

***Stormwater Management System***  
***Operation & Maintenance***  
***Manual***

***Babin Landscaping***  
***23-29 Hollis Street***  
***Pepperell, Massachusetts***

*Prepared for*

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## **Forward**

This document is provided to meet the requirement of the Massachusetts Department of Environmental Protection (DEP) Massachusetts Stormwater Standards. Stormwater Report for an Operations and Maintenance Manual. It is the intent of this manual to provide a guide for the regular inspection and maintenance of the stormwater management system.



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## **SECTION 1 BACKGROUND**

### ***1.1 Introduction***

When a site is developed, some of the landscape is changed from pervious surfaces to less pervious or impervious surfaces. These new surfaces have different drainage characteristics as compared to the existing conditions. Since the new areas are not as pervious, less rain and snowmelt can be absorbed into the ground. This results in less groundwater recharge. Water that runs over these new surfaces also moves more quickly to downstream areas. This can cause flooding if the amount of water reaching downstream areas is increased in volume, or if water accumulates in downstream areas more quickly, or both. Additionally, water that is moving faster is likely to cause erosion and siltation of downstream areas. The solution to these problems is to collect and manage stormwater runoff and to attenuate the volume and rate of discharge. By doing this runoff water can be recharged to the groundwater supply, sediments and other pollutants can be trapped, and downstream areas can be protected from increased runoff. Collection of stormwater can be accomplished by a system of swales, catch basins and subsurface drain pipes. Recharge can be accomplished by infiltration facilities, rain gardens, or dry wells. Suspended solids can be removed by various types of basins and channels, constructed wetlands, or filters. Attenuation can be accomplished by providing surface or subsurface storage of the stormwater and releasing the water at a controlled rate. These structural facilities are referred to as best management practices or BMP's.

### ***1.2 Design Basis***

Peak rate attenuation of the drainage system was designed on the basis of 2, 10, 25 and 100-yr. frequency storms in accordance with the USDA Natural Resources Conservation Service Technical Release 20. Stormwater management was further refined using smaller more frequent rainfall events in accordance with the Mass. DEP Stormwater Management Standards. Detailed calculations are available in the Stormwater Report as part of the Site Plan submission package.

### ***1.3 Inspection & Maintenance Responsibility***

Inspection & Maintenance of the drainage system will be the responsibility of the owner of the site.



## **SECTION 2      OPERATION**

### ***2.1    Background***

Drainage systems are designed to operate with minimal outside intervention. Design calculations take into account the smaller more frequent storms as well as the less frequent but larger storms. A wide range of variables are considered with the final specification of pipes, swales, basins and other structures. It must be realized, however, that the design of a drainage system, which is based on engineering calculations and field experience, also includes some approximations and assumptions. This fact, together with local variations in topography, changes within the drainage area, and other factors, may affect the actual operation of the system. Therefore, field adjustments may need to be made in some cases to accommodate these variations.

### ***2.2    Operation of BMP's***

The following paragraphs describe the best management practices (BMP's) used in the drainage system for the Babin Landscaping project as shown on the Site Plan.

#### ***Porous Pavers***

Porous pavers are usually made of stone, pre-cast concrete or bricks that are installed with porous aggregate between the paver units. The base materials are usually porous ungraded stone that provides excellent drainage and temporary storage of stormwater runoff. Sometimes drain pipes are installed within the base material in order to drain off excess water. Porous pavers are usually installed in locations that receive pedestrian traffic or low to moderate vehicular traffic. The function of porous pavers includes:

- Provide a permanent walking or driving surface that is not impermeable
- Collect stormwater and infiltrate it into the ground to recharge the groundwater supply
- Remove suspended solids.

#### ***Catch Basins (CB)***

Catch Basins are usually made of reinforce concrete and are wide enough inside for a person to enter and work. A deep sump is provided to collect sediments and an oil hood is provided to prevent floatable materials from escaping into the subsurface drainage chambers. A removable grate is provided. The function of catch basins include:

- Collect stormwater and route it into the drainage system.
- Collect & store oil, debris and sediment.

#### ***Subsurface Drainage Chambers***

Subsurface storage chambers are structures that are installed under the surface that capture runoff and infiltrate it into the ground. They are typically constructed of plastic, concrete or metal in the

configuration of tanks, pipes or arches and often utilize crushed stone for additional storage capacity and/or for structural support. The function of subsurface structures includes:

- Infiltration of stormwater into the ground to recharge the groundwater supply
- Provide storage of runoff to attenuate peak flows.

### ***Strip Drain (forebay)***

A forebay is a basin constructed to trap sediment. The function of a forebay includes:

- Reduce velocity of entering water
- Allow sediment to fall out of slower moving water
- Provide a location to remove sediment from the drainage system
- Protect leaching area that might otherwise be clogged by sediment.

