

**TOWN OF SANDWICH**  
OLDEST TOWN ON CAPE COD

**DEPARTMENT OF PUBLIC WORKS**



500 ROUTE 130, SANDWICH, MA 02563

DIRECTOR & TOWN ENGINEER 508.833.8002 ■ FAX 508.833.8011  
ASSISTANT TOWN ENGINEER 508.833.8000 ■ FAX 508.833.8005  
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EMAIL [dpw@townofsandwich.net](mailto:dpw@townofsandwich.net)

April 27, 2016

Glenda Velez - CIP  
U.S. Environmental Protection Agency - Region 1  
5 Post Office Square – OEP06-01  
Boston, MA 02109-3912

Fred Civian  
Massachusetts Department of Environmental Protection  
One Winter Street - 5th Floor  
Boston, MA 02108

**Subject: Annual Update - NPDES Phase II General Permit**  
**Town of Sandwich Stormwater Management Plan: Year 14 Update**

Dear U.S. EPA and MaDEP:

As required under the NPDES Stormwater General Permit, the Town of Sandwich hereby submits this annual update of the Town's Stormwater Management Plan (SMP). This report is a continuation of the original 5-year permit issued for the Town of Sandwich. During this year, the Town continued many efforts implemented in the initial permit and strove to meet goals that were planned but not met within the first five years. An update of Year 14 accomplishments are listed below and shown in the attached tables.

**Year 14 Update**

The Town of Sandwich continues to be very proactive in the field of stormwater management. It has satisfied the MS4 permit requirements and substantially completed all the goals laid out in the Stormwater Management Plan. This Annual Update provides a look at major accomplishments, new programs and goals. Below is a summary of Year 14 implementation.

**Significant Accomplishments (Spring 2016 - Winter 2017)**

Below is a list of some of the significant goals accomplished over the past year. Further details and illustrations of these accomplishments are shown in the attached appendix.

**Stormwater Mapping**

In anticipation of new requirements expected to be part of the NPDES Stormwater General Permit reissuance, the Town's Engineering Department has continued efforts to refine and improve mapping of catchment and subcatchment areas. This work is being incorporated into the Town's Geographic Information System and will help future stormwater mitigation planning.

#### Stormwater Mitigation of Inland Ponds

The Town of Sandwich has continued efforts to mitigate stormwater pollution affecting the Town's valuable freshwater ponds. The ponds provide valuable wildlife habitat, fishing, swimming, and recreation opportunities for the Town and its visitors. The Town's engineering consultant conducted a study in which they updated the work of previous efforts with recent water quality sampling results and evaluation of BMP mitigation options. Their summary is attached.

#### Comprehensive Water Resources Management Plan Development

The Town of Sandwich has continued Comprehensive Water Resources Management Planning to address water resource issues across Town, including stormwater management. In addition to stormwater, the work will assess and develop solutions for wastewater and other potential pollution sources. The Town's consultant has completed the draft of the first phase of this work, the Needs Assessment: <http://www.graphtechservices.com/ccw/CWRMPreport.pdf>.

#### Household Hazardous Products Collection

The Town collaborates annually with four other neighboring communities to provide opportunities for residents to properly dispose of household hazardous products. This reduces the amount of hazardous material released to the environment, including water resources.

#### Municipal Solid Waste Disposal Enhancements

Town recently implemented a Pay-As-You-Throw program at the Solid Waste Transfer Station. This program requires users to pay for each bag of general trash disposed of. This, together with improvements to the recycling center has reduced the Town's municipal solid waste stream and increased recycling. The Department of Public Works also distributed compost bins for home composting and aired "Home Composting - Turning Your Spoils to Soil" on local TV (a MassDEP DVD). The Town gave away recycling and compost bins at this event.

#### Community Pride Day

The Town of Sandwich continues the annual Community Pride Day where residents participate in the cleanup of the Town. The DPW distributes equipment to assist in the cleanup of trash and identifies locations where residents can focus their efforts, such as at walking trails, roadsides, beaches, marshes and along shorelines. This event helps prevent trash from entering our valuable water bodies.

#### Stormwater Inspections and Monitoring

The Town continues to monitor erosion control at developments and inspect illicit connections throughout town as part of its SMP. The Town's enforcement of this program has effectively cleaned up many sites, minimizing impacts to the Town's drainage system and water bodies.

#### Stormwater Management Plan on Display

The Stormwater Management Plan is on display on the Town's web site for public viewing. Additionally, the Town's GIS allows the public to pinpoint specific stormwater problems and relay this information via e-mail to the Department of Public Works. The e-mail shows a map and ID number of the drainage facility so the DPW can quickly respond to any drainage issues. This process also allows accurate record keeping by the DPW.

### Water Quality Groups

The Town of Sandwich is proactive in matters related to water quality in Sandwich and on Cape Cod. A consortium of Cape Cod Towns, Barnstable County, and local environmental non-profits has formed to support the Town's efforts to address stormwater impacts. The Town has many public officials and volunteers actively involved with water quality committees including but not limited to the Sandwich Water Quality Advisory Board, Mass Estuaries Program, Popponesset Bay State DEP Pilot Intra-municipal Work Group and 3 Bays Initiative.

### **Status of Goals for Year 14**

Similar to the original table submitted for the NPDES General Permit, the attached table shows goals proposed for all Six Control Measures. This updated table reflects new goals and the status of Year 1 through 14 goals. The yellow highlighted cells represent goals scheduled and met in each season of respective years. New goals mentioned earlier have also been included in the table.

The attached appendix shows several of the actions performed by the Town to meet the Year 14 goals listed in the table.

### **Overall Status of 14-Year Permit Term**

As can be seen in the attached table, the goals in the Town's SMP have been substantially met over the permit period. It's important to note that several new goals were added to the Six Control Measures as the SMP evolved. Note: Some of the goals overlap in the Six Control Measures.

### Recently completed/In Progress Goals of Six Control Measures

#### *5.4 Construction Stormwater Runoff Control*

##### *4g. Recommended BMP's*

The Town requires developers to design drainage facilities using BMP's. The Town had anticipated the Cape Cod Commission obtaining a grant to create a list of "Cape Cod BMP's" to distribute to developers. The grant was not awarded, so the Town has prepared a draft Stormwater BMP guidance document.

##### *4i. Erosion Control Guidelines*

The Town has prepared an updated draft of the Erosion Control Guidelines to reflect current BMP practices and design. This guideline is available for developers and homeowners. The guideline will also complement enforcement letters for non-compliance.

#### *5.5 Post Construction Stormwater Management*

*5f. Recommended BMP's – See Goal 5.2, 4g above.*

*5h. Erosion Control Guidelines – See Goal 5.2, 4.i above.*

### **Future Stormwater Management Plan & Permit**

The Town is reviewing the recently issued 2016 MS4 permit. The Town's SMP will be updated as necessary to comply with the new permit requirements.

**Conclusion**

The Town of Sandwich's accomplishments over the permit period meet or exceed nearly all of the scheduled goals. Additionally, new goals have been created to further enhance the Towns Stormwater Management Plan. We trust that these accomplishments will satisfy the Massachusetts Department of Environmental Protection and the United States Environmental Protection Agency requirements for this permit. Please contact Sam Jensen of the Sandwich Engineering Department if you have any questions or require further information regarding this Annual Update.

Sincerely,

A handwritten signature in black ink, appearing to read 'Sam J', with a long, sweeping horizontal line extending to the right.

Samuel J.P. Jensen, P.E.  
Assistant Town Engineer

Encl.

cc: G. Dunham, Town Manager  
P. Tilton, DPW Director, Town Engineer

## **APPENDIX**

### **YEAR 14 UPDATE**

- Recycling Student Award
- Hazardous Materials Program Flyers
- Town of Sandwich DPW Pay-As-You-Throw Brochure
- Sandwich DPW How to Recycle Flyer
- Draft Stormwater BMP Guidance
- Draft Erosion Control Guidance
- Wright-Pierce Memorandum Re: Sandwich, MA – CWRMP – Stormwater BMPs



BMP ID #	PERMIT YEAR ONE				PERMIT YEAR TWO				PERMIT YEAR THREE				PERMIT YEAR FOUR				PERMIT YEAR FIVE				PERMIT YEAR 6	PERMIT YEAR 7	PERMIT YEAR 8	PERMIT YEAR 9	PERMIT YEAR 10	PERMIT YEAR 11	PERMIT YEAR 12	PERMIT YEAR 13	PERMIT YEAR 14	STATUS						
	Spring 03	Summer 03	Fall 03	Winter 03-04	Spring 04	Summer 04	Fall 04	Winter 04-05	Spring 05	Summer 05	Fall 05	Winter 05-06	Spring 06	Summer 06	Fall 06	Winter 06-07	Spring 07	Summer 07	Fall 07	Winter 07-08	ACHIEVEMENTS	ACHIEVEMENTS	ACHIEVEMENTS	ACHIEVEMENTS	ACHIEVEMENTS	ACHIEVEMENTS	ACHIEVEMENTS	ACHIEVEMENTS	ACHIEVEMENTS	Goals	Comments					
5.1: Public Education & Outreach																																				
1a																														Current Educational Brochures	Brochures available at Town buildings and distributed at Stormwater events. Earth Day Events.					
1b																														Development Review	Continue to enforce stormwater and erosion regulations during development review.					
1c																														Public Display of Stormwater Mgmt Plan	Displayed on Town web site and at Public Library.					
1d																														Public Meeting	Held Public Meeting. Updated Board of Selectmen on SMP - BoS endorsed continuation.					
1e																														Proposed Educational Brochure	Continue to distribute brochures and educational information.					
1f																														Outfall & Catch Basin ID & Mapping	GIS Drainage Layer is complete. Continue drainage updates.					
1g																														Web Site Information	SMP is displayed on web site. Future Stormwater information to be displayed on web.					
1h																														Educational Festival	Participated in Water Festivals at Elementary Schools w/ County and AmeriCorps.					
1i																														Educate DPW Employees	Educated DPW employees about disposal and containment of hazardous wastes					
1j																														Educational Video	AmeriCorps Cape Cod w/ Stormwater video in Sandwich complete					
1k																														Catch Basin Stencils	Placing approx 100 CB markers & 500 door hangers in Town Neck area during summer.					
1l																														Stormwater Posters	Displayed 4 stormwater posters in several Town offices.					
1m																														Student Involvement	Assisted Environmental Science Classes at High School.					
1n																														Stormwater Committee	Project Storm team continues to meet to discuss stormwater and implement Phase II Regs					
1o																														Environmental Expo Review Team	Member of Environmental Expo Review Team for Sandwich High School					
5.2: Public Involvement & Participation																																				
2a																														Development Review	Continue to enforce stormwater and erosion regulations during development review.					
2b																														Public Meeting	Held Public Meeting. Updated Board of Selectmen on SMP - BoS endorsed continuation.					
2c																														Public Display of Stormwater Mgmt Plan	Displayed on Town web site and at Public Library.					
2d																														Proposed Educational Brochure	Continue to distribute brochures and educational information.					
2e																														Illicit Discharge Identification	Continued inspection of potential illicit connections.					
2f																														Outfall & Catch Basin ID & Mapping	W/ AmeriCorps, identified over 2,500 CB's and outfalls w/ GPS. Report is available. GIS complete.					
2g																														Water Monitoring Program	Health Dept performs annual sampling.					
2h																														Educational Video	AmeriCorps Cape Cod w/ Stormwater video in Sandwich complete					
2i																														Educational Festival	Participated in Water Festivals at Elementary Schools w/ County and AmeriCorps.					
2j																														Student Involvement	Taught class, interacted w/ students on projects & involved them with data collection.					
2k																														Stormwater Committee	Formed Cape-wide group w/ CCC to develop & distribute educational info related to stormwater					
5.3: Illicit Discharge Detection & Elimination																																				
3a																														Household Hazardous Waste Program	Continue to distribute info and schedule household hazardous waste collection days w/ County.					
3b																														Sandwich Village Stormwater Assessment	Cont'd using Town funds/grants to mitigate stormwater. Completed construction of 319 grant.					
3c																														Illicit Discharge & Dumping Identification	Continued inspections of illicit discharges. Inspected and issued notices to sump pump owners.					
3d																														Catch Basin Cleaning	Continue to clean & monitor CB conditions. GIS drainage layer complete.					
3e																														Outfall & Catch Basin ID & Mapping	W/ AmeriCorps, identified over 2,500 CB's and outfalls w/ GPS. Report is available. GIS complete.					
3f																														Educational Information	Displayed posters & distributed brochures to public & developers. Earth Day Activities.					
3g																														Allowable Non-Stormwater Discharges	Will continue to search for non-stormwater discharges that may be significant polluters.					
3h																														Town Bylaw - Illegal Disposal	Town By-law includes illegal disposal law and fines. Will continue to update regs as necessary					
3i																														Water Sampling	Town continues sampling to monitor water quality improvements and to use for stormwater grants.					

Note: Many of the BMP's above will continue beyond the initial 5-year permit period.  
= Goals completed in the season & year shown above. Words in Red = goals not accomplished under the five year permit.



Massachusetts Department of Environmental Protection  
Bureau of Resource Protection - Watershed Management  
**BRP WM 08A NPDES Stormwater General Permit Notice of Intent**  
for Discharges from Small Municipal Separate Stormwater Sewer Systems (MS4's)  
F. Storm Water Management Program TIME FRAMES

Transmittal Number: W035665

Facility ID (if known): \_\_\_\_\_

Page: 2 of 3

BMP ID #	PERMIT YEAR ONE				PERMIT YEAR TWO				PERMIT YEAR THREE				PERMIT YEAR FOUR				PERMIT YEAR FIVE				PERMIT YEAR 6 ACHIEVEMENTS	PERMIT YEAR 7 ACHIEVEMENTS	PERMIT YEAR 8 ACHIEVEMENTS	PERMIT YEAR 9 ACHIEVEMENTS	PERMIT YEAR 10 ACHIEVEMENTS	PERMIT YEAR 11 ACHIEVEMENTS	PERMIT YEAR 12 ACHIEVEMENTS	PERMIT YEAR 13 ACHIEVEMENTS	PERMIT YEAR 14 ACHIEVEMENTS	STATUS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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Page: 3 of 3[illegible]

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# TOWN OF SANDWICH

THE OLDEST TOWN ON CAPE COD

DEPARTMENT OF PUBLIC WORKS



500 ROUTE 130, SANDWICH, MA 02563

DIRECTOR & TOWN ENGINEER 508.833.8002 • FAX 508.833.8011  
ASSISTANT TOWN ENGINEER 508.833.8000 • FAX 508.833.8005  
TREE WARDEN 508.833.8003 • FAX 508.833.8011  
EMAIL [dpw@townofsandwich.net](mailto:dpw@townofsandwich.net)

**Dear Oak Ridge School Recycler,**

Thank you for recycling at the Oak Ridge School. Your commitment to recycling not only helps the environment but also saves money for the Town of Sandwich.

By signing your name below, you are committing to recycle at home as well.

James Murray

Print Name

James Murray

Sign Name

To assist you with your recycling efforts at home, the Sandwich Department of Public Works is offering you one (1) free recycling bin. Please bring this form with you to the following address to pick up your recycling bin:

Sandwich DPW

500 Route 130 (go to DPW office in green building – not the Transfer Station)

Sandwich, MA 02563

Thank you,

Sandwich DPW





# too TOXIC to TRASH

## UPPER CAPE 2016 SCHEDULE

9am to 1pm

Sandwich High School  
365 Quaker Meetinghouse Rd.

April  
16

9am to 1pm

Falmouth High School  
874 Gifford St., off Brick Kiln Rd.

June  
18

9am to 1pm

Mashpee High School,  
500 Old Barnstable Rd., off Rt 151

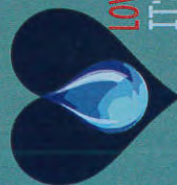
August  
20

9am to 1pm

Peebles Elementary School  
70 Trowbridge Rd.,  
off Bourne Rotary

Oct.  
15

Questions?  
Visit the Hazardous Materials Program at  
[www.capecodextension.org](http://www.capecodextension.org)



LOVE YOUR LOCAL WATER.  
IT'S A CAPE COD THING.

