Drainage Analysis

for the

Carlisle Schools
83 School Street
Carlisle, MA 01741
Map 14 / Lot 27-31

Applicant/Owner:

Town of Carlisle
Carlisle School Department
83 School Street
Carlisle, MA 01741

Architect:

HMFH Architects, Inc.
130 Bishop Allen Drive
Cambridge, MA 02139
(617)492-2200 fax(617)876-9775

Representative/Engineer:

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Date:
August 16, 2010

Drainage Analysis for Sharon Middle School

Description of Project

The existing Middle and Elementary School is located on the east side of School Street in Carlisle, MA, and sits on approximately 23.2 acres of town owned land. The schools are located at 83 School Street in Carlisle, MA.

The project scope includes the demolition of the existing parking lot/drop-off loop located off of School Street and the demolition of the existing Spalding classroom building. New construction consists of the renovations of the existing school buildings, and the addition of approximately 32,000 square feet of building space, related parking and bus loop facilities, new electrical, storm drain and sewer utilities will be installed. The existing impervious lot coverage is 279,930 square feet; the proposed construction will result in a total impervious cover of 289,868 square feet.

Drainage improvements include the installation of hooded deep sump catch basins, oil/grit storm water quality separators, bio-retention cells, subsurface detention beds and leach pits to enhance storm water treatment and groundwater recharge.

Study Area

The subject site involves the redevelopment of the existing school campus. The scope of the analysis consist of areas disturbed by the renovations. The subject area lies southeast of the intersection of School and Church Street. The majority of the 23.2 acre site slopes in the easterly direction to the existing resource area located east of the existing middle school building. The area subject to the analysis, consisting of the building and parking facilities slopes towards the west towards School Street and north towards Church Street

The area encompassed by this analysis and design includes all onsite areas that will be disturbed by the proposed construction.

For purpose of design the site was divided into a number of sub-catchment areas. Runoff rates and storm volumes for both the existing and developed conditions were calculated utilizing the SCS TR-20 method following the rainfall intensity indicated in the Nation Weather Bureau Technical Paper 40 for analysis of the 2, 10, 25, and 100 year storm frequencies. A common design point was developed, which encompasses all areas hydrologically disturbed, for a basis of comparison. The majority of the existing soils on site are hydrologic class C soils.

Existing Condition

The site is divided into four (4) sub-catchments. A description of the sub-catchment is as follows:

Sub-catchment E1

This area is approximately 1.3 acres in size and consists of the existing School Street parking loop, portions of the Spalding building roof, woods adjacent to School Street and portions of the existing fire lane/walkways. Storm water from the building roof within this area discharges to grade, which becomes surface runoff. Surface runoff from this area sheet flows across paved walkways and transitions to

shallow concentrated flow as it enters the existing parking loop. The runoff flows down the existing parking lot to School Street, where it flows to the intersection of Church Street. The runoff then flows easterly down Church Street prior to being intercepted by a series of piped catch basins. The runoff discharges from the parking area with no flow or water quality attenuation. The majority of the catchment area corresponds with the Proposed Condition sub-catchment N1 and N1a boundaries to allow comparison of discharge rates.

Sub-catchment E2

This area is approximately 1.8 acres in size and consists of the existing playground area, woods and portions of the Spalding building roof runoff. Storm water from the building roof within this area discharges to grade, which becomes surface runoff. Surface runoff from this area sheet flows across paved walkways, and transitions to shallow concentrated flow as it enters the existing playground area. The runoff flows through the play area into a wooded area consisting and light underbrush until it intersects Church Street. The runoff flows easterly down Church Street prior to being intercepted by a series of piped catch basins. The majority of the catchment area corresponds with Proposed Condition sub-catchment N2 boundary to allow comparison of discharge rates.

Sub-catchment E3

This area is approximately 1.2 acres in size and consists of the existing paved play area and portions of the Spalding, Wilkins and Robbins building roof runoff. Stormwater from the building roofs within this area discharges at grade, which becomes surface runoff. Surface runoff from this area sheet flows across landscaped areas and transitions to shallow concentrated flow as it enters the existing paved play area. The runoff flows through the play area to a piped network of catch basin drain inlets. The piped network flows to the east into the main parking lot, which ultimately connects to the piped drainage network in Church Street. No means of flow or water quality attenuation were noted. The majority of the catchment area corresponds with Proposed Condition sub-catchment N3 and N3a boundaries to allow comparison of discharge rates.

Sub-catchment E4

This area is approximately 0.8 acres in size and consists of existing paved walkways, existing parking facilities and landscaped areas. Storm water runoff from this area sheet flows across landscaped areas and transitions to shallow concentrated flow as it passes the paved walkways. The runoff then flows through the parking facilities and is direct to the existing piped drainage network, which ultimately connects to the piped drainage network in Church Street. No means of flow or water quality attenuation were noted. The majority of the catchment area corresponds with Proposed Condition sub-catchment N4 boundaries to allow comparison of discharge rates.

Summary of peak runoff rates for the existing catchment areas are as follows.

Existing Condition Peak Runoff Rate and Storm Volume					
Catchment		**2-yr**	**10-yr**	**25-yr**	**100-yr**
E1	Rate (cfs)	2.34	3.91	5.01	6.37
E2	Rate (cfs)	2.10	4.01	5.43	7.22
E3	Rate (cfs)	3.43	5.03	6.13	7.46
E4	Rate (cfs)	2.13	3.23	3.99	4.91
DP	Rate (cfs)	9.70	15.73	20.02	25.31

Proposed Condition

The post construction site was divided into six (6) sub-catchments. For the purpose of the analysis the sub-catchment hydrographs were combined to allow comparison with the existing conditions discharge rates.

Sub-catchment N1

This area is approximately 0.4 acres in size. The area consists of the woods adjacent to School Street a small portion of the revised parking loop exit driveway and portions of the existing fire lane/walkways. Stormwater runoff develops in the wooded area north of the parking lot and sheet flows towards School Street. The runoff develops into a concentrated flow as it nears School Street. It then flows to School Street and makes it's way to the intersection of Church Street. The runoff then flows easterly down Church Street prior to being intercepted by a series of piped catch basins. This runoff will continue to flow with no peak attenuation.

Sub-catchment N1a

This area is approximately 0.5 acres in size. The area consists of the new parking facilities adjacent to School Street, walkways for the new parking facilities and portions of the fire lane/walkways. Stormwater runoff develops on the walkway, concentrates as it crosses the parking lot and then enters a swale. The swale discharges the runoff to a Bioretention pond located east of School Street. The Bioretention pond provides water quality treatment and provides peak flow attenuation. The runoff is allowed to overflow onto School Street at a rate lesser than the existing conditions. The runoff then

flows to School Street and makes it's way to the intersection of Church Street. The runoff then flows easterly down Church Street prior to being intercepted by a series of piped catch basins. Given the soil classification of HSG 'C', the Bioretention pond will provide a limited level of groundwater recharge.

Sub-catchment N2

This area is approximately 1.6 acres in size and continues to consists of the existing playground area and woods. Surface runoff from this area sheet flows across the playground area. shallow. The runoff concentrates through the play area into a wooded area consisting and light underbrush until it intersects Church Street. The runoff flows easterly down Church Street prior to being intercepted by a series of piped catch basins.

Sub-catchment N3

This area is approximately 1.2 acres in size and consists of the new play surface, landscaped areas, walkways and Spalding, Wilkins and Robbins building roof runoff. Storm water from the building roofs within this area discharges at grade, which becomes surface runoff. Surface runoff from this area sheet flows through the landscaped areas and transitions to shallow concentrated flow as it enters the playground area. The runoff flows through the play area to a new piped network of hooded deep sump catch basin drain inlets. The piped network flows north to a water quality structure resulting in TSS and oil removal. The drainage is then piped to a subsurface detention bed. An overflow structure discharges the stored runoff to the existing piped drainage network in the main parking lot, which ultimately connects to the piped drainage network in Church Street. At the point of connection to the existing drainage system, a drain manhole has been set up with the capability of allowing overflow to discharge to the existing parking lot, where it will flow to nearby existing catch basins for discharge into the piped drainage network. The revised drainage results in flow and water quality attenuation.

Sub-catchment N3a

This area is approximately 0.3 acres in size and consists of the new paved walkways, new plaza areas and the building addition roof runoff. The new addition runoff is captured either by roof drains in flat areas or gutters and downspouts. The roof drains and downspouts pipe the runoff to a subsurface drainage system which discharges the runoff to two underground leaching pits. Runoff in the plaza is captured by a Stormceptor water quality drain inlet and discharges to the two leaching pits. The leaching pits are equipped with a piped overflow, which discharges to the new drainage network described in Sub-catchment N3. The piped drainage network and leaching pits will provide water quality treatment, peak flow attenuation and recharge. The recharge volume provided by the leaching pits is equivalent to 24,200 square feet of impervious cover in HSG 'C' soil per MassDEP regulations.

Sub-catchment N4

This area is approximately 0.7 acres in size and consists of existing paved walkways, existing parking facilities, landscaped areas and new paved walkways. Storm water runoff from this area sheet flows across landscaped areas and transitions to shallow concentrated flow as it passes the paved walkways. The runoff then flows through the parking facilities and is direct to the existing piped drainage network, which ultimately connects to the piped drainage network in Church Street. This area continues to have no means of flow or water quality attenuation.

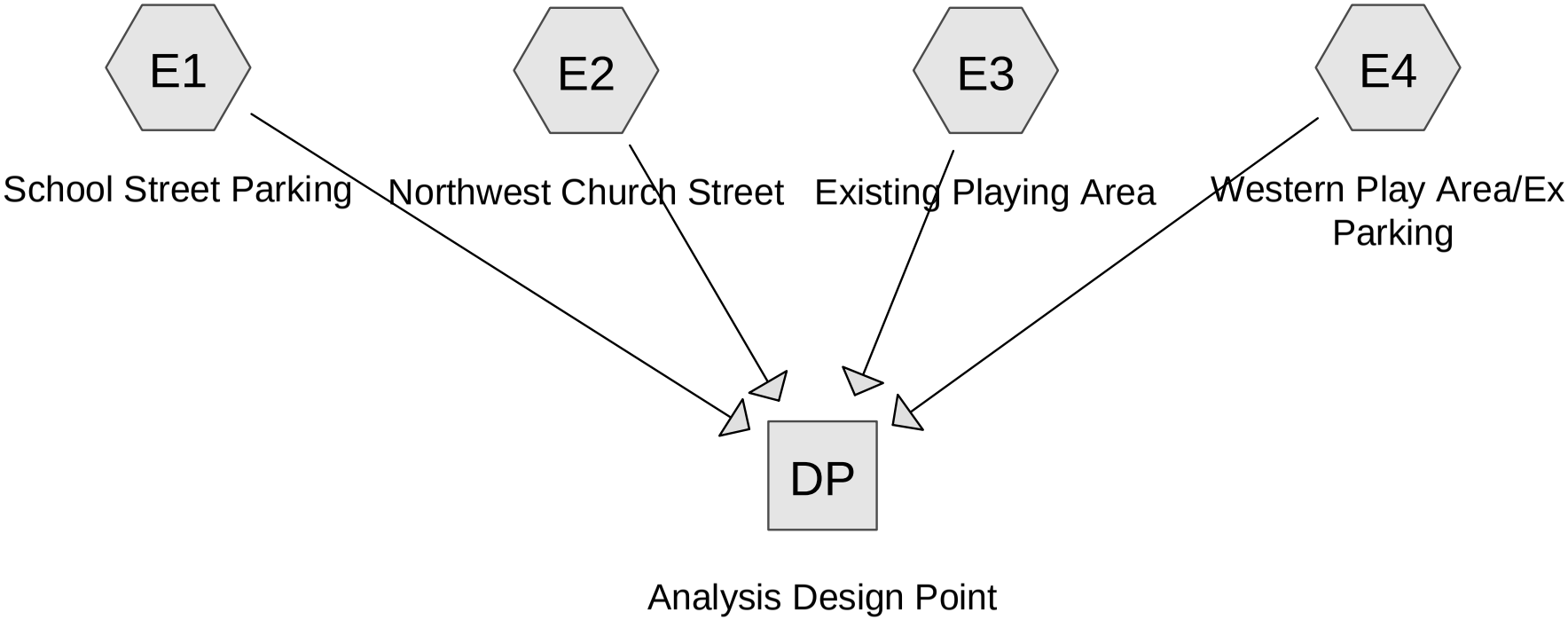
Summary of peak runoff rates for the proposed catchment areas are as follows.

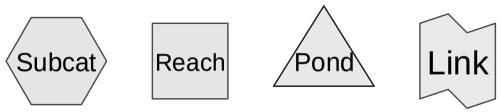
Developed Condition Peak Runoff Rate and Storm Volume					
Catchment		**2-yr**	**10-yr**	**25-yr**	**100-yr**
Design Point (N1 & N1a)	Rate (cfs)	1.75	2.91	3.73	4.75
N2	Rate (cfs)	1.75	3.49	4.80	6.46
Design Point (N3 & N3a)	Rate (cfs)	3.95	5.73	6.90	8.43
N4	Rate (cfs)	1.83	2.81	3.48	4.30
DP	Rate (cfs)	9.13	14.71	18.62	23.52

In exception of sub-catchment N3/N3a, the peak runoff rates are reduced for all sub-catchments for the 2, 10, 25 and 100 year storm events. Overall, the analysis indicates that the composite site runoff will be reduced by 5% for the 2 year storm event, 6.5% for the 10 year storm event, 7% for the 25 year storm event and 7% for the 100 year storm event.

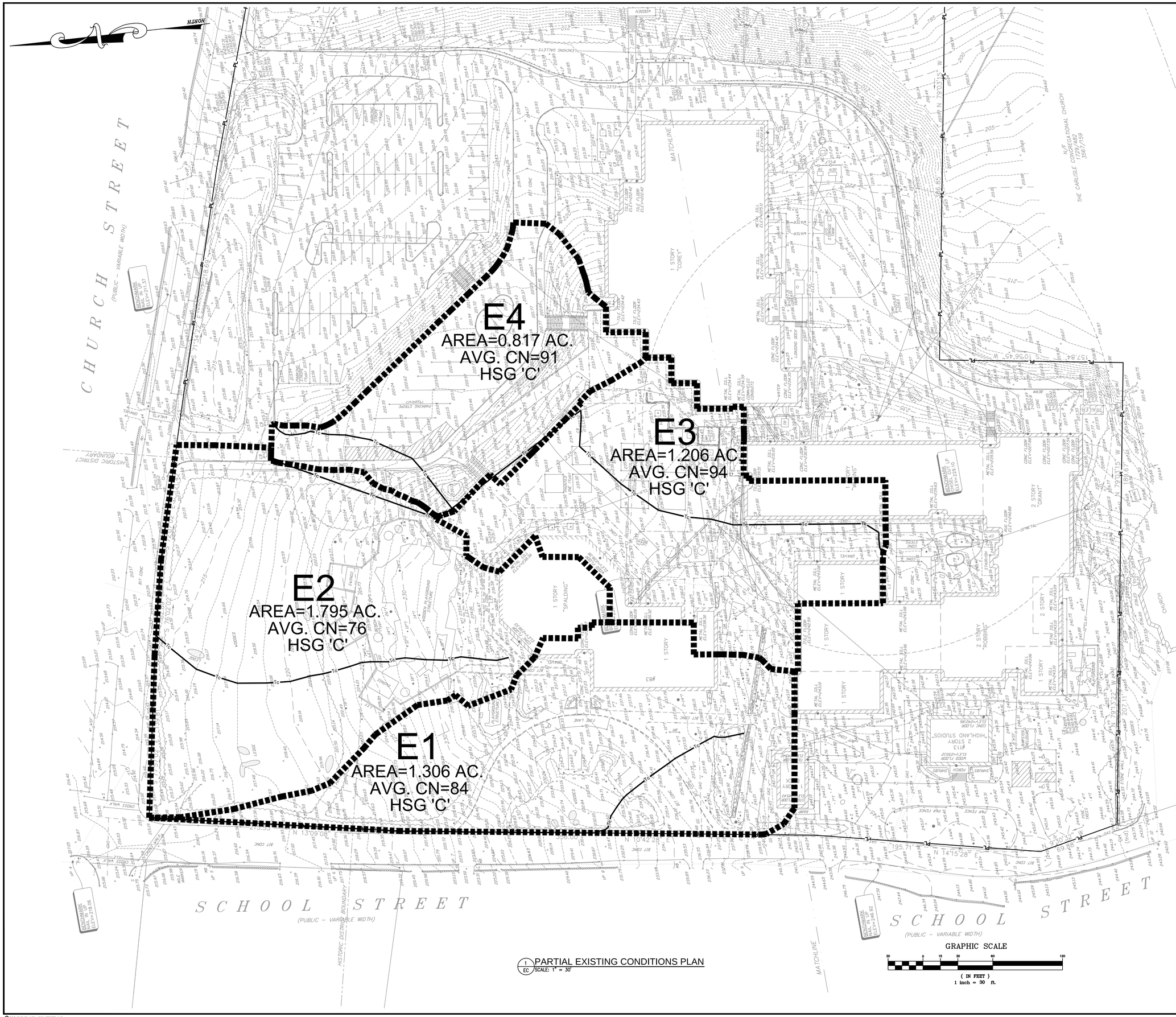
Project: Carlisle Schools
Location: Carlisle, MA

Drainage Calculations
Existing Conditions





Drainage Diagram for Existing Conditions
Prepared by Garcia, Galuska, DeSousa, Inc.
HydroCAD® 8.50 s/n 001076 © 2007 HydroCAD Software Solutions LLC



1 EC PARTIAL EXISTING CONDITIONS PLAN
SCALE: 1" = 30'

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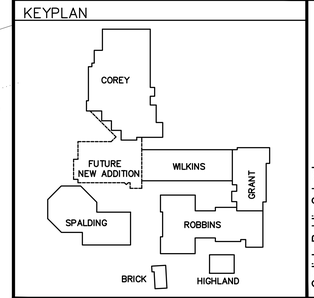
SITE PLAN REVIEW APPLICATION
08-16-2010

TRUE NORTH
PLAN NORTH

KEYPLAN



REVISIONS NO.	DATE	REMARKS	BY

Carlisle Public School
Carlisle, MA
Partial Existing Conditions Plan

SCALE: As indicated DRAWN BY: NCK CHECKED BY: CMG

DRAWING NUMBER
EC

JOB NUMBER 492208

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Summary for Subcatchment E1: School Street Parking

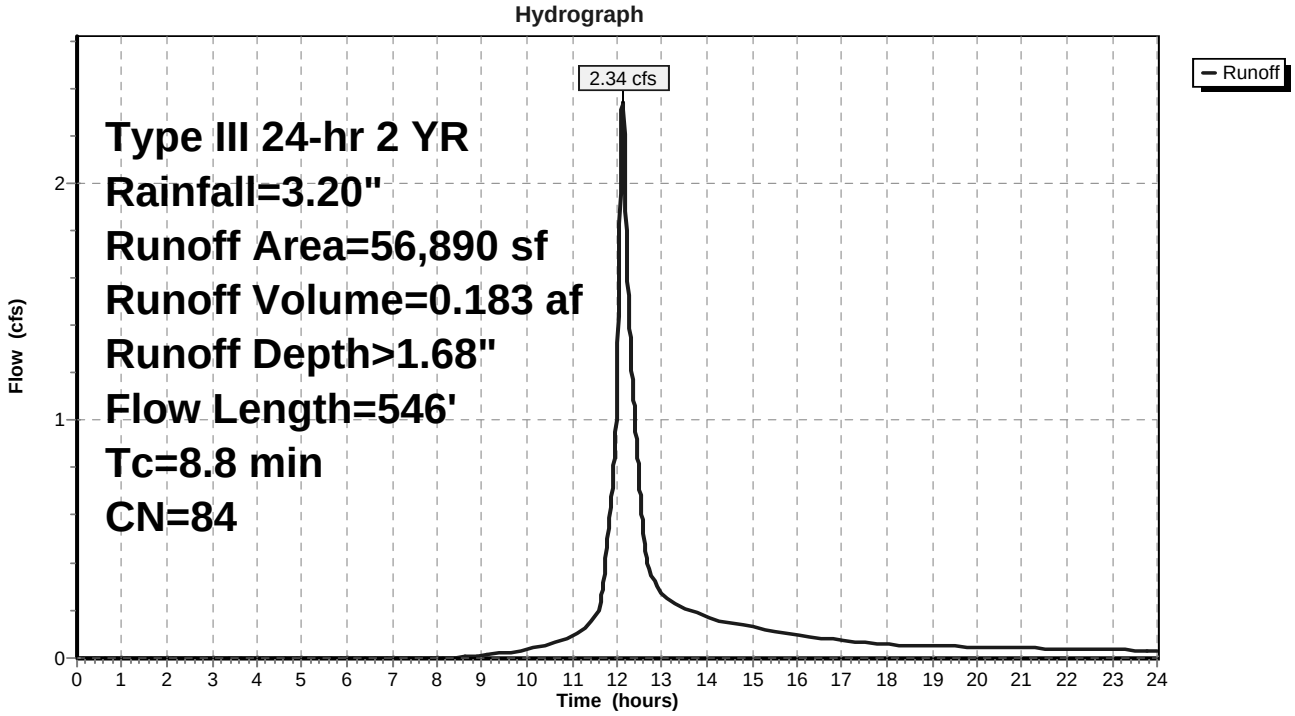
Runoff = 2.34 cfs @ 12.13 hrs, Volume= 0.183 af, Depth> 1.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YR Rainfall=3.20"

Area (sf)	CN	Description
23,479	98	Paved parking & roofs
15,246	73	Woods, Fair, HSG C
18,165	74	>75% Grass cover, Good, HSG C
56,890	84	Weighted Average
33,411		Pervious Area
23,479		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	50	0.0898	0.12		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.1	15	0.0433	3.35		**Shallow Concentrated Flow, B to C** Unpaved Kv= 16.1 fps
0.2	52	0.0340	3.74		**Shallow Concentrated Flow, C to D** Paved Kv= 20.3 fps
0.1	33	0.1070	5.27		**Shallow Concentrated Flow, D to E** Unpaved Kv= 16.1 fps
1.6	396	0.0400	4.06		**Shallow Concentrated Flow, E to F** Paved Kv= 20.3 fps
8.8	546	Total			

Subcatchment E1: School Street Parking



Summary for Subcatchment E2: Northwest Church Street

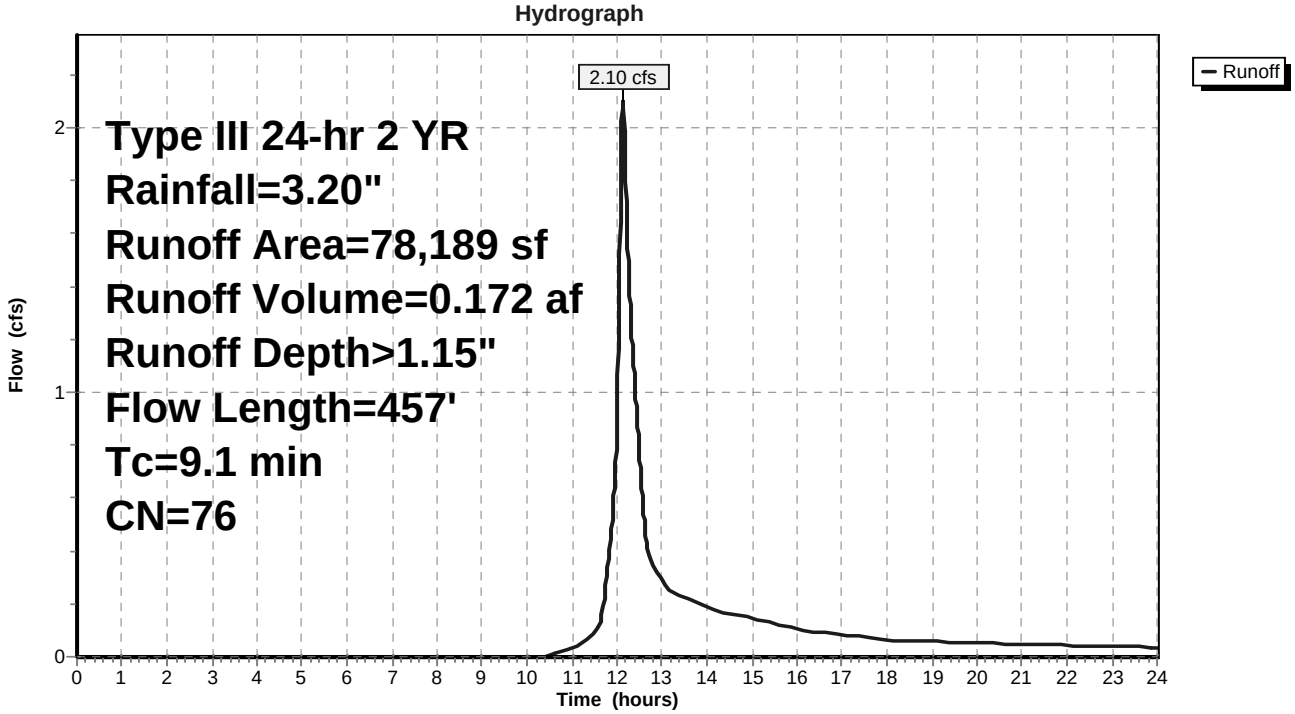
Runoff = 2.10 cfs @ 12.14 hrs, Volume= 0.172 af, Depth> 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YR Rainfall=3.20"

Area (sf)	CN	Description
7,187	98	Paved parking & roofs
38,463	73	Woods, Fair, HSG C
32,539	74	>75% Grass cover, Good, HSG C
78,189	76	Weighted Average
71,002		Pervious Area
7,187		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	50	0.0900	0.12		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.20"
1.1	269	0.0680	4.20		**Shallow Concentrated Flow, B to C** Unpaved Kv= 16.1 fps
1.2	138	0.0140	1.90		**Shallow Concentrated Flow, C to D** Unpaved Kv= 16.1 fps
9.1	457	Total			

Subcatchment E2: Northwest Church Street



Summary for Subcatchment E3: Existing Playing Area

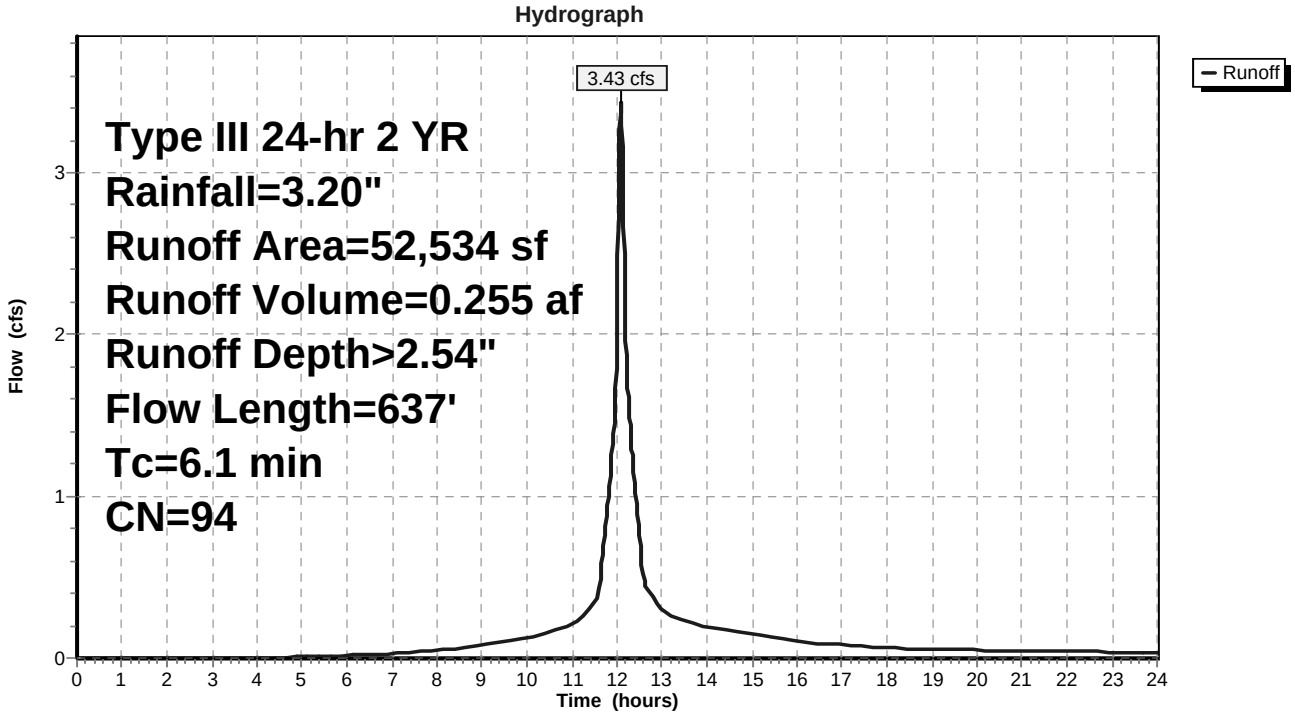
Runoff = 3.43 cfs @ 12.09 hrs, Volume= 0.255 af, Depth> 2.54"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YR Rainfall=3.20"

Area (sf)	CN	Description
43,604	98	Paved parking & roofs
8,930	74	>75% Grass cover, Good, HSG C
52,534	94	Weighted Average
8,930		Pervious Area
43,604		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	24	0.0420	0.12		**Sheet Flow, A to B** Grass: Dense n= 0.240 P2= 3.20"
1.9	312	0.0190	2.80		**Shallow Concentrated Flow, B to C** Paved Kv= 20.3 fps
0.6	152	0.0090	4.30	3.38	**Circular Channel (pipe), C to D** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Concrete pipe, straight & clean
0.2	149	0.1069	14.83	11.65	**Circular Channel (pipe), D to E** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
6.1	637	Total			

Subcatchment E3: Existing Playing Area



Summary for Subcatchment E4: Western Play Area/Ex Parking

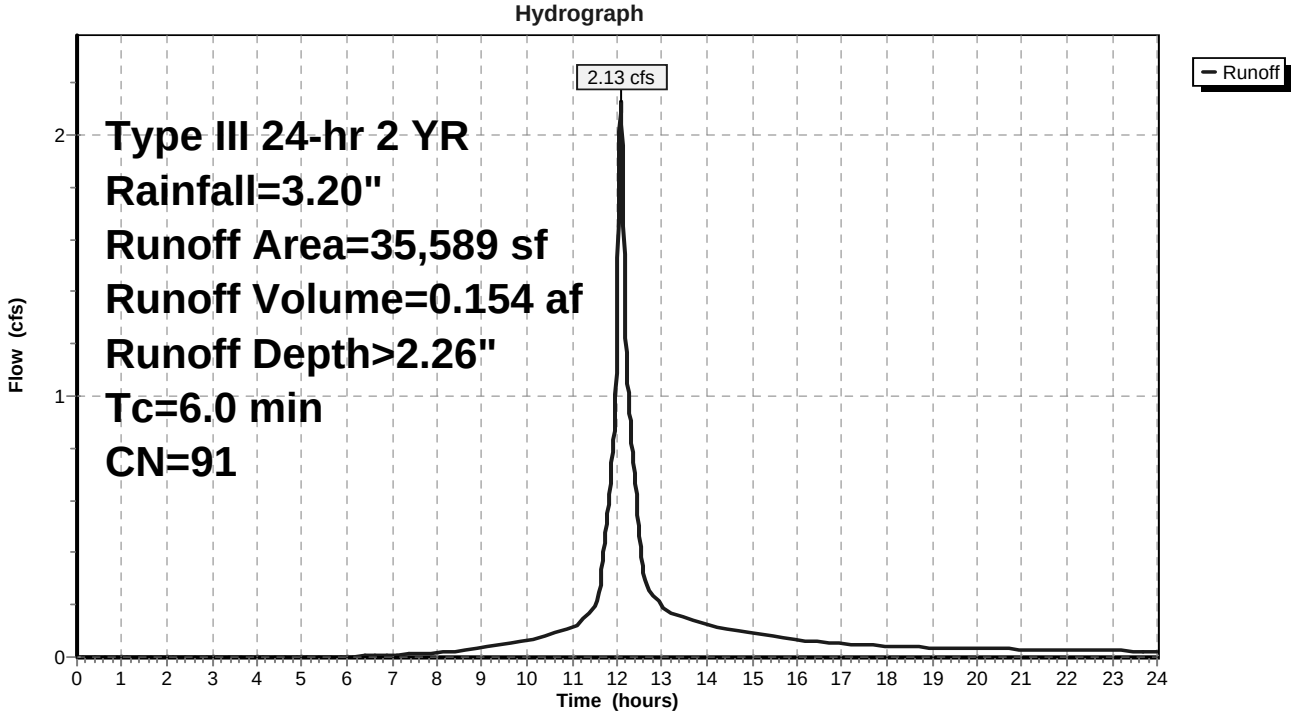
Runoff = 2.13 cfs @ 12.09 hrs, Volume= 0.154 af, Depth> 2.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YR Rainfall=3.20"

Area (sf)	CN	Description
24,481	98	Paved parking & roofs
11,108	74	>75% Grass cover, Good, HSG C
35,589	91	Weighted Average
11,108		Pervious Area
24,481		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Calculated Value <6 mins: Direct Entry**

Subcatchment E4: Western Play Area/Ex Parking

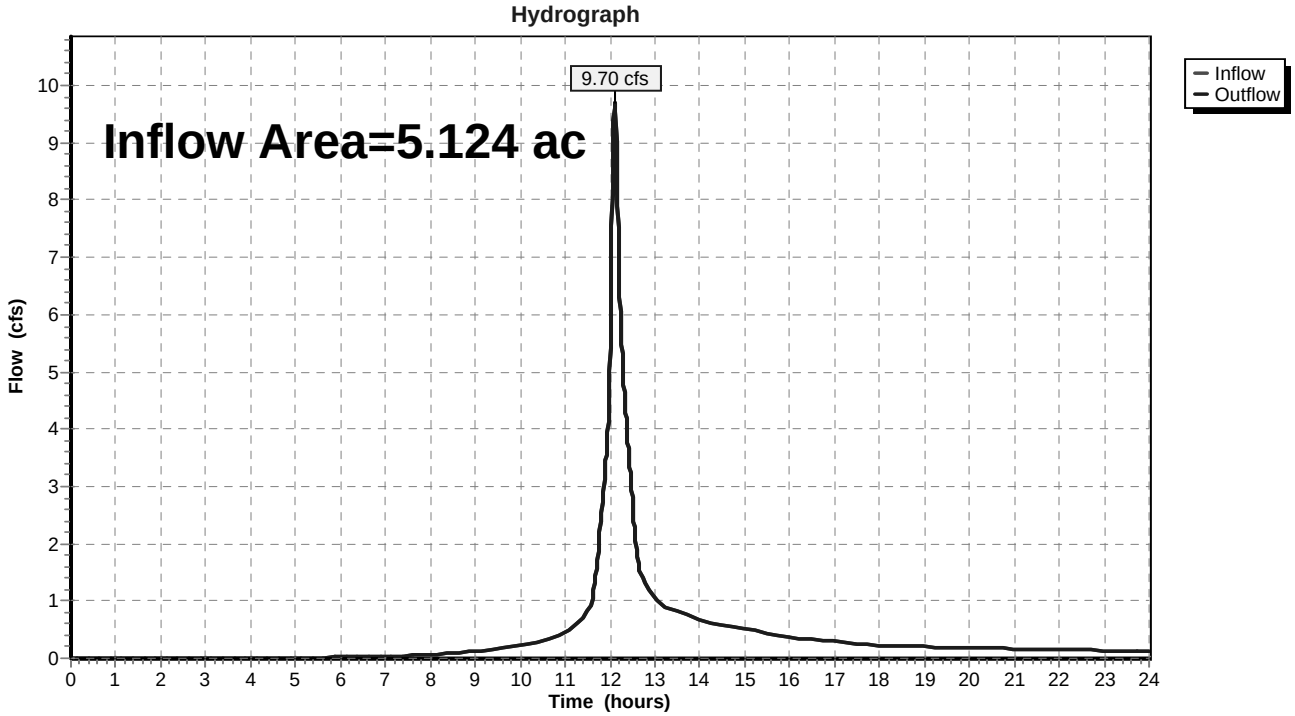


Summary for Reach DP: Analysis Design Point

Inflow Area = 5.124 ac, 44.24% Impervious, Inflow Depth > 1.79" for 2 YR event
Inflow = 9.70 cfs @ 12.10 hrs, Volume= 0.764 af
Outflow = 9.70 cfs @ 12.10 hrs, Volume= 0.764 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach DP: Analysis Design Point



Summary for Subcatchment E1: School Street Parking

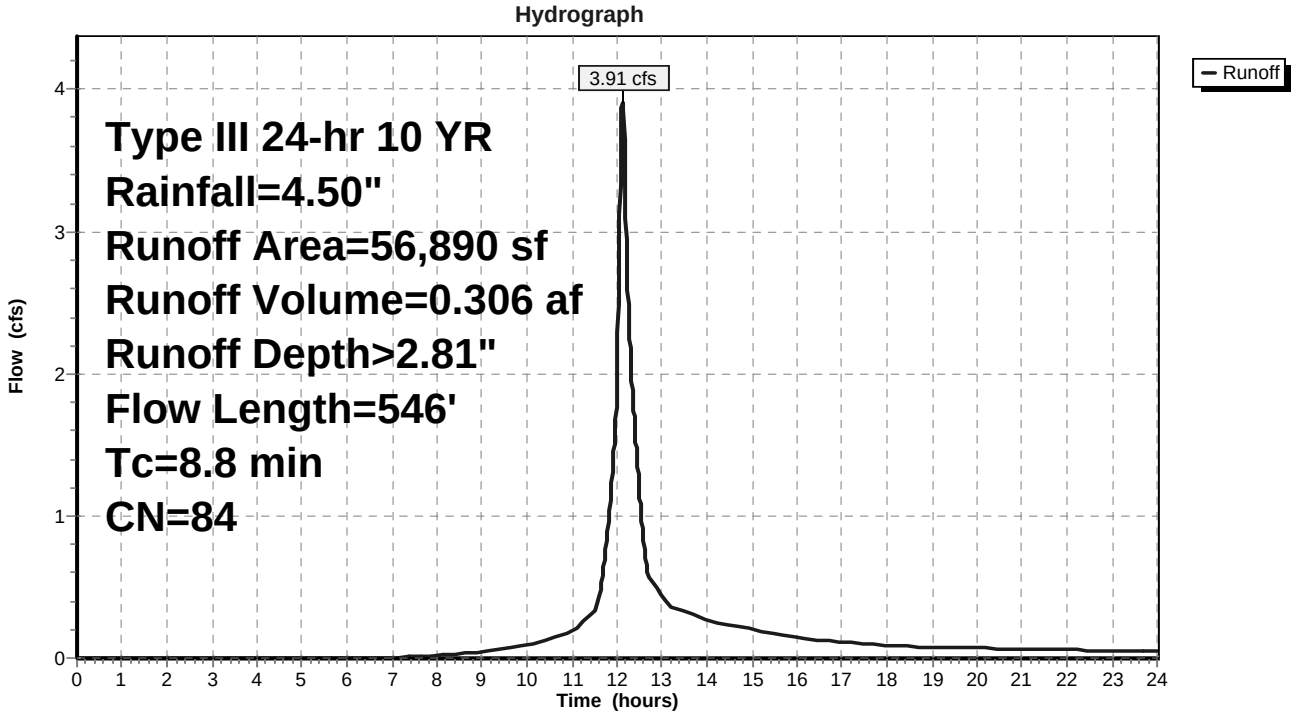
Runoff = 3.91 cfs @ 12.12 hrs, Volume= 0.306 af, Depth> 2.81"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=4.50"

Area (sf)	CN	Description
23,479	98	Paved parking & roofs
15,246	73	Woods, Fair, HSG C
18,165	74	>75% Grass cover, Good, HSG C
56,890	84	Weighted Average
33,411		Pervious Area
23,479		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	50	0.0898	0.12		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.1	15	0.0433	3.35		**Shallow Concentrated Flow, B to C** Unpaved Kv= 16.1 fps
0.2	52	0.0340	3.74		**Shallow Concentrated Flow, C to D** Paved Kv= 20.3 fps
0.1	33	0.1070	5.27		**Shallow Concentrated Flow, D to E** Unpaved Kv= 16.1 fps
1.6	396	0.0400	4.06		**Shallow Concentrated Flow, E to F** Paved Kv= 20.3 fps
8.8	546	Total			

Subcatchment E1: School Street Parking



Summary for Subcatchment E2: Northwest Church Street

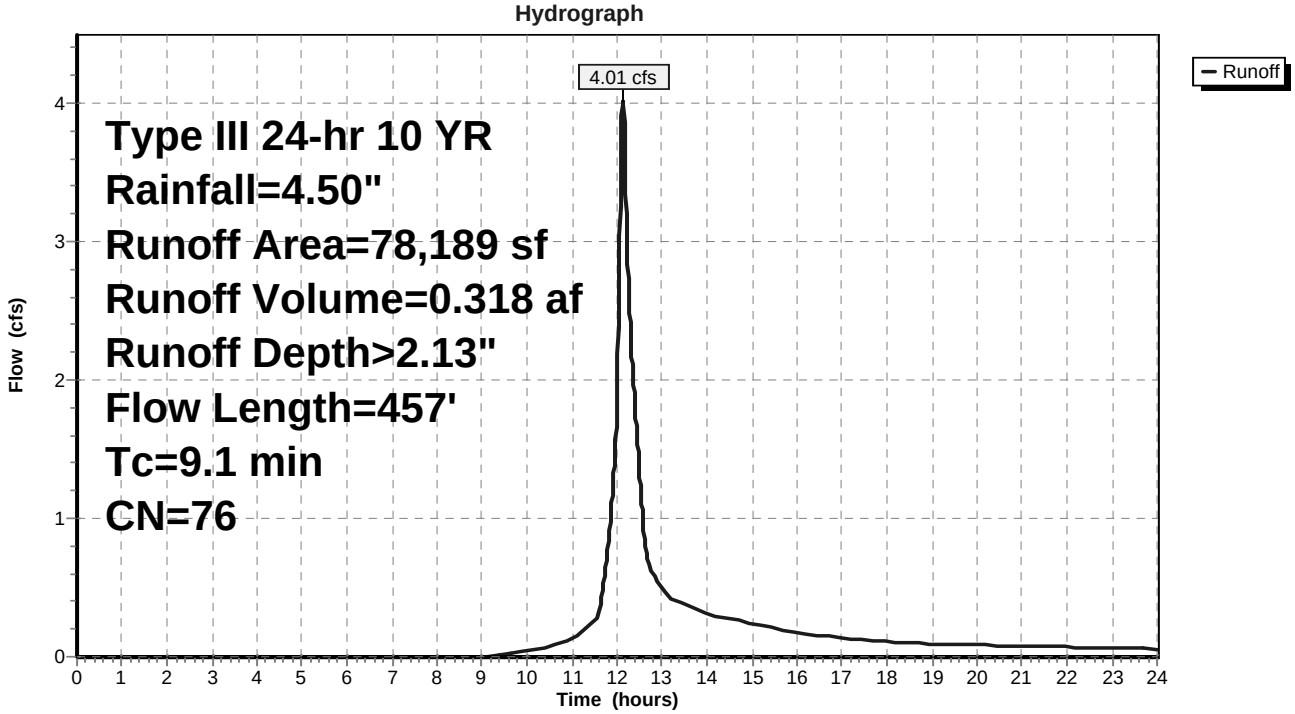
Runoff = 4.01 cfs @ 12.13 hrs, Volume= 0.318 af, Depth> 2.13"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=4.50"

Area (sf)	CN	Description
7,187	98	Paved parking & roofs
38,463	73	Woods, Fair, HSG C
32,539	74	>75% Grass cover, Good, HSG C
78,189	76	Weighted Average
71,002		Pervious Area
7,187		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	50	0.0900	0.12		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.20"
1.1	269	0.0680	4.20		**Shallow Concentrated Flow, B to C** Unpaved Kv= 16.1 fps
1.2	138	0.0140	1.90		**Shallow Concentrated Flow, C to D** Unpaved Kv= 16.1 fps
9.1	457	Total			

Subcatchment E2: Northwest Church Street



Summary for Subcatchment E3: Existing Playing Area

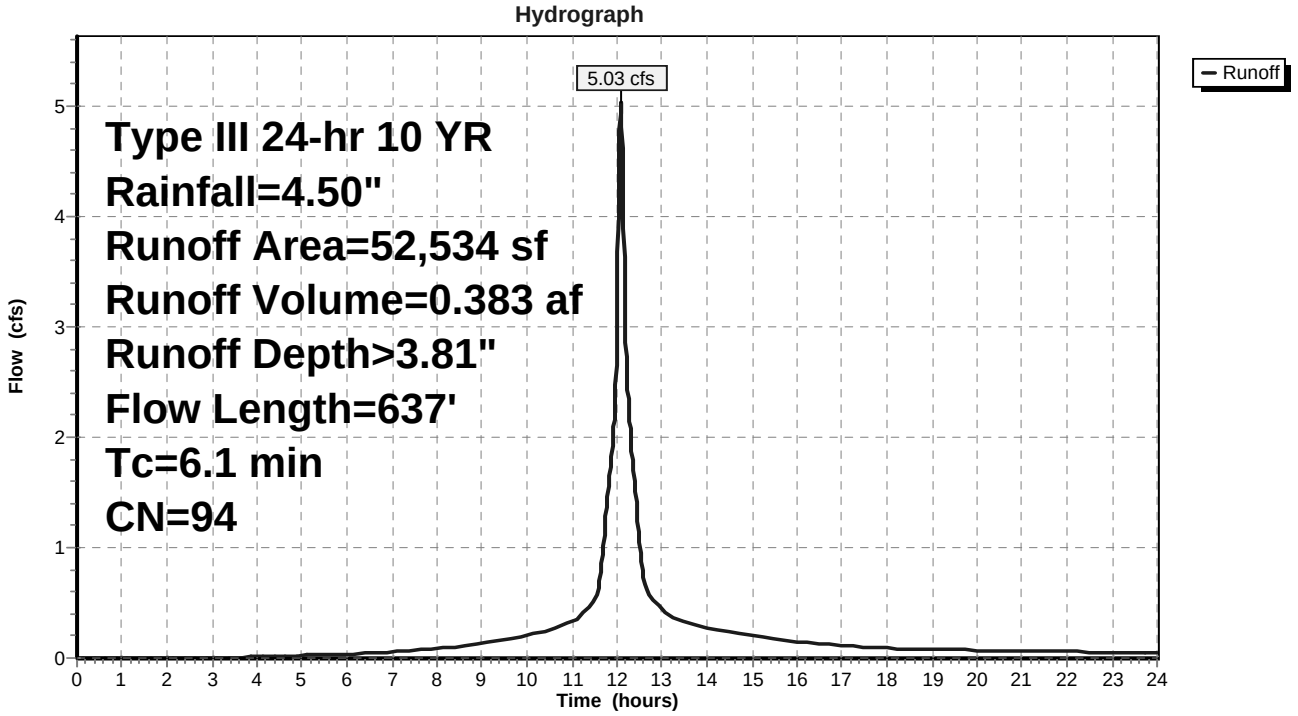
Runoff = 5.03 cfs @ 12.09 hrs, Volume= 0.383 af, Depth> 3.81"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=4.50"

Area (sf)	CN	Description
43,604	98	Paved parking & roofs
8,930	74	>75% Grass cover, Good, HSG C
52,534	94	Weighted Average
8,930		Pervious Area
43,604		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	24	0.0420	0.12		**Sheet Flow, A to B** Grass: Dense n= 0.240 P2= 3.20"
1.9	312	0.0190	2.80		**Shallow Concentrated Flow, B to C** Paved Kv= 20.3 fps
0.6	152	0.0090	4.30	3.38	**Circular Channel (pipe), C to D** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Concrete pipe, straight & clean
0.2	149	0.1069	14.83	11.65	**Circular Channel (pipe), D to E** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
6.1	637	Total			

Subcatchment E3: Existing Playing Area



Summary for Subcatchment E4: Western Play Area/Ex Parking

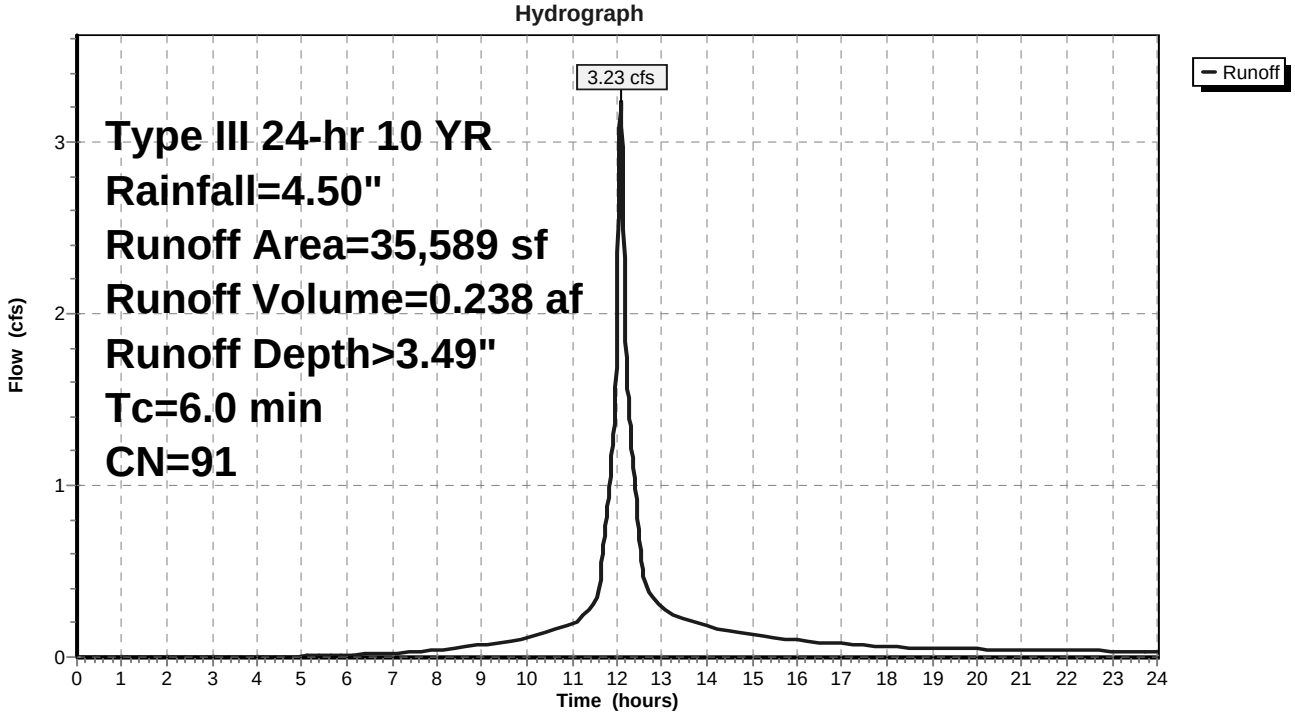
Runoff = 3.23 cfs @ 12.09 hrs, Volume= 0.238 af, Depth> 3.49"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=4.50"

Area (sf)	CN	Description
24,481	98	Paved parking & roofs
11,108	74	>75% Grass cover, Good, HSG C
35,589	91	Weighted Average
11,108		Pervious Area
24,481		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Calculated Value <6 mins: Direct Entry**

Subcatchment E4: Western Play Area/Ex Parking

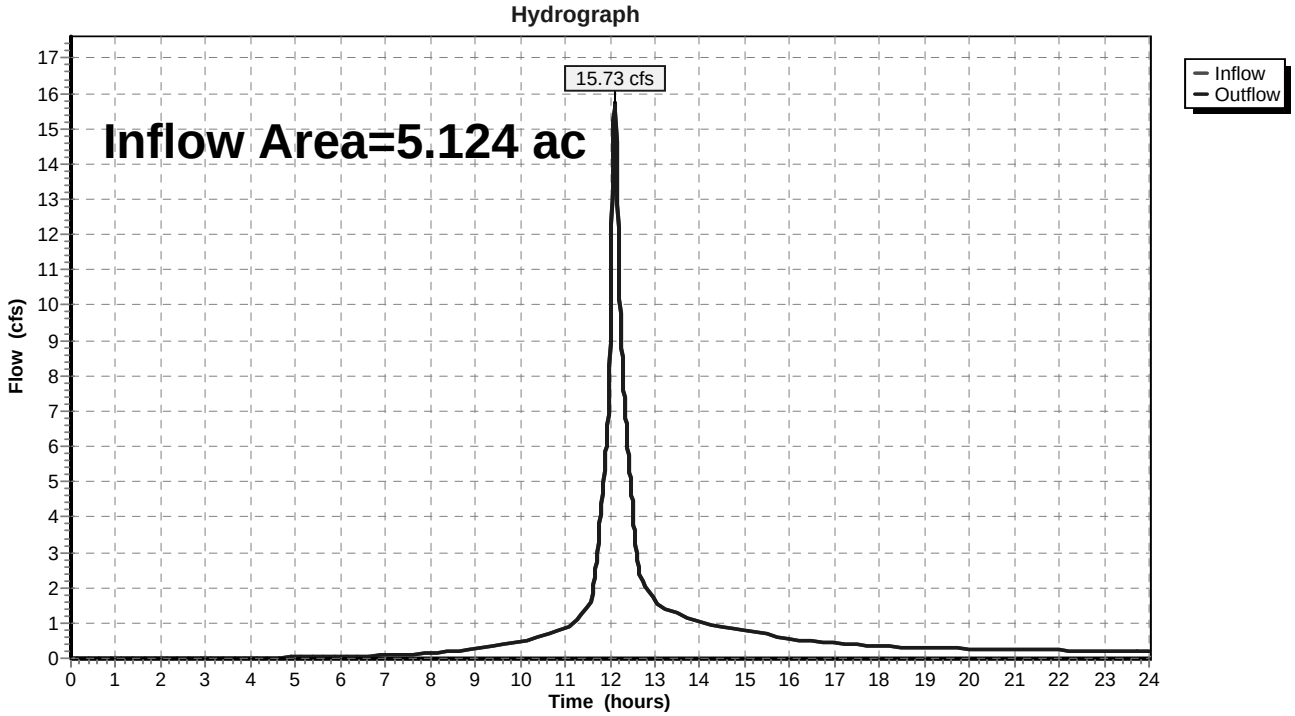


Summary for Reach DP: Analysis Design Point

Inflow Area = 5.124 ac, 44.24% Impervious, Inflow Depth > 2.92" for 10 YR event
Inflow = 15.73 cfs @ 12.10 hrs, Volume= 1.245 af
Outflow = 15.73 cfs @ 12.10 hrs, Volume= 1.245 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach DP: Analysis Design Point



Summary for Subcatchment E1: School Street Parking

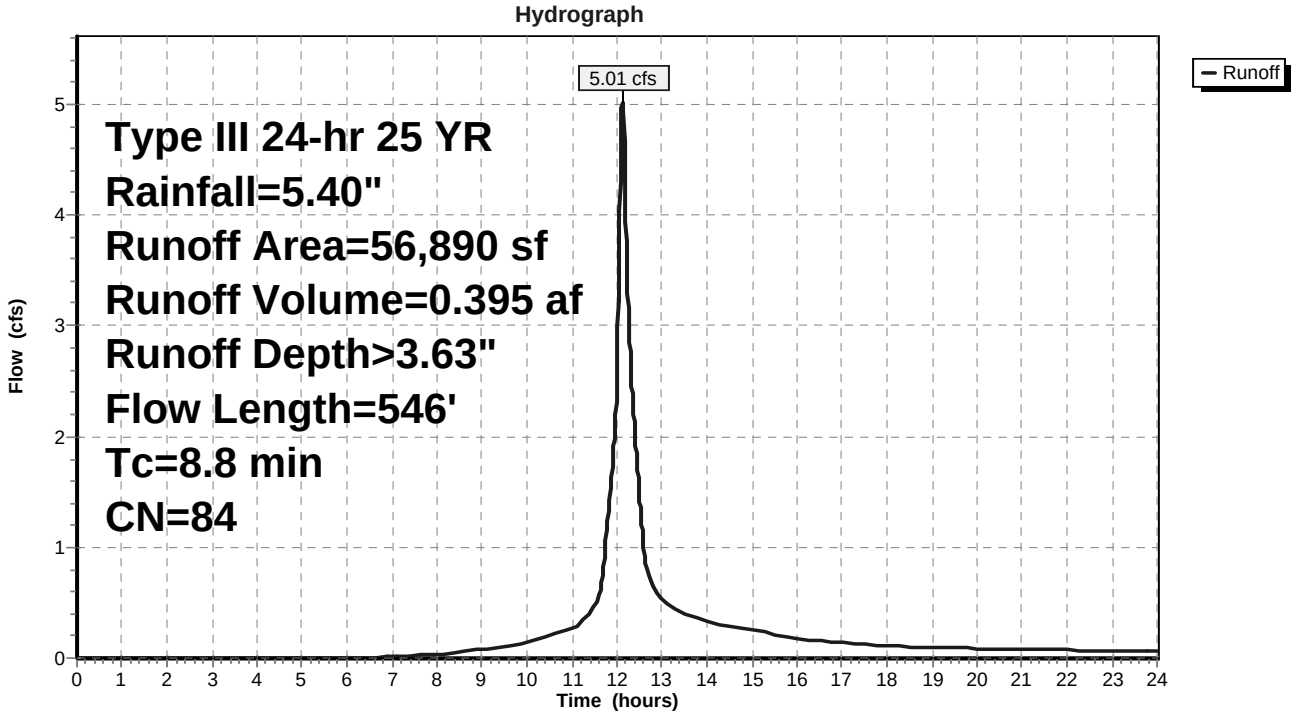
Runoff = 5.01 cfs @ 12.12 hrs, Volume= 0.395 af, Depth> 3.63"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YR Rainfall=5.40"

Area (sf)	CN	Description
23,479	98	Paved parking & roofs
15,246	73	Woods, Fair, HSG C
18,165	74	>75% Grass cover, Good, HSG C
56,890	84	Weighted Average
33,411		Pervious Area
23,479		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	50	0.0898	0.12		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.1	15	0.0433	3.35		**Shallow Concentrated Flow, B to C** Unpaved Kv= 16.1 fps
0.2	52	0.0340	3.74		**Shallow Concentrated Flow, C to D** Paved Kv= 20.3 fps
0.1	33	0.1070	5.27		**Shallow Concentrated Flow, D to E** Unpaved Kv= 16.1 fps
1.6	396	0.0400	4.06		**Shallow Concentrated Flow, E to F** Paved Kv= 20.3 fps
8.8	546	Total			

Subcatchment E1: School Street Parking



Summary for Subcatchment E2: Northwest Church Street

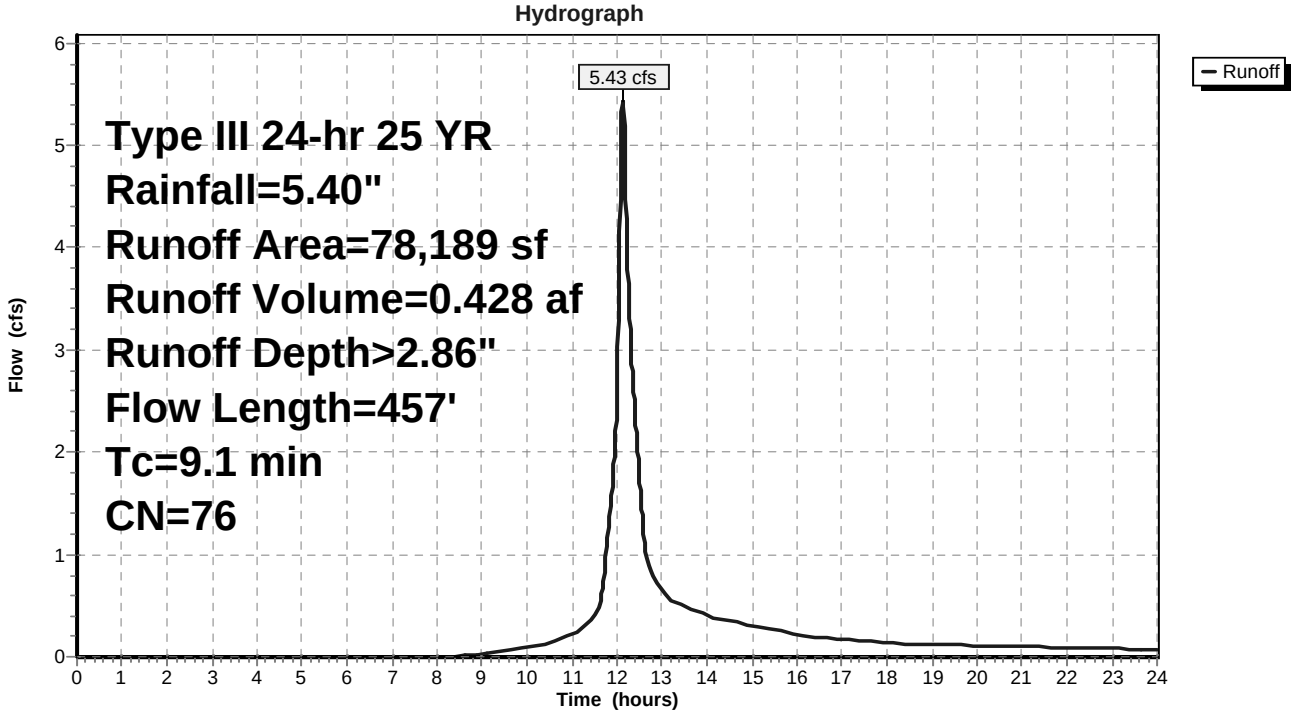
Runoff = 5.43 cfs @ 12.13 hrs, Volume= 0.428 af, Depth> 2.86"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YR Rainfall=5.40"

Area (sf)	CN	Description
7,187	98	Paved parking & roofs
38,463	73	Woods, Fair, HSG C
32,539	74	>75% Grass cover, Good, HSG C
78,189	76	Weighted Average
71,002		Pervious Area
7,187		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	50	0.0900	0.12		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.20"
1.1	269	0.0680	4.20		**Shallow Concentrated Flow, B to C** Unpaved Kv= 16.1 fps
1.2	138	0.0140	1.90		**Shallow Concentrated Flow, C to D** Unpaved Kv= 16.1 fps
9.1	457	Total			

Subcatchment E2: Northwest Church Street



Summary for Subcatchment E3: Existing Playing Area

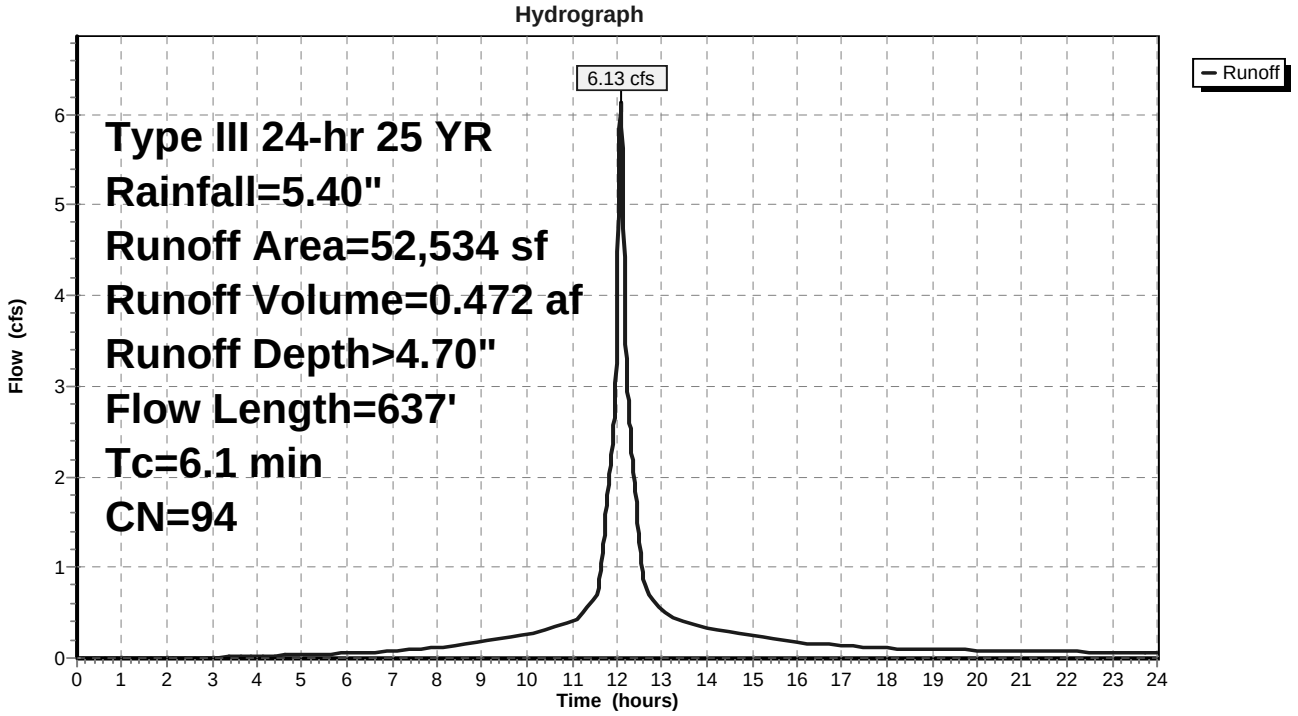
Runoff = 6.13 cfs @ 12.08 hrs, Volume= 0.472 af, Depth> 4.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YR Rainfall=5.40"

Area (sf)	CN	Description
43,604	98	Paved parking & roofs
8,930	74	>75% Grass cover, Good, HSG C
52,534	94	Weighted Average
8,930		Pervious Area
43,604		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	24	0.0420	0.12		**Sheet Flow, A to B** Grass: Dense n= 0.240 P2= 3.20"
1.9	312	0.0190	2.80		**Shallow Concentrated Flow, B to C** Paved Kv= 20.3 fps
0.6	152	0.0090	4.30	3.38	**Circular Channel (pipe), C to D** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Concrete pipe, straight & clean
0.2	149	0.1069	14.83	11.65	**Circular Channel (pipe), D to E** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
6.1	637	Total			

Subcatchment E3: Existing Playing Area



Summary for Subcatchment E4: Western Play Area/Ex Parking

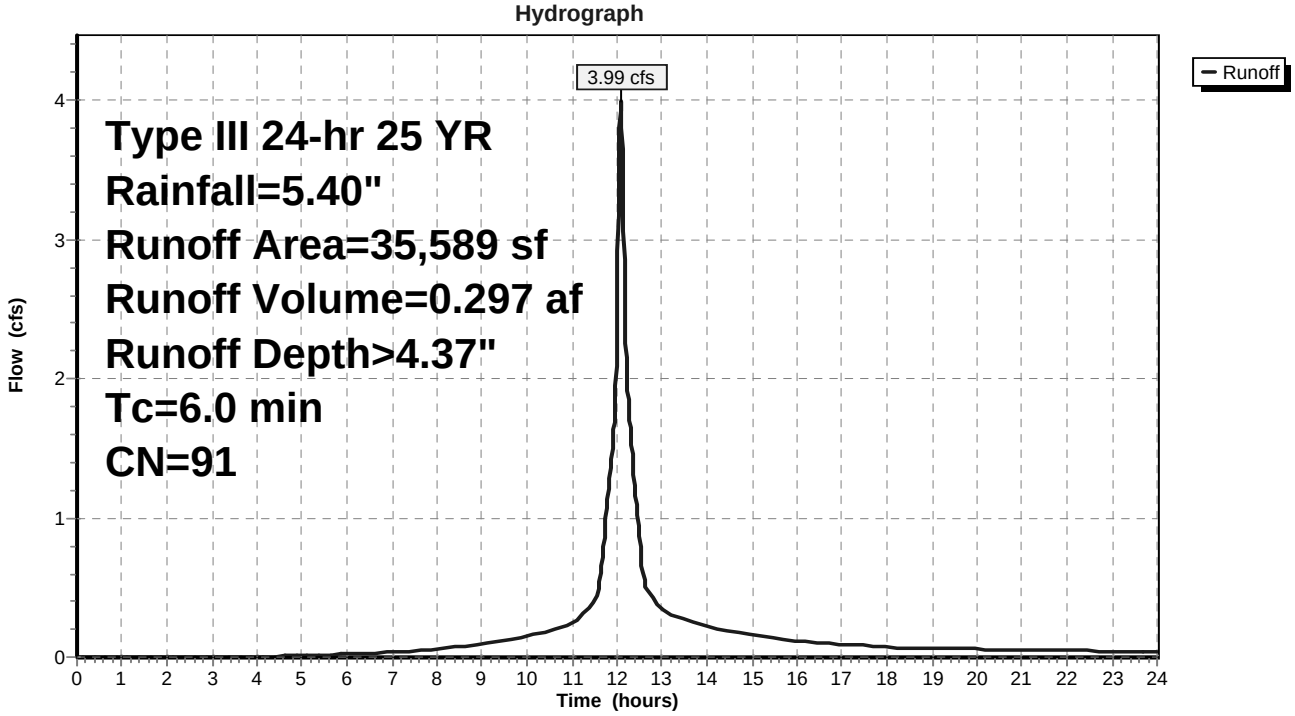
Runoff = 3.99 cfs @ 12.08 hrs, Volume= 0.297 af, Depth> 4.37"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YR Rainfall=5.40"

Area (sf)	CN	Description
24,481	98	Paved parking & roofs
11,108	74	>75% Grass cover, Good, HSG C
35,589	91	Weighted Average
11,108		Pervious Area
24,481		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Calculated Value <6 mins: Direct Entry**

Subcatchment E4: Western Play Area/Ex Parking

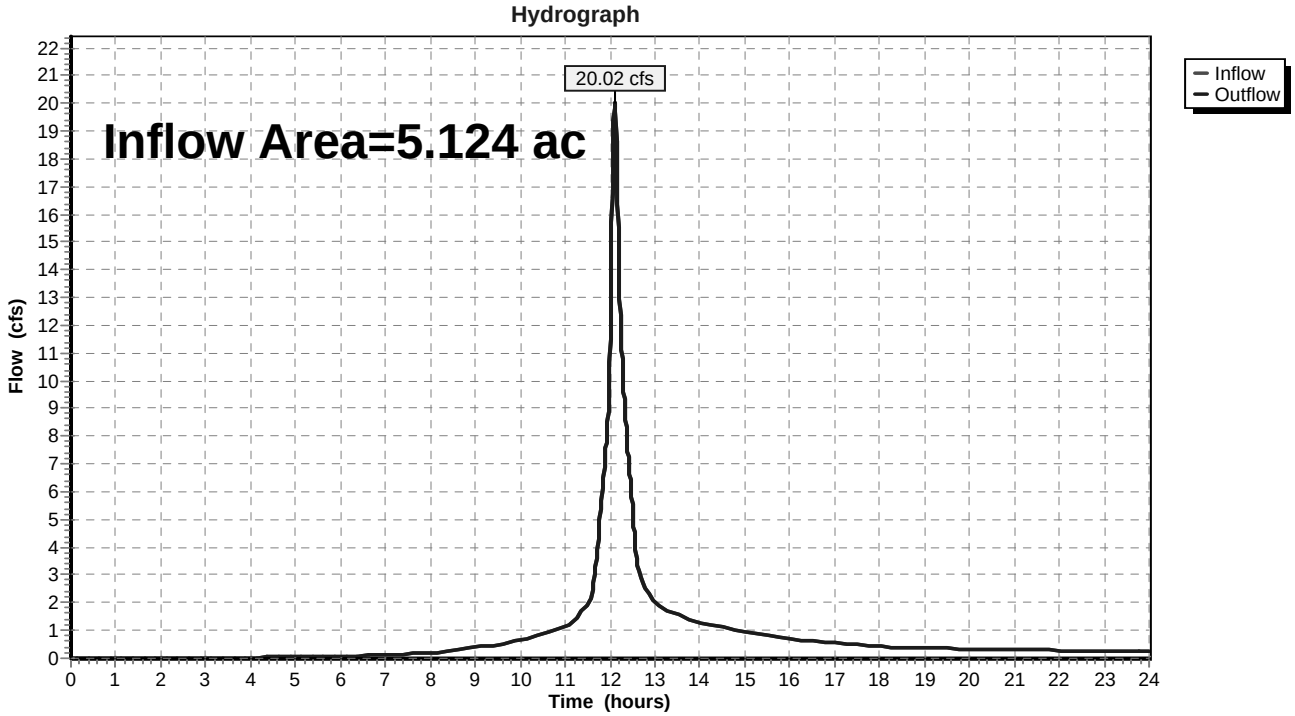


Summary for Reach DP: Analysis Design Point

Inflow Area = 5.124 ac, 44.24% Impervious, Inflow Depth > 3.73" for 25 YR event
Inflow = 20.02 cfs @ 12.10 hrs, Volume= 1.593 af
Outflow = 20.02 cfs @ 12.10 hrs, Volume= 1.593 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach DP: Analysis Design Point



Summary for Subcatchment E1: School Street Parking

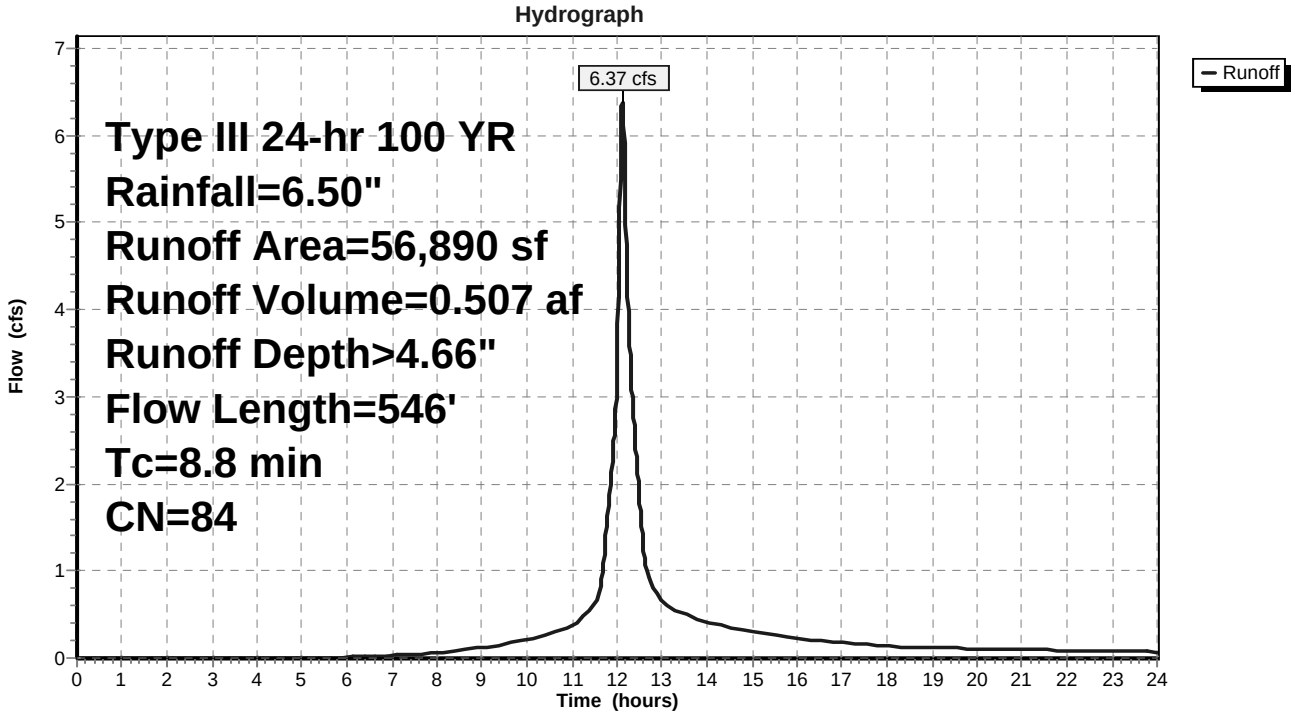
Runoff = 6.37 cfs @ 12.12 hrs, Volume= 0.507 af, Depth> 4.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=6.50"

