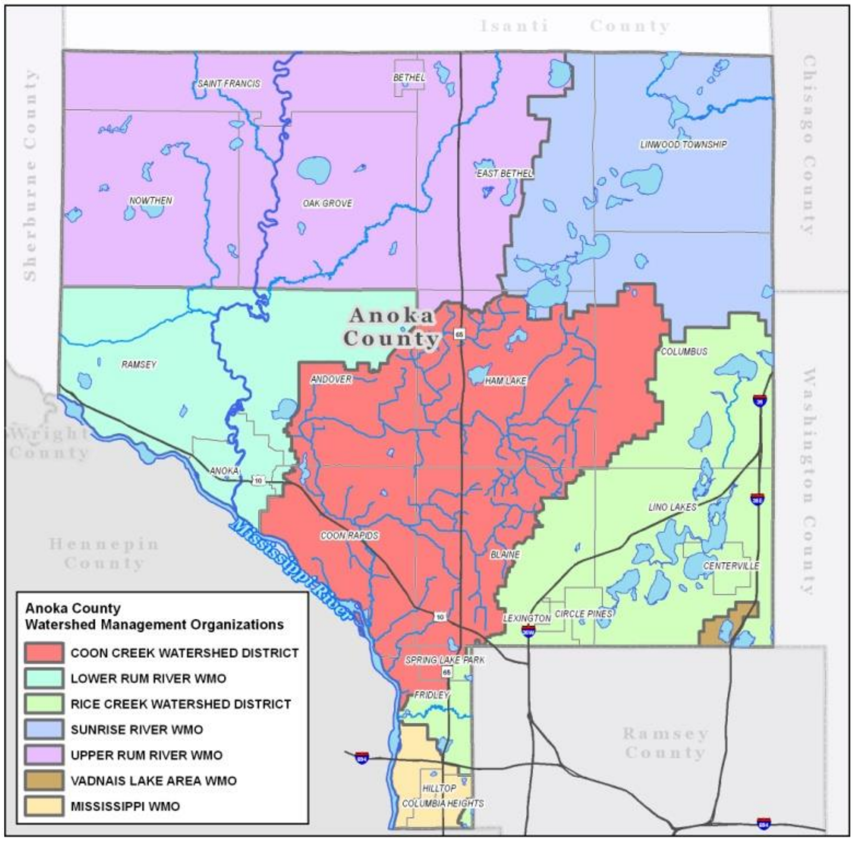
Overview of the Coon Creek Watershed

Location

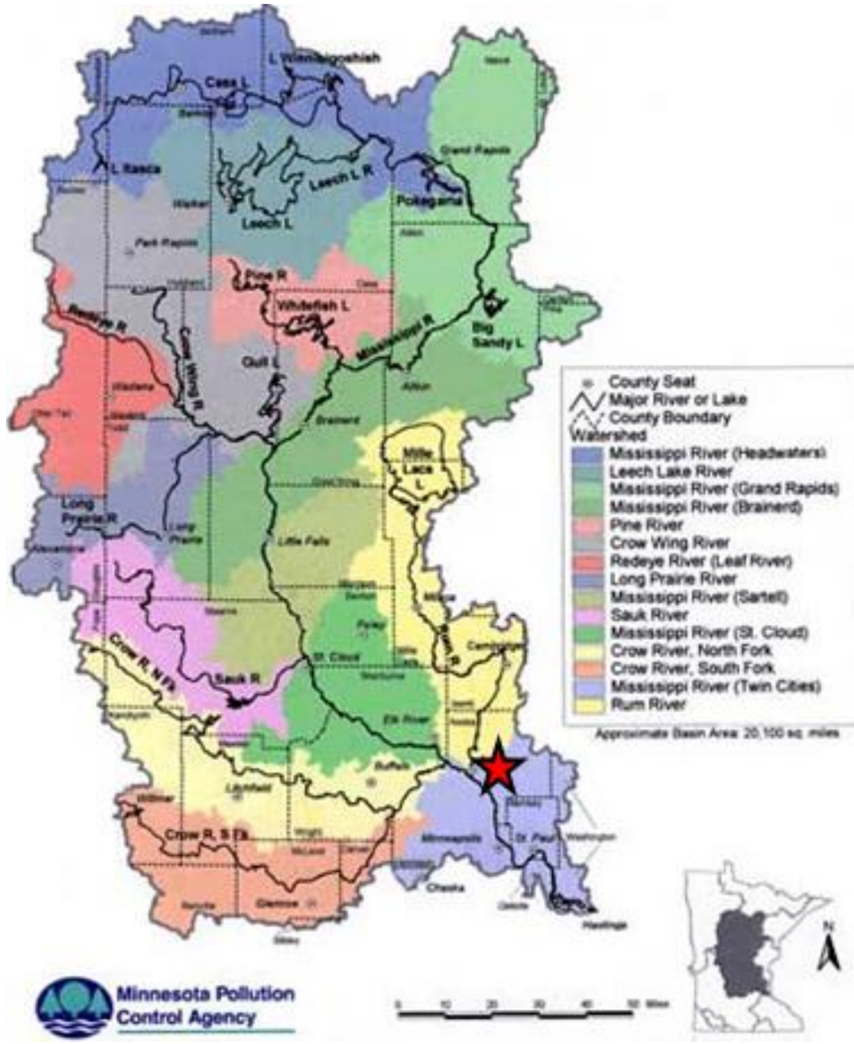
The Coon Creek Watershed District is a 107-square mile drainage area in Central Anoka County, Minnesota.

Anoka County Minnesota



Upper Mississippi River Watershed

The Coon Creek watershed is part of the Twin Cities portion of the Upper Mississippi River Watershed (UMRW). The UMRW includes the headwaters of the Mississippi River and its outlet is at its confluence with the Minnesota River. The Coon Creek Watershed outlets to the Mississippi River approximately 21 miles upstream from where those rivers join.



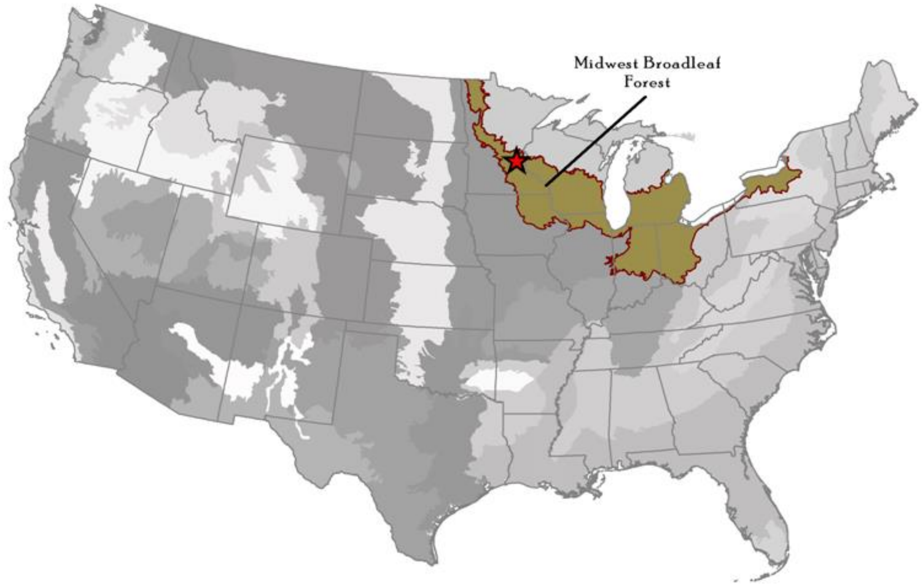
Ecological Setting

To address ecosystem hierarchy we will use the National Framework of Ecological Units based on terms defined by Bailey (1995). The Ecological Classification System (ECS) is a method to identify, describe and map units of land with different capabilities to support natural resources. This is done by integrating climatic, geologic, hydrologic, topographic, soil and vegetation data.

ECS divides the landscape into a series of ecosystems that are nestled within one another in a hierarchy of spatial sizes. In Minnesota, the classification and mapping is divided into six levels of detail. These levels are:

Province	Midwest Broadleaf Forest
Section	**Minnesota and NE Iowa Moraine**
Subsection	Anoka Sand Plain
Land type association	Anoka Lake Plain
Land types	Glacial Lake Hugo Lake Plain
	Glacial Lake Fridley Lake Plain
	Mississippi Sand Plain

Midwest Broadleaf Forest Province

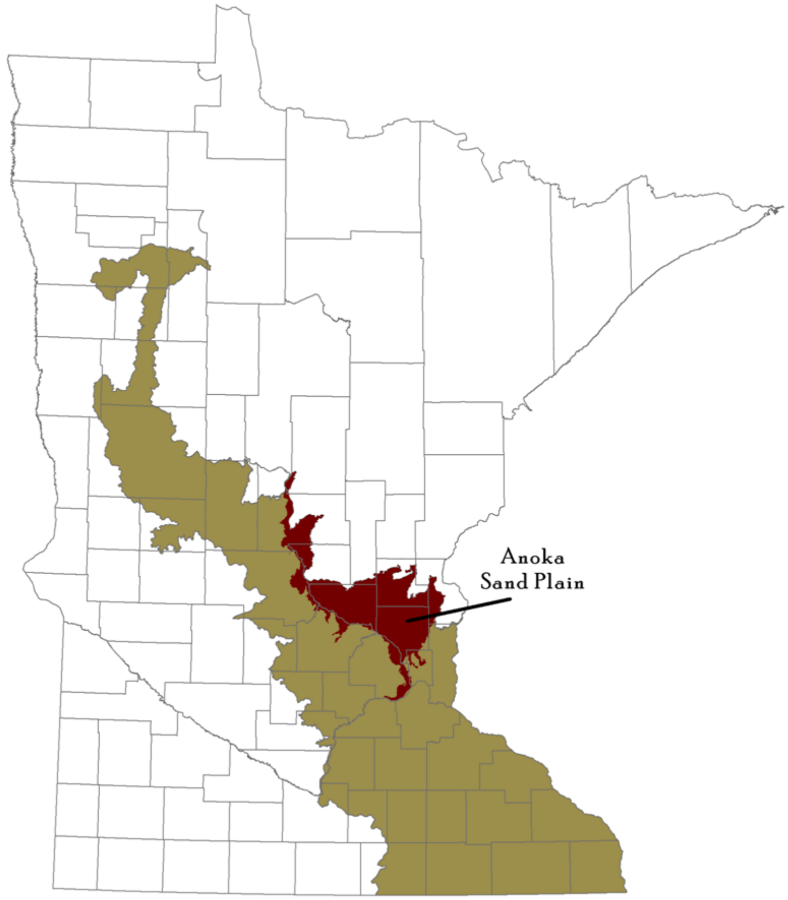


Subsection - Anoka Sand Plain

The Anoka Sand Plain is approximately 1,960 square miles in size. It is a sand outwash plain formed by the retreat of the Superior Lobe of the Grantsburg Sub-lobe of the Late Wisconsin glaciers.

Outwash plains consist mainly of sandy and coarsely textured material of glaciofluvial origin; generally smooth, and where pitted is of generally low topographic relief.

The Anoka Sand Plain consists of a flat, sandy lake plain along the Mississippi River.

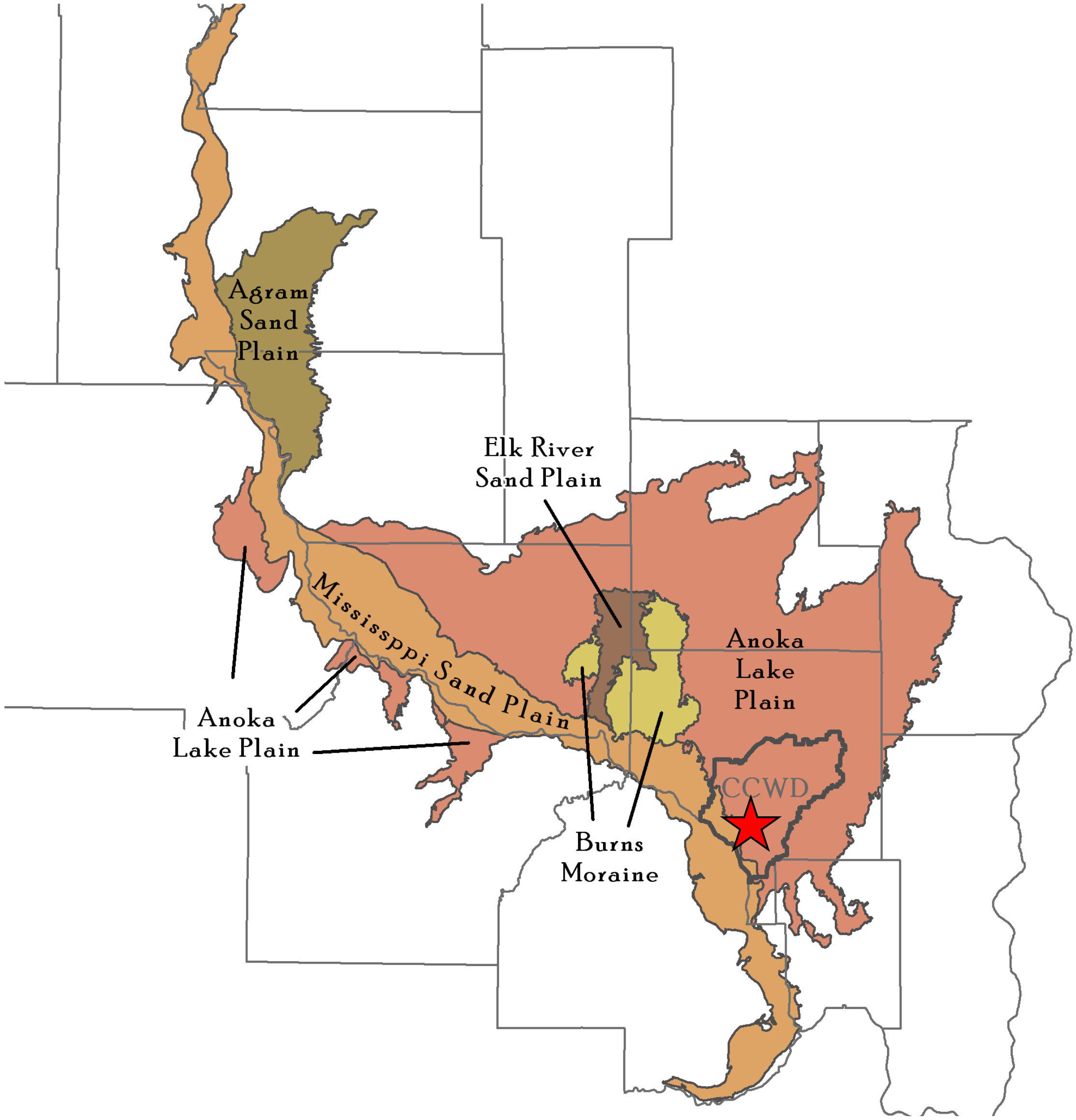


Land Type Association: Anoka Lake Plain

Coon Creek Watershed is included in a portion of the Anoka Sand Plain known as the Anoka Lake Plain.

The Anoka Lake Plain is a nearly level to gently rolling lake plain formed by melt water from the Grantsburg Sublobe. Some areas of the lake plain have been reworked by wind to form dunes.

The soils are primarily fine sands with organic and loamy and hemic hydric soils in depressions. The regional water table is very shallow, usually less than 17 feet below the surface with much of it exposed in the form of wetlands, lakes and streams.


Agram
Sand
Plain
Elk River
Sand Plain
Anoka
Lake
Plain
Mississppi Sand Plain
Anoka
Lake Plain
CCWD
Burns
Moraine

Land Types

The basic character of the watershed landscape occurs in three geomorphic land types that contain distinctive landforms and landscape patterns (Glacial Lake Hugo, Glacial Lake Fridley and the Mississippi River Terrace).

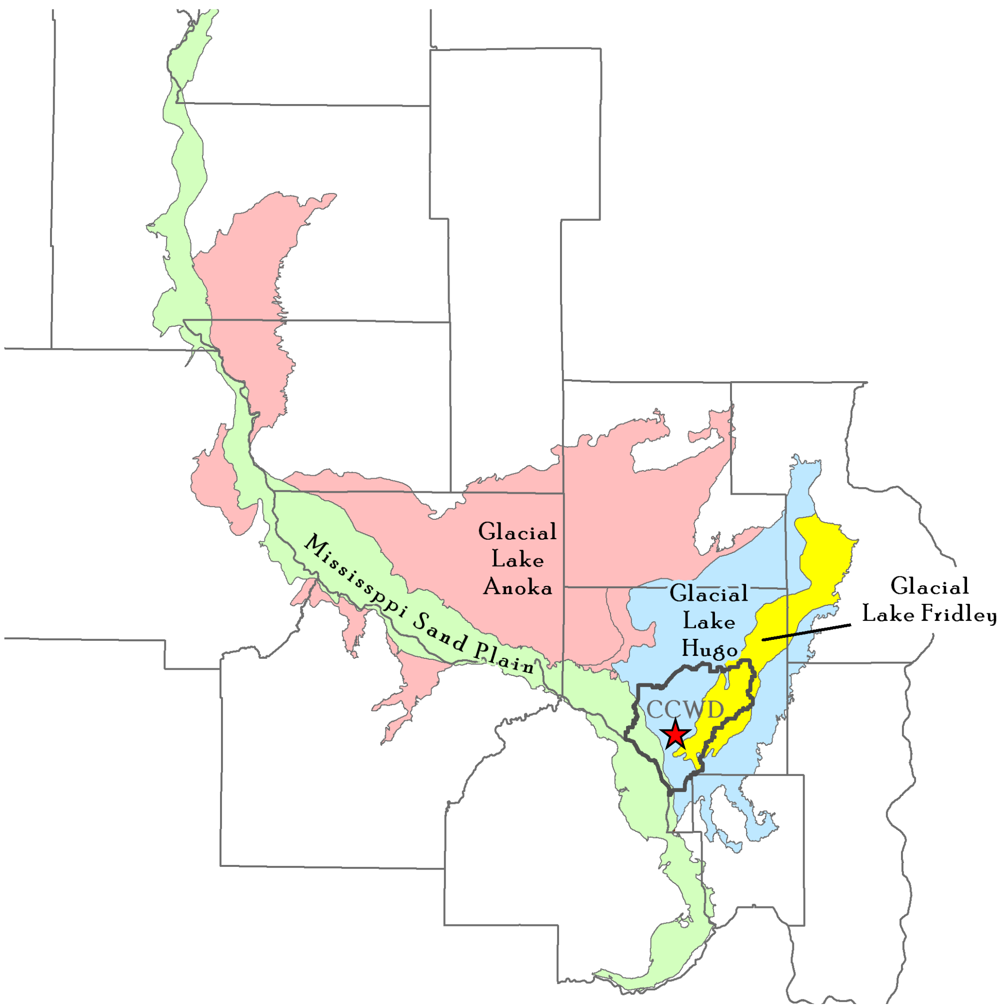
Glacial Lake Hugo

Glacial Lake Fridley

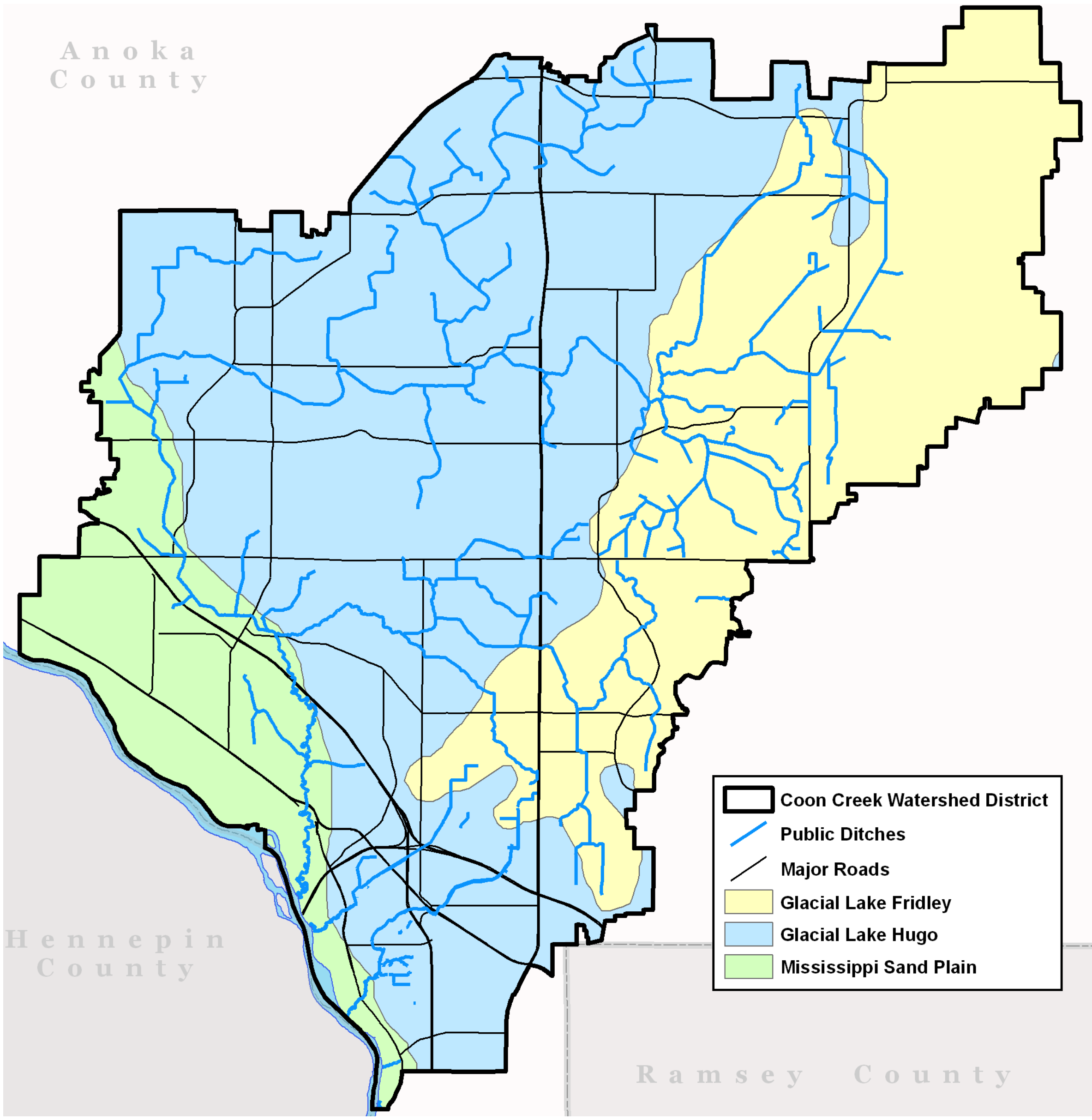
These land types were formed from glacial meltwater as the Grantsburg sublobe melted between 16,000 and 13,000 years ago. The meltwaters formed a large outwash and lake plain. The outwash plain is mainly sandy or coarsely textured material of glaciofluvial material. An outwash plain is commonly smooth, and where pitted or contains depressions, generally is low in relief. The lake deposited sands across much of eastern part of the Anoka Sand Plain (Meyer, 1993).

Mississippi Sand Plain

A third land type, The Mississippi River Terraces provides a distinctive landscape formed by the Mississippi River. Here the erosion and down cutting created by the river is steep in some places in contrast to the smooth and flat landscape of the lake plains.



Major Land Types within Coon Creek Watershed District



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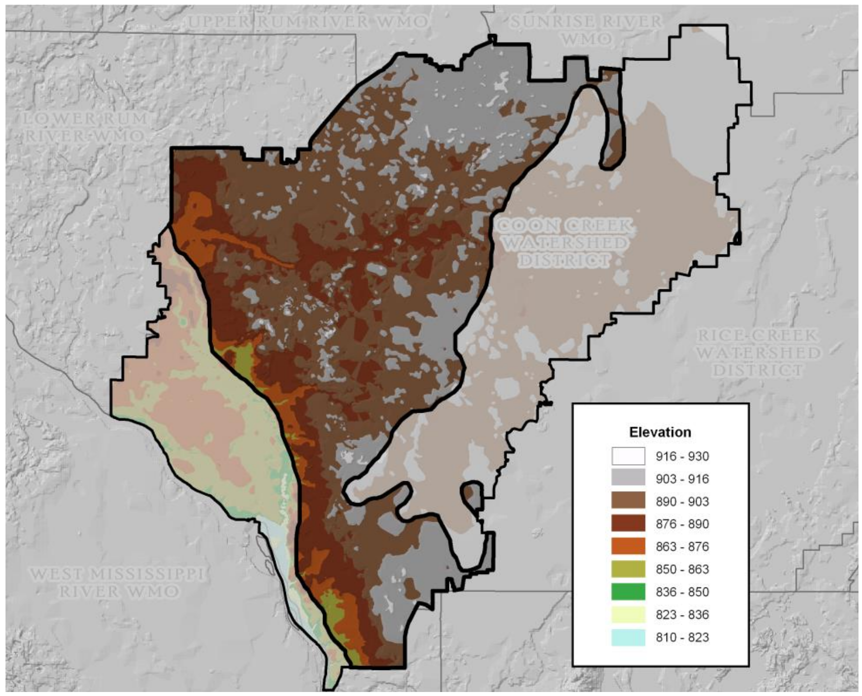
Glacial Lake Hugo Lake Plain

Occurrence

This is the predominant land type in the watershed. It occurs in all of the portions of the watershed within Andover and Coon Rapids, and in Ham Lake and Blaine west of TH 65.

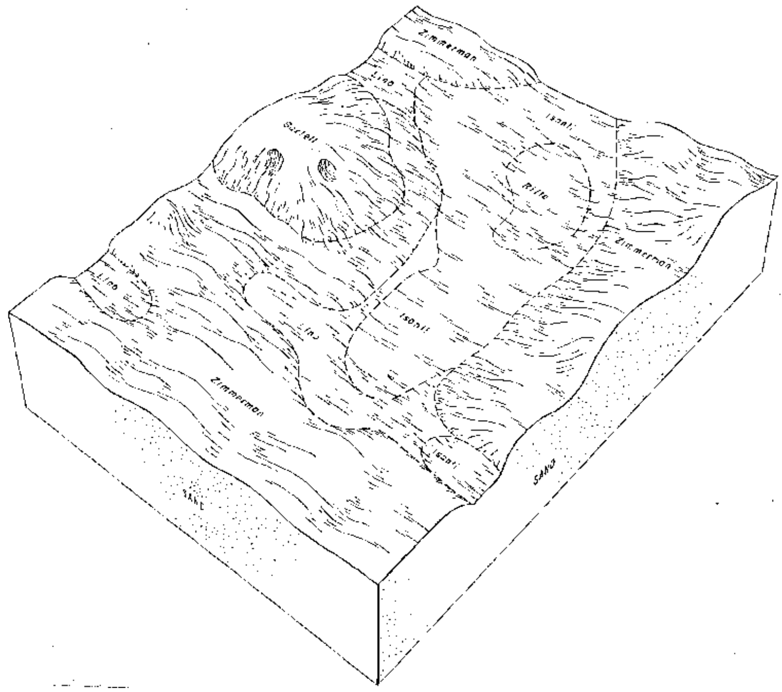
The Coon Creek portion of the Glacial Lake Hugo Lake Plain is approximately 37,000 acres (57 sq mi.). This comprises about 54% of the watershed.



The lake plain is a broad undulating sand plain comprised of rolling dunes and small flats in the upland, and low-lying depressions and flats.

Elevations range from 930 to 840 FASL
Topographic changes of 5-15 feet are typical.
The average slope of 0.95%

Glacial Lake Hugo Lake Plain



Soils

The soils are excessively drained, somewhat poorly drained, or very poorly drained and are dominated by fine sands throughout.

- Zimmerman fine sand (45%)
- Isanti fine sand (15%)
- Lino fine sand (10%)

Soil hydrology and conductivity within the Lake Hugo Lake Plain has changed:

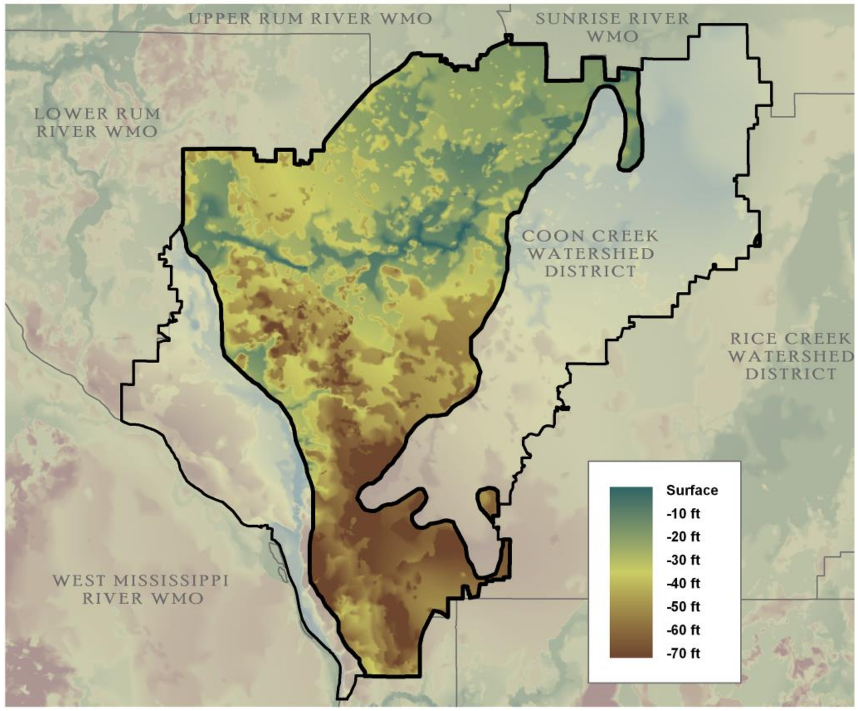
Hydrologic Soil Group	Presettlement	Current	Change
A-Well Drained	64%	88%	+24%
B-Moderately Well Drained	0%	11%	+11%
C- Poorly Drained			
D-Very Poorly Drained	35%	1%	-34%

Surficial Groundwater

The naturally-occurring high water table is at or near the surface in most depressed areas.

Water Table	Historic Depth (Ft)	Current Depth (Ft)	Change
Average	17	21	-4
Maximum	57	65	-8

Glacial Lake Hugo Lake Plain



Ditches and Water Courses

The Hugo Lake Plain has nearly 400 miles of creek, ditch and storm sewer systems:

	Miles	
Channels (Public)	64.5	
Channels (Private)	63.5	
Channels (Total)	**128.0**	
Stormsewer	271.3	
Total	**399.3**	
Drainage Density	**7.0**	**Miles per Square M**

Glacial Lake Hugo Lake Plain

Impervious Area

Approximately 19% of the Hugo Lake Plain is impervious:

Land Use	Acres	% Land Type	% Imprv.	Imprv. Acres
Agricultural	3,065	8%	5%	153
Airport	124	0%	20%	25
Commercial	1,266	3%	75%	950
Industrial	1,091	3%	70%	764
Major Highway	1,041	3%	50%	520
Multi-Family Residential	1,274	3%	40%	509
Parks & Rec	3,734	10%	5%	187
Public/Semipublic	1,009	3%	30%	303
Railway	24	0%	35%	8
Single Family Residential	13,252	36%	25%	3,313
Vacant	10,469	28%	5%	523
Water	700	2%	100%	700

Stormwater

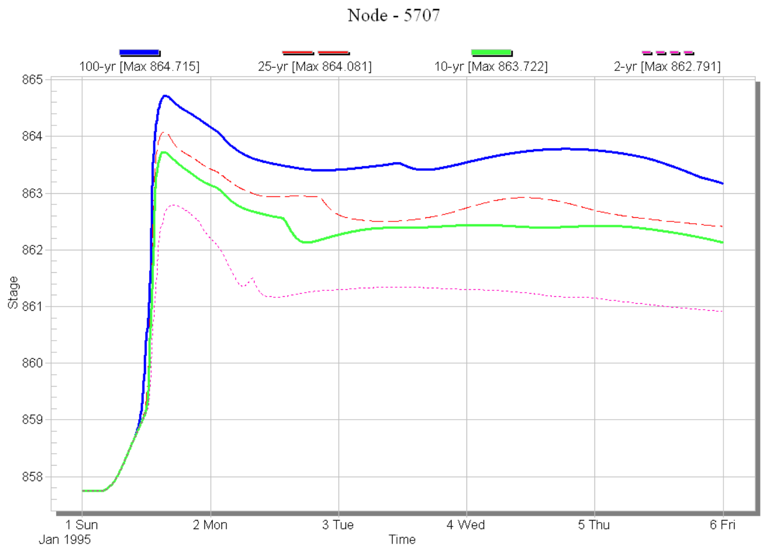
The Glacial Lake Hugo Lake Plain outlets in two locations:

1. Where Coon Creek (Ditch 57) crosses under South Coon Creek Drive
2. Where Sand Creek enters Coon Creek north of Northdale Boulevard in Coon Rapids.

The Time of Concentration at this point is approximately 16 hours on all storm events.

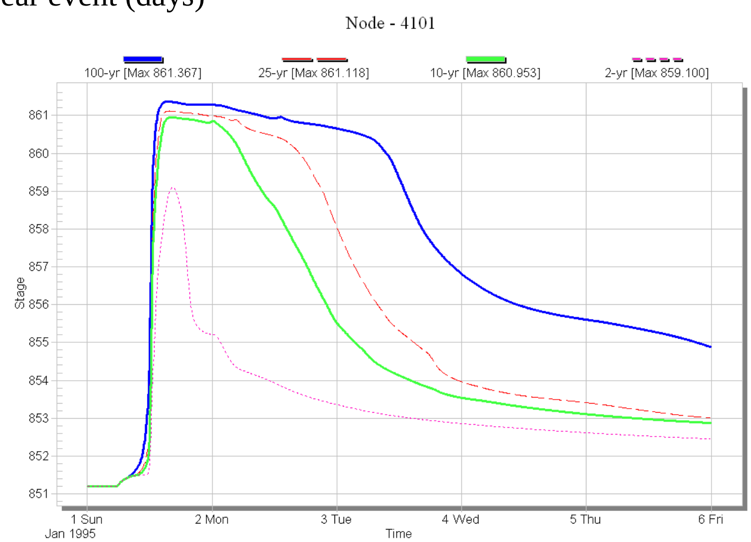
Coon Creek (Ditch 57) at South Coon Creek Drive

	1999	2009	Change	Percent Change
Time to Peak (Hrs)	28.4	17	-11.4	-40%
100 yr Elevation	886.6	884.7	-1.9	-
Peak Discharge (cfs)	1,883	1,490	-393	-20%
Flow Duration on 2 year event (days)	11 days			



Sand Creek at Coon Creek

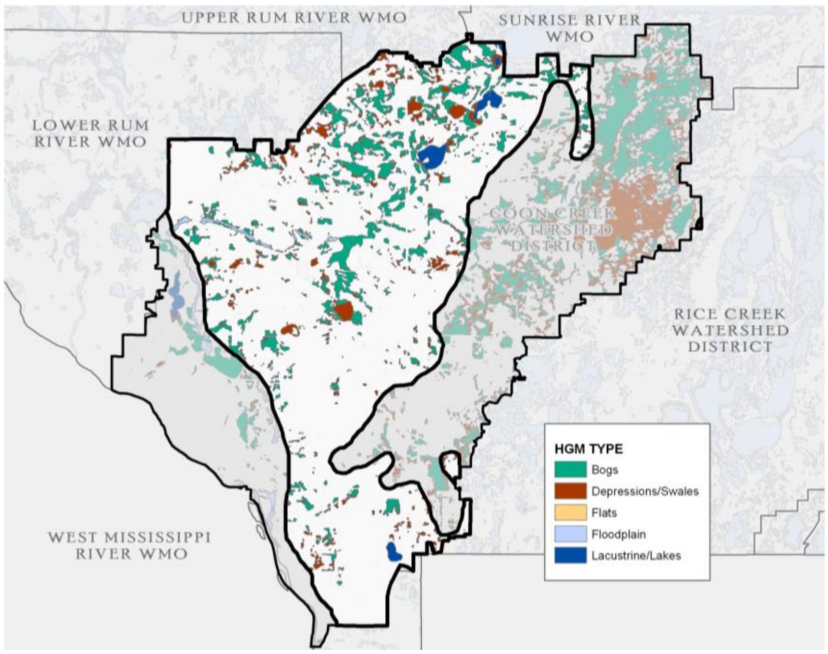
	1998	2009	Change	% Change
Time to Peak (Hrs)	24.2	16.5	-7.7	-31%
100 yr Elevation	861.5	861.4	.1	-
Peak Discharge (cfs)	678	544	134	-20%
Flow Duration on 2 year (days)		12 days		



Water Quality

	Standard	Ditch 57		Sand Creek	
		Base flow	**Storm**	**Base flow**	**Storm**
Chloride	≥ 230 mg/L	39.3	32.8	95.9	52.6
Dissolved Oxygen	<6.3 mg/L	15	8	8	8.5
Total Phosphorus	>.130 mg/L	.090	.160	.090	.130
Total Suspended Solids	>13.7 mg/L	5.5	18.5	7.7	37.3
Turbidity	>25 FRNU	8.3	27	7.3	29.3

Lakes and Wetlands



Lakes

The Hugo Lake Plain has three lakes and lacustrine wetlands comprising 393 acres:

Lake Name	Nature	Lake ID	Size (Ac)	Littoral Zone (%)	Max Depth (ft)	Water Clarity (ft)	Overall Condition	TSI
Amelia	Man Made							
Andover	Man Made							
Bunker	Wetland	020090	70	100%	6			
Dianne	Man Made							
Ham	Shallow Lake	020053	174	92%	22	6.8	A	47

Laddie	Shallow Lake	020072	61	77%	4	na	na	na
McKay	Wetland	020083		100%	6			
Netta	Shallow Lake	020052	115		19	7.6	B	51

Wetlands

The Lake Hugo Land Type contains 5,551 acres of wetlands.

Approximately 91% of these wetlands are ephemeral in nature, relying on saturated, seasonal or temporary hydrology to sustain their wetland characteristics.

The remaining wetlands tend to be semi-permanently flooded.

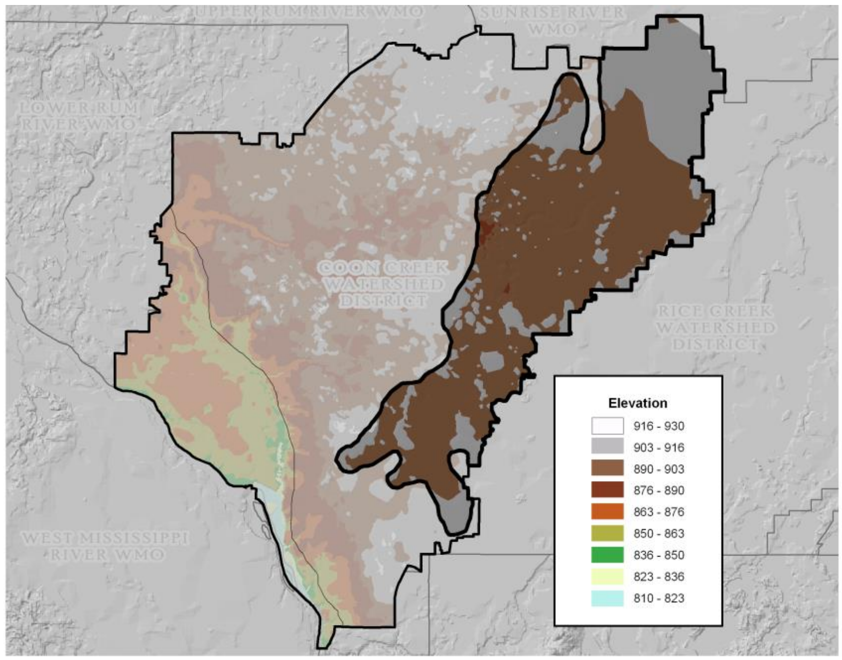
Hydrogeomorphic Classification	Acres	% Land Type
Bogs	3,482.2	64%
Depressions/Swales	1,557.1	27%
Flats	8.1	0%
Floodplain	142.9	3%
Lacustrine	361.3	6%

Glacial Lake Fridley Lake Plain

Occurrence

This land type occurs in Blaine, Columbus and southeastern Ham Lake.

The Coon Creek portion of the Glacial Lake Fridley Lake Plain is approximately 22,042 acres (34 sq mi.). This comprises about 32% of the watershed.



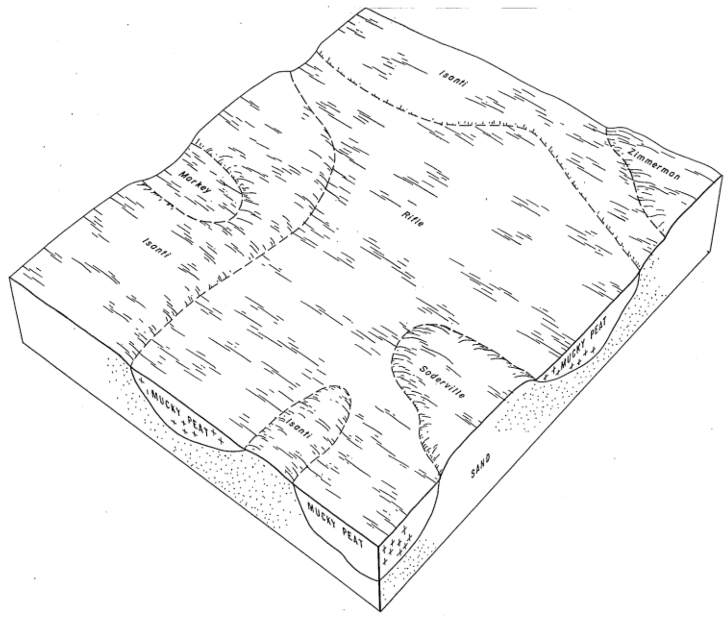
Landscape and Topography

Characterized by large level areas that were, or still are, bogs with small sandy island-like features that rise 0-15 feet above the general level of the surrounding land.

Elevations range from 920 to 890 FASL
The average slope is 0.7%.

It is the flattest portion of the watershed.

Glacial Lake Fridley Lake Plain



Soils

Soils are very poorly drained and formed in organic material and also fine sands that are very poorly drained.
Rifle peat and muck (60%)
Isanti fine sand (20%)

Soil hydrology has changed significantly:

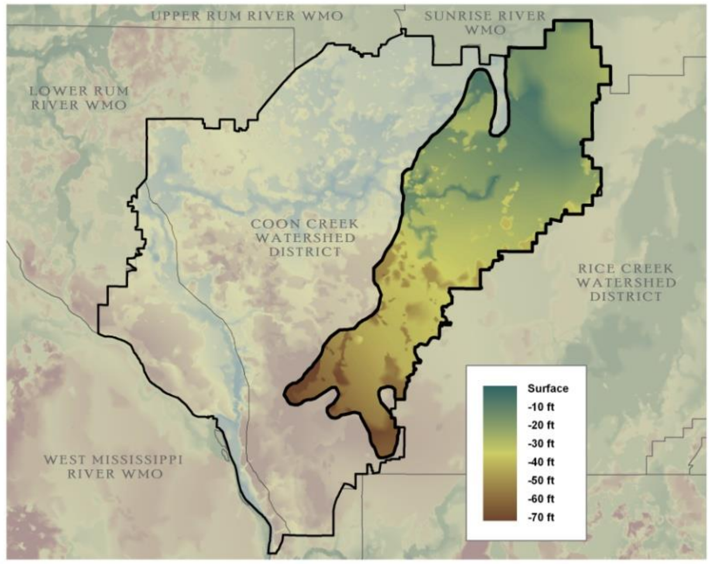
Hydrologic Soil Group	Presettlement	Current	Change
A-Well Drained	33%	75%	42%
B-Moderately Well Drained	0%	25%	25%
D-Very Poorly Drained	67%	0%	-67%

Surficial Groundwater

The naturally occurring high water table is at or near the surface in most depressed areas.

Water Table	Historic Depth (Ft)	Current Depth (Ft)	Change
Average	16	17	1
Maximum	60	60	0

Glacial Lake Fridley Lake Plain



Ditches and Water Courses

The Fridley Lake Plain has approximately 218 miles of creek, ditch, and storm sewer:

	Miles
Channels (Public)	49
Channels (Private)	75
Channels (Total)	**125**
Stormsewer	92.9
Total	**217.9**
Drainage Density	**6.4** **per Square Mile**

Imperviousness

Approximately 13% of this land type is impervious:

Land Use	Acres	% Land Type	% Imperv	Imperv Acres
Agriculture	2,303	10%	5%	115
Airport	371	2%	20%	74
Commercial	303	1%	75%	227
Industrial	264	1%	70%	185
Major Highway	106	0%	50%	53
Multi-Family Residential	270	1%	40%	108
Parks & Rec	5,738	26%	5%	287
Public/Semipublic	55	0%	30%	16
Single Family Residential	3,300	15%	25%	825
Vacant	8,806	40%	5%	440
Water	523	2%	100%	523

Stormwater

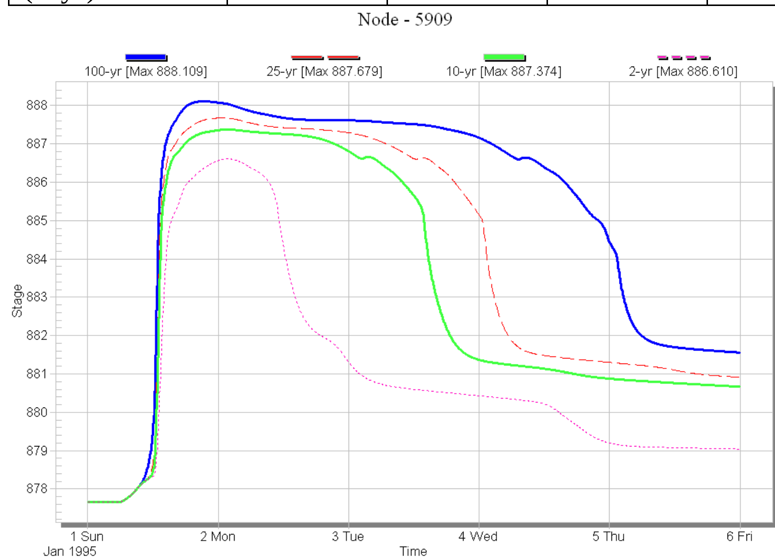
The Glacial Lake Fridley Lake Plain outlets in two locations:

Glacial Lake Fridley Lake Plain

1. Coon Creek (Ditch 59) upstream from Radisson Road
2. Sand Creek (Ditch 41) at Central Avenue

Ditch 59 at Radisson Road

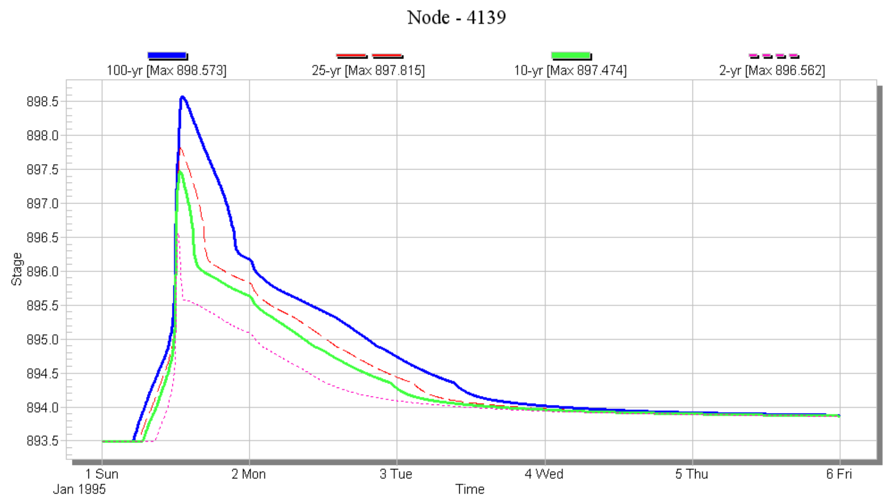
	1999	**2009**	**Change**	**Pct Change**
Time to Peak (Hrs)	17	35	18	105%
100 yr Elevation	883.3	888.1	4.8	
Peak Discharge (cfs)	950	876	-74	-774%
Flow Duration on 2 year event (days)		6		



Glacial Lake Fridley Lake Plain

Sand Creek (Ditch 41) at Central Avenue

	1999	2009	Change	% Change
Time to Peak (Hrs)	35	27	-8	-23%
100-year Elevation	895.3	898.6	3.3	-
Peak Discharge (cfs)	350	221	-129	-37%
Flow Duration on 2 yr event (days)		13 days		



Water Quality

	Standard	Ditch 59 @ Radisson Rd		Ditch 41 @ Central Ave	
		Base flow	Storm	Base flow	Storm
Chloride	≥ 230 mg/L			88.8	81.8
Dissolved Oxygen	<6.3 mg/L			11.2	9.6
Total Phosphorus	.130 mg/L			.070	.100
Total Suspended Solids	>13.7 mg/L			8.5	8.0
Turbidity	>25 FRNU			12.3	12

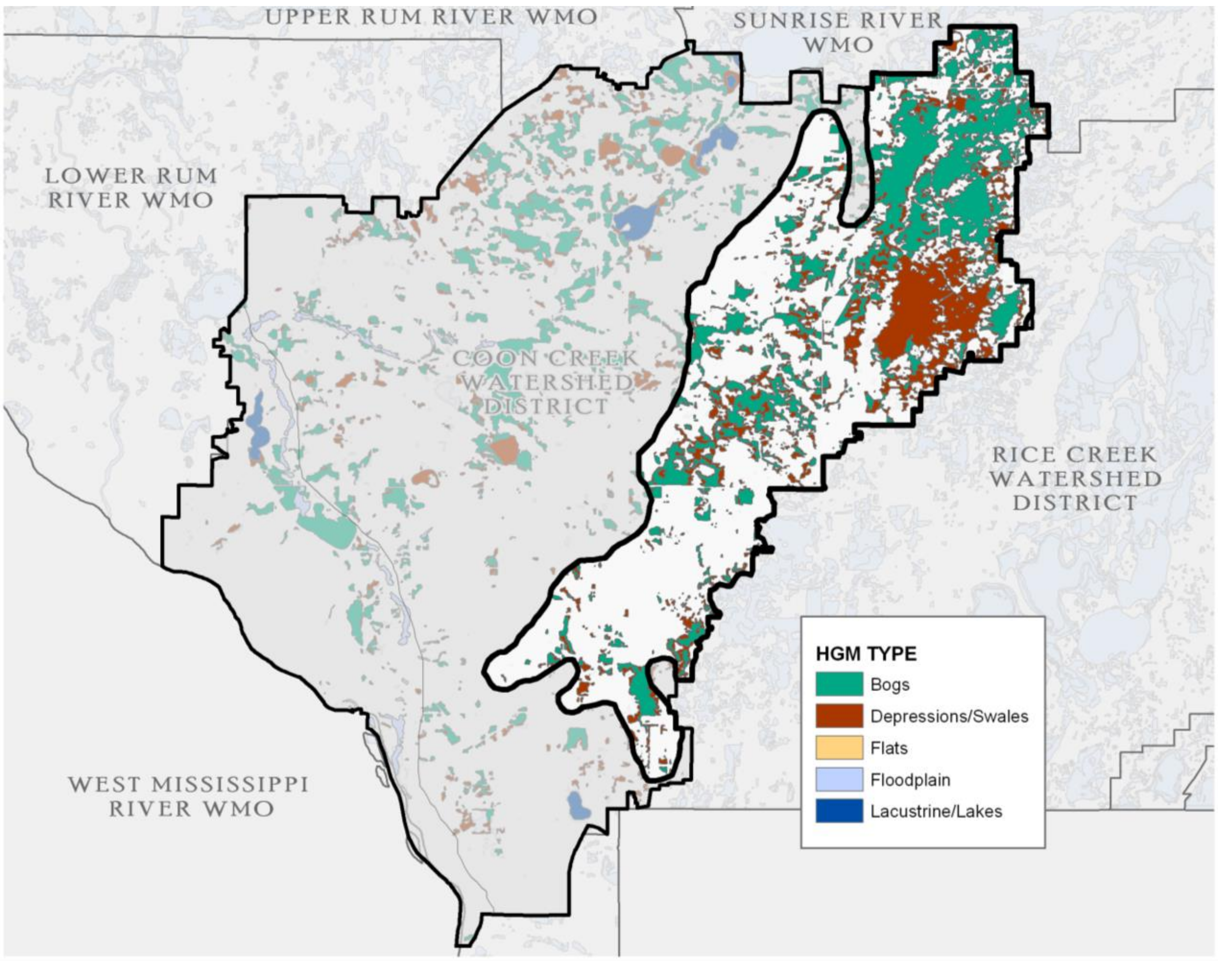
Glacial Lake Fridley Lake Plain

Lakes and Wetlands

The Lake Fridley Lake Plain has 33 acres of Lakes and Lacustrine wetlands comprised of two shallow lakes within the Carlos Avery Wildlife Management Area.

All lakes within this land type are man-made:

Name	Nature	Lake ID	Size (Ac)	Max Depth (ft)	Water Clarity (ft)
Club West	Man Made	020764	27.9	26	3.5
Sunrise	Man Made				
TPC	Man Made				



Wetlands

The Lake Fridley Land Type contains 7,900 acres of wetland. Approximately 57% of these wetlands (4,500) are ephemeral in nature, relying on saturated, seasonal or temporary hydrology to sustain their wetland characteristics. The vast majority of wetlands with more permanent hydrology are within the Carlos Avery Wildlife Management Area.

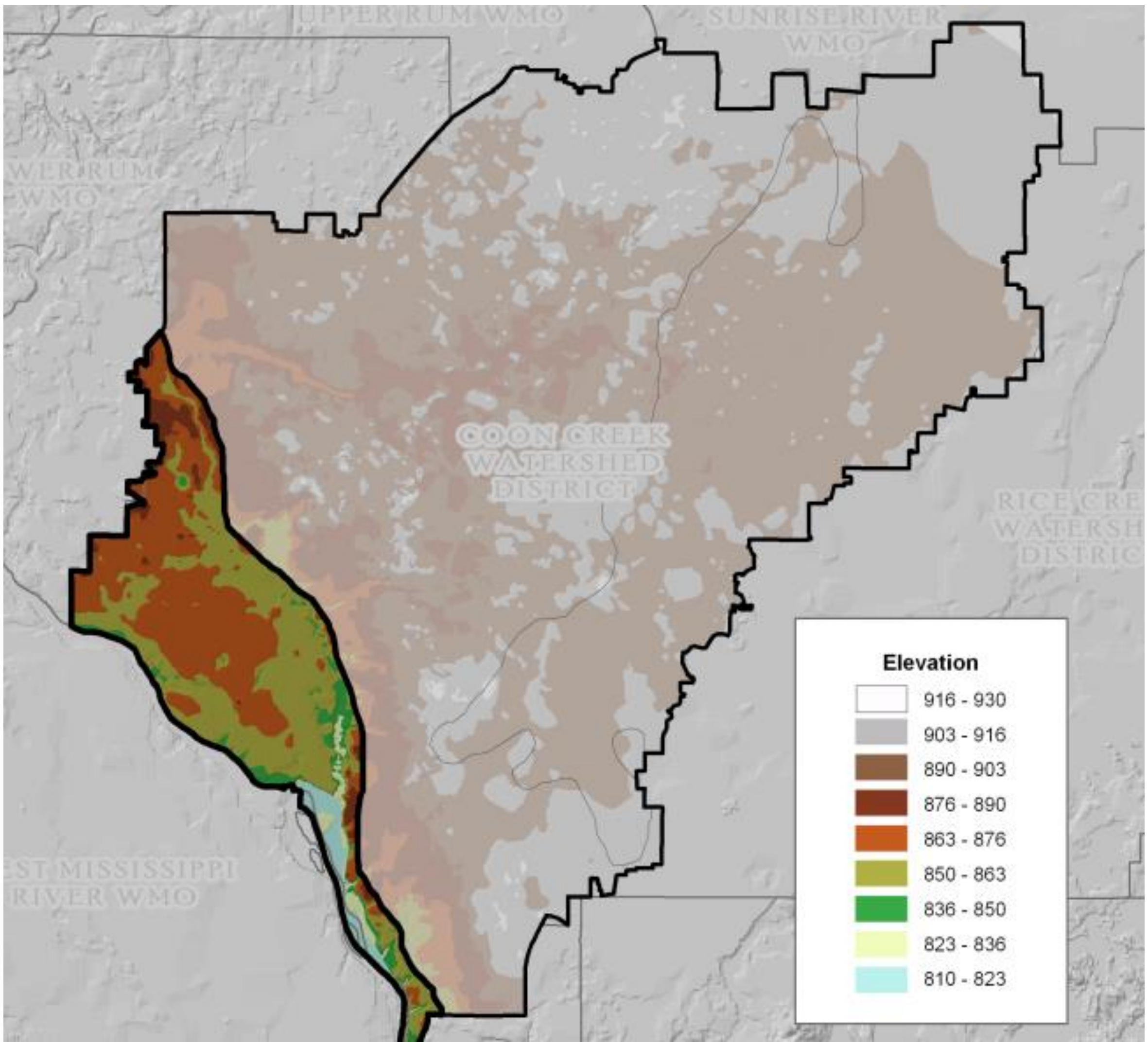
Hydrogeomorphic Classification	Acres	% Land Type
Bogs	4,547.3	57%
Depressions/Swales	3,403.5	42%
Flats	0	0%
Floodplain	0	0%
Lacustrine	33.1	0%

Mississippi Sand Plain

Occurrence

The Mississippi River Terrace occurs west of the Burlington Northern Railroad tracks which define most of the eastern boundary.

The Coon Creek portion of the Mississippi River Terrace is approximately 8,736 acres (13.7 sq mi). This comprises about 13% of the watershed.



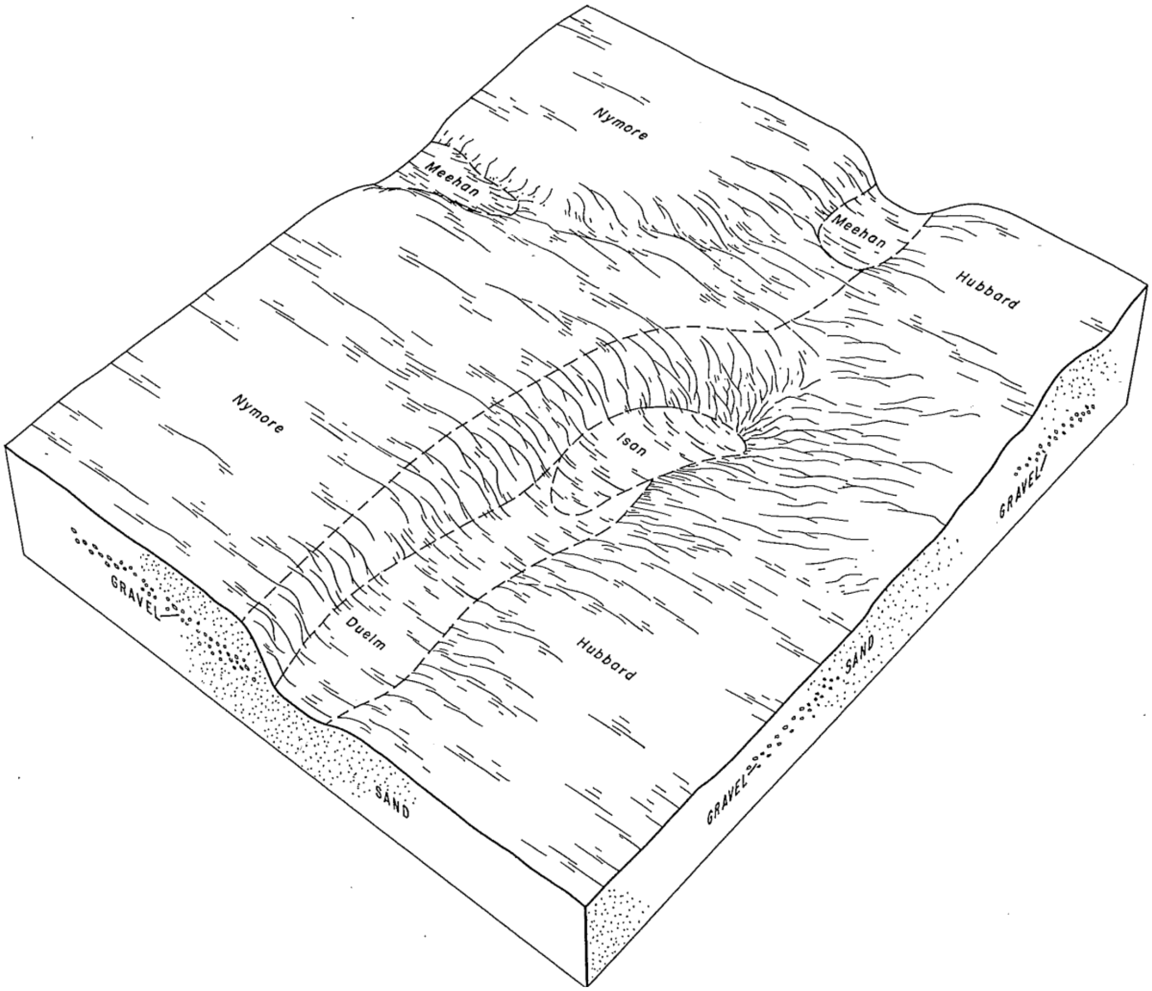
Landscape

This land type is a nearly-level to gently sloping outwash plain that is dissected by drainageways that historically lead to the Mississippi River. The area is pitted by large depressions. Steeper slopes occur next to these larger depressions and drainageways.

Elevations range from 890 to 810 FASL.

The average slope is 1.4%.

Mississippi Sand Plain



Soils

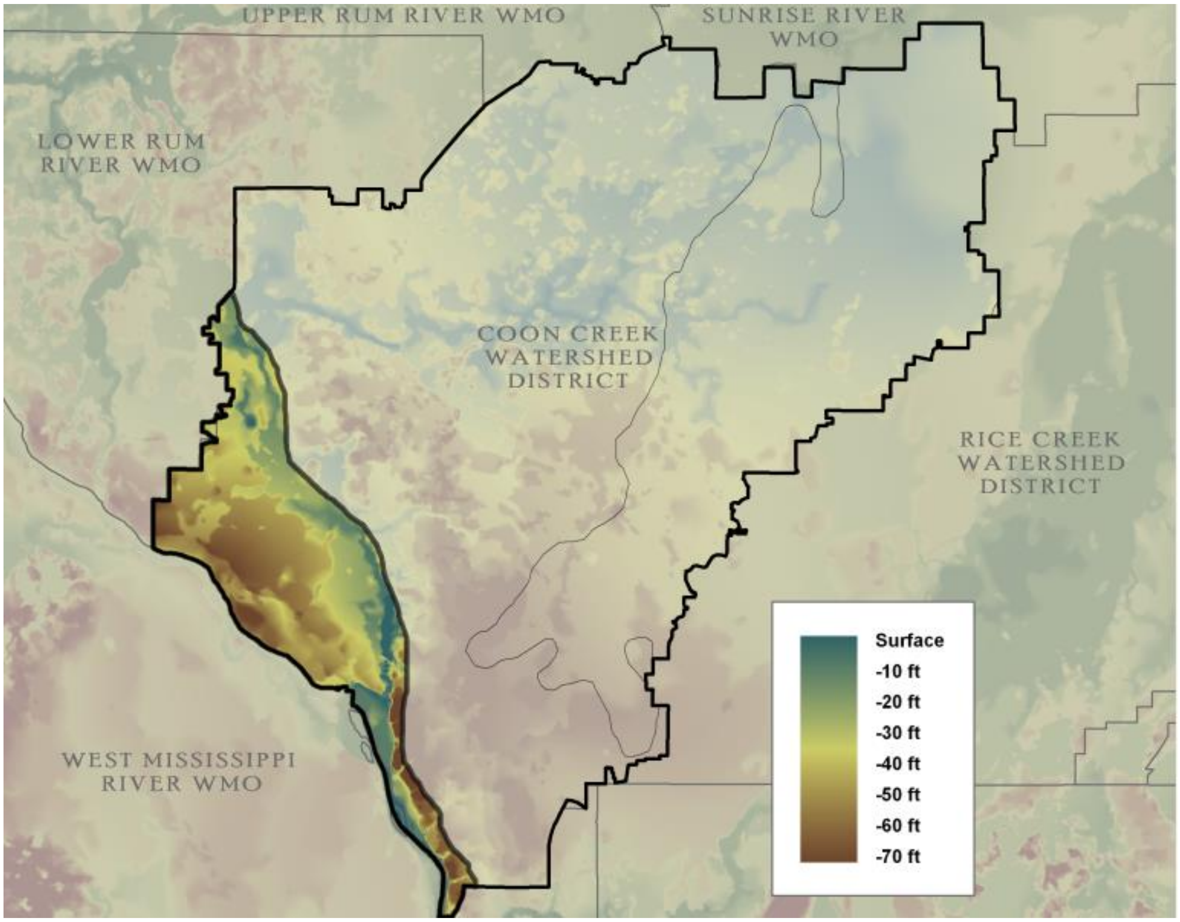
Soils tend to be excessively drained and sandy throughout.

Hydrologic Soil Group	Presettlement	Current	Change
A-Well Drained	67%	79%	12%
B-Moderately Well Drained	3%	6%	3%
D-Very Poorly Drained	22%	7%	-15%

Surficial Groundwater

Water Table	Historic Depth (Ft)	Current Depth (Ft)	Change (Ft)
Average	17	22	-5
Maximum	74	80	-6

Mississippi Sand Plain



Ditches and Water Courses

The Mississippi Sand Plain has approximately 141 miles of creek, ditch and storm sewer:

Channels (Public)	19.2 miles	
Channels (Private)	11.0	
Channels (Total)	**30.2**	
Stormsewer	110.9	
Total	141.1	
Drainage Density	**10.3**	**Per Square Mile**

Imperviousness

Approximately 28% of this land type is impervious.

Land use	Acres	% Land Type	% Imperv	Imperv Acres
Agriculture	91	1%	5%	5
Commercial	645	7%	70%	451
Industrial	143	2%	50%	71
Major Hwy	243	3%	40%	97
Multi-Fam. Residential	601	7%	5%	30
Park & Rec.	1,130	13%	30%	339
Public /	430	5%	35%	151

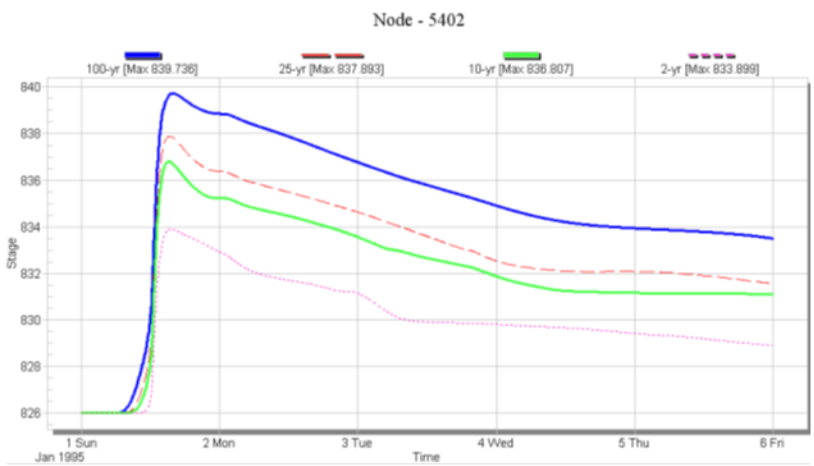
Mississippi Sand Plain

Semipublic				
Single Fam. Residential	4,056	46%	25%	1,014
Vacant	1,009	12%	5%	50
Water	322	4%	100%	322

Stormwater

Coon Creek near the Mississippi River

	1999	2009	Change	% Change
Time to Peak (Hrs)	40.5	24		
100 yr Elevation	842.1	839.7		
Peak Discharge (cfs)	2,195.4	650		
Flow Duration on 2 year event (days)		12		

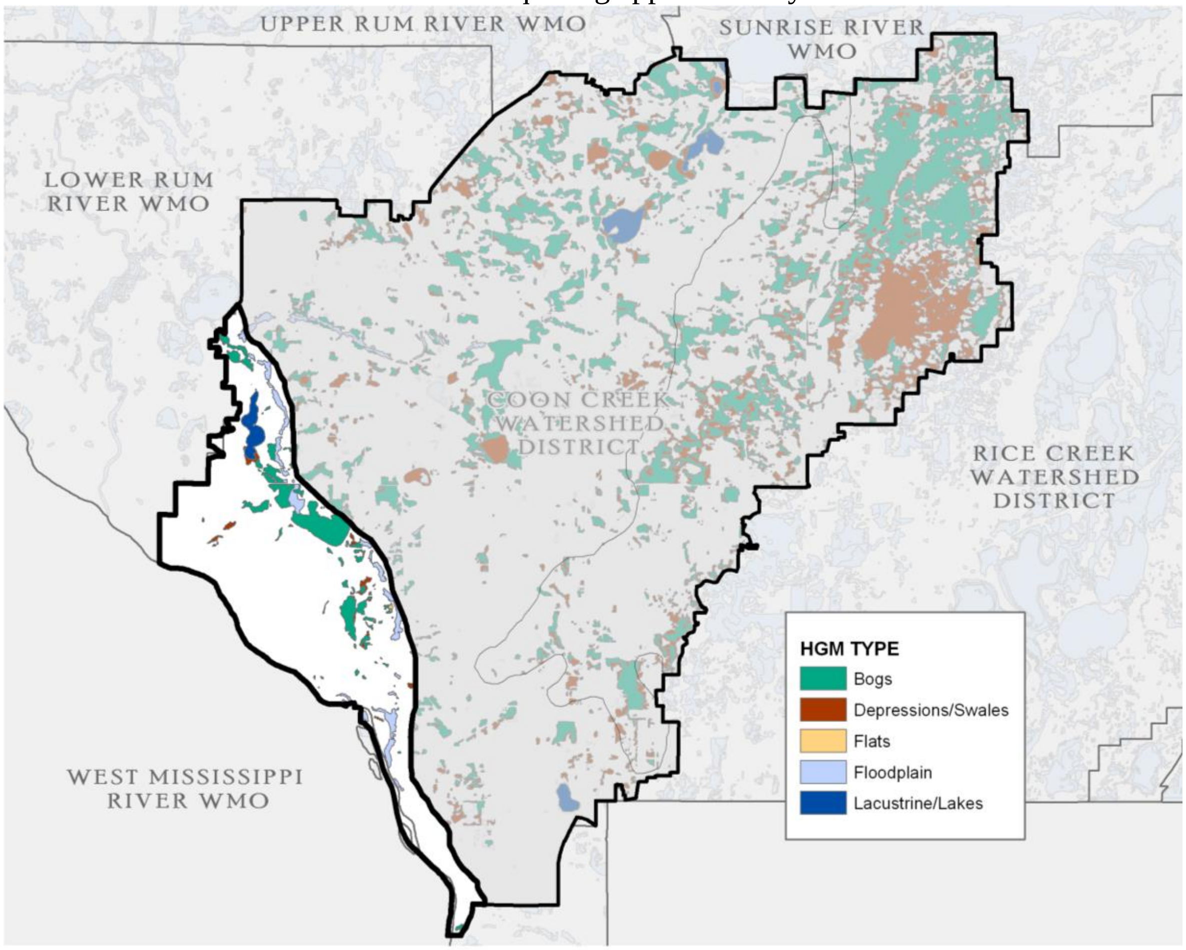


Water Quality

	Standard	Base Flow	Storm
Chloride	≥230 mg/L	73.8	54.4
Dissolved Oxygen	<6.3 mg/L	9.4	7.6
Total Phosphorus	.130 mg/L	.09	.16
Total Suspended Solids	>13.7 mg/L	10.3	119.5
Turbidity	>25 FRNU	10	121

Lakes & Wetlands

The Mississippi River Terrace has one lake plus Lacustrine wetlands equaling approximately 148 acres.



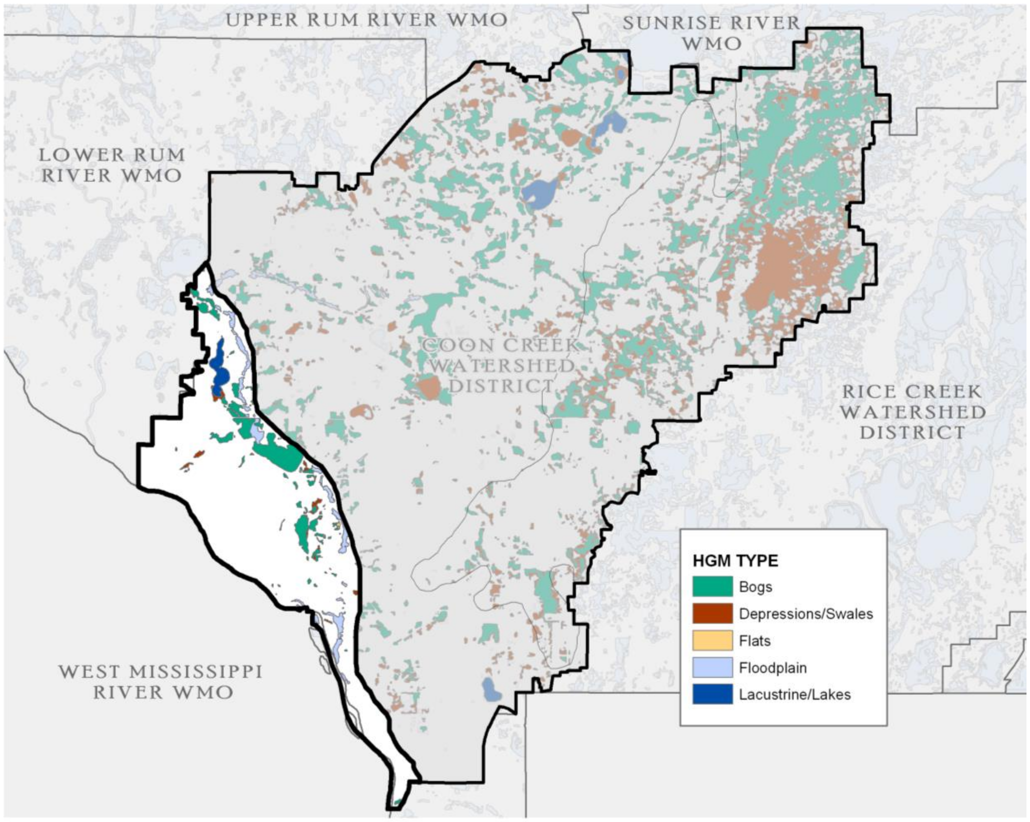
Name	Nature	ID	Size (AC)	Littoral Zone (%)	Max Depth (ft)	Clarity (ft)	Cond.	TSI
Cenaiko	Man Made	020654	28.6	40%	36	5.4		
Crooked	Shallow Lake	020084	118.3	73%	26	8.5	B	51

Wetlands

The Mississippi River Terrace contains approximately 1,068 acres of wetland. Approximately 86% of these wetlands are ephemeral in nature relying on saturated, seasonal hydrology to sustain their wetland characteristics.

Hydrogeomorphic classification	Acres	% Land Type
Bogs	571.1	53%
Depressions/ Swales	75.5	7%

Flats	6.5	1%
Floodplains	295.1	28%
Lacustrine	120.4	11%



Resource Assessment

Introduction

In 2010 the Coon Creek Watershed District reviewed the resource inventory for the watershed, analyzed trends and considered the implications of those trends for water management over the next ten years.

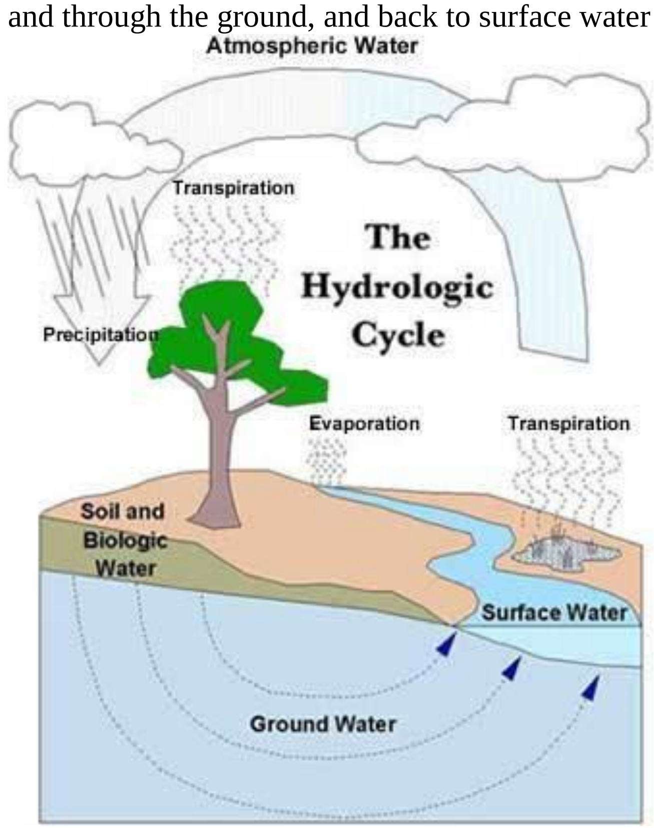
The 2010 Resource Assessment is the third prepared in response to the requirements of the Metropolitan Water Management Act and Watershed Act (M.S. 103B and 103D).

The assessment is the second prepared in response to the requirements of the NPDES permit and the District's Storm Water Pollution Prevention Plan (SWPPP)

Several features of the watershed's surface, such as soil type, slope, storm sewer and impervious are, are key in affecting the hydrology and peak discharges as well as the water quality of Coon Creek.

The term "hydrologic cycle" denotes the general circulation of water in various states (liquid, solid, gaseous) from surface water to the atmosphere, from the atmosphere over and through the ground, and back to surface water again.

The Hydrologic Cycle



Water Budget

Quantification of the hydrologic cycle is accomplished by developing a drainage basin water budget. The parameters of the hydrologic cycle (precipitation, evaporation, transpiration, infiltration, and runoff) are balanced until all of the water entering and leaving the watershed is accounted for. The budget of any drainage basin may be represented by the equation:

$$P = ET + R + \Delta SMS + \Delta GMS + \Delta DS + GWF$$

Where

Variable	Definition
P	Total precipitation input
ET	Total evapotranspiration loss
R	Total stream flow
ΔSMS	Change in soil moisture storage
ΔGMS	Change in groundwater storage
ΔDS	Change in depression storage
GWF	Groundwater flux (groundwater flow into or out of the drainage basin).

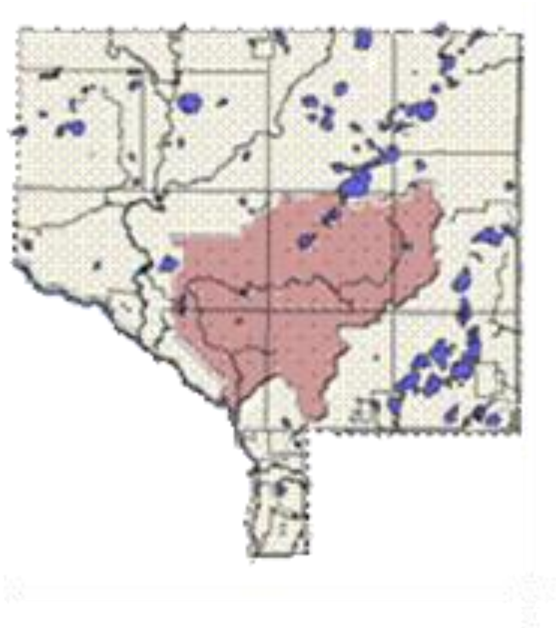
Emphasis has been placed on the components and characteristics of stream flow. This is because sources, quantity and distribution of stream flow and any changes that may result from future development have direct impacts on the water quality and quantity downstream.

Watershed Area

Current Plan

The 2000 to 2010 Comprehensive Plan addressed management of the 94 square mile watershed.

Coon Creek Watershed District Boundary



Coon Creek drains 94 square miles of Anoka County, Minnesota.

Trends in Watershed Area

An objective of the 2000 – 2010 Comprehensive Plan was to review the accuracy of the Districts hydrologic boundary and, where needed, amend the legal boundary of the District to more closely reflect the hydrologic boundary. Six boundary amendments have occurred:

Boundary Amendments

Year	WMO	Adding to CCWD (Ac)	Subtracting from CCWD (Ac)	BWSR Approved
2004	Rice Creek WD	40	0	2004
2007	Upper Rum River WMO	115	379	2008
2008	Rice Creek WD	340	863	2008
2009	Lower Rum River WMO	8	365	2010
2010	Lower Rum River WMO	175	53	2011
2011	Six Cities WMO	8,920		2011
	Totals (Ac)	9,095	1660	
	Total (Sq Mi)	14.2	2.6	

Population

Between 2000 and 2010 the District grew approximately 22%.

