

AASHTO: 2014 NATIONAL STORMWATER
PRACTITIONERS MEETING

PLANNING & DESIGNING FOR
BMP MANAGEMENT

Presented by

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Overview of Presentation

Purpose:

- ▣ Inspection and maintenance are key components of effective stormwater management practice
- ▣ Preparation for these key functions is essential during the planning and design process

Overview of Presentation

Topics:

- ▣ Maintenance as a design criterion
- ▣ Maintenance as an operation
- ▣ Maintenance as regulatory compliance

- ▣ (Construction oversight also affects BMP Maintenance)

Maintenance as a Design Criterion

- ▣ BMP Screening and Selection
- ▣ BMP Design

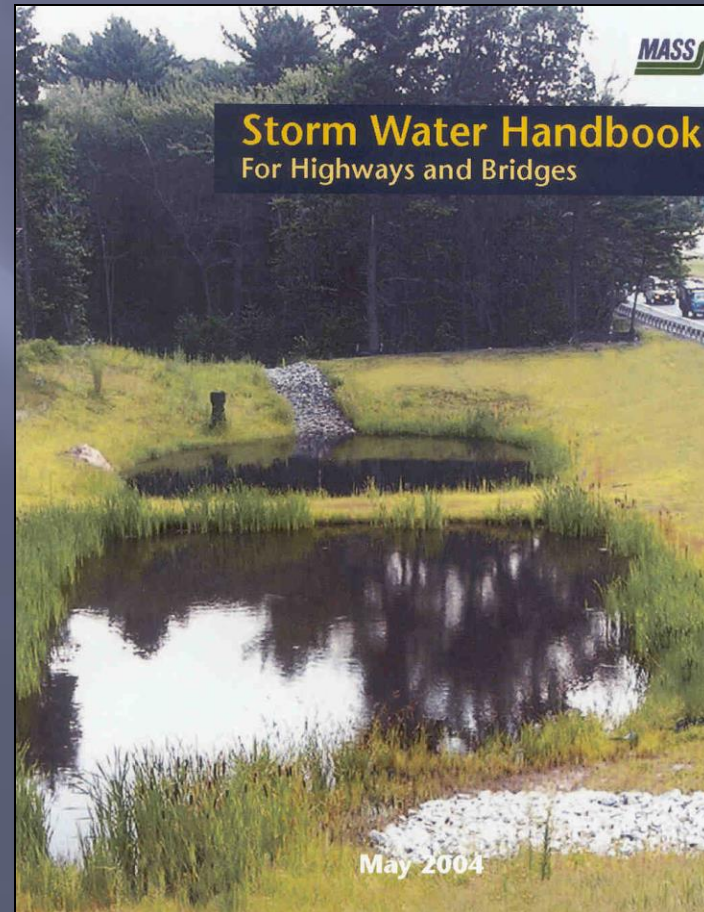


Table 4-2. Installation and Operational Factors for Screening BMPs

INSTALLATION OR OPERATIONAL FACTOR	Considerations for Roadway Drainage Design
Construction Feasibility	<p>Road improvement projects can be complex to design and construct. Even though the general site conditions discussed in Section 4.2.1 and Table 4-1 may be favorable for a certain BMP, other factors may preclude the BMP because of difficulties in constructing the facility. Some examples include:</p> <ul style="list-style-type: none"> • The installation of deep sump catch basins or other underground structures at the edge of pavement or shoulder may be restricted by the presence of other underground utilities; • Existing traffic must be accommodated during road improvement projects. Space within the right-of-way may be required to route traffic around the construction. This may temporarily (or in some cases, permanently) preclude the use of that space for siting a particular BMP or type of BMP; • Along existing roads, candidate locations for BMPs are sometimes identified at the toe of slope of the roadway embankments. However, these areas are frequently inaccessible to construction equipment, because of the height and slope of the existing embankment. In these cases, installation of the BMPs in otherwise suitable locations may be precluded by the limitations on construction or maintenance access. <p>Designers will need to review actual construction conditions on each project, for particular conditions that may affect the choice of BMPs.</p>
Adequate Safety	<p>Safety is of paramount concern in the roadway setting. Designers must evaluate BMPs for their compatibility with vehicular safety requirements. Depending on particular site conditions, this may rule out the use of certain BMPs, or affect their siting and design if they are used.</p> <p>Along heavily used roadways (such as limited access highways and urban arterial roadways), designers should consider the safety implications posed by BMPs that require frequent maintenance. BMPs should be selected and sited so that maintenance crews can access and service the measures, with an absolute minimum of disturbance to traffic flow. For example, installation of a device that requires closing a lane of traffic for routine maintenance should be avoided – particularly if there is an alternative BMP with lower maintenance requirements, or that can be sited in a less disruptive location.</p> <p>In addition, other public safety requirements will need to be considered. For example, in many residential settings, the provision of BMPs that have permanent open pools of water may either be precluded from further consideration because of public safety concerns (e.g., accidental drowning), or require special design requirements and access controls (e.g., protective fencing).</p>