Area (sf)	CN	Description
23,479	98	Paved parking & roofs
15,246	73	Woods, Fair, HSG C
18,165	74	>75% Grass cover, Good, HSG C
56,890	84	Weighted Average
33,411		Pervious Area
23,479		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	50	0.0898	0.12		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.1	15	0.0433	3.35		**Shallow Concentrated Flow, B to C** Unpaved Kv= 16.1 fps
0.2	52	0.0340	3.74		**Shallow Concentrated Flow, C to D** Paved Kv= 20.3 fps
0.1	33	0.1070	5.27		**Shallow Concentrated Flow, D to E** Unpaved Kv= 16.1 fps
1.6	396	0.0400	4.06		**Shallow Concentrated Flow, E to F** Paved Kv= 20.3 fps
8.8	546	Total			

Subcatchment E1: School Street Parking



Summary for Subcatchment E2: Northwest Church Street

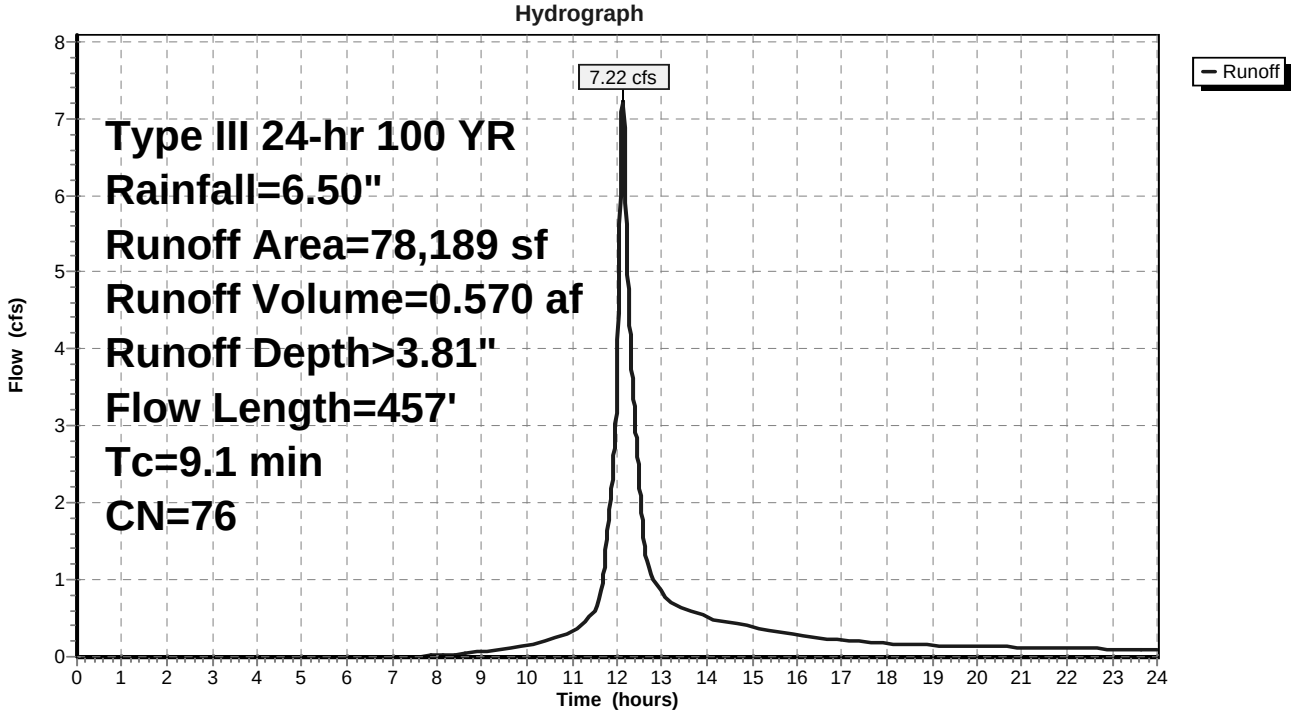
Runoff = 7.22 cfs @ 12.13 hrs, Volume= 0.570 af, Depth> 3.81"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=6.50"

Area (sf)	CN	Description
7,187	98	Paved parking & roofs
38,463	73	Woods, Fair, HSG C
32,539	74	>75% Grass cover, Good, HSG C
78,189	76	Weighted Average
71,002		Pervious Area
7,187		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	50	0.0900	0.12		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.20"
1.1	269	0.0680	4.20		**Shallow Concentrated Flow, B to C** Unpaved Kv= 16.1 fps
1.2	138	0.0140	1.90		**Shallow Concentrated Flow, C to D** Unpaved Kv= 16.1 fps
9.1	457	Total			

Subcatchment E2: Northwest Church Street



Summary for Subcatchment E3: Existing Playing Area

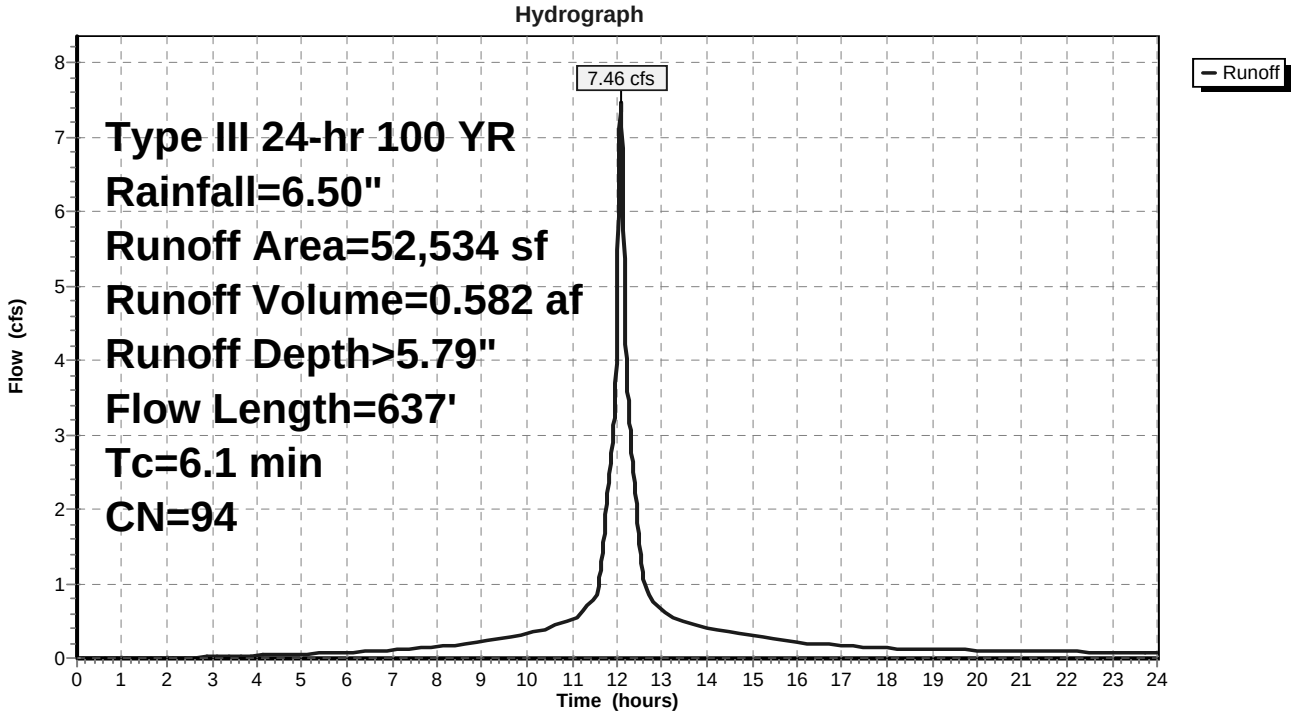
Runoff = 7.46 cfs @ 12.08 hrs, Volume= 0.582 af, Depth> 5.79"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=6.50"

Area (sf)	CN	Description
43,604	98	Paved parking & roofs
8,930	74	>75% Grass cover, Good, HSG C
52,534	94	Weighted Average
8,930		Pervious Area
43,604		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	24	0.0420	0.12		**Sheet Flow, A to B** Grass: Dense n= 0.240 P2= 3.20"
1.9	312	0.0190	2.80		**Shallow Concentrated Flow, B to C** Paved Kv= 20.3 fps
0.6	152	0.0090	4.30	3.38	**Circular Channel (pipe), C to D** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Concrete pipe, straight & clean
0.2	149	0.1069	14.83	11.65	**Circular Channel (pipe), D to E** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
6.1	637	Total			

Subcatchment E3: Existing Playing Area



Summary for Subcatchment E4: Western Play Area/Ex Parking

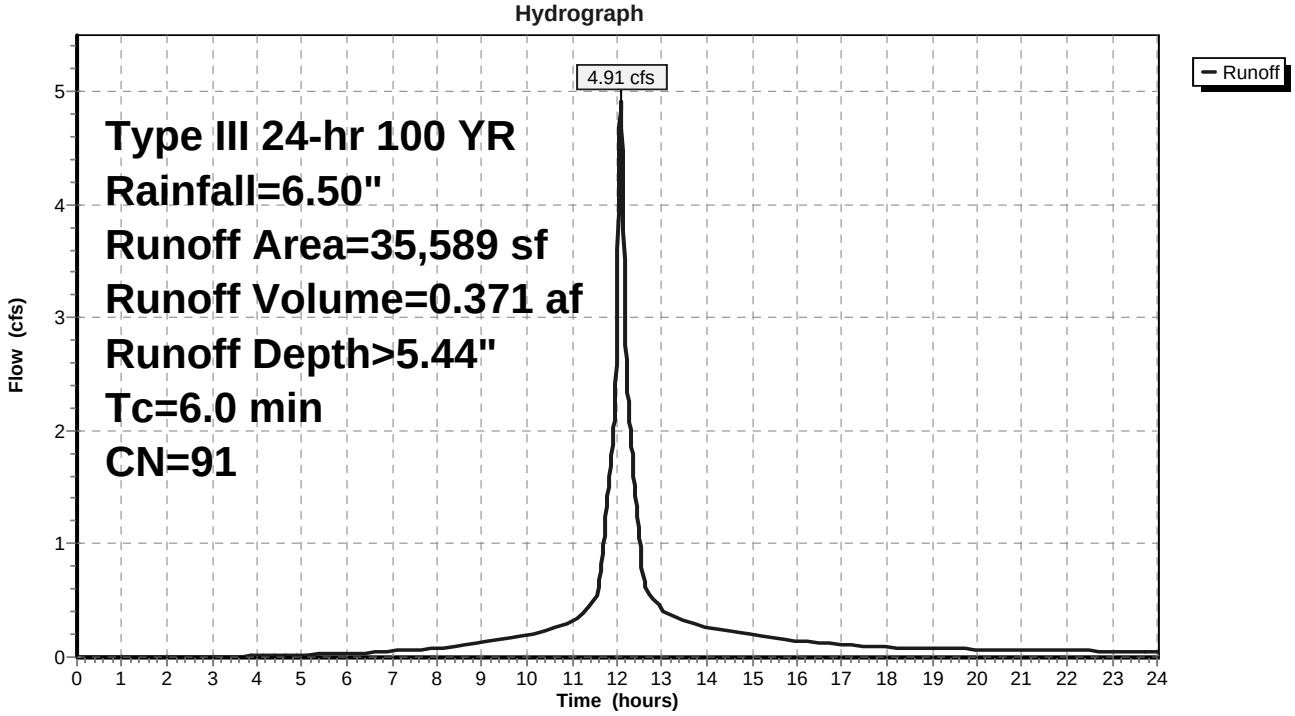
Runoff = 4.91 cfs @ 12.08 hrs, Volume= 0.371 af, Depth> 5.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=6.50"

Area (sf)	CN	Description
24,481	98	Paved parking & roofs
11,108	74	>75% Grass cover, Good, HSG C
35,589	91	Weighted Average
11,108		Pervious Area
24,481		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Calculated Value <6 mins: Direct Entry**

Subcatchment E4: Western Play Area/Ex Parking

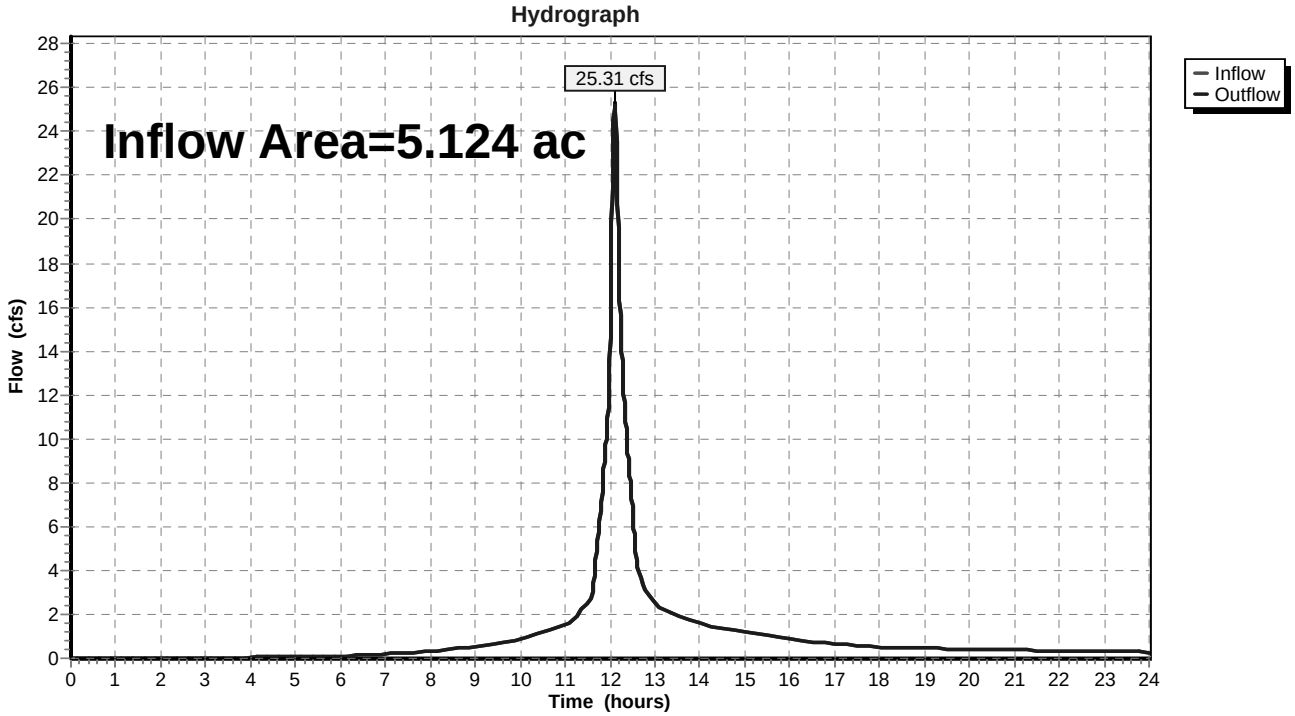


Summary for Reach DP: Analysis Design Point

Inflow Area = 5.124 ac, 44.24% Impervious, Inflow Depth > 4.75" for 100 YR event
Inflow = 25.31 cfs @ 12.10 hrs, Volume= 2.029 af
Outflow = 25.31 cfs @ 12.10 hrs, Volume= 2.029 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach DP: Analysis Design Point

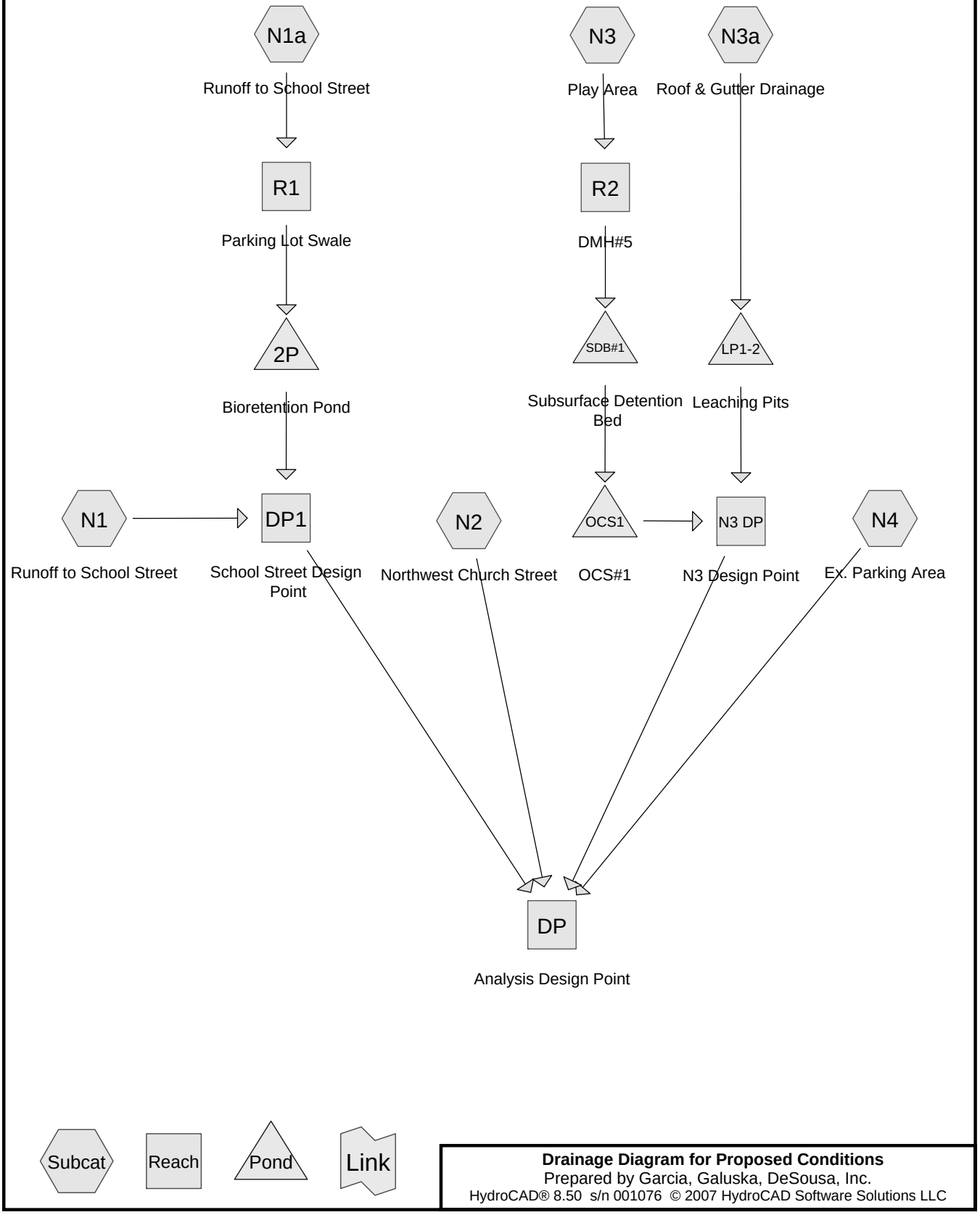


GARCIA • GALUSKA • DESOUSA
Consulting Engineers Inc.

Project: Carlisle Schools
Location: Carlisle, MA

Drainage Calculations
Developed Conditions

TEL 508-998-5700 FAX 508-998-0883 email: info@g-g-d.com



Drainage Diagram for Proposed Conditions
Prepared by Garcia, Galuska, DeSousa, Inc.
HydroCAD® 8.50 s/n 001076 © 2007 HydroCAD Software Solutions LLC

NORTH

CHURCH STREET
(PUBLIC – VARIABLE WIDTH)

SCHOOL STREET
(PUBLIC – VARIABLE WIDTH)

HISTORIC DISTRICT BOUNDARY

MATCHLINE

N1
AREA=0.435 AC.
AVG. CN=79
HSG 'C'

N1a
AREA=0.483 AC.
AVG. CN=89
HSG 'C'

N2
AREA=1.653 AC.
AVG. CN=74
HSG 'C'

N3
AREA=1.244 AC.
AVG. CN=93
HSG 'C'

N3a
AREA=0.299 AC.
AVG. CN=96
HSG 'C'

N4
AREA=0.726 AC.
AVG. CN=90
HSG 'C'

RIP RAP SPILLWAY
INV. ELEV.=221.96

RIP RAP SPILLWAY
ELEV.=225.33

PROPOSED ADDITION
F.F.E.=230.51

FIRE DEPARTMENT OUTLET CONNECTION

100' ZONE 1 RADIUS

APPROXIMATE LOCATION OF EXISTING CARLISLE CONGREGATIONAL CHURCH WELL P.W.S.#3051006

THE CARLISLE CONGREGATIONAL CHURCH

N/F THE CARLISLE CONGREGATIONAL CHURCH 1729/482 3561/159

BENCHMARK ELEV.=211.37

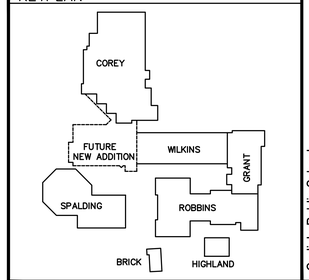
BENCHMARK ELEV.=218.06

BENCHMARK ELEV.=245.92

1 / C1.1 DEVELOPED CONDITIONS PLAN
SCALE: 1" = 30'

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

KEYPLAN



REVISIONS NO.	DATE	REMARKS	BY

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62 Fitch Street, Worcester, MA 01610
508-868-5350 • FAX: 508-868-0883 • Email: info@ggd-g.com

SITE PLAN REVIEW APPLICATION
08-16-2010

Carlisle Public School
Carlisle, MA
Developed Conditions Plan

SCALE: As indicated DRAWN BY: NCK CHECKED BY: CMG

DRAWING NUMBER
DC

JOB NUMBER 493208

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Summary for Subcatchment N1: Runoff to School Street

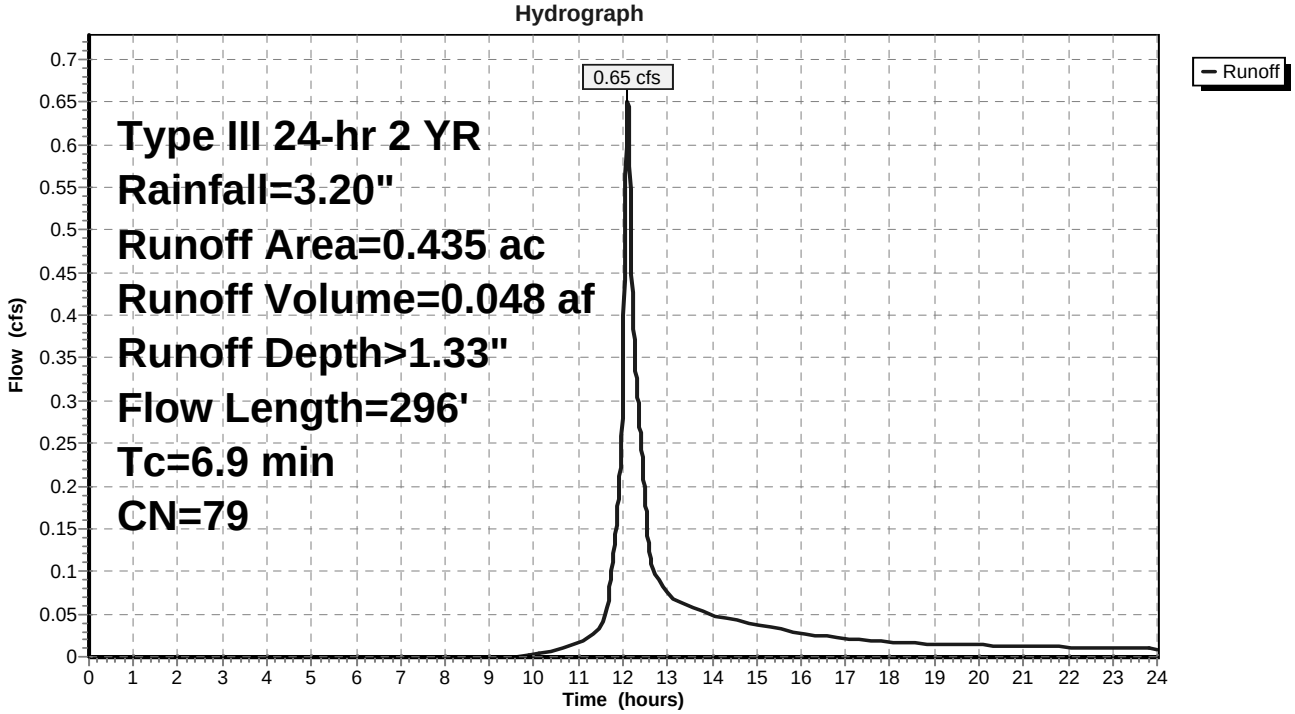
Runoff = 0.65 cfs @ 12.10 hrs, Volume= 0.048 af, Depth> 1.33"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YR Rainfall=3.20"

Area (ac)	CN	Description
0.097	98	Paved parking & roofs
0.136	73	Woods, Fair, HSG C
0.202	74	>75% Grass cover, Good, HSG C
0.435	79	Weighted Average
0.338		Pervious Area
0.097		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.9	50	0.1240	0.14		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.3	82	0.0700	4.26		**Shallow Concentrated Flow, B to C** Unpaved Kv= 16.1 fps
0.7	164	0.0400	4.06		**Shallow Concentrated Flow, C to D** Paved Kv= 20.3 fps
6.9	296	Total			

Subcatchment N1: Runoff to School Street



Summary for Subcatchment N1a: Runoff to School Street

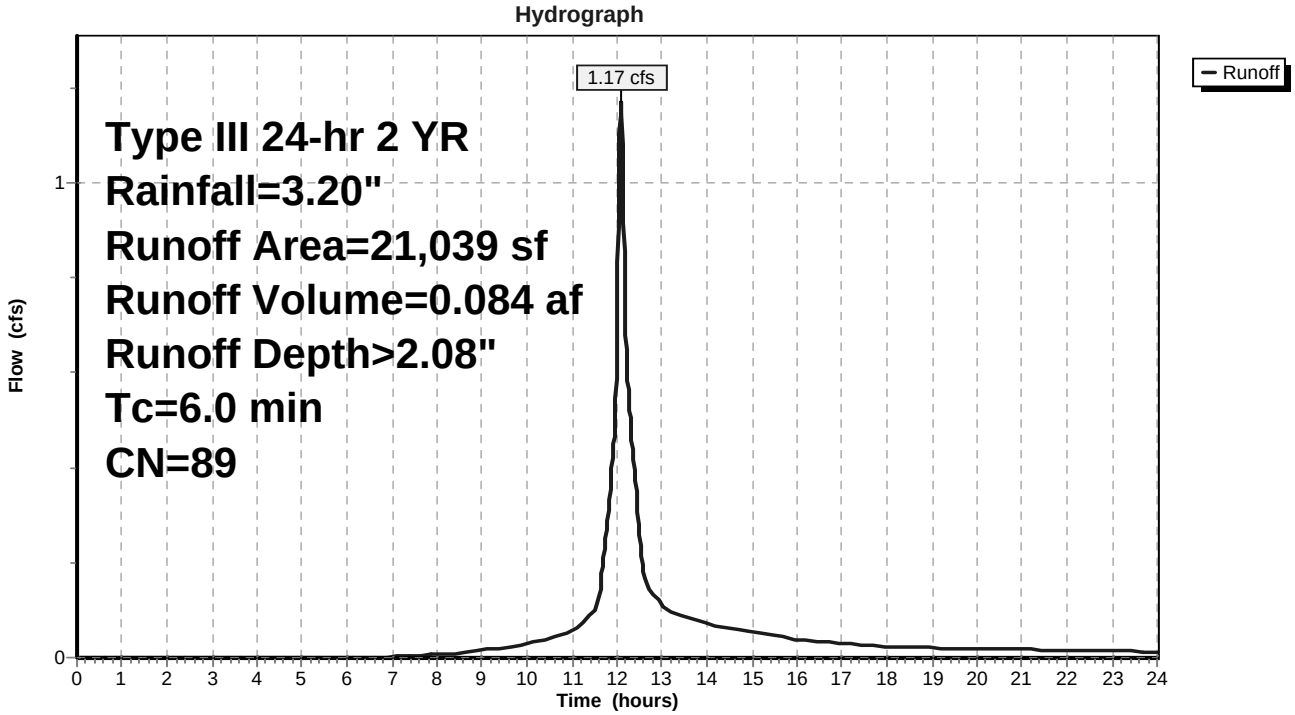
Runoff = 1.17 cfs @ 12.09 hrs, Volume= 0.084 af, Depth> 2.08"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YR Rainfall=3.20"

Area (sf)	CN	Description
13,024	98	Paved parking & roofs
348	73	Woods, Fair, HSG C
7,667	74	>75% Grass cover, Good, HSG C
21,039	89	Weighted Average
8,015		Pervious Area
13,024		Impervious Area

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

Subcatchment N1a: Runoff to School Street



Summary for Reach R1: Parking Lot Swale

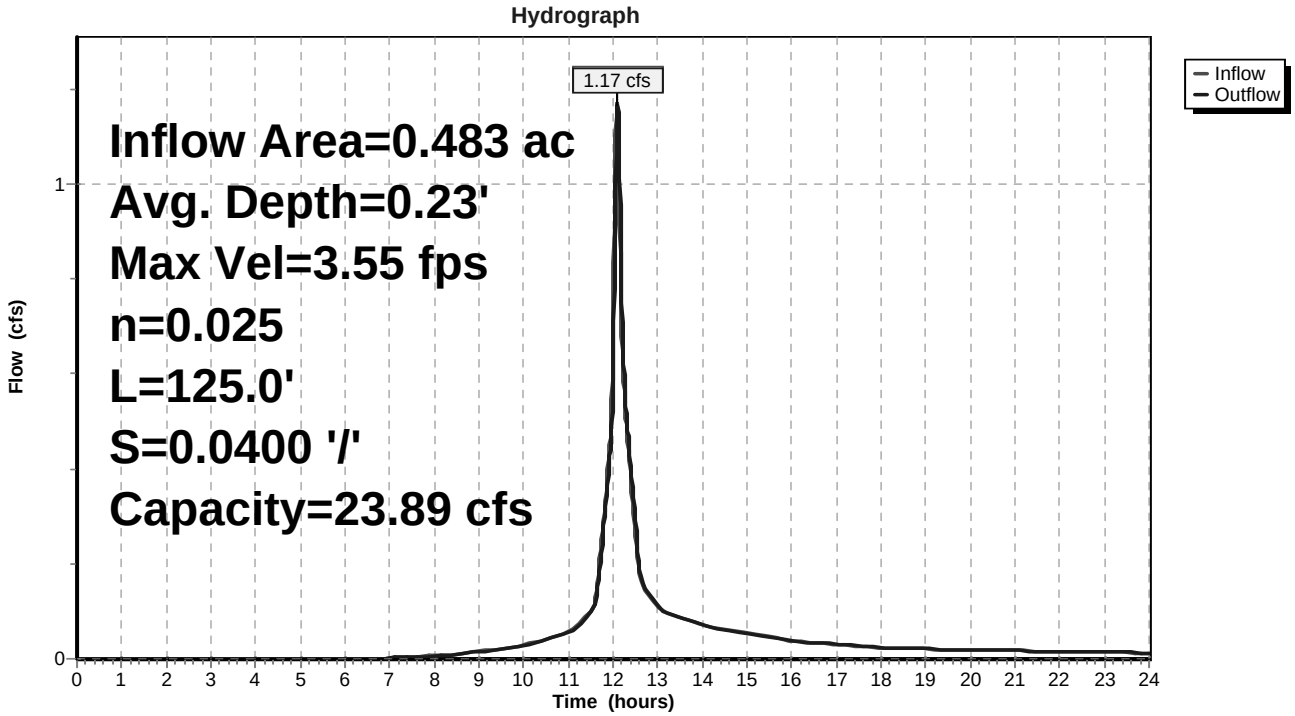
Inflow Area = 0.483 ac, 61.90% Impervious, Inflow Depth > 2.08" for 2 YR event
Inflow = 1.17 cfs @ 12.09 hrs, Volume= 0.084 af
Outflow = 1.17 cfs @ 12.10 hrs, Volume= 0.084 af, Atten= 0%, Lag= 1.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.55 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.09 fps, Avg. Travel Time= 1.9 min

Peak Storage= 41 cf @ 12.09 hrs, Average Depth at Peak Storage= 0.23'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 23.89 cfs

1.00' x 1.00' deep channel, n= 0.025 Earth, grassed & winding
Side Slope Z-value= 2.0 '/' Top Width= 5.00'
Length= 125.0' Slope= 0.0400 '/'
Inlet Invert= 232.00', Outlet Invert= 227.00'

Reach R1: Parking Lot Swale



Summary for Pond 2P: Bioretention Pond

Inflow Area =	0.483 ac, 61.90% Impervious, Inflow Depth > 2.08" for 2 YR event				
Inflow =	1.17 cfs @	12.10 hrs,	Volume=	0.084 af	
Outflow =	1.12 cfs @	12.13 hrs,	Volume=	0.067 af,	Atten= 4%, Lag= 1.5 min
Discarded =	0.00 cfs @	12.13 hrs,	Volume=	0.004 af	
Primary =	1.11 cfs @	12.13 hrs,	Volume=	0.062 af	

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 225.57' @ 12.13 hrs Surf.Area= 647 sf Storage= 889 cf

Plug-Flow detention time= 118.6 min calculated for 0.067 af (80% of inflow)
Center-of-Mass det. time= 41.7 min (853.6 - 811.9)

Volume	Invert	Avail.Storage	Storage Description
#1	221.75'	1,484 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

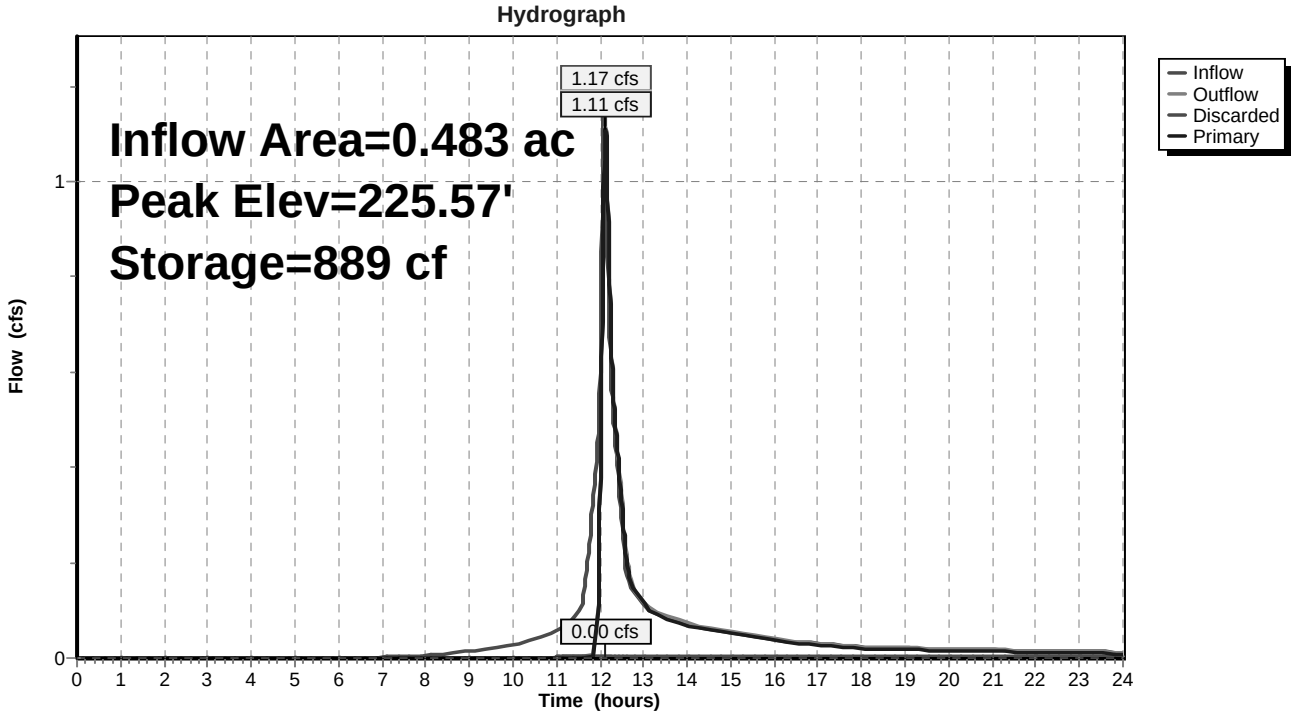
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
221.75	0	0.0	0	0	0
222.00	9	13.6	1	1	15
223.00	90	38.1	42	43	119
224.00	251	63.3	164	207	328
225.00	484	88.2	361	568	638
226.00	787	110.0	629	1,198	996
226.33	950	124.2	286	1,484	1,263

Device	Routing	Invert	Outlet Devices
#1	Primary	225.33'	**4.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	221.75'	**0.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.00 cfs @ 12.13 hrs HW=225.57' (Free Discharge)
└─**2=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=1.11 cfs @ 12.13 hrs HW=225.57' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 1.11 cfs @ 1.16 fps)

Pond 2P: Bioretention Pond

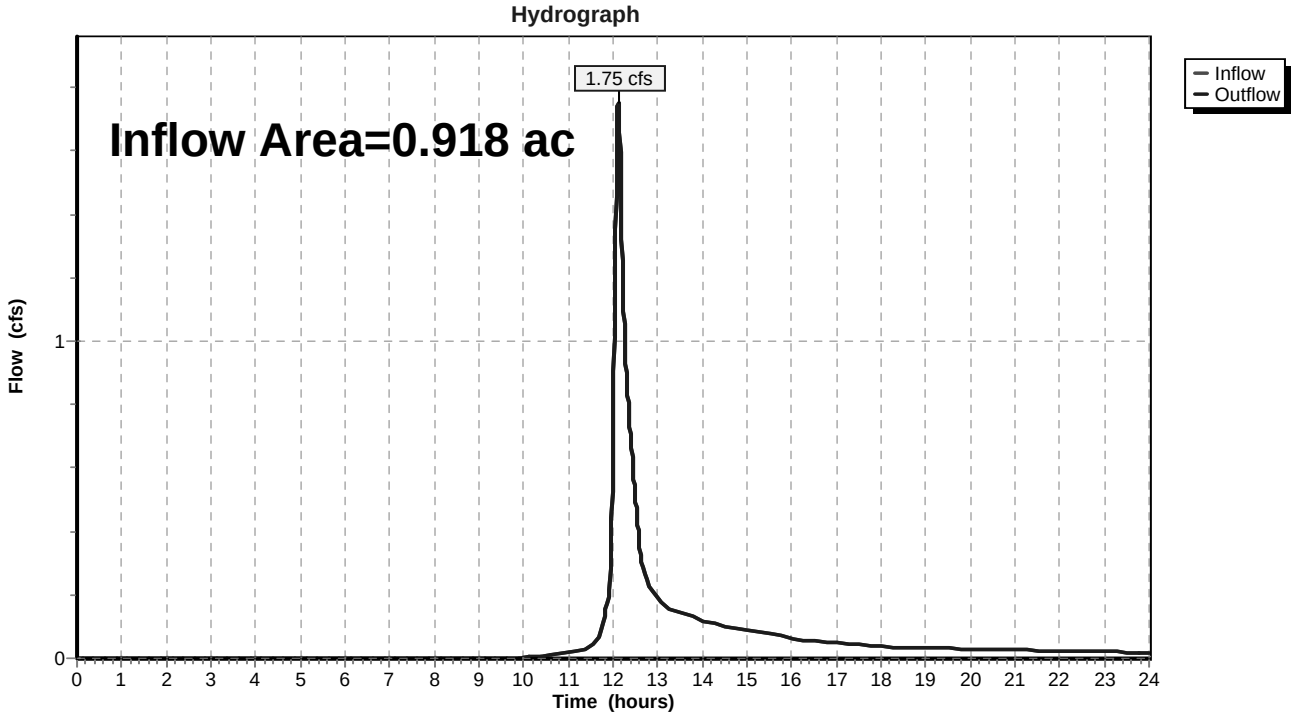


Summary for Reach DP1: School Street Design Point

Inflow Area = 0.918 ac, 43.14% Impervious, Inflow Depth > 1.45" for 2 YR event
Inflow = 1.75 cfs @ 12.12 hrs, Volume= 0.111 af
Outflow = 1.75 cfs @ 12.12 hrs, Volume= 0.111 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach DP1: School Street Design Point



Summary for Subcatchment N2: Northwest Church Street

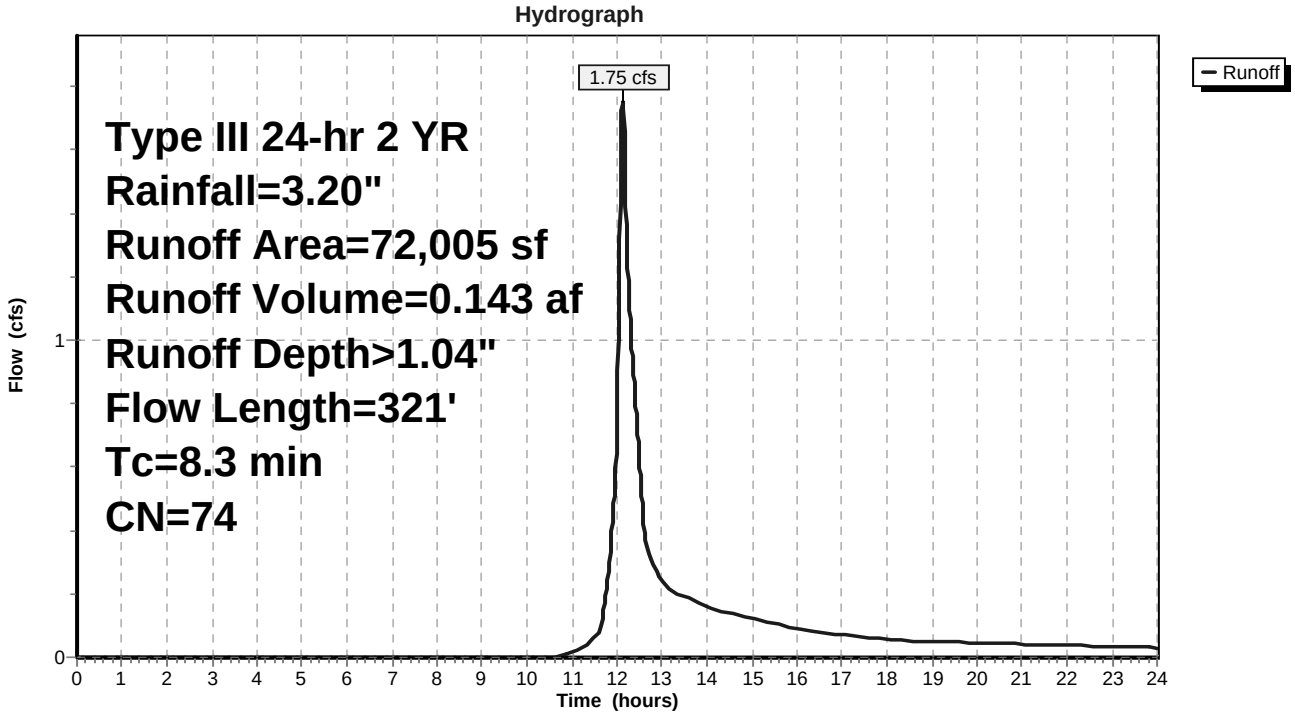
Runoff = 1.75 cfs @ 12.13 hrs, Volume= 0.143 af, Depth> 1.04"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YR Rainfall=3.20"

	Area (sf)	CN	Description
	784	98	Paved parking & roofs
	36,024	73	Woods, Fair, HSG C
	32,191	74	>75% Grass cover, Good, HSG C
*	3,006	89	Porous Pavement Fire Lane
	72,005	74	Weighted Average
	71,221		Pervious Area
	784		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0800	0.12		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.8	229	0.0800	4.55		**Shallow Concentrated Flow, B to C** Unpaved Kv= 16.1 fps
0.4	42	0.0140	1.90		**Shallow Concentrated Flow, C to D** Unpaved Kv= 16.1 fps
8.3	321	Total			

Subcatchment N2: Northwest Church Street



Summary for Subcatchment N3: Play Area

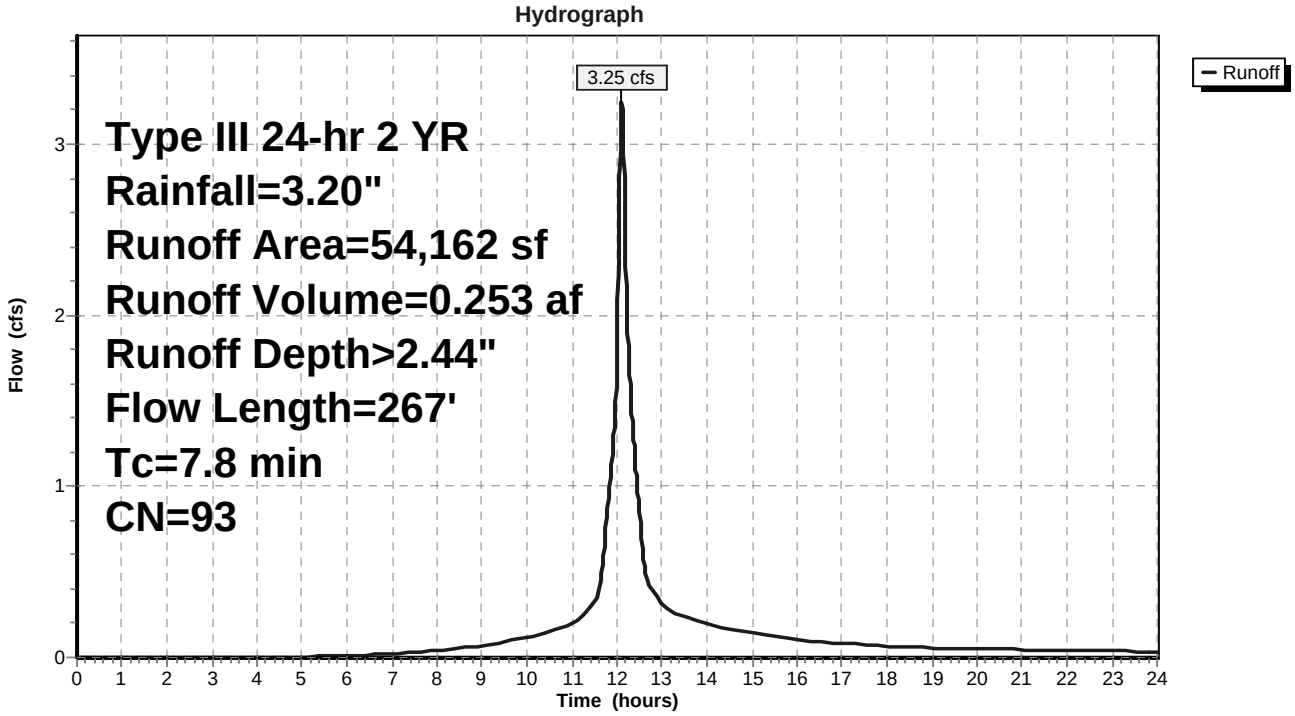
Runoff = 3.25 cfs @ 12.11 hrs, Volume= 0.253 af, Depth> 2.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YR Rainfall=3.20"

Area (sf)	CN	Description
41,936	98	Paved parking & roofs
12,226	74	>75% Grass cover, Good, HSG C
54,162	93	Weighted Average
12,226		Pervious Area
41,936		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	35	0.0180	0.09		**Sheet Flow, A to B** Grass: Dense n= 0.240 P2= 3.20"
0.2	46	0.0250	3.21		**Shallow Concentrated Flow, B to C** Paved Kv= 20.3 fps
1.2	186	0.0160	2.57		**Shallow Concentrated Flow, C to D** Paved Kv= 20.3 fps
7.8	267	Total			

Subcatchment N3: Play Area

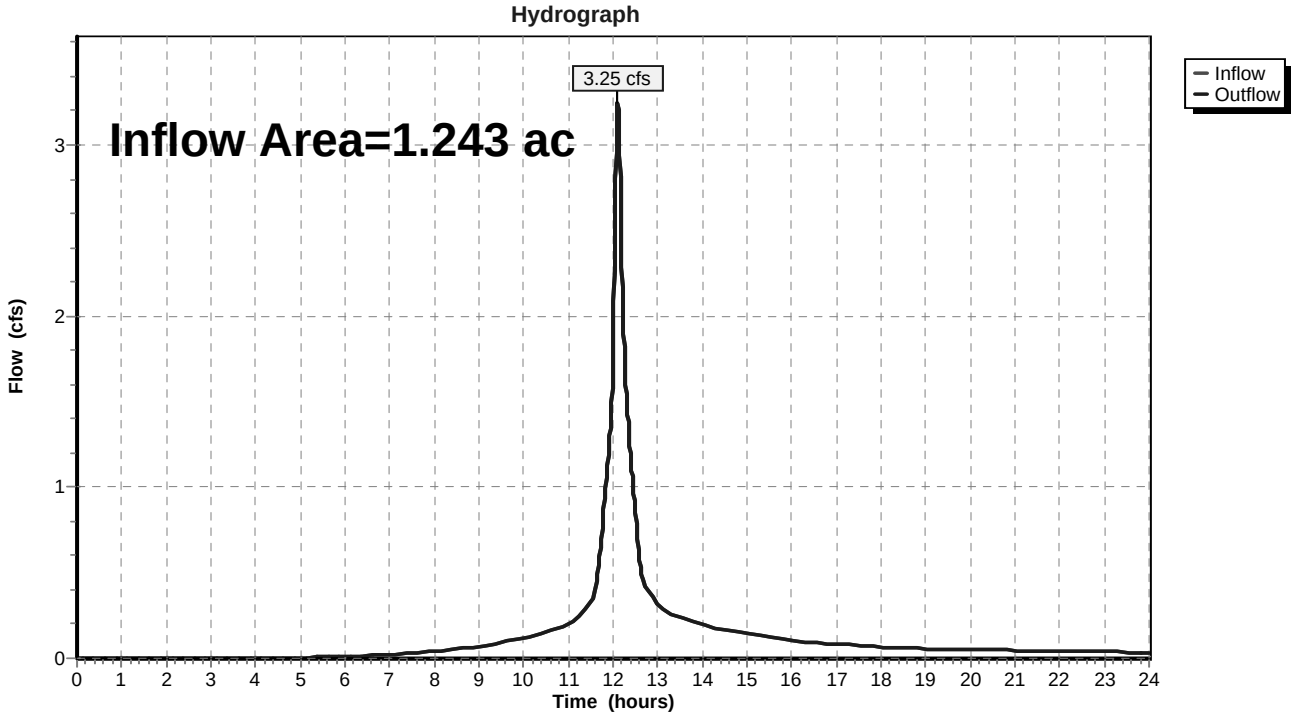


Summary for Reach R2: DMH#5

Inflow Area = 1.243 ac, 77.43% Impervious, Inflow Depth > 2.44" for 2 YR event
Inflow = 3.25 cfs @ 12.11 hrs, Volume= 0.253 af
Outflow = 3.25 cfs @ 12.11 hrs, Volume= 0.253 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach R2: DMH#5



Summary for Pond SDB#1: Subsurface Detention Bed

Inflow Area = 1.243 ac, 77.43% Impervious, Inflow Depth > 2.44" for 2 YR event
Inflow = 3.25 cfs @ 12.11 hrs, Volume= 0.253 af
Outflow = 3.13 cfs @ 12.13 hrs, Volume= 0.253 af, Atten= 4%, Lag= 1.5 min
Primary = 3.13 cfs @ 12.13 hrs, Volume= 0.253 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 227.74' @ 12.13 hrs Surf.Area= 0.015 ac Storage= 0.012 af

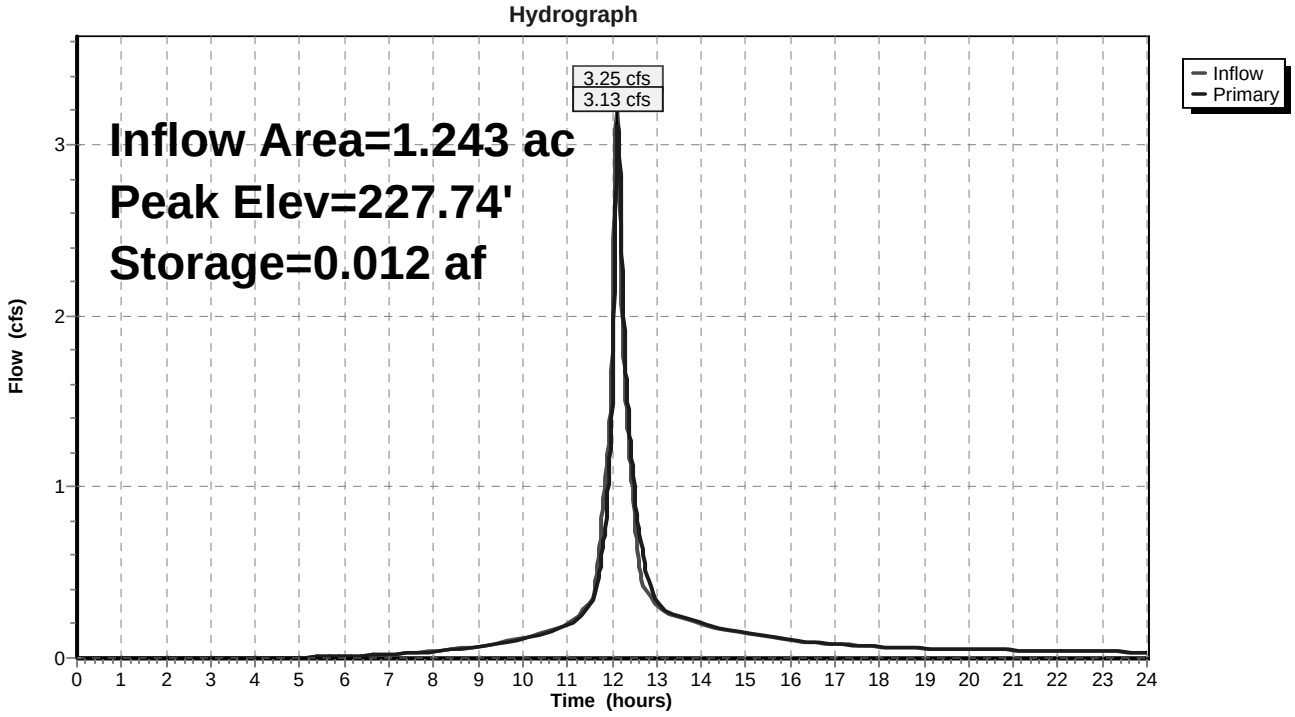
Plug-Flow detention time= 4.0 min calculated for 0.253 af (100% of inflow)
Center-of-Mass det. time= 3.3 min (796.9 - 793.5)

Volume	Invert	Avail.Storage	Storage Description
#1	226.73'	0.021 af	**24.0"D x 41.00'L (7) 24" HDPE Pipe Laterals** x 7
#2	226.73'	0.003 af	**24.0"D x 22.31'L (2) 24" HDPE Pipe Headers** x 2
		0.024 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	226.73'	**4.0" Vert. Orifice/Grate X 3.00** C= 0.600
#2	Primary	227.25'	**8.0" Vert. Orifice/Grate X 3.00** C= 0.600

Primary OutFlow Max=3.12 cfs @ 12.13 hrs HW=227.74' (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 1.16 cfs @ 4.42 fps)
└─**2=Orifice/Grate** (Orifice Controls 1.96 cfs @ 2.38 fps)

Pond SDB#1: Subsurface Detention Bed



Summary for Pond OCS1: OCS#1

Inflow Area = 1.243 ac, 77.43% Impervious, Inflow Depth > 2.44" for 2 YR event
Inflow = 3.13 cfs @ 12.13 hrs, Volume= 0.253 af
Outflow = 3.13 cfs @ 12.13 hrs, Volume= 0.252 af, Atten= 0%, Lag= 0.1 min
Primary = 3.13 cfs @ 12.13 hrs, Volume= 0.252 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 226.06' @ 12.13 hrs Surf.Area= 17 sf Storage= 35 cf

Plug-Flow detention time= 2.2 min calculated for 0.252 af (100% of inflow)
Center-of-Mass det. time= 1.0 min (797.9 - 796.9)

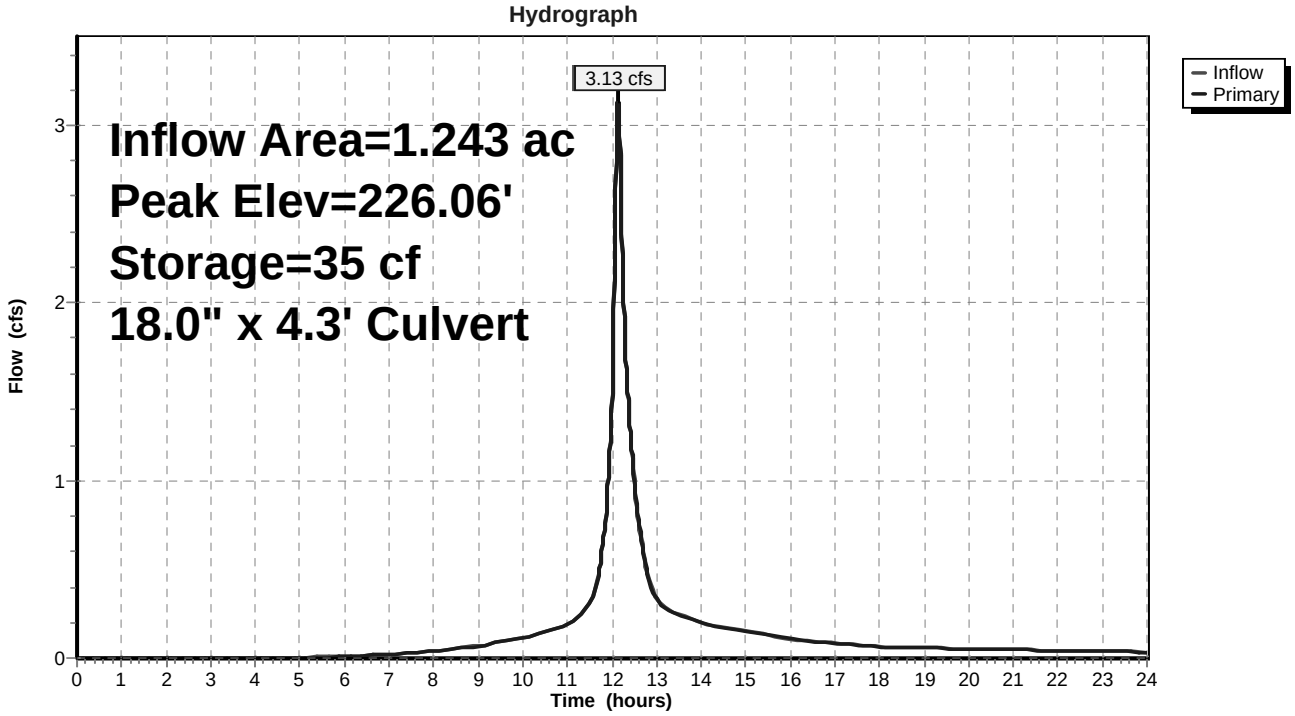
Volume	Invert	Avail.Storage	Storage Description
#1	223.98'	76 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
223.98	17	0	0
228.43	17	76	76

Device	Routing	Invert	Outlet Devices
#1	Primary	225.10'	**18.0" x 4.3' long 18" HDPE** CPP, square edge headwall, Ke= 0.500 Outlet Invert= 225.00' S= 0.0233 '/' Cc= 0.900 n= 0.012

Primary OutFlow Max=3.12 cfs @ 12.13 hrs HW=226.06' (Free Discharge)
└**1=18" HDPE** (Barrel Controls 3.12 cfs @ 3.73 fps)

Pond OCS1: OCS#1



Summary for Subcatchment N3a: Roof & Gutter Drainage

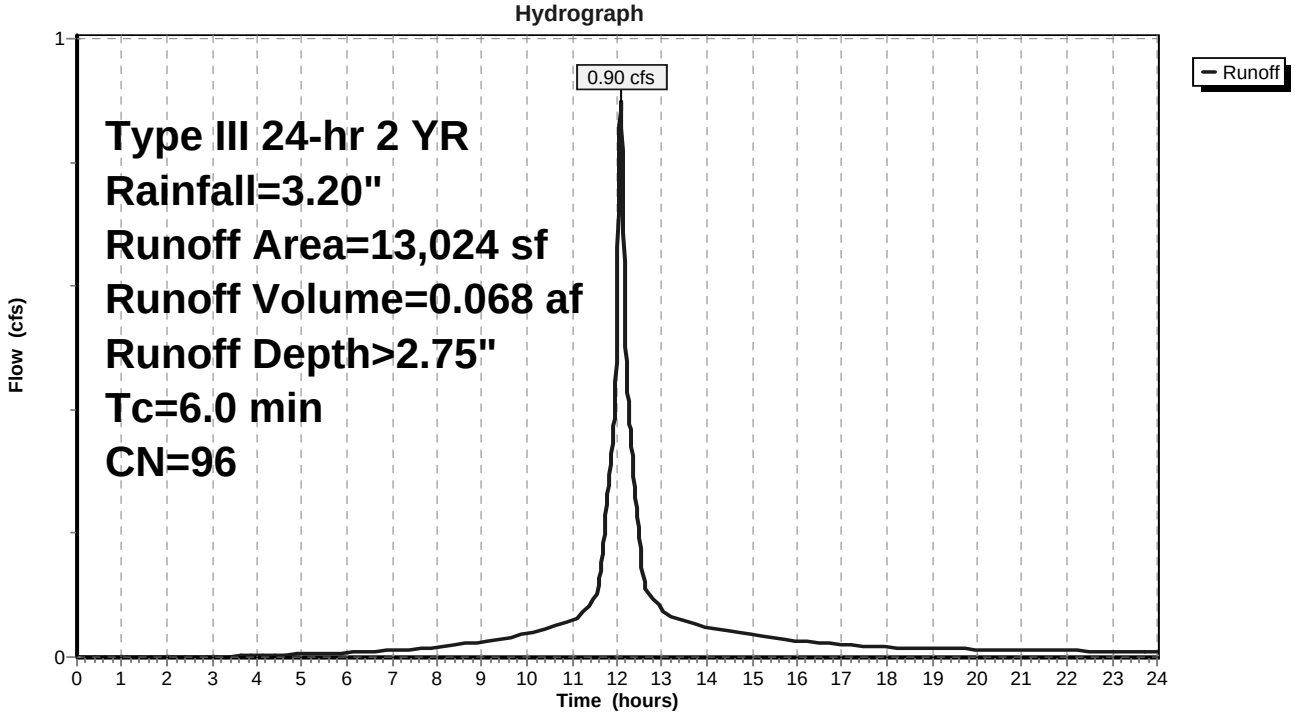
Runoff = 0.90 cfs @ 12.08 hrs, Volume= 0.068 af, Depth> 2.75"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YR Rainfall=3.20"

Area (sf)	CN	Description
12,153	98	Paved parking & roofs
871	74	>75% Grass cover, Good, HSG C
13,024	96	Weighted Average
871		Pervious Area
12,153		Impervious Area

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

Subcatchment N3a: Roof & Gutter Drainage



Summary for Pond LP1-2: Leaching Pits

Inflow Area =	0.299 ac, 93.31% Impervious, Inflow Depth > 2.75" for 2 YR event				
Inflow =	0.90 cfs @	12.08 hrs,	Volume=	0.068 af	
Outflow =	0.88 cfs @	12.10 hrs,	Volume=	0.055 af,	Atten= 2%, Lag= 1.1 min
Discarded =	0.00 cfs @	4.47 hrs,	Volume=	0.003 af	
Primary =	0.87 cfs @	12.10 hrs,	Volume=	0.052 af	

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 231.15' @ 12.10 hrs Surf.Area= 0.007 ac Storage= 0.015 af

Plug-Flow detention time= 121.7 min calculated for 0.055 af (81% of inflow)
Center-of-Mass det. time= 48.5 min (822.0 - 773.5)

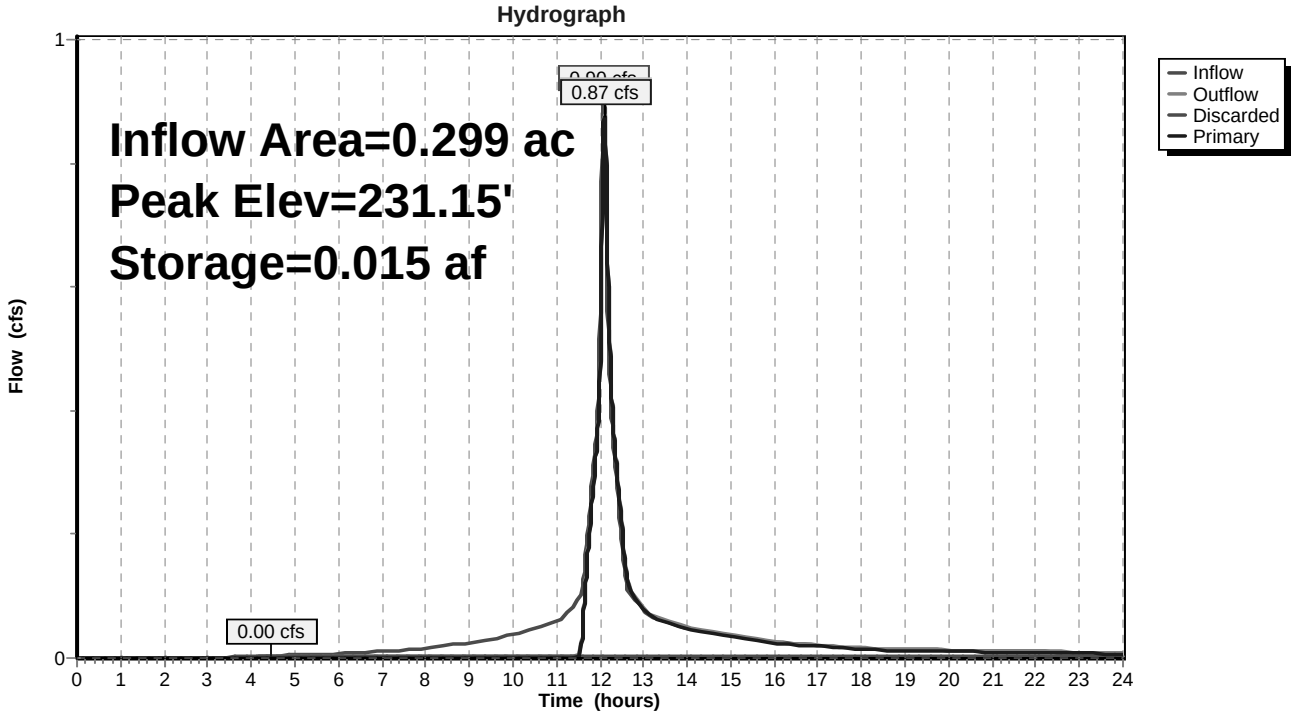
Volume	Invert	Avail.Storage	Storage Description
#1	227.19'	0.010 af	**14.00'D x 5.17'H Gravel** x 2 0.037 af Overall - 0.011 af Embedded = 0.026 af x 40.0% Voids
#2	227.86'	0.009 af	**8.00'D x 4.00'H Leaching Pit Structure** x 2 Inside #1 0.011 af Overall - 4.0" Wall Thickness = 0.009 af
		0.020 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	227.19'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	230.60'	**12.0" x 171.4' long 12" HDPE** CMP, projecting, no headwall, Ke= 0.900 Outlet Invert= 225.00' S= 0.0327 '/' Cc= 0.900 n= 0.012

Discarded OutFlow Max=0.00 cfs @ 4.47 hrs HW=227.24' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.87 cfs @ 12.10 hrs HW=231.15' (Free Discharge)
└─**2=12" HDPE** (Inlet Controls 0.87 cfs @ 1.99 fps)

Pond LP1-2: Leaching Pits

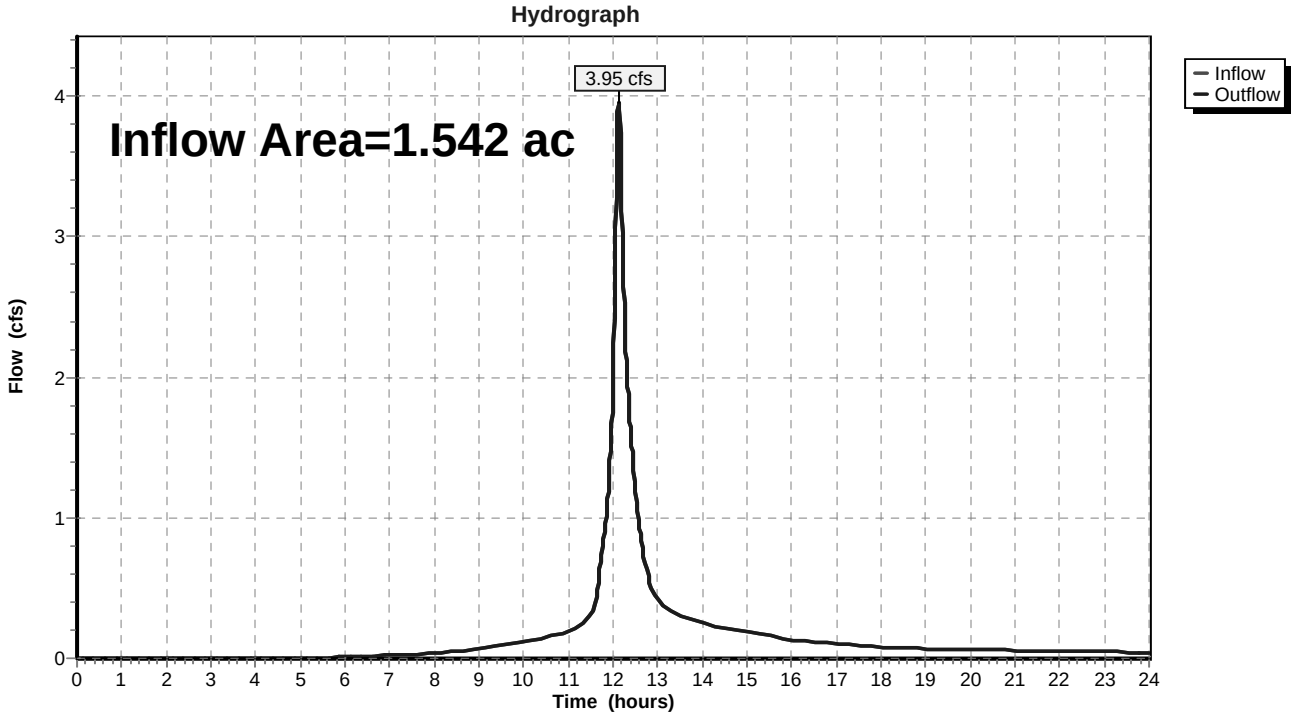


Summary for Reach N3 DP: N3 Design Point

Inflow Area = 1.542 ac, 80.51% Impervious, Inflow Depth > 2.37" for 2 YR event
Inflow = 3.95 cfs @ 12.13 hrs, Volume= 0.304 af
Outflow = 3.95 cfs @ 12.13 hrs, Volume= 0.304 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach N3 DP: N3 Design Point



Summary for Subcatchment N4: Ex. Parking Area

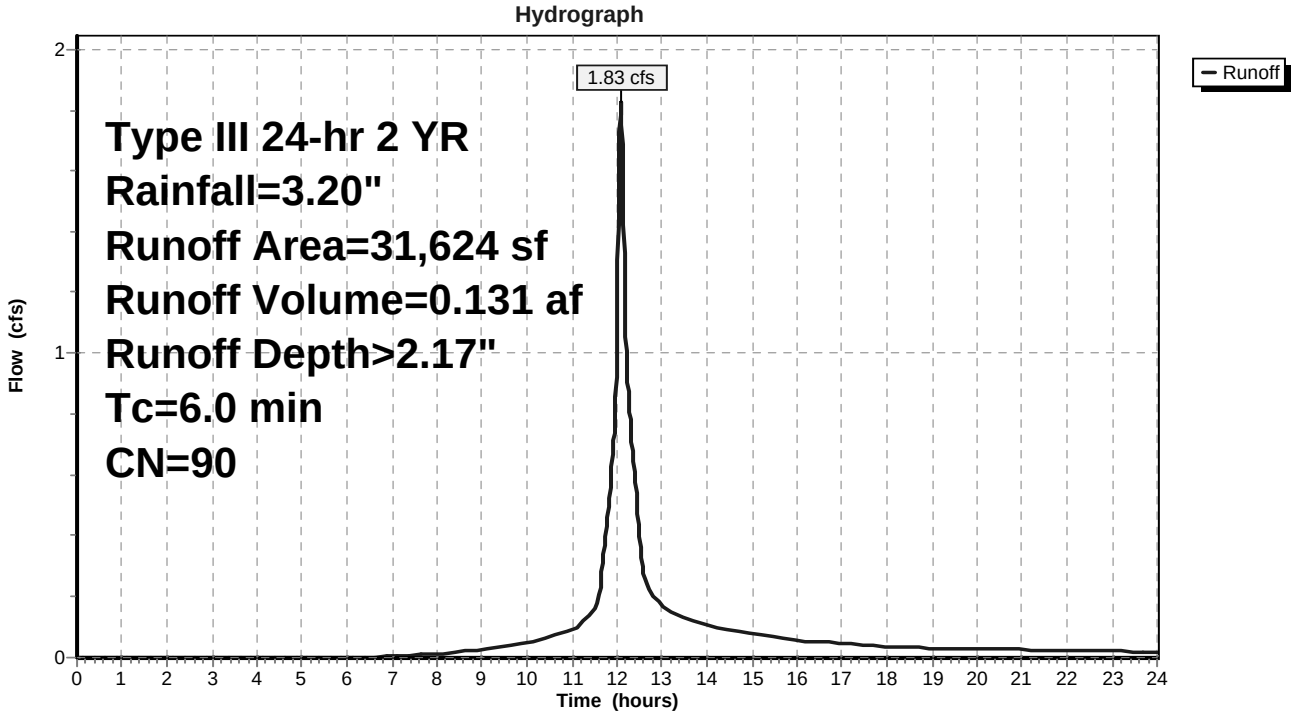
Runoff = 1.83 cfs @ 12.09 hrs, Volume= 0.131 af, Depth> 2.17"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YR Rainfall=3.20"

Area (sf)	CN	Description
21,562	98	Paved parking & roofs
697	73	Woods, Fair, HSG C
9,365	74	>75% Grass cover, Good, HSG C
31,624	90	Weighted Average
10,062		Pervious Area
21,562		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Calculated Value <6 mins: Direct Entry**

