10 Main Street, Lakeville, MA 02347 | T (508) 923-1010 | F (508) 923-6309
allenmajor.com

ALLEN & MAJOR ASSOCIATES, INC.

April 12, 2022

Bolton Zoning Board of Appeals
c/o Ms. Valerie Oorthuys, Town Planner
Bolton Town Hall
663 Main Street
Bolton, MA 01740

RE: A&M Project # 1670-15

Proposed Comprehensive Permit
648 & 652 Canton Ave.
Response to Peer Review Comments

Dear Ms. Oorthys and Member of the Zoning Board of Appeals:

On behalf of our Client, WP East Acquisitions, LLC, Allen & Major Associates Inc. (A&M) would like to provide responses, summarized below as related to peer review memos prepared by Janet Carter Bernardo PE, Associate Principal and Amy M. Ball, Senior Ecologist of Horsley Witten Group Inc. dated February 4, 2022 and Jeffrey S. Dirk, PE of Vanasse & Associates, Inc. dated February 9, 2022.

The responses to the comments are shown below in **bold** preceded by the original comment shown in *italics*.

Revisions to the site plans reflecting these comments are identified as part of Revision 1 dated April 12, 2022.

Horsley Witten Group, Inc.

Wetland Resources:

Comment 1: *HW recommends that the Applicant clarify the jurisdictional status of the two interior wetland areas.*

Response 1: **The applicant has filed an Abbreviated Notice of Resource Area Delineation (ANRAD) with the Bolton Conservation Commission. The ANRAD requests the Commission render a finding as to the classification of the interior pocketed areas depicted as Series 'B' and 'C' on the application drawings. Through historical evidence in conjunction with the property owner and Goddard Consulting LLC., it is the team's opinion that these areas do not fall under the protection of the local wetlands bylaw or the Wetlands Protection Act. Each area was created to receive developed runoff during initial construction of the Bolton Office Park. The process with the Commission is ongoing. The findings of the ANRAD will be reflected in the required Notice of Intent for the project. The applicant would request that any approval of the Comprehensive Permit by accompanied by a condition requiring Conservation Commission approval. Should the site development drawings change as part of the Commission's process, the applicant would return to the Zoning Board of Appeals for an insubstantial change determination and permit modification request as required by the Permit program.**

Resource Area Alterations:

Comment 2: *HW recommends that the Applicant clarify the amount of wetland resource area fill and the jurisdictional status of the wetland resource areas.*

Alterations are also proposed within the locally regulated 25-foot buffer zone in three locations:

a) Grading associated with the installation of Subsurface Infiltration System #1 located south of Building 4;

b) Grading associated with the installation of Subsurface Infiltration System #2 located east of Garage C; and

c) Grading associated with the provision of 2,500 CY of compensatory flood storage.

Response 2: **As noted in Response 1 above, the jurisdictional status of the "resource areas" is being evaluated by the Bolton Conservation Commission and will be reported when completed. It is the intent of the application to fill in non-jurisdictional areas 'B' and 'C' as designated on the site plans.**

As part of the Zoning Board review process, A&M attended a site walk with Ms. Amy Ball of Horsley Witten, and Valerie Oorthuys, Town Planner, as part of the peer review process. During the walk, the potential resource area south of Building 4 was shown to be associated with the existing fire pond that receives direct stormwater runoff from the rear parking lot through sheet flow. As a condition of an Order of Conditions issued to the current landowner, rip-rap spillways have recently been installed that are intended to mitigate erosion that is occurring at the edge of the pavement. These spillways are intended to reinforce the pond's use as stormwater management and would eliminate the 25-foot buffer zone noted in Comment 2a.

As part of the Revision 1 site plan drawings, A&M has eliminated a portion of the slope grading that would have occurred within the 25 foot buffer zone. This has been replaced with a retaining wall located outside of the 25-foot buffer. Where subsurface drainage system 2 is located within 10 feet of the retaining wall, an impermeable liner will be provided to eliminate the possibility of breakout from the drain field. The final wall block construction will be determined as part of the construction drawings for the project.

The Revision 1 site plan drawings continue to reflect an area that will be grading to provide compensatory flood storage volume for the area of construction proposed around Garage C and subsurface infiltration system 2. The foot per foot calculation to meet the performance standards shall be provided within the application for Notice of Intent with the Bolton Conservation Commission. It is A&M's opinion that replication directly adjacent to the wetland resource area will be beneficial to the overall site environs. If the Commission requests the flood storage area to be relocated, it will be assessed at that time. A final set of plans, presuming an Order of Conditions from the Commission, shall be provided to the Zoning Board of Appeals for review and record.

Additional Permitting Considerations:

Comment 3: *HW recommends that the Applicant provide clarifications of the additional wetland permits and/or reviews required at a minimum, when filing the NOI with the Conservation Commission, so that the full extent of resource area alterations is understood by the Town, and we recommend that the Applicant provide copies of all wetland permits to the Town.*

Response 3: **A&M has filed the ANRAD application with the Conservation Commission and anticipates filing of a WPA Form 3 Notice of Intent (NOI) in due course. The NOI will outline the construction of elements within the jurisdictional areas, including a Riverfront Alternatives Analysis, as is required for this project. Bordering Vegetated Wetlands, Riverfront, and Bordering Land Subject to Flooding are anticipated.**

Should "wetland" areas 'B' and 'C' be determined jurisdictional, the applicant will file a WW 10/11 Major/Minor Fill application through MassDEP. This is a state action permit that will be sought wholly through MassDEP with copies to the Bolton Conservation Commission.

A filing with the Army Corps. of Engineers shall also be made dependent on the outcome of the ANRAD process.

Waiver Requests:

Comment 4: *However, at this time, given the extent of alterations within the 25-foot buffer and within just 2-3 feet of the BVW, and in the southernmost area, an outfall is proposed at the wetland boundary, HW recommends that the ZBA consider holding the local bylaw provisions for protection of local wetland areas (to be filled) as well as the 25-foot buffer.*

Response 4: **HW's opinion is noted. The revisions made to the buffer encroachment adjacent to Garage C and Subsurface Infiltration System 2 have been eliminated. The waiver request has not been rescinded pending outcome of the ANRAD process with the Conservation Commission.**

Stormwater Review:

Comment 1: ***Standard 1*** *states that no new stormwater conveyances may discharge untreated stormwater directly to or cause erosion in wetlands of the Commonwealth.*

a) The project includes two new outfalls for each subsurface infiltration system, which will discharge treated stormwater at stabilized outlets protected by riprap energy dissipators as detailed on Sheet C-503. The outlets for Subsurface Infiltration System 1 discharge treated stormwater to the south, into the BVW at the rear of the site. The outlets for Subsurface Infiltration System 2 discharge treated stormwater to the east toward Great Brook and the adjacent BVW. HW notes that the riprap energy dissipators do not appear to be drawn to scale on the Grading & Drainage Plans and recommends that the Applicant revise them for consistency with the detail on Sheet C-503.

b) It does appear that both systems are discharging within feet of the edge of the adjacent,

BVWs. HW recommends that if feasible the Applicant pull back the outfalls to respect the local 25-foot buffer zone. It is not clear why the Applicant has chosen to create a parking lot on the east side of the site within an existing grassed area so close to the wetland and in turn remove an existing parking lot that is further from the wetland.

c) *HW further recommends that the Applicant limit the area of disturbance on the south side of the project area to the edge of the existing parking lot.*

d) *The existing outfall location at the northern BVW at the front of the site will be maintained, which will receive runoff from the portion of the site being considered "redevelopment" as it relates to the MSH. The first 150 feet ± of the existing access drive will be preserved, including the drainage infrastructure which captures and conveys runoff to the northern BVW. Further discussion of the redevelopment aspects can be found under Standard 7.*

Response 1: **a) A&M has revised the rip-rap dissipater pads to be at the correct scaled length on the Revision 1 drawings.**

b) The selection of the parking lot is driven by the proximity to the proposed drinking water well in the southeast corner of the site. The well, by MassDEP standards, will require a Zone 1 radius of 312 feet. Per the standards to minimize pollutant introduction, no vehicular parking is allowed within the Zone 1 radius. Under this standard, the existing parking lot is being reclaimed and the new easterly lot constructed. The area of the easterly lot is currently cleared and has been previously disturbed. It is A&M's opinion that the construction can be accomplished without any degradation to the adjacent resource areas.

c) The work adjacent to the southern fire pond remains as originally shown save for modifications to the rip-rap dissipater pads. The entirety of the parking field currently sheet flows toward the rear fire pond. It is A&M's opinion that the development shown on the project plans can be constructed without any degradation of the areas that currently exist, noting that the Conservation Commission has approved work outside of the pavement for the installation of the rip-rap dissipater pads noted above.

d) No response required.

Comment 2: ***Standard 2*** *requires that the stormwater management systems be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates.*

a) *The Applicant provided a hydrologic analysis for the 2-year, 10-year, 25-year, and 100- year storm events, under both Existing and Proposed Conditions. The precipitation rates utilized were obtained from the NOAA Atlas 14 database for the Bolton area, which is currently the local industry standard. HW reviewed all components of the hydrologic analysis, which include Existing & Proposed Watershed Plans, Existing & Proposed HydroCAD models, and a Narrative summary of the hydrologic analysis.*

The proposed subsurface infiltration systems were sized appropriately, such that the peak

discharge rates under Proposed Conditions do not exceed those under Existing Conditions for all storm events analyzed. Additionally, the Applicant has documented that total runoff volumes are decreased in the Proposed Condition for all storm events.

b) *There is a minor discrepancy between the total watershed areas reported in the Existing and Proposed models. HW recommends that the Applicant revise the models as necessary to ensure the total areas match.*

c) *The Applicant has chosen to include two separate areas within Subcatchment E-3, both technically are tributary to Great Brook, however one side flows into a large wetland before reaching Great Brook. HW recommends that the Applicant separate these two areas of Subcatchment E-3 and revise the HydroCAD model accordingly.*

d) *The peak discharge rates and volumes are controlled by the use of two outlet control structures for each subsurface infiltration system, which are located within the pavement areas. These outlet control structures discharge treated stormwater to the stabilized outlets described under Standard 1. HW notes that the inside diameter of the outlet control structures is listed as 4 feet on the detail on Sheet C-506, but the plan view appears to depict a larger diameter to accommodate the inlet and outlet pipe connections. HW recommends that the Applicant verify the required diameter of the outlet structures (and any other oversized manholes) and update the plans and/or details accordingly. As noted previously HW recommends that the outfalls be pulled further away from the edge of the adjacent wetlands.*

e) *Due to the large size of the subsurface infiltration systems, the Applicant included pipe manifolds on either end to facilitate even distribution of stormwater during large storm events. The manifold elevation is set approximately 12 inches above the primary inlet to the isolator row, which means that stormwater is forced to first enter the isolator row for treatment and will only enter the manifold pipe when the depth exceeds 12 inches. HW finds this to be an acceptable design but recommends that the Applicant adds text to the inlet manhole call-outs to clarify which pipe is meant to be higher.*

f) *The Applicant provided pipe sizing calculations for both the 25-year and 100-year storm events using the Rational Method, which document that all pipes within the closed drainage system are sized properly. No further action required.*

Response 2: **a) No further response required. However, as a result of some minor changes and HydroCAD routing, the runoff rates and volumes are slightly different than the original submission. This is largely due to the separation of existing watershed E-3 into two (2) sub basins as requested. The updated figures are shown in the table below:**

Design Point #1 – Front Wet Basin/Fire Pond

Design Point 1 Existing vs Proposed peak rate of runoff to Front Wet Basin/Fire Pond

Design Storm	Existing (cfs)	Proposed (cfs)	Difference (cfs)
2-year	11.54	10.44	-1.1 (9.2%)
10-year	23.34	21.10	-2.24 (9.6%)
25-year	31.02	28.04	-2.98 (9.6%)
100-year	42.99	38.87	-4.12 (9.6%)

Design Point 1 Existing vs Proposed runoff volume to Front Wet Basin/Fire Pond

Design Storm	Existing (cf)	Proposed (cf)	Difference (cf)
2-year	41,807	37,793	-4,014 (9.6%)
10-year	83,594	75,567	-8,027 (9.6%)
25-year	111,477	100,773	-10,704 (9.6%)
100-year	155,956	140,981	-14,975 (9.6%)

Design Point #2 – Rear Wet Basin/Fire Pond

Design Point 2 Existing vs Proposed peak rate of runoff to Rear Wet Basin/Fire Pond

Design Storm	Existing (cfs)	Proposed (cfs)	Difference (cfs)
2-year	12.44	3.72	-8.72 (70.1%)
10-year	21.50	9.73	-11.77 (54.7%)
25-year	27.13	17.65	-9.48 (34.9%)
100-year	35.73	35.54	-0.19 (0.5%)

Design Point 2 Existing vs Proposed runoff volume to Rear Wet Basin/Fire Pond

Design Storm	Existing (cf)	Proposed (cf)	Difference (cf)
2-year	40,386	12,533	-27,853 (69.0%)
10-year	71,369	39,266	-32,103 (45.0%)
25-year	91,157	57,855	-33,302 (36.5%)
100-year	122,015	88,202	-33,813 (27.7%)

Design Point #3 – Great Brook

Design Point 3 Existing vs Proposed peak rate of runoff at Great Brook

Design Storm	Existing (cfs)	Proposed (cfs)	Difference (cfs)
2-year	3.50	3.08	-0.42 (12.0%)
10-year	14.28	13.55	-0.73 (5.1%)
25-year	22.88	22.52	-0.36 (1.6%)
100-year	37.38	36.46	-0.92 (2.5%)

Design Point 3 Existing vs Proposed runoff volume at Great Brook

Design Storm	Existing (cf)	Proposed (cf)	Difference (cf)
2-year	19,385	14,115	-5,270 (27.2%)
10-year	59,111	51,535	-7,576 (12.8%)
25-year	91,460	80,342	-11,118 (12.2%)
100-year	147,170	130,327	-16,843 (11.4%)

b) A&M has reviewed the watershed areas and reconciled the pre- and post-development total areas to 25.74 acres coordinated within the HydroCAD and watershed maps as attached.

c) As recommended, A&M has divided watershed area E-3 into two (2) separate sub-basin watersheds (E-3 and E-5) with curve numbers and times of concentrations as appropriate. Both watersheds combine at Design Point 3 for the total runoff from the site. Watershed boundaries were limited to the wetland resource area boundaries with no flow time or volume storage within the wetland areas.

d) The inside diameters for the referenced control structures have been corrected to five-foot diameter on the detail sheets. Additionally, any diameter over 4 foot (standard) has been annotated on the Revision 1 site plans. The outfall pipes have been relocated further away from the resource areas as described above.

Comment 3: ***Standard 3*** *requires that the annual recharge from the post-development site approximate the annual recharge from pre-development conditions based on soil type.*

a) The Applicant provides calculations for the required recharge volume using both the Hydrologic Soil Group (HSG B=0.35") and the MA MS4 General Permit requirement of 1" rainfall over the total post-development impervious area. Based on the 1" rainfall depth over 377,668 square feet (SF) of impervious area, the required recharge volume is 31,472 cubic feet (CF). The Applicant utilized the Simple Dynamic Method for sizing the two subsurface infiltration systems to retain/infiltrate the required recharge volume. HW notes that there are minor discrepancies in the impervious area number used, between the Narrative, the Post-Development HydroCAD model and the Simple Dynamic Method HydroCAD model. These discrepancies should be rectified by the Applicant based on the final impervious area calculations.

HW further notes that the total recharge volume presented in the Simple Dynamic Method calculation is 30,755 CF, which is less than the required 31,472 CF. It is also noted that the Simple Dynamic Method HydroCAD model shows a minor amount of additional storage above the peak elevation and below the low outlets, which effectively adds storage volume to the numbers reported. HW recommends that the Applicant revisit this calculation or provide further explanation of its design methodology.

b) The Applicant included soil testing results in the application package, but the test locations are not depicted on the plans. HW notes that small symbols appear on the grading and drainage plans which appear to indicate the locations of TP-11, 12 & 14, but the corresponding test pit logs were not found in the application package. In accordance with Volume 2, Chapter 2, page 97 of the MSH the Applicant is required to conduct a minimum of two test pits within each infiltration system. HW recommends that the Applicant revisit the soil testing information to ensure that all available test results are adequately documented on the plans and report(s).

c) In accordance with the previous comment, HW is unable to confirm the soil testing information used in the design of the subsurface infiltration systems. However, both systems

are located within a "fill" area, which will likely provide adequate separation to the seasonal high groundwater table. Based on the narrative description, the infiltration rates used seem appropriate, but will need to be confirmed based on HW's review of the additional soil testing information to be submitted by the Applicant.

d) HW recommends that the Applicant modify the construction detail for the subsurface infiltration systems to clearly state which existing soil layers must be removed prior to installation.

Response 3: **a) A&M has re-calculated the total impervious area reflective of the Revision 1 site plans. The total area for the entirety of the site is 377,030 s.f. with 109,161 routed through subsurface infiltration system 1 and 146,643 routed through subsurface infiltration system 2 (proposed sub-watersheds P5A and P5B). The remainder is based on the impervious areas contained within existing watersheds E-1 and E-3.**

A&M has provided a recharge volume equivalent to 1" of runoff over the impervious area which equates to 31,419 c.f. This is a correction over the previous recharge volume as part of the recalculation of watershed areas. The provided recharge volume within sub-surface system 1 is 14,182 c.f. Sub-surface system 2 is 17,313 c.f.. This equates to a total recharge volume available of 31,495 c.f. meeting the required standard. This information is contained within the HydroCAD information.

The revised basin drawdown time is defined as:

$Time_{drawdown}$ = R_v / (K)(bottom area)
where R_v = Required Recharge Volume, ft3
K = Saturated Hydraulic Conductivity (Rawls Table)
Bottom area = Bottom area of recharge structure

Drawdown Calculation

System	R_v	K	Bottom Area	$Time_{drawdown}$
Sub-surface Sys 1	10,868 cf	2.41 in/hr	9,620 sf	5.6 hrs (0.23 day)
Sub-surface Sys 2	7,295 cf	8.27 in/hr	12,059 sf	0.9 hrs (0.04 day)
Note: Volume for drawdown is based on the volume from HydroCAD below the lowest outlet.				

b) A&M has highlighted the soil testing locations on the Revision 1 site plan drawings as well as providing the soil logs on Sheet C-107.

c) See Comment b above. Additionally, attached hereto, A&M has provided the Hantush calculations required for the groundwater mounding analysis as required when a system has less than four feet of separation to the estimated seasonal high groundwater elevation.

The parameters used for the groundwater mounding were:

Subsurface system 1

Recharge Rate:	**1.13 ft/day (10,868 c.f./9,620 s.f.)**
Specific Yield:	**0.2**
Hydraulic Conductivity:	**2.41 in/hr (4.82 ft/day)**
½ length of field:	**100.5 ft**
½ width of field:	**23.9 ft**
Duration of infiltration:	**0.23 days (based on full drawdown of recharge volume)**
Initial saturated thickness:	**10 ft (soil boring data for drilled water reports initial refusal depths at 20 ft. 10 ft was used as a minimum recommended value by MassDEP.**

Calculated mound height is 1.291 feet

Subsurface system 2

Recharge Rate:	**0.60 ft/day (7,295 c.f./12,059 s.f.)**
Specific Yield:	**0.2**
Hydraulic Conductivity:	**8.27 in/hr (16.54 ft/day)**
½ length of field:	**65.0 ft**
½ width of field:	**46.4 ft**
Duration of infiltration:	**0.04 days (based on full drawdown of recharge volume)**
Initial saturated thickness:	**10 ft (soil boring data for drilled water reports initial refusal depths at 20 ft. 10 ft was used as a minimum recommended value by MassDEP.**

Calculated mound height is 0.12 feet.

d) A&M has revised the construction detail to denote remove of organic layers, asphalt, brick and other materials that would be unacceptable for use below the drain fields. The note requires consultation with the engineer prior to installation of the chambers.

Comment 4: ***Standard 4*** *requires that the stormwater system be designed to remove 80% Total Suspended Solids (TSS) and to treat 1-inch of volume from the impervious area for water quality. The drainage system must also provide at least 44% TSS removal for pre-treatment of runoff from paved surfaces prior to entering any infiltration practices.*

a) The Applicant has provided the required water quality calculations to verify compliance with Standard 4 on pages 4-4 through 4-6 of the Project Narrative & Drainage Report. The stormwater treatment train included deep-sump hooded catch basins, proprietary water quality structures (Contech CDS, Cascade, and Stormceptors), and subsurface infiltration systems (Stormtech SC-740 chambers) equipped with isolator rows. HW finds the selected best management practices (BMPs) and associated calculations reasonable and appropriate for the project. No further action required.

b) HW notes that the Applicant has proposed a Contech CDS unit within the parking lot of the adjacent office building property, which treats runoff from the adjacent proposed pavement areas. HW finds this to be a reasonable design approach, but notes that an easement would likely need to be secured for future maintenance of the structure.

The Applicant appears to comply with Standard 4.

Response 4: **a) No response required.**

b) The applicant is currently working with the existing property owner on the development of easements that will be required to construct and manage the project as shown. The easements shall be recorded as part of the transaction for the project.

Comment 5: ***Standard 5*** *relates to projects with a Land Use of Higher Potential Pollutant Loads (LUHPPL).*

a) The Applicant explains that the proposed project is considered a LUHPPL because the parking area is "high intensity" (greater than 1,000 trips per day). As required, the Applicant documents that the stormwater management system was designed using the 1" Water Quality Volume and that proprietary water quality structures will provide greater than 44% pretreatment prior to conveyance to the subsurface infiltration systems. No further action required.

The Applicant appears to comply with standard 5.

Response 5: **a) No response required.**

Comment 6: ***Standard 6*** *relates to projects with stormwater discharging into a critical area, a Zone II or an Interim Wellhead Protection Area of a public water supply. These discharges require the use of the specific source control and pollution prevention measures and the specific structure stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the MSH.*

a) Standard 6 applies because the project development is located adjacent to several Zone I's and within the Interim Wellhead Protection Area. The stormwater treatment train and infiltration practices described previously in this letter are suitable for use in these areas. No further action required.

b) The Applicant states that the existing southerly wet basin/fire pond will be located within a Zone I to the proposed drinking water supply well. As a result, this pond is no longer considered as part of the stormwater management system but will continue to perform its function as a fire pond and receiving water body for the outlets from proposed subsurface infiltration system 1. Based upon the proposed stormwater design, HW finds this to be a reasonable assessment. No further action required.

Response 6: **a) No response required.**

b) No response required.

Comment 7: ***Standard 7*** *relates to projects considered redevelopment. A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice*

requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

a) The proposed development is considered a mix of redevelopment and new development. The main access road and existing driveway to the office building parking lot will generally be preserved, with proposed pavement resurfacing, sidewalks, and landscaping improvements. The redevelopment portion of the project also includes runoff from the proposed clubhouse roof and associated parking lot and amenity space. These flows will be treated by a proposed CDS unit prior to draining toward the front wet basin/fire pond. The overall impervious area draining to the front wet basin/fire pond will be reduced, which satisfies the requirement for the redevelopment classification.

b) HW notes that there are two existing catch basins at the existing driveway entrance off Main Street, with the westerly catch basin flowing through the easterly catch basin prior to discharging toward the existing BVW. The existing discharge pipe is a 12-inch reinforced concrete pipe which runs underneath proposed Leaching Field B. HW recommends that the Applicant review the drainpipe network in this area to confirm that it complies with Title 5, and also whether any drainage improvements could be made to provide additional treatment for this runoff from the high-intensity driveway entrance, prior to discharging into the existing BVW.

Response 7: **a) No response required.**

b) The catch basins have been relocated away from the proposed leaching fields to avoid this conflict.

Comment 8: ***Standard 8*** *requires a plan to control construction related impacts including erosion, sedimentation or other pollutant sources.*

a) The Applicant prepared an Erosion Control Plan (Sheet C-100) and has also included Erosion Control Notes on Sheet C-002 and corresponding details on Sheet C-501. The design calls for "silt fence & tubular barrier" around the limit of work where warranted and shows the location of a stabilized construction entrance and proper protection for the existing catch basins on site. These erosion control measures, and associated documentation are consistent with standard engineering practice. The Applicant also notes that the project will require the preparation of a Stormwater Pollution Prevention Plan (SWPPP) prior to construction, which is a requirement of the EPA National Pollutant Discharge Elimination System (NPDES) Construction General Permit for construction sites which disturb more than one acre of land. HW recommends that the Town require receipt of the SWPPP a minimum of 14 days prior to land disturbance.

b) HW recommends that the Applicant confirm that the proposed grading and erosion control barrier along the Great Brook corridor can be constructed without disturbing the existing native trees or shrubs. There is a minor adjustment to the treeline in the proposed conditions, but it is unclear what type of vegetation will be affected. HW further recommends that trees

greater than 10-inch diameter within the work area be located on the existing conditions plan, if not already shown, and recommends that the Applicant note any trees that will be removed because of the proposed development. It appears that the Applicant has chosen to protect the trees that are located within the islands of the existing southern parking lot. The parking lot is proposed to be removed and a meadow created with a number of the trees within the parking lot to remain.

c) HW recommends adding construction fence surrounding the infiltration areas during construction to protect from compaction due to heavy equipment.

d) A note on the Sheet C-002 describes basic instructions for dewatering. If the Applicant anticipates dewatering to be required, HW recommends that a detail for dewatering be provided along with proposed locations.

