

Land Surveying Civil Engineering Land Use Planning Landscape Architecture

CITY OF LA CENTER

PRELIMINARY STORMWATER REPORT

MINIT MANAGEMENT

MINIT MANAGEMENT, LLC

JOB # 9825.01.01

REVIEWED BY: CHARLES E. "CHAD" McMURRY, P.E.

DESIGNED BY: CHARLES E. "CHAD" McMURRY, P.E.



**OLSON**



# City of La Center

## Preliminary Stormwater Report

### Minit Management

### Minit Management, LLC

Job #9825.01.01



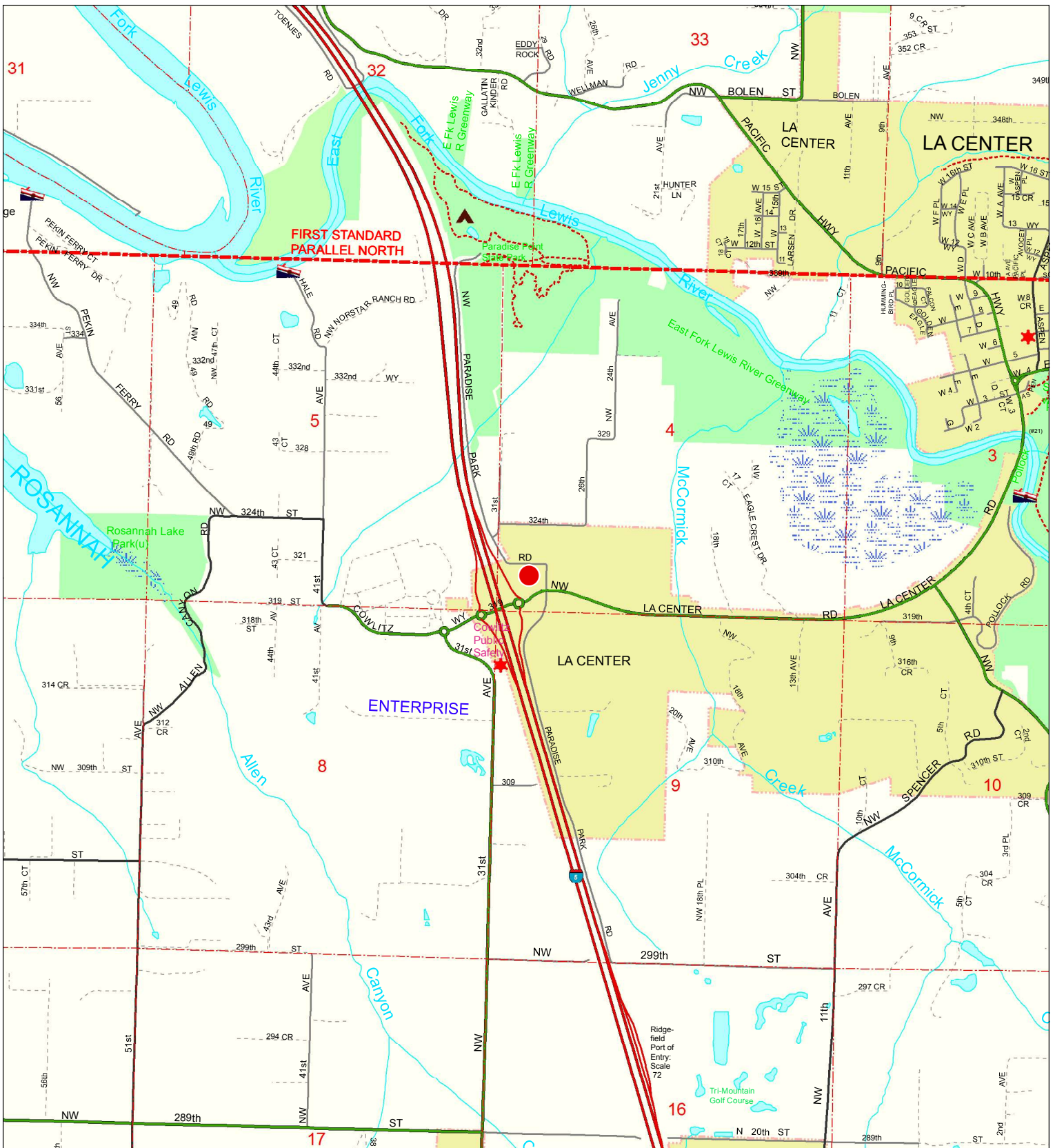
March 6, 2020

Designed by: Charles E. "Chad" McMurry, P.E.

Reviewed by: Charles E. "Chad" McMurry, P.E.

Olson Engineering, Inc.  
222 E. Evergreen Blvd  
Vancouver, WA 98660  
(360) 695-1385

REVISION	BY	DATE	COMMENTS



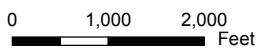
### General Location

Account: 209738000  
 Owner: MINIT MANAGEMENT LLC  
 Address: PO BOX 5889  
 C/S/Z: VANCOUVER, WA 98668


Printed on: February 11, 2020

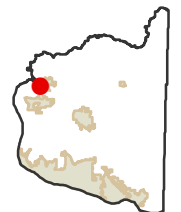


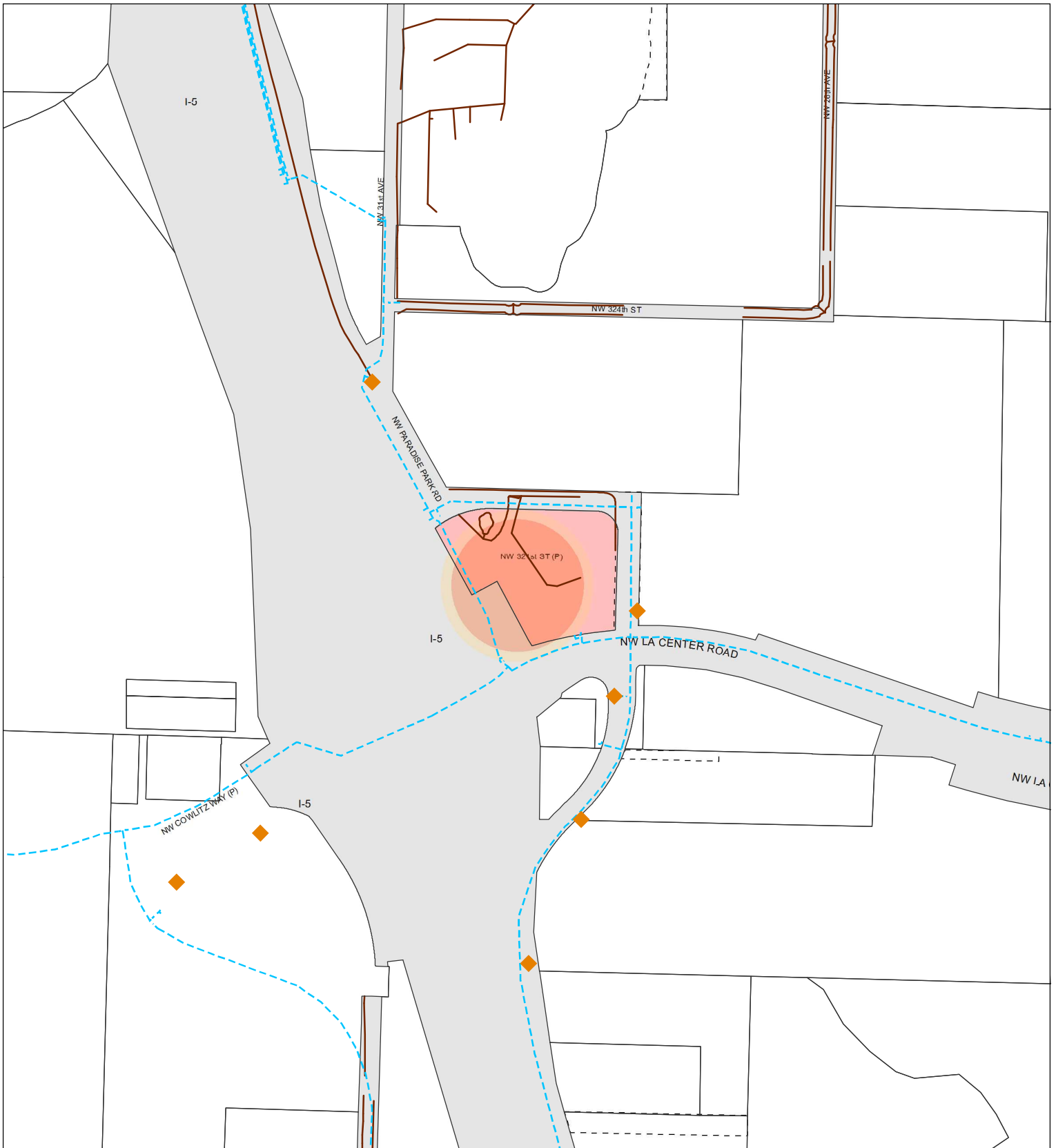
Geographic Information System



Information shown on this map was collected from several sources. Clark County accepts no responsibility for any inaccuracies that may be present.

 Location of Subject Property(s)





**CLARK COUNTY, WASHINGTON**

Geographic Information System

0 200 400 Feet

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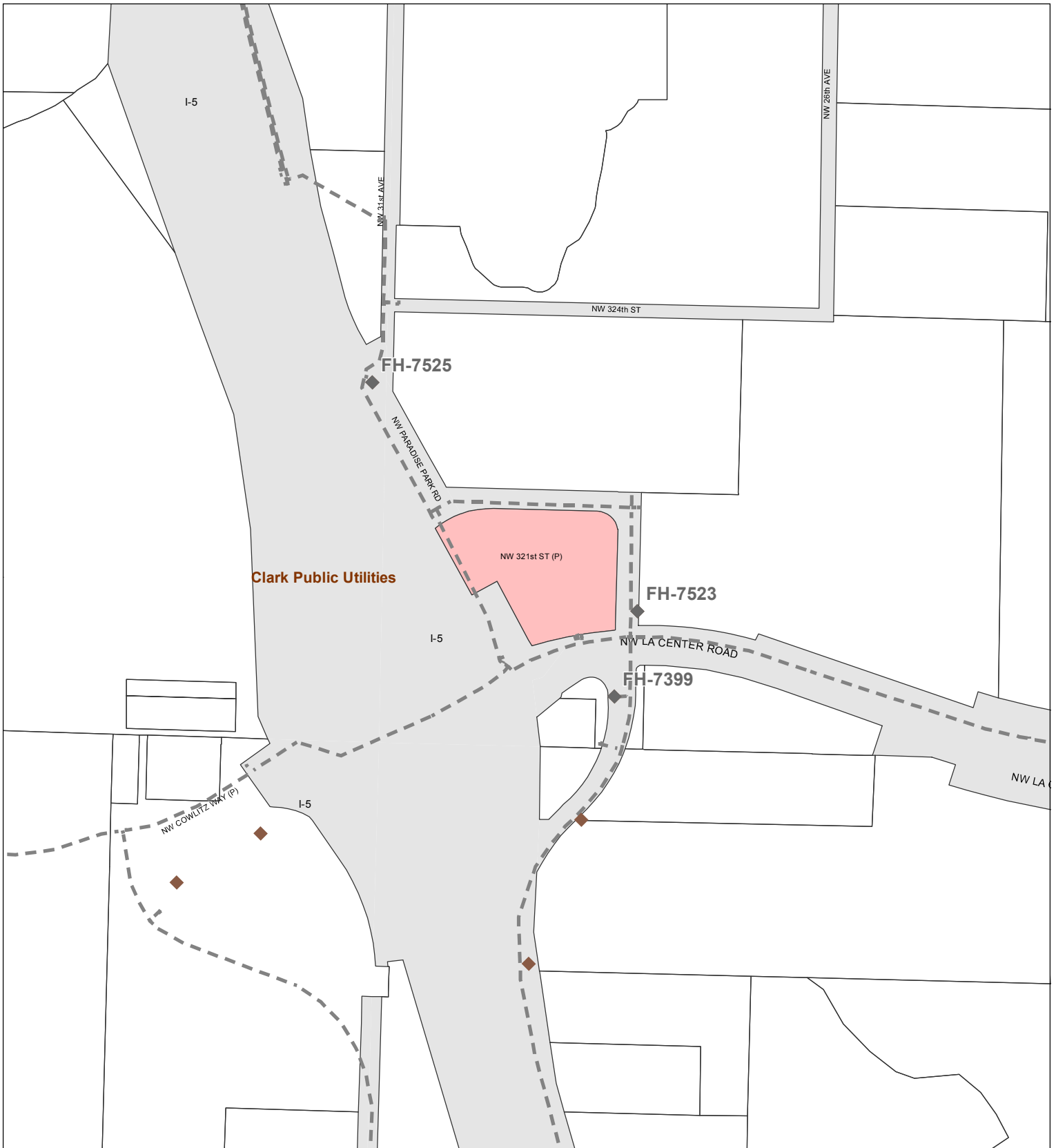
### Water, Sewer, and Storm Systems

Account: 209738000  
 Owner: MINIT MANAGEMENT LLC  
 Address: PO BOX 5889  
 C/S/Z: VANCOUVER, WA 98668

- Subject Property(s)
- Public Road
- Transportation or Major Utility Easement
- Water Lines
- Sewer Lines
- Storm Water Lines
- 1-year Wellhead ZOC
- 5-year Wellhead ZOC
- 10-year Wellhead ZOC
- Hydrants

Printed on: February 11, 2020





**CLARK COUNTY, WASHINGTON**  
Geographic Information System

0 200 400 Feet

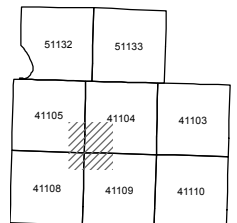
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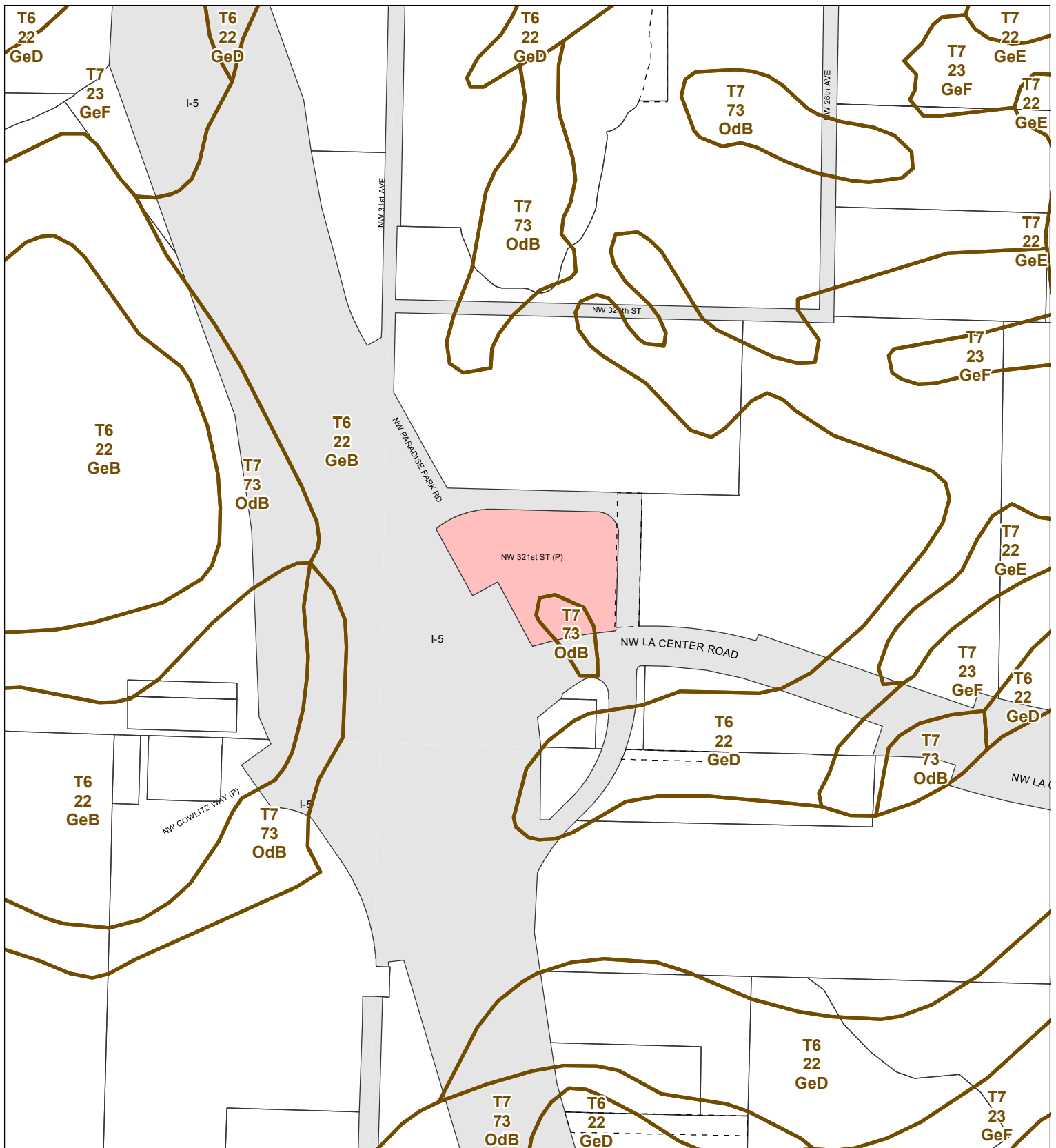
### Water Systems

Account: 209738000  
 Owner: MINIT MANAGEMENT LLC  
 Address: PO BOX 5889  
 C/S/Z: VANCOUVER, WA 98668

- Subject Property(s)
- Public Road
- Water District Boundary
- Unknown Size Water Line
- < 10" Water Line
- 10-20" Water Line
- > 20" Water Line
- No Flow Data Hydrant
- 0 - 499 GPM at 20 PSI
- 500 - 999 GPM at 20 PSI
- > 1000 - 1749 GPM at 20 PSI
- > 1750 GPM at 20 PSI
- Hydrant > 500' from parcel(s)

