

civil engineering
structural design
land surveying

PRELIMINARY DRAINAGE STUDY

Project Name:

**VALLEY VIEW CASINO
PARKING LOT**

APN 189-051-02

**San Diego County Project No. R04-17
Log No. 04-09-014**

Prepared By:
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27315 Valley Center Road
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March 4, 2008

**For:
San Pasqual Casino Development Group
Mr. Joe Navaro
16300 Nyemii Pass Road
Valley Center, California 92082**

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I. DISCUSSION

The San Pasqual Casino Development Group (SPCDG) desires to use the property located at the intersection of Valley Center Road and Lake Wohlford Road as additional parking for Valley View Casino located on the San Pasqual Reservation. The project site is located in the southwest corner of the intersection in the Valley Center planning area of the County of San Diego. This project will consist of a rezone from the A70, Limited Agricultural Use Regulation to the S86 Parking Use Regulation to allow the use of the parcel as a remote paved parking lot.

The drainage area is less than 1 square mile, allowing the use of the Rational Method for analysis. The TR-20 model, as implemented in the HydroCAD® hydrology and hydraulics modeling program, is used where hydrograph routing gives a more detailed estimate of predevelopment versus post development conditions.

II. Purpose

The purpose of this drainage study is evaluate pre- and post-development runoff characteristics for the site to use in designing adequate drainage structures and treatment control BMPs. These findings are also used to address CEQA level drainage aspects.

III. Pre-Development Conditions

Run-on

The subject 9.58 acre property is bounded on the north by Valley Center Road, on the east by Lake Wohlford Road, on the south by property belonging to Valley Center-Pauma Unified School District, and to the west by private property. A road known as School Bus Road connects Valley Center Road and Lake Wohlford Road. The north-south trending section of School Bus Road divides the site property approximately in half. The site is situated at the upstream extent of the Rincon Hydrologic Subarea. The section of Valley Center Road adjacent to the project follows the natural north-south drainage divide. The portion that flows to the southern side of the road primarily drains to the west. However, its impervious area is included in the runoff calculation for School Bus Road. The main run-on occurs from Lake Wohlford Road, entering the site at the southeast corner of the property. This run-on is generated in the developed area south of the project area, including a portion of Lake Wohlford Road¹. The contributing area is approximately 1.5 acres. Runoff is calculated for the 10 and 100 year return periods. Runoff from this area used to flow into the Upper San Luis Rey via Lower Hellhole Canyon but prior off site development in the area has diverted the flow to the north via Lake Wohlford Road.

¹ Field observation during a significant storm event

Runoff

There is only one discharge point from the property. It is located approximately 140 feet south of Valley Center Road on the western property line. The runoff from the eastern half of the property flows to the southwest corner formed by School Bus Road. From there, it crosses School Bus Road via a concrete swale/CMP culvert system, and discharges to the western portion of the property (see drainage/topographic map attached). The runoff from School Bus Road joins this runoff on the west side of the culvert/swale system. The poorly defined channel meanders, forming two bends before it reaches the discharge point flowing in a northwesterly direction. The site soil is roughly an even split between soil hydrologic group C and B (see Soils Map and Index Pages). The runoff coefficient for soil group C will be used in all calculations. Previously the land was used for a citrus orchard but the trees were removed before this project was proposed.

IV. Post-Development Conditions

The parking lot will occupy the area of the subject property east and north of School Bus Road. The development consists of paving enough area to provide 446 parking spaces. This requires the creation of approximately 3.2 acres of impervious surface (asphaltic concrete). This amount of impervious surface comprises approximately 68% of the eastern 4.71 acres. The impact of this will be to raise the runoff coefficient of the parking lot area from 0.30 to 0.71 as shown in the following calculation taken from the San Diego County Hydrology Manual.

$$C = 0.90 \cdot (\% \text{ Impervious}) + C_p \cdot (1 - \% \text{ Impervious})$$
$$C = 0.90 \cdot (.68) + 0.30 \cdot (1 - .68) = 0.71$$

The larger value of C results in a greater computed peak discharge rate, discharge quantity, and discharge velocity. These impacts will be mitigated by first utilizing the required interior landscaping to provide some initial detention and infiltration. This will be accomplished by constructing the landscape islands with a convex surface profile. The convex areas are provided with atrium drains to avoid standing water. The parking lot drains to a vegetated swale along the southern margin of the parking lot. The vegetated swale will provide filtration treatment. The swale carries water to the existing swale/culvert which flows into the detention basin.

The summary table in Section IV shows runoff characteristics for pre-development and post development. The modeling program printouts demonstrate the how the increased flow and velocity is mitigated by the detention pond. Model output also provides details of the existing culvert performance. The discharge point will remain unchanged, i.e., flow will exit the property at the pre-development discharge point.

V. CEQA Level Considerations

The California Environment Quality Act requires the determination of whether or not a project will "substantially alter the existing drainage pattern" of the project area or site to assess whether this would result in substantial erosion or siltation. Insofar as there will be virtually no modification of the drainage pattern on site or in the area, it can be concluded that the project will not cause substantial erosion or siltation, either on site or in the area. The project will improve conditions by paving or landscaping bare ground currently susceptible to erosion.

The required interior landscaping (Valley Center Planning Standards) is designed to retain and filter runoff where possible through the use of concave planter surfaces and vegetated swales. In combination with the detention basin, these measures will address the increased runoff parameters.

VI. Summary/Conclusion

There are no proposed public storm drain systems associated with this project. The outlet of the existing culvert, which also forms the entrance to the detention basin, will be provided with a riprap apron energy dissipator. The increased volume and flow rate resulting from the project will be mitigated by the use of the planned detention basin and vegetated swales (please see the Section 5.0 of the Stormwater Management Plan for Maintenance Mechanism details). Therefore project drainage will cause no impact on downstream drainage facilities. The pre-development and post-development discharge characteristics for the property discharge point are summarized in the following table.

Concentration Point	Pre/Post	Tc (min)	C	I (in/hr)	A (ac)	V(ft/s)	Q (ft ³ /s)
1	Pre	13.14	0.30	5.65	4.71	8.1	8.0
	Post	10.22	0.71	6.65	4.71	7.8	22.2
2	Pre	17.20	0.43	4.75	9.58	1.5	19.6
	Post	13.04	0.52	5.68	9.58	1.6	28.3
	Post with Detention Pond	-----	-----	-----	-----	1.4	18.7

Notes: Concentration point 1 = outlet of culvert/detention basin entrance.

Concentration point 2 = property discharge point at western property boundary.

Drainage Pattern Alteration Statement:

The proposed project does not substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site. The proposed detention basin will be used to mitigate the increase in storm water runoff.

Flooding Statement:

The proposed project does not substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site. The proposed detention basin will be used to mitigate the increase in storm water runoff and prevent any threat of flowing on or off site.

Existing Storm Drain Capacity Statement:

Since there is no existing storm drain facilities on or adjacent to the project site their will not be any effect on a non-existent storm drain system.

Housing in a 100-Year Flood Hazard Statement:

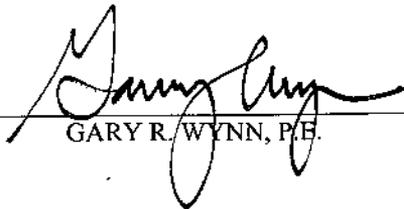
The project is for the creation of a parking lot and no housing is proposed. However, a flood map for the project site is provided in Attachment XVI.

VII. References

San Diego County Hydrology Manual
CASQA Stormwater BMP Handbook
San Diego County SUSMP Manual

VIII. ENGINEER'S CERTIFICATION

This Preliminary Drainage Study has been prepared under the direction of the following Registered Civil Engineer. The Registered Civil Engineer attests to the technical information contained herein and the engineering data upon which recommendations, conclusions, and decisions are based.


GARY R. WYNN, P.E.

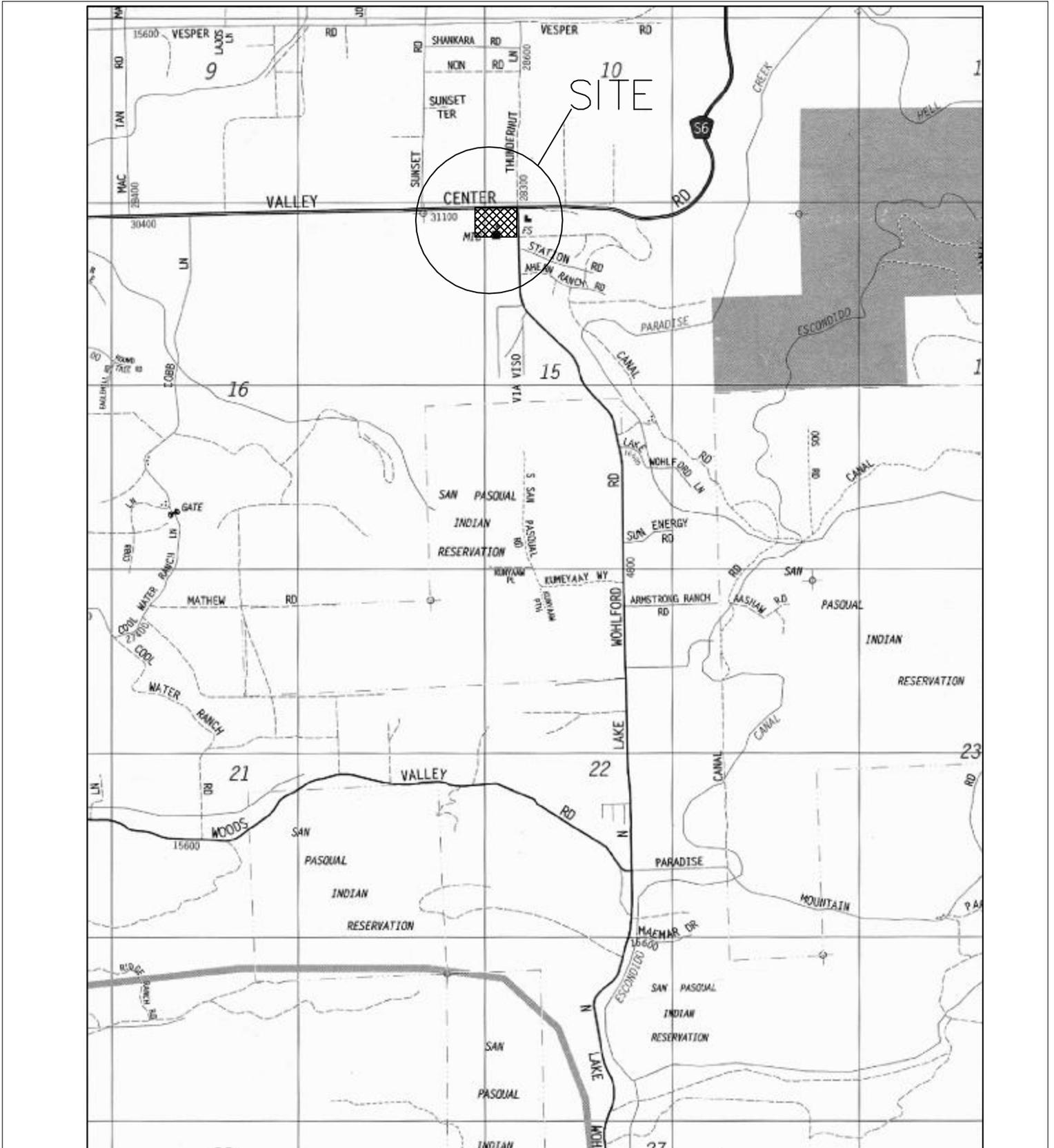
3-5-08

DATE



IX. VICINITY MAP

Please see the attached vicinity map.



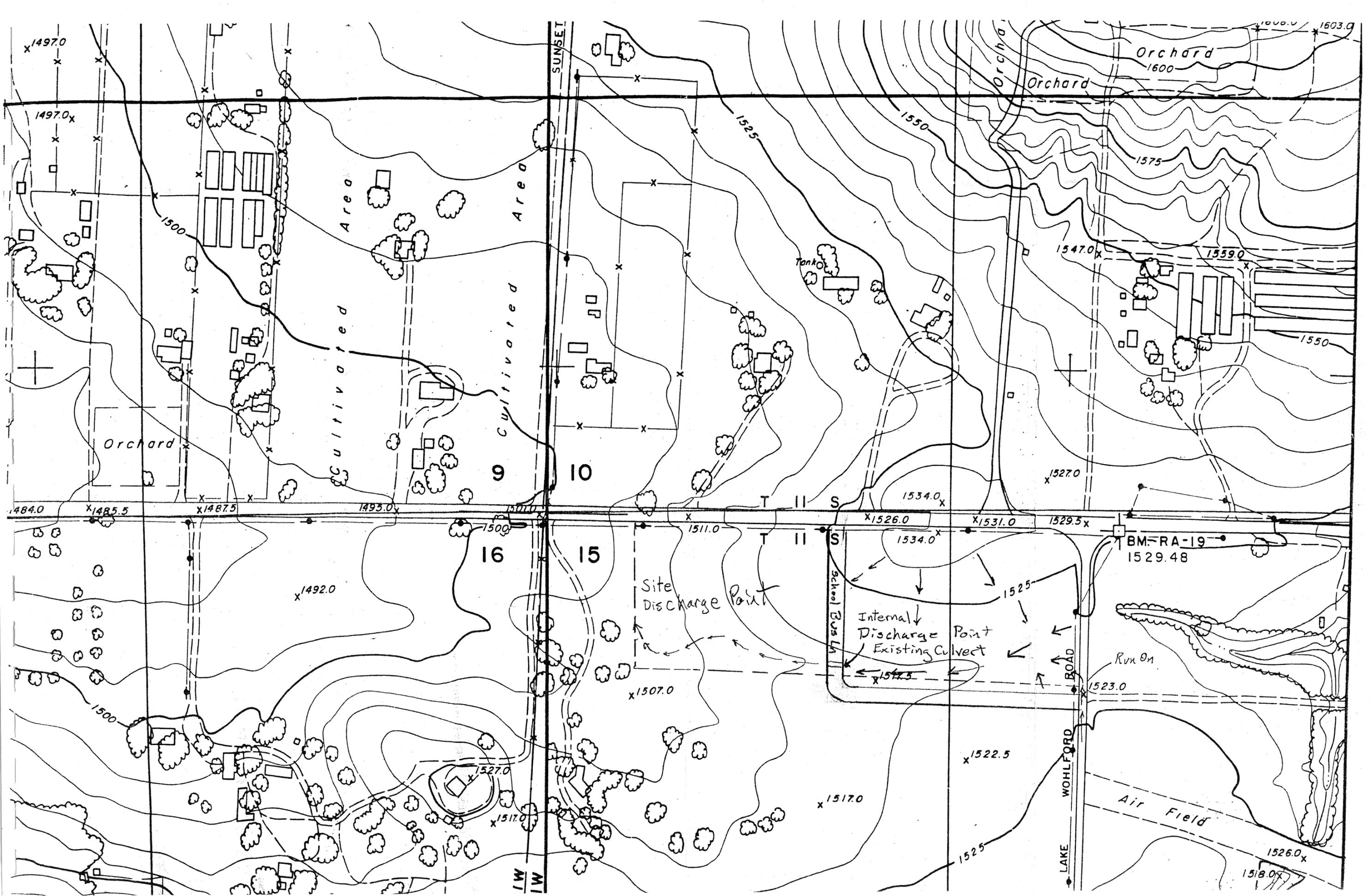
San Pasqual Casino Development Group
 Remote Parking Area Project
 Preliminary Drainage Study

VICINITY MAP

No Scale

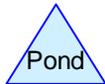
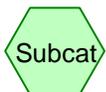
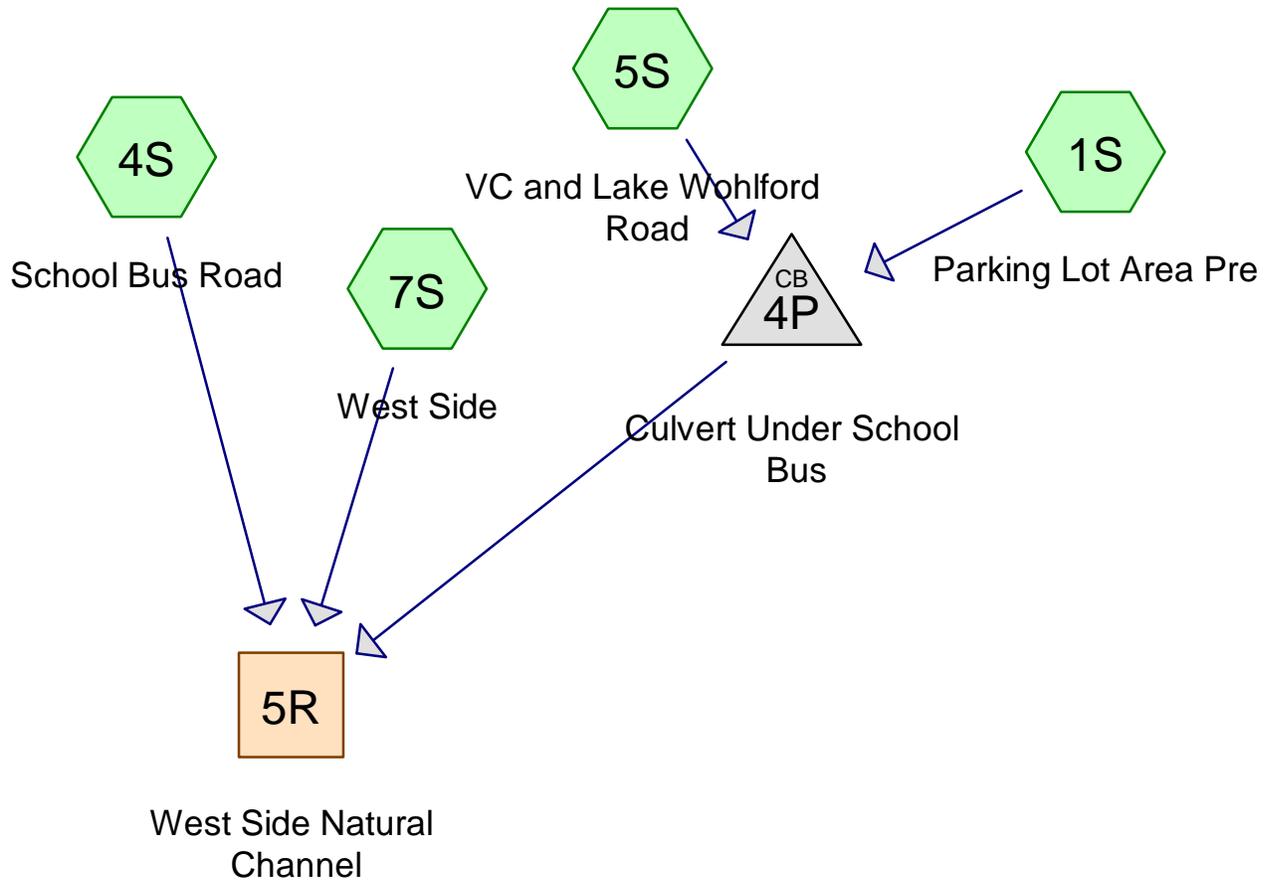
X. DRAINAGE/BASIN BOUNDARY/TOPOGRAPHIC MAP

Please see the attached maps.



