PARE PROJECT NO. 23048.00

STORMWATER MANAGEMENT REPORT

GATH MEMORIAL POOL IMPROVEMENTS
250 ALBEMARLE RD
NEWTON, MA

Assessors Sec. 21022, Lot 001

Newton, MA

Prepared for:

City of Newton Parks, Recreation, and Culture Department
246 Dudley Road
Newton, MA

Prepared by:

Pare Corporation
10 Lincoln Road
Foxboro, MA 02035

May 2023

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PURPOSE

Pare Corporation (Pare) has prepared this report to summarize the stormwater management system proposed for the Gath Pool Project. The building is located 250 Albemarle Road, Newton, MA. The project will include a new pool and access area, and new stormwater improvements. The proposed project area encompasses 1.51 +/- acres on a 16.88 +/- acre parcel. The existing Site is home to the existing Gath Pool area and existing courts and recreational fields.

The following sections of the report discuss the existing conditions, proposed development, methodology employed to evaluate stormwater runoff for existing and proposed conditions, and design elements for the proposed stormwater management system components. Supporting documentation is provided in the attached appendices.

PROJECT DESCRIPTION

The study area, hereby referred to as the "Site", included in this hydrologic study comprises approximately 1.51 +/- acres of land. The Site is bound by Albemarle Road to the west and athletic fields to the north, east, and south.

There are no NHESP Priority Habitats, Certified Vernal Pools, or Potential Vernal Pools onsite as mapped by MassGIS. The Site is not located in a Zone II Wellhead Protection Area, Interim Wellhead Protection Area, or Zone I Wellhead Protection Area. Additionally, the Site is not located in a Zone A, B, or C Surface Water Protection Area.

The only wetland resource areas in the vicinity of the Site are Cheesecake Brook, a perennial stream, with an associated 200-foot Riverfront Area and Bordering Land Subject to Flooding (BLSF). The stream flows south-to-north along the west side of the Site within a defined channel bound by masonry retaining walls on either side. The 200-foot Riverfront area extends perpendicular to the banks of the stream, without regard for topography. The BLSF on site is defined by the location of the Flood Zone A (as described below) where it exists up gradient of the banks of the perennial stream.

The existing topography of the Site is generally flat with an elevated center portion that contains the existing pool area. The entire site drains westward to Cheesecake Brook either via overland flow or conveyance structures running underneath the athletic fields.

According to the FEMA Flood Insurance Rate Map for Middlesex, Massachusetts (Community-Panel 2502080552F, effective date August 13, 2021), included in Appendix A of this report, the project site

falls within a Zone A flood area. The flood elevation for this area has been derived using available elevation information provided by the City of Newton, and is set at 27.7 (NAVD88). A compensatory flood storage calculation is being provided in the plan set on sheet CFS-1. 3 rows of box culverts are being proposed to bring the site into compensatory flood storage compliance. The City of Newton has a 110% flood storage capacity policy for post development conditions. We are requesting an exemption from this policy as all of the below criteria from the City of Newton are met by this project.

- "Complies with the WPA" – The site is designed in such a manner that complies with the WPA without relief or exemption. See the wetland narrative for further information.
- "Is the only reasonable alternative to achieve the stated project purpose" – The project is essentially an existing mounded pool complex that is being expanded in an open field. There is no other way to provide compensatory storage as the pool itself is the only infrastructure at these elevations. All manner of regrading and providing flood storage under the pool itself through box culverts is being done to bring the project in compliance with flood regulations.
- "Will further a significant public interest" – Gath Pool provides a huge recreational opportunity for the public and students alike and is a central fixture at the overall site where many community events take place.
- "Is the only available alternative that does not constitute an unconstitutional taking of private property without just compensation" – As mentioned above, all storage solutions are being exhausted at this time.

SOIL DATA

NRCS Soil mapping indicated that natural soil in the vicinity of the Site is comprised of Urban Land, 0 to 8 percent slopes. Urban land does not have a Hydrologic Soil Group (HSG) rating, however a portion of the site is adjacent to an area of Hinckley series soil, which has a rating A. A type soils are typically well drained to excessively well drained soils. NRCS Hydrologic Soil Report for the Site are provided in Appendix A.

A subsurface investigation, comprising a single test pit within 5' of the layout of the proposed underground infiltration system was conducted on 4/10/2023. This subsurface investigation confirmed the NRCS data, finding a very well drained and course glaciofaluvial deposit. Despite the well drained soils, a seasonal high groundwater table was found at 48" through redoximorphic features. No restrictive layers were uncovered in the test pit and none would be expected in this area. It is assumed that this test pit is representative of the soils within the entire limit of disturbance.

Soil disturbance onsite will include the excavation in the existing pool area, construction of the proposed stormwater systems, and excavation for proposed utilities. Water will be sprayed as necessary to control dust. Existing catch basins in the vicinity of the Site will require inlet protection. Compost filter socks will be installed at the limit of work edges.

METHODOLOGY

Hydrologic calculations for existing and proposed conditions were performed using HydroCAD Version 10.00 software, which uses TR-55 methodology to calculate runoff and TR-20 methodology for storm routing through the stormwater detention facilities. Site hydrology was evaluated for the 2-year, 10-year, 25-year, and 100-year frequency storms in accordance with the guidelines of the Massachusetts Stormwater Handbook. Existing and Proposed Watershed Maps, indicating the subwatersheds and associated stormwater flow paths may be found in Appendix D.

The hydraulic design calculations were completed using HydroCAD to calculate the accumulated flows to each structure. The stormwater conveyance system was designed using Manning's Equation. The stormwater conveyance system was designed to handle the runoff generated by a 25-year design storm.

EXISTING CONDITIONS OF STUDY AREA

The Site is currently used as a recreational area for pool and tennis activities, among others. Also on site are a few landscaped areas with various trees, a parking area, concrete walkways, and existing bath house. Under existing conditions, the composite curve numbers are 85 and 75 respectively for the two subcatchment areas: EDA-1A and EDA-1B, which are described below. Stormwater runoff generated from the Site generally flows to Cheesecake Brook, via overland flow and conveyance structures.

The existing Site contains approximately 1.05 acres of impervious area within the hydrologic boundary, which consists of paved parking, concrete sidewalks, and the existing building and pool area. The remaining portions of the Site are grassed with some negligible landscaped features and concrete pads.

The Site is considered to have a single design point: Cheesecake Brook. Under existing conditions, two subwatersheds were analyzed. The Existing Hydrology Plan, H1.0, included in Appendix D, depicts the limits of the Existing Drainage Areas (EDA), described below:

- **EDA-1A**: EDA-1A is comprised of the existing pool, tennis, and bath house areas. Also in these areas are miscellaneous landscaped areas and impervious walks and pads.

- **EDA-1B**: EDA-1B is comparable in composition to EDA-1A, comprising of the impervious pool area and walks, along with landscaped features.

PROPOSED CONDITIONS OF STUDY AREA

The proposed site improvements include an upgraded and enlarged pool recreation area. Those site improvements include a new underground infiltration system and associated utilities, a new pool deck, as well as existing pool deck areas being converted to landscaped features. The proposed subcatchment areas (PDA-1A, PDA-1B, and PDA-1C) were designed to replicate the existing drainage profiles. The curve numbers are 98, 73, and 42.

The proposed project will add an underground infiltration system to achieve groundwater recharge, treatment requirements, and peak flow attenuation for the site improvements. All new stormwater collection, storage, and treatment systems have been designed in accordance with the guidelines of the Massachusetts Stormwater Handbook prepared by the Massachusetts Department of Environmental Protection (MADEP). Post-development runoff rates will be maintained or reduced from the pre-development condition and released into existing drainage paths downstream of proposed improvements. Proposed impervious areas will be treated prior to leaving the Site in accordance with the handbook. A portion of the existing infrastructure conveying stormwater through the athletic fields to Cheesecake Brook is also being rerouted around the pool area to make way for those developments.

The grading scheme is designed to shed water to match the existing conditions to the maximum extent practicable. Grades generally slope away from the Pool Complex to protect the structure from stormwater runoff. Stormwater is conveyed to best management practices (BMP's) via overland flow.

- **Source Control and Maintenance**: Properly maintaining sources of pollutants promotes a site that produces higher quality stormwater runoff than sites that do not control sources of pollutants. An example of source control includes the removal of sediment buildup from best management practices during regular maintenance per the Long-Term Operations & Maintenance Plan.

- **Underground Infiltration System**: The underground infiltration system has been designed in accordance with the Massachusetts Stormwater Handbook Standards to promote water quality. The system is sized to exfiltrate the entire water quality volume through the surrounding soils prior to use of any overflows. Any excess stormwater that enters the infiltration system will overflow into the outlet control structure and subsequently into the stormwater system in the athletic fields.

Under proposed conditions, three subwatersheds were analyzed. The Proposed Hydrology Plan, H-2.0, included in Appendix D, depicts the limits of the Proposed Drainage Areas (PDA), described below:

- **PDA-1**: PDA-1 is comprised of the proposed pool deck area and associated recreational areas. PDA-1A contains numerous stormwater collection and conveyance structures routing directly to the underground infiltration area.

- **PDA-1B**: PDA-1B is comprised of the existing-to-remain bath house along with other landscaped and impervious features. This area in the proposed conditions flows via overland flow to cheesecake brook.

- **PDA-1C**: PDA-1C is comprised of the sloped landscaped areas immediately east of the proposed pool area, with select landscape and drainage structure improvements. This area flows to Cheesecake Brook through either conveyance structures or overland flow.

STORMWATER MANAGEMENT STANDARDS

This proposed stormwater management system complies with the current regulations of the Massachusetts Stormwater Handbook) and the City of Newton requirements. Compliance and applicability of the ten (10) Stormwater Management Standards for this redevelopment project are discussed below.

STANDARD #1 – NO NEW UNTREATED DISCHARGES

No new point discharges of untreated stormwater are proposed for the project. Water quality is achieved by source control and conveying stormwater from impervious areas through the proposed best management practices. Stormwater throughout the Site is treated using the underground infiltration system. Portions of the Site directly adjacent to offsite areas will remain untreated as in the existing condition. There is no new trafficked impervious being proposed and there is an overall net reduction in impervious surfaces.

STANDARD #2 – POST-DEVELOPMENT PEAK DISCHARGE RATES

MassDEP Stormwater Standard #2 states that runoff rates from the developed Site must not exceed existing runoff rates for the 2-year and 10-year, 24-hour storm events. Standard 2 states that the 100-year, 24-hour storm event must also be evaluated to demonstrate that there will be no increased flooding impacts off-site. The 25-year storm is shown for additional clarity.

