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DRAINAGE REPORT FOR 343-351 SUMMER STREET SOMERVILLE, MA

February 2011



Prepared for:

Strategic Capital Group, LLC.
Waltham, MA

I. Project Descriptions:

This report represents a hydrologic study of the proposed site redevelopment of two existing lots at 343 and 351 Summer Street in Somerville, MA. DCI prepared a plan for the Applicant, Strategic Capital, LLC, to combine the two lots, however we are not aware of the status of the lot consolidation. The proposed redevelopment will consist of the construction of a new 3-story residential building with surface and underground parking at 351, and 1-story function hall building with surface parking at 343. Site access will be provided by a new curb cut and the modification of an existing curb cut, all on Summer Street.

The purpose of this hydrologic study is to insure that the proposed improvements of this site meet the requirements of the City of Somerville's Rules and Regulations and to insure there is no increase of stormwater runoff from the property. This report does not reflect any future proposed drainage system outside of the site limits.

II. Hydraulic Data:

The hydraulic model used for this analysis is based upon the Natural Resources Conservation Service (NRCS) (previously known as Soil Conservation Service) Technical Release 20 (TR-20) method in HydroCAD. Peak runoff rate and volume were modeled for the statistical 24-hour duration of the 2, 10, 25 and 100-year storm events. The results of these calculations for both existing and proposed conditions are included in Appendix A of this report.

III. Soils:

A Report of Subsurface Conditions was prepared by Geotechnical Consultants, Inc. in June, 2007. Boring logs (Appendix B) from that study indicate that the existing soils at the location of proposed infiltration are "medium sand." Groundwater elevation near this location (Boring B-1 and B-6) is at a minimum of 10ft below grade. A conservative percolation rate of 0.27 inches per hour (Rawls Number) was used for design purposes.

IV. Hydrologic Analysis:

EXISTING

The site consists of two lots and has a combined area of approximately 0.93 acres. The lot at 351 Summer Street (0.55 acres) is currently an asphalt parking lot for the properties at 5 Cutter Avenue and 361 Summer Street. The parking lot is completely impervious and has no stormwater collection or treatment system. Topography is relatively flat, but grades indicate that stormwater sheetflows from the northeast to the southwest and into catch basins on Summer Street.

The lot at 343 Summer Street (0.38 acres) is mostly grass, with the exception of an MBTA vent shaft and a concrete area for access to the vent. The topography and drainage patterns are consistent with the adjacent lot at 343 Summer Street.

There is a 24"x17" municipal combined sewer/drainage system located in Summer Street. There is an existing sewer manhole onsite with a 12" service connecting to the combined sewer in the street. Anticipated runoff rates and volumes to the combined sewer are shown in Table 1 below:

Table 1
Time of Concentration = 6 Min.
Peak Discharges & Volumes

<i>Description</i>	<i>Pre-Development</i>	<i>Post Development</i>
Drainage Area	0.93 Ac.	0.93 Ac
Curve Number	84	87
Time of Concentration	6 Min.	6 Min.
<i>Peak Discharge</i>	<i>Cubic Feet Per Second</i>	<i>Cubic Feet Per Second</i>
2-Year	1.80	1.62
10-Year	3.08	2.38
25-Year	4.06	3.01
100-Year	6.10	5.54
<i>Volume</i>	<i>Cubic Feet</i>	<i>Cubic Feet</i>
2-Year	6,057	5,840
10-Year	10,129	10,046
25-Year	13,269	13,188
100-Year	19,820	19,532

PROPOSED SITE IMPROVEMENTS

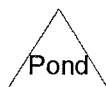
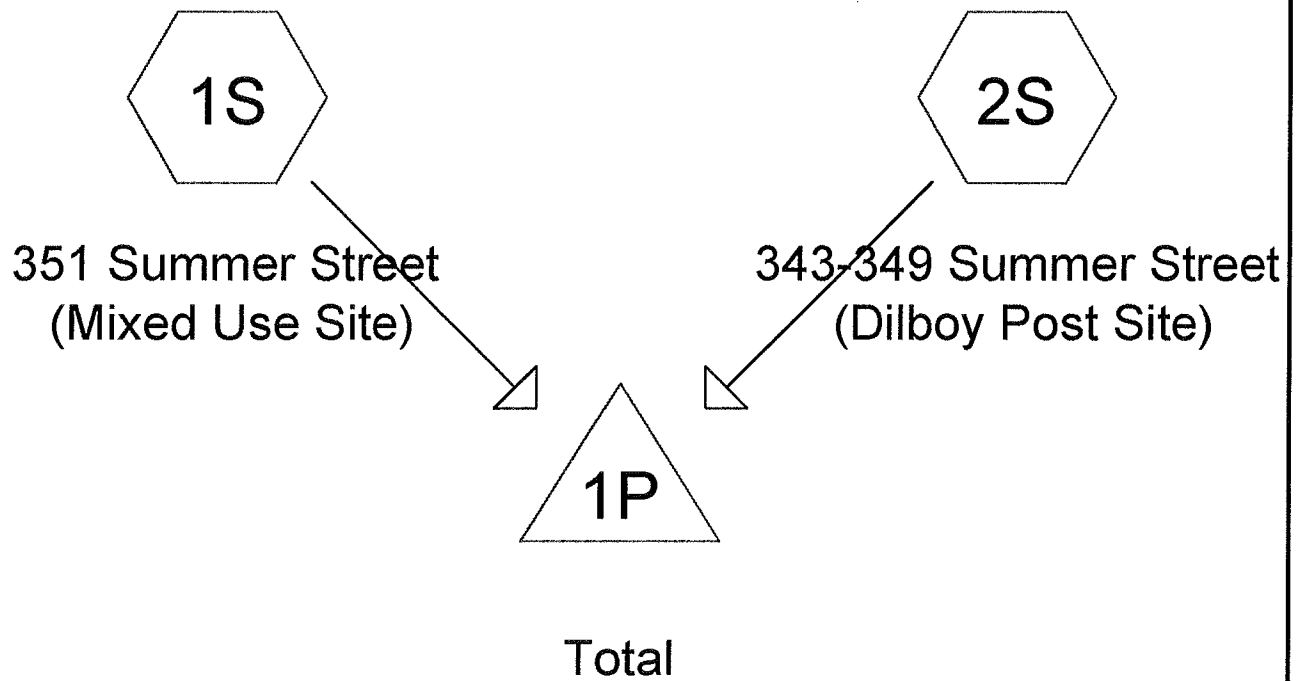
The proposed site improvements will result in an increase in impervious area. The increase in stormwater discharge rate and volume will be mitigated by the proposed stormwater management system, including roof collection, trench drain with sump, deep sump catch basins, particle separator, grass swales, and an infiltration trench.

Improvements to the (westerly) lot at 351 Summer St. include a 3-story residential building with garage and surface parking, and the majority of the proposed 1-story Function Hall, which straddles the lot line. Roof runoff will be collected internally and discharged to the proposed infiltration trench. Surface parking is under the building and will be fitted with floor drains, per Plumbing Code. Landscaped area in the rear and west side of the building will contain a grass swale sized to collect and recharge the 100 year storm event for the limited contributing areas. For storms larger than the 100 year event, a pipe is proposed to carry emergency overflow to Summer Street, rather than the abutters. The landscaping and walkways at the front of the building will be pitched away from the building and will sheetflow directly to catch basins in Summer Street.

Improvements to the (easterly) lot at 343 Summer St. include a parking lot accessed by a proposed curb cut. Runoff from the parking area will be collected, treated, and routed to the infiltration trench. The infiltration trench also acts as a detention system. An outlet pipe will be installed roughly 5 inches above the bottom of the infiltration chamber to control the discharge rate, but also allowing for complete storage and infiltration of small storm events.

V. Conclusions:

As this analysis shows, the proposed stormwater management system will be capable of mitigating all storm events up to and including a 100-year storm. With the proposed drainage improvements the demand on the local drainage infrastructure will be reduced.



Drainage Diagram for EXISTING SCS

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EXISTING SCS

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EXISTING
Type III 24-hr 2-Year Rainfall=3.25"

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Summary for Subcatchment 1S: 351 Summer Street (Mixed Use Site)

Runoff = 1.59 cfs @ 12.09 hrs, Volume= 5,279 cf, Depth> 2.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.25"

Area (sf)	CN	Description
22,467	98	Paved parking & roofs
22,467		100.00% Impervious Area

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

Summary for Subcatchment 2S: 343-349 Summer Street (Dilboy Post Site)

Runoff = 0.22 cfs @ 12.11 hrs, Volume= 778 cf, Depth> 0.56"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.25"

Area (sf)	CN	Description
14,831	61	Grass
1,965	98	Cem Conc Paving
16,796	65	Weighted Average
14,831		88.30% Pervious Area
1,965		11.70% Impervious Area

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

Summary for Pond 1P: Total

Inflow Area = 39,263 sf, 62.23% Impervious, Inflow Depth > 1.85" for 2-Year event
 Inflow = 1.80 cfs @ 12.09 hrs, Volume= 6,057 cf
 Primary = 1.80 cfs @ 12.09 hrs, Volume= 6,057 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

EXISTING SCS

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EXISTING

Type III 24-hr 10-Year Rainfall=4.90"

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Summary for Subcatchment 1S: 351 Summer Street (Mixed Use Site)

Runoff = 2.41 cfs @ 12.09 hrs, Volume= 8,102 cf, Depth> 4.33"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (sf)	CN	Description
22,467	98	Paved parking & roofs
22,467		100.00% Impervious Area

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

Summary for Subcatchment 2S: 343-349 Summer Street (Dilboy Post Site)

