



Memorandum

TO: Amanda Lima and Nathan Whetten, Town of Yarmouth
April Wobst and Jordan Mora, APCC

FROM: Michelle West and Gemma Kite, HW

DATE: June 30, 2023

RE: Yarmouth Stormwater Retrofit Assessment – Final Report

This technical memorandum summarizes the Horsley Witten Group, Inc.'s (HW) field assessment efforts for the Yarmouth Stormwater Retrofit project, as well as the final prioritization of top stormwater retrofit sites to advance with future funding. The field work took place in Spring 2023.

Background

This assessment is funded through a Coastal Habitat and Water Quality Grant from the MA Coastal Zone Management (CZM) Program. The focus area for this project is the portion of Yarmouth south of Route 6, where the majority of the Town's impaired waterbodies are located (**ATTACHMENT A-Figure 1**). The specific goal of this project is to identify and prioritize green stormwater infrastructure (GSI) retrofit sites to address nutrient and bacteria loading to freshwater ponds and coastal embayments in the project's focus area. The Project Team includes Town of Yarmouth staff, Association to Preserve Cape Cod (APCC), and HW.

Retrofit Inventory and Concepts

Preliminary Mapping and Data Collection. HW worked with APCC and the Town to compile existing data, design plans, and prior studies for the focus area. The Team met and worked together to identify target areas for fieldwork (**ATTACHMENT A-Figure 2**). HW reviewed the compiled information, and the GIS data were used to prepare field maps including contours, town-owned parcels, easements, drainage infrastructure, catchments to mapped outfalls, impervious cover, land use, mapped areas of high groundwater, environmental resource features and constraints, and soil types. In addition, HW added this data to ArcGIS Online for access while in the field to help streamline the assessments.

Two recent datasets were referenced specifically in this assessment so that overlapping sites and priorities could be identified and cross-referenced, including the following:

- Yarmouth Municipal Property BMP Retrofits Memorandum (CEI, 2022)
- Yarmouth Impaired Waters BMP Assessment and Implementation Memorandum - Coastal Pollutant Remediation (CPR) Grant program (CEI, 2017)

Field Assessment. Field teams of HW, APCC, and Town of Yarmouth staff conducted multiple field assessments throughout the focus area in Spring 2023 (March 3, March 29, April 20, and April 28) using an adapted retrofit inventory methodology outlined in the publication "Urban Stormwater Retrofit

Practices” (Schueler et al., 2007), and relying on the resources previously described. HW visited over 80 sites in the target areas to assess drainage conditions, site constraints, and opportunities. The primary goals of the retrofitting process were to propose low impact GSI management strategies for reducing nutrient (phosphorus & nitrogen) and bacteria loads, stabilizing eroding slopes, modifying land uses/land cover for better source control, and improving habitat. Proposed GSI practice types fall in three categories: infiltration (infiltration basins, underground infiltration chambers and permeable pavements), filters (bioretentions, tree trenches, and dry swales), and wet practices (wet swales and constructed wetlands). These are described briefly below. Opportunities for non-structural improvements, such as impervious cover reduction (i.e., pavement removal), revegetation/invasive species management, source control, and public education and outreach, were also explored and discussed further below.

Field assessments were performed using computer tablet-based data collection methods utilizing available GIS data. Pre-defined data entry forms were used in the ArcGIS Field Maps application to collect geo-referenced information (e.g., drainage area to practice; available space for proposed GSI practice; and site constraints) and photos at each site. The assessment provided information necessary to determine at minimum: impervious surface area addressed, estimated reduction in pollutant loading (phosphorus, nitrogen, bacteria, etc.), planning-level estimates of construction cost, ease of installation, and calculation of other resource area and public education benefits.

Structural GSI Practice Types. The following structural GSI practices were proposed for this project.

Infiltration

Infiltration practices are those that direct stormwater into native soils to slowly seep into the ground rather than flowing over the land. Infiltration practices can remove many pollutants and reduce stormwater runoff volumes as long as they are paired with effective pretreatment. Pretreatment practices collect sediments and debris from the runoff to prevent clogging of the native soils, which reduces their effectiveness. Infiltration practices can have a vegetative component (e.g., grass-covered infiltration basins), can replace traditionally impervious surfaces (e.g., permeable pavements), or even be placed underground (e.g., drywells, underground chambers, etc.). For permeable pavement designs, we aim to design the systems to only treat the rain that falls directly on the permeable pavement rather than allow “run-on” from adjacent impervious surfaces. This minimizes the clogging potential, and thus, the maintenance needs. For underground chamber systems, we try to design them with a vegetative pretreatment practice to maximize nutrient removal as well as sediment and debris before infiltration.

Photo 1. Porous pavers for parking lot runoff (left); underground stormwater infiltration chambers (right).



Filters

Filters are practices that collect runoff in shallow surface depressions or underground chambers and remove pollutants by filtering runoff through a soil or stone media. These practices also typically have a vegetative component, and do not stay permanently wet. Filters are very flexible practices that can be designed with varying geometries and vegetation to fit in with a large variety of land uses and site constraints. We have proposed three main types of filters for this project: bioretentions, dry swales, and tree trenches. Bioretention practices tend to be planted with a variety of native species that can handle both wet and dry conditions. Dry swales are linear, shallow systems typically planted with grass. Tree trenches do not have a surface depression, but instead, rely on an underground stone reservoir with trees or other native species planted above. Tree trenches can be worked into the road right-of-way and even placed under sidewalks.

Photo 2. Bioretention facility for parking lot runoff (left); dry swale planted with grass (right).



Photo 3. Roadside tree trench during construction (left); and after construction (right).



Wet Practices

Wet practices are those that mimic natural wetlands by utilizing a high groundwater table at the site or a created permanent pool (with an impermeable liner) for pollutant removal. These include different types of constructed wetlands and wet swales. Constructed wetlands include shallow wetlands (tend to look like natural marsh systems) and gravel wetlands (surface water not typically seen; present just below the surface of a gravel bed and planted with specific wetland species like sedges and rushes). Wet swales are linear constructed wetlands that tend to have a permanent pool most of the year and

are planted with wetland plant species. These practices also create wetland habitat and are easy to maintain.

Photo 4. Wet swale (left) and constructed wetland (right) examples.



GSI Non-structural Opportunities. The following opportunities for non-structural improvements were also identified.

Impervious Cover Reduction

Impervious cover reduction involves removing existing hard surfaces such as pavement to reduce total runoff created and the associated pollutant loading. This practice involves evaluating current and future use patterns in an area and identifying opportunities to reduce pavement to only what is needed. This practice is particularly important near our shorelines where coastal retreat can not only reduce pavement/runoff, but also build resiliency in vulnerable areas subject to climate change impacts.

Photo 5. Excess pavement at the end of Hawes Run Road (left) and Curve Hill Road (right) examples.



Revegetation/Invasive Species Management

The Field Teams looked for opportunities at each site to revegetate denuded areas or pervious areas maintained as lawn. Revegetation with native species improves habitat as well as provides stabilization and, in some cases, a wind block to reduce maintenance needs for structural GSI practices and parking/road areas. In addition, upland invasive plant species were identified at some sites; in these cases, invasive species removal is proposed along with native revegetation.

Source Control Opportunities

While on site, Field Teams looked for source control opportunities – ways to prevent pollutant loading at the source before it is picked up by stormwater rather than just removing it downstream in structural practices. Examples of source control include the following: increased street sweeping, reducing fertilizer usage, improving waste management (cleaning up and preventing on-going dumping sites), stabilizing eroding areas and/or construction sites, and hotspot management (increasing preventative maintenance at “hotspot” places such as high-volume parking lots, etc.). These are topics that should also be targeted with any public outreach efforts in the identified areas.

Photo 6. Residential yard waste dumped at the end of Grove Road (left) and construction site with no erosion and sediment controls (right) – examples of source control opportunities.



Public Education and Outreach

Some assessed sites are located in highly visible, public places where Cape Cod residents and/or visitors frequent and perhaps interact with water resources, experiencing firsthand impacts to water quality and habitat. These sites are uniquely suited for public education and outreach on stormwater and watershed issues. Field Teams identified specific locations where educational signage and/or activities would be most effective for reaching the public.

Concept Designs and Prioritization. HW used the information collected in the field to create an inventory of sites, grouped by overarching project type, listed below:

- Bioretention – a larger Town-owned open space available for a typical bioretention practice
- Existing BMP Retrofit – opportunity to retrofit an existing BMP to provide enhanced treatment
- Infiltration Basin – a larger Town-owned open space available for an infiltration basin
- Outfall Easement Retrofit – a retrofit targeting the drainage easement between the road and the outfall
- Pavement Reduction – a project solely focused on pavement reduction
- Porous Pavement – replacement of typical pavement with porous pavement
- Right-of-way (ROW) Practices – practices focused within the ROW
- Rain Garden – a simple practice typically for roof runoff and education/outreach
- Revegetation – a project solely focused on revegetation, typically for a wetland buffer
- Road End – a project focused on retrofitting the end of a road, often at the edge of a waterbody
- Salt Marsh Restoration – a project solely focused on restoring the hydrology and habitat of a salt marsh system
- Tree Trenches – specific practices within the ROW that do not have a surface depression
- Wet Practice – practices that utilize high groundwater and mimic natural wetlands

The Project Team reviewed the total list and narrowed down to 28 sites that covered a wide geographic and project type range to advance to 10% concepts and include in the ranking process. The projects that the Town determined could be addressed without a concept design (e.g., infiltration basin, porous pavement, pavement reduction, rain garden, and revegetation) were not included, as were the salt marsh restoration opportunities, as those are outside the stormwater focus for this project. For other unranked sites, the Town will refer to one of the similar concepts within the relevant project type as a guide for implementation.

HW updated GIS mapping and developed 10% concept designs for the selected 28 sites. Specifically, information for the concepts includes:

- A list (**Table 1**) and map of these retrofit locations with concepts (**ATTACHMENT A-Figure 4**). The unranked sites are shown in **ATTACHMENT A-Figure 3** by project type and listed in **ATTACHMENT D**;
- Two page “fact sheets” for each assessed site summarizing existing conditions, proposed GSI design features, potential non-structural practices (if any) including possible impervious cover reduction and/or disconnection, and photos collected at each site (**ATTACHMENT B**);
- Preliminary retrofit sizing information, anticipated treatment performance, preliminary cost range estimates, and relative implementation and other benefit factors (**ATTACHMENT C**).
- Scores for pollutant removal potential, estimated costs, ease of implementation, and additional benefits based on the priority ranking criteria (see next section below) and the total ranking score (**ATTACHMENT C**).

In **Table 1** below, the sites are ordered alphabetically by site ID. Each site’s ranking score is also provided in **Table 1** below. More details about each site’s ranking score are provided in **ATTACHMENT C**.

Table 1. List of Sites (with Concepts) by Project and Practice Types.

ID	Site Name	Latitude, Longitude	Project Type	Proposed GSI Retrofits	Non-structural Controls	Ranking Score
HIH-2	Park Avenue	41.64733688, -70.27006144	ROW Practices	Bioretention	Street Sweeping (Source Control)	44.8
HIH-3	End of Grove Street	41.64628278, -70.26994963	Road End	Bioretention	Pavement Removal, Buffer Revegetation, and Public Education	70.9
HIH-4	Park Avenue near Vernon	41.64647022, -70.268232	ROW Practices	Bioretention	Lawn Management (Source Control)	49.5
LB-2	Wimbleton Drive	41.64902019, -70.24801269	ROW Practices	Bioretentions, Tree Trenches	Street Sweeping (Source Control), Public Education	48.4
LB-8/9	Tanglewood Drive	41.64843432, -70.25014058	ROW Practices	Bioretentions	Street Sweeping (Source Control), Invasives Management	43.8
LPBR-1	Wings Grove Beach	41.67116752, -70.19169182	Existing BMP Retrofit	Bioretention	Street Sweeping (Source Control), Public Education	57.9
LPBR-4	Indian Memorial Drive (gazebo)	41.66928179, -70.19478825	Existing BMP Retrofit	Bioretention	Street Sweeping (Source Control), Public Education	56.8
LPBR-10	Long Pond Plaza	41.66618084, -70.20577707	Bioretention	Bioretention	Street Sweeping (Source Control), Public Education	52.7
LPBR-13	Smith Road	41.66620937, -70.19555464	Road End	Bioretention	Pavement Removal, Stabilization (Source Control) and Public Education	41.3
LPBR-14	Wood Road at James Pond	41.66658736, -70.19638395	Wet Practice	Constructed Wetland	Street Sweeping (Source Control)	36.0
MC-2	Baxter Avenue	41.65207829, -70.26239193	Wet Practice	Constructed Wetland	Trash Management (Source Control), Invasives Management	49.2

ID	Site Name	Latitude, Longitude	Project Type	Proposed GSI Retrofits	Non-structural Controls	Ranking Score
MC-3	Standish Way	41.64700569, -70.25608318	ROW Practices	Bioretention, Tree Trench	Lawn Management (Source Control), Public Education	67.2
MC-5	End of Baker Avenue	41.65905851, -70.262049	Road End	Bioretention	Pavement Removal, Buffer Revegetation, and Invasives Management	60.1
MC-8	Buck Island Road - 1	41.66371959, -70.26175144	ROW Practices	Wet Swale	Buffer Revegetation	43.2
MC-11	Buck Island Road - 4	41.66092207, -70.25672078	ROW Practices	Wet Swale	None	43.0
OM-1	Old Main Street East	41.6642204, -70.18814219	ROW Practices	Bioretentions, Tree Trenches	Street Sweeping (Source Control)	64.1
OM-2	Old Main Street West	41.6611065, -70.19541634	ROW Practices	Bioretentions, Tree Trenches	Street Sweeping (Source Control)	73.1
OM-3	Homer Avenue	41.66256922, -70.1870762	Road End	Bioretention	Pavement Removal, Buffer Revegetation, and Public Education	65.9
OM-7	Cemetery on Wood Road	41.65937869, -70.19978144	Bioretention	Bioretention, Porous Pavement	Stabilization (Source Control) and Public Education	65.4
PR-1	Buck Island Road/West Yarmouth Road	41.6648429, -70.23038561	Bioretention	Bioretention	None	53.2
PR-3	19 Lake Road West	41.66353392, -70.21985473	Wet Practice	Constructed Wetland	Street Sweeping (Source Control)	64.3
PR-4	Lake Road Neighborhood	41.66448466, -70.22009596	ROW Practices	Bioretention	Pavement Removal	58.4
PR-7	End of Maushops Path	41.6413361, -70.23061659	Road End	Wet Swale	Pavement Removal, Buffer Revegetation	55.9
PR-8	Pawnee Road	41.64387648, -70.22642436	Wet Practice	Wet Swale	None	56.0
SP-4	Lake Road/Nauset Road	41.66173417, -70.21694233	ROW Practices	Bioretention	Street Sweeping (Source Control)	48.0
UBR-2	Wilbur Park Entrance – Driveway Runoff	41.68521919, -70.16073429	Existing BMP Retrofit	Bioretention	Street Sweeping (Source Control), Public Education	49.1
UBR-4	Curve Hill Road - 1	41.68591788, -70.16843767	Wet Practice	Constructed Wetland	Street Sweeping (Source Control)	66.2
UBR-7	Great Western Road near Hersey Street	41.6894731, -70.17993414	Bioretention	Bioretention	Street Sweeping (Source Control)	47.0

Note: Upper Bass River (UBR) code corresponds to the Bass River within the target area south of Route 6 (Figure 2).

The remaining sites the field teams assessed that were not ranked above in **Table 1** are shown in **ATTACHMENT A-Figure 3** by project type and listed in **ATTACHMENT D**. In addition, HW made some additional observations during the field assessments that are included in a table in **ATTACHMENT D**. While these observations were outside the scope of this project, the field teams highlight these areas for the Town’s review and management.

Priority Ranking Criteria

Since not all recommendations are equal when it comes to implementation, prioritization allows retrofit opportunities to be compared to find the most effective and feasible sites to advance as funding

becomes available. The ranking system for this project used a 100-point scoring system, where the relative merit of each proposed site was evaluated by assigning points based on the ranking criteria listed below. The complete ranking spreadsheet is found in **ATTACHMENT C**.

- 1) Pollutant Removal Potential (35 points)** — This category is allotted the highest number of possible points based on the main project goal of addressing the pollutants of concern. We analyzed this category based on water quality volume treated (with a goal of 1 inch per impervious acre), as well as the most currently accepted removal efficiencies for the proposed practices.
 - Water Quality Volume Treated - The site with the maximum volume treated received 20 points, and the remaining sites were ranked accordingly.
 - Pollutant Reduction – The practices were ranked based on their removal efficiency for nitrogen/phosphorus (depending on estuarine or freshwater) and bacteria, for a maximum of 5 points possible (2.5 points for each pollutant).
 - Water Quality Impairment – Sites were ranked based on whether they discharge to receiving waters with water quality impairments for nutrients (2.5 points) and/or bacteria (2.5 points). The 2018/2020 DEP Integrated Waters listing was the main data source, with 2021 State of the Waters Report ratings used to supplement nutrient impairment data as needed (5 points total). Sites with no known impairments received 0 points.
 - Priority Catchment – Sites were ranked based on whether they are located within priority catchments for nutrients (2.5 possible points) and/or bacteria (2.5 possible points). The 2017 CZM-CPR Grant project was the main data source. Sites in catchments with low priority or not in mapped catchments received 0 points.

- 2) Estimated Planning-level Construction Cost (10 points)**— Preliminary construction costs will be roughly estimated on a unit cost per volume or area of the practice based on literature and HW’s recent experience with implementation of local projects. Next, relative scores will be assigned to each project, where the lowest cost/treatment volume is assigned 10 points and the highest cost assigned 1 point.

- 3) Ease of Implementation (25 points)** — This category compared the concepts based on the following implementation factors:
 - Overlaps with planned projects
 - Completely overlaps with upcoming project = 5 points;
 - Overlaps partially with upcoming project = 2.5 points; and
 - Does not overlap with any known, planned project = 0 points.
 - Potential required permitting
 - Minimal permitting required = 5 points;
 - Moderate permitting likely = 2.5 points; and
 - Complicated permitting likely = 0 points.
 - Construction access issues
 - Site easily accessed = 5 points;
 - Some difficulty getting equipment to the site = 2.5 points; and
 - Site is difficult to access = 0 points.
 - Potential abutter property impacts
 - Large Town-owned space, no impacts to abutters likely= 5 points;
 - Impact to adjacent properties potentially an issue = 2.5 points; and
 - Likely to impact adjacent property = 0 points.
 - Maintenance burden

- Low = 5 points;
- Medium = 2.5 points; and
- High = 0 points.

4) Additional benefits/factors (30 points) — This category compared the proposed concepts based on additional factors of interest to this project, as listed below:

- Environmental Justice Populations
 - Site is located within one or more than one mapped environmental justice population (e.g., income, minority) = 5 points;
 - Site is located within one mile of one or more than one mapped environmental justice population (e.g., income, minority) = 2.5 points; and
 - Site is not located within one mile of mapped environmental justice populations = 0 points.
- High priority resource areas (anadromous fish runs or shellfish areas) and/or public beach benefits
 - Concept addresses direct discharges to both a priority resource area and a public beach = 5 points;
 - Concept addresses direct discharges to either a priority resource area or a public beach = 2.5 points; and
 - Site does not directly discharge to a priority resource area or public beach = 0 points.
- Habitat Improvements
 - Site concept greatly improves habitat in the area = 5 points;
 - Concept provides moderate opportunities to improve habitat at the site = 2.5 points; and
 - Site concept provides minimal to no habitat improvements = 0 points.
- Addresses Existing Conditions
 - Concept greatly addresses existing stabilization/disrepair issues that contribute to water quality/habitat degradation at site = 5 points;
 - Concept provides moderate opportunities to address existing stabilization/disrepair issues that contribute to water quality/habitat degradation at site = 2.5 points; and
 - No existing stabilization/disrepair issues at site that contribute to water quality/habitat degradation are specifically addressed with concept = 0 points.
- Builds Resiliency
 - Concept greatly addresses future expected climate change impacts at site = 5 points;
 - Concept provides moderate opportunities to address future expected climate change impacts at site = 2.5 points; and
 - No future expected climate change impacts specifically addressed with concept = 0 points.
- Public Education/Demonstration
 - Site is located in a high visibility area and provides an excellent opportunity for reaching the public = 5 points;
 - Site provides moderate visibility and located where some portion of the public could benefit = 2.5 points; and
 - Site provides low visibility and is located in an area few people will visit = 0 points.

Final List of Top Priority Sites

Based on the ranking information described above as well as Project Team discussions and input provided at the public meeting, the retrofit sites in **Table 2** (and also on **ATTACHMENT A-Figure 4**) were chosen as top priority for future funding to advance to 25%/75% designs, permitting, construction documents, and construction.

The virtual public meeting on June 13, 2023 provided an opportunity to engage stakeholders outside of the Project Team, such as neighboring residents, homeowner associations, and local non-profits, regarding the project scope and the concept designs. The responses from these additional stakeholders were positive and supportive overall, so priority site selection is solely based on the criteria scoring.

In **Table 2** below, the sites are ordered alphabetically by site ID. Each site’s ranking score is also provided in **Table 2** below. More details about each site’s ranking score are provided in **ATTACHMENT C**.

Table 2. Top Priority Sites

ID	Site Name	Latitude, Longitude	Project Type	Proposed GSI Retrofits	Non-structural Controls	Ranking Score
HIH-3	End of Grove Street	41.64628278, -70.26994963	Road End	Bioretention	Pavement Removal, Buffer Revegetation, and Public Education	70.9
MC-3	Standish Way	41.64700569, -70.25608318	ROW Practices	Bioretention, Tree Trench	Lawn Management, Public Education	67.2
MC-5	End of Baker Avenue	41.65905851, -70.262049	Road End	Bioretention	Pavement Removal, Buffer Revegetation, and Invasives Management	60.1
OM-1	Old Main Street East	41.6642204, -70.18814219	ROW Practices	Bioretentions, Tree Trenches	Street Sweeping	64.1
OM-2	Old Main Street West	41.6611065, -70.19541634	ROW Practices	Bioretentions, Tree Trenches	Street Sweeping	73.1
OM-3	Homer Avenue	41.66256922, -70.1870762	Road End	Bioretention	Pavement Removal, Buffer Revegetation, and Public Education	65.9
OM-7	Cemetery on Wood Road	41.65937869, -70.19978144	Bioretention	Bioretention, Porous Pavement	Stabilization and Public Education	65.4
PR-3	19 Lake Road West	41.66353392, -70.21985473	Wet Practice	Constructed Wetland	N/A	64.3
PR-4	Lake Road Neighborhood	41.66448466, -70.22009596	ROW Practices	Bioretention	Pavement Removal	58.4
UBR-4	Curve Hill Road	41.68591788, -70.16843767	Wet Practice	Constructed Wetland	Street Sweeping	66.2

Note: Upper Bass River (UBR) code corresponds to the Bass River within the target area south of Route 6 (Figure 2).

Next Steps

The CZM FY23 funded stormwater management assessment for Yarmouth helped to advance stormwater improvement and establish a process for identifying and prioritizing BMPs that can be applied elsewhere in Yarmouth and in other municipalities aiming to improve stormwater management.

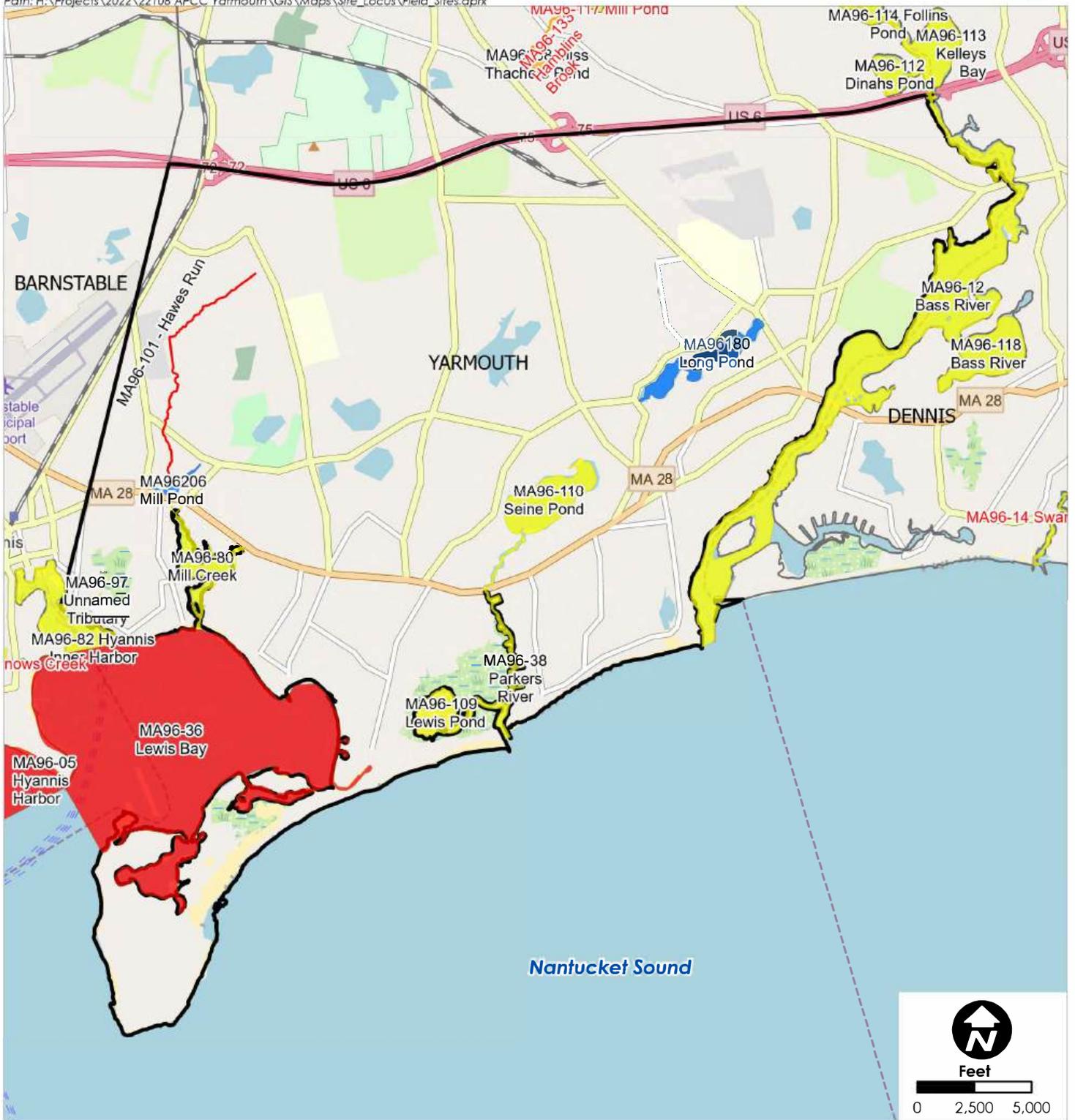
After the completion of this project, the Town of Yarmouth, APCC, and HW are proposing to complete design, permitting and installation of priority stormwater retrofits. A CZM FY24 grant application was submitted in June 2023 to fund this next phase of the project. If funding is awarded, the team will select

up to five stormwater retrofit sites for completion of 25% designs and select the top two sites for completion of 75% designs by June 30, 2024. These top two sites will be advanced through permitting, final design, and construction by June 30, 2025. The project area includes impaired water bodies south of Route 6 within the Town of Yarmouth and will prioritize areas that will benefit impaired waters, fish, shellfish, beaches and Environmental Justice communities.