The proposed stormwater management system is designed to reduce runoff rates from the 2-, 10-, 25-, and 100-year, 24-hour storm events. This is achieved by controlling runoff using the proposed stormwater management systems and their associated outlet control structures.

Existing and proposed peak runoff rates from the Site were generated for the rainfall events having a return rate of 2-year, 10-year, and 100-year using the SCS TR-20 Method (refer to Appendix B for hydrology calculations). Runoff hydrographs were developed for the existing and proposed conditions for each of the design points of the Site. Results for each storm event and the net difference in pre- and post-development flows are shown in Table 1 below; a negative number indicates flows are decreased in the proposed condition.

Table 1: Peak Flow Table – DP-1 (CFS)

Design Storm:	2	10	25	100
Pre	3.87	7.09	9.67	15.33
Post	0.54	3.76	5.97	9.63
Difference	-3.33	-3.33	-3.70	-5.70

Table 2: Peak Volume Table – DP-1 (CF)

Design Storm:	2	10	25	100
Pre	7,601	14,281	19,832	32,344
Post	1,998	6,403	10,466	20,578
Percent Reduction	73.7%	55.1%	47.2%	36.3%

STANDARD #3 – RECHARGE TO GROUNDWATER

Stormwater Standard #3 states that loss of groundwater recharge from the proposed development shall be eliminated or minimized and at a minimum, the recharge volume, which is dependent on soil type, shall be recharged to the groundwater. The intent of this standard is to ensure that the infiltration volume of precipitation into the ground under post-development conditions is at least as much as the infiltration volume under pre-development conditions. Groundwater recharge requirements are being met through the introduction of an underground infiltration system.

STANDARD #4 – TSS REMOVAL

Stormwater Standard #4 requires that stormwater management systems shall be designed to remove the annual post-construction load of Total Suspended Solids (TSS) to the maximum extent practicable. There are no new pollutant loading surfaces within the scope of the project development, with an overall reduction in impervious. Therefore, the project meets the requirements of Standard #4.

STANDARD #5 – LAND USES WITH HIGHER POTENTIAL POLLUTANT LOADS (LUHPPL)

Standard #5 specifies that LUHPPLs appropriately reduce and control potential pollutants from entering groundwater or waterways. The Site is not classified by the Handbook as a LUHPPL and therefore this standard does not apply.

STANDARD #6 – PROTECTION OF CRITICAL AREAS

The proposed development is not located within a Zone II or Interim Wellhead Protection Area. Standard #6 is not applicable to this project.

STANDARD #7 – REDEVELOPMENT PROJECTS

Under Standard #7, the project would be required by the Handbook to meet the Stormwater Standards to the full extent for the net increase in impervious area, required to meet Standards 2, 3, 4, 5, and 6 only to the maximum extent practicable and improve existing conditions for the existing impervious area. There is a net reduction in impervious for the site amounting to 3,194 SF, therefore Standard #7 does not apply in this scenario.

STANDARD #8 – EROSION & SEDIMENT CONTROL PLAN

The project proposes to disturb greater than 1 acre of land and is therefore required to develop a Storm Water Pollution Prevention Plan (SWPPP) in accordance with the Environmental Protection Agency (EPA) National Pollution Discharge Elimination System (NPDES) Construction General Permit (CGP) for discharges from construction activities.

Minimum erosion and sediment control features, including perimeter filter socks, and inlet protection are shown on the Project Plans. The contractor shall be responsible to submit a SWPPP prior to construction.

STANDARD #9 – OPERATIONS AND MAINTENANCE PLAN

The City of Newton will be responsible for the Operation and Maintenance of the Stormwater Management System post-construction. The Stormwater Operation and Maintenance Plan is included under separate cover.

STANDARD #10 – ILLICIT DISCHARGES

The Stormwater Management System has been designed to treat stormwater by a best-management practice prior to discharge. To Pare Corporation's knowledge, based on the best-available information

and in-field reviews of the current Site, there are no known non-stormwater discharges that will be connected to the proposed stormwater collection system that would convey pollutants directly to groundwater or surface waters.

PROPOSED DRAINAGE CONVEYANCE SYSTEM

The proposed stormwater conveyance system includes a catch basin, an underground infiltration system, an Outlet Control Structure, and associated piping. The proposed system has been designed for a 25-year 24-hour storm event utilizing the Rational Method. The Manning equation was used to model the stormwater conveyance system and perform the hydraulic analysis of the system. The following criteria were used to design the conveyance system:

- Manholes are provided at directional changes, connections, and conduit size increases.
- Pipes are designed to convey the 25-year stormwater event.
- All new conduit is HDPE pipe sized 12" diameter or larger.
- Minimum pipe velocity is 4.87 feet per second.
- Maximum pipe velocity is 9.00 feet per second.

All pipes are modeled in the hydraulic calculations in Appendix B of this report.

SUMMARY

The proposed developments at the Gath Pool in Newton will be creating new, non-vehicular, impervious areas. The post-development stormwater management system has been designed in accordance with the Massachusetts Stormwater Handbook requirements. The proposed stormwater management system addresses both the quantity and quality of the stormwater runoff well beyond the minimum requirements of the Massachusetts Stormwater Handbook. The stormwater management system promotes recharge and ultimately provides reductions in peak runoff rate within the hydrologic analysis area for the design storm events. The development of the property is proposed to improve existing conditions and the stormwater discharges to the area's natural resources.

APPENDIX A

Aerial Map
NRCS Soils Map
FEMA Firmette
IDF Curve
TR-55 Curve numbers
Design Storms
Stormwater Checklist
Test Pit Logs

Map Scale: 1:2,550 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 35 70 140 210

Feet: 0 100 200 400 600

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

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 1:25,000.

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: Middlesex County, Massachusetts
Survey Area Data: Version 22, Sep 9, 2022

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

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
253C	Hinckley loamy sand, 8 to 15 percent slopes	A	4.2	14.4%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	A	0.7	2.5%
629C	Canton-Charlton-Urban land complex, 3 to 15 percent slopes	A	0.6	2.1%
654	Udorthents, loamy		23.5	81.1%
Totals for Area of Interest			**29.1**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

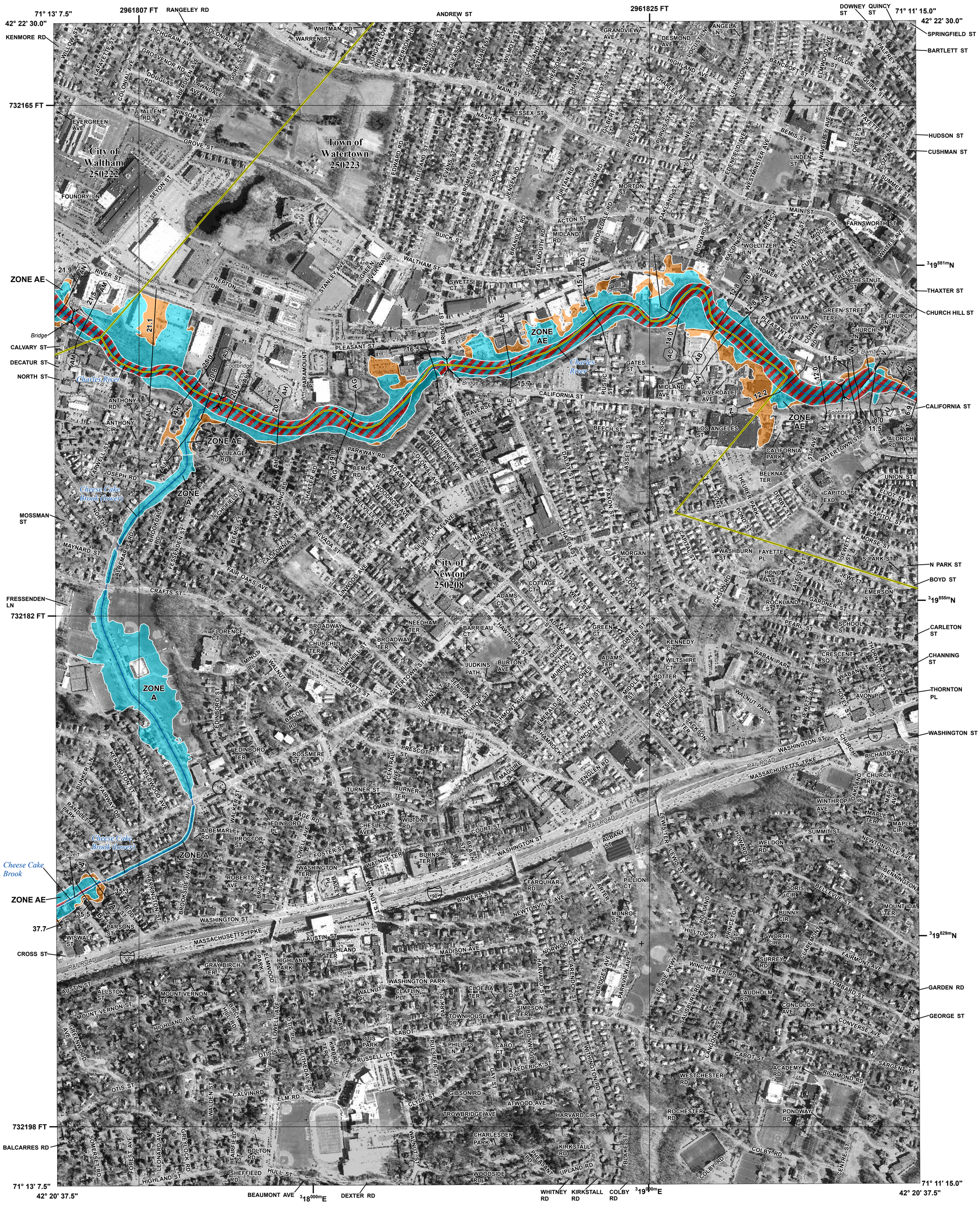
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



FLOOD HAZARD INFORMATION

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

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT HTTPS://MSC.FEMA.GOV

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

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

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Area of Undetermined Flood Hazard *Zone D*

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

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

NOTES TO USERS

For information and questions about this Flood Insurance Rate Map (FIRM), available products associated with this FIRM, including historic versions, the current map date for each FIRM panel, how to order products, or the National Flood Insurance Program (NFIP) in general, please call the FEMA Mapping and Insurance eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Flood Map Service Center website at https://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 website.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Flood Map Service Center at the number listed above.

For community and countywide map dates refer to 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.

Base map information shown on the FIRM uses imagery from 2019 provided by the U.S. Geological Survey at a resolution of 0.15 meter and 2016 transportation data provided by the U.S. Census Bureau with an undefined scale, and political boundaries from 2017 provided by MassGIS at a scale of 1:5,000.