"Love your local water. It's a Cape Cod Thing." is a campaign of Cape Cod Cooperative Extension's Hazardous Waste & Water Quality Department.

Cape Cod Cooperative Extension  
P.O. Box 367  
Barnstable, MA 02630-0367  
[www.capecodextension.org](http://www.capecodextension.org)  
508-375-6699



\*\*\*\*\*ECRWSS\*\*\*  
LOCAL  
POSTAL CUSTOMER

PRSRT STD  
U.S. POSTAGE  
PAID  
LEOMINSTER, MA  
PERMIT NO. 17

HHW Collections are funded by the Towns of Bourne, Sandwich, Mashpee and Falmouth, and Barnstable County's Cape Cod Cooperative Extension. Photos by Christopher Harding Photography.



## HOUSEHOLD HAZARDOUS WASTE 2016 COLLECTION SCHEDULE

**BOURNE, SANDWICH, FALMOUTH,  
MASHPEE, JOINT BASE CAPE COD**

\*Small Business disposal accepted. See inside panel for info



LOVE YOUR LOCAL WATER.  
IT'S A CAPE COD THING.





# SIMPLE & FREE



LOVE YOUR LOCAL WATER.  
IT'S A CAPE COD THING.



PROTECT WHAT WE LOVE ABOUT THE CAPE.  
IT ALL STARTS WITH **YOU!**

Household hazardous waste (HHW) collections protect what we love about Cape Cod, especially our precious local drinking water. Most chemicals are too toxic to throw away in regular trash or dump down the drain, so FREE collections are being held to take that waste off your hands and keep it out of our water supply.

Are you a small business? Do you use chemicals? To make your state required disposal arrangements and obtain pricing, contact Kalliope Egloff #508-375-6699.



## BRING THESE ITEMS TO YOUR COLLECTION



### PAINTS, POLISHES & STAINS **\*NO LATEX\***

Alkyd-Based Paint & Stain • Marine Paints & Sealers • Metal & Furniture Polish • Oil-Based Paint & Stain  
Paint Thinner & Remover • Solvent-Based Wood Finish • Wood Preservatives • Auto Paint (no latex)



### YARD CHEMICALS

Driveway Sealer with Solvent • Fertilizers with Weed Killer • Rodent Poison • Weed Killer  
Insecticides • Pesticides



### CLEANERS & CHEMICALS

Pool Cleaners & Chemicals Solvents • Photo & Hobby Chemicals • Oven Cleaner • Drain Cleaner  
Spot Remover • Acids • Degreasers • Disinfectants



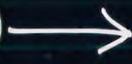
### AUTO FLUIDS

Car Cleaner with Solvent • Brake & Power Steering Fluid • Bug & Tar Remover • Camp Fuel  
Radiator Flush • Car Polish • Gasoline

For items not listed here visit [www.capecodextension.org](http://www.capecodextension.org) for disposal instruction.

**WANTED!  
MERCURY**

It is important to keep mercury out of our environment and water supply. To dispose of household mercury containing products, such as **thermometers, thermostats or barometers**, bring these items to your local HHW collection. If you come across larger amounts of mercury in your home please contact the Barnstable County Hazardous Waste team at #508-375-6699.



(508) 375-6699



## ***Disposing of Hazardous Paints, Stains and Wood Finishes***

### **How can I identify hazardous materials?**

#### **Look for these words on the label:**

- Clean up with paint thinner or mineral spirits.
- Combustible
- Oil
- Alkyd
- Alkyd Resin
- Petroleum Distillates
- Mineral Spirits
- Linseed Oil
- Hydrocarbons
- Solvent-based
- Lacquer
- Thinner
- Lead
- Chromium
- Two-part Paint
- Car or Boat Paint
- Swimming Pool Paint



### **How do I dispose of these materials?**

**Solid in can:** Throw away in household trash.

**Recycle:** Most towns accept *usable* oil and alkyd paints, stains and wood finishes from town residents at the Recycling Center from May through October. Good paint is available at no cost.

**Evaporate:** Small quantities—less than two inches in the bottom of a can—may be disposed of by allowing the liquid to evaporate. Move the container to a sheltered, outdoor area away from children and pets; remove the lid and allow liquid to dry. Once the liquid evaporates, recycle the *open* can or discard in the trash.

**Use Up Or Share:** Leftover paint can be used as a prime coat or to paint items where matching colors is not a concern. Or ask neighbors, friends, theater groups, recreation departments or service organizations if they can use your paint, stain or wood finishes.

**Full or partially full cans:** Take to household hazardous products collection.

**Recycle Empty Cans:** Leave the lid off the can to dry the remaining paint residue, then recycle the open can and lid with metal cans at your town's recycling center. Recycle empty aerosol cans at your town's recycling center.

6/05



Barnstable County

**HAZARDOUS MATERIALS PROGRAM**

In cooperation with the University of Massachusetts Extension

800-319-2783

508-375-6699

Cape Cod Cooperative Extension  
Deeds and Probate Building  
Barnstable, MA 02630-0367  
508-375-6690  
[www.capecodextension.org](http://www.capecodextension.org)

## ***Disposing of Non-hazardous Paints, Stains and Wood Finishes***

### **How can I identify non-hazardous materials?**

**Look for these words on the label:**

- Clean up with soap and water.
- Latex
- Water-based
- Ethylene Glycol
- Vinyl Emulsion
- Acrylic
- Acrylic Emulsion
- Glycol
- Poly Vinyl Alcohol



### **How do I dispose of these materials?**

**Absorb:** Large quantities of latex or acrylic paint, stains and wood finishes—more than two inches in the bottom of a can—may be absorbed with clay-based kitty litter. Pour kitty litter into a box or container, then pour the paint into the container and stir. Add kitty litter until you can't stir anymore. Put the *container with the absorbed paint* into your household trash. Recycle open, dry paint cans.

**Evaporate:** Small quantities—less than two inches in the bottom of a can—may be disposed of by allowing the liquid to evaporate. Move the container to a sheltered, outdoor area away from children and pets; remove the lid and allow liquid to dry. Once the liquid evaporates, recycle the *open* can or discard in the trash. Up to two inches in the bottom of an oil-based paint can may also be disposed of in this manner.

**Recycle Empty Cans:** Leave the lid off the can to dry the remaining paint residue, then recycle the open can and lid with metal cans at your town's recycling center. Recycle empty aerosol cans at your town's recycling center.

6/05



Barnstable County

**HAZARDOUS MATERIALS PROGRAM**

In cooperation with the University of Massachusetts Extension

**800-319-2783**

**508-375-6699**

Cape Cod Cooperative Extension  
Deeds and Probate Building  
Barnstable, MA 02630-0367  
508-375-6690  
[www.capecodextension.org](http://www.capecodextension.org)



## Who wins with PAYT?

Everyone wins from the environmental and cost saving benefits. Residents who recycle to control their trash will have lower costs. PAYT is good public policy.

## What is Dual Stream Recycling?

Dual stream is a system in which recyclables are collected in two streams. One stream is fiber (paper, cardboard) and the other is standard recyclables (glass, plastic, cans). Using only two streams of recyclables reduces the need to separate all materials brought to the Transfer Station.



## Is there a limit to the amount of material I can recycle?

No. The Town encourages residents to recycle as much as they can. The more you recycle, the fewer bags you need to purchase and the more money you save. Consequently, the more residents recycle the less the Town of Sandwich pays to have their trash incinerated.

## What is recyclable in Sandwich?

Sandwich residents may recycle a lot more than many realize. Recycling facilities now accept more types of materials and can sort them more effectively.

## What types of material can be recycled?

- Newspaper and magazines with inserts
- Paperback books
- Office paper - staples, spirals, paper clips **do not** have to be removed.
- Colored paper
- Shredded paper in closed clear plastic or paper bags
- Junk mail, with windows
- Phone books
- Cereal boxes, paper towel tubes
- Pasta and cracker boxes
- Cardboard (unless it has food stains)
- Steel and tin cans
- Aluminum cans, pie plates, trays, foil
- Glass, containers
- All plastics marked #1-#7,



For further questions or information, please contact the Town of Sandwich DPW at 508-833-8002, or view the website at [Sandwichmass.org](http://Sandwichmass.org) – Public Works – Transfer Station – General Information



# SAVE MONEY & REDUCE TRASH

## NOW IS THE TIME FOR PAY-AS-YOU-THROW (PAYT) IN SANDWICH

Prepared by the Sandwich DPW with assistance from MassDEP



Printed on recycled paper



## What is Pay-As-You-Throw?

Pay-As-You-Throw (PAYT) is a system much like electricity, gas or telephone under which the user pays a basic amount that covers fixed costs and then a user fee for the amount used.

## How does PAYT work?

You buy blue, Town approved bags at stores where you usually shop. You put your trash in those bags and bring them to the Transfer Station to dispose of as you currently do with your trash.

## Why would PAYT be good for Sandwich?

It would be fairer. Right now, every household, regardless of size, pays the same fee. Under PAYT, people who generate less trash would pay less by using fewer bags. It would remind people to recycle more, lowering the amount of trash thrown away and reducing the Town's trash disposal costs.

## Why not continue to charge every household the same trash fee?

The present system is not fair. A lot of people, who are serious about recycling, are saying that they don't want to pay for the trash that other people throw away.

## Is PAYT easy and convenient?

Yes. Residents will be able to buy bags at local stores where they shop. It's just that the bags will be different. They will be blue with the town logo printed on them.

## What about large families?

If large families buy more than smaller families, they will have more to throw away and will have to buy more trash bags. The PAYT program will give them a chance and a new incentive to lower their costs by recycling everything they can. The present flat fee system doesn't offer any choice or incentive to recycle. In PAYT towns, residents have reduced their trash tonnage by 25%-40% by recycling more, composting more, donating more and buying more wisely.

## How will PAYT reduce Town Disposal Fees and User Costs?

Without PAYT, the annual cost of trash disposal per household will significantly increase. Currently, the solid waste budget is supplemented by the tax base. If you and most of the households in Sandwich actively recycle all you can, you will use less bags and the total cost of disposal will go down. We cannot control the cost of disposal per ton but, as a town, we can control the total tons that are sent to the incinerator, and that will lower our costs as a community.

## How does PAYT help the environment?

As residents recycle more, less trash would go to Semass/Covanta Energy for incineration. Incineration of plastics and other recyclable material, contributes to global warming by adding CO<sub>2</sub> to the atmosphere. By increasing recycling, we would save on raw materials, natural resources and energy consumption and reduce the amount of greenhouse gas.

## What will not change with the PAYT?

- Household Hazardous Waste Days
- Christmas Tree recycling
- Yard Waste Drop off
- Compost processing

## How much are PAYT bags and where can I buy them?

There are three sizes of bags available, a 30 gallon (barrel size) at a cost of \$1.20, a 15 gallon (kitchen size) at a cost of \$0.60 and 8 gallon (office size) at a cost of \$0.25 (all costs subject to change). Bags are available at the following locations in Sandwich. Additional retailers may be added at a later date.

- Anchor Ace Hardware (Cotuit Rd)
- Aubuchon Hardware (Cotuit Rd)
- Aubuchon Hardware (Merchants Square)
- Meetinghouse Liquors (Cotuit Rd)
- Merchant Square Liquors (Merchant Sq)
- Mobil - Forestdale (Rt 130)
- Rt 6A Convenience Store (E. Sandwich)
- Sandwich Car Wash (Rt 130)
- Sandwich Food Mart & Deli (corner of Rt 130 & Cotuit Rd)
- Sandwich Mart & Spirits (Rt 6A)
- Stop & Shop (Merchant Square)
- Stop & Shop (QMH Rd)
- Tedeschi Food Shops (Rt 6A)





# How to Recycle in Sandwich

MATERIAL	WHAT TO RECYCLE	HOW TO PREPARE	DO NOT INCLUDE
----------	-----------------	----------------	----------------

## METAL



- Steel/tin and metal food cans
- Aluminum pie plates and trays
- Deposit and non-deposit beverage cans

Deposit cans may also be donated at the Sandwich Little League shed  
Recycle **DO NOT INCLUDE** items in the light-iron pile

- Rinse clean
- Labels OK

- Aerosol cans
- Paint cans
- Coat hangers
- Cookware

## GLASS



- Clear and colored beverage containers
- Food and sauce jars
- Rinse clean
- Collar, neck rings & labels OK
- Caps & lids OK

Deposit bottles may also be donated at the Sandwich Little League shed

- Broken glass/auto glass
- Mirrors
- Ceramics: plates, cookware
- Drinking glasses
- Light bulbs
- Windows

## PLASTIC



- All number 1 thru 7 recyclable rigid plastic containers
- Milk, water, soda, juice bottles
- Shampoo, conditioner bottles
- Laundry, bleach, fabric softener bottles
- Waxy gable cartons: Milk and Juice

- Rinse clean, caps OK



- Plastic bags: recycled in waste receptacles located in front of each compactor
- Styrofoam packaging of ANY KIND
- Chemical and motor oil containers
- Water/Garden Hose

## CARDBOARD



- All cardboard must be recycled and will not be allowed in the trash-trailer except as noted in **DO NOT INCLUDE**

Complete list on back of brochure

- Break down, flatten or fold

- Contaminated boxes
- Food soiled and frozen food boxes example: pizza and Chinese take out

## PAPER



- Newspapers
- Magazines, catalogs
- Junk mail, envelopes: tearable
- Books
- Paper bags
- Phone books
- Office and computer paper
- Boxboard: cereal, cracker - remove plastic liners

Complete list on back of brochure

- Place in paper grocery bags

- Food soiled as noted above
- Paper towels
- Tissues
- Diapers
- Boxboard plastic liners: recycled in waste receptacles located in front of each recycling compactor.

Paper (Fiber) is recycled in first or second designated compactor from left to right. Commingled metal, glass and plastic is recycled in third or fourth designated compactors from left to right. Only one Fiber and one Commingled compactor is open at a time. Limited recycling and Transfer station stickers may be obtained at the Town Hall Annex, 145 Main Street, across from the Sandwich Library. If unsure where a specific item should be recycled, please ask an attendant.



# How to Recycle Fiber (Paper) in Sandwich

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## WHAT FIBER TO RECYCLE

Booklets  
Books: soft cover  
Boxes: for office supplies, like paper clips  
Boxes: cereal, cracker, pasta, shoe, etc  
Boxes: with plastic window  
Brochures: including glossy  
Calendars: wall type  
Cardboard: corrugated and paperboard  
Catalogs  
Clasp envelopes  
Colored paper  
Construction and kraft paper  
Cover and card stock, index cards  
Envelopes: with plastic windows or labels  
File folders  
Flyers  
Glossy paper  
Greeting cards  
Lottery tickets  
Mail  
Magazines  
Mat board: used in picture framing  
Math paper: graph and ledger, etc.  
Newspapers: with or without inserts  
Newsprint  
Office and copy paper  
Packing paper  
Paper: lined and white  
Paper: fax  
Paper bags: brown and white  
Paper bags: with handles  
Paper towel and toilet paper tubes  
Phone books  
Photocopies  
Post-it notes  
Receipts  
Shredded paper: in paper bags  
Spiral notebooks  
Writing tablets

## DO NOT INCLUDE

Candy wrappers  
Carbon paper  
Disposable diapers  
Envelopes with bubble wrap  
Food-soiled paper and cardboard  
Label backings  
Paper cups or plates  
Paper towels, napkins, tissues  
Photographs  
Take-out food containers: Chinese, etc.  
Tyvek® mailing envelopes  
Waxed paper and cardboard  
Waxy gable cartons: Milk and Orange Juice

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Metal spiral notebooks, paper clips, plastic envelope windows, self-stick labels and staples are allowed to be recycled with the items listed above

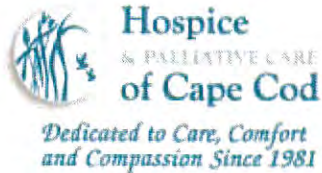
Items containing personal information should be shredded and recycled in paper bags

# REDUCE, REUSE & RECYCLE



## TOWN OF SANDWICH DEPARTMENT OF PUBLIC WORKS

In an effort to encourage the 3 R's (Reduce, Reuse and Recycle) and minimize solid waste, below is a list of web sites from organizations providing opportunities for residents to donate and/or find free, usable items. Some charities will pick up items at homes and certain donations may be tax deductible.