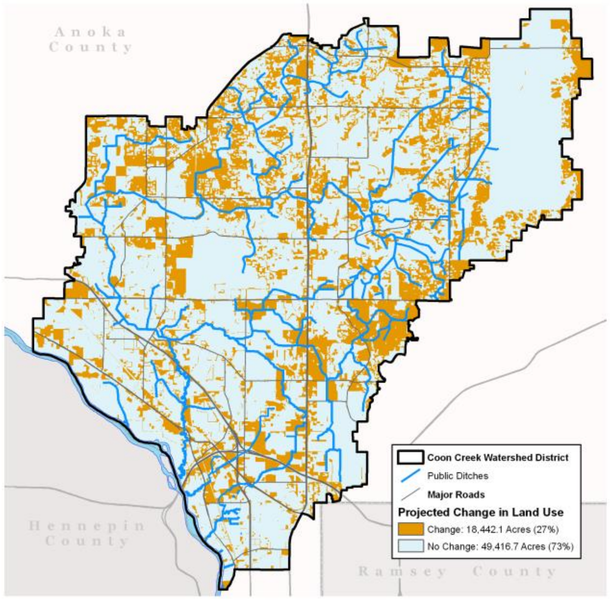
The table below shows the projected population changes by City for 2010 to 2020

City	2010	2020	Projected Pct Change
Andover	24,048	27,006	12%
Blaine	39,597	50,987	29%
Columbus	508	623	23%
Coon Rapids	64,386	64,680	0%
Fridley	16,200	16,140	0%
Ham Lake	15,017	16,686	11%
Spring Lake Park	4,026	4,026	0%
	163,783	180,148	10%

Land Use

Between 2013 and 2023 the District expects to a 15,750 acre change in land use. Most of this change will involve a conversion of agricultural and vacant land to some for of development.

A map of the areas of expected change is provided below:



Implications of Changes in Watershed Area

Larger Drainage Area The Coon Creek Watershed is now approximately 107 square miles, an increase of approximately 9,000 acres since 2000.

Continued Growth Continued population growth is expected but at a lower rate.

Increases in Impervious Area Significant increases in impervious area are projected for the headwaters of ditch 41, ditch 59 and ditch 37.

Management Needs

Targeted Infiltration Review the District's infiltration rule to address rate and volume especially in those basins with the largest projected increase in impervious area.

Monitoring Consistent flow monitoring at basin outlets with the largest change in land use.

Precipitation

Current Plan

The average annual precipitation in the watershed during the period of record is approximately 30 inches (UM, 1999). About 70 percent of the annual precipitation (22 inches) falls between April and September. About 6 inches of precipitation occurs during the spring groundwater recharge period of April and May.

Measurable precipitation of 0.01 inches occurs on about 110 days per year, 4 of which have 1 inch or more. Annual amounts of precipitation have ranged from a low of 15.56 inches in 1976 to a high of 43.03 inches in 1991 (UM, 1999). The most precipitation occurring in any month was 9.35 inches in June 1975.

Amount

Month	Monthly Average (in)	3 years in 10 Less Than (in)	3 years in 10 More Than (in)
January	1.13	0.75	1.50
February	0.81	0.51	1.05
March	1.73	1.32	2.30
April	2.62	1.82	3.48
May	3.57	2.85	4.39
June	4.29	3.46	5.13
July	3.99	3.28	4.97
August	4.04	3.51	4.99
September	3.04	2.40	3.73
October	2.38	1.49	3.28
November	1.92	1.46	2.48
December	1.06	0.53	1.32
Annual	**30.60**	**28.26**	**34.11**

Storm Size and Intensity

The size of a storm can be described by the total amount of precipitation, the intensity of the precipitation (amount per time period), and how often this type of storm is expected to occur (frequency). Thus, a 10-year, 24-hour storm can be thought of as a storm with a 10% chance of occurrence in any given year, producing a given amount of rain in 24 hours. A rainfall intensity of 1.5 inches per hour can be expected to occur once every 3 years and has and annual probability of 33%.

Precipitation

Frequency (Yrs)	Yearly Probability (%)	30 Min (in)	1-Hr (in)	2-Hr (in)	6-Hr (in)	12-Hr (in)	24-Hr (in)	Atlas 14: 24-Hour (in)	10-Day (in)
1 Year	99%	0.9	1.15	1.4	1.65	1.95	2.3		3.8
2 Year	50%	1.1	1.4	1.6	2.1	2.4	2.7	2.8	
5 Year	20%	1.4	1.8	2.1	2.65	3.05	3.5	3.8	6.3
10 Year	10%	1.6	2.05	2.5	3	3.55	4.1	4.6	7.4
25 Year	4%	1.9	2.35	2.8	3.5	4.1	4.7	5.8	8.8
50 Year	2%	2.1	2.6	3.1	3.95	4.6	5.2	6.7	9.8
100 Year	1%	2.4	2.8	3.5	4.4	5.1	5.85	7.6	10.9

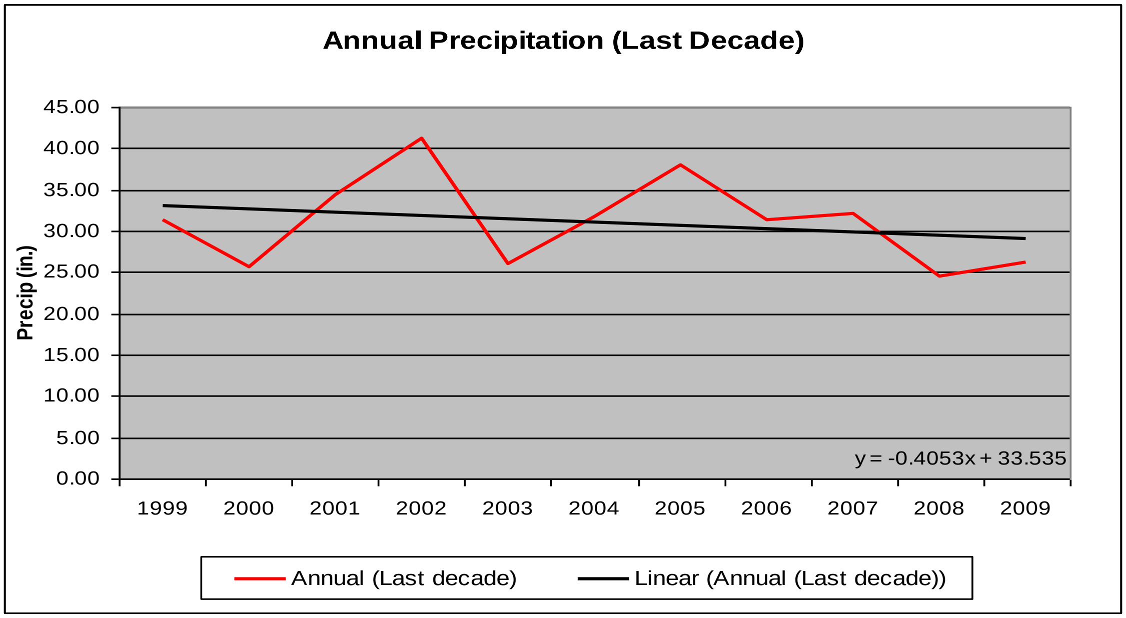
Snowfall

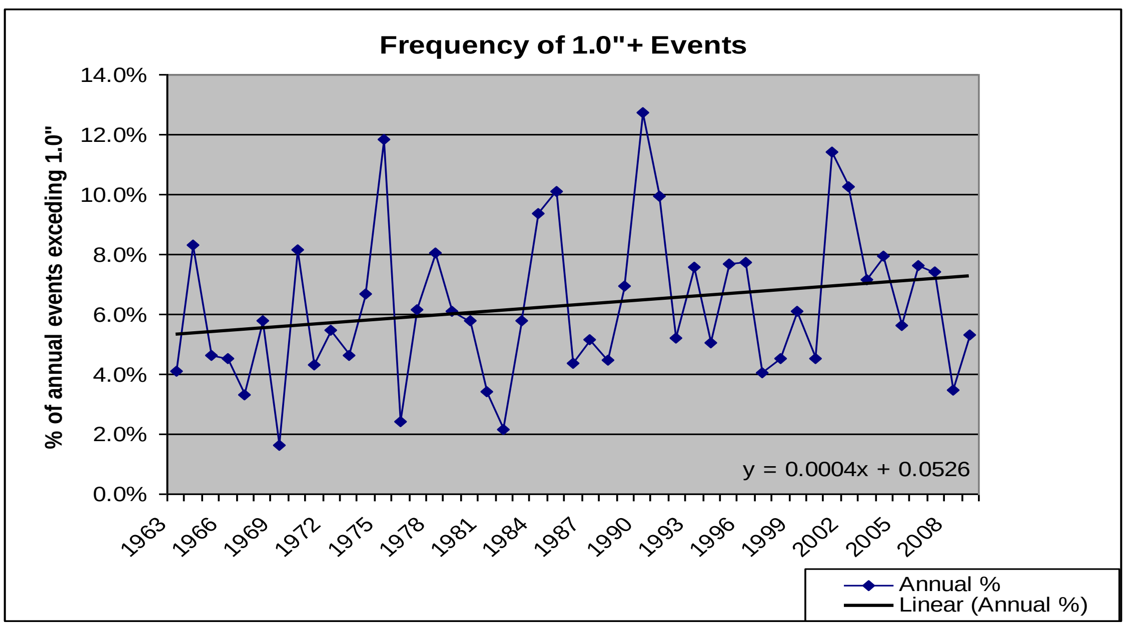
The first measurable snowfall typically occurs in the middle of October (1 year in 10), and the last mid-April or later (3 years in 10). The annual snowfall average is 43.2 inches. Since 1932, annual snowfall has ranged from 5.4 inches (1958 - 59) to 81.6 inches (1950 - 1951). An average of four major snowstorms occur each winter.

Month	Snow days: (1" or More)	Average depth (in):
January	27	10.4
February	25	11.3
March	20	10.2
April	3	2.4
May	-	-
June	-	-
July	-	-
August	-	-
September	-	-
October	>0.5	2.0
November	9	3.9
December	23	6.9

Precipitation

Trends in Precipitation





Implications of Changes in Precipitation

There are three implications for the changes in precipitation observed within the Coon Creek Watershed if these trends continue through 2023:

Less Rainfall If trends continue to 2023 there will be 5% less annual precipitation by that year (An annual average of

Precipitation

approximately 28.5 inches).

Less Effective Precipitation If the probability of larger events continues to increase, the amount of precipitation that infiltrates will decrease.

Less Infiltration Less naturally-occurring infiltration.

Atlas 14

Management Needs

Retention Capture and Retain maximum amount of precipitation.

Break up routing of stormwater to maximize retention and detention to benefit water quality, flood control, habitat and water supply.

Infiltration Adopt 'treatment train' approach to the management and retention of water.

Evapotranspiration
Current Plan

Evapotranspiration includes evaporation from all water, soil, ice, vegetative and other surfaces and transpiration from plants. Evapotranspiration losses can be grouped into three categories:

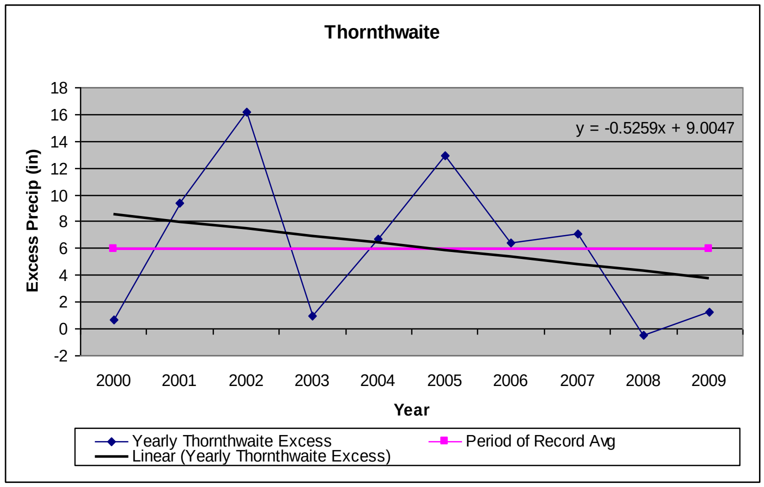
1. Interception losses,
2. Evaporation from undrained basins and
3. Evapotranspiration from soil and groundwater.

Potential Evapotranspiration (PET), the amount of water that would be lost to the atmosphere if water were not limiting, can be estimated using a number of methods. The Thornthwaite equation (Thornthwaite, 1955) uses mean temperature and latitude to determine monthly potential evapotranspiration

Estimate of Monthly Potential Evapotranspiration Rates (PET)

Month	Average Precip. (in)	Thornthwaite PET (in.)	Avg. Precip. minus PET (in)
January	1.13	0.00	1.13
February	0.81	0.00	0.81
March	1.73	0.00	1.73
April	2.62	1.34	1.28
May	3.57	3.55	0.02
June	4.29	4.89	-0.60
July	3.99	5.70	-1.71
August	4.04	4.94	-0.90
September	3.04	3.07	-0.03
October	2.38	1.48	0.90
November	1.92	0.00	1.92
December	1.06	0.00	1.06
Total	**30.58**	24.98 (80%)	5.61

Evapotranspiration
Trends in Evapotranspiration



Implications of Changes in Evapotranspiration

Approximately 80% of all precipitation falling on the District is lost to evapotranspiration.

Greater Potential of Water Loss in the Spring

On average, the largest hydrologic impact due to evapotranspiration occurs during May and April due primarily low humidity levels combined with high incidence of solar radiation (May) and wind (April) . July is third highest due to temperatures and solar radiation.

Less Excess Evapotranspiration 2000 to 2010

Excess evapotranspiration has decreased over the last decade.

Spring is Critical for Water Retention

If average annual temperatures continue to rise, April and May will become pivotal times for water conservation because it is early in the water year and replenished groundwater and filled basins supply baseflows to the creek system.

Management Needs

Encourage Retention in the Spring

Water retention for infiltration needs to be encouraged during the spring, especially April and May.

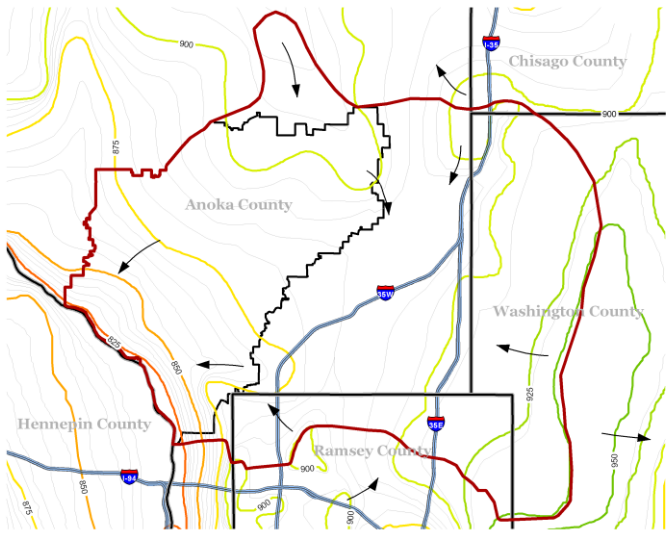
Groundwater Storage & Flux

Current Plan

Presents a review of the geology of the District and assumes that 5% (23.9 mgy) of precipitation that falls on the watershed recharges the surficial aquifer.

Surficial groundwater flow is conceptualized as follows

Flow System	Depth (Ft)	Flow Pattern	Length (mi)	Response Time (yrs)
Shallow	0-16	Mirrors surface	3.1	2 - 10
Intermediate	16-300	Influenced by Bed-rock &/or large surface feature	<25	10-50
Regional	>300	Function of geology	>25	≥100+



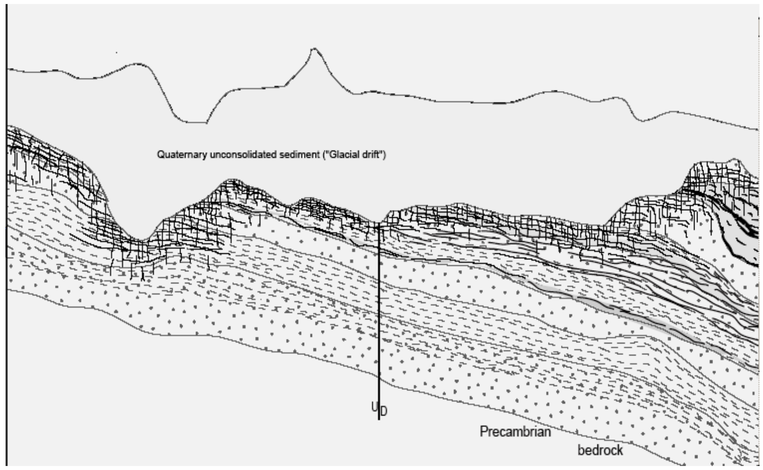
Shallow and intermediate groundwater source and flow within Coon Creek Watershed

Glacial Unconsolidated Sediment

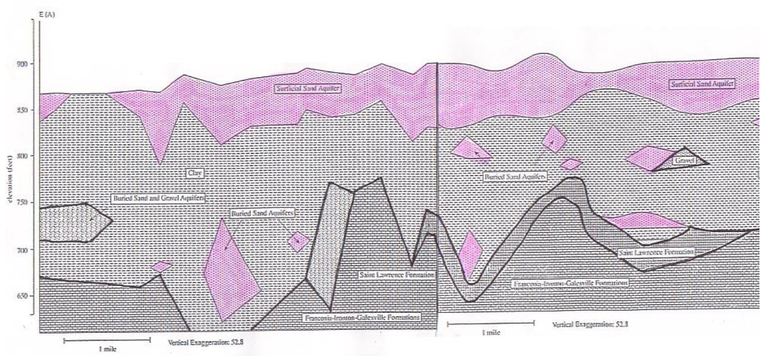
The 2010 Resource Assessment focuses on the hydrology of the glacial drift that covers the watershed and retains the surficial aquifer.

Groundwater Storage & Flux

Northwest Metro Cross-Section. MDNR



Example of the Upper 300 Feet



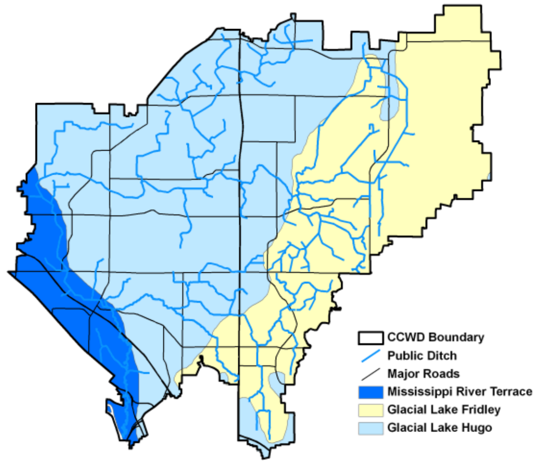
West to East Cross Section of Coon Creek Watershed, MPCA 1997

Surficial Groundwater Flow

The 2010 Resource Assessment looks at the surficial aquifer from a landscape perspective and identifies two geomorphic land types within the watershed that influence shallow and intermediate groundwater flow.

1. Lake Deposits of Glacial Lakes Hugo and Fridley (shown below)
2. River Terrace Deposits of the Mississippi River (shown below)

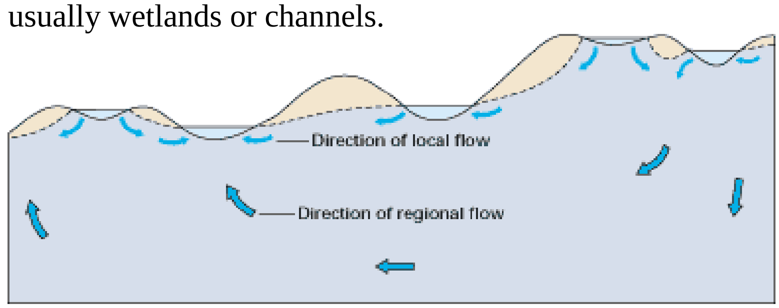
Groundwater Storage & Flux



Lake Deposits

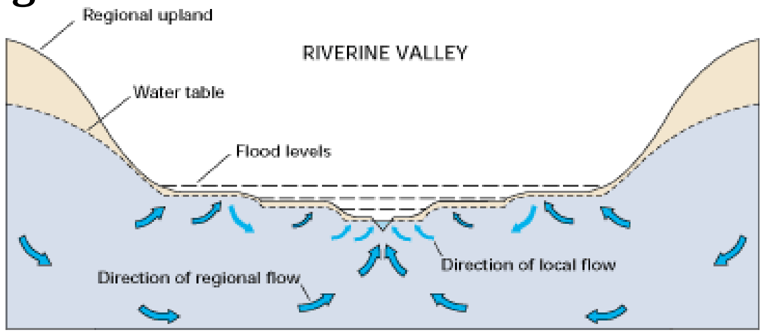
The Lake Deposits of the majority of the watershed are comprised of medium to fine sands with typical infiltration rates of 6 to 20 inches per hour. The hydraulic conductivity of the top 16 to 20 feet of soils is governed by slope and the rate at which water moves laterally (transmisivity) through the soils. The slopes and gradient are influenced by the thickness and density of material.

Within the Anoka Sand Plain, shallow groundwater flow can be expected to be between 1 and 10 feet per day and generally flow to areas of the lowest potential which is usually wetlands or channels.



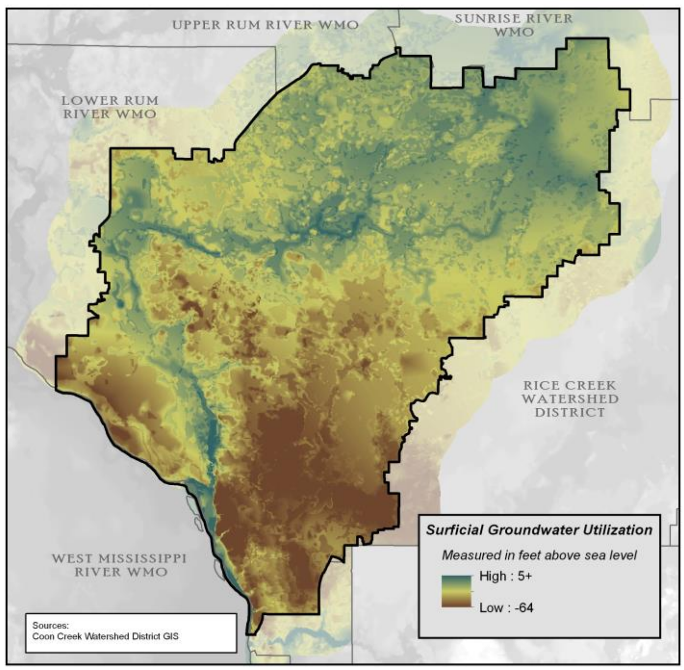
The Mississippi river is a major influence on shallow and regional groundwater flows within the watershed. For water that does not discharge to the surface through lakes or wetlands, or percolate to the regional groundwater system, the Mississippi river is the ultimate destination of not only surface waters but groundwater as well.

Groundwater Storage & Flux



Conceptualized shallow groundwater flow within a river valley

Trends in Surficial Groundwater Use



Surficial Water Table Elevation Change 1979-2008 (CCWD 2010)

Implications of Changes in Surficial Groundwater Supplies

Three major implications for water management can be drawn from these trends:

More Storage

As surficial groundwater declines there is more groundwater storage available.

Infiltration Should be Easy

Given the soils over most of the watershed, infiltration will be very difficult to prevent (vice versa: Infiltration of groundwater and therefore groundwater recharge should be easy to accomplish).

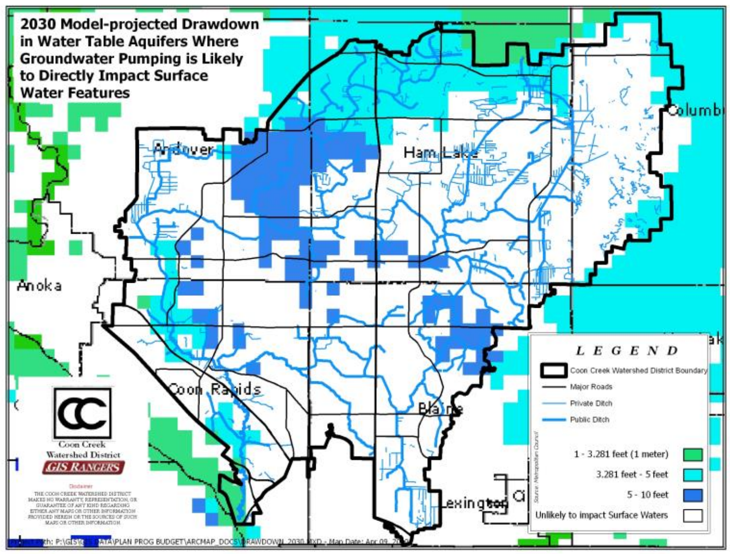
Groundwater Storage & Flux

Loss of Groundwater Driven Surface Water Features

If surficial groundwater levels continue to fall between 2013 and 2023, surficial water features, such as

a. Lakes (decline of 50% surface area)
b. Wetlands (8,375 acres)
c. Base Flow

will be difficult to protect and sustain in the areas shown below:



Metropolitan Council, 2009

Management Needs

Increased Infiltration/ Groundwater Recharge

If precipitations and groundwater continues to decline, an aggressive program of infiltration and groundwater recharge will be essential to slow, halt or reverse the effects of a decline in surficial groundwater levels.

Changes in Soil Moisture Storage

Current Plan

The soils of the Coon Creek watershed developed from glacial outwash and organic deposits (USDA 1977). The differences in glacial deposits account for many of the differences in soils.

Permeability/Infiltration And Texture

Permeability is the rate at which water moves downward through the soil profile (Brady 1974). Permeability is measured as the number of inches per hour that water moves downward when the soil is saturated. Soils with low permeability are easily ponded and may develop wetland characteristics (Brady 1974, USDA 1977, NTCHS 1987).

Soils with high permeability can contribute greatly to groundwater recharge and the sensitivity of groundwater to pollution (DNR 1991). An accepted cut-off between high and low permeability soils is 6 inches per hour (NTCHS 1987). The permeability of soils within the watershed is shown in the following table (USDA 1977, NTCHS 1987).

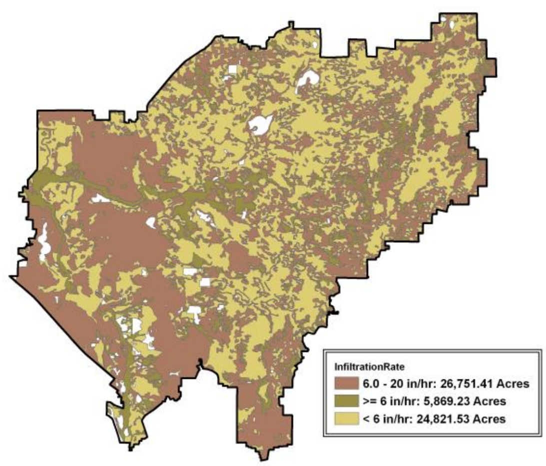
District Soils by permeability factor (K)

K	*Drain Class*	*Rate (in./hr)*	*Texture*	*Soil Series*
0.00	Low	< 6	Muck (Sapric)	Markey Muck
0.00	Low	< 6	Muck (Hemic)	Millerville Mucky Peat
0.00	Low	< 6	Muck (Hemic)	Rifle Muck
0.00	Low	< 6	Muck (Sapric)	Rondeau Muck
0.00	Low	< 6	Muck (Sapric)	Seelyeville Muck
0.00	Low	< 6	Loamy fine sand	Alluvial Land, Mixed
0.15	High	≥ 6	Sandy loam	Isan Sandy Loam
0.15	High	6 - 20	Coarse sand	Hubbard Sand
0.15	High	6 – 20	Fine sand	Sartell Fine Sand
0.15	High	6 - 20	Fine sand	Soderville Fine Sand
0.17	High	≥ 6	Fine sandy loam	Isanti Fine Sandy Loam
0.17	High	6 - 20	Loamy fine	Anoka Sand

Changes in Soil Moisture Storage

			sand	
0.17	High	6 - 20	Loamy fine sand	Lino Loamy Fine Sand
0.17	High	6 – 20	Loamy sand	Nymore Loamy Sand
0.17	High	6 - 20	Fine sand	Zimmerman Fine Sand
0.28	High	6 - 20	Loamy coarse sand	Duelm Sand

Acres of permeability classes



Seasonal Soil Moisture Variation

Soil water can be analyzed by dividing the year into four stages; grand consumption, fall recharge, frozen stage, and spring recharge. These stages, in turn, influence runoff and groundwater recharge (Baker, et. al. 1979):

Stages of Soil Moisture

Stage	Significance
Frozen stage (Dec-Apr)	During a normal year, the soil moisture will be high enough to result in a concrete frost. The exception to this occurs following excessively dry years that result in soils with low soil moisture contents at freeze-up. Under these conditions, only the smallest soil pores contain water, leaving the larger pores open, which results in a granular frost.
Spring recharge (Apr-Jun)	During this time precipitation exceeds ET, and soil water is again recharged.
Grand consumption (summer stage)	Results in the soil water reserves becoming depleted over the summer to make up the difference.

Changes in Soil Moisture Storage

(Jun-Sep)	
Fall recharge	Normally this is the most significant period for soil water recharge, with a majority of precipitation remaining in the soil for use the following growing season. The remainder of the rainfall is lost as evapotranspiration or runoff.

Hydrologic Soil Grouping

Four hydrologic soil groups classify soils according to their infiltration and transmission rates (USDA 1977). Three soil groups occur within the watershed. They are:

Group A

Group A soils have low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sands or gravels and have a high rate of water transmission (greater than 0.30 in/hr).

Group B

Group B soils have moderate infiltration rates when thoroughly wetted and consist chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately course textures. These soils have a moderate rate of water transmission (0.15 to 0.30 in/hr).

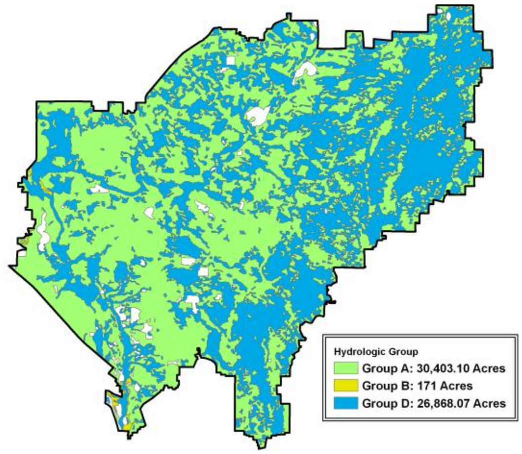
Group C

Group C soils have low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately coarse textures. These soils have a moderate rate of water transmission (0.05-0.15 in/hr).

Group D

Group D soils have high runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a clay pan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very low rate of water transmission (0.00 to 0.05 in/hr).

Changes in Soil Moisture Storage



Hydrologic Soil Group	Acres	Pct of District
A	30,403	52%
B	171	-
D	26,868	46%

Antecedent Moisture Conditions

The volume of stormwater runoff is generally determined by the soil's characteristics, as classified in the SCS hydrologic groups and by its hydrologic condition (Brady 1974). The hydrologic condition of the runoff depends on the antecedent moisture conditions (AMC) of the soil at the time of the storm, the soil's hemic and organic content, and temperature.

Antecedent moisture conditions (AMC) is the amount of water within the soil, and thus not available for storage, prior to the design storm. For convenience in hydrologic modeling, it is often defined as the amount of rainfall in a period of five to thirty days preceding the design storm. In general the heavier the antecedent rainfall, the greater the runoff potential. Three levels of AMC are considered:

AMC 1: Soils are dry, but not to the wilting point. Available water capacity (AWC=inches of water per inches of soil) is below published values. This is the lowest runoff potential.

AMC 2: Soils moisture and available water capacity is average.

Changes in Soil Moisture Storage

AMC 3: Soils are at or near field capacity. Heavy or light rainfall and low temperatures have occurred during the previous five days. This is the highest runoff potential.

Trends in Soil Hydrology

Decrease in Permeability As land is developed soils tend to be compacted thereby reducing the void space between soil particles and restricting the movement of water

Change to predominantly 'A' HSG Class Soils The decrease in both precipitation and the surficial water table have led to many organic soil modeled as Hydrologic Soil Group D soils (very slow infiltration rates - <6 in/hr) to behave as A soils (high infiltration rates-6 to 20 in/hr)

Decrease in Antecedent Moisture Conditions Dry fall and spring conditions have left soils dry (AMC 1) over the past five years. However, the horizontal disposition of peat soils within the soil profile may well leave the soils dry but in some areas result in increased runoff if the soils have become hydrophobic.

Implications of Changes in Soil Moisture Storage

Increase in Hydrophobic Soils Fibric soils, particularly Peats, tend to lie horizontally on the landscape. As these, as well as other organic soils dry (from drainage or prolonged declines in the water table) they can become hydrophobic and repel water thus decreasing their water holding capacity.

Decrease in Volume of Infiltration Peats, because of how they lie in the landscape can act as a retardant to the vertical movement of water, by readily moving water horizontally, parallel with how the peat deposit occurs. The result is a highly conductive system that tends to move water laterally better and faster than it moves water vertically.

Contribution to Increased Flashiness In areas close to open channels and ditches The horizontal conductivity and A HSG classification of drained peats contributes to additional discharges, versus the "water retaining sponge on the landscape" so often referenced.

Management Needs

Keep Organic Soil Saturated It is vital to keep organic soils saturated in areas where the District hopes to capitalize on the water storage abilities of wetlands and organic soils.

Changes in Soil Moisture Storage

Mitigate to ≥ Predevelopment Site Infiltration

Infiltration is vital to the watershed's water resources for the following reasons:

1. Recharge of the surficial aquifer
2. Maintaining absorptive and storage capacity of organic soils

Mitigating infiltration to predevelopment volumes is essential to the conservation and utilization of these soils. Mitigating to greater than predevelopment volumes would be essential in returning the water table to levels needed to sustain dependent surface water features.

Depression Storage
Current Plan

Depression storage plays an important role in the watershed's hydrology. Lower level, long duration flows are associated with watersheds where water concentrates over a longer period of time. A short concentration time can produce floods of shorter duration and higher level. Because water travels through wetlands at low velocity or is detained in ponds, the time of concentration is decreased and peak flow rates are reduced.

Approximately one-half of the wetlands and essentially all of the ponds within the District have restricted outlets. In the case of partially drained wetlands, water outlets to a ditch through subsurface flow, resulting in a low rate of outflow. During runoff events, wetlands and ponds temporarily store water until the outlet overflows. The result is reduced peak runoff.

An exception to this is when ponds or wetlands are at capacity and can not store additional water.

Trends in Depression Storage

The volume, in inches that must be filled prior to the occurrence of runoff. It represents the loss or "initial abstraction" caused by such phenomena as surface ponding, surface wetting, interception and evaporation.

Separate depression stores are required for pervious and impervious areas.

Impervious Depression Storage There has been an increase in impervious surface in the last ten years and therefore an overall decrease in the initial abstraction.

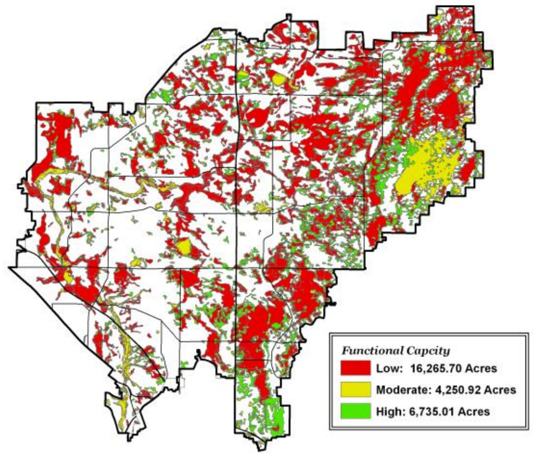
Pervious Depression Storage Likewise there has been a general decrease in pervious area within the watershed through the conversion and smoothing of land.

Stormwater Ponds There has been a considerable increase in the number and acreage of stormwater and water quality ponds within the watershed during the past 10 years. A complete inventory of stormwater ponds is being conducted by the Cities within the watershed as part of the NPDES program. The

Depression Storage

inventory should be completed by the summer of 2014.

Wetlands



The degree of outlet restriction and inlet/outlet classification had the greatest influence on wetlands functional capacity to retain or detain water. Most wetlands within the watershed are flow through systems with unrestricted outlets.

Implications of Changes in Depression Storage

Increased Duration of Flow On average, over the last 10 years, there has been a 3.5 day increase in time it takes for the system to return to base flow after a two inch rainfall across the watershed. The increased duration is likely from the ponding constructed during development over the past ten years. The exception is the headwaters of Coon Creek, where little development has occurred.

Decreased Peak Flows Peak flows have decreased an estimated 44% across the system. The greatest decrease has occurred on Sand Creek at Central Avenue where peak flows have decreased 80% to 35 cfs. Ditch 58 has seen a 20 cfs increase in peak flows.

Management Needs

Restrict Wetland Outlets Outlets to wetlands should be restricted where there is no upstream interference with drainage needs. The restrictions can serve to not only detain water but encourage infiltration.

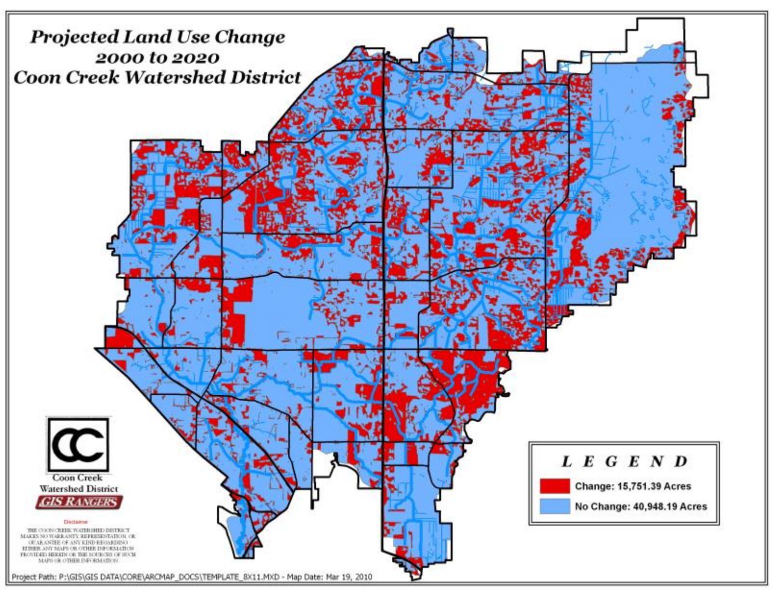
Land Use and Cover
Current Plan

The 2000 plan notes that the District lies within one of the fastest developing areas in the Twin Cities metropolitan area. Approximately 35% of its land is urbanized. This is an increase from approximately 25% in 1987.

2000 Land Use & Impervious Runoff Estimates

Land Use Category	Pct Impervious Surface	Mean Annual Runoff (in)	Percent of Watershed
Open Space	<10%	1.2 in	18%
Agriculture	<10%	1.2 in	46%
Residential	20% - 40% mean= 5%	3.8 in	28%
Commercial	45%-60% mean= 50%	12.2 in	5%
Industrial	60%-100% mean= 75%	17.6 in	3%

Trends in Land Use



Land Use Category	Pct Impervious Surface	Percent of Watershed 2000	Percent of Watershed 2010
Open Space	<10%	18%	5%
Agriculture	<10%	46%	37%
Residential	20%- 40% (mean=25%)	28%	26%
Commercial	45%-60% (mean=50%)	5%	7%
Industrial	60%-100% (mean=75%)	3%	25%

Implications of Changes in Land Use

Decrease in Agricultural Land

It is estimated that the watershed will see an approximately 7,500 acre decrease in agricultural land over the next ten years fostering a continued change in operations and maintenance practices needed for ditches.

Increase in Impervious Surfaces

The greatest change in land use was in uses that are highly impervious, although the overall acreage of change was still small compared to residential.

Increased Traffic and Road Construction

The District population grew approximately 10% -15% from 2000 to 2010. With that growth, Anoka County has committed to a much needed road widening and construction program to accommodate the increased traffic and ensure the safety of those people using the highway system. This construction is part of the increase in impervious surface. This construction also involves increased maintenance. Particularly in the winter when plowing and de-icing agents are applied to roadways.

Increased Occurrence of Chloride

The maintenance of the increase in roadways and traffic will likely result in an increase in chloride use District wide.

Unplanned/Unmanaged Stormwater on Public Lands & Facilities

Approximately 20% of the watershed is in public ownership. The majority (15%) is predominantly park and open space such as Bunker Hills Park and Carlos Avery WMA. However, there remains approximately 1,500 acres of public land (eg. Schools and Airport) that do not manage their stormwater on site but rely exclusively on municipal storm water systems.

Management Needs

Change in Maintenance Standards	Change in Operations and Maintenance Strategy for Drainage Ditches.
Establish 'Critical Reaches' for Drainage	Ditch sections critical to providing agricultural drainage need to be identified and managed through increased frequency of inspection and maintenance.
Increased Volume Control	The increase in impervious surfaces will necessitate and increase in volume management within the watershed.
Road Salt Training & Inspection	With the increase in miles and acres of roadway, an ongoing program needs to be developed to train, calibrate and monitor the use of chlorides within the watershed.
Development of SWPPPs or SAMPs for Public Land	Large public holdings that are not covered by the housekeeping provisions of a local Storm Water Pollution Prevention Plan (SWPPP) need to be considered for a Special Area Management Plan that focuses on Stormwater and uses the NPDES SWPPP requirements as criteria.

Lakes

Current Plan

The Coon Creek watershed contains twelve lakes. Half of those lakes (6) are man-made and while originally constructed for a source of barrow material have become a central aesthetic feature in a subdivision and in most cases also used for boating and fishing. Cenaiko Lake is stocked with trout.

Three of the lakes (Bunker, Laddie, McKay) are type 5 wetlands with maximum depths of 4 to 6 feet.

Two lakes (Crooked Lake and Ham Lake) support fisheries and Crooked experiences a variety of recreational boating.

Lake Netta, while more wetland than lake, has a long history of recreational use by the residents that live on the lake.

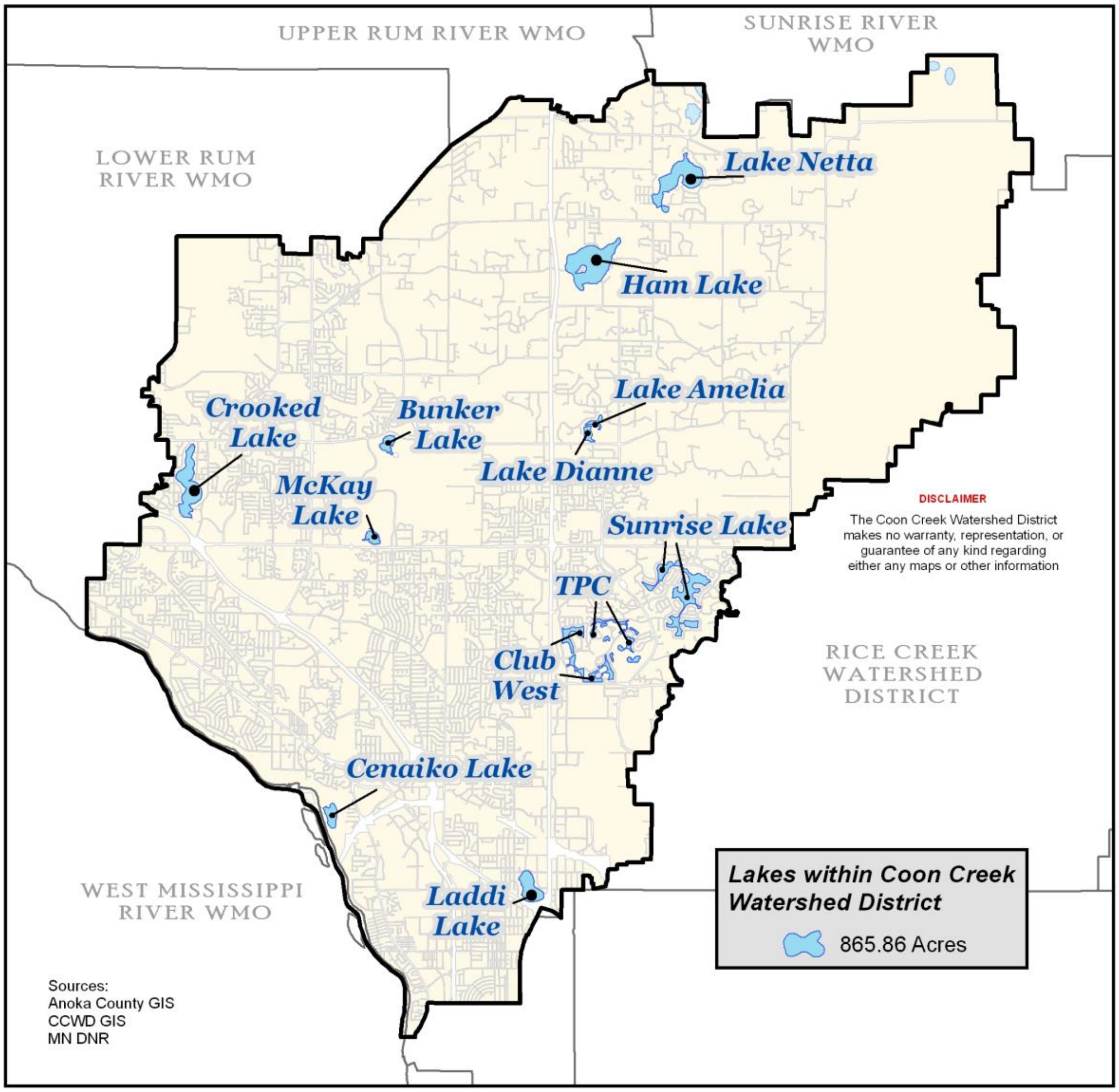
Lake Name	Nature	Lake ID	Size (Ac)	Littoral Zone (%)	Max Depth (ft)	Water Clarity (ft)
Amelia	Man Made		10			
Bunker	Wetland	020090	70	100%	6	
Cenaiko	Man Made	020654	29	40%	36	5.4
Club West	Man Made	020764	37		26	3.5
Crooked	Shallow	020084	118	73%	26	8.5
Dianne	Man Made		14			
Ham	Shallow	020053	193	92%	22	6.8
Laddi	Wetland	020072	77	100%	4	3.9
McKay	Wetland	020083		100%	6	
Netta	Shallow	020052	168	80%	19	7.6
Sunrise	Man Made		134			
TPC	Man Made		34			

"**<u>Lake</u>**" means an enclosed basin filled or partially filled with standing fresh water with a maximum depth greater than 15 feet. A lake may have no inlet or outlet, an inlet or outlet, or both. If a different definition of lake is adopted in chapter 7050, that definition applies to this chapter (MR6115.0920).

<u>Lake</u>. "Lake" means, for the purpose of these parts, any public water basin identified and classified in the shoreland management ordinances of the local county or municipal unit of government.

<u>Shallow lake</u>."Shallow lake" means a body of water, excluding a stream, that is greater than or equal to 50 acres in size and less than or equal to 15 feet in maximum depth.

Map of Lakes within Coon Creek



The Current Plan reviews basic bathymetric data and water quality trends for both Crooked and Ham Lakes and cites a treatment history for Eurasian water milfoil on Crooked Lake.

Crooked Lake Comprehensive Lake Management Plan March, 2009

The purpose for the Plan is to provide a comprehensive "picture" of the lake based on scientific and historical information. The planning period is 2009 to 2013.

The Plan addresses previous research and management actions, long-term goals, ways to achieve those goals, and ecological and economic consequences of those goals. To do this, the scope of the plan includes review and analysis of watershed hydrology, lake water quality, nutrient budgets, aquatic communities and ecology, and specific management and control of the invasive species: Eurasian water milfoil & curly leaf pondweed.

Two primary goals of this Plan are:

1. Understanding the water quality condition of Crooked Lake
2. Developing strategies for the protection and enhancement of water quality

Crooked Lake Issues

During development of the plan, the public identified 15 aspects of Crooked Lake they would like to see improved.

Of the 15 issues identified, only eleven were identified when the group was asked to identify three priorities. Of the eleven, three issues clearly stood out above the rest:

1. Eurasian Water Milfoil control/management
2. Water quality (including water clarity and non-point pollution)
3. Muck

Trash and lake water levels were also identified.

Trends in Lakes

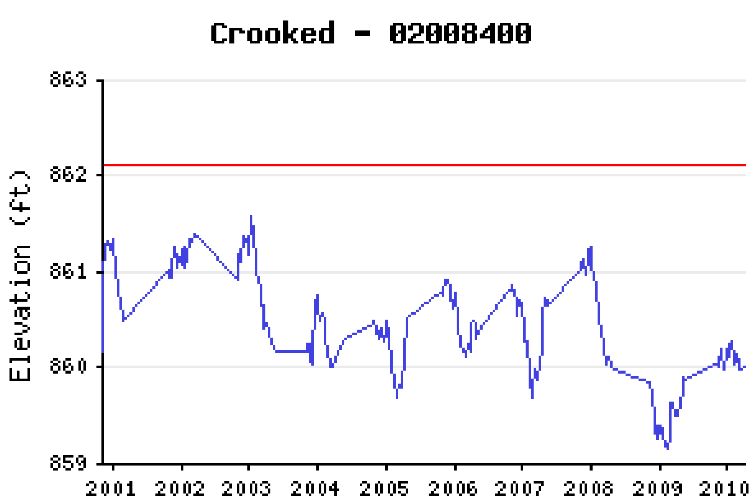
Creation of Man-Made Lakes

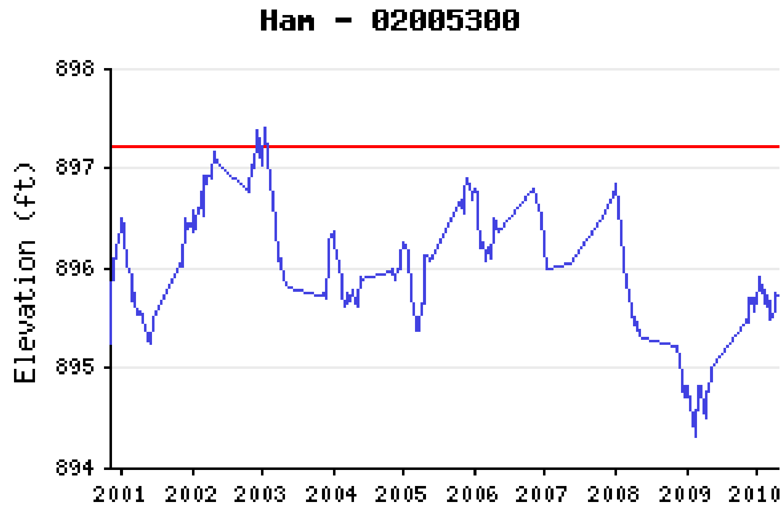
Since 2000, two man-made lakes have been constructed within the watershed bringing the total to five. The shorelines of TPC, Club West and Sunrise all are fully or substantially developed.

Lake Name	Year Const	Size (Ac)
Dianne	1992	
Amelia	1998	
TPC	1999	
Club West	2000	27.87
Sunrise	2005	

Lake Levels

Lake levels have decreased significantly over the past 10 years.





Lake Water Quality 2009

Lake Name	Total Phosphorus	Cl-a	Clarity	Overall Condition	TSI
Crooked	C	A	B	B	51
Ham	A	A	B	A	47
Netta	C	A	B	B	51

Invasive Species

Lake Name	Eurasian Water Milfoil	Curly Leaf Pondweed
Cenaiko	?	
Crooked	1990	2005
Ham		Yes (<2005)

Implications of Changes in Lakes

Loss of Lake Acreage The continued decline in water levels appears to reinforce that groundwater tables are dropping. In turn as lake levels decrease the surface area and depth decreases. In the worst case scenario a lake could follow the course of Bunker Lake and eventually devolve from the type 5 to type 2/3 wetland.

Decrease in Navigation & Recreational Use As lake levels drop, navigation and recreational use, including fishing become difficult to impossible to pursue on the body of water.

Impairment of As Lakes decrease in depth, fish populations can become more

Fishery concentrated and the animals incur more stress. While fishing may improve over the short term, the potential for winter kill and disease increase significantly.

Spread of Invasive Species As boat traffic and recreational use of all lakes increases, the spread of Eurasian Water Milfoil and Zebra mussels has become a common concern throughout the District.

Management Needs

Comprehensive Lake Management Plans Each of the 12 lakes within the watershed is different in relation to landscape position, water source, surrounding land use, recreational use and water quality challenges. Lake Management Plans need to be developed for each lake based on their risk of loss of hydrology. That prioritization would appear to be as follows:

Lake	Year
Crooked	2013
Ham	2015
Netta	2017
Sunrise	2019

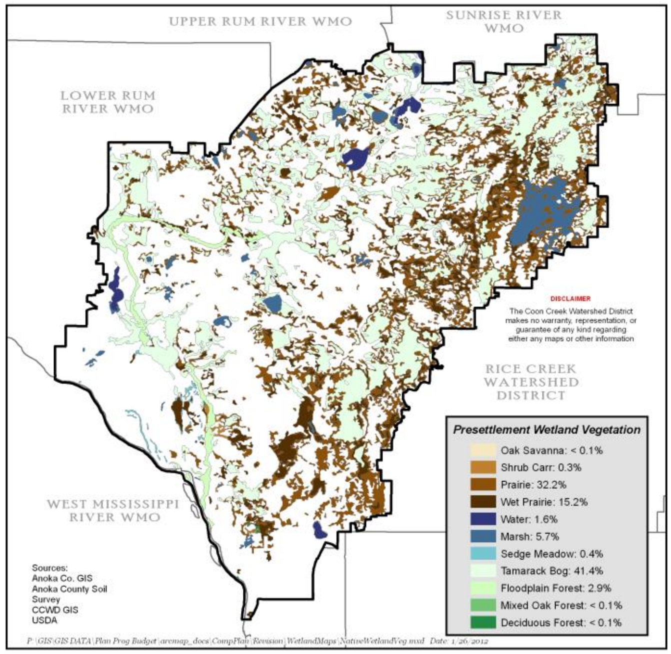
Wetlands

Current Plan

The Coon Creek Watershed contains approximately 15,508 acres of wetland (NWI, 1979). An additional 6,500 acres of wetland may be farmed. Wetlands comprise approximately 31% of the watershed.

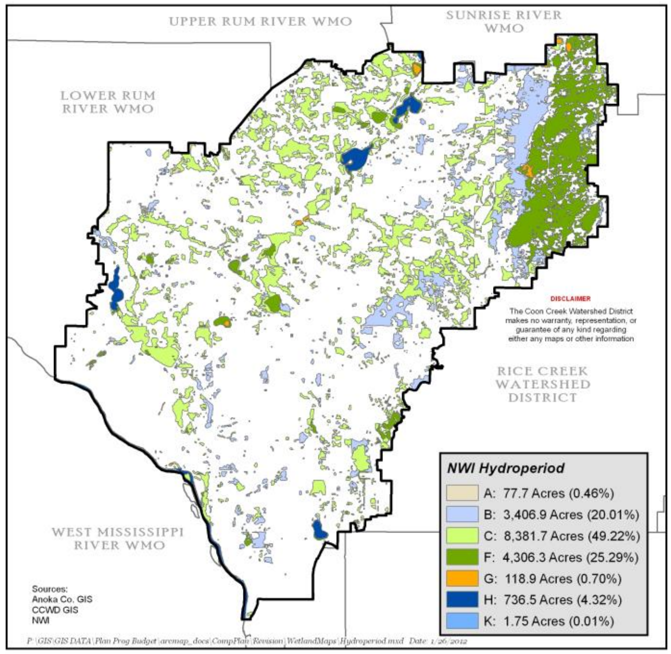
Historic estimates, based on hydric soil mapping, are that approximately 47% of the watershed was wetland prior to settlement (USDA, 1977).

Presettlement Wetland map of Coon Creek Watershed



Wetland Hydrology

According to the NWI, approximately 70% of the wetlands within the District are temporarily flooded, saturated or seasonally flooded (NWI). This finding is consistent with the District's location in the Anoka Sand Plain and reinforces that under normal circumstances, the wetland hydrology in the watershed is groundwater related.

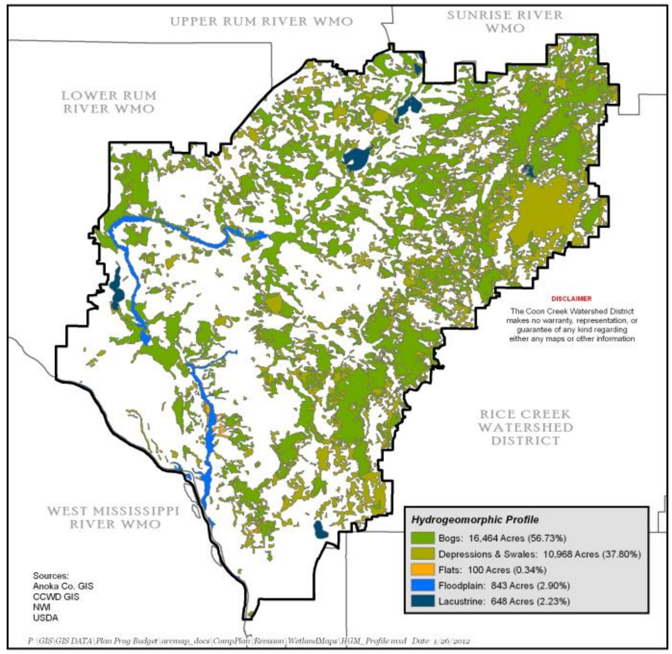


Hydrogeomorphic Classes and Profile

The hydrogeomorphology of the watershed is generally characterized by shallow surficial groundwater on a gently undulating and generally flat or level landscape.

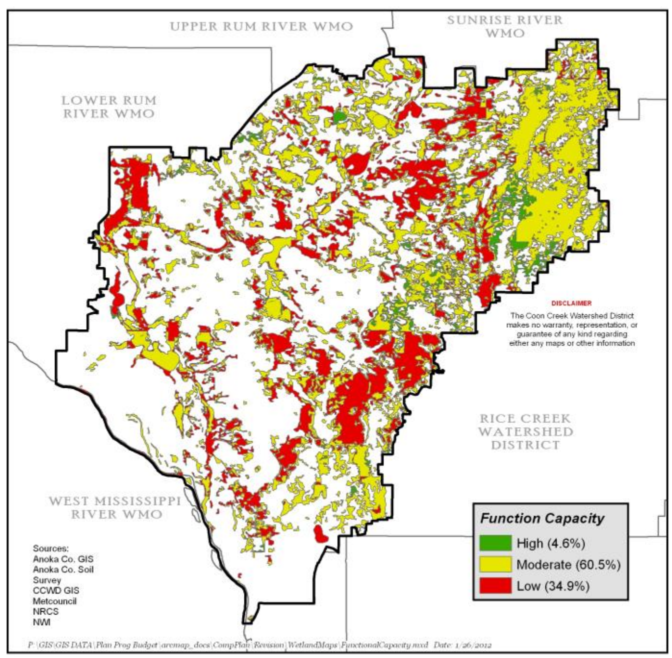
Where the landscape is pitted, it is generally low in relief and the regional surficial water table breeches the land surface. These conditions have lead to five basic wetland types based on geomorphic setting, water source and hydrodynamics.

1. Bogs and Extensive Peatlands
2. Depressions and Swales
3. Flats
4. Floodplains
5. Lacustrine



2010 Functional Capacity Assessment

The 2000-2010 Comprehensive Plan included a discussion and model of wetland functions. In 2010 the District performed a functional capacity assessment on all wetlands within the watershed using the HGM approach.

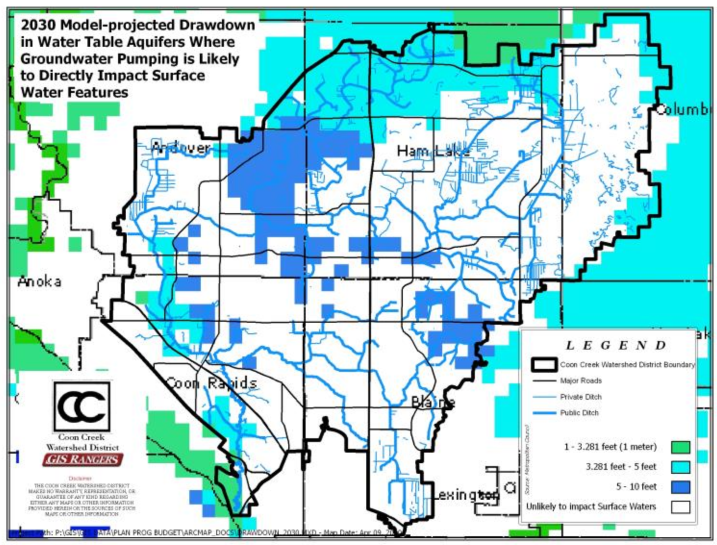


Trends in Wetlands

Loss of Wetland Hydrology

During the past 10 years the District has observed a general drying out of the landscape. This drying out appears to be directly related to the decline in the surficial groundwater table. Wetlands most affected are those with saturated or temporarily flooded hydroperiods.

A 2009 Metropolitan Council Study showed surface water features likely to be affected by draw downs in the surficial aquifer. A map of the affected areas is shown below:



Oxidation of Hydric Soils

During the past 10 years the District has also observed a general breakdown and change in hydric soils, particularly organic soils. Signs of decomposition and hydrophobic conditions are becoming increasingly evident.

Invasive Species

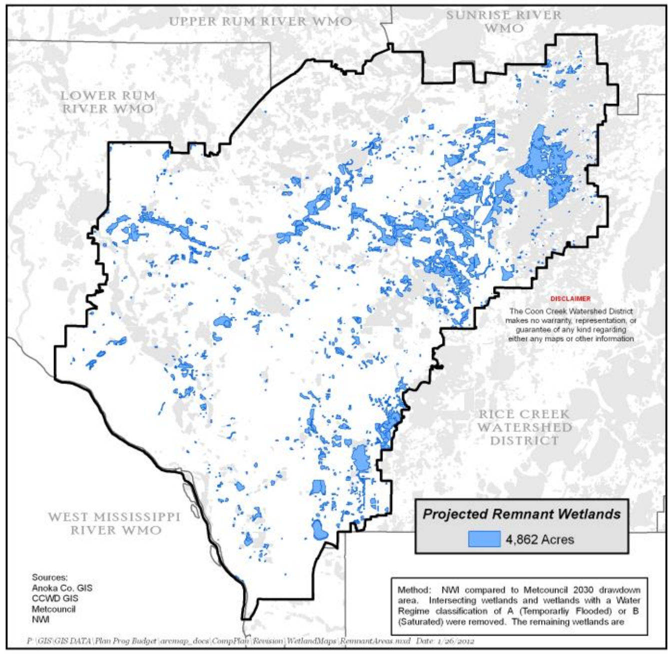
Wetlands continue to be invaded by Reed Canary grass (*Phalaris arundinacea*) and Common Buckthorn (*Rhamnus cathartica*). Both species appear to have received a boost from the decline in surficial groundwater levels and the generally droughty conditions during most of the decade.

Implications of Changes in Wetlands

Loss of Wetlands

If the Metropolitan Council model is correct we estimate a loss of approximately 52% of the wetlands identified on the National Wetland Inventory.

Projected Coon Creek WD wetlands if Met Council Model is correct



Permanent Loss of Organic Soils The general drying out of the watershed through declines in surficial groundwater levels and changes in precipitation are contributing to a permanent loss of organic soils through oxidation and decomposition. An aspect of this is the soils becoming hydrophobic and losing their ability to absorb water and thereby incrementally decreasing the amount of soil water storage occurring in the watershed and therefore increasing runoff.

Land Subsidence As organic soils decompose, land subsidence can and will occur. Depending on the size, location and degree of decomposition, subsidence can range from a curiosity to a major threat to the structural integrity of infrastructure such as pipes and roadways as well as buildings.

More Involved Delineations With changes in hydrology and soils as well as invasions or changes in vegetation, jurisdictional delineations will become more involved and potentially more difficult.

Management Needs

Encourage Groundwater Recharge The Retention and detention of water o water and the encouragement of infiltration equal to or greater than predevelopment rates is needed either assist in recovering the surficial groundwater or slowing its decline.

Discourage Drainage where its not Needed

There will remain areas within the watershed that require drainage for their continued use. However, land that is not drainage dependent does not require the same efficiency of drainage and therefore do not need to be maintained to the same degree as drainage dependent and sensitive lands.

Water Quality

Current Plan

The 2000-2010 Comprehensive Plan reviewed the effects of geology and soils on water quality noting that studies of the outwash sands of the Anoka Sand Plain have found significant amounts of apatite, a mineral containing phosphorus (Larson 1985). Such apatite levels have the potential to raise the background concentration of phosphorus in water passing through the outwash. These high baseline phosphorus levels must be kept in mind when evaluating water quality data from the sand plain.

In addition, sesquioxides (aluminum and iron oxides) and calcium are fairly abundant in the Anoka Sand Plain peatlands (Larson 1985). Therefore, many water samples analyzed in the following studies exhibited elevated concentrations of aluminum, iron and/or calcium—whether or not the water had come into contact with other sources of the compounds.

The 2000-2010 assessment reviewed the chemical parameters being tested, the tests and studies that have occurred within the watershed and the nature of any exceedences that may have occurred. The information is based wholly on the Water Quality Monitoring efforts conducted by the Anoka Conservation District and reported in their annual Anoka County Water Atlas and in Storet.

Trends in Water Quality

This report includes data from all monitoring years and all sites to provide a broad view of Coon Creek's water quality under a variety of conditions. We focus upon an upstream-to-downstream comparison of water quality, as well as an overall assessment (ACD, 2009).

2000 Impairment Sampling

In August 2000 the MPCA sampled four sites within the watershed.

Site	Location
Coon Creek (CD 59)	TH 65
Coon Creek	South of US 10
Sand Creek	TH 65
Pleasure Creek	River Road
Springbrook Creek	River Road

2006 Impairment Listing (303(d))

In 2006 the Minnesota Pollution Control Agency (MPCA) listed Coon Creek, Sand Creek, Pleasure Creek and Springbrook Creek as biologically impaired and listed these resources on the 303d list reported to the U.S. Environmental

Protection Agency as required.

The Impairment is listed as a Category 5C, meaning the water quality standard is not attained due to “suspected” natural conditions. Further, the water is impaired for one or more designated uses by a pollutant(s) and may require development of a Total Maximum Daily Load (TMDL) to bring the pollutant under control. Water Quality Standards for these waters may be re-evaluated due to the presence of natural conditions.

303(d) Listing Information

Reach name	Year Impair List	Affected designated use	Pollutant or stressor	
Coon Creek	2006	Aquatic life	Aquatic macroinvertebrate bioassessments	2C
Pleasure Creek	2006	Aquatic life	Aquatic macroinvertebrate bioassessments	
Sand Creek	2006	Aquatic life	Aquatic macroinvertebrate bioassessments	
Spring Brook Creek (CD 17)	2006	Aquatic life	Aquatic macroinvertebrate bioassessments	

Biomonitoring Trends

Portions of Coon Creek have been monitored for biota every year since 2000 (ACD Water Atlases). The invertebrate community suggests Coon Creek’s health is average compared to other nearby streams. The stream’s habitat is relatively sparse, due mostly to excavations performed to repair and maintain the County Ditch function of most of the drainage system within the watershed.

The biomonitoring suggests that stream health is similar to the average for Anoka County streams, despite the good quality habitat. Family Biotic Index (FBI) has been consistently higher than the county average, but the number of families and number of pollution sensitive families (EPT) has been similar to county averages.

The invertebrate community suggests Coon Creek’s health is average compared to other nearby streams. This is unexpected because habitat at the Egret Street site is much better, including riffles, pools, snags, and forested areas around the stream. At Crosstown Boulevard the creek has been ditched so there are no riffles or pools, there is no rocky habitat, few snags, and adjacent habitat is grassy. One possible explanation is that the biotic community at Egret Street is limited by poorer water quality despite the better habitat. Chemical monitoring has found that Coon Creek's water quality declines from upstream to downstream. This corresponds with an increase in urbanization. Future monitoring will provide insight.

Conductivity, Salinity and Chlorides

Conductivity, chlorides, and salinity are all measures of a broad range of dissolved pollutants. Dissolved pollutant sources include urban road runoff, industrial sources, and others. Metals, hydrocarbons, road salts, and others are often of concern in a suburban environment.

Conductivity is the broadest measure of dissolved pollutants we used. It measures electrical conductivity of the water; pure water with no dissolved constituents has zero conductivity.

Salinity measures dissolved salts as a percent salinity.

Chlorides tests for chloride salts, the most common of which are road de-icing chemicals. Chlorides can also be present in other pollutant types, such as wastewater.

These pollutants are of greatest concern because of the effect they can have on the stream's biological community; however it is noteworthy that Coon Creek is upstream from the drinking water intakes on the Mississippi River for the Twin Cities. Overall, dissolved pollutants in Coon Creek are slightly high.

Coon Creek

Overall, dissolved pollutants in Coon Creek are slightly high. Dissolved pollutants, as measured by conductivity, salinity, and chlorides, were slightly elevated in Coon Creek and showed little variability in different flow conditions and little variability from upstream to downstream. Some of these dissolved pollutants are originating from the shallow groundwater which feeds the creek during baseflow (ACD, 2009).

Conductivity and Salinity

Conductivity and salinity in Coon Creek were only slightly higher than typically found in Anoka County streams, but chlorides were significantly higher and of greater concern (see figures below). Median conductivity in Coon Creek (all sites) was 0.491 mS/cm compared to the countywide median of

0.318 mS/cm. Median salinity in Coon Creek (all sites) was 0.02% compared to the countywide median of 0.01%, though salinity is not a very sensitive or useful measure.

Dissolved pollutants were higher in downstream reaches of Coon Creek, where there is more impervious area (see figures below). The increase is slight for conductivity and salinity. It is most pronounced when comparing among baseflow conditions, probably because baseflow sampling conditions were all similar, whereas storm conditions were more variable. Median baseflow conductivity increased modestly from upstream to downstream (0.568, 0.586, and 0.654 mS/cm, respectively).

Conductivity and salinity sources likely included road deicing salts as well as a broad mixture of other chemicals found on roads and other impervious surfaces.

Chlorides

Median chlorides in Coon Creek (all sites), were more than four times higher than the countywide median (49 vs 12 mg/L). Elevated chlorides have been found in most urban and suburban areas of Anoka County and elsewhere due to higher road deicing salt application.

The Minnesota Pollution Control Agency (MPCA) has a water quality standard for only one of the dissolved pollutant parameters, chlorides, but Coon Creek does not exceed this standard. The chronic water quality standard is 230 mg/L. The maximum observed in Coon Creek was 85 mg/L. It is possible that higher levels do occur at other times, such as during snowmelt, but were not captured by the monitoring.

Dissolved pollutants were higher in downstream reaches of Coon Creek, where there is more impervious area (see figures below). The difference from upstream to downstream for chlorides was much more dramatic, especially between the Shadowbrook and Lions Park monitoring sites. Median baseflow chlorides from upstream to downstream were 37, 52, 63 mg/L, respectively.

Sand Creek

Sand Creek dissolved pollutant levels are often double the level typically found in Anoka County streams.

From upstream to downstream there is little change in dissolved pollutants in Sand Creek. While upstream sites seem to have a little more variability with an occasional higher reading, all sites were similar. This suggests dissolved pollutant concentrations in all parts of the watershed are similar.

There was little difference between storm and baseflow conditions. If road runoff was the primary dissolved pollutant source, then readings would be highest during storms. Dissolved pollutants can also easily infiltrate into shallow groundwater that feed streams during baseflow. If this has occurred, dissolved pollutants will be high during baseflow.

Conductivity and Salinity

Considering all sites in all years, median conductivity in Sand Creek is nearly two times greater than the median for all Anoka County streams (0.711 mS/cm compared to 0.318 mS/cm).

Chlorides

Sand Creek median chlorides were 6 times greater than the median of all Anoka County streams (75 mg/L vs 12 mg/L). This is still less than the Minnesota Pollution Control Agency's chronic water quality standard for chloride of 230 mg/L. Salinity is not as sensitive of a test, but salinity in Sand Creek averaged 0.03% compared to 0.01% for the county-wide median. It is possible that higher levels of conductivity, chlorides, and salinity do occur at other times, such as during snowmelt, but were not captured by the monitoring.

For Sand Creek at Xeon Street, the site with the most data and at the bottom of the watershed, measures of dissolved pollutants were similar during storms and baseflow. However, it is notable that baseflow readings were slightly higher overall. The two tributaries (Ditch 39 and 60) had their highest conductivity, chlorides, and salinity during baseflow too, but the difference was greater. For all other sites baseflow and storm readings were indistinguishable.

Effect of Sand Creek on Coon Creek

Sand Creek degrades Coon Creek with dissolved pollutants. Both creeks were monitored just before Sand Creek joins with Coon Creek. Across all years monitored, Sand Creek's median conductivity was 0.689 mS/cm, while Coon Creek's was 0.519. Sand Creek's median chlorides were 22 mg/L higher than Coon Creek. The two streams have similar salinity, but this measure is not very sensitive.

Pleasure Creek

All three parameters of dissolved pollutants were high and increased from upstream to downstream. The increase between the uppermost three monitoring sites (i.e. in the City of Blaine) was small, likely because these sites are in close proximity to each other. Greater increases were observed between the two downstream monitoring sites in the City of Coon Rapids but this is not surprising because these monitoring sites are farther apart and a larger portion of the watershed is between them.

At the outlet to the Mississippi River dissolved pollutants in Pleasure Creek were among the highest observed in Anoka County, but similar to other streams in urban settings.

Conductivity and Salinity

Median conductivity was 0.945 mS/cm or three times higher than the county-wide median and the third highest among 41 Anoka County streams that have been tested (nearby Springbrook was second highest). Salinity averaged about four times higher than other Anoka County streams.

At the upstream monitoring sites dissolved pollutants were lower, but were still substantially higher than other streams in the county. At the Blaine-Coon Rapids City boundary (96th Lane) conductivity averaged 0.643 mS/cm, or two times higher than the median of other Anoka County streams. At 99th Avenue and Pleasure Creek Parkway West (near the stormwater ponds at the headwaters of Pleasure Creek) median conductivity was 0.509 and 0.643 mS/cm, respectively, compared to the county-wide median of 0.318 mS/cm.

Chlorides

Median chlorides at the outlet to the Mississippi was 159 mg/L, which is the second-highest of any Anoka County stream (Springbrook was highest). Chloride levels occasionally approached the Minnesota Pollution Control Agency’s (MPCA) chronic standard for aquatic life of 230 mg/L, and in some cases exceed it (maximum observed was 262 mg/L).

Chlorides at the Blaine-Coon Rapids City boundary (96th Lane) and at 99th Avenue and Pleasure Creek Parkway West (near the stormwater ponds at the headwaters of Pleasure Creek) had medians of 71 and 70 mg/L, respectively, which is more than five times higher than the county-wide median of 12 mg/L.

The fact that other nearby streams, such as Springbrook, have similar dissolved pollutant levels further suggests that urban stormwater is an important source. The low phosphorus in

Pleasure Creek suggests that high dissolved pollutants are likely due to inorganic chemical inputs, not organic nutrient-rich inputs like those found in wastewater (see phosphorus section later in this report).

Total Suspended Solids (TSS) and Turbidity

Total suspended solids (TSS) and turbidity both measure solid particles in the water. TSS measures these particles by weighing materials filtered out of the water. Turbidity measures by defraction of a beam of light sent though the water sample, and is therefore most sensitive to large particles.

In Coon Creek TSS and turbidity are low upstream and during baseflow, but increase dramatically during storms and in downstream reaches (see figures below). The stream appears to exceed state water quality standards for turbidity, though it has not yet been listed as impaired by the MPCA.

In Sand Creek, both TSS and turbidity are low in the upstream reaches but are higher downstream, especially during storms.

Suspended solids in Pleasure Creek are low, except in downstream reaches during storms.

Coon Creek During baseflow TSS and turbidity were low. Median turbidity during baseflow from upstream to downstream were 8, 4, and 9 FRNU, respectively. This is lower than the countywide median of 9 FRNU and the MPCA's water quality standard of 25. Median TSS during baseflow from upstream to downstream was 5, 9, and 8 mg/L, respectively. This is lower than the median for streams county-wide of 13.5 mg/L. During storms TSS and turbidity are higher. Median turbidity during storms was 1.6 to 7.9 times higher than during baseflow (comparison is among site medians). Median storm turbidity was 13, 30, and 39 mg/L from upstream to downstream. The greatest increase from baseflow to storms was at the Vale Street monitoring site (farthest downstream). Median TSS during storms was 2.5 to 5.1 times higher than during baseflow. Median storm TSS was 19, 20, and 46 mg/L from upstream to downstream. Both measures were much more variable during storms too.

Exceedences At least three observations and 10% of all observations must exceed the water quality standard of 25 NTU to be considered impaired.

Location (Upstream to Downstream)	Total Number of Samples	Number of Samples Exceeding State Standard	Percent of Samples Exceeding State Standard
Shadowbrook	23	3	13%
Lions Park	25	9	36%
Vale Street	15	40	38%

NOTE Half of all readings are during storms and half during baseflow. All except three exceedences were during storms.

Based on this, the MPCA is likely to list Coon Creek as impaired for high turbidity.

There are some questions regarding the appropriateness of such an impaired listing.
1) Turbidity measurements were taken using units of FNRU, not NTU. It is uncertain how these units differ, but the difference is likely small.
2) Coon Creek exceeded the surrogate standard of 100 mg/L TSS only five times.
3) Only one of five transparency tube measurements exceeded that surrogate standard of 20 cm.

However, given the preference for using turbidity directly, these points are likely irrelevant.

Turbidity and TSS problems are most severe in downstream reaches. Readings in downstream areas are typically two-times higher than those from upstream areas.

Median loadings of turbidity and TSS

Location (Upstream to Downstream)	Median storm turbidity (mg/L)	Median storm TSS (mg/L)
Shadowbrook	13	19
Lions Park	30	20
Vale Street	39	46

Sand Creek TSS is consistently low at upstream sites, but creeps upward at the farthest downstream sites. Down to and including Sand Creek at University Avenue, median TSS reading (6 mg/L) was less than half the median for Anoka County streams (median 14 mg/L) and no readings exceeded it by more than 3 mg/L. Baseflow and storm readings were similar.

Ditch 39 tributary at University Avenue was similar too, but appeared to have slightly higher TSS during storms; the difference is small and not worrisome.

Farthest downstream at Xeon Street, Sand Creek had the highest TSS, especially during storms. During baseflow it was similar to upstream sites (median 4 compared to 6 mg/L), with the exception of one higher reading of 61 mg/L. But during storms at Xeon Street median TSS was 16 mg/L and readings of 114 mg/L was observed.

The results for turbidity were similar; however the stream more often had turbidity that exceeded the county median.

Down to and including Sand Creek at University Avenue, median turbidity was 8 FRNU compared to the county-wide median of 9. This is lower than the Minnesota Pollution Control Agency's water quality standard of 25 NTU. Storm flows and base flows had similar turbidity.

Ditch 39 had over double the turbidity (20 FRNU), but this was only during storms.

Furthest downstream at Xeon Street, baseflow turbidity was similar to all other sites, but storm turbidity was higher. During storms, turbidity at Xeon Street ranged from 4 to 114 FNRU, with a median of 15.5 FNRU.

Pleasure Creek

Upstream portions of Pleasure Creek have low turbidity and suspended solids.

Total suspended solids (TSS) are nearly always lower than the county-wide average at all monitoring sites except the outlet to the Mississippi River.

At these same sites, turbidity occasionally exceeded the county-wide median, but only 2 of 26 (7.7%) turbidity readings exceeded the state's impairment threshold of 25 NTU.

While turbidity and suspended solids are at good (low) levels throughout the upper reaches of Pleasure Creek, high levels regularly occur in the lower portions of the creek. Suspended solids were high, but only during storms, at the creek's outlet to the Mississippi River. Eight storm events have been monitored at that location. Seven had TSS above the median of Anoka County streams, and ranged from 28 to

81 mg/L. Turbidity was higher too, ranging from 18 to 36 FNRU during the same seven storms. Non-storm suspended solids at this site were acceptably low.

E. coli Bacteria

E. coli, a bacteria found in the feces of warm blooded animals, is unacceptably high in Pleasure Creek. E. coli is an easily testable indicator of all pathogens that are associated with fecal contamination. The Minnesota Pollution Control Agency sets E. coli standards for contact recreation (swimming, etc). A stream is designated as "impaired" if:

1. 10% of measurements in a calendar month are >1260 colony forming units per 100 milliliters of water (cfu/100mL) **or**
2. The geometric mean of five samples taken within 30 days is greater than 126 cfu/100mL.

Pleasure Creek Pleasure Creek exceeds both criteria.

The creek has not yet been listed as "impaired" by the State because of confusion about whether the analytical methods used for testing were state-approved, but a water quality problem exists regardless.

Sources of the bacteria likely include:

1. Headwater storm water ponds
2. Storm water runoff from throughout the watershed.

Downstream — Enough data is available for the downstream monitoring site (outlet to Mississippi River) to clearly document exceedances of the "impaired" criteria.

Upstream — At the upstream site not enough data has been gathered, but the E. coli values observed are similar to the downstream site.

2006 — In 2006, five samples taken between 5/24 and 6/21 had a geometric mean of 318 cfu/100mL.

2007 — May 2007 At the farthest-downstream monitoring site three of four samples exceeded 1260 cfu/100mL (261, 1986, and two samples exceeded the test limits of 2420 cfu/100mL).

Also in 2007, five samples were taken between 5/24 and 6/20, but calculating their geometric mean is impossible because two of the samples exceed the test's capacity of 2420 cfu/100mL. If we conservatively replace those readings with 2420 cfu/100mL, then geometric mean is 934 cfu/100mL.