Subcatchment N4: Ex. Parking Area

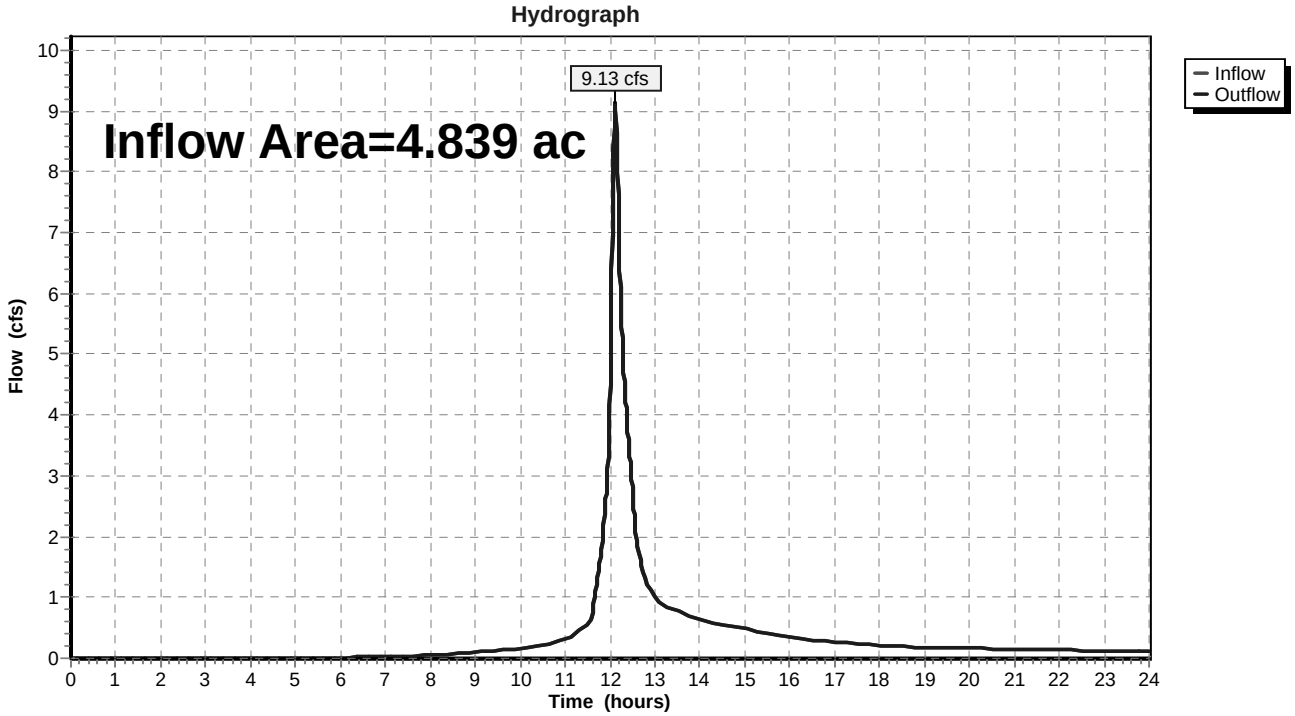


Summary for Reach DP: Analysis Design Point

Inflow Area = 4.839 ac, 44.44% Impervious, Inflow Depth > 1.71" for 2 YR event
Inflow = 9.13 cfs @ 12.12 hrs, Volume= 0.689 af
Outflow = 9.13 cfs @ 12.12 hrs, Volume= 0.689 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach DP: Analysis Design Point



Summary for Subcatchment N1: Runoff to School Street

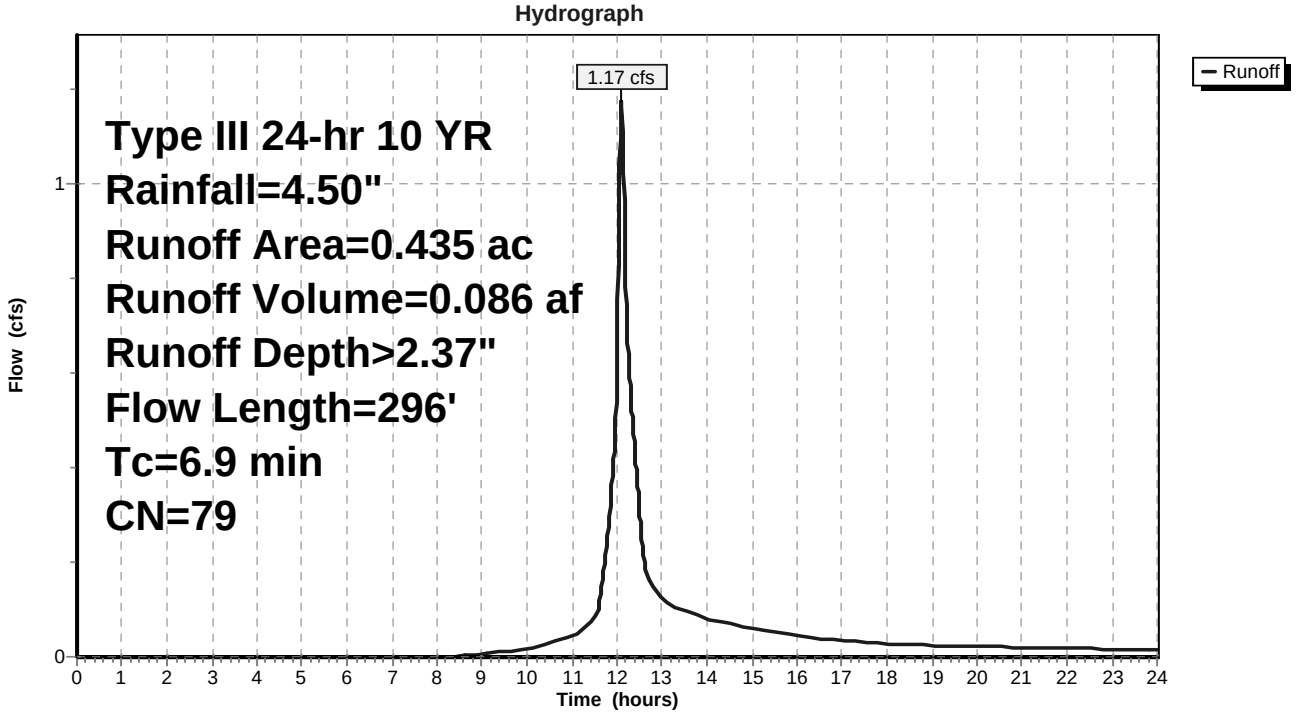
Runoff = 1.17 cfs @ 12.10 hrs, Volume= 0.086 af, Depth> 2.37"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=4.50"

Area (ac)	CN	Description
0.097	98	Paved parking & roofs
0.136	73	Woods, Fair, HSG C
0.202	74	>75% Grass cover, Good, HSG C
0.435	79	Weighted Average
0.338		Pervious Area
0.097		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.9	50	0.1240	0.14		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.3	82	0.0700	4.26		**Shallow Concentrated Flow, B to C** Unpaved Kv= 16.1 fps
0.7	164	0.0400	4.06		**Shallow Concentrated Flow, C to D** Paved Kv= 20.3 fps
6.9	296	Total			

Subcatchment N1: Runoff to School Street



Summary for Subcatchment N1a: Runoff to School Street

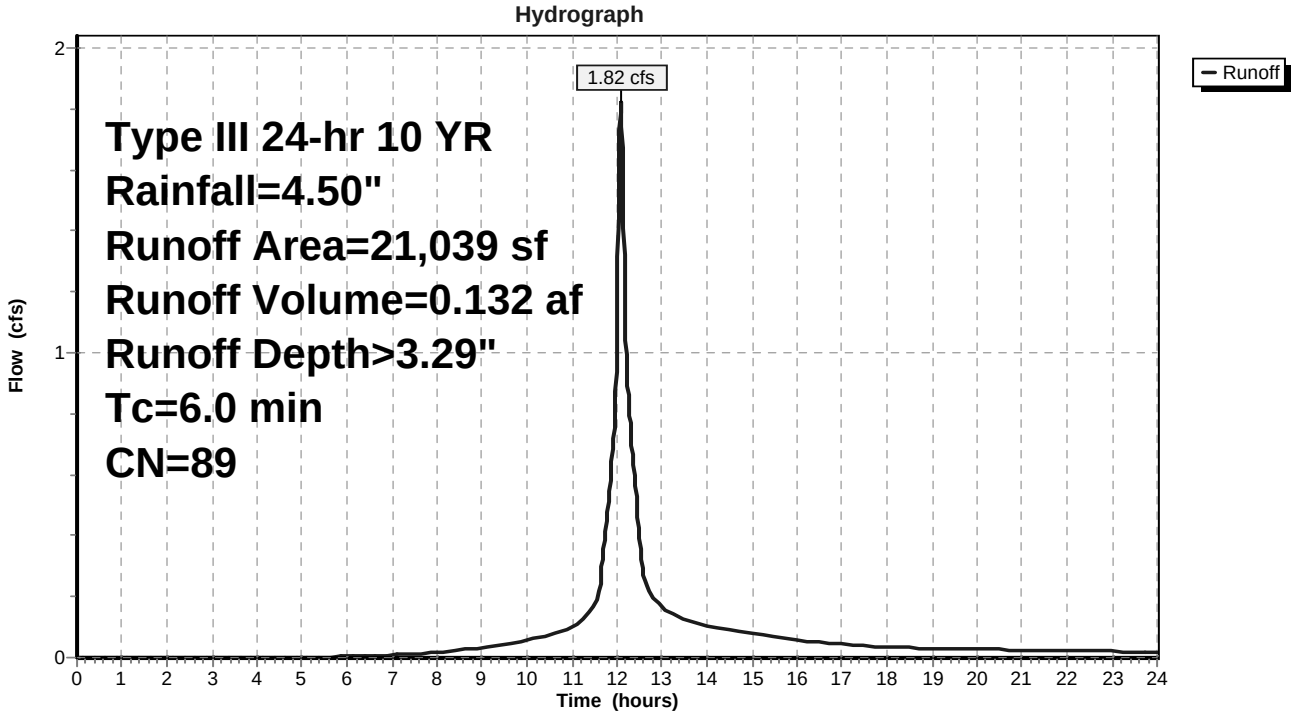
Runoff = 1.82 cfs @ 12.09 hrs, Volume= 0.132 af, Depth> 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=4.50"

Area (sf)	CN	Description
13,024	98	Paved parking & roofs
348	73	Woods, Fair, HSG C
7,667	74	>75% Grass cover, Good, HSG C
21,039	89	Weighted Average
8,015		Pervious Area
13,024		Impervious Area

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

Subcatchment N1a: Runoff to School Street



Summary for Reach R1: Parking Lot Swale

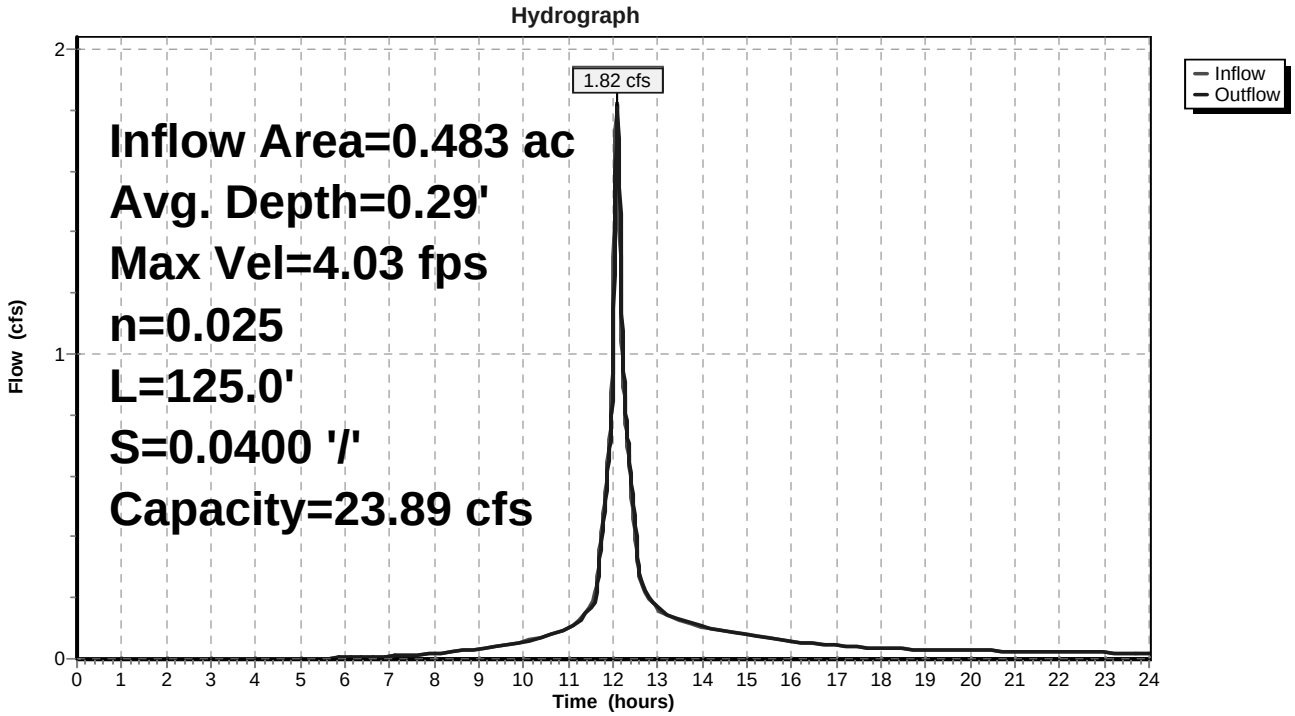
Inflow Area = 0.483 ac, 61.90% Impervious, Inflow Depth > 3.29" for 10 YR event
Inflow = 1.82 cfs @ 12.09 hrs, Volume= 0.132 af
Outflow = 1.82 cfs @ 12.10 hrs, Volume= 0.132 af, Atten= 0%, Lag= 0.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.03 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.23 fps, Avg. Travel Time= 1.7 min

Peak Storage= 56 cf @ 12.09 hrs, Average Depth at Peak Storage= 0.29'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 23.89 cfs

1.00' x 1.00' deep channel, n= 0.025 Earth, grassed & winding
Side Slope Z-value= 2.0 '/' Top Width= 5.00'
Length= 125.0' Slope= 0.0400 '/'
Inlet Invert= 232.00', Outlet Invert= 227.00'

Reach R1: Parking Lot Swale



Summary for Pond 2P: Bioretention Pond

Inflow Area =	0.483 ac, 61.90% Impervious, Inflow Depth > 3.29" for 10 YR event				
Inflow =	1.82 cfs @	12.10 hrs,	Volume=	0.132 af	
Outflow =	1.76 cfs @	12.12 hrs,	Volume=	0.115 af,	Atten= 3%, Lag= 1.3 min
Discarded =	0.00 cfs @	12.12 hrs,	Volume=	0.004 af	
Primary =	1.76 cfs @	12.12 hrs,	Volume=	0.111 af	

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 225.65' @ 12.12 hrs Surf.Area= 672 sf Storage= 942 cf

Plug-Flow detention time= 90.3 min calculated for 0.115 af (87% of inflow)
Center-of-Mass det. time= 32.6 min (831.4 - 798.8)

Volume	Invert	Avail.Storage	Storage Description
#1	221.75'	1,484 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

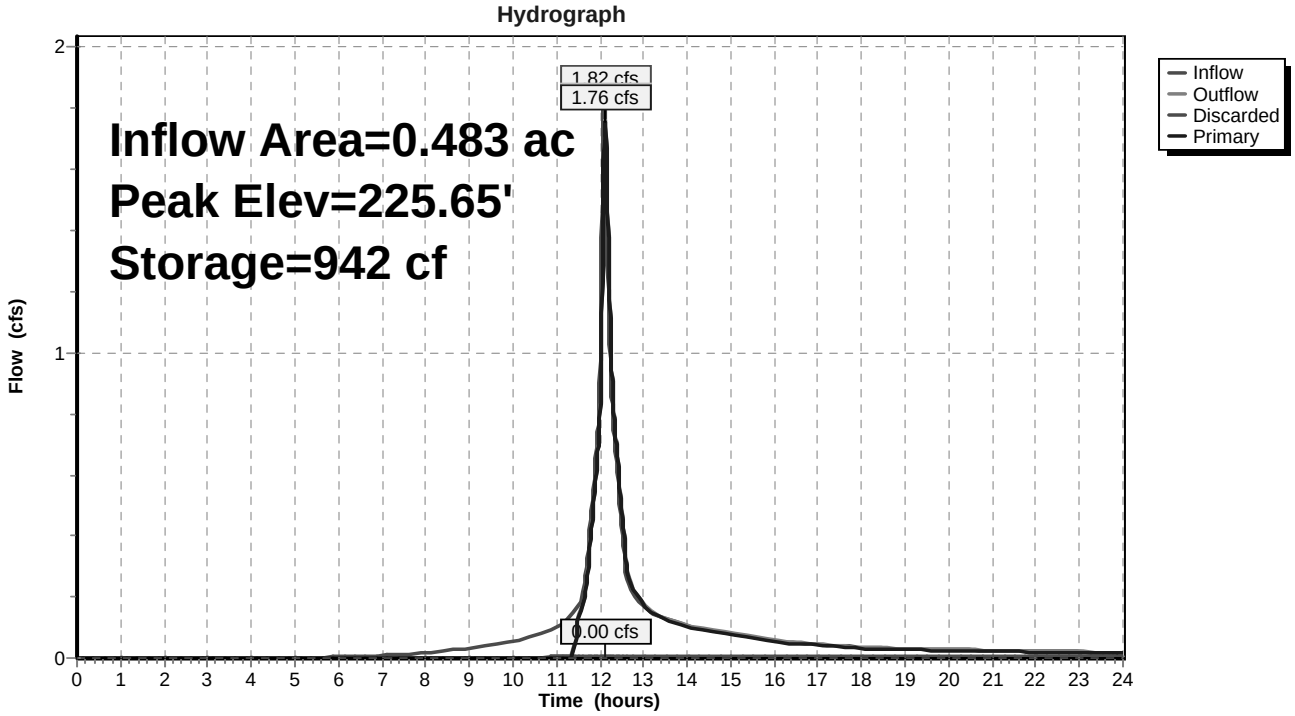
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
221.75	0	0.0	0	0	0
222.00	9	13.6	1	1	15
223.00	90	38.1	42	43	119
224.00	251	63.3	164	207	328
225.00	484	88.2	361	568	638
226.00	787	110.0	629	1,198	996
226.33	950	124.2	286	1,484	1,263

Device	Routing	Invert	Outlet Devices
#1	Primary	225.33'	**4.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	221.75'	**0.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.00 cfs @ 12.12 hrs HW=225.65' (Free Discharge)
└─**2=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=1.75 cfs @ 12.12 hrs HW=225.65' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 1.75 cfs @ 1.37 fps)

Pond 2P: Bioretention Pond

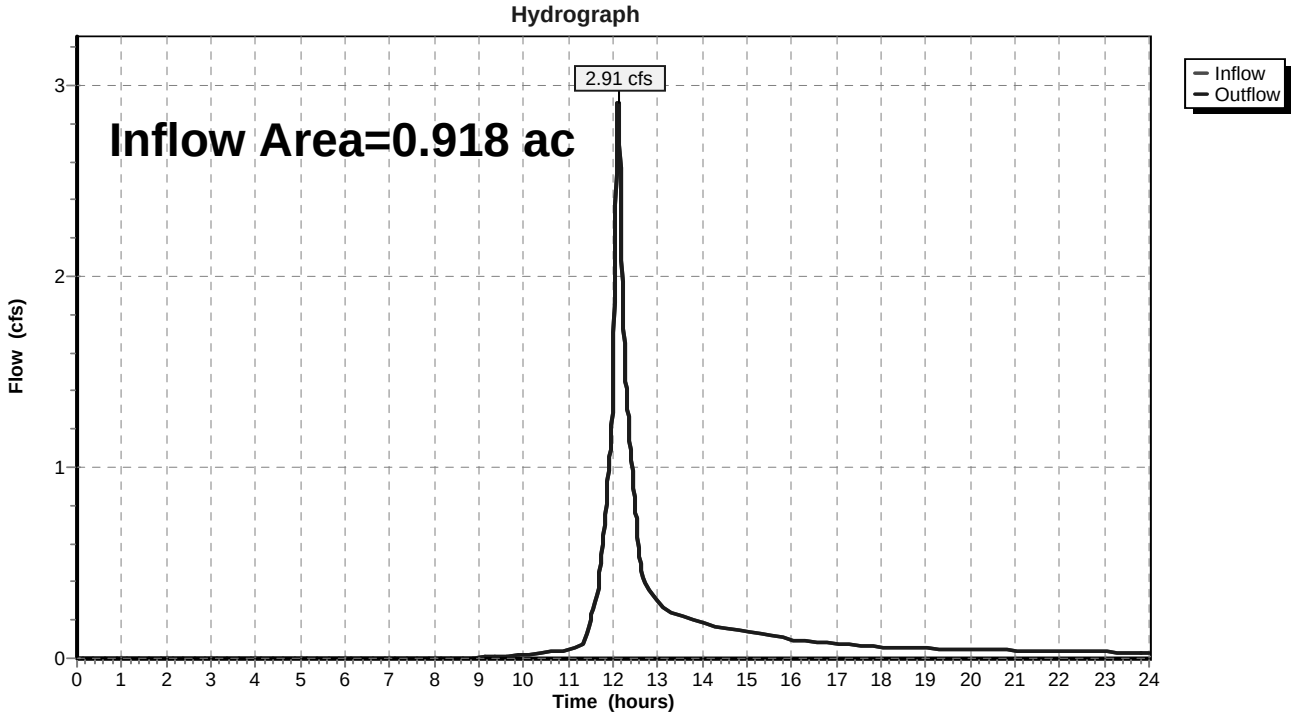


Summary for Reach DP1: School Street Design Point

Inflow Area = 0.918 ac, 43.14% Impervious, Inflow Depth > 2.57" for 10 YR event
Inflow = 2.91 cfs @ 12.11 hrs, Volume= 0.197 af
Outflow = 2.91 cfs @ 12.11 hrs, Volume= 0.197 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach DP1: School Street Design Point



Summary for Subcatchment N2: Northwest Church Street

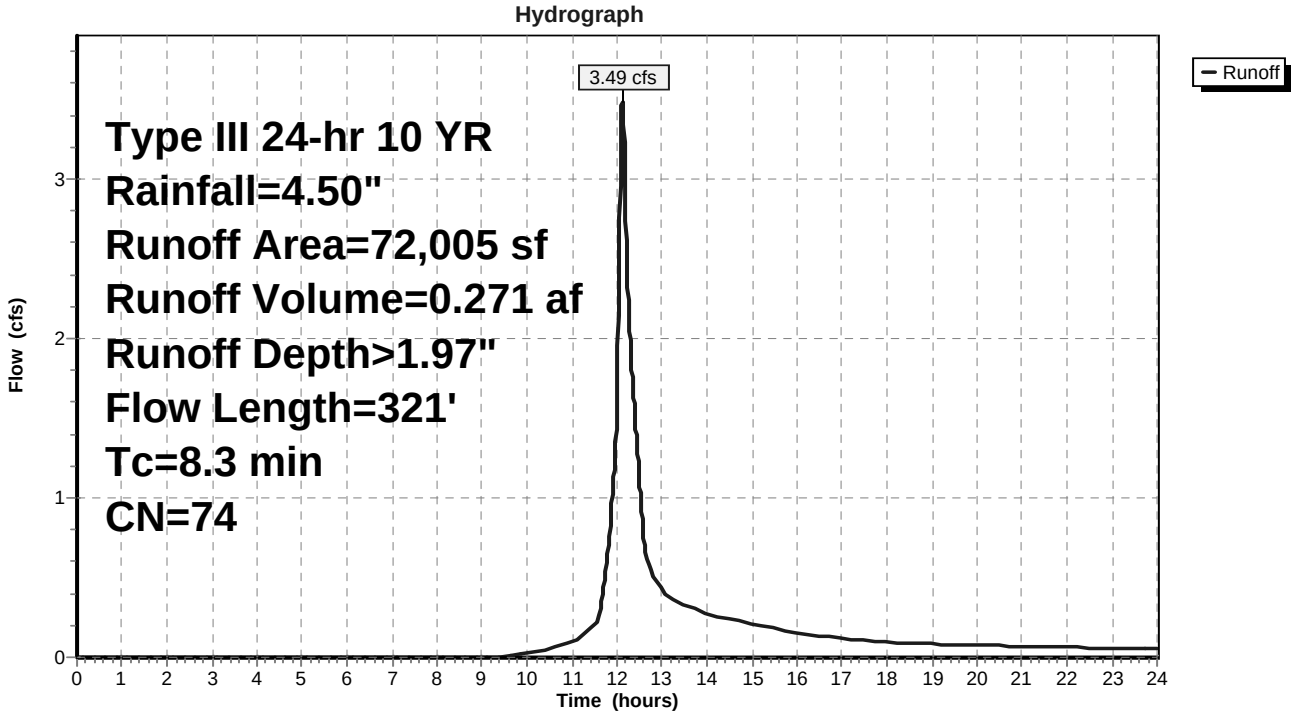
Runoff = 3.49 cfs @ 12.12 hrs, Volume= 0.271 af, Depth> 1.97"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=4.50"

	Area (sf)	CN	Description
	784	98	Paved parking & roofs
	36,024	73	Woods, Fair, HSG C
	32,191	74	>75% Grass cover, Good, HSG C
*	3,006	89	Porous Pavement Fire Lane
	72,005	74	Weighted Average
	71,221		Pervious Area
	784		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0800	0.12		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.8	229	0.0800	4.55		**Shallow Concentrated Flow, B to C** Unpaved Kv= 16.1 fps
0.4	42	0.0140	1.90		**Shallow Concentrated Flow, C to D** Unpaved Kv= 16.1 fps
8.3	321	Total			

Subcatchment N2: Northwest Church Street



Summary for Subcatchment N3: Play Area

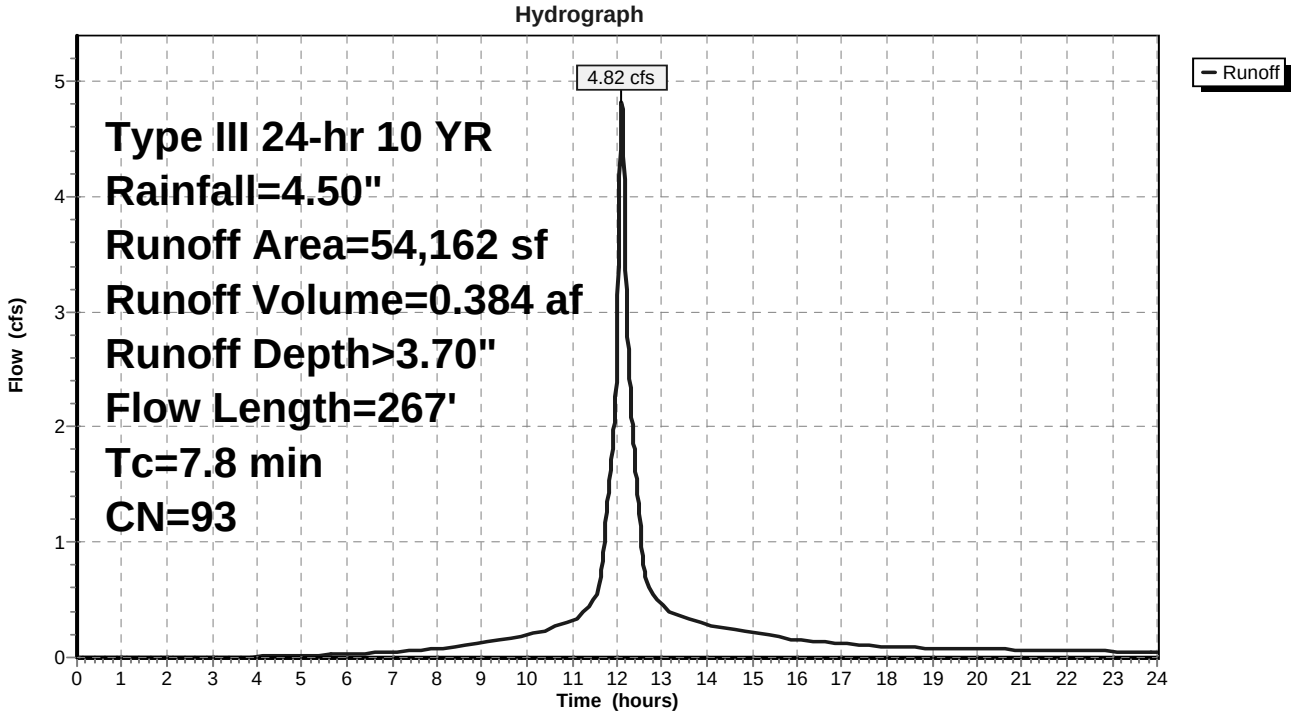
Runoff = 4.82 cfs @ 12.11 hrs, Volume= 0.384 af, Depth> 3.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=4.50"

Area (sf)	CN	Description
41,936	98	Paved parking & roofs
12,226	74	>75% Grass cover, Good, HSG C
54,162	93	Weighted Average
12,226		Pervious Area
41,936		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	35	0.0180	0.09		**Sheet Flow, A to B** Grass: Dense n= 0.240 P2= 3.20"
0.2	46	0.0250	3.21		**Shallow Concentrated Flow, B to C** Paved Kv= 20.3 fps
1.2	186	0.0160	2.57		**Shallow Concentrated Flow, C to D** Paved Kv= 20.3 fps
7.8	267	Total			

Subcatchment N3: Play Area

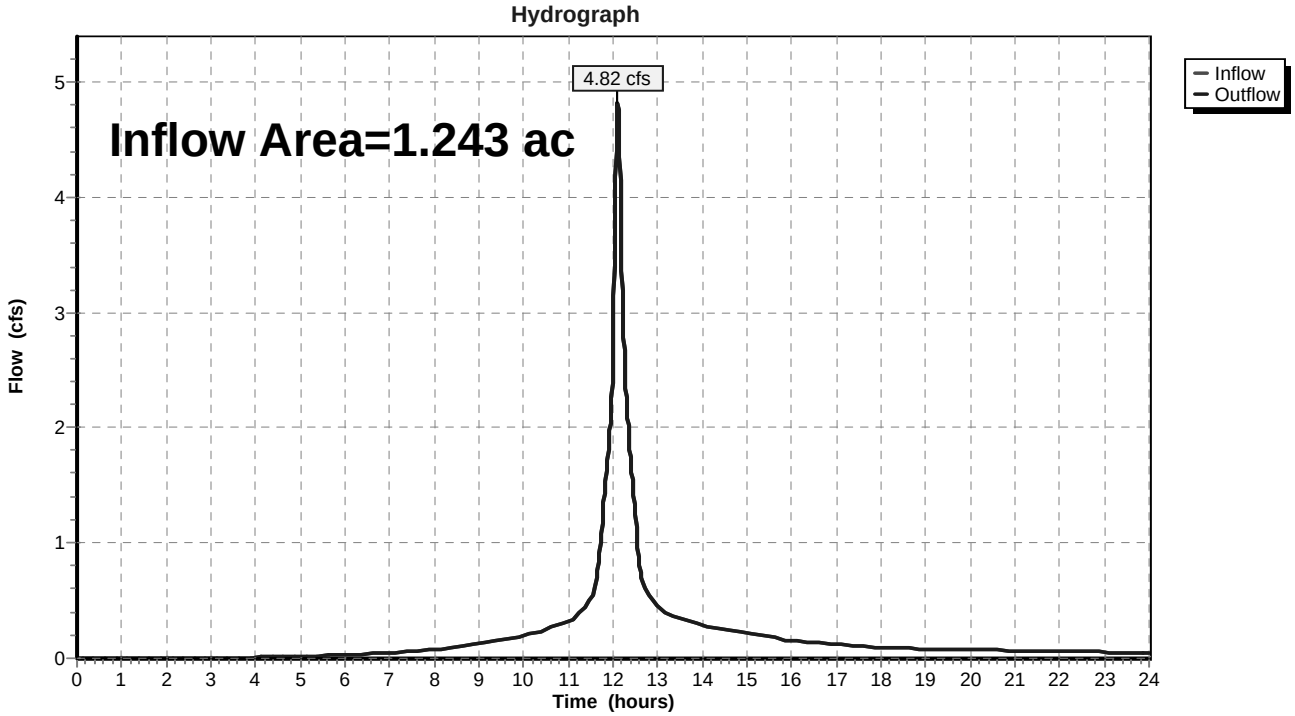


Summary for Reach R2: DMH#5

Inflow Area = 1.243 ac, 77.43% Impervious, Inflow Depth > 3.70" for 10 YR event
Inflow = 4.82 cfs @ 12.11 hrs, Volume= 0.384 af
Outflow = 4.82 cfs @ 12.11 hrs, Volume= 0.384 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach R2: DMH#5



Summary for Pond SDB#1: Subsurface Detention Bed

Inflow Area = 1.243 ac, 77.43% Impervious, Inflow Depth > 3.70" for 10 YR event
Inflow = 4.82 cfs @ 12.11 hrs, Volume= 0.384 af
Outflow = 4.55 cfs @ 12.14 hrs, Volume= 0.383 af, Atten= 5%, Lag= 1.8 min
Primary = 4.55 cfs @ 12.14 hrs, Volume= 0.383 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 227.99' @ 12.14 hrs Surf.Area= 0.015 ac Storage= 0.016 af

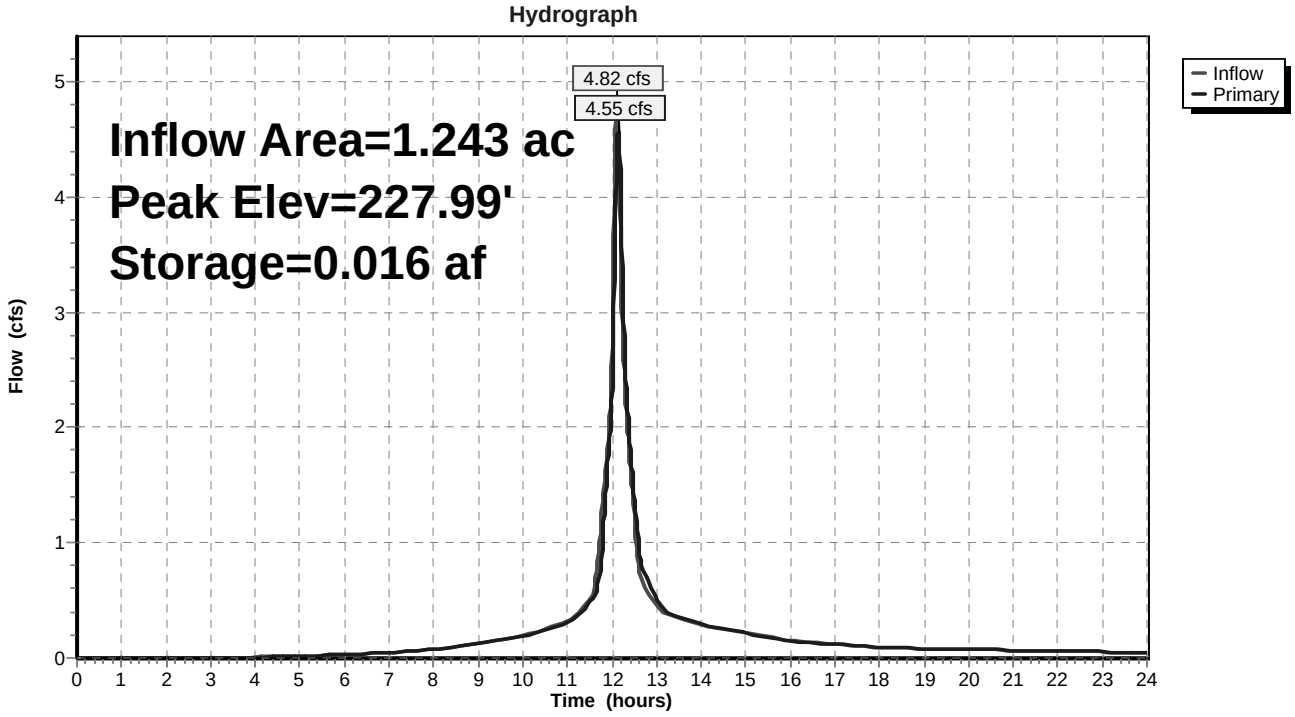
Plug-Flow detention time= 3.7 min calculated for 0.383 af (100% of inflow)
Center-of-Mass det. time= 3.1 min (785.5 - 782.4)

Volume	Invert	Avail.Storage	Storage Description
#1	226.73'	0.021 af	**24.0"D x 41.00'L (7) 24" HDPE Pipe Laterals** x 7
#2	226.73'	0.003 af	**24.0"D x 22.31'L (2) 24" HDPE Pipe Headers** x 2
		0.024 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	226.73'	**4.0" Vert. Orifice/Grate X 3.00** C= 0.600
#2	Primary	227.25'	**8.0" Vert. Orifice/Grate X 3.00** C= 0.600

Primary OutFlow Max=4.55 cfs @ 12.14 hrs HW=227.99' (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 1.32 cfs @ 5.04 fps)
└─**2=Orifice/Grate** (Orifice Controls 3.23 cfs @ 3.09 fps)

Pond SDB#1: Subsurface Detention Bed



Summary for Pond OCS1: OCS#1

Inflow Area = 1.243 ac, 77.43% Impervious, Inflow Depth > 3.70" for 10 YR event
Inflow = 4.55 cfs @ 12.14 hrs, Volume= 0.383 af
Outflow = 4.55 cfs @ 12.14 hrs, Volume= 0.383 af, Atten= 0%, Lag= 0.0 min
Primary = 4.55 cfs @ 12.14 hrs, Volume= 0.383 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 226.31' @ 12.14 hrs Surf.Area= 17 sf Storage= 40 cf

Plug-Flow detention time= 1.6 min calculated for 0.383 af (100% of inflow)
Center-of-Mass det. time= 0.8 min (786.3 - 785.5)

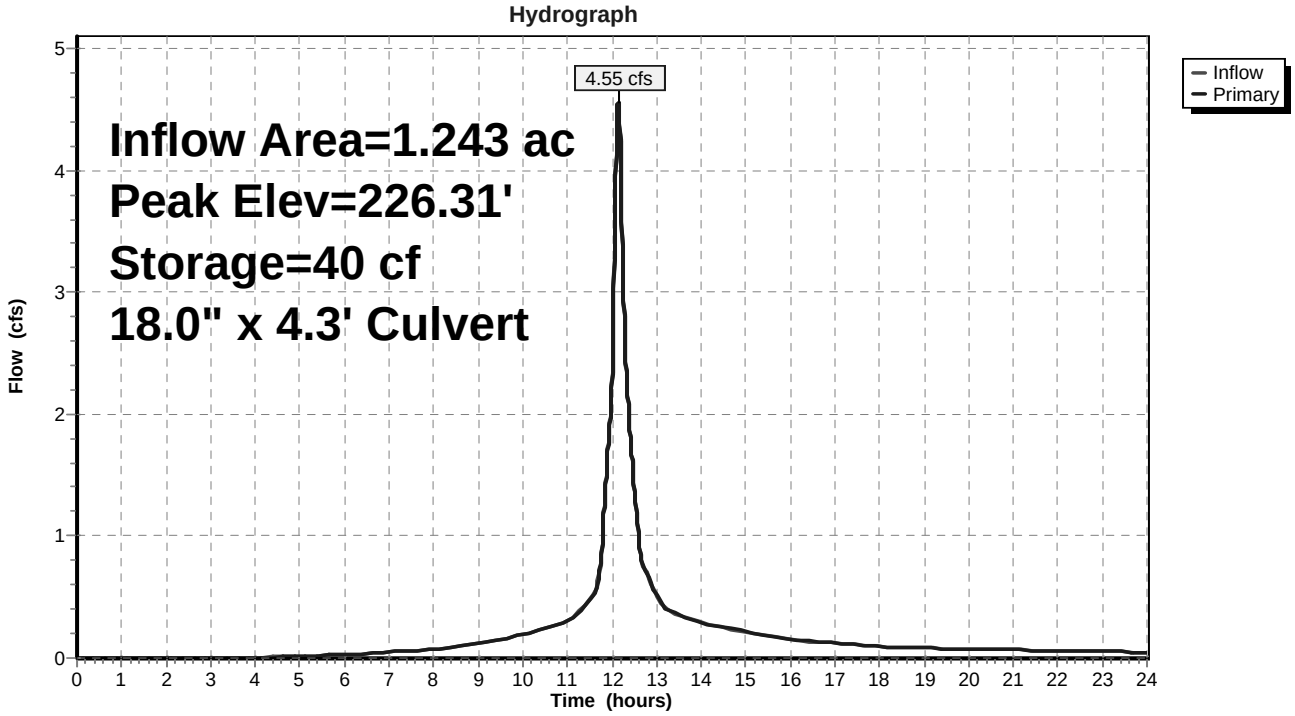
Volume	Invert	Avail.Storage	Storage Description
#1	223.98'	76 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
223.98	17	0	0
228.43	17	76	76

Device	Routing	Invert	Outlet Devices
#1	Primary	225.10'	**18.0" x 4.3' long 18" HDPE** CPP, square edge headwall, Ke= 0.500 Outlet Invert= 225.00' S= 0.0233 '/' Cc= 0.900 n= 0.012

Primary OutFlow Max=4.55 cfs @ 12.14 hrs HW=226.31' (Free Discharge)
└─**1=18" HDPE** (Barrel Controls 4.55 cfs @ 4.08 fps)

Pond OCS1: OCS#1



Summary for Subcatchment N3a: Roof & Gutter Drainage

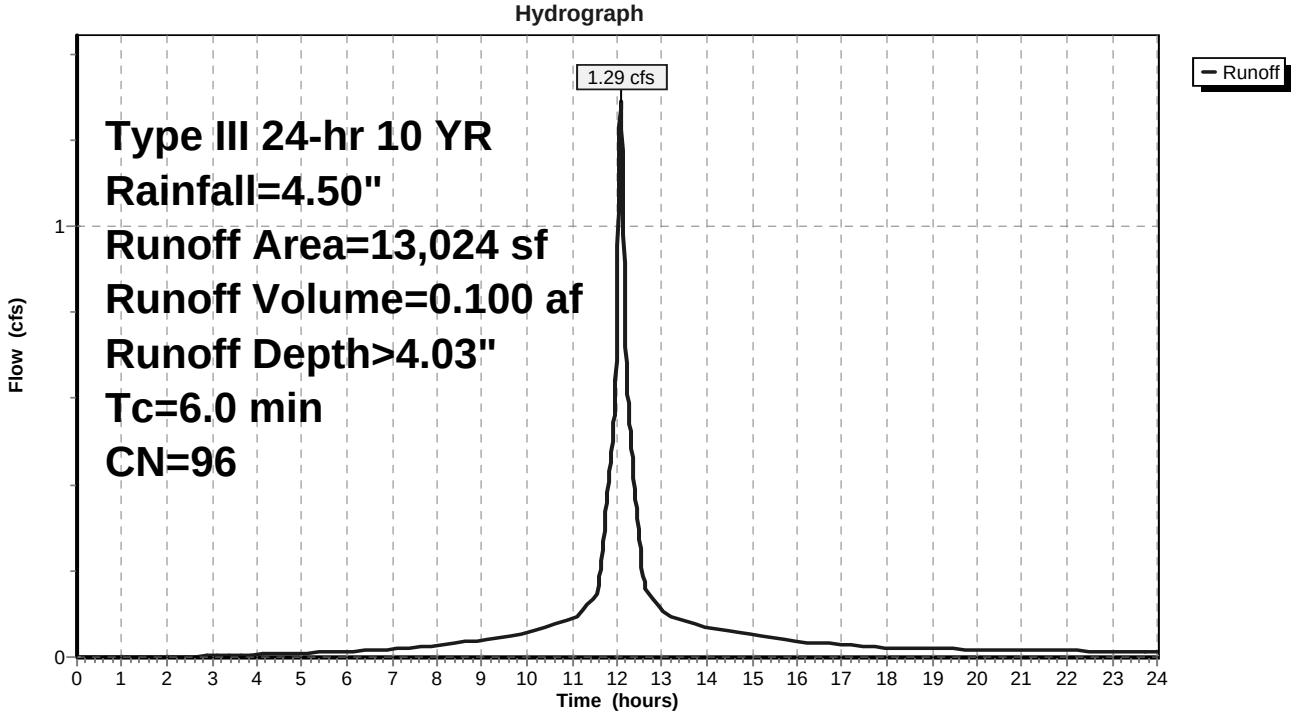
Runoff = 1.29 cfs @ 12.08 hrs, Volume= 0.100 af, Depth> 4.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=4.50"

Area (sf)	CN	Description
12,153	98	Paved parking & roofs
871	74	>75% Grass cover, Good, HSG C
13,024	96	Weighted Average
871		Pervious Area
12,153		Impervious Area

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

Subcatchment N3a: Roof & Gutter Drainage



Summary for Pond LP1-2: Leaching Pits

Inflow Area =	0.299 ac, 93.31% Impervious, Inflow Depth > 4.03" for 10 YR event				
Inflow =	1.29 cfs @	12.08 hrs,	Volume=	0.100 af	
Outflow =	1.26 cfs @	12.10 hrs,	Volume=	0.087 af,	Atten= 2%, Lag= 1.0 min
Discarded =	0.00 cfs @	3.31 hrs,	Volume=	0.003 af	
Primary =	1.26 cfs @	12.10 hrs,	Volume=	0.084 af	

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 231.28' @ 12.10 hrs Surf.Area= 0.007 ac Storage= 0.016 af

Plug-Flow detention time= 100.8 min calculated for 0.087 af (87% of inflow)
Center-of-Mass det. time= 42.0 min (806.4 - 764.4)

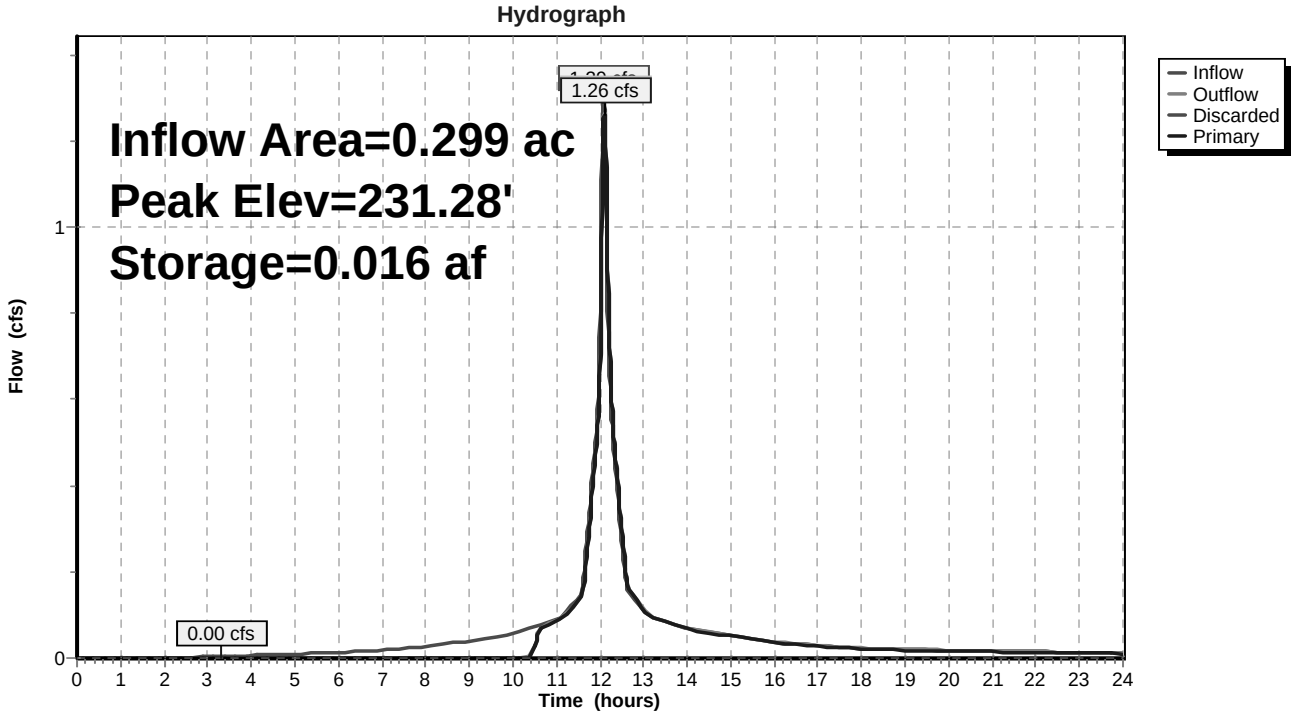
Volume	Invert	Avail.Storage	Storage Description
#1	227.19'	0.010 af	**14.00'D x 5.17'H Gravel** x 2 0.037 af Overall - 0.011 af Embedded = 0.026 af x 40.0% Voids
#2	227.86'	0.009 af	**8.00'D x 4.00'H Leaching Pit Structure** x 2 Inside #1 0.011 af Overall - 4.0" Wall Thickness = 0.009 af
		0.020 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	227.19'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	230.60'	**12.0" x 171.4' long 12" HDPE** CMP, projecting, no headwall, Ke= 0.900 Outlet Invert= 225.00' S= 0.0327 '/' Cc= 0.900 n= 0.012

Discarded OutFlow Max=0.00 cfs @ 3.31 hrs HW=227.24' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=1.26 cfs @ 12.10 hrs HW=231.28' (Free Discharge)
└─**2=12" HDPE** (Inlet Controls 1.26 cfs @ 2.22 fps)

Pond LP1-2: Leaching Pits

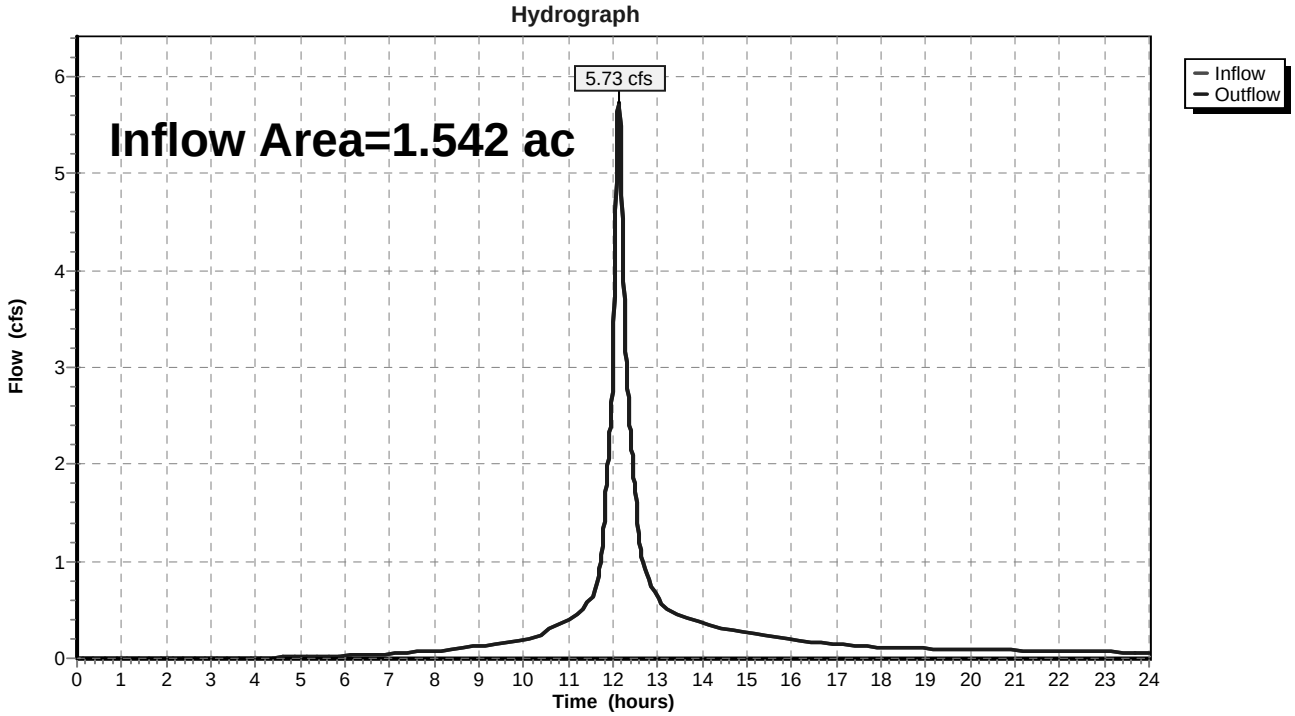


Summary for Reach N3 DP: N3 Design Point

Inflow Area = 1.542 ac, 80.51% Impervious, Inflow Depth > 3.63" for 10 YR event
Inflow = 5.73 cfs @ 12.13 hrs, Volume= 0.467 af
Outflow = 5.73 cfs @ 12.13 hrs, Volume= 0.467 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach N3 DP: N3 Design Point



Summary for Subcatchment N4: Ex. Parking Area

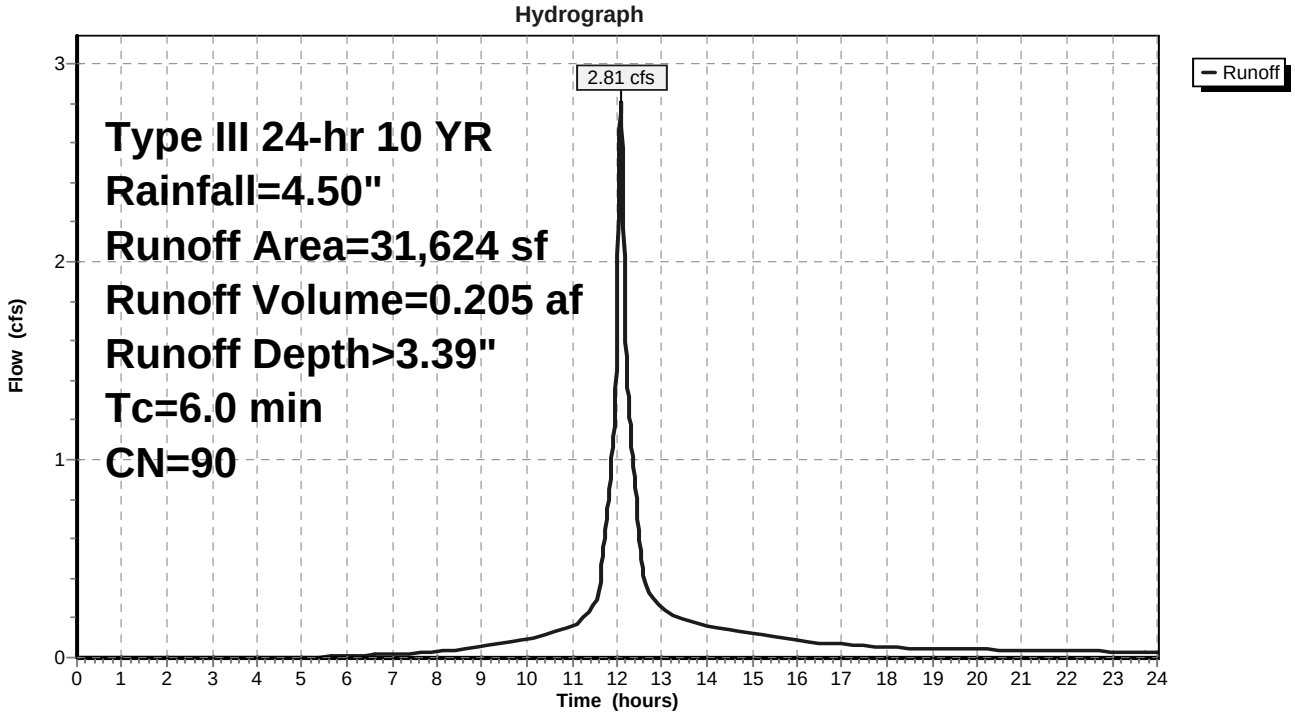
Runoff = 2.81 cfs @ 12.09 hrs, Volume= 0.205 af, Depth> 3.39"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=4.50"

Area (sf)	CN	Description
21,562	98	Paved parking & roofs
697	73	Woods, Fair, HSG C
9,365	74	>75% Grass cover, Good, HSG C
31,624	90	Weighted Average
10,062		Pervious Area
21,562		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Calculated Value <6 mins: Direct Entry**

Subcatchment N4: Ex. Parking Area

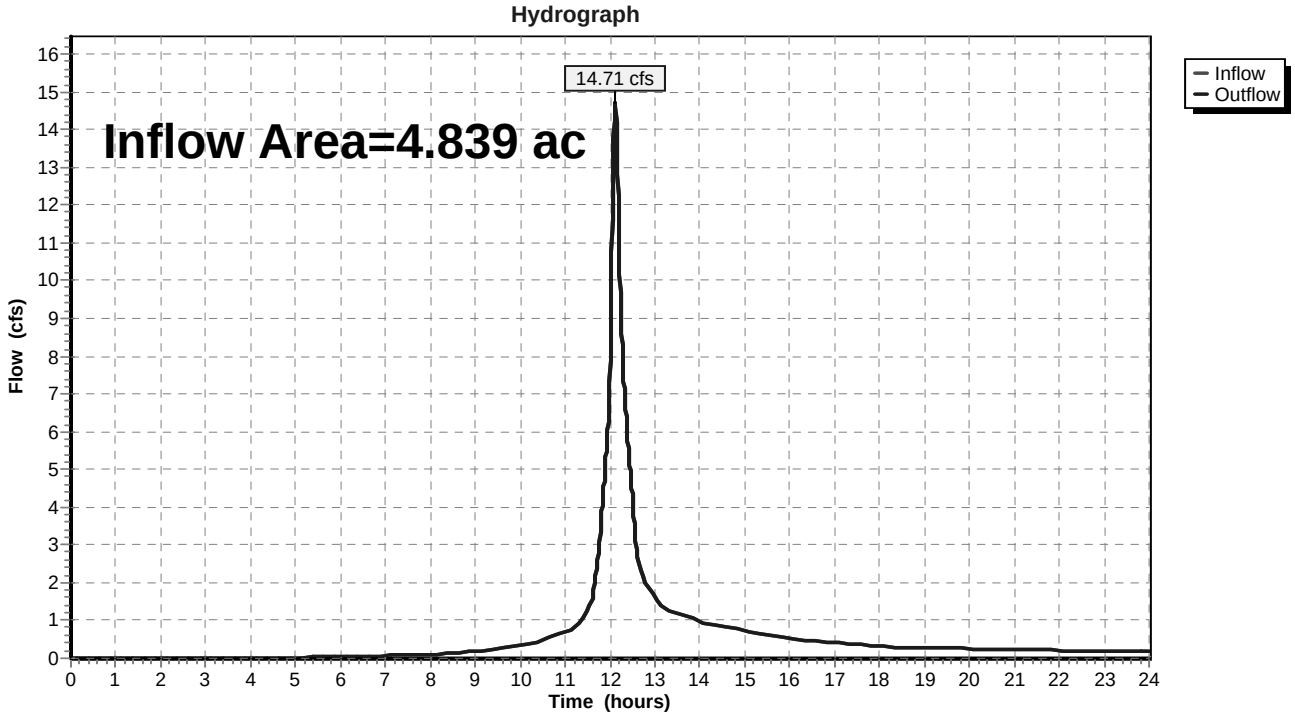


Summary for Reach DP: Analysis Design Point

Inflow Area = 4.839 ac, 44.44% Impervious, Inflow Depth > 2.83" for 10 YR event
Inflow = 14.71 cfs @ 12.11 hrs, Volume= 1.140 af
Outflow = 14.71 cfs @ 12.11 hrs, Volume= 1.140 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach DP: Analysis Design Point



Summary for Subcatchment N1: Runoff to School Street

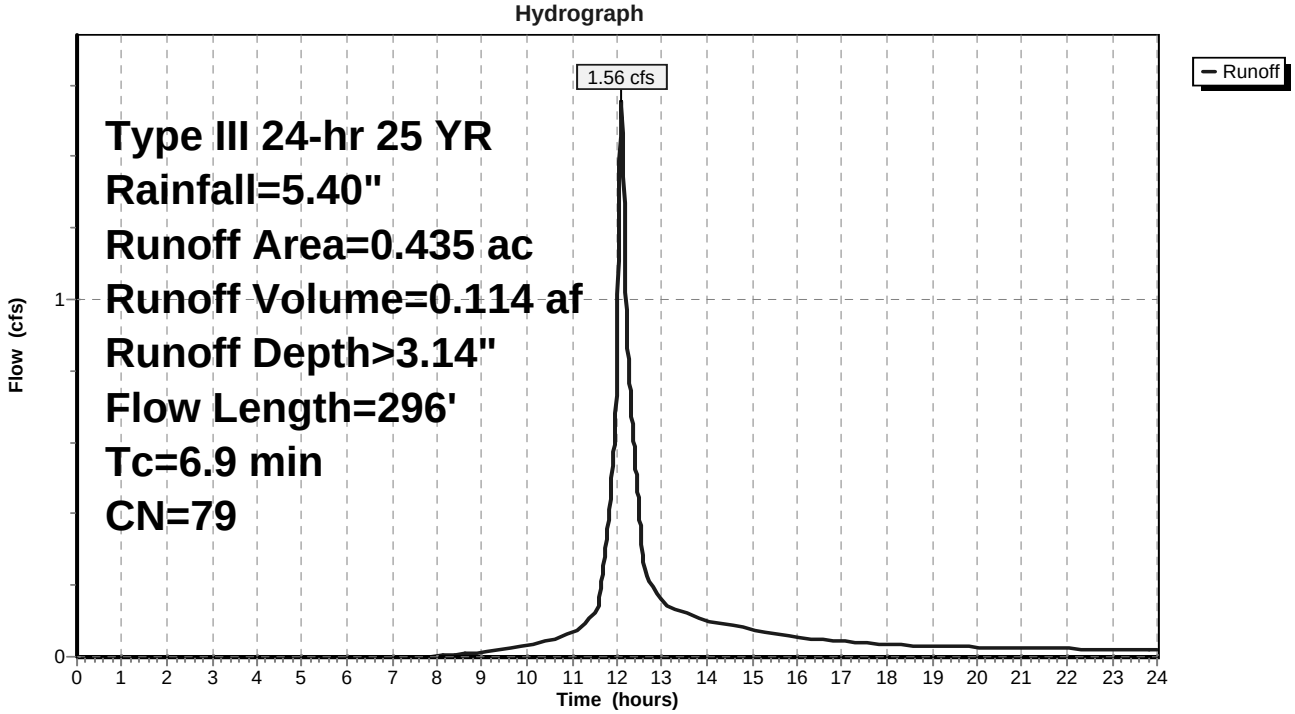
Runoff = 1.56 cfs @ 12.10 hrs, Volume= 0.114 af, Depth> 3.14"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YR Rainfall=5.40"

Area (ac)	CN	Description
0.097	98	Paved parking & roofs
0.136	73	Woods, Fair, HSG C
0.202	74	>75% Grass cover, Good, HSG C
0.435	79	Weighted Average
0.338		Pervious Area
0.097		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.9	50	0.1240	0.14		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.3	82	0.0700	4.26		**Shallow Concentrated Flow, B to C** Unpaved Kv= 16.1 fps
0.7	164	0.0400	4.06		**Shallow Concentrated Flow, C to D** Paved Kv= 20.3 fps
6.9	296	Total			

Subcatchment N1: Runoff to School Street



Summary for Subcatchment N1a: Runoff to School Street

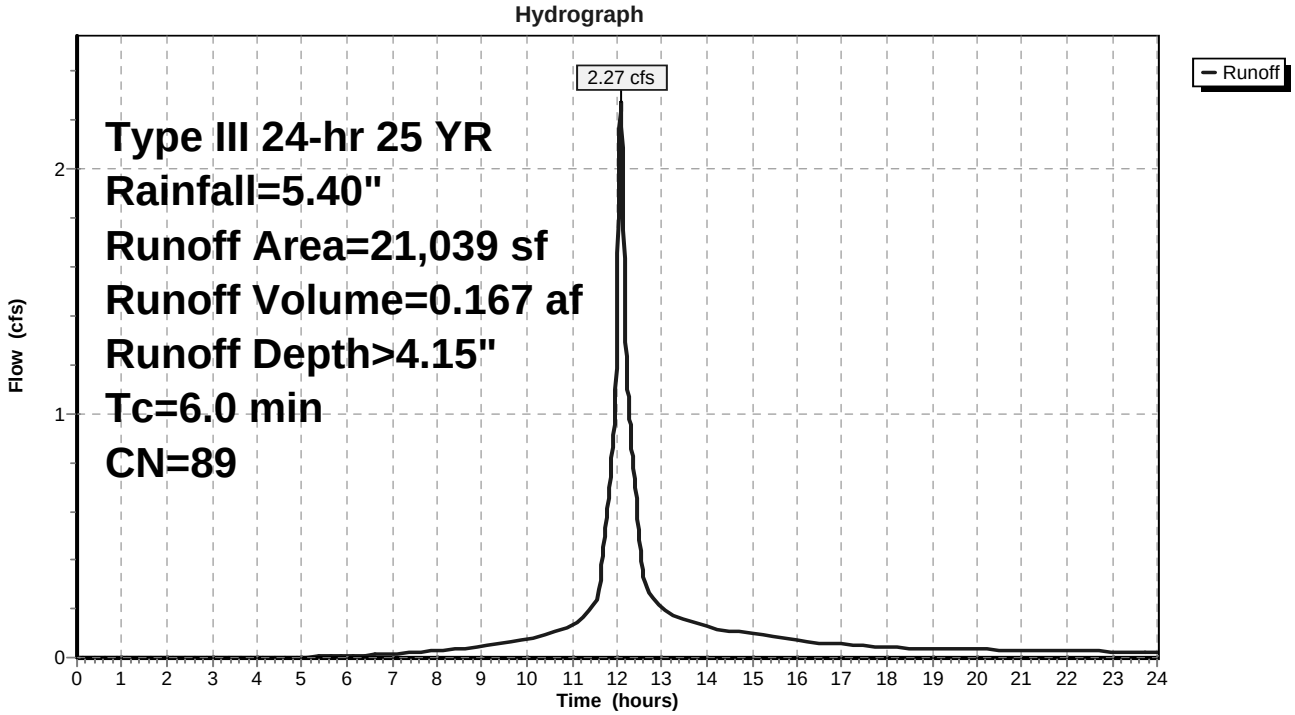
Runoff = 2.27 cfs @ 12.09 hrs, Volume= 0.167 af, Depth> 4.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YR Rainfall=5.40"

Area (sf)	CN	Description
13,024	98	Paved parking & roofs
348	73	Woods, Fair, HSG C
7,667	74	>75% Grass cover, Good, HSG C
21,039	89	Weighted Average
8,015		Pervious Area
13,024		Impervious Area

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

Subcatchment N1a: Runoff to School Street



Summary for Reach R1: Parking Lot Swale

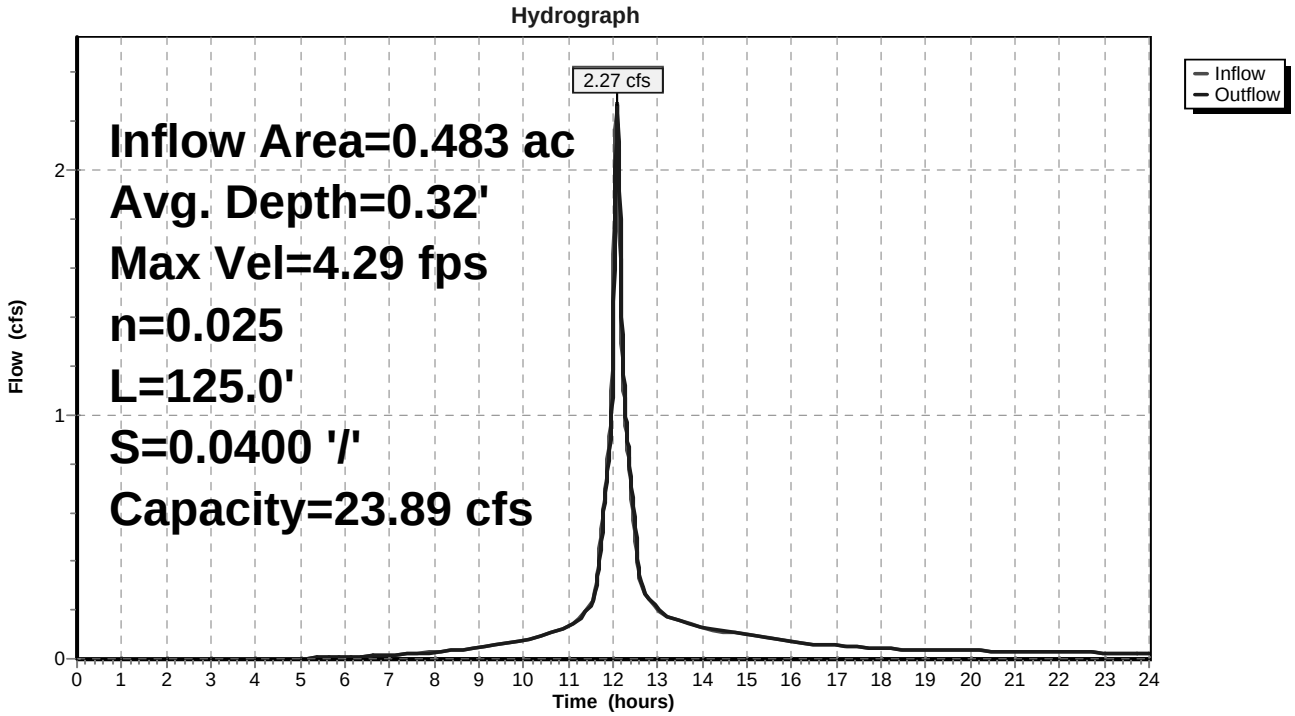
Inflow Area = 0.483 ac, 61.90% Impervious, Inflow Depth > 4.15" for 25 YR event
Inflow = 2.27 cfs @ 12.09 hrs, Volume= 0.167 af
Outflow = 2.27 cfs @ 12.10 hrs, Volume= 0.167 af, Atten= 0%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.29 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.31 fps, Avg. Travel Time= 1.6 min

Peak Storage= 66 cf @ 12.09 hrs, Average Depth at Peak Storage= 0.32'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 23.89 cfs

1.00' x 1.00' deep channel, n= 0.025 Earth, grassed & winding
Side Slope Z-value= 2.0 '/' Top Width= 5.00'
Length= 125.0' Slope= 0.0400 '/'
Inlet Invert= 232.00', Outlet Invert= 227.00'

Reach R1: Parking Lot Swale



Summary for Pond 2P: Bioretention Pond

Inflow Area =	0.483 ac, 61.90% Impervious, Inflow Depth > 4.15" for 25 YR event				
Inflow =	2.27 cfs @	12.10 hrs,	Volume=	0.167 af	
Outflow =	2.20 cfs @	12.12 hrs,	Volume=	0.150 af,	Atten= 3%, Lag= 1.2 min
Discarded =	0.00 cfs @	12.12 hrs,	Volume=	0.005 af	
Primary =	2.20 cfs @	12.12 hrs,	Volume=	0.145 af	

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 225.70' @ 12.12 hrs Surf.Area= 687 sf Storage= 974 cf

Plug-Flow detention time= 78.7 min calculated for 0.150 af (90% of inflow)
Center-of-Mass det. time= 29.6 min (821.9 - 792.3)

Volume	Invert	Avail.Storage	Storage Description
#1	221.75'	1,484 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

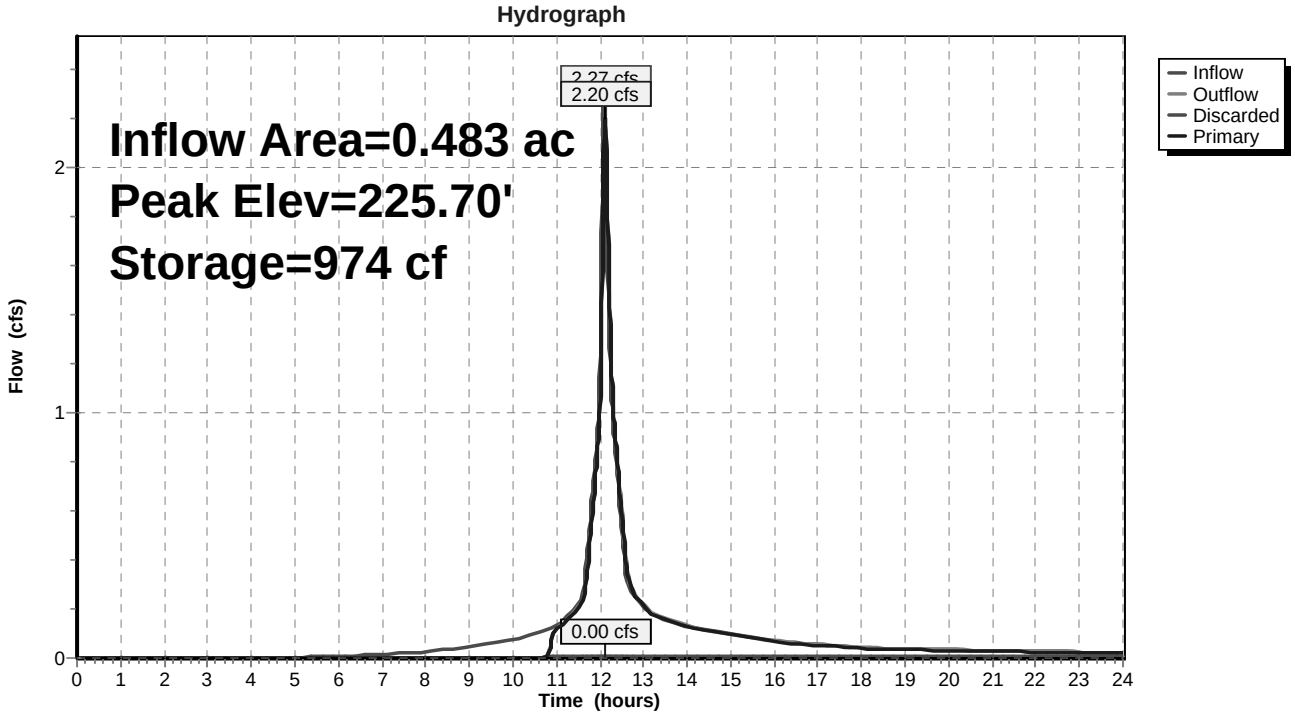
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
221.75	0	0.0	0	0	0
222.00	9	13.6	1	1	15
223.00	90	38.1	42	43	119
224.00	251	63.3	164	207	328
225.00	484	88.2	361	568	638
226.00	787	110.0	629	1,198	996
226.33	950	124.2	286	1,484	1,263

Device	Routing	Invert	Outlet Devices
#1	Primary	225.33'	**4.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	221.75'	**0.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.00 cfs @ 12.12 hrs HW=225.70' (Free Discharge)
└─**2=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=2.19 cfs @ 12.12 hrs HW=225.70' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 2.19 cfs @ 1.50 fps)