XI. HYDROLOGY CALCULATIONS

Please see the attached hydrology calculations.



Pre Development 8-20-07

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Area Listing (all nodes)

<u>Area (acres)</u>	<u>CN</u>	<u>Description (subcats)</u>
4.710	72.00	Urban commercial, 85% imp, HSG C (1S)
4.870	74.00	(7S)
0.650	98.00	(4S)
0.586	98.00	Paved roads w/curbs & sewers (5S)
<hr/>		
10.816		

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Drainage Pattern for PRedevelopment 8-20-07

Type I 24-hr 6.00 hrs Rainfall=4.00"

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Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Parking Lot Area Pre

Runoff Area=4.710 ac Runoff Depth=1.49"
Tc=13.1 min CN=72.44 Runoff=7.98 cfs 0.585 af

Subcatchment 4S: School Bus Road

Runoff Area=0.650 ac Runoff Depth=3.77"
Tc=11.2 min CN=98.00 Runoff=3.43 cfs 0.204 af

Subcatchment 5S: VC and Lake Wohlford Road

Runoff Area=0.586 ac Runoff Depth=3.77"
Tc=15.0 min CN=98.00 Runoff=2.62 cfs 0.184 af

Subcatchment 7S: West Side

Runoff Area=4.870 ac Runoff Depth=1.61"
Tc=17.2 min CN=74.16 Runoff=7.82 cfs 0.652 af

Reach 5R: West Side Natural Channel

Avg. Depth=0.82' Max Vel=1.45 fps Inflow=20.86 cfs 1.625 af
n=0.070 L=263.0' S=0.0152 '/' Capacity=616.99 cfs Outflow=19.72 cfs 1.625 af

Pond 4P: Culvert Under School Bus

Peak Elev=1,517.92' Inflow=10.60 cfs 0.769 af
Outflow=10.60 cfs 0.769 af

Total Runoff Area = 10.816 ac Runoff Volume = 1.625 af Average Runoff Depth = 1.80"
51.56% Pervious Area = 5.577 ac 48.44% Impervious Area = 5.239 ac

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Subcatchment 1S: Parking Lot Area Pre

Runoff = 7.98 cfs @ 2.65 hrs, Volume= 0.585 af, Depth= 1.49"

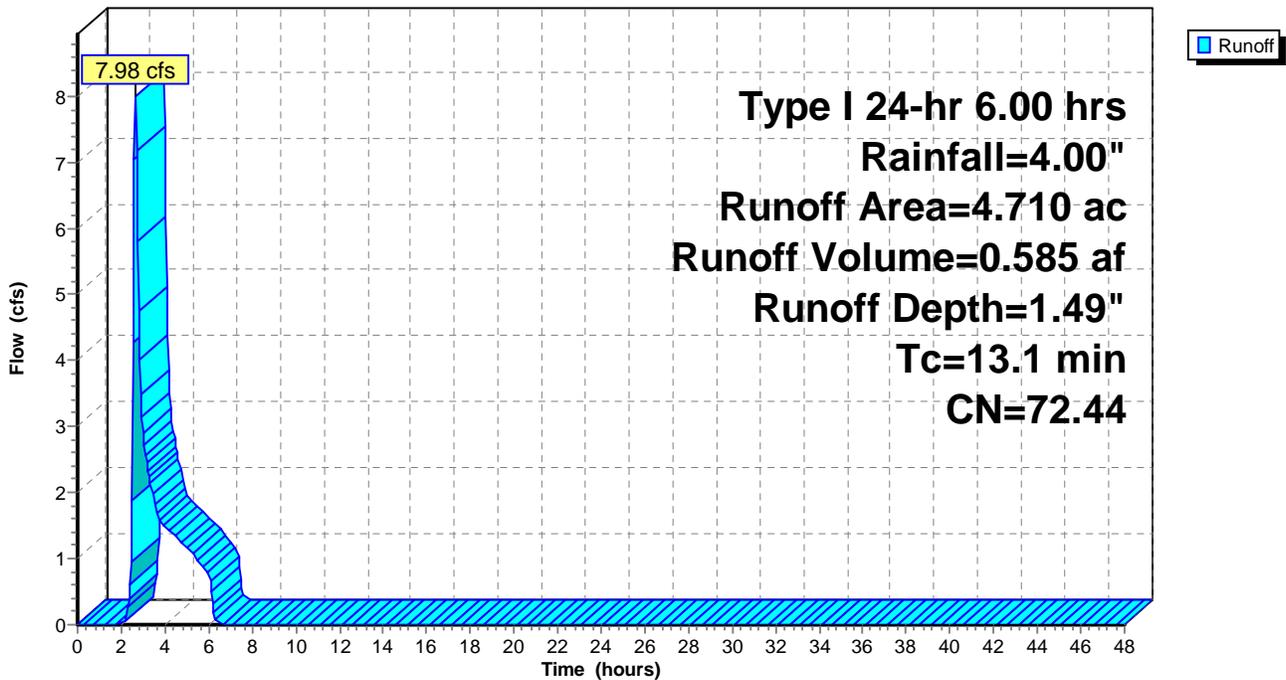
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type I 24-hr 6.00 hrs Rainfall=4.00"

Area (ac)	CN	Description
4.710	72.44	Urban commercial, 85% imp, HSG C
0.707		Pervious Area
4.004		Impervious Area

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

Subcatchment 1S: Parking Lot Area Pre

Hydrograph



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Subcatchment 4S: School Bus Road

Runoff = 3.43 cfs @ 2.61 hrs, Volume= 0.204 af, Depth= 3.77"

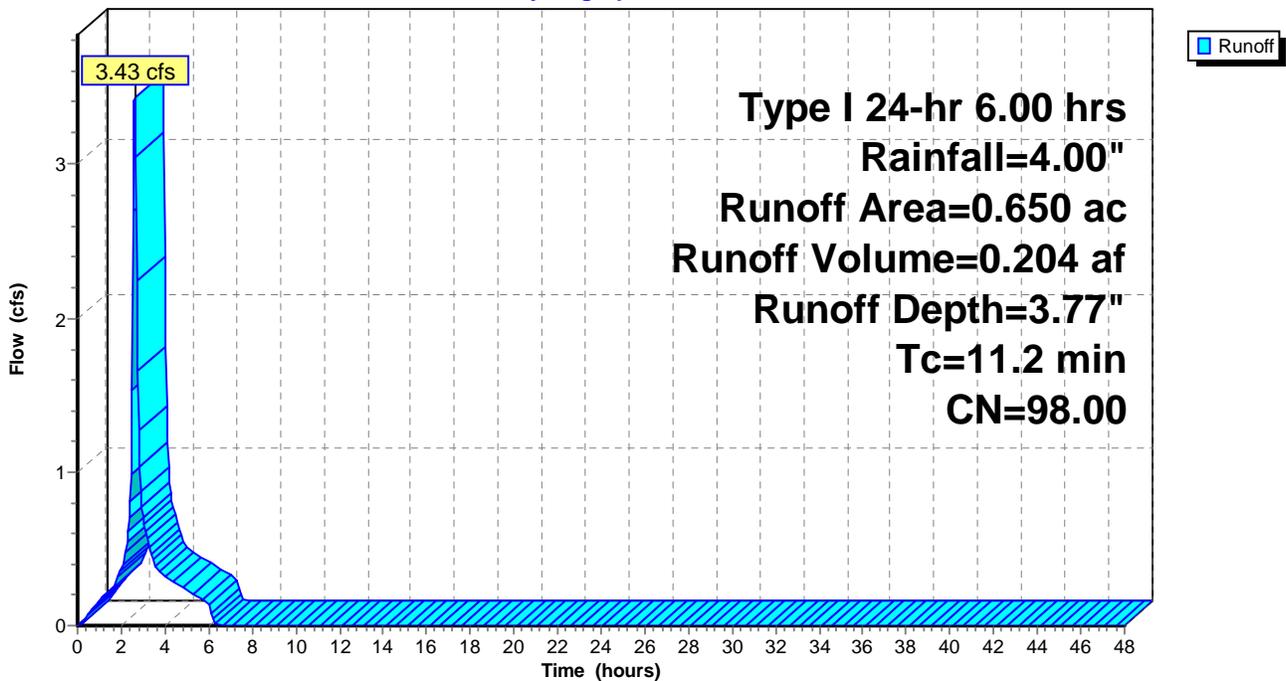
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type I 24-hr 6.00 hrs Rainfall=4.00"

Area (ac)	CN	Description
0.650	98.00	
0.650		Impervious Area

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

Subcatchment 4S: School Bus Road

Hydrograph



Pre Development 8-20-07

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Subcatchment 5S: VC and Lake Wohlford Road

Runoff = 2.62 cfs @ 2.66 hrs, Volume= 0.184 af, Depth= 3.77"

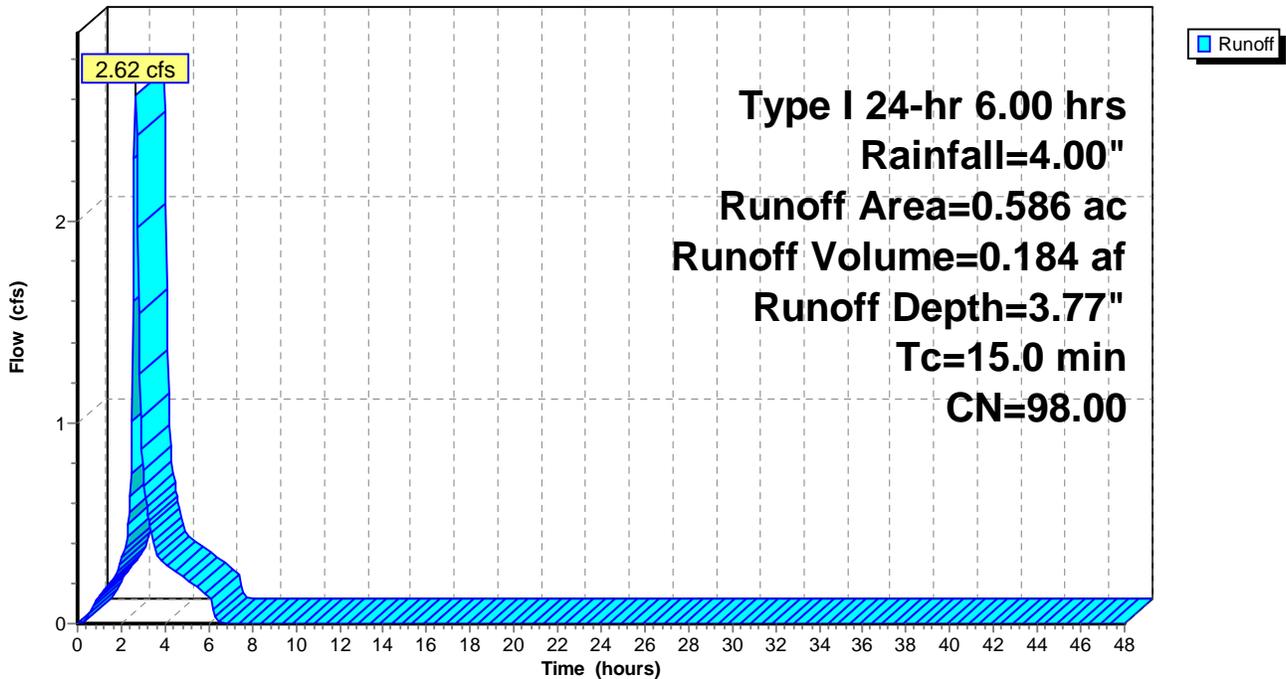
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type I 24-hr 6.00 hrs Rainfall=4.00"

Area (ac)	CN	Description
0.586	98.00	Paved roads w/curbs & sewers
0.586		Impervious Area

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

Subcatchment 5S: VC and Lake Wohlford Road

Hydrograph



Pre Development 8-20-07

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Subcatchment 7S: West Side

Runoff = 7.82 cfs @ 2.71 hrs, Volume= 0.652 af, Depth= 1.61"

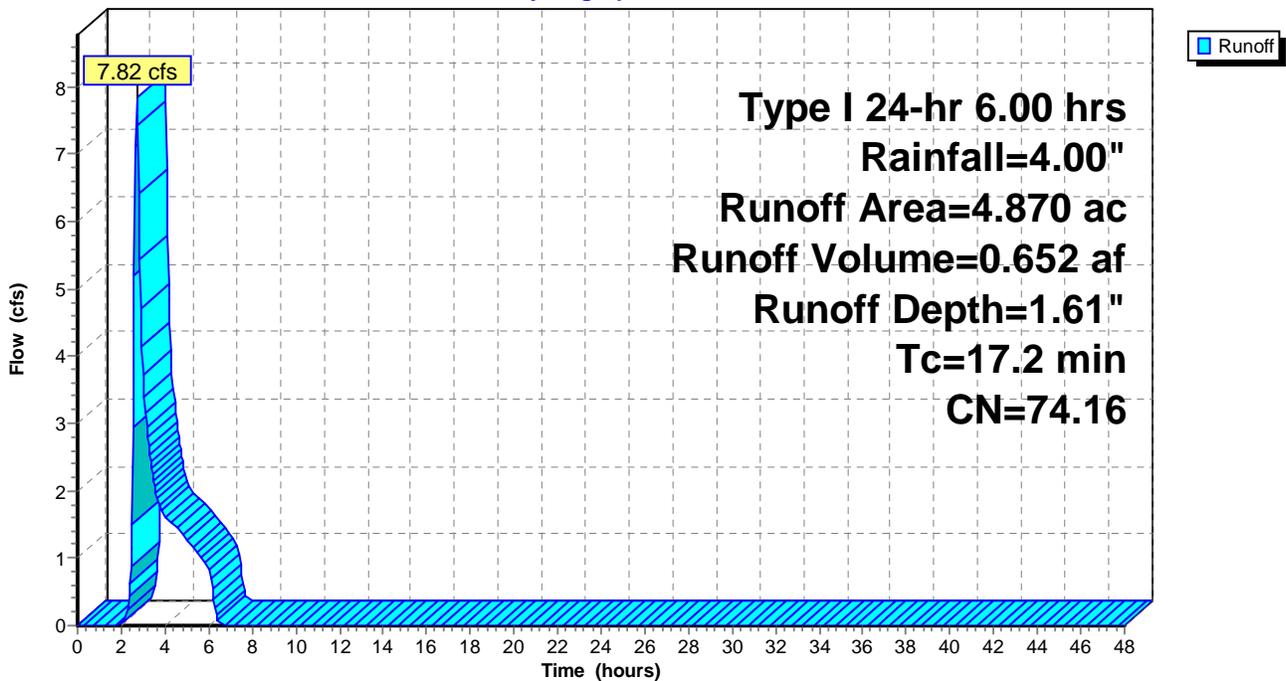
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type I 24-hr 6.00 hrs Rainfall=4.00"

Area (ac)	CN	Description
4.870	74.16	
4.870		Pervious Area

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

Subcatchment 7S: West Side

Hydrograph



Pre Development 8-20-07

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Reach 5R: West Side Natural Channel