Printed on: February 11, 2020





### Soil Types

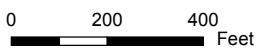
Account: 209738000  
 Owner: MINIT MANAGEMENT LLC  
 Address: PO BOX 5889  
 C/S/Z: VANCOUVER, WA 98668

- Subject Property(s)
- Public Road
- Transportation or Major Utility Easement
- Soil Type Boundary

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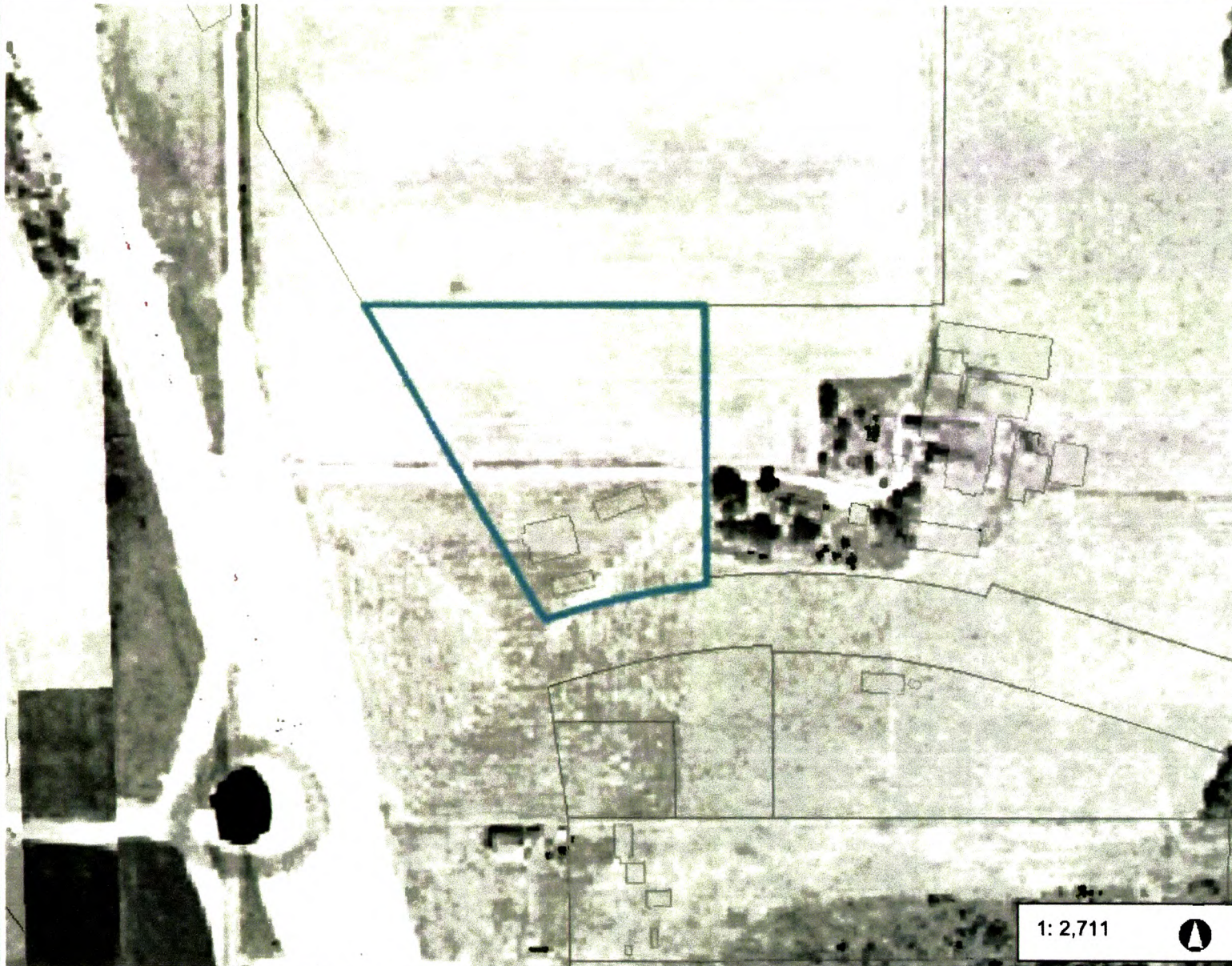
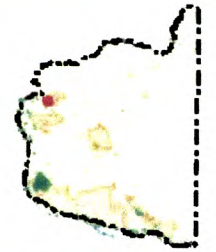
Geographic Information System







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# Minit Mart Historic Condition



### Legend

-  Building Footprints
-  Taxlots
-  Cities Boundaries
-  Urban Growth Boundaries

### Notes:

1955 Aerial Photography

1: 2,711



451.9 0 225.95 451.9Feet

WGS\_1984\_Web\_Mercator\_Auxiliary\_Sphere  
Clark County, WA. GIS - <http://gis.clark.wa.gov>

This map was generated by Clark County's "MapsOnline" website. Clark County does not warrant the accuracy, reliability or timeliness of any information on this map, and shall not be held liable for losses caused by using this information.

## **1.1 Project Introduction**

Minit Management LLC proposes the construction of four commercial pads on the site of the current Minit Mart which lies on a parcel bounded by La Center Road, Paradise Park Road, and the I-5 freeway. This phased commercial development includes the following:

- 101-unit, 5-story hotel.
- 11,600 square foot, one-story multi-tenant commercial building.
- 4,510 square foot, one-story convenience store with a drive through window.
- 2,800 square foot, one-story drive-through restaurant.
- 12-pump automobile fueling island.
- Associated parking, utility, and other infrastructure improvements.
- Four-lot commercial short plat.

The existing convenience store and fueling islands will be removed. This parcel is already served by a treatment and detention system installed during the reconstruction of the La Center Road/I-5 interchange. This report will demonstrate the adequacy of that system to treat and detain runoff from the proposed improvements.

The requirements for stormwater management on this parcel are described in a Development Agreement between Minit Management and the City of La Center, vesting stormwater design requirements at those described in Chapter 18 of the La Center Municipal Code in effect on March 28, 2016.

## **1.2 Site Location**

Minit Management owns property at the northwest quadrant of the I-5/La Center Road Interchange in the SW  $\frac{1}{4}$  of Section 4, T4N, R1E, W.M. The parcel is bounded on the west by I-5, on the north and east by Paradise Park Road, and on the south by La Center Road.

## **1.3 Scope of Work**

The redevelopment of the property is expected to replace approximately 2.9 acres of existing pavement, two fueling islands, and a convenience store with approximately 0.7 acres of roof area and 2.7 acres of pavement and hardscape. Frontage improvements (with the exception of the removal of one driveway) were previously completed with the La Center Road improvements.



## **Site Improvements**

### **2.1 Existing Conditions**

The area of the project is currently developed as a fueling station, convenience store, and associated parking and truck maneuvering area. An existing drainage system captures runoff from the southerly portions of the site and directs that runoff to a flow splitter, which directs events equivalent to the water quality treatment storm through treatment and bypasses larger flows directly to the detention pipe gallery. Water quality treatment is provided by a coalescing plate oil-water separator and a StormFilter treatment vault.

### **2.2 Soils**

Based on the Washington Division of Geology and Earth Resources Geologic Map of the Vancouver Quadrangle, the site is mapped as Quaternary periglacial deposits of sand silt and clay resulting from outburst from the Missoula floods. In addition, the near surface soils have been mapped by the USDA Soil Conservation Service as Gee Silt Loam with a small amount of Odne silt loam at the southeast corner of the property.

- A) Topsoil – approximately 5 inches of organic root mat with a tilled zone extending approximately 18 inches from the surface.
- B) Silt – below the tilled zone, a deposit of silt with variable percentages of clay and sand extends to approximately 12.5 feet to 15 feet. In general, the silt zone is stiff in the upper 5 feet with an underlying softer layer.
- C) Clay – Below the silt, a stiff to very stiff clay layer extends to a depth of between 23 and over 42 feet below the surface. In some locations, gravel is present within the clay layer.
- D) Sandy Silt – Below the clay, a stiff deposit of sandy silt exists. Total depth of the sandy silt was not determined by the onsite testing.

As seen in the soil profile, the predominant soil types consist of silts and clays which generally have little to no infiltration capability. This has been confirmed by field testing.

### **2.3 Groundwater**

Based on testing in the project vicinity, groundwater may be present in the vicinity of the stormwater facility. This is a closed detention system, however, groundwater does not appear to affect it.

### **2.4 Existing Stormwater System**

The existing onsite system has already been described. There is an additional storm system adjacent to the site in La Center Road and in Paradise Park Road; this system drains to an existing stormwater treatment and detention facility southeast of the intersection of these two streets.

## **3.0 Drainage Analysis**

Runoff quantities for this project were estimated using the SCS TR-20 method in HydroCAD software. Soil conditions were selected based on the City's requirements; Odne silt loam and Gee silt loam are classified as Hydrologic Soil Groups D and C, respectively. Soil Group C was used for the historic and developed

conditions.

### 3.1 Design Storms

In accordance with the La Center stormwater standards, the following design storms were used to determine the detention and conveyance requirements:

Water Quality Storm	1.54 inches (70% of the 2-year Storm)
2-year Storm	2.2 inches
10-year Storm	3.1 inches
25-year Storm	3.7 inches
100-year Storm	4.4 inches

### 3.2 Historic and Developed Land Uses

Based on historic photography, the historic land use was determined to be pasture.

The developed land uses anticipated in the preliminary site plan are:

- 2.31 acres pavement
- 0.35 acres sidewalk
- 0.74 acres roof
- 1.03 acres landscape

These do include landscaped right-of-way along La Center Road that drains onto the site, but does not include limited driveway areas on the north edge of the site that cannot be routed through this project's storm system, but are caught, treated, and detained by the public facility constructed with the Paradise Park Road realignment.

### 3.3 Water Quality Treatment

Pre-treatment of runoff is provided by a coalescing plate oil-water separator designed in accordance with the *Stormwater Management Manual for the Puget Sound Basin*. This is followed by a Contech Stormfilter™. A splitter manhole is used upstream of the oil-water separator to limit flows through the treatment devices as required by the stormwater manual; large storm events bypass these treatment devices and are routed directly to the detention facility. An outlet trap is used to limit the transport of floatable debris and oils in these overflow events.

The water quality storm runoff rate for the existing and proposed pavement north of the building and truck fueling island was determined to be 1.00 cfs, or 448 gpm. At 22.5 gpm/cartridge, this requires 18 StormFilter ZPG cartridges (27" height) to treat the water quality storm. Vault size for this number of cartridges is 8' x 11'. These BMPs were installed with the previous project and are still appropriate for the proposed use. Additional details are included in the appendices.

### 3.4 Water Quantity Control

Where infiltration of the 100-year storm event is not feasible, La Center requires detention to match the historic runoff rates in the 2-, 10-, and 100-year storm events. In order to meet this standard, an underground gallery of detention pipe was used, providing approximately 600 linear feet of 72" diameter pipe (16,965 cf storage) with a control structure at the northwest corner. A pond volume correction factor was also applied in accordance with the requirements of the *Stormwater Management*

*Manual for the Puget Sound Basin*. This correction factor increased the required storage by 80%.

The following table summarizes the results of the detention design calculations:

Design Storm	Historic Flow (cfs)	Developed Flow (cfs)	Storage Required (cf)*	Depth (ft)
2-year	0.85	0.78	3,257	2.58
10-year	1.66	1.54	5,255	3.60
100-year	2.97	2.92	8,037	5.13

Table A1: Detention Design Calculations

\* indicates storage required before application of the Pond Volume Correction Factor as required under the Puget Sound Manual.

As shown in the table, the facility proposed limits flows following site development to less than the pre-developed flows in the 2-, 10-, and 100-year storm events.

A review of the existing ditch and culvert conditions and the current stormwater management indicates no downstream conveyance capacity limitations sufficient to further limit discharge from this site. The roadside ditch network has not had identified capacity issues. No further downstream analysis is necessary.

The capacity of the proposed pipe network will be calculated in accordance with LCMC. In the 25-year storm event, the storm sewer will be designed to convey all flow in an open channel manner without surcharging.

#### **4.0 Erosion Control**

All improvements are required to meet the latest requirements for Erosion and Sediment Prevention as required by the City of La Center and WSDOE when obtaining an NPDES permit for the construction of the site improvements.

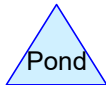
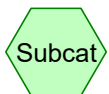
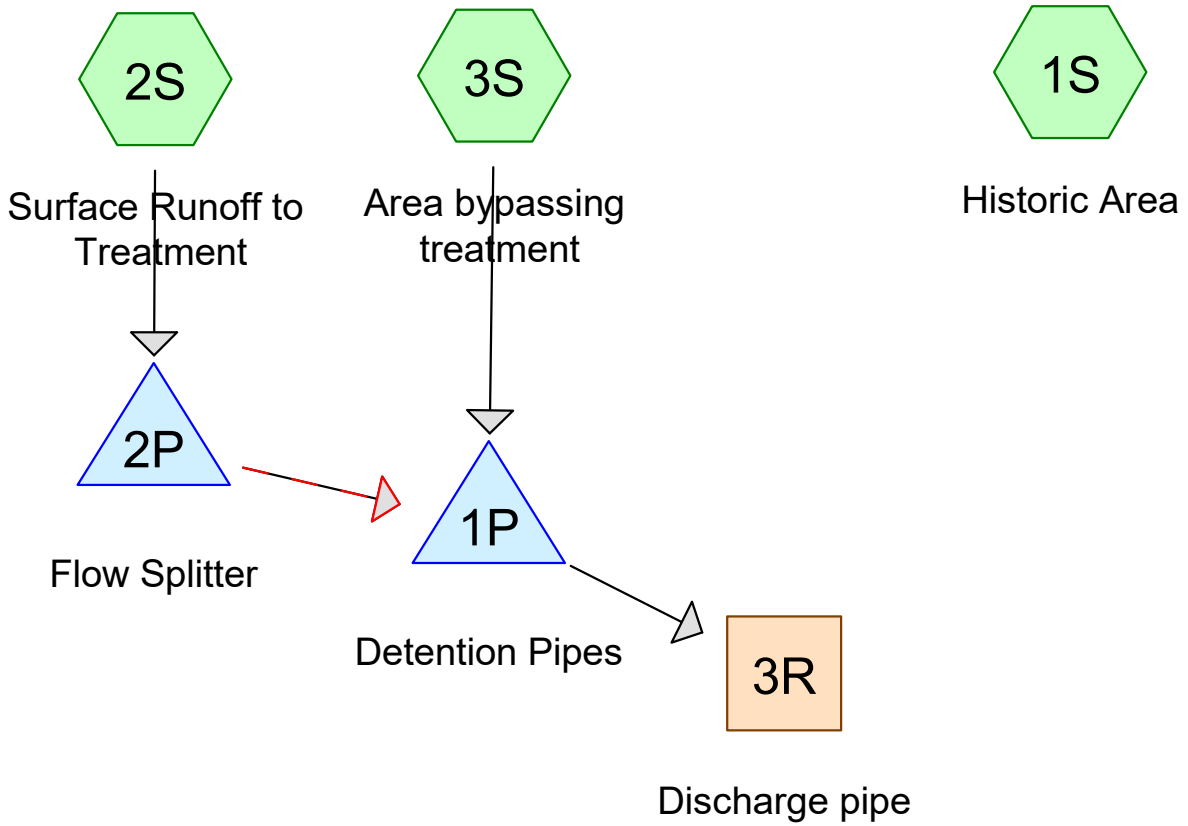
To meet the requirements of the Construction Stormwater General Permit (NPDES Permit), a SWPPP must be developed. The SWPPP must consist of and make provisions for:

- Erosion prevention and sediment control
- Control of other potential pollutants

The Construction SWPPP will describe construction practices, stabilization techniques and structural BMPs that are to be implemented to prevent erosion and minimize sediment transport. The preparation of that SWPPP will be done with the preparation of final construction drawings.

