

Applicant:

APX Construction
3 Civic Center Plaza Suite 400
Mankato, MN 56001

Project Description

APX Construction is proposing to construct 2 36 unit apartment buildings in the West 1. Of the East ½ of Section S21-T108-26W near the roundabout at Victory Drive and Stadium Road in Mankato, MN. An existing street access off Victory Drive will be utilized for egress to the parcel.

Existing Conditions

The current condition of the site is a previously developed site which now appears vacant. Wetlands are present on the site and were recently delineated. An undisturbed buffer of 16.5' will be maintained from the wetland delineation lines as part of development. The site is relatively flat with a high point in the southern portion of the site with slope northerly and primarily westerly from the high point. The soils on site consist of silty clays and muck near the north as outlined by the attached NRCS soils report. Approximately 1.25 acres of existing gravel surfacing exists on the site.

Adjacent Areas

Victory Drive and Stadium Road front the property on the two sides while developed commercial parcels abut the south and east sides of the site.

The site is not located within a 100 year flood plain as defined by FEMA Flood Insurance Rate Maps.

Areas and Volumes

The parcel consists of approximately 3.9 acres and approximately 2 acres of new impervious surfaces consisting of parking lots and the buildings will be constructed.

Stormwater Management Considerations

Storm water treatment for the proposed construction is proposed via a wet retention basin located in the northwest side of the development. Stormwater off the new roof and parking areas will be collected with curb inlets and be transported via underground storm sewer to the basin. The attached plans illustrate the locations and grades of proposed storm sewer utilities. The proposed bottom of the basin is proposed at elevation 982.50. The basin would have a control structure at the outlet with a 30 degree V-notch weir wall at elevation 987.50 and an overflow weir wall at elevation 988.75 with a basin emergency overflow elevation of 992.00 as outlined in the attached hydro cad calculations. The top of berm for the basin is at 993.00 elevation allowing for a freeboard of at least 2 feet for the 100 year high water elevation of 990.42.

The basin will provide rate control for the 2,10 and 100 year rain events thereby keeping post development rates of runoff the same or less than pre-development rates. This basin will also serve to provide removal of total suspended solids, particulate phosphorus and to a lesser degree, dissolved phosphorus. Consideration was given to implementing infiltration practices, however the onsite silty clay loams are not suitable for infiltration due to being HSG D soils with a shallow water table.

The basin should provide total suspended solids (TSS) on the order of 80% removal as well as particulate phosphorus as shown on the attached Minimal Impact Design Standards (MIDS) pre and post development calculations.

The proposed impervious surface tributary to the new basin will be approximately 4 acres. Storm water runoff will enter the basin via underground storm sewer piping and surface runoff. A dry storage volume of approximately 35,000 cubic feet will be provided via the basin. A WQV of 1.25 acres of new impervious surface * 3600 cu. ft = 0.104 acre ft will be retained. The 1.1" water quality volume (approximately water elevation 988.50) discharge rate will be approximately 2.28 cfs.

Predevelopment and post development rates discharging from the new basin are summarized below. Discharge for the new basin will occur via a 12" outlet pipe into an existing roadway ditch that is currently tributary to existing City storm sewer.

	Pre Development	Post Development
2 Year	5.10 cfs	2.85 cfs
10 Year	9.41 cfs	8.02 cfs
100 Year	23.21 cfs	15.71 cfs

A summary of the treatment calculations and rate calculations is appended to this report.

Maintenance

Seasonal maintenance of the storm water basin will be required to remove accumulated sediment, removal of undesired vegetation and to ensure all upstream and downstream areas are stabilized. Sediment removal can be accomplished via long reach backhoe.

Signatures and Acceptance

We hereby acknowledge we have prepared the grading plan associated with this report.

Brian J. Johnson, Jones Haugh & Smith, Inc.

Date: 6/25/2025

Project Information

Calculator Version:

Version 4: July 2020

Project Name:

Mankato Apartments Existing

User Name / Company Name:

Jones, Haugh & Smith Inc

Date:

6/25/2025

Project Description:

Mankato Apartments

Construction Permit?:

Yes

Site Information

Retention Requirement (inches):

1.1

Site's Zip Code:

56001

Annual Rainfall (inches):

30.7

Phosphorus EMC (mg/l):

0.3

TSS EMC (mg/l):

54.5

Total Site Area

Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)
Forest/Open Space - Undisturbed, protected forest/open space or reforested land				0	0
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed				2.74	2.74
			Impervious Area (acres)		1.26
			Total Area (acres)		4

Site Areas Routed to BMPs

Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)
Forest/Open Space - Undisturbed, protected forest/open space or reforested land					0
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed					0
			Impervious Area (acres)		
			Total Area (acres)		0

Summary Information

Performance Goal Requirement

Performance goal volume retention requirement: 5031 ft³
Volume removed by BMPs towards performance goal: ft³
Percent volume removed towards performance goal %

Annual Volume and Pollutant Load Reductions

Post development annual runoff volume 4.3333 acre-ft
Annual runoff volume removed by BMPs: acre-ft
Percent annual runoff volume removed: %

Post development annual particulate P load: 1.9448 lbs
Annual particulate P removed by BMPs: lbs
Post development annual dissolved P load: 1.591 lbs
Annual dissolved P removed by BMPs: 0 lbs
Total P removed by BMPs 0 lbs
Percent annual total phosphorus removed: %

Post development annual TSS load: 642.4 lbs
Annual TSS removed by BMPs: lbs
Percent annual TSS removed: %

BMP Summary

Performance Goal Summary

BMP Name	BMP Volume Capacity (ft ³)	Volume Recieved (ft ³)	Volume Retained (ft ³)	Volume Outflow (ft ³)	Percent Retained
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Annual Volume Summary

BMP Name	Volume From Direct Watershed (acre-ft)	Volume From Upstream BMPs (acre-ft)	Volume Retained (acre-ft)	Volume outflow (acre-ft)	Percent Retained (%)
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Particulate Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained
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Dissolved Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained
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Total Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained
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TSS Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained
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BMP Schematic

Project Information

Calculator Version:	Version 4: July 2020
Project Name:	Mankato Apartments Proposed Conditions
User Name / Company Name:	Jones, Haugh & Smith Inc
Date:	6/25/2025
Project Description:	Mankato Apartments
Construction Permit?:	Yes

Site Information

Retention Requirement (inches):	1.1
Site's Zip Code:	56001
Annual Rainfall (inches):	30.7
Phosphorus EMC (mg/l):	0.3
TSS EMC (mg/l):	54.5

Total Site Area

Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)
Forest/Open Space - Undisturbed, protected forest/open space or reforested land				0	0
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed				1.5	1.5
			Impervious Area (acres)		2.5
			Total Area (acres)		4

Site Areas Routed to BMPs

Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)
Forest/Open Space - Undisturbed, protected forest/open space or reforested land					0
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed				1.5	1.5
			Impervious Area (acres)		2.5
			Total Area (acres)		4

Summary Information

Performance Goal Requirement

Performance goal volume retention requirement: 9982 ft³
Volume removed by BMPs towards performance goal: ft³
Percent volume removed towards performance goal %

Annual Volume and Pollutant Load Reductions

Post development annual runoff volume 6.3319 acre-ft
Annual runoff volume removed by BMPs: 0 acre-ft
Percent annual runoff volume removed: 0 %

Post development annual particulate P load: 2.8417 lbs
Annual particulate P removed by BMPs: 1.705 lbs
Post development annual dissolved P load: 2.325 lbs
Annual dissolved P removed by BMPs: 0 lbs
Total P removed by BMPs 1.705 lbs
Percent annual total phosphorus removed: 33 %

Post development annual TSS load: 938.6 lbs
Annual TSS removed by BMPs: 563.2 lbs
Percent annual TSS removed: 60 %

BMP Summary

Performance Goal Summary

BMP Name	BMP Volume Capacity (ft ³)	Volume Recieved (ft ³)	Volume Retained (ft ³)	Volume Outflow (ft ³)	Percent Retained
1 - Constructed stormwater pond	0	9982	0	9982	0

Annual Volume Summary

BMP Name	Volume From Direct Watershed (acre-ft)	Volume From Upstream BMPs (acre-ft)	Volume Retained (acre-ft)	Volume outflow (acre-ft)	Percent Retained (%)
1 - Constructed stormwater pond	6.3319	0	0	6.3319	0

Particulate Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained
1 - Constructed stormwater pond	2.8417	0	1.705	1.1367	60

Dissolved Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained
1 - Constructed stormwater pond	2.3251	0	0	2.3251	0

