Stormwater Management Report

Proposed Industrial Building

Gales Ferry, Connecticut

March 7, 2023
Revised: April 12, 2023

Prepared for

Gales Ferry Intermodal, LLC

549 South Street

Quincy, MA 02169

Loureiro
Engineering • Construction • EH&S • Energy
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An Employee-Owned Company

Comm. No. 045JC2.06

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1. INTRODUCTION

This stormwater management report has been prepared by Loureiro Engineering Associates, Inc. (Loureiro) on behalf of Gales Ferry Intermodal LLC to provide a description and calculations for the stormwater management of the proposed 20,000 SF industrial building at 1761 Route 12 in Gales Ferry, Connecticut. The property is 158 acres with the proposed work encompassing approximately 3.68 acres of the property (hereinafter referred to as the "Site").

1.1 Physical Setting

The subject property is approximately 158 acres (ac) and is located in the Industrial zone (I). The property is the site of the former DOW Chemical manufacturing facility and been an industrial use for years. A portion of the property is currently used for the manufacturing of Styrofoam products by Americas Styrenics, a tenant of the property. The DOW Chemical facilities at the property terminated their manufacturing existence in 2011 and the former DOW Chemical manufacturing buildings have been removed from the property. The property has rail service with a rail siding and waterfront with an existing pier.

The property has inland wetlands as well as Allyn's Pond. There is no activity with the wetland or 100 foot inland wetland upland review area with the proposed work.

The eastern boundary is bordered by Route 12 as well as some smaller industrial lots and a church that is in the R-40 zone. The western boundary is the Thames River. The northern boundary are residential lots in the R-40 zone. The southern boundary is bordered by properties zoned Commercial Marine (CM) and R-20.

1.2 Flood Plain and Soil Conditions

Federal Emergency Management Agency's (FEMA) National Flood Insurance Program (NFIP) Flood Insurance Rate Map (FIRM) Number 09011C0354G, effective July 18, 2011, for Town of Ledyard identifies a portion of the property within the Zone AE (EL12) and Zone X. The Site is located outside of any FEMA flood zones. Appendix B includes the FEMA FIRM map for the Site.

The National Resource Conservation Service (NRCS) Soil Survey for the State of Connecticut identified soils within the Site area as Agawam (29B) and as Urban Land (307). Agawam fine sandy loam corresponds with the Hydrologic Soil Group (HSG) rating B. Other soils just offsite correspond with the HSG rating B as well. Urban Land corresponds with the Hydrologic Soil

Group (HSG) rating D. HSG D soils generally have slow or unpredictable infiltration rates correlating to high runoff potential. Appendix C includes the NRCS soil map for the site.

Permeability tests were run by Loureiro on representative samples taken from the Site on March 7, 2023. Permeability results were 1.21 in/min, or 145 ft/day. Applying a factor of safety of 1.5, a permeability of 100 ft/day was used in drainage calculations.

2. EVALUATION OF EXISTING CONDITIONS

2.1 Overview

The property currently has an existing manufacturing area, concrete pads left and paved areas from the removal of the DOW Chemical buildings, and woods. The area of the Site is currently wooded or densely brushed, with less than 2 percent (%) impervious coverage.

2.2 Existing Stormwater Management

The area of the Site currently has no existing drainage or stormwater management features. Stormwater is conveyed 100 percent (%) through surface runoff. The area of the Site currently is a plateaued mound that flows east and south then west toward the railroad tracks, which then flows downslope towards the Thames River. The section along the northern property line flows north offsite.

Through available survey information, the existing catch basin network and drainage system on the developed portion of the property flows south before discharging into Allyn's Pond. Allyn's Pond then flows west into the Thames River.

2.3 Existing Subcatchment Areas

The total analyzed drainage area for the property is approximately 892,258 sf or 20.48 ac. The Site is divided into five (5) subcatchment areas. Subcatchment area 1 is comprised of the existing building foundations and paved area, with runoff being captured by the existing drainage system and discharging into Allyn's Pond, or running off through surface flow into Allyn's Pond. Subcatchment area 2 flows south through surface flow into Allyn's Brook, a tributary of Allyn's Pond, or is captured by the existing drainage system. Subcatchment area 3 flows through surface flow to a large depressed area east of the Site. This depressed area captures and infiltrates all runoff from this subcatchment. Subcatchment area 4 flows north off-Site. Subcatchment area 5 flows west through surface flow West Off-Site towards the Thames River. Drawing 1, Existing Drainage Areas, depicts the existing drainage areas on the property. The three points of compliance (Allyn's

Pond, North Off-Site, and West Off-Site) are utilized in HydroCAD to evaluate peak-flow leaving the property.

3. PROPOSED DEVELOPMENT

3.1 Overview

The proposed work includes a new 20,000 SF industrial building, which will be utilized by the Applicant, for the storage and repair of marine equipment and appurtenances in conjunction with marine contracting and dredging operations. The Site will include a new parking layout, paved entrance, curbing, lighting, landscaped areas, and utilities. A gravel access road is also proposed to connect to the parking area from the west.

3.2 Proposed Subcatchment Areas

The redeveloped Site and overall property is divided into seven (7) subcatchment areas. Subcatchment areas 1 and 2 will be unchanged under proposed conditions. Subcatchment area 3 will be similar to existing conditions, but will instead flow into the new drainage system instead of the depressed area on Site. Subcatchment area 4 is a large portion of the new paved area and building. Subcatchment area 5 is the western portion of the new paved area and building. Subcatchment area 6 is similar to subcatchment area 5 under existing conditions, but will now include a section of the northern paved area and landscaped buffer that will runoff through surface flow to the west. Subcatchment area 7 will flow north off-site, similar to subcatchment area 4 under existing conditions. The Site work will result in an increase in impervious area for the property, from 41% to 50%. Drawing 2, Proposed Drainage Areas, depict the new drainage areas on the property.

3.3 Design Criteria & Proposed Stormwater Management Systems

The post-development stormwater runoff analysis was based on the 2-, 10-, 25-, 50-, and 100-year 24-hour storm events. The increase in impervious area requires on-site attenuation to meet the existing runoff rates as closely as possible.

The drainage improvements for the site will include a manhole and catch basin network to collect most of the paved area and the entirety of the building roof. To attenuate and reduce peak flows, a subsurface infiltration system will be included in the drainage system. The infiltration system is with 12 inches of stone surrounding the system and typical system requirements of 6 inches of stone beneath and above the system. The system is designed to fully retain and infiltrate captured runoff up to the 100-year storm event. Any runoff that outlets from the system will flow into the

existing drainage system south of the Site. Stormwater runoff from the new gravel access road will be captured by a catch basin and discharge via rip rap apron west of the new gravel road.

To improve stormwater quality discharging from the Site, the infiltration system has been sized to hold the full water quality volume (WQV) and will include isolator rows for improved stormwater treatment and suspended solid removal. WQV calculations are provided in Appendix E.

4. STORMWATER MANAGEMENT EVALUATION

4.1 Stormwater Runoff Calculations

The following evaluation was prepared to identify the qualitative and quantitative stormwater runoff characteristics for the existing and proposed conditions at the site. The stormwater management system was designed for the 2-year, 10-year, 25-year, 50-year, and 100-year design storms.

4.1.1 Design Methodology

Site specific point precipitation frequency estimates used to generate peak stormwater flow were obtained from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14, Volume 10 Version 3: Precipitation-Frequency Atlas of the United States, Northeastern States (rev. 2015). Precipitation-frequency estimates are based upon frequency analysis of partial duration series with a 90% confidence interval of data largely from the National Centers for Environmental Information (NCEI).

The methods described in Urban Hydrology for Small Watersheds, 2nd Edition, (Technical Release Number 55 [TR-55]) from the Natural Resources Conservation Service formerly the Soil Conservation Service – [SCS], 1986) were used to calculate stormwater peak-flow generated from pre- and post-redevelopment conditions. These methods, which are incorporated into the HydroCAD computer software program, use well documented procedures to calculate stormwater runoff volume, peak-flow rate of discharge, hydrographs and storage volumes required for floodwater reservoirs in small watersheds. The method uses the SCS Runoff Curve Number method to estimate runoff volume, calculates times of concentration, produces tabular hydrographs and estimates basin storage capacity.

4.1.2 Curve Numbers

The curve numbers (CN) values utilized for the analysis of the existing and proposed conditions included:

Existing lawn/grassed area, CN = 84 (fair grass cover, HSG D)

New grassed area, CN = 61 (Good grass cover, HSG B)
New grassed area, CN = 80 (Good grass cover, HSG D)
Brush, CN = 35 (fair condition, HSG A)
Brush, CN = 56 (fair condition, HSG B)

Brush, CN = 77 (fair condition, HSG D)
Gravel, CN = 85 (HSG B)
Gravel, CN = 91 (HSG D)
Woods, CN = 30 (Good condition, HSG A)
Woods, CN = 55 (Good condition, HSG B)
Woods, CN = 77 (Good condition, HSG D)
Impervious areas (pavement, roofs, etc), CN = 98

The weighted CN of the existing property is 80. The weighted CN of the property with the new Site is 83. This is due to the increase in impervious areas.

4.2 Existing and Proposed Peak-Flow Comparison

With the use of subsurface infiltration, total peak flows are reduced during all analyzed storm events.