Runoff = 0.67 cfs @ 12.10 hrs, Volume= 2,026 cf, Depth> 1.45"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (sf)	CN	Description
14,831	61	Grass
1,965	98	Cem Conc Paving
16,796	65	Weighted Average
14,831		88.30% Pervious Area
1,965		11.70% Impervious Area

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

Summary for Pond 1P: Total

Inflow Area = 39,263 sf, 62.23% Impervious, Inflow Depth > 3.10" for 10-Year event
 Inflow = 3.08 cfs @ 12.09 hrs, Volume= 10,129 cf
 Primary = 3.08 cfs @ 12.09 hrs, Volume= 10,129 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

EXISTING SCS

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EXISTING

Type III 24-hr 25-Year Rainfall=6.10"

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Summary for Subcatchment 1S: 351 Summer Street (Mixed Use Site)

Runoff = 3.01 cfs @ 12.09 hrs, Volume= 10,148 cf, Depth> 5.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.10"

Area (sf)	CN	Description
22,467	98	Paved parking & roofs
22,467		100.00% Impervious Area

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

Summary for Subcatchment 2S: 343-349 Summer Street (Dilboy Post Site)

Runoff = 1.05 cfs @ 12.10 hrs, Volume= 3,121 cf, Depth> 2.23"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.10"

Area (sf)	CN	Description
14,831	61	Grass
1,965	98	Cem Conc Paving
16,796	65	Weighted Average
14,831		88.30% Pervious Area
1,965		11.70% Impervious Area

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

Summary for Pond 1P: Total

Inflow Area = 39,263 sf, 62.23% Impervious, Inflow Depth > 4.06" for 25-Year event
 Inflow = 4.06 cfs @ 12.09 hrs, Volume= 13,269 cf
 Primary = 4.06 cfs @ 12.09 hrs, Volume= 13,269 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

EXISTING SCS

Type III 24-hr 100-Year Rainfall=8.50"

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Summary for Subcatchment 1S: 351 Summer Street (Mixed Use Site)

Runoff = 4.20 cfs @ 12.09 hrs, Volume= 14,225 cf, Depth> 7.60"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.50"

Area (sf)	CN	Description
22,467	98	Paved parking & roofs
22,467		100.00% Impervious Area

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

Summary for Subcatchment 2S: 343-349 Summer Street (Dilboy Post Site)

Runoff = 1.91 cfs @ 12.09 hrs, Volume= 5,595 cf, Depth> 4.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.50"

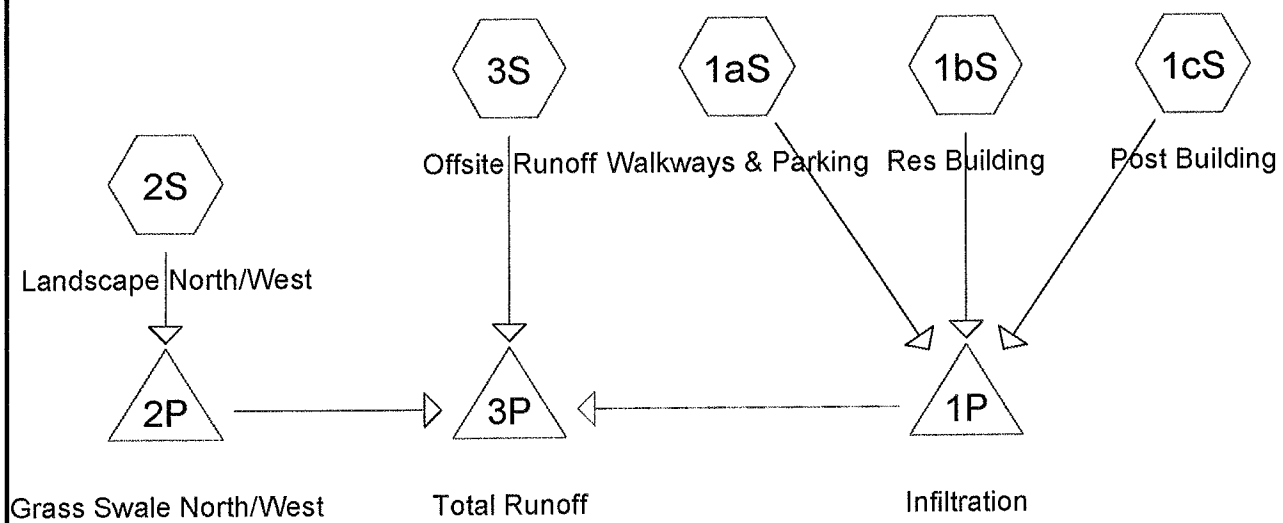
Area (sf)	CN	Description
14,831	61	Grass
1,965	98	Cem Conc Paving
16,796	65	Weighted Average
14,831		88.30% Pervious Area
1,965		11.70% Impervious Area

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

Summary for Pond 1P: Total

Inflow Area = 39,263 sf, 62.23% Impervious, Inflow Depth > 6.06" for 100-Year event
 Inflow = 6.10 cfs @ 12.09 hrs, Volume= 19,820 cf
 Primary = 6.10 cfs @ 12.09 hrs, Volume= 19,820 cf, Atten= 0%, Lag= 0.0 min

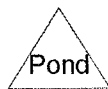
Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs



Subcat



Reach



Pond



Link

Drainage Diagram for PROPOSED SCS 2011

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PROPOSED SCS 2011

Type III 24-hr 2-Year Rainfall=3.25"

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Summary for Subcatchment 1aS: Walkways & Parking

Runoff = 0.77 cfs @ 12.09 hrs, Volume= 2,675 cf, Depth= 2.91"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Type III 24-hr 2-Year Rainfall=3.25"

Area (sf)	CN	Description
10,752	98	Paved parking & roofs
* 295	47	Brush, Good, HSG B
11,047	97	Weighted Average
295		2.67% Pervious Area
10,752		97.33% Impervious Area

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

Summary for Subcatchment 1bS: Res Building

Runoff = 0.98 cfs @ 12.09 hrs, Volume= 3,484 cf, Depth= 3.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Type III 24-hr 2-Year Rainfall=3.25"

Area (sf)	CN	Description
13,858	98	Paved parking & roofs
13,858		100.00% Impervious Area

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

Summary for Subcatchment 1cS: Post Building

Runoff = 0.29 cfs @ 12.09 hrs, Volume= 1,033 cf, Depth= 3.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Type III 24-hr 2-Year Rainfall=3.25"

Area (sf)	CN	Description
4,107	98	Paved parking & roofs
4,107		100.00% Impervious Area

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

Summary for Subcatchment 2S: Landscape North/West

Runoff = 0.04 cfs @ 12.12 hrs, Volume= 174 cf, Depth= 0.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.25"

Area (sf)	CN	Description
4,490	61	>75% Grass cover, Good, HSG B
4,490		100.00% Pervious Area

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

Summary for Subcatchment 3S: Offsite Runoff

Runoff = 0.01 cfs @ 12.40 hrs, Volume= 81 cf, Depth= 0.19"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.25"

Area (sf)	CN	Description
* 4,743	47	Brush, Good, HSG B
518	98	Building, Walks & Parking
5,261	52	Weighted Average
4,743		90.15% Pervious Area
518		9.85% Impervious Area

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

Summary for Pond 1P: Infiltration

Inflow Area = 29,012 sf, 98.98% Impervious, Inflow Depth = 2.98" for 2-Year event
 Inflow = 2.04 cfs @ 12.09 hrs, Volume= 7,193 cf
 Outflow = 1.63 cfs @ 12.15 hrs, Volume= 6,303 cf, Atten= 20%, Lag= 3.8 min
 Discarded = 0.01 cfs @ 3.45 hrs, Volume= 545 cf
 Primary = 1.62 cfs @ 12.15 hrs, Volume= 5,758 cf
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 31.43' @ 12.15 hrs Surf.Area= 885 sf Storage= 1,641 cf

Plug-Flow detention time= 123.2 min calculated for 6,293 cf (87% of inflow)
 Center-of-Mass det. time= 67.3 min (826.9 - 759.6)

PROPOSED SCS 2011

Type III 24-hr 2-Year Rainfall=3.25"

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Volume	Invert	Avail.Storage	Storage Description
#1	33.40'	150 cf	Custom Stage Data (Prismatic) Listed below (Recalc) 16.75'W x 52.84'L x 5.00'H Field A 4,425 cf Overall - 965 cf Embedded = 3,461 cf x 40.0% Voids StormTech SC-740 x 21 Inside #2 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
#2A	28.00'	1,384 cf	
#3A	30.00'	965 cf	
		2,499 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
33.40	4	0	0
33.50	750	38	38
33.60	1,500	113	150

Device	Routing	Invert	Outlet Devices
#1	Primary	30.40'	10.0" Round Outlet L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 30.40' / 30.30' S= 0.0100 '/' Cc= 0.900 n= 0.013
#2	Discarded	28.00'	0.270 in/hr Exfiltration over Surface area
#3	Secondary	33.50'	179.9 deg x 65.0' long sheet flow to street C= 2.46

Discarded OutFlow Max=0.01 cfs @ 3.45 hrs HW=28.06' (Free Discharge)

└─2=Exfiltration (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=1.62 cfs @ 12.15 hrs HW=31.43' (Free Discharge)

└─1=Outlet (Inlet Controls 1.62 cfs @ 2.97 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=28.00' (Free Discharge)

└─3=sheet flow to street (Controls 0.00 cfs)