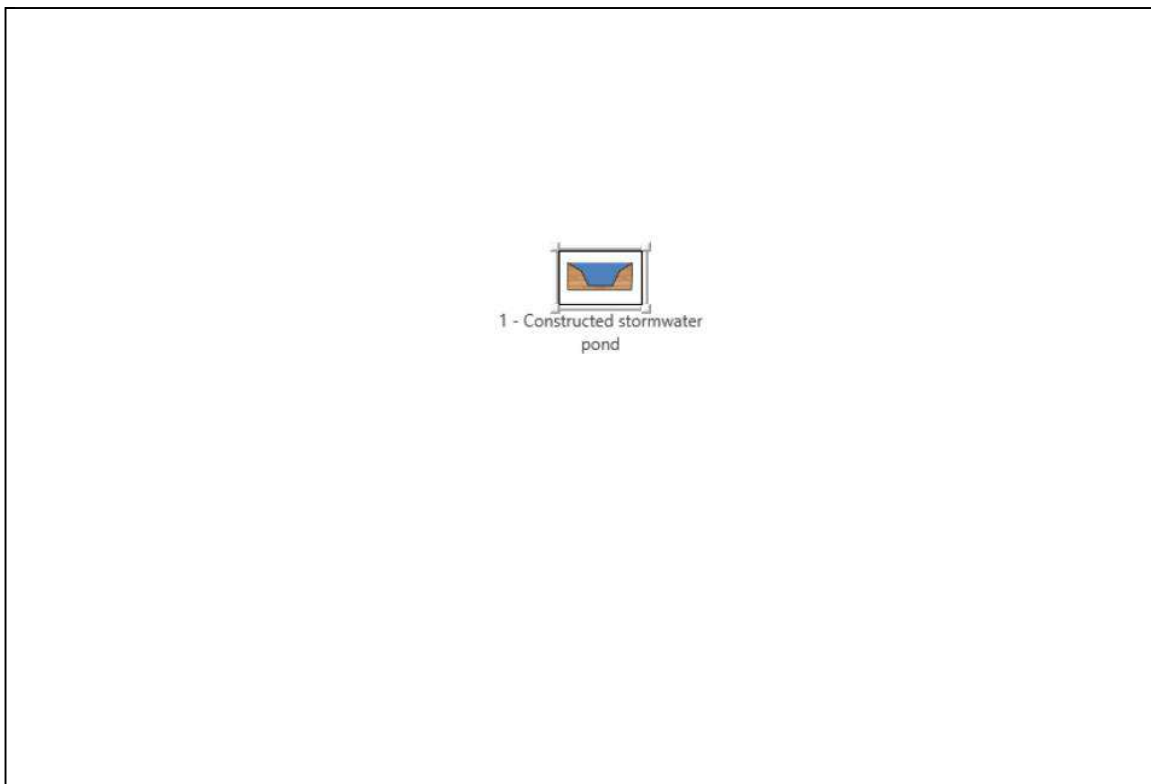
Total Phosphorus Summary

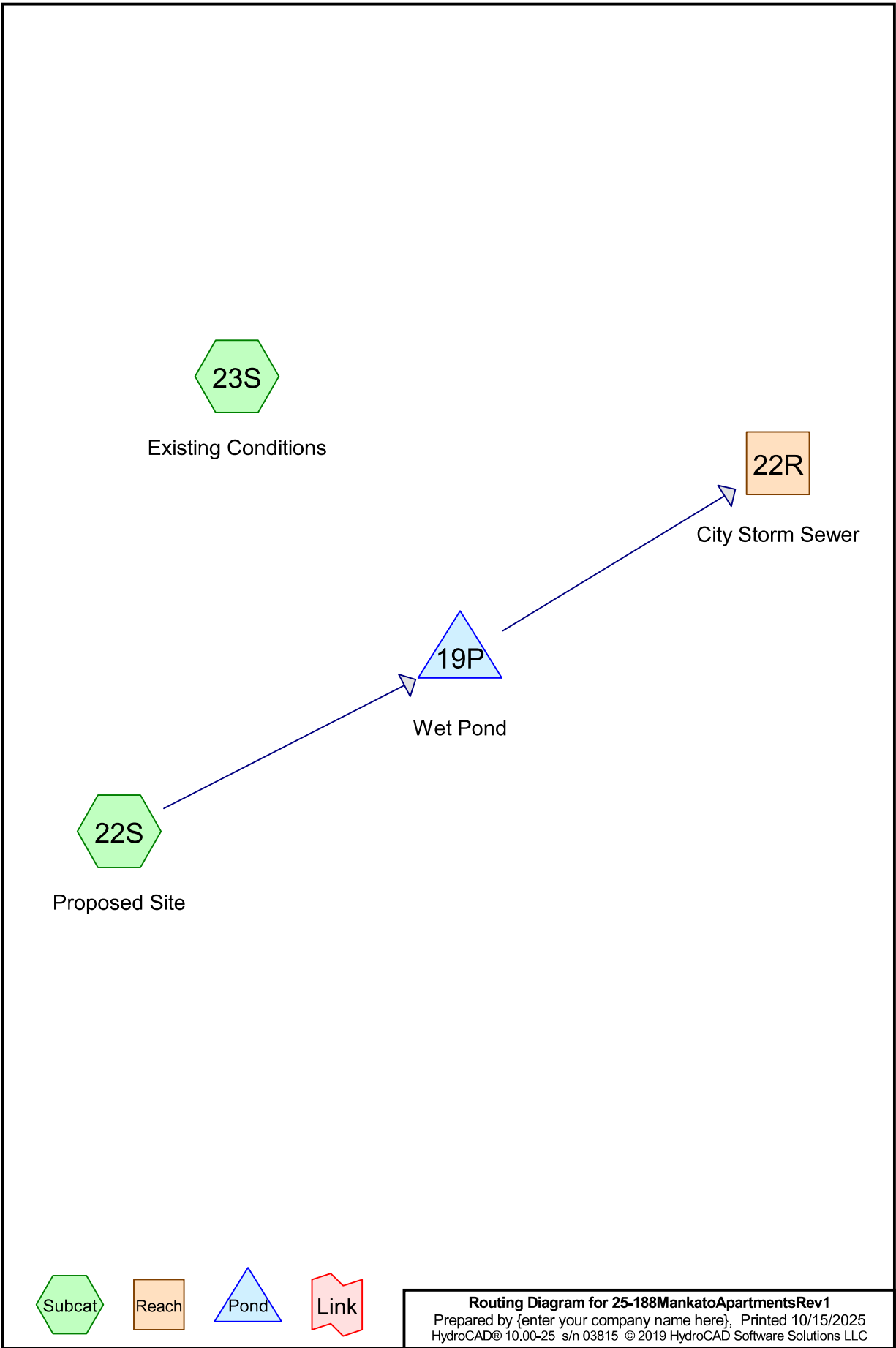
BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained
1 - Constructed stormwater pond	5.1668	0	1.705	3.4618	30

TSS Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained
1 - Constructed stormwater pond	938.64	0	563.18	375.46	60

BMP Schematic





Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
4.240	80	>75% Grass cover, Good, HSG D (22S, 23S)
1.260	96	Gravel surface, HSG D (23S)
1.500	98	Paved parking, HSG D (22S)
1.000	98	Roofs, HSG D (22S)
8.000	88	TOTAL AREA

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
8.000	HSG D	22S, 23S
0.000	Other	
8.000		TOTAL AREA

25-188MankatoApartmentsRev1

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Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	4.240	0.000	4.240	>75% Grass cover, Good	22S, 23S
0.000	0.000	0.000	1.260	0.000	1.260	Gravel surface	23S
0.000	0.000	0.000	1.500	0.000	1.500	Paved parking	22S
0.000	0.000	0.000	1.000	0.000	1.000	Roofs	22S
0.000	0.000	0.000	8.000	0.000	8.000	TOTAL AREA	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	19P	987.50	984.00	50.0	0.0700	0.012	24.0	0.0	0.0
2	19P	987.50	987.50	20.0	0.0000	0.013	15.0	0.0	0.0

25-188MankatoApartmentsRev1*MSE 24-hr 1 2-Year Rainfall=2.87"*

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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, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 22S: Proposed Site Runoff Area=4.000 ac 62.50% Impervious Runoff Depth=1.95"
Tc=20.0 min CN=91 Runoff=10.61 cfs 0.650 af

Subcatchment 23S: Existing Conditions Runoff Area=4.000 ac 0.00% Impervious Runoff Depth=1.48"
Tc=30.0 min CN=85 Runoff=6.42 cfs 0.493 af

Reach 22R: City Storm Sewer Inflow=4.38 cfs 0.641 af
Outflow=4.38 cfs 0.641 af

Pond 19P: Wet Pond Peak Elev=988.91' Storage=0.307 af Inflow=10.61 cfs 0.650 af
Outflow=4.38 cfs 0.641 af

Total Runoff Area = 8.000 ac Runoff Volume = 1.143 af Average Runoff Depth = 1.72"
68.75% Pervious = 5.500 ac 31.25% Impervious = 2.500 ac

Summary for Subcatchment 22S: Proposed Site

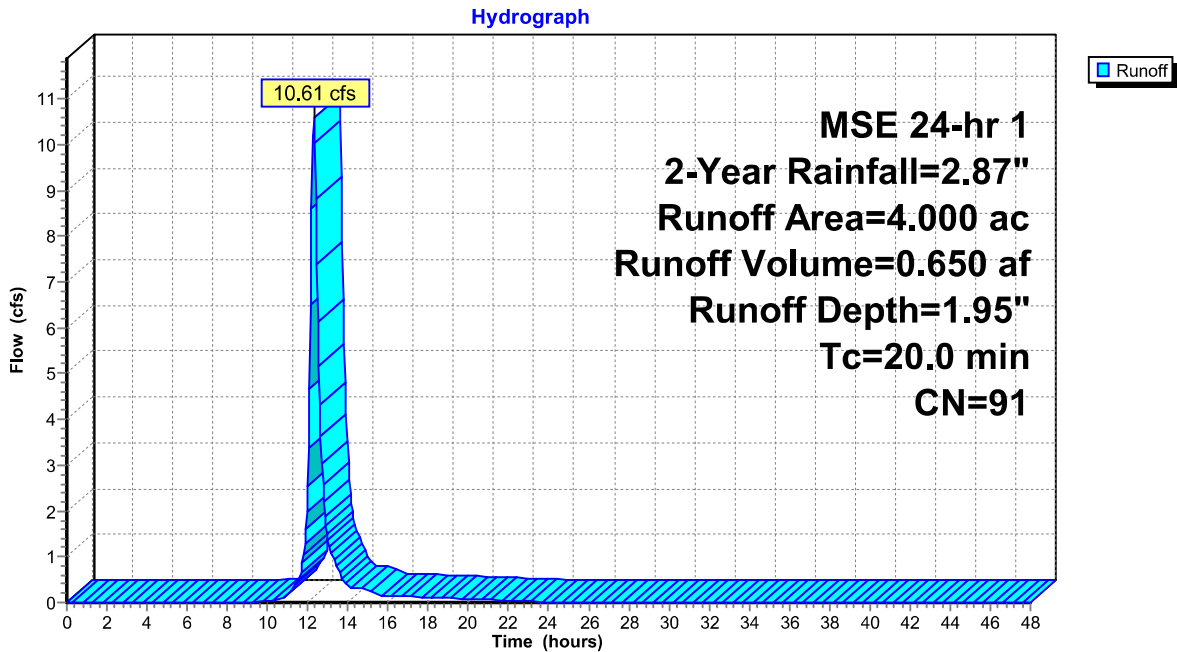
Runoff = 10.61 cfs @ 12.30 hrs, Volume= 0.650 af, Depth= 1.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
MSE 24-hr 1 2-Year Rainfall=2.87"

Area (ac)	CN	Description
1.000	98	Roofs, HSG D
1.500	98	Paved parking, HSG D
1.500	80	>75% Grass cover, Good, HSG D
4.000	91	Weighted Average
1.500		37.50% Pervious Area
2.500		62.50% Impervious Area

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

Subcatchment 22S: Proposed Site



Summary for Subcatchment 23S: Existing Conditions

Runoff = 6.42 cfs @ 12.44 hrs, Volume= 0.493 af, Depth= 1.48"

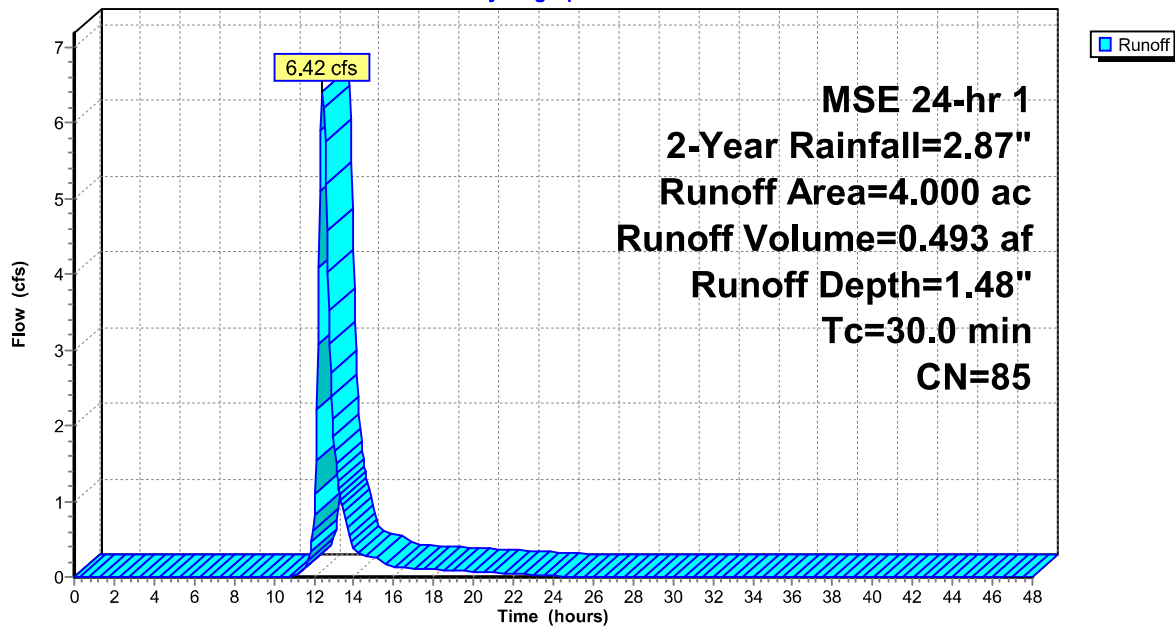
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
MSE 24-hr 1 2-Year Rainfall=2.87"