Table 1 – Peak-Flow Comparison, Cubic Feet per Second

	2-Year Event		10-Year Event		25-Year Event		50-year Event		100-year Event	
	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
Allyn's Pond	17.81	18.05	32.33	33.11	41.94	43.16	49.27	50.83	57.15	59.1
North Off-Site	0.05	0	0.17	0.04	0.27	0.11	0.34	0.17	0.43	0.24
West Off-Site	6.97	6.46	12.67	11.56	16.29	14.78	19.01	17.19	21.91	19.77
Existing Depression	0	0	0	0	0	0	0	0	0	0
Total West Off-Site	6.97	6.46	12.67	11.56	16.29	14.78	19.01	17.19	21.91	19.77
Total	24.83	24.51	45.17	44.71	58.5	58.05	68.62	68.19	79.49	79.11

The table shows decreasing peak total peak flow runoff during all analyzed storm events. There are minor increases in total peak flow runoff to Allyn's Pond in all storm events, ranging from 1.3 percent (%) to 3.4 percent (%). This is due to subcatchment 3 flowing to Allyn's Pond under new conditions, as opposed to West Off-Site under existing conditions. Also, the limited amount of runoff that the new drainage system captures relative to the total property restricts the influence of new stormwater management systems. However, due to Allyn's Pond being on the property and all subcatchment areas ultimately draining to the Thames River, the small increase in peak flows will not result in negative impacts to the property or receiving waters. Overall, new drainage conditions should function similarly to those of existing conditions. Appendix D includes the HydroCAD report for the existing and new Site analysis.

4.3 Runoff Volume

Total runoff from the property was also analyzed volumetrically to ensure similar or lower runoff volumes under new conditions as volumes under existing conditions. The results for the 2-year and 100-year storm events are below:

Table 2 – Total Runoff Volume Comparison, Cubic Feet

	Existing	New	Volume Infiltrated	Surface Runoff Volume
2-Year	131,509	147,063	19,280	127,783
100-year	402,000	429,069	50,130	378,939

The table shows that the new infiltration system reduces total proposed runoff volume below that of existing conditions. Therefore, receiving waters will not receive increased runoff volumes and should not be negatively impacted. Appendix D includes the HydroCAD reports showing runoff volume calculations.

4.4 Water Quality

The methods described in the 2004 Connecticut Stormwater Quality Manual were utilized to calculate the WQV of the redevelopment. The WQV for the site is equivalent to the runoff generated with the first one-inch of rainfall. The developed Site is approximately 88,400 sf and 88% impervious, resulting in a WQV of 6,215 cf. The subsurface infiltration provides a storage volume of approximately 7,000 cf between the Stormtech chambers and surrounding stone. The infiltration system provides adequate amount of storage to store the WQV. In addition to the aforementioned Isolator Rows, the drainage system also leads to two (2) hydrodynamic separators before entering the subsurface chamber systems. These separators are designed to capture oil, trash, and floatables while removing total suspended solids and other pollutants. The proposed hydrodynamic separators are also designed to treat the Water Quality Flow (WQF) of 1.74 cfs. Appendix F includes the calculations used for selecting hydrodynamic separators.

4.5 Stormwater System Maintenance Program

To help facilitate the function and longevity of the stormwater management system, a maintenance program and inspection checklist has been developed for the components and surrounding areas. The maintenance includes periodic inspections, scheduled cleanings and details on identifying signs of failures in the system. A full checklist of system features shall be completed to provide a log of inspections, cleanings, repairs, and any important information regarding the system. The program will be implemented after installation with more frequent inspections early and fewer

inspections after a year or when the system function becomes more predictable. The program, checklist, and past inspection/maintenance logs will be provided to the current or future owners and necessary facility personnel. The maintenance program and checklist is included as Appendix G.

5. CONCLUSION

The new Site work includes a new stormwater management system for the primary conveyance of the stormwater discharging from the site. The proposed system provides attenuation and treatment of all stormwater events leaving the Site, managing post-development runoff rates and allowing for potential groundwater recharge. The subsurface infiltration system includes Isolator Rows and sufficient storage capacity for the WQV to offer treatment of Site stormwater, along with treatment of WQF provided by hydrodynamic separators. Overall, the new drainage system will improve water quality discharging from the property while providing similar flow rates to receiving waters.

DRAWINGS

Drawing 1 –Existing Drainage Areas

DA 1

DA 2

DA 3

DA 4

DA 5

N/F PROVIDENCE AND WORCESTER RAILROAD COMPANY VOL. 119 / PG. 1136

N/F SIDRINSEO LLC

N/F TRINSEO LLC

N/F KAREN SA... VOL. 565 / PG... #9 RIVER DR...

HERBERT JOAN ... VOL. 1... #3

"SALTY'S COVE"

BLDG 45 (FOUNDATION REMAINS)

BLDG 42A

BLDG 44

BLDG 46E

BLDG 46A

BLDG 46F

BLDG 46P

WAREHOUSE BLDG 46D

BLDG 46L

BLDG 46C REMOVED

BLDG 46H REMOVED

46N (PIPE TOWER)

BLDG 46M

BLDG 46K

BLDG 46J

BLDG 49 WAREHOUSE

ACCESS ENTRANCE

ACCESS

MILITARY HIGHWAY

ROUTE #12

RIVER DR.

SCALE IN FEET

V:\CT\GALES FERRY\ROUTE 12-2766\1643\C2.06 LOCAL PERMIT FOR STERLING BUILDING\DWGS\CIVIL\NON PLANSET DWG\DRAINAGE AREAS.DWG Tab: EXISTING DRAINAGE AREAS Saved: 4/6/2023 5:10 PM by APHELY Plotted: 4/10/2023 2:30 PM

REV.	DESCRIPTION OF REVISION	DATE	APPR.
1	REVISED PER UPDATED LAYOUT	04/06/2023	SRM

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SCALE: 1"=60'

COMM. NO.: 043-2C.06

DRAWN BY: ESF — DATE: 04/06/2023

APPROVED BY: SRM — DATE: 04/06/2023

EXISTING DRAINAGE AREAS

GALES FERRY INTERMODAL
1761 ROUTE 12, GALES FERRY, CONNECTICUT 06335

PREPARED FOR:

GALES FERRY INTERMODAL LLC
549 SOUTH STREET, QUINCY, MA 02169

DRAWING: DA-1

SHEET NO. 1 — NO. OF SHEETS 2

Drawing 2 – Proposed Drainage Areas

DA 1

DA 2

DA 3

DA 4

DA 5

DA 6

DA 7

FUTURE 10,000 SF EXPANSION FF=34.00

NEW 10,000 SF STERLING INDUSTRIAL BUILDING FF=34.00

"ALLYN'S COVE"

POND

TOM ALLYN'S COVE INLET

N/F PROVIDENCE AND WORCESTER RAILROAD COMPANY VOL. 119 / PG. 1136

N/F TRINSEO LLC

THAMESVEE

RAILROAD

BLDG 41

BLDG 45 (FOUNDATION REMAINS)

BLDG 46L FOUNDATION

BLDG 46C, D & P FOUNDATION

BLDG 46M & N REMOVED

BLDG 46K FOUNDATION

46A

46E

46F

46H

46J

BLDG 49 FOUNDATION

BLDG 42A

BLDG 44

ACCESS ENTRANCE

BROOK

N/F KAREN SA... VOL. 565 / PG... #9 RIVER DR...

HERBERT JOAN ... VOL. 1... #3

RIVER DR.

ROUTE #12

HIGHWAY

MILITARY

316+0

SCALE IN FEET

30 0 30 60 90

V:\CIT\GALES FERRY\ROUTE 12-1761\045C2.06 LOCAL PERMIT FOR STERLING BUILDING\DWGS\CIVIL\NON PLANSET DWG\DRAINAGE AREAS DWG Tab: PROPOSED DRAINAGE AREAS Saved: 4/6/2023 5:10 PM by APHEALY Plotted: 4/10/2023 2:28 PM

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1	REVISED PER UPDATED LAYOUT	04/06/2023	SRM

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SCALE: 1"=60'
COMM. NO.: 045C2.06
DRAWN BY: ESF
DATE: 04/06/2023
APPROVED BY: SRM
DATE: 04/06/2023

PROPOSED DRAINAGE AREAS

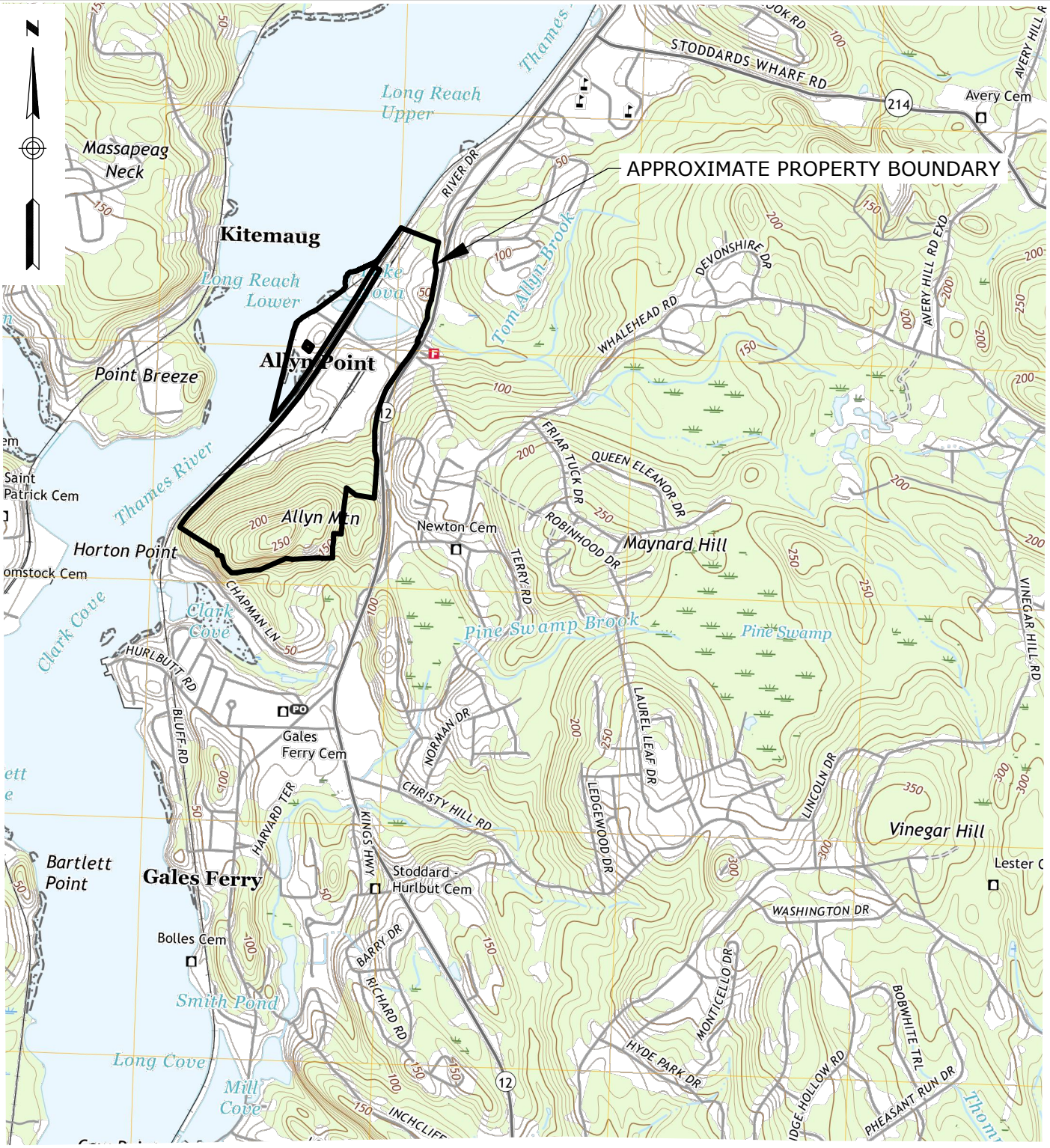
GALES FERRY INTERMODAL
1761 ROUTE 12, GALES FERRY, CONNECTICUT 06335
PREPARED FOR:
GALES FERRY INTERMODAL LLC
249 SOUTH STREET, QUINCY, MA 02169