Summary for Pond 2P: Grass Swale North/West

Inflow Area = 4,490 sf, 0.00% Impervious, Inflow Depth = 0.46" for 2-Year event
 Inflow = 0.04 cfs @ 12.12 hrs, Volume= 174 cf
 Outflow = 0.00 cfs @ 16.24 hrs, Volume= 162 cf, Atten= 91%, Lag= 246.8 min
 Discarded = 0.00 cfs @ 16.24 hrs, Volume= 162 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 32.82' @ 16.24 hrs Surf.Area= 493 sf Storage= 80 cf

Plug-Flow detention time= 332.2 min calculated for 162 cf (93% of inflow)

Center-of-Mass det. time= 297.7 min (1,210.5 - 912.8)

Volume	Invert	Avail.Storage	Storage Description
#1	32.50'	2,572 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
32.50	0	0	0
32.90	608	122	122
33.70	1,463	828	950
34.50	2,593	1,622	2,572

Device	Routing	Invert	Outlet Devices
#1	Primary	34.50'	200.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#2	Discarded	32.50'	0.270 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 0.00'

Discarded OutFlow Max=0.00 cfs @ 16.24 hrs HW=32.82' (Free Discharge)
 ↳2=Exfiltration (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=32.50' (Free Discharge)
 ↳1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 3P: Total Runoff

Inflow Area = 38,763 sf, 75.42% Impervious, Inflow Depth = 1.81" for 2-Year event
 Inflow = 1.62 cfs @ 12.15 hrs, Volume= 5,840 cf
 Primary = 1.62 cfs @ 12.15 hrs, Volume= 5,840 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

PROPOSED SCS 2011

Type III 24-hr 10-Year Rainfall=4.90"

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Summary for Subcatchment 1aS: Walkways & Parking

Runoff = 1.18 cfs @ 12.09 hrs, Volume= 4,186 cf, Depth= 4.55"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (sf)	CN	Description
10,752	98	Paved parking & roofs
* 295	47	Brush, Good, HSG B
11,047	97	Weighted Average
295		2.67% Pervious Area
10,752		97.33% Impervious Area

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

Summary for Subcatchment 1bS: Res Building

Runoff = 1.49 cfs @ 12.09 hrs, Volume= 5,385 cf, Depth= 4.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (sf)	CN	Description
13,858	98	Paved parking & roofs
13,858		100.00% Impervious Area

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

Summary for Subcatchment 1cS: Post Building

Runoff = 0.44 cfs @ 12.09 hrs, Volume= 1,596 cf, Depth= 4.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (sf)	CN	Description
4,107	98	Paved parking & roofs
4,107		100.00% Impervious Area

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

Summary for Subcatchment 2S: Landscape North/West

Runoff = 0.14 cfs @ 12.10 hrs, Volume= 490 cf, Depth= 1.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Rainfall=4.90"

Area (sf)	CN	Description
4,490	61	>75% Grass cover, Good, HSG B
4,490		100.00% Pervious Area

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

Summary for Subcatchment 3S: Offsite Runoff

Runoff = 0.07 cfs @ 12.12 hrs, Volume= 333 cf, Depth= 0.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Rainfall=4.90"

Area (sf)	CN	Description
* 4,743	47	Brush, Good, HSG B
518	98	Building, Walks & Parking
5,261	52	Weighted Average
4,743		90.15% Pervious Area
518		9.85% Impervious Area

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

Summary for Pond 1P: Infiltration

Inflow Area = 29,012 sf, 98.98% Impervious, Inflow Depth = 4.62" for 10-Year event
 Inflow = 3.11 cfs @ 12.09 hrs, Volume= 11,168 cf
 Outflow = 2.32 cfs @ 12.16 hrs, Volume= 10,275 cf, Atten= 25%, Lag= 4.5 min
 Discarded = 0.01 cfs @ 2.30 hrs, Volume= 562 cf
 Primary = 2.31 cfs @ 12.16 hrs, Volume= 9,713 cf
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 32.06' @ 12.16 hrs Surf.Area= 885 sf Storage= 1,990 cf

Plug-Flow detention time= 95.7 min calculated for 10,258 cf (92% of inflow)
 Center-of-Mass det. time= 54.4 min (805.7 - 751.3)

PROPOSED SCS 2011

Type III 24-hr 10-Year Rainfall=4.90"

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Volume	Invert	Avail.Storage	Storage Description
#1	33.40'	150 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
#2A	28.00'	1,384 cf	16.75'W x 52.84'L x 5.00'H Field A 4,425 cf Overall - 965 cf Embedded = 3,461 cf x 40.0% Voids
#3A	30.00'	965 cf	StormTech SC-740 x 21 Inside #2 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
		2,499 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
33.40	4	0	0
33.50	750	38	38
33.60	1,500	113	150

Device	Routing	Invert	Outlet Devices
#1	Primary	30.40'	10.0" Round Outlet L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 30.40' / 30.30' S= 0.0100 ' /' Cc= 0.900 n= 0.013
#2	Discarded	28.00'	0.270 in/hr Exfiltration over Surface area
#3	Secondary	33.50'	179.9 deg x 65.0' long sheet flow to street C= 2.46

Discarded OutFlow Max=0.01 cfs @ 2.30 hrs HW=28.06' (Free Discharge)↑**2=Exfiltration** (Exfiltration Controls 0.01 cfs)**Primary OutFlow** Max=2.29 cfs @ 12.16 hrs HW=32.04' (Free Discharge)↑**1=Outlet** (Inlet Controls 2.29 cfs @ 4.21 fps)**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=28.00' (Free Discharge)↑**3=sheet flow to street** (Controls 0.00 cfs)**Summary for Pond 2P: Grass Swale North/West**

Inflow Area = 4,490 sf, 0.00% Impervious, Inflow Depth = 1.31" for 10-Year event
 Inflow = 0.14 cfs @ 12.10 hrs, Volume= 490 cf
 Outflow = 0.01 cfs @ 17.43 hrs, Volume= 330 cf, Atten= 96%, Lag= 319.7 min
 Discarded = 0.01 cfs @ 17.43 hrs, Volume= 330 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 33.14' @ 17.43 hrs Surf.Area= 867 sf Storage= 301 cf

Plug-Flow detention time= 486.4 min calculated for 330 cf (67% of inflow)

Center-of-Mass det. time= 374.3 min (1,248.1 - 873.8)

PROPOSED SCS 2011

Type III 24-hr 10-Year Rainfall=4.90"

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Volume	Invert	Avail.Storage	Storage Description
#1	32.50'	2,572 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
32.50	0	0	0
32.90	608	122	122
33.70	1,463	828	950
34.50	2,593	1,622	2,572

Device	Routing	Invert	Outlet Devices
#1	Primary	34.50'	200.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#2	Discarded	32.50'	0.270 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 0.00'

Discarded OutFlow Max=0.01 cfs @ 17.43 hrs HW=33.14' (Free Discharge)↳ **2=Exfiltration** (Controls 0.01 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=32.50' (Free Discharge)↳ **1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)**Summary for Pond 3P: Total Runoff**

Inflow Area = 38,763 sf, 75.42% Impervious, Inflow Depth = 3.11" for 10-Year event
 Inflow = 2.38 cfs @ 12.16 hrs, Volume= 10,046 cf
 Primary = 2.38 cfs @ 12.16 hrs, Volume= 10,046 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

PROPOSED SCS 2011

Type III 24-hr 25-Year Rainfall=6.10"

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Summary for Subcatchment 1aS: Walkways & Parking

Runoff = 1.47 cfs @ 12.09 hrs, Volume= 5,288 cf, Depth= 5.74"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.10"

Area (sf)	CN	Description
10,752	98	Paved parking & roofs
* 295	47	Brush, Good, HSG B
11,047	97	Weighted Average
295		2.67% Pervious Area
10,752		97.33% Impervious Area

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

Summary for Subcatchment 1bS: Res Building

Runoff = 1.86 cfs @ 12.09 hrs, Volume= 6,769 cf, Depth= 5.86"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.10"

Area (sf)	CN	Description
13,858	98	Paved parking & roofs
13,858		100.00% Impervious Area

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

Summary for Subcatchment 1cS: Post Building

Runoff = 0.55 cfs @ 12.09 hrs, Volume= 2,006 cf, Depth= 5.86"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.10"

Area (sf)	CN	Description
4,107	98	Paved parking & roofs
4,107		100.00% Impervious Area

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

Summary for Subcatchment 2S: Landscape North/West

Runoff = 0.24 cfs @ 12.10 hrs, Volume= 776 cf, Depth= 2.07"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25-Year Rainfall=6.10"

Area (sf)	CN	Description
4,490	61	>75% Grass cover, Good, HSG B
4,490		100.00% Pervious Area

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

Summary for Subcatchment 3S: Offsite Runoff

Runoff = 0.16 cfs @ 12.11 hrs, Volume= 588 cf, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25-Year Rainfall=6.10"

Area (sf)	CN	Description
* 4,743	47	Brush, Good, HSG B
518	98	Building, Walks & Parking
5,261	52	Weighted Average
4,743		90.15% Pervious Area
518		9.85% Impervious Area

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

Summary for Pond 1P: Infiltration

Inflow Area = 29,012 sf, 98.98% Impervious, Inflow Depth = 5.82" for 25-Year event
 Inflow = 3.88 cfs @ 12.09 hrs, Volume= 14,063 cf
 Outflow = 2.88 cfs @ 12.16 hrs, Volume= 13,169 cf, Atten= 26%, Lag= 4.6 min
 Discarded = 0.01 cfs @ 1.85 hrs, Volume= 570 cf
 Primary = 2.87 cfs @ 12.16 hrs, Volume= 12,599 cf
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 32.74' @ 12.16 hrs Surf.Area= 885 sf Storage= 2,256 cf