Area (ac)	CN	Description
2.740	80	>75% Grass cover, Good, HSG D
1.260	96	Gravel surface, HSG D
4.000	85	Weighted Average
4.000		100.00% Pervious Area

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

Subcatchment 23S: Existing Conditions

Hydrograph

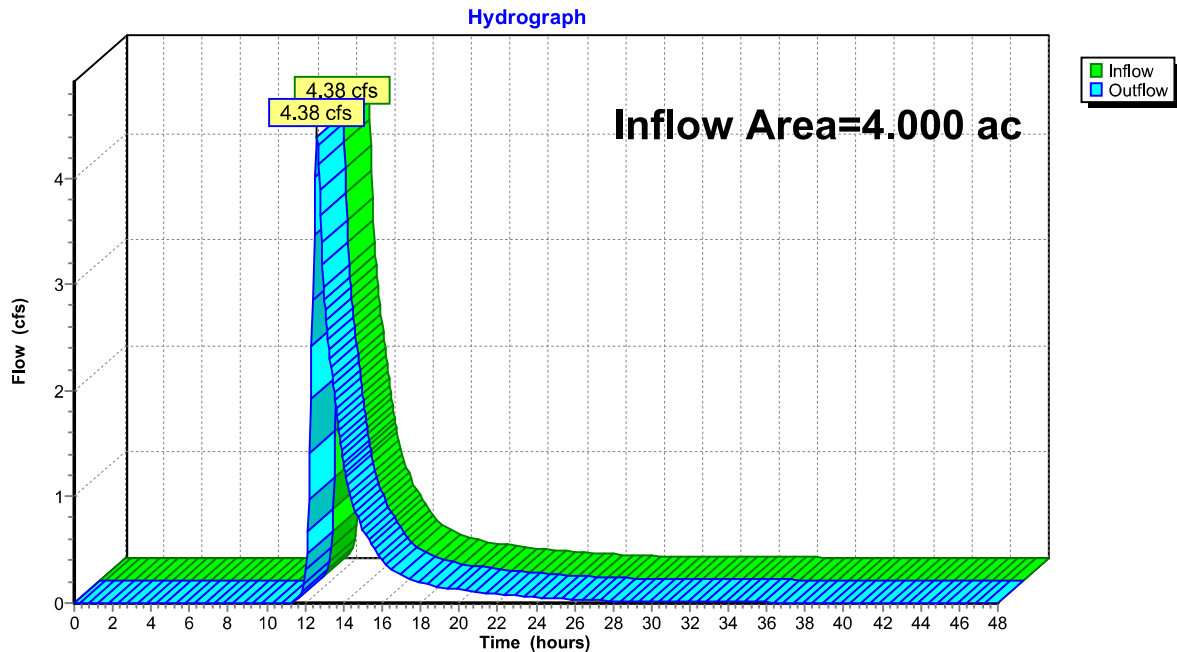


Summary for Reach 22R: City Storm Sewer

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.000 ac, 62.50% Impervious, Inflow Depth > 1.92" for 2-Year event
Inflow = 4.38 cfs @ 12.60 hrs, Volume= 0.641 af
Outflow = 4.38 cfs @ 12.60 hrs, Volume= 0.641 af, Atten= 0%, Lag= 0.0 min

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

Reach 22R: City Storm Sewer

Summary for Pond 19P: Wet Pond

[95] Warning: Outlet Device #1 rise exceeded

Inflow Area = 4.000 ac, 62.50% Impervious, Inflow Depth = 1.95" for 2-Year event
 Inflow = 10.61 cfs @ 12.30 hrs, Volume= 0.650 af
 Outflow = 4.38 cfs @ 12.60 hrs, Volume= 0.641 af, Atten= 59%, Lag= 18.2 min
 Primary = 4.38 cfs @ 12.60 hrs, Volume= 0.641 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 988.91' @ 12.60 hrs Surf.Area= 0.256 ac Storage= 0.307 af

Plug-Flow detention time= 115.1 min calculated for 0.641 af (99% of inflow)
 Center-of-Mass det. time= 107.3 min (892.3 - 785.0)

Volume	Invert	Avail.Storage	Storage Description
#1	987.50'	1.708 af	Custom Stage Data (Prismatic) Listed below
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
987.50	0.160	0.000	0.000
988.00	0.210	0.093	0.093
989.00	0.260	0.235	0.328
990.00	0.310	0.285	0.612
991.00	0.350	0.330	0.943
992.00	0.370	0.360	1.302
993.00	0.440	0.405	1.708

Device	Routing	Invert	Outlet Devices
#1	Device 2	987.50'	30.0 deg x 0.7' long x 1.00' rise Sharp-Crested Vee/Trap Weir Cv= 2.61 (C= 3.26)
#2	Primary	987.50'	24.0" Round Culvert L= 50.0' Ke= 1.000 Inlet / Outlet Invert= 987.50' / 984.00' S= 0.0700 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf
#3	Device 2	988.75'	5.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Device 1	987.50'	15.0" Round Culvert L= 20.0' Ke= 1.000 Inlet / Outlet Invert= 987.50' / 987.50' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=4.38 cfs @ 12.60 hrs HW=988.91' (Free Discharge)

2=Culvert (Passes 4.38 cfs of 7.21 cfs potential flow)

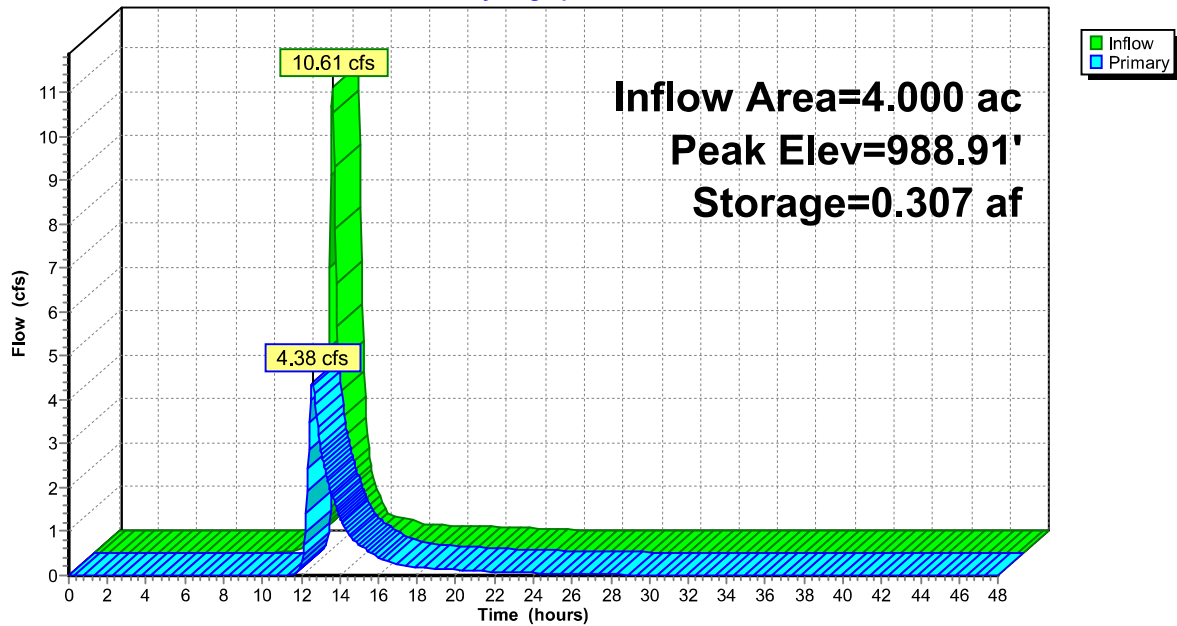
1=Sharp-Crested Vee/Trap Weir (Passes 3.45 cfs of 4.35 cfs potential flow)

4=Culvert (Barrel Controls 3.45 cfs @ 3.11 fps)

3=Broad-Crested Rectangular Weir (Weir Controls 0.93 cfs @ 1.13 fps)

Pond 19P: Wet Pond

Hydrograph



25-188MankatoApartmentsRev1*MSE 24-hr 1 10-Year Rainfall=4.29"*

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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, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 22S: Proposed Site

Runoff Area=4.000 ac 62.50% Impervious Runoff Depth=3.30"
Tc=20.0 min CN=91 Runoff=17.57 cfs 1.099 af

Subcatchment 23S: Existing Conditions

Runoff Area=4.000 ac 0.00% Impervious Runoff Depth=2.72"
Tc=30.0 min CN=85 Runoff=11.79 cfs 0.906 af

Reach 22R: City Storm Sewer

Inflow=10.46 cfs 1.089 af
Outflow=10.46 cfs 1.089 af

Pond 19P: Wet Pond

Peak Elev=989.34' Storage=0.424 af Inflow=17.57 cfs 1.099 af
Outflow=10.46 cfs 1.089 af

Total Runoff Area = 8.000 ac Runoff Volume = 2.005 af Average Runoff Depth = 3.01"
68.75% Pervious = 5.500 ac 31.25% Impervious = 2.500 ac

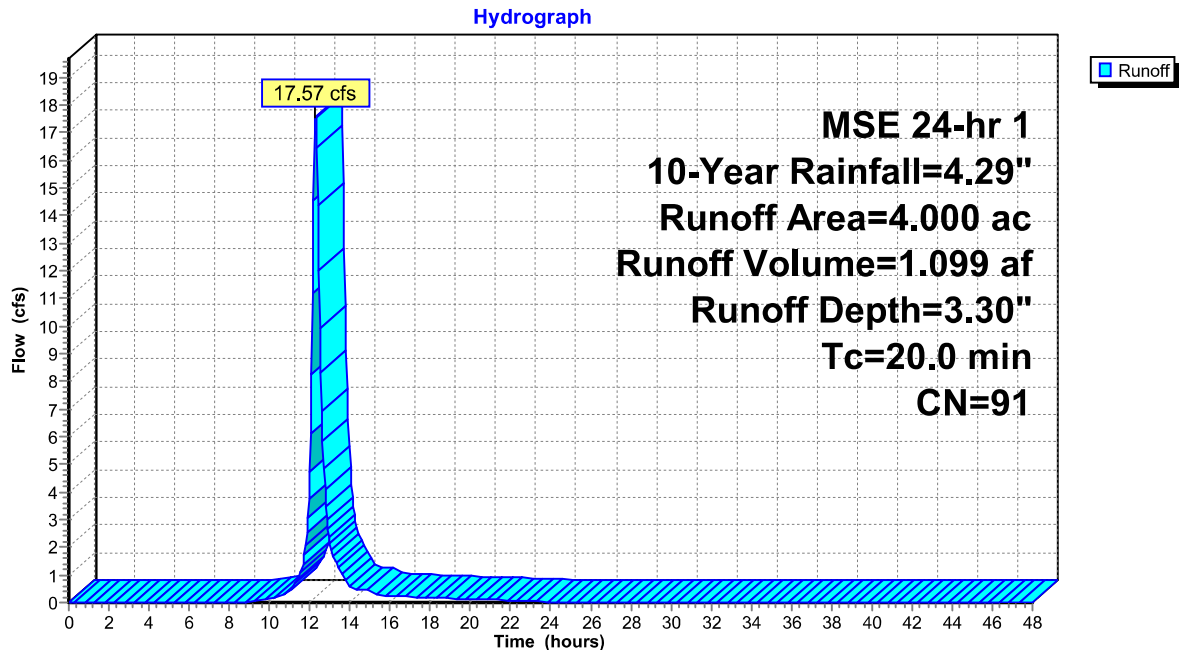
Summary for Subcatchment 22S: Proposed Site

Runoff = 17.57 cfs @ 12.29 hrs, Volume= 1.099 af, Depth= 3.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
MSE 24-hr 1 10-Year Rainfall=4.29"