SCALE

N

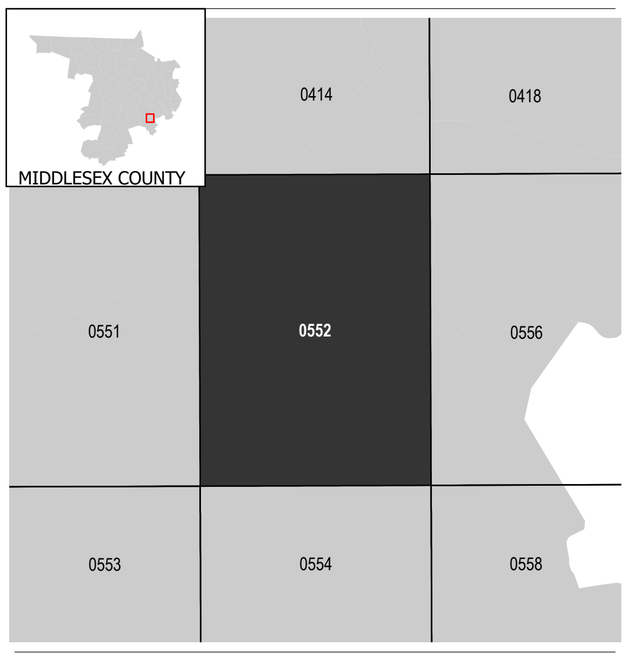
Map Projection:
NAD 1983 State Plane, Massachusetts Mainland, FIPS 2001, Feet; Western Hemisphere; Vertical Datum: NAVD 88

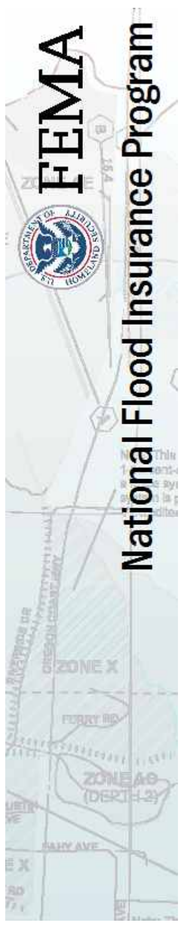
1 inch = 500 feet — 1:6,000

0 — 500 — 1,000 — 2,000 feet

0 — 125 — 250 — 500 meters

PANEL LOCATOR





NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

MIDDLESEX COUNTY, MASSACHUSETTS
(All Jurisdictions)

PANEL 0552 OF 0656

FEMA

Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
NEWTON, CITY OF	250208	0552	F
WALTHAM, CITY OF	250222	0552	F
WATERTOWN, TOWN OF	250223	0552	F

PRELIMINARY
08/13/2021

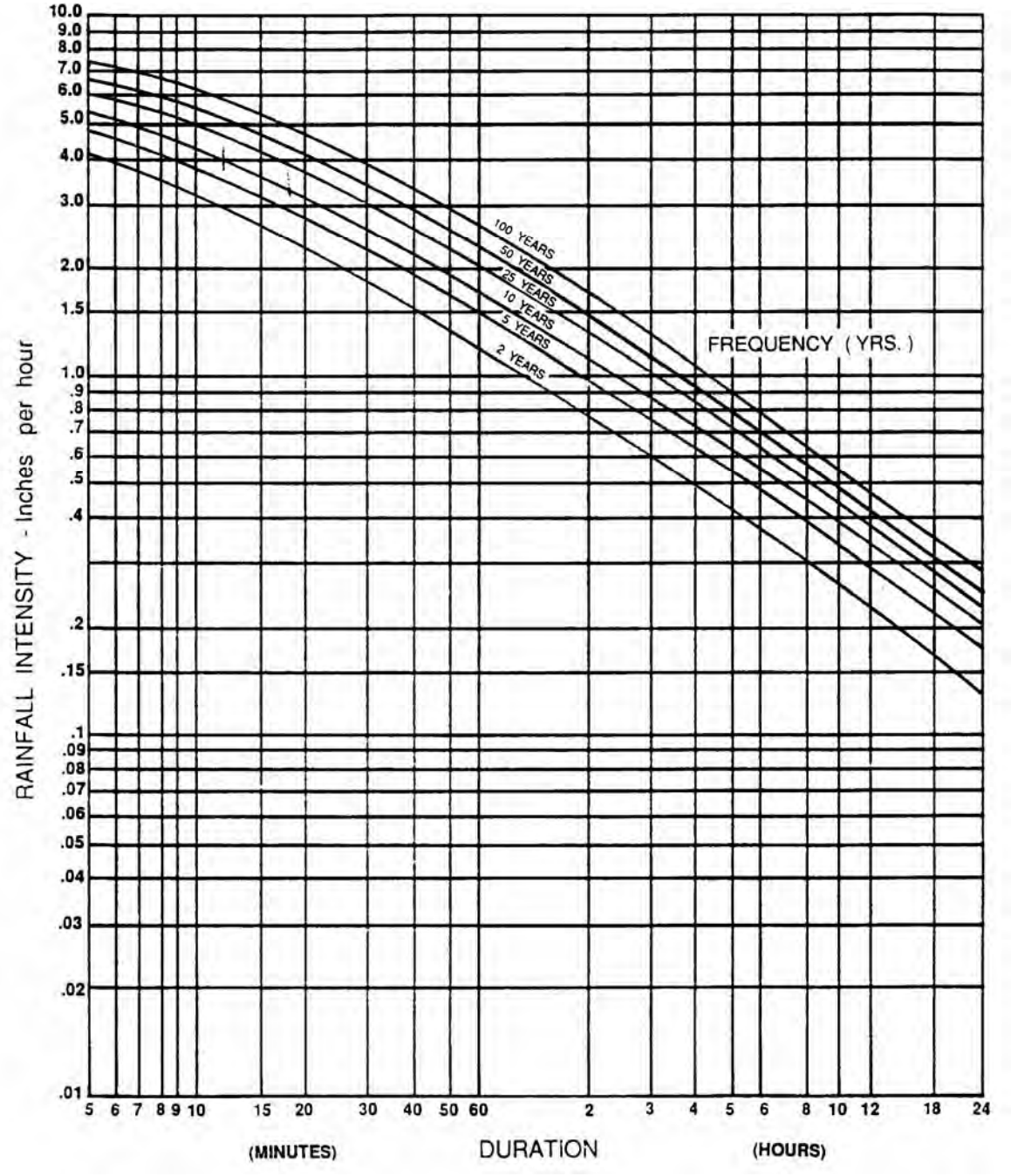
VERSION NUMBER
2.6.3.6

MAP NUMBER
25017C0552F

MAP REVISED

Exhibit 8-12

Intensity – Duration – Frequency Curve for Boston, MA



Source: TR55 - Urban Hydrology for Small Wetlands, NRCS

Table 2-2a Runoff curve numbers for urban areas [1]

Cover description: Cover type and hydrologic condition	Average percent impervious area [2]	Curve numbers for hydrologic soil group: A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

[1] Average runoff condition, and $I_a = 0.2S$.

[2] The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

[3] CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

[4] Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

[5] Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

F-1. Rainfall Data for Massachusetts from *Rainfall Frequency Atlas of the United States* (TP-40)

- Users of this Handbook should note that current MA DEP written guidance (see DEP Waterlines newsletter -- Fall 2000) requires the use of TP-40 Rainfall Data for calculations under the Wetlands Protection Regulations and the Stormwater Management Policy. More stringent design storms may be used under a local bylaw or ordinance. However, DEP will continue to require the use of TP-40 in any case it reviews under the Wetlands Protection Act and Stormwater Management Policy.

Adjusted Technical Paper 40 Design Storms for 24-hour Event by County

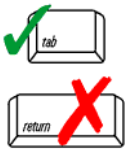
County Name	1-yr 24-hr	2-yr 24-hr	5-yr 24-hr	10-yr 24-hr	25-yr 24-hr	50-yr 24-hr	100-yr 24-hr
Barnstable	2.5	3.6	4.5	4.8	5.7	6.4	7.1
Berkshire	2.5	2.9	3.8	4.4	5.1	5.9	6.4
Bristol	2.5	3.4	4.3	4.8	5.6	6.3	7.0
Dukes	2.5	3.6	4.6	4.9	5.8	6.5	7.2
Essex	2.5	3.1	3.9	4.5	5.4	5.9	6.5
Franklin	2.5	2.9	3.8	4.3	5.1	5.8	6.2
Hampden	2.5	3.0	4.0	4.6	5.3	6.0	6.5
Hampshire	2.5	3.0	3.9	4.5	5.2	5.9	6.4
Middlesex	2.5	3.1	4.0	4.5	5.3	5.9	6.5
Nantucket	2.5	3.6	4.6	4.9	5.8	6.5	7.2
Norfolk	2.5	3.2	4.1	4.7	5.5	6.1	6.7
Plymouth	2.5	3.4	4.3	4.7	5.6	6.2	7.0
Suffolk	2.5	3.2	4.0	4.6	5.5	6.0	6.6
Worcester	2.5	3.0	4.0	4.5	5.3	5.9	6.5

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

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[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☐ New development

☒ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☒ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☒ Reduced Impervious Area (Redevelopment Only)
- ☒ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☐ Use of “country drainage” versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☒ Other (describe): Underground Infiltration System

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☐ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☒ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☐ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☒ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☒ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☐ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☒ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☐ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☐ Name of the stormwater management system owners;
- ☐ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☐ Description and delineation of public safety features;
- ☐ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☐ An Illicit Discharge Compliance Statement is attached;

☒ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

PARE CORPORATION

8 BLACKSTONE VALLEY PLACE, LINCOLN, RHODE ISLAND

ENGINEERS *** PLANNERS *** CONSULTANTS

TEST HOLE NO. **TP-1**

SHEET 1 OF 1

Property Owner: City of Newton

Project: Gath Pool — Contractor: Newton DPW

Property Location: 256 Albemarle Road, Newton, MA — Excavator: Backhoe

Date of Test Hole: April 10, 2023

Soil Evaluator: Spencer Lynds SE#14275 — State / Date of Exam: MA

Weather: Clear — Shaded: Yes ☐ No ☐

SAMPLE DESCRIPTION

Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox Description			Texture	Structure	Consistence	Percent Gravel Cobbles Stone
		Dist	Topo	Matrix	Re-Dox Features	Ab.	S.	Con.				
Fill A	0-10								SL	Massive	FRIABLE	0% C/S
Fill B	10-24								CS	Massive	LOOSE	25% C/S
C1	24-66			Redox	48"				CS	Massive	LOOSE	25% C/S

