Urban Design and Low Impact Development Near Long Island Sound Stewardship Sites

New England Interstate Water Pollution Control Commission

Project Summary Report

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1.0 INTRODUCTION

The New England Interstate Water Pollution Control Commission (NEIWPCC) is a not-for-profit interstate organization, established by Congress in 1947 to serve and assist its member states individually and collectively by providing coordination, research, public education, training, and leadership in the management and protection of water quality in the New England states and New York. Long Island Sound (LIS) is one of North America's most urban and biologically diverse estuaries. Although the Sound is a resource of extraordinary productivity, it is under significant stress. Accordingly, in 1987 the states of Connecticut and New York and the U.S. Environmental Protection Agency (EPA) recognized the LIS as an Estuary of National Significance. The state and federal partners operate under an approved Long Island Sound Study (LISS) Comprehensive Conservation and Management Plan (CCMP), an overall plan to restore and protect the Sound.

Periodically, the LISS has developed agreements and initiatives to guide and prioritize implementation of the CCMP including the 2003 Long Island Sound Agreement, the Long Island Sound Stewardship Initiative, and most recently, the Action Agenda 2011-2013. The LISS CCMP Enhancement Award Program, administered by NEIWPCC, is designed to help the LISS partners implement actions consistent with the CCMP. This project, being part of the LISS CCMP Enhancement Award Program, will enhance CCMP implementation, follow through with commitments made in the Action Agenda 2011-2013, and advance the Stewardship Initiative. More specifically, this project seeks to select two of the Long Island Sound Stewardship Sites, assess the benefits they provide and threats to the sites, and to develop a Green Infrastructure/Low Impact Development (GI/LID) project to minimize and mitigate existing impacts to these sites.

CCMP goals supported by this project include:

- Reduce Impacts of Existing Development
- Minimize Impacts of New Development
- Improve Information Management, Training, and Education
- Conserve and Enhance Natural Resources and Open Spaces
- Increase Public Access (through residents' greater awareness of their local Stewardship Sites)

The Action Agenda identifies priority actions to implement the CCMP from 2011 through 2013. Priority Action 1 from the Sound Communities section of the Action Agenda relates directly to this project:

"Support and build local partnerships for urban waterways that foster community involvement, connection, understanding, and stewardship, promote public access, and help communities become active participants in restoration and protection."

Further, this project will advance the Stewardship Initiative and the Stewardship Workgroup in the protection and enhancement of Stewardship Sites through green design and public participation on lands surrounding these sites. Therefore, priority actions 15 and 16 from the Waters and Watersheds section of the Action Agenda also relate to this project.

Priority Action 15:
"Promote watershed planning efforts to implement Low Impact Development (LID) and other programs to reduce runoff volume and pollutant load from new development and retrofitting existing development, encouraging municipalities to adopt a "no net increase in runoff" approach that seeks to cap the water quality and quantity impacts of impervious surfaces in LIS watersheds."

Priority Action 16:
"Promote green storm water infrastructure projects in municipalities and at large facilities such as college campuses, shopping malls, and commercial industrial parks to reduce runoff from existing development."

1.1 Long Island Sound Study Stewardship Sites

The LIS Stewardship Initiative was formed by the LISS to identify places with significant ecological or recreational value throughout the Sound and develop a strategy to protect and enhance these special places. The Stewardship Initiative follows through on recommendations made in the CCMP and the 2003 Long Island Sound Agreement, which call for the conservation of natural resources and increased public access around the Sound. To coordinate Stewardship Initiative efforts and to identify sites with ecological and/or recreational importance (e.g., Stewardship Sites), the LISS formed a bi-state (CT and NY) Stewardship Workgroup (http://longislandsoundstudy.net/about/committees/stewardship-work-group/).

As a culmination of over three years of effort, the Stewardship Workgroup identified 33 inaugural Stewardship Areas (**Figure 1**). LIS's Stewardship Sites represent some of the best examples of intact, highly-functioning terrestrial and intertidal coastal habitats along LIS. These sites provide essential habitat supporting a diversity of plant and wildlife species, open space for people to enjoy, and outdoor laboratories for studies on marsh migration, climate change and other critical natural resource management research questions.

1.2 Project Goals and Objectives

Patches of high ecological value, like Stewardship Sites, cannot be managed in isolation. They are part of a larger landscape mosaic affected by activities on surrounding lands. Many of the Stewardship Sites are embedded within a highly urbanized or developed landscape accommodating a variety of uses. The proximity of developed areas to some of the most ecologically significant habitat around LIS poses both threats and opportunities to maintain or enhance the ecological function of these habitats. The objectives of this project are as follows:

- This project will provide a better understanding of both the most critical environmental services and threats to those services on land surrounding Stewardship Sites.
- This project will create design solutions using GI/LID and other conservation and resource management practices, including an evaluation of the benefits and effectiveness of these design solutions.
- Through community involvement in the pilot GI/LID assessment and design process, the project will engage a broader audience in urban GI/LID and redevelopment design and

future implementation that could lead to enhanced ecological planning and design across multiple Stewardship Sites.

The intent of the project is to evaluate if green infrastructure (GI) and low impact development (LID) practices can be adopted at or near Stewardship Sites to address these threats and opportunities. Such practices might include restoring or creating wetlands to control flooding or manage water pollution pathways adjacent to Stewardship Sites. Other opportunities might include creating urban patch habitat to provide stopover areas for wildlife using Stewardship Sites for feeding or breeding. It's further intended that such practices will help develop public support, recognition, and awareness of resource management issues near Stewardship Sites through community involvement in the planning and design of GI/LID projects.

2.0 SITE ASSESSMENT AND DESIGN PROCESS

As previously indicated, there are 33 LISS sites, fourteen of which are in New York and nineteen of which are in Connecticut. As this project seeks to serve as a pilot project for other LISS sites, a site selection methodology was developed to assist in selecting priority sites for implementation of a GI/LID project. The following details the site selection methodology, results of the methodology, and delineation of the project study area to receive the GI/LID design.

2.1 Site Selection Methodology

It is recognized that there are many factors that can affect the health and quality of a LISS site, such as surrounding land uses, presence and abundance of invasive species, presence and abundance of wetlands, presence and abundance of rare, threatened and/or endangered species, nitrogen inputs from both stormwater and groundwater, soil type, marsh stability, current level of site management, and participation of surrounding landowners in stewardship. Ultimately, factors that were equally comparable across the broader landscape that represented the greatest impacts to each site were chosen for site evaluation.

In developing the site selection methodology, several important considerations included:

- The landscape and regional scale of the analysis – as the sites span two States and are on two coastlines, data selected for analysis should represent a similar scale.
- Availability of data that represented this scale – while there may be certain factors that play an important role in the quality and health of a site, it is impossible to compare and assess these factors if they are not available for all sites.
- Of the available data, determining which data provided the best assessment of the health and quality of each site – while some data sets may be available at the appropriate scale, they may not provide the information needed for site health and quality assessment.
- The feasibility of implementing a project within the selected study area – availability of land, willingness of land managers to participate in a project, and site constraints are key considerations when ultimately selecting a site and a project.
- The visibility of a project for public education purposes – sites must be easily accessible and publicly visible to serve as demonstration sites for GI/LID projects.

The above listed factors were the primary drivers of what data was chosen for analysis, and how to proceed with the development of the methodology. Once these were established, a broader review of the sites was conducted. As public visibility of the sites and projects were considered a key factor, prior to detailed analysis of the sites, the potential visibility of sites was assessed. As certain sites represented isolated islands with limited public opportunity for viewing, these sites were removed from consideration for further assessment. In total, seven stewardship sites that were isolated islands were removed from the selection process.

As the willingness to participate by the local land managers was also key in site selection, stewardship site land managers were contacted to determine their interest in participating in the project. If a land manager was not interested in participating in such a project, the site was removed from consideration. Responses from the communications with the land managers resulted in the removal of one Stewardship Site from the selection process.

Once sites were narrowed down to 25 potential candidate sites, sites that were aggregated from a variety of smaller sites in proximity to each other (e.g. the Edith G. Read Marshlands Stewardship Site is comprised of the Edith Read Wildlife Sanctuary, the Marshlands Conservancy and Playland Park) were divided to allow for uniform analysis of the contributing areas. In total, 45 properties that comprise the Stewardship Sites were individual analyzed (30 in New York and 15 in Connecticut).

Upon determining properties appropriate for further analysis and selection, review of available geographic information systems (GIS) data was conducted to determine what factors should be considered in property assessment. Review of available data that represented the landscape and regional scale of the sites revealed that the following datasets were available for all sites and would be the most useful in ranking site health, quality and threats:

- Topography (allows for the delineation of surface water contributing areas and an indication of the extent of the impacts of the surrounding lands)
- Land Cover (provides an indication of quantity and density of development within the contributing area)
- Publicly Owned Lands (illustrates public lands available within the contributing area for potential improvements)
- Significant Habitats (indication of high health and quality of the site and surrounding area)

The following table provides the sources for each data type in each region.

Data Type	NY Source	CT Source
Topography	Suffolk County: Suffolk County LiDAR, 2006 Nassau County: National Elevation Dataset, 2011	State of Connecticut Department of Environmental Protection 2 ft Contours, 2011; Connecticut Watershed Boundary Dataset, USGS 2001
Land Cover	National Land Cover Dataset, 2011	Connecticut Center for Land use Education and Research (CLEAR) Land Cover Data, 2010
Publicly Owned Lands	Suffolk County Tax Maps, 2015; Nassau County Tax Maps, 2015, New York City Tax Database, 2015; Westchester County Public Lands, 2015	Connecticut Parcels for Open Space Mapping provided by Connecticut Municipalities, 2010
Significant Habitats	NYNHP Significant Natural Habitats, July 2013	Connecticut Critical Habitats, CT DEEP 2009

Prior to data use and analysis, a Quality Assurance Project Plan (QAPP) was developed to ensure the highest quality data was utilized for selection and analysis. A copy of the QAPP is provided as **Appendix A**.

In order to select a site, the watershed contributing areas to each site were delineated utilizing the available topographic information to provide a boundary for further GIS analysis. Watershed contributing areas were utilized as such areas represent a good indication of the limits of what is contributing to the site in terms of pollutants that result from upland development and what natural resources are worth protecting in the site and surrounding area. It is noted that the watershed areas utilized for each site are the "first flush" (i.e., areas in which a typical rain event would carry pollutants to a site) areas as these areas would contribute the greatest pollutants to a site.

To facilitate site selection, a matrix was developed which ranked each site based on land cover, publicly owned lands, significant natural habitats, and land manager response. The percentage of each of the following was determined for the contributing areas utilizing the datasets listed above:

- Land Cover: the percent area within the watershed classified as "developed"
- Publicly Owned Lands: the percent area within the watershed that is comprised of publicly owned parcels that may be available for use for GI/LID projects
- Significant Natural Habitats: the percent area occupied by significant natural habitats.

For each of the items above, a score was assigned for that category based on the percentage range that the category resulted in, as follows:

- 0%-20%: 1
- 2%-40%: 2
- 41%-60%: 3
- 61%-80%: 4
- 81%-100%: 5

Additionally, if a land manager responded "Yes" for willingness to participate in the project, a score of "3" was given to the site. If no response was received, a default score of "1" was given for the site.

Once scores were assigned for each category, scores were tallied. The mean score and standard deviation of the scores were determined, and were utilized to select sites that would be considered for final evaluation and selection. Sites which received a score one standard deviation greater than the mean were utilized in the final selection process.

Finally, in order to rank the highest scoring sites and arrive at a single site for further consideration for a GI/LID project, the types of developed land cover were further analyzed. The actual acreage of each developed category within the land cover dataset was reviewed. Each site was ranked for each developed category in order from highest to lowest, and given a corresponding score. The score was then weighted by land use type, as follows:

- Developed, High Intensity: 0.4
- Developed, Medium Intensity: 0.3
- Developed, Low Intensity: 0.2
- Developed, Open Space: 0.1

The site with the highest score is the one ultimately selected for initial consideration for design of a GI/LID improvement project.

2.2 Results & Site Selected for Conceptual Design

In utilizing the methodology described above, three sites in New York and five sites in Connecticut were preliminarily selected for final analysis. A copy of the decision matrix, site scores and statistics are provided in **Appendix B**. The mean score for the New York sites was 7, with a standard deviation of 2.016. Therefore, sites receiving a score of greater than 9.016 were selected for inclusion in the final decision matrix. In New York, the top sites for final consideration included Pelham Bay Park, Alley Pond Park, and Sunken Meadow State Park.

In Connecticut, the mean score was also 7, while the standard deviation was 1.826; sites receiving a score of greater than 8.826 were selected for inclusion in the final decision matrix. Sites selected include Calf Pasture Beach, Great Meadows Unit of the Stewart B. McKinney National Wildlife Refuge, Hammonasset Beach State Park and Natural Area, and Veterans Memorial Park.

As indicated in **Section 2.1**, the final decision matrix was based on the intensity of development within the contributing area to the site, which was weighted based on said intensity. The final selection matrix and associated scores are included in **Appendix B**. For the New York sites, Pelham Bay Park received the highest final score of 2.4, followed by Alley Pond Park which scored 2, and Sunken Meadow State Park which received a score of 1.6. For the Connecticut sites, the Great Meadows Unit of the Steward B. McKinney National Wildlife Refuge received the highest score of 3.9, followed by Hammonasset Beach State Park and Natural Area (score of 2.7), Calf Pasture Beach (score of 2.4) and finally Veterans Memorial Park (score of 1).

Both land managers for the two highest scoring sites in NY and CT were contacted to further discuss the project, assess potential areas for improvements, and determine further willingness to participate. The land managers at Pelham Bay Park were contacted regarding potential locations for improvements and actively reviewed the park's needs. Several potential locations for marsh restoration projects were identified as priority improvements. Review of the marsh restoration sites with the project leads determined that while the marsh restoration projects would be beneficial to the park, they did not provide the public visibility sought to meet the goals of this project. Consideration was given to improvements in the main parking lot within the park, however, concerns regarding the need and availability of parking spaces during peak use were raised and as a result, improvements in this location were not pursued. Therefore, it was determined that Pelham Bay Park did not have a project that would currently meet the goals of this project and as a result, a conceptual design for this site was not pursued.

The remaining high scoring sites in NY were then considered (Sunken Meadow State Park and Alley Pond Park) in terms of availability of public land and project visibility to the public. While Alley Pond Park scored higher than Sunken Meadow State Park, Alley Pond Park did not have as many opportunities for GI/LID projects that would be highly visible to the public; as a result, Sunken Meadow State Park was ultimately chosen as the pilot site for a conceptual GI/LID design.

As with New York, both the site land managers and land managers of the public lands in the surrounding area were contacted to determine the feasibility of designing a project within or in the vicinity of the Great Meadows Unit of the Stewart B. McKinney National Wildlife Refuge in CT. Conversations with the land managers of the Stewardship Site revealed that several regulatory hurdles would be difficult to overcome to conduct improvements within the Stewardship Site boundary. As a result, the surrounding area was reviewed to determine opportunities for improvements. A property slated for development by FedEx was considered; however, the proposed FedEx development had already received necessary development approvals and development activities were well underway. Therefore, changes to the site were not considered feasible at the time of contact. Review of public lands available within the watershed revealed that several additional opportunities for improvements existed in the area surrounding the Stewardship Site; these sites were discussed with the local municipality. The ultimate delineation and determination for a project on or within both the New York and Connecticut site are described in further detail below.

2.3 Delineation of Project Areas

Once each site was selected for conceptual GI/LID design, review of available site data was conducted to determine potential locations for GI/LID improvements. Each site and associated contributing watershed were assessed, and three locations for potential improvements at each site/watershed were chosen to be further discussed with land managers. Meetings were held with the land managers for each site to discuss each location, the results of which are summarized below. Locations considered are illustrated in **Figures 2** and **3**.

Sunken Meadow State Park

Three locations were chosen for potential GI/LID design within Sunken Meadow State Park: Parking Field 1, Parking Field 3 and Parking Field 4 (**Figure 2**). Review of the drainage data for Parking Fields 1 and 3 indicated that drainage infrastructure consists of several catch basins which directly lead to an outfall to surface water; no treatment of stormwater is provided at these locations prior to discharge. However, due to the parking field elevations, elevations of the existing infrastructure, depth to groundwater, and limited ability to remove parking spaces within these fields, a GI/LID project that included biological pretreatment was not considered feasible. While catch basin inserts and installation of storm separator chambers may have been feasible within the existing infrastructure, such GI/LID improvements are not highly visible and are less suited for public visibility and education purposes.

Review of Parking Field 4 revealed that existing drainage infrastructure is comprised of several catch basins that either discharge directly to Sunken Meadow Creek or discharge to a vegetated area with a leaching pool on the south side of the parking lot. The catch basins that drain directly to the creek provide no pretreatment of stormwater, and the vegetated area on the south side of the parking lot is currently overrun with *Phragmites australis*, an invasive species. Topography within the parking lot includes a high point in the center (11 feet above sea level [asl]) while the northern and southern ends are lower (9 feet asl). As a result, stormwater drains from the center of the parking lot towards the catch basins on both the north and south ends of the lot. Depth to groundwater is estimated to be 5 to 7 feet beneath the surface (**USGS, 2010**). Due to the potential of GI/LID improvements at this location, and the public visibility of the parking field, which has high use for the adjacent picnic grounds, it was determined that conceptual design of a GI/LID project should proceed. The project limits and direct contributing area are depicted in **Figure 4**. Design details for this site are further described in **Section 3.1**.

Great Meadows Unit of the Stewart B. McKinney National Wildlife Refuge

As with the NY site, review of existing data including drainage infrastructure and availability of public lands was reviewed for the watershed contributing area to the CT site. Based on this information, three potential locations for a GI/LID project were chosen (**Figure 3**). The first location considered includes a public green space on the east side of Ketcham Road. The space is currently comprised of mowed lawn the gently pitches to a depression located in the southern portion of the parcel. Review of existing drainage infrastructure data, surface elevations and elevations of infrastructure revealed that the open area at the southern portion of the parcel is an existing low. Drainage within Ketcham Road and Meadow Avenue to the east collect and eventually overflow to Fresh Pond (**Figure 5**). Due to the existing topography and elevations of

the existing drainage infrastructure, modification of this area to provide pretreatment of stormwater that directly discharges to Fresh Pond would be very limited. As a result, this location was not further pursued for design consideration.

The second location considered is located at the intersection of Access Road and Lordship Boulevard. Areas of existing public land surround this intersection, and stormwater is currently directed to ditches located on the north side of Lordship Boulevard, and are connected beneath Access Road through a culvert. Ultimately, stormwater discharges to outfalls located on the south side of Lordship Boulevard. No pretreatment of stormwater occurs within the existing drainage system. Field review of the conditions of this location reveal shallow depth to groundwater, and limited land areas for modification of the drainage system. It was also noted that some areas are well buffered/vegetated along the ditch. Due to the limited opportunity for improvements at this location, it was not further pursued for design consideration.

The final location considered for GI/LID improvements is located in the right-of-way on the west side of Oak Bluff Avenue, south of Lordship Boulevard. Drainage along Oak Bluff Avenue includes a series of catch basins that directly discharge to the wetlands within the Stewardship Site; no pretreatment of stormwater is provided. The right-of-way in this location contains some upland area of variable width that has the potential to allow for surface detention and biological treatment of stormwater prior to discharge to the Stewardship Site. As sufficient area is available to establish a pretreatment solution, this location was ultimately selected for a GI/LID concept design. The project limits and direct contributing area are depicted in **Figure 6**. Design details for this site are further described in **Section 3.2**.

2.4 Assessment of the Beneficial Environmental Services of Selected Sites

An assessment of the beneficial environmental services of the selected sites was conducted to quantify the benefits each site provides to their respective watershed. Specifically, the benefit investigated was the ability of the ecosystem to purify stormwater runoff by retaining or providing uptake of phosphorus and nitrogen as water flows over the landscape before entering a stream or other water source. The EPA states the nutrient pollution is one of the most costly and challenging environmental problems facing the United States today. As such, the ability of an ecosystem to purify and uptake nutrient loads is a benefit to the entire watershed it services, as well as the surface and groundwater systems to which it is connected. An existing model known as InVEST (Integrated Valuation of Environmental Services and Tradeoffs) was used to assess these beneficial environmental services. InVEST was developed as part of the Natural Capital Project, a joint venture between Stanford University and University of Minnesota implemented through The Nature Conservancy and World Wildlife Fund for Nature. The InVest model was chosen for this project as it is a comprehensive model that can be utilized at the watershed scale the parameters of which appropriately represented the scale of this project. Specifically, the sub-model Nutrient Delivery Ratio (NDR) was utilized for this project. The parameters for NDR included elevation, land use/land cover, average annual precipitation and nitrogen and phosphorus retention efficiencies for each land use class within the watershed among others. Given these parameters the sub-model NDR computes the total nutrient loads and total nutrient exported from the watershed and provides a pixel level output map depicting how much load from each pixel eventually reaches a stream.

Sunken Meadow State Park

The contributing area for Sunken Meadow State Park was divided into fifteen (15) sub-watersheds (see **Figure 7**) that retain, on average, 69% of the total phosphorus load and 71% of the total nitrogen load of the contributing area. Sub-watersheds that remain predominately vegetated (sub-watersheds 1,7,8,10,13) exhibit higher nutrient retention rates and retain, on average, 75% of the total Phosphorus load and 78% of the total nitrogen load. A full table of InVEST model outputs and calculations is included in **Appendix C.**

Sub-watershed 2 and sub-watershed 10 are the two largest contributing areas and experience the highest nitrogen and phosphorus loading values. However, sub-watershed 2 has been largely developed for residential purposes, while sub-watershed 10 still predominately consists of natural vegetation. As such, the total phosphorus load in sub-watershed 2 is nearly double that of sub-watershed 10; 1,223 kg/yr compared to 686 kg /yr (**Figure 8**). The total nitrogen export of sub-watershed 2 is nearly triple that of sub-watershed 10; 3,009 kg/yr compared to 1,060 kg/year (**Figure 9**). The natural vegetation in sub-watershed 10 successfully retains 80% of the phosphorus load and 85% of the nitrogen load while the developed nature of sub-watershed 2 only allows for the retention of 65% of the Phosphorus load and 67% of the Nitrogen load.

The two most efficient nutrient retention areas are sub-watershed 7 and sub-watershed 10. These sub-watershed remain mostly undeveloped and are dominated by natural vegetation and wetlands. Sub-watershed 7, located in the northeastern most portion of the study area, retains 82% of its total phosphorus load and 83 % of its total nitrogen load (**Figures 10** and **11**). Conversely, the two most inefficient sub-watershed are sub-watershed 6 and sub-watershed 9. Sub-watershed 6 consists of residential development and a portion of the Sunken Meadow Golf Course and as such was found to retain only 62% of the total phosphorus load and 63% of the total nitrogen load. Furthermore, this watershed exports the second most phosphorus and nitrogen per acre per year; 1.15 kg.$^{yr-}$1/acre of phosphorus and 7.80 kg.yr^{-1}/ac.

As illustrated by the results of the InVEST model, the woodlands and wetlands within the contributing area provide the greatest benefits for pollutant load reductions and thus are most crucial for protection. Protecting these areas and working to increase nutrient retention will help protect aquatic ecosystems which have a limited ability to adapt to increases in nitrogen and phosphorus loads as well as protect human health and welfare.

Great Meadows Unit of the Stewart B. McKinney National Wildlife Refuge

The contributing area of the Great Meadows Unit consist of one watershed which is able to retain 65% of the total phosphorus load and 66% of the total nitrogen load leaving 16,725 kg/yr of phosphorus and 39,889 kg/yr of nitrogen to be exported to surface waters. As shown in **Figures 12 and 13** the majority of the phosphorus and nitrogen load within the contributing area is generated in the highly developed area to the north. The developed areas that exhibit high loading rates also exhibit low effective retention rates, **Figure 14 and 15,** which contributes to the reduced overall retention rate. It is expected that the nutrient loading and export rates would be significantly higher if the remainder of the watershed were to be developed as the natural vegetation provides significant nutrient retention through the southern portion of the watershed.