## **DRAFT STORMWATER BEST MANAGEMENT PRACTICES**

**APRIL 2017**

Stormwater management is an important aspect of site development and construction in all areas of Town. As noted in the Town's Stormwater Management Plan (SMP) and Local Comprehensive Plan (LCP), Stormwater Best Management Practices (BMPs), when properly designed and implemented, can protect water quality, reduce the risk of flooding, minimize the expense of conventional infrastructure, and become part of an attractive landscape. All stormwater management facilities should be designed in accordance with applicable regulations and engineering standards, including the Town's Protective Zoning Bylaw and Subdivision Rules and Regulations. These require that stormwater be managed with naturally vegetated low areas on the site that are designated for drainage and protected from future development. This approach is one element of Low-Impact Design, which can be highly effective, and is recommended for incorporation with all site development. The LCP states:

### *Low-Impact Design Applications*

*The low-impact development, or LID, site design approach is a precise arrangement of natural and engineered technologies. The devices, or Integrated Management Practices (IMPs), function as a comprehensive system across the site to achieve the goals of:*

- *Peak flow control;*
- *Volume reduction;*
- *Water quality improvement (filter and treat pollutants); and*
- *Water conservation.*

*Future development in Sandwich should use LID principles, which can be generally described as incorporating a series of techniques in the conceptual site plans with decentralized stormwater management to reduce the environmental footprint of new development.*

Specific measures identified in the LCP include:

***Site Design and Layout** - LID applications used in Sandwich should integrate hydrology and stormwater management into site design using existing conditions to influence the location and layout of roadways, buildings, and parking areas. Buildings and roadways are placed in areas less sensitive to disturbance, and the stormwater management system design creates a symbiotic relationship between the development and natural hydrology.*

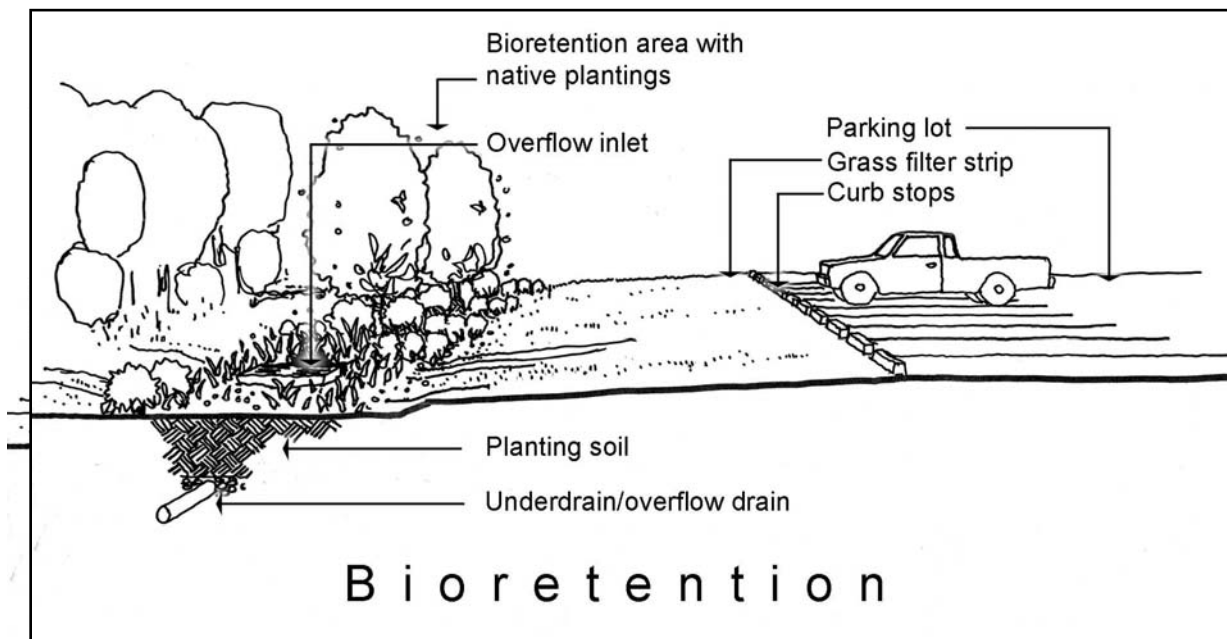




**Decentralized Stormwater Treatment System** - The goal for Sandwich is to reduce impervious surface areas that drain directly into conventional pipe-and-pond stormwater systems. Creating small drainage basins and more natural treatment systems such as swales, bioretention areas, infiltration structures, and filter strips should include LID stormwater treatment design.

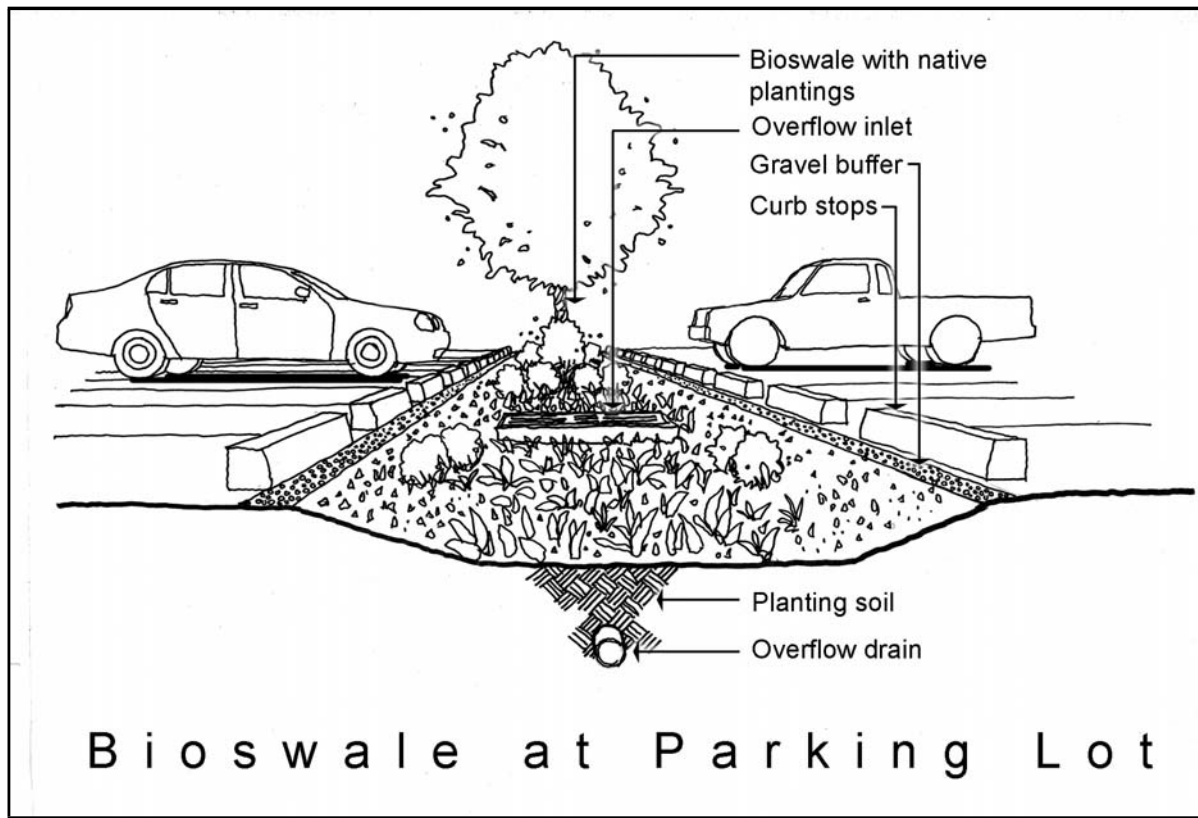
**Filter Strips** – Filter strips are bands of densely vegetated slopes, designed to reduce water runoff volume and improve water quality prior to entering stormwater drainage basins.

**Bioretention Cells (Rain Gardens)** – Rain gardens, also known as bioretention cells, are vegetated depressions that store and infiltrate runoff. Rain gardens are designed to encourage vegetative uptake of stormwater to reduce runoff volume and pollutant concentrations.

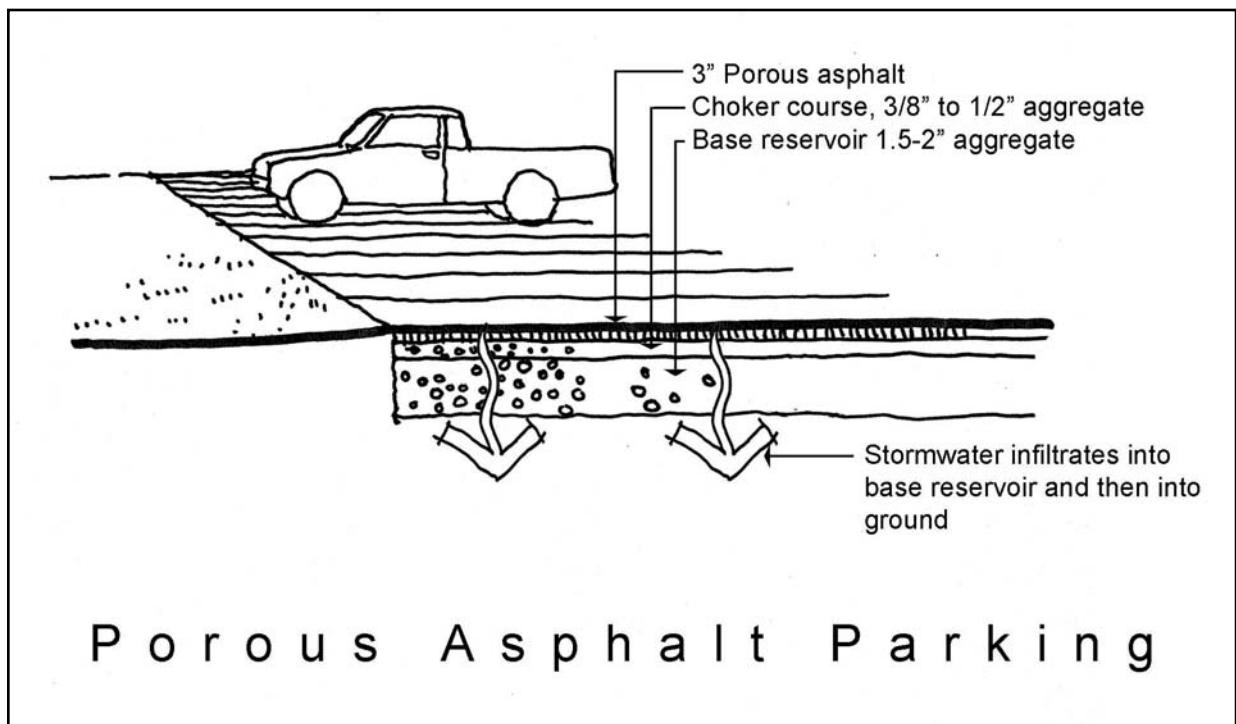


**Vegetated Swales (Bioswales)** – Vegetated swales are broad, shallow channels designed to convey and infiltrate stormwater runoff. The design of swales in Sandwich should seek to reduce

stormwater volume through infiltration, improve water quality through infiltration and vegetative filtering, and reduce runoff velocity by increasing flow path lengths and channel roughness.



**Infiltration** – Infiltration includes designs that enhance water percolation through a media matrix that slows and partially holds stormwater runoff. Infiltration practices also promote groundwater recharge and facilitate pollutant removal.



***Subsurface Retention Facilities (Stormwater Vaults)*** – Subsurface retention facilities are typically constructed below parking lots (either permeable or impervious) and can be built to any depth to retain, filter, infiltrate, and alter the runoff volume and timing. This practice is well suited to dense urban areas or areas with constraints of open space uses such as in Sandwich Activity Centers.

***Pocket Wetlands*** – Pocket wetlands are constructed wetland systems designed to control stormwater volume and facilitate pollutant removal. Pocket wetlands generally have less biodiversity than natural wetlands, but still require a base flow through the wetland to support the aquatic vegetation present. Pollutant removal in these systems occurs through the settling of larger solids and coarse organic material and also by uptake in the aquatic vegetation.

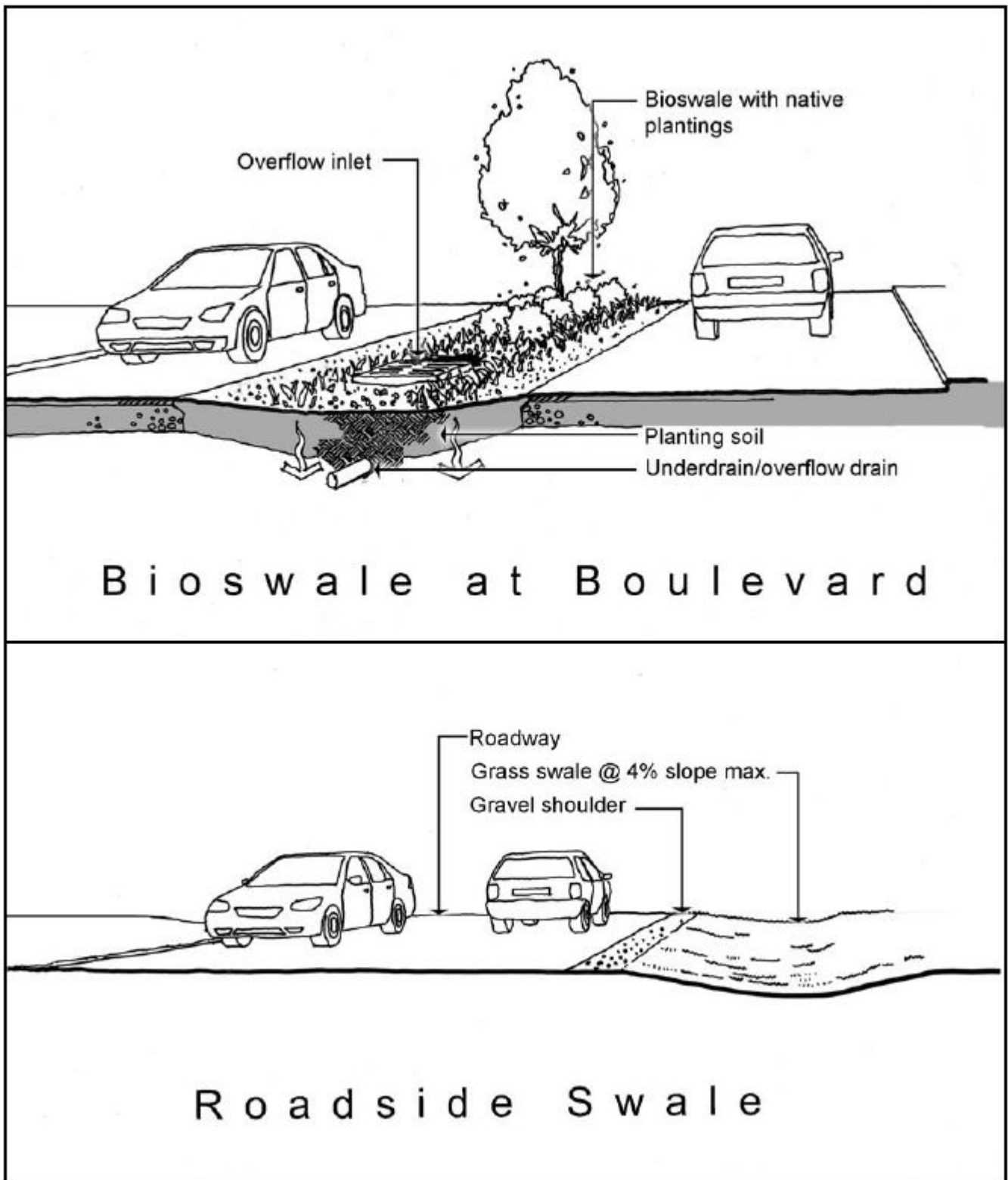
***Roadway Design*** - Basic strategies for low-impact roadway design in Sandwich should include narrow road widths, shared driveways, and open-section roadways. Parking lot design includes breaking up large paved areas into smaller lots, maximizing shared parking, providing adequate parking (based on actual demand rather than general standards), and using permeable paving where appropriate. The design objectives for roadways and parking lots are to:

- Reduce total impervious surfaces;
- Reduce road and parking construction and long-term maintenance costs;
- Provide safe access and adequate parking;
- Minimize disturbance to natural site hydrology;
- Create opportunities for stormwater treatment and infiltration; and
- Improve site appearance.