### ***Leaching Basin***

Leaching basins are usually made of reinforced concrete and are wide enough inside for a person to enter and work. A sump is typically provided to collect sediments. An access cover and a ladder are provided. The function of leaching basins include:

- Collect stormwater and infiltrate it into the ground to recharge the groundwater supply
- Provide a positive outlet for an infiltration basin in case of clogging.

### ***Leaching Area***

A leaching area is a constructed stormwater holding area that allows stormwater to infiltrate into the ground. A leaching area also provides storage of additional water that is expected during periods of high runoff. If the leaching area was completely filled with stormwater the pavement surface above is designed as a detention area that will hold the water until it can infiltrate. An emergency spillway is also provided. The function of an infiltration basin includes:

- Infiltration of stormwater into the ground to recharge the groundwater supply
- Storage of water during periods of high runoff

### ***Emergency Spillway***

An Emergency Spillway is usually constructed of graded crushed stone. The spillway is designed to safely pass the 100-yr rainfall event. The function of an emergency spillway includes:

- Provide an escape for ponded water that rises to the top level of a detention basin due to an extreme rainfall event, back to back large rainfall events, or clogged outlet facilities.

## SECTION 3 INSPECTION & MAINTENANCE

### 3.1 Background

Closed drainage systems in general are designed to be self-cleaning with only a limited amount of regular maintenance being required. So much emphasis is placed on the ability of the system to provide drainage control that it is not realized by most people that the design must also provide for this self-cleaning ability. Catch basin grates are designed to allow as much water as possible to enter the basin without allowing large debris to enter at the same time. Catch basins are typically provided with sumps at the bottom of the basins that collect sand and other heavy debris that gets into the system. Oil hoods are also provided at the basin exit pipes that prevent most oil, and other materials that float to the top, from entering the closed drainage system.

Leaching Areas are designed to store & infiltrate stormwater during runoff events. To keep silt, sand and debris out of the leaching area a forebay must be provided that can easily be cleaned. Where there is additional storage provided above the leaching area a berm is constructed to contain the stored water. A spillway is also provided as an emergency outlet. The berm and spillway must be kept in good condition.

### 3.3 Inspection & Maintenance

The following paragraphs describe measures that must be taken on a frequent basis to insure the drainage system will continue to operate as it was designed. Additional maintenance may also be required after severe storms or prolonged rainfall. A log of inspections and repairs should be kept detailing their frequency and extent.

#### **Porous Pavers**

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><i>Inspection:</i></b>  | Inspect the porous pavers for damage in the spring and fall. Monitor the system and to insure the system is draining properly. Determine if sediment has accumulated. Determine if any of the pavers gave settled or heaved due to freeze-thaw conditions or flooding..                                                                                                                                                                          |
| <b><i>Maintenance:</i></b> | Sanding and salting of pavers should be avoided. Light occasional sanding with the originally specified spacing aggregate is permissible. If any sediment has accumulated remove it by mechanical means or by vacuuming. Sweep or vacuum the pavement quarterly. Vacuuming is the preferred method. Refill the spaces between the pavers with the same aggregate as originally specified.. Repair and misplaced pavers by removal and resetting. |

#### **Catch Basins**

|                           |                                                                                                                                                                                |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><i>Inspection:</i></b> | Inspect the basins once per year. Determine the level of silt & debris that has accumulated in the sumps by visual inspection. Inspect frames, covers and concrete for damage. |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                            |                                                                                                                                                                                     |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><i>Maintenance:</i></b> | Clean out the silt and debris by mechanical means. Dispose of the sediment & debris according to local regulations. Repair or replace any structural components that may be damaged |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**CAUTION.** Entry of confined spaces such as manholes, catch basins, leaching basins, and drainage lines may be hazardous. Gases such as carbon monoxide may accumulate in these areas. Breathing these gases may cause temporary disorientation or permanent health problems. Accumulated water levels in sumps may be higher than expected. Flash rainstorms may result in rapidly rising water levels. Mud levels in sumps may be higher than expected. Manhole and catch basin covers are extremely heavy and awkward.

Only qualified and experience persons should enter confined spaces. Persons entering these systems must have proper equipment, including safety lines as required. Persons entering these systems must be assisted by at least one other qualified and experienced person at the surface.