Area (ac)	CN	Description
1.000	98	Roofs, HSG D
1.500	98	Paved parking, HSG D
1.500	80	>75% Grass cover, Good, HSG D
4.000	91	Weighted Average
1.500		37.50% Pervious Area
2.500		62.50% Impervious Area

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

Subcatchment 22S: Proposed Site

Summary for Subcatchment 23S: Existing Conditions

Runoff = 11.79 cfs @ 12.43 hrs, Volume= 0.906 af, Depth= 2.72"

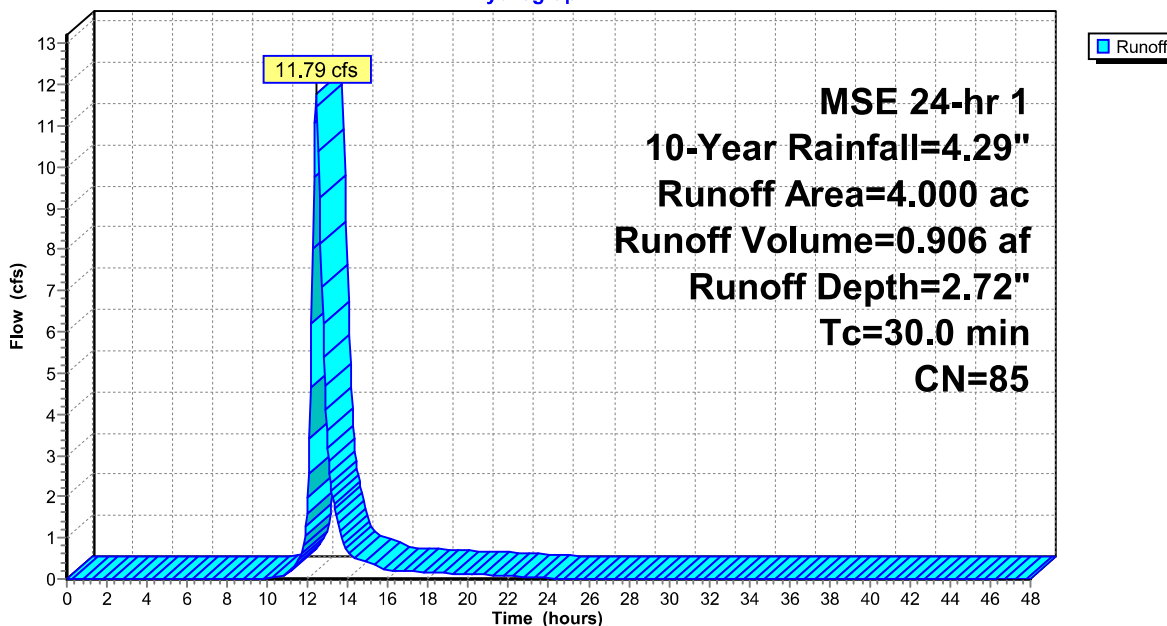
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
MSE 24-hr 1 10-Year Rainfall=4.29"

Area (ac)	CN	Description
2.740	80	>75% Grass cover, Good, HSG D
1.260	96	Gravel surface, HSG D
4.000	85	Weighted Average
4.000		100.00% Pervious Area

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

Subcatchment 23S: Existing Conditions

Hydrograph



Summary for Reach 22R: City Storm Sewer

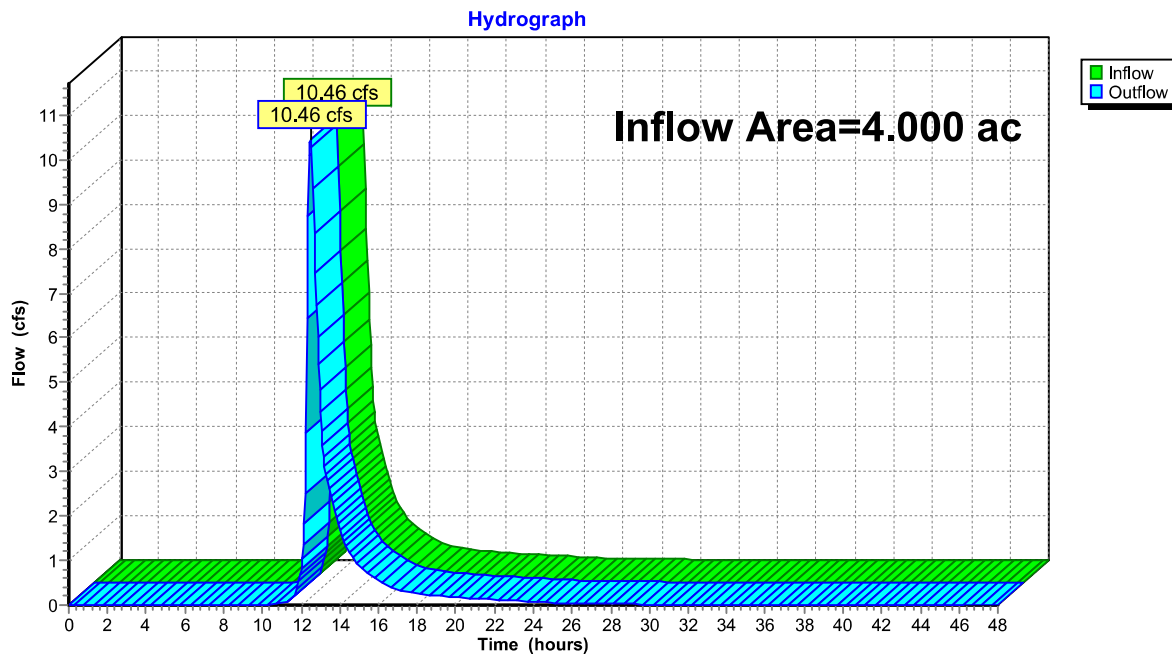
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.000 ac, 62.50% Impervious, Inflow Depth > 3.27" for 10-Year event

Inflow = 10.46 cfs @ 12.49 hrs, Volume= 1.089 af

Outflow = 10.46 cfs @ 12.49 hrs, Volume= 1.089 af, Atten= 0%, Lag= 0.0 min

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

Reach 22R: City Storm Sewer

Summary for Pond 19P: Wet Pond

[95] Warning: Outlet Device #1 rise exceeded

Inflow Area = 4.000 ac, 62.50% Impervious, Inflow Depth = 3.30" for 10-Year event
 Inflow = 17.57 cfs @ 12.29 hrs, Volume= 1.099 af
 Outflow = 10.46 cfs @ 12.49 hrs, Volume= 1.089 af, Atten= 40%, Lag= 11.9 min
 Primary = 10.46 cfs @ 12.49 hrs, Volume= 1.089 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 989.34' @ 12.49 hrs Surf.Area= 0.277 ac Storage= 0.424 af

Plug-Flow detention time= 83.0 min calculated for 1.088 af (99% of inflow)
 Center-of-Mass det. time= 79.4 min (857.6 - 778.2)

Volume	Invert	Avail.Storage	Storage Description
#1	987.50'	1.708 af	Custom Stage Data (Prismatic) Listed below
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
987.50	0.160	0.000	0.000
988.00	0.210	0.093	0.093
989.00	0.260	0.235	0.328
990.00	0.310	0.285	0.612
991.00	0.350	0.330	0.943
992.00	0.370	0.360	1.302
993.00	0.440	0.405	1.708

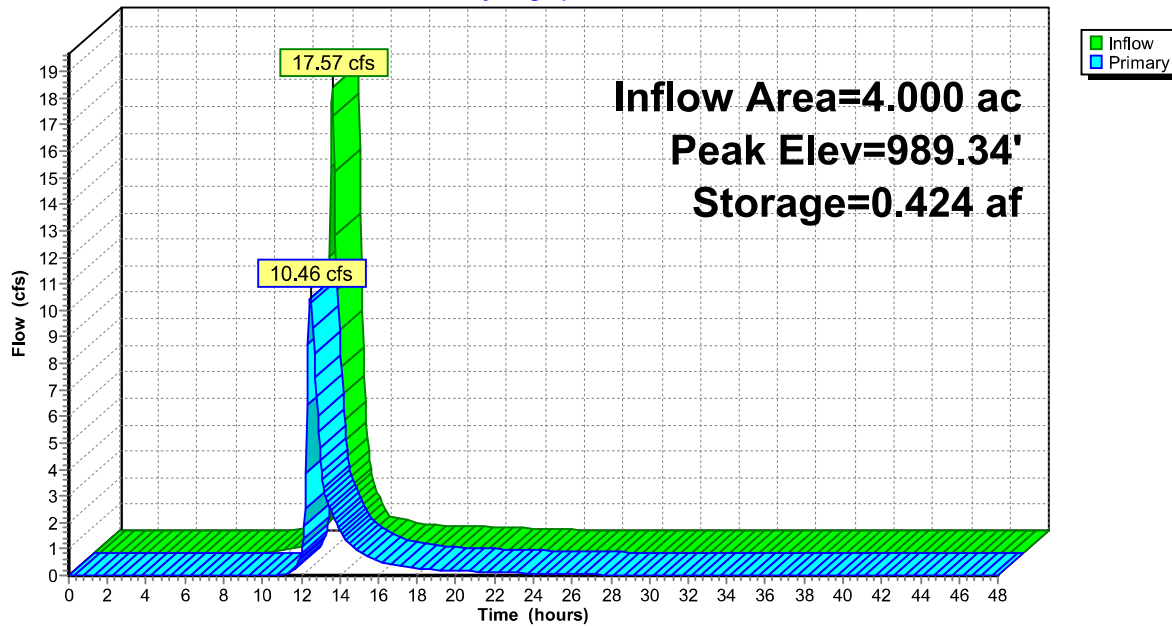
Device	Routing	Invert	Outlet Devices
#1	Device 2	987.50'	30.0 deg x 0.7' long x 1.00' rise Sharp-Crested Vee/Trap Weir Cv= 2.61 (C= 3.26)
#2	Primary	987.50'	24.0" Round Culvert L= 50.0' Ke= 1.000 Inlet / Outlet Invert= 987.50' / 984.00' S= 0.0700 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf
#3	Device 2	988.75'	5.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Device 1	987.50'	15.0" Round Culvert L= 20.0' Ke= 1.000 Inlet / Outlet Invert= 987.50' / 987.50' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=10.45 cfs @ 12.49 hrs HW=989.34' (Free Discharge)

2=Culvert (Inlet Controls 10.45 cfs @ 3.46 fps)
 1=Sharp-Crested Vee/Trap Weir (Passes < 5.35 cfs potential flow)
 4=Culvert (Passes < 4.80 cfs potential flow)
 3=Broad-Crested Rectangular Weir (Passes < 6.88 cfs potential flow)

Pond 19P: Wet Pond

Hydrograph



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 22S: Proposed Site Runoff Area=4.000 ac 62.50% Impervious Runoff Depth=6.14"
Tc=20.0 min CN=91 Runoff=31.70 cfs 2.045 af

Subcatchment 23S: Existing Conditions Runoff Area=4.000 ac 0.00% Impervious Runoff Depth=5.44"
Tc=30.0 min CN=85 Runoff=23.21 cfs 1.815 af

Reach 22R: City Storm Sewer Inflow=15.71 cfs 2.035 af
Outflow=15.71 cfs 2.035 af

Pond 19P: Wet Pond Peak Elev=990.42' Storage=0.750 af Inflow=31.70 cfs 2.045 af
Outflow=15.71 cfs 2.035 af

Total Runoff Area = 8.000 ac Runoff Volume = 3.860 af Average Runoff Depth = 5.79"
68.75% Pervious = 5.500 ac 31.25% Impervious = 2.500 ac

