AAI afghan associates, inc.
ENGINEERING

Reser's Fine Foods East Development

Drainage Report

401-545 SE Croco Road.
Topeka, Kansas

Revised November 29, 2016
November 2, 2016
PROJECT NUMBER: A13042.11

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Reser's Fine Foods East Development

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I. Project Overview

Reser's Fine Foods East Development

Project Overview

The Reser's Fine Foods East Development project is located at 401-545 SE Croco Road in Topeka Kansas. The project will include construction of a manufacturing facility with a footprint of ~315,840SF, an automobile parking lot, truck docks and additional asphalt to facilitate vehicle maneuvering and drive aisles. The proposed impervious area will total ~866,688SF. The existing site consists mainly of moderately sloping fallow crop residue. There is a small portion of the site that is currently developed. This is at the intersection of Se Croco Rd. and SE 6th Ave. There is a gas station and car wash which is not currently in operation and a single family residence. The amount of impervious area within this developed portion of the site is ~52,562SF. The total site area is 1,129,615SF. Existing drainage patterns on-site collect ~60,351SF at the corner of SE Croco and SE 6th and ~12,320SF along the frontage of SE Croco which is conveyed to an unimproved storm drainage system in SE Croco. 361,222SF of the site drains to the north and the remaining 695,722SF drains to the north/northwest. Both of these areas flow offsite to the north and west respectively. The northern flows pass across the neighboring property and are collected in an existing drainage area that flows north and eventually flows into Shunganunga Creek. The westerly flows are collected in this same drainage area which is located just west of our property line.

Post construction, most of the site ~1,030,756SF will be routed to a proposed Extended Dry Detention Basin (EDDB) located in the northwest portion of the property. We are lowering the amount of drainage to SE Croco to ~10,063SF and preserving ~88,796SF of the drainage area that currently flows to the north. The EDDB has been designed to accommodate runoff from a 100-year design storm (10.2"/hour) while maintaining a minimum 1' of freeboard; it has a drawdown time of less than 40 hours and a release rate at or below that of the existing site conditions.

Discharge from the EDDB will be directed to a dispersion trench located near the EDDB that will spread the flows over a large area to avoid ponding or other adverse effects to the surrounding areas. After the dispersion trench, the flow will join the same drainage area that currently serves to convey runoff from this site to Shunganunga Creek.

Please see the attached calculations and following report sections showing that the on-site stormwater system meets the said requirement.

Reser's Fine Foods East Development

II. Water Quality Design

Reser's Fine Foods East Development

Water Quality Design

We are proposing to capture the storm runoff from the new parking lot and maneuvering aisles in catchbasins and roof runoff in downspouts. These will both be hard piped to the EDDB. Utilizing the APWA/MARC BMP manual dated October 2012, Section 4, we completed Worksheet 1 to determine the Level of Service (LS) this site requires. That form yielded a LS of (4). We then completed Worksheet 2, to verify our usage of the EDDB was appropriate to achieve minimum LS of (4). That form yielded a LS of 4.27 which exceeded the minimum LS of 4 required for WQ mitigation (See Section IV for Worksheets). The EDDB provides WQ by allowing the runoff to settle within the basin which aids in the removal of suspended solids and the vegetation also removes some nutrients, metals and bacteria. We modeled this EDDB using HyrdoCAD modeling software that utilizes the SBUH method of analysis (See Section V for Calculations). Per the calculations the maximum elevation of the water quality storm flows (1.37") is 1.01' deep. The bottom of the EDDB is set at 906.00' and the top of the EDDB is set at 211.00". Per Section 8.1 of the APWA/MARC BMP 90% of the WQ storm event must drain from the EDDB within 40 hours. This eliminates conditions that may harbor mosquito larvae and other water born pests. The calculations show that the entire WQ event will drain down within 20 hours.

Reser's Fine Foods East Development

III. Water Quantity Design

Reser's Fine Foods East Development

Water Quantity Design

We are required to detain runoff on-site and release it at or below the rates of the existing site for the 2-yr, 10-yr, 50-yr and 100-yr storm events. Below is a table the lists the flow rates (Q) of the existing site and those from the EDDB with the outfalls as designed ((4) 48" pipes).

Storm Event	Existing Site Q (cfs)	Required Q (cfs)	Post-Developed Q (cfs)	Meets Requirements
2-yr	187.67	187.67	184.34	Y
10-yr	259.91	259.91	253.87	Y
50-yr	338.78	338.78	324.87	Y
100-yr	372.85	372.85	351.80	Y

The required 100yr detention volume is 37,741 cf. The EDDB has an available detention volume of 50,895 cf. This additional volume gives enough storage to detain the volume of the 100yr storm and provided a minimum of 1' of freeboard to assure no adverse affects to on-site or downstream components.

Storm Event	Storage Volume Required	Maximum Water Elevation
2-yr	19,903CF	908.55'
10-yr	26,037CF	909.13'
50-yr	33,525CF	909.75'
100-yr	37,741CF	910.08'

See HydroCAD calculations for design verification.

Reser's Fine Foods East Development

IV. Worksheets 1 & 2

WORKSHEET 1: REQUIRED LEVEL OF SERVICE - UNDEVELOPED SITE

Project: REEDS FINE FOODS EAST DEVELOPMENT
Location: 401-545 SE CROCO RD, TOPEKA KS

By: NWS Date: 11/29/16
Checked: HRA Date: 11/29/16

1. Runoff Curve Number

A. Predevelopment CN

Cover Description	Soil HSG	CN from Table 1	Area (ac.)	Product of CN x Area
AC / ROOFS	D	98	2.75	270
FALLOW CROPS	D	93	19.19	1785
FALLOW CROPS	C	90	2.85	257
BRUSH / WEEDS/GRASS	C	77	1.15	89
		Totals:	25.94	2401

Area-Weighted CN = total product/total area = 93 (Round to integer)

B. Postdevelopment CN

Cover Description	Soil HSG[1]	CN from Table 1	Area (ac.)	Product of CN x Area
AC / ROOFS	C/D	98	19.90	1950
TURF	C	74	3.25	240
TURF	D	80	2.79	223
		Totals:	25.94	2413

[1] Postdevelopment CN is one HSG higher for all cover types except preserved vegetation, absent documentation showing how postdevelopment soil structure will be preserved.

Area-Weighted CN = total product/total area = 93 (Round to integer)

C. Level of Service (LS) Calculation

Predevelopment CN:	93
Postdevelopment CN:	93
Difference:	0
LS Required (see scale at right):	4

Change in CN	LS
17+	8
7 to 16	7
4 to 6	6
1 to 3	5
0	4
-7 to -1	3
-8 to -17	2
-18 to -21	1
-22 -	0

WORKSHEET 2: DEVELOP MITIGATION PACKAGE(S) THAT MEET THE REQUIRED LS

Project: ROGERS FINE FOODS EAST DEVELOPMENT By: NWS Date: 11/29/16
Location: 401-545 SE CRISCO RD, TOPEKA KS Checked: HRA Date: 11/29/16
Sheet 1 **of** 1

1. **Required LS (New Development, Wksht 1) or Total VR (Redevelopment, Wksht 1A):** 4

   Note: Various BMPs may alter CN of proposed development, and LS; recalculate both if applicable.

2. **Proposed BMP Option Package No. ___**

Cover/BMP Description	Treatment Area	VR from Table 4.4 or 4.6[1]	Product of VR x Area
PRESERVE NAT. VEG.	2.04	9.25	18.87
AC/ROOF TO BDDS	19.90	4.0	79.6
TURF TO BDDS	3.05	4.0	12.2
TURF	0.95	0.0	0.0
Total[2]:	25.94	Total:	110.67
		*Weighted VR:	4.27 = total product/total a

[1] VR calculated for final BMP only in Treatment Train.
[2] Total treatment area cannot exceed 100 percent of the actual site area.
* Blank In Redevelopment

Meets required LS (Yes/No)? YES (If No, or if additional options are being tested, proceed below.)

3. **Proposed BMP Option Package No. ___**

Cover/BMP Description	Treatment Area	VR from Table 4.4 or 4.6[1]	Product of VR x Area
Total[2]:		Total:	
		*Weighted VR:	= total product/total a

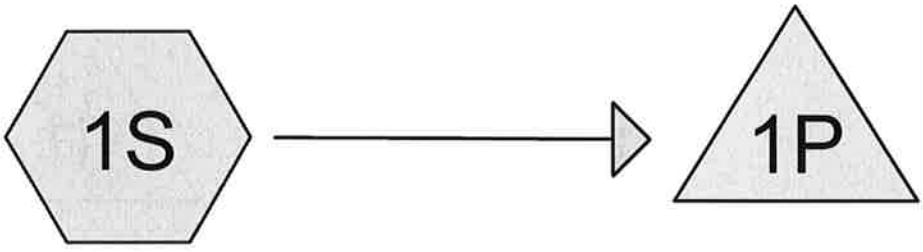
[1] VR calculated for final BMP only in Treatment Train.
[2] Total treatment area cannot exceed 100 percent of the actual site area.
* Blank In Redevelopment

Meets required LS (Yes/No)? (If No, or if additional options are being tested, move to next sheet.)

Reser's Fine Foods East Development

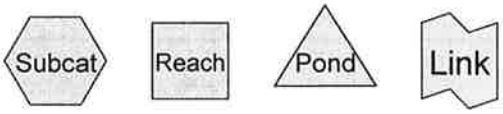
V. HydroCAD Calculations

ExistingConditions



Post Construction

Pond



Routing Diagram for A16186.11 - Reser's Croco
Prepared by AAI Engineering, Printed 11/29/2016

Time span=5.00-24.00 hrs, dt=0.05 hrs, 381 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Post Construction Runoff Area=25.940 ac 76.72% Impervious Runoff Depth>4.65"
Tc=5.0 min CN=94 Runoff=195.28 cfs 10.053 af

Subcatchment 2S: ExistingConditions Runoff Area=25.940 ac 10.60% Impervious Runoff Depth>4.35"
Tc=5.0 min CN=91 Runoff=187.67 cfs 9.408 af

Pond 1P: Pond Peak Elev=908.55' Storage=19,903 cf Inflow=195.28 cfs 10.053 af
Outflow=184.34 cfs 10.025 af

Total Runoff Area = 51.880 ac Runoff Volume = 19.461 af Average Runoff Depth = 4.50"
56.34% Pervious = 29.230 ac 43.66% Impervious = 22.650 ac

Summary for Subcatchment 1S: Post Construction

[49] Hint: Tc<2dt may require smaller dt

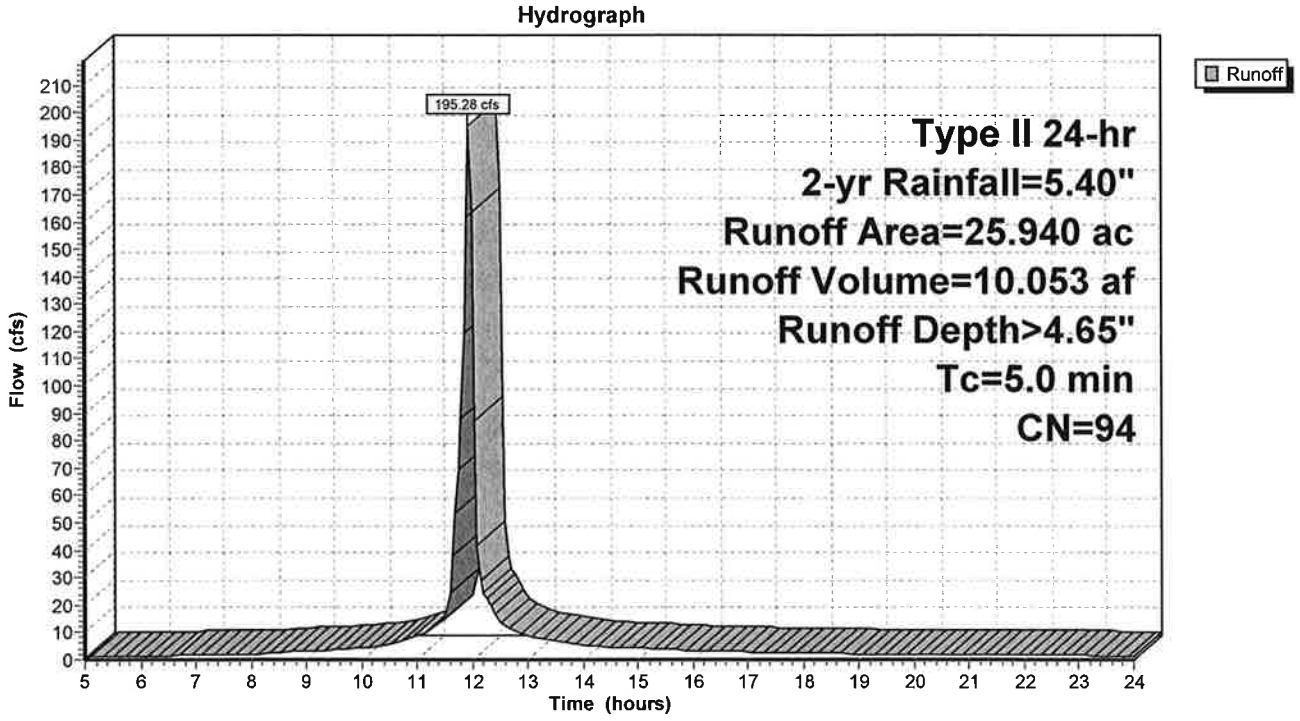
Runoff = 195.28 cfs @ 11.95 hrs, Volume= 10.053 af, Depth> 4.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=5.40"