As illustrated by the results of the InVEST model the wetlands located predominately within the southern region of the contributing area provide the greatest benefits for pollutant load reductions and thus are most crucial for protection. Failure to protect these wetlands could lead to an increase in the total amount of nutrients exported to aquatic ecosystems which have a limited ability to adapt to increases in nitrogen and phosphorus loads. As demonstrated by other areas within the Long Island Sound, significant increases in nutrient levels can cause harmful algal blooms that have the potential to lead to large fish die offs or toxic algal blooms that can negatively impact human health. Uncontrolled nutrient inputs to the site have the potential to cause such impacts, although the threshold for the exact nutrient input that would cause these effects is currently unknown. In general, reduction of nutrient inputs is always a benefit to a site and surrounding waters to aid in prevention of such potential impacts.

2.5 Assessment of the Environmental Threats to Each Selected Site

Potential threats to each site include both anthropogenic and environmental changes. Anthropogenic threats include changes in land use while environmental threats include items that while anthropogenically influenced, are not directly driven by human actions, such as invasive species spread and sea level rise. A list of potential threats to each site is provided below, with a brief explanation of each threat, and general opportunities for threat mitigation.

<u>Sunken Meadow State Park</u>

1. *Threat: Development of vacant, privately owned properties.*
   Existing land uses within the contributing area to the site are comprised of mostly residential uses, however, some commercial, industrial and institutional uses are located within the area (see **Figure 16**). A total of 76 vacant, privately owned parcels are located within the watershed. Of these, 43 are parcels that are considered not developable due to the size and/or shape of the parcel. These parcels were most likely intended as access ways or potential roadways that were undeveloped, and do not had adequate widths for development. The remaining vacant parcels do have the potential to be developed. Based on existing zoning, one of these lots could be developed as a commercial use, 29 lots could be developed as single family residences, and three lots have the potential for large residential subdivisions (**Figure 17**). If the larger lots are subdivided, it is estimated that an additional 40 single family residences could be constructed. Development of these vacant lands increases the intensity of use, which increases impacts to the site through increases in stormwater runoff, potential for increases in invasive species on developed lands, increases in forest edges which reduce forest quality, and increases in sanitary inputs to groundwater which ultimately discharges to the marshes within the site.

   Mitigation Opportunity: Acquisition of vacant, undeveloped parcels.
   Acquisition of the vacant parcels provide the opportunity for preservation of the parcels as open space, or selective reuse of the parcels for green infrastructure practices. Most municipalities have budgets for open space acquisitions, so coordination with a local municipality could occur to facilitate acquisition and preservation.

2. *Threat: Unmitigated stormwater runoff.*
   Both the site and the surrounding area contain an aged network of drainage infrastructure that collects stormwater, and often discharges said stormwater directly through outfalls without any form of pretreatment. Stormwater carries a variety of pollutants which can impact the site and its marshes, including nitrogen, phosphorus, coliforms, and suspended solids. Sunken Meadow Park contains several direct outfalls from the parking lots and internal roadways that currently do not have any form of pretreatment.

   Mitigation Opportunity: Removing direct outfalls where feasible, or providing GI/LID pretreatment where outfall removal cannot occur.
   Ideally, removal of direct outfalls always provides the best opportunity for pollutant reduction, however, due to the age of infrastructure, limited depth to groundwater, and soil conditions, it is often not feasible to remove an outfall. When this is not possible, pretreatment in the form of GI/LID practices provides an alternative for a reduction of pollutants to a site and its waterbody. Such practices could include biological options (bioretention areas, stormwater wetlands, etc.) or structural modifications (swirl separator chambers, catch basin filter inserts, etc.).

3. *Threat: Invasive species on Long Island, just establishing on the island and approaching the region.*
   Invasive species pose a threat as they reduce biodiversity and prohibit proper functioning of native ecosystems. There are several common invasive species on Long Island and in the immediate vicinity of the site, and pose a continued threat to the site. Species identified by iMapInvasives that currently exist on the site or in the vicinity include Oriental Bittersweet, Multiflora Rose, Chinese Privet, and Japanese Honeysuckle (**Appendix D**). Species just establishing in the region that would benefit from regular early detection/rapid response (EDRR) surveys include Asiatic sand sedge, caper spurge, giant hogweed, and perennial pepper grass, as habitats suitable for these species exist on the site. Species approaching the region that may become established on the site given existing habitats include woodland angelica, slender false brome, big-headed sedge, purple corydalis, cut-leaf teasel, devil's thorn, mudmats, Chinese lobelia, Standish's honeysuckle, Chinaberry tree, wavyleaf basketgrass, ricegrass paspalum, beefsteak plant, trifoliate orange, Dahurian buckthorn, McCartney rose, tansy ragwort, common valerian, lilac chaste tree, and beach vitex.

   Mitigation Opportunity: EDRR surveys by the land manager and public education.
   EDRR surveys provide a landowner with a regular opportunity to review the site and note new occurrences of invasive species. These surveys could be conducted in conjunction with other habitat assessments or as part of other routine site maintenance activities. Plans for rapid response should a new species be encountered would also benefit the land manager to rapidly prevent the spread of a potentially harmful species.

   Public education regarding invasive species would aid in protecting the site as well. Education of site patrons aids in preventing the spread of invasive species to the site, as patrons would have knowledge of plants, animals and/or insects that may cause significant

harm to the site. Strategically placed signs throughout the site could serve as a quick visual cue regarding invasive species for patron and could serve as reminders of what species may potentially harm the site.

4. *Threat: Sea level rise and associated marsh loss.*
   Sea level rise is a documented effect occurring in the northeast, most likely from global anthropogenic actions affecting climate. As sea levels rise, the potential exists for marshes to be lost as daily inundation of marshes would be replaced by a permanent area of standing water, effectively drowning the marshes. The benefits of tidal marshes are well documented, and include erosion protection, biodiversity, filtration of pollutants, and habitat for a variety of species.

   Mitigation Opportunity: Long term site planning and identification of areas for marsh migration.
   While rising sea level is an inevitability, planning for such rises would benefit the site. Planning could include an analysis of the potential for marsh migration, areas that could be protected from erosion, areas that would benefit from an increase in elevation, and areas that would ultimately be lost in its current condition. Modeling to determine these areas would aid in land managers planning and decision making.

<u>Great Meadows Unit of the Stewart B. McKinney National Wildlife Refuge</u>

1. *Threat: Development of vacant, privately owned properties.*
   The watershed contributing area to the Stewardship Site is primarily comprised of a mix of industrial and residential uses. Commercial, institutional, parks, and vacant uses comprise a much smaller portion of the watershed (**Figure 18**). Currently, there are 73 vacant parcels within the watershed that are vacant; of these, 10 are considered undevelopable due to size, configuration, or presence of wetlands. Of the remaining 63 parcels, one can be developed for future airport uses, three can be developed for future commercial uses, 34 could be developed with industrial uses, two could be utilized as public parkland, and 18 could be single family residences. Of the five remaining parcels, all could be developed as residential subdivisions, yielding an estimated total of 16 additional residences (**Figure 19**). As the majority of the contributing area is industrial in nature, and there is significant potential for additional industrial uses on or in proximity to the waterfront, such development pressure is considered a major threat to the site. Industrial uses are typically considered stormwater "hotspots," i.e., areas that typically release a greater amount of pollutants during storm events due to increase impervious surfaces and activities associated with industrial use.

   Mitigation Opportunity: Acquisition of vacant, undeveloped parcels, or strategically changing the zone of parcels to RCD – Resource Conservation District.
   Acquisition of the vacant parcels provide the opportunity for preservation of the parcels as open space, or selective reuse of the parcels for green infrastructure practices. The Town of Stratford has a Conservation Commission that promotes the development and conservation of natural resources within the Town, so coordination with this commission could occur to facilitate acquisition and preservation.

Additionally, the Town of Stratford has a zoning district that only permits passive recreational uses or minor improvements to sites to allow for recreational uses (e.g., docks, ramps, etc.). Changing the zone of key parcels to this zoning district would further aid in protecting key sites.

2. *Threat: Unmitigated stormwater runoff.*
   Both the site and the surrounding area contain an aged network of drainage infrastructure that collects stormwater through underground piping and open ditches adjacent to roadways, and often discharges said stormwater directly through outfalls without any form of pretreatment. Stormwater carries a variety of pollutants which can impact the site and its marshes, including nitrogen, phosphorus, coliforms, and suspended solids. The drainage infrastructure surrounding Great Meadows is comprised of a network of open ditches, culverts, and catch basin which directly discharge to the marsh complex. Some pretreatment is afforded to the open ditches through vegetative buffering, but other locations contain direct discharges to the Great Meadows marsh.

   Mitigation Opportunity: Removing direct outfalls where feasible, or providing GI/LID pretreatment where outfall removal cannot occur.
   Ideally, removal of direct outfalls always provides the best opportunity for pollutant reduction, however, due to the age of infrastructure, limited depth to groundwater, and soil conditions, it is often not feasible to remove an outfall. When this is not possible, pretreatment in the form of GI/LID practices provides an alternative for a reduction of pollutants to a site and its waterbody. Such practices could include biological options (bioretention areas, stormwater wetlands, etc.) or structural modifications (swirl separator chambers, catch basin filter inserts, etc.).

3. *Threat: Invasive species in Connecticut, just establishing in the state and approaching the region.*
   Invasive species pose a threat as they reduce biodiversity and prohibit proper functioning of native ecosystems. There are several common invasive species in Connecticut and in the immediate vicinity of the site, and pose a continued threat to the site. One species identified by Invasive Plant Atlas of New England that currently exist on the site or in the vicinity is phragmites. Species just establishing in the region that would benefit from regular early detection/rapid response (EDRR) surveys include annual rabbitsfoot grass, perennial pepperweed, Asiatic sand sedge, and big-headed sedge as habitats suitable for these species (i.e., tidal marshes) exist on the site.

   Mitigation Opportunity: EDRR surveys by the land manager and public education.
   EDRR surveys provide a landowner with a regular opportunity to review the site and note new occurrences of invasive species. These surveys could be conducted in conjunction with other habitat assessments or as part of other routine site maintenance activities. Plans for rapid response should a new species be encountered would also benefit the land manager to rapidly prevent the spread of a potentially harmful species.

   Public education regarding invasive species would aid in protecting the site as well. Education of site patrons aids in preventing the spread of invasive species to the site, as

patrons would have knowledge of plants, animals and/or insects that may cause significant harm to the site. Strategically placed signs throughout the site could serve as a quick visual cue regarding invasive species for patron and could serve as reminders of what species may potentially harm the site.

4. *Threat: Sea level rise and associated marsh loss.*
   Sea level rise is a documented effect occurring in the northeast, most likely from global anthropogenic actions affecting climate. As sea levels rise, the potential exists for marshes to be lost as daily inundation of marshes would be replaced by a permanent area of standing water, effectively drowning the marshes. The benefits of tidal marshes are well documented, and include erosion protection, biodiversity, filtration of pollutants, and habitat for a variety of species.

   Mitigation Opportunity: Long term site planning and identification of areas for marsh migration.
   While rising sea level is an inevitability, planning for such rises would benefit the site. Planning could include an analysis of the potential for marsh migration, areas that could be protected from erosion, areas that would benefit from an increase in elevation, and areas that would ultimately be lost in its current condition. Modeling to determine these areas would aid in land managers planning and decision making. It is noted that the Connecticut Department of Energy and Environmental Protection is currently in the process of utilizing the SLAMM (Sea Level Affecting Marsh Model) model to demonstrate potential changes as a result of sea level rise.

3.0 CONCEPTUAL GI/LID DESIGN IMPROVEMENTS

Once project locations were selected, and benefits and threats were assessed, conceptual design plans were prepared for each project site. The conceptual plans (see **Attachments 1 and 2**) are described in further detail below.

3.1 Sunken Meadow State Park

Design improvements for this site include the establishment of green infrastructure practices to collect and treat stormwater runoff prior to discharge to Sunken Meadow Creek (see Attachment 1, **Conceptual Drainage Plan for Sunken Meadow Park**). These improvements are aimed at addressing the threat of unmitigated stormwater runoff, as direct outfalls exist in various locations in the project area. Five existing catch basins are located on the north side of the access road north of the parking lot. Due to the limited depth to groundwater and limited area for vegetative improvements, catch basin inserts are proposed to treat stormwater runoff from the roadway. In the northern portion of the parking lot itself, select removal of parking spaces for the installation of rain gardens surrounding each inlet are proposed. Approximately six inches of ponding will be available within the rain gardens, which will be vegetated with native species to provide biological uptake of stormwater pollutants. In storm events with significant precipitation, an overflow will be built into the rain garden to prevent flooding from large storm events within the parking lot. These improvements are designed to provide treatment for the northern half of the parking lot.

Treatment for the southern half of the parking lot is proposed through rain gardens and a vegetated wetland. The southern half of the parking lot will be regraded to better direct stormwater towards the green infrastructure practices located at the southern end of the parking lot. A raingarden will be constructed in the central portion of the parking lot to capture and treat stormwater runoff in the immediate vicinity. Overflows from this raingarden will be piped to the vegetated forebay for the stormwater wetland in the southern portion of the parking lot.

Three drainage swales will be installed at the southern end of the parking lot to direct stormwater to the vegetated forebay while maintaining the access of the walking trail located along the parking lot. Catch basins located in the southern corners of the parking lot would be piped to the vegetated forebay. All stormwater would receive initial treatment within the forebay. A stabilized overflow would direct runoff from more intense storms to the stormwater wetland.

The existing stormwater wetland is currently impacted by phragmites; remediation of this area and regrading for improved treatment capacity would occur as part of the overall project. Phragmites remediation is expected to include removal of vegetative material above the surface prior to flowering and removal of impacted soil. The stormwater wetland would then be revegetated with native species, and be monitored for 3-5 years to ensure plant survival and to monitor and remove invasive species as necessary.

As a variety of green infrastructure practices are proposed, treatment for all of the major stormwater pollutants is possible through this project, including nitrogen, phosphorus, total suspended solids, and coliforms. Overall, use of these practices is anticipated to improve water quality to Sunken Meadow Creek and the overall health of the marsh within it as direct discharges of stormwater will receive some form of pretreatment.

Due to the high levels of use and visibility of the proposed improvements, ample opportunity exists for educational programs for green infrastructure projects. Signage placed at key locations could serve to inform the general public about the project and the benefits it offers, while educational programs could serve to give more targeted information about the improvements and potentially serve as opportunities for volunteer maintenance (e.g., replanting vegetation as needed, removal of invasive species as needed). Overall, both site improvement and educational goals for this project are met through the proposed design.

3.2 Great Meadows Unit of the Stewart B. McKinney National Wildlife National Wildlife Refuge

Due to the highly developed nature of the surrounding area and aged drainage infrastructure, unmitigated stormwater runoff was determined to be a significant threat to the site. In order to mitigate this threat, green infrastructure improvements proposed at this site include the disconnection of outfalls that discharge stormwater directly to the marsh and use of rain gardens to provide pretreatment. Oak Bluff Avenue has several outfalls located on the northwest side of the road that discharge directly to the marsh. The road shoulder on the northwest side of the marsh varies in width, however, adequate upland space is available at key locations to provide pretreatment of stormwater runoff from the immediate vicinity. In total, the use of four raingardens

is proposed in proximity to existing catch basins and associated outfalls or in areas where adequate area for pretreatment is available. It is noted that the existing drainage outfall with the largest contributing area is proposed to have the direct discharge point removed completely as adequate area is available for pretreatment of this outfall. Minor regrading of the roadway in this area would be required to provide adequate flow of stormwater to the rain garden. Concept designs for the proposed improvements are provided as **Attachment 2**, **Conceptual Drainage Plan for Oak Bluff Avenue.** Additionally, overflows for all of the rain gardens will be stabilized to prevent erosion and scour during higher velocity storm events. As all of the green infrastructure practices proposed are vegetative, major stormwater pollutants to be treated include nitrogen, phosphorus, total suspended solids, and coliforms.

As Oak Bluff Avenue leads to a popular local beach and connects to several residential areas, significant opportunity for public education exists for this project. In particular, signage at several locations (see **Conceptual Drainage Plan for Oak Bluff Avenue**) on the northwest side of the roadway could create a visual "Stormwater Education Trail" providing key information about the improvement project. Project signage could be designed to be attractive and cohesive with the character of the existing area. Education regarding actions both residents and visitors could take to protect the marsh and implement green infrastructure practices at their own homes could also be provided. Overall, as both treatment of pollutants that currently impact the marsh and educational opportunities for a highly visible public area are provided through this design, the goals of this project are met for this location.

4.0 COMMUNITY ENGAGEMENT

As discussed in **Section 1.2**, places with high ecological value, such as Stewardship Sites, cannot be managed in isolation. They are part of a larger landscape mosaic and are impacted by activities on surrounding lands. A key goal of the project is to engage a broader audience in urban GI/LID and to help develop public support, recognition, and awareness of resource management issues near Stewardship Sites through community involvement in the planning and design of GI/LID and related projects and initiatives. Therefore, a Community Engagement Protocol has been prepared to provide guidance to assist land managers and potential Stewardship Site partners with recommended steps for conducting successful community engagement programs and obtaining input for the implementation of GI/LID projects. The Community Engagement Protocol is included in **Appendix E**.

.

5.0 SUMMARY AND CONCLUSION

This project was funded by NEIWPCC to provide a green infrastructure/low impact development demonstration project at two LISS sites to aid in reducing existing threats to each site and provide educational opportunities to the public. Using a site selection methodology, a site that had both the greatest threats from the surrounding area and the greatest opportunity for public visibility and education were selected to receive a conceptual GI/LID design. Each design was conceptualized with site land managers whose input and feedback was critical in selecting a specific project location and the ultimate design drafted for each site. Ultimately, both designs met the overall goals of this project as threats to the selected LISS sites are reduced through implementation of

these projects, and public education opportunities are abundant at each project site. Additionally, a Community Engagement Protocol has been prepared to provide guidance to assist land managers and potential Stewardship Site partners with recommended steps for conducting successful community engagement programs and obtaining input for the implementation of GI/LID projects.

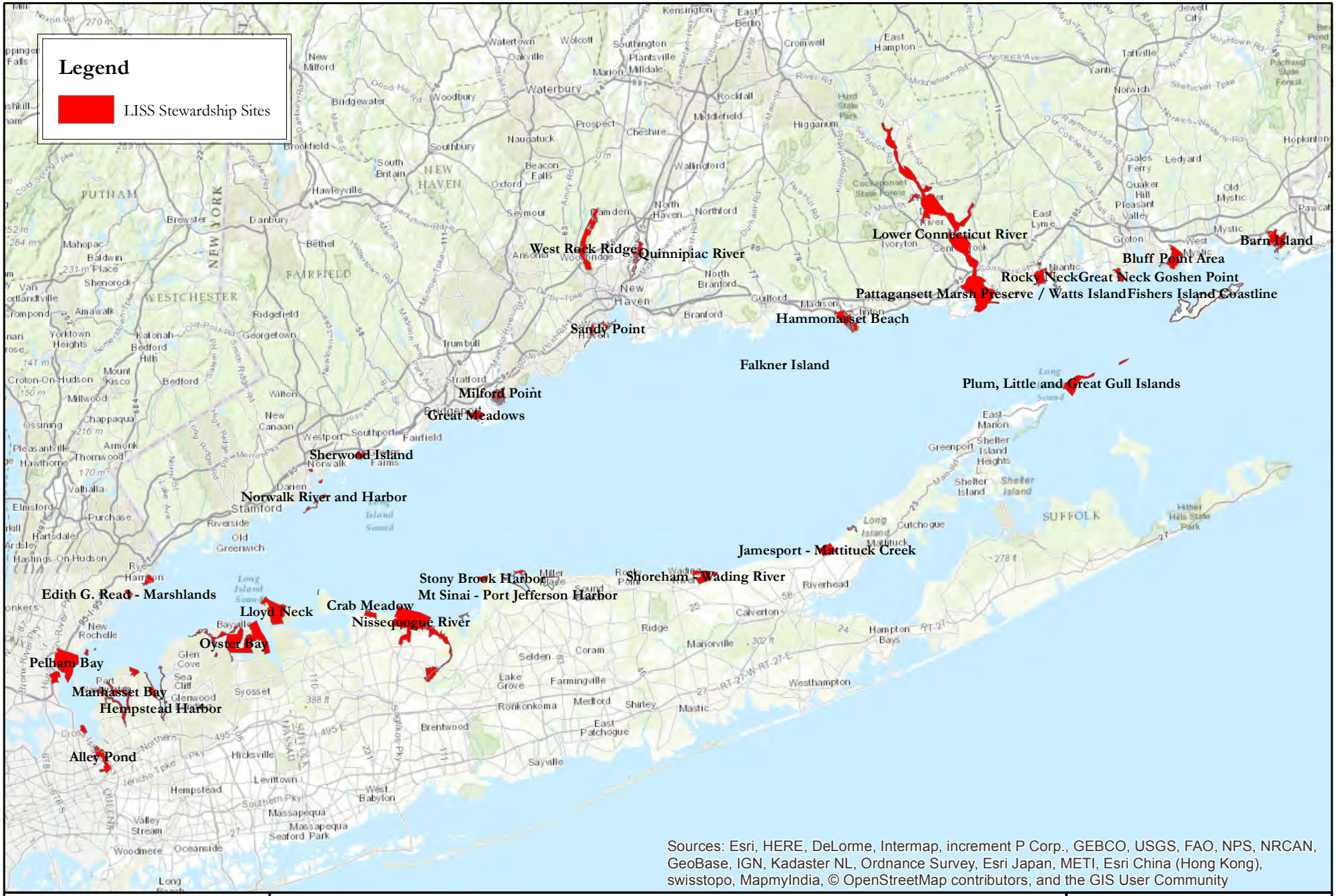

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FIGURE 1
LONG ISLAND SOUND STUDY STEWARDSHIP SITES

Source: ESRI Web Mapping Service; Long Island Sound Study
Scale: 1 inch = 11 miles

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FIGURE 2
SUNKEN MEADOW: POTENTIAL PROJECT LOCATIONS

Source: ESRI Web Mapping Service; Long Island Sound Study
Scale: 1 inch = 500 feet

N

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FIGURE 3
GREAT MEADOWS UNIT OF THE STEWART B. MCKINNEY PRESERVE: POTENTIAL PROJECT LOCATIONS

Source: ESRI Web Mapping Service; Long Island Sound Study
Scale: 1 inch = 1,250 feet