Soil Class: CLASS A — Total Depth of Test Hole: 66"

Depth to Groundwater or Seepage: N/A — Depth to Impervious or Limiting Layer: 66"

Estimated Seasonal High Water Table: 48" — Surface Elevation of Test Pit (approximate): -

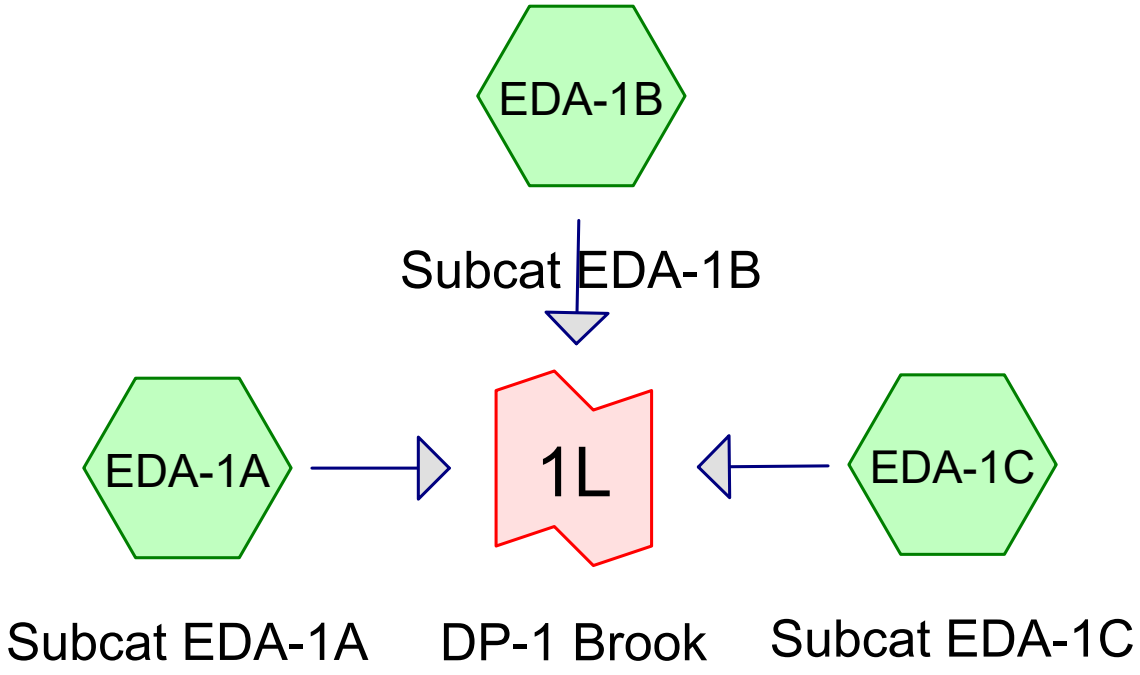
COMMENTS:

Very course and stony natural material, Fill materials consist of topsoil and legacy common borrow.

TEST HOLE NO. **TP-1**

APPENDIX B

Hydrologic Calculations – Existing and Proposed Conditions



Subcat Reach Pond Link

Routing Diagram for ex hydro
Prepared by HP Inc., Printed 5/8/2023

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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 EDA-1A: Subcat EDA-1A Runoff Area=59,875 sf 71.87% Impervious Runoff Depth>1.32"
Tc=6.0 min CN=81 Runoff=3.41 cfs 6,575 cf

Subcatchment EDA-1B: Subcat EDA-1B Runoff Area=15,820 sf 59.98% Impervious Runoff Depth>0.91"
Tc=6.0 min CN=74 Runoff=0.63 cfs 1,202 cf

Subcatchment EDA-1C: Subcat EDA-1C Runoff Area=4,142 sf 100.00% Impervious Runoff Depth>2.71"
Tc=6.0 min CN=98 Runoff=0.41 cfs 935 cf

Link 1L: DP-1 Brook Inflow=4.44 cfs 8,712 cf
Primary=4.44 cfs 8,712 cf

Total Runoff Area = 79,836 sf Runoff Volume = 8,712 cf Average Runoff Depth = 1.31"
29.03% Pervious = 23,174 sf 70.97% Impervious = 56,663 sf

Summary for Subcatchment EDA-1A: Subcat EDA-1A

Runoff = 3.41 cfs @ 11.97 hrs, Volume= 6,575 cf, Depth> 1.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-YR Rainfall=3.16"

Area (sf)	CN	Description
16,843	39	>75% Grass cover, Good, HSG A
39,001	98	Paved parking, HSG A
4,031	98	Roofs, HSG A
59,875	81	Weighted Average
16,843		28.13% Pervious Area
43,032		71.87% Impervious Area

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

Summary for Subcatchment EDA-1B: Subcat EDA-1B

Runoff = 0.63 cfs @ 11.98 hrs, Volume= 1,202 cf, Depth> 0.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-YR Rainfall=3.16"

Area (sf)	CN	Description
6,331	39	>75% Grass cover, Good, HSG A
9,489	98	Paved parking, HSG A
15,820	74	Weighted Average
6,331		40.02% Pervious Area
9,489		59.98% Impervious Area

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

Summary for Subcatchment EDA-1C: Subcat EDA-1C

Runoff = 0.41 cfs @ 11.96 hrs, Volume= 935 cf, Depth> 2.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-YR Rainfall=3.16"

Area (sf)	CN	Description
2,158	98	Paved parking, HSG A
1,984	98	Roofs, HSG A
0	39	>75% Grass cover, Good, HSG A
4,142	98	Weighted Average
0		0.00% Pervious Area
4,142		100.00% Impervious Area

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

Summary for Link 1L: DP-1 Brook

Inflow Area = 79,836 sf, 70.97% Impervious, Inflow Depth > 1.31" for 2-YR event
Inflow = 4.44 cfs @ 11.97 hrs, Volume= 8,712 cf
Primary = 4.44 cfs @ 11.97 hrs, Volume= 8,712 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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 EDA-1A: Subcat EDA-1A Runoff Area=59,875 sf 71.87% Impervious Runoff Depth>2.58"
Tc=6.0 min CN=81 Runoff=6.52 cfs 12,873 cf

Subcatchment EDA-1B: Subcat EDA-1B Runoff Area=15,820 sf 59.98% Impervious Runoff Depth>2.00"
Tc=6.0 min CN=74 Runoff=1.37 cfs 2,638 cf

Subcatchment EDA-1C: Subcat EDA-1C Runoff Area=4,142 sf 100.00% Impervious Runoff Depth>4.16"
Tc=6.0 min CN=98 Runoff=0.63 cfs 1,437 cf

Link 1L: DP-1 Brook Inflow=8.51 cfs 16,947 cf
Primary=8.51 cfs 16,947 cf

Total Runoff Area = 79,836 sf Runoff Volume = 16,947 cf Average Runoff Depth = 2.55"
29.03% Pervious = 23,174 sf 70.97% Impervious = 56,663 sf

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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 EDA-1A: Subcat EDA-1A Runoff Area=59,875 sf 71.87% Impervious Runoff Depth>3.64"
Tc=6.0 min CN=81 Runoff=9.04 cfs 18,178 cf

Subcatchment EDA-1B: Subcat EDA-1B Runoff Area=15,820 sf 59.98% Impervious Runoff Depth>2.96"
Tc=6.0 min CN=74 Runoff=2.00 cfs 3,907 cf

Subcatchment EDA-1C: Subcat EDA-1C Runoff Area=4,142 sf 100.00% Impervious Runoff Depth>5.30"
Tc=6.0 min CN=98 Runoff=0.79 cfs 1,828 cf

Link 1L: DP-1 Brook Inflow=11.83 cfs 23,913 cf
Primary=11.83 cfs 23,913 cf

Total Runoff Area = 79,836 sf Runoff Volume = 23,913 cf Average Runoff Depth = 3.59"
29.03% Pervious = 23,174 sf 70.97% Impervious = 56,663 sf

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

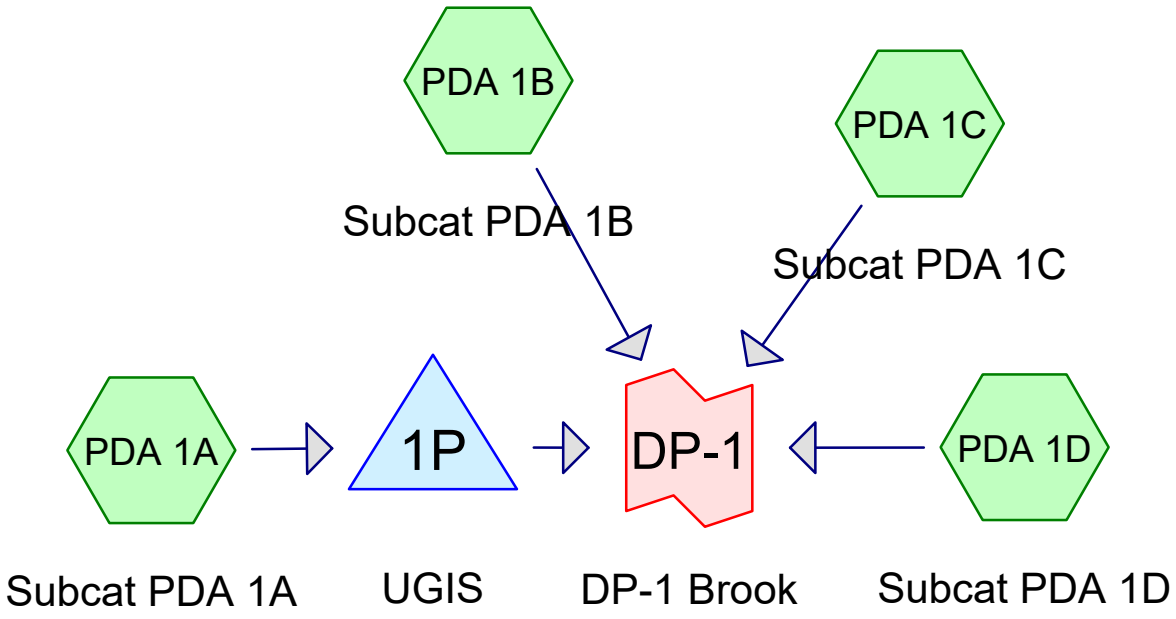
Subcatchment EDA-1A: Subcat EDA-1A Runoff Area=59,875 sf 71.87% Impervious Runoff Depth>6.07"
Tc=6.0 min CN=81 Runoff=14.59 cfs 30,297 cf