Response 8: **a) HW's recommendation is noted. A SWPPP shall be prepared in advance of construction and provided to the appropriate Town department at least 14 days in advance of land disturbance.**

b) The applicant is unaware of a specific bylaw provision that requires the tagging of trees over a certain diameter in size but would otherwise request a waiver from this level of detail being provided.

c) A&M has included HW's recommendation on the Revision 1 site plan drawings and included notations to install protective fencing around the infiltration systems during construction until they can be protected from compaction of soils.

d) A&M has revised the note regarding dewatering to specifically require the preparation of a plan of action by the contractor inclusive of pertinent details. This plan can be provided to the Town's designated representative for record prior to dewatering activities. While a geotechnical investigation report has been prepared that indicated groundwater conditions, the applicant would like to defer completion of this report until it can be coordinated with the input of the contractor's that shall be required to implement it.

Comment 9: ***Standard 9*** *requires a Long-Term Operation and Maintenance (O&M) Plan be provided.*

The Applicant has provided an Operation & Maintenance Plan for this project, prepared by Allen & Major Associates, Inc. and dated September 10, 2021. HW has the following comments:

a) Under the "Structural Pretreatment BMPs" section, the reference to the various Contech water quality structures does not match the design plans. HW recommends that the Applicant revisit this section to clearly state the different types of structures and ensure that the corresponding manufacturer O&M Plans are included for each structure. References to cast iron hoods and deep sump catch basins should also be removed from this section as appropriate.

b) The "Subsurface Structures" section should be modified to include provisions for inspecting

the systems at certain intervals following large rain events to ensure they are properly draining. HW notes that a detail is included for inspection ports, but their locations are not identified on the plan view. HW recommends that the Applicant identify the proposed inspection port locations on the plans, which are preferably located in drive aisles rather than parking spaces to facilitate access. A note should also be added for the inspection of outlet control structures on an annual basis.

c) *The Applicant included plan sheet O&M 1 entitled "Operation & Maintenance Plan" which depicts the key elements of the stormwater management system for reference during long term maintenance activities. HW recommends that all water quality structure labels are updated to call out the specific Contech products being used, since each has individual O&M requirements. It may also be appropriate to coordinate further with Contech to see if future maintenance could be simplified by reducing the number of different Contech products being used in the design.*

d) *Sheet O&M 1 should be updated to call out the inlet and outlet locations for both of the existing wet basins/fire ponds, so that they can be regularly inspected for signs of erosion or blockage. Even though the rear wet basin is no longer considered part of the project's drainage system, it is still important that it is inspected regularly.*

Response 9: **a) The Contech devices have been revised in the O&M report narrative as recommended. A&M has elected to leave the deep sump catch basins in the report as they are included as pre-treatment devices in Volume 2 Chapter 2 of the MassDEP stormwater regulations.**

b) Details regarding system inspections have been added to the O&M report as recommended. Inspection ports have been located within each subsurface infiltration field. A note regarding inspection of the outlet control structures annually has also been added.

c) The specific Contech information labels have been added to the Revision 1 site plans as recommended. A&M has not endeavored to coordinate specific models with the manufacturer at this time, but can solicit this information prior to construction to simplify inspection and maintenance.

d) The inlet, outlet, and weirs for the existing fire ponds have been added to the site plans as recommended.

Comment 10: ***Standard 10*** *requires an Illicit Discharge Compliance Statement be provided.*

a) *To comply with Standard 10 the Applicant states that an Illicit Discharge Compliance Statement will be provided to the Town prior to the discharge of stormwater to the post-construction stormwater BMPs and prior to the issuance of a Certificate of Compliance. The Town may choose to require receipt of this statement as a condition of approval.*

Response 10: **Noted. The applicant is amenable to the proposed condition.**

General Technical Review:

Comment 11: Water Comments:

a) The proposed development will be serviced by a combination of new and existing private wells on the subject property. Due to the intensity of use, this is considered a Public Water System (PWS), and the Applicant states that all permitting will be done through MassDEP in accordance with 310 CMR 22 and MassDEP's Guidelines for Public Water Systems. A waiver has been requested from local permitting through the Bolton Board of Health. HW has no opposition to this waiver request, but defers to the appropriate Town of Bolton staff, Boards and Commissions.

b) b) The Public Water System wells generate a Zone I radius of protection and an Interim Wellhead Protection Area (IWPA), which are both dependent on the approved yield/volume of each well. The Zone I radii for the existing and proposed well(s) are depicted on the Site Development Plans. The Applicant states that the proposed well is only shown conceptually and that final layout is subject to MassDEP approvals. The Applicant further states that the drilling and installation of all private wells will be coordinated with the Bolton Conservation Commission and Board of Health.

c) The design of the Public Water System is being performed by Onsite Engineering, Inc. and a design summary memo can be found in Appendix C of the Project Narrative which provides details about the existing and proposed wells along with a description of water treatment, distribution and fire protection.

Response 11: a) Noted. No additional response required.

b) Noted. The drilling of the wells has been coordinated with the Bolton Conservation Commission. Further work (extension of piping, storage, etc.) will be subject to inclusion under the Notice of Intent application. The final details of the Public Water Supply are subject to MassDEP review.

c) As noted by the Board of Health Assistant to the ZBA, both the proposed public water supply and private onsite wastewater treatment facility are permitted at the State level only. The Town of Bolton has local regulations that govern 1) private water supply wells, 2) groundwater protection, which specifically exclude subsurface sewage disposal system discharges, and 3) supplemental regulations to 310 CMR 15.000 (Title 5) for subsurface sewage disposals systems that have a calculated design flow less than 10,000 gallons per day (gpd).

As the development of public groundwater sources in Massachusetts is governed by the Massachusetts Drinking Water Regulations (310 CMR 22.21) and the approval of onsite sewage disposal for sites that generate greater than 10,000 gpd are governed by the Massachusetts Groundwater Discharge Permit Program (314 CMR 5.00), neither of these State regulations are supplemented by local bylaws and/or regulations.

Based on the email issued from the Board of Health Assistant, this position was affirmed by the Board of Health at their October 26, 2021 meeting where this project was discussed relative to the planned public water supply and Groundwater Discharge Permit. Specifically, the Board indicated that only State level jurisdiction was applicable to this project since it was a public water supply and that Title 5 was not applicable (specifically because the site is larger than 10,000 gpd and therefore 310 CMR 15.000 does not apply). The email issued is attached to this memorandum for reference.

Further, it is important to note that the level of active treatment and processing of sewage generated at the site necessary to meet a State issued standard Groundwater Discharge Permit far exceeds the standards noted in both Title 5 and the Town's local bylaw for septic system disposal. The components of active treatment (and regular operator oversight) ensures that the actual discharge meets or exceeds Groundwater Quality Standards at the point of discharge.

Based on this information, in response to the peer review comments to the ZBA, since there are no local regulations that are applicable to the planned public water supply and private wastewater treatment facility, waivers to local bylaws/regulations and/or permitting at the local level for these aspects of the project are not required and therefore, are not subject to waiver request approvals by the ZBA as part of the Comprehensive Permit Process. Given this, it is customary that comprehensive permits of this nature are written such that the local ZBA approval is only contingent ant securing all necessary State approvals for public water supply and a Groundwater Discharge Permit.

Comment 12: Wastewater Disposal Comments:

a) *The project will include a new on-site wastewater treatment and disposal system to serve both the proposed residential development and the modified office building. The Applicant states that the system will be designed by Onsite Engineering, Inc. in accordance with MassDEP Guidelines for the Design, Construction, Operation and Maintenance of Small Treatment Facilities with Land Disposal, revised July 2018, and that it is subject to a MassDEP Groundwater Discharge Permit subsequent to a hydrogeological evaluation approval process.*

b) *The design flow for the proposed residential development is 43,440 gallons per day (GPD) based on 394 total bedrooms (at 110 GPD/bedroom) along with a 100 GPD allowance for the leasing office space. Since the clubhouse and amenity space are restricted to only residents and their guests, there are no additional flows associated with those elements, as per MassDEP advisory opinions. HW agrees with this preliminary design flow calculation.*

c) *The design flow for the modified office building is 4,688 GPD, which is based on a total floor area of 62,500 SF. Since the office building modifications will be carried out by others under a separate application, HW notes that the actual design flows may vary based on the final architectural plans.*

d) HW recommends that the existing leaching facility location be called out on the Existing Conditions Plans, and that the existing office building sewer service is depicted on the Utility Plans with connection to the proposed sewer.

e) HW recommends that the proposed sewer manhole annotation is changed on the Utility Plans from PDMH to PSMH and that the Utility Legend is depicted on all Utility Plans.

f) An existing drainpipe near the driveway entrance flows under the proposed leach field toward the wet basin/fire pond. HW notes that this pipe and other elements of the drainage system may need to be modified to comply with Title 5 requirements.

Response 12: a) Noted. See Response 11c above.

b) No response required.

c) Noted. The final square footage and wastewater flow will be determined prior to discharge based on the Bolton Office Park's building configuration.

d) The existing conditions plan has been revised to include the approximate location of the Bolton Office Park leaching field on the westerly sideline of the driveway entrance.

e) The sewer manhole labels have been revised on the Revision 1 site plan drawings.

f) The existing drain pipe is proposed to be relocated as shown on the Revision 1 site plan drawings.

Comment 13: Additional Comments:

a) There is a small dog park proposed to service the apartment buildings, which is shown to the west of Building 3. HW recommends that the Applicant confirm that the dog park size and shape shown are appropriate for the project, and that additional information is added, such as the surface materials, fence specifications, park amenities, drainage and means of disposal for both dog waste and regular trash/recycling. HW notes that the dog park is located outside of the Zone I boundary and outside of any jurisdictional areas under the Wetlands Protection Act, but it is within the Interim Wellhead Protection Area associated with the existing wells on the subject property.

b) HW recommends that the flow direction of Great Brook is added to the Site Development Plans.

c) A proposed maintenance gate for the existing well area is shown on the Site Development Plans, but the access drive linework appears to be missing. HW also advises the Applicant to consider whether any dedicated access is required for the new well location.

d) There is a large ledge outcrop located within and to the north of proposed Building 1 which will need to be entirely removed to accommodate the project, including subsurface elements such as the foundation and utilities. HW recommends that the Applicant provides a preliminary description of the proposed ledge removal method(s) being considered for the

project, for review by applicable Town staff, Boards and Commissions.

Response 13: a) It is the applicant's opinion that the dog park is sufficiently sized for a project of this nature given their experience in prior developments. During final design, the dog park fencing, waste receptacles, waste bags, water stations, etc. shall be determined. These can be provided for record to the Commission. At present, it is anticipated that the surface treatment of the dog park shall be six inches of mulch.

b) Flow arrows of Great Brook have been added to the Revision 1 site design plans as requested.

c) The access path was inadvertently omitted from the prior plans. It is shown on the Revision 1 site plan drawings.

d) Based on observations from the test pit program and our observations of the rock outcrops, site bedrock is considered very hard and may be difficult, if not impossible, to remove efficiently using mechanical means and conventional excavation equipment. Thus, it is anticipated that rock removal will require either localized hoe-ramming, breaking by fracturing and splitting with non-explosive means, or controlled blasting. Where the depth of bedrock removal is limited to a few feet, the use of a hoe ram may be appropriate. However, where the depth of bedrock removal is more significant, a combination of hoe ramming and controlled blasting methods may be needed. If blasting is required, it shall adhere to all applicable local and State regulations.

Comment 14: Waiver Requests:

a) Applications for a Comprehensive Permit through the Zoning Board of Appeals requires an Applicant to comply with all local codes, ordinances, Bylaws or regulations unless an exemption or variance is formally requested in the application or modification to the application. As described in detail in Section 5.1 of the Project Narrative & Drainage Report, the Applicant is requesting waivers from the following local Bylaws, rules and regulations:

- *Town of Bolton Bylaws (Zoning & Wetlands)*
- *Planning Board Rules & Regulations*
- *Conservation Commission Rules & Regulations*
- *Rules & Regulations of the Board of Health*

b) b) HW defers to the Bolton ZBA on the granting of these waivers, but notes that the proposed development project is still required to comply with all applicable regulations, permits and policies of the Commonwealth of Massachusetts. These include, but are not limited to, the Massachusetts Stormwater Handbook, the Wetlands Protection Act/Regulations, Title 5 of the State Environmental Code, MassDEP Guidelines for the Design, Construction, Operation and Maintenance of Small Treatment Facilities with Land Disposal, MassDEP Groundwater Discharge Permit, and MassDEP's Guidelines for Public Water Systems. As noted above HW recommends that the Applicant respect the local 25-foot no disturb zone to the adjacent BVWs surrounding the project site.

Response 14: a) No response required.

b) HW's recommendation is noted. The Revision 1 site plan drawings have removed the encroachment into the 25' buffer adjacent to Great Brook as suggested. The work within adjacency to the rear fire pond remains under the anticipation that these areas shall be determined to be stormwater management and not subject to the Bolton wetlands bylaw.

Vanasse & Associates, Inc.

Site Plans:

Comment S1: A vehicle turning analysis should be provided using the AutoTurn© software for service and delivery vehicles (SU-30 or SU-40 design vehicle). The turning analysis should depict all maneuvers required to enter and exit the Project site, loading areas and the locations for trash/recycling, and should demonstrate that the subject vehicles can access the Project site and circulate in an unimpeded manner.

Response S1: The service vehicle autoturn plan has been added as sheet C-602 to the Revision 1 site plan drawings.

Comment S2: A narrative should be provided that describes how tenant moves and trash/recycling pick-up will be accommodated/managed. The narrative should be consistent with and inform the vehicle turning analysis.

Response S2: The applicant provides on-site property managers that are involved in the scheduling of move-ins and large deliveries. Designated areas have been added to the site that will be cordoned off during scheduled periods.

Comment S3: "Keep Right" signs should be installed in the leading edge (nose) of the median of the Bolton Office Park driveway facing Route 117 and for motorists exiting the Project site.

Response S3: A "Keep Right" sign has been added as recommended.

Comment S4: "Only" pavement markings should be installed to accompany the turn arrows in the lane approaching Route 117 and a lane use regulatory sign should be installed prior to the entrance to the turn lanes.

Response S4: Pavement markings have been added as recommended.

Comment S5: STOP-signs and STOP-lines should be added for the drive aisles that intersect the main drive from Route 117.

Response S5: Stop signs and lines have been added at the recommended locations.

Comment S6: "One-Way" and "Do Not Enter" signs should be installed to regulate the flow of traffic where one-way traffic is to be conveyed (mail center and between Building 1 and Building 4).

Response S6: "One-Way" and "Do Not Enter" signs are located at the entry and exit of the one way movement between Buildings 1 and 4.

Comment S7: Pedestrian crossing warning signs should be installed at the crossings at the mail center and between Building 1 and Building 3.

Response S7: Pedestrian crossing signs have been added as recommended at the crosswalk locations noted.

Comment S8: The sight triangle areas for the Bolton Office Park driveway intersection with Route 117 should be shown along with a note to indicate: "Signs, landscaping and other features located within sight triangle areas shall be designed, installed and maintained so as not to exceed 2.5-feet in height. Snow accumulation (windrows) located within sight triangle areas that exceed 3.5-feet in height or that would otherwise inhibit sight lines shall be promptly removed."

Response S8: The sight triangle designation and note has been added to the site plan. The triangles were evaluated by TEC and are contained within the Traffic Impact and Assessment Study.

Comment S9: Consideration should be given to installing electric vehicle (EV) charging stations.

Response S9: The applicant has designated 2 charging stations (4 vehicles) at each building. Additionally, infrastructure will be installed for a future installation of 2 additional stations (4 additional vehicles) at each building. These locations are designated on the site layout plan.

Comment S10: Bicycle racks should be provided at the clubhouse and at appropriate locations proximate to each residential building. Interior, weather protected bicycle parking should also be provided within each building.

Response S10: Bicycle storage has been provided within the onsite garages for resident use.

A&M believes these responses will provide sufficient information for the final review of this application.

If you require any additional information, please feel free to contact me.

Very truly yours,

ALLEN & MAJOR ASSOCIATES, INC.

Philip Cordeiro, P.E.
Branch Manager
pcordeiro@allenmajor.com

cc: WP East Acquisitions, LLC
J. Bernardo, P.E., Horsely Witten Group
File

Enclosure: Revision 1 Site Development Drawings dated April 12, 2022

HANTUSH GROUNDWATER MOUNDING SPREADSHEETS

SUBSURFACE INFILTRATION SYSTEM 1

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days **or** inches & hours)

Input Values		
1.1300	*R*	**Recharge (infiltration) rate (feet/day)**
0.200	Sy	**Specific yield, Sy (dimensionless, between 0 and 1)**
4.82	K	**Horizontal hydraulic conductivity, Kh (feet/day)***
100.500	x	**1/2 length of basin (x direction, in feet)**
23.900	y	**1/2 width of basin (y direction, in feet)**
0.230	t	**duration of infiltration period (days)**
10.000	hi(0)	**initial thickness of saturated zone (feet)**

Conversion Table

inch/hour	feet/day
0.67	1.33
2.00	4.00

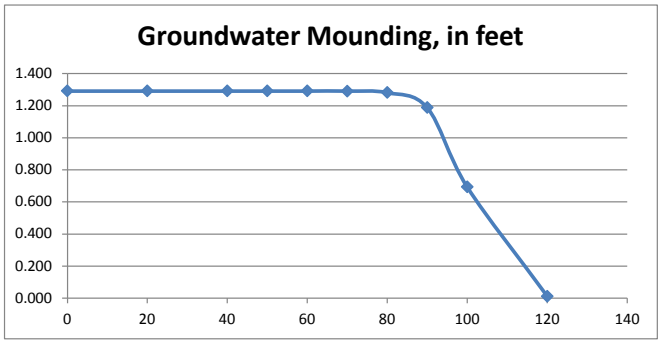
hours	days
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

11.291	h(max)	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
1.291	Δh(max)	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
1.291	0
1.291	20
1.291	40
1.291	50
1.291	60
1.291	70
1.281	80
1.188	90
0.693	100
0.012	120

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

SUBSURFACE INFILTRATION SYSTEM 2

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days **or** inches & hours)

Input Values		
0.6000	*R*	**Recharge (infiltration) rate (feet/day)**
0.200	Sy	**Specific yield, Sy (dimensionless, between 0 and 1)**
16.54	K	**Horizontal hydraulic conductivity, Kh (feet/day)***
65.000	x	**1/2 length of basin (x direction, in feet)**
46.400	y	**1/2 width of basin (y direction, in feet)**
0.040	t	**duration of infiltration period (days)**
10.000	hi(0)	**initial thickness of saturated zone (feet)**

Conversion Table

inch/hour	feet/day
0.67	1.33
2.00	4.00

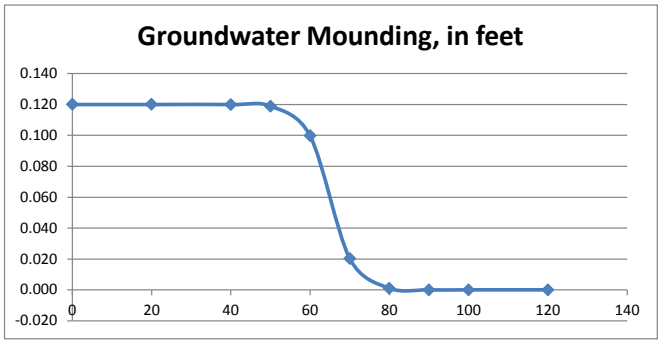
hours	days
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

10.120	h(max)	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
0.120	Δh(max)	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
0.120	0
0.120	20
0.120	40
0.119	50
0.100	60
0.020	70
0.001	80
0.000	90
0.000	100
0.000	120

Re-Calculate Now

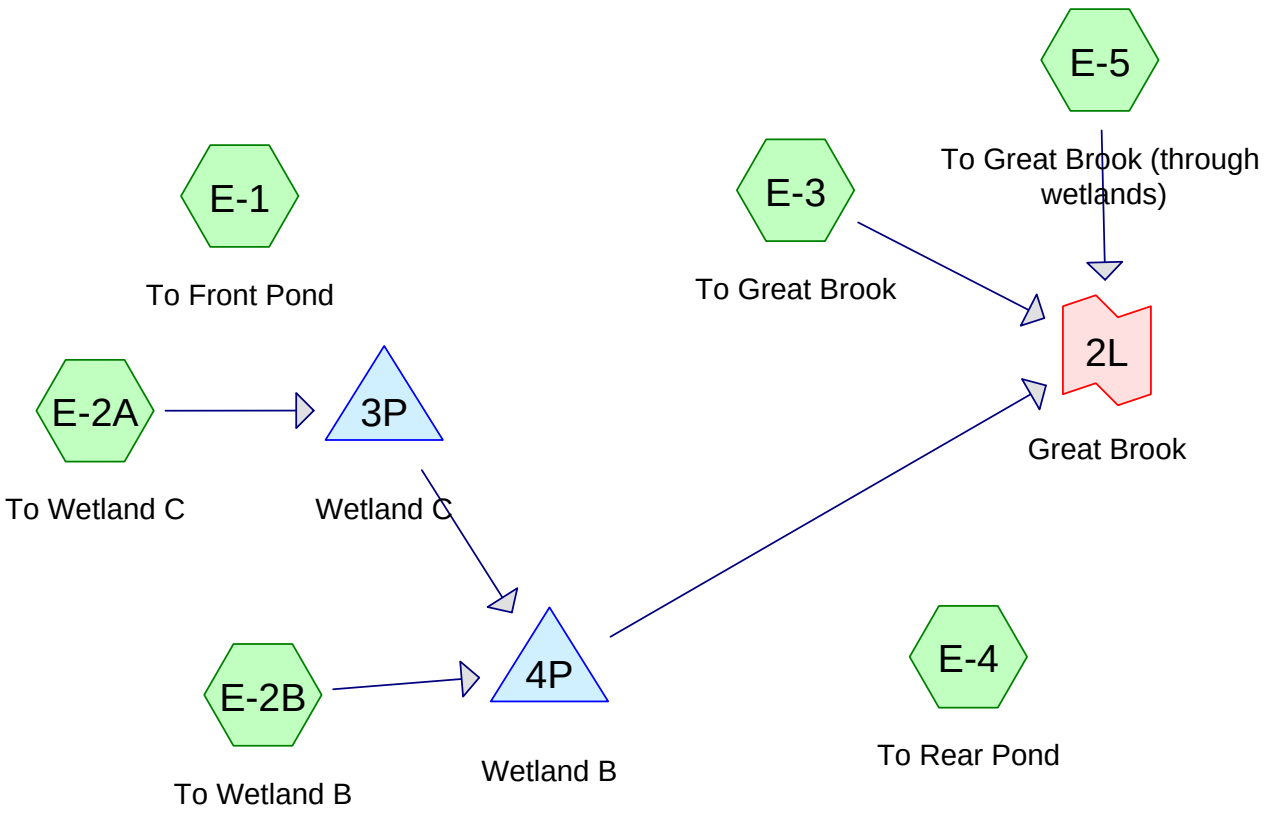


Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

APPENDIX G
HydroCAD

PRE-DEVELOPMENT



Subcat Reach Pond Link

Routing Diagram for 1670-15 Existing HydroCAD
Prepared by Microsoft, Printed 4/13/2022

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: To Front Pond Runoff Area=345,377 sf 53.30% Impervious Runoff Depth>1.45"
Flow Length=405' Tc=10.4 min CN=80 Runoff=11.54 cfs 41,807 cf

Subcatchment E-2A: To Wetland C Runoff Area=63,246 sf 6.89% Impervious Runoff Depth>0.51"
Flow Length=314' Tc=7.8 min UI Adjusted CN=62 Runoff=0.56 cfs 2,687 cf

Subcatchment E-2B: To Wetland B Runoff Area=62,941 sf 6.46% Impervious Runoff Depth>0.51"
Flow Length=203' Tc=5.7 min UI Adjusted CN=62 Runoff=0.61 cfs 2,676 cf

Subcatchment E-3: To Great Brook Runoff Area=202,379 sf 3.81% Impervious Runoff Depth>0.51"
Flow Length=353' Tc=8.6 min UI Adjusted CN=62 Runoff=1.74 cfs 8,596 cf

Subcatchment E-4: To Rear Pond Runoff Area=226,166 sf 78.70% Impervious Runoff Depth>2.14"
Flow Length=219' Tc=7.2 min CN=89 Runoff=12.44 cfs 40,386 cf

Subcatchment E-5: To Great Brook Runoff Area=221,230 sf 0.00% Impervious Runoff Depth>0.47"
Flow Length=353' Tc=5.0 min CN=61 Runoff=1.91 cfs 8,703 cf

Pond 3P: Wetland C Peak Elev=344.67' Storage=2,687 cf Inflow=0.56 cfs 2,687 cf
Outflow=0.00 cfs 0 cf

Pond 4P: Wetland B Peak Elev=344.75' Storage=823 cf Inflow=0.61 cfs 2,676 cf
18.0" Round Culvert n=0.013 L=107.0' S=0.0169 '/' Outflow=0.11 cfs 2,086 cf