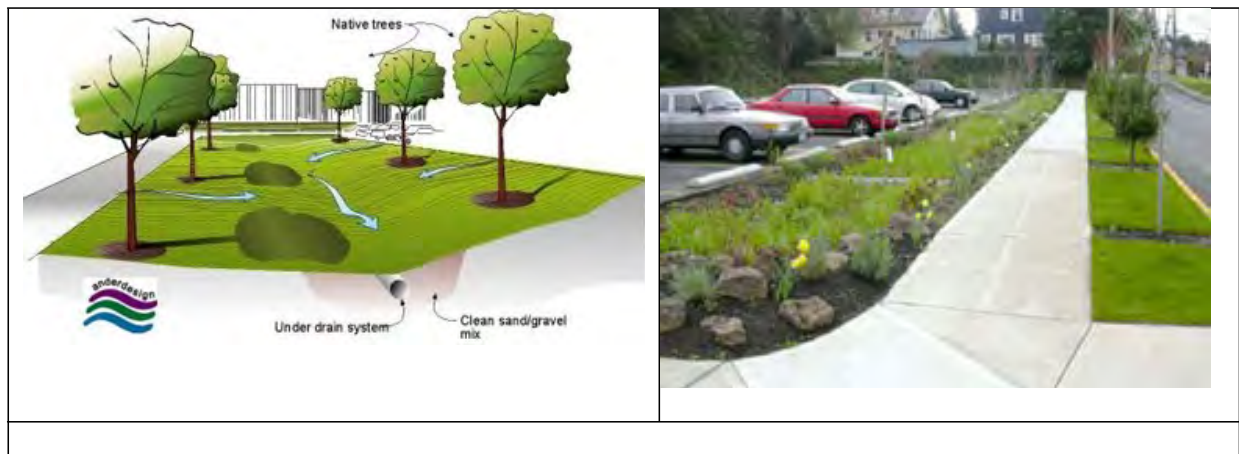
*Example Open-Section Road For LID Development in NH*

Low-impact roadways use a narrower, more traditional design that enhances site character and produces less runoff, which is directed to roadside swales for treatment and conveyance. This technique helps to filter roadway runoff, promote infiltration, and reduce runoff velocity, resulting in lower peak discharge rates. If properly designed, open section roadways will be no more prone to flooding than conventional roadway profiles.



**Turnarounds and Cul-De-Sacs** - Cul-de-sacs should be designed to reduce runoff and improve character, while still providing sufficient room for emergency vehicles and delivery trucks to maneuver. One treatment for the circles is landscaped islands built as bioretention areas with proper grading to catch and treat roadway runoff.

***Parking Lot Design*** - Expansive parking lots that drain to catch basins create large volumes and high velocities that require pipe-and-pond stormwater infrastructure. LID parking design should be incorporated into new developments in Sandwich to create multiple parking areas at different elevations that can reduce the amount of grading necessary to preserve natural hydrology.



*Example Bioswale Treatment in Parking Lots*

***Natural Landscaping and Xeriscaping*** - Natural resource preservation and Xeriscaping™ can be used to minimize the need for irrigation systems and enhance property values. Preserving existing wooded areas, mature trees, and natural terrain can give new developments a premium "mature landscape" appearance and provide residents with additional recreational amenities. Both of these features can improve marketability. Xeriscaping refers to landscaping with plants native to area climate and soil conditions. These plants thrive naturally, requiring less maintenance and irrigation than most hybrid or imported varieties.

Additional information may be found at the following:

[Town of Sandwich Local Comprehensive Plan](http://www.sandwichmass.org/Documents.asp?iFrame=Sandwich LCP May 2009.pdf&ID=159&DID=109)

<http://www.sandwichmass.org/Documents.asp?iFrame=Sandwich LCP May 2009.pdf&ID=159&DID=109>

[Massachusetts Stormwater Handbook](http://www.mass.gov/eea/agencies/massdep/water/regulations/massachusetts-stormwater-handbook.html)

<http://www.mass.gov/eea/agencies/massdep/water/regulations/massachusetts-stormwater-handbook.html>

[Low Impact Development Center](https://lowimpactdevelopment.org/)

<https://lowimpactdevelopment.org/>

[UNH Stormwater Center](https://www.unh.edu/unhsc/)

<https://www.unh.edu/unhsc/>

[Town of Sandwich Zoning Bylaw and Subdivision Rules & Regulations](http://www.sandwichmass.org/Documents.asp?ID=113&DID=7)

<http://www.sandwichmass.org/Documents.asp?ID=113&DID=7>





## **DRAFT EROSION CONTROL GUIDELINES**

**APRIL 2017**

Property owners and their construction contractors are responsible for managing stormwater and preventing offsite discharge of sediment and other stormwater-borne pollution. Besides being a nuisance, sediment and other pollution can permanently damage drainage systems and impair receiving waters and other sensitive features. Property owners and their contractors can minimize erosion and sedimentation by properly implementing appropriate Best Management Practices (BMPs). Sample BMPs and links to resources for additional information are included below.

A properly implemented erosion control program will:

- Minimize exposed soil areas through maintaining existing vegetation, site control, construction sequencing, temporary seeding, and other management measures;
- Protect downslope resources;
- Provide and maintain barriers and devices to manage stormwater runoff and erosion; and
- Establish a permanent vegetative cover or other stabilization as soon as possible.

Prior to construction:

- Review and adhere to all applicable permit requirements;
- Install appropriate BMPs, such as a stone construction entrance, sediment barriers, etc.
- Protect all vulnerable features downslope of the proposed work with appropriate BMPs.

During construction:

- Limit construction vehicle access to approved driveways only.
- Replenish crushed stone driveway aprons as needed to prevent sediment tracking.
- Do not exceed slopes of 2H to 1V.
- Restrict disturbances to the approved limits of work.
- Apply erosion control blankets, mulch, or bonded fiber matrix to exposed soils that will not be permanently stabilized within 30 days. Mulch should be hydraulically applied and anchored with netting or approved tacking agent.
- Inspect all BMPs at least once per day during rain events and at least once per week during dry weather. Repair deficiencies immediately.
- Promptly remove any soil, debris, or other material that has washed onto adjacent properties. Restore affected areas immediately.

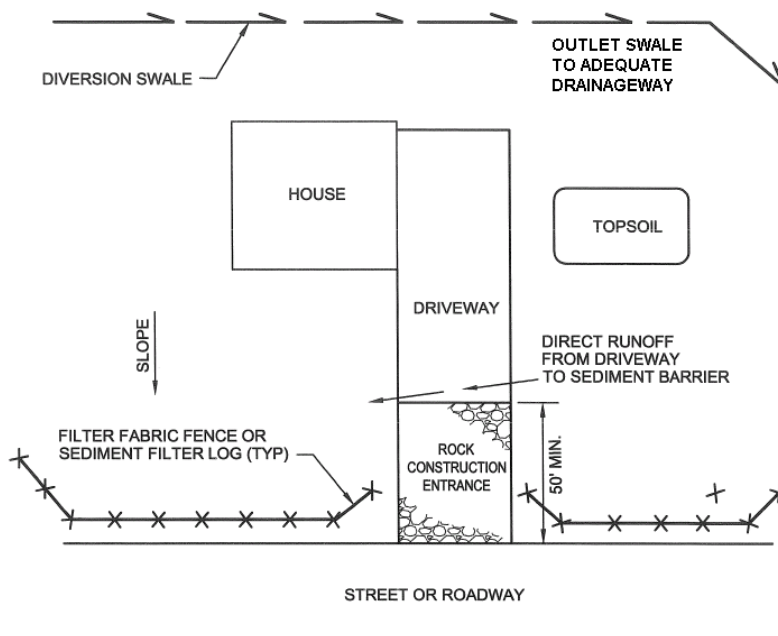
At the close of construction:

- Stabilize disturbed areas with grass and 6-inches of topsoil or other approved method. Foundation plantings and mulch may be established in areas retained by walls with slopes less than 3H to 1V.
- Apply soil stabilization fabric/ erosion control blankets to disturbed areas sloped more than 3H to 1V and as needed.
- Pipe roof drains to drywells.
- Grade final driveway aprons to maintain the gutter line of the adjacent street and pave in accordance with the Town's driveway regulations. Provide berms or curbing along sides of driveways as needed.
- Remove and properly dispose of all silt fence, hay/straw bales, and other BMPs after vegetation is established and the site is stabilized.

Sample BMPs:

### Site Configuration

#### Typical On-lot BMPs for Lot Above Roadway

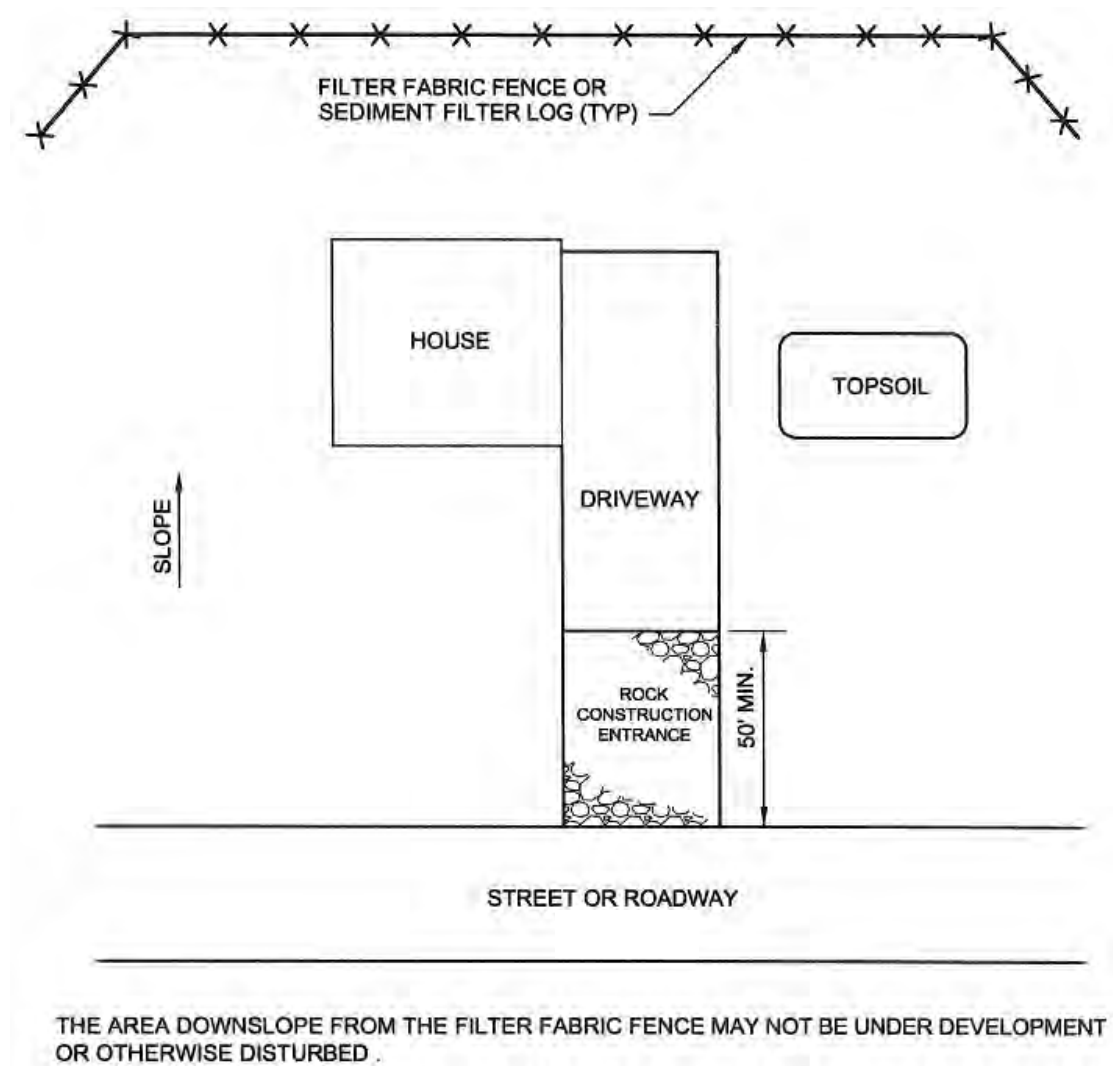


THE UPSLOPE DIVERSION CHANNEL SHOULD BE INSTALLED WHEREVER THE LOT EXTENDS MORE THAN 150 FEET ABOVE THE ROADWAY OR WHERE RUNOFF FROM AREAS ABOVE THE LOT IS NOT OTHERWISE DIVERTED AWAY FROM THE LOT. THE CHANNEL SHOULD BE PROPERLY SIZED AND PROVIDED WITH A SUITABLE PROTECTIVE LINING. THE DESIGNER MUST EXERCISE CAUTION TO PROTECT ALL DOWNSTREAM PROPERTY OWNERS WHEN SELECTING THE DISCHARGE POINT FOR THIS CHANNEL.

Source: PA DEP Erosion and Sediment Control Program Manual

NTS

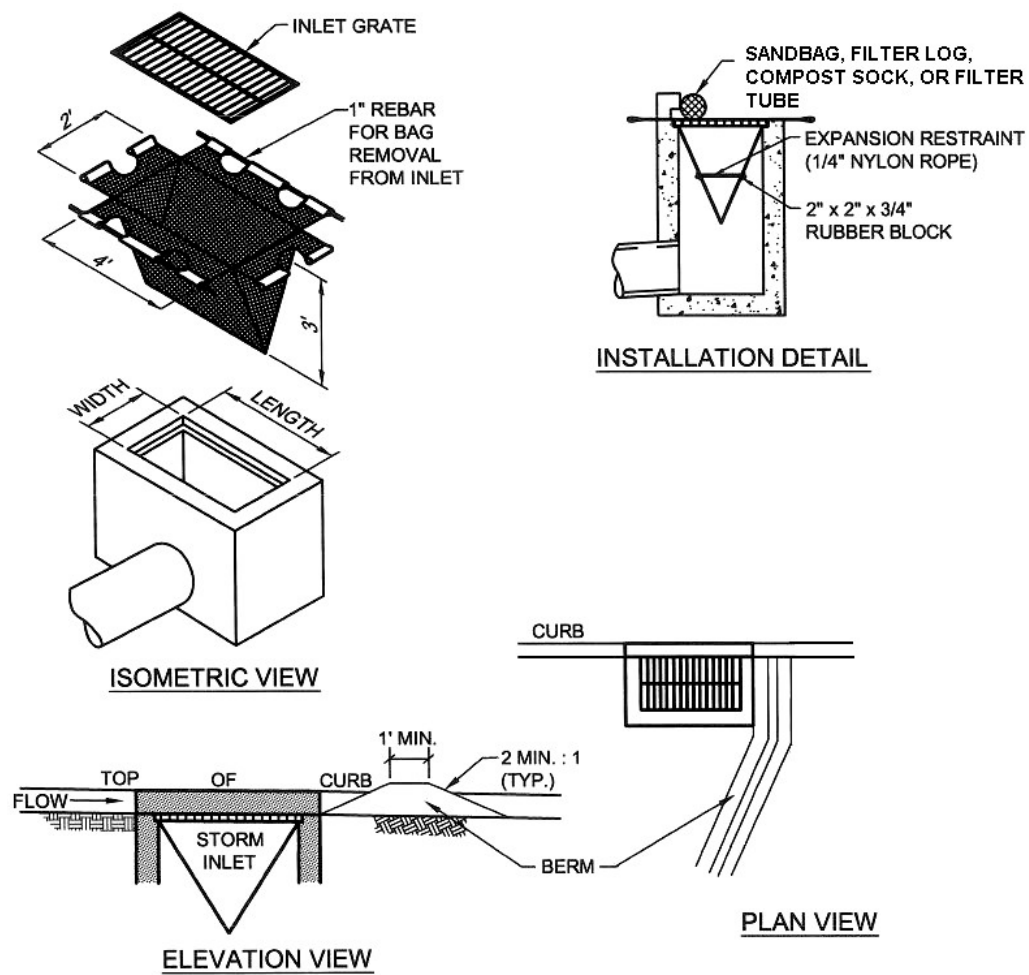
# Typical On-lot BMPs for Lot Below Roadway



