CHA
design/construction solutions

December 3, 2018

Ms. Mary Ellen Schloss, Conservation Agent
Weymouth Conservation Commission
Town Hall
75 Middle Street
Weymouth, MA 02189

RE: **DEP FILE # 081-1231**
Intersection Improvements at Pleasant Street and
Libbey Industrial Parkway
Weymouth, Massachusetts

Dear Ms. Schloss and Commissioners:

On behalf of the Applicant, JF Price Co. enclosed are supplemental plans and documents to the Notice of Intent Application for Intersection Improvements at Pleasant Street and Libbey Industrial Parkway project. The enclosed supplemental information provides supportive data regarding project related impacts to wetland resources and measures proposed to mitigate those impacts, in accordance with the Massachusetts Wetlands Protection Act and Weymouth Wetlands Protection Ordinance. Included in this submittal package are the following items for the Board's consideration:

- Seven (7) copies of the Supplemental Plans for Intersection Improvements at Pleasant Street and Libbey Industrial Parkway prepared by CHA dated 12/3/18.
- Seven (7) copies of the Stormwater Report prepared by CHA dated 12/3/18
- Revised Notice of Intent page 3 of 9 that reflect the updated resource area impacts.

The proposed project involves the creation of a new 4-way signalized intersection at the current 3-way intersection at Pleasant Street and Libbey Industrial Parkway. The new segment of roadway is located opposite Libbey Industrial Parkway and will provide access to the businesses on the easterly side of Pleasant Street. The intersection improvements include widening Pleasant Street and adding left and right turning lanes. The project also includes improvements to the Pleasant Street and Quarry Road intersection. The existing intersection of Quarry Road and Pleasant Street will be converted to a right-in, right-out condition. It's proposed that the new roadway segment and Quarry Road intersect approximately 300' easterly of Pleasant Street and combine into a single roadway to the east that will align and match the existing Quarry Road access. These improvements are undertaken as required to improve safety and access at this hazardous intersection.

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Wetland resources have been identified and delineated by South River Environmental (SRE). A Bordering Vegetated Wetland lies adjacent to and southerly of the Quarry Road, from its intersection with Pleasant to the project limits. A 30" corrugated metal culvert, approximately 40' in length, conveys flows northerly from this BVW beneath the Quarry Road. The culvert discharges into an intermittent stream that flows northerly.

An inland bank resource and BVW associated with the intermittent stream have been identified and delineated. The BVW associated with the stream is relatively narrow for a distance of approximately 100' downstream of the culvert and then expands into a larger wetland system. FEMA has identified a 100-year flood plain associated with the BVW and the culvert and intermittent stream, although a base flood elevation has not been established. This flood plain is considered a Bordering Land Subject to Flooding (BLSF) resource area under the Massachusetts Wetlands Protection Act and Weymouth Wetlands Protection Ordinance.

The location of the culvert and intermittent stream with respect to the proposed work requires that the culvert be replaced and extended and the accompanying loss of inland bank resource and BVW be mitigated. Compensatory flood storage is required to offset the proposed fill associated with the new roadway configuration.

Wetlands Impacts and Mitigation

The proposed project requires that the existing 30" culvert be replaced and extended to accommodate the realignment of Quarry Road and the new segment of roadway from Pleasant Street. This results in a loss of 320 linear feet of inland bank (approximately 160 linear feet on each side) and 3,500 square feet of BVW associated with the intermittent stream. Wetland replication is proposed at the upstream end of the proposed culvert at Quarry Road and at the downstream end adjacent to the contractor's yard. The total area of wetland replication provided is 7,800 square feet, resulting in a 2.2 to 1 ratio. The plans accompanying this submission provide details of the locations and the means and methods proposed to be used to construct the wetland replication areas.

A cut/fill analysis of the site has been conducted to compute cut and fill volumes for flood compensation on a "foot-by-foot" basis for the project. The results of this analysis demonstrate the project, as designed, will result in equivalent or greater volume of flood storage at all foot-by-foot cross section elevations. A table summarizing the cut/fill volumes is included on the project plans accompanying this submission.

Stormwater

The stormwater design has been modified since the initial submittal package. This revised design incorporates several pairs of new catch basins along the new Quarry Road with each pair being conveyed to subsurface stormwater infiltration systems underneath the roadway. These subsurface systems provide a significant opportunity for stormwater recharge and infiltration

and have been designed such that they entirely capture, detain and infiltrate up through the 100-year storm event.

A pocket wetland system (which is an approved Stormwater BMP per the Massachusetts Stormwater Handbook) has been designed to capture the stormwater runoff at/near the lowpoint and intersection of the existing Quarry Road and the new roadway extension. This pocket wetland is designed to treat the stormwater runoff and to feed that treated runoff to the proposed wetland mitigation/floodplain compensation area. This wetland mitigation/floodplain compensation area is also located in what is currently a degraded contractor's yard and thus the combination of both the new wetland mitigation system coupled with the pocket wetland system creates a significant environmental benefit at this location.

The stormwater runoff from the existing Quarry Road is also collected via new deep sump hooded catch basins and conveyed through new water quality treatment units before discharge. This also represents a significant improvement over current stormwater conditions as the existing roadway system essentially discharges overland directly into the intermittent stream without any form of treatment. Ultimately, this design provides for full compliance for Stormwater Treatment for not just the new segment of roadway but also for the entire segment of the Quarry Road at this location.

In summary, it is our sincere intent and belief that this revised project design provides for an overall significant environmental benefit compared to the existing conditions. The stormwater quality will be significantly improved and brought into full compliance with current stormwater standards. The proposed wetland replication system and pocket wetland system will replace what is currently an existing degraded contractor's yard, newly designed bank will be formed within the replication area which will not just provide for bank replacement for the existing stream but will provide a greatly improved environment that includes new wetland to be formed on either side which will provide for much improved habitat value and function compared to the existing stream condition.

We greatly appreciate your time and effort in the review of this submittal and we look forward to discussing the details of the project further at the December 19th meeting of the Commission. Should you have any questions, please don't hesitate to contact myself or Jeffery Tocchio (project Counsel) at any time.

Sincerely,

Scott F. Arnold, PE

CHA

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

Weymouth
City/Town

B. Buffer Zone & Resource Area Impacts (temporary & permanent) (cont'd)

For all projects affecting other Resource Areas, please attach a narrative explaining how the resource area was delineated.

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
a. ☒ Bank	~~100~~ 320 1. linear feet	~~0~~ 378 2. linear feet
b. ☒ Bordering Vegetated Wetland	~~3,000~~ 3,500 1. square feet	~~6,100~~ 8,000 2. square feet
c. ☐ Land Under Waterbodies and Waterways	1. square feet 3. cubic yards dredged	2. square feet

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
d. ☒ Bordering Land Subject to Flooding	Approx. 6,000 1. square feet 700 3. cubic feet of flood storage lost	~~Approx. 6,000~~ 21,600 2. square feet ~~700~~ 19,900 4. cubic feet replaced
e. ☐ Isolated Land Subject to Flooding	1. square feet 2. cubic feet of flood storage lost	3. cubic feet replaced

f. ☐ Riverfront Area

1. Name of Waterway (if available) - **specify coastal or inland**

2. Width of Riverfront Area (check one):

☐ 25 ft. - Designated Densely Developed Areas only

☐ 100 ft. - New agricultural projects only

☐ 200 ft. - All other projects

3. Total area of Riverfront Area on the site of the proposed project: _____ square feet

4. Proposed alteration of the Riverfront Area:

a. total square feet _____ b. square feet within 100 ft. _____ c. square feet between 100 ft. and 200 ft. _____

5. Has an alternatives analysis been done and is it attached to this NOI? ☐ Yes ☐ No

6. Was the lot where the activity is proposed created prior to August 1, 1996? ☐ Yes ☐ No

3. ☐ Coastal Resource Areas: (See 310 CMR 10.25-10.35)

Note: for coastal riverfront areas, please complete **Section B.2.f**. above.

Supplemental Plans

for

Intersection Improvements at Pleasant Street & Libbey Industrial Parkway

Weymouth, Massachusetts

APPLICANT: **JF PRICE COMPANY**
611 PLEASANT STREET
WEYMOUTH, MA 02189

CIVIL ENGINEER: **CHA CONSULTING, INC.**
141 LONGWATER DRIVE, SUITE 104
NORWELL, MA 02061

LEGAL COUNSEL: **DROHAN, TOCCHIO & MORGAN**
175 DERBY STREET, SUITE 30
HINGHAM, MA 02043

TRAFFIC ENGINEER: **McMAHON ASSOCIATES, INC**
1350 MYLES STANDISH BLVD., SUITE 103
TAUNTON, MA 02780

WETLAND SCIENTIST: **JOHN ZIMMER**
SOUTH RIVER ENVIRONMENTAL
61 MEETINGHOUSE LANE
MARSHFIELD, MA 02050

LOCUS MAP

SCALE: 1" = 800'

DRAWING INDEX

Sheet No.	Sheet Title
C-001	TITLE SHEET
C-002	NOTES-LEGEND
C-201	GRADING & DRAINAGE PLAN
C-202	WETLAND REPLICATION PLAN (SHEET 1 OF 2)
C-203	WETLAND REPLICATION PLAN (SHEET 2 OF 2)
C-601	DETAILS - 1
C-602	DETAILS - 2
C-603	DETAILS - 3
C-604	DETAILS - 4
C-605	DETAILS - 5
C-606	DETAILS - 6

SUPPLEMENTAL INDEX

Sheet No.	Sheet Title
1	EXISTING CONDITIONS PLAN
2	EXISTING CONDITIONS PLAN
3	EXISTING CONDITIONS PLAN
4	EXISTING CONDITIONS PLAN

SUBMISSION DATE: 12 - 03 - 2018

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JF PRICE COMPANY
611 PLEASANT STREET
WEYMOUTH, MASSACHUSETTS
02189

COMMONWEALTH OF MASSACHUSETTS
KELLY, KILLEEN, CIVIL, No. 53471, REGISTERED PROFESSIONAL ENGINEER
12.3.18

PLEASANT STREET &
LIBBEY IND. PARKWAY
WEYMOUTH, MA

No.	Submittal / Revision	App'd.	By	Date
A	ConCom Submittal	KK	JM	12/03/18

TITLE SHEET

Designed By:	Drawn By:	Checked By:
SA/JM	JPM	KK
Issue Date:	Project No:	Scale:
12/03/18	25424-9100	AS SHOWN

Drawing No.:
C-001

SUPPLEMENTAL NOTE

THESE PLANS ARE PREPARED FOR SUBMITTAL TO THE WEYMOUTH CONSERVATION COMMISSION ONLY AND ARE SUPPLEMENTARY TO PLANS PREPARED BY MCMAHON ASSOCIATES. REFER TO THE MCMAHON ASSOCIATES PLANS FOR ADDITIONAL IMPROVEMENTS PROPOSED WITHIN THE PROJECT AREA.

SURVEY NOTES:

1. THE LIMITS OF THIS PROJECT ARE SHOWN ON THE TOWN OF WEYMOUTH ASSESSOR'S MAPS 38 AND 39 THEREON.
2. PROPERTY LINE CONFIGURATION AS SHOWN HEREON WAS COMPILED FROM RECORD PLANS AND ASSESSORS INFORMATION, AND SUPPLEMENTED BY ON-THE-GROUND FIELD SURVEY BY HOYT LAND SURVEYING. BEING THAT A PROPERTY LINE RETRACEMENT OR VERIFICATION SURVEY HAS NOT BEEN PERFORMED BY DASILVA SURVEY SERVICES, HOYT LAND SURVEYING BEARS NO RESPONSIBILITY FOR THE DEPICTION THEREOF.
3. EXISTING CONDITIONS DETAIL AS SHOWN HEREON WAS DERIVED FROM ACTUAL FIELD LOCATION DURING JUNE & JULY OF 2016 BY HOYT LAND SURVEYING.
4. PRIOR TO CONSTRUCTION OR ANY RELIANCE HEREON, THE LOCATION OF REMAINING EXISTING DETAIL WITH RESPECT TO THE DATA SHOWN HEREON MUST BE VERIFIED BY A COMPREHENSIVE REVIEW BY HOYT LAND SURVEYING.
5. LOCATION AND DEPTH OF UNDERGROUND UTILITIES IS APPROXIMATE ONLY, AND IS NOT WARRANTED TO BE CORRECT. UNDERGROUND UTILITIES ARE SHOWN BASED ON A VISUAL INSPECTION OF SURFACE OBSERVABLE FEATURES ONLY, AND HAVE BEEN FIELD INSPECTED FOR CONNECTIONS WHERE POSSIBLE. ADDITIONAL UTILITIES MAY EXIST WHICH ARE NOT INDICATED ON THESE PLANS. ALL EXISTING UTILITIES SHALL BE VERIFIED FOR SERVICE, SIZE, INVERT ELEVATION, LOCATIONS, ETC. PRIOR TO NEW CONNECTIONS TO OR RELOCATION OF SAME. CONTRACTOR MUST NOTIFY DIG-SAFE AT 1-888-344-7233 AT LEAST 72 HOURS PRIOR TO ANY CONSTRUCTION. NOTIFY HOYT LAND SURVEYING IN WRITING OF ANY AND ALL DISCREPANCIES PRIOR TO COMMENCING ANY WORK.
6. THE ELEVATIONS DEPICTED HEREON ARE REFERENCED TO THE TOWN OF WEYMOUTH VERTICAL DATUM BASED ON RESULTS FROM A RTK GPS OBSERVATION AND SUBSEQUENT CONVERSION. TO OBTAIN THE NORTH AMERICAN VERTICAL DATUM OF 1988, SUBTRACT 6.63 FEET FROM THE ELEVATIONS NOTED HEREON.
7. WETLANDS DELINEATION PERFORMED BY SRE ENVIRONMENTAL ON APRIL 1, 2016 & OCTOBER 2, 2017 AND SUBSEQUENTLY FIELD LOCATED BY HOYT LAND SURVEYING.
8. THE PROJECT LIES WITHIN A FEMA FLOOD ZONE A (NO BASE FLOOD ELEVATION ESTABLISHED) AS SHOWN ON FEMA FLOOD INSURANCE RATE MAP 25021C0233E WITH AN EFFECTIVE DATE OF JULY 12, 2012.

LEGEND - EXISTING

Symbol	Description	Symbol	Description
	CATCH BASIN	RP	RISER POLE
Ⓓ	DRAIN MANHOLE	UP	UTILITY POLE
Ⓔ	ELECTRIC MANHOLE	VGC	VERTICAL CONCRETE CURB
Ⓢ	SEWER MANHOLE	VCC	VERTICAL CONCRETE CURB
Ⓣ	TELEPHONE MANHOLE	BCC	BITUMINOUS CONCRETE CURB
	SIGN	DYCL	DOUBLE YELLOW CENTERLINE
	UTILITY POLE	SWLL	SOLID WHITE LANE LINE
Ⓦ	PRESSURE RELIEF VALVE	SWEL	SOLID WHITE EDGE LINE
	LIGHT POLE	□ SCV	SPRINKLER CONTROL VALVE
	DOUBLE CATCH BASIN	RCP	REINFORCED CONCRETE PIPE
HYD	HYDRANT	INV	PIPE INVERT
GG	GAS GATE	FES	FLARED END SECTION
WG	WATER GATE	SD	DRAIN LINE
	GUY WIRE	UGE	UNDERGROUND ELECTRIC LINE
	CONIFEROUS TREE	SS	SEWER MANHOLE
	DECIDUOUS TREE	W	WATER LINE
□ MBOX	MAIL BOX	109	CONTOUR LINE
x109.2	SPOT ELEVATION	GAS	GAS LINE
● wf-b10	WETLAND FLAG	OHE	OVERHEAD ELECTRIC LINE

GENERAL

1. PROTECTIONS

A. PROVIDE PROTECTION NECESSARY TO PREVENT DAMAGE TO EXISTING IMPROVEMENTS, TREES OR VEGETATION.

B. PROTECT IMPROVEMENTS ON ADJOINING PROPERTIES AND ON OWNER'S PROPERTY.

C. RESTORE DAMAGED IMPROVEMENTS TO ORIGINAL CONDITION AS ACCEPTABLE TO PARTIES HAVING JURISDICTION.

D. CONDUCT OPERATIONS TO ENSURE MINIMUM INTERFERENCE WITH OPERATIONS, STREETS, WALKS, AND OTHER ADJACENT FACILITIES. DO NOT CLOSE OR OBSTRUCT STREETS, WALKS, OR OTHER OCCUPIED OR USED FACILITIES WITHOUT PERMISSION FROM AUTHORITIES HAVING JURISDICTION. STREETS AND ROADWAYS SHALL BE THOROUGHLY CLEANED AND/OR SWEPT ON A DAILY BASIS OR MORE FREQUENTLY AS REQUIRED BY THE GOVERNING AUTHORITY.

2. UNLESS SPECIFIED OTHERWISE ALL MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE MASSACHUSETTS DOT SPECIFICATIONS FOR HIGHWAYS AND BRIDGES AND/OR THE APPROPRIATE LOCAL AUTHORITIES.
3. ALL SLOPES, UNLESS OTHERWISE SPECIFIED, SHALL BE LOAMED AND SEEDED FOR STABILIZATION AS SOON AS POSSIBLE TO PREVENT EROSION TOWARD RESOURCE AREAS AND BUFFERS, ABUTTING PROPERTIES, OR PUBLIC WAYS. EROSION CONTROL BLANKETS ARE REQUIRED FOR ALL 2H:1V SLOPES. SLOPES MAY NOT EXCEED 2H:1V.
4. ANY DEVIATIONS, I.E. "FIELD CHANGES" FROM THE DESIGN PLAN(S) MUST BE APPROVED BY THE DESIGN ENGINEER IN WRITING. CONTRACTOR SHOULD BE AWARE THAT LOCAL AND STATE AUTHORITIES HAVE JURISDICTION AND APPROVALS MUST BE OBTAINED FROM THE APPROPRIATE AUTHORITY PRIOR TO THE IMPLEMENTATION OF THE "FIELD CHANGE." CHA INC. ASSUMES NO LIABILITY OR RESPONSIBILITY FOR WORK ASSOCIATED WITH FIELD CHANGES COMPLETED WITHOUT REGARD TO THE "FIELD CHANGE" PROCEDURE.
5. RELOCATION OF ANY UTILITIES SHALL BE PERFORMED IN ACCORDANCE WITH THE PROVISIONS OF THE APPROPRIATE UTILITY COMPANY AND/OR REGULATORY AGENCY.
6. * * * DIG SAFE NOTE * * * IN ACCORDANCE WITH MGL. CH. 82, SEC. 40 INCLUDING AMENDMENTS, ALL CONTRACTORS SHALL NOTIFY UTILITY COMPANIES AND GOVERNMENT AGENCIES, IN WRITING, OF THE INTENT TO EXCAVATE, BLAST, DEMOLISH, BORE, OR PERFORM OTHER EARTH MOVING OPERATIONS NO LESS THAN 72 HOURS AND NO MORE THAN 30 DAYS PRIOR TO THE COMMENCEMENT OF SUCH WORK (EXCLUSIVE OF SATURDAYS, SUNDAYS, AND LEGAL HOLIDAYS) OR CALL "DIG SAFE" AT 1-888-DIG-SAFE.
7. ADDITIONAL BENCHMARKS TO BE SET BY CONTRACTOR PRIOR TO CONSTRUCTION TO ENSURE QUALITY WORKMANSHIP.
8. ANY STILLING AND/OR DETENTION BASINS SHOULD RECEIVE PERIODIC MAINTENANCE DURING CONSTRUCTION TO REMOVE DEPOSITED SILTS AND DEBRIS TO ENSURE PROPERTY DRAINAGE AND SETTLING OF PARTICULATE MATTER.
9. ALL MANHOLE COVERS FOR CROSS-COUNTRY LOCATIONS OR IN PUBLIC GATHERING LOCATIONS SHALL BE FITTED WITH BOLT LOCKS OR EQUIVALENT.
10. UNLESS OTHERWISE LABELED, ALL REINFORCED CONCRETE PIPE, RCP, SHALL BE CLASS III.
11. PERMITS: THE SITE IS SUBJECT TO A SPECIAL PERMIT WITH SITE PLAN REVIEW FROM THE WEYMOUTH ZONING BOARD OF APPEALS. IT IS ALSO SUBJECT TO A NPDES CONSTRUCTION GENERAL PERMIT TO BE ISSUED PRIOR TO COMMENCEMENT OF WORK. THE PROJECT HAS BEEN DESIGNED TO REMAIN ENTIRELY OUTSIDE OF ALL RESOURCE AREAS, RIPARIAN ZONES AND ASSOCIATED BUFFERS. CONTRACTOR SHALL LIMIT WORK AREA TO WITHIN THE "LIMIT OF WORK" LINE IDENTIFIED ON THE PLANS. CONTRACTOR SHALL MAINTAIN COPIES OF ALL PERMITS ON SITE DURING CONSTRUCTION AND SHALL ADHERE TO ANY / ALL CONDITIONS IMPOSED BY THOSE PERMITS.

SITE WORK

1. CAUTION - NOTICE TO CONTRACTOR

THE CONTRACTOR IS SPECIFICALLY CAUTIONED THAT THE LOCATION AND/OR ELEVATION OF EXISTING UTILITIES AS SHOWN ON THESE PLANS IS BASED ON DESIGN PLANS AND LIMITED AS-BUILT INFORMATION. THE INFORMATION IS NOT TO BE RELIED ON AS BEING EXACT OR COMPLETE. THE CONTRACTOR MUST CALL THE APPROPRIATE UTILITY COMPANIES AT LEAST 72 HOURS (EXCLUSIVE OF SATURDAYS, SUNDAYS, AND LEGAL HOLIDAYS) PRIOR TO ANY EXCAVATION, DEMOLITION, BORING, OR OTHER EARTH MOVING OPERATIONS TO REQUEST EXACT FIELD LOCATIONS OF UTILITIES. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RELOCATE ALL EXISTING UTILITIES WHICH CONFLICT WITH THE PROPOSED IMPROVEMENTS AT NO ADDITIONAL EXPENSE TO OWNER.

2. FILL MATERIAL

A. ENSURE THAT AREAS TO BE FILLED ARE FREE OF STANDING WATER, FROST, FROZEN MATERIAL, TRASH, AND DEBRIS PRIOR TO FILL PLACEMENT.

B. PLACE APPROPRIATE FILL MATERIAL AS DESIGNATED BY THE GEOTECHNICAL ENGINEER IN HORIZONTAL LAYERS NOT EXCEEDING EIGHT INCHES (8") IN LOOSE DEPTH AND COMPACT EACH LAYER AT OPTIMUM MOISTURE CONTENT TO THE GREATER OF:

B.1. ADJACENT UNDISTURBED SOIL, OR

B.2. 95% OF THE MAXIMUM DRY DENSITY OF THE EMBANKMENT MATERIAL AS DETERMINED BY AASHTO STANDARD METHOD T99, METHOD C.

3. FINISH GRADING

A. GRADE ALL AREAS WHERE FINISH GRADE ELEVATIONS ARE INDICATED ON DRAWINGS, OTHER THAN PAVED AREAS AND BUILDINGS, INCLUDING EXCAVATED AREAS, FILLED AND TRANSITION AREAS, AND LANDSCAPED AREAS. GRADED AREAS SHALL BE UNIFORM AND SMOOTH, FREE FROM DEBRIS, OR IRREGULAR SURFACE CHANGES. FINISHED SUBGRADE SURFACE SHALL NOT BE MORE THAN 0.10 FEET ABOVE OR BELOW ESTABLISHED SUBGRADE ELEVATIONS, AND ALL GROUND SURFACES SHALL VARY UNIFORMLY BETWEEN INDICATED ELEVATIONS. FINISH DITCHES SHALL BE GRADED TO ALLOW FOR PROPER DRAINAGE WITHOUT PONDING AND IN A MANNER THAT WILL MINIMIZE EROSION POTENTIAL

B. GRADE SURFACE TO MATCH ADJACENT GRADES AND TO PROVIDE FLOW TO SURFACE DRAINAGE STRUCTURES, OR GRADE AS DESIGNATED ON THE PLANS AFTER FILL PLACEMENT AND COMPACTION.

4. THE CONTRACTOR IS RESPONSIBLE FOR GENERAL CLEANUP OF THE PROJECT ON A DAILY BASIS AND AT THE COMPLETION OF THE PROJECT. OPEN TRENCHES, DITCHES, EXCAVATIONS, ETC. SHALL NOT BE PERMITTED TO BE LEFT OPEN OVERNIGHT. CONTRACTOR WILL BACKFILL OR UTILIZE SUITABLE STEEL PLATES FOR THE SECURING OF THE PROJECT SITE PRIOR TO CEASING WORK EACH DAY.
5. APPROPRIATE TRAFFIC CONTROL, I.E. SIGNAGE, BARRICADES, AND OTHER MEANS, WILL BE SUPPLIED BY THE CONTRACTOR IN ACCORDANCE WITH ALL FEDERAL, STATE AND LOCAL AGENCIES.
6. UNDER NO CIRCUMSTANCES MAY ANY UTILITY, STRUCTURE, AND/OR REPAIR BE BACKFILLED UNLESS INSPECTED AND APPROVED BY THE TOWN OFFICIALS AND/OR REPRESENTATIVE. RECEIPT OF APPROVAL TO BACKFILL WILL NOT RELEASE THE CONTRACTOR FROM ANY RESPONSIBILITY OR LIABILITY FOR PERFORMANCE TESTS REQUIRED AS PART OF THIS PROJECT.
7. PROPER SHORING AND TRENCH BOXES SHALL BE UTILIZED AS REQUIRED BY LOCAL, STATE, AND FEDERAL REGULATORY AGENCIES TO PROVIDE A SAFE WORKING ENVIRONMENT. SHORING SHALL BE DESIGNED BY A PROFESSIONAL ENGINEER LICENSED IN THE STATE OF MASSACHUSETTS WITH EXPERIENCE IN SHORING DESIGN.
8. ALL UTILITIES DISTURBED DURING CONSTRUCTION SHALL BE REPAIRED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER.

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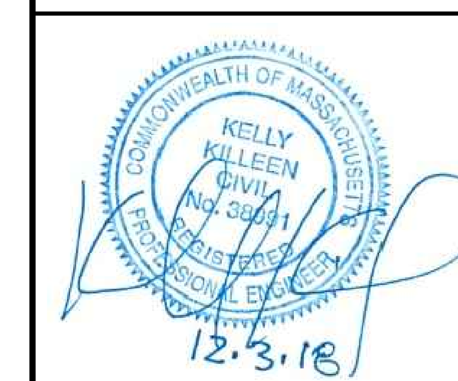

PLEASANT STREET & LIBBEY IND. PARKWAY
WEYMOUTH, MA

No.	Submittal / Revision	App'd.	By	Date
A	ConCom Submittal	KK	JM	12/03/18

NOTES-LEGEND

Designed By:	Drawn By:	Checked By:
SA/JM	JPM	KK
Issue Date:	Project No:	Scale:
12/03/18	25424-9100	AS SHOWN

Drawing No.:

C-002

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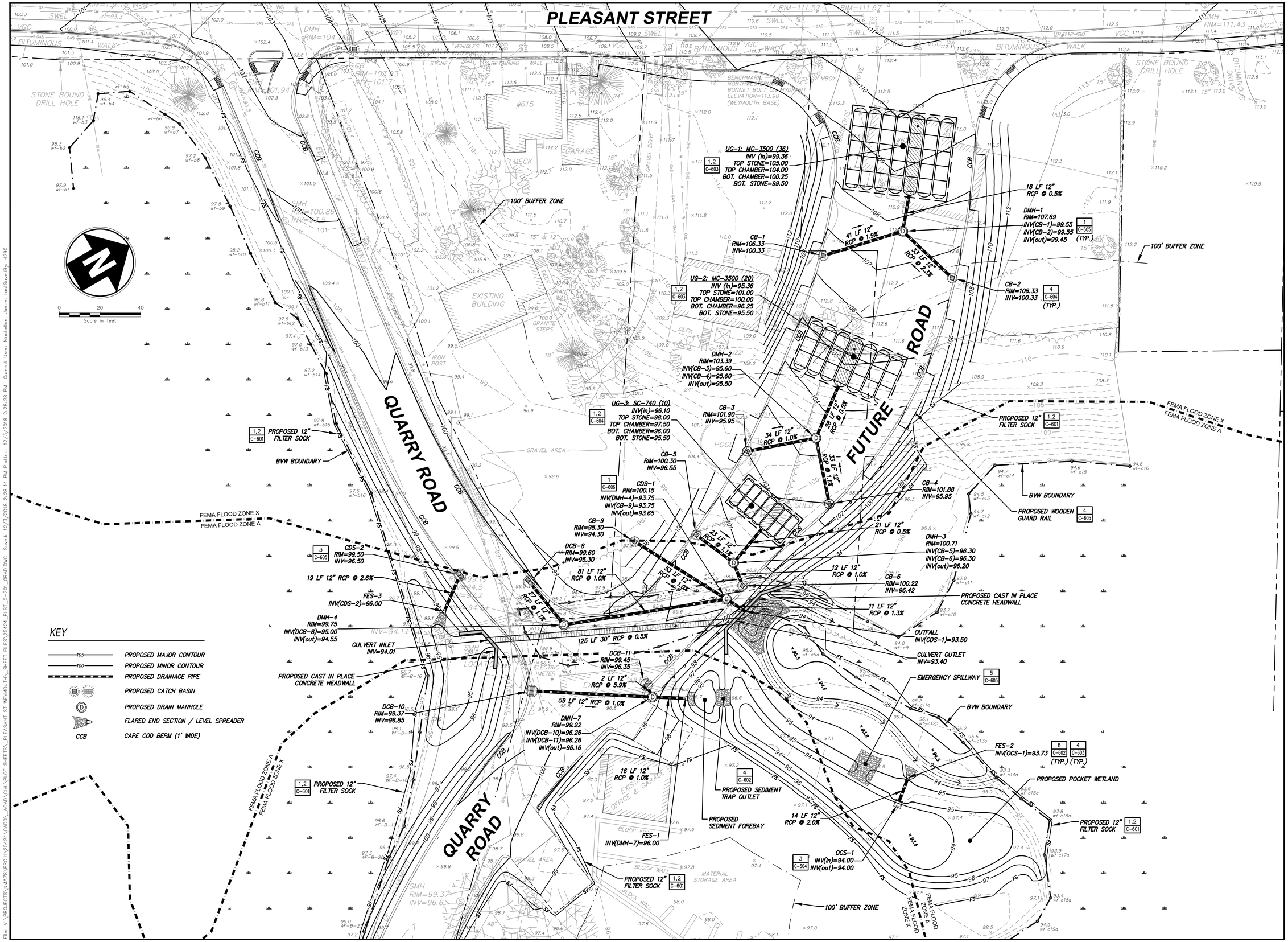

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COMMONWEALTH OF MASSACHUSETTS
KELLY KILLEEN
CIVIL
No. 50241
REGISTERED PROFESSIONAL ENGINEER
12.3.18

PLEASANT STREET &
LIBBEY IND. PARKWAY
WEYMOUTH, MA

No.	Submittal / Revision	App'd.	By	Date
A	ConCom Submittal	KK	JM	12/03/18

GRADING &
DRAINAGE PLAN

Designed By:	Drawn By:	Checked By:
SA/JM	JPM	KK
Issue Date:	Project No:	Scale:
12/03/18	25424-9100	AS SHOWN

Drawing No.:
C-201

WETLAND CONSTRUCTION SEQUENCING/PLANTING GUIDELINES

1. THE REPLACEMENT AREA SHALL MEET STRICT PERFORMANCE STANDARDS AS LISTED UNDER 310 CMR 10.55(4)(B) AND THE TOWN OF WEYMOUTH WETLANDS PROTECTION BYLAW AND REGULATIONS. CONSTRUCTION OF THE WETLAND REPLACEMENT AREA SHALL BE PERFORMED IN AGREEMENT WITH THE ORDER OF CONDITIONS ISSUED BY THE CONSERVATION COMMISSION. WETLAND REPLACEMENT WORK SHALL BE SUPERVISED BY AN ENVIRONMENTAL INSPECTOR (EI) OR LANDSCAPE CONTRACTOR APPROVED BY THE CONSERVATION COMMISSION. THESE STANDARDS HAVE BEEN SET IN ORDER TO PROTECT THE FUNCTIONS WHICH BORDERING VEGETATED WETLANDS AND BORDERING VEGETATED WETLANDS PROVIDE. THESE STANDARDS SHALL BE MET BY ADHERING TO THE FOLLOWING CONSTRUCTION SPECIFICATIONS.

2. A MEETING SHALL BE SCHEDULED WITH THE CONTRACTOR AND CONSERVATION AGENT PRIOR TO CONSTRUCTION TO REVIEW THE CONSTRUCTION METHODOLOGY AND DESIGNATED STORAGE AREAS FOR EXCESS SOIL MATERIAL. AS REQUIRED IN THE ORDER OF CONDITIONS, ALL EROSION CONTROL MEASURES SHALL BE INSTALLED AND INSPECTED PRIOR TO THE START OF WORK AND THE LIMITS OF THE WETLAND REPLACEMENT AREA SHALL BE CLEARLY MARKED WITH WOODEN STAKES. EROSION CONTROL FENCING SHALL REMAIN IN PLACE UNTIL EXPOSED SOILS ARE VEGETATED AND STABLE. HAY BALES USED IN CONJUNCTION WITH THE EROSION CONTROL FENCES MUST BE FREE OF WEED SPECIES.

3. THE WETLAND REPLACEMENT AREAS INDICATED ON THE PLAN SHALL BE EXCAVATED TO THE INDICATED SUBGRADE (SEE WETLAND REPLICATION PROFILE) BEFORE THE REPLACEMENT AREA SOILS ARE PLACED. THE ENVIRONMENTAL INSPECTOR OR LANDSCAPE CONTRACTOR SHALL BE ON-SITE TO INSPECT THE WETLAND REPLACEMENT AREA DURING THE CONSTRUCTION PROCESS AND CONFIRM THE FINAL GRADES IN THE WETLAND REPLACEMENT AREA.

4. THE TRANSITION ZONE BETWEEN THE WETLAND REPLACEMENT AREA AND THE SURROUNDING UPLAND PLANT COMMUNITY ADJACENT TO THE WETLAND REPLACEMENT AREA SHALL BE GRADED TO CREATE A SMOOTH TRANSITIONAL SLOPE BETWEEN THE WETLAND REPLACEMENT AREA AND THE UPLAND PLANT COMMUNITY. SITE GRADES AND SLOPES SHALL BE CONSTRUCTED IN AGREEMENT WITH THE GRADING DETAILS SHOWN ON THE APPROVED SITE PLAN.

5. ORGANIC SOILS CONTAIN 12-18 % ORGANIC CARBON BY DRY WEIGHT DEPENDING ON CLAY CONTENT. SOILS IN THE PREPARED REPLACEMENT AREA SHALL COMPRISE A 6"± B HORIZON CONSISTING OF SANDY LOAM, AND A 6"± A HORIZON CONSISTING OF SANDY LOAM AND DECOMPOSED LEAF LITTER OR OTHER APPROVED ORGANIC MATTER, TO PROVIDE A MIN. 50% ORGANIC MATTER BY VOLUME. ANY EXISTING/IMPORTED WETLAND SOIL AND SOIL AMENDMENT MATERIAL SHALL BE INSPECTED BY THE EI FOR INVASIVE/EXOTIC SPECIES PRIOR TO TRANSLOCATION TO THE SITE. COARSE, WOODY DEBRIS/STUMPS SHALL BE ADDED THROUGHOUT THE REPLACEMENT WETLAND SURFACE AREA TO ACHIEVE COVERAGE OF AT LEAST 4%.

6. OPTIMAL PLANTING CONDITIONS OCCUR FROM APRIL 1 - MAY 15 IN THE SPRING AND SEPTEMBER 1 - OCTOBER 15 IN THE FALL. SEEDING AND PLANTING WILL OCCUR ONLY DURING THESE TIME PERIODS UNLESS APPROVED BY THE ENVIRONMENTAL COMPLIANCE MONITOR/OTHER QUALIFIED INSPECTOR. WETLAND VEGETATION PLANTED IN THE WETLAND REPLACEMENT AREA MAY INCLUDE PLANTS SALVAGED FROM THE BORDERING VEGETATED WETLAND PROPOSED TO BE FILLED AND TRANSFERRED TO THE WETLAND REPLACEMENT AREA IF DEEMED SUITABLE BY THE ENVIRONMENTAL COMPLIANCE MONITOR / OTHER QUALIFIED INSPECTOR. ADDITIONAL NATIVE SHRUBS WILL BE ADDED TO THE PLANTING AREA TO SUPPLEMENT THE SALVAGED MATERIAL AS IDENTIFIED IN THE TABLE 1 - PROPOSED VEGETATION FOR WETLAND REPLICATION AREA. TREE AND SHRUB WOODY ROOT STOCK MATERIAL SHALL BE PLANTED IN APPROXIMATED DENSITIES/SPACING AS IDENTIFIED IN THE TABLE, ALTHOUGH SHRUB SPECIES MAY BE CLUSTERED IN GROUPS OF 2/3 TO CREATED MORE NATURAL CONDITIONS. SUPPLEMENTAL PLANTINGS SHALL BE OBTAINED FROM REPUTABLE LOCAL NURSERY SOURCES.

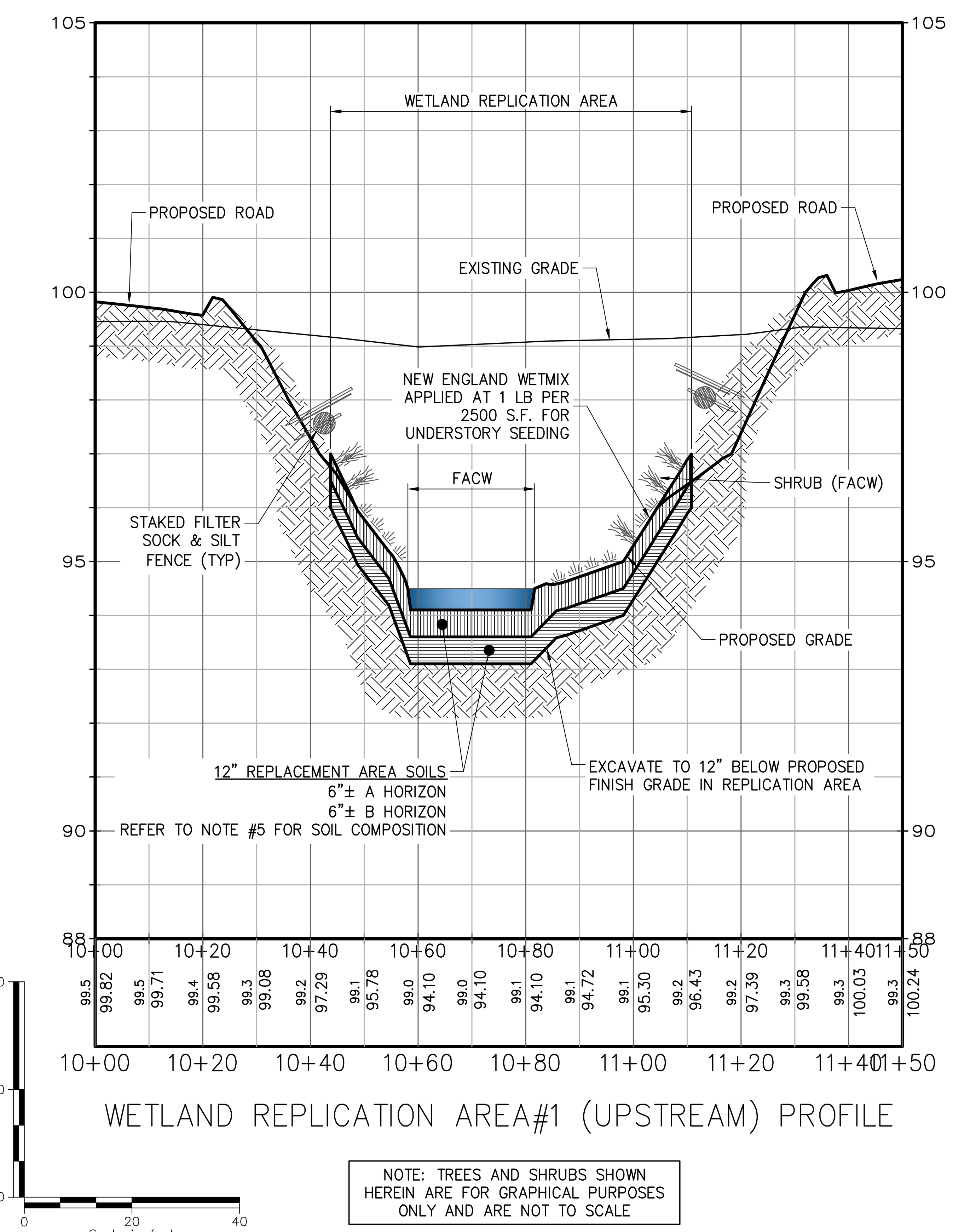
7. A WETLAND SEED MIX SUCH AS NEW ENGLAND WETMIX BY NEW ENGLAND WETLAND PLANTS, INC., AMHERST MASSACHUSETTS, OR APPROVED EQUIVALENT, SHALL BE BROADCAST THROUGHOUT THE AREA AT AN APPLICATION RATE OF 1 LB PER 2,500 S.F. AS SPECIFIED BY THE MANUFACTURER, AND IT SHALL BE MULCHED WITH 1-2" THICK LAYER OF STRAW OR OTHER SUITABLE ORGANIC EQUIVALENT AND MAINTAINED UNTIL VEGETATION HAS BEEN ESTABLISHED. UPLAND BUFFER ZONES DISTURBED AS A RESULT OF CONSTRUCTION OF THE WETLAND REPLICATION AREA SHALL BE SEEDED WITH A NEW ENGLAND EROSION CONTROL/RESTORATION FOR DRY SITES BY NEW ENGLAND WETLAND PLANTS, INC., OR APPROVED EQUIVALENT, AT AN APPLICATION RATE OF 1 LB PER 1,750 SF OF AS SPECIFIED BY THE MANUFACTURER, AND IT SHALL BE MULCHED WITH 1-2" THICK LAYER OF STRAW OR OTHER SUITABLE ORGANIC EQUIVALENT AND MAINTAINED UNTIL VEGETATION HAS BEEN ESTABLISHED.

8. TWO ANNUAL INSPECTIONS SHALL BE MADE OF THE COMPLETED REPLACEMENT AREA BY THE EI, IN COMPLIANCE WITH MASSACHUSETTS INLAND WETLAND REPLICATION GUIDELINES, MARCH, 2002 AND WEYMOUTH WETLAND PROTECTION BY-LAWS AND REGULATIONS IN ORDER TO DETERMINE WHETHER ADDITIONAL PLANTINGS (NATURAL OR FROM A NURSERY) WILL BE NECESSARY, AS WELL AS ASSESS THE OVERALL SUCCESS OF THE REPLACEMENT PROCEDURES.