Inflow Area = 10.816 ac, Inflow Depth = 1.80"
 Inflow = 20.86 cfs @ 2.66 hrs, Volume= 1.625 af
 Outflow = 19.72 cfs @ 2.71 hrs, Volume= 1.625 af, Atten= 5%, Lag= 2.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Max. Velocity= 1.45 fps, Min. Travel Time= 3.0 min

Avg. Velocity = 0.59 fps, Avg. Travel Time= 7.4 min

Peak Storage= 3,578 cf @ 2.71 hrs, Average Depth at Peak Storage= 0.82'

Defined Flood Depth= 3.00', Capacity at Flood Depth= 616.99 cfs

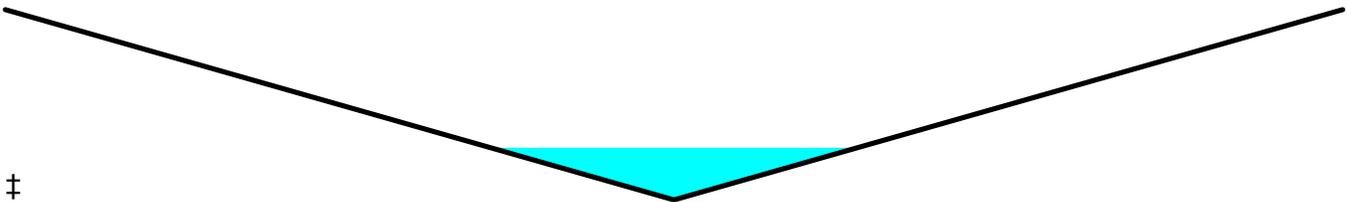
Bank-Full Depth= 3.00', Capacity at Bank-Full= 616.99 cfs

0.00' x 3.00' deep channel, n= 0.070 Sluggish weedy reaches w/pools

Side Slope Z-value= 20.0 ' / ' Top Width= 120.00'

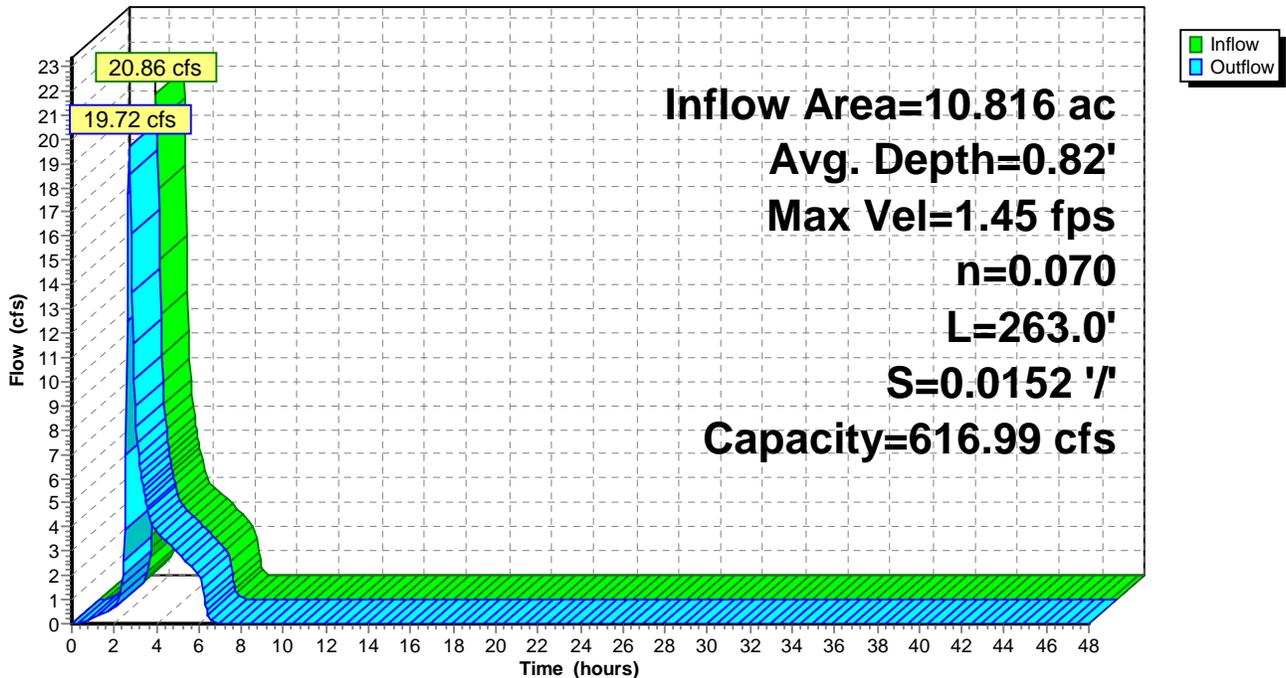
Length= 263.0' Slope= 0.0152 ' / '

Inlet Invert= 1,510.00', Outlet Invert= 1,506.00'



Reach 5R: West Side Natural Channel

Hydrograph



Pre Development 8-20-07

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Pond 4P: Culvert Under School Bus

Culvert/Concrete Swale crossing School Bus Road

Riprap Apron Energy Dissipator Per SDCo D-40

Type 2

Riprap: No. 2 Backing 10' x 4.5' x 1.5' deep

Filter Blanket: D.G. 1' Thick

Inflow Area = 5.296 ac, Inflow Depth = 1.74"
 Inflow = 10.60 cfs @ 2.65 hrs, Volume= 0.769 af
 Outflow = 10.60 cfs @ 2.65 hrs, Volume= 0.769 af, Atten= 0%, Lag= 0.0 min
 Primary = 10.60 cfs @ 2.65 hrs, Volume= 0.769 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Peak Elev= 1,517.92' @ 2.65 hrs

Flood Elev= 1,518.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,517.03'	18.00" x 39.5' long Culvert CMP, square edge headwall, Ke= 0.500 Outlet Invert= 1,515.06' S= 0.0499 '/' Cc= 0.900 n= 0.025 Corrugated metal
#2	Primary	1,517.00'	3.0' long x 3.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=10.54 cfs @ 2.65 hrs HW=1,517.92' TW=1,510.79' (Dynamic Tailwater)

↑ **1=Culvert** (Inlet Controls 3.51 cfs @ 3.21 fps)

└ **2=Broad-Crested Rectangular Weir** (Weir Controls 7.03 cfs @ 2.55 fps)

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Drainage Pattern for PRedevelopment 8-20-07

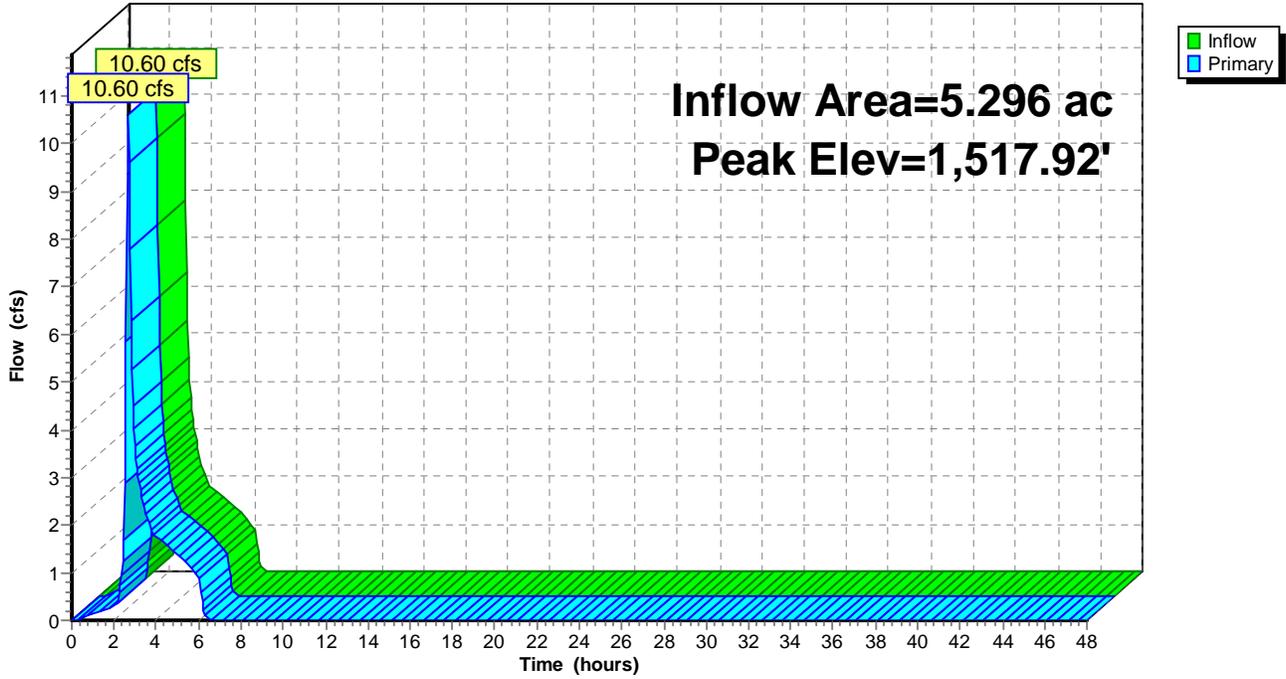
Type I 24-hr 6.00 hrs Rainfall=4.00"

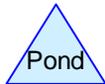
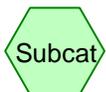
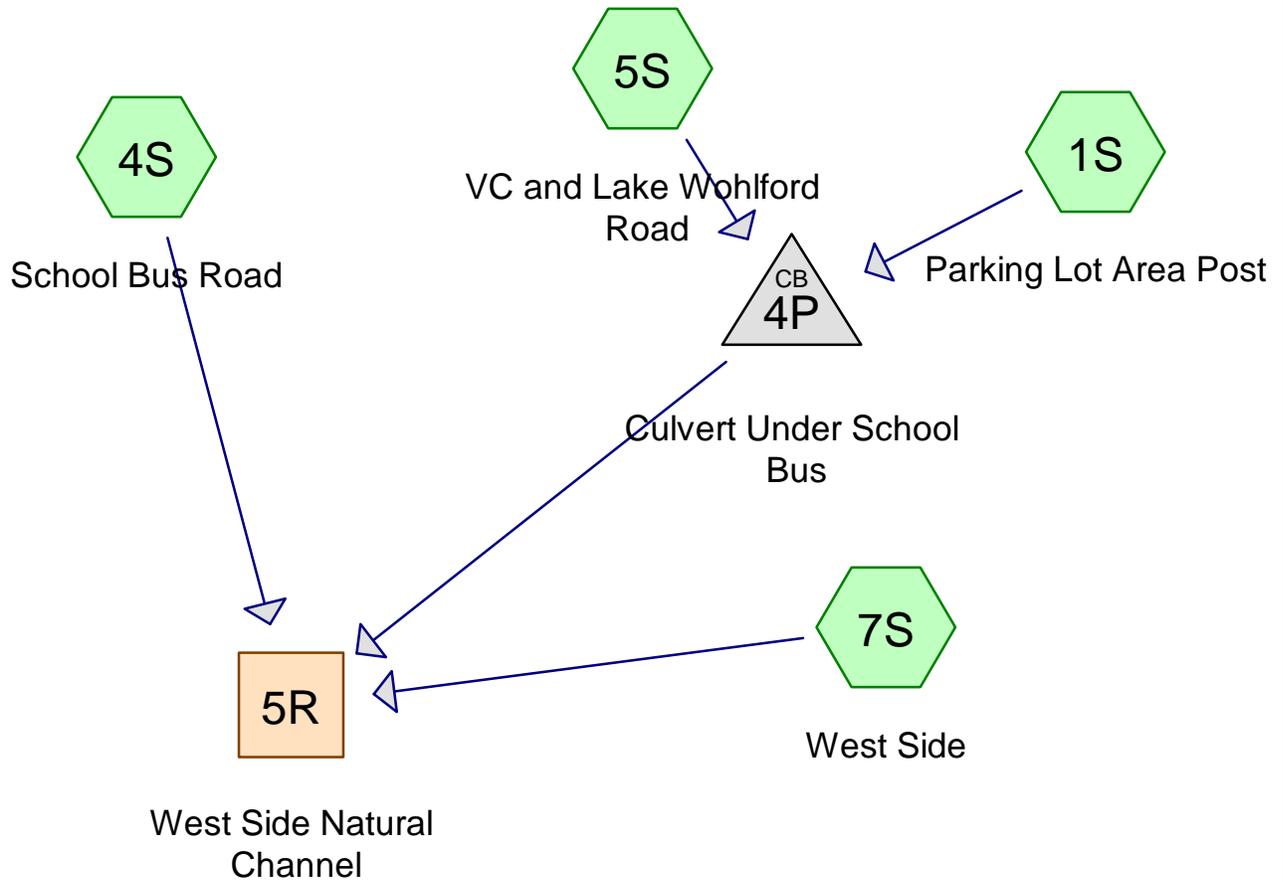
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Pond 4P: Culvert Under School Bus

Hydrograph





Drainage Diagram for Post Dev No Det Pond 8-20-07
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Post Dev No Det Pond 8-20-07

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Area Listing (all nodes)

<u>Area (acres)</u>	<u>CN</u>	<u>Description (subcats)</u>
1.300	60.00	Landscaping (1S)
4.870	69.00	(7S)
3.410	93.00	Urban commercial, 85% imp, HSG C (1S)
0.650	98.00	(4S)
0.586	98.00	Paved roads w/curbs & sewers (5S)
<hr/>		
10.816		

Post Dev No Det Pond 8-20-07

Type I 24-hr 6.00 hrs Rainfall=4.00"

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Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Parking Lot Area Post

Runoff Area=4.710 ac Runoff Depth=2.36"
Tc=8.3 min CN=83.89 Runoff=18.14 cfs 0.927 af

Subcatchment 4S: School Bus Road

Runoff Area=0.650 ac Runoff Depth=3.77"
Tc=11.2 min CN=98.00 Runoff=3.43 cfs 0.204 af

Subcatchment 5S: VC and Lake Wohlford Road

Runoff Area=0.586 ac Runoff Depth=3.77"
Tc=15.0 min CN=98.00 Runoff=2.62 cfs 0.184 af

Subcatchment 7S: West Side

Runoff Area=4.870 ac Runoff Depth=1.29"
Tc=14.2 min CN=69.43 Runoff=6.41 cfs 0.525 af

Reach 5R: West Side Natural Channel

Avg. Depth=0.92' Max Vel=1.55 fps Inflow=28.32 cfs 1.840 af
n=0.070 L=263.0' S=0.0152 '/' Capacity=616.99 cfs Outflow=26.02 cfs 1.840 af

Pond 4P: Culvert Under School Bus

Peak Elev=1,518.06' Inflow=20.20 cfs 1.111 af
Outflow=20.20 cfs 1.111 af

Total Runoff Area = 10.816 ac Runoff Volume = 1.840 af Average Runoff Depth = 2.04"
61.77% Pervious Area = 6.682 ac 38.23% Impervious Area = 4.135 ac

Post Dev No Det Pond 8-20-07

Type I 24-hr 6.00 hrs Rainfall=4.00"

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Subcatchment 1S: Parking Lot Area Post

Runoff = 18.14 cfs @ 2.58 hrs, Volume= 0.927 af, Depth= 2.36"

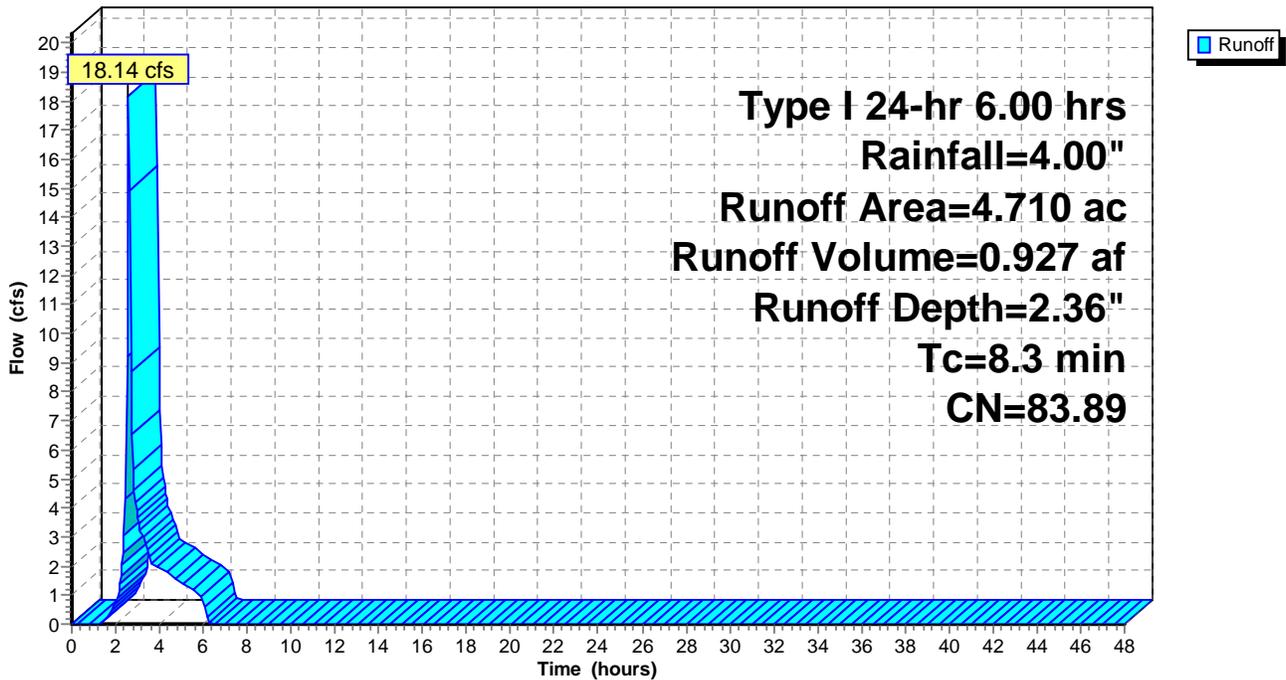
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type I 24-hr 6.00 hrs Rainfall=4.00"