PA DEP Erosion and Sediment Control Program Manual

NTS

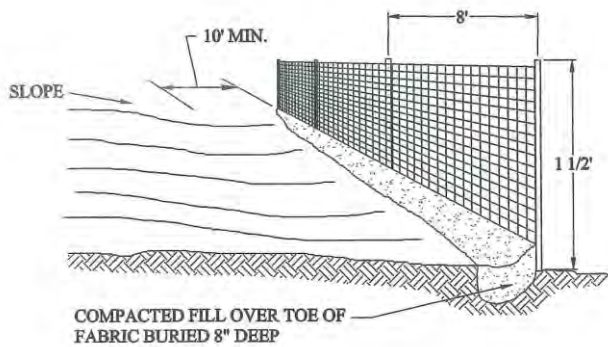
## Catch Basin Protection



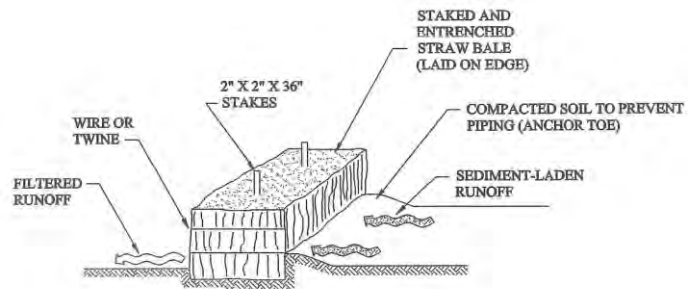
Source: PA DEP Erosion and Sediment Control Program Manual

NTS

## Sediment Barriers

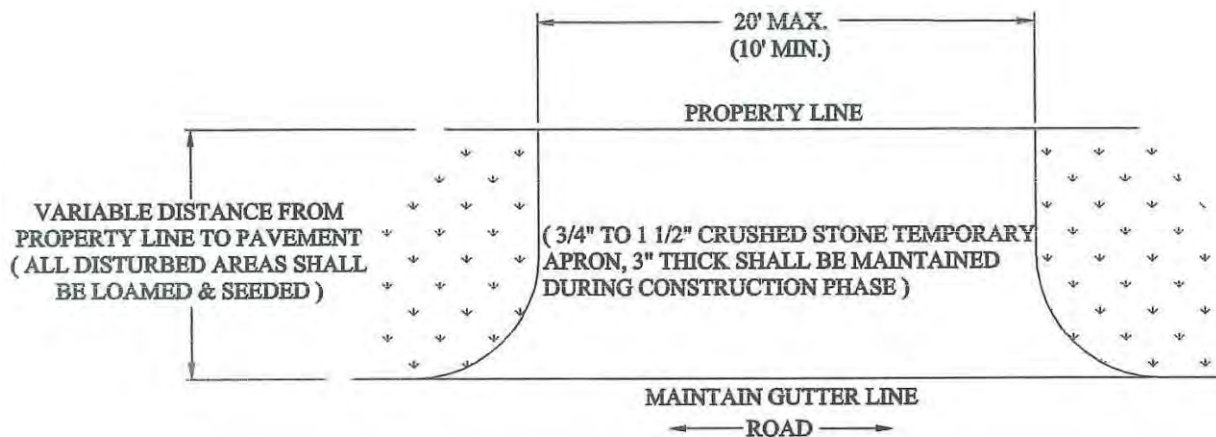


**SILT/SEDIMENT FENCE  
INSTALLATION**

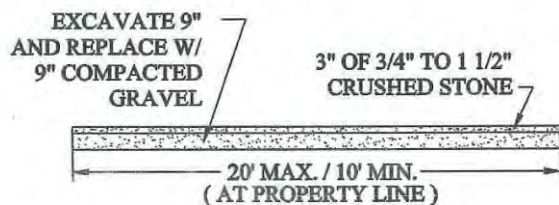


**HAYBALE INSTALLATION  
CROSS SECTION**

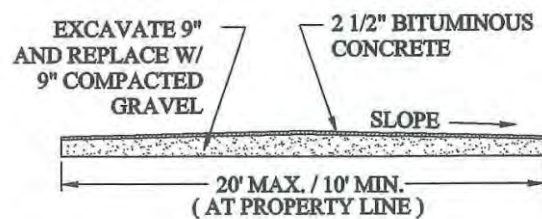
## Small-Scale Site Development Driveway Apron Plan



**DRIVEWAY APRON  
PLAN VIEW**

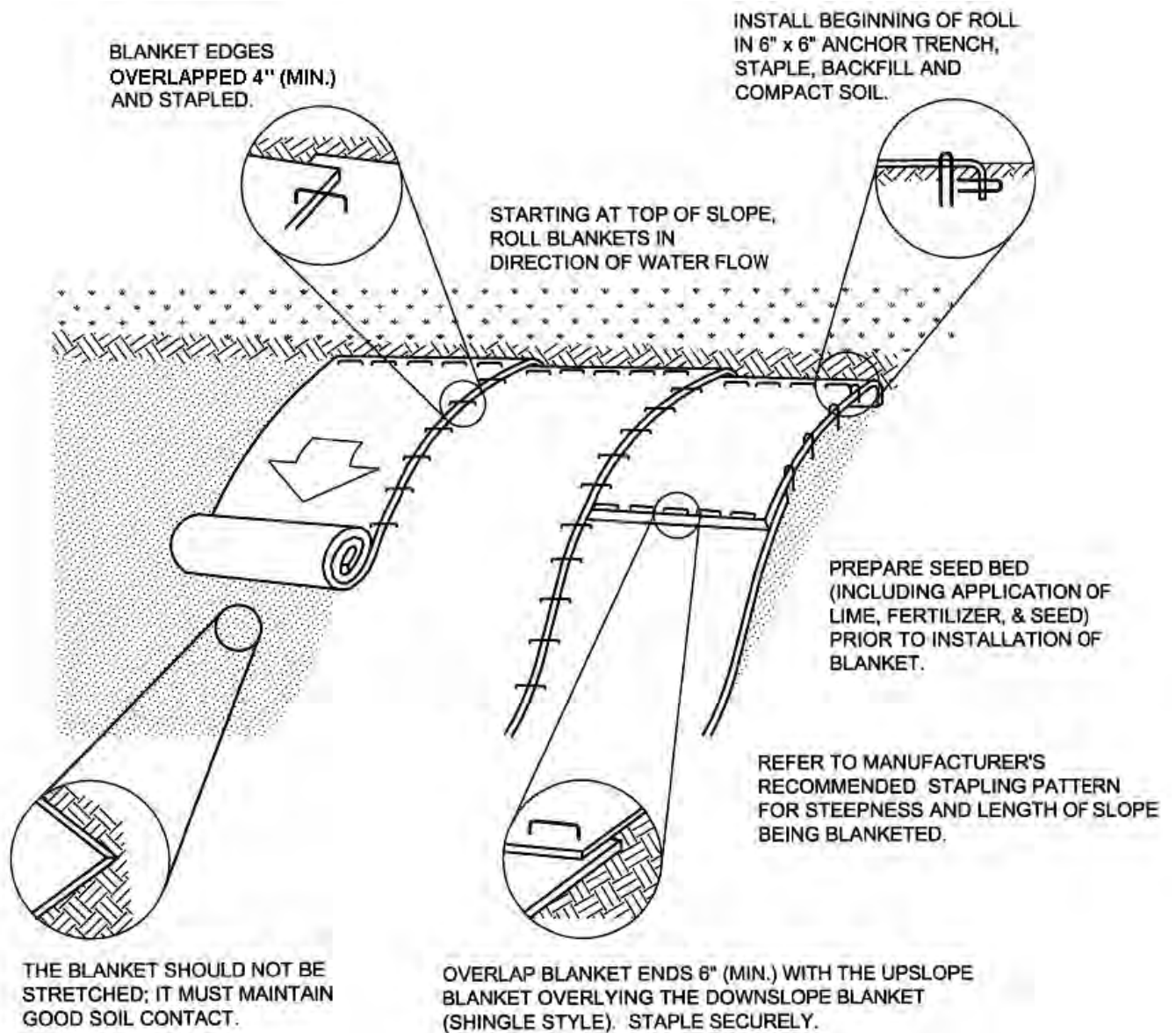


**TEMPORARY  
DRIVEWAY APRON  
CROSS - SECTION**



**COMPLETED  
DRIVEWAY APRON  
CROSS - SECTION**

## Erosion Control Blanket



Source: PA DEP Erosion and Sediment Pollution Control Program Manual

Excerpt from MassDOT Erosion and Sediment Control Field Guide:

## Erosion and Sediment Control Practice Matrix

The following chart is designed to help select erosion and sediment control practices that may be appropriate for the site. It is often advantageous to use several practices, including retaining existing vegetation, as a combined treatment approach for addressing erosion and sedimentation issues at the site.

Vegetative cover is the best and often the most cost-effective practice for controlling site erosion!

Practice	Prevention	Runoff Control	Erosion Control	Sediment Control	Good Housekeeping	Page
Site Layout, Project Staging and Phasing	X					7
Vegetation Preservation/Buffers	X					7
Ditch Checks (Temporary)		X				9
Stone Check Dams		X				11
Level Spreaders		X				13
Diversions (Temp. & Perm.)		X				15
Temporary Slope Drains		X				17
Mulch			X			19
Surface Roughening			X			22
Slope Breaks			X			23
Erosion Control Blankets, Nets, Turf Reinforcement Mats			X			26
Seeding and Sod			X			30
Silt Fence				X		33
Straw Bales				X		35
Compost Socks & Berms				X		36
Wattles and Fiber Rolls				X		39
Temporary Sediment Traps				X		42
Temporary Sediment Basins				X		44
Inlet Protection				X		46
Outlet Protection & Stabilization				X		49
Floating Silt Barriers				X		51
Stabilized Ingress & Egress					X	53
Tire Washes					X	53
Construction Road Stabilization					X	55
Swamp Mats/Timber Mats					X	57
Stockpile Management					X	59
Dewatering					X	61
Concrete Washout Areas					X	63
Dust Control					X	64
Construction Waste Material Management					X	66
Street Sweeping					X	67

Additional information for BMPs and managing sites may be found at the following:

MassDEP - Erosion & Sedimentation Guidelines

<http://www.mass.gov/eea/docs/dep/water/esfull.pdf>

MassDOT Erosion and Sediment Control Field Guide

<http://www.massdot.state.ma.us/Portals/8/docs/FieldOperations/ErosionSedimentFieldGuide2013.pdf>

PA DEP Erosion and Sediment Pollution Control Program Manual

<http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-88925/363-2134-008.pdf>

EPA - Stormwater Menu of BMPs

<http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm>



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<b>TO:</b>	Ed Leonard, PE	<b>DATE:</b>	3/1/2017
<b>FROM:</b>	Steve Guerrette, PE	<b>PROJECT NO.:</b>	12217A
	Brian Montejunas, PE		
<b>SUBJECT:</b>	Sandwich, MA – CWRMP - Stormwater BMPs		

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The purpose of this memorandum is to summarize a planning level stormwater BMP assessment conducted for the treatment of stormwater runoff from Town roadways and facilities adjacent to six ponds throughout Sandwich, MA including Snake Pond, Peters Pond, Pimilico Pond, Hoxie Pond, and Upper and Lower Shawme Ponds. A map showing the location of each pond with the Town is included as Figure 1 in Appendix A. This analysis was conducted as part of the Comprehensive Water Resources Management Plan (CWRMP).

Town staff identified several potential locations where the construction of stormwater BMPs could occur within the existing roadway shoulders, adjacent town property, and/or drainage easements. The individual sites were reviewed and required water quality volumes were determined for each site by delineating the estimated town-owned impervious surface area that is tributary to each site. The delineations are based on available aerial imagery and 2-foot topographic data developed from LiDAR data obtained from Stantec, 2011. Plan views showing these delineations with each BMP location were prepared to illustrate the segments of roadway that could potentially be treated.

For the purpose of this analysis, it was assumed that the minimum water quality volume (WQV) that each BMP needs to capture and treat was equal to the first 0.5 inch of runoff from impervious areas, based on Stormwater Standard No. 4, Water Quality. It was also assumed that Stormwater Standard No. 3, sizing for groundwater recharge applications, Stormwater Standard No. 5, land uses with higher potential pollutant loads, and Stormwater Standard No. 6, discharges to critical areas, were not applicable. It is important to note that while many of the stormwater BMPs may be designed to infiltrate to groundwater, the WQVs would still be driven by Stormwater Standard No. 4. This is because the BMPs are being constructed to treat existing roadways and impervious surfaces and not in areas with new or proposed pavement or impervious surface.

Planning-level cost estimates were developed for each BMP and are presented in Table 1. Backup for the cost estimates is contained in Appendix B. The cost estimates have been developed using typical bid items received on other Wright-Pierce projects that are similar in nature to the proposed stormwater BMPs proposed for the Town of Sandwich. The costs are presented using unit pricing that has been adjusted for February 2017 (ENR CCI 10280). The cost for the implementation of the stormwater BMPs include installation of the recommended BMP alternative and do not include costs associated with the excavation and installation of infrastructure necessary to direct runoff into the proposed BMPs or to connect the BMPs back into existing or proposed storm drainage. A contingency of 25% is carried as well as a separate allowance of 20% for engineering design, construction administration, and construction inspection services.

The proposed BMPs are bioretention systems and water quality swales. More detailed information for each BMP option is provided in Appendix C. An estimated annual pollutant removal rate in pounds per year was calculated for each BMP. Removal rates were based on the estimated pollutant removal efficiencies provided in the Massachusetts Stormwater Handbook. The calculations to estimate total annual loading generated by the watershed were based on the Simple Method described on <http://stormwatercenter.net> provided by the Center for Watershed Protection. The values for pollutant concentrations were default values listed on the same website for roadway land use and represent best professional judgement.

### **Snake Pond**

Three bioretention systems are proposed for treatment of runoff from Snake Pond Road along the southern boundary of Snake Pond. The proposed locations are shown on Figure 2 in Appendix A. BMP-1 would treat runoff from approximately 0.75 acres of impervious roadway surface, resulting in a required WQV of approximately 1,360 ft<sup>3</sup>. BMP-2 would treat runoff from approximately 0.20 acres of impervious roadway surface, resulting in a required WQV of approximately 357 ft<sup>3</sup>. BMP-3 would treat runoff from approximately 0.51 acres of impervious or compacted gravel surfaces, resulting in a required WQV of approximately 923 ft<sup>3</sup>.

### **Peters Pond**

Six bioretention systems are proposed for treatment of runoff from the Town's Oak Crest Cove facility on the northern boundary of Peters Pond. The proposed locations are shown on Figure 3 in Appendix A. BMP-4 would treat runoff from approximately 0.08 acres of impervious surface, resulting in a required WQV of approximately 138 ft<sup>3</sup>. BMP-5 would treat runoff from approximately 0.31 acres of impervious surface, resulting in a required WQV of approximately 556 ft<sup>3</sup>. BMP-6 would treat runoff from approximately 0.38 acres of impervious surface, resulting in a required WQV of approximately 682 ft<sup>3</sup>. BMP-7 would treat runoff from approximately 0.30 acres of impervious surface, resulting in a required WQV of approximately 550 ft<sup>3</sup>. BMP-8 would treat runoff from approximately 0.22 acres of impervious surface, resulting in a required WQV of approximately 391 ft<sup>3</sup>. BMP-9 would treat runoff from approximately 0.08 acres of impervious surface, resulting in a required WQV of approximately 138 ft<sup>3</sup>.