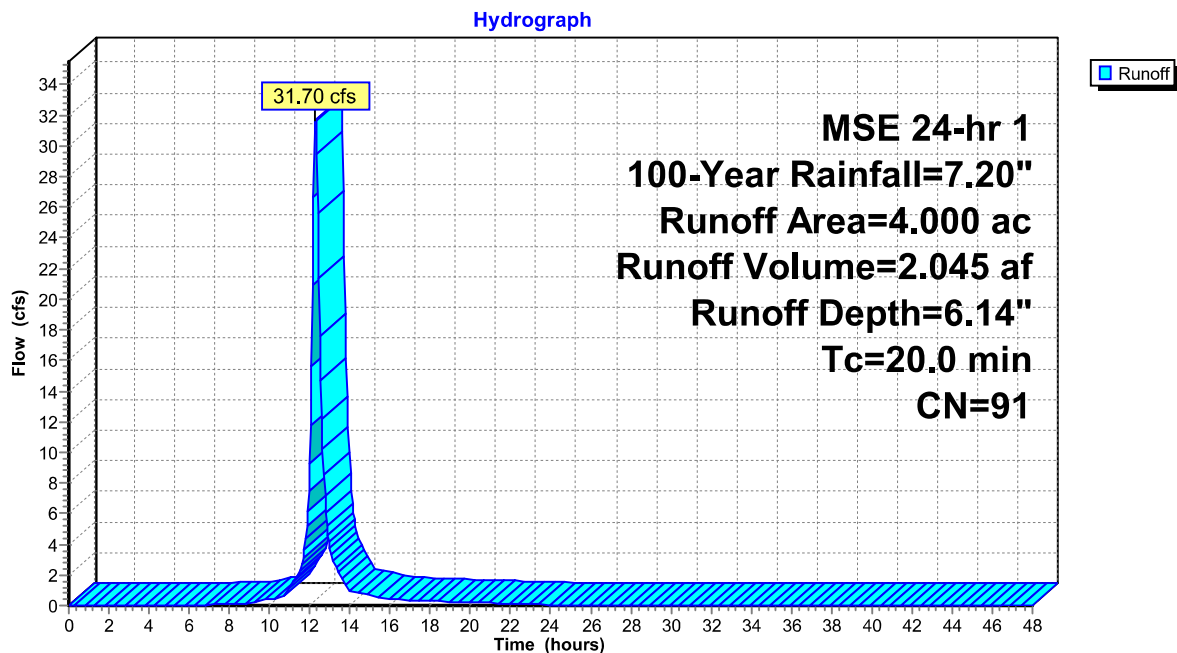
Summary for Subcatchment 22S: Proposed Site

Runoff = 31.70 cfs @ 12.29 hrs, Volume= 2.045 af, Depth= 6.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
MSE 24-hr 1 100-Year Rainfall=7.20"

Area (ac)	CN	Description
1.000	98	Roofs, HSG D
1.500	98	Paved parking, HSG D
1.500	80	>75% Grass cover, Good, HSG D
4.000	91	Weighted Average
1.500		37.50% Pervious Area
2.500		62.50% Impervious Area

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

Subcatchment 22S: Proposed Site

Summary for Subcatchment 23S: Existing Conditions

Runoff = 23.21 cfs @ 12.42 hrs, Volume= 1.815 af, Depth= 5.44"

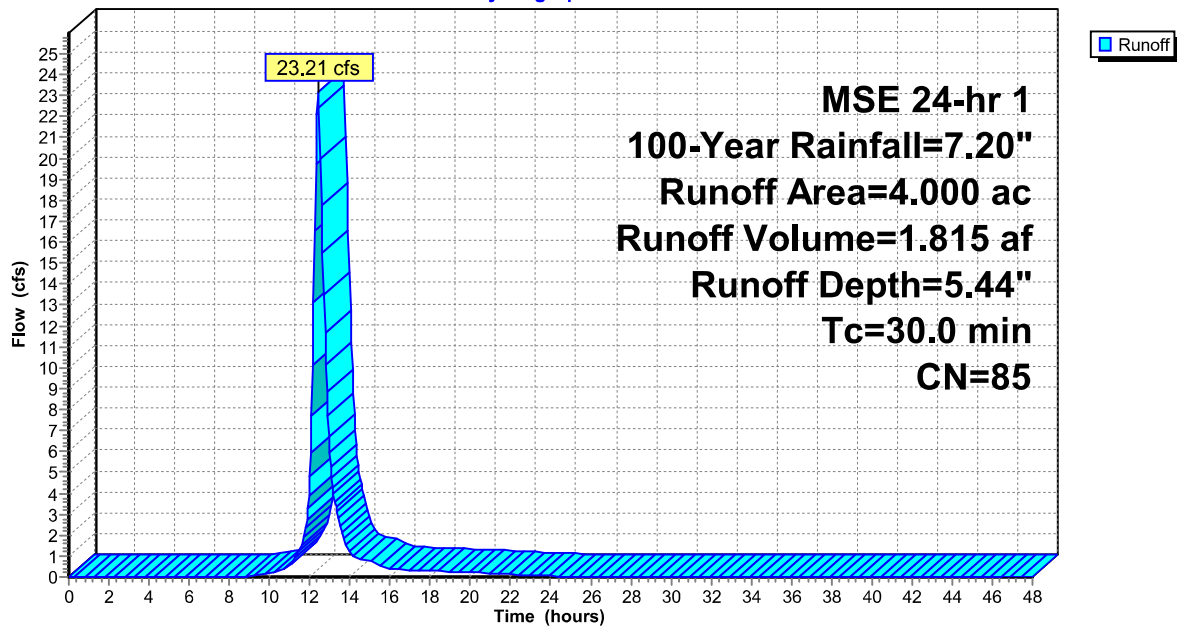
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
MSE 24-hr 1 100-Year Rainfall=7.20"

Area (ac)	CN	Description
2.740	80	>75% Grass cover, Good, HSG D
1.260	96	Gravel surface, HSG D
4.000	85	Weighted Average
4.000		100.00% Pervious Area

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

Subcatchment 23S: Existing Conditions

Hydrograph



Summary for Reach 22R: City Storm Sewer

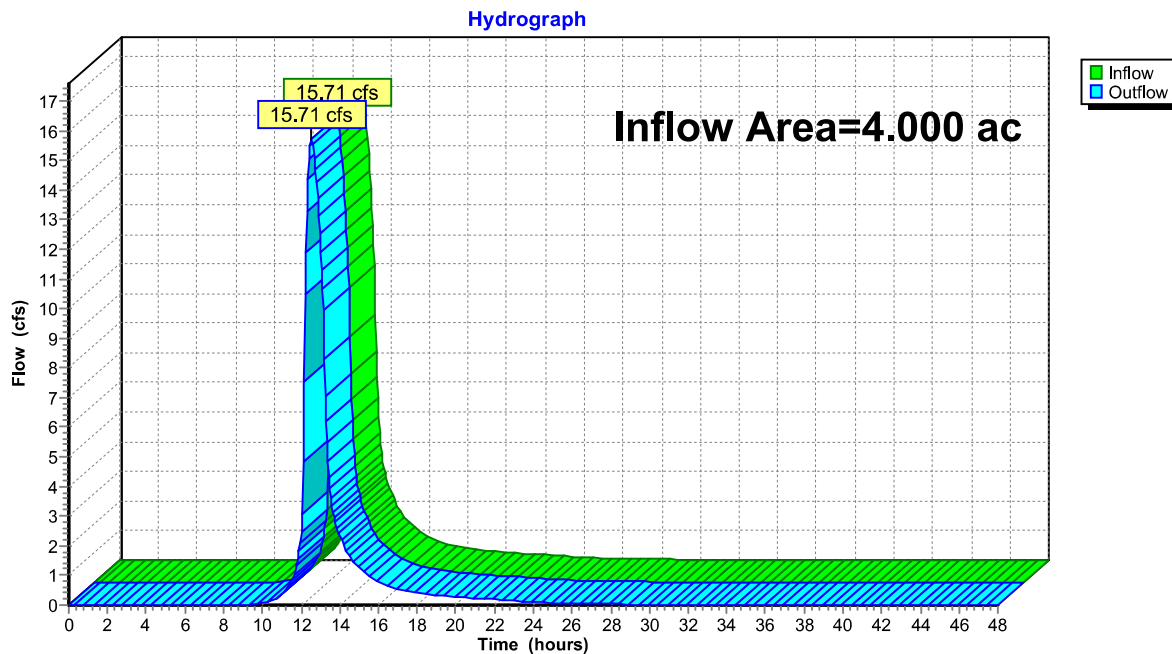
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.000 ac, 62.50% Impervious, Inflow Depth > 6.11" for 100-Year event

Inflow = 15.71 cfs @ 12.53 hrs, Volume= 2.035 af

Outflow = 15.71 cfs @ 12.53 hrs, Volume= 2.035 af, Atten= 0%, Lag= 0.0 min

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

Reach 22R: City Storm Sewer

Summary for Pond 19P: Wet Pond

[95] Warning: Outlet Device #1 rise exceeded

Inflow Area = 4.000 ac, 62.50% Impervious, Inflow Depth = 6.14" for 100-Year event
 Inflow = 31.70 cfs @ 12.29 hrs, Volume= 2.045 af
 Outflow = 15.71 cfs @ 12.53 hrs, Volume= 2.035 af, Atten= 50%, Lag= 14.7 min
 Primary = 15.71 cfs @ 12.53 hrs, Volume= 2.035 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 990.42' @ 12.53 hrs Surf.Area= 0.327 ac Storage= 0.750 af

Plug-Flow detention time= 65.1 min calculated for 2.035 af (100% of inflow)
 Center-of-Mass det. time= 62.2 min (832.4 - 770.1)

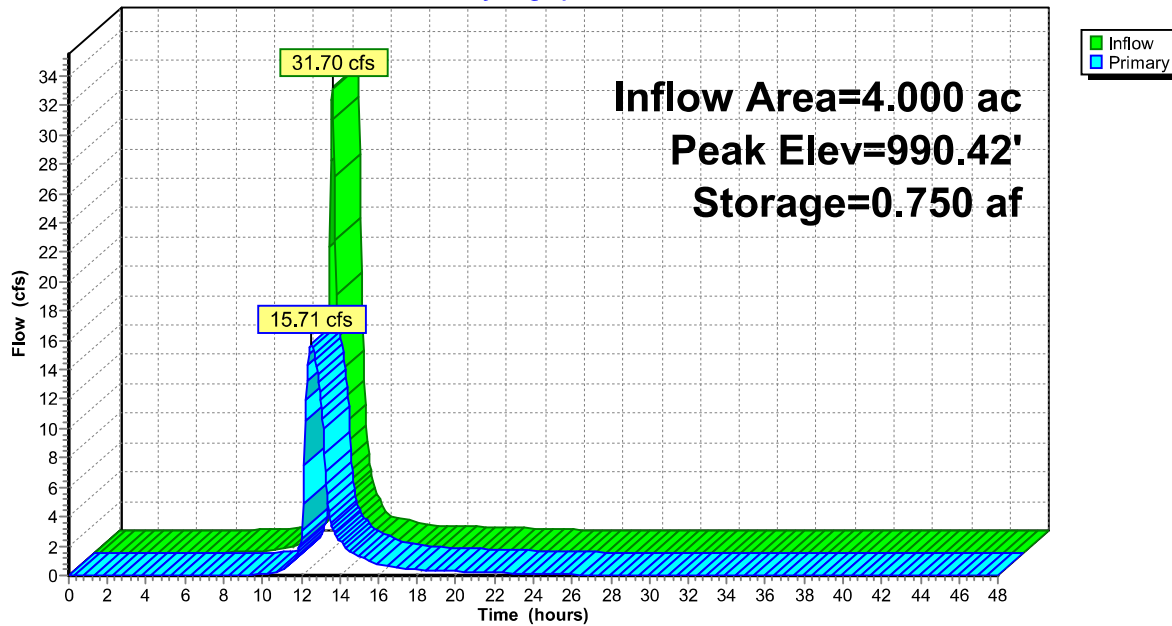
Volume	Invert	Avail.Storage	Storage Description
#1	987.50'	1.708 af	Custom Stage Data (Prismatic) Listed below