2008	In 2008 monitoring occurred at the Blaine-Coon Rapids Boundary (96th Lane) to determine if the problem originated up or downstream of that point. Average baseflow E. coli was 235 MPN/100mL (n=4) and varied little (standard deviation 135). Average storm E. coli was 1102 MPN/100mL (n=3) and varied widely (standard deviation 1187). This is similar to the outlet to the Mississippi River, so it appears that an important bacteria source is within the City of Blaine. It is likely that urban runoff within Coon Rapids is also contributing E. coli to the stream.
2009	In 2009 monitoring moved further upstream to diagnose the bacteria source. The portions of the watershed above the 2008 monitoring site are a network of stormwater ponds in the City of Blaine. 2009 monitoring was designed to determine which drainage areas to these ponds are bacteria sources or if the ponds themselves might be the source. One monitoring site split was mid-way through the pond network (Pleasure Cr Parkway W), while the other was at the outlet of the last pond (99th Avenue, see monitoring sites map above). Most monitoring (6 of 8 occasions) was during storms because the highest bacteria levels were found during storms in previous years. The results suggest that the ponds themselves are a source of E. coli, while additional bacteria may come from the neighborhoods around the ponds.
Effect of Storms	E. coli levels were highest and most variable at the outlet to the Mississippi River during storms. Average baseflow E. coli was 257 MPN/100mL (n=8; units MPN/100mL are comparable to cfu/100mL and differ in analytical method) and varied little (standard deviation 179). During storms average E. coli jumped to 935 MPN/100mL (n=9) and varied widely (standard deviation 1046). A large part of this variability might be explained by the intensity of the storm, phenology of the storm, and when during the storm the sampling was done. E. coli during storms is higher because storms flush bacteria from impermeable surfaces throughout the watershed, and because higher flows suspend and transport E. coli that were already present in the creek.
Effect of Location	The monitoring site mid-way through the pond network (Pleasure Cr Parkway W) did have elevated E. coli during baseflow and storms, which suggests that the small drainage area upstream of this site contributes E. coli to the creek.

Only two baseflow samples were taken and little flow was moving; E. coli levels were 307 and 770 MPN/100mL, which is moderately high. This would seem to suggest that bacteria levels my have a regular, non-storm related presence in the ponds (i.e. the ponds are a bacteria source). During storms, six samples had widely different E. coli levels. On the low end, one storm had only 34 MPN/100mL and another had only 122 MPN/100mL. These readings are below the state water quality standard. Two other storms had moderate E. coli levels of 307 and 387 MPN/100mL. But during the other two storms E. coli levels were so high they exceeded the laboratory's maximum test result of 2420 MPN/100mL. E. coli levels were not correlated with precipitation totals or stream water level.

The monitoring site at the bottom of the pond network (99th Avenue) had low E. coli during baseflow. Only two samples were taken during baseflow, and the E. coli levels were low (55 and 58 MPN/100mL). While two samples are too few for a confident assessment, it suggests that few bacteria exit the last stormwater pond during baseflow. The last ponds are the largest and deepest, and therefore least likely to harbor bacteria and most likely to remove them during baseflow. While the smaller, shallower upper ponds may harbor E. coli, the larger, deeper lower ponds remove them during baseflow. However, higher flows during storms can allow bacteria to pass through all of the ponds.

E. coli levels during storms at 99th Avenue were much more variable, similar to what was found in the ponds. While one storm sample had desirably low E. coli (104 MPN/100mL), others were high (248, 435, 727, 727, and 1986 MPN/100mL). Again, E. coli levels were not correlated with precipitation totals or stream water level.

There is some evidence that E. coli is not associated with nutrient-rich sources such as wastewater. Phosphorus in Pleasure Creek is low, especially for an urban stream (see 2009 ACD report). If wastewater or other nutrient rich sources were significant, phosphorus would be higher.

Fecal coliform and fecal streptococcus bacteria testing were done at 99th Avenue to determine if the bacteria source was human sewage. The feces of different animals have different ratios of these two bacteria types.

Admittedly, this is an imperfect test for several reasons. First, pollution from multiple sources can alter the ratio. Second, bacterial ratios will change over time because of different die-off rates; fecal streptococci die-off faster thereby increasing the ratio and possibly resulting in incorrect determinations that the bacterial source is human.

Research has found that these bacteria types can survive and reproduce outside of the digestive tracts of warm-blooded animals. The population dynamics of these “free-living” bacteria could affect the ratio. These limitations are important to recognize when interpreting the data.

Coon Creek In 2011 the MPCA informed the CCWD that the Creek was exceeding State standards for bacteria at the Vale Street, Coon Rapids site.

No detailed data have been provided at the time this report was prepared.

Dissolved Oxygen

Coon Creek Dissolved oxygen was similar at all sites, only once dropping below 5 mg/L at which point some aquatic life becomes stressed.

Sand Creek Dissolved oxygen in Sand Creek was within the acceptable level on 95% of the site visits. On four occasions it dropped below 5 mg/L. These four readings occurred at three different sites; two during storms and two during baseflow. Three occurred in 2009, which was a severe drought year. Stagnant conditions are probably responsible for these low oxygen conditions, and are likely natural.

Pleasure Creek Dissolved oxygen was at acceptable levels commonly found in the area.

Total Phosphorus

Total phosphorus (TP) is a common nutrient pollutant. It is limiting for most algae growth.

Coon Creek Total phosphorus (TP) in Coon Creek was consistently low during baseflow conditions, but more than doubled during storms.

During baseflow the three monitoring sites had median TP of 70, 76, 77 ug/L, respectively, from upstream to downstream.

This is much lower than the countywide median for streams of 126 ug/L. There was little variability among baseflow samples, with only three samples exceeding 126 ug/L. The maximum was 179 ug/L.

During storms TP was higher, and sometimes much higher. Median TP during storms was 2.5 times the median for baseflow at each site. Storms also had much greater variability. The standard deviation for storm readings were 99 mg/L at Shadowbrook, 102 at Lions Park, and 159 at Vale Street. By contrast, the standard deviations during baseflow were 22, 34, and 33 mg/L, respectively. Variation in the timing, magnitude, and intensity of the storm is likely responsible for the greater variability in TP during storms compared to baseflow.
TP increased in an upstream to downstream direction during storms. While median storm TP was similar at the three sites (174, 194, and 192 ug/L, respectively, upstream to downstream), the Vale Street site had the highest individual readings and much more variability. At Vale Street there were six readings over 300 ug/L, while there were three such instances at Lions Park and only one at Shadowbrook. More sampling events at Vale Street could partially explain this.

Sand Creek Total Phosphorus is generally low in Sand Creek. Median Sand Creek TP for all sites in all years during baseflow (0.063 mg/L) and storms (0.094 mg/L) were below the median for Anoka County streams (0.126 mg/L) and below the published value for minimally impacted streams in this ecoregion (0.130 mg/L). While TP is slightly higher at most sites during storms compared to baseflow, this difference is minor. No apparent TP increase occurs from upstream to downstream; all sites are similar, including the tributary ditches.

These low phosphorus levels, even during storms, are surprising in a suburban setting. The fact that the watershed is mostly residential probably helps to keep phosphorus inputs relatively low. Additionally, storm flushing into Sand Creek is light; the hydrograph is relatively flat, even in response to moderate storms.

Pleasure Creek Phosphorus in Pleasure Creek is low. In Pleasure Creek total phosphorus was consistently lower than the median for Anoka County streams at both the upstream and downstream monitoring sites. It was highest at Pleasure Creek Parkway West, but this is not surprising given that this site is within a network of stormwater ponds designed to capture these pollutants. At the downstream end of the stormwater ponds phosphorus was lower. This is evidence that the ponds are effectively removing that pollutant.

pH

Coon Creek pH was within the expected range at all sites, with one exception. pH is expected to be between 6.5 and 8.5 according to MPCA water quality standards. While occasional readings outside of this range did occur, they were not large departures that generate concerns. pH was notably lower during all storm events, but this is not surprising because rainfall has a lower pH and the creek serves as a stormwater conveyance for four cities. One unusually low pH reading of 6.24 occurred on July 20, 2009. The reason for this low reading is unknown, but it appears to be isolated.

Sand Creek Sand Creek pH was within the expected range at all sites and during all conditions, ranging from 7.05 to 8.71. The median was 7.65. The Minnesota Pollution Control Agency water quality standards set an expectation for pH between 6.5 and 8.5. At the farthest downstream sites (Ditch 39 at University Ave and Sand Cr at Xeon), storm pH was noticeably lower than baseflow, but this is likely because of higher percentage by volume of rain downstream. Rainwater has a lower pH.

Pleasure Creek pH was at acceptable levels commonly found in the area.

Maintenance Regime	Reach	2008	2009	2010
Unmaintained	D58 x 165th	ACD	ACD	ACD
	D58 x Andover Bld		ACD	ACD
	Sand Creek x Olive		ACD	ACD
	Coon Creek x Egret[1]	ACD	ACD	ACD
Maintained	D59-4 x Bunker Lake Bld	ACD		ACD
	D41 x TH65	ACD	ACD	ACD
	Coon Creek x TH65[1]	ACD	ACD	ACD
	Coon Creek x 131st	ACD	ACD	ACD
[1]Locations of MPCA 2000 Samples				

Implications of Changes in Water Quality

Pleasure and Coon Creeks Exceeds State Standards for E. Coli and Could be Impaired

On all accounts, Pleasure Creek at the outlet to the Mississippi River exceeds the State of Minnesota E.coli standard for contact with the water.

Pleasure Creek E. coli levels are not Waste Water Related

The lack of nutrient inputs despite high levels of other dissolved pollutants and E. coli lends some insight into the source of the pollutants.

High dissolved pollutants are likely due to inorganic chemical inputs, not organic nutrient-rich inputs like those found in wastewater. Likewise, it indicates that the source of E. coli is not likely to be active inputs of wastewater.

The Biological Impairment Listing of Coon, Sand and Pleasure Creeks is Inappropriate

The biomonitoring results point to a number of problems with the current system of identifying biological impairments and correcting them.

First, MPCA's use of single samples to determine impaired conditions does not take into account the variability in natural environments and is therefore prone to erroneous results. In the case of Coon Creek, it appears that they may have overestimated long-term stream health.

Secondly, there are questions about the appropriateness of state biological standards for streams being applied to ditches. The MPCA has recognized this and begun developing tiered biotic standards for different types of waterways, but until those are completed the current "impaired" designations have not been rescinded. The fact that Coon Creek's biota is typical among the Anoka County streams monitored provides some evidence that either many streams are biologically impaired or the standards are inappropriate.

Third, a single biotic impairment designation for all of Coon Creek is inappropriate because of the great variability throughout this watershed. Two sampling sites are not sufficient to understand the entire creek length, especially in such a diverse watershed; the MPCA plans to monitor more sites in 2010. Any total maximum daily load study for Coon Creek will likely identify different stressors in different areas. In upstream areas, which have experienced greater disturbance through ditching, habitat is likely most limiting to stream life. Farther downstream, habitat is better but water quality is poorer. Many of the stressors will be related to factors that are difficult to change, such as the effect of 100 years of ditching activity or urban development. More realistic protocols are needed that allow managers to focus on realistic ways to improve stream health.

A final concern is the use of biological stream standards in the total maximum daily load (TMDL) framework. This framework originated from the Federal Clean Water Act and was used to address industrial, point source pollutants. The process is based upon determining the maximum amount of pollutant that can be discharged while still meeting water quality standards. Biological standards do not fit this approach. Biota are not a stressor or pollutant. A TMDL for impaired biota begins with a stressor identification process. This process focuses on water quality. In many waterways, but most obviously ditches, habitat may be the problem, not water quality. In other cases, the stressors identified (usually TSS or DO) may only be partial or intermittent factors. Efforts to address any one factor may be beneficial, but not result in the biotic community outcomes that are sought.

Sand, Pleasure and Springbrook Creeks are Approaching Chronic Chloride Problems

Sand, Pleasure and Springbrook Creeks have water quality problems that affect aquatic life, recreation, and pose a health threat to humans that contact the water.

Urban stormwater is likely the most important source of dissolved pollution. No one neighborhood or city seems to contribute disproportionately to the problem; the source is diffuse. Urban storm water is known to generally carry high levels of dissolved pollutants. The Pleasure Creek watershed is densely populated and has a high percentage of impervious surfaces. In the older areas, the stormwater treatment measures in place are much less than would be required of a similar development built today. While up-to-date stormwater treatment such as settling ponds, street sweeping and catch basins do exist in part of the watershed, these practices are designed to remove particulate pollutants, and do not effectively remove dissolved pollutants.

Given that dissolved pollutant concentrations are similar during baseflow and stormflow, urban stormwater is not likely the only contributor. Dissolved pollutants during baseflow are from one or more of the following:

- Conductivity and salinity sources likely include road

deicing salts as well as a broad mixture of other chemicals found on roads and other impervious surfaces.
- Dissolved pollutants that have permeated into the shallow groundwater that feeds the stream during baseflow.
- Continuous discharges to the creek, such as industrial wastes or illicit discharges through the stormwater conveyance system.
- Storm water ponds upstream which may retain pollutants from storms and release them to the creek continuously.

In any case, there are multiple sources of dissolved pollutants to these creeks. There was little difference between storm and baseflow conditions. If road runoff was the primary dissolved pollutant source, then readings would be highest during storms. Dissolved pollutants can also easily infiltrate into shallow groundwater that feed streams during baseflow. If this has occurred, dissolved pollutants will be high during baseflow.

Coon, Pleasure and Sand Creeks Regularly Exceed State Turbidity Standard

There is likely enough data for the MPCA to consider Coon, pleasure and Sand Creeks “impaired” due to violations of turbidity water quality standards.

Whenever possible, MPCA prefers to use turbidity for these determinations rather than use TSS and transparency tube as surrogates. A minimum of 20 readings are required. At least three observations and 10% of all observations must exceed the water quality standard of 25 NTU to be considered impaired.

Higher flows in downstream areas probably contribute to greater bedload transport of sediment. Greater impervious area in downstream portions of the watershed results more urban stormwater runoff, which is often high in suspended materials. The lower portions of the Coon Creek watershed were mostly developed before rigorous stormwater treatment regulations were enacted.

In the case of Pleasure Creek, because of the positioning of monitoring sites, we can confidently say that high suspended solids during storms originate within the City of Coon Rapids. This is the oldest developed portion of the watershed and has fewer stormwater treatment facilities. The source of suspended solids is likely materials swept into the creek through storm water conveyances, but may also include spot erosion of the stream bank.

Based on the monitored data, the MPCA is likely to list Coon Pleasure and Sand Creeks as impaired for high turbidity.

There are some questions regarding the appropriateness of such an impaired listing.

1. Turbidity measurements were taken using units of FNRU, not NTU. It is uncertain how these units differ, but the difference is likely small.
2. Coon Creek exceeded the surrogate standard of 100 mg/L TSS only five times.
3. Only one of five transparency tube measurements exceeded that surrogate standard of 20 cm.

However, given the preference for using turbidity directly, these points are likely irrelevant.

Insufficient Water Quality Data Exists for Springbrook Creek

In 2003 the Anoka Conservation District with the support of the Six Cities Watershed Management Organization and the City of Fridley along with the MPCA made a good faith effort to address the water quality and hydrology concerns on Springbrook Creek. Equipment failures, data corruption and the complexity of the watershed made accurate assessment and diagnosis of problems and the hydrodynamics in play with those problems impossible and confounded further continuous monitoring of Springbrook Creek.

Management Needs

Continue Water Quality Monitoring

Water quality monitoring needs to continue on Coon Creek and the principle tributaries and watersheds including Springbrook Creek.

Cooperate on the Upper Mississippi River bacteria (E. coli) TMDL study

Join the Upper Mississippi Bacteria TMDL Study. The Minnesota Pollution Control Agency began this study in 2010. They are seeking partners for monitoring, and will at least partially fund it. Their monitoring will be more intense, but less diagnostic. More may be learned through this monitoring, but the more substantial benefit of joining this project would be access to funds for correcting the problem after the study is done.

Clean stormwater ponds frequently to Address E. Coli

The network of stormwater ponds that the creek flows through in Blaine should receive regular removal of accumulated sediments and trash. The shallower, smaller ponds should be of highest priority for more frequent cleaning. The goal should be to remove organic materials and sediment that provide a substrate for bacterial growth. While the ponds are effectively removing suspended solids and phosphorus, maintaining the ponds will improve their effectiveness.

Catch basin testing, increased cleaning to Assess E. coli levels

By testing water and sediment from catch basins during dry weather conditions it can be determined if they are acting as reservoirs for bacterial survival. If E. coli concentrations are high, more frequent cleaning should be considered. This activity should be targeted in the Blaine neighborhoods draining to stormwater ponds first because of the known issues in that area. If problems are found there, similar work in Coon Rapids should occur.

Targeted public education on Dissolved pollutants, E. coli, and suspended solids

Given that the likelihood of contact with water is low, especially during storms when E. coli is highest but flows are most hazardous, the focus of public education need not be water contact advisories. Instead, a blended public education messages that states the risks and problems but focuses on changing behaviors that will alleviate the problem should be undertaken.

Subwatershed Plans or Retrofit Assessments Should be Conducted for Springbrook, Pleasure, Lower Coon and Middle Coon Creeks

A comprehensive assessment of the watershed for opportunities to improve stormwater treatment and ranking of those opportunities by cost-effectiveness should be undertaken. A focus should be practices that most effectively address bacteria, dissolved pollutants, and reducing storm flow rate and volume. Project and practices identified through this process should be installed. The Anoka Conservation District has staff specialized in this process and can assist.

From a management perspective, water quality improvement projects should focus upon treating stormwater, especially in the lower half of the watershed. Retrofitting the existing stormwater conveyance and treatment system will be necessary in many instances. Where redevelopment occurs, improved stormwater practices should be installed. In some areas, stabilization of the creek itself is needed; several areas of significant streambank erosion exist. This is not surprising given that upper reaches of the creek have been ditched.

In addition to the data presented above, some transparency tube data and photos are available from the Anoka Conservation District. Transparency tube readings were not included in this report because they were taken only in 2009 and because in many instances water clarity was greater than the tube's length, resulting in a reading of >100cm.

Corrective actions should include:

- Heightened best management practices that keep suspended materials from reaching stormwater conveyances, such as street sweeping, settling ponds, swales, and others.
- Reduction of storm flow velocities in the creek by improving storm water detention or infiltration throughout the watershed. This will reduce the size of particles that can be carried and reduce streambank erosion.

Water Quality Inventory

Inventory water quality on all Coon Creek Watershed System lands as needed for management of all District resources. Inventory water quality characteristics when land and resource management plans are being developed. Develop statistical sampling design based on analysis procedures that provide the desired water quality interpretations.

Display the results of inventories characterizing water quality using maps, data bases, or other appropriate documentation. Inventories should be analyzed and interpreted to help establish management objectives. Water quality inventories must provide specific information sufficient to address issues and concerns identified in land and resource planning and management activities.

Analysis and Interpretation of Water Quality Data

Analyze and interpret water quality inventory data to predict the effect of proposed land management practices on present and future water quality. Use this information, along with watershed condition and other soil and water resource data, to develop improved design of management practices, provide a comparison of outputs under alternative management practices, and establish a basis for use in defining water resource management objectives. The analysis must be rigorous enough to make definitive statements concerning anticipated water quality response. Apply a risk analysis to selected alternatives.

Water Quality Standards, Rules and TMDLs

Participate in review of State standards and work toward change where consideration is not given to the following factors:

1. Standards should reflect local as well as State and Federal water quality objectives; be related to beneficial uses, and recognize natural background and variability.

2. Compliance with approved best management practices for control of nonpoint sources should constitute compliance with water quality standards and these practices should be based upon site-specific conditions and should include a consideration of political, social, economic, and technical feasibility.

3. Water quality standards that reflect nonpoint source conditions should be used to measure effectiveness of best management practices.

4. Consideration should be given to evaluating certain water quality concerns, such as sediment, by observing a surrogate such as channel condition.

5. Antidegradation policy should include a consideration of both time and space and should not be based on change at a single point.

Water Quality Planning

Consider the quality of the District's water resources and establish goals and objectives for water quality management in the land and resource planning process. Inventory and analyze the characteristics of the water resource to provide background information for determining water quality management goals and objectives.

When establishing water quality management objectives, consider

1. The needs and concerns of local interests, as well as regional and state users

2. The long-term and short-term natural water quality characteristics

3. The cumulative effects of pollution sources in and out of the Watershed.

Emphasize preventive conservation practices in all water quality management programs. Tailor such practices to individual site characteristics. Include definition of practices, application of practices and evaluation to ensure that prescriptions achieve water quality goals.

Coordinate Watershed District land management planning with water quality management planning by State and local agencies pursuant to Section 208 of Public Law 92-500, as amended (Clean Water Act).

Water Quality Monitoring

Water quality monitoring is an evaluation of the success of meeting water quality goals, objectives, and targets identified in the Comprehensive plan or Subwatershed plans. The Comprehensive plan provides guidelines for establishing a monitoring program. Included are criteria for identifying specific activities to monitor, expected precision, accuracy, and reliability of results, and for determining an appropriate balance between long-term and short-term monitoring. Consider utilizing surrogates for evaluation of water quality impacts. For example, evaluate channel condition in place of sediment sampling.

Plans of Operation

Water quality monitoring requires systematic sample design, data collection, analysis, and reporting processes. Design these systematic processes to meet monitoring requirements specified in the Watershed Plan or available guides and establish them in an approved monitoring plan of operation prepared prior to start of monitoring activities.

Pollution Control

Coordinate Watershed District plans and activities with water quality management planning and implementation efforts of local, State and local water quality management agencies.

Delegate appropriate District personnel to advise other agencies when critical lands or facilities within the watershed are included in water related projects.

Designate Watershed District coordinators to participate directly with the local or State water quality management agency in all levels of the stormwater management planning effort where Watershed District facilities and lands are significantly involved.

State and Local Water Quality Management

Identify the Watershed District as the management agency for lands or resources under Watershed District administrative control when developing cooperative agreements with individual Cities.

Wildlife

Current Plan

The current plan provides lists of known fist and wildlife species within the watershed and the basic principles of wildlife management. The plan also addresses endangered, threatened and special concern species within the watershed.

Wildlife and Fisheries Resources

The wildlife and fisheries resources of the watershed have traditionally provided a considerable amount of recreational and economic benefit to area residents and others. In addition to the traditional activities of hunting and trapping, nature observation and nature photography have become important wildlife related activities.

Three lakes are open to the fishing public within the watershed. Crooked Lake in the western portion of the watershed is noted as a special regulation lake for bass. Ham Lake and Lake Netta are known to be Northern Pike fisheries. Lake Netta; however, is known to experience freeze out.

Wildlife Management Areas

Approximately 5,000 acres in the northeastern part of the watershed are part of the Carlos Avery Wildlife Management Area (CAWMA). The CAWMA is a wetland area that supports a large waterfowl population along with other wetland wildlife such as beaver and muskrat. Other species such as deer, fox, rabbit, squirrel and other small game are also found in this area. Black bear and coyotes have been sighted in the District according to a 1981 study by the USFWS.

Property	**Size (acres)**	**City**
Carlos Avery WMA	4,873	Columbus
Bunker Hills Regional Park	1,475	Coon Rapids
Coon Rapids Dam Regional Park	215	Coon Rapids
Erlandson Nature Center	76	Coon Rapids
Springbrook Nature Center	127	Fridley

Endangered and Threatened Species

The Minnesota Natural Heritage Program has conducted a computer search for occurrences of rare plants, animals and other significant natural features known in the Coon Creek watershed.

The Natural Heritage Program is a unit within the Ecological Services section of the Division of Fish and Wildlife, DNR. The program has compiled the most complete single source of data on Minnesota's rare, endangered or otherwise significant plant and

Wildlife

animal species, plant communities and other natural features. While this information is comprehensive, it cannot be considered a substitute for on-site surveys. A current list of Endangered and Threatened Species can be found at: www.dnr.state.mn.us/rsg/filter_search.html

Endangered Species

An endangered species is a species that is threatened with extinction throughout all or a significant portion of its range.

Common Name	Scientific Name	Group	Federal Status
Karner Blue	Lycaeides melissa samuelis	insect	endangered
Tubercled Rein-orchid	Platanthera flava var. herbiola	vascular plant	none
Twisted Yellow-eyed Grass	Xyris torta	vascular plant	none
Virginia Bartonia	Bartonia virginica	vascular plant	none
Cross-leaved Milkwort	Polygala cruciata	vascular plant	none
Diverse-leaved Pondweed	Potamogeton diversifolius	vascular plant	none
Blunt-lobed Grapefern	Botrychium oneidense	vascular plant	none
Snailseed Pondweed	Potamogeton bicupulatus	vascular plant	none
Tall Nut-rush	Scleria triglomerata	vascular plant	none

Threatened Species

A threatened species is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

Wildlife

Common Name	Scientific Name	Group	Federal Status
Wilson's Phalarope	Phalaropus tricolor	bird	none
Peregrine Falcon	Falco peregrinus	bird	none
Trumpeter Swan	Cygnus buccinator	bird	none
Loggerhead Shrike	Lanius ludovicianus	bird	none
Little White Tiger Beetle	Cicindela lepida	insect	none
Blanding's Turtle	Emydoidea blandingii	reptile	none
Tooth-cup	Rotala ramosior	vascular plant	none
Ram's-head Lady's-slipper	Cypripedium arietinum	vascular plant	none
St. Lawrence Grapefern	Botrychium rugulosum	vascular plant	none

Special Concern A species of special concern, while not endangered or threatened, is extremely uncommon in the state, or has a unique or highly specific habitat requirement and deserves careful monitoring of its status. Species on the periphery of their range that are not listed as threatened may be included in this category along with species that were once threatened or endangered but now have increased or protected populations.

Wildlife

Common Name	Scientific Name	Group	Federal Status
Cerulean Warbler	Setophaga cerulea	bird	none
Common Gallinule	Gallinula galeata	bird	none
Forster's Tern	Sterna forsteri	bird	none
Hooded Warbler	Setophaga citrina	bird	none
Louisiana Waterthrush	Parkesia motacilla	bird	none
Red-shouldered Hawk	Buteo lineatus	bird	none
Bald Eagle	Haliaeetus leucocephalus	bird	none
Sandy Laccaria	Laccaria trullisata	fungus	none
A Species of Fungus	Lactarius fuliginellus	fungus	none
Leonard's Skipper	Hesperia leonardus	insect	none
Regal Fritillary	Speyeria idalia	insect	none
Northern Barrens Tiger Beetle	Cicindela patruela patruela	insect	none
Plains Pocket Mouse	Perognathus flavescens	mammal	none
Black Sandshell	Ligumia recta	mussel	none
Creek Heelsplitter	Lasmigona compressa	mussel	none
Plains Hog-nosed Snake	Heterodon nasicus	reptile	none
Gophersnake	Pituophis catenifer	reptile	none
A Jumping Spider	Tutelina formicaria	spider	none

Wildlife

Common Name	Scientific Name	Group	Federal Status
A Jumping Spider	Paradamoetas fontana	spider	none
Rhombic-petaled Evening Primrose	Oenothera rhombipetala	vascular plant	none
Sea-beach Needlegrass	Aristida tuberculosa	vascular plant	none
Autumn Fimbristylis	Fimbristylis autumnalis	vascular plant	none
American Ginseng	Panax quinquefolius	vascular plant	none
Thread-like Naiad	Najas gracillima	vascular plant	none
Beach-heather	Hudsonia tomentosa	vascular plant	none
Least Moonwort	Botrychium simplex	vascular plant	none
Waterwillow	Decodon verticillatus	vascular plant	none
Marginated Rush	Juncus marginatus	vascular plant	none
One-flowered Broomrape	Orobanche uniflora	vascular plant	none

Other species and elements of interest

In addition to these species, sand hill crane breeding areas and waterbird colonies (including great blue herons and great egrets) are known from areas adjacent to the watershed. These species use wetland and farmland areas in the watershed for feeding.

Common Name	**Scientific Name**
Plants:	
Long-Bearded Hawkweed	Hieracium longipilum
A Species of Pondweed	Potamogeton bicupulatus
Half Bristly Bramble	Rubus semisetosus

Wildlife

Rare Natural Communities

1. Conifer Swamp
2. Dry Sand Prairie
3. Emergent Marsh
4. Mixed Oak Forest
5. Oak Savanna Dune Subtype
6. Poor Fen

Invasive Species Two invasive plant species are found within the watershed:

Form(s)	**Sources**
Invasive Plant Species	• Eurasian watermilfoil (*Myriophyllum spicatum*)
	• Curly-leaf pondweed (*Potamogeton crispus*)
	• Flowering rush (*Butomus umbellatus*)
	• Reed Canary Grass (*Phalaris arundinacea*)
	• Purple loosestrife (*Lythrum salicaria*)
	• Buckthorn (*Rhamnus frangula*)
	• Common Reed grass (*Phragmites australis subsp. australis*)
Invasive Animal Species	• Rusty crayfish (*Orconectes rusticus*)

Trends in Wildlife

Increase in E&T Species	In the past 10 years, 25 plant and animal species found within the watershed have been added to the endangered, threatened or special concern species list either due to habitat loss, discovery within the watershed or both.
Increase in Invasive Species	While the number of confirmed presence of Aquatic Invasive Species has really not increased significantly (the plant species listed above were all present in the watershed in 2004), the concern and emphasis on having AIS addressed has increased significantly. In addition the publicity and air of impending threat brought on by new species to Minnesota (most notably Zebra Mussels and Asian Carp) have increased public concern and compelled action by the legislature and state agencies.
Loss of Habitat	The Metropolitan Water Management Act provides that wildlife and fish conservation shall receive equal consideration and be coordinated with other features of water resource development programs.
Riparian Habitats	Riparian habitat is found along the banks of a river, stream, lake or other body of water. Riparian habitats are ecologically diverse and may be home to a wide range of plants, insects and amphibians that make them ideal for different species of birds. Riparian areas can be found in many types of habitats, including grassland, wetland and forest environments. Riparian vegetation is ideally suited to stabilize stream or lake banks, and anchor soil from the fluctuating water levels found in many Sand Plain water resources thereby reducing erosion and delivery of suspended solids. Riparian habitat in the District has been increasingly converted to more formal landscape covers which favor shallow rooted plants unable to properly protect the sandy easily eroded lake and stream banks.
Animal Damage	Wildlife damage management is an activity that seeks to balance the needs of human activity with the needs of wildlife to the mutual enhancement of both. Sometimes the solution to an animal-human conflict requires the human to change his or her behavior. Other times, the solution is to change the animal's behavior. Various tools and strategies are

used to reduce human-animal conflict, such as behavior modification, repellents, exclusion, habitat modification, relocation, lethal control etc.

Wildlife Management Needs

Cooperation With Other State Organizations

To develop and maintain partnerships with the appropriate State agencies to jointly establish and meet wildlife, fish, and threatened, endangered, and sensitive species habitat goals, objectives, and standards.

To cooperate with other agencies, conservation organizations, concerned landowners, and individuals in all appropriate aspects of wildlife, fish, and threatened, endangered, and sensitive species habitat management.

The District needs to maintain contacts with State and other educational institutions teaching wildlife and fish management or related courses. These contacts shall keep the institutions currently informed on Watershed District issues, concerns, and opportunities and promote the fact finding necessary to their resolution.

Frequently, schools can make use of Watershed District resources for study and experimental or demonstration areas. Studies of Watershed District issues, concerns, and opportunities by graduate students are encouraged.

Protection and Development of Wildlife and Fish Habitat

The Metropolitan Water Management Act provides that wildlife and fish conservation shall receive equal consideration and be coordinated with other features of water resource development programs.

Contact the MDNR Fish and Wildlife regarding water related projects within the Watershed District, regardless of size, where existing or potential wildlife and fish values, public relations considerations, or technical problems warrant such action. This direction also applies to ditches, other construction projects, and similar activities which the Watershed District carries out or permits within the Watershed District, where such activities affect streams or water impoundments.

Management Indicators

Selection of Management Indicators

Select management indicators for the watershed plan or project that best represent the issues, concerns, and opportunities to support recovery of State-listed species, provide continued viability of sensitive species, and enhance management of wildlife and fish for recreational, scientific, or aesthetic values or uses. Management indicators representing overall objectives for wildlife, fish, and plants may include species, groups of species with similar habitat relationships, or habitats that are of high concern.

Determination of Conservation Strategies

To preclude trends toward endangerment that would result in the need for State listing, units must develop conservation strategies for those sensitive species whose continued existence may be negatively affected by the watershed plan or a proposed project. To devise conservation strategies, first conduct biological assessments of identified sensitive species.

Analysis of Habitat Capability

In analyzing proposed actions, conduct habitat analyses to determine the cumulative effects of each alternative on management indicators selected in the plan or project area.

Habitat

Accomplish Watershed District objectives for wildlife and fish habitat improvement through direct management and integrate wildlife and fish habitat improvements into other resource project activities, as well.

Habitat Management

Accomplish Watershed District objectives for wildlife and fish habitat improvement through direct management and integrate wildlife and fish habitat improvements into other resource project activities, as well.

Coordination With Other Resources And Mitigation Of Impacts On Fish And Wildlife Resources

Coordinate fish and wildlife habitat requirements with other resource needs in all Watershed District planning activities. Determine how resource management activities can be conducted to meet wildlife and fish habitat objectives. Mitigate adverse impacts of resource management activities. Examine projects that affect wildlife and fish needs, and evaluate the effects of alternative proposals in relation to the desired habitat conditions.

Riparian Habitats

Develop and implement management strategies (objectives, management prescriptions, and monitoring) to meet riparian habitat goals for dependent fish and wildlife species.

During project environmental analysis, describe the desired riparian habitat condition at some future time in terms of specific objectives for stream surface shaded, streambank stability, streambed sedimentation, gross-forb cover, shrub cover, and tree cover needed to meet planned objectives.

Animal Damage

To protect Watershed District resources

To protect activities taking place within the watershed and to reduce threats to human health and safety.

Wildlife And Fish Damage Management

Threatened and Endangered Species — Follow specific species control plans for state listed species cleared through consultation with the DNR.

Game and Furbearers — Control damage caused by game animals and furbearers through hunting or trapping, where practicable, in cooperation and consultation with the State fish and wildlife agencies, where appropriate.

Nongame Species — Control damage caused by nongame species within the Watershed District in close cooperation with the State fish and wildlife agencies, or other involved state or federal agencies.

Birds — Nonlethal repellents, frightening devices, pesticides, or physical barriers may be used to prevent or reduce resource damage or hazards, where birds damage reforestation or other resources, or where they create health hazards. Obtain permits from the DNR for any lethal control of species protected under law. Consult the DNR for permit requirements and procedures.

Fish and Aquatic Animals — States or other responsible agencies have the authority to control undesirable fish and aquatic animals in Watershed District waters. The Watershed District is responsible for coordinating with the responsible agencies to develop a work plan to ensure control activities are consistent with direction provided in the Comprehensive Plan. Control activities conducted by the Watershed District must meet appropriate environmental analysis requirements and be consistent with forest plan direction.

Endangered & Threatened Species

Manage Watershed District habitats and activities for threatened and endangered species to achieve recovery objectives so that special protection measures provided under the Endangered Species Act are no longer necessary.

Promote recovery efforts through Research and Development and State and Private conservation programs.

Sensitive Species

Develop and implement management practices to ensure that species do not become threatened or endangered because of Watershed District actions.

Maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range within the Watershed District.

Develop and implement management objectives for populations and/or habitat of sensitive species.

Planning for Management and Recovery

Sensitive species of native plant and animal species must receive special management emphasis to ensure their viability and to preclude trends toward endangerment that would result in the need for listing as an endangered, threatened or special concern species.

There must be no impacts to sensitive species without an analysis of the significance of adverse effects on the populations, its habitat, and on the viability of the species as a whole. It is essential to establish population viability objectives when making decisions that would significantly reduce sensitive species numbers.

Appendix C

Demand for and Value of Beneficial Uses of Water

Demand for and Value of Beneficial Uses of Water

The overall value of water is derived from the values associated with the services water and related land resources are expected to provide over time. These services can include any outcome that contributes to a generally accepted measure of human welfare.

Demand

Demand is typically defined as the quantity of a good or service that may be purchased or utilized at varying prices. Fundamentally, demand is driven by the tastes and preferences of the consumer.

All public goods, water among them, are complex and highly integrated resources. It is often impossible to utilize one service or group of services without affecting other goods or services.

Services & Benefits Provided

Because public goods and services are integrated and often provide a collective or common benefit, the problem of demand and valuation is approached by separating the demand for water and related resources into direct and indirect demand. We have also framed the beneficial uses in terms of services provided to the public.

Directly Demanded Services

Direct demand involves the use of water and related land resources in a manner that they are consumed or used directly:

Direct Beneficial Use	Page
• Drinking Water	53
• Drainage	37
• Irrigation	102

Indirectly Demanded Services

Indirect demand is the demand for the benefits derived from the indirect use of water. Water is not directly consumed. After utilization the quantity of water remains for additional use.

Indirect Beneficial Use	Page
• Aesthetics & Recreation	12
• Aquatic Life and Recreation	21
• Drainage	37
• Flood Control	72
• Groundwater Recharge	89
• Storm Protection & Water Quality	115

For the purposes of assessing the demand for and value of the direct and indirect services provided by water within the Coon Creek Watershed, it is important to note that:

1. All watersheds, regardless of their size and complexity, provide some beneficial uses

2. Different watersheds in different landscape contexts can provide very different mixes of beneficial uses.
3. Beneficial uses, when they are provided in different locations, may not be equally scarce, suitable or replaceable, and may be more or less accessible to people who value them.

Definitions

Functions, services, values, risk and several other terms are used in different ways in the assessment literature and in the economics literature. The following definitions are offered to minimize confusion over what will be used in the following sections as building blocks for determining the demand fort and value of the beneficial uses of water.

Features On-site characteristics of a water or related resource that establishes the capacity to perform or support various functions (soil, geology, slope, ground cover)

Functions The biogeochemical processes that take place within a given water or related resource. The level of function depends on site and landscape characteristics and can be assessed independent of human context.

The following biogeochemical processes occur within the Coon Creek Watershed which influence the type and extent of benefits provided by the watershed:

- Conveyance of Water (Stream flow, groundwater recharge, infiltration)
- Storage of Surface Water (lakes, wetlands, ponds)
- Storage of Groundwater
- Dissipation of water (Evapotranspiration loss)

As the Watershed has developed over the last 30 years the degree to which these functions can occur has changed and in some cases been diminished to the point that in some areas of the watershed they cease to function. Groundwater storage and stream flow are two examples.

Landscape Context Proximity of the resource to other natural or man-made features in the surrounding landscape. Landscape context influences the opportunity of a resource to function at capacity, the services that will flow from those functions, the value of those services, and the risk that the services will not persist.

Relative Preferences The rank or uses, services and benefits in order of importance. Relative preferences for various uses and services are much easier to determine than differences in dollar value measures of service values. Although less common than dollar measures of value, individual and community ranked preferences can be used to aggregate service values and compare resource uses using a single measure.

Risk The volatility of potential outcomes. In the case of water and related resource values, the important risk factors are those that

1. Affect the possibility of service flow disruption
2. The reversibility of service flow disruptions

These are associated with controllable and uncontrollable on-site risk factors (eg. Invasive plants, over appropriation, mitigation failure such as stormwater features that no longer work properly) and landscape risk factors (eg. Changes in land use or climate)

Services The beneficial outcomes that result from biogeochemical functions (potable water, fishable and swimmable lakes, flow regimes that do not damage property of flood fields)

These require some interaction with, or at least some appreciation by, humans. However, they can be measured in physical terms (water quality measures, increased catch rates or visitor days, property damages avoided). The capacity of a resource to provide services can be estimated without any ethical or subjective judgments about how much the services are worth. The types of potential services depend to some degree on the level of functions but predominantly on other factors (eg. Access, proximity to people, position in the watershed).

Values Defined in strict economic terms, the full range of water resource values includes each person's "willingness-to-pay" in dollars for each service summed across all people and all services. In most cases, tracing or estimating the absolute (dollar) value of water and all related resources is impossible. However, overall willingness to pay for a service depends on:

- The number of people with access
- Their income and tastes
- The cost of access
- The availability of substitutes
- Other factors related to local, regional and national supply and demand

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Approach

The District's approach to assessing demand and value relies heavily on available public data to expand indices of ecological and hydrologic function to reflect human services and values. It is intended as a toll for comparing and contrasting services and benefits based on accepted economic principles. For a complete review of the economic background and approaches to valuation see King, D.M., et al. 2000. Expanding Wetland Assessment Procedures: Linking Indices of Wetland Function with Services and Values. USACE ERDC/EL TR-00-17.

The approach adopted employ a two tier system that considers both:

1. Relative value of a service or beneficial use (Expected Service Value at different locations) and
2. Relative preferences that people have for different services.

The analysis and discussion on demand and value for each beneficial use will involve an assessment of 10 factors:

1. Level of Function Is an assessment of the biogeochemical condition and landscape context of the processes or factors required to provide a given use or benefit.

2. Service Capacity Is an assessment of the quantity and quality of the services or beneficial uses expected per unit of function.

3. Level of Service An assessment of how well an area is functioning relative to the biogeochemical processes that support a service and an area's service capacity.

The level of service (provision of a beneficial uses, specific benefits and services) reflects the level and type of biogeochemical functions and any other off-site characteristics that either limit or enhance the ability to provide the chosen service. It is in essence a product of the level of function and the service capacity

4. Value of Service The necessary factors and conditions that affect aggregate demand for a service within the Coon Creek Watershed.

The initial value is based on the expected value per unit of service and is used to modify the level of service.

5. Risk to Service Involves an assessment of the exposure and vulnerability of the water and related resource functions for a given time period

Risks of disruptions to services differ from site to site and are associated with the exposure and vulnerability of the drainage system itself and the vulnerability and exposure of important landscape features that affect the functional capacity of the system. Threats that cause risk can arise from physical, social or managerial actions or processes.

6. Expected Service Level	Is the product of assessing the value of a given benefit, use or service and the risks to that benefit, use or service.
7. Service Preferences	Reflects the preferences expressed in a survey of citizens, City Engineers and water resource professional conducted in April and May of 2011.
8. Adjusted Service Value	Shows the relative value of the benefit, use or service relative to other benefits, uses or services
9. Overall Value	Discusses the value of all of the benefits, uses and services over all time periods

Beneficial Uses

"Beneficial uses" are the uses that water and related land resources provide for people. The U.S. Environmental Protection Agency (EPA), which administers the Clean Water Act, uses a related term "designated uses." Seven beneficial uses are defined in Minn. Rule. 7050.0140.

Five 'Beneficial Uses' occur within the Coon Creek Watershed. Those uses are

1. Domestic Consumption
2. Aquatic Life And Recreation
3. Industrial Consumption
4. Agriculture And Wildlife
5. Aesthetic Enjoyment And Navigation
6. Other Uses And Protection of Border Waters
7. Limited Resource Value Waters

Drinking water

Class 1 waters, domestic consumption.

Domestic consumption includes all waters of the state that are or may be used as a source of supply for drinking, culinary or food processing use, or other domestic purposes and for which quality control is or may be necessary to protect the public health, safety, or welfare.

Aquatic life and recreation

Class 2 waters, aquatic life and recreation.

Aquatic life and recreation includes all waters of the state that support or may support fish, other aquatic life, bathing, boating, or other recreational purposes and for which quality control is or may be necessary to protect aquatic or terrestrial life or their habitats or the public health, safety, or welfare.

Industrial Use **Class 3 waters, industrial consumption**.

Industrial consumption includes all waters of the state that are or may be used as a source of supply for industrial process or cooling water, or any other industrial or commercial purposes, and for which quality control is or may be necessary to protect the public health, safety, or welfare.

Irrigation **Class 4 waters, agriculture and wildlife**.

Class 4A - Irrigation
Class 4B - Livestock and wildlife watering

Agriculture and wildlife includes all waters of the state that are or may be used for any agricultural purposes, including stock watering and irrigation, or by waterfowl or other wildlife and for which quality control is or may be necessary to protect terrestrial life and its habitat or the public health, safety, or welfare.

Aesthetics **Class 5 waters, aesthetic enjoyment and navigation**

Aesthetic enjoyment and navigation includes all waters of the state that are or may be used for any form of water transportation or navigation or fire prevention and for which quality control is or may be necessary to protect the public health, safety, or welfare.

Other Uses **Class 6 waters, other uses and protection of border waters**.

Other uses includes all waters of the state that serve or may serve the uses in subparts 2 to 6 or any other beneficial uses not listed in this part, including without limitation any such uses in this or any other state, province, or nation of any waters flowing through or originating in this state, and for which quality control is or may be necessary for the declared purposes in this part, to conform with the requirements of the legally constituted state or national agencies having jurisdiction over such waters, or for any other considerations the agency may deem proper.

Limited Resource Value Waters **Class 7 waters, limited resource value waters**.

Limited resource value waters include surface waters of the state that have been subject to a use attainability analysis and have been found to have limited value as a water resource.

Water quantities in these waters are intermittent or less than one cubic foot per second at the 7Q10 flow as defined in part 7050.0130, subpart 3.

These waters shall be protected so as to allow secondary body contact use, to preserve the groundwater for use as a potable water supply, and to protect aesthetic qualities of the water.

It is the intent of the MPCA that very few waters be classified as limited resource value waters. The use attainability analysis must take into consideration those factors listed in Minnesota Statutes, section 115.44, subdivisions 2 and 3. The agency, in cooperation and agreement with the Department of Natural Resources with respect to determination of fisheries values and potential, shall use this information to determine the extent to which the waters of the state demonstrate that:

A. The existing and potential faunal and floral communities are severely limited by natural conditions as exhibited by poor water quality characteristics, lack of habitat, or lack of water;
B. The quality of the resource has been significantly altered by human activity and the effect is essentially irreversible; or
C. There are limited recreational opportunities, such as fishing, swimming, wading, or boating, in and on the water resource.

The conditions in items A and C or B and C must be established by the use attainability analysis before the waters can be classified as limited resource value waters.

Ground Water All groundwater is protected for just one use, as an actual or potential source of drinking water. All ground water is designated as Class 1.

Surface Water All surface waters, lakes, rivers, streams and wetlands, in Minnesota are protected for multiple uses. The vast majority of surface waters are designated as Class 2; that is, they are protected for aquatic life and recreation.

Class 2 waters (i.e., all surface waters) are also protected for industrial use (Class 3), agricultural uses (Class 4A and 4B), aesthetics and navigation (Class 5), and other uses (Class 6).

In addition, some surface waters are protected as a source of drinking water (Class 1). An example of Class 1 waters include portions of the Mississippi River upstream of St. Anthony Falls.

This classification is consistent with the Clean Water Act goal that all waters should have “quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides recreation in and on the water,” wherever attainable.

People’s Preferences

Reflects the preferences expressed in a survey of citizens, city engineers and water resource professional conducted in April and May of 2011.

In April and May 2011 29 citizens, engineers from the seven cities within the watershed and water resource professionals who are members of the ‘planning advisory committee’ were administered a paired comparison survey of the beneficial uses of and the demands on water resources.

Rank Ordered Preferences for Beneficial Uses of Water within Coon Creek Watershed

Beneficial Use of Water	**Citizens**	**City Engineers**	**Water Professionals**	**National**
Drinking water	1	1	1	1
Water Quality	2	2	2	2
Flood Control	2	2	3	5
Groundwater Recharge	4	4	4	7
Storm Protection	6	5	6	6
Drainage	5	8	7	8
Aquatic life and recreation	8	8	5	9
Hunting and Fishing	**8**	**8**	**9**	**10**
Irrigation	9	9	10	4
Livestock and wildlife watering	10	10	8	11
Aesthetics	**11**	**11**	**11**	**12**
Industrial use and cooling	13	13	12	3

Demand Summary

Demand	**Measure**	**Projected Change in Demand 2010-2020**
Water Quality	Impairments	300%
Wildlife	E&T & Invasive spp	42%
Land	Res, Comm & Indust	22%
Aesthetics & Recreation	Population	10%
Flood Control	Acres	10%
Drinking Water	MGD	4%
Irrigation	MGD	-16%
Drainage	Acres of Ag Land	-17%

Aesthetic Character

Aesthetics is one of the beneficial uses of water cited in numerous federal and state laws, rules and programs. The Coon Creek Watershed District manages and influences water and related lands with inherent aesthetic value. Some of these water resources are significant to the cultural and historic landscapes of central Anoka County and the communities within the watershed. Other lands within the watershed provide a place to escape and enjoy the beauty of nature. In some areas, public lands and parks are the backyard for individuals and communities.

Watershed resources may also be valued and used for many other uses and analysis has shown that there is an increasing demand for housing, communication sites, R-O-W, recreation, sand mining, etc.

If not carefully designed, these activities have the potential to:

- Modify the character of the landscape
- Reflect on the image of the communities of the watershed
- Affect recreation use experiences and community quality of life
- Increase long term costs due to restoration needs

Aesthetic resources of the watershed include the features and its landforms, vegetation, water surfaces and cultural modifications (physical changes caused by human activities) that give the landscape aesthetic qualities. Landscape features, natural appearing or otherwise, form the overall impression of an area. This impression is referred to as "Aesthetic character".

Aesthetic character is studied as a point of reference to assess whether a given project would be compatible with established features of the setting or would contract noticeably and unfavorable with them.

Aesthetic Capacity Is an assessment of the quantity and quality of the aesthetic resources of the District

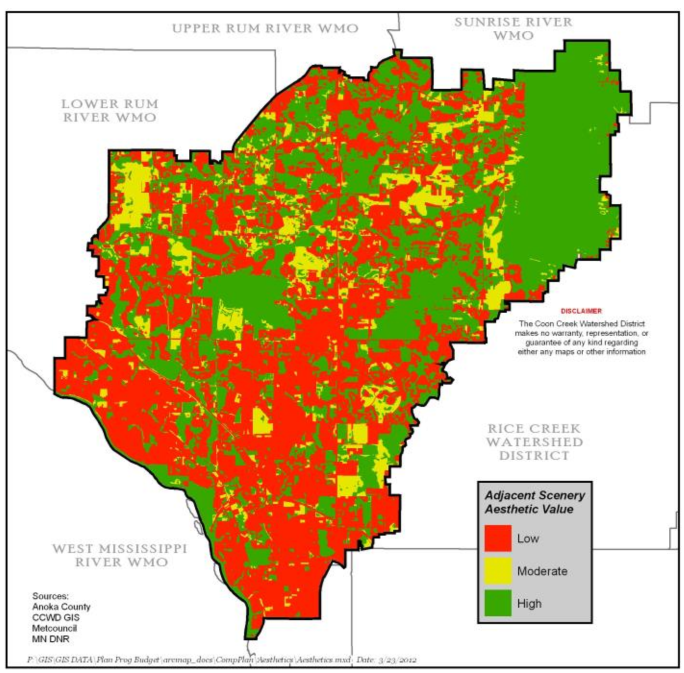
Landscape Types Four landscape types occur within the watershed

Landscape Type	Example
Panoramic	Lakes Sod Fields
Enclosed	Woods adjacent to creek
Feature	Dam Bridge
Focal	Waterfall Riffle/Rapids

Landscape Character Landscape character is the overall impression created by an area's unique combination of features (such as land, vegetation, water and structures).

It is defined by the elements of:

- Line
- Form
- Color and
- Texture



Aesthetic Quality All lands within the watershed have some aesthetic value, but areas with the most variety and the most harmonious composition have the greatest value.

Aesthetic value is a measure of the visual appeal of a water or related land resource and are evaluated using seven key factors:

- Land form
- Vegetation
- Water
- Color
- Adjacent Scenery
- Scarcity
- Cultural modifications

Aesthetic Sensitivity Aesthetic resources have a social setting, which includes public expectations, values, goals, awareness and concern regarding Aesthetic quality. This social setting is addressed as "aesthetic sensitivity", the relative degree of public interest in aesthetic resources and concern over adverse changes in the quality of that resource.

Aesthetic sensitivity is a reflection of:

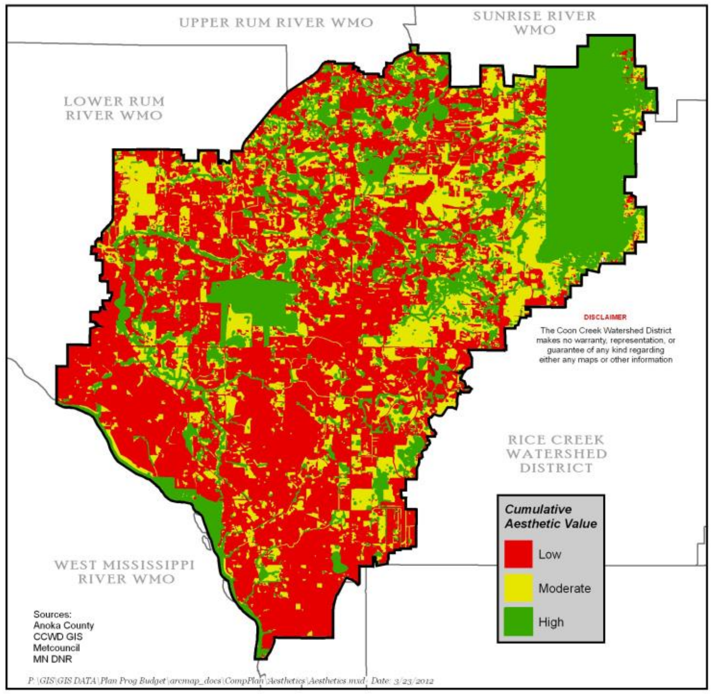
1. Types of use (farming, park & recreation)
2. Amount of use (Large numbers of people are often more sensitive)
3. Public interest (Visual quality may be a concern on Wild and Scenic Rivers, Critical Areas or key features in parks)
4. Adjacent land uses (Interrelationships with adjacent land uses can affect the aesthetic sensitivity of an area)
5. Special areas (management objectives for special areas may require special consideration)

As applied to aesthetic impact analysis, sensitivity refers to public attitudes about specific views, or interrelated views, and is key to

- identifying critical public views
- assessing how important aesthetic impact may be, and
- whether or not it represents a significant impact

Existing Aesthetic Condition

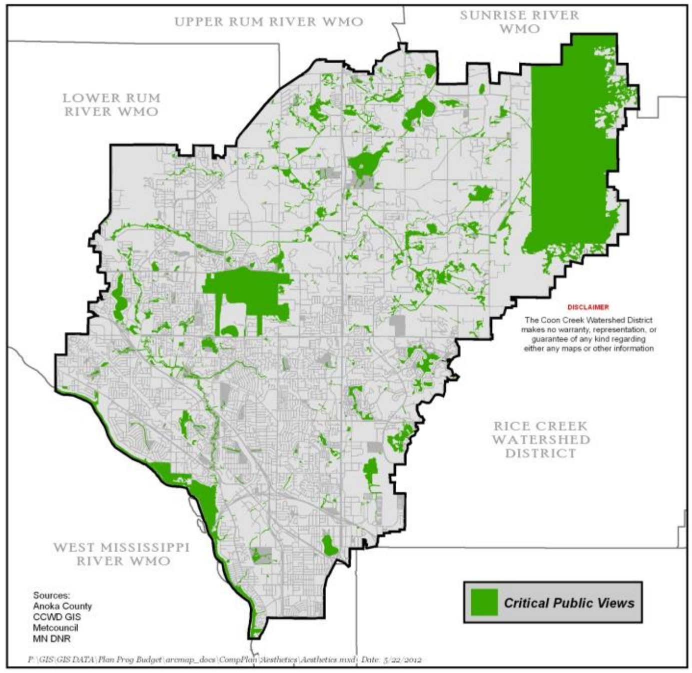
The existing aesthetic condition of the watershed is the baseline against which the visual impacts of a proposed action or alternatives are measured. It is compared to the critical public views and described in terms of the prevailing character and its quality.



Critical Public Views

Critical public views are those sensitive public views that would be most affected by an action because of :

- viewer proximity
- project visibility
- duration of the affected view



Value of Aesthetics

The necessary factors and conditions that affect aggregate demand for a service within the Coon Creek Watershed.

The initial value is based on the expected value per unit of service and is used to modify the level of service.

The necessary factors and conditions that affect aggregate demand for a service within the Coon Creek Watershed.

The initial value is based on the expected value per unit of service and is used to modify the level of service.

In general the factors that affect aggregate demand for drainage within the Coon Creek Watershed at a particular location include:

1. The number of people with access to the service
2. Their incomes and wealth
3. The cost in time or money of getting and keeping access to the service
4. The availability of perfect or near-perfect substitutes for the service
5. People's expressed or revealed preferences for this service compared with other competing services

Population An estimated 7,000 people live adjacent to highly aesthetic water and related land resources. Another 25,000 live adjacent to moderately aesthetic areas.

High	Medium	Low
7,000	30,304 24,000 90,960	30,304 34,060 90,960

30,304 90,960

Income Median annual income of household within and adjacent to high aesthetic areas is $83,000.

	High	Medium	Low
Income: Median HH	85,042	83,750	71,382
Income: Mean Median HH	83,066	80,098	73,933
Income: Est. Total*	908,166,833	278,619,746	1,170,452,200

Property Values

	High	Medium	Low
Total Prop Value ($)	2,099,088,100	3,020,072,400	8,078,020,400
Prop Values ($): Median	215,950	186,600	160,000
Prop Values ($): Mean	363,737	270,305	197,669

People's Preferences

Reflects the preferences expressed in a survey of citizens, City Engineers and water resource professional conducted in April and May of 2011.

In April and May 2011 29 citizens, engineers from the seven cities within the watershed and water resource professionals who are members of the 'planning advisory committee' were administered a paired comparison survey of the beneficial uses of and the demands on water resources.

Aesthetics ranked second to last as a preferred use of water.

Beneficial Use of Water	Citizens	City Engineers	Water Professionals	National
Drinking water	1	1	1	1
Water Quality	2	2	2	2
Flood Control	2	2	3	5
Groundwater Recharge	4	4	4	7
Storm Protection	6	5	6	6
Drainage	5	8	7	8
Aquatic life and recreation	8	8	5	9
Hunting and Fishing	8	8	9	10
Irrigation	9	9	10	4
Livestock and wildlife watering	10	10	8	11
Aesthetics	**11**	**11**	**11**	**12**
Industrial use and cooling	13	13	12	3

Risks to Aesthetic Resources

Involves an assessment of the exposure and vulnerability of the water and related resource functions for a given time period.

Risks of disruptions to services differ from site to site and are associated with the exposure and vulnerability of the drainage system itself and the vulnerability and exposure of important landscape features that affect the functional capacity of the system. Threats that cause risk can arise from physical, social or managerial actions or processes.

High Aesthetic Sensitivity

High Aesthetic sensitivity is assumed to exist where landscapes, particular views or the visual characteristics of certain features are protected as a matter of public policy.

High Aesthetic sensitivity suggests that there is a great potential for the public to react strongly to a threat to the aesthetic resource.

Moderate Aesthetic Sensitivity Suggests that there is a substantial potential for the public to voice some concern over impacts of moderate to high intensity.

Low Sensitivity A small minority of the public may have a concern over resource impacts on affected areas.

No Sensitivity There is no sensitivity where the potentially affected views are not "public" or because they are not valued by the public.

Expected Future of Aesthetics

The future demand for aesthetics and issues related to aesthetics will involve:

Increase in Intensity of Concerns Involving Aesthetics As the economy recovers, the District will see a slight increase in the overall number of concerns and demands related to aesthetics. Demands will express themselves as concerns about development or projects conducted by neighbors or government that can be seen from the plaintiff's property and perceived to affect the enjoyment or value of that property.

Other demands will arise from projects within or affecting the view of natural settings in parks, the Mississippi river or Carlos Avery WMA.

Water Levels The District can expect to receive increased complaints from lakeshore owners and property owner with wetlands or large open space, as water levels drop.

Physical and Visual Access Demand for aesthetics will largely revolve around physical and or visual access to the resource in question.

Management Needs

Manage Watershed District lands to attain the highest possible quality of landscape aesthetics and scenery commensurate with other appropriate public uses, costs, and benefits.

Policy

It is Watershed District policy to:

1. Inventory, evaluate, manage, and, where necessary,

restore scenery as a fully integrated part of the ecosystems of the Watershed District and of the land and resource management and planning process.

2. Employ a systematic, interdisciplinary approach to scenery management to ensure the integrated use of the natural and social sciences and environmental design.

3. Apply scenery management principles in all Watershed District activities where appropriate and practicable.

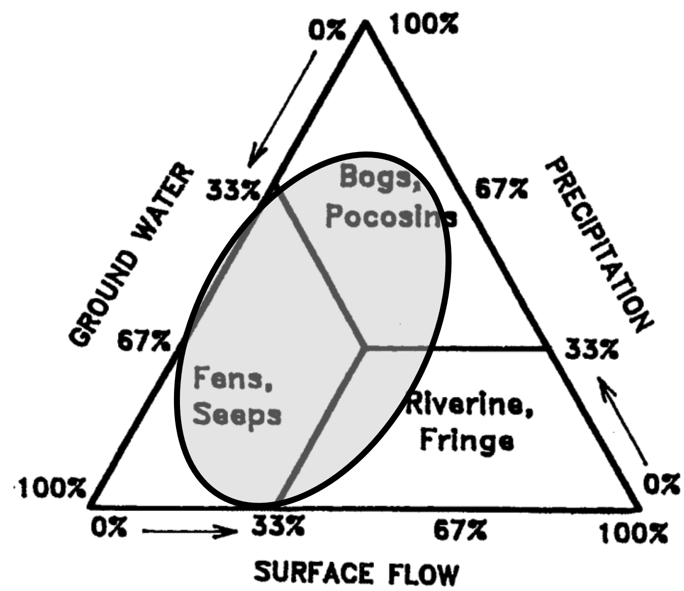
Demand for Aquatic Life and Recreation

Landscape The hydrogeomorphology of the watershed is generally characterized by shallow surficial groundwater on a gently undulating and generally flat or level landscape.

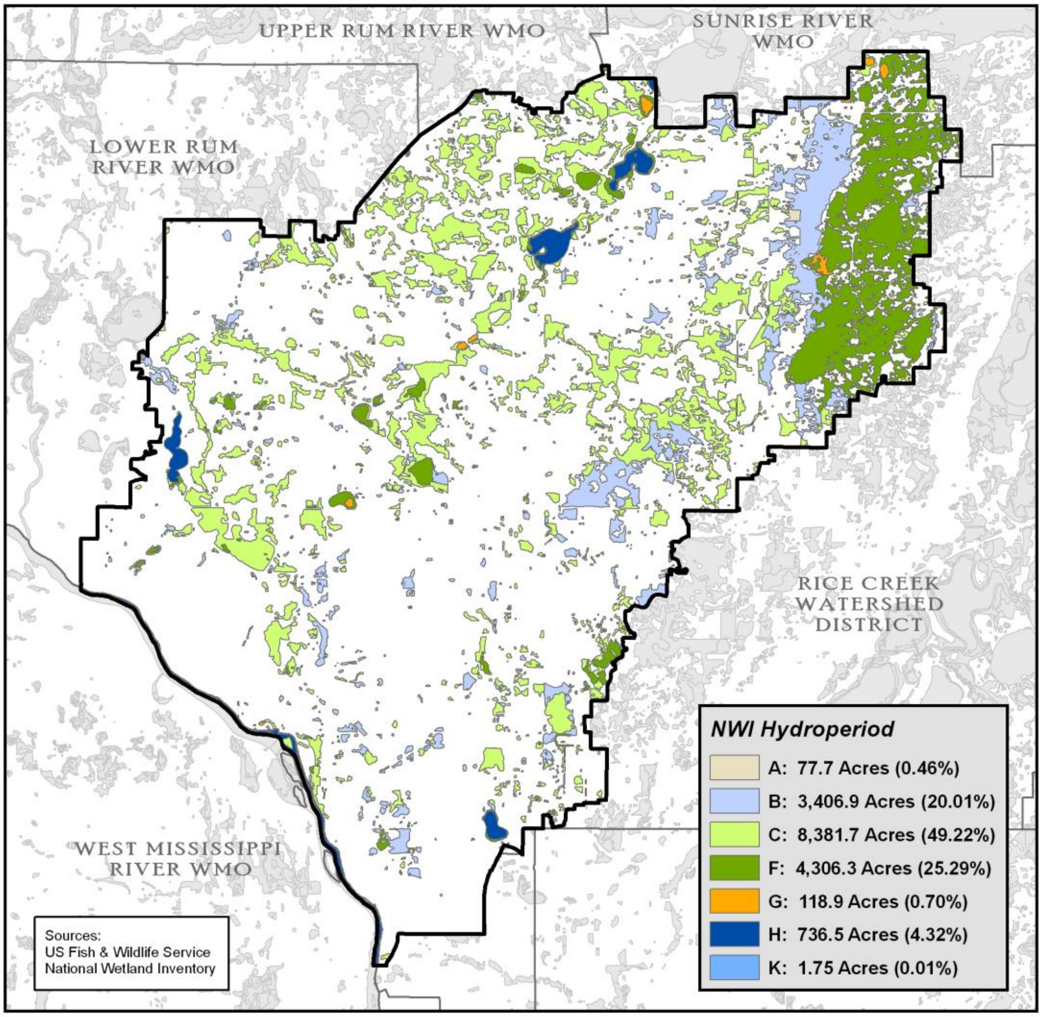
Where the landscape is pitted, it is generally low in relief, and the regional surficial water table breeches the land surface contributing to the creation of wetlands and shallow lakes. These conditions have lead to five basic wetland types based on geomorphic setting, water source and hydrodynamics.

Water Source While precipitation is the ultimate source of all water within the watershed, the majority of water resources supporting aquatic life receive the majority of their annual water from the surficial ground water.

Predominant Water Sources in the Coon Creek Watershed



Hydroperiod According to the NWI, approximately 70% of the wetlands within the District are temporarily flooded, saturated or seasonally flooded (NWI). This finding is consistent with the District's location in the Anoka Sand Plain and reinforces that under normal circumstances, the wetland hydrology in the watershed is groundwater related.

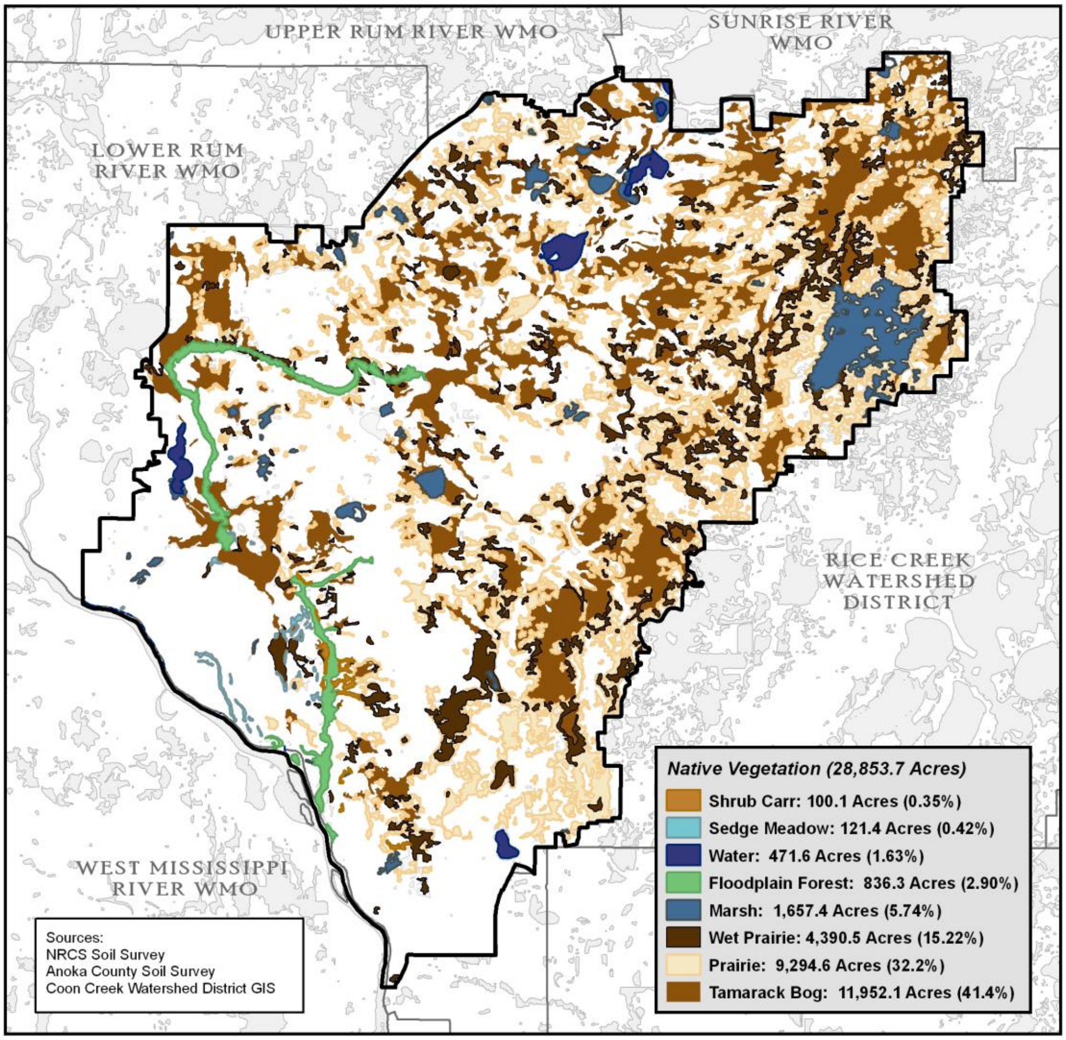


Habitat and Recreational Capability

Approximately 29,000 acres of aquatic habitat existed within the coon Creek watershed prior to settlement. Most of that habitat was marsh, meadow and prairie (54%). However, Tamarack bogs comprised the single largest habitat type (41%).

The quantity and quality of aquatic habitat from landscape processes of the watershed is shown below.

Presettlement water resource map of Coon Creek Watershed



Recreational Landscape

The recreational landscape of the watershed is composed of three principal components:

1. Surface water resources
2. Vegetative communities
3. Topographic relief

All contribute to the overall quality and quantity of the area's water based recreational resources.

Fishery Habitat

The Coon Creek watershed contains twelve lakes. Half of those lakes (6) are man-made and while originally constructed for a source of barrow material they have become a central aesthetic feature in a subdivision and in most cases also used for boating and fishing. Cenaiko Lake is stocked with trout.

1. Three lakes (Cenaiko Lake, Crooked Lake and Ham Lake) support active recreational fisheries.

2. Lake Netta, while more wetland than lake, has a long history of recreational use by the residents that live on the lake but is subject to winter kill
3. Crooked, while classified as a deep lake behaves much more like a shallow lake
4. Cenaiko Lake (Man Made) is stocked with trout
5. Sunrise Lake (Man Made) supports a centrarchid fishery

Lake Name	Nature	Lake ID	Size (Ac)	Littoral Zone (%)	Max Depth (ft)	Water Clarity (ft)
Amelia	Man Made		10			
Bunker	Wetland	020090	70	100%	6	
Cenaiko	Man Made	020654	29	40%	36	5.4
Club West	Man Made	020764	37		26	3.5
Crooked	Shallow	020084	118	73%	26	8.5
Dianne	Man Made		14			
Ham	Shallow	020053	193	92%	22	6.8
Laddi	Wetland	020072	77	100%	4	3.9
McKay	Wetland	020083	20	100%	6	
Netta	Shallow	020052	168	80%	19	7.6
Sunrise	Man Made		134			
TPC	Man Made		34			

Invertebrate Habitat

Total number of families, FBI, and EPT indices of stream health are not different among unmaintained reaches of stream and those that have been maintained (ditched or cleaned) in the last 10 years.

Year	2008	2008	2009	2009	2009	2010	2010	2010	Mean	Mean
Season	Summer-ACD	Fall-ACD	Summer-ACD	Fall-ACD	Fall	Spring	Summer-ACD	Fall-ACD	2010 Anoka Co.	1998-2010 Anoka Co.
FBI	4.40	4.40	4.00	4.20	6.00		4.10	4.20	5.5	5.8
# Families	15	19	7	10	19		15	16	19.4	14.3
EPT	4	6	4	3	4		6	5	4.7	4.3
Date	27-Aug	9-Oct	24-Aug	5-Oct	7-Oct	28-Apr	5-Aug	1-Oct		
Sampled By	ACD	ACD	ACD	ACD	BHS	BHS	ACD	ACD		
Sampling Method	MH	MH	MH	MH	MH	MH	MH	MH		
Mean # Individuals/Rep.	202	177	142	143	296		426	447		
# Replicates	1	1	1	1	1		1	1		
Dominant Family	Baetidae	Heptageniidae	Baetidae	Hydropsychidae	Corixidae		Gammaridae	Gammaridae		
% Dominant Family	41.1	30.5	57.7	39.9	29.1		57.6	32.3		
% Ephemeroptera	59.9	53.1	74.6	46.2	2.7		13.6	40		
% Trichoptera	10.4	15.3	19	39.9	14.2		22.1	19.5		
% Plecoptera	0	0	0	0	0		0	0		

Wetland Habitat

The Coon Creek Watershed contains approximately 13,300 acres of wetland (NWI, 1979). An additional 6,500 acres of wetland may be farmed. Wetlands, under normal conditions, comprise approximately 22% of the watershed.

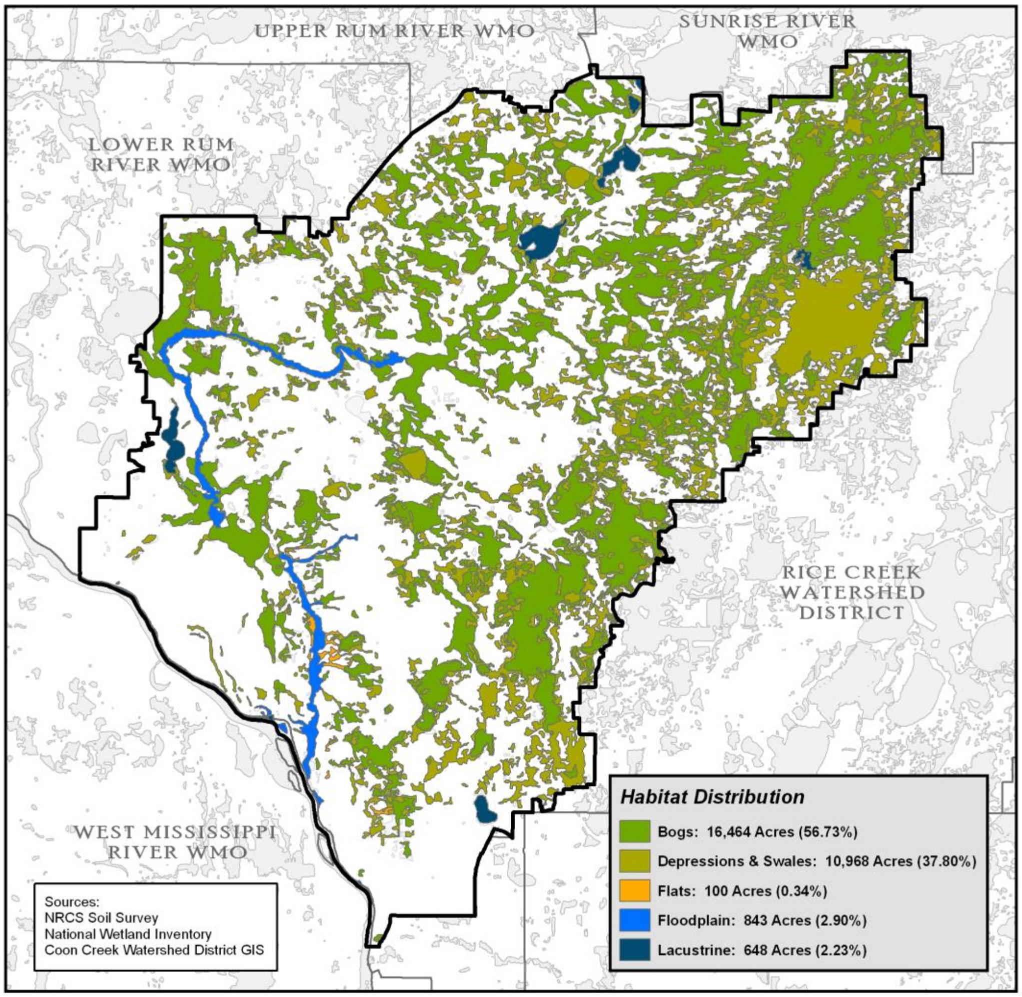
Historic estimates, based on hydric soil mapping, are that approximately 47% of the watershed was wetland prior to settlement (USDA, 1977).

Current Distribution of Aquatic Life and Recreational Opportunities

Aquatic Life Habitat Distribution

The hydrogeomorphology of the watershed is generally characterized by shallow surficial groundwater on a gently undulating and generally flat or level landscape.

Where the landscape is pitted, it is generally low in relief, and the regional surficial water table breeches the land surface helping create wetlands and shallow lakes. These conditions have lead to five basic wetland types based on geomorphic setting, water source and hydrodynamics.



Aquatic Recreation Opportunities

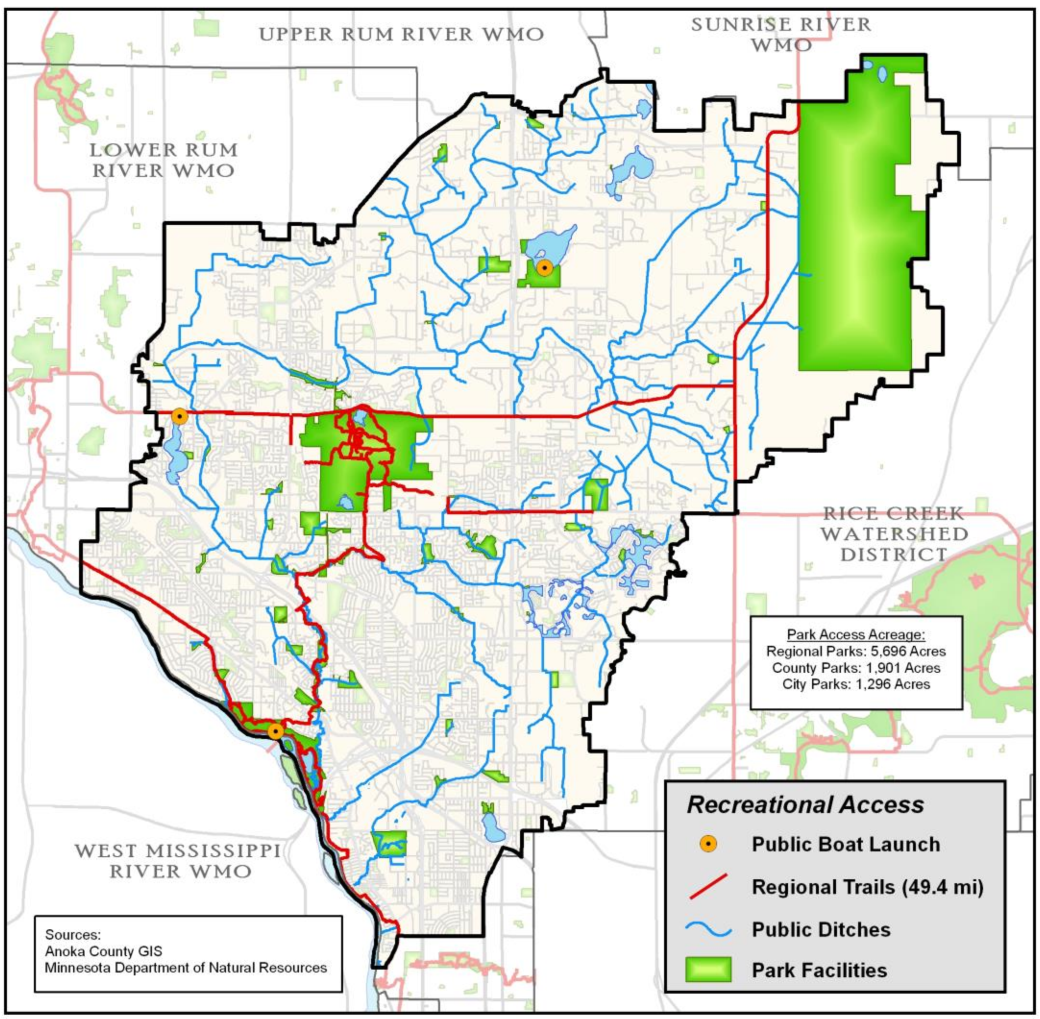
Primary contact activities such as swimming, diving and wading occur in three of the District's lakes:

1. Crooked
2. Ham
3. Sunfish

Very limited contact occurs in some portions of Coon and Sand Creeks. Boating and canoeing occur on these lakes as well as lake Netta.