Plug-Flow detention time= 84.1 min calculated for 13,169 cf (94% of inflow)
 Center-of-Mass det. time= 48.4 min (795.9 - 747.5)

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Type III 24-hr 25-Year Rainfall=6.10"

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Volume	Invert	Avail.Storage	Storage Description
#1	33.40'	150 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
#2A	28.00'	1,384 cf	16.75'W x 52.84'L x 5.00'H Field A 4,425 cf Overall - 965 cf Embedded = 3,461 cf x 40.0% Voids
#3A	30.00'	965 cf	StormTech SC-740 x 21 Inside #2 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
		2,499 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
33.40	4	0	0
33.50	750	38	38
33.60	1,500	113	150

Device	Routing	Invert	Outlet Devices
#1	Primary	30.40'	10.0" Round Outlet L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 30.40' / 30.30' S= 0.0100 '/' Cc= 0.900 n= 0.013
#2	Discarded	28.00'	0.270 in/hr Exfiltration over Surface area
#3	Secondary	33.50'	179.9 deg x 65.0' long sheet flow to street C= 2.46

Discarded OutFlow Max=0.01 cfs @ 1.85 hrs HW=28.06' (Free Discharge)↑**2=Exfiltration** (Exfiltration Controls 0.01 cfs)**Primary OutFlow** Max=2.84 cfs @ 12.16 hrs HW=32.70' (Free Discharge)↑**1=Outlet** (Inlet Controls 2.84 cfs @ 5.21 fps)**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=28.00' (Free Discharge)↑**3=sheet flow to street** (Controls 0.00 cfs)**Summary for Pond 2P: Grass Swale North/West**

Inflow Area = 4,490 sf, 0.00% Impervious, Inflow Depth = 2.07" for 25-Year event
 Inflow = 0.24 cfs @ 12.10 hrs, Volume= 776 cf
 Outflow = 0.01 cfs @ 17.88 hrs, Volume= 431 cf, Atten= 97%, Lag= 346.8 min
 Discarded = 0.01 cfs @ 17.88 hrs, Volume= 431 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 33.36' @ 17.88 hrs Surf.Area= 1,104 sf Storage= 518 cf

Plug-Flow detention time= 515.7 min calculated for 431 cf (56% of inflow)

Center-of-Mass det. time= 391.2 min (1,250.4 - 859.2)

PROPOSED SCS 2011

Type III 24-hr 25-Year Rainfall=6.10"

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Volume	Invert	Avail.Storage	Storage Description
#1	32.50'	2,572 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
32.50	0	0	0
32.90	608	122	122
33.70	1,463	828	950
34.50	2,593	1,622	2,572

Device	Routing	Invert	Outlet Devices
#1	Primary	34.50'	200.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#2	Discarded	32.50'	0.270 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 0.00'

Discarded OutFlow Max=0.01 cfs @ 17.88 hrs HW=33.36' (Free Discharge)

↑2=Exfiltration (Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=32.50' (Free Discharge)

↑1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 3P: Total Runoff

Inflow Area = 38,763 sf, 75.42% Impervious, Inflow Depth = 4.08" for 25-Year event
 Inflow = 3.01 cfs @ 12.16 hrs, Volume= 13,188 cf
 Primary = 3.01 cfs @ 12.16 hrs, Volume= 13,188 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

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Type III 24-hr 100-Year Rainfall=8.50"

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Summary for Subcatchment 1aS: Walkways & Parking

Runoff = 2.06 cfs @ 12.09 hrs, Volume= 7,493 cf, Depth= 8.14"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Type III 24-hr 100-Year Rainfall=8.50"

Area (sf)	CN	Description
10,752	98	Paved parking & roofs
* 295	47	Brush, Good, HSG B
11,047	97	Weighted Average
295		2.67% Pervious Area
10,752		97.33% Impervious Area

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

Summary for Subcatchment 1bS: Res Building

Runoff = 2.59 cfs @ 12.09 hrs, Volume= 9,539 cf, Depth= 8.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Type III 24-hr 100-Year Rainfall=8.50"

Area (sf)	CN	Description
13,858	98	Paved parking & roofs
13,858		100.00% Impervious Area

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

Summary for Subcatchment 1cS: Post Building

Runoff = 0.77 cfs @ 12.09 hrs, Volume= 2,827 cf, Depth= 8.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Type III 24-hr 100-Year Rainfall=8.50"

Area (sf)	CN	Description
4,107	98	Paved parking & roofs
4,107		100.00% Impervious Area

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

Summary for Subcatchment 2S: Landscape North/West

Runoff = 0.45 cfs @ 12.10 hrs, Volume= 1,433 cf, Depth= 3.83"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-Year Rainfall=8.50"

Area (sf)	CN	Description
4,490	61	>75% Grass cover, Good, HSG B
4,490		100.00% Pervious Area

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

Summary for Subcatchment 3S: Offsite Runoff

Runoff = 0.37 cfs @ 12.10 hrs, Volume= 1,222 cf, Depth= 2.79"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-Year Rainfall=8.50"

Area (sf)	CN	Description
* 4,743	47	Brush, Good, HSG B
518	98	Building, Walks & Parking
5,261	52	Weighted Average
4,743		90.15% Pervious Area
518		9.85% Impervious Area

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

Summary for Pond 1P: Infiltration

Inflow Area = 29,012 sf, 98.98% Impervious, Inflow Depth = 8.21" for 100-Year event
 Inflow = 5.42 cfs @ 12.09 hrs, Volume= 19,859 cf
 Outflow = 5.19 cfs @ 12.11 hrs, Volume= 18,890 cf, Atten= 4%, Lag= 1.5 min
 Discarded = 0.01 cfs @ 12.12 hrs, Volume= 580 cf
 Primary = 3.41 cfs @ 12.10 hrs, Volume= 17,843 cf
 Secondary = 1.72 cfs @ 12.11 hrs, Volume= 466 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 33.52' @ 12.10 hrs Surf.Area= 1,820 sf Storage= 2,408 cf

Plug-Flow detention time= 69.0 min calculated for 18,890 cf (95% of inflow)
 Center-of-Mass det. time= 40.1 min (782.7 - 742.6)

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Type III 24-hr 100-Year Rainfall=8.50"

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Volume	Invert	Avail.Storage	Storage Description
#1	33.40'	150 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
#2A	28.00'	1,384 cf	16.75'W x 52.84'L x 5.00'H Field A
			4,425 cf Overall - 965 cf Embedded = 3,461 cf x 40.0% Voids
#3A	30.00'	965 cf	StormTech SC-740 x 21 Inside #2
			Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
			Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
		2,499 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
33.40	4	0	0
33.50	750	38	38
33.60	1,500	113	150

Device	Routing	Invert	Outlet Devices
#1	Primary	30.40'	10.0" Round Outlet L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 30.40' / 30.30' S= 0.0100 ' S= 0.0100 ' Cc= 0.900 n= 0.013
#2	Discarded	28.00'	0.270 in/hr Exfiltration over Surface area
#3	Secondary	33.50'	179.9 deg x 65.0' long sheet flow to street C= 2.46

Discarded OutFlow Max=0.01 cfs @ 12.12 hrs HW=33.52' (Free Discharge)↑ **2=Exfiltration** (Exfiltration Controls 0.01 cfs)**Primary OutFlow** Max=3.41 cfs @ 12.10 hrs HW=33.52' (Free Discharge)↑ **1=Outlet** (Inlet Controls 3.41 cfs @ 6.26 fps)**Secondary OutFlow** Max=0.90 cfs @ 12.11 hrs HW=33.52' (Free Discharge)↑ **3=sheet flow to street** (Weir Controls 0.90 cfs @ 0.44 fps)**Summary for Pond 2P: Grass Swale North/West**

Inflow Area = 4,490 sf, 0.00% Impervious, Inflow Depth = 3.83" for 100-Year event
 Inflow = 0.45 cfs @ 12.10 hrs, Volume= 1,433 cf
 Outflow = 0.01 cfs @ 18.98 hrs, Volume= 623 cf, Atten= 98%, Lag= 413.1 min
 Discarded = 0.01 cfs @ 18.98 hrs, Volume= 623 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 33.76' @ 18.98 hrs Surf.Area= 1,550 sf Storage= 1,042 cf

Plug-Flow detention time= 530.7 min calculated for 622 cf (43% of inflow)