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
987.50	0.160	0.000	0.000
988.00	0.210	0.093	0.093
989.00	0.260	0.235	0.328
990.00	0.310	0.285	0.612
991.00	0.350	0.330	0.943
992.00	0.370	0.360	1.302
993.00	0.440	0.405	1.708

Device	Routing	Invert	Outlet Devices
#1	Device 2	987.50'	30.0 deg x 0.7' long x 1.00' rise Sharp-Crested Vee/Trap Weir Cv= 2.61 (C= 3.26)
#2	Primary	987.50'	24.0" Round Culvert L= 50.0' Ke= 1.000 Inlet / Outlet Invert= 987.50' / 984.00' S= 0.0700 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf
#3	Device 2	988.75'	5.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Device 1	987.50'	15.0" Round Culvert L= 20.0' Ke= 1.000 Inlet / Outlet Invert= 987.50' / 987.50' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=15.69 cfs @ 12.53 hrs HW=990.41' (Free Discharge)

2=Culvert (Inlet Controls 15.69 cfs @ 5.00 fps)
 1=Sharp-Crested Vee/Trap Weir (Passes < 7.28 cfs potential flow)
 4=Culvert (Passes < 6.70 cfs potential flow)
 3=Broad-Crested Rectangular Weir (Passes < 35.62 cfs potential flow)

Pond 19P: Wet Pond**Hydrograph**

25-188MankatoApartmentsRev1*Type II 24-hr Custom Rainfall=4.29"*

Prepared by {enter your company name here}

Printed 10/15/2025

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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, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 22S: Proposed Site Runoff Area=4.000 ac 62.50% Impervious Runoff Depth=3.30"
Tc=20.0 min CN=91 Runoff=14.17 cfs 1.099 af

Subcatchment 23S: Existing Conditions Runoff Area=4.000 ac 0.00% Impervious Runoff Depth=2.72"
Tc=30.0 min CN=85 Runoff=9.41 cfs 0.906 af

Reach 22R: City Storm Sewer Inflow=8.02 cfs 1.089 af
Outflow=8.02 cfs 1.089 af

Pond 19P: Wet Pond Peak Elev=989.16' Storage=0.374 af Inflow=14.17 cfs 1.099 af
Outflow=8.02 cfs 1.089 af

Total Runoff Area = 8.000 ac Runoff Volume = 2.005 af Average Runoff Depth = 3.01"
68.75% Pervious = 5.500 ac 31.25% Impervious = 2.500 ac

Summary for Subcatchment 22S: Proposed Site

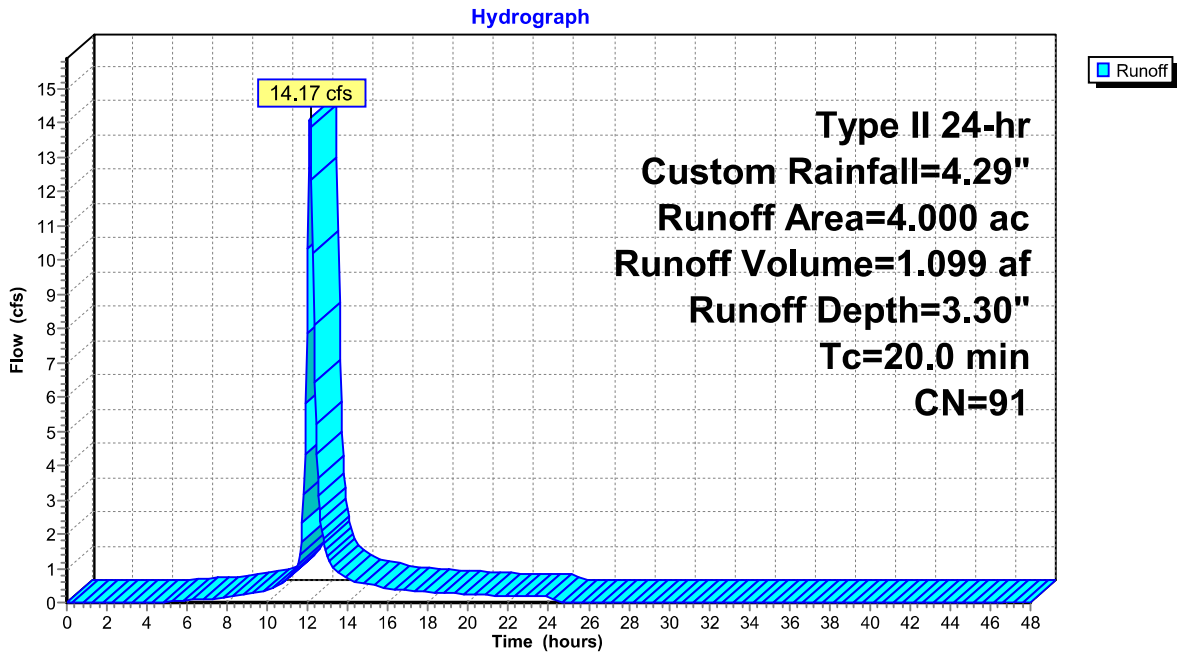
Runoff = 14.17 cfs @ 12.12 hrs, Volume= 1.099 af, Depth= 3.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Custom Rainfall=4.29"

Area (ac)	CN	Description
1.000	98	Roofs, HSG D
1.500	98	Paved parking, HSG D
1.500	80	>75% Grass cover, Good, HSG D
4.000	91	Weighted Average
1.500		37.50% Pervious Area
2.500		62.50% Impervious Area

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

Subcatchment 22S: Proposed Site



Summary for Subcatchment 23S: Existing Conditions

Runoff = 9.41 cfs @ 12.24 hrs, Volume= 0.906 af, Depth= 2.72"

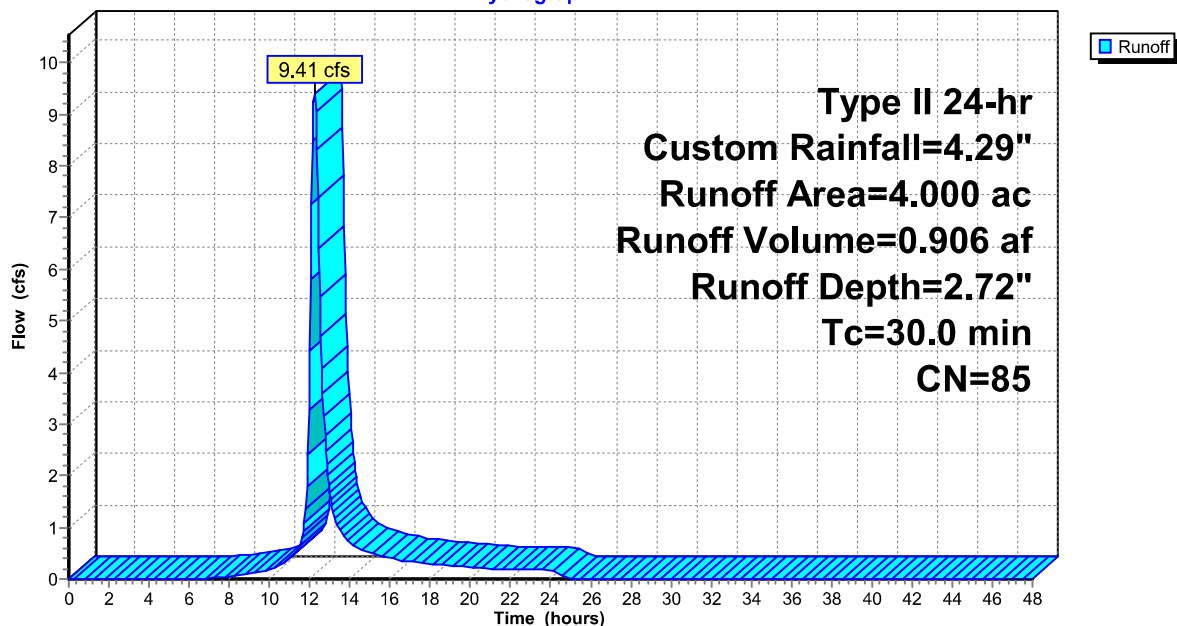
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Custom Rainfall=4.29"

Area (ac)	CN	Description
2.740	80	>75% Grass cover, Good, HSG D
1.260	96	Gravel surface, HSG D
4.000	85	Weighted Average
4.000		100.00% Pervious Area

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

Subcatchment 23S: Existing Conditions

Hydrograph

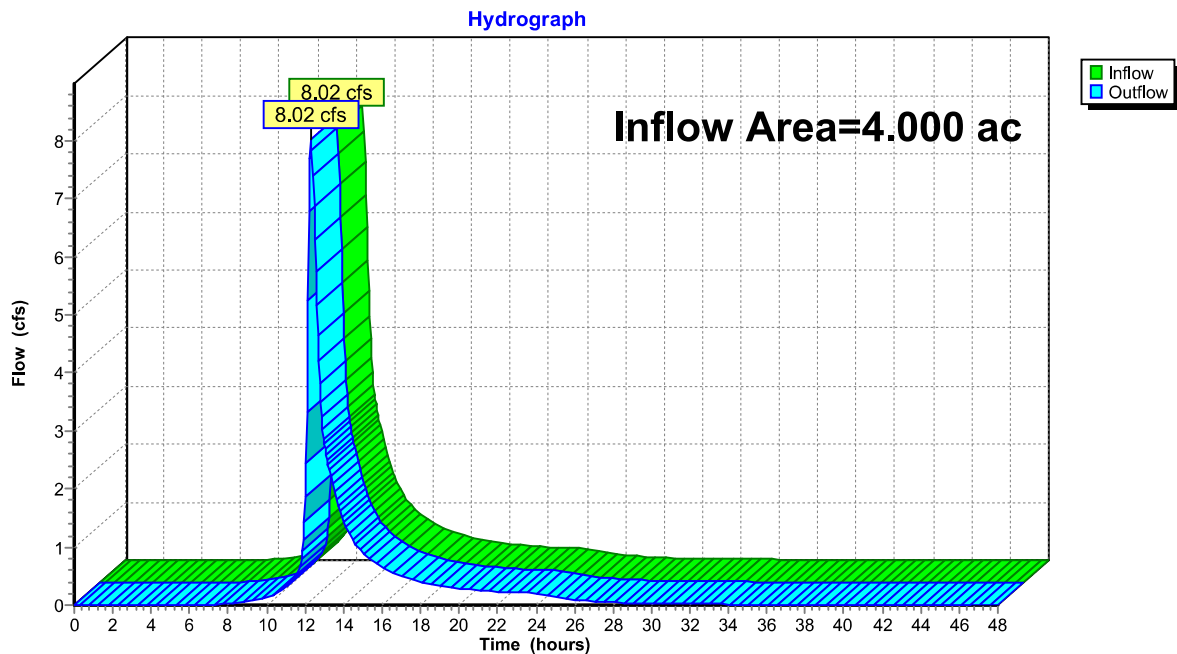


Summary for Reach 22R: City Storm Sewer

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.000 ac, 62.50% Impervious, Inflow Depth > 3.27" for Custom event
Inflow = 8.02 cfs @ 12.31 hrs, Volume= 1.089 af
Outflow = 8.02 cfs @ 12.31 hrs, Volume= 1.089 af, Atten= 0%, Lag= 0.0 min