Ease of Inspection	<p>BMPs require periodic inspection, to monitor performance and to identify conditions that might interfere with the proper function of the storm water management system. Preference should be given to BMPs that can be easily observed by roadway maintenance personnel. Routinely employed BMP measures with which maintenance personnel are familiar, and which can be easily observed, are more likely to receive routine attention than devices that are difficult to access or to observe.</p>
Operational Considerations	<p>The designer should give preference to BMPs that require no special operational measures. Designers should avoid BMPs that have flow controls that require frequent adjustments or that otherwise require the regular presence of personnel to keep the facility operational. BMPs should also be selected and designed to be compatible with local emergency response procedures for spill containment, especially in “critical areas”.</p> <p>BMPs selected for roadway use should have full documentation of performance in the highway setting.</p>
Maintenance Considerations	<p>Designers should give preference to BMPs that are simple to maintain, can be maintained with the routine procedures and equipment typically used by the party responsible for maintenance, and require the least maintenance over the long-term. The following criteria should be considered:</p> <ul style="list-style-type: none"> • Frequency of scheduled maintenance required by the selected BMP; • Chronic maintenance problems (such as clogging) associated with any BMP, as reported in the literature or experienced by the designer or implementing agency personnel; • Reported failure rates for any particular BMP; • The need for special equipment or procedures to accomplish routine maintenance (for example, some enclosed structures will require confined-space entry procedures under OSHA). <p>Many roadway projects implemented by MassDOT involve sections of roadways maintained by local communities. Where a project will be designed and constructed by one agency, but operated and maintained by another agency, written agreements should clearly specify responsibilities for maintenance.</p>
Life-Cycle Cost	<p>The designer should select BMPs that meet project objectives (including regulatory requirements), but that are also cost-effective. Roadway improvement projects are primarily publicly funded, as well as maintained by public agencies. The designer should screen BMPs for those with life-cycle costs (including installation, operation, maintenance, and repair) commensurate with available funding. BMPs with extraordinary costs of installation or maintenance may be deleted from further consideration.</p>

Maintenance as a Design Criterion: BMP Screening and Selection

- ▣ Ease of inspection
 - Visual and physical accessibility
 - Above ground vs. underground

Source: MASTEP



Good visibility/accessibility



Poor visibility/accessibility

Maintenance as a Design Criterion: BMP Screening and Selection

- ▣ Operational Considerations
 - O&M measures compatible with standard DOT practices
 - Discourage devices with unique or extraordinary O&M requirements
 - Self-operating vs. operator-dependent
 - Minimize need for intervention by personnel (e.g., avoid devices that require stop logs or valves that require attendance by an operator)
 - Consider “protocols” instead of devices for managing contingency events
 - e.g., develop spill response maps and protocols, instead of using stop logs or valves to manage spills

