

# Preliminary Stormwater Management Plan

For

## Rosemount Business Park Third Addition

Rosemount, Minnesota

Prepared By:  
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 *Creating  
Extraordinary  
Communities*



**Rosemount Business Park Third Addition**  
Rosemount, Minnesota

**Preliminary Stormwater Management Plan**  
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# Rosemount Business Park Third Addition

Rosemount, Minnesota

## Preliminary Stormwater Management Plan

### Introduction

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This preliminary stormwater management plan was created for the Rosemount Business Park Third Addition located in the southwest quadrant of Boulder Trail and Biscayne Ave W in Rosemount, Minnesota. Included in this plan are calculations for the existing runoff discharges from the site to the surrounding areas and calculations for the proposed stormwater plan that utilizes a water quality pond and infiltration basin to meet the city's requirement for zero discharge during a 100-year event, while providing water quality treatment and infiltration.

### Methodology

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The stormwater calculations were made utilizing the stormwater-modeling program HydroCAD. Calculations were performed for the Type II 24-hour NURP, 2-year, 10-year and 100-year rainfall events of 2.50 inches, 2.80 inches, 4.2 inches and 6.00 inches, respectively. Calculations were also performed for a 10-day snowmelt event using a runoff distribution curve developed specifically for a 10-day snowmelt event in Minnesota.

### Existing Conditions

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The 52.9± acre site, located in the southwest quadrant of Boulder Trail and Biscayne Ave W, currently serves agricultural purposes. Bordering the site on the north is the Rosemount Business Park Second Addition, the JTT Business Center First Addition borders the site on the west, and agricultural land owned by the Pahl Family Limited Partnership lies to the south and east.

For the existing drainage analysis, the site was divided into six subcatchments. The largest of these subcatchments is in the southwest corner of the site designated SW. This subcatchment consists of 23.8± acres and discharges to a low area in the southwest corner of the site designated as discharge point 2R. Moving counterclockwise around the site, the next subcatchment, designated as S, consists of 10.2± acres and discharges to a low area near the south side of the site designated as discharge point 1R. The next subcatchment is designated SE and consists of 0.9± acres. This subcatchment discharges to a low area, discharge point 3R, off the southeast corner of the site. The next subcatchment, and also the second largest, is designated as the E subcatchment. It consists of 11.5± acres and discharges to a low area off the eastern side of the property designated as discharge point 4R. The next subcatchment in the counterclockwise direction is the smallest of the six and is designated as the NE subcatchment. This area

consists of 0.4± acres and discharges to a low point near the northeast corner of the site designated as discharge point 6R. The last subcatchment is designated as the N subcatchment. This subcatchment consists of 6.1± acres and it drains to the north into the storm sewer along Boulder Trail. Refer to the "Existing Drainage Conditions" exhibit for an illustration of these subcatchments and discharge points.

All of these subcatchments, with the exception of the N subcatchment, consist entirely of land that has been previously used for agricultural purposes. The majority of the N subcatchment has been used for agricultural purposes, but also contains a very small amount (0.10± acres) of impervious surface belonging to a municipal well house and adjacent driveway. The five subcatchments discharging to the south and east sides of the site (SW, S, SE, E, and NE) all appear to combine and discharge over land to one ultimate discharge point to the southeast of the site.

There are no existing wetlands on site.

### **Proposed Conditions**

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This preliminary stormwater management plan includes calculations for the post development conditions of the site. The proposed scenario divides the site into three basic subcatchments covering approximately 52.9 acres. The features of the area that are proposed to be developed include parking lot areas, office/warehouse buildings, a portion of public road, and a storm water quality pond and infiltration area. The southeast corner of the site, 12.2± acres, is slated to be developed by the City of Rosemount in the future.

The model used to analyze the proposed conditions of the site consists of three subcatchments, a storm water pond and an infiltration basin. The area of the site to be privately developed is indicated as "Developed Lot". This area consists of 36.6± acres. An impervious coverage of 80% was used for this area, with the remaining 20% of the site consisting of grassy areas. An impervious coverage of 85% was used for the area slated for development by the city (12.2± acres), subcatchment "City Lot", with the remaining 15% being grassy areas. The last subcatchment in the model is the 4.1± acre outlot that contains the storm water pond and infiltration basin. This outlot will have approximately one acre of pond surface modeled as impervious surface and the remaining area modeled as vegetated pervious area.

Each of the three proposed subcatchments contribute runoff to the storm water pond and infiltration basin. The storm water pond has been sized to sufficiently treat the runoff from the entire 52.9± acres for a 2.50" rainfall event, meeting NURP requirements, before entering the infiltration basin. The storm water pond and infiltration basin have also been designed to completely retain every rain event up to and including the 100-year event, while providing infiltration. Therefore, there is no offsite discharge during all storm events equal to the 100-year event and smaller. During rain events larger than the 100-year event an emergency overflow from the infiltration basin has been provided in the form of a broad crested weir at an elevation of 949'. Flows during rain events larger than the 100-year event may overtop the weir at this elevation and discharge to the south, as in existing conditions.

## **Conclusion**

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Currently, there is no stormwater rate control or water quality treatment for existing discharge into the several low areas to the south and east of the site and to the storm sewer system along Boulder Trail. These existing discharge rates can be found in Table 1.1. It appears that all of the subcatchments contained on the existing property ultimately discharge to the same point to the southeast of the site. The proposed storm water system would capture all of this existing runoff and direct it, via a storm sewer system, into the proposed stormwater pond and infiltration basin at an elevation of 942.0'. The stormwater pond and infiltration basin are to be connected via a 36" culvert at 0.00%. Proposed discharge rates into the pond and high water elevations for the pond can be found in Table 1.2.

A request was made by the City of Rosemount that all stormwater during a 100-year rainfall event be completely retained on site due to downstream regional storm water facilities not being completed yet. Because of this request, the proposed storm water pond and infiltration basin have been designed with enough volume above the normal water level to completely retain every rain event up to and including the 100-year event. The stormwater pond has also been designed with sufficient water quality volume to pre-treat storm events up to and including the NURP event (2.50" rainfall) before entering the infiltration basin.

This proposed stormwater management plan will significantly improve the quality and reduce the quantity of stormwater discharged from this site.

Table 1.1 – Discharge Rate and Volume from Existing Subcatchments

Subcatchment	NURP Event (2.50 inches)	2-Year Event (2.80 inches)	10-Year Event (4.20 inches)	100-Year Event (6.0 inches)	10-Day Snowmelt (7.1 inches)
N	6.83 cfs (0.332 af)	8.89 cfs (0.425 af)	19.80 cfs (0.927 af)	35.42 cfs (1.674 af)	0.84 cfs (3.499 af)
NE	0.37 cfs (0.022 af)	0.49 cfs (0.028 af)	1.11 cfs (0.061 af)	2.00 cfs (0.109 af)	0.06 cfs (0.229 af)
E	4.91 cfs (0.622 af)	6.56 cfs (0.796 af)	15.45 cfs (1.738 af)	28.48 cfs (3.137 af)	1.58 cfs (6.558 af)
SE	0.64 cfs (0.051 af)	0.85 cfs (0.065 af)	1.97 cfs (0.142 af)	3.59 cfs (0.257 af)	0.13 cfs (0.537 af)
S	4.27 cfs (0.552 af)	5.71 cfs (0.706 af)	13.48 cfs (1.542 af)	24.84 cfs (2.784 af)	1.40 cfs (5.820 af)
SW	8.54 cfs (1.290 af)	11.44 cfs (1.651 af)	27.09 cfs (3.606 af)	49.96 cfs (6.509 af)	3.28 cfs (13.607 af)
<b>Total</b>	<b>18.39 cfs (2.868 af)</b>	<b>24.49 cfs (3.671 af)</b>	<b>57.79 cfs (8.016 af)</b>	<b>106.58 cfs (14.471 af)</b>	<b>7.28 cfs (30.251 af)</b>

Table 1.2 – Discharge Rate and Volumes into Proposed Pond and High Water Elevations

	Rate (Volume)	High Water Elevation
NURP Event (2.50 inches)	143.04 cfs (6.808 af)	944.6'±
2-Year Event (2.80 inches)	166.51 cfs (7.986 af)	945.0'±
10-Year Event (4.20 inches)	276.77 cfs (13.691 af)	946.7'±
100-Year Event (6.0 inches)	418.25 cfs (21.282 af)	948.8'±
10-Day Snowmelt (7.1 inches)	7.30 cfs (30.262 af)	946.9'±

\*Pond NWL = 942.0', Bottom of Infiltration Basin = 942.0'.

**Rosemount Business Park Third Addition**  
Rosemount, Minnesota

**HydroCAD Calculations**  
**Existing 2.5" Event (NURP)**

**Existing Site 20070523**

Type II 24-hr 2.5" Storm Event Rainfall=2.50"

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Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment E: (new Subcat)**Runoff Area=11.470 ac Runoff Depth=0.65"  
Flow Length=1,146' Tc=36.7 min CN=75 Runoff=4.91 cfs 0.622 af**Subcatchment N: (new Subcat)**Runoff Area=6.120 ac Runoff Depth=0.65"  
Flow Length=170' Tc=6.2 min CN=75 Runoff=6.83 cfs 0.332 af**Subcatchment NE: (new Subcat)**Runoff Area=0.400 ac Runoff Depth=0.65"  
Flow Length=173' Tc=10.3 min CN=75 Runoff=0.37 cfs 0.022 af**Subcatchment S: (new Subcat)**Runoff Area=10.180 ac Runoff Depth=0.65"  
Flow Length=1,097' Tc=37.7 min CN=75 Runoff=4.27 cfs 0.552 af**Subcatchment SE: (new Subcat)**Runoff Area=0.940 ac Runoff Depth=0.65"  
Flow Length=282' Tc=18.5 min CN=75 Runoff=0.64 cfs 0.051 af**Subcatchment SW: (new Subcat)**Runoff Area=23.800 ac Runoff Depth=0.65"  
Flow Length=1,159' Tc=46.6 min CN=75 Runoff=8.54 cfs 1.290 af**Reach 1R: S Discharge Point**Inflow=4.27 cfs 0.552 af  
Outflow=4.27 cfs 0.552 af**Reach 2R: SW Discharge Point**Inflow=8.54 cfs 1.290 af  
Outflow=8.54 cfs 1.290 af**Reach 3R: SE Discharge Point**Inflow=0.64 cfs 0.051 af  
Outflow=0.64 cfs 0.051 af**Reach 4R: E Discharge Point**Inflow=4.91 cfs 0.622 af  
Outflow=4.91 cfs 0.622 af**Reach 5R: N Discharge Point**Inflow=6.83 cfs 0.332 af  
Outflow=6.83 cfs 0.332 af**Reach 6R: NE Discharge Point**Inflow=0.37 cfs 0.022 af  
Outflow=0.37 cfs 0.022 af**Reach 7R: (new Reach)**Inflow=18.39 cfs 2.868 af  
Outflow=18.39 cfs 2.868 af**Total Runoff Area = 52.910 ac Runoff Volume = 2.868 af Average Runoff Depth = 0.65"**

**Existing Site 20070523**

Type II 24-hr 2.5" Storm Event Rainfall=2.50"

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**Subcatchment E: (new Subcat)**

Runoff = 4.91 cfs @ 12.36 hrs, Volume= 0.622 af, Depth= 0.65"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 2.5" Storm Event Rainfall=2.50"

Area (ac)	CN	Description
11.470	75	Row crops, SR + CR, Good, HSG B

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.8	300	0.0061	0.3		Sheet Flow, Fallow n= 0.050 P2= 2.80"
0.6	27	0.0061	0.7		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
17.3	560	0.0036	0.5		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
2.0	259	0.0560	2.1		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
36.7	1,146	Total			

**Subcatchment N: (new Subcat)**

Runoff = 6.83 cfs @ 11.99 hrs, Volume= 0.332 af, Depth= 0.65"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 2.5" Storm Event Rainfall=2.50"