Area (ac)	CN	Description
3.410	93.00	Urban commercial, 85% imp, HSG C
1.300	60.00	Landscaping
4.710	83.89	Weighted Average
1.812		Pervious Area
2.899		Impervious Area

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

Subcatchment 1S: Parking Lot Area Post

Hydrograph



Post Dev No Det Pond 8-20-07

Type I 24-hr 6.00 hrs Rainfall=4.00"

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Subcatchment 4S: School Bus Road

Runoff = 3.43 cfs @ 2.61 hrs, Volume= 0.204 af, Depth= 3.77"

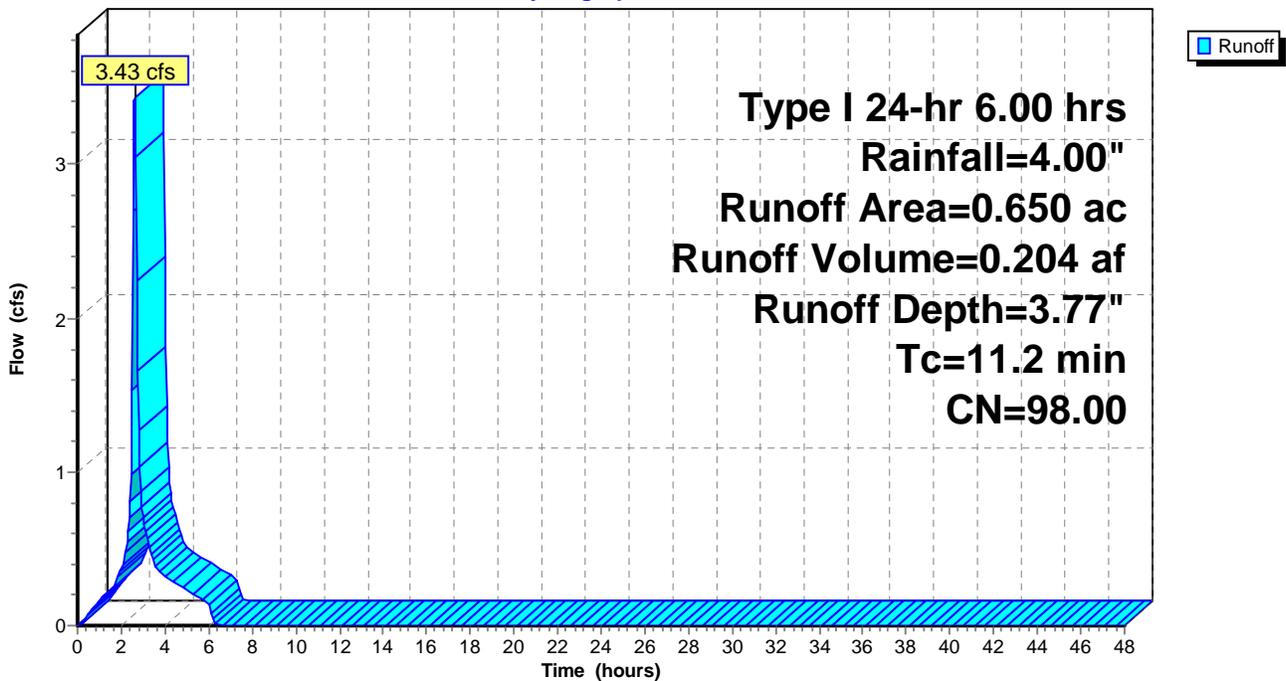
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type I 24-hr 6.00 hrs Rainfall=4.00"

Area (ac)	CN	Description
0.650	98.00	
0.650		Impervious Area

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

Subcatchment 4S: School Bus Road

Hydrograph



Post Dev No Det Pond 8-20-07

Type I 24-hr 6.00 hrs Rainfall=4.00"

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Subcatchment 5S: VC and Lake Wohlford Road

Runoff = 2.62 cfs @ 2.66 hrs, Volume= 0.184 af, Depth= 3.77"

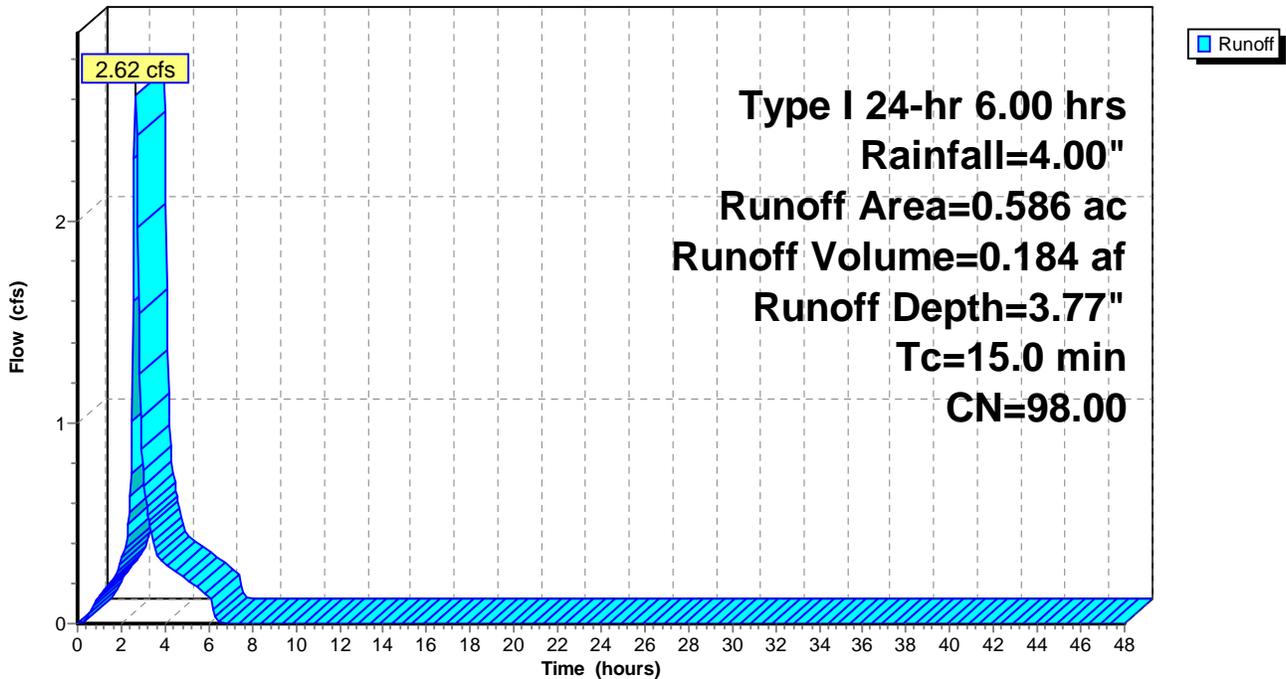
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type I 24-hr 6.00 hrs Rainfall=4.00"

Area (ac)	CN	Description
0.586	98.00	Paved roads w/curbs & sewers
0.586		Impervious Area

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

Subcatchment 5S: VC and Lake Wohlford Road

Hydrograph



Post Dev No Det Pond 8-20-07

Type I 24-hr 6.00 hrs Rainfall=4.00"

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Subcatchment 7S: West Side

Runoff = 6.41 cfs @ 2.67 hrs, Volume= 0.525 af, Depth= 1.29"

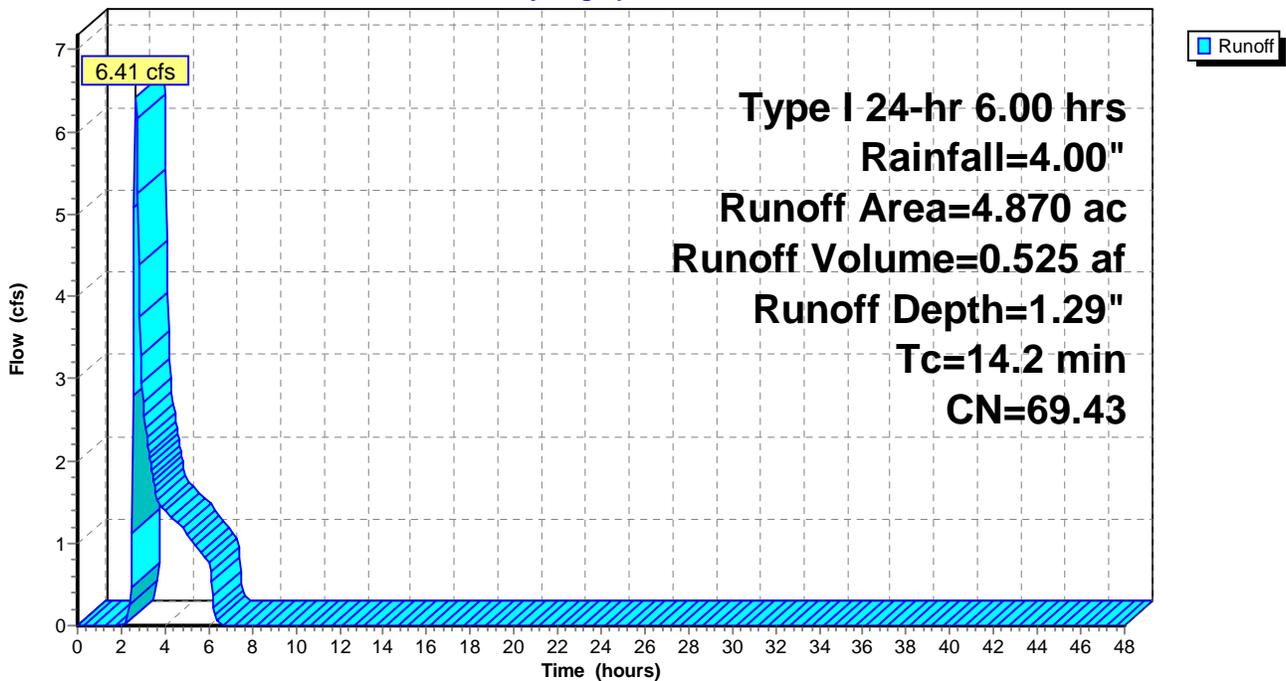
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type I 24-hr 6.00 hrs Rainfall=4.00"

Area (ac)	CN	Description
4.870	69.43	
4.870		Pervious Area

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

Subcatchment 7S: West Side

Hydrograph



Post Dev No Det Pond 8-20-07

Type I 24-hr 6.00 hrs Rainfall=4.00"

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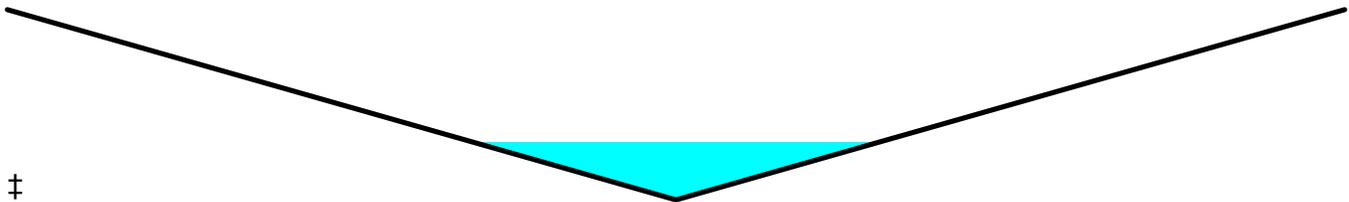
Reach 5R: West Side Natural Channel

Inflow Area = 10.816 ac, Inflow Depth = 2.04"
 Inflow = 28.32 cfs @ 2.60 hrs, Volume= 1.840 af
 Outflow = 26.02 cfs @ 2.64 hrs, Volume= 1.840 af, Atten= 8%, Lag= 2.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Max. Velocity= 1.55 fps, Min. Travel Time= 2.8 min
 Avg. Velocity = 0.61 fps, Avg. Travel Time= 7.2 min

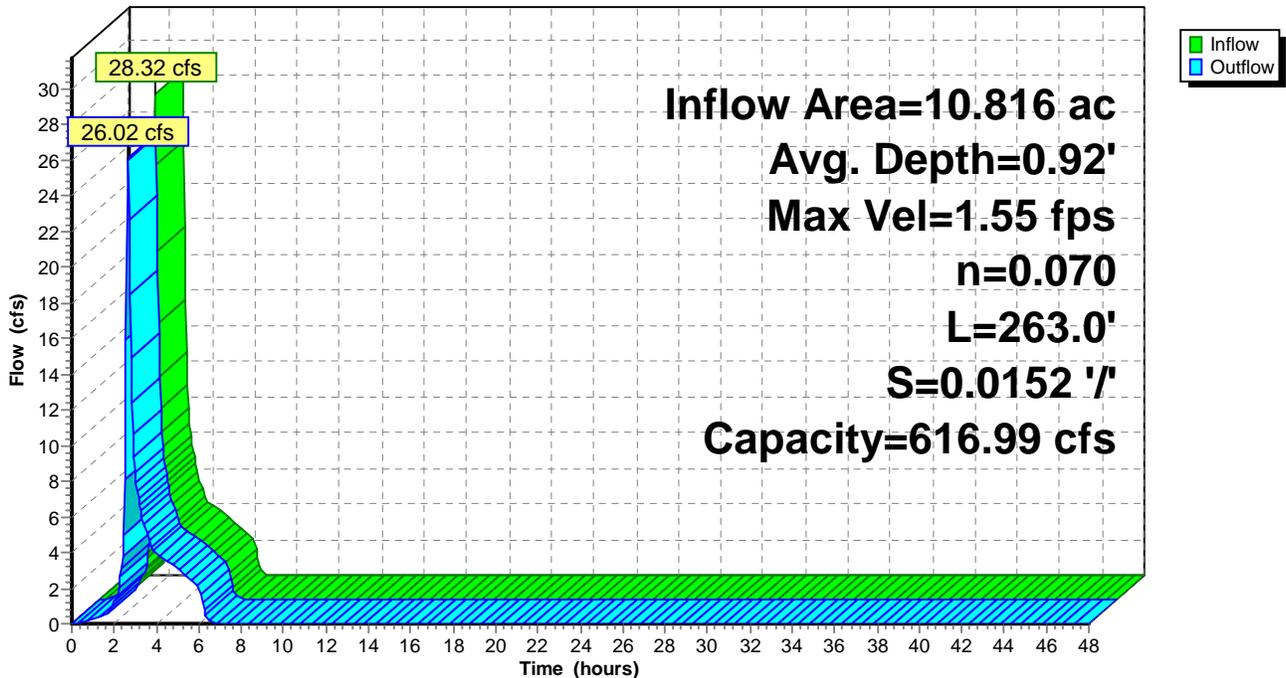
Peak Storage= 4,406 cf @ 2.64 hrs, Average Depth at Peak Storage= 0.92'
 Defined Flood Depth= 3.00', Capacity at Flood Depth= 616.99 cfs
 Bank-Full Depth= 3.00', Capacity at Bank-Full= 616.99 cfs

0.00' x 3.00' deep channel, n= 0.070 Sluggish weedy reaches w/pools
 Side Slope Z-value= 20.0 ' Top Width= 120.00'
 Length= 263.0' Slope= 0.0152 ' / '
 Inlet Invert= 1,510.00', Outlet Invert= 1,506.00'



Reach 5R: West Side Natural Channel

Hydrograph



Post Dev No Det Pond 8-20-07

Type I 24-hr 6.00 hrs Rainfall=4.00"

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Pond 4P: Culvert Under School Bus

Culvert/Concrete Swale crossing School Bus Road

Riprap Apron Energy Dissipator Per SDCo D-40

Type 2

Riprap: No. 2 Backing 10' x 4.5' x 1.5' deep

Filter Blanket: D.G. 1' Thick

Inflow Area = 5.296 ac, Inflow Depth = 2.52"
 Inflow = 20.20 cfs @ 2.58 hrs, Volume= 1.111 af
 Outflow = 20.20 cfs @ 2.58 hrs, Volume= 1.111 af, Atten= 0%, Lag= 0.0 min
 Primary = 20.20 cfs @ 2.58 hrs, Volume= 1.111 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Peak Elev= 1,518.06' @ 2.58 hrs

Flood Elev= 1,518.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,516.03'	18.00" x 39.5' long Culvert Ke= 0.200 Outlet Invert= 1,514.06' S= 0.0499 '/' Cc= 0.900 n= 0.025 Corrugated metal
#2	Primary	1,517.00'	3.0' long x 3.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=19.72 cfs @ 2.58 hrs HW=1,518.01' TW=1,510.84' (Dynamic Tailwater)