9. WITHIN TWO GROWING SEASONS, AT LEAST 75 % OF THE SURFACE OF THE REPLACEMENT AREAS SHALL BE REESTABLISHED WITH INDIGENOUS WETLAND PLANT SPECIES. IF RE-ESTABLISHMENT IS INCOMPLETE AS JUDGED BY THE ENGINEER, THE CONTRACTOR SHALL MAKE ADDITIONAL PLANTINGS WITH SPECIES WHICH ALREADY OCCUR IN THE ADJACENT WETLAND.

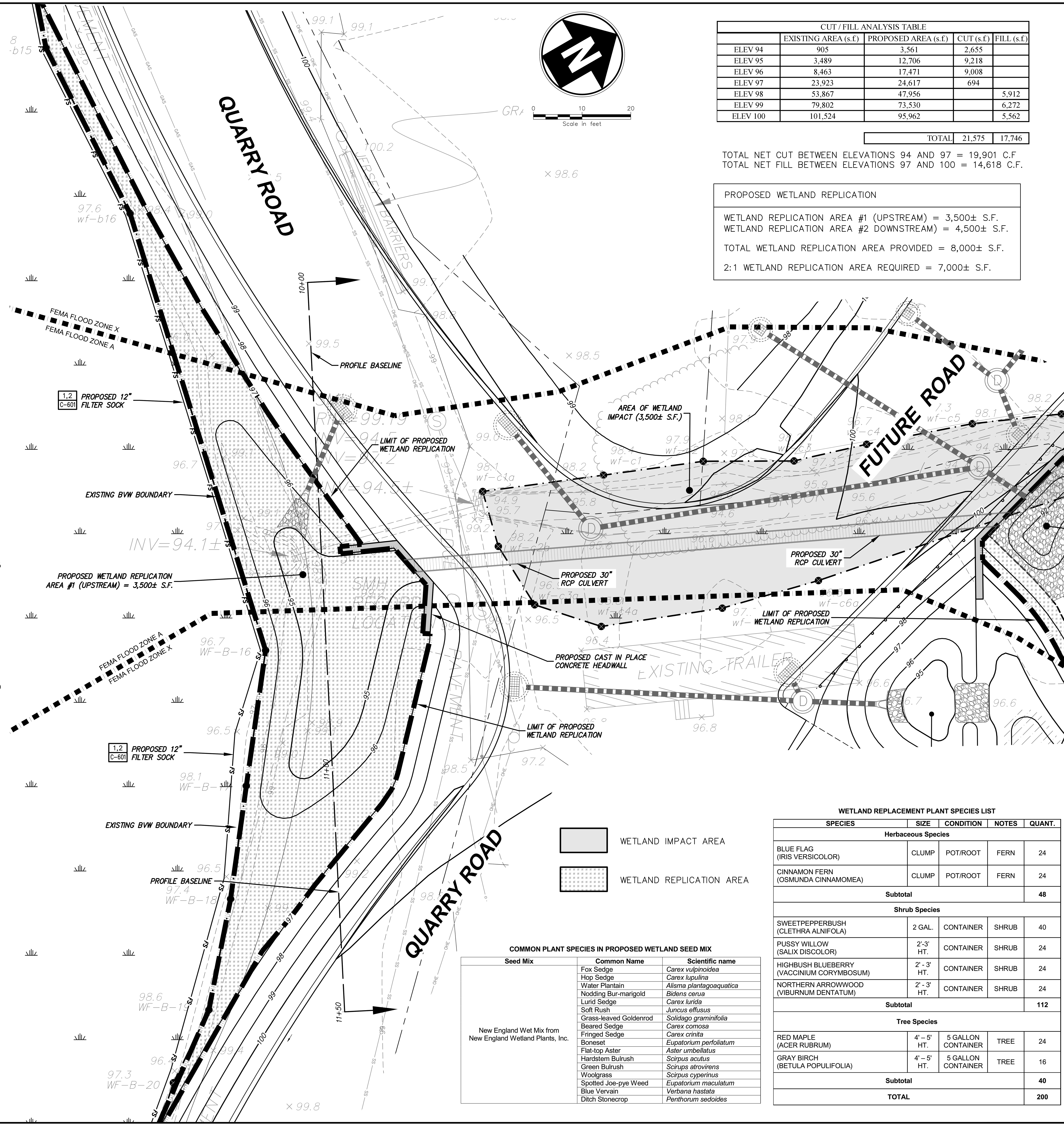
10. IF ANY QUESTIONS ARISE CONCERNING IMPLEMENTATION OF THESE WETLAND CONSTRUCTION SPECIFICATIONS, THE ENGINEER SHALL BE CONTACTED IMMEDIATELY.

11. DURING THE TWO ANNUAL INSPECTIONS OF THE REPLACEMENT WETLAND AREA, THE CONTRACTOR SHALL IDENTIFY AND REMOVE BY HAND ALL INVASIVE PLANT SPECIES. IF THE INVASIVE POPULATION EXCEEDS 10% OF THE AERIAL EXTENT OF THE REPLACEMENT WETLAND AREA, AN INVASIVE SPECIES ACTION PLAN WILL BE SUBMITTED TO WEYMOUTH CONSERVATION COMMISSION FOR REVIEW AND APPROVAL



WETLAND REPLICATION AREA#1 (UPSTREAM) PROFILE

NOTE: TREES AND SHRUBS SHOWN HEREIN ARE FOR GRAPHICAL PURPOSES ONLY AND ARE NOT TO SCALE



CUT / FILL ANALYSIS TABLE				
	EXISTING AREA (s.f.)	PROPOSED AREA (s.f.)	CUT (s.f.)	FILL (s.f.)
ELEV 94	905	3,561	2,655	
ELEV 95	3,489	12,706	9,218	
ELEV 96	8,463	17,471	9,008	
ELEV 97	23,923	24,617	694	
ELEV 98	53,867	47,956		5,912
ELEV 99	79,802	73,530		6,272
ELEV 100	101,524	95,962		5,562
		TOTAL	21,575	17,746

TOTAL NET CUT BETWEEN ELEVATIONS 94 AND 97 = 19,901 C.F
TOTAL NET FILL BETWEEN ELEVATIONS 97 AND 100 = 14,618 C.F.

PROPOSED WETLAND REPLICATION

WETLAND REPLICATION AREA #1 (UPSTREAM) = 3,500± S.F.
WETLAND REPLICATION AREA #2 DOWNSTREAM) = 4,500± S.F.

TOTAL WETLAND REPLICATION AREA PROVIDED = 8,000± S.F.

2:1 WETLAND REPLICATION AREA REQUIRED = 7,000± S.F.

COMMON PLANT SPECIES IN PROPOSED WETLAND SEED MIX

Seed Mix	Common Name	Scientific name
New England Wet Mix from New England Wetland Plants, Inc.	Fox Sedge	*Carex vulpinoidea*
	Hop Sedge	*Carex lupulina*
	Water Plantain	*Alisma plantagoaquatica*
	Nodding Bur-marigold	*Bidens cerua*
	Lurid Sedge	*Carex lurida*
	Soft Rush	*Juncus effusus*
	Grass-leaved Goldenrod	*Solidago graminifolia*
	Beared Sedge	*Carex comosa*
	Fringed Sedge	*Carex crinita*
	Boneset	*Eupatorium perfoliatum*
	Flat-top Aster	*Aster umbellatus*
	Hardstem Bulrush	*Scirpus acutus*
	Green Bulrush	*Scirups atrovirens*
	Woolgrass	*Scirpus cyperinus*
	Spotted Joe-pye Weed	*Eupatorium maculatum*
	Blue Vervain	*Verbana hastata*
	Ditch Stonecrop	*Penthorum sedoides*

WETLAND REPLACEMENT PLANT SPECIES LIST

SPECIES	SIZE	CONDITION	NOTES	QUANT.
Herbaceous Species				
BLUE FLAG (IRIS VERSICOLOR)	CLUMP	POT/ROOT	FERN	24
CINNAMON FERN (OSMUNDA CINNAMOMEA)	CLUMP	POT/ROOT	FERN	24
Subtotal				**48**
Shrub Species				
SWEETPEPPERBUSH (CLETHRA ALNIFOLA)	2 GAL.	CONTAINER	SHRUB	40
PUSSY WILLOW (SALIX DISCOLOR)	2'-3' HT.	CONTAINER	SHRUB	24
HIGHBUSH BLUEBERRY (VACCINIUM CORYMBOSUM)	2' - 3' HT.	CONTAINER	SHRUB	24
NORTHERN ARROWWOOD (VIBURNUM DENTATUM)	2' - 3' HT.	CONTAINER	SHRUB	24
Subtotal				**112**
Tree Species				
RED MAPLE (ACER RUBRUM)	4' – 5' HT.	5 GALLON CONTAINER	TREE	24
GRAY BIRCH (BETULA POPULIFOLIA)	4' – 5' HT.	5 GALLON CONTAINER	TREE	16
Subtotal				**40**
TOTAL				**200**

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611 PLEASANT STREET
WEYMOUTH, MASSACHUSETTS 02189

12.3.18

PLEASANT STREET & LIBBEY IND. PARKWAY
WEYMOUTH, MA

No.	Submittal / Revision	App'd.	By	Date
A	ConCom Submittal	KK	JM	12/03/18

WETLAND REPLICATION PLAN (SHEET 1 OF 2)

Designed By:	Drawn By:	Checked By:
SA/JM	JPM	KK
Issue Date:	Project No:	Scale:
12/03/18	25424-9100	AS SHOWN

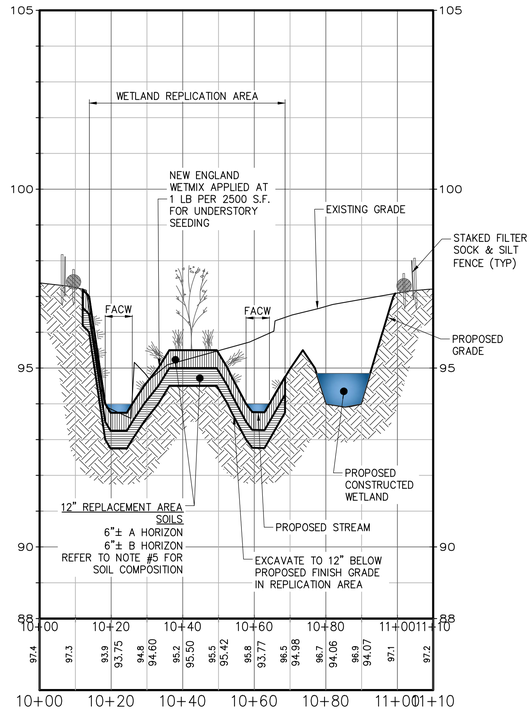
Drawing No.:
C-202

COMMON PLANT SPECIES IN PROPOSED WETLAND SEED MIX

Seed Mix	Common Name	Scientific name
New England Wet Mix from New England Wetland Plants, Inc.	Fox Sedge	*Carex vulpinoidea*
	Hop Sedge	*Carex lupulina*
	Water Plantain	*Alisma plantagoaquatica*
	Nodding Bur-marigold	*Bidens cerua*
	Lurid Sedge	*Carex lurida*
	Soft Rush	*Juncus effusus*
	Grass-leaved Goldenrod	*Solidago graminifolia*
	Beared Sedge	*Carex comosa*
	Fringed Sedge	*Carex crinita*
	Boneset	*Eupatorium perfoliatum*
	Flat-top Aster	*Aster umbellatus*
	Hardstem Bulrush	*Scirpus acutus*
	Green Bulrush	*Scirpus atrovirens*
	Woolgrass	*Scirpus cyperinus*
	Spotted Joe-pye Weed	*Eupatorium maculatum*
	Blue Vervain	*Verbana hastata*
	Ditch Stonecrop	*Penthorum sedoides*

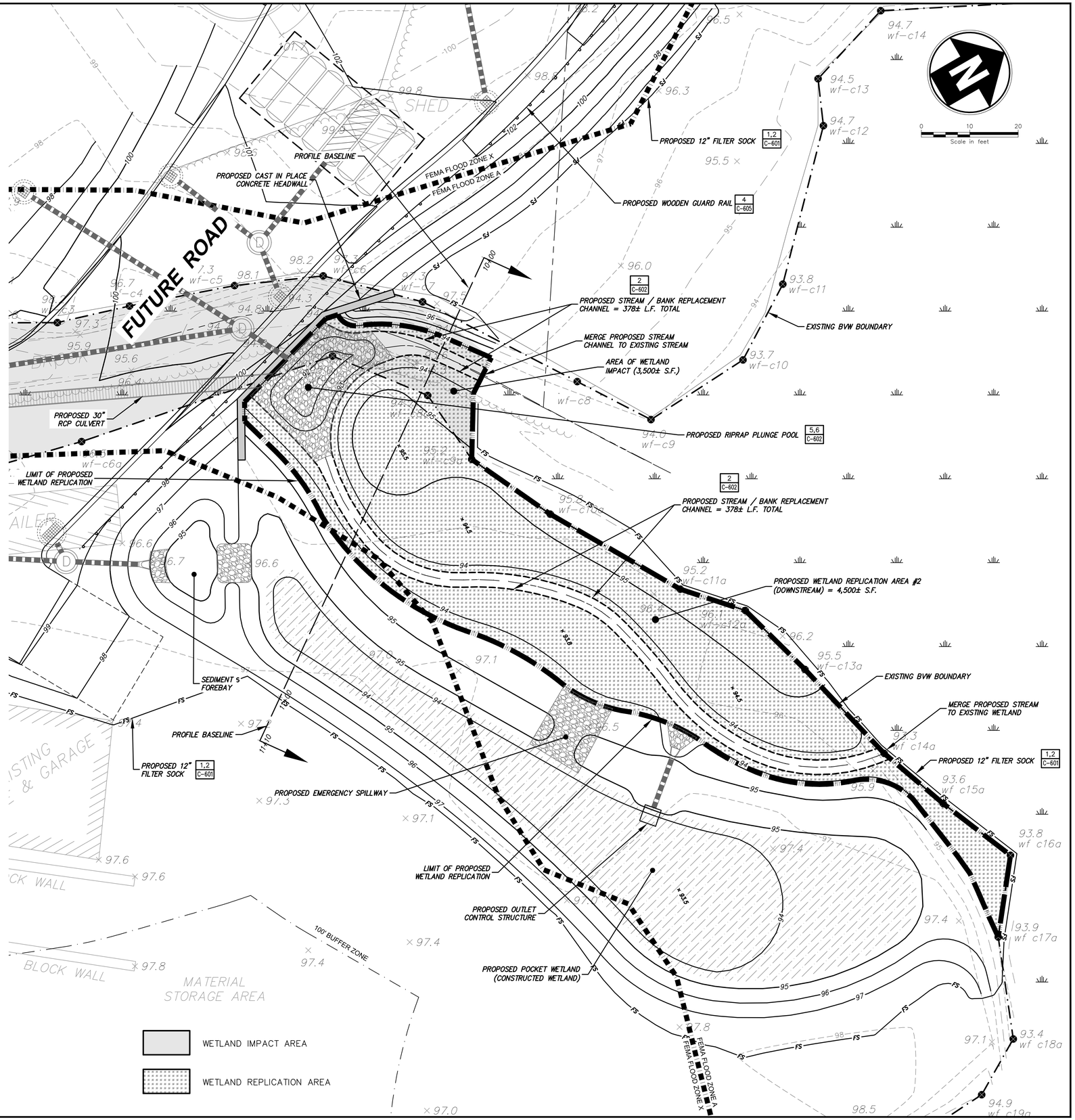
WETLAND REPLACEMENT PLANT SPECIES LIST

SPECIES	SIZE	CONDITION	NOTES	QUANT.
Herbaceous Species				
BLUE FLAG (IRIS VERSICOLOR)	CLUMP	POT/ROOT	FERN	30
CINNAMON FERN (OSMUNDA CINNAMOMEA)	CLUMP	POT/ROOT	FERN	30
Subtotal				**60**
Shrub Species				
SWEETPEPPERBUSH (CLETHRA ALNIFOLA)	2 GAL.	CONTAINER	SHRUB	50
PUSSY WILLOW (SALIX DISCOLOR)	2'-3' HT.	CONTAINER	SHRUB	30
HIGHBUSH BLUEBERRY (VACCINIUM CORYMBOSUM)	2' - 3' HT.	CONTAINER	SHRUB	30
NORTHERN ARROWWOOD (VIBURNUM DENTATUM)	2' - 3' HT.	CONTAINER	SHRUB	30
Subtotal				**140**
Tree Species				
RED MAPLE (ACER RUBRUM)	4' – 5' HT.	5 GALLON CONTAINER	TREE	30
GRAY BIRCH (BETULA POPULIFOLIA)	4' – 5' HT.	5 GALLON CONTAINER	TREE	20
Subtotal				**50**
TOTAL				**250**



WETLAND REPLICATION AREA #2 (DOWNSTREAM) PROFILE

NOTE: TREES AND SHRUBS SHOWN HEREIN ARE FOR GRAPHICAL PURPOSES ONLY AND ARE NOT TO SCALE



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KELLY KILLEEN DIVINE
No. 39471
REGISTERED PROFESSIONAL ENGINEER
COMMONWEALTH OF MASSACHUSETTS
12.3.18

PLEASANT STREET &
LIBBEY IND. PARKWAY
WEYMOUTH, MA

No.	Submittal / Revision	App'd.	By	Date
A	ConCom Submittal	KK	JM	12/03/18

WETLAND REPLICATION PLAN (SHEET 2 OF 2)

Designed By:	Drawn By:	Checked By:
SA/JM	JPM	KK
Issue Date:	Project No:	Scale:
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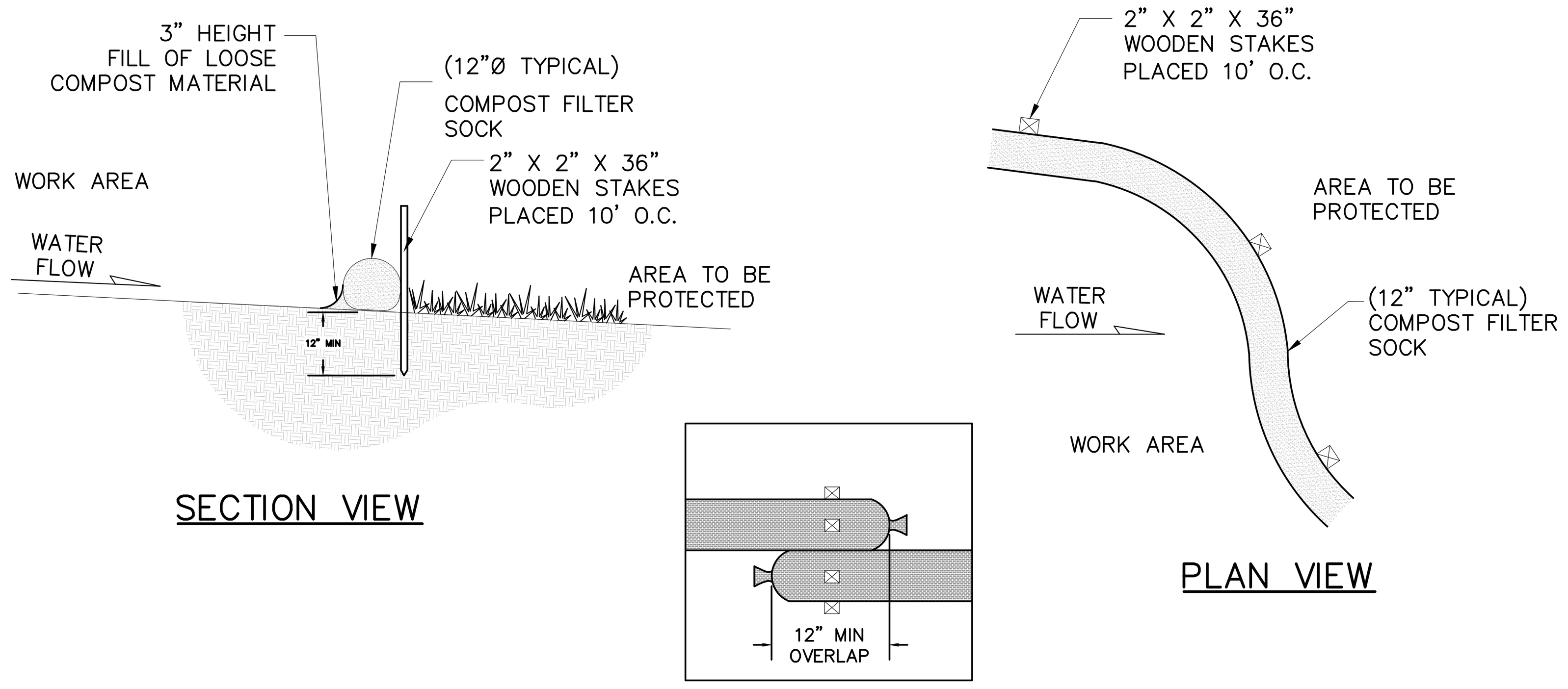
Drawing No.:
C-203



NOTES:

1. PREFABRICATED COMPOST SOCK SHALL BE FILTREXX SOXX OR APPROVED EQUAL.
2. MATERIAL FOR SOCKS SHALL CONSIST OF SANITIZED MATURE COMPOST, FREE OF VIABLE WEED SEEDS AND FOREIGN DEBRIS SUCH AS GLASS AND PLASTIC. COMPOST SHALL BE IN SHREDDED OR GRANULAR FORM AND FREE FROM HARD LUMPS. IN ADDITION, NO KILN-DRIED WOOD OR CONSTRUCTION DEBRIS SHALL BE ALLOWED. CONTRACTOR SHALL REFER TO MASSDOT SPECIFICATIONS M1.06.0 FOR MATERIAL SPECIFICATIONS.
3. SOCK SHALL CONSIST OF JUTE MESH OR OTHER APPROVED BIODEGRADABLE MATERIAL.

PRACTICE: COMPOST FILTER SOCK:

A COMPOST FILTER SOCK IS A TYPE OF CONTAINED COMPOST FILTER BERM CONSISTING OF A MESH TUBE FILLED WITH COMPOST MATERIAL THAT IS PLACED PERPENDICULAR TO SHEET FLOW RUNOFF TO RETAIN SEDIMENT FROM DISTURBED AREAS. THE COMPOST FILTER SOCK ACTS AS A FILTER TO RETAIN SEDIMENT AND OTHER POLLUTANTS (E.G., SUSPENDED SOLIDS, NUTRIENTS) WHILE ALLOWING THE WATER TO FLOW THROUGH IT. COMPOST QUALITY MUST MEET AASHTO 2010 SPECIFICATIONS.

INSTALLATIONS REQUIREMENTS:

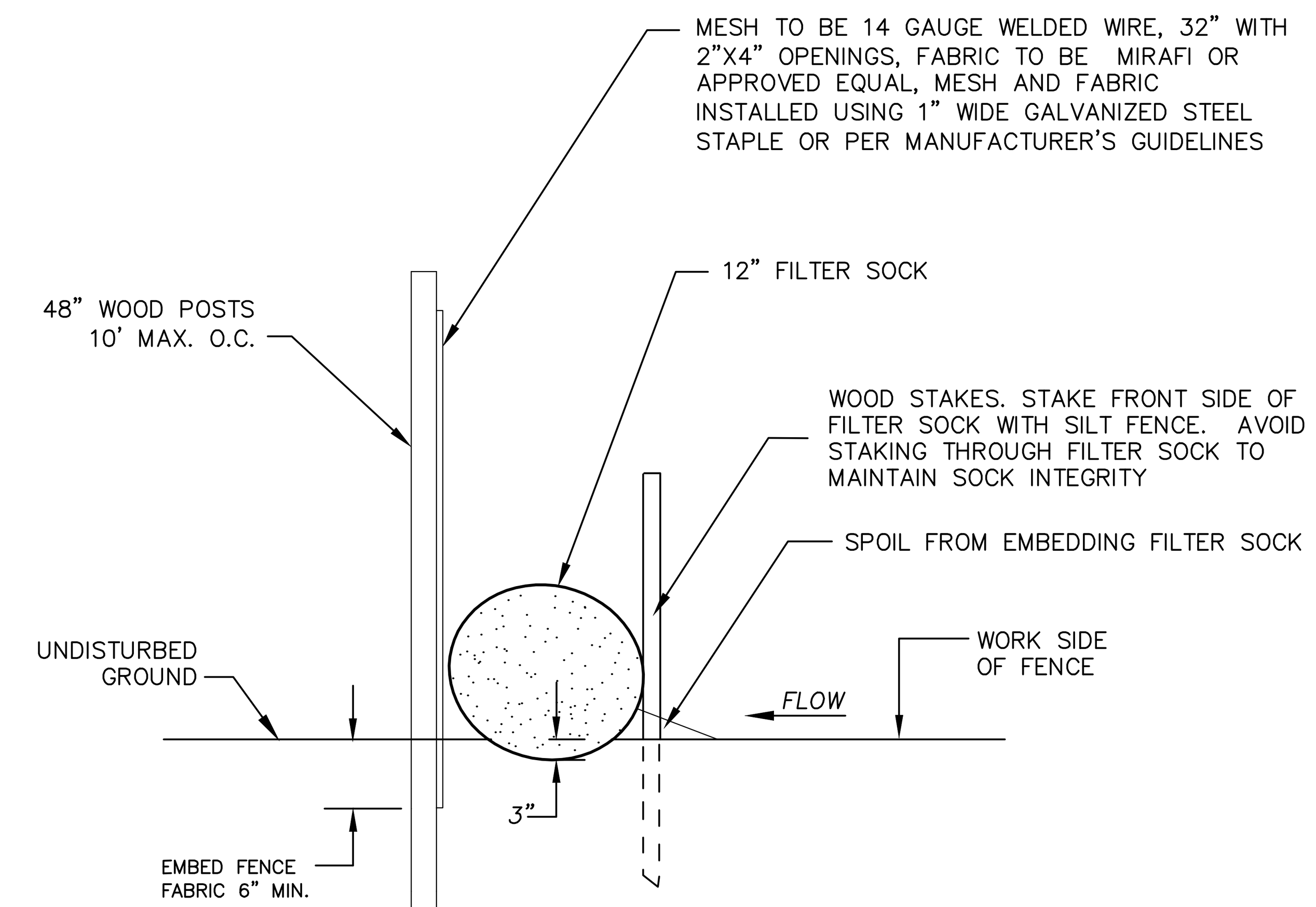
ONCE THE FILTER SOCK IS FILLED AND PUT IN PLACE, IT SHOULD BE ANCHORED TO THE SLOPE BY STAKES ALONG THE DOWNHILL SIDE OF THE SOCK AT 10' SPACING ON CENTER (O.C.)0 THE ENDS OF THE FILTER SOCK SHOULD BE DIRECTED UPSLOPE, TO PREVENT STORMWATER FROM RUNNING AROUND THE END OF THE TUBE.

MAINTENANCE REQUIREMENTS:

SOCK MUST BE INSPECTED FOR SEDIMENT ACCUMULATION. IF THERE IS EXCESSIVE PONDING BEHIND THE FILTER SOCK OR ACCUMULATED SEDIMENT REACHES THE TOP OF THE SOCK, AN ADDITIONAL SOCK SHOULD BE ADDED ON TOP OR INFRONT OF THE EXISTING SOCK IN THESE AREAS. AN ADEQUATE RESERVE OF SOCKS MUST BE KEPT ON SITE AT ALL TIMES FOR EMERGENCY AND/OR ROUTINE REPLACEMENT. SOCKS SHALL BE REMOVED ONLY AFTER EXPOSED SOILS IN THE CONTRIBUTING DRAINAGE AREA ACHIEVE FINAL STABILIZATION. SEDIMENT ACCUMULATION MUST BE REMOVED ONCE IT HAS REACHED 1/2 OF THE EXPOSED HEIGHT OF THE SOCK.

1 12-INCH COMPOST FILTER SOCK

SCALE: NO SCALE

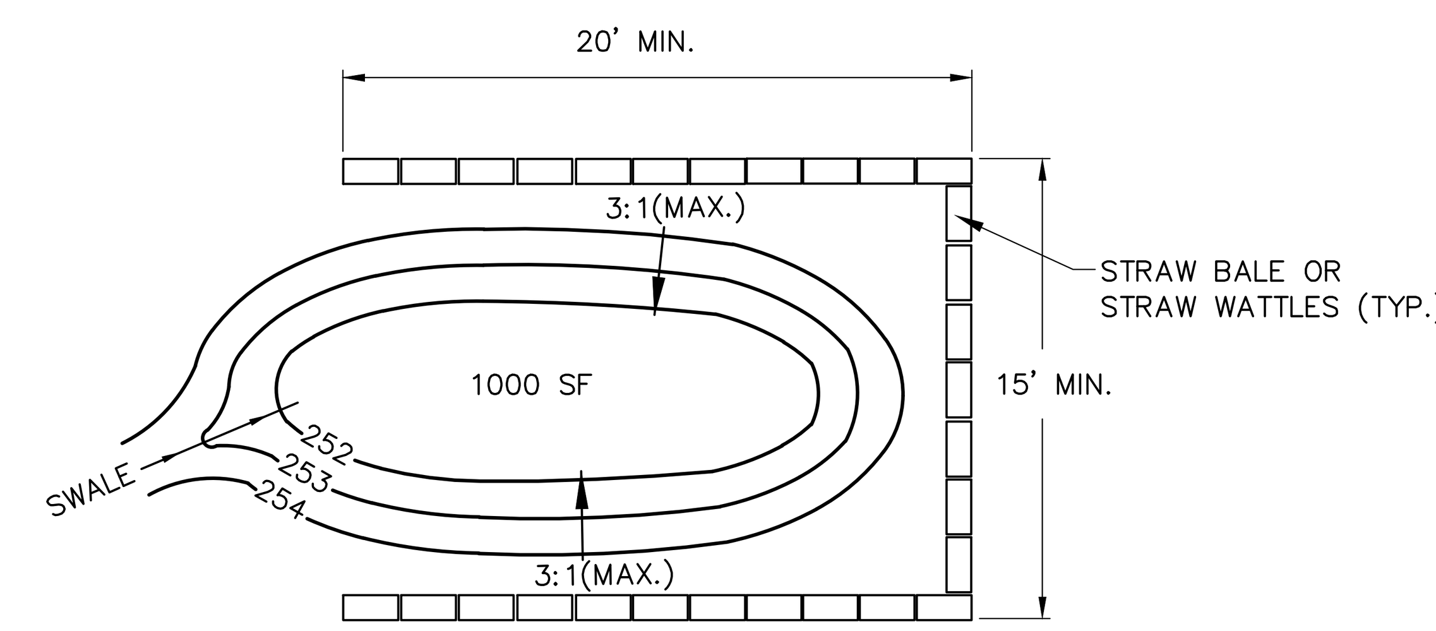


NOTES:

1. BALES TO BE TIED W/WIRE.
2. STRAW BALES TO BE SECURED W/ MIN. TWO (2) 1"x1"x3' WOOD STAKES PER BALE, DRIVEN 12" MIN. INTO GRADE.

2 12" FILTER SOCK WITH WIRE BACKED SILT FENCE

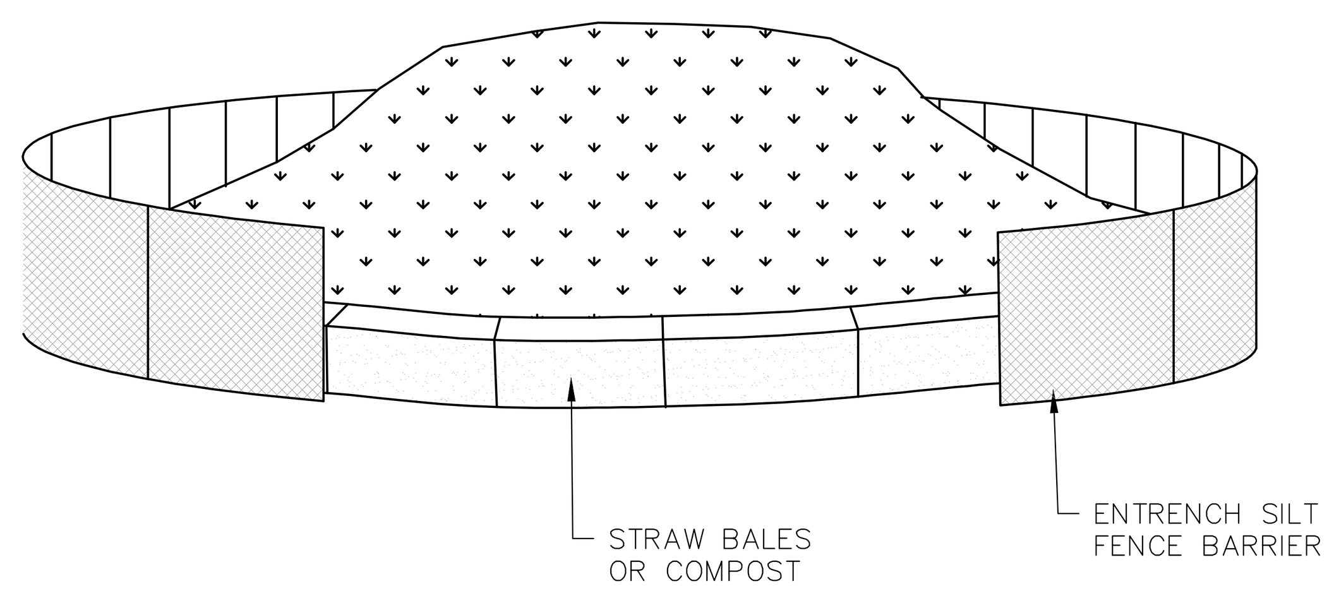
SCALE: NO SCALE



1. SEDIMENT BASINS AND TRAPS SHALL BE SIZED IN ACCORDANCE WITH EPA NPDES GUIDELINES.
2. SEDIMENT TRAPS ARE UTILIZED FOR DRAINAGE AREAS SMALLER THAN 5 ACRES. THE SEDIMENT TRAP SHOULD HAVE A MINIMUM VOLUME BASED ON 1/2 INCH OF STORAGE FOR EACH ACRE OF DRAINAGE AREA. THIS VOLUME EQUATES TO 1800 CUBIC FEET OF STORAGE OR 67 CUBIC YARDS FOR EACH ACRE OF DRAINAGE AREA.
3. SEDIMENT BASIN ARE UTILIZED FOR DRAINAGE AREAS FROM 5 TO 100 ACRES. THE TEMPORARY SEDIMENT BASIN SHOULD HAVE A MINIMUM VOLUME OF 3,600 CUBIC FEET FOR EACH ACRE OF DRAINAGE AREA.
4. LOCATION DICTATED BY SEQUENCE OF CONSTRUCTION. CONTRACTOR TO PROVIDE WHERE NECESSARY TO FILTER RUNOFF FROM CONSTRUCTION AREAS PRIOR TO DISCHARGE.

3 TEMPORARY SEDIMENT BASIN

SCALE: NO SCALE

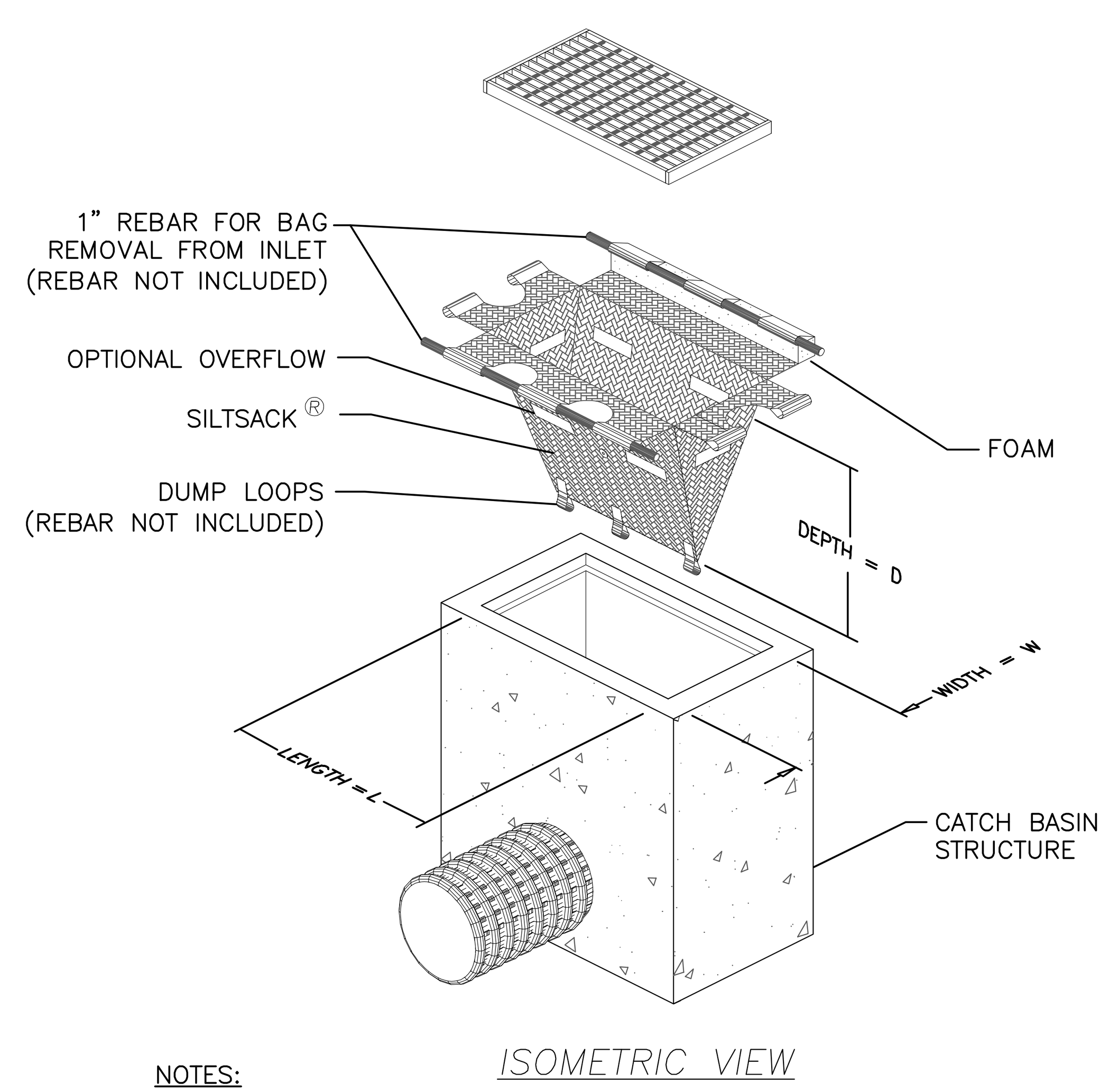


INSTALLATION NOTES:

1. AREA CHOSEN FOR STOCKPILING OPERATIONS SHALL BE DRY AND STABLE.
2. MAXIMUM SLOPE OF STOCKPILE SHALL BE 2:1.
3. UPON COMPLETION OF STOCKPILING, EACH PILE SHALL BE SURROUNDED WITH STRAW BALES, THEN STABILIZED WITH VEGETATION, OR COVERED.
4. SEE SPECIFICATIONS FOR INSTALLATION OF STRAW BALES.

4 SOIL STOCKPILE

SCALE: NO SCALE

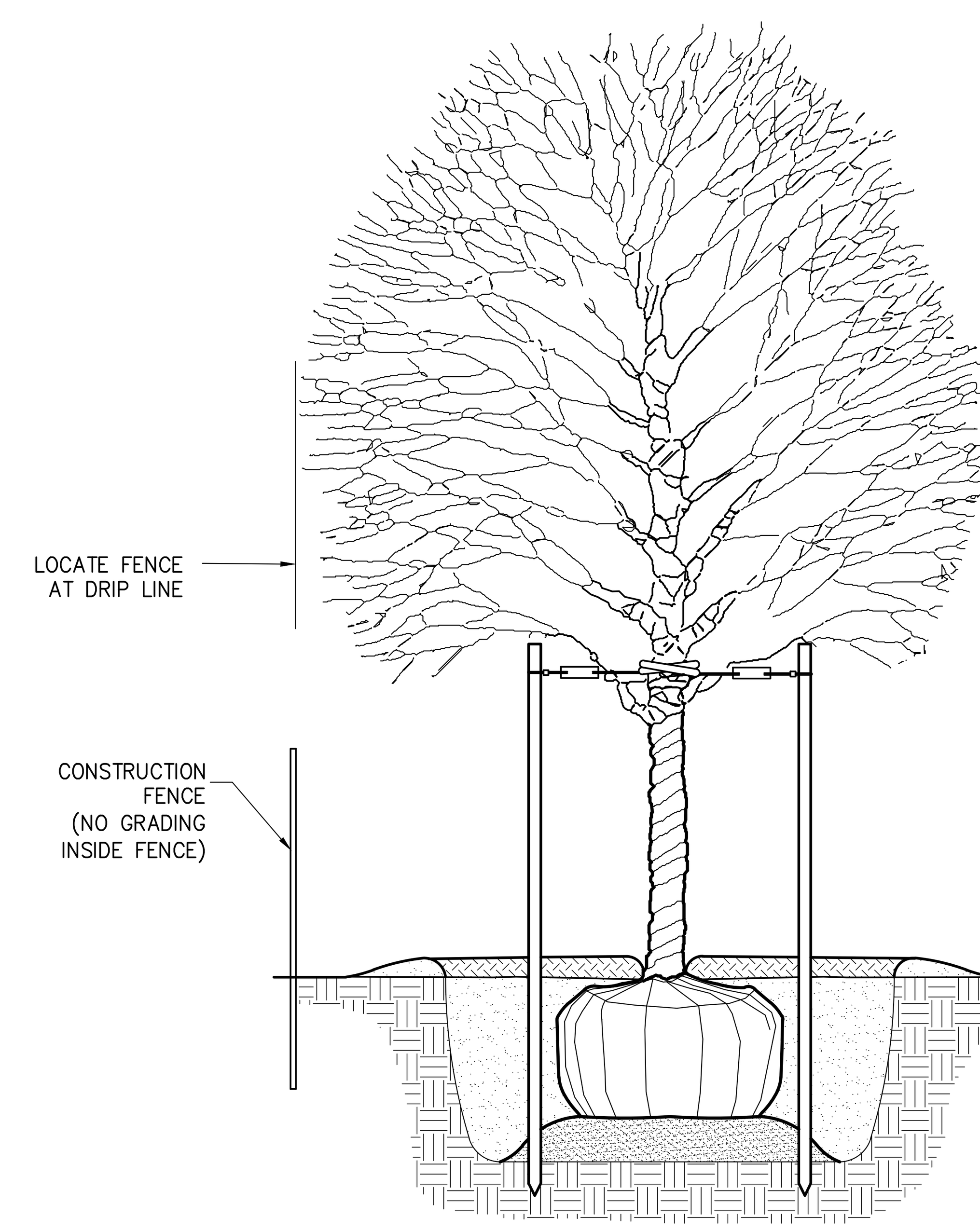


NOTES:

1. REMOVE ACCUMULATED SEDIMENT WHEN CAPACITY IS REDUCED BY HALF OR PER MANUFACTURER'S RECOMMENDATIONS.
2. CATCH BASIN INSERT TO BE SILTSACK® BY ACF ENVIRONMENTAL, PHONE: 1-800-448-3636, acfenvironmental.com OR EQUIVALENT.
3. INSTALL ON ALL EXISTING CATCH BASINS WITHIN MAIN STREET AND ON SITE. INSTALL ON ALL PROPOSED CATCH BASINS AFTER STRUCTURE INSTALLATION.