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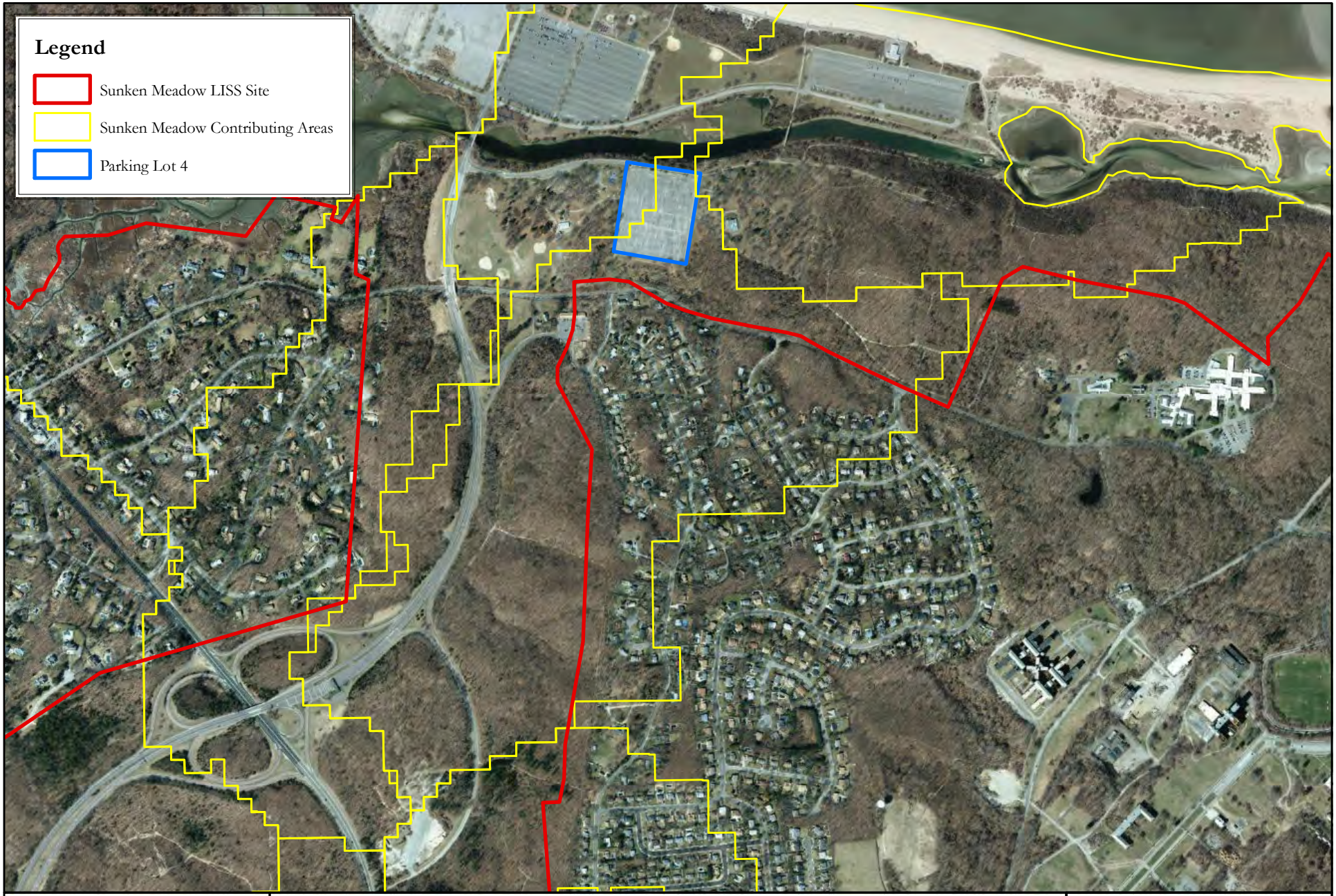

FIGURE 4
SUNKEN MEADOW: PROJECT LIMITS AND CONTRIBUTING AREA

Source: ESRI Web Mapping Service.
Scale: 1 inch = 1,000 feet

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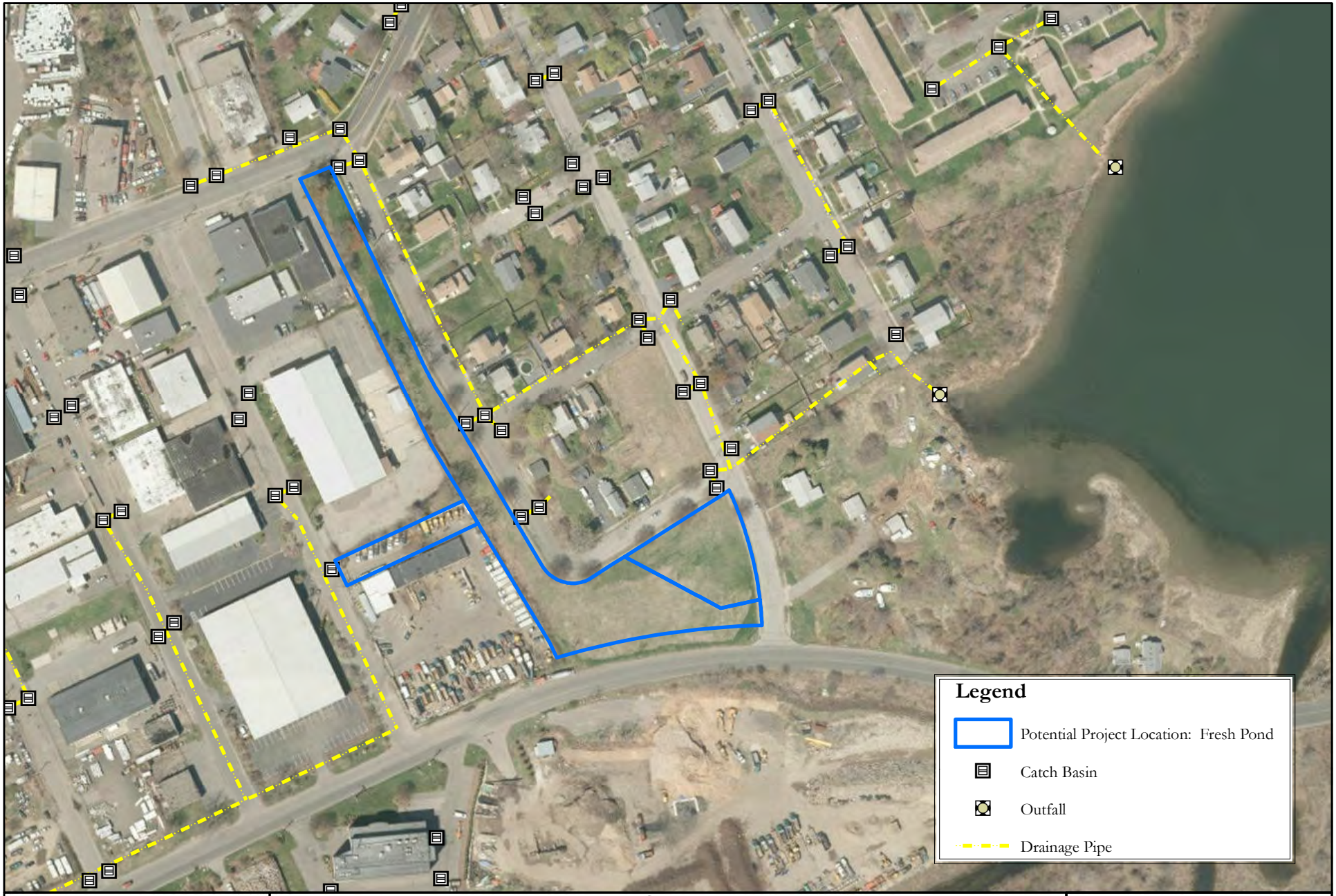

FIGURE 5
GREAT MEADOWS UNIT OF THE STEWART B. MCKINNEY PRESERVE: KETCHAM ROAD DRAINAGE INFRASTRUCTURE

Source: ESRI Web Mapping Service; Long Island Sound Study
Scale: 1 inch = 200 feet

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FIGURE 6
GREAT MEADOWS UNIT OF THE STEWART B. MCKINNEY PRESERVE: PROJECT LIMITS AND CONTRIBUTING AREAS

Source: ESRI Web Mapping Service; Long Island Sound Study
Scale: 1 inch = 200 feet

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FIGURE 7
SUNKEN MEADOW: SUB-WATERSHEDS

Source: ESRI Web Mapping Service.
Scale: 1 inch = 3,000 feet

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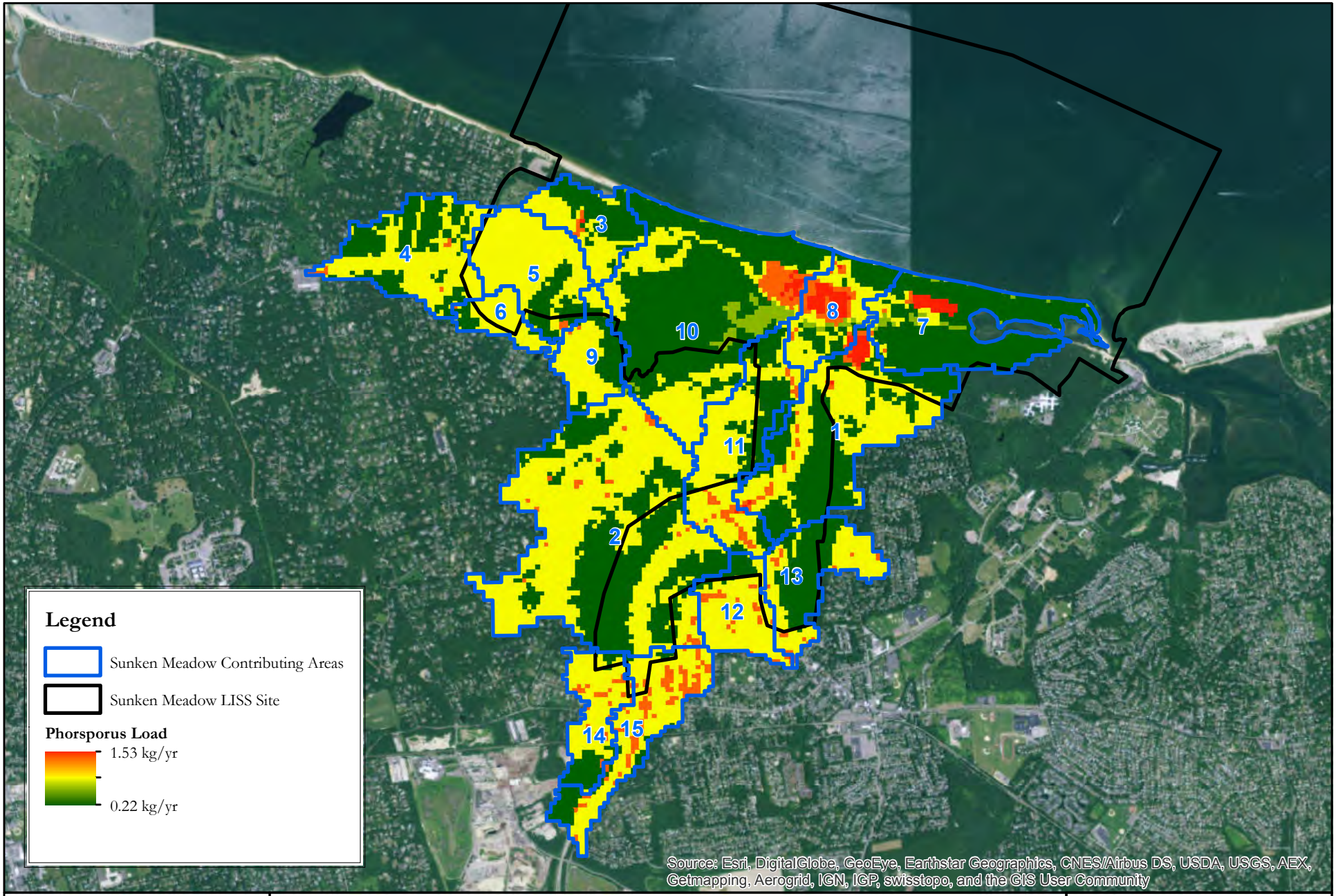

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FIGURE 8
SUNKEN MEADOW: PHOSPHORUS LOAD CONTRIBUTIONS

Source: ESRI Web Mapping Service, Long Island Sound Study.
Scale: 1 inch = 3,000 feet

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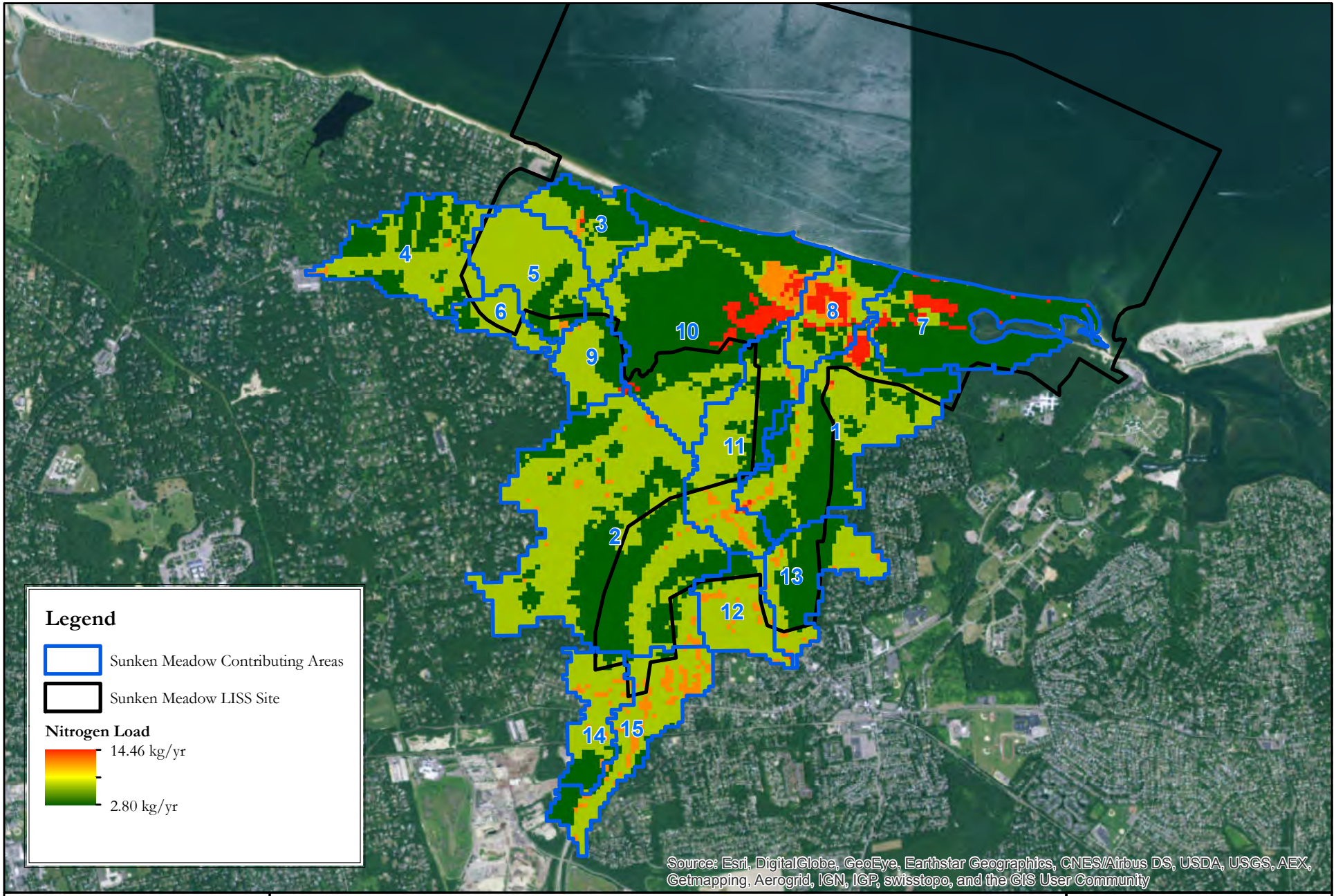

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FIGURE 9
SUNKEN MEADOW: NiITROGEN LOAD CONTRIBUTIONS

Source: ESRI Web Mapping Service, Long Island Sound Study, InVEST: Natural Capital.
Scale: 1 inch = 3,000 feet

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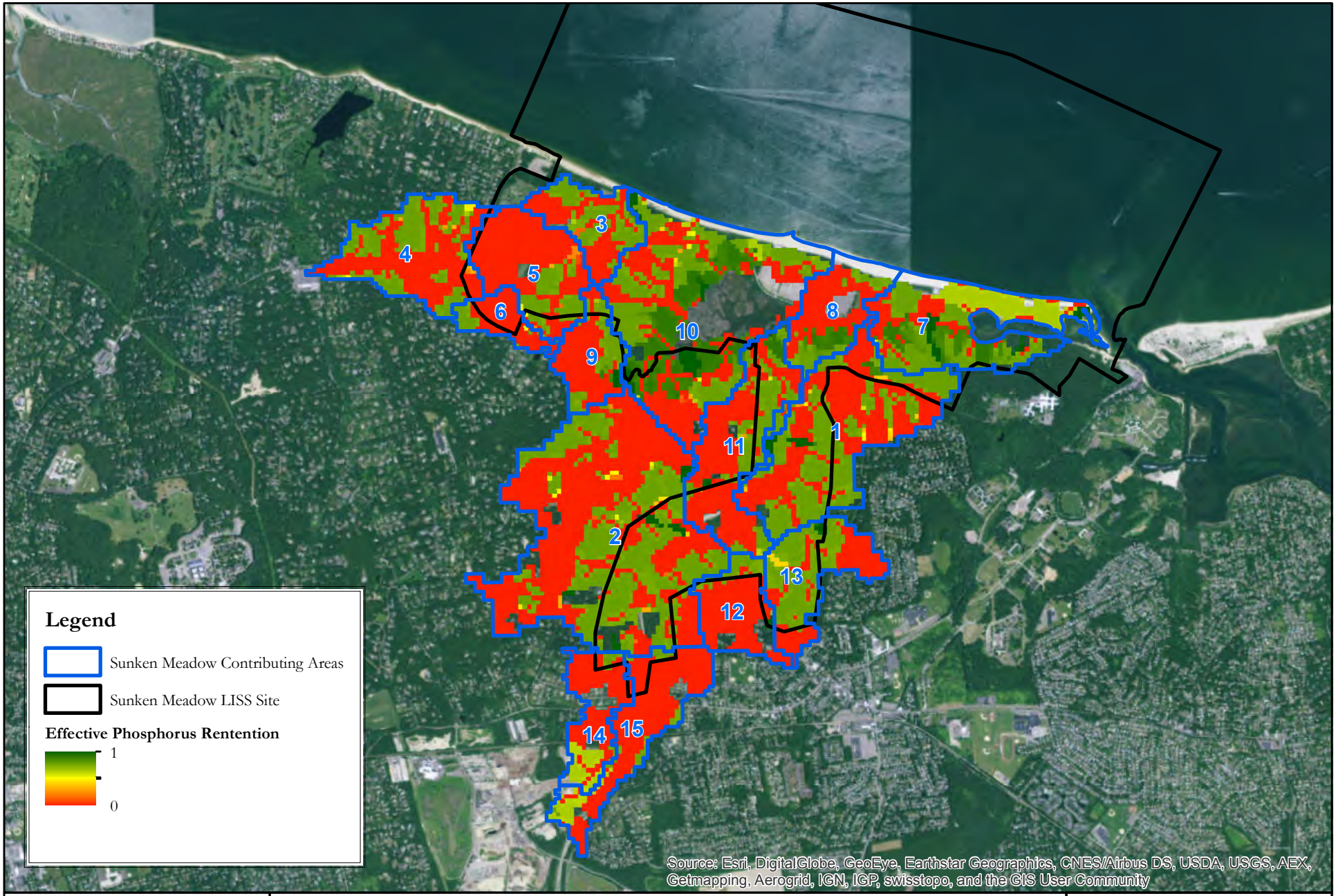

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FIGURE 10
SUNKEN MEADOW: EFFECTIVE PHOSPHORUS RETENTION

Source: ESRI Web Mapping Service, Long Island Sound Study, InVEST: Natural Capital.
Scale: 1 inch = 3,000 feet

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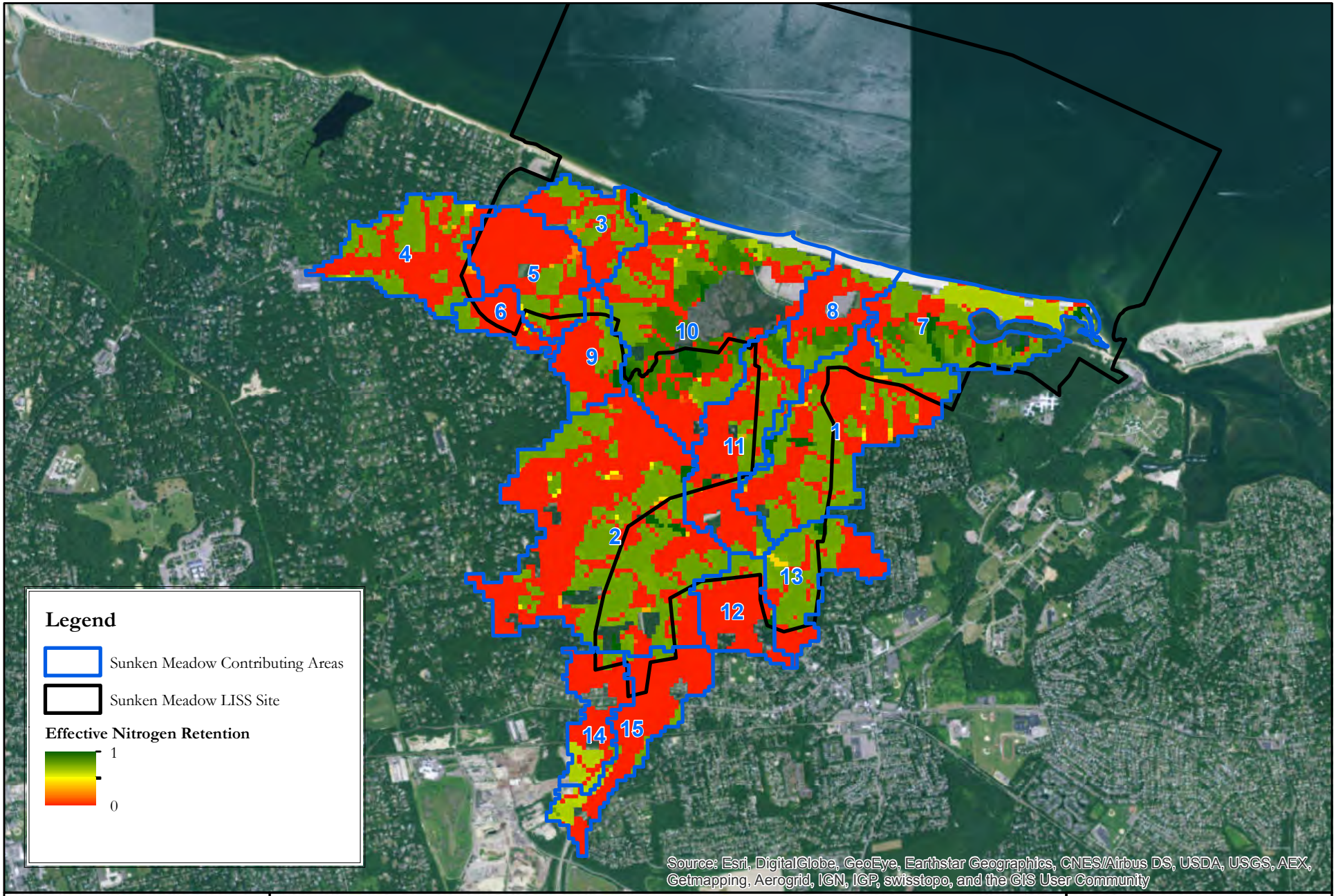

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FIGURE 11
SUNKEN MEADOW: EFFECTIVE NITROGEN RETENTION

Source: ESRI Web Mapping Service, Long Island Sound Study, InVEST: Natural Capital.
Scale: 1 inch = 3,000 feet