1=Culvert (Barrel Controls 11.61 cfs @ 6.58 fps)

2=Broad-Crested Rectangular Weir (Weir Controls 8.11 cfs @ 2.67 fps)

Post Dev No Det Pond 8-20-07

Type I 24-hr 6.00 hrs Rainfall=4.00"

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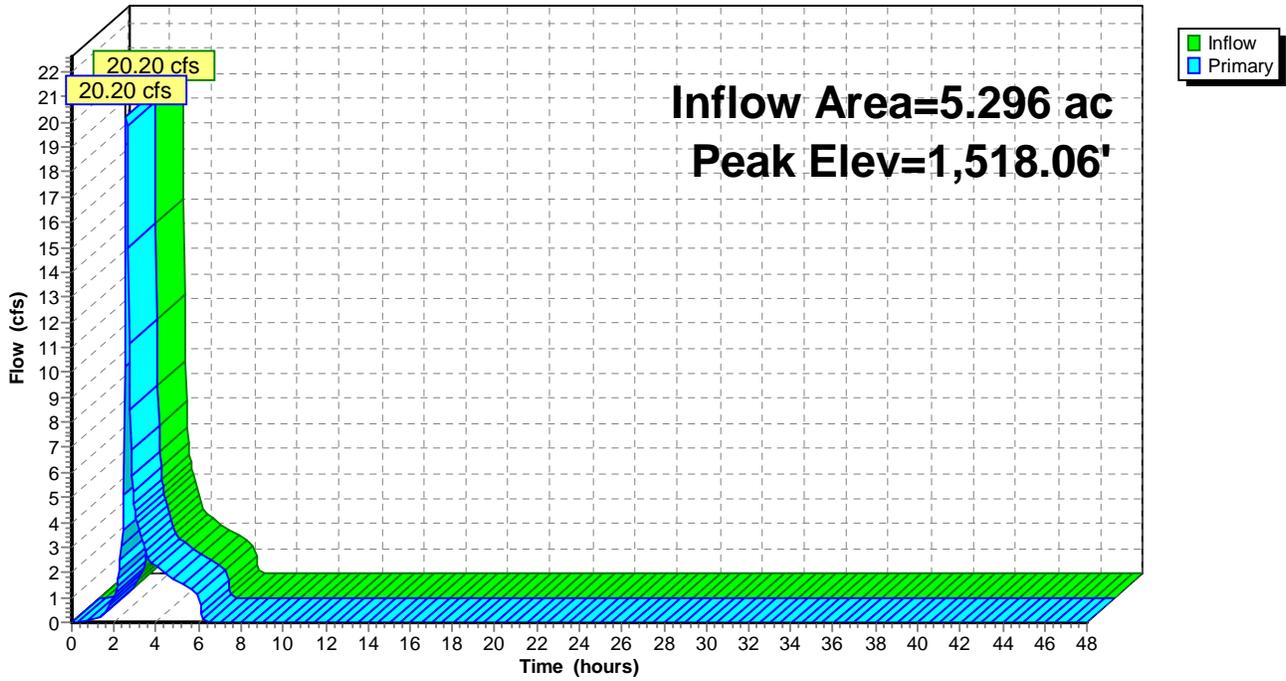
Page 10

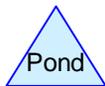
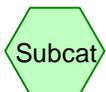
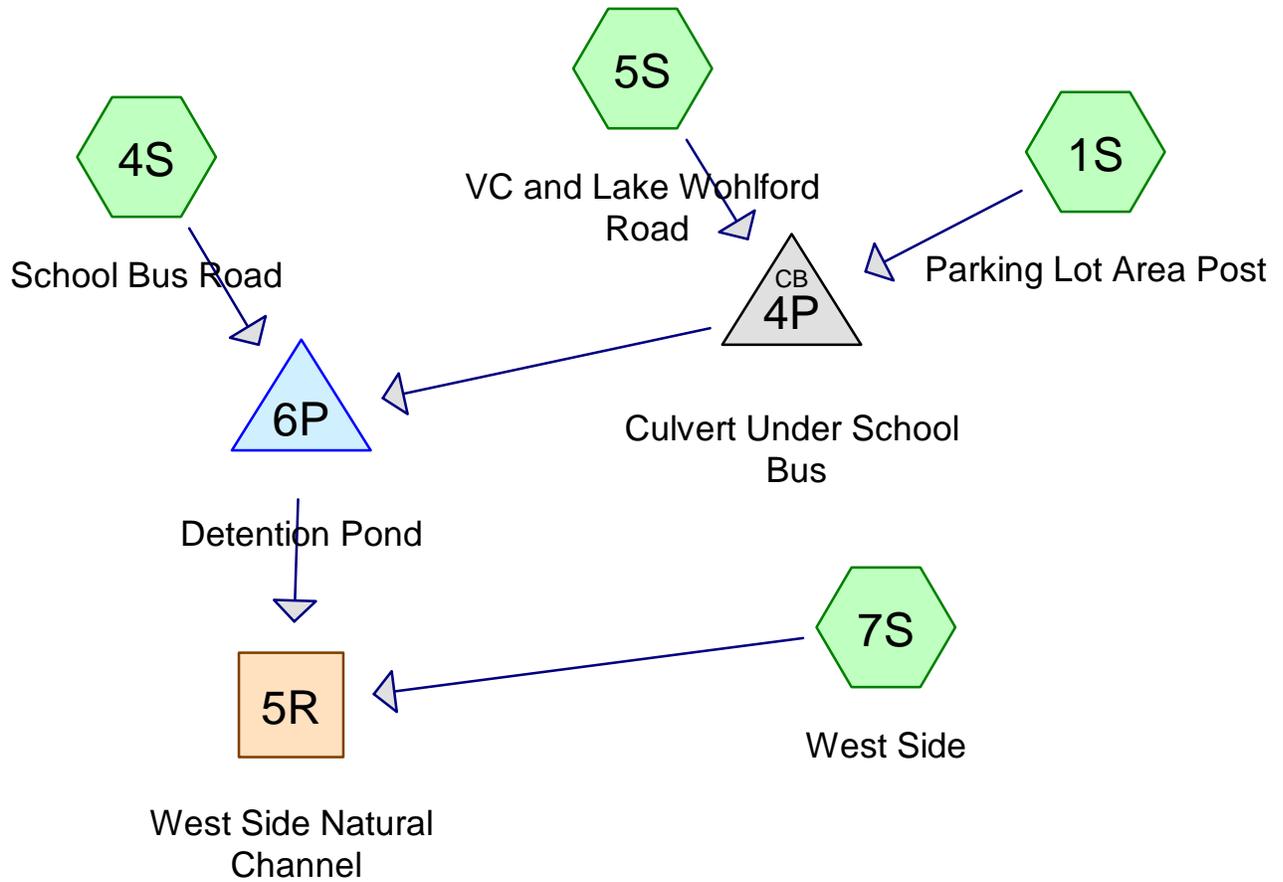
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Pond 4P: Culvert Under School Bus

Hydrograph





Post Dev With Pond 8-20-07

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Area Listing (all nodes)

<u>Area (acres)</u>	<u>CN</u>	<u>Description (subcats)</u>
4.870	74.00	(7S)
1.300	74.00	Landscaping (1S)
3.410	94.00	Urban commercial, 85% imp, HSG C (1S)
0.650	98.00	(4S)
0.586	98.00	Paved roads w/curbs & sewers (5S)
<hr/>		
10.816		

Post Dev With Pond 8-20-07

Type I 24-hr 6.00 hrs Rainfall=4.00"

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Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Parking Lot Area Post

Runoff Area=4.710 ac Runoff Depth=2.76"
Tc=8.3 min CN=88.38 Runoff=22.14 cfs 1.085 af

Subcatchment 4S: School Bus Road

Runoff Area=0.650 ac Runoff Depth=3.77"
Tc=11.2 min CN=98.00 Runoff=3.43 cfs 0.204 af

Subcatchment 5S: VC and Lake Wohlford Road

Runoff Area=0.586 ac Runoff Depth=3.77"
Tc=15.0 min CN=98.00 Runoff=2.62 cfs 0.184 af

Subcatchment 7S: West Side

Runoff Area=4.870 ac Runoff Depth=1.61"
Tc=14.2 min CN=74.16 Runoff=8.79 cfs 0.652 af

Reach 5R: West Side Natural Channel

Avg. Depth=0.81' Max Vel=1.43 fps Inflow=19.41 cfs 2.125 af
n=0.070 L=263.0' S=0.0152 '/' Capacity=616.99 cfs Outflow=18.67 cfs 2.125 af

Pond 4P: Culvert Under School Bus

Peak Elev=1,518.31' Inflow=23.67 cfs 1.269 af
Outflow=23.67 cfs 1.269 af

Pond 6P: Detention Pond

Peak Elev=1,513.32' Storage=14,140 cf Inflow=26.94 cfs 1.473 af
Outflow=11.54 cfs 1.473 af

Total Runoff Area = 10.816 ac Runoff Volume = 2.125 af Average Runoff Depth = 2.36"
61.77% Pervious Area = 6.682 ac 38.23% Impervious Area = 4.135 ac

Post Dev With Pond 8-20-07

Type I 24-hr 6.00 hrs Rainfall=4.00"

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Subcatchment 1S: Parking Lot Area Post

Runoff = 22.14 cfs @ 2.57 hrs, Volume= 1.085 af, Depth= 2.76"

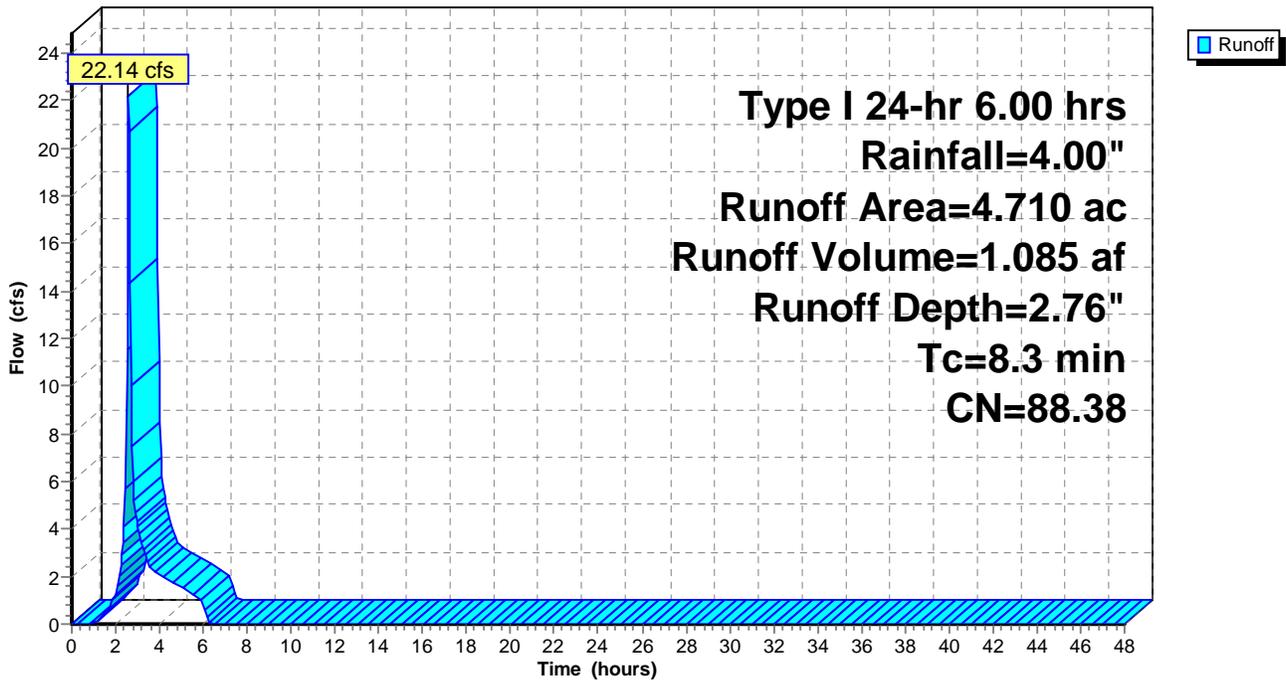
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type I 24-hr 6.00 hrs Rainfall=4.00"

Area (ac)	CN	Description
3.410	94.00	Urban commercial, 85% imp, HSG C
1.300	73.65	Landscaping
4.710	88.38	Weighted Average
1.812		Pervious Area
2.899		Impervious Area

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

Subcatchment 1S: Parking Lot Area Post

Hydrograph



Post Dev With Pond 8-20-07

Type I 24-hr 6.00 hrs Rainfall=4.00"

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Subcatchment 4S: School Bus Road

Runoff = 3.43 cfs @ 2.61 hrs, Volume= 0.204 af, Depth= 3.77"

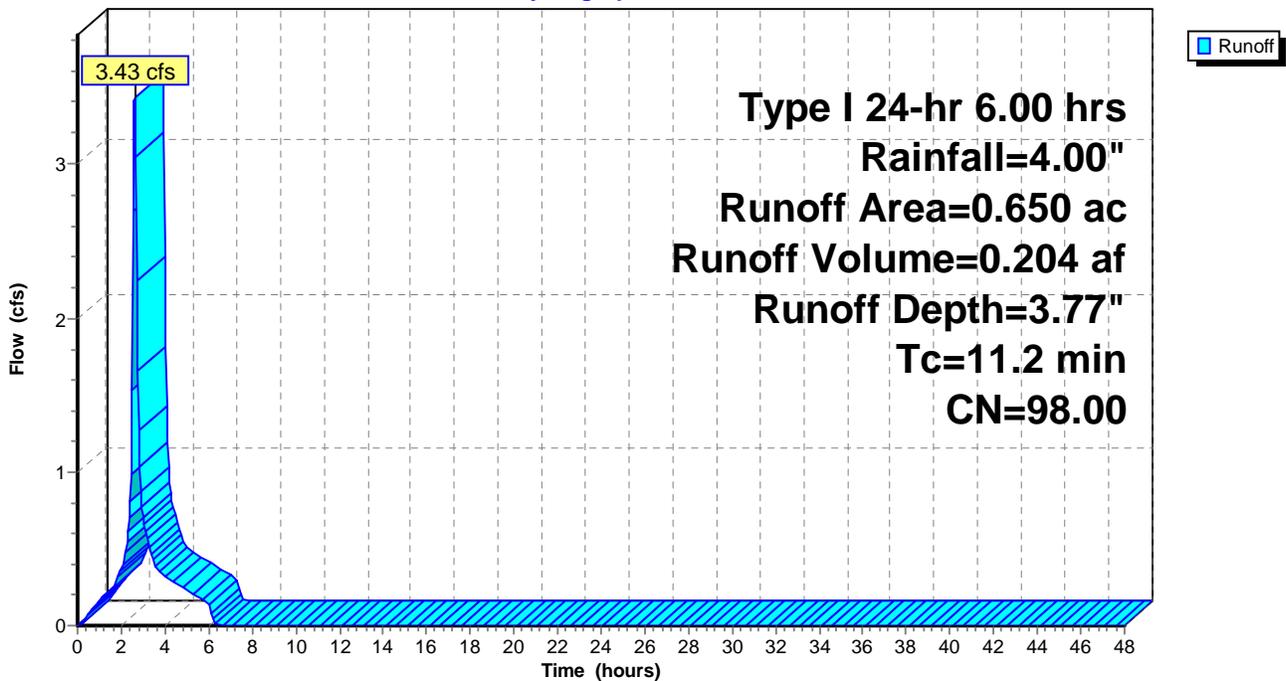
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type I 24-hr 6.00 hrs Rainfall=4.00"

Area (ac)	CN	Description
0.650	98.00	
0.650		Impervious Area

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

Subcatchment 4S: School Bus Road

Hydrograph



Post Dev With Pond 8-20-07

Type I 24-hr 6.00 hrs Rainfall=4.00"

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Subcatchment 5S: VC and Lake Wohlford Road

Runoff = 2.62 cfs @ 2.66 hrs, Volume= 0.184 af, Depth= 3.77"