Maintenance as a Design Criterion: BMP Screening and Selection

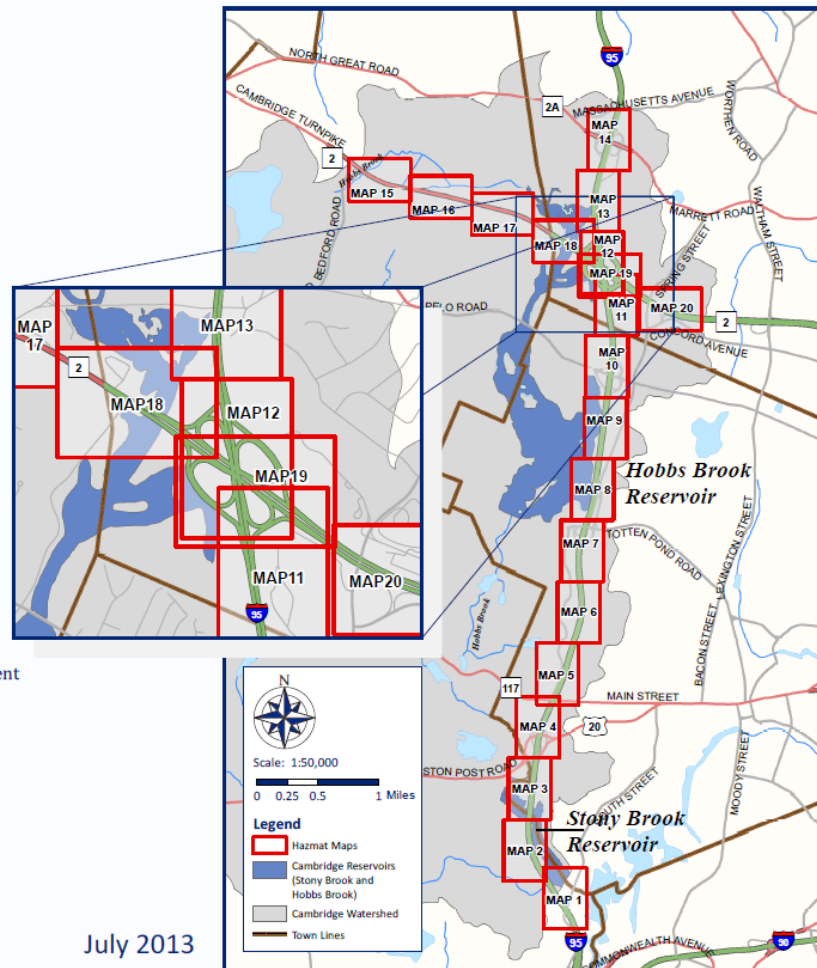
The Cambridge Watershed Hazardous Materials Emergency Response Atlas Route 128 and Route 2

This Atlas was produced in an effort to safeguard the City's drinking water supply from a hazardous material release along Route 128 and Route 2. The Atlas was developed to assist state and local officials in locating the highways' drainage system which, without intervention, could convey such a hazardous material spill to the Cambridge water supply reservoirs.

The Atlas consists of twenty (20) 1:2,400 scale maps of the Route 128 and Route 2 corridors in the Cambridge drinking water watershed in the towns of Waltham, Weston, Lexington and Lincoln. Thanks to all who supplied information to make this Atlas as accurate and usable as possible.