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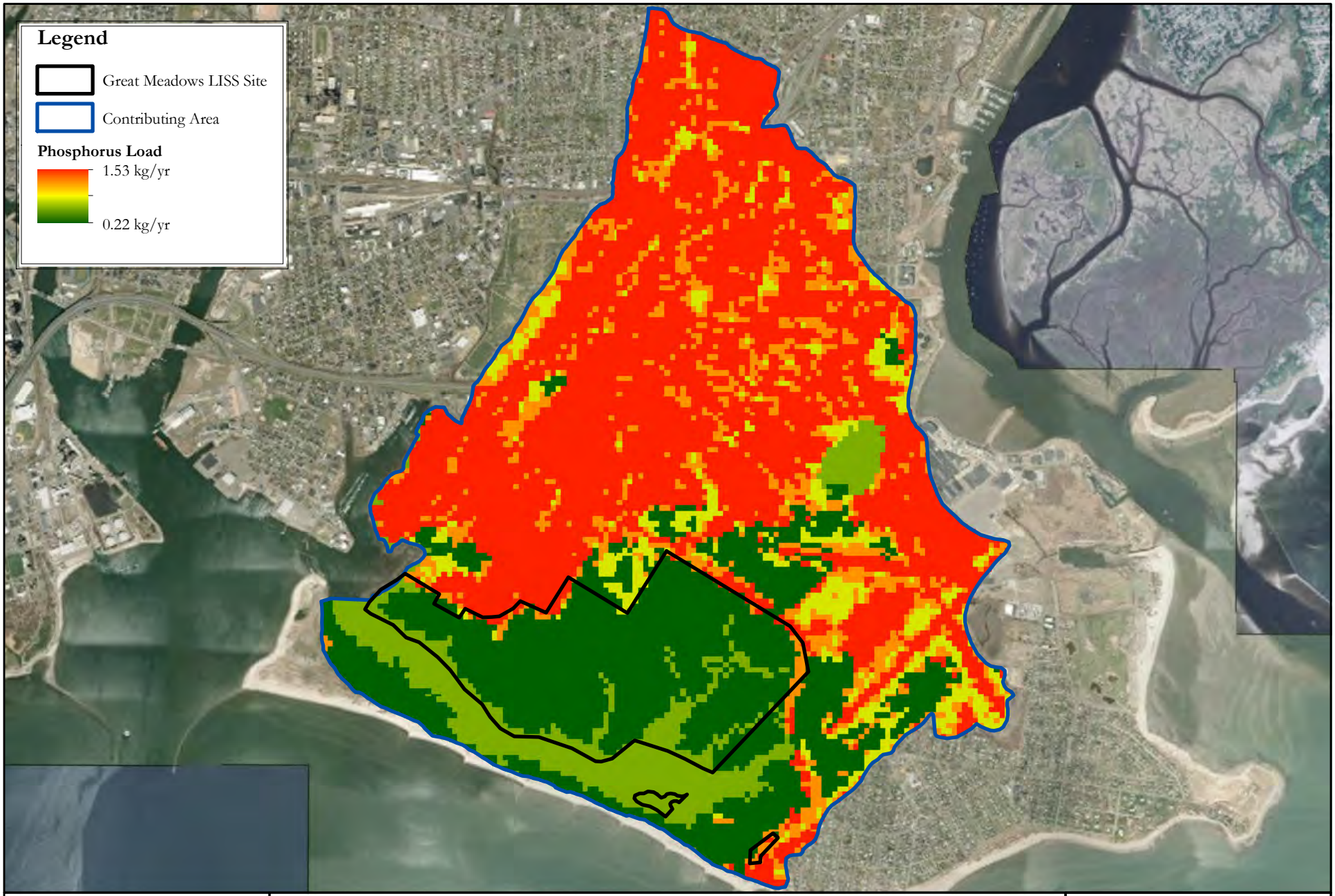

FIGURE 12
GREAT MEADOWS UNIT OF THE STEWART B. MCKINNEY PRESERVE: PHOSPHORUS LOAD CONTRIBUTIONS

Source: ESRI Web Mapping Service; Long Island Sound Study
Scale: 1 inch = 2,500 feet

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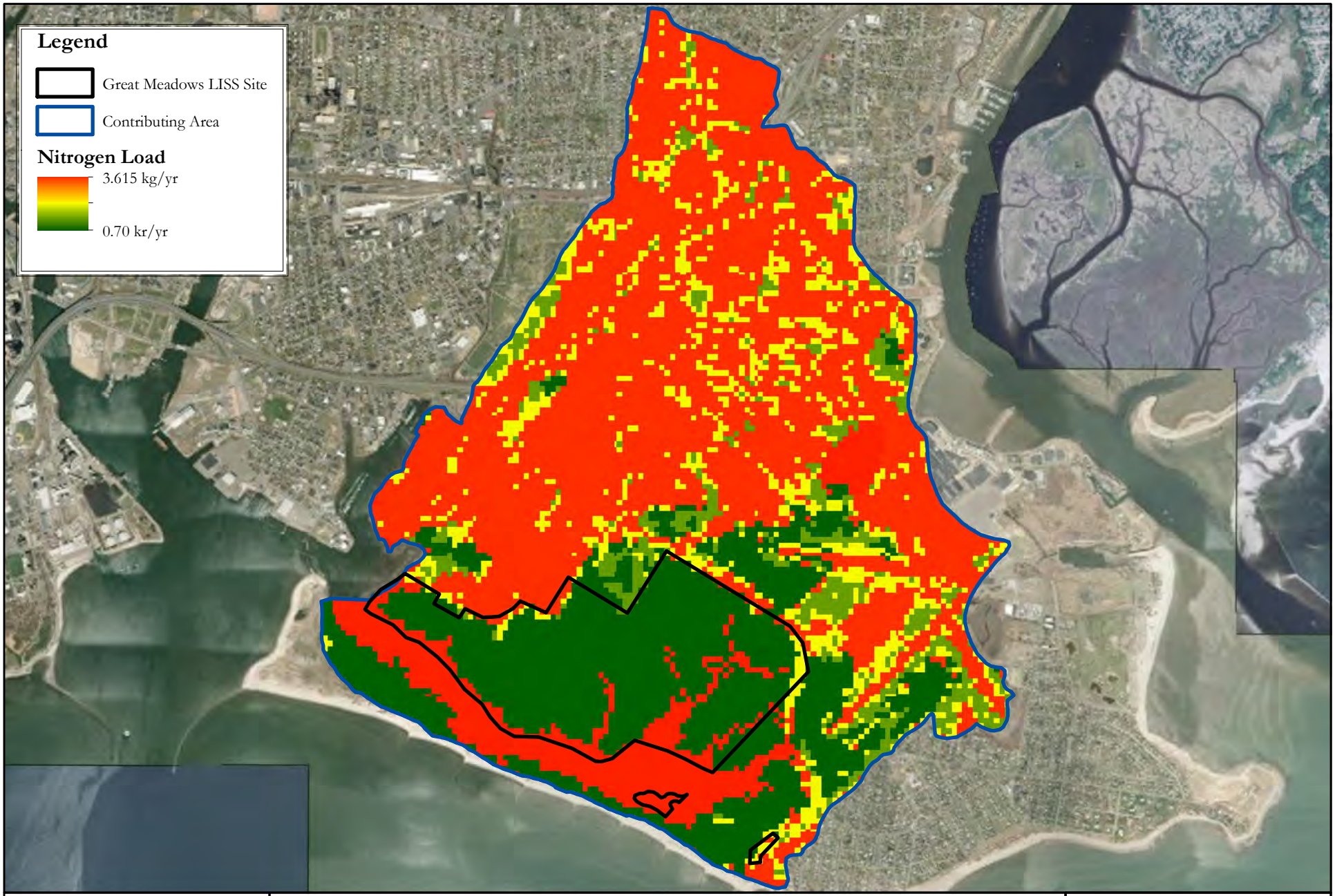

FIGURE 13
GREAT MEADOWS UNIT OF THE STEWART B. MCKINNEY PRESERVE: NITROGEN LOAD CONTRIBUTIONS

Source: ESRI Web Mapping Service; Long Island Sound Study
Scale: 1 inch = 2,500 feet

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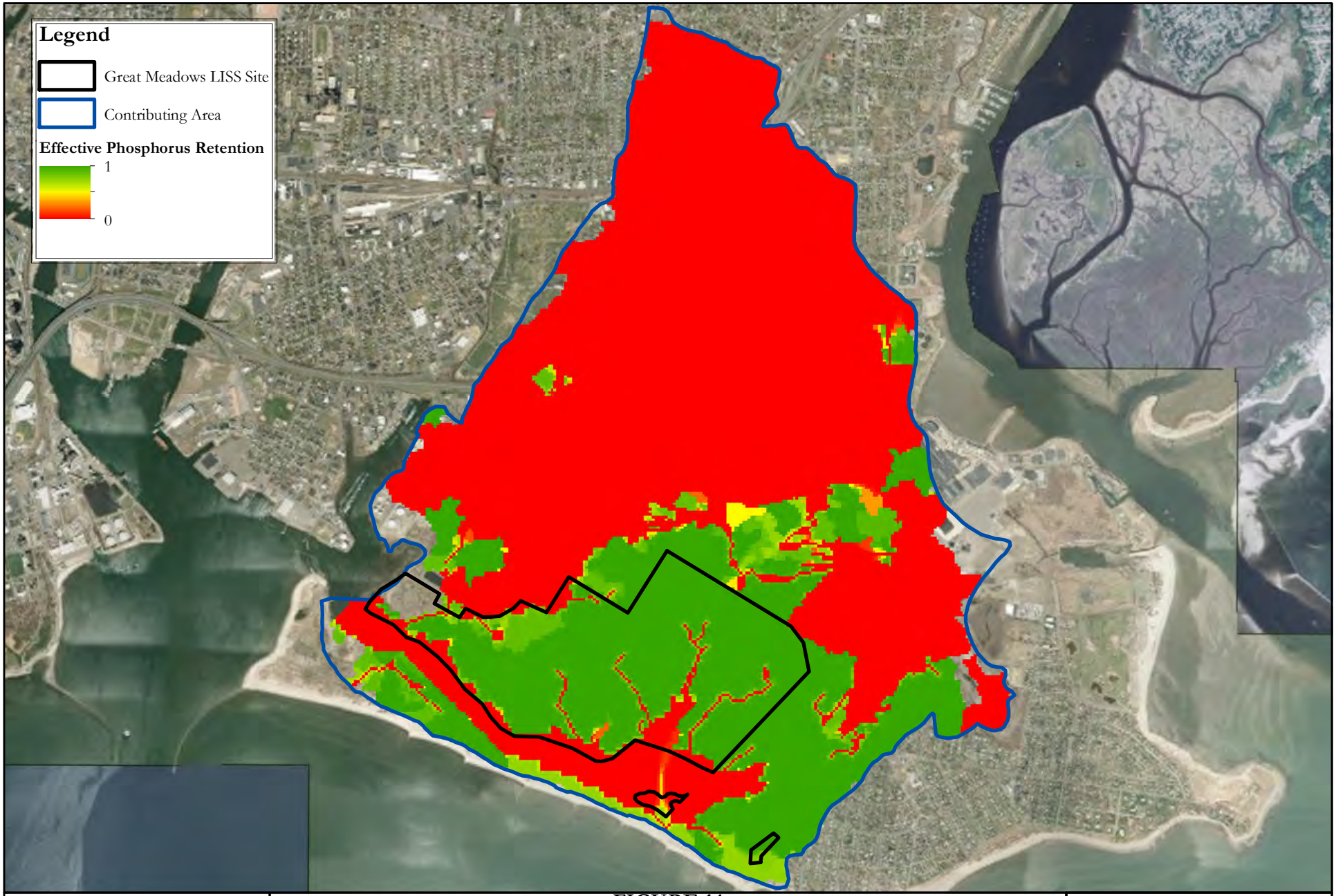

FIGURE 14

GREAT MEADOWS UNIT OF THE STEWART B. MCKINNEY PRESERVE: EFFECTIVE PHOSPHORUS RETENTION

Source: ESRI Web Mapping Service; Long Island Sound Study

Scale: 1 inch = 2,500 feet

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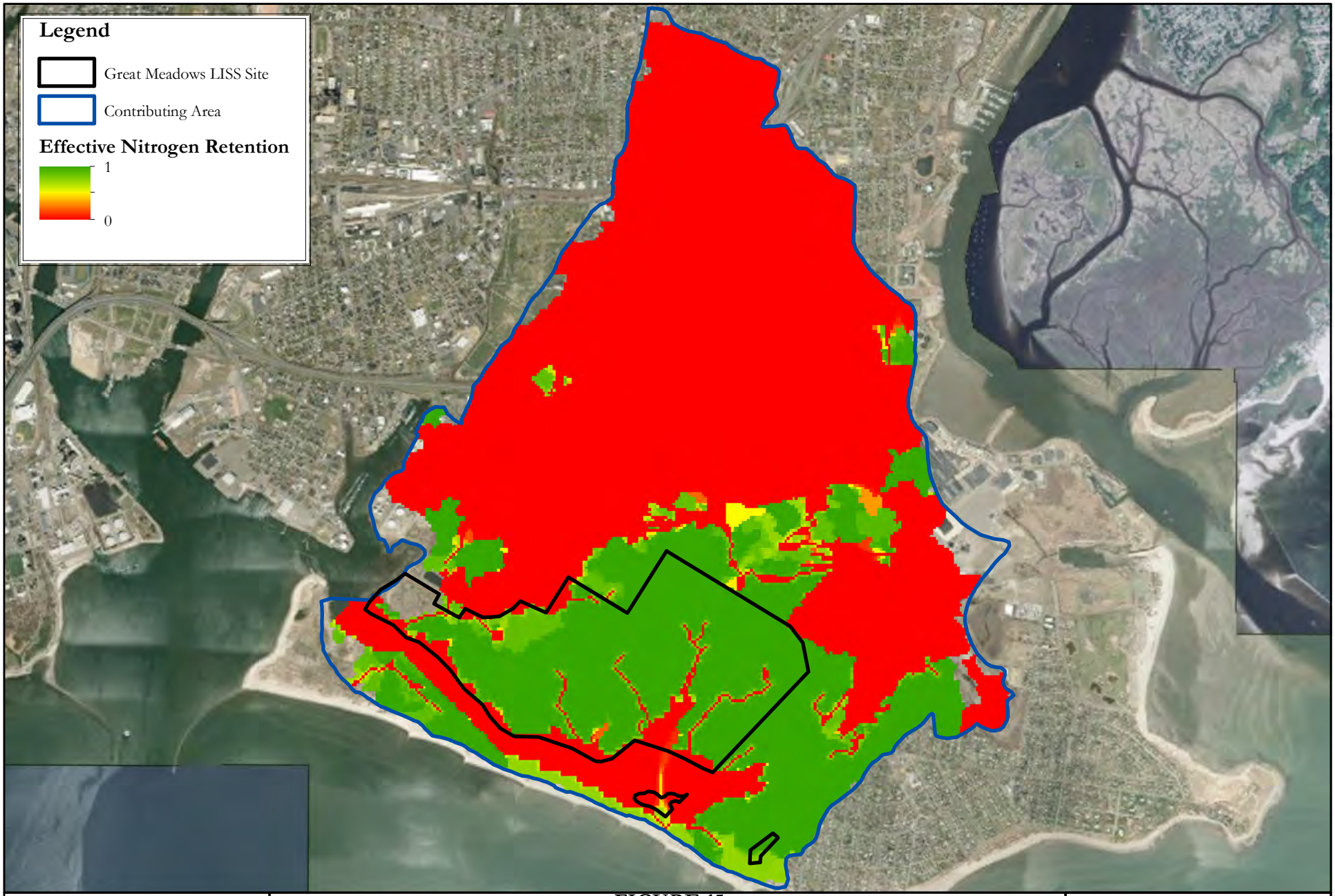

FIGURE 15
GREAT MEADOWS UNIT OF THE STEWART B. MCKINNEY PRESERVE: EFFECTIVE NITROGEN RETENTION

Source: ESRI Web Mapping Service; Long Island Sound Study
Scale: 1 inch = 2,500 feet

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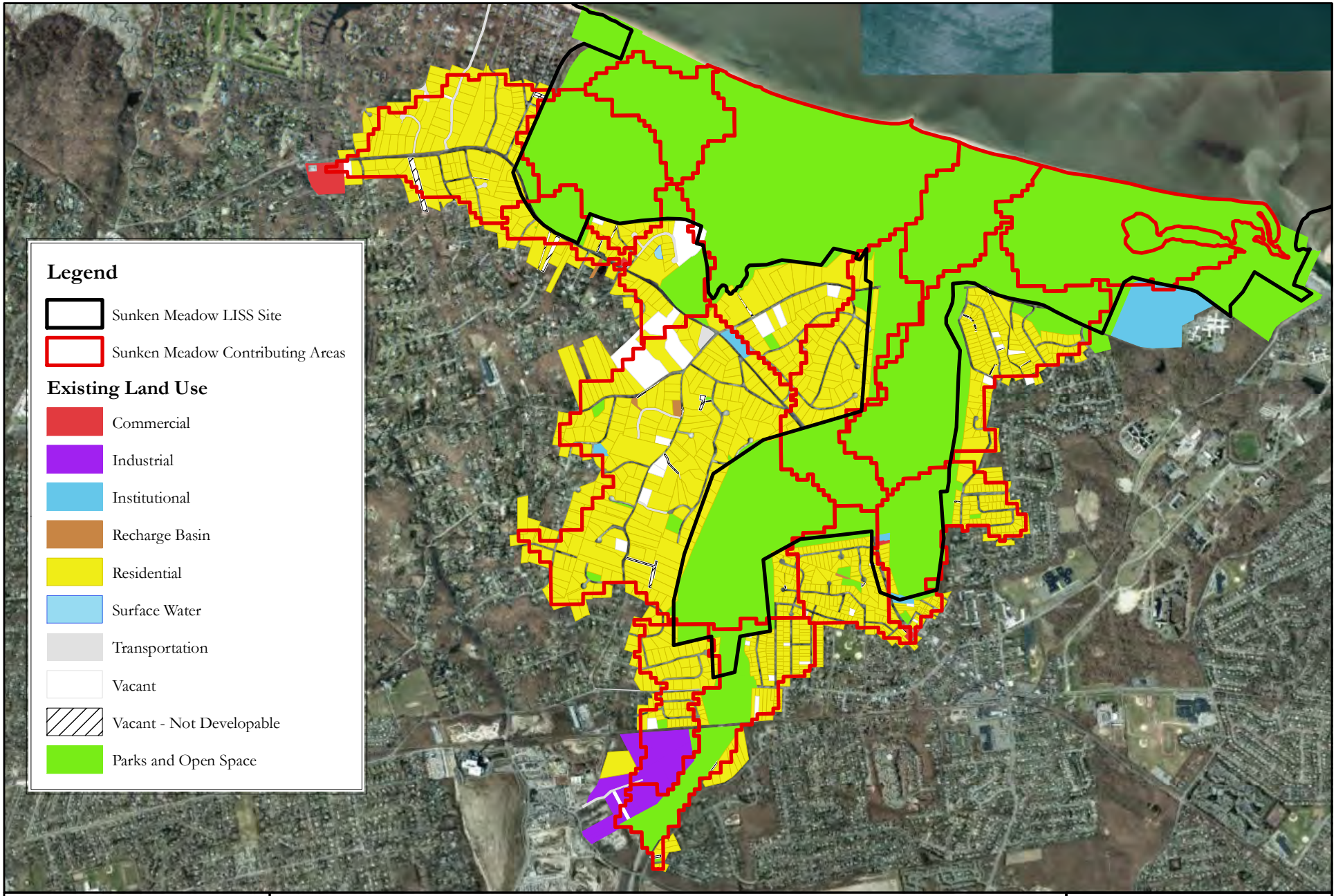

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FIGURE 16
SUNKEN MEADOW: CONTRIBUTING AREA EXISTING LAND USE

Source: ESRI Web Mapping Service; Suffolk County Tax Maps; NYS OrthoImagery Program, 2013.
Scale: 1 inch = 2,500 feet

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Urban Design and Low Impact Development Near Long Island Sound Stewardship Sites

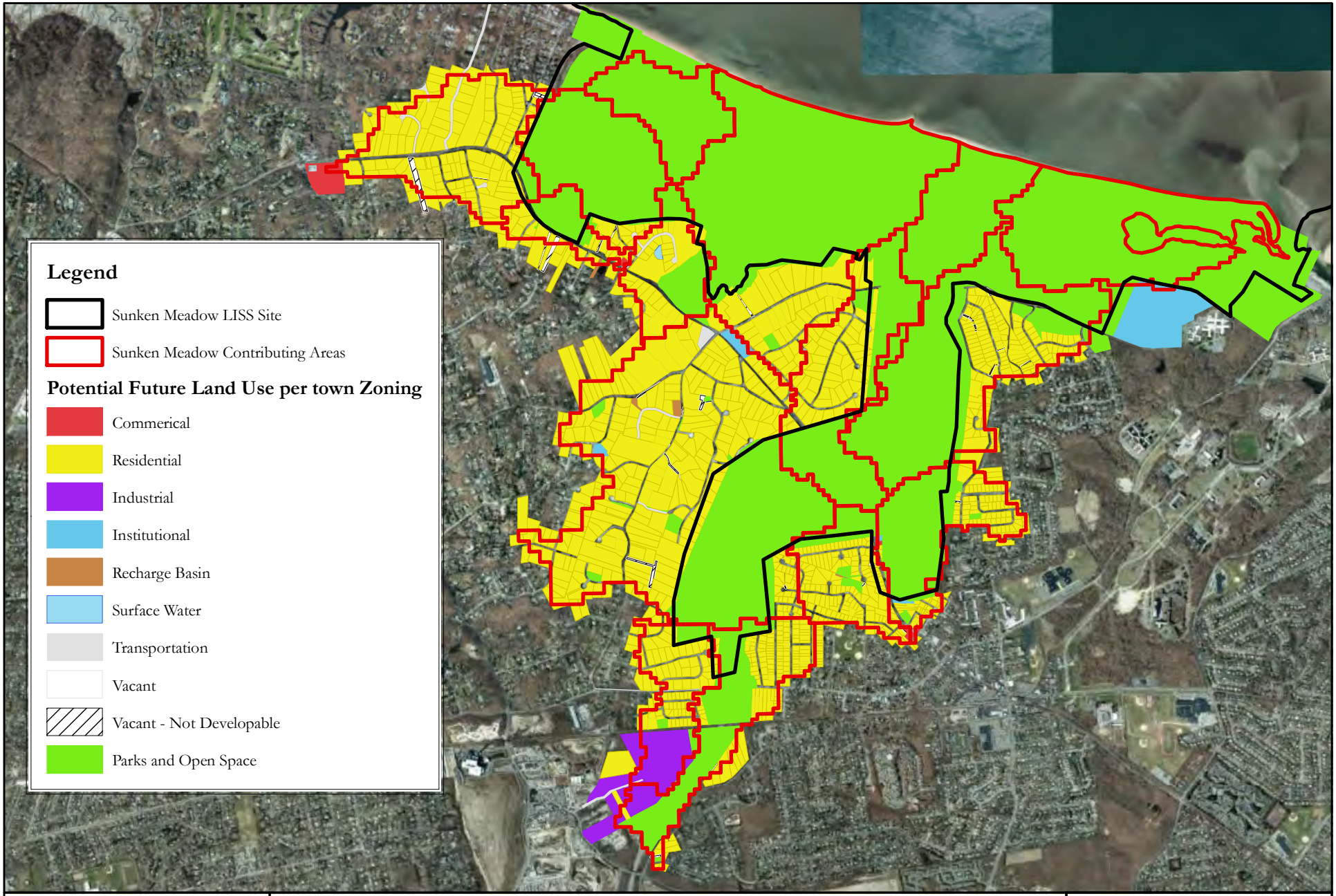

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FIGURE 17
SUNKEN MEADOW: CONTRIBUTING AREA FUTURE LAND USE

Source: ESRI Web Mapping Service; Suffolk County Tax Maps; NYS OrthoImagery Program, 2013.
Scale: 1 inch = 2,500 feet

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Urban Design and Low Impact Development Near Long Island Sound Stewardship Sites