DRAWING
DA-2

SHEET NO. 2 NO. OF SHEETS 2

APPENDIX A

USGS Site Location Map



MAP REFERENCE:

SECTION OF THE USGS 7.5 MINUTE SERIES TOPOGRAPHIC MAP FOR UNCASVILLE, CT; MAP VERSION DATE 2021.

0 2000

APPROXIMATE SCALE IN FEET

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DRAINAGE REPORT
ATTACHMENT A
SITE LOCATION MAP

NEW 20,000 SF INDUSTRIAL BUILDING
1761 ROUTE 12, GALES FERRY, CT

PREPARED FOR:

GALES FERRY INTERMODAL LLC
549 SOUTH STREET, QUINCY, MA

SCALE
1" = 2,000'±

COMM. NO.
045JC2.06

DATE
03-07-2023

1

V:\CT\GALES FERRY\ROUTE 12-1761\045JC2.06 LOCAL PERMIT FOR STERLING BUILDING\DWGS\CIVIL\NON PLANSET DWG\ATTACHMENT A - SITE LOCATION MAP.DWG Tab: FIGURE 1 Saved: 3/5/2023 1:02 PM Plotted: 3/5/2023 1:02 PM

APPENDIX B

FEMA FIREMETTE Map

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) Report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS Report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study Report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study Report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Connecticut State Plane Zone (FIPS zone 0600). The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713- 3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from digital orthophotography provided by the Connecticut Deptarment of Environmental Planning. This information was created from photography dated 2000, 2004 and 2005.

The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

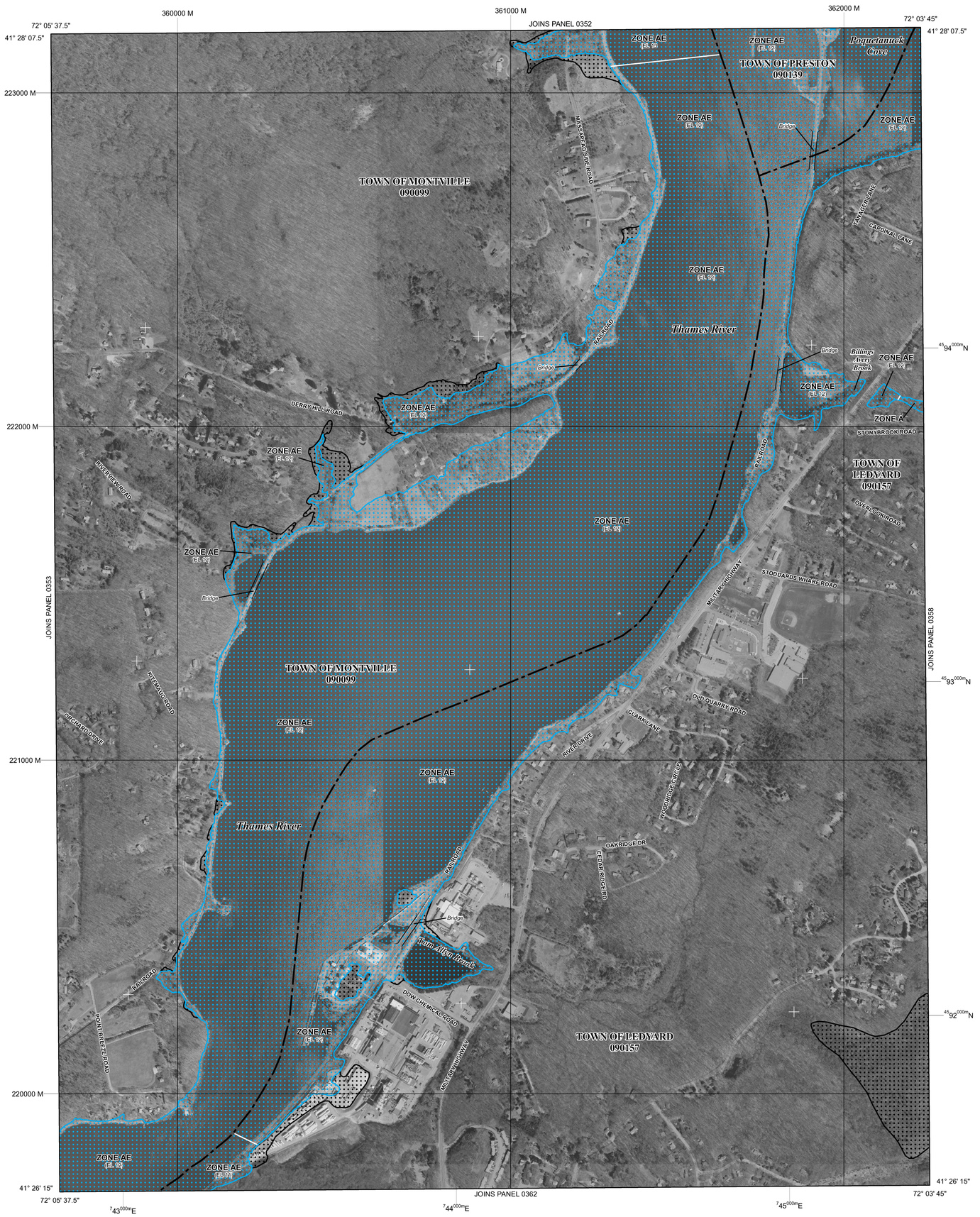
Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map,** how to order products, or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at **1-877-FEMA-MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% Annual Chance Floodplain Boundary
- 0.2% Annual Chance Floodplain Boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

- Cross section line
- Transect line
- Culvert
- Bridge
- 45° 02' 08", 93° 02' 12" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
- 4989000 M — 1000-meter ticks: Connecticut State Plane Zone (FIPS Zone 0600), Lambert Conformal Conic projection
- 4589000 N — 1000-meter Universal Transverse Mercator grid values, zone 18N
- DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
July 18, 2011

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

PANEL 0354G

FIRM

FLOOD INSURANCE RATE MAP

NEW LONDON COUNTY, CONNECTICUT
ALL JURISDICTIONS

PANEL 354 OF 554
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
LEDYARD, TOWN OF	090157	0354	G
MONTVILLE, TOWN OF	090099	0354	G
PRESTON, TOWN OF	090139	0354	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
09011C0354G
EFFECTIVE DATE
JULY 18, 2011

Federal Emergency Management Agency

MAP REVISED

APPENDIX C

Natural Resources Conservation Service – Web Soil Survey

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for State of Connecticut



March 4, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:2,960 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 40 80 160 240

Feet
0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N 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 1:12,000.