Link 2L: Great Brook Inflow=3.50 cfs 19,385 cf
Primary=3.50 cfs 19,385 cf

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: To Front Pond Runoff Area=345,377 sf 53.30% Impervious Runoff Depth>2.90"
Flow Length=405' Tc=10.4 min CN=80 Runoff=23.34 cfs 83,594 cf

Subcatchment E-2A: To Wetland C Runoff Area=63,246 sf 6.89% Impervious Runoff Depth>1.45"
Flow Length=314' Tc=7.8 min UI Adjusted CN=62 Runoff=2.14 cfs 7,630 cf

Subcatchment E-2B: To Wetland B Runoff Area=62,941 sf 6.46% Impervious Runoff Depth>1.45"
Flow Length=203' Tc=5.7 min UI Adjusted CN=62 Runoff=2.29 cfs 7,598 cf

Subcatchment E-3: To Great Brook Runoff Area=202,379 sf 3.81% Impervious Runoff Depth>1.45"
Flow Length=353' Tc=8.6 min UI Adjusted CN=62 Runoff=6.64 cfs 24,409 cf

Subcatchment E-4: To Rear Pond Runoff Area=226,166 sf 78.70% Impervious Runoff Depth>3.79"
Flow Length=219' Tc=7.2 min CN=89 Runoff=21.50 cfs 71,369 cf

Subcatchment E-5: To Great Brook Runoff Area=221,230 sf 0.00% Impervious Runoff Depth>1.38"
Flow Length=353' Tc=5.0 min CN=61 Runoff=7.77 cfs 25,428 cf

Pond 3P: Wetland C Peak Elev=345.32' Storage=5,239 cf Inflow=2.14 cfs 7,630 cf
Outflow=0.15 cfs 2,440 cf

Pond 4P: Wetland B Peak Elev=345.05' Storage=1,891 cf Inflow=2.29 cfs 10,037 cf
18.0" Round Culvert n=0.013 L=107.0' S=0.0169 '/' Outflow=0.95 cfs 9,274 cf

Link 2L: Great Brook Inflow=14.28 cfs 59,111 cf
Primary=14.28 cfs 59,111 cf

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: To Front Pond Runoff Area=345,377 sf 53.30% Impervious Runoff Depth>3.87"
Flow Length=405' Tc=10.4 min CN=80 Runoff=31.02 cfs 111,477 cf

Subcatchment E-2A: To Wetland C Runoff Area=63,246 sf 6.89% Impervious Runoff Depth>2.16"
Flow Length=314' Tc=7.8 min UI Adjusted CN=62 Runoff=3.33 cfs 11,394 cf

Subcatchment E-2B: To Wetland B Runoff Area=62,941 sf 6.46% Impervious Runoff Depth>2.16"
Flow Length=203' Tc=5.7 min UI Adjusted CN=62 Runoff=3.57 cfs 11,345 cf

Subcatchment E-3: To Great Brook Runoff Area=202,379 sf 3.81% Impervious Runoff Depth>2.16"
Flow Length=353' Tc=8.6 min UI Adjusted CN=62 Runoff=10.36 cfs 36,452 cf

Subcatchment E-4: To Rear Pond Runoff Area=226,166 sf 78.70% Impervious Runoff Depth>4.84"
Flow Length=219' Tc=7.2 min CN=89 Runoff=27.13 cfs 91,157 cf

Subcatchment E-5: To Great Brook Runoff Area=221,230 sf 0.00% Impervious Runoff Depth>2.08"
Flow Length=353' Tc=5.0 min CN=61 Runoff=12.29 cfs 38,290 cf

Pond 3P: Wetland C Peak Elev=345.35' Storage=5,375 cf Inflow=3.33 cfs 11,394 cf
Outflow=0.53 cfs 6,194 cf

Pond 4P: Wetland B Peak Elev=345.21' Storage=2,709 cf Inflow=3.57 cfs 17,539 cf
18.0" Round Culvert n=0.013 L=107.0' S=0.0169 '/' Outflow=1.63 cfs 16,718 cf

Link 2L: Great Brook Inflow=22.88 cfs 91,460 cf
Primary=22.88 cfs 91,460 cf

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: To Front Pond Runoff Area=345,377 sf 53.30% Impervious Runoff Depth>5.42"
Flow Length=405' Tc=10.4 min CN=80 Runoff=42.99 cfs 155,956 cf

Subcatchment E-2A: To Wetland C Runoff Area=63,246 sf 6.89% Impervious Runoff Depth>3.39"
Flow Length=314' Tc=7.8 min UI Adjusted CN=62 Runoff=5.36 cfs 17,860 cf

Subcatchment E-2B: To Wetland B Runoff Area=62,941 sf 6.46% Impervious Runoff Depth>3.39"
Flow Length=203' Tc=5.7 min UI Adjusted CN=62 Runoff=5.75 cfs 17,783 cf

Subcatchment E-3: To Great Brook Runoff Area=202,379 sf 3.81% Impervious Runoff Depth>3.39"
Flow Length=353' Tc=8.6 min UI Adjusted CN=62 Runoff=16.70 cfs 57,139 cf

Subcatchment E-4: To Rear Pond Runoff Area=226,166 sf 78.70% Impervious Runoff Depth>6.47"
Flow Length=219' Tc=7.2 min CN=89 Runoff=35.73 cfs 122,015 cf

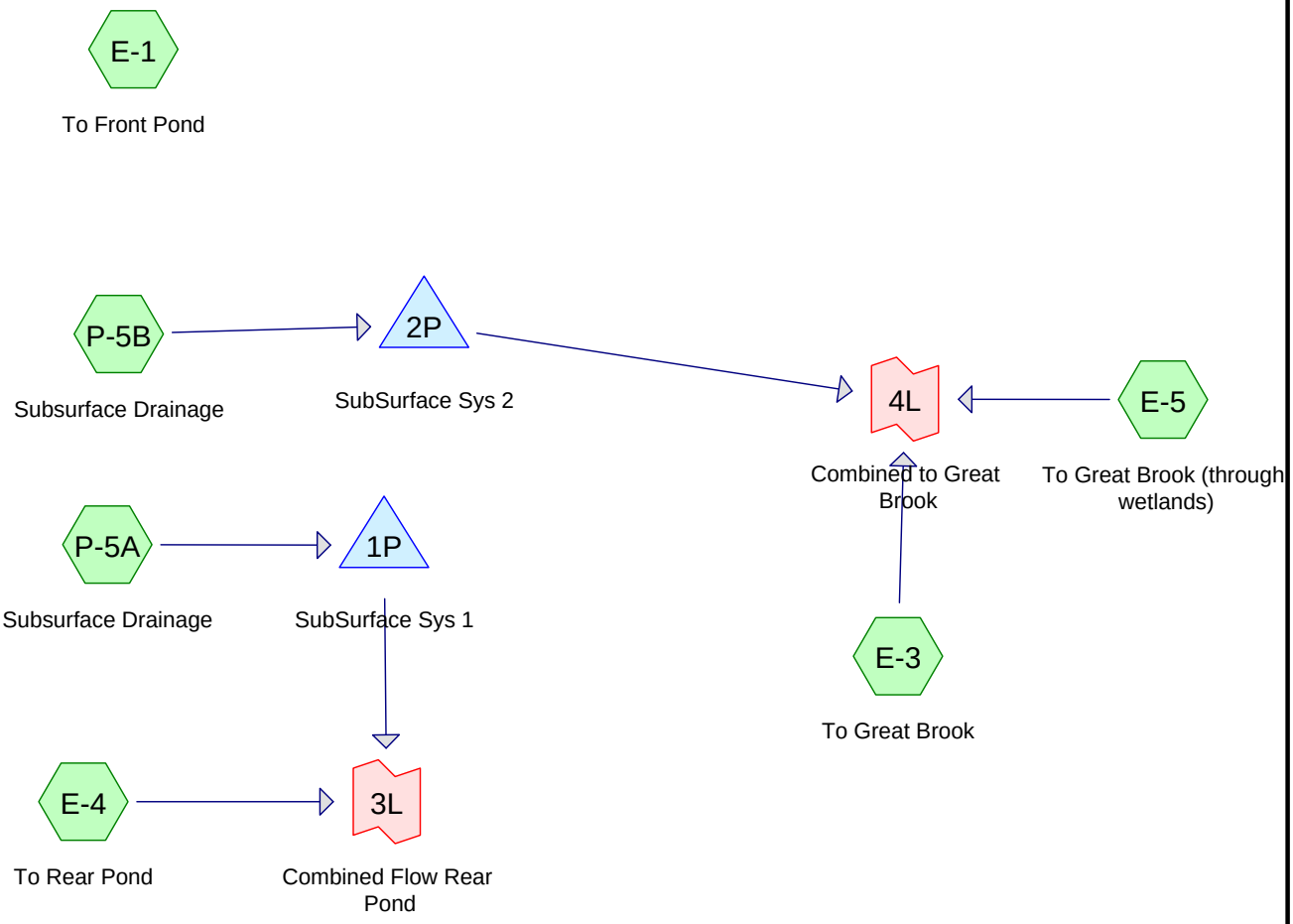
Subcatchment E-5: To Great Brook Runoff Area=221,230 sf 0.00% Impervious Runoff Depth>3.28"
Flow Length=353' Tc=5.0 min CN=61 Runoff=20.00 cfs 60,502 cf

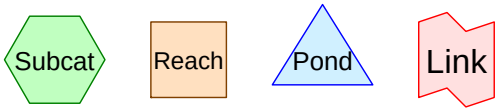
Pond 3P: Wetland C Peak Elev=345.45' Storage=5,885 cf Inflow=5.36 cfs 17,860 cf
Outflow=2.99 cfs 12,651 cf

Pond 4P: Wetland B Peak Elev=345.59' Storage=5,705 cf Inflow=5.78 cfs 30,433 cf
18.0" Round Culvert n=0.013 L=107.0' S=0.0169 '/' Outflow=3.77 cfs 29,529 cf

Link 2L: Great Brook Inflow=37.38 cfs 147,170 cf
Primary=37.38 cfs 147,170 cf

POST-DEVELOPMENT





Routing Diagram for 1670-15 Proposed HydroCAD
Prepared by Microsoft, Printed 4/13/2022

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: To Front Pond Runoff Area=312,214 sf 53.40% Impervious Runoff Depth>1.45"
Flow Length=405' Tc=10.4 min CN=80 Runoff=10.44 cfs 37,793 cf

Subcatchment E-3: To Great Brook Runoff Area=151,818 sf 4.17% Impervious Runoff Depth>0.51"
Flow Length=420' Tc=6.0 min CN=62 Runoff=1.45 cfs 6,455 cf

Subcatchment E-4: To Rear Pond Runoff Area=120,015 sf 42.40% Impervious Runoff Depth>1.20"
Flow Length=197' Tc=6.3 min CN=76 Runoff=3.72 cfs 11,993 cf

Subcatchment E-5: To Great Brook Runoff Area=190,039 sf 0.42% Impervious Runoff Depth>0.47"
Flow Length=353' Tc=5.0 min CN=61 Runoff=1.64 cfs 7,476 cf

Subcatchment P-5A: Subsurface Drainage Runoff Area=139,454 sf 78.28% Impervious Runoff Depth>2.23"
Tc=6.0 min CN=90 Runoff=8.29 cfs 25,930 cf

Subcatchment P-5B: Subsurface Drainage Runoff Area=207,812 sf 70.57% Impervious Runoff Depth>1.97"
Tc=6.0 min CN=87 Runoff=11.04 cfs 34,198 cf

Pond 1P: SubSurface Sys 1 Peak Elev=348.07' Storage=11,368 cf Inflow=8.29 cfs 25,930 cf
Discarded=0.50 cfs 25,364 cf Primary=0.12 cfs 539 cf Outflow=0.62 cfs 25,903 cf

Pond 2P: SubSurface Sys 2 Peak Elev=339.48' Storage=8,304 cf Inflow=11.04 cfs 34,198 cf
Discarded=2.31 cfs 34,005 cf Primary=0.19 cfs 184 cf Outflow=2.50 cfs 34,189 cf

Link 3L: Combined Flow Rear Pond Inflow=3.72 cfs 12,533 cf
Primary=3.72 cfs 12,533 cf

Link 4L: Combined to Great Brook Inflow=3.08 cfs 14,115 cf
Primary=3.08 cfs 14,115 cf

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: To Front Pond Runoff Area=312,214 sf 53.40% Impervious Runoff Depth>2.90"
Flow Length=405' Tc=10.4 min CN=80 Runoff=21.10 cfs 75,567 cf

Subcatchment E-3: To Great Brook Runoff Area=151,818 sf 4.17% Impervious Runoff Depth>1.45"
Flow Length=420' Tc=6.0 min CN=62 Runoff=5.47 cfs 18,324 cf

Subcatchment E-4: To Rear Pond Runoff Area=120,015 sf 42.40% Impervious Runoff Depth>2.55"
Flow Length=197' Tc=6.3 min CN=76 Runoff=8.15 cfs 25,490 cf

Subcatchment E-5: To Great Brook Runoff Area=190,039 sf 0.42% Impervious Runoff Depth>1.38"
Flow Length=353' Tc=5.0 min CN=61 Runoff=6.68 cfs 21,843 cf

Subcatchment P-5A: Subsurface Drainage Runoff Area=139,454 sf 78.28% Impervious Runoff Depth>3.89"
Tc=6.0 min CN=90 Runoff=14.10 cfs 45,229 cf

Subcatchment P-5B: Subsurface Drainage Runoff Area=207,812 sf 70.57% Impervious Runoff Depth>3.58"
Tc=6.0 min CN=87 Runoff=19.69 cfs 62,042 cf

Pond 1P: SubSurface Sys 1 Peak Elev=348.61' Storage=14,712 cf Inflow=14.10 cfs 45,229 cf
Discarded=0.50 cfs 28,310 cf Primary=5.34 cfs 13,776 cf Outflow=5.84 cfs 42,086 cf

Pond 2P: SubSurface Sys 2 Peak Elev=340.20' Storage=15,171 cf Inflow=19.69 cfs 62,042 cf
Discarded=2.31 cfs 50,660 cf Primary=4.30 cfs 11,368 cf Outflow=6.61 cfs 62,028 cf

Link 3L: Combined Flow Rear Pond Inflow=9.73 cfs 39,266 cf
Primary=9.73 cfs 39,266 cf

Link 4L: Combined to Great Brook Inflow=13.55 cfs 51,535 cf
Primary=13.55 cfs 51,535 cf

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: To Front Pond Runoff Area=312,214 sf 53.40% Impervious Runoff Depth>3.87"
Flow Length=405' Tc=10.4 min CN=80 Runoff=28.04 cfs 100,773 cf

Subcatchment E-3: To Great Brook Runoff Area=151,818 sf 4.17% Impervious Runoff Depth>2.16"
Flow Length=420' Tc=6.0 min CN=62 Runoff=8.53 cfs 27,364 cf

Subcatchment E-4: To Rear Pond Runoff Area=120,015 sf 42.40% Impervious Runoff Depth>3.47"
Flow Length=197' Tc=6.3 min CN=76 Runoff=11.12 cfs 34,715 cf

Subcatchment E-5: To Great Brook Runoff Area=190,039 sf 0.42% Impervious Runoff Depth>2.08"
Flow Length=353' Tc=5.0 min CN=61 Runoff=10.55 cfs 32,891 cf

Subcatchment P-5A: Subsurface Drainage Runoff Area=139,454 sf 78.28% Impervious Runoff Depth>4.95"
Tc=6.0 min CN=90 Runoff=17.70 cfs 57,508 cf

Subcatchment P-5B: Subsurface Drainage Runoff Area=207,812 sf 70.57% Impervious Runoff Depth>4.62"
Tc=6.0 min CN=87 Runoff=25.09 cfs 79,975 cf

Pond 1P: SubSurface Sys 1 Peak Elev=349.06' Storage=16,990 cf Inflow=17.70 cfs 57,508 cf
Discarded=0.50 cfs 29,672 cf Primary=9.59 cfs 23,140 cf Outflow=10.09 cfs 52,812 cf

Pond 2P: SubSurface Sys 2 Peak Elev=340.78' Storage=20,000 cf Inflow=25.09 cfs 79,975 cf
Discarded=2.31 cfs 59,871 cf Primary=6.08 cfs 20,087 cf Outflow=8.39 cfs 79,958 cf

Link 3L: Combined Flow Rear Pond Inflow=17.64 cfs 57,855 cf
Primary=17.64 cfs 57,855 cf

Link 4L: Combined to Great Brook Inflow=22.52 cfs 80,342 cf
Primary=22.52 cfs 80,342 cf

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: To Front Pond Runoff Area=312,214 sf 53.40% Impervious Runoff Depth>5.42"
Flow Length=405' Tc=10.4 min CN=80 Runoff=38.87 cfs 140,981 cf

Subcatchment E-3: To Great Brook Runoff Area=151,818 sf 4.17% Impervious Runoff Depth>3.39"
Flow Length=420' Tc=6.0 min CN=62 Runoff=13.73 cfs 42,890 cf

Subcatchment E-4: To Rear Pond Runoff Area=120,015 sf 42.40% Impervious Runoff Depth>4.96"
Flow Length=197' Tc=6.3 min CN=76 Runoff=15.81 cfs 49,622 cf

Subcatchment E-5: To Great Brook Runoff Area=190,039 sf 0.42% Impervious Runoff Depth>3.28"
Flow Length=353' Tc=5.0 min CN=61 Runoff=17.18 cfs 51,972 cf

Subcatchment P-5A: Subsurface Drainage Runoff Area=139,454 sf 78.28% Impervious Runoff Depth>6.59"
Tc=6.0 min CN=90 Runoff=23.20 cfs 76,620 cf

Subcatchment P-5B: Subsurface Drainage Runoff Area=207,812 sf 70.57% Impervious Runoff Depth>6.24"
Tc=6.0 min CN=87 Runoff=33.37 cfs 108,057 cf

Pond 1P: SubSurface Sys 1 Peak Elev=349.43' Storage=18,368 cf Inflow=23.20 cfs 76,620 cf
Discarded=0.50 cfs 31,401 cf Primary=20.46 cfs 38,580 cf Outflow=20.96 cfs 69,981 cf

Pond 2P: SubSurface Sys 2 Peak Elev=341.67' Storage=25,238 cf Inflow=33.37 cfs 108,057 cf
Discarded=2.31 cfs 72,569 cf Primary=14.67 cfs 35,465 cf Outflow=16.99 cfs 108,034 cf

Link 3L: Combined Flow Rear Pond Inflow=35.54 cfs 88,202 cf
Primary=35.54 cfs 88,202 cf

Link 4L: Combined to Great Brook Inflow=36.46 cfs 130,327 cf
Primary=36.46 cfs 130,327 cf

SIMPLE DYNAMIC METHOD HYDROCAD MODEL

The Required Recharge Volume was done in accordance with the Massachusetts Stormwater Handbook, Volume 3 Chapter 1 – Documenting Compliance with the Massachusetts Stormwater Management Standards for the Simple Dynamic Method.

To size an infiltration BMP using the "Simple Dynamic" Method, applicants may also use a computer model based on TR-20 as described below. As more fully set forth below, this computer model assumes that the Required Water Quality Volume is entering the infiltration BMP during the peak two hours of the storm and that runoff is being discharged from the BMP during the same two hour period at the Rawls Rate. This contemporaneous exfiltration allows a proponent to reduce the size of the infiltration BMP.

a. *Use Equation 1 (Rv=F x impervious area) to determine the Required Recharge Volume*
b. *Select a 24-hour rainfall event that generates the Required Recharge Volume during the peak 2 hours. Use only the Site's impervious drainage area and the default NRCS Initial Abstraction of 0.2S and Type III storm. Set the storm duration for 24 hours, but use a start time of 11 hours and an end time of 13 hours. This creates a truncated hydrograph where most of the rainfall typical of a 24-hour Type III Storm occurs in just 2 hours. Selecting the correct precipitation depth is an iterative process. Various precipitation depths must be tested to determine which depth generates the Required Recharge Volume, using the Win TR-20 method (or other software based on TR-20). Each precipitation depth evaluated generates a runoff hydrograph. The area under the hydrograph is a volume. The correct result is achieved when the volume under the inflow hydrograph equals the Required Recharge Volume.*
c. *Using the resulting inflow hydrograph, choose an appropriate exfiltration structure with an appropriate bottom area and storage volume.*[1]
d. *Use recharge system bottom as maximum infiltrative surface area. Do not use sidewalls.*[2]
e. *Assume stormwater exfiltrates from the device over the peak 2-hour period of the rainfall event determined in step b above*
f. *Set exfiltration rates no higher than the Rawls Rates for the corresponding soil at the specific location where infiltration is proposed (see Table 2.3.3).*
g. *Assume exfiltration rate is constant.*
h. *Using the computer model, confirm adequate Storage Volume.*
i. *Go to STEP 5 to confirm that the bottom of the proposed infiltration BMP is large enough to ensure that the practice will drain completely in 72 hours or less. For purposes of the STEP 5 evaluation, assume the exfiltration rates are no higher than the Rawls Rates*

[1] An applicant may have to select several different size infiltration structures before s/he identifies a structure that is adequately sized.
[2] If the recharge system includes stone or other media, remember that the effective storage volume only includes the voids between the stone or other media.

Subcat Reach Pond Link

Routing Diagram for 1670-15 Proposed HydroCAD - Simple Dynamic Tes

Prepared by Microsoft, Printed 4/13/2022

Time span=11.00-13.00 hrs, dt=0.01 hrs, 201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P-5A: Rear Site Runoff Area=169,775 sf 100.00% Impervious Runoff Depth>1.00"
Tc=6.0 min CN=98 Runoff=7.74 cfs 14,182 cf

Subcatchment P-5B: Front Site Runoff Area=207,257 sf 100.00% Impervious Runoff Depth>1.00"
Tc=6.0 min CN=98 Runoff=9.45 cfs 17,313 cf

Pond 1P: SubSurface Sys 1 Peak Elev=347.97' Storage=10,652 cf Inflow=7.74 cfs 14,182 cf
Discarded=0.50 cfs 3,527 cf Primary=0.00 cfs 0 cf Outflow=0.50 cfs 3,527 cf

Pond 2P: SubSurface Sys 2 Peak Elev=339.29' Storage=6,402 cf Inflow=9.45 cfs 17,313 cf
Discarded=2.31 cfs 13,131 cf Primary=0.00 cfs 0 cf Outflow=2.31 cfs 13,131 cf

APPENDIX I
OPERATION & MAINTENANCE PLAN

ALLEN & MAJOR ASSOCIATES, INC.

OPERATION & MAINTENANCE PLAN

Multi-Family Development
580 Main Street Bolton, MA

Prepared: September 10, 2021
Revised: April 12, 2022

Site Locus

CLIENT:
Limited Dividend Affiliate of
WP East Acquisitions, LLC
91 Hartwell Avenue
Lexington, MA 02421

PREPARED BY:
Allen & Major Associates, Inc.
10 Main Street
Lakeville, Massachusetts 02347

OPERATION & MAINTENANCE PLAN

Multi-Family Development
580 Main Street Bolton, MA

PROPONENT:
Limited Dividend Affiliate of
WP East Acquisitions, LLC
91 Hartwell Avenue
Lexington, MA 02421

PREPARED BY:
Allen & Major Associates, Inc.
10 Main Street
Lakeville, Massachusetts 02347

ISSUED:
September 10, 2021

REVISED:
April 12, 2022

A&M PROJECT NO.:
1670-15

TABLE OF CONTENTS

SECTION 1.0
OPERATIONS & MAINTENANCE PLAN

1.1 INTRODUCTION

In accordance with the standards set forth by the Stormwater Management Policy issued by the Massachusetts Department of Environmental Protection (MassDEP), Allen & Major Associates, Inc. has prepared the following Operations & Maintenance (O&M) Plan for the proposed stormwater management system for the Multi-Family Development located at 580 Main Street in Bolton, MA.

This plan focuses on post construction maintenance of the on-site drainage system. Operation and Maintenance (O&M) practices discussed below are recommendations made by the Design Engineer based on available reference material on Best Management Practices (BMP's) and experience. The property owner is responsible for implementation of the plan, and is encouraged to revise / supplement this plan accordingly based on actual site conditions.

The plan is broken down into two major sections. The first section describes the long-term pollution prevention measures (Long Term Pollution Prevention Plan). The second section is a post-construction operation and maintenance plan designed to address the long-term maintenance needs of the stormwater management system (Long Term Maintenance Plan).

1.2 NOTIFICATION PROCEDURES FOR CHANGE OF RESPONSIBILITY FOR O&M

The Stormwater Management System (SMS) for this project is owned by a Limited Dividend Affiliate of WP East Acquisitions, LLC (owner). The owner shall be legally responsible for the long-term operation and maintenance of this SMS as outlined in this Operation and Maintenance Plan.

The owner shall submit an annual summary report and the completed Operation & Maintenance Schedule & Checklist to the Conservation Commission (via email or print copy), highlighting inspection and maintenance activities including performances of BMPs. Should ownership of the SMS change, the owner will continue to be responsible until the succeeding owner shall notify the Commission that the succeeding owner has assumed such responsibility. Upon subsequent transfers, the responsibility shall continue to be that of transferring owner until the transferee owner notifies the Commission of its assumption of responsibility.