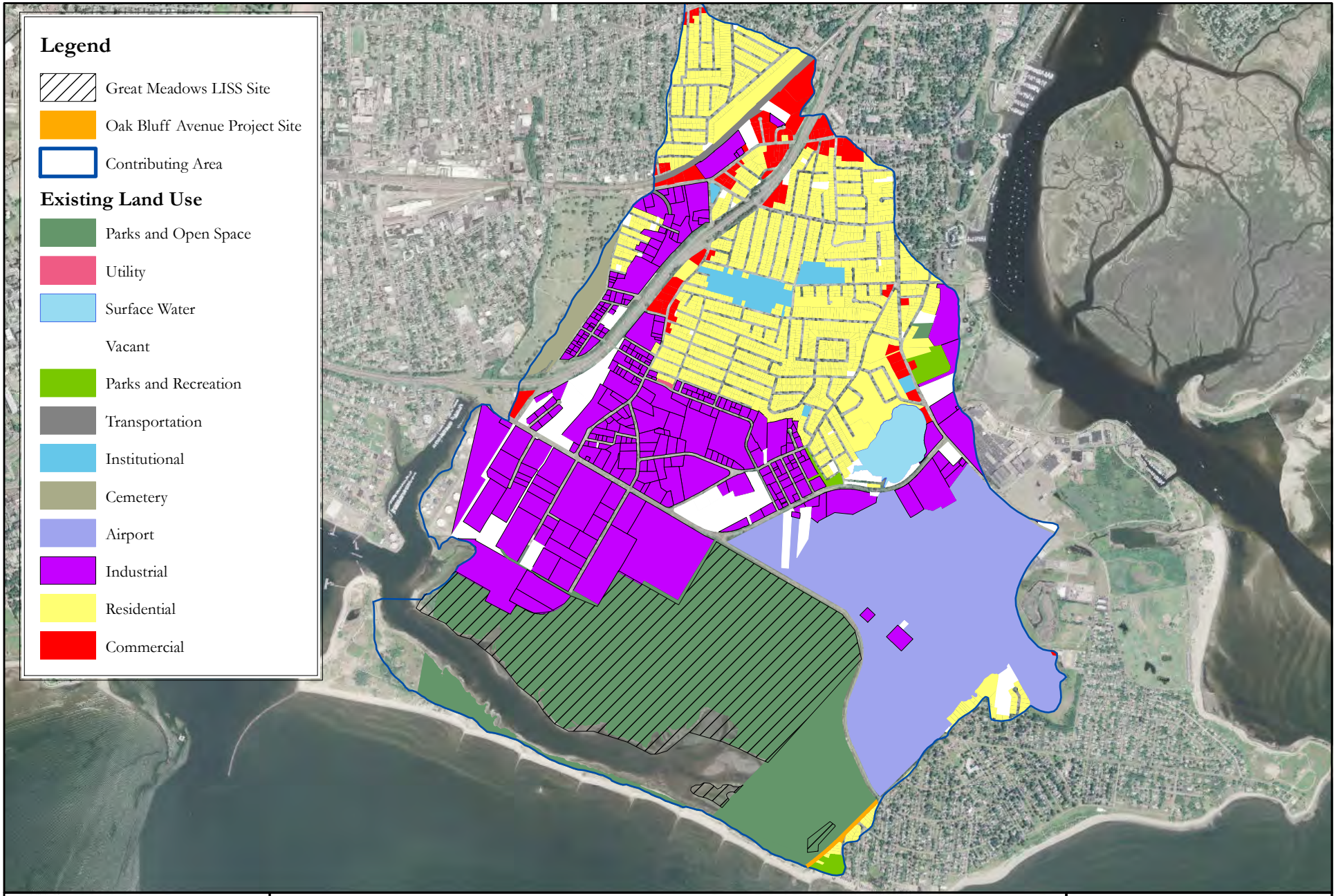

FIGURE 18
GREAT MEADOWS UNIT OF THE STEWART B. MCKINNEY PRESERVE: CONTRIBUTING AREA EXSITING LAND USE

Source: State of Connecticut Aerial Imagery, 2011; State of Connecticut Parcel Data
Scale: 1 inch = 2,500 feet

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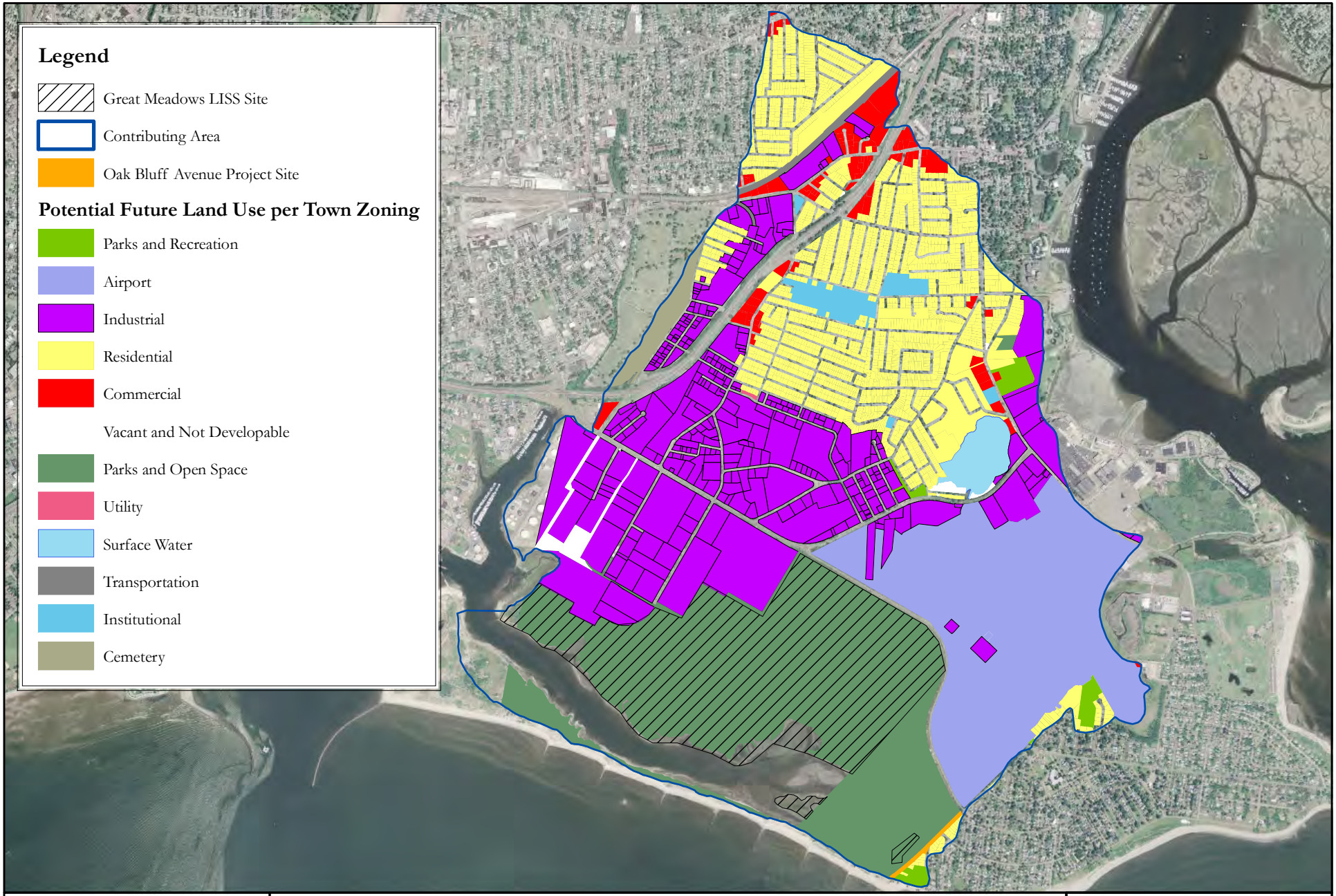

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FIGURE 19
GREAT MEADOWS UNIT OF THE STEWART B. MCKINNEY PRESERVE: CONTRIBUTING AREA FUTURE LAND USE

Source: State of Connecticut Aerial Imagery, 2011; State of Connecticut Parcel Data
Scale: 1 inch = 2,500 feet

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Urban Design and Low Impact Development Near Long Island Sound Stewardship Sites

APPENDIX A

APPROVED QAPP

Urban Design and Low Impact Development Near Long Island Sound Stewardship Sites
New England Interstate Water Pollution Control Commission
Quality Assurance Project Plan
NEI Code 0302-012-000
EPA QAPP #RFA 15002

Prepared by:
Nelson Pope & Voorhis, LLC
572 Walt Whitman Road
Melville, NY 11747

Funded by:
New England Interstate Water Pollution Control Commission (NEIWPCC)
This project is funded through NEIWPCC Grant #LI96144501 awarded by EPA Region 1.

Prepared for:
US EPA Region 1
5 Post Office Square, #100
Boston, MA 02109

Approvals Signature (required prior to project start):

NEIWPCC Project Manager	Emily Bird (Print Name)	Date: 10/31/14
NEIWPCC QA Designee	Michael Jennings (Print Name)	Date: 10/31/14
EPA Project Officer	Leah O'Neill (Print Name)	Date: 11/4/14
EPA QA Officer	Nora J. Conlon (Print Name)	Date: 10/31/2014
NP&V Primary Investigator	Lisa A. Pozzi-Urbat (Print Name)	Date: 10/30/2014
NP&V Project QA Officer	Elizabeth Cartwright (Print Name)	Date: 10/31/2014

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1.0 PROJECT MANAGEMENT

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1.2 Table of Contents - See page 2

1.3 Distribution List

Signed copies of this quality Assurance Project Plan (QAPP) and all subsequent revisions will be distributed to the following individuals:

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The QAPP and any revised versions will be distributed via email by Lara Urbat, the Environmental Scientist for the project consultant.

1.4 Project Organization and Responsibilities

The following details the project participants and their individual roles in the overall project:

Leah O'Neill, EPA Project Officer
Responsible for grant administration of this project for EPA, which provided funding to NEIWPCC through the LISS Enhancement Program. This includes reviewing and approving the project work plan and QAPP, as well as reviewing progress and deliverables, including a final report.

Nora Conlon, EPA Quality Assurance Officer
Responsible for reviewing and approving the QAPP on behalf of the EPA Region 1 QA Unit.

Emily Bird, NEIWPCC Project Officer
Responsible for oversight of the coordination, management, and implementation of the project through an assistance agreement and work plan approved by the EPA Project Officer and the Long Island Sound

Study's Management Committee. The project is executed through an assistance agreement between NEIWPCC and Nelson, Pope & Voorhis, LLC.

Mike Jennings, NEIWPCC Quality Assurance Designee
Responsible for reviewing and approving the QAPP to ensure adherence to the NEIWPCC Quality Management Plan. As the Quality Assurance Designee for NEIWPCC, TBD is independent from the division responsible for management of this project.

Beth Cartwright, NP&V, Project QA Officer
Responsible for reviewing and approving the QAPP to ensure adherence to the project QAPP. As the Project QA Officer for NP&V, Beth Cartwright is independent from the division responsible for management of this project.

Carrie O'Farrell, NP&V Project Manager
Responsible for oversight and coordination of contractor staff, provide input and technical expertise associated with site selection, GI/LID conceptual design and will conduct contractor product review prior to submission to NEIWPCC.

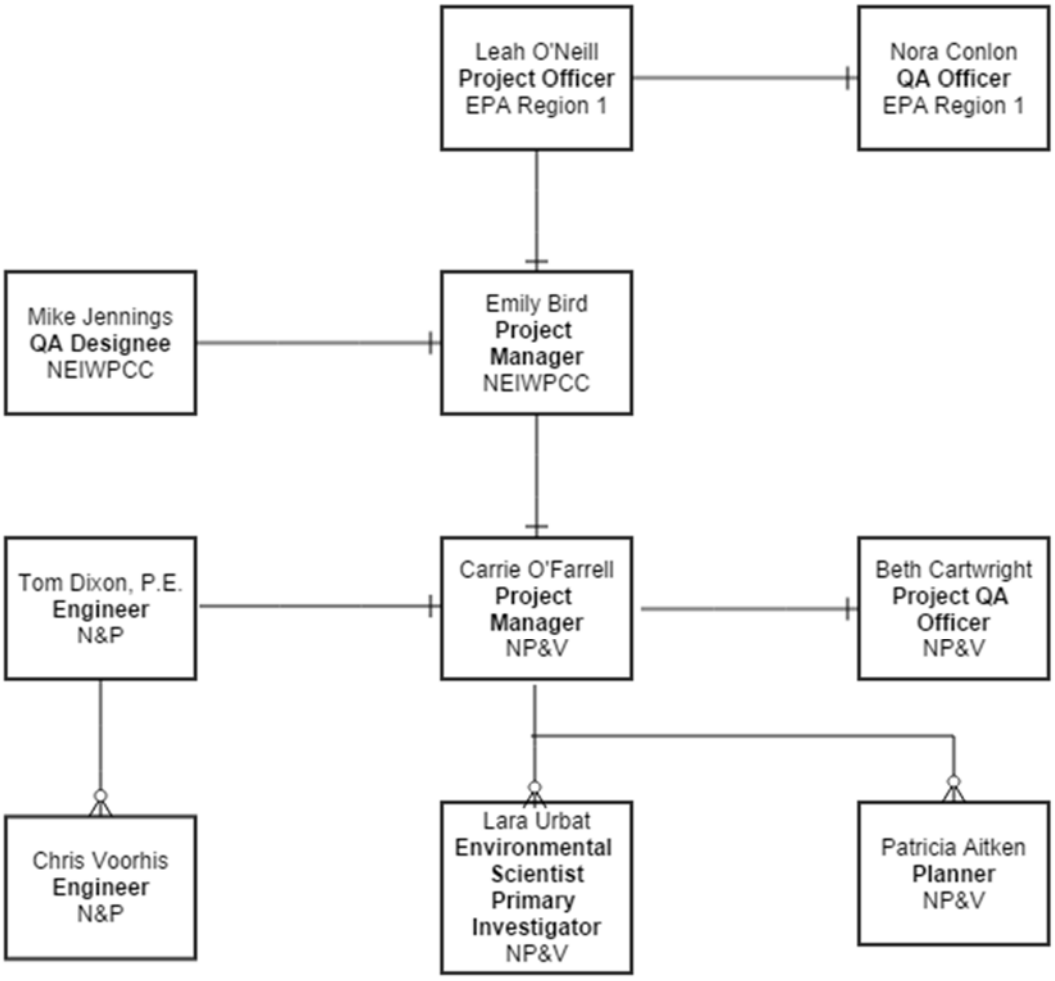
Lara Urbat, NP&V Environmental Scientist, Primary Investigator
Responsible for QAPP preparation, QAPP distribution, data management, site selection methodology, ecological assessment, and will provide input into GI/LID conceptual design.

Patricia Aitken, NP&V Planner
Responsible for development of community engagement protocol and conducting community outreach.

Tom Dixon, P.E., N&P Partner
Responsible for technical design concepts and engineering oversight of GI/LID design concepts for selected sites.

Chris Voorhis, N&P Engineer
Responsible for assisting with site selection and development of GI/LID design concepts for selected sites.

The following Organization Chart depicts the proper lines of communication for the project to ensure information is disseminated to the appropriate project team member.


Leah O'Neill
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EPA Region 1
Nora Conlon
QA Officer
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Mike Jennings
QA Designee
NEIWPCC
Emily Bird
Project Manager
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Tom Dixon, P.E.
Engineer
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Carrie O'Farrell
Project Manager
NP&V
Beth Cartwright
Project QA Officer
NP&V
Chris Voorhis
Engineer
N&P
Lara Urbat
Environmental Scientist
Primary Investigator
NP&V
Patricia Aitken
Planner
NP&V

1.5 Project Schedule

The tentative project schedule is provided in the table below.

Task Name	Expected Start Date	Expected Date of Completion
Develop a Quality Assurance Project Plan (QAPP)	July 10, 2014	October 15, 2014
Develop Site Selection Methodology	October 15, 2014	November 28, 2014
Delineate the Pilot Site Study Boundary	October 15, 2014	November 28, 2014
Assess the Beneficial Environmental Services of the Study Area	November 29, 2014	December 31, 2014
Assess Existing and Potential Adverse Impacts within the Study Area	November 29, 2014	December 31, 2014
Design a GI/LID Project for Each Study Area	January 2, 2015	March 6, 2015
Create Partnerships and Engage Community	October 15, 2014	June 1, 2015
Establish a Protocol for Community Involvement	October 15, 2014	July 15, 2015

1.6 Purpose of Study and Background Information

General Background

NEIWPCC is a not-for-profit interstate organization, established by Congress in 1947 to serve and assist its member states individually and collectively by providing coordination, research, public education, training, and leadership in the management and protection of water quality in the New England states and New York. Long Island Sound (LIS) is one of North America's most urban and biologically diverse estuaries. Although the Sound is a resource of extraordinary productivity, it is under significant stress. Accordingly, in 1987 the states of Connecticut and New York and the U.S. Environmental Protection Agency (EPA) recognized the LIS as an Estuary of National Significance. The state and federal partners operate under an approved Long Island Sound Study (LISS) *Comprehensive Conservation and Management Plan* (CCMP), an overall plan to restore and protect the Sound.

Periodically, the LISS has developed agreements and initiatives to guide and prioritize implementation of the CCMP including the *2003 Long Island Sound Agreement*, the *Long Island Sound Stewardship Initiative*, and most recently, the *Action Agenda 2011-2013*. The LISS CCMP Enhancement Award Program, administered by NEIWPCC, is designed to help the LISS partners implement actions consistent with the CCMP. This project, being part of the LISS CCMP Enhancement Award Program, will enhance

CCMP implementation, follow through with commitments made in the *Action Agenda 2011-2013*, and advance the Stewardship Initiative.

CCMP goals supported by this project include:

- Reduce Impacts of Existing Development
- Minimize Impacts of New Development
- Improve Information Management, Training, and Education
- Conserve and Enhance Natural Resources and Open Spaces
- Increase Public Access (through residents' greater awareness of their local Stewardship Sites)

The Action Agenda identifies priority actions to implement the CCMP from 2011 through 2013. Priority Action 1 from the Sound Communities section of the Action Agenda relates directly to this project:

"Support and build local partnerships for urban waterways that foster community involvement, connection, understanding, and stewardship, promote public access, and help communities become active participants in restoration and protection."

Further, this project will advance the Stewardship Initiative and the Stewardship Workgroup in the protection and enhancement of Stewardship Sites through green design and public participation on lands surrounding these sites. Therefore, priority actions 15 and 16 from the Waters and Watersheds section of the Action Agenda also relate to this project.

Priority Action 15:
"Promote watershed planning efforts to implement Low Impact Development (LID) and other programs to reduce runoff volume and pollutant load from new development and retrofitting existing development, encouraging municipalities to adopt a "no net increase in runoff" approach that seeks to cap the water quality and quantity impacts of impervious surfaces in LIS watersheds."

Priority Action 16:
"Promote green storm water infrastructure projects in municipalities and at large facilities such as college campuses, shopping malls, and commercial industrial parks to reduce runoff from existing development."

The LIS Stewardship Initiative and Workgroup
The LIS Stewardship Initiative was formed by the LISS to identify places with significant ecological or recreational value throughout the Sound and develop a strategy to protect and enhance these special places. The Stewardship Initiative follows through on recommendations made in the CCMP and the *2003 Long Island Sound Agreement*, which call for the conservation of natural resources and increased public access around the Sound. To coordinate Stewardship Initiative efforts and to identify sites with ecological and/or recreational importance (e.g., Stewardship Sites), the LISS formed a bi-state (CT and NY) Stewardship Workgroup (http://longislandsoundstudy.net/about/committees/stewardship-work-group/).

As a culmination of over three years of effort, the Stewardship Workgroup identified 33 inaugural Stewardship Areas. LIS's Stewardship Sites represent some of the best examples of intact, highly-

functioning terrestrial and intertidal coastal habitats along LIS. These sites provide essential habitat supporting a diversity of plant and wildlife species, open space for people to enjoy, and outdoor laboratories for studies on marsh migration, climate change and other critical natural resource management research questions.

Patches of high ecological value, like Stewardship Sites, cannot be managed in isolation. They are part of a larger landscape mosaic affected by activities on surrounding lands. Many of the Stewardship Sites are embedded within a highly urbanized landscape accommodating a variety of uses. The proximity of urban areas to some of the most ecologically significant habitat around LIS poses both threats and opportunities to maintain or enhance the ecological function of these habitats. The intent of the project is to evaluate if green infrastructure (GI) and low impact development (LID) practices can be adopted at or near Stewardship Sites to address these threats and opportunities. Such practices might include restoring or creating wetlands to control flooding or manage water pollution pathways adjacent to Stewardship Sites. Other opportunities might include creating urban patch habitat to provide stopover areas for wildlife using Stewardship Sites for feeding or breeding. It's further intended that such practices will help develop public support, recognition, and awareness of resource management issues near Stewardship Sites through community involvement in the planning and design of GI/LID projects.

1.7 Project Objectives

The objectives of this project are as follows:

- This project will provide a better understanding of both the most critical environmental services and threats to those services on land surrounding Stewardship Sites.
- This project will create design solutions using GI/LID and other conservation and resource management practices, including an evaluation of the benefits and effectiveness of these design solutions.
- Through community involvement in the pilot GI/LID assessment and design process, the project will engage a broader audience in urban GI/LID and redevelopment design and future implementation that could lead to enhanced ecological planning and design across multiple Stewardship Sites.

Secondary data will be utilized to guide site selection, evaluate the benefits and threats to selected sites, and to provide base information needed for conceptual GI/LID design.

1.8 Secondary Data Needed

Secondary data needed includes a variety of Geographic Information System (GIS) based datasets to evaluate and select sites for conceptual project design. Types of data will include environmental and geographical data necessary for model inputs and site evaluation, including but not limited to soils, topography, land use/land cover, significant habitats, and invasive species locations. The age of the data will vary based on the dataset, as geological data (i.e., soils) is older (greater than 30 years old) while fine topographical data and land use/land cover data is newer (less than 10 years old). The most recent data

available will be utilized for each parameter required for analysis. As the Stewardship Sites are located both within New York and Connecticut, datasets with broad geographical ranges will be preferred, however, based on availability, datasets with narrower geographical ranges may be utilized to supplement gaps in data with broader ranges. Data of the highest geographical precision and most thorough collection of information will be preferred, however, coarser datasets (i.e., those with less geographical precision and greater information generalizations) will not be excluded from use if finer datasets are not available.

1.9 Planned Approach

The Site Selection methodology, Analysis of Environmental Benefits and Analysis of Environmental Threats will all require some form of data analysis. The Site Selection methodology will rely on review of existing data to generate outputs needed for site analysis. Complex statistics will not be utilized for Site Selection; only basic statistics (such as averages and percentages) will be utilized to quantify land use and land cover. Units of analysis for land use and land cover are acres.

Assessment of the Beneficial Environmental Services of the Study Area will utilize an existing model known as InVEST (Integrated Valuation of Environmental Services and Tradeoffs). The model was developed by the Natural Capital Project, which is a partnership among Stanford University, The Nature Conservancy, the World Wildlife Fund, and the University of Minnesota to provide a valuation of ecosystem services for target sites. NP&V evaluated a number of existing models that could be used to provide economic valuation of ecosystem services, and found the InVEST model to be the most comprehensive model for application in this portion of the project. The InVEST model can be utilized at the watershed scale and utilizes input parameters that appropriate represent the scale of the study area. Parameters to be utilized for analysis at the watershed scale include soils, topography, and land use/land cover. Use of this model for the project will only include inputs of secondary data; no modification to the model will be conducted as part of this project. In particular, the sub-model Nutrient Retention: Water Purification will be utilized. This model computes the nutrient export and retention with the watershed and can provide an estimation of cost of nutrient removal, and therefore a valuation of ecosystem services. Units utilized in this model include kilograms of nutrient per hectare or per watershed, and currency per watershed per year.

Assessment of Existing and Potential Adverse Impacts within the Study Areas will include both an analysis of existing land uses of concern (e.g., industrial uses, high density residential uses) and potential land uses and associated land coverage under a scenario in which lots are fully developed as per current zoning regulations. Uses of concern (e.g., industrial uses, high density residential uses) will be clearly identified and mapped, and provided in a GIS database. Other impacts to the selected sites to be analyzed will include the presence, abundance and potential spread of invasive species within the site. Each site's habitat suitability will be evaluated for invasive species approaching the region to determine the threat potential of these species. No statistical analysis will be utilized for this task.

2.0 SOURCES OF SECONDARY DATA

2.1 Data Sources

The following table presents the sources of data anticipated to be used for the project analysis.