In the future, partners hope to conduct the same analysis, ranking, preliminary design and review to the area north of Route 6A in Yarmouth. The goal is to work collaboratively to improve stormwater management at priority sites to improve water quality and habitat.

Attachment A – Project Maps

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Date: 6/23/2023

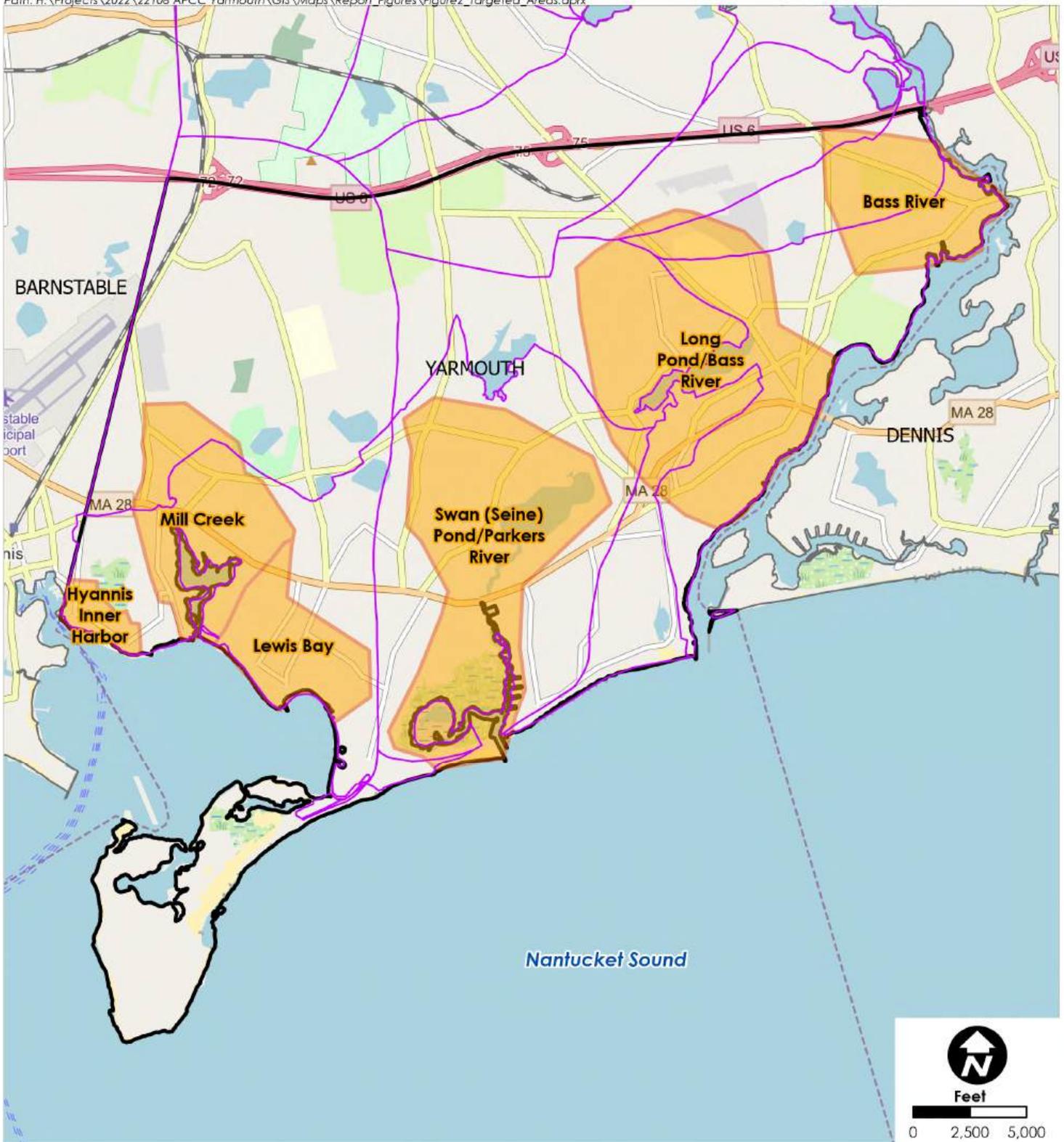
Data Sources: Bureau of Geographic Information (MassGIS), ESRI

This map is for informational purposes and may not be suitable for legal, engineering, or surveying purposes.

Yarmouth Stormwater Retrofit Assessment
Yarmouth, MA

Figure 1
Impaired Waters

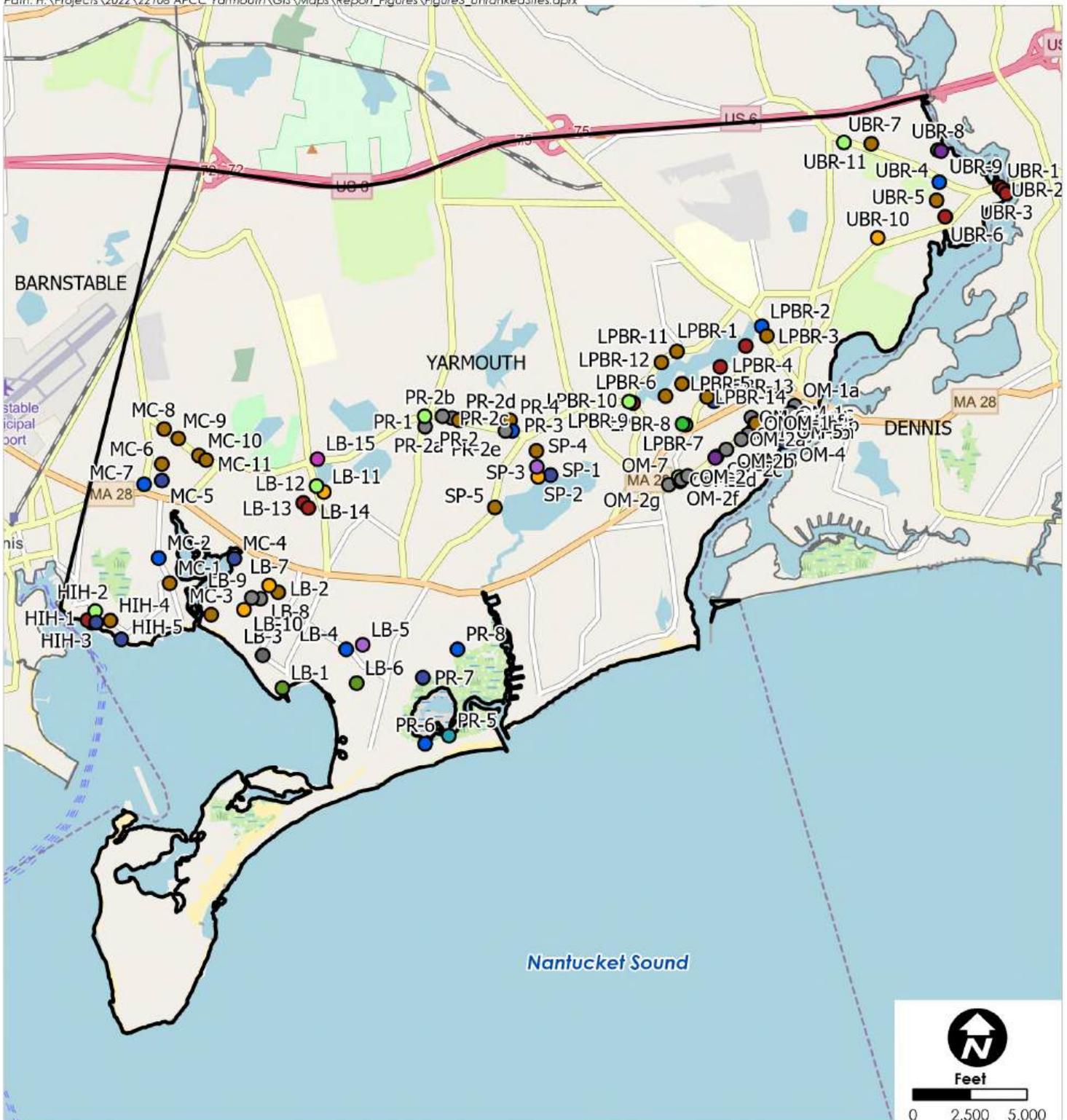
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Date: 6/27/2023
Data Sources: Bureau of Geographic Information (MassGIS), ESRI
 This map is for informational purposes and may not be suitable for legal, engineering, or surveying purposes.

- Targeted Areas for Fieldwork
- Watersheds
- Project Focus Area
- Towns

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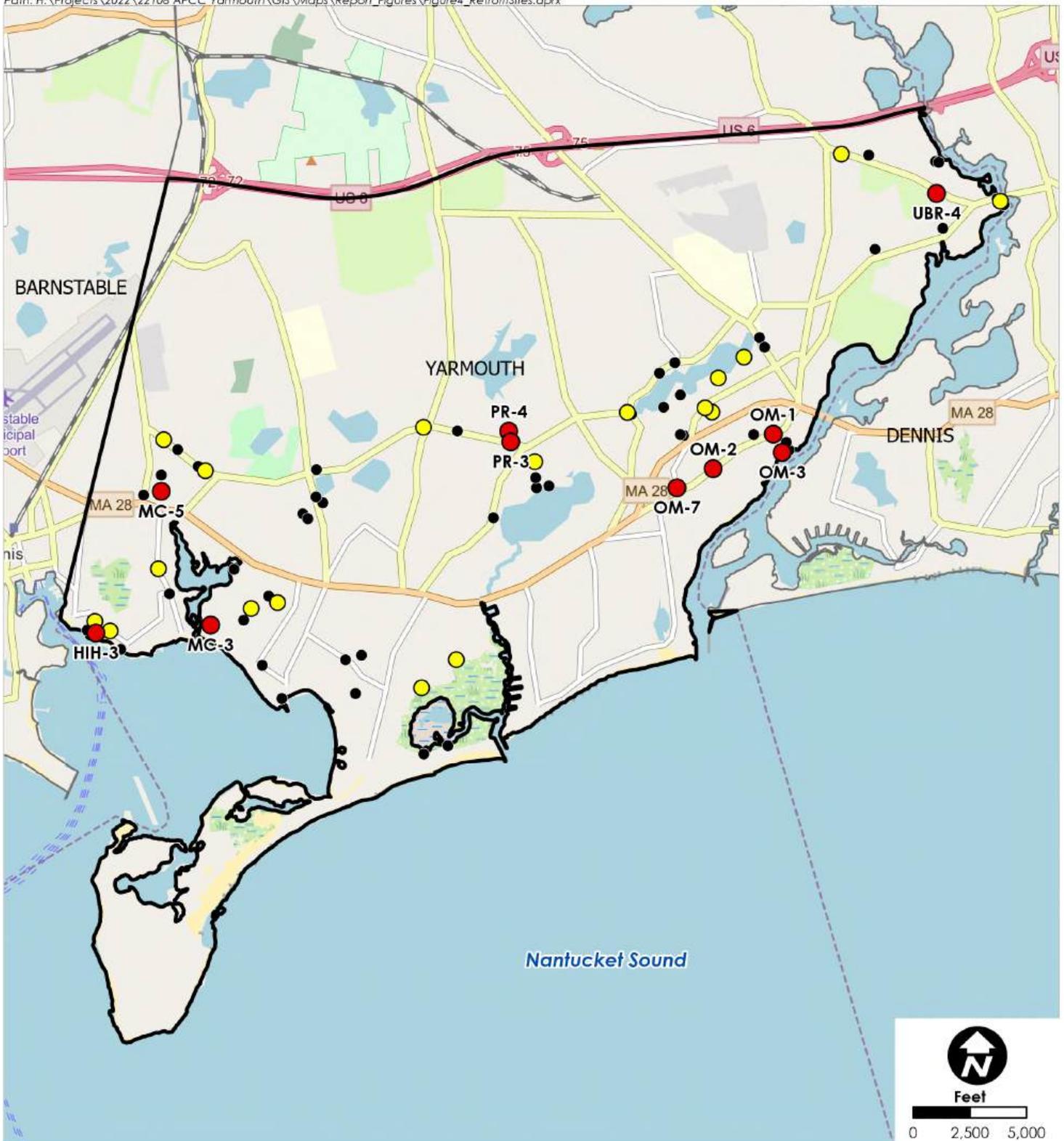
Date: 6/27/2023
Data Sources: Bureau of Geographic Information (MassGIS), ESRI
This map is for informational purposes and may not be suitable for legal, engineering, or surveying purposes.

- | | | |
|--------------------|---------------------------|------------------------|
| Project Focus Area | Existing BMP retrofit | Rain Garden |
| Towns | Infiltration Basin | Revegetation |
| Type | Outfall Easement Retrofit | Road End |
| <Null> | Pavement Reduction | Salt Marsh Restoration |
| Bioretention | Porous Pavement | Tree trenches |
| | ROW practices | Wet Practice |

Yarmouth Stormwater Retrofit Assessment
Yarmouth, MA

Figure 3
Unranked Sites By Type

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Date: 6/27/2023

Data Sources: Bureau of Geographic Information (MassGIS), ESRI

This map is for informational purposes and may not be suitable for legal, engineering, or surveying purposes.

- Top 10 Sites
- Sites with Concepts
- Sites
- Project Focus Area
- Towns

Attachment B – Retrofit Field Forms

Yarmouth Stormwater Retrofits

Field Forms

Stormwater retrofit field forms were produced for 28 sites during the field assessment for the Yarmouth SW Retrofit Project from both data collected in the field on iPads as well as information collected and calculated in the office. The following is a summary of the information included on each form, organized by section.

SITE AND CONCEPT DESCRIPTION:

This section provides a brief description of the existing site conditions and proposed concepts. Specific information important for ranking and/or design is included here, particularly information provided by the Project Team, residents or other stakeholders throughout the assessment process.

Existing BMP? (Y/N): Existing BMP refers to an actual SW management practice, not just infrastructure.

SITE LOCATION:

Address for the site as well as a location map.

GENERAL SITE INFORMATION:

This section provides general overview information about the site.

Site Contact(s): Contact(s) for site is included if known.

Ownership: Typically "Town" or "Private", with more information included where known.

Existing Site Condition: Refers to existing condition at the site. Sites in poor condition to start with may be higher priority to upgrade to prevent further damage and pollutant loading.

Land Use: Information on dominant land use(s) at the site.

Yarmouth Watershed: Specific Yarmouth Watershed site is located in.

Receiving Water: Name and type (freshwater-F, or estuarine-E) of waterbody to which the site drains.

Known Impairment: Type of water quality impairment if known

Catchment ID: Catchment ID from GIS database, if applicable

Priority Catchment: Yes or no (Y/N) and type of priority (bacteria or nitrogen)

Site Previously Assessed?: Yes or no (Y/N) and site ID if relevant.

Adjacent Critical Resources: Lists whether the site is at or adjacent to a public beach, anadromous fish run, shellfishing area, or other critical resource.

Hotspot? (Y/N): Hotspots are sites with potentially higher pollutant loads, such as sites with fueling station/pumpouts, etc.

High Pollutant(s) Observed: Yes or no (Y/N) based on quantity of pollutants observed.

Observed Pollutant(s): This is a list of pollutants actually observed, whether in great quantity or not.

Sanitary Sewer Overlap: Yes or no (Y/N) and which contract phase.

Soils: Lists whether the site is expected to have good or poor infiltration based on soil survey (GIS), along with hydrologic soil group (HSG). A/B – Good, C – Fair, D – Poor, UNK.

Invasives: Lists whether project area has invasive plant species present, and if known, which kind(s).

EJ Community (minority/income/minority & income): Lists whether the site is within one or more mapped Environmental Justice (EJ) populations based on mapped census (GIS) information OR within 1 mile of one or more populations.

RETROFIT DETAILS:

Description of proposed concept components, and information needed for ranking and design.

Existing BMP Retrofit or New? Is the proposed practice a retrofit of existing BMP or a new BMP?

Proposed BMP/Pretreatment: General category of proposed BMPs and proposed type of pretreatment. Bioretention, Wet/Dry Swales, Constructed Wetlands, Permeable Pavement, Rainwater Harvesting, Tree/infiltration Trenches, etc.

Non-structural Controls: Describes any additional non-structural practice recommended for the site, such as public education, stabilization, wetland restoration, etc.

BMP Maintenance Burden: Estimated maintenance level for proposed BMP(s) based on type of practice and expected pollutant load. High, Medium, Low.

BMP Benefits: Benefits from proposed practice(s), in addition to the assumed water quality treatment:

Recharge – provides infiltration, recharging groundwater;

Reuse – rainwater harvesting opportunity;

Storage – provides additional volume control for larger storm events;

Demo – location provides opportunity for outreach as a demonstration project;

Repair – opportunity to address an existing problem;

CIP – site already planned for other improvements within 5 years;

Habitat – results in improved habitat, such as wetland restoration, buffer planting, etc.;

Resiliency – opportunity to address future climate-related impacts.

Primary Site Conflicts: Lists potential site conflicts that could affect design and/or construction.

Soils – Poor soils (low infiltration) that may affect design;

Access – Limited access to area for construction and/or future maintenance;

Land Use – usage of site or surrounding area could limit/impact ultimate design (e.g., traffic patterns);

Utilities – actually observed at the site or indications of underground utilities (e.g., digsafe markings);

Polluted – site has existing contamination issues that would complicate permitting/construction;

High WT – sites with high groundwater tables can restrict design and construction options;

Wetlands – sites near wetlands may have complicated permitting burdens or limit design options.

SIZING INFO:

Information needed for the sizing of the proposed concept.

Estimated Drainage Area (ac): Total contributing DA in acres, based on GIS topography. Identified in field; calculated in the office.

Estimated Impervious Area (ac): Total impervious area in DA in acres, based on GIS data. Calculated in the office.

Impervious Area Type: Category of impervious area in DA (e.g., street, parking lot, rooftop, etc.)

WQv Goal/WQv Provided (cf): The water quality volume goal in cubic feet based on one inch of runoff from total estimated impervious area draining to proposed BMP site, as well as the volume provided based on space available and type of proposed BMP(s).

Estimated Practice Area (sf): Available space at site in square feet for the proposed concept. Identified in field; calculated in the office.

Existing Head Available? (Y/N): Is there a generous amount of hydraulic head (vertical distance) available between drainage area and practice area? Certain BMPs require more head than others.

PHOTOS/GRAPHICS:

Up to four photos are included for each site. A drainage area (DA) map with a site sketch is also included to show more detail about the area.

Yarmouth Stormwater Retrofit Field Summary Sheet

Name: Park Avenue - Bioretention		ID#: HIH-2
<p>Site Description: This site is on the corner of Park Avenue and Park Street. The parcel on the west side of Park Street is town owned. There is a flat grassy area on the shoulder of the road; however, most of the parcel consists of a vegetated steep slope. There is a culvert stream crossing under Park Avenue that connects to Hyannis Harbor. Park Avenue is a 20ft wide road and the low point is at the stream crossing. There are two paved flumes at the low point that directly discharge road runoff into the stream.</p> <p>Existing BMP on site? None</p>	<p>Site Location: Corner of Park Street and Park Avenue</p> 	
<p>Concept Description: The concept for this site consists of three roadside bioretention areas. There are two bioretentions proposed within the ROW and one bioretention area proposed on the town-owned parcel. The overflow for this bioretention would be directed into the stream.</p>		
GENERAL SITE INFORMATION		RETROFIT DETAILS
<p>Site Contact: Amanda Lima (Town Engineer) Ownership: Town Existing Site Condition: Fair Land Use: Residential</p>	<p>Existing or New?: New Proposed BMP/Pretreatment: Bioretention / Sediment Forebay Non-Structural Controls: Street Sweeping BMP Maintenance Burden: Medium</p>	
<p>Yarmouth Watershed: South Lewis Bay Watershed (11) Receiving Water: Hyannis Inner Harbor (MA96-82) (E) Known Impairment? Fecal Coliform, Nitrogen Catchment ID: T-203 Priority Catchment: (Y/N) Yes, Bacteria (med), Nitrogen (med) Site Previously Assessed? (Y/N) Y Previous Site ID T-203 (CZM-CPR Grant 2017)</p>	<p>BMP Benefit(s): Recharge</p>	
<p>Adjacent Critical Resources: None Is site a hotspot? No High Pollutants Observed? No Observed Pollutant(s): None Sanitary Sewer Overlap: (Y/N) No Soils: Good - HSG A/B Invasives: No EJ Community: In Income and 1-mile of Minority</p>	<p>Primary Site Conflict(s): Land Use Wetlands</p>	
RETROFIT SIZING INFORMATION		
<p>Estimated Drainage Area (ac): 1.45</p>	<p>WQv Goal/WQv Provided (cf): 2,758/1,065</p>	
<p>Estimated Impervious Area (ac): 0.76</p>	<p>Estimated Practice Area (sf): 580</p>	
<p>Impervious Area Type: Street, Rooftop</p>	<p>Existing Head Available? No</p>	

Date Assessed: 3/3/2023 3:16:14 PM

Assessed by: MW/JV

PHOTOS/SKETCHES



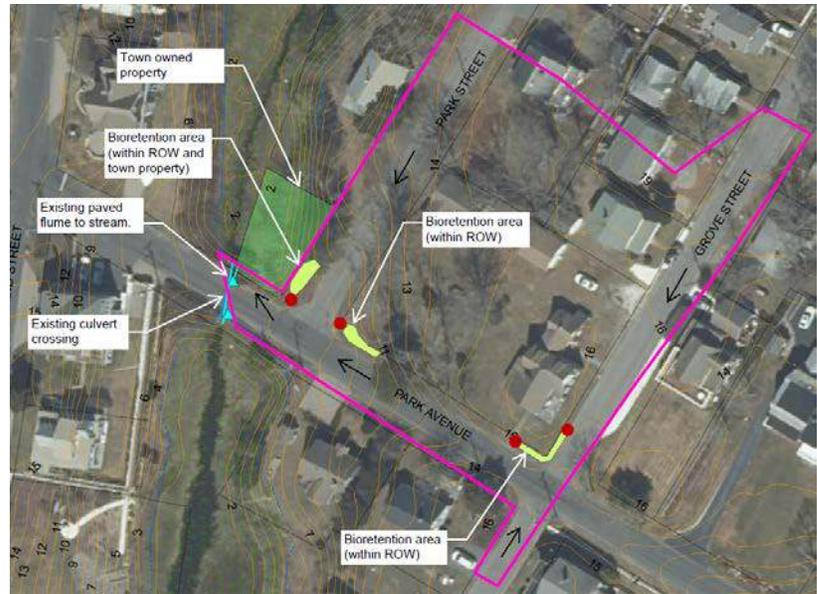
Photo Caption: Standing above the culvert looking toward the ocean showing the paved flume at the low point of the street.



Photo Caption: Park Avenue looking west toward the low point of the road.



Photo Caption: Eastern Corner of Park Avenue and Park Street where a bioretention is proposed.



Site Sketch: Drainage area (pink), BMPs (light green), paved flumes (dark red), existing drainage infrastructure (cyan), and drainage flow paths (arrows).

Date Assessed: 3/3/2023 3:16:14 PM

Assessed by: MW/JV

Yarmouth Stormwater Retrofit Field Summary Sheet

Name: End of Grove Street - Bioretention		ID#: HIH-3
<p>Site Description: Grove Street ends at a public beach on Hyannis Harbor. The road provides room to park a couple cars on the shoulder. Grove Street extends well past the last driveway and slopes steeply down to beach. There is evidence of erosion and damage to the edge pavement, with little vegetation between the road and beach.</p> <p>Existing BMP on site? None</p>	<p>Site Location: End of Grove Street</p> 	
<p>Concept Description: The concept for this site is to shorten the road to a length where two cars are still able to park at the end of the street without blocking driveways. This pavement removal area would then be replaced with a bioretention and vegetated buffer between the beach and the road. A path would be incorporated into the design for continued access to the beach.</p>		
GENERAL SITE INFORMATION	RETROFIT DETAILS	
<p>Site Contact: Amanda Lima (Town Engineer) Ownership: Town Existing Site Condition: Poor Land Use: Residential, beach access</p>	<p>Existing or New?: New Proposed BMP/Pretreatment: Bioretention / Sediment Forebay Non-Structural Controls: Pavement Removal, Buffer Planting, Public Education BMP Maintenance Burden: Low</p>	
<p>Yarmouth Watershed: South Lewis Bay Watershed (11) Receiving Water: Hyannis Inner Harbor (MA96-82) (E) Known Impairment? Fecal Coliform, Nitrogen Catchment ID: N/A Priority Catchment: (Y/N) No Site Previously Assessed? (Y/N) No Previous Site ID N/A</p>	<p>BMP Benefit(s): Demo Habitat Recharge Repair Resiliency</p>	
<p>Adjacent Critical Resources: Public beach, shellfishing area Is site a hotspot? No High Pollutants Observed? No Observed Pollutant(s): Sediment Sanitary Sewer Overlap: (Y/N) No Soils: Good - HSG A/B Invasives: No EJ Community: In Income and 1-mile of Minority</p>	<p>Primary Site Conflict(s): Land Use Wetlands</p>	
RETROFIT SIZING INFORMATION		
<p>Estimated Drainage Area (ac): 0.35</p>	<p>WQv Goal/WQv Provided (cf): 849/847</p>	
<p>Estimated Impervious Area (ac): 0.23</p>	<p>Estimated Practice Area (sf): 375</p>	
<p>Impervious Area Type: Street, Rooftop</p>	<p>Existing Head Available? Yes</p>	

Date Assessed: 3/3/2023 3:26:58 PM

Assessed by: MW/JV

PHOTOS/SKETCHES



Photo Caption: Grove Street looking toward beach access.



