STORMWATER MANAGEMENT REPORT

FOR

105 HIGH ROAD,
NEWBURY, MA 01951

Prepared for:
Mark DePiero
DePiero Properties, LLC
3 Graf Road, Unit 14
Newburyport, MA

Prepared by:
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Project No. 2019-132
August, 2021

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APPENDICES

1.0 INTRODUCTION

DePiero Properties, LLC proposes a new subdivision that will include 10 single family homes located at the parcel of land currently 16.31 acres in size. Access to the new homes will be provided via a new 600' private drive located off of High Road. The objective of this analysis is to address the drainage design of the new drive and new homes proposed at the site.

2.0 EXISTING CONDITIONS

The subject site is located in Newbury, Massachusetts along High Road or Route 1A. The parcel is identified by the Town of Newbury's Assessor's Department as parcel R48-0-49. The parcel is in an Agriculture-Residential Zoning District within Precinct-1. The total parcel area is approximately 16.31 acres (709,156 square feet).

The property is abutted to the north and south by residential property. The property is abutted to the west by High Road and the east by private owned conservation area consisting of wetland resource areas. Facing the property on the other side of High Road is Tendercrop Farm.

The existing site consists of a semi-developed area at the lower southwestern portion of the site. As mentioned above, the northeastern portion of the site remains undeveloped. The semi-developed portion of the site consists of an existing single family home with a patio and a pool, as well as another building that acts as a single family home. Further east on the property, there are two existing sheds and a large barn. The larger northeastern portion of the site to remain undeveloped consists of mixture of upland area and wetland resource area.

2.1 Existing Hydrology

For hydrological design purposes of the study, due to limits of available survey information, the drainage areas have been defined by the parcel boundaries and the abutting property ay 107 High Road at the southwest corner of the property. The property that abuts on the North and South discharge their stormwater to the west and does not appear to flow onto the locus parcel. Within these parcel boundaries, there is one design discharge point located on the site within the property:

Design Point 100 – The design discharge point is located at the wetland region further southwest, making up the majority of the drainage area on the property. The catchment area that drains to this design discharge point consists of all the stormwater runoff from the entire parcel east of the wetland boundary, as well as a small portion to the west of the wetland boundary. Therefore, the area that drains to Design Point 100 consists of some roof area, as well as pavement, but mostly grass, pasture area. All of this runoff drains down along the topography and ultimately drains to the wetland area and the unnamed brook that flows offsite to the southeast abutters.

Design Point 1 and the remaining undeveloped wooded section are ultimately hydrologically connected, as they both drain to Pine Island Creek, however the wetland area at Design Point 100 drains to an unnamed brook that flows through abutting properties prior to draining to Pine Island Creek. Design Point 1 leaves the property into the abutter's property. The existing site is only 1.95% impervious. Therefore, only Design Point 100 is analyzed in this portion of the study.

2.2 Soils

According to the Natural Resource Conservation Service (NRCS) Web Soil Survey, the majority of the site area to be developed is categorized as Merrimac Fine Sandy Loam. A small portion of the front of the site is categorized as Unadilla Fine Sandy Loam. The rear of the site also consists of Ninnigret Fine Sandy Loam, Birdsall Fine Sandy Loam and Sudbury Fine Sandy Loam. These various soil types are categorized as Hydrologic Soil Group (HSG) A, B and C. The soil type regions and their associated HSGs are shown on the Existing and Proposed Drainage Plans.

Soil Suitability Deep Observation Holes were completed on July 9, 2020, May 2021, and again in August 2021 to gain a clearer understanding of the subsurface conditions at the site. These test pits largely found that the majority of the site consists of sandy loam at the subsurface, ranging from surface level, to approximately 2 feet Below Ground Surface (BGS). Below the sandy loam across the majority of the site is a gravelly sand. The test pits also found that the drainage class across the portion of the site to be developed was somewhat excessively drained, as part of Hydrologic Soil Group A. The Ksat was high to very high (1.42 – 99 in/hr).

2.3 FEMA Flood Insurance Rate Map

According to the FEMA Flood Insurance Rate Map Number 25009C0136G, with an effective date of July 16, 2014, a small portion of the rear site is located within a Zone AE, or the 100-Yr Floodplain. This area has a base flood elevation of 13 feet and is shown on the plan. However, the area of the property that is within the 100-Yr Floodplain is far to the rear of the site and not part of the site analyzed in this study.

3.0 PROPOSED CONDITION

As mentioned above, this stormwater analysis will address the proposed access drive, 9 new homes and one existing home, 10 individual driveways, and overland flow of the project development. The current project is proposing a 22' wide drive that will provide access to the proposed homes to be developed at the site. This new drive will be a lollipop cul de sac that will be 600' in length and 22' wide. The roadway will follow a gentle slope as it runs away from High Road, at 2% - 6% downgrade. The watershed analyzed for the site is 21.36% impervious.

3.1 Proposed Hydrology

In the proposed design there 1s one design point, which is in the same locations as discussed above in the existing hydrology. Therefore, only Design Point 200 is addressed as part of the proposed hydrology.

Design Point 200 is broken into 7 subcatchments. D1-D6 consists of all the surrounding area that drains to Bio-Infiltration Basin-1. D7 is the bypass area that drains directly to the Design Point 200.

This Bio-Infiltration Basin will provide approximately 3,343 CF of groundwater recharge volume within the system below the outlet elevation. The Water Quality Volume required to be treated is 2866 CF.

See the hydrological model for summarized hydrologic calculations for offsite flow rates and volumes for Design Point 200. See Appendix B: Existing and Proposed Drainage Areas for detailed layout of the above discussed drainage areas.

4.0 HYDROLOGIC MODEL

The hydrologic model was developed in HydroCAD, a computer program based on USDA's Technical Release TR-55, Urban Hydrology for Small Watersheds. Both existing and proposed conditions are modeled for the 2-year, 10-year, 25-year, and 100-year 24-hour storm events. Rainfall amounts are from "Northeast Regional Climate Center Extreme Precipitation Estimates". The rainfall amounts are; 2 year – 3.23", 10 year – 4.96", 25 year – 6.33", 100 year – 9.18". HydroCAD allows for variable rainfall intensity throughout the storm duration, peaking near the middle of the Type III, 24-hour storm. The drainage area's time of concentrations (t_c) are calculated and shown in the provided HydroCAD calculations. Any Tc concentrations calculated to be under 6 minutes are assumed to be the 6 minutes, as it is the minimum recommended by HydroCAD. Complete calculations, performed using the HydroCAD software, are included in the appendix.

Calculations show that the designated on-site stormwater management system reduces overall off-site rates and volumes for all storm events. The site was analyzed under both the existing and proposed conditions to compare the pre and post development peak discharge rates at design point leaving the property. A copy of the HydroCAD reports for both existing and proposed conditions area provided in Appendix D.

Table 4.1 Hydrologic Calculation Summary for Design Point 1

Description	Existing Conditions Design Point 100		Proposed Conditions Design Point 200	
Drainage Area	282,487 +/- Square Feet		282,487 +/- Square Feet	
Storm Event (Year)	Offsite Peak Runoff (CFS)	Offsite Runoff Volume (CF)	Offsite Peak Runoff (CFS)	Offsite Runoff Volume (CF)
2	0.03	564	0.00	0
10	0.98	8,369	0.51	9,223
25	3.29	19,651	2.05	23,044
100	11.66	53,241	8.02	61,138

5.0 CONCLUSION

Based on DCI's analysis of the existing and proposed conditions, the proposed site conditions meet the stormwater criteria set forth by the Town of Newbury. Design Point runoff volumes and peak flow rates for the 2-year, 5-year, 10-year, 25-year, and 100-year storm events are decreased. DCI concludes that the proposed roadway as part of the proposed project at the parcel located at 105 High Road adheres to all applicable stormwater management policies.

Massachusetts Stormwater Management Standards

The ten Stormwater Management Standards provided in the Massachusetts Stormwater Handbook are discussed and a statement regarding compliance with each is provided.

Standard 1

No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

The Project's stormwater control system, when constructed, will not produce untreated stormwater or cause erosion in wetlands or waters of the Commonwealth.

Standard 2

Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.

The Project's stormwater control system, when constructed, will produce runoff rates less than or equal to pre-developed conditions. Refer to Table below

Description	**Existing Conditions Design Point 100**		**Proposed Conditions Design Point 200**	
Drainage Area	282,487 +/- Square Feet		282,487 +/- Square Feet	
Storm Event (Year)	Offsite Peak Runoff (CFS)	Offsite Runoff Volume (CF)	Offsite Peak Runoff (CFS)	Offsite Runoff Volume (CF)
2	0.03	564	0.00	0
10	0.98	8,369	0.51	9,223
25	3.29	19,651	2.05	23,044
100	11.66	53,241	8.02	61,138

Standard 3

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.

Recharge Volume Calculations. The total REv responsibility based on hydrologic soil group and impervious area is 3,352 cubic feet. The total volume exfiltrated below the lowest invert in Infiltration Basin 1 is 3,388 cubic feet. Refer to the HydroCAD reports for the exfiltration volumes. The amount of stormwater exfiltrated exceeds the minimum required therefore Standard 3 has been met.

The Hydrologic Soil Group is 'A'. For this group, the volume is calculated by 0.6 inches (0.05 feet) times the total impervious surface. As depicted in the Post Development Stormwater Calculations, the total impervious area is 67,040 sf.
0.05 x 67,040 = 3,352 cf.

The total impervious area for the analyzed watershed is 67,040 sf. 3,578 sf bypass the Infiltration Basin, leaving 63,462 sf entering the Infiltration basin which is 94.7% of the total impervious area. Stormwater Standards require 65% of impervious areas be directed to infiltration BMP's.

Drawdown Calculation. Rv/(k x bottom area)
Rv = Recharge volume = 3388 cf
k = Infiltration rate = 1.12 inches per hour
Bottom area = 6500 sf (Elev. 20)

3388/(1.02/12 x 6500) = 6.13 hours
Stormwater Standards require drawdown be less than 72 hours.

Standard 4

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 includes suitable measures to pre-treat runoff from paved impervious areas prior to conveyance into the basins and eventual discharge. Stormwater controls have been selected which results in a significant reduction in annual stormwater pollutant loads from the Project. Through the use of structural and non-structural best

management practices (BMPs), the water quality volume from the catchment areas contribution to the basins will undergo treatment to the maximum extent practicable.

Water Quality Volume. The Water Quality Volume responsibility based on 1.0-inch of rain over the impervious areas is 2,866 cubic feet. The total volume exfiltrated out of Infiltration Basin 1 is 3,388 cubic feet. The proposed WQv of 3,388 cubic feet exceeds the minimum requirement of 2,866 cubic feet therefore Standard 4 has been met.

80% TSS Removal is achieved is by Stormwater flowing through deep sump catch basins (25%) and then through a Stormwater treatment tank (25%) (DMH-4) and then into a bio-filtration Basin (75%) before being discharged for all the Road way pavement as well as a majority of the driveways.
The minimum TSS Removal prior to entering an Infiltration device is 44%.

Attachment K indicates Infiltration Basin 2 which drains to watershed B achieves a TSS Removal of 90%.

Attachments H, I, and J indicate TSS removal of 33%, 91%, and 90% for Detention Basin 4, Focal Point 2, and Infiltration Basin 1, respectively. Because these three BMP's drain to Watershed A and Detention Basin 4 only achives 33% TSS removal the Weighted Average method was used to determine the average TSS removal for the BMP's draining to Watershed A. Refer to Attachment L for results. Attachment L indicates the average TSS removal for Watershed A is 85.3% which exceeds the minimum 80% therefore Standard 4 has been met.

Standard 5

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.

Standard 5 is not applicable. The land use proposed is not considered to have a high potential pollutant load.

Standard 6

Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook.

This site has a A.C.E.C. area at the east end of the property. This area is 1450 feet from the closest stormwater BMP. The water quality volume is calculated using 1 inch of runoff from paved surfaces within the development as required by Standard 6.

Standard 7

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.

Standard 7 is not applicable. The Project is considered new construction.

Standard 8

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.

An Erosion and Sedimentation Control Plan, Details, and construction sequence is included with the Site Plan. Refer to Sheets C1.41 and C1.42.

Standard 9

A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.

Refer to Appendix H - Stormwater Operation and Maintenance Plan.

Standard 10

All illicit discharges to the stormwater management system are prohibited.

Refer to the Illicit Discharge Statement attached.

Appendix A

SITE PLANS

Appendix B

FEMA FLOOD INSURANCE RATE MAP

National Flood Hazard Layer FIRMette

FEMA

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Area of 1% annual chance flood with average depth less than one foot or with drainag areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represe an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 2/4/2020 at 9:36:20 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Appendix C

SOILS INFORMATION

Appendix C

SOILS INFORMATION

Soil Map—Essex County, Massachusetts, Northern Part
(105 High Road, Newbury)

Map Scale: 1:6,890 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 100, 200, 400, 600

Feet: 0, 300, 600, 1200, 1800

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Essex County, Massachusetts, Northern Part
Survey Area Data: Version 15, Sep 12, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 30, 2011—Apr 8, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
6A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	7.3	3.0%
9A	Birdsall silt loam, 0 to 3 percent slopes	23.1	9.6%
16A	Scantic silt loam, 0 to 3 percent slopes	0.2	0.1%
30A	Raynham silt loam, 0 to 3 percent slopes	2.4	1.0%
31A	Walpole sandy loam, 0 to 3 percent slopes	13.8	5.7%
32A	Wareham loamy sand, 0 to 3 percent slopes	11.3	4.7%
225A	Belgrade very fine sandy loam, 0 to 3 percent slopes	3.3	1.4%
225B	Belgrade very fine sandy loam, 3 to 8 percent slopes	13.7	5.7%
228A	Buxton silt loam, 0 to 3 percent slopes	2.1	0.9%
228B	Buxton silt loam, 3 to 8 percent slopes	3.4	1.4%
228C	Buxton silt loam, 8 to 15 percent slopes	3.3	1.4%
230B	Unadilla very fine sandy loam, 3 to 8 percent slopes	29.3	12.2%
230C	Unadilla very fine sandy loam, 8 to 15 percent slopes	12.8	5.3%
254A	Merrimac fine sandy loam, 0 to 3 percent slopes	18.7	7.8%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	28.3	11.8%
254C	Merrimac fine sandy loam, 8 to 15 percent slopes	9.0	3.8%
260A	Sudbury fine sandy loam, 0 to 3 percent slopes	5.6	2.3%
276A	Ninigret fine sandy loam, 0 to 3 percent slopes	45.9	19.1%
712A	Ipswich and Westbrook mucky peats, 0 to 2 percent slopes, very frequently flooded	3.5	1.4%
716C	Rock outcrop-Buxton complex, 3 to 15 percent slopes	2.3	1.0%
719C	Suffield silt loam, 8 to 15 percent slopes	1.3	0.5%
Totals for Area of Interest		**240.6**	**100.0%**

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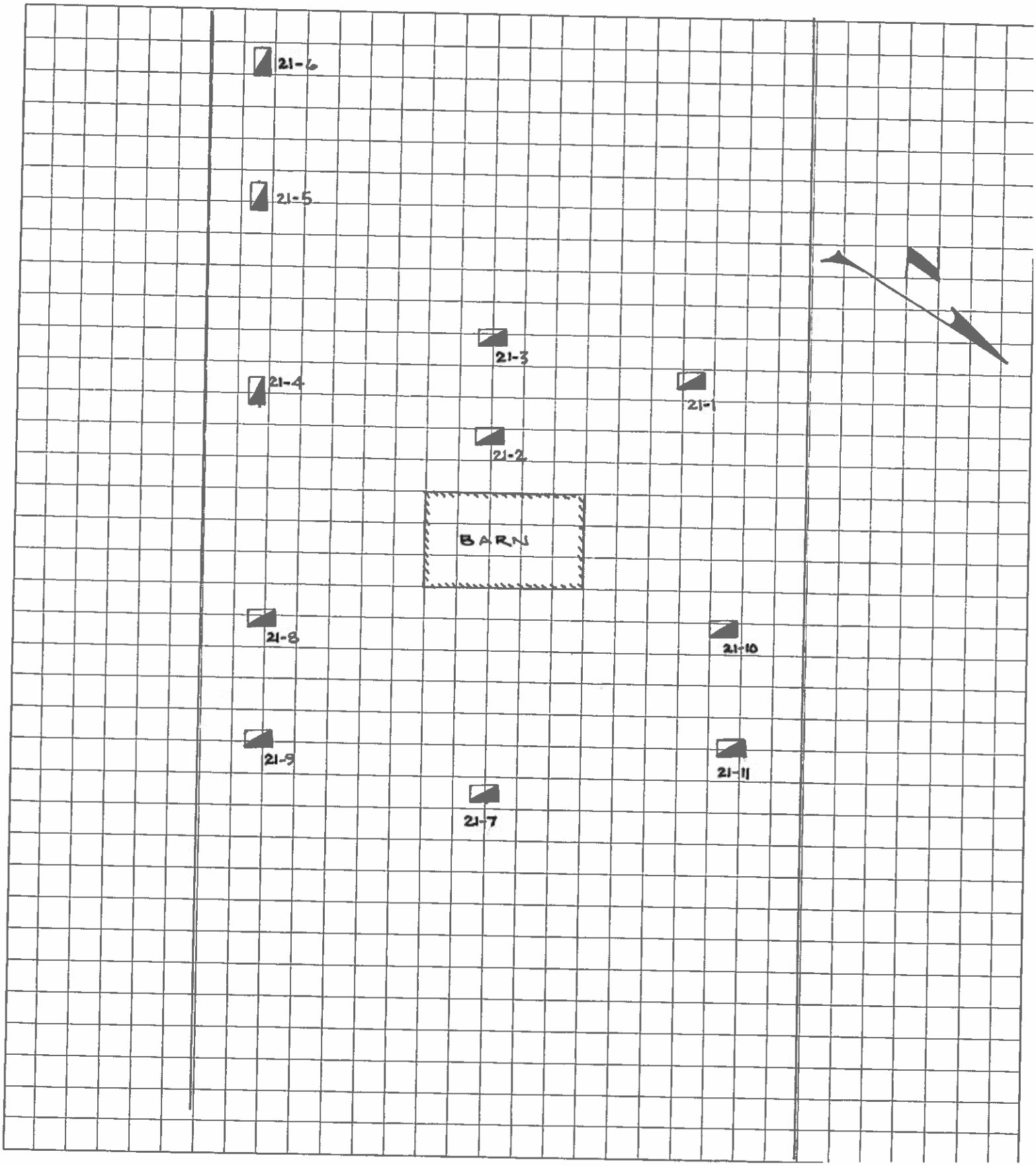
PROJECT ADDRESS 105 HIGH RD, NEWBURY 5.1.21
SHEET NO. 1 OF 1
CALCULATED BY _____ DATE _____
CHECKED BY _____ DATE _____
JOB NO. _____ CLIENT _____



SOIL SUITABILITY ASSESSMENT REPORT
COMMONWEALTH OF MASSACHUSETTS
NEWBURY, MASSACHUSETTS
SOIL EVALUATION FOR ON-SITE STORMWATER DRAINAGE DESIGN

SITE INFORMATION

Street Address: 105 High Road Town: Newbury State: Massachusetts Zip Code: 01951 County: Essex

Land Use: Agricultural/Residential (R-AG) Latitude: ~42°46'25.3"N Longitude: ~70°50'21.9" W

PUBLISHED SOIL DATA AND MAP UNIT DESCRIPTION

Physiographic Division: Appalachian Highlands Province: New England Section: Seaboard lowland section

Soil map unit: 254A – Merrimac fine sandy loam (Sandy, mixed, mesic Typic Dystrochrepts), 0-3% slopes

NRCS/USDA web soil survey: Essex County, Massachusetts, Northern Part Map Scale: 1: 300'

Drainage Class: Somewhat excessively drained Hydrologic Soil Group: A Ksat: High to very high (1.42 – 99.00 in/hr)

Soil hydric or upland: Upland Depth to phreatic water table: >80" Depth to restrictive feature: >80"

Frequency of flooding: None Frequency of ponding: None Available water capacity: Low (~4.6")

Soil limitations: Loose, unstable matrix, rapid permeability, high porosity, moderate seasonal groundwater table elevation,

WETLAND AREA & USGS WELL MEASUREMENTS

National Wetland Inventory Map: NA Wetlands Conservancy Program: NA Bordering vegetative wetland: >200 feet

Current Water Resource Condition (USGS): Well Site # 424520070562401- MA-NIW 27 Newbury, MA

Well completed in Sand and gravel aquifers and ice-contact deposits, including kames and eskers.