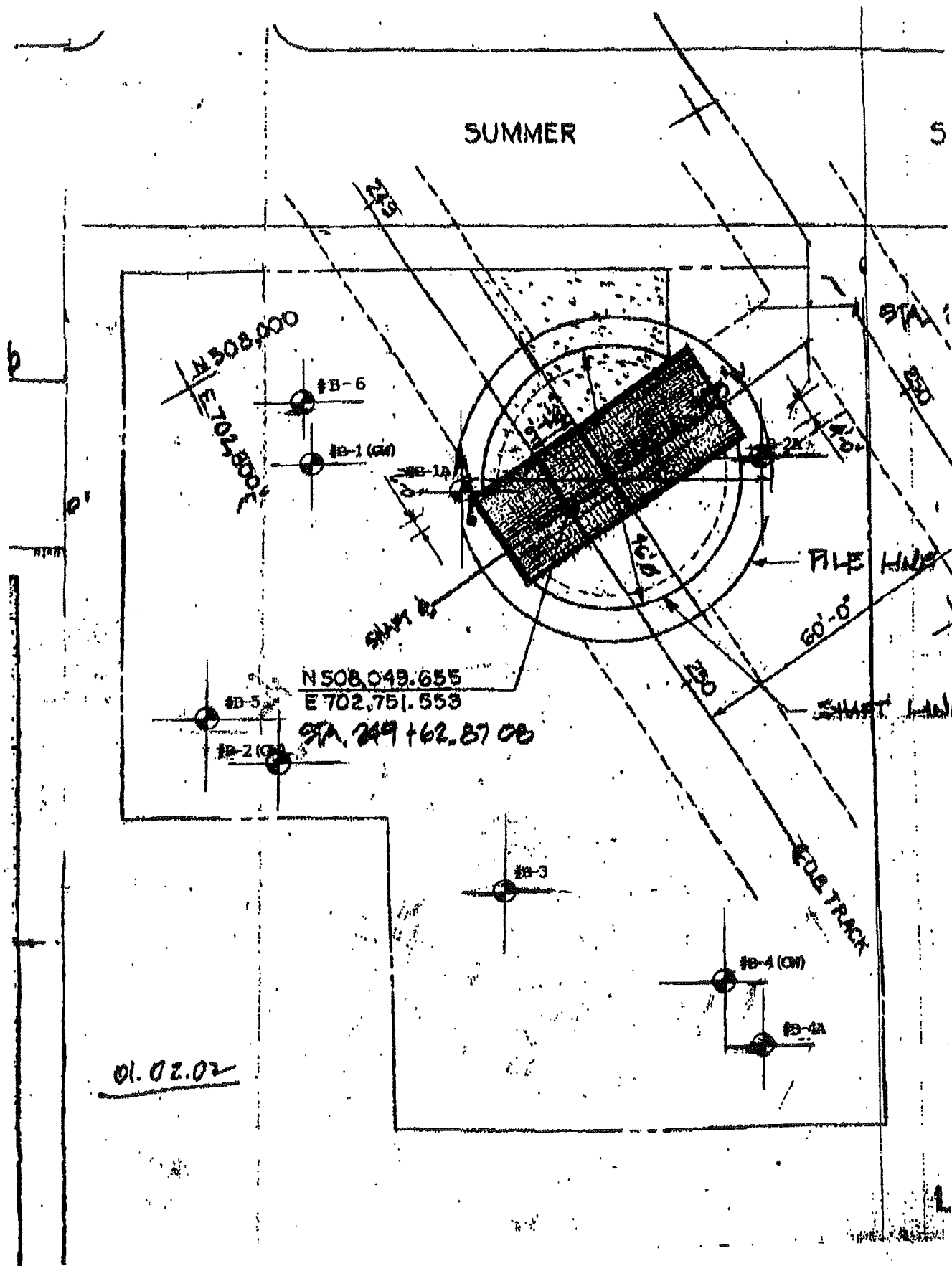
Center-of-Mass det. time= 406.6 min (1,247.4 - 840.8)

APPENDIX B

Soil Boring Logs

(from "Report of Subsurface Conditions and Foundation
Recommendations," by Geotechnical Consultants, Inc, dated July 3, 2007)

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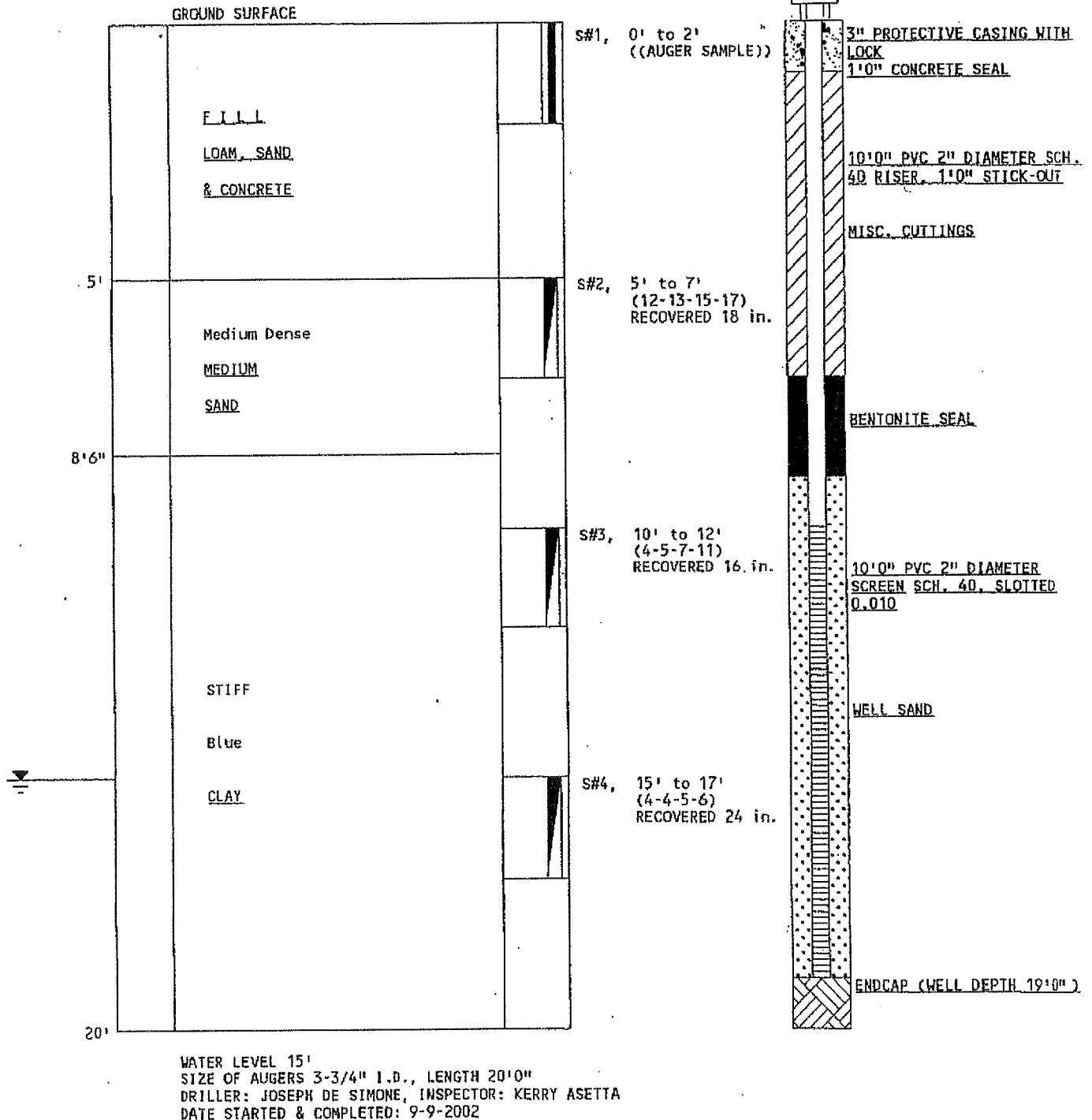


CARR-DEE CORP.

37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone (617) 391-4500
 To: EMERALD DEVELOPMENT GROUP, INC., WATERTOWN, MA Date: 9-16-2002 Job No.: 2002-138
 Location: 343-345-349 SUMMER STREET, SOMERVILLE, MA Scale: 1 in. = 3 ft.