Area (ac)	CN	Description
6.120	75	Row crops, SR + CR, Good, HSG B

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	170	0.0240	0.5		Sheet Flow, Fallow n= 0.050 P2= 2.80"

**Subcatchment NE: (new Subcat)**

Runoff = 0.37 cfs @ 12.03 hrs, Volume= 0.022 af, Depth= 0.65"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 2.5" Storm Event Rainfall=2.50"

Area (ac)	CN	Description
0.400	75	Row crops, SR + CR, Good, HSG B

**Existing Site 20070523**

Type II 24-hr 2.5" Storm Event Rainfall=2.50"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.5	138	0.0072	0.3		<b>Sheet Flow,</b> Fallow n= 0.050 P2= 2.80"
1.8	35	0.0215	0.3		<b>Sheet Flow,</b> Fallow n= 0.050 P2= 2.80"
10.3	173	Total			

**Subcatchment S: (new Subcat)**

Runoff = 4.27 cfs @ 12.36 hrs, Volume= 0.552 af, Depth= 0.65"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 2.5" Storm Event Rainfall=2.50"

Area (ac)	CN	Description
10.180	75	Row crops, SR + CR, Good, HSG B

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.6	300	0.0037	0.2		<b>Sheet Flow,</b> Fallow n= 0.050 P2= 2.80"
7.0	229	0.0037	0.5		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
8.5	348	0.0057	0.7		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
1.6	220	0.0650	2.3		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
37.7	1,097	Total			

**Subcatchment SE: (new Subcat)**

Runoff = 0.64 cfs @ 12.13 hrs, Volume= 0.051 af, Depth= 0.65"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 2.5" Storm Event Rainfall=2.50"

Area (ac)	CN	Description
0.940	75	Row crops, SR + CR, Good, HSG B

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.4	265	0.0038	0.2		<b>Sheet Flow,</b> Fallow n= 0.050 P2= 2.80"
0.1	17	0.0597	2.2		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
18.5	282	Total			

**Existing Site 20070523**

Type II 24-hr 2.5" Storm Event Rainfall=2.50"

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**Subcatchment SW: (new Subcat)**

Runoff = 8.54 cfs @ 12.48 hrs, Volume= 1.290 af, Depth= 0.65"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 2.5" Storm Event Rainfall=2.50"

Area (ac)	CN	Description
23.800	75	Row crops, SR + CR, Good, HSG B

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.1	300	0.0025	0.2		Sheet Flow, Fallow n= 0.050 P2= 2.80"
18.6	503	0.0025	0.4		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
3.9	356	0.0280	1.5		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
46.6	1,159	Total			

**Reach 1R: S Discharge Point**

Inflow Area = 10.180 ac, Inflow Depth = 0.65" for 2.5" Storm Event event  
 Inflow = 4.27 cfs @ 12.36 hrs, Volume= 0.552 af  
 Outflow = 4.27 cfs @ 12.36 hrs, Volume= 0.552 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Reach 2R: SW Discharge Point**

Inflow Area = 23.800 ac, Inflow Depth = 0.65" for 2.5" Storm Event event  
 Inflow = 8.54 cfs @ 12.48 hrs, Volume= 1.290 af  
 Outflow = 8.54 cfs @ 12.48 hrs, Volume= 1.290 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Reach 3R: SE Discharge Point**

Inflow Area = 0.940 ac, Inflow Depth = 0.65" for 2.5" Storm Event event  
 Inflow = 0.64 cfs @ 12.13 hrs, Volume= 0.051 af  
 Outflow = 0.64 cfs @ 12.13 hrs, Volume= 0.051 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Reach 4R: E Discharge Point**

Inflow Area = 11.470 ac, Inflow Depth = 0.65" for 2.5" Storm Event event  
Inflow = 4.91 cfs @ 12.36 hrs, Volume= 0.622 af  
Outflow = 4.91 cfs @ 12.36 hrs, Volume= 0.622 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Reach 5R: N Discharge Point**

Inflow Area = 6.120 ac, Inflow Depth = 0.65" for 2.5" Storm Event event  
Inflow = 6.83 cfs @ 11.99 hrs, Volume= 0.332 af  
Outflow = 6.83 cfs @ 11.99 hrs, Volume= 0.332 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Reach 6R: NE Discharge Point**

Inflow Area = 0.400 ac, Inflow Depth = 0.65" for 2.5" Storm Event event  
Inflow = 0.37 cfs @ 12.03 hrs, Volume= 0.022 af  
Outflow = 0.37 cfs @ 12.03 hrs, Volume= 0.022 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Reach 7R: (new Reach)**

Inflow Area = 52.910 ac, Inflow Depth = 0.65" for 2.5" Storm Event event  
Inflow = 18.39 cfs @ 12.43 hrs, Volume= 2.868 af  
Outflow = 18.39 cfs @ 12.43 hrs, Volume= 2.868 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Rosemount Business Park Third Addition**  
Rosemount, Minnesota

**HydroCAD Calculations**  
**Proposed 2.5" Event (NURP)**

**20070522 Proposed Site-PBJ**

Type II 24-hr 2.5" Storm Event Rainfall=2.50"

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Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 4

Runoff by SCS TR-20 method, UH=SCS

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

**Subcatchment City Lot: City Lot**

Runoff Area=12.270 ac Runoff Depth=1.69"  
Tc=5.0 min CN=92 Runoff=37.08 cfs 1.731 af

**Subcatchment Developed Lot: Developed Lot**

Runoff Area=36.590 ac Runoff Depth=1.61"  
Flow Length=2,060' Tc=5.9 min CN=91 Runoff=102.90 cfs 4.910 af

**Subcatchment Pond Outlot: Pond Outlot**

Runoff Area=4.070 ac Runoff Depth=0.49"  
Flow Length=50' Tc=2.2 min CN=71 Runoff=3.86 cfs 0.167 af

**Pond INF BASIN: Infiltration Basin**

Peak Elev=944.41' Storage=116,087 cf Inflow=23.39 cfs 5.234 af  
Discarded=0.94 cfs 4.392 af Secondary=0.00 cfs 0.000 af Outflow=0.94 cfs 4.392 af

**Pond Pond: Stormwater Pond**

Peak Elev=944.60' Storage=439,214 cf Inflow=143.04 cfs 6.808 af  
Discarded=0.18 cfs 0.609 af Primary=23.39 cfs 5.234 af Secondary=0.00 cfs 0.000 af Outflow=23.57 cfs 5.843 af

**Total Runoff Area = 52.930 ac Runoff Volume = 6.808 af Average Runoff Depth = 1.54"**

**Subcatchment City Lot: City Lot**

Runoff = 37.08 cfs @ 11.96 hrs, Volume= 1.731 af, Depth= 1.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 2.5" Storm Event Rainfall=2.50"

Area (ac)	CN	Description
10.430	98	Paved parking & roofs
1.840	61	>75% Grass cover, Good, HSG B
12.270	92	Weighted Average

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

**Subcatchment Developed Lot: Developed Lot**

Runoff = 102.90 cfs @ 11.97 hrs, Volume= 4.910 af, Depth= 1.61"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 2.5" Storm Event Rainfall=2.50"

Area (ac)	CN	Description
29.270	98	Paved parking & roofs
7.320	61	>75% Grass cover, Good, HSG B
36.590	91	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	60	0.0200	1.2		<b>Sheet Flow, Across Pavement</b> Smooth surfaces n= 0.011 P2= 2.80"
5.0	2,000	0.0040	6.6	63.63	<b>Circular Channel (pipe), Pipe</b> Diam= 42.0" Area= 9.6 sf Perim= 11.0' r= 0.88' n= 0.013
5.9	2,060	Total			

**Subcatchment Pond Outlot: Pond Outlot**

Runoff = 3.86 cfs @ 11.94 hrs, Volume= 0.167 af, Depth= 0.49"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 2.5" Storm Event Rainfall=2.50"

Area (ac)	CN	Description
1.080	100	Pond NWL
2.990	61	>75% Grass cover, Good, HSG B
4.070	71	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	50	0.2500	0.4		<b>Sheet Flow, Grass Slope</b> Grass: Short n= 0.150 P2= 2.80"

**Pond INF BASIN: Infiltration Basin**

Inflow Area = 52.930 ac, Inflow Depth = 1.19" for 2.5" Storm Event event  
 Inflow = 23.39 cfs @ 12.16 hrs, Volume= 5.234 af  
 Outflow = 0.94 cfs @ 24.06 hrs, Volume= 4.392 af, Atten= 96%, Lag= 714.2 min  
 Discarded = 0.94 cfs @ 24.06 hrs, Volume= 4.392 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 4  
 Peak Elev= 944.41' @ 24.06 hrs Surf.Area= 54,224 sf Storage= 116,087 cf  
 Plug-Flow detention time=(not calculated: outflow precedes inflow)  
 Center-of-Mass det. time=(not calculated)

#	Invert	Avail.Storage	Storage Description
1	942.00'	426,330 cf	<b>Custom Stage Data (Prismatic)</b> Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
942.00	40,450	0	0
944.00	51,780	92,230	92,230
946.00	63,600	115,380	207,610
948.00	75,980	139,580	347,190
949.00	82,300	79,140	426,330

#	Routing	Invert	Outlet Devices
1	Discarded	0.00'	<b>0.001042 fpm Exfiltration over entire Surface area</b>
2	Secondary	949.00'	<b>30.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

**Discarded OutFlow** Max=0.94 cfs @ 24.06 hrs HW=944.41' (Free Discharge)  
 ↳1=Exfiltration (Exfiltration Controls 0.94 cfs)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=942.00' (Free Discharge)  
 ↳2=Broad-Crested Rectangular Weir( Controls 0.00 cfs)

**Pond Pond: Stormwater Pond**

Inflow Area = 52.930 ac, Inflow Depth = 1.54" for 2.5" Storm Event event  
 Inflow = 143.04 cfs @ 11.97 hrs, Volume= 6.808 af  
 Outflow = 23.57 cfs @ 12.16 hrs, Volume= 5.843 af, Atten= 84%, Lag= 11.5 min  
 Discarded = 0.18 cfs @ 12.16 hrs, Volume= 0.609 af  
 Primary = 23.39 cfs @ 12.16 hrs, Volume= 5.234 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 4

**20070522 Proposed Site-PBJ**

Type II 24-hr 2.5" Storm Event Rainfall=2.50"

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Starting Elev= 942.00' Surf.Area= 48,464 sf Storage= 298,123 cf  
 Peak Elev= 944.60' @ 12.16 hrs Surf.Area= 58,986 sf Storage= 439,214 cf (141,092 cf above start)  
 Plug-Flow detention time=(not calculated)  
 Center-of-Mass det. time=(not calculated)

#	Invert	Avail.Storage	Storage Description
1	932.00'	820,640 cf	<b>Custom Stage Data (Prismatic)</b> listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
932.00	18,228	0	0
934.00	22,402	40,630	40,630
936.00	26,830	49,232	89,862
938.00	31,567	58,397	148,259
940.00	36,577	68,144	216,403
941.00	39,199	37,888	254,291
942.00	48,464	43,832	298,123
944.00	56,453	104,917	403,040
946.00	64,955	121,408	524,448
948.00	73,968	138,923	663,371
950.00	83,301	157,269	820,640

#	Routing	Invert	Outlet Devices
1	Primary	942.00'	<b>36.0" x 50.0' long Culvert RCP</b> , end-section conforming to fill, Ke= 0.500 Outlet Invert= 942.00' S= 0.0000 '/' n= 0.013 Cc= 0.900
2	Discarded	942.00'	<b>0.001042 fpm Exfiltration over Surface area above invert</b>
3	Secondary	949.50'	<b>150.0' long x 50.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

**Discarded OutFlow** Max=0.18 cfs @ 12.16 hrs HW=944.60' (Free Discharge)

↳ **2=Exfiltration** (Exfiltration Controls 0.18 cfs)

**Primary OutFlow** Max=23.39 cfs @ 12.16 hrs HW=944.60' TW=942.42' (Dynamic Tailwater)

↳ **1=Culvert** (Barrel Controls 23.39 cfs @ 4.8 fps)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=942.00' TW=942.00' (Dynamic Tailwater)