Well depth: 19.8 feet Land altitude: 55.00 feet above NGVD29 Latitude: ~42°45'19.3"N Longitude: ~70°56'22.1"

Most recent data value: 4.05' on 05/01/21 (depth to water level in feet below land surface) Range: Above normal

SURFICIAL GEOLOGY:

Surficial Geology: Deposits in the Merrimac River area. Light brown, fine to medium, well-sorted, glaciofluvial sand in the valleys of Parker River and its tributaries. Contains thin beds of cobble gravel locally.

Geologic parent material: Gravelly glaciofluvial deposits Geomorphic landform: Outwash terraces

Slope aspect: Easterly Landform position (2D): Footslope Landform position (3D): Tread

Slope gradient: ~0-3% Down slope shape: Convex Across slope shape: Convex Slope complexity: Simple

Bedrock outcropping in vicinity: None observed Glacial erratics in vicinity: None observed

Bedrock Type: Newbury Volcanic Complex; porphyritic andesite, includes tuffaceous mudstone beds containing fossils of Late Silurian through Early Devonian age.

TP 21-1 DEEP OBSERVATION HOLE

105 High Road, Newbury, Massachusetts

Date: May 01, 2021 Time: 12:20 Weather: Clear, ~65-70°F, dry, light West breeze

Landscape: Upland Landform: Proglacial outwash terrace Position on landscape: Footslope

Slope aspect: Easterly Slope (%): 00- 03% Slope complexity: Simple Land Cover: Grass Lawn

Property line: 10+ feet Drainage way: 50+ feet Drinking water well: 100+ feet Abutting septic system: 50+ feet

Wetlands: 100+ feet Public water supply reservoir: 400+ feet Tributary to reservoir: 200+ feet

SOIL PROFILE ▶ TP 21-1

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 18"	A_P	Sandy Loam	10YR 3/2 very dark grayish brown	none observed	Very friable; moderate-grade; fine-to-medium granular structure; somewhat cohesive; fine grained mineral content; slightly damp; non-sticky; non-plastic; many fine grass roots; free of clasts; clear wavy boundary.
18" → 24"	B_W	Sandy Loam	10YR 5/6 yellowish brown	none observed	Very friable; moderate-grade, fine, sub-angular blocky structure; non-cohesive; mixed medium to mostly fine-grained mineral content; slightly damp; non-sticky; non-plastic; few fine grass roots; ~05% rounded to sub-rounded gravel content of mixed lithology; gradual wavy boundary.
24" → 55"	$2C_1$	Loamy Sand	2.5Y 6/4 light yellowish brown	none observed	Very friable; weak-grade; fine, granular to sub-angular blocky structure; non-cohesive matrix; mixed medium to fine-grained mineral content; slightly damp matrix; non-sticky; non-plastic; approximately 05% sub-angular to sub-rounded gravel content of mixed lithology; clear smooth boundary.
55" → 120"	$2C_2$	Sand very gravelly	10YR 4/4 dark yellowish brown	none observed	Loose; structurless; unstable; mixed fine-to-coarse grained mineral content; free of fines; damp matrix; non-sticky; non-plastic; well graded/ poorly sorted; approximately 40 - 45% angular to sub-rounded gravel and cobble content of mixed lithology; no bedrock refusal at test hole depth

Depth to bedrock: > 120" Seasonal High Groundwater Table: Not observed Apparent water table: Not observed

TP 21-1 DEEP OBSERVATION HOLE

105 High Road, Newbury, Massachusetts

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE: None Observed

Apparent water seeping from pit face:___ (below land surface) Depth to stabilized apparent water: ___ (below land surface)

Soil moisture state: Slightly damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE: None Observed

Depth of Estimated Seasonal High Groundwater Table:___ (below land surface)

Kind: _____

Shape: _____ Location: _____

Hardness: _____ Boundary: _____ Abundance: _____ Size: _____ Contrast: _____

Concentration color: _____ Reduction color:_____ Moisture state: _____

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: ___ inches below grade

Observed water weeping from side of deep hole: ___ inches below grade

Observed depth to stabilized phreatic water: ___ inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ▶ 8.50 feet

Depth of naturally occurring pervious material in TP 21-1 Upper boundary: 18"
Lower boundary: 120"

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

Alexander F. Parker *#1848*
Massachusetts Evaluator & Certification number

June 1998
Date of Soil Evaluator Certification

Unofficial soil testing
Newbury Town Witness

05/01/21
Date of soil testing

TP 21-2 DEEP OBSERVATION HOLE

105 High Road, Newbury, Massachusetts

Date: May 01, 2021 Time: 12:35 Weather: Clear, ~65-70°F, dry, light West breeze

Landscape: Upland Landform: Proglacial outwash terrace Position on landscape: Footslope

Slope aspect: Easterly Slope (%): 00- 03% Slope complexity: Simple Land Cover: Grass Lawn

Property line: 10+ feet Drainage way: 50+ feet Drinking water well: 100+ feet Abutting septic system: 50+ feet

Wetlands: 100+ feet Public water supply reservoir: 400+ feet Tributary to reservoir: 200+ feet

SOIL PROFILE ▶ TP 21-2

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 12"	A_P	Sandy Loam	10YR 3/2 very dark grayish brown	none observed	Very friable; moderate-grade; fine-to-medium granular structure; somewhat cohesive; fine grained mineral content; slightly damp; non-sticky; non-plastic; many fine grass roots; free of clasts; clear wavy boundary.
12" → 26"	B_W	Sandy Loam	10YR 5/6 yellowish brown	none observed	Very friable; moderate-grade, fine, sub-angular blocky structure; non-cohesive; mixed medium to mostly fine-grained mineral content; slightly damp; non-sticky; non-plastic; few fine grass roots; ~05% rounded to sub-rounded gravel content of mixed lithology; gradual wavy boundary.
26" → 93"	2C	Sand	10YR 4/4 dark yellowish brown	none observed	Loose; structurless; unstable; mixed fine-to-coarse grained mineral content; free of fines; damp matrix; non-sticky; non-plastic; well graded; approximately 10 - 15% angular to sub-rounded gravel and content of mixed lithology; no bedrock refusal at test hole depth

Depth to bedrock: > 93" Seasonal High Groundwater Table: Not observed Apparent water table: Not observed

TP 20-3 DEEP OBSERVATION HOLE

105 High Road, Newbury, Massachusetts

Date: Friday, July 10, 2020 Time: 09:07 Weather: Clear, ~75-80°F, calm & humid

Landscape: Upland Landform: Proglacial outwash terrace Position on landscape: Footslope

Slope aspect: Easterly Slope (%): 00- 03% Slope complexity: Simple Land Cover: Meadow grass

Property line: 10+ feet Drainage way: 50+ feet Drinking water well: 100+ feet Abutting septic system: 50+ feet

Wetlands: 100+ feet Public water supply reservoir: 400+ feet Tributary to reservoir: 200+ feet

SOIL PROFILE ▶ TP 20-3

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 13"	A_P	Sandy Loam	10YR 3/2 very dark grayish brown	none observed	Very friable; moderate-grade; fine-to-medium granular structure; somewhat cohesive; fine grained mineral content; slightly damp; non-sticky; non-plastic; many fine grass roots; free of clasts; clear wavy boundary.
13" → 25"	B_W	Sandy Loam	10YR 5/6 dark yellowish brown	none observed	Very friable; moderate-grade, fine, sub-angular blocky structure; non-cohesive; mixed medium to mostly fine-grained mineral content; slightly damp; non-sticky; non-plastic; few fine grass roots; ~05% rounded to sub-rounded gravel content of mixed lithology; gradual wavy boundary.
25" → 120"	2C	Sand gravelly	2.5Y 5/4 light olive brown	100" (c,1-2,p) 10YR 7/1 5YR 5/8	Loose; structurless; unstable; mixed fine-to-coarse grained mineral content; crudely stratified layers of sand and gravel; free of fines; damp matrix; non-sticky; non-plastic; well graded/ poorly sorted; approximately 25 - 30% angular to sub-rounded gravel and cobble content of mixed lithology; no bedrock refusal at test hole depth

Depth to bedrock: >120" Seasonal High Groundwater Table: 100" Apparent water:113"

TP 20-3 DEEP OBSERVATION HOLE

105 High Road, Newbury, Massachusetts

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE:

Apparent water seeping from pit face: 113" (below land surface) Depth to stabilized apparent water: 113" (below land surface)

Soil moisture state: Damp

DEPTH TO ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 100" (below land surface)

Kind: Iron concentrations; noncemented iron masses and reduction spots – iron coatings on sand grains

Location: In 2C matrix surrounding redox depletions Shape: Irregular/ spherical

Hardness: Soft Boundary: Clear Abundance: Common Size: Fine to medium Contrast: Prominent

Concentration color: 5YR 5/8 yellowish red Reduction color: 10YR 7/1 light gray Moisture state: Damp

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 100" inches below grade

Observed water weeping from side of deep hole: 113" inches below grade

Observed depth to stabilized phreatic water: 113" inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ► 8.92 feet

Depth of naturally occurring pervious material in TP 20-3 Upper boundary: 13"
Lower boundary: 120"

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

Alexander F. Parker *#1848*
Massachusetts Evaluator & Certification number

June 1998
Date of Soil Evaluator Certification

Unofficial soil testing
Newbury Town Witness

07/10/20
Date of soil testing

TP 20-4 DEEP OBSERVATION HOLE

105 High Road, Newbury, Massachusetts

Date: Friday, July 10, 2020 Time: 09:28 Weather: Clear, ~75-80°F, calm & humid

Landscape: Upland Landform: Proglacial outwash terrace Position on landscape: Footslope

Slope aspect: Easterly Slope (%): 00- 03% Slope complexity: Simple Land Cover: Meadow grass

Property line: 10+ feet Drainage way: 50+ feet Drinking water well: 100+ feet Abutting septic system: 50+ feet

Wetlands: 100+ feet Public water supply reservoir: 400+ feet Tributary to reservoir: 200+ feet

SOIL PROFILE ▶ TP 20-4

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 13"	A_P	Sandy Loam	10YR 3/2 very dark grayish brown	none observed	Very friable; moderate-grade; fine-to-medium granular structure; somewhat cohesive; fine grained mineral content; slightly damp; non-sticky; non-plastic; many fine grass roots; free of clasts; clear wavy boundary.
13" → 23"	B_W	Sandy Loam	10YR 5/6 dark yellowish brown	none observed	Very friable; moderate-grade, fine, sub-angular blocky structure; non-cohesive; mixed medium to mostly fine-grained mineral content; slightly damp; non-sticky; non-plastic; few fine grass roots; ~05% rounded to sub-rounded gravel content of mixed lithology; gradual wavy boundary.
23" → 121"	2C	Sand gravelly	2.5Y 5/4 light olive brown	100" (c,1-2,p) 10YR 7/1 5YR 5/8	Loose; structurless; unstable; mixed fine-to-coarse grained mineral content; crudely stratified layers of sand and gravel; free of fines; damp matrix; non-sticky; non-plastic; well graded/ poorly sorted; approximately 25 - 30% angular to sub-rounded gravel and cobble content of mixed lithology; no bedrock refusal at test hole depth

Depth to bedrock: >121" Seasonal High Groundwater Table: 100" Apparent water:112"

TP 20-4 DEEP OBSERVATION HOLE

105 High Road, Newbury, Massachusetts

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE:

Apparent water seeping from pit face: 112" (below land surface) Depth to stabilized apparent water: 112" (below land surface)

Soil moisture state: Damp

DEPTH TO ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 100" (below land surface)

Kind: Iron concentrations; noncemented iron masses and reduction spots – iron coatings on sand grains

Location: In 2C matrix surrounding redox depletions Shape: Irregular/ spherical

Hardness: Soft Boundary: Clear Abundance: Common Size: Fine to medium Contrast: Prominent

Concentration color: 5YR 5/8 yellowish red Reduction color: 10YR 7/1 light gray Moisture state: Damp

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 100" inches below grade

Observed water weeping from side of deep hole: 112" inches below grade

Observed depth to stabilized phreatic water: 112" inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ▶ 9.00 feet

Depth of naturally occurring pervious material in TP 20-4 Upper boundary: 13"
Lower boundary: 121"

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

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June 1998
Date of Soil Evaluator Certification

Unofficial soil testing
Newbury Town Witness

07/10/20
Date of soil testing

TP 20-5 DEEP OBSERVATION HOLE

105 High Road, Newbury, Massachusetts

Date: Friday, July 10, 2020 Time: 09:40 Weather: Clear, ~75-80°F, calm & humid

Landscape: Upland Landform: Proglacial outwash terrace Position on landscape: Footslope

Slope aspect: Easterly Slope (%): 00- 03% Slope complexity: Simple Land Cover: Meadow grass

Property line: 10^{+} feet Drainage way: 50^{+} feet Drinking water well: 100^{+} feet Abutting septic system: 50^{+} feet

Wetlands: 100^{+} feet Public water supply reservoir: 400^{+} feet Tributary to reservoir: 200^{+} feet

SOIL PROFILE ▶ TP 20-5

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 14"	A_P	Sandy Loam	10YR 3/2 very dark grayish brown	none observed	Very friable; moderate-grade; fine-to-medium granular structure; somewhat cohesive; fine grained mineral content; slightly damp; non-sticky; non-plastic; many fine grass roots; free of clasts; clear wavy boundary.
14" → 24"	B_W	Sandy Loam	10YR 5/6 dark yellowish brown	none observed	Very friable; moderate-grade, fine, sub-angular blocky structure; non-cohesive; mixed medium to mostly fine-grained mineral content; slightly damp; non-sticky; non-plastic; few fine grass roots; ~05% rounded to sub-rounded gravel content of mixed lithology; gradual wavy boundary.
24" → 122"	2C	Sand gravelly	2.5Y 5/4 light olive brown	101" (c,1-2,p) 10YR 7/1 5YR 5/8	Loose; structurless; unstable; mixed fine-to-medium grained mineral content; crudely stratified layers of sand and gravel; free of fines; damp matrix; non-sticky; non-plastic; well graded/ poorly sorted; approximately 25 - 30% angular to sub-rounded gravel and cobble content of mixed lithology; no bedrock refusal at test hole depth

Depth to bedrock: >122" Seasonal High Groundwater Table: 101" Apparent water:113"

TP 20-5 DEEP OBSERVATION HOLE

105 High Road, Newbury, Massachusetts

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE:

Apparent water seeping from pit face: 113" (below land surface) Depth to stabilized apparent water: 113" (below land surface)

Soil moisture state: Damp

DEPTH TO ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 101" (below land surface)

Kind: Iron concentrations; noncemented iron masses and reduction spots – iron coatings on sand grains

Location: In 2C matrix surrounding redox depletions Shape: Irregular/ spherical

Hardness: Soft Boundary: Clear Abundance: Common Size: Fine to medium Contrast: Prominent

Concentration color: 5YR 5/8 yellowish red Reduction color: 10YR 7/1 light gray Moisture state: Damp

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 101" inches below grade

Observed water weeping from side of deep hole: 113" inches below grade

Observed depth to stabilized phreatic water: 113" inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ► 9.00 feet

Depth of naturally occurring pervious material in TP 20-5 Upper boundary: 14"
Lower boundary: 122"

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

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Unofficial soil testing
Newbury Town Witness

07/10/20
Date of soil testing

TP 20-6 DEEP OBSERVATION HOLE

105 High Road, Newbury, Massachusetts

Date: Friday, July 10, 2020 Time: 09:48 Weather: Clear, ~75-80°F, calm & humid

Landscape: Upland Landform: Proglacial outwash terrace Position on landscape: Footslope

Slope aspect: Easterly Slope (%): 00- 03% Slope complexity: Simple Land Cover: Meadow grass

Property line: 10+ feet Drainage way: 50+ feet Drinking water well: 100+ feet Abutting septic system: 50+ feet

Wetlands: 100+ feet Public water supply reservoir: 400+ feet Tributary to reservoir: 200+ feet

SOIL PROFILE ▶ TP 20-6

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 13"	A_P	Sandy Loam	10YR 3/2 very dark grayish brown	none observed	Very friable; moderate-grade; fine-to-medium granular structure; somewhat cohesive; fine grained mineral content; slightly damp; non-sticky; non-plastic; many fine grass roots; free of clasts; clear wavy boundary.
13" → 24"	B_W	Sandy Loam	10YR 5/6 dark yellowish brown	none observed	Very friable; moderate-grade, fine, sub-angular blocky structure; non-cohesive; mixed medium to mostly fine-grained mineral content; slightly damp; non-sticky; non-plastic; few fine grass roots; ~05% rounded to sub-rounded gravel content of mixed lithology; gradual wavy boundary.
24" → 122"	2C	Sand gravelly	2.5Y 5/4 light olive brown	99" (c,1-2,p) 10YR 7/1 5YR 5/8	Loose; structurless; unstable; mixed fine-to-medium grained mineral content; crudely stratified layers of sand and gravel; free of fines; damp matrix; non-sticky; non-plastic; well graded/ poorly sorted; approximately 25 - 30% angular to sub-rounded gravel and cobble content of mixed lithology; no bedrock refusal at test hole depth

Depth to bedrock: >122" Seasonal High Groundwater Table: 99" Apparent water: 111"

TP 20-6 DEEP OBSERVATION HOLE

105 High Road, Newbury, Massachusetts

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE:

Apparent water seeping from pit face: 111" (below land surface) Depth to stabilized apparent water: 111" (below land surface)

Soil moisture state: Damp

DEPTH TO ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 99" (below land surface)

Kind: Iron concentrations; noncemented iron masses and reduction spots – iron coatings on sand grains

Location: In 2C matrix surrounding redox depletions Shape: Irregular/ spherical

Hardness: Soft Boundary: Clear Abundance: Common Size: Fine to medium Contrast: Prominent

Concentration color: 5YR 5/8 yellowish red Reduction color: 10YR 7/1 light gray Moisture state: Damp

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 99" inches below grade

Observed water weeping from side of deep hole: 111" inches below grade

Observed depth to stabilized phreatic water: 111" inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ▶ 9.08 feet

Depth of naturally occurring pervious material in TP 20-6 Upper boundary: 13"
Lower boundary: 122"

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

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Unofficial soil testing
Newbury Town Witness

07/10/20
Date of soil testing

TP 20-7 DEEP OBSERVATION HOLE

105 High Road, Newbury, Massachusetts

Date: Friday, July 10, 2020 Time: 10:11 Weather: Clear, ~75-80°F, calm & humid

Landscape: Upland Landform: Proglacial outwash terrace Position on landscape: Footslope

Slope aspect: Easterly Slope (%): 00- 03% Slope complexity: Simple Land Cover: Meadow grass

Property line: 10+ feet Drainage way: 50+ feet Drinking water well: 100+ feet Abutting septic system: 50+ feet

Wetlands: 100+ feet Public water supply reservoir: 400+ feet Tributary to reservoir: 200+ feet