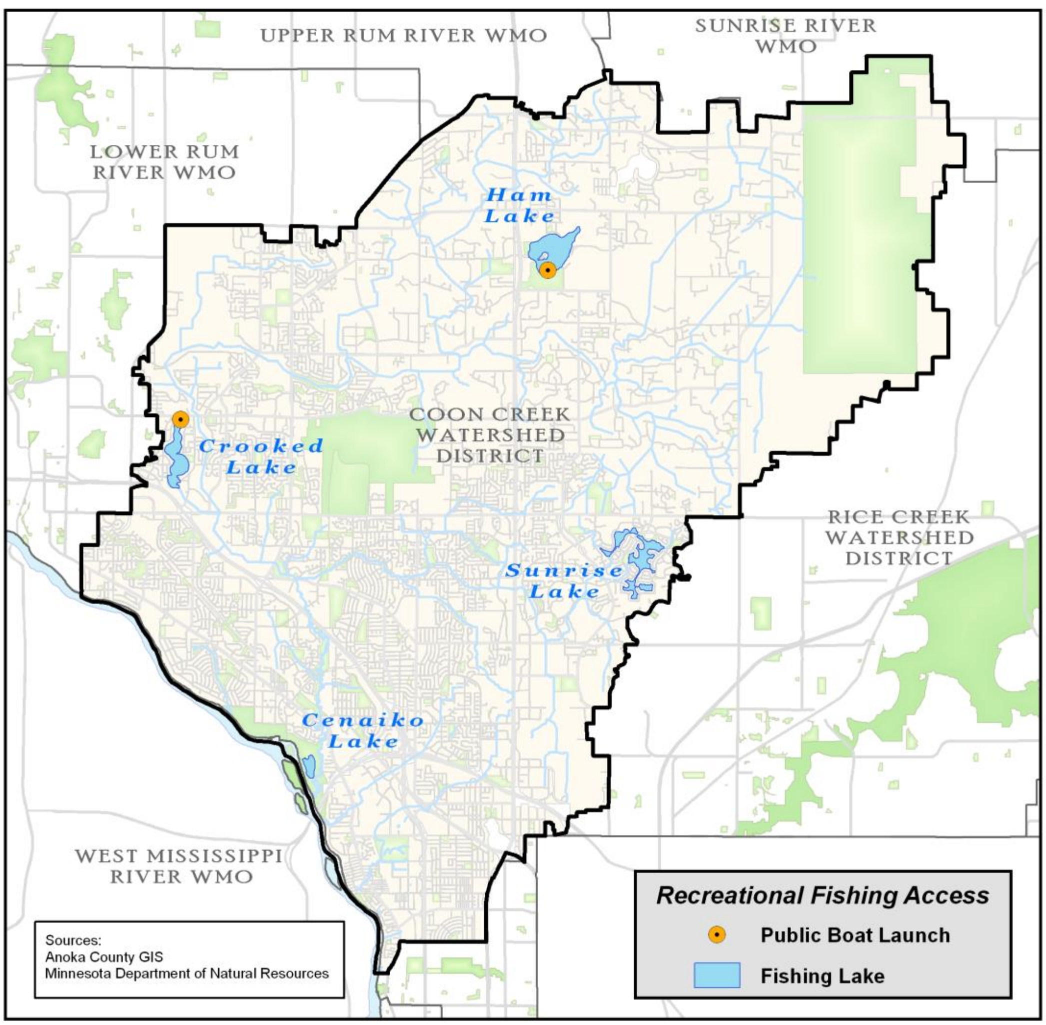
Coon Creek is a major water feature of the District. It begins in northeastern Ham Lake and flows south, then west and then south again entering the Mississippi River at the TH 610 Bridge in southern Coon Rapids. The upper three quarters of the creek is generally slow moving and shallow. Below US 10 it encounters more vertical relief and begins to pick up speed until it enters Coon Rapids Dam Regional Park and the Floodplain of the Mississippi River.

Coon Creek generally is not considered navigable except by small craft such as canoes and kayaks during high flows. Artificial constrictions, such as bridges and culverts, could make passage along some portions of the creek hazardous during higher flows.



Fish The Coon Creek watershed contains twelve lakes. Half of those lakes (6) are man-made and while originally constructed for a source of barrow material have become a central aesthetic feature in a subdivision and in most cases also used for boating and fishing.

1. Cenaiko Lake is stocked with trout.
2. Two lakes (Crooked Lake and Ham Lake) support fisheries.
3. Lake Netta, has a history of recreational use by the residents that live on the lake but is subject to winter kill
4. Crooked, while classified as a deep lake behaves much more like a shallow lake
5. Sunrise Lake (Man Made) has an active centrarchid fishery that is used by residents of the Lakes community



Invertebrate The invertebrate community suggests Coon Creek's health is average compared to other nearby streams. The stream's habitat is relatively sparse, mostly due to past excavations aimed at making the creek perform as a ditch. The supplemental stream water chemistry readings taken during biomonitoring indicate a higher than expected level of dissolved pollutants, as measured by conductivity. Conductivity and salinity were similar to, though not as extreme as, some urbanized streams at the same time of year. The source could be road salts, failing septic systems, and/or chemical wastes. Turbidity was also high. These factors, as well as the general lack of habitat in this ditched stream, probably limit the invertebrate community.

Map of Stream Habitat

Aquatic Endangered & Threatened Species There are 22 endangered and threatened species within the watershed that either depend on or prefer aquatic habitats for portion of their life cycle or livelihood.

	Plant	Animal	Total
Endangered	2	1	3
Threatened	2	3	5
Special Concern	4	10	14
	8	14	22

Value of Aquatic Life and Recreation

The necessary factors and conditions that affect aggregate demand for aquatic life and recreation within the Coon Creek Watershed are discussed below.

Population Served It is estimated that aquatic habitat served by public access to water resources directly benefits approximately 4 million users per year. Below are the most popular water related activities.

Activity	Percent of Use	Visitors
Trail Related	51%	2,053,689
Swimming-Lake Creek & River	13%	502,892
Relaxing	9%	371,432
Sun Bathing	8%	316,751
Other	7%	227,464
Playground Use	5%	215,323

Fishing	3%	124,661
Picnic	2%	76,307
Camping	0%	12,183
Boating	0%	10,200

Cost to Use

The cost of accessing and utilizing aquatic habitat and recreational opportunities within the watershed is low.

Most aquatic habitat and recreational opportunities within the District is accessed by a fully developed road and street system as well as trail systems developed and maintained by the cities and Anoka County within the watershed.

This connectedness makes the costs associated with travel time and effort convenient and low.

Available Substitutes

Substitutes for specific aquatic habitat types are closely related to a particular use associated with that habitat. Most aquatic habitat, with the exception of specialized opportunities (eg: Springbrook Nature Center, Bunker Hills Park, Coon Rapids Dam Park) there are substitutes for the aquatic habitats within the District.

Ease of Adopting Substitutes

However, adapting, replacing or mitigating these aquatic habitats is extremely difficult because of particular combination of landscape, soils and water sources that combine to manifest the habitat types that are present.

Marginal Value of Aquatic Life

The value of each acre of aquatic habitat and the life forms they support is moderate to high.

On a simple basis (Dividing the total benefits, lakes could be valued at approximately $320,000 per lake acre or $113.20 per aquatic habitat user

Service Preferences

While Aquatic life was ranked ninth on the national level, 8th by citizens and local professionals and 5th by all water resource professionals.

	Citizens	City Engineers	Water Professionals	National
Drinking water	1	1	1	1
Water Quality	2	2	2	2
Flood Control	2	2	3	5
Groundwater Recharge	4	4	4	7
Storm Protection	6	5	6	6
Drainage	5	8	7	8
Aquatic life and recreation	**8**	**8**	**5**	**9**

Hunting and Fishing	**8**	**8**	**9**	**10**
Irrigation	9	9	10	4
Livestock and wildlife watering	10	10	8	11
Aesthetics	**11**	**11**	**11**	**12**
Industrial use and cooling	13	13	12	3

Risks and Impairments to Aquatic Life and Recreation

Risks of disruptions to services differ from site to site and are associated with the exposure and vulnerability of the drainage system itself and the vulnerability and exposure of important landscape features that affect the functional capacity of the system. Threats that cause risk can arise from physical, social or managerial actions or processes.

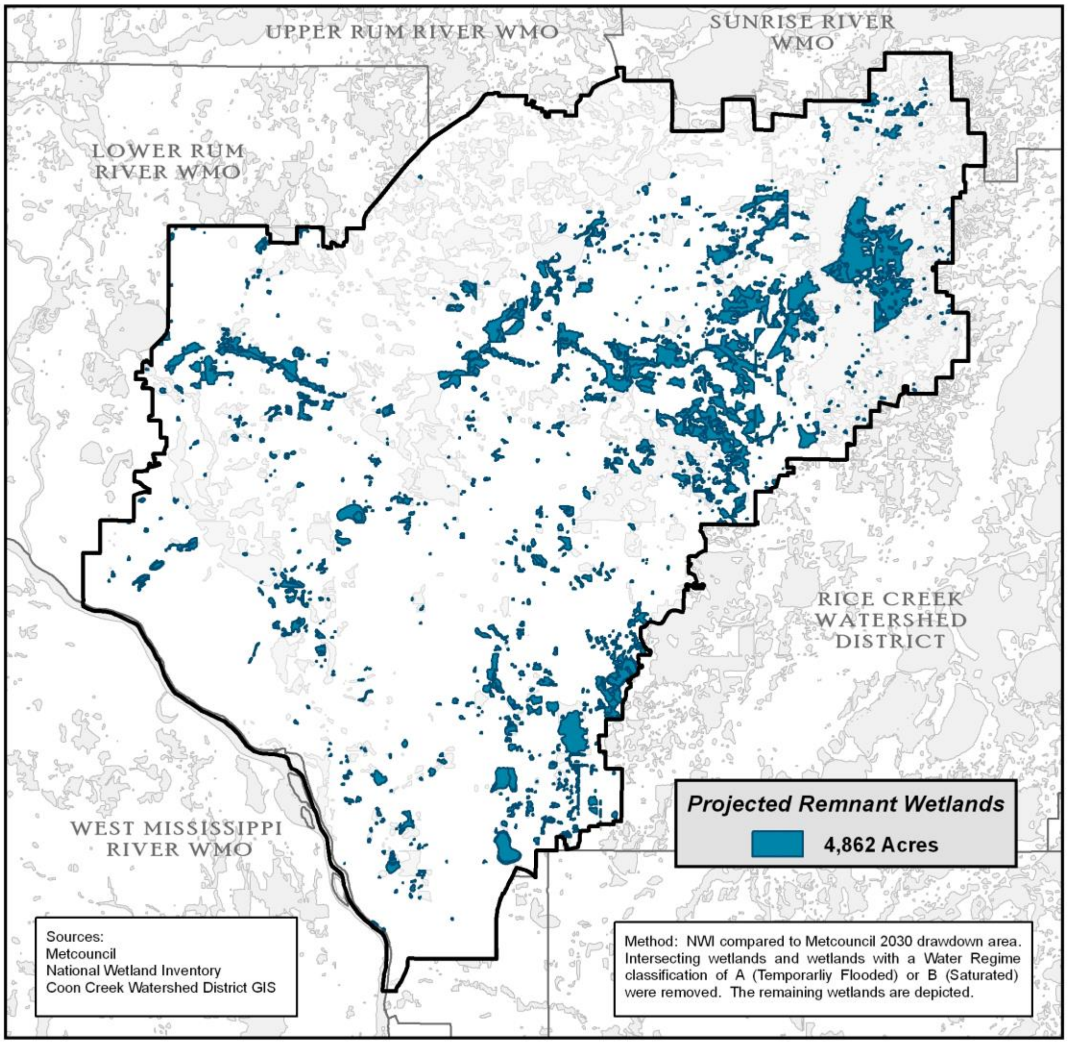
The State shall determine if a water body is impaired based on degradation of the physical, chemical or biological qualities of the water resource to the extent that attainable or previously existing beneficial uses are actually or potentially lost.

Loss of Hydrology

During the past 10 years the District has observed a general drying out of the landscape. This drying out appears to be directly related to the decline in the surficial groundwater table. Wetlands most affected are those with saturated or temporarily flooded hydroperiods.

A 2009 Metropolitan Council Study showed surface water features likely to be affected by draw downs in the surficial aquifer. A map of the affected areas is shown below

Projected loss of wetlands Coon Creek WD, if Met Council Model is correct



Oxidation of Organic Soils

During the past 10 years the District has also observed a general breakdown and change in hydric soils, particularly organic soils. Signs of decomposition and hydrophobic conditions are becoming increasingly evident.

Invasive Species

Wetlands continue to be invaded by Reed Canary grass (Phalaris arundinacea) and Common Buckthorn. Both species appear to have received a boost from the decline in surficial groundwater levels and the generally droughty conditions during most of the past decade.

With the decline in lake levels, several lakes have experienced a spread in invasive species such as Eurasian Water Milfoil and Curly Leaf pondweed.

As boat traffic and recreational use of all lakes increases, the spread of Eurasian Water Milfoil and Zebra mussels has become a common concern throughout the District.

Lake Name	Eurasian Water Milfoil	Curly Leaf Pondweed
Cenaiko	?	
Crooked	1990	2005
Ham		Yes (<2005)

Impairment of Fishery

As Lakes decrease in depth, fish populations can become more concentrated and the animals incur more stress. While fishing may improve over the short term, the potential for winter kill and disease increase significantly.

In addition, the normal fishery and the lower aquatic biota upon which it is dependent shall not be seriously impaired or endangered.

Species composition shall not be altered materially. Propagation of fish and biota normally present shall not be prevented or hindered by the discharge of sewage, industrial waste or other wastes.

Excessive Algae and Plant Growth

The State goal is for **no material increase in undesirable plants, including algae,** nor shall there be any significant increase in:

- Harmful pesticides or other residues
- Sediments
- Aquatic Flora and Fauna

To evaluate these narrative standards, the following must be met:

Total Phosphorus Concentrations

	Std.	**Unit**	**Crooked**	**Ham**	**Netta**	**L-side Common**
Lake	≥40	mg/L	.36	37	30	23
			Coon Hallow	**Lions Park**	**Shadow brook**	
Stream	.100	mg/L	**151**	94	91	

Chlorophyll-a Concentrations

	Std.	**Unit**	**Crooked**	**Ham**	**Netta**	**L-side Common**
Lake	≥14	mg/L	8	10.7	7.4	8.2
			Coon Hallow	**Lions Park**	**Shadow brook**	
Stream	.100	mg/L				

Transparency

	Std.	Unit	Crooked	Ham	Netta	L-side Common
Lake	<4.5	feet	6	5.2	7.3	7.5
			Coon Hallow	**Lions Park**	**Shadow brook**	
Stream						

Biological Community and Aquatic Health

Portions of Coon Creek have been monitored for biota every year since 2000 (ACD Water Atlases). The invertebrate community suggests Coon Creek's health is average compared to other nearby streams. The stream's habitat is relatively sparse, due mostly to excavations performed to repair and maintain the County Ditch function of most of the drainage system within the watershed.

The biomonitoring suggests that stream health is similar to the average for Anoka County streams, despite the good quality habitat. Family Biotic Index (FBI) has been consistently higher than the county average, but the number of families and number of pollution sensitive families (EPT) has been similar to county averages.

The invertebrate community suggests Coon Creek's health is average compared to other nearby streams. This is unexpected because habitat at the Egret Street site is much better, including riffles, pools, snags, and forested areas around the stream. At Crosstown Boulevard the creek has been ditched so there are no riffles or pools, there is no rocky habitat, few snags, and adjacent habitat is grassy. One possible explanation is that the biotic community at Egret Street is limited by poorer water quality despite the better habitat. Chemical monitoring has found that Coon Creek's water quality declines from upstream to downstream. This corresponds with an increase in urbanization. Future monitoring will provide insight.

Total Suspended Solids (TSS) and Turbidity

At least three observations and 10% of all observations exceeded the water quality standard of 25 NTU.

Turbidity and TSS problems are most severe in downstream reaches. Readings in downstream areas are typically two-times higher than those from upstream areas.

Dissolved Oxygen

Dissolved oxygen in Coon Creek and Pleasure Creek were similar at all sites, only once dropping below 5 mg/L at which point some aquatic life becomes stressed.

Dissolved oxygen in Sand Creek was within the acceptable level on 95% of the site visits. On four occasions it dropped below 5 mg/L.

These four readings occurred at three different sites; two during storms and two during baseflow. Three occurred in 2009, which was a severe drought year. Stagnant conditions are probably responsible for these low oxygen conditions, and are likely natural.

Expected Future of Aquatic Life and Recreation

The quantity and quality of aquatic life and habitat available in the future will depend largely on several factors:

Population of the Watershed

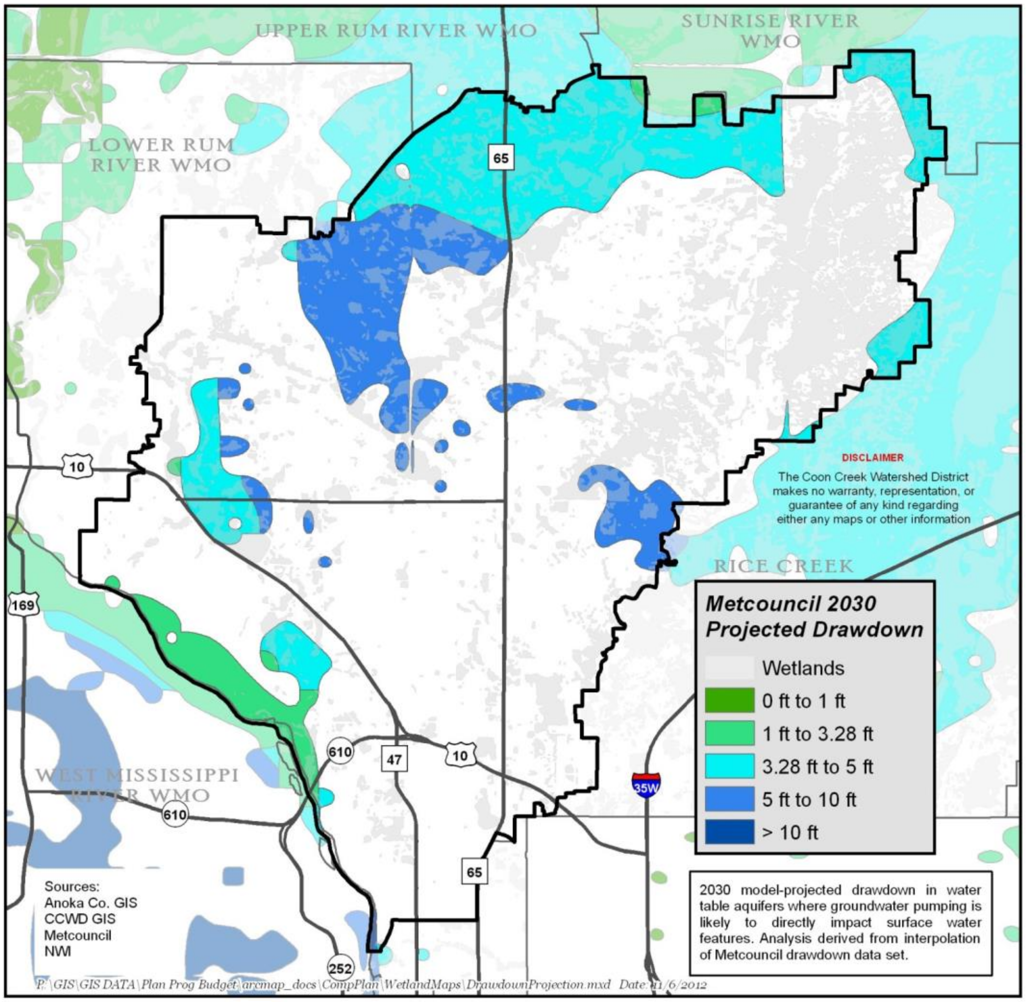
	2000	2010	2020	Pct Chg
Andover	17,450	30,598	39,165	28%
Blaine	46,845	60,643	71,943	19%
Columbus	479	508	623	23%
Coon Rapids	62,295	65,700	66,000	0%
Fridley	27,449	27,000	26,900	0%
Ham Lake	11,782	15,017	16,686	11%
Spring Lake Park	7,090	6,710	6,710	0%
Total	173,390	196,766	216,050	10%
Figures based on 2010 census adjusted to watershed boundary				

Loss of Groundwater Dependent Surface Water Features

If surficial groundwater levels continue to fall between 2013~~0~~ and 2023~~0~~, surficial water features, such as

a. Lakes (decline of 50% surface area)
b. Wetlands (8,375 acres)
c. Base Flow

will be difficult to protect and sustain in the areas shown below:



The result may be increasing demand with a reduced or reducing natural resource base. While some of the decrease in water levels will be a result of increased use of ground water and a decrease then in surficial groundwater levels, which is almost a certainty.

A portion of the expected change will depend on climatic patterns. If the trend toward drought that has dominated the landscape the past ten years continues, then the worst case scenario mapped above will occur. However, if precipitation levels and occurrences become more volatile involving wetter than normal conditions such as 2011, then the acreage impact of lower water levels will be slightly mitigated and habitat changes will occur in the form of plant communities and animal species that are adaptable to life at the extremes of water (Drought and flood separated by shorter periods of time).

Expected Externalities If the climate becomes more volatile (Drier dry periods, wetter wet periods, shorter times between the two),

- Protection and maintenance of a given habitat or species may become impossible
- Die offs of species or communities, either through disease or conditions, and replacement of these species/communities can be expected.

Management Needs

Recreation Provide for recreation-related opportunities for responsible use of water and related resources within the District.

Provide for opportunities for a variety of recreational pursuits, with emphasis on activities that harmonize with water and related natural environment and are consistent with the applicable land uses.

To provide for development and management of sites consistent with the available natural resources to provide a safe, healthful, aesthetic atmosphere.

To ensure safe water quality for designated primary contact recreation areas.

.

Mitigate adverse impacts of recreational uses on water and related resources through education, and on-the-ground management, including rule enforcement.

Encourage water recreation opportunities that meet the public needs in ways that are appropriate to the Watershed District role and are within the capabilities of the resource base.

Aquatic Life Manage riparian areas under the principles of multiple-use, while emphasizing protection and improvement of soil, water, and vegetation, particularly because of their effects upon aquatic and wildlife resources. Give preferential consideration to riparian dependent resources when conflicts among land use activities occur.

Determine the effects of fluctuations in water levels, quantities, and timing of flow in relation to habitat of fish, waterfowl, mammals, and aquatic organisms, and to maintenance of phreatophytes and other riparian vegetation.

Demand for Drainage

Requirements for Drainage

For subsurface drainage systems to be successful, the following conditions should exist (SCS 1984, DNR 1991):

Groundwater Movement Information on the elevation and movement of groundwater is essential for the design and operation of an effective agricultural drainage system.

Sufficient Soil Permeability Soils must be permeable enough to allow the required movement of water through the soils toward the ditch. Soils vary in their ability to move water to a drain.

Drainage is Influenced by the Landscape Topography and the geomorphology of an area greatly influence the drainage system.

Suitable Outlet Subsurface drainage systems must have a suitable outlet available, either by gravity flow or by pumping.

The outlet must have the capacity to remove surface and subsurface water from its drainage area in sufficient time to prevent crop damage.

Location: The location of the outlet is of primary importance in the operation of interceptor ditches.

Adequate Outlet The outlet must be adequate for the quantity and quality of the outflow to be conveyed.

Adequacy: Fields may discharge by gravity into natural or artificial ditches. Any of these are suitable provided they are deep enough and of sufficient capacity to carry the drainage water from their entire drainage system.

Channel Capacity Cross-Sectional Volume: The outlet ditch must have the capacity to remove the drainage runoff from its watershed in a period of time sufficient to prevent crop damage.

Channel Depth The ditch must be deep enough so that there is at least one foot clearance between the bottom of the root zone and soil water flow line and the normal low water stage in the ditch.

Channel Grade In the fine sands of Anoka County, minimum grades should produce a velocity of at least 1.4 feet per second whenever possible.

Flow Rate The drainage system should conduct flow without causing excessive erosion ($\leq$ 3 ft per second).

Drainage Capacity

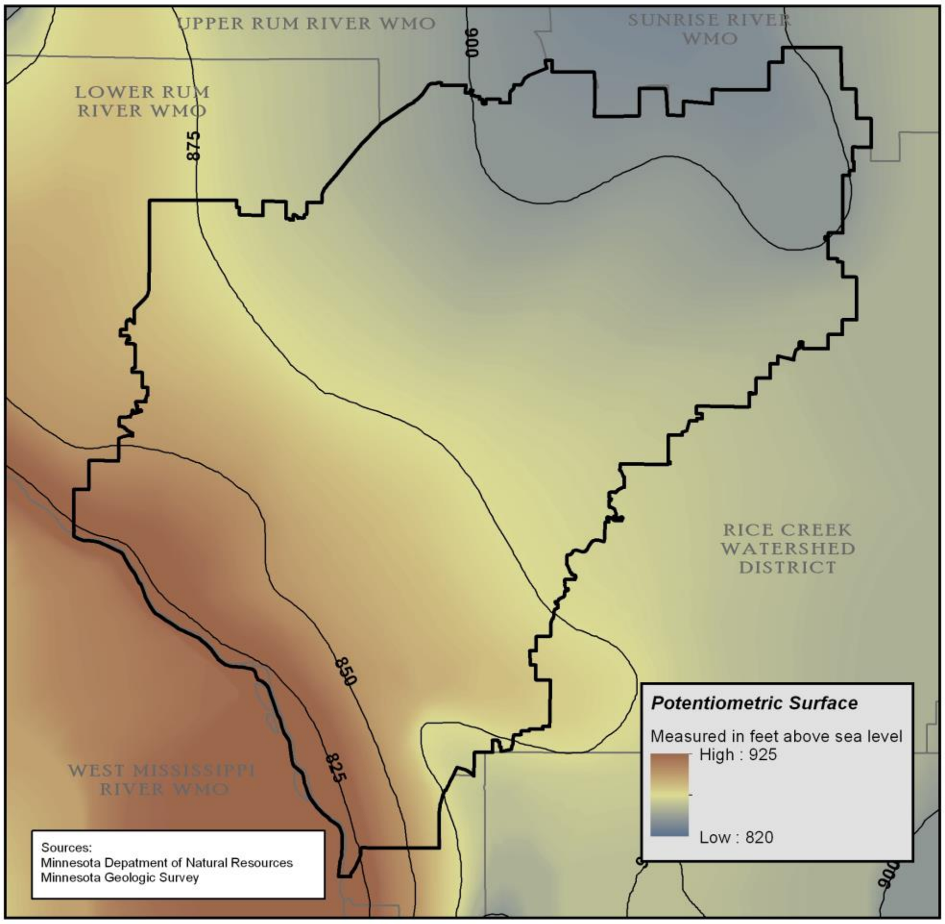
Subsurface drainage is used to control high water table conditions in areas where the benefits of lowering such water tables justify installation costs.

The drainage and conveyance system of the watershed was originally designed and constructed between 1889 and 1918 for one purpose:

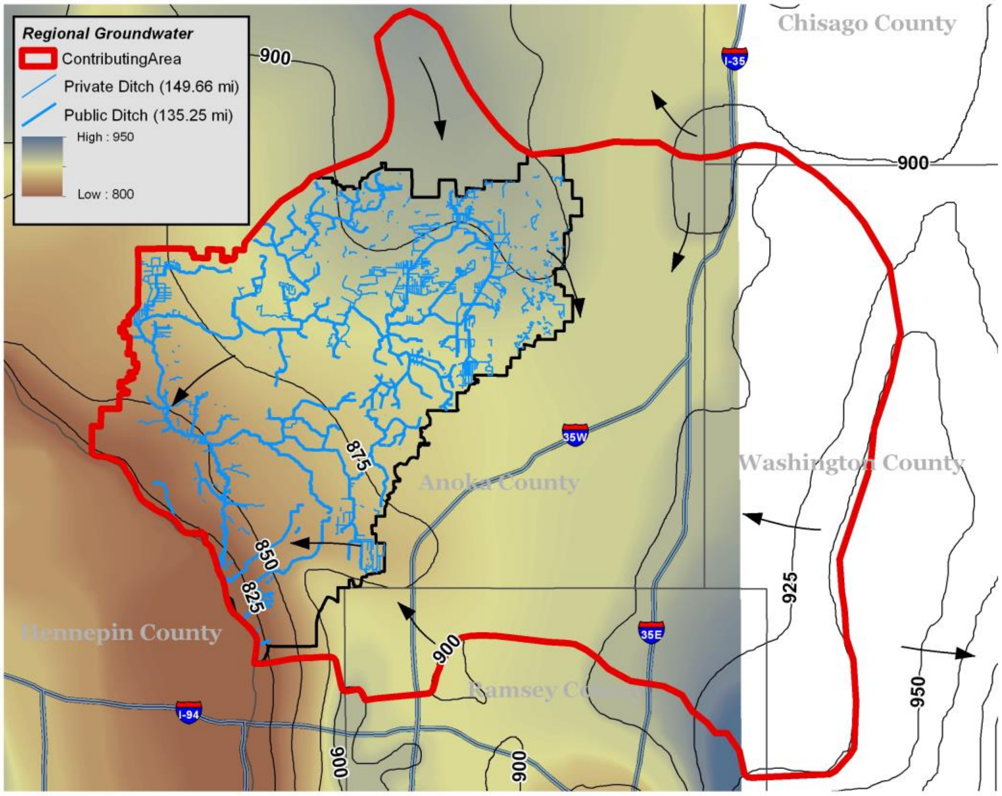
'to move water.'

The service expected from drainage is the removal of water from the root zone of sod or root crops within 24 hours, after which the plants begin to experience stress and thereby decreasing quality and/or yields.

Surficial Groundwater Elevation and Movement



Source of Shallow Groundwater



Ditch	Suitable Outlet	Adequacy (Drainage Density)	Slope	Hydric Soil (ac)	Level of Function (%)
11	10	4	11		25
17			1		1
20	10	1	3		14
23	10	8	1		19
37	7	2	3		12
39	7	7	5		19
41	4	10	6		20
44	4	12	11		27
52					0
54	1	11	11		23
57	1	3	10		14
58	4	5	7		16
59	1	6	7		14
60	7	9	7		23
LCC					0
Springbrook					0

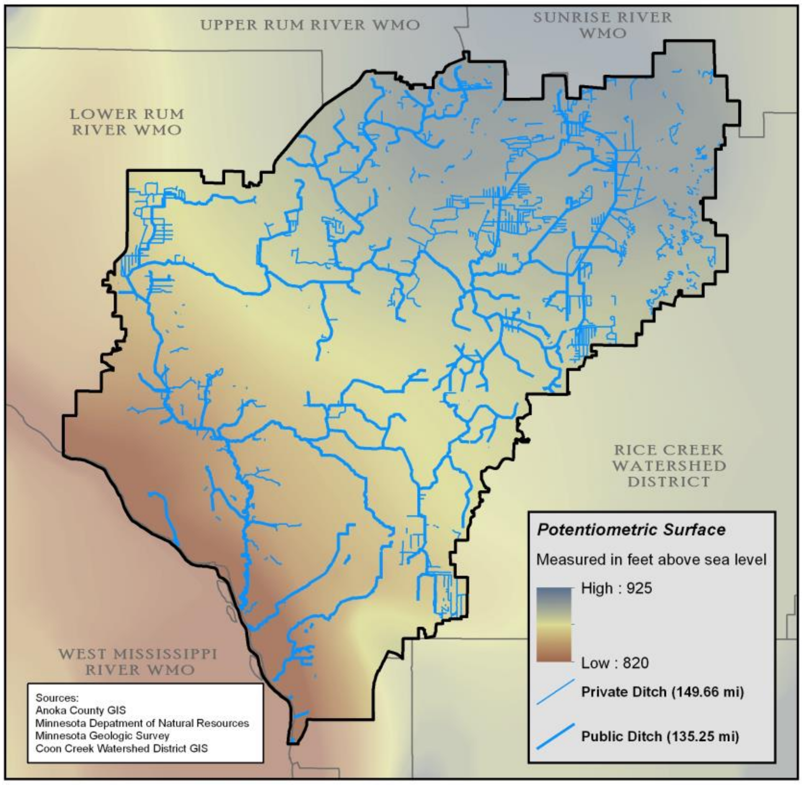
	Land Type Association		
	River Terrace	**Lake Hugo**	**Lake Fridley**
Pct of HSG Soils			
A	79%	88%	75%
B	7%	11%	25%
C	7%	0%	0%
D	7%	1%	0%
Percent Slope	1.4%	0.9%	0.7%

Current Distribution of Public and Private Drainage

An assessment of how well an area is draining relative to the biogeochemical processes that support a service and an area's service capacity.

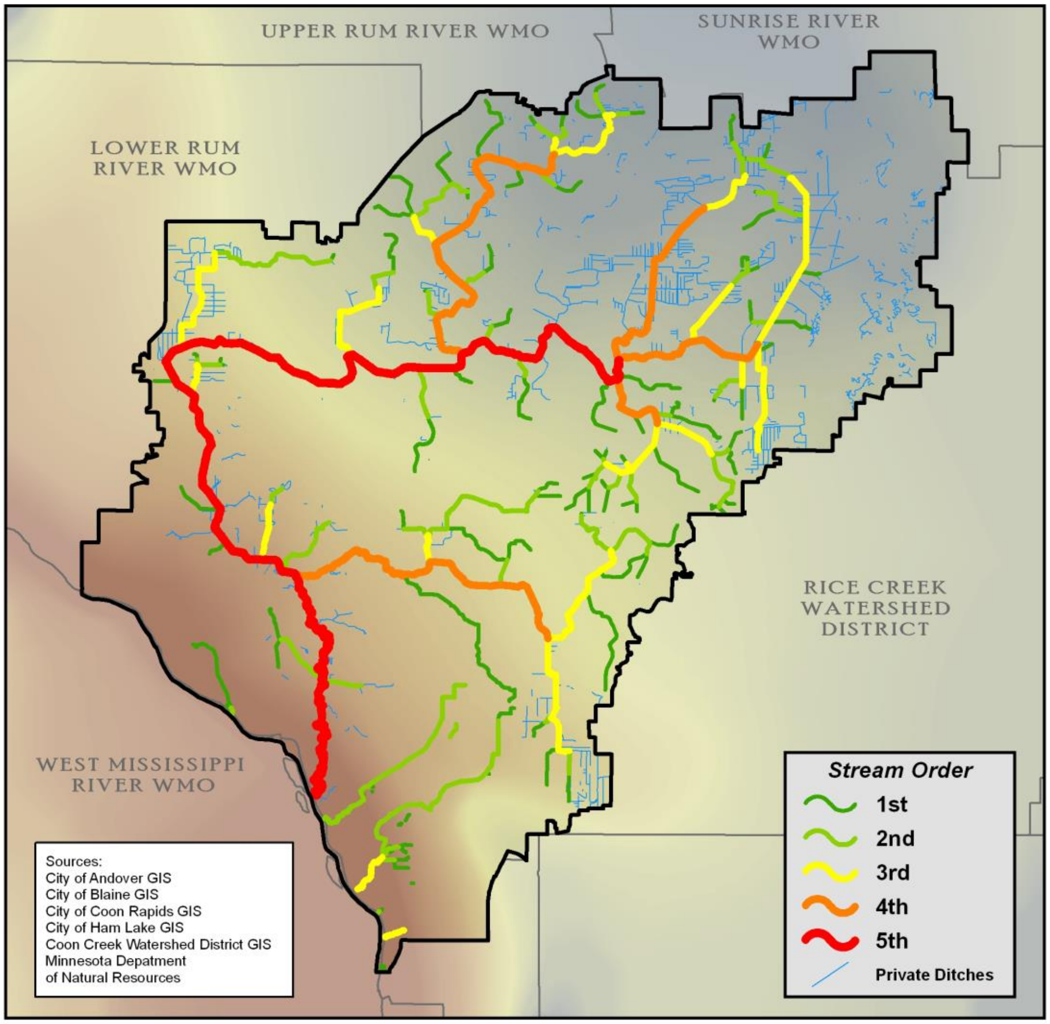
The level of service (provision of a beneficial uses, specific benefits and services) reflects the level and type of biogeochemical functions and any other off-site characteristics that either limit or enhance the ability to provide the chosen service. It is in essence a product of the level of function and the service capacity.

Drainage system



Ditch	Public (ft)	Private tributaries estimate (ft)
11	28,212	122,097
17	26,672	10,265
20	16,125	12,931
23	9,882	2,888
37	22,001	56,245
39	17,232	0
41	96,804	55,048
44	77,438	165,973
52	10,432	340
54	27,000	36,245
57	64,286	31,777
58	98,203	63,389
59	108,491	58,493
60	29,724	4,929
Lower Coon Creek	28,349	15,344
Oak Glen Creek	1,832	
Pleasure Creek	20,949	
Riverview Creek	8,249	

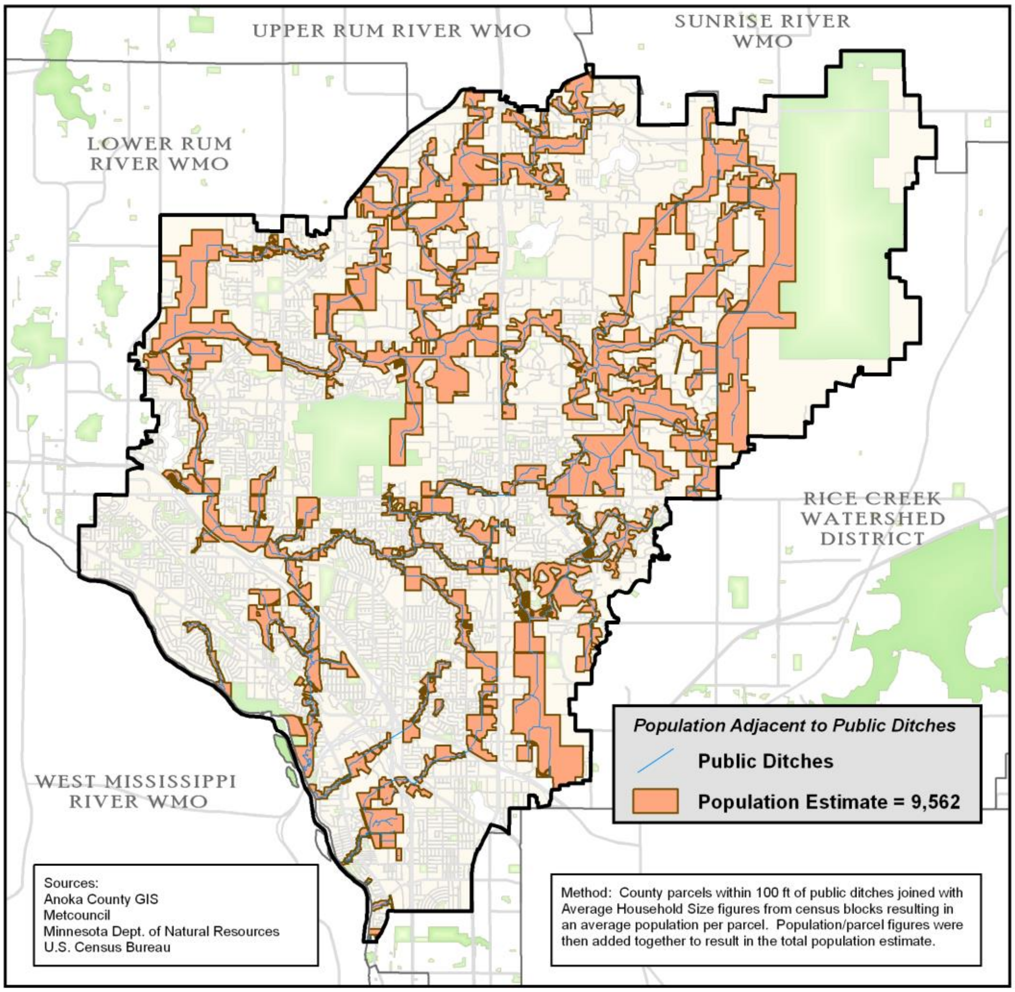
Stoneybrook Creek	422	
Tronson Creek	6,840	4,310
Woodcrest Creek	3,149	5,344
SUM FT:	702,054	645,618
Private Non-tributary Est.:		157,024
Total Feet:	702,054	802,642
TOTAL MILES:	133	152



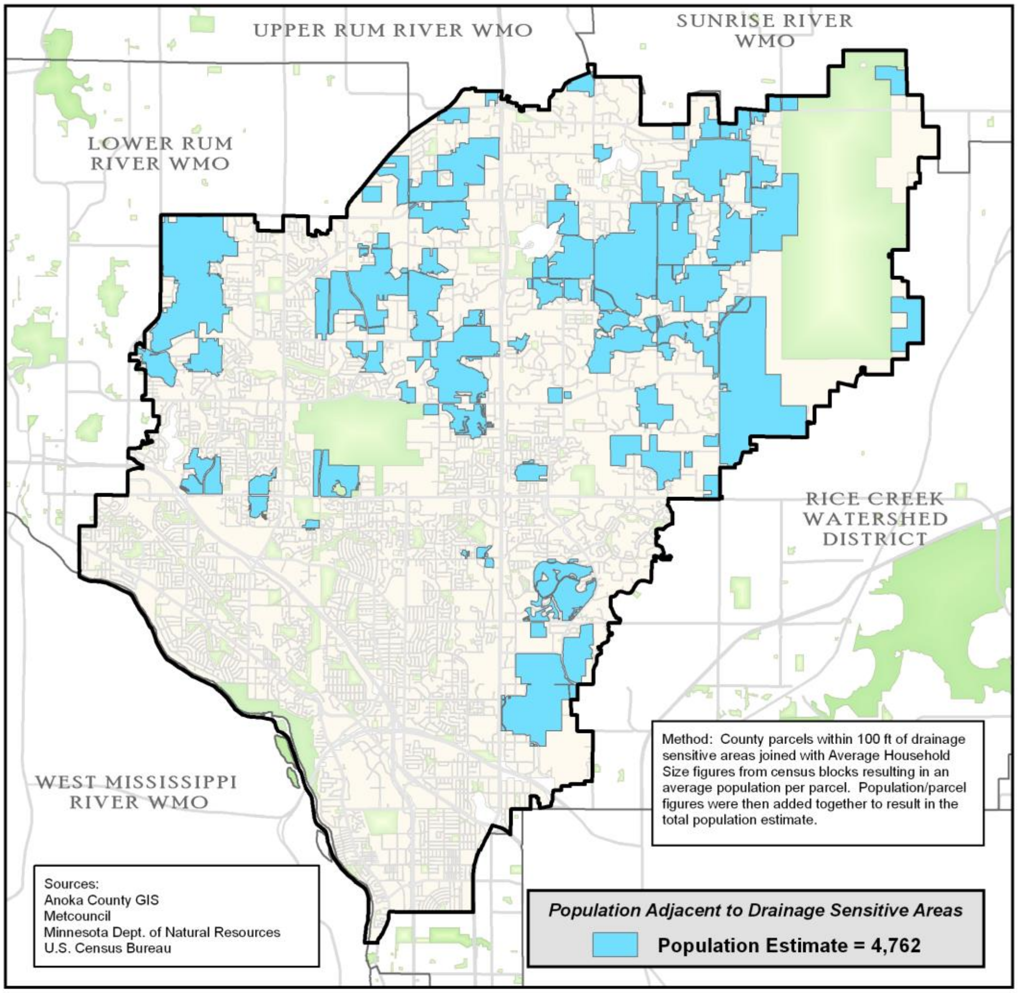
Value of Drainage

The aggregate demand for drainage within the Coon Creek Watershed is a function of the following.

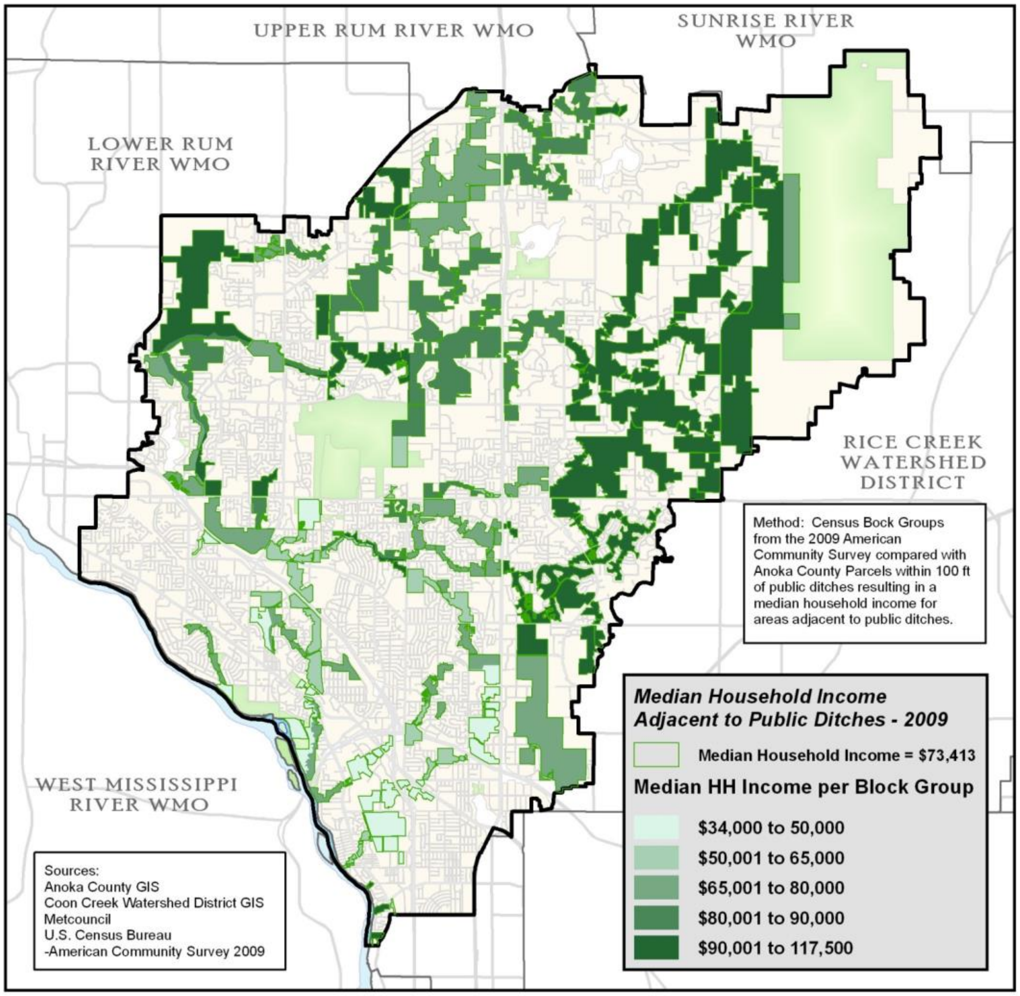
Population Approximately 9,500 people depend directly upon drainage.



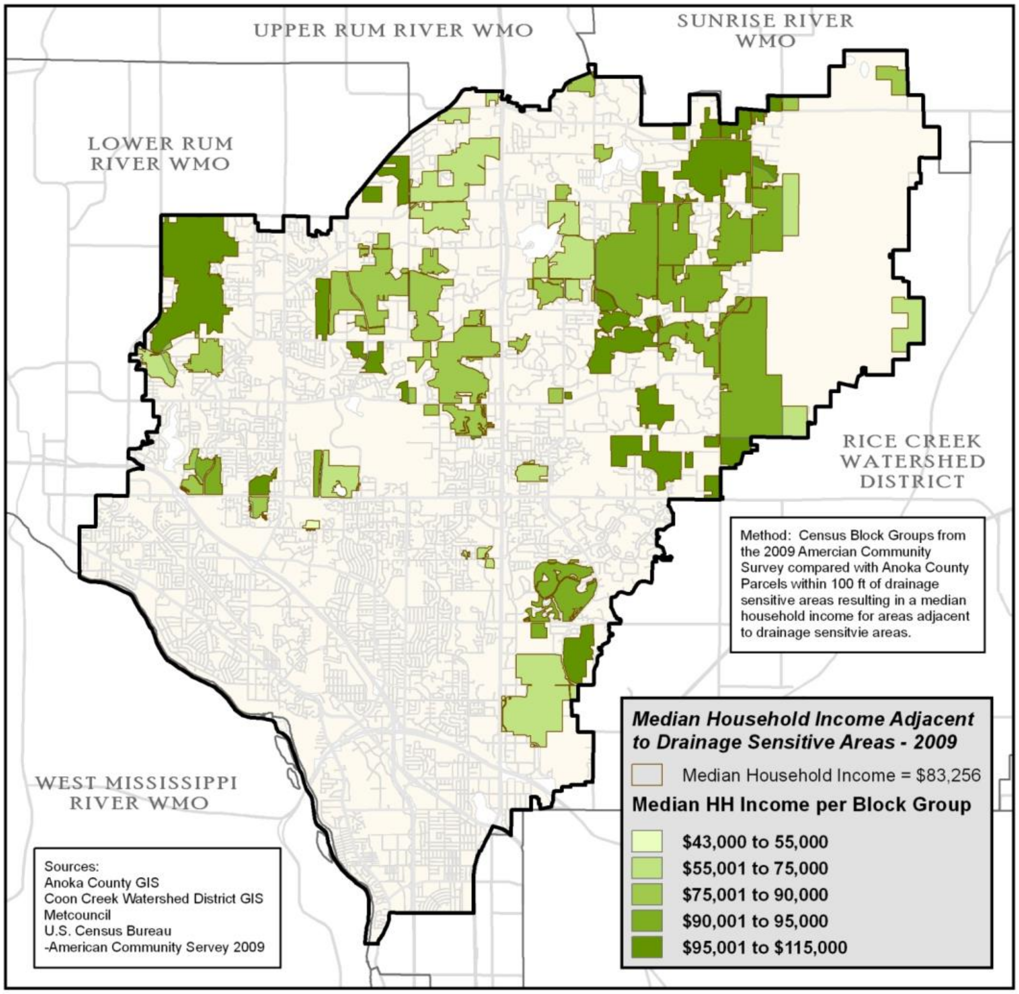
Approximately 4,700 people live adjacent to and are dependent on subsurface drainage for their land to continue in its current land use.



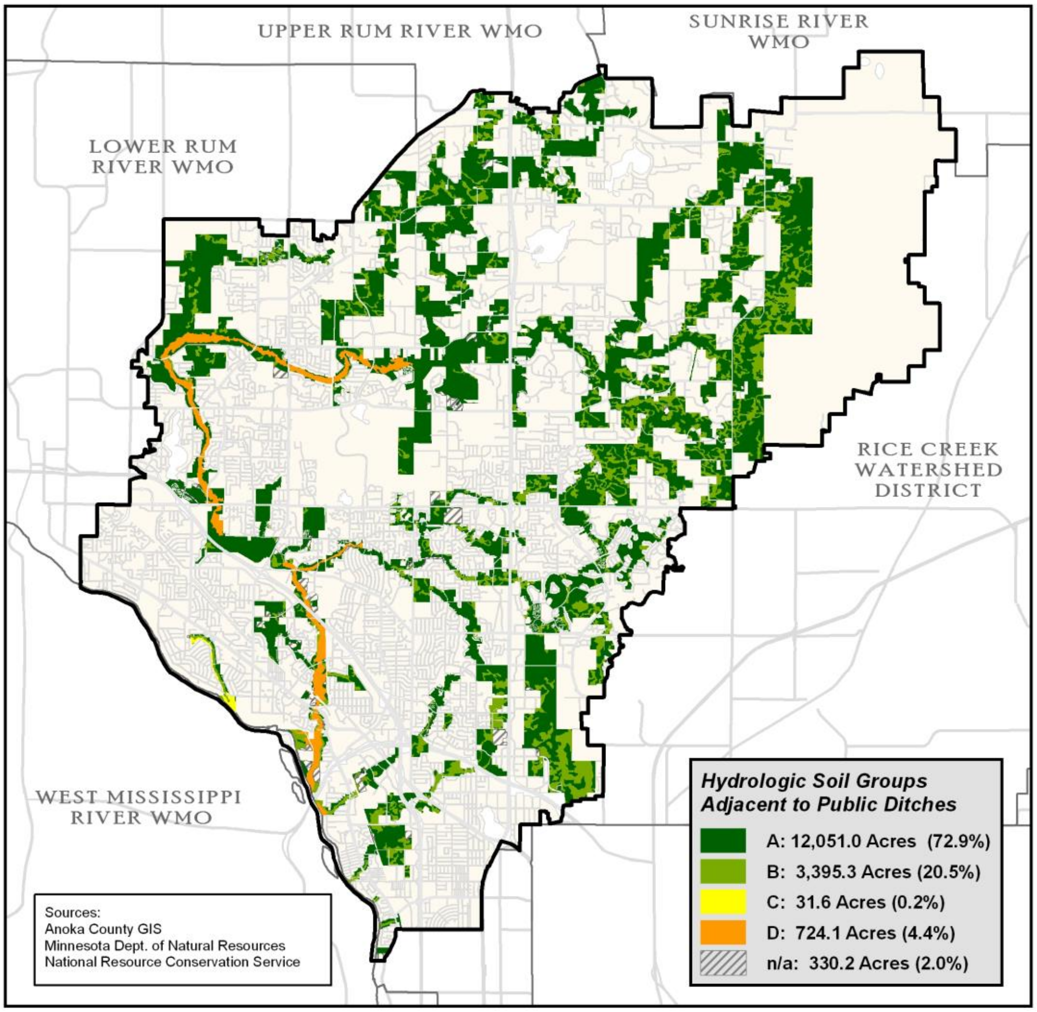
Income Income of property adjacent to the public ditch system is shown below.



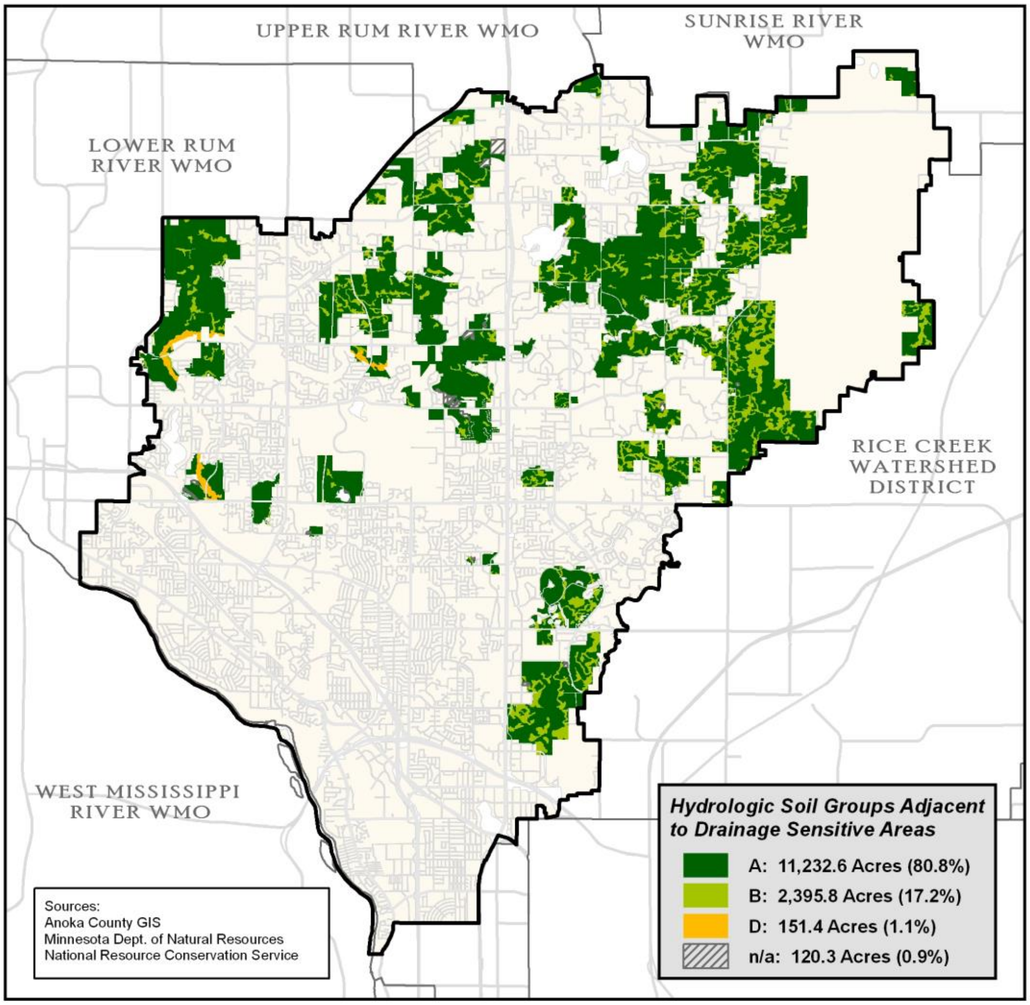
The income of property adjacent to drainage sensitive land is shown below:



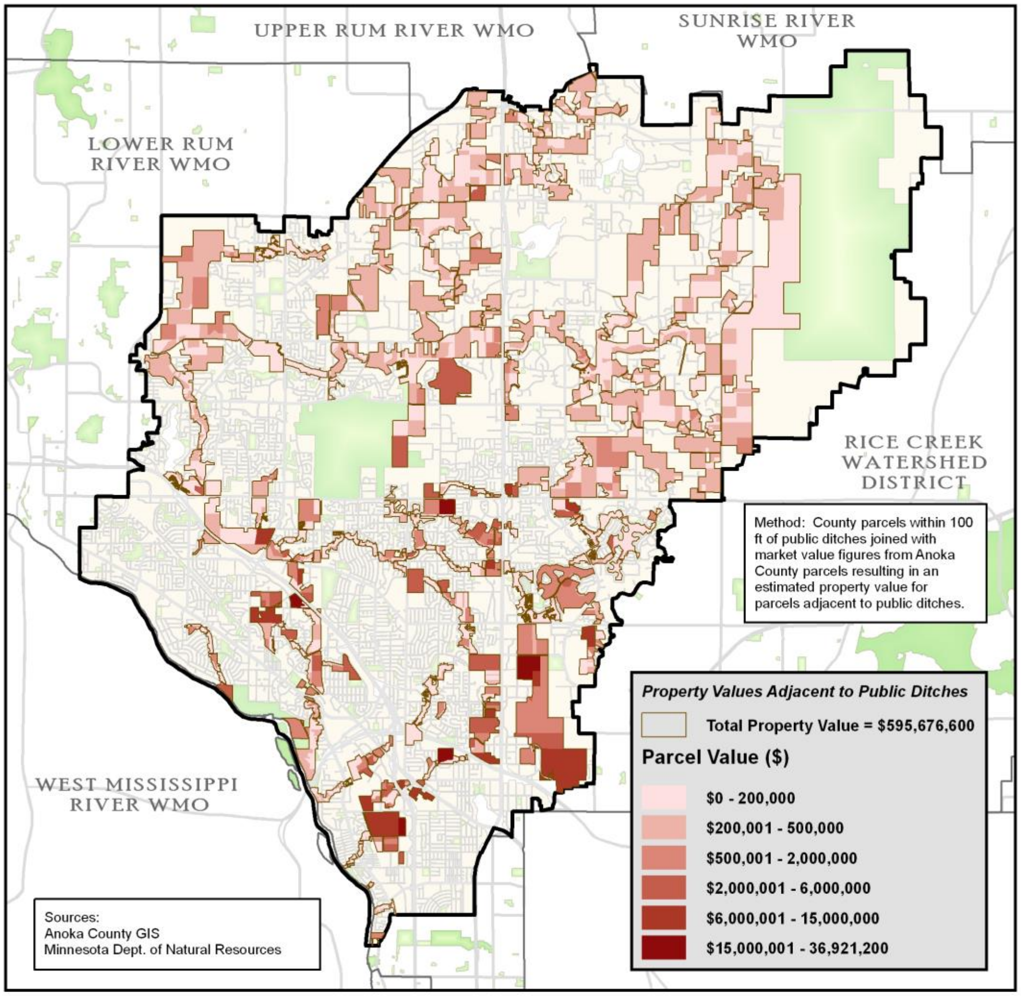
Soil Characteristic Map and acres of HSG adjacent to public ditches



Map and acres of HSG within or benefiting from Drainage sensitive lands



Property Value Drainage influences the value on approximately $600 million dollars of land



Service Preference

While drainage ranked 5th among citizens within the District it should be noted that it is closely related to flood control, which tied with water quality across all groups surveyed.

	Citizens	City Engineers	Water Professionals	National
Drinking water	1	1	1	1
Water Quality	2	2	2	2
Flood Control	2	2	3	5
Groundwater Recharge	4	4	4	7
Storm Protection	6	5	6	6
Drainage	**5**	**6**	**7**	**8**
Aquatic life and recreation	7	6	5	9
Hunting and Fishing	7	6	9	10
Irrigation	9	9	10	4
Livestock and wildlife watering	10	10	8	11
Aesthetics	11	11	11	12
Industrial use and cooling	13	13	12	3

Substitutes

There are no natural substitutes for subsurface drainage of soils for agricultural purposes.

Man-Made Substitutes

Removal of water through pumping is perhaps the only man-made substitute to drainage. Pumping allows drainage to occur when an outlet is either unsuitable or inadequate by moving water around or by-passing that outlet. However, water still needs to drain from the discharge point for efficient drainage and prevention of local flooding and recycling of water.

Adoption of Substitutes

The ability to substitute pumping for drainage ditches is moderately to very difficult. The degree of difficulty and expense will depend upon the following:

1. The size of the area to be dewatered
2. The number of wells and pumps needing to be drilled and installed
3. The availability and cost to power the pumps
4. The ability to dispose of the pumped water

The Marginal Value of Drainage

The marginal value of draining land for drainage dependent uses is high. Drainage of land, in areas such as the Anoka Sand Plain, is one of, if not the most fundamental improvement increasing the utility of land.

While at one time, when the county was largely agriculture, the marginal value of additional acres made productive through drainage was high, the steady rise in land values, the conversion of land to urban purposes and the advent of the wetland conservation act and the floodplain management acts have decreased the marginal value of converting additional land to crop production purposes.

Risks and Impairments to Drainage

The value of drainage to a particular area is the expected flow of services a given ditch or drainage network will provide over time, where expected means risk adjusted.

Risks of disruptions to drainage differ from site to site and are associated with the exposure and vulnerability of the drainage system itself and the vulnerability and exposure of important landscape features that effect the functional capacity of the system. Threats that cause risk can arise from physical, social or managerial actions or processes.

Changes in Outlet Conditions

Changes in outlet conditions arising from vegetation, tree fall or bank erosion or sedimentation. Changes can also occur from improperly placed or sized culverts.

Changes in Outlet Adequacy

Changes in outlet adequacy arising from the same variables mentioned above in addition to changes (usually an increase in volume needing to be discharged) in the hydrology of water flowing to and through the site.

With higher intensity storms, the adequacy of outlets for drainage sensitive uses may be inadequate.

Illicit Connections

Illegal connections to the drainage system which increase the volume or timing of water to be discharged.

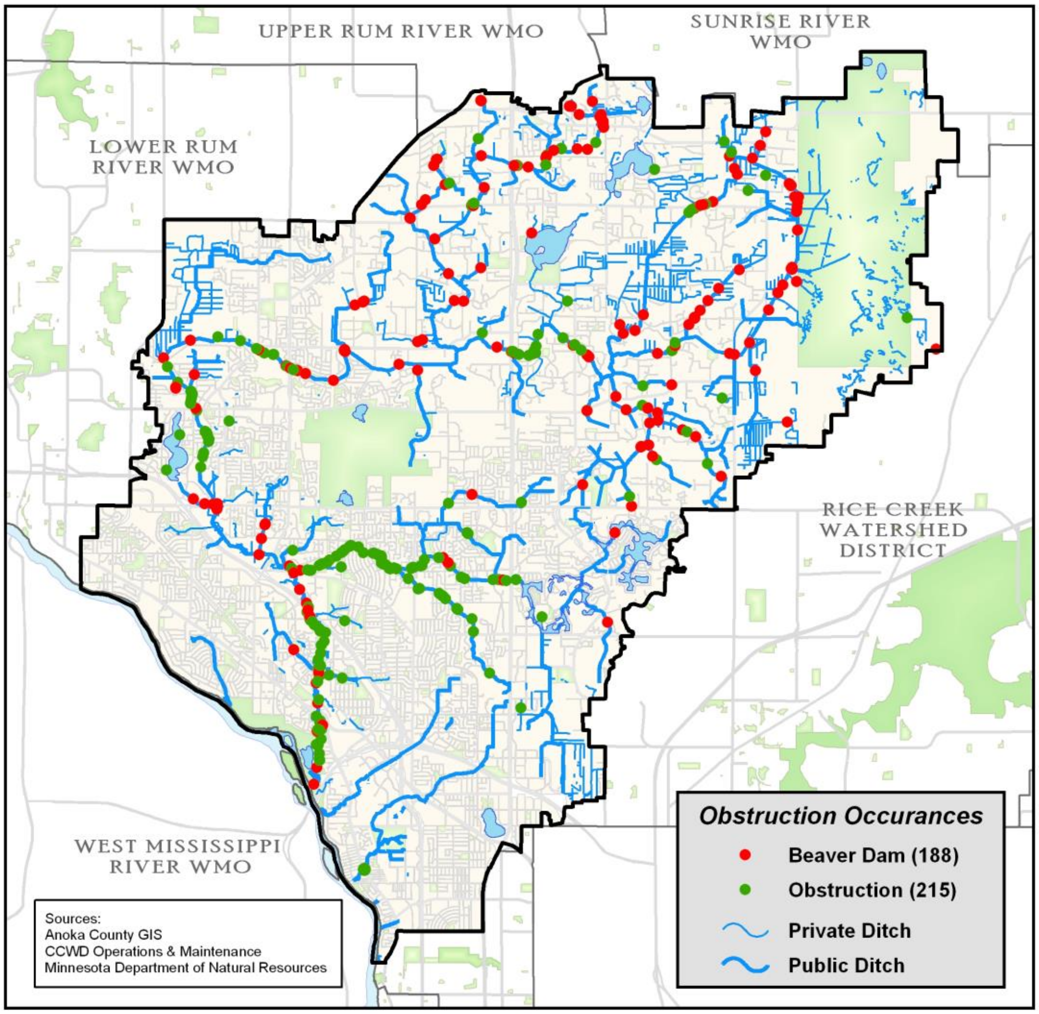
Restricting Access

Restricting access for maintenance and repair through fencing plantings or construction of a structure.

Obstructions

Blockages of flow resulting from improperly sized or placed culverts, beaver dams or accumulations of vegetative debris resulting from downed trees or brush.

Inefficiencies Inefficiencies in the channel can slow the rate and or volume of discharge to the point where drainage dependent land uses can be adversely affected. Inefficiencies can occur for partial blockages and from excess vegetation growth in the channel and on the ditch bank or the accumulation of sediment in the form of a sand bar or sediment fan.



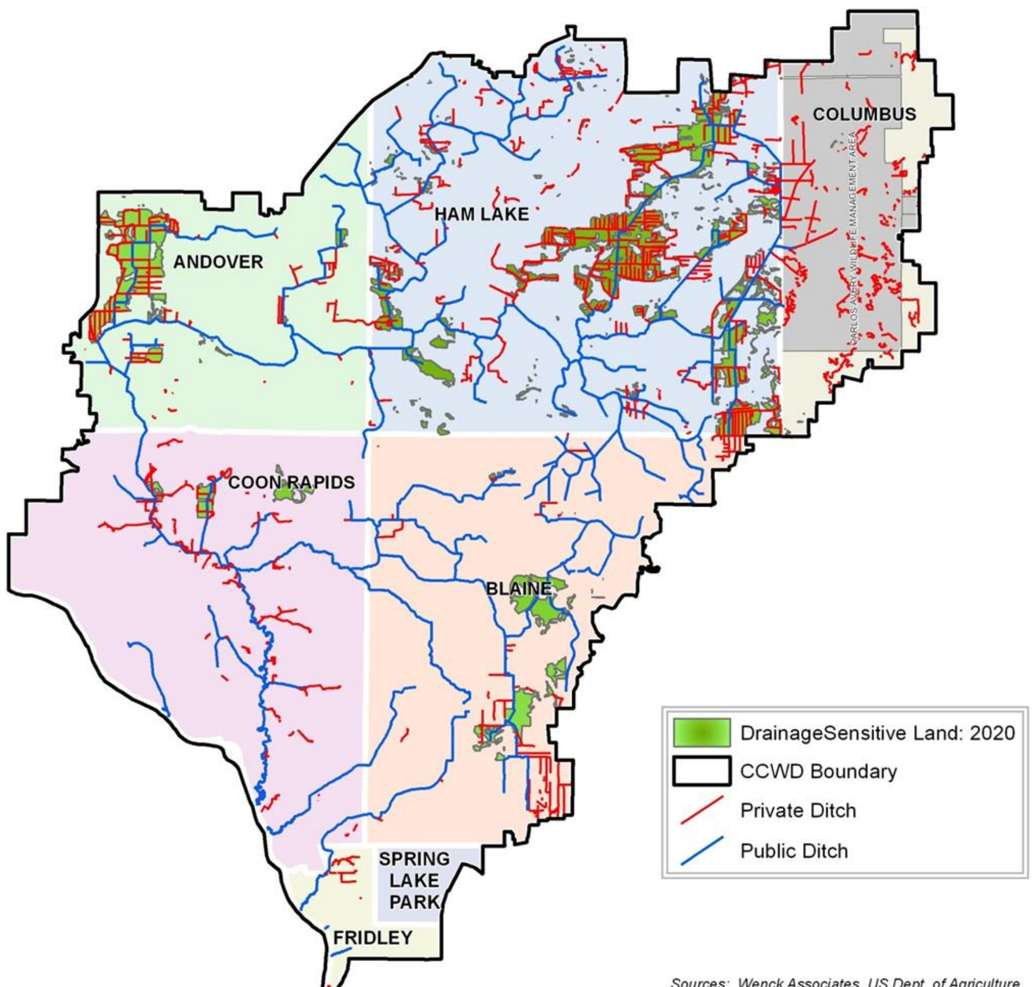
Expected Future of Drainage

The quantity and quality of land drainage for agriculture by 2023 will depend on:

Population

Expected Surficial Groundwater Levels Surficial groundwater levels are expected to decline up to 10 feet in some areas of the watershed over the next 10 to 20 years.

Amount of Drainage Dependent Land A 642 acre (17%) decrease in drainage dependent land by 2020 is expected. However, the geomorphology of the Coon Creek watershed is such that large portions of the watershed will continue to need drainage for flood control and to influence surficial groundwater elevations



Sources: Wenck Associates, US Dept. of Agriculture, Anoka County GIS, Coon Creek Watershed District GIS

Needs

The public ditch system needs to be managed for both drainage and conveyance with an awareness of the water quality impacts and varying maintenance needs of both.

Increases in impervious surface can result in sufficient volumes and rates of runoff to short-circuit the drainage system and prevent infiltration and sub-surface drainage from occurring.

Apply methods

It is the policy of the District to:

1. Maintain ditch and conveyance systems within the watershed to fulfill the role identified within the District's Comprehensive Management Plan and the drainage law.
2. Promote, preserve and enhance the water and related land resources of the Coon Creek Watershed.
3. Protect the water and related land resources of the Coon Creek Watershed from the adverse effects resulting from poor or incompatible land use activities.
4. Encourage compatibility between land use activities upstream and downstream.
5. Regulate land-disturbing activities affecting the course, current, cross section and quality of ditches and water courses.
6. Regulate improvements by riparian property owners of the bed, banks, and shores of lakes, streams, and wetlands for preservation and beneficial use.
7. Protect stream channels from degradation.
8. To regulate crossings of ditches and watercourses in the District to maintain channel profile stability and conveyance capacity.

To manage Watershed District water resources for multiple-uses by balancing present and future resource use with domestic water supply needs.

Identify minor sub-watersheds providing water within the drinking water supply Management Area as defined in the City's well-head protection plan or 1 year travel time of municipal and other public wells and water supplies during land management planning.

Develop prescriptions on a case-by-case basis to ensure desired multiple-use outputs while recognizing domestic water supply needs.

Do not rely on management practices to provide pure drinking water. Use only proven techniques in management prescriptions for municipal supply watersheds.

Determine increased costs of any unusually restrictive practices required to meet state-approved Best Management Practices for protection of drinking water; identify any revenue losses from applying such restrictions.

O&M To maintain in operable condition all drainage and Stormwater improvements in the Watershed and other lands controlled by the Watershed District.

Planning To plan and execute a coordinated program of water resource development to maximize public benefits within the Watershed.

O&M To respond quickly and effectively to alleviate the effects of natural disasters and reduce the threat to life, public health, and property.

PGR To integrate water resource management with Watershed District land and resource management planning and to coordinate Watershed District water resource protection, development, and improvement programs with similar programs of other Federal, State, and local agencies.

Demand for Drinking Water

Aquifers and Water-Bearing Characteristics

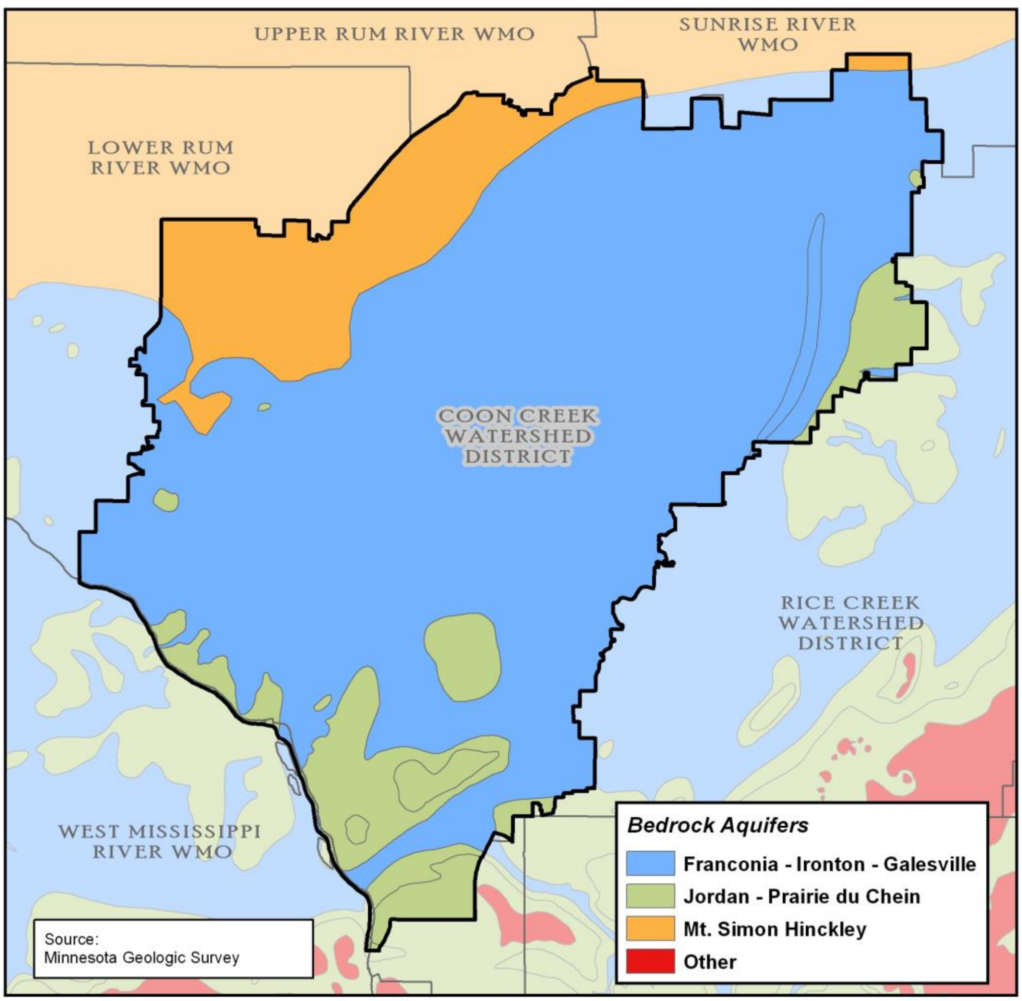
Four aquifers are considered to be capable of supplying substantial quantities of drinking water

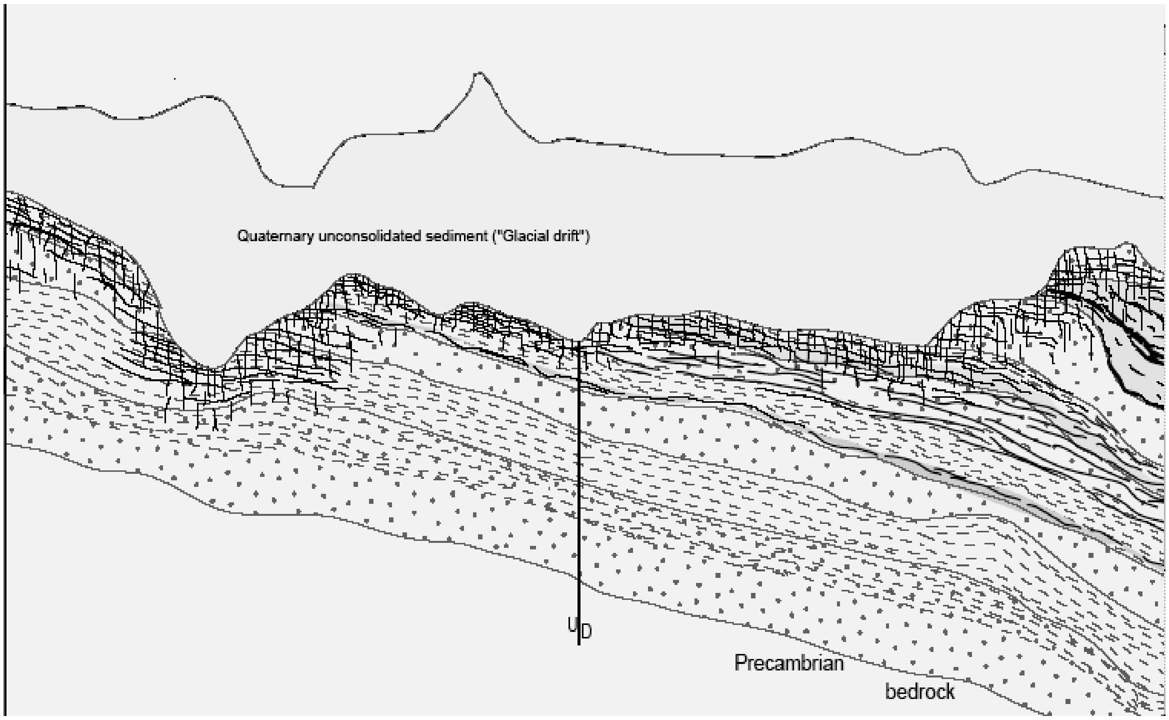
1. Drift
2. Jordan - Prairies Du Chien
3. Franconia- Ironton-Galesville
4. Mt Simon Hinckley

Drinking Water Availability

The watershed is fortunate to have a relative abundance of available groundwater. However, productive aquifers are not evenly distributed across the watershed.

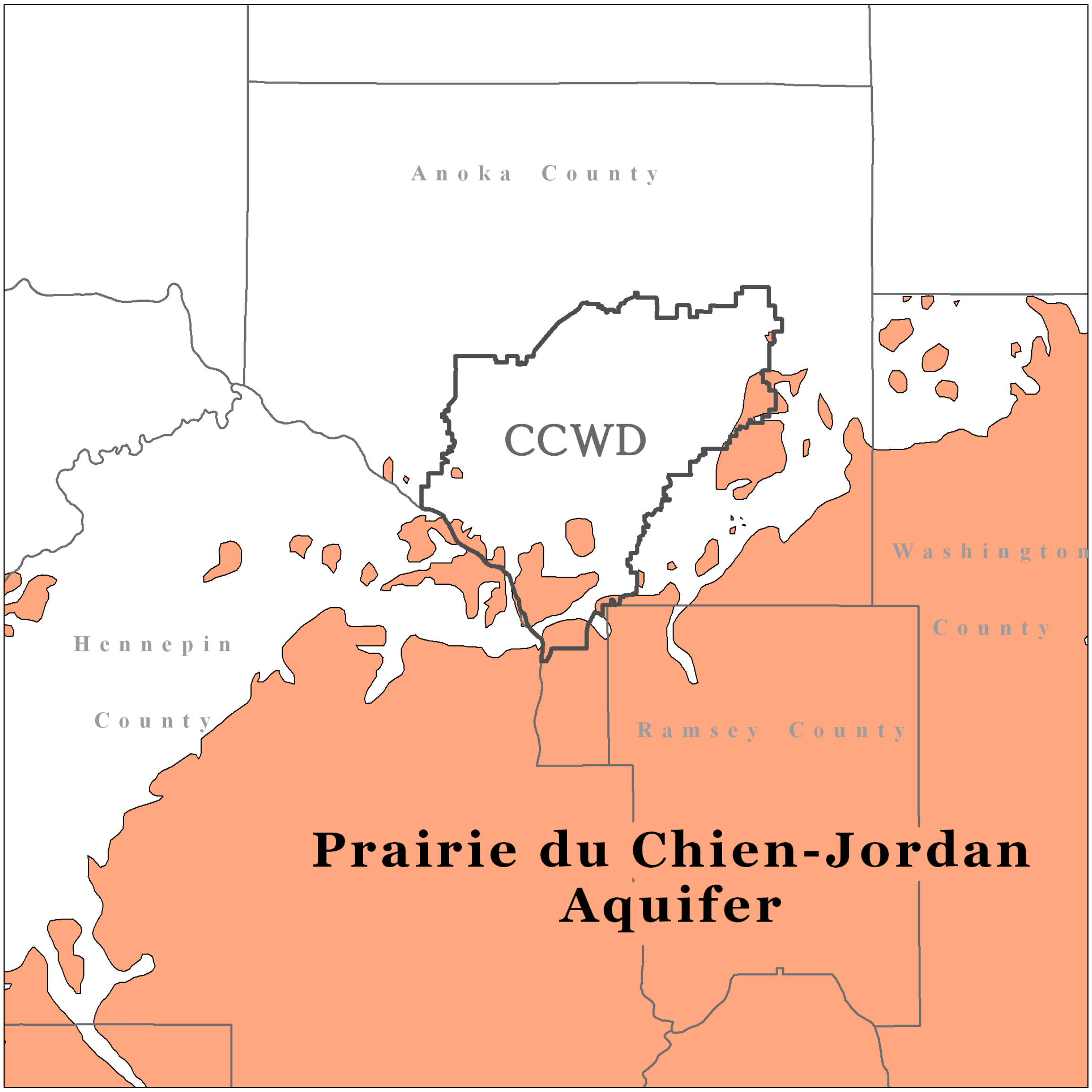
Distribution of bedrock aquifers within Coon Creek Watershed





Drift In addition to its own water supply potential, the Anoka Sand Plain Aquifer is important with regard to underlying aquifers. Underlying sand stone units form part of the northwestern flank of the Twin Cities artesian basin, from which large quantities of water are withdrawn. Direct hydraulic connection between the surficial bedrock aquifers occurs in some areas. Although the red-brown sandy till in much of the area forms the lower boundary of the surficial aquifer, it may be sufficiently permeable to permit a significant amount of vertical leakage to other aquifers below.