	Area (ac)	CN	Description
*	19.900	98	Paved parking, Roofs HSG C
	6.040	79	50-75% Grass cover, Fair, HSG C
	25.940	94	Weighted Average
	6.040		23.28% Pervious Area
	19.900		76.72% Impervious Area

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

Subcatchment 1S: Post Construction



Summary for Subcatchment 2S: ExistingConditions

[49] Hint: Tc<2dt may require smaller dt

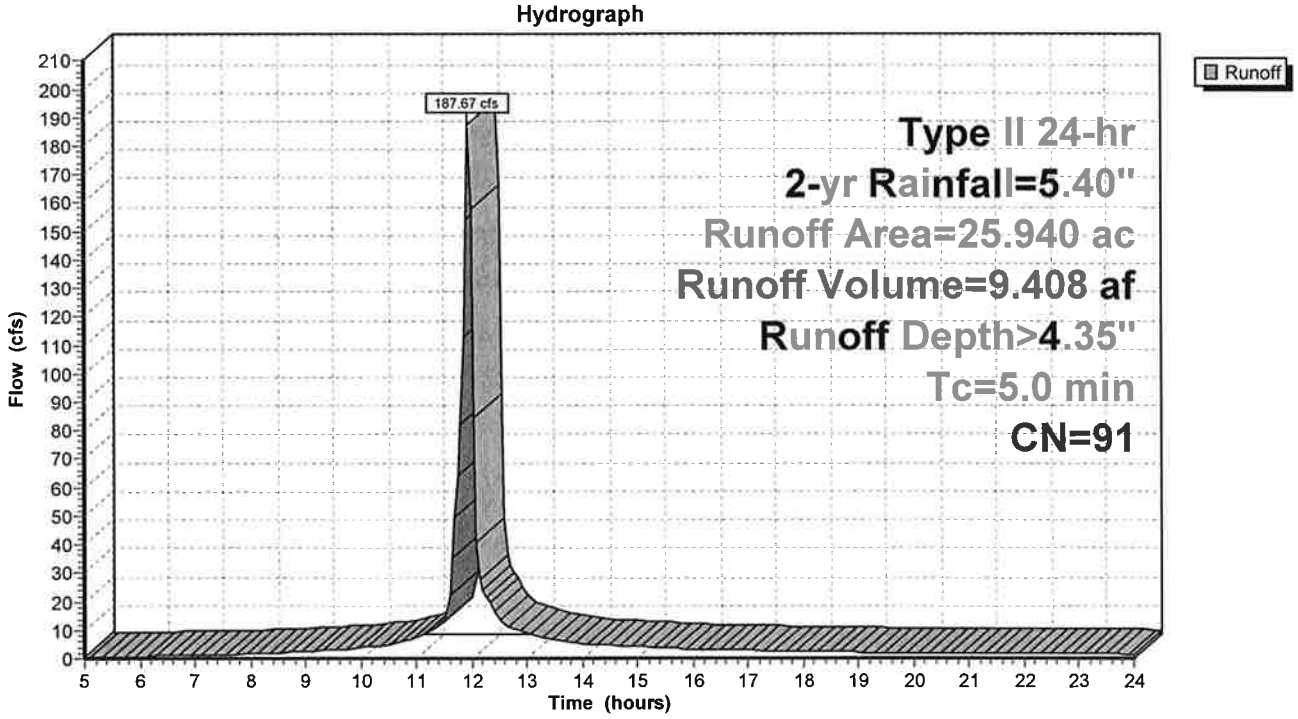
Runoff = 187.67 cfs @ 11.95 hrs, Volume= 9.408 af, Depth> 4.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=5.40"

	Area (ac)	CN	Description
*	2.750	98	Paved parking, Roofs HSG C
	23.190	90	Fallow, crop residue, Poor, HSG C
	25.940	91	Weighted Average
	23.190		89.40% Pervious Area
	2.750		10.60% Impervious Area

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

Subcatchment 2S: ExistingConditions



Summary for Pond 1P: Pond

[82] Warning: Early inflow requires earlier time span

Inflow Area = 25.940 ac, 76.72% Impervious, Inflow Depth > 4.65" for 2-yr event
Inflow = 195.28 cfs @ 11.95 hrs, Volume= 10.053 af
Outflow = 184.34 cfs @ 11.97 hrs, Volume= 10.025 af, Atten= 6%, Lag= 1.4 min
Primary = 184.34 cfs @ 11.97 hrs, Volume= 10.025 af

Routing by Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 908.55' @ 11.97 hrs Surf.Area= 10,153 sf Storage= 19,903 cf

Plug-Flow detention time= 5.6 min calculated for 9.997 af (99% of inflow)
Center-of-Mass det. time= 3.6 min (775.6 - 772.0)

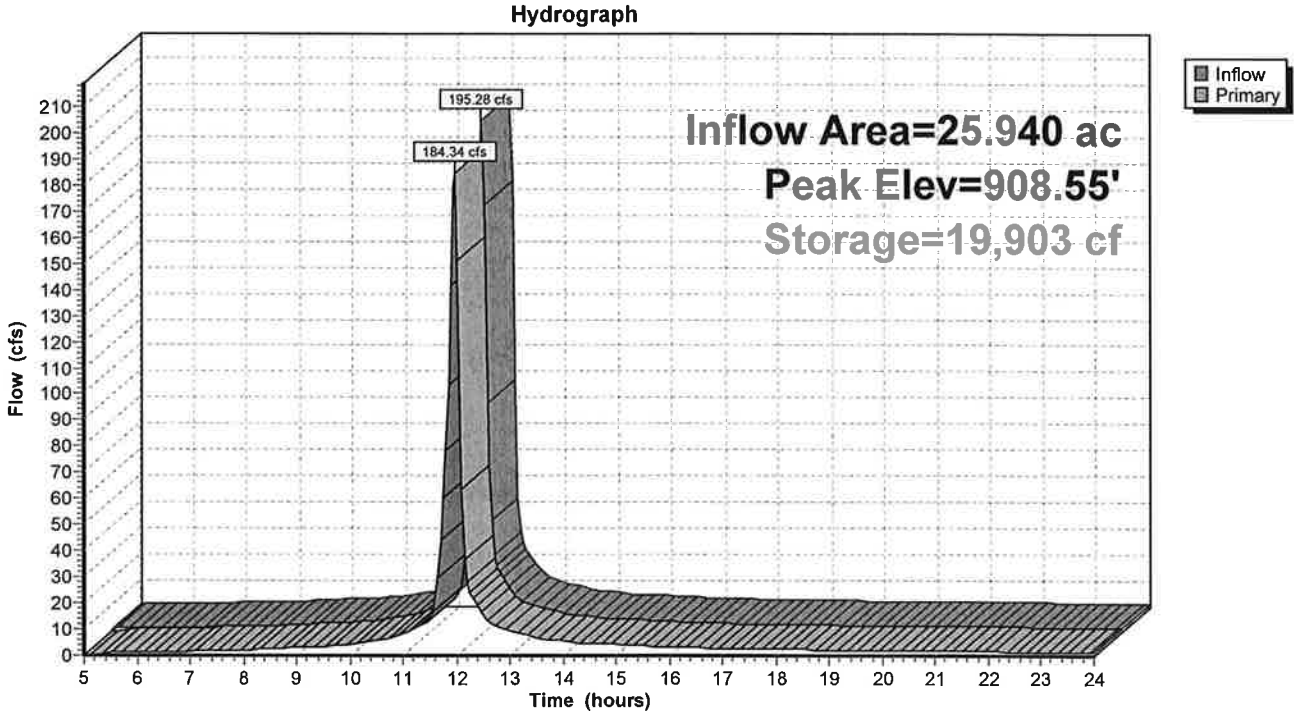
Volume	Invert	Avail.Storage	Storage Description
#1	906.00'	50,859 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
906.00	5,695	0	0
907.00	7,194	6,445	6,445
908.00	9,061	8,128	14,572
909.00	11,028	10,045	24,617
910.00	13,096	12,062	36,679
911.00	15,265	14,181	50,859

Device	Routing	Invert	Outlet Devices	
#1	Primary	906.00'	**48.0" Vert. Outfall**	C= 0.600
#2	Primary	906.00'	**48.0" Vert. Outfall**	C= 0.600
#3	Primary	906.00'	**48.0" Vert. Outfall**	C= 0.600
#4	Primary	906.00'	**48.0" Vert. Outfall**	C= 0.600

Primary OutFlow Max=179.54 cfs @ 11.97 hrs HW=908.51' (Free Discharge)
- **1=Outfall** (Orifice Controls 44.88 cfs @ 5.40 fps)
- **2=Outfall** (Orifice Controls 44.88 cfs @ 5.40 fps)
- **3=Outfall** (Orifice Controls 44.88 cfs @ 5.40 fps)
- **4=Outfall** (Orifice Controls 44.88 cfs @ 5.40 fps)

Pond 1P: Pond


Hydrograph
Inflow
Primary
195.28 cfs
184.34 cfs
Inflow Area=25.940 ac
Peak Elev=908.55'
Storage=19,903 cf
Flow (cfs)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
Time (hours)

Stage-Area-Storage for Pond 1P: Pond

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
906.00	5,695	0
906.05	5,770	287
906.10	5,845	577
906.15	5,920	871
906.20	5,995	1,169
906.25	6,070	1,471
906.30	6,145	1,776
906.35	6,220	2,085
906.40	6,295	2,398
906.45	6,370	2,715
906.50	6,445	3,035
906.55	6,519	3,359
906.60	6,594	3,687
906.65	6,669	4,018
906.70	6,744	4,354
906.75	6,819	4,693
906.80	6,894	5,036
906.85	6,969	5,382
906.90	7,044	5,733
906.95	7,119	6,087
907.00	7,194	6,445
907.05	7,287	6,807
907.10	7,381	7,173
907.15	7,474	7,545
907.20	7,567	7,921
907.25	7,661	8,301
907.30	7,754	8,687
907.35	7,847	9,077
907.40	7,941	9,471
907.45	8,034	9,871
907.50	8,128	10,275
907.55	8,221	10,684
907.60	8,314	11,097
907.65	8,408	11,515
907.70	8,501	11,938
907.75	8,594	12,365
907.80	8,688	12,797
907.85	8,781	13,234
907.90	8,874	13,675
907.95	8,968	14,121
908.00	9,061	14,572
908.05	9,159	15,028
908.10	9,258	15,488
908.15	9,356	15,953
908.20	9,454	16,424
908.25	9,553	16,899
908.30	9,651	17,379
908.35	9,749	17,864
908.40	9,848	18,354
908.45	9,946	18,849
908.50	10,045	19,348
908.55	10,143	19,853
908.60	10,241	20,363
908.65	10,340	20,877
908.70	10,438	21,397
908.75	10,536	21,921
908.80	10,635	22,450
908.85	10,733	22,984
908.90	10,831	23,524
908.95	10,930	24,068
909.00	11,028	24,617
909.05	11,131	25,170
909.10	11,235	25,730
909.15	11,338	26,294
909.20	11,442	26,863
909.25	11,545	27,438
909.30	11,648	28,018
909.35	11,752	28,603
909.40	11,855	29,193
909.45	11,959	29,788
909.50	12,062	30,389
909.55	12,165	30,995
909.60	12,269	31,606
909.65	12,372	32,222
909.70	12,476	32,843
909.75	12,579	33,469
909.80	12,682	34,101
909.85	12,786	34,737
909.90	12,889	35,379
909.95	12,993	36,026
910.00	13,096	36,679
910.05	13,204	37,336
910.10	13,313	37,999
910.15	13,421	38,667
910.20	13,530	39,341
910.25	13,638	40,020
910.30	13,747	40,705
910.35	13,855	41,395
910.40	13,964	42,090
910.45	14,072	42,791
910.50	14,181	43,498
910.55	14,289	44,209
910.60	14,397	44,927
910.65	14,506	45,649
910.70	14,614	46,377
910.75	14,723	47,111
910.80	14,831	47,849
910.85	14,940	48,594
910.90	15,048	49,343
910.95	15,157	50,098
911.00	**15,265**	**50,859**

Time span=5.00-24.00 hrs, dt=0.05 hrs, 381 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Post Construction Runoff Area=25.940 ac 76.72% Impervious Runoff Depth>6.44"
Tc=5.0 min CN=94 Runoff=266.48 cfs 13.914 af