Photo Caption: Beach access at end of Grove Street.



Photo Caption: Grove Street looking north.



Site Sketch: Drainage area (pink), BMPs (light green), paved flumes (dark red), pavement removal (striped gray), revegetation (dark green), and drainage flow paths (arrows).

Date Assessed: 3/3/2023 3:26:58 PM

Assessed by: MW/JV

Yarmouth Stormwater Retrofit Field Summary Sheet

Name: Park Avenue near Vernon - Bioretention		ID#: HIH-4
<p>Site Description: This site includes the length of Park Avenue between Grove Street and Glenwood Street. The portion of Park Ave is low-lying and has a low point/wetland crossing between Vernon Street and Stone Avenue. The map shows a culvert crossing but it appears to be completely buried. There is evidence that water occasionally flows over the road during large events/high groundwater and sediment accumulation at road inlets. Existing BMP on site? None</p>	<p>Site Location: Park Avenue near Vernon Street</p> 	
<p>Concept Description: The concept for this site is to install BMPs along Park Avenue. There are three bioretention areas and one infiltration trench proposed within the ROW. The infiltration trench design will allow continued roadside parking. Overflow for the BMPs would continue down the street to the low point. <i>*Future work here should consider culvert replacement and marsh restoration to improve connectivity/habitat/resiliency.</i></p>		
GENERAL SITE INFORMATION	RETROFIT DETAILS	
<p>Site Contact: Amanda Lima (Town Engineer) Ownership: Town Existing Site Condition: Fair Land Use: Residential</p>	<p>Existing or New?: New Proposed BMP/Pretreatment: Bioretention / Sediment Forebays Non-Structural Controls: Neighborhood Education on Lawn Management BMP Maintenance Burden: Medium</p>	
<p>Yarmouth Watershed: South Lewis Bay Watershed (11) Receiving Water: Hyannis Inner Harbor (MA96-82) (E) Known Impairment? Fecal Coliform Nitrogen Catchment ID: T-201 Priority Catchment: (Y/N) Yes, Bacteria (high), Nitrogen (med) Site Previously Assessed? (Y/N) Y Previous Site ID T-201 (CZM-CPR Grant 2017)</p>	<p>BMP Benefit(s): Recharge</p>	
<p>Adjacent Critical Resources: Is site a hotspot? No High Pollutants Observed? No Observed Pollutant(s): Sediment Sanitary Sewer Overlap: (Y/N) No Soils: Good - HSG A/B Invasives: Yes, Phragmites EJ Community: In Income and 1-mile of Minority</p>	<p>Primary Site Conflict(s): Utilities Land Use Wetlands High WT</p>	
RETROFIT SIZING INFORMATION		
<p>Estimated Drainage Area (ac): 3.30</p>	<p>WQv Goal/WQv Provided (cf): 7,186/2,866</p>	
<p>Estimated Impervious Area (ac): 1.98</p>	<p>Estimated Practice Area (sf): Bioretention: 1,113 Infiltration Trench: 830</p>	
<p>Impervious Area Type: Street, Rooftop</p>	<p>Existing Head Available? No</p>	

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Assessed by: MW/JV

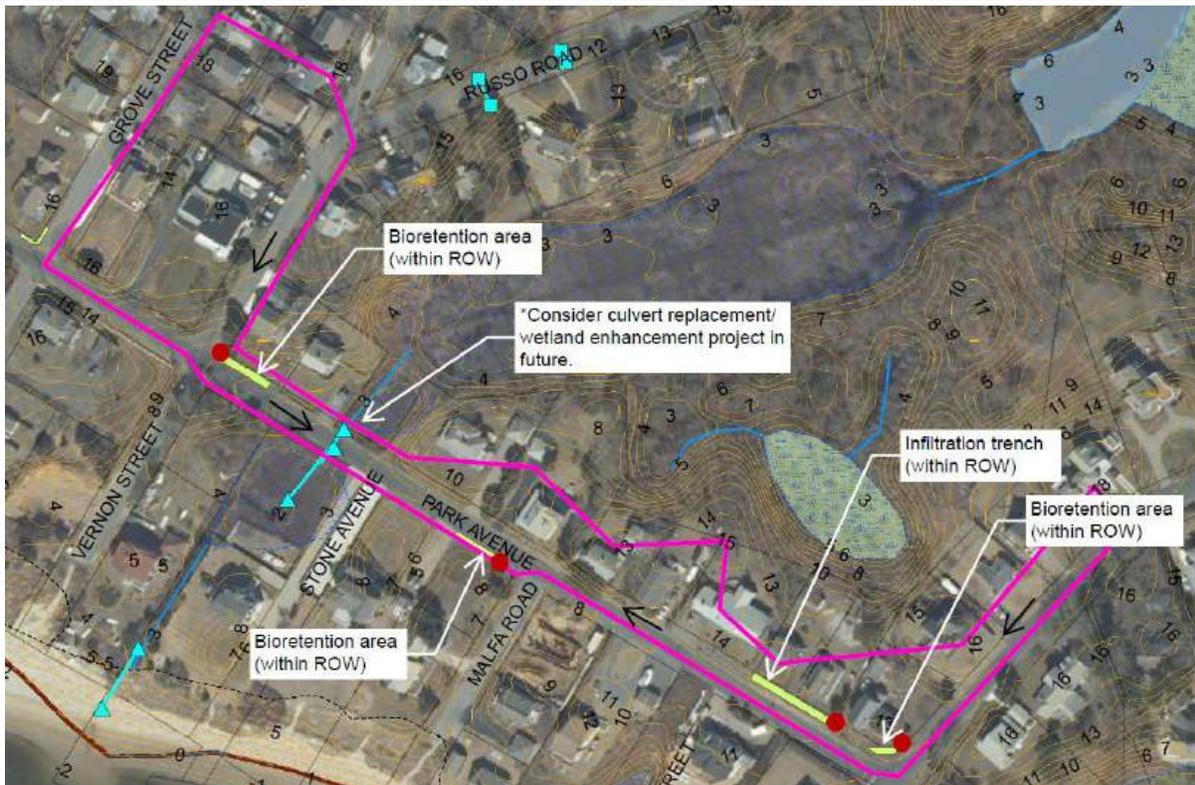
PHOTOS/SKETCHES



Photo Caption: Corner of Park Ave and Malfa Road looking west – proposed bioretention along southside of road.



Photo Caption: Standing at low point of Park Avenue looking inland.



Site Sketch: Drainage area (pink), BMPs (light green), paved flumes (dark red), existing infrastructure (cyan), and drainage flow paths (arrows).

Date Assessed: 3/3/2023 3:44:55 PM

Assessed by: MW/JV

Yarmouth Stormwater Retrofit Field Summary Sheet

Name: Wimbledon Drive – Infiltration Trench/Bioretention		ID#: LB-2
<p>Site Description: There is a closed drainage system along Wimbledon Drive and Preston Avenue consisting of seven catch basins (some leaching) and a piped outfall into a wetland that continues to Lewis Bay. The two roads are quite flat and have some evidence of sediment accumulation and ponding.</p> <p>Existing BMP on site? None</p>	<p>Site Location: Wimbledon Drive</p> 	
<p>Concept Description: The concept for this site is to install roadside BMPs prior to the existing catch basins along Wimbledon Drive and Preston Way. There are four bioretention areas and two infiltration trenches proposed within the ROW. The BMPs would overflow into the existing catch basins and continue to the existing piped outfall.</p>		
GENERAL SITE INFORMATION	RETROFIT DETAILS	
<p>Site Contact: Amanda Lima (Town Engineer) Ownership: Town Existing Site Condition: Fair Land Use: Residential</p>	<p>Existing or New?: New Proposed BMP/Pretreatment: Infiltration Trench / Bioretention Area / Sediment Forebay Non-Structural Controls: Street Sweeping, Public Education BMP Maintenance Burden: Low</p>	
<p>Yarmouth Watershed: South Lewis Bay Watershed (11) Receiving Water: Lewis Bay (MA96-36) (E) Known Impairment? Estuarine Bioassessments, Fecal Coliform, Nitrogen, Nutrient/Eutrophication, Biological Indicators Catchment ID: T-184 Priority Catchment: (Y/N) Yes, Bacteria (high), Nitrogen (med) Site Previously Assessed? (Y/N) No Previous Site ID N/A</p>	<p>BMP Benefit(s): Recharge Demo</p>	
<p>Adjacent Critical Resources: None Is site a hotspot? No High Pollutants Observed? No Observed Pollutant(s): None Sanitary Sewer Overlap: (Y/N) No Soils: Good - HSG A/B Invasives: None EJ Community: 1-mile of both Income and Minority</p>	<p>Primary Site Conflict(s): Land Use</p>	
RETROFIT SIZING INFORMATION		
<p>Estimated Drainage Area (ac): 3.55</p>	<p>WQv Goal/WQv Provided (cf): 5,458/3,436</p>	
<p>Estimated Impervious Area (ac): 1.5</p>	<p>Estimated Practice Area (sf): Bioretention: 1,655 Infiltration Trench: 400</p>	
<p>Impervious Area Type: Street, Rooftop</p>	<p>Existing Head Available? No</p>	

Date Assessed: 3/29/2023 1:39:22 PM

Assessed by: MW/JV

PHOTOS/SKETCHES



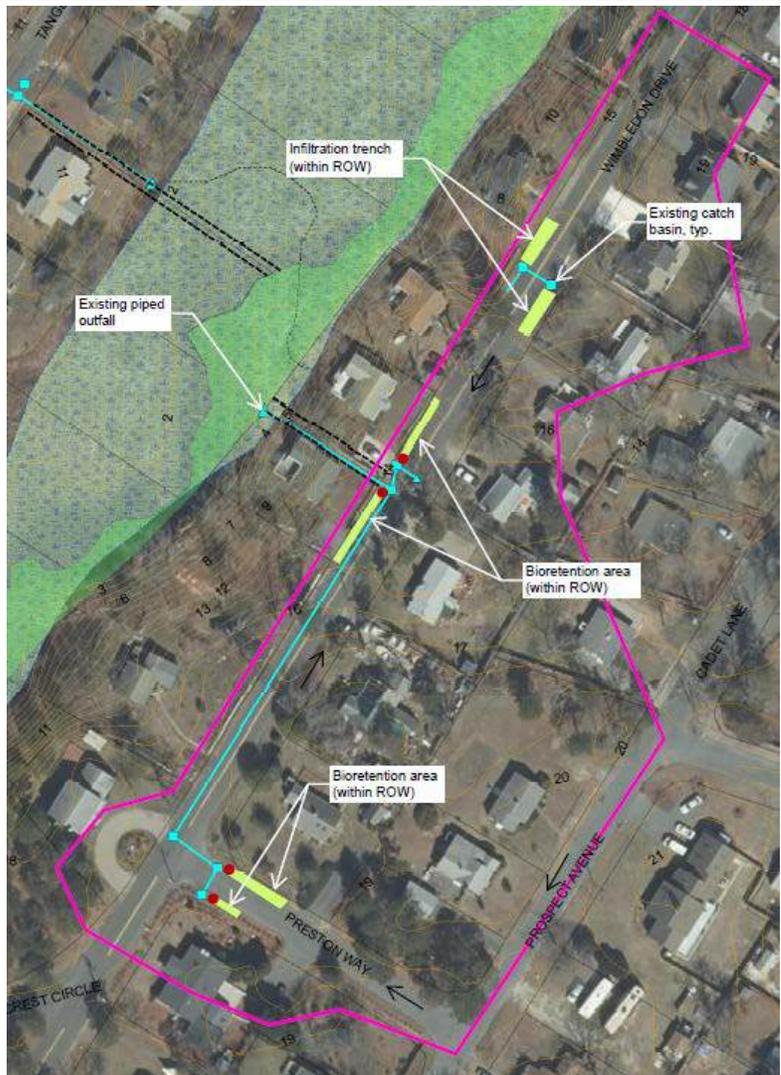
Photo Caption: Catch basin on the west side of Wimbledon Drive furthest north.



Photo Caption: Two catch basins on Preston Way that connect to Wimbledon outfall.



Photo Caption: Catch basin on the west side of Wimbledon Drive closest to outfall.

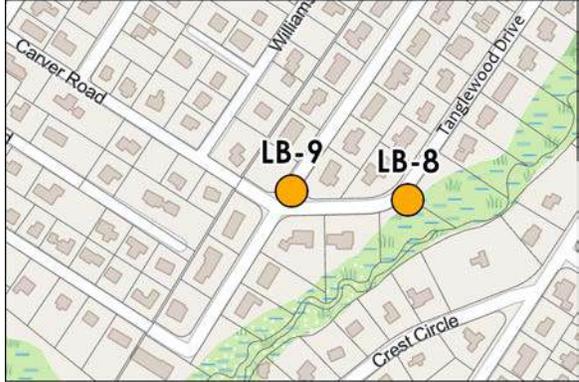


Site Sketch: Drainage area (pink), BMPs (light green), paved flumes (dark red), existing infrastructure (cyan), and drainage flow paths (arrows).

Date Assessed: 3/29/2023 1:39:22 PM

Assessed by: MW/JV

Yarmouth Stormwater Retrofit Field Summary Sheet

Name: Tanglewood Drive - Bioretention		ID#: LB-8/9
<p>Site Description: Tanglewood Drive is a 19-ft wide loop road with a high point in the middle of the loop splitting the road into two drainage areas. This site is focusing on the southern drainage area. There is one catch basin at the low point that discharges via a piped outfall directly into a wetland connecting to Lewis Bay. There are two town-owned parcels at the low point of the road; most of which consist of wetlands.</p> <p>Existing BMP on site? None</p> <p>Concept Description: The concept for this site is to install roadside bioretention areas along Tanglewood Drive that are within the ROW and/or town-owned property. The low point of the road would be regraded to direct runoff to the bioretention area rather than the catch basin. Overflow for the BMPs would continue down the street to the low point. The lowest bioretention area would overflow via a spillway into the wetland.</p>	<p>Site Location: Tanglewood Drive</p> 	
GENERAL SITE INFORMATION		RETROFIT DETAILS
<p>Site Contact: Amanda Lima (Town Engineer) Ownership: Town Existing Site Condition: Good Land Use: Residential</p>	<p>Existing or New?: New Proposed BMP/Pretreatment: Bioretention / Sediment Forebay Non-Structural Controls: Street Sweeping, Invasive Management BMP Maintenance Burden: High</p>	
<p>Yarmouth Watershed: South Lewis Bay Watershed (11) Receiving Water: Lewis Bay (MA96-36) (E) Known Impairment? Estuarine Bioassessments, Fecal Coliform, Nitrogen, Nutrient/Eutrophication, Biological Indicators Catchment ID: N/A Priority Catchment: (Y/N) No Site Previously Assessed? (Y/N) No Previous Site ID N/A</p>	<p>BMP Benefit(s): Habitat Recharge</p>	
<p>Adjacent Critical Resources: None Is site a hotspot? No High Pollutants Observed? No Observed Pollutant(s): None Sanitary Sewer Overlap: (Y/N) No Soils: Good - HSG A/B Invasives: Yes EJ Community: 1-mile of both Income and Minority</p>	<p>Primary Site Conflict(s): Wetlands Land Use</p>	
RETROFIT SIZING INFORMATION		
<p>Estimated Drainage Area (ac): 4.86</p>	<p>WQv Goal/WQv Provided (cf): 6,546/5,327</p>	
<p>Estimated Impervious Area (ac): 1.80</p>	<p>Estimated Practice Area (sf): 2,900</p>	
<p>Impervious Area Type: Street, Rooftop</p>	<p>Existing Head Available? No</p>	

Date Assessed: 3/29/2023 4:31:32 PM

Assessed by: MW/JV

PHOTOS/SKETCHES



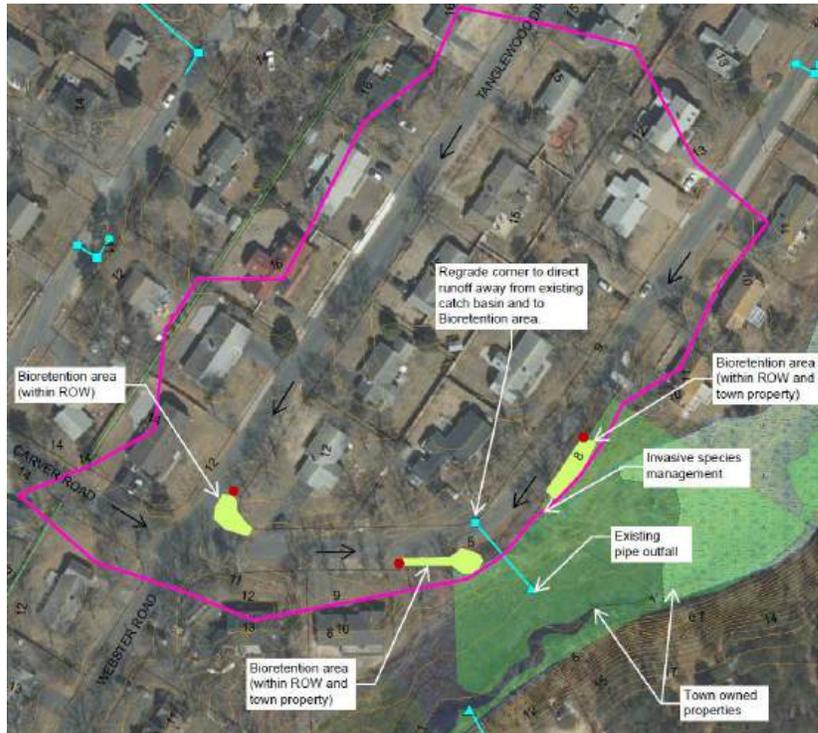
Photo Caption: Tanglewood Drive looking northeast. Town property on right side of photo.



Photo Caption: Catch basin at low point of Tanglewood Drive looking west towards Webster Road.



Photo Caption: Southwest corner of Tanglewood Drive where a bioretention is proposed in the ROW in front of the flag pole.



Site Sketch: Drainage area (pink), BMPs (light green), paved flumes (dark red), existing infrastructure (cyan), and drainage flow paths (arrows).

Date Assessed: 3/29/2023 4:31:32 PM

Assessed by: MW/JV

Yarmouth Stormwater Retrofit Field Summary Sheet

Name: Wings Grove Beach - Bioretention		ID#: LPBR-1
<p>Site Description: Wings Grove Beach and Park is a public recreation area on Long Pond located off Indian Memorial Drive. The paved parking lot is fairly steep and drains towards the beach and to a catch basin in the low point in the northwestern corner of the parking lot. The existing catch basin connects to underground leaching galleys and also a discharge pipe to the pond.</p> <p>Existing BMP on site? Catch basins and leaching galleys to an outfall.</p> <p>Concept Description: The concept for this site is to bypass the existing catch basin at the low point and redirect to a paved flume to a sediment forebay and bioretention area. The bioretention would overflow to the existing leaching system/pond.</p>	<p>Site Location: Indian Memorial Drive</p> 	
GENERAL SITE INFORMATION		RETROFIT DETAILS
<p>Site Contact: Amanda Lima (Town Engineer) Ownership: Town Existing Site Condition: Poor Land Use: Park/Beach</p>	<p>Existing or New?: Existing Proposed BMP/Pretreatment: Bioretention / Sediment Forebay Non-Structural Controls: Street Sweeping, Public Education BMP Maintenance Burden: Medium</p>	
<p>Yarmouth Watershed: Bass River Watershed (10) Receiving Water: Long Pond (MA96180) (F) Known Impairment? Unacceptable for Phosphorus (SOTW) Catchment ID: T-116 Priority Catchment: (Y/N) Yes, Bacteria (low), Nitrogen (low) Site Previously Assessed? (Y/N) Yes Previous Site ID RP4 (Municipal Property Retrofits 2022)</p>	<p>BMP Benefit(s): Repair Demo</p>	
<p>Adjacent Critical Resources: Anadromous Fish Run, Public Beach Is site a hotspot? No High Pollutants Observed? No Observed Pollutant(s): Sediment Sanitary Sewer Overlap: (Y/N) No Soils: Good - HSG A/B Invasives: No EJ Community: In Minority</p>	<p>Primary Site Conflict(s): Wetlands</p>	
RETROFIT SIZING INFORMATION		
<p>Estimated Drainage Area (ac): 1.12</p>	<p>WQv Goal/WQv Provided (cf): 985/985</p>	
<p>Estimated Impervious Area (ac): 0.27</p>	<p>Estimated Practice Area (sf): 536</p>	
<p>Impervious Area Type: Parking Lot</p>	<p>Existing Head Available? Yes</p>	

Date Assessed: 3/3/2023 8:42:16 PM

Assessed by: EK/GK

PHOTOS/SKETCHES



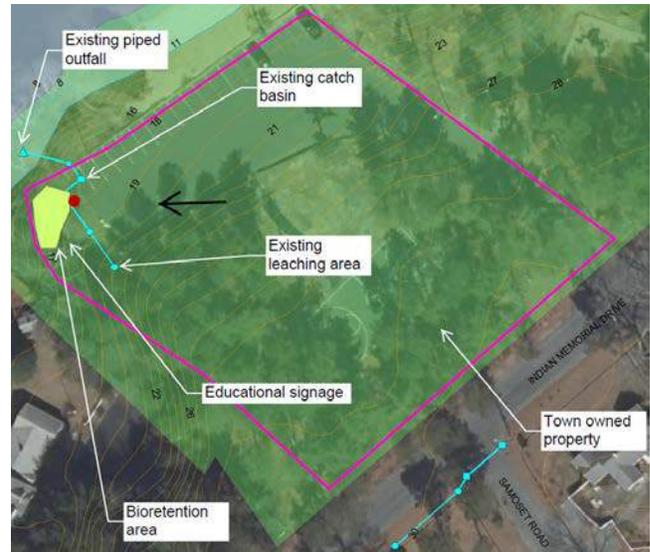
Photo Caption: Area of proposed BMP.



Photo Caption: Low point in parking lot.



Photo Caption: Outfall at Long Pond.



Site Sketch: Drainage area (pink), BMPs (light green), paved flumes (dark red), existing infrastructure (cyan), and drainage flow paths (arrows).