SOIL PROFILE ▶ TP 20-7

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 12"	A_P	Sandy Loam	10YR 3/2 very dark grayish brown	none observed	Very friable; moderate-grade; fine-to-medium granular structure; somewhat cohesive; fine grained mineral content; slightly damp; non-sticky; non-plastic; many fine grass roots; free of clasts; clear wavy boundary.
12" → 22"	B_W	Sandy Loam	10YR 5/6 dark yellowish brown	none observed	Very friable; moderate-grade, fine, sub-angular blocky structure; non-cohesive; mixed medium to mostly fine-grained mineral content; slightly damp; non-sticky; non-plastic; few fine grass roots; ~05% rounded to sub-rounded gravel content of mixed lithology; gradual wavy boundary.
22" → 121"	2C	Sand gravelly	2.5Y 5/4 light olive brown	102" (c,1-2,p) 10YR 7/1 5YR 5/8	Loose; structurless; unstable; mixed fine-to-medium grained mineral content; crudely stratified layers of sand and gravel; free of fines; damp matrix; non-sticky; non-plastic; well graded/ poorly sorted; approximately 25 - 30% angular to sub-rounded gravel and cobble content of mixed lithology; no bedrock refusal at test hole depth

Depth to bedrock: >121" Seasonal High Groundwater Table: 102" Apparent water:113"

TP 20-7 DEEP OBSERVATION HOLE

105 High Road, Newbury, Massachusetts

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE:

Apparent water seeping from pit face: 113" (below land surface) Depth to stabilized apparent water: 113" (below land surface)

Soil moisture state: Damp

DEPTH TO ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 102" (below land surface)

Kind: Iron concentrations; noncemented iron masses and reduction spots – iron coatings on sand grains

Location: In 2C matrix surrounding redox depletions Shape: Irregular/ spherical

Hardness: Soft Boundary: Clear Abundance: Common Size: Fine to medium Contrast: Prominent

Concentration color: 5YR 5/8 yellowish red Reduction color: 10YR 7/1 light gray Moisture state: Damp

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 102" inches below grade

Observed water weeping from side of deep hole: 113" inches below grade

Observed depth to stabilized phreatic water: 113" inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ▶ 9.08 feet

Depth of naturally occurring pervious material in TP 20-7 Upper boundary: 12"
Lower boundary: 121"

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

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Massachusetts Evaluator & Certification number

June 1998
Date of Soil Evaluator Certification

Unofficial soil testing
Newbury Town Witness

07/10/20
Date of soil testing

TP 20-8 DEEP OBSERVATION HOLE

105 High Road, Newbury, Massachusetts

Date: Friday, July 10, 2020 Time: 10:39 Weather: Clear, ~75-80°F, calm & humid

Landscape: Upland Landform: Proglacial outwash terrace Position on landscape: Footslope

Slope aspect: Easterly Slope (%): 00- 03% Slope complexity: Simple Land Cover: Meadow grass

Property line: 10+ feet Drainage way: 50+ feet Drinking water well: 100+ feet Abutting septic system: 50+ feet

Wetlands: 100+ feet Public water supply reservoir: 400+ feet Tributary to reservoir: 200+ feet

SOIL PROFILE ▶ TP 20-8

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 11"	A_P	Sandy Loam	10YR 3/2 very dark grayish brown	none observed	Very friable; moderate-grade; fine-to-medium granular structure; somewhat cohesive; fine grained mineral content; slightly damp; non-sticky; non-plastic; many fine grass roots; free of clasts; clear wavy boundary.
11" → 23"	B_W	Sandy Loam	10YR 5/6 dark yellowish brown	none observed	Very friable; moderate-grade, fine, sub-angular blocky structure; non-cohesive; mixed medium to mostly fine-grained mineral content; slightly damp; non-sticky; non-plastic; few fine grass roots; ~05% rounded to sub-rounded gravel content of mixed lithology; gradual wavy boundary.
23" → 120"	2C	Sand gravelly	2.5Y 5/4 light olive brown	75" (c,1-2,p) 10YR 7/1 5YR 5/8	Loose; structurless; unstable; mixed fine-to-medium grained mineral content; crudely stratified layers of sand and gravel; free of fines; damp matrix; non-sticky; non-plastic; well graded/ poorly sorted; approximately 25 - 30% angular to sub-rounded gravel and cobble content of mixed lithology; no bedrock refusal at test hole depth

Depth to bedrock: >120" Seasonal High Groundwater Table: 75" Apparent water: 98"

TP 20-8 DEEP OBSERVATION HOLE

105 High Road, Newbury, Massachusetts

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE:

Apparent water seeping from pit face: 98" (below land surface) Depth to stabilized apparent water: 114" (below land surface)

Soil moisture state: Damp

DEPTH TO ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 75" (below land surface)

Kind: Iron concentrations; noncemented iron masses and reduction spots – iron coatings on sand grains

Location: In 2C matrix surrounding redox depletions Shape: Irregular/ spherical

Hardness: Soft Boundary: Clear Abundance: Common Size: Fine to medium Contrast: Prominent

Concentration color: 5YR 5/8 yellowish red Reduction color: 10YR 7/1 light gray Moisture state: Damp

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 75" inches below grade

Observed water weeping from side of deep hole: 98" inches below grade

Observed depth to stabilized phreatic water: 114" inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ▶ 9.08 feet

Depth of naturally occurring pervious material in TP 20-8 Upper boundary: 11"
Lower boundary: 120"

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

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June 1998
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Unofficial soil testing
Newbury Town Witness

07/10/20
Date of soil testing

TP 20-9 DEEP OBSERVATION HOLE

105 High Road, Newbury, Massachusetts

Date: Friday, July 10, 2020 Time: 10:50 Weather: Clear, ~75-80°F, calm & humid

Landscape: Upland Landform: Proglacial outwash terrace Position on landscape: Footslope

Slope aspect: Easterly Slope (%): 00- 03% Slope complexity: Simple Land Cover: Meadow grass

Property line: 10+ feet Drainage way: 50+ feet Drinking water well: 100+ feet Abutting septic system: 50+ feet

Wetlands: 100+ feet Public water supply reservoir: 400+ feet Tributary to reservoir: 200+ feet

SOIL PROFILE ▶ TP 20-9

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 14"	A_P	Sandy Loam	10YR 3/2 very dark grayish brown	none observed	Very friable; moderate-grade; fine-to-medium granular structure; somewhat cohesive; fine grained mineral content; slightly damp; non-sticky; non-plastic; many fine grass roots; free of clasts; clear wavy boundary.
14" → 24"	B_W	Sandy Loam	10YR 5/6 dark yellowish brown	none observed	Very friable; moderate-grade, fine, sub-angular blocky structure; non-cohesive; mixed medium to mostly fine-grained mineral content; slightly damp; non-sticky; non-plastic; few fine grass roots; ~05% rounded to sub-rounded gravel content of mixed lithology; gradual wavy boundary.
24" → 120"	2C	Sand gravelly	2.5Y 5/4 light olive brown	63" (c,1-2,p) 10YR 7/1 5YR 5/8	Loose; structurless; unstable; mixed fine-to-medium grained mineral content; crudely stratified layers of sand and gravel; free of fines; damp matrix; non-sticky; non-plastic; well graded/ poorly sorted; approximately 25 - 30% angular to sub-rounded gravel and cobble content of mixed lithology; no bedrock refusal at test hole depth

Depth to bedrock: >120" Seasonal High Groundwater Table: 63" Apparent water: 80"

TP 20-9 DEEP OBSERVATION HOLE

105 High Road, Newbury, Massachusetts

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE:

Apparent water seeping from pit face: 80" (below land surface) Depth to stabilized apparent water: 111" (below land surface)

Soil moisture state: Damp

DEPTH TO ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 63" (below land surface)

Kind: Iron concentrations; noncemented iron masses and reduction spots – iron coatings on sand grains

Location: In 2C matrix surrounding redox depletions Shape: Irregular/ spherical

Hardness: Soft Boundary: Clear Abundance: Common Size: Fine to medium Contrast: Prominent

Concentration color: 5YR 5/8 yellowish red Reduction color: 10YR 7/1 light gray Moisture state: Damp

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 63" inches below grade

Observed water weeping from side of deep hole: 80" inches below grade

Observed depth to stabilized phreatic water: 111" inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ► 8.83 feet

Depth of naturally occurring pervious material in TP 20-9 Upper boundary: 14"
Lower boundary: 120"

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

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Unofficial soil testing

Newbury Town Witness

07/10/20

Date of soil testing

TP 20-10 DEEP OBSERVATION HOLE

105 High Road, Newbury, Massachusetts

Date: Friday, July 10, 2020 Time: 11:28 Weather: Clear, ~75-80°F, calm & humid

Landscape: Upland Landform: Proglacial outwash terrace Position on landscape: Footslope

Slope aspect: Easterly Slope (%): 00- 03% Slope complexity: Simple Land Cover: Meadow grass

Property line: 10+ feet Drainage way: 50+ feet Drinking water well: 100+ feet Abutting septic system: 50+ feet

Wetlands: 100+ feet Public water supply reservoir: 400+ feet Tributary to reservoir: 200+ feet

SOIL PROFILE ▶ TP 20-10

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 15"	A_P	Sandy Loam	10YR 3/2 very dark grayish brown	none observed	Very friable; moderate-grade; fine-to-medium granular structure; somewhat cohesive; fine grained mineral content; slightly damp; non-sticky; non-plastic; many fine grass roots; free of clasts; clear wavy boundary.
15" → 25"	B_W	Sandy Loam	10YR 5/6 dark yellowish brown	none observed	Very friable; moderate-grade, fine, sub-angular blocky structure; non-cohesive; mixed medium to mostly fine-grained mineral content; slightly damp; non-sticky; non-plastic; few fine grass roots; ~05% rounded to sub-rounded gravel content of mixed lithology; gradual wavy boundary.
25" → 120"	2C	Sand gravelly	2.5Y 5/4 light olive brown	50" (c,1-2,p) 10YR 7/1 5YR 5/8	Loose; structurless; unstable; mixed fine-to-medium grained mineral content; crudely stratified layers of sand and gravel; free of fines; damp matrix; non-sticky; non-plastic; well graded/ poorly sorted; approximately 25 - 30% angular to sub-rounded gravel and cobble content of mixed lithology; no bedrock refusal at test hole depth

Depth to bedrock: >120" Seasonal High Groundwater Table: 50" Apparent water: 67"

TP 20-10 DEEP OBSERVATION HOLE

105 High Road, Newbury, Massachusetts

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE:

Apparent water seeping from pit face: 67" (below land surface) Depth to stabilized apparent water: 110" (below land surface)

Soil moisture state: Damp

DEPTH TO ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 50" (below land surface)

Kind: Iron concentrations; noncemented iron masses and reduction spots – iron coatings on sand grains

Location: In 2C matrix surrounding redox depletions Shape: Irregular/ spherical

Hardness: Soft Boundary: Clear Abundance: Common Size: Fine to medium Contrast: Prominent

Concentration color: 5YR 5/8 yellowish red Reduction color: 10YR 7/1 light gray Moisture state: Damp

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 50" inches below grade

Observed water weeping from side of deep hole: 67" inches below grade

Observed depth to stabilized phreatic water: 110" inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ▶ 8.75 feet

Depth of naturally occurring pervious material in TP 20-10 Upper boundary: 15"
Lower boundary: 120"

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

Alexander F. Parker *#1848*
Massachusetts Evaluator & Certification number

June 1998
Date of Soil Evaluator Certification

Unofficial soil testing
Newbury Town Witness

07/10/20
Date of soil testing

SOIL SUITABILITY PERCOLATION TEST

COMMONWEALTH OF MASSACHUSETTS

NEWBURY, MASSACHUSETTS

105 High Road, Newbury, Massachusetts

Percolation Test	Percolation Test-1 TP20-1	Percolation Test-2 TP20-2
Depth of test:	Depth to shelf: 55" 73" Depth of hole: 18"	Depth to shelf: 20" 38" Depth of hole: 18"
Start presoak:	08:00	08:45
End presoak:	08:15	09:00
Time at 12"→	08:15	09:00
Time at 9"→	08:18	09:02
Time at 6"→	08:21	09:05
Total time 9" to 6"→	3 minutes	3 minutes
Rate (minutes per inch)	1.0 MPI Class I Soil LTAR 0.74	1.0 MPI Class I Soil LTAR 0.74

Alexander F. Parker *#1848*

Massachusetts Evaluator & Certification number

Unofficial soil testing

Newbury Town Witness

07/10/20

Date of perc testing

SOIL SUITABILITY PERCOLATION TEST

COMMONWEALTH OF MASSACHUSETTS

NEWBURY, MASSACHUSETTS

105 High Road, Newbury, Massachusetts

Percolation Test	Percolation Test-3 TP20-3	Percolation Test-4 TP20-4
Depth of test:	Depth to shelf: 30" 48" Depth of hole: 18"	Depth to shelf: 25" 43" Depth of hole: 18"
Start presoak:	09:10	09:35
End presoak:	09:25	09:50
Time at 12"→	09:25	09:50
Time at 9"→	09:28	09:54
Time at 6"→	09:31	09:59
Total time 9" to 6"→	3 minutes	5 minutes
Rate (minutes per inch)	1.0 MPI Class I Soil LTAR 0.74	1.66 MPI Class I Soil LTAR 0.74

Alexander F. Parker *#1848*

Massachusetts Evaluator & Certification number

Unofficial soil testing

Newbury Town Witness

07/10/20

Date of perc testing

SOIL SUITABILITY PERCOLATION TEST

COMMONWEALTH OF MASSACHUSETTS

NEWBURY, MASSACHUSETTS

105 High Road, Newbury, Massachusetts

Percolation Test	Percolation Test-5 TP20-5	Percolation Test-6 TP20-6
Depth of test:	Depth to shelf: 26" 44" Depth of hole: 18"	Depth to shelf: 28" 46" Depth of hole: 18"
Start presoak:	09:46	09:50
End presoak:	10:01	10:05
Time at 12"→	10:01	10:05
Time at 9"→	10:04	10:07
Time at 6"→	10:10	10:10
Total time 9" to 6"→	6 minutes	3 minutes
Rate (minutes per inch)	2.0 MPI Class I Soil LTAR 0.74	1.0 MPI Class I Soil LTAR 0.74

Alexander F. Parker *#1848*

Massachusetts Evaluator & Certification number

Unofficial soil testing

Newbury Town Witness

07/10/20

Date of perc testing

SOIL SUITABILITY PERCOLATION TEST

COMMONWEALTH OF MASSACHUSETTS

NEWBURY, MASSACHUSETTS

105 High Road, Newbury, Massachusetts

Percolation Test	Percolation Test-7 TP20-7	Percolation Test-8 TP20-8
Depth of test:	Depth to shelf: 25" 43" Depth of hole: 18"	Depth to shelf: 25" 43" Depth of hole: 18"
Start presoak:	10:15	10:45
End presoak:	10:30	Could not maintain presoak 24 gallons absorbed within 15 minutes
Time at 12"→	10:30	
Time at 9"→	10:33	
Time at 6"→	10:37	
Total time 9" to 6"→	4 minutes	
Rate (minutes per inch)	1.33 MPI Class I Soil LTAR 0.74	< 2.0 MPI Class I Soil LTAR 0.74

Alexander F. Parker *#1848*

Massachusetts Evaluator & Certification number

Unofficial soil testing

Newbury Town Witness

07/10/20

Date of perc testing

SOIL SUITABILITY PERCOLATION TEST

COMMONWEALTH OF MASSACHUSETTS

NEWBURY, MASSACHUSETTS

105 High Road, Newbury, Massachusetts

Percolation Test	Percolation Test-9 TP20-9	Percolation Test-10 TP20-10
Depth of test:	Depth to shelf: 30" 48" Depth of hole: 18"	Depth to shelf: 25" 43" Depth of hole: 18"
Start presoak:	10:55	11:30
End presoak:	11:10	11:45
Time at 12"→	11:10	11:45
Time at 9"→	11:14	11:48
Time at 6"→	11:20	11:52
Total time 9" to 6"→	6 minutes	4 minutes
Rate (minutes per inch)	2.0 MPI Class I Soil LTAR 0.74	1.33 MPI Class I Soil LTAR 0.74

Alexander F. Parker *#1848*

Massachusetts Evaluator & Certification number

Unofficial soil testing

Newbury Town Witness

07/10/20

Date of perc testing

TP 21-12 DEEP OBSERVATION HOLE

105 High Road, Newbury, Massachusetts
Test Hole logged by Denis Hamel, CPESC
August 11, 2021

0"-8"	Ap	Sandy Loam	10YR 3/4
8"-24"		Loamy Sand	10 YR 4/6
24"-34"		Sand	10 YR 5/4
34"-80"		Loamy Sand	10YR 4/3

Water Seeping @ 66"
SHWT @ 46"
Ledge greater than 80"

TP 21-13 DEEP OBSERVATION HOLE

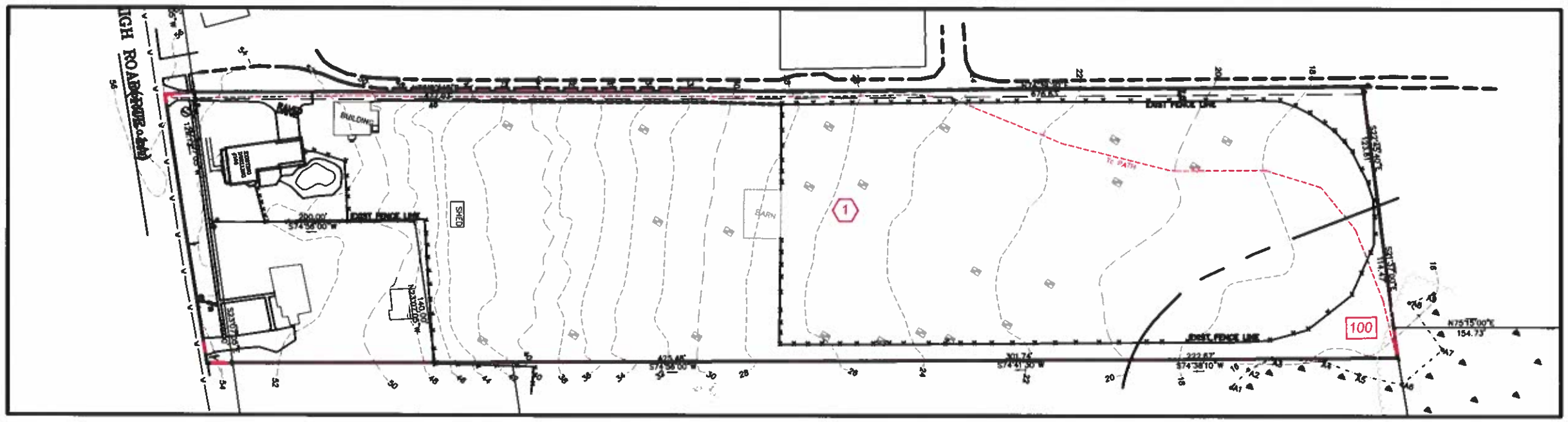
105 High Road, Newbury, Massachusetts
Test Hole logged by Denis Hamel, CPESC
August 11, 2021

0"-8"	Ap	Sandy Loam	10YR 3/4
8"-34"		Loamy Sand	10 YR 5/6
34"-90"		Sand	10 YR 4/6

Water Seeping @ 74"
SHWT @ 72"
Ledge greater than 90"