Subcatchment 2S: ExistingConditions Runoff Area=25.940 ac 10.60% Impervious Runoff Depth>6.14"
Tc=5.0 min CN=91 Runoff=259.91 cfs 13.275 af

Pond 1P: Pond Peak Elev=909.13' Storage=26,037 cf Inflow=266.48 cfs 13.914 af
Outflow=253.87 cfs 13.881 af

Total Runoff Area = 51.880 ac Runoff Volume = 27.188 af Average Runoff Depth = 6.29"
56.34% Pervious = 29.230 ac 43.66% Impervious = 22.650 ac

Summary for Subcatchment 1S: Post Construction

[49] Hint: Tc<2dt may require smaller dt

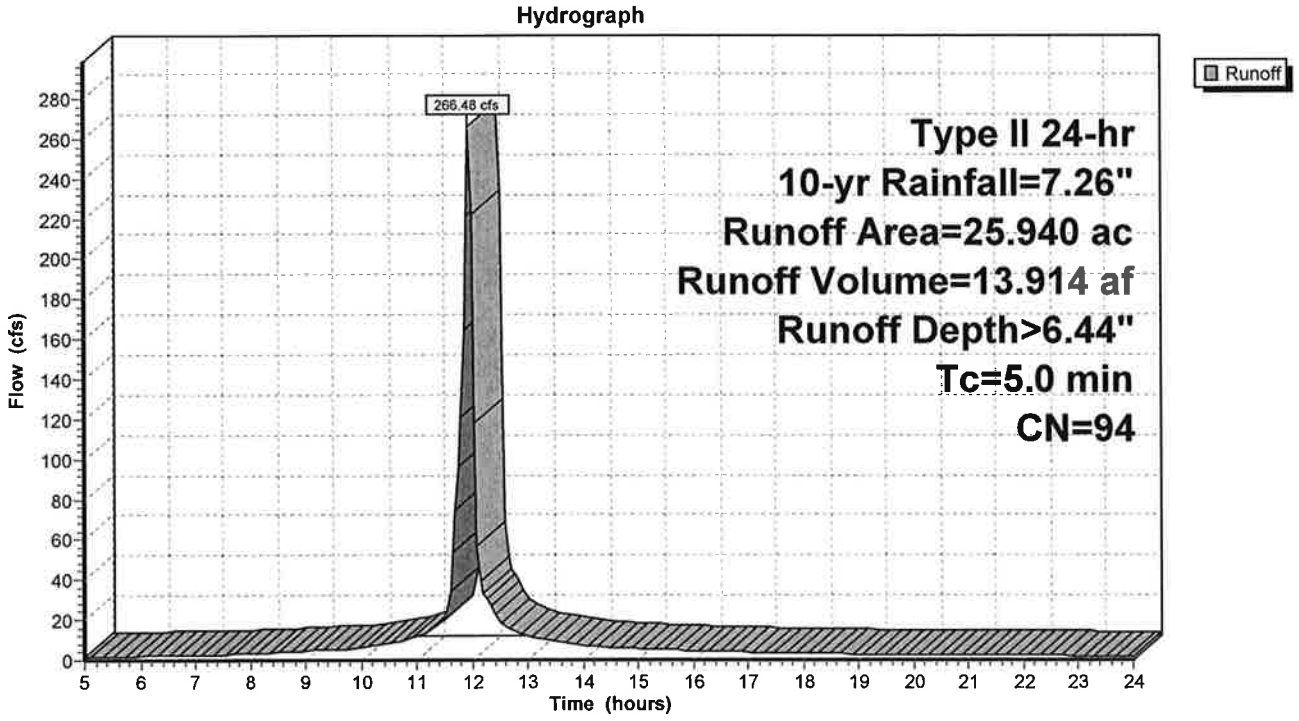
Runoff = 266.48 cfs @ 11.95 hrs, Volume= 13.914 af, Depth> 6.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=7.26"

	Area (ac)	CN	Description
*	19.900	98	Paved parking, Roofs HSG C
	6.040	79	50-75% Grass cover, Fair, HSG C
	25.940	94	Weighted Average
	6.040		23.28% Pervious Area
	19.900		76.72% Impervious Area

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

Subcatchment 1S: Post Construction



Summary for Subcatchment 2S: ExistingConditions

[49] Hint: Tc<2dt may require smaller dt

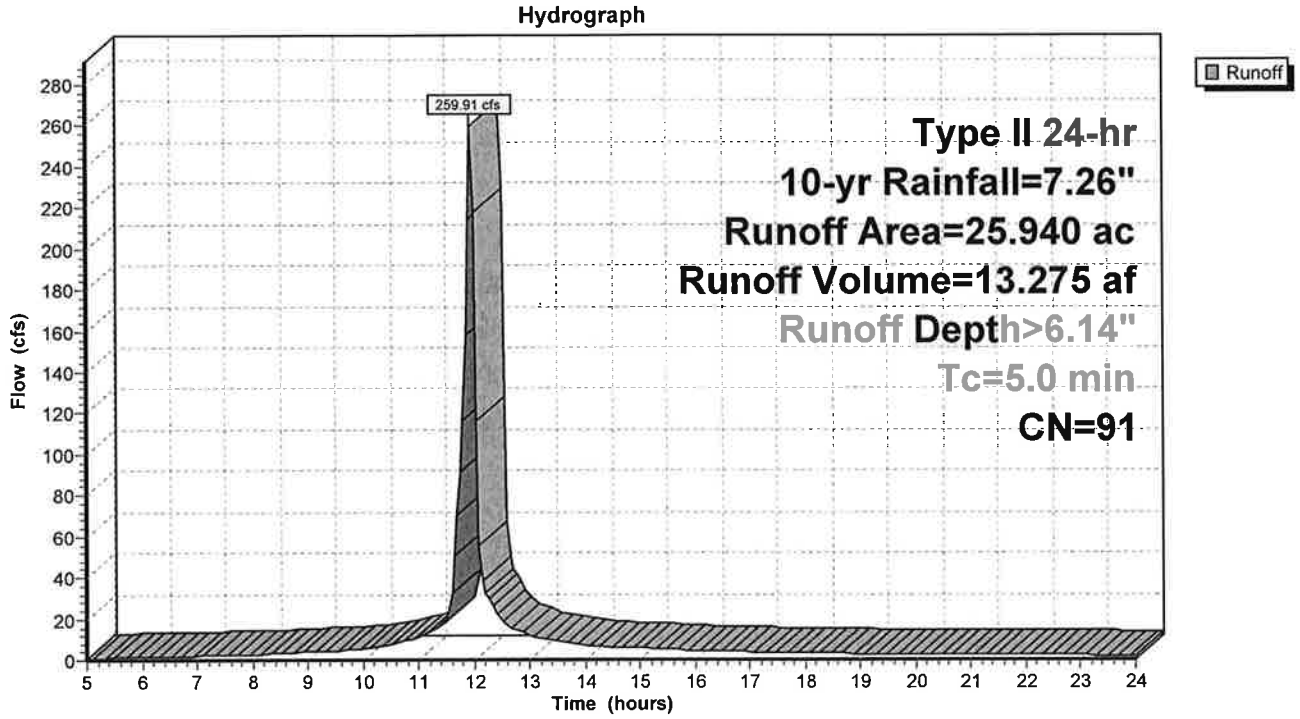
Runoff = 259.91 cfs @ 11.95 hrs, Volume= 13.275 af, Depth> 6.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=7.26"

	Area (ac)	CN	Description
*	2.750	98	Paved parking, Roofs HSG C
	23.190	90	Fallow, crop residue, Poor, HSG C
	25.940	91	Weighted Average
	23.190		89.40% Pervious Area
	2.750		10.60% Impervious Area

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

Subcatchment 2S: ExistingConditions



Summary for Pond 1P: Pond

[82] Warning: Early inflow requires earlier time span

Inflow Area = 25.940 ac, 76.72% Impervious, Inflow Depth > 6.44" for 10-yr event
Inflow = 266.48 cfs @ 11.95 hrs, Volume= 13.914 af
Outflow = 253.87 cfs @ 11.98 hrs, Volume= 13.881 af, Atten= 5%, Lag= 1.5 min
Primary = 253.87 cfs @ 11.98 hrs, Volume= 13.881 af

Routing by Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 909.13' @ 11.98 hrs Surf.Area= 11,291 sf Storage= 26,037 cf

Plug-Flow detention time= 5.0 min calculated for 13.878 af (100% of inflow)
Center-of-Mass det. time= 3.2 min (770.4 - 767.2)

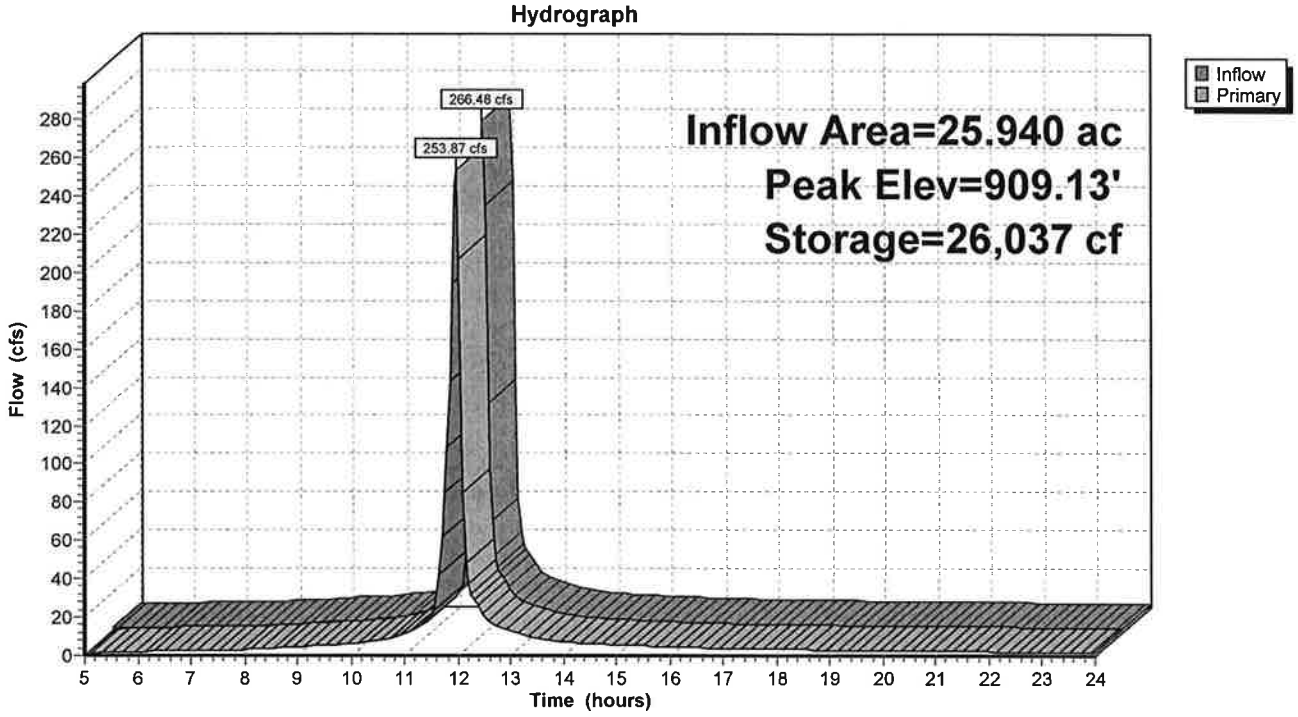
Volume	Invert	Avail.Storage	Storage Description
#1	906.00'	50,859 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
906.00	5,695	0	0
907.00	7,194	6,445	6,445
908.00	9,061	8,128	14,572
909.00	11,028	10,045	24,617
910.00	13,096	12,062	36,679
911.00	15,265	14,181	50,859

Device	Routing	Invert	Outlet Devices	
#1	Primary	906.00'	**48.0" Vert. Outfall**	C= 0.600
#2	Primary	906.00'	**48.0" Vert. Outfall**	C= 0.600
#3	Primary	906.00'	**48.0" Vert. Outfall**	C= 0.600
#4	Primary	906.00'	**48.0" Vert. Outfall**	C= 0.600

Primary OutFlow Max=244.45 cfs @ 11.98 hrs HW=909.05' (Free Discharge)
- **1=Outfall** (Orifice Controls 61.11 cfs @ 5.95 fps)
- **2=Outfall** (Orifice Controls 61.11 cfs @ 5.95 fps)
- **3=Outfall** (Orifice Controls 61.11 cfs @ 5.95 fps)
- **4=Outfall** (Orifice Controls 61.11 cfs @ 5.95 fps)

Pond 1P: Pond


Hydrograph
Inflow
Primary
266.48 cfs
253.87 cfs
Inflow Area=25.940 ac
Peak Elev=909.13'
Storage=26,037 cf
Flow (cfs)
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
Time (hours)