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: State of Connecticut
Survey Area Data: Version 22, Sep 12, 2022

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

Date(s) aerial images were photographed: Jun 14, 2022—Oct 6, 2022

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
29B	Agawam fine sandy loam, 3 to 8 percent slopes	5.6	21.7%
34B	Merrimac fine sandy loam, 3 to 8 percent slopes	1.7	6.6%
73C	Charlton-Chatfield complex, 0 to 15 percent slopes, very rocky	7.3	28.2%
307	Urban land	11.3	43.6%
Totals for Area of Interest		**26.0**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

State of Connecticut

29B—Agawam fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tyqx
Elevation: 0 to 820 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Agawam and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Agawam

Setting

Landform: Outwash plains, kames, kame terraces, outwash terraces, moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Crest, side slope, riser, tread, rise, dip
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Coarse-loamy eolian deposits over sandy and gravelly glaciofluvial deposits derived from gneiss, granite, schist, and/or phyllite

Typical profile

Ap - 0 to 11 inches: fine sandy loam
Bw1 - 11 to 16 inches: fine sandy loam
Bw2 - 16 to 26 inches: fine sandy loam
2C1 - 26 to 45 inches: loamy fine sand
2C2 - 45 to 55 inches: loamy fine sand
2C3 - 55 to 65 inches: loamy sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 15 to 35 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: B
Ecological site: F145XY008MA - Dry Outwash

Hydric soil rating: No

Minor Components

Sudbury

Percent of map unit: 5 percent
Landform: Deltas, terraces, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Hinckley

Percent of map unit: 5 percent
Landform: Deltas, kames, eskers, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Head slope, nose slope, crest, side slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Merrimac

Percent of map unit: 3 percent
Landform: Outwash plains, outwash terraces, moraines, eskers, kames
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Crest, side slope, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Windsor

Percent of map unit: 2 percent
Landform: Dunes, outwash plains, deltas, outwash terraces
Landform position (three-dimensional): Tread, riser
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Hydric soil rating: No

34B—Merrimac fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tyqs
Elevation: 0 to 1,290 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Merrimac and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Merrimac

Setting

Landform: Outwash plains, outwash terraces, moraines, eskers, kames
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Crest, side slope, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bw1 - 10 to 22 inches: fine sandy loam
Bw2 - 22 to 26 inches: stratified gravel to gravelly loamy sand
2C - 26 to 65 inches: stratified gravel to very gravelly sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Maximum salinity: Nonsaline (0.0 to 1.4 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Ecological site: F145XY008MA - Dry Outwash
Hydric soil rating: No

Minor Components

Sudbury

Percent of map unit: 5 percent
Landform: Deltas, terraces, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Hinckley

Percent of map unit: 5 percent
Landform: Deltas, kames, eskers, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Head slope, nose slope, crest, side slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Windsor

Percent of map unit: 3 percent
Landform: Outwash terraces, dunes, deltas, outwash plains
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Agawam

Percent of map unit: 2 percent
Landform: Outwash plains, outwash terraces, moraines, stream terraces, eskers, kames
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

73C—Charlton-Chatfield complex, 0 to 15 percent slopes, very rocky

Map Unit Setting

National map unit symbol: 2w698
Elevation: 0 to 1,550 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Charlton, very stony, and similar soils: 50 percent
Chatfield, very stony, and similar soils: 30 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Charlton, Very Stony

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest, nose slope

Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 4 inches: fine sandy loam
Bw - 4 to 27 inches: gravelly fine sandy loam
C - 27 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 3 to 15 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Description of Chatfield, Very Stony

Setting

Landform: Hills, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex
Across-slope shape: Linear, convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 2 inches: fine sandy loam
Bw - 2 to 30 inches: gravelly fine sandy loam
2R - 30 to 40 inches: bedrock

Properties and qualities

Slope: 3 to 15 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 20 to 41 inches to lithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Rock outcrop

Percent of map unit: 5 percent
Hydric soil rating: No

Hollis, very stony

Percent of map unit: 5 percent
Landform: Hills, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Leicester, very stony

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

Sutton, very stony

Percent of map unit: 5 percent
Landform: Ground moraines, hills
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

307—Urban land

Map Unit Setting

National map unit symbol: 9lmh
Elevation: 0 to 2,000 feet
Mean annual precipitation: 43 to 56 inches

Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 120 to 185 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Typical profile

H - 0 to 6 inches: material

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Udorthents, wet substratum

Percent of map unit: 10 percent
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Unnamed, undisturbed soils

Percent of map unit: 10 percent
Hydric soil rating: No

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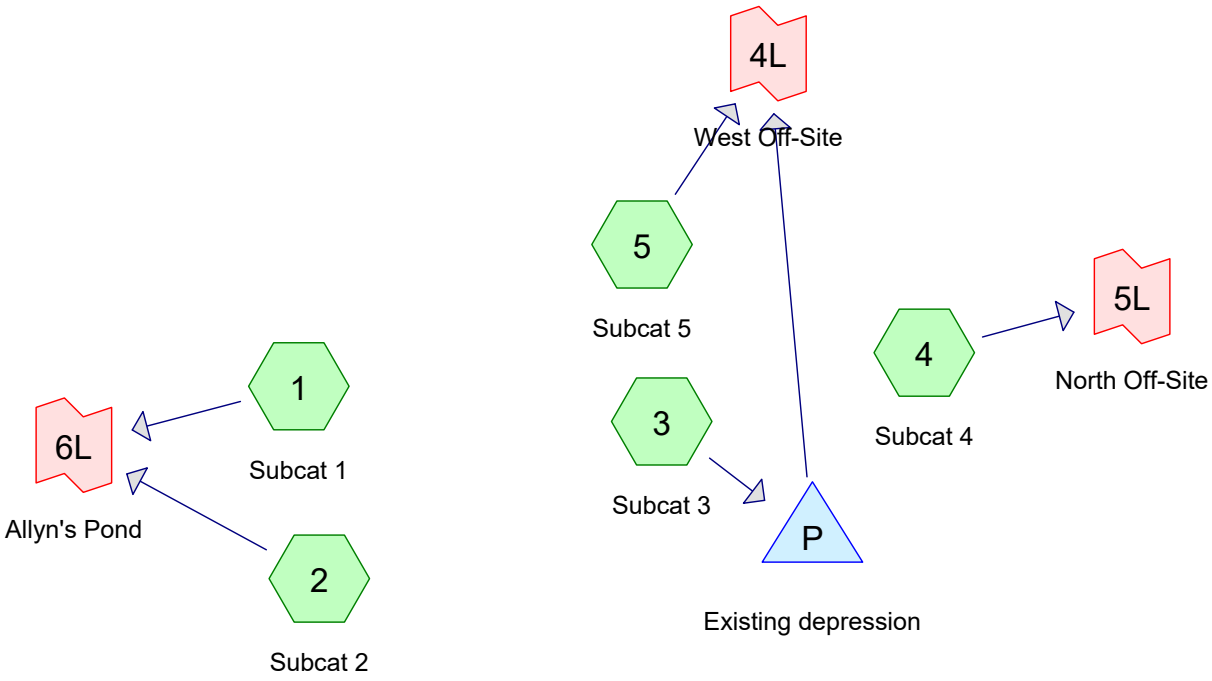
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APPENDIX D

HydroCAD Reports



Subcat Reach Pond Link

Routing Diagram for Existing Conditions
Prepared by Loureiro Engineering Assoc, Inc, Printed 4/5/2023
HydroCAD® 10.20-2g s/n 06006 © 2022 HydroCAD Software Solutions LLC

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-yr	Type III 24-hr		Default	24.00	1	3.46	2
2	10-yr	Type III 24-hr		Default	24.00	1	5.12	2
3	25-yr	Type III 24-hr		Default	24.00	1	6.15	2
4	50-yr	Type III 24-hr		Default	24.00	1	6.92	2
5	100-yr	Type III 24-hr		Default	24.00	1	7.74	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
5,408	84	50-75% Grass cover, Fair, HSG D (1, 2)
6,320	35	Brush, Fair, HSG A (3, 4)
117,684	56	Brush, Fair, HSG B (1, 2, 3, 5)
89,342	77	Brush, Fair, HSG D (1, 2, 3, 4, 5)
35,959	85	Gravel roads, HSG B (1, 2)
75,277	91	Gravel roads, HSG D (1, 2, 5)
65,824	98	Unconnected pavement, HSG B (1, 2, 3, 5)
297,862	98	Unconnected pavement, HSG D (1, 2, 5)
572	30	Woods, Good, HSG A (3)
164,356	55	Woods, Good, HSG B (2, 3, 5)
33,664	77	Woods, Good, HSG D (1, 2, 3, 5)
892,267	**80**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
6,892	HSG A	3, 4
383,823	HSG B	1, 2, 3, 5
0	HSG C	
501,553	HSG D	1, 2, 3, 4, 5
0	Other	
892,267		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Sub Num
0	0	0	5,408	0	5,408	50-75% Grass cover, Fair	
6,320	117,684	0	89,342	0	213,345	Brush, Fair	
0	35,959	0	75,277	0	111,236	Gravel roads	
0	65,824	0	297,862	0	363,686	Unconnected pavement	
572	164,356	0	33,664	0	198,592	Woods, Good	
6,892	**383,823**	**0**	**501,553**	**0**	**892,267**	**TOTAL AREA**	

Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: Subcat 1 Runoff Area=272,438 sf 90.85% Impervious Runoff Depth=3.11"
Flow Length=254' Tc=28.5 min CN=97 Runoff=12.19 cfs 70,713 cf

Subcatchment 2: Subcat 2 Runoff Area=354,049 sf 31.26% Impervious Runoff Depth=1.21"
Flow Length=349' Tc=9.0 min CN=74 Runoff=9.99 cfs 35,771 cf

Subcatchment 3: Subcat 3 Runoff Area=114,415 sf 0.01% Impervious Runoff Depth=0.40"
Tc=5.0 min CN=57 Runoff=0.66 cfs 3,823 cf

Subcatchment 4: Subcat 4 Runoff Area=8,418 sf 0.00% Impervious Runoff Depth=0.51"
Flow Length=640' Tc=24.9 min CN=60 Runoff=0.05 cfs 361 cf

Subcatchment 5: Subcat 5 Runoff Area=142,946 sf 3.83% Impervious Runoff Depth=1.75"
Tc=5.0 min CN=82 Runoff=6.97 cfs 20,842 cf

Pond P: Existing depression Peak Elev=22.01' Storage=63 cf Inflow=0.66 cfs 3,823 cf
Discarded=0.62 cfs 3,823 cf Primary=0.00 cfs 0 cf Outflow=0.62 cfs 3,823 cf

Link 4L: West Off-Site Inflow=6.97 cfs 20,842 cf
Primary=6.97 cfs 20,842 cf

Link 5L: North Off-Site Inflow=0.05 cfs 361 cf
Primary=0.05 cfs 361 cf

Link 6L: Allyn's Pond Inflow=17.81 cfs 106,483 cf
Primary=17.81 cfs 106,483 cf

Total Runoff Area = 892,267 sf Runoff Volume = 131,509 cf Average Runoff Depth = 1.77"
59.24% Pervious = 528,581 sf 40.76% Impervious = 363,686 sf

Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: Subcat 1 Runoff Area=272,438 sf 90.85% Impervious Runoff Depth=4.77"
Flow Length=254' Tc=28.5 min CN=97 Runoff=18.29 cfs 108,219 cf

Subcatchment 2: Subcat 2 Runoff Area=354,049 sf 31.26% Impervious Runoff Depth=2.46"
Flow Length=349' Tc=9.0 min CN=74 Runoff=21.07 cfs 72,590 cf

Subcatchment 3: Subcat 3 Runoff Area=114,415 sf 0.01% Impervious Runoff Depth=1.17"
Tc=5.0 min CN=57 Runoff=3.20 cfs 11,147 cf

Subcatchment 4: Subcat 4 Runoff Area=8,418 sf 0.00% Impervious Runoff Depth=1.37"
Flow Length=640' Tc=24.9 min CN=60 Runoff=0.17 cfs 962 cf

Subcatchment 5: Subcat 5 Runoff Area=142,946 sf 3.83% Impervious Runoff Depth=3.19"
Tc=5.0 min CN=82 Runoff=12.67 cfs 37,960 cf

Pond P: Existing depression Peak Elev=22.06' Storage=350 cf Inflow=3.20 cfs 11,147 cf
Discarded=2.74 cfs 11,147 cf Primary=0.00 cfs 0 cf Outflow=2.74 cfs 11,147 cf

Link 4L: West Off-Site Inflow=12.67 cfs 37,960 cf
Primary=12.67 cfs 37,960 cf

Link 5L: North Off-Site Inflow=0.17 cfs 962 cf
Primary=0.17 cfs 962 cf

Link 6L: Allyn's Pond Inflow=32.33 cfs 180,809 cf
Primary=32.33 cfs 180,809 cf

Total Runoff Area = 892,267 sf Runoff Volume = 230,878 cf Average Runoff Depth = 3.11"
59.24% Pervious = 528,581 sf 40.76% Impervious = 363,686 sf

Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: Subcat 1 Runoff Area=272,438 sf 90.85% Impervious Runoff Depth=5.79"
Flow Length=254' Tc=28.5 min CN=97 Runoff=22.06 cfs 131,538 cf

Subcatchment 2: Subcat 2 Runoff Area=354,049 sf 31.26% Impervious Runoff Depth=3.31"
Flow Length=349' Tc=9.0 min CN=74 Runoff=28.48 cfs 97,701 cf

Subcatchment 3: Subcat 3 Runoff Area=114,415 sf 0.01% Impervious Runoff Depth=1.77"
Tc=5.0 min CN=57 Runoff=5.21 cfs 16,855 cf

Subcatchment 4: Subcat 4 Runoff Area=8,418 sf 0.00% Impervious Runoff Depth=2.02"
Flow Length=640' Tc=24.9 min CN=60 Runoff=0.27 cfs 1,417 cf

Subcatchment 5: Subcat 5 Runoff Area=142,946 sf 3.83% Impervious Runoff Depth=4.13"
Tc=5.0 min CN=82 Runoff=16.29 cfs 49,142 cf

Pond P: Existing depression Peak Elev=22.18' Storage=1,133 cf Inflow=5.21 cfs 16,855 cf
Discarded=3.20 cfs 16,855 cf Primary=0.00 cfs 0 cf Outflow=3.20 cfs 16,855 cf

Link 4L: West Off-Site Inflow=16.29 cfs 49,142 cf
Primary=16.29 cfs 49,142 cf

Link 5L: North Off-Site Inflow=0.27 cfs 1,417 cf
Primary=0.27 cfs 1,417 cf

Link 6L: Allyn's Pond Inflow=41.94 cfs 229,239 cf
Primary=41.94 cfs 229,239 cf

Total Runoff Area = 892,267 sf Runoff Volume = 296,653 cf Average Runoff Depth = 3.99"
59.24% Pervious = 528,581 sf 40.76% Impervious = 363,686 sf

Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: Subcat 1 Runoff Area=272,438 sf 90.85% Impervious Runoff Depth=6.56"
Flow Length=254' Tc=28.5 min CN=97 Runoff=24.87 cfs 148,983 cf

Subcatchment 2: Subcat 2 Runoff Area=354,049 sf 31.26% Impervious Runoff Depth=3.97"
Flow Length=349' Tc=9.0 min CN=74 Runoff=34.17 cfs 117,202 cf

Subcatchment 3: Subcat 3 Runoff Area=114,415 sf 0.01% Impervious Runoff Depth=2.26"
Tc=5.0 min CN=57 Runoff=6.85 cfs 21,550 cf

Subcatchment 4: Subcat 4 Runoff Area=8,418 sf 0.00% Impervious Runoff Depth=2.55"
Flow Length=640' Tc=24.9 min CN=60 Runoff=0.34 cfs 1,787 cf

Subcatchment 5: Subcat 5 Runoff Area=142,946 sf 3.83% Impervious Runoff Depth=4.84"
Tc=5.0 min CN=82 Runoff=19.01 cfs 57,670 cf

Pond P: Existing depression Peak Elev=22.30' Storage=1,980 cf Inflow=6.85 cfs 21,550 cf
Discarded=3.64 cfs 21,550 cf Primary=0.00 cfs 0 cf Outflow=3.64 cfs 21,550 cf

Link 4L: West Off-Site Inflow=19.01 cfs 57,670 cf
Primary=19.01 cfs 57,670 cf

Link 5L: North Off-Site Inflow=0.34 cfs 1,787 cf
Primary=0.34 cfs 1,787 cf

Link 6L: Allyn's Pond Inflow=49.27 cfs 266,186 cf
Primary=49.27 cfs 266,186 cf

Total Runoff Area = 892,267 sf Runoff Volume = 347,192 cf Average Runoff Depth = 4.67"
59.24% Pervious = 528,581 sf 40.76% Impervious = 363,686 sf

Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: Subcat 1 Runoff Area=272,438 sf 90.85% Impervious Runoff Depth=7.38"
Flow Length=254' Tc=28.5 min CN=97 Runoff=27.85 cfs 167,569 cf

Subcatchment 2: Subcat 2 Runoff Area=354,049 sf 31.26% Impervious Runoff Depth=4.69"
Flow Length=349' Tc=9.0 min CN=74 Runoff=40.32 cfs 138,487 cf

Subcatchment 3: Subcat 3 Runoff Area=114,415 sf 0.01% Impervious Runoff Depth=2.82"
Tc=5.0 min CN=57 Runoff=8.71 cfs 26,875 cf

Subcatchment 4: Subcat 4 Runoff Area=8,418 sf 0.00% Impervious Runoff Depth=3.14"
Flow Length=640' Tc=24.9 min CN=60 Runoff=0.43 cfs 2,203 cf

Subcatchment 5: Subcat 5 Runoff Area=142,946 sf 3.83% Impervious Runoff Depth=5.61"
Tc=5.0 min CN=82 Runoff=21.91 cfs 66,866 cf

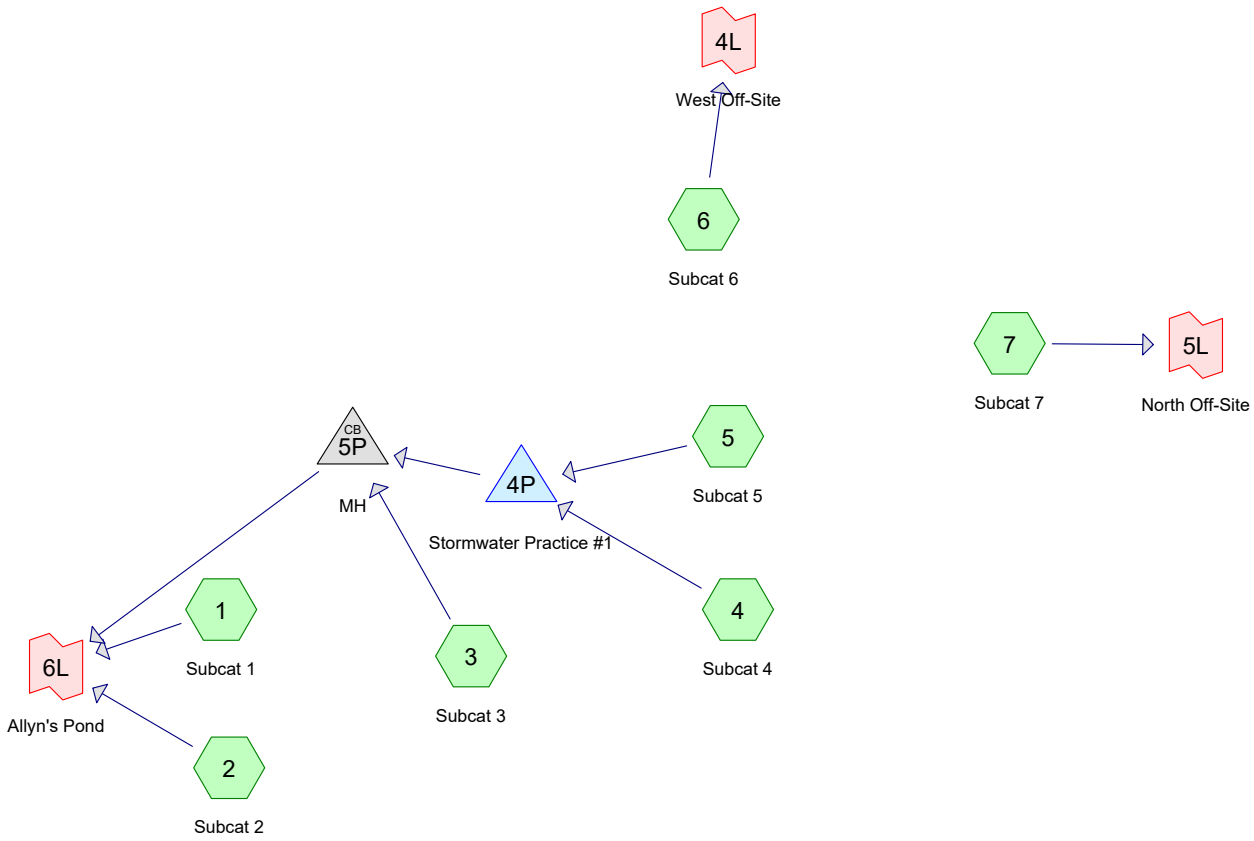
Pond P: Existing depression Peak Elev=22.43' Storage=3,074 cf Inflow=8.71 cfs 26,875 cf
Discarded=4.14 cfs 26,875 cf Primary=0.00 cfs 0 cf Outflow=4.14 cfs 26,875 cf