Pond 2P: Bioretention Pond

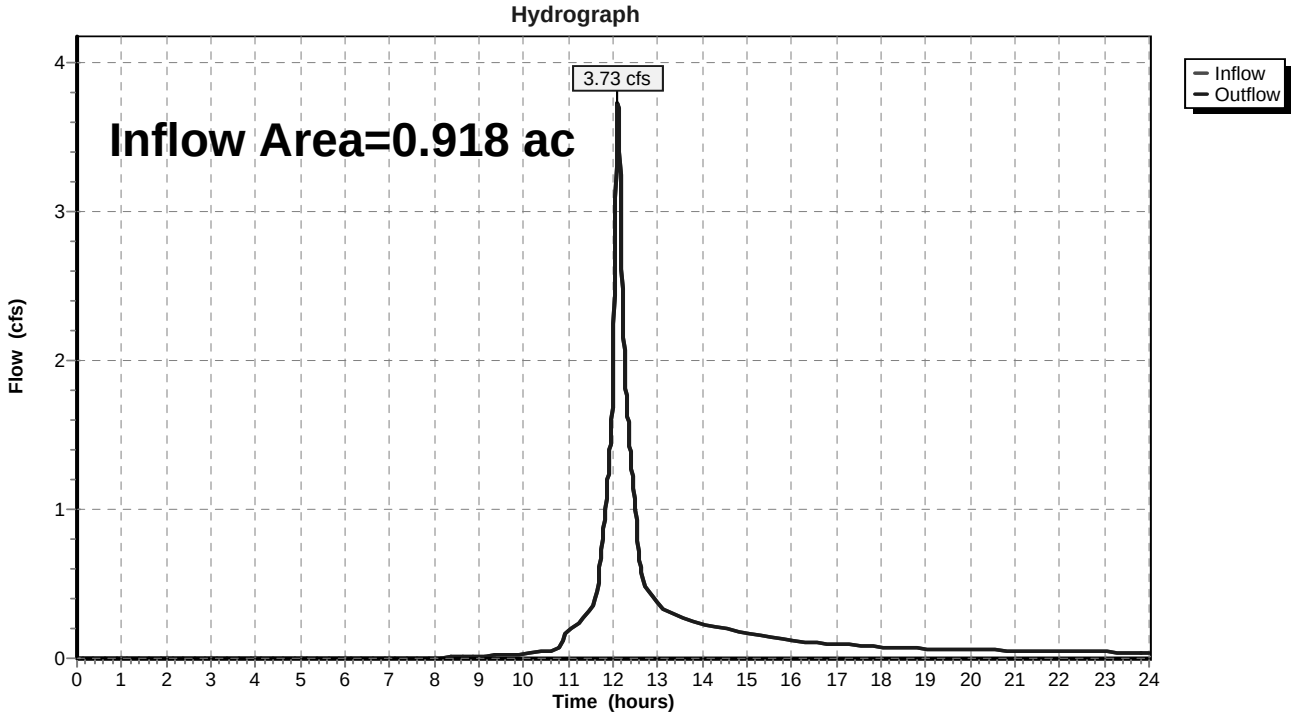


Summary for Reach DP1: School Street Design Point

Inflow Area = 0.918 ac, 43.14% Impervious, Inflow Depth > 3.39" for 25 YR event
Inflow = 3.73 cfs @ 12.11 hrs, Volume= 0.259 af
Outflow = 3.73 cfs @ 12.11 hrs, Volume= 0.259 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach DP1: School Street Design Point



Summary for Subcatchment N2: Northwest Church Street

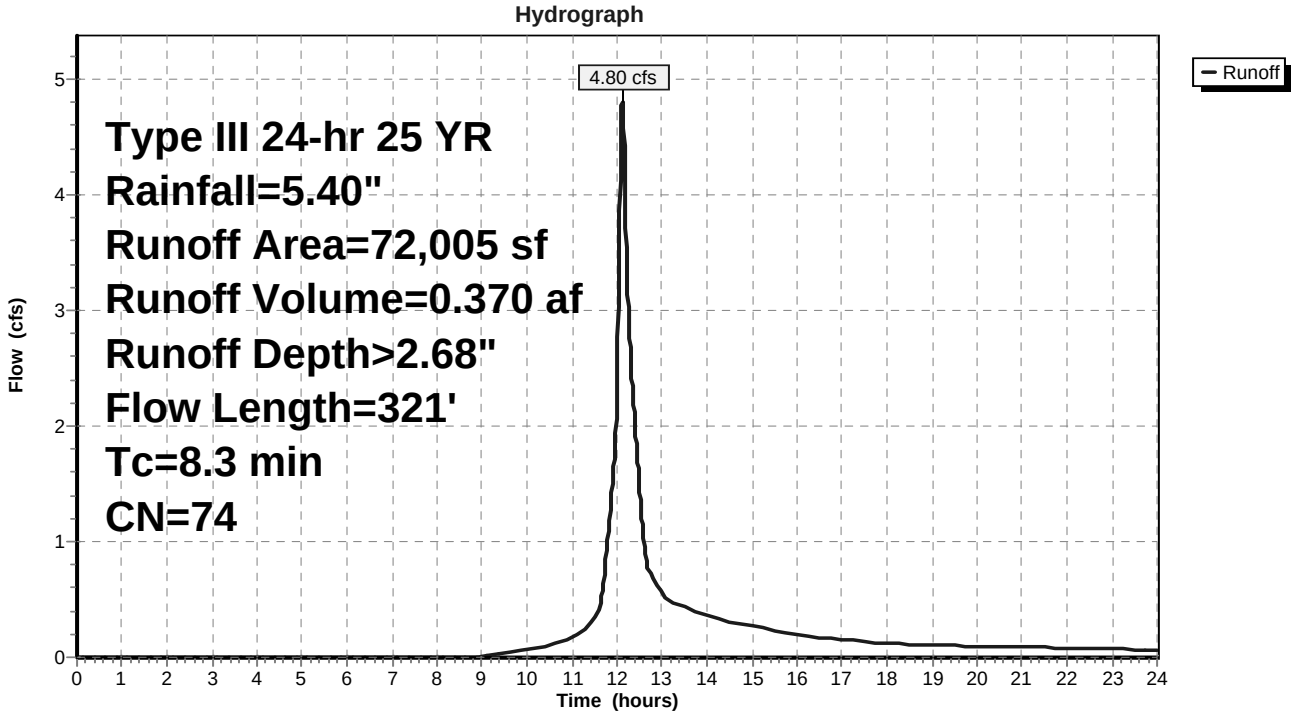
Runoff = 4.80 cfs @ 12.12 hrs, Volume= 0.370 af, Depth> 2.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YR Rainfall=5.40"

	Area (sf)	CN	Description
	784	98	Paved parking & roofs
	36,024	73	Woods, Fair, HSG C
	32,191	74	>75% Grass cover, Good, HSG C
*	3,006	89	Porous Pavement Fire Lane
	72,005	74	Weighted Average
	71,221		Pervious Area
	784		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0800	0.12		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.8	229	0.0800	4.55		**Shallow Concentrated Flow, B to C** Unpaved Kv= 16.1 fps
0.4	42	0.0140	1.90		**Shallow Concentrated Flow, C to D** Unpaved Kv= 16.1 fps
8.3	321	Total			

Subcatchment N2: Northwest Church Street



Summary for Subcatchment N3: Play Area

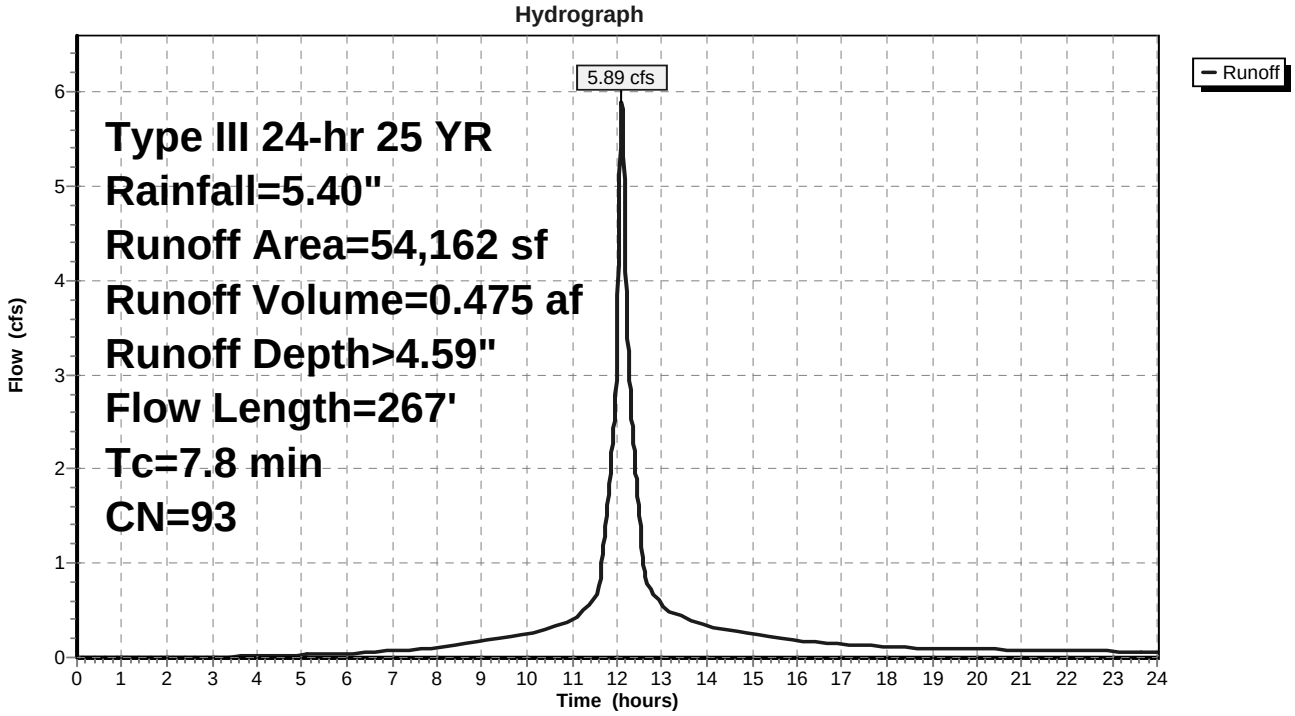
Runoff = 5.89 cfs @ 12.11 hrs, Volume= 0.475 af, Depth> 4.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YR Rainfall=5.40"

Area (sf)	CN	Description
41,936	98	Paved parking & roofs
12,226	74	>75% Grass cover, Good, HSG C
54,162	93	Weighted Average
12,226		Pervious Area
41,936		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	35	0.0180	0.09		**Sheet Flow, A to B** Grass: Dense n= 0.240 P2= 3.20"
0.2	46	0.0250	3.21		**Shallow Concentrated Flow, B to C** Paved Kv= 20.3 fps
1.2	186	0.0160	2.57		**Shallow Concentrated Flow, C to D** Paved Kv= 20.3 fps
7.8	267	Total			

Subcatchment N3: Play Area

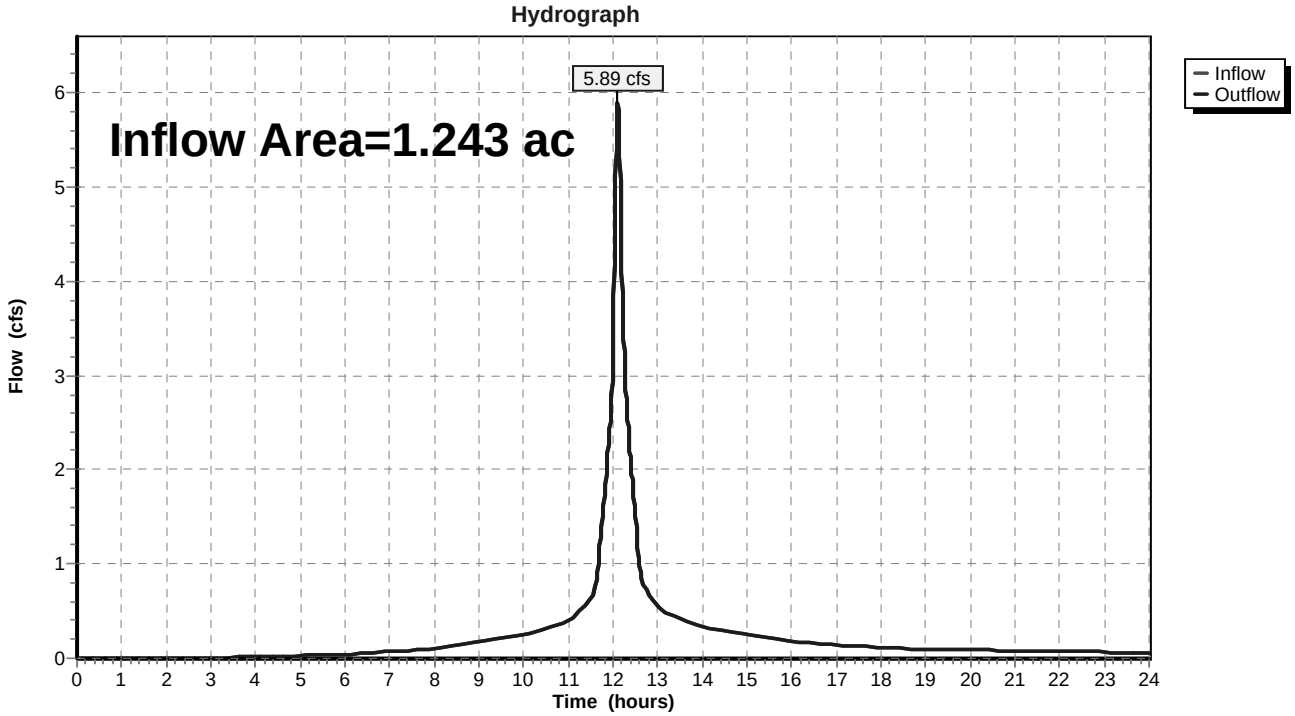


Summary for Reach R2: DMH#5

Inflow Area = 1.243 ac, 77.43% Impervious, Inflow Depth > 4.59" for 25 YR event
Inflow = 5.89 cfs @ 12.11 hrs, Volume= 0.475 af
Outflow = 5.89 cfs @ 12.11 hrs, Volume= 0.475 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach R2: DMH#5



Summary for Pond SDB#1: Subsurface Detention Bed

Inflow Area = 1.243 ac, 77.43% Impervious, Inflow Depth > 4.59" for 25 YR event
Inflow = 5.89 cfs @ 12.11 hrs, Volume= 0.475 af
Outflow = 5.50 cfs @ 12.14 hrs, Volume= 0.475 af, Atten= 7%, Lag= 2.0 min
Primary = 5.50 cfs @ 12.14 hrs, Volume= 0.475 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 228.23' @ 12.14 hrs Surf.Area= 0.013 ac Storage= 0.019 af

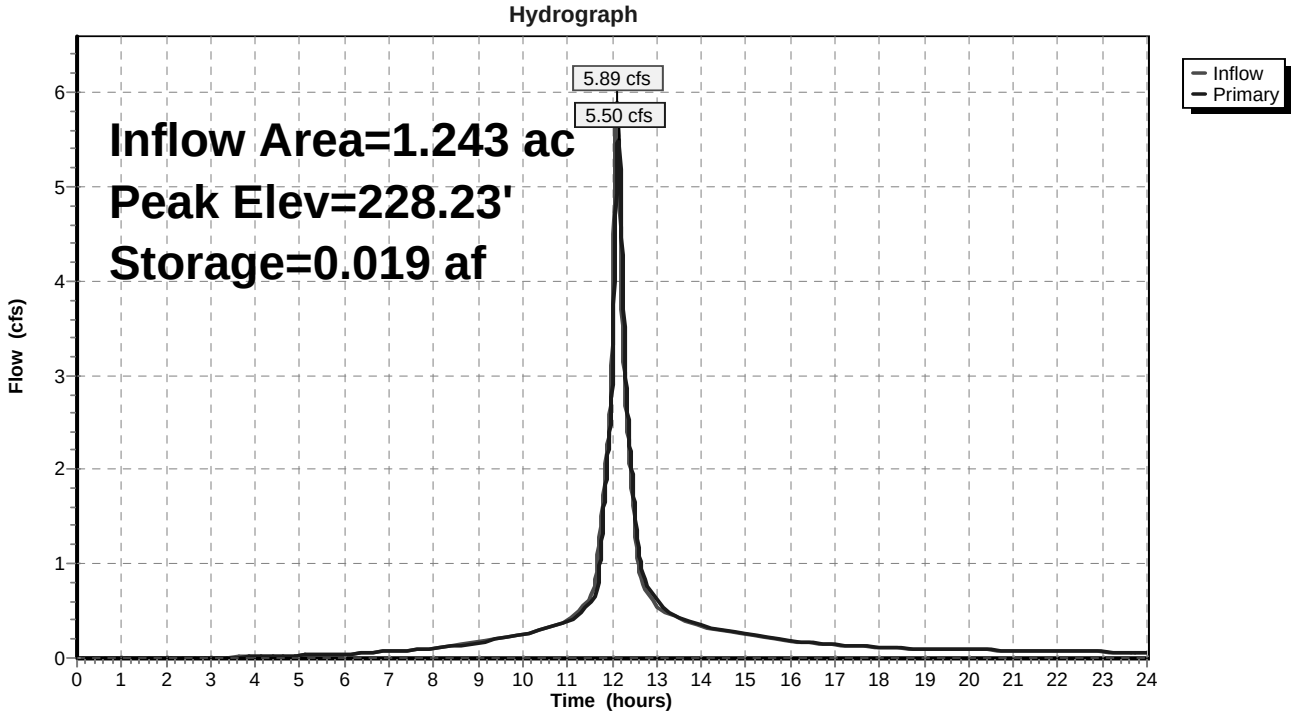
Plug-Flow detention time= 3.6 min calculated for 0.475 af (100% of inflow)
Center-of-Mass det. time= 3.0 min (780.0 - 776.9)

Volume	Invert	Avail.Storage	Storage Description
#1	226.73'	0.021 af	**24.0"D x 41.00'L (7) 24" HDPE Pipe Laterals** x 7
#2	226.73'	0.003 af	**24.0"D x 22.31'L (2) 24" HDPE Pipe Headers** x 2
		0.024 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	226.73'	**4.0" Vert. Orifice/Grate X 3.00** C= 0.600
#2	Primary	227.25'	**8.0" Vert. Orifice/Grate X 3.00** C= 0.600

Primary OutFlow Max=5.50 cfs @ 12.14 hrs HW=228.23' (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 1.45 cfs @ 5.55 fps)
└─**2=Orifice/Grate** (Orifice Controls 4.05 cfs @ 3.86 fps)

Pond SDB#1: Subsurface Detention Bed



Summary for Pond OCS1: OCS#1

Inflow Area =	1.243 ac, 77.43% Impervious, Inflow Depth > 4.58" for 25 YR event				
Inflow =	5.50 cfs @	12.14 hrs, Volume=	0.475 af		
Outflow =	5.50 cfs @	12.14 hrs, Volume=	0.474 af, Atten= 0%, Lag= 0.0 min		
Primary =	5.50 cfs @	12.14 hrs, Volume=	0.474 af		

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 226.47' @ 12.14 hrs Surf.Area= 17 sf Storage= 42 cf

Plug-Flow detention time= 1.3 min calculated for 0.474 af (100% of inflow)
Center-of-Mass det. time= 0.7 min (780.6 - 780.0)

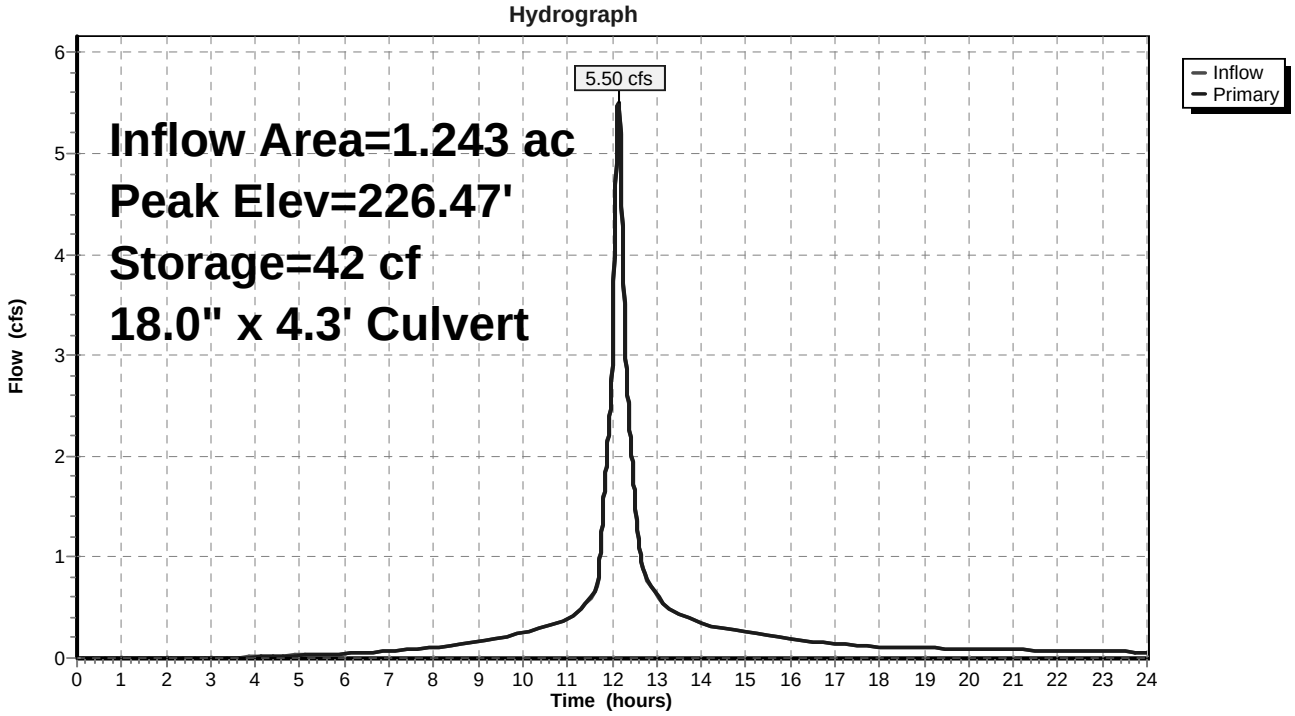
Volume	Invert	Avail.Storage	Storage Description
#1	223.98'	76 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
223.98	17	0	0
228.43	17	76	76

Device	Routing	Invert	Outlet Devices
#1	Primary	225.10'	**18.0" x 4.3' long 18" HDPE** CPP, square edge headwall, Ke= 0.500 Outlet Invert= 225.00' S= 0.0233 '/' Cc= 0.900 n= 0.012

Primary OutFlow Max=5.50 cfs @ 12.14 hrs HW=226.47' (Free Discharge)
└**1=18" HDPE** (Barrel Controls 5.50 cfs @ 4.28 fps)

Pond OCS1: OCS#1



Summary for Subcatchment N3a: Roof & Gutter Drainage

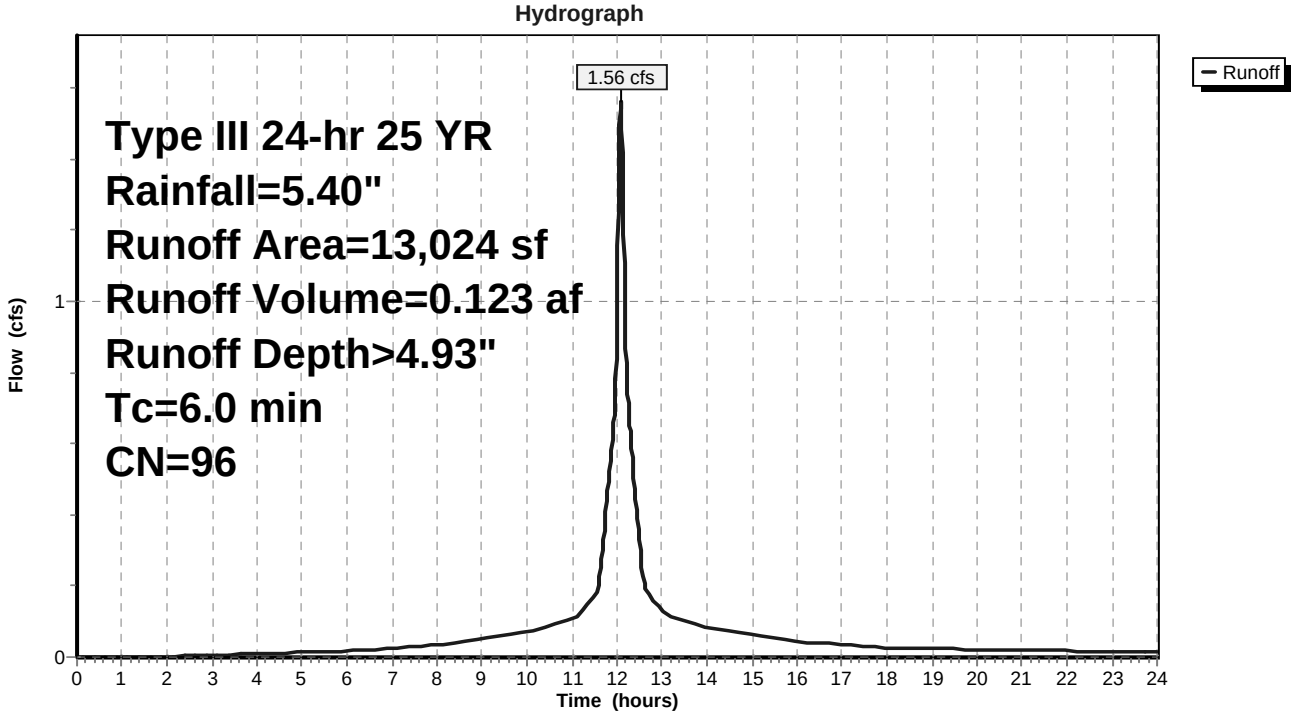
Runoff = 1.56 cfs @ 12.08 hrs, Volume= 0.123 af, Depth> 4.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YR Rainfall=5.40"

Area (sf)	CN	Description
12,153	98	Paved parking & roofs
871	74	>75% Grass cover, Good, HSG C
13,024	96	Weighted Average
871		Pervious Area
12,153		Impervious Area

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

Subcatchment N3a: Roof & Gutter Drainage



Summary for Pond LP1-2: Leaching Pits

Inflow Area =	0.299 ac, 93.31% Impervious, Inflow Depth > 4.93" for 25 YR event				
Inflow =	1.56 cfs @	12.08 hrs,	Volume=	0.123 af	
Outflow =	1.53 cfs @	12.10 hrs,	Volume=	0.110 af,	Atten= 2%, Lag= 1.0 min
Discarded =	0.00 cfs @	2.79 hrs,	Volume=	0.003 af	
Primary =	1.53 cfs @	12.10 hrs,	Volume=	0.106 af	

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 231.37' @ 12.10 hrs Surf.Area= 0.007 ac Storage= 0.016 af

Plug-Flow detention time= 90.4 min calculated for 0.109 af (89% of inflow)
Center-of-Mass det. time= 38.8 min (798.8 - 760.0)

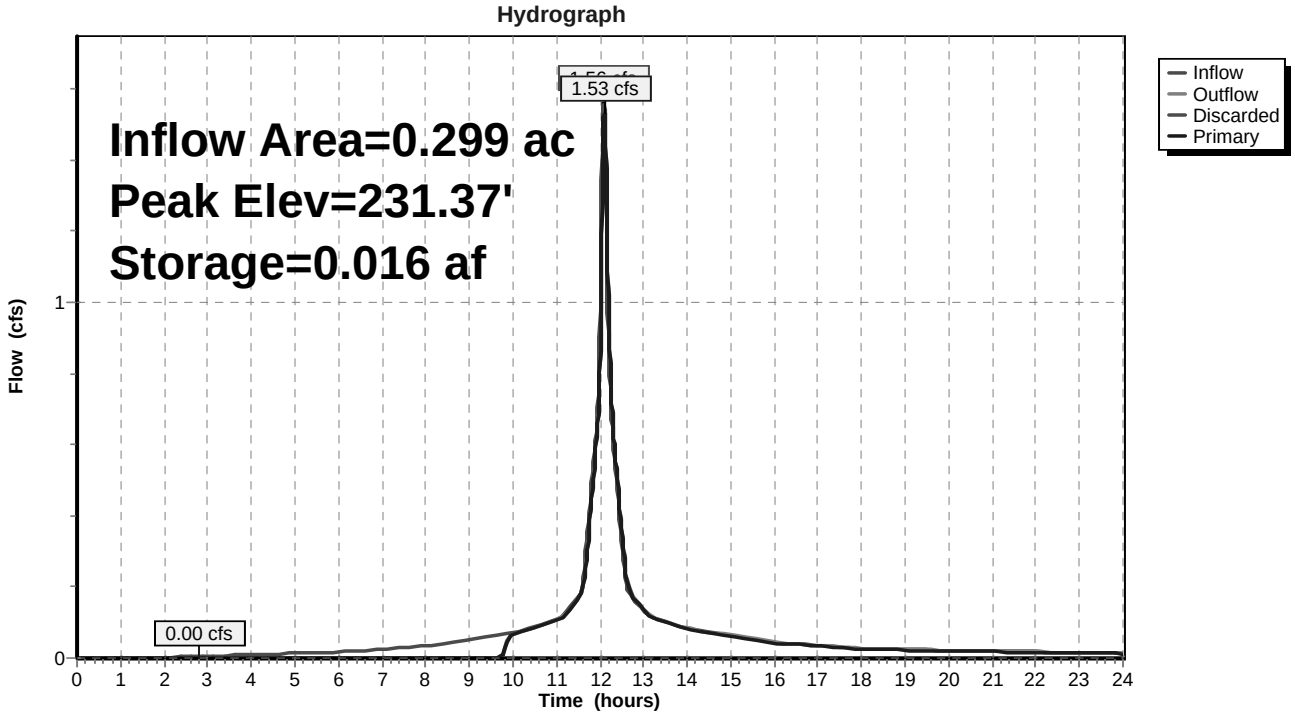
Volume	Invert	Avail.Storage	Storage Description
#1	227.19'	0.010 af	**14.00'D x 5.17'H Gravel** x 2 0.037 af Overall - 0.011 af Embedded = 0.026 af x 40.0% Voids
#2	227.86'	0.009 af	**8.00'D x 4.00'H Leaching Pit Structure** x 2 Inside #1 0.011 af Overall - 4.0" Wall Thickness = 0.009 af
		0.020 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	227.19'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	230.60'	**12.0" x 171.4' long 12" HDPE** CMP, projecting, no headwall, Ke= 0.900 Outlet Invert= 225.00' S= 0.0327 '/' Cc= 0.900 n= 0.012

Discarded OutFlow Max=0.00 cfs @ 2.79 hrs HW=227.24' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=1.53 cfs @ 12.10 hrs HW=231.37' (Free Discharge)
└─**2=12" HDPE** (Inlet Controls 1.53 cfs @ 2.36 fps)

Pond LP1-2: Leaching Pits

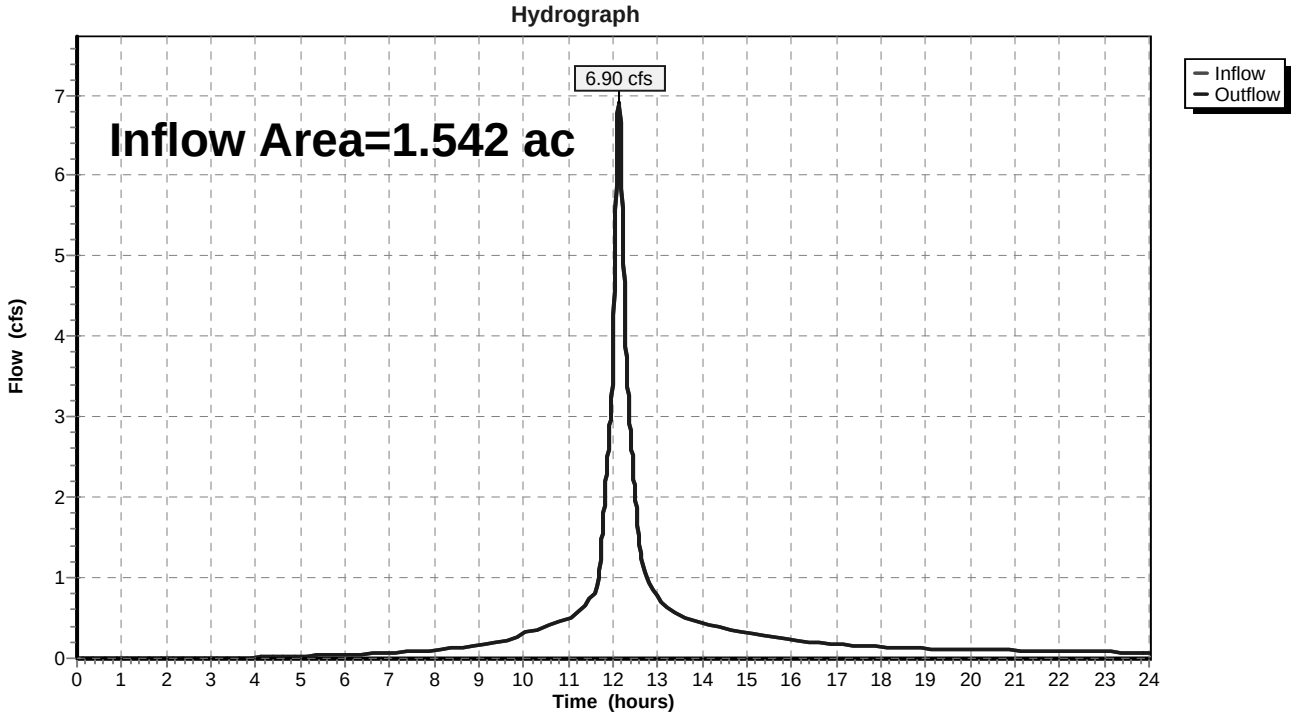


Summary for Reach N3 DP: N3 Design Point

Inflow Area = 1.542 ac, 80.51% Impervious, Inflow Depth > 4.52" for 25 YR event
Inflow = 6.90 cfs @ 12.13 hrs, Volume= 0.580 af
Outflow = 6.90 cfs @ 12.13 hrs, Volume= 0.580 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach N3 DP: N3 Design Point



Summary for Subcatchment N4: Ex. Parking Area

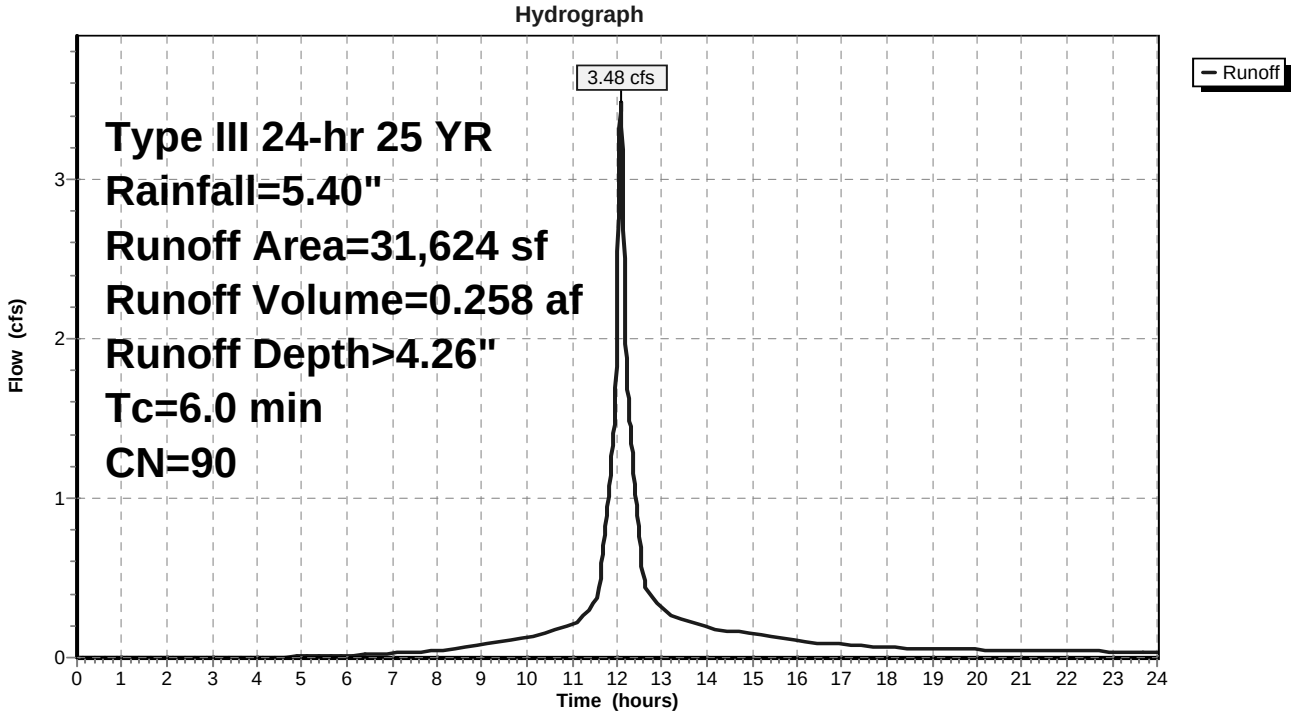
Runoff = 3.48 cfs @ 12.08 hrs, Volume= 0.258 af, Depth> 4.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YR Rainfall=5.40"

Area (sf)	CN	Description
21,562	98	Paved parking & roofs
697	73	Woods, Fair, HSG C
9,365	74	>75% Grass cover, Good, HSG C
31,624	90	Weighted Average
10,062		Pervious Area
21,562		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Calculated Value <6 mins: Direct Entry**

Subcatchment N4: Ex. Parking Area

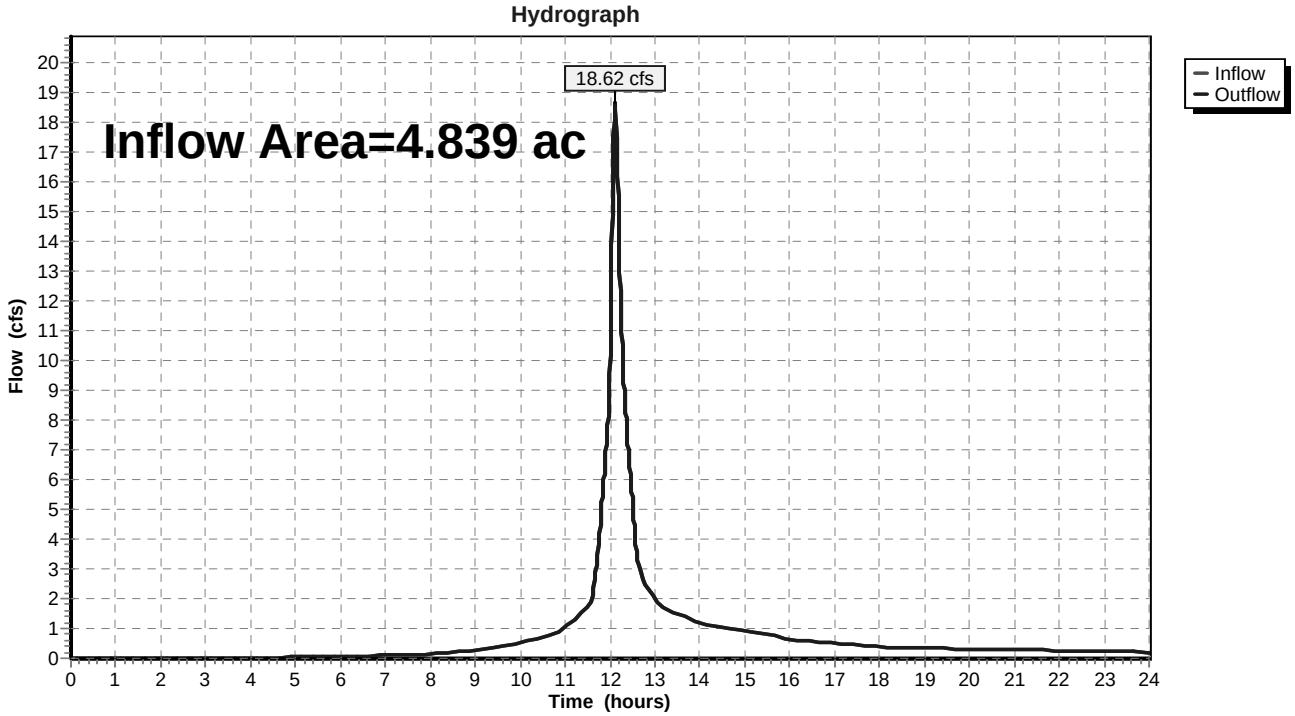


Summary for Reach DP: Analysis Design Point

Inflow Area = 4.839 ac, 44.44% Impervious, Inflow Depth > 3.64" for 25 YR event
Inflow = 18.62 cfs @ 12.11 hrs, Volume= 1.467 af
Outflow = 18.62 cfs @ 12.11 hrs, Volume= 1.467 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach DP: Analysis Design Point



Summary for Subcatchment N1: Runoff to School Street

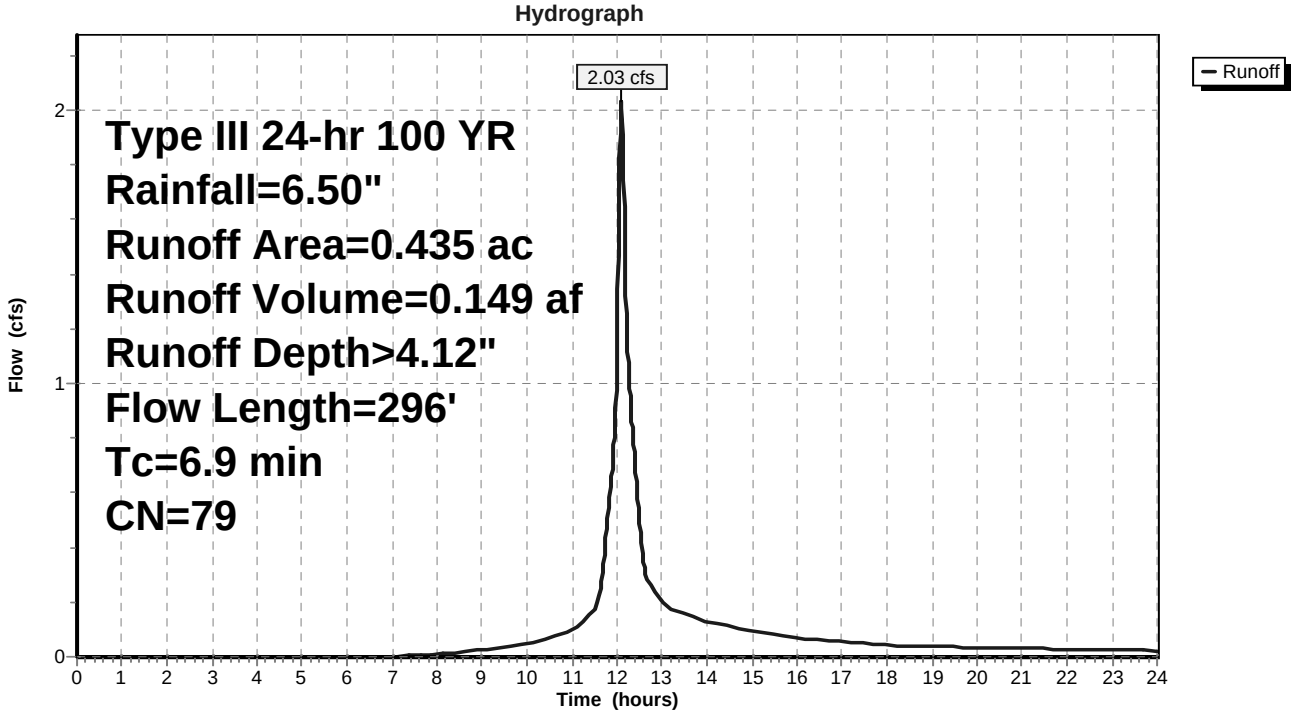
Runoff = 2.03 cfs @ 12.10 hrs, Volume= 0.149 af, Depth> 4.12"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=6.50"

Area (ac)	CN	Description
0.097	98	Paved parking & roofs
0.136	73	Woods, Fair, HSG C
0.202	74	>75% Grass cover, Good, HSG C
0.435	79	Weighted Average
0.338		Pervious Area
0.097		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.9	50	0.1240	0.14		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.3	82	0.0700	4.26		**Shallow Concentrated Flow, B to C** Unpaved Kv= 16.1 fps
0.7	164	0.0400	4.06		**Shallow Concentrated Flow, C to D** Paved Kv= 20.3 fps
6.9	296	Total			

Subcatchment N1: Runoff to School Street



Summary for Subcatchment N1a: Runoff to School Street

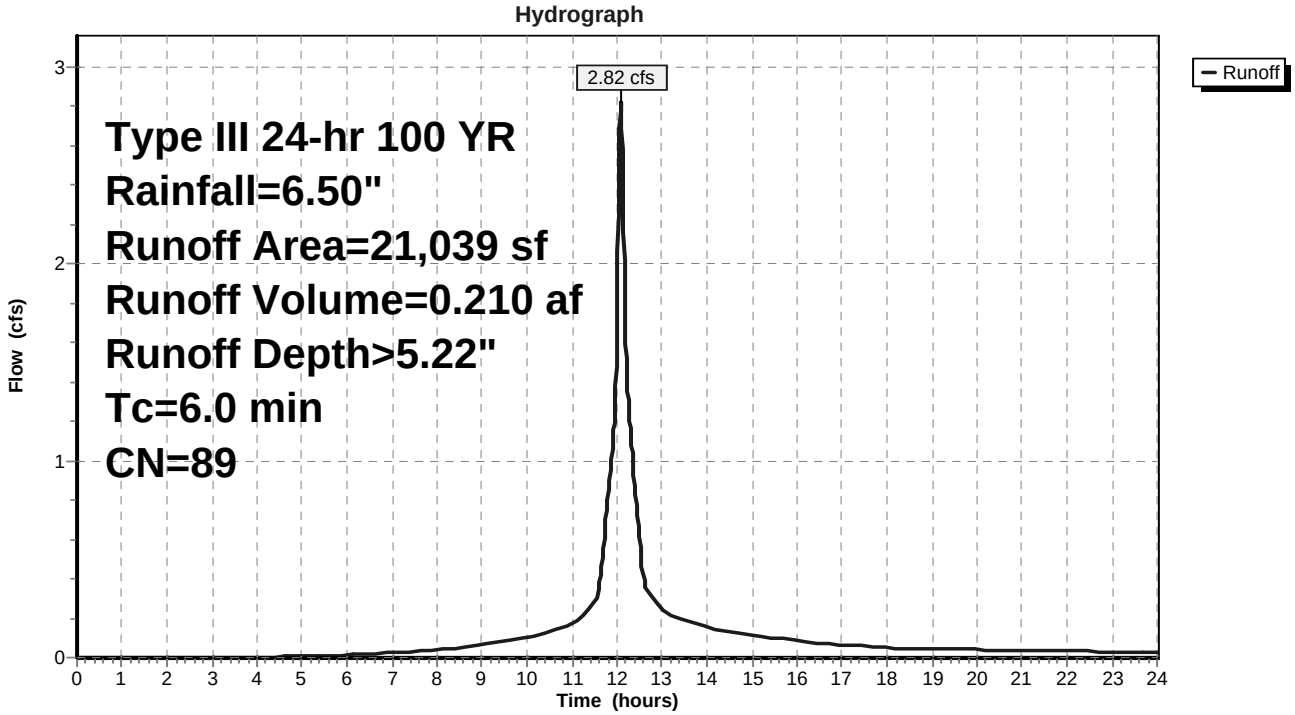
Runoff = 2.82 cfs @ 12.08 hrs, Volume= 0.210 af, Depth> 5.22"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=6.50"

Area (sf)	CN	Description
13,024	98	Paved parking & roofs
348	73	Woods, Fair, HSG C
7,667	74	>75% Grass cover, Good, HSG C
21,039	89	Weighted Average
8,015		Pervious Area
13,024		Impervious Area

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

Subcatchment N1a: Runoff to School Street



Summary for Reach R1: Parking Lot Swale

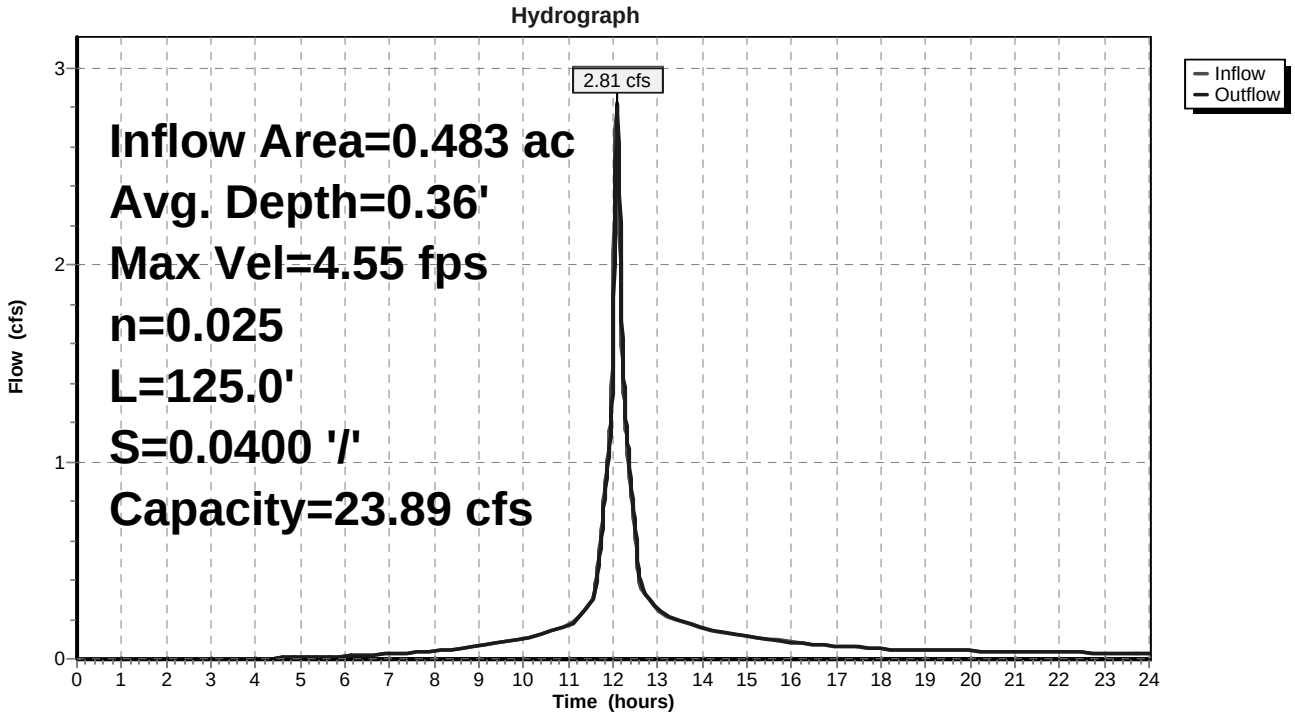
Inflow Area = 0.483 ac, 61.90% Impervious, Inflow Depth > 5.22" for 100 YR event
Inflow = 2.82 cfs @ 12.08 hrs, Volume= 0.210 af
Outflow = 2.81 cfs @ 12.10 hrs, Volume= 0.210 af, Atten= 0%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.55 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.41 fps, Avg. Travel Time= 1.5 min

Peak Storage= 77 cf @ 12.09 hrs, Average Depth at Peak Storage= 0.36'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 23.89 cfs

1.00' x 1.00' deep channel, n= 0.025 Earth, grassed & winding
Side Slope Z-value= 2.0 '/' Top Width= 5.00'
Length= 125.0' Slope= 0.0400 '/'
Inlet Invert= 232.00', Outlet Invert= 227.00'

Reach R1: Parking Lot Swale



Summary for Pond 2P: Bioretention Pond

Inflow Area =	0.483 ac, 61.90% Impervious, Inflow Depth > 5.21" for 100 YR event				
Inflow =	2.81 cfs @	12.10 hrs,	Volume=	0.210 af	
Outflow =	2.75 cfs @	12.12 hrs,	Volume=	0.193 af,	Atten= 2%, Lag= 1.1 min
Discarded =	0.00 cfs @	12.12 hrs,	Volume=	0.005 af	
Primary =	2.74 cfs @	12.12 hrs,	Volume=	0.188 af	

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 225.75' @ 12.12 hrs Surf.Area= 704 sf Storage= 1,011 cf

Plug-Flow detention time= 68.7 min calculated for 0.193 af (92% of inflow)
Center-of-Mass det. time= 26.9 min (813.0 - 786.1)

Volume	Invert	Avail.Storage	Storage Description
#1	221.75'	1,484 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

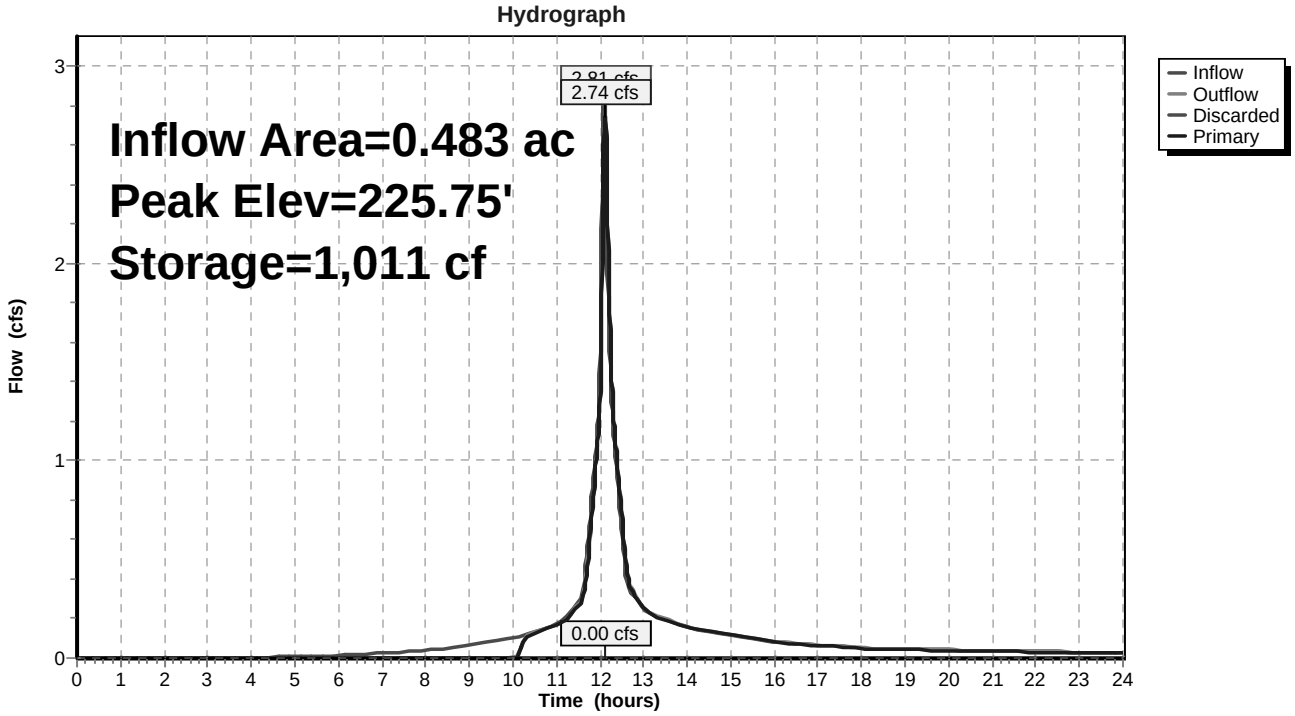
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
221.75	0	0.0	0	0	0
222.00	9	13.6	1	1	15
223.00	90	38.1	42	43	119
224.00	251	63.3	164	207	328
225.00	484	88.2	361	568	638
226.00	787	110.0	629	1,198	996
226.33	950	124.2	286	1,484	1,263

Device	Routing	Invert	Outlet Devices
#1	Primary	225.33'	**4.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	221.75'	**0.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.00 cfs @ 12.12 hrs HW=225.75' (Free Discharge)
└─**2=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=2.73 cfs @ 12.12 hrs HW=225.75' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 2.73 cfs @ 1.63 fps)

Pond 2P: Bioretention Pond

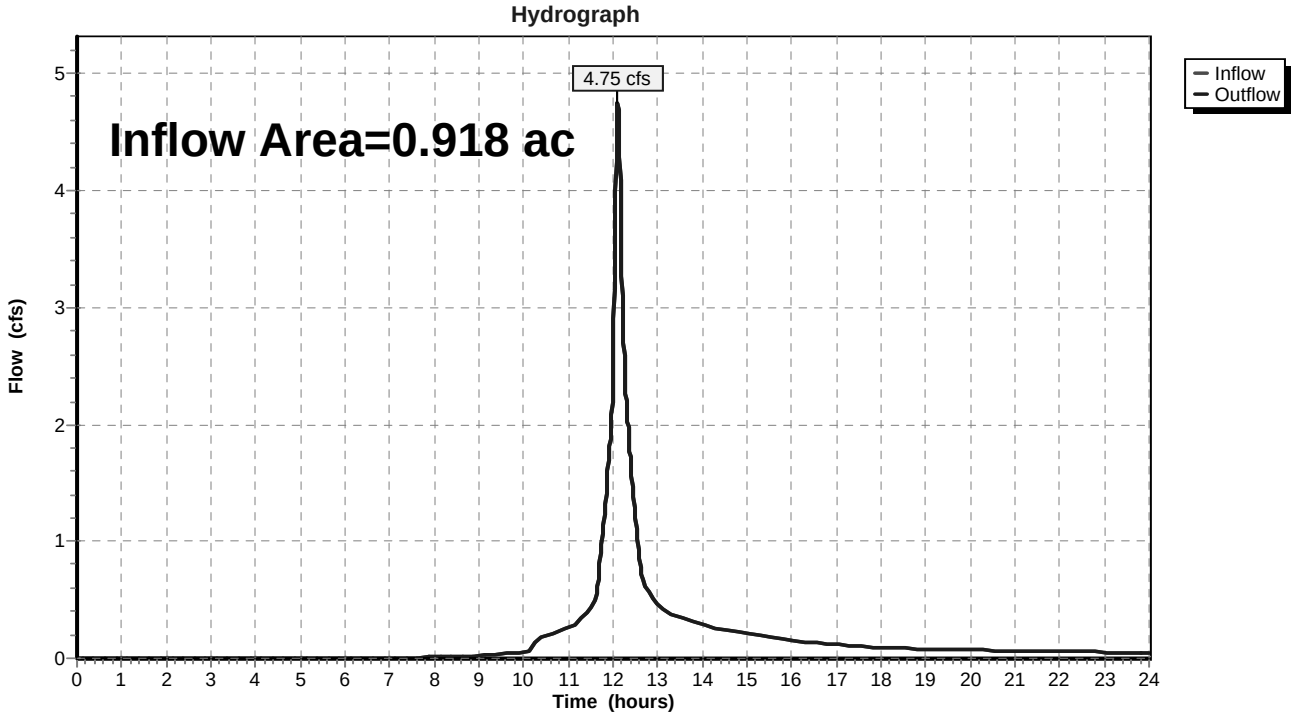


Summary for Reach DP1: School Street Design Point

Inflow Area = 0.918 ac, 43.14% Impervious, Inflow Depth > 4.41" for 100 YR event
Inflow = 4.75 cfs @ 12.11 hrs, Volume= 0.337 af
Outflow = 4.75 cfs @ 12.11 hrs, Volume= 0.337 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach DP1: School Street Design Point



Summary for Subcatchment N2: Northwest Church Street

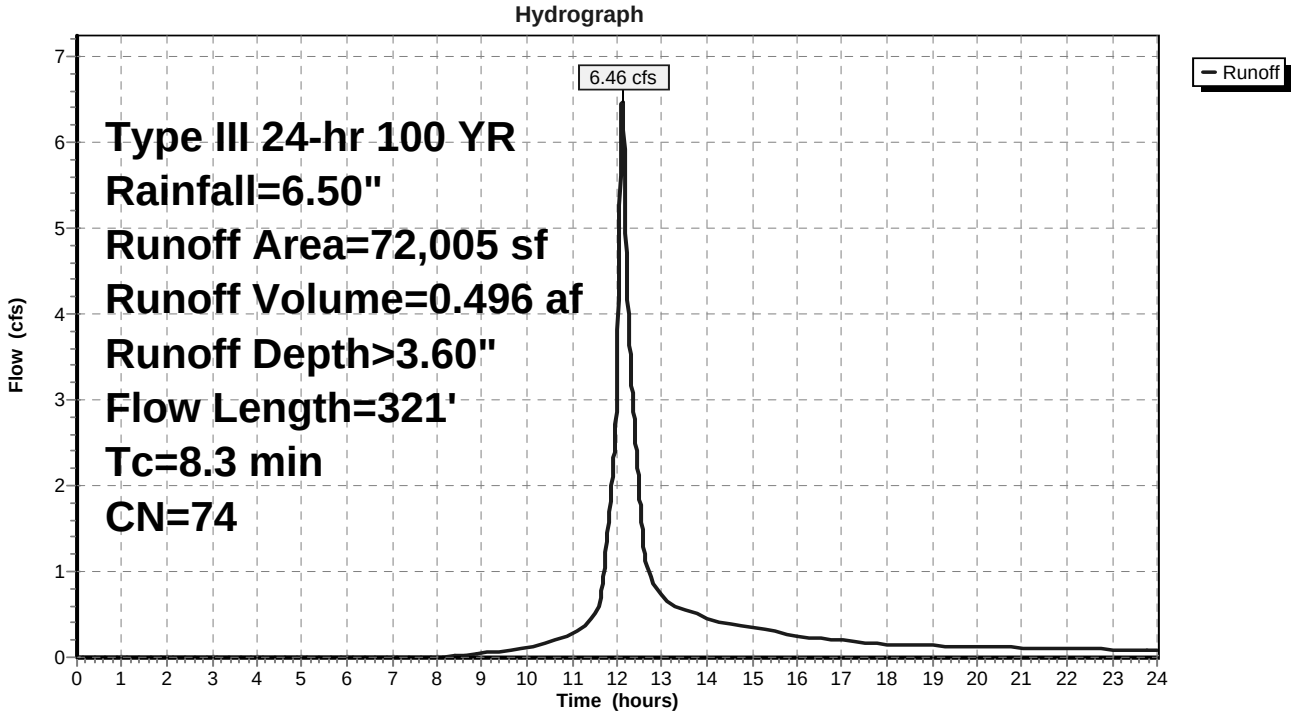
Runoff = 6.46 cfs @ 12.12 hrs, Volume= 0.496 af, Depth> 3.60"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=6.50"

	Area (sf)	CN	Description
	784	98	Paved parking & roofs
	36,024	73	Woods, Fair, HSG C
	32,191	74	>75% Grass cover, Good, HSG C
*	3,006	89	Porous Pavement Fire Lane
	72,005	74	Weighted Average
	71,221		Pervious Area
	784		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0800	0.12		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.8	229	0.0800	4.55		**Shallow Concentrated Flow, B to C** Unpaved Kv= 16.1 fps
0.4	42	0.0140	1.90		**Shallow Concentrated Flow, C to D** Unpaved Kv= 16.1 fps
8.3	321	Total			

Subcatchment N2: Northwest Church Street



Summary for Subcatchment N3: Play Area

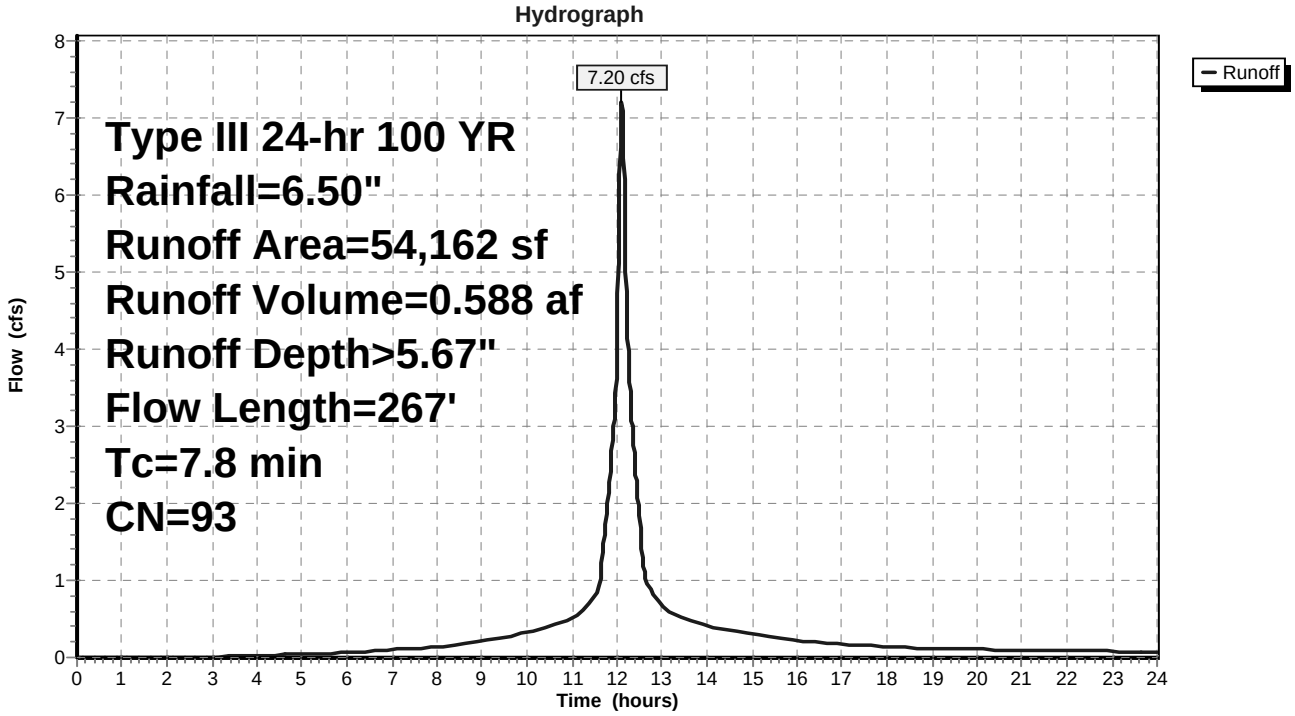
Runoff = 7.20 cfs @ 12.11 hrs, Volume= 0.588 af, Depth> 5.67"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=6.50"

Area (sf)	CN	Description
41,936	98	Paved parking & roofs
12,226	74	>75% Grass cover, Good, HSG C
54,162	93	Weighted Average
12,226		Pervious Area
41,936		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	35	0.0180	0.09		**Sheet Flow, A to B** Grass: Dense n= 0.240 P2= 3.20"
0.2	46	0.0250	3.21		**Shallow Concentrated Flow, B to C** Paved Kv= 20.3 fps
1.2	186	0.0160	2.57		**Shallow Concentrated Flow, C to D** Paved Kv= 20.3 fps
7.8	267	Total			

Subcatchment N3: Play Area

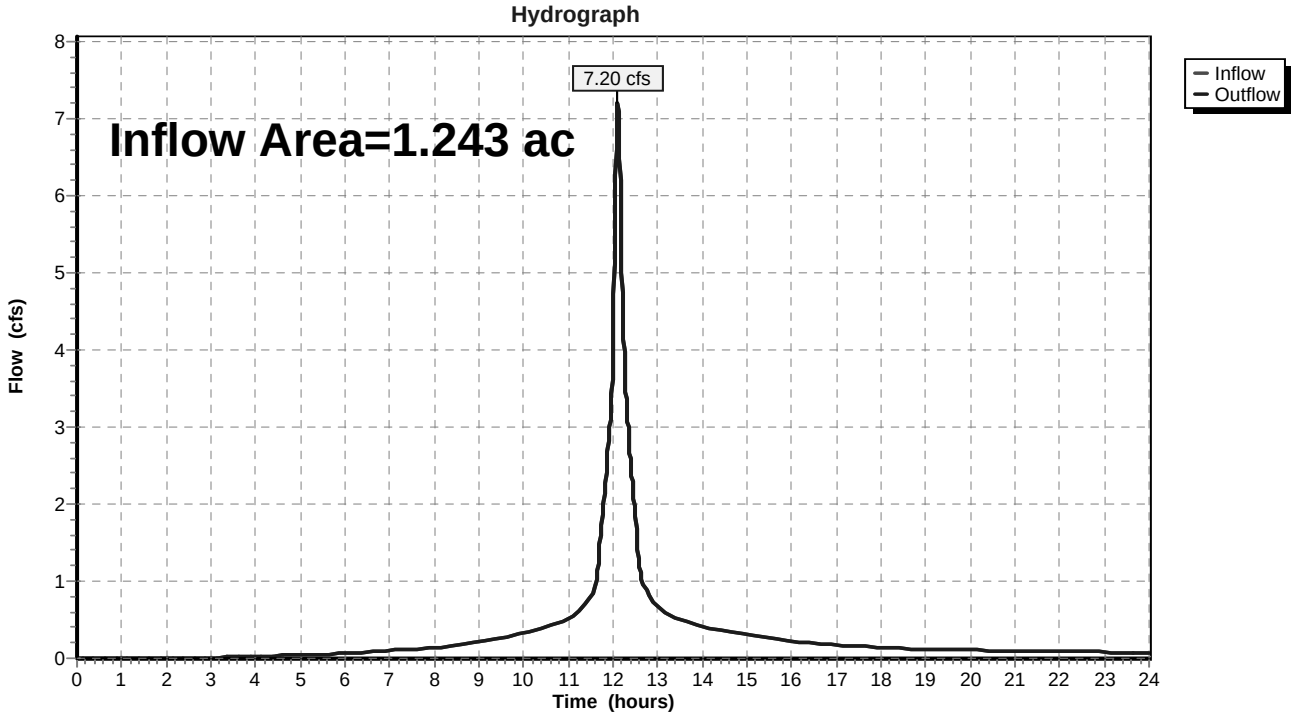


Summary for Reach R2: DMH#5

Inflow Area = 1.243 ac, 77.43% Impervious, Inflow Depth > 5.67" for 100 YR event
Inflow = 7.20 cfs @ 12.11 hrs, Volume= 0.588 af
Outflow = 7.20 cfs @ 12.11 hrs, Volume= 0.588 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach R2: DMH#5



Summary for Pond SDB#1: Subsurface Detention Bed

Inflow Area = 1.243 ac, 77.43% Impervious, Inflow Depth > 5.67" for 100 YR event
Inflow = 7.20 cfs @ 12.11 hrs, Volume= 0.588 af
Outflow = 6.74 cfs @ 12.14 hrs, Volume= 0.587 af, Atten= 6%, Lag= 2.0 min
Primary = 6.74 cfs @ 12.14 hrs, Volume= 0.587 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 228.60' @ 12.14 hrs Surf.Area= 0.007 ac Storage= 0.023 af

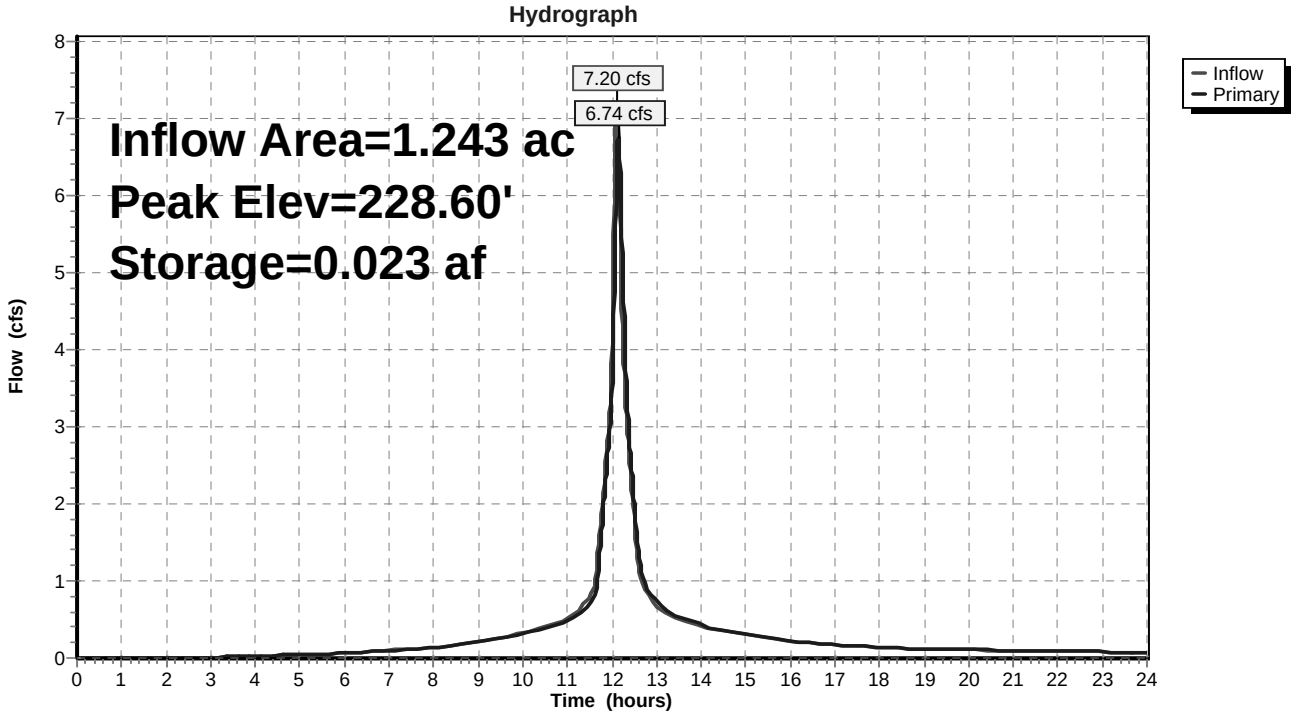
Plug-Flow detention time= 3.5 min calculated for 0.587 af (100% of inflow)
Center-of-Mass det. time= 3.0 min (774.7 - 771.7)

Volume	Invert	Avail.Storage	Storage Description
#1	226.73'	0.021 af	**24.0"D x 41.00'L (7) 24" HDPE Pipe Laterals** x 7
#2	226.73'	0.003 af	**24.0"D x 22.31'L (2) 24" HDPE Pipe Headers** x 2
		0.024 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	226.73'	**4.0" Vert. Orifice/Grate X 3.00** C= 0.600
#2	Primary	227.25'	**8.0" Vert. Orifice/Grate X 3.00** C= 0.600

Primary OutFlow Max=6.74 cfs @ 12.14 hrs HW=228.60' (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 1.65 cfs @ 6.29 fps)
└─**2=Orifice/Grate** (Orifice Controls 5.09 cfs @ 4.86 fps)

Pond SDB#1: Subsurface Detention Bed



Summary for Pond OCS1: OCS#1

Inflow Area = 1.243 ac, 77.43% Impervious, Inflow Depth > 5.67" for 100 YR event
Inflow = 6.74 cfs @ 12.14 hrs, Volume= 0.587 af
Outflow = 6.74 cfs @ 12.14 hrs, Volume= 0.587 af, Atten= 0%, Lag= 0.0 min
Primary = 6.74 cfs @ 12.14 hrs, Volume= 0.587 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 226.67' @ 12.14 hrs Surf.Area= 17 sf Storage= 46 cf

Plug-Flow detention time= 1.1 min calculated for 0.586 af (100% of inflow)
Center-of-Mass det. time= 0.6 min (775.3 - 774.7)