5 FILTER SACK CATCH BASIN INSERT DETAIL

SCALE: NO SCALE



FENCE NOTES:

1. CONTRACTOR TO MAINTAIN INTEGRITY OF CONSTRUCTION FENCE FOR DURATION OF PROJECT.
2. FOR EVERGREEN TREES LOCATE CONSTRUCTION FENCE 5' CLEAR OF BASE BRANCHES.
3. IF ROCK IS ENCOUNTERED BEFORE DRIVEN DEPTH SHOWN, SECURE POST IN 12" DIAMETER CONCRETE FOOTING.
4. REMOVE FENCE AND RESTORE LAWN AT COMPLETION OF CONTRACT.
5. ALL TIES TO BE 9 GAUGE.
6. ALL COMPONENTS TO BE GALVANIZED STEEL.
7. INSTALL BRACE RAIL ASSEMBLIES IN EACH DIRECTION FROM CORNER POSTS AND AT ALL END POSTS.
8. BRACE / TENSION BANDS TO BE ⅛" x 1" AND FASTENED WITH ⅜" x 1 ½" CARRIAGE BOLTS.
9. IF LANDSCAPE PLANS CONTAIN TREE PROTECTION DETAIL, THAT DETAIL SHALL GOVERN OVER THIS DETAIL.

6 TREE PROTECTION DETAIL

SCALE: NO SCALE

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No.	Submittal / Revision	App'd.	By	Date
A	ConCom Submittal	KK	JM	12/03/18

DETAILS - 1

Designed By:	Drawn By:	Checked By:
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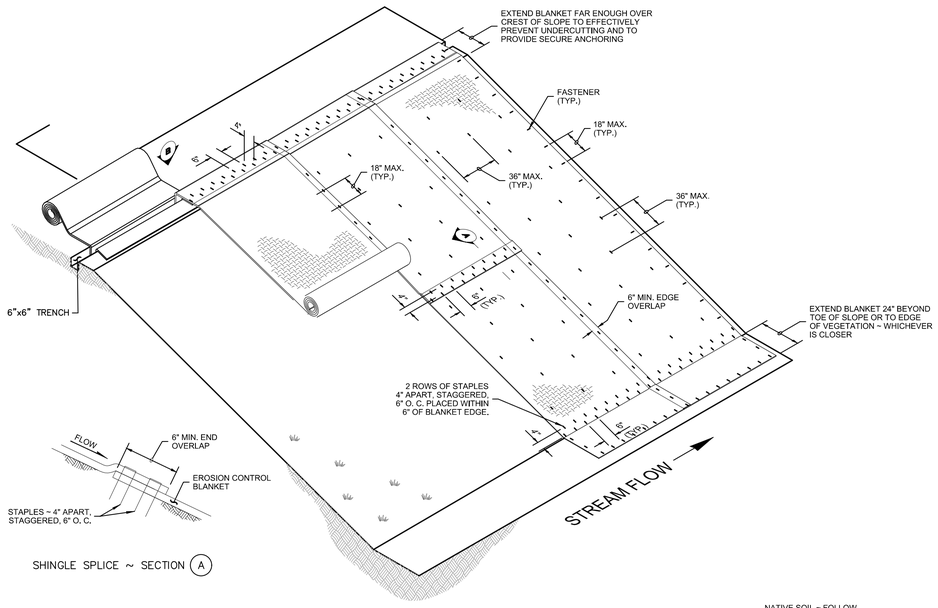
Issue Date:	Project No:	Scale:
12/03/18	25424-9100	AS SHOWN

Drawing No.:

C-601

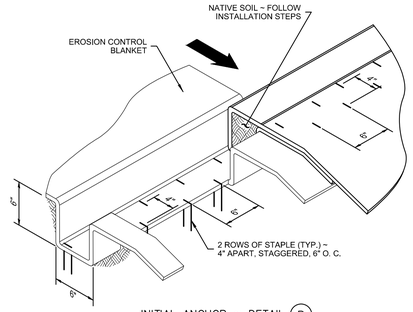


NOTES

1. BIODEGRADABLE EROSION CONTROL BLANKETS SHALL BE INSTALLED ON ALL SLOPES 3:1 OR STEEPER AND AT THE DIRECTION OF THE ENVIRONMENTAL CONSULTANT OR ENGINEER AS REQUIRED PER SITE CONDITIONS.
2. MORE THAN THE MINIMUM OF ONE FASTENER PER SQUARE YARD MAY BE REQUIRED DUE TO CONDITIONS SUCH AS BLANKET COMPOSITION, SOIL TYPE, SURFACE UNIFORMITY, AND SLOPE STEEPNESS.
3. USE MANUFACTURER'S REQUIREMENTS. WHEN MANUFACTURER'S REQUIREMENTS ARE NOT PROVIDED, USE INSTALLATION REQUIREMENTS SHOWN ON STANDARD PLANS.
4. ADDITIONAL STAPLES MAY BE REQUIRED ON SLOPES GREATER THAN 3H : 1V.

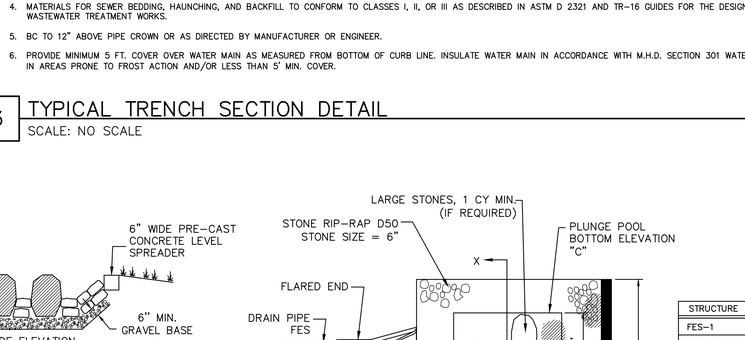
INSTALLATION STEPS:

1. PREPARE SMOOTH SLOPE.
2. AMEND SOIL AND SEED, AS SPECIFIED.
3. DIG ANCHOR TRENCH. SET ASIDE NATIVE SOIL REMOVED FROM TRENCH.
4. SECURE BLANKET IN ANCHOR TRENCH, STAKING OR STAPLING BLANKET AS SHOWN.
5. REPLACE NATIVE SOIL PREVIOUSLY REMOVED FROM TRENCH.
6. ROLL BLANKET DOWN THE SLOPE IN A CONTROLLED MANNER, TAKING CARE TO REMOVE EXCESS SLACK, AND TAKING CARE NOT TO STRETCH BLANKET.
7. STAKE OR STAPLE BLANKET AS SHOWN SO THERE ARE NO GAPS BETWEEN THE BLANKET AND THE SOIL.STAPLE WHILE UNROLLING BLANKET TO MINIMIZE WALKING ON BLANKET.



1 BIODEGRADABLE EROSION CONTROL BLANKET PLACEMENT FOR SLOPES DETAIL

SCALE: NO SCALE

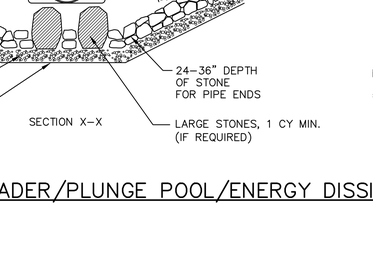


NOTES:

1. STREAM BANKS WILL BE SEEDED AND PLANTED WITH VEGETATION TO STABILIZE.
2. RIPRAP SHALL NOT BE USED ON STREAM BANKS.

2 TYPICAL CHANNEL STREAM CROSS SECTION DETAIL

SCALE: NO SCALE



COMMON FILL TO CONSIST OF GRANULAR MATERIAL CONTAINING NO STONES LARGER THAN 6" IN GREATEST DIMENSION.

BACKFILL WATER OR DRAIN TRENCH WITH SELECT MATERIAL (M.H.D. M1.03.0 TYPE B OR EQUAL) CONTAINING NO STONES LARGER THAN 3" IN GREATEST DIMENSION TO 12" OVER PIPE.

PROVIDE SCREENED GRAVEL (CONFORMING TO M.H.D. M2.01.4) BEDDING TO MID-PIPE DIAMETER IN SEWER APPLICATIONS OR WHERE GROUNDWATER IS ENCOUNTERED AS DIRECTED BY THE ENGINEER.

REMOVE UNSUITABLE MATERIAL BELOW GRADE, IF ENCOUNTERED, TO SUITABLE DEPTHS AS DIRECTED BY ENGINEER AND REPLACE WITH CLEAN GRANULAR FILL AND FILTER FABRIC.

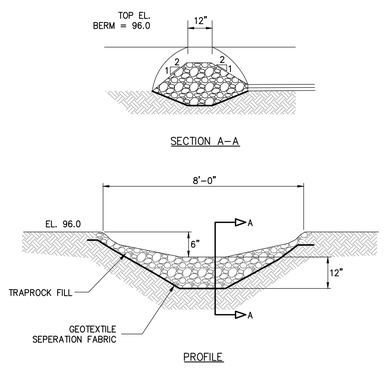
TRENCH WIDTH (W)		
D DIA. OF PIPE	W UNSHEETED	W SHEETED
TO 12"	3'	4'
14" TO 24"	4'	5'
30" TO 364"	5'	6'

NOTES:

1. ALL TRENCH CONSTRUCTION TO CONFORM TO APPLICABLE FEDERAL, STATE AND LOCAL REGULATIONS.
2. COMPACT FILL AND TAMP PIPE TO 95% MAX. DRY DENSITY IN 8" LIFTS UNLESS OTHERWISE SPECIFIED.
3. INSTALL DUCTILE IRON WATER PIPE IN ACCORDANCE WITH ANSI A21.51 (AWWA C151) LAYING CONDITION TYPE 2. BACKFILL TO CONFORM TO MHD M1.03.0 GRAVEL BURROW TYPE c TO 12" ABOVE PIPE CROWN OR AS DIRECTED BY MANUFACTURER OR ENGINEER.
4. MATERIALS FOR SEWER BEDDING, HAUNCHING, AND BACKFILL TO CONFORM TO CLASSES I, II, OR III AS DESCRIBED IN ASTM D 2321 AND TR-16 GUIDES FOR THE DESIGN OF WASTEWATER TREATMENT WORKS.
5. BC TO 12" ABOVE PIPE CROWN OR AS DIRECTED BY MANUFACTURER OR ENGINEER.
6. PROVIDE MINIMUM 5 FT. COVER OVER WATER MAIN AS MEASURED FROM BOTTOM OF CURB LINE. INSULATE WATER MAIN IN ACCORDANCE WITH M.H.D. SECTION 301 WATER SYSTEMS IN AREAS PRONE TO FROST ACTION AND/OR LESS THAN 5' MIN. COVER.

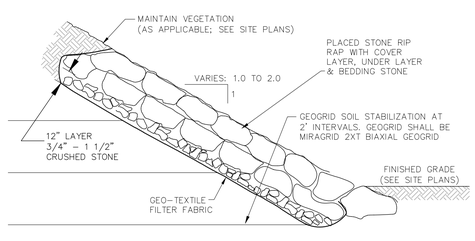
3 TYPICAL TRENCH SECTION DETAIL

SCALE: NO SCALE



4 SEDIMENT TRAP OUTLET DETAIL

SCALE: NO SCALE

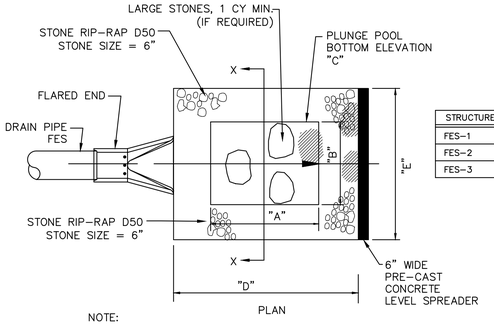


NOTES:

1. RIP-RAP SHALL BE 16" WITH MAXIMUM STONE SIZE OF 24" AND TOTAL THICKNESS OF 36".
2. RIP-RAP TO BE UNDERLAIN WITH A WOVEN GEOTEXTILE FILTER SUCH AS MIRAFI 600X OR APPROVED EQUAL. THE FILTER LAYER SHOULD EXTEND FROM THE TOP OF SLOPE TO BENEATH THE KEYWAY AT THE TOE AND IT SHOULD BE ANCHORED IN A MIN. 24 INCH DEEP TRENCH AT THE TOP OF SLOPE. STONE MAYBE UTILIZED AT A SLOPE STEEPER THAN 1:1 BUT SHALL CONSIST OF LARGE PLACED BOULDERS STACKED WITH SUFFICIENT BATTER TO BE STABLE UNDER VEHICLE LOAD. CONTRACTOR SHALL PROVIDE STRUCTURAL SHOP DRAWINGS TO ENGINEER FOR REVIEW AND APPROVAL PRIOR TO INSTALLATION.
3. CONTRACTOR SHALL SUBMIT SHOP DRAWING(S) OF PROPOSED RIP-RAP SLOPE TO PROJECT ENGINEER FOR APPROVAL. SHOP DRAWING(S) SHALL BE PREPARED AND ENDORSED BY A PROFESSIONAL GEOTECHNICAL ENGINEER. PROJECT ENGINEER SHALL SUBMIT COPIES OF THE APPROVED SHOP DRAWING(S) TO THE CONSERVATION AGENT PRIOR TO INSTALLATION.

5 RIP RAP SLOPE DETAIL

SCALE: NO SCALE



STRUCTURE	A	B	C	D	E
FES-1	6.0'	4.0'	162.05	9.0'	7.0'
FES-2	3.0'	2.0'	162.0	6.0'	5.0'
FES-3	3.0'	2.0'	161.7	6.0'	5.0'

NOTE:

* DIMENSIONS PROVIDED ARE GREATER THAN THE MINIMUM INDICATED IN THE CALCULATION, HOWEVER FOR CONSTRUCTIBILITY PURPOSES WE HAVE PROVIDED A LARGER RIP-RAP APRON SIZE. REFER TO GRADING & DRAINAGE PLANS FOR LOCATION AND INVERT INFORMATION.

6 LEVEL SPREADER/PLUNGE POOL/ENERGY DISSIPATER

SCALE: NO SCALE

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COMMONWEALTH OF MASSACHUSETTS
KELLY KILLEEN
CIVIL
No. 39041
REGISTERED PROFESSIONAL ENGINEER
12/3/18

PLEASANT STREET &
LIBBEY IND. PARKWAY
WEYMOUTH, MA

No.	Submittal / Revision	App'd	By	Date
A	ConCom Submittal	KK	JM	12/03/18

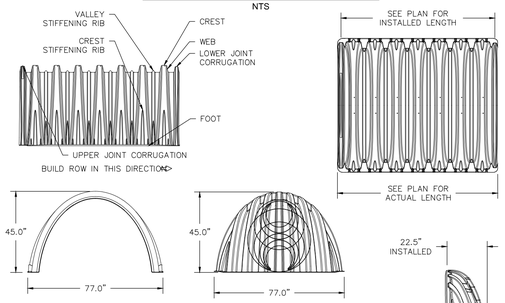
DETAILS - 2

Designed By:	Drawn By:	Checked By:
SA/JM	JPM	KK
Issue Date: 12/03/18	Project No: 25424-9100	Scale: AS SHOWN

Drawing No.:
C-602

MC-3500 TECHNICAL SPECIFICATION

NTS



NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	77.0" X 45.0" X XX.X"
CHAMBER STORAGE	109.9 CUBIC FEET
MINIMUM INSTALLED STORAGE*	178.9 CUBIC FEET
WEIGHT	135.0 lbs.

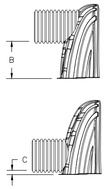
NOMINAL END CAP SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	77.0" X 45.0" X 22.5"
END CAP STORAGE	14.9 CUBIC FEET
MINIMUM INSTALLED STORAGE*	46.0 CUBIC FEET
WEIGHT	50.0 lbs.

*ASSUMES 12" STONE ABOVE, 9" STONE FOUNDATION AND BETWEEN CHAMBERS, 12" STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY

STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"

PART #	STUB	B	C
MC3500IEPP06T	6"	33.21"	---
MC3500IEPP06B		---	0.66"
MC3500IEPP08T	8"	31.16"	---
MC3500IEPP08B		---	0.81"
MC3500IEPP10T	10"	29.04"	---
MC3500IEPP10B		---	0.93"
MC3500IEPP12T	12"	26.36"	---
MC3500IEPP12B		---	1.35"
MC3500IEPP15T	15"	23.39"	---
MC3500IEPP15B		---	1.50"
MC3500IEPP18TC	18"	20.03"	---
MC3500IEPP18BC		---	1.77"
MC3500IEPP24TC	24"	14.48"	---
MC3500IEPP24BC		---	2.06"
MC3500IEPP30BC	30"	---	---



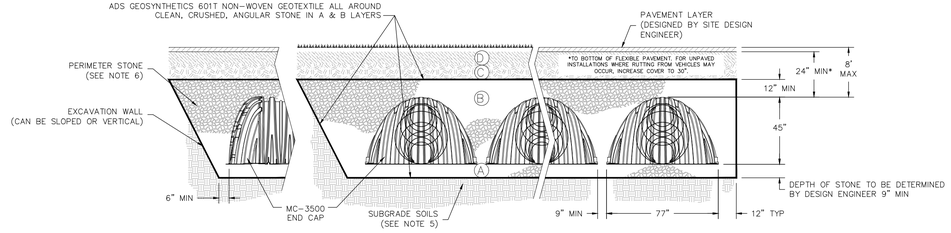
NOTE: ALL DIMENSIONS ARE NOMINAL

CUSTOM PRECORED INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" SIZE ON SIZE AND 15-48" ECCENTRIC MANIFOLDS.
CUSTOM INVERT LOCATIONS ON THE MC-3500 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10".
THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SIZE.

ACCEPTABLE FILL MATERIALS: STORMTECH MC-3500 CHAMBER SYSTEMS

	MATERIAL LOCATION	DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE (B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE, NOMINAL SIZE DISTRIBUTION BETWEEN 3/4-2 INCH (20-50 mm)	AASHTO M43[1] 3, 4	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE, NOMINAL SIZE DISTRIBUTION BETWEEN 3/4-2 INCH (20-50 mm)	AASHTO M43[1] 3, 4	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9"(MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.

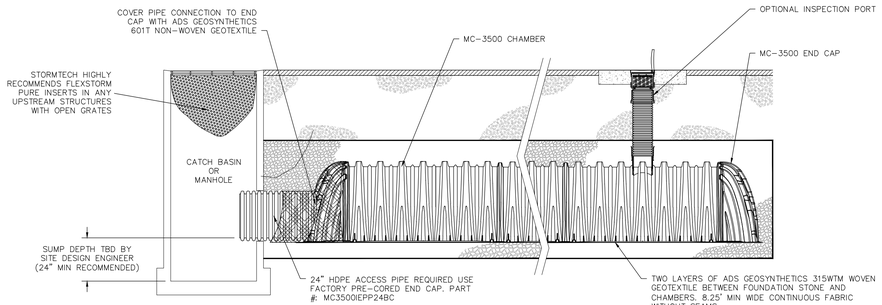


NOTES:

1. MC-3500 CHAMBERS SHALL CONFORM TO THE REQUIREMENTS OF ASTM F2418 "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
2. MC-3500 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. "ACCEPTABLE FILL MATERIALS" TABLE ABOVE PROVIDES MATERIAL LOCATIONS, DESCRIPTIONS, GRADATIONS, AND COMPACTION REQUIREMENTS FOR FOUNDATION, EMBEDMENT, AND FILL MATERIALS.
4. THE "SITE DESIGN ENGINEER" REFERS TO THE ENGINEER RESPONSIBLE FOR THE DESIGN AND LAYOUT OF THE STORMTECH CHAMBERS FOR THIS PROJECT.
5. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
6. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
7. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.

1 STORMTECH MC-3500 CHAMBER UNIT SYSTEMS

SCALE: NO SCALE



MC-3500 ISOLATOR ROW DETAIL
NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW FOR SEDIMENT

A. INSPECTION PORTS
- A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN.
- A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED.
- A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG.
- A.4. LOWER A CAMERA INTO ISOLATOR ROW FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
- A.5. IF SEDIMENT IS AT, OR ABOVE, 3" PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

B. ALL ISOLATOR ROWS:
- B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW
- B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW THROUGH OUTLET PIPE. MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY. FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE.
- B.3. IF SEDIMENT IS AT, OR ABOVE, 3" PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

STEP 2) CLEAN OUT ISOLATOR ROW USING THE JETVAC PROCESS.

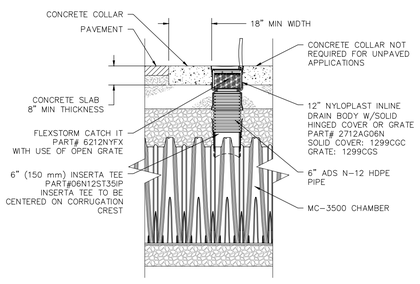
A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45° OR MORE IS PREFERRED.
B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN.
C. VACUUM STRUCTURE SUMP AS REQUIRED.

STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

2 STORMTECH MC-3500 CHAMBER ISOLATOR ROW

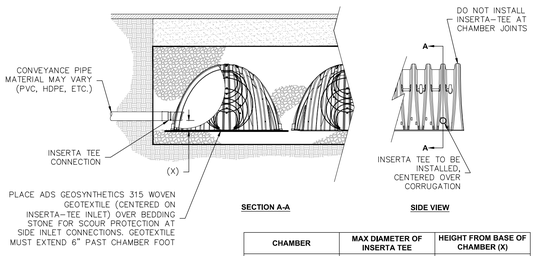
SCALE: NO SCALE



MC-3500 6" INSPECTION PORT DETAIL
NTS

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.
2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.



SECTION A-A

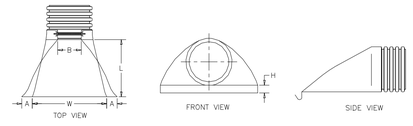
SIDE VIEW

CHAMBER	MAX DIAMETER OF INSERTA TEE	HEIGHT FROM BASE OF CHAMBER (X)
SC-310	6"	4"
SC-740	10"	4"
DC-780	10"	4"
MC-3500	12"	6"
MC-4500	12"	8"
INSERTA TEE FITTINGS AVAILABLE FOR SDR 26, SDR 35, SCH 40 IPS GASKETED & SOLVENT WELD, N-12, HP STORM, C-900 OR DUCTILE IRON		

NOTE:
PART NUMBERS WILL VARY BASED ON INLET PIPE MATERIALS. CONTACT STORMTECH FOR MORE INFORMATION.

3 STORMTECH INSERTA TEE DETAIL

SCALE: NO SCALE



PIPE DIAMETER, (inches)						
DIAMETER	12	15	18	24	30	36
A	6.5	6.5	7.5	7.5	7.5	7.5
B (max)	10.0	10.0	15.0	18.0	22.0	25.0
H	6.5	6.5	6.5	6.5	8.6	8.6
L	25.0	25.0	32.0	36.0	58.0	58.0
W	29.0	29.0	35.0	45.0	63.0	63.0

ADS FLARED END SECTION SPECIFICATION:

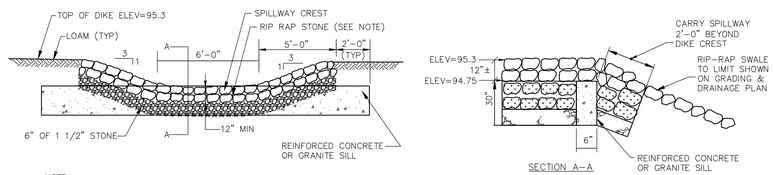
SCOPE
THIS SPECIFICATION DESCRIBES 12" THROUGH 36" ADS FLARED END SECTIONS FOR USE IN CULVERT AND DRAINAGE OUTLET APPLICATIONS.

REQUIREMENTS
THE INVERT OF THE PIPE AND THE END SECTION SHALL BE AT THE SAME ELEVATION. THE ADS FLARED END SECTION SHALL BE HIGH DENSITY POLYETHYLENE MEETING ASTM D3350 MINIMUM CELL CLASSIFICATION 213320C; CONTACT MANUFACTURER FOR ADDITIONAL CELL CLASSIFICATION INFORMATION. WHEN PROVIDED, THE METAL THREADED FASTENING ROD SHALL BE STAINLESS STEEL.

INSTALLATION
INSTALLATION SHALL BE IN ACCORDANCE WITH ADS INSTALLATION INSTRUCTIONS AND WITH THOSE ISSUED BY STATE OR LOCAL AUTHORITIES.

4 ADS HDPE FLARED END SECTION

SCALE: NO SCALE



NOTE:
75% OF RIP-RAP STONE SHALL BE 70 TO 100 LBS. AND SHALL BE HAND CHINKED TO LEAVE A SMOOTH SURFACE ALONG THE TOP OF THE DIKE AND A ROUGH SURFACE ALONG DOWNSTREAM SURFACE AND TOE OF THE DIKE. ALL SILL JOINTS TO BE MORTARED TO PREVENT SEEPAGE.

5 EMERGENCY SPILLWAY

SCALE: NO SCALE

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COMMONWEALTH OF MASSACHUSETTS
KELLY KILLEEN DAVIS
No. 39471
REGISTERED PROFESSIONAL ENGINEER
12.3.18

PLEASANT STREET &
LIBBEY IND. PARKWAY
WEYMOUTH, MA

No.	Submittal / Revision	App'd.	By	Date
A	ConCom Submittal	KK	JM	12/03/18

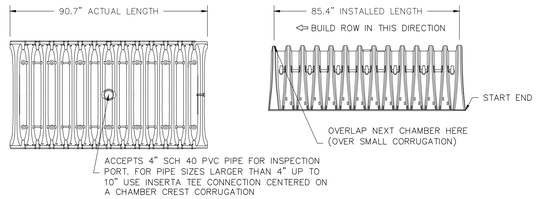
DETAILS - 3

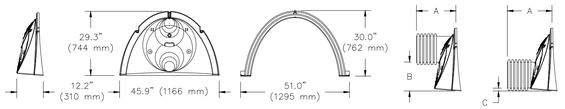
Designed By:	Drawn By:	Checked By:
SA/JM	JPM	KK
Issue Date:	Project No:	Scale:
12/03/18	25424-9100	AS SHOWN

Drawing No.:
C-603

SC-740 TECHNICAL SPECIFICATION

NTS





NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	51.0" X 30.0" X 85.4"
CHAMBER STORAGE	45.9 CUBIC FEET
MINIMUM INSTALLED STORAGE*	74.9 CUBIC FEET
WEIGHT	75.0 lbs.

*ASSUMES 6" STONE ABOVE, BELOW, AND BETWEEN CHAMBERS

STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"

PART #	STUB	A	B	C
SC740EPE06T / SC740EPE06TPC	6"	10.9"	18.5" (470 mm)	---
SC740EPE06B / SC740EPE06BPC			---	0.5"
SC740EPE08T /SC740EPE08TPC	8"	12.2"	16.5"	---
SC740EPE08B / SC740EPE08BPC			---	0.6"
SC740EPE10T / SC740EPE10TPC	10"	13.4"	14.5"	---
SC740EPE10B / SC740EPE10BPC			---	0.7"
SC740EPE12T / SC740EPE12TPC	12"	14.7"	12.5"	---
SC740EPE12B / SC740EPE12BPC			---	1.2"
SC740EPE15T / SC740EPE15TPC	15"	18.4"	9.0"	---
SC740EPE15B / SC740EPE15BPC			---	1.3"
SC740EPE18T / SC740EPE18TPC	18"	19.7"	5.0"	---
SC740EPE18B / SC740EPE18BPC			---	1.6"
SC740EPE24B*	24"	18.5"	---	0.1"

ALL STUBS, EXCEPT FOR THE SC740EPE24B ARE PLACED AT BOTTOM OF END CAP SUCH THAT THE OUTSIDE DIAMETER OF THE STUB IS FLUSH WITH THE BOTTOM OF THE END CAP. FOR ADDITIONAL INFORMATION CONTACT STORMTECH AT 1-888-892-2694.

* FOR THE SC740EPE24B THE 24" STUB LIES BELOW THE BOTTOM OF THE END CAP APPROXIMATELY 1.75". BACKFILL MATERIAL SHOULD BE REMOVED FROM BELOW THE N-12 STUB SO THAT THE FITTING SITS LEVEL.

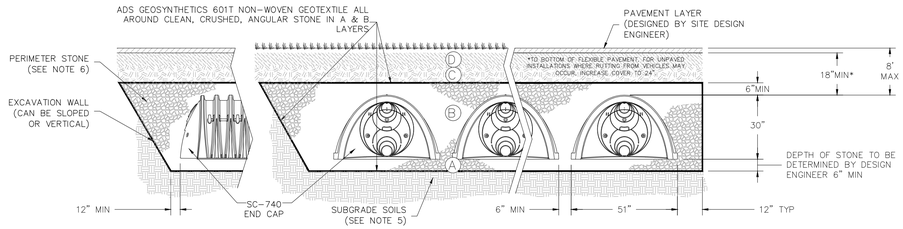
NOTES:

1. ALL DIMENSIONS ARE NOMINAL.
2. CONTRACTOR TO SUBMIT SHOP DRAWINGS FOR APPROVAL PRIOR TO CONSTRUCTION.

ACCEPTABLE FILL MATERIALS: STORMTECH SC-740 AND MC-3500 CHAMBER SYSTEMS

	MATERIAL LOCATION	DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 18" (450 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[3] A-1, A-2-4, A-3 OR AASHTO M43[3] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 12" (300 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 6" (150 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS. ROLLER GROSS VEHICLE WEIGHT NOT TO EXCEED 12,000 lbs (53 kN). DYNAMIC FORCE NOT TO EXCEED 20,000 lbs (89 kN).
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE TOP OF THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE, NOMINAL SIZE DISTRIBUTION BETWEEN 3/4-2 INCH (20-50 mm)	AASHTO M43[3] 3, 357, 4, 467, 5, 56, 57	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE, NOMINAL SIZE DISTRIBUTION BETWEEN 3/4-2 INCH (20-50 mm)	AASHTO M43[3] 3, 357, 4, 467, 5, 56, 57	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE. [2] [3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 6" (150 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.



NOTES:

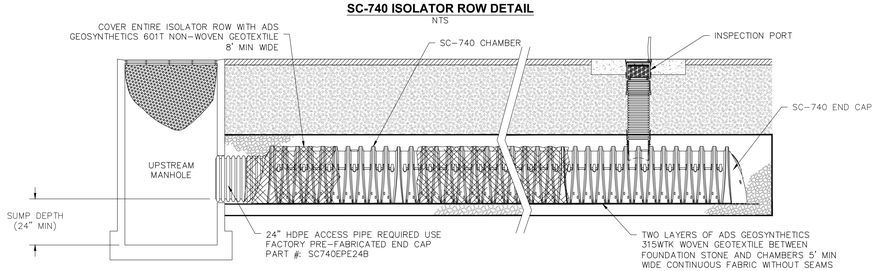
1. SC-740 CHAMBERS SHALL CONFORM TO THE REQUIREMENTS OF ASTM F2418 "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS", OR ASTM F2922 "STANDARD SPECIFICATION FOR POLYETHYLENE (PE) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
2. SC-740 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. "ACCEPTABLE FILL MATERIALS" TABLE ABOVE PROVIDES MATERIAL LOCATIONS, DESCRIPTIONS, GRADATIONS, AND COMPACTION REQUIREMENTS FOR FOUNDATION, EMBEDMENT, AND FILL MATERIALS.
4. THE "SITE DESIGN ENGINEER" REFERS TO THE ENGINEER RESPONSIBLE FOR THE DESIGN AND LAYOUT OF THE STORMTECH CHAMBERS FOR THIS PROJECT.
5. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
6. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
7. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.
8. STORMTECH SC-740 UNITS TO BE H20 RATED FOR VEHICLE LOADS.

1 STORMTECH SC-740 CHAMBER UNIT SYSTEMS

SCALE: NO SCALE

SC-740 ISOLATOR ROW DETAIL

NTS



SC-740 ISOLATOR ROW DETAIL

NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW FOR SEDIMENT

A. INSPECTION PORTS
- A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN.
- A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED.
- A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG.
- A.4. LOWER A CAMERA INTO ISOLATOR ROW FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
- A.5. IF SEDIMENT IS AT, OR ABOVE, 3" PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

B. ALL ISOLATOR ROWS:
- B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW
- B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW THROUGH OUTLET PIPE. MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY. FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE.
- B.3. IF SEDIMENT IS AT, OR ABOVE, 3" PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

STEP 2) CLEAN OUT ISOLATOR ROW USING THE JETVAC PROCESS.

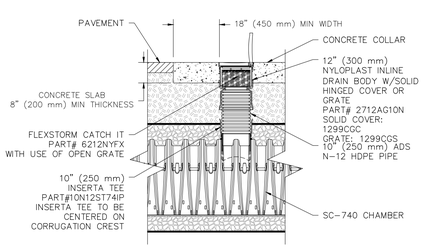
A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" OR MORE IS PREFERRED.
B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN.
C. VACUUM STRUCTURE SUMP AS REQUIRED.

STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

2 STORMTECH SC-740 CHAMBER ISOLATOR ROW

SCALE: NO SCALE

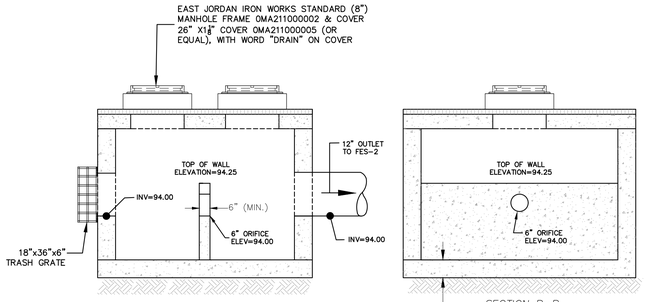


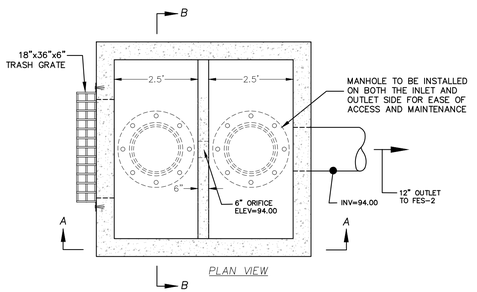
SC-740 INSPECTION PORT DETAIL

NTS

NOTES

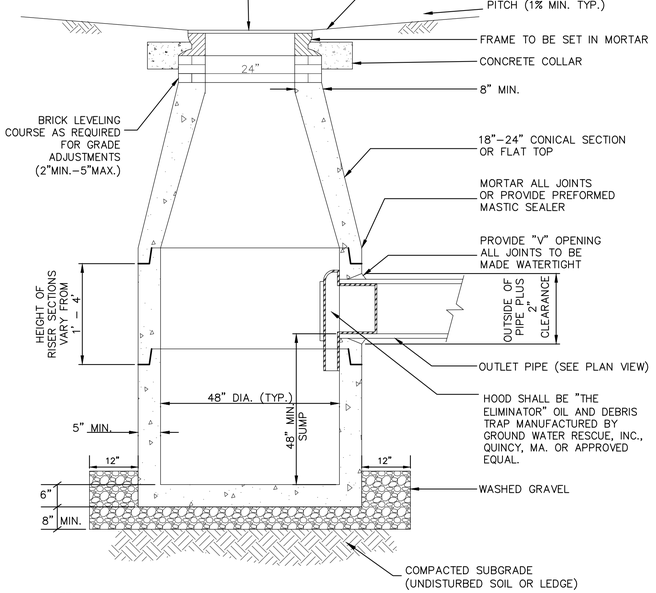
1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.
2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.





3 OUTLET CONTROL STRUCTURE (OCS-1)

SCALE: NO SCALE



NOTE:
1. CONTRACTOR TO CONFIRM ALL SIZES IN SHOP DRAWING PHASE.
2. CONTRACTOR SHALL PROVIDE SIGNED & SEALED BUOYANCY CALCULATIONS FOR ALL PRECAST STRUCTURES WITH SHOP DRAWINGS SUBMITTED TO CHA. CALCULATIONS SHALL ASSUME SEASONAL HIGH GROUNDWATER ELEVATION FOR FOR GROUNDWATER DEPTH AT EACH STRUCTURE WITH A 1.5 FACTOR OF SAFETY APPLIED TO THE UPLIFT.

4 PRECAST CONCRETE SINGLE GRATE CATCH BASIN

SCALE: NO SCALE

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COMMONWEALTH OF MASSACHUSETTS
KELLY KILLEEN BRUSH
No. 39041
REGISTERED PROFESSIONAL ENGINEER
12.3.18

PLEASANT STREET &
LIBBEY IND. PARKWAY
WEYMOUTH, MA

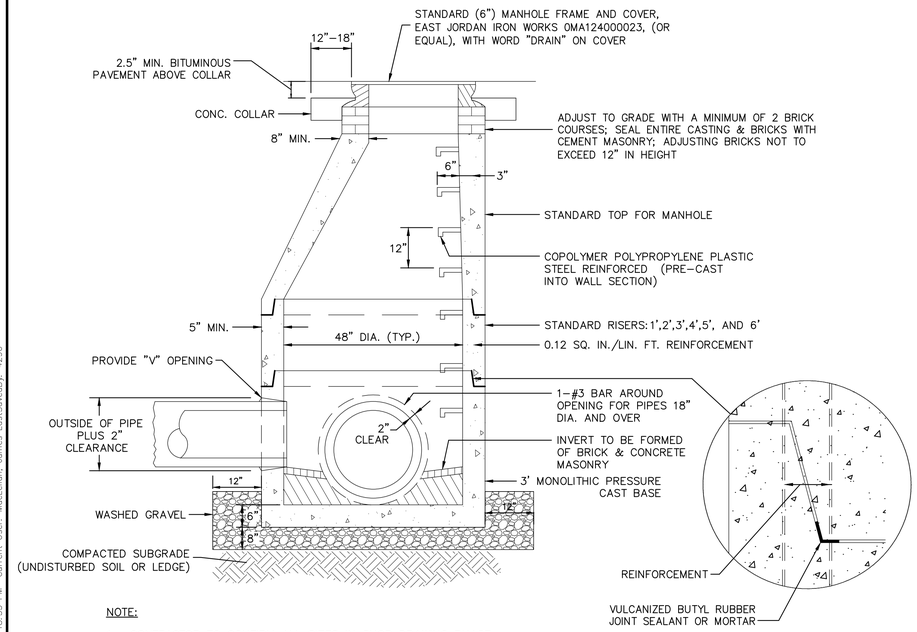
No.	Submittal / Revision	App'd.	By	Date
A	ConCom Submittal	KK	JM	12/03/18

DETAILS - 4

Designed By:	Drawn By:	Checked By:
SA/JM	JPM	KK
Issue Date: 12/03/18	Project No: 25424-9100	Scale: AS SHOWN

Drawing No.:

C-604

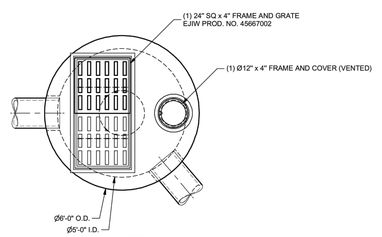


NOTE:

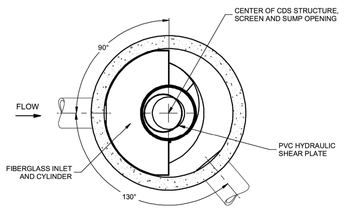
1. CONTRACTOR TO CONFIRM ALL SIZES IN SHOP DRAWING PHASE.
2. CONTRACTOR SHALL PROVIDE SIGNED & SEALED BUOYANCY CALCULATIONS FOR ALL PRECAST STRUCTURES WITH SHOP DRAWINGS SUBMITTED TO CHA. CALCULATIONS SHALL ASSUME THE HIGHER OF FEMA FLOODPLAIN ELEVATION OR SEASONAL HIGH GROUNDWATER ELEVATION FOR FOR GROUNDWATER DEPTH AT EACH STRUCTURE.

1 STANDARD PRECAST DRAIN MANHOLE

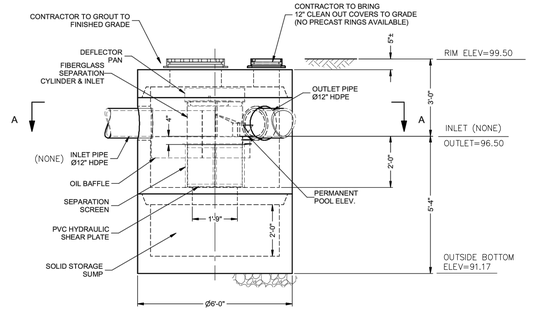
SCALE: NO SCALE



PLAN VIEW



SECTION A-A



ELEVATION VIEW

MATERIAL LIST - PROVIDED BY CONTECH

COUNT	DESCRIPTION	INSTALLED BY
1	FIBERGLASS INLET AND CYLINDER	CONTECH
N/A	CYLINDER EXTENSION	CONTRACTOR
N/A	STABILIZATION COLLAR	CONTRACTOR
1	HYDRAULIC SHEAR PLATE	CONTECH
1	2400 micron SEP. SCREEN	CONTECH
1	DEFLECTOR PAN	CONTRACTOR
N/A	SEDIMENT WEIR	CONTECH
1	SEALANT FOR JOINTS	CONTRACTOR
	GRADE RINGS/RISERS	CONTRACTOR
1	Ø12" x 4" FRAME AND COVER (VENTED)	CONTRACTOR
1	24" SQ x 4" FRAME AND GRATE	CONTRACTOR

SITE DESIGN DATA

WATER QUALITY FLOW RATE	0.7 CFS
PEAK FLOW RATE	3.7 CFS
RETURN PERIOD OF PEAK FLOW	10 YRS

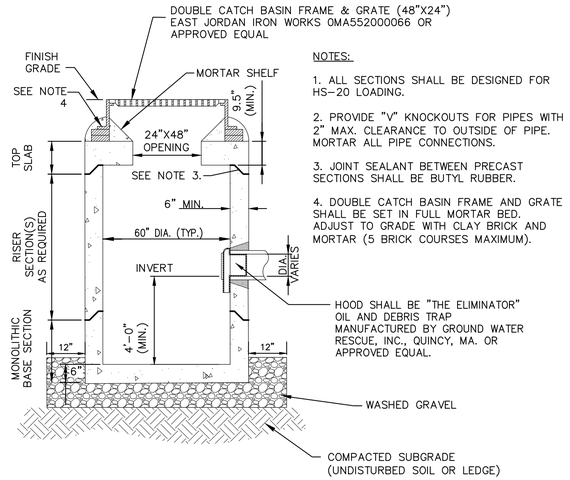
GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH REPRESENTATIVE. www.contech-cpi.com
3. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF PROJECT.
4. STRUCTURE SHALL MEET AASHTO HS20 LOAD RATING. CASTINGS SHALL MEET AASHTO M306, CAST WITH THE CONTECH STORMWATER SOLUTIONS LOGO.
5. IF REQUIRED, PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.