Non-Direct Measurement (Secondary Data)	Data Source (Originating Organization, Report Title and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/Collection Dates)	How Data Will Be Used	Limitations on Data Use
Topography	1. Suffolk County: Suffolk County LiDAR Topography, 2006 2. Remaining New York Study Area: National Elevation Dataset, 2011 3. Connecticut - ACOE Coastal LiDAR 2012	1. Suffolk County, GIS shapefiles, collected 2006 2. USGS partnership, Digital Elevation Models, Collected 2011 3. Army Corp of Engineers, Digital Elevation Model, collected 2012	Topographic data will be utilized to delineate watershed contributing areas to target study areas.	1. Data accuracy limited to resolution of data collected. 2. Data not corrected for large buildings which may display as mounds.
Land Use	Appropriate municipal organization that maintains property tax records	Municipal tax assessor, GIS shapefiles, generated for the current tax year	Land use codes provided by municipal tax assessor will be utilized to determine land use patterns in the watershed contributing area to the study areas.	1. Data accuracy is limited to the accuracy of the codes entered by the tax assessor.
Land Cover	1. New York: National Land Cover Dataset	1. Multi-Resolution Land Characteristics Consortium (MRLC), raster, collected 2011	Land cover will be utilized to provide coverage type for the InVEST model.	1. Data accuracy is limited to the

	2. Connecticut: University of Connecticut Land Cover Dataset	2. University of Connecticut, 2010		resolution of the raster dataset.
Public Lands	Appropriate municipal organization that maintains tax records	Municipal tax assessor, GIS shapefiles for the current tax year	Availability of public lands will be assessed to determine locations for GI/LID improvements.	1. Data based on tax parcel boundaries and do not represent survey grade boundaries.
Soil Data	Natural Resource Conservation Service (NRCS) of the United States Department of Agriculture (USDA)	NRCS GIS shapefiles	The root restricting layer depth will be utilized in the InVEST model.	1. Data limited to the resolution the data was generated at.
Significant Natural Habitats	1. New York – New York Natural Heritage Program (NYNHP) 2. Connecticut – Connecticut Critical Habitat Dataset	1. NYNHP GIS based shapefiles 2. University of Connecticut, GIS based shapefiles	Habitat locations will be utilized to aid in site selection.	1. Data limited to lands surveyed by NYNHP.
Invasive Species	1. New York – iMap Invasives 2. Connecticut – Invasive Data from Land Managers	1. NYNHP GIS based shapefiles 2. Site specific land manager data	Invasive species locations will be utilized to aid in site selection and assess threats to target sites.	1. Data limited to areas surveyed by users. 2. Data limited to that collected by land manager.

2.2 Data Generators

Data generators of data anticipated to be utilized in the project include a variety of municipalities, counties, and State and Federal agencies. A list of anticipated data generators is provided in the table in Section 2.1 above.

2.3 Hierarchy of Data Sources

A hierarchy of data sources to be utilized for the proposed project is not anticipated to be necessary as most data for the proposed project contains a single source. In the event that multiple sources are available, the most complete and highest quality dataset will be utilized first, followed by any additional data sources that have the information needed to fill data gaps in the primary data source. All data limitations and gaps will be fully disclosed, and supplementation of data will be noted in any deliverable.

2.4 Rationale for Selecting Data Sources

In many cases, a single source of data is anticipated to be available due to the specific nature of the data source. In the event that multiple data sources are available, the dataset that is the most complete and of the highest quality will be selected for inclusion in project analysis. Complete data, as defined in Section 3.1, is data that provides good geographic coverage of the area being studied, and has values for the geographic area of interest (i.e., no null values are present). Also as defined in Section 3.1 below, high quality data includes data from a reliable source, data that is complete, data that has been widely utilized and is trusted, and data that is precise.

2.5 List of Sources of Secondary Data

The sources of secondary data gathered will be identified in any project deliverable. All associated metadata for each dataset utilized will be listed within the final report. If the list of sources is too long for inclusion on the deliverable (e.g., a map with limited space for text), a separate reference page will be generated to accompany the deliverable.

3.0 QUALITY OF SECONDARY DATA

3.1 Quality Requirements

Data should meet the following quality assurance requirements. It is recognized that some data may not meet all of these requirements; however, the data may still be necessary for analysis. If a particular requirement is not met, it will be disclosed in the appropriate deliverable product.

- Data should come from a reliable source.
    - Examples of reliable sources include Federal, State, County and municipal agencies. Other reliable sources include recognized not-for-profit organizations (e.g., The Nature Conservancy), and volunteer groups with established Quality Assurance/Quality Control procedures.
    - Data re published in peer-reviewed articles or publications.
- Data have been widely used and/or trusted by scientists and professionals in the subject.
- Completeness
    - Data should provide good coverage for the geographic area being studied.
    - Data should have a value for the geographic area of interest (i.e., null values should not be present)
- Precision
    - Data should be precise. Precision is a measure of agreement among repeated measurements of the same property under identical, or substantially similar conditions, expressed generally in terms of the standard deviation (USEPA 2002). Geographic data should be at the highest level of precision possible given the environmental factor being represented by the data.

NEIWPCC may implement, at their discretion, various audits or reviews of this project to assess conformance and compliance to the quality assurance project plan in accordance with the NEIWPCC Quality Management Plan.

3.2 Data Review and Evaluation

The quality of the secondary data will be determined based on data quality requirements defined in Section 3.1 of this document. In determining data quality, the completeness of the dataset will be assessed first, by inspecting data description (usually metadata) or the dataset itself (whichever is more readily available). If completeness is deemed adequate, other quality requirements will be assessed by inspecting the QAPP for the data, other QA/QC documentation, metadata, and/or other information obtained from data providers.

If the project team encounters issues with the data and limitations of the data, the following hierarchy of corrective actions will be utilized:

1. Utilize another data source if available and deemed appropriate for the intended use.
2. If another data source is not available, consider loosening or tightening of acceptance criteria, as applicable.
3. If loosening or tightening the acceptance criteria still does not meet the needs of the intended use of the data, alternative corrective actions will be determined and documented in the final report.

3.3 Disclaimers

All project deliverables will indicate the existence of this QAPP. As stated previously, any limitations in data quality will be fully disclosed. If a decision is made to use data of unknown quality, this will be indicated in a disclaimer that will be added to any project deliverable. The disclaimer will read as follows:

"These data are of unknown quality and presented here for illustrative purposes only. No inferences regarding the environmental health or character of the study site should be made based on these data until their quality can be determined."

4.0 DATA REPORTING, DATA REDUCTION, AND DATA VALIDATION

4.1 Data Reduction

In general, data will be manipulated as little as possible. Data reduction may be required to graphically display the information in a condensed, more easily understandable format and, in some cases, to establish or show specific data characteristics.

The following are some examples of anticipated or possible data reduction procedures (provided that adequate data are available):

- Data units may need to be changed for report consistency and/or to allow comparisons across data sources.
- Certain datasets may be reduced and presented as percentages (e.g., percentage of a study area that is comprised of industrially used land)
- Some data reduction may also be needed to display data in map form (maps will normally be intended to summarize some of the available information). Possible data reductions include:
    - Illustration of overall land use rather than on a parcel by parcel basis.
    - Illustrate of significant natural habitats, regardless of habitat type.
    - Illustration of overall watershed contributing area, regardless of sub-watersheds.

4.2 Data Validation

The reporting of accurate project data will generally be ensured by carefully conducting and clearly expressing data reduction (if and when needed) and visual inspection of data before including in the final report. Specifically, the following validation process will be utilized:

- A copy of every original dataset obtained from each data source will be saved as a read-only, protected file in the event the integrity of the working datasets is compromised.
- Working data will be stored in a file geodatabase and will include all relevant raw data, which will be locked for editing.
- Data manipulation will be minimized to decrease the chances of inadvertently introducing errors. If any data reduction or manipulation is needed, it will be calculated starting from the raw, protected dataset.
- Prior to inclusion in the final report, raw and/or reduced data will be displayed in graphic form and inspected to detect any anomalous value (to be performed by Lara Urbat, NP&V Environmental Scientist). If apparently anomalous values are detected, any data reduction will be verified. If the seeming anomaly is present in the original dataset, the data generator will be contacted for clarification and/or the issue will be discussed with the appropriate parties. Any decision to eliminate “anomalous values” will be documented in the working data spreadsheets which will be

kept as part of the project files and will be noted in the list of sources of secondary data (Section 2.5).

- In rare occasions, a datset may only be available in hard copy format. In these cases, data will be manually entered into a spreadsheet and/or digitized to correlate the dataset with its geographic locaiton. To ensure an error-free copy, summary statistics will be checked if possible. In addition, all manually entered values will be crossed-checked for accuracy.
- Data will be maintained for the duration of the project by the project consultant. All data will then be transferred to NEIWPCC for maintenance in accordance with NEIWPCC's grant requirements. A permanent copy of the data will be kept by the consultant.
- Data will be backed up in two ways:
    - Data will be copied to a DVD and stored with the file documents at the consultant's place of business
    - Data will be backed up electronically through the consultant's routine back up of the entire company network
- For all GIS data, verification and validation will occur through the following:
    - verifying that each output data set falls into the correct geographic location and has the specified coordinate system and precision (to be performed by Lara Urbat, NP&V Environmental Scientist);
    - verifying that the files to be delivered are of the specified format (to be performed by Lara Urbat, NP&V Environmental Scientist);
    - verifying that each data set can be unpackaged, uncompressed, or otherwise configured for use by end-users (to be performed by Lara Urbat, NP&V Environmental Scientist);
    - and verifying that all of the needed database tables and fields are present (to be performed by Lara Urbat, NP&V Environmental Scientist).

All data collection and analysis will stop if there is a problem with following the QAPP or if it is necessary to amend the QAPP.

4.3 Deliverables

The deliverable of this project will be a report with associated maps, model outputs, and a conceptual GI/LID design for each of the two selected sites. The final report will document any uncertainty of the validated data and will document the limitations of the data used. Any QA anomalies, unanticipated circumstances affecting data quality, or derivations from the approved QAPP will be reported in the appropriate quarterly report to NEIWPCC (to be reported by Lara Urbat, NP&V Environmental Scientist). A summary of each public meeting, including a summary of topics discussed, comments received and action items will be provided. A two page project summary of the project will also be produced based on the final report for the purpose of future public education. These products will be available in hard copy and online.

5.0 REFERENCES

New England Interstate Water Pollution Control Commission (NEIWPCC) 2006. Guidance for Quality Assurance Project Plans. http://www.neiwpcc.org/quality/quality-docs/qapp31march06.pdf

U.S. EPA. 2002. QA/G-5 - Guidance for Quality Assurance Project Plans. EPA/240/R-02/009 December. http://www.epa.gov/quality/qs-docs/g5-final.pdf

U.S. EPA. 2001. EPAQA/R-5. EPA Requirements for Quality Assurance Project Plans. EPA/240/B-01/003. March. http://www.epa.gov/quality/qs-docs/r5-final.pdf

U.S. EPA Region I. 2006. EPA New England Example Streamlined QAPP Tables/Template. http://www.epa.gov/NE/lab/qa/streamlinedqapp.html

U.S. EPA Region I and IX. 2005. Quality Assurance Project Plan Development Tool Version 1.1. December. http://www.epa.gov/region1/lab/qa/qaprojectplandevtool.html

APPENDIX B

SITE SELECTION MATRICES

New York Site Selecction - Tier 1

Scoring Criteria					
Land Cover - Percent Developed	0-20	20-40	40-60	60-80	80-100
Score	1	2	3	4	5
Percent of Watershed with Significant Natural Habitat	0-20	20-40	40-60	60-80	80-100
Score	1	2	3	4	5
Percent of Watershed that is Comprised of Publicly Owned Land	0-20	20-40	40-60	60-80	80-100
Score	1	2	3	4	5

New York Site Selecction - Tier 1

Site	Land Cover Score	Natural Habitat Score	Public Land Score	Land Manager Response	Score
Alley Pond Park	4	0	3	3	10
Baiting Hollow Tidal Wetlands	1	1	2	3	7
Caleb Smith State Park	4	1	2	1	8
Caumsett State Park	1	3	4	1	9
Cedar Beach	1	0	1	1	3
Centre Island Town Beach	4	0	2	1	7
Crab Meadow Wetlands and Beach	3	2	3	1	9
Eatons Neck Point	1	0	1	1	3
Edith Read Wildlife Sanctuary	2	0	5	1	8
Flax Pond State Tidal Wetlands and Laboratory	2	0	2	1	5
Fort Totten	5	0	5	0	10
Hempstead Harbor/Tappen Beach and Marina	4	0	1	1	6
Hempstead Harbor Park	3	0	3	1	7
Jamesport State Park and Preserve	1	0	5	1	7
Long Beach	1	0	3	1	5
Manhasset Bay	5	0	1	3	9
Marshland Conservancy	1	0	5	1	7
Mattituck State Tidal Wetlands	3	0	1	1	5
Mill Neck Preserve County Park	4	0	1	1	6
Mitchells Creek	5	0	1	1	7
Morgan Memorial Park	5	0	1	1	7
Mount Sinai Harbor	4	0	2	1	7
Nissequogue River/Nissequogue River State Park	4	1	2	1	8
Oyster Bay National Wildlife Refuge/The Waterfront Center	2	0	1	1	4
Pelham Bay Park	2	1	5	3	11
Playland Park	5	0	3	1	9
Port Jefferson Harbor	3	0	1	1	5
Sands Point Preserve	3	0	2	1	6
Shu Swamp Nature Preserve	3	0	1	1	5
Sunken Meadow State Park	3	1	3	3	10
Wildwood State Park	1	4	1	1	7
	St. Dev.	**Mean**			
	2.016064515	7			

NY Site Selection - Tier 2

Site	Developed High Intensity (Acres)	Developed Medium Intensity (Acres)	Developed Low Intensity (Acres)	Developed Open Space (Acres)	Totals
Alley Pond Park	74.4710792	216.0475374	190.6629881	160.4014963	641.583101
Pelham Bay Park	80.67128903	181.8017252	215.0332388	544.8331579	1022.339411
Sunken Meadow	29.1835163	83.45699633	271.0523905	891.2393744	1274.932278
Category Weight	0.4	0.3	0.2	0.1	1
Raw Scores					
Alley Pond Park	2	3	1	1	7
Pelham Bay Park	3	2	2	2	9
Sunken Meadow	1	1	3	3	8
Weighted Scores					
Alley Pond Park	0.8	0.9	0.2	0.1	2
Pelham Bay Park	1.2	0.6	0.4	0.2	2.4
Sunken Meadow	0.4	0.3	0.6	0.3	1.6

CT Site Selection - Tier 1

Scoring Criteria					
Land Cover - Percent Developed	0-20	20-40	40-60	60-80	80-100
Score	1	2	3	4	5
Percent of Watershed with Significant Natural Habitat	0-20	20-40	40-60	60-80	80-100
Score	1	2	3	4	5
Percent of Watershed that is Comprised of Publicly Owned Land	0-20	20-40	40-60	60-80	80-100
Score	1	2	3	4	5

CT Site Selection - Tier 1

Site	Land Cover Score	Natural Habitat Score	Public Land Score	Land Manager Response	Score
Barn Island Wildlife Management Area	2	1	1	1	5
Bluff Point State Park Reserve	2	1	2	1	6
Calf Pasture Beach	5	0	4	1	10
Charles E. Wheeler Wildlife Area	4	1	1	1	7
Connecticut River Ramsar Complex	1	1	1	1	4
Great Meadows Unit of the Stewart B. McKinney	4	2	2	1	9
Hammonasset Beach State Park and Natural Area	2	2	4	1	9
Harkness Memorial State Park	2	1	2	1	6
Pattagansett Marsh Preserve/Watts Island	2	1	1	3	7
Quinnipiac River Marsh Wildlife Area	4	1	1	1	7
Rocky Neck State Park	1	1	1	1	4
Sandy Point Bird Sanctuary	4	1	1	1	7
Sherwood Island State Park	4	1	1	1	7
Veterans Memorial Park	5	0	4	1	10
West Rock Ridge State Park	3	1	2	1	7
	St. Dev.	**Mean**			
	1.825741858	7			

CT Site Selection - Tier 2

Site	Developed High Intensity (Acres)	Developed Medium Intensity (Acres)	Developed Low Intensity (Acres)	Developed Open Space (Acres)	Totals
Calf Pasture Beach	21.35367723	29.15747521	28.66659252	27.51931749	106.6971
Great Meadows Unit of the Stewart B. McKinney	502.1864605	834.1215767	293.3601033	137.9224986	1767.591
Hammonasset Beach State Park and Natural Area	14.0485815	79.4392477	246.7251894	275.0433354	615.2564
Veterans Memorial Park	8.652254132	27.93884734	5.376586777	9.99680303	51.96449
Weight	0.4	0.3	0.2	0.1	1
Raw Scores					
Calf Pasture Beach	3	2	2	2	9
Great Meadows Unit of the Stewart B. McKinney	4	4	4	3	15
Hammonasset Beach State Park and Natural Area	2	3	3	4	12
Veterans Memorial Park	1	1	1	1	4
Weighted Scores					
Calf Pasture Beach	1.2	0.6	0.4	0.2	2.4
Great Meadows Unit of the Stewart B. McKinney	1.6	1.2	0.8	0.3	3.9
Hammonasset Beach State Park and Natural Area	0.8	0.9	0.6	0.4	2.7
Veterans Memorial Park	0.4	0.3	0.2	0.1	1

APPENDIX C

InVEST MODEL OUTPUTS & CALCULATIONS

Sunken Meadow State Park

Watershed ID	Area (ac)	Percent of Total Area (ac)	Total Phosphorus Load (kg/yr)	Total Phosphorus Export (kg/yr)	Percent Phosphorus Rentention	Phosphorus Exported Per Year Per Acre (kg/yr)/ac	Total Nitrogen Load (kg/yr)	Total Nitrogen Export (kg/yr)	Percent Nitrogen Retention	Nitrogen Exported Per Year Per Acre (kg/yr)/ac	Percent of Total Phosphorus Exported to Contributing Area	Percent of Total Nitrogen Exported to Contributing Area
1	251.05	10.70	585.23	197.82	66	0.79	4719.69	1462.94	69	5.83	11	11
2	484.34	20.63	1223.63	429.67	65	0.89	9257.22	3009.43	67	6.21	24	23
3	77.33	3.29	176.38	52.79	70	0.68	1412.89	379.09	73	4.90	3	3
4	147.38	6.28	357.44	116.83	67	0.79	2730.03	825.13	70	5.60	7	6
5	121.90	5.19	357.33	120.95	66	0.99	2513.38	821.82	67	6.74	7	6
6	38.57	1.64	116.57	44.55	62	1.15	810.42	300.88	63	7.80	3	2
7	170.84	7.28	253.35	46.50	82	0.27	2924.19	505.30	83	2.96	3	4
8	86.08	3.67	291.68	65.27	78	0.76	2481.15	531.67	79	6.18	4	4
9	67.55	2.88	173.17	66.22	62	0.98	1294.53	458.08	65	6.78	4	4
10	367.54	15.66	686.41	134.53	80	0.37	6959.55	1060.62	85	2.89	8	8
11	161.62	6.89	426.30	158.83	63	0.98	3187.44	1108.22	65	6.86	9	9
12	76.45	3.26	249.02	88.20	65	1.15	1725.06	599.68	65	7.84	5	5
13	102.82	4.38	231.68	69.84	70	0.68	1838.79	507.71	72	4.94	4	4
14	76.22	3.25	229.21	64.84	72	0.85	1637.06	450.05	73	5.90	4	4
15	117.54	5.01	400.93	117.64	71	1.00	2797.28	804.27	71	6.84	7	6

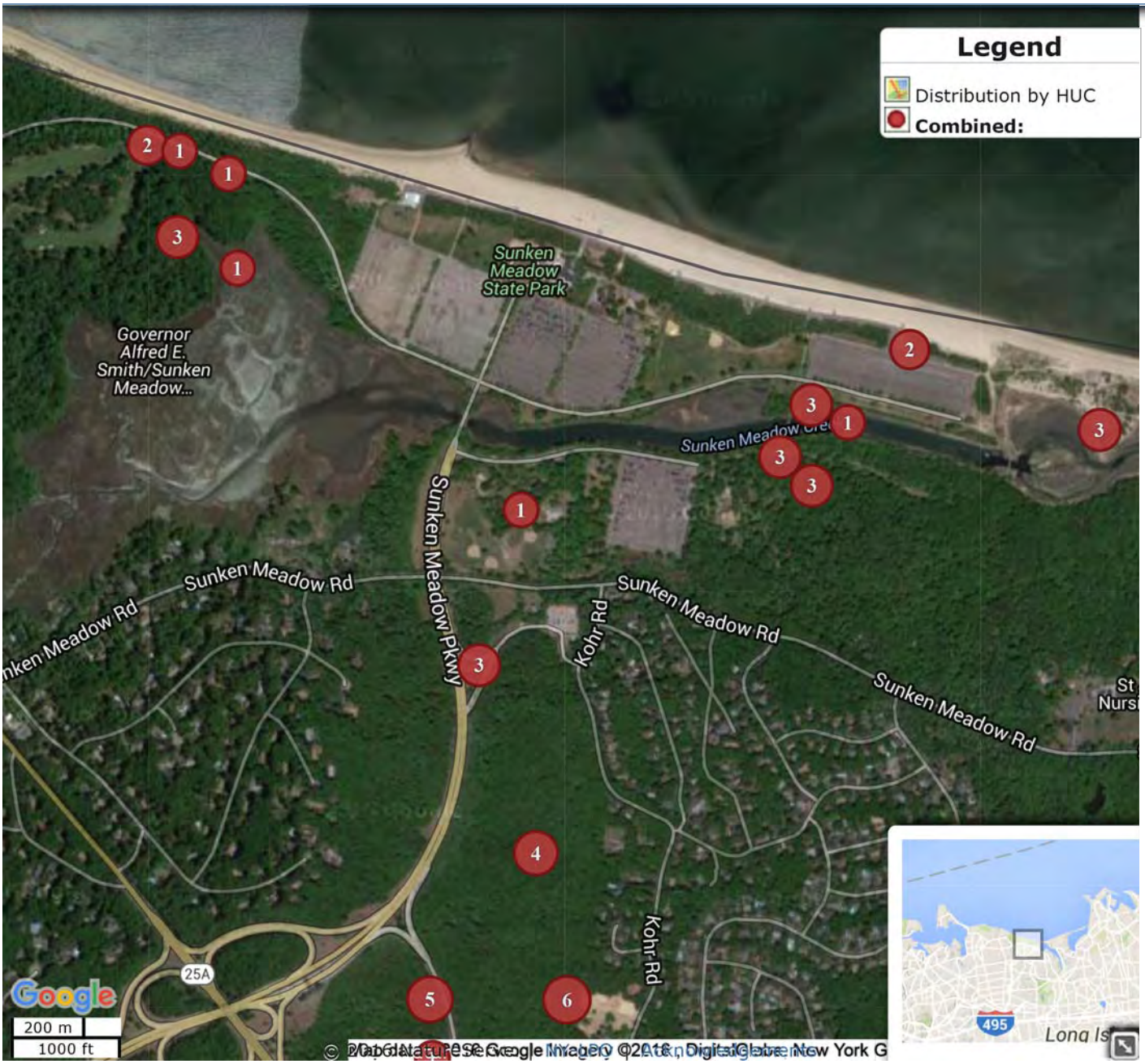
Great Meadows- Stewart B. McKinney Preserve

Watershed ID	Area (ac)	Total Phosphorus Load (kg/yr)	Total Phosphorus Export (kg/yr)	Phosphorus Exported Per Year Per Acre (kg/yr)/ac	Percent Phosphorus Retention	Total Nitrogen Load (kg/yr)	Total Nitrogen Export (kg/yr)	Nitrogen Exported Per Year Per Acre (kg/yr)/ac	Percent Nitrogen Rentention
0	2683.45	48385.91	16725.81	6.23	65.43	118299.35	39889.17	14.86	66.28

APPENDIX D

iMAPINVASIVES REPORT FOR SUNKEN MEADOW STATE PARK

iMapInvasives
Sharing information for strategic management



iMapInvasives
Sharing information for strategic management

New York User Tools

Generated Report

Report for Buffer_distance: 500 , Lon: 646679.6377184187 , Lat: 4529928.73816892

4 Total Observations Found

Date Generated: March 14, 2016

Counties: 1
Species: 4
Projects: 1
Organizations: 1
Data Entry Method: 1
Observation Species ID Method: 1

County Report - 1 Counties

1 **Suffolk**: 4

Species Report - 4 Species

Summary

Total Species: 4
Average Number of Observations: 1

Celastrus orbiculatus *Oriental Bittersweet, Asian Bittersweet, Asiatic Bittersweet* 1
1 observation 2-131407
Featured Species

Rosa multiflora *Multiflora Rose, Rambler Rose* 4
1 observation 2-129203
Featured Species

Ligustrum sinense *Chinese Privet* 2
1 observation 2-139479

Lonicera japonica *Japanese Honeysuckle* 3
1 observation 2-129271
Featured Species

Project Report - 1 Projects

OPRHP Statewide Observations 1

4 observations

Lead Contact: Alyssa Reid
Active: True

Members
Alyssa Reid | Ariana Newell | Bella Ciabattoni | Caitlin Conn | Casey Holzworth | Christina Croll | Danielle Dewey | Edwin McGowan | Evyn Iacovitti | Heidi Krahling | HudsonValleyStrikeTeam OPRHP | Jesse Jaycox | Julie A. Lundgren | Kimberly Smith | Laurel Engelsson | Lynn Bogan | Mark Rogers | Meg Janis | Melissa Plemons | Pamela Otis | Robert O'Brien | StatewideStrikeTeam OPRHP | Tom Hughes

Organizations Report - 1 Organizations

New York State Office of Parks Recreation and Historic Preservation (NYS OPRHP) 1

4 observations

Data Entry Methods Report - 1 Data Entry Methods

On-line 1

4 Data entry methods

Observation Species ID Method Report - 1 Observation Species ID Methods

c) ID by expert 1

4 Observation Species ID methods

APPENDIX E

COMMUNITY ENGAGEMENT PROTOCOL

COMMUNITY OUTREACH TOOLKIT

URBAN DESIGN AND LOW IMPACT DEVELOPMENT

NELSON, POPE & VOORHIS, LLC
ENVIRONMENTAL • PLANNING • CONSULTING

INTRODUCTION AND BACKGROUND

This toolkit has been developed to assist Land Managers and other leaders in conducting effective and meaningful community engagement programs for achieving Urban Design/Low Impact Development projects for Long Island Sound Study Stewardship sites and within the surrounding watershed.