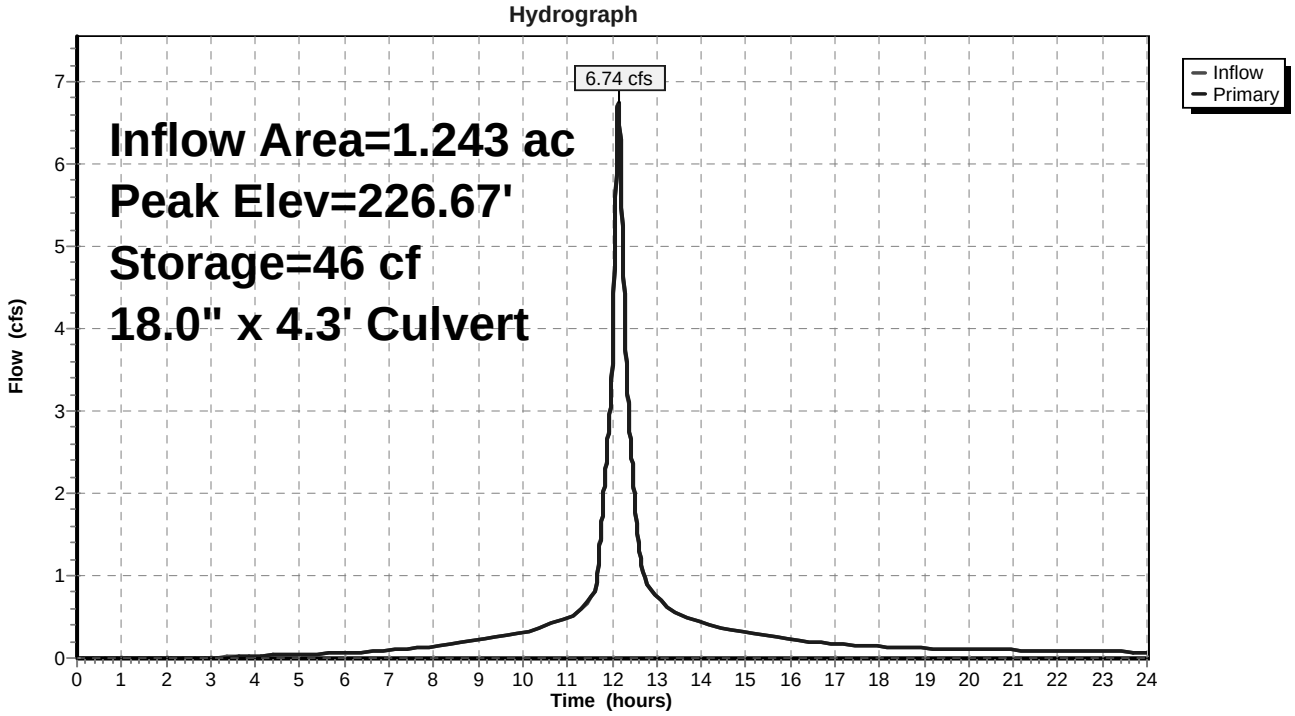
Volume	Invert	Avail.Storage	Storage Description
#1	223.98'	76 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
223.98	17	0	0
228.43	17	76	76

Device	Routing	Invert	Outlet Devices
#1	Primary	225.10'	**18.0" x 4.3' long 18" HDPE** CPP, square edge headwall, Ke= 0.500 Outlet Invert= 225.00' S= 0.0233 '/' Cc= 0.900 n= 0.012

Primary OutFlow Max=6.74 cfs @ 12.14 hrs HW=226.67' (Free Discharge)
└**1=18" HDPE** (Barrel Controls 6.74 cfs @ 4.52 fps)

Pond OCS1: OCS#1



Summary for Subcatchment N3a: Roof & Gutter Drainage

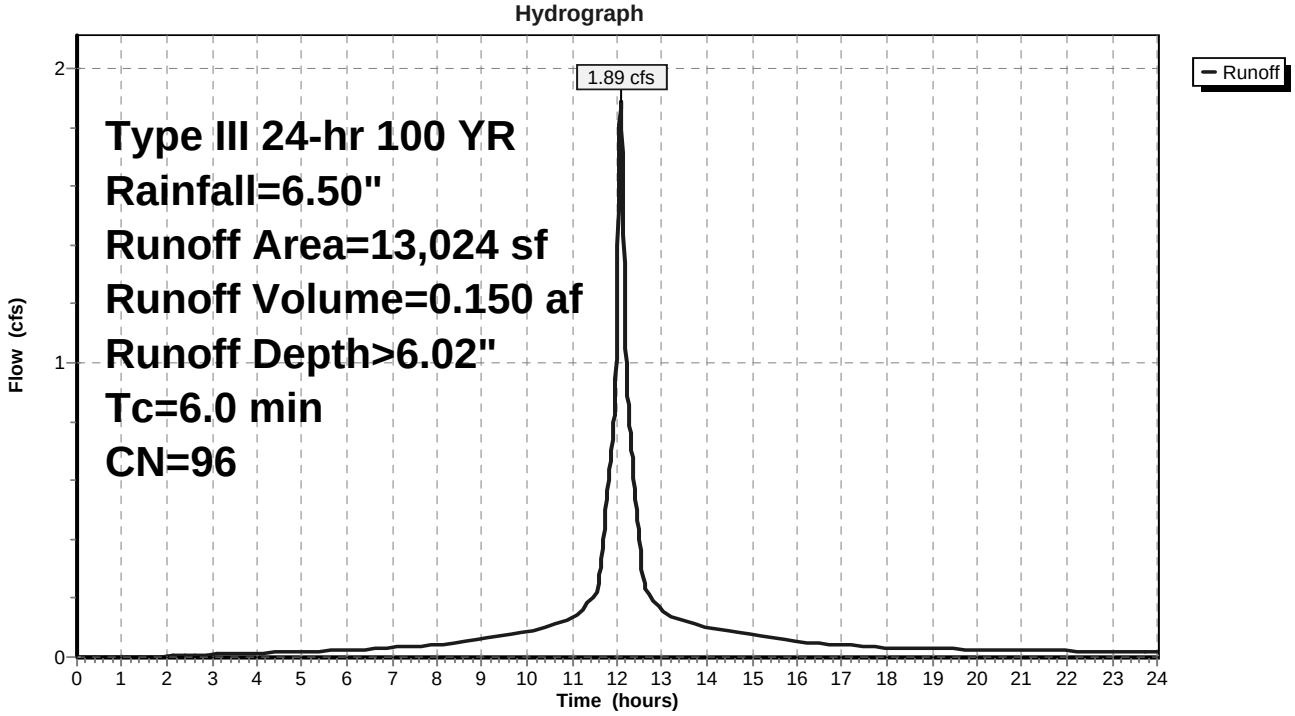
Runoff = 1.89 cfs @ 12.08 hrs, Volume= 0.150 af, Depth> 6.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=6.50"

Area (sf)	CN	Description
12,153	98	Paved parking & roofs
871	74	>75% Grass cover, Good, HSG C
13,024	96	Weighted Average
871		Pervious Area
12,153		Impervious Area

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

Subcatchment N3a: Roof & Gutter Drainage



Summary for Pond LP1-2: Leaching Pits

Inflow Area =	0.299 ac, 93.31% Impervious, Inflow Depth > 6.02" for 100 YR event				
Inflow =	1.89 cfs @	12.08 hrs,	Volume=	0.150 af	
Outflow =	1.85 cfs @	12.10 hrs,	Volume=	0.137 af,	Atten= 2%, Lag= 1.0 min
Discarded =	0.00 cfs @	2.34 hrs,	Volume=	0.004 af	
Primary =	1.85 cfs @	12.10 hrs,	Volume=	0.133 af	

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 231.48' @ 12.10 hrs Surf.Area= 0.007 ac Storage= 0.017 af

Plug-Flow detention time= 80.6 min calculated for 0.137 af (91% of inflow)
Center-of-Mass det. time= 35.5 min (791.5 - 756.0)

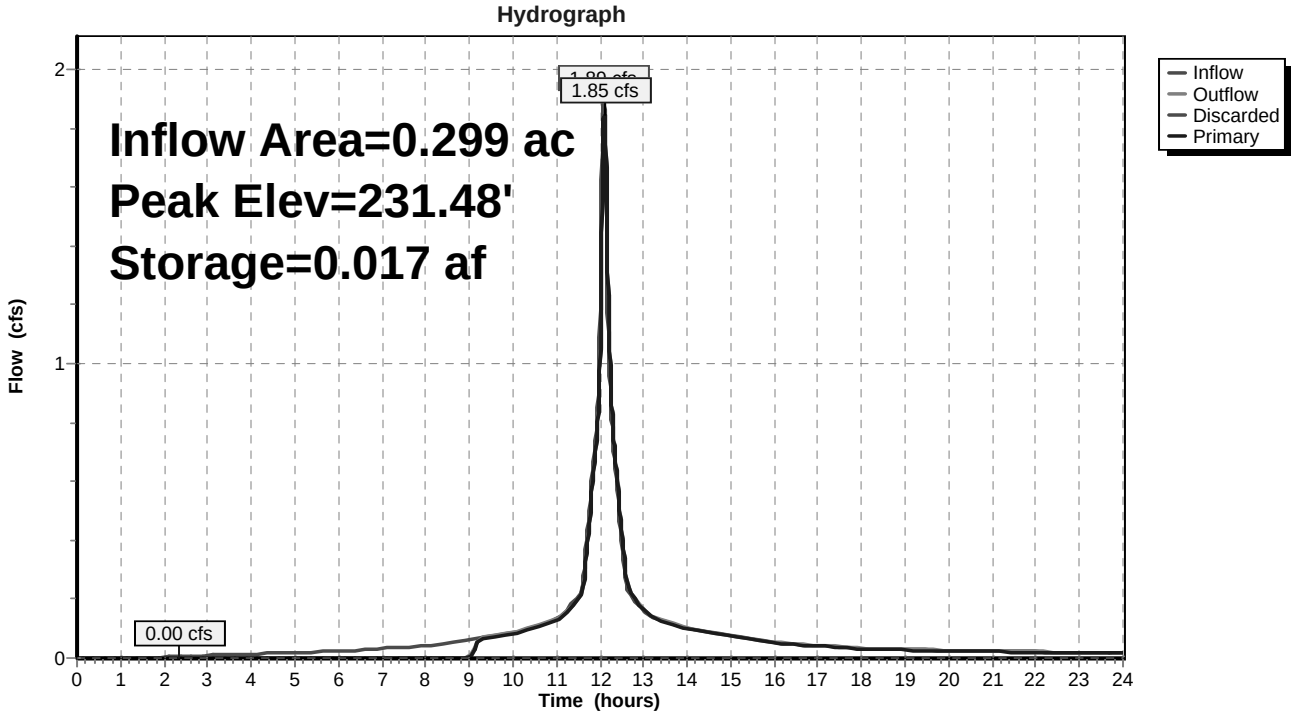
Volume	Invert	Avail.Storage	Storage Description
#1	227.19'	0.010 af	**14.00'D x 5.17'H Gravel** x 2 0.037 af Overall - 0.011 af Embedded = 0.026 af x 40.0% Voids
#2	227.86'	0.009 af	**8.00'D x 4.00'H Leaching Pit Structure** x 2 Inside #1 0.011 af Overall - 4.0" Wall Thickness = 0.009 af
		0.020 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	227.19'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	230.60'	**12.0" x 171.4' long 12" HDPE** CMP, projecting, no headwall, Ke= 0.900 Outlet Invert= 225.00' S= 0.0327 '/' Cc= 0.900 n= 0.012

Discarded OutFlow Max=0.00 cfs @ 2.34 hrs HW=227.24' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=1.85 cfs @ 12.10 hrs HW=231.48' (Free Discharge)
└─**2=12" HDPE** (Inlet Controls 1.85 cfs @ 2.52 fps)

Pond LP1-2: Leaching Pits

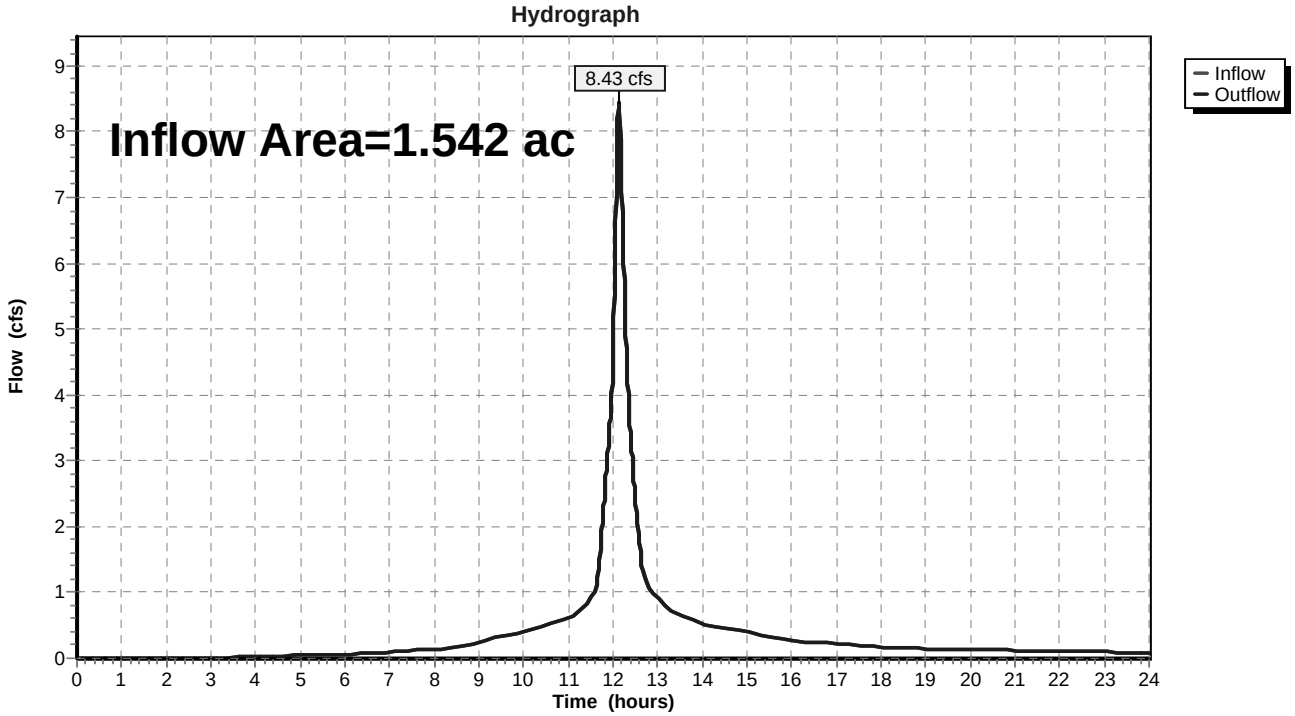


Summary for Reach N3 DP: N3 Design Point

Inflow Area = 1.542 ac, 80.51% Impervious, Inflow Depth > 5.60" for 100 YR event
Inflow = 8.43 cfs @ 12.13 hrs, Volume= 0.720 af
Outflow = 8.43 cfs @ 12.13 hrs, Volume= 0.720 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach N3 DP: N3 Design Point



Summary for Subcatchment N4: Ex. Parking Area

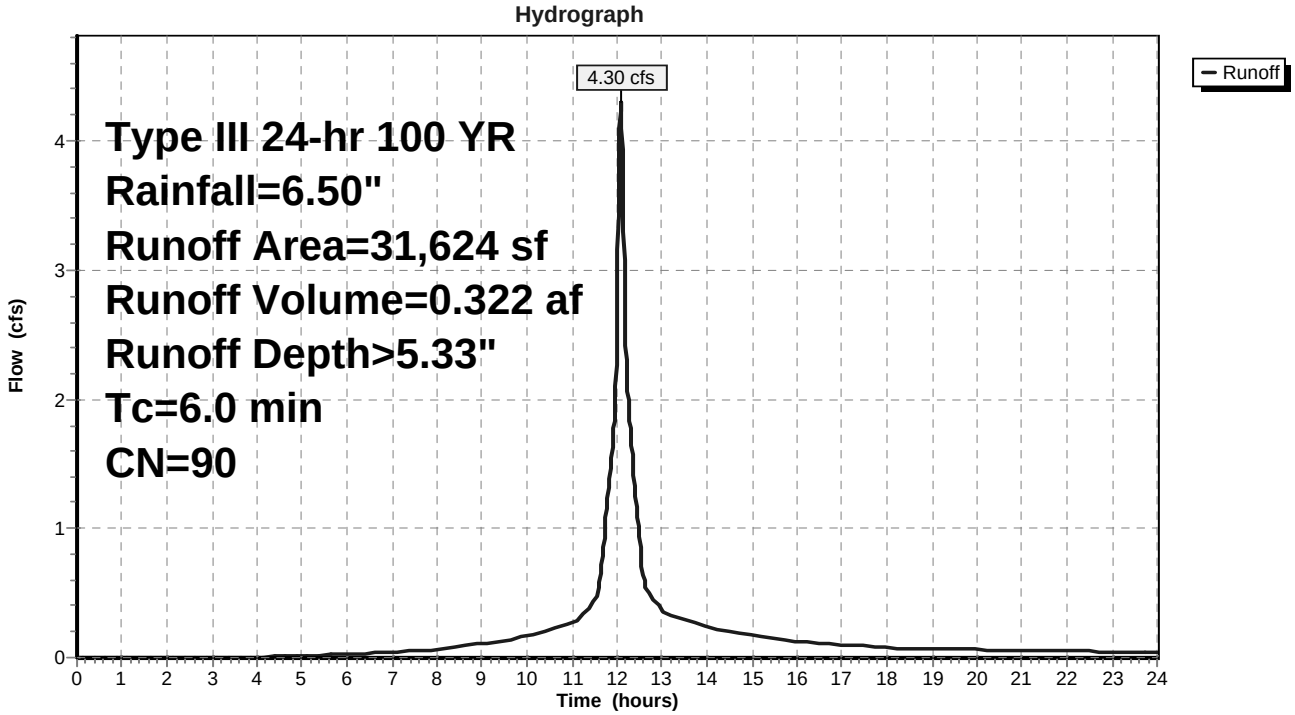
Runoff = 4.30 cfs @ 12.08 hrs, Volume= 0.322 af, Depth> 5.33"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=6.50"

Area (sf)	CN	Description
21,562	98	Paved parking & roofs
697	73	Woods, Fair, HSG C
9,365	74	>75% Grass cover, Good, HSG C
31,624	90	Weighted Average
10,062		Pervious Area
21,562		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Calculated Value <6 mins: Direct Entry**

Subcatchment N4: Ex. Parking Area

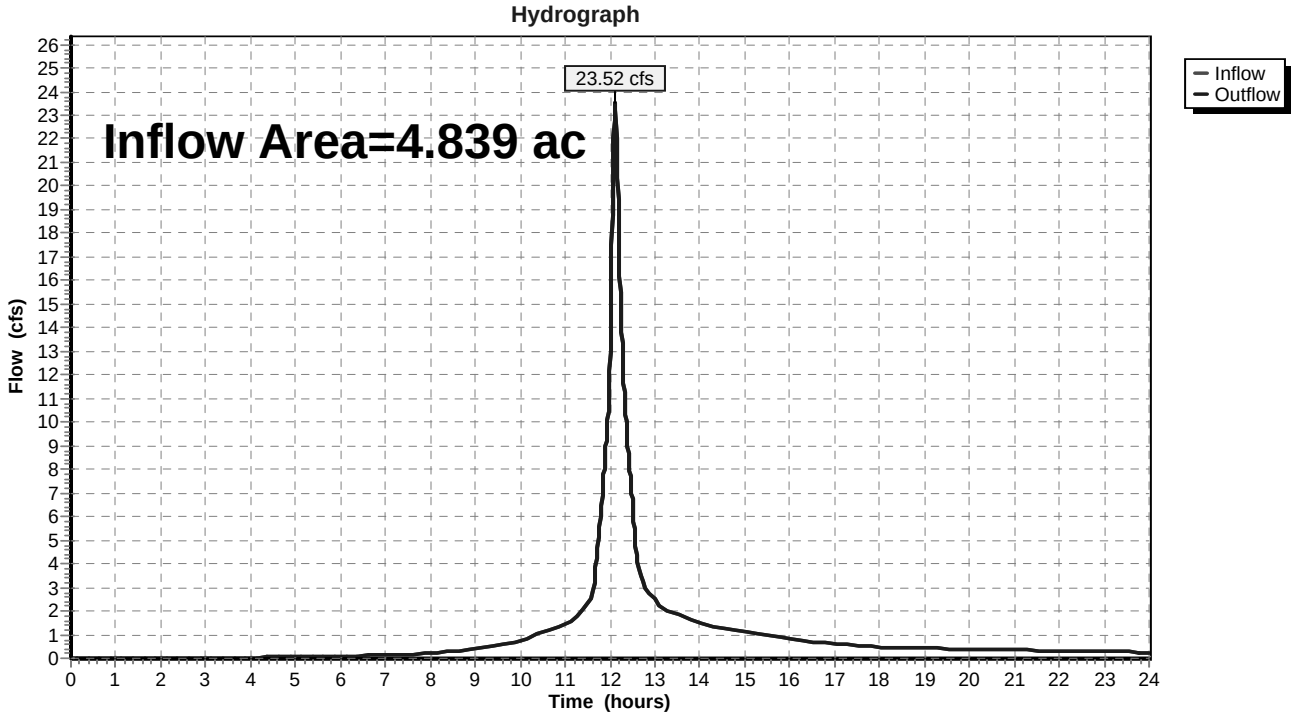


Summary for Reach DP: Analysis Design Point

Inflow Area = 4.839 ac, 44.44% Impervious, Inflow Depth > 4.65" for 100 YR event
Inflow = 23.52 cfs @ 12.11 hrs, Volume= 1.876 af
Outflow = 23.52 cfs @ 12.11 hrs, Volume= 1.876 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach DP: Analysis Design Point



Project: Carlisle Schools
Location: Carlisle, MA

TSS Removal Worksheet

GARCIA GALUSKA DESOUSA
Consulting Engineers
370 Faunce Corner Road, Dartmouth, MA 02747-1217
508-998-5700 FAX 508-998-0883 e-mail: info@g-g-d.com

TSS Removal Worksheet

Project:	Carlisle Schools	Project Loc.:	Carlisle, MA
Architect:	HMFH Architects	Project No.:	83101801.00
Date:	8/16/2010		Sht. No. 1 of 1
By: NCK	Chk. By: CMG		

Play Area

A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS	Amount Removed (BxC)	Remaing Load (C-D)
DSCB	0.25	1.00	0.25	0.75
WQI	0.25	0.75	0.19	0.56
			Total TSS Removal=	0.44

Church Street Parking

A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS	Amount Removed (BxC)	Remaing Load (C-D)
WQS	0.50	1.00	0.50	0.50
BIO	0.90	0.50	0.45	0.05
			Total TSS Removal=	0.95

Entry/Roof

A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS	Amount Removed (BxC)	Remaing Load (C-D)
STC	0.52	1.00	0.52	0.48
LP	0.80	0.48	0.38	0.10
			Total TSS Removal=	0.90

Legend:
SW=sweeping; DSCB=deep sump catch basin; LP=Leaching Pit; IT=infiltration trench; IB=infiltration basin; WQS=water quality swale; WQI=water quality inlet; EDP=extended detention pond; RB=retention basin; CW=constructed wetland; SF=sediment forebay; DC=drainage channel; DP=Detention Pond; BIO=bioretention cell; STC = Stormceptor; POR = Porous Pavement

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Water Quality Structure Worksheet

Project:	Carlisle Schools	Project Loc.:	Carlisle, MA
Architect:	HMFH Architects	Project No.:	83101801.00
Date:	8/4/2010		Sht. No. 1 of 1
By: NCK	Chk. By: CMG		

Location

A	B	C	D	E
Structure	ontrb. Imp. Ar (acres)	Volume Req. (ft^3)	Volume Req. (gallons)	$Q_{First\ Flush}$ (ft^3/s)
WQS#1	0.96	384.8	2878.3	0.91

V=(400 ft^3/acre)(Contributing Impervious Area)
Q=(c)(i)(A) = (0.95)(1)(Contributing Impervious Area)

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Stormceptor Structures Contributing Areas

Project:	Carlisle Schools	Project Loc.:	Carlisle, MA
Architect:	HMFH Architects	Project No.:	83101801.00
Date:	8/16/2010		Sht. No. 1 of 1
By: NCK	Chk. By: CMG		

Water Quality Structure	Stormceptor Model	Contributing Paved Area (Acres)
CB#4	STC 450i	0.09
CB#5	STC 450i	0.09

Table TSS

TSS Removal Efficiencies for Best Management Practices	
Best Management Practice (BMP)	**TSS Removal Efficiency**
Non-Structural Pretreatment BMPs	
Street Sweeping	0-10%, See Volume 2, Chapter 1.
Structural Pretreatment BMPs	
Deep Sump Catch Basins	25% only if used for pretreatment and only if off-line
Oil Grit Separator	25% only if used for pretreatment and only if off-line
Proprietary Separators	Varies – see Volume 2, Chapter 4.
Sediment Forebays	25% if used for pretreatment
Vegetated filter strips	10% if at least 25 feet wide, 45% if at least 50 feet wide
Treatment BMPs	
Bioretention Areas including rain gardens	90% provided it is combined with adequate pretreatment
Constructed Stormwater Wetlands	80% provided it is combined with a sediment forebay
Extended Dry Detention Basins	50% provided it is combined with a sediment forebay
Gravel Wetlands	80% provided it is combined with a sediment forebay
Proprietary Media Filters	Varies – see Volume 2, Chapter 4
Sand/Organic Filters	80% provided it is combined with sediment forebay
Treebox filter	80% provided it is combined with adequate pretreatment
Wet Basins	80% provided it is combined with sediment forebay
Conveyance	
Drainage Channels	For conveyance only. No TSS Removal credit.
Grass Channels (formerly biofilter swales)	50% if combined with sediment forebay or equivalent
Water Quality Swale – wet & dry	70% provided it is combined with sediment forebay or equivalent
Infiltration BMPs	
Dry Wells	80% for runoff from non-metal roofs; may also be used for runoff from metal roofs but only if metal roof is not located within a Zone II, or IWPA or at an industrial site
Infiltration Basins & Infiltration Trenches	80% provided it is combined with adequate pretreatment (sediment forebay or vegetated filter strip, grass channel, water quality swale) prior to infiltration
Leaching Catch Basins	80% provided a deep sump catch basin is used for pretreatment
Subsurface Structure	80% provided they are combined with one or more pretreatment BMPs prior to infiltration.
Other BMPs	
Dry Detention Basins	For peak rate attenuation only. No TSS Removal credit.
Green Roofs	See Volume 2. Chapter 2. May reduce required water quality volume. No TSS Removal Credit.
Porous Pavement	80% if designed to prevent runon and with adequate storage capacity. Limited to uses identified in Volume 2, Chapter 2.
Rain Barrels and Cisterns	May reduce required water quality volume. No TSS Removal Credit.

Fact Sheet #4

Stormwater Technology: Stormceptor

(Hydro Conduit, formerly CSR New England Pipe)

Revised February 2003

*The **Stormceptor Fact Sheet** is one in a series of fact sheets for stormwater technologies and related performance evaluations, which are undertaken by the **Massachusetts STrategic Envirotechnology Partnership (STEP).***

The STEP evaluation entitled, *Technology Assessment, Stormceptor CSR New England Pipe*, January 1998 is the information source for this fact sheet. When a more thorough understanding of a system is required, the full *Technology Assessment* should be reviewed. Copies are available for downloading from the STEP Web site (www.STEPSITE.org/) or by contacting the STEP Program (Phone: 617/626/1197, FAX: 617/626/1180, email: linda.benevides@state.ma.us). This fact sheet is subject to future updates as additional performance information becomes available.

Description/Definition

Stormceptor is a prefabricated, underground unit that separates oils, grease, and sediment from stormwater runoff when installed with an existing or new pipe conveyance system. The unit is divided into two chambers–a treatment and a flow bypass chamber. During typical storm events, runoff is directed by the inflow weir through a drop pipe into the lower treatment chamber where sediment, oil, and grease are separated from the flow by gravity. The bypass chamber is designed to convey excess stormwater, which overtops the inflow weir, through the system without treatment.

Equipment and Sizing

The on-line Stormceptor units are available in eight sizes ranging from six and twelve feet in diameter with capacities of 900 to 7200 gallons. Since issuing the STEP assessment in 1998, the manufacturer has expanded the Stormceptor product line to include a storm drain inlet (STC 450i) and three units (Models STC 11000, STC 13000, and STC16000). These systems are not included in the STEP evaluation. Users and decision-makers may require additional field test results and new data for these new systems in order to accept performance ratings, particularly if they are higher than those reported in the STEP technology assessment and this fact sheet.

Stormceptor units are available in either precast concrete or fiberglass for special applications. Concrete units are pre-engineered for HS-20 min. traffic loading at the surface. Fiberglass units can be used in areas where there is a potential for oil and chemical spills.

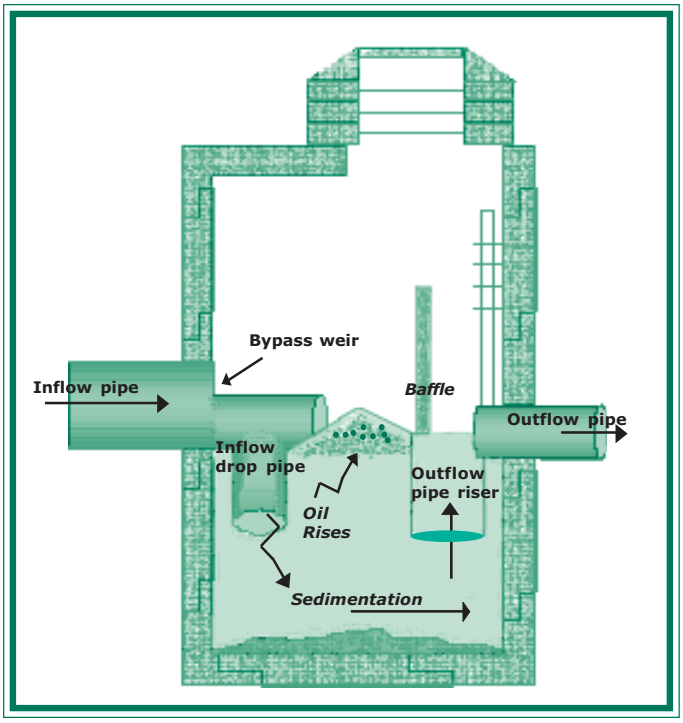


Figure 1. Stormceptor operation during average flow conditions.

Performance/Effectiveness

The system is designed to provide separation of sediment, oil, and grease from stormwater by routing runoff into a low-turbulence environment where solids settle and oils float out of solution. The system sizing is based on the drainage area, historical rainfall data, and the solids removal efficiency required. It is recommended that the system be used in combination with other stormwater controls to conform with the Massachusetts Stormwater Management Policy and standards.

An Imperial Model STC 2000 (equivalent to the Model STC 2400) in Edmonton, Canada treats flow from a 9.8 acre commercial parking lot. This system was monitored during four storm events in 1996 and shown to have an average total suspended solids (TSS) removal efficiency of 52 percent. In designing a system to achieve a comparable removal efficiency, the relationship between system size and impervious drainage area should be considered, as detailed in Table 1 and the Technology Assessment Report.

A Model STC 1200 in Westwood, Massachusetts treats flow from 0.65 acres consisting of a paved truck loading area at a manufacturing facility. The unit was monitored for six storm events in 1997, but only four events had measurable TSS influent concentrations. Of these four events, the average TSS removal efficiency was calculated to be 77 percent, which is less than the 80 percent removal targeted by the manufacturer.

Based on these field monitoring results, and when the unit sizing follows the guidance in Table 1, removal efficiencies between 52 percent and 77 percent may be achieved where installations have similar rainfall and land use characteristics as those reviewed for the STEP evaluation. It is recommended that additional field research and new data be evaluated to validate performance ratings higher than those verified by STEP.

Specific performance claims for oil and grease were not evaluated by STEP. However, total petroleum hydrocarbons (TPH) were analyzed during the Westwood study. Results indicated that the unit was effective in capturing oils.

Stormceptor Model Number	Maximum Impervious Area (acres)	
	77% TSS removal	52% TSS removal
STC 900	0.45	0.9
STC 1200	0.7	1.45
STC 1800	1.25	2.55
STC 2400	1.65	3.35
STC 3600	2.6	5.3
STC 4800	3.6	7.25
STC 6000	4.6	9.25
STC 7200	5.55	11.25

Table 1: Sizing for TSS removal (adapted from the manufacturer's sizing in the 1998 STEP Report) Use the table to determine a TSS removal rate. Use the new Rinker method for sizing Stormceptor units. The sizing method has been changed since publication of the STEP Report. **Note:** To achieve 52% and 77% TSS removal rates on some sites, it may be necessary to use lower maximum impervious areas than those in Table 1.

Technology Status

The Stormceptor system provides greater solids separation and higher TSS removal efficiencies than oil and grit separators. Stormceptor systems are among the category of hydrodynamic separators, which are flow-through devices with the capacity to settle or separate grit, oil, sediment, or other pollutants from stormwater. According to the U.S. Environmental Protection Agency, "Hydrodynamic separators are most effective where the materials to be removed from runoff are heavy particulates - which can be settled - or floatables - which can be captured, rather than solids with poor settleability or dissolved pollutants."

The field studies evaluated for the STEP assessment predate the Stormwater Best Management Practice Demonstration Tier II Protocol (2001), which is applicable in Massachusetts and other states in the Technology Acceptance Reciprocity Partnership (TARP), to ensure quality controlled studies that can be shared among participating states. Therefore, interstate reciprocity is not available to the manufacturer, based on performance claims that were evaluated by STEP in 1998. If the TARP Protocol requirements are fulfilled in the future, the manufacturer could pursue reciprocal verification for Stormceptor systems in participating TARP states. More information on the TARP Protocol is available on the following Web site: www.dep.state.pa.us/dep/deputate/pollprev/techservices/tarp.

Applications/Advantages

- Stormceptor systems identified in Table 1 should be used in combination with other BMPs to remove 80 percent of the average annual load of TSS (DEP Stormwater Policy Standard 4). Systems may be well suited for pretreatment in a mixed component system designed for stormwater recharge.
- Performance data show that Stormceptor may provide TSS removal rates in the range of 52 percent to 77 percent when sized according to Table 1. Higher TSS removal rates were achieved during low flow, low intensity storms with less than one third of an inch of runoff. Also, by reducing the impervious drainage area, relative to the system size, the STEP Technology Assessment Report indicated that higher removal efficiencies may be achievable. However, STEP recommends collection of additional data "representing a varied set of operating conditions over a realistic maintenance cycle to verify TSS removal rates greater than 80 percent."
- The Stormceptor system is suitable for new and retrofit applications. For retrofit applications, it should not

take the place of a catch basin for the systems that have been verified. Also, for retrofit applications, it should be installed in lateral lines and not main trunk lines.

- The system is particularly well suited in constricted areas and where space is limited.
- It also is suitable for use in areas of high potential pollutant loads (DEP Stormwater Policy Standard 5), where it may be used effectively in capturing and containing oil and chemical spills. *Web site:* www.state.ma.us/dep/brp/stormwtr/stormpub.htm.

Considerations/Limitations

- Systems are not expected to provide significant nutrient (nitrogen and phosphorus) or fecal coliform removal.
- The systems are not recommended for use in critical areas, such as public drinking water supplies, certified vernal pools, public swimming beaches, shellfish growing areas, cold water fisheries, and some Areas of Critical Environmental Concern (ACECs), except as a pretreatment device for BMPs that have been approved by DEP for use in critical areas. The structural BMPs approved for use in critical areas are described in Standard 6 of the Stormwater Management Policy, www.state.ma.us/dep/brp/stormwtr/stormpub.htm.
- There is a limited set of useful data for predicting the relationship between treatment efficiency and loading rates. Removal efficiencies have not been demonstrated for all unit sizes.
- Further research is needed to determine how much TSS bypasses the treatment chamber during certain, higher velocity storm events which recur less frequently.
- Systems require regular maintenance to minimize the potential for washout of the accumulated sediments.

Reliability/Maintenance

All BMPs require scheduled, routine maintenance to ensure that they operate as efficiently as possible. Although maintenance requirements are site specific, a general relationship between cleaning needs and depths of sediment has been established by the manufacturer. Inspection of the Stormceptor interior should be done after major storm events, particularly in the first year of operation. It is recommended that material in the treatment chamber be pumped out by a vacuum truck semiannually, or when the sediment and pollutant loads reach about 15 percent of the total storage. If the unit is used for spill containment, it should be pumped after the event is contained. Typical cleaning costs were estimated by the manufacturer in 1998 to be $250, with disposal costs averaging $300 to $500. The expected life of a system has been estimated to be 50 to 100 years.

Sediment Depths Indicating Required Maintenance	
Model Number	**Sediment Depth (feet)**
STC 900	0.5
STC 1200	0.75
STC 1800	1
STC 2400	1
STC 3600	1.25
STC 4800	1
STC 6000	1.5
STC 7200	1.25

Table 2: The Stormceptor clean out is based on 15 percent of the sediment storage volume in the

References

Winkler, E.S. 1998. "Technology Assessment, Stormceptor." University of Massachusetts, Amherst, MA. *STEP Web site:* www.STEPSITE.org/

Massachusetts Department of Environmental Protection and Office of Coastal Zone Management. 1997. "Stormwater Management Handbooks, Volumes One and Two." Boston, MA. *Handbooks Web site:* www.state.ma.us/dep/brp/stormwtr/stormpub.htm.

United States Environmental Protection Agency. "Storm Water Technology Fact Sheet Hydrodynamic Separators." EPA 832-F-99-017.

Stormceptor Web sites: www.rinkermaterials.com/stormceptor

TARP Web site: www.dep.state.pa.us/dep/deputate/pollprev/techservices/tarp

STEP Verification vs. Regulatory Approval

STEP assistance to developers of innovative technologies and STEP verification of stormwater treatment systems is not required to receive necessary approvals from conservation commissions or the Department of Environmental Protection (DEP). However, if a system has received verfication, a conservation commission shall presume that the technology will function as proposed, provided the conditions are similar to those in which performance was verified. STEP reports are not technology approvals, and do not constitute an endorsement or recommendation for use. Questions on regulatory issues should be referred to the DEP regional offices.

Project: Carlisle Schools
Location: Carlisle, MA

Drainage Calculations
Closed Pipe Drainage System

Closed pipe system calculations are provided for the 100-yr storm event.

Calculation of Equivalent Area			
Project: Carlisle Schools			
Location: Carlisle, MA			
Calc. By: NCK	Date: 8/16/2010		
Chk. By: CMG	Date: 8/16/2010		

Garcia-Galuska-DeSousa
370 Faunce Corner Road
Dartmouth, MA 02747
Tel.: (508)998-5700

Sub Area Number	Structure Number	Area (Ac.)				Equiv. Area (C x A)				Tot.Area
		Pvmnt.	Woods	Grass	Gravel	Pvmnt.	Wood	Grass	Gravel	∑(CxA)
1	CB#1	0.172	0.000	0.064	0.000	0.155	0.000	0.026	0.000	0.180
2	CB#2	0.217	0.000	0.105	0.000	0.195	0.000	0.042	0.000	0.237
3	CB#3	0.559	0.000	0.110	0.000	0.503	0.000	0.044	0.000	0.547
4	CB#4	0.091	0.000	0.020	0.000	0.082	0.000	0.008	0.000	0.090
5	CB#5	0.090	0.000	0.004	0.000	0.081	0.000	0.001	0.000	0.083
6	RD#1	0.118	0.000	0.000	0.000	0.106	0.000	0.000	0.000	0.106
7	DS#1	0.014	0.000	0.000	0.000	0.013	0.000	0.000	0.000	0.013
8	DS#2	0.005	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.005
9	DS#3	0.021	0.000	0.000	0.000	0.019	0.000	0.000	0.000	0.019
10	DS#4	0.027	0.000	0.000	0.000	0.025	0.000	0.000	0.000	0.025
11	DS#5	0.013	0.000	0.000	0.000	0.011	0.000	0.000	0.000	0.011
12	DS#6	0.032	0.000	0.000	0.000	0.029	0.000	0.000	0.000	0.029
13	DS#7	0.016	0.000	0.000	0.000	0.014	0.000	0.000	0.000	0.014
14	DS#8	0.008	0.000	0.000	0.000	0.008	0.000	0.000	0.000	0.008
15	DS#9	0.005	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.005
16	DS#10	0.028	0.000	0.000	0.000	0.025	0.000	0.000	0.000	0.025
17	DS#11	0.006	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.005
18	DS#12	0.029	0.000	0.000	0.000	0.026	0.000	0.000	0.000	0.026
19	DS#13	0.043	0.000	0.000	0.000	0.039	0.000	0.000	0.000	0.039
20										
21										
22										
23										
24										

Hydraulic Design													
Project: Carlisle School													
Location: Carlisle, MA													
Calc. By: NCK	Date: 08/16/2010												
Chk. By: CMG	Date: 08/16/2010												

Garcia-Galuska-DeSousa
370 Faunce Corner Road
Dartmouth, MA 02747
Tel.: (508)998-5700

Storm Freq.= 100 **Curve: USDA** **Method = Rational**

Location	Struct. No.		Equiv. Ac.		T.O.C.	I	Q	Length	Slope	Dia.	Q_{full}	V_{full}	T_t
	From	To	Add	Total	(min.)	(in/hr)	(cfs)	(ft.)	(ft./ft.)	(in.)	(cfs)	(ft./sec)	(min.)
	DS#1	DMH#1		0.013	5.0	9.0	**0.12**	19.2	0.09	6	**1.99**	10.12	0.0
	CB#1	DMH#1		0.180	8.5	7.4	**1.33**	241	0.0276	12	**6.41**	8.16	0.5
	CB#2	DMH#1		0.237	11.5	6.8	**1.61**	33.5	0.01	12	**3.86**	4.91	0.1
	DMH#1	DMH#2		0.430	11.7	6.7	**2.88**	11	0.01	12	**3.86**	4.91	0.0
	CB#3	DMH#2		0.547	15.5	6.0	**4.31**	37.5	0.01	15	**6.99**	5.70	0.1
	DMH#2	DMH#3		0.860	15.6	6.0	**5.16**	1.5	0.02	12	**5.45**	6.95	0.0
	DMH#3	SDB#1		0.860	15.6	6.0	**5.16**	1.75	0.02	12	**5.45**	6.95	0.0
	SDB#1	OCS#1		0.860	15.6	6.0	**5.16**	0	0	24	**0.00**	0.00	#DIV/0!
	OCS#1	DMH#4		0.860	15.6	6.0	**5.16**	4.3	0.024	18	**17.61**	9.97	0.0
	DMH#4	DMH#5		0.860	15.6	6.0	**5.16**	51	0.007	15	**5.85**	4.77	0.2
	DS#2	DS#3		0.005	5.0	9.0	**0.05**	43.9	0.015	6	**0.81**	4.13	0.2
	DS#3	DS#4	0.019	0.024	5.0	9.0	**0.22**	23	0.015	6	**0.81**	4.13	0.1
	DS#4	DS#5	0.025	0.049	5.0	9.0	**0.44**	14.7	0.015	6	**0.81**	4.13	0.1
	DS#5	DS#6	0.011	0.060	5.0	9.0	**0.54**	21.9	0.03	6	**1.15**	5.85	0.1
	DS#6	DS#7	0.029	0.089	5.0	9.0	**0.80**	48.2	0.03	6	**1.15**	5.85	0.1
	DS#7	DMH#6	0.014	0.103	5.0	9.0	**0.93**	2	0.03	6	**1.15**	5.85	0.0
	DS#8	DMH#6		0.008	5.0	9.0	**0.07**	32.2	0.03	6	**1.15**	5.85	0.1
	CB#5	DMH#6		0.083	5.0	9.0	**0.75**	30.6	0.01	12	**4.21**	5.36	0.1

Hydraulic Design	**Garcia-Galuska-DeSousa**
Project: Carlisle School	**370 Faunce Corner Road**
Location: Carlisle, MA	**Dartmouth, MA 02747**
Calc. By: NCK Date: 08/16/2010	Tel.: (508)998-5700
Chk. By: CMG Date: 08/16/2010	2 of 2

Storm Freq.= 100 **Curve: USDA** **Method = Rational**

Location	Struct. No.		Equiv. Ac.		T.O.C.	I	Q	Length	Slope	Dia.	Q_{full}	V_{full}	T_t
	From	To	Add	Total	(min.)	(in/hr)	(cfs)	(ft.)	(ft./ft.)	(in.)	(cfs)	(ft./sec)	(min.)
	DMH#6	DMH#5		0.194	5.0	9.0	**1.75**	41.8	0.01	12	**3.86**	4.91	0.1
	DMH#5	DMH#7		1.054	15.8	6.0	**6.32**	62	0.01	15	**6.99**	5.70	0.2
	CB#4	LP#1		0.090	5.0	9.0	**0.81**	9.1	0.011	12	**4.04**	5.15	0.0
	RD#1	LP#1		0.106	5.0	9.0	**0.95**	47.8	0.01	8	**1.43**	4.09	0.2
	DS#11-13	LP#1		0.070	5.0	9.0	**0.63**	35	0.015	6	**0.81**	4.13	0.1
	LP#1	LP#2		0.266	5.2	8.9	**2.37**	9	0	12	**0.00**	0.00	0.0
	LP#2	DS#10		0.266	5.2	8.9	**2.37**	36.9	0.033	12	**7.00**	8.92	0.1
	DS#10	DS#9	0.005	0.271	5.3	8.9	**2.41**	21.8	0.033	12	**7.00**	8.92	0.0
	DS#9	DMH#7	0.025	0.296	5.4	8.9	**2.63**	112.7	0.033	12	**7.00**	8.92	0.2
	DMH#7	DMH#8		1.350	16.0	6.0	**8.10**	105.7	0.03	15	**12.11**	9.87	0.2
	DMH#8	EX CB#1		1.350	16.2	5.9	**7.97**	52.1	0.1	12	**12.19**	15.53	0.1

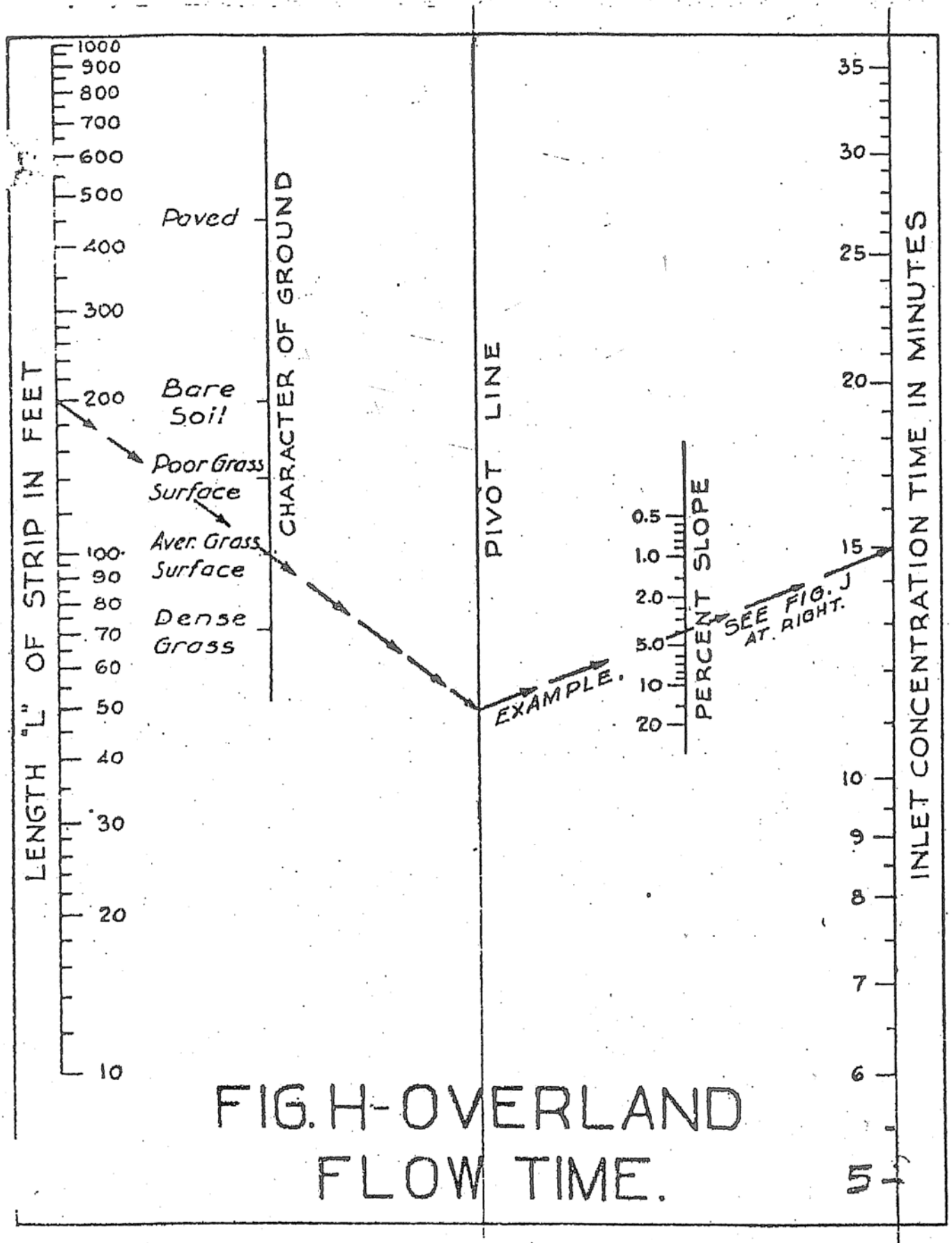
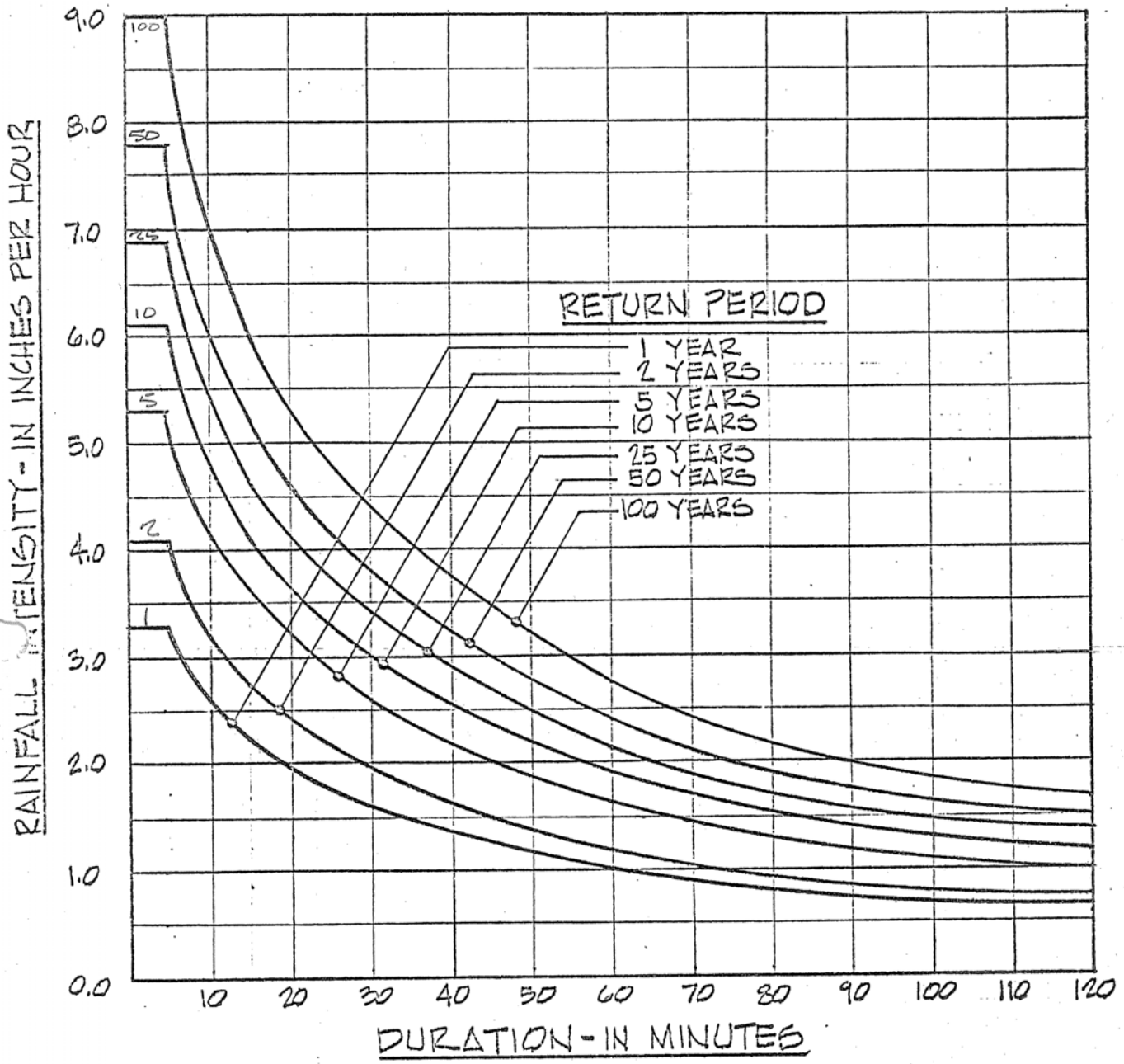


FIG. H-OVERLAND FLOW TIME.

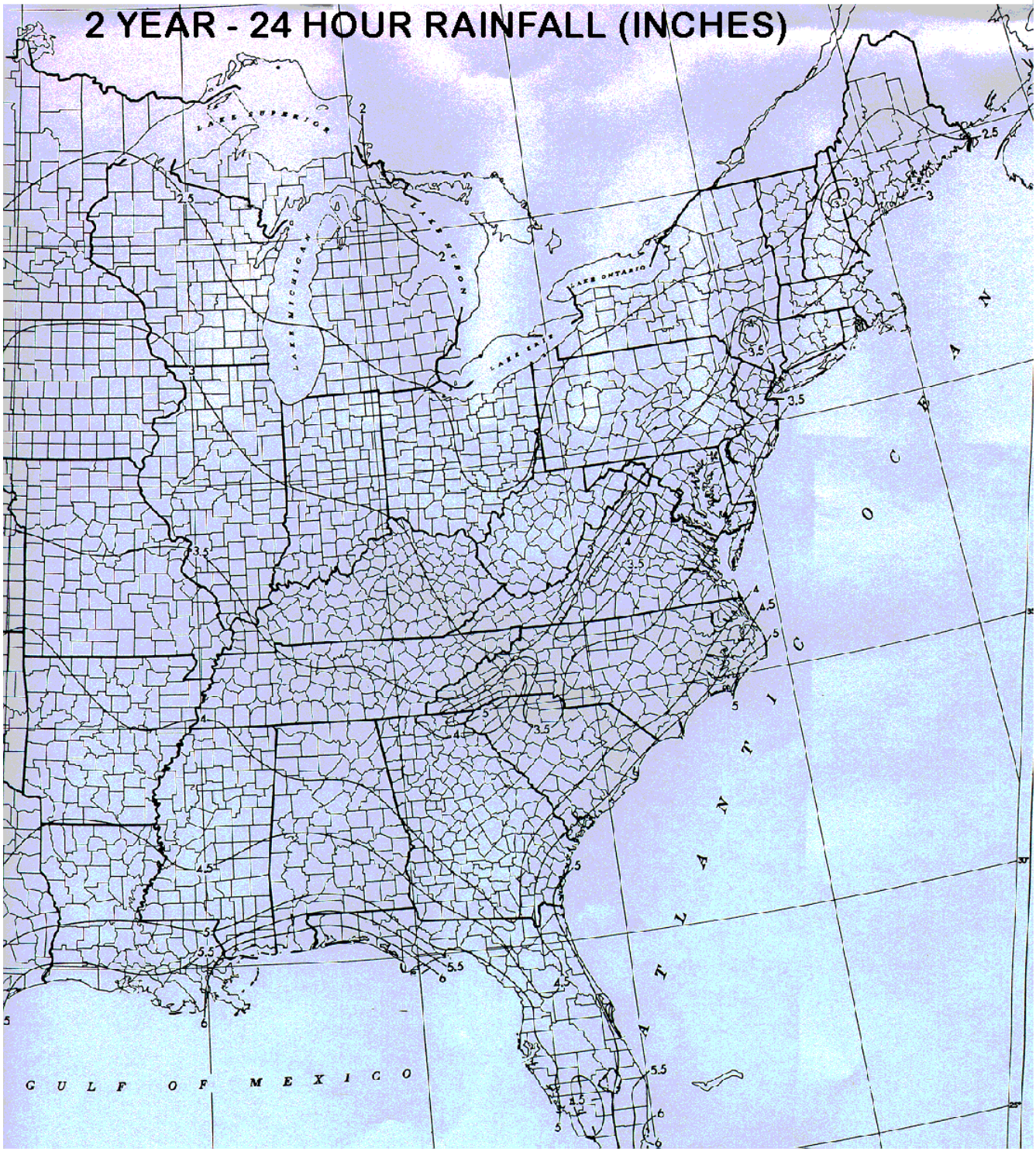
*Reproduced from Miscellaneous Publication NO. 204.

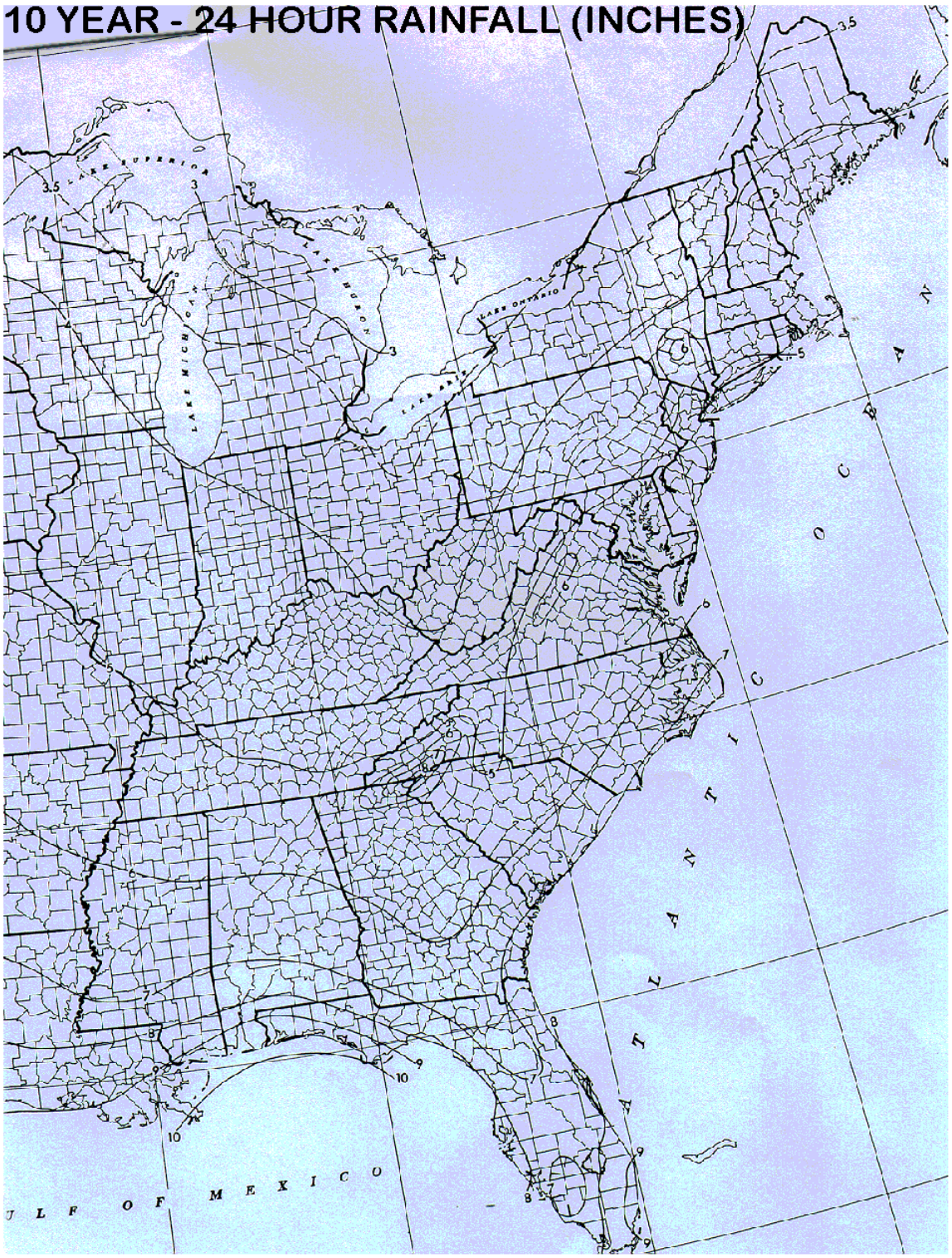


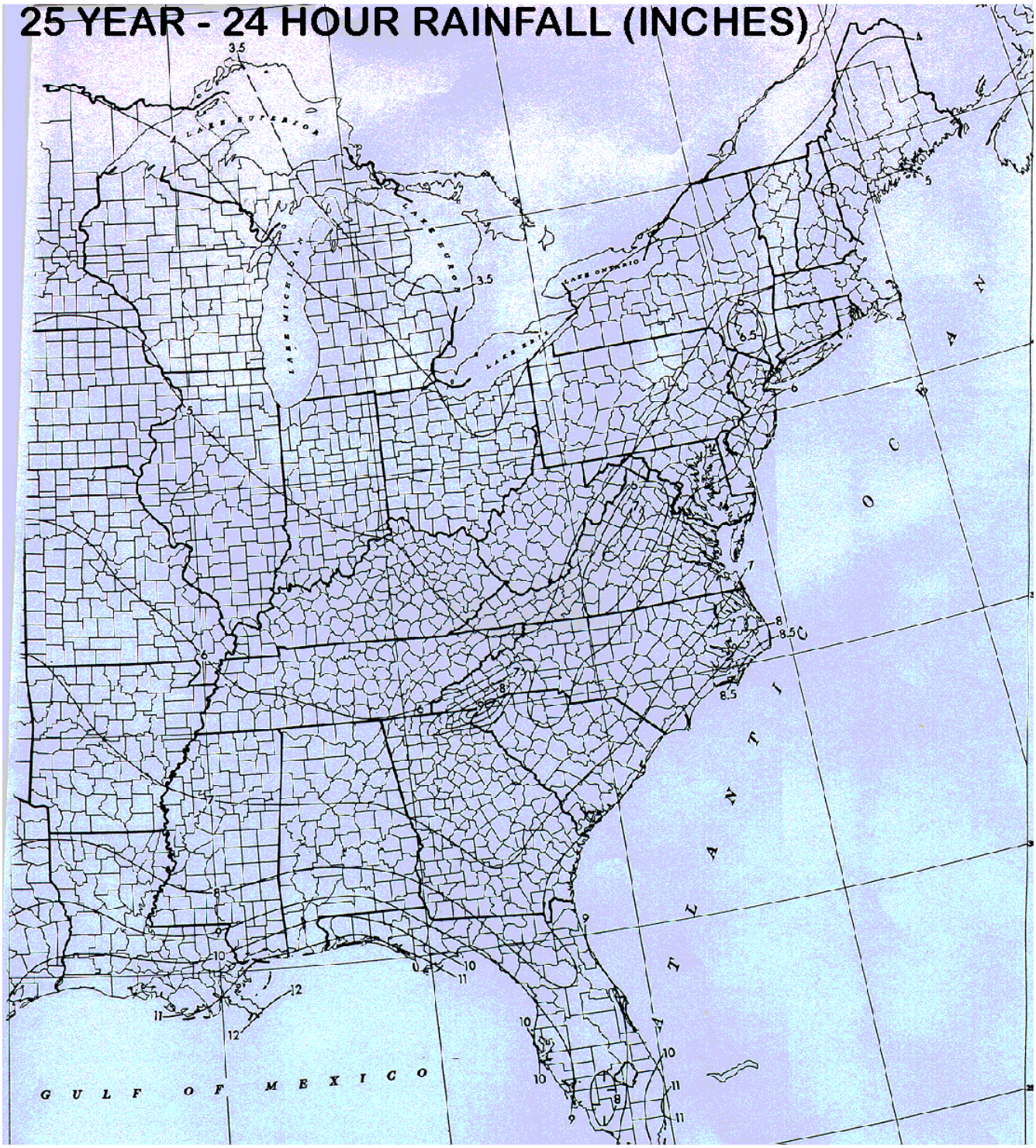
RAINFALL INTENSITY - DURATION CURVES

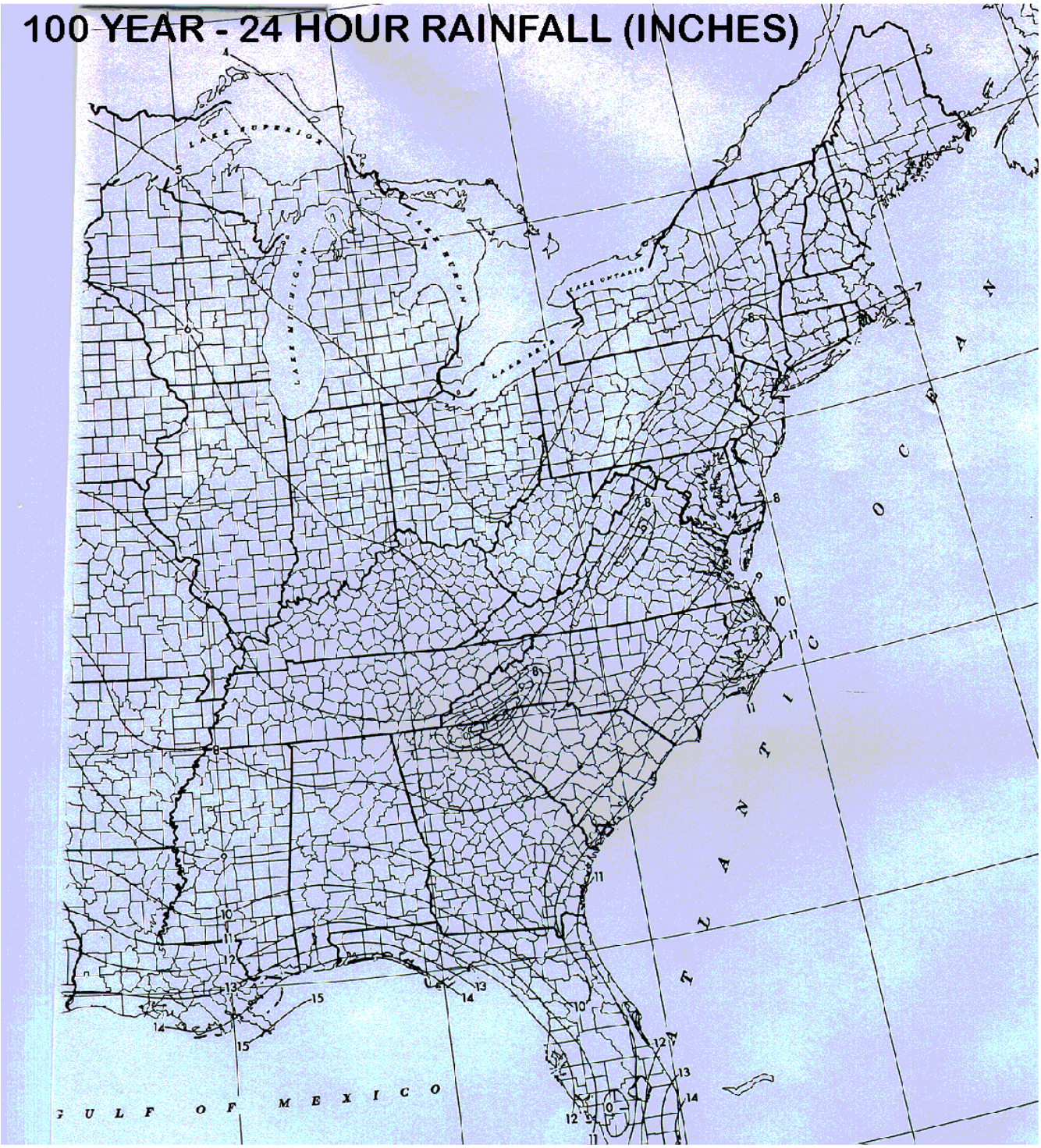
FOR

MASSACHUSETTS


2 YEAR - 24 HOUR RAINFALL (INCHES)
LAKE SUPERIOR
LAKE MICHIGAN
LAKE HURON
LAKE ONTARIO
LAKE ERIE
GULF OF MEXICO
ATLANTIC OCEAN


10 YEAR - 24 HOUR RAINFALL (INCHES)
LAKE SUPERIOR
LAKE MICHIGAN
LAKE HURON
LAKE ERIE
LAKE ONTARIO
ATLANTIC OCEAN
GULF OF MEXICO


25 YEAR - 24 HOUR RAINFALL (INCHES)
LAKE SUPERIOR
LAKE MICHIGAN
LAKE HURON
LAKE ONTARIO
LAKE ERIE
GULF OF MEXICO
ATLANTIC OCEAN


100 YEAR - 24 HOUR RAINFALL (INCHES)
LAKE SUPERIOR
LAKE MICHIGAN
LAKE HURON
LAKE ONTARIO
LAKE ERIE
ATLANTIC OCEAN
GULF OF MEXICO

Project: Carlisle Schools
Location: Carlisle, MA

Groundwater Recharge

GARCIA GALUSKA DESOUSA
Consulting Engineers
370 Faunce Corner Road, Dartmouth, MA 02747-1217
508-998-5700 FAX 508-998-0883 e-mail: info@g-g-d.com

Recharge Requirement Worksheet

Project:	Carlisle Schools	Project Loc.:	Carlisle, MA
Architect:	HMFH Architects, Inc.	Project No.:	831018.01
Date:	8/16/2010		Sht. No. 1 of 1
By: NCK	Chk. By: CMG		

Total Developed Site

A	B	C	D
Soil Type	Impervious Area (ft^2)	Recharge Factor (Inches)	Recharge Volume Required (ft^3)
HSG 'C'	289,868	0.25"	6,039
		Recharge Volume Required=	6,039

Proposed Increase to Impervious Cover

A	B	C	D
Soil Type	Impervious Area (ft^2)	Recharge Factor (Inches)	Recharge Volume Required (ft^3)
HSG 'C'	9,938	0.25"	207
		Recharge Volume Required=	207

Recharge Provided

A	B	C	D
Infiltration Structure	Pond/Structure Storage (ft^3)	Crushed Stone Storage (ft^3)	Total Storage (D+E) (ft^3)
LP#1	122	120	242
LP#2	122	120	242
		Recharge Volume Provided=	484

Project: Carlisle Schools
Location: Carlisle, MA

Drawdown Calculations

GARCIA GALUSKA DESOUSA
Consulting Engineers
370 Faunce Corner Road, Dartmouth, MA 02747-1217
508-998-5700 FAX 508-998-0883 e-mail: info@g-g-d.com

Recharge Facilities Drawdown Calculation

Project:	Carlisle Schools	Project Loc.:	Carlisle, MA
Architect:	HMFH Architects	Project No.:	831018.01
Date:	8/16/2010		Sht. No. 2 of 4
By: NCK	Chk. By: CMG		

Leaching Pit Drawdown Time

A	B	C	D
Storage Volume (ft^3) (At Elev. 230.60)	Bottom Area (ft^2) (LxW)	Infiltration Rate (Inches/Hour)	Drawdown Time (Hrs) (A / (B x (C / 12)))
484.0	307.80	0.27	69.89

69.9 hrs < 72 hrs. OK

Project: Carlisle Schools
Location: Carlisle, MA

Catch Basin Grate Capacities

Catch Basin grate capacities are provided for the 100-yr storm event.