INSTALLATION NOTES
1. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
2. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE.
3. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLE STRUCTURE.
4. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
5. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

STRUCTURE WEIGHT
APPROXIMATE HEAVIEST PICK = 7500 LBS.
STRUCTURE IS DELIVERED IN 3 PIECES

3 CDS2015–5–C WATER QUALITY UNIT WITH DOUBLE GRATE DETAIL

SCALE: NO SCALE



NOTES:

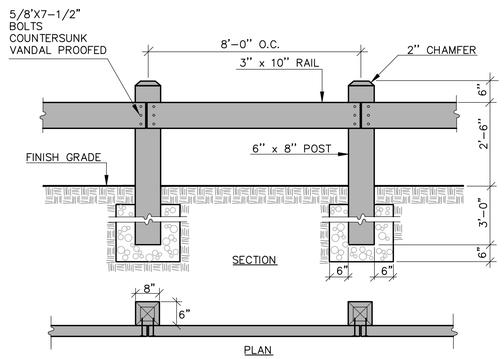
1. ALL SECTIONS SHALL BE DESIGNED FOR HS–20 LOADING.
2. PROVIDE "V" KNOCKOUTS FOR PIPES WITH 2" MAX. CLEARANCE TO OUTSIDE OF PIPE. MORTAR ALL PIPE CONNECTIONS.
3. JOINT SEALANT BETWEEN PRECAST SECTIONS SHALL BE BUTYL RUBBER.
4. DOUBLE CATCH BASIN FRAME AND GRATE SHALL BE SET IN FULL MORTAR BED. ADJUST TO GRADE WITH CLAY BRICK AND MORTAR (5 BRICK COURSES MAXIMUM).

NOTE:

1. CONTRACTOR TO CONFIRM ALL SIZES IN SHOP DRAWING PHASE.
2. CONTRACTOR SHALL PROVIDE SIGNED & SEALED BUOYANCY CALCULATIONS FOR ALL PRECAST STRUCTURES WITH SHOP DRAWINGS SUBMITTED TO CHA. CALCULATIONS SHALL ASSUME SEASONAL HIGH GROUNDWATER ELEVATION FOR FOR GROUNDWATER DEPTH AT EACH STRUCTURE WITH A 1.5 FACTOR OF SAFETY APPLIED TO THE UPLIFT.

2 PRECAST DOUBLE GRATE CATCH BASIN

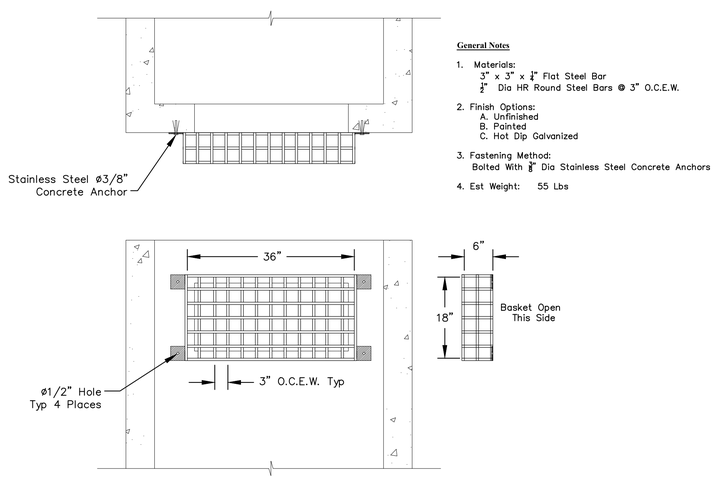
SCALE: NO SCALE



NOTES:
1. ALL WOOD TO BE PRESSURE TREATED, SELECT PINE GRADE 'B' OR BETTER.
2. ALL HARDWARE TO BE GALVANIZED.
3. SET POSTS 3' – 6" DEEP IN WELL–TAMPED GRAVEL BACKFILL.
4. CONTRACTOR MAY OPT TO DRIVE POSTS.

4 DECORATIVE WOOD GUARDRAIL

SCALE: NO SCALE



General Notes

1. Materials:
   3" x 3" x ¼" Flat Steel Bar
   ½" Dia HR Round Steel Bars @ 3" O.C.E.W.
2. Finish Options:
   A. Unfinished
   B. Painted
   C. Hot Dip Galvanized
3. Fastening Method:
   Bolted With ⅜" Dia Stainless Steel Concrete Anchors
4. Est Weight: 55 Lbs

5 18"x36"x6" FLAT WALL TRASH RACK DETAIL

SCALE: NO SCALE

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COMMONWEALTH OF MASSACHUSETTS
KELLY, KILLEEN, CIVIL, No. 53041, REGISTERED PROFESSIONAL ENGINEER
12.3.18

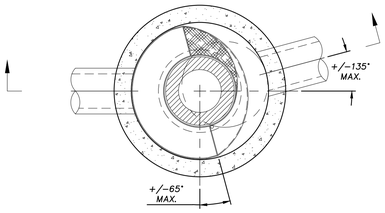
PLEASANT STREET & LIBBEY IND. PARKWAY
WEYMOUTH, MA

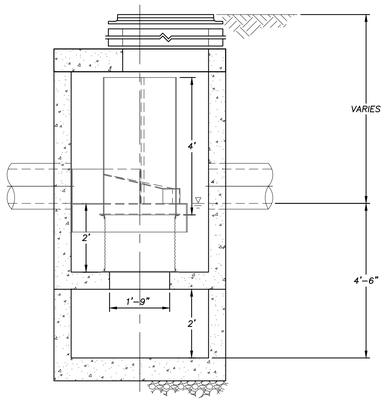
No.	Submittal / Revision	App'd	By	Date
A	ConCom Submittal	KK	JM	12/03/18

DETAILS - 5

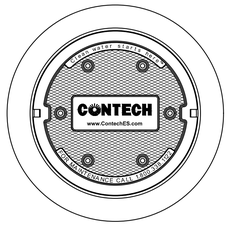
Designed By:	Drawn By:	Checked By:
SA/JM	JPM	KK
Issue Date: 12/03/18	Project No: 25424-9100	Scale: AS SHOWN

Drawing No.:
C-605





CDS2015-4-C DESIGN NOTES
CDS2015-4-C RATED TREATMENT CAPACITY IS 0.7 CFS [19.8 L/s], OR PER LOCAL REGULATIONS. MAXIMUM HYDRAULIC INTERNAL BYPASS CAPACITY IS 10.0 CFS [283 L/s]. IF THE SITE CONDITIONS EXCEED 10.0 [283 L/s] CFS, AN UPSTREAM BYPASS STRUCTURE IS REQUIRED. THE STANDARD CDS2015-4-C CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.
CONFIGURATION DESCRIPTION
GRATED INLET ONLY (NO INLET PIPE)
GRATED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES
SEPARATE OIL BAFFLE (SINGLE INLET PIPE REQUIRED FOR THIS CONFIGURATION)
SEDIMENT WEIR FOR NJDEP / NJCAT CONFORMING UNITS



GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
3. STRUCTURE SHALL MEET AASHTO HS20 AND CASTINGS SHALL MEET HS20 (AASHTO M 306) LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION.
4. PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS SHALL MEET SECTION 5 OFTHE WEYMOUTH SUBDIVISION RULES AND REGULATIONS.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

CONTECH ENGINEERED SOLUTIONS LLC

1 CDS2015-4-C WATER QUALITY UNIT DETAIL
SCALE: NO SCALE

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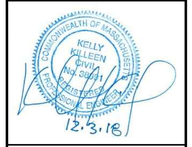

PLEASANT STREET &
LIBBEY IND. PARKWAY
WEYMOUTH, MA

No.	Submittal / Revision	App'd.	By	Date
A	ConCom Submittal	KK	JM	12/03/18

DETAILS - 6

Designed By:	Drawn By:	Checked By:
SA/JM	JPM	KK
Issue Date:	Project No:	Scale:
12/03/18	25424-9100	AS SHOWN

Drawing No.:
C-606

GENERAL NOTES:

1. THE LIMITS OF THIS PROJECT ARE SHOWN ON THE TOWN OF WEYMOUTH ASSESSOR'S MAPS 38 AND 39 THEREON.

2. PROPERTY LINE CONFIGURATION AS SHOWN HEREON WAS COMPILED FROM RECORD PLANS AND ASSESSORS INFORMATION, AND SUPPLEMENTED BY ON-THE-GROUND FIELD SURVEY BY THIS FIRM. BEING THAT A PROPERTY LINE RETRACEMENT OR VERIFICATION SURVEY HAS NOT BEEN PERFORMED BY DASILVA SURVEY SERVICES, THIS FIRM BEARS NO RESPONSIBILITY FOR THE DEPICTION THEREOF.

3. EXISTING CONDITIONS DETAIL AS SHOWN HEREON WAS DERIVED FROM ACTUAL FIELD LOCATION DURING JUNE & JULY OF 2016 AND NOVEMBER OF 2018 BY THIS FIRM.

4. PRIOR TO CONSTRUCTION OR ANY RELIANCE HEREON, THE LOCATION OF REMAINING EXISTING DETAIL WITH RESPECT TO THE DATA SHOWN HEREON MUST BE VERIFIED BY A COMPREHENSIVE REVIEW BY THIS FIRM.

5. LOCATION AND DEPTH OF UNDERGROUND UTILITIES IS APPROXIMATE ONLY, AND IS NOT WARRANTED TO BE CORRECT. UNDERGROUND UTILITIES ARE SHOWN BASED ON A VISUAL INSPECTION OF SURFACE OBSERVABLE FEATURES ONLY, AND HAVE BEEN FIELD INSPECTED FOR CONNECTIONS WHERE POSSIBLE. ADDITIONAL UTILITIES MAY EXIST WHICH ARE NOT INDICATED ON THESE PLANS. ALL EXISTING UTILITIES SHALL BE VERIFIED FOR SERVICE, SIZE, INVERT ELEVATION, LOCATIONS, ETC. PRIOR TO NEW CONNECTIONS TO OR RELOCATION OF SAME. CONTRACTOR MUST NOTIFY DIG-SAFE AT 1-888-344-7233 AT LEAST 72 HOURS PRIOR TO ANY CONSTRUCTION. NOTIFY THIS FIRM IN WRITING OF ANY AND ALL DISCREPANCIES PRIOR TO COMMENCING ANY WORK.

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SYMBOL & LINE LEGEND

▦	CATCH BASIN	RP	RISER POLE
Ⓓ	DRAIN MANHOLE	UP	UTILITY POLE
Ⓔ	ELECTRIC MANHOLE	VGC	VERTICAL CONCRETE CURB
Ⓢ	SEWER MANHOLE	VCC	VERTICAL CONCRETE CURB
Ⓣ	TELEPHONE MANHOLE	BCC	BITUMINOUS CONCRETE CURB
⊸	SIGN	DYCL	DOUBLE YELLOW CENTERLINE
⊸	UTILITY POLE	SWLL	SOLID WHITE LANE LINE
Ⓦ	PRESSURE RELIEF VALVE	SWEL	SOLID WHITE EDGE LINE
☼	LIGHT POLE	□ SCV	SPRINKLER CONTROL VALVE
▦	DOUBLE CATCH BASIN	RCP	REINFORCED CONCRETE PIPE
⋈	HYDRANT	INV	PIPE INVERT
GG	GAS GATE	FES	FLARED END SECTION
WG	WATER GATE	—SD—	DRAIN LINE
⊸	GUY WIRE	—UGE—	UNDERGROUND ELECTRIC LINE
✱	CONIFEROUS TREE	—SS—	SEWER MANHOLE
✱	DECIDUOUS TREE	—W—	WATER LINE
□ MBOX	MAIL BOX	—109—	CONTOUR LINE
x109.2	SPOT ELEVATION	—GAS—	GAS LINE
• wf-b10	WETLAND FLAG	—OHE—	OVERHEAD ELECTRIC LINE

GRAPHIC SCALE

30 0 15 30 60 120

(IN FEET)
1 inch = 30 ft.

NO	DATE	REVISIONS	MADE BY	CHECKED BY

PROJECT TITLE:
PLEASANT STREET @ LIBBEY INDUSTRIAL PARKWAY
WEYMOUTH, MASSACHUSETTS

PROJECT NO. | FILE NO.

SCALE: 1"=30'

APPROVED BY: PGH

CHECKED BY: LGD/PGH

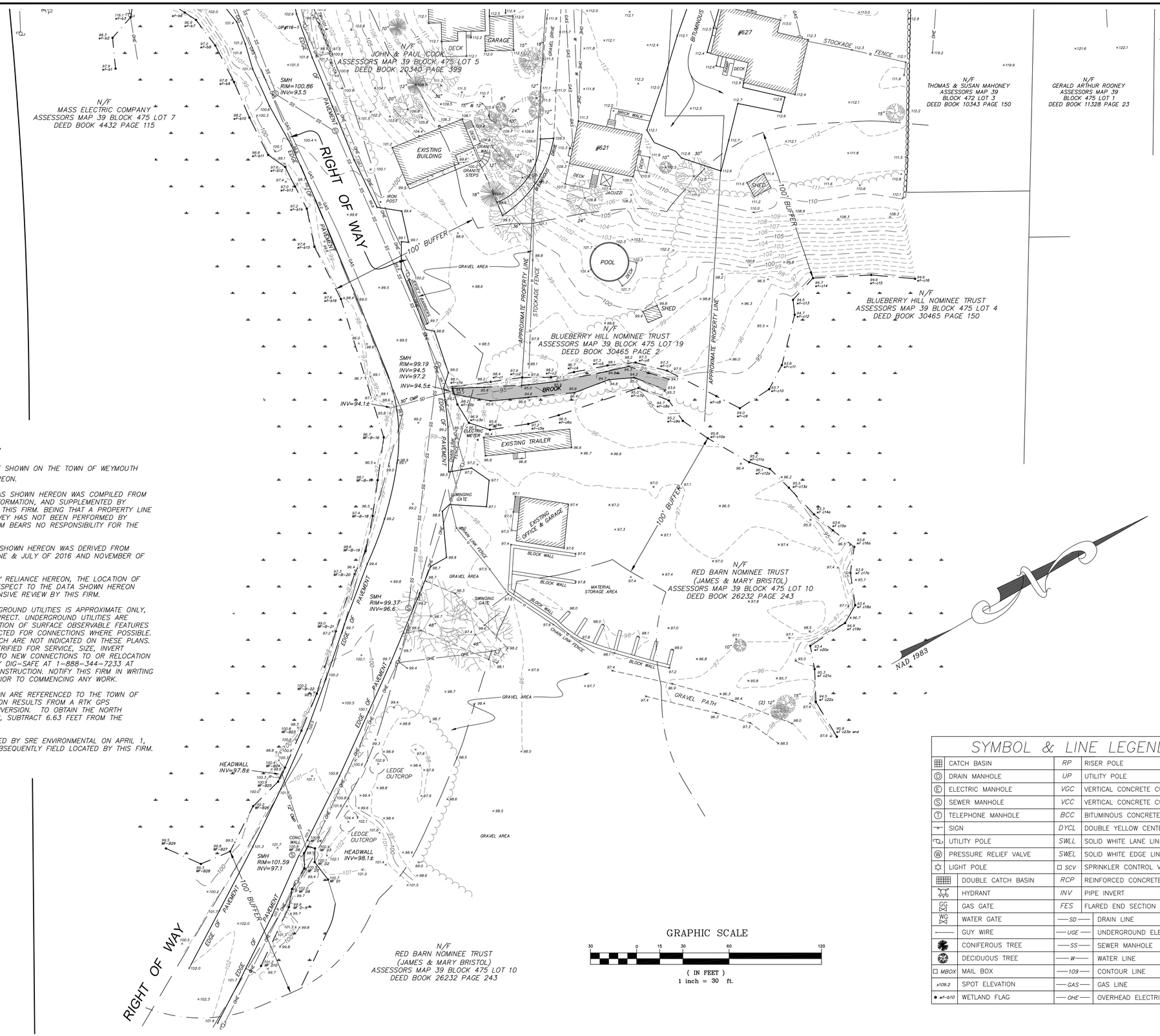
DRAWN BY: LGD

DATE: 11-09-2018

SHEET TITLE:
EXISTING CONDITIONS PLAN

HOYT LAND SURVEYING
1287 WASHINGTON STREET
WEYMOUTH, MA 02189
TEL.: 781-682-9192

1



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SYMBOL & LINE LEGEND

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D	DRAIN MANHOLE	UP	UTILITY POLE
E	ELECTRIC MANHOLE	VGC	VERTICAL CONCRETE CURB
S	SEWER MANHOLE	VCC	VERTICAL CONCRETE CURB
T	TELEPHONE MANHOLE	BCC	BITUMINOUS CONCRETE CURB
	SIGN	DYCL	DOUBLE YELLOW CENTERLINE
	UTILITY POLE	SWLL	SOLID WHITE LANE LINE
W	PRESSURE RELIEF VALVE	SWEL	SOLID WHITE EDGE LINE
	LIGHT POLE	SCV	SPRINKLER CONTROL VALVE
	DOUBLE CATCH BASIN	RCP	REINFORCED CONCRETE PIPE
	HYDRANT	INV	PIPE INVERT
GG	GAS GATE	FES	FLARED END SECTION
WG	WATER GATE	SD	DRAIN LINE
	GUY WIRE	UGE	UNDERGROUND ELECTRIC LINE
	CONIFEROUS TREE	SS	SEWER MANHOLE
	DECIDUOUS TREE	W	WATER LINE
MBOX	MAIL BOX	109	CONTOUR LINE
x109.2	SPOT ELEVATION	GAS	GAS LINE
wf-b10	WETLAND FLAG	OHE	OVERHEAD ELECTRIC LINE

NO	DATE	REVISIONS	MADE BY	CHECKED BY

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PLEASANT STREET @ LIBBEY
INDUSTRIAL PARKWAY
WEYMOUTH, MASSACHUSETTS

PROJECT NO. | FILE NO.

SHEET TITLE:
EXISTING CONDITIONS PLAN

DATE	DRAWN BY	CHECKED BY	APPROVED BY	SCALE
11-09-2018	LGD	LGD/PGH	PGH	1"=30'

HOYT LAND SURVEYING
1287 WASHINGTON STREET
WEYMOUTH, MA 02189
TEL.: 781-682-9192

2

SYMBOL & LINE LEGEND

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NAD 1983

N/F
GIDEON LLC
ASSESSORS MAP 38 BLOCK 472 LOT 2
DEED BOOK 15283 PAGE 341

N/F
LIBBEY INDUSTRIAL PARK CONDOMINIUM
ASSESSORS MAP 39 BLOCK 445 LOT 10
DEED BOOK 7387 PAGE 41

N/F
KENNETH J. MALLOY
ASSESSORS MAP 39 BLOCK 472 LOT 6
DEED BOOK 28922 PAGE 343

N/F
HELIO A. DESOUZA
ASSESSORS MAP 39
BLOCK 472 LOT 5
DEED BOOK 22842 PAGE 409

N/F
622 PLEASANT ST NOMINEE TRUST
ASSESSORS MAP 39
BLOCK 472 LOT 4
DEED BOOK 33133 PAGE 39

N/F
HARVARD VANGUARD MEDICAL ASSOC. INC.
ASSESSORS MAP 39 BLOCK 445 LOT 1
LAND COURT CERTIFICATE #182922

"OLD CEMETERY"
ESSORS MAP 39 BLOCK 472 LOT 5

N/F
JOHN & PAUL COOK
ASSESSORS MAP 39 BLOCK 475 LOT 5
DEED BOOK 20340 PAGE 399

N/F
THOMAS & SUSAN MAHONEY
ASSESSORS MAP 39
BLOCK 472 LOT 3
DEED BOOK 10343 PAGE 150

N/F
GERALD ARTHUR ROONEY
ASSESSORS MAP 39
BLOCK 475 LOT 1
DEED BOOK 11328 PAGE 23

N/F
DANIEL ALLEN & STEPHEN HENDERSON
ASSESSORS MAP 39 BLOCK 448 LOT 23
DEED BOOK 33636 PAGE 41

LIBBEY INDUSTRIAL PARKWAY (50' WIDE)

PLEASANT STREET (60' WIDE)

100' BUFFER

GRAPHIC SCALE
30 0 15 30 60 120
(IN FEET)
1 inch = 30 ft.

NO	DATE	REVISIONS	MADE BY	CHKED BY

PROJECT TITLE:
PLEASANT STREET @ LIBBEY
INDUSTRIAL PARKWAY
WEYMOUTH, MASSACHUSETTS

SCALE 1"=30' | PROJECT NO. | FILE NO.

SHEET TITLE:
EXISTING CONDITIONS PLAN

DATE 11-09-2018 | DRAWN BY LGD | CHECKED BY LGD/PGH | APPROVED BY PGH

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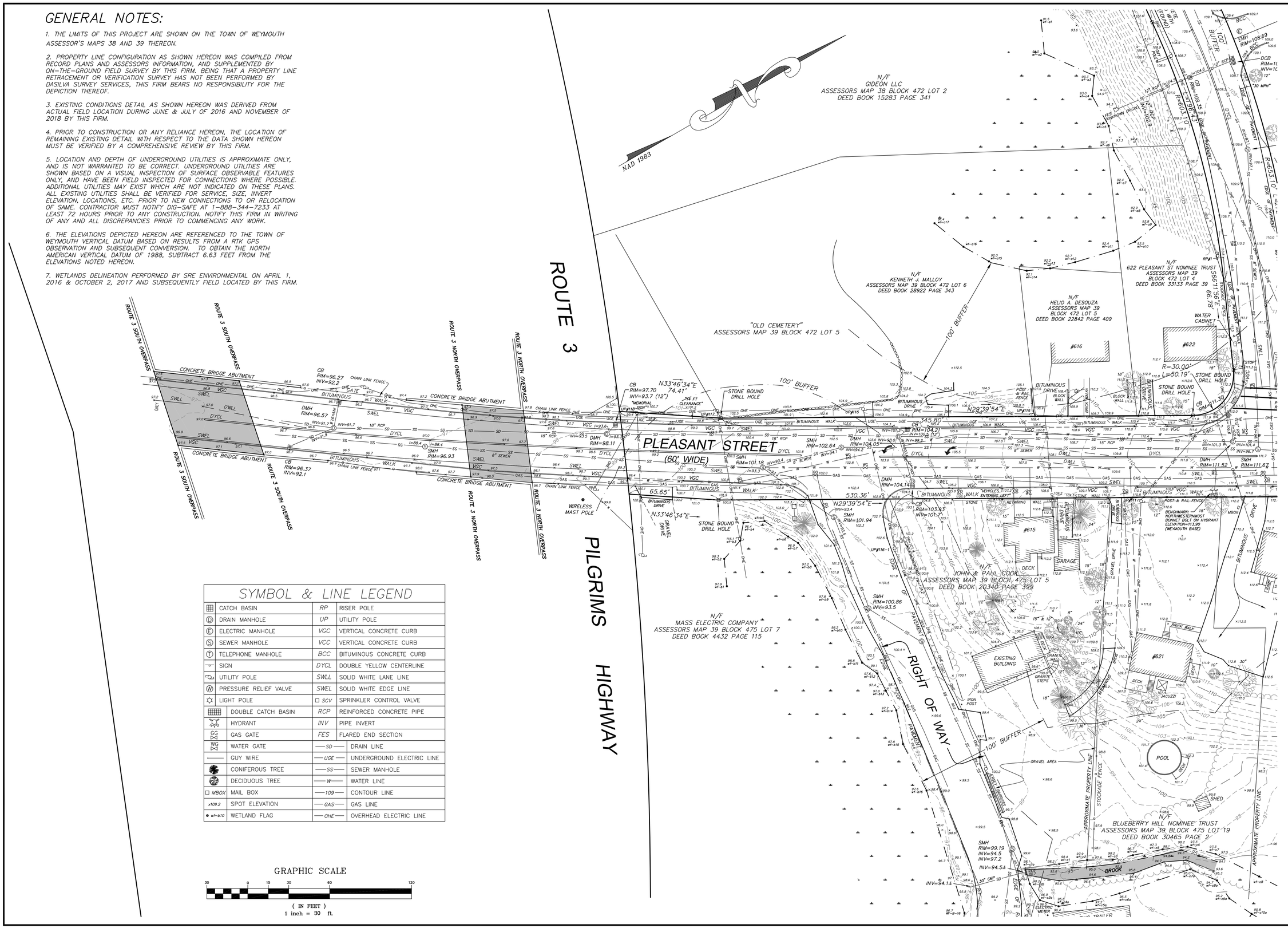

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Ⓔ	ELECTRIC MANHOLE	VGC	VERTICAL CONCRETE CURB
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GRAPHIC SCALE

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(IN FEET)
1 inch = 30 ft.

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PLEASANT STREET @ LIBBEY INDUSTRIAL PARKWAY
WEYMOUTH, MASSACHUSETTS

FILE NO.

PROJECT NO.

SCALE 1"=30'

APPROVED BY PGH

CHECKED BY LGD/PGH

DRAWN BY LGD

DATE 11-09-2018

SHEET TITLE:
EXISTING CONDITIONS PLAN

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1287 WASHINGTON STREET
WEYMOUTH, MA 02189
TEL.: 781-682-9192

4

Supplemental Stormwater Report

Intersection Improvements at Pleasant Street & Libbey Industrial Parkway Weymouth, Massachusetts

CHA Project Number: 25424

Submitted To:
Town of Weymouth Conservation Commission
75 Middle Street
Weymouth, MA 02189

Applicant:
JF Price Co.
611 Pleasant Street
Weymouth, MA 02189

Prepared by:

141 Longwater Drive
Norwell, Massachusetts 02061
Phone: (781) 982-5400
Fax: (781) 982-5490

December 2018

TABLE OF CONTENTS

LIST OF ACRONYMS & ABBREVIATIONS

BFE	Base Flood Elevation
BLSP	Bordering Land Subject to Flooding
BMP	Best Management Practice
BVW	Bordering Vegetated Wetland
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
HSG	Hydrologic Soil Group
IWPA	Interim Wellhead Protection Area
MAHW	Mean Annual High-Water
MassDEP	Massachusetts Department of Environmental Protection
NAVD	North American Vertical Datum
NRCS	Natural Resources Conservation Service
ORW	Outstanding Resource Water
SHGW	Seasonal High Groundwater
SWMSH	Stormwater Management Standards Handbook
Tc	Time of Concentration
TSS	Total Suspended Solids
USGS	United States Geological Survey

1.0 NARRATIVE

1.1 EXECUTIVE SUMMARY

On behalf of JF Price Co., (Applicant), CHA has prepared this Stormwater Report for the proposed 4-way signalized intersection located at Pleasant Street and Libbey Industrial Parkway in Weymouth, MA. The features of this project include geometric modifications to Pleasant Street to widen the roadway to accommodate left and right turn lanes. A new roadway has been designed across from Libbey Industrial Parkway and continues its profile downhill until connecting with Quarry Road. The new roadway will create a fork with Quarry Road which continues east to provide access to several businesses. An existing culvert located at this intersection will be replaced with a new pipe of the same size. The culvert will be lengthened to span the intersection and ultimately discharge on the northerly side of the new roadway.

The intersection of Quarry Road with Pleasant Street is located south of the proposed 4-way intersection and will be reconfigured to limit traffic to right-in, right-out only turning movements. Approximately 660 linear feet of Quarry Road is proposed to be rehabilitated with new pavement and 1-foot wide asphalt berm on both sides to channel stormwater runoff. The proposed future roadway will also feature the same berms on both sides.

Existing sidewalk along Pleasant street will also be removed and replaced during the road widening. The total land disturbance is approximately 3.43 acres in size (See Figure 1 – Vicinity Map in McMahon Stormwater Report). Within the limit of work, two of the three existing residences will remain. The project site is bordered on the north and south by Bordering Vegetated Wetlands.

A portion of the site is located within Bordering Land Subject to Flooding (BLSF) as mapped by FEMA (See Figure 2 – FEMA Flood Zones in McMahon Stormwater Report)., although the base flood elevation has not been established. The site is not located within a Zone II as designated by MA DEP or within a habitat area designated by the Natural Heritage and Endangered Species Program (NHESP). The site is not located within a Zone I of Zone II of public water supply. Outstanding Resource Waters associated Old Swamp River with have been established by MassGIS data layers and shown west of Pleasant Street. (See Figure 3- Outstanding Resource Waters in McMahon Stormwater Report).

The purpose of this stormwater analysis and report is to assess and compare existing and proposed hydrologic conditions at the property to demonstrate that the stormwater management system design effectively satisfies the requirements of the Massachusetts Stormwater Regulations and the Weymouth Stormwater Protection Ordinance. This analysis includes a study of the overall watershed tributary to the southern wetland resource area and the existing 30’ culvert to estimate the water surface elevation at the upstream end of the culvert during the 100-year storm event.

Since there is no existing drainage infrastructure on Quarry Road, stormwater runoff from the pavement sheet flows overland towards the southern wetland resource area and upstream of the 30’ culvert. The grading around the residences in the center portion of the project site directs

stormwater runoff overland east-northeast towards an existing stream channel and northern wetland resource area. Pleasant Street does have existing catch basins collecting surface runoff and piping it offsite to the west. Gutter swales along Libby Industrial Parkway control stormwater from adjacent parcels.

The proposed project will create a net new impervious area of 14,070 square feet (0.323 acres). To offset impacts from the increase in impervious area the site design provides stormwater runoff treatment using Best Management Practices (BMPs) including deep-sump hooded catch basins, isolator rows, hydrodynamic separator structures, subsurface infiltration chamber systems, and a constructed stormwater wetland. These BMPs are further described in this report and as shown on the attached site development plans. The proposed stormwater management system will reduce the peak stormwater discharge rates and volume by appropriately sized stormwater storage volumes to detention and infiltrate stormwater runoff as documented in the included HydroCAD model.

Culvert replacement is also part of the proposed project. A new 30' culvert is proposed to replace the existing to span Quarry Road and new roadway. The realignment of Quarry Road allows for significant new flood storage to be provided upstream of the culvert. Proposed earth removal in this area will provide the additional flood storage and wetland resource area replication. Similarly, new flood storage and wetland resource area replacement are proposed northerly of the new roadway.

The proposed stormwater management system design complies with all applicable sections of Weymouth Wetlands Protection Ordinance and the 2008 Massachusetts Stormwater Regulations by utilizing multiple BMP's including the subsurface detention/infiltration systems to collect, treat, and control stormwater runoff generated on the site during storm events. The proposed improvements are shown on the attached site development plans prepared by CHA, 141 Longwater Park Drive, Norwell, Massachusetts.

1.2 OBJECTIVE OF CALCULATIONS

The purpose of this stormwater analysis is to assess and quantify the existing and proposed stormwater runoff conditions from the site based upon standard methodologies in accordance with the 2008 Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Standards and the applicable provisions of the Town of Weymouth Wetlands Protection Ordinance.

The goals of the stormwater management system design for this project are to provide reduction in post-development peak runoff rates and volumes as compared to pre-development peak runoff rates and volumes, improve water quality, and to protect the surrounding area from any potential flooding impacts in accordance with the Stormwater Management Regulations. The following analysis includes stormwater routing calculations performed using the 2-year, 10-year, 25-year, and 100-year frequency, Type III, 24-hour SCS design storms.

1.3 METHODOLOGY

The HydroCAD Stormwater Modeling computer program, version 10.00, by Applied Microcomputer Systems, Inc. is used to develop peak stormwater runoff rates and volumes for the existing and proposed conditions at the project site. The HydroCAD software is a hydrograph generation and routing program like TR-20. The software uses Soil Conservation Service (SCS) Unit Hydrograph Methodology. Information regarding the equations and calculation procedures utilized in HydroCAD will be made available upon request.

The following basic steps are employed in the routing procedure:

1. A rainfall distribution is selected which indicates how the storm rainfall depth will be distributed over time. This is the standardized Type III SCS distribution based upon the project's location.
2. The design storm rainfall amount is determined from rainfall frequency atlas based upon the return period being modeled. Combined with the distribution of rainfall, a cumulative rainfall depth at each period during the storm is determined.
3. Based upon the Time of Concentration (Tc), the storm is divided into bursts of equal duration. For each burst, the SCS runoff equation and the average Curve Number are used to determine the portion of that burst that will appear as runoff.
4. A unit hydrograph representing the runoff resulting from one inch of precipitation excess generated uniformly over the watershed in conjunction with the Time of Concentration is used to determine how the runoff from a burst is distributed over time. The result is a runoff hydrograph for a single burst.
5. Individual hydrographs are added together for all bursts in the storm yielding the complete runoff hydrograph for each storm.

The SCS rainfall distributions are derived from data compiled by the Northeast Regional Climate Center located at Cornell University. The "Extreme Precipitation in New York & New England, An interactive Web tool for Extreme Precipitation Analysis", at web address http://precip.eas.cornell.edu/ was used to develop a rainfall distribution. The program's output included the return period estimates for all durations and recurrences. (See attached "Extreme Precipitation Table for the project location in Weymouth, MA)

The HydroCAD software has the additional capability to describe shallow concentrated flow. The "NEH-4 Upland Method" included in the HydroCAD software is applicable for conditions which occur in the headwaters of a watershed up to 2,000 acres. The NEH-4 Upland Method allows the Time of Concentration (Tc) to reflect ground conditions such as overland flow, grassed waterways, paved areas and upland gullies. This results in a model that more accurately reflects the ground surface for shallow concentrated flow conditions, than TR-20, which is limited to distinguishing only paved and unpaved surfaces. Tc is the time required for water to flow from the most distant point on a runoff area to the measurement or collection point. In instances where the watersheds are small and impervious, Tc has been directly entered as a 6-minute minimum, or 0.1 hours. This is consistent with standard engineering practice and Technical Release (TR-55) Urban Hydrology for Small Watersheds graphical method. A lower boundary of 6 minutes will yield a conservative, yet practical measure of stormwater runoff flow for small watersheds contained within the development.

The curve number or CN is a land sensitive coefficient that determines the relationship between total rainfall depth and direct stormwater runoff. Based upon the cover in each sub-watershed a weighted average CN value was determined. The area, CN value, and time of concentration are input into the HydroCAD modeling software to develop runoff hydrographs for the pre and post-developed conditions at the site.

Design points were chosen at down gradient points in each of the drainage areas to compare runoff conditions for both the pre development and post development conditions for each of the following SCS Type III 24-hour design storm events. The design storm frequencies and corresponding rainfall depths were compiled from the "Extreme Precipitation in New York & New England" as explained above and have been estimated as follows for Norfolk County:

Storm Frequency (Years)	Rainfall Depth (Inches)
2	3.32
10	4.91
25	6.15
100	8.66

Drainage area maps for both pre- and post-development conditions have been included in this submission in Section 3.2 of this Stormwater Report.

1.4 SITE HYDROLOGY

Hydrologic soil groups (HSG) are used primarily to estimate runoff from precipitation in engineering calculations. HSG designations vary from "A" to "D" with "A" having the highest infiltration rate and "D" the slowest. The delineated soil boundaries from the Natural Resources Conservation Service (NRCS) soil survey show that the west portion of the site consist of 602 Udorthents and the east portion consists of 245 Hinckley loamy sand (HSG A). Additional soil information can be found in the McMahon Stormwater Report.

An array of soil test pits were performed across the site to examine soils and groundwater levels. The soil test pit data sheets, by McMahon, summarizes the onsite testing information and confirms widespread fill of loamy sands. For surface runoff calculations, the entire site has been classified as HSG A to approximate the amount of runoff generated by the fill soils and remaining soils. The HSG A assumption will also be used in the post developed runoff conditions.

For the infiltration calculations in the HydroCAD model, the rate has been conservatively assumed as Sandy Loam (HSG B) at 1.02 in/hr.

1.4.1 PRE-DEVELOPED HYDROLOGY

The existing Quarry Road utilized overland flow to direct stormwater runoff to the Wetland #1 adjacent to the roadway (Design Point, DP-1). The majority of the project site flows overland directly to the Wetland #2 (Design Point DP-2) or the existing stream channel that discharges to the Wetland #2. There is currently no onsite stormwater infrastructure to

capture and conveyance runoff in the subcatchments tributary to DP-1 and 2. A portion of Pleasant Street collects stormwater in catch basins and conveys it via piped connections to the west away from the project site. The catch basin closest to the existing Pleasant Street, Quarry Road has been designated Design Point, DP-3.

The site was analyzed and divided into sub-watershed areas that are tributary to those design points. The sub-watershed areas are depicted on the Pre-Developed Drainage Subcatchment Plan (DR-1) included in Section 3.2.1. of this report. The ground cover condition of the existing drainage areas consists impervious (pavement, sidewalks and, roofs), grass (good condition), gravel, woods (good condition), and wetlands (woods/grass combination poor) areas. The hydrologic soil group (HSG) is assumed to be "A" for all sub catchments in this analysis. The CN values used for the corresponding ground cover are shown below in the table:

Ground Cover	CN Value
Impervious	98
Gravel	96
Grass	39
Woods	30
Wetland	57

Existing Conditions Sub-catchment Area 1S

This sub-catchment encompasses the existing Quarry Road tributary to the existing Wetland #1. Stormwater runoff runs from a high point at the intersection with Pleasant Street and follows the roads profile down to a low point where the pavement slope towards the wetland. A portion of Quarry Road that extends east towards the Aggregate Industries quarry is also tributary to the Wetland #1. The major cover types in Sub-catchment Area 1S are woods, and impervious area (pavement and roofs), and some grass.

Existing Conditions Sub-catchment Area 2S

This sub-catchment encompasses the majority of the project site and is the area tributary to DP-2. It consists of the existing residential buildings and driveways, lawn areas, gravel parking areas, and woods. Stormwater runoff runs from a high point near Pleasant Street down to the existing stream channel. A portion of Quarry Road extending east towards Aggregate Industries quarry and the existing commercial business building and equipment/storage yard is also tributary to the channel and Wetland #2.

Existing Conditions Sub-catchment Area 3S

This sub-catchment encompasses an area of Pleasant Street tributary to the catch basin (DP-3) at the intersection with Quarry Road. It consists of mainly pavement and sidewalks.

1.4.2 POST DEVELOPED HYDROLOGY

The proposed project consists of the construction of a 4-way signalized intersection at the existing crossroads of Pleasant Street and Libbey Industrial Parkway. A new section of

roadway is proposed to fork off from the existing Quarry Road and angle northwest to the new signal. The runoff from the proposed impervious area of the future roadway will be collected, treated, and infiltrated through deep sump hooded catch basins and multiple subsurface StormTech drainage chambers systems (UG-1, 2, & 3) located beneath the pavement. The redevelopment of Quarry Road will add 1 foot wide asphalt berms and a series of catch basins to collect stormwater runoff and convey it to hydrodynamic separator structures for treatment. This will improve the water quality in the post-developed condition.

Stormwater runoff generated from east half of the site flow overland or collected via catch basin and directed to a pretreatment sedimentation forebay and constructed stormwater wetland BMP. Stormwater discharges from the constructed stormwater wetland will be controlled through an outlet control structure (OC) and conveyed via a pipe system to the existing Wetland #2. In large storm events the constructed stormwater wetland BMP will also discharge over a rip-rap lined broad-crested weir.

The post development hydrologic model consists of eight (8) different sub-catchment areas, Area 1S through Area 8S. Refer to the Post-developed Drainage Subcatchment Plan (DR-2), attached in Section 3.2.2 of this report. The analysis is performed utilizing the same three design points referenced in the existing conditions to allow comparison. Design Point 1 (DP-1) is the analysis point for post developed hydrologic conditions at the existing Wetland #1. Design Point 2 (DP-2) is the Wetland #2. Design Point (DP-3) is the analysis point for conditions expected at the catch basin inlet at the Pleasant Street/ Quarry Road intersection.

Proposed Conditions Sub-catchment Area 1S

This sub-catchment is comprised of a portion of the redeveloped Quarry Road from the intersection with Pleasant Street to the intersection with the future roadway. The sub-catchment also includes the area adjacent to the redeveloped Quarry Road that is tributary to the Wetland #1. The catchment area consists the remaining wooded areas outside the project's limit of work, grass along the proposed road shoulder, a section of proposed pavement, and a wetland replication area at the new culvert entrance. Stormwater runoff adjacent to the roadway flows overland directly to the Wetland #1. Runoff from the impervious area of the road is collected in an inlet style water quality hydrodynamic separator structure and then discharged to a plunge pool/energy dissipator at Wetland #1.

Proposed Conditions Sub-catchment Area 2S

This sub-catchment encompasses a large portion of the project site and is tributary to DP-2. It consists of the two remaining existing residential buildings and driveways, lawn areas, gravel parking areas, and woods. This area also includes impervious area from a portion of the intersection of Quarry Road and the future road. Runoff in this sub-catchment is collected via catch basin inlets or area drains and conveyed to a water quality structure for TSS treatment prior to discharge to Wetland #2.

Proposed Conditions Sub-catchment Area 3S

This sub-catchment encompasses an area of Pleasant Street tributary to the catch basin

(DP-3) at the intersection with Quarry Road. It consists of mainly pavement and sidewalks of the redeveloped Pleasant Street.

Proposed Conditions Sub-catchment Areas 4S – 6S
The sub-catchment areas 4S through 6S are made up of proposed segments of the future roadway and have mainly impervious ground cover. Each sub-catchment collects stormwater through sets of catch basins and conveys runoff to the respective subsurface infiltration chamber systems, labeled 1P through 3P in the hydrology model and on plan DR-2. The Tc path is set to the minimum recommended time of 6 minutes.