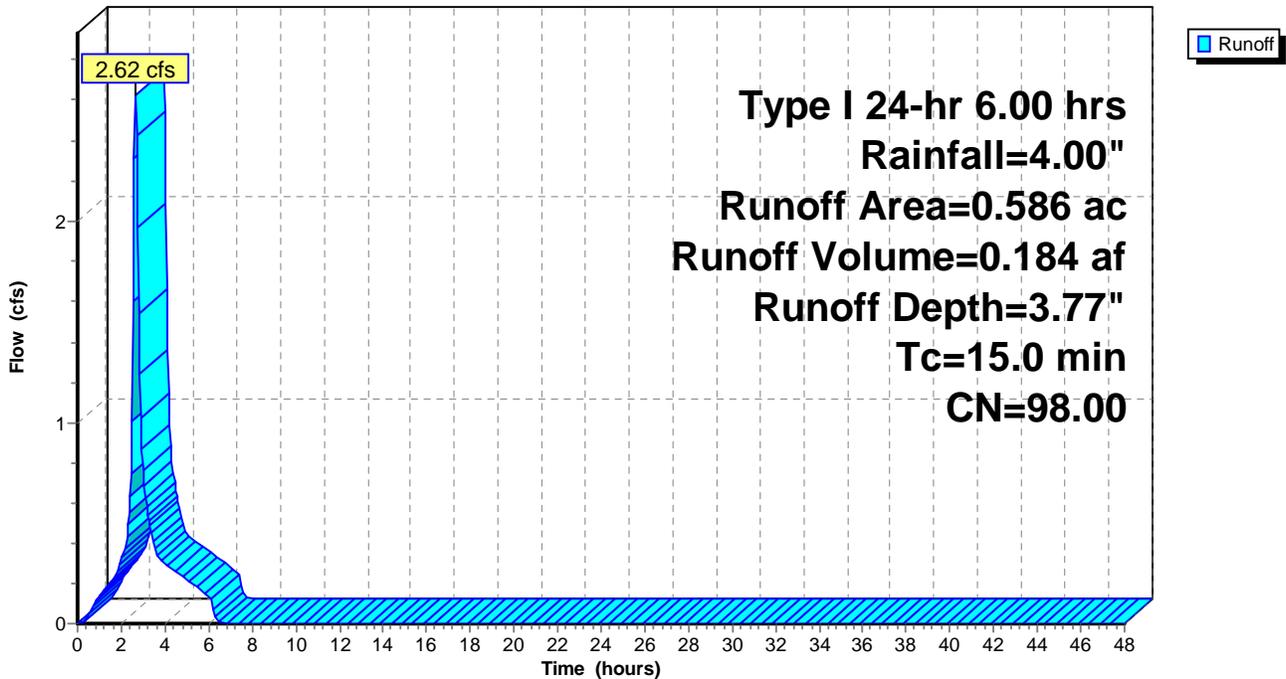
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type I 24-hr 6.00 hrs Rainfall=4.00"

Area (ac)	CN	Description
0.586	98.00	Paved roads w/curbs & sewers
0.586		Impervious Area

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

Subcatchment 5S: VC and Lake Wohlford Road

Hydrograph



Post Dev With Pond 8-20-07

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Subcatchment 7S: West Side

Runoff = 8.79 cfs @ 2.66 hrs, Volume= 0.652 af, Depth= 1.61"

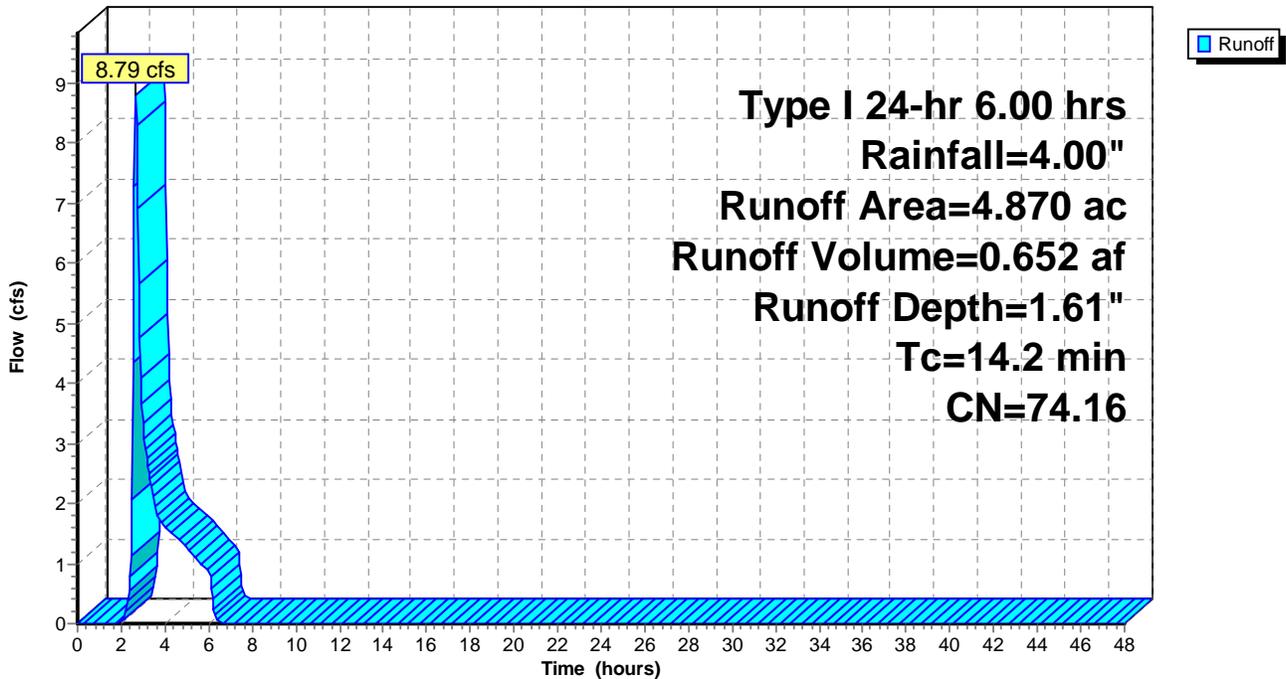
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type I 24-hr 6.00 hrs Rainfall=4.00"

Area (ac)	CN	Description
4.870	74.16	
4.870		Pervious Area

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

Subcatchment 7S: West Side

Hydrograph



Post Dev With Pond 8-20-07

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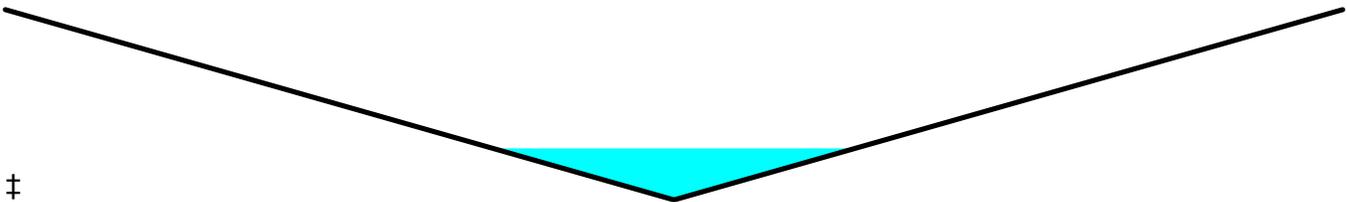
Reach 5R: West Side Natural Channel

Inflow Area = 10.816 ac, Inflow Depth = 2.36"
 Inflow = 19.41 cfs @ 2.71 hrs, Volume= 2.125 af
 Outflow = 18.67 cfs @ 2.75 hrs, Volume= 2.125 af, Atten= 4%, Lag= 2.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Max. Velocity= 1.43 fps, Min. Travel Time= 3.1 min
 Avg. Velocity = 0.58 fps, Avg. Travel Time= 7.5 min

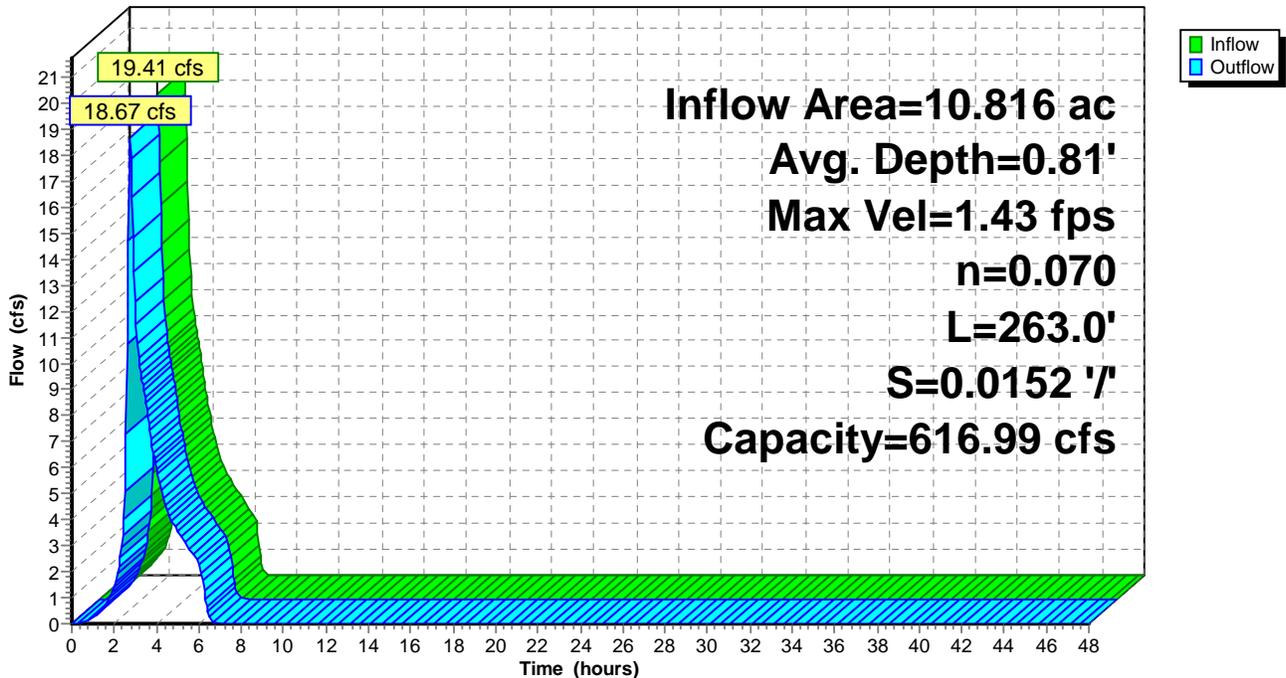
Peak Storage= 3,434 cf @ 2.75 hrs, Average Depth at Peak Storage= 0.81'
 Defined Flood Depth= 3.00', Capacity at Flood Depth= 616.99 cfs
 Bank-Full Depth= 3.00', Capacity at Bank-Full= 616.99 cfs

0.00' x 3.00' deep channel, n= 0.070 Sluggish weedy reaches w/pools
 Side Slope Z-value= 20.0 ' Top Width= 120.00'
 Length= 263.0' Slope= 0.0152 ' / '
 Inlet Invert= 1,510.00', Outlet Invert= 1,506.00'



Reach 5R: West Side Natural Channel

Hydrograph



Post Dev With Pond 8-20-07

Type I 24-hr 6.00 hrs Rainfall=4.00"

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Pond 4P: Culvert Under School Bus

Culvert/Concrete Swale crossing School Bus Road

Riprap Apron Energy Dissipator Per SDCo D-40

Type 2

Riprap: No. 2 Backing 10' x 4.5' x 1.5' deep

Filter Blanket: D.G. 1' Thick

Inflow Area = 5.296 ac, Inflow Depth = 2.88"
 Inflow = 23.67 cfs @ 2.58 hrs, Volume= 1.269 af
 Outflow = 23.67 cfs @ 2.58 hrs, Volume= 1.269 af, Atten= 0%, Lag= 0.0 min
 Primary = 23.67 cfs @ 2.58 hrs, Volume= 1.269 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Peak Elev= 1,518.31' @ 2.58 hrs

Flood Elev= 1,518.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,516.03'	18.00" x 39.5' long Culvert Ke= 0.200 Outlet Invert= 1,514.06' S= 0.0499 '/' Cc= 0.900 n= 0.025 Corrugated metal
#2	Primary	1,517.00'	3.0' long x 3.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=22.88 cfs @ 2.58 hrs HW=1,518.25' TW=1,512.74' (Dynamic Tailwater)

1=Culvert (Barrel Controls 11.82 cfs @ 6.69 fps)

2=Broad-Crested Rectangular Weir (Weir Controls 11.06 cfs @ 2.95 fps)

Post Dev With Pond 8-20-07

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Drainage Diagram for Post Dev With Pond 8-20-07

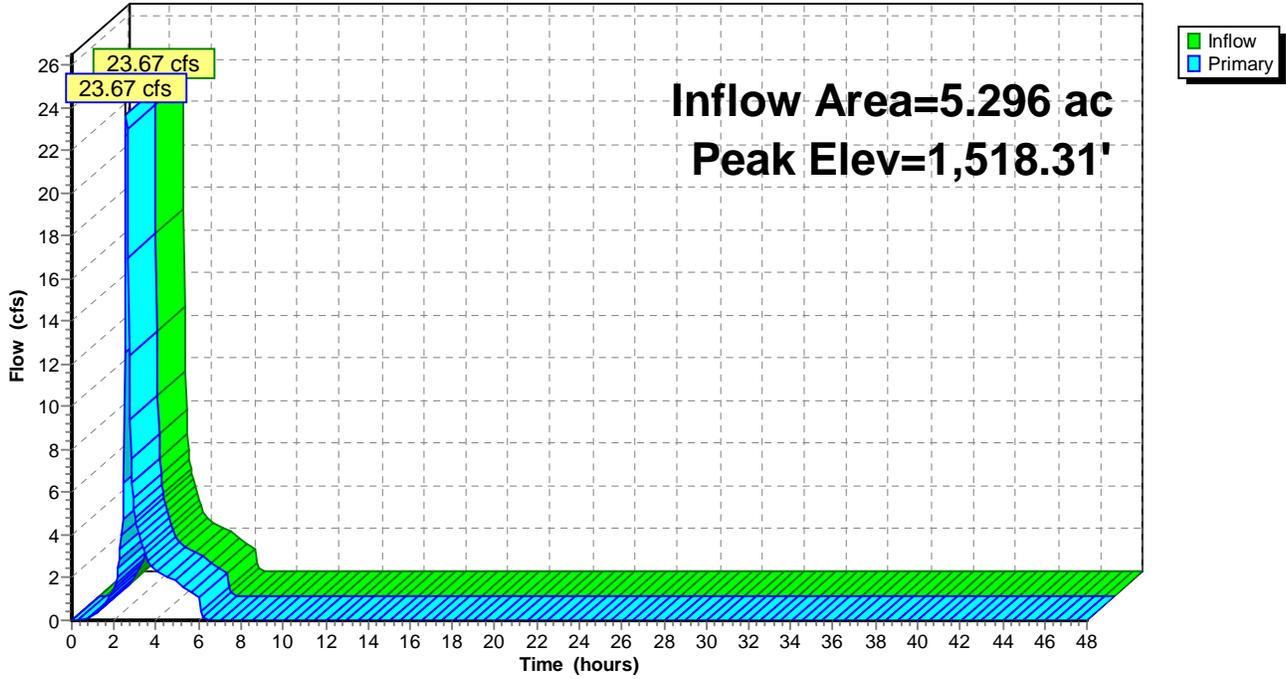
Type I 24-hr 6.00 hrs Rainfall=4.00"

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Pond 4P: Culvert Under School Bus

Hydrograph



Post Dev With Pond 8-20-07

Type I 24-hr 6.00 hrs Rainfall=4.00"

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Pond 6P: Detention Pond

Inflow Area = 5.946 ac, Inflow Depth = 2.97"
 Inflow = 26.94 cfs @ 2.58 hrs, Volume= 1.473 af
 Outflow = 11.54 cfs @ 2.75 hrs, Volume= 1.473 af, Atten= 57%, Lag= 10.1 min
 Primary = 11.54 cfs @ 2.75 hrs, Volume= 1.473 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Peak Elev= 1,513.32' @ 2.75 hrs Surf.Area= 11,713 sf Storage= 14,140 cf

Plug-Flow detention time= 15.5 min calculated for 1.471 af (100% of inflow)
 Center-of-Mass det. time= 15.5 min (210.4 - 194.9)

Volume	Invert	Avail.Storage	Storage Description			
#1	1,510.00'	23,297 cf	Custom Stage Data (Irregular) Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
1,510.00	33	21.1	0	0	33	
1,511.00	1,069	132.0	430	430	1,386	
1,512.00	4,985	361.0	2,787	3,217	10,374	
1,513.00	10,091	450.0	7,390	10,607	16,132	
1,514.00	15,481	543.0	12,690	23,297	23,498	

Device	Routing	Invert	Outlet Devices	
#1	Primary	1,510.00'	18.00" x 30.0' long Culvert RCP, rounded edge headwall, Ke= 0.100 Outlet Invert= 1,509.47' S= 0.0177 '/' Cc= 0.900 n= 0.010	
#2	Device 1	1,510.25'	1.25" Vert. Orifice/Grate X 10.00 columns X 13 rows with 2.00" cc spacing C= 0.600	
#3	Device 1	1,513.00'	24.00" Horiz. Orifice/Grate Limited to weir flow C= 0.600	
#4	Device 1	1,510.00'	3.00" Vert. Orifice/Grate C= 0.600	

Primary OutFlow Max=11.53 cfs @ 2.75 hrs HW=1,513.32' TW=1,510.81' (Dynamic Tailwater)

- ↑ **1=Culvert** (Passes 11.53 cfs of 18.23 cfs potential flow)
- ↑ **2=Orifice/Grate** (Orifice Controls 7.36 cfs @ 6.65 fps)
- ↑ **3=Orifice/Grate** (Weir Controls 3.79 cfs @ 1.86 fps)
- ↑ **4=Orifice/Grate** (Orifice Controls 0.37 cfs @ 7.64 fps)

Post Dev With Pond 8-20-07

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Drainage Diagram for Post Dev With Pond 8-20-07