Subcatchment EDA-1B: Subcat EDA-1B Runoff Area=15,820 sf 59.98% Impervious Runoff Depth>5.24"
Tc=6.0 min CN=74 Runoff=3.44 cfs 6,909 cf

Subcatchment EDA-1C: Subcat EDA-1C Runoff Area=4,142 sf 100.00% Impervious Runoff Depth>7.76"
Tc=6.0 min CN=98 Runoff=1.16 cfs 2,678 cf

Link 1L: DP-1 Brook Inflow=19.19 cfs 39,884 cf
Primary=19.19 cfs 39,884 cf

Total Runoff Area = 79,836 sf Runoff Volume = 39,884 cf Average Runoff Depth = 5.99"
29.03% Pervious = 23,174 sf 70.97% Impervious = 56,663 sf



Subcat Reach Pond Link

Routing Diagram for pro hydro
Prepared by HP Inc., Printed 5/8/2023

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 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 PDA 1A: Subcat PDA 1A Runoff Area=31,367 sf 99.99% Impervious Runoff Depth=2.93"
Tc=6.0 min CN=98 Runoff=2.21 cfs 7,653 cf

Subcatchment PDA 1B: Subcat PDA 1B Runoff Area=37,411 sf 46.79% Impervious Runoff Depth=0.67"
Tc=6.0 min CN=67 Runoff=0.56 cfs 2,077 cf

Subcatchment PDA 1C: Subcat PDA 1C Runoff Area=6,944 sf 7.99% Impervious Runoff Depth=0.03"
Tc=6.0 min CN=44 Runoff=0.00 cfs 16 cf

Subcatchment PDA 1D: Subcat PDA 1D Runoff Area=4,142 sf 99.86% Impervious Runoff Depth=2.93"
Tc=6.0 min CN=98 Runoff=0.29 cfs 1,010 cf

Pond 1P: UGIS Peak Elev=28.44' Storage=2,353 cf Inflow=2.21 cfs 7,653 cf
Discarded=0.22 cfs 7,409 cf Primary=0.37 cfs 243 cf Outflow=0.59 cfs 7,653 cf

Link DP-1: DP-1 Brook Inflow=0.84 cfs 3,347 cf
Primary=0.84 cfs 3,347 cf

Total Runoff Area = 79,863 sf Runoff Volume = 10,756 cf Average Runoff Depth = 1.62"
32.93% Pervious = 26,301 sf 67.07% Impervious = 53,562 sf

Summary for Subcatchment PDA 1A: Subcat PDA 1A

Runoff = 2.21 cfs @ 12.08 hrs, Volume= 7,653 cf, Depth= 2.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
2	39	>75% Grass cover, Good, HSG A
27,534	98	Paved parking, HSG A
3,821	98	Roofs, HSG A
9	98	Unconnected pavement, HSG A
31,367	98	Weighted Average
2		0.01% Pervious Area
31,364		99.99% Impervious Area
9		0.03% Unconnected

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

Summary for Subcatchment PDA 1B: Subcat PDA 1B

Runoff = 0.56 cfs @ 12.10 hrs, Volume= 2,077 cf, Depth= 0.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
19,905	39	>75% Grass cover, Good, HSG A
11,192	98	Paved parking, HSG A
4,244	98	Roofs, HSG A
2,070	98	Unconnected pavement, HSG A
37,411	67	Weighted Average
19,905		53.21% Pervious Area
17,506		46.79% Impervious Area
2,070		11.82% Unconnected

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

Summary for Subcatchment PDA 1C: Subcat PDA 1C

Runoff = 0.00 cfs @ 16.78 hrs, Volume= 16 cf, Depth= 0.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
6,389	39	>75% Grass cover, Good, HSG A
555	98	Paved parking, HSG A
6,944	44	Weighted Average
6,389		92.01% Pervious Area
555		7.99% Impervious Area

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

Summary for Subcatchment PDA 1D: Subcat PDA 1D

Runoff = 0.29 cfs @ 12.08 hrs, Volume= 1,010 cf, Depth= 2.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
6	39	>75% Grass cover, Good, HSG A
2,150	98	Paved parking, HSG A
1,986	98	Roofs, HSG A
4,142	98	Weighted Average
6		0.14% Pervious Area
4,136		99.86% Impervious Area

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

Summary for Pond 1P: UGIS

Inflow Area = 31,367 sf, 99.99% Impervious, Inflow Depth = 2.93" for 2-Year event
Inflow = 2.21 cfs @ 12.08 hrs, Volume= 7,653 cf
Outflow = 0.59 cfs @ 12.43 hrs, Volume= 7,653 cf, Atten= 73%, Lag= 21.1 min
Discarded = 0.22 cfs @ 11.39 hrs, Volume= 7,409 cf
Primary = 0.37 cfs @ 12.43 hrs, Volume= 243 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 28.44' @ 12.43 hrs Surf.Area= 1,135 sf Storage= 2,353 cf

Plug-Flow detention time= 68.4 min calculated for 7,651 cf (100% of inflow)
Center-of-Mass det. time= 68.4 min (825.1 - 756.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	25.00'	974 cf	**7.00'W x 162.17'L x 4.00'H Field A** 4,541 cf Overall - 1,589 cf Embedded = 2,952 cf x 33.0% Voids
#2A	25.50'	1,589 cf	**Cultec R-360HD** x 43 Inside #1 Effective Size= 54.9"W x 36.0"H => 9.99 sf x 3.67'L = 36.6 cf Overall Size= 60.0"W x 36.0"H x 4.17'L with 0.50' Overlap Cap Storage= +6.5 cf x 2 x 1 rows = 12.9 cf
		2,563 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	25.00'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	28.35'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.22 cfs @ 11.39 hrs HW=25.04' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.22 cfs)

Primary OutFlow Max=0.37 cfs @ 12.43 hrs HW=28.44' (Free Discharge)
↑**2=Sharp-Crested Rectangular Weir** (Weir Controls 0.37 cfs @ 1.00 fps)

Pond 1P: UGIS - Chamber Wizard Field A

Chamber Model = Cultec R-360HD (Cultec Recharger® 360HD)
Effective Size= 54.9"W x 36.0"H => 9.99 sf x 3.67'L = 36.6 cf
Overall Size= 60.0"W x 36.0"H x 4.17'L with 0.50' Overlap
Cap Storage= +6.5 cf x 2 x 1 rows = 12.9 cf

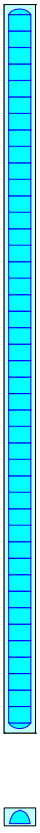
43 Chambers/Row x 3.67' Long +1.25' Cap Length x 2 = 160.17' Row Length +12.0" End Stone x 2 = 162.17' Base Length
1 Rows x 60.0" Wide + 12.0" Side Stone x 2 = 7.00' Base Width
6.0" Stone Base + 36.0" Chamber Height + 6.0" Stone Cover = 4.00' Field Height

43 Chambers x 36.6 cf + 6.5 cf Cap Volume x 2 x 1 Rows = 1,588.6 cf Chamber Storage

4,540.7 cf Field - 1,588.6 cf Chambers = 2,952.0 cf Stone x 33.0% Voids = 974.2 cf Stone Storage

Chamber Storage + Stone Storage = 2,562.8 cf = 0.059 af
Overall Storage Efficiency = 56.4%
Overall System Size = 162.17' x 7.00' x 4.00'

43 Chambers
168.2 cy Field
109.3 cy Stone



Stage-Discharge for Pond 1P: UGIS

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)
25.00	0.00	**0.00**	0.00
25.05	0.22	**0.22**	0.00
25.10	0.22	0.22	0.00
25.15	0.22	0.22	0.00
25.20	0.22	0.22	0.00
25.25	0.22	0.22	0.00
25.30	0.22	0.22	0.00
25.35	0.22	0.22	0.00
25.40	0.22	0.22	0.00
25.45	0.22	0.22	0.00
25.50	0.22	0.22	0.00
25.55	0.22	0.22	0.00
25.60	0.22	0.22	0.00
25.65	0.22	0.22	0.00
25.70	0.22	0.22	0.00
25.75	0.22	0.22	0.00
25.80	0.22	0.22	0.00
25.85	0.22	0.22	0.00
25.90	0.22	0.22	0.00
25.95	0.22	0.22	0.00
26.00	0.22	0.22	0.00
26.05	0.22	0.22	0.00
26.10	0.22	0.22	0.00
26.15	0.22	0.22	0.00
26.20	0.22	0.22	0.00
26.25	0.22	0.22	0.00
26.30	0.22	0.22	0.00
26.35	0.22	0.22	0.00
26.40	0.22	0.22	0.00
26.45	0.22	0.22	0.00
26.50	0.22	0.22	0.00
26.55	0.22	0.22	0.00
26.60	0.22	0.22	0.00
26.65	0.22	0.22	0.00
26.70	0.22	0.22	0.00
26.75	0.22	0.22	0.00
26.80	0.22	0.22	0.00
26.85	0.22	0.22	0.00
26.90	0.22	0.22	0.00
26.95	0.22	0.22	0.00
27.00	0.22	0.22	0.00
27.05	0.22	0.22	0.00
27.10	0.22	0.22	0.00
27.15	0.22	0.22	0.00
27.20	0.22	0.22	0.00
27.25	0.22	0.22	0.00
27.30	0.22	0.22	0.00
27.35	0.22	0.22	0.00
27.40	0.22	0.22	0.00
27.45	0.22	0.22	0.00
27.50	0.22	0.22	0.00
27.55	0.22	0.22	0.00
27.60	0.22	0.22	0.00
27.65	0.22	0.22	0.00
27.70	0.22	0.22	0.00
27.75	0.22	0.22	0.00
27.80	0.22	0.22	0.00
27.85	0.22	0.22	0.00
27.90	0.22	0.22	0.00
27.95	0.22	0.22	0.00
28.00	0.22	0.22	0.00
28.05	0.22	0.22	0.00
28.10	0.22	0.22	0.00
28.15	0.22	0.22	0.00
28.20	0.22	0.22	0.00
28.25	0.22	0.22	0.00
28.30	0.22	0.22	0.00
28.35	0.22	0.22	0.00
28.40	0.36	0.22	0.15
28.45	0.63	0.22	0.41
28.50	0.97	0.22	0.75
28.55	1.38	0.22	1.16
28.60	1.83	0.22	1.61
28.65	2.33	0.22	2.12
28.70	2.88	0.22	2.66
28.75	3.46	0.22	3.24
28.80	4.08	0.22	3.86
28.85	4.73	0.22	4.51
28.90	5.41	0.22	5.19
28.95	6.11	0.22	5.90
29.00	**6.85**	0.22	**6.63**