Link 4L: West Off-Site Inflow=21.91 cfs 66,866 cf
Primary=21.91 cfs 66,866 cf

Link 5L: North Off-Site Inflow=0.43 cfs 2,203 cf
Primary=0.43 cfs 2,203 cf

Link 6L: Allyn's Pond Inflow=57.15 cfs 306,055 cf
Primary=57.15 cfs 306,055 cf

Total Runoff Area = 892,267 sf Runoff Volume = 402,000 cf Average Runoff Depth = 5.41"
59.24% Pervious = 528,581 sf 40.76% Impervious = 363,686 sf



Subcat Reach Pond Link

Routing Diagram for New Conditions

Prepared by Loureiro Engineering Assoc, Inc, Printed 4/5/2023

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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-yr	Type III 24-hr		Default	24.00	1	3.46	2
2	10-yr	Type III 24-hr		Default	24.00	1	5.12	2
3	25-yr	Type III 24-hr		Default	24.00	1	6.15	2
4	50-yr	Type III 24-hr		Default	24.00	1	6.92	2
5	100-yr	Type III 24-hr		Default	24.00	1	7.74	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
158	61	>75% Grass cover, Good, HSG B (4)
5,410	80	>75% Grass cover, Good, HSG D (1, 2)
1,990	35	Brush, Fair, HSG A (5)
120,751	56	Brush, Fair, HSG B (2, 3, 4, 5, 6)
63,588	77	Brush, Fair, HSG D (1, 2, 5, 6)
35,972	85	Gravel roads, HSG B (1, 2)
85,982	91	Gravel roads, HSG D (1, 2, 5, 6)
126	98	Paved parking, HSG A (4, 5)
36,207	98	Paved parking, HSG B (2, 3, 4, 5, 6)
25,526	98	Paved parking, HSG D (5, 6)
8,264	98	Roofs, HSG B (4, 5)
11,765	98	Roofs, HSG D (5)
1	98	Unconnected pavement, HSG A (5)
65,239	98	Unconnected pavement, HSG B (1, 2, 3, 4, 5, 6)
297,913	98	Unconnected pavement, HSG D (1, 2, 5, 6)
4,772	30	Woods, Good, HSG A (5, 7)
117,245	55	Woods, Good, HSG B (2, 3, 4, 5, 6)
11,149	77	Woods, Good, HSG D (1, 2, 5, 6, 7)
892,058	**83**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
6,889	HSG A	4, 5, 7
383,836	HSG B	1, 2, 3, 4, 5, 6
0	HSG C	
501,334	HSG D	1, 2, 5, 6, 7
0	Other	
892,058		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Sub Num
0	158	0	5,410	0	5,568	>75% Grass cover, Good	
1,990	120,751	0	63,588	0	186,329	Brush, Fair	
0	35,972	0	85,982	0	121,954	Gravel roads	
126	36,207	0	25,526	0	61,859	Paved parking	
0	8,264	0	11,765	0	20,029	Roofs	
1	65,239	0	297,913	0	363,152	Unconnected pavement	
4,772	117,245	0	11,149	0	133,167	Woods, Good	
6,889	**383,836**	**0**	**501,334**	**0**	**892,058**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	4P	25.60	24.90	66.0	0.0106	0.013	0.0	12.0	0.0
2	5P	24.90	24.00	90.0	0.0100	0.013	0.0	15.0	0.0

Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: Subcat 1 Runoff Area=272,496 sf 90.85% Impervious Runoff Depth=3.11"
Tc=28.5 min CN=97 Runoff=12.20 cfs 70,728 cf

Subcatchment 2: Subcat 2 Runoff Area=362,229 sf 31.18% Impervious Runoff Depth=1.21"
Tc=9.0 min CN=74 Runoff=10.22 cfs 36,597 cf

Subcatchment 3: Subcat 3 Runoff Area=36,552 sf 0.03% Impervious Runoff Depth=0.37"
Flow Length=541' Tc=21.6 min CN=56 Runoff=0.13 cfs 1,115 cf

Subcatchment 4: Subcat 4 Runoff Area=25,287 sf 93.26% Impervious Runoff Depth=2.90"
Tc=5.0 min CN=95 Runoff=1.92 cfs 6,111 cf

Subcatchment 5: Subcat 5 Runoff Area=63,132 sf 86.10% Impervious Runoff Depth=2.50"
Tc=5.0 min CN=91 Runoff=4.32 cfs 13,170 cf

Subcatchment 6: Subcat 6 Runoff Area=126,834 sf 5.20% Impervious Runoff Depth=1.82"
Tc=5.0 min CN=83 Runoff=6.46 cfs 19,289 cf

Subcatchment 7: Subcat 7 Runoff Area=5,528 sf 0.00% Impervious Runoff Depth=0.12"
Tc=5.0 min CN=47 Runoff=0.00 cfs 54 cf

Pond 4P: Stormwater Practice #1 Peak Elev=24.02' Storage=56 cf Inflow=6.24 cfs 19,280 cf
Discarded=6.24 cfs 19,280 cf Primary=0.00 cfs 0 cf Outflow=6.24 cfs 19,280 cf

Pond 5P: MH Peak Elev=25.07' Inflow=0.13 cfs 1,115 cf
15.0" Round Culvert n=0.013 L=90.0' S=0.0100 '/' Outflow=0.13 cfs 1,115 cf

Link 4L: West Off-Site Inflow=6.46 cfs 19,289 cf
Primary=6.46 cfs 19,289 cf

Link 5L: North Off-Site Inflow=0.00 cfs 54 cf
Primary=0.00 cfs 54 cf

Link 6L: Allyn's Pond Inflow=18.05 cfs 108,440 cf
Primary=18.05 cfs 108,440 cf

Total Runoff Area = 892,058 sf Runoff Volume = 147,063 cf Average Runoff Depth = 1.98"
50.11% Pervious = 447,018 sf 49.89% Impervious = 445,041 sf

Pond 4P: Stormwater Practice #1 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

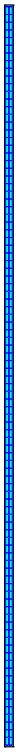
96 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 684.72' Row Length +12.0" End Stone x 2 = 686.72' Base Length
2 Rows x 34.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 8.17' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

192 Chambers x 14.7 cf = 2,830.5 cf Chamber Storage

13,085.8 cf Field - 2,830.5 cf Chambers = 10,255.4 cf Stone x 40.0% Voids = 4,102.1 cf Stone Storage

Chamber Storage + Stone Storage = 6,932.6 cf = 0.159 af
Overall Storage Efficiency = 53.0%
Overall System Size = 686.72' x 8.17' x 2.33'

192 Chambers
484.7 cy Field
379.8 cy Stone



Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: Subcat 1 Runoff Area=272,496 sf 90.85% Impervious Runoff Depth=4.77"
Tc=28.5 min CN=97 Runoff=18.30 cfs 108,242 cf

Subcatchment 2: Subcat 2 Runoff Area=362,229 sf 31.18% Impervious Runoff Depth=2.46"
Tc=9.0 min CN=74 Runoff=21.55 cfs 74,267 cf

Subcatchment 3: Subcat 3 Runoff Area=36,552 sf 0.03% Impervious Runoff Depth=1.10"
Flow Length=541' Tc=21.6 min CN=56 Runoff=0.59 cfs 3,363 cf

Subcatchment 4: Subcat 4 Runoff Area=25,287 sf 93.26% Impervious Runoff Depth=4.54"
Tc=5.0 min CN=95 Runoff=2.93 cfs 9,564 cf

Subcatchment 5: Subcat 5 Runoff Area=63,132 sf 86.10% Impervious Runoff Depth=4.10"
Tc=5.0 min CN=91 Runoff=6.90 cfs 21,563 cf

Subcatchment 6: Subcat 6 Runoff Area=126,834 sf 5.20% Impervious Runoff Depth=3.28"
Tc=5.0 min CN=83 Runoff=11.56 cfs 34,698 cf

Subcatchment 7: Subcat 7 Runoff Area=5,528 sf 0.00% Impervious Runoff Depth=0.58"
Tc=5.0 min CN=47 Runoff=0.04 cfs 267 cf

Pond 4P: Stormwater Practice #1 Peak Elev=24.51' Storage=1,166 cf Inflow=9.83 cfs 31,127 cf
Discarded=6.49 cfs 31,127 cf Primary=0.00 cfs 0 cf Outflow=6.49 cfs 31,127 cf

Pond 5P: MH Peak Elev=25.26' Inflow=0.59 cfs 3,363 cf
15.0" Round Culvert n=0.013 L=90.0' S=0.0100 '/' Outflow=0.59 cfs 3,363 cf

Link 4L: West Off-Site Inflow=11.56 cfs 34,698 cf
Primary=11.56 cfs 34,698 cf

Link 5L: North Off-Site Inflow=0.04 cfs 267 cf
Primary=0.04 cfs 267 cf

Link 6L: Allyn's Pond Inflow=33.11 cfs 185,872 cf
Primary=33.11 cfs 185,872 cf

Total Runoff Area = 892,058 sf Runoff Volume = 251,965 cf Average Runoff Depth = 3.39"
50.11% Pervious = 447,018 sf 49.89% Impervious = 445,041 sf

Pond 4P: Stormwater Practice #1 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