### **Pimlico Pond**

The treatment method proposed for runoff at Pimlico Pond is a single water quality swale along Pimlico Pond Road, located adjacent to the northern shore of the pond. The proposed location of BMP-10 is shown on Figure 4 in Appendix A. BMP-10 would treat runoff from approximately 0.38 acres of impervious roadway surface, resulting in a required WQV of approximately 684 ft<sup>3</sup>.

### **Hoxie Pond**

The treatment method proposed for runoff at Pimlico Pond is a single water quality swale along Old County Road, located adjacent to the southwestern shoreline of the pond. The proposed location of BMP-11 is shown on Figure 5 in Appendix A. BMP-11 would treat runoff from approximately 0.20 acres of impervious roadway surface, resulting in a required WQV of approximately 363 ft<sup>3</sup>.

### **Upper Shawme Pond**

Five bioretention systems are proposed for treatment of runoff from Shawme Road and Shaker House Road along the eastern and southern shoreline of Upper Shawme Pond. The proposed locations are shown on Figure 6 in Appendix A. BMP-12 would treat runoff from approximately

0.36 acres of impervious roadway surface, resulting in a required WQV of approximately 650 ft<sup>3</sup>. BMP-13 would treat runoff from approximately 0.30 acres of impervious roadway surface, resulting in a required WQV of approximately 552 ft<sup>3</sup>. BMP-14 would treat runoff from approximately 0.44 acres of impervious roadway surface, resulting in a required WQV of approximately 798 ft<sup>3</sup>. BMP-15 would treat runoff from approximately 0.33 acres of impervious roadway surface, resulting in a required WQV of approximately 607 ft<sup>3</sup>. BMP-16 would treat runoff from approximately 0.28 acres of impervious roadway surface, resulting in a required WQV of approximately 509 ft<sup>3</sup>.

### **Lower Shawme Pond**

Six bioretention systems are proposed for treatment of runoff from Grove Street, Jonathan Lane, and Water Street along the northern shoreline of Lower Shawme Pond. The proposed locations are shown on Figure 7 in Appendix A. BMP-17 would treat runoff from approximately 0.56 acres of impervious roadway surface, resulting in a required WQV of approximately 1,014 ft<sup>3</sup>. BMP-18 would treat runoff from approximately 0.24 acres of impervious roadway surface, resulting in a required WQV of approximately 437 ft<sup>3</sup>. BMP-19 would treat runoff from approximately 0.14 acres of impervious roadway surface, resulting in a required WQV of approximately 255 ft<sup>3</sup>. BMP-20 would treat runoff from approximately 0.27 acres of impervious roadway surface, resulting in a required WQV of approximately 493 ft<sup>3</sup>. BMP-21 would treat runoff from approximately 0.20 acres of impervious roadway surface, resulting in a required WQV of approximately 360 ft<sup>3</sup>. BMP-22 would treat runoff from approximately 0.15 acres of impervious roadway surface, resulting in a required WQV of approximately 276 ft<sup>3</sup>.

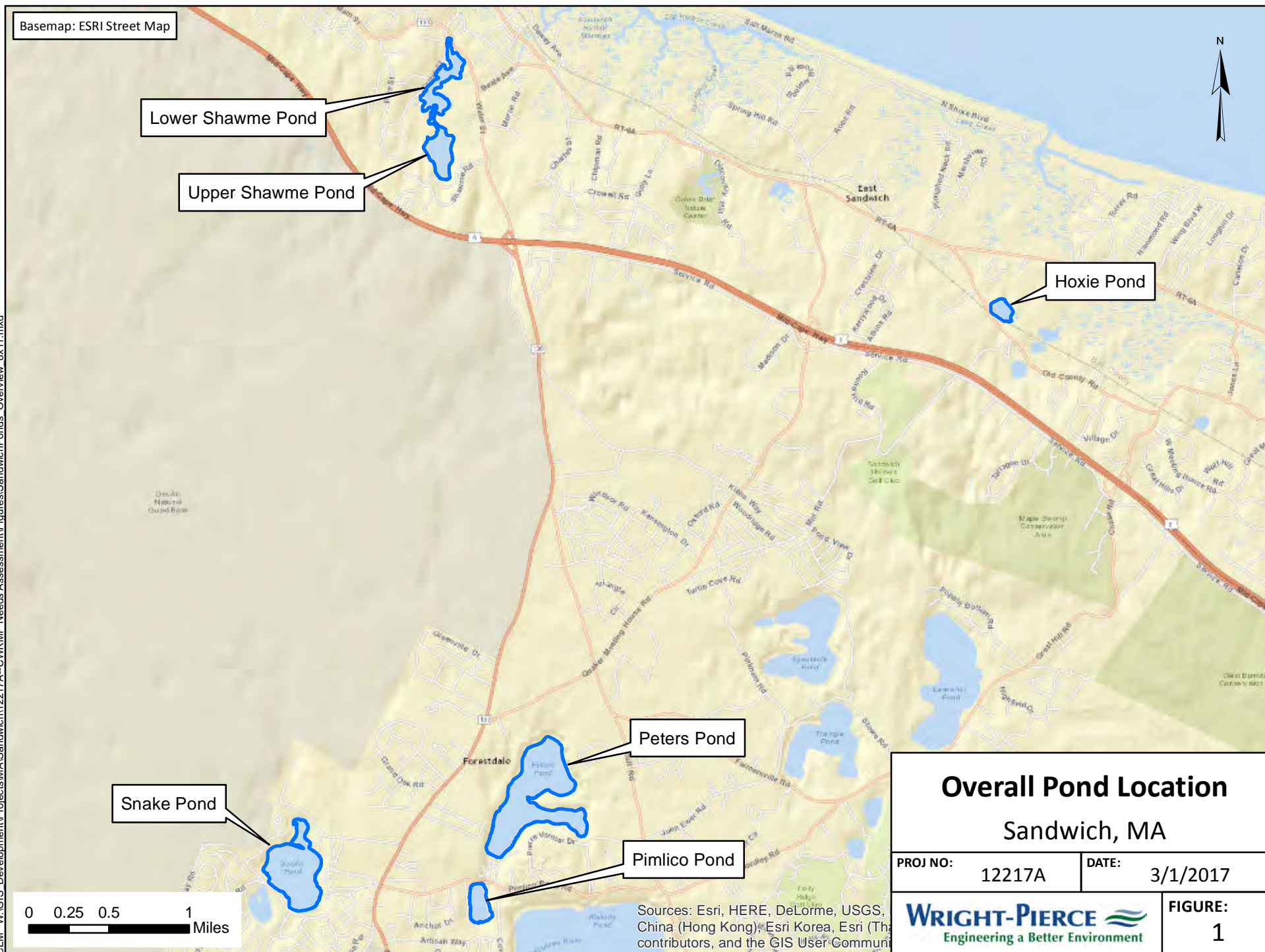
Table 1 summarizes the results of the assessment for each stormwater BMP. The total budget costs for the 22 BMPs is \$1.05M (ENR CCI 10280).

**TABLE 1**  
**STORMWATER BMP SUMMARY**

BMP ID	Waterbody	BMP Type	Tributary Area (Ac)	WQV (ft3)	Budget Cost	Estimated Annual Pollutant Removal Rate (lbs/year)		
						TSS	TN	TP
BMP-1	Snake Pond	Bioretention System	0.75	1360	\$120,000	811	7.2	1.8
BMP-2	Snake Pond	Bioretention System	0.20	357	\$32,000	216	1.9	0.5
BMP-3	Snake Pond	Bioretention System	0.51	923	\$82,000	552	4.9	1.2
BMP-4	Peters Pond	Bioretention System	0.08	138	\$13,000	87	0.8	0.2
BMP-5	Peters Pond	Bioretention System	0.31	556	\$50,000	335	3.0	0.7
BMP-6	Peters Pond	Bioretention System	0.38	682	\$61,000	411	3.7	0.9
BMP-7	Peters Pond	Bioretention System	0.30	550	\$49,000	325	2.9	0.7
BMP-8	Peters Pond	Bioretention System	0.22	391	\$35,000	238	2.1	0.5
BMP-9	Peters Pond	Bioretention System	0.08	138	\$13,000	87	0.8	0.2
BMP-10	Pimlico Pond	Water Quality Swale	0.38	684	\$30,000	320	3.7	0.9
BMP-11	Hoxie Pond	Water Quality Swale	0.20	363	\$19,000	168	1.9	0.5
BMP-12	Upper Shawme Pond	Bioretention System	0.36	650	\$58,000	389	3.5	0.9
BMP-13	Upper Shawme Pond	Bioretention System	0.30	552	\$49,000	325	2.9	0.7
BMP-14	Upper Shawme Pond	Bioretention System	0.44	798	\$70,000	476	4.2	1.1
BMP-15	Upper Shawme Pond	Bioretention System	0.33	607	\$54,000	357	3.2	0.8
BMP-16	Upper Shawme Pond	Bioretention System	0.28	509	\$45,000	303	2.7	0.7
BMP-17	Lower Shawme Pond	Bioretention System	0.56	1014	\$89,000	606	5.4	1.3
BMP-18	Lower Shawme Pond	Bioretention System	0.24	437	\$39,000	260	2.3	0.6
BMP-19	Lower Shawme Pond	Bioretention System	0.14	255	\$22,000	151	1.3	0.3
BMP-20	Lower Shawme Pond	Bioretention System	0.27	493	\$44,000	292	2.6	0.6
BMP-21	Lower Shawme Pond	Bioretention System	0.20	360	\$32,000	216	1.9	0.5
BMP-22	Lower Shawme Pond	Bioretention System	0.15	276	\$25,000	162	1.4	0.4

Costs are presented in current dollars at ENR CCI 10280.

## APPENDIX A Figures



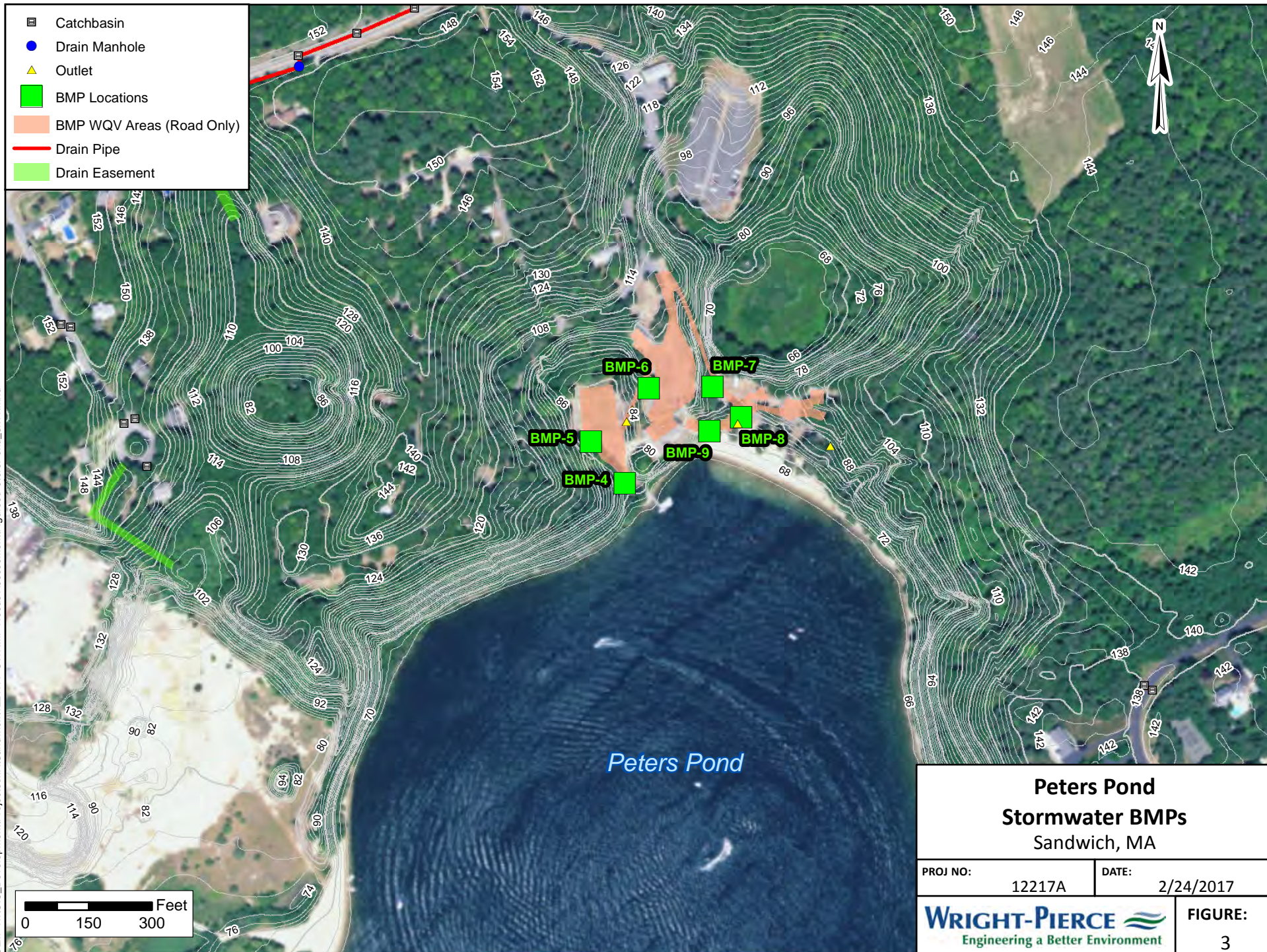


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**Peters Pond  
Stormwater BMPs  
Sandwich, MA**

PROJ NO:	12217A	DATE:	2/24/2017
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**WRIGHT-PIERCE**   
Engineering a Better Environment

**FIGURE:**  
3



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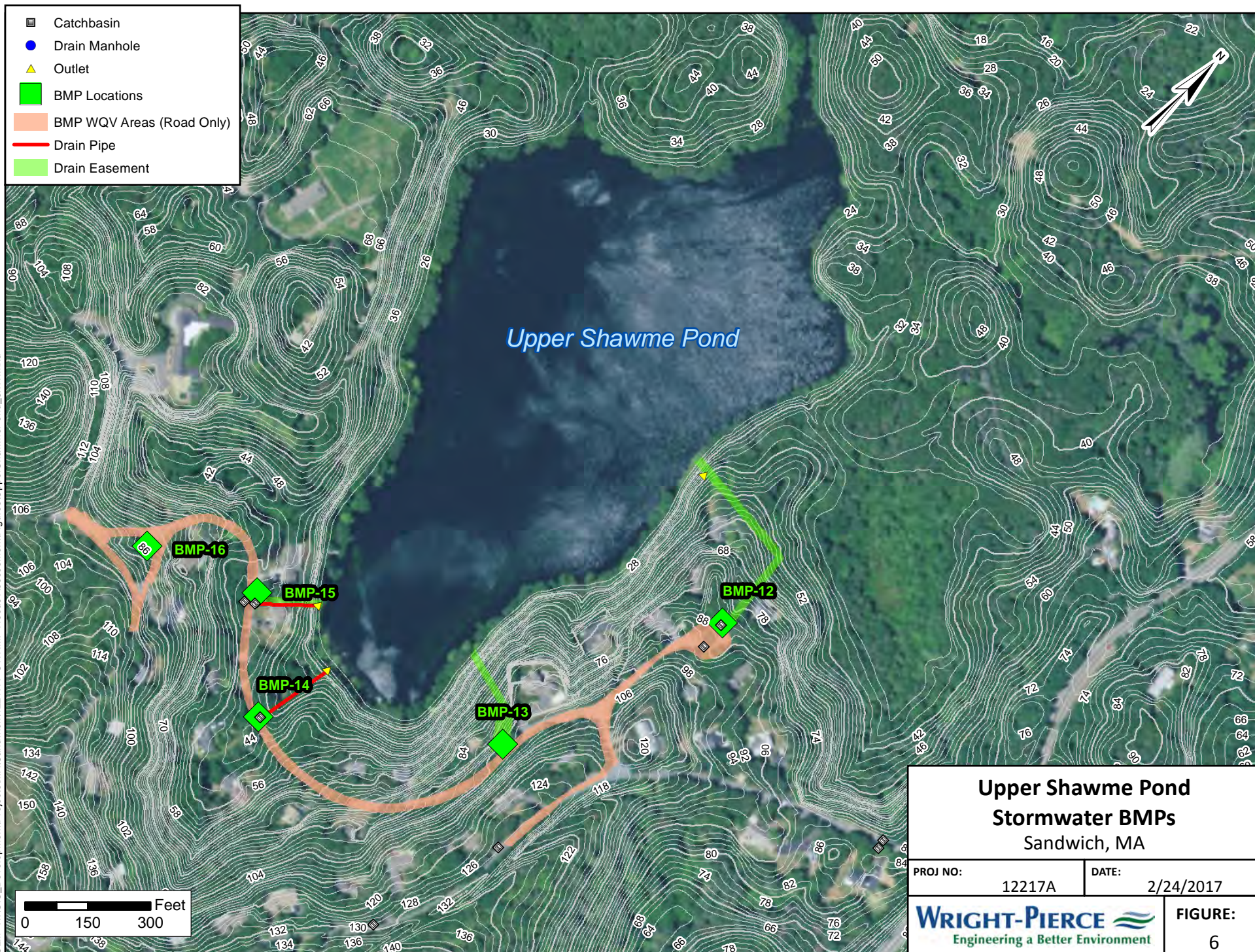