Drainage Analysis for Carlisle Schools

Catch Basin #1

Ponded Capacity
- Flow = 1.33 cfs
- Open Area = 3.0 s.f.
- Perimeter = 8'
- Head = 0.25 ft.
- Capacity = 2.8 cfs > 1.33 cfs ok

Catch Basin #2

Gutter Flow Capacity
- Flow = 1.61 cfs
- Trav. Slope = 0.005
- Long. Slope = 0.018
- K = 27
- Depth = 0.1
- Capacity = 0.582 cfs < 1.61 cfs
- (1.03 cfs bypasses to CB#3)

Catch Basin #3 (Double Grate)

Ponded Capacity
- Flow = 3.28 cfs + 1.03 cfs =4.31
- Open Area = 3.0 s.f.
- Perimeter = 12'
- Head = 0.25 ft.
- Capacity = 4.9 cfs > 4.31 cfs ok

Catch Basin #4

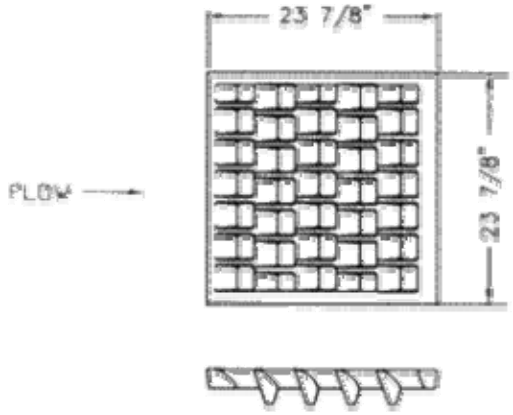
Ponded Capacity
- Flow = 0.75 cfs
- Open Area = 1.5 s.f.
- Perimeter = 8'
- Head = 0.25 ft.
- Capacity = 2.8 cfs > 0.75 cfs ok

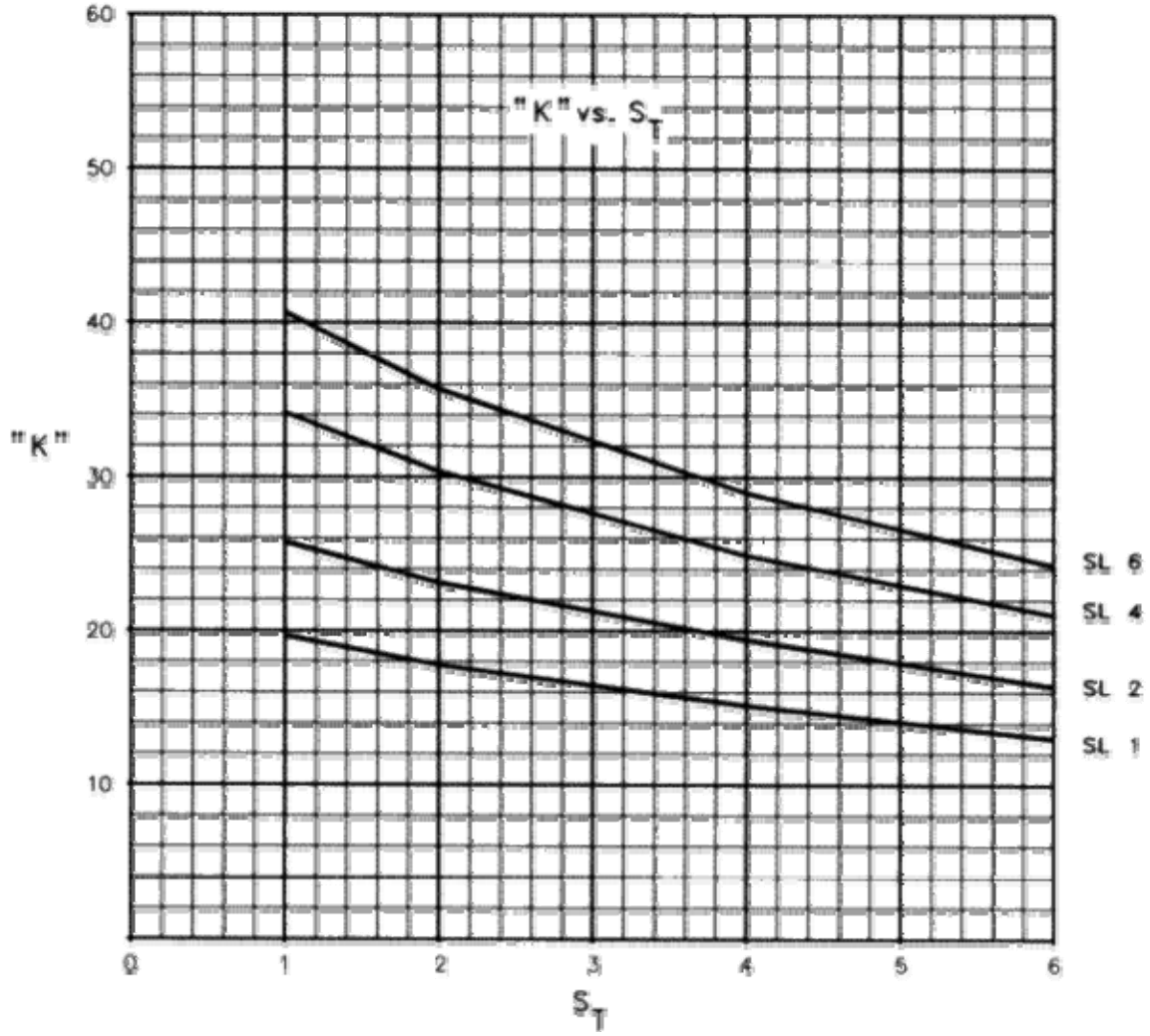
Catch Basin #5

Ponded Capacity
- Flow = 0.81 cfs
- Open Area = 1.5 s.f.
- Perimeter = 8'
- Head = 0.25 ft.
- Capacity = 2.8 cfs > 0.81 cfs ok

Grate capacities were calculated using "Neenah Inlet Grate Capacities for Gutter Flow and Ponded Water" (©1987). For design use Neenah Catalog No. R-3210-A Type C, *equal to LeBaron LF-248-2.*

CAT. NO.= R= 3210-L
DESCRIPTION- TYPE L GRATE





Attached Figures

- Figure 1: Quadrangle Map
- Figure 2: FEMA Flood Insurance Rate Map
- Figure 3: Assessor Map
- Figure 4: Priority Habitat and Estimated Habitat Natural Heritage & Endangered Species Program
- Figure 5: DEP Water Supply Protection Areas Map

Figure 1

USGS Topographic Map

Billerica Quad 1984

Carlisle, Massachusetts

Source: TopoScout CD-ROM USGS Quadrangle Map

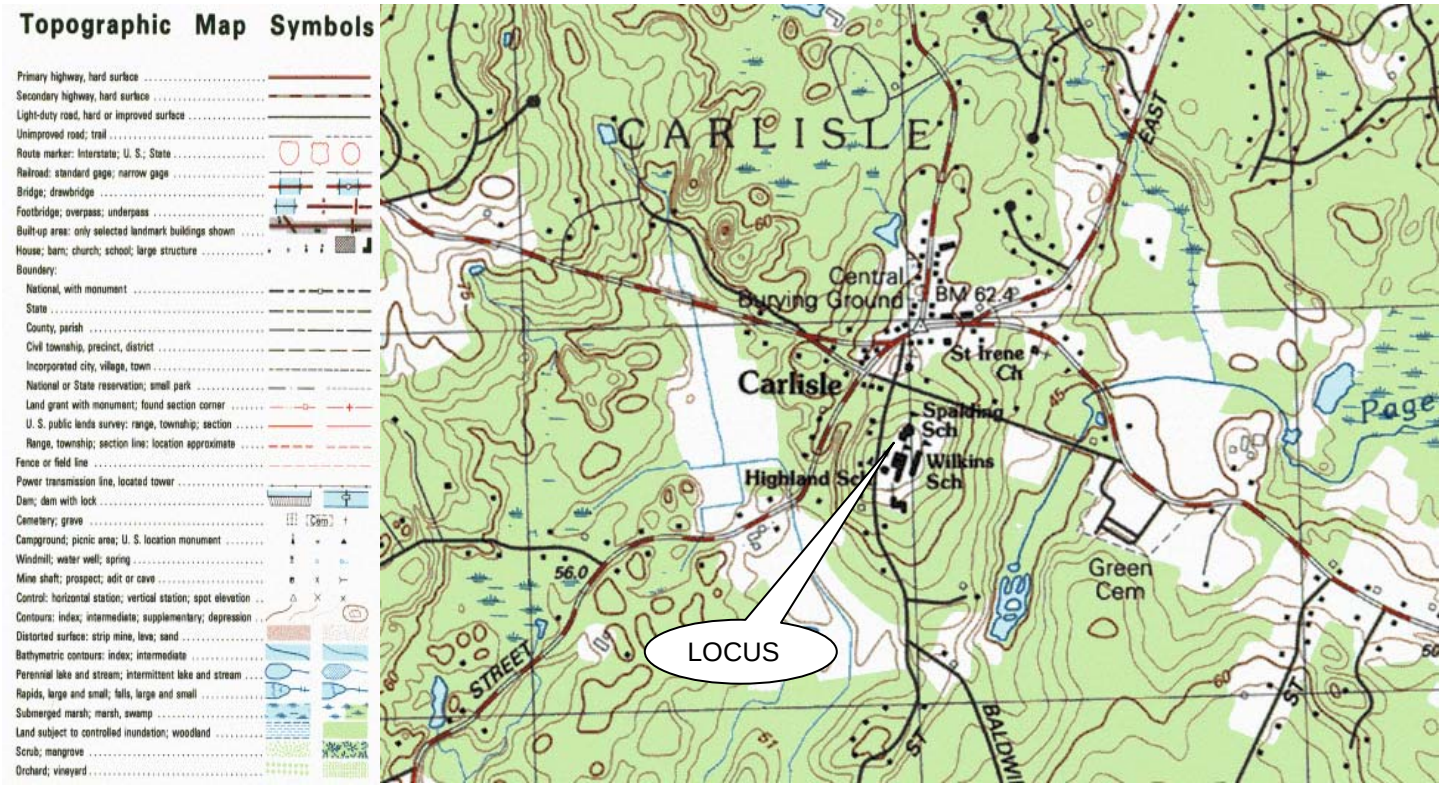


Figure 2

Flood Insurance Rate Map
Town of Carlisle, MA
Middlesex County
Community Panel Number: 25017C 0263 E **Effective Date: June 4, 2010**

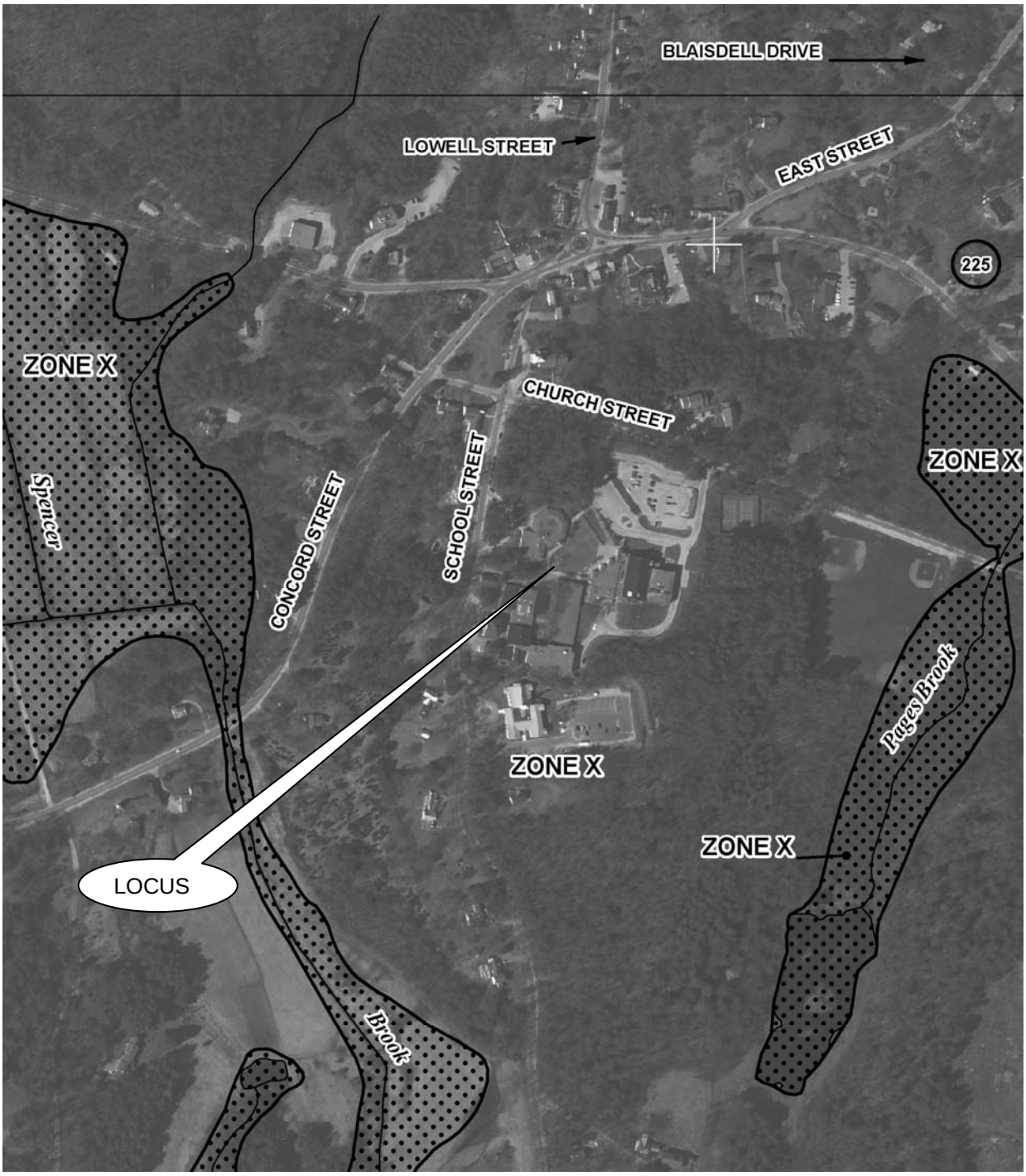
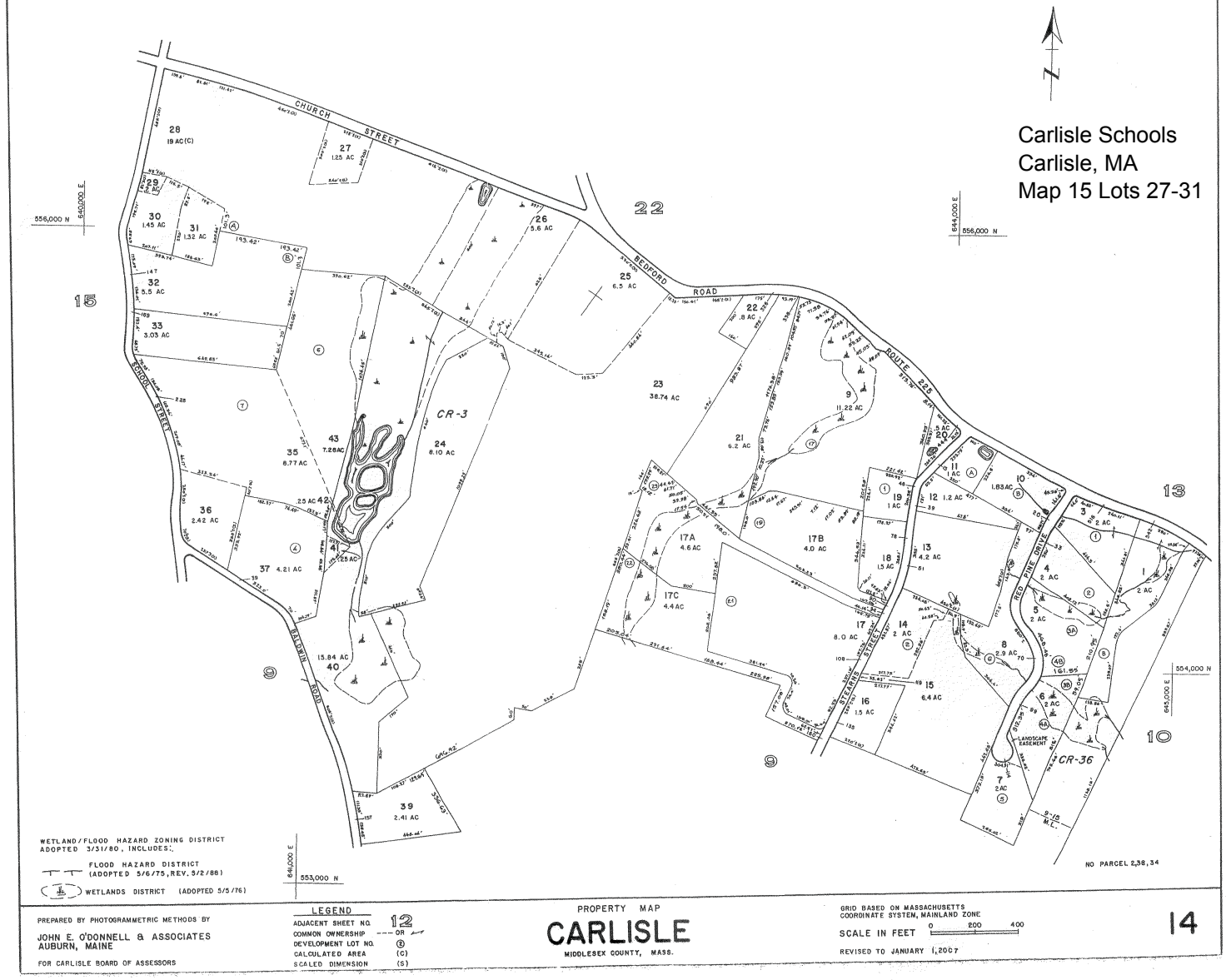


Figure 3

Carlisle Schools
Carlisle, MA
Map 15 Lots 27-31



WETLAND/FLOOD HAZARD ZONING DISTRICT
ADOPTED 3/31/80, INCLUDES:

FLOOD HAZARD DISTRICT
(ADOPTED 5/6/75, REV. 5/2/88)

WETLANDS DISTRICT (ADOPTED 5/3/76)

PREPARED BY PHOTOGRAMMETRIC METHODS BY

JOHN E. O'DONNELL & ASSOCIATES
AUBURN, MAINE

FOR CARLISLE BOARD OF ASSESSORS

LEGEND

ADJACENT SHEET NO.	12
COMMON OWNERSHIP	OR
DEVELOPMENT LOT NO.	(B)
CALCULATED AREA	(C)
SCALED DIMENSION	(S)

PROPERTY MAP

CARLISLE

MIDDLESEX COUNTY, MASS.

GRID BASED ON MASSACHUSETTS COORDINATE SYSTEM, MAINLAND ZONE

SCALE IN FEET 0 200 400

REVISED TO JANUARY 1, 2007

14

Figure 4

Priority Habitat and Estimated Habitat Natural Heritage & Endangered Species Program

Town of Carlisle, MA
Source: MassGIS 2008 Edition

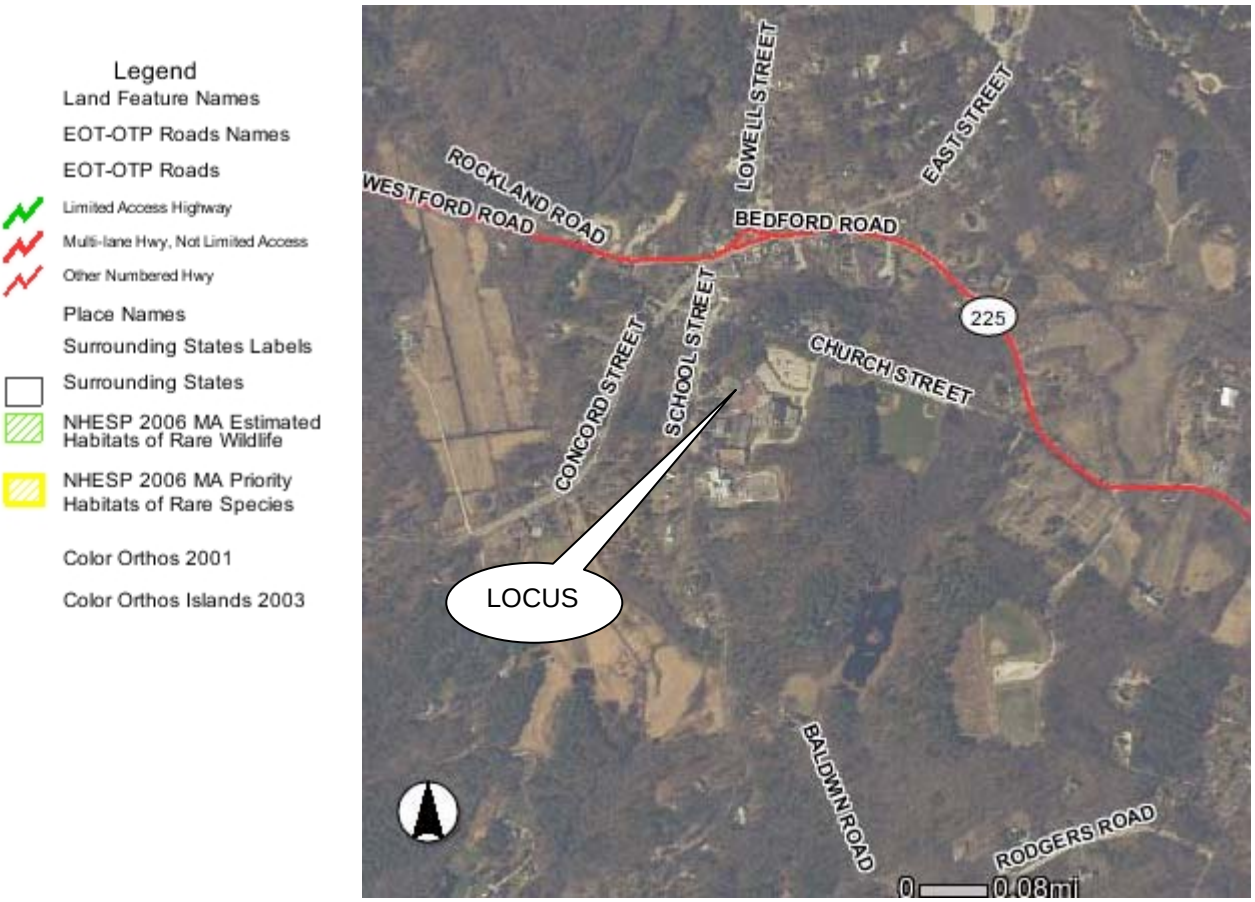
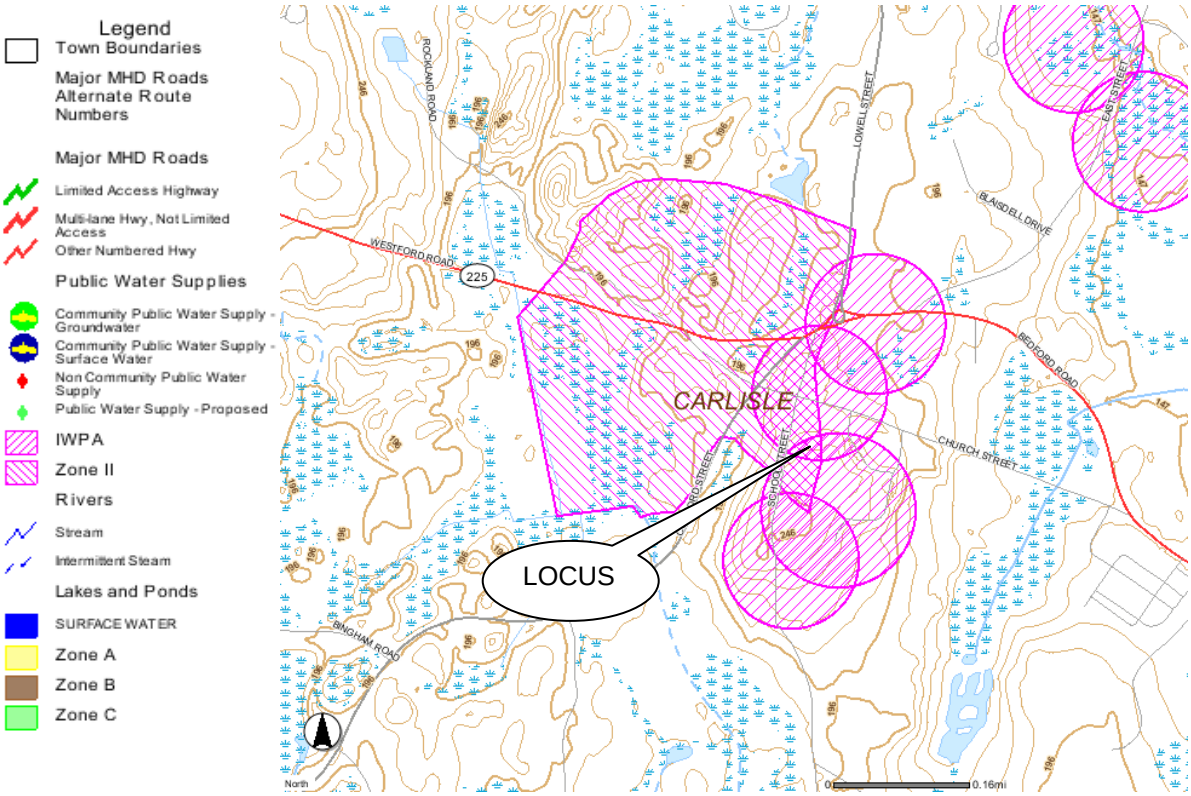


Figure 5

Water Supply Protection Areas Map
Carlisle, MA
Source: Mass GIS



Project: Carlisle Schools
Location: Carlisle, MA

Geotechnical Data

McPHAIL ASSOCIATES, INC

Geotechnical Engineers

PRELIMINARY FOUNDATION ENGINEERING REPORT

ADDITION TO CARLISLE SCHOOL

CARLISLE MASSACHUSETTS

for

Daedalus Projects Incorporated

November 13, 2009

Project No. 5010

McPHAIL ASSOCIATES, INC

Geotechnical Engineers

November 13, 2009

Daedalus Projects Incorporated
112 South Street
Boston, MA 02111

Attention: Mr. Sean Fennel

Reference: Addition to Carlisle School; Carlisle, MA
Preliminary Foundation Engineering Report

Ladies and Gentlemen:

This letter report documents the results of our subsurface exploration and preliminary foundation design study for the proposed addition to the Carlisle School in Carlisle, Massachusetts. Refer to the Project Location Plan (Figure 1) for the general site location.

This report was prepared in accordance with our proposal dated September 29, 2009 and the subsequent authorization of Daedalus Projects Incorporated (Daedalus). These services are subject to the limitations contained in Appendix A.

Available Information

Available information provided to McPhail Associates, Inc. by the project architect, HMFH Architects, Inc., included:

- Six (6), historic drawings for the Spalding Building entitled, "Elementary School for Town of Carlisle" dated January 1956 prepared by A. B. Sziklas Architect & Engineer.
- Five (5), historic drawings for the Wilkins Building entitled, "Carlisle Elementary School" dated August 23, 1962 prepared by Smith & Sellew, Architects.
- Six (6), historic drawings for the Robbins Building entitled, "New Elementary School" dated February 5, 1968 prepared by Smith, Sellew Dohery Architects & Engineers.
- Six (6), historic drawings for the Corey Building entitled, "Carlisle Public School Expansion and Renovation" dated June 11, 1986 prepared by Earl R. Flansburgh Associates, Inc.
- A set of historic boring logs dated June 1961 prepared by Raymond.
- A set of historic boring logs dated July 1967 prepared by Carr-Dee Test Boring and Construction Corporation.
- A set of historic boring logs dated March 1986 prepared by GZA Drilling Inc.
- A 30-scale drawing entitled "Existing Conditions Plan" (Site Plan) dated October 12, 2009 prepared by Precision Land Surveying, Inc.

2269 Massachusetts Avenue
Cambridge, Massachusetts 02140
617 / 868-1420
617 / 868-1423 (Fax)

Existing Conditions

Fronting onto School Street to the west, the site is bounded by Church Street to the north, the Carlisle Congregational Church and woodlands to the south and the Green Cemetery and woodlands to the east. The western portion of the school campus generally consists of six one to 3-story buildings, many of which are interconnected. The remainder of the site generally contains paved parking lots within the northern portion of the site and athletic fields and wooded areas within the eastern portion of the site. It is understood that oil tanks were previously located within the footprint of the proposed addition and have reportedly been removed.

The Spalding Building, the Corey Building and the Wilkins Building are all located adjacent to the proposed construction. The Spalding Building is 1 story in height without a basement and the ground floor slab is at understood to be at Elevation +238.3. The Corey Building is 2-stories in height with a partial basement located within approximately the eastern 2/3 of the of the building. The lowest level slabs of the western and eastern portions of the Corey building are understood to be at about Elevation +234.4 and Elevation +212.4, respectively. The Wilkins Building is 1 story in height with a partial basement located within the northeastern portion of the building. The basement and ground floor slabs of the Wilkins building are understood to be at Elevation +231.1 and Elevation +239.5, respectively.

Within the footprint of the proposed construction, the existing ground surface generally consists of a bituminous play area with concrete walkways and small landscaped areas. Based on the Site Plan, the ground surface across the area of proposed construction slopes upward to the southwest ranging from about Elevation +234 to Elevation +240 over a horizontal distance of about 210 feet.

Proposed Site Development

The proposed construction is planned to consist of an irregularly-shaped, 2-story addition that will connect to both the Wilkins Building and the Corey Building and will extend to within about 5 feet of the Spalding Building, as indicated on the enclosed Subsurface Exploration Plan (Figure 2). It is understood that the addition will have a footprint of about 17,250 square feet and the ground floor slab will range from about Elevation +234.4 to Elevation +239.5. The proposed addition is not planned to have a basement. Proposed construction is also understood to include an underground water storage tank and new underground utilities.

Recent Investigation

On October 19, 2009, six (6) soil borings were advanced at the site by Seaboard Drilling, Inc. of Springfield, Massachusetts under contract to McPhail Associates, Inc. (McPhail). On the same date, three (3) test pits were excavated at the site by Mattuchio Construction of Malden, Massachusetts also under contract to McPhail. Approximate exploration locations are indicated on the enclosed Subsurface Exploration Plan, Figure 2, which is based on the above referenced Site Plan.

The borings were performed within the footprint of the proposed addition and site areas to assess the subsurface soil, bedrock and groundwater conditions at the site as they relate to foundation design and construction. The borings were performed utilizing truck-mounted drilling equipment and advanced using hollow-stem augers. Standard 2-inch O.D. split-spoon samples and standard penetration tests (SPT)

were obtained at minimum 5-foot intervals of depth in accordance with the standard procedures in ASTM D1586. Each of the borings was terminated at refusal at depths ranging from about 2.5 to 10.8 feet below the existing ground surface. Groundwater observation wells were installed in completed boreholes B-2 and B-4. Boring logs prepared by Seaboard Drilling, Inc. are presented in Appendix B following the text of this report.

The test pits were excavated adjacent to the perimeter wall foundations of the existing Wilkins Building and Spalding Building to document the depth and configuration of the existing foundations and to further document the subsurface soil and groundwater conditions at the site. The test pits were advanced to depths ranging between about 3 and 8 feet below the existing ground surface using a rubber-tired Case extendahoe. Test pit logs prepared by McPhail are presented in Appendix B following the text of this report.

The explorations were monitored by a representative of McPhail Associates, Inc. who performed field layout, prepared field logs, obtained and visually classified soil samples, monitored groundwater conditions in the completed explorations and groundwater monitoring wells, made minor relocations of the explorations and determined the required exploration depths based upon the actual subsurface conditions encountered.

Field locations of the borings were determined by taping from existing site features indicated on the above referenced Site Plan. The existing ground surface elevation at each boring location was determined by a level survey performed by our field staff utilizing vertical control information on the Site Plan.

Previous Investigations

Based on the information provided to us, it is understood that several previous subsurface investigation programs were conducted at the project site in connection with previous phases of building construction and site improvements. The exploration programs typically consisted of test borings and bedrock probes. At some of the boring locations bedrock cores were obtained. The previous subsurface explorations were performed by Raymond in June 1961, Carr-Dee Test Boring and Construction Corporation in July 1967, and GZA Drilling Inc. in March 1986. It should be noted that the previous investigations were performed from approximately 23 to 48 years ago. Therefore, the ground surface elevations and soil conditions indicated on the logs may have been impacted by the various phases of site development performed from that time period to the present. The logs and exploration location plans for the previous explorations performed at the site are contained in Appendix C.

Subsurface Conditions

A detailed description of the subsurface conditions encountered at each of the recent and previous explorations are presented on the exploration logs contained in Appendices B and C, respectively. The generalized subsurface conditions across the site were inferred primarily from the recent explorations, but also from the previous explorations and our general knowledge of the local geology. The subsurface conditions encountered in the recent explorations are described below.

With the exception of explorations TP-2, B-2, B-5 and B-6, an approximate 2 to 8-inch thickness of topsoil was encountered just beneath the existing ground surface. At borings B-2 and B-6 an approximate 6-inch

thickness of concrete and asphalt was encountered directly beneath the existing ground surface, respectively.

Underlying the existing surface treatments or directly beneath the existing ground surface at explorations TP-2 and B-5, a fill deposit was encountered that was observed to extend to depths ranging from about 2.5 to 10.2 feet below the existing ground surface. The fill deposit generally consists of a loose to very dense, brown to gray well-graded mixture of silt, sand and gravel, varying to a silt and sand with a trace to some gravel. Directly beneath the fill deposit at explorations B-2, TP-2 and TP-3, a 0.5 to 2.5-foot thickness of subsoil was encountered that generally consists of a compact, yellow-brown silt and sand with a trace of gravel.

Underlying the existing fill or subsoil deposits at explorations TP-2, TP-3, B-2 and B-4, the top of glacial till deposit was encountered at depths ranging from about 5 to 9.5 feet below the existing ground surface, or from Elevation +233 to Elevation +225.1. The glacial till deposit generally consists of a very dense, gray to gray-brown well-graded mixture of silt, sand and gravel and containing frequent cobbles and boulders.

With the exception of test pit TP-2, refusal on what was believed to be boulders or the bedrock surface was encountered at each exploration location. Additionally, borings B-1 and B-3 encountered auger refusal at relatively shallow depths and were drilled a total of 3 and 2 times, respectively, to confirm the initial results. The depth to refusal varied from approximately 2.5 to 10.8 feet beneath the existing ground surface, or from about Elevation +236.9 to Elevation +223.7.

Upon completion of drilling, groundwater was not observed within any of the completed boreholes or groundwater observation wells. During excavation at test pits TP-1 and TP-2, groundwater was observed moderately entering the test pits at depths of 3 and 4.5 feet beneath the existing ground surface, respectively. Groundwater at the site is anticipated to be seasonally perched at on the surface of the glacial till deposit or underlying bedrock.

It is anticipated that future groundwater levels across the project site may vary from those reported herein based on such factors such as normal seasonal changes, runoff during or following periods of heavy precipitation, and alterations to existing drainage patterns. Monitoring reports documenting groundwater levels observed within the observation wells installed at the site are included in Appendix D.

Existing Foundation Conditions

To observe and document the depth and configuration of the foundations of the existing Wilkins Building and Spalding Building, two (2) test pits were excavated along the exterior perimeter wall of the Wilkins Building and one (1) test pit was excavated along the exterior perimeter wall of the Spalding Building.

Test pit TP-1 was performed adjacent to the eastern perimeter wall of the existing Wilkins Building adjacent to the basement area of the building. In the test pit, the exposed perimeter foundation was observed to consist of a formed concrete wall and concrete spread footing bearing on bedrock at a depth of about 3 feet below the existing ground surface or at approximately Elevation +227.7. The footing was observed to be about 1.5 feet in height and extends about 0.5 feet laterally from the face of the wall.

Test pit TP-2 was performed adjacent to the western perimeter wall of the existing Wilkins Building adjacent to the non-basement area of the building. Based on the results of the test pit, the exposed

foundation consists of a formed concrete wall and concrete spread footing bearing on about 7 inches of subsoil overlying the glacial till deposit at a depth of about 5.4 feet below the existing ground surface or at approximately Elevation +233.6. The footing was observed to be about 1.1 feet in height and extends about 0.4 feet laterally from the face of the wall.

Test pit TP-3 was performed adjacent to the southeastern perimeter wall of the existing Spalding Building. In the test pit, the exposed perimeter foundation wall was observed to consist of a formed concrete wall and concrete spread footing bearing on about 6 inches of subsoil overlying the glacial till deposit at a depth of about 5.1 feet below the existing ground surface or at about Elevation +232.8. The footing was observed to be about 1.5 feet in height and extends laterally about 0.9 feet from the face of the wall.

A detailed description of the subsurface conditions observed in the test pits is provided on the test pit logs contained in Appendix B.

Results of Chemical Testing

Following completion of the field investigations, two (2) discrete samples of the fill deposit underlying the site were forwarded to a testing laboratory for chemical analysis for the presence of Extractable Petroleum Hydrocarbons (EPH) and associated target analytes. Additionally, two (2) composite samples of the fill deposit were analyzed for the presence of pesticides and RCRA-8 metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver). The soil chemical analyses results are included in Appendix E and are summarized in Table 1.

The results of the analyses for EPH with target analytes indicated concentrations below the method detection limits, which were well below the applicable RCS-1 reporting thresholds as defined in the Massachusetts Contingency Plan (MCP) 310 CMR 40.0000.

The results of the analyses for organochlorine pesticides indicated concentrations below the method detection limits or below the applicable RCS-1 reporting thresholds.

With the exception of chromium, the concentrations of the remaining metals analyzed were below the applicable method detection limits and/or below the applicable RCS-1 reporting thresholds. Total chromium was detected at concentrations of 38 mg/kg and 31mg/kg in the two composite samples tested, which exceeds the RCS-1 reporting threshold of 30 mg/kg. As a result, these samples were also analyzed for hexavalent chromium, which indicated concentrations below the method detection limit. Total chromium is a measure of the sum of the concentrations of chromium III and chromium VI (hexavalent chromium) which have RCS-1 reporting thresholds of 1,000 mg/kg and 30 mg/kg, respectively. Therefore, based upon the hexavalent chromium analyses, the concentrations of total chromium detected in these samples are attributable to the presence of chromium III and are therefore well below the RCS-1 standard of 1,000 mg/kg.

Based on the results of the chemical analyses, there we found evidence of a reportable release at the site.

Preliminary Foundation Design Recommendations and Construction Considerations

Based upon our current understanding of the proposed project and the subsurface conditions encountered during our subsurface investigation, it is recommended that the proposed addition be founded on conventional spread footing foundations in conjunction with a soil-supported slab-on-grade. The foundations should bear directly on the undisturbed glacial till deposit or bedrock, or on compacted structural fill placed directly over the undisturbed glacial till deposit or bedrock after removal of the existing surface treatments, fill and subsoil deposits.

The spread footings should be proportioned utilizing a maximum allowable bearing pressure of 3 tons per square foot. Recommended minimum footing widths for continuous and isolated spread footings are 24 and 36-inches, respectively. All foundations should be designed in accordance with the 7th edition of the Massachusetts State Building Code (Code).

Perimeter foundations bearing in soil should be provided with a minimum 4-foot thickness of soil cover as frost protection. Footings bearing directly on the bedrock surface may be founded 2 feet below exterior grades and should be provided with a 6-inch thick cushion of compacted 3/4-inch crushed stone placed directly over the bedrock surface. Interior foundations should be located such that the top of the foundation concrete is a minimum of 6 inches below the underside of the lowest level slab. All foundations should be located such that they are below a theoretical line drawn upward and outward at 2 to 1 (horizontal to vertical) from the bottom exterior edge of all adjacent footings, structures and utilities. Where new footings are located immediately adjacent to the existing foundations, the bottom of the footing should bear at the same elevation as the existing foundations. Where new foundations extend below the bottom elevation of the existing foundations, underpinning of the existing foundations should be provided.

Based on the results of our subsurface investigation it is anticipated that the natural glacial till and existing fill soils can be reused on-site as structural fill and ordinary fill, respectively, provided that they can be compacted to the required densities. The explorations indicate the presence of cobbles and boulders in the glacial till and existing fill deposits, thus, prior to reusing these soils it will be necessary to cull out all material in excess of 4 inches in largest dimension. Additionally, it should be noted that the glacial till and existing fill deposits contain a moderately high silt content and may become unsuitable for reuse as structural or ordinary fill if these materials become too wet.

Imported structural fill should consist of well-graded, natural sand and gravel containing less than 8 percent passing the No. 200 sieve. All structural fill placed within the footprint of the proposed building for support of the spread footings and slab-on-grade should be placed in lifts having a compacted thickness of 6 inches and be compacted to a minimum of 95 percent of its maximum modified Proctor dry density. Structural fill placed for support of foundations and slabs-on-grade should extend laterally beyond the edge of footings a distance equal to the depth of fill plus 2 feet.

The lowest level floor slab should be designed as a conventional slab-on-grade underlain by a polyethylene vapor barrier placed directly over a minimum 6-inch thickness of gravel fill, after proper preparation of the subgrade. After removal of the existing surface treatments, where encountered, the existing fill may remain in place below the slab-on-grade provided it is proof-compacted with a vibratory drum roller prior to the placement of any additional fill to raise grades. All soft and/or compressible areas detected by the proof-compaction should be removed and replaced with compacted structural fill.

It is understood that the proposed building will not include any below-grade space and the adjacent exterior grades will be coincident or lower than the elevation of the ground floor slab, thus, underslab and perimeter drainage is not required. However, exterior finished grades should be pitched away from the perimeter walls to minimize surface water infiltration.

Based on the results of the explorations, relatively shallow refusal on what was believed to be bedrock or large boulders was encountered throughout the site. In general, it is not anticipated that the bedrock surface will significantly impact footing construction for the proposed addition. However, some rock removal will likely be required for proposed utilities and utility structures depending upon their locations and depths. Depending upon the extent of the rock removal and the quality of the bedrock, shallow rock excavation with conventional excavating equipment may be feasible. Where rock removal cannot be accomplished using conventional excavating equipment, it is recommended that controlled blasting techniques be employed to limit the depth of overblast below the proposed finished grades or foundation elevations, to minimize the potential of damage to adjacent structures due to vibration, and to create a uniform exposed rock cut face.

Vibrations resulting from blasting operations should be monitored during the construction period. It is recommended that a maximum resultant peak particle velocity of 2.0 inches per second (ips) be established for blasts having a frequency above 40 Hz, 1.5 ips for blasts having a frequency between 30 Hz and 40 Hz, 1.0 ips for blasts having a frequency between 20 Hz and 30 Hz, and 0.5 ips for blasts having a frequency below 20 Hz. These levels should not be exceeded immediately adjacent to all in-place construction and at adjacent structures to maintain the risk of damage to within generally acceptable levels.

Cantilevered site retaining walls may be designed utilizing a lateral earth pressure corresponding to an equivalent fluid density of 40 pounds per cubic foot. These pressures are conditioned upon the walls being provided with positive drainage to prevent hydrostatic pressures from acting on the walls. To these values must be added the pressures attributable to earthquake forces per Section 1612.4.9 of the Massachusetts State Building Code.

Lateral forces can be considered to be transmitted from the structure to the soil by passive pressure against the foundation walls utilizing an equivalent fluid density of 120 pounds per cubic foot providing that the walls are designed to resist these pressures. Lateral force can also be considered to be transmitted from the structure to the soil by friction on the base of footings using a coefficient of 0.5, to which a safety factor of 1.5 should be applied.

Seismic Design Considerations

For the purposes of determining parameters for structural seismic design, this site is considered to be a Site Class C as defined in Section 1615.0 of the Code. The bearing strata on the proposed site is not considered to be subject to liquefaction during an earthquake based on the criterion of Section 1804.6 of the Code.

Final Comments

Based on our current understanding of the project scope, a final subsurface exploration program will likely need to be conducted once the final location and configuration of the proposed building is selected. In addition, a final foundation engineering report should be prepared in conjunction with the final subsurface exploration program which provides final foundation recommendations based on the specific design of the proposed building.

In addition, it is recommended that McPhail be retained to provide design assistance to the design team during the final design phase of this project. The purpose of this involvement would be to review the structural foundation drawings and foundation notes for conformance with the recommendations presented herein and to generate the earthwork specification section for inclusion into the Contract Documents for construction.

We trust that the above is sufficient for your present requirements. Should you have any questions concerning the recommendations presented herein, please do not hesitate to call us.

Very truly yours,

McPHAIL ASSOCIATES, INC.

Scott S. Smith

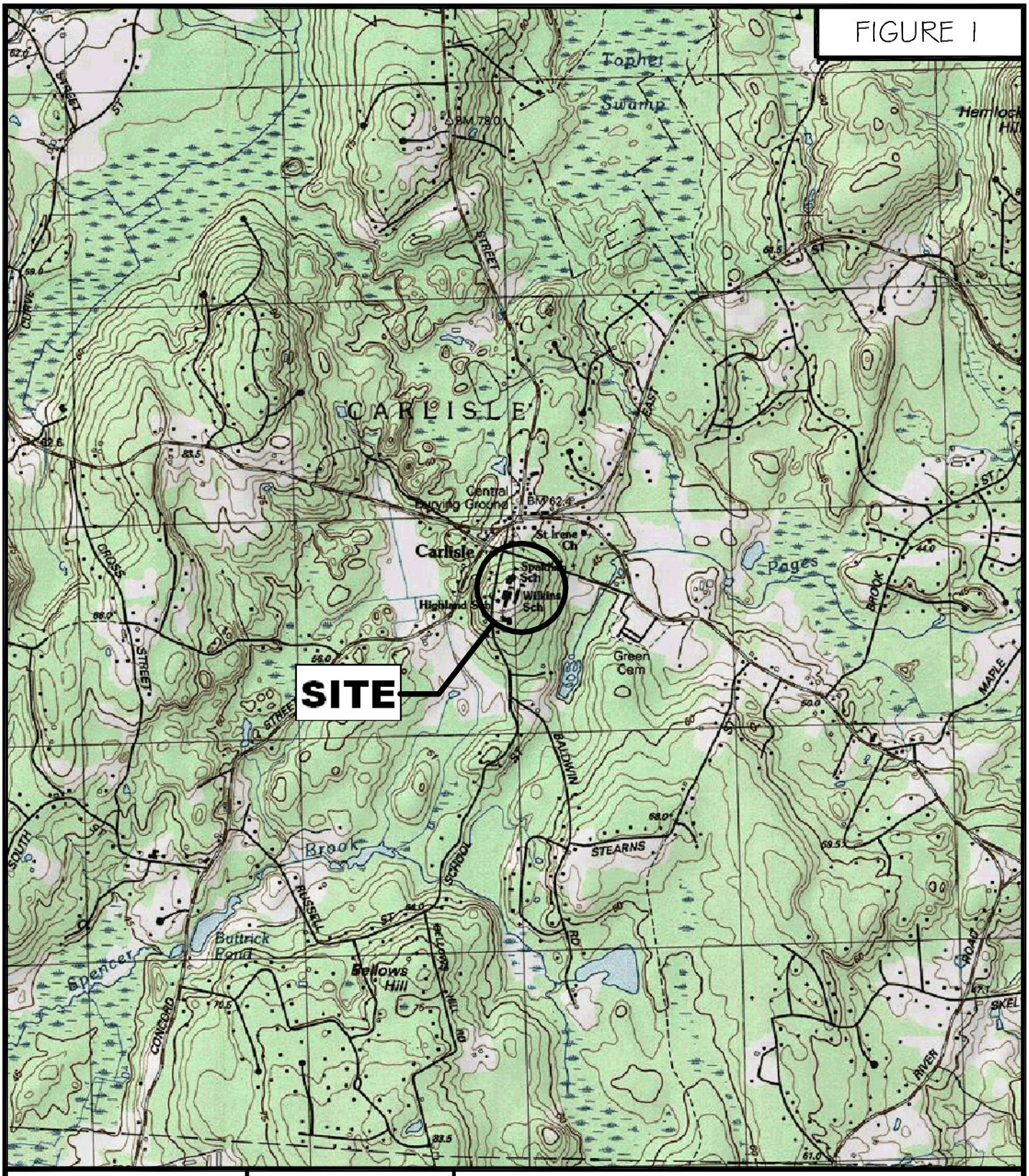
Ambrose J. Donovan, P.E.

Enclosures

5010_Prelim_Found-Rep.wpd

SSS/ajd

FIGURE 1



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N

SCALE 1:25,000

PROJECT LOCATION PLAN

ADDITION TO CARLISLE SCHOOL

CARLISLE MASSACHUSETTS

FIGURE 2

NORTH

B-5

B-2 (OW)

APPROXIMATE LIMITS OF PROPOSED ADDITION

B-6

TP-1

TP-2

TP-3

B-4 (OW)

B-1

B-3

1 STORY "COREY"

1 STORY "WILKINS"

1 STORY "SPALDING"

2 STORY "GRANT"

2 STORY "ROBBINS"

2 STORY "HIGHLAND STUDIOS"

CHURCH

BENCHMARK BOLT IN UP ELEV=239.48

BENCHMARK CHISEL CUT UP ELEV=229.10

LEGEND

— LOCATION OF BORING PERFORMED BY CARR-DEE CORP. ON OCTOBER 19, 2009 FOR McPHAIL ASSOCIATES, INC.

— LOCATION OF TEST PITS PERFORMED BY MATTUCHIO CONSTRUCTION ON OCTOBER 19, 2009 FOR McPHAIL ASSOCIATES, INC.

REFERENCE: THIS PLAN WAS PREPARED FROM A 30-SCALE DRAWING ENTITLED "EXISTING CONDITIONS PLAN" DATED OCTOBER 12, 2009 BY PRECISION LAND SURVEYING, INC.

GRAPHIC SCALE

50 0 50 100

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ADDITION TO CARLISLE SCHOOL

CARLISLE MASSACHUSETTS

SUBSURFACE EXPLORATION PLAN

FOR

DAEDALUS PROJECTS INCORPORATED

BY

McPHAIL ASSOCIATES, INC.

CONSULTING GEOTECHNICAL ENGINEERS

Date: NOVEMBER 2009	Dwn: F.G.P.	Chkd: S.S.S.	Scale: 1" = 50'
Project No: 5010			

FILE NAME: 5010-F02

TABLE 1
Summary of Chemical Testing - Soil
Addition to Carlisle School
McPhail Job No. 5010

SAMPLE IDENTIFICATION	RCS-1 Reportable Concentration	TP-3	B-2	B-2.B-4.B-5 COMP	B-1.B-3 COMP
SAMPLING DATE		10/19/2009	10/19/2009	10/19/2009	10/19/2009
LAB SAMPLE ID		L0914981-01	L0914981-02	L0914981-03	L0914981-04
SAMPLE DEPTH (ft.)		6-7'	5-7'	0-2.5'	0-2'
SAMPLE TYPE		Fill	Fill	Fill	Fill
Extractable Petroleum Hydrocarbons (mg/kg)					
C9-C18 Aliphatics	1000	ND	ND		
C19-C36 Aliphatics	3000	ND	ND		
C11-C22 Aromatics		ND	ND		
Naphthalene	4	ND	ND		
2-Methylnaphthalene	0.7	ND	ND		
Acenaphthylene	1	ND	ND		
Acenaphthene	4	ND	ND		
Fluorene	1000	ND	ND		
Phenanthrene	10	ND	ND		
Anthracene	1000	ND	ND		
Fluoranthene	1000	ND	ND		
Pyrene	1000	ND	ND		
Benzo(a)anthracene	7	ND	ND		
Chrysene	70	ND	ND		
Benzo(b)fluoranthene	7	ND	ND		
Benzo(k)fluoranthene	70	ND	ND		
Benzo(a)pyrene	2	ND	ND		
Indeno(1,2,3-cd)Pyrene	7	ND	ND		
Dibenzo(a,h)anthracene	0.7	ND	ND		
Benzo(ghi)perylene	1000	ND	ND		
Organochlorine Pesticides (mg/kg)					
Delta-BHC				ND	ND
Lindane	0.003			ND	ND
Alpha-BHC				ND	ND
Beta-BHC				ND	ND
Heptachlor	0.2			ND	ND
Aldrin	0.04			ND	ND
Heptachlor epoxide	0.09			ND	ND
Endrin	8			ND	ND
Endrin ketone				ND	ND
Dieldrin	0.05			ND	ND
4,4'-DDE	3			ND	0.00568
4,4'-DDD	4			ND	ND
4,4'-DDT	3			ND	0.00678
Endosulfan I	0.5			ND	ND
Endosulfan II	0.5			ND	ND
Endosulfan sulfate				ND	ND
Methoxychlor	200			ND	ND
Chlordane	0.7			ND	ND
Hexachlorobenzene	0.7			ND	ND
Metals (mg/kg)					
Arsenic	20			13	12
Barium	1000			54	37
Cadmium	2			ND	ND
Chromium				38	31
Hexavalent Chromium	30			ND	ND
Lead	300			11	12
Mercury	20			ND	ND
Selenium	400			ND	ND
Silver	100			ND	ND

ND - Indicates Not Detected Above Laboratory Method Detection Limits
Blank - Indicates Not Analyzed
Shaded - Indicates Detected Concentration Exceeds MCP RCS-1 Standard

McPHAIL ASSOCIATES, INC

Geotechnical Engineers

Appendix A

Limitations

McPHAIL ASSOCIATES, INC

Geotechnical Engineers

Limitations

This preliminary report has been prepared on behalf of and for the exclusive use of Daedalus Projects Incorporated for specific application to the proposed Addition to Carlisle School in Carlisle, Massachusetts in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.

In the event that any changes in nature or design of the proposed addition are planned, the conclusions and recommendations contained in this report should not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing.

The analyses and recommendations presented in this report are based upon the data obtained from the borings and test pits performed at the approximate locations indicated on the enclosed plan. If variations in the nature and extent of subsurface conditions between the widely spaced explorations become evident during the course of construction, it will be necessary for a re-evaluation of the recommendations of this report to be made after performing on-site observations during the construction period and noting the characteristics of any variations.

Based on our current understanding of the project scope, a final subsurface exploration program may need to be conducted once the proposed design scheme is finalized. In addition, a final foundation engineering report should be prepared in conjunction with the final subsurface exploration program which provides detailed foundation recommendations based on the specific design of the proposed site development.

McPHAIL
ASSOCIATES, INC
Geotechnical Engineers

Appendix B

Seaboard Drilling, Inc.'s
Boring Logs B-1 through B-6 and
McPhail Associates, Inc.'s
Test Pit Logs TP-1 through TP-3

Client:	McPhail Associates, Inc.			**SEABOARD**		**Test Boring/**
Location:	Carlisle, MA			**DRILLING, INC.**		**Monitor Well ID:** B-1
Project:	Carlisle Elementary School			**P.O. BOX 3026 SPFLD, MA 01101**		
Contractor:	**Seaboard Drilling, Inc.**			**DRILLING/SOIL LOG**		**Sheet No.** **1 of 1**
	Casing		**Core Barrel**	**Hammer (Weight-lb./fall-30")**		**Start:** 10/19/2009
Type	**HSA**	**SS**	**N/A**	**140/30 300/24**		**Finish:** 10/19/2009
O.D. Inch	**8-1/2"**			**Rig Type: B-53**		**Driller: Jeff Nitsch**
I.D. Inch	**4-1/4"**			**Elevation:** +242.1		

Depth (ft.) Range	Blows	Sample No.	Recovery	**FIELD CLASSIFICATIONS AND REMARKS**
0-2'	4-15-10-5	S-1	9"	Compact Brown SAND, Trace Silt and Gravel (Fill).
5-5'.3"	100/4"	S-2	2"	Very Dense Yellow/Brown Silt and SAND (Fill). Auger Refusal @ 5.3'
				Moved Hole 2.0' West. Auger Refusal @ 5.0'
				Moved Hole 5.0' East. Auger Refusal @ 5.0'
				No Groundwater Encountered

SAMPLE PENETRATION RESISTANCE - 140 lb. Wt. Falling 30" on 2" O.D. sampler

Density			Cohesive Consistence				PROPORTIONS	
# of Hammer Blows		very loose	# of Hammer Blows		very soft /	soft	trace	0 to 10%
0-4		loose	0-2	3-4	med-stiff /	stiff	little	10 to 20%
5-9		med/dens	5-8	9-15	very stiff /	hard	some	20 to 35%
10-29		dense	16-30	31+			and	30 to 50%
30-49	50+	very dense						

Client:	McPhail Associates, Inc.			**SEABOARD**		**Test Boring/**
Location:	Carlisle, MA			**DRILLING, INC.**		**Monitor Well ID:** B-2(OW)
Project:	Carlisle Elementary School			**P.O. BOX 3026 SPFLD, MA 01101**		
Contractor:	**Seaboard Drilling, Inc.**			**DRILLING/SOIL LOG**		**Sheet No.** **1 of 1**
	Casing		**Core Barrel**	**Hammer (Weight-lb./fall-30")**		**Start:** 10/19/2009
Type	**HSA**	**SS**	**N/A**	**140/30 300/24**		**Finish:** 10/19/2009
O.D. Inch	**8-1/2"**			**Rig Type: B-53**		**Driller: Jeff Nitsch**
I.D. Inch	**4-1/4"**			**Elevation:** +234.6		

Depth (ft.) Range	Blows	Sample No.	Recovery	**FIELD CLASSIFICATIONS AND REMARKS**
0-2'	19-90-14-14	S-1	10"	Very Dense Grey/Brown Gravel, Silt and SAND (Fill).
5-7'	19-20-22-10	S-2	12"	Dense Grey/Brown Silt and Gravel (Fill). Yellow/Brown to Orange/Brown Cuttings Between 7.0' -9.5' (Fill). Probable Glacial Till From 9.5 -10'
10-10'	100/0"	S-3	NR	No Recovery. Auger Refusal @ 10'
				Install Monitoring Well to 10' No Groundwater Encountered

SAMPLE PENETRATION RESISTANCE - 140 lb. Wt. Falling 30" on 2" O.D. sampler

Density			Cohesive Consistence				PROPORTIONS	
# of Hammer Blows		very loose	# of Hammer Blows		very soft /	soft	trace	0 to 10%
0-4		loose	0-2	3-4	med-stiff /	stiff	little	10 to 20%
5-9		med/dens	5-8	9-15	very stiff /	hard	some	20 to 35%
10-29		dense	16-30	31+			and	30 to 50%
30-49	50+	very dense						

Client: McPhail Associates, Inc. **Location:** Carlisle, MA **Project:** Carlisle Elementary School **Contractor: Seaboard Drilling, Inc.**				**SEABOARD DRILLING, INC.** **P.O. BOX 3026 SPFLD, MA 01101** **DRILLING/SOIL LOG**		**Test Boring/ Monitor Well ID:** B-3 **Sheet No. 1 of 1**
	Casing		**Core Barrel**	**Hammer (Weight-lb./fall-30")**		**Start:** 10/19/2009
Type	**HSA**	**SS**	**N/A**	**140/30 300/24**		**Finish:** 10/19/2009
O.D. Inch	**8-1/2"**			**Rig Type: B-53**		**Driller: Jeff Nitsch**
I.D. Inch	**4-1/4"**			**Elevation:** +237.5		
Depth (ft.) Range	Blows	Sample No.	Recovery	**FIELD CLASSIFICATIONS AND REMARKS**		
0-2'	3-3-9-12	S-1	17"	Compact Grey/Brown Silt, SAND and Gravel (Fill). Auger Refusal @ 3.0'.		
				Moved Hole 3.0' Northwest. Auger Refusal @ 3.0'.		
				No Groundwater Encountered		

SAMPLE PENETRATION RESISTANCE - 140 lb. Wt. Falling 30" on 2" O.D. sampler

Density			Cohesive Consistence				PROPORTIONS	
# of Hammer Blows		very loose	# of Hammer Blows		very soft /	soft	trace	0 to 10%
0-4		loose	0-2	3-4	med-stiff /	stiff	little	10 to 20%
5-9		med/dens	5-8	9-15	very stiff /	hard	some	20 to 35%
10-29		dense	16-30	31+			and	30 to 50%
30-49	50+	very dense						

Client: McPhail Associates, Inc. **Location:** Carlisle, MA **Project:** Carlisle Elementary School **Contractor: Seaboard Drilling, Inc.**				**SEABOARD DRILLING, INC.** **P.O. BOX 3026 SPFLD, MA 01101** **DRILLING/SOIL LOG**		**Test Boring/ Monitor Well ID:** B-4(OW) **Sheet No.** **1 of 1**
	Casing		**Core Barrel**	**Hammer (Weight-lb./fall-30")**		**Start:** 10/19/2009
Type	**HSA**	**SS**	**N/A**	**140/30 300/24**		**Finish:** 10/19/2009
O.D. Inch	**8-1/2"**			**Rig Type: B-53**		**Driller: Jeff Nitsch**
I.D. Inch	**4-1/4"**			**Elevation:** +238.0		
Depth (ft.) Range	Blows	Sample No.	Recovery	**FIELD CLASSIFICATIONS AND REMARKS**		
0-2'	2-3-5-3	S-1	11"	Loose Yellow/Brown Silt, SAND, Trace Gravel (Fill).		
5-7'	29-71-13-33	S-2	14"	Very Dense Grey Silt, SAND and Gravel (Glacial Till).		
10-10.8'	34-100/4"	S-3	8"	Very Dense Grey/Brown Silt, SAND and Gravel (Glacial Till). Auger Refusal @ 10.8'.		
				No Groundwater Encountered		

SAMPLE PENETRATION RESISTANCE - 140 lb. Wt. Falling 30" on 2" O.D. sampler

Density			Cohesive Consistence				PROPORTIONS	
# of Hammer Blows		very loose	# of Hammer Blows		very soft /	soft	trace	0 to 10%
0-4		loose	0-2	3-4	med-stiff /	stiff	little	10 to 20%
5-9		med/dens	5-8	9-15	very stiff /	hard	some	20 to 35%
10-29		dense	16-30	31+			and	30 to 50%
30-49	50+	very dense						

Client: McPhail Associates, Inc. **Location:** Carlisle, MA **Project:** Carlisle Elementary School **Contractor: Seaboard Drilling, Inc.**				**SEABOARD DRILLING, INC.** **P.O. BOX 3026 SPFLD, MA 01101** **DRILLING/SOIL LOG**		**Test Boring/ Monitor Well ID:** B-5 **Sheet No.** **1 of 1**
	Casing		**Core Barrel**	**Hammer (Weight-lb./fall-30")**		**Start:** 10/19/2009
Type	**HSA**	**SS**	**N/A**	**140/30 300/24**		**Finish:** 10/19/2009
O.D. Inch	**8-1/2"**			**Rig Type: B-53**		**Driller: Jeff Nitsch**
I.D. Inch	**4-1/4"**			**Elevation:** +233.9		
Depth (ft.) Range	Blows	Sample No.	Recovery	**FIELD CLASSIFICATIONS AND REMARKS**		
0-2'	4-6-4-6	S-1	10"	Loose to Compact Grey/Brown Silt and SAND, Some Gravel (Fill).		
5-7'	29-20-12-10	S-2	8"	Dense Grey Silt, SAND and Gravel (Fill).		
10-10.'2"	100/2"	S-3	2"	Very Dense Grey/Brown SAND and Gravel, Some Silt (Fill). Auger Refusal @ 10.2'		
				No Groundwater Encountered		

SAMPLE PENETRATION RESISTANCE - 140 lb. Wt. Falling 30" on 2" O.D. sampler

Density			Cohesive Consistence				PROPORTIONS	
# of Hammer Blows		very loose	# of Hammer Blows		very soft /	soft	trace	0 to 10%
0-4		loose	0-2	3-4	med-stiff /	stiff	little	10 to 20%
5-9		med/dens	5-8	9-15	very stiff /	hard	some	20 to 35%
10-29		dense	16-30	31+			and	30 to 50%
30-49	50+	very dense						

Client: McPhail Associates, Inc. **Location:** Carlisle, MA **Project:** Carlisle Elementary School **Contractor: Seaboard Drilling, Inc.**				**SEABOARD DRILLING, INC.** **P.O. BOX 3026 SPFLD, MA 01101** **DRILLING/SOIL LOG**	**Test Boring/ Monitor Well ID:** B-6 **Sheet No.** **1 of 1**
	Casing		**Core Barre**	**Hammer (Weight-lb./fall-30")**	**Start:** 10/19/2009
Type	**HSA**	**SS**	**N/A**	**140/30 300/24**	**Finish:** 10/19/2009
O.D. Inch	**8-1/2"**			**Rig Type: B-53**	**Driller: Jeff Nitsch**
I.D. Inch	**4-1/4"**			**Elevation:** +235.1	

Depth (ft.) Range	Blows	Sample No.	Recovery	**FIELD CLASSIFICATIONS AND REMARKS**
0.5-2.3'	40-59-34-100/3"	S-1	14"	Very Dense Grey/Brown Silty SAND and Gravel (Fill).
				Auger Refusal @ 2.5. No Groundwater Encountered

SAMPLE PENETRATION RESISTANCE - 140 lb. Wt. Falling 30" on 2" O.D. sampler

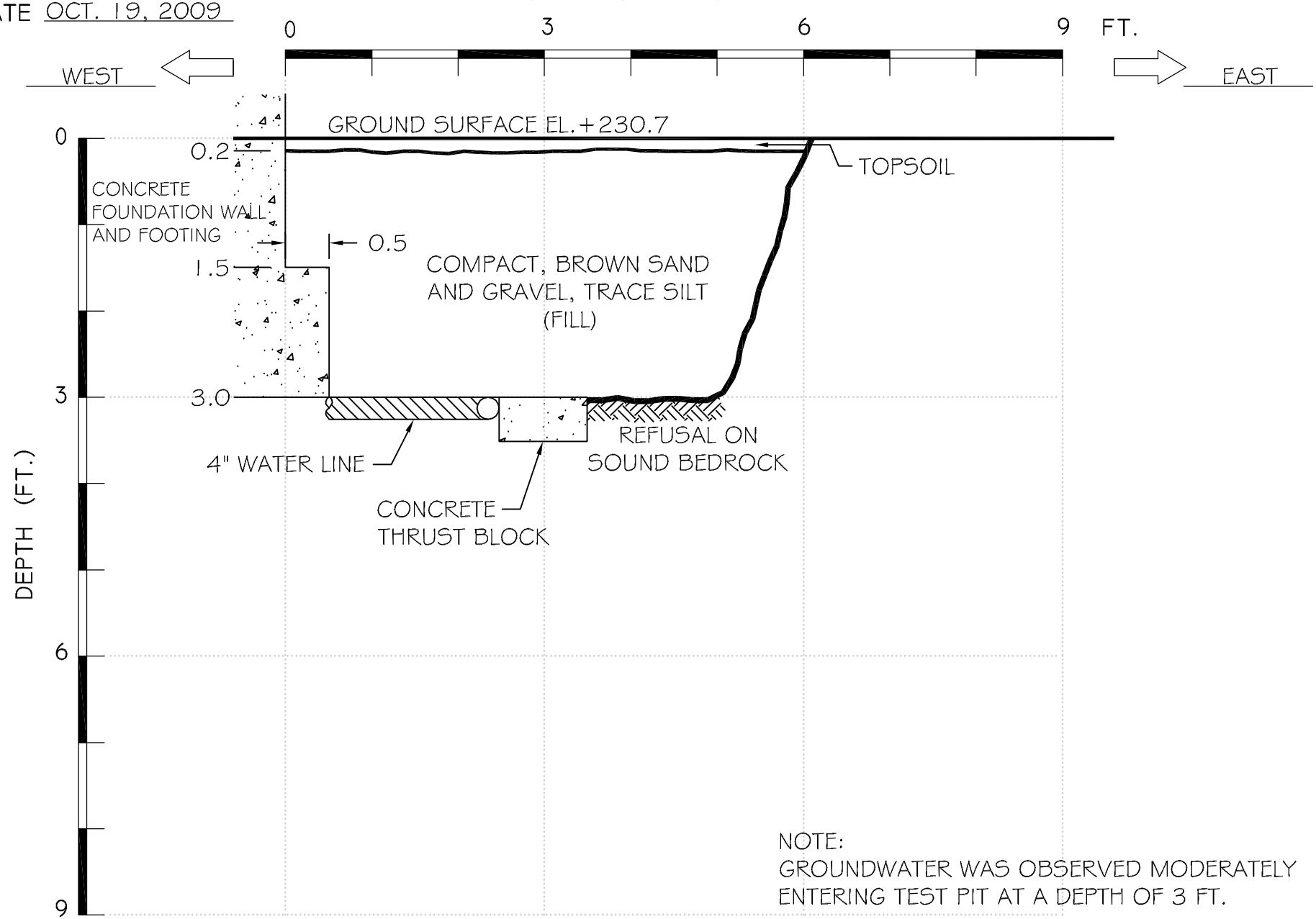
Density			Cohesive Consistence				PROPORTIONS	
# of Hammer Blows		very loo	# of Hammer Blows		very soft /	soft	trace	0 to 10%
0-4		loose	0-2	3-4	med-stiff /	stiff	little	10 to 20%
5-9		med/de	5-8	9-15	very stiff /	hard	some	20 to 35%
10-29		dense	16-30	31+			and	30 to 50%
30-49	50+	very dense						

JOB NO. 5010

DATE OCT. 19, 2009

TEST PIT LOG

TEST PIT NO. 1



NOTE:
GROUNDWATER WAS OBSERVED MODERATELY ENTERING TEST PIT AT A DEPTH OF 3 FT.

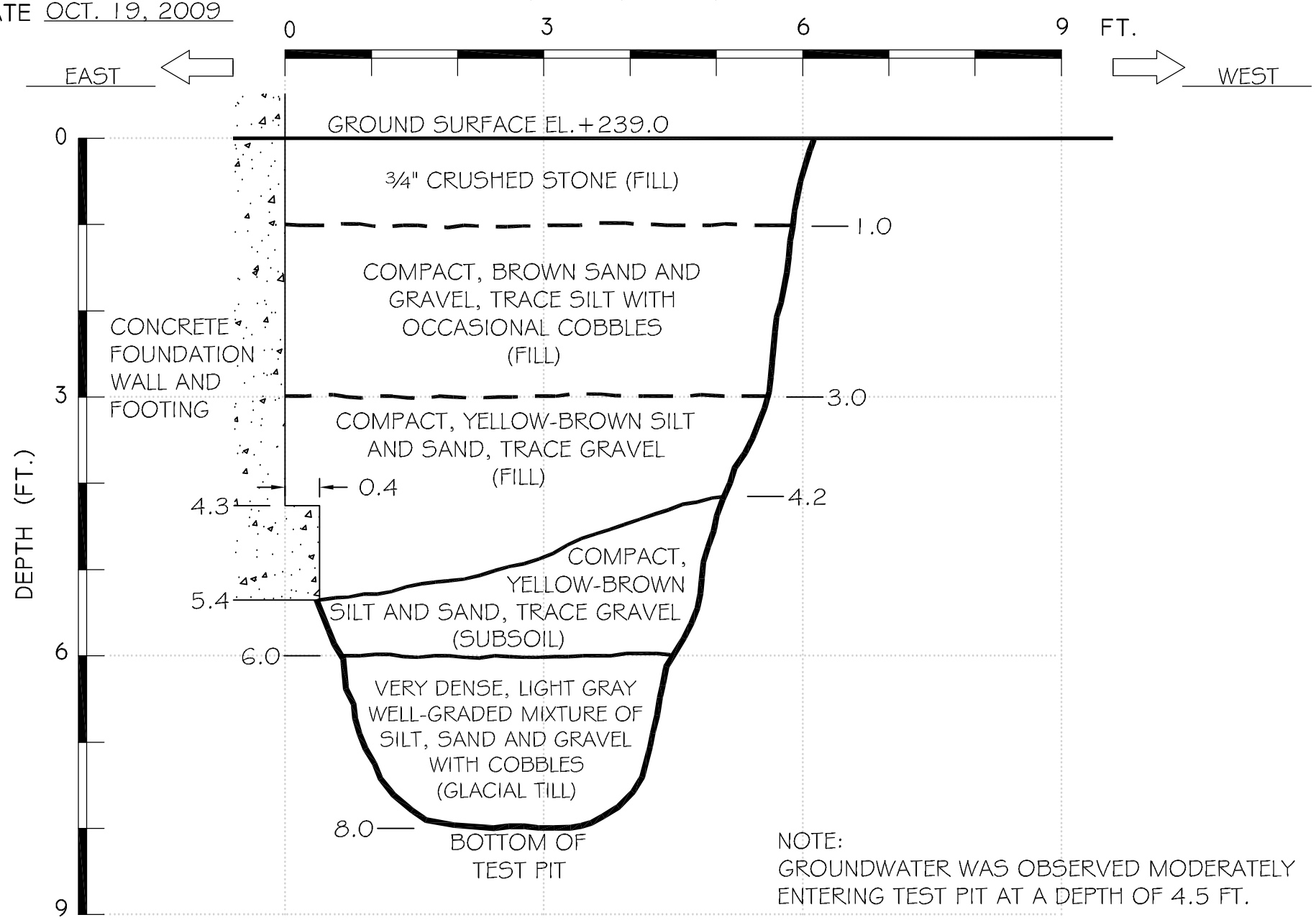
McPHAIL ASSOCIATES INC.

JOB NO. 5010

DATE OCT. 19, 2009

TEST PIT LOG

TEST PIT NO. 2



NOTE:
GROUNDWATER WAS OBSERVED MODERATELY ENTERING TEST PIT AT A DEPTH OF 4.5 FT.

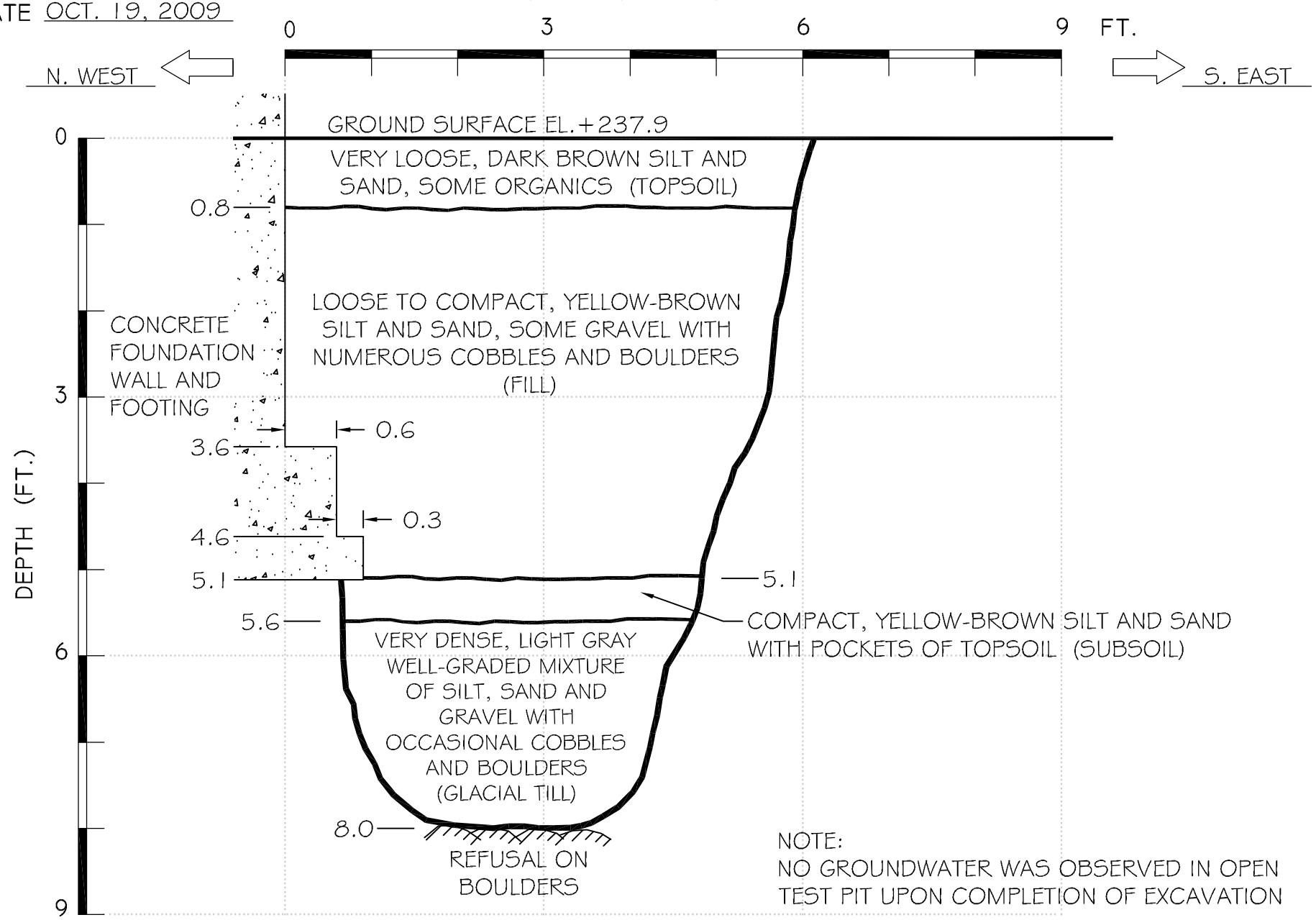
McPHAIL ASSOCIATES INC.

JOB NO. 5010

DATE OCT. 19, 2009

TEST PIT LOG

TEST PIT NO. 3



NOTE:
NO GROUNDWATER WAS OBSERVED IN OPEN TEST PIT UPON COMPLETION OF EXCAVATION

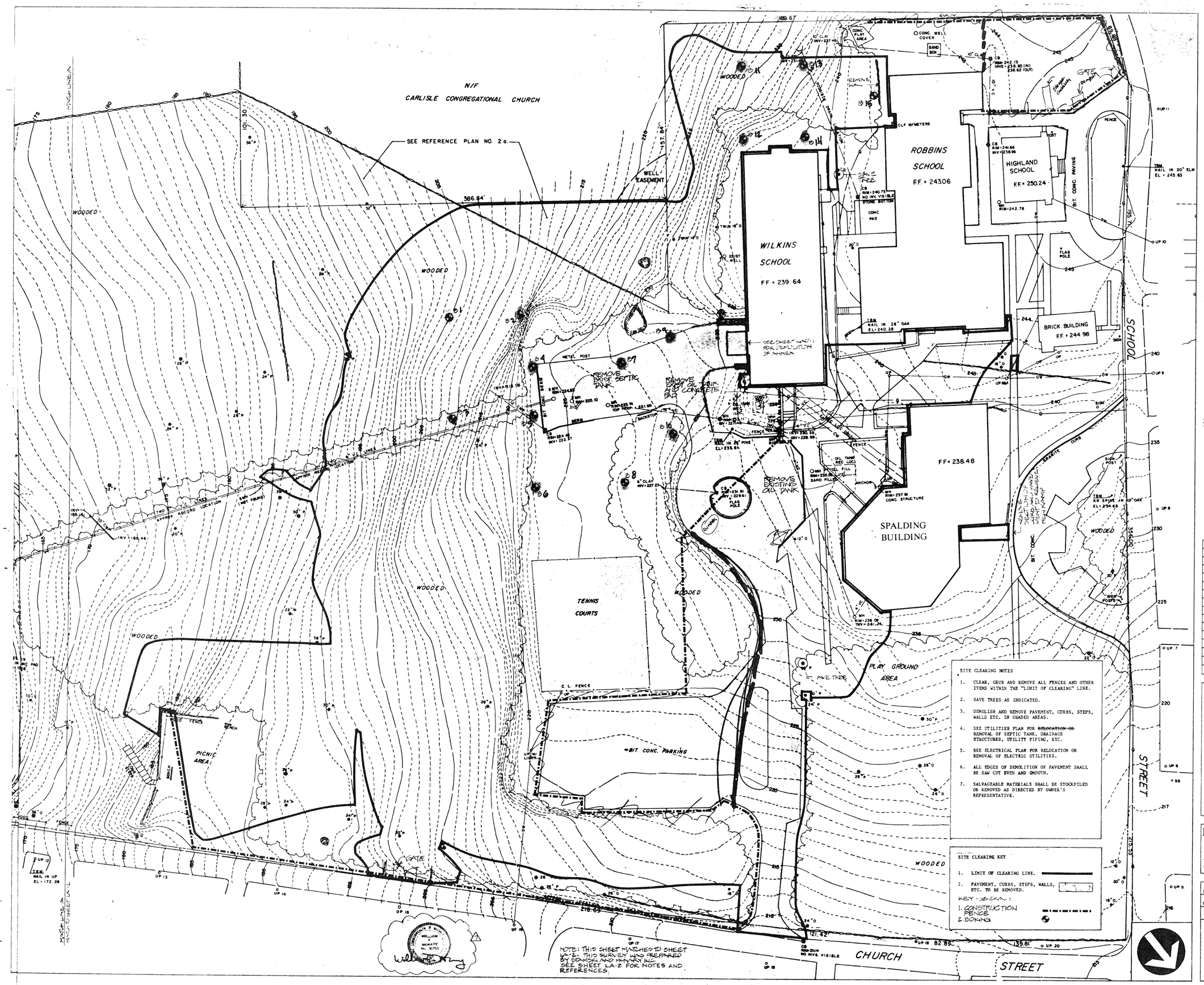
McPHAIL ASSOCIATES INC.