Jordan-Prairie Du Chien The Jordan Aquifer, in conjunction with the Prairie Du Chien, is the most heavily used water bearing and supply aquifer. The aquifer supplies approximately 80 percent of the groundwater used in the metropolitan area. The aquifer is 100 to 300 feet thick, is readily accessible, and can yield nearly 3,000 gallon per minute. The quality of the water is generally quite good, though hard, containing high amounts of dissolved minerals.



Franconia-Ironton-Galesville Aquifer

The Ironton-Galesville aquifer subcrops over approximately 2,400 acres of the watershed in Andover and Ham Lake. This aquifer has a transmisivity of 500 to 1500 feet squared per day in this region. It varies between 0 to 100 feet in thickness with an average thickness of 70 feet. The flow is from north to the south. Water yields in this aquifer range from 100 to 500 gallons per minute. Wells are commonly completed through to the underlying Mount Simon Hinckley.

Mount Simon-Hinckley Aquifer

The Mount Simon-Hinckley is the deepest aquifer in the watershed. The aquifer is typically viewed as a supplemental source of water to the Jordan. Well yields generally range from 200 to 700 gpm. This aquifer has been known to yield as much as 2,000 gpm. As with the Jordan, water in the Mt. Simon-

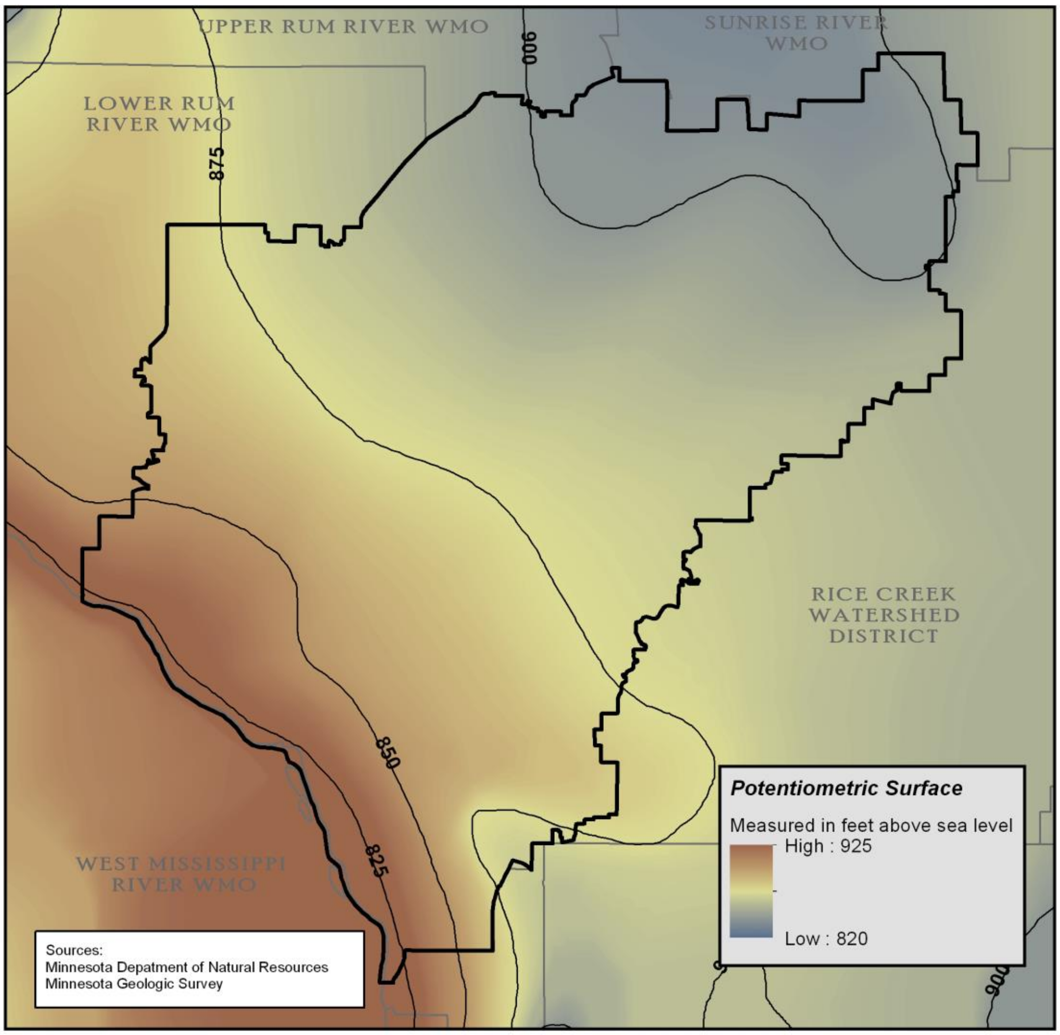
Hinckley is clean and hard, with locally high levels of iron and manganese.

The depth of this aquifer and its isolation by the Eau Claire formation confining layer has so far protected this aquifer from contamination. This aquifer is recharged to the north where the aquifer is the first bedrock encountered under glacial drift. The remaining recharge occurs through seepage downward through the confining Eau Claire sandstone unit.

Groundwater Availability and the Capacity to Provide Drinking Water

The watershed is fortunate to have a relative abundance of available groundwater. However, productive aquifers are not evenly distributed across the watershed.

Potentiometric Surface

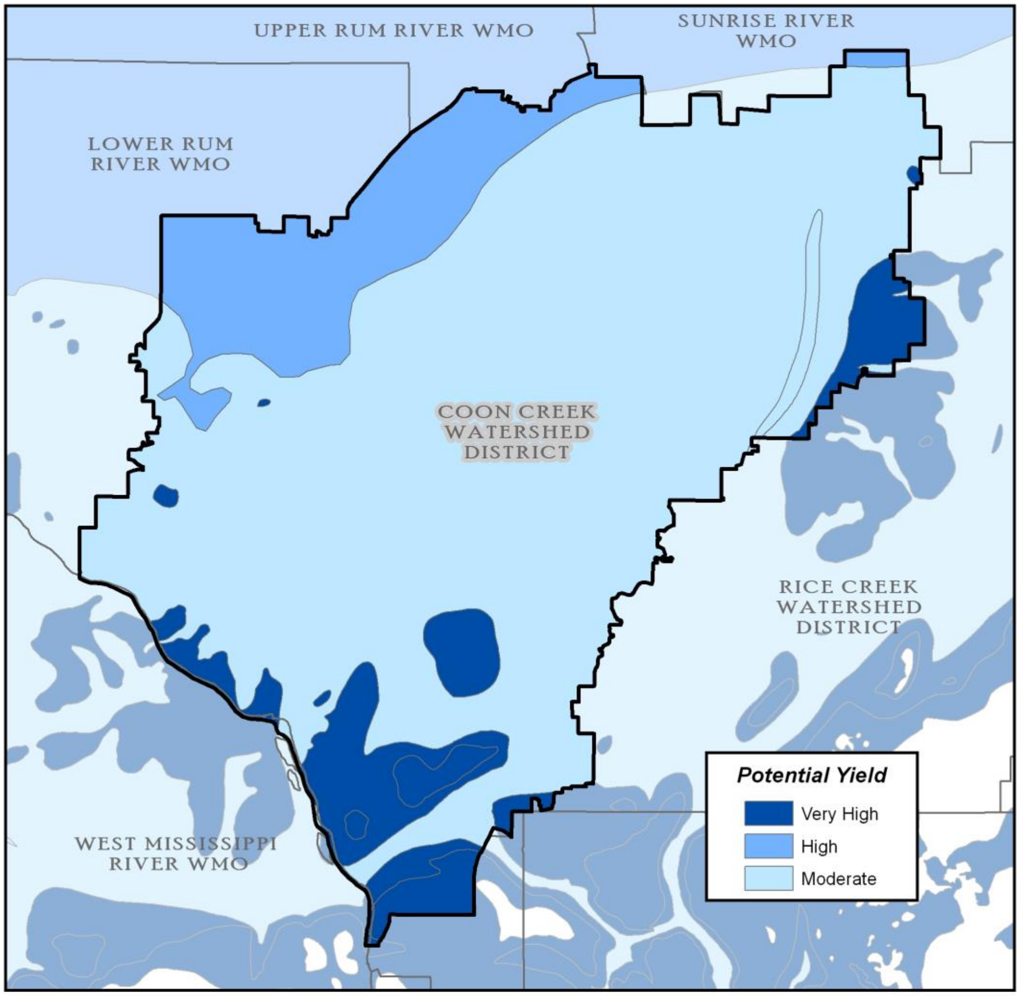


Water Yield

Water Source	Potential Yield	Yield (gpm)	Specific Yield (%)	Thickness (ft)
Drift	Varies		25%	150-250
Prairie Du Chien-Jordan	Very High	3,000	27%	180-325
Franconia-Ironton-Galesville	High to Moderate	100-500	20%	195-225
Mt. Simon-Hinckley	Very High	200-700	27%	145-165

Specific Yield is the quantity of water which a unit volume of aquifer, after being saturated, will yield by gravity; it is expressed either as a ratio or as a percentage of the volume of the aquifer; specific yield is a measure of the water available to wells.

Potential Yield of Bedrock Aquifers



Groundwater Quality Precipitation that recharges the District groundwater supply percolates through the ground cover and enters the porous, chemically inert groundwater reservoir. The investigation of groundwater quality and its connection with land uses and surface water quality was the objective of the Clean Water Partnership study, conducted by ACD and the MPCA. The following table presents results from that study.

Quality of Shallow Groundwater

	Back ground	Peat	Residential	Urban
pH	-	7.39	7.92	7.91
Cl (ppm)	1.34	41.68	33.9	29.56
Fe(ppm)	24.19	4.26	0.51	0.25
K (ppm)	1.81	2.02	1.84	1.24
Na (ppm)	2.18	6.48	19.23	35.71
NO_2(ppm)	0.01	<0.01	<0.01	0.27
NO_3 (ppm)	0.01	<0.01	<0.01	12.25
TP (ppm)	0.64	0.21	0.04	0.03

*Data from CWP, 1997. Values represent mean concentrations from downstream sites.

Quality of Deep Groundwater

	Back ground	Peat	Residential	Urban
pH		7.84	8.01	8.2
Cl (ppm)	4.75	0.83	51.8	0.67
Fe(ppm)	3.19	2.39	0.73	0.44
K (ppm)	26.72	1.33	1.69	0.97
Na (ppm)	68.48	7.34	23.55	3.1
NO_2(ppm)	0.01	0.83	<0.01	<0.01
NO_3 (ppm)	0.01	<0.01	1.18	<0.01
TP (ppm)	0.7	0.36	0.16	0.15

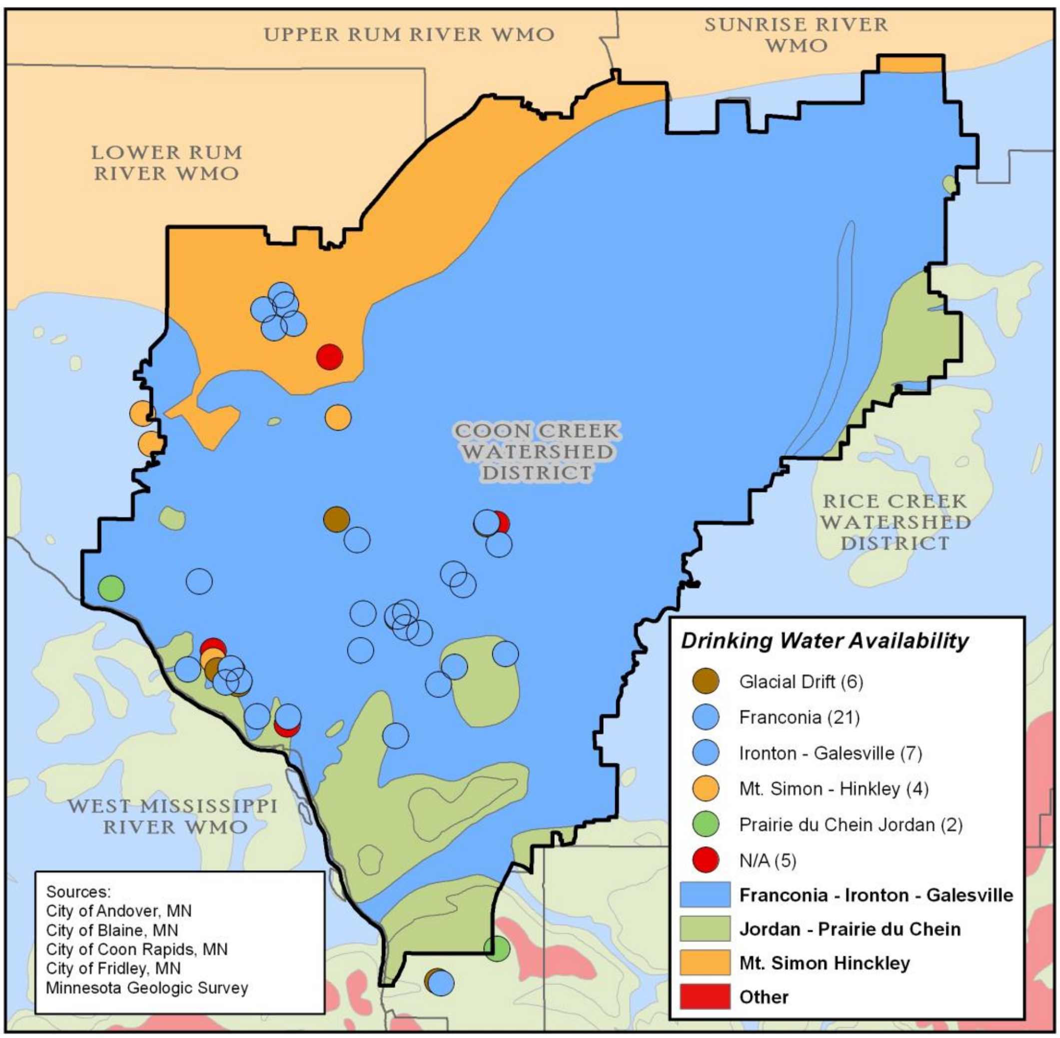
*Data from CWP, 1997. Values represent mean concentrations from downstream sites.

Current Provision of Drinking Water

Groundwater

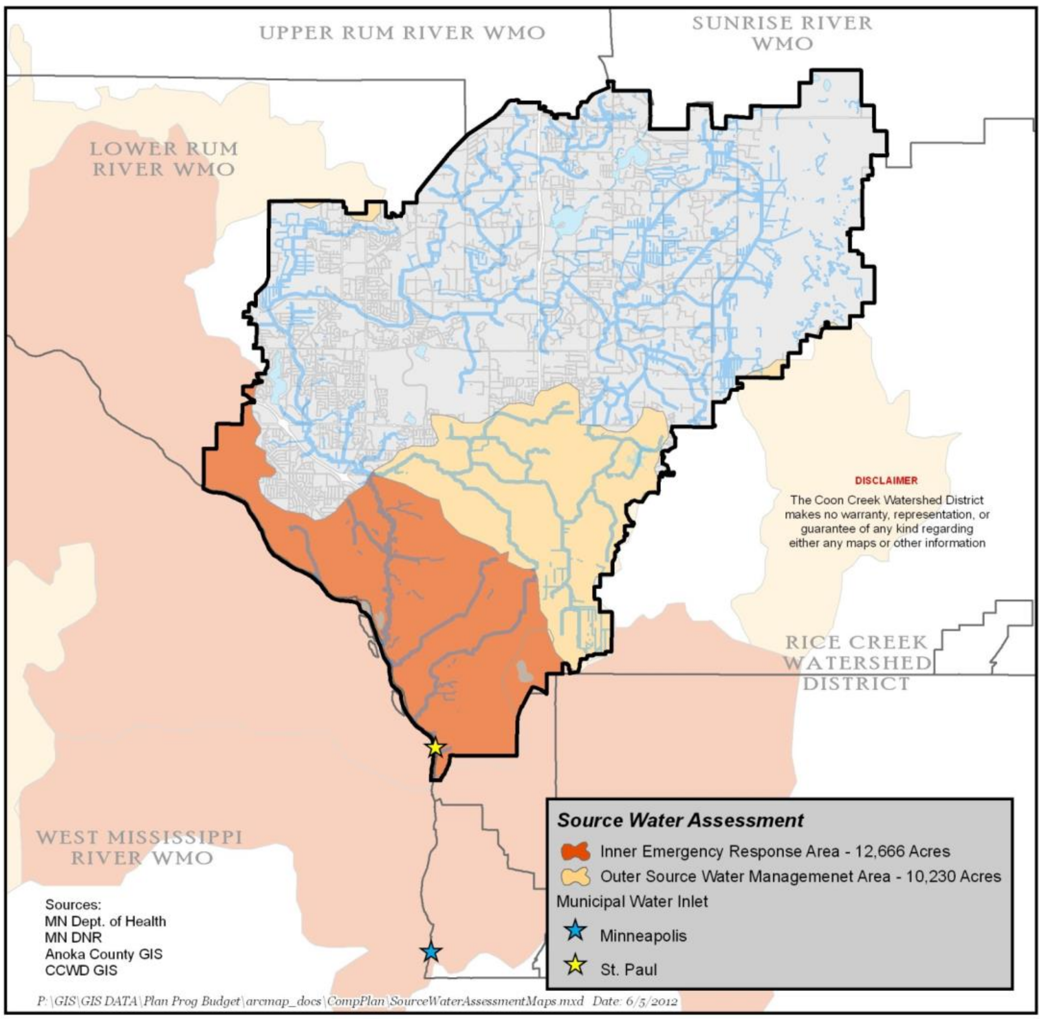
Water Source	Number of Wells	Current Use (MGD)	Percent of Current Use
Drift	8	7,750	12%
Prairie Du Chien-Jordan	8	7,775	13%
Franconia-Ironton-Galesville	37	39,910	62%
Mt. Simon-Hinckley	10	8,625	13%

Well distribution



Mississippi River

The Coon Creek watershed is directly upstream from the water intakes for both Minneapolis and St. Paul. The St Paul intakes are within the District boundary.



Value of Drinking Water

The factors that contribute to and affect the aggregate demand for drinking water within the Coon Creek Watershed are:

Population

	2000	2010	2020	Pct Chg
Andover	17,450	21,188	27,188	28%
Blaine	46,845	60,643	71,943	19%
Columbus	479	508	623	23%
Coon Rapids	62,295	65,700	66,000	0%
Fridley	27,449	27,000	26,900	0%
Ham Lake	11,782	15,017	16,686	11%
Spring Lake Park	7,090	6,710	6,710	0%
Total	173,390	196,766	216,050	10%

Projected Average Daily Water Use (mgd)

	2004	2010	2020	Change
Municipal	20.730	23.486	24.577	5%
Private	3.045	3.095	3.116	1%
Non-Municipal	2.757	2.709	2.709	0%
Total	26.532	29.290	30.402	4%

Metropolitan Council 2007

Service Preferences

Reflects the preferences expressed in a survey of citizens, City Engineers and water resource professional conducted in April and May of 2011.

In April and May 2011 29 citizens, engineers from the seven cities within the watershed and water resource professionals who are members of the ‘planning advisory committee’ were administered a paired comparison survey of the beneficial uses of and the demands on water resources.

Drinking water was ranked the most important and most valuable use of water by all three groups.

	Citizens	City Engineers	Water Professionals	National
Drinking water	**1**	**1**	**1**	**1**
Water Quality	2	2	2	2
Flood Control	2	2	3	5
Groundwater Recharge	4	4	4	7
Storm Protection	6	5	6	6
Drainage	5	8	7	8
Aquatic life and recreation	**8**	**8**	**5**	**9**
Hunting and Fishing	**8**	**8**	**9**	**10**
Irrigation	9	9	10	4
Livestock and wildlife watering	10	10	8	11
Aesthetics	11	11	11	12
Industrial use and cooling	13	13	12	3

Cost to Use

At present the cost of using groundwater is low.

Costs are simply the financial outlay involved with well-drilling, placing the pump and the operating and maintenance costs of pumping and distributing the water.

The economic cost, however, is significantly larger. Groundwater appropriated from the sources utilized within the watershed are non-renewable within the practical time frames of municipal and private use. The current arrangement of pricing rewards over appropriation and waste of a non-renewable resource through block pricing, where the marginal price decreases as the volume of water utilized increases. The result is in essence mining of the resource, making water unavailable for other uses in both the short and long term.

Available Substitutes

The Cities of Coon Rapids and Fridley do have a natural substitute for potable groundwater in the form of the Mississippi river.

While the capital investment would be substantial, the river provides an alternate supply once the water is pumped and treated.

Ease of Adopting Substitutes

Adopting substitutes for groundwater would probably be difficult. In addition to the size of the initial capital investment, the demands and regulations on the Mississippi river would require the cities to commence actions with significant lead time to ensure uninterrupted service.

Marginal Value of Drinking Water

At present the marginal value of each gallon or acre feet of water appropriated within the watershed is low.

Groundwater is a common-pool resource i.e., while one entity's use of groundwater may preclude another's, it is very difficult to effectively exclude individuals from using it. This applies to consumptive as well as non-consumptive uses.

Risks and Impairments to Drinking Water and Water Supplies

An adequate water supply is a necessity for any home or city. The source must provide quality water at a constant and dependable rate. Groundwater supplies 100 per cent of public drinking water within the watershed for both domestic use and livestock and wildlife watering.

Risks of disruptions to drinking water differ from site to site and are associated with the exposure and vulnerability of the water supply.

Uncertainty in meeting the projected demand in an area generally corresponds to:

- Areas lacking in productive aquifers
- Groundwater/surface water interdependence
- High susceptibility to contamination

Climate Change

The Coon Creek watershed has experienced an increase in temperature over the past two decades. Increasing temperatures have a direct impact on water resources and cause a decline in water supply availability and higher drought risk; changes in precipitation and precipitation patterns; decrease in snow pack, runoff, and streamflow and increased evapotranspiration. Warmer temperatures also increase water demand due to warmer temperatures and population growth coupled with the afore-mentioned impacts, adequate water supplies for future uses and generations remain uncertain.

Areas Lacking In Productive Aquifers

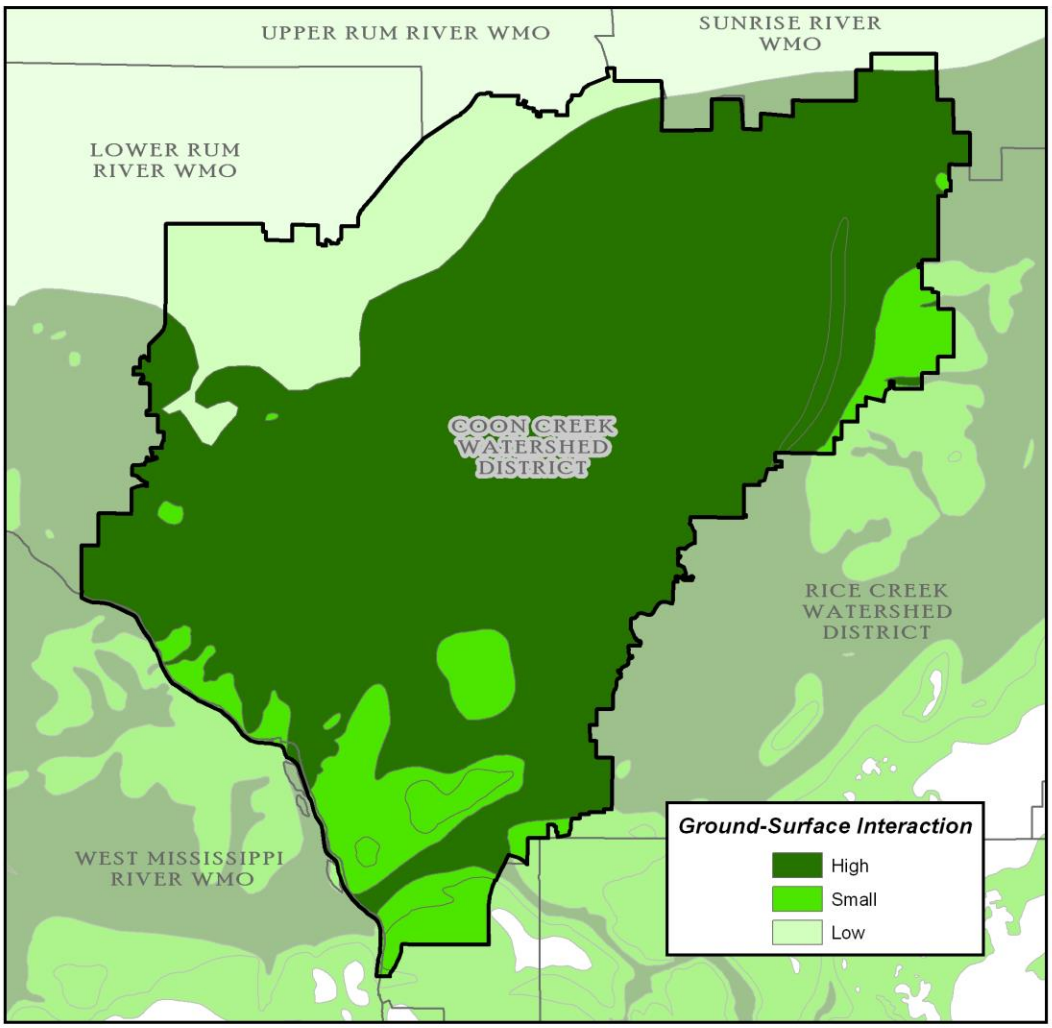
The watershed is fortunate to have a relative abundance of available groundwater. However, productive aquifers are not evenly distributed across the watershed.

Groundwater/ Surface Water Interaction

The fresh groundwater in the unconsolidated formations of the watershed is derived largely from precipitation over the outcrop areas (Helegesen 1977). Rainfall lost to evapotranspiration has been estimated at 79 percent (Corrigan 1991). An additional 16 percent is lost to overland flow, leaving 5 percent for recharge. (Enviroscience 1983, USGS 1985)

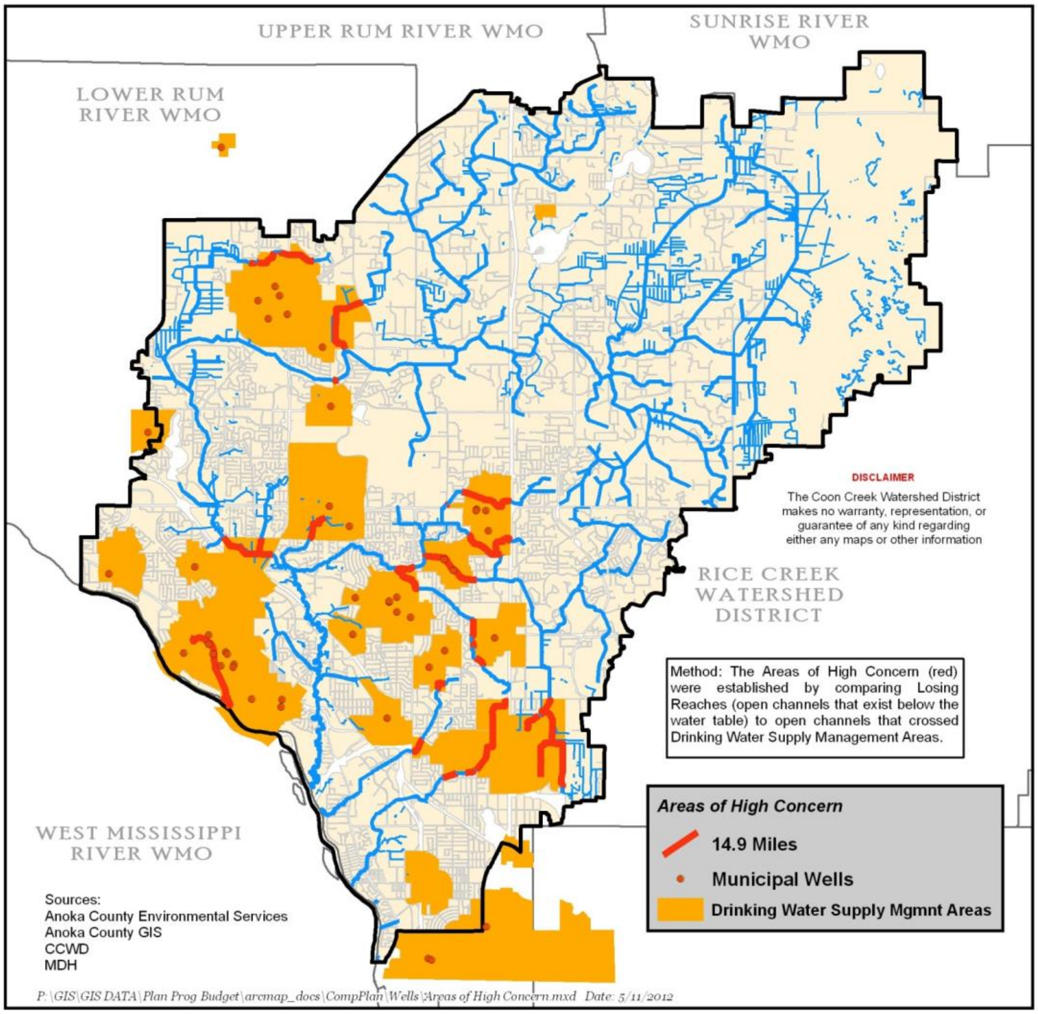
Since rainfall averages 30 inches per year in the watershed, approximately 1.5 inches per year (23.9 mgy) is potentially available to recharge the surficial groundwater reservoir.

Water Source	**Ground x Surface interaction**
Drift	Very High
Franconia-Ironton- Galesville	High
Prairie Du Chien-Jordan	Small
Mt. Simon- Hinckley	Low



Surface Water Effects on Water Supplies

Areas where the drainage system of Coon Creek are losing reaches within drinking water supply management areas is shown below. These ditch segments are potentially concentrating and transmitting surface pollutants to drinking water.

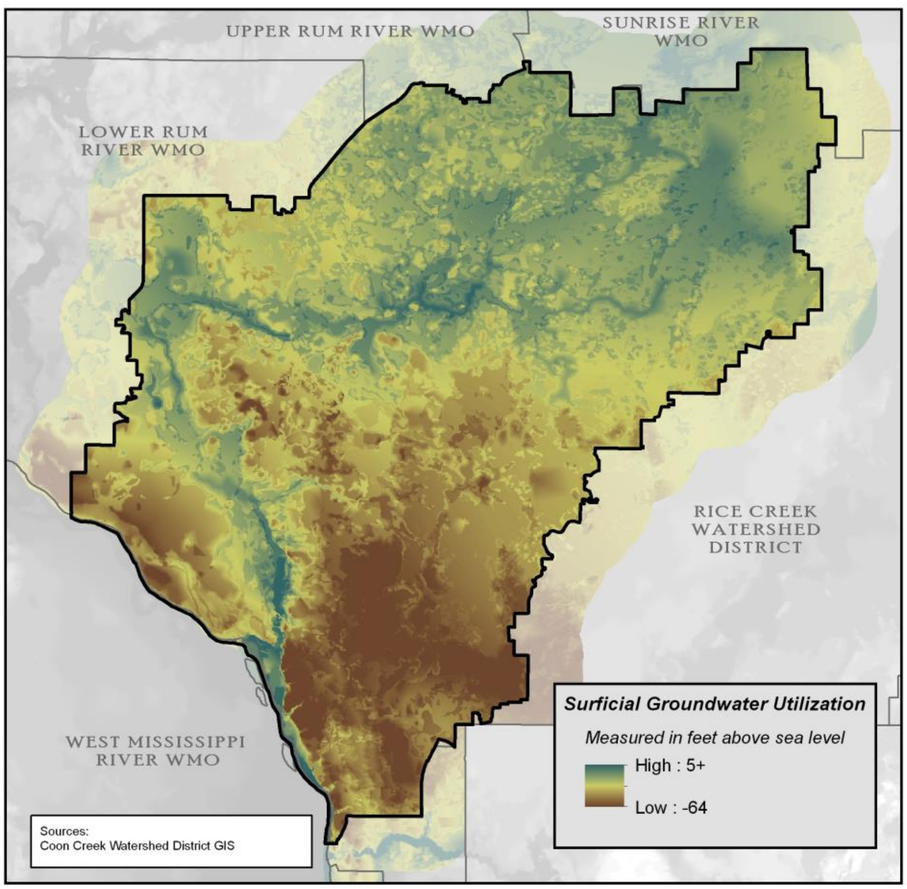


Groundwater Recharge/Over Appropriation

The ultimate source feeding groundwater is precipitation. Actual aquifer recharge rates are not well quantified within the watershed which leads to uncertainty in assessing sustainable withdraws.

Over appropriation is the result of removing water at a rate and or volume faster than the aquifer can supply. In cases where a water source takes 100 of years to recharge, appropriations are an irreversible withdrawal.

Water Source	Horizontal Conductivity (K)(ft/d)	Horizontal Migration	Vertical Migration
Drift-Local Water Table	1.61-137.14	Impeded by small pore space of clays	Low-Limited by low permeability of underlying clays
Prairie Du Chien-Jordan	1-40	Due to joints, fractures and solution cavities	
Franconia-Ironton-Galesville	7-11	Due to pores and bedded plane fractures	
Mt. Simon-Hinckley	5	Medium to coarse grained quartzose sand stone embedded with pebbles overlaying shale and mudstone	



Susceptibility to Contamination

The surface, unconsolidated sands can hold a vast quantity of water. Significant pollution sources, actual or potential, include

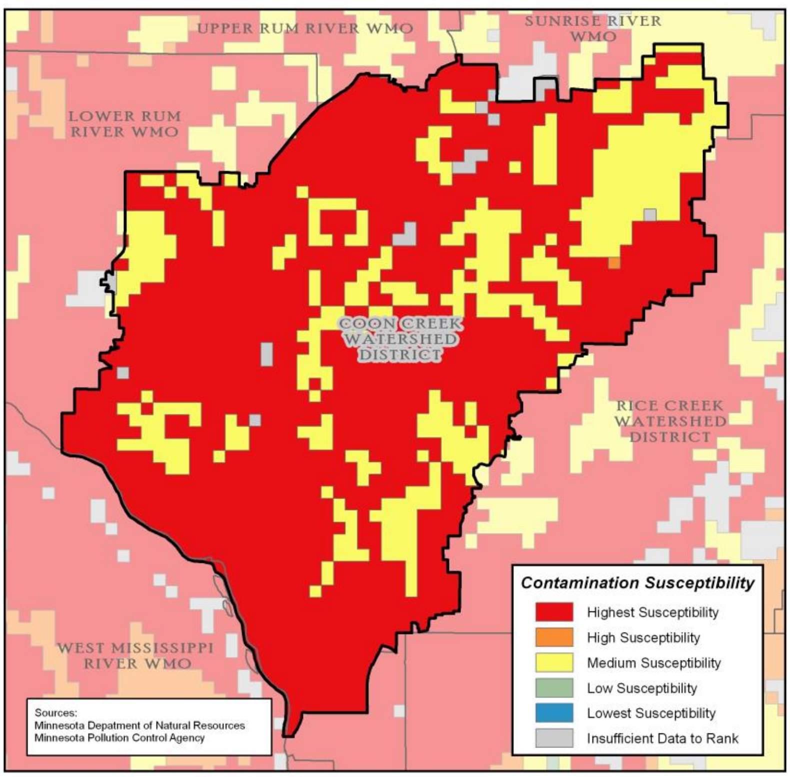
- septic tanks
- landfills
- chemical spills and dumping
- chemical storage leaks
- Highway deicing
- Agricultural chemicals.

These sources may have immediate local impacts and may also pose long-term, cumulative threats.

Pollutants detected in groundwater that could be harmful to humans or animals should they rise to inappropriate levels include:

- Bacteria
- Chloride,
- Nitrate, and
- Crop protection chemicals

It is estimated that 60,000 people reside in the unsewered portions of the watershed, producing 4.5 mgd of sewage and 6.6 million gallons per year of septage (septic tank pumpage).



Water Source	Vulnerability
Drift	Very High
Franconia-Ironton- Galesville	High
Prairie Du Chien-Jordan	Moderately Low
Mt. Simon- Hinckley	Low

Well Interference Well interference occurs when high capacity wells influence other wells causing reduced productivity or limitations on the ability to withdraw/appropriate water from a given aquifer.

Expected Service Level

Most of the watershed has adequate water supplies to meet the current and projected demand for drinking water. Work done by the Metropolitan Council indicates that supplies within the City of Blaine to be "uncertain."

Projected Demand for Drinking Water (MGD)

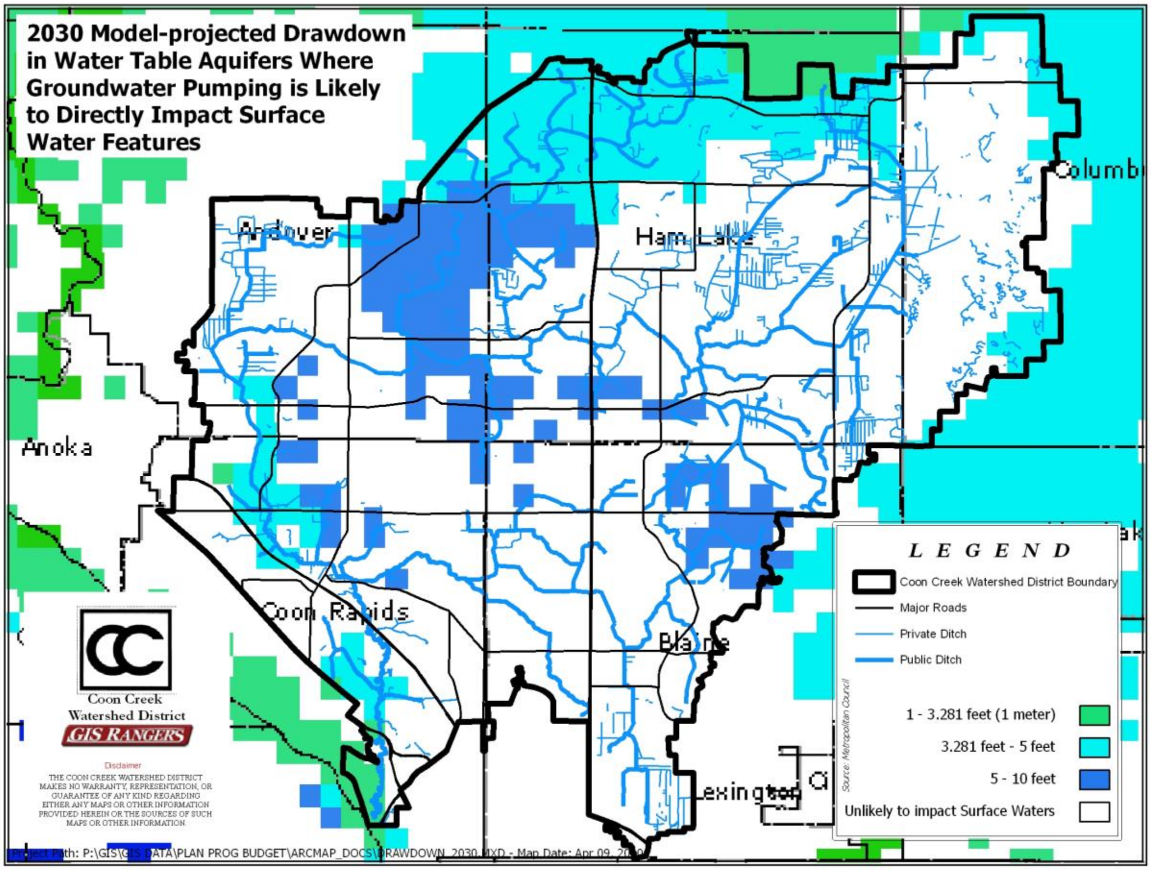
	2010	2020	Pct Chg
Andover	2.5-5.0	2.5-5.0	0%
Blaine	5.0-10.0	10.0-20.0	100%
Columbus	0.4-0.8	0.4-0.8	0%
Coon Rapids	5.0-10.0	5.0-10.0	0%
Fridley	2.5-5.0	2.5-5.0	0%
Ham Lake	1.5-2.5	1.5-2.5	0%
Spring Lake Park	0.4-0.8	0.4-0.8	0%
Total	17.3-34.1	22.3-44.1	29%

Externalities

Loss of Groundwater Driven Surface Water Features If surficial groundwater levels continue to fall between 2013 and 2023, surficial water features, such as

a. Lakes (decline of 50% surface area)
b. Wetlands (8,375 acres)
c. Base Flow

will be difficult to protect and sustain in the areas shown below:


2030 Model-projected Drawdown in Water Table Aquifers Where Groundwater Pumping is Likely to Directly Impact Surface Water Features
Andover
Ham Lake
Anoka
Coon Rapids
Blaine
Lexington
Coon Creek Watershed District
GIS RANGERS
Disclaimer
THE COON CREEK WATERSHED DISTRICT MAKES NO WARRANTY, REPRESENTATION, OR GUARANTEE OF ANY KIND REGARDING EITHER ANY MAPS OR OTHER INFORMATION PROVIDED HEREIN OR THE SOURCES OF SUCH MAPS OR OTHER INFORMATION.
L E G E N D
Coon Creek Watershed District Boundary
Major Roads
Private Ditch
Public Ditch
1 - 3.281 feet (1 meter)
3.281 feet - 5 feet
5 - 10 feet
Unlikely to impact Surface Waters
Source: Metropolitan Council
PLAN PROG BUDGET\ARCMAP_DOCS\

Blaine "Uncertainty"

The Met Council study indicates that the 'uncertainty in meeting the projected demand in an area generally corresponds to:

- Areas lacking in productive aquifers
- Groundwater/surface water interdependence
- High susceptibility to contamination.

Potential Impacts on Surface Water Contribute to Drinking Water Uncertainty in Certain Areas

If the Metropolitan Council projections are correct, the watershed will experience a loss of almost 52% (8,400 acres) of surficial water and related land resources by 2030.

The District estimates that there will be an additional impact (either through conversion of wetland type or lower lake levels) to an additional 2,000 acres (approx 12%).

Drinking Water Management Needs

To protect groundwater in the well head area, there are many Best Management Practices to choose from. Start with proper siting and locations of wells and potential contaminants such as manure storages, fertilizer, fuel and pesticide storages, septic systems and maintenance shops. Proper maintenance of these facilities and management of the nutrients, pesticides and fuels will help reduce groundwater contamination. Wells need managing too - they may require repair, upgrading, replacement or proper abandonment.

Integrate Drinking Water into Existing Water Management Program

To manage Watershed District water resources for multiple-uses by balancing present and future resource use with domestic water supply needs:

1. Identify minor sub-watersheds providing water within the drinking water supply Management Area as defined in the City's well-head protection plan or 1 year travel time of municipal and other public wells and water supplies during land management planning.

2. Develop prescriptions on a case-by-case basis to ensure desired multiple-use outputs while recognizing domestic water supply needs.

3. Determine increased costs to cities and homeowners associations of any unusually restrictive practices required to meet state-approved Best Management Practices for protection of drinking water; identify any revenue losses from applying such restrictions.

Support Anoka County Geologic Atlas

Anoka County, The WMOs within the county and several cities have contributed money for the development of a geologic atlas for the County. The District needs to continue to support the development of this Atlas and encourage digitizing the data associated with the Atlas.

Show Municipal Water Supply Areas as Special Management Areas

Show municipal water supply areas as 'special management areas' in the Comprehensive plan when management intensity and timing differs from other areas. Watershed plans shall include:

1. A statement of objectives for managing the water resources on and flowing from the watershed. Include quality, quantity, and timing criteria for the water resource.
2. Guidelines for protection, management, use, and development, together with coordinating requirements for other uses and activities within the watershed.
3. Guidelines for monitoring uses, activities, and water quality characteristics that may be affected by watershed management activities.
4. An assessment of the contribution that should be made by the water-user toward management efforts, including such activities as operating a water-quality monitoring system and patrols needed to enforce any use restrictions.

Notices of Restrictions

1. Inform the public of use restrictions imposed on municipal water supply and reasons for restrictions.
2. Include use restriction clauses in all permits, or other documents authorizing use within the watershed.
3. Designate restricted municipal water supply areas on maps prepared for public use.

Conservation Water Fees

Extensive water use for public water supply, irrigated agriculture, and periodic droughts has led to a significant decline in surficial aquifer levels in some areas of the watershed, and lowered lake and wetland levels and spring discharges throughout the Anoka Sand Plain.

Water conservation is seen as the most important action we can take to sustain our water supplies, meet future needs, and reduce demands on the District's fragile water-dependent ecosystems such as lakes, streams, and wetlands.

The District will work with cities to develop strategies and implementation plans. A significant opportunity exists here to work with and educate decision makers on the need and benefits for water harvesting and reuse.

Currently, the State of Minnesota, Metropolitan Council and some cities encourage public water suppliers to implement such water conservation measures as:

- adoption of local irrigation and landscaping ordinances,
- leak detection,
- public education, and
- conservation-based water rates.

A focus on conservation-based rates (also referred to as "conservation rates," "conservation-oriented rates," or "demand management pricing") is needed. Below, are criteria used to design and evaluate conservation-based rates, consider alternative rate structures, and some of the challenges posed by conservation-oriented rates for utility companies.

Conservation-oriented water rates are aimed at stimulating water use efficiency and conservation through economic incentives, specifically through water price signals. American Water Works Association suggested four criteria to design and evaluate a conservation water rate structure. Three of the criteria are discussed here:

1. The structural form of the rate;
2. The proportion of utility costs that is recovered through fixed versus commodity charges; and
3. Effective communication of the price signal through consumer billing.
4. The fourth suggested criterion is relevant only for public-sector utilities and is not listed here: the extent to which the cost of the utility service is covered through user fees as opposed to other sources, such as taxes or general funds transfer.

Increase Groundwater Recharge

Groundwater recharge plays a critical role in the hydrology of the surficial aquifer of the watershed and is strongly encouraged by MPCA.

Recharge is a long-established and effective water management tool that allows renewable surface water supplies to be stored underground now for recovery later during periods of reduced water supply.

The District's Recharge/Infiltration Program and standard was established with the principal goal of protecting the economy and welfare of the District by managing the reliability of its most valuable resource …water. The water management benefits of recharge are numerous and include the following:

- Encourages the use of renewable water supplies instead of continued over-reliance on finite groundwater supplies;
- Mitigate impacts of groundwater overdraft including subsidence and increased power costs for pumping water from greater depths;
- Firms the District's water supply by providing a "reserve" of water that may be recovered during prolonged drought;
- Water stored underground eliminates the need to construct costly surface reservoirs that are prone to excessive evaporation;
- Provides an alternative mechanism to deliver water through recharge and recovery instead of constructing costly water treatment plants and distribution facilities;
- The quality of recharged surface water is improved by filtration through underlying sediments in a process known as soil aquifer treatment.

Decrease Waste of Groundwater

Timed residential and commercial irrigation units often run when it is raining or when soil and plant conditions do need additional water. The result of waste of a resource that is in essence non-renewable.

Drip or trickle irrigation technology plus mulching is very water efficient combination: only the root zone of growing crop is watered and the mulch reduces evaporation.

Estimate Groundwater Storage and Supply within the Watershed

Water stored underground eliminates the need to construct costly surface reservoirs that are prone to excessive evaporation. However the amount of water stored is unknown. The approximate capacity needs to be known for rational public service and facilities planning.

Support Proper Abandonment of Unused Wells

Unused wells are safety hazard and pose a risk to groundwater quality. They should be properly plugged and sealed.

Demand for Flood Control

Causes of Flooding and Property Damage

Floods occur when ponds, lakes, riverbeds, soil, and vegetation cannot absorb all the water. Water then runs off the land in quantities that cannot be carried within stream channels or retained in natural ponds, lakes, and man-made reservoirs. About 30 percent of all precipitation becomes runoff and that amount might be increased by water from melting snow.

The Watershed District has found that flooding can occur in the watershed both upstream and downstream from changes in land use.

The flooding is generally due to the flat nature of the watershed, and increases in the rate of runoff, and the volume of runoff resulting from site hardening. The result is often more water than a ditch or watercourse was designed to convey and can result in water backing up stream and preventing discharge and subsurface drainage from occurring.

Within the Coon Creek Watershed, Flooding is caused by many factors:

- Landscape Position
- Heavy rainfall
- Highly accelerated snowmelt
- Failure of dams, levees, retention ponds, or other structures that retained the water
- Unexpected drainage obstructions such as bank failures, ice, or debris can cause slow flooding upstream of the obstruction.

Flooding can be exacerbated by:

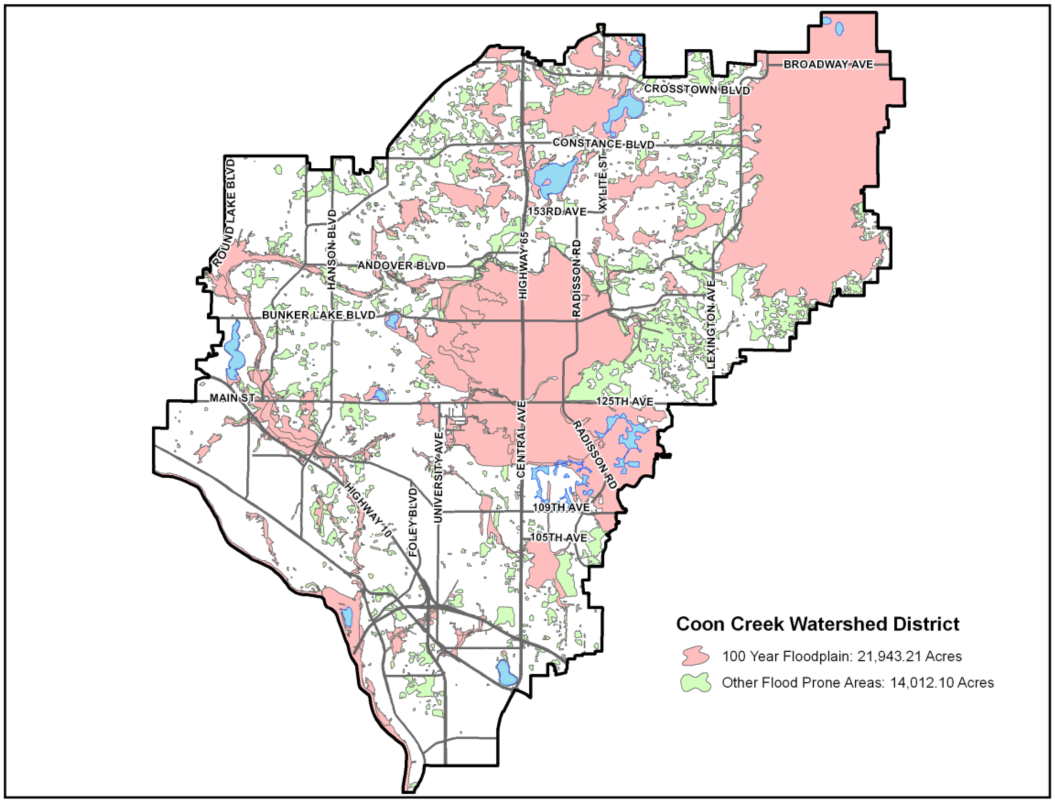
- Increased amounts of impervious surface

Landscape Position/ Flood Prone Areas

At present the system is designed and maintained to convey a 25 year event (4.7 inches in 24 hours) with no inconvenience or damage to people or property. The channel, combined with the flood plain and the District, Municipal and State regulations are designed to prevent or minimize structural as well as operational damage from the 100 year event (6 inches in 24 hours).

In the past 10 to 20 years, the District has experienced varying degrees of drought. Consequently, a significant number of the Watershed's population have never seen or been forced to contend with what is required to live with naturally high water levels, or dealt with the consequences of poor land use decisions or circumventing rules designed to limit land uses inconsistent with the nature of floodplains.

The Federal floodplain maps for the watershed are shown below



Rainfall Over the past ten years annual precipitation has generally decreased causing drought conditions. While annual precipitation has generally been below the normal annual fluctuation and the droughty conditions are among the driest on record, the occurrence of below normal precipitation has not altered the expected frequency, duration and intensity for this area of the state.

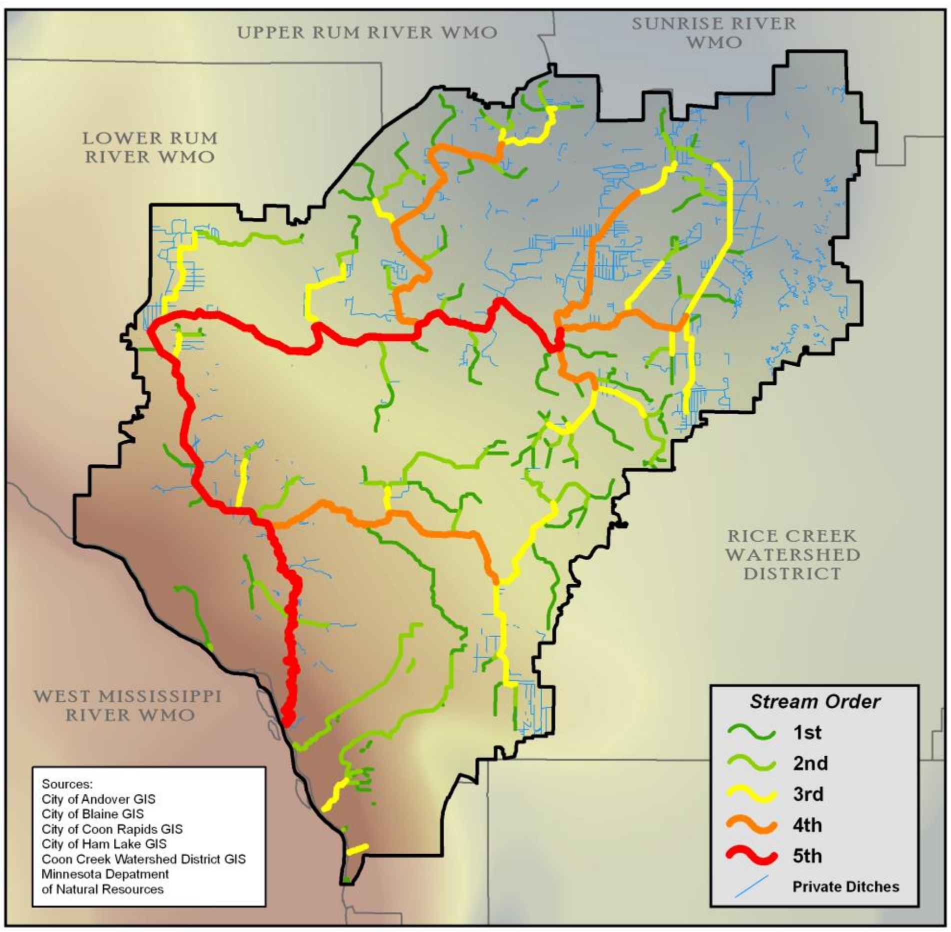
Some flooding within the watershed generally occurs after approximately 4 inches of precipitation. The probability and durations for a 4-inch rain event are presented below:

Frequency (Yrs)	Annual Probability	12 Hours (in)	24 Hours (in)	48 Hours (in)
5	20%			4.2
10	10%		4.1	4.8
25	4%	4.1	4.7	5.7
50	2%	4.6	5.2	6.3
100	1%	5.1	5.9	7.0

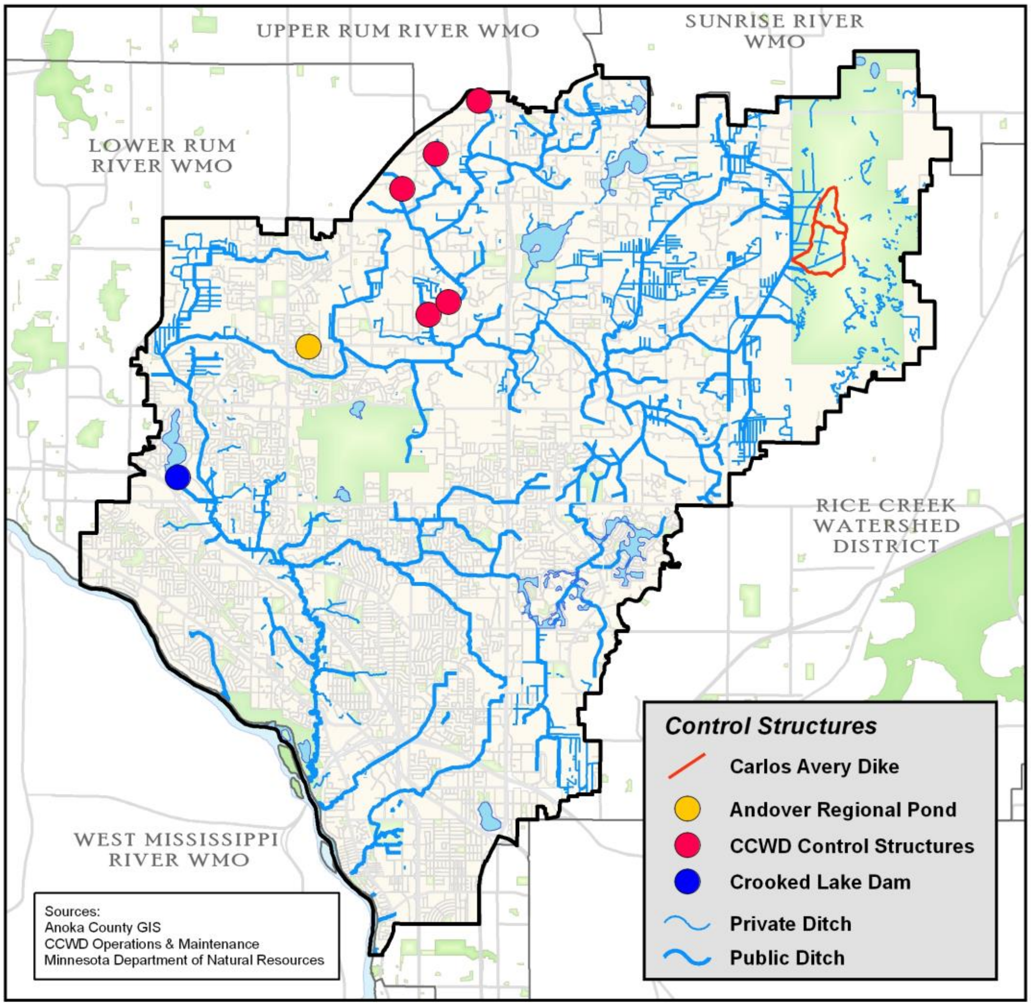
Snowmelt Rapid snow melt can be a source of water volumes beyond the capacity of the drainage system. During the spring when warm days and more direct sunlight are facilitating melt a warm front and or a rain event of relatively warm water can yield and equivalent of 4 or more inches of water resulting in both localized and regional flooding.

Frequency (Yrs)	Annual Probability	2 Day (in)	4 Day (in)	10 Day (in)
5	20%	4.2	4.9	6.3
10	10%	4.8	5.7	7.4
25	4%	5.7	6.6	8.8
50	2%	6.3	7.4	9.8
100	1%	7.0	8.1	10.9

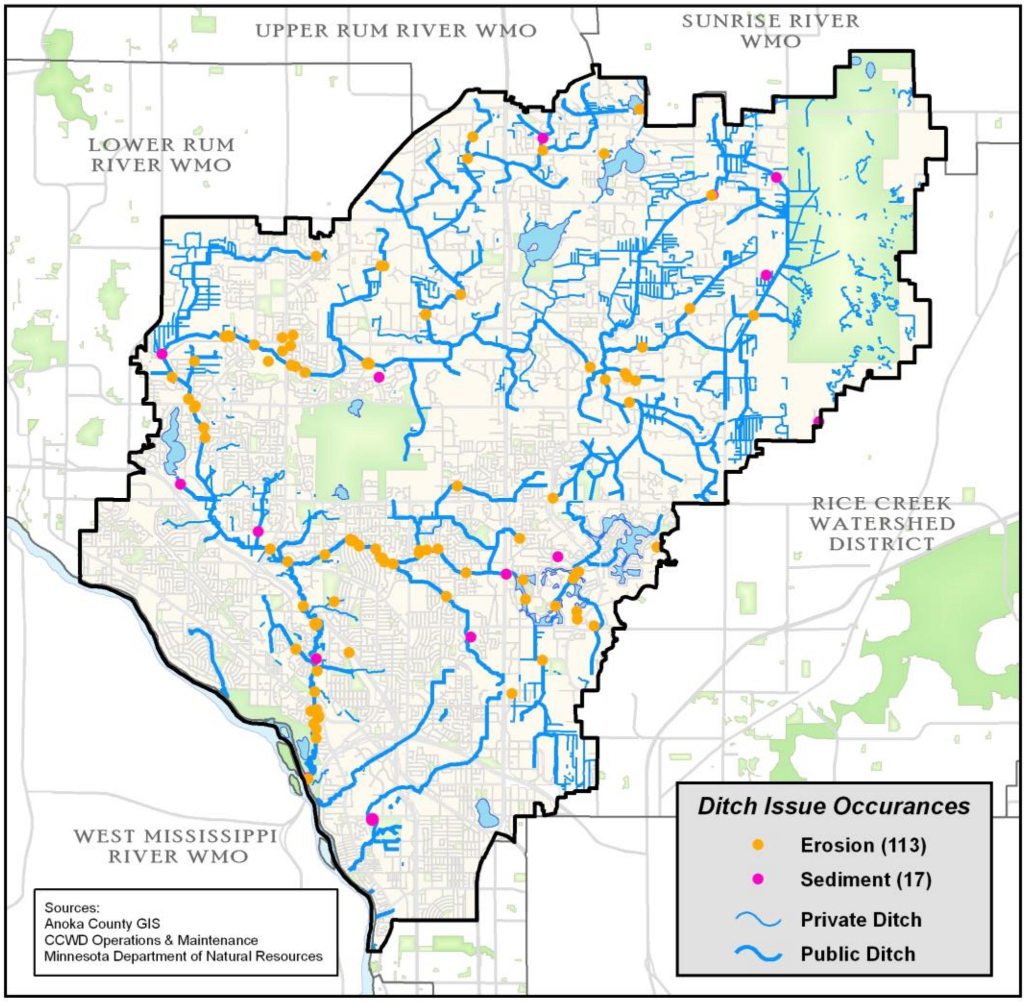
Rises in Groundwater Because of the naturally high ground water levels in the watershed and annual fluctuations of 3 to 5 feet flooding can occur in structures that do not have sufficient separation or are constructed at times when surficial groundwater levels are low.



Sudden Release of Water or Failure of Impoundment Failure of water control structures, levees, retention ponds, or other structures that retain water can lead to localized flooding. There are eight such structures within the watershed.

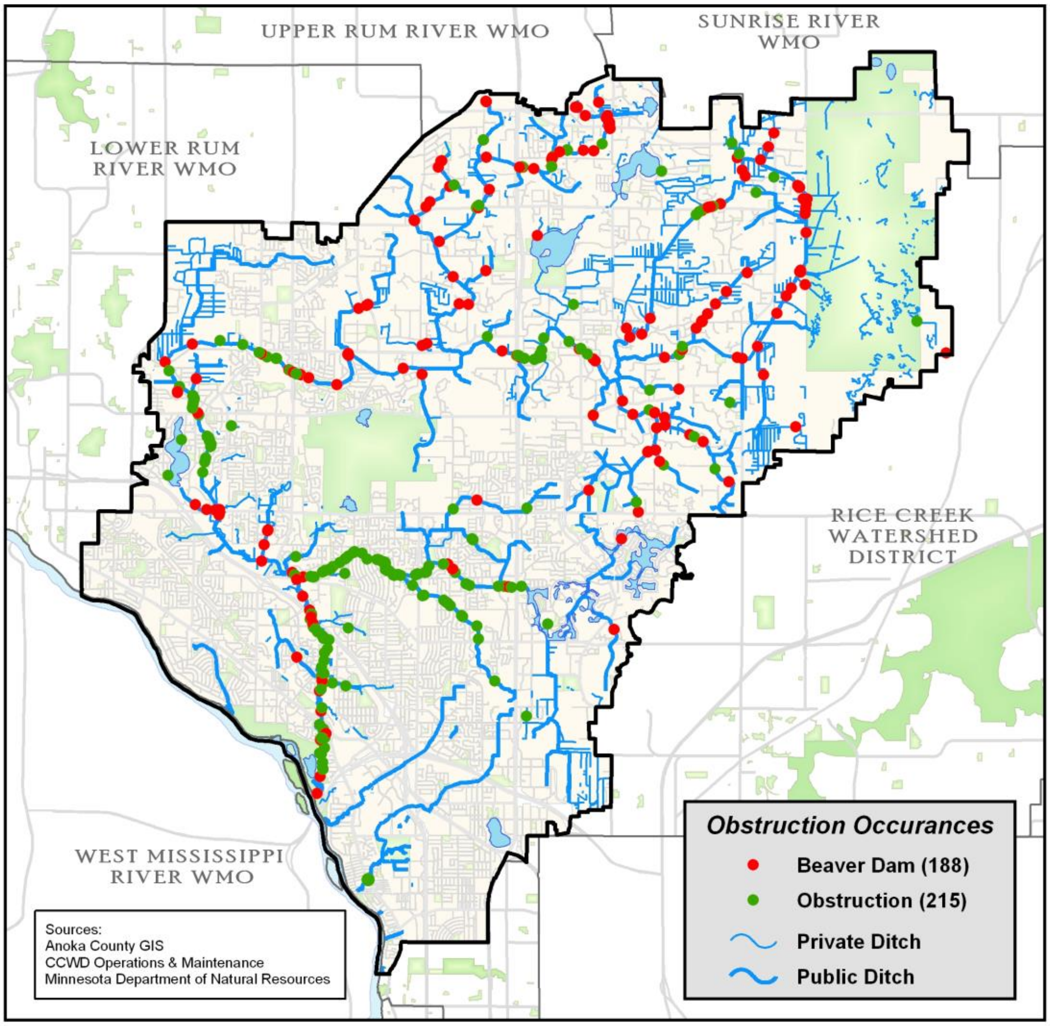


Sediment Buildup in Channel Sediment build up within a channel from either bank failures, erosion up stream or accumulation of bed load, acts to reduce the capacity of the channel and raise the elevation at a point in the flowage. Both situations result in ponding water upstream and require flows to leave the channel at a certain volume (flood) in order to continue downstream.



Obstructions Complete or partial obstruction of an outlet or drainage system due to:

- Culvert blockages from ice build up, or debris
- Trees down in the channel can form dams
- Beaver Dams

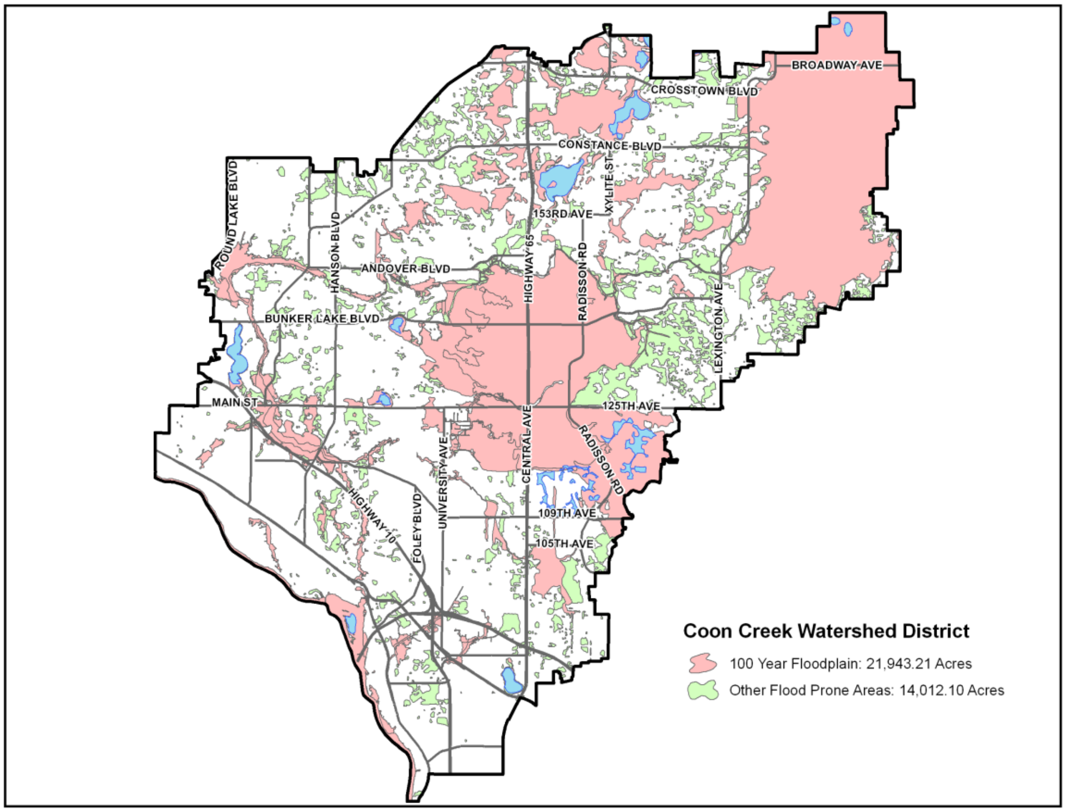


Flood Control Capacity

The Coon Creek Watershed is within the Anoka Sand Plain, an area of relative flat topography and historically high water tables. The result combines to make approximately one half of the watershed flood prone, hence the importance of drainage and maintenance and repair of the drainage system.

Within the Coon Creek watershed there are four strategies employed to control flooding and the impacts associated with floods. The strategies are used in combination to prevent and/or reduce the adverse effects of flooding.

The Federal floodplain maps for the watershed are shown below



Water Level Control

Water level control either through dams (impoundments) or pumps is a time honored flood control strategy. Dams act to hold or store 'excess' water from arriving downstream and either contributing to flood conditions through volume or the time of arrival.

Volume control, primarily through infiltration, is intended to reduce the volume of water flowing into the creek or stream that is subject to flooding.

Rate control is the process of detaining water in a pond or other structure and releasing small enough quantities to achieve essentially the same result as volume control, reduce the amount of water contributing to out of bank flow.

Pumps are typically employed to protect relatively small areas (1 to 10 lots) for discreet periods of time (days to weeks) and are used in conjunction with dikes or some structure such as a road, to separate the structure from the water.

Barriers

Barriers, such as dikes, flood walls or embankments are intended to separate flood prone lands and structures from flood waters which would inundate those areas without the presence of the dike.

Channel Alteration

Altering the creek channel involves modifying the stream channel to speed up or slow down water in order to prevent or reduce flood conditions. Much of the system has already been altered or improved as public ditches, where the channel has been straightened, widened and deepened to facilitate drainage and get water off the land.

The caution of sole reliance on this strategy is the potential to contribute to down stream flooding.

Control Land Use

Floodplain zoning is perhaps the most widely used method to avoid or reduce the damage caused by flooding. Minnesota Statute 103F establishes a comprehensive approach to solving flood problems by emphasizing nonstructural measures, such as

- floodplain zoning regulations,
- flood insurance,
- floodproofing, and
- flood warning and response planning.

By law, Minnesota's flood prone communities are required to:

1. Adopt floodplain management regulations when adequate technical information is available to identify floodplain areas; and
2. Enroll and maintain eligibility in the National Flood Insurance Program (NFIP) so that the people of Minnesota may insure themselves from future losses through the purchase of flood insurance.

At the state level, the DNR has promulgated minimum standards for floodplain management entitled "Statewide Standards and Criteria for Management of Flood Plain Areas of Minnesota" (Minn. Rules 6120.5000 - 6120.6200).

These standards have two direct applications:
1) all local floodplain regulations adopted after June 30, 1970 must be compliant with these standards; and
2) all state agencies and local units of government must comply with Minnesota Regulations in the construction of structures, roads, bridges or other facilities located within floodplain areas delineated by local ordinance.

Local floodplain regulatory programs, administered by county government, predominately for the unincorporated areas of a county, and by municipal government for the incorporated areas of a county, must be compliant with federal and state floodplain management standards.

Both federal and state standards identify the 100-year floodplain as the minimum area necessary for regulation at the local level. These regulations are intended to protect new development and modifications to existing development from flood damages when locating in a flood prone area cannot be avoided.

Current Distribution of Flood Control Efforts

An assessment of how well an area is draining relative to the biogeochemical processes that support a service and an area's service capacity.

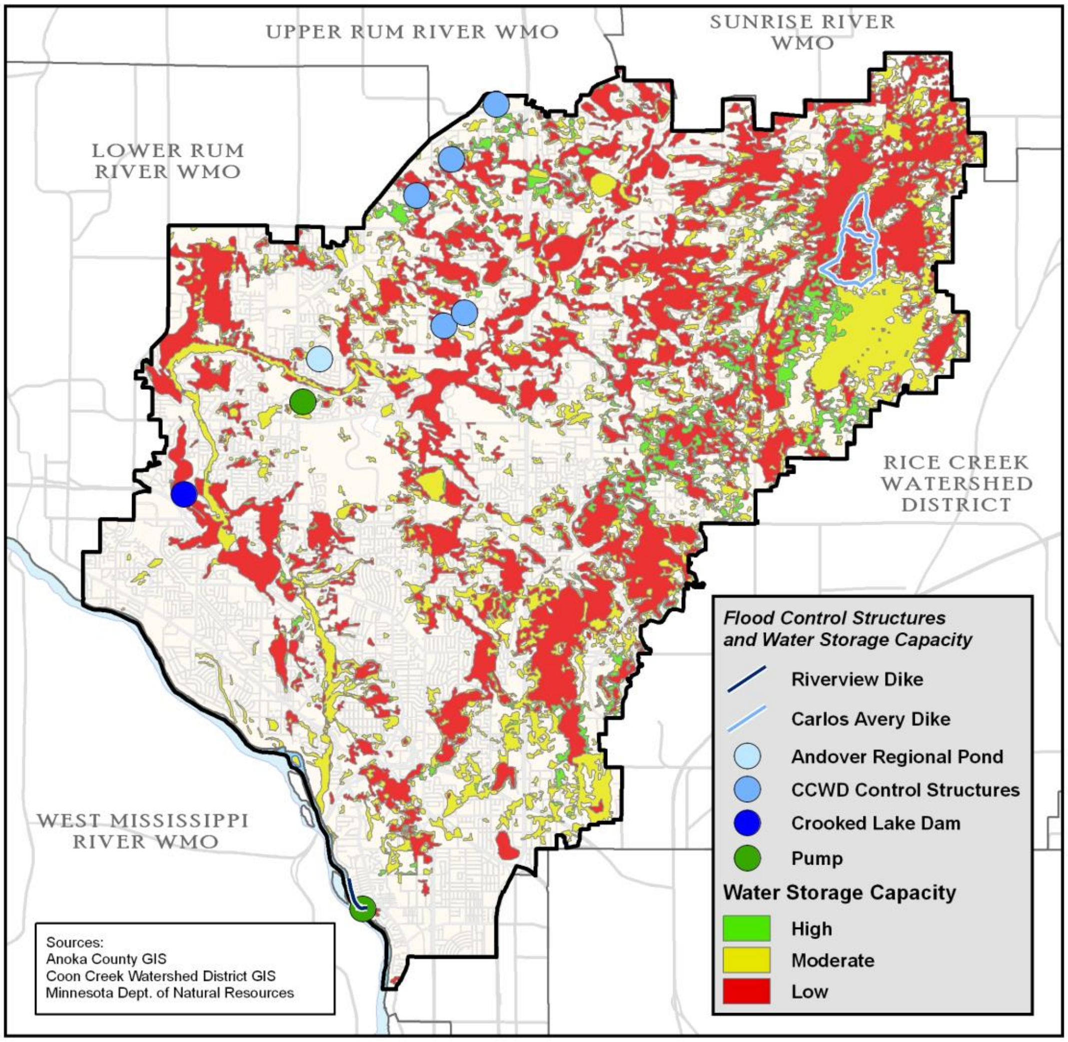
The level of flood control (provision of a beneficial uses, specific benefits and services) reflects the level and type of biogeochemical functions and any other off-site characteristics that either limit or enhance the ability to provide the chosen service. It is in essence a product of the level of function and the service capacity.

Water Control Structures

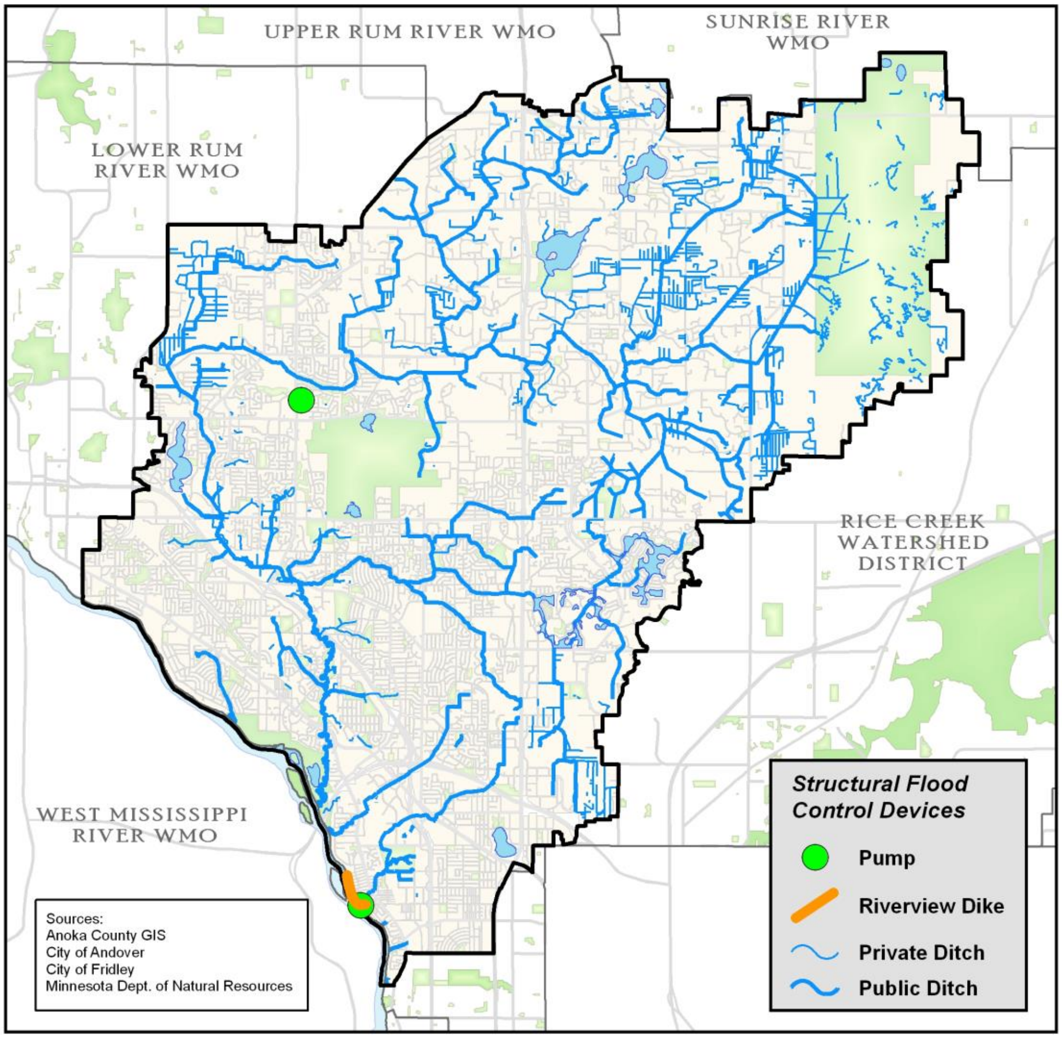
There are two dams, two pumps and hundreds of stormwater ponds designed to retain or detain water in order to reduce downstream peaks or volume of water and thereby reduce water levels associated with flooding.

The retention and detention functions are also achieved through wetlands.