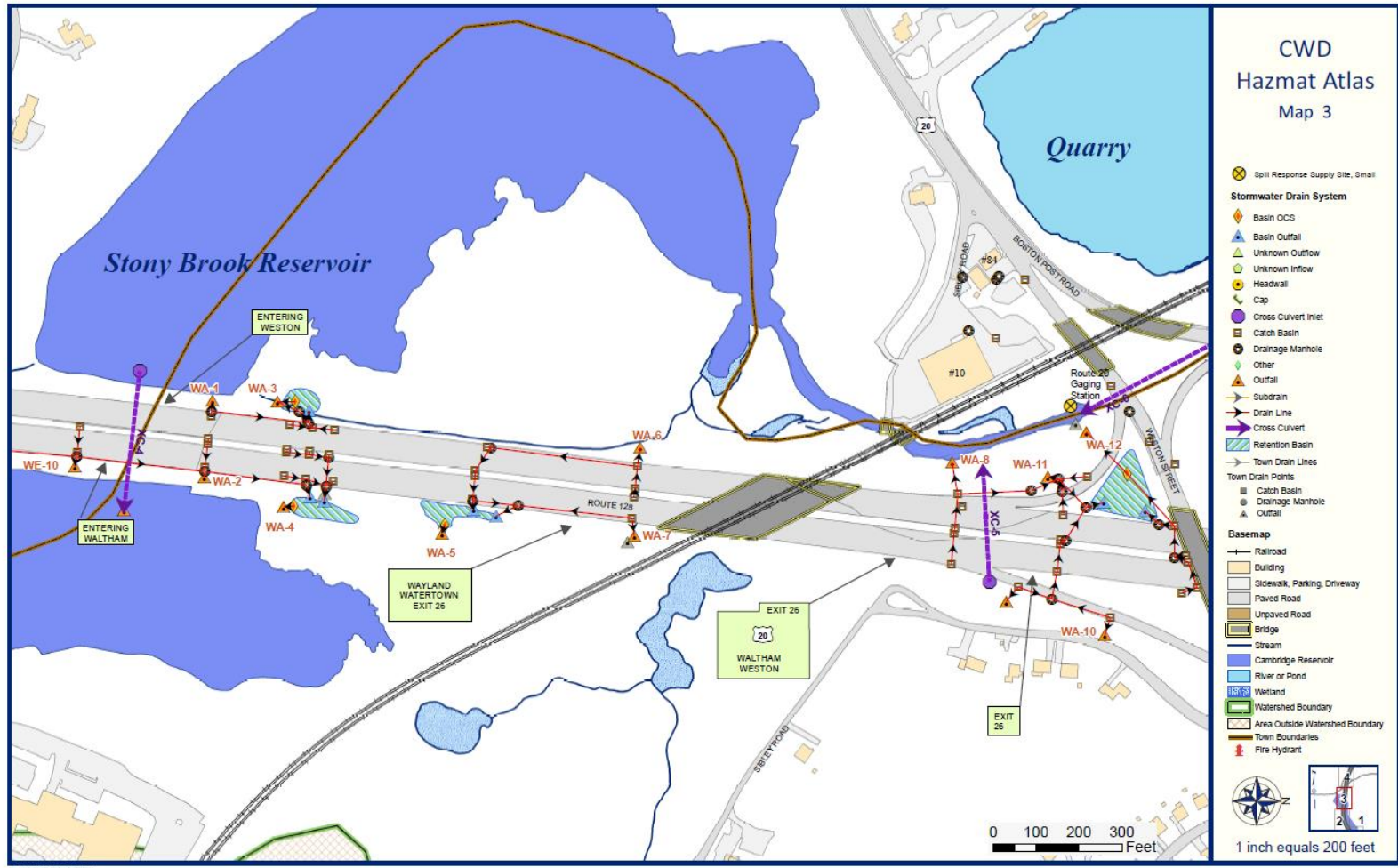
For additional information about these maps, please contact:
Mr. David Kaplan, Watershed Protection Supervisor, City of Cambridge Water Department
(617) 349-4799 dkaplan@cambridgema.gov

Data Sources:
MassGIS
City of Cambridge
City of Waltham
Town of Lexington
Town of Weston
Town of Lincoln
USGS



July 2013

Maintenance as a Design Criterion: BMP Screening and Selection



Maintenance as a Design Criterion: BMP Screening and Selection

- ▣ Maintenance Considerations
 - Frequency?
 - Relative difficulty?
 - Accessibility?
 - Cost?



Maintenance as a Design Criterion: BMP Screening and Selection

- ▣ Maintenance Considerations
 - Special equipment required?
 - Safety considerations (e.g. confined space entry, lane closures)?



Maintenance as a Design Criterion: BMP Design

- ▣ Design to Facilitate Inspection
 - Inspection aids (examples)
 - ▣ Marker posts to indicate key outfall locations
 - ▣ Staff gauges to measure sediment accumulation
 - ▣ Drainage system maps