MONITORING WELL

BORING B-1

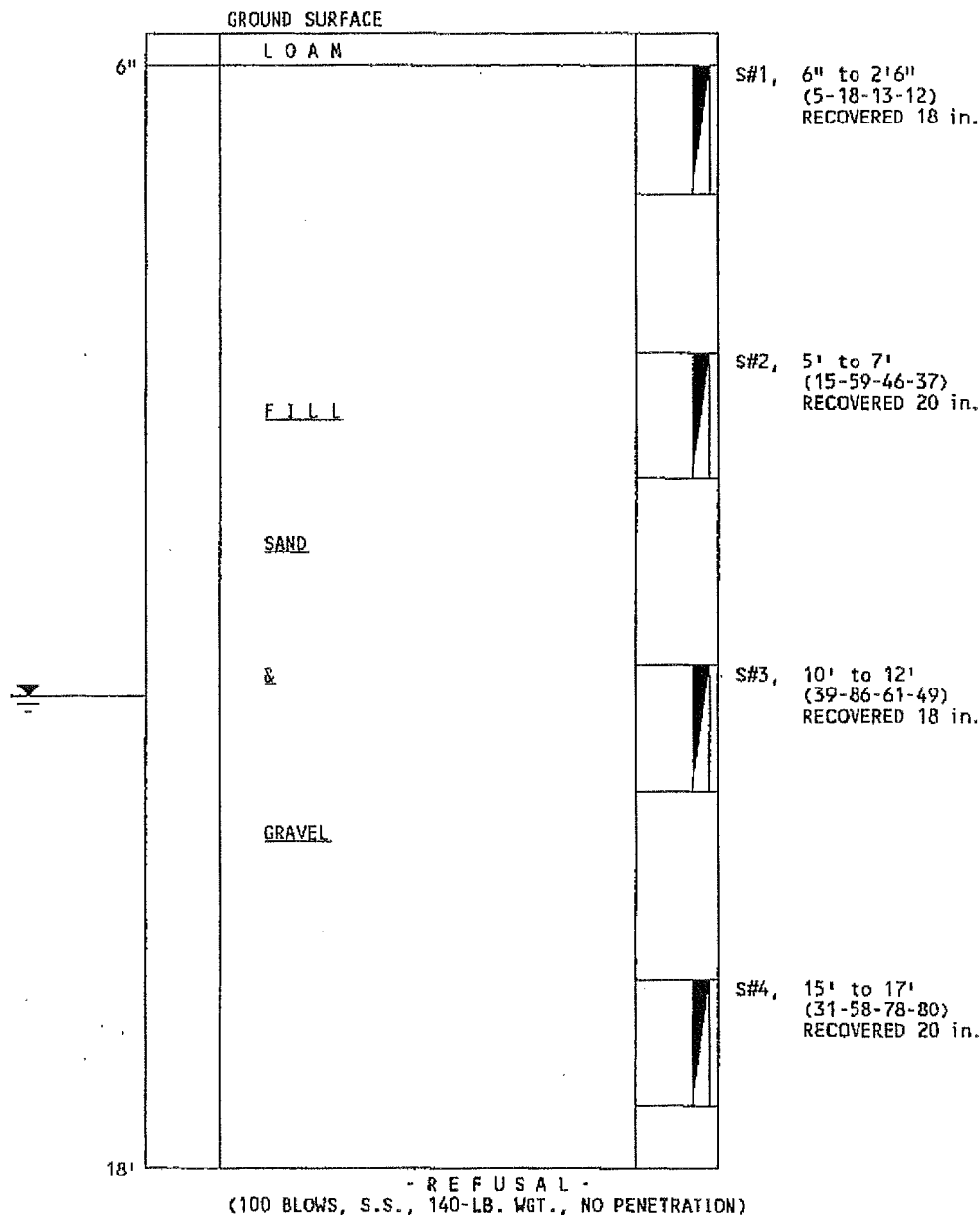


All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches (±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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To: EMERALD DEVELOPMENT GROUP, INC., WATERTOWN, MA Date: 9-16-2002 Job No.: 2002-138
Location: 343-345-349 SUMMER STREET, SOMERVILLE, MA Scale: 1 in. = .3 ft.

BORING B-1A



WATER LEVEL 10'6"
SIZE OF CASING BW, LENGTH 15'0"
DRILLER: JOSEPH DE SIMONE, INSPECTOR: KERRY ASETTA
DATE STARTED & COMPLETED: 9-10-2002

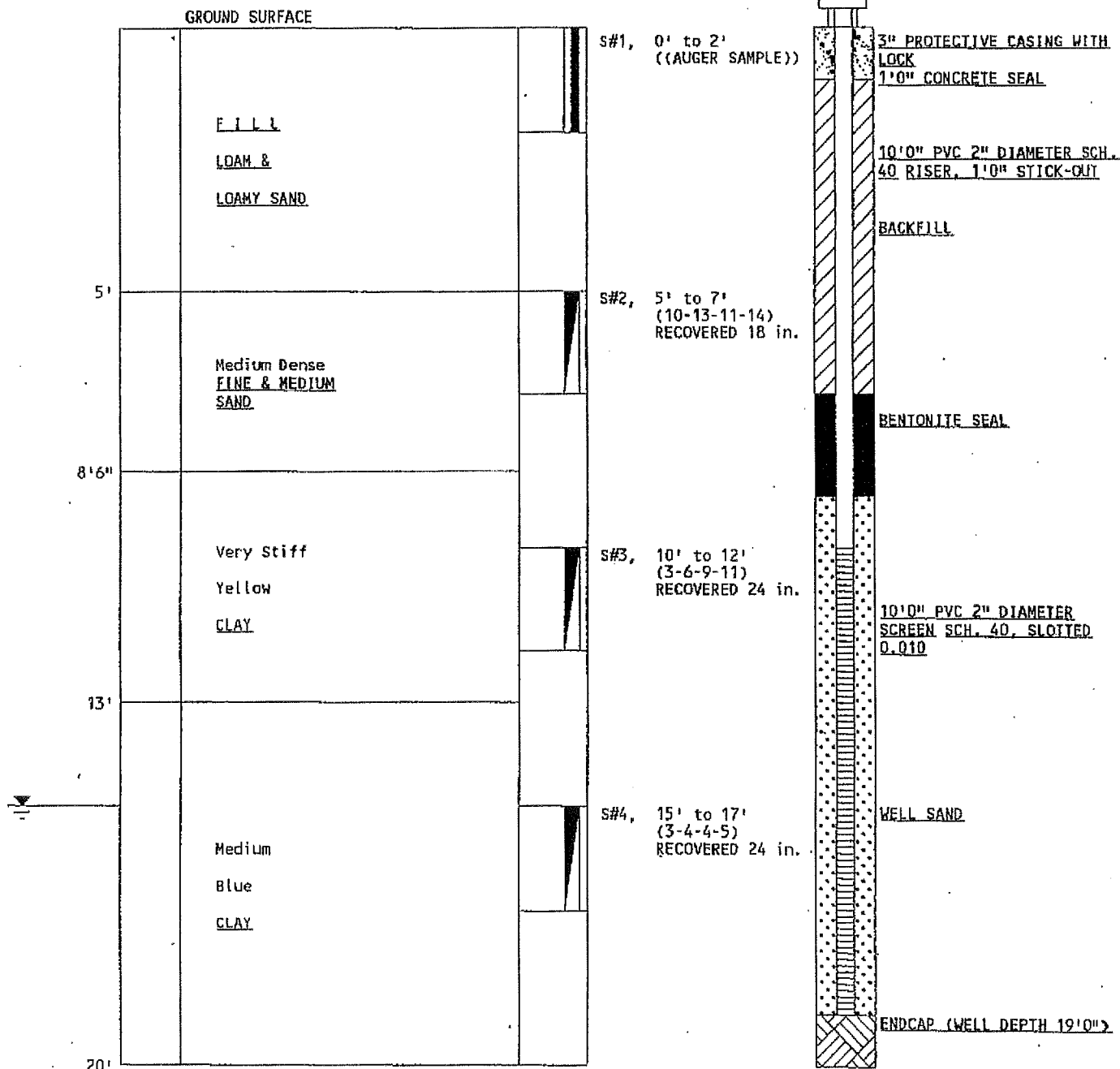
All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches (±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone (617) 391-4500
 To: EMERALD DEVELOPMENT GROUP, INC., WATERTOWN, MA Date: 9-16-2002 Job No.: 2002-138
 Location: 343-345-349 SUMMER STREET, SOMERVILLE, MA Scale: 1 in. = 3 ft.

MONITORING WELL

BORING B-2

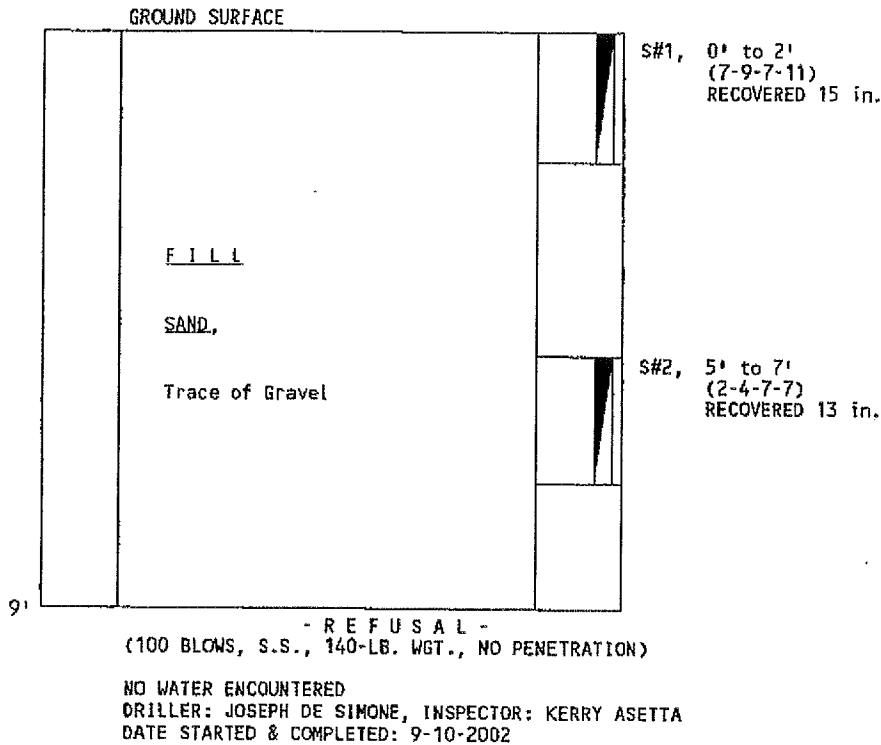


All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches (±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

CARR-DEE CORP.

37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone (617) 391-4500
To: EMERALD DEVELOPMENT GROUP, INC., WATERTOWN, MA Date: 9-16-2002 Job No.: 2002-138
Location: 343-345-349 SUMMER STREET, SOMERVILLE, MA Scale: 1 in. = 3 ft.

BORING B-2A

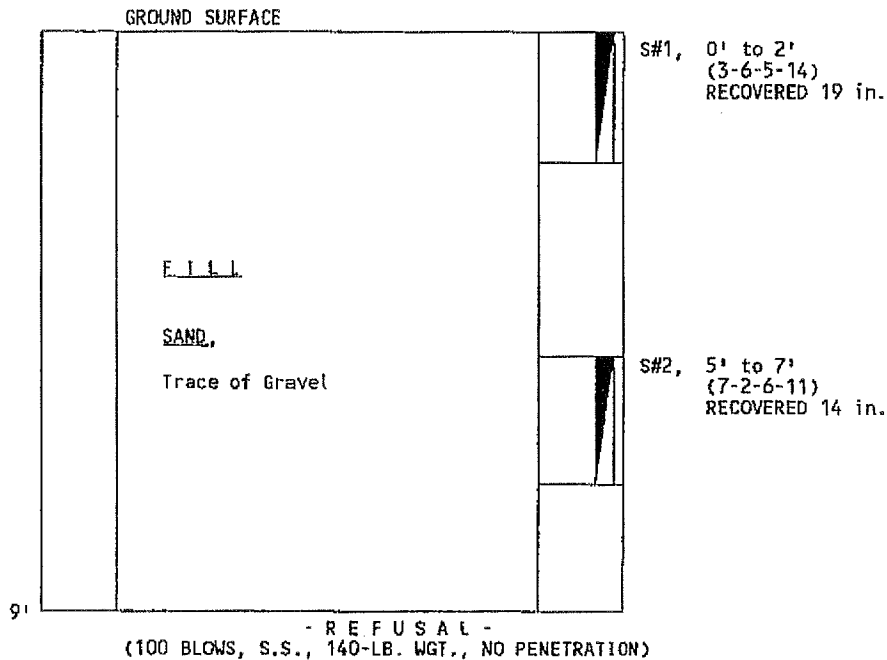


All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches (\pm). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (\pm).