Stage-Area-Storage for Pond 1P: UGIS

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
25.00	**1,135**	0
25.05	1,135	19
25.10	1,135	37
25.15	1,135	56
25.20	1,135	75
25.25	1,135	94
25.30	1,135	112
25.35	1,135	131
25.40	1,135	150
25.45	1,135	169
25.50	1,135	187
25.55	1,135	230
25.60	1,135	273
25.65	1,135	316
25.70	1,135	359
25.75	1,135	402
25.80	1,135	445
25.85	1,135	487
25.90	1,135	530
25.95	1,135	572
26.00	1,135	614
26.05	1,135	656
26.10	1,135	698
26.15	1,135	740
26.20	1,135	782
26.25	1,135	823
26.30	1,135	865
26.35	1,135	906
26.40	1,135	947
26.45	1,135	988
26.50	1,135	1,028
26.55	1,135	1,069
26.60	1,135	1,109
26.65	1,135	1,150
26.70	1,135	1,190
26.75	1,135	1,229
26.80	1,135	1,269
26.85	1,135	1,308
26.90	1,135	1,347
26.95	1,135	1,386
27.00	1,135	1,425
27.05	1,135	1,463
27.10	1,135	1,502
27.15	1,135	1,539
27.20	1,135	1,577
27.25	1,135	1,614
27.30	1,135	1,651
27.35	1,135	1,688
27.40	1,135	1,724
27.45	1,135	1,760
27.50	1,135	1,796
27.55	1,135	1,831
27.60	1,135	1,866
27.65	1,135	1,901
27.70	1,135	1,935
27.75	1,135	1,968
27.80	1,135	2,001
27.85	1,135	2,034
27.90	1,135	2,065
27.95	1,135	2,097
28.00	1,135	2,127
28.05	1,135	2,157
28.10	1,135	2,186
28.15	1,135	2,214
28.20	1,135	2,241
28.25	1,135	2,267
28.30	1,135	2,291
28.35	1,135	2,313
28.40	1,135	2,335
28.45	1,135	2,356
28.50	1,135	2,376
28.55	1,135	2,394
28.60	1,135	2,413
28.65	1,135	2,432
28.70	1,135	2,450
28.75	1,135	2,469
28.80	1,135	2,488
28.85	1,135	2,507
28.90	1,135	2,525
28.95	1,135	2,544
29.00	1,135	**2,563**

Summary for Link DP-1: DP-1 Brook

Inflow Area = 79,863 sf, 67.07% Impervious, Inflow Depth = 0.50" for 2-Year event
Inflow = 0.84 cfs @ 12.10 hrs, Volume= 3,347 cf
Primary = 0.84 cfs @ 12.10 hrs, Volume= 3,347 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 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 PDA 1A: Subcat PDA 1A Runoff Area=31,367 sf 99.99% Impervious Runoff Depth=4.53"
Tc=6.0 min CN=98 Runoff=3.36 cfs 11,850 cf

Subcatchment PDA 1B: Subcat PDA 1B Runoff Area=37,411 sf 46.79% Impervious Runoff Depth=1.64"
Tc=6.0 min CN=67 Runoff=1.59 cfs 5,127 cf

Subcatchment PDA 1C: Subcat PDA 1C Runoff Area=6,944 sf 7.99% Impervious Runoff Depth=0.33"
Tc=6.0 min CN=44 Runoff=0.02 cfs 192 cf

Subcatchment PDA 1D: Subcat PDA 1D Runoff Area=4,142 sf 99.86% Impervious Runoff Depth=4.53"
Tc=6.0 min CN=98 Runoff=0.44 cfs 1,565 cf

Pond 1P: UGIS Peak Elev=28.71' Storage=2,455 cf Inflow=3.36 cfs 11,850 cf
Discarded=0.22 cfs 9,487 cf Primary=2.81 cfs 2,363 cf Outflow=3.03 cfs 11,850 cf

Link DP-1: DP-1 Brook Inflow=4.71 cfs 9,247 cf
Primary=4.71 cfs 9,247 cf

Total Runoff Area = 79,863 sf Runoff Volume = 18,734 cf Average Runoff Depth = 2.81"
32.93% Pervious = 26,301 sf 67.07% Impervious = 53,562 sf

Pond 1P: UGIS - Chamber Wizard Field A

Chamber Model = Cultec R-360HD (Cultec Recharger® 360HD)
Effective Size= 54.9"W x 36.0"H => 9.99 sf x 3.67'L = 36.6 cf
Overall Size= 60.0"W x 36.0"H x 4.17'L with 0.50' Overlap
Cap Storage= +6.5 cf x 2 x 1 rows = 12.9 cf

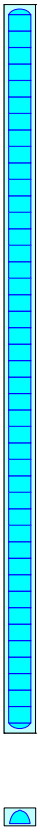
43 Chambers/Row x 3.67' Long +1.25' Cap Length x 2 = 160.17' Row Length +12.0" End Stone x 2 = 162.17' Base Length
1 Rows x 60.0" Wide + 12.0" Side Stone x 2 = 7.00' Base Width
6.0" Stone Base + 36.0" Chamber Height + 6.0" Stone Cover = 4.00' Field Height

43 Chambers x 36.6 cf + 6.5 cf Cap Volume x 2 x 1 Rows = 1,588.6 cf Chamber Storage

4,540.7 cf Field - 1,588.6 cf Chambers = 2,952.0 cf Stone x 33.0% Voids = 974.2 cf Stone Storage

Chamber Storage + Stone Storage = 2,562.8 cf = 0.059 af
Overall Storage Efficiency = 56.4%
Overall System Size = 162.17' x 7.00' x 4.00'

43 Chambers
168.2 cy Field
109.3 cy Stone



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 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 PDA 1A: Subcat PDA 1A Runoff Area=31,367 sf 99.99% Impervious Runoff Depth=5.79"
Tc=6.0 min CN=98 Runoff=4.26 cfs 15,139 cf

Subcatchment PDA 1B: Subcat PDA 1B Runoff Area=37,411 sf 46.79% Impervious Runoff Depth=2.55"
Tc=6.0 min CN=67 Runoff=2.54 cfs 7,958 cf

Subcatchment PDA 1C: Subcat PDA 1C Runoff Area=6,944 sf 7.99% Impervious Runoff Depth=0.75"
Tc=6.0 min CN=44 Runoff=0.08 cfs 433 cf

Subcatchment PDA 1D: Subcat PDA 1D Runoff Area=4,142 sf 99.86% Impervious Runoff Depth=5.79"
Tc=6.0 min CN=98 Runoff=0.56 cfs 1,999 cf

Pond 1P: UGIS Peak Elev=28.81' Storage=2,492 cf Inflow=4.26 cfs 15,139 cf
Discarded=0.22 cfs 10,826 cf Primary=4.02 cfs 4,314 cf Outflow=4.23 cfs 15,139 cf

Link DP-1: DP-1 Brook Inflow=7.18 cfs 14,704 cf
Primary=7.18 cfs 14,704 cf

Total Runoff Area = 79,863 sf Runoff Volume = 25,530 cf Average Runoff Depth = 3.84"
32.93% Pervious = 26,301 sf 67.07% Impervious = 53,562 sf

Pond 1P: UGIS - Chamber Wizard Field A

Chamber Model = Cultec R-360HD (Cultec Recharger® 360HD)
Effective Size= 54.9"W x 36.0"H => 9.99 sf x 3.67'L = 36.6 cf
Overall Size= 60.0"W x 36.0"H x 4.17'L with 0.50' Overlap
Cap Storage= +6.5 cf x 2 x 1 rows = 12.9 cf

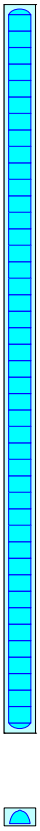
43 Chambers/Row x 3.67' Long +1.25' Cap Length x 2 = 160.17' Row Length +12.0" End Stone x 2 = 162.17' Base Length
1 Rows x 60.0" Wide + 12.0" Side Stone x 2 = 7.00' Base Width
6.0" Stone Base + 36.0" Chamber Height + 6.0" Stone Cover = 4.00' Field Height

43 Chambers x 36.6 cf + 6.5 cf Cap Volume x 2 x 1 Rows = 1,588.6 cf Chamber Storage

4,540.7 cf Field - 1,588.6 cf Chambers = 2,952.0 cf Stone x 33.0% Voids = 974.2 cf Stone Storage

Chamber Storage + Stone Storage = 2,562.8 cf = 0.059 af
Overall Storage Efficiency = 56.4%
Overall System Size = 162.17' x 7.00' x 4.00'

43 Chambers
168.2 cy Field
109.3 cy Stone



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 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 PDA 1A: Subcat PDA 1A Runoff Area=31,367 sf 99.99% Impervious Runoff Depth=8.54"
Tc=6.0 min CN=98 Runoff=6.21 cfs 22,322 cf

Subcatchment PDA 1B: Subcat PDA 1B Runoff Area=37,411 sf 46.79% Impervious Runoff Depth=4.78"
Tc=6.0 min CN=67 Runoff=4.81 cfs 14,892 cf

Subcatchment PDA 1C: Subcat PDA 1C Runoff Area=6,944 sf 7.99% Impervious Runoff Depth=2.05"
Tc=6.0 min CN=44 Runoff=0.33 cfs 1,186 cf

Subcatchment PDA 1D: Subcat PDA 1D Runoff Area=4,142 sf 99.86% Impervious Runoff Depth=8.54"
Tc=6.0 min CN=98 Runoff=0.82 cfs 2,947 cf

Pond 1P: UGIS Peak Elev=28.95' Storage=2,546 cf Inflow=6.21 cfs 22,322 cf
Discarded=0.22 cfs 13,099 cf Primary=5.97 cfs 9,223 cf Outflow=6.19 cfs 22,322 cf

Link DP-1: DP-1 Brook Inflow=11.92 cfs 28,249 cf
Primary=11.92 cfs 28,249 cf

Total Runoff Area = 79,863 sf Runoff Volume = 41,347 cf Average Runoff Depth = 6.21"
32.93% Pervious = 26,301 sf 67.07% Impervious = 53,562 sf

Pond 1P: UGIS - Chamber Wizard Field A

Chamber Model = Cultec R-360HD (Cultec Recharger® 360HD)
Effective Size= 54.9"W x 36.0"H => 9.99 sf x 3.67'L = 36.6 cf
Overall Size= 60.0"W x 36.0"H x 4.17'L with 0.50' Overlap
Cap Storage= +6.5 cf x 2 x 1 rows = 12.9 cf