In the event the SMS will serve multiple lots/owners, such as the subdivision of the existing parcel or creation of lease areas, the owner(s) shall establish an association on other legally enforceable arrangements under which the association or a single party shall have legal responsibility for the operation and maintenance of the entire SMS. The legal instrument creating such responsibility shall be recorded with the Registry of Deeds and promptly following its recording, a copy thereof shall be furnished to the Commission.

1.3 CONTACT INFORMATION

Stormwater Management System Owner:	Limited Dividend Affiliate of WP East Acquisitions, LLC 91 Hartwell Avenue Lexington, MA 02421 Phone: TBD

Emergency Contact Information:

Limited Dividend Affiliate of WP East Acquisitions, LLC (Owner/Operator)	Phone: TBD
Bolton Department of Public Works	Phone: 978-779-6402
Bolton Fire Department (non-emergency line)	Phone: 978-779-2203
MassDEP Emergency Response	Phone: (888) 304-1133
Clean Harbors Inc (24-Hour Line)	Phone: (800) 645-8265

1.4 CONSTRUCTION PERIOD

1. Call Digsafe: 1-888-344-7233
2. Schedule a meeting with the various Town Departments, Design Engineer and Owner at least three (3) days prior to start of construction.
3. Install Erosion Control measures (construction entrance, wattles, straw bales, silt fence, silt sac, etc.) as shown on the Plans prepared by A&M. If required, by any special conditions, the Town shall review the installation of erosion control measures prior to the start of any site demolition work. Install Construction fencing if determined to be necessary at the commencement of construction.
4. All erosion and sedimentation controls shall be in accordance with MassDEP's Erosion and Sedimentation Control guidelines revised through May 2003 and the USDA SCS Erosion and Sedimentation Control in site development dated September 1983.
5. Site access shall be achieved only from the designated construction entrances.
6. Cut and clear trees in construction areas only (within the limit of work; see plans).
7. Stockpiles of materials subject to erosion shall be stabilized with erosion control matting or temporary seeding whenever practicable, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased.

8. Install silt sacks and straw bales around each drain inlet prior to any demolition and or construction activities.
9. All erosion control measures shall be inspected weekly and after every rainfall event. Records of these inspections shall be kept on-site for review.
10. All erosion control measures shall be maintained, repaired, or replaced as required or at the direction of the owner's engineer or the Town's representative.
11. Sediment accumulation up-gradient of the straw bales, silt fence, and stone check dams greater than 6" in depth shall be removed and disposed of in accordance with all applicable regulations.
12. If it appears that sediment is exiting the site, silt sacks shall be installed in all catch basins adjacent to the site. Sediment accumulation on all adjacent catch basin inlets shall be removed and the silt sack replaced if torn or damaged.
13. Install stone check dam on-site during construction as needed. Refer to the erosion control details. Temporary sediment basins combined with stone check damns shall be installed on-site during construction to control and collect runoff from upland areas of this site during demolition and construction activities.
14. The contractor shall comply with the Sedimentation and Erosion Control Notes as shown on the Site Development Plans and Specifications.
15. The stabilized construction entrances shall be inspected weekly and records of inspections kept. The entrances shall be maintained by adding additional clean, angular, durable stone to remove the soil from the construction vehicle's tires when exiting the site. If soil is still leaving the site via the construction vehicle tires, adjacent roadways shall be kept clean by street sweeping.
16. Dust pollution shall be controlled using on-site water trucks and/or an approved soil stabilization product.
17. During demolition and construction activities, Status Reports on compliance with this O&M Document shall be submitted weekly. The report shall document any deficiencies and corrective actions taken by the applicant.
18. No overuse, over-compaction, or storage of materials shall occur within any areas defined as stormwater infiltration to prevent the incidental compaction of soils. The areas are to be constructed as soon as possible and protected from construction traffic. NO CONSTRUCTION WATERS are to be emptied into an infiltration system. An allowance may be accommodated for a temporary excavation of soils within the infiltration basin for collection and handling of construction water, but the entirety of the debris is to be removed in order to achieve the grades as shown on the construction drawings.

19. The entire drainage system, including but not limited to catch basin, manholes, piping, water quality structures and infiltration system should be cleaned prior to turnover to the Owner.

1.5 LONG-TERM POLLUTION PREVENTION PLAN

Standard #4 from the MassDEP Stormwater Management Handbook requires that a Long-Term Pollution Prevention Plan (LTPPP) be prepared and incorporated as part of the Operation and Maintenance Plan of the Stormwater Management System. The purpose of the LTPPP is to identify potential sources of pollution that may affect the quality of stormwater discharges, and to describe the implementation of practices to reduce the pollutants in stormwater discharges. The following items describe the source control and proper procedures of the LTPPP.

- **Housekeeping**
  The existing development has been designed to maintain a high level of water quality treatment for all stormwater discharge to the wetland areas. An Operation and Maintenance (O&M) plan has been prepared and is included in this section of the report. The owner (or its designee) is responsible for adherence to the O&M plan in a strict and complete manner.

- **Storing of Materials & Water Products**
  The trash and waste program for the site includes exterior dumpsters. There is a trash contractor used to pick up the waste material in the dumpsters. The stormwater drainage system has water quality inlets designed to capture trash and debris.

- **Vehicle Washing**
  Outdoor vehicle washing has the potential to result in high loads of nutrients, metals, and hydrocarbons during dry weather conditions, as the detergent-rich water used to wash the grime off the vehicle enters the stormwater drainage system. The existing development does not include any designated vehicle washing areas, nor is it expected that any vehicle washing will take place on-site.

- **Spill Prevention & Response**
  Sources of potential spill hazards include vehicle fluids, liquid fuels, pesticides, paints, solvents, and liquid cleaning products. The majority of the spill hazards would likely occur within the buildings and would not enter the stormwater drainage system. However, there are spill hazards from vehicle fluids or liquid fuels located outside of the buildings. These exterior spill hazards have the potential to enter the stormwater drainage system and are to be addressed as follows:

1. Spill hazards of pesticides, paints, and solvents shall be remediated using the Manufacturers' recommended spill cleanup protocol.
2. Vehicle fluids and liquid fuel spill shall be remediated according to the local and state regulations governing fuel spills.
3. The owner shall have the following equipment and materials on hand to address a spill clean-up: brooms, dust pans, mops, rags, gloves, absorptive material, sand, sawdust, plastic and metal trash containers.
4. All spills shall be cleaned up immediately after discovery.
5. Spills of toxic or hazardous material shall be reported, regardless of size, to the Massachusetts Department of Environmental Protection at (888) 304-1333.
6. Should a spill occur, the pollution prevention plan will be adjusted to include measures to prevent another spill of a similar nature. A description of the spill, along with the causes and cleanup measures will be included in the updated pollution prevention plan.

- **Maintenance of Lawns, Gardens, and Other Landscaped Areas**
  It should be recognized that this is a general guideline towards achieving high quality and well-groomed landscaped areas. The grounds staff/landscape contractor must recognize the shortcomings of a general maintenance plan such as this, and modify and/or augment it based on weekly, monthly, and yearly observations. In order to assure the highest quality conditions, the staff must also recognize and appreciate the need to be aware of the constantly changing conditions of the landscaping and be able to respond to them on a proactive basis. No trees shall be planted over the drain lines or recharge area, and that only shallow rooted plants and shrubs will be allowed.

  - **Fertilizer**

    Maintenance practices should be aimed at reducing environmental, mechanical and pest stresses to promote healthy and vigorous growth. When necessary, pest outbreaks should be treated with the most sensitive control measure available. Synthetic chemical controls should be used only as a last resort to organic and biological control methods. Fertilizer, synthetic chemical controls and pest management applications (when necessary) shall be performed only by licensed applicators in accordance with the manufacturer's label instructions when environmental conditions are conducive to controlled product application.

Only slow-release organic fertilizers should be used in the planting and mulch areas to limit the amount of nutrients that could enter downstream resource areas. Fertilization of the planting and mulch areas will be performed within manufacturers labeling instructions and shall not exceed an NPK ration of 1:1:1 (i.e. Triple 10 fertilizer mix), considered a low nitrogen mixture. Fertilizers approved for the use under this O&M Plan are as follows:

Type: LESCO® 28-0-12 (Lawn Fertilizer)
MERIT® 0.2 Plus Turf Fertilizer
MOMENTUM™ Force Weed & Feed

- **Suggested Aeration Program**

In-season aeration of lawn areas is good cultural practice, and is recommended whenever feasible. It should be accomplished with a solid thin tine aeration method to reduce disruption to the use of the area. The depth of solid tine aeration is similar to core type, but should be performed when the soil is somewhat drier for a greater overall effect.

Depending on the intensity of use, it can be expected that all landscaped lawn areas will need aeration to reduce compaction at least once per year. The first operation should occur in late May following the spring season. Methods of reducing compaction will vary based on the nature of the compaction. Compaction on newly established landscaped areas is generally limited to the top 2-3" and can be alleviated using hollow core or thin tine aeration methods.

The spring aeration should consist of two passes at opposite directions with 1/4" hollow core tines penetrating 3-5" into the soil profile. Aeration should occur when the soil is moist but not saturated. The soil cores should be shattered in place and dragged or swept back into the turf to control thatch. If desired the cores may also be removed and the area top-dressed with sand or sandy loam. If the area drains on average too slowly, the topdressing should contain a higher percentage of sand. If it is draining on average too quickly, the top dressing should contain a higher percentage of soil and organic matter.

- **Landscape Maintenance Program Practices**:

  - **Lawn**

    1. Mow a minimum of once a week in spring, to a height of 2” to 2 1/2” high. Mowing should be frequent enough so that no more than 1/3 of grass blade is removed at each mowing. The top growth supports the roots; the shorter the grass is cute, the less

the roots will grow. Short cutting also dries out the soil and encourages weeds to germinate.

2. Mow approximately once every two weeks from July 1st to August 15th depending on lawn growth.
3. Mow on a ten-day cycle in fall, when growth is stimulated by cooler nights and increased moisture.
4. Do not remove grass clippings after mowing.
5. Keep mower blades sharp to prevent ragged cuts on grass leaves, which cause a brownish appearance and increase the chance for disease to enter a leaf.

- **Shrubs**

1. Mulch not more than 3" depth with shredded pine or fir bark.
2. Hand prune annually, immediately after blooming, to remove 1/3 of the above-ground biomass (older stems). Stem removals are to occur within 6" of the ground to open up shrub and maintain two-year wood (the blooming wood).
3. Hand-prune evergreen shrubs only as needed to remove dead and damaged wood and to maintain the naturalistic form of the shrub. Never mechanically shear evergreen shrubs.

- **Trees**

1. Provide aftercare of new tree plantings for the first three years.
2. Do not fertilize trees, it artificially stimulates them (unless tree health warrants).
3. Water once a week for the first year; twice a month for the second; once a month for the third year.
4. Prune trees on a four-year cycle.

- **Invasive Species**

1. Inform the Conservation Commission Agent prior to the removal of invasive species proposed either through hand work or through chemical removal.

- **Storage and Use of Herbicides and Pesticides**

Integrated Pest Management is the combination of all methods (of pest control) which may prevent, reduce, suppress, eliminate, or repel an insect population. The main requirements necessary to support any pest population are food, shelter and

water, and any upset of the balance of these will assist in controlling a pest population. Scientific pest management is the knowledgeable use of all pest control methods (sanitation, mechanical, chemical) to benefit mankind's health, welfare, comfort, property and food. A Pest Management Professional (PMP) should be retained who is licensed with the Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs, Department of Agricultural Resources.

The site manager will be provided with approved bulletin before entering into or renewing an agreement to apply pesticides for the control of indoor household or structural pests, refer to 333 CMR 13.08.

Before beginning each application, the applicator must post a Department approved notice on all of the entrances to the treated room or area. The applicator must leave such notices posted after the application. The notice will be posted at conspicuous point(s) of access to the area treated. The location and number of signs will be determined by the configuration of the area to be treated based on the applicator's best judgment. It is intended to give sufficient notice so that no one comes into an area being treated unaware that the applicator is working and pesticides are being applied. However, if the contracting entity does not want the signs posted, he/she may sign a Department approved waiver indicating this.

The applicator or employer will provide to any person upon their request the following information on previously conducted applications:

1. Name and phone number of pest control company;
2. Date and time of the application;
3. Name and license number of the applicator;
4. Target pests; and
5. Name and EPA Registration Number of pesticide products applied.

- **Pet Waste Management**
  The owner's landscape crew (or designee) shall remove any obvious pet waste that has been left behind by pet owners within the development. The pet waste shall be disposed of in accordance with local and state regulations.

- **Operations and Management of Septic Systems**
  The private on-site wastewater treatment systems shall be inspected in accordance with the special conditions from the groundwater discharge permit issues by MassDEP.

- **Management of Deicing Chemicals and Snow**
  Snow will be stockpiled on site until the accumulated snow becomes a hazard to the daily operations of the site. It will be the responsibility of the snow removal contractor to properly dispose of transported snow according to MassDEP, Bureau of Resource Protection – Snow Disposal Guideline #BRPG01-01, governing the proper disposal of snow. It will be the responsibility of the snow removal contractor to follow these guidelines and all applicable laws and regulations

  The owner's maintenance staff (or its designee) will be responsible for the clearing of the sidewalk and building entrances. The owner may be required to use a de-icing agent such as potassium chloride to maintain a safe walking surface. If used, the de-icing agent for the walkways and building entrances will be kept within the storage rooms located within the building. If used, de-icing agents will not be stored outside. The owner's maintenance staff will limit the application of sand.

1.6 LONG-TERM MAINTENANCE PLAN – FACILITIES DESCRIPTION

A maintenance log will be kept (i.e. report) summarizing inspections, maintenance, and any corrective actions taken. The log will include the date on which each inspection or maintenance task was performed, a description of the inspection findings or maintenance completed, and the name of the inspector or maintenance personnel performing the task. If a maintenance task requires the clean-out of any sediments or debris, the location where the sediment and debris was disposed after removal will be indicated. The log will be made accessible to department staff and a copy provided to the department upon request.

The following is a description of the Stormwater Management System for the project site.

- **Stormwater Collection System – On-Site**: The stormwater collection system is comprised of deep sump hooded catch basins, Contech CDS 2015-4 water quality structures, Stormtech Isolator Row, a sub-surface infiltration system consisting of Stormtech SC-740 Chambers, wet basin, a closed gravity pipe network and several outlet control structures.
  The stormwater runoff from the building rooftops are collected using roof drains. The stormwater is conveyed to the discharge locations using internal building plumbing and external roof leaders. The building rooftop runoff discharges to one of several sub-surface infiltration systems.

1.7 INSPECTION AND MAINTENANCE FREQUENCY AND CORRECTIVE MEASURES

In accordance with MA DEP Stormwater Handbook: Volume 2, Chapter 2; the following areas, facilities, and measures will be inspected and the identified deficiencies will be corrected. Clean-out must include the removal and legal disposal of any accumulated sediments, trash, and debris. In any and all cases, operations, inspections, and

maintenance activities shall utilize best practical measures to avoid and minimize impacts to wetland resource areas outside the footprint of the SMS.

Attached is an Operation and Maintenance Plan (OM-1) illustrating the location of the following SMS components that will require continuing inspection as outlined in the document:

- *Street Sweeping*
- *Deep Sump Hooded Catch Basin*
- *Contech CDS 2015-4 Water Quality Structures*
- *Stormtech Isolator Row*
- *Sub-Surface Infiltration Systems (Stormtech SC-740 Chambers)*
- *Pipe Ends*
- *Wet Basin*
- *Snow Storage (as outlined on plan)*

1.8 STRUCTURAL PRETREATMENT BMPS

Regular maintenance of these BMPs is especially critical because they typically receive the highest concentration of suspended solids during the first flush of a storm event.

Deep Sump Catch Basins:

Deep sump catch basins, also known as oil and grease or hooded catch basins, are underground retention systems designed to remove trash, debris, and coarse sediment from stormwater runoff, and serve as temporary spill containment devices for floatables such as oils and greases.

Regular maintenance is essential. Deep sump catch basins remain effective by removing pollutants only if they are cleaned out frequently. One study found that once 50% of the sump volume is filled, the catch basin is not able to retain additional sediments.

Inspect or clean deep sump catch basins at least four times per year and at the end of the foliage and snow-removal seasons. Sediments must also be removed four times per year or whenever the depths of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin.

Clamshell buckets are typically used to remove sediment in Massachusetts. However, vacuum trucks are preferable, because they remove more trapped sediment and supernatant than clamshells. Vacuuming is also a speedier process and is less likely to snap the cast iron hood within the deep sump catch basin.

Always consider the safety of the staff cleaning deep sump catch basins. Cleaning a deep sump catch basin within a road with active traffic or even within a parking lot is dangerous, and a police detail may be necessary to safeguard workers.

Although catch basin debris often contains concentrations of oil and hazardous materials, such as petroleum hydrocarbons and metals, MassDEP classifies them as solid waste. Unless there is evidence that they have been contaminated by a spill or other means, MassDEP does not routinely require catch basin cleanings to be tested before disposal. Contaminated catch basin cleanings must be evaluated in accordance with the Hazardous Waste Regulations, 310 CMR 30.000, and handled as hazardous waste.

In the absence of evidence of contamination, catch basin cleanings may be taken to a landfill or other facility permitted by MassDEP to accept solid waste, without any prior approval by MassDEP. However, some landfills require catch basin cleanings to be tested before they are accepted.

With prior MassDEP approval, catch basin cleanings may be used as grading and shaping materials at landfills undergoing closure (see Revised Guidelines for Determining Closure Activities at Inactive Unlined Landfill Sites) or as daily cover at active landfills. MassDEP also encourages the beneficial reuse of catch basin cleanings whenever possible. A Beneficial Reuse Determination is required for such use.

MassDEP regulations prohibit landfills from accepting materials that contain free-draining liquids. One way to remove liquids is to use a hydraulic lift truck during cleaning operations so that the material can be decanted at the site. After loading material from several catch basins into a truck, elevate the truck so that any free-draining liquid can flow back into the structure. If there is no free water in the truck, the material may be deemed to be sufficiently dry. Otherwise catch basin cleanings must undergo a Paint Filter Liquids Test. Go to www.Mass.gov/dep/recycle/laws/cafacts.doc for information on all of the MassDEP requirements pertaining to the disposal of catch basin cleanings

Contech Cascade Separator Water Quality Structure

Cascade Separator systems should be inspected at regular intervals with maintenance performed as necessary to maintain performance. Sediment accumulation rates will vary based on treatment location and site utilization.

Inspections should be performed twice per year in the spring and fall. If upon routine inspection, increased loading is observed, more frequent inspections may be warranted. The inspections should quantify the accumulation of hydrocarbons, trash, and sediment using a calibrated dipstick, tape measure or other instrument. Cleaning is required before the observed level of sediment reaches the maximum sediment depth and/or when an appreciable level of hydrocarbons and trash has accumulated. Cleaning procedures can follow those described under the 450i water quality structure below.

Contech CDS 2015-4 Water Quality Structure

CDS 2015 Water Quality Structure systems should be inspected at regular intervals with maintenance performed as necessary to maintain performance. Sediment accumulation rates will vary based on treatment location and site utilization.

Inspections should be performed twice per year in the spring and fall. If upon routine inspection, increased loading is observed, more frequent inspections may be warranted. The inspections should confirm no blockages or obstructions are present on the inlet and separator screens. Inspection should also quantify the accumulation of hydrocarbons, trash, and sediment using a calibrated dipstick, tape measure or other instrument. Cleaning is required when the level of sediment has reached 75% of the capacity in the isolated sump and/or when an appreciable level of hydrocarbons and trash has accumulated. Cleaning procedures can follow those described under the 450i water quality structure below.

Contech 450i Water Quality Structure:

Regular maintenance is essential. Inspect or clean water quality structure at least twice per year (e.g. spring & fall) and snow-removal seasons. Sediments must also be removed whenever the depths of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin. Please refer to the Stormceptor STC Operation and Maintenance Guide attached hereafter.

Vacuum trucks are preferable, because they remove more trapped sediment and supernatant than clamshells. Vacuuming is also a speedier process and is less likely to snap the cast iron hood within the deep sump catch basin.

Always consider the safety of the staff cleaning the structure. Cleaning structures within a road with active traffic or even within a parking lot is dangerous, and a police detail may be necessary to safeguard workers.

Although debris often contains concentrations of oil and hazardous materials, such as petroleum hydrocarbons and metals, MassDEP classifies them as solid waste. Unless there is evidence that they have been contaminated by a spill or other means, MassDEP does not routinely require catch basin cleanings to be tested before disposal. Contaminated catch basin cleanings must be evaluated in accordance with the Hazardous Waste Regulations, 310 CMR 30.000, and handled as hazardous waste.

In the absence of evidence of contamination, catch basin cleanings may be taken to a landfill or other facility permitted by MassDEP to accept solid waste, without any prior approval by MassDEP. However, some landfills require catch basin cleanings to be tested before they are accepted.

With prior MassDEP approval, catch basin cleanings may be used as grading and shaping materials at landfills undergoing closure (see Revised Guidelines for Determining Closure Activities at Inactive Unlined Landfill Sites) or as daily cover at active landfills. MassDEP also encourages the beneficial reuse of catch basin cleanings whenever possible. A Beneficial Reuse Determination is required for such use.

MassDEP regulations prohibit landfills from accepting materials that contain free-draining liquids. One way to remove liquids is to use a hydraulic lift truck during cleaning operations so that the material can be decanted at the site. After loading material from several catch basins into a truck, elevate the truck so that any free-draining liquid can flow back into the structure. If there is no free water in the truck, the material may be deemed to be sufficiently dry. Otherwise catch basin cleanings must undergo a Paint Filter Liquids Test. Go to www.Mass.gov/dep/recycle/laws/cafacts.doc for information on all of the MassDEP requirements pertaining to the disposal of catch basin cleanings.

1.9 TREATMENT BMPS

Stormtech Isolator Row:

Stormtech's Isolator Row is an isolated row of chambers wrapped in geotextile fabric which filters the stormwater, trapping pollutants in the row before entering the adjacent chambers. The Isolator Row inspection/maintenance should be done in accordance with the manufacturer's guidelines and documentation. A copy is attached hereafter.

Wet Basins:

Wet basins use a permanent pool of water as the primary mechanism to treat stormwater. The pool allows sediments to settle (including fine sediments) and removes soluble pollutants. Wet basins must have additional dry storage capacity to control peak discharge rates. Wet basins have a moderate to high capacity to remove most urban pollutants, depending on how large the volume of the permanent pool is in relation to the runoff from the surrounding watershed.

Inspect wet basins at least once per year to ensure they are operating as designed. Inspect the outlet structure for evidence of clogging or excessive outflow releases. Potential problems to check include: subsidence, erosion, cracking or tree growth on the embankment, damage to the emergency spillway, sediment accumulation around the outlet, inadequacy of the inlet/outlet channel erosion control measures, change in the condition of the pilot channel, erosion within the basin and banks, and the emergence of invasive species. During inspections, note any changes to the wet basin or the contributing watershed area because these may affect basin

performance. At least twice a year, mow the upper-stage, side slopes, embankment and emergency spillway. At this time, also check the sediment in the forebay for accumulated material, sediment, trash, and debris and remove it. Remove sediment from the basin as necessary, and at least once every 10 years.

1.10 CONVEYANCE BMPS

Grass Swale:

Grass Drainage Channels should be inspected within the first three months after construction to ensure proper vegetation is established; thereafter, Inspect 2 times per year (preferably in Spring and Fall) to ensure they are working in their intended fashion and that they are free of sediment and debris. Remove any obstructions to flow, including accumulated sediments and debris and vegetated growth. Repair any erosion of the ditch lining. Vegetated ditches will be mowed at least annually or otherwise maintained to control the growth of woody vegetation and maintain flow capacity. Any woody vegetation growing through riprap linings must also be removed. Repair any slumping side slopes as soon as practicable and correct any erosion of the channel's bottom or side slopes.

1.11 INFILTRATION BMPS

Subsurface Structures:

Subsurface structures are underground systems that capture runoff, and gradually infiltrate it into the groundwater through rock and gravel.

Because subsurface structures are installed underground, they are extremely difficult to maintain. Inspect inlets at least twice a year. Remove any debris that might clog the system. Include mosquito controls in the Operation and Maintenance Plan.

Inspect outlet from subsurface structures to adjacent resource area for signs of scour and sediment accumulation at least twice annually. Remove sediment accumulation and add rip rap as necessary to prevent scour.

Outlet control structures should be evaluated at least once per year.

1.12 OTHER BMPS AND ACCESSORIES:

Outlet Control Structures:

Outlets of BMPs are devices that control the flow of stormwater out of the BMP to the conveyance system.

Inspect outlet structures twice per year. Remove any accumulated sediment and debris that could prevent flow at the outlet structure.

Culverts:
Inspect culverts 2 times per year (preferably in Spring and Fall) to ensure that the culverts are working in their intended fashion and that they are free of debris. Remove any obstructions to flow; remove accumulated sediments and debris at the inlet, at the outlet, and within the conduit and repair any erosion damage at the culvert's inlet and outlet.

