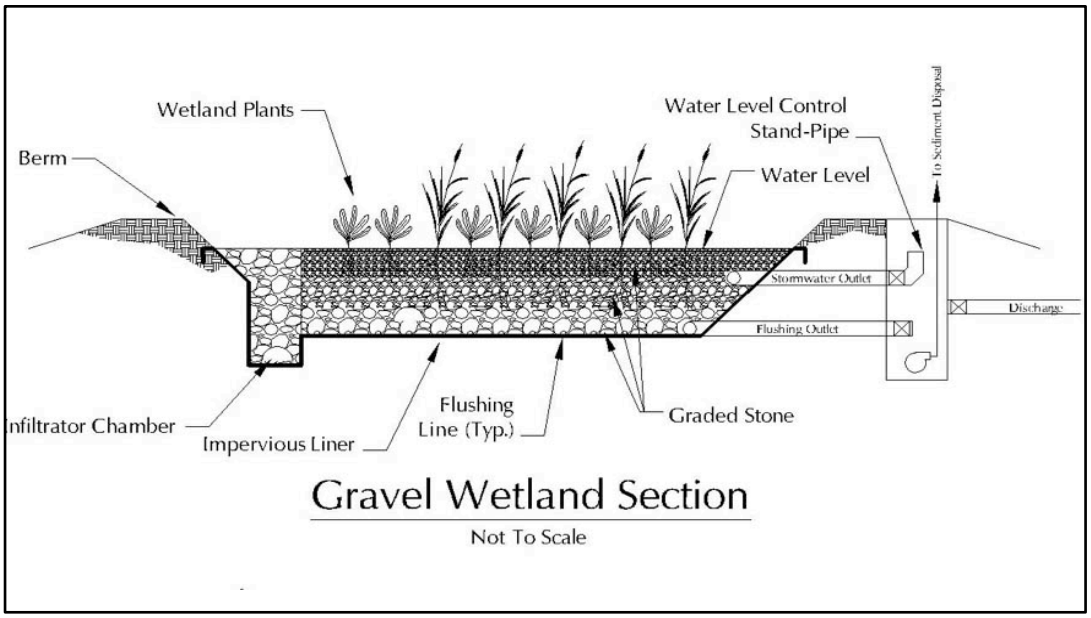
BEST MANAGEMENT PRACTICE PLAN

Building on two prior studies, a preliminary plan for the entire 220 square mile watershed was developed by Renewage LLC* in 2010, that proposed utilizing gravel filter wetland treatment systems at critical outfall points, to both manage and treat stormwater run-off before it reached critical loading points in the watershed. The proposed network of integrated Green Infrastructure (GI) practices would provide flood resiliency using retention ponds, but would also provide significant water quality improvement using gravel filter wetlands to trap sediment (and attached phosphorus, nitrogen and other unwanted nutrients) before it could re-enter the creek and adversely impact the aquifers, drinking water resources and surrounding eco-system.

In 2011 The Village was awarded a Green Innovation Grant from NYS Environment Facilities Corp, to design and build a gravel-filter wetland storm water treatment at an infill site in the Village to be a demonstration of this approach, and as a first phase in the remediation of the lake and it's watershed.



Planning rendering of Treatment system showing retention forebay, wetland treatment area and outlet