↳ **3=Broad-Crested Rectangular Weir**( Controls 0.00 cfs)

**Rosemount Business Park Third Addition**  
Rosemount, Minnesota

**HydroCAD Calculations**  
**2-Year Existing Conditions**

**Existing Site 20070523**

Type II 24-hr 2-yr Storm event Rainfall=2.80"

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Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment E: (new Subcat)** Runoff Area=11.470 ac Runoff Depth=0.83"  
Flow Length=1,146' Tc=36.7 min CN=75 Runoff=6.56 cfs 0.796 af

**Subcatchment N: (new Subcat)** Runoff Area=6.120 ac Runoff Depth=0.83"  
Flow Length=170' Tc=6.2 min CN=75 Runoff=8.89 cfs 0.425 af

**Subcatchment NE: (new Subcat)** Runoff Area=0.400 ac Runoff Depth=0.83"  
Flow Length=173' Tc=10.3 min CN=75 Runoff=0.49 cfs 0.028 af

**Subcatchment S: (new Subcat)** Runoff Area=10.180 ac Runoff Depth=0.83"  
Flow Length=1,097' Tc=37.7 min CN=75 Runoff=5.71 cfs 0.706 af

**Subcatchment SE: (new Subcat)** Runoff Area=0.940 ac Runoff Depth=0.83"  
Flow Length=282' Tc=18.5 min CN=75 Runoff=0.85 cfs 0.065 af

**Subcatchment SW: (new Subcat)** Runoff Area=23.800 ac Runoff Depth=0.83"  
Flow Length=1,159' Tc=46.6 min CN=75 Runoff=11.44 cfs 1.651 af

**Reach 1R: S Discharge Point** Inflow=5.71 cfs 0.706 af  
Outflow=5.71 cfs 0.706 af

**Reach 2R: SW Discharge Point** Inflow=11.44 cfs 1.651 af  
Outflow=11.44 cfs 1.651 af

**Reach 3R: SE Discharge Point** Inflow=0.85 cfs 0.065 af  
Outflow=0.85 cfs 0.065 af

**Reach 4R: E Discharge Point** Inflow=6.56 cfs 0.796 af  
Outflow=6.56 cfs 0.796 af

**Reach 5R: N Discharge Point** Inflow=8.89 cfs 0.425 af  
Outflow=8.89 cfs 0.425 af

**Reach 6R: NE Discharge Point** Inflow=0.49 cfs 0.028 af  
Outflow=0.49 cfs 0.028 af

**Reach 7R: (new Reach)** Inflow=24.49 cfs 3.671 af  
Outflow=24.49 cfs 3.671 af

**Total Runoff Area = 52.910 ac Runoff Volume = 3.671 af Average Runoff Depth = 0.83"**

**Existing Site 20070523**

Type II 24-hr 2-yr Storm event Rainfall=2.80"

Prepared by RLK Incorporated

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**Subcatchment E: (new Subcat)**

Runoff = 6.56 cfs @ 12.36 hrs, Volume= 0.796 af, Depth= 0.83"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 2-yr Storm event Rainfall=2.80"

Area (ac)	CN	Description
11.470	75	Row crops, SR + CR, Good, HSG B

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.8	300	0.0061	0.3		Sheet Flow, Fallow n= 0.050 P2= 2.80"
0.6	27	0.0061	0.7		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
17.3	560	0.0036	0.5		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
2.0	259	0.0560	2.1		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
36.7	1,146	Total			

**Subcatchment N: (new Subcat)**

Runoff = 8.89 cfs @ 11.98 hrs, Volume= 0.425 af, Depth= 0.83"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 2-yr Storm event Rainfall=2.80"

Area (ac)	CN	Description
6.120	75	Row crops, SR + CR, Good, HSG B

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	170	0.0240	0.5		Sheet Flow, Fallow n= 0.050 P2= 2.80"

**Subcatchment NE: (new Subcat)**

Runoff = 0.49 cfs @ 12.03 hrs, Volume= 0.028 af, Depth= 0.83"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 2-yr Storm event Rainfall=2.80"

Area (ac)	CN	Description
0.400	75	Row crops, SR + CR, Good, HSG B

**Existing Site 20070523**

Type II 24-hr 2-yr Storm event Rainfall=2.80"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.5	138	0.0072	0.3		<b>Sheet Flow,</b> Fallow n= 0.050 P2= 2.80"
1.8	35	0.0215	0.3		<b>Sheet Flow,</b> Fallow n= 0.050 P2= 2.80"
10.3	173	Total			

**Subcatchment S: (new Subcat)**

Runoff = 5.71 cfs @ 12.36 hrs, Volume= 0.706 af, Depth= 0.83"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 2-yr Storm event Rainfall=2.80"

Area (ac)	CN	Description
10.180	75	Row crops, SR + CR, Good, HSG B

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.6	300	0.0037	0.2		<b>Sheet Flow,</b> Fallow n= 0.050 P2= 2.80"
7.0	229	0.0037	0.5		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
8.5	348	0.0057	0.7		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
1.6	220	0.0650	2.3		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
37.7	1,097	Total			

**Subcatchment SE: (new Subcat)**

Runoff = 0.85 cfs @ 12.13 hrs, Volume= 0.065 af, Depth= 0.83"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 2-yr Storm event Rainfall=2.80"

Area (ac)	CN	Description
0.940	75	Row crops, SR + CR, Good, HSG B

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.4	265	0.0038	0.2		<b>Sheet Flow,</b> Fallow n= 0.050 P2= 2.80"
0.1	17	0.0597	2.2		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
18.5	282	Total			

**Existing Site 20070523**

Type II 24-hr 2-yr Storm event Rainfall=2.80"

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**Subcatchment SW: (new Subcat)**

Runoff = 11.44 cfs @ 12.48 hrs, Volume= 1.651 af, Depth= 0.83"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 2-yr Storm event Rainfall=2.80"

Area (ac)	CN	Description
23.800	75	Row crops, SR + CR, Good, HSG B

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.1	300	0.0025	0.2		Sheet Flow, Fallow n= 0.050 P2= 2.80"
18.6	503	0.0025	0.4		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
3.9	356	0.0280	1.5		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
46.6	1,159	Total			

**Reach 1R: S Discharge Point**

Inflow Area = 10.180 ac, Inflow Depth = 0.83" for 2-yr Storm event event  
 Inflow = 5.71 cfs @ 12.36 hrs, Volume= 0.706 af  
 Outflow = 5.71 cfs @ 12.36 hrs, Volume= 0.706 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Reach 2R: SW Discharge Point**

Inflow Area = 23.800 ac, Inflow Depth = 0.83" for 2-yr Storm event event  
 Inflow = 11.44 cfs @ 12.48 hrs, Volume= 1.651 af  
 Outflow = 11.44 cfs @ 12.48 hrs, Volume= 1.651 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Reach 3R: SE Discharge Point**

Inflow Area = 0.940 ac, Inflow Depth = 0.83" for 2-yr Storm event event  
 Inflow = 0.85 cfs @ 12.13 hrs, Volume= 0.065 af  
 Outflow = 0.85 cfs @ 12.13 hrs, Volume= 0.065 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Reach 4R: E Discharge Point**

Inflow Area = 11.470 ac, Inflow Depth = 0.83" for 2-yr Storm event event  
 Inflow = 6.56 cfs @ 12.36 hrs, Volume= 0.796 af  
 Outflow = 6.56 cfs @ 12.36 hrs, Volume= 0.796 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Reach 5R: N Discharge Point**

Inflow Area = 6.120 ac, Inflow Depth = 0.83" for 2-yr Storm event event  
 Inflow = 8.89 cfs @ 11.98 hrs, Volume= 0.425 af  
 Outflow = 8.89 cfs @ 11.98 hrs, Volume= 0.425 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Reach 6R: NE Discharge Point**

Inflow Area = 0.400 ac, Inflow Depth = 0.83" for 2-yr Storm event event  
 Inflow = 0.49 cfs @ 12.03 hrs, Volume= 0.028 af  
 Outflow = 0.49 cfs @ 12.03 hrs, Volume= 0.028 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Reach 7R: (new Reach)**

Inflow Area = 52.910 ac, Inflow Depth = 0.83" for 2-yr Storm event event  
 Inflow = 24.49 cfs @ 12.41 hrs, Volume= 3.671 af  
 Outflow = 24.49 cfs @ 12.41 hrs, Volume= 3.671 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Rosemount Business Park Third Addition**  
Rosemount, Minnesota

**HydroCAD Calculations**  
**2-Year Proposed Conditions**

**20070522 Proposed Site-PBJ**

Type II 24-hr 2-yr Storm event Rainfall=2.80"

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Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 4

Runoff by SCS TR-20 method, UH=SCS

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

**Subcatchment City Lot: City Lot**

Runoff Area=12.270 ac Runoff Depth=1.97"  
Tc=5.0 min CN=92 Runoff=42.82 cfs 2.017 af

**Subcatchment Developed Lot: Developed Lot**

Runoff Area=36.590 ac Runoff Depth=1.89"  
Flow Length=2,060' Tc=5.9 min CN=91 Runoff=119.51 cfs 5.749 af

**Subcatchment Pond Outlot: Pond Outlot**

Runoff Area=4.070 ac Runoff Depth=0.65"  
Flow Length=50' Tc=2.2 min CN=71 Runoff=5.27 cfs 0.220 af

**Pond INF BASIN: Infiltration Basin**

Peak Elev=944.81' Storage=139,177 cf Inflow=29.35 cfs 5.838 af  
Discarded=0.98 cfs 4.608 af Secondary=0.00 cfs 0.000 af Outflow=0.98 cfs 4.608 af

**Pond Pond: Stormwater Pond**

Peak Elev=944.98' Storage=462,757 cf Inflow=166.51 cfs 7.986 af  
Discarded=0.21 cfs 0.748 af Primary=29.35 cfs 5.838 af Secondary=0.00 cfs 0.000 af Outflow=29.56 cfs 6.586 af

**Total Runoff Area = 52.930 ac Runoff Volume = 7.986 af Average Runoff Depth = 1.81"**

**Subcatchment City Lot: City Lot**

Runoff = 42.82 cfs @ 11.96 hrs, Volume= 2.017 af, Depth= 1.97"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 2-yr Storm event Rainfall=2.80"

Area (ac)	CN	Description
10.430	98	Paved parking & roofs
1.840	61	>75% Grass cover, Good, HSG B
12.270	92	Weighted Average

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

**Subcatchment Developed Lot: Developed Lot**

Runoff = 119.51 cfs @ 11.97 hrs, Volume= 5.749 af, Depth= 1.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 2-yr Storm event Rainfall=2.80"

Area (ac)	CN	Description
29.270	98	Paved parking & roofs
7.320	61	>75% Grass cover, Good, HSG B
36.590	91	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	60	0.0200	1.2		Sheet Flow, Across Pavement Smooth surfaces n= 0.011 P2= 2.80"
5.0	2,000	0.0040	6.6	63.63	Circular Channel (pipe), Pipe Diam= 42.0" Area= 9.6 sf Perim= 11.0' r= 0.88' n= 0.013
5.9	2,060	Total			

**Subcatchment Pond Outlot: Pond Outlot**

Runoff = 5.27 cfs @ 11.93 hrs, Volume= 0.220 af, Depth= 0.65"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 2-yr Storm event Rainfall=2.80"

Area (ac)	CN	Description
1.080	100	Pond NWL
2.990	61	>75% Grass cover, Good, HSG B
4.070	71	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	50	0.2500	0.4		<b>Sheet Flow, Grass Slope</b> Grass: Short n= 0.150 P2= 2.80"