Proposed Conditions Sub-catchment Area 7S
This sub-catchment is comprised of the redeveloped portion of Quarry Road that extends east towards the Aggregate Industries quarry and the existing commercial business on the east side of the project site. The major cover types in Sub-catchment Area 1S are gravel and impervious area (pavement and roofs). The redeveloped Quarry Road is proposed to have a set of catch basins to collect and convey stormwater runoff to the sediment forebay of the constructed stormwater wetland BMP. The BMP then discharges to the Wetland #2 Design Point 2 (DP-2).

Proposed Conditions Sub-catchment Area 8S
This sub-catchment is comprised of the remaining area adjacent to the future roadway and is the tributary area to the Wetland #2. The catchment area consists the remaining wooded areas outside the project's limit of work, grass along the proposed road shoulder, and a wetland replication area at the new culvert's downstream end. Stormwater runoff flows overland directly to the Wetland #2.

1.5 STORMWATER MANAGEMENT

The following section describes how the proposed project addresses and complies with the 2008 MassDEP Stormwater Management Regulation requirements.

Standard 1: No New Untreated Discharges – No new stormwater system conveyances will discharge untreated runoff or cause erosion in wetlands or waters of the Commonwealth.

The new stormwater system conveyances will not discharge untreated runoff or cause erosion in wetlands or waters of the Commonwealth. The runoff from the redeveloped and proposed impervious areas of the project will flow to BMPs to treat the stormwater prior to discharge.

Standard 2: Peak Rate Attenuation – Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates.

The peak discharge rates are calculated with the aid of a hydrograph routing program using TR-20 methodology called HydroCAD. The HydroCAD calculations estimating the expected Pre- and Post-Development runoff peak rates have been performed. The proposed HydroCAD analysis examines hydrologic conditions at three design points as shown on the Subcatchment Plans DR-1

and 2. The analysis demonstrates that the proposed stormwater management system reduces post-development peak rates of runoff below pre-development peak rates for all design storm events. Refer to Section 1.8 for a summary of pre-development and post-development peak runoff rates for comparison.

<u>Standard 3: Recharge</u> – Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook. MassDEP also recognizes that on some sites, there is a risk that infiltrating the required recharge volume may cause or contribute to groundwater contamination. MassDEP requires infiltration only to the maximum extent practicable on project sites where contamination has been capped in place.

The project's stormwater management system utilizes subsurface infiltration chamber systems to provide recharge. Based on the recharge calculations contained in this Stormwater Report, the proposed project provides the Required Recharge Volume to meet the requirements for Standard 3. Please refer to the Required Recharge Volume calculations located in Section 4 of this Stormwater Report.

<u>Standard 4: Water Quality</u> – Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS).
This Standard is met when:

a. **Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;**
b. **Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and**
c. **Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.**

The project proposes three treatment trains to remove the required 80% TSS. The first treatment train uses deep sump hooded catch basins to remove 25% TSS followed by Isolator Rows (69%) to remove greater than 44% prior to infiltration (80%) from the StormTech chamber units for a total greater than 80% TSS removal for the project. The deep sump catch basins (25%) followed by hydrodynamic separators (80%) also provide proper TSS removal. The sedimentation forebay and constructed stormwater wetland provide 80% TSS removal. The Long-Term Pollution Prevention Plan is included in conjunction with the Operation and Maintenance Plan required by Standard 9, which outlines routine inspections, cleaning & street sweeping procedures and frequencies. Refer to Section 4.1 of this report for the TSS removal calculation worksheet.

<u>Standard 5: Land Uses with Higher Potential Pollutant Loads</u> – For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated there under at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.

The project is not considered a LUHPL (Land Use with Higher Potential Pollutant Load). The stormwater design has however, used the 1.0-inch Water Quality Volume (WQV) converted to a flow in calculating the proposed BMP sizes. The design also provides 44% or greater pretreatment before stormwater is infiltrated through the use of Deep-sump Catch basins (25%) and Isolator Rows (69%) BMPs.

<u>Standard 6: Critical Areas</u> – Critical areas are Outstanding Resource Waters as designated in 314 CMR 4.00, Special Resource Waters as designated in 314 CMR 4.00, recharge areas for public water supplies as defined in 310 CMR 22.02 (Zone Is, Zone IIs, and Interim Wellhead Protection Areas for groundwater sources and Zone (A)s for surface water sources.)

This project is in proximity to an Outstanding Resource Water area. This feature occurs on the west side of Pleasant Street. The stormwater design has used the 1.0-inch Water Quality Volume (WQV) converted to a flow in calculating the proposed BMP sizes. The design also provides 44% or greater pretreatment before stormwater is infiltrated through the use of Deep-sump Catch basins (25%) and Isolator Rows (69%) BMPs. The constructed stormwater wetland BMP is also recommended for used when in an Outstanding Resource Water area.

<u>Standard 7: Redevelopment and Other Projects Subject to the Standards only to the maximum extent practicable</u> – 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.

The project is considered a mix of new development and redevelopment per the Stormwater Handbook. The project has been designed to fully comply with the MA Stormwater regulations as a new development.

<u>Standard 8: Construction Period Pollution Prevention Plan and Erosion and Sedimentation Control</u> – A plan to control construction-related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities

(construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.

The project will require an EPA NPDES Construction General Permit and the prerequisite Stormwater Pollution Prevention Plan prior to commencement of construction activities.

Standard 9: Operation and Maintenance Plan – A long-term Operation and Maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.

An Operation and Maintenance Plan has been prepared for this project. Refer to Section 2 attached. Provisions to maintain runoff control devices have been assured through non-structural, structural, and construction management approaches.

Standard 10: Prohibition of Illicit Discharges – All illicit discharges to the stormwater management system are prohibited.

The Operation and Maintenance plan required by Standard 9 includes measures to prevent illicit discharges. An Illicit Discharge Compliance Statement is included in Section 4.5.

1.6 BEST MANAGEMENT PRACTICES (BMP'S)

A system of deep sump hooded catch basins, StormTech Isolator Rows, hydrodynamic separators, and a constructed stormwater wetland are proposed to treat site generated stormwater runoff. See Section 4.3 for the Total Suspended Solids (TSS) calculation spreadsheet. A description of the devices used to provide treatment is provided below.

1.6.1 PROPOSED STRUCTURAL AND TREATMENT BMPs

1. DEEP SUMP HOODED CATCH BASINS

Deep sump catch basins are modified versions of inlet structures installed to collect and convey stormwater on the site. The deep sumps, typically a 4-ft dimension below the outlet pipe invert, are most effective of placed "off-line"; that is, they do not have inlet pipes. The catch basins contain traps or hoods on the outlet pipes and serve as pretreatment for other downstream BMPs. Deep sump catch basins will be installed throughout the site to remove trash, debris, sediment and a limited amount of oil and grease from stormwater runoff. Catch basins shall be cleaned, in dry weather, when half of the sump capacity is filled or at a minimum quarterly or as required through periodic inspection. Cleaning will take place at the completion of construction and in early spring after sanding of roadways has ceased or as needed depending on the frequency of major storm events (greater than 1-inch of rainfall).

2. ISOLATOR ROWS

The Isolator Row is a series of StormTech chambers surrounded with filter fabric and connected to one or more manholes for access. The chambers are wrapped in fabric and provide settling and filtration. Stormwater runoff is first directed to the Isolator Row where

they capture sediments, thereby protecting the rest of the underground system consisting of standard chambers in a stone bed. This technology will be used as a part of a treatment train consisting of other structural and non-structural approaches such as street sweeping and reduced road salt alternatives. Isolator Rows will be inspected routinely and cleaned in accordance with manufacturer's recommendations.

3. SUBSURFACE INFILTRATION SYSTEMS (UG-1, UG-2, UG-3)

A subsurface drainage system consisting of high-density polyethylene plastic chambers (StormTech) set in a stone bed are proposed to detain, recharge, and infiltrate storm runoff. The chamber system aims to provide peak flow reduction, stormwater runoff volume reduction, and TSS removal for various storm events. The proposed system drains down completely between storm events due to the orifice being placed at the bottom of the detention chambers. Manhole risers or manufacturer recommended inspection ports are proposed at the ground surface to allow inspection and maintenance access.

4. OUTLET CONTROL STRUCTURES

The outlet control structure (OCS) detains the stormwater utilizing orifices to control the outlet flow and are below grade with access via covers to grade. Although the outlet control structures should not collect much debris, they should be inspected along with the underground system inspection to make sure they are clean of debris and functioning properly. Sand accumulation within the OCS is a sign there is an issue with the upstream stormwater treatment device. The OCS shall be inspected once per year. It may be necessary to clean the structure and the use of a vacuum truck may be necessary.

5. CONSTRUCTED STORMWATER WETLAND

The constructed stormwater wetlands have been conceptually designed and intended to provide water quality and quantity control benefits. The constructed stormwater wetlands have been chosen as a BMP for the areas indicated due to relatively shallow groundwater. While not only providing for water quality treatment and peak rate attenuation the BMP's provide ecological value by providing habitat within their wetlands. The constructed stormwater wetlands have been designed as on-line systems with pools for both treatment and storage of peak flows. Final design of the various zones of the wetland will be refined as the development footprints are progressed and definitive design parameters can be identified. Adequate water quality pretreatment best management practices will be provided in the final design. It should be noted that although the constructed stormwater wetlands technically don't provide groundwater recharge per the Mass Stormwater Handbook, however the wetlands do provide a direct connection to groundwater recharge. Constructed stormwater wetlands will be inspected twice a year during both the growing and non-growing seasons for the first three years.

6. CDS - HYDRODYNAMIC SEPARATORS

The CDS stormwater treatment units are a type of hydrodynamic separator. Hydrodynamic separators are a type of water quality manhole that relies on flow through the structures to promote settling and separation within the unit in order to remove sediments and other pollutants that are widely found in storm water. This technology will be used as a part of a

treatment train consisting of other structural and non-structural approaches. Each device has been sized using the 1.0" equivalent water quality flow and will be reviewed per manufacturer's recommendations and checked by the representative. The hydrodynamic separators shall be inspected twice per year and cleaned at least once per year or in accordance with the manufacturer's recommendations. Periodic inspections performed by the responsible party may dictate cleaning on a more frequent basis depending on the suspended solids loading. During construction accumulated sediment may need to be removed more frequently. Usually a vacuum truck removes accumulated sediment and oil most efficiently. See maintenance documentation from the manufacturer contained for additional maintenance criteria.

7. LEVEL SPREADER/PLUNGE POOL/ENERGY DISSIPATER AND DOWNSTREAM SLOPES:

The level spreader/plunge pool/energy dissipaters are utilized at the outlet pipes prior to discharge to the wetland to prevent erosion. The level spreader/plunge pool/energy dissipaters should be inspected at least once a year for sand accumulation and debris which may impact its effectiveness to slow water. Cleaning should take place during the early spring, although, additional inspections and cleaning may be needed.

In order to ensure that the level spreader systems are working, the outlets as well as slopes downstream for the first three (3) years of operation, should be inspected after every storm of 1" or greater to assure no erosion of the slope. After the first three years, we recommend inspections after any large storm (25+ year event) for erosion. If no erosion is evident, then the stone size and level spreader design is adequate. Should there be erosion of the level spreader, stone size should be increased or additional large stones added to enhance energy dissipation of water. If downstream slopes exhibit signs of erosion, repairs to soils and slope should be made and then a treatment such as an erosion control matting should be instituted to reinforce soils until vegetative cover can be restored. We recommend that the aprons and downstream slopes be inspected and cleaned annually as part of the outlet maintenance to ensure future adequacy.

1.7 SUMMARY OF HYDROLOGY & STORMWATER CALCULATIONS

The results of the pre and post-development hydrology calculations provided in Section 3 are summarized in the following tables. The table corresponds to the design points as indicated on the drainage area maps and hydrograph routing calculations.

TOTAL RUNOFF PEAK FLOW RATE (CFS)
DESIGN POINT 1 (DP-1)

STORM SCS 24-HR	EXISTING	PROPOSED	DIFFERENCE
2-YEAR	0.44	0.41	-0.03
10-YEAR	1.25	1.03	-0.22
25-YEAR	1.99	1.59	-0.40
100-YEAR	3.65	2.82	-0.83

TOTAL VOLUME (AF)
DESIGN POINT 1 (DP-1)

STORM SCS 24-HR	EXISTING	PROPOSED	DIFFERENCE
2-YEAR	0.039	0.033	-0.006
10-YEAR	0.093	0.076	-0.017
25-YEAR	0.144	0.114	-0.030
100-YEAR	0.260	0.200	-0.060

TOTAL RUNOFF PEAK FLOW RATE (CFS)
DESIGN POINT 2 (DP-2)

STORM SCS 24-HR	EXISTING	PROPOSED	DIFFERENCE
2-YEAR	1.56	0.98	-0.58
10-YEAR	4.13	3.23	-0.90
25-YEAR	6.44	5.54	-0.90
100-YEAR	11.56	10.01	-1.55

TOTAL VOLUME (AF)
DESIGN POINT 2 (DP-2)

STORM SCS 24-HR	EXISTING	PROPOSED	DIFFERENCE
2-YEAR	0.172	0.170	-0.002
10-YEAR	0.398	0.362	-0.036
25-YEAR	0.605	0.537	-0.068
100-YEAR	1.070	0.934	-0.136

TOTAL RUNOFF PEAK FLOW RATE (CFS)
DESIGN POINT 3 (DP-3)

STORM SCS 24-HR	EXISTING	PROPOSED	DIFFERENCE
2-YEAR	0.68	0.49	-0.19
10-YEAR	1.40	0.80	-0.60
25-YEAR	2.00	1.04	-0.96
100-YEAR	3.26	1.53	-1.73

TOTAL VOLUME (AF)
DESIGN POINT 3 (DP-3)

STORM SCS 24-HR	EXISTING	PROPOSED	DIFFERENCE
2-YEAR	0.050	0.035	-0.015
10-YEAR	0.100	0.058	-0.042
25-YEAR	0.142	0.077	-0.065
100-YEAR	0.233	0.116	-0.117

The proposed project design reduces the flow in the post-developed condition at all Design Points, DP-1, 2, and 3 for the listed design storm events. The design also reduces volume at DP-1, 2, and 3 in the 2, 10, 25, and 100-year design storms.

1.8 CONCLUSION

In conclusion, the project provides a reduction in post-developed peak rates and volume of runoff compared to pre-development rates and volume through the detailed design of stormwater Best Management Practices (BMPs). The overall drainage system has been designed to control peak discharge rates and runoff volumes for up to and including the 100-yr design storm event. The design provides total suspended solids (TSS) removal and water quality treatment, as required by the Massachusetts Stormwater Management Regulations.

It is our professional opinion that the proposed development project will not adversely affect the surrounding drainage patterns. The following routing calculations, Best Management Practice design, and associated documentation within this report have been prepared to illustrate that runoff from the project has been mitigated.

References:

1. Commonwealth of Massachusetts, Department of Environmental Protection, Stormwater Management Standards Handbook. Volumes 1-3 February 2008 (DEP Stormwater Management Policy 2008).

2. Commonwealth of Massachusetts, Department of Environmental Protection. 310 CMR 10.00: Massachusetts Wetlands Protection Act Regulations. 2008.

3. Commonwealth of Massachusetts, Department of Environmental Protection. 314 CMR 4.00: Massachusetts Surface Water Quality Standards. 2007.

4. Commonwealth of Massachusetts, Department of Environmental Protection. 314 CMR 9.00: Massachusetts Water Quality Regulations. 2008.

5. United States Department of Agriculture, Natural Resources Conservation Services Urban Hydrology for Small Watersheds, Technical Release 55 (TR-55). June 1986.

6. United States Department of Agriculture, Natural Resources Conservation Services Project Formulation Hydrology Program System, Technical Release 20 (TR-20). Oct. 2004.

1.10 GENERAL CONSTRUCTION SEQUENCING

The following section provides construction details and highlights the construction sequence and timing of earthmoving activities. The overall project will be broken down into the following phases:

A. Pre-construction Meeting

An on-site meeting will be conducted by the Owner's Representative prior to the start of construction activity. The appropriate State & Town Departments will be invited to participate. A copy of the Stormwater Pollution Prevention Plan (SWPPP) and NPDES Construction General Permit (CGP) will be provided to applicable parties, Authorities, and Town Departments.

B. Installation of Erosion Controls

Erosion and sedimentation controls (i.e. silt fence, filter socks, and inlet protection) will be installed at the limits of work and within the existing catch basins, as applicable. Tree protection will be installed around trees specified to remain within the limit of work. Structures to remain shall also be visibly flagged/protected.

C. Installation of Construction Entrance

A construction entrance and staging area will be in accordance with the construction detail provided in the plan set.

D. Demolition

Any existing building, utilities services, and pavement within the project area will be demolished in accordance with the Construction Plans. Those utilities effected by construction activates shall be coordinated with the utility purveyors and Dig Safe procedures taken prior to implementation of agreed upon connections/disconnections/abandonment of services. Materials that are to be removed from the site will be transported to an appropriate facility or will be disposed of elsewhere according to Federal, State, and Local guidelines. Inactive stockpiles or areas of granular material or topsoil shall be temporarily secured in accordance with the SWPPP in order to control sediment laden runoff.

E. Site Clearing and Rough Grading

The site will be cleared and rough graded in accordance with the proposed grading as shown on the plans. If suitable topsoil is found, it will be removed and stockpiled within the project limits. Areas which have been cleared will be stabilized in accordance with the SWPPP.

F. Installation of Drainage and Utilities

Utility relocations and modifications, including water, gas, and electric, are anticipated to occur in conjunction with the drainage work. Temporary sediment basins will be constructed at this time on an as-needed basis to collect stormwater runoff during construction. Stockpiles will be established in designated areas as shown on project plans. All temporary/inactive stockpile areas will be encompassed by straw bales or other approved erosion control devices to control sediment

laden runoff as necessary and will be temporarily seeded, mulched or covered with plastic, as necessary. Material stabilization will be in accordance with the SWPPP.

G. Fine Grading, Paving, Etc.

The fine grading and shaping will commence, along with the installation of curbing, to prepare for paving operations. Areas outside of the parking lot will be shaped and prepped for loam, seed, or other treatments. Paving operations will begin with the installation of the binder course layer, followed by the finish course layer at the appropriate time.

H. Permanent / Final Site Stabilization

The final phase of the project is to restoration and stabilization of all exposed surfaces. Pavement striping, signage placement, and final landscaping will be performed upon completion construction. Disturbed areas will be landscaped, mulched or seeded in accordance with the landscape requirements. Permanent restoration and revegetation measures serve to control erosion and sedimentation by establishing a vegetative cover. In the event that weather conditions prevent final restoration, temporary erosion and sedimentation measures will be employed until the weather is suitable for final cleanup. A final inspection will ensure that the project site is cleared of all project debris and that erosion and sedimentation controls are functioning properly. Once the site has been stabilized, newly installed catch basins and the subsurface recharge/detention system will be inspected for sediment deposits and cleaned if necessary.

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Section 2.0

Long-Term Pollution Prevention and Operation and Maintenance Plan

Section 2.1

Operation and Maintenance Narrative

LONG-TERM STORMWATER POLLUTION PREVENTION AND OPERATION & MAINTENANCE PLAN TO COMPLY WITH STORMWATER STANDARDS 4, 6, & 9

APPLICABILITY

This document identifies constituents of concern that have the potential to contaminate stormwater runoff from the proposed project site located at Pleasant Street and Libbey Industrial Parkway and provides a framework of Best Management Practices (BMPs) for handling stormwater runoff. It also outlines an inspection and maintenance program to ensure continued effectiveness of the proposed stormwater management system. The proposed BMPs are shown on the plans prepared by CHA, 141 Longwater Drive, Norwell, Massachusetts.

PROJECT OVERVIEW:

The proposed project includes the the creation of a new 4-way signalized intersection at the current 3-way intersection at Pleasant Street and Libbey Industrial Parkway. A new segment of roadway located opposite of Libbey Industrial Parkway and will provide access to the businesses on the easterly side of Pleasant Street. The project also includes improvements to the Pleasant Street and Quarry Road intersection. The existing intersection of Quarry Road and Pleasant Street will be converted to a right-in, right-out condition. The new roadway segment opposite Libbey Industrial Parkway and Quarry Road will intersect approximately 300' easterly of Pleasant Street and combine into a single roadway to the east that will be aligned and match the existing Quarry Road access.

A 30" corrugated metal culvert conveys flows northerly from a BVW, beneath the Quarry Road. The culvert discharges into an intermittent stream that flows northerly.The location of the culvert and intermittent stream with respect to the proposed work requires that it be replaced and extended to span the new roadway. A new 30" culvert will be constucted to replace the existing and a portion of the intermittent stream.

Stormwater management improvements are proposed that incorporate several pairs of new catch basins along the new segment of roadway with each pair being conveyed to subsurface stormwater infiltration systems underneath the roadway. CDS-water quality units with catch basin grates have been added to the Quarry Road and its intersection with the new roadway segment from Pleasant Street.These units collect and treat the roadway runoff prior to discharge into the adjacent wetland system. A pocket wetland has been designed to receive stormwater runoff from catch basins located at/near the lowpoint and intersection of the existing Quarry Road and the new roadway segment. This pocket wetland is designed to treat the stormwater runoff and to feed that treated runoff to a proposed wetland mitigation/floodplain compensation area.

The project proposes to treat stormwater runoff from impervious areas in accordance with the 2008 Massachusetts Stormwater Handbook. The project has been designed to improve management of stormwater by reducing proposed peak runoff rates and volumes below existing peak rates and volumes, and by removal of Total Suspended Solids (TSS) by use of non-structural and structural BMPs.

OWNER AND RESPONSIBLE PARTY:

Owner:

Various

Day-to-day Operation and Maintenance:

The Town of Weymouth will be responsible for the maintenance of the roadway facilities and associated stormwater management features for Pleasant Street, Quarry Road, and Libbey Industrial Parkway. The project proponent will be responsible for the maintenance of the roadway facilities and associated stormwater features for the new roadway.

CONSTRUCTION MANAGEMENT:

A construction manager with adequate knowledge and experience on projects of similar size and scope shall be employed to oversee all site work related construction. The contractor shall incorporate the appropriate techniques to control sediment and erosion pollution during construction in accordance with the Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas and any conditions of approval from the local conservation commission.

The design incorporates measures to control construction-related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities. The information contained herein and within the engineering drawings identifies construction period pollution prevention measures, responsible parties, erosion control measures (straw bales and silt fence, etc.), BMPs for collecting and treating runoff and groundwater during construction[1], site stabilization measures (i.e. gravel, seed, pavement, etc.), an operations and maintenance plan & long-term pollution prevention plan contained herein.

Care should be taken when constructing stormwater control structures. Light earth-moving equipment shall be used when operating over top of buried utilities or drain or chambers.

ON-GOING MAINTENANCE CONTRACT

The non-structural and structural approaches recommended below, as well as the required BMP maintenance, will be completed by an appropriate contractor. Adequate personnel with appropriate training and access to proper equipment will be available to complete the tasks. Future responsible parties must be notified of their responsibility to operate and maintain the system in perpetuity.

LIVING DOCUMENT PROVISIONS

[1] Should the need for de-watering arise during construction at the site, groundwater will be pumped directly from the work area into geotextile filter bags, temporary settling basins, or portable fractionation tanks (depending on the nature and volume of water encountered) which will act as sediment traps during construction. Discharge points will be setback outside of all resource areas and buffers monitored by qualified personnel (wetland scientist, licensed site professional, civil engineer, etc.) to ensure no impacts to resource areas and compliance with applicable Federal and state regulations. All discharges will be free from visible floating, suspended, and settleable solids that would impair the functions of the nearby drainage systems, wetlands, or downstream rivers. Refer to the details provided on the drawing set for additional information.

This document shall be updated as necessary to reflect new procedures, technologies or requirements.

MAINTENANCE LOG

The Responsible Party shall develop and maintain a log of inspections, maintenance, repairs, and disposal (including location of disposal) during the life of the project. Records will be maintained for at least 3 years be made available for viewing to the Massachusetts Department of Environmental Protection in accordance with the provisions of the Massachusetts Stormwater Handbook. Copies of the maintenance log shall be submitted to the Weymouth Conservation Commission annually for their reference. A sample of such a maintenance log is provided.

GOOD HOUSEKEEPING PRACTICES DURING CONSTRUCTION

The Responsible Party shall maintain good housekeeping practices by maintaining a clean and orderly facility to prevent potential pollution sources, including debris, from coming into contact with stormwater and degrading water quality. It includes establishing protocols to reduce the possibility of mishandling materials or equipment and training employees in good housekeeping techniques. Common areas where good housekeeping practices should be followed shall include: material storage areas, vehicle and equipment maintenance areas, and loading areas. Good housekeeping practices must include a designated and secure location for garbage. A schedule for regular pickup and disposal of garbage and waste materials and routine inspections of containers for leaks and structural integrity shall be developed.

Specific good housekeeping practices that will be implemented include routine removal of trash. items including scrap, metal, wood, plastic, miscellaneous trash, paper, glass, insulation, misc. building materials, and packaging. Additional practices include securing and covering any containers, supplies, or equipment that could become sources of stormwater pollution.

MINIMIZING EXPOSURE DURING CONSTRUCTION

The Responsible Party will minimize exposure of potential pollutant sources, including debris, from coming into contact with precipitation and being picked up by stormwater and carried into drains and surface waters using the following steps:

- Storing all containerized materials in a protected, secure location away from drains and plainly labeled.
- Containing all activities that can generate sources of contaminants from reaching the receiving water or the stormwater management system.
- Securing any equipment or supplies so that they are not transported during storm events into receiving waters or stormwater management system.

BEST MANAGEMENT PRACTICES (BMP) MAINTENANCE POST CONSTRUCTION

The proposed stormwater management system has been designed with appropriate BMPs aimed at reducing the pollutants typically found in stormwater discharge based upon the intended subdivision development land use. All BMPs require regular maintenance to function as intended. Some

management measures have simple maintenance requirements; others are more involved. The Responsible Party must have all BMPs regularly inspected to ensure they are operating properly on an as needed basis, including during storm events exceeding 0.5 inches of rainfall.

A description of the non-structural and structural approaches to be incorporated are indicated below. The following Best Management Practices are proposed to be incorporated into the stormwater management system treatment train design to reduce source runoff and improve stormwater runoff discharge quality. The Responsible Party will regularly inspect all BMPs to ensure they are operating properly. If any deficiencies are identified during these inspections, action to resolve it will be initiated and documented on the maintenance log.

NON-STRUCTURAL BEST MANAGEMENT PRACTICES (BMPs)

STREET SWEEPING

As street sweeping is a BMP under MassDEP guidelines, this non-structural BMP is an effective removal of Total Suspended Solids (TSS) in a comprehensive stormwater management program. A maintenance program of street sweeping with a High Efficiency Vacuum Sweeper or a Regenerative Air Sweeper can reduce sediment accumulation in the deep sump catch basins and subsurface systems. Sweeping will be conducted on a monthly basis in the side/rear parking lot which contains porous pavers. Sweeping will be conducted on a semi-annual basis (primarily in the spring and fall) in the front parking lot. Street sweeping is performed to keep downstream treatment train BMPs operating effectively.

GRADING

The impervious areas of the site shall be graded as gently as possible to reduce runoff velocities. Steep slopes will be permanently vegetated to dissipate energy and reduce potential erosion. No constructed vegetated slopes should exceed 2H: 1V without providing additional reinforcement. Steep slopes may require soil reinforcement and additional vegetation.

SNOW STORAGE AND DEICING

Snow storage is anticipated to occur around the perimeter of the parking areas. The landscaping has been designed accordingly.

In the interest of reducing the volume of dissolved salt that enters the watershed, the operator of the development will rely on sand alone where traction on snowy surfaces is the primary objective. However, when deicing is necessary due to safety reasons during winter months, paved surfaces will typically be treated with a mixture of 90% sand and 10% road salt (NaCl).

FERTILIZER:

Slow release organic fertilizers are recommended to be used in landscape areas to limit nutrient transport to groundwater and the wetland area. It is recommended that application be limited to 5 lbs. per 1000 square feet of lawn area.

WASTE MANAGEMENT:

Solid waste will be contained within standard residential trash and recycling containers.

STRUCTURAL BEST MANAGEMENT PRACTICES:

Prior to final completion and full occupancy of the development, it is recommended that a representative of the Contractor, Manufacturer, and/or Engineer either designing or building the facility for the Owner properly instruct the Responsible Party as to the maintenance practices required to responsibly maintain the effectiveness of the drainage system. These frequencies and requirements are recommendations to maintain minimum effectiveness in most typical environments. Ultimately, the Responsible Party will implement the procedures and frequencies as they see fit under their current plan and inspect the systems as needed to maintain minimum effectiveness as recommended by the manufacturer. The following maintenance of structural BMPs will be implemented:

DEEP SUMP HOODED CATCH BASINS AND MANHOLE STRUCTURES

Catch basins shall be cleaned, in dry weather, when half of the sump capacity is filled or at a minimum quarterly or as required through periodic inspection. Cleaning will take place at the completion of construction and in early spring after sanding of roadways has ceased or as needed depending on the frequency of major storm events (greater than 1-inch of rainfall). All manholes shall be inspected bi-annually. Any obstructions, sediment, and debris that could potentially cause clogs shall be removed within the conveyance system as necessary. Inverts, grates, and hoods shall be checked and replaced as necessary to maintain hydraulic effectiveness.

ISOLATOR ROW

The Isolator Rows in the subsurface systems shall be inspected once per year and cleaned as dictated by the results of each inspection and in accordance with the manufacturer's recommendations. Periodic inspections performed by the Responsible Party may dictate cleaning on a more frequent basis depending on the suspended solids loading. During construction accumulated sediment may need to be removed more frequently. Conduct JetVac process annually or when inspection shows that maintenance is necessary. See attached maintenance documentation from the manufacturer.

SUBSURFACE INFILTRATION SYSTEMS

The subsurface system has been designed with StormTech® chamber system from ADS and utilize Isolator Rows to remove sediment and debris within the stormwater. The subsurface system has riser structures/inspection ports at grade to inspect sediment accumulation and allow for removal of sediment and debris from the detention system. The subsurface drainage system connects to a multi-stage outlet structure to regulate discharge from storm events. Once the system goes online, inspections should occur after each major storm event for the first few months to ensure proper stabilization, function, and to ensure that the outlets remain free of obstructions. After that, the system should be inspected annually. Water levels should be checked and recorded against rainfall amounts to verify that the drainage system is working properly.

CDS - HYDRODYNAMIC SEPARATORS

The CDS stormwater treatment units are a type of hydrodynamic separator. Hydrodynamic separators are a type of water quality manhole or catch basin that relies on flow through the structures to promote settling and separation within the unit in order to remove sediments and other pollutants that are widely found in storm water. This technology will be used as a part of a treatment train consisting of other structural and non-structural approaches. Each device has been sized using the 1.0" equivalent water quality flow and will be reviewed per manufacturer's recommendations and checked by the representative. The hydrodynamic separators shall be inspected twice per year and cleaned at least once per year or in accordance with the manufacturer's recommendations. Periodic inspections performed by the responsible party may dictate cleaning on a more frequent basis depending on the suspended solids loading. During construction accumulated sediment may need to be removed more frequently. Usually a vacuum truck removes accumulated sediment and oil most efficiently. See maintenance documentation from the manufacturer for additional maintenance criteria.

CONSTRUCTED POCKET WETLAND

Unlike conventional wet basin systems that require large-scale sediment removal at infrequent intervals, constructed pocket wetlands require small-scale maintenance at regular intervals to evaluate the health and composition of the plant species. Proponents must carefully observe the constructed pocket wetland system over time. In the first three years after construction, inspect the constructed pocket wetlands twice a year during both the growing and non-growing seasons.

During these inspections, record and map the following information:

- The types and distribution of the dominant wetland plants in the marsh;
- The presence and distribution of planted wetland species;
- The presence and distribution of invasive wetland species (invasives must be removed);
- Indications that other species are replacing the planted wetland species;
- Percentage of standing water that is unvegetated;
- Elevation of the normal pool is being maintained for wetlands with extended zones;
- Stability of the original depth zones and the micro-topographic features; and
- Accumulation of sediment in the forebay and micropool; and survival rate of plants (cells with dead plants must be replanted).

Maintenance of Sediment Forebay

Another important maintenance activity is regulating the sediment loading into the constructed stormwater wetland. All constructed stormwater wetlands are required to have a sediment forebay. Sediment accumulating in wetlands reduces water depths, changes the growing conditions for emergent plants, and alters the wetland plant community. Most sediment should be trapped and removed by the forebay or other type of basin before it reaches the wetland. The sediment forebay should be cleaned once a year.

OUTLET CONTROL STRUCTURE

The outlet control structure (OCS) detains the stormwater utilizing orifices to control the outlet flow and are below grade with access via covers to grade. Although the outlet control structures should not collect much debris, they should be inspected along with the constructed pocket wetlands inspection to make sure they are clean of debris and functioning properly. The OCS shall be inspected once per year. It may be necessary to clean the structure and the use of a vacuum truck may be necessary.

LEVEL SPREADER/PLUNGE POOL/ENERGY DISSIPATER AND DOWNSTREAM SLOPES

The level spreader/plunge pool/energy dissipaters are utilized at the outlet pipes prior to discharge to the wetland to prevent erosion. The level spreader/plunge pool/energy dissipaters should be inspected at least once a year for sand accumulation and debris which may impact its effectiveness to slow water. Cleaning should take place during the early spring, although, additional inspections and cleaning may be needed.

In order to ensure that the level spreader systems are working, the outlets as well as slopes downstream for the first three years of operation, should be inspected after every storm of 1" or greater to assure no erosion of the slope. After the first three years, we recommend inspections after any large storm (25+ year event) for erosion. If no erosion is evident, then the stone size and level spreader design is adequate. Should there be erosion of the level spreader, stone size should be increased or additional large stones added to enhance energy dissipation of water. If downstream slopes exhibit signs of erosion, repairs to soils and slope should be made and then a treatment such as an erosion control matting should be instituted to reinforce soils until vegetative cover can be restored. We recommend that the aprons and downstream slopes be inspected and cleaned annually as part of the outlet maintenance to ensure future adequacy.

SPILL CONTROL:

Since the site is mainly a residential development, it is unlikely there will be a spill other than possibly petroleum products from a resident's vehicle. Thus, it is only a recommendation that a contingency plan to address the spillage/release of petroleum products and any hazardous material be implemented for the facility. The recommendation includes that the property manager have all MassDEP emergency spill response information posted on-site at all times. It is also recommended an emergency spill response kit including absorbent pillows be stored on-site along with instructions for the kit, a copy of applicable regulations regarding spills, and a list of individuals to contact (local and state officials) in the event of a spill.

Spills or leaks will be treated properly according to material type, volume of spillage and location of spill. Mitigation will include preventing further spillage, containing the spilled material in the smallest practical area, removing spilled material in a safe and environmentally friendly manner, and remediating any damage to the environment.

LONG-TERM OPERATION AND MAINTENANCE BUDGET:

Consistent with Standard 9 of the Massachusetts Department of Environmental Protection Stormwater Handbook (February 2008) the approximate cost of inspections and maintenance based on the abovementioned post-construction activities and frequencies is as follows:

- Street Sweeping - $2,500 per year based on annual sweepings.
- Deep Sump Catch Basins - inspection/cleaning - $200 per year/per catch basin based on annual inspections and sediment removal of both single and double grate deep sump catch basins.
- Subsurface Infiltration Systems and Isolator Row - inspection - $1,000 per year based on semi-annual inspections. Cleaning/debris removal - $1,000 per year for accumulated sediment and trash removal.
- Hydrodynamic Separators - inspection/cleaning - $1.000 per year based on quarterly inspections (or per manufacturer's guidelines) and sediment removal
- Constructed Pocket Wetlands, Sediment Forebay, and Outlet Control Structure - $1,000 per year based on semi-annual inspections. Cleaning/debris removal - $1,000 per year for accumulated sediment and trash removal.

Additional costs may be incurred if it is determined during routine inspections of the BMP's that further corrective actions are necessary.

LONG TERM STRUCTURAL BEST MANAGEMENT PRACTICE INSPECTION & MAINTENANCE MATRIX AFTER CONSTRUCTION

Note: BMP's shall be visually inspected and repaired by a qualified party in accordance with the following chart. Note these are minimum inspection criteria/frequencies and should be adjusted throughout the project lifespan as required to maintain effectiveness. Refer to maintenance standards for drainage facilities and structural best management practices in the "Recommended Long-Term Stormwater Pollution Prevention Plan."

Conventional & LID Best Management Practices	Recommended Minimum Inspection & Maintenance Frequency	Erosion/Scouring	Tree Growth Hazards	Differential Settlement/Seepage	Structural Damage/Obstructions	Trash & Debris	Removal of Accumulated Sediment	Slope Integrity	*Mow Vegetation/Poor Vegetation Coverage	Remove/Reset Filter Fabric & Stone As Required	Remove & Replace Hardwood mulch/media	Vac Truck Sediment & Contaminants	Remove/Reset Riprap as Required
Catch Basin/Area Drain	Annually		☑	☑	☑	☑	☑					☑	
Energy Dissipaters	Annually	☑	☑	☑		☑	☑		☑	☑			
Drainage Swales	Semi-Annual	☑				☑		☑	☑				☑
Outlet Structure	Semi-Annual	☑		☑	☑	☑	☑			☑			☑
Water Quality Structures	Semi-Annual			☑	☑	☑						☑	
Detention/Infiltration System w/ Isolator Row	Semi-Annual	☑	☑	☑	☑	☑	☑					☑	
Constructed Wetland	Semi-Annual	☑	☑		☑	☑	☑	☑	☑				☑
Level Spreader	Annually	☑	☑			☑			☑	☑			☑
Plunge Pool	Annually	☑				☑	☑		☑	☑			☑

Stormwater BMP Inspection and Maintenance Log

Facility Name	
Address	
Begin Date	End Date

Date	BMP ID#	BMP Description	Inspected by:	Cause for Inspection	Exceptions Noted	Comments and Actions Taken

Instructions: Record all inspections and maintenance for all treatment BMPs on this form. Use additional log sheets and/or attach extended comments or documentation as necessary.

- BMP ID# — Always use ID# from the Operation and Maintenance Manual or Approved Plans.
- Inspected by — Note all inspections and maintenance on this form, including the required independent annual inspection.
- Cause for inspection — Note if the inspection is routine, pre-rainy-season, post-storm, annual, or in response to a noted problem or complaint.
- Exceptions noted — Note any condition that requires correction or indicates a need for maintenance.
- Comments and actions taken — Describe any maintenance done and need for follow-up.

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Save Valuable Land and Protect Water Resources

Isolator® Row O&M Manual

StormTech® Chamber System for Stormwater Management

1.0 The Isolator® Row

1.1 INTRODUCTION

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

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

1.2 THE ISOLATOR ROW

The Isolator Row is a row of StormTech chambers, either 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.

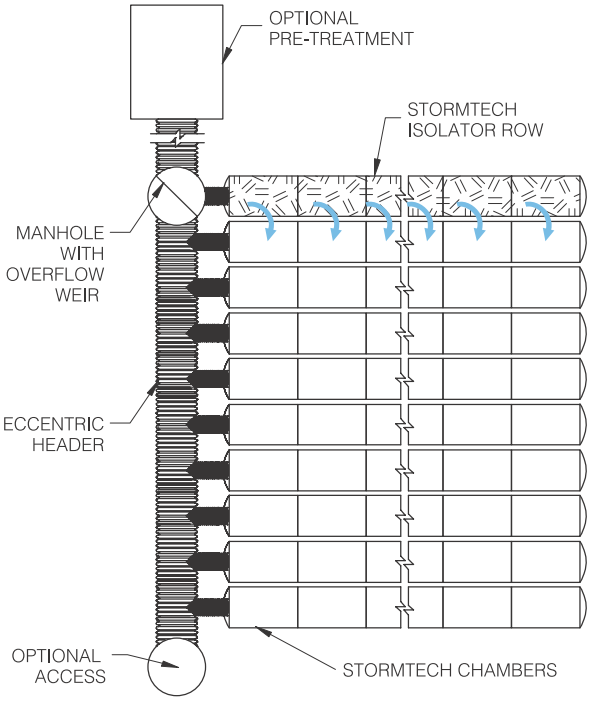
Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of 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 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.

StormTech Isolator Row with Overflow Spillway
(not to scale)



2.0 Isolator Row Inspection/Maintenance

2.1 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.

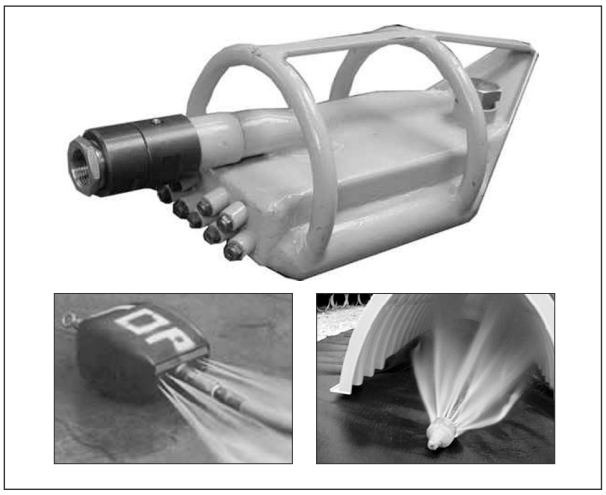
At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

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.

2.2 MAINTENANCE

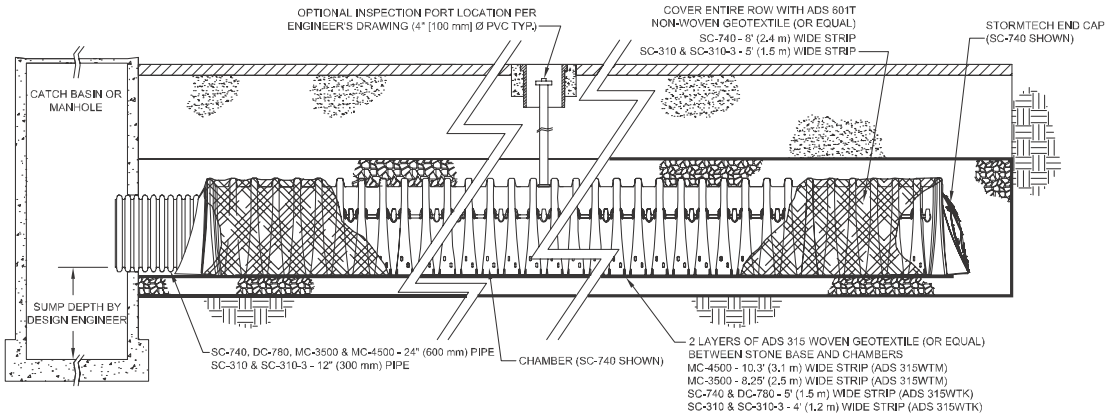
The Isolator Row was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via 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.