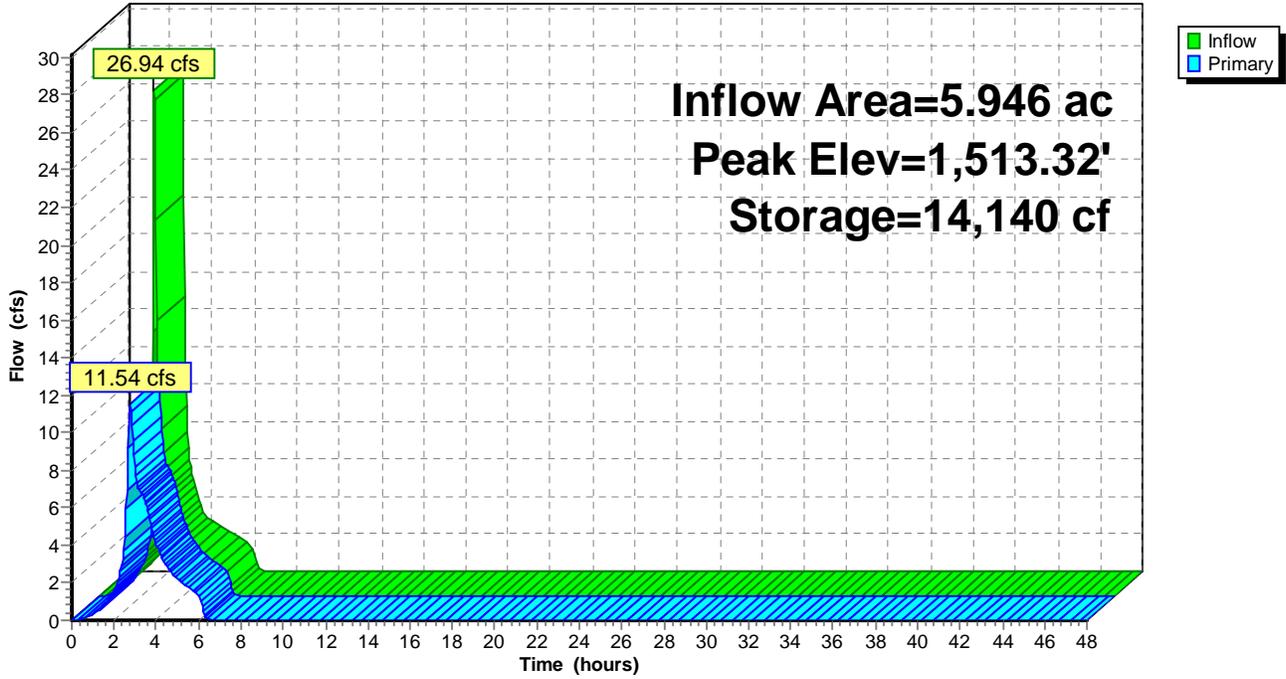
Type I 24-hr 6.00 hrs Rainfall=4.00"

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Pond 6P: Detention Pond

Hydrograph



XII. RUNOFF COEFFICIENTS FOR URBAN AREAS

Please see the attached Table 3-1 from the County of San Diego Hydrology Manual (current edition).

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
NRCSS Elements	County Elements	% IMPER.	Soil Type			
			A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	30 40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).

DU/A = dwelling units per acre

NRCSS = National Resources Conservation Service

Post Development

$$C = 0.9(\% \text{ impervious}) + C_p (1 - \% \text{ impervious})$$

$$= 0.9(0.68) + 0.3(1 - 0.68)$$

$$= 0.71$$

XIII. SOILS MAP AND INDEX PAGES

Please see the attached references.

TABLE 11.--INTERPRETATIONS FOR LAND MANAGEMENT--Continued

Map symbol	Soil	Hydrologic group	Erodibility	Limitations for conversion from brush to grass
DcD	Diablo-Urban land complex, 5 to 15 percent slopes: Diablo----- Urban land-----	D D		
DcF	Diablo-Urban land complex, 15 to 50 percent slopes: Diablo----- Urban land-----	D D		
DoE	Diablo-Olivenhain complex, 9 to 30 percent slopes: Diablo----- Olivenhain-----	D D	Moderate 1--- Moderate 1---	Slight. Severe.
EdC	Elder shaly fine sandy loam, 2 to 9 percent slopes-----	B	Moderate 2---	Slight.
EsC	Escondido very fine sandy loam, 5 to 9 percent slopes.	C	Severe 16----	Slight.
EsD2	Escondido very fine sandy loam, 9 to 15 percent slopes, eroded.	C	Severe 16----	Slight.
EsE2	Escondido very fine sandy loam, 15 to 30 percent slopes, eroded.	C	Severe 16----	Slight.
EvC	Escondido very fine sandy loam, deep, 5 to 9 percent slopes.	C	Severe 16----	Slight.
ExE	Exchequer rocky silt loam, 9 to 30 percent slopes-----	D	Severe 9-----	Severe.
ExG	Exchequer rocky silt loam, 30 to 70 percent slopes-----	D	Severe 1-----	Severe.
FaB	Fallbrook sandy loam, 2 to 5 percent slopes-----	C	Severe 16----	Slight.
FaC	Fallbrook sandy loam, 5 to 9 percent slopes-----	C	Severe 16----	Slight.
FaC2	Fallbrook sandy loam, 5 to 9 percent slopes, eroded-----	C	Severe 16----	Slight.
FaD2	Fallbrook sandy loam, 9 to 15 percent slopes, eroded---	C	Severe 16----	Slight.
FaE2	Fallbrook sandy loam, 15 to 30 percent slopes, eroded---	C	Severe 16----	Slight.
FaE3	Fallbrook sandy loam, 9 to 30 percent slopes, severely eroded.	C	Severe 16----	Severe.
FeC	Fallbrook rocky sandy loam, 5 to 9 percent slopes-----	C	Severe 16----	Slight.
FeE	Fallbrook rocky sandy loam, 9 to 30 percent slopes-----	C	Severe 16----	Moderate.
FeE2	Fallbrook rocky sandy loam, 9 to 30 percent slopes, eroded.	C	Severe 16----	Moderate.
FvD	Fallbrook-Vista sandy loams, 9 to 15 percent slopes: Fallbrook----- Vista-----	C B	Severe 16---- Severe 16----	Slight. Moderate.
FvE	Fallbrook-Vista sandy loams, 15 to 30 percent slopes: Fallbrook----- Vista-----	C B	Severe 16---- Severe 16----	Slight. Moderate.
FwF	Friant fine sandy loam, 30 to 50 percent slopes-----	D	Severe 9-----	Severe.
FxE	Friant rocky fine sandy loam, 9 to 30 percent slopes.	D	Severe 9-----	Severe.
FxG	Friant rocky fine sandy loam, 30 to 70 percent slopes.	D	Severe 1-----	Severe.
GaE	Gaviota fine sandy loam, 9 to 30 percent slopes-----	D	Severe 9-----	Severe.
GaF	Gaviota fine sandy loam, 30 to 50 percent slopes-----	D	Severe 1-----	Severe.
GoA	Grangeville fine sandy loam, 0 to 2 percent slopes-----	B	Severe 16----	Slight.
GrA	Greenfield sandy loam, 0 to 2 percent slopes-----	B	Severe 16----	Slight.
GrB	Greenfield sandy loam, 2 to 5 percent slopes-----	B	Severe 16----	Slight.
GrC	Greenfield sandy loam, 5 to 9 percent slopes-----	B	Severe 16----	Slight.
GrD	Greenfield sandy loam, 9 to 15 percent slopes-----	B	Severe 16----	Slight.
HaG	Hambright gravelly clay loam, 30 to 75 percent slopes.	D	Severe 1-----	Moderate.
HmD	Holland fine sandy loam, 5 to 15 percent slopes-----	C	Severe 16----	Slight.
HmE	Holland fine sandy loam, 15 to 30 percent slopes-----	C	Severe 16----	Slight.
HnE	Holland stony fine sandy loam, 5 to 30 percent slopes.	C	Severe 16----	Moderate.

See footnotes at end of table.

TABLE 11.--INTERPRETATIONS FOR LAND MANAGEMENT--Continued

Map symbol	Soil	Hydro-logic group	Erodibility	Limitations for conversion from brush to grass
→ VaB	Visalia sandy loam, 2 to 5 percent slopes-----	B	Severe 16----	Slight.
VaC	Visalia sandy loam, 5 to 9 percent slopes-----	B	Severe 16----	Slight.
VaD	Visalia sandy loam, 9 to 15 percent slopes-----	B	Severe 16----	Slight.
VbB	Visalia gravelly sandy loam, 2 to 5 percent slopes-----	B	Severe 16----	Slight.
VbC	Visalia gravelly sandy loam, 5 to 9 percent slopes-----	B	Severe 16----	Slight.
VsC	Vista coarse sandy loam, 5 to 9 percent slopes-----	B	Moderate 2---	Slight.
VsD	Vista coarse sandy loam, 9 to 15 percent slopes-----	B	Moderate 2---	Slight.
VSD2	Vista coarse sandy loam, 9 to 15 percent slopes, eroded.	B	Moderate 2---	Slight.
VsE	Vista coarse sandy loam, 15 to 30 percent slopes-----	B	Moderate 2---	Slight.
VsE2	Vista coarse sandy loam, 15 to 30 percent slopes, eroded.	B	Moderate 2---	Slight.
VsG	Vista coarse sandy loam, 30 to 65 percent slopes-----	B	Severe 1-----	Moderate.
VvD	Vista rocky coarse sandy loam, 5 to 15 percent slopes.	B	Moderate 2----	Moderate. <u>3/</u>
VvE	Vista rocky coarse sandy loam, 15 to 30 percent slopes.	B	Moderate 2----	Moderate. <u>3/</u>
VvG	Vista rocky coarse sandy loam, 30 to 65 percent slopes.	B	Severe 1-----	Moderate. <u>3/</u>
WmB	Wyman loam, 2 to 5 percent slopes-----	C	Moderate 2----	Slight.
WmC	Wyman loam, 5 to 9 percent slopes-----	C	Moderate 2----	Slight.
WmD	Wyman loam, 9 to 15 percent slopes-----	C	Moderate 2----	Slight.

1/ Typically a grassland soil; conversion from brush usually not necessary.

2/ Moderate if slope is more than 30 percent, slight if less than 30 percent.

3/ Stoniness or rockiness not a serious impediment to use of grass-planting equipment.

4/ On desert-facing mountain slopes and in valleys, in the eastern part of land resource area 20, the degree of limitation is severe because of climate, regardless of soil properties.

XIV. TIME OF CONCENTRATION TABLE AND NOMOGRAPH

Please see the attached Table 3-2 and Figure 3-4 from the County of San Diego Hydrology Manual (current edition).

Note that the Initial Time of Concentration should be reflective of the general land-use at the upstream end of a drainage basin. A single lot with an area of two or less acres does not have a significant effect where the drainage basin area is 20 to 600 acres.

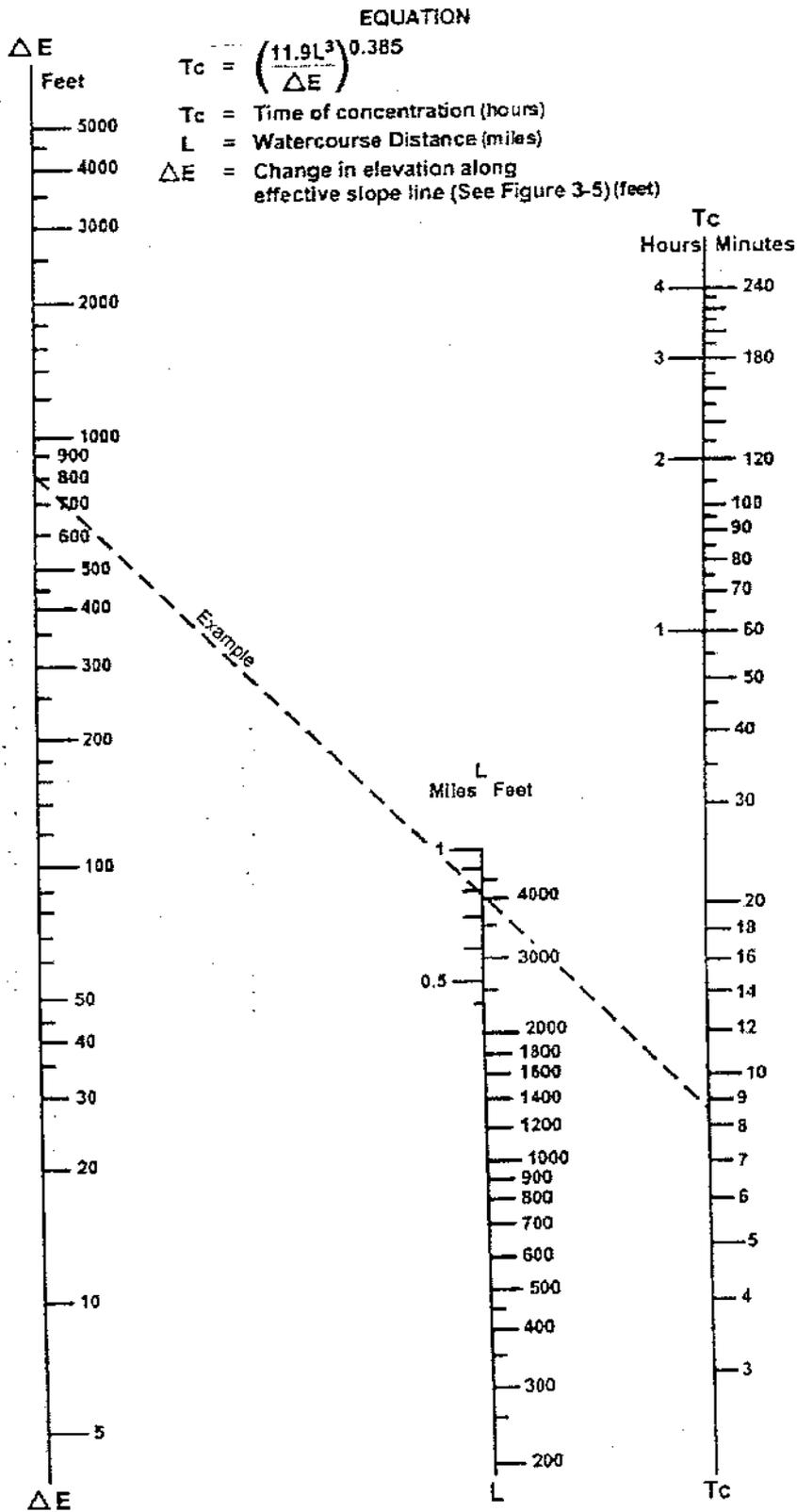
Table 3-2 provides limits of the length (Maximum Length (L_M)) of sheet flow to be used in hydrology studies. Initial T_i values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved by the "Regulating Agency" when submitted with a detailed study.

Table 3-2

**MAXIMUM OVERLAND FLOW LENGTH (L_M)
 & INITIAL TIME OF CONCENTRATION (T_i)**

Element*	DU/ Acre	.5%		1%		2%		3%		5%		10%	
		L_M	T_i										
Natural		50	13.2	70	12.5	85	10.9	100	10.3	100	8.7	100	6.9
LDR	1	50	12.2	70	11.5	85	10.0	100	9.5	100	8.0	100	6.4
LDR	2	50	11.3	70	10.5	85	9.2	100	8.8	100	7.4	100	5.8
LDR	2.9	50	10.7	70	10.0	85	8.8	95	8.1	100	7.0	100	5.6
MDR	4.3	50	10.2	70	9.6	80	8.1	95	7.8	100	6.7	100	5.3
MDR	7.3	50	9.2	65	8.4	80	7.4	95	7.0	100	6.0	100	4.8
MDR	10.9	50	8.7	65	7.9	80	6.9	90	6.4	100	5.7	100	4.5
MDR	14.5	50	8.2	65	7.4	80	6.5	90	6.0	100	5.4	100	4.3
HDR	24	50	6.7	65	6.1	75	5.1	90	4.9	95	4.3	100	3.5
HDR	43	50	5.3	65	4.7	75	4.0	85	3.8	95	3.4	100	2.7
N. Com		50	5.3	60	4.5	75	4.0	85	3.8	95	3.4	100	2.7
G. Com		50	4.7	60	4.1	75	3.6	85	3.4	90	2.9	100	2.4
O.P./Com		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
Limited I.		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
General I.		50	3.7	60	3.2	70	2.7	80	2.6	90	2.3	100	1.9

*See Table 3-1 for more detailed description



SOURCE: California Division of Highways (1941) and Kirpich (1940)

Nomograph for Determination of
Time of Concentration (T_c) or Travel Time (T_t) for Natural Watersheds

FIGURE

3-4

XV. INTENSITY-DURATION CHARTS

Please see the attached Figure 3-1 for the 10-Year and 100-Year Design Storm Events from the County of San Diego Hydrology Manual (current edition).