Stage-Area-Storage for Pond 1P: Pond

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
906.00	5,695	0
906.05	5,770	287
906.10	5,845	577
906.15	5,920	871
906.20	5,995	1,169
906.25	6,070	1,471
906.30	6,145	1,776
906.35	6,220	2,085
906.40	6,295	2,398
906.45	6,370	2,715
906.50	6,445	3,035
906.55	6,519	3,359
906.60	6,594	3,687
906.65	6,669	4,018
906.70	6,744	4,354
906.75	6,819	4,693
906.80	6,894	5,036
906.85	6,969	5,382
906.90	7,044	5,733
906.95	7,119	6,087
907.00	7,194	6,445
907.05	7,287	6,807
907.10	7,381	7,173
907.15	7,474	7,545
907.20	7,567	7,921
907.25	7,661	8,301
907.30	7,754	8,687
907.35	7,847	9,077
907.40	7,941	9,471
907.45	8,034	9,871
907.50	8,128	10,275
907.55	8,221	10,684
907.60	8,314	11,097
907.65	8,408	11,515
907.70	8,501	11,938
907.75	8,594	12,365
907.80	8,688	12,797
907.85	8,781	13,234
907.90	8,874	13,675
907.95	8,968	14,121
908.00	9,061	14,572
908.05	9,159	15,028
908.10	9,258	15,488
908.15	9,356	15,953
908.20	9,454	16,424
908.25	9,553	16,899
908.30	9,651	17,379
908.35	9,749	17,864
908.40	9,848	18,354
908.45	9,946	18,849
908.50	10,045	19,348
908.55	10,143	19,853
908.60	10,241	20,363
908.65	10,340	20,877
908.70	10,438	21,397
908.75	10,536	21,921
908.80	10,635	22,450
908.85	10,733	22,984
908.90	10,831	23,524
908.95	10,930	24,068
909.00	11,028	24,617
909.05	11,131	25,170
909.10	11,235	25,730
909.15	11,338	26,294
909.20	11,442	26,863
909.25	11,545	27,438
909.30	11,648	28,018
909.35	11,752	28,603
909.40	11,855	29,193
909.45	11,959	29,788
909.50	12,062	30,389
909.55	12,165	30,995
909.60	12,269	31,606
909.65	12,372	32,222
909.70	12,476	32,843
909.75	12,579	33,469
909.80	12,682	34,101
909.85	12,786	34,737
909.90	12,889	35,379
909.95	12,993	36,026
910.00	13,096	36,679
910.05	13,204	37,336
910.10	13,313	37,999
910.15	13,421	38,667
910.20	13,530	39,341
910.25	13,638	40,020
910.30	13,747	40,705
910.35	13,855	41,395
910.40	13,964	42,090
910.45	14,072	42,791
910.50	14,181	43,498
910.55	14,289	44,209
910.60	14,397	44,927
910.65	14,506	45,649
910.70	14,614	46,377
910.75	14,723	47,111
910.80	14,831	47,849
910.85	14,940	48,594
910.90	15,048	49,343
910.95	15,157	50,098
911.00	**15,265**	**50,859**

Time span=5.00-24.00 hrs, dt=0.05 hrs, 381 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Post Construction Runoff Area=25.940 ac 76.72% Impervious Runoff Depth>8.40"
Tc=5.0 min CN=94 Runoff=344.44 cfs 18.154 af

Subcatchment 2S: ExistingConditions Runoff Area=25.940 ac 10.60% Impervious Runoff Depth>8.11"
Tc=5.0 min CN=91 Runoff=338.78 cfs 17.536 af

Pond 1P: Pond Peak Elev=909.75' Storage=33,525 cf Inflow=344.44 cfs 18.154 af
Outflow=324.87 cfs 18.117 af

Total Runoff Area = 51.880 ac Runoff Volume = 35.690 af Average Runoff Depth = 8.26"
56.34% Pervious = 29.230 ac 43.66% Impervious = 22.650 ac

Summary for Subcatchment 1S: Post Construction

[49] Hint: Tc<2dt may require smaller dt

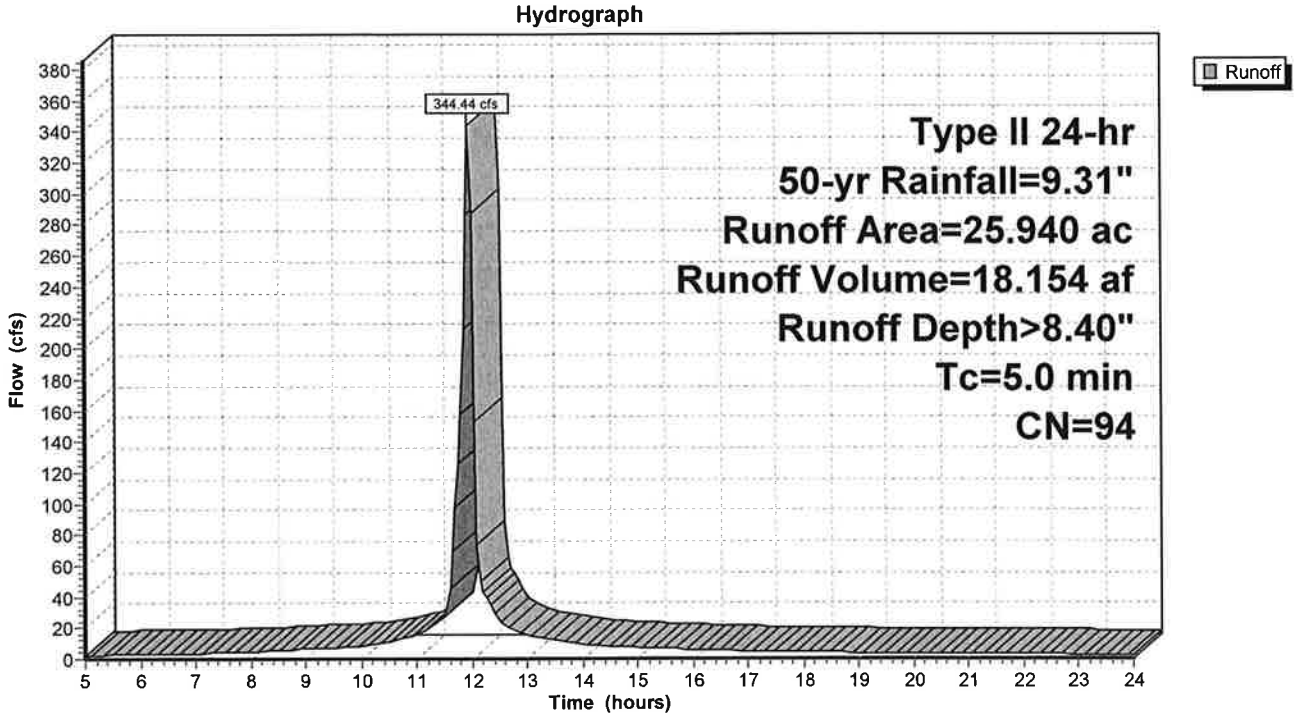
Runoff = 344.44 cfs @ 11.95 hrs, Volume= 18.154 af, Depth> 8.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=9.31"

	Area (ac)	CN	Description
*	19.900	98	Paved parking, Roofs HSG C
	6.040	79	50-75% Grass cover, Fair, HSG C
	25.940	94	Weighted Average
	6.040		23.28% Pervious Area
	19.900		76.72% Impervious Area

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

Subcatchment 1S: Post Construction



Summary for Subcatchment 2S: ExistingConditions

[49] Hint: Tc<2dt may require smaller dt

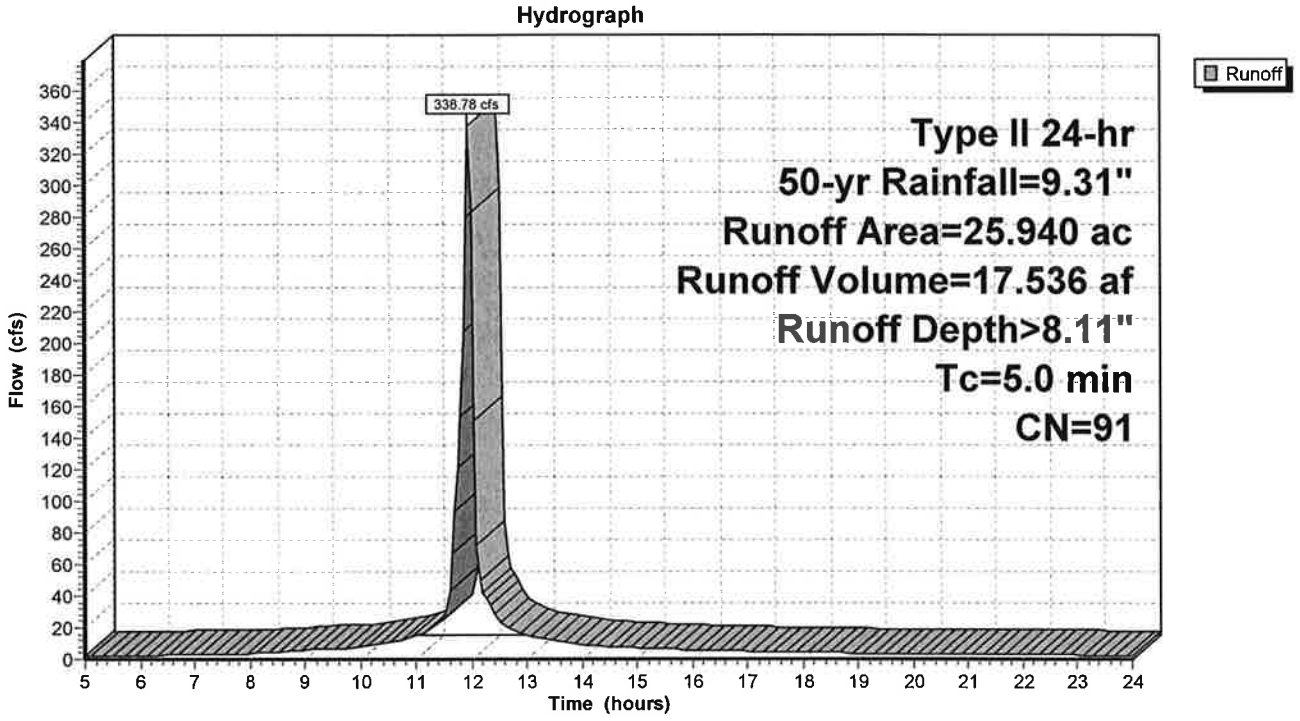
Runoff = 338.78 cfs @ 11.95 hrs, Volume= 17.536 af, Depth> 8.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=9.31"

	Area (ac)	CN	Description
*	2.750	98	Paved parking, Roofs HSG C
	23.190	90	Fallow, crop residue, Poor, HSG C
	25.940	91	Weighted Average
	23.190		89.40% Pervious Area
	2.750		10.60% Impervious Area

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

Subcatchment 2S: ExistingConditions



Summary for Pond 1P: Pond

[82] Warning: Early inflow requires earlier time span

Inflow Area = 25.940 ac, 76.72% Impervious, Inflow Depth > 8.40" for 50-yr event
Inflow = 344.44 cfs @ 11.95 hrs, Volume= 18.154 af
Outflow = 324.87 cfs @ 11.98 hrs, Volume= 18.117 af, Atten= 6%, Lag= 1.6 min
Primary = 324.87 cfs @ 11.98 hrs, Volume= 18.117 af

Routing by Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 909.75' @ 11.98 hrs Surf.Area= 12,588 sf Storage= 33,525 cf

Plug-Flow detention time= 4.6 min calculated for 18.064 af (100% of inflow)
Center-of-Mass det. time= 2.9 min (767.1 - 764.2)