Examples of culvert cleaning nozzles appropriate for Isolator Row maintenance. (These are not StormTech products.)

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 DC-780, MC-3500 AND MC-4500 CHAMBER MODELS AND IS NOT REQUIRED OVER THE ENTIRE ISOLATOR ROW.

3.0 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

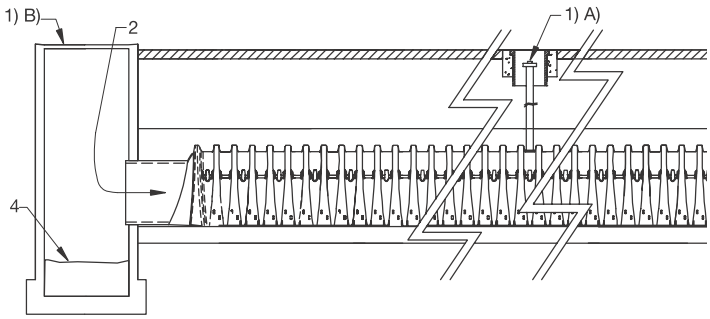
ii. Using a flashlight, inspect down Isolator Row through outlet pipe

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.

StormTech Isolator Row (not to scale)



Step 2) Clean out Isolator Row using the JetVac process

A) A fixed culvert 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)			
3/15/01	6.3 ft.	none		New installation. Fixed point is CI frame at grade	djm
9/24/01		6.2	0.1 ft.	Some grit felt	sm
6/20/03		5.8	0.5 ft.	Mucky feel, debris visible in manhole and in Isolator row, maintenance due	rv
7/7/03	6.3 ft.		0	System jetted and vacuumed	djm

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Section 3.0

Hydrology and Hydraulic Modeling

Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Smoothing	Yes
State	Massachusetts
Location	
Longitude	70.931 degrees West
Latitude	42.188 degrees North
Elevation	0 feet
Date/Time	Thu, 29 Nov 2018 14:07:54 -0500

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.28	0.44	0.54	0.71	0.89	1.12	**1yr**	0.76	1.06	1.30	1.66	2.12	2.73	3.07	**1yr**	2.41	2.96	3.43	4.03	4.80	**1yr**
2yr	0.36	0.55	0.68	0.90	1.13	1.43	**2yr**	0.98	1.31	1.65	2.08	2.63	3.32	3.69	**2yr**	2.94	3.55	4.08	4.84	5.48	**2yr**
5yr	0.43	0.67	0.83	1.12	1.43	1.82	**5yr**	1.23	1.65	2.11	2.65	3.32	4.15	4.70	**5yr**	3.67	4.52	5.17	6.11	6.81	**5yr**
10yr	0.49	0.76	0.96	1.31	1.70	2.18	**10yr**	1.47	1.96	2.54	3.19	3.97	4.91	5.64	**10yr**	4.35	5.43	6.19	7.29	8.03	**10yr**
25yr	0.57	0.91	1.17	1.61	2.15	2.78	**25yr**	1.86	2.46	3.24	4.06	5.02	6.15	7.19	**25yr**	5.44	6.91	7.85	9.22	10.00	**25yr**
50yr	0.66	1.06	1.36	1.91	2.57	3.34	**50yr**	2.22	2.93	3.90	4.87	5.99	7.29	8.64	**50yr**	6.46	8.31	9.41	11.01	11.81	**50yr**
100yr	0.76	1.23	1.59	2.26	3.08	4.02	**100yr**	2.66	3.49	4.69	5.85	7.16	8.66	10.39	**100yr**	7.66	9.99	11.28	13.16	13.96	**100yr**
200yr	0.88	1.43	1.86	2.67	3.69	4.83	**200yr**	3.18	4.15	5.65	7.02	8.55	10.28	12.50	**200yr**	9.10	12.02	13.52	15.73	16.49	**200yr**
500yr	1.08	1.77	2.31	3.35	4.69	6.16	**500yr**	4.04	5.23	7.21	8.93	10.82	12.91	15.98	**500yr**	11.43	15.36	17.21	19.92	20.58	**500yr**

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
10yr	0.45	0.69	0.85	1.19	1.54	1.77	**10yr**	1.33	1.73	2.00	2.59	3.31	4.47	5.04	**10yr**	3.96	4.85	5.49	6.40	7.21	**10yr**
25yr	0.52	0.79	0.98	1.40	1.85	2.09	**25yr**	1.59	2.05	2.35	3.02	3.84	5.38	6.13	**25yr**	4.76	5.89	6.60	7.64	8.61	**25yr**
50yr	0.58	0.88	1.10	1.58	2.13	2.39	**50yr**	1.84	2.34	2.64	3.39	4.29	6.21	7.11	**50yr**	5.50	6.84	7.60	8.72	9.87	**50yr**
100yr	0.66	0.99	1.24	1.80	2.47	2.71	**100yr**	2.13	2.65	2.97	3.82	4.80	7.18	8.26	**100yr**	6.36	7.94	8.78	9.95	11.34	**100yr**
200yr	0.74	1.12	1.42	2.06	2.87	3.09	**200yr**	2.47	3.02	3.35	4.28	5.37	8.32	9.63	**200yr**	7.36	9.26	10.20	11.36	13.04	**200yr**
500yr	0.88	1.31	1.69	2.45	3.49	3.66	**500yr**	3.01	3.58	3.90	4.99	6.23	10.17	11.85	**500yr**	9.00	11.39	12.37	13.60	15.77	**500yr**

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.31	0.48	0.59	0.79	0.97	1.15	**1yr**	0.84	1.12	1.36	1.82	2.33	2.93	3.39	**1yr**	2.59	3.26	3.69	4.40	5.17	**1yr**
2yr	0.37	0.57	0.70	0.95	1.17	1.39	**2yr**	1.01	1.36	1.61	2.12	2.74	3.45	3.87	**2yr**	3.05	3.72	4.28	5.05	5.68	**2yr**
5yr	0.47	0.72	0.89	1.22	1.56	1.83	**5yr**	1.34	1.79	2.12	2.74	3.48	4.44	5.05	**5yr**	3.93	4.86	5.57	6.59	7.33	**5yr**
10yr	0.57	0.88	1.09	1.52	1.96	2.26	**10yr**	1.70	2.21	2.61	3.33	4.19	5.47	6.24	**10yr**	4.84	6.00	6.84	8.09	8.89	**10yr**
25yr	0.75	1.14	1.42	2.03	2.67	2.99	**25yr**	2.30	2.92	3.48	4.33	5.35	7.19	8.22	**25yr**	6.36	7.90	9.02	10.63	11.45	**25yr**
50yr	0.92	1.39	1.74	2.50	3.36	3.71	**50yr**	2.90	3.63	4.31	5.28	6.46	8.82	10.12	**50yr**	7.81	9.74	11.12	13.05	13.87	**50yr**
100yr	1.13	1.71	2.14	3.09	4.24	4.59	**100yr**	3.66	4.48	5.37	6.45	7.80	10.81	12.47	**100yr**	9.57	11.99	13.70	16.02	16.80	**100yr**
200yr	1.39	2.09	2.65	3.83	5.34	5.69	**200yr**	4.61	5.56	6.69	7.87	9.41	13.24	15.36	**200yr**	11.71	14.77	16.84	19.68	20.33	**200yr**
500yr	1.83	2.72	3.51	5.09	7.24	7.55	**500yr**	6.25	7.38	8.96	10.26	12.08	17.27	20.21	**500yr**	15.28	19.43	22.09	25.80	26.16	**500yr**

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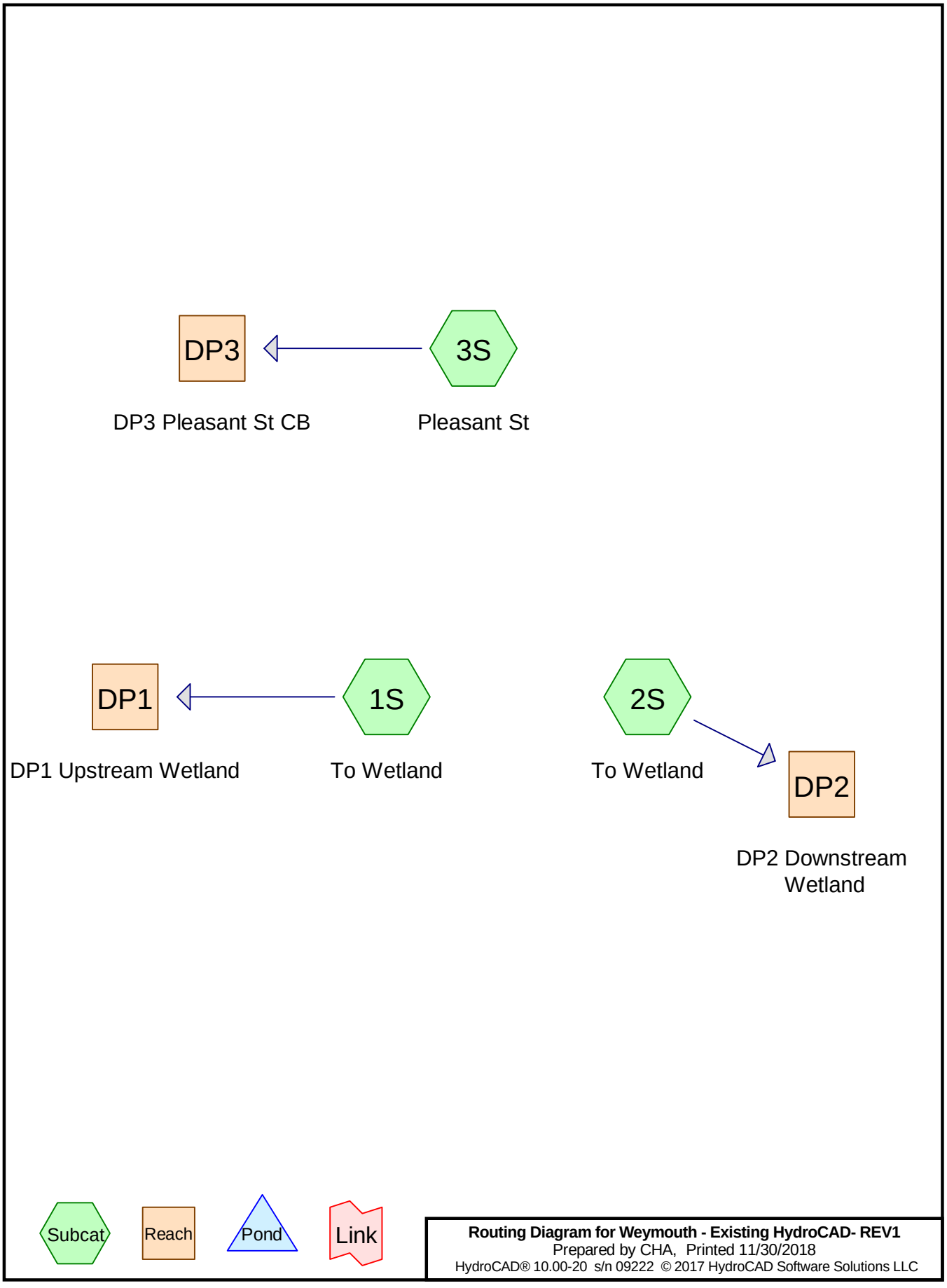
Section 3.1

HydroCAD Site Hydrology Calculation

Section 3.1.1

Pre-Developed Stormwater



Routing Diagram for Weymouth - Existing HydroCAD- REV1
Prepared by CHA, Printed 11/30/2018

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.180	39	>75% Grass cover, Good, HSG A (1S, 2S, 3S)
0.888	96	Gravel surface, HSG A (2S)
1.135	98	Impervious, HSG A (1S, 2S, 3S)
0.625	30	Woods, Good, HSG A (1S, 2S)
0.110	57	Woods/grass comb., Poor, HSG A (2S)
3.937	**68**	**TOTAL AREA**

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 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 1S: To Wetland Runoff Area=30,635 sf 49.60% Impervious Runoff Depth=0.66"
Tc=6.0 min CN=65 Runoff=0.44 cfs 0.039 af

Subcatchment 2S: To Wetland Runoff Area=119,670 sf 17.40% Impervious Runoff Depth=0.75"
Flow Length=165' Tc=14.4 min CN=67 Runoff=1.56 cfs 0.172 af

Subcatchment 3S: Pleasant St Runoff Area=21,175 sf 63.35% Impervious Runoff Depth=1.24"
Tc=6.0 min CN=76 Runoff=0.68 cfs 0.050 af

Reach DP1: DP1 Upstream Wetland Inflow=0.44 cfs 0.039 af
Outflow=0.44 cfs 0.039 af

Reach DP2: DP2 Downstream Wetland Inflow=1.56 cfs 0.172 af
Outflow=1.56 cfs 0.172 af

Reach DP3: DP3 Pleasant St CB Inflow=0.68 cfs 0.050 af
Outflow=0.68 cfs 0.050 af

Total Runoff Area = 3.937 ac Runoff Volume = 0.261 af Average Runoff Depth = 0.79"
71.17% Pervious = 2.802 ac 28.83% Impervious = 1.135 ac

Summary for Subcatchment 1S: To Wetland

Runoff = 0.44 cfs @ 12.11 hrs, Volume= 0.039 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.32"

	Area (sf)	CN	Description
	10,285	30	Woods, Good, HSG A
*	15,195	98	Impervious, HSG A
	5,155	39	>75% Grass cover, Good, HSG A
	30,635	65	Weighted Average
	15,440		50.40% Pervious Area
	15,195		49.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 2S: To Wetland

Runoff = 1.56 cfs @ 12.23 hrs, Volume= 0.172 af, Depth= 0.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.32"

	Area (sf)	CN	Description
*	20,825	98	Impervious, HSG A
	38,660	96	Gravel surface, HSG A
	38,470	39	>75% Grass cover, Good, HSG A
	16,930	30	Woods, Good, HSG A
	4,785	57	Woods/grass comb., Poor, HSG A
	119,670	67	Weighted Average
	98,845		82.60% Pervious Area
	20,825		17.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.0	100	0.0200	0.12		**Sheet Flow, A-B**
					Grass: Dense n= 0.240 P2= 3.32"
0.4	65	0.3750	3.06		**Shallow Concentrated Flow, B-C**
					Woodland Kv= 5.0 fps
14.4	165	Total			

Summary for Subcatchment 3S: Pleasant St

Runoff = 0.68 cfs @ 12.09 hrs, Volume= 0.050 af, Depth= 1.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.32"

	Area (sf)	CN	Description
*	13,415	98	Impervious, HSG A
	7,760	39	>75% Grass cover, Good, HSG A
	21,175	76	Weighted Average
	7,760		36.65% Pervious Area
	13,415		63.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach DP1: DP1 Upstream Wetland

Inflow Area = 0.703 ac, 49.60% Impervious, Inflow Depth = 0.66" for 2-yr event
Inflow = 0.44 cfs @ 12.11 hrs, Volume= 0.039 af
Outflow = 0.44 cfs @ 12.11 hrs, Volume= 0.039 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Reach DP2: DP2 Downstream Wetland

Inflow Area = 2.747 ac, 17.40% Impervious, Inflow Depth = 0.75" for 2-yr event
Inflow = 1.56 cfs @ 12.23 hrs, Volume= 0.172 af
Outflow = 1.56 cfs @ 12.23 hrs, Volume= 0.172 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Reach DP3: DP3 Pleasant St CB

Inflow Area = 0.486 ac, 63.35% Impervious, Inflow Depth = 1.24" for 2-yr event
Inflow = 0.68 cfs @ 12.09 hrs, Volume= 0.050 af
Outflow = 0.68 cfs @ 12.09 hrs, Volume= 0.050 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 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 1S: To Wetland Runoff Area=30,635 sf 49.60% Impervious Runoff Depth=1.59"
Tc=6.0 min CN=65 Runoff=1.25 cfs 0.093 af

Subcatchment 2S: To Wetland Runoff Area=119,670 sf 17.40% Impervious Runoff Depth=1.74"
Flow Length=165' Tc=14.4 min CN=67 Runoff=4.13 cfs 0.398 af

Subcatchment 3S: Pleasant St Runoff Area=21,175 sf 63.35% Impervious Runoff Depth=2.46"
Tc=6.0 min CN=76 Runoff=1.40 cfs 0.100 af

Reach DP1: DP1 Upstream Wetland Inflow=1.25 cfs 0.093 af
Outflow=1.25 cfs 0.093 af

Reach DP2: DP2 Downstream Wetland Inflow=4.13 cfs 0.398 af
Outflow=4.13 cfs 0.398 af

Reach DP3: DP3 Pleasant St CB Inflow=1.40 cfs 0.100 af
Outflow=1.40 cfs 0.100 af

Total Runoff Area = 3.937 ac Runoff Volume = 0.592 af Average Runoff Depth = 1.80"
71.17% Pervious = 2.802 ac 28.83% Impervious = 1.135 ac

Summary for Subcatchment 1S: To Wetland

Runoff = 1.25 cfs @ 12.10 hrs, Volume= 0.093 af, Depth= 1.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.91"

	Area (sf)	CN	Description
	10,285	30	Woods, Good, HSG A
*	15,195	98	Impervious, HSG A
	5,155	39	>75% Grass cover, Good, HSG A
	30,635	65	Weighted Average
	15,440		50.40% Pervious Area
	15,195		49.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 2S: To Wetland

Runoff = 4.13 cfs @ 12.21 hrs, Volume= 0.398 af, Depth= 1.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.91"

	Area (sf)	CN	Description
*	20,825	98	Impervious, HSG A
	38,660	96	Gravel surface, HSG A
	38,470	39	>75% Grass cover, Good, HSG A
	16,930	30	Woods, Good, HSG A
	4,785	57	Woods/grass comb., Poor, HSG A
	119,670	67	Weighted Average
	98,845		82.60% Pervious Area
	20,825		17.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.0	100	0.0200	0.12		**Sheet Flow, A-B**
					Grass: Dense n= 0.240 P2= 3.32"
0.4	65	0.3750	3.06		**Shallow Concentrated Flow, B-C**
					Woodland Kv= 5.0 fps
14.4	165	Total			

Summary for Subcatchment 3S: Pleasant St

Runoff = 1.40 cfs @ 12.09 hrs, Volume= 0.100 af, Depth= 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.91"

	Area (sf)	CN	Description
*	13,415	98	Impervious, HSG A
	7,760	39	>75% Grass cover, Good, HSG A
	21,175	76	Weighted Average
	7,760		36.65% Pervious Area
	13,415		63.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach DP1: DP1 Upstream Wetland

Inflow Area = 0.703 ac, 49.60% Impervious, Inflow Depth = 1.59" for 10-yr event
Inflow = 1.25 cfs @ 12.10 hrs, Volume= 0.093 af
Outflow = 1.25 cfs @ 12.10 hrs, Volume= 0.093 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Reach DP2: DP2 Downstream Wetland

Inflow Area = 2.747 ac, 17.40% Impervious, Inflow Depth = 1.74" for 10-yr event
Inflow = 4.13 cfs @ 12.21 hrs, Volume= 0.398 af
Outflow = 4.13 cfs @ 12.21 hrs, Volume= 0.398 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Reach DP3: DP3 Pleasant St CB

Inflow Area = 0.486 ac, 63.35% Impervious, Inflow Depth = 2.46" for 10-yr event
Inflow = 1.40 cfs @ 12.09 hrs, Volume= 0.100 af
Outflow = 1.40 cfs @ 12.09 hrs, Volume= 0.100 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 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 1S: To Wetland Runoff Area=30,635 sf 49.60% Impervious Runoff Depth=2.46"
Tc=6.0 min CN=65 Runoff=1.99 cfs 0.144 af

Subcatchment 2S: To Wetland Runoff Area=119,670 sf 17.40% Impervious Runoff Depth=2.64"
Flow Length=165' Tc=14.4 min CN=67 Runoff=6.44 cfs 0.605 af

Subcatchment 3S: Pleasant St Runoff Area=21,175 sf 63.35% Impervious Runoff Depth=3.51"
Tc=6.0 min CN=76 Runoff=2.00 cfs 0.142 af

Reach DP1: DP1 Upstream Wetland Inflow=1.99 cfs 0.144 af
Outflow=1.99 cfs 0.144 af

Reach DP2: DP2 Downstream Wetland Inflow=6.44 cfs 0.605 af
Outflow=6.44 cfs 0.605 af

Reach DP3: DP3 Pleasant St CB Inflow=2.00 cfs 0.142 af
Outflow=2.00 cfs 0.142 af

Total Runoff Area = 3.937 ac Runoff Volume = 0.892 af Average Runoff Depth = 2.72"
71.17% Pervious = 2.802 ac 28.83% Impervious = 1.135 ac

Summary for Subcatchment 1S: To Wetland

Runoff = 1.99 cfs @ 12.09 hrs, Volume= 0.144 af, Depth= 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=6.15"

	Area (sf)	CN	Description
	10,285	30	Woods, Good, HSG A
*	15,195	98	Impervious, HSG A
	5,155	39	>75% Grass cover, Good, HSG A
	30,635	65	Weighted Average
	15,440		50.40% Pervious Area
	15,195		49.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 2S: To Wetland

Runoff = 6.44 cfs @ 12.21 hrs, Volume= 0.605 af, Depth= 2.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=6.15"

	Area (sf)	CN	Description
*	20,825	98	Impervious, HSG A
	38,660	96	Gravel surface, HSG A
	38,470	39	>75% Grass cover, Good, HSG A
	16,930	30	Woods, Good, HSG A
	4,785	57	Woods/grass comb., Poor, HSG A
	119,670	67	Weighted Average
	98,845		82.60% Pervious Area
	20,825		17.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.0	100	0.0200	0.12		**Sheet Flow, A-B**
					Grass: Dense n= 0.240 P2= 3.32"
0.4	65	0.3750	3.06		**Shallow Concentrated Flow, B-C**
					Woodland Kv= 5.0 fps
14.4	165	Total			

Summary for Subcatchment 3S: Pleasant St

Runoff = 2.00 cfs @ 12.09 hrs, Volume= 0.142 af, Depth= 3.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=6.15"

	Area (sf)	CN	Description
*	13,415	98	Impervious, HSG A
	7,760	39	>75% Grass cover, Good, HSG A
	21,175	76	Weighted Average
	7,760		36.65% Pervious Area
	13,415		63.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach DP1: DP1 Upstream Wetland

Inflow Area = 0.703 ac, 49.60% Impervious, Inflow Depth = 2.46" for 25-yr event
Inflow = 1.99 cfs @ 12.09 hrs, Volume= 0.144 af
Outflow = 1.99 cfs @ 12.09 hrs, Volume= 0.144 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Reach DP2: DP2 Downstream Wetland

Inflow Area = 2.747 ac, 17.40% Impervious, Inflow Depth = 2.64" for 25-yr event
Inflow = 6.44 cfs @ 12.21 hrs, Volume= 0.605 af
Outflow = 6.44 cfs @ 12.21 hrs, Volume= 0.605 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Reach DP3: DP3 Pleasant St CB

Inflow Area = 0.486 ac, 63.35% Impervious, Inflow Depth = 3.51" for 25-yr event
Inflow = 2.00 cfs @ 12.09 hrs, Volume= 0.142 af
Outflow = 2.00 cfs @ 12.09 hrs, Volume= 0.142 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 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 1S: To Wetland Runoff Area=30,635 sf 49.60% Impervious Runoff Depth=4.43"
Tc=6.0 min CN=65 Runoff=3.65 cfs 0.260 af

Subcatchment 2S: To Wetland Runoff Area=119,670 sf 17.40% Impervious Runoff Depth=4.67"
Flow Length=165' Tc=14.4 min CN=67 Runoff=11.56 cfs 1.070 af

Subcatchment 3S: Pleasant St Runoff Area=21,175 sf 63.35% Impervious Runoff Depth=5.76"
Tc=6.0 min CN=76 Runoff=3.26 cfs 0.233 af

Reach DP1: DP1 Upstream Wetland Inflow=3.65 cfs 0.260 af
Outflow=3.65 cfs 0.260 af

Reach DP2: DP2 Downstream Wetland Inflow=11.56 cfs 1.070 af
Outflow=11.56 cfs 1.070 af

Reach DP3: DP3 Pleasant St CB Inflow=3.26 cfs 0.233 af
Outflow=3.26 cfs 0.233 af

Total Runoff Area = 3.937 ac Runoff Volume = 1.564 af Average Runoff Depth = 4.77"
71.17% Pervious = 2.802 ac 28.83% Impervious = 1.135 ac

Summary for Subcatchment 1S: To Wetland

Runoff = 3.65 cfs @ 12.09 hrs, Volume= 0.260 af, Depth= 4.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=8.66"

	Area (sf)	CN	Description
	10,285	30	Woods, Good, HSG A
*	15,195	98	Impervious, HSG A
	5,155	39	>75% Grass cover, Good, HSG A
	30,635	65	Weighted Average
	15,440		50.40% Pervious Area
	15,195		49.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 2S: To Wetland

Runoff = 11.56 cfs @ 12.20 hrs, Volume= 1.070 af, Depth= 4.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=8.66"

	Area (sf)	CN	Description
*	20,825	98	Impervious, HSG A
	38,660	96	Gravel surface, HSG A
	38,470	39	>75% Grass cover, Good, HSG A
	16,930	30	Woods, Good, HSG A
	4,785	57	Woods/grass comb., Poor, HSG A
	119,670	67	Weighted Average
	98,845		82.60% Pervious Area
	20,825		17.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.0	100	0.0200	0.12		**Sheet Flow, A-B**
					Grass: Dense n= 0.240 P2= 3.32"
0.4	65	0.3750	3.06		**Shallow Concentrated Flow, B-C**
					Woodland Kv= 5.0 fps
14.4	165	Total			

Summary for Subcatchment 3S: Pleasant St

Runoff = 3.26 cfs @ 12.09 hrs, Volume= 0.233 af, Depth= 5.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=8.66"

	Area (sf)	CN	Description
*	13,415	98	Impervious, HSG A
	7,760	39	>75% Grass cover, Good, HSG A
	21,175	76	Weighted Average
	7,760		36.65% Pervious Area
	13,415		63.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach DP1: DP1 Upstream Wetland

Inflow Area = 0.703 ac, 49.60% Impervious, Inflow Depth = 4.43" for 100-yr event
Inflow = 3.65 cfs @ 12.09 hrs, Volume= 0.260 af
Outflow = 3.65 cfs @ 12.09 hrs, Volume= 0.260 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Reach DP2: DP2 Downstream Wetland

Inflow Area = 2.747 ac, 17.40% Impervious, Inflow Depth = 4.67" for 100-yr event
Inflow = 11.56 cfs @ 12.20 hrs, Volume= 1.070 af
Outflow = 11.56 cfs @ 12.20 hrs, Volume= 1.070 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

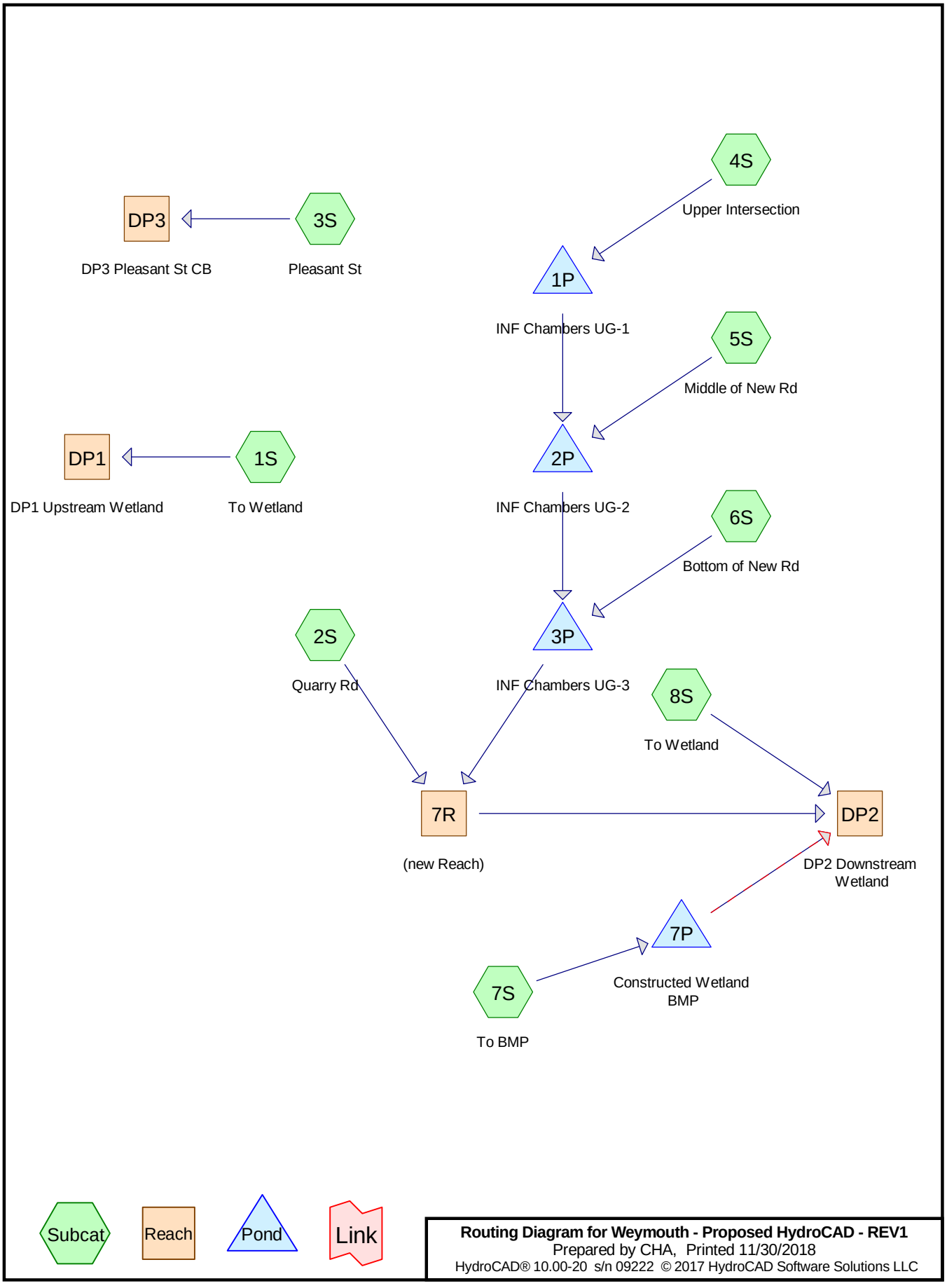
Summary for Reach DP3: DP3 Pleasant St CB

Inflow Area = 0.486 ac, 63.35% Impervious, Inflow Depth = 5.76" for 100-yr event
Inflow = 3.26 cfs @ 12.09 hrs, Volume= 0.233 af
Outflow = 3.26 cfs @ 12.09 hrs, Volume= 0.233 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Section 3.1.2

Post-Developed Stormwater



Routing Diagram for Weymouth - Proposed HydroCAD - REV1
Prepared by CHA, Printed 11/30/2018

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.356	39	>75% Grass cover, Good, HSG A (1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S)
0.560	96	Gravel surface, HSG A (2S, 7S)
1.458	98	Impervious, HSG A (1S, 2S, 3S, 4S, 5S, 6S, 7S)
0.271	30	Woods, Good, HSG A (1S, 8S)
0.293	57	Woods/grass comb., Poor, HSG A (1S, 8S)
3.939	**70**	**TOTAL AREA**

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 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 1S: To Wetland Runoff Area=21,820 sf 48.03% Impervious Runoff Depth=0.80"
Tc=6.0 min CN=68 Runoff=0.41 cfs 0.033 af

Subcatchment 2S: Quarry Rd Runoff Area=45,560 sf 21.35% Impervious Runoff Depth=0.62"
Flow Length=230' Tc=13.9 min CN=64 Runoff=0.45 cfs 0.054 af

Subcatchment 3S: Pleasant St Runoff Area=8,295 sf 84.21% Impervious Runoff Depth=2.19"
Tc=6.0 min CN=89 Runoff=0.49 cfs 0.035 af

Subcatchment 4S: Upper Intersection Runoff Area=18,455 sf 63.97% Impervious Runoff Depth=1.30"
Tc=6.0 min CN=77 Runoff=0.63 cfs 0.046 af

Subcatchment 5S: Middle of New Rd Runoff Area=11,180 sf 73.79% Impervious Runoff Depth=1.71"
Tc=6.0 min CN=83 Runoff=0.51 cfs 0.037 af

Subcatchment 6S: Bottom of New Rd Runoff Area=2,875 sf 93.22% Impervious Runoff Depth=2.66"
Tc=6.0 min CN=94 Runoff=0.20 cfs 0.015 af

Subcatchment 7S: To BMP Runoff Area=38,485 sf 35.29% Impervious Runoff Depth=1.56"
Flow Length=190' Slope=0.0100 '/' Tc=10.1 min CN=81 Runoff=1.40 cfs 0.115 af

Subcatchment 8S: To Wetland Runoff Area=24,895 sf 0.00% Impervious Runoff Depth=0.03"
Flow Length=165' Tc=14.4 min CN=43 Runoff=0.00 cfs 0.002 af

Reach 7R: (new Reach) Inflow=0.45 cfs 0.054 af
Outflow=0.45 cfs 0.054 af

Reach DP1: DP1 Upstream Wetland Inflow=0.41 cfs 0.033 af
Outflow=0.41 cfs 0.033 af

Reach DP2: DP2 Downstream Wetland Inflow=0.98 cfs 0.170 af
Outflow=0.98 cfs 0.170 af

Reach DP3: DP3 Pleasant St CB Inflow=0.49 cfs 0.035 af
Outflow=0.49 cfs 0.035 af

Pond 1P: INF Chambers UG-1 Peak Elev=100.41' Storage=844 cf Inflow=0.63 cfs 0.046 af
Discarded=0.05 cfs 0.046 af Primary=0.00 cfs 0.000 af Outflow=0.05 cfs 0.046 af

Pond 2P: INF Chambers UG-2 Peak Elev=96.58' Storage=737 cf Inflow=0.51 cfs 0.037 af
Discarded=0.03 cfs 0.037 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.037 af

Pond 3P: INF Chambers UG-3 Peak Elev=96.33' Storage=263 cf Inflow=0.20 cfs 0.015 af
Discarded=0.01 cfs 0.015 af Primary=0.00 cfs 0.000 af Outflow=0.01 cfs 0.015 af

Pond 7P: Constructed Wetland BMP Peak Elev=94.63' Storage=1,372 cf Inflow=1.40 cfs 0.115 af
Primary=0.58 cfs 0.115 af Secondary=0.00 cfs 0.000 af Outflow=0.58 cfs 0.115 af

Total Runoff Area = 3.939 ac Runoff Volume = 0.335 af Average Runoff Depth = 1.02"
62.98% Pervious = 2.481 ac 37.02% Impervious = 1.458 ac

Summary for Subcatchment 1S: To Wetland

Runoff = 0.41 cfs @ 12.10 hrs, Volume= 0.033 af, Depth= 0.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.32"

	Area (sf)	CN	Description
	2,540	30	Woods, Good, HSG A
	2,500	57	Woods/grass comb., Poor, HSG A
	6,300	39	>75% Grass cover, Good, HSG A
*	10,480	98	Impervious, HSG A
	21,820	68	Weighted Average
	11,340		51.97% Pervious Area
	10,480		48.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 2S: Quarry Rd

Runoff = 0.45 cfs @ 12.23 hrs, Volume= 0.054 af, Depth= 0.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.32"

	Area (sf)	CN	Description
*	9,725	98	Impervious, HSG A
	10,070	96	Gravel surface, HSG A
	25,765	39	>75% Grass cover, Good, HSG A
	45,560	64	Weighted Average
	35,835		78.65% Pervious Area
	9,725		21.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	90	0.0200	0.12		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.32"
0.5	80	0.1375	2.60		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.5	60	0.0170	2.10		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
13.9	230	Total			

Summary for Subcatchment 3S: Pleasant St

Runoff = 0.49 cfs @ 12.09 hrs, Volume= 0.035 af, Depth= 2.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.32"

	Area (sf)	CN	Description
*	6,985	98	Impervious, HSG A
	1,310	39	>75% Grass cover, Good, HSG A
	8,295	89	Weighted Average
	1,310		15.79% Pervious Area
	6,985		84.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4S: Upper Intersection

Runoff = 0.63 cfs @ 12.09 hrs, Volume= 0.046 af, Depth= 1.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.32"

	Area (sf)	CN	Description
*	11,805	98	Impervious, HSG A
	6,650	39	>75% Grass cover, Good, HSG A
	18,455	77	Weighted Average
	6,650		36.03% Pervious Area
	11,805		63.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 5S: Middle of New Rd

Runoff = 0.51 cfs @ 12.09 hrs, Volume= 0.037 af, Depth= 1.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.32"

	Area (sf)	CN	Description
*	8,250	98	Impervious, HSG A
	2,930	39	>75% Grass cover, Good, HSG A
	11,180	83	Weighted Average
	2,930		26.21% Pervious Area
	8,250		73.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 6S: Bottom of New Rd

Runoff = 0.20 cfs @ 12.08 hrs, Volume= 0.015 af, Depth= 2.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.32"

	Area (sf)	CN	Description
*	2,680	98	Impervious, HSG A
	195	39	>75% Grass cover, Good, HSG A
	2,875	94	Weighted Average
	195		6.78% Pervious Area
	2,680		93.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 7S: To BMP

Runoff = 1.40 cfs @ 12.14 hrs, Volume= 0.115 af, Depth= 1.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.32"

	Area (sf)	CN	Description
*	13,580	98	Impervious, HSG A
	14,335	96	Gravel surface, HSG A
	10,570	39	>75% Grass cover, Good, HSG A
	38,485	81	Weighted Average
	24,905		64.71% Pervious Area
	13,580		35.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	100	0.0100	0.32		**Sheet Flow, A-B**
					Fallow n= 0.050 P2= 3.32"
4.8	90	0.0100	0.31		**Sheet Flow, B-C**
					Fallow n= 0.050 P2= 3.32"
10.1	190	Total			

Summary for Subcatchment 8S: To Wetland

Runoff = 0.00 cfs @ 16.85 hrs, Volume= 0.002 af, Depth= 0.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.32"

Area (sf)	CN	Description
5,335	39	>75% Grass cover, Good, HSG A
9,285	30	Woods, Good, HSG A
10,275	57	Woods/grass comb., Poor, HSG A
24,895	43	Weighted Average
24,895		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.0	100	0.0200	0.12		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.32"
0.4	65	0.3750	3.06		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
14.4	165	Total			

Summary for Reach 7R: (new Reach)

Inflow Area = 1.792 ac, 41.58% Impervious, Inflow Depth = 0.36" for 2-yr event
Inflow = 0.45 cfs @ 12.23 hrs, Volume= 0.054 af
Outflow = 0.45 cfs @ 12.23 hrs, Volume= 0.054 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Reach DP1: DP1 Upstream Wetland

Inflow Area = 0.501 ac, 48.03% Impervious, Inflow Depth = 0.80" for 2-yr event
Inflow = 0.41 cfs @ 12.10 hrs, Volume= 0.033 af
Outflow = 0.41 cfs @ 12.10 hrs, Volume= 0.033 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Reach DP2: DP2 Downstream Wetland

Inflow Area = 3.247 ac, 32.55% Impervious, Inflow Depth = 0.63" for 2-yr event
Inflow = 0.98 cfs @ 12.28 hrs, Volume= 0.170 af
Outflow = 0.98 cfs @ 12.28 hrs, Volume= 0.170 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Reach DP3: DP3 Pleasant St CB

Inflow Area = 0.190 ac, 84.21% Impervious, Inflow Depth = 2.19" for 2-yr event
Inflow = 0.49 cfs @ 12.09 hrs, Volume= 0.035 af
Outflow = 0.49 cfs @ 12.09 hrs, Volume= 0.035 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: INF Chambers UG-1

Inflow Area = 0.424 ac, 63.97% Impervious, Inflow Depth = 1.30" for 2-yr event
Inflow = 0.63 cfs @ 12.09 hrs, Volume= 0.046 af
Outflow = 0.05 cfs @ 11.80 hrs, Volume= 0.046 af, Atten= 92%, Lag= 0.0 min
Discarded = 0.05 cfs @ 11.80 hrs, Volume= 0.046 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 100.41' @ 13.85 hrs Surf.Area= 2,136 sf Storage= 844 cf

Plug-Flow detention time= 166.9 min calculated for 0.046 af (100% of inflow)
Center-of-Mass det. time= 166.9 min (1,017.2 - 850.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.50'	2,693 cf	**51.42'W x 41.55'L x 5.50'H Field A** 11,750 cf Overall - 4,057 cf Embedded = 7,693 cf x 35.0% Voids
#2A	100.25'	4,057 cf	**ADS_StormTech MC-3500 d +Cap** x 35 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 7 Rows of 5 Chambers Cap Storage= +14.9 cf x 2 x 7 rows = 208.6 cf
#3	100.25'	85 cf	**4.00'D x 6.75'H Vertical Cone/Cylinder** -Impervious
		6,834 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	99.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	106.50'	**2.0' long Weir X 2.00** 2 End Contraction(s)

Discarded OutFlow Max=0.05 cfs @ 11.80 hrs HW=99.58' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=99.50' (Free Discharge)
2=Weir (Controls 0.00 cfs)

Summary for Pond 2P: INF Chambers UG-2

Inflow Area = 0.680 ac, 67.67% Impervious, Inflow Depth = 0.64" for 2-yr event
Inflow = 0.51 cfs @ 12.09 hrs, Volume= 0.037 af
Outflow = 0.03 cfs @ 11.66 hrs, Volume= 0.037 af, Atten= 94%, Lag= 0.0 min
Discarded = 0.03 cfs @ 11.66 hrs, Volume= 0.037 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 96.58' @ 14.07 hrs Surf.Area= 1,399 sf Storage= 737 cf

Plug-Flow detention time= 220.8 min calculated for 0.037 af (100% of inflow)
Center-of-Mass det. time= 220.8 min (1,052.0 - 831.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	95.50'	1,812 cf	**51.42'W x 27.21'L x 5.50'H Field A** 7,695 cf Overall - 2,518 cf Embedded = 5,177 cf x 35.0% Voids
#2A	96.25'	2,518 cf	**ADS_StormTech MC-3500 d +Cap** x 21 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 7 Rows of 3 Chambers Cap Storage= +14.9 cf x 2 x 7 rows = 208.6 cf
#3	96.25'	85 cf	**4.00'D x 6.75'H Vertical Cone/Cylinder** -Impervious
		4,414 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	95.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	102.50'	**2.0' long Weir X 2.00** 2 End Contraction(s)