Rip Rap and Level Spreaders:

Inspect twice per year for erosion, debris accumulation, and unwanted vegetation. Erosion areas shall be stabilized and sediment, debris, and woody vegetation will be removed.

Vegetated Areas:

Inspect slopes and embankments early in the growing season to identify active or potential erosion problems. Replant bare areas or areas with sparse growth. Where rill erosion is evident, armor the area with an appropriate lining or divert the erosive flows to on-site areas able to withstand the concentrated flows.

Roadway and Parking Surfaces:

Clear accumulations of winter sand in parking lots and along roadways at least once a year, preferably in the spring. Accumulations on pavement may be removed by pavement sweeping. Accumulations of sand along road shoulders may be removed by grading excess sand to the pavement edge and removing it manually or by a front-end loader.

Mosquito Control Plan:

MA Stormwater Handbook; Volume 2, Chapter 5 (Attached)

Both above ground and underground stormwater BMPs have the potential to serve as mosquito breeding areas. Good design, proper operation and maintenance, and treatment with larvicides can minimize this potential.

1.13 SUPPLEMENTAL INFORMATION

PROPOSED OPERATIONS AND MAINTENANCE LOG FORM

Based on site specific stormwater management system asset list. At a minimum, fields should be provided for:

- Date of inspection
- Name of inspector
- Condition of each BMP, including components such as:
    - Pretreatment devices
    - Vegetation

  - Other safety devices
  - Control structures
  - Embankments, slopes, and safety benches
  - Inlet and outlet channels and structures
  - Underground drainage
  - Sediment and debris accumulation in storage and forebay areas (including catch basins)
  - Any nonstructural practices
  - Any other item that could affect the proper function of the stormwater management system
- Description of the need for maintenance
- Description of maintenance performed

APPENDIX A
SUPPLEMENT INFORMATION

SNOW DISPOSAL GUIDANCE

Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection
One Winter Street Boston, MA 02108 • 617-292-5500

Charles D. Baker
Governor

Karyn E. Polito
Lieutenant Governor

Kathleen A. Theoharides
Secretary

Martin Suuberg
Commissioner

Massachusetts Department of Environmental Protection
Bureau of Water Resources
Snow Disposal Guidance

Effective Date: December 23, 2019

Applicability: Applies to all federal, state, regional and local agencies, as well as to private businesses.

Supersedes: Bureau of Resource Protection (BRP) Snow Disposal Guideline No. BRPG97-1 issued December 12, 1997 and BRPG01-01 issued March 8, 2001; Bureau of Water Resources (BWR) snow disposal guidance issued December 21, 2015 and December 12, 2018.

Approved by: Kathleen Baskin, Assistant Commissioner, Bureau of Water Resources

PURPOSE: To provide guidelines to all government agencies and private businesses regarding snow disposal site selection, site preparation and maintenance, and emergency snow disposal options that are protective of wetlands, drinking water, and water bodies, and are acceptable to the Massachusetts Department of Environmental Protection (MassDEP), Bureau of Water Resources.

APPLICABILITY: These Guidelines are issued by MassDEP's Bureau of Water Resources on behalf of all Bureau Programs (including Drinking Water Supply, Wetlands and Waterways, Wastewater Management, and Watershed Planning and Permitting). They apply to all federal agencies, state agencies, state authorities, municipal agencies and private businesses disposing of snow in the Commonwealth of Massachusetts.

INTRODUCTION

Finding a place to dispose of collected snow poses a challenge to municipalities and businesses as they clear roads, parking lots, bridges, and sidewalks. While MassDEP is aware of the threats to public safety caused by snow, collected snow that is contaminated with road salt, sand, litter, and automotive pollutants such as oil also threatens public health and the environment.

As snow melts, road salt, sand, litter, and other pollutants are transported into surface water or through the soil where they may eventually reach the groundwater. Road salt and other pollutants can contaminate water supplies and are toxic to aquatic life at certain levels. Sand washed into

waterbodies can create sand bars or fill in wetlands and ponds, impacting aquatic life, causing flooding, and affecting our use of these resources.

There are several steps that communities can take to minimize the impacts of snow disposal on public health and the environment. These steps will help communities avoid the costs of a contaminated water supply, degraded waterbodies, and flooding. Everything that occurs on the land has the potential to impact the Commonwealth's water resources. Given the authority of local government over the use of the land, municipal officials and staff have a critically important role to play in protecting our water resources.

The purpose of these guidelines is to help federal agencies, state agencies, state authorities, municipalities and businesses select, prepare, and maintain appropriate snow disposal sites before the snow begins to accumulate through the winter. Following these guidelines and obtaining the necessary approvals may also help municipalities in cases when seeking reimbursement for snow disposal costs from the Federal Emergency Management Agency is possible.

RECOMMENDED GUIDELINES

These snow disposal guidelines address: (1) site selection; (2) site preparation and maintenance; and (3) emergency snow disposal.

1. SITE SELECTION

The key to selecting effective snow disposal sites is to locate them adjacent to or on pervious surfaces in upland areas or upland locations on impervious surfaces away from water resources and drinking water wells. At these locations, the snow meltwater can filter into the soil, leaving behind sand and debris which can be removed in the spring. The following conditions should be followed:

- Within water supply Zone A and Zone II, avoid storage or disposal of snow and ice containing deicing chemicals that has been collected from streets located outside these zones. Municipalities may have a water supply protection land use control that prohibits the disposal of snow and ice containing deicing chemicals from outside the Zone A and Zone II, subject to the Massachusetts Drinking Water Regulations at 310 CMR 22.20C and 310 CMR 22.21(2).
- Avoid storage or disposal of snow or ice in Interim Wellhead Protection Areas (IWPA) of public water supply wells, and within 75 feet of a private well, where road salt may contaminate water supplies.
- Avoid dumping snow into any waterbody, including rivers, the ocean, reservoirs, ponds, or wetlands. In addition to water quality impacts and flooding, snow disposed of in open water can cause navigational hazards when it freezes into ice blocks.
- Avoid dumping snow on MassDEP-designated high and medium-yield aquifers where it may contaminate groundwater.
- Avoid dumping snow in sanitary landfills and gravel pits. Snow meltwater will create more contaminated leachate in landfills posing a greater risk to groundwater, and in gravel pits, there is little opportunity for pollutants to be filtered out of the meltwater because groundwater is close to the land surface.

- Avoid disposing of snow on top of storm drain catch basins or in stormwater drainage systems including detention basins, swales or ditches. Snow combined with sand and debris may block a stormwater drainage system, causing localized flooding. A high volume of sand, sediment, and litter released from melting snow also may be quickly transported through the system into surface water.

Recommended Site Selection Procedures

It is important that the municipal Department of Public Works or Highway Department, Conservation Commission, and Board of Health work together to select appropriate snow disposal sites. The following steps should be taken:

- Estimate how much snow disposal capacity may be needed for the season so that an adequate number of disposal sites can be selected and prepared.
- Identify sites that could potentially be used for snow disposal, such as municipal open space (e.g., parking lots or parks).
- Select sites located in upland locations that are not likely to impact sensitive environmental resources first.
- If more storage space is still needed, prioritize the sites with the least environmental impact (using the site selection criteria, and local or MassGIS maps as a guide).

Snow Disposal Mapping Assistance

MassDEP has an online mapping tool to assist in identifying possible locations to potentially dispose of snow. MassDEP encourages municipalities to use this tool to identify possible snow disposal options. The tool identifies wetland resource areas, public drinking water supplies and other sensitive locations where snow should not be disposed. The tool may be accessed through the Internet at the following web address: **https://maps.env.state.ma.us/dep/arcgis/js/templates/PSF/**.

2. SITE PREPARATION AND MAINTENANCE

In addition to carefully selecting disposal sites before the winter begins, it is important to prepare and maintain these sites to maximize their effectiveness. The following maintenance measures should be undertaken for all snow disposal sites:

- A silt fence or equivalent barrier should be placed securely on the downgradient side of the snow disposal site.
- Wherever possible maintain a 50-foot vegetated buffer between the disposal site and adjacent waterbodies to filter pollutants from the meltwater.
- Clear debris from the site prior to using the site for snow disposal.
- Clear debris from the site and properly dispose of it at the end of the snow season, and no later than May 15.

3. SNOW DISPOSAL APPROVALS

Proper snow disposal may be undertaken through one of the following approval procedures:

- Routine snow disposal – Minimal, if any, administrative review is required in these cases when upland and pervious snow disposal locations or upland locations on impervious surfaces that have functioning and maintained stormwater management systems have been identified, mapped, and used for snow disposal following ordinary snowfalls. Use of upland and pervious snow disposal sites avoids wetland resource areas and allows snow meltwater to recharge groundwater and will help filter pollutants, sand, and other debris. This process will address the majority of snow removal efforts until an entity exhausts all available upland snow disposal sites. The location and mapping of snow disposal sites will help facilitate each entity's routine snow management efforts.
- Emergency Certifications – If an entity demonstrates that there is no remaining capacity at upland snow disposal locations, local conservation commissions may issue an Emergency Certification under the Massachusetts Wetlands Protection regulations to authorize snow disposal in buffer zones to wetlands, certain open water areas, and certain wetland resource areas (i.e. within flood plains). Emergency Certifications can only be issued at the request of a public agency or by order of a public agency for the protection of the health or safety of citizens, and are limited to those activities necessary to abate the emergency. See 310 CMR 10.06(1)-(4). Use the following guidelines in these emergency situations:
    - Dispose of snow in open water with adequate flow and mixing to prevent ice dams from forming.
    - Do not dispose of snow in salt marshes, vegetated wetlands, certified vernal pools, shellfish beds, mudflats, drinking water reservoirs and their tributaries, Zone IIs or IWPAs of public water supply wells, Outstanding Resource Waters, or Areas of Critical Environmental Concern.
    - Do not dispose of snow where trucks may cause shoreline damage or erosion.
    - Consult with the municipal Conservation Commission to ensure that snow disposal in open water complies with local ordinances and bylaws.

- Severe Weather Emergency Declarations – In the event of a large-scale severe weather event, MassDEP may issue a broader Emergency Declaration under the Wetlands Protection Act which allows federal agencies, state agencies, state authorities, municipalities, and businesses greater flexibility in snow disposal practices. Emergency Declarations typically authorize greater snow disposal options while protecting especially sensitive resources such as public drinking water supplies, vernal pools, land containing shellfish, FEMA designated floodways, coastal dunes, and salt marsh. In the event of severe winter storm emergencies, the snow disposal site maps created by municipalities will enable MassDEP and the Massachusetts Emergency Management Agency (MEMA) in helping communities identify appropriate snow disposal locations.

  If upland disposal sites have been exhausted, the Emergency Declaration issued by MassDEP allows for snow disposal near water bodies. In these situations, a buffer of at

least 50 feet, preferably vegetated, should still be maintained between the site and the waterbody. Furthermore, it is essential that the other guidelines for preparing and maintaining snow disposal sites be followed to minimize the threat to adjacent waterbodies.

Under extraordinary conditions, when all land-based snow disposal options are exhausted, the Emergency Declaration issued by MassDEP may allow disposal of snow in certain waterbodies under certain conditions. ***A federal agency, state agency, state authority, municipality or business seeking to dispose of snow in a waterbody should take the following steps***:

- Call the emergency contact phone number [(888) 304-1133)] and notify the MEMA of the municipality's intent.
- MEMA will ask for some information about where the requested disposal will take place.
- MEMA will confirm that the disposal is consistent with MassDEP's Severe Weather Emergency Declaration and these guidelines and is therefore approved.

During declared statewide snow emergency events, MassDEP's website will also highlight the emergency contact phone number [(888) 304-1133)] for authorizations and inquiries. For further non-emergency information about this Guidance you may contact your MassDEP Regional Office Service Center:

Northeast Regional Office, Wilmington, 978-694-3246
Southeast Regional Office, Lakeville, 508-946-2714
Central Regional Office, Worcester, 508-792-7650
Western Regional Office, Springfield, 413-755-2114

MOSQUITO CONTROL

Chapter 5
Miscellaneous Stormwater Topics

Mosquito Control in Stormwater Management Practices

Both aboveground and underground stormwater BMPs have the potential to serve as mosquito breeding areas. Good design, proper operation and maintenance and treatment with larvicides can minimize this potential.

EPA recommends that stormwater treatment practices dewater within 3 days (72 hours) to reduce the number of mosquitoes that mature to adults, since the aquatic stage of many mosquito species is 7 to 10 days. Massachusetts has had a 72-hour dewatering rule in its Stormwater Management Standards since 1996. The 2008 technical specifications for BMPs set forth in Volume 2, Chapter 2 of the Massachusetts Stormwater Handbook also concur with this practice by requiring that all stormwater practices designed to drain do so within 72 hours.

Some stormwater practices are designed to include permanent wet pools. These practices – if maintained properly – can limit mosquito breeding by providing habitat for mosquito predators. Additional measures that can be taken to reduce mosquito populations include increasing water circulation, attracting mosquito predators by adding suitable habitat, and applying larvicides.

The Massachusetts State Reclamation and Mosquito Control Board (SRMCB), through the Massachusetts Mosquito Control Districts, can undertake further mosquito control actions specifically for the purpose of mosquito control pursuant to Massachusetts General Law Chapter 252. The Mosquito Control Board, http://www.mass.gov/agr/mosquito/, describes mosquito control methods and is in the process of developing guidance documents that describe Best Management Practices for mosquito control projects.

The SRMCB and Mosquito Control Districts are not responsible for operating and maintaining stormwater BMPs to reduce mosquito populations. The owners of property that construct the stormwater BMPs or municipalities that "accept" them through local subdivision approval are responsible for their maintenance.[1] The SRMCB is composed of officials from MassDEP, Department of Agricultural Resources, and Department of Conservation and Recreation. The nine (9) Mosquito Control Districts overseen by the SRMCB are located throughout Massachusetts, covering 176 municipalities.

Construction Period Best Management Practices for Mosquito Control

To minimize mosquito breeding during construction, it is essential that the following actions be taken to minimize the creation of standing pools by taking the following actions:

- ***Minimize Land Disturbance:*** Minimizing land disturbance reduces the likelihood of mosquito breeding by reducing silt in runoff that will cause construction period controls to clog and retain standing pools of water for more than 72 hours.
- ***Catch Basin inlets:*** Inspect and refresh filter fabric, hay bales, filter socks or stone dams on a regular basis to ensure that any stormwater ponded at the inlet drains within 8 hours after precipitation stops. Shorter periods may be necessary to avoid hydroplaning in roads

[1] MassDEP and MassHighway understand that the numerous stormwater BMPs along state highways pose a unique challenge. To address this challenge, the 2004 MassHighway Stormwater Handbook will provide additional information on appropriate operation and maintenance practices for mosquito control when the Handbook is revised to reflect the 2008 changes to the Stormwater Management Standards..

caused by water ponded at the catch basin inlet. Treat catch basin sumps with larvicides such as *Bacillus sphaericus* (*Bs*) using a licensed pesticide applicator.

- ***Check Dams:*** If temporary check dams are used during the construction period to lag peak rate of runoff or pond runoff for exfiltration, inspect and repair the check dams on a regular basis to ensure that any stormwater ponded behind the check dam drains within 72 hours.
- ***Design construction period sediment traps*** to dewater within 72 hours after precipitation. Because these traps are subject to high silt loads and tend to clog, treat them with the larvicide *Bs* after it rains from June through October, until the first frost occurs.
- ***Construction period open conveyances:*** When temporary manmade ditches are used for channelizing construction period runoff, inspect them on a regular basis to remove any accumulated sediment to restore flow capacity to the temporary ditch.
- ***Revegetating Disturbed Surfaces:*** Revegetating disturbed surfaces reduces sediment in runoff that will cause construction period controls to clog and retain standing pools of water for greater than 72 hours.
- ***Sediment fences/hay bale barriers:*** When inspections find standing pools of water beyond the 24-hour period after a storm, take action to restore barrier to its normal function.

Post-Construction Stormwater Treatment Practices

- Mosquito control begins with the environmentally sensitive site design. Environmentally sensitive site design that minimizes impervious surfaces reduces the amount of stormwater runoff. Disconnecting runoff using the LID Site Design credits outlined in the Massachusetts Stormwater Handbook reduces the amount of stormwater that must be conveyed to a treatment practice. Utilizing green roofs minimizes runoff from smaller storms. Storage media must be designed to dewater within 72 hours after precipitation.
- Mosquito control continues with the selection of structural stormwater BMPs that are unlikely to become breeding grounds for mosquitoes, such as:
    - ***Bioretention Areas/Rain Gardens/Sand Filter:*** These practices tend not to result in mosquito breeding. If any level spreaders, weirs or sediment forebays are used as part of the design, inspect them and correct them as necessary to prevent standing pools of water for more than 72 hours.
    - ***Infiltration Trenches:*** This practice tends not to result in mosquito breeding. If any level spreaders, weirs, or sediment forebays are used as part of the design, inspect them and correct them as necessary to prevent standing pools of water for more than 72 hours.
- Another mosquito control strategy is to select BMPs that can become habitats for mosquito predators, such as:
    - ***Constructed Stormwater Wetlands:*** Habitat features can be incorporated in constructed stormwater wetlands to attract dragonflies, amphibians, turtles, birds, bats, and other natural predators of mosquitoes.
    - ***Wet Basins:*** Wet basins can be designed to incorporate fish habitat features, such as deep pools. Introduce fish in consultation with Massachusetts Division of Fisheries and Wildlife. Vegetation within wet basins designed as fish habitat must be properly managed to ensure that vegetation does not overtake the habitat. Proper design to ensure that no low circulation or "dead" zones are created may reduce the potential for mosquito breeding. Introducing bubblers may increase water circulation in the wet basin.

Effective mosquito controls require proponents to design structural BMPs to prevent ponding and facilitate maintenance and, if necessary, the application of larvicides. Examples of such design practices include the following:

- ***Basins:*** Provide perimeter access around wet basins, extended dry detention basins and dry detention basins for both larviciding and routine maintenance. Control vegetation to ensure that access pathways stay open.
- ***BMPs without a permanent pool of water:*** All structural BMPs that do not rely on a permanent pool of water must drain and completely dewater within 72 hours after precipitation. This includes dry detention basins, extended dry detention basins, infiltration basins, and dry water quality swales. Use underdrains at extended dry detention basins to drain the small pools that form due to accumulation of silts. Wallace indicates that extended dry extended detention basins may breed more mosquitoes than wet basins. It is, therefore, imperative to design outlets from extended dry detention basins to completely dewater within the 72-hour period.
- ***Energy Dissipators and Flow Spreaders:*** Currier and Moeller, 2000 indicate that shallow recesses in energy dissipators and flow spreaders trap water where mosquitoes breed. Set the riprap in grout to reduce the shallow recesses and minimize mosquito breeding.
- ***Outlet control structures:*** Debris trapped in small orifices or on trash racks of outlet control structures such as multiple stage outlet risers may clog the orifices or the trash rack, causing a standing pool of water. Optimize the orifice size or trash rack mesh size to provide required peak rate attenuation/water quality detention/retention time while minimizing clogging.
- ***Rain Barrels and Cisterns:*** Seal lids to reduce the likelihood of mosquitoes laying eggs in standing water. Install mosquito netting over inlets. The cistern system should be designed to ensure that all collected water is drained into it within 72 hours.
- ***Subsurface Structures, Deep Sump Catch Basins, Oil Grit Separators, and Leaching Catch Basins:*** Seal all manhole covers to reduce likelihood of mosquitoes laying eggs in standing water. Install mosquito netting over the outlet (CALTRANS 2004).

The Operation and Maintenance Plan should provide for mosquito prevention and control.

- ***Check dams:*** Inspect permanent check dams on the schedule set forth in the O&M Plan. Inspect check dams 72 hours after storms for standing water ponding behind the dam. Take corrective action if standing water is found.
- ***Cisterns:*** Apply *Bs* larvicide in the cistern if any evidence of mosquitoes is found. The Operation and Maintenance Plan shall specify how often larvicides should be applied to waters in the cistern.
- ***Water quality swales:*** Remove and properly dispose of any accumulated sediment as scheduled in the Operation and Maintenance Plan.
- ***Larvicide Treatment:*** The Operation and Maintenance Plan must include measures to minimize mosquito breeding, including larviciding.
- The party identified in the Operation and Maintenance Plan as responsible for maintenance shall see that larvicides are applied as necessary to the following stormwater treatment practices: catch basins, oil/grit separators, wet basins, wet water quality swales, dry extended detention basins, infiltration basins, and constructed stormwater wetlands. The Operation and Maintenance Plan must ensure that all larvicides are applied by a licensed pesticide applicator and in compliance with all pesticide label requirements.
- The Operation and Maintenance Plan should identify the appropriate larvicide and the time and method of application. For example, *Bacillus sphaericus (Bs*), the preferred

larvicide for stormwater BMPs, should be hand-broadcast.[2] Alternatively, Altosid, a Methopren product, may be used. Because some practices are designed to dewater between storms, such as dry extended detention and infiltration basins, the Operation and Maintenance Plan should provide that larviciding must be conducted during or immediately after wet weather, when the detention or infiltration basin has a standing pool of water, unless a product is used that can withstand extended dry periods.

REFERENCES

California Department of Transportation, 2004, BMP Retrofit Pilot Program, Final Report, Report ID CTSW – RT – 1 – 050, http://www.dot.ca.gov/hq/env/stormwater/special/newsetup/_pdfs/new_technology/CTSW-RT-01-050.pdf#xml=http://dap1.dot.ca.gov/cgi-bin/texis/webinator/search/pdfhi.txt?query=mosquito&db=db&pr=www&prox=page&rorder=500&rprox=500&rdfreq=500&rwfreq=500&rlead=500&sufs=0&order=r&cq=&id=4673373b7
Appendix E: Vector Monitoring and Abatement, http://www.dot.ca.gov/hq/env/stormwater/special/newsetup/_pdfs/new_technology/
California Department of Transportation, 2001, Final Vector Report, Caltrans BMP Retrofit Project Sites, Districts 7 and 11, http://www.dot.ca.gov/hq/env/stormwater/special/newsetup/_pdfs/new_technology/CTSW-RT-01-050/AppendixE/01_FinalVectorReport.pdf
Currier, Brian, and Moeller, 2000, Glenn, Lessons Learned: The CALTRANS Storm Water Best Management Practice Retrofit Pilot Study, prepared by the California State University Sacramento and University of California Davis for the California Department of Transportation, http://www.owp.csus.edu/research/papers/papers/PP015.pdf
Massachusetts Department of Environmental Protection, 2001, West Nile Virus, Application of Pesticides to Wetland Resource Areas and Buffer Zones and Public Water systems, Guideline No. BRPG01-02, http://www.mass.gov/dep/water/wnvpolcy.doc
O'Meara, G.F., 2003, Mosquitoes Associated With Stormwater Detention/Retention Areas, ENY627, University of Florida, Institute of Food and Agricultural Sciences Extension, http://edis.ifas.ufl.edu/mg338
Taylor, Scott M., and Currier, Brian, 1999, A Wet Pond as a Storm Water Runoff BMP – Case Study, presented at Department of Environmental Resources Engineering, Humboldt State University, Arcata, California http://www.owp.csus.edu/research/papers/papers/PP004.pdf
U.S. EPA, 2005, Stormwater Structures and Mosquitoes, EPA 833-F-05-003, http://www.epa.gov/npdes/pubs/sw_wnv.pdf
U.S. EPA, 2003, Do Stormwater Retention Ponds Contribute to Mosquito Problems, Nonpoint source News-Notes, Issue No. 71, http://notes.tetratech-ffx.com/newsnotes.nsf/0/143f7fa99c3ea25485256d0100618bc9?OpenDocument
Virginia Department of Conservation and Recreation, 2003, Vector Control, Mosquitoes and Stormwater Management, Stormwater Management Technical Bulletin No. 8, http://www.dcr.virginia.gov/soil_&_water/documents/tecbltn8.pdf
Wallace, John R., Stormwater Management and Mosquito Ecology, Stormwater Magazine, March/April 2007, http://www.gradingandexcavation.com/sw_0703_management.html

[2] *Bacillus thuringienis israelensis* or *Bti* is usually applied by helicopter to wetlands and floodplains

Roads and Stormwater BMPs

In general, the stormwater BMPs used for land development projects can also be used for new roadways and roadway improvement projects. However, for improvement of existing roads, there are often constraints that limit the choice of BMP. These constraints derive from the linear configuration of the road, the limited area within the existing right-of-way, the structural and safety requirements attendant to good roadway design, and the long-term maintainability of the roadway drainage systems. The MassHighway Handbook provides strategies for dealing with the constraints associated with providing stormwater BMPs for roadway redevelopment projects.

Roadway design can minimize impacts caused by stormwater. Reducing roadway width reduces the total and peak volume of runoff. Designing a road with country drainage (no road shoulders or curbs) disconnects roadway runoff. Disconnection of roadway runoff is eligible for the Low Impact Site Design Credit provided the drainage is disconnected in accordance with specifications outlined in Volume 3.

Like other parties, municipalities that work within wetlands jurisdictional areas and adjacent buffer zones must design and implement structural stormwater best management practices in accordance with the Stormwater Management Standards and the Stormwater Management Handbook. In addition, in municipalities and areas where state agencies operate stormwater systems, the DPWs (or other town or state agencies) must meet the "good housekeeping" requirement of the municipality's or agency's MS4 permit.