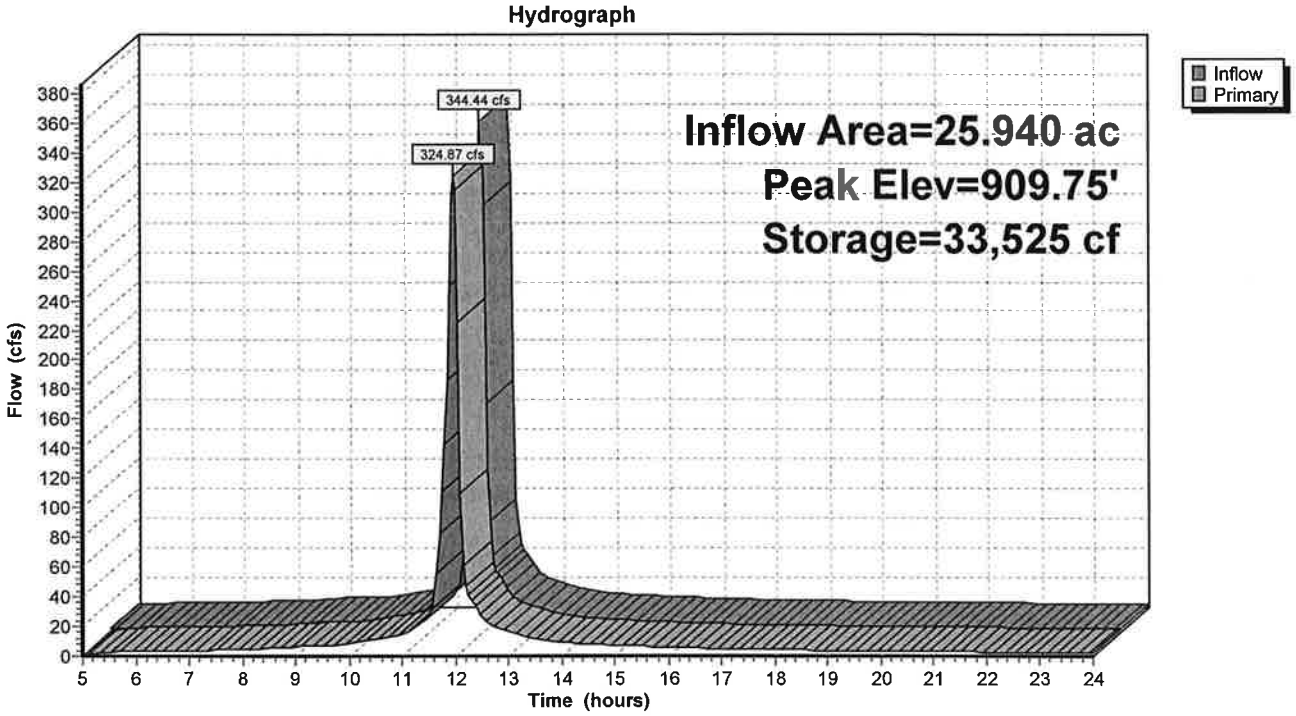
Volume	Invert	Avail.Storage	Storage Description
#1	906.00'	50,859 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
906.00	5,695	0	0
907.00	7,194	6,445	6,445
908.00	9,061	8,128	14,572
909.00	11,028	10,045	24,617
910.00	13,096	12,062	36,679
911.00	15,265	14,181	50,859

Device	Routing	Invert	Outlet Devices	
#1	Primary	906.00'	**48.0" Vert. Outfall**	C= 0.600
#2	Primary	906.00'	**48.0" Vert. Outfall**	C= 0.600
#3	Primary	906.00'	**48.0" Vert. Outfall**	C= 0.600
#4	Primary	906.00'	**48.0" Vert. Outfall**	C= 0.600

Primary OutFlow Max=313.27 cfs @ 11.98 hrs HW=909.65' (Free Discharge)
- **1=Outfall** (Orifice Controls 78.32 cfs @ 6.51 fps)
- **2=Outfall** (Orifice Controls 78.32 cfs @ 6.51 fps)
- **3=Outfall** (Orifice Controls 78.32 cfs @ 6.51 fps)
- **4=Outfall** (Orifice Controls 78.32 cfs @ 6.51 fps)

Pond 1P: Pond


Hydrograph
Inflow
Primary
344.44 cfs
324.87 cfs
Inflow Area=25.940 ac
Peak Elev=909.75'
Storage=33,525 cf
Flow (cfs)
Time (hours)

Stage-Area-Storage for Pond 1P: Pond

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
906.00	5,695	0
906.05	5,770	287
906.10	5,845	577
906.15	5,920	871
906.20	5,995	1,169
906.25	6,070	1,471
906.30	6,145	1,776
906.35	6,220	2,085
906.40	6,295	2,398
906.45	6,370	2,715
906.50	6,445	3,035
906.55	6,519	3,359
906.60	6,594	3,687
906.65	6,669	4,018
906.70	6,744	4,354
906.75	6,819	4,693
906.80	6,894	5,036
906.85	6,969	5,382
906.90	7,044	5,733
906.95	7,119	6,087
907.00	7,194	6,445
907.05	7,287	6,807
907.10	7,381	7,173
907.15	7,474	7,545
907.20	7,567	7,921
907.25	7,661	8,301
907.30	7,754	8,687
907.35	7,847	9,077
907.40	7,941	9,471
907.45	8,034	9,871
907.50	8,128	10,275
907.55	8,221	10,684
907.60	8,314	11,097
907.65	8,408	11,515
907.70	8,501	11,938
907.75	8,594	12,365
907.80	8,688	12,797
907.85	8,781	13,234
907.90	8,874	13,675
907.95	8,968	14,121
908.00	9,061	14,572
908.05	9,159	15,028
908.10	9,258	15,488
908.15	9,356	15,953
908.20	9,454	16,424
908.25	9,553	16,899
908.30	9,651	17,379
908.35	9,749	17,864
908.40	9,848	18,354
908.45	9,946	18,849
908.50	10,045	19,348
908.55	10,143	19,853
908.60	10,241	20,363
908.65	10,340	20,877
908.70	10,438	21,397
908.75	10,536	21,921
908.80	10,635	22,450
908.85	10,733	22,984
908.90	10,831	23,524
908.95	10,930	24,068
909.00	11,028	24,617
909.05	11,131	25,170
909.10	11,235	25,730
909.15	11,338	26,294
909.20	11,442	26,863
909.25	11,545	27,438
909.30	11,648	28,018
909.35	11,752	28,603
909.40	11,855	29,193
909.45	11,959	29,788
909.50	12,062	30,389
909.55	12,165	30,995
909.60	12,269	31,606
909.65	12,372	32,222
909.70	12,476	32,843
909.75	12,579	33,469
909.80	12,682	34,101
909.85	12,786	34,737
909.90	12,889	35,379
909.95	12,993	36,026
910.00	13,096	36,679
910.05	13,204	37,336
910.10	13,313	37,999
910.15	13,421	38,667
910.20	13,530	39,341
910.25	13,638	40,020
910.30	13,747	40,705
910.35	13,855	41,395
910.40	13,964	42,090
910.45	14,072	42,791
910.50	14,181	43,498
910.55	14,289	44,209
910.60	14,397	44,927
910.65	14,506	45,649
910.70	14,614	46,377
910.75	14,723	47,111
910.80	14,831	47,849
910.85	14,940	48,594
910.90	15,048	49,343
910.95	15,157	50,098
911.00	**15,265**	**50,859**

Time span=5.00-24.00 hrs, dt=0.05 hrs, 381 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Post Construction Runoff Area=25.940 ac 76.72% Impervious Runoff Depth>9.25"
Tc=5.0 min CN=94 Runoff=378.19 cfs 19.990 af

Subcatchment 2S: ExistingConditions Runoff Area=25.940 ac 10.60% Impervious Runoff Depth>8.97"
Tc=5.0 min CN=91 Runoff=372.85 cfs 19.384 af

Pond 1P: Pond Peak Elev=910.08' Storage=37,741 cf Inflow=378.19 cfs 19.990 af
Outflow=351.30 cfs 19.952 af

Total Runoff Area = 51.880 ac Runoff Volume = 39.374 af Average Runoff Depth = 9.11"
56.34% Pervious = 29.230 ac 43.66% Impervious = 22.650 ac

Summary for Subcatchment 1S: Post Construction

[49] Hint: Tc<2dt may require smaller dt

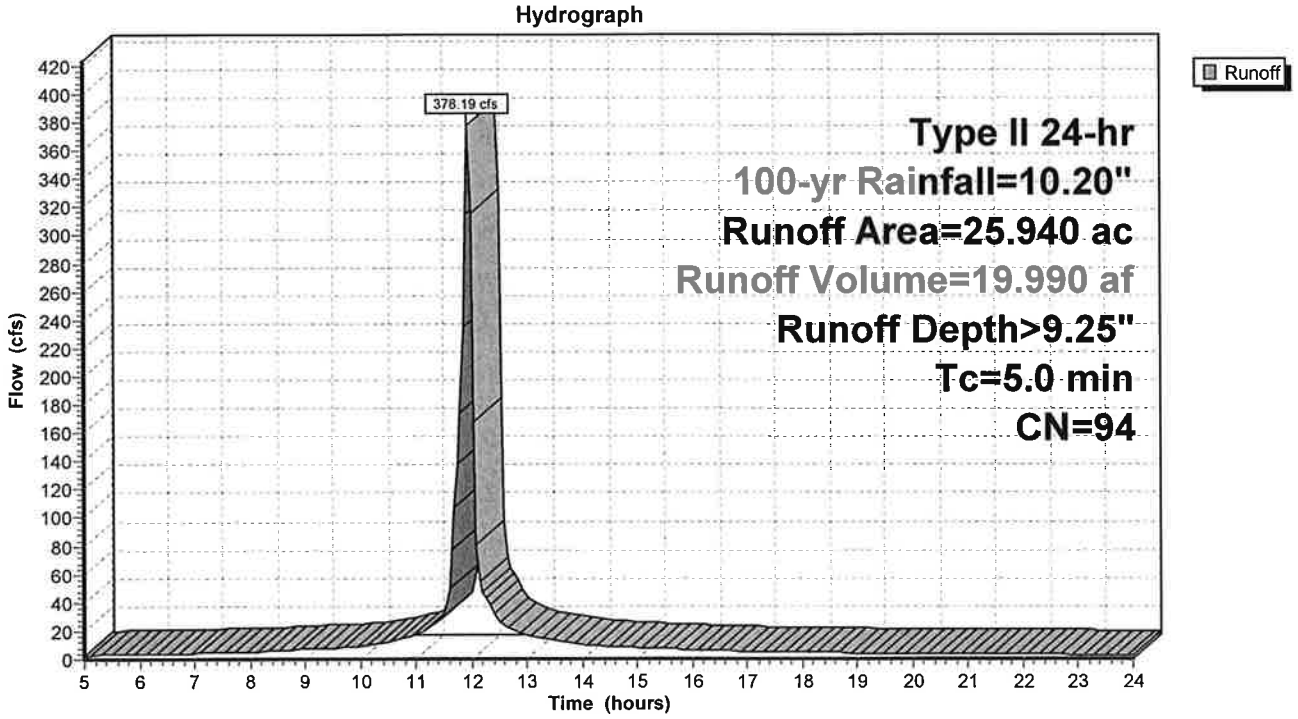
Runoff = 378.19 cfs @ 11.95 hrs, Volume= 19.990 af, Depth> 9.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=10.20"

	Area (ac)	CN	Description
*	19.900	98	Paved parking, Roofs HSG C
	6.040	79	50-75% Grass cover, Fair, HSG C
	25.940	94	Weighted Average
	6.040		23.28% Pervious Area
	19.900		76.72% Impervious Area

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

Subcatchment 1S: Post Construction



Summary for Subcatchment 2S: ExistingConditions

[49] Hint: Tc<2dt may require smaller dt

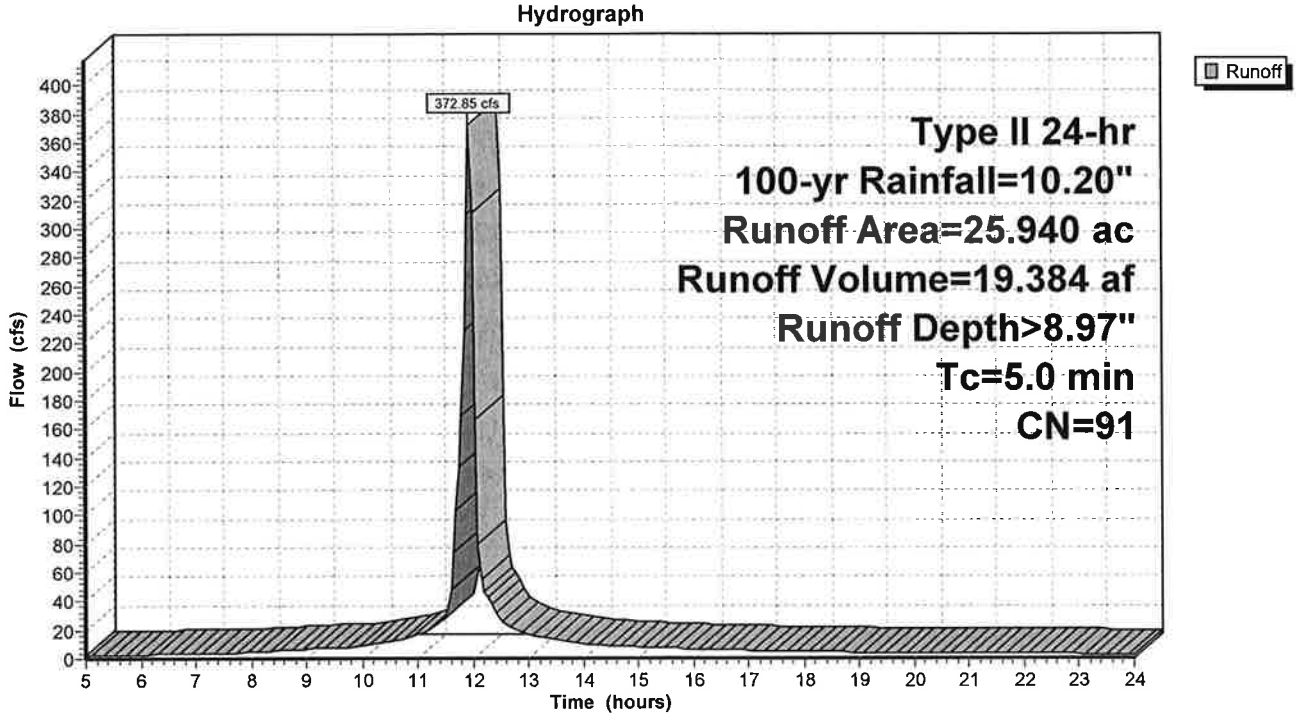
Runoff = 372.85 cfs @ 11.95 hrs, Volume= 19.384 af, Depth> 8.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=10.20"