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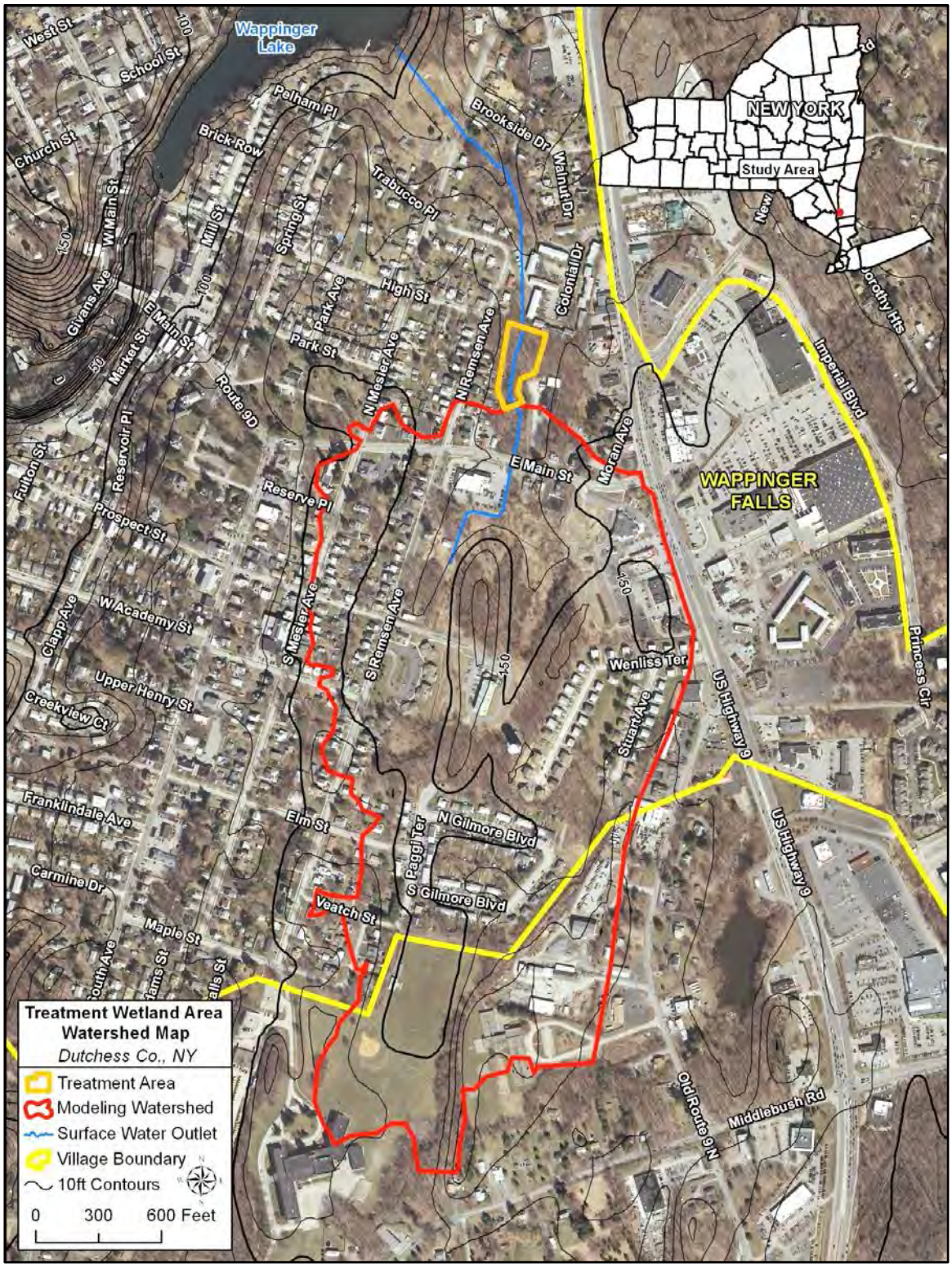
An infill site on a drainage swale taking storm-water run-off into the lake taking was located, and the Village was able to arrange a permanent easement for construction of the treatment system.



Drainage area to treatment system at an infill site in The Village of Wappingers Falls NY

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VILLAGE OF WAPPINGERS FALLS STORMWATER TREATMENT SYSTEM

The Wappingers Falls Storm-water Wetland Treatment system is designed to manage and capture 85-95% of the sediment from run-off from the drainage area into the lake. The system was approved by all regulatory agencies and constructed in 2013. It exceeds the goals and guidelines of current NY storm-water regulations and is the first of its type and scale built in NY State. It will serve as an example of how this low impact design technique is an effective urban retrofit strategy, supports "smart growth" principals and can be replicated throughout The Wappinger Creek watershed and elsewhere in other challenged watersheds and communities experiencing similar issues.