## **Technical Appendix**

- Appendix A**    WQ HydroCAD Report
- Appendix B**    2 Year HydroCAD Report
- Appendix C**    10 Year HydroCAD Report
- Appendix D**    100 Year HydroCAD Report
- Appendix E**    Catchment Plan
- Appendix F**    Development Plans



**Summary for Subcatchment 1S: Historic Area**

Runoff = 0.35 cfs @ 8.16 hrs, Volume= 0.174 af, Depth> 0.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Type IA 24-hr WQ Storm Rainfall=1.54"

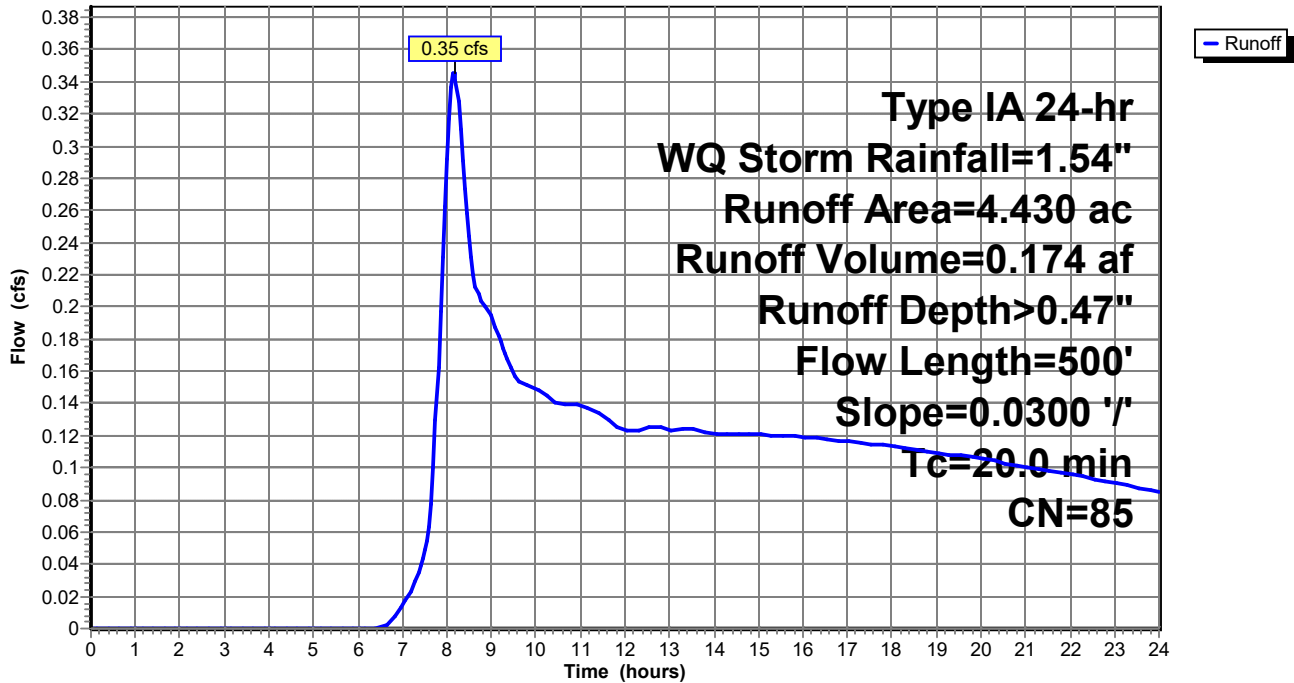
Area (ac)	CN	Description
* 4.430	85	Pasture
4.430		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.6	250	0.0300	0.25		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 3.50"
3.4	250	0.0300	1.21		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
20.0	500	Total			

**Subcatchment 1S: Historic Area**

Hydrograph



**Summary for Subcatchment 2S: Surface Runoff to Treatment**

Runoff = 1.00 cfs @ 7.93 hrs, Volume= 0.322 af, Depth> 1.05"

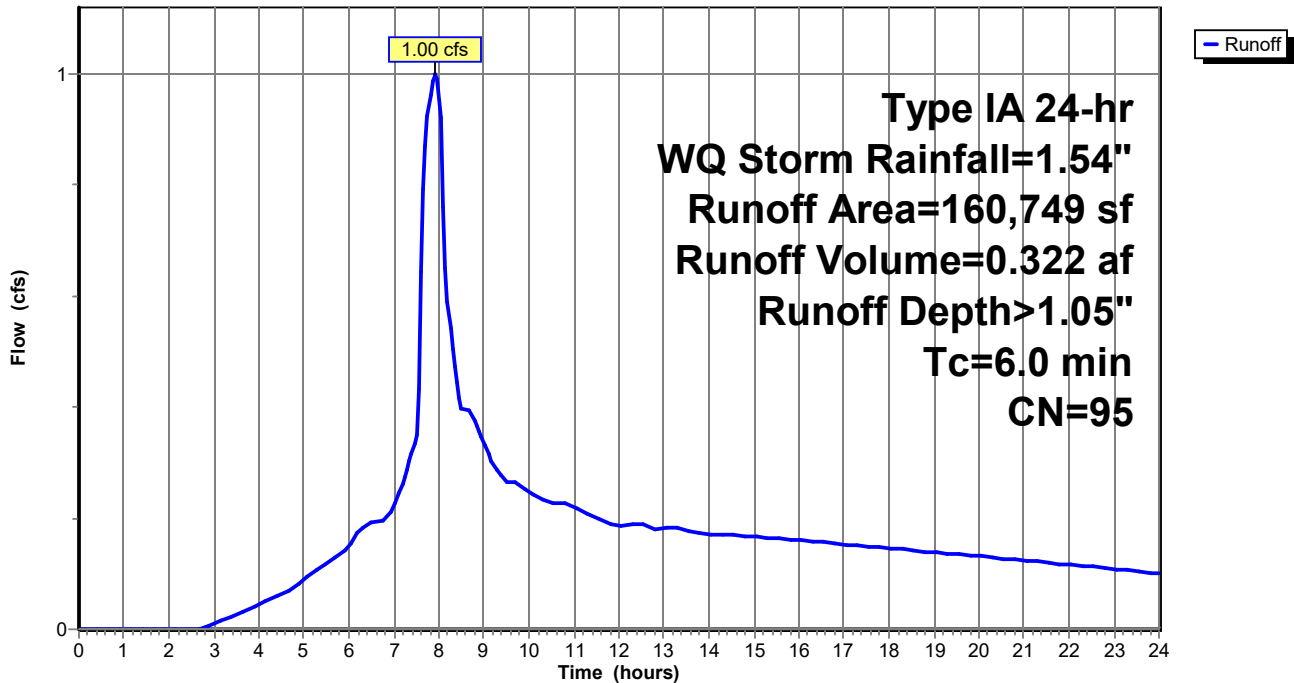
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Type IA 24-hr WQ Storm Rainfall=1.54"

	Area (sf)	CN	Description
*	100,830	98	Pavement
*	15,310	98	Sidewalk
*	44,609	86	Landscape
<hr/>			
	160,749	95	Weighted Average
	44,609		27.75% Pervious Area
	116,140		72.25% Impervious Area

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

**Subcatchment 2S: Surface Runoff to Treatment**

Hydrograph



**Summary for Subcatchment 3S: Area bypassing treatment**

Runoff = 0.25 cfs @ 7.89 hrs, Volume= 0.081 af, Depth> 1.32"

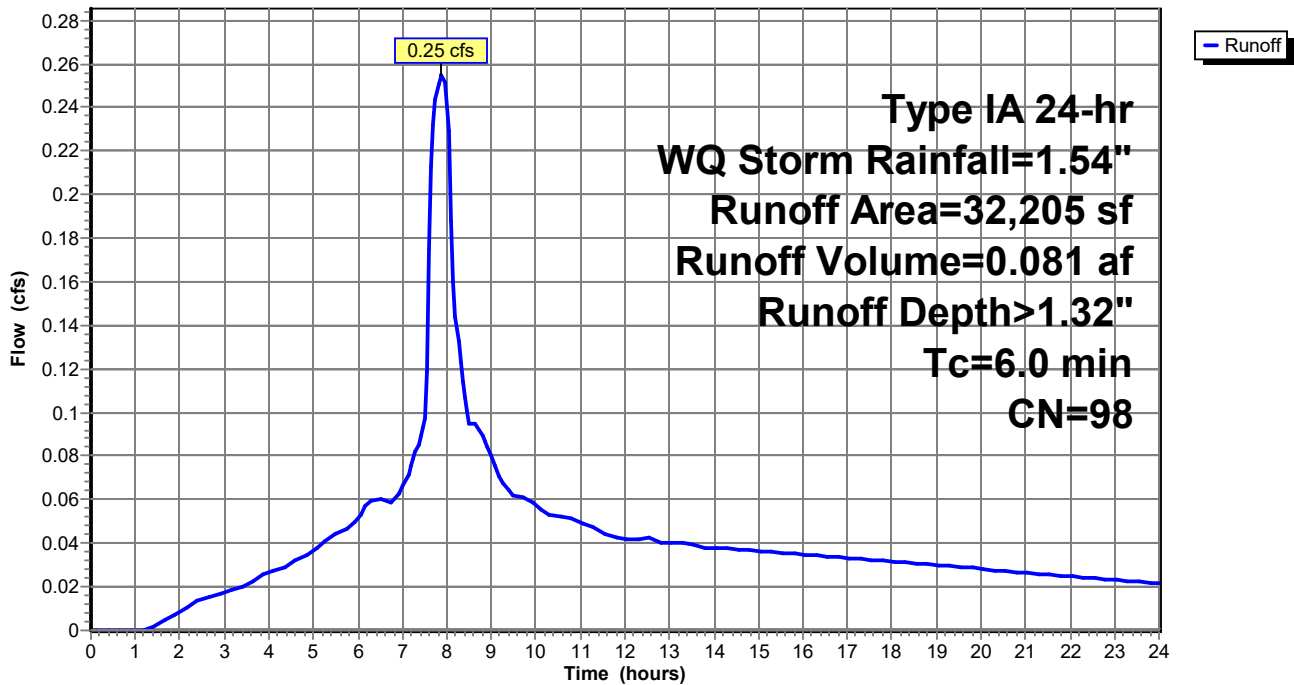
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Type IA 24-hr WQ Storm Rainfall=1.54"

Area (sf)	CN	Description
* 32,205	98	Roof
32,205		100.00% Impervious Area

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

**Subcatchment 3S: Area bypassing treatment**

Hydrograph





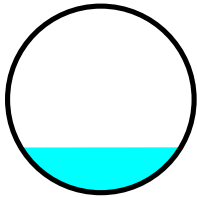
### Summary for Reach 3R: Discharge pipe

Inflow Area = 4.430 ac, 76.88% Impervious, Inflow Depth > 1.09" for WQ Storm event  
 Inflow = 0.61 cfs @ 8.33 hrs, Volume= 0.403 af  
 Outflow = 0.61 cfs @ 8.34 hrs, Volume= 0.403 af, Atten= 0%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Max. Velocity= 2.66 fps, Min. Travel Time= 0.3 min  
 Avg. Velocity = 1.84 fps, Avg. Travel Time= 0.4 min

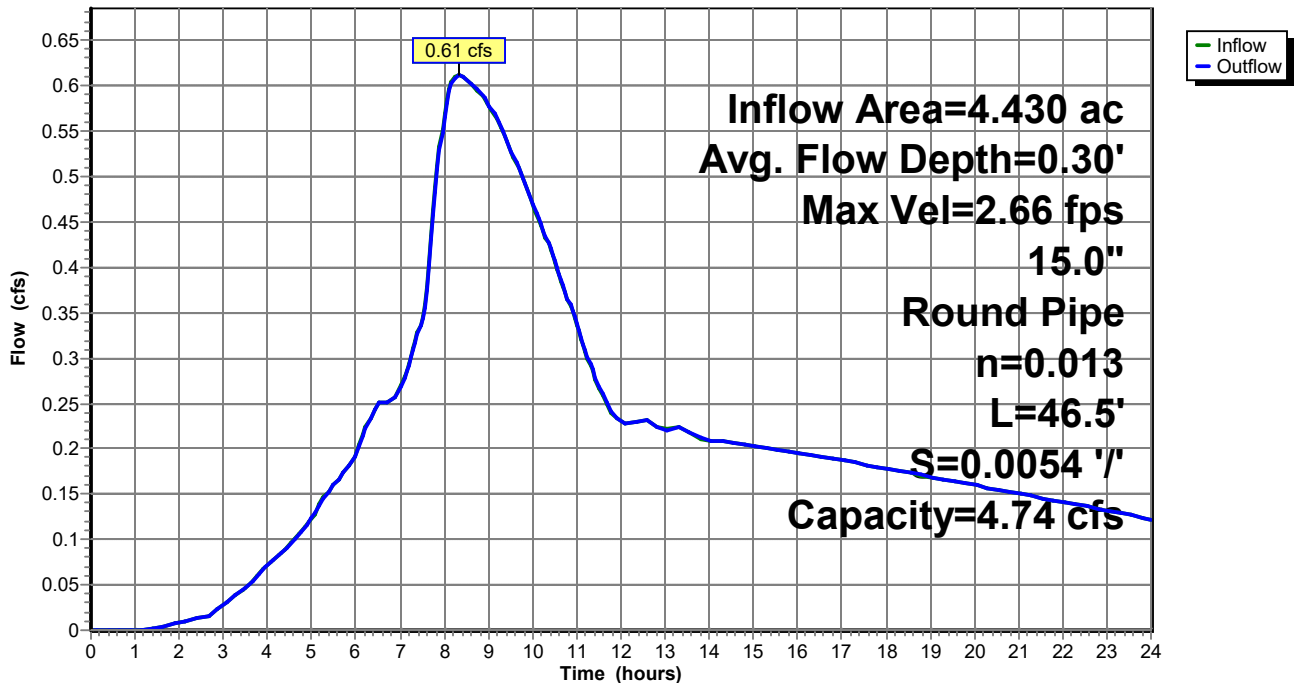
Peak Storage= 11 cf @ 8.34 hrs  
 Average Depth at Peak Storage= 0.30'  
 Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 4.74 cfs

15.0" Round Pipe  
 n= 0.013  
 Length= 46.5' Slope= 0.0054 '/'  
 Inlet Invert= 245.35', Outlet Invert= 245.10'



### Reach 3R: Discharge pipe

Hydrograph



**Summary for Pond 1P: Detention Pipes**

Inflow Area = 4.430 ac, 76.88% Impervious, Inflow Depth > 1.09" for WQ Storm event  
 Inflow = 1.25 cfs @ 7.94 hrs, Volume= 0.403 af  
 Outflow = 0.61 cfs @ 8.33 hrs, Volume= 0.403 af, Atten= 51%, Lag= 23.5 min  
 Primary = 0.61 cfs @ 8.33 hrs, Volume= 0.403 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Peak Elev= 246.94' @ 8.33 hrs Surf.Area= 2,945 sf Storage= 1,477 cf

Plug-Flow detention time= 10.3 min calculated for 0.403 af (100% of inflow)  
 Center-of-Mass det. time= 10.3 min ( 744.4 - 734.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	245.35'	9,331 cf	<b>72.0" Round Pipe Storage</b> L= 600.0' S= 0.0010 '/' 16,965 cf Overall x 55.0% Voids

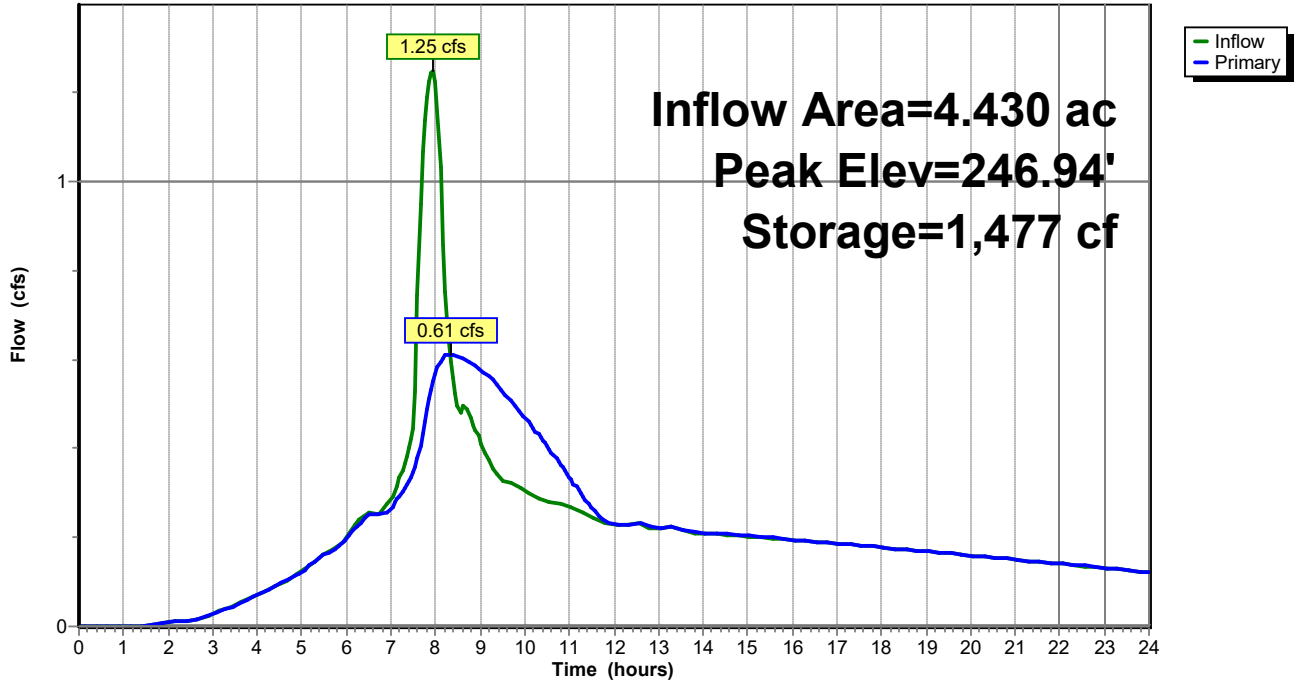
Device	Routing	Invert	Outlet Devices
#1	Primary	245.35'	<b>4.3" Horiz. Orifice/Grate</b> C= 0.600
#2	Primary	248.05'	<b>5.0" Horiz. Orifice/Grate</b> C= 0.600
#3	Primary	249.00'	<b>4.0" Horiz. Orifice/Grate</b> C= 0.600
#4	Primary	250.40'	<b>15.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Primary OutFlow** Max=0.61 cfs @ 8.33 hrs HW=246.94' (Free Discharge)

- 1=Orifice/Grate (Orifice Controls 0.61 cfs @ 6.07 fps)
- 2=Orifice/Grate ( Controls 0.00 cfs)
- 3=Orifice/Grate ( Controls 0.00 cfs)
- 4=Orifice/Grate ( Controls 0.00 cfs)

### Pond 1P: Detention Pipes

Hydrograph



**Summary for Pond 2P: Flow Splitter**

Inflow Area = 3.690 ac, 72.25% Impervious, Inflow Depth > 1.05" for WQ Storm event  
 Inflow = 1.00 cfs @ 7.93 hrs, Volume= 0.322 af  
 Outflow = 1.00 cfs @ 7.95 hrs, Volume= 0.322 af, Atten= 0%, Lag= 1.7 min  
 Primary = 1.00 cfs @ 7.95 hrs, Volume= 0.322 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Peak Elev= 254.72' @ 7.95 hrs Surf.Area= 20 sf Storage= 53 cf

Plug-Flow detention time= 0.3 min calculated for 0.322 af (100% of inflow)  
 Center-of-Mass det. time= 0.2 min ( 745.2 - 745.0 )

Volume	Invert	Avail.Storage	Storage Description
#1	252.00'	157 cf	<b>5.00'D x 8.00'H Vertical Cone/Cylinder</b>