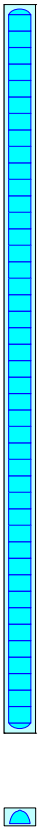
43 Chambers/Row x 3.67' Long +1.25' Cap Length x 2 = 160.17' Row Length +12.0" End Stone x 2 = 162.17' Base Length
1 Rows x 60.0" Wide + 12.0" Side Stone x 2 = 7.00' Base Width
6.0" Stone Base + 36.0" Chamber Height + 6.0" Stone Cover = 4.00' Field Height

43 Chambers x 36.6 cf + 6.5 cf Cap Volume x 2 x 1 Rows = 1,588.6 cf Chamber Storage

4,540.7 cf Field - 1,588.6 cf Chambers = 2,952.0 cf Stone x 33.0% Voids = 974.2 cf Stone Storage

Chamber Storage + Stone Storage = 2,562.8 cf = 0.059 af
Overall Storage Efficiency = 56.4%
Overall System Size = 162.17' x 7.00' x 4.00'

43 Chambers
168.2 cy Field
109.3 cy Stone



APPENDIX C

Recharge Volume Calculation
Water Quality Volume Calculation
Underground Infiltration System Calculation

PARE CORPORATION

PROJECT	Newton Gath Pool	PROJECT NUMBER	23048
SUBJECT	Required Recharge Volume		
COMPUTATIONS BY	CVH	DATE	4/7/2023
CHECK BY		DATE	

Groundwater Recharge Calculation

A. Resources:

MassDEP Stormwater Handbook, 2008 Volume 3

B. Data:

Existing Impervious Area =	56,660	SF
Proposed Impervious Area =	53,564	SF
Net Increase =	-3,096	SF

C. Equation

$$R_v = F \times Impervious\ Area$$

Rv = (0.60'/12") x 4491 SF

R_v = Require Recharge Volume, Ft^3 (soil group A = .60 in)

F = Target Depth Factor

Impervious Area = net impervious area

C. Calculations:

Required Recharge Volume:

Soil Group	Impervious Area (SF)	Required Volume (CF)	Volume Provided* (CF)
A	-3096	-155	*2,313

*Volume provided by the Underground Infiltration System below the invert out at el. 28.35'

PARE CORPORATION

PROJECT	Newton Gath Pool	PROJECT NUMBER	23048
SUBJECT	Required Water Quality Calculations		
COMPUTATIONS BY	CVH	DATE	4/7/2023
CHECK BY		DATE	

Water Quality Calculation

Underground Infiltration System

Vehicular Surface to Basin	0	acres
Vehicular Surface to Basin	0	sf
Required Water Quality Volume (WQV)	0	cf
Provided WQV	2313	CF

PARE CORPORATION

PROJECT	Newton Gath Pool	PROJECT NUMBER	23048.00
SUBJECT	Infiltration Practices		
COMPUTATIONS BY	CVH	DATE	4/7/2023
CHECK BY		DATE	

Underground Infiltration System Calculation

Infiltration System

Total Area to Infiltration System =	31,366	SF
Total Impervious Area =	27,534	SF

Water Quality Volume (WQV)

WQV = Impervious Area x 1.0 inches =	2,295	CF
Required WQV Volume=	**2,295**	**CF**
Volume provided in UGIS =	**2,313**	CF @ Elev 28.35
Total Volume =	**2,313**	**CF**

The impervious area considered are non-vehicular impervious areas and the entire water quality storm is infiltrated.

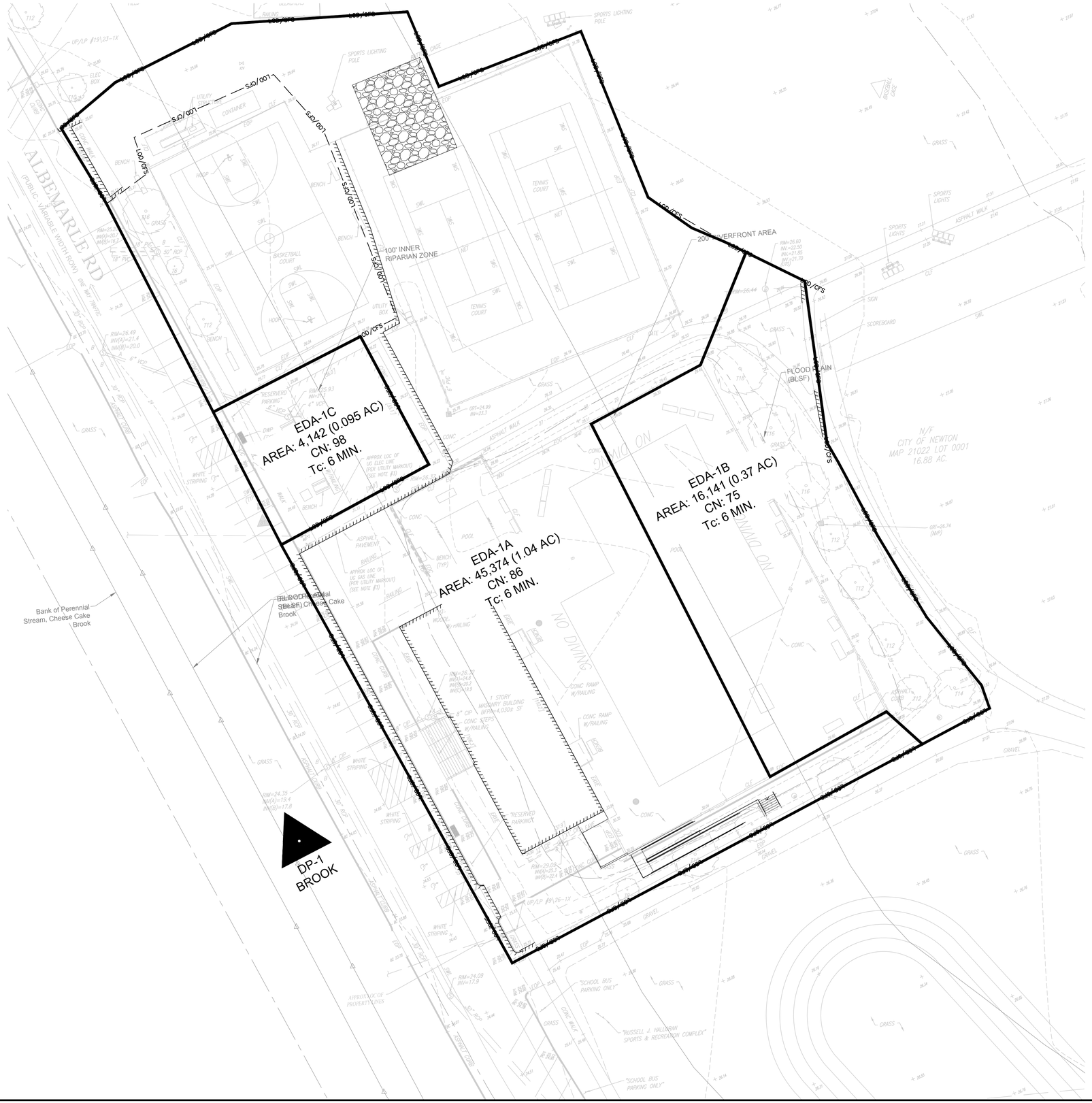
Drawdown within 72 hours

Time = (Provided Volume) / (K x Bottom Area)

Provided Volume =	**2,313**	**CF**	
K = saturated hydraulic conductivity =	**8.27**	**FT/DAY**	
Bottom Area (Average) =	**1,135**	**SF**	
Time (hrs) =	**6**	**hrs**	**< 72 hrs**

APPENDIX D

H1.0 Existing Hydrology
H2.0 Proposed Hydrology



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(617) 350 0450

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

GATH MEMORIAL POOL IMPROVEMENTS

256 ALBEMARLE RD NEWTON, MA 02460
ASSESSOR'S MAP 21022 LOT 0001

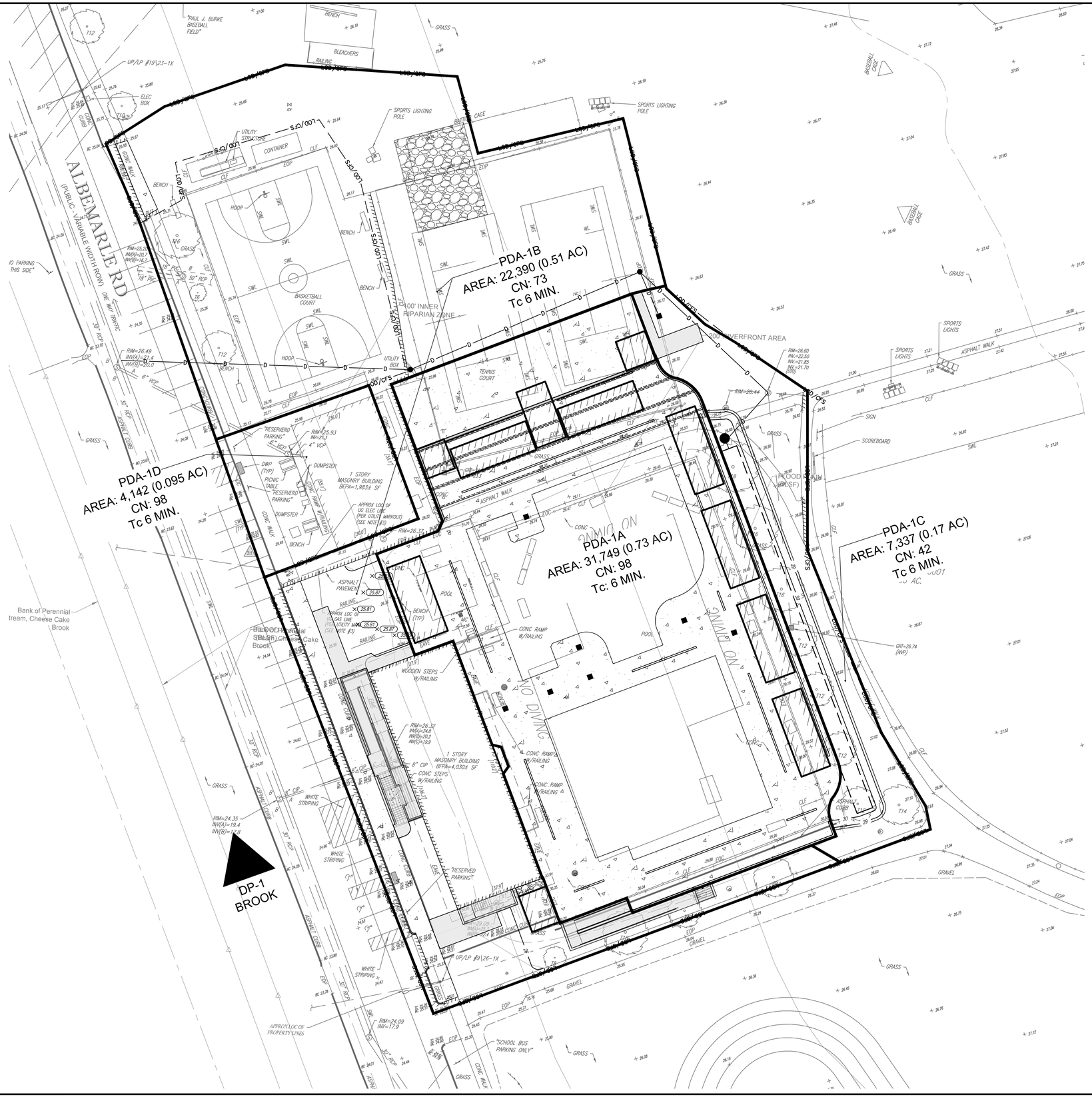
REVISIONS:

PROJECT NO.:	23048.00
DATE:	MAY 5, 2023
SCALE:	
DESIGNED BY:	SL
CHECKED BY:	CH
DRAWN BY:	SB
APPROVED BY:	JJ

DRAWING TITLE:
EXISTING HYDROLOGY

DRAWING NO.:
H1.0

SHEET NO. 1 OF 2



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DESIGNED BY:	SL
CHECKED BY:	CH
DRAWN BY:	SB
APPROVED BY:	JJ

DRAWING TITLE:
PROPOSED HYDROLOGY

DRAWING NO.:
H2.0

SHEET NO. 2 OF 2

APPENDIX E

O&M Report

PARE PROJECT NO. 23048.00

STORMWATER OPERATION AND MAINTENANCE PLAN
LONG TERM POLLUTION PREVENTION PLAN

NEWTON GATH POOL

256 Albemarle Rd,

Newton, Massachusetts

Prepared for:

City of Newton
1000 Commonwealth Ave
Newton Centre, MA

Prepared by:

Pare Corporation
8 Blackstone Valley Place
Lincoln, RI 02865

April 2023

STORMWATER OPERATION AND MAINTENANCE PLAN
LONG TERM POLLUTION PREVENTION PLAN
TABLE OF CONTENTS

STORMWATER OPERATION AND MAINTENANCE PLAN

General Operation and Maintenance Notes

Following construction, the completion of the inspection and maintenance requirements below shall be the responsibility of the Owner (See Attachment OM-1).

1. The parking lot and entry drives shall be swept by the Owner once in the spring and once during the fall to remove sediments.

2. Trash, litter, sediment and other debris shall be removed from any stormwater facility (including catch basins, manholes, erosion control measures, inlets, diversion and outlet structures) at least once per month at the cost of the Owner.

3. The site shall be checked for all signs of erosion monthly. All signs of erosion shall be reported to the owner.

4. All sediments removed shall be disposed of at an approved and permitted location.

5. Snow storage is prohibited in the stormwater BMP's.

6. All cleaning and maintenance of drainage system BMP's shall be the responsibility of the property owner. See additional inspection, maintenance, and repair notes for the stormwater system.

Underground Infiltration/Detention System Inspection, Maintenance, and Repair Notes

1. The system shall be maintained as recommended by the manufacturer.

2. Following storm events with rainfall exceeding 3.1"
    - Inspect infiltration/detention system for trash, debris, sediment, erosion, standing water, and overall performance. Defects shall be repaired by the Owner.

3. Bi-annually
    - Inspections shall be performed a minimum of two times per year on the inspection ports and drainage structures of the underground infiltration/detention system to ensure proper operation of the system.

LONG TERM POLLUTION PREVENTION PLAN

Pollution Prevention and Source Controls

In addition, the following site specific controls and performance procedures shall be followed. From *Massachusetts Erosion and Sediment Control Guidelines.*

G.2 General Pollution Prevention Design Features

An inspection and maintenance schedule shall be developed by the owner to prevent trash and debris from backing up the stormwater management system.

G.3 Solid Waste Containment

Trash and recycling receptacles will be placed throughout the site.

G.4 Roads and Parking Area Management

Snow shall not be dumped and/or stored in the water quality best management practices (Underground Infiltration Area).

G.4.1 Street and Parking Lot Sweeping

The roads shall be swept to remove sediment and debris.

G.4.2 Deicing and Salt Storage

Deicing and sanding materials create water quality problems. Refer to Table G-1 in the Appendix when selecting a deicer. All deicing materials shall be stored under cover.

G 4.3 Snow Disposal

Snow shall not be dumped and/or stored in the sand filter or bioretention area.

G.4.4 Driveway and Parking Lot Sealants

DEM recommends asphalt based sealant rather coal-tar based sealants to be used on driveways and parking lots

G.5 Hazardous Materials Containment

Stormwater shall be prevented from entering areas with hazardous materials to the maximum extent feasible. Spill containment is provided in areas where a spill might occur.

APPENDIX A

BMP, Maintenance and Management Inspection Checklist
OM – 1 Operation and Maintenance Plan (11” x 17”)

Sample Operation and Maintenance Log

Site Maintenance Supervisor: _____ Date: _____

☐ Routine ☐ Response to Rainfall Event _____ in ☐ Other _____

BMP	Frequency	Date Performed	Comments
Yard Drain/ Catch Basins/ Manholes/ Outlet Control Structures	Quarterly Inspections		
	Maintenance as necessary		
	Maintain per manufacturer's recommendations		
Water Quality Structures	Inspect per manufacturer's recommendations		
	Maintain per manufacturer's recommendations		
Vegetated Areas	Maintenance as necessary		
Spring Clean Up	Between April and May		
Sweeping	Biannually		
Grass Fertilization	First Application		
	Second Application		
Tree and Shrub Fertilization	Annual Application		
Grass Mowing	As required		
Mulching	AS required; At least biennially for the Bioretention Area		
Edging	As required		
Weed Control	As required		
Pruning	As required		
Aeration	As required		
Lime Application	As required		
Fall Clean up	Between October and December		
Drainage Piping	Annual Inspection		
	Maintenance as necessary		

UDERGROUND INFILTRATION SYSTEM INSPECTION FORM

Newton Gath Pool

Owner: _____

Property Manager: _____

Inspected by: _____

Date of Inspection: _____

Underground Infiltration System Inspected #_____

Acceptable ☐ Needs Work ☐

NOTES:

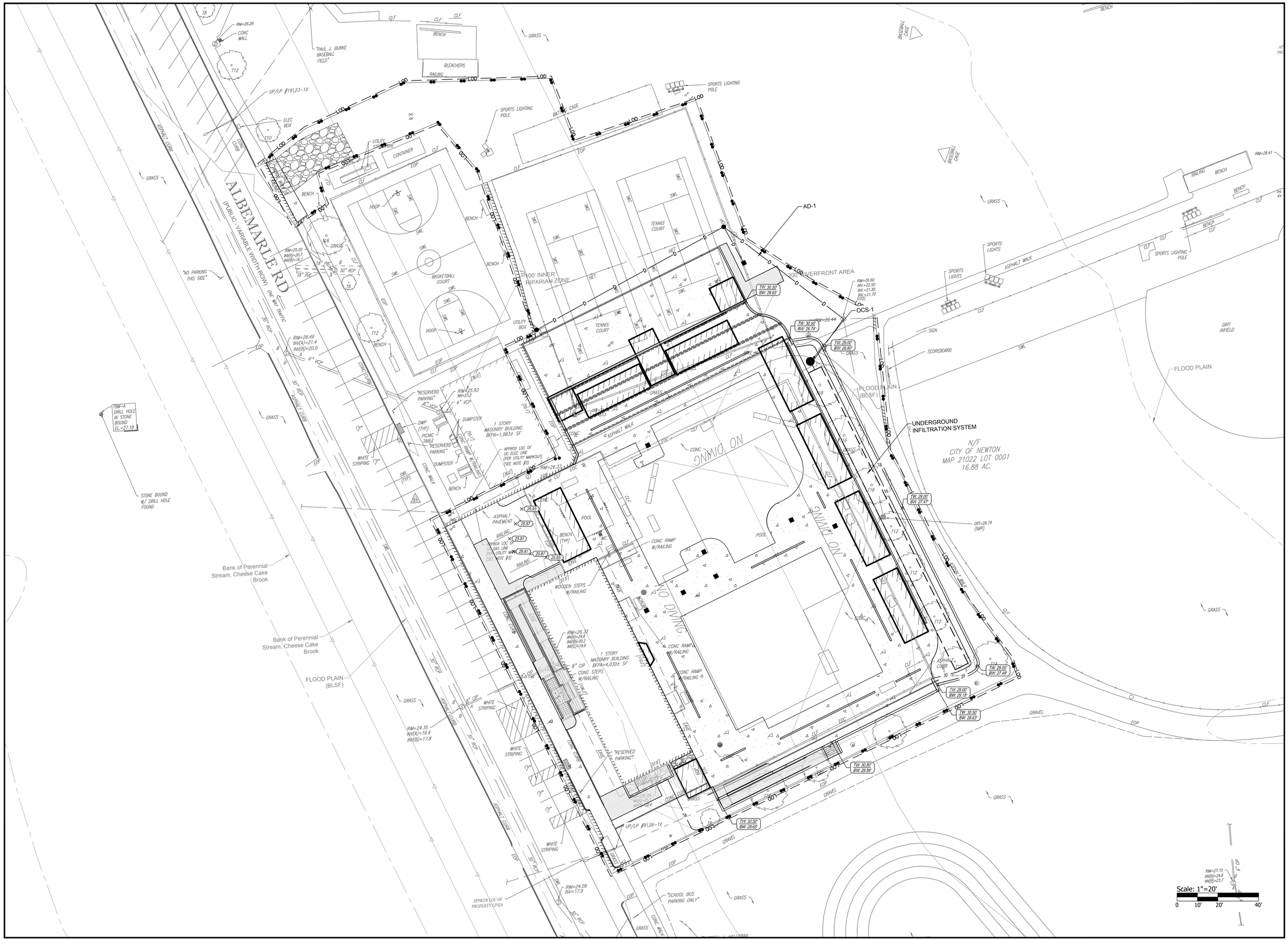
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Date of cleaning: _____ By Whom: _____

Date of repair: _____ By Whom: _____

Note any discrepancies and suggested corrective actions

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____



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DRAWING TITLE:

OPERATION AND MAINTENANCE PLAN

DRAWING NO.:

OM-1

SHEET NO. 1 OF 1