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

Reach 22R: City Storm Sewer

Summary for Pond 19P: Wet Pond

[95] Warning: Outlet Device #1 rise exceeded

Inflow Area = 4.000 ac, 62.50% Impervious, Inflow Depth = 3.30" for Custom event
 Inflow = 14.17 cfs @ 12.12 hrs, Volume= 1.099 af
 Outflow = 8.02 cfs @ 12.31 hrs, Volume= 1.089 af, Atten= 43%, Lag= 11.3 min
 Primary = 8.02 cfs @ 12.31 hrs, Volume= 1.089 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 989.16' @ 12.31 hrs Surf.Area= 0.268 ac Storage= 0.374 af

Plug-Flow detention time= 101.6 min calculated for 1.088 af (99% of inflow)
 Center-of-Mass det. time= 97.2 min (898.9 - 801.7)

Volume	Invert	Avail.Storage	Storage Description
#1	987.50'	1.708 af	Custom Stage Data (Prismatic) Listed below

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
987.50	0.160	0.000	0.000
988.00	0.210	0.093	0.093
989.00	0.260	0.235	0.328
990.00	0.310	0.285	0.612
991.00	0.350	0.330	0.943
992.00	0.370	0.360	1.302
993.00	0.440	0.405	1.708

Device	Routing	Invert	Outlet Devices
#1	Device 2	987.50'	30.0 deg x 0.7' long x 1.00' rise Sharp-Crested Vee/Trap Weir Cv= 2.61 (C= 3.26)
#2	Primary	987.50'	24.0" Round Culvert L= 50.0' Ke= 1.000 Inlet / Outlet Invert= 987.50' / 984.00' S= 0.0700 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf
#3	Device 2	988.75'	5.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Device 1	987.50'	15.0" Round Culvert L= 20.0' Ke= 1.000 Inlet / Outlet Invert= 987.50' / 987.50' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=7.95 cfs @ 12.31 hrs HW=989.16' (Free Discharge)

2=Culvert (Passes 7.95 cfs of 9.19 cfs potential flow)

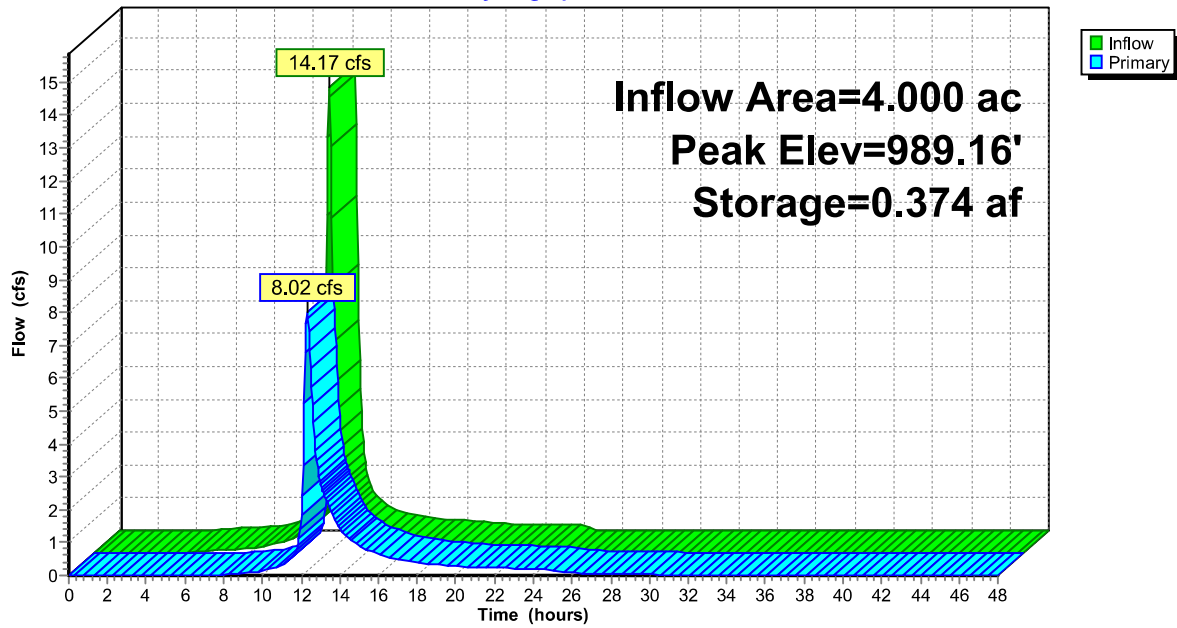
1=Sharp-Crested Vee/Trap Weir (Passes 4.06 cfs of 4.96 cfs potential flow)

4=Culvert (Barrel Controls 4.06 cfs @ 3.31 fps)

3=Broad-Crested Rectangular Weir (Weir Controls 3.89 cfs @ 1.88 fps)

Pond 19P: Wet Pond

Hydrograph





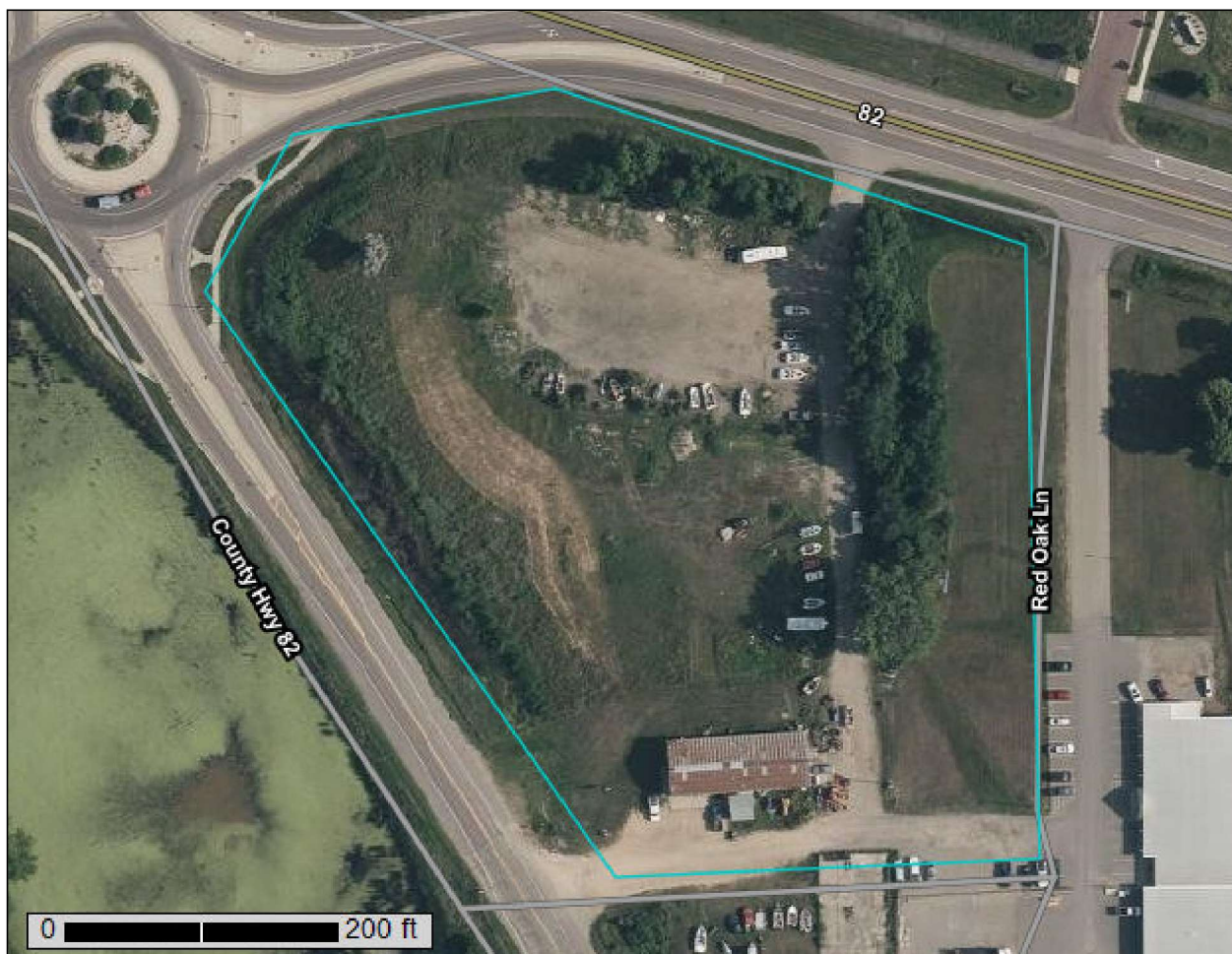
United States
Department of
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NRCS

Natural
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A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for **Blue Earth County, Minnesota**



June 20, 2025

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

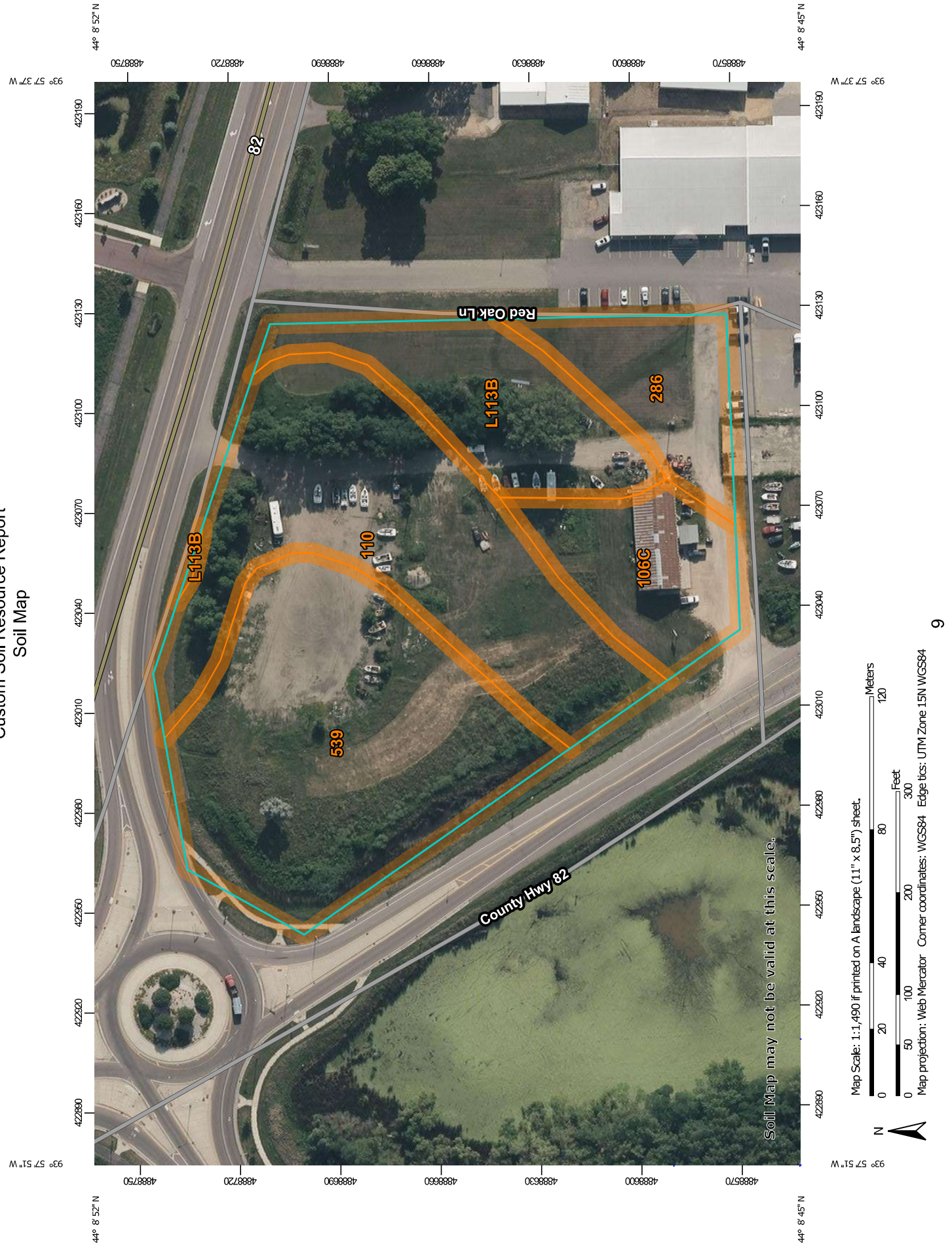
Custom Soil Resource Report

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
106C	Lester loam, 6 to 10 percent slopes	0.6	10.7%
110	Marna silty clay loam, 0 to 2 percent slopes	1.9	32.1%
286	Shorewood silty clay loam, 1 to 6 percent slopes	0.5	9.2%
539	Klossner muck, lake plain, depressional, 0 to 1 percent slopes	2.0	34.4%
L113B	Reedslake-Le Sueur complex, 1 to 6 percent slopes	0.8	13.6%
Totals for Area of Interest		5.8	100.0%