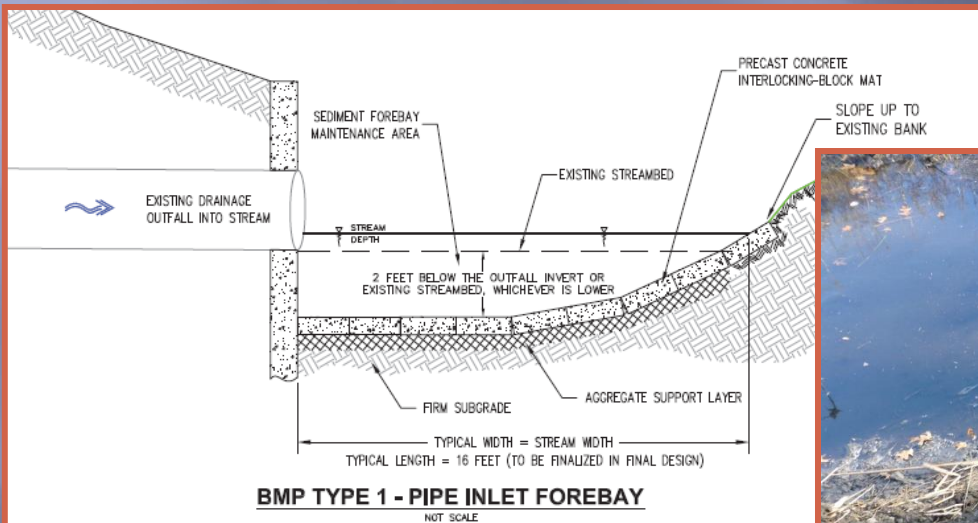
Maintenance as a Design Criterion: BMP Design

- ▣ Design to Facilitate Maintenance
 - Banks requiring mowing $\leq 3:1$ slope
 - Access ramps for basin maintenance
 - Embankment top widths adequate for maintenance access



Maintenance as a Design Criterion: BMP Design

- Design to Facilitate Maintenance (Cont'd)
 - Line forebays with paver blocks, for sediment clean-out



Maintenance as an Operation

- ▣ Source Control
- ▣ Inspection
- ▣ Maintenance of Stormwater Structures
- ▣ Tracking & Documentation



Maintenance as an Operation: Source Control

- ▣ Reduced load at source = reduced need for structures
 - ▣ Street sweeping
 - ▣ Shoulder and embankment stabilization
 - ▣ Reduced (or elimination of) winter sanding
 - ▣ Management of deicing materials
 - ▣ Run-on prevention
 - ▣ Discourage/reduce drainage tie-ins; proactively regulate unavoidable tie-ins

Maintenance as an Operation: Inspection

- ▣ Standard maintenance practices outlined in MS4 SWMP
- ▣ Standard inspection checklist keyed to maintenance practices



Maintenance as an Operation:

Inspection/O&M Checklist

Best Management Practice	Sweep	Mow	Inspect	Clean	Repair	Notes
Deep Sump Catch Basins	NA	NA	Annually (after snow melt)	<ul style="list-style-type: none"> Sediment > 50% sump depth Litter and debris clogging inlet grate or curb inlet opening 	<ul style="list-style-type: none"> Damage to grate or inlet stone 	<ul style="list-style-type: none"> Clean catch basins as warranted by inspection
Bioretention Areas	NA	NA	Annually	<ul style="list-style-type: none"> Litter and debris at least once per year Pruning vegetation at least once per year 	<ul style="list-style-type: none"> Bare patches, stressed or dead vegetation > 10% of surface area Presence of invasive species Erosion within the bioretention area Settlement or erosion of surfaces adjacent to bioretention area Replace mulch to maintain 2-3 inch depth 	<ul style="list-style-type: none"> If system does not drain within 72 hours following a rainfall event, then a qualified professional should assess the condition of the facility to determine measures required to restore infiltration function

Maintenance as an Operation: Maintenance of Stormwater Structures

- ▣ Maintenance program components:
 - Preventive Maintenance
 - ▣ E.g., mowing, sweeping, cleaning
 - Repair/Corrective Maintenance
 - Replacement/Reconstruction
- ▣ Maintenance thresholds:
 - Maintain based on inspection vs. maintain on scheduled cycle
- ▣ Maintenance implementation:
 - In-house staff & equipment vs. sub-contractors

Maintenance as an Operation: Tracking and Documentation

- ▣ Tracking
 - Asset management software vs. Geo Database vs. Excel spreadsheet
 - Scheduling/prioritizing inspection, clean-out, BMP conditions
- ▣ Documentation
 - Record keeping
 - No paper –tablet computers and geodatabase
 - Triggers for action (e.g., clean-out, repairs, IDDE measures)



Geo Database

- Geo Database allows for documentation of stormwater BMPs constructed as part of projects
- Attribute tables provide detailed information

The screenshot displays the ArcMap interface with a map of stormwater BMPs. A table of contents is visible on the left, and an attribute table is overlaid on the map. The attribute table provides detailed information for each BMP project.