CARR-DEE CORP.

37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone (617) 391-4500
To: EMERALD DEVELOPMENT GROUP, INC., WATERTOWN, MA Date: 9-16-2002 Job No.: 2002-138
Location: 343-345-349 SUMMER STREET, SOMERVILLE, MA Scale: 1 in. = .3 ft.

BORING B-2B



NO WATER ENCOUNTERED
DRILLER: JOSEPH DE SIMONE, INSPECTOR: KERRY ASETTA
DATE STARTED & COMPLETED: 9-10-2002

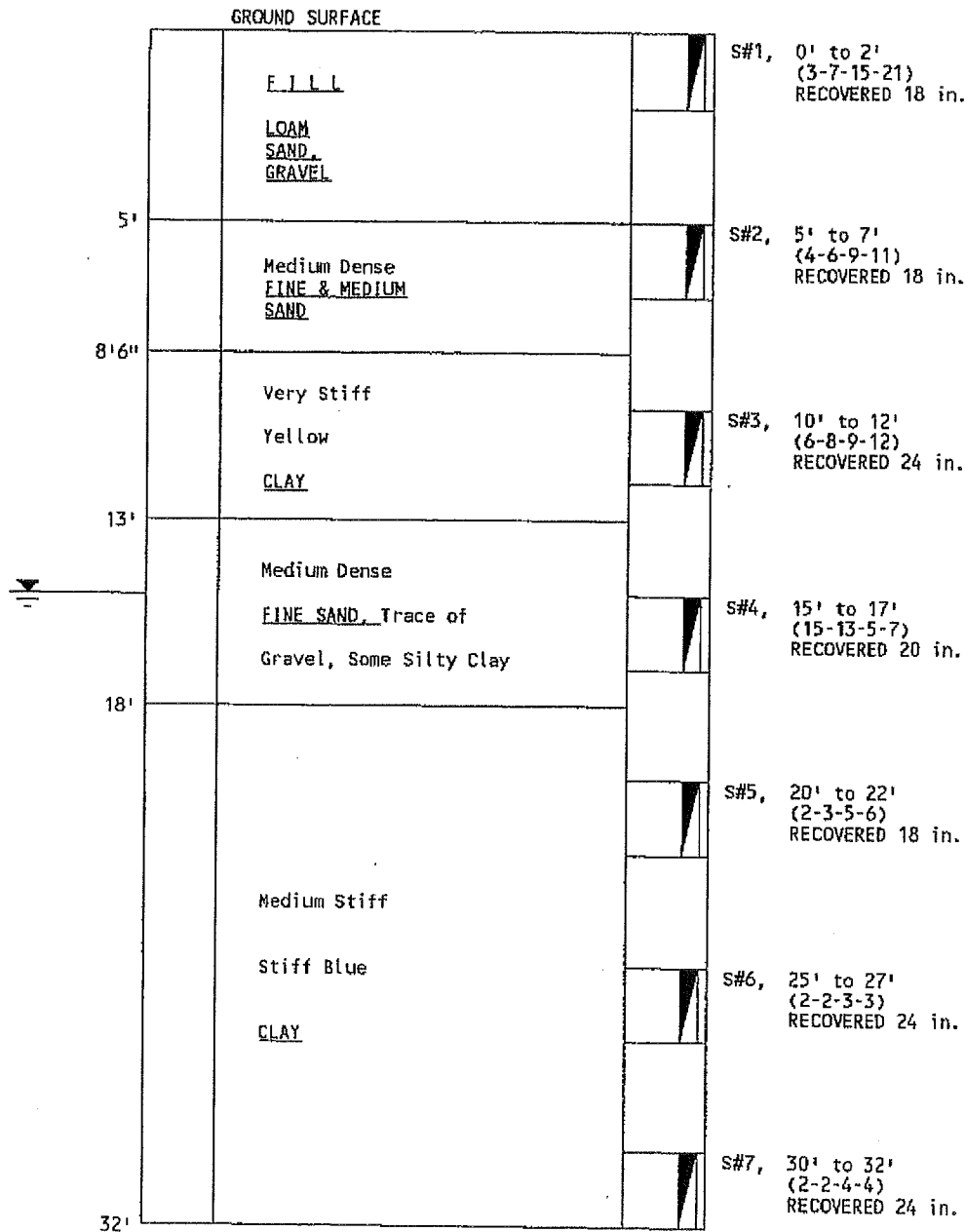
NOTE: THIS BORING WAS MADE 1'0" CLOSER TOWARDS VENT SHAFT FROM ORIGINAL LOCATION NO. 2A.

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches (\pm). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (\pm).

CARR-DEE CORP.

37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone (617) 391-4500
 To: EMERALD DEVELOPMENT GROUP, INC., WATERTOWN, MA Date: 9-16-2002 Job No.: 2002-138
 Location: 343-345-349 SUMMER STREET, SOMERVILLE, MA Scale: 1 in. = .5 ft.

BORING B-3



SIZE OF AUGERS 3-3/4" I.D., LENGTH 5'0"
 SIZE OF CASING NW, LENGTH 20'0"
 DRILLER: JOSEPH DE SIMONE, INSPECTOR: JOHN SCHROEDER
 DATE STARTED & COMPLETED: 9-9-2002, 9-10-2002

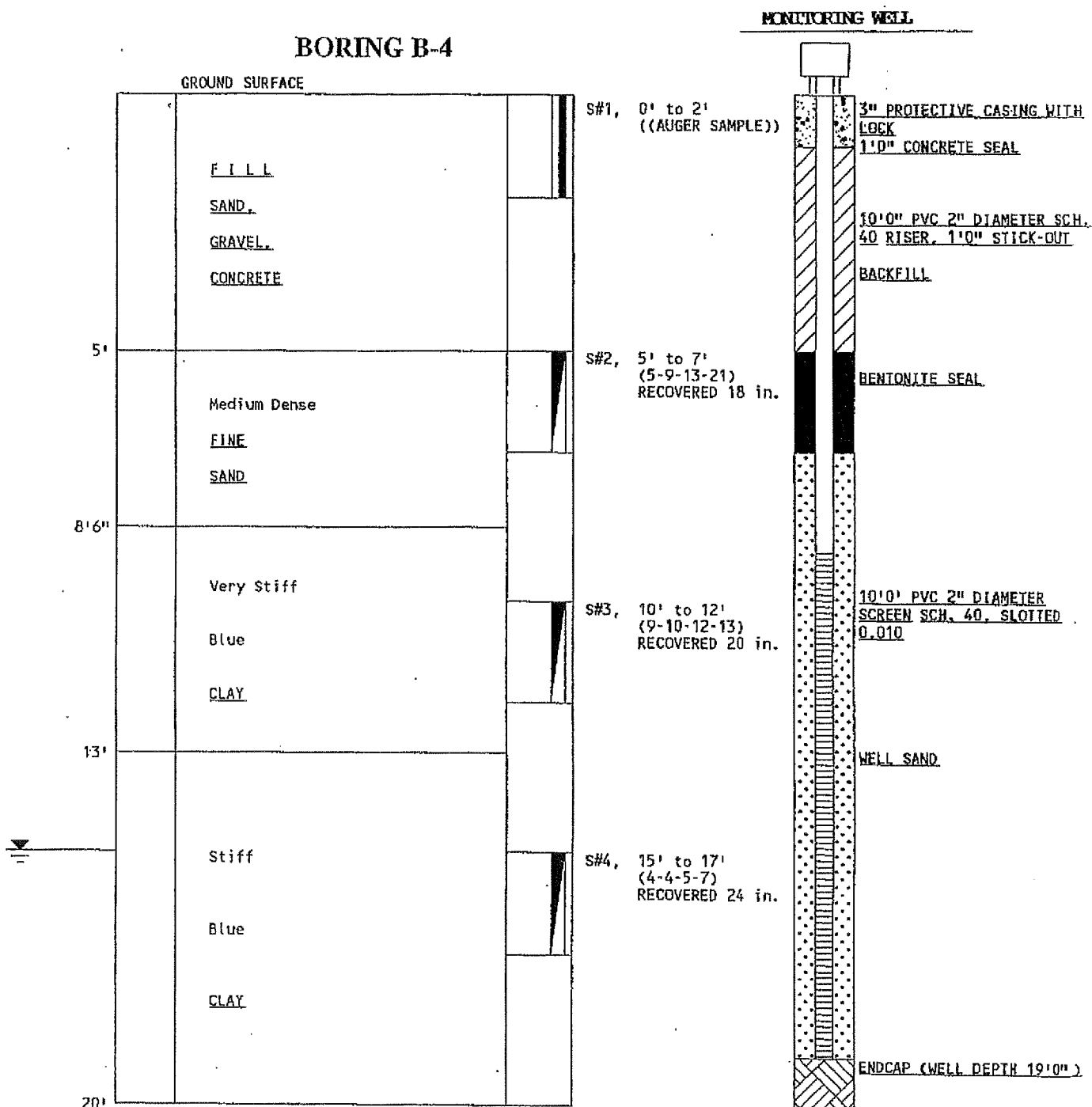
2A.