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it

was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Blue Earth County, Minnesota

106C—Lester loam, 6 to 10 percent slopes

Map Unit Setting

National map unit symbol: 2ttc7

Elevation: 690 to 1,840 feet

Mean annual precipitation: 24 to 37 inches

Mean annual air temperature: 43 to 52 degrees F

Frost-free period: 140 to 180 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Lester and similar soils: 80 percent

Minor components: 20 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lester

Setting

Landform: Hillslopes, ground moraines

Landform position (two-dimensional): Summit, shoulder, backslope

Landform position (three-dimensional): Interfluve, rise

Down-slope shape: Convex

Across-slope shape: Convex, linear

Parent material: Fine-loamy till

Typical profile

Ap - 0 to 9 inches: loam

Bt - 9 to 30 inches: clay loam

C - 30 to 79 inches: loam

Properties and qualities

Slope: 6 to 10 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.20 to 2.00 in/hr)

Depth to water table: About 47 to 63 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 20 percent

Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water supply, 0 to 60 inches: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: C

Ecological site: R103XY020MN - Loamy Upland Savannas

Forage suitability group: Sloping Upland, Acid (G103XS006MN)

Other vegetative classification: Sloping Upland, Acid (G103XS006MN)

Hydric soil rating: No

Minor Components

Le sueur

Percent of map unit: 10 percent
Landform: Ground moraines, hillslopes
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluvium, talus
Down-slope shape: Convex, linear
Across-slope shape: Linear
Ecological site: R103XY020MN - Loamy Upland Savannas
Other vegetative classification: Sloping Upland, Acid (G103XS006MN)
Hydric soil rating: No

Webster

Percent of map unit: 5 percent
Landform: Ground moraines
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R103XY001MN - Loamy Wet Prairies
Other vegetative classification: Level Swale, Neutral (G103XS001MN)
Hydric soil rating: Yes

Storden, moderately eroded

Percent of map unit: 3 percent
Landform: Ground moraines
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Rise
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Ecological site: R103XY020MN - Loamy Upland Savannas
Other vegetative classification: Sloping Upland, Calcareous (G103XS010MN)
Hydric soil rating: No

Lester

Percent of map unit: 2 percent
Landform: Ground moraines, hillslopes
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Interfluvium, rise
Down-slope shape: Convex
Across-slope shape: Linear, convex
Ecological site: R103XY020MN - Loamy Upland Savannas
Other vegetative classification: Sloping Upland, Acid (G103XS006MN)
Hydric soil rating: No

110—Marna silty clay loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2vbk0
Elevation: 690 to 1,840 feet
Mean annual precipitation: 24 to 37 inches

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Mean annual air temperature: 43 to 52 degrees F

Frost-free period: 140 to 180 days

Farmland classification: Prime farmland if drained

Map Unit Composition

Marna and similar soils: 85 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Marna

Setting

Landform: Lake plains, ground moraines, flats

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Glaciolacustrine deposits over till

Typical profile

Ap - 0 to 7 inches: silty clay loam

A - 7 to 18 inches: silty clay loam

Bg - 18 to 36 inches: silty clay

2Bkg - 36 to 45 inches: clay loam

2Cg - 45 to 79 inches: clay loam

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Poorly drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high
(0.06 to 2.00 in/hr)

Depth to water table: About 0 to 8 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 20 percent

Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water supply, 0 to 60 inches: High (about 9.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2w

Hydrologic Soil Group: C/D

Ecological site: R103XY008MN - Clayey Wet Prairies

Forage suitability group: Level Swale, Neutral (G103XS001MN)

Other vegetative classification: Level Swale, Neutral (G103XS001MN)

Hydric soil rating: Yes

Minor Components

Okoboji

Percent of map unit: 7 percent

Landform: Depressions, depressions

Down-slope shape: Concave

Across-slope shape: Concave

Ecological site: R103XY015MN - Depressional Marsh

Other vegetative classification: Ponded If Not Drained (G103XS013MN)

Hydric soil rating: Yes

Guckeen

Percent of map unit: 5 percent
Landform: Ground moraines, flats, lake plains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: R103XY005MN - Clayey Upland Prairies
Other vegetative classification: Level Swale, Neutral (G103XS001MN)
Hydric soil rating: No

Brownton

Percent of map unit: 3 percent
Landform: Lake plains, flats, ground moraines
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R103XY008MN - Clayey Wet Prairies
Other vegetative classification: Level Swale, Calcareous (G103XS009MN)
Hydric soil rating: Yes

286—Shorewood silty clay loam, 1 to 6 percent slopes

Map Unit Setting

National map unit symbol: f97m
Elevation: 700 to 1,570 feet
Mean annual precipitation: 23 to 35 inches
Mean annual air temperature: 43 to 50 degrees F
Frost-free period: 155 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Shorewood

Setting

Landform: Rises on lake plains
Landform position (two-dimensional): Summit
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Clayey lacustrine deposits over fine-loamy till

Typical profile

Ap,A - 0 to 17 inches: silty clay loam
Bt - 17 to 39 inches: silty clay
C - 39 to 60 inches: loam

Properties and qualities

Slope: 1 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.57 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Available water supply, 0 to 60 inches: High (about 9.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C/D
Ecological site: R103XY021MN - Clayey Upland Savannas
Forage suitability group: Sloping Upland, Neutral (G103XS002MN)
Other vegetative classification: Sloping Upland, Neutral (G103XS002MN)
Hydric soil rating: No

Minor Components

Minnetonka

Percent of map unit: 5 percent
Landform: Flats
Hydric soil rating: Yes

Guckeen

Percent of map unit: 5 percent
Landform: Lake plains
Hydric soil rating: No

539—Klossner muck, lake plain, depressional, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2s8x1
Elevation: 690 to 1,840 feet
Mean annual precipitation: 24 to 37 inches
Mean annual air temperature: 43 to 52 degrees F
Frost-free period: 140 to 180 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Klossner, Drained

Setting

Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Organic material over glaciolacustrine deposits

Typical profile

Oap - 0 to 9 inches: muck
Oa - 9 to 24 inches: muck
2A - 24 to 46 inches: silty clay loam
2Cg - 46 to 79 inches: silty clay loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 2.00 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: Occasional
Calcium carbonate, maximum content: 20 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very high (about 17.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Ecological site: R103XY016MN - Organic Marsh
Forage suitability group: Organic (G103XS014MN)
Other vegetative classification: Organic (G103XS014MN)
Hydric soil rating: Yes

Minor Components

Lura

Percent of map unit: 10 percent
Landform: Depressions, ground moraines, lake plains
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R103XY015MN - Depressional Marsh
Other vegetative classification: Ponded If Not Drained (G103XS013MN)
Hydric soil rating: Yes

Brownnton

Percent of map unit: 5 percent
Landform: Lake plains, flats, ground moraines
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R103XY008MN - Clayey Wet Prairies
Other vegetative classification: Level Swale, Calcareous (G103XS009MN)

Hydric soil rating: Yes

L113B—Reedslake-Le Sueur complex, 1 to 6 percent slopes

Map Unit Setting

National map unit symbol: 2y037

Elevation: 690 to 1,450 feet

Mean annual precipitation: 24 to 37 inches

Mean annual air temperature: 37 to 52 degrees F

Frost-free period: 140 to 168 days

Farmland classification: All areas are prime farmland

Map Unit Composition

Reedslake and similar soils: 59 percent

Le sueur and similar soils: 30 percent

Minor components: 11 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Reedslake

Setting

Landform: Hillslopes

Landform position (two-dimensional): Summit, shoulder, backslope

Landform position (three-dimensional): Rise

Down-slope shape: Convex, linear

Across-slope shape: Linear, convex

Parent material: Fine-loamy till

Typical profile

Ap - 0 to 6 inches: loam

A - 6 to 15 inches: loam

Bt - 15 to 33 inches: loam

Bk - 33 to 54 inches: loam

C - 54 to 79 inches: loam

Properties and qualities

Slope: 2 to 6 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Moderately well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.20 to 2.00 in/hr)

Depth to water table: About 20 to 41 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 25 percent

Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water supply, 0 to 60 inches: High (about 10.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2e

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Hydrologic Soil Group: C

Ecological site: R103XY020MN - Loamy Upland Savannas

Forage suitability group: Sloping Upland, Neutral (G103XS002MN)

Other vegetative classification: Sloping Upland, Neutral (G103XS002MN)

Hydric soil rating: No

Description of Le Sueur

Setting

Landform: Hillslopes

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Talf

Down-slope shape: Concave, linear

Across-slope shape: Linear

Parent material: Fine-loamy till

Typical profile

Ap - 0 to 6 inches: clay loam

A - 6 to 11 inches: clay loam

Bt - 11 to 24 inches: clay loam

Bkg - 24 to 36 inches: loam

BC - 36 to 55 inches: loam

C - 55 to 79 inches: loam

Properties and qualities

Slope: 1 to 3 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat poorly drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high
(0.06 to 2.00 in/hr)

Depth to water table: About 12 to 24 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 25 percent

Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water supply, 0 to 60 inches: High (about 10.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 1

Hydrologic Soil Group: C/D

Ecological site: R103XY020MN - Loamy Upland Savannas

Forage suitability group: Sloping Upland, Acid (G103XS006MN)

Other vegetative classification: Sloping Upland, Acid (G103XS006MN)

Hydric soil rating: No

Minor Components

Cordova

Percent of map unit: 7 percent

Landform: Depressions

Landform position (three-dimensional): Talf

Down-slope shape: Concave

Across-slope shape: Concave

Ecological site: R103XY022MN - Loamy Wet Savannas

Other vegetative classification: Level Swale, Neutral (G103XS001MN)

Hydric soil rating: Yes

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Swanlake

Percent of map unit: 4 percent

Landform: Hillslopes

Landform position (two-dimensional): Summit, shoulder, backslope

Landform position (three-dimensional): Rise

Down-slope shape: Convex, linear

Across-slope shape: Convex

Ecological site: R103XY020MN - Loamy Upland Savannas

Other vegetative classification: Sloping Upland, Calcareous (G103XS010MN)

Hydric soil rating: No

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