**Pond INF BASIN: Infiltration Basin**

Inflow Area = 52.930 ac, Inflow Depth = 1.32" for 2-yr Storm event event  
 Inflow = 29.35 cfs @ 12.14 hrs, Volume= 5.838 af  
 Outflow = 0.98 cfs @ 24.06 hrs, Volume= 4.608 af, Atten= 97%, Lag= 715.3 min  
 Discarded = 0.98 cfs @ 24.06 hrs, Volume= 4.608 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 4  
 Peak Elev= 944.81' @ 24.06 hrs Surf.Area= 56,589 sf Storage= 139,177 cf  
 Plug-Flow detention time=(not calculated: outflow precedes inflow)  
 Center-of-Mass det. time=(not calculated)

#	Invert	Avail.Storage	Storage Description
1	942.00'	426,330 cf	<b>Custom Stage Data (Prismatic)</b> listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
942.00	40,450	0	0
944.00	51,780	92,230	92,230
946.00	63,600	115,380	207,610
948.00	75,980	139,580	347,190
949.00	82,300	79,140	426,330

#	Routing	Invert	Outlet Devices
1	Discarded	0.00'	<b>0.001042 fpm Exfiltration over entire Surface area</b>
2	Secondary	949.00'	<b>30.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

**Discarded OutFlow** Max=0.98 cfs @ 24.06 hrs HW=944.81' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.98 cfs)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=942.00' (Free Discharge)  
 ↑2=Broad-Crested Rectangular Weir( Controls 0.00 cfs)

**Pond Pond: Stormwater Pond**

Inflow Area = 52.930 ac, Inflow Depth = 1.81" for 2-yr Storm event event  
 Inflow = 166.51 cfs @ 11.96 hrs, Volume= 7.986 af  
 Outflow = 29.56 cfs @ 12.14 hrs, Volume= 6.586 af, Atten= 82%, Lag= 10.6 min  
 Discarded = 0.21 cfs @ 12.14 hrs, Volume= 0.748 af  
 Primary = 29.35 cfs @ 12.14 hrs, Volume= 5.838 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 4

**20070522 Proposed Site-PBJ**

Type II 24-hr 2-yr Storm event Rainfall=2.80"

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Starting Elev= 942.00' Surf.Area= 48,464 sf Storage= 298,123 cf  
 Peak Elev= 944.98' @ 12.14 hrs Surf.Area= 60,635 sf Storage= 462,757 cf (164,634 cf above start)  
 Plug-Flow detention time=(not calculated)  
 Center-of-Mass det. time=(not calculated)

#	Invert	Avail.Storage	Storage Description
1	932.00'	820,640 cf	<b>Custom Stage Data (Prismatic)</b> , listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
932.00	18,228	0	0
934.00	22,402	40,630	40,630
936.00	26,830	49,232	89,862
938.00	31,567	58,397	148,259
940.00	36,577	68,144	216,403
941.00	39,199	37,888	254,291
942.00	48,464	43,832	298,123
944.00	56,453	104,917	403,040
946.00	64,955	121,408	524,448
948.00	73,968	138,923	663,371
950.00	83,301	157,269	820,640

#	Routing	Invert	Outlet Devices
1	Primary	942.00'	<b>36.0" x 50.0' long Culvert RCP</b> , end-section conforming to fill, Ke= 0.500 Outlet Invert= 942.00' S= 0.0000 '/' n= 0.013 Cc= 0.900
2	Discarded	942.00'	<b>0.001042 fpm Exfiltration over Surface area above invert</b>
3	Secondary	949.50'	<b>150.0' long x 50.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

**Discarded OutFlow** Max=0.21 cfs @ 12.14 hrs HW=944.98' (Free Discharge)  
 ↳ **2=Exfiltration** (Exfiltration Controls 0.21 cfs)

**Primary OutFlow** Max=29.35 cfs @ 12.14 hrs HW=944.98' TW=942.54' (Dynamic Tailwater)  
 ↳ **1=Culvert** (Barrel Controls 29.35 cfs @ 5.2 fps)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=942.00' TW=942.00' (Dynamic Tailwater)  
 ↳ **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

**Rosemount Business Park Third Addition**  
Rosemount, Minnesota

**HydroCAD Calculations**  
**10-Year Existing Conditions**

**Existing Site 20070523**

Type II 24-hr 10-yr Storm event Rainfall=4.20"

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Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

<b>Subcatchment E: (new Subcat)</b>	Runoff Area=11.470 ac Runoff Depth=1.82" Flow Length=1,146' Tc=36.7 min CN=75 Runoff=15.45 cfs 1.738 af
<b>Subcatchment N: (new Subcat)</b>	Runoff Area=6.120 ac Runoff Depth=1.82" Flow Length=170' Tc=6.2 min CN=75 Runoff=19.80 cfs 0.927 af
<b>Subcatchment NE: (new Subcat)</b>	Runoff Area=0.400 ac Runoff Depth=1.82" Flow Length=173' Tc=10.3 min CN=75 Runoff=1.11 cfs 0.061 af
<b>Subcatchment S: (new Subcat)</b>	Runoff Area=10.180 ac Runoff Depth=1.82" Flow Length=1,097' Tc=37.7 min CN=75 Runoff=13.48 cfs 1.542 af
<b>Subcatchment SE: (new Subcat)</b>	Runoff Area=0.940 ac Runoff Depth=1.82" Flow Length=282' Tc=18.5 min CN=75 Runoff=1.97 cfs 0.142 af
<b>Subcatchment SW: (new Subcat)</b>	Runoff Area=23.800 ac Runoff Depth=1.82" Flow Length=1,159' Tc=46.6 min CN=75 Runoff=27.09 cfs 3.606 af
<b>Reach 1R: S Discharge Point</b>	Inflow=13.48 cfs 1.542 af Outflow=13.48 cfs 1.542 af
<b>Reach 2R: SW Discharge Point</b>	Inflow=27.09 cfs 3.606 af Outflow=27.09 cfs 3.606 af
<b>Reach 3R: SE Discharge Point</b>	Inflow=1.97 cfs 0.142 af Outflow=1.97 cfs 0.142 af
<b>Reach 4R: E Discharge Point</b>	Inflow=15.45 cfs 1.738 af Outflow=15.45 cfs 1.738 af
<b>Reach 5R: N Discharge Point</b>	Inflow=19.80 cfs 0.927 af Outflow=19.80 cfs 0.927 af
<b>Reach 6R: NE Discharge Point</b>	Inflow=1.11 cfs 0.061 af Outflow=1.11 cfs 0.061 af
<b>Reach 7R: (new Reach)</b>	Inflow=57.79 cfs 8.016 af Outflow=57.79 cfs 8.016 af

**Total Runoff Area = 52.910 ac Runoff Volume = 8.016 af Average Runoff Depth = 1.82"**

**Existing Site 20070523**

Type II 24-hr 10-yr Storm event Rainfall=4.20"

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**Subcatchment E: (new Subcat)**

Runoff = 15.45 cfs @ 12.35 hrs, Volume= 1.738 af, Depth= 1.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 10-yr Storm event Rainfall=4.20"

Area (ac)	CN	Description
11.470	75	Row crops, SR + CR, Good, HSG B

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.8	300	0.0061	0.3		<b>Sheet Flow,</b> Fallow n= 0.050 P2= 2.80"
0.6	27	0.0061	0.7		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
17.3	560	0.0036	0.5		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
2.0	259	0.0560	2.1		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
36.7	1,146	Total			

**Subcatchment N: (new Subcat)**

Runoff = 19.80 cfs @ 11.98 hrs, Volume= 0.927 af, Depth= 1.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 10-yr Storm event Rainfall=4.20"

Area (ac)	CN	Description
6.120	75	Row crops, SR + CR, Good, HSG B

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	170	0.0240	0.5		<b>Sheet Flow,</b> Fallow n= 0.050 P2= 2.80"

**Subcatchment NE: (new Subcat)**

Runoff = 1.11 cfs @ 12.02 hrs, Volume= 0.061 af, Depth= 1.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 10-yr Storm event Rainfall=4.20"

Area (ac)	CN	Description
0.400	75	Row crops, SR + CR, Good, HSG B

**Existing Site 20070523**

Type II 24-hr 10-yr Storm event Rainfall=4.20"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.5	138	0.0072	0.3		<b>Sheet Flow,</b> Fallow n= 0.050 P2= 2.80"
1.8	35	0.0215	0.3		<b>Sheet Flow,</b> Fallow n= 0.050 P2= 2.80"
10.3	173	Total			

**Subcatchment S: (new Subcat)**

Runoff = 13.48 cfs @ 12.36 hrs, Volume= 1.542 af, Depth= 1.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 10-yr Storm event Rainfall=4.20"

Area (ac)	CN	Description
10.180	75	Row crops, SR + CR, Good, HSG B

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.6	300	0.0037	0.2		<b>Sheet Flow,</b> Fallow n= 0.050 P2= 2.80"
7.0	229	0.0037	0.5		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
8.5	348	0.0057	0.7		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
1.6	220	0.0650	2.3		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
37.7	1,097	Total			

**Subcatchment SE: (new Subcat)**

Runoff = 1.97 cfs @ 12.11 hrs, Volume= 0.142 af, Depth= 1.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 10-yr Storm event Rainfall=4.20"

Area (ac)	CN	Description
0.940	75	Row crops, SR + CR, Good, HSG B

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.4	265	0.0038	0.2		<b>Sheet Flow,</b> Fallow n= 0.050 P2= 2.80"
0.1	17	0.0597	2.2		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
18.5	282	Total			

**Subcatchment SW: (new Subcat)**

Runoff = 27.09 cfs @ 12.48 hrs, Volume= 3.606 af, Depth= 1.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 10-yr Storm event Rainfall=4.20"

Area (ac)	CN	Description
23.800	75	Row crops, SR + CR, Good, HSG B

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.1	300	0.0025	0.2		Sheet Flow, Fallow n= 0.050 P2= 2.80"
18.6	503	0.0025	0.4		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
3.9	356	0.0280	1.5		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
46.6	1,159	Total			

**Reach 1R: S Discharge Point**

Inflow Area = 10.180 ac, Inflow Depth = 1.82" for 10-yr Storm event event  
Inflow = 13.48 cfs @ 12.36 hrs, Volume= 1.542 af  
Outflow = 13.48 cfs @ 12.36 hrs, Volume= 1.542 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Reach 2R: SW Discharge Point**

Inflow Area = 23.800 ac, Inflow Depth = 1.82" for 10-yr Storm event event  
Inflow = 27.09 cfs @ 12.48 hrs, Volume= 3.606 af  
Outflow = 27.09 cfs @ 12.48 hrs, Volume= 3.606 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Reach 3R: SE Discharge Point**

Inflow Area = 0.940 ac, Inflow Depth = 1.82" for 10-yr Storm event event  
Inflow = 1.97 cfs @ 12.11 hrs, Volume= 0.142 af  
Outflow = 1.97 cfs @ 12.11 hrs, Volume= 0.142 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Reach 4R: E Discharge Point**

Inflow Area = 11.470 ac, Inflow Depth = 1.82" for 10-yr Storm event event  
Inflow = 15.45 cfs @ 12.35 hrs, Volume= 1.738 af  
Outflow = 15.45 cfs @ 12.35 hrs, Volume= 1.738 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Reach 5R: N Discharge Point**

Inflow Area = 6.120 ac, Inflow Depth = 1.82" for 10-yr Storm event event  
Inflow = 19.80 cfs @ 11.98 hrs, Volume= 0.927 af  
Outflow = 19.80 cfs @ 11.98 hrs, Volume= 0.927 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Reach 6R: NE Discharge Point**

Inflow Area = 0.400 ac, Inflow Depth = 1.82" for 10-yr Storm event event  
Inflow = 1.11 cfs @ 12.02 hrs, Volume= 0.061 af  
Outflow = 1.11 cfs @ 12.02 hrs, Volume= 0.061 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Reach 7R: (new Reach)**

Inflow Area = 52.910 ac, Inflow Depth = 1.82" for 10-yr Storm event event  
Inflow = 57.79 cfs @ 12.38 hrs, Volume= 8.016 af  
Outflow = 57.79 cfs @ 12.38 hrs, Volume= 8.016 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Rosemount Business Park Third Addition**  
Rosemount, Minnesota