The storm-water system is located on a 2 acre undeveloped, and privately owned site in The Village. The site was selected because it is able to capture the greatest outfall into the lake at a major culvert where frequent stormwater flooding has damaged neighboring residences. The system will addresses water quality in Wappinger Lake, as well as stormwater storage capacity associated with storm events to prevent flooding.

The system is comprised of four treatment stages that include a sediment forebay, gravel wetland filter, shallow wetland system and an outlet pool. Sub-surface flow gravel wetlands trap and treat 85-95% of sediment and suspended solids. Accumulated sediment is safely flushed, enhancing treatment and extending the life of the system indefinitely.

Sediment within the gravel wetland is removed using a unique flushing system. The flushing system pumps air into the base of the wetland, using a small compressor. While the sediment is agitated within the wetland, it is pumped out, into a silt bag. The silt bag captures the suspended sediment, and the filtered water drains back into the storm-water treatment system, replacing what had been previously pumped out. This process is conducted twice annually.

Operation and Maintenance costs are minimal and the system can be managed locally and will become an integral, aesthetic and educational part of the community. The system should be routinely inspected for invasive species, signs of erosion, or washout. Storm water run-off can be treated to a higher level than alternative approaches and exceed MS4 standards.

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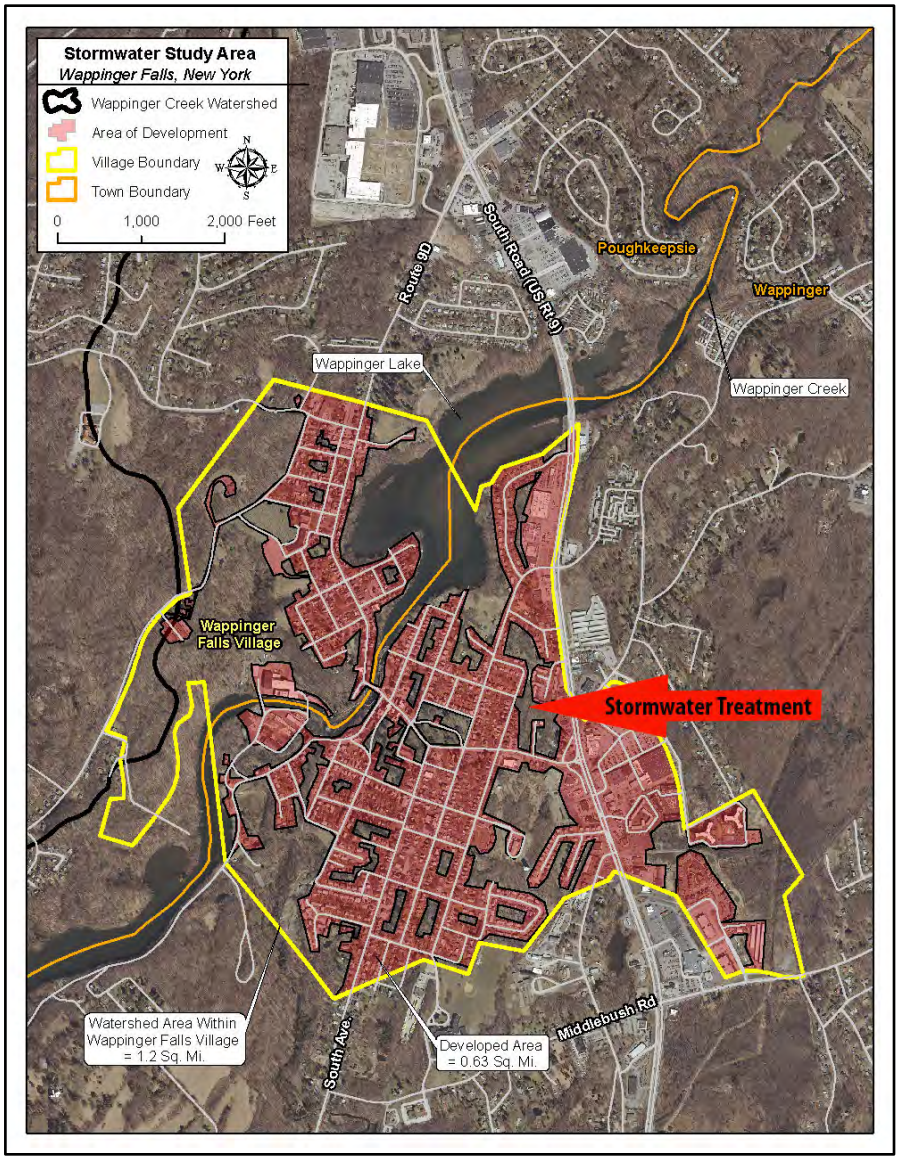