Discarded OutFlow Max=0.03 cfs @ 11.66 hrs HW=95.58' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=95.50' (Free Discharge)
↑—**2=Weir** (Controls 0.00 cfs)

Summary for Pond 3P: INF Chambers UG-3

Inflow Area = 0.746 ac, 69.93% Impervious, Inflow Depth = 0.24" for 2-yr event
Inflow = 0.20 cfs @ 12.08 hrs, Volume= 0.015 af
Outflow = 0.01 cfs @ 11.41 hrs, Volume= 0.015 af, Atten= 93%, Lag= 0.0 min
Discarded = 0.01 cfs @ 11.41 hrs, Volume= 0.015 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 96.33' @ 13.24 hrs Surf.Area= 621 sf Storage= 263 cf

Plug-Flow detention time= 150.0 min calculated for 0.015 af (100% of inflow)
Center-of-Mass det. time= 150.0 min (935.9 - 785.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	95.50'	535 cf	**34.75'W x 17.86'L x 3.50'H Field A** 2,172 cf Overall - 643 cf Embedded = 1,529 cf x 35.0% Voids
#2A	96.00'	643 cf	**ADS_StormTech SC-740 +Cap** x 14 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 7 Rows of 2 Chambers
#3	96.00'	63 cf	**4.00'D x 5.00'H Vertical Cone/Cylinder** -Impervious
		1,241 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	95.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	100.50'	**2.0' long Weir X 2.00** 2 End Contraction(s)

Discarded OutFlow Max=0.01 cfs @ 11.41 hrs HW=95.56' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=95.50' (Free Discharge)
↑—**2=Weir** (Controls 0.00 cfs)

Summary for Pond 7P: Constructed Wetland BMP

Inflow Area = 0.883 ac, 35.29% Impervious, Inflow Depth = 1.56" for 2-yr event
Inflow = 1.40 cfs @ 12.14 hrs, Volume= 0.115 af
Outflow = 0.58 cfs @ 12.46 hrs, Volume= 0.115 af, Atten= 59%, Lag= 19.0 min
Primary = 0.58 cfs @ 12.46 hrs, Volume= 0.115 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 94.63' @ 12.46 hrs Surf.Area= 2,716 sf Storage= 1,372 cf

Plug-Flow detention time= 62.1 min calculated for 0.115 af (100% of inflow)
Center-of-Mass det. time= 61.4 min (902.9 - 841.5)

Volume	Invert	Avail.Storage	Storage Description
#1	94.00'	3,681 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
94.00	1,710	275.0	0	0	1,710
95.00	3,430	365.0	2,521	2,521	6,305
95.30	4,325	385.0	1,161	3,681	7,504

Device	Routing	Invert	Outlet Devices
#1	Primary	94.00'	**12.0" Round Culvert** L= 10.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 94.00' / 93.95' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	94.00'	**6.0" Vert. Orifice/Grate** C= 0.600

#3	Device 1	94.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Secondary	94.75'	**6.0' long (Profile 6) Broad-Crested Rectangular Weir**
			Head (feet) 0.49 0.98 1.48
			Coef. (English) 3.12 3.41 3.59

Primary OutFlow Max=0.58 cfs @ 12.46 hrs HW=94.63' (Free Discharge)
└─**1=Culvert** (Passes 0.58 cfs of 0.97 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.58 cfs @ 2.95 fps)
  └─**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=94.00' (Free Discharge)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 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 1S: To Wetland Runoff Area=21,820 sf 48.03% Impervious Runoff Depth=1.82"
Tc=6.0 min CN=68 Runoff=1.03 cfs 0.076 af

Subcatchment 2S: Quarry Rd Runoff Area=45,560 sf 21.35% Impervious Runoff Depth=1.52"
Flow Length=230' Tc=13.9 min CN=64 Runoff=1.35 cfs 0.133 af

Subcatchment 3S: Pleasant St Runoff Area=8,295 sf 84.21% Impervious Runoff Depth=3.69"
Tc=6.0 min CN=89 Runoff=0.80 cfs 0.058 af

Subcatchment 4S: Upper Intersection Runoff Area=18,455 sf 63.97% Impervious Runoff Depth=2.55"
Tc=6.0 min CN=77 Runoff=1.27 cfs 0.090 af

Subcatchment 5S: Middle of New Rd Runoff Area=11,180 sf 73.79% Impervious Runoff Depth=3.09"
Tc=6.0 min CN=83 Runoff=0.93 cfs 0.066 af

Subcatchment 6S: Bottom of New Rd Runoff Area=2,875 sf 93.22% Impervious Runoff Depth=4.22"
Tc=6.0 min CN=94 Runoff=0.30 cfs 0.023 af

Subcatchment 7S: To BMP Runoff Area=38,485 sf 35.29% Impervious Runoff Depth=2.91"
Flow Length=190' Slope=0.0100 '/' Tc=10.1 min CN=81 Runoff=2.62 cfs 0.214 af

Subcatchment 8S: To Wetland Runoff Area=24,895 sf 0.00% Impervious Runoff Depth=0.33"
Flow Length=165' Tc=14.4 min CN=43 Runoff=0.06 cfs 0.016 af

Reach 7R: (new Reach) Inflow=1.35 cfs 0.133 af
Outflow=1.35 cfs 0.133 af

Reach DP1: DP1 Upstream Wetland Inflow=1.03 cfs 0.076 af
Outflow=1.03 cfs 0.076 af

Reach DP2: DP2 Downstream Wetland Inflow=3.23 cfs 0.362 af
Outflow=3.23 cfs 0.362 af

Reach DP3: DP3 Pleasant St CB Inflow=0.80 cfs 0.058 af
Outflow=0.80 cfs 0.058 af

Pond 1P: INF Chambers UG-1 Peak Elev=101.19' Storage=2,190 cf Inflow=1.27 cfs 0.090 af
Discarded=0.05 cfs 0.090 af Primary=0.00 cfs 0.000 af Outflow=0.05 cfs 0.090 af

Pond 2P: INF Chambers UG-2 Peak Elev=97.42' Storage=1,650 cf Inflow=0.93 cfs 0.066 af
Discarded=0.03 cfs 0.066 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.066 af

Pond 3P: INF Chambers UG-3 Peak Elev=96.82' Storage=487 cf Inflow=0.30 cfs 0.023 af
Discarded=0.01 cfs 0.023 af Primary=0.00 cfs 0.000 af Outflow=0.01 cfs 0.023 af

Pond 7P: Constructed Wetland BMP Peak Elev=94.86' Storage=2,060 cf Inflow=2.62 cfs 0.214 af
Primary=1.21 cfs 0.199 af Secondary=0.68 cfs 0.015 af Outflow=1.89 cfs 0.214 af

Total Runoff Area = 3.939 ac Runoff Volume = 0.676 af Average Runoff Depth = 2.06"
62.98% Pervious = 2.481 ac 37.02% Impervious = 1.458 ac

Summary for Subcatchment 1S: To Wetland

Runoff = 1.03 cfs @ 12.09 hrs, Volume= 0.076 af, Depth= 1.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.91"

	Area (sf)	CN	Description
	2,540	30	Woods, Good, HSG A
	2,500	57	Woods/grass comb., Poor, HSG A
	6,300	39	>75% Grass cover, Good, HSG A
*	10,480	98	Impervious, HSG A
	21,820	68	Weighted Average
	11,340		51.97% Pervious Area
	10,480		48.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 2S: Quarry Rd

Runoff = 1.35 cfs @ 12.21 hrs, Volume= 0.133 af, Depth= 1.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.91"

	Area (sf)	CN	Description
*	9,725	98	Impervious, HSG A
	10,070	96	Gravel surface, HSG A
	25,765	39	>75% Grass cover, Good, HSG A
	45,560	64	Weighted Average
	35,835		78.65% Pervious Area
	9,725		21.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	90	0.0200	0.12		**Sheet Flow, A-B**
					Grass: Dense n= 0.240 P2= 3.32"
0.5	80	0.1375	2.60		**Shallow Concentrated Flow, B-C**
					Short Grass Pasture Kv= 7.0 fps
0.5	60	0.0170	2.10		**Shallow Concentrated Flow, C-D**
					Unpaved Kv= 16.1 fps
13.9	230	Total			

Summary for Subcatchment 3S: Pleasant St

Runoff = 0.80 cfs @ 12.09 hrs, Volume= 0.058 af, Depth= 3.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.91"

	Area (sf)	CN	Description
*	6,985	98	Impervious, HSG A
	1,310	39	>75% Grass cover, Good, HSG A
	8,295	89	Weighted Average
	1,310		15.79% Pervious Area
	6,985		84.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4S: Upper Intersection

Runoff = 1.27 cfs @ 12.09 hrs, Volume= 0.090 af, Depth= 2.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.91"

	Area (sf)	CN	Description
*	11,805	98	Impervious, HSG A
	6,650	39	>75% Grass cover, Good, HSG A
	18,455	77	Weighted Average
	6,650		36.03% Pervious Area
	11,805		63.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 5S: Middle of New Rd

Runoff = 0.93 cfs @ 12.09 hrs, Volume= 0.066 af, Depth= 3.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.91"

	Area (sf)	CN	Description
*	8,250	98	Impervious, HSG A
	2,930	39	>75% Grass cover, Good, HSG A
	11,180	83	Weighted Average
	2,930		26.21% Pervious Area
	8,250		73.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 6S: Bottom of New Rd

Runoff = 0.30 cfs @ 12.08 hrs, Volume= 0.023 af, Depth= 4.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.91"

	Area (sf)	CN	Description
*	2,680	98	Impervious, HSG A
	195	39	>75% Grass cover, Good, HSG A
	2,875	94	Weighted Average
	195		6.78% Pervious Area
	2,680		93.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 7S: To BMP

Runoff = 2.62 cfs @ 12.14 hrs, Volume= 0.214 af, Depth= 2.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.91"

	Area (sf)	CN	Description
*	13,580	98	Impervious, HSG A
	14,335	96	Gravel surface, HSG A
	10,570	39	>75% Grass cover, Good, HSG A
	38,485	81	Weighted Average
	24,905		64.71% Pervious Area
	13,580		35.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	100	0.0100	0.32		**Sheet Flow, A-B**
					Fallow n= 0.050 P2= 3.32"
4.8	90	0.0100	0.31		**Sheet Flow, B-C**
					Fallow n= 0.050 P2= 3.32"
10.1	190	Total			

Summary for Subcatchment 8S: To Wetland

Runoff = 0.06 cfs @ 12.50 hrs, Volume= 0.016 af, Depth= 0.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.91"

Area (sf)	CN	Description
5,335	39	>75% Grass cover, Good, HSG A
9,285	30	Woods, Good, HSG A
10,275	57	Woods/grass comb., Poor, HSG A
24,895	43	Weighted Average
24,895		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.0	100	0.0200	0.12		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.32"
0.4	65	0.3750	3.06		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
14.4	165	Total			

Summary for Reach 7R: (new Reach)

Inflow Area = 1.792 ac, 41.58% Impervious, Inflow Depth = 0.89" for 10-yr event
Inflow = 1.35 cfs @ 12.21 hrs, Volume= 0.133 af
Outflow = 1.35 cfs @ 12.21 hrs, Volume= 0.133 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Reach DP1: DP1 Upstream Wetland

Inflow Area = 0.501 ac, 48.03% Impervious, Inflow Depth = 1.82" for 10-yr event
Inflow = 1.03 cfs @ 12.09 hrs, Volume= 0.076 af
Outflow = 1.03 cfs @ 12.09 hrs, Volume= 0.076 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Reach DP2: DP2 Downstream Wetland

Inflow Area = 3.247 ac, 32.55% Impervious, Inflow Depth = 1.34" for 10-yr event
Inflow = 3.23 cfs @ 12.24 hrs, Volume= 0.362 af
Outflow = 3.23 cfs @ 12.24 hrs, Volume= 0.362 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Reach DP3: DP3 Pleasant St CB

Inflow Area = 0.190 ac, 84.21% Impervious, Inflow Depth = 3.69" for 10-yr event
Inflow = 0.80 cfs @ 12.09 hrs, Volume= 0.058 af
Outflow = 0.80 cfs @ 12.09 hrs, Volume= 0.058 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: INF Chambers UG-1

Inflow Area = 0.424 ac, 63.97% Impervious, Inflow Depth = 2.55" for 10-yr event
Inflow = 1.27 cfs @ 12.09 hrs, Volume= 0.090 af
Outflow = 0.05 cfs @ 11.33 hrs, Volume= 0.090 af, Atten= 96%, Lag= 0.0 min
Discarded = 0.05 cfs @ 11.33 hrs, Volume= 0.090 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 101.19' @ 15.74 hrs Surf.Area= 2,136 sf Storage= 2,190 cf

Plug-Flow detention time= 441.9 min calculated for 0.090 af (100% of inflow)
Center-of-Mass det. time= 442.0 min (1,272.5 - 830.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.50'	2,693 cf	**51.42'W x 41.55'L x 5.50'H Field A** 11,750 cf Overall - 4,057 cf Embedded = 7,693 cf x 35.0% Voids
#2A	100.25'	4,057 cf	**ADS_StormTech MC-3500 d +Cap** x 35 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 7 Rows of 5 Chambers Cap Storage= +14.9 cf x 2 x 7 rows = 208.6 cf
#3	100.25'	85 cf	**4.00'D x 6.75'H Vertical Cone/Cylinder** -Impervious
		6,834 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	99.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	106.50'	**2.0' long Weir X 2.00** 2 End Contraction(s)

Discarded OutFlow Max=0.05 cfs @ 11.33 hrs HW=99.58' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=99.50' (Free Discharge)
2=Weir (Controls 0.00 cfs)

Summary for Pond 2P: INF Chambers UG-2

Inflow Area = 0.680 ac, 67.67% Impervious, Inflow Depth = 1.17" for 10-yr event
Inflow = 0.93 cfs @ 12.09 hrs, Volume= 0.066 af
Outflow = 0.03 cfs @ 10.89 hrs, Volume= 0.066 af, Atten= 96%, Lag= 0.0 min
Discarded = 0.03 cfs @ 10.89 hrs, Volume= 0.066 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 97.42' @ 15.79 hrs Surf.Area= 1,399 sf Storage= 1,650 cf

Plug-Flow detention time= 489.6 min calculated for 0.066 af (100% of inflow)
Center-of-Mass det. time= 489.6 min (1,303.8 - 814.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	95.50'	1,812 cf	**51.42'W x 27.21'L x 5.50'H Field A** 7,695 cf Overall - 2,518 cf Embedded = 5,177 cf x 35.0% Voids
#2A	96.25'	2,518 cf	**ADS_StormTech MC-3500 d +Cap** x 21 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 7 Rows of 3 Chambers Cap Storage= +14.9 cf x 2 x 7 rows = 208.6 cf
#3	96.25'	85 cf	**4.00'D x 6.75'H Vertical Cone/Cylinder** -Impervious
		4,414 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	95.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	102.50'	**2.0' long Weir X 2.00** 2 End Contraction(s)

Discarded OutFlow Max=0.03 cfs @ 10.89 hrs HW=95.58' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=95.50' (Free Discharge)
↑—**2=Weir** (Controls 0.00 cfs)

Summary for Pond 3P: INF Chambers UG-3

Inflow Area = 0.746 ac, 69.93% Impervious, Inflow Depth = 0.37" for 10-yr event
Inflow = 0.30 cfs @ 12.08 hrs, Volume= 0.023 af
Outflow = 0.01 cfs @ 10.55 hrs, Volume= 0.023 af, Atten= 95%, Lag= 0.0 min
Discarded = 0.01 cfs @ 10.55 hrs, Volume= 0.023 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 96.82' @ 14.38 hrs Surf.Area= 621 sf Storage= 487 cf

Plug-Flow detention time= 293.0 min calculated for 0.023 af (100% of inflow)
Center-of-Mass det. time= 293.0 min (1,067.0 - 774.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	95.50'	535 cf	**34.75'W x 17.86'L x 3.50'H Field A** 2,172 cf Overall - 643 cf Embedded = 1,529 cf x 35.0% Voids
#2A	96.00'	643 cf	**ADS_StormTech SC-740 +Cap** x 14 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 7 Rows of 2 Chambers
#3	96.00'	63 cf	**4.00'D x 5.00'H Vertical Cone/Cylinder** -Impervious
		1,241 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	95.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	100.50'	**2.0' long Weir X 2.00** 2 End Contraction(s)

Discarded OutFlow Max=0.01 cfs @ 10.55 hrs HW=95.56' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=95.50' (Free Discharge)
↑—**2=Weir** (Controls 0.00 cfs)

Summary for Pond 7P: Constructed Wetland BMP

Inflow Area = 0.883 ac, 35.29% Impervious, Inflow Depth = 2.91" for 10-yr event
Inflow = 2.62 cfs @ 12.14 hrs, Volume= 0.214 af
Outflow = 1.89 cfs @ 12.25 hrs, Volume= 0.214 af, Atten= 28%, Lag= 6.6 min
Primary = 1.21 cfs @ 12.25 hrs, Volume= 0.199 af
Secondary = 0.68 cfs @ 12.25 hrs, Volume= 0.015 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 94.86' @ 12.25 hrs Surf.Area= 3,153 sf Storage= 2,060 cf

Plug-Flow detention time= 48.4 min calculated for 0.214 af (100% of inflow)
Center-of-Mass det. time= 48.0 min (871.7 - 823.6)

Volume	Invert	Avail.Storage	Storage Description
#1	94.00'	3,681 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
94.00	1,710	275.0	0	0	1,710
95.00	3,430	365.0	2,521	2,521	6,305
95.30	4,325	385.0	1,161	3,681	7,504

Device	Routing	Invert	Outlet Devices
#1	Primary	94.00'	**12.0" Round Culvert** L= 10.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 94.00' / 93.95' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	94.00'	**6.0" Vert. Orifice/Grate** C= 0.600

#3	Device 1	94.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Secondary	94.75'	**6.0' long (Profile 6) Broad-Crested Rectangular Weir**
			Head (feet) 0.49 0.98 1.48
			Coef. (English) 3.12 3.41 3.59

Primary OutFlow Max=1.21 cfs @ 12.25 hrs HW=94.86' (Free Discharge)
└─**1=Culvert** (Passes 1.21 cfs of 1.67 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.74 cfs @ 3.76 fps)
  └─**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.47 cfs @ 1.08 fps)

Secondary OutFlow Max=0.68 cfs @ 12.25 hrs HW=94.86' (Free Discharge)
└─**4=Broad-Crested Rectangular Weir** (Weir Controls 0.68 cfs @ 1.03 fps)

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 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 1S: To Wetland Runoff Area=21,820 sf 48.03% Impervious Runoff Depth=2.74"
Tc=6.0 min CN=68 Runoff=1.59 cfs 0.114 af

Subcatchment 2S: Quarry Rd Runoff Area=45,560 sf 21.35% Impervious Runoff Depth=2.37"
Flow Length=230' Tc=13.9 min CN=64 Runoff=2.19 cfs 0.207 af

Subcatchment 3S: Pleasant St Runoff Area=8,295 sf 84.21% Impervious Runoff Depth=4.88"
Tc=6.0 min CN=89 Runoff=1.04 cfs 0.077 af

Subcatchment 4S: Upper Intersection Runoff Area=18,455 sf 63.97% Impervious Runoff Depth=3.61"
Tc=6.0 min CN=77 Runoff=1.79 cfs 0.127 af

Subcatchment 5S: Middle of New Rd Runoff Area=11,180 sf 73.79% Impervious Runoff Depth=4.23"
Tc=6.0 min CN=83 Runoff=1.26 cfs 0.090 af

Subcatchment 6S: Bottom of New Rd Runoff Area=2,875 sf 93.22% Impervious Runoff Depth=5.45"
Tc=6.0 min CN=94 Runoff=0.39 cfs 0.030 af

Subcatchment 7S: To BMP Runoff Area=38,485 sf 35.29% Impervious Runoff Depth=4.02"
Flow Length=190' Slope=0.0100 '/' Tc=10.1 min CN=81 Runoff=3.60 cfs 0.296 af

Subcatchment 8S: To Wetland Runoff Area=24,895 sf 0.00% Impervious Runoff Depth=0.73"
Flow Length=165' Tc=14.4 min CN=43 Runoff=0.21 cfs 0.035 af

Reach 7R: (new Reach) Inflow=2.19 cfs 0.207 af
Outflow=2.19 cfs 0.207 af

Reach DP1: DP1 Upstream Wetland Inflow=1.59 cfs 0.114 af
Outflow=1.59 cfs 0.114 af

Reach DP2: DP2 Downstream Wetland Inflow=5.54 cfs 0.537 af
Outflow=5.54 cfs 0.537 af

Reach DP3: DP3 Pleasant St CB Inflow=1.04 cfs 0.077 af
Outflow=1.04 cfs 0.077 af

Pond 1P: INF Chambers UG-1 Peak Elev=101.96' Storage=3,459 cf Inflow=1.79 cfs 0.127 af
Discarded=0.05 cfs 0.127 af Primary=0.00 cfs 0.000 af Outflow=0.05 cfs 0.127 af

Pond 2P: INF Chambers UG-2 Peak Elev=98.22' Storage=2,477 cf Inflow=1.26 cfs 0.090 af
Discarded=0.03 cfs 0.090 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.090 af

Pond 3P: INF Chambers UG-3 Peak Elev=97.29' Storage=689 cf Inflow=0.39 cfs 0.030 af
Discarded=0.01 cfs 0.030 af Primary=0.00 cfs 0.000 af Outflow=0.01 cfs 0.030 af

Pond 7P: Constructed Wetland BMP Peak Elev=94.93' Storage=2,283 cf Inflow=3.60 cfs 0.296 af
Primary=1.76 cfs 0.260 af Secondary=1.42 cfs 0.036 af Outflow=3.19 cfs 0.296 af

Total Runoff Area = 3.939 ac Runoff Volume = 0.977 af Average Runoff Depth = 2.98"
62.98% Pervious = 2.481 ac 37.02% Impervious = 1.458 ac

Summary for Subcatchment 1S: To Wetland

Runoff = 1.59 cfs @ 12.09 hrs, Volume= 0.114 af, Depth= 2.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=6.15"

	Area (sf)	CN	Description
	2,540	30	Woods, Good, HSG A
	2,500	57	Woods/grass comb., Poor, HSG A
	6,300	39	>75% Grass cover, Good, HSG A
*	10,480	98	Impervious, HSG A
	21,820	68	Weighted Average
	11,340		51.97% Pervious Area
	10,480		48.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 2S: Quarry Rd

Runoff = 2.19 cfs @ 12.20 hrs, Volume= 0.207 af, Depth= 2.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=6.15"

	Area (sf)	CN	Description
*	9,725	98	Impervious, HSG A
	10,070	96	Gravel surface, HSG A
	25,765	39	>75% Grass cover, Good, HSG A
	45,560	64	Weighted Average
	35,835		78.65% Pervious Area
	9,725		21.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	90	0.0200	0.12		**Sheet Flow, A-B**
					Grass: Dense n= 0.240 P2= 3.32"
0.5	80	0.1375	2.60		**Shallow Concentrated Flow, B-C**
					Short Grass Pasture Kv= 7.0 fps
0.5	60	0.0170	2.10		**Shallow Concentrated Flow, C-D**
					Unpaved Kv= 16.1 fps
13.9	230	Total			

Summary for Subcatchment 3S: Pleasant St

Runoff = 1.04 cfs @ 12.08 hrs, Volume= 0.077 af, Depth= 4.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=6.15"

	Area (sf)	CN	Description
*	6,985	98	Impervious, HSG A
	1,310	39	>75% Grass cover, Good, HSG A
	8,295	89	Weighted Average
	1,310		15.79% Pervious Area
	6,985		84.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4S: Upper Intersection

Runoff = 1.79 cfs @ 12.09 hrs, Volume= 0.127 af, Depth= 3.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=6.15"

	Area (sf)	CN	Description
*	11,805	98	Impervious, HSG A
	6,650	39	>75% Grass cover, Good, HSG A
	18,455	77	Weighted Average
	6,650		36.03% Pervious Area
	11,805		63.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 5S: Middle of New Rd

Runoff = 1.26 cfs @ 12.09 hrs, Volume= 0.090 af, Depth= 4.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=6.15"

	Area (sf)	CN	Description
*	8,250	98	Impervious, HSG A
	2,930	39	>75% Grass cover, Good, HSG A
	11,180	83	Weighted Average
	2,930		26.21% Pervious Area
	8,250		73.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 6S: Bottom of New Rd

Runoff = 0.39 cfs @ 12.08 hrs, Volume= 0.030 af, Depth= 5.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=6.15"

	Area (sf)	CN	Description
*	2,680	98	Impervious, HSG A
	195	39	>75% Grass cover, Good, HSG A
	2,875	94	Weighted Average
	195		6.78% Pervious Area
	2,680		93.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 7S: To BMP

Runoff = 3.60 cfs @ 12.14 hrs, Volume= 0.296 af, Depth= 4.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=6.15"

	Area (sf)	CN	Description
*	13,580	98	Impervious, HSG A
	14,335	96	Gravel surface, HSG A
	10,570	39	>75% Grass cover, Good, HSG A
	38,485	81	Weighted Average
	24,905		64.71% Pervious Area
	13,580		35.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	100	0.0100	0.32		**Sheet Flow, A-B**
					Fallow n= 0.050 P2= 3.32"
4.8	90	0.0100	0.31		**Sheet Flow, B-C**
					Fallow n= 0.050 P2= 3.32"
10.1	190	Total			

Summary for Subcatchment 8S: To Wetland

Runoff = 0.21 cfs @ 12.34 hrs, Volume= 0.035 af, Depth= 0.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=6.15"

Area (sf)	CN	Description
5,335	39	>75% Grass cover, Good, HSG A
9,285	30	Woods, Good, HSG A
10,275	57	Woods/grass comb., Poor, HSG A
24,895	43	Weighted Average
24,895		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.0	100	0.0200	0.12		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.32"
0.4	65	0.3750	3.06		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
14.4	165	Total			

Summary for Reach 7R: (new Reach)

Inflow Area = 1.792 ac, 41.58% Impervious, Inflow Depth = 1.38" for 25-yr event
Inflow = 2.19 cfs @ 12.20 hrs, Volume= 0.207 af
Outflow = 2.19 cfs @ 12.20 hrs, Volume= 0.207 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Reach DP1: DP1 Upstream Wetland

Inflow Area = 0.501 ac, 48.03% Impervious, Inflow Depth = 2.74" for 25-yr event
Inflow = 1.59 cfs @ 12.09 hrs, Volume= 0.114 af
Outflow = 1.59 cfs @ 12.09 hrs, Volume= 0.114 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Reach DP2: DP2 Downstream Wetland

Inflow Area = 3.247 ac, 32.55% Impervious, Inflow Depth = 1.99" for 25-yr event
Inflow = 5.54 cfs @ 12.20 hrs, Volume= 0.537 af
Outflow = 5.54 cfs @ 12.20 hrs, Volume= 0.537 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Reach DP3: DP3 Pleasant St CB

Inflow Area = 0.190 ac, 84.21% Impervious, Inflow Depth = 4.88" for 25-yr event
Inflow = 1.04 cfs @ 12.08 hrs, Volume= 0.077 af
Outflow = 1.04 cfs @ 12.08 hrs, Volume= 0.077 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: INF Chambers UG-1

Inflow Area = 0.424 ac, 63.97% Impervious, Inflow Depth = 3.61" for 25-yr event
Inflow = 1.79 cfs @ 12.09 hrs, Volume= 0.127 af
Outflow = 0.05 cfs @ 10.72 hrs, Volume= 0.127 af, Atten= 97%, Lag= 0.0 min
Discarded = 0.05 cfs @ 10.72 hrs, Volume= 0.127 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 101.96' @ 16.82 hrs Surf.Area= 2,136 sf Storage= 3,459 cf

Plug-Flow detention time= 675.2 min calculated for 0.127 af (100% of inflow)
Center-of-Mass det. time= 675.3 min (1,495.8 - 820.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.50'	2,693 cf	**51.42'W x 41.55'L x 5.50'H Field A** 11,750 cf Overall - 4,057 cf Embedded = 7,693 cf x 35.0% Voids
#2A	100.25'	4,057 cf	**ADS_StormTech MC-3500 d +Cap** x 35 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 7 Rows of 5 Chambers Cap Storage= +14.9 cf x 2 x 7 rows = 208.6 cf
#3	100.25'	85 cf	**4.00'D x 6.75'H Vertical Cone/Cylinder** -Impervious
		6,834 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	99.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	106.50'	**2.0' long Weir X 2.00** 2 End Contraction(s)

Discarded OutFlow Max=0.05 cfs @ 10.72 hrs HW=99.58' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=99.50' (Free Discharge)
2=Weir (Controls 0.00 cfs)

Summary for Pond 2P: INF Chambers UG-2

Inflow Area = 0.680 ac, 67.67% Impervious, Inflow Depth = 1.60" for 25-yr event
Inflow = 1.26 cfs @ 12.09 hrs, Volume= 0.090 af
Outflow = 0.03 cfs @ 10.20 hrs, Volume= 0.090 af, Atten= 97%, Lag= 0.0 min
Discarded = 0.03 cfs @ 10.20 hrs, Volume= 0.090 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 98.22' @ 16.78 hrs Surf.Area= 1,399 sf Storage= 2,477 cf

Plug-Flow detention time= 716.2 min calculated for 0.090 af (100% of inflow)
Center-of-Mass det. time= 716.3 min (1,521.6 - 805.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	95.50'	1,812 cf	**51.42'W x 27.21'L x 5.50'H Field A** 7,695 cf Overall - 2,518 cf Embedded = 5,177 cf x 35.0% Voids
#2A	96.25'	2,518 cf	**ADS_StormTech MC-3500 d +Cap** x 21 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 7 Rows of 3 Chambers Cap Storage= +14.9 cf x 2 x 7 rows = 208.6 cf
#3	96.25'	85 cf	**4.00'D x 6.75'H Vertical Cone/Cylinder** -Impervious
		4,414 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	95.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	102.50'	**2.0' long Weir X 2.00** 2 End Contraction(s)

Discarded OutFlow Max=0.03 cfs @ 10.20 hrs HW=95.58' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=95.50' (Free Discharge)
↑—**2=Weir** (Controls 0.00 cfs)

Summary for Pond 3P: INF Chambers UG-3

Inflow Area = 0.746 ac, 69.93% Impervious, Inflow Depth = 0.48" for 25-yr event
Inflow = 0.39 cfs @ 12.08 hrs, Volume= 0.030 af
Outflow = 0.01 cfs @ 9.83 hrs, Volume= 0.030 af, Atten= 96%, Lag= 0.0 min
Discarded = 0.01 cfs @ 9.83 hrs, Volume= 0.030 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 97.29' @ 15.20 hrs Surf.Area= 621 sf Storage= 689 cf

Plug-Flow detention time= 416.0 min calculated for 0.030 af (100% of inflow)
Center-of-Mass det. time= 416.0 min (1,183.9 - 767.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	95.50'	535 cf	**34.75'W x 17.86'L x 3.50'H Field A** 2,172 cf Overall - 643 cf Embedded = 1,529 cf x 35.0% Voids
#2A	96.00'	643 cf	**ADS_StormTech SC-740 +Cap** x 14 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 7 Rows of 2 Chambers
#3	96.00'	63 cf	**4.00'D x 5.00'H Vertical Cone/Cylinder** -Impervious
		1,241 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	95.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	100.50'	**2.0' long Weir X 2.00** 2 End Contraction(s)

Discarded OutFlow Max=0.01 cfs @ 9.83 hrs HW=95.56' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=95.50' (Free Discharge)
2=Weir (Controls 0.00 cfs)

Summary for Pond 7P: Constructed Wetland BMP

Inflow Area = 0.883 ac, 35.29% Impervious, Inflow Depth = 4.02" for 25-yr event
Inflow = 3.60 cfs @ 12.14 hrs, Volume= 0.296 af
Outflow = 3.19 cfs @ 12.20 hrs, Volume= 0.296 af, Atten= 12%, Lag= 3.5 min
Primary = 1.76 cfs @ 12.20 hrs, Volume= 0.260 af
Secondary = 1.42 cfs @ 12.20 hrs, Volume= 0.036 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 94.93' @ 12.20 hrs Surf.Area= 3,289 sf Storage= 2,283 cf

Plug-Flow detention time= 41.2 min calculated for 0.296 af (100% of inflow)
Center-of-Mass det. time= 41.3 min (855.7 - 814.4)

Volume	Invert	Avail.Storage	Storage Description
#1	94.00'	3,681 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
94.00	1,710	275.0	0	0	1,710
95.00	3,430	365.0	2,521	2,521	6,305
95.30	4,325	385.0	1,161	3,681	7,504

Device	Routing	Invert	Outlet Devices
#1	Primary	94.00'	**12.0" Round Culvert** L= 10.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 94.00' / 93.95' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	94.00'	**6.0" Vert. Orifice/Grate** C= 0.600

#3	Device 1	94.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Secondary	94.75'	**6.0' long (Profile 6) Broad-Crested Rectangular Weir**
			Head (feet) 0.49 0.98 1.48
			Coef. (English) 3.12 3.41 3.59

Primary OutFlow Max=1.76 cfs @ 12.20 hrs HW=94.93' (Free Discharge)
└─**1=Culvert** (Passes 1.76 cfs of 1.88 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.78 cfs @ 3.97 fps)
  └─**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.98 cfs @ 1.38 fps)

Secondary OutFlow Max=1.42 cfs @ 12.20 hrs HW=94.93' (Free Discharge)
└─**4=Broad-Crested Rectangular Weir** (Weir Controls 1.42 cfs @ 1.32 fps)

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 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 1S: To Wetland Runoff Area=21,820 sf 48.03% Impervious Runoff Depth=4.80"
Tc=6.0 min CN=68 Runoff=2.82 cfs 0.200 af

Subcatchment 2S: Quarry Rd Runoff Area=45,560 sf 21.35% Impervious Runoff Depth=4.31"
Flow Length=230' Tc=13.9 min CN=64 Runoff=4.11 cfs 0.376 af

Subcatchment 3S: Pleasant St Runoff Area=8,295 sf 84.21% Impervious Runoff Depth=7.34"
Tc=6.0 min CN=89 Runoff=1.53 cfs 0.116 af

Subcatchment 4S: Upper Intersection Runoff Area=18,455 sf 63.97% Impervious Runoff Depth=5.88"
Tc=6.0 min CN=77 Runoff=2.89 cfs 0.208 af

Subcatchment 5S: Middle of New Rd Runoff Area=11,180 sf 73.79% Impervious Runoff Depth=6.61"
Tc=6.0 min CN=83 Runoff=1.93 cfs 0.141 af

Subcatchment 6S: Bottom of New Rd Runoff Area=2,875 sf 93.22% Impervious Runoff Depth=7.94"
Tc=6.0 min CN=94 Runoff=0.55 cfs 0.044 af

Subcatchment 7S: To BMP Runoff Area=38,485 sf 35.29% Impervious Runoff Depth=6.37"
Flow Length=190' Slope=0.0100 '/' Tc=10.1 min CN=81 Runoff=5.62 cfs 0.469 af

Subcatchment 8S: To Wetland Runoff Area=24,895 sf 0.00% Impervious Runoff Depth=1.87"
Flow Length=165' Tc=14.4 min CN=43 Runoff=0.80 cfs 0.089 af

Reach 7R: (new Reach) Inflow=4.11 cfs 0.376 af
Outflow=4.11 cfs 0.376 af

Reach DP1: DP1 Upstream Wetland Inflow=2.82 cfs 0.200 af
Outflow=2.82 cfs 0.200 af

Reach DP2: DP2 Downstream Wetland Inflow=10.01 cfs 0.934 af
Outflow=10.01 cfs 0.934 af

Reach DP3: DP3 Pleasant St CB Inflow=1.53 cfs 0.116 af
Outflow=1.53 cfs 0.116 af

Pond 1P: INF Chambers UG-1 Peak Elev=104.46' Storage=6,400 cf Inflow=2.89 cfs 0.208 af
Discarded=0.05 cfs 0.208 af Primary=0.00 cfs 0.000 af Outflow=0.05 cfs 0.208 af

Pond 2P: INF Chambers UG-2 Peak Elev=100.90' Storage=4,339 cf Inflow=1.93 cfs 0.141 af
Discarded=0.03 cfs 0.141 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.141 af

Pond 3P: INF Chambers UG-3 Peak Elev=98.67' Storage=1,140 cf Inflow=0.55 cfs 0.044 af
Discarded=0.01 cfs 0.044 af Primary=0.00 cfs 0.000 af Outflow=0.01 cfs 0.044 af

Pond 7P: Constructed Wetland BMP Peak Elev=95.04' Storage=2,660 cf Inflow=5.62 cfs 0.469 af
Primary=2.22 cfs 0.380 af Secondary=2.92 cfs 0.088 af Outflow=5.15 cfs 0.469 af

Total Runoff Area = 3.939 ac Runoff Volume = 1.643 af Average Runoff Depth = 5.01"
62.98% Pervious = 2.481 ac 37.02% Impervious = 1.458 ac

Summary for Subcatchment 1S: To Wetland

Runoff = 2.82 cfs @ 12.09 hrs, Volume= 0.200 af, Depth= 4.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=8.66"

	Area (sf)	CN	Description
	2,540	30	Woods, Good, HSG A
	2,500	57	Woods/grass comb., Poor, HSG A
	6,300	39	>75% Grass cover, Good, HSG A
*	10,480	98	Impervious, HSG A
	21,820	68	Weighted Average
	11,340		51.97% Pervious Area
	10,480		48.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 2S: Quarry Rd

Runoff = 4.11 cfs @ 12.19 hrs, Volume= 0.376 af, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=8.66"

	Area (sf)	CN	Description
*	9,725	98	Impervious, HSG A
	10,070	96	Gravel surface, HSG A
	25,765	39	>75% Grass cover, Good, HSG A
	45,560	64	Weighted Average
	35,835		78.65% Pervious Area
	9,725		21.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	90	0.0200	0.12		**Sheet Flow, A-B**
					Grass: Dense n= 0.240 P2= 3.32"
0.5	80	0.1375	2.60		**Shallow Concentrated Flow, B-C**
					Short Grass Pasture Kv= 7.0 fps
0.5	60	0.0170	2.10		**Shallow Concentrated Flow, C-D**
					Unpaved Kv= 16.1 fps
13.9	230	Total			

Summary for Subcatchment 3S: Pleasant St

Runoff = 1.53 cfs @ 12.08 hrs, Volume= 0.116 af, Depth= 7.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=8.66"

	Area (sf)	CN	Description
*	6,985	98	Impervious, HSG A
	1,310	39	>75% Grass cover, Good, HSG A
	8,295	89	Weighted Average
	1,310		15.79% Pervious Area
	6,985		84.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4S: Upper Intersection

Runoff = 2.89 cfs @ 12.09 hrs, Volume= 0.208 af, Depth= 5.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=8.66"

	Area (sf)	CN	Description
*	11,805	98	Impervious, HSG A
	6,650	39	>75% Grass cover, Good, HSG A
	18,455	77	Weighted Average
	6,650		36.03% Pervious Area
	11,805		63.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 5S: Middle of New Rd

Runoff = 1.93 cfs @ 12.09 hrs, Volume= 0.141 af, Depth= 6.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=8.66"

	Area (sf)	CN	Description
*	8,250	98	Impervious, HSG A
	2,930	39	>75% Grass cover, Good, HSG A
	11,180	83	Weighted Average
	2,930		26.21% Pervious Area
	8,250		73.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 6S: Bottom of New Rd

Runoff = 0.55 cfs @ 12.08 hrs, Volume= 0.044 af, Depth= 7.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=8.66"

	Area (sf)	CN	Description
*	2,680	98	Impervious, HSG A
	195	39	>75% Grass cover, Good, HSG A
	2,875	94	Weighted Average
	195		6.78% Pervious Area
	2,680		93.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 7S: To BMP

Runoff = 5.62 cfs @ 12.14 hrs, Volume= 0.469 af, Depth= 6.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=8.66"

	Area (sf)	CN	Description
*	13,580	98	Impervious, HSG A
	14,335	96	Gravel surface, HSG A
	10,570	39	>75% Grass cover, Good, HSG A
	38,485	81	Weighted Average
	24,905		64.71% Pervious Area
	13,580		35.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	100	0.0100	0.32		**Sheet Flow, A-B**
					Fallow n= 0.050 P2= 3.32"
4.8	90	0.0100	0.31		**Sheet Flow, B-C**
					Fallow n= 0.050 P2= 3.32"
10.1	190	Total			

Summary for Subcatchment 8S: To Wetland

Runoff = 0.80 cfs @ 12.23 hrs, Volume= 0.089 af, Depth= 1.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=8.66"

Area (sf)	CN	Description
5,335	39	>75% Grass cover, Good, HSG A
9,285	30	Woods, Good, HSG A
10,275	57	Woods/grass comb., Poor, HSG A
24,895	43	Weighted Average
24,895		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.0	100	0.0200	0.12		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.32"
0.4	65	0.3750	3.06		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
14.4	165	Total			

Summary for Reach 7R: (new Reach)

Inflow Area = 1.792 ac, 41.58% Impervious, Inflow Depth = 2.52" for 100-yr event
Inflow = 4.11 cfs @ 12.19 hrs, Volume= 0.376 af
Outflow = 4.11 cfs @ 12.19 hrs, Volume= 0.376 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Reach DP1: DP1 Upstream Wetland

Inflow Area = 0.501 ac, 48.03% Impervious, Inflow Depth = 4.80" for 100-yr event
Inflow = 2.82 cfs @ 12.09 hrs, Volume= 0.200 af
Outflow = 2.82 cfs @ 12.09 hrs, Volume= 0.200 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Reach DP2: DP2 Downstream Wetland

Inflow Area = 3.247 ac, 32.55% Impervious, Inflow Depth = 3.45" for 100-yr event
Inflow = 10.01 cfs @ 12.19 hrs, Volume= 0.934 af
Outflow = 10.01 cfs @ 12.19 hrs, Volume= 0.934 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Reach DP3: DP3 Pleasant St CB

Inflow Area = 0.190 ac, 84.21% Impervious, Inflow Depth = 7.34" for 100-yr event
Inflow = 1.53 cfs @ 12.08 hrs, Volume= 0.116 af
Outflow = 1.53 cfs @ 12.08 hrs, Volume= 0.116 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: INF Chambers UG-1

Inflow Area = 0.424 ac, 63.97% Impervious, Inflow Depth = 5.88" for 100-yr event
Inflow = 2.89 cfs @ 12.09 hrs, Volume= 0.208 af
Outflow = 0.05 cfs @ 9.53 hrs, Volume= 0.208 af, Atten= 98%, Lag= 0.0 min
Discarded = 0.05 cfs @ 9.53 hrs, Volume= 0.208 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 104.46' @ 18.87 hrs Surf.Area= 2,136 sf Storage= 6,400 cf