**HydroCAD Calculations**  
**10-Year Proposed Conditions**

**20070522 Proposed Site-PBJ**

Type II 24-hr 10-yr Storm event Rainfall=4.20"

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Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 4

Runoff by SCS TR-20 method, UH=SCS

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

**Subcatchment City Lot: City Lot**

Runoff Area=12.270 ac Runoff Depth=3.31"  
Tc=5.0 min CN=92 Runoff=69.49 cfs 3.385 af

**Subcatchment Developed Lot: Developed Lot**

Runoff Area=36.590 ac Runoff Depth=3.21"  
Flow Length=2,060' Tc=5.9 min CN=91 Runoff=196.99 cfs 9.785 af

**Subcatchment Pond Outlot: Pond Outlot**

Runoff Area=4.070 ac Runoff Depth=1.53"  
Flow Length=50' Tc=2.2 min CN=71 Runoff=12.92 cfs 0.520 af

**Pond INF BASIN: Infiltration Basin**

Peak Elev=946.64' Storage=252,435 cf Inflow=54.07 cfs 8.774 af  
Discarded=1.17 cfs 5.596 af Secondary=0.00 cfs 0.000 af Outflow=1.17 cfs 5.596 af

**Pond Pond: Stormwater Pond**

Peak Elev=946.69' Storage=572,578 cf Inflow=276.77 cfs 13.691 af  
Discarded=0.34 cfs 1.391 af Primary=54.07 cfs 8.774 af Secondary=0.00 cfs 0.000 af Outflow=54.41 cfs 10.165 af

**Total Runoff Area = 52.930 ac Runoff Volume = 13.691 af Average Runoff Depth = 3.10"**

**Subcatchment City Lot: City Lot**

Runoff = 69.49 cfs @ 11.96 hrs, Volume= 3.385 af, Depth= 3.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 10-yr Storm event Rainfall=4.20"

Area (ac)	CN	Description
10.430	98	Paved parking & roofs
1.840	61	>75% Grass cover, Good, HSG B
12.270	92	Weighted Average

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

**Subcatchment Developed Lot: Developed Lot**

Runoff = 196.99 cfs @ 11.97 hrs, Volume= 9.785 af, Depth= 3.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 10-yr Storm event Rainfall=4.20"

Area (ac)	CN	Description
29.270	98	Paved parking & roofs
7.320	61	>75% Grass cover, Good, HSG B
36.590	91	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	60	0.0200	1.2		<b>Sheet Flow, Across Pavement</b> Smooth surfaces n= 0.011 P2= 2.80"
5.0	2,000	0.0040	6.6	63.63	<b>Circular Channel (pipe), Pipe</b> Diam= 42.0" Area= 9.6 sf Perim= 11.0' r= 0.88' n= 0.013
5.9	2,060	Total			

**Subcatchment Pond Outlot: Pond Outlot**

Runoff = 12.92 cfs @ 11.93 hrs, Volume= 0.520 af, Depth= 1.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 10-yr Storm event Rainfall=4.20"

Area (ac)	CN	Description
1.080	100	Pond NWL
2.990	61	>75% Grass cover, Good, HSG B
4.070	71	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	50	0.2500	0.4		<b>Sheet Flow, Grass Slope</b> Grass: Short n= 0.150 P2= 2.80"

**Pond INF BASIN: Infiltration Basin**

Inflow Area = 52.930 ac, Inflow Depth = 1.99" for 10-yr Storm event event  
 Inflow = 54.07 cfs @ 12.12 hrs, Volume= 8.774 af  
 Outflow = 1.17 cfs @ 24.08 hrs, Volume= 5.596 af, Atten= 98%, Lag= 717.5 min  
 Discarded = 1.17 cfs @ 24.08 hrs, Volume= 5.596 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 4  
 Peak Elev= 946.64' @ 24.08 hrs Surf.Area= 67,576 sf Storage= 252,435 cf  
 Plug-Flow detention time=(not calculated: outflow precedes inflow)  
 Center-of-Mass det. time=(not calculated)

#	Invert	Avail.Storage	Storage Description
1	942.00'	426,330 cf	<b>Custom Stage Data (Prismatic)</b> Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
942.00	40,450	0	0
944.00	51,780	92,230	92,230
946.00	63,600	115,380	207,610
948.00	75,980	139,580	347,190
949.00	82,300	79,140	426,330

#	Routing	Invert	Outlet Devices
1	Discarded	0.00'	<b>0.001042 fpm Exfiltration over entire Surface area</b>
2	Secondary	949.00'	<b>30.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

**Discarded OutFlow** Max=1.17 cfs @ 24.08 hrs HW=946.64' (Free Discharge)  
 ↳1=Exfiltration (Exfiltration Controls 1.17 cfs)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=942.00' (Free Discharge)  
 ↳2=Broad-Crested Rectangular Weir( Controls 0.00 cfs)

**Pond Pond: Stormwater Pond**

Inflow Area = 52.930 ac, Inflow Depth = 3.10" for 10-yr Storm event event  
 Inflow = 276.77 cfs @ 11.96 hrs, Volume= 13.691 af  
 Outflow = 54.41 cfs @ 12.12 hrs, Volume= 10.165 af, Atten= 80%, Lag= 9.7 min  
 Discarded = 0.34 cfs @ 12.12 hrs, Volume= 1.391 af  
 Primary = 54.07 cfs @ 12.12 hrs, Volume= 8.774 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 4

**20070522 Proposed Site-PBJ**

Type II 24-hr 10-yr Storm event Rainfall=4.20"

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Starting Elev= 942.00' Surf.Area= 48,464 sf Storage= 298,123 cf

Peak Elev= 946.69' @ 12.12 hrs Surf.Area= 68,078 sf Storage= 572,578 cf (274,456 cf above start)

Plug-Flow detention time=1,915.5 min calculated for 3.321 af (24% of inflow)

Center-of-Mass det. time= 581.7 min ( 1,372.0 - 790.3 )

#	Invert	Avail.Storage	Storage Description
1	932.00'	820,640 cf	<b>Custom Stage Data (Prismatic)</b> listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
932.00	18,228	0	0
934.00	22,402	40,630	40,630
936.00	26,830	49,232	89,862
938.00	31,567	58,397	148,259
940.00	36,577	68,144	216,403
941.00	39,199	37,888	254,291
942.00	48,464	43,832	298,123
944.00	56,453	104,917	403,040
946.00	64,955	121,408	524,448
948.00	73,968	138,923	663,371
950.00	83,301	157,269	820,640

#	Routing	Invert	Outlet Devices
1	Primary	942.00'	<b>36.0" x 50.0' long Culvert RCP</b> , end-section conforming to fill, Ke= 0.500 Outlet Invert= 942.00' S= 0.0000 '/' n= 0.013 Cc= 0.900
2	Discarded	942.00'	<b>0.001042 fpm Exfiltration over Surface area above invert</b>
3	Secondary	949.50'	<b>150.0' long x 50.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.34 cfs @ 12.12 hrs HW=946.69' (Free Discharge)

↳ 2=Exfiltration (Exfiltration Controls 0.34 cfs)

Primary OutFlow Max=54.07 cfs @ 12.12 hrs HW=946.69' TW=943.39' (Dynamic Tailwater)

↳ 1=Culvert (Barrel Controls 54.07 cfs @ 7.6 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=942.00' TW=942.00' (Dynamic Tailwater)

↳ 3=Broad-Crested Rectangular Weir( Controls 0.00 cfs)

**Rosemount Business Park Third Addition**  
Rosemount, Minnesota

**HydroCAD Calculations**  
**100-Year Existing Conditions**

**Existing Site 20070523**

Type II 24-hr 100-yr Storm event Rainfall=6.00"

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Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

<b>Subcatchment E: (new Subcat)</b>	Runoff Area=11.470 ac Runoff Depth=3.28"
	Flow Length=1,146' Tc=36.7 min CN=75 Runoff=28.48 cfs 3.137 af
<b>Subcatchment N: (new Subcat)</b>	Runoff Area=6.120 ac Runoff Depth=3.28"
	Flow Length=170' Tc=6.2 min CN=75 Runoff=35.42 cfs 1.674 af
<b>Subcatchment NE: (new Subcat)</b>	Runoff Area=0.400 ac Runoff Depth=3.28"
	Flow Length=173' Tc=10.3 min CN=75 Runoff=2.00 cfs 0.109 af
<b>Subcatchment S: (new Subcat)</b>	Runoff Area=10.180 ac Runoff Depth=3.28"
	Flow Length=1,097' Tc=37.7 min CN=75 Runoff=24.84 cfs 2.784 af
<b>Subcatchment SE: (new Subcat)</b>	Runoff Area=0.940 ac Runoff Depth=3.28"
	Flow Length=282' Tc=18.5 min CN=75 Runoff=3.59 cfs 0.257 af
<b>Subcatchment SW: (new Subcat)</b>	Runoff Area=23.800 ac Runoff Depth=3.28"
	Flow Length=1,159' Tc=46.6 min CN=75 Runoff=49.96 cfs 6.509 af
<b>Reach 1R: S Discharge Point</b>	Inflow=24.84 cfs 2.784 af Outflow=24.84 cfs 2.784 af
<b>Reach 2R: SW Discharge Point</b>	Inflow=49.96 cfs 6.509 af Outflow=49.96 cfs 6.509 af
<b>Reach 3R: SE Discharge Point</b>	Inflow=3.59 cfs 0.257 af Outflow=3.59 cfs 0.257 af
<b>Reach 4R: E Discharge Point</b>	Inflow=28.48 cfs 3.137 af Outflow=28.48 cfs 3.137 af
<b>Reach 5R: N Discharge Point</b>	Inflow=35.42 cfs 1.674 af Outflow=35.42 cfs 1.674 af
<b>Reach 6R: NE Discharge Point</b>	Inflow=2.00 cfs 0.109 af Outflow=2.00 cfs 0.109 af
<b>Reach 7R: (new Reach)</b>	Inflow=106.58 cfs 14.471 af Outflow=106.58 cfs 14.471 af

**Total Runoff Area = 52.910 ac Runoff Volume = 14.471 af Average Runoff Depth = 3.28"**

**Existing Site 20070523**

Type II 24-hr 100-yr Storm event Rainfall=6.00"

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**Subcatchment E: (new Subcat)**

Runoff = 28.48 cfs @ 12.32 hrs, Volume= 3.137 af, Depth= 3.28"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 100-yr Storm event Rainfall=6.00"

Area (ac)	CN	Description
11.470	75	Row crops, SR + CR, Good, HSG B

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.8	300	0.0061	0.3		<b>Sheet Flow,</b> Fallow n= 0.050 P2= 2.80"
0.6	27	0.0061	0.7		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
17.3	560	0.0036	0.5		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
2.0	259	0.0560	2.1		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
36.7	1,146	Total			

**Subcatchment N: (new Subcat)**

Runoff = 35.42 cfs @ 11.98 hrs, Volume= 1.674 af, Depth= 3.28"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 100-yr Storm event Rainfall=6.00"

Area (ac)	CN	Description
6.120	75	Row crops, SR + CR, Good, HSG B

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	170	0.0240	0.5		<b>Sheet Flow,</b> Fallow n= 0.050 P2= 2.80"

**Subcatchment NE: (new Subcat)**

Runoff = 2.00 cfs @ 12.02 hrs, Volume= 0.109 af, Depth= 3.28"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 100-yr Storm event Rainfall=6.00"

Area (ac)	CN	Description
0.400	75	Row crops, SR + CR, Good, HSG B

**Existing Site 20070523**

Type II 24-hr 100-yr Storm event Rainfall=6.00"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.5	138	0.0072	0.3		<b>Sheet Flow,</b> Fallow n= 0.050 P2= 2.80"
1.8	35	0.0215	0.3		<b>Sheet Flow,</b> Fallow n= 0.050 P2= 2.80"
10.3	173	Total			

**Subcatchment S: (new Subcat)**

Runoff = 24.84 cfs @ 12.35 hrs, Volume= 2.784 af, Depth= 3.28"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 100-yr Storm event Rainfall=6.00"