WAPPINGERS FALLS TREATMENT SYSTEM DATA

Overall Wappingers Creek Watershed: 220 Sq Miles
Sub Watershed Area being treated – 1.2 Square miles (Area within Village of WF)
Drainage Area= 240 acres (overall drainage area into treatment facility)
Wetland Treatment Area= 9,000 sq-ft,
Total storm-water treatment system is 35,000 sq-ft (0.8 acres), including the wetland
Infill site encompassing treatment system = 2 acres
Water Quality Volume Treated (draining to location) = 182,000 cu-ft
Storm Attenuation Treatment: up to a 25-YR/24-HR (existing discharge culverts)
Note: (A planned next phase 60 inch diameter ADS N-12 HDPE outlet culvert will handle peak discharge from a 100 year storm event)
Cost of Project: $ 750,000 (approx.)
Funding: NYS EFC Green Innovation Grant $635,000
(NYS EFC GIGP 362 CWSRF# 5325-02-00)
Village Match: 10%
Estimated Annual Operating Cost: $6-8,000
Estimated Return on Investment 6-8 years

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PHOTO FLOW OF SYSTEM CONSTRUCTION AND OPERATION

Before - Pre Construction Drainage swale

Construction gravel wetland

Construction of Forebay

System complete – after heavy rain

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Sedimentary forebay (retention pond) in foreground, with gravel wetland filter above and outlet pool on right

Wide view of forebay and inlet channel, Vegetation filling in June 2014

Lead Engineer David Whitney uses “sludge-judge” to demonstrate clean water coming from clean out pipes

Water quality before and after treatment

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'Community' shines in Wappinger, E. Fishkill

Village shows off its new weapon in drainage war

By Ray Fashona

WAPPINGERS FALLS – We at the Southern Dutchess News are often asked: What's all that construction going on in back of your building?

Our answer until now was: We're not really sure, but it has something to do with drainage.

A presentation last week to communities in the Wappinger Creek watershed made the picture much clearer. Organized by Mayor Matthew Alexander and Village Clerk John Karge, who heads the village's storm drainage efforts, the talk and field trip demonstrated how the construction project is one step in trying to clean up Wappinger Lake.

After the talk at village hall, participants traveled to the excavation site to see the work in progress.

Funded by a $638,000 Green Innovation Grant from the state Environmental Facilities Corp., the huge pit being dug behind the Southern Dutchess News building is actually the first wetland storm water treatment facility of its kind in the state. The object is to keep storm drainage – and the harmful sediment, phosphorus and nitrogen it brings with it – from flowing into the lake.

Steve Gruber of Renewage, an environmental company involved with sustainable water treatment solutions, explained that the object of the facility is to manage storm water before it hits sensitive bodies of water, such as Wappinger Lake, and to prevent flooding by storm water runoff.

"The idea is to capture and manage storm water," he said.

A previous study had pinpointed the area now being excavated as a key pathway for storm runoff. What the storm water wetland treatment system does is allow for large volumes of water to be channeled into what amounts to a huge holding area, which is coated with an impervious liner and then covered with gravel. The gravel acts like a filter, taking out pollutants and sediment. On top of the gravel are plants intended to absorb even more water.

The filtered water is then allowed to drain slowly into the lake, minus the unwanted chemicals and sediment.

Gruber said the system should be cleaned out twice a year to remove the sediment that has been collected.