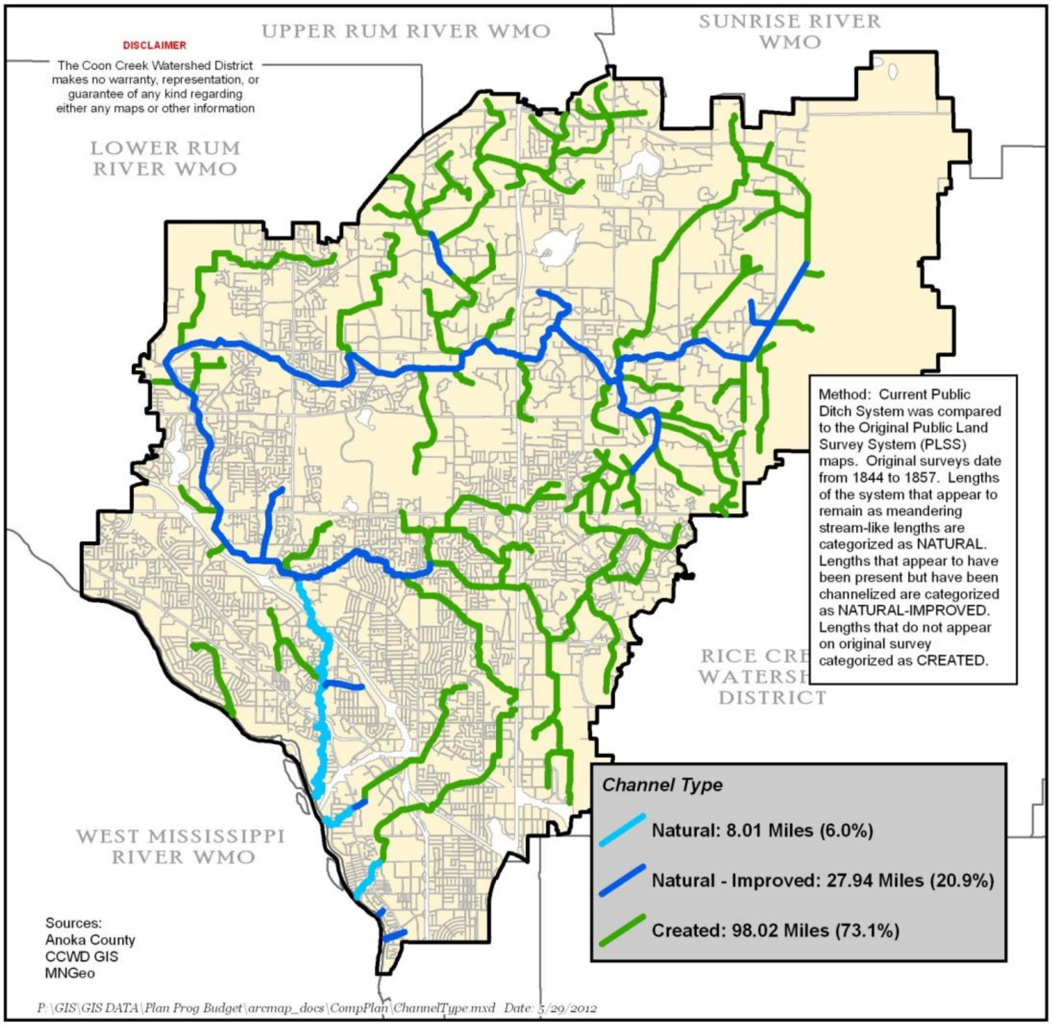
Functional capacity of Wetlands to store storm and flood waters



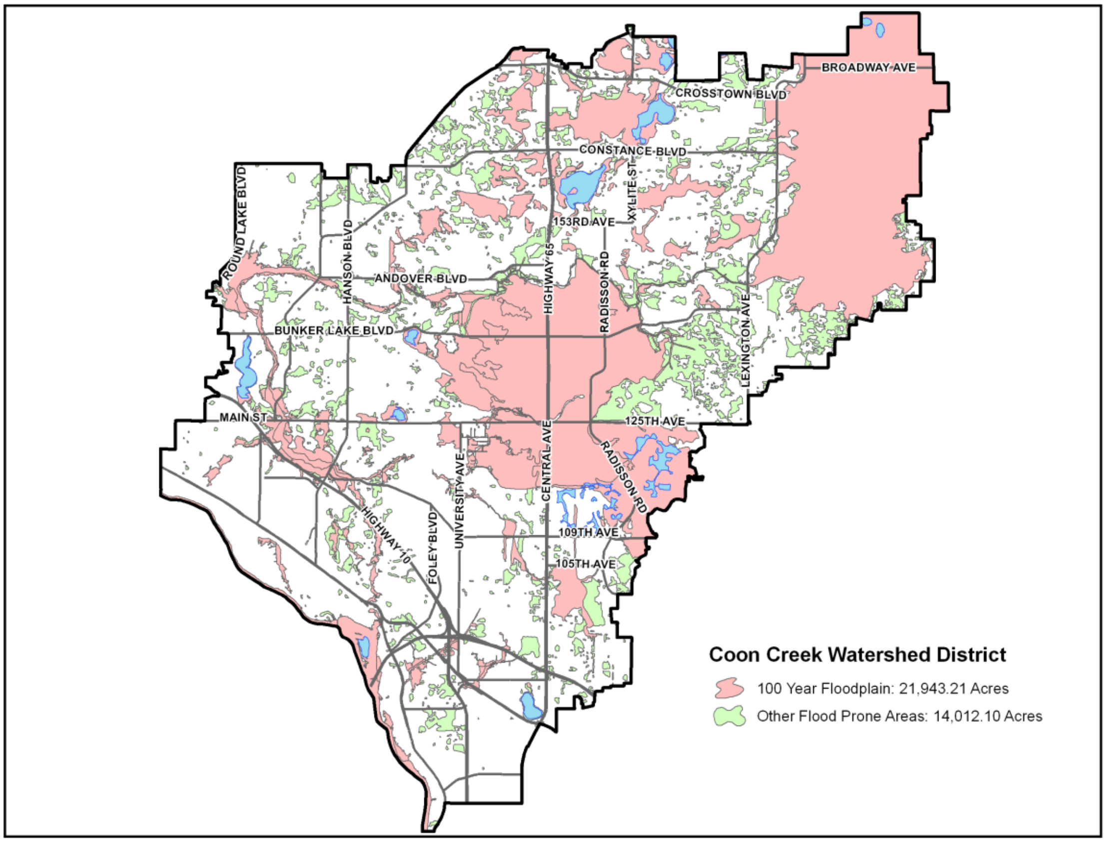
Barriers and Dikes There is only 1 dike within the watershed designed to protect adjacent lands from flooding. The Riverview dike is in Fridley adjacent to the Mississippi river.



Channel Alteration Approximately 134 miles of stream channel have been straightened, deepened and in some cases widened for the sole purpose of moving water to facilitate drainage and discourage flooding.



Land Use Control and Floodplain Zoning



Value of Flood Control

The necessary factors and conditions that affect aggregate demand for a service within the Coon Creek Watershed.

The initial value is based on the expected value per unit of service and is used to modify the level of service.

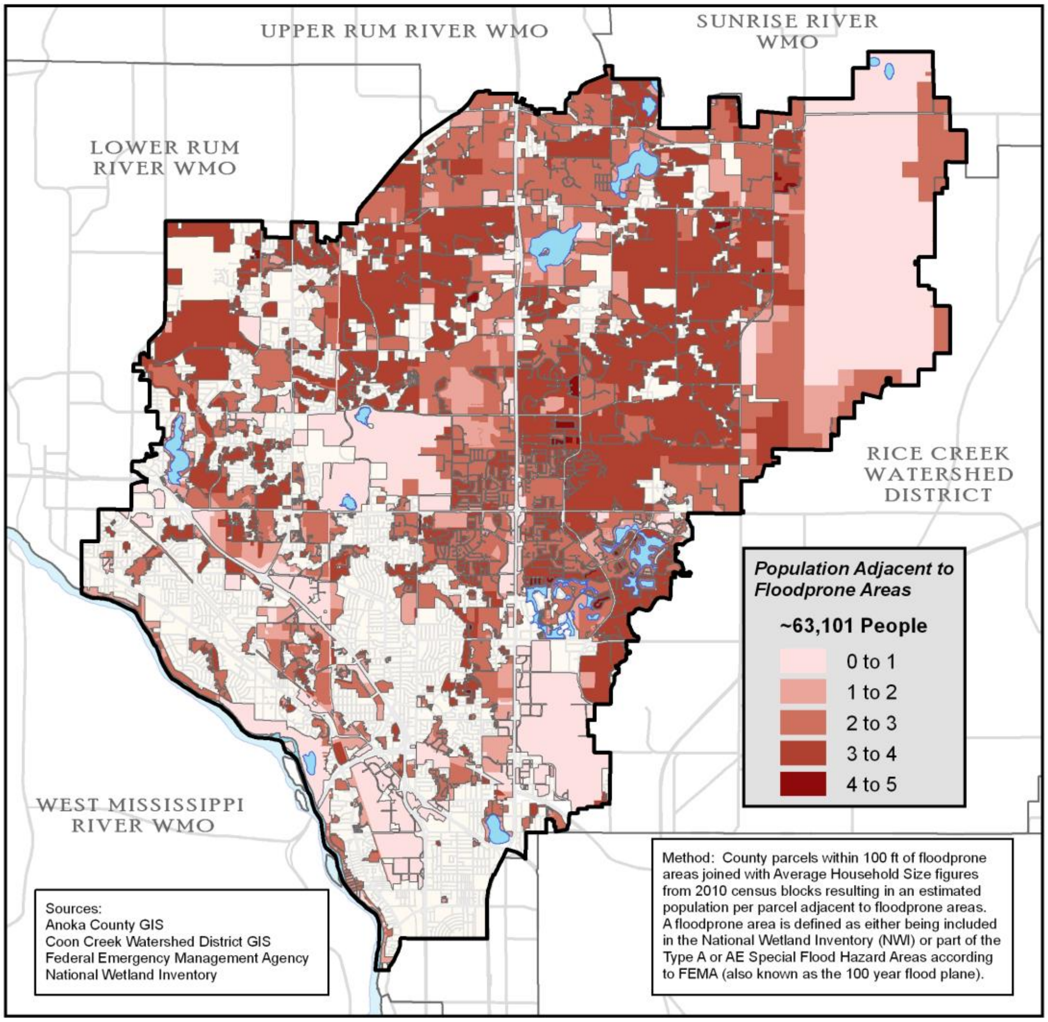
In general the factors that affect aggregate demand for drainage within the Coon Creek Watershed at a particular location include:

1. The number of people with access to the service
2. Their incomes and wealth
3. The cost in time or money of getting and keeping access to the service
4. The availability of perfect or near-perfect substitutes for the service
5. People's expressed or revealed preferences for this service compared with other competing services

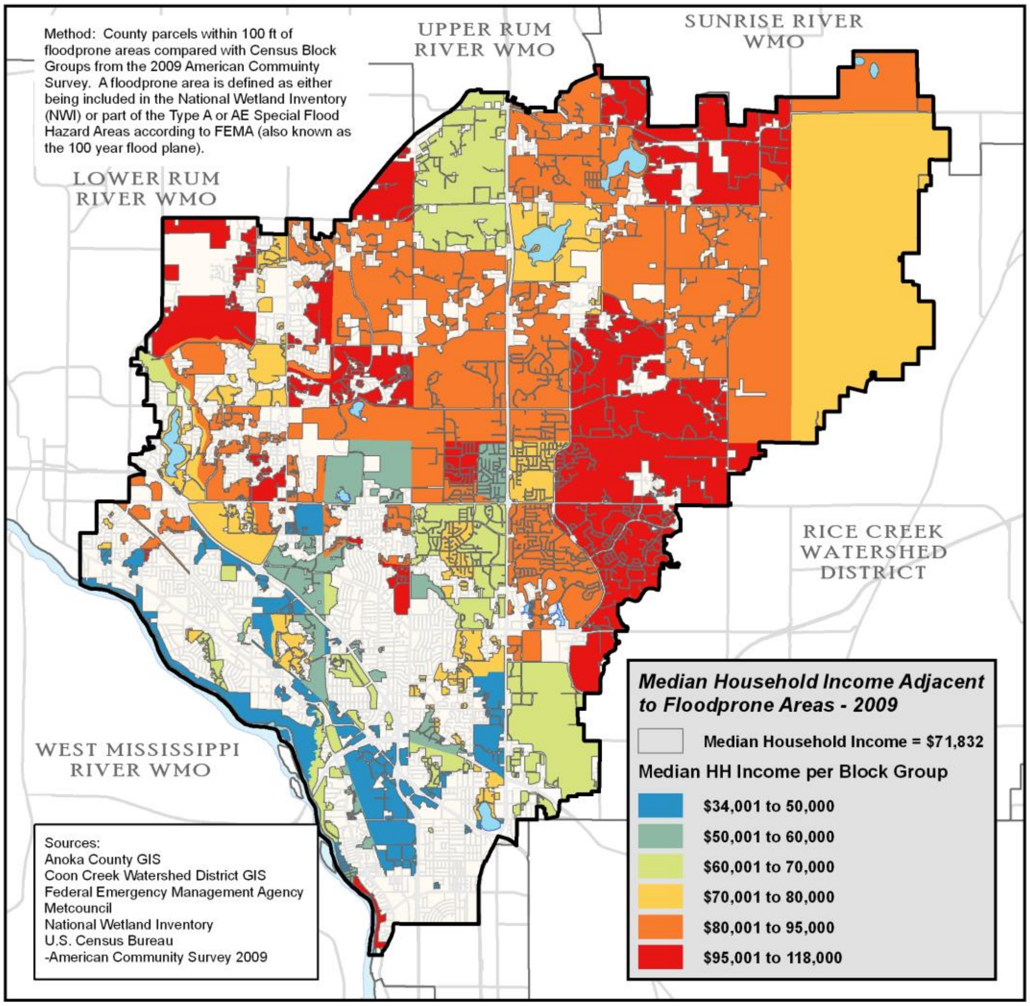
The following factors/conditions will be considered in assessing the value of drainage to a particular area within the watershed.

Population Approximately 63,101 people live adjacent to the flood prone lands. By 2020 that number is expected to be 77,819.

2010 Population adjacent to Floodprone Areas

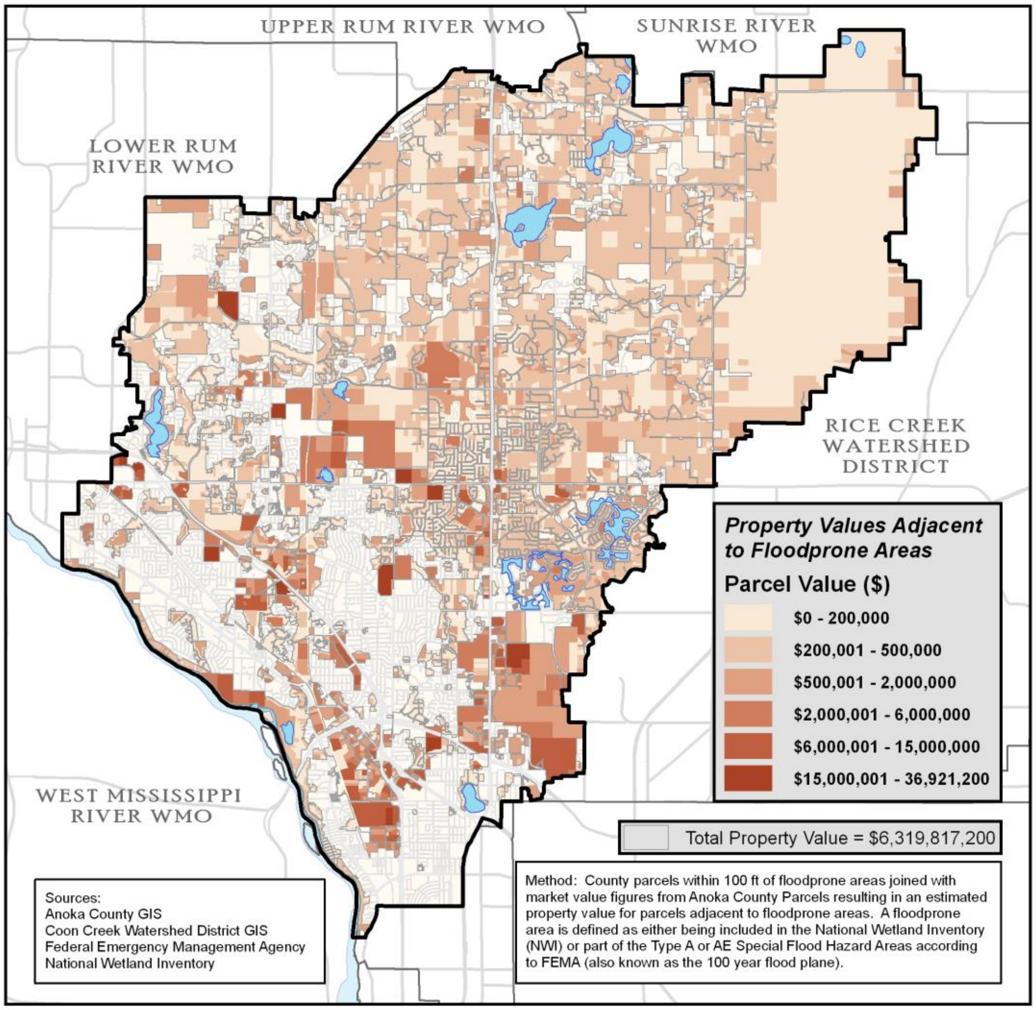


Income Map of income and wealth of property adjacent to flood prone lands



Property Value The total value of flood prone land within the watershed is $6,319,817,200. The average value of flood prone land within the watershed is $141,361 per acre. The average value of non-flood prone land is $296, 365.

Map of value of property adjacent to flood prone lands



Substitutes The only substitutes for flood control would be property that outside the floodplain.

Adoption of Substitutes Adoption of these alternatives lands is a function of cost. Non flood plain land.

The Marginal Value of Flood control The marginal value for flood control remains high. In spite of floodplain regulations and other control efforts, as development has occurred, flooding has become more localized making additional local control efforts that much more valuable.

Risks to Flood Control

Involves an assessment of the exposure and vulnerability of the water and related resource functions for a given time period.

Risks of disruptions to services differ from site to site and are associated with the exposure and vulnerability of the drainage system itself and the vulnerability and exposure of important landscape features that affect the functional capacity of the system. Threats that cause risk can arise from physical, social or managerial actions or processes.

Climate Change (Moderately high probability)

According to the 2003 report on climate change by the Soil and Water Conservation Society, total precipitation amounts are increasing, as are storm intensities in the upper Midwest. In addition, precipitation is projected to increase by around 15% in winter, summer, and fall, with little change projected for spring.

This trend will significantly increase the frequency with in which we receive 4 inch and greater precipitation events and shorten the time in which we would receive that rain.

The result would be increased occurrence of flooding at the local and subwatershed level and rendering water control structures as though they are under sized.

Rises in Surficial Groundwater (Seasonally high probability)

In 2011 the watershed experienced several record setting months for precipitation following a very wet winter and fall. By mid fall surface and groundwater levels were falling rapidly.

The risk of rises in groundwater on a seasonal basis is high, however, permanent rises over the next ten years are low.

Sudden Release of Water from an Carlos Avery WMA (Very Low Probability)

Only Carlos Avery WMA would be capable of a sudden release that could create or contribute to flooding. While at one time, the CAWMA was compelled to release water from pool 13 during high water periods to protect the integrity of the outlet and dike containing the pool, the creation of an armored overflow to the south of the existing outlet to Coon Creek in the 1990's has eliminated, or at least greatly reduced, the need to pull boards from that weir structure to lower the pool was all but eliminated.

Failure of Impoundment Structures

The chance that an outlet structure controlling water levels to decrease peak flows or volume of failing is low.

(Low probability) Most structures only hold back 1 to 3 feet of water, the sudden release of which would attenuate within a mile of flow and would be contained within the channel.

Sediment Buildup and Decrease in Channel Capacity (Very High Probability) Sedimentation and silting in of creek and ditch channels will occur. Creek flows through sand cuts and movement of bed loads will occur in places where flow velocities are in excess of 3 feet per second, and will settle out and accumulate in an over areas where flow velocities drop below 3 feet per second.

The result is a constant and steady 'filling in' of the channel, decreasing the volume of the channel below the banks in the area. The result is either a further slowing down of water upstream and therefore additional deposition of sediment and or localized flooding at ever smaller volumes of water. If the channel is an agricultural drainage ditch, designed to remove water from the soil profile, the time required to drain the rooting zone will increase and flooding and plant stress will result.

Obstructions (Very High Probability) The chance of obstructions occurring within the drainage system and creating flooding is very high.

As precipitation and therefore flows become more volatile, obstruction from tree fall or vegetative litter flushed and accumulating in culverts increases. In addition, with the economic downturn, the incentive to replace culverts with undersized and shorter pipe becomes greater and leads to insufficient flow and increased ease to bury or damage culverts during road maintenance.

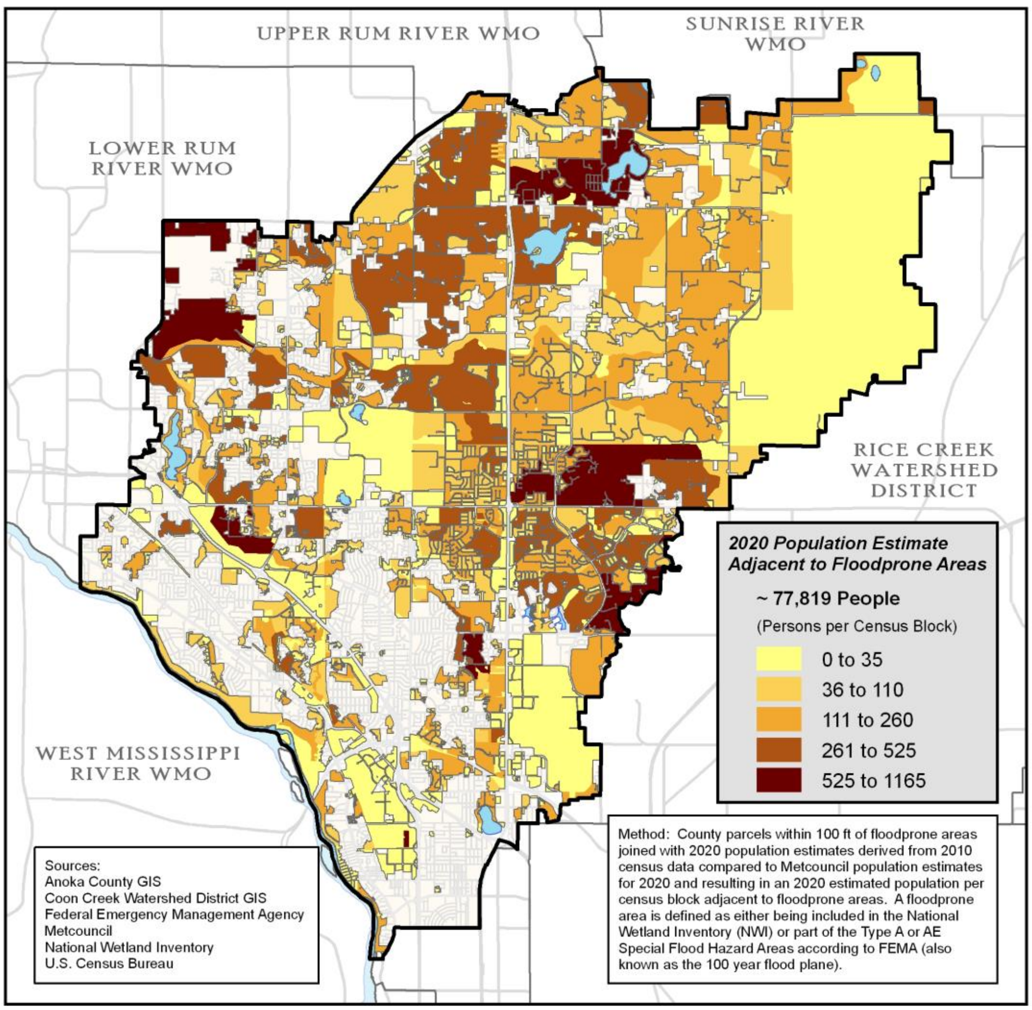
Expected Future of Flood Control

The quantity and quality of flood control in 2020 will depend on:

Population

	2000	2010	2020	Pct Chg
Andover	17,450	21,188	27,188	28%
Blaine	46,845	60,643	71,943	19%
Columbus	479	508	623	23%
Coon Rapids	62,295	65,700	66,000	0%
Fridley	27,449	27,000	26,900	0%
Ham Lake	11,782	15,017	16,686	11%
Spring Lake Park	7,090	6,710	6,710	0%
Total	173,390	196,766	216,050	10%

Projected 2020 Population of Floodprone Lands



Expected Operation and Maintenance of Flood Control Efforts

All lands within the Coon Creek Watershed depend on some form of stormwater drainage facility:

- Drainage Ditches
- Storm Sewer
- Roadside Ditches
- Creeks
- Wetlands Or
- Groundwater through infiltration facilities.

In March 2009 the Coon Creek Watershed District adopted Rules that require all land use modification to use Best Management Practices (BMPs) to reduce flooding. Section 13 of that rule requires maintenance of those facilities.

Effective Operations and Maintenance (O&M) is one of the most cost-effective methods of ensuring reliability, safety and efficiency in the drainage system. Inadequate maintenance of the drainage system and stormwater treatment practices can be a major cause of inadequate performance.

In addition to keeping a site from flooding, properly maintained drainage system can help reduce surface water and groundwater pollution. Stormwater treatment facilities cost many thousands of dollars to install, and require more maintenance than a system of pipe and catch basins.

Stormwater maintenance is necessary to protect streams, lakes, wetlands and groundwater. Proper maintenance helps assure that stormwater conveyance systems:

- Operate as they were designed
- Are cleaned so that area stormsewer are not overwhelmed and become pollutant sources

Expected Risk of Flooding Events

Localized flooding and flash flooding can be expected to increase as a result of increasingly intense and localized precipitation events.

Amount of Flood Prone Land

The amount of flood prone is not expected to change in the next 10 years.

Service Preferences

Reflects the preferences expressed in a survey of citizens, City Engineers and water resource professional conducted in April and May of 2011.

In April and May 2011 29 citizens, engineers from the seven cities within the watershed and water resource professionals who are members of the ‘planning advisory committee’ were administered a paired comparison survey of the beneficial uses of and the demands on water resources.

While Aquatic life was ranked third on the national level, it was ranked 8th by citizens and local professionals and 5th by all water resource professionals.

	Citizens	**City Engineers**	**Water Professionals**	**National**
Drinking water	1	1	1	1
Water Quality	2	2	2	2
Flood Control	**2**	**2**	**3**	**5**
Groundwater Recharge	4	4	4	7
Storm Protection	6	5	6	6
Drainage	5	8	7	8
Aquatic life and recreation	8	8	5	9
Hunting and Fishing	8	8	9	10
Irrigation	9	9	10	4
Livestock and wildlife watering	10	10	8	11
Aesthetics	11	11	11	12
Industrial use and cooling	13	13	12	3

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Demand for Irrigation

Requirements for Irrigation

During most years it is not uncommon for the watershed to receive sufficient rainfall for good plant growth while at other times reduced yields or quality may occur because of water stress from insufficient soil moisture.

Irrigation is the artificial application of water to the land or soil. It is used to assist in the

- Growing of agricultural crops
- Maintenance of landscapes
- Revegetation of disturbed soils in dry areas and during periods of inadequate rainfall.

Irrigation is used to provide a dependable yield every year. It is also used on plants where water stress affects the quality of the plants.

Irrigation Requirement

The irrigation requirement for crop production and landscape maintenance is the amount of water, in addition to rainfall, that must be applied to meet a plant’s evapotranspiration needs without significant reduction in quality or yield.

Irrigation as practiced in the Coon Creek Watershed is "supplemental irrigation" because it is used to augment the rainfall that occurs during the growing season.

Factors Influencing the Need for Irrigation

For irrigation planning purposes, average precipitation during the growing season is not a good yardstick for determining the need for irrigation. Factors which influence the need for irrigation include:

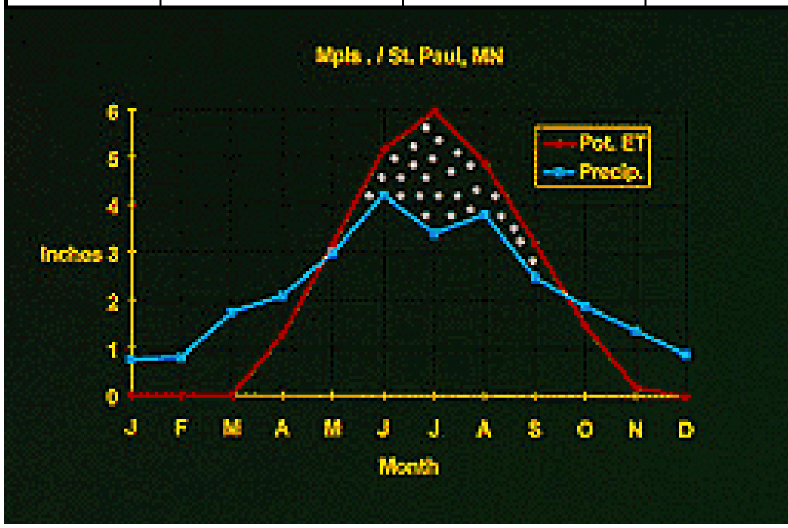
1. The timing and amounts of rainfall during the growing season
2. Influence of other climatic factors
3. The soil's ability to hold water
4. Plant types grown
5. The plant water requirements during different growth stages.

Rainfall During the Growing Season

The agronomic growing season (Period between the last and the first killing frost) within the Watershed District is approximately April 15 to October 15.

Average Growing Season Precipitation & Evapotranspiration

Month	Average Precip. (in)	Thornthwaite PET (in.)	Avg. Precip. minus PET (in)
April	2.6	1.3	1.3
May	3.6	3.6	0.0
June	4.3	4.9	-0.6
July	3.9	5.7	-1.7
August	4.0	4.9	-0.9
September	3.0	3.1	-0.1
October	2.4	1.5	0.9
Total	**23.9**	24.9	-1.0



Other Climatic Factors

A certain pant grown in a sunny and hot environment needs, per day, more water than the same plant grown in a cloudy and cooler environment. There are, however - apart from sunshine and temperature – other factors which influence a plant's water needs. These factors are:

- Humidity
- Wind Speed

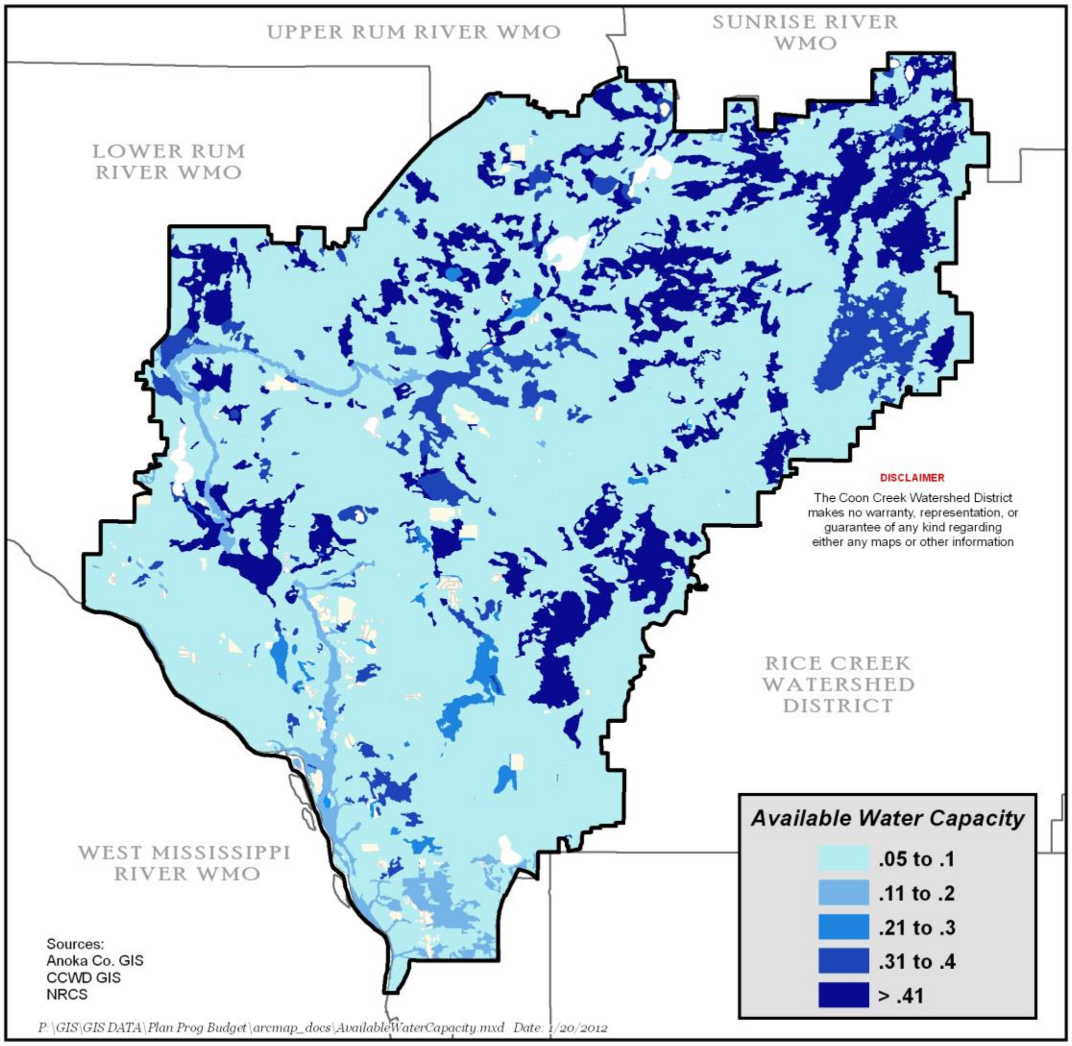
The effect of these four climatic factors on the water needs of plants is shown below:

	Plant Use of Water	
	Low	**High**
Sunshine	Cloudy (no sun)	Sunny (no clouds)
Temperature	Cool (<60°F avg Daily)	Hot (>60°F avg Daily)
Humidity	High (humid)	Low (dry)
Windspeed	Little Wind	Windy

Soil Water Holding Capacity

Available Water Capacity (AWC) is the amount of water available to plants from the time the soil stops draining water to the time the soil becomes too dry to prevent permanent wilting.

The water retention of a soil relates the amount of water retained in a soil to the energy state (potential) of that water. The AWC of the watershed's soils are shown below.



Influence of Plant Growth Stage on the Demand for Water

A fully grown carrot crop, mature lawn or golf course will need more water than plants that have just been planted.

When the plants are small the evaporation will be more important than the transpiration. When plants are fully grown or mature, the transpiration is more important than the evaporation.

Approximate Duration of Growth Stages

	Duration of Growth stages (Days)				
Plant	**Initial**	**Develop**	**Mid-Season**	**Late-Season**	**Total (days)**
Sod	18	37	79	49	183
Vegetables					
Carrots	20-25	30-35	30-70	20	100-150
Corn	20	25-30	25-50	10	80-110
Potato	25-30	30-35	30-50	20-30	105-145
Radish	5-10	10	15	5	35-45
Landscape	20-25	35	45	25	125-130
Trees	18-20	37-39	79-85	49-53	183-197

Influence of Plant Types Grown on Seasonal Water Needs

The plants grown within the District have an influence on:

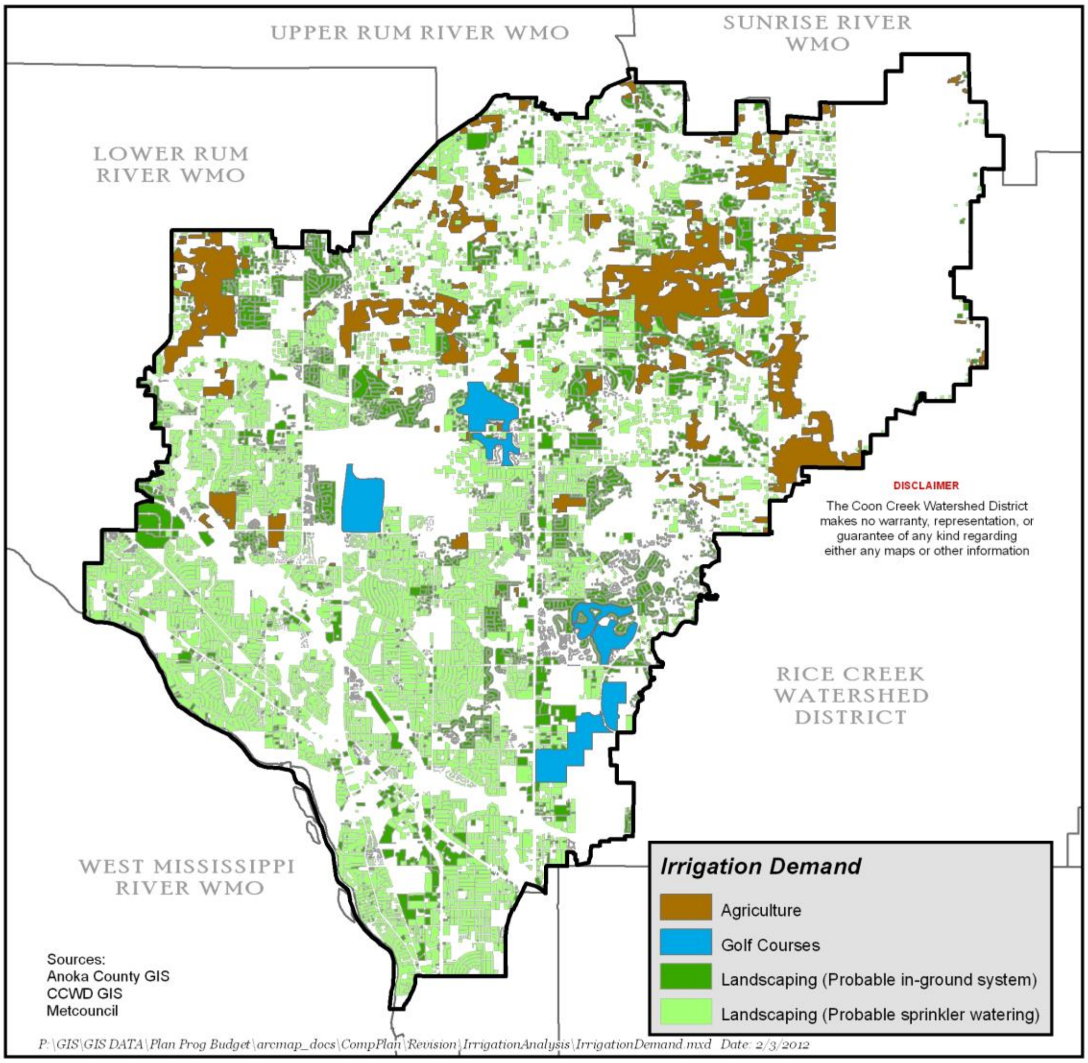
1. Daily water needs
2. Seasonal water needs

The agronomic growing season (period between the last and the first killing frost) within the Watershed is approximately 183 days (April 15 to October 15.).

	Seasonal Plant Water Needs (in/day)			
Plant	**Initial**	**Develop**	**Mid-Season**	**Late-Season**
Sod	0.1	0.3	0.6	0.4
Vegetables				
Carrots	0.8	1.5	2.0	1.0
Corn				
Potato	1.2	1.4	1.4	1.0
Radish				
Landscape	0.3	0.5	1.1	0.7
Trees	0.3	0.5	1.1	0.7

Irrigation Potential Assessing the irrigation potential of the watershed, based on soil and water resources, can only be done by assessing the quantity of water necessary for plant and crop growth.

Areas of Potential Plant Irrigation Needs



Plant Water Needs The approximate seasonal water needs of major plant crops growing in the watershed are:

	Seasonal Plant Water Needs	
Plant/Crop	**Inches of Water/ Growing Period**	**Feet of Water/ Growing Period**
Sod	22 – 59	1.8 - 5
Vegetables		
Carrots	15 – 40	1.3 – 3.3
Corn	12.5 – 33.4	1.0 – 2.8
Potato	16.5 – 44.0	1.4 – 3.7
Radish	4.3 – 11.5	0.4 – 1.0
Landscaping	17.0 – 48.0	1.4 – 3.7
Nursery/Trees	17.0 – 48.0	1.4 – 3.7

Irrigation Water Requirements Irrigation water requirement is the quantity of water necessary for crop growth.

	Seasonal Plant Water Needs	
Plant/Crop	**Feet of Water/ Growing Period**	**Thousands Acre Feet of Water/ Growing Period**
Sod	1.8 - 5	4.8 - 13.5
Veg		
Carrots	1.3 – 3.3	3.0 – 7.6
Corn	1.0 – 2.8	2.3 – 6.5
Potato	1.4 – 3.7	3.2 – 8.6
Radish	0.4 – 1.0	2.8 – 6.9*
Landscaping	1.4 – 3.7	9.0 – 23.8
Nursery/Trees	1.4 – 3.7	20.1 – 53.2
* Assumes multiple crops in one year		

Water Loss and Irrigation Efficiency Information on irrigation efficiency is necessary to calculate Total Water Requirement, which is the quantity of water to be applied, taking into account water losses.

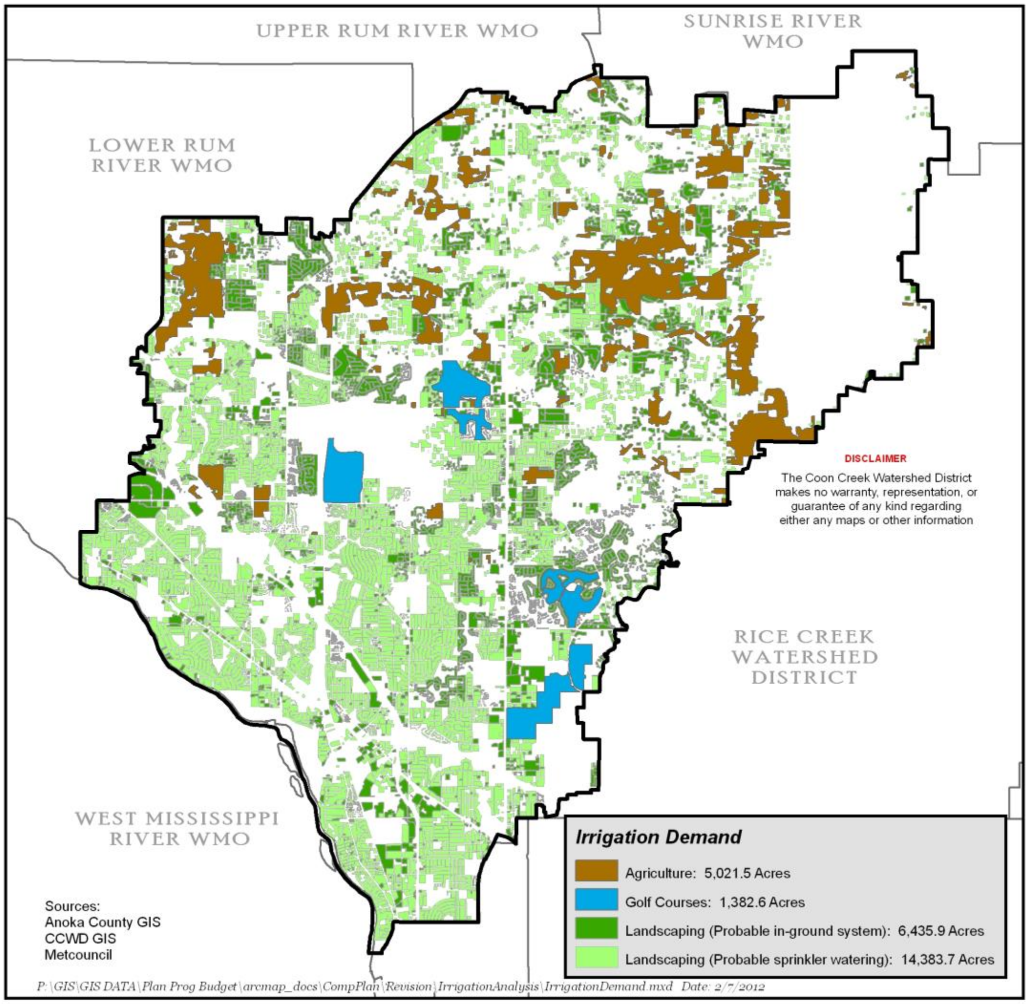
Irrigation efficiency is defined in terms of

1. Irrigation system performance
2. The uniformity of water application
3. The response of the crop/plants to irrigation

	Percent Efficiency (%)		
Method	**Average**	**Range**	**Attainable**
Sprinkler			
Periodic move	75	60-85	80
Side Roll	75	60-85	80
Moving big gun	65	55-75	75
Center Pivot			
Impact heads w/ end gun	80	75-90	85
Spray heads w/o end gun	90	75-90	95
Lateral Move			
Spray heads w/ hose feed	90	75-95	95
Microirrigation			
Surface drip	90	70-95	95
Microspray	85	70-95	95
Water Table Control			
Surface ditch	65	50-80	80

Total Water Requirement Multiplying TWR by the area that is suitable for irrigation gives the total water requirement for that area.

Land Uses Potentially Needing Irrigation



Level of Irrigation

Water supply is the heart of any irrigation development. The degree to which water can be made available is a function of the following:

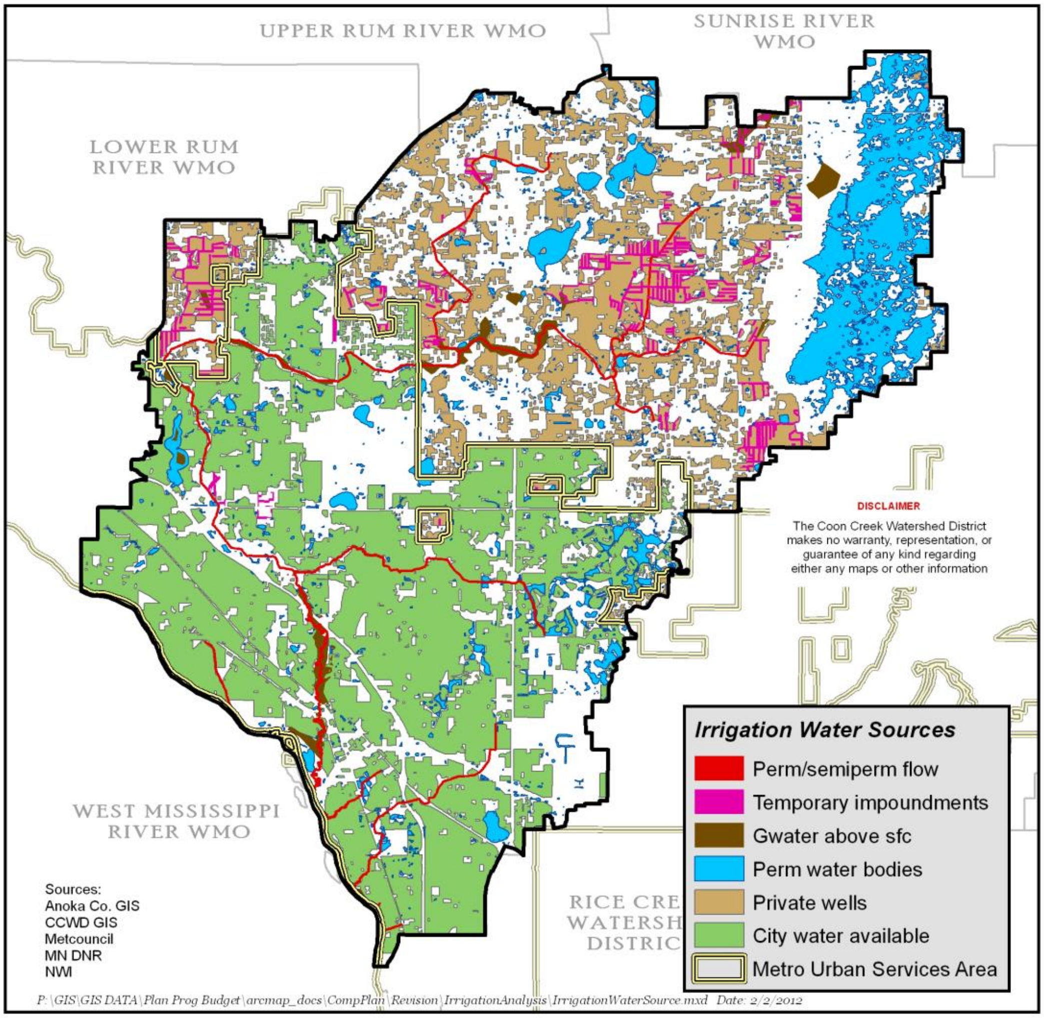
Water Source	Need
Surface	Sufficient water available during the summer months.
Ground	The depth, availability and recovery time need to known.

Irrigation within the Coon Creek Watershed has four main sources:

- Groundwater
- Ditches

- Ponds
- Municipal Water Supply

Availability of Irrigation Water sources



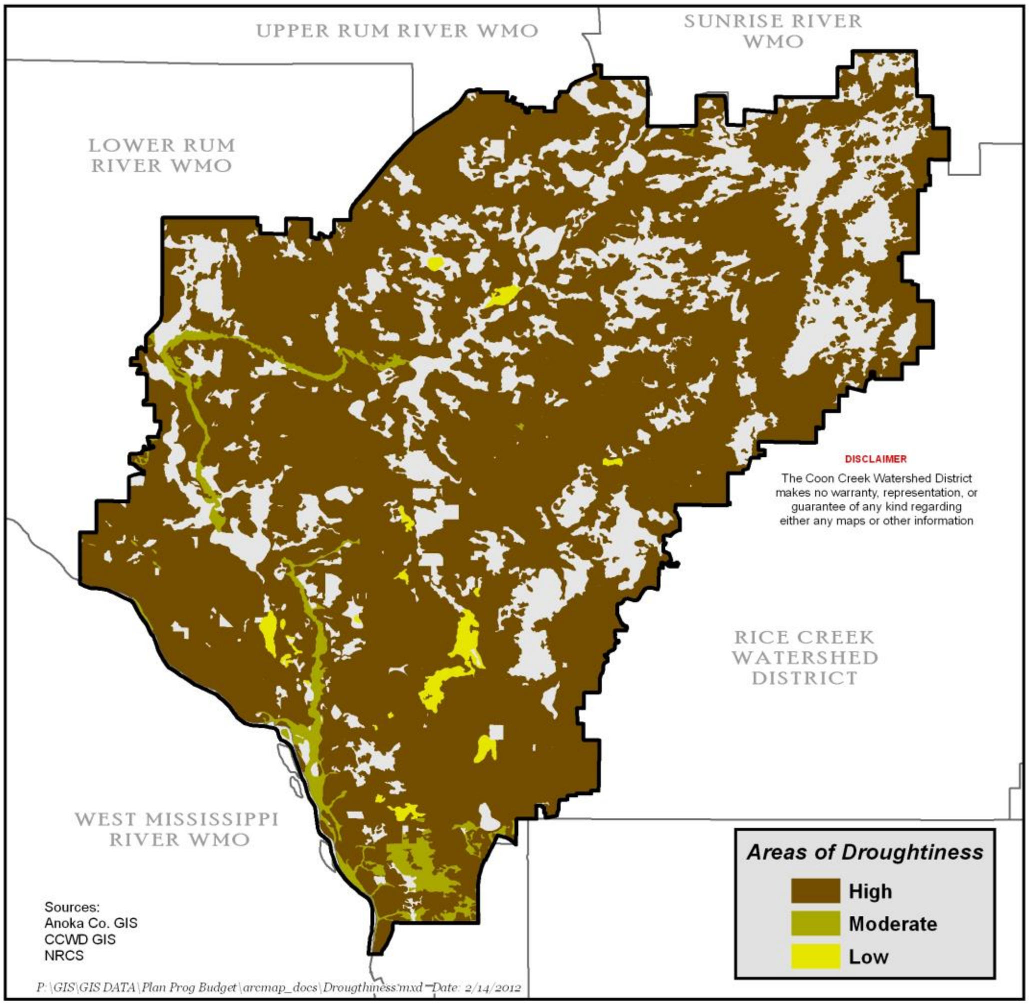
Acres Irrigated

Use	Acres	MGY*
Agriculture	5,022	166
Golf Courses	1,383	500
Landscaping	20,820	150

Value of Irrigation

The factors that contribute affect the aggregate demand for irrigation within the Coon Creek Watershed are:

Acres of Droughty Soils

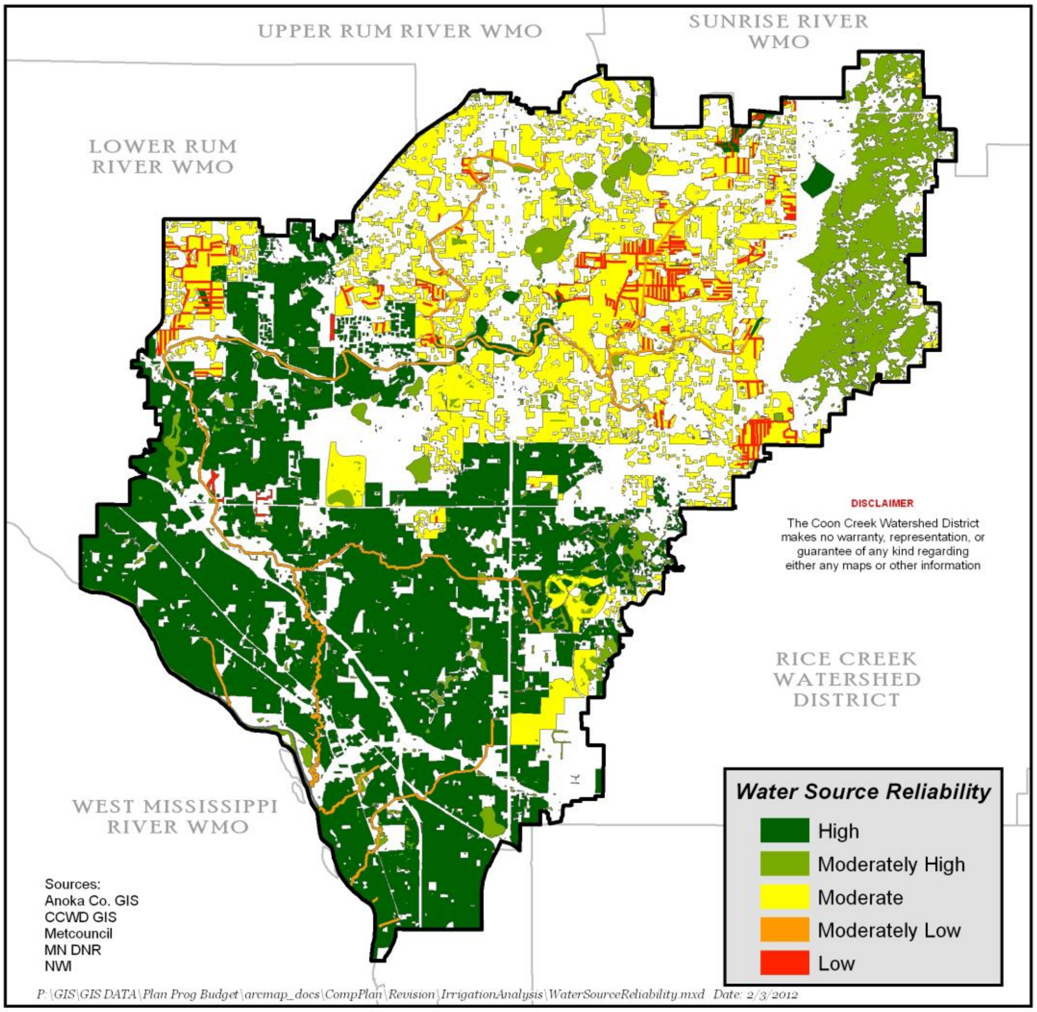


Acres Irrigated

Use	Acres	MGY*
Agriculture	5,022	166
Golf Courses	1,383	500
Landscaping	20,820	150

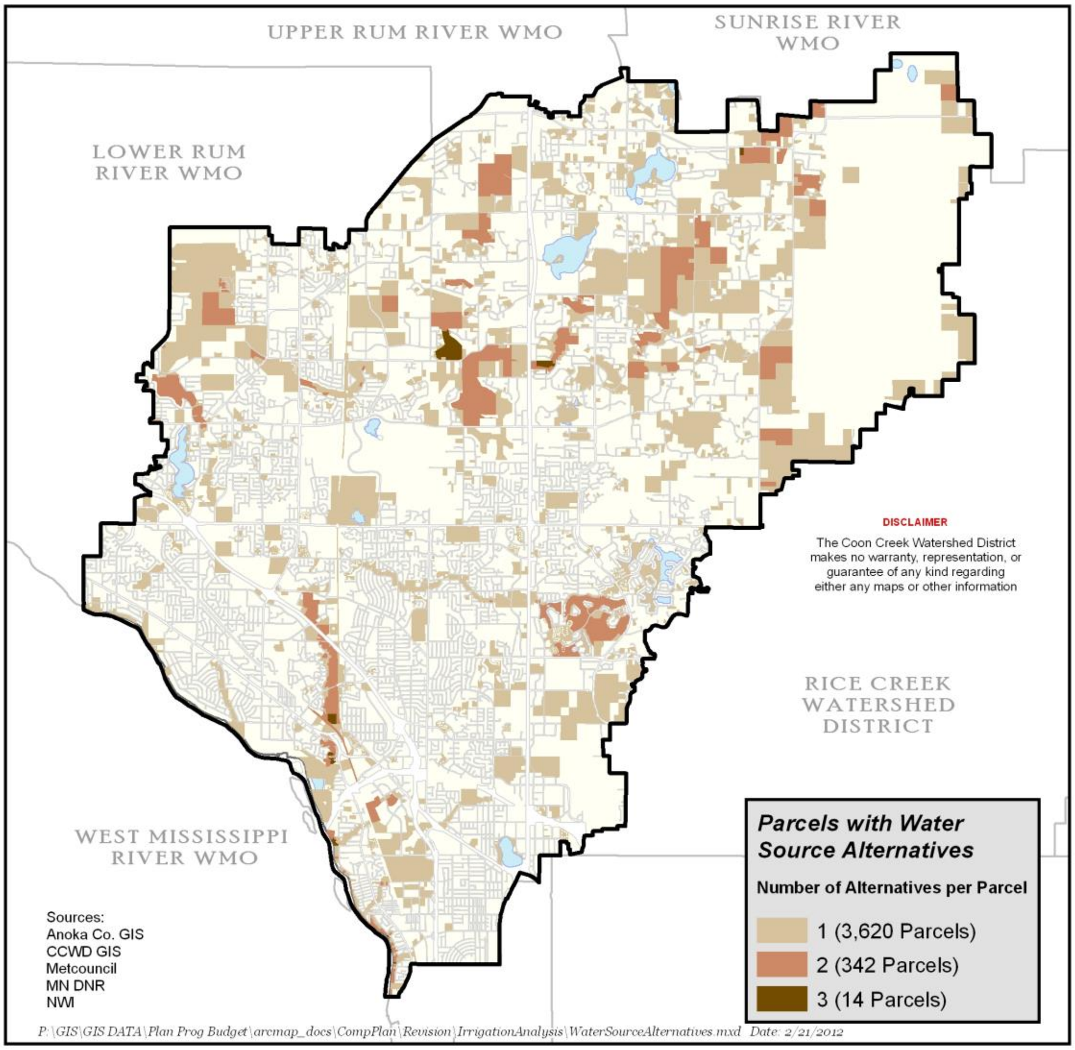
*** Three year average (2006-08) of DNR permitted appropriations**

Reliability of Water Source



Alternatives/ Substitutes

Areas with alternatives or substitutes (such as ponds, impoundments or ditches) for irrigation water are shown below. The vast majority of the watershed relies on a single source (typically municipal or private wells).



Risks to Irrigation

Risks of disruptions to irrigation differ from site to site and are associated with the exposure and vulnerability of the water supply and the vulnerability and exposure of important landscape features that effect the functional capacity of the system. Threats that cause risk can arise from physical, social or managerial actions or processes.

Groundwater Depletion

Due to over pumping, over-use or general declines in water table elevation. In any case the volume of water removed is greater than the volume recharged to the system.

Curtailment of Appropriations to Protect Minimum Flows

Coon Creek has a protected or minimum flow below which the MDNR has the power to cease all appropriations which may affect the water supply needed to maintain or protect that flow.

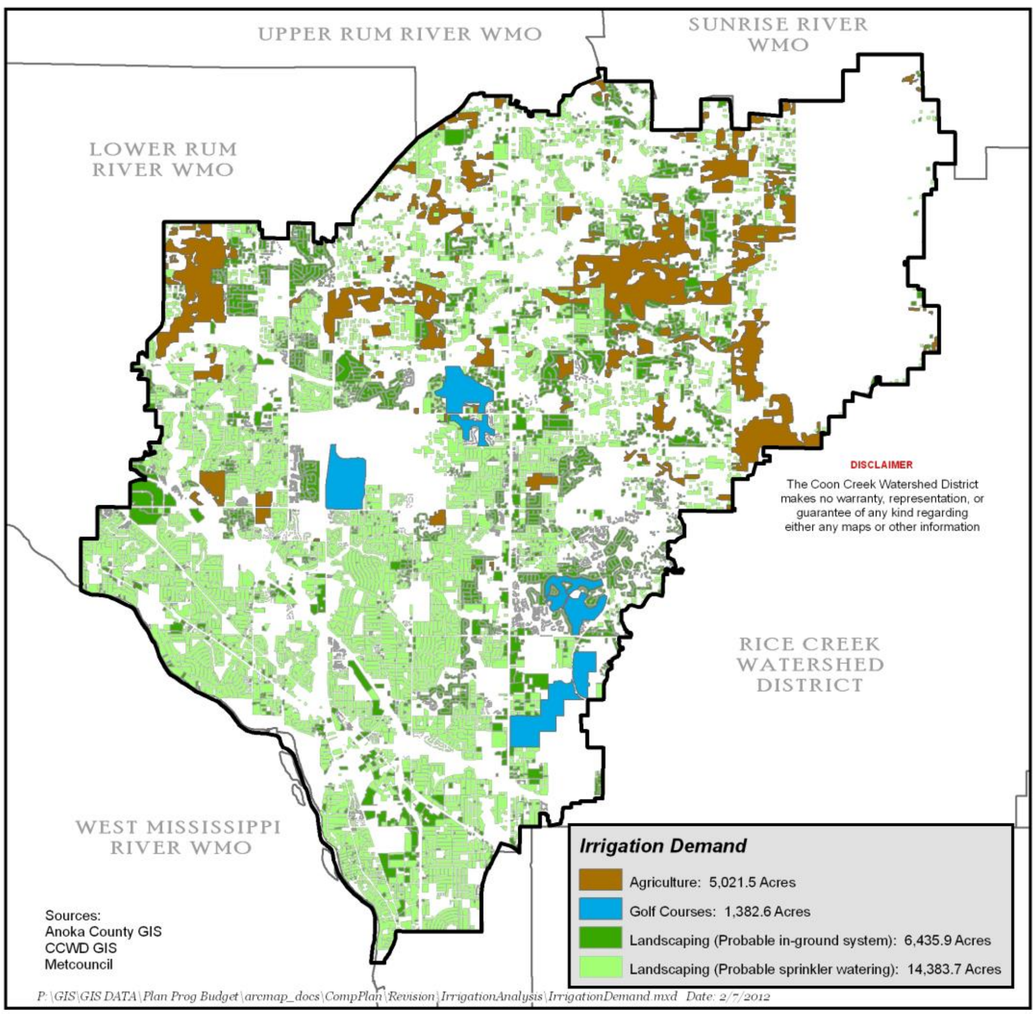
Expected Future of Irrigation

Population

	2010	2020
Agriculture	2,744	2,716
Golf Courses	810	810
Landscaping: In-ground System	18,791	18,920
Landscaping: Probable Sprinkler Watering	67,891	67,891

Projected Demand for Irrigation Water

Use	2010 MGY	2020 MGY
Agriculture	166	163
Golf Courses	500	500
Landscaping	150	165



Expected

Externalities

Competition with Surface Water Uses Due to pumping rates and or volumes which effectively lower the water supply to surface waters such as lakes and wetlands.

Ground Subsidence The use of lowlands, such as organic flats and peat bogs requires drainage. The resulting aeration of the soil leads to the oxidation of its organic components, such as peat, and this decomposition process may cause significant land subsidence.

This decomposition applies especially when ground water levels are periodically adapted to subsidence, in order to maintain desired unsaturated zone depths, exposing more and more peat to oxygen. In addition to this, drained soils consolidate as a result of increased effective stress. In this way, land subsidence has the potential of becoming self-perpetuating; having rates up to 5 cm/yr.

Water management used to be tuned primarily to factors such as crop optimization but, to varying extents, avoiding subsidence has come to be taken into account as well.

Service Preferences

Reflects the preferences expressed in a survey of citizens, City Engineers and water resource professional conducted in April and May of 2011.

	Citizens	**City Engineers**	**Water Profession als**	**National**
Drinking water	1	1	1	1
Water Quality	2	2	2	2
Flood Control	2	2	3	5
Groundwater Recharge	4	4	4	7
Storm Protection	6	5	6	6
Drainage	5	8	7	8
Aquatic life and recreation	8	8	5	9
Hunting and Fishing	8	8	9	10
Irrigation	**9**	**9**	**10**	**4**
Livestock and wildlife watering	10	10	8	11
Aesthetics	**11**	**11**	**11**	**12**
Industrial use and cooling	13	13	12	3

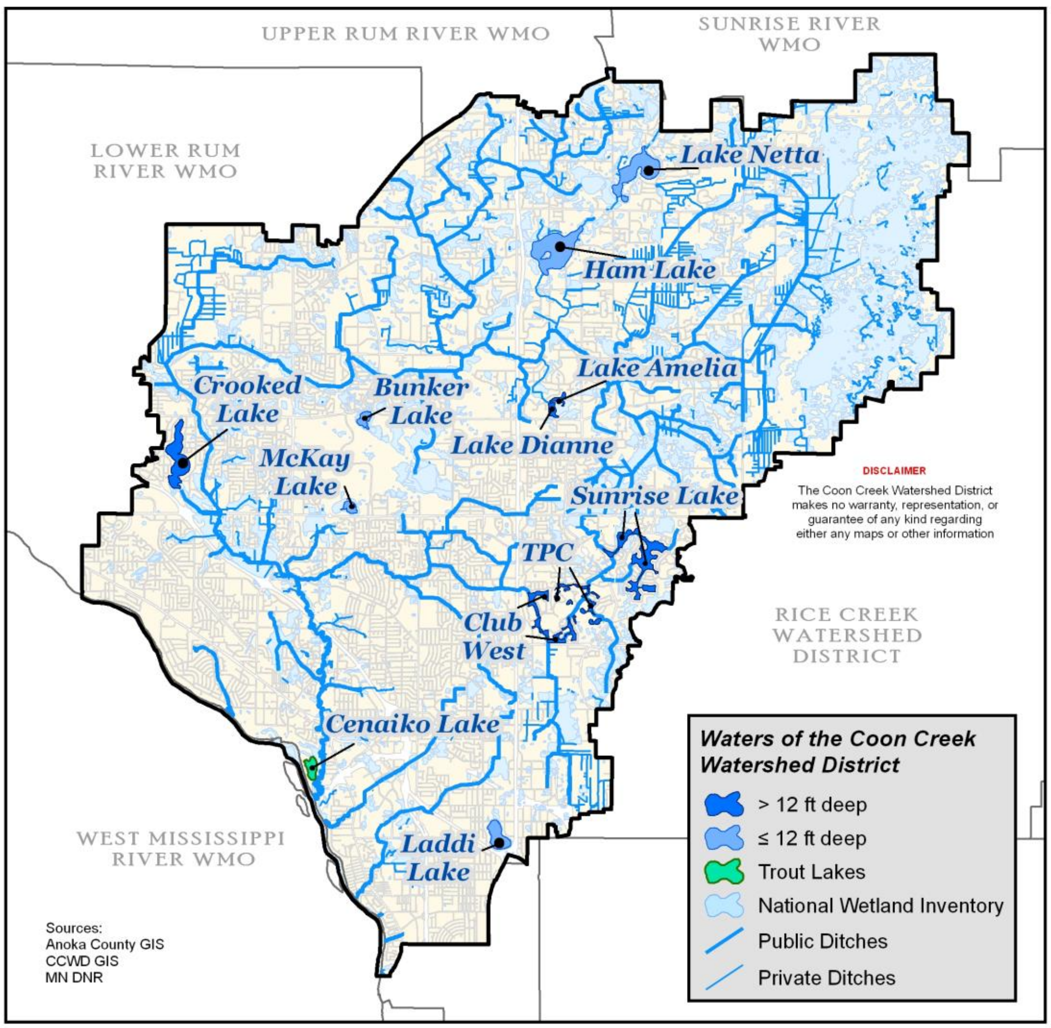
Demand for Water Quality

Water Quality Goals and Standards

Water quality goals and standards apply to a variety of water resources. Within the Coon Creek Watershed those resources and the amount within the watershed are:

Resource	Amount	Unit
Streams and Ditches	250	Miles
Deep Lakes (>12 Ft)	347	Acres
Shallow Lakes & Wetlands (<12 Ft)	15,508	Acres
Trout Lakes	29	Acres

Water Resources within the Watershed



General Groupings of Water Quality Concerns

Water quality issues, standards and management efforts are often organized around general groups of pollutants and concerns. This plan will address pollutants as follows:

- Sediment
- Nutrients
- Oxygen Demanding Substances
- Bacteria
- Chloride
- Water volume
- Aquatic Habitat

Water Quality Standards

Standards

Pollutant	**Streams**	**Deep Lake**	**Shallow Lakes & Wetlands**	**Trout Lake**
Sediment, Clarity	14 mg/L	3.3 Ft		4.6 Ft
& Turbidity	25 NTU			10 NTU
Nutrients				
Phosphorus	130 ug/L	40 ug/L	60 ug/L	20 ug/L
Nitrogen				10 mg/L
Oxygen Demanding Substances (DO)	5 mg/L Average daily minimum			
Bacteria	126 organisms /100 ml			
Chloride	230 mg/L			
Water Volume **(storm bounce & hydroperiod)**	1988 Volumes			
Highly Susceptible			No Chng	No Chng
Moderately Susceptible			0.5 ft	
Slightly Susceptible			1 ft	
Least Susceptible			No limit	
Biological Diversity				

Water Quality Capacity

There are three principle aspects of the biogeochemical processes that most substances must go through to become pollutants:

1. Availability
2. Detachment
3. Transport

Interrupting this process at any point will prevent a substance from being delivered to a receiving water. Some substances are more readily controlled at one step in the delivery process than another. Understanding this process and the characteristics of the pollutants helps to target best management practices to prevent delivery most effectively.

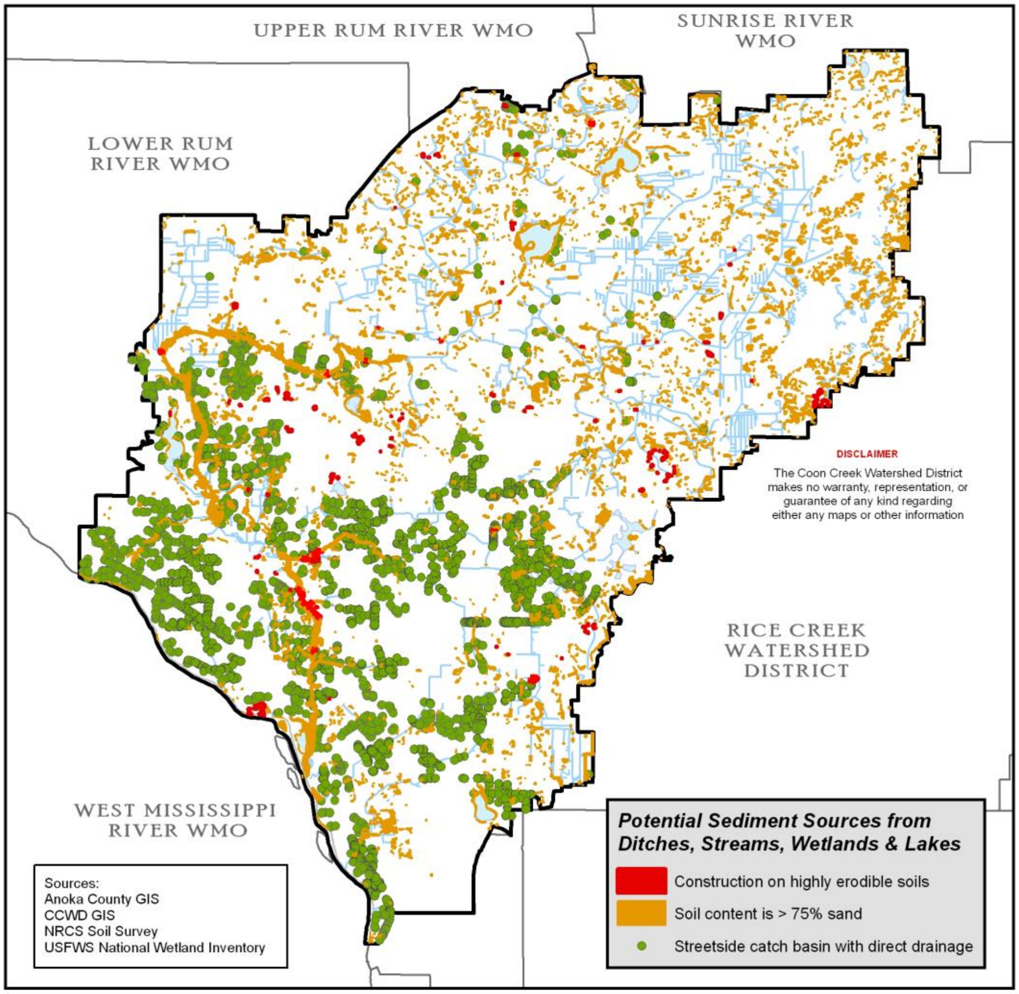
Availability

Obviously a material must be available before it can become a pollutant. The quantity of a material in the environment and its characteristics determine the degree of availability. In a watershed, the quantity of a certain pollutant in the environment is a function of the type and intensity of the land use within the drainage area.