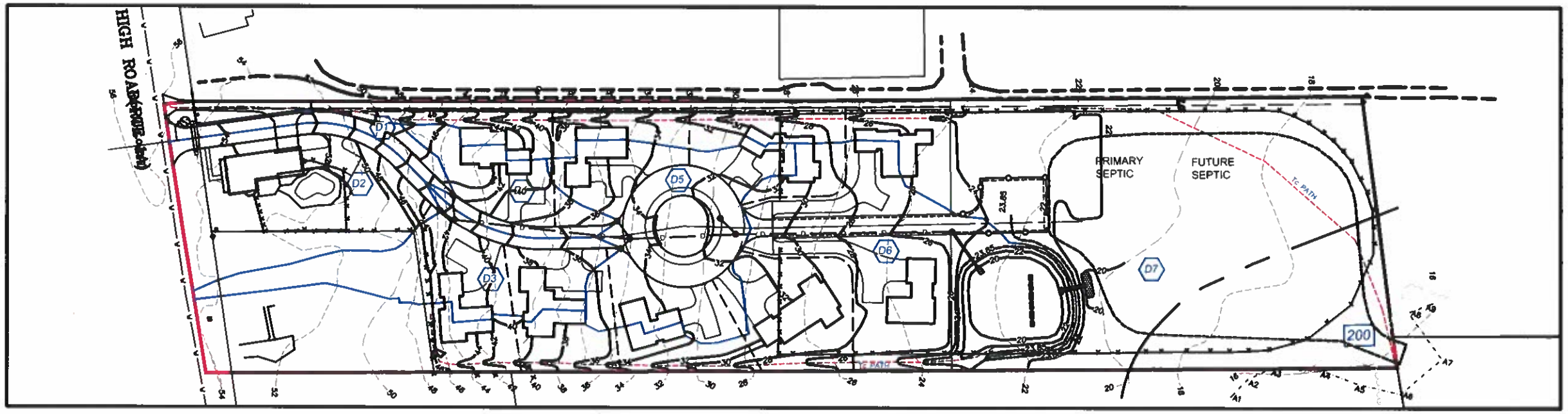
Appendix D

EXISTING & PROPOSED DRAINAGE AREAS



PRE-DEVELOPMENT DRAINAGE ZONES

SCALE: 1"=50'



POST-DEVELOPMENT DRAINAGE ZONES

SCALE: 1"=50'

TOWN OF NEWBURY OFFICE OF THE TOWN CLERK

THIS IS TO CERTIFY THAT ON _____ I RECEIVED FROM THE PLANNING BOARD CERTIFICATION OF ITS APPROVAL OF THIS PLAN AND THAT DURING THE (20) TWENTY DAYS NEXT FOLLOWING I HAVE RECEIVED NO NOTICE OF ANY APPEAL FROM SAID DECISION

CLERK DATE

"PLANNING BOARD APPROVAL UNDER THE OSRD ZONING REGULATIONS"
NEWBURY PLANNING BOARD

DATE

NORTH

DCi Design Consultants Inc.
Somerville - Quincy - Newburyport
www.dci-ma.com

CIVIL
DESIGN CONSULTANTS, INC
SOMERVILLE, MA

LANDSCAPE
HAWK DESIGN
SAGAMORE, MA

CLIENT
DEPIERO PROPERTIES, LLC
NEWBURYPORT, MA

PROJECT TEAM

SEAGATE

105 HIGH ROAD,
NEWBURY, MA

OPEN SPACE CONDOMINIUM LAYOUT, UTILTIES & STORMWATER PLAN

PROJECT INFO

REV	DESCRIPTION	DATE
2	PEER REVIEW REVISIONS	9/12/21
1	DRAINAGE MOD	7/20/21

STAMP

OSRD DRAIN ZONES

SHEET NAME

DR-1

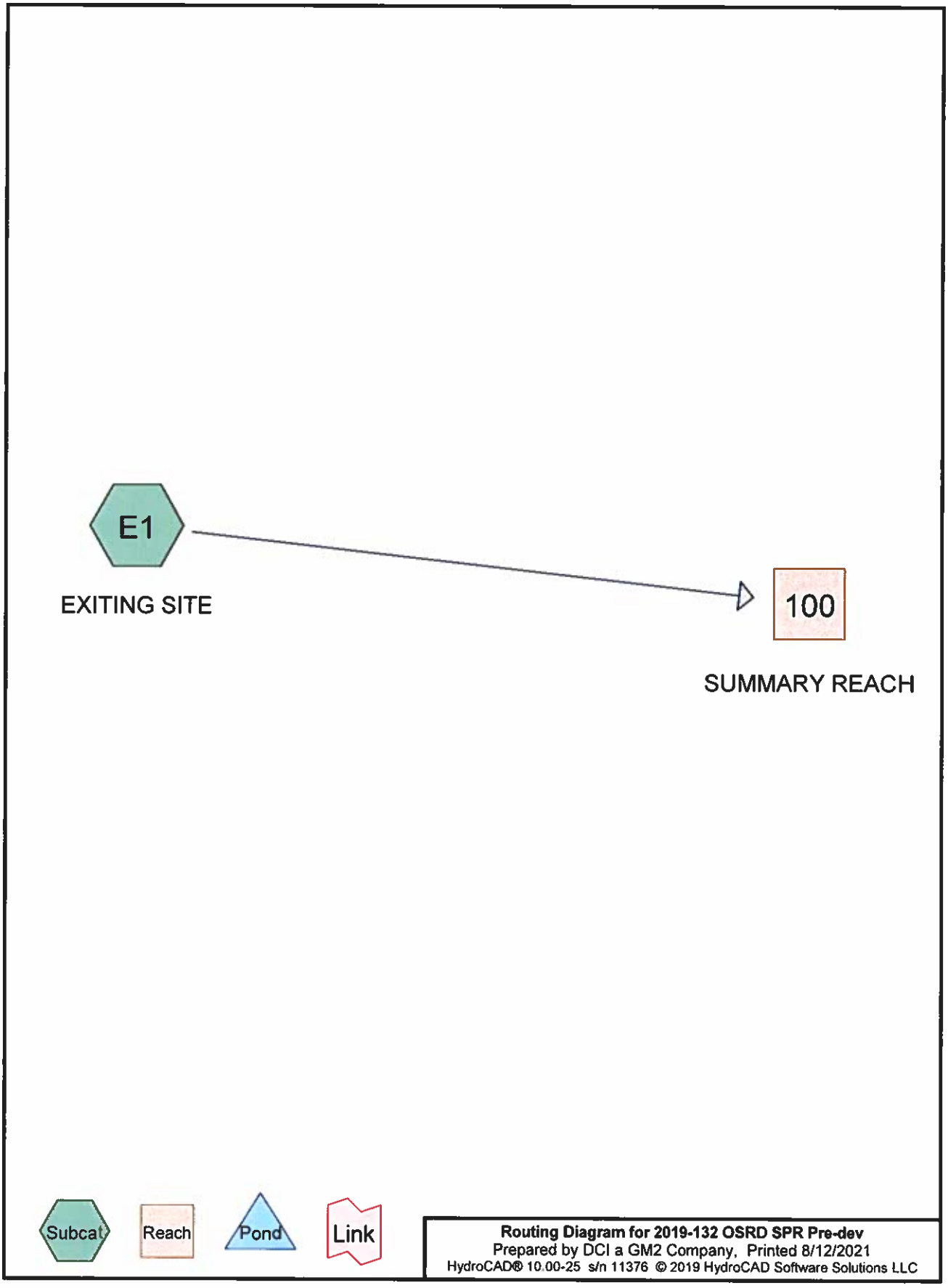
SHT NO

DR BY:	DMH
CHK BY:	SS
PROJ NO:	2019-132
DATE:	05-19-2021
SCALE:	

P:\2019 Projects\19-132 105 High Rd Newbury\Dwg_SUBMISSIONS\OSRD Site Plan Review\1.0 Sheet Files\OSRD DR-2021.dwg

Appendix E

EXISTING & PROPOSED HYDROLOGY


E1
EXITING SITE
100
SUMMARY REACH
Subcat
Reach
Pond
Link
Routing Diagram for 2019-132 OSRD SPR Pre-dev
Prepared by DCI a GM2 Company, Printed 8/12/2021
HydroCAD® 10.00-25 s/n 11376 © 2019 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
73,861	39	>75% Grass cover, Good, HSG A (E1)
25,110	48	Brush, Poor, HSG A (E1)
5,826	96	Gravel surface, HSG A (E1)
193,415	39	Pasture/grassland/range, Good, HSG A (E1)
5,916	98	Paved parking, HSG A (E1)
9,750	98	Roofs,Pool HSG A (E1)
313,878	**44**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
313,878	HSG A	E1
0	HSG B	
0	HSG C	
0	HSG D	
0	Other	
313,878		**TOTAL AREA**

Time span=1.00-20.00 hrs, dt=0.05 hrs, 381 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E1: EXITING SITE Runoff Area=313,878 sf 4.99% Impervious Runoff Depth>0.02"
Flow Length=1,337' Tc=18.4 min CN=44 Runoff=0.03 cfs 564 cf

Reach 100: SUMMARY REACH Inflow=0.03 cfs 564 cf
Outflow=0.03 cfs 564 cf

Total Runoff Area = 313,878 sf Runoff Volume = 564 cf Average Runoff Depth = 0.02"
95.01% Pervious = 298,212 sf 4.99% Impervious = 15,666 sf

Summary for Subcatchment E1: EXITING SITE

Runoff = 0.03 cfs @ 15.80 hrs, Volume= 564 cf, Depth> 0.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.23"

	Area (sf)	CN	Description
*	9,750	98	Roofs,Pool HSG A
	5,916	98	Paved parking, HSG A
	5,826	96	Gravel surface, HSG A
	73,861	39	>75% Grass cover, Good, HSG A
	193,415	39	Pasture/grassland/range, Good, HSG A
	25,110	48	Brush, Poor, HSG A
	313,878	44	Weighted Average
	298,212		95.01% Pervious Area
	15,666		4.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	20	0.0300	0.10		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
0.4	111	0.0500	4.54		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.3	640	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
5.3	314	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.0	252	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
18.4	1,337	Total			

Summary for Reach 100: SUMMARY REACH

Inflow Area = 313,878 sf, 4.99% Impervious, Inflow Depth > 0.02" for 2 Year event
Inflow = 0.03 cfs @ 15.80 hrs, Volume= 564 cf
Outflow = 0.03 cfs @ 15.80 hrs, Volume= 564 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Time span=1.00-20.00 hrs, dt=0.05 hrs, 381 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E1: EXITING SITE Runoff Area=313,878 sf 4.99% Impervious Runoff Depth>0.32"
Flow Length=1,337' Tc=18.4 min CN=44 Runoff=0.98 cfs 8,369 cf

Reach 100: SUMMARY REACH Inflow=0.98 cfs 8,369 cf
Outflow=0.98 cfs 8,369 cf

Total Runoff Area = 313,878 sf Runoff Volume = 8,369 cf Average Runoff Depth = 0.32"
95.01% Pervious = 298,212 sf 4.99% Impervious = 15,666 sf

Summary for Subcatchment E1: EXITING SITE

Runoff = 0.98 cfs @ 12.52 hrs, Volume= 8,369 cf, Depth> 0.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=4.96"

	Area (sf)	CN	Description
*	9,750	98	Roofs,Pool HSG A
	5,916	98	Paved parking, HSG A
	5,826	96	Gravel surface, HSG A
	73,861	39	>75% Grass cover, Good, HSG A
	193,415	39	Pasture/grassland/range, Good, HSG A
	25,110	48	Brush, Poor, HSG A
	313,878	44	Weighted Average
	298,212		95.01% Pervious Area
	15,666		4.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	20	0.0300	0.10		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
0.4	111	0.0500	4.54		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.3	640	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
5.3	314	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.0	252	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
18.4	1,337	Total			

Summary for Reach 100: SUMMARY REACH

Inflow Area = 313,878 sf, 4.99% Impervious, Inflow Depth > 0.32" for 10 Year event
Inflow = 0.98 cfs @ 12.52 hrs, Volume= 8,369 cf
Outflow = 0.98 cfs @ 12.52 hrs, Volume= 8,369 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Time span=1.00-20.00 hrs, dt=0.05 hrs, 381 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E1: EXITING SITE Runoff Area=313,878 sf 4.99% Impervious Runoff Depth>0.75"
Flow Length=1,337' Tc=18.4 min CN=44 Runoff=3.29 cfs 19,651 cf

Reach 100: SUMMARY REACH Inflow=3.29 cfs 19,651 cf
Outflow=3.29 cfs 19,651 cf

Total Runoff Area = 313,878 sf Runoff Volume = 19,651 cf Average Runoff Depth = 0.75"
95.01% Pervious = 298,212 sf 4.99% Impervious = 15,666 sf

Summary for Subcatchment E1: EXITING SITE

Runoff = 3.29 cfs @ 12.37 hrs, Volume= 19,651 cf, Depth> 0.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Rainfall=6.33"

	Area (sf)	CN	Description
*	9,750	98	Roofs,Pool HSG A
	5,916	98	Paved parking, HSG A
	5,826	96	Gravel surface, HSG A
	73,861	39	>75% Grass cover, Good, HSG A
	193,415	39	Pasture/grassland/range, Good, HSG A
	25,110	48	Brush, Poor, HSG A
	313,878	44	Weighted Average
	298,212		95.01% Pervious Area
	15,666		4.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	20	0.0300	0.10		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
0.4	111	0.0500	4.54		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.3	640	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
5.3	314	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.0	252	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
18.4	1,337	Total			

Summary for Reach 100: SUMMARY REACH

Inflow Area = 313,878 sf, 4.99% Impervious, Inflow Depth > 0.75" for 25 Year event
Inflow = 3.29 cfs @ 12.37 hrs, Volume= 19,651 cf
Outflow = 3.29 cfs @ 12.37 hrs, Volume= 19,651 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Time span=1.00-20.00 hrs, dt=0.05 hrs, 381 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E1: EXITING SITE Runoff Area=313,878 sf 4.99% Impervious Runoff Depth>2.04"
Flow Length=1,337' Tc=18.4 min CN=44 Runoff=11.66 cfs 53,241 cf

Reach 100: SUMMARY REACH Inflow=11.66 cfs 53,241 cf
Outflow=11.66 cfs 53,241 cf

Total Runoff Area = 313,878 sf Runoff Volume = 53,241 cf Average Runoff Depth = 2.04"
95.01% Pervious = 298,212 sf 4.99% Impervious = 15,666 sf

Summary for Subcatchment E1: EXITING SITE

Runoff = 11.66 cfs @ 12.29 hrs, Volume= 53,241 cf, Depth> 2.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=9.18"

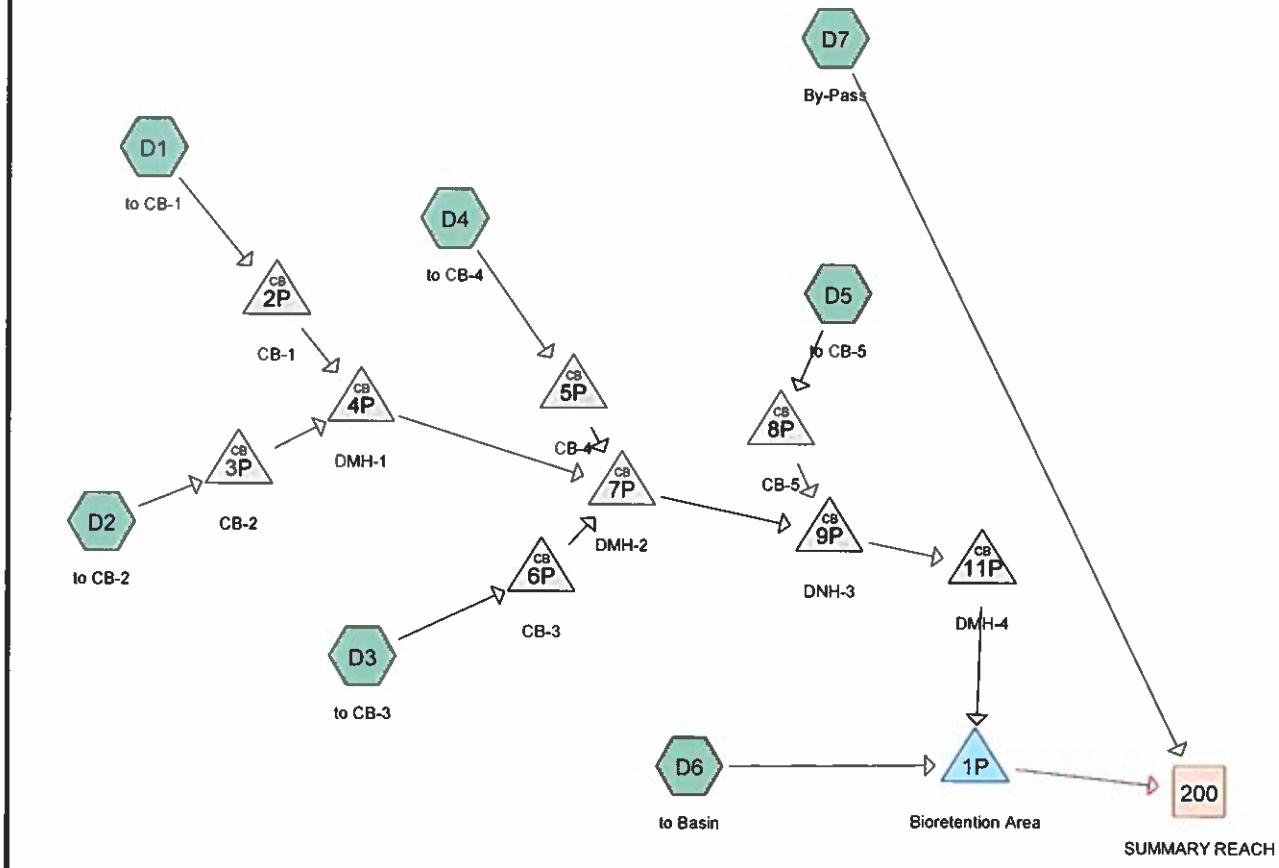
	Area (sf)	CN	Description
*	9,750	98	Roofs,Pool HSG A
	5,916	98	Paved parking, HSG A
	5,826	96	Gravel surface, HSG A
	73,861	39	>75% Grass cover, Good, HSG A
	193,415	39	Pasture/grassland/range, Good, HSG A
	25,110	48	Brush, Poor, HSG A
	313,878	44	Weighted Average
	298,212		95.01% Pervious Area
	15,666		4.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	20	0.0300	0.10		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
0.4	111	0.0500	4.54		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.3	640	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
5.3	314	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.0	252	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
18.4	1,337	Total			

Summary for Reach 100: SUMMARY REACH

Inflow Area = 313,878 sf, 4.99% Impervious, Inflow Depth > 2.04" for 100 Year event
Inflow = 11.66 cfs @ 12.29 hrs, Volume= 53,241 cf
Outflow = 11.66 cfs @ 12.29 hrs, Volume= 53,241 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs



Subcat Reach Pond Link

Routing Diagram for 2019-132 OSRD SPR Post-dev
Prepared by DCI a GM2 Company, Printed 8/12/2021

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
200,128	39	>75% Grass cover, Good, HSG A (D1, D2, D3, D4, D5, D6, D7)
40,424	30	Brush, Good, HSG A (D7)
6,286	76	Gravel roads, HSG A (D6, D7)
35,829	98	Paved roads w/curbs & sewers, HSG A (D1, D2, D3, D4, D5, D6, D7)
31,211	98	Roofs, HSG A (D2, D3, D4, D5, D6, D7)
313,878	**51**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
313,878	HSG A	D1, D2, D3, D4, D5, D6, D7
0	HSG B	
0	HSG C	
0	HSG D	
0	Other	
313,878		**TOTAL AREA**