Area (ac)	CN	Description
10.180	75	Row crops, SR + CR, Good, HSG B

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.6	300	0.0037	0.2		<b>Sheet Flow,</b> Fallow n= 0.050 P2= 2.80"
7.0	229	0.0037	0.5		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
8.5	348	0.0057	0.7		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
1.6	220	0.0650	2.3		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
37.7	1,097	Total			

**Subcatchment SE: (new Subcat)**

Runoff = 3.59 cfs @ 12.11 hrs, Volume= 0.257 af, Depth= 3.28"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 100-yr Storm event Rainfall=6.00"

Area (ac)	CN	Description
0.940	75	Row crops, SR + CR, Good, HSG B

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.4	265	0.0038	0.2		<b>Sheet Flow,</b> Fallow n= 0.050 P2= 2.80"
0.1	17	0.0597	2.2		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
18.5	282	Total			

**Existing Site 20070523**

Type II 24-hr 100-yr Storm event Rainfall=6.00"

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**Subcatchment SW: (new Subcat)**

Runoff = 49.96 cfs @ 12.47 hrs, Volume= 6.509 af, Depth= 3.28"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 100-yr Storm event Rainfall=6.00"

Area (ac)	CN	Description
23.800	75	Row crops, SR + CR, Good, HSG B

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.1	300	0.0025	0.2		Sheet Flow, Fallow n= 0.050 P2= 2.80"
18.6	503	0.0025	0.4		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
3.9	356	0.0280	1.5		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
46.6	1,159	Total			

**Reach 1R: S Discharge Point**

Inflow Area = 10.180 ac, Inflow Depth = 3.28" for 100-yr Storm event event  
 Inflow = 24.84 cfs @ 12.35 hrs, Volume= 2.784 af  
 Outflow = 24.84 cfs @ 12.35 hrs, Volume= 2.784 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Reach 2R: SW Discharge Point**

Inflow Area = 23.800 ac, Inflow Depth = 3.28" for 100-yr Storm event event  
 Inflow = 49.96 cfs @ 12.47 hrs, Volume= 6.509 af  
 Outflow = 49.96 cfs @ 12.47 hrs, Volume= 6.509 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Reach 3R: SE Discharge Point**

Inflow Area = 0.940 ac, Inflow Depth = 3.28" for 100-yr Storm event event  
 Inflow = 3.59 cfs @ 12.11 hrs, Volume= 0.257 af  
 Outflow = 3.59 cfs @ 12.11 hrs, Volume= 0.257 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Existing Site 20070523**

Type II 24-hr 100-yr Storm event Rainfall=6.00"

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**Reach 4R: E Discharge Point**

Inflow Area = 11.470 ac, Inflow Depth = 3.28" for 100-yr Storm event event  
Inflow = 28.48 cfs @ 12.32 hrs, Volume= 3.137 af  
Outflow = 28.48 cfs @ 12.32 hrs, Volume= 3.137 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Reach 5R: N Discharge Point**

Inflow Area = 6.120 ac, Inflow Depth = 3.28" for 100-yr Storm event event  
Inflow = 35.42 cfs @ 11.98 hrs, Volume= 1.674 af  
Outflow = 35.42 cfs @ 11.98 hrs, Volume= 1.674 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Reach 6R: NE Discharge Point**

Inflow Area = 0.400 ac, Inflow Depth = 3.28" for 100-yr Storm event event  
Inflow = 2.00 cfs @ 12.02 hrs, Volume= 0.109 af  
Outflow = 2.00 cfs @ 12.02 hrs, Volume= 0.109 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Reach 7R: (new Reach)**

Inflow Area = 52.910 ac, Inflow Depth = 3.28" for 100-yr Storm event event  
Inflow = 106.58 cfs @ 12.37 hrs, Volume= 14.471 af  
Outflow = 106.58 cfs @ 12.37 hrs, Volume= 14.471 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Rosemount Business Park Third Addition**  
Rosemount, Minnesota

**HydroCAD Calculations**  
**100-Year Proposed Conditions**

**20070522 Proposed Site-PBJ**

Type II 24-hr 100-yr Storm event Rainfall=6.00"

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Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 4

Runoff by SCS TR-20 method, UH=SCS

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

**Subcatchment City Lot: City Lot**

Runoff Area=12.270 ac Runoff Depth=5.07"

Tc=5.0 min CN=92 Runoff=103.34 cfs 5.184 af

**Subcatchment Developed Lot: Developed Lot**

Runoff Area=36.590 ac Runoff Depth=4.96"

Flow Length=2,060' Tc=5.9 min CN=91 Runoff=295.59 cfs 15.115 af

**Subcatchment Pond Outlot: Pond Outlot**

Runoff Area=4.070 ac Runoff Depth=2.90"

Flow Length=50' Tc=2.2 min CN=71 Runoff=24.26 cfs 0.983 af

**Pond INF BASIN: Infiltration Basin**

Peak Elev=948.76' Storage=407,300 cf Inflow=69.43 cfs 12.722 af

Discarded=1.40 cfs 6.773 af Secondary=0.00 cfs 0.000 af Outflow=1.40 cfs 6.773 af

**Pond Pond: Stormwater Pond**

Peak Elev=948.76' Storage=723,318 cf Inflow=418.25 cfs 21.282 af

Discarded=0.50 cfs 2.187 af Primary=69.43 cfs 12.722 af Secondary=0.00 cfs 0.000 af Outflow=69.92 cfs 14.909 af

**Total Runoff Area = 52.930 ac Runoff Volume = 21.282 af Average Runoff Depth = 4.82"**

**Subcatchment City Lot: City Lot**

Runoff = 103.34 cfs @ 11.96 hrs, Volume= 5.184 af, Depth= 5.07"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 100-yr Storm event Rainfall=6.00"

Area (ac)	CN	Description
10.430	98	Paved parking & roofs
1.840	61	>75% Grass cover, Good, HSG B
12.270	92	Weighted Average

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

**Subcatchment Developed Lot: Developed Lot**

Runoff = 295.59 cfs @ 11.97 hrs, Volume= 15.115 af, Depth= 4.96"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 100-yr Storm event Rainfall=6.00"

Area (ac)	CN	Description
29.270	98	Paved parking & roofs
7.320	61	>75% Grass cover, Good, HSG B
36.590	91	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	60	0.0200	1.2		<b>Sheet Flow, Across Pavement</b> Smooth surfaces n= 0.011 P2= 2.80"
5.0	2,000	0.0040	6.6	63.63	<b>Circular Channel (pipe), Pipe</b> Diam= 42.0" Area= 9.6 sf Perim= 11.0' r= 0.88' n= 0.013
5.9	2,060	Total			

**Subcatchment Pond Outlot: Pond Outlot**

Runoff = 24.26 cfs @ 11.93 hrs, Volume= 0.983 af, Depth= 2.90"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 100-yr Storm event Rainfall=6.00"

Area (ac)	CN	Description
1.080	100	Pond NWL
2.990	61	>75% Grass cover, Good, HSG B
4.070	71	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	50	0.2500	0.4		<b>Sheet Flow, Grass Slope</b> Grass: Short n= 0.150 P2= 2.80"

**Pond INF BASIN: Infiltration Basin**

Inflow Area = 52.930 ac, Inflow Depth = 2.88" for 100-yr Storm event event  
 Inflow = 69.43 cfs @ 12.07 hrs, Volume= 12.722 af  
 Outflow = 1.40 cfs @ 24.10 hrs, Volume= 6.773 af, Atten= 98%, Lag= 722.0 min  
 Discarded = 1.40 cfs @ 24.10 hrs, Volume= 6.773 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 4  
 Peak Elev= 948.76' @ 24.10 hrs Surf.Area= 80,780 sf Storage= 407,300 cf  
 Plug-Flow detention time=(not calculated: outflow precedes inflow)  
 Center-of-Mass det. time=(not calculated)

#	Invert	Avail.Storage	Storage Description
1	942.00'	426,330 cf	<b>Custom Stage Data (Prismatic)</b> listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
942.00	40,450	0	0
944.00	51,780	92,230	92,230
946.00	63,600	115,380	207,610
948.00	75,980	139,580	347,190
949.00	82,300	79,140	426,330

#	Routing	Invert	Outlet Devices
1	Discarded	0.00'	<b>0.001042 fpm Exfiltration over entire Surface area</b>
2	Secondary	949.00'	<b>30.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=1.40 cfs @ 24.10 hrs HW=948.76' (Free Discharge)  
 ↳1=Exfiltration (Exfiltration Controls 1.40 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=942.00' (Free Discharge)  
 ↳2=Broad-Crested Rectangular Weir( Controls 0.00 cfs)

**Pond Pond: Stormwater Pond**

Inflow Area = 52.930 ac, Inflow Depth = 4.82" for 100-yr Storm event event  
 Inflow = 418.25 cfs @ 11.96 hrs, Volume= 21.282 af  
 Outflow = 69.92 cfs @ 12.07 hrs, Volume= 14.909 af, Atten= 83%, Lag= 6.4 min  
 Discarded = 0.50 cfs @ 24.05 hrs, Volume= 2.187 af  
 Primary = 69.43 cfs @ 12.07 hrs, Volume= 12.722 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 4

**20070522 Proposed Site-PBJ**

Type II 24-hr 100-yr Storm event Rainfall=6.00"

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Starting Elev= 942.00' Surf.Area= 48,464 sf Storage= 298,123 cf  
 Peak Elev= 948.76' @ 24.05 hrs Surf.Area= 77,526 sf Storage= 723,318 cf (425,195 cf above start)  
 Plug-Flow detention time=1,121.3 min calculated for 8.065 af (38% of inflow)  
 Center-of-Mass det. time=504.1 min ( 1,282.9 - 778.8 )

#	Invert	Avail.Storage	Storage Description
1	932.00'	820,640 cf	<b>Custom Stage Data (Prismatic)</b> , listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
932.00	18,228	0	0
934.00	22,402	40,630	40,630
936.00	26,830	49,232	89,862
938.00	31,567	58,397	148,259
940.00	36,577	68,144	216,403
941.00	39,199	37,888	254,291
942.00	48,464	43,832	298,123
944.00	56,453	104,917	403,040
946.00	64,955	121,408	524,448
948.00	73,968	138,923	663,371
950.00	83,301	157,269	820,640

#	Routing	Invert	Outlet Devices
1	Primary	942.00'	<b>36.0" x 50.0' long Culvert RCP</b> , end-section conforming to fill, Ke= 0.500 Outlet Invert= 942.00' S= 0.0000 '/' n= 0.013 Cc= 0.900
2	Discarded	942.00'	<b>0.001042 fpm Exfiltration over Surface area above invert</b>
3	Secondary	949.50'	<b>150.0' long x 50.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

**Discarded OutFlow** Max=0.50 cfs @ 24.05 hrs HW=948.76' (Free Discharge)  
 ↳ **2=Exfiltration** (Exfiltration Controls 0.50 cfs)

**Primary OutFlow** Max=69.42 cfs @ 12.07 hrs HW=948.54' TW=944.38' (Dynamic Tailwater)  
 ↳ **1=Culvert** (Inlet Controls 69.42 cfs @ 9.8 fps)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=942.00' TW=942.00' (Dynamic Tailwater)  
 ↳ **3=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

**Rosemount Business Park Third Addition**  
Rosemount, Minnesota

**HydroCAD Calculations**  
**10-Day Snowmelt Existing Conditions**

Time span=0.00-240.00 hrs, dt=0.01 hrs, 24001 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment E: (new Subcat)** Runoff Area=11.470 ac Runoff Depth=6.85"  
Flow Length=1,146' Tc=36.7 min Adjusted CN=98 Runoff=1.58 cfs 6.551 af

**Subcatchment N: (new Subcat)** Runoff Area=6.120 ac Runoff Depth=6.86"  
Flow Length=170' Tc=6.2 min Adjusted CN=98 Runoff=0.84 cfs 3.498 af

**Subcatchment NE: (new Subcat)** Runoff Area=0.400 ac Runoff Depth=6.86"  
Flow Length=173' Tc=10.3 min Adjusted CN=98 Runoff=0.06 cfs 0.229 af