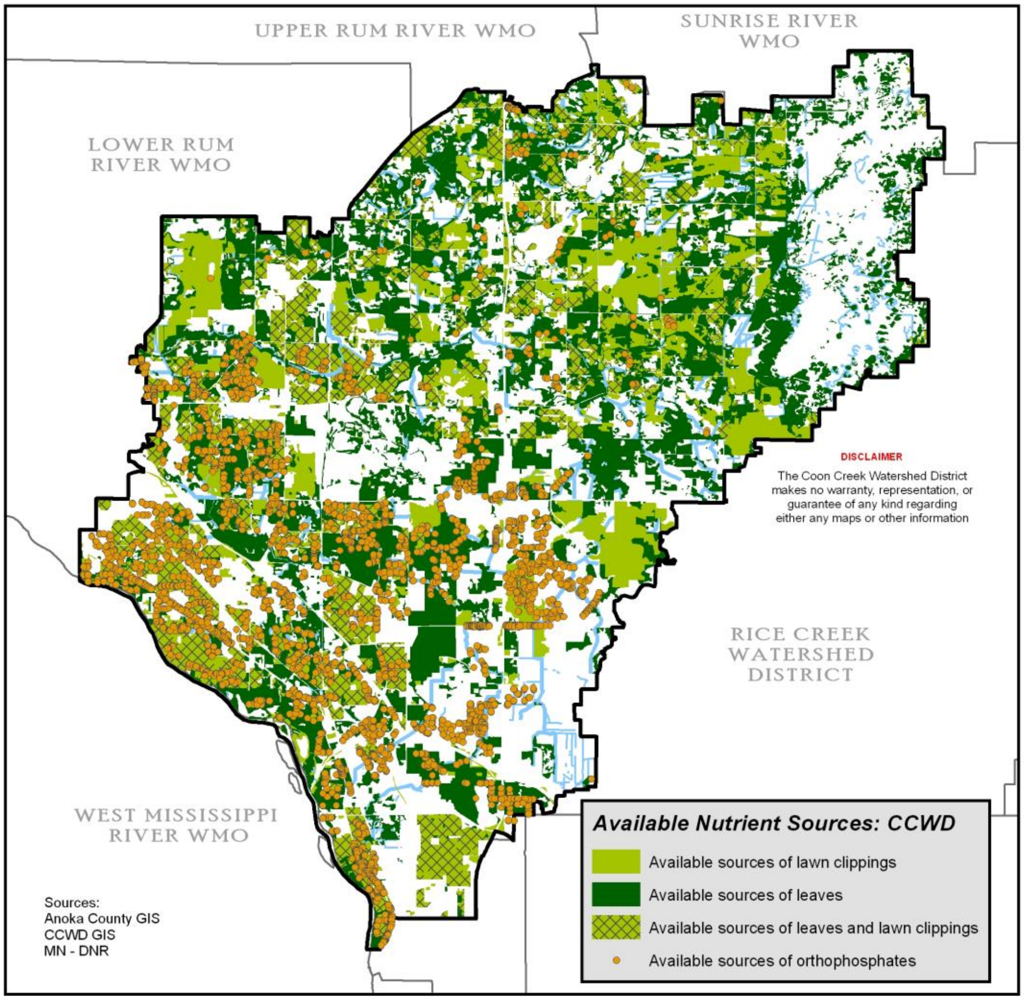
Available Sediment Sources

The major pollutants of concern are:

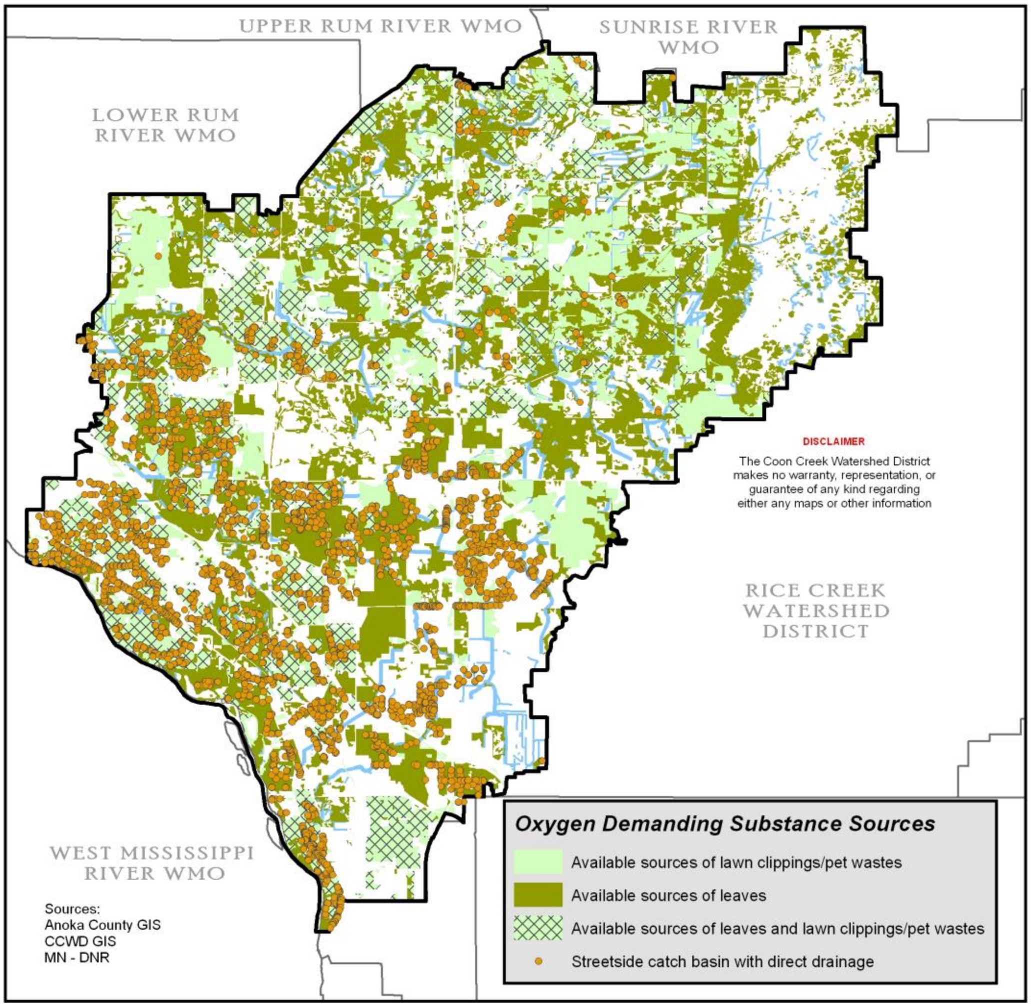
Form	Sources	Availability
Fine Sand	• Stream bank erosion • Bed load • Construction sites • Road de-icing	High



Available Nutrient Sources	Form(s)	Sources	Availability
	Phosphorus Nitrogen	• Lawn clipping • Leaves • Excessive use of fertilizer • Auto emissions • Road de-icing	Medium

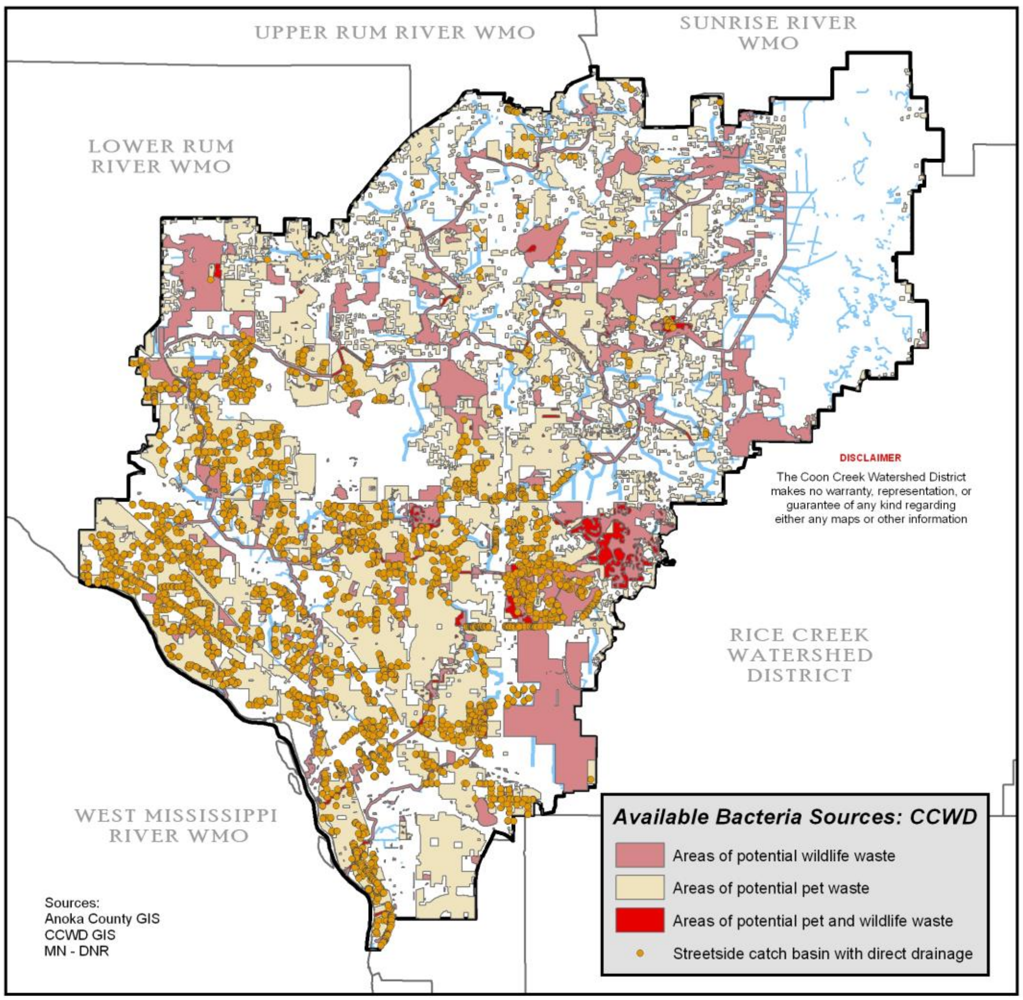


Available Oxygen Demanding Substances	Form(s)	Sources	Availability
	Pet wastes Street litter Lawn clipping Leaves	• Pet wastes • Street litter • Lawn clipping • Leaves	Low

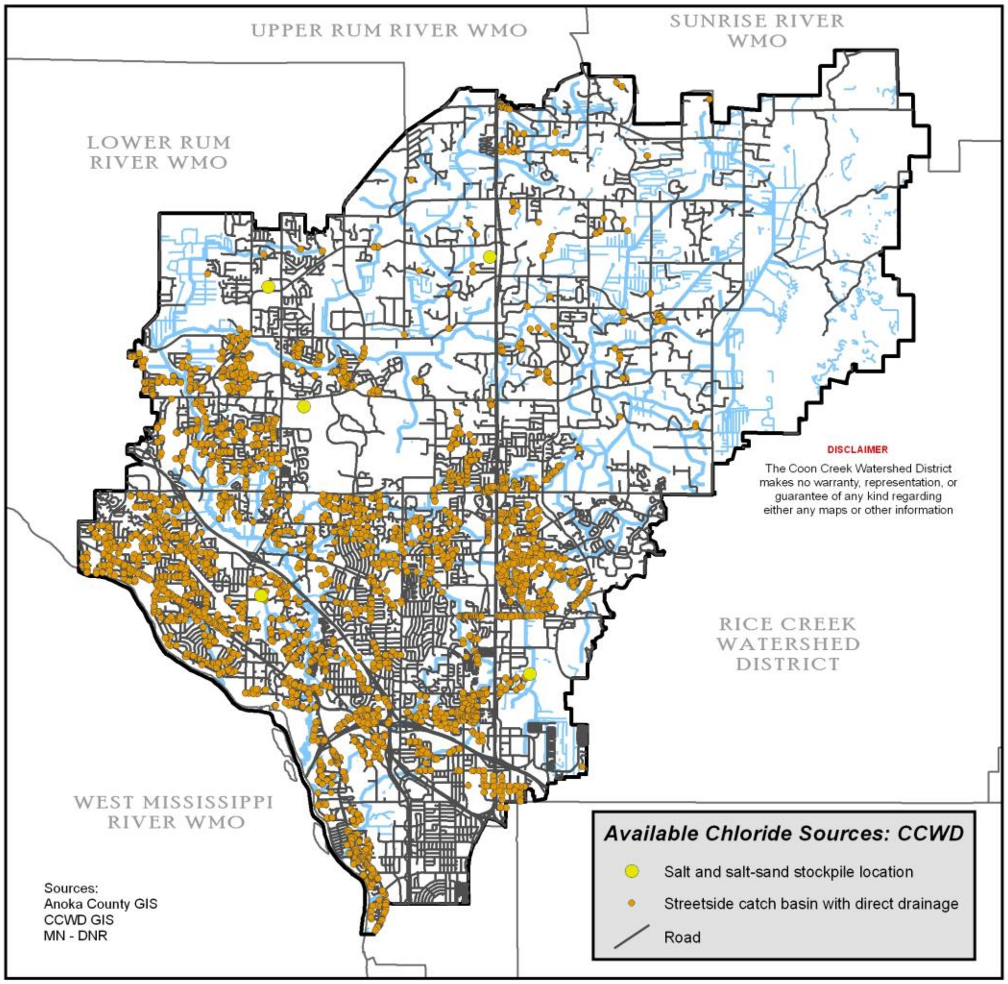


Available Sources of Bacteria

Form(s)	Sources	Availability
Coliform E. coli	• Pet waste • Wildlife waste • Self-reproduction	High

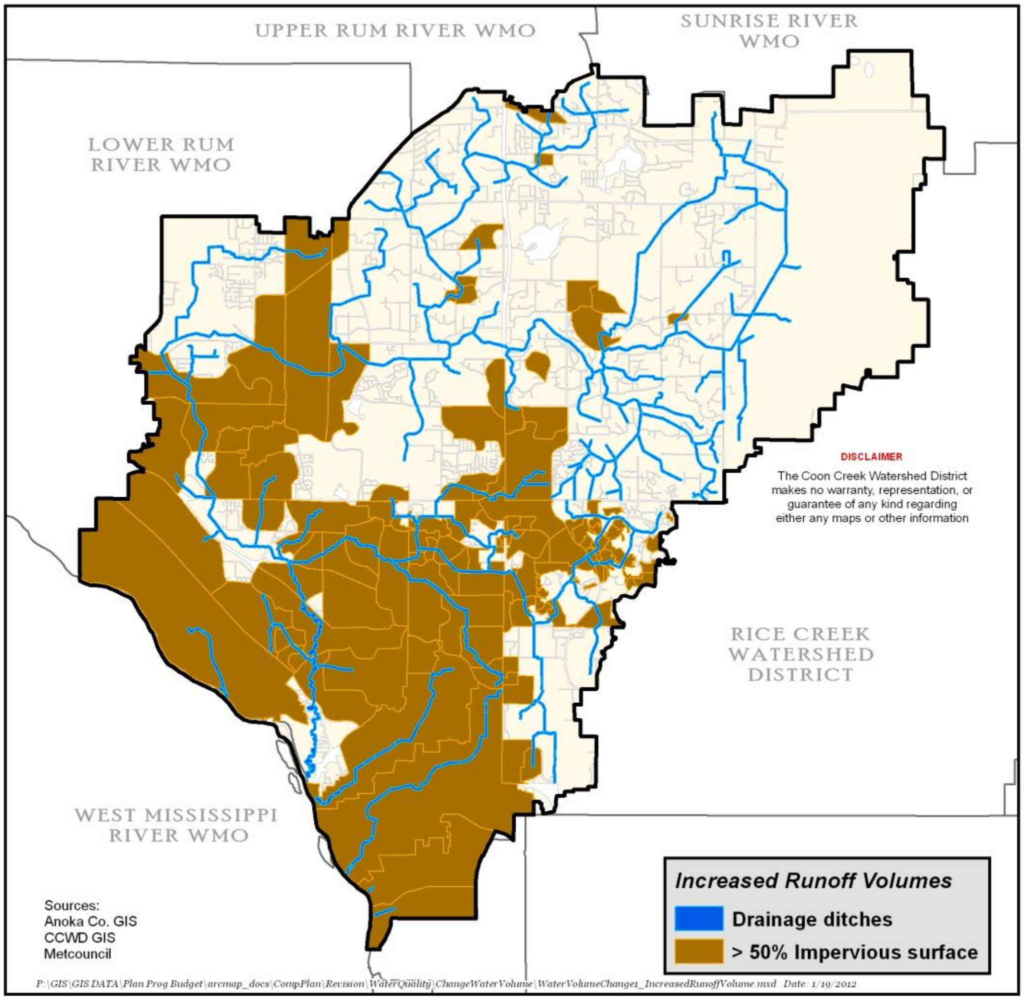


Available Sources of Chloride	Form(s)	Sources	Availability
	Chloride	• De-icing • Inadequate protection of stockpiles	Low



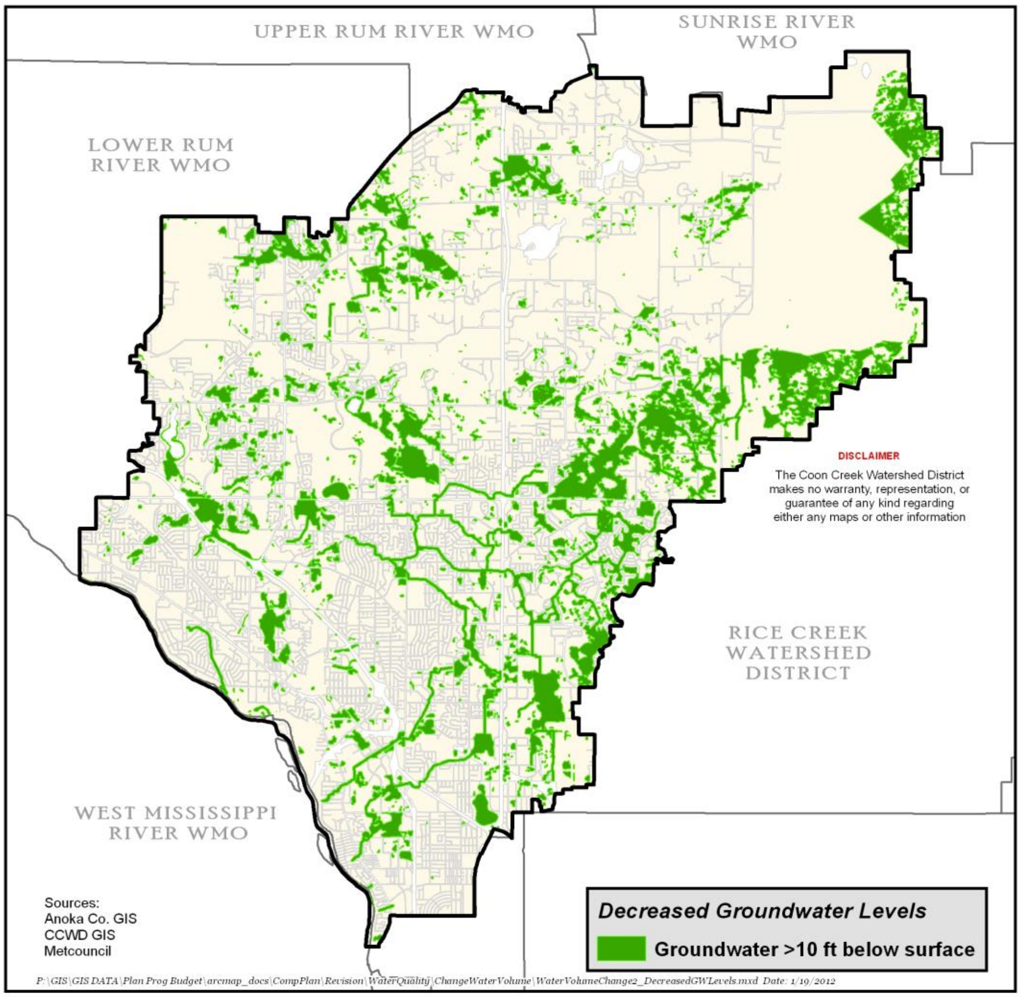
Available Sources of Water Volume Changes	Form(s)	Sources	Availability
	Increased runoff volumes	• Impervious surface • Drainage ditches	High

Available Sources of Increased Runoff Volume



Form(s)	Sources	Availability
Decreased Groundwater Levels	• Decline in surficial groundwater table • Regional drainage toward the Mississippi River	High

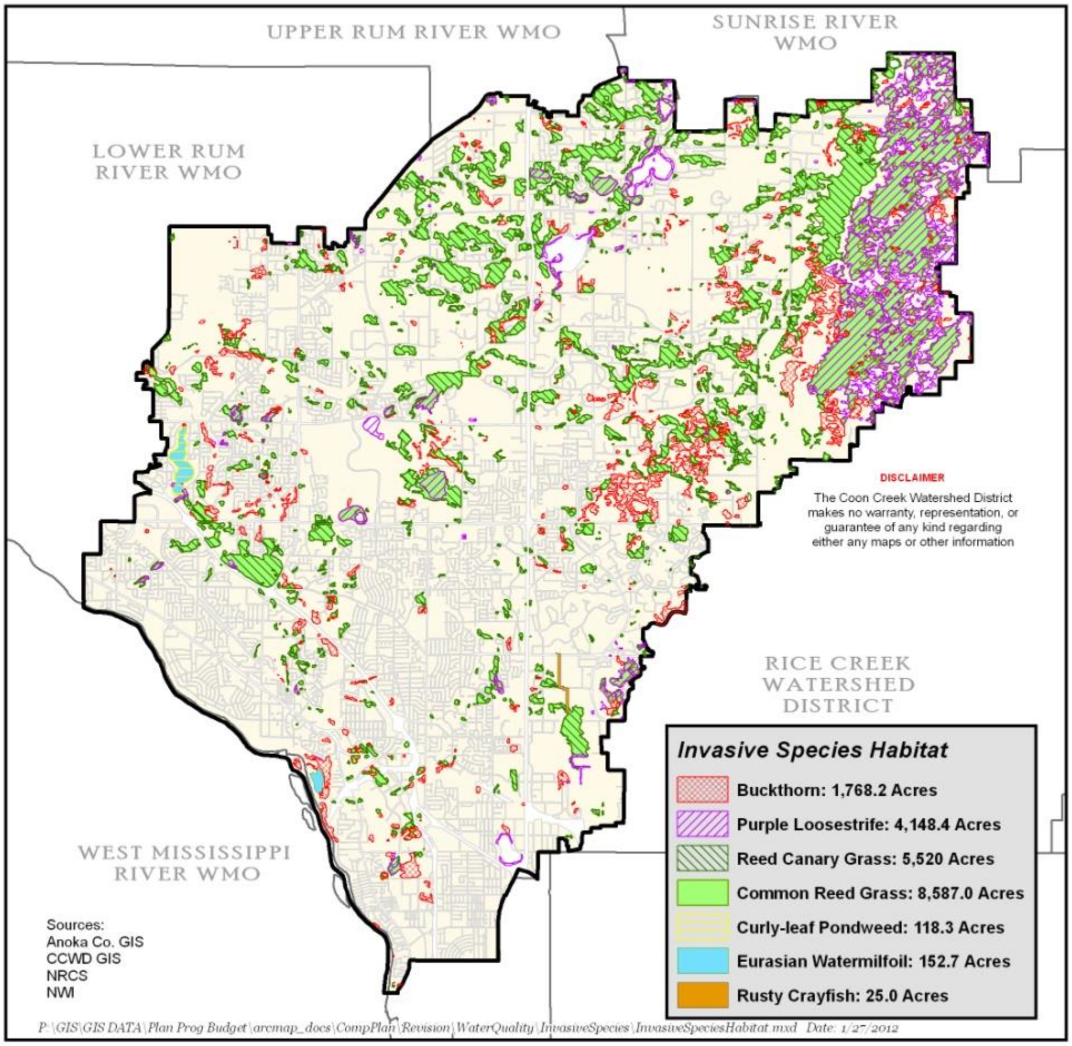
Map of Sources of Decreased Water Availability



Available Sources of Invasive Species

Form(s)	Sources	Availability
Invasive Plant Species	• Eurasian watermilfoil (*Myriophyllum spicatum*)	High
	• Curly-leaf pondweed (*Potamogeton crispus*)	Low
	• Flowering rush (*Butomus umbellatus*)	Low
	• Reed Canary Grass (*Phalaris arundinacea*)	Very High
	• Purple loosestrife (*Lythrum salicaria*)	Low
	• Buckthorn (*Rhamnus spp*)	High
	• Common Reed grass (*Phragmites australis subsp. australis*)	Low
Invasive Animal Species	• Rusty crayfish (*Orconectes rusticus*)	Moderate

Map of Distribution of Invasive Species



Detachment

Detachment is the process by which materials are dislodged from their original location and become mobile. The occurrence of detachment is the central issue leading to illicit discharge. The detachment process can either be physical or chemical.

- Physical detachment is the result of raindrop impact or overland flow.
- Chemical detachment involves dissolving soluble materials or ion exchange processes.

Pollutant	Detachment Process	Form	Detachment Agent
Sediment	Physical	Turbidity Erosion	Rain Peak flows
Nutrients	Physical	Phosphorus Nitrate Nitrite	Rain Excessive use of fertilizer
Oxygen Demanding Substances	Physical	Organic matter	Rain
Bacteria	Physical	Coliform E. coli	Temperature Flow regime
Chloride	Chemical	Chloride	Solubility Rain Flow regime

Transport

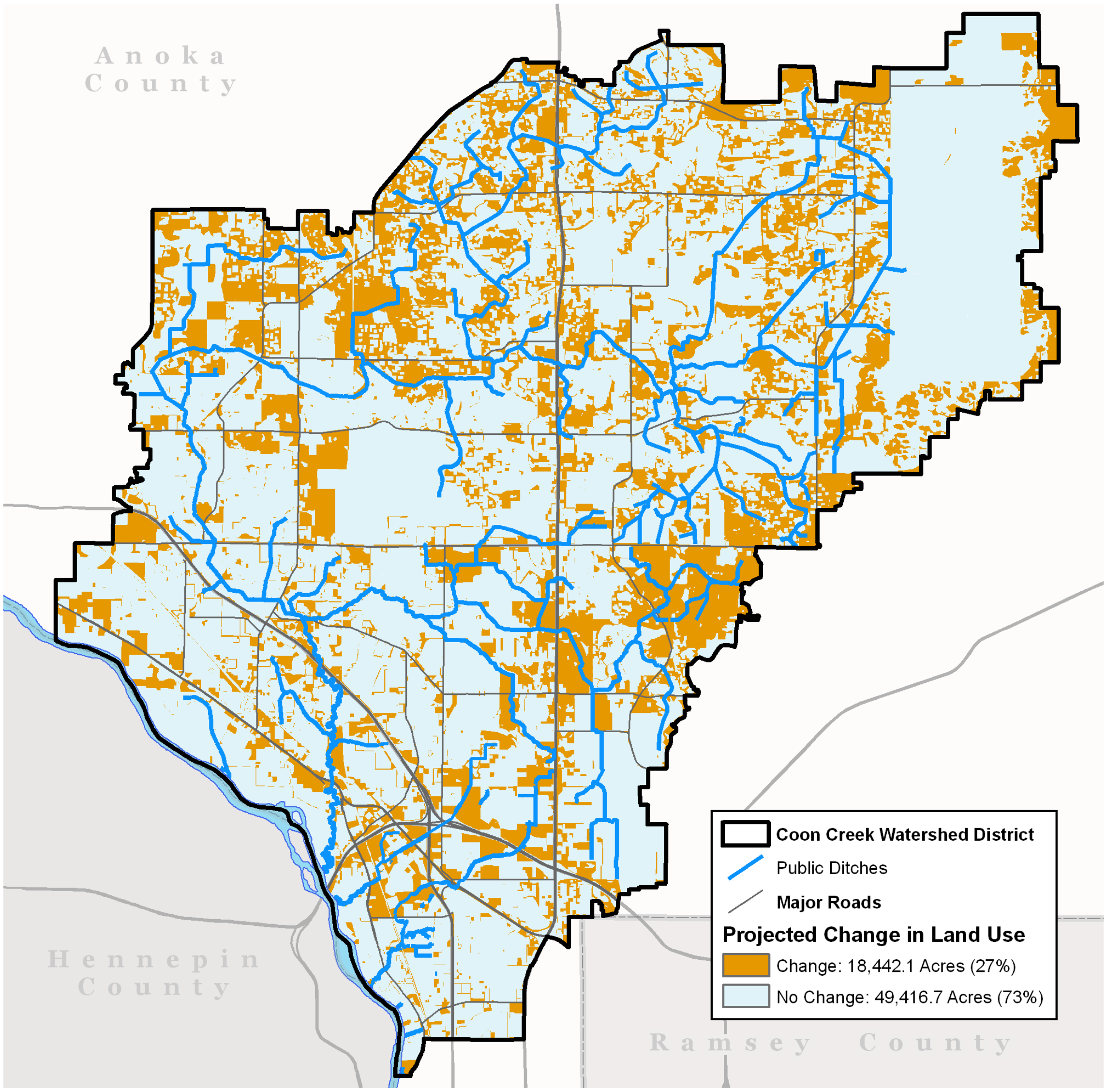
Transport is the final phase of the delivery process. Transport involves moving material from its point of detachment, to a receiving water.

The efficiency and effectiveness of transporting a pollutant is a function of the conductivity of the material through which the transporting medium must travel and reflect changes in the landscape.

The two most important landscape changes that can increase pollutant loading are:

1. Changes in land use typically result in increases in the availability and potential for detachment.
2. Changes in hydrology typically increase the volume and rate of runoff, increasing the capacity to transport pollutants.

Changes in Land Use



Current Land Use	Planned Land Use					
	Ag	Comm	Ind	MFR	SFR	Vacant
Ag		138	8	440	1465	8
Comm			116	53	140	
Ind	12	84		23	169	
MFR		42	1		802	.5
SFR	71	138	12	265		7
Vacant	1002	1631	380	643	8430	

Changes in Hydrology

When the landscape changes (whether is agriculture or suburban uses) there are changes to the local hydrology. Site hardening, either through plowing or paving, of water that can infiltrate is decreased.
This increases the volume and velocity of water that runs off. This in turn decreases the time required to convey water to a certain point.

The result is higher peak discharges and shorter times to reach peach discharges. In a managed system, such as a roadway, this is beneficial. It reduces local flooding and makes for a safer road. It does however have other consequences that are not beneficial:

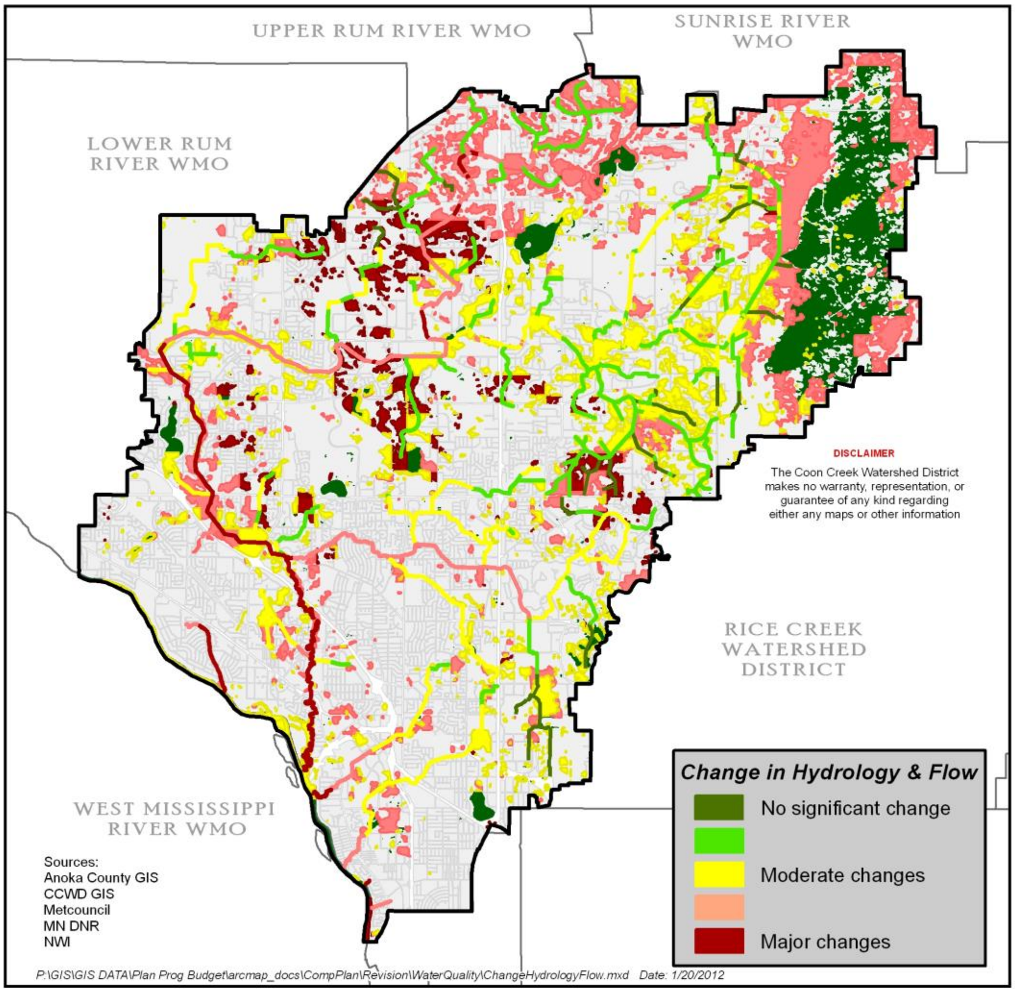
- Changes in stream flow and water source
- Changes to stream hydromorphology
- Changes to aquatic habitat

<u>Changes to Stream Flow and Water Source</u>

A change in land use alters the hydrology (rate and volume) of watersheds and streams by disrupting the natural water cycle. The changes in streams draining altered watersheds are very apparent as they respond to the altered hydrology during the change. Notable changes include:

- Increased runoff volumes
- Increased peak runoff discharges
- Greater runoff velocities
- Shorter times of concentration
- Increased frequency of bank-full and near bank-full events
- Increased flooding
- Lower dry weather flows (baseflows)
- Lowering of surficial groundwater

Changes in Stream Flow & Wetland Hydrology

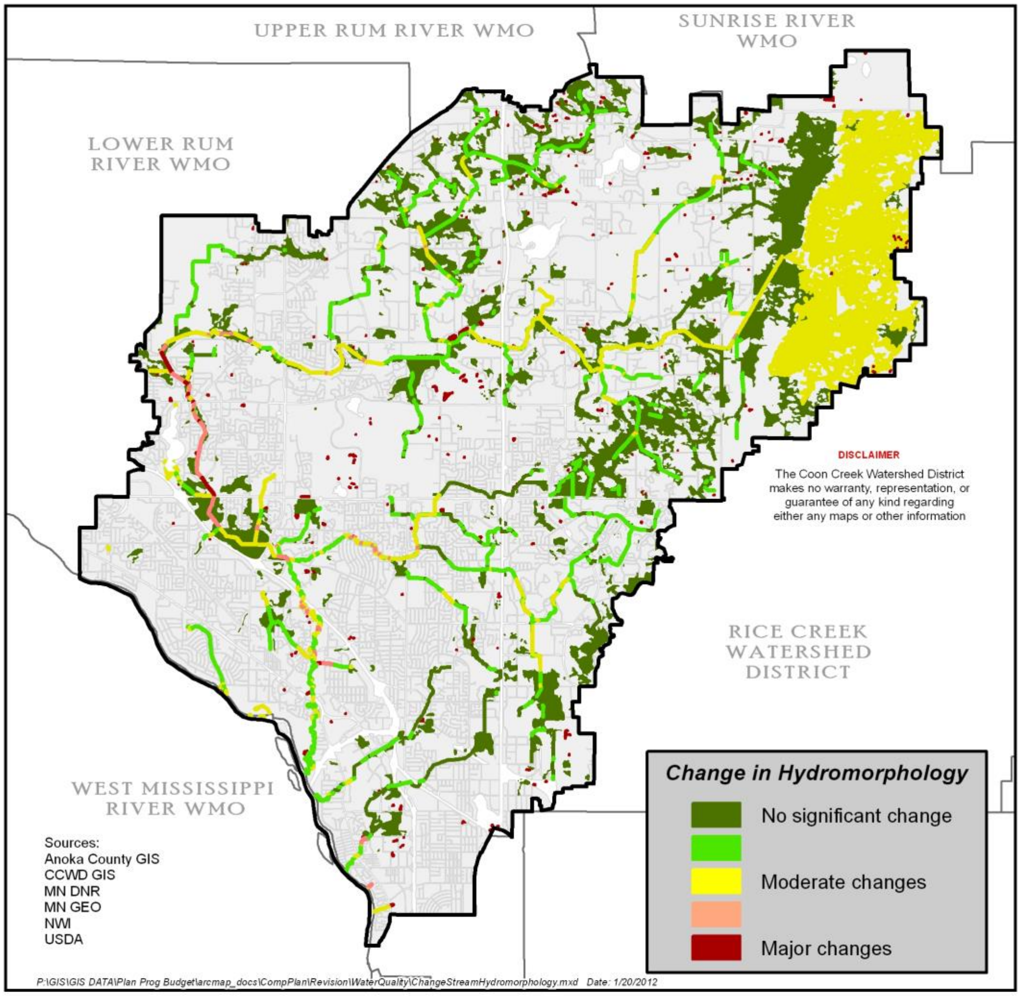


Changes to Hydromorphology

Changes in the rate and volume of runoff directly affect the morphology, or physical shape and character of a streams and drainageways. Some of the impacts include:

- Stream channelization and ditching
- Stream widening and bank erosion
- Higher flow velocities
- Stream down cutting
- Loss of riparian canopy
- Changes in the channel bed due to sedimentation
- Increase in floodplain elevation
- Change in wetland hydro-period

Changes in Stream and Wetland Hydromorphology

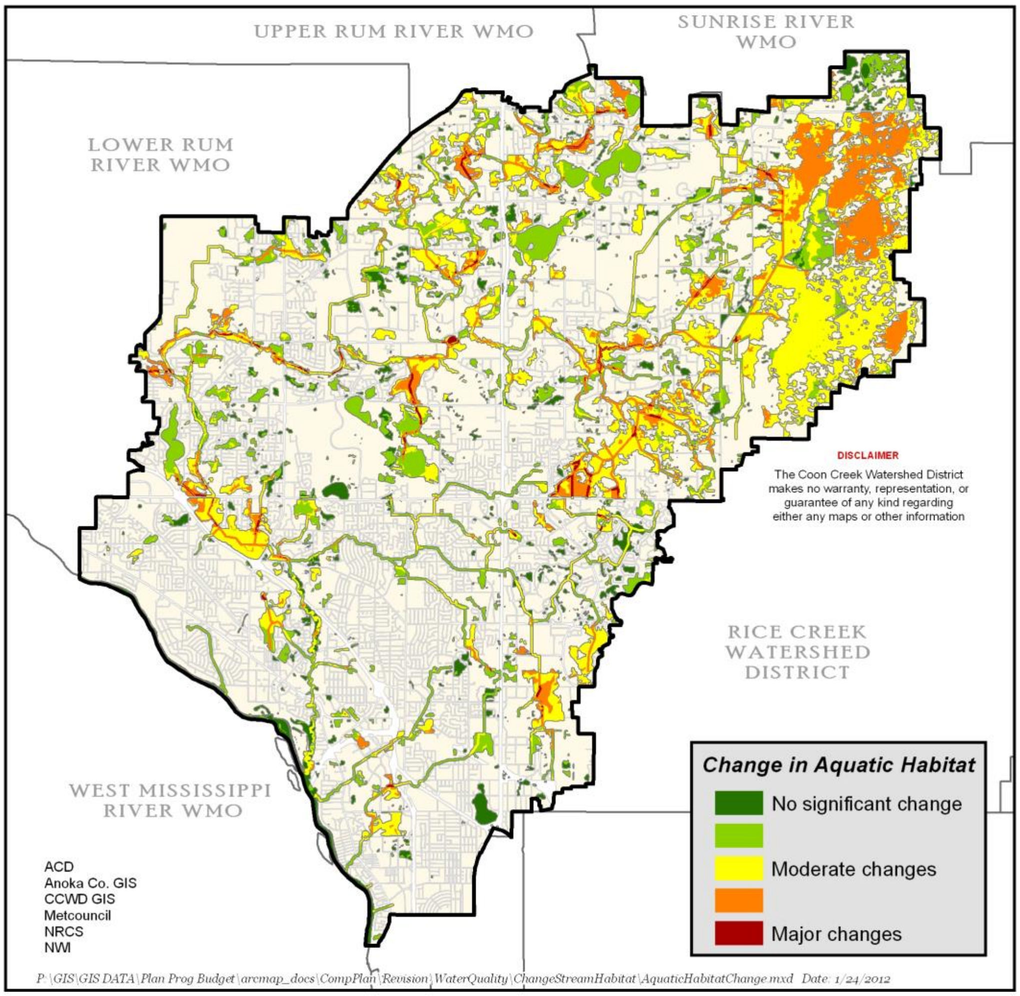


Changes to Aquatic Habitat

Perhaps the most significant impact that results from the physical changes to receiving water is to the habitat value of that water. Impacts on habitat include:

- Degradation of habitat structure
- Loss of pool-riffle structure
- Reduced base flows
- Increased stream temperature
- Decline in abundance and biodiversity

Changes to Aquatic Habitat



Current Water Quality

303d Impairment Listing

In 2006 the Minnesota Pollution Control Agency (MPCA) listed Coon Creek, Sand Creek, Pleasure Creek and Springbrook Creek as biologically impaired and listed these resources on the 303d list reported to the U.S. Environmental Protection Agency as required.

The Impairment is listed as a Category 5C, meaning the water quality standard is not attained due to "suspected" natural conditions. Further, the water is impaired for one or more designated uses by a pollutant(s) and may require development of a Total Maximum Daily Load (TMDL) to bring the pollutant under control. Water Quality Standards for these waters may be re-evaluated due to the presence of natural conditions.

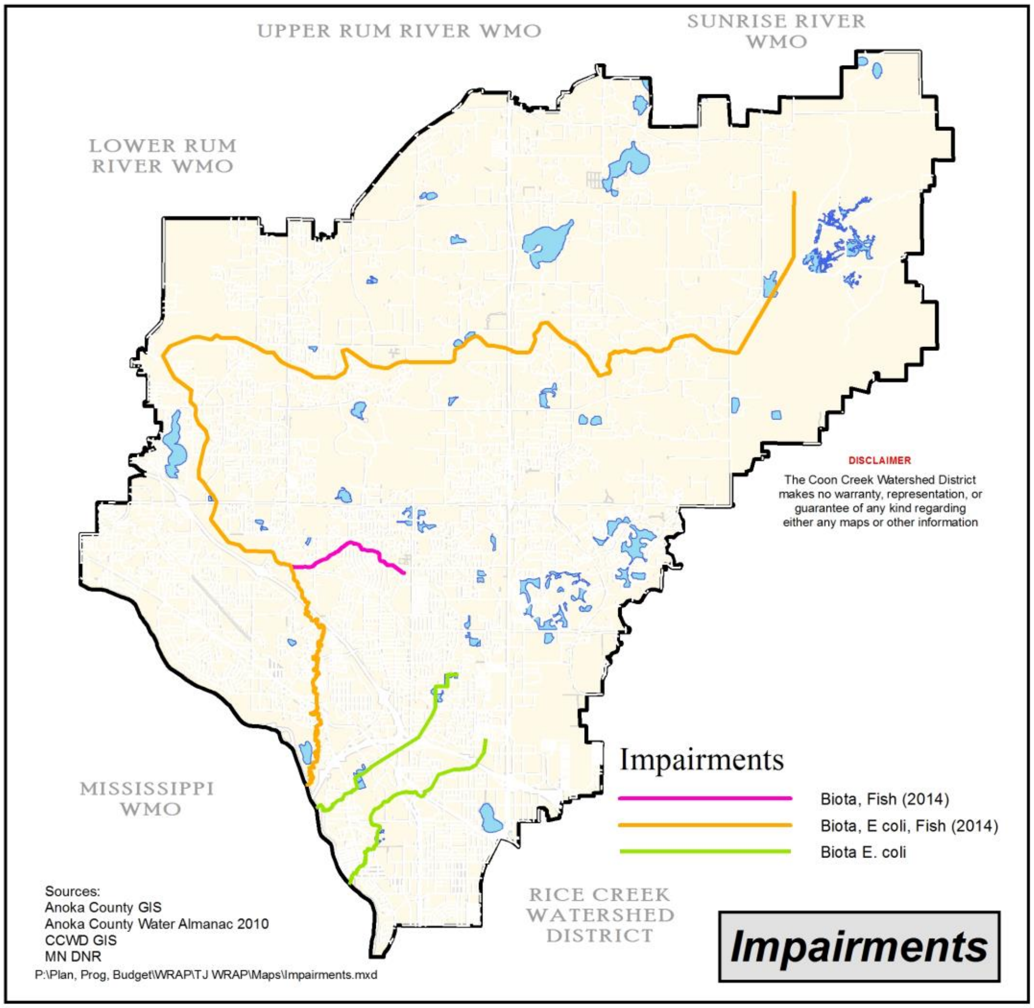
MPCA is currently working to revise its water quality standards (Mn Rule Chapter 7050) to incorporate a tiered aquatic life use (TALU) framework for rivers and streams. The TALU framework represents a significant revision to the water quality standards of the state's aquatic life use classification. The framework builds upon existing water quality standards with a goal of improving how water resources are monitored and managed. Additionally, these changes advance the ability to identify "stressors" and develop effective mechanisms to improve and maintain the condition of waters in the state of Minnesota. Adoption of TALU will only affect Class 2 (Aquatic Life) and Class 7 standards.

In 2011 the MPCA Monitored Coon Creek at Vail Street in Coon Rapids for Bacteria. The sampling was conducted as part of the Upper Mississippi River Bacteria TMDL study.

303(d) Listing Information

Reach name	Year Listed	Affected use	Pollutant or stressor
Coon Creek	2006	Aquatic life	Aquatic macroinvertebrate bioassessments
Pleasure Creek	2006	Aquatic life	Aquatic macroinvertebrate bioassessments
Sand Creek	2006	Aquatic life	Aquatic macroinvertebrate bioassessments
Spring Brook Creek (CD 17)	2006	Aquatic life	Aquatic macroinvertebrate bioassessments
Crooked Lake	2008	Aquatic Consumption	Mercury in Fish Tissue
Ham Lake	2008	Aquatic Consumption	Mercury in Fish Tissue

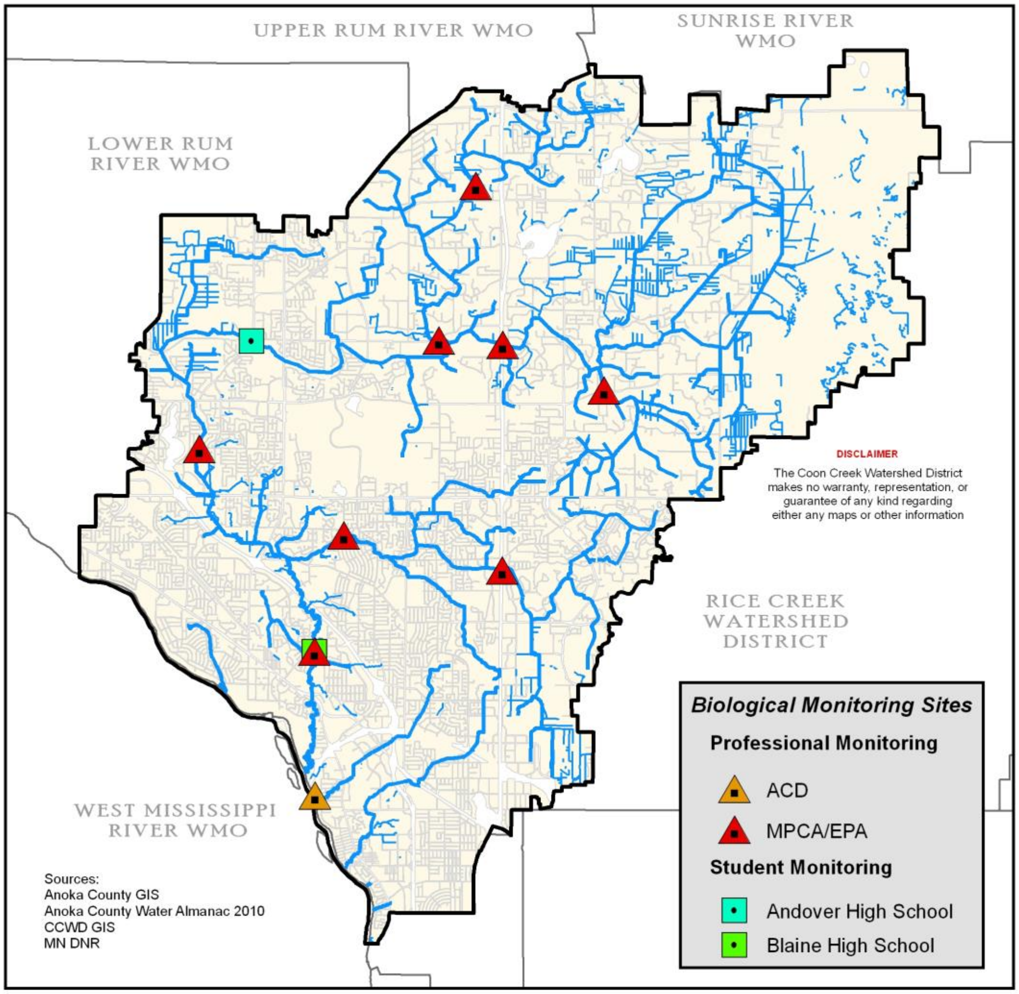
303(d) Impairments within the Coon Creek Watershed



Biomonitoring

Potions of Coon Creek have been monitored for biota every year since 2000 (ACD Water Atlases). The invertebrate community suggests Coon Creek's health is average compared to other nearby streams. The stream's habitat is relatively sparse, due mostly to excavations performed to repair and maintain the County Ditch function of most of the drainage system within the watershed.

Map of Biomonitoring Locations

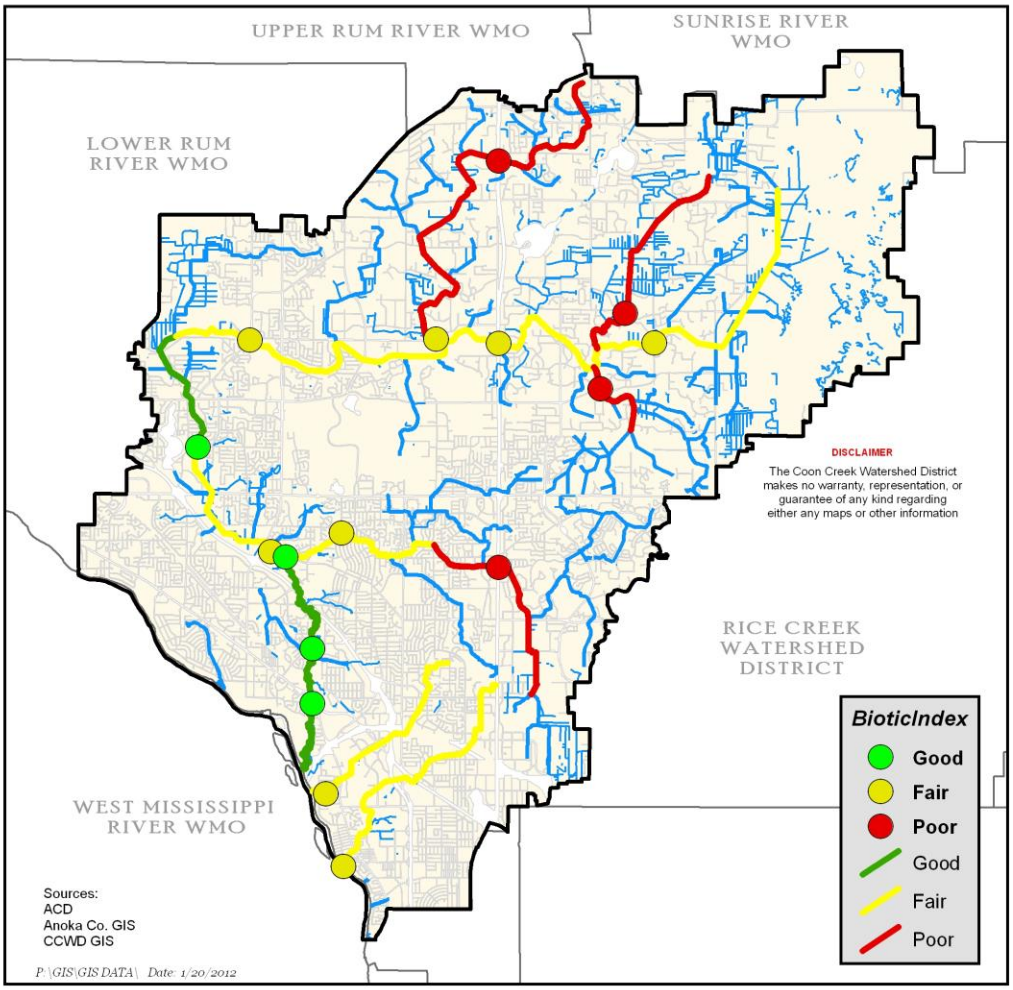


The biomonitoring suggests that stream health is similar to the average for Anoka County streams, despite the good quality habitat. Family Biotic Index (FBI) has been consistently higher than the county average, but the number of families and number of pollution sensitive families (EPT) has been similar to county averages.

The invertebrate community suggests Coon Creek's health is average compared to other nearby streams. This is unexpected because habitat at the Egret Street site is much better, including riffles, pools, snags, and forested areas around the stream.

At Crosstown Boulevard the creek has been ditched so there are no riffles or pools, there is no rocky habitat, few snags, and adjacent habitat is grassy. One possible explanation is that the biotic community at Egret Street is limited by poorer water quality despite the better habitat. Chemical monitoring has found that Coon Creek's water quality declines from upstream to downstream. This corresponds with an increase in urbanization. Future monitoring will provide insight.

Current Biotic Condition



Sediment & Turbidity

In Coon Creek and Sand Creek TSS and turbidity are low upstream and during baseflow, but increase dramatically during storms and in downstream reaches. The stream appears to exceed state water quality standards for turbidity, though it has not yet been listed as impaired by the MPCA. Suspended solids in Pleasure Creek are low, except in downstream reaches during storms.

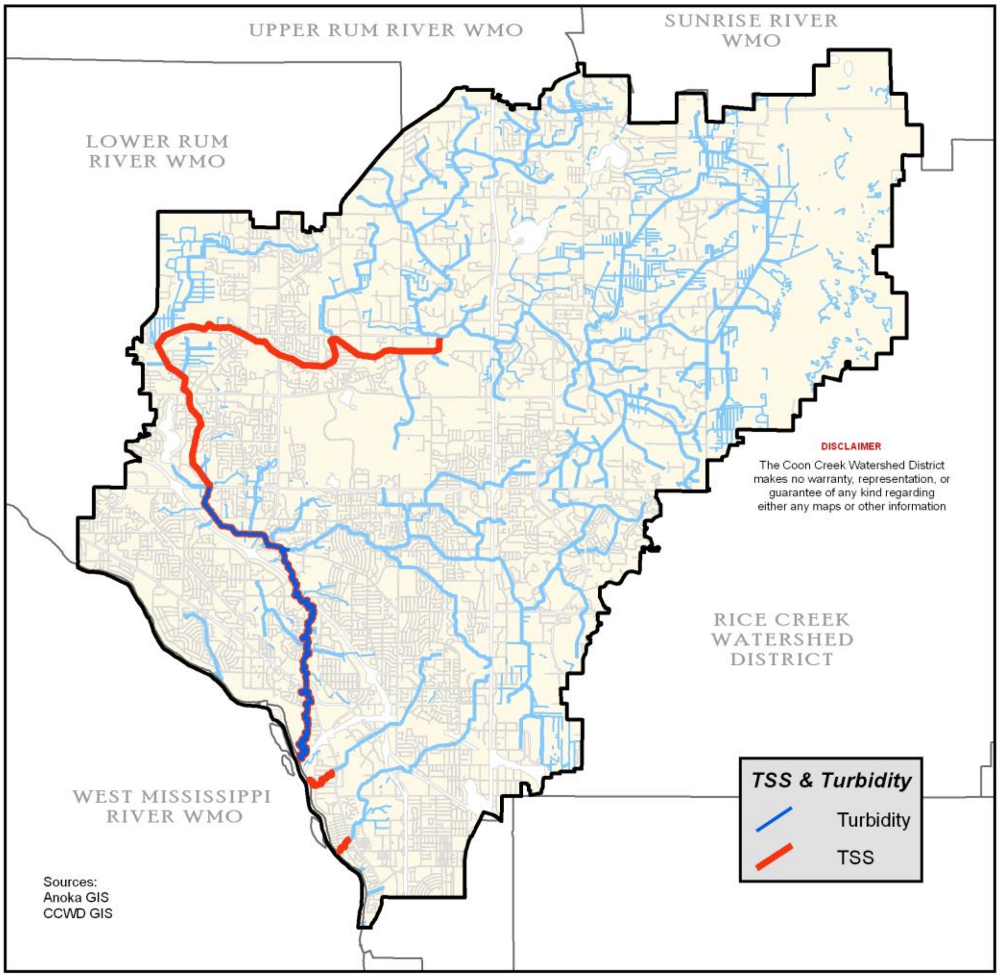
At least three observations and 10% of all observations must exceed the water quality standard of 25 NTU to be considered impaired.

Location (Upstream to Downstream)	Total Number of Samples	Number of Samples Exceeding State Standard	Percent of Samples Exceeding State Standard
Shadowbrook	23	3	13%
Lions Park	25	9	36%
Vale Street	15	40	38%

Turbidity and TSS problems are most severe in downstream reaches. Readings in downstream areas are typically two-times higher than those from upstream areas.

Location (Upstream to Downstream)	Median storm turbidity (NTUs)	Median storm TSS (mg/L)
Standard	**25**	**14**
Shadowbrook	13	19
Lions Park	30	20
Vale Street	39	46

Turbidity and Sediment Exceedences



Nutrients

Total phosphorus (TP) in Coon Creek was consistently low during baseflow conditions, but more than doubled during storms.

The 2000-2010 Comprehensive Plan reviewed the effects of geology and soils on water quality noting that studies of the outwash sands of the Anoka Sand Plain have found significant amounts of apatite, a mineral containing phosphorus (Larson 1985). Such apatite levels have the potential to raise the background concentration of phosphorus in water passing through the outwash. These high baseline phosphorus levels must be kept in mind when evaluating water quality data from the sand plain.

Storm flow

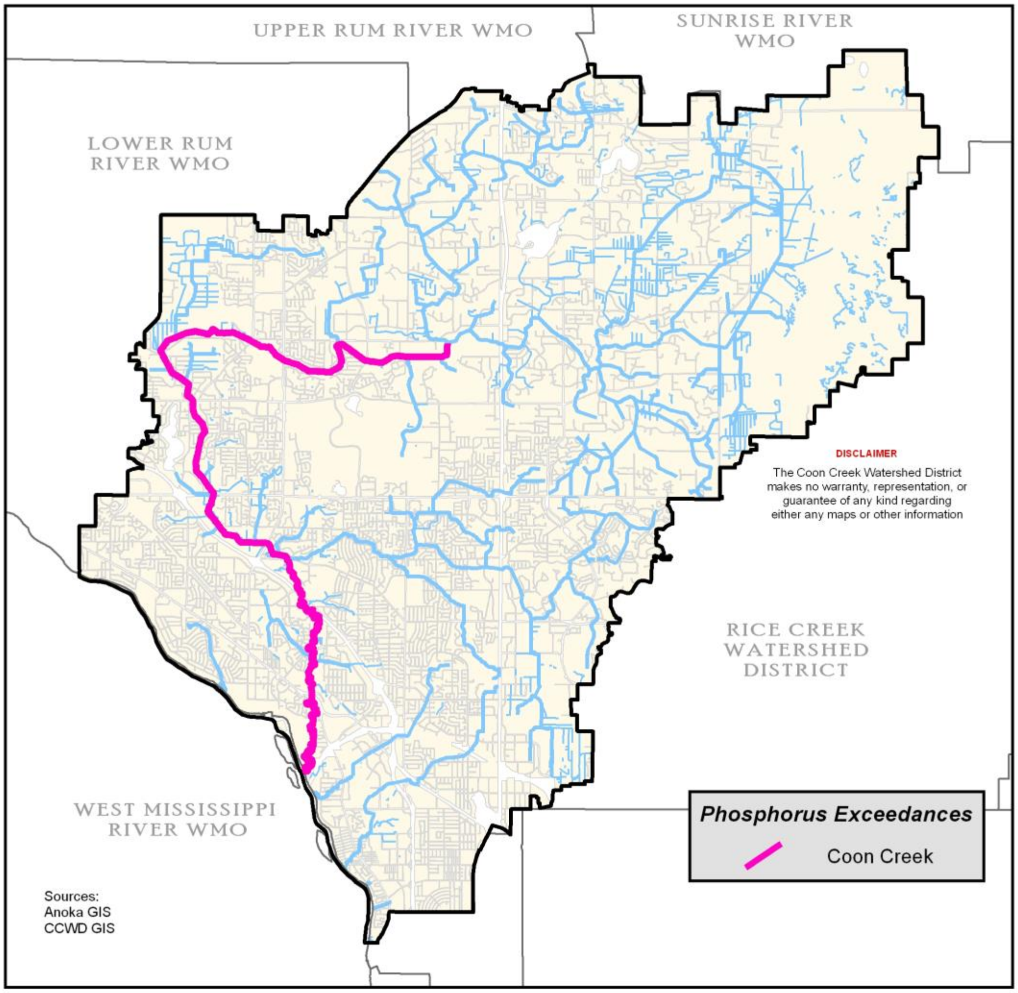
During storms TP is higher, and sometimes much higher. Median TP during storms was 2.5 times the median for baseflow at each site. Storms also had much greater variability. The standard deviation for storm readings were 99 mg/L at Shadowbrook, 102 at Lions Park, and 159 at Vale Street. By contrast, the standard deviations during baseflow were 22, 34, and 33 mg/L, respectively. Variation in the timing, magnitude, and intensity of the storm is likely responsible for the greater variability in TP during storms compared to baseflow.

Total Phosphorus

Median Total Phosphorus (ug/L) Stormflow

Site	County Median	Coon Ck	Sand Ck	Pleasure Ck
St Standard	**130**			
Shadowbrook	126	174		
Lions Pk		194		
Vail St		192		
Xeon St			94	
Mississippi R				69
Highlighting indicates exceedences of State standard				

Phosphorus Exceedences



Oxygen Demanding Substances

Dissolved oxygen was similar at all sites, only once dropping below 5 mg/L at which point some aquatic life becomes stressed.

Dissolved oxygen in Sand Creek was within the acceptable level on 95% of the site visits. On four occasions it dropped below 5 mg/L. These four readings occurred at three different sites; two during storms and two during baseflow. Three occurred in 2009, which was a severe drought year. Stagnant conditions are probably responsible for these low oxygen conditions, and are likely natural.

Dissolved oxygen was at acceptable levels commonly found in the area.

Bacteria

E. coli, a bacteria found in the feces of warm blooded animals, is unacceptably high in Pleasure Creek. E. coli is an easily testable indicator of all pathogens that are associated with fecal contamination. The Minnesota Pollution Control Agency sets E. coli standards for contact recreation (swimming, etc). A stream is designated as "impaired" if:

1. 10% of measurements in a calendar month are >1260 colony forming units per 100 milliliters of water (cfu/100mL) **or**
2. The geometric mean of five samples taken within 30 days is greater than 126 cfu/100mL.

Pleasure Creek exceeds both criteria.

The creek has not yet been listed as "impaired" by the State because of confusion about whether the analytical methods used for testing were state-approved, but a water quality problem exists regardless.

Sources of the bacteria likely include:

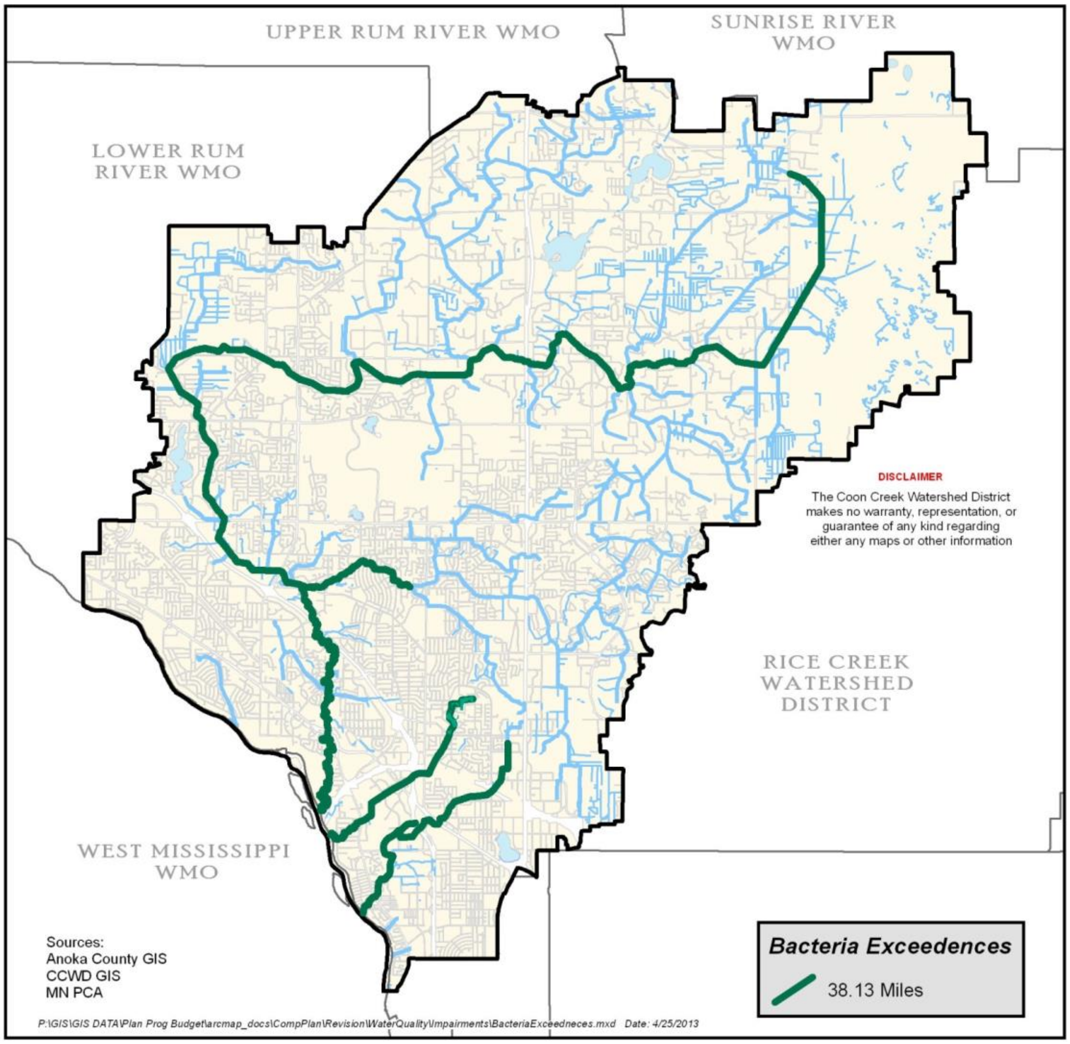
1. Headwater storm water ponds
2. Storm water runoff from throughout the watershed.

Enough data is available for the downstream monitoring site (outlet to Mississippi River) to clearly document exceedances of the "impaired" criteria.

At the upstream site not enough data has been gathered, but the E. coli values observed are similar to the downstream site.

There is some evidence that E. coli is not associated with nutrient-rich sources such as wastewater. Phosphorus in Pleasure Creek is low, especially for an urban stream (see 2009 ACD report). If wastewater or other nutrient rich sources were significant, phosphorus would be higher.

Bacteria Exceedences



Chloride

Conductivity, chlorides, and salinity are all measures of a broad range of dissolved pollutants. Dissolved pollutant sources include urban road runoff, industrial sources, and others. Metals, hydrocarbons, road salts, and others are often of concern in a suburban environment.

Conductivity is the broadest measure of dissolved pollutants we used. It measures electrical conductivity of the water; pure water with no dissolved constituents has zero conductivity.

Salinity measures dissolved salts as a percent salinity.

Chlorides tests for chloride salts, the most common of which are road de-icing chemicals. Chlorides can also be present in other pollutant types, such as wastewater.

These pollutants are of greatest concern because of the effect they can have on the stream's biological community; however it is noteworthy that Coon Creek is upstream from the drinking water intakes on the Mississippi River for the Twin Cities. Overall, dissolved pollutants in Coon Creek are slightly high.

Site	**County Median**	**Coon Ck**	**Sand Ck**	**Pleasure Ck**
St Standard		230	230	230
Median	12	49	75	
Maximum		85		**262**
Shadowbrook		37		
Lions Park		52		
Vail St		63		
Xeon St				
Mississippi R				159
96th Lane				71
99th Lane				70

Volume/Rate

The District has begun to see a change in both the volume and rate of stormwater. While considerable work remains to done, the Districts drainage sensitive use, ponding and infiltration policies as well as the District's retrofit efforts remain the building blocks for holding the line and beginning to decrease volume.

Value of Water Quality

Value of Ensuring Water Quality

The economic value of ensuring water quality within the watershed is both direct and indirect.

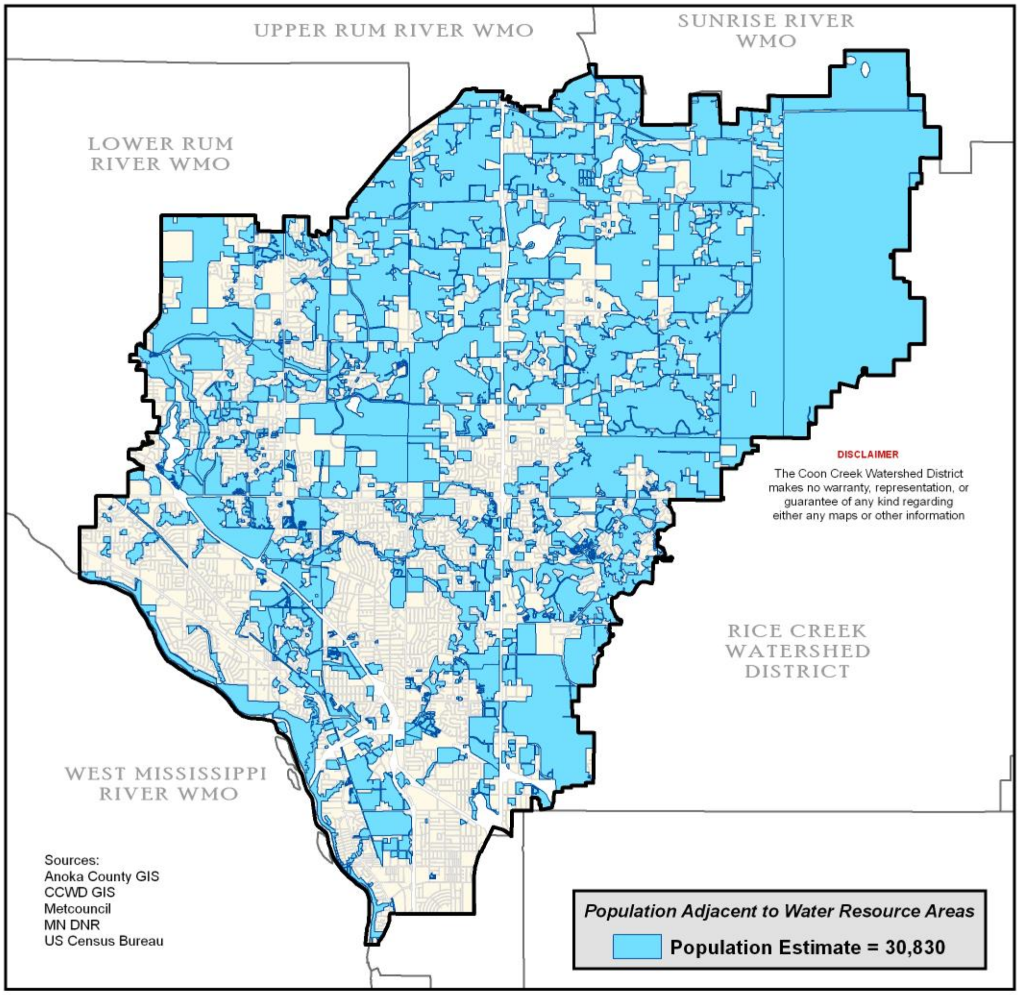
1. The direct value is the cost of protecting human health, supporting a healthy environment and encouraging a productive landscape.

2. The indirect value is based on the prevention of property damage and achieving compliance with state and federal water quality standards and TMDLs through planning, regulatory monitoring and maintenance activities geared toward preventing degradation or remediation of water quality impacts.

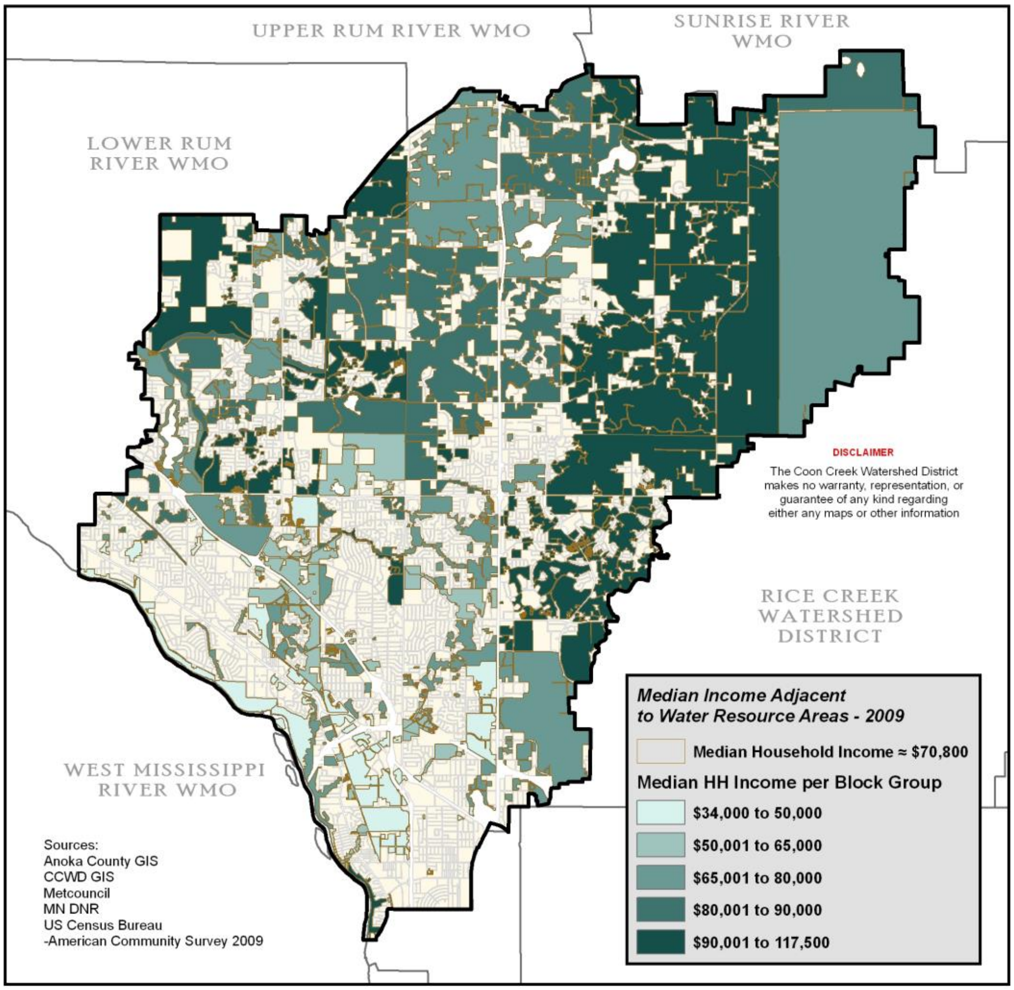
The cumulative economic value of water quality within the Coon Creek Watershed is approximately $5 to 7 billion dollars.

Population Served Approximately 30,830 people within the watershed are directly or indirectly affected by the quality of adjacent water resources. By 2020 that number is expected to be 33,000.

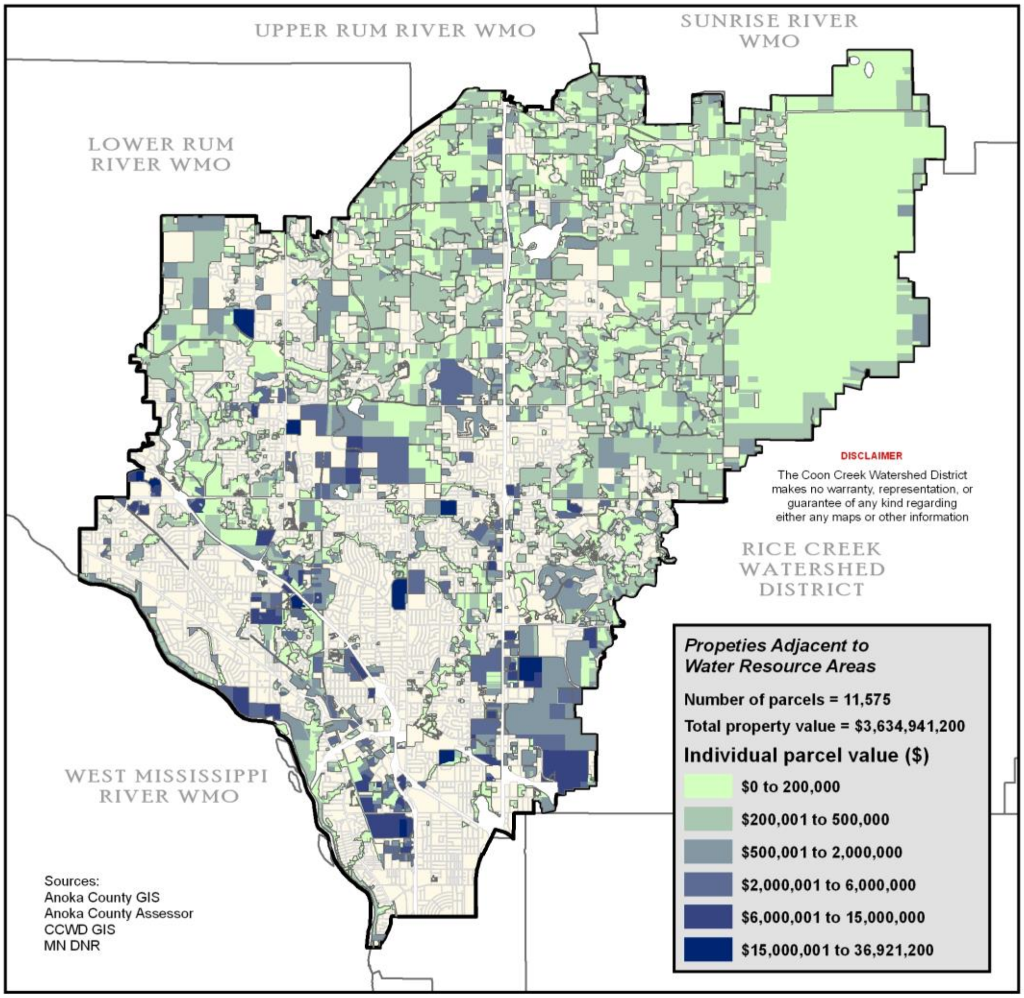
2010 Population adjacent to Water Resource Areas



Income Median household income of people living adjacent to water resources is $70,800.



Property Value In 2010 the watershed contained approximately 11,575 parcels valued at $3.635 billion where the quality of the adjacent lake and waters is critical to property values.



Substitutes There are no natural substitutes for water quality.

The Marginal Value of Water Quality The marginal value for Water Quality remains high.

In spite of water quality regulations and other control efforts, as development has occurred, water quality has become a watershed issue making additional local control efforts that much more valuable.

Stressors to Water Quality

Involves an assessment of the exposure and vulnerability of water quality through 2020.

Risks of disruptions to water quality differ from site to site and are associated with the exposure and vulnerability of the drainage system itself and the vulnerability and exposure of important landscape features that affect the functional capacity of the system. Threats that cause risk can arise from physical, social or managerial actions or processes.

The stressors identified relate the information presented earlier in this chapter to the District's role and priorities in managing water quality.

Altered Hydrology Conditions resulting from periodic dewatering or inundation of habitat (including high velocities and rapidly changing flow resulting from:

- Non-natural variations in flows due to withdraws
- Decreased/altered flows from flood control and other water control structures and ponds
- Lake or pond fluctuations
- Ditching of wetlands
- Channelization of streams

Aquatic Invasive Species Conditions that cause the loss or impairment of recreational opportunities and habitat/ecological integrity of aquatic or riparian habitat due to:

- Human dispersion (aquaria release, ballast release, boat/trailer transfer)
- Natural spread (avian transfer).

Channel Erosion Increased sediment & nutrient loading due to mass wasting and stream disequilibrium (erosion/transport/deposition) from:

- Increased peak flows (watershed ditching/draining, impervious cover runoff, climate change)
- Sediment discontinuity (Control structures, culverts)
- Channelization practices (Channel dredging. Straightening and armoring)
- Bed and bank disturbance.

Encroachments Loss of habitat, equilibrium and ecological process due to encroachments within or adjacent to floodplains, wetlands, lakes, and streams from:

- Earthen fill
- Roads
- Buildings
- Utilities
- Stream crossings
- Dams/control structures

Land Erosion Increased fine sediment and nutrient loading due to erosion of exposed soils and gully erosion from:

- Ditching (conveyed surface flow)
- Cropland
- Construction sites
- Stormwater runoff

Nutrient Loading Non-erosion loading to surface waters from:

- Over-fertilization (Urban & agriculture)
- Inadequately treated domestic waste
- Animal waste

Pathogens From anthropogenic wastes attributable to:

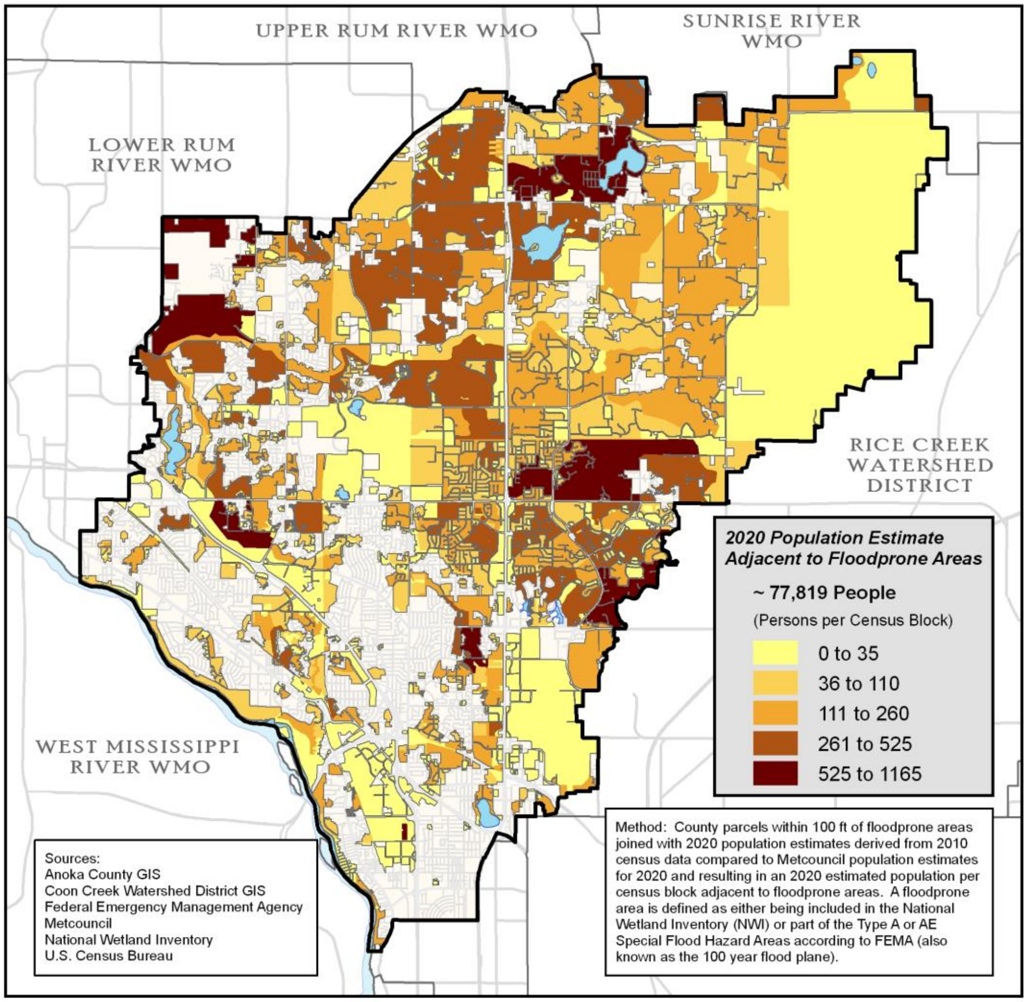
- Poorly-functioning septic systems
- Domestic animals
- Agricultural runoff
- Nuisance wildlife

Expected Future of Water Quality

The quality of water in 2020 will depend on:

Population

	2010	2020	Pct Chg
Andover	21,188	27,188	28%
Blaine	60,643	71,943	19%
Columbus	508	623	23%
Coon Rapids	65,700	66,000	0%
Fridley	27,000	26,900	0%
Ham Lake	15,017	16,686	11%
Spring Lake Park	6,710	6,710	0%
Total	196,766	216,050	10%



Expected Water Quality

Bacteria Not sure what can be done for bacteria levels. Signage of potential public health concerns and advisories on contact or consumption of water should physical contact be made with the water.

Biota Not sure what can be done for biota given that most of the system serves utilitarian uses such as agricultural drainage or stormwater conveyance and needs periodic maintenance and excavation.

Chloride Chloride appears to be as much of a shallow groundwater problem as a surface water problem. As such, a considerable amount of Chloride is already in the system and will continue to be detected during monitoring.

However, the District can encourage and address further applications of chloride through contact with road authorities, retailers and public education.

Total Suspended Solids (TSS) and Turbidity The District should be able to significantly reduce TSS and turbidity through its stormwater retrofit and bank stabilization efforts. Factors limiting success lie in the fine sands that underlie most of the watershed and the degree to which those fine sands represent a bed load which is simply a natural part of low gradient stream in the Anoka Sand Plain.

Volume/Rate The District has begun to see a change in both the volume and rate of stormwater. While considerable work remains to done, the Districts drainage sensitive use, ponding and infiltration policies as well as the District's retrofit efforts remain the building blocks for holding the line and beginning to decrease volume.

Service Preferences

	Citizens	**City Engineers**	**Water Professionals**	**National**
Drinking water	1	1	1	1
Water Quality	**2**	**2**	**2**	**2**
Flood Control	2	2	3	5
Groundwater Recharge	4	4	4	7
Storm Protection	6	5	6	6
Drainage	5	8	7	8
Aquatic life and recreation	8	8	5	9
Hunting and Fishing	**8**	**8**	**9**	**10**
Irrigation	9	9	10	4
Livestock and wildlife watering	10	10	8	11
Aesthetics	**11**	**11**	**11**	**12**
Industrial use and cooling	13	13	12	3

Appendix D

Legal, Institutional, and Economic Framework for Water and Land Conservation and Sustainable Management

Purpose

To present an analysis of, and method for, organizing and discussing the factors critical to the long-term management of the watershed. It is intended as an overall organization of facts.

Goal

To address available management tools (pertinent statutes, levy and special assessment authority, intergovernmental cooperation and public relations).

To assess the managerial capabilities and needs that affect each of these items, and determine the capability and feasibility of addressing the social needs and demands within the capability and constraints of the physical resource.

Scope

The assessment is organized as follows:

History – Chronology of Milestone Events

The following are key dates and events affecting the organization and direction of the Coon creek Watershed District:

Year	Event(s)
1954	Organized efforts to solve water problems in the Coon Creek Watershed began when a steering committee was formed to support a flood control project. Flooding had become a severe problem. Annual flooding of large areas was hurting the agricultural economy of the area, and damaging homes and property along the creek.
	A petition for a P.L. 566 study of the Coon Creek Watershed was submitted to the U.S. Department of Agriculture Soil Conservation Service (SCS). The SCS completed a "Watershed Work Plan" in 1958 with the help of the Anoka Soil and Water Conservation District and the Anoka County Board of Commissioners.
1959	January 8: A nominating petition to establish the Coon Creek Watershed District was signed by the Chairman of Anoka County Board of Commissioners, and was filed with the Minnesota Water Resources Board.
	February 12: The Water Resources Board held a hearing on the establishment of the Coon Creek Watershed District in Coon Rapids.
	May 28: The Water Resources Board issued its Findings of Fact, Conclusions of Law and Order which established the District.
1961	February 6: The Board of Managers adopted their initial Overall Plan and submitted their plan to the Water Resources Board.
	April 14: The Water Resources Board Prescribed an Overall Plan for the District.
1967	The State of Minnesota gave the Metropolitan council the responsibility of preparing a Development Guide" regional plan for the seven county metropolitan area.
1972	The passage of the Clean Water Act (U.S. Code, Title 33).
1977	An amendment to Clean Water Act brings water quality goals of the nation and the region into sharp focus.