Date Assessed: 3/3/2023 8:42:16 PM

Assessed by: EK/GK

Yarmouth Stormwater Retrofit Field Summary Sheet

Name: Indian Memorial Drive (gazebo) - Bioretention		ID#: LPBR-4
<p>Site Description: This site is at a park with a gazebo along Indian Memorial Drive. There is a closed drainage system with catch basins and leaching trenches to an outfall into Long Pond. The park slopes gently toward the gazebo and then there is a steep drop to the pond's edge.</p> <p>Existing BMP on site? Leaching system</p> <p>Concept Description: The concept for this site is to bypass the existing catch basins with paved flumes to bioretention areas with sediment forebays. The bioretention could be connected to the existing leaching trenches as space allows and then overflow to the pond. It appears that there is enough space at this location for both the proposed surface BMP as well as open space for recreational use.</p>	<p>Site Location: Indian Memorial Drive</p> 	
GENERAL SITE INFORMATION		RETROFIT DETAILS
<p>Site Contact: Amanda Lima (Town Engineer) Ownership: Town Existing Site Condition: Fair Land Use: Park</p>	<p>Existing or New?: Existing Proposed BMP/Pretreatment: Bioretention / Sediment Forebay Non-Structural Controls: Street Sweeping, Public Education BMP Maintenance Burden: Medium</p>	
<p>Yarmouth Watershed: Bass River Watershed (10) Receiving Water: Long Pond (MA96180) (F) Known Impairment? Unacceptable for Phosphorus (SOTW) Catchment ID: T-115 Priority Catchment: (Y/N) Yes Bacteria (high), Nitrogen (high) Site Previously Assessed? (Y/N) Yes Previous Site ID RP14 (Municipal Property Retrofits 2022)</p>	<p>BMP Benefit(s): Repair Demo</p>	
<p>Adjacent Critical Resources: Anadromous Fish Run, Public Beach Is site a hotspot? No High Pollutants Observed? No Observed Pollutant(s): Sediment Sanitary Sewer Overlap: (Y/N) No Soils: Good - HSG A/B Invasives: No EJ Community: In Minority</p>	<p>Primary Site Conflict(s): Wetlands Land Use</p>	
RETROFIT SIZING INFORMATION		
<p>Estimated Drainage Area (ac): 3.50</p>	<p>WQv Goal/WQv Provided (cf): 4,449/1,352</p>	
<p>Estimated Impervious Area (ac): 1.23</p>	<p>Estimated Practice Area (sf): 736</p>	
<p>Impervious Area Type: Street, Rooftop</p>	<p>Existing Head Available? Yes</p>	

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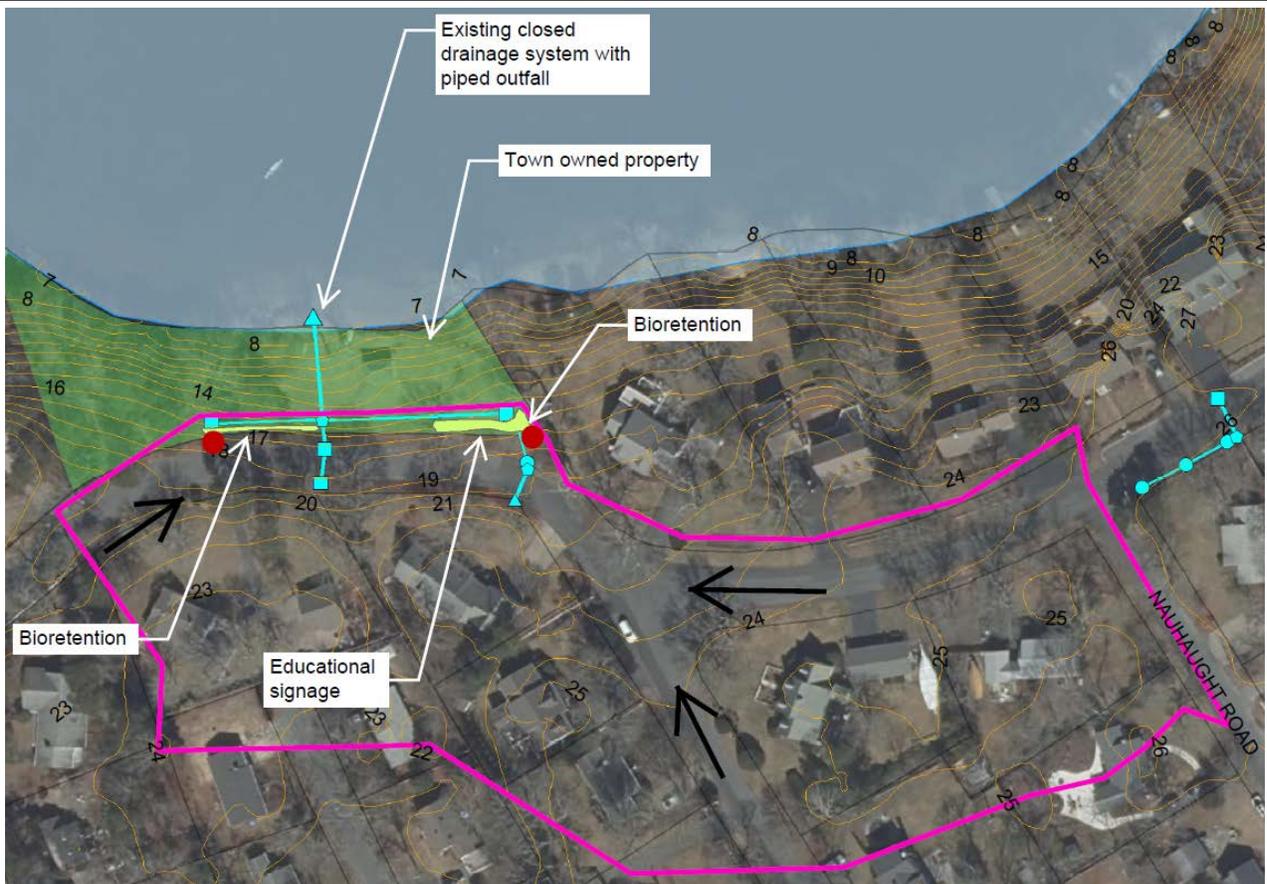
Assessed by: EK/GK

PHOTOS/SKETCHES



Photo Caption: Area of proposed BMP.

Photo Caption: Looking west on Indian Memorial Drive.



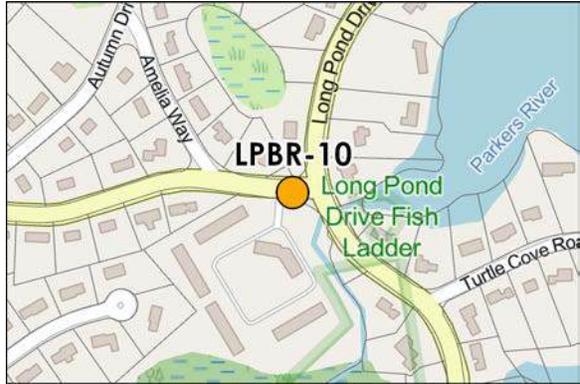
Site Sketch: Drainage area (pink), BMPs (light green), paved flumes (dark red), existing infrastructure (cyan), and drainage flow paths (arrows).

Date Assessed: 3/29/2023 1:50:33 PM

Assessed by: EK/GK

Yarmouth Stormwater Retrofit Field Summary Sheet

Name: Long Pond Plaza - Bioretention	ID#: LPBR-10
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<p>Site Description: There is a closed drainage system at the intersection of Winslow Gray Road and Long Pond Drive that collects runoff from both roads and appears to be discharged to a “bubbler” catch basin on the eastern side of Long Pond Drive near Long Pond. The catch basins at the entrance to the Housing Authority property are connected to leaching trenches and then the closed drainage system.</p> <p>Existing BMP on site? Catch basins to leaching trenches and discharge to Long Pond</p>	<p>Site Location: Winslow Gray Road</p> 
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<p>Concept Description: The concept for this site is to bypass the existing catch basins to paved flumes with bioretention and sediment forebays. The bioretention would overflow to the existing closed drainage system.</p>	
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GENERAL SITE INFORMATION	RETROFIT DETAILS
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<p>Site Contact: Yarmouth Housing Authority Ownership: Town Existing Site Condition: Good Land Use: Municipal/Multi-Family Residential</p>	<p>Existing or New?: Existing Proposed BMP/Pretreatment: Bioretention / Sediment Forebay Non-Structural Controls: Street Sweeping, Public Education BMP Maintenance Burden: Low</p>
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<p>Yarmouth Watershed: North Parker River Watershed (9) Receiving Water: Long Pond (MA96180) (F) Known Impairment? Unacceptable for Phosphorus (SOTW) Catchment ID: T-118 Priority Catchment: (Y/N) Yes, Bacteria (med), Nitrogen (med) Site Previously Assessed? (Y/N) Yes Previous Site ID D8 and R16 (Municipal Property Retrofits 2022)</p>	<p>BMP Benefit(s): Demo</p>
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<p>Adjacent Critical Resources: Anadromous Fish Run Is site a hotspot? No High Pollutants Observed? No Observed Pollutant(s): Sediment Sanitary Sewer Overlap: (Y/N) No Soils: Good - HSG A/B Invasives: No EJ Community: In Minority</p>	<p>Primary Site Conflict(s): Wetlands/River</p>
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RETROFIT SIZING INFORMATION	
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Estimated Drainage Area (ac): 0.59	WQv Goal/WQv Provided (cf): 1,337/781
Estimated Impervious Area (ac): 0.37	Estimated Practice Area (sf): 425
Impervious Area Type: Parking Lot, Street, Rooftop	Existing Head Available? Yes

Date Assessed: 3/29/2023 3:39:59 PM

Assessed by: EK/GK

PHOTOS/SKETCHES



Photo Caption: Area for proposed BMP.

Photo Caption: Catch basin in driveway for Housing Authority property.



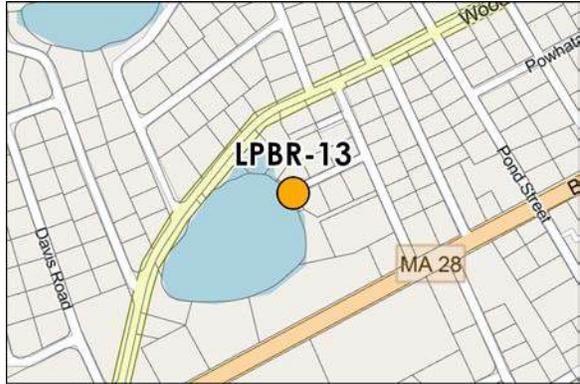
Photo Caption: Looking north on Long Pond Drive.

Site Sketch: Drainage area (pink), BMPs (light green), paved flumes (dark red), existing infrastructure (cyan), and drainage flow paths (arrows).

Date Assessed: 3/29/2023 3:39:59 PM

Assessed by: EK/GK

Yarmouth Stormwater Retrofit Field Summary Sheet

Name: Smith Road - Bioretention		ID#: LPBR-13
<p>Site Description: The majority of the runoff from the neighborhood to the east of James Pond discharges to the pond via a closed drainage system and outfall at the end of Smith Road. However, it does not appear that Smith Road itself is connected to this closed drainage system (no drainage structures), and surface runoff has created an eroded gully from the end of pavement to the pond. It also appears that this road end is used for pond access.</p> <p>Existing BMP on site? None</p> <p>Concept Description: The concept for this site is to construct a bioretention with a sediment forebay at the end of Smith Road to treat the surface runoff (not from the closed drainage system). Need to maintain access for neighbor's driveway and pond access. Possible small area of pavement removal.</p>	<p>Site Location: End of Smith Road</p> 	
GENERAL SITE INFORMATION	RETROFIT DETAILS	
<p>Site Contact: Amanda Lima (Town Engineer) Ownership: Town Existing Site Condition: Fair Land Use: Residential</p>	<p>Existing or New?: New Proposed BMP/Pretreatment: Bioretention / Sediment Forebay Non-Structural Controls: Pavement Removal, Public Education, Stabilization BMP Maintenance Burden: Low</p>	
<p>Yarmouth Watershed: Nantucket Sound Watershed (13) Receiving Water: James Pond (NA) (F) Known Impairment? None Catchment ID: N/A Priority Catchment: (Y/N) No Site Previously Assessed? (Y/N) No Previous Site ID N/A</p>	<p>BMP Benefit(s): Repair Demo</p>	
<p>Adjacent Critical Resources: None Is site a hotspot? No High Pollutants Observed? No Observed Pollutant(s): Sediment Sanitary Sewer Overlap: (Y/N) No Soils: Good - HSG A/B Invasives: No EJ Community: 1-mile of Minority</p>	<p>Primary Site Conflict(s): Land Use Wetlands</p>	
RETROFIT SIZING INFORMATION		
<p>Estimated Drainage Area (ac): 0.69</p>	<p>WQv Goal/WQv Provided (cf): 1,285/575</p>	
<p>Estimated Impervious Area (ac): 0.35</p>	<p>Estimated Practice Area (sf): 313</p>	
<p>Impervious Area Type: Street, Rooftop</p>	<p>Existing Head Available? Yes</p>	

Date Assessed: 3/29/2023 6:19:04 PM

Assessed by: EK/GK

PHOTOS/SKETCHES



Photo Caption: Looking east up Smith Road.



Photo Caption: Looking toward James Pond.

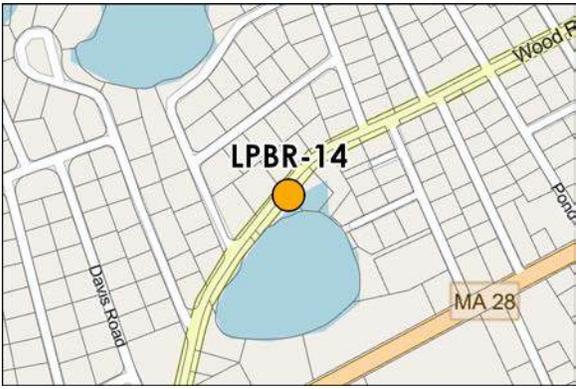


Site Sketch: Drainage area (pink), BMPs (light green), paved flumes (dark red), existing infrastructure (cyan), and drainage flow paths (arrows).

Date Assessed: 3/29/2023 6:19:04 PM

Assessed by: EK/GK

Yarmouth Stormwater Retrofit Field Summary Sheet

Name: Wood Road at James Pond - Constructed Wetland		ID#: LPBR-14
<p>Site Description: There are a series of catch basins, leaching trenches, and outfalls along Wood Road that discharge to James Pond. There is a fairly steep slope behind the sidewalk for most of the area adjacent to the pond. One outfall has a larger level area.</p> <p>Existing BMP on site? Closed drainage system with leaching trenches and outfall</p>	<p>Site Location: Wood Road</p> 	
<p>Concept Description: The concept for this site is to replace a portion of the aging leach trenches with a constructed wetland with an overflow to James Pond. A retaining wall or terraced system may be required due to steep slopes.</p>		
GENERAL SITE INFORMATION	RETROFIT DETAILS	
<p>Site Contact: Amanda Lima (Town Engineer) Ownership: Town Existing Site Condition: Fair Land Use: Residential Roadway</p>	<p>Existing or New?: Existing Proposed BMP/Pretreatment: Constructed Wetland / Sediment Forebay Non-Structural Controls: Street Sweeping BMP Maintenance Burden: Low</p>	
<p>Yarmouth Watershed: Nantucket Sound Watershed (13) Receiving Water: James Pond (NA) (F) Known Impairment? None Catchment ID: T-124 Priority Catchment: (Y/N) No data Site Previously Assessed? (Y/N) No Previous Site ID N/A</p>	<p>BMP Benefit(s): Repair</p>	
<p>Adjacent Critical Resources: None Is site a hotspot? No High Pollutants Observed? No Observed Pollutant(s): Sediment Sanitary Sewer Overlap: (Y/N) No Soils: Good - HSG A/B Invasives: No EJ Community: 1-mile of Minority</p>	<p>Primary Site Conflict(s): Access Utilities Wetlands</p>	
RETROFIT SIZING INFORMATION		
<p>Estimated Drainage Area (ac): 2.88</p>	<p>WQv Goal/WQv Provided (cf): 3,382/2,569</p>	
<p>Estimated Impervious Area (ac): 0.93</p>	<p>Estimated Practice Area (sf): 1,429</p>	
<p>Impervious Area Type: Street, Rooftop</p>	<p>Existing Head Available? Yes</p>	

Date Assessed: 3/29/2023 6:47:03 PM

Assessed by: EK/GK

PHOTOS/SKETCHES



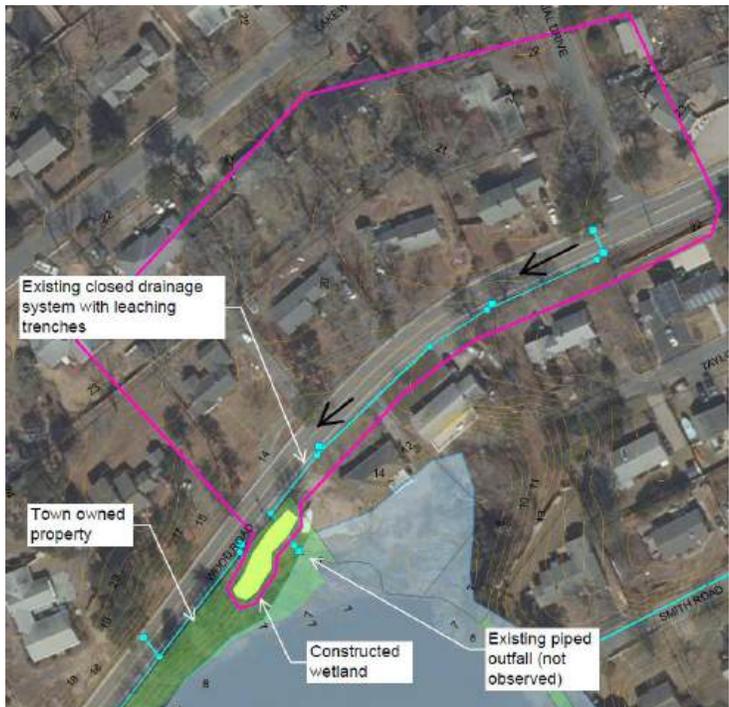
Photo Caption: Looking east on Wood Road.



Photo Caption: Area of proposed BMP.



Photo Caption: Looking west on Wood Road.



Site Sketch: Drainage area (pink), BMPs (light green), existing infrastructure (cyan), and drainage flow paths (arrows).

Date Assessed: 3/29/2023 6:47:03 PM

Assessed by: EK/GK

Yarmouth Stormwater Retrofit Field Summary Sheet

Name: Baxter Avenue – Constructed Wetland	ID#: MC-2
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<p>Site Description: At the low point on Baxter Avenue just north of Pamela Court, there is an eroded flow path (no formal drainage infrastructure) down a steep embankment and into a wetland on a town-owned property. Most of this property is wetlands, however, there is some upland space available in the northwestern corner of the parcel. In the drainage area to the north, there are a four catch basins on Cleveland Way and Gleason Avenue that are directed down Gleason Avenue to the wetland. There is a high point separating the catch basins from the Baxter Avenue low point drainage area.</p> <p>Existing BMP on site? None</p>	<p>Site Location: Baxter Avenue</p> 
<p>Concept Description: The concept for this site consists of installing a constructed wetland on the town-owned property. A catch basin is proposed to be installed at the low point of Baxter Avenue and piped to the constructed wetland. Additionally, the four catch basins to the north are proposed to be redirected via pipes and structures to the constructed wetland.</p>	

GENERAL SITE INFORMATION	RETROFIT DETAILS
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<p>Site Contact: Amanda Lima (Town Engineer) Ownership: Town Existing Site Condition: Fair Land Use: Residential, Conservation</p>	<p>Existing or New?: New Proposed BMP/Pretreatment: Constructed Wetland / Sediment Forebay Non-Structural Controls: Trash Management, Invasive Species Management BMP Maintenance Burden: Low</p>
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<p>Yarmouth Watershed: South Lewis Bay Watershed (11) Receiving Water: Mill Creek (MA96-80) (E) Known Impairment? Fecal Coliform, Nitrogen Catchment ID: N/A Priority Catchment: (Y/N) No Site Previously Assessed? (Y/N) No Previous Site ID N/A</p>	<p>BMP Benefit(s): Habitat Storage Repair</p>
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<p>Adjacent Critical Resources: Anadromous Fish Run Is site a hotspot? No High Pollutants Observed? No Observed Pollutant(s): Trash Sanitary Sewer Overlap: (Y/N) No Soils: Good - HSG A/B Invasives: Yes, variety EJ Community: In Income and 1-mile of Minority</p>	<p>Primary Site Conflict(s): Access High WT Wetlands</p>
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RETROFIT SIZING INFORMATION

<p>Estimated Drainage Area (ac): 4.25</p>	<p>WQv Goal/WQv Provided (cf): 2,212/2,212</p>
<p>Estimated Impervious Area (ac): 0.61</p>	<p>Estimated Practice Area (sf): 2,800</p>
<p>Impervious Area Type: Street, Rooftop</p>	<p>Existing Head Available? Yes</p>

Date Assessed: 3/3/2023 5:28:03 PM

Assessed by: MW/JV

PHOTOS/SKETCHES



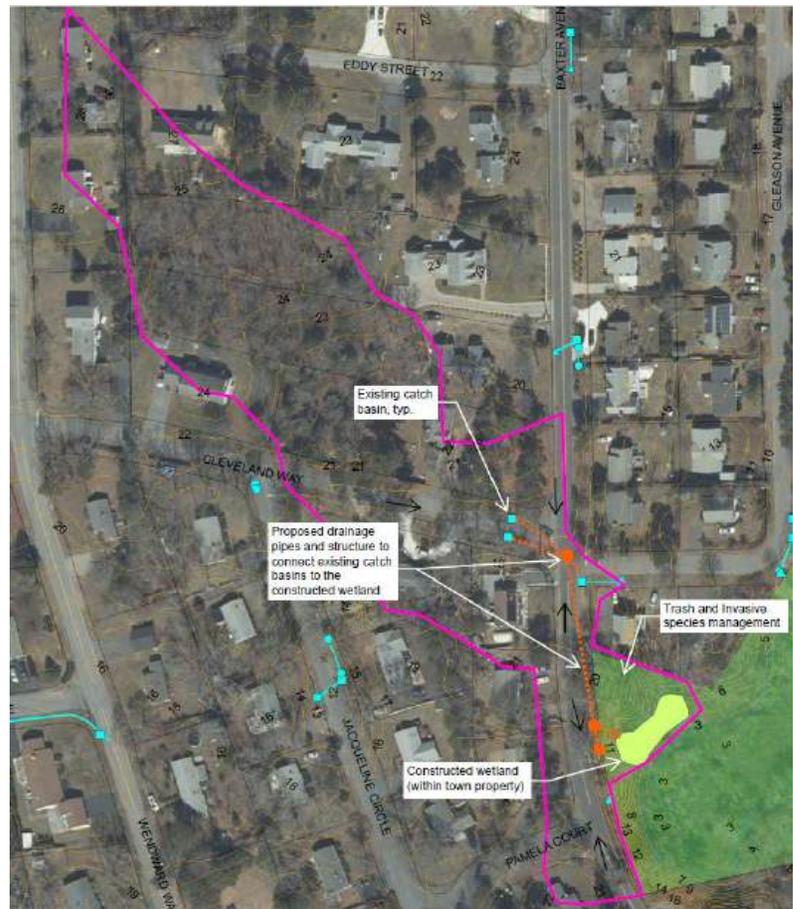
Photo Caption: Baxter Avenue looking north toward Gleason Avenue.



Photo Caption: Town-owned property on Baxter Avenue. Area for BMP.



Photo Caption: Eroded flow path on town-owned property from Baxter Avenue.



Site Sketch: Drainage area (pink), BMPs (light green), existing infrastructure (cyan), proposed infrastructure (orange) and drainage flow paths (arrows).

Date Assessed: 3/3/2023 5:28:03 PM

Assessed by: MW/JV

Yarmouth Stormwater Retrofit Field Summary Sheet

Name: Standish Way – Infiltration Trench/Bioretenion		ID#: MC-3
<p>Site Description: There are two catch basins at bottom of Windemere Road directing runoff to an infiltration trench. Standish Way parking lot recently has had porous pavement and an underground gravel wetland installed. Runoff from Standish Way flows onto the porous pavement parking lot.</p> <p>Existing BMP on site? Porous pavement, gravel wetland, and infiltration trench</p>	<p>Site Location: Standish Way</p> 	
<p>Concept Description: The concept for this site is to install BMPs along Standish Way to reduce pollutants flowing onto the downgradient BMPs. There is one bioretention area and one infiltration trench proposed within the ROW. Overflow for the BMPs would continue down the street to the Standish Way parking lot.</p>		
GENERAL SITE INFORMATION	RETROFIT DETAILS	
<p>Site Contact: Amanda Lima (Town Engineer) Ownership: Town Existing Site Condition: Good Land Use: ROW, Residential</p>	<p>Existing or New?: Existing Proposed BMP/Pretreatment: Infiltration trench / Bioretention / Sediment Forebay Non-Structural Controls: Lawn Management, Public Education BMP Maintenance Burden: Medium</p>	
<p>Yarmouth Watershed: South Lewis Bay Watershed (11) Receiving Water: Mill Creek (MA96-80) (E) Known Impairment? Fecal Coliform, Nitrogen Catchment ID: T-194 Priority Catchment: (Y/N) Yes, Bacteria (med), Nitrogen (med) Site Previously Assessed? (Y/N) Yes Previous Site ID T-194 (CZM-CPR Grant 2017) RB11 (Municipal Property Retrofits 2022)</p>	<p>BMP Benefit(s): Recharge Demo Repair CIP</p>	
<p>Adjacent Critical Resources: Shellfishing Area, Anadromous Fish Run, Public beach Is site a hotspot? No High Pollutants Observed? No Observed Pollutant(s): Sediment Sanitary Sewer Overlap: (Y/N) No Soils: Good - HSG A/B Invasives: No EJ Community: 1-mile of both Income and Minority</p>	<p>Primary Site Conflict(s): Utilities High WT</p>	
RETROFIT SIZING INFORMATION		
<p>Estimated Drainage Area (ac): 1.53</p>	<p>WQv Goal/WQv Provided (cf): 3,393/3,393</p>	
<p>Estimated Impervious Area (ac): 0.93</p>	<p>Estimated Practice Area (sf): Bioretention: 1,800 Infiltration Trench: 200</p>	
<p>Impervious Area Type: Street, Rooftop</p>	<p>Existing Head Available? No</p>	

Date Assessed: 3/3/2023 6:47:02 PM

Assessed by: MW/JV

PHOTOS/SKETCHES



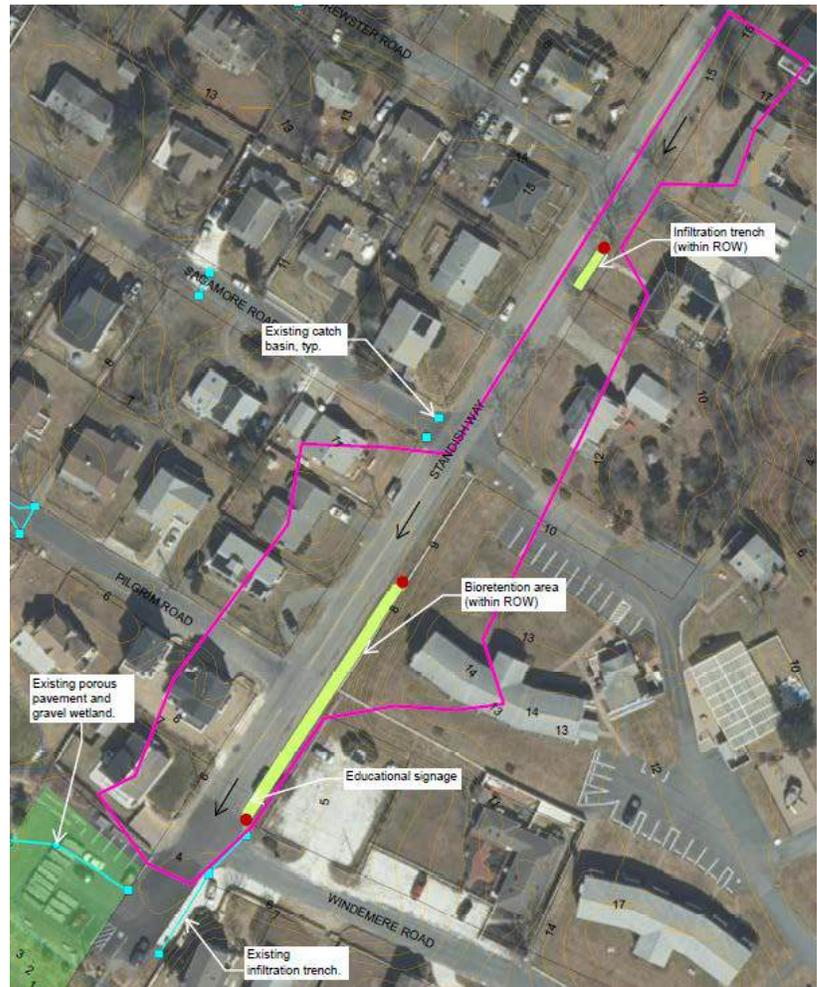
Photo Caption: Standish Way looking toward the beach parking lot.