Job # 05-060

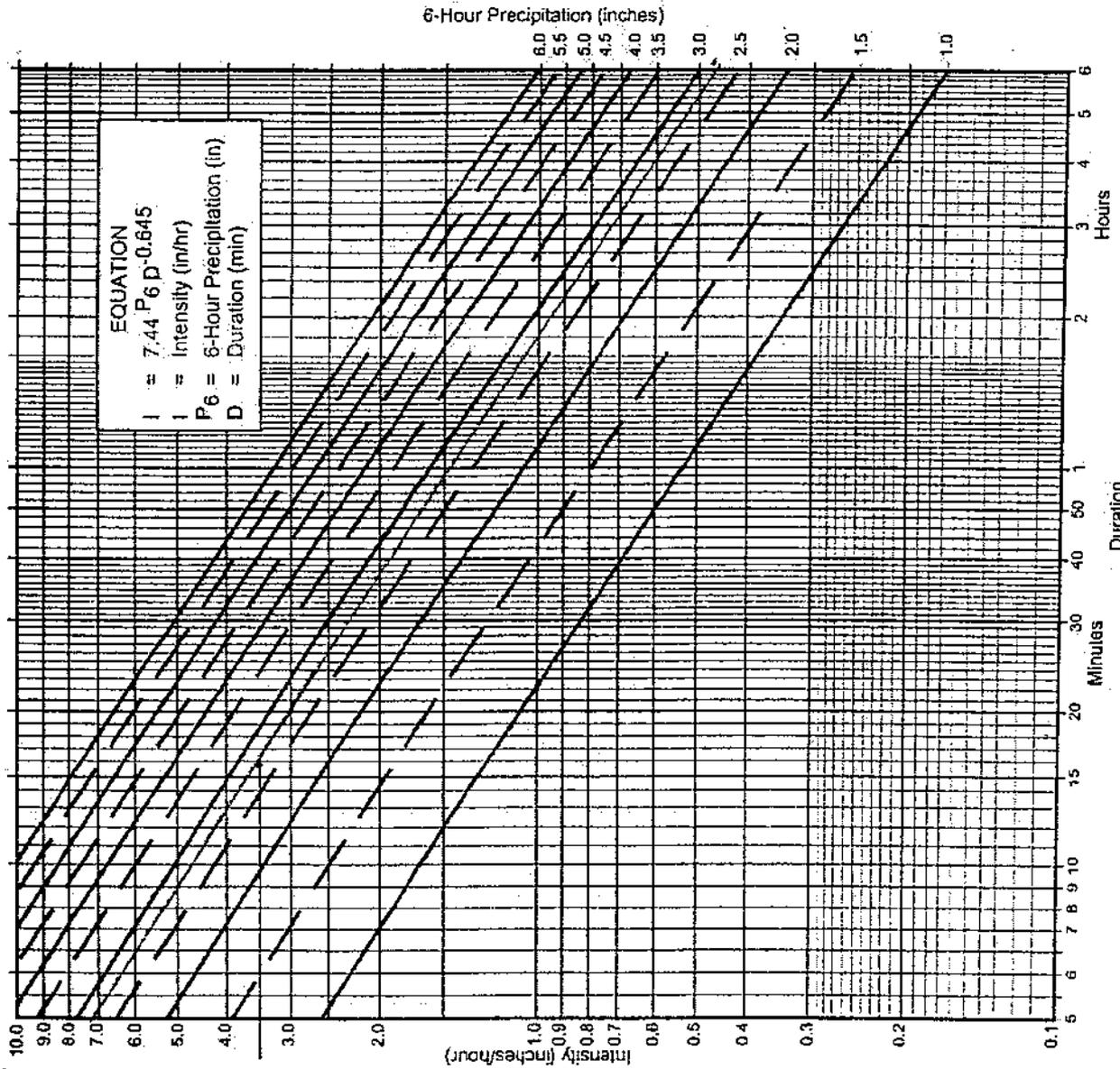
Directions for Application:

- (1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).
- (2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicable to Desert).
- (3) Plot 6 hr precipitation on the right side of the chart.
- (4) Draw a line through the point parallel to the plotted lines.
- (5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

- (a) Selected frequency 10 year
- (b) $P_6 = \frac{2.58 \text{ in.}}{P_{24}} = \frac{5.5}{2.58} \cdot \frac{P_6}{P_{24}} = 47\%$
- (c) Adjusted $P_6^{(2)} = 2.58 \text{ in.}$
- (d) $I_x = 15.8 \text{ min.}$
- (e) $I = 3.6 \text{ in./hr.}$

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.



P_6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.88	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.88	2.12	2.39	2.65	2.92	3.18
80	0.41	0.61	0.82	1.05	1.23	1.43	1.63	1.84	2.04	2.25	2.45
100	0.34	0.51	0.68	0.85	1.02	1.18	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.09	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE

3-1

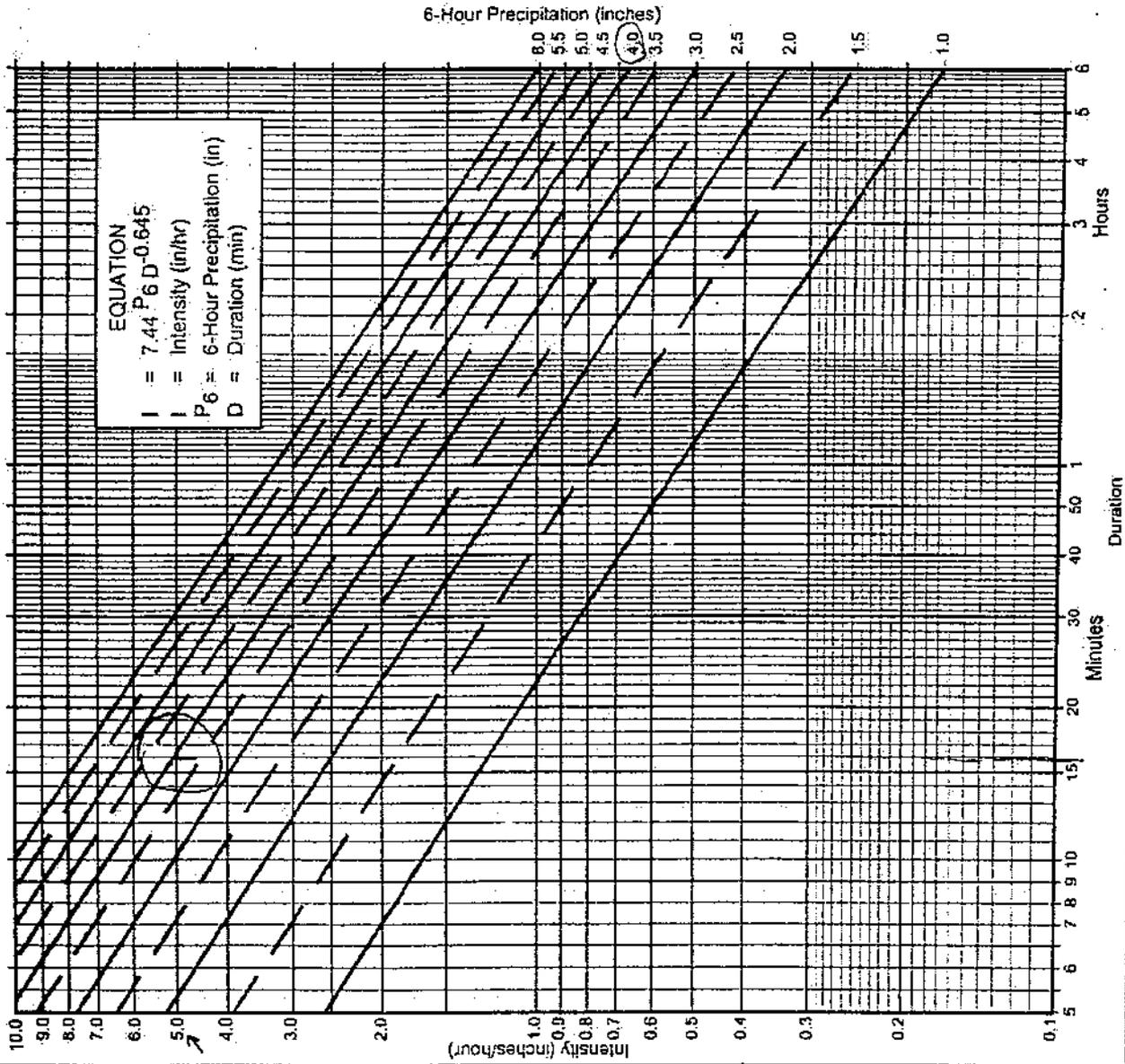
Directions for Application:

- (1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).
- (2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicable to Desert).
- (3) Plot 6 hr precipitation on the right side of the chart.
- (4) Draw a line through the point parallel to the plotted lines.
- (5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

- (a) Selected frequency 100 year
- (b) $P_6 = \frac{4.0}{100} \text{ in.}, P_{24} = \frac{8.5}{100} \text{ in.}, \frac{P_6}{P_{24}} = \frac{47}{100} \% (2)$
- (c) Adjusted $P_6^{(2)} = \frac{4.0}{100} \text{ in.}$
- (d) $I_x = \frac{15.4}{60} \text{ min.}$
- (e) $I = \frac{5.0}{60} \text{ in./hr.}$

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.



P6 Duration	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.58	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.78	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.96	3.28	3.58
60	0.53	0.80	1.06	1.33	1.58	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

FIGURE 3-1

Intensity-Duration Design Chart - Template

XVI. FLOOD ZONE MAP

Please see the attached Flood Zone Map.

XVII. RAINFALL ISOPLUVIAL MAPS

Please see the attached 10-Year, 6 Hour, 10-Year, 24 Hour, 100-Year, 6 Hour, and 100-Year, 24 Hour Isopluvial Maps from the County of San Diego Hydrology Manual (current edition).

County of San Diego Hydrology Manual



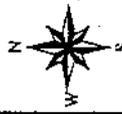
Rainfall Isoplethials

10 Year Rainfall Event - 6 Hours

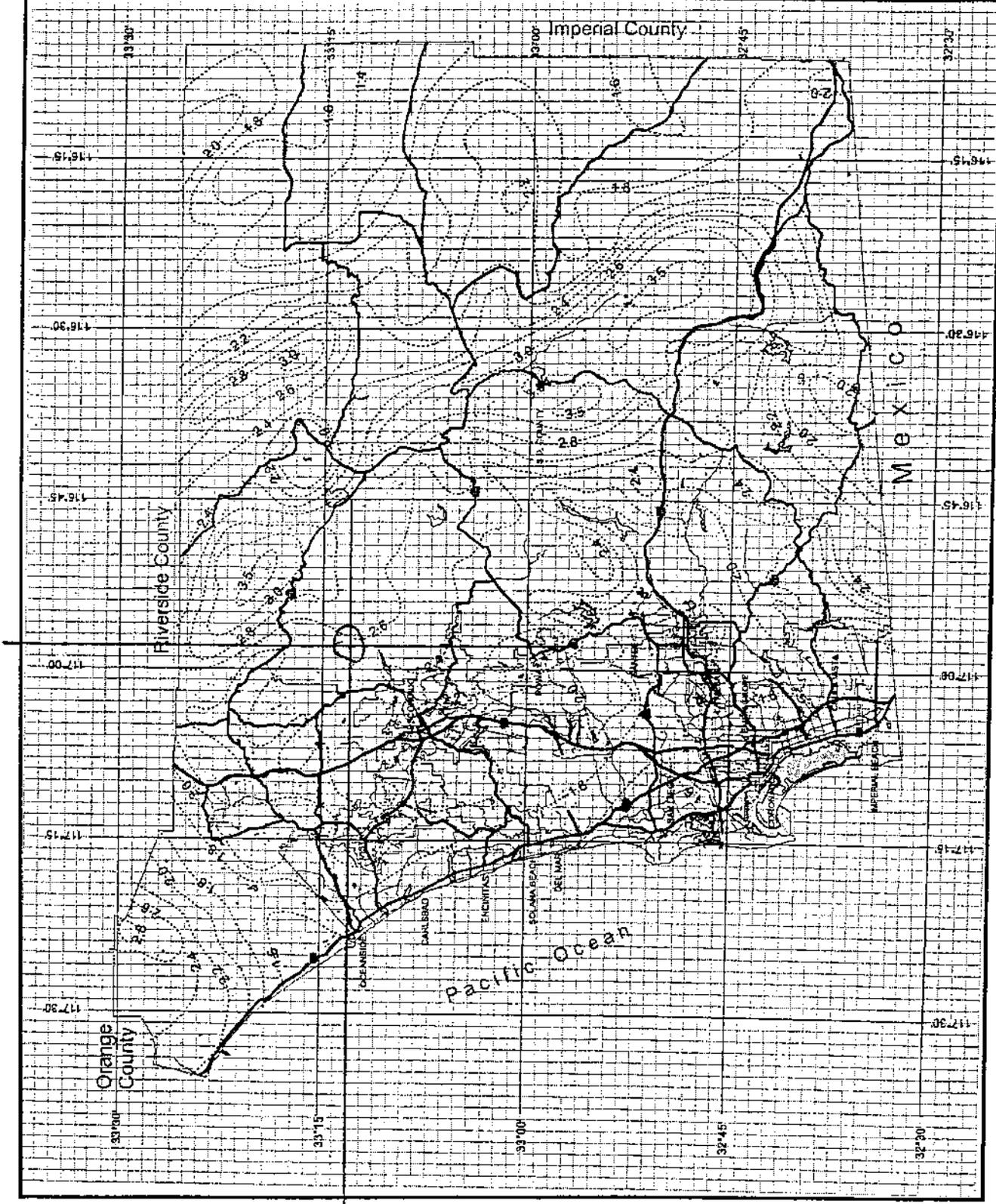


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County of San Diego Hydrology Manual



Rainfall Isophyets

100 Year Rainfall Event - 6 Hours



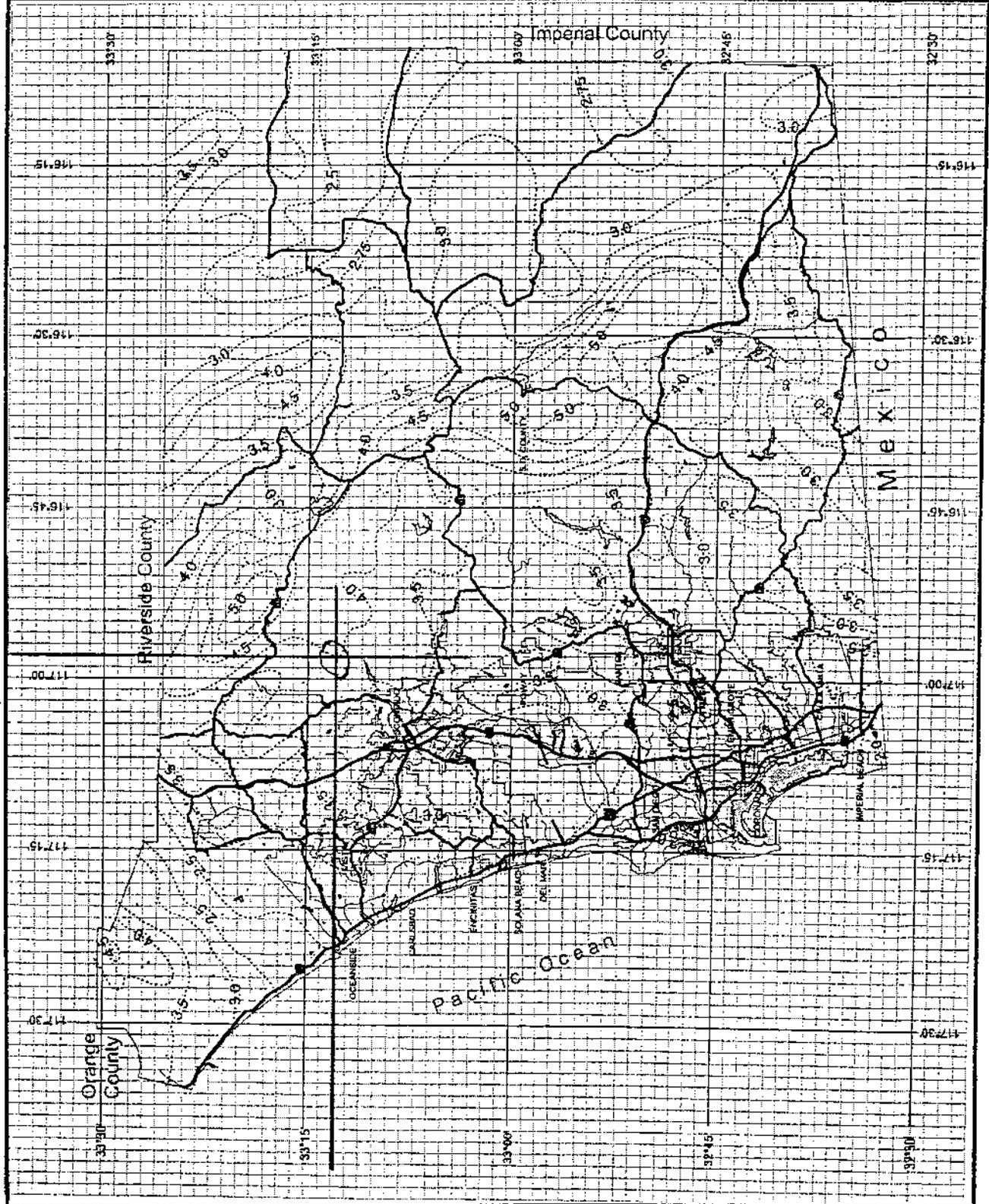
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3 0 3 Miles



County of San Diego Hydrology Manual



Rainfall Isopleths

100 Year Rainfall Event - 24 Hours

..... Isopleth (inches)

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