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches (±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

CARR-DEE CORP.

37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone (617) 391-4500
 To: EMERALD DEVELOPMENT GROUP, INC., WATERTOWN, MA Date: 9-16-2002 Job No.: 2002-138
 Location: 343-345-349 SUMMER STREET, SOMERVILLE, MA Scale: 1 in. = 3 ft.

BORING B-4



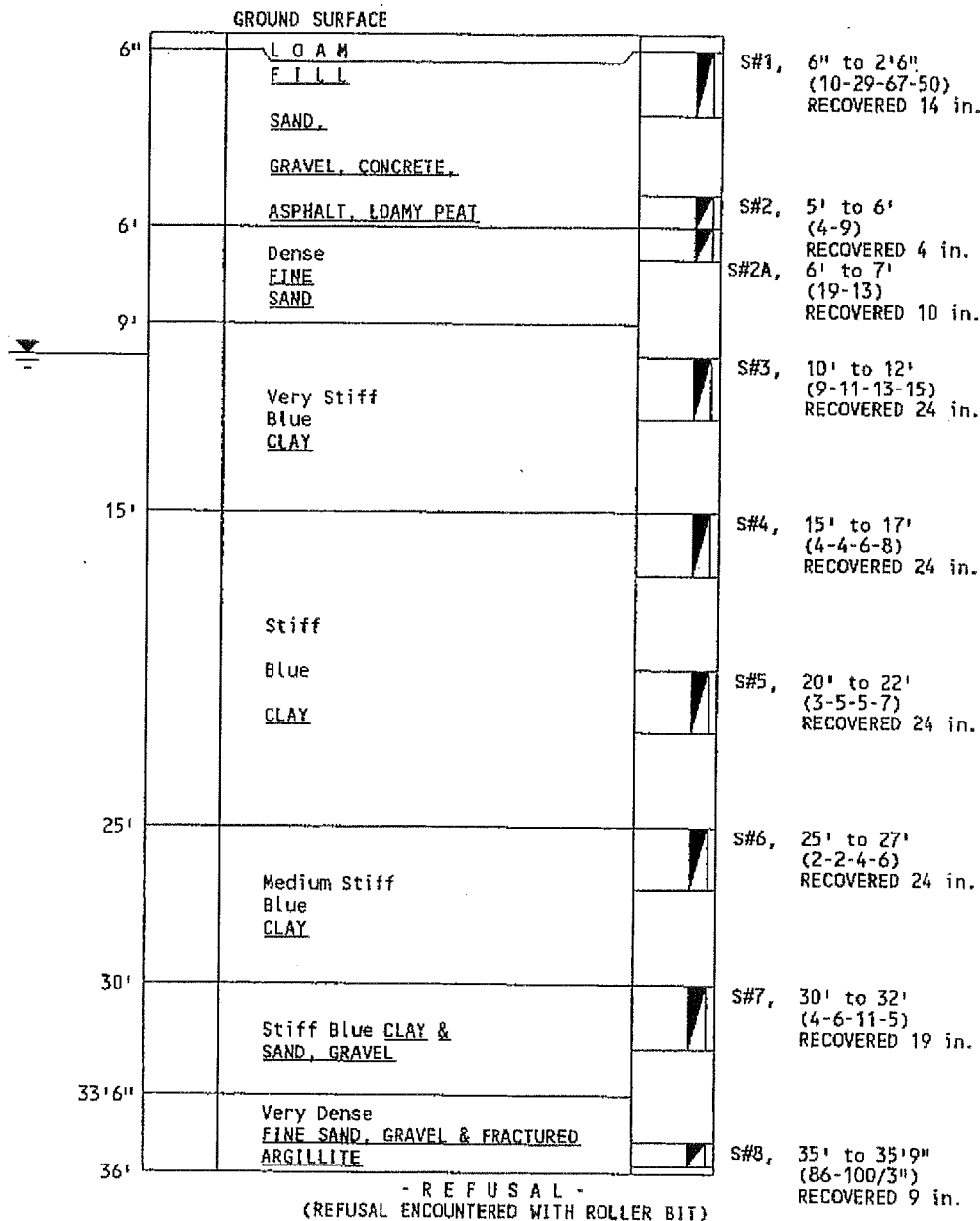
2A.

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches (±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

CARR-DEE CORP.

37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone (617) 391-4500
 To: EMERALD DEVELOPMENT GROUP, INC., WATERTOWN, MA Date: 9-16-2002 Job No.: 2002-138
 Location: 343-345-349 SUMMER STREET, SOMERVILLE, MA Scale: 1 in. = .6 ft.

BORING B-4A



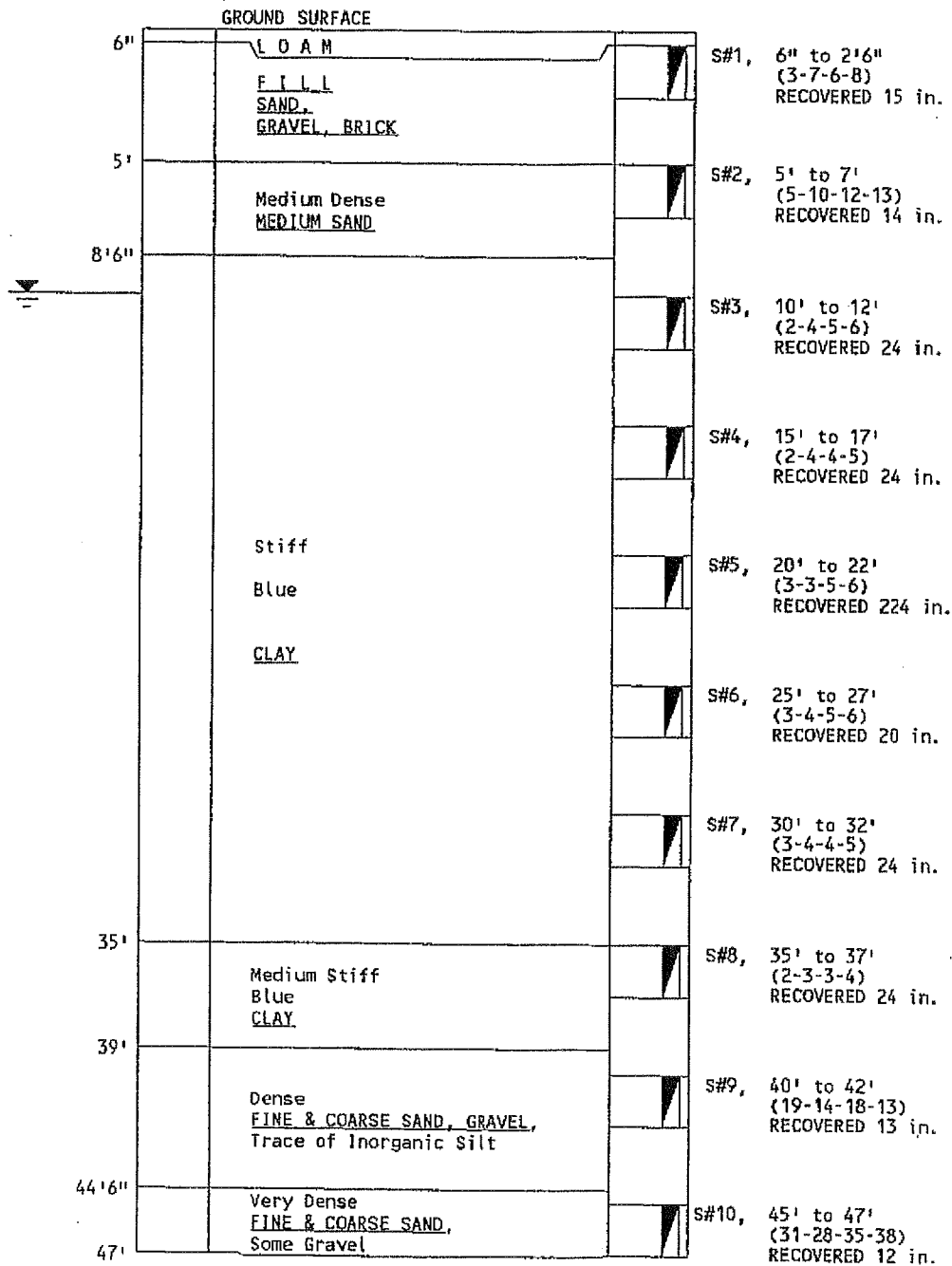
WATER LEVEL 10'
 SIZE OF CASING NW, LENGTH 15'0"
 DRILLER: JOSEPH DE SIMONE, INSPECTOR: KERRY ASETTA
 DATE STARTED & COMPLETED: 9-11-2002

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches (±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

CARR-DEE CORP.

37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone (617) 391-4500
 To: EMERALD DEVELOPMENT GROUP, INC., WATERTOWN, MA Date: 9-16-2002 Job No.: 2002-138
 Location: 343-345-349 SUMMER STREET, SOMERVILLE, MA Scale: 1 in. = .7 ft.

BORING B-6



WATER LEVEL 10'
 SIZE OF CASING NW, LENGTH 15'0"
 DRILLER: JOSEPH DE SIMONE, INSPECTOR: KERRY ASETTA
 DATE STARTED & COMPLETED: 9-10-2002, 9-11-2002

2A.

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches (±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