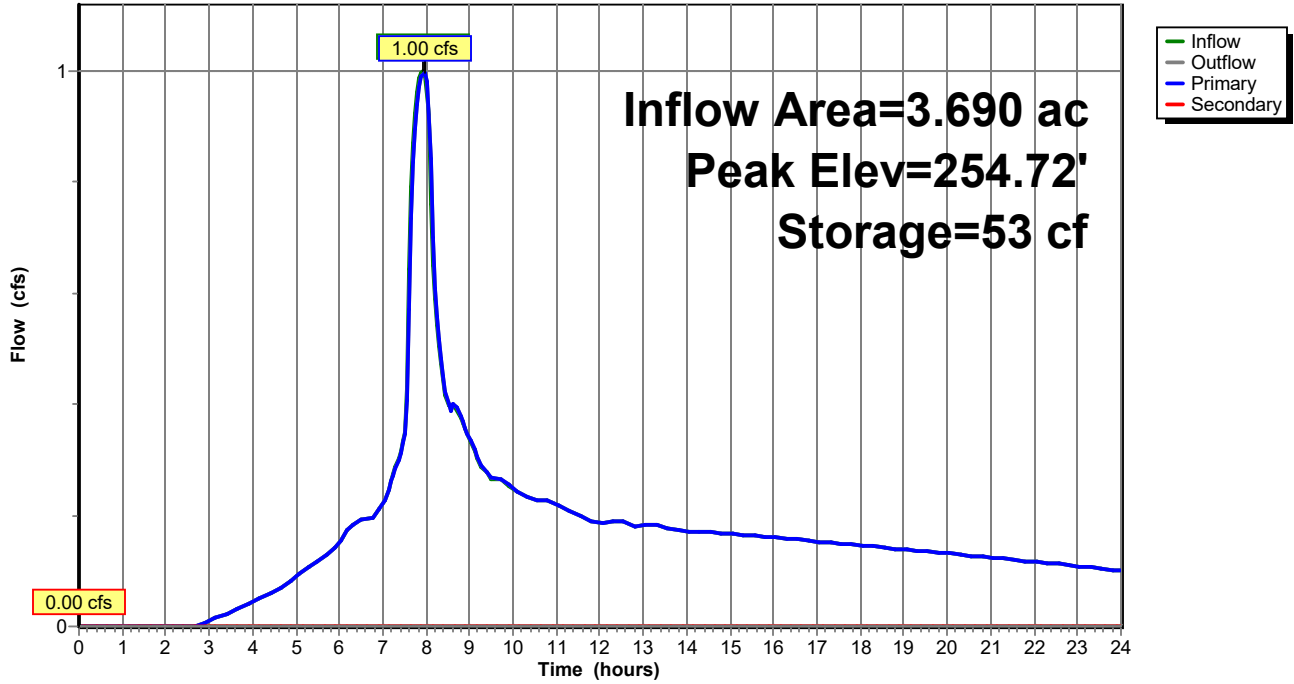
Device	Routing	Invert	Outlet Devices
#1	Primary	252.00'	<b>4.8" Horiz. Orifice/Grate</b> C= 0.600
#2	Secondary	254.75'	<b>12.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

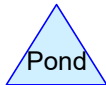
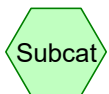
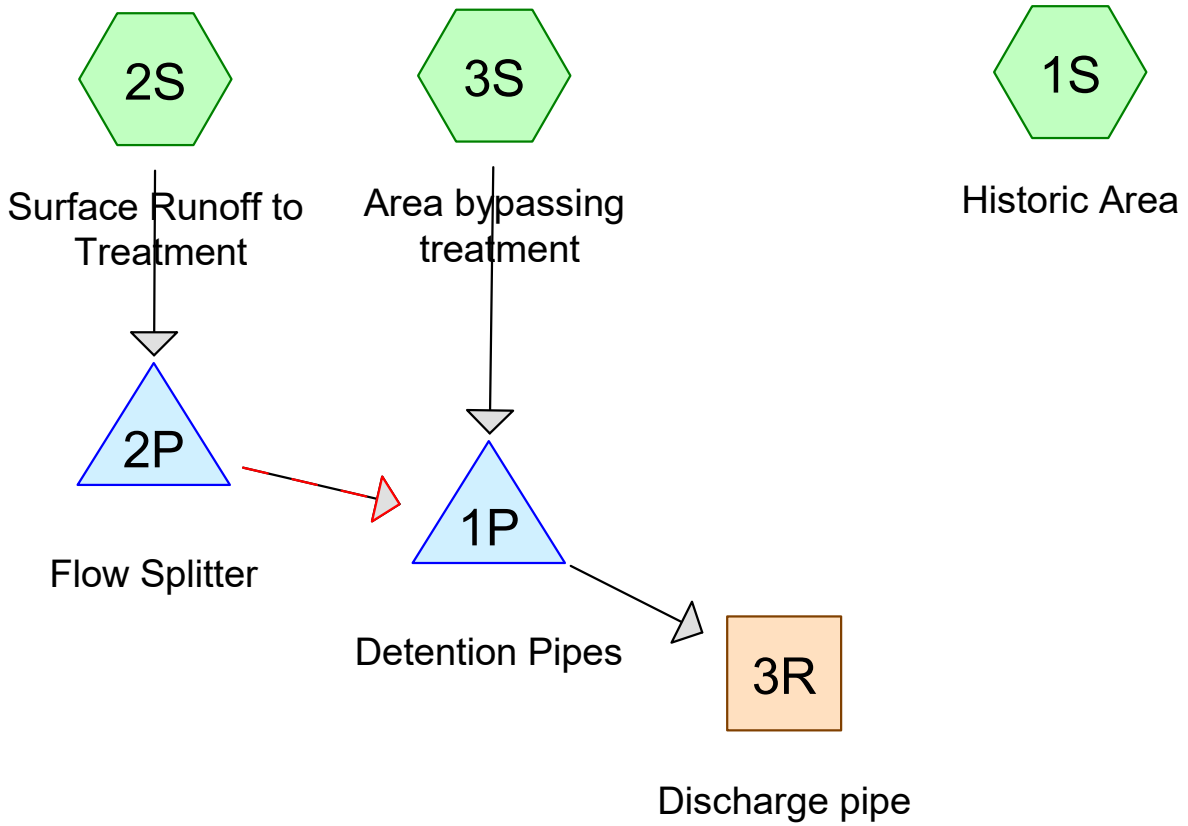
**Primary OutFlow** Max=1.00 cfs @ 7.95 hrs HW=254.71' (Free Discharge)  
 ↖1=Orifice/Grate (Orifice Controls 1.00 cfs @ 7.93 fps)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=252.00' (Free Discharge)  
 ↖2=Orifice/Grate ( Controls 0.00 cfs)

### Pond 2P: Flow Splitter

Hydrograph





**Summary for Subcatchment 1S: Historic Area**

Runoff = 0.85 cfs @ 8.13 hrs, Volume= 0.345 af, Depth> 0.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Type IA 24-hr 2-year Rainfall=2.20"

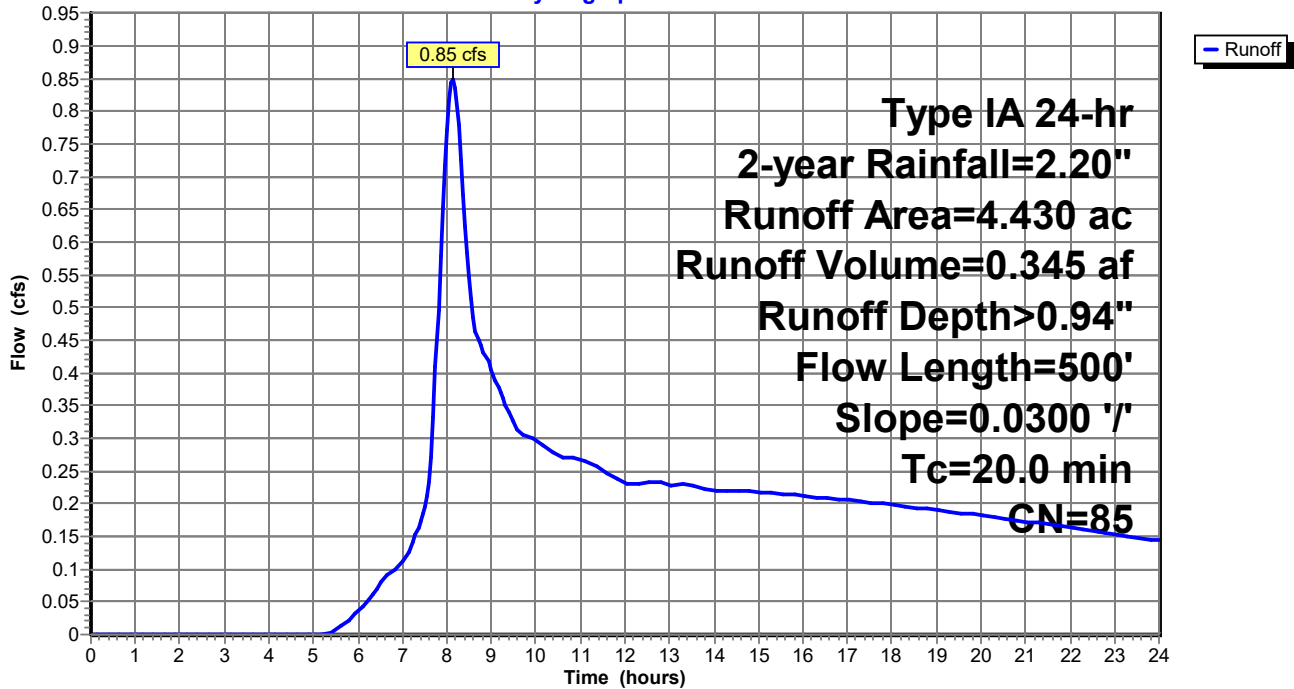
Area (ac)	CN	Description
* 4.430	85	Pasture
4.430		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.6	250	0.0300	0.25		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 3.50"
3.4	250	0.0300	1.21		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
20.0	500	Total			

**Subcatchment 1S: Historic Area**

Hydrograph



### Summary for Subcatchment 2S: Surface Runoff to Treatment

Runoff = 1.62 cfs @ 7.91 hrs, Volume= 0.514 af, Depth> 1.67"

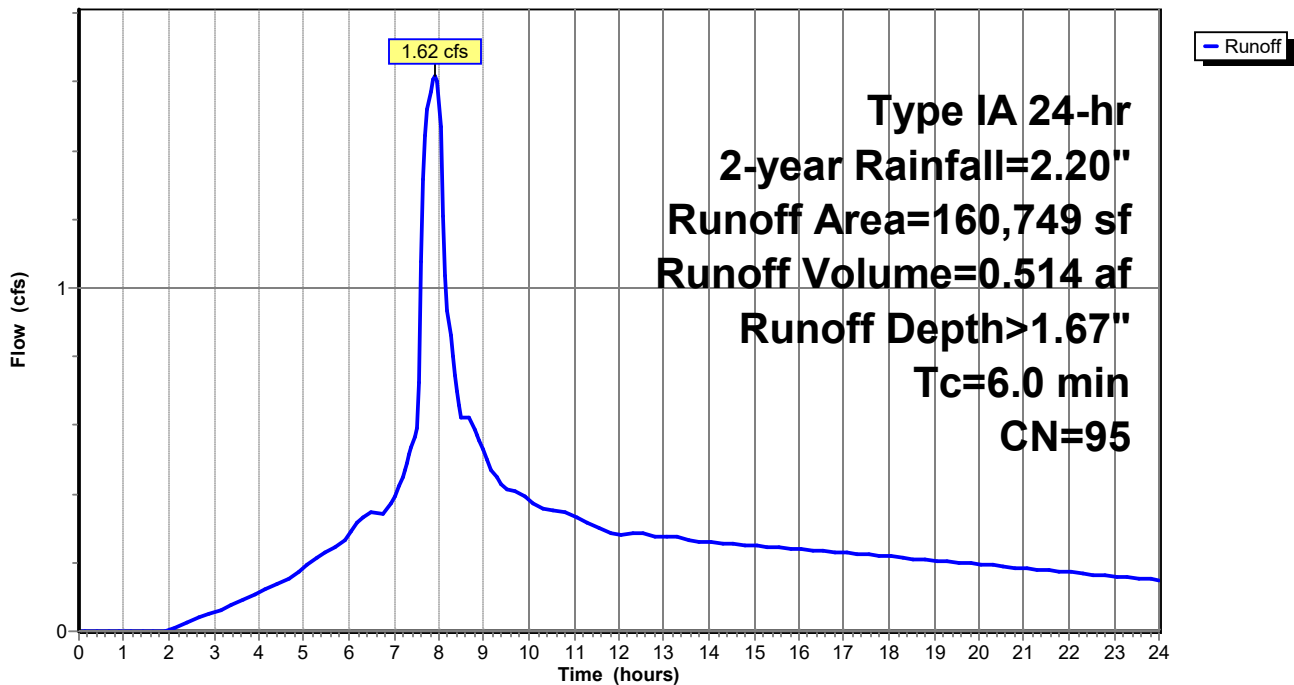
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Type IA 24-hr 2-year Rainfall=2.20"

	Area (sf)	CN	Description
*	100,830	98	Pavement
*	15,310	98	Sidewalk
*	44,609	86	Landscape
	160,749	95	Weighted Average
	44,609		27.75% Pervious Area
	116,140		72.25% Impervious Area

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

### Subcatchment 2S: Surface Runoff to Treatment

Hydrograph





**Summary for Subcatchment 3S: Area bypassing treatment**

Runoff = 0.38 cfs @ 7.88 hrs, Volume= 0.121 af, Depth> 1.97"

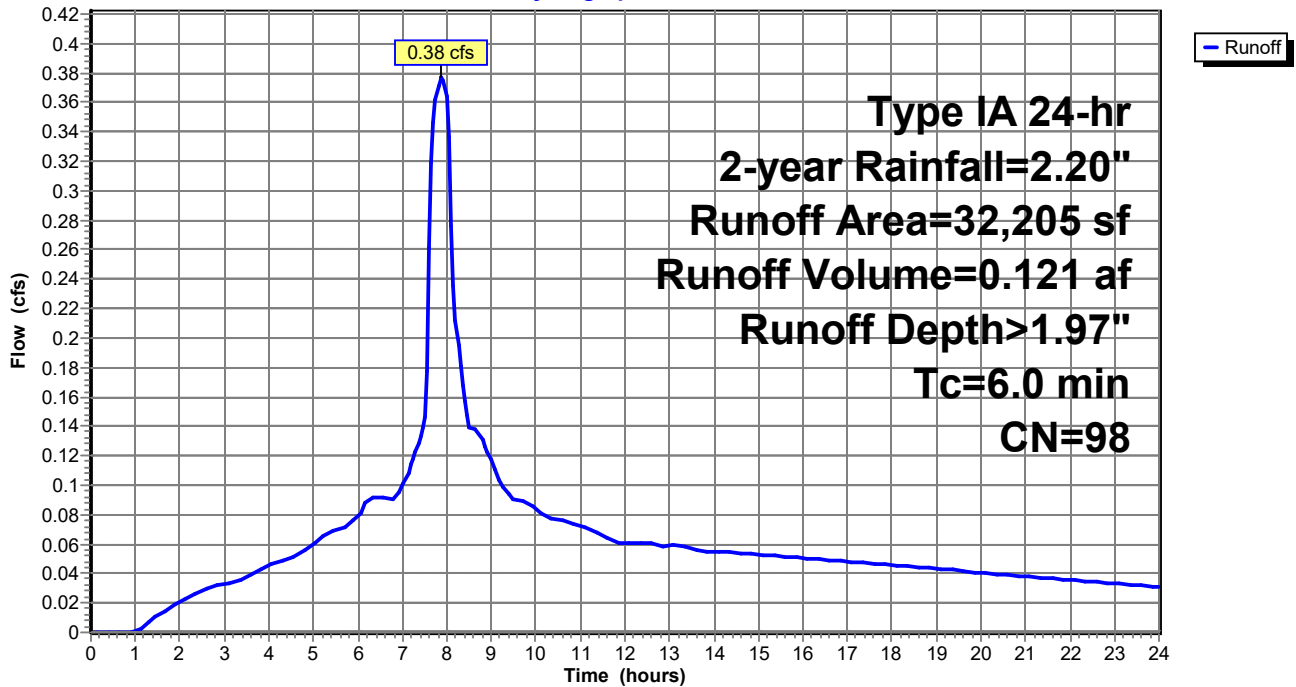
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Type IA 24-hr 2-year Rainfall=2.20"

Area (sf)	CN	Description
* 32,205	98	Roof
32,205		100.00% Impervious Area

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

**Subcatchment 3S: Area bypassing treatment**

Hydrograph



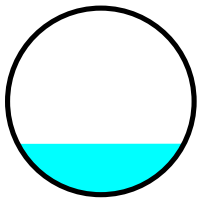
### Summary for Reach 3R: Discharge pipe

Inflow Area = 4.430 ac, 76.88% Impervious, Inflow Depth > 1.72" for 2-year event  
 Inflow = 0.78 cfs @ 8.50 hrs, Volume= 0.635 af  
 Outflow = 0.78 cfs @ 8.51 hrs, Volume= 0.635 af, Atten= 0%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Max. Velocity= 2.85 fps, Min. Travel Time= 0.3 min  
 Avg. Velocity = 2.12 fps, Avg. Travel Time= 0.4 min

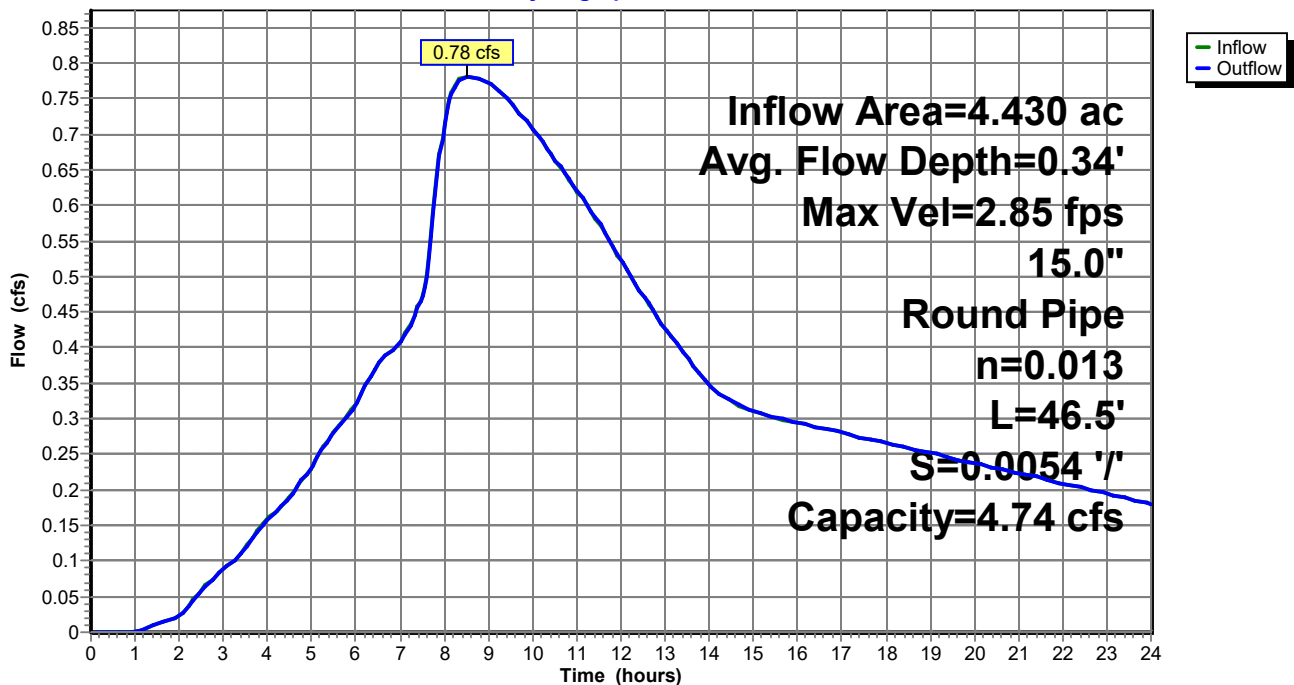
Peak Storage= 13 cf @ 8.50 hrs  
 Average Depth at Peak Storage= 0.34'  
 Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 4.74 cfs