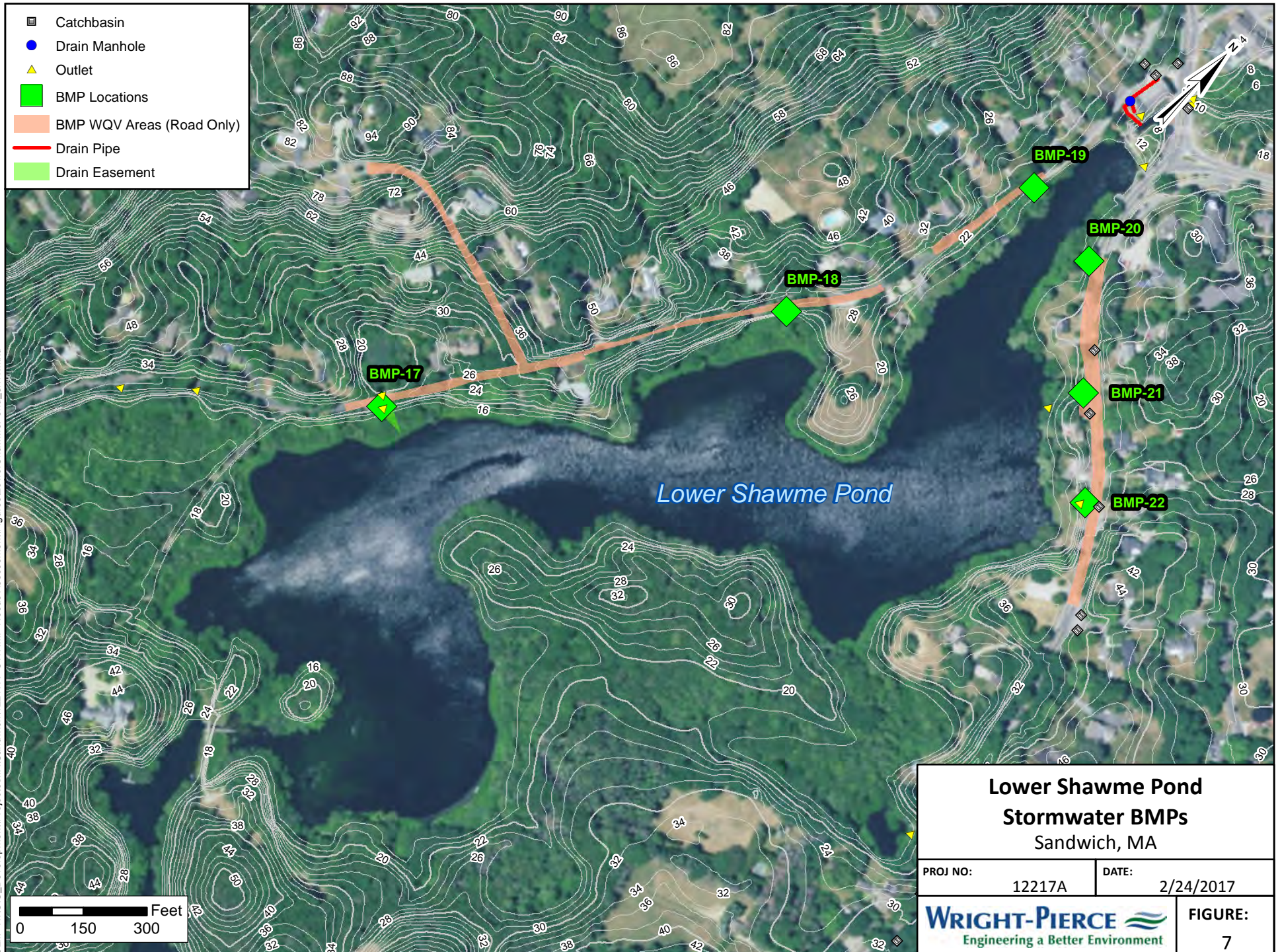


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APPENDIX B  
Cost Estimates

Project Number: BMP-1

Date: 03/01/17

Project: Stormwater BMPs - Sandwich, MA

By: SLG

Location Snake Pond

Treated Area: 0.75 Acres

February 2017 ENR CCI: 10280

	Item	Qty.	UNIT	UNIT AMT	AMOUNT
1	Tree Box Filter		EA	\$15,000	\$0
2	Curb Inlet Infiltration Swale		SF	\$275	\$0
3	Bioretention System/Raingarden	2,300	SF	\$36	\$82,800
4	Pervious Asphalt		SF	\$17	\$0
5	Water Quality Swale/Bio-Swale		LF	\$52	\$0
6	Mass Volume Subsurface Detention		SF	\$42	\$0
7	Roof Drain Downspout Treatment		LF	\$30	\$0
8	Erosion and Sediment Control (Lump Sum = 2% of Construction Cost)	1	LS	\$1,656	\$1,656

<b>Project Subtotal</b>	<b>\$82,800</b>
<b>Construction Administration and Inspection (20%)</b>	<b>\$16,560</b>
<b>Contingency (25%)</b>	<b>\$20,700</b>
<b>Project Total</b>	<b>\$120,060</b>

Project Number: BMP-2

Date: 03/01/17

Project: Stormwater BMPs - Sandwich, MA

By: SLG

Location Snake Pond

Treated Area: 0.20 Acres

February 2017 ENR CCI: 10280

	Item	Qty.	UNIT	UNIT AMT	AMOUNT
1	Tree Box Filter		EA	\$15,000	\$0
2	Curb Inlet Infiltration Swale		SF	\$275	\$0
3	Bioretention System/Raingarden	615	SF	\$36	\$22,140
4	Pervious Asphalt		SF	\$17	\$0
5	Water Quality Swale/Bio-Swale		LF	\$52	\$0
6	Mass Volume Subsurface Detention		SF	\$42	\$0
7	Roof Drain Downspout Treatment		LF	\$30	\$0
8	Erosion and Sediment Control (Lump Sum = 2% of Construction Cost)	1	LS	\$443	\$443

<b>Project Subtotal</b>	<b>\$22,140</b>
<b>Construction Administration and Inspection (20%)</b>	<b>\$4,428</b>
<b>Contingency (25%)</b>	<b>\$5,535</b>
<b>Project Total</b>	<b>\$32,103</b>



Project Number: BMP-3

Date: 03/01/17

Project: Stormwater BMPs - Sandwich, MA

By: SLG

Location Snake Pond

Treated Area: 0.51 Acres

February 2017 ENR CCI: 10280

	Item	Qty.	UNIT	UNIT AMT	AMOUNT
1	Tree Box Filter		EA	\$15,000	\$0
2	Curb Inlet Infiltration Swale		SF	\$275	\$0
3	Bioretention System/Raingarden	1,575	SF	\$36	\$56,700
4	Pervious Asphalt		SF	\$17	\$0
5	Water Quality Swale/Bio-Swale		LF	\$52	\$0
6	Mass Volume Subsurface Detention		SF	\$42	\$0
7	Roof Drain Downspout Treatment		LF	\$30	\$0
8	Erosion and Sediment Control (Lump Sum = 2% of Construction Cost)	1	LS	\$1,134	\$1,134

<b>Project Subtotal</b>	<b>\$56,700</b>
<b>Construction Administration and Inspection (20%)</b>	<b>\$11,340</b>
<b>Contingency (25%)</b>	<b>\$14,175</b>
<b>Project Total</b>	<b>\$82,215</b>

Project Number: BMP-4

Date: 03/01/17

Project: Stormwater BMPs - Sandwich, MA

By: SLG

Location Peters Pond

Treated Area: 0.08 Acres

February 2017 ENR CCI: 10280

	Item	Qty.	UNIT	UNIT AMT	AMOUNT
1	Tree Box Filter		EA	\$15,000	\$0
2	Curb Inlet Infiltration Swale		SF	\$275	\$0
3	Bioretention System/Raingarden	250	SF	\$36	\$9,000
4	Pervious Asphalt		SF	\$17	\$0
5	Water Quality Swale/Bio-Swale		LF	\$52	\$0
6	Mass Volume Subsurface Detention		SF	\$42	\$0
7	Roof Drain Downspout Treatment		LF	\$30	\$0
8	Erosion and Sediment Control (Lump Sum = 2% of Construction Cost)	1	LS	\$180	\$180

Project Subtotal	\$9,000
Construction Administration and Inspection (20%)	\$1,800
Contingency (25%)	\$2,250
Project Total	\$13,050

Project Number: BMP-5

Date: 03/01/17

Project: Stormwater BMPs - Sandwich, MA

By: SLG

Location Peters Pond

Treated Area: 0.31 Acres

February 2017 ENR CCI: 10280

	Item	Qty.	UNIT	UNIT AMT	AMOUNT
1	Tree Box Filter		EA	\$15,000	\$0
2	Curb Inlet Infiltration Swale		SF	\$275	\$0
3	Bioretention System/Raingarden	950	SF	\$36	\$34,200
4	Pervious Asphalt		SF	\$17	\$0
5	Water Quality Swale/Bio-Swale		LF	\$52	\$0
6	Mass Volume Subsurface Detention		SF	\$42	\$0
7	Roof Drain Downspout Treatment		LF	\$30	\$0
8	Erosion and Sediment Control (Lump Sum = 2% of Construction Cost)	1	LS	\$684	\$684

<b>Project Subtotal</b>	<b>\$34,200</b>
<b>Construction Administration and Inspection (20%)</b>	<b>\$6,840</b>
<b>Contingency (25%)</b>	<b>\$8,550</b>
<b>Project Total</b>	<b>\$49,590</b>

Project Number: BMP-6

Date: 03/01/17

Project: Stormwater BMPs - Sandwich, MA

By: SLG

Location Peters Pond

Treated Area: 0.38 Acres

February 2017 ENR CCI: 10280

	Item	Qty.	UNIT	UNIT AMT	AMOUNT
1	Tree Box Filter		EA	\$15,000	\$0
2	Curb Inlet Infiltration Swale		SF	\$275	\$0
3	Bioretention System/Raingarden	1,170	SF	\$36	\$42,120
4	Pervious Asphalt		SF	\$17	\$0
5	Water Quality Swale/Bio-Swale		LF	\$52	\$0
6	Mass Volume Subsurface Detention		SF	\$42	\$0
7	Roof Drain Downspout Treatment		LF	\$30	\$0
8	Erosion and Sediment Control (Lump Sum = 2% of Construction Cost)	1	LS	\$842	\$842

<b>Project Subtotal</b>	<b>\$42,120</b>
<b>Construction Administration and Inspection (20%)</b>	<b>\$8,424</b>
<b>Contingency (25%)</b>	<b>\$10,530</b>
<b>Project Total</b>	<b>\$61,074</b>

Project Number: BMP-7

Date: 03/01/17

Project: Stormwater BMPs - Sandwich, MA

By: SLG

Location Peters Pond

Treated Area: 0.30 Acres

February 2017 ENR CCI: 10280

	Item	Qty.	UNIT	UNIT AMT	AMOUNT
1	Tree Box Filter		EA	\$15,000	\$0
2	Curb Inlet Infiltration Swale		SF	\$275	\$0
3	Bioretention System/Raingarden	940	SF	\$36	\$33,840
4	Pervious Asphalt		SF	\$17	\$0
5	Water Quality Swale/Bio-Swale		LF	\$52	\$0
6	Mass Volume Subsurface Detention		SF	\$42	\$0
7	Roof Drain Downspout Treatment		LF	\$30	\$0
8	Erosion and Sediment Control (Lump Sum = 2% of Construction Cost)	1	LS	\$677	\$677

<b>Project Subtotal</b>	<b>\$33,840</b>
<b>Construction Administration and Inspection (20%)</b>	<b>\$6,768</b>
<b>Contingency (25%)</b>	<b>\$8,460</b>
<b>Project Total</b>	<b>\$49,068</b>

Project Number: BMP-8

Date: 03/01/17

Project: Stormwater BMPs - Sandwich, MA

By: SLG

Location Peters Pond

Treated Area: 0.22 Acres

February 2017 ENR CCI: 10280

	Item	Qty.	UNIT	UNIT AMT	AMOUNT
1	Tree Box Filter		EA	\$15,000	\$0
2	Curb Inlet Infiltration Swale		SF	\$275	\$0
3	Bioretention System/Raingarden	670	SF	\$36	\$24,120
4	Pervious Asphalt		SF	\$17	\$0
5	Water Quality Swale/Bio-Swale		LF	\$52	\$0
6	Mass Volume Subsurface Detention		SF	\$42	\$0
7	Roof Drain Downspout Treatment		LF	\$30	\$0
8	Erosion and Sediment Control (Lump Sum = 2% of Construction Cost)	1	LS	\$482	\$482

<b>Project Subtotal</b>	<b>\$24,120</b>
<b>Construction Administration and Inspection (20%)</b>	<b>\$4,824</b>
<b>Contingency (25%)</b>	<b>\$6,030</b>
<b>Project Total</b>	<b>\$34,974</b>

Project Number: BMP-9

Date: 03/01/17

Project: Stormwater BMPs - Sandwich, MA

By: SLG

Location Peters Pond

Treated Area: 0.08 Acres

February 2017 ENR CCI: 10280

	Item	Qty.	UNIT	UNIT AMT	AMOUNT
1	Tree Box Filter		EA	\$15,000	\$0
2	Curb Inlet Infiltration Swale		SF	\$275	\$0
3	Bioretention System/Raingarden	250	SF	\$36	\$9,000
4	Pervious Asphalt		SF	\$17	\$0
5	Water Quality Swale/Bio-Swale		LF	\$52	\$0
6	Mass Volume Subsurface Detention		SF	\$42	\$0
7	Roof Drain Downspout Treatment		LF	\$30	\$0
8	Erosion and Sediment Control (Lump Sum = 2% of Construction Cost)	1	LS	\$180	\$180

Project Subtotal	\$9,000
Construction Administration and Inspection (20%)	\$1,800
Contingency (25%)	\$2,250
Project Total	\$13,050



Project Number: BMP-10

Date: 03/01/17

Project: Stormwater BMPs - Sandwich, MA

By: SLG

Location Pimlico Pond

Treated Area: 0.38 Acres

February 2017 ENR CCI: 10280

	Item	Qty.	UNIT	UNIT AMT	AMOUNT
1	Tree Box Filter		EA	\$15,000	\$0
2	Curb Inlet Infiltration Swale		SF	\$275	\$0
3	Bioretention System/Raingarden		SF	\$36	\$0
4	Pervious Asphalt		SF	\$17	\$0
5	Water Quality Swale/Bio-Swale	400	LF	\$52	\$20,800
6	Mass Volume Subsurface Detention		SF	\$42	\$0
7	Roof Drain Downspout Treatment		LF	\$30	\$0
8	Erosion and Sediment Control (Lump Sum = 2% of Construction Cost)	1	LS	\$416	\$416