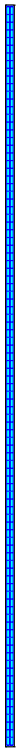
96 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 684.72' Row Length +12.0" End Stone x 2 = 686.72' Base Length
2 Rows x 34.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 8.17' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

192 Chambers x 14.7 cf = 2,830.5 cf Chamber Storage

13,085.8 cf Field - 2,830.5 cf Chambers = 10,255.4 cf Stone x 40.0% Voids = 4,102.1 cf Stone Storage

Chamber Storage + Stone Storage = 6,932.6 cf = 0.159 af
Overall Storage Efficiency = 53.0%
Overall System Size = 686.72' x 8.17' x 2.33'

192 Chambers
484.7 cy Field
379.8 cy Stone



Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: Subcat 1 Runoff Area=272,496 sf 90.85% Impervious Runoff Depth=5.79"
Tc=28.5 min CN=97 Runoff=22.06 cfs 131,566 cf

Subcatchment 2: Subcat 2 Runoff Area=362,229 sf 31.18% Impervious Runoff Depth=3.31"
Tc=9.0 min CN=74 Runoff=29.14 cfs 99,958 cf

Subcatchment 3: Subcat 3 Runoff Area=36,552 sf 0.03% Impervious Runoff Depth=1.69"
Flow Length=541' Tc=21.6 min CN=56 Runoff=0.98 cfs 5,135 cf

Subcatchment 4: Subcat 4 Runoff Area=25,287 sf 93.26% Impervious Runoff Depth=5.56"
Tc=5.0 min CN=95 Runoff=3.56 cfs 11,718 cf

Subcatchment 5: Subcat 5 Runoff Area=63,132 sf 86.10% Impervious Runoff Depth=5.10"
Tc=5.0 min CN=91 Runoff=8.48 cfs 26,853 cf

Subcatchment 6: Subcat 6 Runoff Area=126,834 sf 5.20% Impervious Runoff Depth=4.23"
Tc=5.0 min CN=83 Runoff=14.78 cfs 44,717 cf

Subcatchment 7: Subcat 7 Runoff Area=5,528 sf 0.00% Impervious Runoff Depth=1.00"
Tc=5.0 min CN=47 Runoff=0.11 cfs 461 cf

Pond 4P: Stormwater Practice #1 Peak Elev=24.80' Storage=2,349 cf Inflow=12.04 cfs 38,570 cf
Discarded=6.49 cfs 38,570 cf Primary=0.00 cfs 0 cf Outflow=6.49 cfs 38,570 cf

Pond 5P: MH Peak Elev=25.37' Inflow=0.98 cfs 5,135 cf
15.0" Round Culvert n=0.013 L=90.0' S=0.0100 '/' Outflow=0.98 cfs 5,135 cf

Link 4L: West Off-Site Inflow=14.78 cfs 44,717 cf
Primary=14.78 cfs 44,717 cf

Link 5L: North Off-Site Inflow=0.11 cfs 461 cf
Primary=0.11 cfs 461 cf

Link 6L: Allyn's Pond Inflow=43.16 cfs 236,659 cf
Primary=43.16 cfs 236,659 cf

Total Runoff Area = 892,058 sf Runoff Volume = 320,407 cf Average Runoff Depth = 4.31"
50.11% Pervious = 447,018 sf 49.89% Impervious = 445,041 sf

Pond 4P: Stormwater Practice #1 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

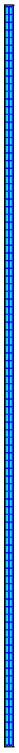
96 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 684.72' Row Length +12.0" End Stone x 2 = 686.72' Base Length
2 Rows x 34.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 8.17' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

192 Chambers x 14.7 cf = 2,830.5 cf Chamber Storage

13,085.8 cf Field - 2,830.5 cf Chambers = 10,255.4 cf Stone x 40.0% Voids = 4,102.1 cf Stone Storage

Chamber Storage + Stone Storage = 6,932.6 cf = 0.159 af
Overall Storage Efficiency = 53.0%
Overall System Size = 686.72' x 8.17' x 2.33'

192 Chambers
484.7 cy Field
379.8 cy Stone



Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: Subcat 1 Runoff Area=272,496 sf 90.85% Impervious Runoff Depth=6.56"
Tc=28.5 min CN=97 Runoff=24.87 cfs 149,015 cf

Subcatchment 2: Subcat 2 Runoff Area=362,229 sf 31.18% Impervious Runoff Depth=3.97"
Tc=9.0 min CN=74 Runoff=34.96 cfs 119,910 cf

Subcatchment 3: Subcat 3 Runoff Area=36,552 sf 0.03% Impervious Runoff Depth=2.17"
Flow Length=541' Tc=21.6 min CN=56 Runoff=1.30 cfs 6,598 cf

Subcatchment 4: Subcat 4 Runoff Area=25,287 sf 93.26% Impervious Runoff Depth=6.33"
Tc=5.0 min CN=95 Runoff=4.02 cfs 13,331 cf

Subcatchment 5: Subcat 5 Runoff Area=63,132 sf 86.10% Impervious Runoff Depth=5.86"
Tc=5.0 min CN=91 Runoff=9.66 cfs 30,830 cf

Subcatchment 6: Subcat 6 Runoff Area=126,834 sf 5.20% Impervious Runoff Depth=4.95"
Tc=5.0 min CN=83 Runoff=17.19 cfs 52,344 cf

Subcatchment 7: Subcat 7 Runoff Area=5,528 sf 0.00% Impervious Runoff Depth=1.36"
Tc=5.0 min CN=47 Runoff=0.17 cfs 629 cf

Pond 4P: Stormwater Practice #1 Peak Elev=25.06' Storage=3,386 cf Inflow=13.68 cfs 44,160 cf
Discarded=6.49 cfs 44,160 cf Primary=0.00 cfs 0 cf Outflow=6.49 cfs 44,160 cf

Pond 5P: MH Peak Elev=25.45' Inflow=1.30 cfs 6,598 cf
15.0" Round Culvert n=0.013 L=90.0' S=0.0100 '/' Outflow=1.30 cfs 6,598 cf

Link 4L: West Off-Site Inflow=17.19 cfs 52,344 cf
Primary=17.19 cfs 52,344 cf

Link 5L: North Off-Site Inflow=0.17 cfs 629 cf
Primary=0.17 cfs 629 cf

Link 6L: Allyn's Pond Inflow=50.83 cfs 275,524 cf
Primary=50.83 cfs 275,524 cf

Total Runoff Area = 892,058 sf Runoff Volume = 372,657 cf Average Runoff Depth = 5.01"
50.11% Pervious = 447,018 sf 49.89% Impervious = 445,041 sf

Pond 4P: Stormwater Practice #1 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

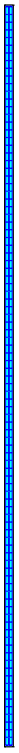
96 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 684.72' Row Length +12.0" End Stone x 2 = 686.72' Base Length
2 Rows x 34.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 8.17' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

192 Chambers x 14.7 cf = 2,830.5 cf Chamber Storage

13,085.8 cf Field - 2,830.5 cf Chambers = 10,255.4 cf Stone x 40.0% Voids = 4,102.1 cf Stone Storage

Chamber Storage + Stone Storage = 6,932.6 cf = 0.159 af
Overall Storage Efficiency = 53.0%
Overall System Size = 686.72' x 8.17' x 2.33'

192 Chambers
484.7 cy Field
379.8 cy Stone



Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: Subcat 1 Runoff Area=272,496 sf 90.85% Impervious Runoff Depth=7.38"
Tc=28.5 min CN=97 Runoff=27.86 cfs 167,604 cf

Subcatchment 2: Subcat 2 Runoff Area=362,229 sf 31.18% Impervious Runoff Depth=4.69"
Tc=9.0 min CN=74 Runoff=41.25 cfs 141,687 cf

Subcatchment 3: Subcat 3 Runoff Area=36,552 sf 0.03% Impervious Runoff Depth=2.71"
Flow Length=541' Tc=21.6 min CN=56 Runoff=1.67 cfs 8,264 cf

Subcatchment 4: Subcat 4 Runoff Area=25,287 sf 93.26% Impervious Runoff Depth=7.14"
Tc=5.0 min CN=95 Runoff=4.51 cfs 15,051 cf

Subcatchment 5: Subcat 5 Runoff Area=63,132 sf 86.10% Impervious Runoff Depth=6.67"
Tc=5.0 min CN=91 Runoff=10.91 cfs 35,080 cf

Subcatchment 6: Subcat 6 Runoff Area=126,834 sf 5.20% Impervious Runoff Depth=5.73"
Tc=5.0 min CN=83 Runoff=19.77 cfs 60,558 cf

Subcatchment 7: Subcat 7 Runoff Area=5,528 sf 0.00% Impervious Runoff Depth=1.79"
Tc=5.0 min CN=47 Runoff=0.24 cfs 827 cf

Pond 4P: Stormwater Practice #1 Peak Elev=25.41' Storage=4,646 cf Inflow=15.42 cfs 50,130 cf
Discarded=6.49 cfs 50,130 cf Primary=0.00 cfs 0 cf Outflow=6.49 cfs 50,130 cf

Pond 5P: MH Peak Elev=25.53' Inflow=1.67 cfs 8,264 cf
15.0" Round Culvert n=0.013 L=90.0' S=0.0100 '/' Outflow=1.67 cfs 8,264 cf

Link 4L: West Off-Site Inflow=19.77 cfs 60,558 cf
Primary=19.77 cfs 60,558 cf

Link 5L: North Off-Site Inflow=0.24 cfs 827 cf
Primary=0.24 cfs 827 cf

Link 6L: Allyn's Pond Inflow=59.10 cfs 317,555 cf
Primary=59.10 cfs 317,555 cf

Total Runoff Area = 892,058 sf Runoff Volume = 429,069 cf Average Runoff Depth = 5.77"
50.11% Pervious = 447,018 sf 49.89% Impervious = 445,041 sf