15.0" Round Pipe  
 n= 0.013  
 Length= 46.5' Slope= 0.0054 '/'  
 Inlet Invert= 245.35', Outlet Invert= 245.10'



### Reach 3R: Discharge pipe

Hydrograph



**Summary for Pond 1P: Detention Pipes**

Inflow Area = 4.430 ac, 76.88% Impervious, Inflow Depth > 1.72" for 2-year event  
 Inflow = 2.01 cfs @ 7.85 hrs, Volume= 0.635 af  
 Outflow = 0.78 cfs @ 8.50 hrs, Volume= 0.635 af, Atten= 61%, Lag= 39.1 min  
 Primary = 0.78 cfs @ 8.50 hrs, Volume= 0.635 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Peak Elev= 247.93' @ 8.50 hrs Surf.Area= 3,488 sf Storage= 3,257 cf

Plug-Flow detention time= 24.7 min calculated for 0.634 af (100% of inflow)  
 Center-of-Mass det. time= 24.5 min ( 737.3 - 712.7 )

Volume	Invert	Avail.Storage	Storage Description
#1	245.35'	9,331 cf	<b>72.0" Round Pipe Storage</b> L= 600.0' S= 0.0010 '/' 16,965 cf Overall x 55.0% Voids

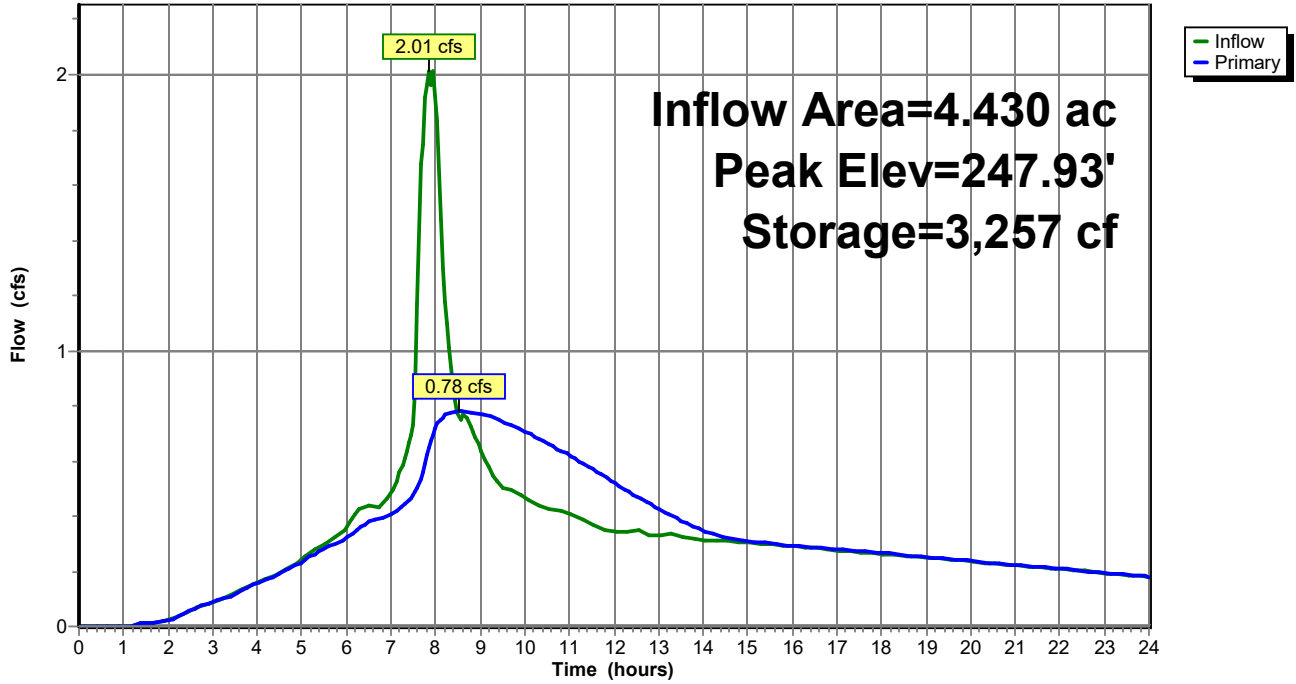
Device	Routing	Invert	Outlet Devices
#1	Primary	245.35'	<b>4.3" Horiz. Orifice/Grate</b> C= 0.600
#2	Primary	248.05'	<b>5.0" Horiz. Orifice/Grate</b> C= 0.600
#3	Primary	249.00'	<b>4.0" Horiz. Orifice/Grate</b> C= 0.600
#4	Primary	250.40'	<b>15.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Primary OutFlow** Max=0.78 cfs @ 8.50 hrs HW=247.93' (Free Discharge)

- 1=Orifice/Grate (Orifice Controls 0.78 cfs @ 7.73 fps)
- 2=Orifice/Grate ( Controls 0.00 cfs)
- 3=Orifice/Grate ( Controls 0.00 cfs)
- 4=Orifice/Grate ( Controls 0.00 cfs)

### Pond 1P: Detention Pipes

Hydrograph



**Summary for Pond 2P: Flow Splitter**

Inflow Area = 3.690 ac, 72.25% Impervious, Inflow Depth > 1.67" for 2-year event  
 Inflow = 1.62 cfs @ 7.91 hrs, Volume= 0.514 af  
 Outflow = 1.64 cfs @ 7.95 hrs, Volume= 0.514 af, Atten= 0%, Lag= 2.6 min  
 Primary = 1.03 cfs @ 7.95 hrs, Volume= 0.494 af  
 Secondary = 0.61 cfs @ 7.95 hrs, Volume= 0.020 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Peak Elev= 254.90' @ 7.95 hrs Surf.Area= 20 sf Storage= 57 cf

Plug-Flow detention time= 0.3 min calculated for 0.513 af (100% of inflow)  
 Center-of-Mass det. time= 0.3 min ( 721.4 - 721.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	252.00'	157 cf	<b>5.00'D x 8.00'H Vertical Cone/Cylinder</b>

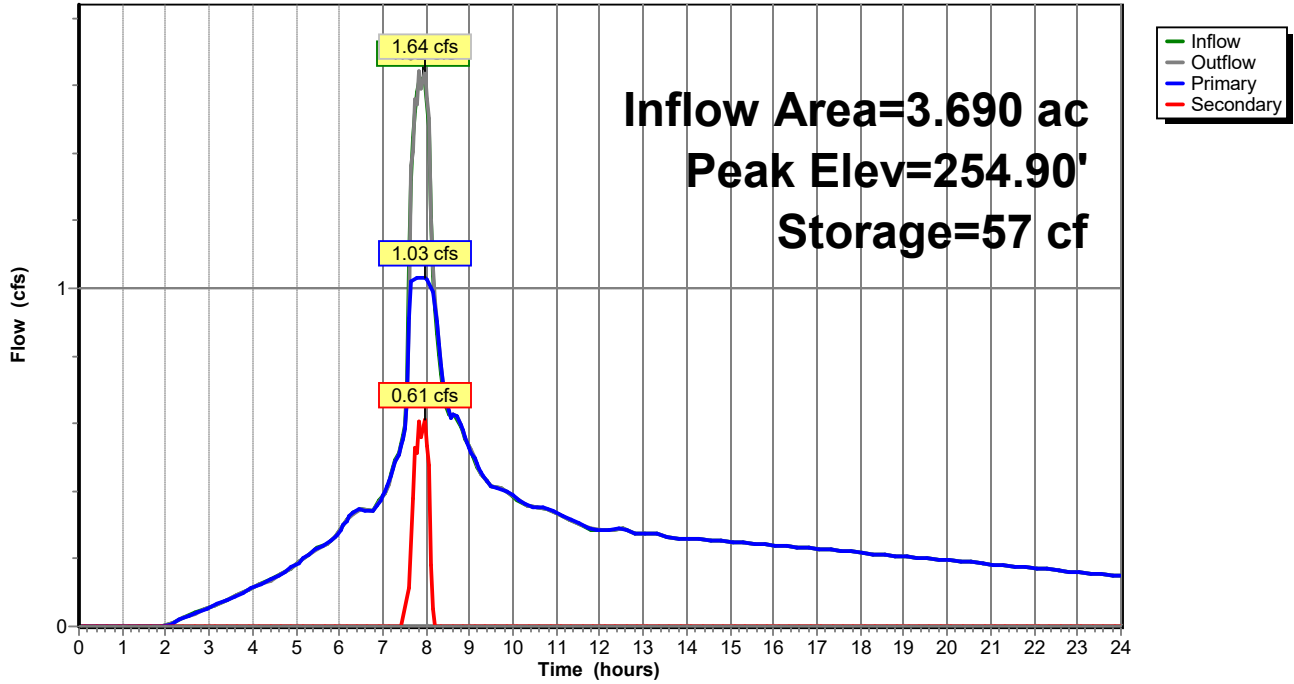
Device	Routing	Invert	Outlet Devices
#1	Primary	252.00'	<b>4.8" Horiz. Orifice/Grate</b> C= 0.600
#2	Secondary	254.75'	<b>12.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

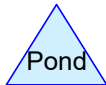
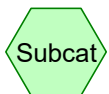
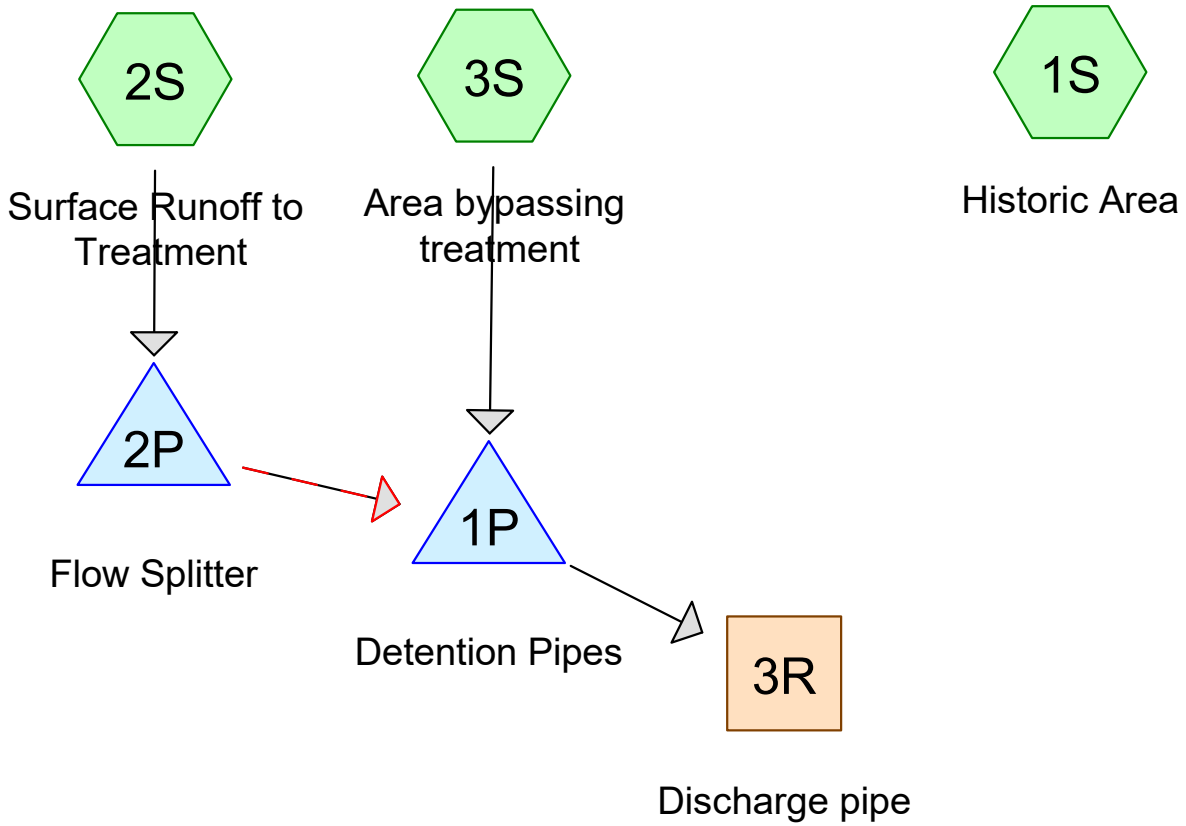
**Primary OutFlow** Max=1.03 cfs @ 7.95 hrs HW=254.90' (Free Discharge)  
 ↑1=Orifice/Grate (Orifice Controls 1.03 cfs @ 8.20 fps)

**Secondary OutFlow** Max=0.60 cfs @ 7.95 hrs HW=254.90' (Free Discharge)  
 ↑2=Orifice/Grate (Weir Controls 0.60 cfs @ 1.27 fps)

### Pond 2P: Flow Splitter

Hydrograph





**Summary for Subcatchment 1S: Historic Area**

Runoff = 1.66 cfs @ 8.12 hrs, Volume= 0.612 af, Depth> 1.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Type IA 24-hr 10-year Rainfall=3.10"

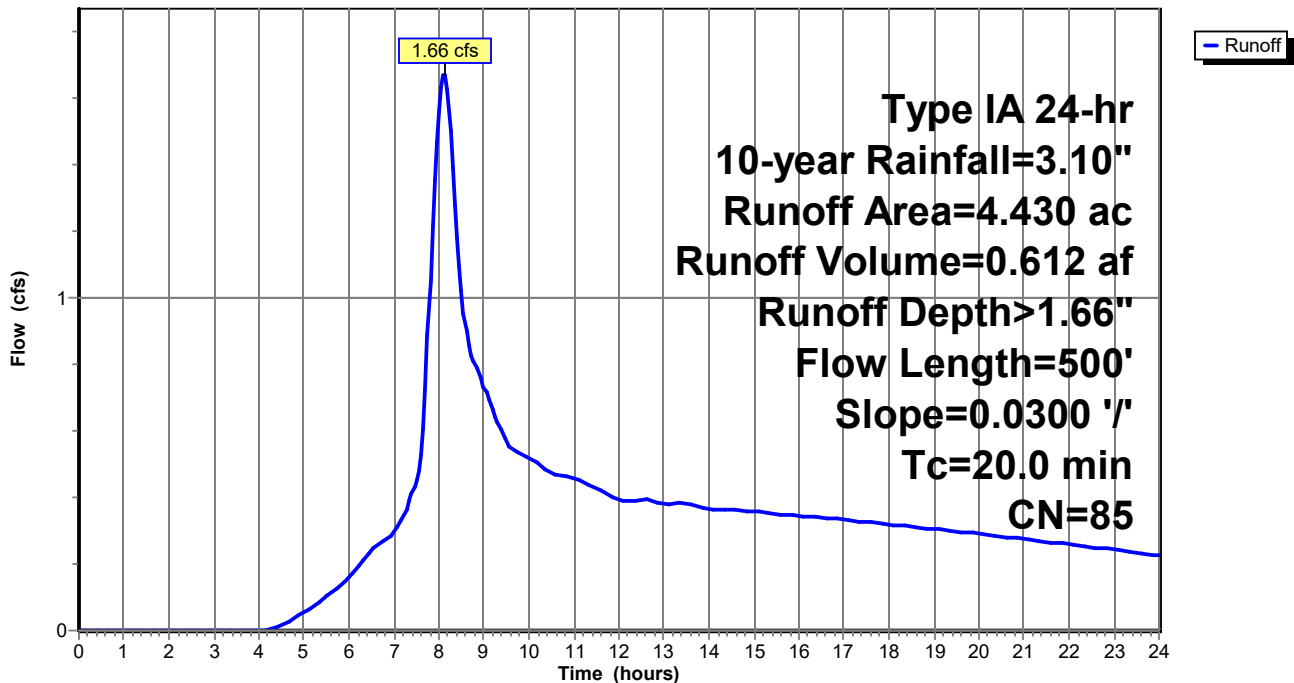
Area (ac)	CN	Description
* 4.430	85	Pasture
4.430		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.6	250	0.0300	0.25		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 3.50"
3.4	250	0.0300	1.21		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
20.0	500	Total			

**Subcatchment 1S: Historic Area**

Hydrograph





### Summary for Subcatchment 2S: Surface Runoff to Treatment

Runoff = 2.47 cfs @ 7.89 hrs, Volume= 0.782 af, Depth> 2.54"