Project Subtotal	\$20,800
Construction Administration and Inspection (20%)	\$4,160
Contingency (25%)	\$5,200
Project Total	\$30,160

Project Number: BMP-11

Date: 03/01/17

Project: Stormwater BMPs - Sandwich, MA

By: SLG

Location Hoxie Pond

Treated Area: 0.20 Acres

February 2017 ENR CCI: 10280

	Item	Qty.	UNIT	UNIT AMT	AMOUNT
1	Tree Box Filter		EA	\$15,000	\$0
2	Curb Inlet Infiltration Swale		SF	\$275	\$0
3	Bioretention System/Raingarden		SF	\$36	\$0
4	Pervious Asphalt		SF	\$17	\$0
5	Water Quality Swale/Bio-Swale	250	LF	\$52	\$13,000
6	Mass Volume Subsurface Detention		SF	\$42	\$0
7	Roof Drain Downspout Treatment		LF	\$30	\$0
8	Erosion and Sediment Control (Lump Sum = 2% of Construction Cost)	1	LS	\$260	\$260

<b>Project Subtotal</b>	<b>\$13,000</b>
<b>Construction Administration and Inspection (20%)</b>	<b>\$2,600</b>
<b>Contingency (25%)</b>	<b>\$3,250</b>
<b>Project Total</b>	<b>\$18,850</b>

Project Number: BMP-12

Date: 03/01/17

Project: Stormwater BMPs - Sandwich, MA

By: SLG

Location Upper Shawme Pond

Treated Area: 0.36 Acres

February 2017 ENR CCI: 10280

	Item	Qty.	UNIT	UNIT AMT	AMOUNT
1	Tree Box Filter		EA	\$15,000	\$0
2	Curb Inlet Infiltration Swale		SF	\$275	\$0
3	Bioretention System/Raingarden	1,115	SF	\$36	\$40,140
4	Pervious Asphalt		SF	\$17	\$0
5	Water Quality Swale/Bio-Swale		LF	\$52	\$0
6	Mass Volume Subsurface Detention		SF	\$42	\$0
7	Roof Drain Downspout Treatment		LF	\$30	\$0
8	Erosion and Sediment Control (Lump Sum = 2% of Construction Cost)	1	LS	\$803	\$803

Project Subtotal	\$40,140
Construction Administration and Inspection (20%)	\$8,028
Contingency (25%)	\$10,035
Project Total	\$58,203

Project Number: BMP-13

Date: 03/01/17

Project: Stormwater BMPs - Sandwich, MA

By: SLG

Location Upper Shawme Pond

Treated Area: 0.30 Acres

February 2017 ENR CCI: 10280

	Item	Qty.	UNIT	UNIT AMT	AMOUNT
1	Tree Box Filter		EA	\$15,000	\$0
2	Curb Inlet Infiltration Swale		SF	\$275	\$0
3	Bioretention System/Raingarden	940	SF	\$36	\$33,840
4	Pervious Asphalt		SF	\$17	\$0
5	Water Quality Swale/Bio-Swale		LF	\$52	\$0
6	Mass Volume Subsurface Detention		SF	\$42	\$0
7	Roof Drain Downspout Treatment		LF	\$30	\$0
8	Erosion and Sediment Control (Lump Sum = 2% of Construction Cost)	1	LS	\$677	\$677

Project Subtotal	\$33,840
Construction Administration and Inspection (20%)	\$6,768
Contingency (25%)	\$8,460
Project Total	\$49,068

Project Number: BMP-14

Date: 03/01/17

Project: Stormwater BMPs - Sandwich, MA

By: SLG

Location Upper Shawme Pond

Treated Area: 0.44 Acres

February 2017 ENR CCI: 10280

	Item	Qty.	UNIT	UNIT AMT	AMOUNT
1	Tree Box Filter		EA	\$15,000	\$0
2	Curb Inlet Infiltration Swale		SF	\$275	\$0
3	Bioretention System/Raingarden	1,350	SF	\$36	\$48,600
4	Pervious Asphalt		SF	\$17	\$0
5	Water Quality Swale/Bio-Swale		LF	\$52	\$0
6	Mass Volume Subsurface Detention		SF	\$42	\$0
7	Roof Drain Downspout Treatment		LF	\$30	\$0
8	Erosion and Sediment Control (Lump Sum = 2% of Construction Cost)	1	LS	\$972	\$972

Project Subtotal	\$48,600
Construction Administration and Inspection (20%)	\$9,720
Contingency (25%)	\$12,150
Project Total	\$70,470

Project Number: BMP-15

Date: 03/01/17

Project: Stormwater BMPs - Sandwich, MA

By: SLG

Location Upper Shawme Pond

Treated Area: 0.33 Acres

February 2017 ENR CCI: 10280

	Item	Qty.	UNIT	UNIT AMT	AMOUNT
1	Tree Box Filter		EA	\$15,000	\$0
2	Curb Inlet Infiltration Swale		SF	\$275	\$0
3	Bioretention System/Raingarden	1,040	SF	\$36	\$37,440
4	Pervious Asphalt		SF	\$17	\$0
5	Water Quality Swale/Bio-Swale		LF	\$52	\$0
6	Mass Volume Subsurface Detention		SF	\$42	\$0
7	Roof Drain Downspout Treatment		LF	\$30	\$0
8	Erosion and Sediment Control (Lump Sum = 2% of Construction Cost)	1	LS	\$749	\$749

<b>Project Subtotal</b>	<b>\$37,440</b>
<b>Construction Administration and Inspection (20%)</b>	<b>\$7,488</b>
<b>Contingency (25%)</b>	<b>\$9,360</b>
<b>Project Total</b>	<b>\$54,288</b>

Project Number: BMP-16

Date: 03/01/17

Project: Stormwater BMPs - Sandwich, MA

By: SLG

Location Upper Shawme Pond

Treated Area: 0.28 Acres

February 2017 ENR CCI: 10280

	Item	Qty.	UNIT	UNIT AMT	AMOUNT
1	Tree Box Filter		EA	\$15,000	\$0
2	Curb Inlet Infiltration Swale		SF	\$275	\$0
3	Bioretention System/Raingarden	870	SF	\$36	\$31,320
4	Pervious Asphalt		SF	\$17	\$0
5	Water Quality Swale/Bio-Swale		LF	\$52	\$0
6	Mass Volume Subsurface Detention		SF	\$42	\$0
7	Roof Drain Downspout Treatment		LF	\$30	\$0
8	Erosion and Sediment Control (Lump Sum = 2% of Construction Cost)	1	LS	\$626	\$626

<b>Project Subtotal</b>	<b>\$31,320</b>
<b>Construction Administration and Inspection (20%)</b>	<b>\$6,264</b>
<b>Contingency (25%)</b>	<b>\$7,830</b>
<b>Project Total</b>	<b>\$45,414</b>



Project Number: BMP-17

Date: 03/01/17

Project: Stormwater BMPs - Sandwich, MA

By: SLG

Location Lower Shawme Pond

Treated Area: 0.56 Acres

February 2017 ENR CCI: 10280

	Item	Qty.	UNIT	UNIT AMT	AMOUNT
1	Tree Box Filter		EA	\$15,000	\$0
2	Curb Inlet Infiltration Swale		SF	\$275	\$0
3	Bioretention System/Raingarden	1,700	SF	\$36	\$61,200
4	Pervious Asphalt		SF	\$17	\$0
5	Water Quality Swale/Bio-Swale		LF	\$52	\$0
6	Mass Volume Subsurface Detention		SF	\$42	\$0
7	Roof Drain Downspout Treatment		LF	\$30	\$0
8	Erosion and Sediment Control (Lump Sum = 2% of Construction Cost)	1	LS	\$1,224	\$1,224

Project Subtotal	\$61,200
Construction Administration and Inspection (20%)	\$12,240
Contingency (25%)	\$15,300
Project Total	\$88,740

Project Number: BMP-18

Date: 03/01/17

Project: Stormwater BMPs - Sandwich, MA

By: SLG

Location Lower Shawme Pond

Treated Area: 0.24 Acres

February 2017 ENR CCI: 10280

	Item	Qty.	UNIT	UNIT AMT	AMOUNT
1	Tree Box Filter		EA	\$15,000	\$0
2	Curb Inlet Infiltration Swale		SF	\$275	\$0
3	Bioretention System/Raingarden	750	SF	\$36	\$27,000
4	Pervious Asphalt		SF	\$17	\$0
5	Water Quality Swale/Bio-Swale		LF	\$52	\$0
6	Mass Volume Subsurface Detention		SF	\$42	\$0
7	Roof Drain Downspout Treatment		LF	\$30	\$0
8	Erosion and Sediment Control (Lump Sum = 2% of Construction Cost)	1	LS	\$540	\$540

Project Subtotal	\$27,000
Construction Administration and Inspection (20%)	\$5,400
Contingency (25%)	\$6,750
Project Total	\$39,150

Project Number: BMP-19

Date: 03/01/17

Project: Stormwater BMPs - Sandwich, MA

By: SLG

Location Lower Shawme Pond

Treated Area: 0.14 Acres

February 2017 ENR CCI: 10280

	Item	Qty.	UNIT	UNIT AMT	AMOUNT
1	Tree Box Filter		EA	\$15,000	\$0
2	Curb Inlet Infiltration Swale		SF	\$275	\$0
3	Bioretention System/Raingarden	430	SF	\$36	\$15,480
4	Pervious Asphalt		SF	\$17	\$0
5	Water Quality Swale/Bio-Swale		LF	\$52	\$0
6	Mass Volume Subsurface Detention		SF	\$42	\$0
7	Roof Drain Downspout Treatment		LF	\$30	\$0
8	Erosion and Sediment Control (Lump Sum = 2% of Construction Cost)	1	LS	\$310	\$310

<b>Project Subtotal</b>	<b>\$15,480</b>
<b>Construction Administration and Inspection (20%)</b>	<b>\$3,096</b>
<b>Contingency (25%)</b>	<b>\$3,870</b>
<b>Project Total</b>	<b>\$22,446</b>

Project Number: BMP-20

Date: 03/01/17

Project: Stormwater BMPs - Sandwich, MA

By: SLG

Location Lower Shawme Pond

Treated Area: 0.27 Acres

February 2017 ENR CCI: 10280

	Item	Qty.	UNIT	UNIT AMT	AMOUNT
1	Tree Box Filter		EA	\$15,000	\$0
2	Curb Inlet Infiltration Swale		SF	\$275	\$0
3	Bioretention System/Raingarden	840	SF	\$36	\$30,240
4	Pervious Asphalt		SF	\$17	\$0
5	Water Quality Swale/Bio-Swale		LF	\$52	\$0
6	Mass Volume Subsurface Detention		SF	\$42	\$0
7	Roof Drain Downspout Treatment		LF	\$30	\$0
8	Erosion and Sediment Control (Lump Sum = 2% of Construction Cost)	1	LS	\$605	\$605

Project Subtotal	\$30,240
Construction Administration and Inspection (20%)	\$6,048
Contingency (25%)	\$7,560
Project Total	\$43,848

Project Number: BMP-21

Date: 03/01/17

Project: Stormwater BMPs - Sandwich, MA

By: SLG

Location Lower Shawme Pond

Treated Area: 0.20 Acres

February 2017 ENR CCI: 10280

	Item	Qty.	UNIT	UNIT AMT	AMOUNT
1	Tree Box Filter		EA	\$15,000	\$0
2	Curb Inlet Infiltration Swale		SF	\$275	\$0
3	Bioretention System/Raingarden	620	SF	\$36	\$22,320
4	Pervious Asphalt		SF	\$17	\$0
5	Water Quality Swale/Bio-Swale		LF	\$52	\$0
6	Mass Volume Subsurface Detention		SF	\$42	\$0
7	Roof Drain Downspout Treatment		LF	\$30	\$0
8	Erosion and Sediment Control (Lump Sum = 2% of Construction Cost)	1	LS	\$446	\$446

<b>Project Subtotal</b>	<b>\$22,320</b>
<b>Construction Administration and Inspection (20%)</b>	<b>\$4,464</b>
<b>Contingency (25%)</b>	<b>\$5,580</b>
<b>Project Total</b>	<b>\$32,364</b>

Project Number: BMP-22

Date: 03/01/17

Project: Stormwater BMPs - Sandwich, MA

By: SLG

Location Lower Shawme Pond

Treated Area: 0.15 Acres

February 2017 ENR CCI: 10280

	Item	Qty.	UNIT	UNIT AMT	AMOUNT
1	Tree Box Filter		EA	\$15,000	\$0
2	Curb Inlet Infiltration Swale		SF	\$275	\$0
3	Bioretention System/Raingarden	470	SF	\$36	\$16,920
4	Pervious Asphalt		SF	\$17	\$0
5	Water Quality Swale/Bio-Swale		LF	\$52	\$0
6	Mass Volume Subsurface Detention		SF	\$42	\$0
7	Roof Drain Downspout Treatment		LF	\$30	\$0
8	Erosion and Sediment Control (Lump Sum = 2% of Construction Cost)	1	LS	\$338	\$338

<b>Project Subtotal</b>	<b>\$16,920</b>
<b>Construction Administration and Inspection (20%)</b>	<b>\$3,384</b>
<b>Contingency (25%)</b>	<b>\$4,230</b>
<b>Project Total</b>	<b>\$24,534</b>

APPENDIX C  
Stormwater BMP Options



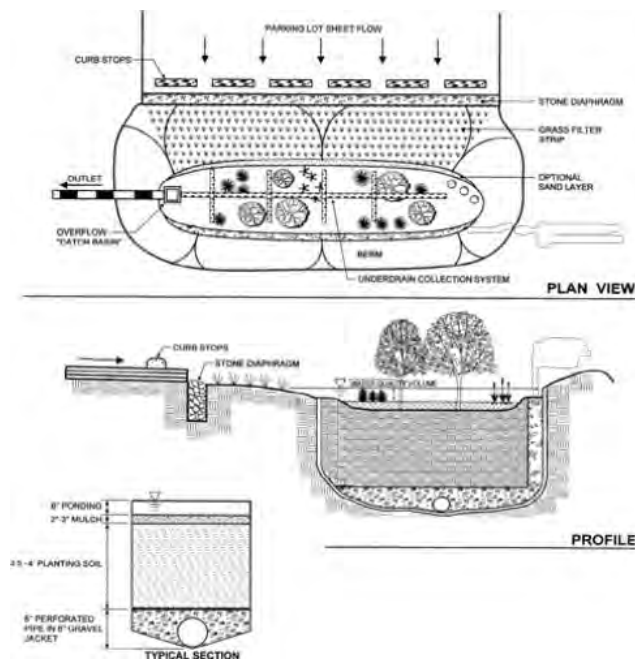
# **BIORETENTION SYSTEM/RAINGARDEN**

## **Benefits:**

- Reduce runoff by absorbing and retaining stormwater
- Filters sediment and pollutants
- Mitigates heat island effects
- Adds aesthetic value
- Evapotranspiration benefits
- Low maintenance
- Can be designed to any shape and size

Plants must withstand the extremes of moisture and nutrients, particularly nitrogen and phosphorus.

Average price: \$30 to \$36 per square foot plus the cost of drainage pipe.



Source: Mass Stormwater Handbook



Photo Source: Wright-Pierce

## **WATER QUALITY SWALE/BIO-SWALE**

### **Benefits:**

- Reduce runoff
- Maximizes time of concentration
- Promotes groundwater recharge
- Filters sediments and pollutants

Long, continuous water quality swales maximize the time water spends in the swale and trench. This reduces stormwater quantity in the piped system and aids in the trapping of pollutants.

Average price assumed at 2 feet deep x 4 feet wide: \$42 to \$52 per linear foot.



Photo source: New England Water Environment Association