Photo Caption: Corner of Standish Way and Windemere Road. Area for BMP.



Photo Caption: End of Standish Way. Porous pavement parking lot to the right. Infiltration trench under the white shell area.



Site Sketch: Drainage area (pink), BMPs (light green), paved flumes (dark red), existing infrastructure (cyan), and drainage flow paths (arrows).

Date Assessed: 3/3/2023 6:47:02 PM

Assessed by: MW/JV

Yarmouth Stormwater Retrofit Field Summary Sheet

Name: End of Baker Avenue - Bioretention		ID#: MC-5
<p>Site Description: The eastern end of Baker Avenue stops at Mill Pond. The road extends past the last driveway on Baker Avenue. There is some vegetation between Baker Avenue and Mill Pond. There is evidence of sediment accumulation and ponding at the end of Baker Avenue.</p> <p>Existing BMP on site? None</p>	<p>Site Location: End of Baker Avenue</p> 	
<p>Concept Description: The concept for this site is to remove the pavement on Baker Avenue up to the last driveway. This area would then be replaced with a bioretention area and a vegetated buffer between the wetland and the road.</p>		
GENERAL SITE INFORMATION	RETROFIT DETAILS	
<p>Site Contact: Amanda Lima (Town Engineer) Ownership: Town Existing Site Condition: Fair Land Use: Residential</p>	<p>Existing or New?: New Proposed BMP/Pretreatment: Bioretention / Sediment Forebay Non-Structural Controls: Pavement Removal, Revegetation, Invasives Management BMP Maintenance Burden: Low</p>	
<p>Yarmouth Watershed: South Lewis Bay Watershed (11) Receiving Water: Mill Pond (MA96206) (F) Known Impairment? None Catchment ID: N/A Priority Catchment: (Y/N) No Site Previously Assessed? (Y/N) No Previous Site ID N/A</p>	<p>BMP Benefit(s): Habitat Recharge</p>	
<p>Adjacent Critical Resources: Anadromous Fish Run Is site a hotspot? No High Pollutants Observed? No Observed Pollutant(s): Sediment, Litter Sanitary Sewer Overlap: (Y/N) No Soils: Good - HSG A/B Invasives: Yes EJ Community: In Minority and 1-mile of Income</p>	<p>Primary Site Conflict(s): Wetlands Land Use</p>	
RETROFIT SIZING INFORMATION		
<p>Estimated Drainage Area (ac): 0.75</p>	<p>WQv Goal/WQv Provided (cf): 1,370/1,370</p>	
<p>Estimated Impervious Area (ac): 0.38</p>	<p>Estimated Practice Area (sf): 720</p>	
<p>Impervious Area Type: Street, Rooftop</p>	<p>Existing Head Available? No</p>	

Date Assessed: 3/29/2023 6:11:13 PM

Assessed by: MW/JV

PHOTOS/SKETCHES



Photo Caption: End of Baker Avenue.



Photo Caption: End of Baker Ave looking toward Camp Street.



Photo Caption: Sediment accumulation at the end of Baker Avenue.



Site Sketch: Drainage area (pink), BMPs (light green), paved flumes (dark red), pavement removal (striped gray), revegetation (dark green), and drainage flow paths (arrows).

Date Assessed: 3/29/2023 6:11:13 PM

Assessed by: MW/JV

Yarmouth Stormwater Retrofit Field Summary Sheet

Name: Buck Island Road 1 - Wet Swale		ID#: MC-8
<p>Site Description: There are two catch basins along Buck Island Road that are connected via underground pipes to an outfall on the southern side of Buck Island Road slightly upgradient of the Mill Creek culvert crossing. A swale connects the outfall with Mill Creek. There is some erosion present along the swale.</p> <p>Existing BMP on site? Swale</p>	<p>Site Location: 645 Buck Island Rd</p> 	
<p>Concept Description: The concept for this site is to convert the existing swale into a wet swale with an overflow spillway that outlets into the creek.</p>		
GENERAL SITE INFORMATION		RETROFIT DETAILS
<p>Site Contact: Amanda Lima (Town Engineer) Ownership: Town Existing Site Condition: Good Land Use: Main road</p>	<p>Existing or New?: Existing Proposed BMP/Pretreatment: Wet Swale / Sediment Forebay Non-Structural Controls: Buffer Restoration BMP Maintenance Burden: Low</p>	
<p>Yarmouth Watershed: North Lewis Bay Watershed (8) Receiving Water: Hawes Run (MA96-1001) (F) Known Impairment? Trash Catchment ID: T-61 Priority Catchment: (Y/N) Yes, Bacteria (low), Nitrogen (low) Site Previously Assessed? (Y/N) N Previous Site ID N/A</p>	<p>BMP Benefit(s): Repair Habitat</p>	
<p>Adjacent Critical Resources: Anadromous Fish Run Is site a hotspot? No High Pollutants Observed? No Observed Pollutant(s): Sanitary Sewer Overlap: (Y/N) No Soils: Good - HSG A/B Invasives: No EJ Community: In Minority and 1-mile of Income</p>	<p>Primary Site Conflict(s): Wetlands Access</p>	
RETROFIT SIZING INFORMATION		
<p>Estimated Drainage Area (ac): 0.86</p>	<p>WQv Goal/WQv Provided (cf): 1,392/521</p>	
<p>Estimated Impervious Area (ac): 0.38</p>	<p>Estimated Practice Area (sf): 210</p>	
<p>Impervious Area Type: Street</p>	<p>Existing Head Available? Yes</p>	

Date Assessed: 3/29/2023 7:22:08 PM

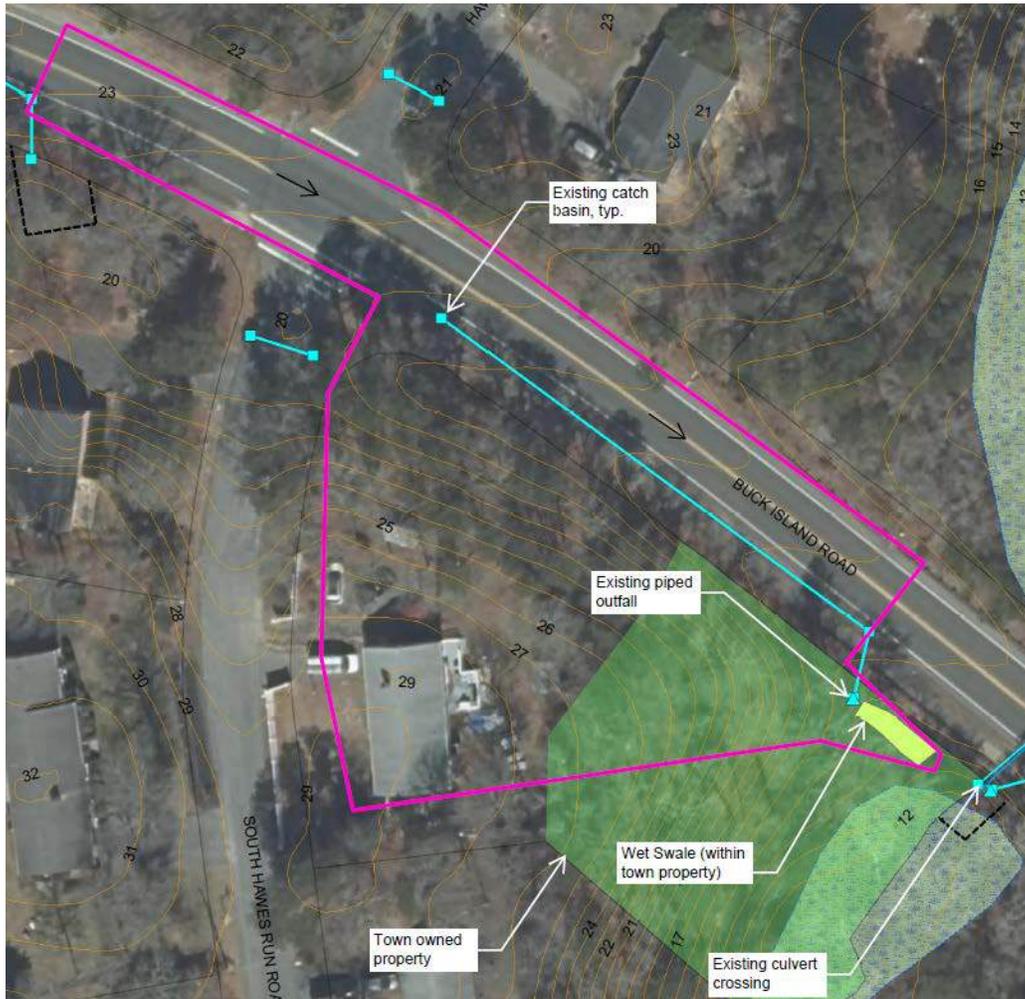
Assessed by: MW/JV

PHOTOS/SKETCHES



Photo Caption: Culvert crossing under Buck Island Road.

Photo Caption: Standing at culvert crossing looking at existing swale.

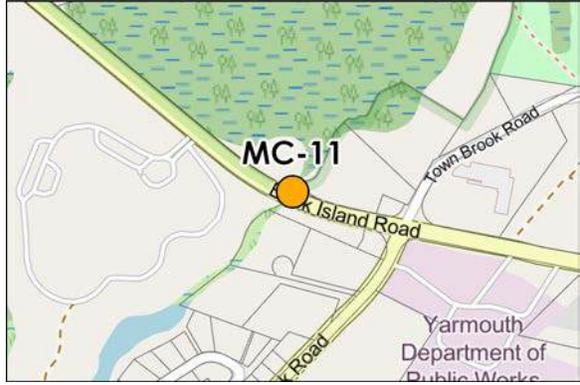


Site Sketch: Drainage area (pink), BMPs (light green), existing infrastructure (cyan), and drainage flow paths (arrows).

Date Assessed: 3/29/2023 7:22:08 PM

Assessed by: MW/JV

Yarmouth Stormwater Retrofit Field Summary Sheet

Name: Buck Island Road 4 – Wet Swale		ID#: MC-11
<p>Site Description: There are two catch basins along Buck Island Road that are connected via underground pipes to an outfall on the northern side of Buck Island Road and upgradient of a stream that connects into Mill Pond. The stream crosses under Buck Island Road via a culvert. The catch basins also appear to be connected into the headwall of the culvert crossing.</p> <p>Existing BMP on site? None</p> <p>Concept Description: The concept for this site is to block the headwall outlet, enhance the pipe outfall and install a wet swale with an overflow spillway that outlets into the creek.</p>	<p>Site Location: 541 Buck Island Road</p> 	
GENERAL SITE INFORMATION	RETROFIT DETAILS	
<p>Site Contact: Amanda Lima (Town Engineer) Ownership: Town/Private Existing Site Condition: Good Land Use: Main road</p>	<p>Existing or New?: New Proposed BMP/Pretreatment: Wet Swale / Sediment Forebay Non-Structural Controls: None BMP Maintenance Burden: Low</p>	
<p>Yarmouth Watershed: South Lewis Bay Watershed (11) Receiving Water: Mill Pond (MA96206) (F) Known Impairment? None Catchment ID: T-70, T-67 Priority Catchment: (Y/N) Yes, Bacteria (low), Nitrogen (low) Site Previously Assessed? (Y/N) No Previous Site ID N/A</p>	<p>BMP Benefit(s): Habitat</p>	
<p>Adjacent Critical Resources: Anadromous Fish Run Is site a hotspot? No High Pollutants Observed? No Observed Pollutant(s): None Sanitary Sewer Overlap: (Y/N) No Soils: Good - HSG A/B Invasives: No EJ Community: In Income and 1-mile of Minority</p>	<p>Primary Site Conflict(s): Wetlands Access Ownership</p>	
RETROFIT SIZING INFORMATION		
<p>Estimated Drainage Area (ac): 0.92</p>	<p>WQv Goal/WQv Provided (cf): 1,905/1,600</p>	
<p>Estimated Impervious Area (ac): 0.52</p>	<p>Estimated Practice Area (sf): 505</p>	
<p>Impervious Area Type: Street</p>	<p>Existing Head Available? Yes</p>	

Date Assessed: 3/29/2023 1:43:15 PM

Assessed by: MW/JV

PHOTOS/SKETCHES



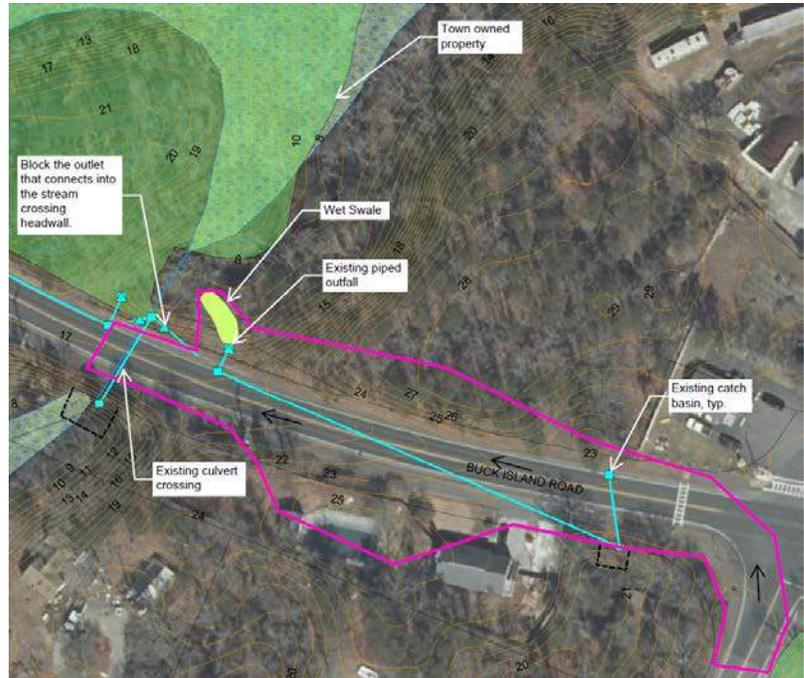
Photo Caption: BMP area upgradient of creek.



Photo Caption: Northern culvert crossing headwall on Buck Island Road – second outfall from target drainage area visible on left side of photo.



Photo Caption: Catch basin on Buck Island Road.



Site Sketch: Drainage area (pink), BMPs (light green), existing infrastructure (cyan), and drainage flow paths (arrows).

Date Assessed: 3/29/2023 1:43:15 PM

Assessed by: MW/JV

Yarmouth Stormwater Retrofit Field Summary Sheet

Name: Old Main Street East – Infiltration Trench/Bioretention		ID#: OM-1
<p>Site Description: There is a closed drainage system collecting runoff from Old Main Street as well as Wing Avenue and North Cove Landing and then discharges into Bass River. The drainage system consists of catch basins, manholes, and a few leaching galleys along Wing Avenue, Pleasant Street, and North Cove Landing. There are several utilities on Old Main Street including a gas line, water line, and overhead wires. The gas line is running along the southern sidewalk.</p> <p>Existing BMP on site? Leaching galleys</p>	<p>Site Location: Old Main Street (East of 213 Old Main St)</p> 	
<p>Concept Description: The concept for this site is to install roadside BMPs that are contained in the ROW prior to the Bass River outfall. There are four bioretention areas and nine infiltration trenches proposed. Where possible, trees are proposed within the infiltration trenches. The BMPs would overflow into the catch basins and continue to the existing piped outfall.</p>		
GENERAL SITE INFORMATION		RETROFIT DETAILS
<p>Site Contact: Amanda Lima (Town Engineer) Ownership: Town Existing Site Condition: Good Land Use: Residential, Commercial, Roadway</p>	<p>Existing or New?: New Proposed BMP/Pretreatment: Infiltration Trench / Bioretention / Sediment Forebay / Catch Basin Non-Structural Controls: Street Sweeping BMP Maintenance Burden: Medium</p>	
<p>Yarmouth Watershed: Bass River Watershed (10) Receiving Water: Bass River (MA96-12) (E) Known Impairment? Estuarine Bioassessments, Fecal Coliform, Nitrogen Catchment ID: T-152 Priority Catchment: (Y/N) Yes, Bacteria (high), Nitrogen (high) Site Previously Assessed? (Y/N) Y Previous Site ID T-152 (CZM-CPR Grant 2017)</p>	<p>BMP Benefit(s): CIP Storage Recharge</p>	
<p>Adjacent Critical Resources: Shellfishing Area Is site a hotspot? No High Pollutants Observed? No Observed Pollutant(s): None Sanitary Sewer Overlap: (Y/N) Yes Soils: Good - HSG A/B Invasives: No EJ Community: 1-mile of Minority</p>	<p>Primary Site Conflict(s): Utilities Land Use</p>	
RETROFIT SIZING INFORMATION		
<p>Estimated Drainage Area (ac): 25.80</p>	<p>WQv Goal/WQv Provided (cf): 40,061/4,592</p>	
<p>Estimated Impervious Area (ac): 11.04</p>	<p>Estimated Practice Area (sf): Bioretention: 1,050 Infiltration Trenches: 2,690</p>	
<p>Impervious Area Type: Parking Lot, Street, Rooftop</p>	<p>Existing Head Available? Yes</p>	

Date Assessed: 4/19/2023 6:41:03 PM

Assessed by: JV/CC

PHOTOS/SKETCHES



Photo Caption: Catch Basin at 311 Old Main Street (Location 2- Infiltration Trench location).

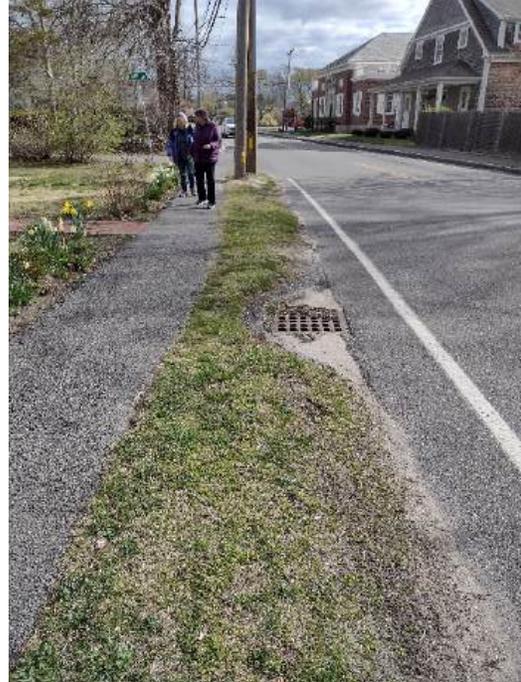


Photo Caption: Catch Basin at 296 Old Main Street (Location 3- Infiltration Trench (with tree) location).



Photo Caption: Catch Basin at 221 Old Main Street (Location 9- Bioretention location).

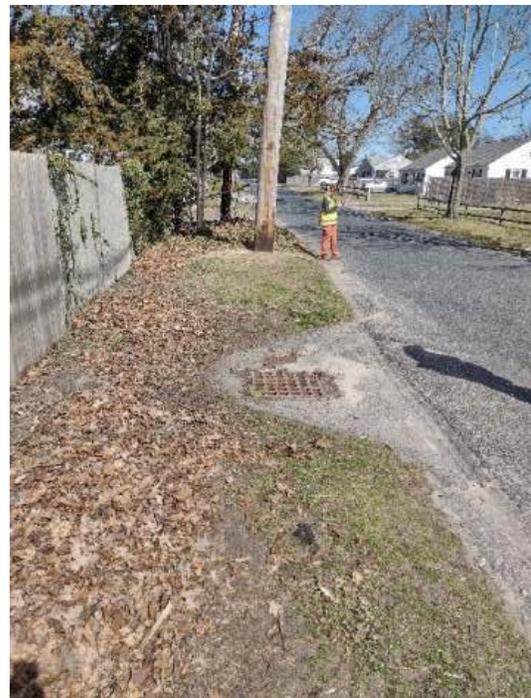


Photo Caption: Catch Basin at 15 Pond Road (Location 13- Bioretention location).

Date Assessed: 4/19/2023 6:41:03 PM

Assessed by: JV/CC

QM-1 Old Main East

Location #	Site	BMP Type	Length	Width	Area	Tree?
1	308 Old Main Street	Infiltration Trench	50	5	250	No
2	311 Old Main Street	Infiltration Trench	40	8	320	No
3	296 Old Main Street	Infiltration Trench	30	8	240	Yes
4	280 Old Main Street	Infiltration Trench	30	8	240	Yes
5	1 Homer Ave	Bioretention	40	6	240	N/A
6	264 Old Main Street	Infiltration Trench	50	8	400	Yes
7	226 Old Main Street	Infiltration Trench	20	8	160	No
8	229 Old Main Street	Bioretention	30	8	240	N/A
9	221 Old Main Street	Bioretention	40	8	320	N/A
10	220 Old Main Street	Infiltration Trench	35	8	280	Yes
11	214 Old Main Street	Infiltration Trench	40	6	240	No
12	8 Pond Road	Infiltration Trench	80	7	560	No
13	15 Pond Road	Bioretention	25	10	250	N/A

Total Trench area 2690
 Total Bio area 1050



Yarmouth Stormwater Retrofit Field Summary Sheet

Name: Old Main Street West - Infiltration Trench/Bioretenion		ID#: OM-2
<p>Site Description: There is a closed drainage system collecting runoff from Old Main Street as well as Aunt Jane’s Road and then discharges into Bass River. The drainage system consists of catch basins, manholes, and one leaching galley on Aunt Jane’s Road. There are several utilities on Old Main Street including a gas line, water line, and overhead wires. The gas line is running along the southern sidewalk.</p> <p>Existing BMP on site? Leaching galley</p>	<p>Site Location: Old Main Street (West of 213 Old Main St)</p> 	
<p>Concept Description: The concept for this site is to install roadside BMPs in the ROW prior to the Bass River outfall. There are three bioretention areas, twelve infiltration trenches, and one infiltration chamber system proposed. Where possible, trees are proposed within the infiltration trenches. The BMPs would overflow into the catch basins and continue to the existing piped outfall.</p>		
GENERAL SITE INFORMATION	RETROFIT DETAILS	
<p>Site Contact: Amanda Lima (Town Engineer) Ownership: Town Existing Site Condition: Good Land Use: Residential, Commercial, Road</p>	<p>Existing or New?: New Proposed BMP/Pretreatment: Infiltration Trench / Bioretention / Sediment Forebay / Catch Basin Non-Structural Controls: Street Sweeping BMP Maintenance Burden: Medium</p>	
<p>Yarmouth Watershed: Bass River Watershed (10) Receiving Water: Bass River (MA96-12) (E) Known Impairment? Estuarine Bioassessments, Fecal Coliform, Nitrogen Catchment ID: T-154 Priority Catchment: (Y/N) Yes, Bacteria (high), Nitrogen (high) Site Previously Assessed? (Y/N) N Previous Site ID N/A</p>	<p>BMP Benefit(s): CIP Storage Recharge</p>	
<p>Adjacent Critical Resources: Shellfishing Area Is site a hotspot? No High Pollutants Observed? No Observed Pollutant(s): None Sanitary Sewer Overlap: (Y/N) Yes Soils: Good - HSG A/B Invasives: No EJ Community: 1-mile of Minority</p>	<p>Primary Site Conflict(s): Utilities Land Use</p>	
RETROFIT SIZING INFORMATION		
<p>Estimated Drainage Area (ac): 33.01</p>	<p>WQv Goal/WQv Provided (cf): 32,561/17,296</p>	
<p>Estimated Impervious Area (ac): 8.97</p>	<p>Estimated Practice Area (sf): Bio: 1,350, Infiltration Trenches:4,360, Underground Infiltration Chambers:3,500</p>	
<p>Impervious Area Type: Parking Lot, Street, Rooftop</p>	<p>Existing Head Available? No</p>	

Date Assessed: 4/19/2023 6:47:10 PM

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PHOTOS/SKETCHES



Photo Caption: Catch Basin at 154 Old Main Street (Location 4- Infiltration Trench (with tree) location).

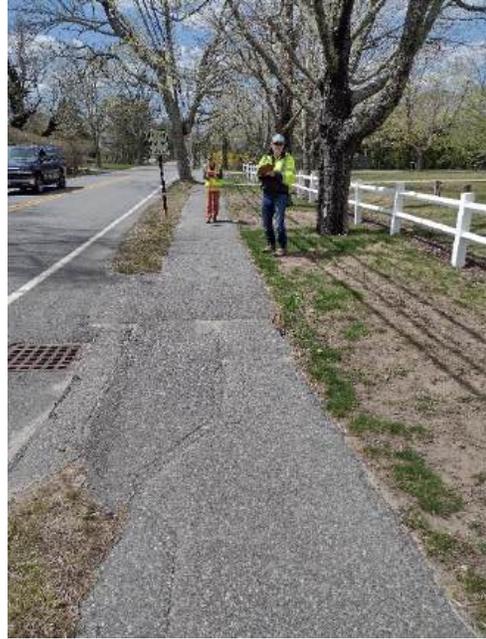


Photo Caption: Catch Basin at 134 Old Main Street (Location 6- Infiltration Trench location).



Photo Caption: Catch Basin at 96 Old Main Street (Yarmouth Fire Department) (Location 10- Underground chambers location).



Photo Caption: Catch Basin at 54 Old Main Street (Location 14- Bioretention location).