	Area (ac)	CN	Description
*	2.750	98	Paved parking, Roofs HSG C
	23.190	90	Fallow, crop residue, Poor, HSG C
	25.940	91	Weighted Average
	23.190		89.40% Pervious Area
	2.750		10.60% Impervious Area

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

Subcatchment 2S: ExistingConditions



Summary for Pond 1P: Pond

[82] Warning: Early inflow requires earlier time span

Inflow Area = 25.940 ac, 76.72% Impervious, Inflow Depth > 9.25" for 100-yr event
Inflow = 378.19 cfs @ 11.95 hrs, Volume= 19.990 af
Outflow = 351.30 cfs @ 11.98 hrs, Volume= 19.952 af, Atten= 7%, Lag= 1.7 min
Primary = 351.30 cfs @ 11.98 hrs, Volume= 19.952 af

Routing by Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 910.08' @ 11.98 hrs Surf.Area= 13,271 sf Storage= 37,741 cf

Plug-Flow detention time= 4.4 min calculated for 19.893 af (100% of inflow)
Center-of-Mass det. time= 2.8 min (766.1 - 763.3)

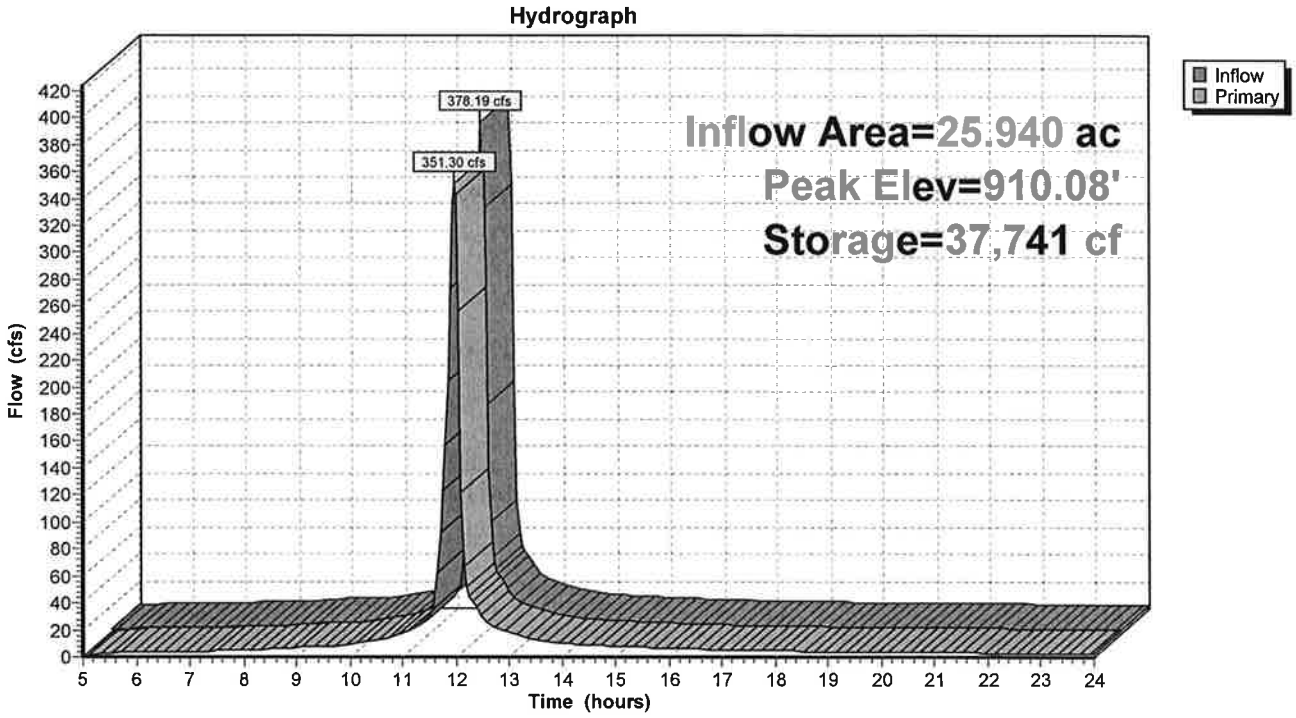
Volume	Invert	Avail.Storage	Storage Description
#1	906.00'	50,859 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
906.00	5,695	0	0
907.00	7,194	6,445	6,445
908.00	9,061	8,128	14,572
909.00	11,028	10,045	24,617
910.00	13,096	12,062	36,679
911.00	15,265	14,181	50,859

Device	Routing	Invert	Outlet Devices	
#1	Primary	906.00'	**48.0" Vert. Outfall**	C= 0.600
#2	Primary	906.00'	**48.0" Vert. Outfall**	C= 0.600
#3	Primary	906.00'	**48.0" Vert. Outfall**	C= 0.600
#4	Primary	906.00'	**48.0" Vert. Outfall**	C= 0.600

Primary OutFlow Max=340.18 cfs @ 11.98 hrs HW=909.96' (Free Discharge)
- **1=Outfall** (Orifice Controls 85.04 cfs @ 6.78 fps)
- **2=Outfall** (Orifice Controls 85.04 cfs @ 6.78 fps)
- **3=Outfall** (Orifice Controls 85.04 cfs @ 6.78 fps)
- **4=Outfall** (Orifice Controls 85.04 cfs @ 6.78 fps)

Pond 1P: Pond


Hydrograph
Inflow
Primary
378.19 cfs
351.30 cfs
Inflow Area=25.940 ac
Peak Elev=910.08'
Storage=37,741 cf
Flow (cfs)
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360
380
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420
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21
22
23
24
Time (hours)

Stage-Area-Storage for Pond 1P: Pond

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
906.00	5,695	0	908.60	10,241	20,363
906.05	5,770	287	908.65	10,340	20,877
906.10	5,845	577	908.70	10,438	21,397
906.15	5,920	871	908.75	10,536	21,921
906.20	5,995	1,169	908.80	10,635	22,450
906.25	6,070	1,471	908.85	10,733	22,984
906.30	6,145	1,776	908.90	10,831	23,524
906.35	6,220	2,085	908.95	10,930	24,068
906.40	6,295	2,398	909.00	11,028	24,617
906.45	6,370	2,715	909.05	11,131	25,170
906.50	6,445	3,035	909.10	11,235	25,730
906.55	6,519	3,359	909.15	11,338	26,294
906.60	6,594	3,687	909.20	11,442	26,863
906.65	6,669	4,018	909.25	11,545	27,438
906.70	6,744	4,354	909.30	11,648	28,018
906.75	6,819	4,693	909.35	11,752	28,603
906.80	6,894	5,036	909.40	11,855	29,193
906.85	6,969	5,382	909.45	11,959	29,788
906.90	7,044	5,733	909.50	12,062	30,389
906.95	7,119	6,087	909.55	12,165	30,995
907.00	7,194	6,445	909.60	12,269	31,606
907.05	7,287	6,807	909.65	12,372	32,222
907.10	7,381	7,173	909.70	12,476	32,843
907.15	7,474	7,545	909.75	12,579	33,469
907.20	7,567	7,921	909.80	12,682	34,101
907.25	7,661	8,301	909.85	12,786	34,737
907.30	7,754	8,687	909.90	12,889	35,379
907.35	7,847	9,077	909.95	12,993	36,026
907.40	7,941	9,471	910.00	13,096	36,679
907.45	8,034	9,871	910.05	13,204	37,336
907.50	8,128	10,275	910.10	13,313	37,999
907.55	8,221	10,684	910.15	13,421	38,667
907.60	8,314	11,097	910.20	13,530	39,341
907.65	8,408	11,515	910.25	13,638	40,020
907.70	8,501	11,938	910.30	13,747	40,705
907.75	8,594	12,365	910.35	13,855	41,395
907.80	8,688	12,797	910.40	13,964	42,090
907.85	8,781	13,234	910.45	14,072	42,791
907.90	8,874	13,675	910.50	14,181	43,498
907.95	8,968	14,121	910.55	14,289	44,209
908.00	9,061	14,572	910.60	14,397	44,927
908.05	9,159	15,028	910.65	14,506	45,649
908.10	9,258	15,488	910.70	14,614	46,377
908.15	9,356	15,953	910.75	14,723	47,111
908.20	9,454	16,424	910.80	14,831	47,849
908.25	9,553	16,899	910.85	14,940	48,594
908.30	9,651	17,379	910.90	15,048	49,343
908.35	9,749	17,864	910.95	15,157	50,098
908.40	9,848	18,354	911.00	**15,265**	**50,859**
908.45	9,946	18,849			
908.50	10,045	19,348			
908.55	10,143	19,853			

Time span=5.00-24.00 hrs, dt=0.05 hrs, 381 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Post Construction Runoff Area=25.940 ac 76.72% Impervious Runoff Depth>0.82"
Tc=5.0 min CN=94 Runoff=37.75 cfs 1.773 af

Subcatchment 2S: ExistingConditions Runoff Area=25.940 ac 10.60% Impervious Runoff Depth>0.64"
Tc=5.0 min CN=91 Runoff=29.72 cfs 1.373 af

Pond 1P: Pond Peak Elev=907.03' Storage=6,641 cf Inflow=37.75 cfs 1.773 af
Outflow=35.19 cfs 1.759 af

Total Runoff Area = 51.880 ac Runoff Volume = 3.146 af Average Runoff Depth = 0.73"
56.34% Pervious = 29.230 ac 43.66% Impervious = 22.650 ac

Summary for Subcatchment 1S: Post Construction

[49] Hint: Tc<2dt may require smaller dt

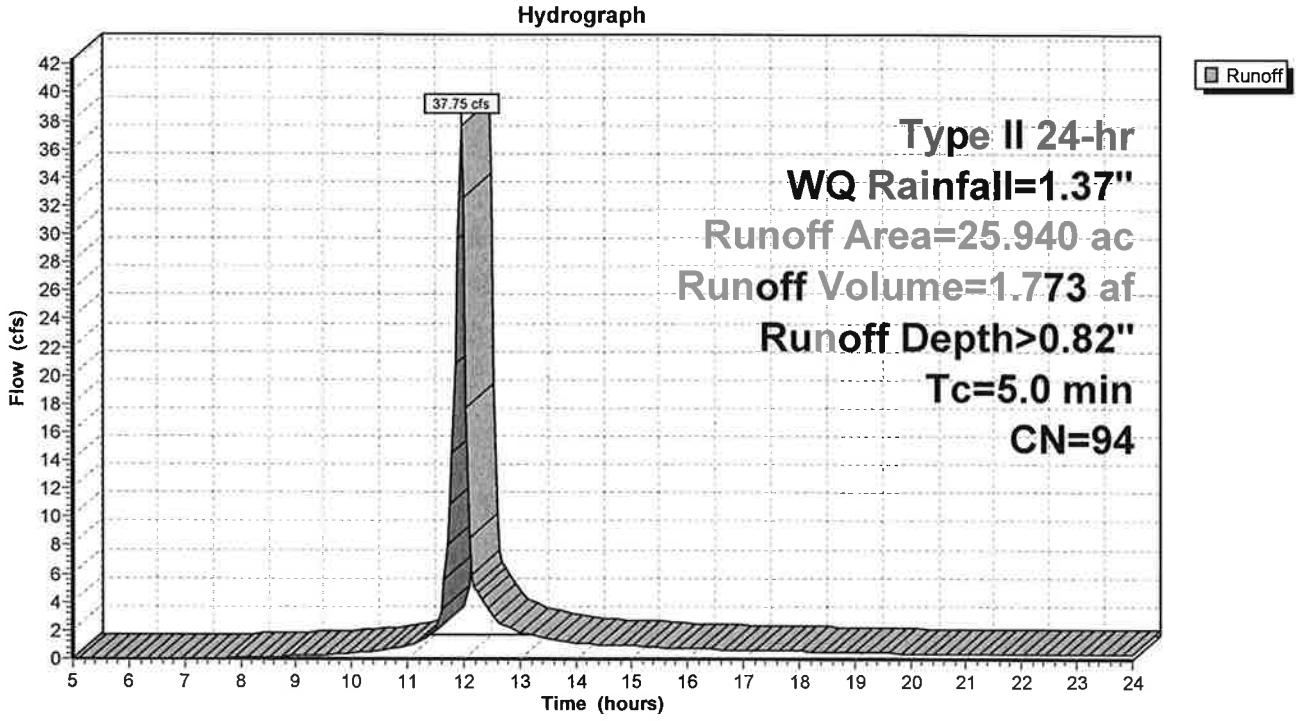
Runoff = 37.75 cfs @ 11.96 hrs, Volume= 1.773 af, Depth> 0.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr WQ Rainfall=1.37"