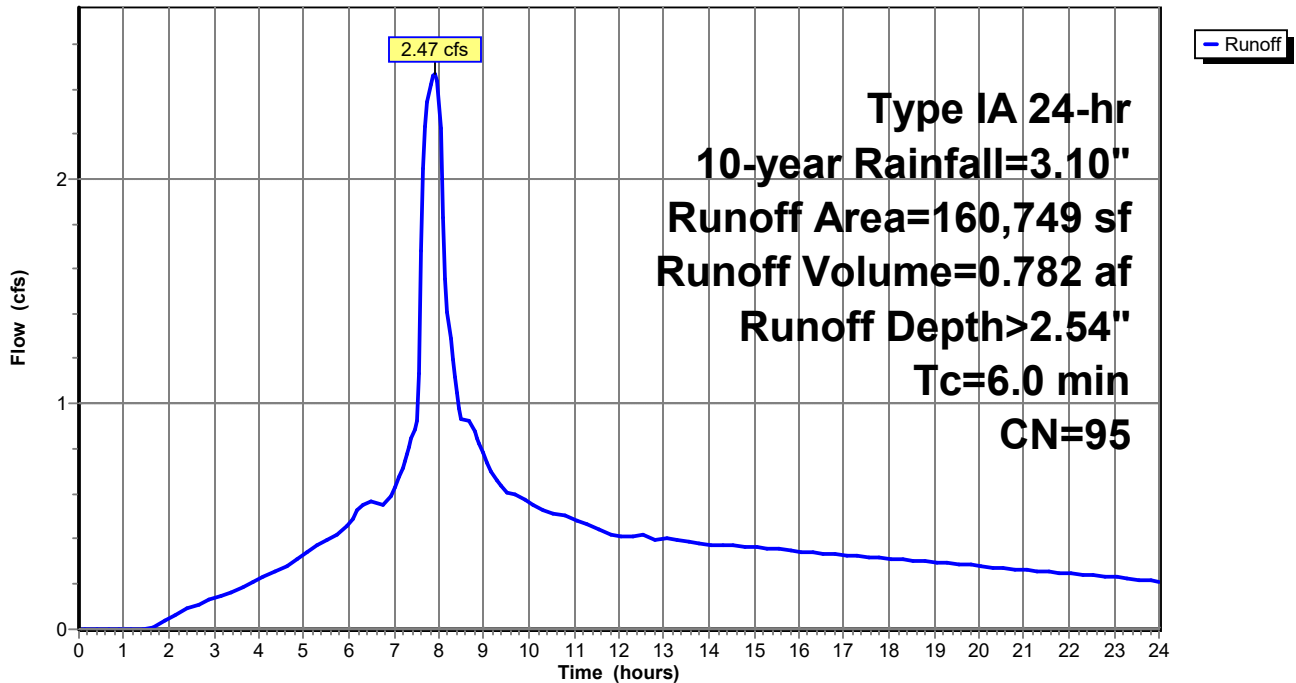
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Type IA 24-hr 10-year Rainfall=3.10"

	Area (sf)	CN	Description
*	100,830	98	Pavement
*	15,310	98	Sidewalk
*	44,609	86	Landscape
	160,749	95	Weighted Average
	44,609		27.75% Pervious Area
	116,140		72.25% Impervious Area

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

### Subcatchment 2S: Surface Runoff to Treatment

Hydrograph



**Summary for Subcatchment 3S: Area bypassing treatment**

Runoff = 0.54 cfs @ 7.87 hrs, Volume= 0.176 af, Depth> 2.86"

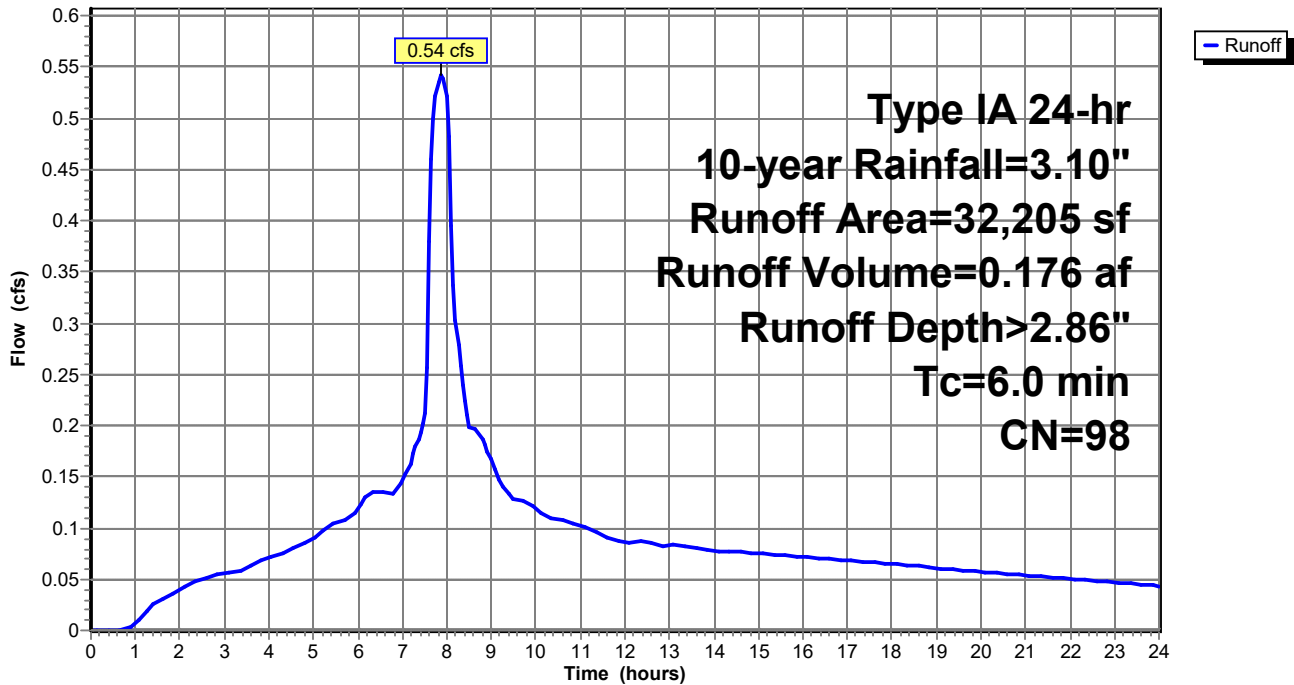
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Type IA 24-hr 10-year Rainfall=3.10"

Area (sf)	CN	Description
* 32,205	98	Roof
32,205		100.00% Impervious Area

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

**Subcatchment 3S: Area bypassing treatment**

Hydrograph



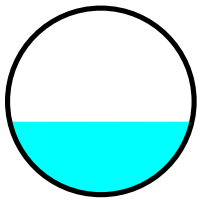
### Summary for Reach 3R: Discharge pipe

Inflow Area = 4.430 ac, 76.88% Impervious, Inflow Depth > 2.59" for 10-year event  
 Inflow = 1.54 cfs @ 8.26 hrs, Volume= 0.958 af  
 Outflow = 1.54 cfs @ 8.29 hrs, Volume= 0.958 af, Atten= 0%, Lag= 1.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Max. Velocity= 3.45 fps, Min. Travel Time= 0.2 min  
 Avg. Velocity = 2.38 fps, Avg. Travel Time= 0.3 min

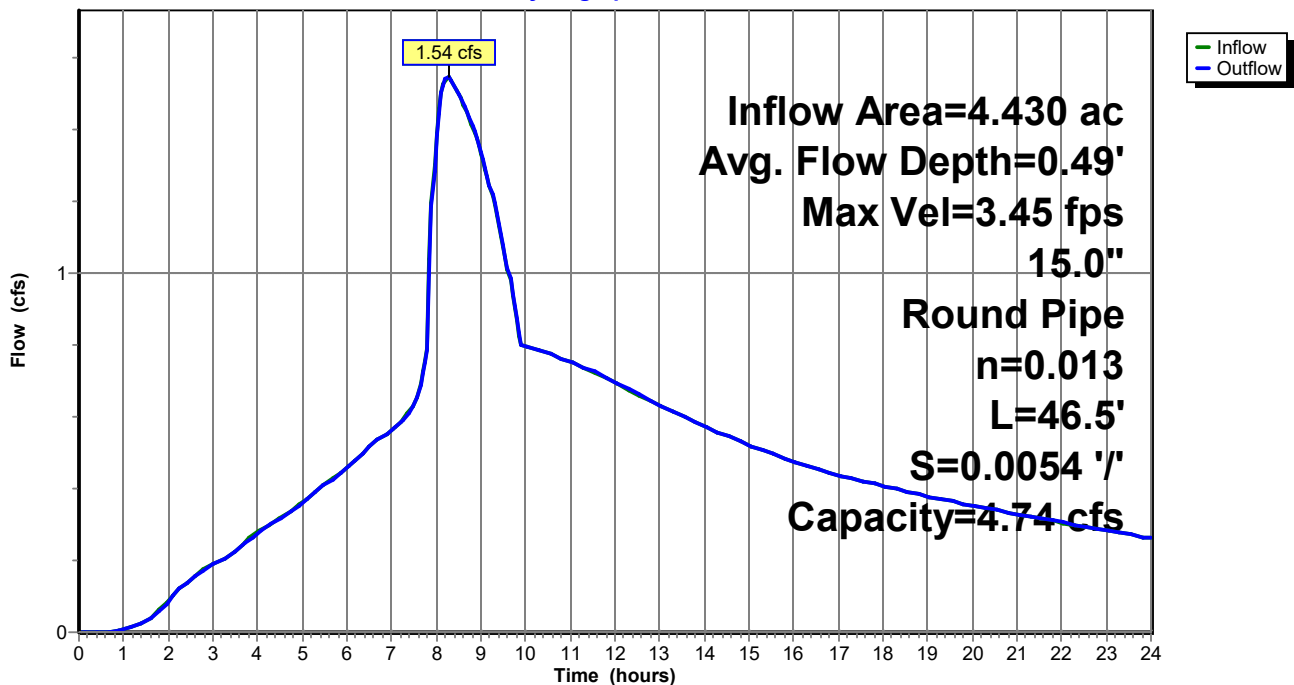
Peak Storage= 21 cf @ 8.29 hrs  
 Average Depth at Peak Storage= 0.49'  
 Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 4.74 cfs

15.0" Round Pipe  
 n= 0.013  
 Length= 46.5' Slope= 0.0054 '/'  
 Inlet Invert= 245.35', Outlet Invert= 245.10'



### Reach 3R: Discharge pipe

Hydrograph



**Summary for Pond 1P: Detention Pipes**

Inflow Area = 4.430 ac, 76.88% Impervious, Inflow Depth > 2.60" for 10-year event  
 Inflow = 3.05 cfs @ 7.90 hrs, Volume= 0.958 af  
 Outflow = 1.54 cfs @ 8.26 hrs, Volume= 0.958 af, Atten= 49%, Lag= 21.9 min  
 Primary = 1.54 cfs @ 8.26 hrs, Volume= 0.958 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Peak Elev= 248.95' @ 8.26 hrs Surf.Area= 3,576 sf Storage= 5,255 cf

Plug-Flow detention time= 35.3 min calculated for 0.958 af (100% of inflow)  
 Center-of-Mass det. time= 34.7 min ( 730.2 - 695.5 )

Volume	Invert	Avail.Storage	Storage Description
#1	245.35'	9,331 cf	<b>72.0" Round Pipe Storage</b> L= 600.0' S= 0.0010 '/' 16,965 cf Overall x 55.0% Voids

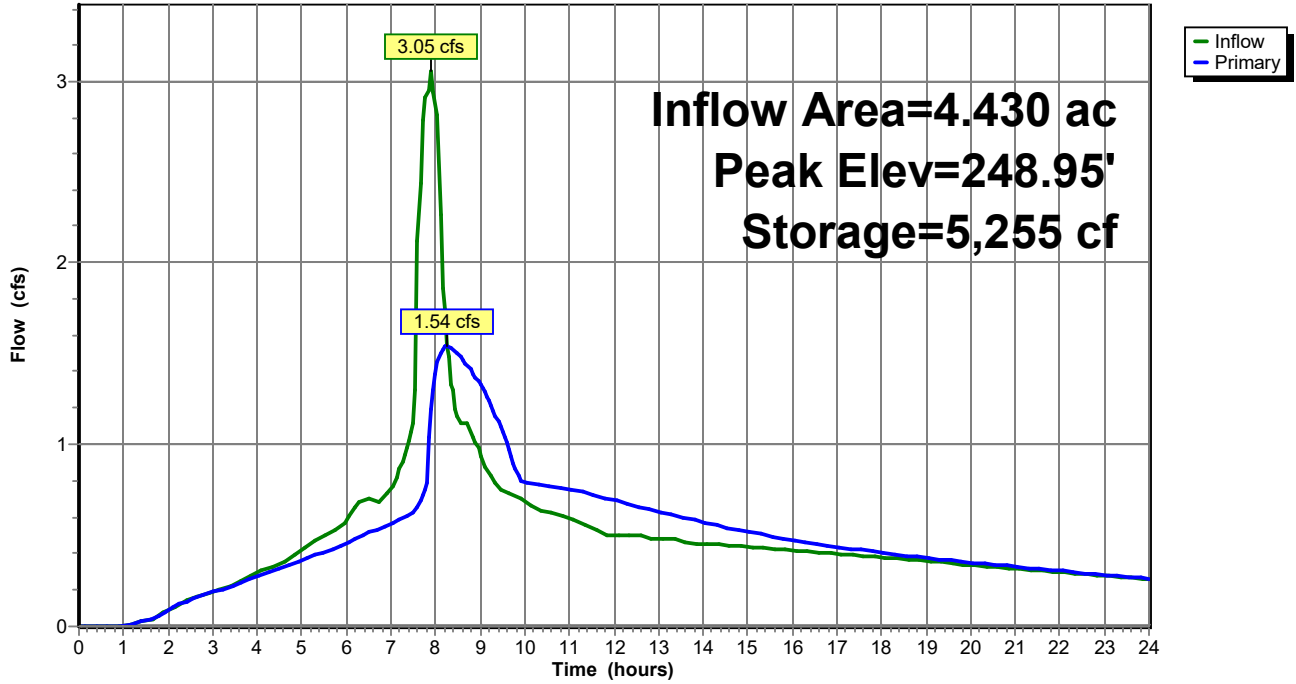
Device	Routing	Invert	Outlet Devices
#1	Primary	245.35'	<b>4.3" Horiz. Orifice/Grate</b> C= 0.600
#2	Primary	248.05'	<b>5.0" Horiz. Orifice/Grate</b> C= 0.600
#3	Primary	249.00'	<b>4.0" Horiz. Orifice/Grate</b> C= 0.600
#4	Primary	250.40'	<b>15.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Primary OutFlow** Max=1.54 cfs @ 8.26 hrs HW=248.95' (Free Discharge)

- 1=Orifice/Grate (Orifice Controls 0.92 cfs @ 9.13 fps)
- 2=Orifice/Grate (Orifice Controls 0.62 cfs @ 4.56 fps)
- 3=Orifice/Grate ( Controls 0.00 cfs)
- 4=Orifice/Grate ( Controls 0.00 cfs)

### Pond 1P: Detention Pipes

Hydrograph



**Summary for Pond 2P: Flow Splitter**

Inflow Area = 3.690 ac, 72.25% Impervious, Inflow Depth > 2.54" for 10-year event  
 Inflow = 2.47 cfs @ 7.89 hrs, Volume= 0.782 af  
 Outflow = 2.51 cfs @ 7.90 hrs, Volume= 0.782 af, Atten= 0%, Lag= 0.4 min  
 Primary = 1.05 cfs @ 7.90 hrs, Volume= 0.722 af  
 Secondary = 1.46 cfs @ 7.90 hrs, Volume= 0.061 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Peak Elev= 255.02' @ 7.90 hrs Surf.Area= 20 sf Storage= 59 cf

Plug-Flow detention time= 0.4 min calculated for 0.780 af (100% of inflow)  
 Center-of-Mass det. time= 0.4 min ( 702.3 - 701.9 )

Volume	Invert	Avail.Storage	Storage Description
#1	252.00'	157 cf	<b>5.00'D x 8.00'H Vertical Cone/Cylinder</b>

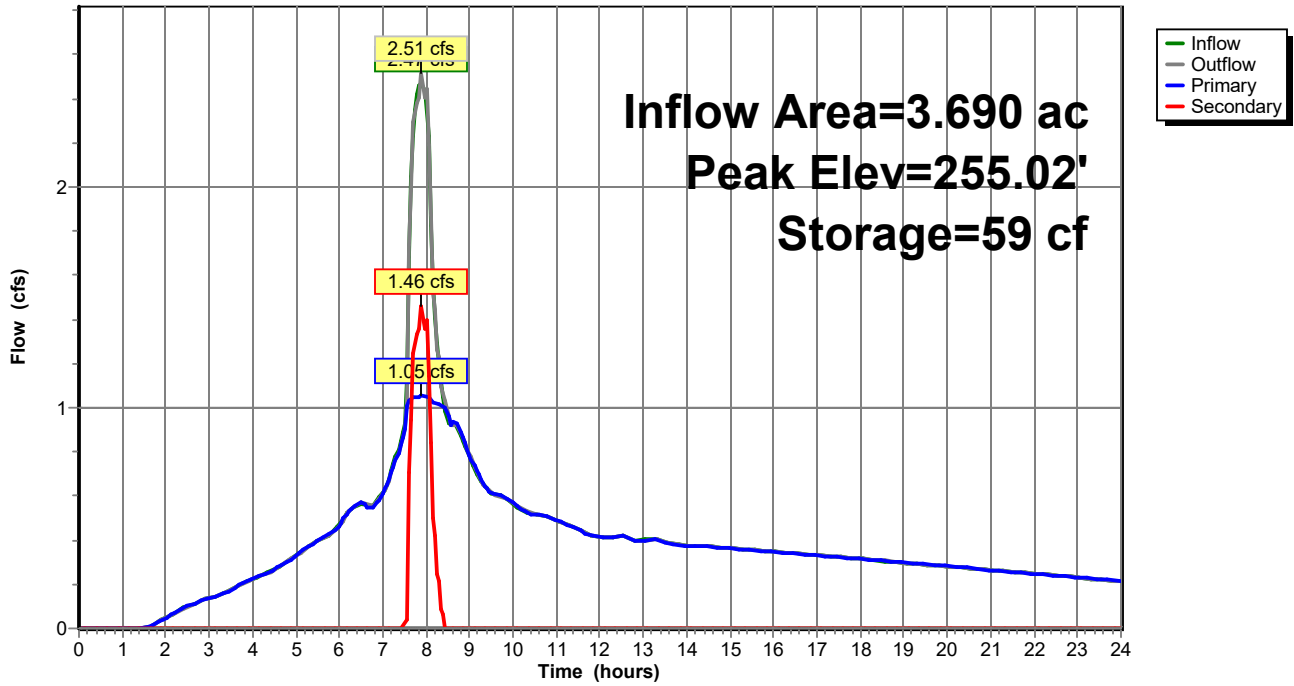
Device	Routing	Invert	Outlet Devices
#1	Primary	252.00'	<b>4.8" Horiz. Orifice/Grate</b> C= 0.600
#2	Secondary	254.75'	<b>12.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