MassHighway has taken stormwater management one step further by working with MassDEP to develop the MassHighway Storm Water Handbook for Highways and Bridges. The purpose of the MassHighway Handbook is to provide guidance for persons involved in the design, permitting, review and implementation of state highway projects, especially those involving existing roadways where physical constraints often limit the stormwater management options available. These constraints, like those common to redevelopment sites, may make it difficult to comply precisely with the requirements of the Stormwater Management Standards and the Massachusetts Stormwater Handbook.[3] In response to these constraints, MassDEP and MHD developed specific design, permitting, review and implementation practices that meet the unique challenges of providing environmental protection for existing state roads. The information in the MassHighway Handbook may also aid in the planning and design of projects to build new highways and to add lanes to existing highways, since they may face similar difficulties in meeting the requirements of the Stormwater Management Standards.

Although it is very useful, the MassHighway Handbook does not allow MassHighway projects to proceed without individual review and approval by the issuing authority when subject to the Wetlands Protection Act Regulations, 310 CMR 10.00, or the 401 Water Quality Certification Regulations, 314 CMR 9.00. For example, MassHighway must provide a Conservation Commission with a project-specific Operation and Maintenance Plan in accordance with Standard 9 that documents how the project's post-construction BMPs will be operated and maintained.[4]

[3] The 2004 MassHighway Handbook outlines standardized methods for dealing with these constraints as they apply to highway redevelopment projects. MassDEP and MassHighway intend to work together to provide guidance for add a lane projects when the 2004 Handbook is revised to reflect the 2008 changes to the Stormwater Management Standards.

[4] The general permit for municipal separate storm sewer systems (the MS4 Permit) requires MassHighway to develop and implement procedures for the proper operation and maintenance of stormwater BMPs. To

Some municipalities have asked if the MassHighway Handbook governs municipal road projects. The answer is no.[5] The MassHighway Handbook was developed in response to the unique problems and challenges arising out of the management of the state highway system. Like other project proponents, cities and towns planning road or other projects in areas subject to jurisdiction under the Wetlands Protection Act must design and implement LID, non-structural and structural best management practices in accordance with the Stormwater Management Standards and the Massachusetts Stormwater Handbook.

avoid duplication of effort, MassHighway may be able rely on the same procedures to fulfill the operation and maintenance requirements of Standard 9 and the MS 4 Permit.

[5] Although the MassHighway Handbook does not govern municipal road projects, cities and towns may find some of the information presented in the Handbook useful.

OPERATION & MAINTENANCE SUMMARY TABLE

OPERATION AND MAINTENANCE PLAN SCHEDULE **Date:**

ALLEN & MAJOR ASSOCIATES, INC.

Project: Multi-Family Development
Project Address: 580 Main Street Bolton, MA

Responsible for O&M Plan: WP East Acquisitions, LLC
Address: 91 Hartwell Avenue Lexington, MA 02421
Phone:

All information within table is derived from Massachussetts Stormwater Handbook: Volume 2, Chapter 2

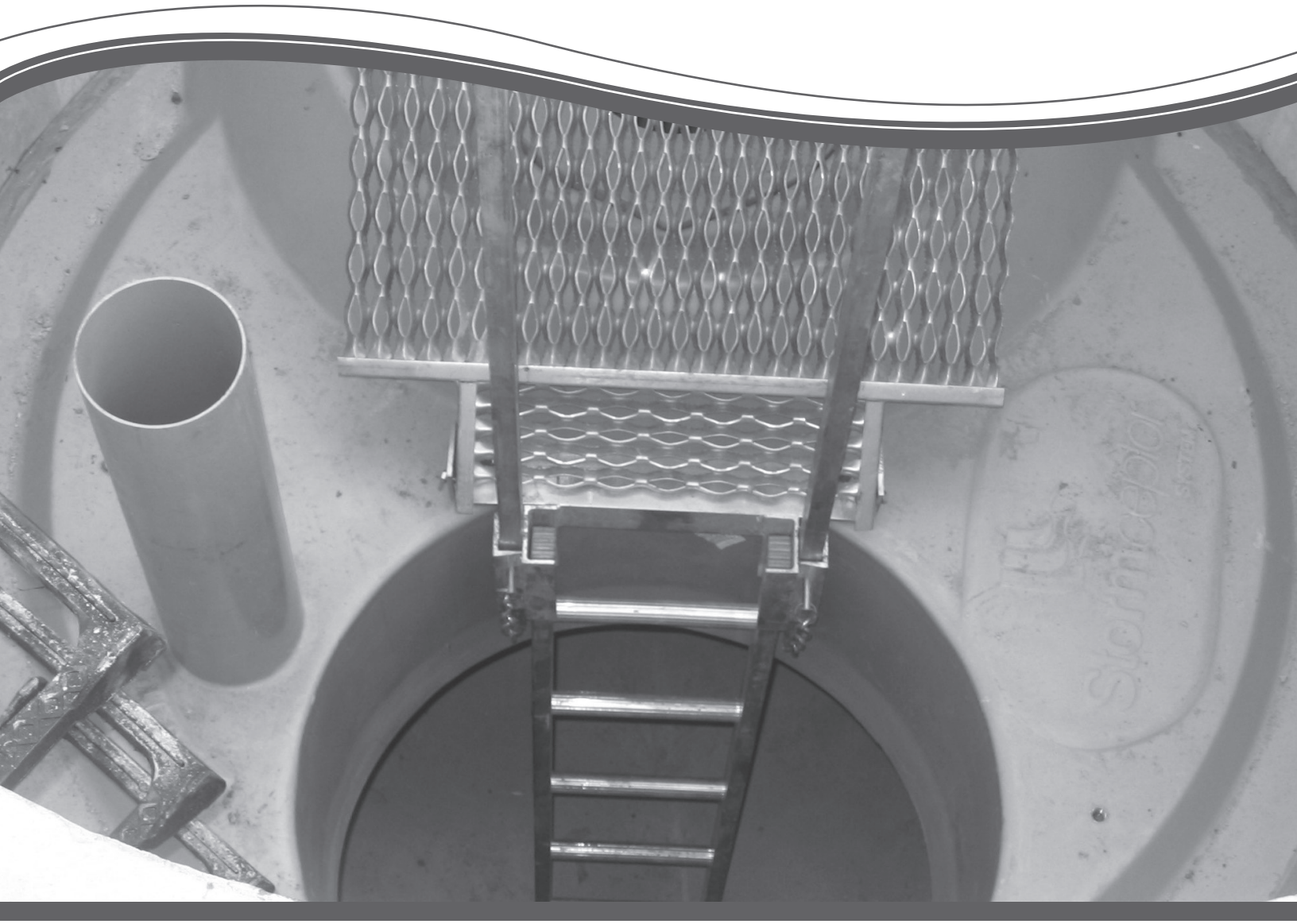
BMP CATEGORY	BMP OR MAINTENANCE ACTIVITY	SCHEDULE/ FREQUENCY	NOTES	ESTIMATED ANNUAL MAINTENANCE COST	INSPECTION PERFORMED	
					DATE:	BY:
STRUCTURAL PRETREATMENT BMPs	**DEEP SUMP HOODED CATCH BASIN**	Twice per year.	Inspect and clean catch basin units whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin.	$1,000		
	PROPRIETARY SEPARATORS	In accordance with manufacturers requirements, but no less than twice a year following installation and once a year thereafter.	Remove sediment and other trapped pollutants at frequency or level specified by manufacturer.	$1,000		
TREATMENT BMP'S	**PROPRIETARY STORMTECH ISOLATOR ROW**	Twice per year minimum; follow manufacturer's schedule	Inspect for standing water, sediment, trash and debris and clogging. Inspect to determine if system drains in 72 hours once a year during wet season after a large storm.	$1,000		
	WET BASIN	Twice per year.	Inspect wet basins to ensure they are operating as designed. Mow the upper stage, side slopes, embankments and emergency spillway. Check the sediment forebay for accumulated sediment, trash, debris and remove it. Remove sediment from the basin as necessary and at least once evry 10 yrs.	$1,000		
CONVEYANCE BMPs	**GRASS SWALE**	Remove sediment annually. Mow once a month during growing season. Repair erosion no less than once per year.	Remove sediment from forebay and grass channel, mow, repair areas of erosion and revegetate.	$500		
INFILTRATION BMPs	**SUBSURFACE STRUCTURES**	Inspect structure inlets at least twice a year. Remove debris that may clog the system as needed.	Because subsurface structures are installed underground, they are extremely difficult to maintain. Remove any debris that might clog the system.	$1,000		

OTHER BMP's	**POROUS PAVEMENT**	Assess exfiltration capability at least once a year. Inspect for deterioration annually. Monitor if paving surface is draining properly as needed.	Monitor to ensure that the paving surface drains properly after storms. For porous asphalts and concretes, clean the surface using power washer to dislodge trapped particles and then vacuum sweep the area. Inspect the surface annually for deterioration.	$2,000		
BMP ACCESSORIES	**LEVEL SPREADERS**	Inspect regularly, especially after large rainfall events.	Inspect level spreaders regularly, especially after large rainfall events. Note and repair any erosion or low spots in the spreader.	$1,000		
	OUTLET STRUCTURES	Periodic cleaning of Outlet Control Structures as needed.	Clear trash and debris as necessary.	$500		
OTHER MAINTENANCE ACTIVITY	**MISQUITO CONTROL**	Inspect BMPs as needed to ensure the system's drainage time is less than the maximum 72 hour period.	Massachusetts stormwater handbook requires all stormwater practices that are designed to drain do so within 72 hours to reduce the number of mosquitos that mature to adults since the aquatic stage of a mosquito is 7-10 days.	$300		
	SNOW STORAGE	Clear and remove snow to approved storage locations as necessary to ensure systems are working properly and are protected from meltwater pollutants.	Carefully select snow disposal sites before winter. Avoid dumping removed snow over catch basins, or in detention ponds, sediment forebays, rivers, wetlands, and flood plains. It is also prohibited to dump snow in the bioretention basins or gravel swales.	$500		
	STREET SWEEPING	Clear accumulations of winter sand in parking lots and along roadways at least once a year, preferably in the spring.	Sweep, power broom or vacuum paved areas. Submit information that confirms that all street sweepings have been completed in accordance with state and local requirements	$2,000		

STORMCEPTOR OPERATION & MAINTENANCE

CONTECH®
ENGINEERED SOLUTIONS

Stormceptor® STC
Operation and Maintenance Guide



Stormceptor® STC

Stormceptor Design Notes

- Only the STC 450i is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 450i to STC 7200 may accommodate multiple inlet pipes.

Inlet and outlet invert elevation differences are as follows:

Inlet and Outlet Pipe Invert Elevations Differences			
Inlet Pipe Configuration	STC 450i	STC 900 to STC 7200	STC 11000 to STC 16000
Single inlet pipe	3 in. (75 mm)	1 in. (25 mm)	3 in. (75 mm)
Multiple inlet pipes	3 in. (75 mm)	3 in. (75 mm)	Only one inlet pipe.

Maximum inlet and outlet pipe diameters:

Inlet/Outlet Configuration	Inlet Unit STC 450i	In-Line Unit STC 900 to STC 7200	Series* STC 11000 to STC 16000
Straight Through	24 inch (600 mm)	42 inch (1050 mm)	60 inch (1500 mm)
Bend (90 degrees)	18 inch (450 mm)	33 inch (825 mm)	33 inch (825 mm)

- The inlet and in-line Stormceptor units can accommodate turns to a maximum of 90 degrees.
- Minimum distance from top of grade to crown is 2 feet (0.6 m)
- Submerged conditions. A unit is submerged when the standing water elevation at the proposed location of the Stormceptor unit is greater than the outlet invert elevation during zero flow conditions. In these cases, please contact your local Stormceptor representative and provide the following information:
- Top of grade elevation
- Stormceptor inlet and outlet pipe diameters and invert elevations
- Standing water elevation
- Stormceptor head loss, K = 1.3 (for submerged condition, K = 4)

Stormceptor® STC

OPERATION AND MAINTENANCE GUIDE
Table of Content

1. About Stormceptor

The Stormceptor® STC (Standard Treatment Cell) was developed by Imbrium™ Systems to address the growing need to remove and isolate pollution from the storm drain system before it enters the environment. The Stormceptor STC targets hydrocarbons and total suspended solids (TSS) in stormwater runoff. It improves water quality by removing contaminants through the gravitational settling of fine sediments and floatation of hydrocarbons while preventing the re-suspension or scour of previously captured pollutants.

The development of the Stormceptor STC revolutionized stormwater treatment, and created an entirely new category of environmental technology. Protecting thousands of waterways around the world, the Stormceptor System has set the standard for effective stormwater treatment.

1.1. Patent Information

The Stormceptor technology is protected by the following patents:

- Australia Patent No. 693,164 • 693,164 • 707,133 • 729,096 • 779401
- Austrian Patent No. 289647
- Canadian Patent No 2,009,208 •2,137,942 • 2,175,277 • 2,180,305 • 2,180,383 • 2,206,338 • 2,327,768 (Pending)
- China Patent No 1168439
- Denmark DK 711879
- German DE 69534021
- Indonesian Patent No 16688
- Japan Patent No 9-11476 (Pending)
- Korea 10-2000-0026101 (Pending)
- Malaysia Patent No PI9701737 (Pending)
- New Zealand Patent No 314646
- United States Patent No 4,985,148 • 5,498,331 • 5,725,760 • 5,753,115 • 5,849,181 • 6,068,765 • 6,371,690
- Stormceptor OSR Patent Pending • Stormceptor LCS Patent Pending

2. Stormceptor Design Overview

2.1. Design Philosophy

The patented Stormceptor System has been designed to focus on the environmental objective of providing long-term pollution control. The unique and innovative Stormceptor design allows for continuous positive treatment of runoff during all rainfall events, while ensuring that all captured pollutants are retained within the system, even during intense storm events.

An integral part of the Stormceptor design is PCSWMM for Stormceptor - sizing software developed in conjunction with Computational Hydraulics Inc. (CHI) and internationally acclaimed expert, Dr. Bill James. Using local historical rainfall data and continuous simulation modeling, this software allows a Stormceptor unit to be designed for each individual site and the corresponding water quality objectives.

By using PCSWMM for Stormceptor, the Stormceptor System can be designed to remove a wide range of particles (typically from 20 to 2,000 microns), and can also be customized to remove a specific particle size distribution (PSD). The specified PSD should accurately reflect what is in the stormwater runoff to ensure the device is achieving the desired water quality objective. Since stormwater runoff contains small particles (less than 75 microns), it is important to design a treatment system to remove smaller particles in addition to coarse particles.

2.2. Benefits

The Stormceptor System removes free oil and suspended solids from stormwater, preventing spills and non-point source pollution from entering downstream lakes and rivers. The key benefits, capabilities and applications of the Stormceptor System are as follows:

- Provides continuous positive treatment during all rainfall events
- Can be designed to remove over 80% of the annual sediment load
- Removes a wide range of particles
- Can be designed to remove a specific particle size distribution (PSD)
- Captures free oil from stormwater
- Prevents scouring or re-suspension of trapped pollutants
- Pre-treatment to reduce maintenance costs for downstream treatment measures (ponds, swales, detention basins, filters)
- Groundwater recharge protection
- Spills capture and mitigation
- Simple to design and specify
- Designed to your local watershed conditions
- Small footprint to allow for easy retrofit installations
- Easy to maintain (vacuum truck)
- Multiple inlets can connect to a single unit
- Suitable as a bend structure
- Pre-engineered for traffic loading (minimum AASHTO HS-20)
- Minimal elevation drop between inlet and outlet pipes
- Small head loss
- Additional protection provided by an 18" (457 mm) fiberglass skirt below the top of the insert, for the containment of hydrocarbons in the event of a spill.

2.3. Environmental Benefit

Freshwater resources are vital to the health and welfare of their surrounding communities. There is increasing public awareness, government regulations and corporate commitment to reducing the pollution entering our waterways. A major source of this pollution originates from stormwater runoff from urban areas. Rainfall runoff carries oils, sediment and other contaminants from roads and parking lots discharging directly into our streams, lakes and coastal waterways.

The Stormceptor System is designed to isolate contaminants from getting into the natural environment. The Stormceptor technology provides protection for the environment from spills that occur at service stations and vehicle accident sites, while also removing contaminated sediment in runoff that washes from roads and parking lots.

3. Key Operation Features

3.1. Scour Prevention

A key feature of the Stormceptor System is its patented scour prevention technology. This innovation ensures pollutants are captured and retained during all rainfall events, even extreme storms. The Stormceptor System provides continuous positive treatment for all rainfall events, including intense storms. Stormceptor slows incoming runoff, controlling and reducing velocities in the lower chamber to create a non-turbulent environment that promotes free oils and floatable debris to rise and sediment to settle.

The patented scour prevention technology, the fiberglass insert, regulates flows into the lower chamber through a combination of a weir and orifice while diverting high energy flows away through the upper chamber to prevent scouring. Laboratory testing demonstrated no scouring when tested up to 125% of the unit's operating rate, with the unit loaded to 100% sediment capacity (NJDEP, 2005). Second, the depth of the lower chamber ensures the sediment storage zone is adequately separated from the path of flow in the lower chamber to prevent scouring.

3.2. Operational Hydraulic Loading Rate

Designers and regulators need to evaluate the treatment capacity and performance of manufactured stormwater treatment systems. A commonly used parameter is the "operational hydraulic loading rate" which originated as a design methodology for wastewater treatment devices.

Operational hydraulic loading rate may be calculated by dividing the flow rate into a device by its settling area. This represents the critical settling velocity that is the prime determinant to quantify the influent particle size and density captured by the device. PCSWMM for Stormceptor uses a similar parameter that is calculated by dividing the hydraulic detention time in the device by the fall distance of the sediment.

$$v_{SC} = \frac{H}{6_H} = \frac{Q}{A_S}$$

Where:

v_{SC} = critical settling velocity, ft/s (m/s)

H = tank depth, ft (m)

$Ø_H$ = hydraulic detention time, ft/s (m/s)

Q = volumetric flow rate, ft3/s (m3/s)

A_S = surface area, ft^2 (m^2)

(Tchobanoglous, G. and Schroeder, E.D. 1987. Water Quality. Addison Wesley.)

Unlike designing typical wastewater devices, stormwater systems are designed for highly variable flow rates including intense peak flows. PCSWMM for Stormceptor incorporates all of the flows into its calculations, ensuring that the operational hydraulic loading rate is considered not only for one flow rate, but for all flows including extreme events.

3.3. Double Wall Containment

The Stormceptor System was conceived as a pollution identifier to assist with identifying illicit discharges. The fiberglass insert has a continuous skirt that lines the concrete barrel wall for a depth of 18 inches (457 mm) that provides double wall containment for hydrocarbons storage. This protective barrier ensures that toxic floatables do not migrate through the concrete wall into the surrounding soils.

4. Stormceptor Product Line

4.1. Stormceptor Models

A summary of Stormceptor models and capacities are listed in Table 1.

Table 1. Stormceptor Models

Stormceptor Model	Total Storage Volume U.S. Gal (L)	Hydrocarbon Storage Capacity U.S. Gal (L)	Maximum Sediment Capacity ft^3 (L)
STC 450i	470 (1,780)	86 (330)	46 (1,302)
STC 900	952 (3,600)	251 (950)	89 (2,520)
STC 1200	1,234 (4,670)	251 (950)	127 (3,596)
STC 1800	1,833 (6,940)	251 (950)	207 (5,861)
STC 2400	2,462 (9,320)	840 (3,180)	205 (5,805)
STC 3600	3,715 (1,406)	840 (3,180)	373 (10,562)
STC 4800	5,059 (1,950)	909 (3,440)	543 (15,376)
STC 6000	6,136 (23,230)	909 (3,440)	687 (19,453)
STC 7200	7,420 (28,090)	1,059 (4,010)	839 (23,757)
STC 11000	11,194 (42,370)	2,797 (10, 590)	1,086 (30,752)
STC 13000	13,348 (50,530)	2,797 (10, 590)	1,374 (38,907)
STC 16000	15,918 (60,260)	3,055 (11, 560)	1,677 (47,487)

NOTE: Storage volumes may vary slightly from region to region. For detailed information, contact your local Stormceptor representative.

4.2. Inline Stormceptor

The Inline Stormceptor, Figure 1, is the standard design for most stormwater treatment applications. The patented Stormceptor design allows the Inline unit to maintain continuous positive treatment of total suspended solids (TSS) year-round, regardless of flow rate. The Inline Stormceptor is composed of a precast concrete tank with a fiberglass insert situated at the invert of the storm sewer pipe, creating an upper chamber above the insert and a lower chamber below the insert.

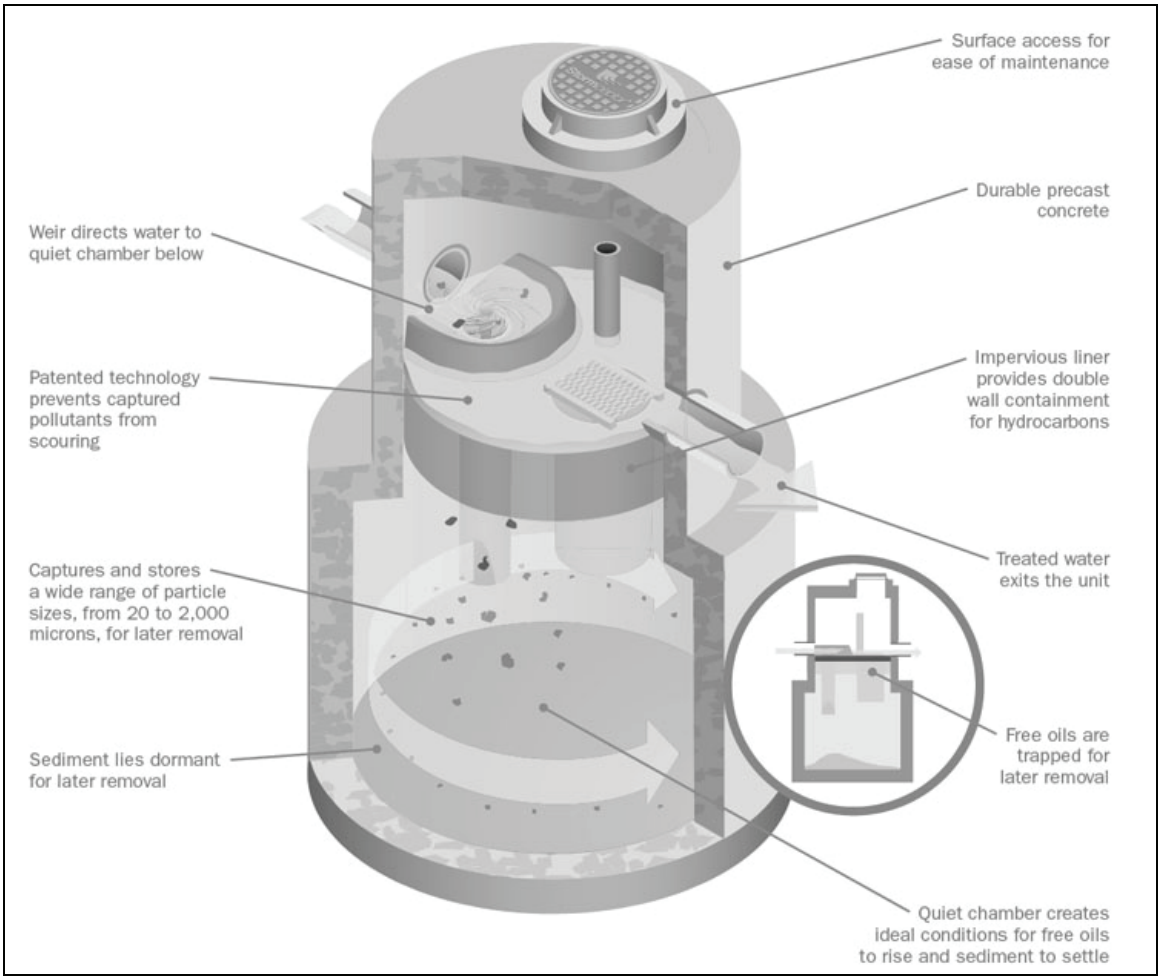


Figure 1. Inline Stormceptor

Operation

As water flows into the Stormceptor unit, it is slowed and directed to the lower chamber by a weir and drop tee. The stormwater enters the lower chamber, a non-turbulent environment, allowing free oils to rise and sediment to settle. The oil is captured underneath the fiberglass insert and shielded from exposure to the concrete walls by a fiberglass skirt. After the pollutants separate, treated water continues up a riser pipe, and exits the lower chamber on the downstream side of the weir before leaving the unit. During high flow events, the Stormceptor System's patented scour prevention technology ensures continuous pollutant removal and prevents re-suspension of previously captured pollutants.