	Area (ac)	CN	Description
*	19.900	98	Paved parking, Roofs HSG C
	6.040	79	50-75% Grass cover, Fair, HSG C
	25.940	94	Weighted Average
	6.040		23.28% Pervious Area
	19.900		76.72% Impervious Area

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

Subcatchment 1S: Post Construction



Summary for Subcatchment 2S: ExistingConditions

[49] Hint: Tc<2dt may require smaller dt

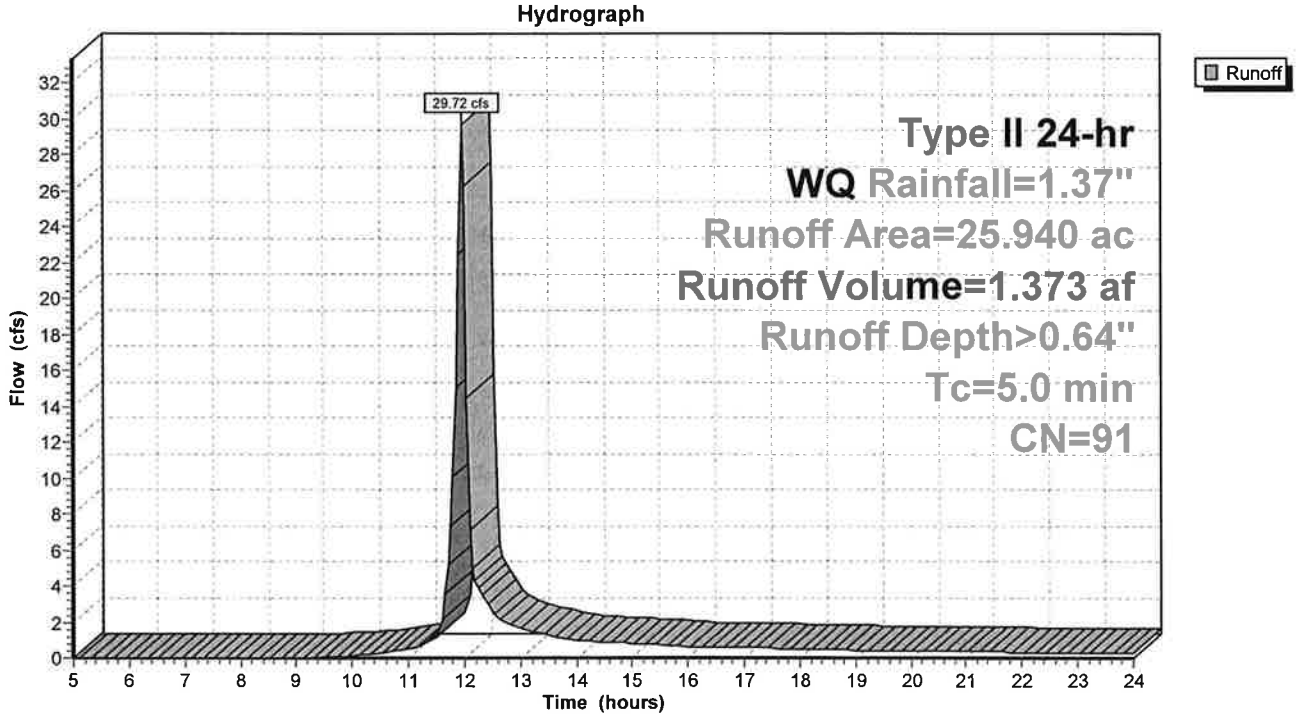
Runoff = 29.72 cfs @ 11.96 hrs, Volume= 1.373 af, Depth> 0.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr WQ Rainfall=1.37"

	Area (ac)	CN	Description
*	2.750	98	Paved parking, Roofs HSG C
	23.190	90	Fallow, crop residue, Poor, HSG C
	25.940	91	Weighted Average
	23.190		89.40% Pervious Area
	2.750		10.60% Impervious Area

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

Subcatchment 2S: ExistingConditions



Summary for Pond 1P: Pond

Inflow Area = 25.940 ac, 76.72% Impervious, Inflow Depth > 0.82" for WQ event
Inflow = 37.75 cfs @ 11.96 hrs, Volume= 1.773 af
Outflow = 35.19 cfs @ 11.99 hrs, Volume= 1.759 af, Atten= 7%, Lag= 1.9 min
Primary = 35.19 cfs @ 11.99 hrs, Volume= 1.759 af

Routing by Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 907.03' @ 11.99 hrs Surf.Area= 7,245 sf Storage= 6,641 cf

Plug-Flow detention time= 11.1 min calculated for 1.759 af (99% of inflow)
Center-of-Mass det. time= 6.5 min (820.8 - 814.2)

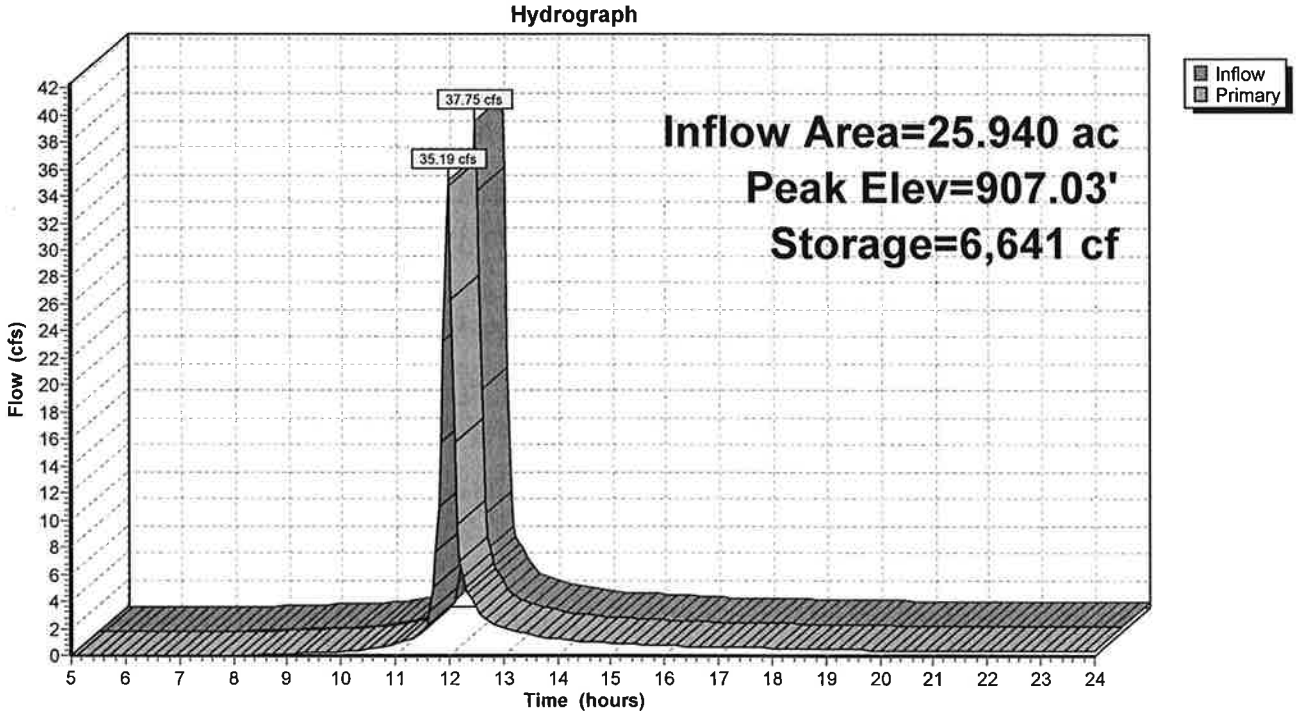
Volume	Invert	Avail.Storage	Storage Description
#1	906.00'	50,859 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
906.00	5,695	0	0
907.00	7,194	6,445	6,445
908.00	9,061	8,128	14,572
909.00	11,028	10,045	24,617
910.00	13,096	12,062	36,679
911.00	15,265	14,181	50,859

Device	Routing	Invert	Outlet Devices	
#1	Primary	906.00'	**48.0" Vert. Outfall**	C= 0.600
#2	Primary	906.00'	**48.0" Vert. Outfall**	C= 0.600
#3	Primary	906.00'	**48.0" Vert. Outfall**	C= 0.600
#4	Primary	906.00'	**48.0" Vert. Outfall**	C= 0.600

Primary OutFlow Max=34.10 cfs @ 11.99 hrs HW=907.01' (Free Discharge)
- **1=Outfall** (Orifice Controls 8.52 cfs @ 3.42 fps)
- **2=Outfall** (Orifice Controls 8.52 cfs @ 3.42 fps)
- **3=Outfall** (Orifice Controls 8.52 cfs @ 3.42 fps)
- **4=Outfall** (Orifice Controls 8.52 cfs @ 3.42 fps)

Pond 1P: Pond


Hydrograph
Inflow
Primary
37.75 cfs
35.19 cfs
Inflow Area=25.940 ac
Peak Elev=907.03'
Storage=6,641 cf
Flow (cfs)
Time (hours)

Stage-Area-Storage for Pond 1P: Pond

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
906.00	5,695	0
906.05	5,770	287
906.10	5,845	577
906.15	5,920	871
906.20	5,995	1,169
906.25	6,070	1,471
906.30	6,145	1,776
906.35	6,220	2,085
906.40	6,295	2,398
906.45	6,370	2,715
906.50	6,445	3,035
906.55	6,519	3,359
906.60	6,594	3,687
906.65	6,669	4,018
906.70	6,744	4,354
906.75	6,819	4,693
906.80	6,894	5,036
906.85	6,969	5,382
906.90	7,044	5,733
906.95	7,119	6,087
907.00	7,194	6,445
907.05	7,287	6,807
907.10	7,381	7,173
907.15	7,474	7,545
907.20	7,567	7,921
907.25	7,661	8,301
907.30	7,754	8,687
907.35	7,847	9,077
907.40	7,941	9,471
907.45	8,034	9,871
907.50	8,128	10,275
907.55	8,221	10,684
907.60	8,314	11,097
907.65	8,408	11,515
907.70	8,501	11,938
907.75	8,594	12,365
907.80	8,688	12,797
907.85	8,781	13,234
907.90	8,874	13,675
907.95	8,968	14,121
908.00	9,061	14,572
908.05	9,159	15,028
908.10	9,258	15,488
908.15	9,356	15,953
908.20	9,454	16,424
908.25	9,553	16,899
908.30	9,651	17,379
908.35	9,749	17,864
908.40	9,848	18,354
908.45	9,946	18,849
908.50	10,045	19,348
908.55	10,143	19,853
908.60	10,241	20,363
908.65	10,340	20,877
908.70	10,438	21,397
908.75	10,536	21,921
908.80	10,635	22,450
908.85	10,733	22,984
908.90	10,831	23,524
908.95	10,930	24,068
909.00	11,028	24,617
909.05	11,131	25,170
909.10	11,235	25,730
909.15	11,338	26,294
909.20	11,442	26,863
909.25	11,545	27,438
909.30	11,648	28,018
909.35	11,752	28,603
909.40	11,855	29,193
909.45	11,959	29,788
909.50	12,062	30,389
909.55	12,165	30,995
909.60	12,269	31,606
909.65	12,372	32,222
909.70	12,476	32,843
909.75	12,579	33,469
909.80	12,682	34,101
909.85	12,786	34,737
909.90	12,889	35,379
909.95	12,993	36,026
910.00	13,096	36,679
910.05	13,204	37,336
910.10	13,313	37,999
910.15	13,421	38,667
910.20	13,530	39,341
910.25	13,638	40,020
910.30	13,747	40,705
910.35	13,855	41,395
910.40	13,964	42,090
910.45	14,072	42,791
910.50	14,181	43,498
910.55	14,289	44,209
910.60	14,397	44,927
910.65	14,506	45,649
910.70	14,614	46,377
910.75	14,723	47,111
910.80	14,831	47,849
910.85	14,940	48,594
910.90	15,048	49,343
910.95	15,157	50,098
911.00	**15,265**	**50,859**

Reser's Fine Foods East Development

VI. Downstream Analysis

Reser's Fine Foods East Development

Downstream Analysis

We will be lessoning the discharge to the unimproved storm system in SE Croco and reducing the amount of flow to the property to the north. These areas will see a reduction in runoff once our project is completed. We are utilizing the EDDB to treat and detain the runoff form the rest of the site and will be releasing it to levels that are below the current flow rates. By reducing the offsite flows to SE Croco as well as to the north and utilizing the EDDB we will be lessoning downstream impacts in both flow volumes and water quality.