Plug-Flow detention time= 1,188.9 min calculated for 0.208 af (100% of inflow)
Center-of-Mass det. time= 1,188.9 min (1,995.6 - 806.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.50'	2,693 cf	**51.42'W x 41.55'L x 5.50'H Field A** 11,750 cf Overall - 4,057 cf Embedded = 7,693 cf x 35.0% Voids
#2A	100.25'	4,057 cf	**ADS_StormTech MC-3500 d +Cap** x 35 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 7 Rows of 5 Chambers Cap Storage= +14.9 cf x 2 x 7 rows = 208.6 cf
#3	100.25'	85 cf	**4.00'D x 6.75'H Vertical Cone/Cylinder** -Impervious
		6,834 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	99.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	106.50'	**2.0' long Weir X 2.00** 2 End Contraction(s)

Discarded OutFlow Max=0.05 cfs @ 9.53 hrs HW=99.58' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=99.50' (Free Discharge)
2=Weir (Controls 0.00 cfs)

Summary for Pond 2P: INF Chambers UG-2

Inflow Area = 0.680 ac, 67.67% Impervious, Inflow Depth = 2.49" for 100-yr event
Inflow = 1.93 cfs @ 12.09 hrs, Volume= 0.141 af
Outflow = 0.03 cfs @ 8.95 hrs, Volume= 0.141 af, Atten= 98%, Lag= 0.0 min
Discarded = 0.03 cfs @ 8.95 hrs, Volume= 0.141 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 100.90' @ 18.48 hrs Surf.Area= 1,399 sf Storage= 4,339 cf

Plug-Flow detention time= 1,207.9 min calculated for 0.141 af (100% of inflow)
Center-of-Mass det. time= 1,207.8 min (2,000.6 - 792.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	95.50'	1,812 cf	**51.42'W x 27.21'L x 5.50'H Field A** 7,695 cf Overall - 2,518 cf Embedded = 5,177 cf x 35.0% Voids
#2A	96.25'	2,518 cf	**ADS_StormTech MC-3500 d +Cap** x 21 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 7 Rows of 3 Chambers Cap Storage= +14.9 cf x 2 x 7 rows = 208.6 cf
#3	96.25'	85 cf	**4.00'D x 6.75'H Vertical Cone/Cylinder** -Impervious
		4,414 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	95.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	102.50'	**2.0' long Weir X 2.00** 2 End Contraction(s)

Discarded OutFlow Max=0.03 cfs @ 8.95 hrs HW=95.58' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=95.50' (Free Discharge)
↑—**2=Weir** (Controls 0.00 cfs)

Summary for Pond 3P: INF Chambers UG-3

Inflow Area = 0.746 ac, 69.93% Impervious, Inflow Depth = 0.70" for 100-yr event
Inflow = 0.55 cfs @ 12.08 hrs, Volume= 0.044 af
Outflow = 0.01 cfs @ 8.69 hrs, Volume= 0.044 af, Atten= 97%, Lag= 0.0 min
Discarded = 0.01 cfs @ 8.69 hrs, Volume= 0.044 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 98.67' @ 16.18 hrs Surf.Area= 621 sf Storage= 1,140 cf

Plug-Flow detention time= 684.6 min calculated for 0.044 af (100% of inflow)
Center-of-Mass det. time= 684.6 min (1,444.2 - 759.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	95.50'	535 cf	**34.75'W x 17.86'L x 3.50'H Field A** 2,172 cf Overall - 643 cf Embedded = 1,529 cf x 35.0% Voids
#2A	96.00'	643 cf	**ADS_StormTech SC-740 +Cap** x 14 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 7 Rows of 2 Chambers
#3	96.00'	63 cf	**4.00'D x 5.00'H Vertical Cone/Cylinder** -Impervious
		1,241 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	95.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	100.50'	**2.0' long Weir X 2.00** 2 End Contraction(s)

Discarded OutFlow Max=0.01 cfs @ 8.69 hrs HW=95.56' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=95.50' (Free Discharge)
↑—**2=Weir** (Controls 0.00 cfs)

Summary for Pond 7P: Constructed Wetland BMP

Inflow Area = 0.883 ac, 35.29% Impervious, Inflow Depth = 6.37" for 100-yr event
Inflow = 5.62 cfs @ 12.14 hrs, Volume= 0.469 af
Outflow = 5.15 cfs @ 12.18 hrs, Volume= 0.469 af, Atten= 8%, Lag= 2.9 min
Primary = 2.22 cfs @ 12.18 hrs, Volume= 0.380 af
Secondary = 2.92 cfs @ 12.18 hrs, Volume= 0.088 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 95.04' @ 12.18 hrs Surf.Area= 3,543 sf Storage= 2,660 cf

Plug-Flow detention time= 34.2 min calculated for 0.469 af (100% of inflow)
Center-of-Mass det. time= 34.0 min (835.4 - 801.4)

Volume	Invert	Avail.Storage	Storage Description
#1	94.00'	3,681 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
94.00	1,710	275.0	0	0	1,710
95.00	3,430	365.0	2,521	2,521	6,305
95.30	4,325	385.0	1,161	3,681	7,504

Device	Routing	Invert	Outlet Devices
#1	Primary	94.00'	**12.0" Round Culvert** L= 10.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 94.00' / 93.95' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	94.00'	**6.0" Vert. Orifice/Grate** C= 0.600

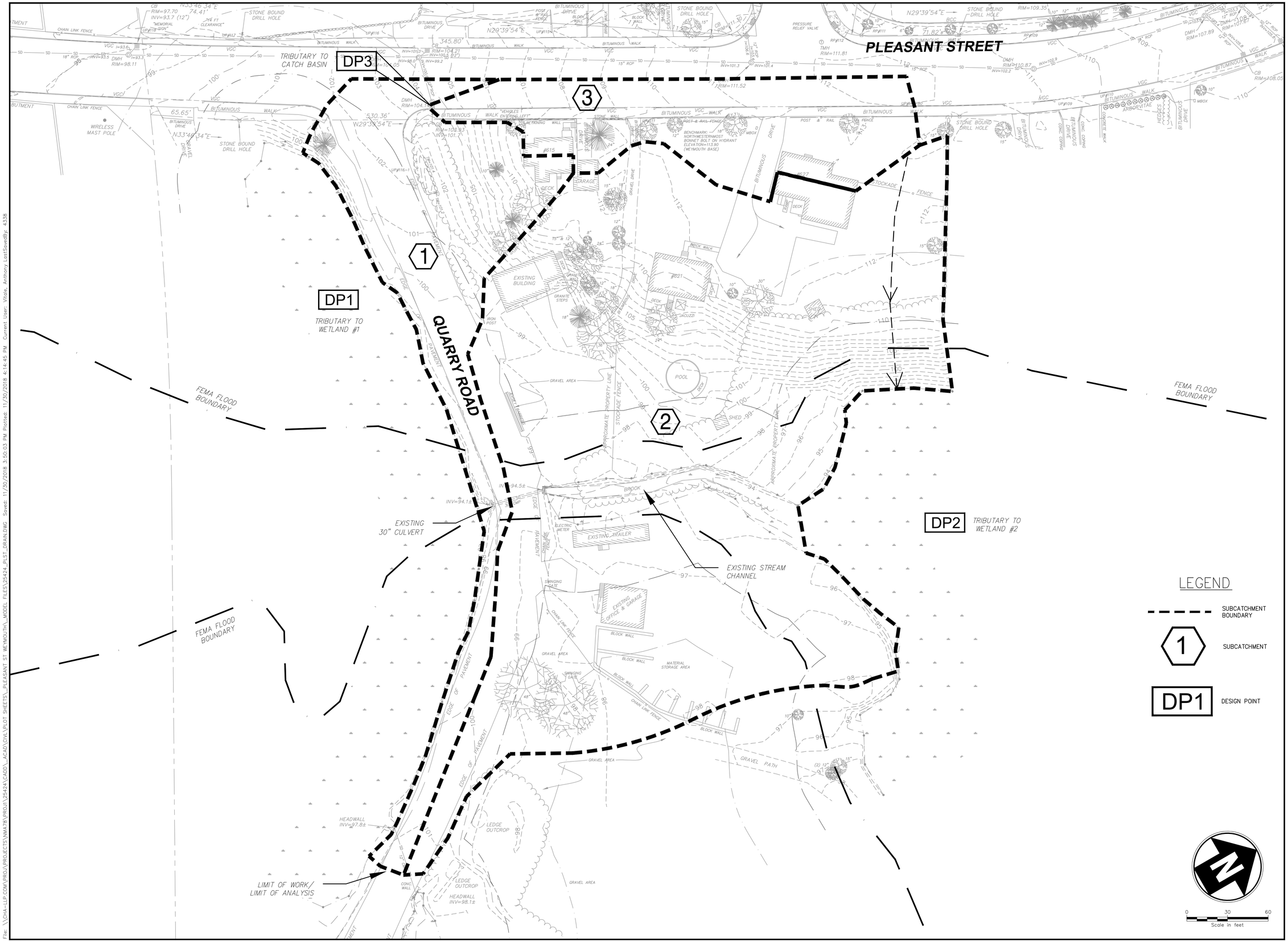
#3	Device 1	94.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Secondary	94.75'	**6.0' long (Profile 6) Broad-Crested Rectangular Weir**
			Head (feet) 0.49 0.98 1.48
			Coef. (English) 3.12 3.41 3.59

Primary OutFlow Max=2.22 cfs @ 12.18 hrs HW=95.04' (Free Discharge)
└─**1=Culvert** (Barrel Controls 2.22 cfs @ 3.38 fps)
  ├─**2=Orifice/Grate** (Passes < 0.84 cfs potential flow)
  └─**3=Sharp-Crested Rectangular Weir** (Passes < 2.01 cfs potential flow)

Secondary OutFlow Max=2.92 cfs @ 12.18 hrs HW=95.04' (Free Discharge)
└─**4=Broad-Crested Rectangular Weir** (Weir Controls 2.92 cfs @ 1.68 fps)

Section 3.3

Drainage Area Plans



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WEYMOUTH, MA

No.	Submittal / Revision	App'd.	By	Date
A	ConCom Submittal	KK	JM	12/03/18

PRE DEVELOPMENT DRAINAGE SUBCATCHMENT PLAN

Designed By:	Drawn By:	Checked By:
SA/JM	JPM	KK
Issue Date:	Project No:	Scale:
12/03/18	25424-9100	AS SHOWN

Drawing No.:
DR-1

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WEYMOUTH, MA

No.	Submittal / Revision	App'd.	By	Date
A	ConCom Submittal	KK	JM	12/03/18

POST DEVELOPMENT
DRAINAGE
SUBCATCHMENT
PLAN

Designed By:	Drawn By:	Checked By:
SA/JM	JPM	KK
Issue Date:	Project No:	Scale:
12/03/18	25424-9100	AS SHOWN

Drawing No.:
DR-2

PLEASANT STREET

QUARRY ROAD

FUTURE ROADWAY

TRIBUTARY TO CATCH BASIN DP3

DP1
TRIBUTARY TO WETLAND #1

DP2
TRIBUTARY TO WETLAND #2

PROPOSED UNDERGROUND INFILTRATION SYSTEM #1

PROPOSED UNDERGROUND INFILTRATION SYSTEM #2

PROPOSED UNDERGROUND INFILTRATION SYSTEM #3

PROPOSED STORMWATER WATER QUALITY STRUCTURE

PROPOSED STORMWATER WATER QUALITY STRUCTURE

PROPOSED LEVEL SPREADER

PROPOSED HEADWALL, PROPOSED 30" CULVERT

PROPOSED SEDIMENT FOREBAY

PROPOSED OUTLET CONTROL STRUCTURE

PROPOSED CONSTRUCTED STORMWATER WETLAND BMP

FEMA FLOOD BOUNDARY

FEMA FLOOD BOUNDARY

FEMA FLOOD BOUNDARY

LIMIT OF WORK/ LIMIT OF ANALYSIS

LEGEND

SUBCATCHMENT BOUNDARY

1 SUBCATCHMENT

DP1 DESIGN POINT

4 SUBSURFACE CHAMBER SYSTEM

0 30 60
Scale in feet

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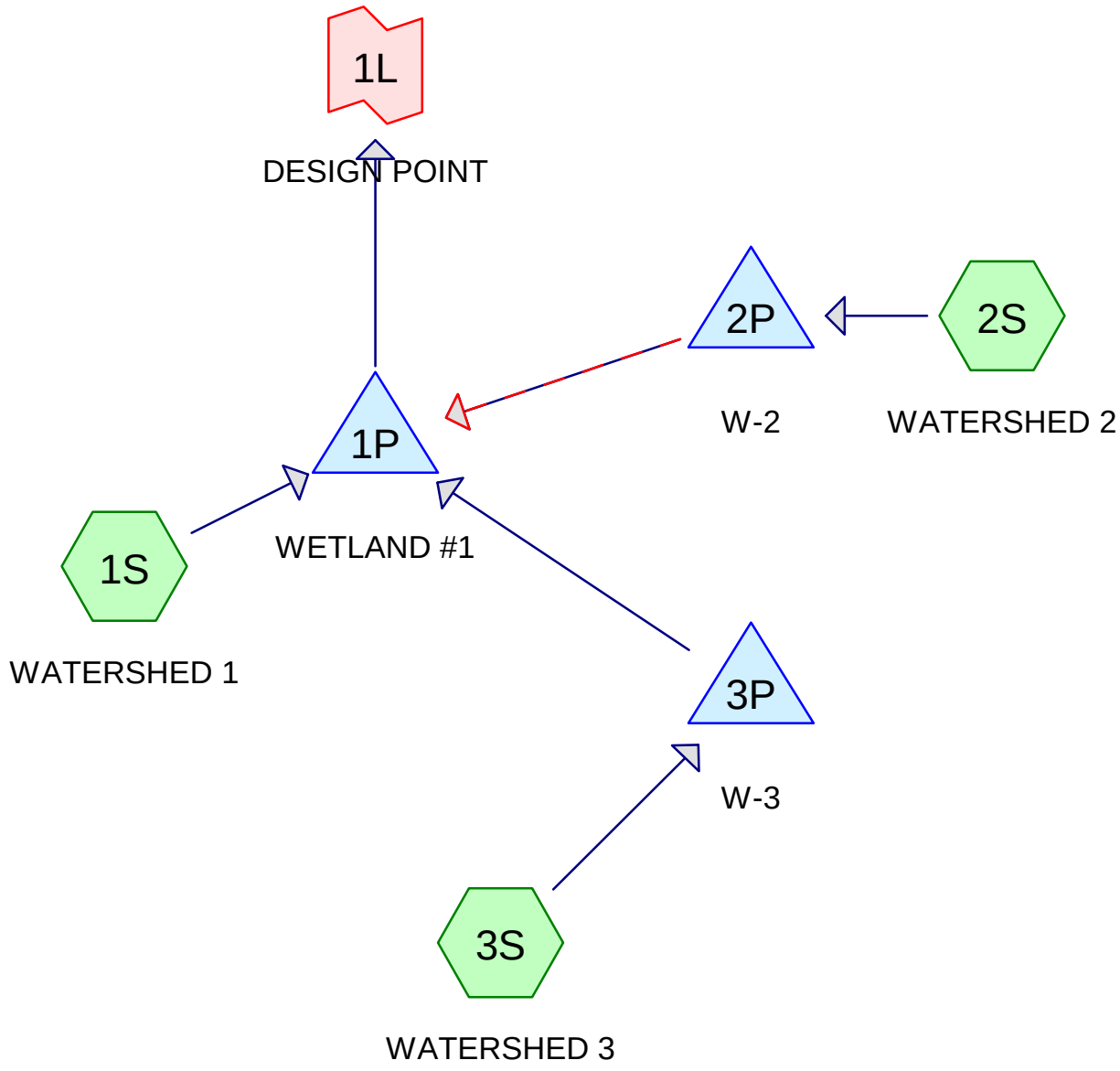
Section 3.3

Watershed Analysis



Subcat Reach Pond Link

Routing Diagram for Weymouth - Existing Culvert Contributory Area
Prepared by CHA, Printed 12/2/2018

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
47.511	57	1/3 acre lots, 30% imp, HSG A (3S)
2.120	39	>75% Grass cover, Good, HSG A (1S)
2.878	96	Gravel surface, HSG A (1S, 2S)
7.274	98	Paved roads w/curbs & sewers, HSG A (1S, 2S, 3S)
10.369	36	Woods, Fair, HSG A (1S, 2S, 3S)
32.427	79	Woods, Fair, HSG D (1S, 2S, 3S)
102.579	**65**	**TOTAL AREA**

Time span=0.00-96.00 hrs, dt=0.05 hrs, 1921 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 1S: WATERSHED 1 Runoff Area=548,000 sf 27.93% Impervious Runoff Depth=4.43"
Flow Length=2,000' Tc=25.9 min CN=65 Runoff=39.36 cfs 4.649 af

Subcatchment 2S: WATERSHED 2 Runoff Area=335,000 sf 18.06% Impervious Runoff Depth=5.88"
Flow Length=500' Tc=27.1 min CN=77 Runoff=31.11 cfs 3.770 af

Subcatchment 3S: WATERSHED 3 Runoff Area=3,585,340 sf 20.20% Impervious Runoff Depth=4.43"
Flow Length=1,400' Tc=52.9 min CN=65 Runoff=180.65 cfs 30.415 af

Pond 1P: WETLAND #1 Peak Elev=96.57' Storage=101,751 cf Inflow=41.47 cfs 32.261 af
30.0" Round Culvert n=0.025 L=40.0' S=0.0013 '/' Outflow=15.96 cfs 31.692 af

Pond 2P: W-2 Peak Elev=100.87' Storage=96,121 cf Inflow=31.11 cfs 3.770 af
12.0" Round Culvert n=0.025 L=50.0' S=0.0060 '/' Outflow=3.36 cfs 3.640 af

Pond 3P: W-3 Peak Elev=103.80' Storage=976,878 cf Inflow=180.65 cfs 30.415 af
36.0" Round Culvert n=0.012 L=180.0' S=0.0011 '/' Outflow=10.93 cfs 23.972 af

Link 1L: DESIGN POINT Inflow=15.96 cfs 31.692 af
Primary=15.96 cfs 31.692 af

Total Runoff Area = 102.579 ac Runoff Volume = 38.834 af Average Runoff Depth = 4.54"
79.01% Pervious = 81.051 ac 20.99% Impervious = 21.528 ac

Summary for Subcatchment 1S: WATERSHED 1

Runoff = 39.36 cfs @ 12.37 hrs, Volume= 4.649 af, Depth= 4.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.66"

Area (sf)	CN	Description
96,850	79	Woods, Fair, HSG D
29,470	96	Gravel surface, HSG A
153,030	98	Paved roads w/curbs & sewers, HSG A
176,290	36	Woods, Fair, HSG A
92,360	39	>75% Grass cover, Good, HSG A
548,000	65	Weighted Average
394,970		72.07% Pervious Area
153,030		27.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.0	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.32"
6.7	450	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
3.2	1,500	0.0100	7.84	391.90	**Channel Flow,** Area= 50.0 sf Perim= 40.0' r= 1.25' n= 0.022 Earth, clean & straight
25.9	2,000	Total			

Summary for Subcatchment 2S: WATERSHED 2

Runoff = 31.11 cfs @ 12.37 hrs, Volume= 3.770 af, Depth= 5.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.66"

Area (sf)	CN	Description
96,280	79	Woods, Fair, HSG D
95,880	96	Gravel surface, HSG A
60,490	98	Paved roads w/curbs & sewers, HSG A
82,350	36	Woods, Fair, HSG A
335,000	77	Weighted Average
274,510		81.94% Pervious Area
60,490		18.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.1	50	0.0200	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.32"
15.0	450	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
27.1	500	Total			

Summary for Subcatchment 3S: WATERSHED 3

Runoff = 180.65 cfs @ 12.74 hrs, Volume= 30.415 af, Depth= 4.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.66"

Area (sf)	CN	Description
1,219,380	79	Woods, Fair, HSG D
103,350	98	Paved roads w/curbs & sewers, HSG A
2,069,580	57	1/3 acre lots, 30% imp, HSG A
193,030	36	Woods, Fair, HSG A
3,585,340	65	Weighted Average
2,861,116		79.80% Pervious Area
724,224		20.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	100	0.0200	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.32"
43.3	1,300	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
52.9	1,400	Total			

Summary for Pond 1P: WETLAND #1

Inflow Area = 102.579 ac, 20.99% Impervious, Inflow Depth > 3.77" for 100-yr event
Inflow = 41.47 cfs @ 12.37 hrs, Volume= 32.261 af
Outflow = 15.96 cfs @ 16.49 hrs, Volume= 31.692 af, Atten= 62%, Lag= 247.2 min
Primary = 15.96 cfs @ 16.49 hrs, Volume= 31.692 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 96.57' @ 16.49 hrs Surf.Area= 39,585 sf Storage= 101,751 cf

Plug-Flow detention time= 174.3 min calculated for 31.692 af (98% of inflow)
Center-of-Mass det. time= 109.1 min (1,923.9 - 1,814.9)

Volume	Invert	Avail.Storage	Storage Description
#1	94.00'	197,925 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
94.00	39,585	910.0	0	0	39,585
95.00	39,585	910.0	39,585	39,585	40,495
96.00	39,585	910.0	39,585	79,170	41,405
97.00	39,585	910.0	39,585	118,755	42,315
98.00	39,585	910.0	39,585	158,340	43,225
99.00	39,585	910.0	39,585	197,925	44,135

Device	Routing	Invert	Outlet Devices
#1	Primary	94.10'	**30.0" Round Culvert** L= 40.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 94.10' / 94.05' S= 0.0013 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 4.91 sf

Primary OutFlow Max=15.96 cfs @ 16.49 hrs HW=96.57' (Free Discharge)
1=Culvert (Barrel Controls 15.96 cfs @ 4.09 fps)

Summary for Pond 2P: W-2

Inflow Area = 7.691 ac, 18.06% Impervious, Inflow Depth = 5.88" for 100-yr event
Inflow = 31.11 cfs @ 12.37 hrs, Volume= 3.770 af
Outflow = 3.36 cfs @ 14.14 hrs, Volume= 3.640 af, Atten= 89%, Lag= 106.3 min
Primary = 3.36 cfs @ 14.14 hrs, Volume= 3.640 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 100.87' @ 14.14 hrs Surf.Area= 33,482 sf Storage= 96,121 cf

Plug-Flow detention time= 476.1 min calculated for 3.640 af (97% of inflow)
Center-of-Mass det. time= 456.1 min (1,282.3 - 826.2)

Volume	Invert	Avail.Storage	Storage Description
#1	98.00'	117,187 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
98.00	33,482	997.0	0	0	33,482
99.00	33,482	997.0	33,482	33,482	34,479
100.00	33,482	997.0	33,482	66,964	35,476
101.50	33,482	997.0	50,223	117,187	36,972

Device	Routing	Invert	Outlet Devices
#1	Primary	98.10'	**12.0" Round Culvert** L= 50.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 98.10' / 97.80' S= 0.0060 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.79 sf

Primary OutFlow Max=3.36 cfs @ 14.14 hrs HW=100.87' (Free Discharge)
1=Culvert (Barrel Controls 3.36 cfs @ 4.27 fps)

Summary for Pond 3P: W-3

Inflow Area = 82.308 ac, 20.20% Impervious, Inflow Depth = 4.43" for 100-yr event
Inflow = 180.65 cfs @ 12.74 hrs, Volume= 30.415 af
Outflow = 10.93 cfs @ 18.25 hrs, Volume= 23.972 af, Atten= 94%, Lag= 330.9 min
Primary = 10.93 cfs @ 18.25 hrs, Volume= 23.972 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 103.80' @ 18.25 hrs Surf.Area= 541,322 sf Storage= 976,878 cf

Plug-Flow detention time= 1,289.1 min calculated for 23.972 af (79% of inflow)
Center-of-Mass det. time= 1,207.8 min (2,082.8 - 875.1)

Volume	Invert	Avail.Storage	Storage Description
#1	102.00'	1,623,966 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
102.00	541,322	5,034.0	0	0	541,322
103.00	541,322	5,034.0	541,322	541,322	546,356
104.00	541,322	5,034.0	541,322	1,082,644	551,390
105.00	541,322	5,034.0	541,322	1,623,966	556,424

Device	Routing	Invert	Outlet Devices
#1	Primary	102.10'	**36.0" Round Culvert** L= 180.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 102.10' / 101.90' S= 0.0011 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 7.07 sf

Primary OutFlow Max=10.93 cfs @ 18.25 hrs HW=103.80' (Free Discharge)
1=Culvert (Barrel Controls 10.93 cfs @ 3.80 fps)

Summary for Link 1L: DESIGN POINT

Inflow Area = 102.579 ac, 20.99% Impervious, Inflow Depth > 3.71" for 100-yr event
Inflow = 15.96 cfs @ 16.49 hrs, Volume= 31.692 af
Primary = 15.96 cfs @ 16.49 hrs, Volume= 31.692 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

NOTES:
1. *THE PURPOSE OF THIS PLAN IS TO SHOW THE APPROXIMATE WATERSHED AREA TRIBUTARY TO THE PROJECT SITE.*
2. *THE DATA LAYERS AND MAPS SHOWN WERE OBTAINED FROM THE MASSGIS DATABASE.*
3. *TOPOGRAPHY SHOWN IS FOR WATERSHED BOUNDARY DELINEATION ONLY.*

LEGEND

- *WATERSHED BOUNDARY*
- *VEGETATED WETLAND RESOURCE AREA*
- *APPROX. STREAM CENTERLINE*
- *PROPERTY LINES*
- *CONTOURS*
- *TOWN LINE*
- 1 *WATERSHED SUB-CATCHMENT*

N

0 200 400
Scale in feet

CHA
141 Longwater Drive - Suite 104
Norwell, MA 02061
781.982.5400 • www.chacompanies.com

BRISTOL BROS. DEVELOPMENT CORP.
190 OLD DERBY STREET, SUITE 311
HINGHAM, MASSACHUSETTS 02043

PLEASANT STREET &
LIBBEY IND. PARKWAY
WEYMOUTH, MA

No.	Submittal / Revision	App'd.	By	Date

WATERSHED AREA DISPLAY

Designed By:	Drawn By:	Checked By:
SM	SM	
Issue Date:	Project No:	Scale:
		1"=200'

Drawing No.:
WA

File: \\CHA-LLP.COM\PROJ\PROJECTS\WMA78\PROJ\25424\CADD_ACAD\CIVL\PLOT SHEETS_PLEASANT ST WEYMOUTH_MODEL FILES\25424_DRAINAGE_ANALYSIS_DISPLAY.DWG Saved: 12/2/2018 2:38:02 PM Plotted: 12/2/2018 3:08:35 PM Current User: Vitale, Anthony LastSavedBy: 4338

Section 4.0

Stormwater Management Calculations

Section 4.1

TSS Calculations

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: UG-1 through 3

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
Proprietary - Isolator Row	**0.69**	**0.75**	**0.52**	**0.23**
Subsurface Infiltration Chambers	**0.80**	**0.23**	**0.18**	**0.05**

Total TSS Removal = **95%**

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: **Pleasant Street**

Prepared By: **AV**

Date: **12/3/2018**

*Equals remaining load from previous BMP (E) which enters the BMP

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: CDS-Hydrodynamic Separator

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Hydrodynamic Separator	**0.80**	**1.00**	**0.80**	**0.20**

Total TSS Removal = **80%**

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: **Pleasant Street**

Prepared By: **AV**

Date: **12/3/2018**

*Equals remaining load from previous BMP (E) which enters the BMP

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: Constructed Wetland BMP

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Sediment Forebay	**required pretreatment**			
Constructed Stormwater Wetland	**0.80**	**1.00**	**0.80**	**0.20**

Total TSS Removal = **80%**

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: **Pleasant Street**

Prepared By: **AV**

Date: **12/3/2018**

*Equals remaining load from previous BMP (E) which enters the BMP

Section 4.2

Required Recharge Volume

RECHARGE NARRATIVE

The calculation for the *Required Recharge Volume* is done using the equation in the 2008 Massachusetts Stormwater Handbook. The *Required Recharge Volume* equals a depth of runoff corresponding to the soil type times the new impervious areas covering that soil type at the post-development site. The *Required Recharge Volume* is based on the *Static* method. The infiltration BMPs proposed are three (3) subsurface infiltration chamber systems.

Rv = F x impervious area (Equation 1) Volume 3, Ch 1, page 15

Rv = Required Recharge Volume, expressed in cubic feet, cubic yards, or acre-feet
F = Target Depth Factor associated with each Hydrologic Soil Group (HSG)
Impervious Area = new pavement and new rooftop area

F for A soils = 0.60 inches (Table 2.3.2) Volume 3, Ch 1, page 16
F for B soils = 0.35 inches
F for C soils = 0.25 inches
F for D soils = 0.10 inches

Using the formula above, the following table shows the site's proposed impervious surface area overlying particular Hydrologic Soil Groups and the calculated *Required Recharge Volume*. The majority of the soil explorations across the site indicate Loamy Sand, HSG A characteristics. The *Required Recharge Volume* will consider the net increase in impervious area in the calculation. The proposed design will, at a minimum, approximate the annual recharge from the pre-developed conditions.

Impervious Areas Calculation

Existing Impervious	= 49,441 sq. ft.	= 1.135 ac.
Proposed Impervious	= 63,510 sq. ft.	= 1.458 ac.
Increase	**= 14,070 sq. ft.**	**= 0.323 ac.**

Impervious Areas Tributary to Infiltration BMPs

UG-1 = 11,805 sq. ft. = 0.271 ac.
UG-2 = 8,250 sq. ft. = 0.189 ac.
UG-3 = 2,680 sq. ft. = 0.062 ac

Total = 22,735 sq. ft. = 0.522 ac.

The impervious area tributary to the infiltration BMPs exceeds the proposed increase in impervious area. **0.522 ac > 0.323**. The proposed project not only mitigates for the proposed impervious area but collects redeveloped impervious area for recharge to groundwater.

Required Recharge Volume

Rv = F x Imp
Rv = 0.60 in x (0.323 ac) x 1 ft/12 in
Rv = **0.016 ac-ft or 703 cu. ft.**

Storage volume for Recharge (below lowest orifice invert) calculated in HydroCAD:

UG-1 = 6,750 cu. ft.
UG-2 = 4,330 cu. ft.
UG-3 = 1,178 cu. ft.

Total =12,258 cu. ft. = 0.281 ac. Ft.

The storage available in UG-1 through 3 is more than the Required Recharge Volume.

12,258 cu. ft. > 703 cu. ft.

Conclusion:

The recharge provided by the proposed underground systems exceeds the required recharge for the proposed impervious on the site. The proposed design exceeds the requirements in Standard 3 of the MassDEP Stormwater regulations.

Section 4.3

Water Quality Calculations

Sizing using the equivalent water quality flow from 1.0" rainfall depth

Discharge Point	Structure	Tributary Area (acres)	Tributary Area (sq miles)	% Impervious	CN Value (Estimated)	WQV (Watershed Inches)	Tc (min)	qu (csm/in)	WQF = qu A Q (cfs)	Unit	Unit's Max Capacity (cfs)
Isolator Row	UG-1	0.27	0.0004	100%	98	1.00	5	795	0.34	ISO MC-3500	See Sizing Below
Isolator Row	UG-2	0.19	0.0003	100%	98	1.00	5	795	0.24	ISO MC-3500	See Sizing Below
Isolator Row	UG-3	0.06	0.0001	100%	98	1.00	5	795	0.08	ISO SC-740	See Sizing Below
Wetland #1	CDS-1	0.24	0.0004	100%	98	1.00	5	795	0.30	2015-4	0.70
Wetland #2	CDS-2	0.22	0.0003	100%	98	1.00	5	795	0.28	2015-4	0.70

* Abbreviations
ISO Isolator Row

StormTech Isolator Row Sizing	Unit Type	Chamber Area (SF)	Treated flow per unit** (CFS)	Flow Required WQF	Number of Units Req.	Number of Units Provided	Treated Flow
UG-1-ISO	MC-3500	43.2	0.24	0.34	2	5	1.20
UG-2-ISO	MC-3500	43.2	0.24	0.24	1	3	0.72
UG-3-ISO	SC-740	27.8	0.15	0.08	1	2	0.30

**Treatment Flow Capacity
2.5 GPM/SF NJCAT verified treated flow rate
(2.5 GPM=0.0055 CFS)

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STORMTECH ISOLATOR ROW SIZING CHART					
	SC-310	SC-740	DC-780	MC-3500	MC-4500
Chamber Area (Sq.Ft.)	20	27.8	27.8	43.2	30.1
Treated Flow Rate per chamber (CFS)	0.11	0.15	0.15	0.24	0.17

NOTE: *Testing of the Isolator Row completed by Tennesse Tech has been verified by NJCAT and it has shown to have a TSS removal efficiency of 84% for SIL-CO-SIL 250*

NJCAT verified Treated Flow Rate (GPM / Sq.Ft.) 2.5

Performance Evaluation

Back to Profile

StormTech Isolator Row :: A product from STORMTECH LLC ::

Performance information: (This product was evaluated in at least one third-party study. See MASTEP Evaluation Summary.)

The StormTech Isolator Row was tested several times at a laboratory at Tennessee Tech University and also in the field by the UNH Stormwater Center (initially reported on in 2008, expanded and updated in a 2010 report). UNH analyzed runoff from a 9 acre parking lot for TSS, TPH, nitrogen as nitrate (DIN), TZn, and TP. Samples were collected during 23 events (13.2" rainfall) from 2007- 2009. The following pollutants were monitored, with results obtained: TSS (81% Efficiency Ratio (ER), 69% mean Removal Efficiency (RE), 83% median RE); SSC (only 5 storms monitored (94% ER, 93% mean RE, 91% median RE); Zinc (61% ER, 60% mean RE, 57% median RE); Total Phosphorus (53% ER, 29% mean RE, 33% median RE); Dissolved Inorganic Nitrogen(-74% ER, -97% mean RE, -80% median RE); Total Petroleum Hydrocarbons (79% ER, 81% mean RE, 91% median RE). A full scale StormTech SC-740 isolator Row was tested in the laboratory at Tennessee Tech University. Three different influent mixes were used in the testing including a SIL-CO-SIL 106, SIL-CO-SIL250 and US Silica OK-110. The SIL-CO-SIL106 had a median particle size of 22 microns and was tested at a hydraulic loading rate of 3.2gpm/ft2 of filter area. The SIL-CO-SIL 250 had a median particle size of 45 microns and was tested at 3.2 and 1.7 gpm/ft2 of filter area. The OK-110 influent slurry had a median particle size of 110 microns and was tested at rates up to 4.8 and 8.1 gpm/ft2 in the four and two chamber configurations. Five runs were done with the SIL-CO-SIL 106 influent at 3.2gpm/ft2 (125% of treatment operating rate). One run was done with the SIL-CO-SIL 250 slurry at each of the two hydraulic loading rates (3.2, 1.7gpm/ft2-62.5% of treatment operating rate). Each run lasted 15 detention times, allowing 3 detention times prior to collecting samples. OK-110 tests were run for 11 treatment flows from 44.9-539gpm (0.1-1.2cfs) or hydraulic loading rates of 0.4-4.8gpm/ft2 with a four chamber Isolator row. They also ran tests with a two chamber model at 0.4, 1.0, and 1.2 cfs, up to a hydraulic loading rate of 8.1gpm/ft2. Results of SIL-CO-SIL 106 runs show an average influent of 270 +/-59mg/l (range 139-361mg/l). This influent was higher than expected and due to recirculation of sediments that were not trapped in the filter sock at the outlet. Average removal efficiency was 60% across all samples but average removal by sample number (1-5) shows that removal efficiency decreased with increasing detention time from 66% at sample 1 to 58% at sample 5. Results for the SIL-CO-SIL 250 test at 3.2gpm/ft2 an average removal of 71%. Recirculation in these tests would have reduced the D50 below 45microns in the influent but a PSD was not done as it was with the SIL-CO-SIL 106 influent mix. Results for SIL-CO-SIL 250 at 1.7gpm/ft2 found an average removal of 88%. Compared to the demonstrated results for the SIL-CO-SIL106, these values appear reasonable since higher removal efficiencies are expected when the particle size distribution is greater. Results from OK-110 testing demonstrated an average removal of 99.14% from discrete samples and 98.06% from the grab samples across all flow rates tested.

Pollutants addressed	Manufacturer's Removal Efficiency claim	Minimum particle size	Tested removal efficiency (*)	Test Data Status (**)	Notes
Suspended sediment concentration	60-95%	-	60-95 %	2	average removal for all rates and influent types from Tenn Tech studies verified by NJCAT
Total suspended solids	66%	-	69-83 %	2	UNH Stormwater Center field studies, removal efficiency and efficiency ratio methods.
Zinc	50%	-	57-61 %	2	UNH Stormwater Center field studies, removal efficiency and efficiency ratio methods.
Hydrocarbons	78%	-	79-91 %	2	UNH Stormwater Center field studies, removal efficiency and efficiency ratio methods.
Total Phosphorus	37%	-	29-53 %	2	UNH Stormwater Center field studies, removal efficiency and efficiency ratio methods.

* - Pollution removal efficiency evaluated by MASTEP staff based on review of available performance evaluation reports.

** - **1** = sufficient credible data to be able to evaluate pollution removal efficiency claims. **2** = promising studies are underway. **3** = insufficient credible data be able to evaluate claims. **0** = data review not yet conducted.

Test reports: (click on link to view a summary of a test, click on disk icon to download the full report)

Title	Author / Agency	Date	TARP compliancy	Test protocol compliancy	Documents
Hydraulic Performance and Sediment Trap Efficiency for the StormTech SC-740 Isolator Row	Andrew Christensen and Vince Neary	02/23/2005	No	-	Hydraulic_Perf_Sed_Trap_Eff_StormTech_Isolator.pdf
PERFORMANCE EVALUATION OF SEDIMENT REMOVAL EFFICIENCY STORMTECH ISOLATOR ROW	Vincent Neary	10/20/2006	No	-	Tenn Tech Oct 2006 Report.pdf
NJCAT Technology Verification of the StormTech Isolotor Row	-	08/01/2007	No	-	NJCAT_Verification_StormTech_081507finalbdapprov-doc1.pdf
FINAL REPORT ON FIELD VERIFICATION TESTING OF THE STORMTECH ISOLATOR ROW TREATMENT UNIT	University of New Hampshire Stormwater Center	06/01/2008	No	The UNHSC QAPP was designed tobsubstantially comply with TARP and TAPE guidelines	UNHSC_StormTech Isolator Row_Final Report_6_08.pdf
Performance Evaluation Report of the StormTech Isolator Row Treatment Unit	Roseen et al	09/01/2010	No	TARP and TAPE	UNHSC_Stormtech PER_9_9_10-Final.pdf

Return to the Home Page

Section 4.5

Drawdown Time Calculations

DRAWDOWN TIME

Below are the drawdown time calculations for the recharge systems proposed on the site. The calculation uses a conservative estimated hydraulic conductivity value "*K*" of 1.02 inches per hour, corresponding to Sandy Loam, HSG B in the Rawls Rate table. The soil classifications found on the site found from the NRCS soil data is Hinkley Loamy Sand and Udorthents. The presence of loamy sand fill and native soils were confirmed based on the test pit logs from McMahon.

The formula below is the recommended method of calculating drawdown times from the Massachusetts Stormwater Management Handbook

DRAWDOWN TIME CALCULATION

$$Time_{drawdown} = \frac{Rv}{(K)(Bottom\ Area)}$$

Where:
Rv = Required Recharge Storage Volume
K = Saturated Hydraulic Conductivity, Rawls Rate
Bottom Area = Bottom Area of Recharge BMP

The drawdown time is the time it takes to drain the BMP down from the lowest outlet invert. The infiltration rate has been assumed at 1.02 in/hr (the Rawls Rate for HSG B, Sandy Loam)

See the following Drawdown Calculation table for volume, infiltration rate, bottom area, and drawdown time.

Recharge BMP	*Storage in System below lowest orifice (cf)*	*Infiltration Rate (in/hr)*	*Square Footage of Basin (sf)*	*Drawdown Time (hrs)*
UG-1	6,750	1.02	2,137	**37.2**
UG-2	4,330	1.02	1,399	**36.4**
UG-3	1,178	1.02	621	**22.3**

Conclusion:

The calculations show that the infiltration BMP draws down in less than 72 hours, as required.

Section 4.6

Illicit Discharge Statement

ILLICIT DISCHARGE COMPLIANCE STATEMENT

Standard 10: Massachusetts Stormwater Standards Handbook

Illicit discharges are defined as discharges into waters of the State or municipal separate stormwater system (MS4) that are not entirely comprised of stormwater. Exclusions for non-stormwater discharges into drainage systems include activities or facilities for firefighting, water line flushing, landscape irrigation, uncontaminated groundwater discharge, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, water used to clean residential buildings without detergents, water used for street washing, and flows from riparian habitats/wetlands. These exclusions are subject to change and are under the discretion of the local governing authority.

To the best of our knowledge and professional belief no illicit discharges to the stormwater system, surface waters, or wetland resource areas will remain on the site after construction. We will agree to implement a pollution prevention plan to prevent illicit discharges into the stormwater management system. The design of the site based on the plans prepared by CHA, 141 Longwater Drive, Norwell, Massachusetts show a separation and no direct connection between the stormwater management systems and the wastewater and/ or groundwater on the site. To the maximum extent practicable, the design prevents entry of illicit discharges into the stormwater management system.

Engineer's Name: KELLY KULLEN
(please print)

Engineer's Signature: _____ Date: 12.3.18

Company: CHA

Section 5.0

Stormwater Checklist

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature

Kelly Killeen, P.E.
CHA
141 Longwater Drive
Norwell, MA 02061
(781) 982-5400

12.3.18

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☐ New development

☐ Redevelopment

☒ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

☐ No disturbance to any Wetland Resource Areas

☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)

☐ Reduced Impervious Area (Redevelopment Only)

☒ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

- ☐ Credit 1
- ☐ Credit 2
- ☐ Credit 3

☐ Use of "country drainage" versus curb and gutter conveyance and pipe

☐ Bioretention Cells (includes Rain Gardens)

☒ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☐ Grass Channel

☐ Green Roof

☒ Other (describe): Subsurface Drainage Systems

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth

☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☒ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☒ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☒ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☒ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☒ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☐ The ½" or 1" Water Quality Volume or
- ☒ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☒ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☒ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☒ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☒ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☒ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has *not* been included in the Stormwater Report but will be submitted *before* land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☒ Description and delineation of public safety features;
- ☒ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☒ An Illicit Discharge Compliance Statement is attached;

☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.