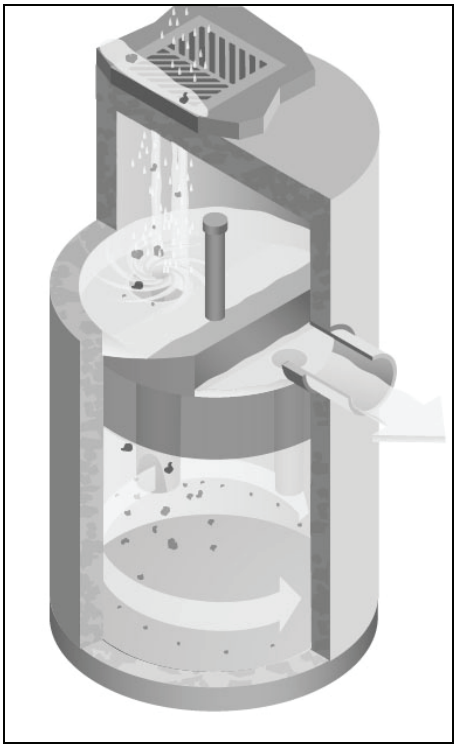


Figure 2. Inlet Stormceptor

4.3. Inlet Stormceptor

The Inlet Stormceptor System, Figure 2, was designed to provide protection for parking lots, loading bays, gas stations and other spill-prone areas. The Inlet Stormceptor is designed to remove sediment from stormwater introduced through a grated inlet, a storm sewer pipe, or both.

The Inlet Stormceptor design operates in the same manner as the Inline unit, providing continuous positive treatment, and ensuring that captured material is not re-suspended.

4.4. Series Stormceptor

Designed to treat larger drainage areas, the Series Stormceptor System, Figure 3, consists of two adjacent Stormceptor models that function in parallel. This design eliminates the need for additional structures and piping to reduce installation costs.

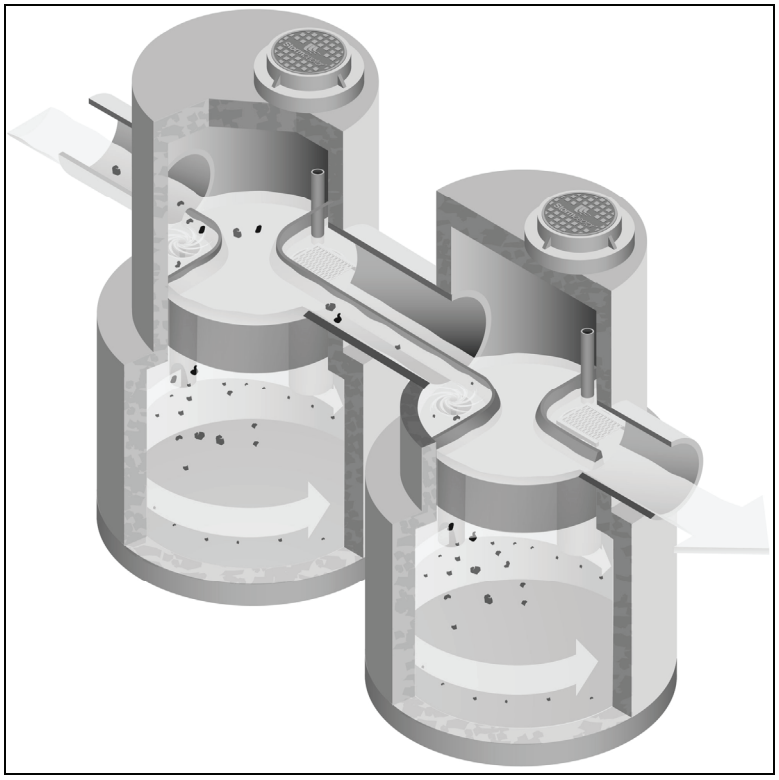


Figure 3. Series System

The Series Stormceptor design operates in the same manner as the Inline unit, providing continuous positive treatment, and ensuring that captured material is not re-suspended.

5. Sizing the Stormceptor System

The Stormceptor System is a versatile product that can be used for many different aspects of water quality improvement. While addressing these needs, there are conditions that the designer needs to be aware of in order to size the Stormceptor model to meet the demands of each individual site in an efficient and cost-effective manner.

PCSWMM for Stormceptor is the support tool used for identifying the appropriate Stormceptor model. In order to size a unit, it is recommended the user follow the seven design steps in the program. The steps are as follows:

STEP 1 – Project Details

The first step prior to sizing the Stormceptor System is to clearly identify the water quality objective for the development. It is recommended that a level of annual sediment (TSS) removal be identified and defined by a particle size distribution.

STEP 2 – Site Details

Identify the site development by the drainage area and the level of imperviousness. It is recommended that imperviousness be calculated based on the actual area of imperviousness based on paved surfaces, sidewalks and rooftops.

STEP 3 – Upstream Attenuation

The Stormceptor System is designed as a water quality device and is sometimes used in conjunction with onsite water quantity control devices such as ponds or underground detention systems. When possible, a greater benefit is typically achieved when installing a Stormceptor unit upstream of a detention facility. By placing the Stormceptor unit upstream of a detention structure, a benefit of less maintenance of the detention facility is realized.

STEP 4 – Particle Size Distribution

It is critical that the PSD be defined as part of the water quality objective. PSD is critical for the design of treatment system for a unit process of gravity settling and governs the size of a treatment system. A range of particle sizes has been provided and it is recommended that clays and silt-sized particles be considered in addition to sand and gravel-sized particles. Options and sample PSDs are provided in PCSWMM for Stormceptor. The default particle size distribution is the Fine Distribution, Table 2, option.

Table 2. Fine Distribution

Particle Size	Distribution	Specific Gravity
20	20%	1.3
60	20%	1.8
150	20%	2.2
400	20%	2.65
2000	20%	2.65

If the objective is the long-term removal of 80% of the total suspended solids on a given site, the PSD should be representative of the expected sediment on the site. For example, a system designed to remove 80% of coarse particles (greater than 75 microns) would provide relatively poor removal efficiency of finer particles that may be naturally prevalent in runoff from the site.

Since the small particle fraction contributes a disproportionately large amount of the total available particle surface area for pollutant adsorption, a system designed primarily for coarse particle capture will compromise water quality objectives.

STEP 5 – Rainfall Records

Local historical rainfall has been acquired from the U.S. National Oceanic and Atmospheric Administration, Environment Canada and regulatory agencies across North America. The rainfall data provided with PCSMM for Stormceptor provides an accurate estimation of small storm hydrology by modeling actual historical storm events including duration, intensities and peaks.

STEP 6 – Summary

At this point, the program may be executed to predict the level of TSS removal from the site. Once the simulation has completed, a table shall be generated identifying the TSS removal of each Stormceptor unit.

STEP 7 – Sizing Summary

Performance estimates of all Stormceptor units for the given site parameters will be displayed in a tabular format. The unit that meets the water quality objective, identified in Step 1, will be highlighted.

5.1. PCSWMM for Stormceptor

The Stormceptor System has been developed in conjunction with PCSWMM for Stormceptor as a technological solution to achieve water quality goals. Together, these two innovations model, simulate, predict and calculate the water quality objectives desired by a design engineer for TSS removal.

PCSWMM for Stormceptor is a proprietary sizing program which uses site specific inputs to a computer model to simulate sediment accumulation, hydrology and long-term total suspended solids removal. The model has been calibrated to field monitoring results from Stormceptor units that have been monitored in North America. The sizing methodology can be described by three processes:

1. Determination of real time hydrology
2. Buildup and wash off of TSS from impervious land areas
3. TSS transport through the Stormceptor (settling and discharge). The use of a calibrated model is the preferred method for sizing stormwater quality structures for the following reasons:
    - » The hydrology of the local area is properly and accurately incorporated in the sizing (distribution of flows, flow rate ranges and peaks, back-to-back storms, inter-event times)
    - » The distribution of TSS with the hydrology is properly and accurately considered in the sizing
    - » Particle size distribution is properly considered in the sizing
    - » The sizing can be optimized for TSS removal
    - » The cost benefit of alternate TSS removal criteria can be easily assessed
    - » The program assesses the performance of all Stormceptor models. Sizing may be selected based on a specific water quality outcome or based on the Maximum Extent Practicable

For more information regarding PCSWMM for Stormceptor, contact your local Stormceptor representative, or visit www.imbriumsystems.com to download a free copy of the program.

5.2. Sediment Loading Characteristics

The way in which sediment is transferred to stormwater can have a considerable effect on which type of system is implemented. On typical impervious surfaces (e.g. parking lots) sediment will build over time and wash off with the next rainfall. When rainfall patterns are examined, a short intense storm will have a higher concentration of sediment than a long slow drizzle. Together with rainfall data representing the site's typical rainfall patterns, sediment loading characteristics play a part in the correct sizing of a stormwater quality device.

Typical Sites

For standard site design of the Stormceptor System, PCSWMM for Stormceptor is utilized to accurately assess the unit's performance. As an integral part of the product's design, the program can be used to meet local requirements for total suspended solid removal. Typical installations of manufactured stormwater treatment devices would occur on areas such as paved parking lots or paved roads. These are considered "stable" surfaces which have non – erodible surfaces.

Unstable Sites

While standard sites consist of stable concrete or asphalt surfaces, sites such as gravel parking lots, or maintenance yards with stockpiles of sediment would be classified as "unstable". These types of sites do not exhibit first flush characteristics, are highly erodible and exhibit atypical sediment loading characteristics and must therefore be sized more carefully. Contact your local Stormceptor representative for assistance in selecting a proper unit sized for such unstable sites.

6. Spill Controls

When considering the removal of total petroleum hydrocarbons (TPH) from a storm sewer system there are two functions of the system: oil removal, and spill capture.

'Oil Removal' describes the capture of the minute volumes of free oil mobilized from impervious surfaces. In this instance relatively low concentrations, volumes and flow rates are considered. While the Stormceptor unit will still provide an appreciable oil removal function during higher flow events and/or with higher TPH concentrations, desired effluent limits may be exceeded under these conditions.

'Spill Capture' describes a manner of TPH removal more appropriate to recovery of a relatively high volume of a single phase deleterious liquid that is introduced to the storm sewer system over a relatively short duration. The two design criteria involved when considering this manner of introduction are overall volume and the specific gravity of the material. A standard Stormceptor unit will be able to capture and retain a maximum spill volume and a minimum specific gravity.

For spill characteristics that fall outside these limits, unit modifications are required. Contact your local Stormceptor Representative for more information.

One of the key features of the Stormceptor technology is its ability to capture and retain spills. While the standard Stormceptor System provides excellent protection for spill control, there are additional options to enhance spill protection if desired.

6.1. Oil Level Alarm

The oil level alarm is an electronic monitoring system designed to trigger a visual and audible alarm when a pre-set level of oil is reached within the lower chamber. As a standard, the oil

level alarm is designed to trigger at approximately 85% of the unit's available depth level for oil capture. The feature acts as a safeguard against spills caused by exceeding the oil storage capacity of the separator and eliminates the need for manual oil level inspection.

The oil level alarm installed on the Stormceptor insert is illustrated in Figure 4.

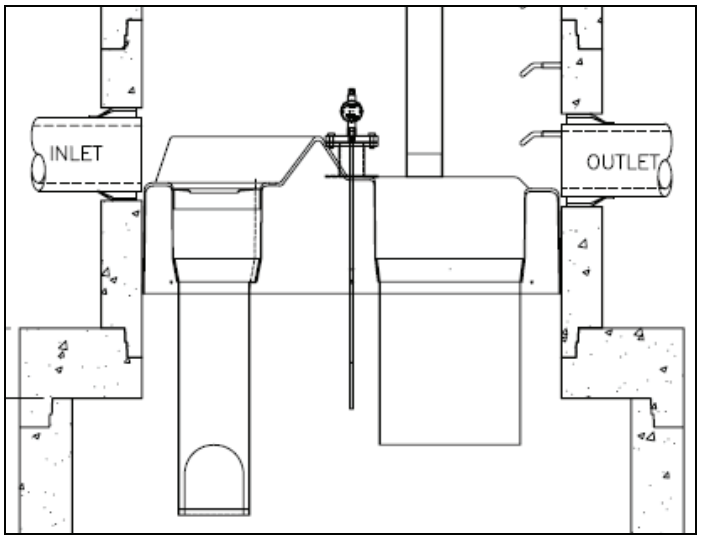


Figure 4. Oil level alarm

6.2. Increased Volume Storage Capacity

The Stormceptor unit may be modified to store a greater spill volume than is typically available. Under such a scenario, instead of installing a larger than required unit, modifications can be made to the recommended Stormceptor model to accommodate larger volumes. Contact your local Stormceptor representative for additional information and assistance for modifications.

7. Stormceptor Options

The Stormceptor System allows flexibility to incorporate to existing and new storm drainage infrastructure. The following section identifies considerations that should be reviewed when installing the system into a drainage network. For conditions that fall outside of the recommendations in this section, please contact your local Stormceptor representative for further guidance.

7.1. Installation Depth Minimum Cover

The minimum distance from the top of grade to the crown of the inlet pipe is 24 inches (600 mm). For situations that have a lower minimum distance, contact your local Stormceptor representative.

7.2. Maximum Inlet and Outlet Pipe Diameters

Maximum inlet and outlet pipe diameters are illustrated in Figure 5. Contact your local Stormceptor representative for larger pipe diameters

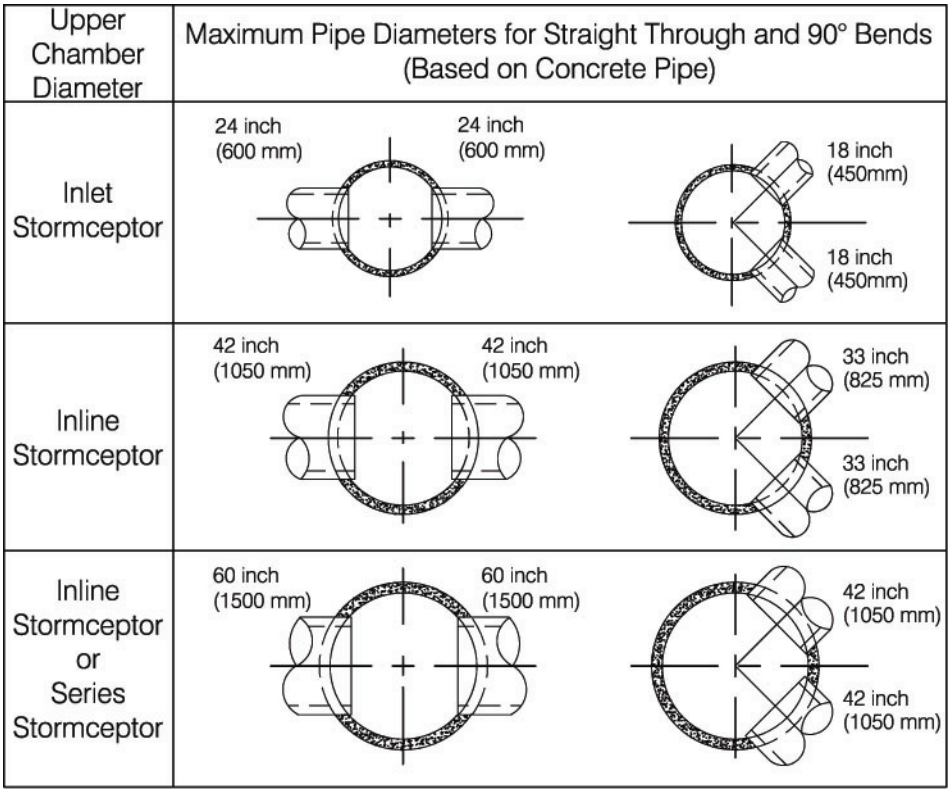


Figure 5. Maximum pipe diameters for straight through and bend applications

*The bend should only be incorporated into the second structure (downstream structure) of the Series Stormceptor System

7.3. Bends

The Stormceptor System can be used to change horizontal alignment in the storm drain network up to a maximum of 90 degrees. Figure 6 illustrates the typical bend situations of the Stormceptor System. Bends should only be applied to the second structure (downstream structure) of the Series Stormceptor System.

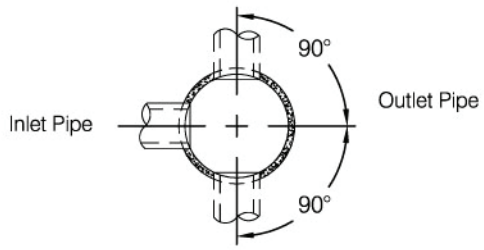
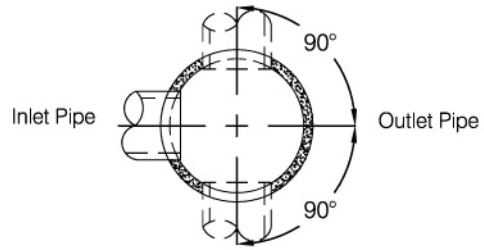
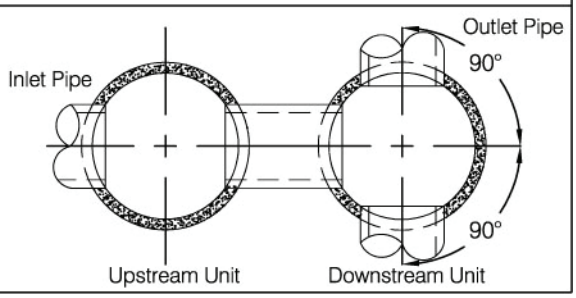
Stormceptor System	Maximum Bend Configurations
Inlet Stormceptor	
Inline Stormceptor	
Series Stormceptor	

Figure 6. Maximum bend angles

7.4. Multiple Inlet Pipes

The Inlet and Inline Stormceptor System can accommodate two or more inlet pipes. The maximum number of inlet pipes that can be accommodated into a Stormceptor unit is a function of the number, alignment and diameter of the pipes and its effects on the structural integrity of the precast concrete. When multiple inlet pipes are used for new developments, each inlet pipe shall have an invert elevation 3 inches (75 mm) higher than the outlet pipe invert elevation.

7.5. Inlet/Outlet Pipe Invert Elevations

Recommended inlet and outlet pipe invert differences are listed in Table 3.

Table 3. Recommended Drops Between Inlet and Outlet Pipe Inverts

Number of Inlet Pipes	Inlet System	In-Line System	Series System
1	3 inches (75 mm)	1 inch (25 mm)	3 inches (75 mm)
>1	3 inches (75 mm)	3 inches (75 mm)	Not Applicable

7.6. Shallow Stormceptor

In cases where there may be restrictions to the depth of burial of storm sewer systems. In this situation, for selected Stormceptor models, the lower chamber components may be increased in diameter to reduce the overall depth of excavation required.

7.7. Customized Live Load

The Stormceptor system is typically designed for local highway truck loading (AASHTO HS- 20). When the project requires live loads greater than HS-20, the Stormceptor System may be customized structurally for a pre-specified live load. Contact your local Stormceptor representative for customized loading conditions.

7.8. Pre-treatment

The Stormceptor System may be sized to remove sediment and for spills control in conjunction with other stormwater BMPs to meet the water quality objective. For pretreatment applications, the Stormceptor System should be the first unit in a treatment train. The benefits of pre-treatment include the extension of the operational life (extension of maintenance frequency) of large stormwater management facilities, prevention of spills and lower total life- cycle maintenance cost.

7.9. Head loss

The head loss through the Stormceptor System is similar to a 60 degree bend at a manhole. The K value for calculating minor losses is approximately 1.3 (minor loss = k*1.3v2/2g).

However, when a Submerged modification is applied to a Stormceptor unit, the corresponding K value is 4.

7.10. Submerged

The Submerged modification, Figure 7, allows the Stormceptor System to operate in submerged or partially submerged storm sewers. This configuration can be installed on all models of the Stormceptor System by modifying the fiberglass insert. A customized weir height and a secondary drop tee are added.

Submerged instances are defined as standing water in the storm drain system during zero flow conditions. In these instances, the following information is necessary for the proper design and application of submerged modifications:

- Stormceptor top of grade elevation
- Stormceptor outlet pipe invert elevation
- Standing water elevation

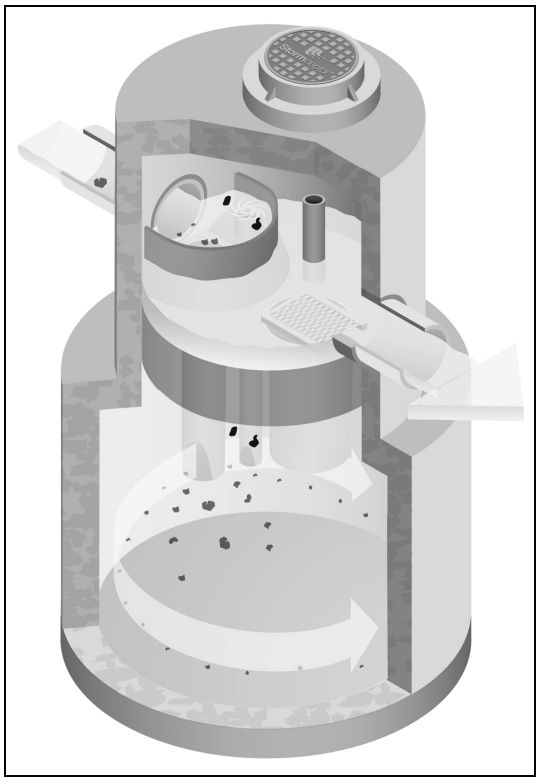


Figure 7. Submerged Stormceptor

8. Comparing Technologies

Designers have many choices available to achieve water quality goals in the treatment of stormwater runoff. Since many alternatives are available for use in stormwater quality treatment it is important to consider how to make an appropriate comparison between "approved alternatives". The following is a guide to assist with the accurate comparison of differing technologies and performance claims.

8.1. Particle Size Distribution (PSD)

The most sensitive parameter to the design of a stormwater quality device is the selection of the design particle size. While it is recommended that the actual particle size distribution (PSD) for sites be measured prior to sizing, alternative values for particle size should be selected to represent what is likely to occur naturally on the site. A reasonable estimate of a particle size distribution likely to be found on parking lots or other impervious surfaces should consist of a wide range of particles such as 20 microns to 2,000 microns (Ontario MOE, 1994).

There is no absolute right particle size distribution or specific gravity and the user is cautioned to review the site location, characteristics, material handling practices and regulatory requirements when selecting a particle size distribution. When comparing technologies, designs using different PSDs will result in incomparable TSS removal efficiencies. The PSD of the TSS removed needs to be standard between two products to allow for an accurate comparison.

8.2. Scour Prevention

In order to accurately predict the performance of a manufactured treatment device, there must be confidence that it will perform under all conditions. Since rainfall patterns cannot be predicted, stormwater quality devices placed in storm sewer systems must be able to withstand extreme events, and ensure that all pollutants previously captured are retained in the system.

In order to have confidence in a system's performance under extreme conditions, independent validation of scour prevention is essential when examining different technologies. Lack of independent verification of scour prevention should make a designer wary of accepting any product's performance claims.

8.3. Hydraulics

Full scale laboratory testing has been used to confirm the hydraulics of the Stormceptor System. Results of lab testing have been used to physically design the Stormceptor System and the sewer pipes entering and leaving the unit. Key benefits of Stormceptor are:

- Low head loss (typical k value of 1.3)
- Minimal inlet/outlet invert elevation drop across the structure
- Use as a bend structure
- Accommodates multiple inlets

The adaptability of the treatment device to the storm sewer design infrastructure can affect the overall performance and cost of the site.

8.4. Hydrology

Stormwater quality treatment technologies need to perform under varying climatic conditions. These can vary from long low intensity rainfall to short duration, high intensity storms. Since a treatment device is expected to perform under all these conditions, it makes sense that any system's design should accommodate those conditions as well.

Long-term continuous simulation evaluates the performance of a technology under the varying conditions expected in the climate of the subject site. Single, peak event design does not provide this information and is not equivalent to long-term simulation. Designers should request long-term simulation performance to ensure the technology can meet the long-term water quality objective.

9. Testing

The Stormceptor System has been the most widely monitored stormwater treatment technology in the world. Performance verification and monitoring programs are completed to the strictest standards and integrity. Since its introduction in 1990, numerous independent field tests and studies detailing the effectiveness of the Stormceptor System have been completed.

- Coventry University, UK – 97% removal of oil, 83% removal of sand and 73% removal of peat
- National Water Research Institute, Canada, - scaled testing for the development of the Stormceptor System identifying both TSS removal and scour prevention.
- New Jersey TARP Program – full scale testing of an STC 900 demonstrating 75% TSS removal of particles from 1 to 1000 microns. Scour testing completed demonstrated that the system does not scour. The New Jersey Department of Environmental Protection was followed.
- City of Indianapolis – full scale testing of an STC 900 demonstrating over 80% TSS removal of particles from 50 microns to 300 microns at 130% of the unit's operating rate. Scour testing completed demonstrated that the system does not scour.
- Westwood Massachusetts (1997), demonstrated >80% TSS removal
- Como Park (1997), demonstrated 76% TSS removal
- Ontario MOE SWAMP Program – 57% removal of 1 to 25 micron particles
- Laval Quebec – 50% removal of 1 to 25 micron particles

10. Installation

The installation of the concrete Stormceptor should conform in general to state highway, or local specifications for the installation of manholes. Selected sections of a general specification that are applicable are summarized in the following sections.

10.1. Excavation

Excavation for the installation of the Stormceptor should conform to state highway, or local specifications. Topsoil removed during the excavation for the Stormceptor should be stockpiled in designated areas and should not be mixed with subsoil or other materials.