Project Name	MassDOT	Municipality	MassDOT Road	BMP Ownership	Type of BMP	BMP Notes	Effective IC reduce	P load of waters	P reduced by BMP	Date
<Null>	4	Waltham	95	MassDOT	Extended Detention Basin	Wet Pond - Construction completed in 2008 (EEA No. 13	<Null>	<Null>	<Null>	<Null>
<Null>	6	Weston	95	MassDOT	Extended Detention Basin	Construction completed in 2008 (EEA No. 13858)	<Null>	<Null>	<Null>	<Null>
<Null>	4	Waltham	95	MassDOT	Extended Detention Basin	Construction completed in 2010 (EEA No. 12448)	<Null>	<Null>	<Null>	<Null>
<Null>	4	Waltham	95	MassDOT	Other	Gravel Wetland - Construction completed in 2010 (EEA	<Null>	<Null>	<Null>	<Null>
<Null>	4	Waltham	95	MassDOT	Extended Detention Basin	Wet Pond - Construction completed in 2010 (EEA No. 14	<Null>	<Null>	<Null>	<Null>
<Null>	4	Waltham	95	MassDOT	Extended Detention Basin	Construction completed in 2010 (EEA No. 14593)	<Null>	<Null>	<Null>	<Null>
<Null>	4	Waltham	95	MassDOT	Extended Detention Basin	Wet Pond - Construction completed in 2010 (EEA No. 14	<Null>	<Null>	<Null>	<Null>
<Null>	4	Waltham	95	MassDOT	Other	Gravel Wetland - Construction completed in 2010 (EEA	<Null>	<Null>	<Null>	<Null>
<Null>	4	Waltham	95	MassDOT	Other	Sediment Forebay - Construction completed in 2010 (EEA	<Null>	<Null>	<Null>	<Null>
<Null>	4	Waltham	95	MassDOT	Extended Detention Basin	Wet Pond - Construction completed in 2010 (EEA No. 14	<Null>	<Null>	<Null>	<Null>
Faunce Corner Road	5	Dartmouth	Faunce Corner	MassDOT	Infiltration Swale	Grass swale with stone at pipe ends	<Null>	<Null>	<Null>	<Null>
Faunce Corner Road	5	Dartmouth	Faunce Corner	MassDOT	Infiltration Swale		<Null>	<Null>	<Null>	<Null>
Faunce Corner Road	5	Dartmouth	Faunce Corner	MassDOT	Infiltration Swale		<Null>	<Null>	<Null>	<Null>
Faunce Corner Road	5	Dartmouth	Faunce Corner	MassDOT	Leaching Catch Basin		<Null>	<Null>	<Null>	<Null>
Faunce Corner Road	5	Dartmouth	Faunce Corner	MassDOT	Leaching Catch Basin		<Null>	<Null>	<Null>	<Null>
Faunce Corner Road	5	Dartmouth	Faunce Corner	MassDOT	Leaching Catch Basin		<Null>	<Null>	<Null>	<Null>
Faunce Corner Road	5	Dartmouth	Faunce Corner	MassDOT	Leaching Catch Basin		<Null>	<Null>	<Null>	<Null>
Faunce Corner Road	5	Dartmouth	Faunce Corner	MassDOT	Leaching Catch Basin		<Null>	<Null>	<Null>	<Null>
Faunce Corner Road	5	Dartmouth	Faunce Corner	MassDOT	Leaching Catch Basin		<Null>	<Null>	<Null>	<Null>
Faunce Corner Road	5	Dartmouth	Faunce Corner	MassDOT	Infiltration Swale		<Null>	<Null>	<Null>	<Null>
Faunce Corner Road	5	Dartmouth	Faunce Corner	MassDOT	Infiltration Swale		<Null>	<Null>	<Null>	<Null>
Faunce Corner Road	5	Dartmouth	Faunce Corner	MassDOT	Infiltration Swale		<Null>	<Null>	<Null>	<Null>
Faunce Corner Road	5	Dartmouth	Faunce Corner	MassDOT	Infiltration Swale	in MassDOT Maintenance Yard drive	<Null>	<Null>	<Null>	<Null>
Feeding Hills Road	2	Westfield	187	Municipality	Leaching Catch Basin		<Null>	<Null>	<Null>	<Null>