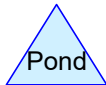
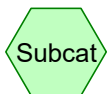
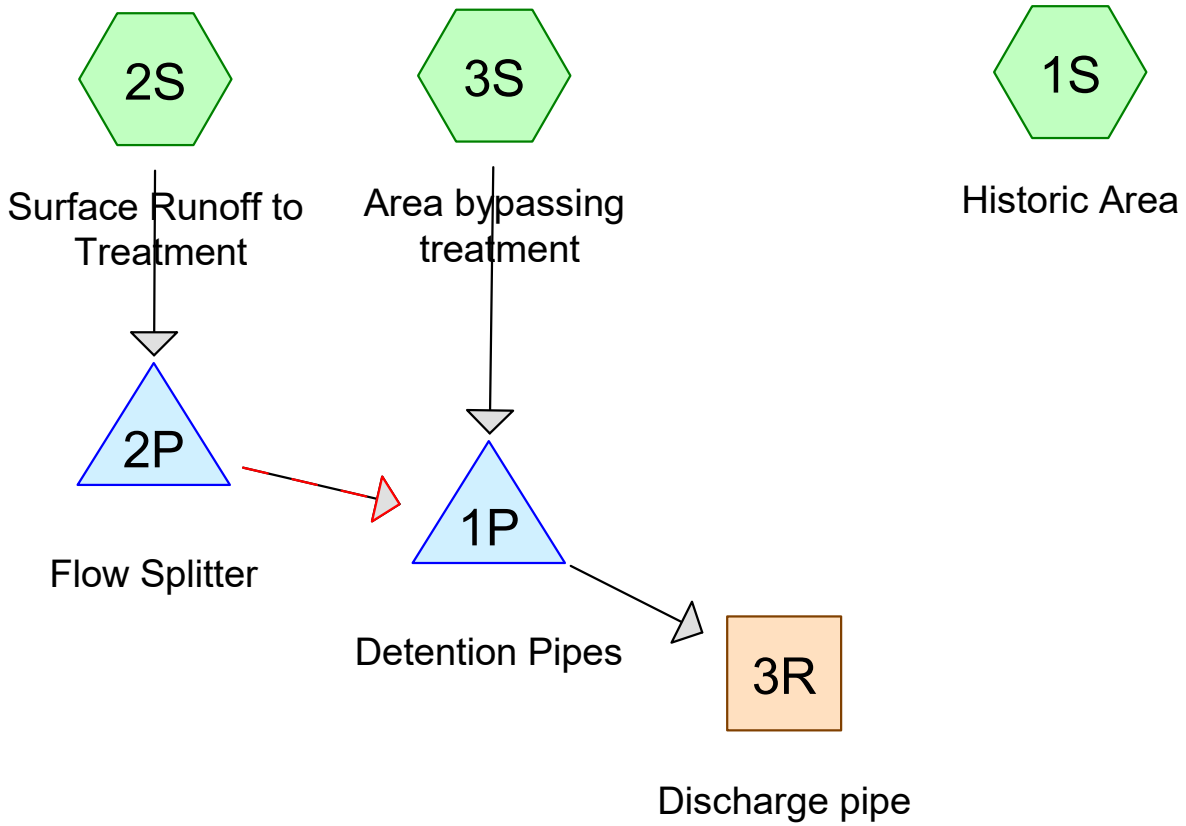
**Primary OutFlow** Max=1.05 cfs @ 7.90 hrs HW=255.02' (Free Discharge)  
 ←1=Orifice/Grate (Orifice Controls 1.05 cfs @ 8.37 fps)

**Secondary OutFlow** Max=1.45 cfs @ 7.90 hrs HW=255.02' (Free Discharge)  
 ←2=Orifice/Grate (Weir Controls 1.45 cfs @ 1.70 fps)

### Pond 2P: Flow Splitter

Hydrograph







**Summary for Subcatchment 1S: Historic Area**

Runoff = 2.97 cfs @ 8.10 hrs, Volume= 1.032 af, Depth> 2.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Type IA 24-hr 100-year Rainfall=4.40"

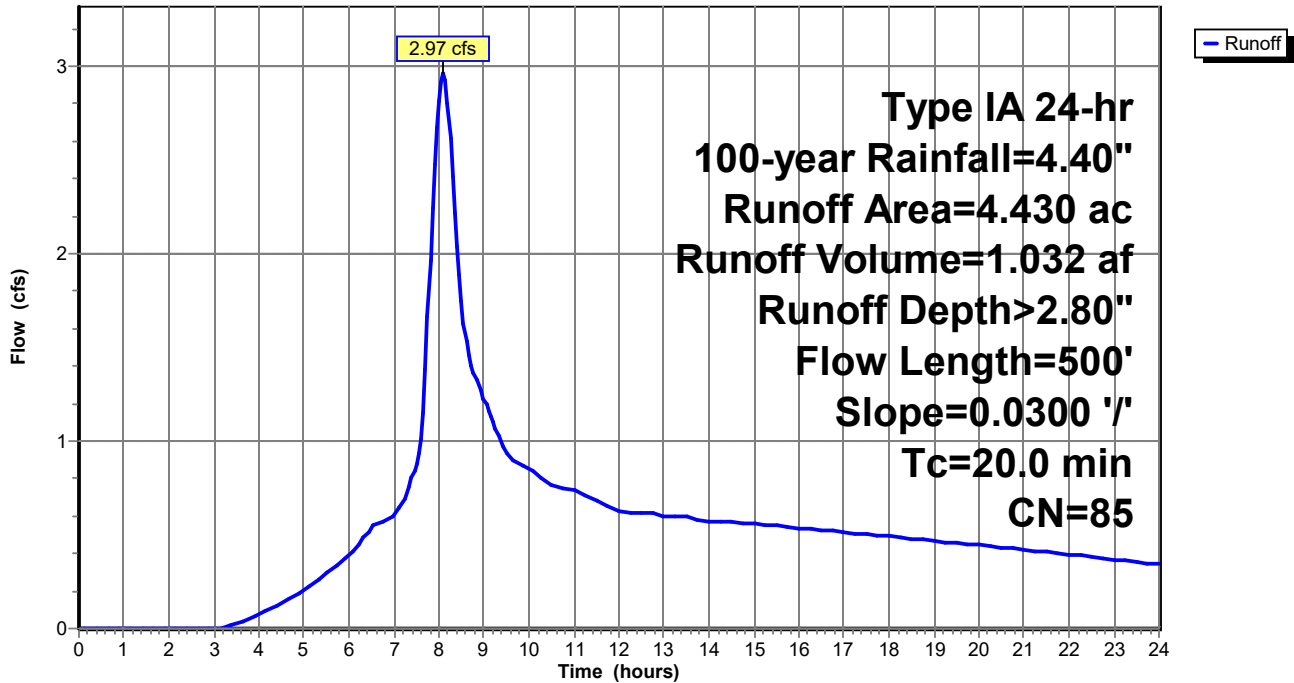
Area (ac)	CN	Description
* 4.430	85	Pasture
4.430		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.6	250	0.0300	0.25		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 3.50"
3.4	250	0.0300	1.21		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
20.0	500	Total			

**Subcatchment 1S: Historic Area**

Hydrograph



**Summary for Subcatchment 2S: Surface Runoff to Treatment**

Runoff = 3.68 cfs @ 7.88 hrs, Volume= 1.175 af, Depth> 3.82"

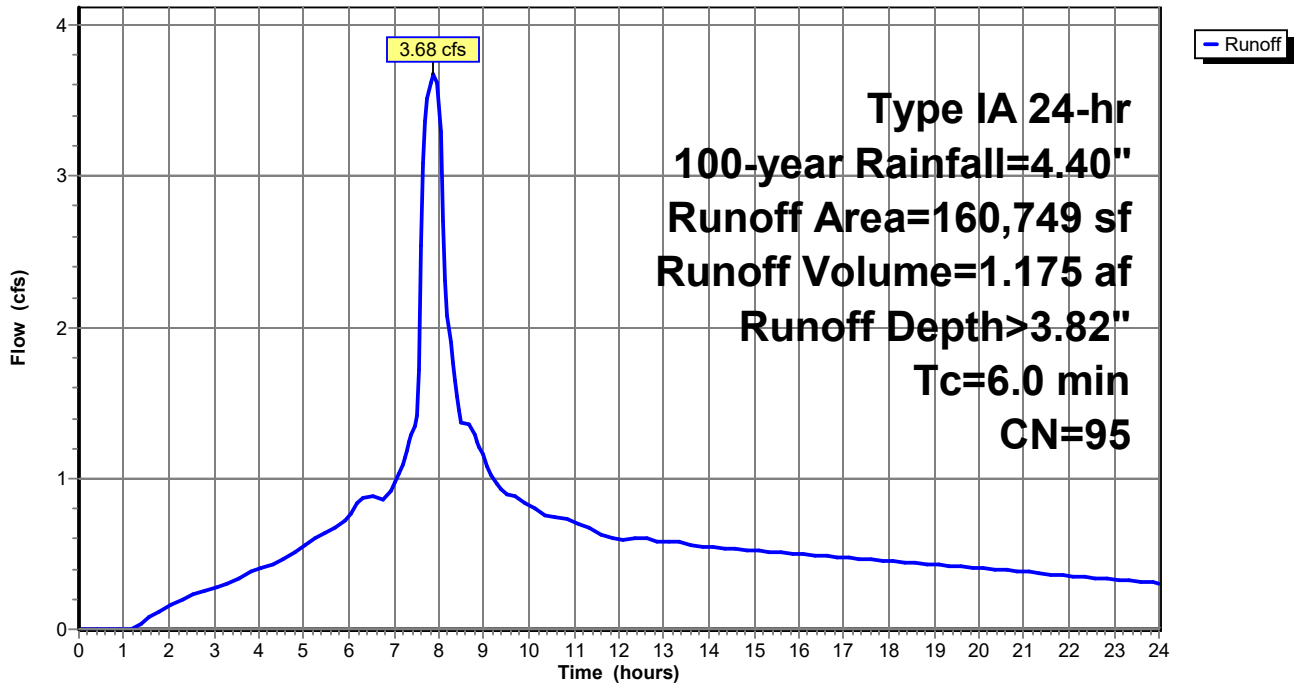
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Type IA 24-hr 100-year Rainfall=4.40"

	Area (sf)	CN	Description
*	100,830	98	Pavement
*	15,310	98	Sidewalk
*	44,609	86	Landscape
	160,749	95	Weighted Average
	44,609		27.75% Pervious Area
	116,140		72.25% Impervious Area

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

**Subcatchment 2S: Surface Runoff to Treatment**

Hydrograph



**Summary for Subcatchment 3S: Area bypassing treatment**

Runoff = 0.78 cfs @ 7.87 hrs, Volume= 0.256 af, Depth> 4.16"

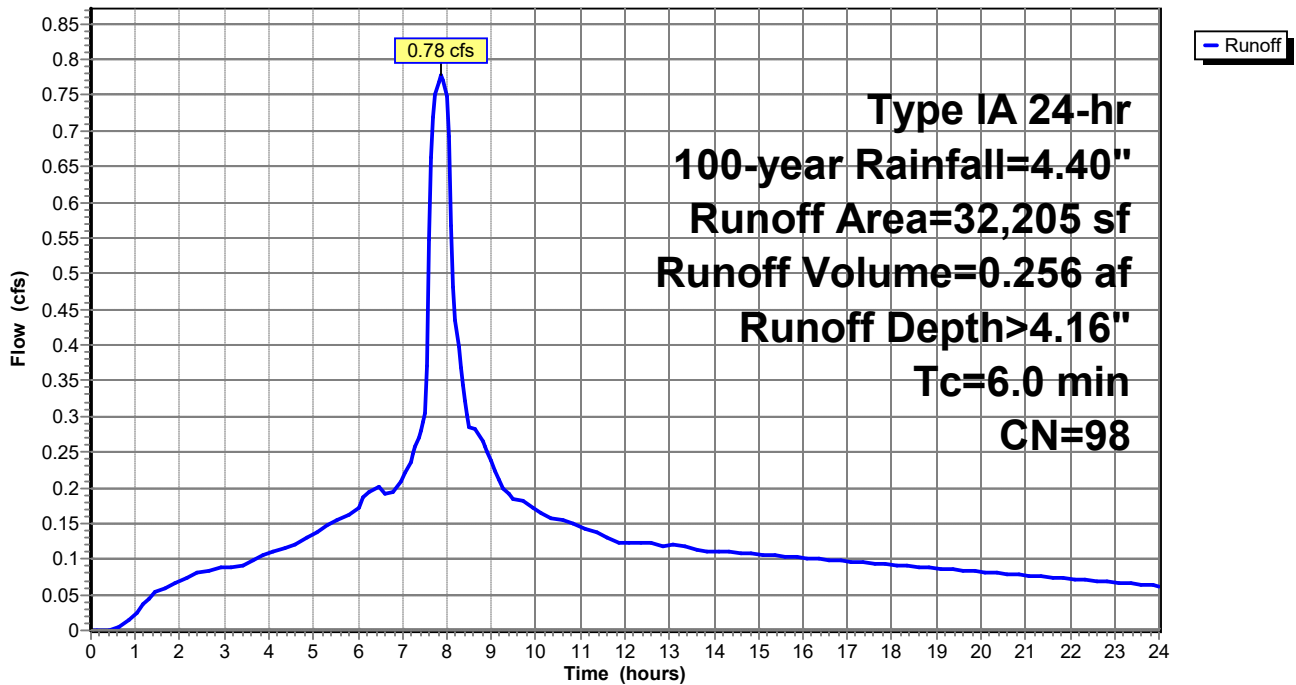
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Type IA 24-hr 100-year Rainfall=4.40"

Area (sf)	CN	Description
* 32,205	98	Roof
32,205		100.00% Impervious Area

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

**Subcatchment 3S: Area bypassing treatment**

Hydrograph



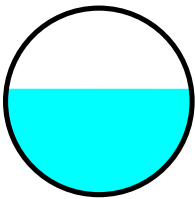
### Summary for Reach 3R: Discharge pipe

Inflow Area = 4.430 ac, 76.88% Impervious, Inflow Depth > 3.86" for 100-year event  
 Inflow = 2.92 cfs @ 8.15 hrs, Volume= 1.425 af  
 Outflow = 2.92 cfs @ 8.15 hrs, Volume= 1.424 af, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Max. Velocity= 4.06 fps, Min. Travel Time= 0.2 min  
 Avg. Velocity = 2.67 fps, Avg. Travel Time= 0.3 min

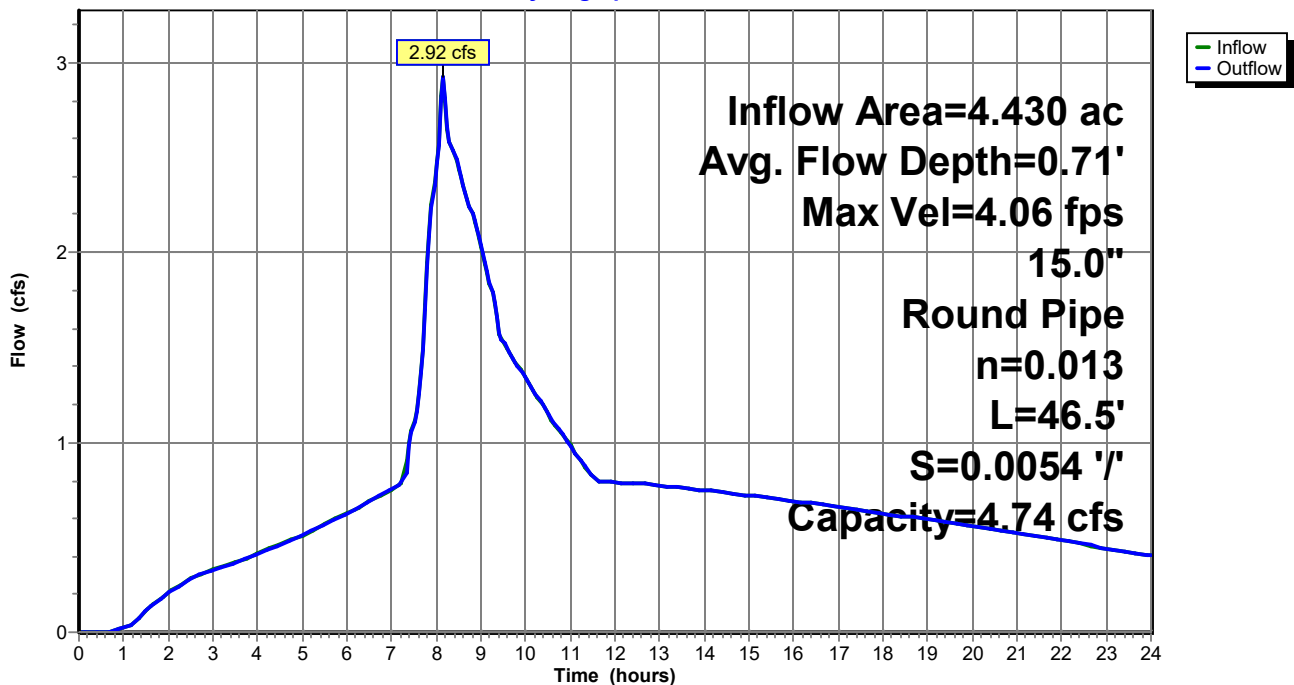
Peak Storage= 34 cf @ 8.15 hrs  
 Average Depth at Peak Storage= 0.71'  
 Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 4.74 cfs

15.0" Round Pipe  
 n= 0.013  
 Length= 46.5' Slope= 0.0054 '/'  
 Inlet Invert= 245.35', Outlet Invert= 245.10'



### Reach 3R: Discharge pipe

Hydrograph



**Summary for Pond 1P: Detention Pipes**

Inflow Area = 4.430 ac, 76.88% Impervious, Inflow Depth > 3.88" for 100-year event  
 Inflow = 4.45 cfs @ 7.88 hrs, Volume= 1.431 af  
 Outflow = 2.92 cfs @ 8.15 hrs, Volume= 1.425 af, Atten= 34%, Lag= 16.2 min  
 Primary = 2.92 cfs @ 8.15 hrs, Volume= 1.425 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Peak Elev= 250.48' @ 8.15 hrs Surf.Area= 2,844 sf Storage= 8,037 cf