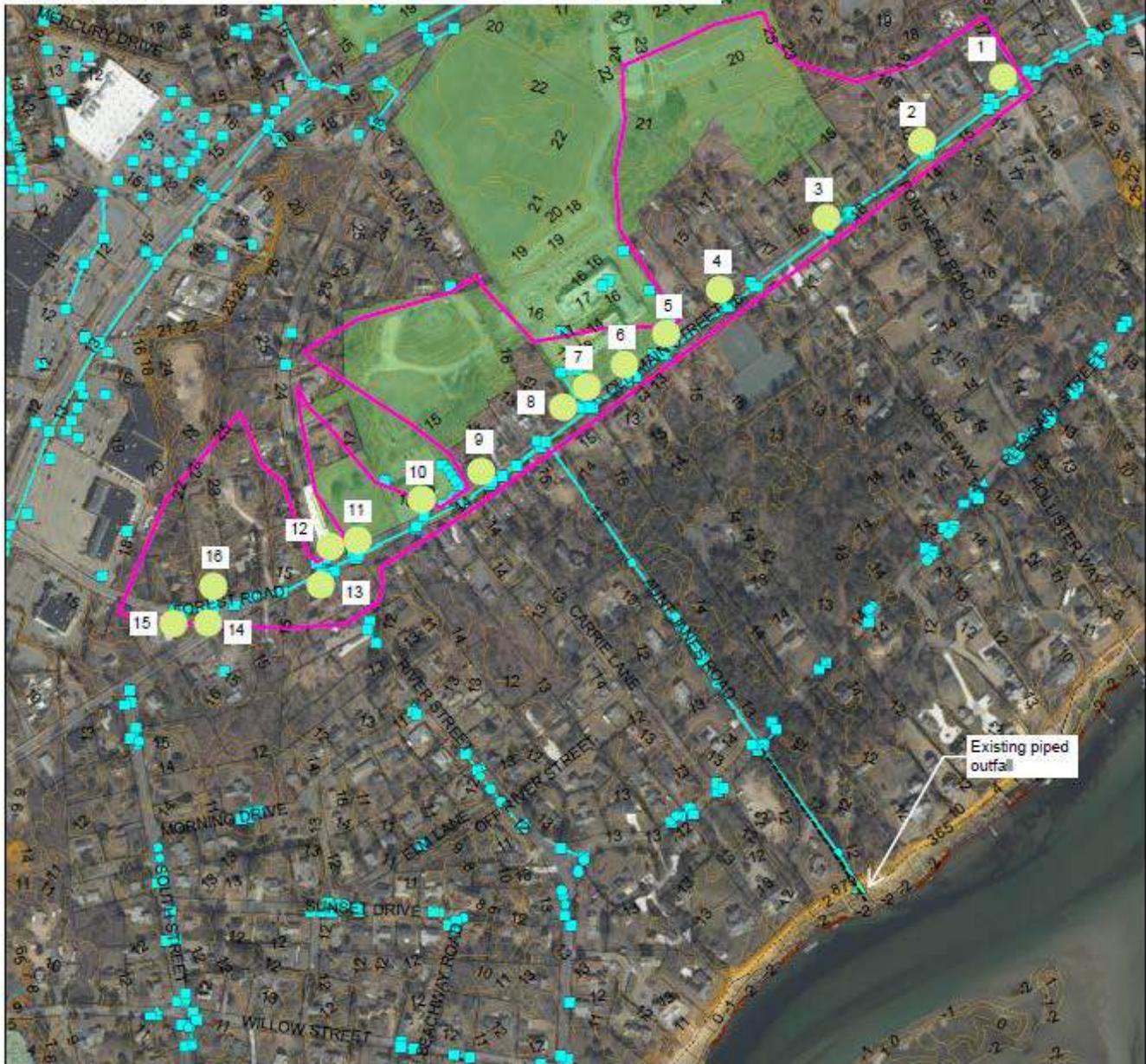
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Assessed by: JV/CC

OM-2 Old Main West

Location #	Site	BMP Type	Length	Width	Area	Tree?
1	206 Old Main Street	Infiltration Trench	50	8	400	No
2	190 Old Main Street	Infiltration Trench	50	8	400	Yes
3	172 Old Main Street	Infiltration Trench	50	8	400	Yes
4	154 Old Main Street	Infiltration Trench	40	8	320	Yes
5	134 Old Main Street	Infiltration Trench	50	8	400	No
6	134 Old Main Street	Infiltration Trench	35	8	280	No
7	134 Old Main Street	Infiltration Trench	40	8	320	No
8	122 Old Main Street	Infiltration Trench	20	8	160	No
9	108 Old Main Street	Infiltration Trench	50	8	400	Yes
10	96 Old Main Street	Infiltration Chambers	70	50	3500	N/A
11	88 Old Main Street	Infiltration Trench	50	10	500	Yes
12	88 Old Main Street	Bioretention	30	20	600	N/A
13	1 River Street	Infiltration Trench	35	8	280	No
14	54 Old Main Street	Bioretention	50	7	350	N/A
15	54 Old Main Street	Bioretention	50	8	400	N/A
16	12 Forest Road	Infiltration Trench	50	10	500	No

Total Trench area 4360
 Total Bio area 1350
 Total Chambers area 3500



Yarmouth Stormwater Retrofit Field Summary Sheet

Name: Homer Avenue - Bioretention		ID#: OM-3
<p>Site Description: Homer Avenue is a steep road that ends at a public beach access point on Bass River. The road extends past the last driveway. There is a leaching basin at the end of Homer Avenue that is covered in sediment and leaves with a flattened silt sock around the structure with signs of erosion. There is no vegetation between Baker Avenue and Mill Pond.</p> <p>Existing BMP on site? Leaching basin</p>	<p>Site Location: End of Homer Avenue</p> 	
<p>Concept Description: The concept for this site is to remove pavement at the end of the road. This area would be replaced with a bioretention area that overflows into the leaching basin and a vegetated buffer between the beach and the road.</p>		
GENERAL SITE INFORMATION		RETROFIT DETAILS
<p>Site Contact: Amanda Lima (Town Engineer) Ownership: Town Existing Site Condition: Poor Land Use: Residential, beach access</p>		<p>Existing or New?: Existing Proposed BMP/Pretreatment: Bioretention / Sediment Forebay Non-Structural Controls: Pavement Removal, Revegetation, Public Education BMP Maintenance Burden: Low</p>
<p>Yarmouth Watershed: Bass River Watershed (10) Receiving Water: Bass River (MA96-12) (E) Known Impairment? Estuarine Bioassessments, Fecal Coliform, Nitrogen Catchment ID: N/A Priority Catchment: (Y/N) No Site Previously Assessed? (Y/N) N Previous Site ID N/A</p>		<p>BMP Benefit(s): Habitat Recharge Repair Resiliency</p>
<p>Adjacent Critical Resources: Shellfishing area, public beach Is site a hotspot? No High Pollutants Observed? No Observed Pollutant(s): Sediment, leaf litter Sanitary Sewer Overlap: (Y/N) No Soils: Good - HSG A/B Invasives: No EJ Community: 1-mile of Minority</p>		<p>Primary Site Conflict(s): Wetlands Land Use</p>
RETROFIT SIZING INFORMATION		
<p>Estimated Drainage Area (ac): 0.36</p>	<p>WQv Goal/WQv Provided (cf): 513/513</p>	
<p>Estimated Impervious Area (ac): 0.14</p>	<p>Estimated Practice Area (sf): 250</p>	
<p>Impervious Area Type: Street, Rooftop</p>	<p>Existing Head Available? No</p>	

Date Assessed: 4/19/2023 6:08:47 PM

Assessed by: JV/CC

PHOTOS/SKETCHES



Photo Caption: Existing leaching basin clogged with leaf litter and sediment.



Photo Caption: End of Homer Avenue looking toward Bass River.



Photo Caption: Beach access at end of Homer Avenue.



Site Sketch: Drainage area (pink), BMPs (light green), paved flumes (dark red), pavement removal (striped gray), revegetation (dark green), and drainage flow paths (arrows).

Date Assessed: 4/19/2023 6:08:47 PM

Assessed by: JV/CC

Yarmouth Stormwater Retrofit Field Summary Sheet

Name: Cemetery parking on Wood Road – Bioretention/Porous Pavement		ID#: OM-7
<p>Site Description: The site consists of an informal gravel parking lot at a cemetery on town-owned property at the corner of Wood Road and Old Main Street. There are two catch basins on Wood Road that the site drains into. The catch basins connect into the Old Main West closed drainage system. There is evidence of gullyng in parking area.</p> <p>Existing BMP on site? None</p>	<p>Site Location: 84 Old Main Street</p> 	
<p>Concept Description: The concept for this site is to replace the gravel parking area with porous pavement or pavers and to add a bioretention area along the parking area. Runoff from Wood Road would be directed to the bioretention area and any overflow would continue to the existing catch basins.</p>		
GENERAL SITE INFORMATION	RETROFIT DETAILS	
<p>Site Contact: Amanda Lima (Town Engineer) Ownership: Town Existing Site Condition: Poor Land Use: Cemetery parking</p>	<p>Existing or New?: New Proposed BMP/Pretreatment: Bioretention / Sediment Forebay and Porous Pavement Non-Structural Controls: Street Sweeping, Stabilization, Public Education BMP Maintenance Burden: Medium</p>	
<p>Yarmouth Watershed: Bass River Watershed (10) Receiving Water: Bass River (MA96-12) (E) Known Impairment? Estuarine Bioassessments, Fecal Coliform, Nitrogen Catchment ID: T-154 Priority Catchment: (Y/N) Yes, Bacteria (high), Nitrogen (high) Site Previously Assessed? (Y/N) Yes Previous Site ID RC7 (Municipal Property Retrofits 2022)</p>	<p>BMP Benefit(s): Recharge Demo Repair</p>	
<p>Adjacent Critical Resources: Shellfishing Area Is site a hotspot? No High Pollutants Observed? No Observed Pollutant(s): None Sanitary Sewer Overlap: (Y/N) Yes Soils: Good - HSG A/B Invasives: No EJ Community: 1-mile of Minority</p>	<p>Primary Site Conflict(s): Utilities Land Use</p>	
RETROFIT SIZING INFORMATION		
<p>Estimated Drainage Area (ac): 1.69</p>	<p>WQv Goal/WQv Provided (cf): 2,876/2,876</p>	
<p>Estimated Impervious Area (ac): 0.79</p>	<p>Estimated Practice Area (sf): 1,300</p>	
<p>Impervious Area Type: Parking Lot, Street, Rooftop</p>	<p>Existing Head Available? No</p>	

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Assessed by: JV/CC

PHOTOS/SKETCHES



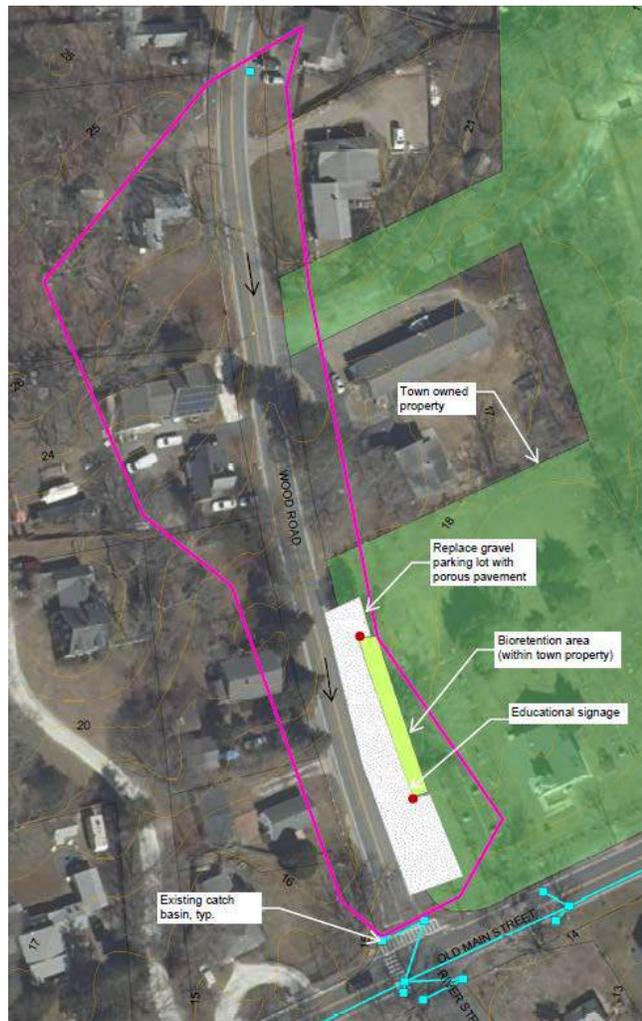
Photo Caption: Cemetery informal parking looking northeast.



Photo Caption: Gravel parking lot area.



Photo Caption: Cemetery informal parking looking southeast.



Site Sketch: Drainage area (pink), BMPs (light green), porous pavement (speckled orange), paved flumes (dark red), existing infrastructure (cyan), and drainage flow paths (arrows).

Date Assessed: 4/19/2023 3:20:56 PM

Assessed by: JV/CC

Yarmouth Stormwater Retrofit Field Summary Sheet

Name: Buck Island Road/West Yarmouth Road - Bioretention		ID#: PR-1
<p>Site Description: The site consists of a town-owned property on the south side of Buck Island Road. The site is flat and grassy. There are three catch basins on Buck Island Road along the property that ultimately discharge into a wetland to the east.</p> <p>Existing BMP on site? None</p>	<p>Site Location: 206 Buck Island Road</p> 	
<p>Concept Description: The concept consists of a grassy bioretention area within town property on Buck Island Road. The two western catch basins would be blocked off and replaced with an inlet flume to the bioretention area. The bioretention area would overflow into the third catch basin connected to the closed drainage system along Buck Island Road.</p>		
GENERAL SITE INFORMATION	RETROFIT DETAILS	
<p>Site Contact: Amanda Lima (Town Engineer) Ownership: Town Existing Site Condition: Good Land Use: Road</p>	<p>Existing or New?: New Proposed BMP/Pretreatment: Bioretention / Sediment Forebay Non-Structural Controls: None BMP Maintenance Burden: Low</p>	
<p>Yarmouth Watershed: South Parker River Watershed (12) Receiving Water: Parkers River (MA96-38) (F) Known Impairment? Fecal Coliform, Nitrogen, Nutrient/Eutrophication, Biological Indicators Catchment ID: T-82 Priority Catchment: (Y/N) Yes, Bacteria (low), Nitrogen (med) Site Previously Assessed? (Y/N) N Previous Site ID N/A</p>	<p>BMP Benefit(s): Recharge</p>	
<p>Adjacent Critical Resources: None Is site a hotspot? No High Pollutants Observed? No Observed Pollutant(s): None Sanitary Sewer Overlap: (Y/N) No Soils: Good - HSG A/B Invasives: No EJ Community: 1-mile of Minority</p>	<p>Primary Site Conflict(s): Utilities</p>	
RETROFIT SIZING INFORMATION		
<p>Estimated Drainage Area (ac): 1.75</p>	<p>WQv Goal/WQv Provided (cf): 2,848/2,848</p>	
<p>Estimated Impervious Area (ac): 0.78</p>	<p>Estimated Practice Area (sf): 1,550</p>	
<p>Impervious Area Type: Street</p>	<p>Existing Head Available? No</p>	

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Assessed by: JV/CC

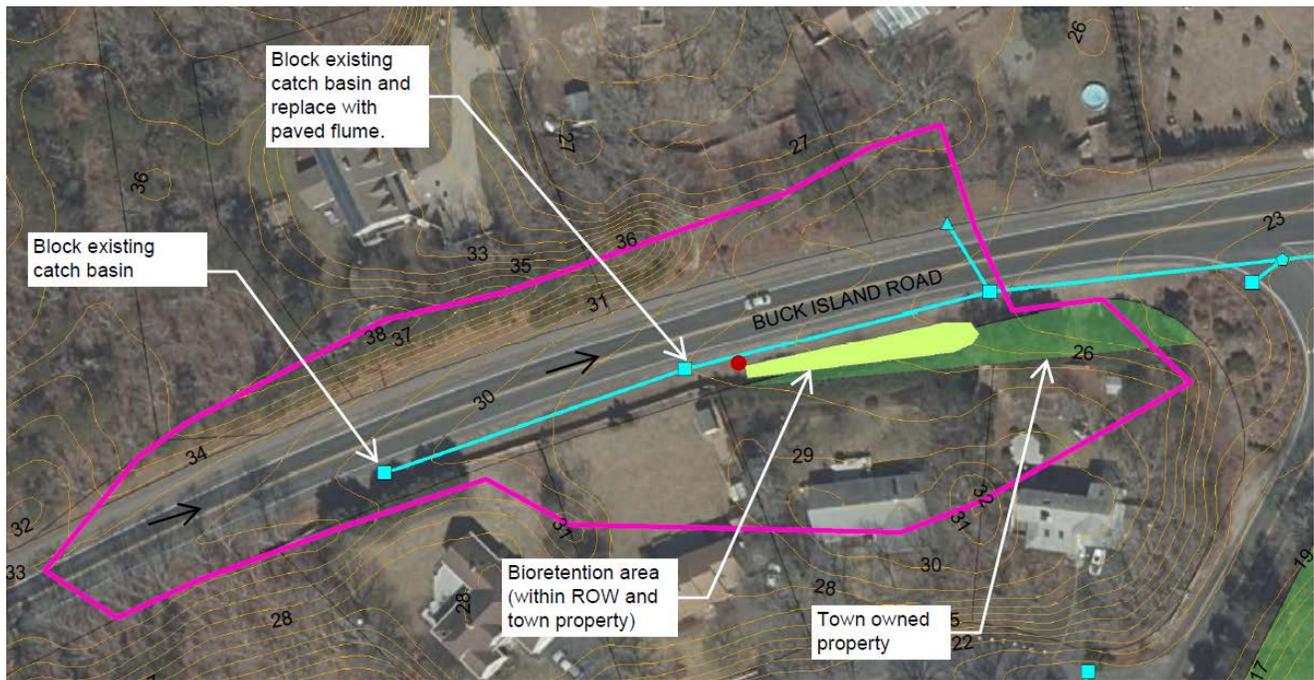
PHOTOS/SKETCHES



Photo Caption: Town-owned property on Buck Island Road.



Photo Caption: Catch Basin second closest to West Yarmouth Road intersection on the south side of Buck Island Road.

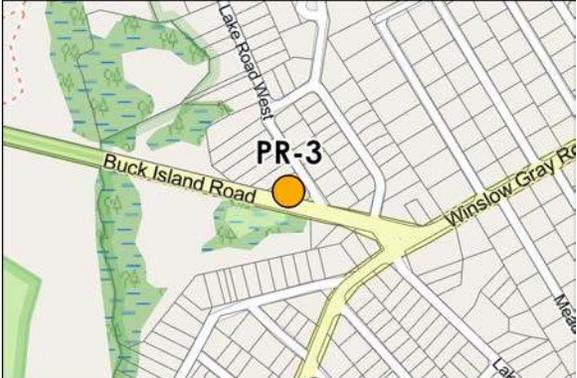


Site Sketch: Drainage area (pink), BMPs (light green), paved flumes (dark red), existing infrastructure (cyan), and drainage flow paths (arrows).

Date Assessed: 4/19/2023 6:32:21 PM

Assessed by: JV/CC

Yarmouth Stormwater Retrofit Field Summary Sheet

Name: 19 Lake Road West - Constructed Wetland		ID#: PR-3
<p>Site Description: There is a closed drainage system on Lake Road West and Buck Island Road that outfalls to a swale on town-owned property. The swale connects back into the closed drainage system and outfalls to the wetland on the southern side of Buck Island Road. The pipe outlets/inlets to the swale appear to be clogged with sediment and debris.</p> <p>Existing BMP on site? Swale</p>	<p>Site Location: 19 Lake Road West</p> 	
<p>Concept Description: A constructed wetland is proposed to replace the swale on the town-owned property.</p>		
GENERAL SITE INFORMATION	RETROFIT DETAILS	
<p>Site Contact: Amanda Lima (Town Engineer) Ownership: Town Existing Site Condition: Fair Land Use: Residential</p>	<p>Existing or New?: Existing Proposed BMP/Pretreatment: Constructed Wetland / Sediment Forebay Non-Structural Controls: BMP Maintenance Burden: Low</p>	
<p>Yarmouth Watershed: South Parker River Watershed (12) Receiving Water: Parkers River (MA96-38) (F) Known Impairment? Fecal Coliform, Nitrogen, Nutrient/Eutrophication, Biological Indicators Catchment ID: T-90 Priority Catchment: (Y/N) Yes, Bacteria (high), Nitrogen (high) Site Previously Assessed? (Y/N) N Previous Site ID N/A</p>	<p>BMP Benefit(s): Habitat Repair Storage Resiliency</p>	
<p>Adjacent Critical Resources: None Is site a hotspot? No High Pollutants Observed? No Observed Pollutant(s): Sediment, leaf litter Sanitary Sewer Overlap: (Y/N) No Soils: Good - HSG A/B Invasives: No EJ Community: 1-mile of Minority</p>	<p>Primary Site Conflict(s): High WT</p>	
RETROFIT SIZING INFORMATION		
<p>Estimated Drainage Area (ac): 7.96</p>	<p>WQv Goal/WQv Provided (cf): 2,271/1,960</p>	
<p>Estimated Impervious Area (ac): 2.62</p>	<p>Estimated Practice Area (sf): 4,500</p>	
<p>Impervious Area Type: Street</p>	<p>Existing Head Available? Yes</p>	

Date Assessed: 4/19/2023 5:36:13 PM

Assessed by: JV/CC

PHOTOS/SKETCHES



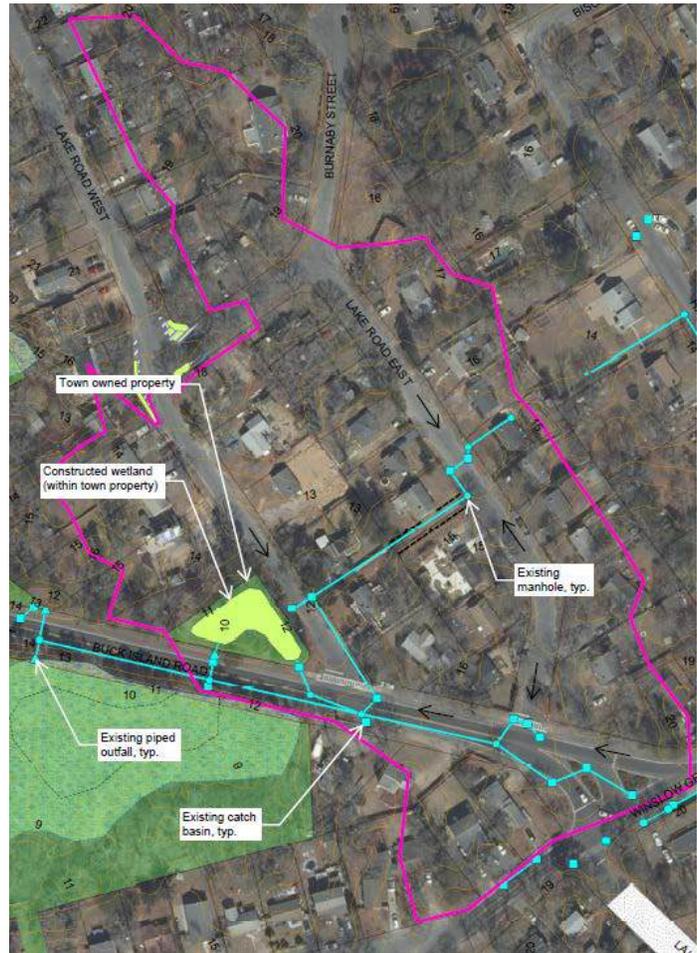
Photo Caption: East outlet/inlet of closed drainage system on Buck Island Road. Looking at existing swale.



Photo Caption: Catch basin on Lake Road West.



Photo Caption: Standing above west outlet/inlet of closed drainage system on Buck Island Road. Looking at existing swale.



Site Sketch: Drainage area (pink), BMPs (light green), existing infrastructure (cyan), and drainage flow paths (arrows).

Date Assessed: 4/19/2023 5:36:13 PM

Assessed by: JV/CC

Yarmouth Stormwater Retrofit Field Summary Sheet

Name: Lake Road Neighborhood - Bioretention		ID#: PR-4
<p>Site Description: This site is at the intersection of Lake Road West and Lake Road East. Lake Road West is a 22ft wide road and has a large turning radius to Lake Road East. The runoff from the two roads currently continues down Lake Road West into an existing catch basin that is a part of the Buck Island Road closed drainage system.</p> <p>Existing BMP on site? None</p>	<p>Site Location: Lake Road West/Lake Road East</p> 	
<p>Concept Description: The concept for this site is to decrease the width of the road and turning radii of the intersection. These areas would be replaced with infiltrating bioretention areas just upgradient of a mapped high groundwater area. Overflow for the bioretentions would continue down the street to the existing catch basin.</p>		
GENERAL SITE INFORMATION		RETROFIT DETAILS
<p>Site Contact: Amanda Lima (Town Engineer) Ownership: Town Existing Site Condition: Fair Land Use: Residential</p>	<p>Existing or New?: New Proposed BMP/Pretreatment: Bioretention / Sediment Forebay Non-Structural Controls: Pavement Removal BMP Maintenance Burden: Medium</p>	
<p>Yarmouth Watershed: South Parker River Watershed (12) Receiving Water: Parkers River (MA96-38) (F) Known Impairment? Fecal Coliform, Nitrogen, Nutrient/Eutrophication, Biological Indicators Catchment ID: T-90 Priority Catchment: (Y/N) Yes, Bacteria (high), Nitrogen (high) Site Previously Assessed? (Y/N) No Previous Site ID N/A</p>	<p>BMP Benefit(s): Recharge</p>	
<p>Adjacent Critical Resources: None Is site a hotspot? No High Pollutants Observed? No Observed Pollutant(s): Sediment Sanitary Sewer Overlap: (Y/N) No Soils: Good - HSG A/B Invasives: No EJ Community: 1-mile of Minority</p>	<p>Primary Site Conflict(s): Land Use High WT</p>	
RETROFIT SIZING INFORMATION		
<p>Estimated Drainage Area (ac): 1.45</p>	<p>WQv Goal/WQv Provided (cf): 2,271/1,960</p>	
<p>Estimated Impervious Area (ac): 0.63</p>	<p>Estimated Practice Area (sf): 995</p>	
<p>Impervious Area Type: Street, Rooftop</p>	<p>Existing Head Available? No</p>	

Date Assessed: 4/19/2023 7:13:04 PM

Assessed by: JV/CC

PHOTOS/SKETCHES



Photo Caption: Lake Road West east towards Lake Road East.