**Subcatchment S: (new Subcat)** Runoff Area=10.180 ac Runoff Depth=6.85"  
Flow Length=1,097' Tc=37.7 min Adjusted CN=98 Runoff=1.40 cfs 5.814 af

**Subcatchment SE: (new Subcat)** Runoff Area=0.940 ac Runoff Depth=6.86"  
Flow Length=282' Tc=18.5 min Adjusted CN=98 Runoff=0.13 cfs 0.537 af

**Subcatchment SW: (new Subcat)** Runoff Area=23.800 ac Runoff Depth=6.85"  
Flow Length=1,159' Tc=46.6 min Adjusted CN=98 Runoff=3.28 cfs 13.590 af

**Reach 1R: S Discharge Point** Inflow=1.40 cfs 5.814 af  
Outflow=1.40 cfs 5.814 af

**Reach 2R: SW Discharge Point** Inflow=3.28 cfs 13.590 af  
Outflow=3.28 cfs 13.590 af

**Reach 3R: SE Discharge Point** Inflow=0.13 cfs 0.537 af  
Outflow=0.13 cfs 0.537 af

**Reach 4R: E Discharge Point** Inflow=1.58 cfs 6.551 af  
Outflow=1.58 cfs 6.551 af

**Reach 5R: N Discharge Point** Inflow=0.84 cfs 3.498 af  
Outflow=0.84 cfs 3.498 af

**Reach 6R: NE Discharge Point** Inflow=0.06 cfs 0.229 af  
Outflow=0.06 cfs 0.229 af

**Reach 7R: (new Reach)** Inflow=7.28 cfs 30.220 af  
Outflow=7.28 cfs 30.220 af

**Total Runoff Area = 52.910 ac Runoff Volume = 30.220 af Average Runoff Depth = 6.85"**

**Subcatchment E: (new Subcat)**

Runoff = 1.58 cfs @ 96.36 hrs, Volume= 6.551 af, Depth= 6.85"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
snow unit hyetograph 10-Day Snowmelt Rainfall=7.10", AMC=4

Area (ac)	CN	Description
11.470	75	Row crops, SR + CR, Good, HSG B
11.470	75	Weighted Average, Adjusted for AMC = 98

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.8	300	0.0061	0.3		<b>Sheet Flow,</b> Fallow n= 0.050 P2= 2.80"
0.6	27	0.0061	0.7		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
17.3	560	0.0036	0.5		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
2.0	259	0.0560	2.1		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
36.7	1,146	Total			

**Subcatchment N: (new Subcat)**

Runoff = 0.84 cfs @ 96.08 hrs, Volume= 3.498 af, Depth= 6.86"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
snow unit hyetograph 10-Day Snowmelt Rainfall=7.10", AMC=4

Area (ac)	CN	Description
6.120	75	Row crops, SR + CR, Good, HSG B
6.120	75	Weighted Average, Adjusted for AMC = 98

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	170	0.0240	0.5		<b>Sheet Flow,</b> Fallow n= 0.050 P2= 2.80"

**Subcatchment NE: (new Subcat)**

Runoff = 0.06 cfs @ 96.10 hrs, Volume= 0.229 af, Depth= 6.86"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
snow unit hyetograph 10-Day Snowmelt Rainfall=7.10", AMC=4

Area (ac)	CN	Description
0.400	75	Row crops, SR + CR, Good, HSG B
0.400	75	Weighted Average, Adjusted for AMC = 98

**Existing Site 20070523**

snow unit hyetograph 10-Day Snowmelt Rainfall=7.10", AMC=4

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.5	138	0.0072	0.3		<b>Sheet Flow,</b> Fallow n= 0.050 P2= 2.80"
1.8	35	0.0215	0.3		<b>Sheet Flow,</b> Fallow n= 0.050 P2= 2.80"
10.3	173	Total			

**Subcatchment S: (new Subcat)**

Runoff = 1.40 cfs @ 96.30 hrs, Volume= 5.814 af, Depth= 6.85"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
snow unit hyetograph 10-Day Snowmelt Rainfall=7.10", AMC=4

Area (ac)	CN	Description
10.180	75	Row crops, SR + CR, Good, HSG B
10.180	75	Weighted Average, Adjusted for AMC = 98

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.6	300	0.0037	0.2		<b>Sheet Flow,</b> Fallow n= 0.050 P2= 2.80"
7.0	229	0.0037	0.5		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
8.5	348	0.0057	0.7		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
1.6	220	0.0650	2.3		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
37.7	1,097	Total			

**Subcatchment SE: (new Subcat)**

Runoff = 0.13 cfs @ 96.18 hrs, Volume= 0.537 af, Depth= 6.86"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
snow unit hyetograph 10-Day Snowmelt Rainfall=7.10", AMC=4

Area (ac)	CN	Description
0.940	75	Row crops, SR + CR, Good, HSG B
0.940	75	Weighted Average, Adjusted for AMC = 98

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.4	265	0.0038	0.2		<b>Sheet Flow,</b> Fallow n= 0.050 P2= 2.80"
0.1	17	0.0597	2.2		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
18.5	282	Total			

**Subcatchment SW: (new Subcat)**

Runoff = 3.28 cfs @ 96.46 hrs, Volume= 13.590 af, Depth= 6.85"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
 snow unit hyetograph 10-Day Snowmelt Rainfall=7.10", AMC=4

Area (ac)	CN	Description
23.800	75	Row crops, SR + CR, Good, HSG B
23.800	75	Weighted Average, Adjusted for AMC = 98

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.1	300	0.0025	0.2		Sheet Flow, Fallow n= 0.050 P2= 2.80"
18.6	503	0.0025	0.4		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
3.9	356	0.0280	1.5		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
46.6	1,159	Total			

**Reach 1R: S Discharge Point**

Inflow Area = 10.180 ac, Inflow Depth = 6.85" for 10-Day Snowmelt event  
 Inflow = 1.40 cfs @ 96.30 hrs, Volume= 5.814 af  
 Outflow = 1.40 cfs @ 96.30 hrs, Volume= 5.814 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs

**Reach 2R: SW Discharge Point**

Inflow Area = 23.800 ac, Inflow Depth = 6.85" for 10-Day Snowmelt event  
 Inflow = 3.28 cfs @ 96.46 hrs, Volume= 13.590 af  
 Outflow = 3.28 cfs @ 96.46 hrs, Volume= 13.590 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs

**Reach 3R: SE Discharge Point**

Inflow Area = 0.940 ac, Inflow Depth = 6.86" for 10-Day Snowmelt event  
 Inflow = 0.13 cfs @ 96.18 hrs, Volume= 0.537 af  
 Outflow = 0.13 cfs @ 96.18 hrs, Volume= 0.537 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs

**Reach 4R: E Discharge Point**

Inflow Area = 11.470 ac, Inflow Depth = 6.85" for 10-Day Snowmelt event  
Inflow = 1.58 cfs @ 96.36 hrs, Volume= 6.551 af  
Outflow = 1.58 cfs @ 96.36 hrs, Volume= 6.551 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs

**Reach 5R: N Discharge Point**

Inflow Area = 6.120 ac, Inflow Depth = 6.86" for 10-Day Snowmelt event  
Inflow = 0.84 cfs @ 96.08 hrs, Volume= 3.498 af  
Outflow = 0.84 cfs @ 96.08 hrs, Volume= 3.498 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs

**Reach 6R: NE Discharge Point**

Inflow Area = 0.400 ac, Inflow Depth = 6.86" for 10-Day Snowmelt event  
Inflow = 0.06 cfs @ 96.10 hrs, Volume= 0.229 af  
Outflow = 0.06 cfs @ 96.10 hrs, Volume= 0.229 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs

**Reach 7R: (new Reach)**

Inflow Area = 52.910 ac, Inflow Depth = 6.85" for 10-Day Snowmelt event  
Inflow = 7.28 cfs @ 96.36 hrs, Volume= 30.220 af  
Outflow = 7.28 cfs @ 96.36 hrs, Volume= 30.220 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs

**Rosemount Business Park Third Addition**  
Rosemount, Minnesota

**HydroCAD Calculations**  
**10-Day Snowmelt Proposed Conditions**

Time span=0.00-240.00 hrs, dt=0.01 hrs, 24001 points x 4  
Runoff by SCS TR-20 method, UH=SCS  
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment City Lot: City Lot** Runoff Area=12.270 ac Runoff Depth=6.86"  
Tc=5.0 min Adjusted CN=98 Runoff=1.69 cfs 7.014 af

**Subcatchment Developed Lot: Developed Lot** Runoff Area=36.590 ac Runoff Depth=6.86"  
Flow Length=2,060' Tc=5.9 min Adjusted CN=98 Runoff=5.04 cfs 20.917 af

**Subcatchment Pond Outlot: Pond Outlot** Runoff Area=4.070 ac Runoff Depth=6.86"  
Flow Length=50' Tc=2.2 min Adjusted CN=98 Runoff=0.56 cfs 2.327 af

**Pond INF BASIN: Infiltration Basin** Peak Elev=946.94' Storage=273,459 cf Inflow=3.98 cfs 21.899 af  
Discarded=1.21 cfs 18.077 af Secondary=0.00 cfs 0.000 af Outflow=1.21 cfs 18.077 af

**Pond Pond: Stormwater Pond** Peak Elev=946.94' Storage=590,073 cf Inflow=7.30 cfs 30.258 af  
Discarded=0.36 cfs 4.156 af Primary=3.98 cfs 21.899 af Secondary=0.00 cfs 0.000 af Outflow=4.26 cfs 26.055 af

**Total Runoff Area = 52.930 ac Runoff Volume = 30.258 af Average Runoff Depth = 6.86"**

**Subcatchment City Lot: City Lot**

Runoff = 1.69 cfs @ 96.05 hrs, Volume= 7.014 af, Depth= 6.86"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
 snow unit hyetograph 10-Day Snowmelt Rainfall=7.10", AMC=4

Area (ac)	CN	Description
10.430	98	Paved parking & roofs
1.840	61	>75% Grass cover, Good, HSG B
12.270	92	Weighted Average, Adjusted for AMC = 98

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

**Subcatchment Developed Lot: Developed Lot**

Runoff = 5.04 cfs @ 96.06 hrs, Volume= 20.917 af, Depth= 6.86"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
 snow unit hyetograph 10-Day Snowmelt Rainfall=7.10", AMC=4

Area (ac)	CN	Description
29.270	98	Paved parking & roofs
7.320	61	>75% Grass cover, Good, HSG B
36.590	91	Weighted Average, Adjusted for AMC = 98

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	60	0.0200	1.2		Sheet Flow, Across Pavement Smooth surfaces n= 0.011 P2= 2.80"
5.0	2,000	0.0040	6.6	63.63	Circular Channel (pipe), Pipe Diam= 42.0" Area= 9.6 sf Perim= 11.0' r= 0.88' n= 0.013
5.9	2,060	Total			

**Subcatchment Pond Outlot: Pond Outlot**

Runoff = 0.56 cfs @ 96.02 hrs, Volume= 2.327 af, Depth= 6.86"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
 snow unit hyetograph 10-Day Snowmelt Rainfall=7.10", AMC=4

Area (ac)	CN	Description
1.080	100	Pond NWL
2.990	61	>75% Grass cover, Good, HSG B
4.070	71	Weighted Average, Adjusted for AMC = 98

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	50	0.2500	0.4		<b>Sheet Flow, Grass Slope</b> Grass: Short n= 0.150 P2= 2.80"

**Pond INF BASIN: Infiltration Basin**

Inflow Area = 52.930 ac, Inflow Depth = 4.96" for 10-Day Snowmelt event  
 Inflow = 3.98 cfs @ 95.93 hrs, Volume= 21.899 af  
 Outflow = 1.21 cfs @ 125.10 hrs, Volume= 18.077 af, Atten= 70%, Lag= 1,750.3 min  
 Discarded = 1.21 cfs @ 125.10 hrs, Volume= 18.077 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs / 4  
 Peak Elev= 946.94' @ 125.10 hrs Surf.Area= 69,440 sf Storage= 273,459 cf  
 Plug-Flow detention time=(not calculated: outflow precedes inflow)  
 Center-of-Mass det. time=(not calculated)