Topsoil stockpiles and the general site preparation for the installation of the Stormceptor should conform to state highway or local specifications.

The Stormceptor should not be installed on frozen ground. Excavation should extend a minimum of 12 inches (300 mm) from the precast concrete surfaces plus an allowance for shoring and bracing where required. If the bottom of the excavation provides an unsuitable foundation additional excavation may be required.

In areas with a high water table, continuous dewatering may be required to ensure that the excavation is stable and free of water.

10.2. Backfilling

Backfill material should conform to state highway or local specifications. Backfill material should be placed in uniform layers not exceeding 12 inches (300mm) in depth and compacted to state highway or local specifications.

11. Stormceptor Construction Sequence

The concrete Stormceptor is installed in sections in the following sequence:

1. Aggregate base
2. Base slab
3. Lower chamber sections
4. Upper chamber section with fiberglass insert
5. Connect inlet and outlet pipes
6. Assembly of fiberglass insert components (drop tee, riser pipe, oil cleanout port and orifice plate
7. Remainder of upper chamber
8. Frame and access cover

The precast base should be placed level at the specified grade. The entire base should be in contact with the underlying compacted granular material. Subsequent sections, complete with joint seals, should be installed in accordance with the precast concrete manufacturer's recommendations.

Adjustment of the Stormceptor can be performed by lifting the upper sections free of the excavated area, re-leveling the base and re-installing the sections. Damaged sections and gaskets should be repaired or replaced as necessary. Once the Stormceptor has been constructed, any lift holes must be plugged with mortar.

12. Maintenance

12.1. Health and Safety

The Stormceptor System has been designed considering safety first. It is recommended that confined space entry protocols be followed if entry to the unit is required. In addition, the fiberglass insert has the following health and safety features:

- Designed to withstand the weight of personnel
- A safety grate is located over the 24 inch (600 mm) riser pipe opening
- Ladder rungs can be provided for entry into the unit, if required

12.2. Maintenance Procedures

Maintenance of the Stormceptor system is performed using vacuum trucks. No entry into the unit is required for maintenance (in most cases). The vacuum service industry is a well- established sector of the service industry that cleans underground tanks, sewers and catch basins. Costs to clean a Stormceptor will vary based on the size of unit and transportation distances.

The need for maintenance can be determined easily by inspecting the unit from the surface. The depth of oil in the unit can be determined by inserting a dipstick in the oil inspection/cleanout port.

Similarly, the depth of sediment can be measured from the surface without entry into the Stormceptor via a dipstick tube equipped with a ball valve. This tube would be inserted through the riser pipe. Maintenance should be performed once the sediment depth exceeds the guideline values provided in the Table 4.

Table 4. Sediment Depths Indicating Required Servicing*

Particle Size	Specific Gravity
Model	Sediment Depth inches (mm)
450i	8 (200)
900	8 (200)
1200	10 (250)
1800	15 (381)
2400	12 (300)
3600	17 (430)
4800	15 (380)
6000	18 (460)
7200	15 (381)
11000	17 (380)
13000	20 (500)
16000	17 (380)
* based on 15% of the Stormceptor unit's total storage	

Although annual servicing is recommended, the frequency of maintenance may need to be increased or reduced based on local conditions (i.e. if the unit is filling up with sediment more quickly than projected, maintenance may be required semi-annually; conversely once the site has stabilized maintenance may only be required every two or three years).

Oil is removed through the oil inspection/cleanout port and sediment is removed through the riser pipe. Alternatively oil could be removed from the 24 inches (600 mm) opening if water is removed from the lower chamber to lower the oil level below the drop pipes.

The following procedures should be taken when cleaning out Stormceptor:

1. Check for oil through the oil cleanout port
2. Remove any oil separately using a small portable pump
3. Decant the water from the unit to the sanitary sewer, if permitted by the local regulating authority, or into a separate containment tank
4. Remove the sludge from the bottom of the unit using the vacuum truck
5. Re-fill Stormceptor with water where required by the local jurisdiction

12.3. Submerged Stormceptor

Careful attention should be paid to maintenance of the Submerged Stormceptor System. In cases where the storm drain system is submerged, there is a requirement to plug both the inlet and outlet pipes to economically clean out the unit.

12.4. Hydrocarbon Spills

The Stormceptor is often installed in areas where the potential for spills is great. The Stormceptor System should be cleaned immediately after a spill occurs by a licensed liquid waste hauler.

12.5. Disposal

Requirements for the disposal of material from the Stormceptor System are similar to that of any other stormwater Best Management Practice (BMP) where permitted. Disposal options for the sediment may range from disposal in a sanitary trunk sewer upstream of a sewage treatment plant, to disposal in a sanitary landfill site. Petroleum waste products collected in the Stormceptor (free oil/chemical/fuel spills) should be removed by a licensed waste management company.

12.6. Oil Sheens

With a steady influx of water with high concentrations of oil, a sheen may be noticeable at the Stormceptor outlet. This may occur because a rainbow or sheen can be seen at very small oil concentrations (<10 mg/L). Stormceptor will remove over 98% of all free oil spills from storm sewer systems for dry weather or frequently occurring runoff events.

The appearance of a sheen at the outlet with high influent oil concentrations does not mean the unit is not working to this level of removal. In addition, if the influent oil is emulsified the Stormceptor will not be able to remove it. The Stormceptor is designed for free oil removal and not emulsified conditions.

SUPPORT

Drawings and specifications are available at www.ContechES.com.

Site-specific design support is available from our engineers.

Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater, and earth stabilization products. For information, visit www.ContechES.com or call 800.338.1122

CONTECH ENGINEERED SOLUTIONS
800-925-5240
www.ContechES.com

STORMTECH ISOLATOR ROW OPERATION & MAINTENANCE

StormTech
Detention • Retention • Water Quality
An ADS company

Isolator® Row O&M Manual

THE MOST ADVANCED NAME IN WATER MANAGEMENT SOLUTIONS™

ADS®

THE ISOLATOR® ROW

INTRODUCTION

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row is a technique to inexpensively enhance Total Suspended Solids (TSS) removal and provide easy access for inspection and maintenance.

THE ISOLATOR ROW

The Isolator Row is a row of StormTech chambers, either SC-160LP, SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-4500 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC- 310-3 and SC-740 models) allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of the underlying stone and remain intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber. The non-woven fabric is not required over the SC-160LP, DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

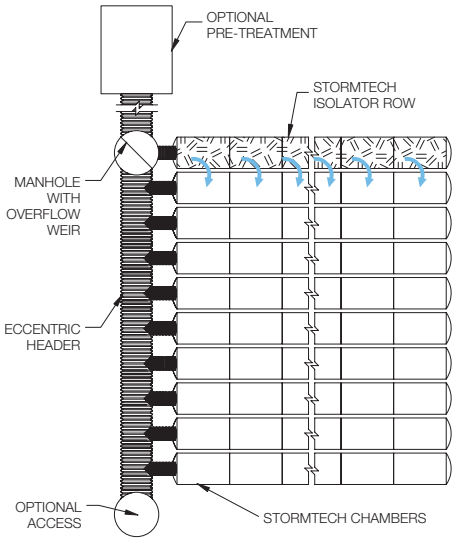
The Isolator Row is typically designed to capture the “first flush” and offers the versatility to be sized on a volume basis or flow rate basis. An upstream manhole not only provides access to the Isolator Row but typically includes a high flow weir such that storm water flowrates or volumes that exceed the capacity of the Isolator Row overtop the over flow weir and discharge through a manifold to the other chambers.

The Isolator Row may also be part of a treatment train. By treating storm water prior to entry into the chamber system, the service life can be extended and pollutants such as hydrocarbons can be captured. Pre-treatment best management practices can be as simple as deep sump catch basins, oil-water separators or can be innovative storm water treatment devices. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row.

Looking down the Isolator Row from the manhole opening, woven geotextile is shown between the chamber and stone base.

StormTech Isolator Row with Overflow Spillway (not to scale)



ISOLATOR ROW INSPECTION/MAINTENANCE

INSPECTION

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row, clean-out should be performed.

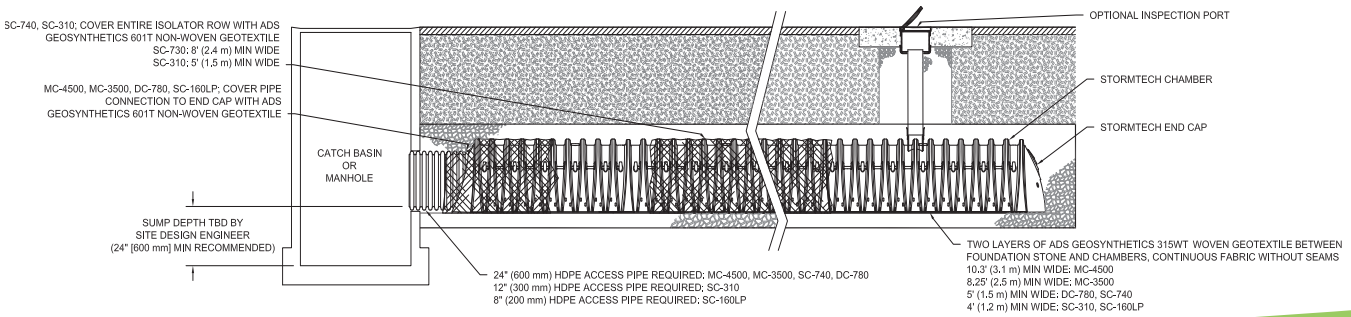
MAINTENANCE

The Isolator Row was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row up to 50 chambers long. **The JetVac process shall only be performed on StormTech Isolator Rows that have AASHTO class 1 woven geotextile (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row (not to scale)

Note: Non-woven fabric is only required over the inlet pipe connection into the end cap for SC-160LP, DC-780, MC-3500 and MC-4500 chamber models and is not required over the entire Isolator Row.



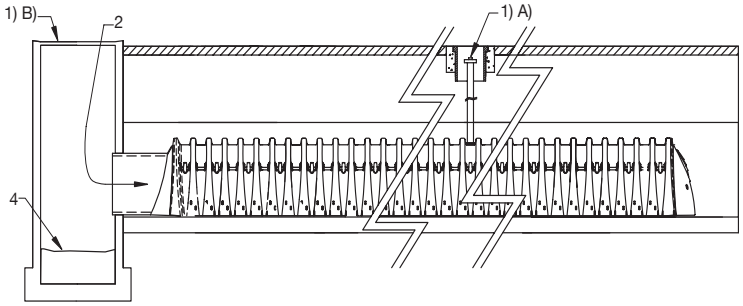
ISOLATOR ROW STEP BY STEP MAINTENANCE PROCEDURES

STEP 1
Inspect Isolator Row for sediment.
- A) Inspection ports (if present)
  - i. Remove lid from floor box frame
  - ii. Remove cap from inspection riser
  - iii. Using a flashlight and stadia rod,measure depth of sediment and record results on maintenance log.
  - iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.
- B) All Isolator Rows
  - i. Remove cover from manhole at upstream end of Isolator Row
  - ii. Using a flashlight, inspect down Isolator Row through outlet pipe
    1. Mirrors on poles or cameras may be used to avoid a confined space entry
    2. Follow OSHA regulations for confined space entry if entering manhole
  - iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2. If not, proceed to Step 3.

STEP 2
Clean out Isolator Row using the JetVac process.
- A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
- B) Apply multiple passes of JetVac until backflush water is clean
- C) Vacuum manhole sump as required

STEP 3
Replace all caps, lids and covers, record observations and actions.

STEP 4
Inspect & clean catch basins and manholes upstream of the StormTech system.



SAMPLE MAINTENANCE LOG

Date	Stadia Rod Readings		Sediment Depth (1)–(2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/11	6.3 ft	none		New installation. Fixed point is CI frame at grade	DJM
9/24/11		6.2	0.1 ft	Some grit felt	SM
6/20/13		5.8	0.5 ft	Mucky feel, debris visible in manhole and in Isolator Row, maintenance due	NV
7/7/13	6.3 ft		0	System jetted and vacuumed	DJM

StormTech® Detention • Retention • Water Quality
A division of ADS

Advanced Drainage Systems, Inc.
4640 Trueman Blvd., Hilliard, OH 43026
1-800-821-6710 www.ads-pipe.com

StormTech Maintenance Log

Project Name:
Location:

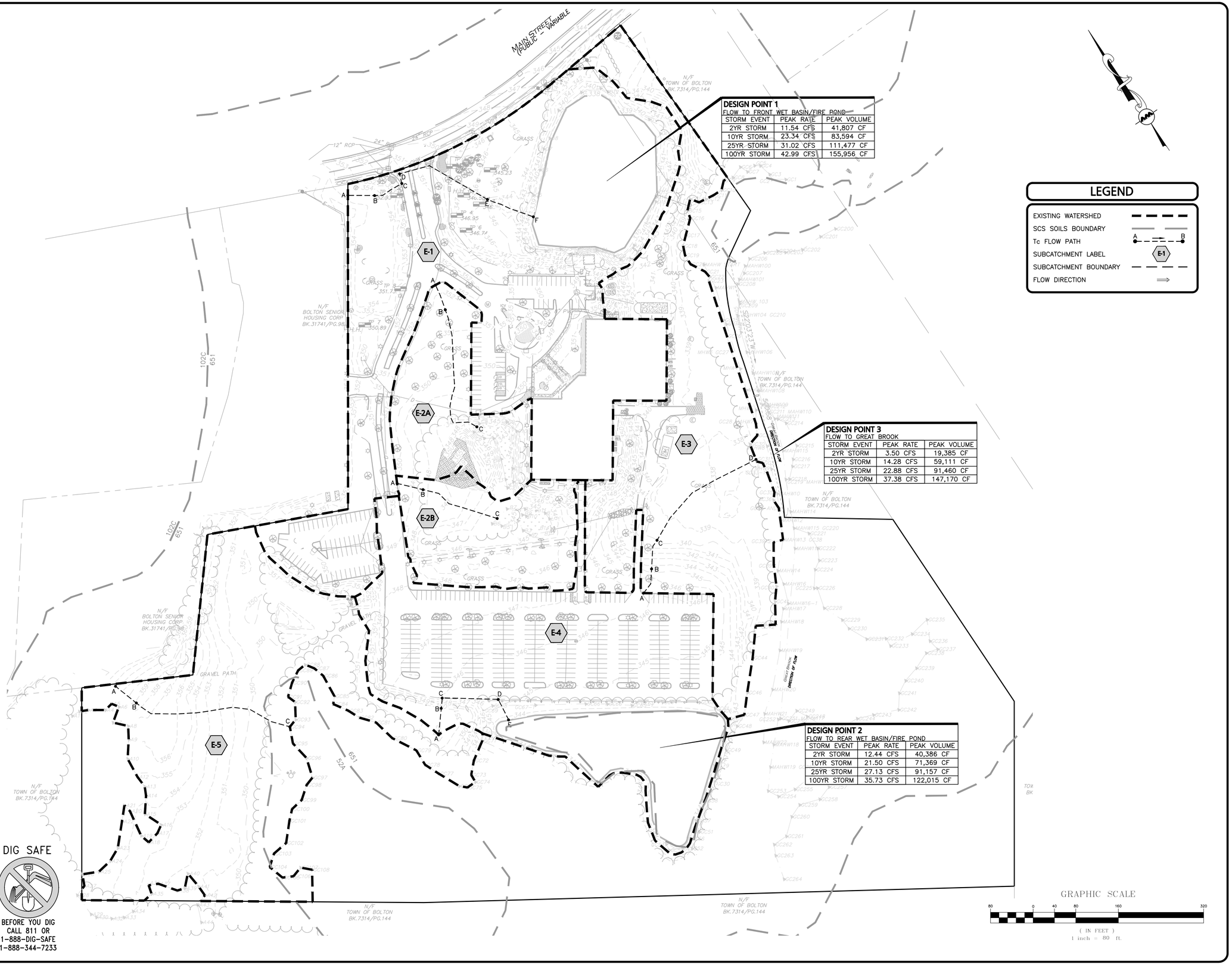
	Stadia Rod Readings				
Date	**Fixed point to chamber bottom (1)**	**Fixed point to top of sediment (2)**	**Sediment Depth (1) - (2)**	**Observations / Actions**	**Inspector**

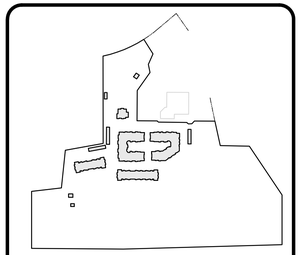
APPENDIX B SITE PLANS

SITE PLAN

APPENDIX J
WATERSHED PLANS

EXISTING WATERSHED PLAN EWS-1





KEYSHEET

ISSUED FOR COMPREHENSIVE PERMIT APPLICATION
REV. 1- 04-12-2022

COMMONWEALTH OF MASSACHUSETTS
PHILIP L. CORDERO
CIVIL
NO. 47083
REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

REV	DATE	DESCRIPTION
1	04-12-2022	PER REVIEW COMMENTS

APPLICANT\OWNER:
LIMITED DIVIDEND AFFILIATE OF
WP EAST ACQUISITIONS, LLC.
91 HARTWELL AVENUE, 3RD FLOOR
LEXINGTON, MA 02421

PROJECT:
APPLICATION FOR COMPREHENSIVE PERMIT ALTA NASHOBA VALLEY
580 MAIN STREET BOLTON, MA

PROJECT NO.	1670-15	DATE:	09-10-2021
SCALE:	1" = 80'	DWG. NAME:	C1670-15
DESIGNED BY:	PGM	CHECKED BY:	PLC

PREPARED BY:

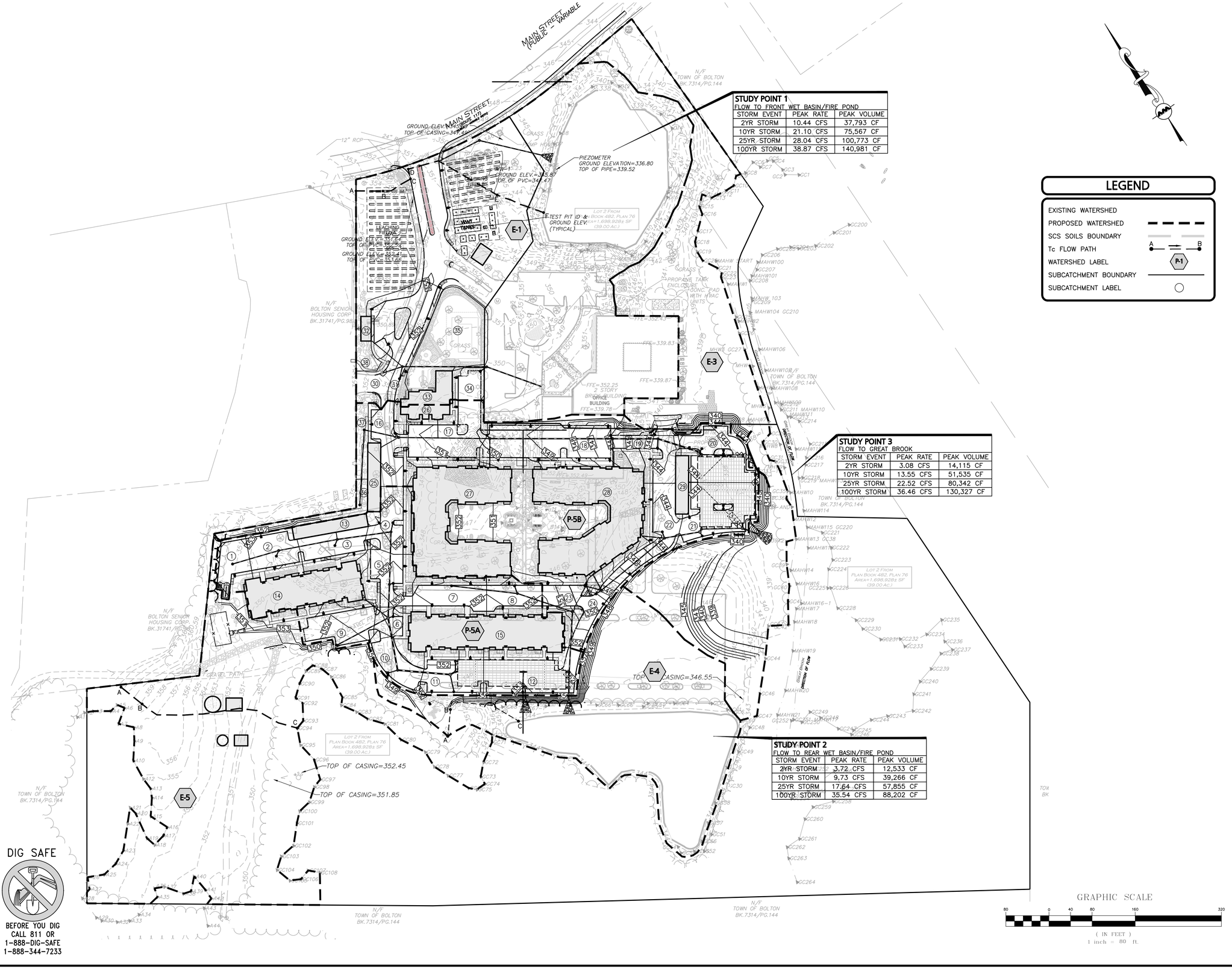
ALLEN & MAJOR ASSOCIATES, INC.
civil engineering ◆ land surveying
environmental consulting ◆ landscape architecture
www.allenmajor.com
10 MAIN STREET
LAKEVILLE, MA 02347
TEL: (508) 923-1010
FAX: (508) 923-6309
WOBURN, MA ◆ LAKEVILLE, MA ◆ MANCHESTER, NH

DRAWING TITLE:
EXISTING WATERSHED PLAN

SHEET No.
EWS-1

M:\PROJECTS\1670-15\CIVIL\DRAWINGS\CURRENT\C-1670-15_WATERSHED-EXISTING.DWG

PROPOSED WATERSHED PLAN – PWS-1



STUDY POINT 1
FLOW TO FRONT WET BASIN/FIRE POND

STORM EVENT	PEAK RATE	PEAK VOLUME
2YR STORM	10.44 CFS	37,793 CF
10YR STORM	21.10 CFS	75,567 CF
25YR STORM	28.04 CFS	100,773 CF
100YR STORM	38.87 CFS	140,981 CF

STUDY POINT 3
FLOW TO GREAT BROOK

STORM EVENT	PEAK RATE	PEAK VOLUME
2YR STORM	3.08 CFS	14,115 CF
10YR STORM	13.55 CFS	51,535 CF
25YR STORM	22.52 CFS	80,342 CF
100YR STORM	36.46 CFS	130,327 CF

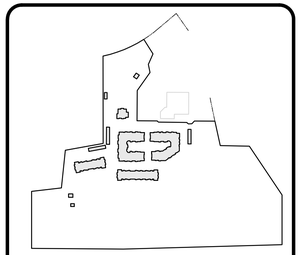
STUDY POINT 2
FLOW TO REAR WET BASIN/FIRE POND

STORM EVENT	PEAK RATE	PEAK VOLUME
2YR STORM	3.72 CFS	12,533 CF
10YR STORM	9.73 CFS	39,266 CF
25YR STORM	17.64 CFS	57,855 CF
100YR STORM	35.54 CFS	88,202 CF

LEGEND

- EXISTING WATERSHED
- PROPOSED WATERSHED
- SCS SOILS BOUNDARY
- Tc FLOW PATH (A — B)
- WATERSHED LABEL (P-1)
- SUBCATCHMENT BOUNDARY
- SUBCATCHMENT LABEL

GRAPHIC SCALE
80 0 40 80 160 320
(IN FEET)
1 inch = 80 ft.



KEYSHEET

ISSUED FOR COMPREHENSIVE PERMIT APPLICATION
REV. 1- 04-12-2022

COMMONWEALTH OF MASSACHUSETTS
PHILIP L. CORDERO
CIVIL
NO. 47083
REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

REV	DATE	DESCRIPTION
1	04-12-2022	PER REVIEW COMMENTS

APPLICANT\OWNER:
LIMITED DIVIDEND AFFILIATE OF
WP EAST ACQUISITIONS, LLC.
91 HARTWELL AVENUE, 3RD FLOOR
LEXINGTON, MA 02421

PROJECT:
APPLICATION FOR COMPREHENSIVE PERMIT ALTA NASHOBA VALLEY
580 MAIN STREET BOLTON, MA

PROJECT NO.	1670-15	DATE:	09-10-2021
SCALE:	1" = 80'	DWG. NAME:	C1670-15
DESIGNED BY:	PGM	CHECKED BY:	PLC

PREPARED BY:
ALLEN & MAJOR ASSOCIATES, INC.
civil engineering ◆ land surveying
environmental consulting ◆ landscape architecture
www.allenmajor.com
10 MAIN STREET
LAKEVILLE, MA 02347
TEL: (508) 923-1010
FAX: (508) 923-6309
WOBURN, MA ◆ LAKEVILLE, MA ◆ MANCHESTER, NH

DRAWING TITLE:
PROPOSED WATERSHED PLAN

SHEET No.
PWS-1

M:\PROJECTS\1670-15\CIVIL\DRAWINGS\CURRENT\C-1670-15_WATERSHED-PROPOSED.DWG