Reser's Fine Foods East Development

VII. Soil Map and Classifications

Map Scale: 1:2,290 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 30 60 120 180

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Shawnee County, Kansas
Survey Area Data: Version 14, Sep 14, 2015

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

Date(s) aerial images were photographed: Apr 5, 2011—Apr 12, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Shawnee County, Kansas (KS177)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
3891	Ladysmith silty clay loam, 1 to 3 percent slopes	6.3	23.3%
7303	Martin silty clay loam, 3 to 7 percent slopes, eroded	3.7	13.8%
7423	Morrill clay loam, 3 to 7 percent slopes	1.5	5.5%
7501	Pawnee clay loam, 4 to 8 percent slopes, eroded	13.0	48.0%
7541	Sharpsburg silty clay loam, 4 to 8 percent slopes	2.5	9.4%
Totals for Area of Interest		**27.0**	**100.0%**

Shawnee County, Kansas

3891—Ladysmith silty clay loam, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: 1igwl
Elevation: 1,310 to 1,640 feet
Mean annual precipitation: 26 to 34 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 165 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Ladysmith and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ladysmith

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from limestone and shale

Typical profile

Ap - 0 to 8 inches: silty clay loam
Bt - 8 to 36 inches: silty clay
BC - 36 to 49 inches: silty clay
C - 49 to 79 inches: silty clay

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 24 to 35 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 3 percent
Available water storage in profile: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: D
Ecological site: Clay Upland (PE 26-30) (R074XY007KS)

Hydric soil rating: No

Minor Components

Irwin

Percent of map unit: 5 percent
Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Upland Hills 32-40" (R076XY100KS)
Hydric soil rating: No

Dwight

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Claypan 32-40" (R076XY103KS)
Hydric soil rating: No

Aquolls

Percent of map unit: 0 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Shawnee County, Kansas
Survey Area Data: Version 14, Sep 14, 2015

Shawnee County, Kansas

7303—Martin silty clay loam, 3 to 7 percent slopes, eroded

Map Unit Setting

National map unit symbol: 1lg96
Elevation: 800 to 1,700 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 175 to 215 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Martin, eroded, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Martin, Eroded

Setting

Landform: Hillslopes
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Silty and clayey colluvium derived from limestone and shale over silty and clayey residuum weathered from limestone and shale

Typical profile

A - 0 to 7 inches: silty clay loam
Bt - 7 to 30 inches: silty clay
C - 30 to 72 inches: silty clay

Properties and qualities

Slope: 3 to 7 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 21 to 26 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 1 percent
Available water storage in profile: High (about 9.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: Loamy Upland (Draft) (PE 35-42) (R112XY015KS)
Hydric soil rating: No

Minor Components

Elmont, eroded

Percent of map unit: 10 percent
Landform: Hillslopes
Ecological site: LIMY UPLAND (PE35-42) (R112XY012KS)
Hydric soil rating: No

Data Source Information

Soil Survey Area: Shawnee County, Kansas
Survey Area Data: Version 14, Sep 14, 2015

Shawnee County, Kansas

7423—Morrill clay loam, 3 to 7 percent slopes

Map Unit Setting

National map unit symbol: 1lg9d
Elevation: 700 to 1,500 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 52 to 59 degrees F
Frost-free period: 175 to 215 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Morrill and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Morrill

Setting

Landform: Hillslopes
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Fine-loamy glaciofluvial deposits

Typical profile

A - 0 to 10 inches: clay loam
BA - 10 to 16 inches: clay loam
Bt - 16 to 56 inches: clay loam
C - 56 to 66 inches: clay loam

Properties and qualities

Slope: 3 to 7 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 10.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: Loamy Upland (PE 30-37) (R106XY015KS)
Hydric soil rating: No

Minor Components

Oska

Percent of map unit: 5 percent
Landform: Hillslopes
Ecological site: Loamy Upland (Draft) (PE 35-42) (R112XY015KS)
Hydric soil rating: No

Pawnee

Percent of map unit: 5 percent
Landform: Hillslopes
Ecological site: Clay Upland (PE 30-37) (R106XY007KS)
Hydric soil rating: No

Aquolls

Percent of map unit: 0 percent
Landform: Depressions, drainageways, hillslopes
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Shawnee County, Kansas
Survey Area Data: Version 14, Sep 14, 2015

Shawnee County, Kansas

7501—Pawnee clay loam, 4 to 8 percent slopes, eroded

Map Unit Setting

National map unit symbol: 2lpsn
Elevation: 800 to 1,680 feet
Mean annual precipitation: 29 to 39 inches
Mean annual air temperature: 51 to 55 degrees F
Frost-free period: 163 to 186 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Pawnee, Eroded

Setting

Landform: Hillslopes on till plains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Till

Typical profile

Ap - 0 to 7 inches: clay loam
BA - 7 to 13 inches: clay loam
Bt - 13 to 53 inches: clay
C - 53 to 79 inches: clay loam

Properties and qualities

Slope: 4 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 7 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: D
Ecological site: Clayey Upland (R106XY074NE)
Other vegetative classification: Clayey Subsoil (G106XY210NE)

Hydric soil rating: No

Minor Components

Morrill, eroded

Percent of map unit: 5 percent
Landform: Hillslopes on till plains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Loamy Upland (R106XY075NE)
Other vegetative classification: Loam (G106XY100NE)
Hydric soil rating: No

Shelby, eroded

Percent of map unit: 4 percent
Landform: Hillslopes on till plains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: Loamy Upland (R106XY075NE)
Other vegetative classification: Loam (G106XY100NE)
Hydric soil rating: No

Grundy, eroded

Percent of map unit: 3 percent
Landform: Hillslopes on till plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Clayey Upland (R106XY074NE)
Other vegetative classification: Clayey Subsoil (G106XY210NE)
Hydric soil rating: No

Wymore, eroded

Percent of map unit: 3 percent
Landform: Hillslopes on till plains
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Side slope, interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Clayey Upland (R106XY074NE)
Other vegetative classification: Clayey Subsoil (G106XY210NE)
Hydric soil rating: No

Data Source Information

Soil Survey Area: Shawnee County, Kansas
Survey Area Data: Version 14, Sep 14, 2015

Shawnee County, Kansas

7541—Sharpsburg silty clay loam, 4 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2scy3
Elevation: 980 to 1,660 feet
Mean annual precipitation: 28 to 39 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 158 to 203 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Sharpsburg

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loess

Typical profile

Ap - 0 to 6 inches: silty clay loam
A - 6 to 11 inches: silty clay loam
Bt1 - 11 to 18 inches: silty clay loam
Bt2 - 18 to 46 inches: silty clay loam
BC - 46 to 58 inches: silty clay loam
C - 58 to 79 inches: silty clay loam

Properties and qualities

Slope: 4 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 45 to 50 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline (0.0 to 0.4 mmhos/cm)
Available water storage in profile: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): 4e

Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: Loamy Upland (PE 30-37) (R106XY015KS)
Other vegetative classification: Loam (G106XY100NE)
Hydric soil rating: No

Minor Components

Martin

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: Loamy Upland (PE 30-37) (R106XY015KS)
Other vegetative classification: Loam (G106XY100NE)
Hydric soil rating: No

Pawnee

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: Clayey Upland (R106XY074NE)
Other vegetative classification: Clayey Subsoil (G106XY210NE)
Hydric soil rating: No

Shelby

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: Loamy Upland (PE 30-37) (R106XY015KS)
Other vegetative classification: Loam (G106XY100NE)
Hydric soil rating: No

Data Source Information

Soil Survey Area: Shawnee County, Kansas
Survey Area Data: Version 14, Sep 14, 2015

Reser's Fine Foods East Development

VIII. O&M

Reser's Fine Foods East Development

STORMWATER OPERATIONS & MAINTENANCE PLAN

Reser's Fine Foods East Development

November 29, 2016

Prepared by:
Hamid Afghan, PE
AAI Engineering
47875 SW Griffith Drive, Suite 300
Beaverton, OR 97005

Responsibility

The catch basins, conveyance piping, Extended Dry Detention Basin (EDDB) and dispersion trench are to be maintained by the property owner. These facilities have been designed for ease of maintenance outlined herein.

Reser's Contact info:

Primary
Jeff Russell
Reser's Fine Foods
3167 SE 10th St
Topeka, KS
785-817-7770

Description

The EDDB is a reservoir that is used to filter stormwater runoff and allowing pollutants to settle before being released through a control structure to a dispersion trench. The runoff from the proposed impervious areas will be collected by catch basins (AC and concrete) and downspouts (Roof). Once collected it will be conveyed to the EDDB where the water will be released to a dispersion trench located near the EDDB.

Inspection/Maintenance Schedule

Each part of the system shall be inspected and maintained quarterly and within 48 hours after each major storm event. For this O&M Plan, a major storm event is defined as 2.0 inches of rain (or more) in 24 hours. All components of the storm system as described above must be inspected and maintained frequently or they will cease to function effectively. The facility owner shall keep a log, recording all

inspection dates, observations, and maintenance activities. Receipts shall be saved when maintenance is performed and there is a record of expense.

The following items shall be inspected and maintained as stated:

Extended Dry Detention Basin (EDDB):

- Vegetation or roots from large shrubs and trees that limit or interfere with planter operations shall be prevented.
- Fallen leaves and debris from deciduous plant foliage shall be raked and removed biannually.
- Nuisance and prohibited vegetation of all species shall be removed biannually. Invasive vegetation shall be removed and replaced with approved species.
- Dead vegetation shall be removed to maintain less than 10% of area coverage or when basin function is impaired. Vegetation shall be replaced within 3 months or immediately if the season is appropriate in order to maintain cover density and control erosion where soils are exposed.
- Inlets and outlets shall be inspected quarterly and after any large rain event.
- Any trash or debris that collects in the planter and may inhibit basin function shall be removed quarterly.

Catchbasins, Conveyance Pipes (Storm System):

- Sediment shall be removed biannually, more frequently if site produces a high volume of sediment.
- Debris shall be removed from inlets and outlets quarterly, or as necessary to maintain free flow of runoff.
- Quarterly inspections for clogging shall be preformed, or if "ponding" is observed in basins or at Catchbasin inlets.
- Grates shall be tamper proof.

Source Control

Source control measures prevent pollutants from mixing with stormwater. Typical non-structure control measures include raking and removing leaves, pavement sweeping, vacuum sweeping, and limited and controlled application of pesticides, herbicides and fertilizers.

- Source control measures shall be inspected and maintained quarterly.
- Signage shall be maintained.

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Spill Prevention

Spill prevention measures shall be exercised when handling substances that can contaminate stormwater. Virtually all sites present dangers from spills. It is important to exercise caution when handling substances that can contaminate stormwater. Activities that pose the chance of hazardous material spills shall not take place near collection facilities.

- The proper authority and property owner shall be contacted immediately if a spill is observed.
- A spill kit shall be kept near spill-prone operations and refreshed annually.
- Employees shall be trained on spill control measures.
- Shut-off valves shall be tested quarterly.
- Release of pollutants shall be corrected within 12 hours.

Insects and Rodents

Insects and Rodents shall not be harbored in any part of the storm system.

- Pest control measures shall be taken when insects/rodents are found to be present. Standing water and food sources shall be prevented.
- Holes in the ground located in and around the basins shall be filled.
- Outfalls shall be inspected and cleaned regularly to ensure no rodent activity, which can clog or decrease the efficiency of the storm system.
- Pest control measures shall be taken when insects/rodents are found to be present. Standing water and food sources shall be prevented.

Access

Access shall be maintained for the basins, catchbasins, overflows and cleanouts so operations and maintenance can be performed as regularly scheduled.

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Stormwater Facility Monitoring Log

EDDB

- The Pond shall drain within 40 hours. Time/Date, weather and site conditions when ponding occurs shall be recorded.

Pollution prevention

- All sites shall implement best management practices (BMP's), to prevent hazardous wastes, litter, or excessive oil and sediment from contaminating stormwater. Contact Spill Prevention & Citizen Response at 503-823-7180 for immediate assistance with responding to spills. Record time/date, weather and site conditions if site activities are found to contaminate stormwater.

Vectors (mosquitoes and rodents)

- Stormwater facilities shall not harbor mosquito larvae or rodents that pose a threat to public health or that undermine the facility structure. Monitor standing water for small wiggling sticks perpendicular to the waters' surface. Note holes/burrows in and around the basin and access road. Call Washington County Vector Control for immediate assistance with eradication of vectors. Record time/date, weather and site conditions when vector activity is observed.

Maintenance

- Record date, description and contractor (if applicable) for all structure repairs, landscape maintenance and facility cleanout activities.

Date: _____ Initials: _____

Work performed by: _____

Work performed: _____

_____

Details: _____

_____

Reser's Fine Foods East Development

Date: _____ Initials: _____
Work performed by: _____

Work performed: _____
_____

Details: _____
_____

Date: _____ Initials: _____

Work performed by: _____

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