Pond 4P: Stormwater Practice #1 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

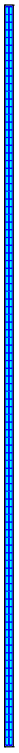
96 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 684.72' Row Length +12.0" End Stone x 2 = 686.72' Base Length
2 Rows x 34.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 8.17' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

192 Chambers x 14.7 cf = 2,830.5 cf Chamber Storage

13,085.8 cf Field - 2,830.5 cf Chambers = 10,255.4 cf Stone x 40.0% Voids = 4,102.1 cf Stone Storage

Chamber Storage + Stone Storage = 6,932.6 cf = 0.159 af
Overall Storage Efficiency = 53.0%
Overall System Size = 686.72' x 8.17' x 2.33'

192 Chambers
484.7 cy Field
379.8 cy Stone



APPENDIX E

Water Quality Volume and Water Quality Flow Calculations

Loureiro
Engineering • Construction • EH&S • Energy
Waste • Facility Services • Laboratory

Project:	Sterling Building Stormwater Practice		
Calculated By:	Alex Healy	**Date:**	**04/05/23**
Checked By:	Susan Marquardt	**Date:**	**04/05/23**

Water Quality Volume and Water Quality Flow Worksheet

Watershed:	DA-4, DA-5
Condition:	Proposed

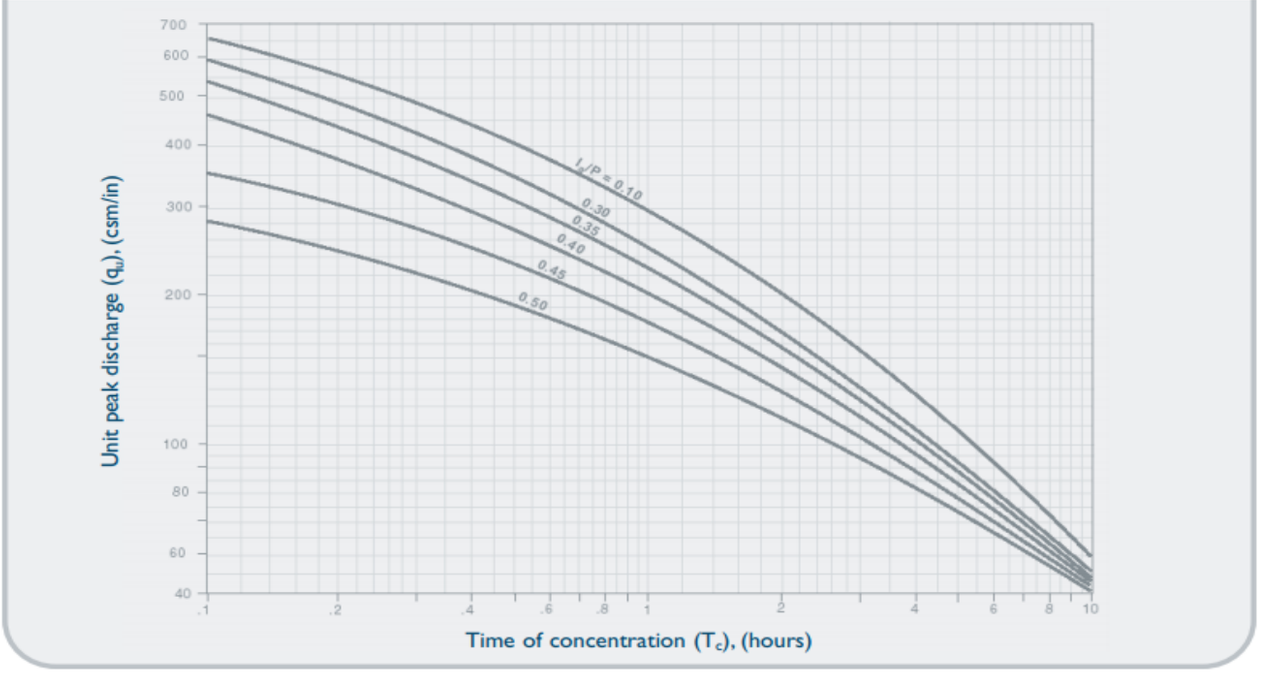
Water Quality Volume

Design Precipitation, P:	1	*in*
Percent Impervious Cover, I:	88%	
Volumetric Runoff Coefficient, R:	*0.843*	
Area, A:	2.03	acres
Water Quality Volume, WQV:	***6,215***	C.F.

Water Quality Flow

Runoff Depth, Q:	*0.843*	*in*	
Runoff Curve Number, CN:	*99*		
Time of Concentration, Tc: (>=10 min)	10.0	*min*	
Time of Concentration, Tc:	0.167	*hr*	
Initial Abstraction, I_a:	*0.041*	*in*	
I_a/P:	*0.041*		
Unit Peak Discharge, q_u:	650	*csm/in*	(from Exhibit 4-111 below)
Area, A:	*0.00317*	mi^2	
Water Quality Flow, WQF:	***1.74***	*cfs*	

Exhibit 4-111 Unit peak discharge (q_u) for NRCS (SCS) type III rainfall distribution



APPENDIX F

Hydrodynamic Separator calculations

Hydrodynamic Separation Product Calculator

Gales Ferry Intermodal LLC

HDS #1

CDS CDS5653-10-C

Project Information					
Project Name	Gales Ferry Intermodal LLC			**Option #**	A
Country	UNITED_STATES	**State**	Connecticut	**City**	Gales Ferry

Contact Information			
First Name	Susan	**Last Name**	Marquardt
Company	Loureiro Engineering Associates, Inc.	**Phone #**	860-448-0400
Email	srmarquardt@loureiro.com		

Design Criteria					
Site Designation	HDS #1			**Sizing Method**	Treatment Flow Rate
Screening Required?	No	**Treatment Flow Rate**	5.00	**Peak Flow (cfs)**	7.72
Groundwater Depth (ft)	10 - 15	**Pipe Invert Depth (ft)**	0 - 5	**Bedrock Depth (ft)**	10 - 15
Multiple Inlets?	Yes	**Grate Inlet Required?**	No	**Pipe Size (in)**	12.00
Required Particle Size Distribution?	No	**90° between two inlets?**	No		

Treatment Selection				
Treatment Unit	CDS	**System Model**	CDS5653-10-C	
Target Removal	80%	**Particle Size Distribution (PSD)**	50	

Hydrodynamic Separation Product Calculator

Gales Ferry Intermodal LLC

HDS #2

CDS CDS4045-8-C

Project Information					
Project Name	Gales Ferry Intermodal LLC			**Option #**	A
Country	UNITED_STATES	**State**	Connecticut	**City**	Gales Ferry

Contact Information			
First Name	Susan	**Last Name**	Marquardt
Company	Loureiro Engineering Associates, Inc.	**Phone #**	860-448-0400
Email	srmarquardt@loureiro.com		

Design Criteria					
Site Designation	HDS #2			**Sizing Method**	Treatment Flow Rate
Screening Required?	No	**Treatment Flow Rate**	3.52	**Peak Flow (cfs)**	5.33
Groundwater Depth (ft)	10 - 15	**Pipe Invert Depth (ft)**	0 - 5	**Bedrock Depth (ft)**	10 - 15
Multiple Inlets?	No	**Grate Inlet Required?**	No	**Pipe Size (in)**	12.00
Required Particle Size Distribution?	No	**90° between two inlets?**	N/A		

Treatment Selection				
Treatment Unit	CDS	**System Model**	CDS4045-8-C	
Target Removal	80%	**Particle Size Distribution (PSD)**	50	

APPENDIX G

Stormwater Management Maintenance Program and Inspection Checklist

1761 Route 12, Gales Ferry, CT

Stormwater Management System Maintenance Program

There shall be periodic maintenance of the stormwater systems on the property after installation. In order to ensure effective performance of the system, the following stormwater maintenance program has been established. The property owner will be responsible for implementation of this program. A log and schedule of all inspections, cleanings, and repairs shall be maintained by the property owner. All maintenance documents shall be transferred to any future owners upon sale or transfer of the property.

A. Catch basins/Manholes

   Catch basins are designed with sumps for the purpose of collecting coarse sediment. All catch basins should be inspected two times per year, specifically during times for high levels of maintenance around the site. Sediment should be removed when it extends to within 6 inches of the outlet pipe invert or not less than once per year. Cleanout should be facilitated via vacuum truck or other means that accomplish sediment removal. The sediment shall be disposed of in an approved off-site location in accordance with town and state requirements.

B. Asphalt

   Asphalt areas should be swept annually. Ideal sweeping timeframe is in the spring after winter sanding or salting for deicing. Deicing chemicals should be kept to a minimum during the winter months.

C. Subsurface detention systems

   Underground detention systems shall be inspected through the surface openings quarterly and sediment/debris shall be removed as needed to ensure proper functioning of structures and inlets/outlets. Areas of disturbance that may be as a result of cleaning shall be seeded and planted in accordance with the original planting plan. Associated structures shall be maintained yearly, or more frequently, as required, by the condition of the site and system. Waste material will be properly disposed of off-site.

D. Lawn and vegetated areas

   Vegetated cover shall be maintained on all earth surfaces to minimize soil erosion. Fertilizer use should be minimized and applied using careful application processes.

1761 Route 12, Gales Ferry,CT

Stormwater Management System Maintenance Checklist

Inspection Date: _____

Inspector: _____

Maintenance Item	Satisfactory	Unsatisfactory	Comments
Drainage Structures			
Sedimentation Accumulation			
Large Floating Debris			
Inlet/Outlet			
Structure walls			
Riser			
Frame and Cover			
Subsurface Infiltration System			
Settling Over System			
Sedimentation Accumulation			
Large Floating Debris			
Inspection Structure Integrity			
Inspection Structure Frame and Cover			
Surrounding Lawn and Vegetated Areas			
Signs of Erosion			
Ponding/Settling			
Overgrowth			

Additional Comments: _____