He added that the state Department of Environmental Conservation supports the approach taken by Renewage and the village.

Alexander said it was not after he took office in 2006 that he and other village officials made cleaning up Wappinger Lake one of their top priorities. Between the sediment buildup and the chemicals in the water, he said, people in the village were "losing a recreational asset, a source of clean water and a cultural asset."

Workers put the finishing touches on the drainage project in Wappingers Falls.

-Photos by Ray Fashona

Mayor Matt Alexander explains aspects of the drainage project before a trip to the site.

Although encouraged by the innovative approach to storm water control, the mayor is realistic about the amount of work ahead to really clean up Wappinger Lake.

A broad assessment must done of the entire Wappinger Creek watershed, including how communities upstream from the lake are dealing with their storm water runoff. The majority of the sediment and pollution in the lake, he said, comes from the creek itself, not from runoff produced in the village.

At some point, he added, once the runoff problem is addressed throughout the watershed, the lake will have to be dredged to remove the excess sediment and pollution. That will be an expensive proposition, he added.

Gruber noted that with the recent spate of heavy rainstorms in the Northeast, and the consequent flooding, it would behoove all communities to begin looking at solutions to drainage and runoff.

"The Hudson Valley is growing at a rapid rate," Gruber said, "and as it grows, more and more open land is paved over. It gets to the point where there is nowhere for the rainwater to be absorbed."

NEXT STEPS
Wappingers Creek Watershed

A study has been proposed that will continue the work begun with the stormwater wetland project in the The Village of Wappingers Falls

Goals and Description

1. To develop Best Management Practice / Green Infrastructure projects that will provide enhanced stormwater management, hazard mitigation, flood resiliency and water quality improvement to the affected communities in the watershed
2. Provide planning for GI renewal and water quality improvement throughout Wappinger Creek Watershed impacting 13 other communities and the greater Hudson River Estuary
3. Develop preliminary engineering plans for specific "low impact design" practices to provide water quality improvement and flooding resilience
4. Further water quality improvement and remediation of Wappinger Lake
5. Develop specific practices that will provide a positive cash flow ROI to the stakeholders within 6-10 years.

A proposal has been developed that calls for the installation of strategically placed ecological stormwater filtration and retention systems that will provide both flood resiliencies, and water quality improvement, (such as the gravel filter storm-water wetland system built in The Village of Wappingers Falls 2013), capturing and treating stormwater runoff, returning clean water to the ecosystem at minimal cost. These approaches have widespread state and federal support. These governances call for policy makers, regulatory and funding agencies to implement such technologies. NYSDEC, EPA and many others recognize these practices as being essential municipality developments the support economic and smart growth.

The study will gather available data from Dutchess County agencies to:

1. Examine ownership of properties alongside Wappinger Creek in the target area of Town of Wappinger, Town of Poughkeepsie and the Village of Wappinger Falls, from Dutchess County Airport to the Village of Wappingers Falls
2. Assess existing stormwater management practices within the target area
3. Evaluate point and non-point stormwater runoff throughout the three communities that contribute to the deterioration of water quality
4. Determine whether these practices engage sanitary sewers and septics, their proximity to public and private aquifers and drinking water sources
5. Identify key locations that adversely impact communities and vital (developed and natural) resources, where a stormwater management / treatment practice could provide or enhance hazard mitigation protection and provide significant water quality improvement

During the study, local officials, including the DPW, will be engaged in order to address their concerns and suggestions relating to stormwater management and the deterioration of drinking water quality in their community.