The Long Island Sound Stewardship Initiative was formed by the Long Island Sound Study (LISS) to identify places with significant ecological or recreational value throughout the Sound and develop a strategy to protect and enhance these special places. The Stewardship Initiative follows through on recommendations made in the Comprehensive Conservation and Management Plan (CCMP) and the 2003 Long Island Sound Agreement, which call for the conservation of natural resources and increased public access around the Sound. To coordinate Stewardship Initiative efforts and to identify sites with ecological and/or recreational importance (e.g., Stewardship Sites), the LISS formed a bi-state (CT and NY) Stewardship Workgroup[1].

***Project objectives include to*:**

- **Provide a better understanding of both the most critical environmental services and threats to those services on land surrounding Stewardship Sites.**
- **Create design solutions using GI/LID and other conservation and resource management practices, including an evaluation of the benefits and effectiveness of these design solutions.**
- **Engage a broader audience in urban GI/LID and redevelopment design**

Places with high ecological value, such as Stewardship Sites, cannot be managed in isolation. They are part of a larger landscape mosaic and are impacted by activities on surrounding lands. Many of the Stewardship Sites are embedded within highly urbanized landscapes accommodating a variety of uses. The proximity of urban areas to some of the most ecologically significant habitat around LIS can pose both threats and opportunities for maintaining and even enhancing the ecological function of these habitats. An

[1] www.longislandsoundstudy.net/about/committees/stewardship-work-group

evaluation of green infrastructure (GI) and low impact development (LID) practices for Stewardship Sites is beneficial to determine if such practices can be adopted at or near Stewardship Sites to address these threats and opportunities. Such practices might include restoring or creating wetlands to control flooding, managing water pollution pathways adjacent to Stewardship Sites, or creating urban patch habitat areas to provide stopover areas for wildlife using Stewardship Sites for feeding or breeding. It's further intended that such practices will help develop public support, recognition, and awareness of resource management issues near Stewardship Sites through community involvement in the planning and design of GI/LID and related projects and initiatives.

This protocol has been designed to provide Project Managers, Land Managers and/or Project Partners guidance and recommended steps for conducting successful community engagement programs and obtaining input for the implementation of GI/LID projects.

Before the community outreach process begins, a plan to build partnerships and to engage the community should be developed.

The following sections are intended to provide a step by step guide to a successful community engagement program. This guide is written for land managers of Stewardship Sites to take the lead role in community outreach and engagement, however, it is noted that it can be used by any individual or organization that seeks to act as project manager in achieving goals and objectives.

It is recognized that the goals and objectives for each site and watershed area will be unique, and thus it is suggested that the very first step be the creation of a map of the watershed area which identifies issues and opportunities that can provide focus for defining goals and objectives - and ultimately possible solutions and well defined projects for achieving goals. While each site and watershed will be unique, this document provides a basic roadmap for land managers or other leaders to follow, with suggestions for identifying strengths, weaknesses, opportunities an

threats, identifying projects/solutions, tools that can be used to engage in partnerships, methods for reaching and engaging the right partners to achieve goals.

An overview of the community engagement roadmap is provided below and more details are provided in the following sections. In addition, the guide provides examples that can be applied to or can simply inspire new ideas for the specific location.

GENERAL "ROADMAP" FOR A COMMUNITY ENGAGEMENT PROGRAM

1. Identify Issues & Opportunities for the Stewardship Site and watershed area.

2. Define goals and objectives, including specific projects and solutions for addressing identified issues and opportunities.

3. Identify and engage appropriate partners and champions. Identify and engage champions for achieving goals and objectives. Depending upon the opportunities that exist and specific objectives, identify appropriate partners for achieving goals. For example, if the goal is the reduction of nitrogen generated by pet waste and excessive use of fertilizer, partners could be local civic organizations, chamber of commerce, local landscaping companies and the municipal stormwater manager.

4. Create the message and get the message out. This can be a fact sheet and/or webpage which identifies basic information and benefits of the projects. The materials should have enough artistic and aesthetic features to generate interest and hold the audience's attention. The intent should be to educate and create excitement, and ideally, engage the community in the project. If appropriate, the message should then be refined to reflect the specific audience (for example, local officials would be most interested in those features that provide benefits to their constituents, whereas local stormwater official would be interested in how a project achieves goals in the municipality's Stormwater Program).

5. Engage the community.

6. Monitor effectiveness of tools utilized and continue to refine program. (This includes revisiting the objectives as goals are achieved to ensure that meaningful community engagement occurs and the program isn't stale. It also includes updating outreach tools and methods to stay up to date with changes in the way people use social media - which is changing rapidly).

STEP 1: IDENTIFY ISSUES, OPPORTUNITIES, GOALS & OBJECTIVES

This step will assist in the identification of issues, opportunities, goals and objectives for a Stewardship Site and watershed area.

It is recommended that a large base map be prepared at the onset of each project which illustrates the boundary of the watershed, location of the Stewardship Site, and key features within the watershed area (such as major land uses, major roads, water features, public lands, institutional uses). The base map can then be utilized to generate an Issues and Opportunities map such as the sample shown below.

Source: Town of Riverhead Peconic River/Route 25 Corridor NYS Brownfield Opportunity Area Step II Nomination, December 2015.

Each site and contributing watershed will have its own unique issues and opportunities that will be identified on the map, but commonalities could include:

- Site specific issues, underutilized areas, needs
- Marsh loss
- Invasive species
- Point sources and known non-point sources of pollution
- Local land uses of concern
- Vacant lands that could present an opportunity for LID projects
- Sensitive shoreline areas (erosion etc.)
- Shellfish closure areas
- Recreational features (trails/parks)

STEP 2: DEFINE GOALS & OBJECTIVES AND IDENTIFY PRIORITIES

Utilize the Issues and Opportunities Map to identify goals and specific objectives to achieve the goals. An example of goals and objectives is as follows:

Goal: Reduction in nitrogen loading to the LIS.

Objectives: (It is noted that objectives can be broad in nature, but should be refined for specific projects/initiatives to implement the objective).

1. *Installation of Green Infrastructure to intercept stormwater to allow uptake of nutrients prior to recharge to groundwater and ultimate conveyance to surface waters.*
2. *Encourage compliance with pet waste laws by installing pet waste stations in strategic locations.*
3. *Discourage feeding waterfowl in parks through installation of educational signage.*

Objectives should be refined at this stage as tangible projects and initiatives geared towards achievement of the site and contributing watershed goals. These could include actual physical construction of LID projects, implementation of regulatory changes in coordination with municipalities, or educational programs. For a physical improvement, this could involve defining the location for and conceptual design for proposed enhancements. For regulatory initiatives, this might involve working with local municipal representative on suggested changes in local standards for stormwater management, procedures for local public works, or changes in local zoning designations.

The final task is this step is to identify Priorities. It is important to prioritize the various initiatives and chose paths for implementation. A large, or long range project should be mapped out into smaller tasks (for example phases outlined such as research, survey work, engineering design, funding, permitting, bid documents, and construction).

When starting the process, it is often a good idea to identify short term projects which can be achieved to create momentum and commitment from partners.

A project tracking worksheet is a useful tool to identify projects and tasks, and to track progress on implementation.

STEP 3: ADVISORY GROUP AND ESTABLISHING PROJECT PARTNERSHIPS

Where a plan includes multiple layers of goals and objectives, it is recommended that an advisory group or steering committee of key stakeholders be created to act as champions for the plan, oversee implementation of priority projects, and to act as liaisons to the organizations they represent and others in the community. This group should be chosen with care to ensure commitment to the mission. It is also important that the membership provide a balance of representation of the community, and also to create a group that will be respectful to one another and united in the goals of the plan. Members of this group will need to be able to commit to a long term appointment and be willing to agree to the terms established (for example to ensure that no one member dominate discussions or that no member uses the position pursue individual agendas). The advisory committee will be invaluable in identifying appropriate partners, as well as in project planning and implementation. Depending upon the expertise of the group, the committee may be available to assist in prioritization of projects, providing local knowledge, offering individual professional expertise, and assistance in outreach to achieve project goals. The level of involvement will depend upon the individual members of this committee, which is why it is important to choose the members carefully.

For implementation of individual projects and initiatives, it is important to identify and form appropriate partnerships which could include the local municipality, organizations, land owners and/or businesses. The involvement of various groups and individuals should vary depending upon the initiative being pursued. It is important to be respectful of people's time and involve partners where individuals can have a meaningful contribution to the implementation of a project. Potential partnerships may include:

- The local Stewardship Site Land Manager (if not the project manager)
- Municipal elected officials and staff (while this varies by municipality, it is expected that involvement of representatives from the departments dealing with community development, land management, planning, environmental, stormwater management, public works, and grants would be most beneficial)
- County, State and Federal Agencies (EPA, NYSDEC, CTDEEP)
- Long Island Sound Study representatives
- Local Soil and Water Conservation District
- Local Environmental Organizations
- Civic Associations and local residents
- Business Organizations (BID and/or Chamber of Commerce) and business owners
- Local Community Groups (such as Lions Club, Rotary, Kiwanis, Garden Club)

- Local schools and colleges/universities

Outreach to potential partners should occur as early as possible, since their expertise can be helpful in refining project/initiative details, identification of volunteer or funding options, and access to other resources that can be useful in implementation. For example, for a residential rain garden installation initiative, partnership with a local homeowner's association could aid in the identification of potential installation locations, have the ability to reach all of the homeowners in a neighborhood (to identify residents interested in building a rain garden on their property), and provide information about HOA restrictions.

STEP 4: CREATE A MESSAGE

In the beginning, the outreach goal should be to educate the community about the overall importance of the Stewardship Site and protection of the resources associated with it. This is intended to create an awareness of the program and mission, alert the public to watch for specific initiatives in the future that would benefit from their participation, and to provide a way for people to get involved. A project leader should consider the use of various mediums to get the message out, and always provide a means to collect contact information. See Section 5B on outreach tools and database management.

As projects are initiated, there will be a need to create project specific outreach materials which could be in the form of fact sheets, websites, tweets, facebook posts or radio announcements. It is important to remember to create messages that will appeal to the audience.

TIPS FOR CREATING MESSAGES:

- Always consider who you are appealing to. If you are looking for assistance, know what you're asking for.
- If you are preparing materials for an elected official, remember that they are often very busy, so keep your message brief and focus on what they will care about most. Highlight the benefits and consider how these will appeal to the goals of the official.

STEP 5: COMMUNITY ENGAGEMENT

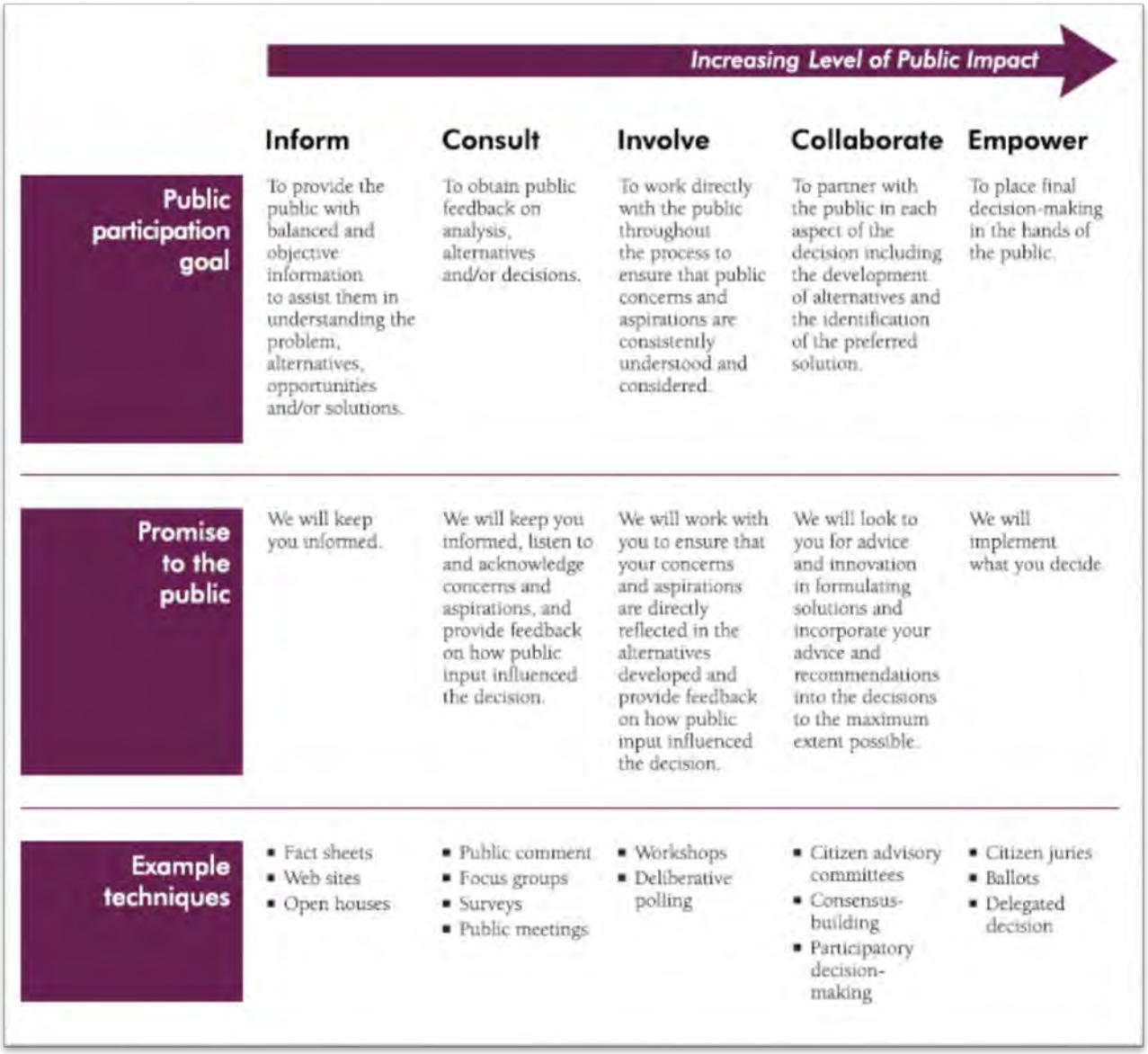
Once a project is defined, partnerships are established, and a message is created, engagement of the local community can begin.

STEP 5A: ENGAGE THE COMMUNITY

WHEN PLANNING EVENTS TO REACH THE PUBLIC, CONSIDER THE FOLLOWING:

- Messages (written or spoken) addressed to the public should be free of jargon and easily understandable.
- Events should be planned to allow for meaningful input - always consider the goal of the event.
- Rely on the Advisory Committee (if applicable) and/or other existing community networks to publicize events and invite participation from the public.
- Recognize community diversity – consider methods to involve individuals who would not typically attend a community meeting (but may be reached through participation in a local fair or athletic event).
- Design engagement events to keep in mind the level of participation that is appropriate to achieve the goals for public participation. The graphic below identifies the goals of the 5 levels of public participation (inform, consult, involve, collaborate, and empower).[2] The public should inherently or explicitly recognize their role from the onset and should never be misled about their role.

[2] Source: International Association for Public Participation "Spectrum of Public Participation"



EXAMPLE: GREEN INFRASTRUCTURE

Stakeholders are those people or organizations who may be affected by the design and implementation of a GI/LID project or those who can influence the implementation of that project. Stakeholders may be the residents or civic groups in the community the project is situated in or those who utilize the site. Any entity that uses the site should be included in the outreach process. Local knowledge on the part of project managers and land managers of people and groups active in the community is key to identifying and engaging stakeholders in the design and implementation process.

Stakeholders, including community groups, local land managers, municipal officials and staff, and local residents may not have a clear understanding of what green infrastructure is, and what role it can play in handling stormwater and improving water quality. "Why Green Infrastructure" which follows at the end of this section, may be reproduced and given to participants.

STEP 5B: DEVELOP A COMMUNICATION STRATEGY

A communication strategy provides a clear path for project communication with stakeholders and the community. In developing this strategy, it is important to be clear about the scope and purpose of the community engagement process – is the goal to design and prioritize elements of the project, achieve consensus and inform decision making, assist in implementation, review progress and track success of implementation? Having clear objectives will assist in encouraging partners to collaborate and will help determine what forms of public outreach to use. There are many avenues to engage the public, through public meetings, workshops and volunteer activities, and by using traditional media or online social media. All options should be considered in order to maximize outreach.

It is important to scale the scope of social media outreach to the size and location of the project. Setting up (and managing) a Facebook page, creating a blogsite or using traditional print media may be the most effective tools for a smaller, short term project, whereas a larger, more comprehensive project may justify using more options such as creating a project webpage, using an email management service such as Constant Contact (which both helps to manage contacts and can interface with Facebook automatically if desired), using radio station messages, and print media.

For each project, the project leader (and Advisory Committee if desired) should determine what resources are available and chose those that meet the specific needs that will target the appropriate audiences.

The following is an overview of some popular message packages. Choose one (or more) that helps achieve the desired result with the available resources. Combining formats can reinforce your message considerably.

Print. By far the most popular format is print. Printed materials include fact sheets, brochures, flyers, magazine and newspaper articles, booklets, posters, bus placards, billboards, and doorknob hangers. They can be easily created and can be referred to again and again by the target audience.

Stuff. "Stuff" refers to promotional items or "give-aways." These include Frisbees, magnets, key chains, tote bags, coffee mugs, and bumper stickers. Give-aways represent a good format to promote watershed organizations, simple actions, and general awareness.

Media. Working with the professional media—newspapers, television, magazines, and radio—will help to reach broad target audiences. Opportunities to place your message in the media include informational news stories, people features, issue analyses, public service announcements, interview programs, call-in shows, editorial columns, and feature items related to sports, recreation, or outdoor living.

Internet. Increasingly, the Internet is becoming a powerful means of communication. It provides worldwide access to hundreds of thousands of sites containing millions of documents, chat rooms for special interest groups, and database/mapping features that are almost mind-boggling. Although the World Wide Web is used regularly and extensively by agency personnel, environmental group leaders, and the business community and can be a valuable format, average citizens still get the great bulk of their environmental messages from more traditional venues. Remember, too, that a Web-based approach is geared to a certain target audience—one that is very much "plugged in" and perhaps already attuned to your objectives.

GENERAL METHODS FOR OUTREACH INCLUDE:

- Social Media/Email, and
- Print Media (advertising, promoting articles via press releases) [3]

GENERAL COMMUNITY ENGAGEMENT ACTIVITIES INCLUDE:

- Public Meetings
- Public Workshops and Focus Groups
- Participation in community events

IN CONSIDERING METHODS FOR OUTREACH:

➲ Consider the time length of the project, and the capacity of the project managers to engage in a sustained social media campaign.

➲ Good database management practices are essential to conducting public outreach efficiently. Organization contacts into groups (such as press, local residents, community leaders, civic organizations and municipal managers) is advisable. A tool such as Constant Contact allows management of contacts by group, to make it easy to send messages to the appropriate groups.

***KEY* CONSIDERATION**

Before Engaging in a Social Media Campaign…

- Scale the scope of social media outreach to the size of the project
- Consider the time length of the project
- Use good database management practices

OUTREACH METHOD 1: SOCIAL MEDIA/EMAIL

Social media, such as Facebook, Instagram, Twitter, email marketing tools such as constant contact, blogsites, online surveys and online forums provide a myriad of opportunities for getting the word out and conducting public outreach. To successfully use these online tools, consideration should be given to scaling the scope of the outreach to the size of the project, and the capacity of the project managers and project partners to conduct and monitor these online platforms. It may be best to focus on one or two platforms, such as Facebook and LinkedIn, to achieve the best result. Additionally, it should be determined early in the engagement process who will have the authority to post on behalf of the project and who will monitor for responses. Maintaining a database of all participants, including people who attend public events, answer surveys and sign up for email updates is an important aspect of conducting any outreach

[3] There are other means of outreach, such as posting flyers on local bulletin boards, leaflets (door to door campaigning), use of lawn signs and digital signs (such as used at Fire Departments) to post event dates, however, this document provides more detail on those outreach tools that would be most efficient for long term GI/LID planning.

campaign. For more information on considerations to be given when making decisions regarding social media and database management, refer to the checklists in **Attachment A** including "Things to Consider" and "Database Management".

OUTREACH METHOD 2: PRINT MEDIA

It is recommended that all community engagement programs include the use of print media if possible. Print media includes articles and notices in print publications (including advertising), and also includes posters, flyers and handouts.

KEY CONSIDERATION

Remember to Use Traditional Media – not everyone has access to the web!

- Get to know your local reporter
- Use press releases
- Communicate clear

TIPS FOR USE OF PRINT MEDIA:

➲ When preparing a press release to send to a newspaper or journal:

- Communicate clearly and succinctly – provide information in the body of the press release giving details on the project. If for a community event, communicate when and where an event is being held, and a website if applicable, where more information can be found.
- Provide contact information for the responsible party.
- Know the local deadlines for printing – keep in mind that local papers may have a deadline a week or more before the day the paper is published.
- It is best to send a press release *as an attachment* to an email and in *Microsoft Word* format (do not send the release as a .jpg, and do not embed the release in the body of the email). The idea is to make it simple for the paper to print the story or notice. If pictures are included, send these as an attachment to the email, not embedded in it.

➲ If possible, become acquainted with journalists/reporters from the local papers. It is beneficial to foster relationships with journalists to help get the word out about the mission of the project, and to provide details about events that will spur interest from local publications. A journalist will be more likely to cover a story thoroughly and accurately if they have a personal relationship and feel they can contact someone with questions.