#	Invert	Avail.Storage	Storage Description
1	942.00'	426,330 cf	<b>Custom Stage Data (Prismatic)</b> Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
942.00	40,450	0	0
944.00	51,780	92,230	92,230
946.00	63,600	115,380	207,610
948.00	75,980	139,580	347,190
949.00	82,300	79,140	426,330

#	Routing	Invert	Outlet Devices
1	Discarded	0.00'	<b>0.001042 fpm Exfiltration over entire Surface area</b>
2	Secondary	949.00'	<b>30.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

**Discarded OutFlow** Max=1.21 cfs @ 125.10 hrs HW=946.94' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 1.21 cfs)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=942.00' (Free Discharge)  
 ↑2=Broad-Crested Rectangular Weir( Controls 0.00 cfs)

**Pond Pond: Stormwater Pond**

Inflow Area = 52.930 ac, Inflow Depth = 6.86" for 10-Day Snowmelt event  
 Inflow = 7.30 cfs @ 96.06 hrs, Volume= 30.258 af  
 Outflow = 4.26 cfs @ 97.89 hrs, Volume= 26.055 af, Atten= 42%, Lag= 109.6 min  
 Discarded = 0.36 cfs @ 125.07 hrs, Volume= 4.156 af  
 Primary = 3.98 cfs @ 95.93 hrs, Volume= 21.899 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs / 4

Starting Elev= 942.00' Surf.Area= 48,464 sf Storage= 298,123 cf  
 Peak Elev= 946.94' @ 125.07 hrs Surf.Area= 69,213 sf Storage= 590,073 cf (291,951 cf above start)  
 Plug-Flow detention time=3,901.6 min calculated for 19,211 af (63% of inflow)  
 Center-of-Mass det. time=873.6 min ( 7,550.7 - 6,677.1 )

#	Invert	Avail.Storage	Storage Description
1	932.00'	820,640 cf	<b>Custom Stage Data (Prismatic)</b> listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
932.00	18,228	0	0
934.00	22,402	40,630	40,630
936.00	26,830	49,232	89,862
938.00	31,567	58,397	148,259
940.00	36,577	68,144	216,403
941.00	39,199	37,888	254,291
942.00	48,464	43,832	298,123
944.00	56,453	104,917	403,040
946.00	64,955	121,408	524,448
948.00	73,968	138,923	663,371
950.00	83,301	157,269	820,640

#	Routing	Invert	Outlet Devices
1	Primary	942.00'	<b>36.0" x 50.0' long Culvert RCP</b> , end-section conforming to fill, Ke= 0.500 Outlet Invert= 942.00' S= 0.0000 '/' n= 0.013 Cc= 0.900
2	Discarded	942.00'	<b>0.001042 fpm Exfiltration over Surface area above invert</b>
3	Secondary	949.50'	<b>150.0' long x 50.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

**Discarded OutFlow** Max=0.36 cfs @ 125.07 hrs HW=946.94' (Free Discharge)

↑ **2=Exfiltration** (Exfiltration Controls 0.36 cfs)

**Primary OutFlow** Max=3.97 cfs @ 95.93 hrs HW=945.73' TW=945.72' (Dynamic Tailwater)

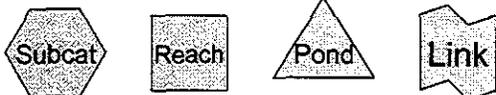
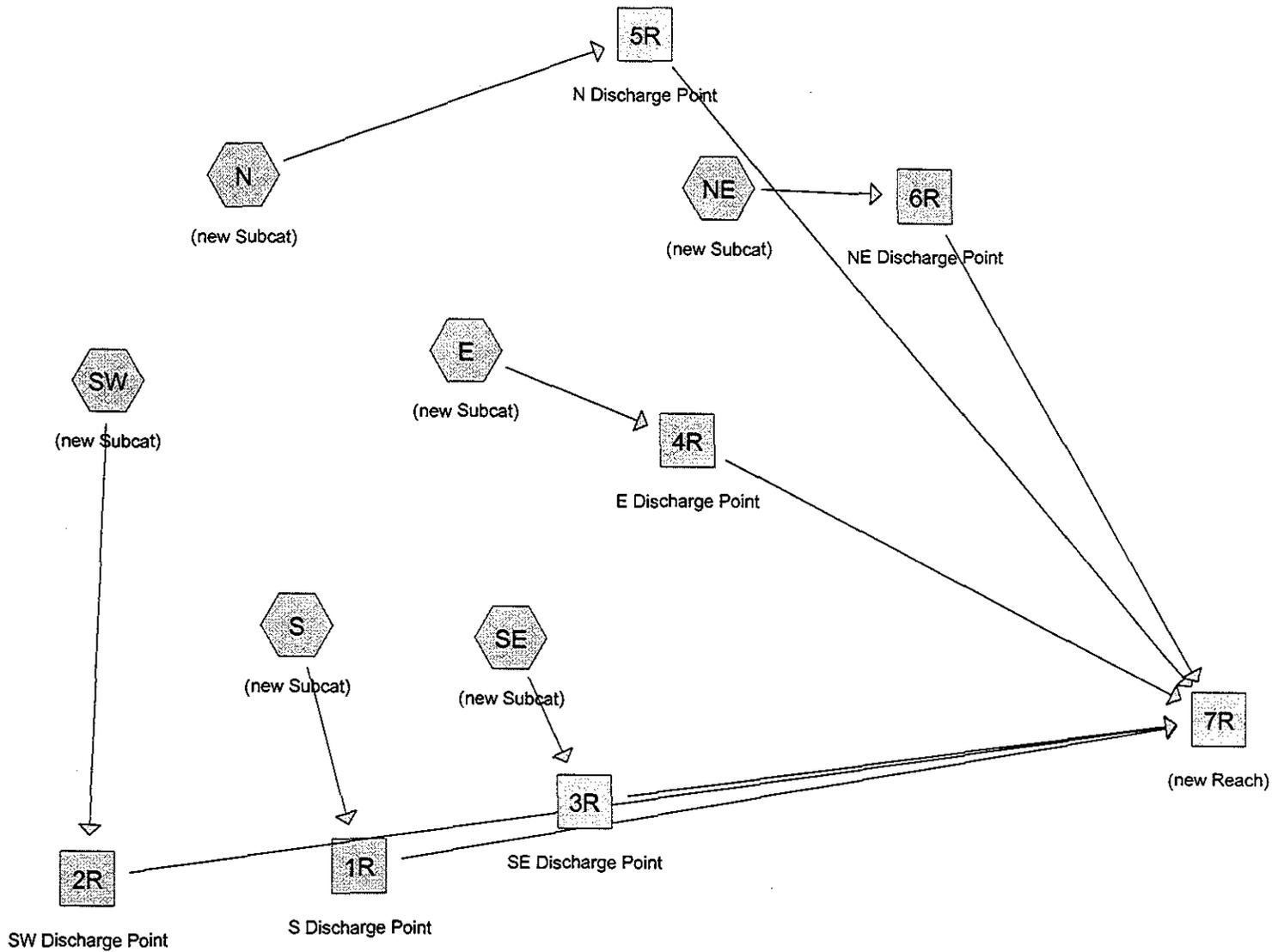
↑ **1=Culvert** (Inlet Controls 3.97 cfs @ 0.6 fps)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=942.00' TW=942.00' (Dynamic Tailwater)

↑ **3=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

**Rosemount Business Park Third Addition**  
Rosemount, Minnesota

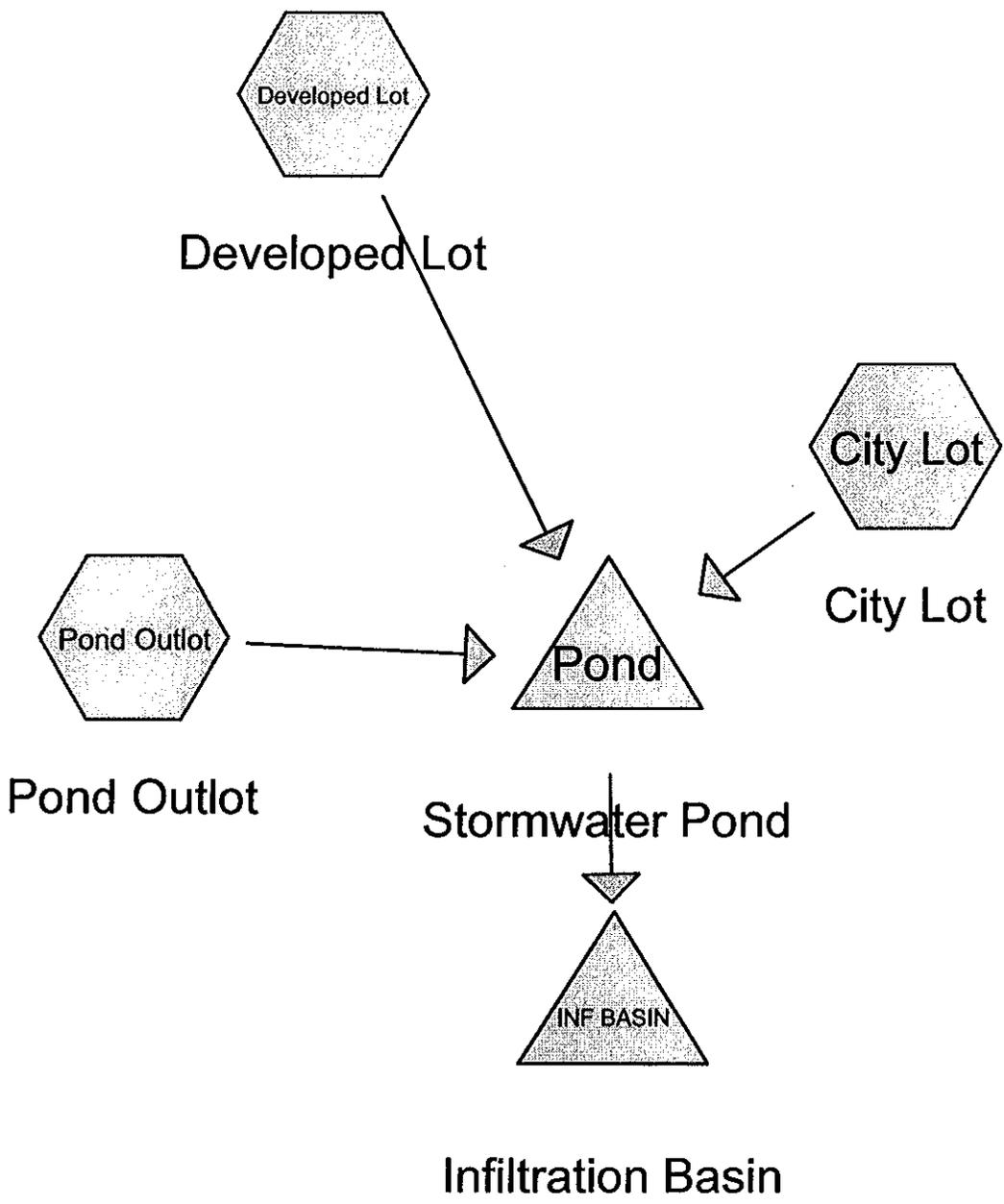
**HydroCAD Drainage Diagram for Existing Conditions**



**Drainage Diagram for Existing Site 20070523**  
 Prepared by RLK Incorporated 5/29/2007  
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**Rosemount Business Park Third Addition**  
Rosemount, Minnesota

**HydroCAD Drainage Diagram for Proposed Conditions**



**Rosemount Business Park Third Addition**  
Rosemount, Minnesota

**Drawings**

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Existing Drainage Areas for HydroCAD Model  
Proposed Drainage Areas for HydroCAD Model  
Preliminary Site Plan  
Preliminary Grading Plan  
Preliminary Utility Plan