McPHAIL ASSOCIATES, INC

Geotechnical Engineers

Appendix C

Previous Exploration Logs



NOTE: THIS SHEET MATCHED TO SHEET LA-2. THIS SURVEY WAS PREPARED BY DEMOSI AND McNARY INC. SEE SHEET LA-2 FOR NOTES AND REFERENCES.

SITE CLEARING NOTES

1. CLEAR, GRUB AND REMOVE ALL FENCES AND OTHER ITEMS WITHIN THE "LIMIT OF CLEARING" LINE.
2. SAVE TREES AS INDICATED.
3. DEMOLISH AND REMOVE PAVEMENT, CURBS, STEPS, WALLS ETC. IN SHADED AREAS.
4. SEE UTILITIES PLAN FOR ~~RELOCATION OR~~ REMOVAL OF SEPTIC TANK, DRAINAGE STRUCTURES, UTILITY PIPING, ETC.
5. SEE ELECTRICAL PLAN FOR RELOCATION OR REMOVAL OF ELECTRIC UTILITIES.
6. ALL EDGES OF DEMOLITION OF PAVEMENT SHALL BE SAW CUT EVEN AND SMOOTH.
7. SALVAGEABLE MATERIALS SHALL BE STOCKPILED OR REMOVED AS DIRECTED BY OWNER'S REPRESENTATIVE.

SITE CLEARING KEY

1. LIMIT OF CLEARING LINE.
2. PAVEMENT, CURBS, STEPS, WALLS, ETC. TO BE REMOVED.

KEY - GENERAL:

1. CONSTRUCTION FENCE
2. BORING

CARLISLE PUBLIC SCHOOL EXPANSION AND RENOVATION

Earl R. Flansburgh Associates, Inc.

CONSULTANTS

Structural:
Boston Building Consultants
Boston, MA

Mechanical:
R.G. Vanderweil Engineers, Inc.
Boston, MA

Food Service Equipment:
Tavares Design Associates
Arlington, MA

Civil Engineering:
Stamski & McNary, Inc.
Acton, MA

Acoustics:
BBN Laboratories, Inc.
Cambridge, MA

Cost:
Hanscomb Associates, Inc.
Cambridge, MA

Specifications:
Charles H. Stretton
Arlington, MA

No.	Description of Revisions	Date
7	ADD SURVEYOR'S STAMP	9/4/86

EXISTING CONDITIONS & DEMOLITION - NORTH

Drawn By M.H.	Date 11 JUNE 1986
Checked By M.E.	Job Number 8532.04
	Scale 1"=30'-0"
	Drawing No. LA-1
	Sequence No. 1

GZA DRILLING INC.
1215 W. CHESTNUT ST., BROCKTON, MA 02401
(A DIVISION OF GOLDBERG . ZOINO & ASSOC., INC.)

PROJECT
Public Schools Additions
Carlisle, MA

REPORT OF BORING No. B-1
SHEET 1 OF 1
FILE No. 9792
CHKD. BY JH

FOREMAN: C. Lanling
CLASSIFIED BY: R. Zoino
INSPECTOR: None

BORING LOCATION As on plan
GROUND SURFACE ELEVATION _____ DATUM _____
DATE START 3-5-86 DATE END 3-5-86

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. HAMMER FALLING 30 in.
CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING 300 lb. HAMMER FALLING 24 in.

CASING SIZE: 2½" HSA OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
3-5	10:00	3'6	0	30 Min.

DEPTH (ft)	CASING (bl/ft)	SAMPLE No.	PEN./REC. (in)	DEPTH (ft)	BLOWS/6"	SAMPLE DESCRIPTION BURMISTER CLASSIFICATION	REMARKS	DEPTH OF STRATUM CHANGE
0		S-1	24/24	0'-2'0	1-1-1-1	Very loose, brown, fine SAND, some Silt, trace Roots.		SAND, Silt
								2'0
5		S-2	24/16	5'-7'0	13-21-30-44	Very dense, brown, fine to coarse SAND, little Silt, little fine to coarse Gravel, little Boulders		SAND, Gravel, Silt
10		S-3	24/18	10'-12'0	15-21-25-27	Dense, brown, fine to coarse SAND, little fine Gravel, trace Silt.		
		S-4	24/10	15'-16'0	29-100	Medium dense, brown, fine to coarse SAND, some Gravel, trace Silt		
								16'0 Auger Refusal
20								
25								
30								
35								

GRANULAR SOILS BLOWS/FT.	DENSITY	COHESIVE SOILS BLOWS/FT.	DENSITY
-4	V. LOOSE	< 2	V. SOFT
	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
>50	V. DENSE	15-30	V. STIFF
		>30	HARD

REMARKS:

GZA

NOTES: 1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

BORING No. B-1

GZA DRILLING INC.
1215 W. CHESTNUT ST., BROCKTON, MA 02401
(A DIVISION OF GOLDBERG . ZOINO & ASSOC., INC.)

PROJECT
Public Schools Additions
Carlisle , MA

REPORT OF BORING No. B-2
SHEET 1 OF 1
FILE No. 9792
CHKD. BY JH

FOREMAN: C. Lenling
CLASSIFIED BY: P. Zoino
INSPECTOR: None

BORING LOCATION As on plan
GROUND SURFACE ELEVATION _____ DATUM _____
DATE START 3-5-86 DATE END 3-5-86

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. HAMMER FALLING 30 in.
CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING 300 lb. HAMMER FALLING 24 in.

CASING SIZE: OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
3-6	2:00	10'	10'	30 Min.

DEPTH (ft)	CASING (bl/ft)	SAMPLE No.	PEN. (in) / REC.	DEPTH (ft)	BLOWS/6"	SAMPLE DESCRIPTION BURMISTER CLASSIFICATION	REMARKS	DEPTH OF STRATUM CHANGE
0		S-1	24/24	0'-2'0	1-1-1-1	Very loose, brown, fine SAND, some Silt		SAND, Silt 2'6
5		S-2	24/19	5'-7'0	19-23-31-40	Very dense, brown, fine to coarse SAND, little Silt, little fone to coarse Gravel, little Boulders		SAND, Silt, Gravel 10'0
10		C-1	60/50	10'1-15'1	CORED	Grey, Mica SCHIST, fractured		Mica SCHIST 15'1 Bottom of Boring
15								
20								

GRANULAR SOILS BLOWS/FT.	DENSITY	COHESIVE SOILS BLOWS/FT.	DENSITY
0-4	V. LOOSE	< 2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
>50	V. DENSE	15-30	V. STIFF
		>30	HARD

REMARKS:

GZA

NOTES: 1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

BORING No. B-2

GZA DRILLING INC.
1215 W. CHESTNUT ST., BROCKTON, MA 02401
(A DIVISION OF GOLDBERG . ZOINO & ASSOC., INC.)

PROJECT: Public Schools Additions, Carlisle, MA

REPORT OF BORING No. B-3
SHEET 1 OF 1
FILE No. 9792
CHKD. BY JH

FOREMAN: C. Lenling
CLASSIFIED BY: P. Zoino
CONTRACTOR: NORG

BORING LOCATION: As on plan
GROUND SURFACE ELEVATION: DATUM:
DATE START 3-5-86 DATE END 3-6-86

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. HAMMER FALLING 30 in.
CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING 300lb. HAMMER FALLING 24 in.

CASING SIZE: OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER	CASING AT	STABILIZATION TIME
3-6	2:25	10'3	10'	30 Min.

DEPTH (ft)	CASING (bl/ft)	SAMPLE No.	PEN. (in)/REC.	DEPTH (ft)	BLOWS/6"	SAMPLE DESCRIPTION (BURMISTER CLASSIFICATION)	REMARKS	DEPTH OF STRATUM CHANGE
0								
		S-1	24/18	0'-2'0	1-2-2-3	Loose, brown, fine SAND and Organic SILT, trace Leaves, trace Roots.		ORGANICS
								2'0
5		S-2	24/13	5'-7'0	25-30-31-36	Very dense, brown, fine to coarse SAND, trace fine Gravel, trace Silt.		SAND, Gravel, Silt
10		C-1	60/60	10'-15'0	CORED	Grey, Mica SCHIST, fractured		10'0 Mica SCHIST
15								15'0 Bottom of Boring
20								
25								
30								
35								

GRANULAR SOILS BLOWS/FT.	DENSITY	COHESIVE SOILS BLOWS/FT.	DENSITY
0-4	V. LOOSE	<2	V. SOFT
4-10	LOOSE	2-4	SOFT
	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
>50	V. DENSE	15-30	V. STIFF
		>30	HARD

REMARKS:

GZA

NOTES: 1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

BORING No. B-3

GZA DRILLING INC.
1215 W. CHESTNUT ST., BROCKTON, MA 02401
(A DIVISION OF GOLDBERG . ZOINO & ASSOC., INC.)

PROJECT
Public Schools Additions
Carlisle, MA

REPORT OF BORING No. B-4
SHEET 1 OF 1
FILE No. 9792
CHKD. BY JB

FOREMAN: C. Lenling
CLASSIFIED BY: F. Zoino
INSPECTOR: None

BORING LOCATION: As on plan
GROUND SURFACE ELEVATION: DATUM:
DATE START: 3-6-86 DATE END: 3-7-86

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140lb. HAMMER FALLING 30 in.
CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING 300lb. HAMMER FALLING 24 in.
CASING SIZE: OTHER:

GROUNDWATER READINGS				
DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
3-7		None		@ Completion

DEPTH (ft)	CASING (bl/ft)	SAMPLE No.	PEN. (in)/REC	DEPTH (ft)	BLOWS/6"	SAMPLE DESCRIPTION BURMISTER CLASSIFICATION	REMARKS	DEPTH OF STRATUM CHANGE
0		S-1	24/19	0'-2'0	1-1-3-4	Loose, brown, fine SAND, some Silt, trace Roots		SAND, Silt 2'0
5		C	60/60	4'-9'0	CORED	Grey, Mica SCHIST, very fractured and seamy		4'0 Mica SCHIST
10								9'0 Bottom of Boring

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT.	DENSITY	BLOWS/FT.	DENSITY
0-4	V. LOOSE	< 2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
>50	V. DENSE	15-30	V. STIFF
		>30	HARD

REMARKS:

GZA

NOTES: 1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

BORING No. B-4

GZA DRILLING INC.
1215 W. CHESTNUT ST., BROCKTON, MA 02401
(A DIVISION OF GOLDBERG . ZOINO & ASSOC., INC.)

PROJECT
Public Schools Additions
Carlisle, MA

REPORT OF BORING No. B-5
SHEET 1 OF 1
FILE No. 9792
CHKD. BY JH

FOREMAN: C. Lenling
CLASSIFIED BY: P. Zoino
INSPECTOR: None

BORING LOCATION As on plan
GROUND SURFACE ELEVATION _____ DATUM _____
DATE START 3-7-86 DATE END 3-7-86

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. HAMMER FALLING 30 in.
CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING 300 lb. HAMMER FALLING 24 in.
CASING SIZE: OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
		None		@ Completion

DEPTH (ft)	CASING (blows/ft)	SAMPLE No.	PEN. (in) / REC.	DEPTH (ft)	BLOWS/6"	SAMPLE DESCRIPTION BURMISTER CLASSIFICATION	REMARKS	DEPTH OF STRATUM CHANGE
0		S-1	24/20	0'-2'0	6-4-3-3	Loose, brown, fine to medium SAND, little Silt, trace fine Gravel, trace Roots		SAND, Silt
								2'0
5		S-2	24/18	5'-7'0	28-32-34-26	Very dense, brown, fine to coarse SAND, trace Silt, trace fine Gravel		SAND, Gravel
								7'0 Auger Refusal
10								
15								
20								
25								
30								
35								

GRANULAR SOILS BLOWS/FT.	DENSITY	COHESIVE SOILS BLOWS/FT.	DENSITY
0-4	V. LOOSE	<2	V. SOFT
4-10	LOOSE	2-4	SOFT
[illegible]	M. DENSE	4-8	M. STIFF
[illegible]	DENSE	8-15	STIFF
>50	V. DENSE	15-30	V. STIFF
		>30	HARD

REMARKS:

GZA

NOTES: 1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

BORING No. B-5

GZA DRILLING INC.
1215 W. CHESTNUT ST., BROCKTON, MA 02401
(A DIVISION OF GOLDBERG . ZOINO & ASSOC., INC.)

PROJECT
Public Schools Additions
Carlisle, MA

REPORT OF BORING No. B-6
SHEET 1 OF 1
FILE No. 9792
CHKD. BY JH

FOREMAN: C. Lenling
CLASSIFIED BY: P. Zoino
INSPECTOR: None

BORING LOCATION As on plan
GROUND SURFACE ELEVATION _____ DATUM _____
DATE START 3-7-86 DATE END 3-7-86

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. HAMMER FALLING 30 in.
CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING 300lb. HAMMER FALLING 24 in.

CASING SIZE: OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
		None		@ Completion

DEPTH (ft)	CASING (bl/ft)	SAMPLE No.	PEN. (in) / REC	DEPTH (ft)	BLOWS/6"	SAMPLE DESCRIPTION BURMISTER CLASSIFICATION	REMARKS	DEPTH OF STRATUM CHANGE
0		S-1	24/17	0'-2'0	3-4-3-3	Loose, brown, fine to medium SAND, some Silt, trace fine Gravel, trace Roots.		SAND, Silt
								2'6
5		S-2	24/19	5'-7'0	36-43-51-68	Very dense, brown, fine to coarse SAND, trace Silt, trace fine Gravel		Sand, Silt, Gravel
								7'3 Auger Refusal
10								
15								
20								
25								
30								
35								

GRANULAR SOILS BLOWS/FT.	DENSITY	COHESIVE SOILS BLOWS/FT.	DENSITY
0-4	V. LOOSE	< 2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
>50	V. DENSE	15-30	V. STIFF
		>30	HARD

REMARKS:

GZA

NOTES: 1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

BORING No. B-6

GZA DRILLING INC.
1215 W. CHESTNUT ST., BROCKTON, MA 02401
(A DIVISION OF GOLDBERG . ZOINO & ASSOC., INC.)

PROJECT
Public Schools Additons
Carlisle, MA

REPORT OF BORING No. B-7
SHEET 1 OF 1
FILE No. 9792
CHKD. BY JH

FOREMAN: C. Lenling
CLASSIFIED BY: F. Zoino
DTOR: None

BORING LOCATION As on plan
GROUND SURFACE ELEVATION _____ DATUM _____
DATE START 3-7-86 DATE END 3-7-86

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. HAMMER FALLING 30 in.
CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING 300lb. HAMMER FALLING 24 in.

CASING SIZE: OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
3-7		None		@ Completion

DEPTH (ft)	CASING (b/ft)	SAMPLE No.	PEN. (in) / REC.	DEPTH (ft)	BLOWS/6"	SAMPLE DESCRIPTION BURMISTER CLASSIFICATION	REMARKS	DEPTH OF STRATUM CHANGE
0								
		S-1	24/21	0'-2'0	13-16-14-21	Medium dense, brown, fine to coarse SAND, trace Silt, trace fine Gravel		SAND, Silt, Gravel
				3'9"	100	No penetration		3'9 Auger Refusal
5								

GRANULAR SOILS BLOWS/FT.	DENSITY	COHESIVE SOILS BLOWS/FT.	DENSITY
0-4	V. LOOSE	<2	V. SOFT
4-10	LOOSE	2-4	SOFT
	M. DENSE	4-8	M. STIFF
[illegible]	DENSE	8-15	STIFF
>50	V. DENSE	15-30	V. STIFF
		>30	HARD

REMARKS:

GZA

NOTES: 1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

BORING No. B-7

GZA DRILLING INC.
1215 W. CHESTNUT ST., BROCKTON, MA 02401
(A DIVISION OF GOLDBERG . ZOINO & ASSOC., INC.)

PROJECT
Public Schools Additions
Carlisle, MA

REPORT OF BORING No. B-8
SHEET 1 OF 1
FILE No. 9792
CHKD. BY JH

FOREMAN: C. Lenling
CLASSIFIED BY: P. Zoino
INSPECTOR: None

BORING LOCATION As on plan
GROUND SURFACE ELEVATION _____ DATUM _____
DATE START 3-7-86 DATE END 3-7-86

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. HAMMER FALLING 30 in.
CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING 300lb. HAMMER FALLING 24 in.

CASING SIZE: OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
3-7		None		@ Completion

DEPTH (ft)	CASING (bl/ft)	SAMPLE No.	PEN. (in)/REC.	DEPTH (ft)	BLOWS/6"	SAMPLE DESCRIPTION BURMISTER CLASSIFICATION	REMARKS	DEPTH OF STRATUM CHANGE
0		S-1	24/16	0'-2'0	12-15-14-16	Medium dense, brown, fine to medium SAND, little Silt, trace fine Gravel		SAND, Silt, Gravel
								2'9 Auger Refusal
5								
10								
15								

GRANULAR SOILS BLOWS/FT.	DENSITY	COHESIVE SOILS BLOWS/FT.	DENSITY
0-4	V. LOOSE	< 2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
>50	V. DENSE	15-30	V. STIFF
		>30	HARD

REMARKS:

NOTES: 1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

BORING No. B-8

GZA DRILLING INC.
1215 W. CHESTNUT ST., BROCKTON, MA 02401
(A DIVISION OF GOLDBERG . ZOINO & ASSOC., INC.)

PROJECT: Public Schools Additions, Carlisle, MA

REPORT OF BORING No. B-9
SHEET 1 OF 1
FILE No. 9792
CHKD. BY JH

FOREMAN: C. Lenling
CLASSIFIED BY: P. Zoino
INSPECTOR: None

BORING LOCATION As on plan
GROUND SURFACE ELEVATION _____ DATUM _____
DATE START 3-7-86 DATE END 3-7-86

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. HAMMER FALLING 30 in.
CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING 300 lb. HAMMER FALLING 24 in.

CASING SIZE: OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
3-7		None		@ Completion

DEPTH (ft)	CASING (blows/ft)	SAMPLE No.	PEN./REC. (in)	DEPTH (ft)	BLOWS/6"	SAMPLE DESCRIPTION (BURMISTER CLASSIFICATION)	REMARKS	DEPTH OF STRATUM CHANGE
0		S-1	24/7	0'-1'0	18-43	Dense, brown, fine to coarse SAND, trace Gravel		SAND, Gravel
								1'0 Auger Refusal
5							1	
10								
15								

GRANULAR SOILS BLOWS/FT.	DENSITY	COHESIVE SOILS BLOWS/FT.	DENSITY
0-4	V. LOOSE	<2	V. SOFT
4-10	LOOSE	2-4	SOFT
[illegible]-30	M. DENSE	4-8	M. STIFF
-50	DENSE	8-15	STIFF
>50	V. DENSE	15-30	V. STIFF
		>30	HARD

REMARKS:

1. Three trial borings at 5'0 with Auger Refusal at 1'0.

GZA

NOTES: 1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

BORING No. B-9

GZA DRILLING INC.
1215 W. CHESTNUT ST., BROCKTON, MA 02401
(A DIVISION OF GOLDBERG . ZOINO & ASSOC., INC.)

PROJECT
Public Schools Additions
Carlisle, MA

REPORT OF BORING No. B-10
SHEET 1 OF 1
FILE No. 9792
CHKD. BY JH

FOREMAN: C. Lenling
CLASSIFIED BY: P. Zoino
INSPECTOR: None

BORING LOCATION As on plan
GROUND SURFACE ELEVATION
DATE START 3-7-86 DATE END 3-7-86 DATUM

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. HAMMER FALLING 30 in.
CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING 300lb. HAMMER FALLING 24 in.
CASING SIZE:
OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
3-7		None		@ Completion

DEPTH (ft)	CASING (bl/ft)	SAMPLE No.	PEN. (in) / REC.	DEPTH (ft)	BLOWS/6"	SAMPLE DESCRIPTION BURMISTER CLASSIFICATION	REMARKS	DEPTH OF STRATUM CHANGE
0		S-1	24/20	0'-2'0	6-8-11-14	Medium dense, brown, fine to medium SAND, little Silt, trace fine to medium Gravel.		SAND, Silt, Gravel
5		S-2	24/6	5'0-5'6	39	Dense, brown, fine to coarse SAND, little fine Gravel, trace(-) Silt.		5'6 Auger Refusal
10								

GRANULAR SOILS BLOWS/FT.	DENSITY	COHESIVE SOILS BLOWS/FT.	DENSITY
0-4	V. LOOSE	< 2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
>50	V. DENSE	15-30	V. STIFF
		>30	HARD

REMARKS:

GZA

NOTES: 1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

BORING No. B-10

GZA DRILLING INC.
1215 W. CHESTNUT ST., BROCKTON, MA 02401
(A DIVISION OF GOLDBERG . ZOINO & ASSOC., INC.)

PROJECT: Public Schools Additions, Carlisle, MA

REPORT OF BORING No. B-11
SHEET 1 OF 1
FILE No. 9792
CHKD. BY JH

FOREMAN: C. Lenling
CLASSIFIED BY: P. Zoino
INSPECTOR: None

BORING LOCATION: As on plan
GROUND SURFACE ELEVATION: DATUM:
DATE START: 3-11-86 DATE END: 3-11-86

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. HAMMER FALLING 30 in.
CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING 300 lb. HAMMER FALLING 24 in.
CASING SIZE: OTHER:

GROUNDWATER READINGS				
DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
		None		@ Completion

DEPTH (ft)	CASING (bl/ft)	SAMPLE No.	PEN. (in)/REC	DEPTH (ft)	BLOWS/6"	SAMPLE DESCRIPTION BURMISTER CLASSIFICATION	REMARKS	DEPTH OF STRATUM CHANGE
0		S-1	24/13	0'-2'0	10-6-6-5	Medium dense, brown, fine to medium SAND, little Silt, trace coarse Gravel.		SAND, Silt, Gravel
5		S-2	24/8	5'-5'10	27-97/100"	Very dense, brown, fine to medium SAND and GRAVEL, trace (-) Silt.		5'10 Auger Refusal
10								

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT.	DENSITY	BLOWS/FT.	DENSITY
0-4	V. LOOSE	<2	V. SOFT
4-10	LOOSE	2-4	SOFT
[illegible]-30	M. DENSE	4-8	M. STIFF
[illegible]	DENSE	8-15	STIFF
>50	V. DENSE	15-30	V. STIFF
		>30	HARD

REMARKS:

GZA

NOTES: 1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

BORING No. B-11

GZA DRILLING INC.
1215 W. CHESTNUT ST., BROCKTON, MA 02401
(A DIVISION OF GOLDBERG . ZOINO & ASSOC., INC.)

PROJECT
Public Schools Additions
Carlisle, MA

REPORT OF BORING No. B-12
SHEET 1 OF 1
FILE No. 9792
CHKD. BY JH

FOREMAN: C. Lenling
CLASSIFIED BY: P. Zoino
INSPECTOR: None

BORING LOCATION As on plan
GROUND SURFACE ELEVATION _____ DATUM _____
DATE START 3-11-86 DATE END 3-11-86

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. HAMMER FALLING 30 in.
CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING 300 lb. HAMMER FALLING 24 in.

CASING SIZE: OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME

DEPTH (ft)	CASING (bl/ft)	SAMPLE No.	PEN. (in) / REC	DEPTH (ft)	BLOWS/6"	SAMPLE DESCRIPTION BURMISTER CLASSIFICATION	REMARKS	DEPTH OF STRATUM CHANGE
0		S-1	24/	0'-2'0	8-11-14-13	Medium dense, brown, fine to coarse SAND, trace fine to coarse Gravel, little Silt.		SAND, Gravel , Silt
5		S-2	24/24	5'-7'0	28-30-34-40	Very dense, brown, fine to coarse SAND and GRAVEL, trace Silt		7'0 Auger Refusal
10								

GRANULAR SOILS BLOWS/FT.	DENSITY	COHESIVE SOILS BLOWS/FT.	DENSITY
0-4	V. LOOSE	< 2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
>50	V. DENSE	15-30	V. STIFF
		>30	HARD

REMARKS:

GZA

NOTES: 1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

BORING No. B-12

GZA DRILLING INC.
1215 W. CHESTNUT ST., BROCKTON, MA 02401
(A DIVISION OF GOLDBERG . ZOINO & ASSOC., INC.)

PROJECT
Public Schools Additions
Carlisle, MA

REPORT OF BORING No. B-13
SHEET 1 OF 1
FILE No. 9792
CHKD. BY JH

FOREMAN: C. Lenling
CLASSIFIED BY: P. Zoino
CTOR: None

BORING LOCATION As on plan
GROUND SURFACE ELEVATION _____ DATUM _____
DATE START 3-11-86 DATE END 3-11-86

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. HAMMER FALLING 30 in.
CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING 300 lb. HAMMER FALLING 24 in.

CASING SIZE: OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME

DEPTH (ft)	CASING (lb/ft)	SAMPLE No.	PEN. (in)/REC	DEPTH (ft)	BLOWS/6"	SAMPLE DESCRIPTION (BURMISTER CLASSIFICATION)	REMARKS	DEPTH OF STRATUM CHANGE
0		S-1	24/20	0'-2'0	18-16-16-19	Dense, brown, fine to coarse SAND, little fine to coarse Gravel, little Silt.		SAND, Gravel, Silt
5		S-2	24/	5'0-5'2	75	Very dense, grey, weathered ROCK fragments little fine SAND.		5'2 Auger Refusal
10								

GRANULAR SOILS BLOWS/FT.	DENSITY	COHESIVE SOILS BLOWS/FT.	DENSITY
0-4	V. LOOSE	<2	V. SOFT
4-10	LOOSE	2-4	SOFT
	M. DENSE	4-8	M. STIFF
	DENSE	8-15	STIFF
		15-30	V. STIFF
>50	V. DENSE	>30	HARD

REMARKS:

GZA

NOTES: 1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

BORING No. B-13

GZA DRILLING INC.
1215 W. CHESTNUT ST., BROCKTON, MA 02401
(A DIVISION OF GOLDBERG . ZOINO & ASSOC., INC.)

PROJECT
Public Schools Additions
Carlisle, MA

REPORT OF BORING No. B-14
SHEET 1 OF 1
FILE No. 9792
CHKD. BY JH

FOREMAN: C. Lenling
CLASSIFIED BY: P. Zoino
INSPECTOR: None

BORING LOCATION As on plan
GROUND SURFACE ELEVATION _____ DATUM _____
DATE START 3-11-86 DATE END 3-11-86

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. HAMMER FALLING 30 in.
CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING 300lb. HAMMER FALLING 24 in.

CASING SIZE: OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
3-11		None		@ Completion

DEPTH (ft)	CASING (bl/ft)	SAMPLE No.	PEN. (in) / REC	DEPTH (ft)	BLOWS/6"	SAMPLE DESCRIPTION BURMISTER CLASSIFICATION	REMARKS	DEPTH OF STRATUM CHANGE
0		S-1	24/16	0'-2'0	11-9-8-6	Medium dense, brown, fine to coarse SAND, some Silt, trace Gravel, trace Fibers		SAND, Silt, Gravel
								2'6 Auger Refusal

GRANULAR SOILS BLOWS/FT.	DENSITY	COHESIVE SOILS BLOWS/FT.	DENSITY
0-4	V. LOOSE	< 2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
>50	V. DENSE	15-30	V. STIFF
		>30	HARD

REMARKS:

NOTES: 1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

GZA DRILLING INC.
1215 W. CHESTNUT ST., BROCKTON, MA 02401
(A DIVISION OF GOLDBERG . ZOINO & ASSOC., INC.)

PROJECT
Public Schools Additions
Carlisle, MA

REPORT OF BORING No. B-15
SHEET 1 OF 1
FILE No. 9792
CHKD. BY JH

FOREMAN: C. Lenling
CLASSIFIED BY: P. Zoino
INSPECTOR: None

BORING LOCATION: As on plan
GROUND SURFACE ELEVATION: DATUM:
DATE START 3-11-86 DATE END 3-11-86

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. HAMMER FALLING 30 in.
CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING 300lb. HAMMER FALLING 24 in.

CASING SIZE: OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
3-11		None		@ Completion

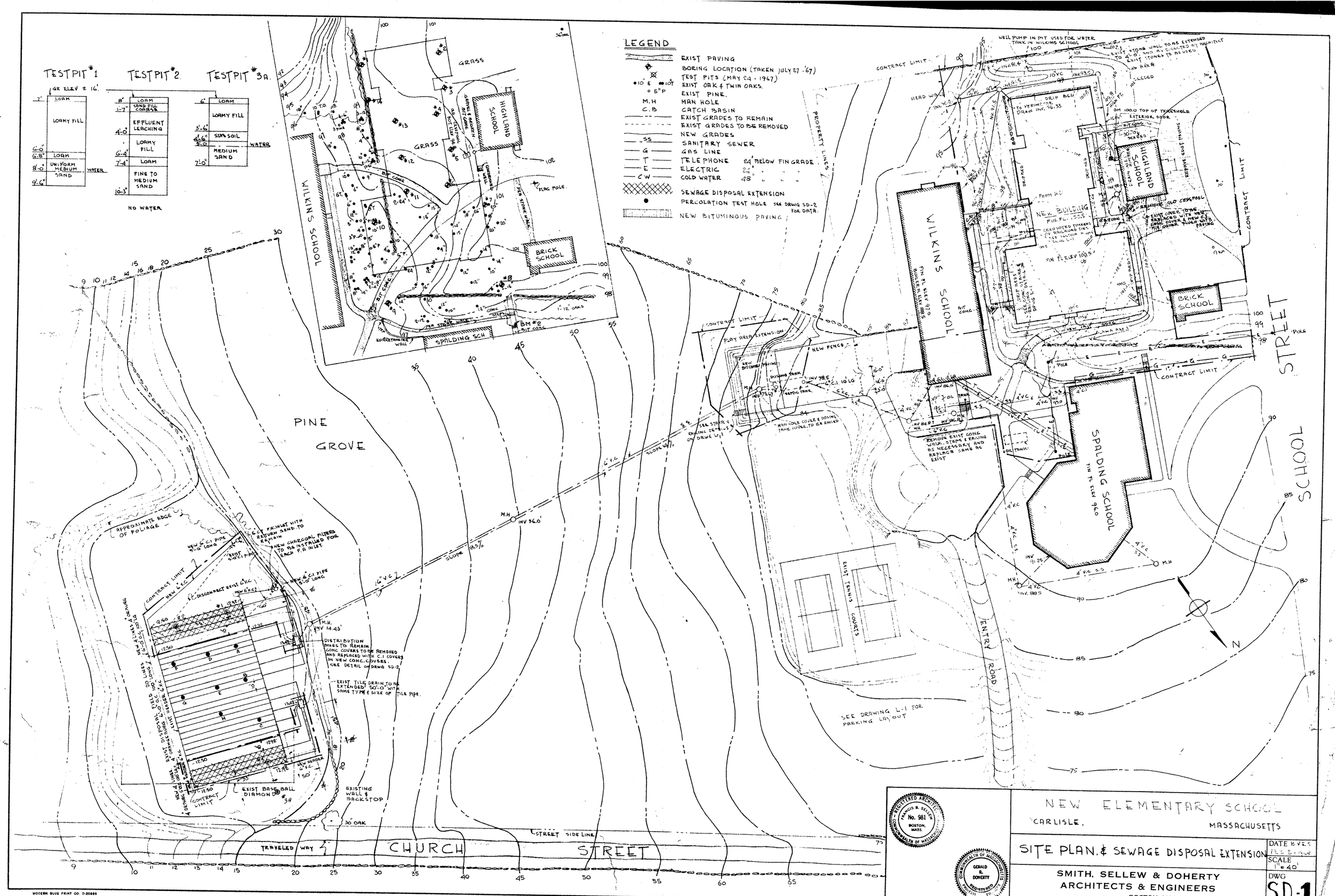
DEPTH (ft)	CASING (bl/ft)	SAMPLE No.	PEN. (in)/REC	DEPTH (ft)	BLOWS/6"	SAMPLE DESCRIPTION BURMISTER CLASSIFICATION	REMARKS	DEPTH OF STRATUM CHANGE
0								
		S-1	24/21	0'-2'0	13-15-14-16	Medium dense, brown, fine to medium SAND, little Silt, trace fine to coarse Gravel, trace Cobbles.		SAND, Silt, Gravel
5		S-2	24/5	5'0-5'5	68	Very dense, brown, fine to medium SAND and SILT, little Gravel.		5'5 Auger Refusal

GRANULAR SOILS BLOWS/FT.	DENSITY	COHESIVE SOILS BLOWS/FT.	DENSITY
0-4	V. LOOSE	< 2	V. SOFT
4-10	LOOSE	2-4	SOFT
	M. DENSE	4-8	M. STIFF
	DENSE	8-15	STIFF
>50	V. DENSE	15-30	V. STIFF
		>30	HARD

REMARKS:

NOTES: 1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

BORING No. B-15



REGISTERED ARCHITECT FRANCIS B. SELLEW No. 981 BOSTON, MASS. COMMONWEALTH OF MASSACHUSETTS

COMMONWEALTH OF MASSACHUSETTS GERALD R. DOHERTY REGISTERED

NEW ELEMENTARY SCHOOL

CARLISLE, MASSACHUSETTS

SITE PLAN & SEWAGE DISPOSAL EXTENSION

DATE 8 V 65

SCALE 1" = 40'

DWG SD-1

SMITH, SELLEW & DOHERTY
ARCHITECTS & ENGINEERS
BOSTON, MASS.

MODERN BLUE PRINT CO. D-20886

CARR-DEE TEST BORING AND CONSTRUCTION CORPORATION

37 LINDEN STREET MEDFORD, MASSACHUSETTS 02155 Telephone EXport 1-4500

To SMITH, SELLEW & DOHERTY, ARCHITECTS & ENGINEERS, BOSTON, MASS. Date JULY 27, 1967 Job No. 67238

Location CARLISLE ELEMENTARY SCHOOL ADDITION, MASS. Scale 1" = 4 ft.

BORING #1

GROUND SURFACE ELEV. 99.5 [illegible]

	LOOSE LOAMY SAND, SOME GRAVEL	4
2'0"		
	FIRM FINE SAND, SOME GRAVEL	14
3'0"		
	VERY HARD, FINE SAND, GRAV. STONES	74
5'0"		

- REFUSAL -
(120 BLOWS, NO PENETRATION)

NO WATER ENCOUNTERED

DATE 7-24-67

BORING #2

GROUND SURFACE ELEV. 101.6 [illegible]

	LOOSE LOAMY SAND, LITTLE GRAVEL	7
2'0"		
	HARD FINE SAND & GRAVEL	30
3'0"		
	VERY HARD, FINE SAND & GRAVEL	68
4'6"		

- REFUSAL -
(120 BLOWS, NO PENETRATION)

NO WATER ENCOUNTERED

DATE 7-24-67

BORING #3

GROUND SURFACE ELEV. 100.3 [illegible]

	LOOSE LOAMY SAND, SOME GRAVEL FILL	4
2'0"		
	FIRM FINE SAND, SOME GRAVEL	24
3'0"		
	HARD FINE SAND, SOME GRAVEL	48
4'0"		
	VERY HARD, FINE SAND & GRAVEL	94
6'0"		

- REFUSAL -
(120 BLOWS, NO PENETRATION)

NO WATER ENCOUNTERED

DATE 7-24-67

BORING #3-A
(5'0" SOUTH OF ORIGINAL LOCATION)

GROUND SURFACE ELEV. 100.3 ±

	LOOSE LOAMY SAND, GRAVEL, TRACE BRICK FILL	3
2'0"		
	FIRM FINE SAND, SOME GRAVEL	22
3'0"		
3'6"	HARD, FINE SAND, SOME GRAVEL	23
	VERY HARD, FINE SAND, & GRAVEL	86
5'6"		

- REFUSAL -
(120 BLOWS, NO PENETRATION)

NO WATER ENCOUNTERED

DATE 7-24-67

UNLESS OTHERWISE SPECIFIED, WATER LEVELS NOTED, WERE OBSERVED AT COMPLETION OF BORINGS, AND DO NOT NECESSARILY REPRESENT PERMANENT GROUND WATER LEVELS. FIGURES IN RIGHT HAND COLUMN INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE 2" O.D. SPLIT TUBE SAMPLER 12 INCHES USING 140 LB WEIGHT FALLING 30 INCHES ±

CARR-DEE TEST BORING AND CONSTRUCTION CORPORATION

37 LINDEN STREET MEDFORD, MASSACHUSETTS 02155 Telephone EXport 1-4500

To SMITH, SELEW & DOHERTY, ARCHITECTS & ENGINEERS, BOSTON, MASS. Date JULY 27, 1967 Job No. 67238

Location CARLISLE ELEMENTARY SCHOOL, ADDITION, MASS. Scale 1" = 4 ft.

BORING #4

GROUND SURFACE ELEV. 99.5 [241.08]

	LOOSE LOAMY SAND	4
2'0"		8
	HARD FINE SAND, SOME GRAVEL	40
3'0"		
	VERY HARD, FINE SAND, GRAVEL, STONES	78
		99
6'0"		

- REFUSAL -

(120 BLOWS, NO PENETRATION)

NO WATER ENCOUNTERED

DATE 7-26-67

BORING #5

GROUND SURFACE ELEV. 99.0 [241.48]

	LOOSE LOAMY SAND, SOME GRAVEL, TRACE CINDERS FILL	8
2'6"		
	HARD FINE SAND, SOME GRAVEL, STONES	36
3'6"		
	VERY HARD, FINE SAND, GRAVEL, SOME STONES	72
		50
		54
6'6"		

- REFUSAL -

(120 BLOWS, NO PENETRATION)

NO WATER ENCOUNTERED

DATE 7-26-67

BORING #6

GROUND SURFACE ELEV. 98.6 [241.08]

	~~FIRM~~ LOAMY SAND, LITTLE GRAVEL	9
3'0"		
	FIRM FINE SAND & GRAVEL	28
5'6"		
	VERY HARD, FINE SAND & GRAVEL	60
6'6"		

- REFUSAL -

(120 BLOWS, NO PENETRATION)

NO WATER ENCOUNTERED

DATE 7-26-67

UNLESS OTHERWISE SPECIFIED, WATER LEVELS NOTED, WERE OBSERVED AT COMPLETION OF BORINGS, AND DO NOT NECESSARILY REPRESENT PERMANENT GROUND WATER LEVELS. FIGURES IN RIGHT HAND COLUMN INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE 2" O.D. SPLIT TUBE SAMPLER 12 INCHES USING 140 LB. WEIGHT FALLING 30 INCHES ±

CARR-DEE TEST BORING AND CONSTRUCTION CORPORATION

37 LINDEN STREET MEDFORD, MASSACHUSETTS 02155 Telephone EXport 1-4500

To SMITH, SELEW & DOHERTY, ARCHITECTS & ENGINEERS, BOSTON, MASS. Date JULY 27, 1967 Job No. 67238

Location CARLISLE ELEMENTARY SCHOOL ADDITION, MASS. Scale 1" = 4 ft.

BORING #7

GROUND SURFACE ELEV. 100.6 [24.08]

	LOOSE LOAMY SAND	8
3'0"	HARD FINE SAND, GRAVEL & STONES	34
4'0"		

= REFUSAL =
(120 BLOWS, NO PENETRATION)

NO WATER ENCOUNTERED

DATE 7-26-67

BORING #8

GROUND SURFACE ELEV. 99.3 [24.78]

	LOOSE LOAMY SAND, TRACE OF ROOTS	5
2'0"	FIRM FINE SAND SOME GRAVEL	21
3'6"		

= REFUSAL =
(120 BLOWS, NO PENETRATION)

NO WATER ENCOUNTERED

DATE 7-26-67

BORING #9

GROUND SURFACE ELEV. 96.5 [28.98]

	LOOSE LOAMY SAND, LITTLE GRAVEL	4
3'6"		

= REFUSAL =
(120 BLOWS, NO PENETRATION)

NO WATER ENCOUNTERED

DATE 7-25-67

UNLESS OTHERWISE SPECIFIED, WATER LEVELS NOTED, WERE OBSERVED AT COMPLETION OF BORINGS, AND DO NOT NECESSARILY REPRESENT PERMANENT GROUND WATER LEVELS. FIGURES IN RIGHT HAND COLUMN INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE 2" O.D. SPLIT TUBE SAMPLER 12 INCHES USING 140 LB. WEIGHT FALLING 30 INCHES ±

SHEET 3 OF 5

CARR-DEE TEST BORING AND CONSTRUCTION CORPORATION

37 LINDEN STREET MEDFORD, MASSACHUSETTS 02155 Telephone EXport 1-4500

To SMITH, SELEM & DOHERTY, ARCHITECS & ENGINEERS, BOSTON, MASS. Date JULY 27, 1967 Job No. 67238

Location CARLISLE ELEMENTARY SCHOOL ADDITION, MASS. Scale 1" = 4 ft.

BORING #10

GROUND SURFACE ELEV. 96.5

1'0"	LOOSE LOAMY SAND TRACE OF GRAVEL	3
2'0"	LOOSE FINE SAND, SOME GRAVEL	8
3'6"	HARD FINE SAND & GRAVEL	39
6'6"	VERY HARD, FINE SAND & GRAVEL	73 98

- REFUSAL -
(120 BLOWS, NO PENETRATION)

NO WATER ENCOUNTERED

DATE 7-24-67

BORING #11

GROUND SURFACE ELEV. 98.3

2'0"	FIRM LOAMY SAND, SOME GRAVEL, TRACE COAL FILL	12
3'0"	FIRM FINE SAND & GRAVEL	22
4'6"	VERY HARD FINE SAND & GRAVEL	95

- REFUSAL -
(120 BLOWS, NO PENETRATION)

NO WATER ENCOUNTERED

DATE 7-25-67

BORING #12

GROUND SURFACE ELEV. 98.6

2'0"	FIRM LOAMY SAND, GRAVEL, TRACE OF ASHES FILL	18
4'0"	HARD FINE SAND, GRAVEL & STONES	38
5'6"	VERY HARD FINE SAND, GRAVEL & STONES	96

- REFUSAL -
(120 BLOWS, NO PENETRATION)

NO WATER ENCOUNTERED

DATE 7-25-67

BORING #10-A
(5'0" SOUTH OF ORIGINAL LOCATION)

GROUND SURFACE ELEV. 96.5 ±

1'6"	LOOSE LOAMY SAND, TRACE OF GRAVEL	4
2'0"	LOOSE FINE SAND & GRAVEL	4
3'0"	HARD FINE SAND & GRAVEL	30
6'0"	VERY HARD, FINE SAND & GRAVEL	100

- REFUSAL -
(120 BLOWS, NO PENETRATION)

NO WATER ENCOUNTERED

DATE 7-24-67

UNLESS OTHERWISE SPECIFIED, WATER LEVELS NOTED, WERE OBSERVED AT COMPLETION OF BORINGS, AND DO NOT NECESSARILY REPRESENT PERMANENT GROUND WATER LEVELS. FIGURES IN RIGHT HAND COLUMN INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE 2" O.D. SPLIT TUBE SAMPLER 12 INCHES USING 140 LB. WEIGHT FALLING 30 INCHES ±

CARR-DEE TEST BORING AND CONSTRUCTION CORPORATION

37 LINDEN STREET MEDFORD, MASSACHUSETTS 02155 Telephone EXport 1-4500

To SMITH, SELEW & DOHERTY, ARCHITECTS & ENGINEERS, BOSTON, MASS. Date JULY 27, 1967 Job No. 67238

Location CARLISLE ELEMENTARY SCHOOL ADDITION, MASS. Scale 1" = 4 ft.

BORING #13

GROUND SURFACE ELEV. 99.2 [94.48]

	LOOSE LOAMY SAND, LITTLE GRAVEL FILL	8
2'0"	HARD FINE SAND, GRAVEL & STONES	40
4'0"	VERY HARD, FINE SAND, GRAVEL	78
5'0"		

= REFUSAL =

(120 BLOWS, NO PENETRATION)

NO WATER ENCOUNTERED

DATE 7-25-67

BORING #14

GROUND SURFACE ELEV. 99.2 [94.48]

	LOOSE LOAMY SAND, LITTLE GRAVEL FILL	4
1'6"	FIRM FINE SAND & GRAVEL	21
3'0"	VERY HARD, FINE SAND, GRAVEL & STONES	88
4'0"		

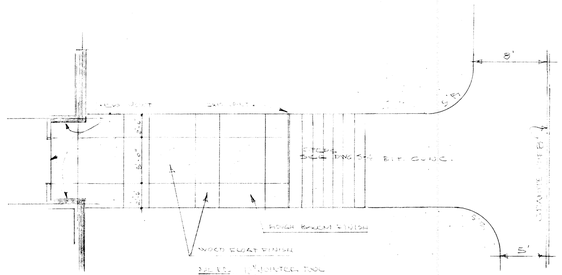
= REFUSAL =

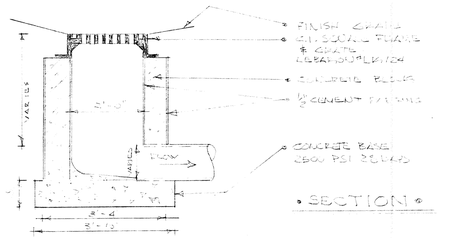
(120 BLOWS, NO PENETRATION)

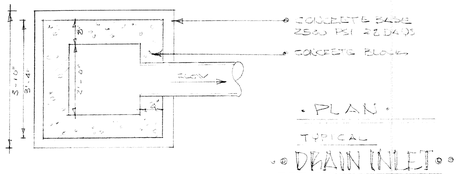
NO WATER ENCOUNTERED

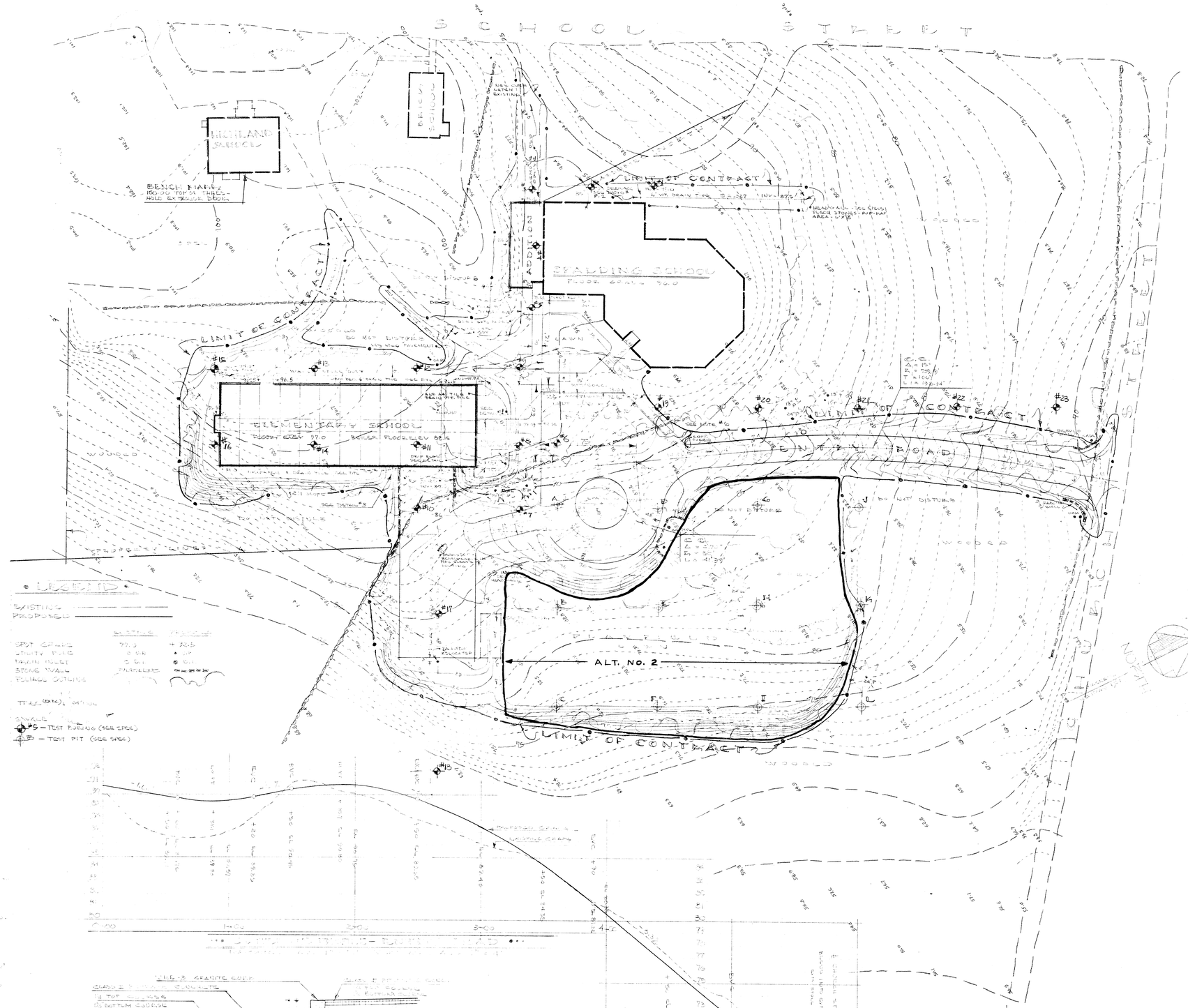
DATE 7-25-67

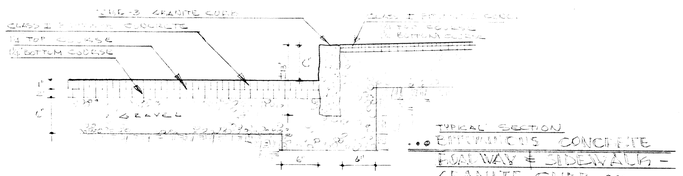
UNLESS OTHERWISE SPECIFIED, WATER LEVELS NOTED, WERE OBSERVED AT COMPLETION OF BORINGS, AND DO NOT NECESSARILY REPRESENT PERMANENT GROUND WATER LEVELS. FIGURES IN RIGHT HAND COLUMN INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE 2" O.D. SPLIT TUBE SAMPLER 12 INCHES USING 140 LB. WEIGHT FALLING 30 INCHES ±











NOTES

1. EXISTING TREES SHOWN ON PLAN BY AUDRY & ARRUDA, ROSS, BOSS & EDWARDS, CONSULTING ENGINEERS, WINCHESTER, MASS. DATED 26 JANUARY 1961.
2. FOR DIMENSIONS OF BUILDINGS SEE DRAWINGS # A-2 AND A-13.
3. CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND GRADES ON THE GROUND. ALL DISCREPANCIES MUST BE REPORTED IMMEDIATELY TO THE ARCHITECT FOR DECISION.
4. NOT ALL EXISTING TREES ARE SHOWN.
5. BEFORE ANY TREES ARE CUT IN THIS AREA THE CONTRACTOR SHALL LAYOUT ROADS & PARKING AREAS. NO TREES MAY BE CUT WITHOUT WRITTEN INSTRUCTION FROM THE ARCHITECT.
6. INDIVIDUAL & GROUPS OF TREES SHALL BE PROTECTED AS DIRECTED BY THE ARCHITECT.
7. FOR DATA ON SANITARY SEWER SYSTEM SEE DRAWING # A-13.
8. BITUMINOUS CURB AND WALKS SHALL BE CONTINUOUS WITH TRUELY FLAT RADIUS CORNERS, AS SHOWN AND LENGTH WALKS NOTED, AT INTERSECTIONS OF FOOTPATHS AND JUNCTURES WITH ROADWAYS.
9. DO NOT DISTURB - MEANS THE CONTRACTOR SHALL HELP NOT DO ANY PROJECT THE TREES & SHRUBS THEREON AS DIRECTED BY THE ARCHITECT.
10. THE EXACT LOCATION OF THE AREA SHALL BE ULTIMATELY ON THE GROUND BY THE ARCHITECT.

CARLISLE ELEMENTARY SCHOOL
CARLISLE MASSACHUSETTS

SITE PLAN

DATE AUG. 23, '62
SCALE 1" = 20'-0"

SMITH & SELLEW, ARCHITECTS
283 DARTMOUTH ST, BOSTON, MASS CO 7-4077

A-1

TEST BORING REPORT

NEW YORK OFFICE COPY

RAYMOND

CONCRETE PILE DIVISION

NEW YORK GOW DIVISION BOSTON

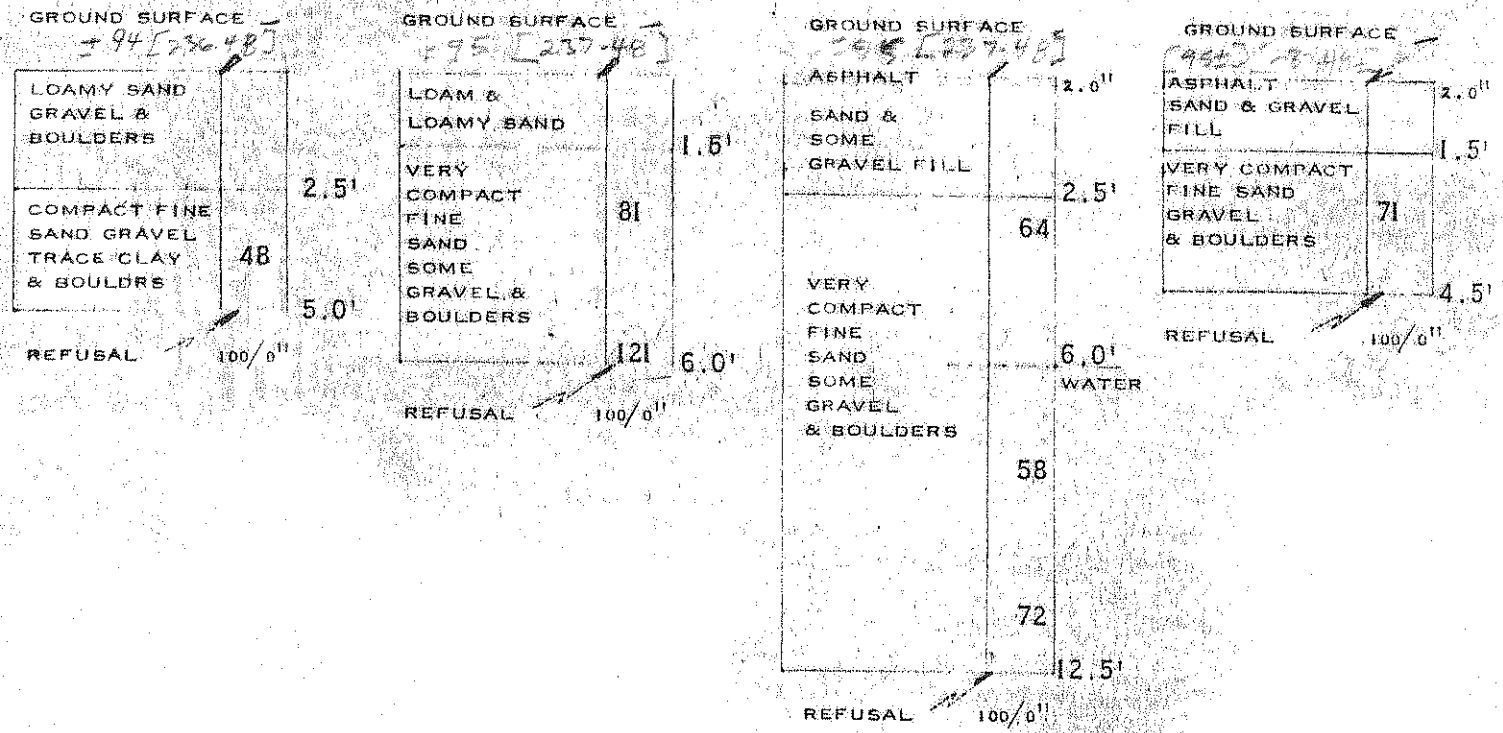
To Smith and Sellew, Architects Date June 5, 1961 Job No. BE-588-BOS

Location of Borings Proposed School, Carlisle, Massachusetts

All borings are plotted to a scale of 1" = 4 ft. using _____ as a fixed datum.

No. 1 No. 2 No. 3 No. 4

LOCATIONS OF BORINGS ARE SHOWN ON DRAWING A-1



Total Footage 28.0'

Foreman B. Ronan Jr.

Classification by B.R. & F.M.

Sheet 2 of 8

Figures in right hand column indicate number of blows required to drive 2" sampling pipe one foot, using 140-lb. weight falling 30 inches.

TEST BORING REPORT

NEW YORK OFFICE COPY

RAYMOND

CONCRETE PILE DIVISION

NEW YORK GOW DIVISION BOSTON

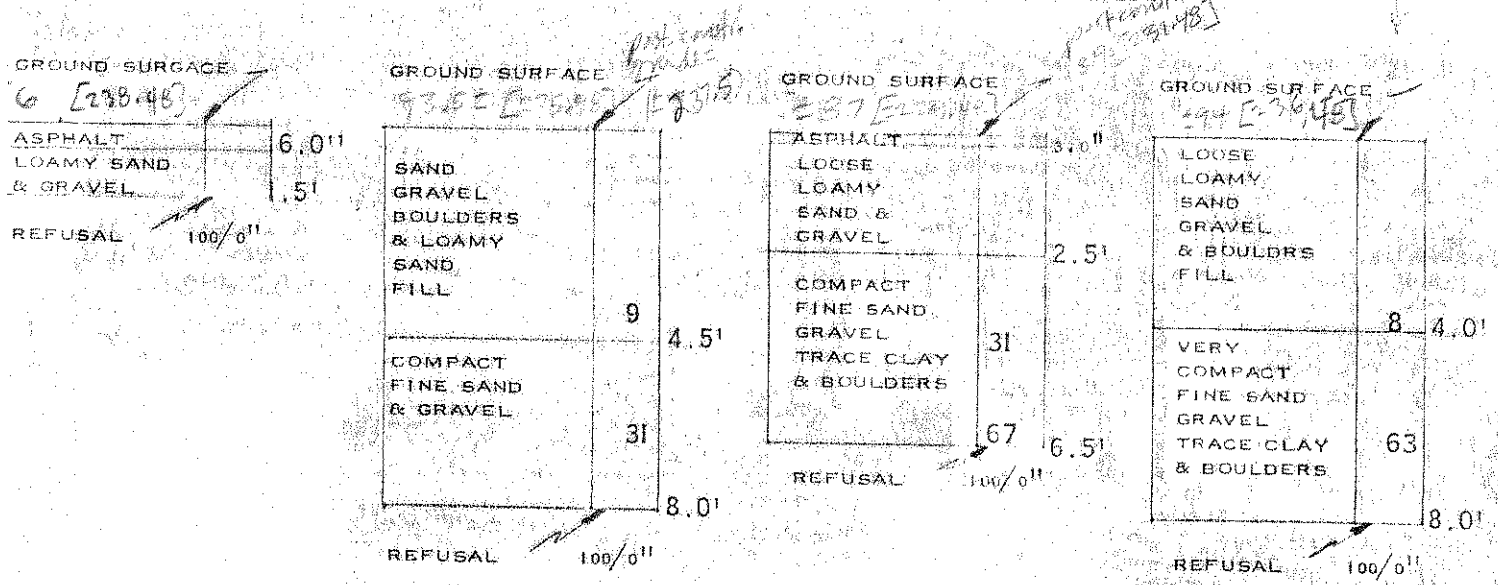
Smith and Sellew, Architects Date June 5, 1961 Job No. BB-588-

cation of Borings Proposed School, Carlisle, Massachusetts

borings are plotted to a scale of 1" = 4 ft. using as a fixed datum.

No. 5 No. 6 No. 7 No. 8

LOCATIONS OF BORINGS ARE SHOWN ON DRAWING A-1



Figures in right hand column indicate number of blows required to drive npling pipe one foot, using 140-lb. weight falling 30 inches.

Total Footage 24.0'

Foreman B. Rona Jr.

Classification by B. R. & F. M.

Sheet 3 of 8

TEST BORING REPORT

OFFICE COPY

RAYMOND

CONCRETE PILE DIVISION

NEW YORK GOW DIVISION BOSTON

Smith and Sellew, Architects Date June 5, 1961 Job No. BF-588-BOS

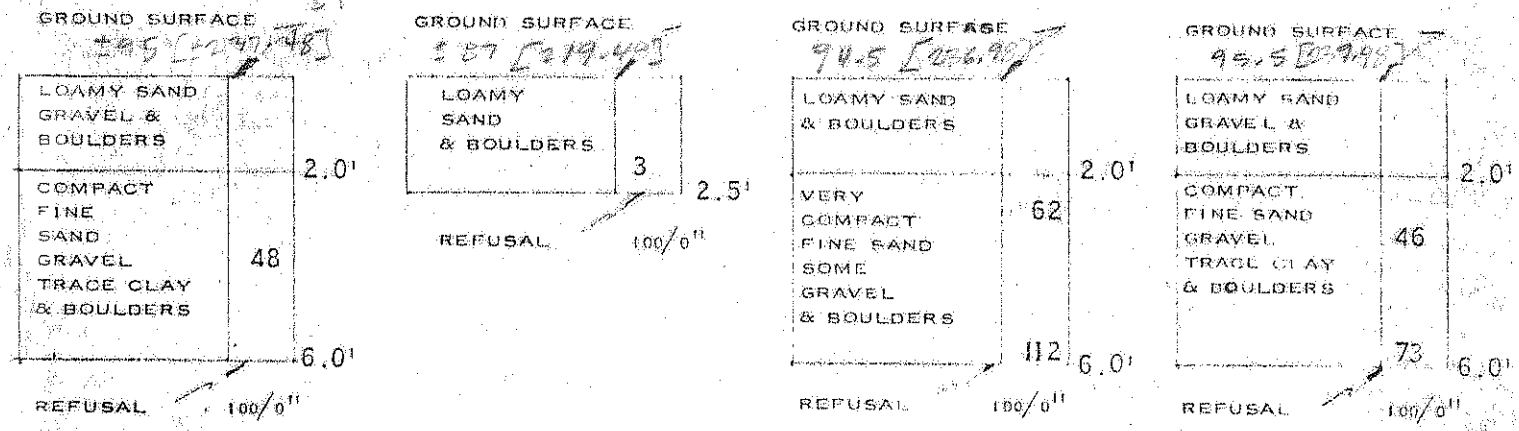
Location of Borings Proposed School, Carlisle, Massachusetts

All borings are plotted to a scale of 1" = 4 ft. using _____ as a fixed datum.

No. 9 No. 10 No. 11 No. 12

LOCATIONS OF BORINGS ARE SHOWN ON DRAWING A-1

post elevation = 93 [28.35.48]



Figures in right hand column indicate number of blows required to drive 2" sampling pipe one foot, using 140-lb. weight falling 30 inches.

Total Footage 20.5'

Foreman B. Rona Jr.

Classification by B.R. & F.M.

Sheet 4 of 8

TEST BORING REPORT

NEW YORK OFFICE COPY

RAYMOND

CONCRETE PILE DIVISION

NEW YORK GOW DIVISION BOSTON

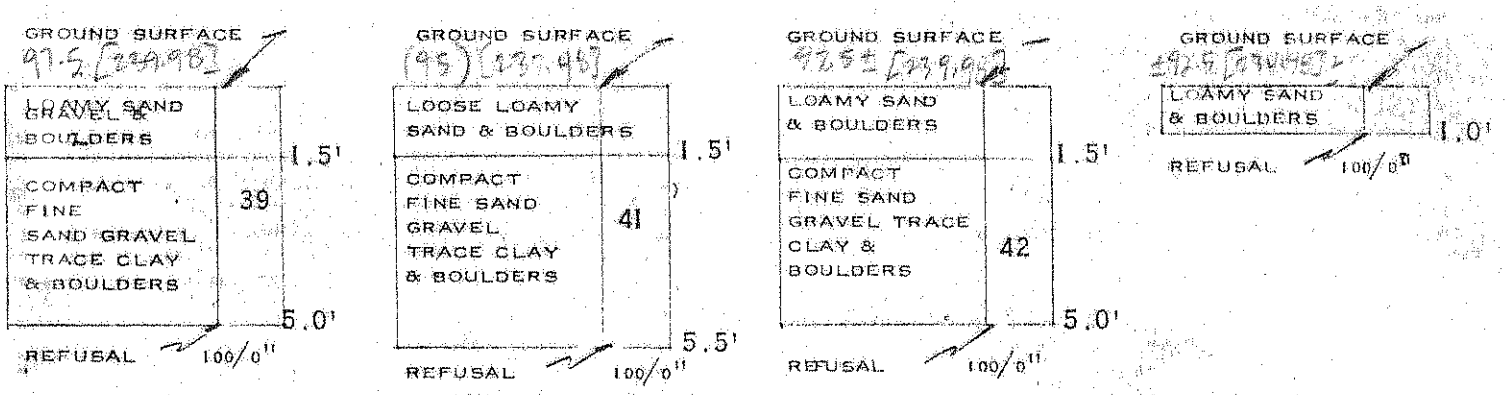
; Smith and Sellew, Architects Date June 5, 19 61 Job No. BE-588-BOS

ocation of Borings Proposed School, Carlisle, Massachusetts

l borings are plotted to a scale of 1" = 4 ft. using _____ as a fixed datum.

No. 13 No. 14 No. 15 No. 16

LOCATIONS OF BORINGS ARE SHOWN ON DRAWING A-1



Figures in right hand column indicate number of blows required to drive sampling pipe one foot, using 140-lb. weight falling 30 inches.

Total Footage 16.5'

Foreman B. Ronen Jr.

Classification by B.R. & F.M.

Sheet 5 of 8

TEST BORING REPORT — NEW YORK OFFICE COPY

RAYMOND

CONCRETE PILE DIVISION

NEW YORK — GOW DIVISION — BOSTON

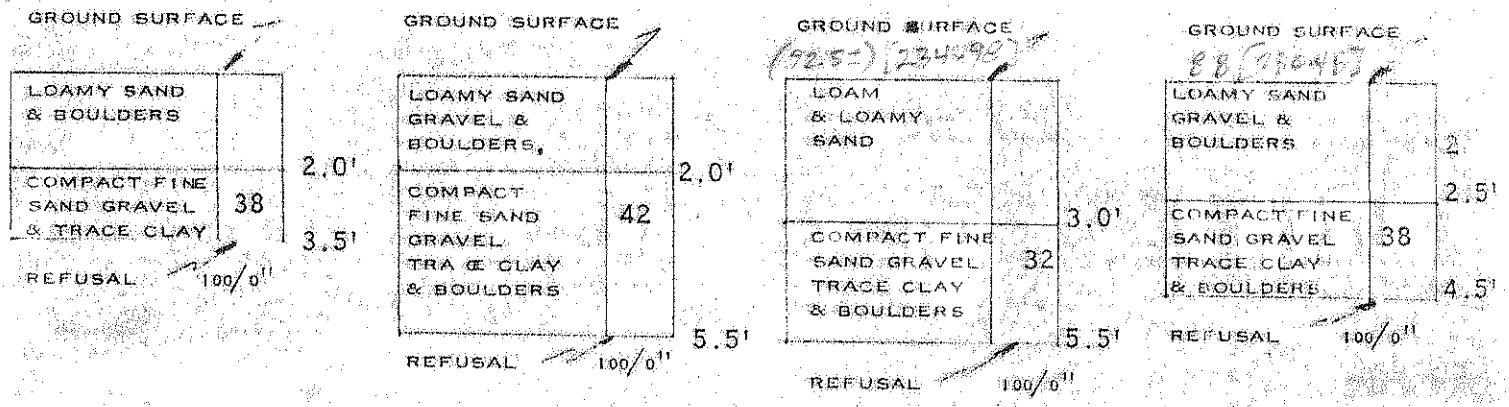
To Smith and Sellew, Architects Date June 5, 19 61 Job No. BE-588-BOS

Location of Borings Proposed School, Carlisle, Massachusetts

All borings are plotted to a scale of 1" = 4 ft. using _____ as a fixed datum.

No. 17 | No. 18 C | No. 19 | No. 20

LOCATIONS OF BORINGS ARE SHOWN ON DRAWING A-1



Figures in right hand column indicate number of blows required to drive 2" sampling pipe one foot, using 140-lb. weight falling 30 inches.

Total Footage 19.5'
Foreman B. RONAN JR.
Classification by B.R. & F.M.
Sheet 6 of 8

TEST BORING REPORT

NEW YORK OFFICE COPY

RAYMOND

CONCRETE PILE DIVISION

NEW YORK GOW DIVISION BOSTON

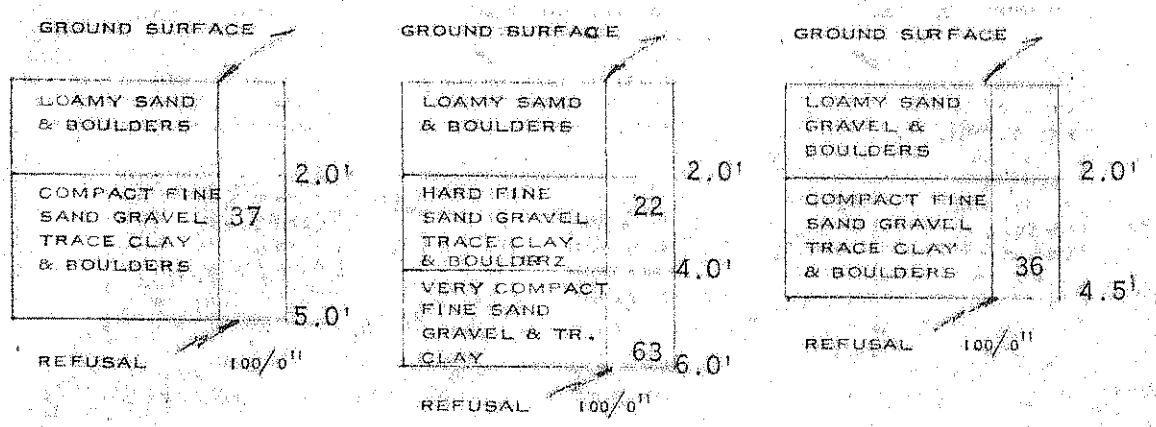
o Smith and Sellew, Architects Date June 5, 1961 Job No. BE-588-HOS

ocation of Borings Proposed School, Carlisle, Massachusetts

ll borings are plotted to a scale of 1" = 4 ft. using _____ as a fixed datum.

No. 21 No. 22 No. 23 No. PROBINGS

LOCATIONS OF BORINGS ARE SHOWN ON DRAWING A-1



PROBING	DEPTH TO REFUSAL
A	4.0'
B	4.5'
C	3.0'
D	3.5'
E	6.0'
F	4.5'
G	4.5'
H	6.5'
I	3.5'
J	3.5'
K	3.5'
L	4.5'

ALL PROBINGS MADE THRU LOAMY SAND GRAVEL & BOULDERS

ALL BORINGS CARRIED TO REFUSAL ON EITHER BEDROCK OR BOULDRS

Figures in right hand column indicate number of blows required to drive sampling pipe one foot, using 140-lb. weight falling 30 inches.

Total Footage 16.0'

Foreman B. RONAN JR.

Classification by B.R. & F.M.

Sheet _____ of 8

McPHAIL
ASSOCIATES, INC
Geotechnical Engineers

Appendix D

McPhail Associates, Inc.'s
Groundwater Monitoring Reports

GROUNDWATER MONITORING REPORT

Well ID: B-2(OW)	**Elevation Subtrahend : +234.6**	**Job No:** 5010 **Job Name:** Addition to Carlisle School

Date	Time	Elapsed Time	Depth of Water from Riser Top	Elevation of Water	Remarks	Read By
10/19/09			NE	NE		TMC

GROUNDWATER MONITORING REPORT

Well ID: B-4(OW)	**Elevation Subtrahend : +238.0**	**Job No:** 5010 **Job Name:** Addition to Carlisle School

Date	Time	Elapsed Time	Depth of Water from Riser Top	Elevation of Water	Remarks	Read By
10/19/09			NE	NE		TMC

McPHAIL ASSOCIATES, INC

Geotechnical Engineers

Appendix E

Chemical Test Results

ALPHA ANALYTICAL

Eight Walkup Drive
Westborough, Massachusetts 01581-1019
(508) 898-9220 www.alphalab.com
MA:M-MA086 NH:2003 CT:PH-0574 ME:MA0086 RI:LAO00065 NY:11148 NJ:MA935 Army:USACE

CERTIFICATE OF ANALYSIS

Client: McPhail Associates

Address: 2269 Massachusetts Avenue

Cambridge, MA 02140

Attn: Mr. Ambrose Donovan

Project Number: 5010.2.00

Laboratory Job Number: L0914981

Date Received: 20-OCT-2009

Date Reported: 26-OCT-2009

Delivery Method: Alpha

Site: ADDITION TO CARLISLE SCHOOL

The following questions pertain only to MCP Analytical Methods

An affirmative response to questions A,B,C & D is required for "Presumptive Certainty" status

A. Were all samples received by the laboratory in a condition consistent with those described on their Chain-of-Custody documentation for the data set?	YES
B. Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines?	YES
C. Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in section 2.0 of the MADEP document CAM VII A, "Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"?	YES
D. **VPH and EPH methods only:** Was the VPH or EPH method run without significant modifications, as specified in Section 11.3?	YES

A response to questions E and F is required for "Presumptive Certainty" status

E. Were all QC performance standards and recommendations for the specified method(s) achieved?	NO
F. Were results for all analyte-list compounds/elements for the specified method(s) reported?	NO

Any answers of NO to the above questions are addressed in the case narrative.

I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this report is, to the best of my knowledge and belief, accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized by: _____
Technical Representative

ALPHA ANALYTICAL

Laboratory Job Number: L0914981
Date Reported: 26-OCT-2009

ALPHA SAMPLE NUMBER	CLIENT IDENTIFICATION	SAMPLE LOCATION
L0914981-01	TP3 6-7'	CARLISLE, MA
L0914981-02	B2 5-7'	CARLISLE, MA
L0914981-03	B2.B4.B5 COMP 0-2.5'	CARLISLE, MA
L0914981-04	B1.B3 COMP 0-2'	CARLISLE, MA

ALPHA ANALYTICAL
NARRATIVE REPORT

Laboratory Job Number: L0914981

The samples were received in accordance with the chain of custody and no significant deviations were encountered during preparation or analysis unless otherwise noted below.

MCP Related Narratives

EPH

Extraction Method: EPA 3546

Pesticides

Extraction Method: EPA 3545

Cleanup Method: EPA 3620B

A copy of the Degradation Standards for 4,4'-DDT and Endrin breakdown products is included as an addendum.

In reference to question E:

The WG385266-3 LCSD recovery associated with L0914981-03 and -04 was below the acceptance criteria for Delta-BHC (36%).

Metals

In reference to question F:

All samples were analyzed for a subset of MCP elements per the Chain of Custody.