Photo Caption: Lake Road West looking south.



Site Sketch: Drainage area (pink), BMPs (light green), paved flumes (dark red), pavement removal (striped gray), and drainage flow paths (arrows).

Date Assessed: 4/19/2023 7:13:04 PM

Assessed by: JV/CC

Yarmouth Stormwater Retrofit Field Summary Sheet

Name: End of Maushops Path - Wet Swale		ID#: PR-7
<p>Site Description: Maushops Path ends at the marsh. This stretch of road is proposed for porous pavement. The end of the roadway does not provide access to any homes.</p> <p>Existing BMP on site? None</p>	<p>Site Location: End of Maushops Path</p> 	
<p>Concept Description: The concept at this site is to remove some existing pavement, revegetate to create a larger buffer, and construct a wet swale for runoff. It appears that neighbors have been trimming / clearing the buffer to maintain views; recommend low growing shrubs in buffer. Permeable pavement could still be installed upgradient with this concept.</p>		
GENERAL SITE INFORMATION	RETROFIT DETAILS	
<p>Site Contact: Amanda Lima (Town Engineer) Ownership: Town Existing Site Condition: Fair Land Use: Residential</p>	<p>Existing or New?: New Proposed BMP/Pretreatment: Wet Swale / None Non-Structural Controls: Pavement Removal, Buffer Vegetation BMP Maintenance Burden: Low</p>	
<p>Yarmouth Watershed: South Parker River Watershed (12) Receiving Water: Lewis Pond (MA96-109) (E) Known Impairment? Nitrogen, Nutrient/Eutrophication, Biological Indicators Catchment ID: N/A Priority Catchment: (Y/N) No Site Previously Assessed? (Y/N) N Previous Site ID N/A</p>	<p>BMP Benefit(s): Habitat Repair Resiliency</p>	
<p>Adjacent Critical Resources: Anadromous Fish Run, Shellfishing area Is site a hotspot? No High Pollutants Observed? No Observed Pollutant(s): Sediment Sanitary Sewer Overlap: (Y/N) No Soils: Good - HSG A/B Invasives: No EJ Community: In Income</p>	<p>Primary Site Conflict(s): High WT Wetlands</p>	
RETROFIT SIZING INFORMATION		
<p>Estimated Drainage Area (ac): 0.35</p>	<p>WQv Goal/WQv Provided (cf): 737/737</p>	
<p>Estimated Impervious Area (ac): 0.20</p>	<p>Estimated Practice Area (sf): 230</p>	
<p>Impervious Area Type: Street, Rooftop</p>	<p>Existing Head Available? No</p>	

Date Assessed: 4/28/2023 1:58:47 PM

Assessed by: EK/CC

PHOTOS/SKETCHES



Photo Caption: Looking east, towards marsh.



Photo Caption: Looking west up Maushops Path.



Photo Caption: Layers of chipseal.

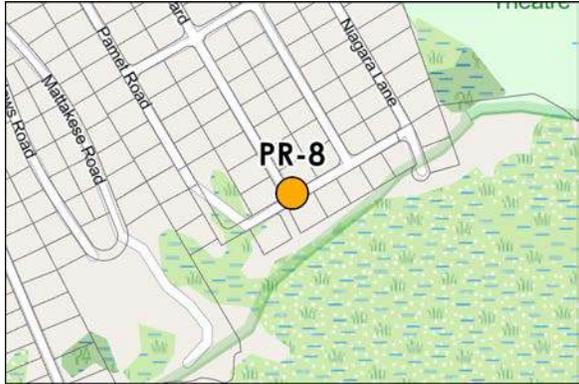


Site Sketch: Drainage area (pink), BMPs (light green), paved flumes (dark red), pavement removal (striped gray), existing infrastructure (cyan), and drainage flow paths (arrows).

Date Assessed: 4/28/2023 1:58:47 PM

Assessed by: EK/CC

Yarmouth Stormwater Retrofit Field Summary Sheet

Name: Pawnee Road - Wet Swale		ID#: PR-8
<p>Site Description: The intersection of Pamet Road, Pawnee Road, and Iroquois Boulevard appears to be an area that ponds after rain events and has been chip-sealed over. It is mapped as a proposed area for porous pavement. There are existing catch basins on Iroquois Boulevard, and the one on the eastern side of the roadway has a rust-colored stain along the inlet and in the roadway; it is possible that something has been discharged repeatedly into the catch basin here. No odor was present.</p> <p>Existing BMP on site? None</p>	<p>Site Location: Pawnee Road / Iroquois Blvd Intersection</p> 	
<p>Concept Description: The concept is to eliminate the existing catch basins and construct a paved flume and wet swale in the ROW. If porous pavement is considered here, should do a larger stretch of road rather than just the intersection which will clog faster from run-on.</p>		
GENERAL SITE INFORMATION		RETROFIT DETAILS
<p>Site Contact: Amanda Lima (Town Engineer) Ownership: Town Existing Site Condition: Poor Land Use: Residential</p>	<p>Existing or New?: New Proposed BMP/Pretreatment: Wet Swale / Sediment Forebay Non-Structural Controls: Other BMP Maintenance Burden: Low</p>	
<p>Yarmouth Watershed: South Parker River Watershed (12) Receiving Water: Lewis Pond (MA96-109) (E) Known Impairment? Nitrogen, Nutrient/Eutrophication, Biological Indicators Catchment ID: T-172 Priority Catchment: (Y/N) Yes Bacteria (high), Nitrogen (high) Site Previously Assessed? (Y/N) Y Previous Site ID T-172 (CZM-CPR Grant 2017)</p>	<p>BMP Benefit(s): Repair</p>	
<p>Adjacent Critical Resources: Anadromous Fish Run, Shellfishing area Is site a hotspot? No High Pollutants Observed? No Observed Pollutant(s): Sediment, rust - colored stain (potential dumping) Sanitary Sewer Overlap: (Y/N) No Soils: Good - HSG A/B Invasives: No EJ Community: In Income</p>	<p>Primary Site Conflict(s): High WT Wetlands Land Use (Abutters)</p>	
RETROFIT SIZING INFORMATION		
<p>Estimated Drainage Area (ac): 1.18</p>	<p>WQv Goal/WQv Provided (cf): 1,678/1,348</p>	
<p>Estimated Impervious Area (ac): 0.46</p>	<p>Estimated Practice Area (sf): 620</p>	
<p>Impervious Area Type: Street, Rooftop</p>	<p>Existing Head Available? No</p>	

Date Assessed: 4/28/2023 2:37:35 PM

Assessed by: EK/CC

PHOTOS/SKETCHES



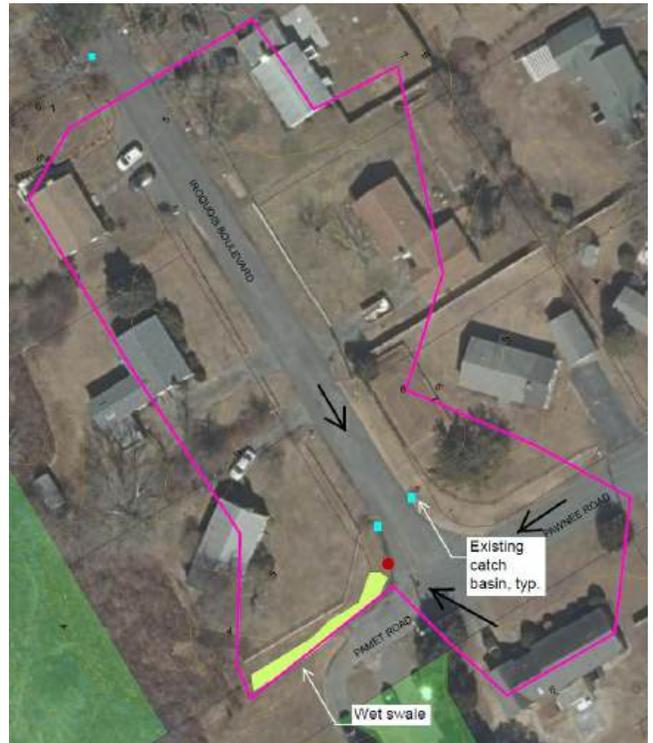
Photo Caption: Looking north on Iroquois Blvd (note rust-colored staining).



Photo Caption: Looking east on Pawnee Road.



Photo Caption: Looking west on Pawnee Road.



Site Sketch: Drainage area (pink), BMPs (light green), paved flumes (dark red), existing infrastructure (cyan), and drainage flow paths (arrows).

Date Assessed: 4/28/2023 2:37:35 PM

Assessed by: EK/CC

Yarmouth Stormwater Retrofit Field Summary Sheet

Name: Lake Road / Nauset Road – Bioretention and Porous Pavement		ID#: SP-4
<p>Site Description: This site is at the intersection of Lake Road and Nauset Road. The northern part of Lake Road is flat and then becomes steeper just upgradient of Nauset Road. The runoff currently travels down the road to a low point on Lake Road that is in a high groundwater area that has issues with flooding.</p> <p>Existing BMP on site? None</p>	<p>Site Location: Lake Road and Nauset Road Intersection</p> 	
<p>Concept Description: The concept for this site includes installing porous pavement at the upper part of Lake Road and adding bioretention areas at the intersection of Lake Road and Nauset Road. There are three bioretention areas proposed within the ROW. Overflow from the bioretention areas would continue down the street to the low point.</p>		
GENERAL SITE INFORMATION	RETROFIT DETAILS	
<p>Site Contact: Amanda Lima (Town Engineer) Ownership: Town Existing Site Condition: Good Land Use: Residential</p>	<p>Existing or New?: New Proposed BMP/Pretreatment: Bioretention / Sediment Forebay and Porous Pavement Non-Structural Controls: Street Sweeping BMP Maintenance Burden: Low</p>	
<p>Yarmouth Watershed: South Parker River Watershed (12) Receiving Water: Swan/Seine Pond (MA96-110) (E) Known Impairment? Nitrogen Nutrient/Eutrophication Biological Indicators Catchment ID: T-165 Priority Catchment: (Y/N) Yes, Bacteria (high), Nitrogen (high) Site Previously Assessed? (Y/N) N Previous Site ID N/A</p>	<p>BMP Benefit(s): Recharge</p>	
<p>Adjacent Critical Resources: Anadromous Fish Run, Shellfishing Area Is site a hotspot? No High Pollutants Observed? No Observed Pollutant(s): None Sanitary Sewer Overlap: (Y/N) No Soils: Good - HSG A/B Invasives: No EJ Community: In Minority and 1-mile of Income</p>	<p>Primary Site Conflict(s): Land Use High WT</p>	
RETROFIT SIZING INFORMATION		
<p>Estimated Drainage Area (ac): 3.82</p>	<p>WQv Goal/WQv Provided (cf): 3,468/1,902</p>	
<p>Estimated Impervious Area (ac): 0.96</p>	<p>Estimated Practice Area (sf): 650</p>	
<p>Impervious Area Type: Street, Rooftop</p>	<p>Existing Head Available? No</p>	

Date Assessed: 4/20/2023 3:53:35 PM

Assessed by: JV/CC

PHOTOS/SKETCHES



Photo Caption: Corner of Lake Road and Nauset Road looking west.



Photo Caption: Corner of Lake Road and Nauset Road looking southwest.



Site Sketch: Drainage area (pink), BMPs (light green), porous pavement (speckled orange), paved flumes (dark red), and drainage flow paths (arrows).

Date Assessed: 4/20/2023 3:53:35 PM

Assessed by: JV/CC

Yarmouth Stormwater Retrofit Field Summary Sheet

Name: Wilbur Park Entrance - Driveway Runoff - Bioretention		ID#: UBR-2
<p>Site Description: This site is the entrance for Wilbur Park, a town-owned boat ramp and fishing area. A portion of the driveway slopes towards Highbank Road where stormwater runoff enters a piped drainage system that is connected to a leaching area. There is a fairly large grassy area adjacent to the entrance.</p> <p>Existing BMP on site? Closed drainage system to leaching galleys</p>	<p>Site Location: 440 Highbank Road</p> 	
<p>Concept Description: The concept for this site is to install a paved flume to bypass existing catch basins for surface treatment (bioretention). This would be a good opportunity for public education with an additional sign at the entrance.</p>		
GENERAL SITE INFORMATION		RETROFIT DETAILS
<p>Site Contact: Amanda Lima (Town Engineer) Ownership: Town Existing Site Condition: Fair Land Use: Park</p>	<p>Existing or New?: Existing Proposed BMP/Pretreatment: Bioretention / Sediment Forebay Non-Structural Controls: Street Sweeping, Public Education BMP Maintenance Burden: Medium</p>	
<p>Yarmouth Watershed: Bass River Watershed (10) Receiving Water: Bass River (MA96-12) (E) Known Impairment? Estuarine Bioassessments, Fecal Coliform, Nitrogen Catchment ID: T-144 Priority Catchment: (Y/N) Yes, Bacteria (low), Nitrogen (low) Site Previously Assessed? (Y/N) Y Previous Site ID RP19 (Municipal Property Retrofits 2022)</p>	<p>BMP Benefit(s): Demo Recharge</p>	
<p>Adjacent Critical Resources: Shellfishing area Is site a hotspot? No High Pollutants Observed? No Observed Pollutant(s): Sediment Sanitary Sewer Overlap: (Y/N) No Soils: Good - HSG A/B Invasives: No EJ Community: None</p>	<p>Primary Site Conflict(s): Utilities Wetlands</p>	
RETROFIT SIZING INFORMATION		
<p>Estimated Drainage Area (ac): 0.19</p>	<p>WQv Goal/WQv Provided (cf): 439/281</p>	
<p>Estimated Impervious Area (ac): 0.12</p>	<p>Estimated Practice Area (sf): 153</p>	
<p>Impervious Area Type: Parking Lot</p>	<p>Existing Head Available? Yes</p>	

Date Assessed: 3/3/2023 3:25:38 PM

Assessed by: EK/GK

PHOTOS/SKETCHES



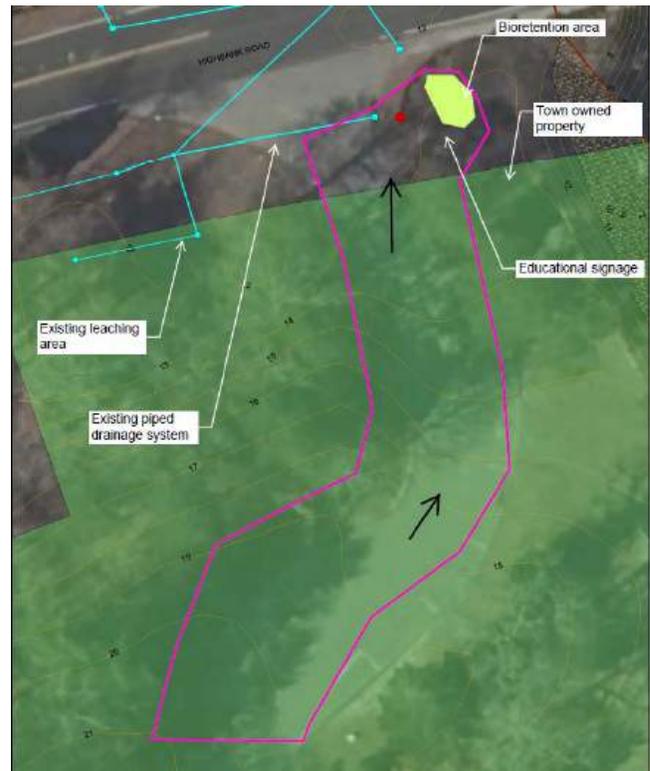
Photo Caption: Area of proposed BMP.



Photo Caption: Looking towards Highbank Road.



Photo Caption: Area of proposed BMP.

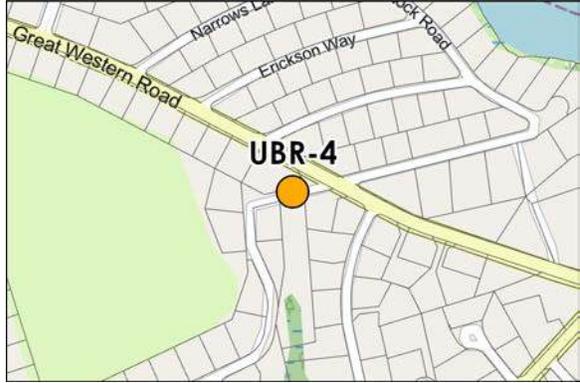


Site Sketch: Drainage area (pink), BMPs (light green), paved flumes (dark red), existing infrastructure (cyan), and drainage flow paths (arrows).

Date Assessed: 3/3/2023 3:25:38 PM

Assessed by: EK/GK

Yarmouth Stormwater Retrofit Field Summary Sheet

Name: Curve Hill Road 1 - Constructed Wetland		ID#: UBR-4
<p>Site Description: There is a fairly large, closed drainage system along Great Western Road that outfalls to town-owned property. The outlet pipe was not visible (under water); lots of sediment was observed. There is a paved flume for runoff from Curve Hill Road that is also directly discharging to this low point.</p> <p>Existing BMP on site? None</p> <p>Concept Description: The concept for this site is to install a constructed wetland at the outfall pipe. A small sediment forebay will be required for the direct discharge from Curve Hill Road.</p>	<p>Site Location: Between 8 and 18 Curve Hill Road</p> 	
GENERAL SITE INFORMATION	RETROFIT DETAILS	
<p>Site Contact: Amanda Lima (Town Engineer) Ownership: Town Existing Site Condition: Fair Land Use: Roadway</p>	<p>Existing or New?: New Proposed BMP/Pretreatment: Constructed Wetland / Sediment Forebay / Deep sump catch basins Non-Structural Controls: Street Sweeping BMP Maintenance Burden: Low</p>	
<p>Yarmouth Watershed: Bass River Watershed (10) Receiving Water: Bass River (MA96-12) (E) Known Impairment? Estuarine Bioassessments, Fecal Coliform, Nitrogen Catchment ID: T-139 Priority Catchment: (Y/N) Yes, Bacteria (high), Nitrogen (high) Site Previously Assessed? (Y/N) No Previous Site ID N/A</p>	<p>BMP Benefit(s): Repair Habitat Storage Resiliency</p>	
<p>Adjacent Critical Resources: None Is site a hotspot? No High Pollutants Observed? No Observed Pollutant(s): Sediment Sanitary Sewer Overlap: (Y/N) No Soils: Good - HSG A/B Invasives: No EJ Community: None</p>	<p>Primary Site Conflict(s): Wetlands</p>	
RETROFIT SIZING INFORMATION		
<p>Estimated Drainage Area (ac): 13.55</p>	<p>WQv Goal/WQv Provided (cf): 18,808/18,808</p>	
<p>Estimated Impervious Area (ac): 5.18</p>	<p>Estimated Practice Area (sf): 8,900</p>	
<p>Impervious Area Type: Street, Rooftop</p>	<p>Existing Head Available? Yes</p>	

Date Assessed: 3/3/2023 4:38:00 PM

Assessed by: EK/GK

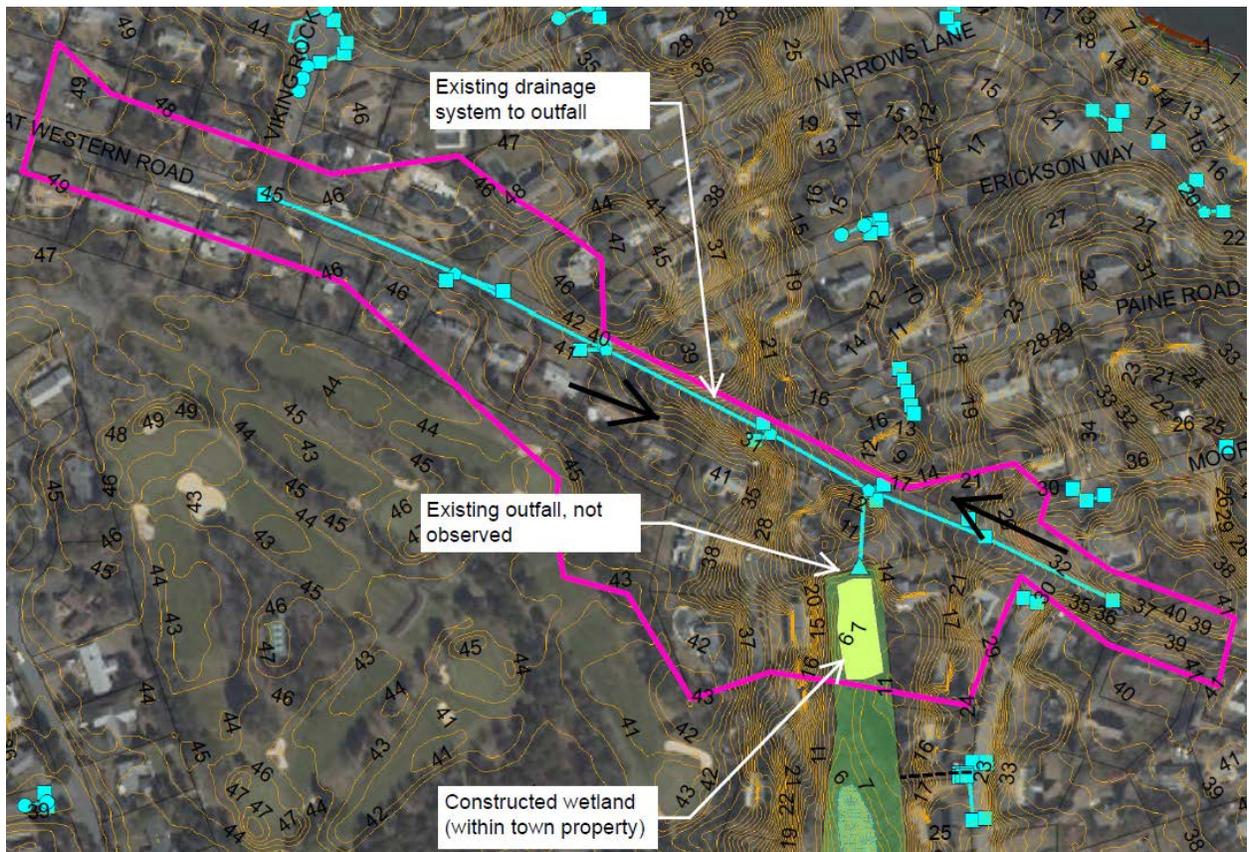
PHOTOS/SKETCHES



Photo Caption: Area of existing outfall / proposed BMP



Photo Caption: Looking up (west) Curve Hill Road



Site Sketch: Drainage area (pink), BMPs (light green), existing infrastructure (cyan), and drainage flow paths (arrows).