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SUMMARY

The communities: The Village of Wappingers Falls, The Town of Wappinger and the Town of Poughkeepsie seek funding to conduct a study that will deliver an actionable plan for water quality improvement and hazard mitigation projects that are Low Impact Design and utilize Best Management Practices to:

- Identify significant point and non-point stormwater runoff at critical locations throughout the targeted area of the watershed and sub-watershed that contribute to the deterioration of water quality in the lake and the lower part of the creek through sedimentation
- Identify key locations that adversely impact communities and vital (developed and natural) resources, where a stormwater management / treatment practice could provide or enhance hazard mitigation protection and provide significant water quality improvement.
- Propose specific stormwater projects that provide cost effective benefit to the affected communities, including: Opportunity for new “smart growth” development
- Increase revenues
- Sustainable and easily operated hazard mitigation and water quality infrastructure

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Project Personnel

Renewage LLC	Steven Gruber (Project Coordinator) Fred Lambiase (Renewage LLC David Whitney P.E. (Lead Engineer) Eco Solutions Evan Fitzgerald MS (Environmental Watershed Scientist David Maciolek P.E. (Aqua Nova Engineering)
Village of Wappingers Falls	Mayor Matt Alexander Jay Paggi P.E. (Village Engineer) John Karge (Village Clerk)
Construction	SunUp Construction

Thanks to **New York State Environmental Facilities Corpora**tion for generous support and Green Infrastructure Grant funding

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renewage Sustainable Water Treatment Solutions

STORMWATER MANAGEMENT
Gravel Filter Wetland Treatment System
Cost / Benefit

Village of Wappingers Falls NY Treatment System Data

Overall Infill Site:	2 Acres
Total storm-water treatment system:	39,600 Square-Feet (0.9 acres)
Water Quality Volume Treated:	182,000 Cubic-Feet (draining to location)
Storm Attenuation Treatment:	Up to a 25-YR/24-HR (existing discharge culverts) *
Overall Wappingers Creek Watershed:	220 Square Miles
Drainage Area:	240 acres (overall drainage area into treatment facility)
Sub Watershed Area being treated:	1.2 Square Miles (Area within Village of WF)
Sediment Removal:	85-95%

Costs of Flooding to Communities without Adequate Stormwater / Hazard Mitigation Practices

Flooding Costs / Consequences	Benefits of Stormwater Wetland Management
Dept. Public Works costs – road repairs, municipal clean up	Adequate stormwater system contains and controls run-off
Emergency Services	Greatly reduced emergency costs
Damage to municipal infrastructure (treatment facilities)	No mixing of I&I, repairs to facilities, down time
Insurance	Lower premiums, limited match payments
Damage to private properties / businesses	Property values higher – more growth, more tax revenue
Relocation of Residents	Limited liabilities and greater community stability
Legal, Engineering and other professional fees	Municipality able to operate within budget
Loss of tax revenues	Ability to pay off stormwater capital costs quickly

Stormwater Wetland Practices are designed to improve water quality and protect drinking water resources

Water Quality Deterioration from Stormwater Run-off	Benefits of Wetland Treatment
Sedimentation fills and pollutes vital / precious water bodies	Stormwater wetlands remove 85-95 of sediment
Stormwater carries PH and other pollutants into lakes, rivers creating algae, odors, destroying fish and other eco habitats	Wetland treatment creates a natural eco-system – revitalizing water quality in watersheds
Recreational assets destroyed –decline in property values	Community growth and health benefit
Aquifers depleted, Drinking water imperiled leading to Health risks; Costs of building water treatment facilities	Capital and O&M costs of wetland filter, with unlimited life cycle returns investment in less than 10 years vs new facility
New Water treatment facility $6,000,000 + debt service	Wetland has unlimited life cycle, low O&M

Overall Cost of Project:	$ 725,000 (not including land)
Construction:	$ 550,000
Overall Cost / Square Foot:	$18 (aprox.)
Funding: NYS EFC Green Innovation Grant:	$635,000 (NYS EFC GIGP 362 CWSRF# 5325-02-00)
Village Match: 10%	$90,000 (includes previous studies)
Estimated Annual Operating Cost:	$6-8,000
Estimated Return on Investment	**6-8 years** **

* A planned 60 inch diameter ADS N-12 HDPE outlet culvert will handle peak discharge of a 100 year storm event
** Factors Village match funding, annual O&M. Each community will have site-specific mitigating cost factors.
All figures provided are assumed to be accurate as of March 2015, but are subject to change by costs and unforeseen factors

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