Time span=1.00-20.00 hrs, dt=0.05 hrs, 381 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment D1: to CB-1 Runoff Area=4,639 sf 76.89% Impervious Runoff Depth>1.59"
Tc=6.0 min CN=84 Runoff=0.21 cfs 614 cf

Subcatchment D2: to CB-2 Runoff Area=30,164 sf 23.92% Impervious Runoff Depth>0.17"
Tc=6.0 min CN=53 Runoff=0.05 cfs 427 cf

Subcatchment D3: to CB-3 Runoff Area=21,544 sf 38.23% Impervious Runoff Depth>0.43"
Tc=6.0 min CN=62 Runoff=0.19 cfs 779 cf

Subcatchment D4: to CB-4 Runoff Area=10,903 sf 39.14% Impervious Runoff Depth>0.43"
Tc=6.0 min CN=62 Runoff=0.10 cfs 394 cf

Subcatchment D5: to CB-5 Runoff Area=30,752 sf 53.14% Impervious Runoff Depth>0.76"
Tc=6.0 min CN=70 Runoff=0.62 cfs 1,957 cf

Subcatchment D6: to Basin Runoff Area=88,065 sf 27.07% Impervious Runoff Depth>0.25"
Flow Length=598' Tc=6.2 min CN=56 Runoff=0.26 cfs 1,801 cf

Subcatchment D7: By-Pass Runoff Area=127,811 sf 2.80% Impervious Runoff Depth=0.00"
Flow Length=1,347' Tc=12.2 min CN=39 Runoff=0.00 cfs 0 cf

Reach 200: SUMMARY REACH Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Pond 1P: Bioretention Area Peak Elev=20.34' Storage=2,246 cf Inflow=1.29 cfs 5,973 cf
Discarded=0.16 cfs 4,800 cf Primary=0.00 cfs 0 cf Outflow=0.16 cfs 4,800 cf

Pond 2P: CB-1 Peak Elev=38.34' Inflow=0.21 cfs 614 cf
12.0" Round Culvert n=0.013 L=20.0' S=0.0200 '/' Outflow=0.21 cfs 614 cf

Pond 3P: CB-2 Peak Elev=38.09' Inflow=0.05 cfs 427 cf
12.0" Round Culvert n=0.013 L=13.0' S=0.0200 '/' Outflow=0.05 cfs 427 cf

Pond 4P: DMH-1 Peak Elev=37.84' Inflow=0.21 cfs 1,041 cf
12.0" Round Culvert n=0.013 L=169.0' S=0.0525 '/' Outflow=0.21 cfs 1,041 cf

Pond 5P: CB-4 Peak Elev=29.49' Inflow=0.10 cfs 394 cf
12.0" Round Culvert n=0.013 L=17.0' S=0.0200 '/' Outflow=0.10 cfs 394 cf

Pond 6P: CB-3 Peak Elev=29.39' Inflow=0.19 cfs 779 cf
12.0" Round Culvert n=0.013 L=9.0' S=0.0200 '/' Outflow=0.19 cfs 779 cf

Pond 7P: DMH-2 Peak Elev=28.98' Inflow=0.50 cfs 2,215 cf
15.0" Round Culvert n=0.013 L=101.0' S=0.0227 '/' Outflow=0.50 cfs 2,215 cf

Pond 8P: CB-5 Peak Elev=27.14' Inflow=0.62 cfs 1,957 cf
12.0" Round Culvert n=0.013 L=17.0' S=0.0200 '/' Outflow=0.62 cfs 1,957 cf

Pond 9P: DNH-3 Peak Elev=26.73' Inflow=1.12 cfs 4,172 cf
18.0" Round Culvert n=0.013 L=209.0' S=0.0271 '/' Outflow=1.12 cfs 4,172 cf

Pond 11P: DMH-4 Peak Elev=20.99' Inflow=1.12 cfs 4,172 cf
18.0" Round Culvert n=0.013 L=41.0' S=0.0100 '/' Outflow=1.12 cfs 4,172 cf

Total Runoff Area = 313,878 sf Runoff Volume = 5,973 cf Average Runoff Depth = 0.23"
78.64% Pervious = 246,838 sf 21.36% Impervious = 67,040 sf

Summary for Subcatchment D1: to CB-1

Runoff = 0.21 cfs @ 12.09 hrs, Volume= 614 cf, Depth> 1.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.23"

Area (sf)	CN	Description
3,567	98	Paved roads w/curbs & sewers, HSG A
1,072	39	>75% Grass cover, Good, HSG A
4,639	84	Weighted Average
1,072		23.11% Pervious Area
3,567		76.89% Impervious Area

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

Summary for Subcatchment D2: to CB-2

Runoff = 0.05 cfs @ 12.38 hrs, Volume= 427 cf, Depth> 0.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.23"

Area (sf)	CN	Description
4,992	98	Paved roads w/curbs & sewers, HSG A
2,222	98	Roofs, HSG A
22,950	39	>75% Grass cover, Good, HSG A
30,164	53	Weighted Average
22,950		76.08% Pervious Area
7,214		23.92% Impervious Area

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

Summary for Subcatchment D3: to CB-3

Runoff = 0.19 cfs @ 12.12 hrs, Volume= 779 cf, Depth> 0.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.23"

Area (sf)	CN	Description
5,035	98	Paved roads w/curbs & sewers, HSG A
3,202	98	Roofs, HSG A
13,307	39	>75% Grass cover, Good, HSG A
21,544	62	Weighted Average
13,307		61.77% Pervious Area
8,237		38.23% Impervious Area

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

Summary for Subcatchment D4: to CB-4

Runoff = 0.10 cfs @ 12.12 hrs, Volume= 394 cf, Depth> 0.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.23"

Area (sf)	CN	Description
3,047	98	Paved roads w/curbs & sewers, HSG A
1,220	98	Roofs, HSG A
6,636	39	>75% Grass cover, Good, HSG A
10,903	62	Weighted Average
6,636		60.86% Pervious Area
4,267		39.14% Impervious Area

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

Summary for Subcatchment D5: to CB-5

Runoff = 0.62 cfs @ 12.10 hrs, Volume= 1,957 cf, Depth> 0.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.23"

Area (sf)	CN	Description
12,468	98	Paved roads w/curbs & sewers, HSG A
3,873	98	Roofs, HSG A
14,411	39	>75% Grass cover, Good, HSG A
30,752	70	Weighted Average
14,411		46.86% Pervious Area
16,341		53.14% Impervious Area

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

Summary for Subcatchment D6: to Basin

Runoff = 0.26 cfs @ 12.30 hrs, Volume= 1,801 cf, Depth> 0.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.23"

Area (sf)	CN	Description
6,642	98	Paved roads w/curbs & sewers, HSG A
17,194	98	Roofs, HSG A
3,411	76	Gravel roads, HSG A
60,818	39	>75% Grass cover, Good, HSG A
88,065	56	Weighted Average
64,229		72.93% Pervious Area
23,836		27.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	10	0.0050	0.06		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
1.6	330	0.0450	3.42		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.9	258	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
6.2	598	Total			

Summary for Subcatchment D7: By-Pass

Runoff = 0.00 cfs @ 1.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.23"

Area (sf)	CN	Description
78	98	Paved roads w/curbs & sewers, HSG A
3,500	98	Roofs, HSG A
2,875	76	Gravel roads, HSG A
80,934	39	>75% Grass cover, Good, HSG A
40,424	30	Brush, Good, HSG A
127,811	39	Weighted Average
124,233		97.20% Pervious Area
3,578		2.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	10	0.0100	0.08		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
1.2	170	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.0	415	0.0480	3.53		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.2	300	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
4.7	452	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.2	1,347	Total			

Summary for Reach 200: SUMMARY REACH

Inflow Area = 313,878 sf, 21.36% Impervious, Inflow Depth = 0.00" for 2 Year event
Inflow = 0.00 cfs @ 1.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 1.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Summary for Pond 1P: Bioretention Area

Inflow Area = 186,067 sf, 34.11% Impervious, Inflow Depth > 0.39" for 2 Year event
Inflow = 1.29 cfs @ 12.12 hrs, Volume= 5,973 cf
Outflow = 0.16 cfs @ 15.22 hrs, Volume= 4,800 cf, Atten= 88%, Lag= 185.7 min
Discarded = 0.16 cfs @ 15.22 hrs, Volume= 4,800 cf
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 20.34' @ 15.22 hrs Surf.Area= 6,766 sf Storage= 2,246 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 98.6 min (948.3 - 849.8)

Volume	Invert	Avail.Storage	Storage Description
#1	20.00'	33,784 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
20.00	6,464	0	0
20.50	6,909	3,343	3,343
22.00	8,763	11,754	15,097
23.80	12,000	18,687	33,784

Device	Routing	Invert	Outlet Devices
#1	Discarded	20.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	20.50'	**6.0" Round Culvert** L= 25.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 20.50' / 20.25' S= 0.0100 '/' Cc= 0.900

			n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf
#3	Primary	21.20'	**12.0" Round Culvert**
			L= 25.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 21.20' / 20.25' S= 0.0380 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=0.16 cfs @ 15.22 hrs HW=20.34' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.16 cfs)

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=20.00' TW=0.00' (Dynamic Tailwater)
├**2=Culvert** (Controls 0.00 cfs)
└**3=Culvert** (Controls 0.00 cfs)

Summary for Pond 2P: CB-1

Inflow Area =	4,639 sf,	76.89% Impervious,	Inflow Depth >	1.59"	for 2 Year event
Inflow =	0.21 cfs @	12.09 hrs, Volume=	614 cf		
Outflow =	0.21 cfs @	12.09 hrs, Volume=	614 cf,	Atten= 0%,	Lag= 0.0 min
Primary =	0.21 cfs @	12.09 hrs, Volume=	614 cf		

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 38.34' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	38.12'	**12.0" Round Culvert**
			L= 20.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 38.12' / 37.72' S= 0.0200 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.21 cfs @ 12.09 hrs HW=38.34' TW=37.84' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 0.21 cfs @ 1.60 fps)

Summary for Pond 3P: CB-2

Inflow Area =	30,164 sf,	23.92% Impervious,	Inflow Depth >	0.17"	for 2 Year event
Inflow =	0.05 cfs @	12.38 hrs, Volume=	427 cf		
Outflow =	0.05 cfs @	12.38 hrs, Volume=	427 cf,	Atten= 0%,	Lag= 0.0 min
Primary =	0.05 cfs @	12.38 hrs, Volume=	427 cf		

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 38.09' @ 12.38 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	37.98'	**12.0" Round Culvert**
			L= 13.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 37.98' / 37.72' S= 0.0200 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.05 cfs @ 12.38 hrs HW=38.09' TW=37.79' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 0.05 cfs @ 1.11 fps)

Summary for Pond 4P: DMH-1

Inflow Area = 34,803 sf, 30.98% Impervious, Inflow Depth > 0.36" for 2 Year event
Inflow = 0.21 cfs @ 12.10 hrs, Volume= 1,041 cf
Outflow = 0.21 cfs @ 12.10 hrs, Volume= 1,041 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.21 cfs @ 12.10 hrs, Volume= 1,041 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 37.84' @ 12.10 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	37.62'	**12.0" Round Culvert** L= 169.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 37.62' / 28.75' S= 0.0525 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.21 cfs @ 12.10 hrs HW=37.84' TW=28.97' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.21 cfs @ 1.61 fps)

Summary for Pond 5P: CB-4

Inflow Area = 10,903 sf, 39.14% Impervious, Inflow Depth > 0.43" for 2 Year event
Inflow = 0.10 cfs @ 12.12 hrs, Volume= 394 cf
Outflow = 0.10 cfs @ 12.12 hrs, Volume= 394 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.10 cfs @ 12.12 hrs, Volume= 394 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 29.49' @ 12.12 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	29.34'	**12.0" Round Culvert** L= 17.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 29.34' / 29.00' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.09 cfs @ 12.12 hrs HW=29.49' TW=28.97' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.09 cfs @ 1.31 fps)

Summary for Pond 6P: CB-3

Inflow Area = 21,544 sf, 38.23% Impervious, Inflow Depth > 0.43" for 2 Year event
Inflow = 0.19 cfs @ 12.12 hrs, Volume= 779 cf
Outflow = 0.19 cfs @ 12.12 hrs, Volume= 779 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.19 cfs @ 12.12 hrs, Volume= 779 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 29.39' @ 12.12 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	29.18'	**12.0" Round Culvert** L= 9.0' CPP, square edge headwall, Ke= 0.500

Inlet / Outlet Invert= 29.18' / 29.00' S= 0.0200 '/' Cc= 0.900
n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.18 cfs @ 12.12 hrs HW=29.39' TW=28.97' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.18 cfs @ 1.56 fps)

Summary for Pond 7P: DMH-2

Inflow Area =	67,250 sf,	34.62% Impervious,	Inflow Depth >	0.40"	for 2 Year event
Inflow =	0.50 cfs @	12.11 hrs, Volume=	2,215 cf		
Outflow =	0.50 cfs @	12.11 hrs, Volume=	2,215 cf,	Atten= 0%,	Lag= 0.0 min
Primary =	0.50 cfs @	12.11 hrs, Volume=	2,215 cf		

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 28.98' @ 12.11 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	28.65'	**15.0" Round Culvert**
			L= 101.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 28.65' / 26.36' S= 0.0227 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=0.48 cfs @ 12.11 hrs HW=28.97' TW=26.72' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.48 cfs @ 1.93 fps)

Summary for Pond 8P: CB-5

Inflow Area =	30,752 sf,	53.14% Impervious,	Inflow Depth >	0.76"	for 2 Year event
Inflow =	0.62 cfs @	12.10 hrs, Volume=	1,957 cf		
Outflow =	0.62 cfs @	12.10 hrs, Volume=	1,957 cf,	Atten= 0%,	Lag= 0.0 min
Primary =	0.62 cfs @	12.10 hrs, Volume=	1,957 cf		

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 27.14' @ 12.10 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	26.74'	**12.0" Round Culvert**
			L= 17.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 26.74' / 26.40' S= 0.0200 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.61 cfs @ 12.10 hrs HW=27.13' TW=26.73' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.61 cfs @ 2.14 fps)

Summary for Pond 9P: DNH-3

Inflow Area =	98,002 sf,	40.43% Impervious,	Inflow Depth >	0.51"	for 2 Year event
Inflow =	1.12 cfs @	12.11 hrs, Volume=	4,172 cf		
Outflow =	1.12 cfs @	12.11 hrs, Volume=	4,172 cf,	Atten= 0%,	Lag= 0.0 min
Primary =	1.12 cfs @	12.11 hrs, Volume=	4,172 cf		

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 26.73' @ 12.11 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	26.26'	**18.0" Round Culvert** L= 209.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 26.26' / 20.60' S= 0.0271 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=1.09 cfs @ 12.11 hrs HW=26.73' TW=20.98' (Dynamic Tailwater)
↑**1=Culvert** (Inlet Controls 1.09 cfs @ 2.33 fps)

Summary for Pond 11P: DMH-4

Inflow Area = 98,002 sf, 40.43% Impervious, Inflow Depth > 0.51" for 2 Year event
Inflow = 1.12 cfs @ 12.11 hrs, Volume= 4,172 cf
Outflow = 1.12 cfs @ 12.11 hrs, Volume= 4,172 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.12 cfs @ 12.11 hrs, Volume= 4,172 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 20.99' @ 12.11 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	20.50'	**18.0" Round Culvert** L= 41.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 20.50' / 20.09' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=1.09 cfs @ 12.11 hrs HW=20.98' TW=20.06' (Dynamic Tailwater)
↑**1=Culvert** (Barrel Controls 1.09 cfs @ 3.33 fps)

Time span=1.00-20.00 hrs, dt=0.05 hrs, 381 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment D1: to CB-1 Runoff Area=4,639 sf 76.89% Impervious Runoff Depth>3.04"
Tc=6.0 min CN=84 Runoff=0.39 cfs 1,174 cf

Subcatchment D2: to CB-2 Runoff Area=30,164 sf 23.92% Impervious Runoff Depth>0.74"
Tc=6.0 min CN=53 Runoff=0.50 cfs 1,872 cf

Subcatchment D3: to CB-3 Runoff Area=21,544 sf 38.23% Impervious Runoff Depth>1.28"
Tc=6.0 min CN=62 Runoff=0.74 cfs 2,302 cf

Subcatchment D4: to CB-4 Runoff Area=10,903 sf 39.14% Impervious Runoff Depth>1.28"
Tc=6.0 min CN=62 Runoff=0.38 cfs 1,165 cf

Subcatchment D5: to CB-5 Runoff Area=30,752 sf 53.14% Impervious Runoff Depth>1.85"
Tc=6.0 min CN=70 Runoff=1.60 cfs 4,734 cf

Subcatchment D6: to Basin Runoff Area=88,065 sf 27.07% Impervious Runoff Depth>0.91"
Flow Length=598' Tc=6.2 min CN=56 Runoff=1.94 cfs 6,690 cf

Subcatchment D7: By-Pass Runoff Area=127,811 sf 2.80% Impervious Runoff Depth>0.15"
Flow Length=1,347' Tc=12.2 min CN=39 Runoff=0.09 cfs 1,596 cf

Reach 200: SUMMARY REACH Inflow=0.52 cfs 9,348 cf
Outflow=0.52 cfs 9,348 cf

Pond 1P: Bioretention Area Peak Elev=21.09' Storage=7,659 cf Inflow=5.53 cfs 17,936 cf
Discarded=0.18 cfs 5,647 cf Primary=0.44 cfs 7,752 cf Outflow=0.62 cfs 13,400 cf

Pond 2P: CB-1 Peak Elev=38.43' Inflow=0.39 cfs 1,174 cf
12.0" Round Culvert n=0.013 L=20.0' S=0.0200 '/' Outflow=0.39 cfs 1,174 cf

Pond 3P: CB-2 Peak Elev=38.35' Inflow=0.50 cfs 1,872 cf
12.0" Round Culvert n=0.013 L=13.0' S=0.0200 '/' Outflow=0.50 cfs 1,872 cf

Pond 4P: DMH-1 Peak Elev=38.10' Inflow=0.88 cfs 3,045 cf
12.0" Round Culvert n=0.013 L=169.0' S=0.0525 '/' Outflow=0.88 cfs 3,045 cf

Pond 5P: CB-4 Peak Elev=29.64' Inflow=0.38 cfs 1,165 cf
12.0" Round Culvert n=0.013 L=17.0' S=0.0200 '/' Outflow=0.38 cfs 1,165 cf

Pond 6P: CB-3 Peak Elev=29.63' Inflow=0.74 cfs 2,302 cf
12.0" Round Culvert n=0.013 L=9.0' S=0.0200 '/' Outflow=0.74 cfs 2,302 cf

Pond 7P: DMH-2 Peak Elev=29.35' Inflow=2.00 cfs 6,512 cf
15.0" Round Culvert n=0.013 L=101.0' S=0.0227 '/' Outflow=2.00 cfs 6,512 cf

Pond 8P: CB-5 Peak Elev=27.49' Inflow=1.60 cfs 4,734 cf
12.0" Round Culvert n=0.013 L=17.0' S=0.0200 '/' Outflow=1.60 cfs 4,734 cf

Pond 9P: DNH-3 Peak Elev=27.16' Inflow=3.60 cfs 11,246 cf
18.0" Round Culvert n=0.013 L=209.0' S=0.0271 '/' Outflow=3.60 cfs 11,246 cf

Pond 11P: DMH-4 Peak Elev=21.46' Inflow=3.60 cfs 11,246 cf
18.0" Round Culvert n=0.013 L=41.0' S=0.0100 '/' Outflow=3.60 cfs 11,246 cf

Total Runoff Area = 313,878 sf Runoff Volume = 19,532 cf Average Runoff Depth = 0.75"
78.64% Pervious = 246,838 sf 21.36% Impervious = 67,040 sf