Feeding Hills Road	2	Westfield	187	Municipality	Other	Proprietary WQ structure - 1200 gallon capacity	<Null>	<Null>	<Null>	<Null>
Feeding Hills Road	2	Westfield	187	Municipality	Other	Proprietary WQ Structure - 1200 gallon	<Null>	<Null>	<Null>	<Null>
Feeding Hills Road	2	Westfield	187	Municipality	Leaching Catch Basin		<Null>	<Null>	<Null>	<Null>
Feeding Hills Road	2	Westfield	187	Municipality	Other	Proprietary WQ Structure - 1200 gallon	<Null>	<Null>	<Null>	<Null>
Feedin Hills Road	2	Westfield	187	Municipality	Leaching Catch Basin		<Null>	<Null>	<Null>	<Null>
Feeding Hills Road	2	Westfield	187	Municipality	Other	Proprietary WQ Structure - 2400 gallon	<Null>	<Null>	<Null>	<Null>
Feeding Hills Road	2	Westfield	187	Municipality	Other		<Null>	<Null>	<Null>	<Null>
Feeding Hills Road	2	Westfield	187	Municipality	Infiltration Basin	Drainage easement taken for basin	<Null>	<Null>	<Null>	<Null>
Feeding Hills Road	2	Westfield	187	Municipality	Infiltration Swale	approximately 300 ft with subdrain	<Null>	<Null>	<Null>	<Null>
Bruce Freeman Rail Trail	3	Westford	<Null>	Municipality	Vegetated Filter Strip	with level spreader	<Null>	<Null>	<Null>	<Null>
Bruce Freeman Rail Trail	3	Acton	<Null>	Municipality	Vegetated Filter Strip	with level spreader	<Null>	<Null>	<Null>	<Null>
Bruce Freeman Rail Trail	3	Acton	<Null>	Municipality	Vegetated Filter Strip	with level spreader	<Null>	<Null>	<Null>	<Null>
Bruce Freeman Rail Trail	3	Acton	<Null>	Municipality	Vegetated Filter Strip	with level spreader	<Null>	<Null>	<Null>	<Null>
Bruce Freeman Rail Trail	3	Acton	<Null>	Municipality	Vegetated Filter Strip	with level spreader	<Null>	<Null>	<Null>	<Null>
Bruce Freeman Rail Trail	3	Acton	<Null>	Municipality	Vegetated Filter Strip	with level spreader	<Null>	<Null>	<Null>	<Null>
Bruce Freeman Rail Trail	3	Acton	<Null>	Municipality	Vegetated Filter Strip	with level spreader	<Null>	<Null>	<Null>	<Null>
Bruce Freeman Rail Trail	3	Acton	<Null>	Municipality	Infiltration Swale		<Null>	<Null>	<Null>	<Null>

Maintenance as an Operation: Tracking and Documentation

- ▣ Tracking/Documentation
 - Asset management software vs. Excel spreadsheet
 - ▣ GIS geodatabase to include BMPs with attribute tables to indicate prior maintenance dates with actions performed as well as BMP condition
 - ▣ Maintenance managers across districts to have access to database
 - Scheduling/prioritizing inspection
 - ▣ Performed in accordance with MassDOT SWMP

Maintenance as Regulatory Compliance

- ▣ State Regulatory Program Requirements
 - MassDEP *Massachusetts Stormwater Handbook*
 - ▣ O&M Plan
 - ▣ LTPPP
- ▣ US EPA NPDES MS4 Permit (Minimum Control Measures)
 - Public Involvement
 - Good Housekeeping
 - Post-Construction BMPs
 - IDDE
- ▣ TMDL Requirements



Questions?



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