Date Assessed: 3/3/2023 4:38:00 PM

Assessed by: EK/GK

Yarmouth Stormwater Retrofit Field Summary Sheet

Name: Great Western Road near Hersey Street - Bioretention		ID#: UBR-7
<p>Site Description: There is an existing closed drainage system along Great Western Road that discharges to the pond at the Blue Rock Golf Course (pipe not observed). This a a fairly large drainage area.</p> <p>Existing BMP on site? None</p>	<p>Site Location: 13 Great Western Road</p> 	
<p>Concept Description: The concept for this site is to install a paved flume to bypass existing catch basins at the town-owned parcel. Additionally, it appears that there is enough head to divert runoff from closed drainage system in road to proposed bioretention area. This site will require tree removal.</p>		
GENERAL SITE INFORMATION	RETROFIT DETAILS	
<p>Site Contact: Amanda Lima (Town Engineer) Ownership: Town Existing Site Condition: Fair Land Use: Roadway</p>	<p>Existing or New?: New Proposed BMP/Pretreatment: Bioretention / Sediment Forebay / Deep sump catch basins Non-Structural Controls: Street Sweeping BMP Maintenance Burden: Medium</p>	
<p>Yarmouth Watershed: Bass River Watershed (10) Receiving Water: Bass River (MA96-12) (E) Known Impairment? Estuarine Bioassessments, Fecal Coliform, Nitrogen Catchment ID: adjacent to T-133 Priority Catchment: (Y/N) Yes, Bacteria (high), Nitrogen (high) Site Previously Assessed? (Y/N) No Previous Site ID N/A</p>	<p>BMP Benefit(s): Storage Recharge</p>	
<p>Adjacent Critical Resources: None Is site a hotspot? No High Pollutants Observed? No Observed Pollutant(s): Sediment and trash Sanitary Sewer Overlap: (Y/N) No Soils: Good - HSG A/B Invasives: No EJ Community: None</p>	<p>Primary Site Conflict(s): Utilities</p>	
RETROFIT SIZING INFORMATION		
<p>Estimated Drainage Area (ac): 6.85</p>	<p>WQv Goal/WQv Provided (cf): 9,195/3,218</p>	
<p>Estimated Impervious Area (ac): 2.53</p>	<p>Estimated Practice Area (sf): 2,654</p>	
<p>Impervious Area Type: Street, Rooftop</p>	<p>Existing Head Available? No</p>	

Date Assessed: 3/3/2023 5:38:35 PM

Assessed by: EK/GK

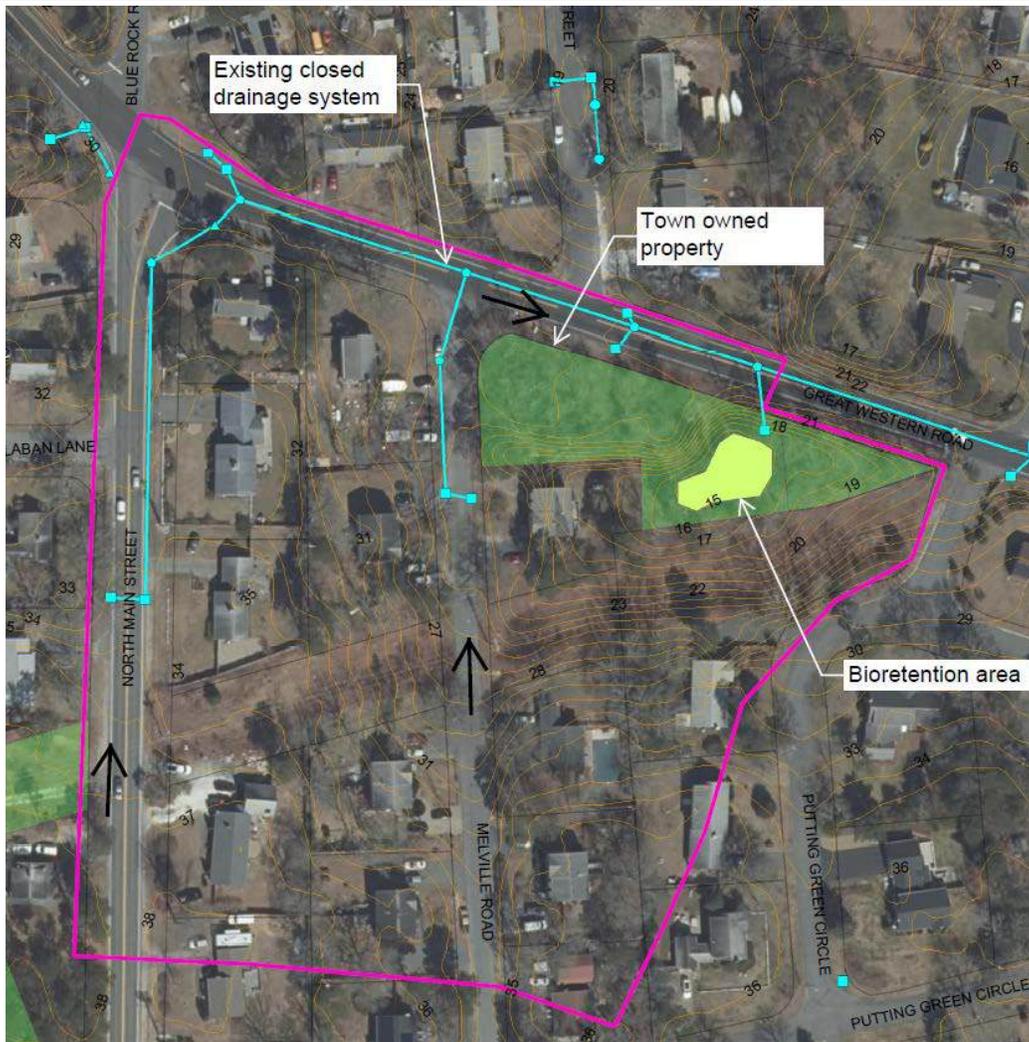
PHOTOS/SKETCHES



Photo Caption: Area of proposed BMP



Photo Caption: Looking East on Great Western Road



Site Sketch: Drainage area (pink), BMPs (light green), existing infrastructure (cyan), and drainage flow paths (arrows).

Date Assessed: 3/3/2023 5:38:35 PM

Assessed by: EK/GK

Attachment C – Retrofit Ranking Information

Yarmouth SW Retrofit Ranking Spreadsheet

DATE June 2023

Preliminary Sizing Calculations and Ranking Criteria for Stormwater Retrofits:

ID	Site Name	Retrofit Type(s)	% Imp.	Drainage Area ac	Imp. Area ac	WQv Goal cf	WQv provided %	WQv provided cf	Bacteria removed %	TN removed %	TP removed %	Bacteria Impairment (Y/N)	Bacteria Priority Catchment (L/M/H)	Nutrient Impairment (Y/N)	Nutrient Priority Catchment (L/M/H)	Total Planning Level Cost \$	Overlaps w/ planned projects	Previously Assessed Site	Wetlands/ Permitting	Construction Access Issues	Potential Abutter Issues	Maintenance Burden	Environmental Justice	High Priority Resource Areas* (Y/N)	Public Beach Benefits (Y/N)	Habitat Improvements	Addresses Existing Issues	Builds Resiliency	Public Education
HIH-2	Park Avenue	Bioretention	52.3	1.45	0.76	2,758	39%	1,065	80	87	95	Y	M	Y	M	\$ 28,967	L	Y	M	L	M	M	2	N	N	L	L	L	M
HIH-3	End of Grove Street	Bioretention	66.8	0.35	0.23	849	100%	847	100	98	100	Y	N/A	Y	N/A	\$ 29,500	L	N	H	L	L	L	2	Y	Y	H	H	H	H
HIH-4	Park Avenue near Vernon	Bioretention/Infiltration Trench	59.9	3.30	1.98	7,186	40%	2,866	80	87	95	Y	H	Y	M	\$ 73,152	L	Y	M	L	H	M	2	N	N	L	M	L	L
LB-2	Wimbledon Drive	Bioretention/Infiltration Trench	42.4	3.55	1.50	5,458	63%	3,436	97	94	98	N	H	Y	M	\$ 90,840	L	N	L	L	H	M	1	N	N	L	L	L	M
LB-8/9	Tanglewood Drive	Bioretention	37.1	4.86	1.80	6,546	81%	5,327	99	97	99	N	N/A	Y	N/A	\$ 144,037	L	N	H	L	M	M	1	N	N	M	L	L	L
LPBR-1	Wings Grove Park	Bioretention	24.3	1.12	0.27	985	100%	985	100	98	100	N	L	Y	L	\$ 26,785	L	Y (Low)	M	L	L	M	2	Y	Y	L	M	L	H
LPBR-4	Indian Memorial Drive - Gazebo	Bioretention	35.0	3.50	1.23	4,449	30%	1,352	79	77	93	N	H	Y	H	\$ 36,705	L	Y (high)	M	M	M	M	2	Y	Y	L	M	L	H
LPBR-10	Long Pond Plaza	Bioretention	61.9	0.59	0.37	1,337	58%	781	98	93	97	N	M	Y	M	\$ 21,280	L	Y (Low)	M	M	L	L	2	Y	N	L	L	L	M
LPBR-13	Smith Road	Bioretention	51.2	0.69	0.35	1,285	45%	575	81	89	96	N	N/A	N	N/A	\$ 15,724	L	N	H	L	H	L	1	N	N	L	M	L	H
LPBR-14	Wood Road at James Pond	Constructed Wetland	32.4	2.88	0.93	3,382	76%	2,569	55	47	30	N	N/A	N	N/A	\$ 43,618	L	N	H	H	L	L	1	N	N	L	M	L	L
MC-2	Baxter Avenue	Constructed Wetland	14.3	4.25	0.61	2,212	100%	2,212	63	53	32	Y	N/A	Y	N/A	\$ 85,981	L	N	H	H	L	L	2	Y	N	M	H	M	L
MC-3	Standish Way	Bioretention/Infiltration Trench	61.3	1.53	0.93	3,393	100%	3,393	100	98	100	Y	M	Y	M	\$ 93,755	H	Y	L	L	M	M	1	Y	Y	L	M	L	H
MC-5	End of Baker Avenue	Bioretention	50.5	0.75	0.38	1,370	100%	1,373	100	98	100	N	N/A	N	N/A	\$ 40,711	L	N	M	L	L	L	2	Y	N	H	M	H	L
MC-8	Buck Island Road 1	Wet Swale	44.6	0.86	0.38	1,392	37%	521	32	47	30	N	L	N	L	\$ 9,001	L	N	H	M	L	L	2	Y	N	M	M	L	L
MC-11	Buck Island Road 4	Wet Swale	57.0	0.92	0.52	1,905	84%	1,600	57	49	31	N	L	N	L	\$ 27,247	L	N	M	M	M	L	2	Y	N	M	L	L	L
OM-1	Old Main Street East	Bioretention/Infiltration Trench	42.8	25.80	11.04	40,061	11%	4,592	100	98	100	Y	H	Y	H	\$ 109,802	H	Y	L	L	H	M	1	Y	N	L	L	M	M
OM-2	Old Main Street West	Bioretention/Infiltration Trench	27.2	33.01	8.97	32,561	53%	17,296	100	98	100	Y	H	Y	H	\$ 500,593	H	N	L	L	H	M	1	Y	N	L	L	M	M
OM-3	Homer Avenue	Bioretention	39.1	0.36	0.14	513	100%	513	100	98	100	Y	N/A	Y	N/A	\$ 17,153	L	N	M	L	M	L	1	Y	Y	H	H	H	M
OM-7	Cemetery parking on Wood Road	Bioretention/Porous Pavement	46.8	1.69	0.79	2,876	100%	2,881	100	98	100	Y	H	Y	H	\$ 150,675	H	Y (Low)	L	L	L	M	1	Y	N	L	H	L	H
PR-1	Buck Island Road/West Yarmouth Road	Bioretention	44.8	1.75	0.78	2,848	100%	2,848	100	98	100	Y	L	Y	M	\$ 77,100	L	N	L	L	L	L	1	N	N	L	L	L	L
PR-3	19 Lake Road West	Constructed Wetland	32.8	7.96	2.62	9,494	86%	8,212	58	49	31	Y	H	Y	H	\$ 138,978	L	N	H	L	L	L	1	N	N	M	H	M	L
PR-4	Lake Road neighborhood	Bioretention	43.3	1.45	0.63	2,271	86%	1,960	99	97	99	Y	H	Y	H	\$ 54,306	L	N	L	L	M	M	1	Y	N	L	L	M	M
PR-7	End of Maushops Path	Wet Swale	57.4	0.35	0.20	737	100%	737	79	63	40	N	N/A	Y	N/A	\$ 17,200	L	N	M	L	H	L	2	Y	N	M	M	H	M
PR-8	Pawnee Road	Wet Swale	39.1	1.18	0.46	1,678	80%	1,348	56	48	31	N	H	Y	H	\$ 22,983	L	Y	M	L	H	L	2	Y	N	M	M	M	L
SP-4	Lake Road/Nauset Road	Bioretention/Porous Pavement	25.0	3.82	0.96	3,468	55%	1,902	94	90	97	N	H	Y	H	\$ 185,439	L	N	L	L	M	M	2	Y	N	L	M	L	L
UBR-2	Wilbur Park - Entrance	Bioretention	62.6	0.19	0.12	439	64%	281	97	94	98	Y	L	Y	L	\$ 7,789	L	Y	M	L	L	M	0	Y	N	L	L	L	H
UBR-4	Curve Hill Road - 1	Constructed Wetland	38.2	13.55	5.18	18,808	100%	18,808	70	54	33	Y	H	Y	H	\$ 318,063	L	N	H	M	M	L	0	N	N	H	M	M	L
UBR-7	Great Western Road - near Hersey Street	Bioretention	37.0	6.85	2.53	9,195	54%	5,002	80	87	95	Y	H	Y	H	\$ 136,384	L	N	L	H	L	M	0	N	N	L	L	L	L

* Anadromous fish runs or shellfish areas

Yarmouth SW Retrofit Ranking Spreadsheet

6/9/2023

Ranking Results:

ID #	Name	1. Pollutant Removal Potential (possible 35 pts)					2. Estimated Unit Cost per WQv (10 pts)		3. Ease of Implementation (25 pts)						4. Additional Benefits/Factors (30 pts)						TOTAL (100 Possible Pts)	
		Total WQv treated (20)	Pollutant Reduction (5)	Water Quality Impairment (5)	High Priority Catchment (5)	#1 Score	Planning Level Cost per WQv Treated	#2 Score*	Overlaps with planned projects (5)	Wetlands/Permitting (5)	Construction Access Issues (5)	Potential Abutter Property Impacts (5)	Maintenance Burden (5)	#3 Score	Environmental Justice Populations (5)	High Priority Resource Areas and/or Public Beach Benefits (5)	Habitat Improvements (5)	Addresses Existing Conditions (5)	Builds Resiliency (5)	Public Education/Demonstration (5)	#4 Score	SCORE
HIH-2	Park Avenue	5.64	4.2	5.0	2.6	17.4	\$27	7	0	2.5	5	2.5	2.5	12.5	5	0	0	0	2.5	7.5	44.8	
HIH-3	End of Grove Street	5.46	9.9	5.0	0.0	20.4	\$34	6	0	0	5	5	5	15	5	5	5	5	5	30	70.9	
HIH-4	Park Avenue near Vernon	7.09	8.4	5.0	3.8	24.2	\$25	8	0	2.5	5	0	2.5	10	5	0	0	2.5	0	7.5	49.5	
LB-2	Wimbledon Drive	7.55	9.6	2.5	3.8	23.4	\$26	8	0	5	5	0	2.5	12.5	2.5	0	0	0	2.5	5	48.4	
LB-8/9	Tanglewood Drive	9.09	9.8	2.5	0.0	21.4	\$27	7	0	0	5	2.5	2.5	10	2.5	0	2.5	0	0	5	43.8	
LPBR-1	Wings Grove Park	5.57	10.0	2.5	0.0	18.1	\$27	7	0	2.5	5	5	2.5	15	5	5	0	2.5	0	17.5	57.9	
LPBR-4	Indian Memorial Drive - Gazebo	5.87	8.6	2.5	5.0	22.0	\$27	7	0	2.5	2.5	2.5	2.5	10	5	5	0	2.5	0	17.5	56.8	
LPBR-10	Long Pond Plaza	5.40	9.8	2.5	2.6	20.3	\$27	7	0	2.5	2.5	5	5	15	5	2.5	0	0	2.5	10	52.7	
LPBR-13	Smith Road	5.24	8.9	0.0	0.0	14.1	\$28	7	0	0	5	0	5	10	2.5	0	0	2.5	0	5	10	41.3
LPBR-14	Wood Road at James Pond	6.85	4.3	0.0	0.0	11.1	\$17	10	0	0	0	5	5	10	2.5	0	0	2.5	0	5	36.0	
MC-2	Baxter Avenue	6.56	5.8	5.0	0.0	17.4	\$39	4	0	0	0	5	5	10	5	2.5	2.5	5	2.5	0	17.5	49.2
MC-3	Standish Way	7.52	9.9	5.0	2.6	25.0	\$28	7	5	5	5	2.5	2.5	20	2.5	5	0	2.5	0	5	15	67.2
MC-5	End of Baker Avenue	5.88	10.0	0.0	0.0	15.9	\$30	7	0	2.5	5	5	5	17.5	5	2.5	5	2.5	0	20	60.1	
MC-8	Buck Island Road 1	5.19	3.1	0.0	0.0	8.3	\$17	10	0	0	2.5	5	5	12.5	5	2.5	2.5	2.5	0	12.5	43.2	
MC-11	Buck Island Road 4	6.07	4.4	0.0	0.0	10.5	\$17	10	0	2.5	2.5	2.5	5	12.5	5	2.5	2.5	0	0	10	43.0	
OM-1	Old Main Street East	8.49	9.9	5.0	5.0	28.4	\$24	8	5	5	5	0	2.5	17.5	2.5	2.5	0	2.5	2.5	10	64.1	
OM-2	Old Main Street West	18.78	9.9	5.0	5.0	38.7	\$29	7	5	5	5	0	2.5	17.5	2.5	2.5	0	0	2.5	2.5	10	73.1
OM-3	Homer Avenue	5.19	9.9	5.0	0.0	20.1	\$33	6	0	2.5	5	2.5	5	15	2.5	5	5	5	2.5	25	65.9	
OM-7	Cemetery parking on Wood Road	7.11	9.9	5.0	5.0	27.0	\$52	1	5	5	5	5	2.5	22.5	2.5	2.5	0	5	0	15	65.4	
PR-1	Buck Island Road/West Yarmouth Road	7.08	9.9	5.0	1.3	23.3	\$27	7	0	5	5	5	5	20	2.5	0	0	0	0	2.5	53.2	
PR-3	19 Lake Road West	11.42	5.4	5.0	5.0	26.8	\$17	10	0	0	5	5	5	15	2.5	0	2.5	5	2.5	12.5	64.3	
PR-4	Lake Road neighborhood	6.36	9.8	5.0	5.0	26.2	\$28	7	0	5	5	2.5	2.5	15	2.5	2.5	0	0	2.5	10	58.4	
PR-7	End of Maushops Path	5.37	7.1	2.5	0.0	15.0	\$23	8	0	2.5	5	0	5	12.5	5	2.5	2.5	2.5	5	20	55.9	
PR-8	Pawnee Road	5.86	5.2	2.5	5.0	18.6	\$17	10	0	2.5	5	0	5	12.5	5	2.5	2.5	2.5	2.5	15	56.0	
SP-4	Lake Road/Nauset Road	6.31	9.2	2.5	5.0	23.0	\$97	0	0	5	5	2.5	2.5	15	5	2.5	0	2.5	0	10	48.0	
UBR-2	Wilbur Park - Entrance	5.00	9.6	5.0	0.0	19.6	\$28	7	0	2.5	5	5	2.5	15	0	2.5	0	0	0	5	7.5	49.1
UBR-4	Curve Hill Road - 1	20.00	6.2	5.0	5.0	36.2	\$17	10	0	0	2.5	2.5	5	10	0	0	5	2.5	2.5	10	66.2	
UBR-7	Great Western Road - near Hersey Street	8.82	8.4	5.0	5.0	27.2	\$27	7	0	5	0	5	2.5	12.5	0	0	0	0	0	0	47.0	

*This score reflects the lowest unit cost getting 10 points, while the highest unit cost gets 1 point.

Site Priority In Descending Order	
Site #	Score
OM-2	73.1
HIH-3	70.9
MC-3	67.2
UBR-4	66.2
OM-3	65.9
OM-7	65.4
PR-3	64.3
OM-1	64.1
MC-5	60.1
PR-4	58.4
LPBR-1	57.9
LPBR-4	56.8
PR-8	56.0
PR-7	55.9
PR-1	53.2
LPBR-10	52.7
HIH-4	49.5
MC-2	49.2
UBR-2	49.1
LB-2	48.4
SP-4	48.0
UBR-7	47.0
HIH-2	44.8
LB-8/9	43.8
MC-8	43.2
MC-11	43.0
LPBR-13	41.3
LPBR-14	36.0

Attachment D – Unranked Sites and Other Observations

Yarmouth SW Retrofit Unranked Sites

6/28/2023

ID	Site Name	Latitude, Longitude	Project Type	Proposed GSI Retrofits	Non-structural Controls
HIH-1	End of Highland Street	41.64652366, -70.27099867	Existing BMP retrofit/Road End	Bioretention	Pavement Removal, Buffer Revegetation
HIH-5	End of Glenwood Street	41.6447941, -70.26693513	Road End	Bioretention	Pavement Removal, Buffer Revegetation
LB-1	Englewood Beach	41.64038086, -70.24751329	Salt Marsh Restoration/ Wet Practice	Wet Swale	Pavement Removal, Buffer Revegetation, Public Education
LB-10	Webster Road	41.64744615, -70.25213299	Outfall Easement Retrofit	Bioretention	Street Sweeping, Pavement Removal, Buffer Revegetation
LB-11	Roberta Drive	41.65803866, -70.2425402	Outfall Easement Retrofit	Bioretention	Street Sweeping, Public Education
LB-12	Higgins Crowell Road	41.65856959, -70.24338557	Bioretention	Bioretention	Street Sweeping
LB-13	Marion Road	41.65703876, -70.24498168	Existing BMP retrofit	Bioretention	Street Sweeping
LB-14	Traders Lane	41.65660216, -70.24437749	Existing BMP retrofit	Bioretention	Street Sweeping
LB-15	Buck Island @ Higgins Crowell Road	41.66101062, -70.24329102	Existing BMP retrofit	Infiltration Basin	Street Sweeping
LB-3	Broadway Street	41.64335868, -70.24986537	Porous Pavement	Porous Pavement	Street Sweeping, Pavement Removal
LB-4	Silverleaf Lane	41.64386049, -70.23981316	Wet Practice	Constructed Wetland	Street Sweeping, Invasives Management
LB-5	Springer Lane	41.6442877, -70.23785301	Porous Pavement	Porous Pavement	Street Sweeping
LB-6	Lewis Bay Road	41.64083774, -70.23859377	Salt Marsh Restoration/Bioretention	Culvert Replacement, Bioretention	Pavement Removal, Buffer Revegetation, Public Education
LB-7	41 Tanglewood Drive	41.649626, -70.24909547	Outfall Easement Retrofit	Bioretention	Street Sweeping
LPBR-11	Long Pond Drive	41.67066222, -70.20003484	ROW practices	Bioretention	Street Sweeping
LPBR-12	Long Pond at Water Dept Drive	41.6697021, -70.20189846	ROW practices	Bioretention	Street Sweeping
LPBR-2	Station Ave at Long Pond	41.67291454, -70.18980441	Wet Practice	Wet Swale	Street Sweeping
LPBR-3	Indian Memorial Drive / Station Ave intersection	41.67205363, -70.18920949	ROW practices	Bioretention	Street Sweeping
LPBR-5	Ice House Road	41.66776894, -70.1993856	ROW practices	Wet swale	Street Sweeping, Pavement Removal
LPBR-6	Lyman Lane	41.66663855, -70.20138326	ROW practices	Bioretention	Street Sweeping, Public Education
LPBR-7	Town Hall (east side)	41.66408142, -70.1989659	Rain Garden	Rain Garden	Public Education
LPBR-8	Town Hall (west side)	41.66416441, -70.19937347	Rain Garden	Rain Garden	Street Sweeping
LPBR-9	Long Pond at Herring Run	41.66604207, -70.20526555	Existing BMP retrofit	Stabilization, Buffer Restoration	Street Sweeping, Public Education
MC-1	Baxter Ave and Harbor Road	41.64981963, -70.2610762	ROW practices	Bioretention	Street Sweeping, Pavement Removal
MC-10	Buck Island - 3	41.66131577, -70.25757629	ROW practices	Bioretention	Street Sweeping
MC-4	Bradford Road	41.65204988, -70.25328635	Road End	Bioretention	Pavement Removal, Buffer Restoration, Stabilization
MC-6	Pondview Avenue	41.66052702, -70.26205129	ROW practices	Bioretention	Street Sweeping

Yarmouth SW Retrofit Unranked Sites

6/28/2023

ID	Site Name	Latitude, Longitude	Project Type	Proposed GSI Retrofits	Non-structural Controls
MC-7	Camp Street	41.65872673, -70.26419258	Wet Practice	Wet Swale	Buffer Restoration
MC-9	Buck Island - 2	41.66283313, -70.26006592	ROW practices	Bioretention	Buffer Restoration
OM-4	N. Cove Landing	41.66278786, -70.18626674	Existing BMP retrofit	Bioretention	Buffer Restoration
OM-5	Pleasant Street	41.66346423, -70.18655799	Existing BMP retrofit	Bioretention/Tree Trenches	Street Sweeping
PR-2	Buck Island Outlets	41.66448916, -70.22626137	ROW practices	Bioretention	Buffer Restoration
PR-5	Seagull Beach Road - Shellfish/Kayak	41.63611323, -70.22745161	Revegetation	Buffer Restoration	Street Sweeping
PR-6	Along Seagull Beach Road	41.6353664, -70.23035425	Wet Practice	Wet Swale	Street Sweeping
SP-2	57 Circuit Road	41.65938182, -70.2167337	Outfall Easement Retrofit	Wet Swale	Street Sweeping
SP-3	Swan Lake Road	41.66028089, -70.2168623	Porous Pavement	Porous pavement	Street Sweeping
SP-5	Winslow Gray Road	41.6566585, -70.22195178	ROW practices	Bioretention	Street Sweeping
UBR-1	Wilber Park Entrance - Road Runoff	41.68544845, -70.16113012	Existing BMP retrofit	Bioretention	Street Sweeping
UBR-10	Green Way	41.68088311, -70.17583784	Outfall Easement Retrofit	Bioretention	Street Sweeping
UBR-11	Wolfson Road	41.68935368, -70.17661871	ROW practices	Bioretention	Street Sweeping
UBR-3	Wilbur Park - Parking Area	41.68488201, -70.16033238	Existing BMP retrofit	Tree Trench	Street Sweeping
UBR-5	Curve Hill Road - 2	41.68424994, -70.16876705	ROW practices	Bioretention	Street Sweeping
UBR-6	Four Seasons Drive cul-de-sac	41.68276658, -70.16768905	Existing BMP retrofit	Bioretention	Pavement Removal
UBR-8	Keel Cape and Blue Rock Corner	41.68878197, -70.16857072	Rain Garden	Rain Garden	Lawn Management, Street Sweeping
UBR-9	Blue Rock Heights Community Building	41.68870432, -70.16819422	Tree trenches	Tree Trench	Public Education

Yarmouth Stormwater Retrofits - Additional Observations

6/28/2023

Site Location	Description
7 Somerset Street - Hyannis Inner Harbor	Recent CZM project consisting of underground infiltrators. Site adjacent to pond where they are trying to improve tidal flushing. Improved management of invasives, trash, and sediment is recommended.
North End of Grove Street - Hyannis Inner Harbor	Dumping of trash observed. Improved trash management is recommended.
Hyannis Inner Harbor	Several locations of sediment on streets from residential construction sites. Improved erosion and sediment control management is recommended.
Grist Mill Lane- Mill Creek	Low-lying road (already underwater at high tides) and public beach. Impacted salt marsh. Porous pavement recommended.
Gleason Ave BMP- Mill Creek	Existing Gravel Wetland for T-197 is in poor condition. Maintenance and revegetation are recommended.
North end of Standish Way- Mill Creek	Opportunity to use street median for stormwater in the future. Also, large amount of erosion undercutting wall near corner of Standish and Route 28 that should be looked at.