Summary for Subcatchment D1: to CB-1

Runoff = 0.39 cfs @ 12.09 hrs, Volume= 1,174 cf, Depth> 3.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=4.96"

Area (sf)	CN	Description
3,567	98	Paved roads w/curbs & sewers, HSG A
1,072	39	>75% Grass cover, Good, HSG A
4,639	84	Weighted Average
1,072		23.11% Pervious Area
3,567		76.89% Impervious Area

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

Summary for Subcatchment D2: to CB-2

Runoff = 0.50 cfs @ 12.12 hrs, Volume= 1,872 cf, Depth> 0.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=4.96"

Area (sf)	CN	Description
4,992	98	Paved roads w/curbs & sewers, HSG A
2,222	98	Roofs, HSG A
22,950	39	>75% Grass cover, Good, HSG A
30,164	53	Weighted Average
22,950		76.08% Pervious Area
7,214		23.92% Impervious Area

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

Summary for Subcatchment D3: to CB-3

Runoff = 0.74 cfs @ 12.10 hrs, Volume= 2,302 cf, Depth> 1.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=4.96"

Area (sf)	CN	Description
5,035	98	Paved roads w/curbs & sewers, HSG A
3,202	98	Roofs, HSG A
13,307	39	>75% Grass cover, Good, HSG A
21,544	62	Weighted Average
13,307		61.77% Pervious Area
8,237		38.23% Impervious Area

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

Summary for Subcatchment D4: to CB-4

Runoff = 0.38 cfs @ 12.10 hrs, Volume= 1,165 cf, Depth> 1.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=4.96"

Area (sf)	CN	Description
3,047	98	Paved roads w/curbs & sewers, HSG A
1,220	98	Roofs, HSG A
6,636	39	>75% Grass cover, Good, HSG A
10,903	62	Weighted Average
6,636		60.86% Pervious Area
4,267		39.14% Impervious Area

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

Summary for Subcatchment D5: to CB-5

Runoff = 1.60 cfs @ 12.10 hrs, Volume= 4,734 cf, Depth> 1.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=4.96"

Area (sf)	CN	Description
12,468	98	Paved roads w/curbs & sewers, HSG A
3,873	98	Roofs, HSG A
14,411	39	>75% Grass cover, Good, HSG A
30,752	70	Weighted Average
14,411		46.86% Pervious Area
16,341		53.14% Impervious Area

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

Summary for Subcatchment D6: to Basin

Runoff = 1.94 cfs @ 12.11 hrs, Volume= 6,690 cf, Depth> 0.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=4.96"

Area (sf)	CN	Description
6,642	98	Paved roads w/curbs & sewers, HSG A
17,194	98	Roofs, HSG A
3,411	76	Gravel roads, HSG A
60,818	39	>75% Grass cover, Good, HSG A
88,065	56	Weighted Average
64,229		72.93% Pervious Area
23,836		27.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	10	0.0050	0.06		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
1.6	330	0.0450	3.42		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.9	258	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
6.2	598	Total			

Summary for Subcatchment D7: By-Pass

Runoff = 0.09 cfs @ 12.60 hrs, Volume= 1,596 cf, Depth> 0.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=4.96"

Area (sf)	CN	Description
78	98	Paved roads w/curbs & sewers, HSG A
3,500	98	Roofs, HSG A
2,875	76	Gravel roads, HSG A
80,934	39	>75% Grass cover, Good, HSG A
40,424	30	Brush, Good, HSG A
127,811	39	Weighted Average
124,233		97.20% Pervious Area
3,578		2.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	10	0.0100	0.08		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
1.2	170	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.0	415	0.0480	3.53		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.2	300	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
4.7	452	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.2	1,347	Total			

Summary for Reach 200: SUMMARY REACH

Inflow Area = 313,878 sf, 21.36% Impervious, Inflow Depth > 0.36" for 10 Year event
Inflow = 0.52 cfs @ 13.58 hrs, Volume= 9,348 cf
Outflow = 0.52 cfs @ 13.58 hrs, Volume= 9,348 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Summary for Pond 1P: Bioretention Area

Inflow Area = 186,067 sf, 34.11% Impervious, Inflow Depth > 1.16" for 10 Year event
Inflow = 5.53 cfs @ 12.11 hrs, Volume= 17,936 cf
Outflow = 0.62 cfs @ 13.55 hrs, Volume= 13,400 cf, Atten= 89%, Lag= 86.6 min
Discarded = 0.18 cfs @ 13.55 hrs, Volume= 5,647 cf
Primary = 0.44 cfs @ 13.55 hrs, Volume= 7,752 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 21.09' @ 13.55 hrs Surf.Area= 7,642 sf Storage= 7,659 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 93.4 min (918.0 - 824.6)

Volume	Invert	Avail.Storage	Storage Description
#1	20.00'	33,784 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
20.00	6,464	0	0
20.50	6,909	3,343	3,343
22.00	8,763	11,754	15,097
23.80	12,000	18,687	33,784

Device	Routing	Invert	Outlet Devices
#1	Discarded	20.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	20.50'	**6.0" Round Culvert** L= 25.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 20.50' / 20.25' S= 0.0100 '/' Cc= 0.900

n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf

#3	Primary	21.20'	**12.0" Round Culvert** L= 25.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 21.20' / 20.25' S= 0.0380 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=0.18 cfs @ 13.55 hrs HW=21.09' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.18 cfs)

Primary OutFlow Max=0.44 cfs @ 13.55 hrs HW=21.09' TW=0.00' (Dynamic Tailwater)
↑**2=Culvert** (Inlet Controls 0.44 cfs @ 2.23 fps)
3=Culvert (Controls 0.00 cfs)

Summary for Pond 2P: CB-1

Inflow Area = 4,639 sf, 76.89% Impervious, Inflow Depth > 3.04" for 10 Year event
Inflow = 0.39 cfs @ 12.09 hrs, Volume= 1,174 cf
Outflow = 0.39 cfs @ 12.09 hrs, Volume= 1,174 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.39 cfs @ 12.09 hrs, Volume= 1,174 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 38.43' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	38.12'	**12.0" Round Culvert** L= 20.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 38.12' / 37.72' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.37 cfs @ 12.09 hrs HW=38.43' TW=38.09' (Dynamic Tailwater)
↑**1=Culvert** (Outlet Controls 0.37 cfs @ 2.73 fps)

Summary for Pond 3P: CB-2

Inflow Area = 30,164 sf, 23.92% Impervious, Inflow Depth > 0.74" for 10 Year event
Inflow = 0.50 cfs @ 12.12 hrs, Volume= 1,872 cf
Outflow = 0.50 cfs @ 12.12 hrs, Volume= 1,872 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.50 cfs @ 12.12 hrs, Volume= 1,872 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 38.35' @ 12.13 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	37.98'	**12.0" Round Culvert** L= 13.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 37.98' / 37.72' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.46 cfs @ 12.12 hrs HW=38.34' TW=38.09' (Dynamic Tailwater)
↑**1=Culvert** (Outlet Controls 0.46 cfs @ 2.67 fps)

Summary for Pond 4P: DMH-1

Inflow Area = 34,803 sf, 30.98% Impervious, Inflow Depth > 1.05" for 10 Year event
Inflow = 0.88 cfs @ 12.11 hrs, Volume= 3,045 cf
Outflow = 0.88 cfs @ 12.11 hrs, Volume= 3,045 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.88 cfs @ 12.11 hrs, Volume= 3,045 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 38.10' @ 12.11 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	37.62'	**12.0" Round Culvert** L= 169.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 37.62' / 28.75' S= 0.0525 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.87 cfs @ 12.11 hrs HW=38.10' TW=29.34' (Dynamic Tailwater)
↑**1=Culvert** (Inlet Controls 0.87 cfs @ 2.35 fps)

Summary for Pond 5P: CB-4

Inflow Area = 10,903 sf, 39.14% Impervious, Inflow Depth > 1.28" for 10 Year event
Inflow = 0.38 cfs @ 12.10 hrs, Volume= 1,165 cf
Outflow = 0.38 cfs @ 12.10 hrs, Volume= 1,165 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.38 cfs @ 12.10 hrs, Volume= 1,165 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 29.64' @ 12.11 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	29.34'	**12.0" Round Culvert** L= 17.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 29.34' / 29.00' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.36 cfs @ 12.10 hrs HW=29.64' TW=29.34' (Dynamic Tailwater)
↑**1=Culvert** (Outlet Controls 0.36 cfs @ 2.66 fps)

Summary for Pond 6P: CB-3

Inflow Area = 21,544 sf, 38.23% Impervious, Inflow Depth > 1.28" for 10 Year event
Inflow = 0.74 cfs @ 12.10 hrs, Volume= 2,302 cf
Outflow = 0.74 cfs @ 12.10 hrs, Volume= 2,302 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.74 cfs @ 12.10 hrs, Volume= 2,302 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 29.63' @ 12.11 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	29.18'	**12.0" Round Culvert** L= 9.0' CPP, square edge headwall, Ke= 0.500

Inlet / Outlet Invert= 29.18' / 29.00' S= 0.0200 '/' Cc= 0.900
n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.73 cfs @ 12.10 hrs HW=29.63' TW=29.34' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 0.73 cfs @ 3.12 fps)

Summary for Pond 7P: DMH-2

Inflow Area =	67,250 sf,	34.62% Impervious,	Inflow Depth >	1.16"	for 10 Year event
Inflow =	2.00 cfs @	12.10 hrs, Volume=	6,512 cf		
Outflow =	2.00 cfs @	12.10 hrs, Volume=	6,512 cf,	Atten= 0%,	Lag= 0.0 min
Primary =	2.00 cfs @	12.10 hrs, Volume=	6,512 cf		

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 29.35' @ 12.10 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	28.65'	**15.0" Round Culvert**
			L= 101.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 28.65' / 26.36' S= 0.0227 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=1.98 cfs @ 12.10 hrs HW=29.34' TW=27.16' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 1.98 cfs @ 2.83 fps)

Summary for Pond 8P: CB-5

Inflow Area =	30,752 sf,	53.14% Impervious,	Inflow Depth >	1.85"	for 10 Year event
Inflow =	1.60 cfs @	12.10 hrs, Volume=	4,734 cf		
Outflow =	1.60 cfs @	12.10 hrs, Volume=	4,734 cf,	Atten= 0%,	Lag= 0.0 min
Primary =	1.60 cfs @	12.10 hrs, Volume=	4,734 cf		

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 27.49' @ 12.12 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	26.74'	**12.0" Round Culvert**
			L= 17.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 26.74' / 26.40' S= 0.0200 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.40 cfs @ 12.10 hrs HW=27.47' TW=27.16' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 1.40 cfs @ 3.17 fps)

Summary for Pond 9P: DNH-3

Inflow Area =	98,002 sf,	40.43% Impervious,	Inflow Depth >	1.38"	for 10 Year event
Inflow =	3.60 cfs @	12.10 hrs, Volume=	11,246 cf		
Outflow =	3.60 cfs @	12.10 hrs, Volume=	11,246 cf,	Atten= 0%,	Lag= 0.0 min
Primary =	3.60 cfs @	12.10 hrs, Volume=	11,246 cf		

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 27.16' @ 12.10 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	26.26'	**18.0" Round Culvert** L= 209.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 26.26' / 20.60' S= 0.0271 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=3.59 cfs @ 12.10 hrs HW=27.16' TW=21.46' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 3.59 cfs @ 3.23 fps)

Summary for Pond 11P: DMH-4

Inflow Area = 98,002 sf, 40.43% Impervious, Inflow Depth > 1.38" for 10 Year event
Inflow = 3.60 cfs @ 12.10 hrs, Volume= 11,246 cf
Outflow = 3.60 cfs @ 12.10 hrs, Volume= 11,246 cf, Atten= 0%, Lag= 0.0 min
Primary = 3.60 cfs @ 12.10 hrs, Volume= 11,246 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 21.46' @ 12.10 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	20.50'	**18.0" Round Culvert** L= 41.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 20.50' / 20.09' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=3.59 cfs @ 12.10 hrs HW=21.46' TW=20.38' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 3.59 cfs @ 4.29 fps)

Time span=1.00-20.00 hrs, dt=0.05 hrs, 381 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment D1: to CB-1 Runoff Area=4,639 sf 76.89% Impervious Runoff Depth>4.25"
Tc=6.0 min CN=84 Runoff=0.54 cfs 1,641 cf

Subcatchment D2: to CB-2 Runoff Area=30,164 sf 23.92% Impervious Runoff Depth>1.39"
Tc=6.0 min CN=53 Runoff=1.09 cfs 3,500 cf

Subcatchment D3: to CB-3 Runoff Area=21,544 sf 38.23% Impervious Runoff Depth>2.13"
Tc=6.0 min CN=62 Runoff=1.28 cfs 3,817 cf

Subcatchment D4: to CB-4 Runoff Area=10,903 sf 39.14% Impervious Runoff Depth>2.13"
Tc=6.0 min CN=62 Runoff=0.65 cfs 1,932 cf

Subcatchment D5: to CB-5 Runoff Area=30,752 sf 53.14% Impervious Runoff Depth>2.85"
Tc=6.0 min CN=70 Runoff=2.48 cfs 7,295 cf

Subcatchment D6: to Basin Runoff Area=88,065 sf 27.07% Impervious Runoff Depth>1.63"
Flow Length=598' Tc=6.2 min CN=56 Runoff=3.83 cfs 11,941 cf

Subcatchment D7: By-Pass Runoff Area=127,811 sf 2.80% Impervious Runoff Depth>0.46"
Flow Length=1,347' Tc=12.2 min CN=39 Runoff=0.66 cfs 4,880 cf

Reach 200: SUMMARY REACH Inflow=2.10 cfs 23,187 cf
Outflow=2.10 cfs 23,187 cf

Pond 1P: Bioretention Area Peak Elev=21.67' Storage=12,262 cf Inflow=9.85 cfs 30,127 cf
Discarded=0.20 cfs 6,317 cf Primary=1.56 cfs 18,307 cf Outflow=1.76 cfs 24,624 cf

Pond 2P: CB-1 Peak Elev=38.53' Inflow=0.54 cfs 1,641 cf
12.0" Round Culvert n=0.013 L=20.0' S=0.0200 '/' Outflow=0.54 cfs 1,641 cf

Pond 3P: CB-2 Peak Elev=38.58' Inflow=1.09 cfs 3,500 cf
12.0" Round Culvert n=0.013 L=13.0' S=0.0200 '/' Outflow=1.09 cfs 3,500 cf

Pond 4P: DMH-1 Peak Elev=38.31' Inflow=1.62 cfs 5,141 cf
12.0" Round Culvert n=0.013 L=169.0' S=0.0525 '/' Outflow=1.62 cfs 5,141 cf

Pond 5P: CB-4 Peak Elev=29.82' Inflow=0.65 cfs 1,932 cf
12.0" Round Culvert n=0.013 L=17.0' S=0.0200 '/' Outflow=0.65 cfs 1,932 cf

Pond 6P: CB-3 Peak Elev=29.86' Inflow=1.28 cfs 3,817 cf
12.0" Round Culvert n=0.013 L=9.0' S=0.0200 '/' Outflow=1.28 cfs 3,817 cf

Pond 7P: DMH-2 Peak Elev=29.64' Inflow=3.55 cfs 10,891 cf
15.0" Round Culvert n=0.013 L=101.0' S=0.0227 '/' Outflow=3.55 cfs 10,891 cf

Pond 8P: CB-5 Peak Elev=27.85' Inflow=2.48 cfs 7,295 cf
12.0" Round Culvert n=0.013 L=17.0' S=0.0200 '/' Outflow=2.48 cfs 7,295 cf

Pond 9P: DNH-3 Peak Elev=27.52' Inflow=6.03 cfs 18,186 cf
18.0" Round Culvert n=0.013 L=209.0' S=0.0271 '/' Outflow=6.03 cfs 18,186 cf

Pond 11P: DMH-4 Peak Elev=21.85' Inflow=6.03 cfs 18,186 cf
18.0" Round Culvert n=0.013 L=41.0' S=0.0100 '/' Outflow=6.03 cfs 18,186 cf

Total Runoff Area = 313,878 sf Runoff Volume = 35,007 cf Average Runoff Depth = 1.34"
78.64% Pervious = 246,838 sf 21.36% Impervious = 67,040 sf

Summary for Subcatchment D1: to CB-1

Runoff = 0.54 cfs @ 12.09 hrs, Volume= 1,641 cf, Depth> 4.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Rainfall=6.33"

Area (sf)	CN	Description
3,567	98	Paved roads w/curbs & sewers, HSG A
1,072	39	>75% Grass cover, Good, HSG A
4,639	84	Weighted Average
1,072		23.11% Pervious Area
3,567		76.89% Impervious Area

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

Summary for Subcatchment D2: to CB-2

Runoff = 1.09 cfs @ 12.11 hrs, Volume= 3,500 cf, Depth> 1.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Rainfall=6.33"

Area (sf)	CN	Description
4,992	98	Paved roads w/curbs & sewers, HSG A
2,222	98	Roofs, HSG A
22,950	39	>75% Grass cover, Good, HSG A
30,164	53	Weighted Average
22,950		76.08% Pervious Area
7,214		23.92% Impervious Area

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

Summary for Subcatchment D3: to CB-3

Runoff = 1.28 cfs @ 12.10 hrs, Volume= 3,817 cf, Depth> 2.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Rainfall=6.33"

Area (sf)	CN	Description
5,035	98	Paved roads w/curbs & sewers, HSG A
3,202	98	Roofs, HSG A
13,307	39	>75% Grass cover, Good, HSG A
21,544	62	Weighted Average
13,307		61.77% Pervious Area
8,237		38.23% Impervious Area

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

Summary for Subcatchment D4: to CB-4

Runoff = 0.65 cfs @ 12.10 hrs, Volume= 1,932 cf, Depth> 2.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Rainfall=6.33"

Area (sf)	CN	Description
3,047	98	Paved roads w/curbs & sewers, HSG A
1,220	98	Roofs, HSG A
6,636	39	>75% Grass cover, Good, HSG A
10,903	62	Weighted Average
6,636		60.86% Pervious Area
4,267		39.14% Impervious Area

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

Summary for Subcatchment D5: to CB-5

Runoff = 2.48 cfs @ 12.09 hrs, Volume= 7,295 cf, Depth> 2.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Rainfall=6.33"

Area (sf)	CN	Description
12,468	98	Paved roads w/curbs & sewers, HSG A
3,873	98	Roofs, HSG A
14,411	39	>75% Grass cover, Good, HSG A
30,752	70	Weighted Average
14,411		46.86% Pervious Area
16,341		53.14% Impervious Area

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

Summary for Subcatchment D6: to Basin

Runoff = 3.83 cfs @ 12.10 hrs, Volume= 11,941 cf, Depth> 1.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Rainfall=6.33"

Area (sf)	CN	Description
6,642	98	Paved roads w/curbs & sewers, HSG A
17,194	98	Roofs, HSG A
3,411	76	Gravel roads, HSG A
60,818	39	>75% Grass cover, Good, HSG A
88,065	56	Weighted Average
64,229		72.93% Pervious Area
23,836		27.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	10	0.0050	0.06		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
1.6	330	0.0450	3.42		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.9	258	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
6.2	598	Total			

Summary for Subcatchment D7: By-Pass

Runoff = 0.66 cfs @ 12.41 hrs, Volume= 4,880 cf, Depth> 0.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Rainfall=6.33"

Area (sf)	CN	Description
78	98	Paved roads w/curbs & sewers, HSG A
3,500	98	Roofs, HSG A
2,875	76	Gravel roads, HSG A
80,934	39	>75% Grass cover, Good, HSG A
40,424	30	Brush, Good, HSG A
127,811	39	Weighted Average
124,233		97.20% Pervious Area
3,578		2.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	10	0.0100	0.08		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
1.2	170	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.0	415	0.0480	3.53		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.2	300	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
4.7	452	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.2	1,347	Total			