Plug-Flow detention time= 47.3 min calculated for 1.422 af (99% of inflow)  
 Center-of-Mass det. time= 43.9 min ( 724.9 - 681.0 )

Volume	Invert	Avail.Storage	Storage Description
#1	245.35'	9,331 cf	<b>72.0" Round Pipe Storage</b> L= 600.0' S= 0.0010 '/' 16,965 cf Overall x 55.0% Voids

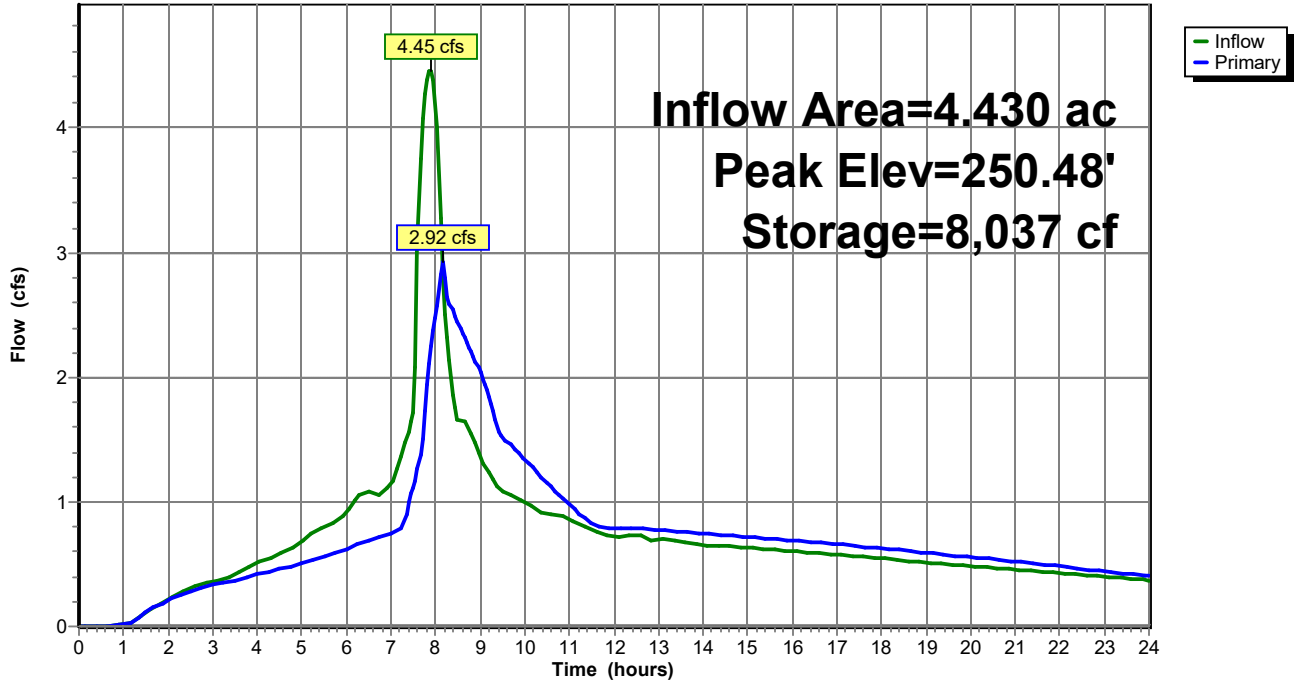
Device	Routing	Invert	Outlet Devices
#1	Primary	245.35'	<b>4.3" Horiz. Orifice/Grate</b> C= 0.600
#2	Primary	248.05'	<b>5.0" Horiz. Orifice/Grate</b> C= 0.600
#3	Primary	249.00'	<b>4.0" Horiz. Orifice/Grate</b> C= 0.600
#4	Primary	250.40'	<b>15.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Primary OutFlow** Max=2.90 cfs @ 8.15 hrs HW=250.48' (Free Discharge)

- 1=Orifice/Grate (Orifice Controls 1.10 cfs @ 10.90 fps)
- 2=Orifice/Grate (Orifice Controls 1.02 cfs @ 7.50 fps)
- 3=Orifice/Grate (Orifice Controls 0.51 cfs @ 5.85 fps)
- 4=Orifice/Grate (Weir Controls 0.27 cfs @ 0.90 fps)

### Pond 1P: Detention Pipes

Hydrograph



**Summary for Pond 2P: Flow Splitter**

Inflow Area = 3.690 ac, 72.25% Impervious, Inflow Depth > 3.82" for 100-year event  
 Inflow = 3.68 cfs @ 7.88 hrs, Volume= 1.175 af  
 Outflow = 3.68 cfs @ 7.88 hrs, Volume= 1.175 af, Atten= 0%, Lag= 0.0 min  
 Primary = 1.09 cfs @ 7.88 hrs, Volume= 1.027 af  
 Secondary = 2.59 cfs @ 7.88 hrs, Volume= 0.148 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Peak Elev= 255.22' @ 7.88 hrs Surf.Area= 20 sf Storage= 63 cf

Plug-Flow detention time= 0.5 min calculated for 1.172 af (100% of inflow)  
 Center-of-Mass det. time= 0.4 min ( 686.3 - 685.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	252.00'	157 cf	<b>5.00'D x 8.00'H Vertical Cone/Cylinder</b>

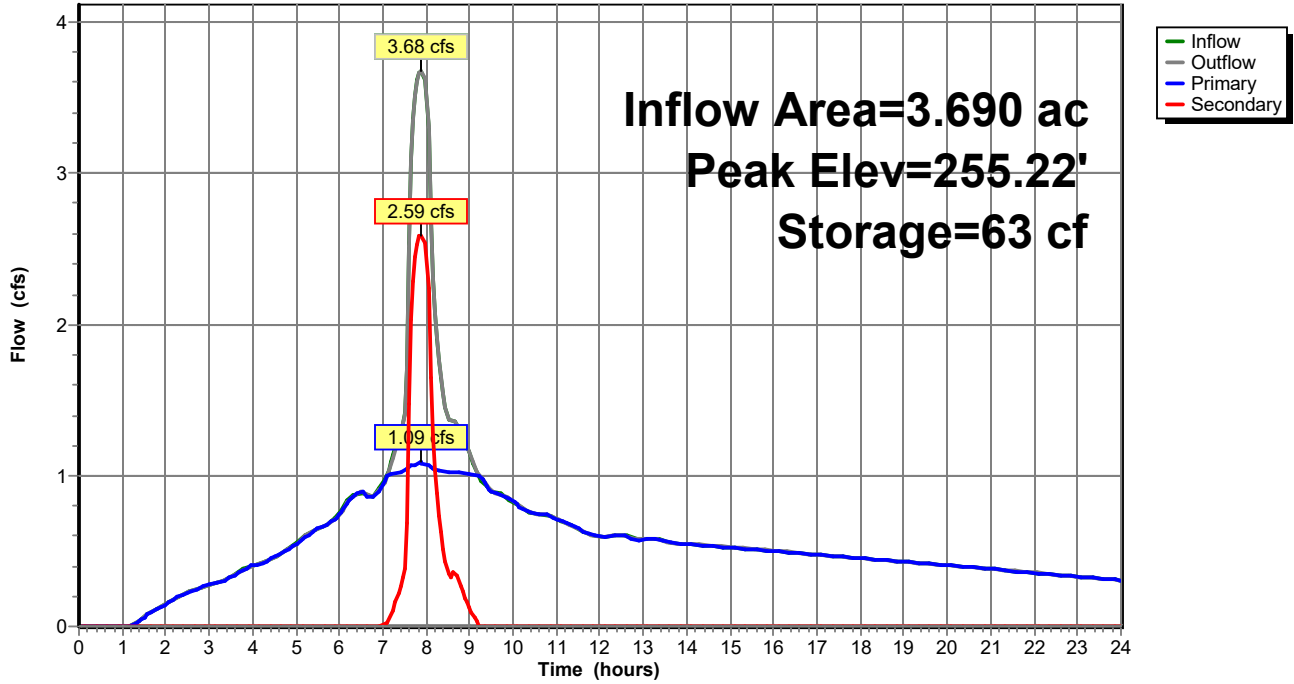
Device	Routing	Invert	Outlet Devices
#1	Primary	252.00'	<b>4.8" Horiz. Orifice/Grate</b> C= 0.600
#2	Secondary	254.75'	<b>12.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Primary OutFlow** Max=1.09 cfs @ 7.88 hrs HW=255.22' (Free Discharge)  
 ↑1=Orifice/Grate (Orifice Controls 1.09 cfs @ 8.64 fps)

**Secondary OutFlow** Max=2.59 cfs @ 7.88 hrs HW=255.22' (Free Discharge)  
 ↑2=Orifice/Grate (Orifice Controls 2.59 cfs @ 3.30 fps)

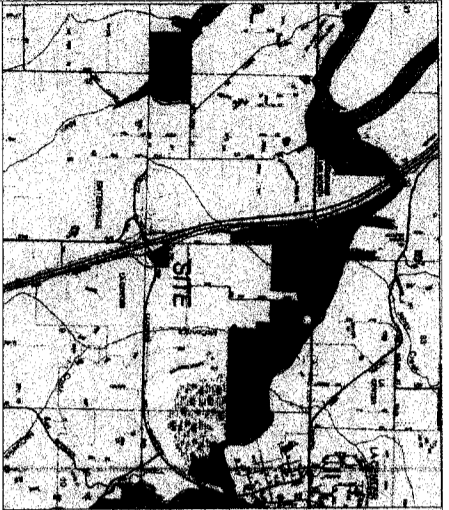
### Pond 2P: Flow Splitter

Hydrograph

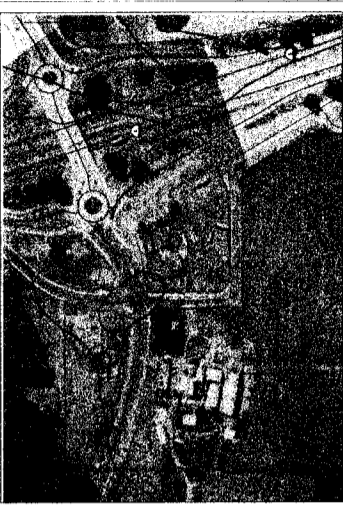








VICINITY MAP  
SEC. 04 T4N R1E W.M.  
NTS



SOILS MAP  
NTS

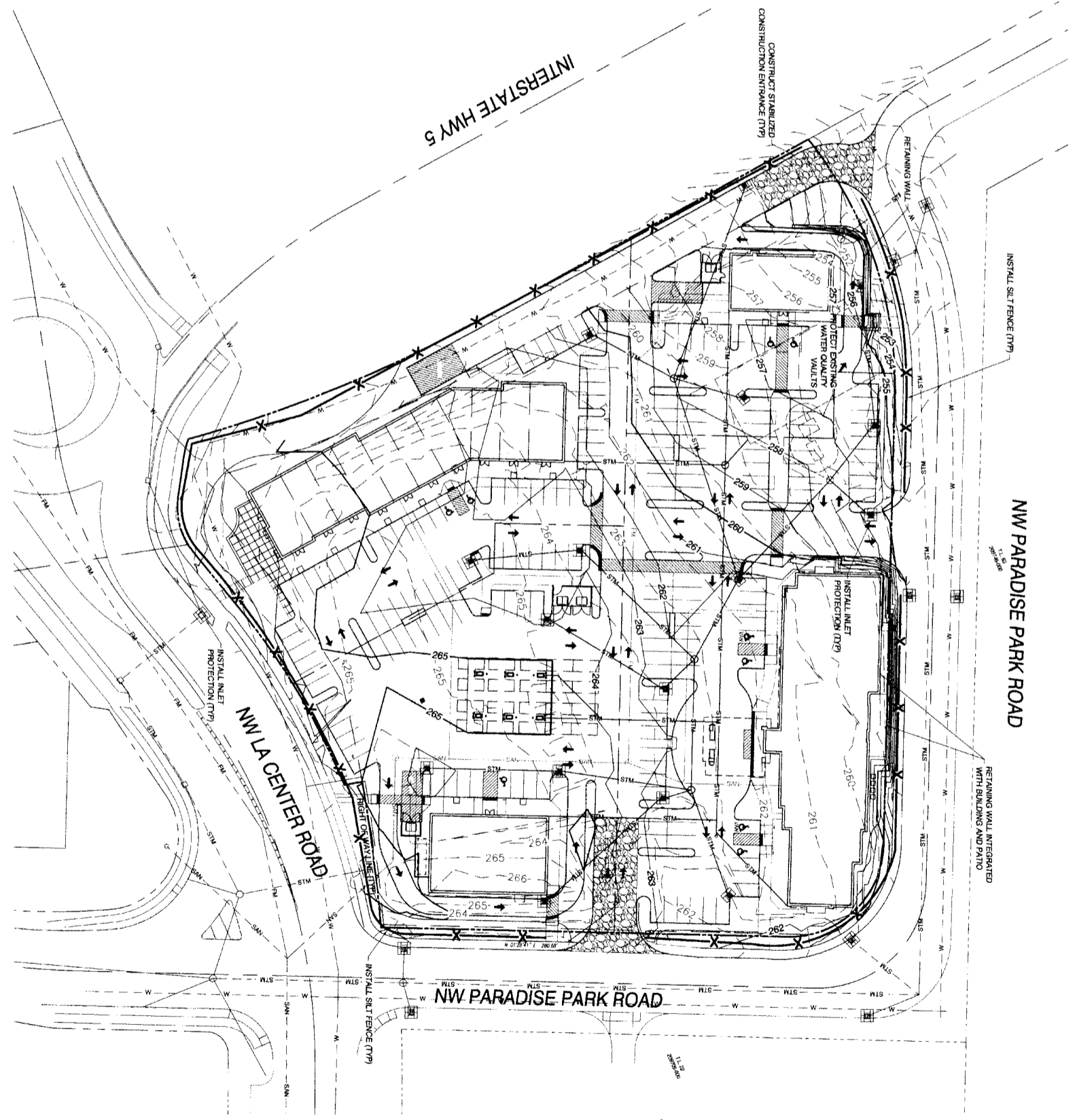
- CONSTRUCTION TIMING NOTES:
1. THE CONTRACTOR SHALL ENSURE THAT THE EXISTING SPECIALS REMAIN CLEAN & FREE FROM CONSTRUCTION MATERIAL & DEBRIS AT ALL TIMES.
  2. CONTRACTOR SHALL INSTALL SILT FENCING ALONG PERIMETER OF THE SITE PRIOR TO ANY ON-SITE CONSTRUCTION ACTIVITY.
  3. ONCE PROPOSED STORM SEWER STRUCTURES HAVE BEEN INSTALLED, THE CONTRACTOR SHALL INSTALL BMP'S AS SHOWN TO PREVENT SEDIMENT FROM ENTERING THE STORM SEWER SYSTEM. ALL BMP'S SHALL BE IN ACCORDANCE WITH CLARK COUNTY CODE CHAPTER 42.800.

**LEGEND**

--- (dashed line)	GRADING LIMITS
— (solid line)	FINISHED GRADE CONTOUR
- - - (dashed line)	EXISTING CONTOUR
- - - (dashed line)	259

**WHEEL WASH NOTE**

A WHEEL WASH MAY BE REQUIRED IF CONSTRUCTION ENTRANCE IS NOT SUFFICIENT IN PREVENTING SEDIMENT FROM BEING TRACKED ONTO PAVEMENT. WHEEL WASH SHALL BE PER STANDARD PLAN E15 AND THE STORMWATER MANUAL. REFER TO SHEET C8.0 FOR STANDARD DETAIL.



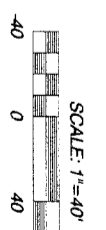
**STANDARD DETAIL NOTE**

ALL MATERIALS AND METHODS OF CONSTRUCTION AND INSTALLATION FOR WATER STORM WATER FACILITIES, AND EROSION CONTROL MEASURES SHALL CONFORM TO CITY OF VANCOUVER ENGINEERING SERVICES' GENERAL REQUIREMENTS AND DETAILS FOR THE DESIGN AND CONSTRUCTION OF WATER AND SURFACE WATER SYSTEMS. CONSTRUCTION SHALL BE AS PER THE MOST CURRENT STANDARD DETAIL CONTAINED THEREIN.

**APPROXIMATE GRADING VOLUMES**

CUT	2,500 CV
FILL	3,380 CV

NOTE: CUT AND FILL AREAS AND VOLUMES ARE CALCULATED FROM EXISTING GROUND TO FINISHED GRADE AND ARE NOT ADJUSTED FOR STRIPPINGS, TRENCH EXCAVATION, STRUCTURAL EXCAVATION OR SHRINK/SWELL. CONTRACTORS ARE SOLELY RESPONSIBLE FOR QUANTITY ESTIMATES FOR BIDDING PURPOSES.

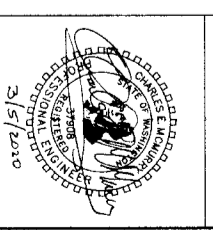


J:\data\9000\9800\9820\9825\Engineering\Plan\4-SHEETS\SEC. E.C1.0 GRADING AND EROSION.DWG  
GRADERSON, STB

CLIENT:  
MINT MANAGEMENT LLC  
P.O. BOX 5988  
VANCOUVER, WA 98688  
PH: (206) 901-3875  
CONTACT: DON RHODAS  
EMAIL: donr@mgm.com

PRELIMINARY GRADING AND EROSION PLAN FOR:  
**MINT MANAGEMENT**

**OLSON** LAND SURVEYORS  
ENGINEERS  
360-695-1385  
503-289-9936  
ENGINEERING INC. 222 E. EVERGREEN, VANCOUVER, WA 98660  
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CHANGES / REVISIONS  
DESCRIPTION: DATE:

DESIGNED: GEM	
DRAWN: TKS	
CHECKED: GEM	
DATE: FEBRUARY 2020	
SCALE: H: 1" = 40'	
V: N/A	
MINIT MANAGEMENT PH 4	
JOB NO. 9825.01.01	

**SHEET**  
C1.0