### ***Subsurface Drainage Chambers***

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><i>Inspection:</i></b>  | Inspect the subsurface storage chambers in the spring and fall and after heavy rainfall.                                                                                                                                                                                                                                                                                                                                       |
| <b><i>Maintenance:</i></b> | Clean out the silt by mechanical means (clean-out ports are provided). Dispose of the sediment & debris according to local regulations. Repair or replace any structural components that may be damaged. Since additional pre-treatment is provided it is not expected that siltation will be a common occurrence. If siltation is observed carefully check the pre-treatment facilities for adequacy and/or signs of failure. |

### ***Strip Drain (Forebay)***

|                            |                                                                                                                                                                                       |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><i>Inspection:</i></b>  | Inspect the strip drain for damage in the spring and fall and after heavy rainfall. Determine the depth of sediment that has accumulated.                                             |
| <b><i>Maintenance:</i></b> | If more than 4 inches of sediment has accumulated remove it by mechanical means. Dispose of the sediment according to local regulations. Repair any damage to the structure or grate. |

### ***Leaching Basins***

|                           |                                                                                                                                                                            |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><i>Inspection:</i></b> | Inspect the leaching basins in the spring and fall. Determine if debris is accumulating in the basin by visual inspection. Inspect frames, covers and concrete for damage. |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                            |                                                                                                                                                                                                                           |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><i>Maintenance:</i></b> | If there is an accumulation of debris within the basin clean out the debris by mechanical means. Dispose of the debris according to local regulations.<br>Repair or replace any structural components that may be damaged |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### ***Leaching Area***

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><i>Inspection:</i></b>  | Inspect the leaching area surface for damage in the spring and fall and after heavy rainfall.. Make note of any obvious settling of ground surfaces. During the first year monitor the drawdown time of the leaching area to determine if the 72 hr. maximum time limit has been met..                                                                                                                                                                                                                                                                                                                |
| <b><i>Maintenance:</i></b> | The leaching area and detention are above should be protected from sediment accumulation by the forebay. If any sediment has accumulated remove it by mechanical means. Dispose of the sediment according to local regulations. Repair any damage to surrounding grassed areas by loaming and seeding or adding sod. If loam & seed are used cover the patch with straw mulch until the vegetation has been established. Make similar repairs to the berm area by first adding enough soil to re-establish the original grades. Remove woody vegetation from the berm to prevent structural weakness. |

### ***Emergency Spillways***

|                            |                                                                                                                                                                                                                                                                     |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><i>Inspection:</i></b>  | Inspect the emergency spillway in the spring and fall and after heavy rainfall                                                                                                                                                                                      |
| <b><i>Maintenance:</i></b> | Repair any damage by repositioning stones that are displaced. Add stones if required. If excessive or unusual damage is observed add a larger and heavier sized stone to increase the effectiveness. Weed the swale to prevent an excessive build-up of vegetation. |

### ***Inspection & Maintenance Schedule***

| BMP's             | Inspection & Maintenance Frequency |      |        |                |
|-------------------|------------------------------------|------|--------|----------------|
|                   | Spring                             | Fall | Winter | Heavy Rainfall |
| Drairage Chambers | X                                  | X    |        |                |
| Porous Pavers     | X                                  | X    |        | X              |
| Leaching Basins   | X                                  | X    |        | X              |
| Leaching Area     | X                                  | X    |        | X              |
| Strip Drain       | X                                  | X    |        | X              |
| Spillway & Berm   | X                                  | X    |        | X              |

### ***Inspection & Maintenance Budget***

|                                                                                                             |  |  | Cost (\$) |        |      |                   |                         | Yaerly     |
|-------------------------------------------------------------------------------------------------------------|--|--|-----------|--------|------|-------------------|-------------------------|------------|
| Task                                                                                                        |  |  | Spring    | Summer | Fall | Winter            | Occasional <sup>1</sup> | Total (\$) |
| Inspection & Documentation                                                                                  |  |  | 125       |        | 125  |                   | 125                     | 250        |
|                                                                                                             |  |  |           |        |      |                   |                         |            |
| Maintenance & Repair                                                                                        |  |  |           |        |      |                   |                         |            |
| Cleaning & Flushing                                                                                         |  |  | 25        | 25     | 25   |                   |                         | 75         |
| Loam, Seed, Mulch                                                                                           |  |  |           |        |      |                   | 150                     |            |
| Mowing & Weeding                                                                                            |  |  | 25        | 25     | 25   |                   |                         | 75         |
| Structural                                                                                                  |  |  |           |        |      |                   | 150                     |            |
|                                                                                                             |  |  |           |        |      | Average Cost (\$) |                         | 400        |
|                                                                                                             |  |  |           |        |      |                   |                         |            |
| <sup>1</sup> . Yearly average includes inspections after heavy rainstorms and Infrequent structural repairs |  |  |           |        |      |                   |                         |            |

## APPENDICES

NOTE: Make additional copies of the original logs found in the Appendix and maintain all logs for at least 3 years



Project: Babin Landscaping; 23-29 Hollis St.; Pepperell MA.

[illegible]



## Appendix B: Maintenance Log

Project: Babin Landscaping; 23-29 Hollis St.; Pepperell MA.

Maintenance by: \_\_\_\_\_

[illegible]



## **Appendix C: Plans**

Refer to the approved Site Plan as well as other approval documents for the site development.