Summary for Reach 200: SUMMARY REACH

Inflow Area = 313,878 sf, 21.36% Impervious, Inflow Depth > 0.89" for 25 Year event
Inflow = 2.10 cfs @ 12.53 hrs, Volume= 23,187 cf
Outflow = 2.10 cfs @ 12.53 hrs, Volume= 23,187 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Summary for Pond 1P: Bioretention Area

Inflow Area = 186,067 sf, 34.11% Impervious, Inflow Depth > 1.94" for 25 Year event
Inflow = 9.85 cfs @ 12.10 hrs, Volume= 30,127 cf
Outflow = 1.76 cfs @ 12.63 hrs, Volume= 24,624 cf, Atten= 82%, Lag= 32.0 min
Discarded = 0.20 cfs @ 12.63 hrs, Volume= 6,317 cf
Primary = 1.56 cfs @ 12.63 hrs, Volume= 18,307 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 21.67' @ 12.63 hrs Surf.Area= 8,354 sf Storage= 12,262 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 82.8 min (896.4 - 813.6)

Volume	Invert	Avail.Storage	Storage Description
#1	20.00'	33,784 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
20.00	6,464	0	0
20.50	6,909	3,343	3,343
22.00	8,763	11,754	15,097
23.80	12,000	18,687	33,784

Device	Routing	Invert	Outlet Devices
#1	Discarded	20.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	20.50'	**6.0" Round Culvert** L= 25.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 20.50' / 20.25' S= 0.0100 '/' Cc= 0.900

n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf

#3	Primary	21.20'	**12.0" Round Culvert**
			L= 25.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 21.20' / 20.25' S= 0.0380 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=0.20 cfs @ 12.63 hrs HW=21.67' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.20 cfs)

Primary OutFlow Max=1.56 cfs @ 12.63 hrs HW=21.67' TW=0.00' (Dynamic Tailwater)
↑—**2=Culvert** (Inlet Controls 0.72 cfs @ 3.64 fps)
└—**3=Culvert** (Inlet Controls 0.84 cfs @ 2.33 fps)

Summary for Pond 2P: CB-1

Inflow Area =	4,639 sf,	76.89% Impervious,	Inflow Depth >	4.25"	for 25 Year event
Inflow =	0.54 cfs @	12.09 hrs, Volume=	1,641 cf		
Outflow =	0.54 cfs @	12.09 hrs, Volume=	1,641 cf,	Atten= 0%,	Lag= 0.0 min
Primary =	0.54 cfs @	12.09 hrs, Volume=	1,641 cf		

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 38.53' @ 12.11 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	38.12'	**12.0" Round Culvert**
			L= 20.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 38.12' / 37.72' S= 0.0200 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.45 cfs @ 12.09 hrs HW=38.51' TW=38.29' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 0.45 cfs @ 2.34 fps)

Summary for Pond 3P: CB-2

Inflow Area =	30,164 sf,	23.92% Impervious,	Inflow Depth >	1.39"	for 25 Year event
Inflow =	1.09 cfs @	12.11 hrs, Volume=	3,500 cf		
Outflow =	1.09 cfs @	12.11 hrs, Volume=	3,500 cf,	Atten= 0%,	Lag= 0.0 min
Primary =	1.09 cfs @	12.11 hrs, Volume=	3,500 cf		

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 38.58' @ 12.12 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	37.98'	**12.0" Round Culvert**
			L= 13.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 37.98' / 37.72' S= 0.0200 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.98 cfs @ 12.11 hrs HW=38.56' TW=38.30' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 0.98 cfs @ 2.95 fps)

Summary for Pond 4P: DMH-1

Inflow Area = 34,803 sf, 30.98% Impervious, Inflow Depth > 1.77" for 25 Year event
Inflow = 1.62 cfs @ 12.10 hrs, Volume= 5,141 cf
Outflow = 1.62 cfs @ 12.10 hrs, Volume= 5,141 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.62 cfs @ 12.10 hrs, Volume= 5,141 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 38.31' @ 12.10 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	37.62'	**12.0" Round Culvert** L= 169.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 37.62' / 28.75' S= 0.0525 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.62 cfs @ 12.10 hrs HW=38.31' TW=29.64' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 1.62 cfs @ 2.82 fps)

Summary for Pond 5P: CB-4

Inflow Area = 10,903 sf, 39.14% Impervious, Inflow Depth > 2.13" for 25 Year event
Inflow = 0.65 cfs @ 12.10 hrs, Volume= 1,932 cf
Outflow = 0.65 cfs @ 12.10 hrs, Volume= 1,932 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.65 cfs @ 12.10 hrs, Volume= 1,932 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 29.82' @ 12.13 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	29.34'	**12.0" Round Culvert** L= 17.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 29.34' / 29.00' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.50 cfs @ 12.10 hrs HW=29.80' TW=29.64' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 0.50 cfs @ 2.11 fps)

Summary for Pond 6P: CB-3

Inflow Area = 21,544 sf, 38.23% Impervious, Inflow Depth > 2.13" for 25 Year event
Inflow = 1.28 cfs @ 12.10 hrs, Volume= 3,817 cf
Outflow = 1.28 cfs @ 12.10 hrs, Volume= 3,817 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.28 cfs @ 12.10 hrs, Volume= 3,817 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 29.86' @ 12.13 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	29.18'	**12.0" Round Culvert** L= 9.0' CPP, square edge headwall, Ke= 0.500

Inlet / Outlet Invert= 29.18' / 29.00' S= 0.0200 '/' Cc= 0.900
n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.04 cfs @ 12.10 hrs HW=29.84' TW=29.64' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 1.04 cfs @ 2.68 fps)

Summary for Pond 7P: DMH-2

Inflow Area =	67,250 sf,	34.62% Impervious,	Inflow Depth >	1.94"	for 25 Year event
Inflow =	3.55 cfs @	12.10 hrs, Volume=	10,891 cf		
Outflow =	3.55 cfs @	12.10 hrs, Volume=	10,891 cf,	Atten= 0%,	Lag= 0.0 min
Primary =	3.55 cfs @	12.10 hrs, Volume=	10,891 cf		

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 29.64' @ 12.10 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	28.65'	**15.0" Round Culvert**
			L= 101.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 28.65' / 26.36' S= 0.0227 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=3.55 cfs @ 12.10 hrs HW=29.64' TW=27.51' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 3.55 cfs @ 3.39 fps)

Summary for Pond 8P: CB-5

Inflow Area =	30,752 sf,	53.14% Impervious,	Inflow Depth >	2.85"	for 25 Year event
Inflow =	2.48 cfs @	12.09 hrs, Volume=	7,295 cf		
Outflow =	2.48 cfs @	12.09 hrs, Volume=	7,295 cf,	Atten= 0%,	Lag= 0.0 min
Primary =	2.48 cfs @	12.09 hrs, Volume=	7,295 cf		

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 27.85' @ 12.12 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	26.74'	**12.0" Round Culvert**
			L= 17.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 26.74' / 26.40' S= 0.0200 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.07 cfs @ 12.09 hrs HW=27.80' TW=27.50' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 2.07 cfs @ 2.64 fps)

Summary for Pond 9P: DNH-3

Inflow Area =	98,002 sf,	40.43% Impervious,	Inflow Depth >	2.23"	for 25 Year event
Inflow =	6.03 cfs @	12.10 hrs, Volume=	18,186 cf		
Outflow =	6.03 cfs @	12.10 hrs, Volume=	18,186 cf,	Atten= 0%,	Lag= 0.0 min
Primary =	6.03 cfs @	12.10 hrs, Volume=	18,186 cf		

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 27.52' @ 12.10 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	26.26'	**18.0" Round Culvert** L= 209.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 26.26' / 20.60' S= 0.0271 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=5.99 cfs @ 12.10 hrs HW=27.51' TW=21.84' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 5.99 cfs @ 3.81 fps)

Summary for Pond 11P: DMH-4

Inflow Area =	98,002 sf,	40.43% Impervious,	Inflow Depth >	2.23"	for 25 Year event
Inflow =	6.03 cfs @	12.10 hrs, Volume=	18,186 cf		
Outflow =	6.03 cfs @	12.10 hrs, Volume=	18,186 cf,	Atten= 0%,	Lag= 0.0 min
Primary =	6.03 cfs @	12.10 hrs, Volume=	18,186 cf		

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 21.85' @ 12.10 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	20.50'	**18.0" Round Culvert** L= 41.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 20.50' / 20.09' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=5.99 cfs @ 12.10 hrs HW=21.84' TW=20.82' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 5.99 cfs @ 4.77 fps)

Time span=1.00-20.00 hrs, dt=0.05 hrs, 381 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment D1: to CB-1 Runoff Area=4,639 sf 76.89% Impervious Runoff Depth>6.84"
Tc=6.0 min CN=84 Runoff=0.85 cfs 2,646 cf

Subcatchment D2: to CB-2 Runoff Area=30,164 sf 23.92% Impervious Runoff Depth>3.09"
Tc=6.0 min CN=53 Runoff=2.61 cfs 7,768 cf

Subcatchment D3: to CB-3 Runoff Area=21,544 sf 38.23% Impervious Runoff Depth>4.17"
Tc=6.0 min CN=62 Runoff=2.55 cfs 7,483 cf

Subcatchment D4: to CB-4 Runoff Area=10,903 sf 39.14% Impervious Runoff Depth>4.17"
Tc=6.0 min CN=62 Runoff=1.29 cfs 3,787 cf

Subcatchment D5: to CB-5 Runoff Area=30,752 sf 53.14% Impervious Runoff Depth>5.14"
Tc=6.0 min CN=70 Runoff=4.45 cfs 13,170 cf

Subcatchment D6: to Basin Runoff Area=88,065 sf 27.07% Impervious Runoff Depth>3.45"
Flow Length=598' Tc=6.2 min CN=56 Runoff=8.52 cfs 25,295 cf

Subcatchment D7: By-Pass Runoff Area=127,811 sf 2.80% Impervious Runoff Depth>1.49"
Flow Length=1,347' Tc=12.2 min CN=39 Runoff=3.60 cfs 15,907 cf

Reach 200: SUMMARY REACH Inflow=8.05 cfs 61,297 cf
Outflow=8.05 cfs 61,297 cf

Pond 1P: Bioretention Area Peak Elev=22.84' Storage=23,076 cf Inflow=20.25 cfs 60,149 cf
Discarded=0.24 cfs 7,458 cf Primary=5.11 cfs 45,390 cf Outflow=5.36 cfs 52,848 cf

Pond 2P: CB-1 Peak Elev=39.00' Inflow=0.85 cfs 2,646 cf
12.0" Round Culvert n=0.013 L=20.0' S=0.0200 '/' Outflow=0.85 cfs 2,646 cf

Pond 3P: CB-2 Peak Elev=39.31' Inflow=2.61 cfs 7,768 cf
12.0" Round Culvert n=0.013 L=13.0' S=0.0200 '/' Outflow=2.61 cfs 7,768 cf

Pond 4P: DMH-1 Peak Elev=38.95' Inflow=3.45 cfs 10,414 cf
12.0" Round Culvert n=0.013 L=169.0' S=0.0525 '/' Outflow=3.45 cfs 10,414 cf

Pond 5P: CB-4 Peak Elev=30.88' Inflow=1.29 cfs 3,787 cf
12.0" Round Culvert n=0.013 L=17.0' S=0.0200 '/' Outflow=1.29 cfs 3,787 cf

Pond 6P: CB-3 Peak Elev=31.12' Inflow=2.55 cfs 7,483 cf
12.0" Round Culvert n=0.013 L=9.0' S=0.0200 '/' Outflow=2.55 cfs 7,483 cf

Pond 7P: DMH-2 Peak Elev=30.79' Inflow=7.29 cfs 21,684 cf
15.0" Round Culvert n=0.013 L=101.0' S=0.0227 '/' Outflow=7.29 cfs 21,684 cf

Pond 8P: CB-5 Peak Elev=29.99' Inflow=4.45 cfs 13,170 cf
12.0" Round Culvert n=0.013 L=17.0' S=0.0200 '/' Outflow=4.45 cfs 13,170 cf

Pond 9P: DNH-3 Peak Elev=28.91' Inflow=11.74 cfs 34,854 cf
18.0" Round Culvert n=0.013 L=209.0' S=0.0271 '/' Outflow=11.74 cfs 34,854 cf

Pond 11P: DMH-4 Peak Elev=23.52' Inflow=11.74 cfs 34,854 cf
18.0" Round Culvert n=0.013 L=41.0' S=0.0100 '/' Outflow=11.74 cfs 34,854 cf

Total Runoff Area = 313,878 sf Runoff Volume = 76,056 cf Average Runoff Depth = 2.91"
78.64% Pervious = 246,838 sf 21.36% Impervious = 67,040 sf

Summary for Subcatchment D1: to CB-1

Runoff = 0.85 cfs @ 12.09 hrs, Volume= 2,646 cf, Depth> 6.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=9.18"

Area (sf)	CN	Description
3,567	98	Paved roads w/curbs & sewers, HSG A
1,072	39	>75% Grass cover, Good, HSG A
4,639	84	Weighted Average
1,072		23.11% Pervious Area
3,567		76.89% Impervious Area

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

Summary for Subcatchment D2: to CB-2

Runoff = 2.61 cfs @ 12.10 hrs, Volume= 7,768 cf, Depth> 3.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=9.18"

Area (sf)	CN	Description
4,992	98	Paved roads w/curbs & sewers, HSG A
2,222	98	Roofs, HSG A
22,950	39	>75% Grass cover, Good, HSG A
30,164	53	Weighted Average
22,950		76.08% Pervious Area
7,214		23.92% Impervious Area

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

Summary for Subcatchment D3: to CB-3

Runoff = 2.55 cfs @ 12.09 hrs, Volume= 7,483 cf, Depth> 4.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=9.18"

Area (sf)	CN	Description
5,035	98	Paved roads w/curbs & sewers, HSG A
3,202	98	Roofs, HSG A
13,307	39	>75% Grass cover, Good, HSG A
21,544	62	Weighted Average
13,307		61.77% Pervious Area
8,237		38.23% Impervious Area

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

Summary for Subcatchment D4: to CB-4

Runoff = 1.29 cfs @ 12.09 hrs, Volume= 3,787 cf, Depth> 4.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=9.18"

Area (sf)	CN	Description
3,047	98	Paved roads w/curbs & sewers, HSG A
1,220	98	Roofs, HSG A
6,636	39	>75% Grass cover, Good, HSG A
10,903	62	Weighted Average
6,636		60.86% Pervious Area
4,267		39.14% Impervious Area

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

Summary for Subcatchment D5: to CB-5

Runoff = 4.45 cfs @ 12.09 hrs, Volume= 13,170 cf, Depth> 5.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=9.18"

Area (sf)	CN	Description
12,468	98	Paved roads w/curbs & sewers, HSG A
3,873	98	Roofs, HSG A
14,411	39	>75% Grass cover, Good, HSG A
30,752	70	Weighted Average
14,411		46.86% Pervious Area
16,341		53.14% Impervious Area

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

Summary for Subcatchment D6: to Basin

Runoff = 8.52 cfs @ 12.10 hrs, Volume= 25,295 cf, Depth> 3.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=9.18"

Area (sf)	CN	Description
6,642	98	Paved roads w/curbs & sewers, HSG A
17,194	98	Roofs, HSG A
3,411	76	Gravel roads, HSG A
60,818	39	>75% Grass cover, Good, HSG A
88,065	56	Weighted Average
64,229		72.93% Pervious Area
23,836		27.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	10	0.0050	0.06		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
1.6	330	0.0450	3.42		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.9	258	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
6.2	598	Total			

Summary for Subcatchment D7: By-Pass

Runoff = 3.60 cfs @ 12.21 hrs, Volume= 15,907 cf, Depth> 1.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=9.18"

Area (sf)	CN	Description
78	98	Paved roads w/curbs & sewers, HSG A
3,500	98	Roofs, HSG A
2,875	76	Gravel roads, HSG A
80,934	39	>75% Grass cover, Good, HSG A
40,424	30	Brush, Good, HSG A
127,811	39	Weighted Average
124,233		97.20% Pervious Area
3,578		2.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	10	0.0100	0.08		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
1.2	170	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.0	415	0.0480	3.53		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.2	300	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
4.7	452	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.2	1,347	Total			

Summary for Reach 200: SUMMARY REACH

Inflow Area = 313,878 sf, 21.36% Impervious, Inflow Depth > 2.34" for 100 Year event
Inflow = 8.05 cfs @ 12.26 hrs, Volume= 61,297 cf
Outflow = 8.05 cfs @ 12.26 hrs, Volume= 61,297 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Summary for Pond 1P: Bioretention Area

Inflow Area = 186,067 sf, 34.11% Impervious, Inflow Depth > 3.88" for 100 Year event
Inflow = 20.25 cfs @ 12.10 hrs, Volume= 60,149 cf
Outflow = 5.36 cfs @ 12.50 hrs, Volume= 52,848 cf, Atten= 74%, Lag= 24.0 min
Discarded = 0.24 cfs @ 12.50 hrs, Volume= 7,458 cf
Primary = 5.11 cfs @ 12.50 hrs, Volume= 45,390 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 22.84' @ 12.50 hrs Surf.Area= 10,271 sf Storage= 23,076 cf

Plug-Flow detention time= 93.6 min calculated for 52,709 cf (88% of inflow)
Center-of-Mass det. time= 56.2 min (855.3 - 799.1)

Volume	Invert	Avail.Storage	Storage Description
#1	20.00'	33,784 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
20.00	6,464	0	0
20.50	6,909	3,343	3,343
22.00	8,763	11,754	15,097
23.80	12,000	18,687	33,784

Device	Routing	Invert	Outlet Devices
#1	Discarded	20.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	20.50'	**6.0" Round Culvert** L= 25.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 20.50' / 20.25' S= 0.0100 '/' Cc= 0.900

n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf

#3 Primary 21.20' **12.0" Round Culvert**
L= 25.0' CPP, square edge headwall, Ke= 0.500
Inlet / Outlet Invert= 21.20' / 20.25' S= 0.0380 '/' Cc= 0.900
n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=0.24 cfs @ 12.50 hrs HW=22.84' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.24 cfs)

Primary OutFlow Max=5.11 cfs @ 12.50 hrs HW=22.84' TW=0.00' (Dynamic Tailwater)
↑**2=Culvert** (Inlet Controls 1.08 cfs @ 5.49 fps)
↑**3=Culvert** (Inlet Controls 4.03 cfs @ 5.14 fps)

Summary for Pond 2P: CB-1

Inflow Area = 4,639 sf, 76.89% Impervious, Inflow Depth > 6.84" for 100 Year event
Inflow = 0.85 cfs @ 12.09 hrs, Volume= 2,646 cf
Outflow = 0.85 cfs @ 12.09 hrs, Volume= 2,646 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.85 cfs @ 12.09 hrs, Volume= 2,646 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 39.00' @ 12.14 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	38.12'	**12.0" Round Culvert** L= 20.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 38.12' / 37.72' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.09 hrs HW=38.82' TW=38.91' (Dynamic Tailwater)
↑**1=Culvert** (Controls 0.00 cfs)