➲ If posters are being sent to community groups, provide the poster as a pdf or jpg that can be printed and placed in libraries, schools, or other local community centers. It's best to format the poster so that it can be printed on letter size paper.

➲ Consider posting the project site prior to an outreach event advising the public of a planned project with contact and other relevant information provided.

ENGAGEMENT METHOD 1: COMMUNITY MEETINGS

KEY CONSIDERATION

Community Meetings

- Opportunity to reach large groups of people at one time
- Presentation can be made to the group
- Smaller working groups allow for discussion and feedback
- Show examples of other successful projects

Community Meetings provide an opportunity to reach large groups of people at one time. Meetings can be structured with a general presentation with break out groups after to allow for discussion and feedback. Exercises, such as mapping or site prioritization can be conducted in the small groups.

Community meetings can also be conducted as an open house to allow participants to learn and provide feedback at multiple stations.

If the meeting is related to a specific project location, a presentation (or station if an open house) should include details about current conditions (utilizing aerial and ground photography), description of the issue/opportunity and possible solutions, and if available, conceptual designs could be incorporated into the presentation. Pictures of a successful project from a similar (and ideally nearby) community should be included if available. An example of a successful project will assist in building enthusiasm and support for a planned project.

Community Meeting Strengths:

- Enables large groups of people to participate
- Provides an opportunity to explain the process, give information and get feedback
- Demonstrates openness and transparency
- Can attract publicity or be used as a launch event
- Enables participants to network

Community Meeting Weaknesses:

- Not everyone has time or ability to attend so may not be representative of the community
- Attendance may be low unless people feel connection to the project
- Some people may feel intimidated to speak in front of a large group
- Traditional formats can limit audience contribution
- If confrontational, poor publicity can result

ENGAGEMENT METHOD 2: WORKSHOPS AND FOCUS GROUPS

KEY CONSIDERATION

Workshops and Focus Groups

- Allows for discussion in an open and relaxed atmosphere
- Encourage participants to exchange information
- Can focus on specific neighborhoods for small projects or entire communities for large scale projects

Workshops can take place in a variety of formats and allow people to discuss ideas in an open and relaxed atmosphere. Different formats can be used to encourage participants to exchange information, discuss strengths, weaknesses, opportunities and threats of the project, obtain ideas or innovative thinking or specifically geared towards prioritization of production of an action plan. For a very large scale project (such as incorporating green infrastructure on a citywide or watershed basis) workshops can focus on neighborhoods or communities.

Focus groups provide the opportunity to meet with representatives of the community - generally no more than 10, for in depth discussion and feedback. Focus groups can be used to reach a specific target audience, such as business owners, or on a specific project.

Workshop and Focus Group Strengths:

- Encourages active discussion and interactive activities
- Time and resource efficient way of identifying and clarifying key issues
- Conflict more easily handled in a small group
- Can be designed to discuss one aspect of the project or the project in its entirety
- Can be directly targeted to address the outreach goal for specific groups – such as municipal managers or local residents.

Workshop and Focus Group Weaknesses:

- Can be difficult to ensure all stakeholders are represented
- An articulate or outspoken individual can dominate the workshop
- Experienced facilitators are needed

ENGAGEMENT METHOD 3: COMMUNITY EVENTS AND STEWARDSHIP/VOLUNTEER PROGRAMS

It is recommended that a community engagement program include a component which encourages citizen participation and engagement by providing opportunities to volunteer and assist in project implementation.

This can often be fun and exciting activities.

- Some possibilities for citizen participation include:
    - Assisting in site preparation by doing a cleanup of the site and surrounding area, if warranted;
    - Planting of grasses, shrubs, plants;
    - Monitoring activities, such as the growth of plants, and what kinds of insects, birds, or mammals may be using the site. This presents a great opportunity for school groups, scouts, or senior citizens to become involved;
- Involve the artistic and creative community by encouraging the community to do photography or create painting, sculpture, poetry inspired by the site and/or the process;
- Participation in community events.

STEP 6: MONITOR EFFECTIVENESS OF THE PROGRAM

Measurable partnership engagement results can be difficult to track and document. However, the success of the program can be inherently clear in the implementation of projects in association with partners. Once the project is underway, monitoring the effectiveness of the program can be documented in a number of ways.

It is recommended that the following be tracked to document and correlate success of projects:

- Involvement of volunteers
- Public support of projects
- Press coverage
- New funding sources generated through partnership involvement
- Tracking visitors to website, followers on Facebook, Twitter, “Likes” and “Shares” on Facebook or LinkedIn posts
- Contact database growth

In addition, public engagement activities can be utilized to obtain feedback in the form of exit surveys and interviews with community participants.

Land use managers and/or municipal officials may be unwilling to utilize or consider green infrastructure. This may be due to lack of understanding of what green infrastructure is, the benefits of using green infrastructure, concerns regarding costs of installation and maintenance, or possibly not having a vision for how green infrastructure can be implemented in the community. In order to address these issues, a workshop or forum geared towards land use managers and municipal officials could be held, where previously successful implementation projects are shared, and funding sources discussed. Green infrastructure projects are often very popular as volunteer activities in the community, and volunteer project leaders could discuss the creation of partnerships to install green infrastructure.

As defined by the EPA, Green Infrastructure "uses natural processes to improve water quality and manage water quantity by restoring hydrologic function of the urban landscape, managing stormwater at its source, and reducing the need for additional gray infrastructure in many instances."

Runoff from stormwater flows over land or impervious surfaces such as parking lots, paved streets, and building rooftops and can accumulate debris, chemicals, sediments and other pollutants that can negatively affect water quality. Stormwater management addresses these issues through techniques such as controlling the source of runoff and use of green infrastructure.

Green infrastructure practices can be incorporated into streets, parking lots, and landscaped areas. Projects can include the utilization of green roofs, trees, rain barrels and cisterns, bioswales and rain gardens, permeable pavements and green spaces.

Managing stormwater and using green infrastructure include benefits such as: reduced maintenance and repair costs, reduced and delayed runoff volumes, enhanced groundwater recharge, pollutant reductions, improved air quality, reduced sewer overflow events, and additional habitat and recreational space.

Further Information Can Be Found At:

Green Infrastructure Opportunities that Arise During Municipal Operations (US EPA, January 2015)

Enhancing Sustainable Communities with Green Infrastructure (US EPA, October 2014)

Managing Stormwater: Natural Vegetation and Green Methodologies Guidance for Municipalities and Developers V.2.0 (Suffolk County)

Stormwater Pollution and Green Infrastructure Solutions: Nassau County Soil and Water District (Nassauswcd.org)

CONSIDERATIONS WHEN USING SOCIAL MEDIA

WEBSITES

Wordpress.com offers free options with templates provided for the user. It is easy to use, and once set up, is relatively easy to maintain. There is minimal support available online. A paid version is available, with more options for templates and better support.

BLOGS

Blogs can be set up either through Wordpress or through Google Blogger. Both are free, and offer step by step directions and templates in setting up a website or blog so that even an inexperienced user can have a site up and running quickly.

SOCIAL NETWORKING SITES

Some of the most popular social media platforms are Facebook, Twitter, LinkedIn, Instagram, Pinterest and YouTube. Each has different advantages and disadvantages, which are summarized below.

- Facebook is widely used by millennials and teenagers. It is user friendly and content can easily be shared and posted by readers.
- Twitter is an information network made up of 140 character messages called "tweets". Tweets can link to websites or blogs where the content resides.
- LinkedIn is a network used by professionals. Sharing information on this site may garner more response from municipal officials, planners, engineers and environmental professionals than that posted on other sites.
- Instagram is used by millennials and teenagers – a picture is posted on the site, with a description and "hashtag" which can be searched for. It's quick and easy to use, and can be shared on Facebook.
- Pinterest is a searchable discovery tool for visual ideas.
- YouTube – videos of meetings, volunteer activities, site visits, can all be filmed (even using a cell phone) and posted on YouTube for viewing by the public.

Hoot Suite is a social media management system that will post content across social media platforms at scheduled times. As of December 2015, prices start at $9.99 per month. Content must still be created and monitored by the project manager or designated person(s).

Key Considerations for Setting up Social Media Platforms for Outreach:

➲ It is important to scale the scope of social media outreach to the size, location and timeline of the project.

➲ *Be careful when setting up any social media accounts.* Set up accounts and passwords for the project itself, rather than using an individual's account on any social media platform used for the project. If part of a personal account, the user will not be able to share any administrative duties with others without providing their own personal information and passwords, which is not advisable.

➲ Establish who is authorized to post to social media on behalf of the project.

➲ The content created for press releases can form the basis for what is shared on social media.

➲ If a website or blog has been established, it is easy to link to it from other social media accounts.

➲ New social media platforms are being developed constantly. Keep on the outlook for one that may be useful to your project.

➲ Beware of Trolls! Internet trolls start inflammatory conversations, aka "Flame Wars" on the internet, and spread false or malicious rumors. For this reason, it is necessary to monitor social media sites and respond quickly by removing offensive content that may be posted.

DATABASE MANAGEMENT

Good Database management is important.

ABOUT DATABASES

Names, addresses and emails have to be stored in a logical and consistent manner, which can be accessed and utilized by individuals who have administrative authority. An excel sheet is an excellent means to compile information. It is recommended that when entering information in the spreadsheet individuals be recognized by what entity they are representing. For example, if an individual is a municipal official, member of a local Civic organization, or a local resident, that affiliation should be recorded in a column on the spreadsheet. Town, state and zip codes should all be recorded in separate columns. This will be of great assistance in segmenting any mailings, targeting emails, and can be useful for project reporting.

If a volunteer is going to be in charge of database management:

- Make sure the volunteer has an understanding that the contact information is confidential, and not to be shared with unauthorized persons, or used for any purpose other than the project.
- Make sure the volunteer has the necessary skillset to design and/or maintain the database.
- Set up a procedure for backing up the database and ask the volunteer to send the database to a project manager when it is updated.

MAILINGS

Once a mailing list is established there are different means available to disseminate information:

Traditional printing and mailing can be expensive and time consuming. In order to qualify for US Post Office bulk mail pricing, a mailing has to:

- Consist of at least 200 pieces;
- Be sorted in zip code order;
- The user must have a bulk mail permit;

Municipalities, agencies, and organizations may have a bulk mailing permit, but may have restrictions on who can use the permit and the process of securing permission can be time consuming;

Mailing houses can print, address, sort and do the mailing, which adds to the cost. Mailing houses have their own bulk mail permits which they can use to do mailings for other entities.

First class mailing, done in-house, is expensive:

- Sealing, stuff and stamping is time consuming;
- Printing adds to the cost;
- Volunteers may be willing to do the job, but their time may be better used elsewhere.

BY EMAIL:

- Create a list by entering information into a database, such as excel;
- Or create a list by setting up a group in Microsoft Outlook or Gmail;
- Some service providers may limit how many emails can be sent at one time;
- Best to create content and save it as a .pdf or .jpg which can be attached to an email.
- This will make it easy to share on social media – jpgs are especially easy to share

Constant Contact and Mail Chimp are email marketing systems which allow users to create content and manage lists easily and quickly. Both allow users to create lists and store photos to be used in mailings. Both have free introductory rates.

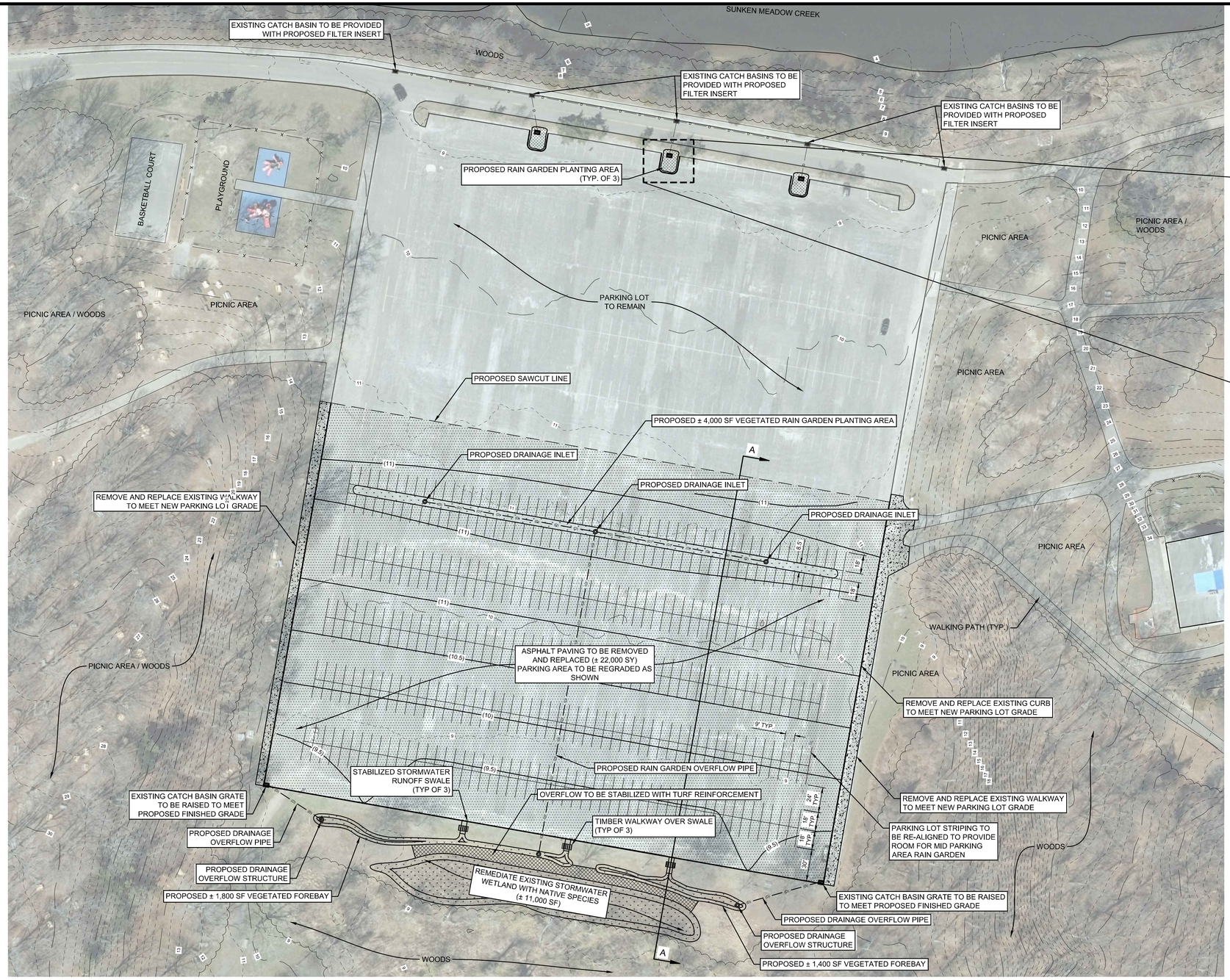
Survey Monkey is an online survey system that will allow project managers to ask questions and receive feedback in an organized format. It is simple to set up and use, and answers can be received in a timely and efficient manner.

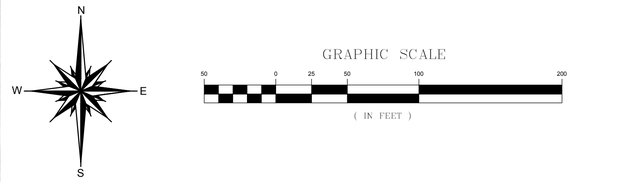
PROJECT METRICS

Develop and implement a system for what metrics need to be tracked at the beginning of the project, what the reporting requirements are (monthly, quarterly, semi-annually) and what significant milestones may need to be reported on. Alerts for project reporting can be posted into Microsoft outlook or other calendar applications.

ATTACHMENT 1

CONCEPTUAL DRAINAGE PLAN
SUNKEN MEADOW STATE PARK





GRAPHIC SCALE

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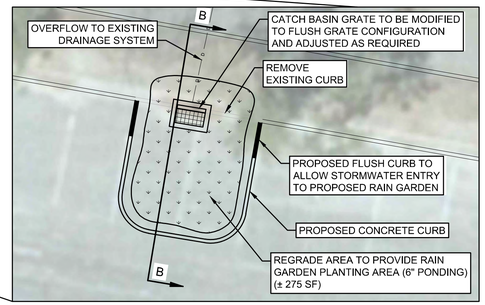
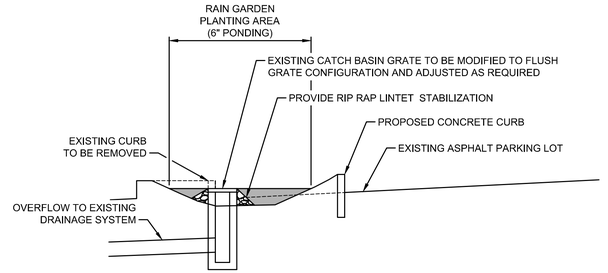
(IN FEET)



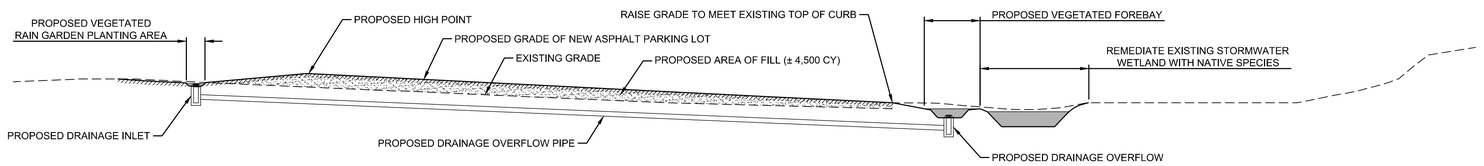


SECTION B-B

SCALE: 1" = 10' HORIZ
1" = 2' VERT.

LEGEND

- PROPOSED ASPHALT
- PROPOSED WALKWAY
- PROPOSED VEGETATED PONDING AREA (RAIN GARDEN, FOREBAY, WETLANDS)
- (200) PROPOSED CONTOUR
- 198 EXISTING MINOR CONTOUR
- 200 EXISTING MAJOR CONTOUR



SECTION A-A

SCALE: 1" = 30' HORIZ
1" = 6' VERT.

DRAFT
3-28-16

NO.	DATE:	REVISIONS:	BY:
-	-	-	-

P.E. SEAL AND SIGNATURE

CONCEPTUAL DRAINAGE PLAN

FOR

SUNKEN MEADOW PARK

SITUATED AT

KINGS PARK

TOWN OF SMITHTOWN, SUFFOLK COUNTY, NEW YORK

NELSON & POPE
ENGINEERS & SURVEYORS
572 WALT WHITMAN ROAD, MELVILLE, N.Y. 11747
PHONE (631) 427-5665 FAX (631) 427-5620
WWW.NELSONPOPE.COM

PROJECT NO.:	14145
DRAWN BY:	CCV
CHECKED BY:	LU
DATE:	3-24-16
SCALE:	1" = 50'
FILE NO.:	-
CADD:	14145-SM-CP
DRAWING NO.:	CP-101
SHEET NO.:	1 OF 1

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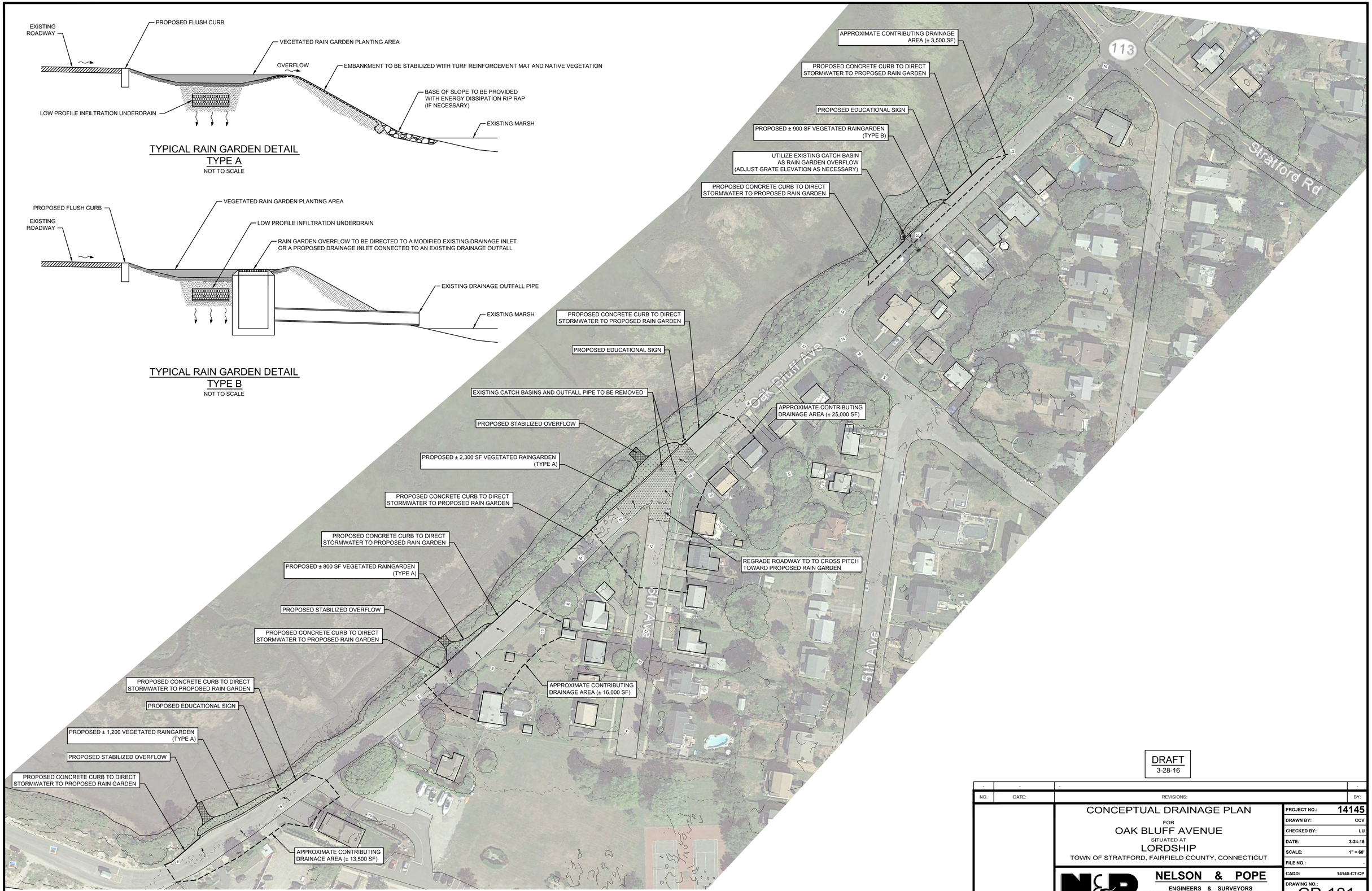
ATTACHMENT 2

CONCEPTUAL DRAINAGE PLAN
OAK BLUFF AVENUE

TYPICAL RAIN GARDEN DETAIL
TYPE A
NOT TO SCALE

TYPICAL RAIN GARDEN DETAIL
TYPE B
NOT TO SCALE



DRAFT
3-28-16

NO.	DATE:	REVISIONS:	BY:
-	-	-	-

P.E. SEAL AND SIGNATURE

CONCEPTUAL DRAINAGE PLAN
FOR
OAK BLUFF AVENUE
SITUATED AT
LORDSHIP
TOWN OF STRATFORD, FAIRFIELD COUNTY, CONNECTICUT

NELSON & POPE
ENGINEERS & SURVEYORS
572 WALT WHITMAN ROAD, MELVILLE, N.Y. 11747
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WWW.NELSONPOPE.COM

PROJECT NO.:	14145
DRAWN BY:	CCV
CHECKED BY:	LU
DATE:	3-24-16
SCALE:	1" = 60'
FILE NO.:	-
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