ALPHA ANALYTICAL
CERTIFICATE OF ANALYSIS

MA:M-MA086 NH:2003 CT:PH-0574 ME:MA0086 RI:LAO00065 NY:11148 NJ:MA935 Army:USACE

Laboratory Sample Number: L0914981-01
TP3 6-7'
Sample Matrix: SOIL

Date Collected: 19-OCT-2009 13:00
Date Received : 20-OCT-2009
Date Reported : 26-OCT-2009

Condition of Sample: Satisfactory

Field Prep: None

Number & Type of Containers: 2-Amber

PARAMETER	RESULT	UNITS	RDL	REF METHOD	DATE PREP	DATE ANAL	ID
General Chemistry - Westborough Lab							
Solids, Total	93	%	0.10	30 2540G		1021 13:09	TL

Comments: Complete list of References and Glossary of Terms found in Addendum I

ALPHA ANALYTICAL
CERTIFICATE OF ANALYSIS

Laboratory Sample Number: L0914981-01
TP3 6-7'

PARAMETER	RESULT	UNITS	RDL	REF METHOD	DATE PREP	DATE ANAL	ID
Extractable Petroleum Hydrocarbons - Westborough Lab				61 EPH-04-1	1021 13:18	1022 14:32	MF

Quality Control Information

Condition of sample received:	Satisfactory
Sample temperature upon receipt:	Received on Ice
Sample extraction method:	Extracted Per the Method

C9-C18 Aliphatics	ND	mg/kg	7.02
C19-C36 Aliphatics	ND	mg/kg	7.02
C11-C22 Aromatics	ND	mg/kg	7.02
C11-C22 Aromatics, Adjusted	ND	mg/kg	7.02
Naphthalene	ND	mg/kg	0.351
2-Methylnaphthalene	ND	mg/kg	0.351
Acenaphthylene	ND	mg/kg	0.351
Acenaphthene	ND	mg/kg	0.351
Fluorene	ND	mg/kg	0.351
Phenanthrene	ND	mg/kg	0.351
Anthracene	ND	mg/kg	0.351
Fluoranthene	ND	mg/kg	0.351
Pyrene	ND	mg/kg	0.351
Benzo(a)anthracene	ND	mg/kg	0.351
Chrysene	ND	mg/kg	0.351
Benzo(b)fluoranthene	ND	mg/kg	0.351
Benzo(k)fluoranthene	ND	mg/kg	0.351
Benzo(a)pyrene	ND	mg/kg	0.351
Indeno(1,2,3-cd)Pyrene	ND	mg/kg	0.351
Dibenzo(a,h)anthracene	ND	mg/kg	0.351
Benzo(ghi)perylene	ND	mg/kg	0.351

Surrogate(s)	Recovery		QC Criteria
Chloro-Octadecane	48.0	%	40-140
o-Terphenyl	61.0	%	40-140
2-Fluorobiphenyl	73.0	%	40-140
2-Bromonaphthalene	77.0	%	40-140

Comments: Complete list of References and Glossary of Terms found in Addendum I

ALPHA ANALYTICAL
CERTIFICATE OF ANALYSIS

MA:M-MA086 NH:2003 CT:PH-0574 ME:MA0086 RI:LAO00065 NY:11148 NJ:MA935 Army:USACE

Laboratory Sample Number: L0914981-02
B2 5-7'
Sample Matrix: SOIL

Date Collected: 19-OCT-2009 13:00
Date Received : 20-OCT-2009
Date Reported : 26-OCT-2009

Condition of Sample: Satisfactory

Field Prep: None

Number & Type of Containers: 1-Amber

PARAMETER	RESULT	UNITS	RDL	REF METHOD	DATE PREP	DATE ANAL	ID
General Chemistry - Westborough Lab							
Solids, Total	89	%	0.10	30 2540G		1021 13:09	TL

Comments: Complete list of References and Glossary of Terms found in Addendum I

ALPHA ANALYTICAL
CERTIFICATE OF ANALYSIS

Laboratory Sample Number: L0914981-02
B2 5-7'

PARAMETER	RESULT	UNITS	RDL	REF METHOD	DATE PREP	DATE ANAL	ID
Extractable Petroleum Hydrocarbons - Westborough Lab				61 EPH-04-1	1021 13:18	1022 15:03	MF

Quality Control Information

Condition of sample received:	Satisfactory
Sample temperature upon receipt:	Received on Ice
Sample extraction method:	Extracted Per the Method

C9-C18 Aliphatics	ND	mg/kg	7.29
C19-C36 Aliphatics	ND	mg/kg	7.29
C11-C22 Aromatics	ND	mg/kg	7.29
C11-C22 Aromatics, Adjusted	ND	mg/kg	7.29
Naphthalene	ND	mg/kg	0.364
2-Methylnaphthalene	ND	mg/kg	0.364
Acenaphthylene	ND	mg/kg	0.364
Acenaphthene	ND	mg/kg	0.364
Fluorene	ND	mg/kg	0.364
Phenanthrene	ND	mg/kg	0.364
Anthracene	ND	mg/kg	0.364
Fluoranthene	ND	mg/kg	0.364
Pyrene	ND	mg/kg	0.364
Benzo(a)anthracene	ND	mg/kg	0.364
Chrysene	ND	mg/kg	0.364
Benzo(b)fluoranthene	ND	mg/kg	0.364
Benzo(k)fluoranthene	ND	mg/kg	0.364
Benzo(a)pyrene	ND	mg/kg	0.364
Indeno(1,2,3-cd)Pyrene	ND	mg/kg	0.364
Dibenzo(a,h)anthracene	ND	mg/kg	0.364
Benzo(ghi)perylene	ND	mg/kg	0.364

Surrogate(s)	Recovery		QC Criteria
Chloro-Octadecane	62.0	%	40-140
o-Terphenyl	61.0	%	40-140
2-Fluorobiphenyl	73.0	%	40-140
2-Bromonaphthalene	73.0	%	40-140

Comments: Complete list of References and Glossary of Terms found in Addendum I

ALPHA ANALYTICAL
CERTIFICATE OF ANALYSIS

MA:M-MA086 NH:2003 CT:PH-0574 ME:MA0086 RI:LAO00065 NY:11148 NJ:MA935 Army:USACE

Laboratory Sample Number: L0914981-03
B2.B4.B5 COMP 0-2.5'
Sample Matrix: SOIL

Date Collected: 19-OCT-2009 13:00
Date Received : 20-OCT-2009
Date Reported : 26-OCT-2009

Condition of Sample: Satisfactory

Field Prep: None

Number & Type of Containers: 2-Amber

PARAMETER	RESULT	UNITS	RDL	REF	METHOD	DATE PREP	DATE ANAL	ID
General Chemistry - Westborough Lab								
Solids, Total	91	%	0.10	30	2540G		1021 13:09	TL
MCP Total Metals - Westborough Lab				60	6010B			
Arsenic, Total	13	mg/kg	0.43	60	6010B	1021 18:50	1023 15:49	TD
Barium, Total	54	mg/kg	0.43	60	6010B	1021 18:50	1023 15:49	TD
Cadmium, Total	ND	mg/kg	0.43	60	6010B	1021 18:50	1023 15:49	TD
Chromium, Total	38	mg/kg	0.43	60	6010B	1021 18:50	1023 15:49	TD
Lead, Total	11	mg/kg	2.2	60	6010B	1021 18:50	1023 15:49	TD
Mercury, Total	ND	mg/kg	0.09	64	7471A	1022 15:50	1023 10:51	EZ
Selenium, Total	ND	mg/kg	2.2	60	6010B	1021 18:50	1023 15:49	TD
Silver, Total	ND	mg/kg	0.43	60	6010B	1021 18:50	1023 15:49	TD
MCP Organochlorine Pesticides - Westborough Lab				64	8081A	1021 08:01	1023 10:44	JB
Delta-BHC	ND	ug/kg	3.54					
Lindane	ND	ug/kg	2.83					
Alpha-BHC	ND	ug/kg	3.54					
Beta-BHC	ND	ug/kg	3.54					
Heptachlor	ND	ug/kg	3.54					
Aldrin	ND	ug/kg	3.54					
Heptachlor epoxide	ND	ug/kg	3.54					
Endrin	ND	ug/kg	3.54					
Endrin ketone	ND	ug/kg	3.54					
Dieldrin	ND	ug/kg	3.54					
4,4'-DDE	ND	ug/kg	3.54					
4,4'-DDD	ND	ug/kg	3.54					
4,4'-DDT	ND	ug/kg	3.54					
Endosulfan I	ND	ug/kg	3.54					
Endosulfan II	ND	ug/kg	3.54					
Endosulfan sulfate	ND	ug/kg	3.54					
Methoxychlor	ND	ug/kg	14.2					
Chlordane	ND	ug/kg	35.4					
Hexachlorobenzene	ND	ug/kg	3.54					

Comments: Complete list of References and Glossary of Terms found in Addendum I

ALPHA ANALYTICAL
CERTIFICATE OF ANALYSIS

Laboratory Sample Number: L0914981-03
B2.B4.B5 COMP 0-2.5'

PARAMETER	RESULT	UNITS	RDL	REF METHOD	DATE PREP	DATE ANAL	ID
MCP Organochlorine Pesticides - Westborough Lab cont'd				64 8081A	1021 08:01	1023 10:44	JB
Surrogate(s)	Recovery		QC Criteria				
2,4,5,6-Tetrachloro-m-xylene	43.0	%	30-150				
Decachlorobiphenyl	52.0	%	30-150				
MCP Organochlorine Pesticides - Westborough Lab				64 8081A	1021 08:01	1023 10:44	JB
Surrogate(s)	Recovery		QC Criteria				
2,4,5,6-Tetrachloro-m-xylene	41.0	%	30-150				
Decachlorobiphenyl	67.0	%	30-150				

Comments: Complete list of References and Glossary of Terms found in Addendum I

ALPHA ANALYTICAL
CERTIFICATE OF ANALYSIS

MA:M-MA086 NH:2003 CT:PH-0574 ME:MA0086 RI:LAO00065 NY:11148 NJ:MA935 Army:USACE

Laboratory Sample Number: L0914981-04
B1.B3 COMP 0-2'
Sample Matrix: SOIL

Date Collected: 19-OCT-2009 13:00
Date Received : 20-OCT-2009
Date Reported : 26-OCT-2009

Condition of Sample: Satisfactory

Field Prep: None

Number & Type of Containers: 2-Amber

PARAMETER	RESULT	UNITS	RDL	REF	METHOD	DATE PREP	DATE ANAL	ID
General Chemistry - Westborough Lab								
Solids, Total	90	%	0.10	30	2540G		1021 13:09	TL
MCP Total Metals - Westborough Lab				60	6010B			
Arsenic, Total	12	mg/kg	0.44	60	6010B	1021 18:50	1023 15:52	TD
Barium, Total	37	mg/kg	0.44	60	6010B	1021 18:50	1023 15:52	TD
Cadmium, Total	ND	mg/kg	0.44	60	6010B	1021 18:50	1023 15:52	TD
Chromium, Total	31	mg/kg	0.44	60	6010B	1021 18:50	1023 15:52	TD
Lead, Total	12	mg/kg	2.2	60	6010B	1021 18:50	1023 15:52	TD
Mercury, Total	ND	mg/kg	0.08	64	7471A	1022 15:50	1023 10:53	EZ
Selenium, Total	ND	mg/kg	2.2	60	6010B	1021 18:50	1023 15:52	TD
Silver, Total	ND	mg/kg	0.44	60	6010B	1021 18:50	1023 15:52	TD
MCP Organochlorine Pesticides - Westborough Lab				64	8081A	1021 08:01	1023 11:10	JB
Delta-BHC	ND	ug/kg	3.69					
Lindane	ND	ug/kg	2.95					
Alpha-BHC	ND	ug/kg	3.69					
Beta-BHC	ND	ug/kg	3.69					
Heptachlor	ND	ug/kg	3.69					
Aldrin	ND	ug/kg	3.69					
Heptachlor epoxide	ND	ug/kg	3.69					
Endrin	ND	ug/kg	3.69					
Endrin ketone	ND	ug/kg	3.69					
Dieldrin	ND	ug/kg	3.69					
4,4'-DDE	5.68	ug/kg	3.69					
4,4'-DDD	ND	ug/kg	3.69					
4,4'-DDT	6.78	ug/kg	3.69					
Endosulfan I	ND	ug/kg	3.69					
Endosulfan II	ND	ug/kg	3.69					
Endosulfan sulfate	ND	ug/kg	3.69					
Methoxychlor	ND	ug/kg	14.7					
Chlordane	ND	ug/kg	36.9					
Hexachlorobenzene	ND	ug/kg	3.69					

Comments: Complete list of References and Glossary of Terms found in Addendum I

ALPHA ANALYTICAL
CERTIFICATE OF ANALYSIS

Laboratory Sample Number: L0914981-04
B1.B3 COMP 0-2'

PARAMETER	RESULT	UNITS	RDL	REF METHOD	DATE PREP	DATE ANAL	ID
MCP Organochlorine Pesticides - Westborough Lab cont'd				64 8081A	1021 08:01	1023 11:10	JB
Surrogate(s)	Recovery		QC Criteria				
2,4,5,6-Tetrachloro-m-xylene	61.0	%	30-150				
Decachlorobiphenyl	74.0	%	30-150				
MCP Organochlorine Pesticides - Westborough Lab				64 8081A	1021 08:01	1023 11:10	JB
Surrogate(s)	Recovery		QC Criteria				
2,4,5,6-Tetrachloro-m-xylene	57.0	%	30-150				
Decachlorobiphenyl	83.0	%	30-150				

Comments: Complete list of References and Glossary of Terms found in Addendum I

ALPHA ANALYTICAL
QUALITY ASSURANCE BATCH DUPLICATE ANALYSIS

Laboratory Job Number: L0914981

Parameter	Value 1	Value 2	Units	RPD	RPD Limits
General Chemistry - Westborough Lab for sample(s) 01-04 (L0914965-12, WG385323-1)					
Solids, Total	80	81	%	1	20

ALPHA ANALYTICAL
QUALITY ASSURANCE BATCH LCS/LCSD ANALYSIS

Laboratory Job Number: L0914981

Parameter	LCS %	LCSD %	RPD	RPD Limit	QC Limits
MCP Total Metals - Westborough Lab for sample(s) 03-04 (WG385390-2, WG385390-3)					
Arsenic, Total	96	98	2	30	75-125
Barium, Total	92	91	1	30	75-125
Cadmium, Total	100	102	2	30	75-125
Chromium, Total	99	99	0	30	75-125
Lead, Total	100	97	3	30	75-125
Selenium, Total	91	94	3	30	75-125
Silver, Total	93	96	3	30	75-125
MCP Total Metals - Westborough Lab for sample(s) 03-04 (WG385565-2, WG385565-3)					
Mercury, Total	108	99	9	30	75-125
MCP Organochlorine Pesticides - Westborough Lab for sample(s) 03-04 (WG385266-2, WG385266-3)					
Delta-BHC	40	36	11	30	40-140
Lindane	55	50	10	30	40-140
Alpha-BHC	56	51	9	30	40-140
Beta-BHC	54	49	10	30	40-140
Heptachlor	51	46	10	30	40-140
Aldrin	63	58	8	30	40-140
Heptachlor epoxide	66	63	5	30	40-140
Endrin	57	54	5	30	40-140
Endrin ketone	55	50	10	30	40-140
Dieldrin	66	64	3	30	40-140
4,4'-DDE	66	65	2	30	40-140
4,4'-DDD	61	57	7	30	40-140
4,4'-DDT	54	52	4	30	40-140
Endosulfan I	63	60	5	30	40-140
Endosulfan II	60	56	7	30	40-140
Endosulfan sulfate	51	46	10	30	40-140
Methoxychlor	62	56	10	30	40-140
Hexachlorobenzene	82	73	12	30	40-140
Surrogate(s)					
2,4,5,6-Tetrachloro-m-xylene	67	64	5		30-150
2,4,5,6-Tetrachloro-m-xylene	62	58	7		30-150
Decachlorobiphenyl	85	88	3		30-150
Decachlorobiphenyl	79	77	3		30-150
Extractable Petroleum Hydrocarbons - Westborough Lab for sample(s) 01-02 (WG385332-2, WG385332-3					
C9-C18 Aliphatics	48	50	4	25	40-140
C19-C36 Aliphatics	52	53	2	25	40-140
C11-C22 Aromatics	79	75	5	25	40-140
Naphthalene	63	59	7	25	40-140
2-Methylnaphthalene	65	61	6	25	40-140
Acenaphthylene	59	53	11	25	40-140
Acenaphthene	63	58	8	25	40-140
Fluorene	64	61	5	25	40-140
Phenanthrene	74	71	4	25	40-140
Anthracene	71	69	3	25	40-140

ALPHA ANALYTICAL
QUALITY ASSURANCE BATCH LCS/LCSD ANALYSIS

Laboratory Job Number: L0914981

Continued

Parameter	LCS %	LCSD %	RPD	RPD Limit	QC Limits
Extractable Petroleum Hydrocarbons - Westborough Lab for sample(s) 01-02 (WG385332-2, WG385332-3					
Fluoranthene	76	74	3	25	40-140
Pyrene	78	74	5	25	40-140
Benzo(a)anthracene	76	76	0	25	40-140
Chrysene	80	80	0	25	40-140
Benzo(b)fluoranthene	83	83	0	25	40-140
Benzo(k)fluoranthene	82	84	2	25	40-140
Benzo(a)pyrene	71	70	1	25	40-140
Indeno(1,2,3-cd)Pyrene	80	82	2	25	40-140
Dibenzo(a,h)anthracene	75	78	4	25	40-140
Benzo(ghi)perylene	78	79	1	25	40-140
Nonane (C9)	44	46	4	25	30-140
Decane (C10)	51	53	4	25	40-140
Dodecane (C12)	54	55	2	25	40-140
Tetradecane (C14)	51	53	4	25	40-140
Hexadecane (C16)	51	52	2	25	40-140
Octadecane (C18)	52	53	2	25	40-140
Nonadecane (C19)	54	55	2	25	40-140
Eicosane (C20)	53	54	2	25	40-140
Docosane (C22)	52	54	4	25	40-140
Tetracosane (C24)	52	54	4	25	40-140
Hexacosane (C26)	53	54	2	25	40-140
Octacosane (C28)	53	54	2	25	40-140
Triacontane (C30)	56	57	2	25	40-140
Hexatriacontane (C36)	58	58	0	25	40-140
Surrogate(s)					
Chloro-Octadecane	45	48	6		40-140
o-Terphenyl	95	88	8		40-140
2-Fluorobiphenyl	72	67	7		40-140
2-Bromonaphthalene	74	68	8		40-140
% Naphthalene Breakthrough	0	0	NC		
% 2-Methylnaphthalene Breakthr ough	0	0	NC		

ALPHA ANALYTICAL
QUALITY ASSURANCE FRACTIONATION CHECK

Laboratory Job Number: L0914981

Parameter	% Recovery	QC Criteria
Fractionation Check Standard Recoveries for Lot 200818205		
C9-C18 Aliphatics	77	40-140
C19-C36 Aliphatics	76	40-140
C11-C22 Aromatics	86	40-140
Naphthalene	82	40-140
2-Methylnaphthalene	78	40-140
Acenaphthylene	76	40-140
Acenaphthene	80	40-140
Fluorene	79	40-140
Phenanthrene	78	40-140
Anthracene	82	40-140
Fluoranthene	84	40-140
Pyrene	84	40-140
Benzo(a)anthracene	82	40-140
Chrysene	88	40-140
Benzo(b)fluoranthene	81	40-140
Benzo(k)fluoranthene	97	40-140
Benzo(a)pyrene	78	40-140
Indeno(1,2,3-cd)Pyrene	76	40-140
Dibenzo(a,h)anthracene	83	40-140
Benzo(ghi)perylene	82	40-140
Nonane (C9)	72	30-140
Decane (C10)	77	40-140
Dodecane (C12)	80	40-140
Tetradecane (C14)	76	40-140
Hexadecane (C16)	78	40-140
Octadecane (C18)	76	40-140
Nonadecane (C19)	75	40-140
Eicosane (C20)	77	40-140
Docosane (C22)	79	40-140
Tetracosane (C24)	83	40-140
Hexacosane (C26)	78	40-140
Octacosane (C28)	77	40-140
Triacontane (C30)	76	40-140
Hexatriacontane (C36)	75	40-140
Surrogate(s)		
Chloro-Octadecane	66	40-140
o-Terphenyl	83	40-140
2-Fluorobiphenyl	75	40-140
2-Bromonaphthalene	76	40-140
% Naphthalene Breakthrough	0	0-5
% 2-Methylnaphthalene Breakthrough	0	0-5

ALPHA ANALYTICAL
QUALITY ASSURANCE BATCH BLANK ANALYSIS

Laboratory Job Number: L0914981

PARAMETER	RESULT	UNITS	RDL	REF	METHOD	DATE PREP	DATE ANAL	ID
Blank Analysis for sample(s) 03-04 (WG385390-1)								
MCP Total Metals - Westborough Lab				60	6010B			
Arsenic, Total	ND	mg/kg	0.40	60	6010B	1021 18:50	1023 14:35	TD
Barium, Total	ND	mg/kg	0.40	60	6010B	1021 18:50	1023 14:35	TD
Cadmium, Total	ND	mg/kg	0.40	60	6010B	1021 18:50	1023 14:35	TD
Chromium, Total	ND	mg/kg	0.40	60	6010B	1021 18:50	1023 14:35	TD
Lead, Total	ND	mg/kg	2.0	60	6010B	1021 18:50	1023 14:35	TD
Selenium, Total	ND	mg/kg	2.0	60	6010B	1021 18:50	1023 14:35	TD
Silver, Total	ND	mg/kg	0.40	60	6010B	1021 18:50	1023 14:35	TD
Blank Analysis for sample(s) 03-04 (WG385565-1)								
MCP Total Metals - Westborough Lab								
Mercury, Total	ND	mg/kg	0.08	64	7471A	1022 15:50	1023 10:27	EZ
Blank Analysis for sample(s) 03-04 (WG385266-1)								
MCP Organochlorine Pesticides - Westborough Lab				64	8081A	1021 08:01	1023 10:05	JB
Delta-BHC	ND	ug/kg	3.31					
Lindane	ND	ug/kg	2.64					
Alpha-BHC	ND	ug/kg	3.31					
Beta-BHC	ND	ug/kg	3.31					
Heptachlor	ND	ug/kg	3.31					
Aldrin	ND	ug/kg	3.31					
Heptachlor epoxide	ND	ug/kg	3.31					
Endrin	ND	ug/kg	3.31					
Endrin ketone	ND	ug/kg	3.31					
Dieldrin	ND	ug/kg	3.31					
4,4'-DDE	ND	ug/kg	3.31					
4,4'-DDD	ND	ug/kg	3.31					
4,4'-DDT	ND	ug/kg	3.31					
Endosulfan I	ND	ug/kg	3.31					
Endosulfan II	ND	ug/kg	3.31					
Endosulfan sulfate	ND	ug/kg	3.31					
Methoxychlor	ND	ug/kg	13.2					
Chlordane	ND	ug/kg	33.1					
Hexachlorobenzene	ND	ug/kg	3.31					
Blank Analysis for sample(s) 03-04 (WG385266-1)								
MCP Organochlorine Pesticides - Westborough Lab				64	8081A	1021 08:01	1023 10:05	JB
Surrogate(s)	Recovery		QC Criteria					
2,4,5,6-Tetrachloro-m-xylene	64.0	%	30-150					
Decachlorobiphenyl	95.0	%	30-150					
Blank Analysis for sample(s) 03-04 (WG385266-1)								
MCP Organochlorine Pesticides - Westborough Lab				64	8081A	1021 08:01	1023 10:05	JB

ALPHA ANALYTICAL
QUALITY ASSURANCE BATCH BLANK ANALYSIS

Laboratory Job Number: L0914981

Continued

PARAMETER	RESULT	UNITS	RDL	REF METHOD	DATE PREP	DATE ANAL	ID
Blank Analysis for sample(s) 03-04 (WG385266-1)							
MCP Organochlorine Pesticides - Westborough Lab cont'd				64 8081A	1021 08:01	1023 10:05	JB
Surrogate(s)	Recovery		QC Criteria				
2,4,5,6-Tetrachloro-m-xylene	62.0	%	30-150				
Decachlorobiphenyl	75.0	%	30-150				
Blank Analysis for sample(s) 01-02 (WG385332-1)							
Extractable Petroleum Hydrocarbons - Westborough Lab				61 EPH-04-1	1021 13:18	1022 08:40	MF
C9-C18 Aliphatics	ND	mg/kg	6.51				
C19-C36 Aliphatics	ND	mg/kg	6.51				
C11-C22 Aromatics	ND	mg/kg	6.51				
C11-C22 Aromatics, Adjusted	ND	mg/kg	6.51				
Naphthalene	ND	mg/kg	0.326				
2-Methylnaphthalene	ND	mg/kg	0.326				
Acenaphthylene	ND	mg/kg	0.326				
Acenaphthene	ND	mg/kg	0.326				
Fluorene	ND	mg/kg	0.326				
Phenanthrene	ND	mg/kg	0.326				
Anthracene	ND	mg/kg	0.326				
Fluoranthene	ND	mg/kg	0.326				
Pyrene	ND	mg/kg	0.326				
Benzo(a)anthracene	ND	mg/kg	0.326				
Chrysene	ND	mg/kg	0.326				
Benzo(b)fluoranthene	ND	mg/kg	0.326				
Benzo(k)fluoranthene	ND	mg/kg	0.326				
Benzo(a)pyrene	ND	mg/kg	0.326				
Indeno(1,2,3-cd)Pyrene	ND	mg/kg	0.326				
Dibenzo(a,h)anthracene	ND	mg/kg	0.326				
Benzo(ghi)perylene	ND	mg/kg	0.326				
Surrogate(s)	Recovery		QC Criteria				
Chloro-Octadecane	42.0	%	40-140				
o-Terphenyl	51.0	%	40-140				
2-Fluorobiphenyl	64.0	%	40-140				
2-Bromonaphthalene	69.0	%	40-140				

REFERENCES

30. Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WPCF. 18th Edition. 1992.

60. Quality Assurance and Quality Control Requirements and Performance Standards for SW-846 Methods. MADEP BWSC. WSC-CAM-IIA (Revision 4), WSC-CAM-V C (Revision 2), WSC-CAM-IIIA (Revision 5). May 2004.

61. Method for the Determination of Extractable Petroleum Hydrocarbons (EPH). Massachusetts Department of Environmental Protection, DEA/ORS/BWSC. May 2004, Revision 1.1.

64. Quality Assurance and Quality Control Requirements and Performance Standards for SW-846 Methods. MADEP BWSC. WSC-CAM-IIA (Revision 4), WSC-CAM-V C (Revision 2), WSC-CAM-IIIA (Revision 5). August 2004.

GLOSSARY OF TERMS AND SYMBOLS

REF	Reference number in which test method may be found.
METHOD	Method number by which analysis was performed.
ID	Initials of the analyst.
ND	Not detected in comparison to the reported detection limit.
NI	Not Ignitable.
ug/cart	Micrograms per Cartridge.
H	The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

LIMITATION OF LIABILITIES

Alpha Analytical, Inc. performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical, Inc., shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical, Inc. be held liable for any incidental consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical, Inc.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding times and splitting of samples in the field.

ALPHA ANALYTICAL
LOGIN SPECIFIC INFORMATION

Laboratory Job Number: L0914981

Were project specific reporting limits specified? YES

Cooler Information

Cooler	Custody Seal
A	Absent

Container Information

Container ID	Container Type	Cooler	pH	Temp	Pres	Seal	Analysis
L0914981-01A	Amber 250ml unpreserved	A	N/A	2.3	Y	Absent	EPH-DELUX-04
L0914981-01B	Amber 250ml unpreserved	A	N/A	2.3	Y	Absent	TS
L0914981-02A	Amber 250ml unpreserved	A	N/A	2.3	Y	Absent	EPH-DELUX-04, TS
L0914981-03A	Amber 250ml unpreserved	A	N/A	2.3	Y	Absent	MCP-8081-04
L0914981-03B	Amber 250ml unpreserved	A	N/A	2.3	Y	Absent	MCP-7471T, MCP-AG-6010T, MCP-AS-6010T, MCP-BA-6010T, MCP-CD-6010T, MCP-CR-6010T, MCP-PB-6010T, MCP-SE-6010T, PREPT, TS
L0914981-04A	Amber 250ml unpreserved	A	N/A	2.3	Y	Absent	MCP-8081-04
L0914981-04B	Amber 250ml unpreserved	A	N/A	2.3	Y	Absent	MCP-7471T, MCP-AG-6010T, MCP-AS-6010T, MCP-BA-6010T, MCP-CD-6010T, MCP-CR-6010T, MCP-PB-6010T, MCP-SE-6010T, PREPT, TS

Container Comments

Container ID	Comments
L0914981-03B	This container has not been properly returned to CUSTODY! It was last assigned to THOANG for department CUSTODY on 10/21/09 14:29 .
L0914981-04B	This container has not been properly returned to CUSTODY! It was last assigned to THOANG for department CUSTODY on 10/21/09 14:29 .

Certificate/Approval Program Summary

Last revised October 22, 2009 - Westboro Facility

The following list includes only those analytes/methods for which certification/approval is currently held.
For a complete listing of analytes for the referenced methods, please contact your Alpha Customer Service Representative.

Connecticut Department of Public Health Certificate/Lab ID: PH-0574. ***NELAP Accredited Solid Waste/Soil.***

Drinking Water (Inorganic Parameters: Color, pH, Turbidity, Conductivity, Alkalinity, Chloride, Free Residual Chlorine, Fluoride, Calcium Hardness, Sulfate, Nitrate, Nitrite, Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Copper, Iron, Lead, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, Zinc, Total Dissolved Solids, Total Organic Carbon, Total Cyanide, Perchlorate. Organic Parameters: Haloacetic Acids, Volatile Organics 524.2, Total Trihalomethanes 524.2, 1,2-Dibromo-3-chloropropane (DBCP), Ethylene Dibromide (EDB).)
Wastewater/Non-Potable Water (Inorganic Parameters: Color, pH, Conductivity, Acidity, Alkalinity, Chloride, Total Residual Chlorine, Fluoride, Total Hardness, Calcium Hardness, Silica, Sulfate, Sulfide, Ammonia, Kjeldahl Nitrogen, Nitrate, Nitrite, O-Phosphate, Total Phosphorus, Aluminum, Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Calcium, Chromium, Hexavalent Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Strontium, Thallium, Tin, Titanium, Vanadium, Zinc, Total Residue (Solids), Total Dissolved Solids, Total Suspended Solids (non-filterable), BOD, CBOD, COD, TOC, Total Cyanide, Phenolics, Foaming Agents (MBAS), Bromide, Oil and Grease. Organic Parameters: PCBs, Organochlorine Pesticides, Technical Chlordane, Toxaphene, 2,4-D, 2,4,5-T, 2,4,5-TP(Silvex), Acid Extractables (Phenols), Benzidines, Phthalate Esters, Nitrosamines, Nitroaromatics & Isophorone, Polynuclear Aromatic Hydrocarbons, Haloethers, Chlorinated Hydrocarbons, Volatile Organics, Extractable Petroleum Hydrocarbons (ETPH), MA-EPH, MA-VPH.)
Solid Waste/Soil (Inorganic Parameters: Lead in Paint, pH, Aluminum, Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Calcium, Chromium, Hexavalent Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Tin, Vanadium, Zinc, Total Cyanide, Ignitability, Phenolics, Corrosivity, TCLP Leach (1311), Reactivity. Organic Parameters: PCBs, Organochlorine Pesticides, Technical Chlordane, Toxaphene, Extractable Petroleum Hydrocarbons (ETPH), MA-EPH, MA-VPH, Dicamba, 2,4-D, 2,4,5-T, 2,4,5-TP(Silvex), Volatile Organics, Acid Extractables (Phenols), 3.3'-Dichlorobenzidine, Phthalates, Nitrosamines, Nitroaromatics & Cyclic Ketones, PAHs, Haloethers, Chlorinated Hydrocarbons.)

Maine Department of Human Services Certificate/Lab ID: 2009024.
Drinking Water (Inorganic Parameters: SM9215B, 9221E, 9222B, 9222D, 9223B, EPA 180.1, 300.0, 353.2, SM2130B, 2320B, 4500Cl-D, 4500CN-C, 4500CN-E, 4500F-C, 4500H+B,4500NO3-F, EPA 200.7, EPA 200.8, 245.1. Organic Parameters: 504.1, 524.2, SM 6251B.)
Wastewater/Non-Potable Water (Inorganic Parameters: EPA 120.1, 1664A, 350.1, 351.1, 353.2, 410.4, 420.1, Lachat 10-107-06-1-B, SM2320B, 2340B, 2510B, 2540C, 2540D, 426C, 4500Cl-D, 4500Cl-E, 4500CN-C, 4500CN-E, 4500F-B, 4500F-C, 4500H+B, 4500Norg-B, 4500Norg-C, 4500NH3-B, 4500NH3-G, 4500NH3-H, 4500NO3-F, 4500P-B.5, 4500P-E, 5210B, 5220D, 5310C, EPA 200.7, 200.8, 245.1. Organic Parameters: 608, 624.)

Massachusetts Department of Environmental Protection Certificate/Lab ID: M-MA086.
Drinking Water
Inorganic Parameters: (EPA 200.8 for: Sb,As,Ba,Be,Cd,Cr,Cu,Pb,Ni,Se,Tl)
(EPA 200.7 for: Ba,Be,Ca,Cd,Cr,Cu,Na,Ni) 245.1, (300.0 for: Nitrate-N, Fluoride, Sulfate)
353.2 for: Nitrate-N, Nitrite-N; SM4500NO3-F, 4500F-C, 4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, 2320B, SM2540C, SM4500H-B.
Organic Parameters: (EPA 524.2 for: Trihalomethanes, Volatile Organics)
(504.1 for: 1,2-Dibromoethane, 1,2-Dibromo-3-Chloropropane), 314.0, 332.
Microbiology Parameters: SM9215B; MF-SM9222B; ENZ. SUB. SM9223; EC-SM9221E; MF-SM9222D
Non-Potable Water
Inorganic Parameters:, (EPA 200.8 for: Al,Sb,As,Be,Cd,Cr,Cu,Pb,Mn,Ni,Se,Ag,Tl,Zn)
(EPA 200.7 for: Al,Sb,As,Be,Cd,Cr,Co,Cu,Fe,Pb,Mn,Mo,Ni,Se,Ag,Sr,Tl,Ti,V,Zn,Ca,Mg,Na,K)
245.1, SM4500H,B, EPA 120.1, SM2510B, 2540C, 2540B, 2340B, 2320B, 4500CL-E, 4500F-BC, 426C, SM4500NH3-BH, (EPA 350.1 for: Ammonia-N), LACHAT 10-107-06-1-B for Ammonia-N, SM4500NO3-F, 353.2 for Nitrate-N, SM4500NH3-B,C-Titr, SM4500NH3-BC-NES, EPA 351.1, SM4500P-E, 4500P-B,E, 5220D, EPA 410.4, SM 5210B, 5310C, 4500CN-CE, 2540D, 4500CL-D, EPA 1664, SM14 510AC, EPA 420.1
Organic Parameters: (EPA 624 for Volatile Halocarbons, Volatile Aromatics)
(608 for: Chlordane, Aldrin, Dieldrin, DDD, DDE, DDT, Heptachlor, Heptachlor Epoxide, PCBs-Water), EPA 625 for SVOC Acid Extractables and SVOC Base/Neutral Extractables, 600/4-81-045-PCB-Oil

New Hampshire Department of Environmental Services Certificate/Lab ID: 200307. ***NELAP Accredited.***
Drinking Water (Inorganic Parameters: SM6215B, 9222B, 9223B Colilert, EPA 200.7, 200.8, 245.2, 120.1, 300.0, 314.0, SM4500CN-E, 4500H+B, 4500NO3-F, 2320B, 2510B, 2540C, 4500F-C, 5310C, 2120B, EPA 331.0. Organic Parameters: 504.1, 524.2, SM6251B.)
Non-Potable Water (Inorganic Parameters: SM9222D, 9221B, 9222B, 9221E-EC, EPA 200.7, 200.8, 245.1, 245.2, SW-846 6010B, 6020, 7196A, 7470A, SM3500-CR-D, EPA 120.1, 300.0, 350.1, 351.1, 353.2, 420.1, 1664A, SW-846 9010, 9030, 9040B, SM426C, SM2310B, 2540B, 2540D, 4500H+B, 4500NH3-H, 4500NH3-E, 4500NO2-B, 4500P-E, 4500-S2-D, 5210B, 2320B, 2540C, 4500F-C, 5310C, 5540C, LACHAT 10-117-07-1-B, LACHAT 10-107-06-1-B, LACHAT 10-107-04-1-C, LACHAT 10-107-04-1-J, LACHAT 10-117-07-1-A, SM4500CL-E, LACHAT 10-204-00-1-A, LACHAT 10-107-06-2-D. Organic Parameters: SW-846 3005A, 3015A, 3510C, 5030B, 8021B, 8260B, 8270C, 8330, EPA 624, 625, 608, SW-846 8082, 8081A.)
Solid & Chemical Materials (Inorganic Parameters: SW-846 6010B, 7196A, 7471A, 7.3.3.2, 7.3.4.2, 1010, 1030, 9010, 9012A, 9014, 9030B, 9040, 9045C, 9050C, 1311, 3005A, 3050B, 3051A. Organic Parameters: SW-846 3540C, 3545, 3580A, 5030B, 5035, 8021B, 8260B, 8270C, 8330, 8151A, 8082, 8081A.)

New Jersey Department of Environmental Protection Certificate/Lab ID: MA935. ***NELAP Accredited.***
Drinking Water (Inorganic Parameters: SM9222B, 9221E, 9223B, 9215B, 4500NO3-F, 4500F-C, EPA 300.0, 200.7, 2540C, 2320B, 314.0, SM2120B, 2510B, 5310C, SM4500H-B, EPA 200.8, 245.2. Organic Parameters: 504.1, SM6251B, 524.2.)
Non-Potable Water (Inorganic Parameters: SM5210B, EPA 410.4, SM5220D, 4500Cl-D, EPA 300.0, SM2120B, SM4500F-BC, EPA 200.7, 351.1, LACHAT 10-107-06-2-D, EPA 353.2, SM4500NO3-F, 4500NO2-B, EPA 1664A, SM5310B, C or D, 4500-PE, EPA 420.1, SM4500P-B5+E, 2540B, 2540C, 2540D, EPA 120.1, SM2510B, SM15 426C, SM9221CE, 9222D, 9221B, 9222B, 9215B, 2310B, 2320B, 4500NH3-H, 4500-S D, EPA 350.1, SM5210B, SW-846 3015, 6020, 7470A, 5540C, 4500H-B, EPA 200.8, SM3500Cr-D, EPA 245.1, 245.2, SW-846 9040B, 3005A, EPA 6010B, 7196A, SW-846 9010B, 9030B. Organic Parameters: SW-846 8260B, 8270C, 3510C, EPA 608, 624, 625, SW-846 5030B, 8021B, 8081A, 8082, 8151A, 8330, NJ OQA-QAM-025 Rev.7.)
Solid & Chemical Materials (Inorganic Parameters: SW-846 9040B, 3005A, 6010B, 7196A, 5030B, 9010B, 9030B, 1030, 1311, 3050B, 3051, 7471A, 9014, 9012A, 9045C, 9050A, 9065. Organic Parameters: SW-846 8021B, 8081A, 8082, 8151A, 8330, 8260B, 8270C, 1311, 1312, 3540C, 3545, 3550B, 3580A, 5035L, 5035H, NJ OQA-QAM-025 Rev.7.)

New York Department of Health Certificate/Lab ID: 11148. ***NELAP Accredited.***
Drinking Water (Inorganic Parameters: SM9223B, 9222B, 9215B, EPA 200.8, 200.7, 245.2, SM5310C, EPA 314.0, 332.0, SM2320B, EPA 300.0, SM2120B, 4500CN-E, 4500F-C, 4500H-B, 4500NO3-F, 2540C, EPA 120.1, SM 2510B. Organic Parameters: EPA 524.2, 504.1.)
Non-Potable Water (Inorganic Parameters: SM9221E, 9222D, 9221B, 9222B, 9215B, 5210B, EPA 410.4, SM5220D, 2310B-4a, 2320B, EPA 200.7, 300.0, LACHAT 10-117-07-1A or B, SM4500Cl-E, 4500F-C, SM15 426C, EPA 350.1, LACHAT 10-107-06-1-B, SM4500NH3-H, EPA 351.1, LACHAT 10-107-06-2, EPA 353.2, LACHAT 10-107-041-C, SM4500-NO3-F, 4500-NO2-B, 4500P-E, 2540C, 2540B, 2540D, EPA 200.8, EPA 6010B, 6020, EPA 7196A, S\M3500Cr-D, EPA 245.1, 245.2, 7470A, SM2120B, SM4500-CN-E LACHAT 10-204-00-1-A, EPA 9040B, SM4500-HB, EPA 1664A, SM5310C, EPA 420.1, SM14 510C, EPA 120.1, SM2510B, SM4500S-D, SM5540C, EPA 3005A, 3015. Organic Parameters: EPA 624, 8260B, 8270C, 625, 608, 8081A, 8151A, 8330, 8082, EPA 3510C, 5030B, 9010B, 9030B.)
Solid & Hazardous Waste (Inorganic Parameters: 1010, 1030, SW-846 Ch 7 Sec 7.3, EPA 6010B, 7196A, 7471A, 9012A, 9014, 9040B, 9045C, 9065, 9050, EPA 1311, 1312, 3005A, 3050B, 9010B, 9030B. Organic Parameters: EPA 8260B, 8270C, 8081A, 8151A, 8330, 8082, 3540C, 3545, 3546, 3580, 5030B, 5035.)

North Carolina Department of the Environment and Natural Resources Certificate/Lab ID : 666. Organic Parameters: MA-EPH, MA-VPH.

Pennsylvania Department of Environmental Protection Certificate/Lab ID : 68-03671. ***NELAP Accredited.***
Non-Potable Water (Organic Parameters: EPA 3510C, 5030B, 625, 624. 608, 8081A, 8082, 8151A, 8260B, 8270C, 8330)
Solid & Hazardous Waste (Inorganic Parameters: EPA 1010, 1030, 1311, 3050B, 3051, 6010B, EPA 7.3.3.2, EPA 7.3.4.2, 7196A, 7471A, 9010B, 9012A, 9014, 9040B, 9045C, 9050, 9065. Organic Parameters: 3540C, 3545, 3580A, 5035, 8021B, 8081A, 8082, 8151A, 8260B, 8270C, 8330)

Rhode Island Department of Health Certificate/Lab ID: LAO00065. ***NELAP Accredited via NY-DOH.***
Refer to MA-DEP Certificate for Potable and Non-Potable Water.
Refer to NY-DOH Certificate for Potable and Non-Potable Water.

Utah Department of Health Certificate/Lab ID: AAMA. ***NELAP Accredited.***
Non-Potable Water (Inorganic Parameters: Chloride EPA 300.0)

Analytes Not Accredited by NELAP

Certification is not available by NELAP for the following analytes: **EPA 8260B:** Freon-113, 1,2,4,5-Tetramethylbenzene. **EPA 8330A:** PETN, Picric Acid, Nitroglycerine, 2,6-DANT, 2,4-DANT. **EPA 8270C:** Methyl naphthalene, Dimethyl naphthalene, Total Methylnapthalenes, Total Dimethylnaphthalenes. **EPA 625:** 4-Chloroaniline. **EPA 350.1** for Ammonia in a Soil matrix.

CHAIN OF CUSTODY

PAGE OF

ALPHA ANALYTICAL

Westborough, MA TEL: 508-898-9220 FAX: 508-898-9193

Mansfield, MA TEL: 508-822-9300 FAX: 508-822-3288

Date Rec'd in Lab: 10/20/09

ALPHA Job #: L0914981

Client Information

Client: McPhail Associates

Address: 2269 Massachusetts Avenue

Cambridge, MA 02140

Phone: 617-868-1420

Fax: 617-868-1423

Email: cwinship@mcphailgeo.com, adonovan@mcphailgeo.com

☐ These samples have been Previously analyzed by Alpha

Project Information

Project Name: Addition to Carlisle School

Project Location: Carlisle, MA

Project #: 5010.2.00

Project Manager: S. Smith

ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ Rush (ONLY IF PRE-APPROVED)

Due Date: 10/27 Time: 5:00 pm

Report Information / Data Deliverables

☐ FAX ☐ EMAIL

☐ ADEx ☐ Add'l Deliverables

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements/Report Limits

State/Fed Program: MA

Criteria: MCP

MCP PRESUMPTIVE CERTAINTY-CT REASONABLE CONFIDENCE PROTOCOLS

☒ Yes ☐ No Are MCP Analytical Methods Required?

☐ Yes ☒ No Are CT RCP (Reasonable Confidence Protocols) Required?

Other Project Specific Requirements/Comments/Detection Limits:

ANALYSIS

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	EPH Deluxe	Pesticides	RCRA-8 Metals	Sample Specific Comments	TOTAL # BOTTLES
4981 1	TP3 6-7'	10/19	1:00	S	TMC	✓				2
2	B2 5-7'	|	|	|	|	✓				1
3	B2, B4, B3 Comp 0-2.5'						✓	✓		2
4	B1, B3 Comp 0-2'						✓	✓		2

SAMPLE HANDLING

Filtration

☐ Done

☐ Not Needed

☐ Lab to do

Preservation

☐ Lab to do

(Please specify below)

Container Type			A	A												
Preservative			A	A	-	-	-	-	-	-	-	-	-	-	-	

PLEASE ANSWER QUESTIONS ABOVE!

IS YOUR PROJECT MA MCP or CT RCP?

FORM NO. 01-01(I) (rev. 30-JUL-07)

Relinquished By:	Date/Time	Received By:	Date/Time
[signature]	10/20/09 3:00	[signature]	10/20/09 1635
[signature]	10/20/09 1750	[signature]	10/20/09 17[illegible]

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Payment Terms.

Alpha Analytical Labs

GC Semi - HP6890 Pest Ch. A

Data file : \\Orgserv1\ee\chem\GCEXT\Pest11.i\091023a.b\10230001.D
Lab Smp Id:
Inj Date : 23-OCT-2009 07:52
Operator : jb Inst ID: Pest11.i
Smp Info : +deg std
Misc Info : wg385667, wg385242, ical4357
Comment : Low Level ICAL - Ultrafast method
Method : \\Orgserv1\ee\chem\GCEXT\Pest11.i\091023a.b\Pest11a.m
Meth Date : 23-Oct-2009 09:09 shaggart Quant Type: ISTD
Cal Date : 15-SEP-2009 19:57 Cal File: 09150022.D
Als bottle: 1 QC Sample: degradation
Dil Factor: 1.00000
Integrator: Falcon Compound Sublist: deg.sub
Target Version: 4.12
Processing Host: EXT-3

Compounds	RT	EXP RT	REL RT	RESPONSE	CONCENTRATIONS ON-COLUMN (ug/mL)	CONCENTRATIONS FINAL (ug/mL)	REVIEW CODE
* 1 1-Bromo-2-nitrobenzene	2.189	2.187	(1.000)	14020465	0.02500		
14 4,4'-DDE	4.612	4.610	(2.107)	425970	0.00069	0.000690(R)	
17 Endrin	5.012	5.010	(2.290)	22038834	0.03792	0.0379(R)	
18 4,4'-DDD	5.050	5.049	(2.307)	955197	0.00187	0.00187(R)	
20 4,4'-DDT	5.247	5.245	(2.397)	19280903	0.03518	0.0352(R)	
21 Endrin Aldehyde	5.462	5.460	(2.495)	1072417	0.00243	0.00242	
24 Endrin Ketone	5.945	5.944	(2.716)	1818365	0.00298	0.00298(R)	

DDT Degradation Percent = 6.684
Endrin Degradataion Percent = 11.60

QC Flag Legend

R - Spike/Surrogate failed recovery limits.

wg385266-1,2,3
1091981-03,04

A ohl

Alpha Analytical Labs

GC Semi - HP6890 Pest Ch. B

Data file : \\Orgserv1\ee\chem\GCEXT\Pest11.i\091023b.b\10230001.D
Lab Smp Id:
Inj Date : 23-OCT-2009 07:52
Operator : jb Inst ID: Pest11.i
Smp Info : +deg std
Misc Info : wg385667, wg385242, ical4358
Comment : Low Level ICAL - Ultrafast method
Method : \\Orgserv1\ee\chem\GCEXT\Pest11.i\091023b.b\Pest11b.m
Meth Date : 23-Oct-2009 09:09 shaggart Quant Type: ISTD
Cal Date : 15-SEP-2009 19:57 Cal File: 09150022.D
Als bottle: 1 QC Sample: degradation
Dil Factor: 1.00000
Integrator: Falcon Compound Sublist: deg.sub
Target Version: 4.12
Processing Host: EXT-3

Compounds	RT	EXP RT	REL RT	RESPONSE	CONCENTRATIONS ON-COLUMN (ug/mL)	FINAL (ug/mL)	REVIEW CODE
* 1 1-Bromo-2-nitrobenzene	2.262	2.261	(1.000)	10761191	0.02500		
14 4,4'-DDE	5.126	5.124	(2.265)	348210	8e-004	0.000847	(RM)
17 Endrin	5.482	5.481	(2.423)	14311669	0.04075	0.0407	(RM)
18 4,4'-DDD	5.534	5.531	(2.446)	799641	0.00277	0.00277	(RM)
20 4,4'-DDT	5.749	5.747	(2.541)	10963194	0.04066	0.0406	(RM)
21 Endrin Aldehyde	5.849	5.847	(2.585)	703375	0.00278	0.00278	(M)
24 Endrin Ketone	6.392	6.391	(2.825)	1135005	0.00334	0.00334	(RM)

DDT Degradation Percent = 9.478
Endrin Degradataion Percent = 11.38

QC Flag Legend

R - Spike/Surrogate failed recovery limits.
M - Compound response manually integrated.

wg 385266-1,2,3
/ 051498L-03,04
B chd

ALPHA ANALYTICAL

Eight Walkup Drive
Westborough, Massachusetts 01581-1019
(508) 898-9220 www.alphalab.com
MA:M-MA086 NH:2003 CT:PH-0574 ME:MA0086 RI:LAO00065 NY:11148 NJ:MA935 Army:USACE

CERTIFICATE OF ANALYSIS

Client: McPhail Associates

Address: 2269 Massachusetts Avenue
Cambridge, MA 02140

Attn: Mr. Ambrose Donovan

Project Number: 5010.2.00

Laboratory Job Number: L0915749

Date Received: 20-OCT-2009

Date Reported: 05-NOV-2009

Delivery Method: Alpha

Site: ADDITION TO CARLISLE SCHOOL

The following questions pertain only to MCP Analytical Methods

An affirmative response to questions A,B,C & D is required for "Presumptive Certainty" status

A. Were all samples received by the laboratory in a condition consistent with those described on their Chain-of-Custody documentation for the data set? YES

B. Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines? YES

C. Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in section 2.0 of the MADEP document CAM VII A, "Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"? YES

D. **VPH and EPH methods only:** Was the VPH or EPH method run without significant modifications, as specified in Section 11.3? N/A

A response to questions E and F is required for "Presumptive Certainty" status

E. Were all QC performance standards and recommendations for the specified method(s) achieved? YES

F. Were results for all analyte-list compounds/elements for the specified method(s) reported? YES

Any answers of NO to the above questions are addressed in the case narrative.

I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this report is, to the best of my knowledge and belief, accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized by: _____
Technical Representative

ALPHA ANALYTICAL

Laboratory Job Number: L0915749
Date Reported: 05-NOV-2009

ALPHA SAMPLE NUMBER	CLIENT IDENTIFICATION	SAMPLE LOCATION
L0915749-01	B2.B4.B5 COMP 0-2.5'	CARLISLE, MA
L0915749-02	B1.B3 COMP 0-2'	CARLISLE, MA

ALPHA ANALYTICAL
NARRATIVE REPORT

Laboratory Job Number: L0915749

The samples were received in accordance with the chain of custody and no significant deviations were encountered during preparation or analysis unless otherwise noted below.

MCP Related Narratives

Chromium, Hexavalent

WG387539: A soluble matrix spike was performed with an acceptable recovery of 85%.

ALPHA ANALYTICAL
CERTIFICATE OF ANALYSIS

MA:M-MA086 NH:2003 CT:PH-0574 ME:MA0086 RI:LAO00065 NY:11148 NJ:MA935 Army:USACE

Laboratory Sample Number: L0915749-01
B2.B4.B5 COMP 0-2.5'
Sample Matrix: SOIL

Date Collected: 19-OCT-2009 13:00
Date Received : 20-OCT-2009
Date Reported : 05-NOV-2009

Condition of Sample: Satisfactory

Field Prep: None

Number & Type of Containers: 1-Amber

PARAMETER	RESULT	UNITS	RDL	REF	METHOD	DATE PREP	DATE ANAL	ID
General Chemistry - Westborough Lab								
Solids, Total	91	%	0.10	30	2540G		1021 13:09	TL
pH	7.3	SU	-	1	9045C		1104 20:45	BH
MCP General Chemistry - Westborough Lab								
Chromium, Hexavalent	ND	mg/kg	0.88	64	7196A	1104 10:00	1105 17:30	ST
General Chemistry - Westborough Lab								
Oxidation/Reduction Potential	290	mv	10	68	1498		1104 17:45	JO

Comments: Complete list of References and Glossary of Terms found in Addendum I

ALPHA ANALYTICAL
CERTIFICATE OF ANALYSIS

MA:M-MA086 NH:2003 CT:PH-0574 ME:MA0086 RI:LAO00065 NY:11148 NJ:MA935 Army:USACE

Laboratory Sample Number: L0915749-02
B1.B3 COMP 0-2'
Sample Matrix: SOIL

Date Collected: 19-OCT-2009 13:00
Date Received : 20-OCT-2009
Date Reported : 05-NOV-2009

Condition of Sample: Satisfactory

Field Prep: None

Number & Type of Containers: 1-Amber

PARAMETER	RESULT	UNITS	RDL	REF	METHOD	DATE PREP	DATE ANAL	ID
General Chemistry - Westborough Lab								
Solids, Total	90	%	0.10	30	2540G		1021 13:09	TL
pH	8.0	SU	-	1	9045C		1104 20:45	BH
MCP General Chemistry - Westborough Lab								
Chromium, Hexavalent	ND	mg/kg	0.89	64	7196A	1104 10:00	1105 17:30	ST
General Chemistry - Westborough Lab								
Oxidation/Reduction Potential	270	mv	10	68	1498		1104 17:45	JO

Comments: Complete list of References and Glossary of Terms found in Addendum I

ALPHA ANALYTICAL
QUALITY ASSURANCE BATCH DUPLICATE ANALYSIS

Laboratory Job Number: L0915749

Parameter	Value 1	Value 2	Units	RPD	RPD Limits
General Chemistry - Westborough Lab for sample(s) 01-02 (L0915658-16, WG387700-1)					
Solids, Total	80	81	%	1	20
General Chemistry - Westborough Lab for sample(s) 01-02 (L0915780-01, WG387553-2)					
pH	7.2	7.2	SU	0	
MCP General Chemistry - Westborough Lab for sample(s) 01-02 (L0915749-01, WG387539-6)					
Chromium, Hexavalent	ND	ND	mg/kg	NC	35
General Chemistry - Westborough Lab for sample(s) 01-02 (L0915749-01, WG387554-2)					
Oxidation/Reduction Potential	290	290	mv	0	

ALPHA ANALYTICAL
QUALITY ASSURANCE BATCH SPIKE ANALYSES

Laboratory Job Number: L0915749

Parameter	% Recovery	QC Criteria
General Chemistry - Westborough Lab LCS for sample(s) 01-02 (WG387553-1)		
pH	100	
General Chemistry - Westborough Lab LCS for sample(s) 01-02 (WG387554-1)		
Oxidation/Reduction Potential	102	

ALPHA ANALYTICAL
QUALITY ASSURANCE BATCH LCS/LCSD ANALYSIS

Laboratory Job Number: L0915749

Parameter	LCS %	LCSD %	RPD	RPD Limit	QC Limits
MCP General Chemistry - Westborough Lab for sample(s) 01-02 (WG387539-2, WG387539-3)					
Chromium, Hexavalent	97	86	12	35	75-125

ALPHA ANALYTICAL
QUALITY ASSURANCE BATCH MS/MSD ANALYSIS

Laboratory Job Number: L0915749

Parameter	MS %	MSD %	RPD	RPD Limit	MS/MSD Limits
MCP General Chemistry - Westborough Lab for sample(s) 01-02 (L0915749-01, WG387539-5)					
Chromium, Hexavalent	85	86	0	35	75-125

ALPHA ANALYTICAL
QUALITY ASSURANCE BATCH BLANK ANALYSIS

Laboratory Job Number: L0915749

PARAMETER	RESULT	UNITS	RDL	REF METHOD	DATE PREP	DATE ANAL	ID
Blank Analysis for sample(s) 01-02 (WG387539-1)							
MCP General Chemistry - Westborough Lab							
Chromium, Hexavalent	ND	mg/kg	0.80	64 7196A	1104 10:00	1105 17:30	ST

REFERENCES

1. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. EPA SW-846. Third Edition. Updates I - IIIA, 1997.

30. Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WPCF. 18th Edition. 1992.

64. Quality Assurance and Quality Control Requirements and Performance Standards for SW-846 Methods. MADEP BWSC. WSC-CAM-IIA (Revision 4), WSC-CAM-V C (Revision 2), WSC-CAM-IIIA (Revision 5). August 2004.

68. Annual Book of ASTM (American Society for Testing and Materials) Standards following extraction by SW-846 EPA Method 9045C under the requirements of MADEP BWSC, WSC-CAM-VIB. August 2004.

GLOSSARY OF TERMS AND SYMBOLS

REF	Reference number in which test method may be found.
METHOD	Method number by which analysis was performed.
ID	Initials of the analyst.
ND	Not detected in comparison to the reported detection limit.
NI	Not Ignitable.
ug/cart	Micrograms per Cartridge.
H	The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

LIMITATION OF LIABILITIES

Alpha Analytical, Inc. performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical, Inc., shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical, Inc. be held liable for any incidental consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical, Inc.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding times and splitting of samples in the field.

ALPHA ANALYTICAL
LOGIN SPECIFIC INFORMATION

Laboratory Job Number: L0915749

Were project specific reporting limits specified? YES

Cooler Information

Cooler	Custody Seal
A	Absent

Container Information

Container ID	Container Type	Cooler	pH	Temp	Pres	Seal	Analysis
L0915749-01A	Amber 250ml unpreserved	A	N/A	2.3	Y	Absent	MCP-HEXCR7196-04, ORP-9045, PH-9045
L0915749-02A	Amber 250ml unpreserved	A	N/A	2.3	Y	Absent	MCP-HEXCR7196-04, ORP-9045, PH-9045

Container Comments

Container ID	Comments

Certificate/Approval Program Summary

Last revised October 22, 2009 - Westboro Facility

The following list includes only those analytes/methods for which certification/approval is currently held.
For a complete listing of analytes for the referenced methods, please contact your Alpha Customer Service Representative.

Connecticut Department of Public Health Certificate/Lab ID: PH-0574. ***NELAP Accredited Solid Waste/Soil.***

Drinking Water (Inorganic Parameters: Color, pH, Turbidity, Conductivity, Alkalinity, Chloride, Free Residual Chlorine, Fluoride, Calcium Hardness, Sulfate, Nitrate, Nitrite, Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Copper, Iron, Lead, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, Zinc, Total Dissolved Solids, Total Organic Carbon, Total Cyanide, Perchlorate. Organic Parameters: Haloacetic Acids, Volatile Organics 524.2, Total Trihalomethanes 524.2, 1,2-Dibromo-3-chloropropane (DBCP), Ethylene Dibromide (EDB).)
Wastewater/Non-Potable Water (Inorganic Parameters: Color, pH, Conductivity, Acidity, Alkalinity, Chloride, Total Residual Chlorine, Fluoride, Total Hardness, Calcium Hardness, Silica, Sulfate, Sulfide, Ammonia, Kjeldahl Nitrogen, Nitrate, Nitrite, O-Phosphate, Total Phosphorus, Aluminum, Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Calcium, Chromium, Hexavalent Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Strontium, Thallium, Tin, Titanium, Vanadium, Zinc, Total Residue (Solids), Total Dissolved Solids, Total Suspended Solids (non-filterable), BOD, CBOD, COD, TOC, Total Cyanide, Phenolics, Foaming Agents (MBAS), Bromide, Oil and Grease. Organic Parameters: PCBs, Organochlorine Pesticides, Technical Chlordane, Toxaphene, 2,4-D, 2,4,5-T, 2,4,5-TP(Silvex), Acid Extractables (Phenols), Benzidines, Phthalate Esters, Nitrosamines, Nitroaromatics & Isophorone, Polynuclear Aromatic Hydrocarbons, Haloethers, Chlorinated Hydrocarbons, Volatile Organics, Extractable Petroleum Hydrocarbons (ETPH), MA-EPH, MA-VPH.)
Solid Waste/Soil (Inorganic Parameters: Lead in Paint, pH, Aluminum, Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Calcium, Chromium, Hexavalent Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Tin, Vanadium, Zinc, Total Cyanide, Ignitability, Phenolics, Corrosivity, TCLP Leach (1311), Reactivity. Organic Parameters: PCBs, Organochlorine Pesticides, Technical Chlordane, Toxaphene, Extractable Petroleum Hydrocarbons (ETPH), MA-EPH, MA-VPH, Dicamba, 2,4-D, 2,4,5-T, 2,4,5-TP(Silvex), Volatile Organics, Acid Extractables (Phenols), 3.3'-Dichlorobenzidine, Phthalates, Nitrosamines, Nitroaromatics & Cyclic Ketones, PAHs, Haloethers, Chlorinated Hydrocarbons.)

Maine Department of Human Services Certificate/Lab ID: 2009024.
Drinking Water (Inorganic Parameters: SM9215B, 9221E, 9222B, 9222D, 9223B, EPA 180.1, 300.0, 353.2, SM2130B, 2320B, 4500Cl-D, 4500CN-C, 4500CN-E, 4500F-C, 4500H+B,4500NO3-F, EPA 200.7, EPA 200.8, 245.1. Organic Parameters: 504.1, 524.2, SM 6251B.)
Wastewater/Non-Potable Water (Inorganic Parameters: EPA 120.1, 1664A, 350.1, 351.1, 353.2, 410.4, 420.1, Lachat 10-107-06-1-B, SM2320B, 2340B, 2510B, 2540C, 2540D, 426C, 4500Cl-D, 4500Cl-E, 4500CN-C, 4500CN-E, 4500F-B, 4500F-C, 4500H+B, 4500Norg-B, 4500Norg-C, 4500NH3-B, 4500NH3-G, 4500NH3-H, 4500NO3-F, 4500P-B.5, 4500P-E, 5210B, 5220D, 5310C, EPA 200.7, 200.8, 245.1. Organic Parameters: 608, 624.)

Massachusetts Department of Environmental Protection Certificate/Lab ID: M-MA086.
Drinking Water
Inorganic Parameters: (EPA 200.8 for: Sb,As,Ba,Be,Cd,Cr,Cu,Pb,Ni,Se,Tl)
(EPA 200.7 for: Ba,Be,Ca,Cd,Cr,Cu,Na,Ni) 245.1, (300.0 for: Nitrate-N, Fluoride, Sulfate)
353.2 for: Nitrate-N, Nitrite-N; SM4500NO3-F, 4500F-C, 4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, 2320B, SM2540C, SM4500H-B.
Organic Parameters: (EPA 524.2 for: Trihalomethanes, Volatile Organics)
(504.1 for: 1,2-Dibromoethane, 1,2-Dibromo-3-Chloropropane), 314.0, 332.
Microbiology Parameters: SM9215B; MF-SM9222B; ENZ. SUB. SM9223; EC-SM9221E; MF-SM9222D
Non-Potable Water
Inorganic Parameters:, (EPA 200.8 for: Al,Sb,As,Be,Cd,Cr,Cu,Pb,Mn,Ni,Se,Ag,Tl,Zn)
(EPA 200.7 for: Al,Sb,As,Be,Cd,Cr,Co,Cu,Fe,Pb,Mn,Mo,Ni,Se,Ag,Sr,Tl,Ti,V,Zn,Ca,Mg,Na,K)
245.1, SM4500H,B, EPA 120.1, SM2510B, 2540C, 2540B, 2340B, 2320B, 4500CL-E, 4500F-BC, 426C, SM4500NH3-BH, (EPA 350.1 for: Ammonia-N), LACHAT 10-107-06-1-B for Ammonia-N, SM4500NO3-F, 353.2 for Nitrate-N, SM4500NH3-B,C-Titr, SM4500NH3-BC-NES, EPA 351.1, SM4500P-E, 4500P-B,E, 5220D, EPA 410.4, SM 5210B, 5310C, 4500CN-CE, 2540D, 4500CL-D, EPA 1664, SM14 510AC, EPA 420.1
Organic Parameters: (EPA 624 for Volatile Halocarbons, Volatile Aromatics)
(608 for: Chlordane, Aldrin, Dieldrin, DDD, DDE, DDT, Heptachlor, Heptachlor Epoxide, PCBs-Water), EPA 625 for SVOC Acid Extractables and SVOC Base/Neutral Extractables, 600/4-81-045-PCB-Oil

New Hampshire Department of Environmental Services Certificate/Lab ID: 200307. ***NELAP Accredited.***
Drinking Water (Inorganic Parameters: SM6215B, 9222B, 9223B Colilert, EPA 200.7, 200.8, 245.2, 120.1, 300.0, 314.0, SM4500CN-E, 4500H+B, 4500NO3-F, 2320B, 2510B, 2540C, 4500F-C, 5310C, 2120B, EPA 331.0. Organic Parameters: 504.1, 524.2, SM6251B.)
Non-Potable Water (Inorganic Parameters: SM9222D, 9221B, 9222B, 9221E-EC, EPA 200.7, 200.8, 245.1, 245.2, SW-846 6010B, 6020, 7196A, 7470A, SM3500-CR-D, EPA 120.1, 300.0, 350.1, 351.1, 353.2, 420.1, 1664A, SW-846 9010, 9030, 9040B, SM426C, SM2310B, 2540B, 2540D, 4500H+B, 4500NH3-H, 4500NH3-E, 4500NO2-B, 4500P-E, 4500-S2-D, 5210B, 2320B, 2540C, 4500F-C, 5310C, 5540C, LACHAT 10-117-07-1-B, LACHAT 10-107-06-1-B, LACHAT 10-107-04-1-C, LACHAT 10-107-04-1-J, LACHAT 10-117-07-1-A, SM4500CL-E, LACHAT 10-204-00-1-A, LACHAT 10-107-06-2-D. Organic Parameters: SW-846 3005A, 3015A, 3510C, 5030B, 8021B, 8260B, 8270C, 8330, EPA 624, 625, 608, SW-846 8082, 8081A.)
Solid & Chemical Materials (Inorganic Parameters: SW-846 6010B, 7196A, 7471A, 7.3.3.2, 7.3.4.2, 1010, 1030, 9010, 9012A, 9014, 9030B, 9040, 9045C, 9050C, 1311, 3005A, 3050B, 3051A. Organic Parameters: SW-846 3540C, 3545, 3580A, 5030B, 5035, 8021B, 8260B, 8270C, 8330, 8151A, 8082, 8081A.)

New Jersey Department of Environmental Protection Certificate/Lab ID: MA935. ***NELAP Accredited.***
Drinking Water (Inorganic Parameters: SM9222B, 9221E, 9223B, 9215B, 4500NO3-F, 4500F-C, EPA 300.0, 200.7, 2540C, 2320B, 314.0, SM2120B, 2510B, 5310C, SM4500H-B, EPA 200.8, 245.2. Organic Parameters: 504.1, SM6251B, 524.2.)
Non-Potable Water (Inorganic Parameters: SM5210B, EPA 410.4, SM5220D, 4500Cl-D, EPA 300.0, SM2120B, SM4500F-BC, EPA 200.7, 351.1, LACHAT 10-107-06-2-D, EPA 353.2, SM4500NO3-F, 4500NO2-B, EPA 1664A, SM5310B, C or D, 4500-PE, EPA 420.1, SM4500P-B5+E, 2540B, 2540C, 2540D, EPA 120.1, SM2510B, SM15 426C, SM9221CE, 9222D, 9221B, 9222B, 9215B, 2310B, 2320B, 4500NH3-H, 4500-S D, EPA 350.1, SM5210B, SW-846 3015, 6020, 7470A, 5540C, 4500H-B, EPA 200.8, SM3500Cr-D, EPA 245.1, 245.2, SW-846 9040B, 3005A, EPA 6010B, 7196A, SW-846 9010B, 9030B. Organic Parameters: SW-846 8260B, 8270C, 3510C, EPA 608, 624, 625, SW-846 5030B, 8021B, 8081A, 8082, 8151A, 8330, NJ OQA-QAM-025 Rev.7.)
Solid & Chemical Materials (Inorganic Parameters: SW-846 9040B, 3005A, 6010B, 7196A, 5030B, 9010B, 9030B, 1030, 1311, 3050B, 3051, 7471A, 9014, 9012A, 9045C, 9050A, 9065. Organic Parameters: SW-846 8021B, 8081A, 8082, 8151A, 8330, 8260B, 8270C, 1311, 1312, 3540C, 3545, 3550B, 3580A, 5035L, 5035H, NJ OQA-QAM-025 Rev.7.)

New York Department of Health Certificate/Lab ID: 11148. ***NELAP Accredited.***
Drinking Water (Inorganic Parameters: SM9223B, 9222B, 9215B, EPA 200.8, 200.7, 245.2, SM5310C, EPA 314.0, 332.0, SM2320B, EPA 300.0, SM2120B, 4500CN-E, 4500F-C, 4500H-B, 4500NO3-F, 2540C, EPA 120.1, SM 2510B. Organic Parameters: EPA 524.2, 504.1.)
Non-Potable Water (Inorganic Parameters: SM9221E, 9222D, 9221B, 9222B, 9215B, 5210B, EPA 410.4, SM5220D, 2310B-4a, 2320B, EPA 200.7, 300.0, LACHAT 10-117-07-1A or B, SM4500Cl-E, 4500F-C, SM15 426C, EPA 350.1, LACHAT 10-107-06-1-B, SM4500NH3-H, EPA 351.1, LACHAT 10-107-06-2, EPA 353.2, LACHAT 10-107-041-C, SM4500-NO3-F, 4500-NO2-B, 4500P-E, 2540C, 2540B, 2540D, EPA 200.8, EPA 6010B, 6020, EPA 7196A, S\M3500Cr-D, EPA 245.1, 245.2, 7470A, SM2120B, SM4500-CN-E LACHAT 10-204-00-1-A, EPA 9040B, SM4500-HB, EPA 1664A, SM5310C, EPA 420.1, SM14 510C, EPA 120.1, SM2510B, SM4500S-D, SM5540C, EPA 3005A, 3015. Organic Parameters: EPA 624, 8260B, 8270C, 625, 608, 8081A, 8151A, 8330, 8082, EPA 3510C, 5030B, 9010B, 9030B.)
Solid & Hazardous Waste (Inorganic Parameters: 1010, 1030, SW-846 Ch 7 Sec 7.3, EPA 6010B, 7196A, 7471A, 9012A, 9014, 9040B, 9045C, 9065, 9050, EPA 1311, 1312, 3005A, 3050B, 9010B, 9030B. Organic Parameters: EPA 8260B, 8270C, 8081A, 8151A, 8330, 8082, 3540C, 3545, 3546, 3580, 5030B, 5035.)

North Carolina Department of the Environment and Natural Resources Certificate/Lab ID : 666. Organic Parameters: MA-EPH, MA-VPH.

Pennsylvania Department of Environmental Protection Certificate/Lab ID : 68-03671. ***NELAP Accredited.***
Non-Potable Water (Organic Parameters: EPA 3510C, 5030B, 625, 624. 608, 8081A, 8082, 8151A, 8260B, 8270C, 8330)
Solid & Hazardous Waste (Inorganic Parameters: EPA 1010, 1030, 1311, 3050B, 3051, 6010B, EPA 7.3.3.2, EPA 7.3.4.2, 7196A, 7471A, 9010B, 9012A, 9014, 9040B, 9045C, 9050, 9065. Organic Parameters: 3540C, 3545, 3580A, 5035, 8021B, 8081A, 8082, 8151A, 8260B, 8270C, 8330)

Rhode Island Department of Health Certificate/Lab ID: LAO00065. ***NELAP Accredited via NY-DOH.***
Refer to MA-DEP Certificate for Potable and Non-Potable Water.
Refer to NY-DOH Certificate for Potable and Non-Potable Water.

Utah Department of Health Certificate/Lab ID: AAMA. ***NELAP Accredited.***
Non-Potable Water (Inorganic Parameters: Chloride EPA 300.0)

Analytes Not Accredited by NELAP

Certification is not available by NELAP for the following analytes: **EPA 8260B:** Freon-113, 1,2,4,5-Tetramethylbenzene. **EPA 8330A:** PETN, Picric Acid, Nitroglycerine, 2,6-DANT, 2,4-DANT. **EPA 8270C:** Methyl naphthalene, Dimethyl naphthalene, Total Methylnapthalenes, Total Dimethylnaphthalenes. **EPA 625:** 4-Chloroaniline. **EPA 350.1** for Ammonia in a Soil matrix.

L0915749

CHAIN OF CUSTODY

PAGE OF

ALPHA ANALYTICAL

Westborough, MA TEL: 508-898-9220 FAX: 508-898-9193
Mansfield, MA TEL: 508-822-9300 FAX: 508-822-3288

Date Rec'd in Lab: 10/20/09

ALPHA Job #: ~~L0914981~~

Client Information

Client: McPhail Associates
Address: 2269 Massachusetts Avenue
Cambridge, MA 02140
Phone: 617-868-1420
Fax: 617-868-1423
Email: cwinship@mcphailgeo.com, adonovan@mcphailgeo.com

☐ These samples have been Previously analyzed by Alpha

Project Information

Project Name: Addition to Carlisle School
Project Location: Carlisle, MA
Project #: 5010.2.00
Project Manager: S. Smith
ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ Rush (ONLY IF PRE-APPROVED)

Due Date: ~~10/27~~ 11/5/09 Time: ~~5:00~~ pm

Report Information Data Deliverables

☐ FAX ☐ EMAIL
☐ ADEx ☐ Add'l Deliverables

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements/Report Limits

State/Fed Program: MA Criteria: MCP

MCP PRESUMPTIVE CERTAINTY-CT REASONABLE CONFIDENCE PROTOCOLS

☒ Yes ☐ No Are MCP Analytical Methods Required?
☐ Yes ☒ No Are CT RCP (Reasonable Confidence Protocols) Required?

Other Project Specific Requirements/Comments/Detection Limits:

ANALYSIS

SAMPLE HANDLING
Filtration
☐ Done
☐ Not Needed
☐ Lab to do
Preservation
☐ Lab to do
(Please specify below)

Sample Specific Comments

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	EPH Option	Restricted	RCRA-8 Metals	Hexavalent Chromium								Total # Bottles
~~4981~~ 1	TP3 0-7'	10/19	1:00	S	TMC	1											2
2	B2 5-7					1											1
5749.1 3	B2.B4.B5 Comp 0-2.5'						1	1	X								2
2 4	B1.B3 Comp 0-2'						1	1	X								2

PLEASE ANSWER QUESTIONS ABOVE!

IS YOUR PROJECT MA MCP or CT RCP?

	A	A									
Container Type	A	A									
Preservative	A	A	-	-	-	-	-	-	-	-	-

Relinquished By:	Date/Time	Received By:	Date/Time
[signature]	10/20/09 1350	[signature]	10/20/09 1635
[signature]	10/20/09 1750	[signature]	10/20/09 17[illegible]

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Payment Terms.

FORM NO. 01-01(I) (rev. 30-JUL-07)