Summary for Pond 3P: CB-2

Inflow Area = 30,164 sf, 23.92% Impervious, Inflow Depth > 3.09" for 100 Year event
Inflow = 2.61 cfs @ 12.10 hrs, Volume= 7,768 cf
Outflow = 2.61 cfs @ 12.10 hrs, Volume= 7,768 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.61 cfs @ 12.10 hrs, Volume= 7,768 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 39.31' @ 12.13 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	37.98'	**12.0" Round Culvert** L= 13.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 37.98' / 37.72' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.98 cfs @ 12.10 hrs HW=39.22' TW=38.94' (Dynamic Tailwater)
↑**1=Culvert** (Inlet Controls 1.98 cfs @ 2.53 fps)

Summary for Pond 4P: DMH-1

Inflow Area = 34,803 sf, 30.98% Impervious, Inflow Depth > 3.59" for 100 Year event
Inflow = 3.45 cfs @ 12.10 hrs, Volume= 10,414 cf
Outflow = 3.45 cfs @ 12.10 hrs, Volume= 10,414 cf, Atten= 0%, Lag= 0.0 min
Primary = 3.45 cfs @ 12.10 hrs, Volume= 10,414 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 38.95' @ 12.10 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	37.62'	**12.0" Round Culvert** L= 169.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 37.62' / 28.75' S= 0.0525 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=3.42 cfs @ 12.10 hrs HW=38.94' TW=30.77' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 3.42 cfs @ 4.35 fps)

Summary for Pond 5P: CB-4

Inflow Area = 10,903 sf, 39.14% Impervious, Inflow Depth > 4.17" for 100 Year event
Inflow = 1.29 cfs @ 12.09 hrs, Volume= 3,787 cf
Outflow = 1.29 cfs @ 12.09 hrs, Volume= 3,787 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.29 cfs @ 12.09 hrs, Volume= 3,787 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 30.88' @ 12.14 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	29.34'	**12.0" Round Culvert** L= 17.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 29.34' / 29.00' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.09 hrs HW=30.51' TW=30.75' (Dynamic Tailwater)
↑—**1=Culvert** (Controls 0.00 cfs)

Summary for Pond 6P: CB-3

Inflow Area = 21,544 sf, 38.23% Impervious, Inflow Depth > 4.17" for 100 Year event
Inflow = 2.55 cfs @ 12.09 hrs, Volume= 7,483 cf
Outflow = 2.55 cfs @ 12.09 hrs, Volume= 7,483 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.55 cfs @ 12.09 hrs, Volume= 7,483 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 31.12' @ 12.14 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	29.18'	**12.0" Round Culvert** L= 9.0' CPP, square edge headwall, Ke= 0.500

Inlet / Outlet Invert= 29.18' / 29.00' S= 0.0200 '/' Cc= 0.900
n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.97 cfs @ 12.09 hrs HW=30.82' TW=30.75' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.97 cfs @ 1.24 fps)

Summary for Pond 7P: DMH-2

Inflow Area = 67,250 sf, 34.62% Impervious, Inflow Depth > 3.87" for 100 Year event
Inflow = 7.29 cfs @ 12.10 hrs, Volume= 21,684 cf
Outflow = 7.29 cfs @ 12.10 hrs, Volume= 21,684 cf, Atten= 0%, Lag= 0.0 min
Primary = 7.29 cfs @ 12.10 hrs, Volume= 21,684 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 30.79' @ 12.10 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	28.65'	**15.0" Round Culvert**
			L= 101.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 28.65' / 26.36' S= 0.0227 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=6.90 cfs @ 12.10 hrs HW=30.76' TW=28.87' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 6.90 cfs @ 5.62 fps)

Summary for Pond 8P: CB-5

Inflow Area = 30,752 sf, 53.14% Impervious, Inflow Depth > 5.14" for 100 Year event
Inflow = 4.45 cfs @ 12.09 hrs, Volume= 13,170 cf
Outflow = 4.45 cfs @ 12.09 hrs, Volume= 13,170 cf, Atten= 0%, Lag= 0.0 min
Primary = 4.45 cfs @ 12.09 hrs, Volume= 13,170 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 29.99' @ 12.12 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	26.74'	**12.0" Round Culvert**
			L= 17.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 26.74' / 26.40' S= 0.0200 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=3.51 cfs @ 12.09 hrs HW=29.70' TW=28.84' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 3.51 cfs @ 4.47 fps)

Summary for Pond 9P: DNH-3

Inflow Area = 98,002 sf, 40.43% Impervious, Inflow Depth > 4.27" for 100 Year event
Inflow = 11.74 cfs @ 12.09 hrs, Volume= 34,854 cf
Outflow = 11.74 cfs @ 12.09 hrs, Volume= 34,854 cf, Atten= 0%, Lag= 0.0 min
Primary = 11.74 cfs @ 12.09 hrs, Volume= 34,854 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 28.91' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	26.26'	**18.0" Round Culvert** L= 209.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 26.26' / 20.60' S= 0.0271 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=11.56 cfs @ 12.09 hrs HW=28.86' TW=23.41' (Dynamic Tailwater)
↑**1=Culvert** (Inlet Controls 11.56 cfs @ 6.54 fps)

Summary for Pond 11P: DMH-4

Inflow Area = 98,002 sf, 40.43% Impervious, Inflow Depth > 4.27" for 100 Year event
Inflow = 11.74 cfs @ 12.09 hrs, Volume= 34,854 cf
Outflow = 11.74 cfs @ 12.09 hrs, Volume= 34,854 cf, Atten= 0%, Lag= 0.0 min
Primary = 11.74 cfs @ 12.09 hrs, Volume= 34,854 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 23.52' @ 12.11 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	20.50'	**18.0" Round Culvert** L= 41.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 20.50' / 20.09' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=10.41 cfs @ 12.09 hrs HW=23.41' TW=21.91' (Dynamic Tailwater)
↑**1=Culvert** (Inlet Controls 10.41 cfs @ 5.89 fps)

Appendix F

Rainfall Table
Extreme Precipitation Estimates

Northeast Regional Climate Center Extreme Precipitation estimates (inches)

Point Estim Smoothed

Data series Partial duration series

State Massachusetts

Location

Lon (dd) -70.851

Lat (dd) 42.787

Elev (feet) 0

MEAN PRECIPITATION FREQUENCY ESTIMATES

Freq (yr)	5-min	10-min	15-min	30-min	60-min	120-min	3-hr	6-hr	12-hr	24-hr	2-day	4-day
1	0.27	0.41	0.51	0.67	0.83	1.06	1.24	1.59	2.06	2.7	2.99	3.31
2	0.33	0.51	0.63	0.83	1.05	1.33	1.54	1.97	2.51	3.23	3.6	3.98
5	0.39	0.6	0.76	1.01	1.3	1.66	1.95	2.5	3.2	4.12	4.62	5.12
10	0.43	0.68	0.86	1.17	1.53	1.98	2.33	3	3.86	4.96	5.59	6.19
25	0.51	0.81	1.03	1.42	1.89	2.48	2.93	3.8	4.91	6.33	7.19	7.98
50	0.58	0.93	1.19	1.66	2.23	2.95	3.51	4.57	5.91	7.62	8.7	9.67
100	0.65	1.06	1.36	1.93	2.63	3.52	4.2	5.49	7.12	9.18	10.53	11.72
200	0.75	1.22	1.57	2.25	3.1	4.18	5.01	6.57	8.55	11.07	12.75	14.2
500	0.89	1.46	1.9	2.76	3.87	5.27	6.34	8.37	10.93	14.18	16.42	18.33

UPPER LIMIT PRECIPITATION FREQUENCY ESTIMATES

Freq (yr)	5-min	10-min	15-min	30-min	60-min	120-min	3-hr	6-hr	12-hr	24-hr	2-day	4-day
1	0.29	0.45	0.55	0.74	0.91	1.08	1.31	1.71	2.18	2.89	3.19	3.56
2	0.34	0.53	0.65	0.88	1.09	1.3	1.51	1.98	2.52	3.31	3.7	4.09
5	0.42	0.64	0.8	1.09	1.39	1.69	1.94	2.56	3.27	4.4	4.94	5.48
10	0.5	0.76	0.95	1.32	1.71	2.07	2.36	3.14	3.97	5.48	6.17	6.87
25	0.62	0.95	1.18	1.69	2.22	2.72	3.08	4.11	5.17	7.33	8.3	9.28
50	0.74	1.12	1.4	2.01	2.71	3.34	3.76	5.04	6.33	9.17	10.39	11.67
100	0.88	1.34	1.67	2.42	3.31	4.1	4.6	6.21	7.75	11.48	13.01	14.66
200	1.05	1.58	2	2.9	4.04	5.04	5.64	7.64	9.5	14.4	16.32	18.47
500	1.33	1.98	2.54	3.69	5.25	6.6	7.38	10.09	12.45	19.47	22.03	25

LOWER LIMIT PRECIPITATION FREQUENCY ESTIMATES

Freq (yr)	5-min	10-min	15-min	30-min	60-min	120-min	3-hr	6-hr	12-hr	24-hr	2-day	4-day
1	0.24	0.36	0.44	0.6	0.73	0.87	0.99	1.33	1.67	2.5	2.65	2.99
2	0.32	0.49	0.61	0.82	1.01	1.22	1.4	1.83	2.34	3.17	3.53	3.89
5	0.37	0.56	0.7	0.96	1.22	1.45	1.65	2.13	2.74	3.86	4.32	4.78
10	0.41	0.62	0.77	1.08	1.4	1.67	1.86	2.4	3.07	4.47	5.02	5.59

Appendix G

Infiltration Basin Volume Table

Stage-Area-Storage for Pond 1P: Bioretention Area

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
20.00	6,500	0
20.05	6,555	326
20.10	6,610	656
20.15	6,665	987
20.20	6,720	1,322
20.25	6,775	1,659
20.30	6,830	2,000
20.35	6,885	2,342
20.40	6,940	2,688
20.45	6,995	3,036
20.50	7,050	3,388
20.55	7,108	3,741
20.60	7,165	4,098
20.65	7,222	4,458
20.70	7,280	4,820
20.75	7,338	5,186
20.80	7,395	5,554
20.85	7,453	5,925
20.90	7,510	6,299
20.95	7,567	6,676
21.00	7,625	7,056
21.05	7,683	7,439
21.10	7,740	7,825
21.15	7,797	8,213
21.20	7,855	8,604
21.25	7,913	8,998
21.30	7,970	9,396
21.35	8,028	9,795
21.40	8,085	10,198
21.45	8,142	10,604
21.50	8,200	11,013
21.55	8,258	11,424
21.60	8,315	11,838
21.65	8,372	12,255
21.70	8,430	12,675
21.75	8,488	13,098
21.80	8,545	13,524
21.85	8,603	13,953
21.90	8,660	14,384
21.95	8,718	14,819
22.00	8,775	15,256
22.05	8,866	15,697
22.10	8,957	16,143
22.15	9,048	16,593
22.20	9,139	17,048
22.25	9,230	17,507
22.30	9,321	17,971
22.35	9,412	18,439
22.40	9,503	18,912
22.45	9,594	19,389
22.50	9,685	19,871
22.55	9,776	20,358
22.60	9,867	20,849
22.65	9,958	21,344
22.70	10,049	21,845
22.75	10,140	22,349
22.80	10,231	22,858
22.85	10,322	23,372
22.90	10,412	23,891
22.95	10,503	24,414
23.00	10,594	24,941
23.05	10,685	25,473
23.10	10,776	26,010
23.15	10,867	26,551
23.20	10,958	27,096
23.25	11,049	27,646
23.30	11,140	28,201
23.35	11,231	28,760
23.40	11,322	29,324
23.45	11,413	29,893
23.50	11,504	30,466
23.55	11,595	31,043
23.60	11,686	31,625
23.65	11,777	32,212
23.70	11,868	32,803
23.75	11,959	33,399
23.80	**12,050**	**33,999**

Appendix H

Stormwater Operation and Maintenance Plan

Stormwater Management System

Operation and Maintenance Plan

For:

Seagate

105 High Road, Newbury, MA

Prepared for:

Depiero, LLC
3 Graf Road Unit 14
Newburyport, MA 01950

Prepared By:

Design Consultants Inc.
Somerville, MA 01913

Date: August 2021

Introduction

This Operation and Maintenance Plan (Plan) has been prepared to aid in ensuring the Stormwater Management System (System) installed at Seagate functions as designed, and to prescribe practices for source control and pollution prevention. The Plan describes the various components of the System, identifies inspection and maintenance tasks that shall be completed post construction, and establishes a schedule for implementing the inspection and maintenance tasks to ensure the proper long term operation of the System.

Owner and Responsible Parties

The land owner, his successors and assignees shall be responsible for compliance with the Plan after construction is complete. The System shall be adequately maintained such that the System performs its intended function.

Any modification to the System may require state and local approval.

The obligation to comply with the Plan is with the land owner, his successors and assignees and never with the Town of Newbury.

Maintenance

The System has been designed such that when constructed will collect, treat, and control stormwater runoff such that the quality and rate of runoff as a result of development closely mimic the undeveloped site. When constructed the System shall comply with the Massachusetts Stormwater Management Standards (Standards). The System accomplishes these objectives by utilizing Best Management Practices (BMP's).

BMP's provided in the System include:

- Pre-Treatment
    - street sweeping;
    - deep sump and hooded catch basins; and
    - Stormwater Treatment Chamber.

- Treatment
    - infiltration basins;

- Conveyance
    - Grassed Swale.

The components of the System shall be inspected, monitored, and maintained in accordance with the Standards to ensure the System functions as intended. Routine inspection and proper maintenance is critical in ensuring long term operation of the System.

Street Sweeping and Site Cleanup

Routine sweeping of paved areas is an effective method to provide important non-point source pollution control and shall be performed by mechanical sweepers. Most stormwater pollutants travel with the suspended solids contained in the stormwater runoff and regular sweeping will help reduce a portion of this load. Sweeping, especially during the period immediately following winter snowmelt (March/April) when road sand and other debris have accumulated on the pavement, will capture a peak sediment load before spring rains wash residual sand from winter applications into nearby resource areas.

Inspection: Paved areas shall be inspected for litter on a weekly basis and picked up and disposed of immediately.

Maintenance: All paved areas, driveways and other impervious surfaces (except roofs) shall be swept clean of sand, litter, trash, etc. on a monthly basis. A log of land/lot sweeping and cleanup shall be kept. Housekeeping concerns shall be documented and acted upon. Separate clean up services will be conducted at least twice a year, once between November 14 and December 15 (after leaf fall) and once during the month of April (after snow melt). Additional cleanup services will be conducted as necessary.

Catch Basins

Catch Basins collect runoff and trap some of the pollutants. The sands and silts will settle in the sump. Oil, grease and floatable debris will collect at the water surface and be trapped by the outlet hood. Stormwater is allowed to discharge downstream for additional treatment. The catch basin will remain full of water up to the outlet elevation under normal conditions.

Inspection and Maintenance:

1. Catch basins shall be inspected or cleaned at least four times per year.

2. Sediment must also be removed four times per year or whenever the depth of deposits is greater than or equal to half the depth from the bottom of the invert of the lowest pipe in the basin. This can be done using clamshell buckets or preferably vacuum trucks. All necessary precautions must be taken to safeguard workers from traffic.

3. Contaminated catch basins must be evaluated in accordance with the Hazardous Waste Regulations, 310 CMR 30.000, and handled as hazardous waste. In the absence of contamination, catch basin cleanings may be taken to a landfill or other facility permitted by MassDEP to accept solid waste.

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

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

Stormwater Treatment Chamber

Treatment Chamber collect runoff and trap some of the pollutants. The sands and silts will settle in the sump. Oil, grease and floatable debris will collect at the water surface and be trapped by the outlet device. Stormwater is allowed to discharge downstream for additional treatment. The Treatment Chamber will remain full of water up to the outlet elevation under normal conditions.

Inspection and Maintenance:

1. Treatment Chamber shall be inspected or cleaned at least twice per year.

2. Sediment must also be removed two times per year or whenever the depth of deposits is greater than or equal to half the depth from the bottom of the invert of the lowest pipe in the basin. This can be done using clamshell buckets or preferably vacuum trucks. All necessary precautions must be taken to safeguard workers from traffic.

3. Contaminated catch basins must be evaluated in accordance with the Hazardous Waste Regulations, 310 CMR 30.000, and handled as hazardous waste. In the absence of contamination, catch basin cleanings may be taken to a landfill or other facility permitted by MassDEP to accept solid waste.

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Snow Management

Snow storage location is important to allow treatment of the pollutants within the snow. The sides of the access drive are sloped towards the pavement so that the snow when melted will flow into the catch basins or other stormwater treatment BMP's for treatment.

Inspections

1. Generally, snow removal from the site will not be required. Snow stockpile areas are provided along the side of the roadway, and/or any open area onsite such that the snow stockpile does not impede the daily operations of the facility.

2. D-icing compounds to be utilized on-site shall consist of $CaCl_2$ and calcium magnesium acetate (CMA).

3. Snow shall not be plowed into the System. Snow removal shall be in accordance with Mass DEP Bureau of Resource Protection – Snow Disposal guidelines – No. BRPG01-01.

4. Accumulated sediment and debris shall be removed in the spring and disposed of in accordance with all local, state and federal laws and regulations.

5. Landscaped areas damaged by snow storage activities shall be restored to original conditions.

Infiltration Basins

Infiltration basins collect stormwater from other BMP's and infiltrate it into the ground. The design intent is to compensate for the impervious surfaces added to the site such as driveways, sidewalks and roof tops, which do not allow the stormwater to infiltrate. The result is the developed site conditions will mimic the existing condition and maintain the groundwater elevations.

Inspections:

1. Inspect the basins twice per year after constructed and fully vegetated.

2. Inspect for debris and silts that may collect within the basin limits.

3. Inspect for erosion of the side slopes within the basin and the outside slopes.

4. Remove any debris and silts that may have collected within the basin.

5. Repair any erosion and stabilize as soon as possible.

6. Inspect the outlet structure for damage or clogging and repair or clean as necessary

7. Inspect the outlet of the outlet structure for accumulation of debris and materials that may reduce flows. Inspect downstream of outlet for erosion or deposits of sediment. If sediment or debris is found, remove immediately and repair damage.

Sediment Forebay

Sediment Forebay are small depressions that are located upstream of other BMP's such as infiltration basins and are used to pretreatment stormwater. The forebay collects stormwater and allow the suspended solids to settle out and sink to the bottom where they can be removed prior to entering the next BMP.

Inspections:

1. Inspect the forebay, often located within an infiltration or detention basins, twice per year after constructed and fully vegetated.

2. Inspect for debris and silts that may collect within the forebay limits.

3. Inspect for erosion of the side slopes within the forebay and the outside slopes.

4. Inspect the stone berm separating the forebay and the basin. Repair any areas that have eroded or slumped.

5. Remove any debris and silts that may have collected within the forebay.

Grass Swales

Grass swales transport stormwater runoff to an area suitable to accept the flow. The swales are vegetated with grasses and have small berms to control the runoff. Swales are used along roadsides from outlets of other BMP's.

Inspections:

1. Inspect the swales twice per year after constructed and fully vegetated.

2. Remove any debris or accumulated silts.

3. Inspect side slopes for erosion and for areas where vegetation has not grown. Repair or replant as needed.

4. Inspect downstream for erosion and repair as needed.

STREET SWEEPING LOG

Project Name: Drakes Landing

Location: 365 Main Street, West Newbury, MA

Owner: land owner, his successors and assignees.

SWEEP DATE	TYPE OF SWEEPER	LOCATIONS

INSPECTION AND MAINTENANCE CHECKLIST

ITEM	DATE OF INSPECTION	MAINTENANCE TO BE PROVIDED / COMMENT	DATE MAINTENANCE COMPLETE
Snow Storage Areas			
Infiltration Basin - 1			
CB 1			
CB 2			
CB 3			
CB 4			

CB 5			
Treatment Chamber DMH 4			
Infiltration Basin			
North Swale			
South Swale			

Inspected By:_____ Date:_____