Section 208 of the Act requires the preparation of "area-wide waste water treatment management plans" to address both point and non-point pollution sources.

1979 The Metropolitan Council initiated extensive field investigations to examine the impact of non-point source runoff on the region's lakes, streams and rivers.

The investigations revealed that, "Indeed, nonpoint source pollution is a major problem for all receiving waters in the Metropolitan Area."

1982 The Metropolitan Council published Part 2 of its Metropolitan Development Guide. The guide fulfills the federal requirements as the Region's plan for controlling non-point source pollution under section 208 of the Clean Water Act.

The Council's work also supported concerns and work within the Minnesota Legislature that resulted in the passage of the ***Metropolitan Water Management Act*** in 1982 (Chapter 509, Laws of 1982, Minnesota Statutes Sections 473.875 to 473.883).

The Metropolitan Water Management Act sets out 7 goals and requires the watershed district to develop a Comprehensive Plan to pursue and achieve those goals.

1987 The Metropolitan Water Management Act is amended to authorize ground water planning.

1988 July 27: The first Comprehensive Plan for the Coon Creek Watershed District required under the Metropolitan Water Management Act is approved by the Board of Water and Soil Resources.

1990 The Metropolitan Water Management Act is revised.

1991 The Legislature enacts the Wetland Conservation Act establishing a “No Net Loss of Wetlands” for the state.

The Legislature enacts Redding Bill which requires ponding for development resulting in greater than 1 acre of impervious area.

The U.S. Environmental Protection Agency requires an erosion control permit for development greater than 5 acres in size.

1992 The BWSR adopts rules governing planning and reporting under the Metropolitan Water Management Act.

The Metropolitan Council adopts an interim policy on Non-Point Source Pollution control tat requires 'pre-treatment prior to discharge' in to waters of the state.

1993 The BWSR proposes rules (MR 8420) for implementing the Wetland Conservation Act.

The Pollution Control Agency adopts rules (MR 7050) for wetlands and water quality standards.

1995 The Wetland Conservation Act is amended and revised.

2000 The Wetland Conservation Act is amended and revised.

August: The MPCA sampled four sites within the watershed.

2003 February: The Minnesota Pollution Control Agency informs the Coon Creek Watershed District that the public ditch system under the Watershed District's jurisdiction functions as a storm sewer, the District had been included in a group of Municipal Separate Storm Sewer Systems (MS4s) under the National Pollution Discharge Elimination System (NPDES).

May: Coon Creek develops and submits its first Storm Water Pollution Prevention Plan (SWPPP) required as an MS4 under the Federal NPDES program administered by the MPCA.

2004 The BWSR approves the second generation Comprehensive Plan required under the Metropolitan Water Management Act. The scope of the plan is 2000 to 2010.

2006 June: The Minnesota Pollution Control Agency (MPCA) lists Coon Creek, Sand Creek, Pleasure Creek and Springbrook Creek as biologically impaired and listed these resources on the 303d list reported to the U.S. Environmental Protection Agency as required.

The Impairment is listed as a Category 5C, meaning the water quality standard is not attained due to "suspected" natural conditions. Further, the water is impaired for one or more designated uses by a pollutant(s) and may require development of a Total Maximum Daily Load (TMDL) to bring the pollutant under control. Water Quality Standards for these waters may be re-evaluated due to the presence of natural conditions.

November: Coon Creek develops and submits its second Storm Water Pollution Prevention Plan (SWPPP) required as an MS4 under the Federal

NPDES program administered by the MPCA.

2007 The Wetland Conservation Act is amended and revised.

District coordinates efforts of Andover, Blaine and Coon Rapids and develops own Non-Degradation Report required by MPCA.

2008 The BWSR Performs a 'Performance Review' of the District's operations and programs through its PRAP program.

The review found that the CCWD is making good progress in the implementation of the comprehensive watershed management plan. The District is efficient in its administrative, planning, execution and communication-coordination functions. The District's annual reports and work plans provide good documentation of progress and the trends, issues and needs facing the District.

2009 MPCA requests CCWD staff to participate in Tiered Aquatic Life Uses (TALU) work team and rule development.

MPCA requests CCWD staff to participate in Minimal Impact Design Standards work team.

MPCA requests CCWD staff to participate in Watershed Approach work team.

CCWD Staff requested to be part of County Groundwater Assessment.

2010 District contributes funds to the development of County Geologic Atlas.

2011 The Cities of Blaine, Coon Rapids, Fridley and Spring Lake Park petition the BWSR for inclusion of parts of those cities (totaling approximately 15 square miles) into the CCWD and to assume watershed management responsibility over those select lands. The BWSR approves the merger in December, 2011.

2012 The CCWD develops a new Comprehensive Watershed Management Plan that covers the entire 107 square mile District.

2013 The CCWD updates its Storm Water Pollution Prevention Plan (SWPPP).

Statutory Obligations, Requirements and Abilities of Coon Creek Watershed District

Statutory Obligations of the Watershed District

The Water Law of this state is contained in many statutes that must be considered as a whole to systematically administer water policy for the public welfare. Water law that seems contradictory as applied to a specific proceeding creates a need for a forum where the public interest conflicts involved can be presented and, by consideration of the whole body of water law, the controlling policy can be determined and apparent inconsistencies resolved (M.S. 103A.211).

The Coon Creek Watershed District is a public body organized pursuant to the Watershed Law, M.S. 103D. The laws that influence its activity determine the basic purposes of the District. Most, but not all, of those statutes are listed.

While the Watershed District Act (103D) and the Metropolitan Water Management Act (103B) provide the most basic authorities for the District, the following statutes also influence the District's operation and priorities.

Statutes

Chapter 103A- Wetland Conservation Act (.201 (Subd. 2 (b)):

1. To achieve no net loss in the quantity, quality and biological diversity of Minnesota's existing wetlands;
2. Increase the quantity, quality, and biological diversity of Minnesota's wetlands by restoring or enhancing diminished or drained wetlands;
3. Avoid direct or indirect impacts from activities that destroy or diminish the quantity, quality, and biological diversity of wetlands;
4. Replace wetland values where avoidance of activity is not feasible and prudent.

Chapter 103A- Wetland Policy (.202):

1. To preserve Wetlands
2. To conserve waters
3. To maintain and improve water quality
4. To preserve wildlife habitat
5. To reduce runoff
6. To provide for floodwater retention
7. To reduce stream sedimentation
8. To contribute to improved subsurface soil moisture
9. To enhance the natural beauty of the landscape
10. To promote comprehensive and total water management

Chapter 103A- Rainwater Conservation Policy (.205):

1. To promote retention and conservation of all water precipitated from the atmosphere in the areas where it falls, as far as practicable.

Chapter 103A- Soil and Water Conservation Policy (.206):

1. To encourage land occupiers to conserve soil and water resources through the implementation of practices to that effectively reduce or prevent erosion, sedimentation, siltation and agriculturally related pollution.
2. To preserve natural resources
3. To Insure continued soil productivity
4. To control floods
5. To prevent impairment of dams and reservoirs
6. To assist in maintaining the navigability of rivers and harbors
7. To preserve wildlife
8. To protect the tax base
9. To protect public lands

Chapter 103A- Floodplain Management Policy (.207):

1. To reduce flood damages through floodplain management, stressing non-structural measures such as floodplain zoning and flood proofing, and flood warning practices
2. To guide development of floodplains consistent with legislative findings
3. To adopt, enforce and administer sound floodplain management ordinances

Chapter 103A- Marginal, Erodible Land Retirement Policy (.209):

1. To encourage the retirement of marginal, highly erodible land adjacent to public waters and drainage systems

Chapter 103A- Water Law Policy (.211):

1. To consider the water law of the state of Minnesota as a whole
2. To systematically administer water policy for the public welfare

Chapter 103B- Metropolitan Surface Water Management Act (.201):

1. To protect, preserve, and use natural surface and ground water storage and retention systems
2. To minimize public capital expenditures needed to correct flooding and water quality problems
3. To identify and plan for means to effectively protect and improve surface and groundwater quality
4. To establish uniform local policies and controls for surface and groundwater management
5. To prevent soil erosion into surface water systems
6. To promote ground water recharge,
7. To protect and enhance fish and wildlife habitat and water recreational facilities,

8. To secure the other benefits associated with the proper management of surface and ground water.

Chapter 103D- Watershed District Law (.201):

1. To conserve natural resources through:
    - Land use planning
    - Flood control
    - Other conservation projects
    - Use sound scientific principals for the protection of public health and welfare and the provident use of natural resources.

Specifically to:

1. Control or alleviate damage from flooding;
2. Improve stream channels for drainage, navigation, and any other public purpose;
3. Reclaim or fill wet or overflowed land;
4. Provide a water supply for irrigation
5. Regulate the flow of streams and conserve stream water;
6. Divert or change all or part of water course;
7. Provide or conserve water supply;
8. Provide for sanitation and public health and regulate the use of streams, ditches or water courses to dispose of waste;
9. Repair, improve, relocate, modify, consolidate, and abandon all or part of drainage systems within a watershed district;
10. Control or alleviate soil erosion and siltation of watercourses or water bodies;
11. Regulate improvements by riparian property owners of the bed, banks, and shores of lakes, streams, and wetlands for preservation and beneficial use;
12. Provide for hydroelectric power generation
13. Protect and enhance the water quality in watercourses or water basins; and
14. Provide for the protection of groundwater and regulate its use to preserve it for beneficial purposes

Chapter 103E- Drainage Act (.011):

1. To construct and maintain drainage systems;
2. To deepen, widen, straighten, or change the channel or bed of a natural drainage way that is part of the drainage system or is located at the outlet of the drainage system;
3. To extend the drainage system into or through a municipality for a suitable outlet;
4. To construct dikes, dams, and control structures.
5. To receive permission from the Commissioner of the Department of Natural Resources to:
    - Remove, construct or alter a dam affecting public water
    - Establish, raise, or lower the level of public water
    - Drain any portion of a public water
6. Before establishing or conducting a drainage project consider **(.015)**:
    - Private and public benefits and costs of the project

- The present and anticipated agricultural land acreage availability and use
- The present and anticipated land use within the drainage project or system
- Flooding characteristics of property in the drainage project or system and downstream for the 5-, 10-, 25-, and 50-year flood events
- The waters to be drained and alternative measures to conserve, allocate, and use the waters including storage and retention of drainage waters
- The effect on water quality
- The effect on fish and wildlife
- Shallow ground water availability
- The overall environmental impact of the above criteria

Chapter 116B-Environmental Rights Act (.01):

1. To create and maintain conditions under which human beings and nature can exist in productive harmony in order that present and future generations may enjoy clean air and water, productive land, and other natural resources with which we have been endowed.

Chapter 116C-Environmental Coordination Procedures Act (.22):

1. To coordinate with and increase the understanding between state and local agencies in the administration of the various programs relating to air, water and land resources.

Chapter 116D-Environmental Policy Act (.01):

1. To encourage productive and enjoyable harmony between human beings and their environment;
2. To promote efforts that will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of human beings; and
3. To enrich the understanding of the ecological systems and natural resources important to the state and the nation.

Statutory Requirements

The following Minnesota Statutes ***require*** the watershed district to:

Administration

The Board must:

1. Take oaths of office (103D.315 Subd 1).
2. File performance bonds (103D.315 Subd 2).
3. Elect managers as president, secretary, and treasurer (103D.315, Subd. 3).
4. Adopt a seal for the watershed district (103D.315 Subd 4).
5. Hold meetings at least annually (103D.315, Subd. 10).
6. Adopt bylaws for the administration of business and affairs of the watershed district (103D.315, Subd. 11).
7. Designate a public facility within the watershed district as a principal place of business (103D.321, Subd. 1).

Records:

1. Keep efficient records of all business done and meetings held by the Board of Managers (103D.315, Subd. 5).

Financial Management:

1. Have an annual audit completed of the books and accounts of the district (103D.355).

Development Regulation and Land Use

1. Adopt rules to accomplish the purposes of M.S. 103D and implement the powers of the managers (103D.341).
2. Charge a permit application fee to defray the cost of administering permit applications (103D.345)

Planning

1. Prepare a local water management plan, capital improvement program, and official controls as necessary to bring local water management into conformance with the watershed plan (103B.231).
2. Adopt a watershed management plan (103D.401).
3. Revise and update the water management plan every 10 years (103D.405)
4. Prepare a yearly report (103D.351).

Operations and Maintenance

1. Manage transferred county ditch systems (103D.625 Subd 1).
2. Maintain transferred projects in a condition to accomplish their constructed purpose (103D.631 Subd 1)

Public and Government Relations

1. Appoint an advisory committee (103D.331, Subd. 1).
2. Establish a technical advisory committee (103D.337)

3. Conduct public hearings on planning and budgeting (103D.401 Subd 4: 103D.729 Subd 3; 103D.911)
4. Recognize preexisting rights to use the waters of the watershed district at those rights existed at the time the watershed district was established (est. 5/28/59) (103D.515 Subd 2)

Statutory Abilities

To accomplish the above, the following Minnesota Statutes ***enable*** the watershed district to:

1. Certify for payment by the county all or any part of the cost of a capital improvement contained in the capital improvement program of the plan (103B.251).
2. Change the boundaries of the watershed district (103D.251).
3. Employ a chief engineer, professional assistants, and other employees (103D.325, Subd. 1).
4. Perform all acts expressly authorized, and all other acts necessary and proper for the watershed district to carry out and exercise the powers expressly vested in it (103D.335, Subd. 1).
5. Cooperate or contract with any state or subdivision of a state or federal agency, private corporation, political subdivision, or cooperative association (103D.335, Subd. 7).
6. Construct, clean, repair, alter, abandon, consolidate, reclaim, or change the course or terminus of any public ditch, drain, sewer, river, watercourse, natural or artificial, within the watershed district (103D.335, Subd. 8).
7. Enter lands inside or outside the watershed district to make surveys and investigations to accomplish the purposes of the watershed district (103D.335, Subd. 14).
8. Make contracts or other arrangements with private and public organizations and corporations for cooperation or assistance in the operations of the watershed district (103D.335, Subd. 21).
9. Charge application and/or field inspection fees (103D.345).
10. Establish projects (103D.601).
11. Initiate emergency projects (103D.615).
12. Determine benefits and damages (103D.721).
13. Build, construct, reconstruct, repair, enlarge, improve, or in any other manner obtain, maintain, or operate storm water systems (103D.730).
14. Levy special assessments and taxes (103D.905).
15. Construct, maintain, deepen, widen, straighten, extend, or change the channel or bed of drainage systems and construct necessary control structures (103E.011).
16. Determine property liability for drainage system costs (103E.601).
17. Conduct research (103D.335).
18. Acquire land rights by eminent domain.(103D.335)
19. Purchase district insurance. (103D.335)
20. Borrow money (103D.335).
21. Join association of watershed districts (103D.335).
22. Administer grants (103D.335).
23. Petition for consolidation with another watershed district (103D.265).
24. Require permit applicant to file bond (103D.345).
25. Seek court orders enforcing rules/permits (103D.545).

Analysis of Management Principles and Resource Concerns Emphasized in Minnesota State Statutes

Principle Analysis

The above statutes were reviewed and key principles that provide direction to water and related land management were counted. The results reflect the number of times a given term was used (frequency) and the number of statutes in which it was used. Emphasis is the product of frequency x number of statutes.

Principle	**# Citations**	**# Laws**	Product
Conserve. prevent, preserve, protect	**16**	**4**	**64**
Comprehensiveness	**4**	**3**	**12**
Health, safety, & welfare	**3**	**3**	**9**
Control	3	2	6
Improve	3	2	6
Alternatives	2	2	4
Awareness of effects	4	1	4
Future	2	2	4
Harmony	2	2	4
Promote/Provide	2	2	4
Construct	2	1	2
Regulate	2	1	2
Use	2	1	2
Benefit Cost Analysis	1	1	1
Coordinate	1	1	1
Maintain	1	1	1
Manage	1	1	1
Reduce	1	1	1
Scientific principals	1	1	1

Resource Concerns Analysis

The above statutes were also reviewed for the resource concerns that appear to be emphasized in the State's water law as a whole. The results reflect the number of times a given term was used (frequency) and the number of statutes in which it was used. Emphasis is the product of frequency x number of statutes.

Resource Concern	Freq	# Laws	Emphasis
Flooding	**5**	**3**	**15**
Lands/Property/Natural Resources	**4**	**3**	**12**
Soils	**4**	**3**	**12**
Water Quality	**4**	**3**	**12**
Drainage	5	2	10
Wetland	5	2	10
Ground water	3	3	9
Wildlife	3	3	9
Water supply	3	2	6
Water Features	2	1	2
Impoundments	1	1	1

Organization of the Coon Creek Watershed District

In 1990 the Board of Managers adopted the following statement of mission to provide more direction to this charge.

> **STATEMENT OF MISSION**
>
> To manage groundwater and the surface water drainage system to
> Prevent property damage,
> Maintain hydrologic balance and
> Protect water quality
> for the safety and enjoyment of citizens, and the preservation and enhancement of wildlife habitat.
>
> The District intends to do this by using the natural drainage system to provide for conveyance and disposal of storm water runoff without degrading the natural system.

Intent

The above statutes emphasize a comprehensive approach to the wise use, preservation, and protection of water and related land resources for the public health, safety and welfare. While the statutes address almost all water resource features, they emphasize flood control and the protection of the soil and water quality. To this end the District's most basic responsibilities are:

1. To protect the health and safety of the present and future people that live, and will live, within the watershed.
2. To provide for opportunities and uses of the water and related natural resources of the watershed which are demanded and appropriate for the area. Appropriate refers to the natural ability of the water and related resources to continue to perform and function on their on or with a minimum subsidy or cost to the public at large;
3. To prevent unacceptable damage to the water and related natural resources of the watershed. Unacceptable here refers to the decreasing or diminishing the ability of the water and related resources to continue to perform and function on their own in perpetuity.

PROCEDURES

1. Mutual Trust, Respect, and Interpersonal Support:

An environment of trust and support is important for an organization. The public must be able to freely state their ideas and not be intimidated. Managers and staff must be sensitive to the different needs of the public, and be able to react to different publics, situations and circumstances as they occur in the District. This requires a sensitivity to others, a willingness and capacity to share information, and to give help when needed and appropriate. It also requires a high level of loyalty to public service, the natural resource and to future generations.

2. Intergovernmental Cooperation

Working together with the cities, county, state and federal governments to solve District wide problems is critically important. Intergovernmental cooperation emphasizes the attainment of organizational objectives through the participation and involvement of individuals and agencies in a group form of problem solving. To be effective, many decisions require significant input from a number of perspectives both in the problem solving and implementation phases. Ownership of decisions requires the capacity and willingness to spend time in group processing of those decisions. It requires the willingness to participate in the group process rather than just observing and receiving information. It also requires willingness and personal courage to stay with and support the decision during the implementation phase. Ideally, decisions should be made at the governmental level in the District closest to the problem. However, overall management responsibility cannot and must not be abdicated. Not every decision can or should be a team decision. Responses to emergency situations and Sub-District or municipal decisions are not appropriate for intergovernmental consideration.

3. Cost Effective Service Provision

The managers should expect to be under constant pressure to develop an organization that is both highly productive and is seen as highly productive. This requires careful study and review of successful productivity applications in other locations around the country with particular sensitivity to the application of automation. To provide services we must have quality check points. These check points can be any number of means of monitoring in the organization such as field inspections, spot checking, written communication, seeking feedback from various citizen groups and seeking feedback from citizens who have dealt with the District. We should be out observing, talking, with citizens and asking staff questions.

We need to develop measurable performance standards in order to measure our performance. We need to have a big picture or vision of where the organization is so that we are "doing the right things" and to have specific detailed plans and objectives to track that we are "doing things right".

4 Shared Leadership

We are all part of a larger effort to manage natural resources at the local level and provide service to present and future generations. The basic mission of the District is to provide service. Service orientation requires a strong commitment to help others and the ability to perceive when services need to be improved to meet standards.

There is a great interdependency among the various governmental units and programs managing water and related land resources. It is necessary to be aware that the whole is greater than the sum of the parts. This viewpoint requires collaboration and compromise.

5. Planning and Review

Planning requires time to determine the future implications of present decisions and to program and schedule activities to enhance the goals of the District. Its basic purpose is the improvement of how the District operates and what the District does.

6. Political Awareness

The District must have the capacity to temper a "rational" point of view with political sensitivity without losing the District's integrity of compromising the public good. We need to be aware of and understand the pressures that are incumbent on elected officials and the cities themselves.

7. Integrity

We must display an uncommon sense of integrity as examples of the District as we carry out our duties. Perception of how we carry out our duties is equally as important as the actual reality of the exercise of our duties. It is imperative that we take that extra step to make sure we are above reproach.

8. Responsibility & Accountability

We should stand up and take responsibility for our actions and have the courage to say "I did it". We must be willing to admit errors, to determine why they happened and learn from them. This requires the willingness to accept the responsibility and to be held accountable, to share credit and failure. We must also tell decision makers what they need to hear rather than what they want to hear. While this must be done with judgment and sensitivity, it is the District's responsibility to offer our findings and conclusions.

Major Resource Management Programs

This overview provides a summary of major programs for resource management efforts which affect the CCWD or activities within its jurisdiction.

It is not intended to be a comprehensive or exhaustive presentation, but rather a snapshot of programs that are relevant to and thus impact the District.

Impaired Waters Program

Overview

Section 303(d) of the federal Clean Water Act requires states to identify waters that do not meet applicable water quality standards or do not fully support their designated uses. Waters failing to attain their designated use are defined as impaired. Each state determines the cause for impairment.

Impaired waters are placed on a list and subject to completion of a Total Maximum Daily Load (TMDL) analysis. A TMDL analysis consists of many steps, but the process is intended to identify ways to restore impaired waters to their full beneficial uses. The implementation of load reduction efforts identified in a TMDL analysis may have future bearing on other activities of the CCWD.

There are multiple stream systems and lakes within the boundaries of the CCWD which are on the 303(d) impaired waters list. These water resources are listed in Table 4-1 and Table 4-2 and displayed in Figure 4-1.

Roles and Responsibilities

MPCA

The MPCA is required to submit a prioritized list of impaired waters, known as the 303(d) list, to the EPA for review and approval every other year. The most recent list was approved in 2008, with a new draft version available, which is scheduled for approval in 2013. TMDL plans must be approved by the MPCA before the EPA provides final approval. The MPCA also provides financial assistance through Clean Water Partnership and Clean Water Act Section 319 programs. These programs address nonpoint source pollution issues and are often used for TMDL projects. Funding also may be available through the Clean Water Legacy Act, which also is managed by the MPCA.

CCWD	For impaired waters within the CCWD boundary, the District may choose to lead a TMDL analysis. The CCWD believes that performing load assessments, studies, or similar analyses is a key role of the District. However, implementation is primarily believed to be a shared responsibility with member cities and other program partners.
Cities	Cities or townships may choose to take initiative to lead a TMDL analysis for water bodies with drainage areas solely (or majority) in their municipality. It is preferable that local government units and the CCWD coordinate so as not to perform duplicate TMDL analyses for the same receiving water. Local government units that are within drainage areas that have an approved TMDL plan will be required to comply with load reductions through the enforcement of various point source and non-point source permits.
Other Entities	Other groups such as the counties or lake associations can take their own initiative to complete a TMDL analysis, undertake implementation of TMDL load reduction practices, or participate in the TMDL process as stakeholders.

National Pollutant Discharge Elimination System Program

Overview

The National Pollution Discharge Elimination System Program (NPDES) is a nation-wide federal regulatory program stemming from the Clean Water Act. In Minnesota, this program is implemented by the MPCA. The NPDES program addresses point source discharges including stormwater and related pollution from various sources. The Phase I of the stormwater NPDES program focused on controlling pollution from industrial activities, and included construction activities disturbing more than 5 acres, and municipal separate storm sewer systems (MS4s) with populations greater than 100,000.

The Phase II of the NPDES program was preliminarily initiated by the MPCA in 2003 and formalized in 2006. It builds on Phase I by lowering the threshold for requiring stormwater permits for construction and municipal activities. The basis of the program is for permittees to complete a Storm Water Pollution Prevention Program (SWPPP). In all cases, Best Management Practices (BMPs) are to be identified and implemented in order to minimize stormwater runoff impacts to receiving waters. Minnesota Rule Chapter 7090 became effective August 15, 2005. This rule emulated the national laws already in effect and address concerns associated with stormwater discharges from regulated municipal, industrial and construction activities in Minnesota.

Roles and Responsibilities

The District is a regulated MS4 permittee. Typically, the District is not a construction site Owner or Operator. However, the CCWD may choose to participate in these programs by assisting affected parties.

MPCA

Administers all three components of NPDES Phase II.

CCWD

Must comply with the MS4 program because the District is identified under the auspices of the permit requirements.

The District may also choose to support cities and other local government units in their MS4 compliance efforts by providing educational materials (considered a BMP) or otherwise partnering, such as with construction site

	erosion control inspections or establishing design guidance for stormwater management. The District administers a construction site inspection program and enforces erosion and sediment control requirements.
Cities	Cities wholly or partially in the urbanized area which own or operate an MS4 are all mandatory permittees. This includes • Andover • Blaine • Coon Rapids • Fridley • Ham Lake Additionally, Andover, Blaine, and Coon Rapids must comply with the MS4 Permit's non-degradation rule. They must perform a loading assessment to evaluate nonpoint source impacts to receiving water since 1988. They must demonstrate on-going or new ways to reduce current and future loads and runoff volumes to 1988 levels.
Anoka County	Will be obligated to meet the same general SWPPP requirements (excluding nondegradation).
Minnesota Department of Transportation	Will be obligated to meet the same general SWPPP requirements (excluding non-degradation).

Wetland Conservation Act

Overview

The Wetland Conservation Act (WCA) was enacted in 1991. The overall goal of WCA is no net loss of wetlands.

Generally under WCA, activities such as draining, excavating, or filling of wetlands is regulated by law. WCA does not apply to public waters wetlands, which are regulated by the MnDNR. The local government unit (LGU) has the primary responsibility for administering WCA and for making key determinations.

The CCWD is the LGU for four of the five cities currently within the watershed. They are

- Andover
- Blaine
- Columbus
- Ham Lake

Roles and Responsibilities

BWSR

The WCA through promulgation of rules and guiding the implementation

CCWD

The District is the LGU for wetlands within the watershed except for within the City of Coon Rapids

Cities

The City of Coon Rapids retains the LGU authority for the WCA program. All cities within the watershed must conform to the wetland standards set forth by the CCWD.

Anoka Conservation District

Representatives of conservation district agencies for each county participate in the Technical Evaluation Panel.

MPCA

NPDES permits for discharges to wetlands must be submitted to MPCA. This agency is responsible for administering Minnesota Rule Chapter 7050 (water quality standards) which include wetlands as specified in Minnesota Rule 7050.0210, subpart 13a.

Army Corps of Engineers

Section 404 of the Clean Water Act gives the Corps jurisdiction over regulating impacts to wetlands and navigable waters. The Corps issues federal permits for all proposed wetland disturbances.

Minnesota Department of Transportation	The Department of Transportation is the WCA LGU on all of its projects. There are various agencies involved in the permitting process for wetland disturbances. In Minnesota a joint application process has been established to streamline the agency review and permitting process. Proposed activities which affect a wetland cannot begin until all agencies authorize a project. Often, Technical Evaluation Panels are convened as a mechanism to resolve permitting issues relating to wetland impacts.

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Surface Water Management Planning

Overview

The Metropolitan Surface Water Management (MSWM) Act was enacted in 1982 to require planning for surface water management throughout the seven-county metropolitan area. The MSWM Act is enforced by Minnesota Statutes 103B.201 to 103B.251 and later, Minnesota Rule 8410. Watershed districts are established and given further authority under the Minnesota Watershed Act (Minnesota Statute 103D) and therefore must conform with the requirements therein. These rules provide the framework for governing surface water management (including wetlands) at the local and regional level.

Roles and Responsibilities

BWSR

Responsible for reviewing and approving the WMP based on Minnesota Rule 8410. Metropolitan Council: The Council reviews and comments on the watershed plan with respect to its consistency with state laws and rules relating to water and related land resources.

CCWD

The role or focus of a district in surface water management varies depending on the specific water issues. The CCWD is responsible for periodically updating their plan and complying with the regulations referenced above. This WMP, and its contents, is in compliance with the requirements.

Cities

Within two years of this WMP adoption by the District, local government units are required to adopt local plans which address the regulations and performance standards set forth in this plan. Local plans must be consistent with the District WMP covering the same area. Local plans should address the expanded list of requirements under Minnesota Rule 8410 as set by the Metropolitan Council's "2030 Regional Development Framework.

Anoka Conservation District

Review and comment on the plan. County water plans must be consistent with the District plan covering the same area. State review agencies: Review and comment on plan. Involved state agencies include the MnDNR, MPCA, Department of Health, Department of Agriculture, and the MnDOT.

Other WMOs	District policies and programs are to be consistent with the adjacent Rice Creek Watershed District and Sunrise River, Upper Rum River and Lower Rum river Water Management Organizations.

Groundwater Planning

Overview

The EPA is responsible for federal activities relating to the quality of groundwater, especially as it relates to drinking-water supplies. Groundwater protection activities by the EPA are authorized by a number of federal laws which focus on controlling potential sources of groundwater impacts. Where federal laws have provided for general groundwater protection activities, the actual implementation of these programs is administered by the states in cooperation with local governments. In Minnesota, several state agencies are involved in administering programs which regulate water supply wells and monitoring of groundwater resources in order to maintain the quality of groundwater supplies for the benefit of the public and the environment.

Groundwater planning done as part of water supply plans and wellhead protection plans is reviewed and approved by Minnesota regulatory agencies. States are also charged with preventing pollution of groundwater by establishing appropriate rules and issuing permits for waste treatment, storage, and disposal activities, as well as performing compliance reviews.

Roles and Responsibilities

CCWD

The District recognizes the important relationship between surface water and groundwater resources. The District can collaborate with the other units of government and may choose to help fund groundwater projects which have a connection to surface water issues. The CCWD is responsible for conforming to groundwater plans developed by relevant Counties.

The District will review and submit comments to the MnDNR for water appropriation permits.

Counties: As directed by Minnesota Statute 103B.255, counties may prepare a plan which provides a county-wide framework for the protection and conservation of groundwater resources. Note that Anoka does not have a plan but does perform an assessment.

Cities	Install water supply systems and are required to comply with the rules and regulations established by state agencies and county governments regarding groundwater protection and uses in compliance with the Safe Drinking Water Act. Responsible for developing wellhead protection plans pursuant to MDH rules.
Minnesota Department of Health (MDH):	Primary role is maintaining a safe drinking water supply. The MDH issues permits for all new wells to be installed and oversees water quality monitoring for all public water supply systems. MDH administers the state wellhead protection program according to Minnesota Rules (Chapter 4720.5100 - 4720.5590), which sets standards for wellhead protection planning. Through this program, MDH approves drinking water supply management areas (DWSMAs) which includes surface and subsurface area surrounding a public water supply well.
Minnesota Pollution Control Agency (MPCA):	Responsible for establishing groundwater quality standards, usually based on health risk limits set by the MDH. The MPCA is also responsible for working with the MDH and MDA to establish an ambient groundwater quality monitoring network in Minnesota.
Minnesota Department of Natural Resources (MnDNR):	Charged with managing the State's ground water supply sustainability by conducting studies of ground water availability and supply; conducting studies of ground water and surface water interaction, administering a water use permitting program, and reviewing/approving municipal water supply plans.
Minnesota Department of Agriculture	Is charged by law with regulating pesticides, including monitoring for them in the environment and preventing pesticides from getting into water.
EPA	Under the EPA's Office of Ground Water and Drinking Water, underground injection wells are regulated through the Underground Injection Control program. This relates to groundwater planning at a local level because some stormwater infiltration systems can be considered Class V injection wells.
Metropolitan Council	Charged with developing a metropolitan area master water supply plan.

Overview of Water Resource Protection

Each state determines which beneficial uses are appropriate for their waters. The uses specify the value of a particular water body in the sense of how society will utilize them and their societal benefits. The best uses for a water body are those determined to be most consistent with the present and potential uses, while considering the economic and social development within an area. The level of water quality improvement or degree of protection necessary to achieve the uses occurs through the establishment and enforcement of water quality standards. Whether a use is being attained is evaluated based upon the physical, chemical and biological characteristics of the water body.

Minnesota Rule 7050 identifies seven use classes describing the beneficial uses for which surface waters are protected. All surface waters in Minnesota, including lakes, rivers, streams and wetlands are protected for aquatic life and recreation where these uses are attainable, unless the waterbody has been individually reassessed and re-classified as limited resource value water. Limited resource value waters include surface waters that have been subject to a use attainability analysis and have been found to have limited value as a water resource because of lack of water, lack of habitat, or extensive physical alterations.

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There are three types of standards used to establish a regulatory limit that supports a designated use:

Type	
Numeric Standard	A numeric standard represents a designated safe concentration for a particular contaminant intended to protect a designated use. The use will be adversely affected if the pollutant concentration exceeds the numeric standard too frequently. Numeric criteria, which form the basis for standards adopted by many states, are defined in federal rules as a recommended minimum water quality standard. A state can establish a more restrictive standard than the numeric criteria.
Narrative	The narrative standard is usually not as easily defined as a numeric standard. Narrative standards involve keeping waters free of unwanted conditions such as oil sheens, floating solids, or algae blooms. The narrative standard may also be interpreted as the physical condition necessary to achieve the designated use. For example, if the designated beneficial use is “cold water fish habitat” the surface water temperature and dissolved oxygen levels must remain within a range that can support cold water fish species.
Nondegradation	The nondegradation standard pertains to waters that currently have water quality better than the applicable

numeric or narrative standards, for the designated use. The anti-degradation standard precludes further degradation of the resource to the numeric standard. It essentially does not allow the polluting of a better quality resource from its current condition “back” to the level of the lower-quality numeric standard for the designated use.

Within this broad context of resource management, under Minnesota Rule 8410.0100, Subpart 3A, the CCWD can establish local goals for lake nutrient concentrations and corresponding pollutant loadings.

Subpart 6: Management Programs of Minnesota Rule 8410.0100, states that ‘each [watershed management organization] plan must, at a minimum, assess or require local plans to assess [E] the need to establish a water body management classification system to provide for water quality and quantity management based on a hierarchical basis.

Subpart 6 further states that ‘All proposed management programs establishing a classification system for the management of water bodies shall be consistent with chapter 7050’, which describes water-quality standards for protection of waters of the state and their classifications.

Lake Classification and Management

State-wide Classification System

One of the most basic and broadly used lake classification systems in Minnesota is employed by the MPCA using eco-regions as the primary baseline. Eco-regions are discussed in Chapter 2 of this plan. Omernik (2004) describes an eco-region as a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterize that region". The MPCA developed eco-region-based lake eutrophication standards for the concentrations of total phosphorus (TP) allowed in those waters.

These are used as part of an overall "weight of evidence" approach to assess whether lakes support swimmable and other uses, and other factors related to the TMDL support for lakes discussed elsewhere.

Minnesota includes four eco-regions shown in the following table, which also further details the use and level of support and the TP guideline:

Table Eco-region-based lake-eutrophication standards

Eco-Region	Use and Level of Support	TP Guideline	Shallow Lake
Northern Lakes and Forests	Cold water fishery, Full support	< 15 µg/liter	
Northern Lakes and Forests	Primary-contact recreation and aesthetics, Full support	< 30 µg/liter	
North Central Sand Forests	Primary-contact recreation and aesthetics, Full support	< 40 µg/liter	< 60 µg/liter
Western Corn Belt Plains and Northern Glaciated Plains	Primary-contact recreation and aesthetics, Full support	< 40 µg/liter	< 90 µg/liter
	Partial support	< 90 µg/liter	

The following descriptions detail the use and level of support:

- Full-support - few algal blooms and adequately high transparency that exist throughout summer to support swimming.

- Partial support (impaired) - algal blooms and low transparency that may limit swimming for a significant portion of the summer.

- Non-support (impaired) - severe and frequent algal blooms and low transparency that will limit swimming for most of the summer.

The CCWD is entirely within the North Central Sand Forest Eco-region, but has climate and land use similar to the Western Corn Belt Plains Eco-region. It also has many shallow lakes that affect the relation between phosphorus and the ecosystem of the lake.

The MPCA generally classifies water as wetlands if it is less than 7-feet deep, for shallow lakes, if it is 7-15 feet deep and deep lakes if it is greater than 15-feet as. A variety of other factors complicate this relation, but the primary reasoning is that wetlands have considerable emergent and submergent vegetation that makes them a different ecosystem than shallow and deep lakes, while lakes have a considerable amount of open water.

Deep lakes differ from shallow lakes because they generally thermally stratify in the summer, which keeps nutrients such as phosphorus in the cooler bottom (hypolimnetic) waters where they are unavailable to over fertilize aquatic plant communities.

The effect of wind action on mixing is controlled somewhat by the lake’s fetch, which is the length of the lake that is affected by strong winds. Shallow lakes having a smaller fetch may hold stratification longer than lakes having a large fetch. Conversely, deeper lakes might mix more frequently if they have a larger fetch. Deeper lakes and some shallow lakes generally are capable of supporting a sustainable a fish population, making them popular to those types of recreational activities.

Table shows the characteristics of lakes, shallow lakes, and wetlands provided by the MPCA.

	Lakes	**Shallow Lakes**	**Wetlands**
Protected Waters Inventory Code	Typically coded as “L or LP in PWI	May be coded as either “L, LP or LW” in PWI	Typically coded as a “LW” in PWI
Depth, Maximum	Typically > 15 feet	Typically < 15 feet	Typically < 7 feet
Littoral area	Typically < 80 %	Typically > 80 %	Typically 100%
Area (minimum)	> 10 acres (Bulletin 25) 2	> 10 acres (Bulletin 25)	No minimum
Thermal Stratification (Summer)	May or may not stratify dependent upon depth, size and fetch of lake	Typically do not thermally stratify	Typically do not thermally stratify
Fetch	Frequently a significant fetch depending on size	Fetch is highly variable	Rarely has a significant fetch
Substrate	Consolidated sand/ silt/gravel	Consolidated to mucky	Mucky to unconsolidated

	Lakes	Shallow Lakes	Wetlands
Shoreline features	Generally wave formed, often sand gravel or rock	Generally wave formed, often sand gravel or rock	Generally dominated by emergents
Emergent vegetation	Shoreline may have ring of emergents	Emergents common, may cover much of lake	Emergents may dominate much of basin often minimal open water
Submergent vegetation	Shoreline may have ring of emergents	Emergents common, may cover much of lake	Emergents may dominate much of basin, often minimal open water
Dissolved Oxygen	Aerobic epilimnion; hypolimnion often anoxic by midsummer	Aerobic epilimnion but wide diurnal flux possible	Diurnal flux and anaerobic conditions common
Fishery	Typically managed for a sport/game fishery. May be stocked MN/DNR fishery assessments typically available	May or may not be managed for a sport fishery. If so, fishery assessment should be available. Winter aeration often used to minimize winterkill potential	Typically not managed for a sport fishery. Little or no MN/DNR fishery information. Seldom aerated. May be managed to remove fish and promote waterfowl
Uses	Wide range of uses including boating, swimming, skiing, fishing; boat ramps and beaches common	Boating, fishing, waterfowl production, hunting, aesthetics; limited swimming; may have boat ramp, beaches uncommon	Waterfowl and wildlife production, hunting, aesthetics. Unimproved boat ramp if any. No beaches

CCWD Classification System

Discussion of Classification Factors

Twelve lakes were considered while developing this classification system.

Three lakes were less than 7-feet deep and would be classified as wetlands.

Three lakes had depths that would make them shallow lakes.

Five lakes have depths greater than 15 feet making them deep lakes. However, two of these are man-made and the other three have more characteristics of a shallow lake than a deep lake.

Four lakes had no depth information readily available.

For this plan, the classification system takes into account qualitative and quantitative factors. These factors often are interdependent, such as the appearance or clarity of water that is measured numerically as transparency. There are also factors that indicate the public importance of a water body: a public boat launch indicates the desire of nearby residents wanting or needing boat access; and that desire often is to go fishing, which has other management implications. These factors are discussed further in order to summarize the range in lake characteristics within the watershed.

Lake Name	Nature	Lake ID	Size (Ac)	Littoral Zone (%)	Max Depth (ft)	Water Clarity (ft)
Amelia	Man Made		10			
Bunker	Wetland	020090	70	100%	6	
Cenaiko	Man Made	020654	29	40%	36	5.4
Club West	Man Made	020764	37		26	3.5
Crooked	Shallow	020084	118	73%	26	8.5
Dianne	Man Made		14			
Ham	Shallow	020053	193	92%	22	6.8
Laddi	Wetland	020072	77	100%	4	3.9
McKay	Wetland	020083	20	100%	6	
Netta	Shallow	020052	168	80%	19	7.6
Sunrise	Man Made		134			
TPC	Man Made		34			

Lake Depth

A major factor that should be built into a classification system for CCWD lakes is the depth. Greater depth imparts greater vertical stability into a lake which has major implications for the lake quality and other characteristics. Alternatively, depth can be incorporated as a term that describes whether the lake stratifies.

Using the MPCA criteria, of maximum depth greater than 15 feet, five CCWD lakes are considered deep.

One of these lakes (Crooked) is known to have Eurasian Watermilfoil.

The remaining 7 lakes include 3 that are wetlands and four that are man-made and whose depth is unclear.

When public access was provided, one lake had an earthen access, but other accesses were limited to carry-in or a pier.

Nutrient Concentration

Total phosphorus concentration is a strong indicator of eutrophication in most Minnesota lakes.

Three of the 12 CCWD lakes considered had recent or historic TP concentration data. These data had been collected recently or from many years ago.

Impairment Listing

An impairment listing results from a lake not meeting its designated standard for nutrient concentrations or some other measure. A TMDL study provides a framework for reducing nutrient or other loading by identifying the magnitude and source of those loadings, and producing an Implementation Plan for guiding load reductions.

None of the lakes within the watershed are currently impaired.

Public Access

The level of public access is a strong indicator of the level of interest by persons wanting to use a lake and its susceptibility to influences that may be related to that access.

The strongest level of access, a concrete boat-launch ramp, had the following relations:

Lake Name	Eurasian Water Milfoil	Curly Leaf Pondweed
Crooked	1990	2005
Ham		Yes (<2005)

The other types of public access listed, by pier, carry-in, or shoreline, were provided for.

Management Plan and other Reports

This grouping is important because it often results from an interest in documenting the quality of an important resource. However, it may need to be qualified based on the focus and relative magnitude of the effort. A management plan can focus on shoreline development, water levels, water quality, fisheries, motorized access, or a number of things. Likewise, water quality reports have similar limitations because they may deal with one of many important water quality concerns or may treat them as a comprehensive system. A common water quality report is a vegetation or macrophyte survey that may result in a report, a map, a management plan or a combination of products.

The table below lists most of the plans and reports that were identified for lakes in the CCWD and other factors that were used in classifying the CCWD lakes.

Name	DNR ID	Management Tier	Depth	Lake Mgt Plan (Yr)	Water Quality Monitoring	Macrophyte Study
Amelia			Man Made			
Bunker	020090		Wetland		-	
Cenaiko	020654		Man Made			
Club West	020764		Man Made			
Crooked	020084		Shallow	2009	*	2011
Dianne			Man Made			
Ham	020053		Shallow		*	
Laddi	020072		Wetland		*	
McKay	020083		Wetland			
Netta	020052		Shallow		*	
Sunrise			Man Made		*	

Other characteristics that were considered for grouping lakes include the concentration of chlorophyll a (chl a) and the Secchi-disk transparency, which also are measurements that are commonly used to evaluate and characterize the trophic status of lakes.

The average transparency of 8 lakes was greater than the 2-meters threshold for eutrophic lakes. All were deep lakes, but even clear-water wetland lakes are unlikely to meet a criterion that typically exceeds their total depth. Shallow lakes often are influenced by factors such as wind-driven turbidity and color from decaying vegetation that reduces their transparency in spite of having high-quality water.

Lake Classifications

Lakes in the CCWD range from deep to shallow, riverine to land-locked; productive (eutrophic) to pristine (oligotrophic), with many other characteristics. Many of the lakes are associated with extensive wetland areas, or are shallow enough to be considered wetlands.

Although each of the CCWD lake systems is unique, they also have much in common since they are part of the same hydrologic system. In order to reduce complexity and better address management issues, placing each of the lakes in a classification system is helpful. This classification system identifies tiers to differentiate among classes. Each tier is intended to guide how actively and to what degree, the CCWD will manage lakes, the purpose of the management, and goals for lake quality. Both shallow and deep lakes are included within each tier. Lakes are subject to reclassification at any time based on new data, project implementation (such as adding a public access), or outcomes of a TMDL study.

The classification system presented here is built upon the logic and experience gained from a variety of lake classification systems employed for the CCWD lakes and for other lacustrine systems. The resource criteria for what comprises each tier are based on many important factors yet not all criteria must be met for a lake to be in a particular tier.

Tier I

This includes lakes that routinely provide regional public recreation opportunities including a range of boating activities, and dedicated swimming facilities. These lakes typically represent a high quality resource for fisheries and wildlife. Tier I lakes are maintaining ecoregion water quality standards or have a very strong likelihood of restoration to those standards.

Management Goal The resource management goal for Tier I lakes is to maintain or fully restore the quality of the lakes for their designated uses. Typical management activities include providing both one-time capital projects, and on-going annual management and lake specific projects as determined through planning efforts.

The CCWD resource investment is usually higher relative to other tiers and with respect to other potential management partners.

A goal for the total phosphorus concentration for deep lakes within Tier I is less than 31 ug/L, and for shallow lakes is less than 48 ug/L. This is a step towards the prevention of nuisance algal blooms.

Tier II

These lakes provide, or have the capability to provide, passive regional public recreation opportunities including aesthetic enjoyment or other special purpose uses. As such, a consideration for lakes in this tier is if they are part of a broader park system or open space plan.

Tier II lakes may not be maintaining eco-region water quality standards but do have a reasonable likelihood of restoration to those standards.

Management Goal The resource management goal for Tier II lakes is to improve the quality of the lakes in order to better support aquatic life and enhance the passive recreation experience.

Typical management activities include continuation of data collection and trend monitoring. Developing projects or supporting the effort of others to minimize the severity and frequency of algal blooms is a management activity to meet the goal.

The CCWD resource investment, relative to other tiers and with respect to other potential management partners,

is usually high.
A goal for the total phosphorus concentration for deep lakes within Tier II is 31-49 ug/L, and for shallow lakes is 48-83 ug/L.

Tier III

Public access is typically minimal for these lakes. As such, existing or potential regional recreation opportunities, active or passive, are negligible unless improvements are made.

Tier III can also reflect lakes where the quality of fisheries is significantly limited by lake depth, presence of invasive species, and land use factors. Another criterion for lakes in this tier is that the drainage area is wholly contained within a single municipal boundary.

If data are available, these lakes exceed eco-region standards; however, there may be some ability to rehabilitate the lake towards more desirable conditions.

Management Goal

The resource management goal for Tier III lakes is to assist others in managing the lake condition, or evaluate the condition of the lake if unknown.

Management activities include collaborating with municipalities and other program partners. Performing lake studies is a desired management activity but should be conducted as part of a larger, multi-lake effort. Collection of data is a management activity that should be done within the context of clear monitoring goals and objectives.

The CCWD resource investment, relative to other tiers and with respect to other potential management partners, is moderate.

A goal for the total phosphorus concentration for deep lakes within Tier III is 49-75 ug/L, and for shallow lakes is 83-150 ug/L.

Tier IV

This tier includes lakes that do not fit into the other 3 tiers. They typically are unable to provide recreational opportunities because they lack public access. Also, Tier IV includes lakes that are part of the CCWD trunk drainage system, which gives them unusually large drainage areas.

Lakes in this tier can also reflect those with no reasonable ability to sustainably maintain, or restore to, eco-region water quality standards. Lakes having unknown depths are considered shallow and Tier 4 until more information is available to establish them in another tier.

Management Goal The resource management goal for Tier IV lakes is to maintain lake water quality.

Management activities to meet this goal include implementation of the CCWD stormwater rules for projects. Algal blooms are generally tolerated and efforts to control invasive species within the lake are not a priority for the District, although efforts by others will be encouraged.

The CCWD resource investment, relative to other tiers and with respect to other potential management partners, is low.

A goal for the total phosphorus concentration generally is not established for lakes grouped within Tier IV, and concentrations greater than 75 ug/L may be tolerated.

Wetland Classifications

Wetlands Definition

The statutory definition of wetlands is:

> Those areas inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas (33 CFR 328).

A wetland is an ecosystem that depends on constant or recurrent, shallow inundation, or saturation at or near the surface of the substrate.

The minimum essential characteristics of a wetland are recurrent, sustained inundation or saturation at or near the surface and the presence of physical, chemical, and biological features reflective of recurrent, sustained inundation or saturation.

Common diagnostic features of wetlands are hydric soils and hydrophytic vegetation. These will be present except where specific physiochemical, biotic, or anthropogenic factors have removed them or prevented their development. (National Research Council, 1995)

Wetland Types and Classifications

A number of wetland classification schemes have been developed (Shaw and Fredine, 1971; Cowardian, et. Al., 1979; Curtis, 1971; Eggers and Reed, 1997). This report will rely principally on the following classification systems by Shaw and Fredine (1971), Cowardian, et. Al. (1970), Eggers and Reed (1997) and Brinson (1992).

Circular 39

Developed by Shaw and Fredine (1971), Circular 39 is actually an update of a classification system published in 1953 by Martin et. Al.. The Circular 39 system classifies wetlands by “Type”, eight of which are found in the Anoka Sand Plain. The wetland types are based on criteria such as water depth and permanence, water chemistry, life form of vegetation and dominant plant species.

Wetlands and Deepwater Habitats

Developed by Cowardian et. al. (1979) it is the most widely used system for classifying wetlands in the United

States. Used for the National Wetland Inventory, the system uses structural vegetative characteristics as a primary criteria. This classification system was designed to meet four objectives:

1. To describe ecological units that have certain homogenous natural attributes,
2. To arrange these units in a system that will aid in decisions about resource management,
3. To furnish units for inventory and mapping,
4. To provide uniformity in concepts and terminology throughout the United States.

Plant Community Types

Developed/Used by Eggers and Reed (1997) in their guide to "Wetland Plants and Plant Communities of Minnesota and Wisconsin" this classification system corresponds closely to the wetland plant communities described by Curtis (1971) and used in the Minnesota Rapids Assessment Methodology. The system identifies 15 plant communities found in the Anoka Sand Plain.

Hydrogeomorphic Classification

Developed by Brinson (1992) this classification is based on the hydrogeomorphic characteristics of geomorphic setting, water source and hydrodynamics. The classification is based on characteristics important in controlling how wetlands function (processes) and is appropriate for identifying wetlands that are functionally similar.

Those functional characteristics are:

1. Landscape position
2. Primary water source
3. Hydroperiod

The system identifies six wetland classes within the Anoka Sand Plain at the highest level based on geomorphic setting. The subclasses listed below each class are based on water source and hydrodynamic characteristics of the wetland.

Wetland Classifications of the Anoka Sand Plain

1. Depression and Swale Wetlands
2. Riverine Wetlands
3. Slope Wetlands
4. Organic Soil Flats
5. Mineral Soil Flats
6. Lacustrine Fringe Wetlands

Wetland Management Categories and Strategies	Six management categories exist as follows:
Preserve	Wetlands placed in this category generally function at a high level.
Manage 1	These wetlands generally function at a high level, contain high vegetative diversity and wildlife habitat with some functions for water quality and flood attenuation.
Manage 2	These wetlands generally provide some functions for vegetative diversity and wildlife habitat with high functions for water quality protection and flood attenuation.
Manage 3	These wetlands generally provide the highest functions for water quality protection and flood attenuation. Many of these wetlands serve stormwater storage and treatment.
Restore	These wetlands received low functional capacity scores due to their location hydrologic disturbance or hydro-period but are good candidates for restoration. .
Storm Pond	Water bodies that were created in upland areas for the purpose of treating and/or storing stormwater.

State-wide Classification

The CCWD has an abundance of wetlands throughout the watershed. Wetlands may be isolated or associated with lakes and streams, and may vary in the amount and length of saturation and/or inundation and types of vegetation.

According to the Minnesota Board of Water and Soil Resources, a wetland must meet three criteria:

1. It must have mostly hydric soils;
2. It must have standing water or saturated soil for at least part of the growing season; and
3. It must support mostly vegetation adapted to wet soil conditions.

The CCWD, as the LGU, is responsible for administering WCA within the District, except within the City of Coon Rapids and state lands as defined by MN Rule 8040.0200 Subpart C.

The National Wetland Inventory is the most comprehensive map, which indicates the probable location of wetlands within the United States. Currently, the predominately used system to categorize wetland types is the Circular 39 (Shaw and Fredine, 1971) by the U.S. Fish and Wildlife Service. Under this method there are eight wetland types are recognized in Minnesota.

Type 1 - Seasonally Flooded Basin or Flat: Upland depressions, bottomland Sands (floodplain forests) that are covered with water or waterlogged during variable seasonal periods. Plant communities in these transitory wetlands are highly variable.
Type 2 - Wet Meadow: Shallow basins, sloughs, or low areas that may border shallow marshes. They usually do not have standing water during most of the growing season but are waterlogged within a few inches of the surface. Plants include grasses, sedges, and rushes.
Type 3 - Shallow Marsh: A shallow basin often covered with 6 inches or more of water. Plants include grasses, bulrush, cattail, arrowhead, and smartweed.
Type 4 - Deep Marsh: Shallow lake basins and potholes that may border open water. They usually are covered with 6 inches to 3 feet or more of water during growing the season and have cattail, wild rice, water milfoil, duckweed, and water lily.
Type 5 - Shallow Open Water: Shallow lake basins that may border large open-water basins. These usually are covered with less than 10-foot-deep water and include shallow ponds and reservoirs. Emergent vegetation is similar to that of Type 4, but is on the fringe of open water.
Type 6 - Shrub Swamp: Occurs along sluggish streams, drainage depressions, and occasionally on floodplains. It often is covered with as much as 6 inches of water and is usually waterlogged during growing season. Vegetation includes alder, willow, buttonbrush, dogwood, and swamp privet.
Type 7 - Wooded Swamp: These occur mostly in shallow ancient lake basins, old riverine oxbows, flat terrains, and along sluggish streams. These often are covered with as much as 1 foot of water, and include Sand and coniferous swamps with tamarack, northern white cedar, black spruce, balsam fir, balsam poplar, red maple, and black ash.
Type 8 - Bogs: These are mostly shallow glacial lake basins and depressions, flat terrains, and along sluggish streams. With the water table at or near the surface and a spongy covering of mosses, they support woody and herbaceous vegetation including sphagnum mosses, sedges, leatherleaf, Labrador tea, cranberry, and cottongrass. They may include stunted black spruce and tamarack.

Classification System and Waterway Management

Assessment Summary: The legal drainage system consists of a series of open channels, tile, storm sewer pipe, swales, and streams, which connects the lakes and wetlands to the Mississippi River. The legal drainage system also consists of cross roads, culverts and bridges which convey the water to the downstream side of the roadway. Sometimes the culverts and bridges are owned by the drainage authority, but usually they are owned by the private landowner where the drainage system crosses a private drive or the city, county, state or township that constructed the road.

The origin of the open channels comprising the legal drainage system varies. The open channel may have been originally constructed where no previous natural swale or stream existed. In this case, the channel was entirely made by humans. Conversely, the open channel may have been created by straightening, deepening, widening or otherwise modifying a natural flow path or waterway. All or only portions of a natural waterway may have been modified. The major waterways within the CCWD (e.g., Sand Creek) serve a unique role, being defined as the "trunk system" because they are part of the legal drainage system and must serve as the outlet to convey runoff from agricultural and urbanizing areas downstream to the Mississippi River. For example, both Sand Creek and Clearwater Creek were originally natural streams that have been modified and now also serve as legal drainage systems.

The issues, considerations, approach and methods used to manage natural unmodified waterways can differ from those used to manage a constructed open channel. The methods used to stabilize the bank of a natural waterway for example, might focus more on the use of materials that fit with the context of the landscape rather than rock rip-rap. Expectations with regard to the ecological value and integrity vary dep ending upon the type of waterway. The MPCA is working toward implementing a Tiered Aquatic Life Use (TALU) framework to achieve the beneficial uses of streams and rivers within the State. The foundation for the TALU is that the biological condition of stream responds to stress along a gradient of biological condition. The biological condition is better where there is less stress. Biological standards are based on expectations established by observing a stream in good condition (i.e., reference condition). This framework is currently being used as the foundation for the TMDL being completed for Sand Creek.

Several issues are associated with classifying and managing the legal drainage systems and waterways within the CCWD:

Because of the varying origins of open channels comprising the legal drainage systems and waterways within the District, one issue is the manner in which waterways should be classified and how the classification method relates to establishing expectation for the biological condition and the approaches, methods and manner to stabilize and rehabilitate these waterways.

The funding of maintenance activities for the Trunk System is presently accomplished using ad Valorem funds. An issue is whether this should remain as the preferred approach.

Opportunities for Resolution: The resolution of these issues is possible through the development and implementation of a classification system for the waterways of the

District. The classification system can include establishing expectations for biological condition and the preferred methods for stabilization and rehabilitation.

Anoka County Geologic Atlas

In 2009 the CCWD provided partial funding to a multi-agency geologic atlas project. A county geologic atlas is a map-based report of groundwater and geology to be used for community planning and groundwater management. It is created by compiling boring records from 20,000+ water wells. The atlas provides detailed information about groundwater, including:

• aquifers, including identifying future water sources,
• aquifer sustainability,
• recharge areas,
• sensitivity to pollution,
• flow directions,
• connections to lakes, streams, and wetlands,
• chemistry,
• well head protection, and others.

Anoka County is the only twin cities metro county without a geologic atlas. This project is a cooperative effort of state and local agencies. 94% of funding is from the Legislative-Citizen Commission of Minnesota Resources (LCCMR). The Anoka Conservation District and all seven Anoka County Water Management Organizations are providing the other funding. The geologic atlas will be completed around 2013 or 2014.

Appendix D

Legal, Institutional, and Economic Framework for Water and Land Conservation and Sustainable Management

Purpose

To present an analysis of, and method for, organizing and discussing the factors critical to the long-term management of the watershed. It is intended as an overall organization of facts.

Goal

To address available management tools (pertinent statutes, levy and special assessment authority, intergovernmental cooperation and public relations).

The goal is to assess the managerial capabilities and needs that affect each of these items, and determine the capability and feasibility of addressing the social needs and demands within the capability and constraints of the physical resource.

Scope

The assessment is organized as follows:

Appendix A-1

ORGANIZATIONAL

History – Chronology of Milestone Events

The following are key dates and events affecting the organization and direction of the Coon creek Watershed District:

Year	Event(s)
1954	Organized efforts to solve water problems in the Coon Creek Watershed began when a steering committee was formed to support a flood control project. Flooding had become a severe problem. Annual flooding of large areas was hurting the agricultural economy of the area, and damaging homes and property along the creek.
	A petition for a P.L. 566 study of the Coon Creek Watershed was submitted to the U.S. Department of Agriculture Soil Conservation Service (SCS). The SCS completed a "Watershed Work Plan" in 1958 with the help of the Anoka Soil and Water Conservation District and the Anoka County Board of Commissioners.
1959	January 8: A nominating petition to establish the Coon Creek Watershed District was signed by the Chairman of Anoka County Board of Commissioners, and was filed with the Minnesota Water Resources Board.
	February 12: The Water Resources Board held a hearing on the establishment of the Coon Creek Watershed District in Coon Rapids.
	May 28: The Water Resources Board issued its Findings of Fact, Conclusions of Law and Order which established the District.
1961	February 6: The Board of Managers adopted their initial Overall Plan and submitted their plan to the Water Resources Board.
	April 14: The Water Resources Board Prescribed an Overall Plan for the District.
1967	The State of Minnesota gave the Metropolitan council the responsibility of preparing a Development Guide" regional plan for the seven county metropolitan area.
1972	The passage of the Clean Water Act (U.S. Code, Title 33).

1977 An amendment to Clean Water Act brings water quality goals of the nation and the region into sharp focus.

Section 208 of the Act requires the preparation of "area-wide waste water treatment management plans" to address both point and non-point pollution sources.

1979 The Metropolitan Council initiated extensive field investigations to examine the impact of non-point source runoff on the region's lakes, streams and rivers.

The investigations revealed that, "Indeed, nonpoint source pollution is a major problem for all receiving waters in the Metropolitan Area".

1982 The Metropolitan Council published Part 2 of its Metropolitan Development Guide. The guide fulfills the federal requirements as the Region's plan for controlling non-point source pollution under section 208 of the Clean Water Act.

The Council's work also supported concerns and work within the Minnesota Legislature that resulted in the passage of the ***Metropolitan Water Management Act*** in 1982 (Chapter 509, Laws of 1982, Minnesota Statutes Sections 473.875 to 473.883).

The Metropolitan Water Management Act sets out 7 goals and requires the watershed district to develop a Comprehensive Plan to pursue and achieve those goals.

1987 The Metropolitan Water Management Act is amended to authorize ground water planning.

1988 <u>July 27</u>: The first Comprehensive Plan for the Coon Creek Watershed District required under the Metropolitan Water Management Act is approved by the Board of Water and Soil Resources.

1990 The Metropolitan Water Management Act is revised.

1991 The Legislature enacts the Wetland Conservation Act establishing a “No Net Loss of Wetlands” for the state.

The Legislature enacts Redding Bill which requires ponding for development resulting in greater than 1 acre of impervious area.

The U.S. Environmental Protection Agency requires an erosion control permit for development greater than 5 acres in size.

1992 The BWSR adopts rules governing planning and reporting under the Metropolitan Water Management Act.

The Metropolitan Council adopts an interim policy on Non-Point Source Pollution control tat requires 'pre-treatment prior to discharge' in to waters of the state.

1993 The BWSR proposes rules (MR 8420) for implementing the Wetland Conservation Act.

The Pollution Control Agency adopts rules (MR 7050) for wetlands and water quality standards.

1995 The Wetland Conservation Act is amended and revised.

2000 The Wetland Conservation Act is amended and revised.

<u>August</u>: The MPCA sampled four sites within the watershed.

2003 <u>February</u>: The Minnesota Pollution Control Agency informs the Coon Creek Watershed District that the public ditch system under the Watershed District's jurisdiction functions as a storm sewer, the District had been included in a group of Municipal Separate Storm Sewer Systems (MS4s) under the National Pollution Discharge Elimination System (NPDES).

<u>May</u>: Coon Creek develops and submits its first Storm Water Pollution Prevention Plan (SWPPP) required as an MS4 under the Federal NPDES program administered by the MPCA.

2004 The BWSR approves the second generation Comprehensive Plan required under the Metropolitan Water Management Act. The scope of the plan is 2000 to 2010.

2006 <u>June</u>: The Minnesota Pollution Control Agency (MPCA) lists Coon Creek, Sand Creek, Pleasure Creek and Springbrook Creek as biologically impaired and listed these resources on the 303d list reported to the U.S. Environmental Protection Agency as required.

The Impairment is listed as a Category 5C, meaning the water quality standard is not attained due to "suspected" natural conditions. Further, the water is impaired for one or more designated uses by a pollutant(s) and may require development of a Total Maximum Daily Load (TMDL) to bring the pollutant under control. Water Quality Standards for these waters may be re-evaluated due to the presence of natural conditions.

November: Coon Creek develops and submits its second Storm Water Pollution Prevention Plan (SWPPP) required as an MS4 under the Federal NPDES program administered by the MPCA.

2007 The Wetland Conservation Act is amended and revised.

District coordinates efforts of Andover, Blaine and Coon Rapids and develops own Non-Degradation Report required by MPCA.

2008 The BWSR Performs a 'Performance Review' of the District's operations and programs through its PRAP program.

The review found that the CCWD is making good progress in the implementation of the comprehensive watershed management plan. The District is efficient in its administrative, planning, execution and communication-coordination functions. The District's annual reports and work plans provide good documentation of progress and the trends, issues and needs facing the District.

2009 MPCA requests CCWD staff to participate in Tiered Aquatic Life Uses (TALU) work team and rule development.

MPCA requests CCWD staff to participate in Minimal Impact Design Standards work team.

MPCA requests CCWD staff to participate in Watershed Approach work team.

CCWD Staff requested to be part of County Groundwater Assessment.

2010 District contributes funds to the development of County Geologic Atlas.

Appendix A-2

Statutory Obligations, Requirements and Abilities of Coon Creek Watershed District

Statutory Obligations of the Watershed District

The Water Law of this state is contained in many statutes that must be considered as a whole to systematically administer water policy for the public welfare. Water law that seems contradictory as applied to a specific proceeding creates a need for a forum where the public interest conflicts involved can be presented and, by consideration of the whole body of water law, the controlling policy can be determined and apparent inconsistencies resolved (M.S. 103A.211).

The Coon Creek Watershed District is a public body organized pursuant to the Watershed Law, M.S. 103D. The laws that influence its activity determine the basic purposes of the District. Most, but not all, of those statutes are listed.

While the Watershed District Act (103D) and the Metropolitan Water Management Act (103B) provide the most basic authorities for the District, the following statutes also influence the District's operation and priorities.

Statutes

Chapter 103A- Wetland Conservation Act (.201 (Subd. 2 (b)):

1. To achieve no net loss in the quantity, quality and biological diversity of Minnesota's existing wetlands;
2. Increase the quantity, quality, and biological diversity of Minnesota's wetlands by restoring or enhancing diminished or drained wetlands;
3. Avoid direct or indirect impacts from activities that destroy or diminish the quantity, quality, and biological diversity of wetlands;
4. Replace wetland values where avoidance of activity is not feasible and prudent.

Chapter 103A- Wetland Policy (.202):

1. To preserve Wetlands
2. To conserve waters
3. To maintain and improve water quality
4. To preserve wildlife habitat
5. To reduce runoff
6. To provide for floodwater retention
7. To reduce stream sedimentation
8. To contribute to improved subsurface soil moisture
9. To enhance the natural beauty of the landscape
10. To promote comprehensive and total water management

Chapter 103A- Rainwater Conservation Policy (.205):

1. To promote retention and conservation of all water precipitated from the atmosphere in the areas where it falls, as far as practicable.

Chapter 103A- Soil and Water Conservation Policy (.206):

1. To encourage land occupiers to conserve soil and water resources through the implementation of practices to that effectively reduce or prevent erosion, sedimentation, siltation and agriculturally related pollution.
2. To preserve natural resources
3. To Insure continued soil productivity
4. To control floods
5. To prevent impairment of dams and reservoirs
6. To assist in maintaining the navigability of rivers and harbors
7. To preserve wildlife
8. To protect the tax base
9. To protect public lands

Chapter 103A- Floodplain Management Policy (.207):

1. To reduce flood damages through floodplain management, stressing non-structural measures such as floodplain zoning and flood proofing, and flood warning practices
2. To guide development of floodplains consistent with legislative findings
3. To adopt, enforce and administer sound floodplain management ordinances.

Chapter 103A- Marginal, Erodible Land Retirement Policy (.209):

1. To encourage the retirement of marginal, highly erodible land adjacent to public waters and drainage systems.

Chapter 103A- Water Law Policy (.211):

1. To consider the water law of the state of Minnesota as a whole
2. To systematically administer water policy for the public welfare.

Chapter 103B- Metropolitan Surface Water Management Act (.201):

1. To protect, preserve, and use natural surface and ground water storage and retention systems
2. To minimize public capital expenditures needed to correct flooding and water quality problems
3. To identify and plan for means to effectively protect and improve surface and groundwater quality
4. To establish uniform local policies and controls for surface and groundwater management
5. To prevent soil erosion into surface water systems
6. To promote ground water recharge,

7. To protect and enhance fish and wildlife habitat and water recreational facilities,
8. To secure the other benefits associated with the proper management of surface and ground water.

Chapter 103D- Watershed District Act (.201):

1. To conserve natural resources through:
    - Land use planning
    - Flood control
    - Other conservation projects
    - Use sound scientific principals for the protection of public health and welfare and the provident use of natural resources.

Specifically to:

1. Control or alleviate damage from flooding;
2. Improve stream channels for drainage, navigation, and any other public purpose;
3. Reclaim or fill wet or overflowed land;
4. Provide a water supply for irrigation
5. Regulate the flow of streams and conserve stream water;
6. Divert or change all or part of water course;
7. Provide or conserve water supply;
8. Provide for sanitation and public health and regulate the use of streams, ditches or water courses to dispose of waste;
9. Repair, improve, relocate, modify, consolidate, and abandon all or part of drainage systems within a watershed district;
10. Control or alleviate soil erosion and siltation of watercourses or water bodies;
11. Regulate improvements by riparian property owners of the bed, banks, and shores of lakes, streams, and wetlands for preservation and beneficial use;
12. Provide for hydroelectric power generation
13. Protect and enhance the water quality in watercourses or water basins; and
14. Provide for the protection of groundwater and regulate its use to preserve it for beneficial purposes

Chapter 103E- Drainage Act (.011):

1. To construct and maintain drainage systems;
2. To deepen, widen, straighten, or change the channel or bed of a natural drainage way that is part of the drainage system or is located at the outlet of the drainage system;
3. To extend the drainage system into or through a municipality for a suitable outlet;
4. To construct dikes, dams, and control structures.
5. To receive permission from the Commissioner of the Department of Natural Resources to:
    - Remove, construct or alter a dam affecting public water
    - Establish, raise, or lower the level of public water
    - Drain any portion of a public water
6. Before establishing or conducting a drainage project consider **(.015)**:

- Private and public benefits and costs of the project
- The present and anticipated agricultural land acreage availability and use
- The present and anticipated land use within the drainage project or system
- Flooding characteristics of property in the drainage project or system and downstream for the 5-, 10-, 25-, and 50-year flood events
- The waters to be drained and alternative measures to conserve, allocate, and use the waters including storage and retention of drainage waters
- The effect on water quality
- The effect on fish and wildlife
- Shallow ground water availability
- The overall environmental impact of the above criteria

Chapter 116B-Environmental Rights Act (.01):

1. To create and maintain conditions under which human beings and nature can exist in productive harmony in order that present and future generations may enjoy clean air and water, productive land, and other natural resources with which we have been endowed.

Chapter 116C-Environmental Coordination Procedures Act (.22):

1. To coordinate with and increase the understanding between state and local agencies in the administration of the various programs relating to air, water and land resources.

Chapter 116D-Environmental Policy Act (.04):

1. To encourage productive and enjoyable harmony between human beings and their environment;
2. To promote efforts that will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of human beings; and
3. To enrich the understanding of the ecological systems and natural resources important to the state and the nation.

Frequency Analysis of Principles and Resource Concerns Emphasized in Minnesota State Statutes

Principle Analysis

The above statutes were reviewed and key principles that provide direction to water and related land management were counted. The results reflect the number of times a given term was used (frequency) and the number of statutes in which it was used. Emphasis is the product of frequency x number of statutes.

Principle	**Freq**	**# Laws**	Product
Conserve. prevent, preserve, protect	**16**	**4**	**64**
Comprehensiveness	**4**	**3**	**12**
Health, safety, & welfare	**3**	**3**	**9**

Control	3	2	6
Improve	3	2	6
Alternatives	2	2	4
Awareness of effects	4	1	4
Future	2	2	4
Harmony	2	2	4
Promote/Provide	2	2	4
Construct	2	1	2
Regulate	2	1	2
Use	2	1	2
Benefit Cost Analysis	1	1	1
Coordinate	1	1	1
Maintain	1	1	1
Manage	1	1	1
Reduce	1	1	1
Scientific principals	1	1	1

Resource Concerns Analysis

The above statutes were also reviewed for the resource concerns that appear to be emphasized in the State's water law as a whole. The results reflect the number of times a given term was used (frequency) and the number of statutes in which it was used. Emphasis is the product of frequency x number of statutes.

Resource Concern	Freq	# Laws	Emphasis
Flooding	**5**	**3**	**15**
Lands/Property/Natural Resources	**4**	**3**	**12**
Soils	**4**	**3**	**12**
Water Quality	**4**	**3**	**12**
Drainage	5	2	10
Wetland	5	2	10
Ground water	3	3	9
Wildlife	3	3	9
Water supply	3	2	6
Water Features	2	1	2
Impoundments	1	1	1

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Appendix A-3

Statutory Requirements

The following Minnesota Statutes ***require*** the watershed district to:

<u>Administration</u>

The Board must:

1. Take oaths of office (103D.315 Subd 1).
2. File performance bonds (103D.315 Subd 2).
3. Elect managers as president, secretary, and treasurer (103D.315, Subd. 3).
4. Adopt a seal for the watershed district (103D.315 Subd 4).
5. Hold meetings at least annually (103D.315, Subd. 10).
6. Adopt bylaws for the administration of business and affairs of the watershed district (103D.315, Subd. 11).
7. Designate a public facility within the watershed district as a principal place of business (103D.321, Subd. 1).

Records:

1. Keep efficient records of all business done and meetings held by the Board of Managers (103D.315, Subd. 5).

Financial Management:

1. Have an annual audit completed of the books and accounts of the district (103D.355).

<u>Development Regulation and Land Use</u>

1. Adopt rules to accomplish the purposes of M.S. 103D and implement the powers of the managers (103D.341).
2. Charge a permit application fee to defray the cost of administering permit applications (103D.345)

<u>Planning</u>

1. Prepare a local water management plan, capital improvement program, and official controls as necessary to bring local water management into conformance with the watershed plan (103B.231).
2. Adopt a watershed management plan (103D.401).
3. Revise and update the water management plan every 10 years (103D.405)
4. Prepare a yearly report (103D.351).

<u>Operations and Maintenance</u>

1. Manage transferred county ditch systems (103D.625 Subd 1).
2. Maintain transferred projects in a condition to accomplish their constructed purpose (103D.631 Subd 1)

<u>Public and Government Relations</u>

1. Appoint an advisory committee (103D.331, Subd. 1).
2. Establish a technical advisory committee (103D.337)
3. Conduct public hearings on planning and budgeting (103D.401 Subd 4: 103D.729 Subd 3; 103D.911)
4. Recognize preexisting rights to use the waters of the watershed district at those rights existed at the time the watershed district was established (est. 5/28/59) (103D.515 Subd 2)

Appendix A-4

Statutory Abilities

To accomplish the above, the following Minnesota Statutes ***enable*** the watershed district to:

1. Certify for payment by the county all or any part of the cost of a capital improvement contained in the capital improvement program of the plan (103B.251).
2. Change the boundaries of the watershed district (103D.251).
3. Employ a chief engineer, professional assistants, and other employees (103D.325, Subd. 1).
4. Perform all acts expressly authorized, and all other acts necessary and proper for the watershed district to carry out and exercise the powers expressly vested in it (103D.335, Subd. 1).
5. Cooperate or contract with any state or subdivision of a state or federal agency, private corporation, political subdivision, or cooperative association (103D.335, Subd. 7).
6. Construct, clean, repair, alter, abandon, consolidate, reclaim, or change the course or terminus of any public ditch, drain, sewer, river, watercourse, natural or artificial, within the watershed district (103D.335, Subd. 8).
7. Enter lands inside or outside the watershed district to make surveys and investigations to accomplish the purposes of the watershed district (103D.335, Subd. 14).
8. Make contracts or other arrangements with private and public organizations and corporations for cooperation or assistance in the operations of the watershed district (103D.335, Subd. 21).
9. Charge application and/or field inspection fees (103D.345).
10. Establish projects (103D.601).
11. Initiate emergency projects (103D.615).
12. Determine benefits and damages (103D.721).
13. Build, construct, reconstruct, repair, enlarge, improve, or in any other manner obtain, maintain, or operate storm water systems (103D.730).
14. File special assessments and collect levies (103D.905).
15. Construct, maintain, deepen, widen, straighten, extend, or change the channel or bed of drainage systems and construct necessary control structures (103E.011).
16. Determine property liability for drainage system costs (103E.601).
17. Conduct research (103D.335).
18. Acquire land rights by eminent domain.(103D.335)
19. Purchase district insurance. (103D.335)
20. Borrow money (103D.335).
21. Join association of watershed districts (103D.335).
22. Administer grants (103D.335).
23. Petition for consolidation with another watershed district (103D.265).
24. Require permit applicant to file bond (103D.345).
25. Seek court orders enforcing rules/permits (103D.545).

Organization of the Coon Creek Watershed District

In 1990 the Board adopted the following statement of mission to provide more direction to this charge.

STATEMENT OF MISSION

To manage groundwater and the surface water drainage system to
Prevent property damage,
Maintain hydrologic balance and
Protect water quality
for the safety and enjoyment of citizens, and the preservation and enhancement of wildlife habitat.

The District intends to do this by using the natural drainage system to provide for conveyance and disposal of storm water runoff without degrading the natural system.

Intent

The above statutes emphasize a comprehensive approach to the wise use, preservation, and protection of water and related land resources for the public health, safety and welfare. While the statutes address almost all water resource features, they emphasize flood control and the protection of the soil and water quality. To this end the District's most basic responsibilities are:

1. To protect the health and safety of the present and future people that live, and will live, within the watershed.
2. To provide for opportunities and uses of the water and related natural resources of the watershed which are demanded and appropriate for the area. Appropriate refers to the natural ability of the water and related resources to continue to perform and function on their on or with a minimum subsidy or cost to the public at large;
3. To prevent unacceptable damage to the water and related natural resources of the watershed. Unacceptable here refers to the decreasing or diminishing the ability of the water and related resources to continue to perform and function on their own in perpetuity.

AMENDMENTS TO PLAN

Amendments to the Comprehensive Plan

The Board of Managers recognizes that it will be necessary to amend the local water plan from time to time, in light of changing conditions and as new information becomes available.

Identifying Amendment Needs

The CCWD Board of Managers each year during its annual budget process will discuss and consider the need for any potential amendments to this Plan. Need will be evaluated based on:

- annual and comprehensive evaluations
- changed conditions
- changes in statute
- monitoring and inspection program information
- new information.

Issues or opportunities may arise when the public comments on the need for change and proposed plan amendment or revision are received.

The Board of Managers will determine what method will be used to provide for public participation about the need for change issues and proposed plan revision or amendment. The Board has the discretion to determine, at any time, whether to further consider an issue or opportunity in the amendment or revision process.

Administrative corrections and additions may be applied to plans developed or revised as minor plan amendments provided the changes have been reviewed by the District's Advisory Committees.

Public Notification

It is the responsibility of the Board of Managers to determine the need for and method of public notification of administrative corrections.

Amendment Process

This Watershed Management Plan extends to the year 2023. The Coon Creek Watershed District Board of Managers, in accordance with the following amendment procedure, may initiate interim amendments to the Plan.

All amendments to the Plan, excepting minor amendments, must adhere to the full review process outlined in Minnesota Statutes section 103B.231, subdivisions 7, 8 and 9, as they now exist or as subsequently amended. The CCWD Board of Managers shall adopt the proposed plan amendments upon their approval by the Board of Water and Soil Resources under Minnesota Statutes section 103B.231 (9), as amended.

The amendment procedure for proposed “minor” plan amendments as defined in Minnesota Rules 8410.0020, subpart 10, and 8410.0140, subpart 3, as amended, will be in accordance with Minnesota Rules 8410.0140, subpart 2 (A), (B) and (C), as such rules now exist or as subsequently amended.

Form of Amendments: Unless the entire plan document is reprinted, all amendments adopted by the CCWD Board of Managers must be printed in the form of replacement pages for the plan, each page of which must:

a. On draft amendments being considered, show deleted text as stricken and new text as underlined.
b. Be renumbered as appropriate; and
c. Include the effective date of the amendment.

COON CREEK WATERSHED DISTRICT

POLICY & PROCEDURES MANUAL

Policy # 4.7
Pages: 1 of 5
Program: Planning, Programming and Budgeting
Policy Name: Certification and Approval of Local Water Plans

POLICY
To ensure that the policies, plans, programs, and regulations of all state and local agencies are consistent with the comprehensive management plan.

It is the policy of the Coon Creek Watershed District to allow the municipalities and township in the District, the greatest degree of flexibility and discretion in the preparation of local water management plans and ordinances, so long as the plans and ordinances do not conflict with the ultimate objectives and minimum requirements and standards of the District's Comprehensive plan.

It is the policy of the Coon Creek Watershed District to accept a local agency's Storm Water Pollution Prevention Plan (SWPPP) as an appropriate substitute for the same components required by Minnesota Statutes 103B.235.

SOURCE
Minnesota Statutes 103B.235

GENERAL INFORMATION
The Metropolitan Water Management Act (Minnesota Statutes 103B) is a legislative determination that management and protection of water and related land resource values in the Metropolitan area is a regional and statewide concern. The Act also recognizes, as does the District's Comprehensive Plan, that local governmental participation in the management process is fundamental to achieving the goals and objectives of the act.

The Act also contemplates that the Watershed District will achieve local participation in the implementation programs and oversee the implementation of the plan. The Act provides for approval of local water plans and land use ordinances by the Watershed District, after which the approved plans and ordinances act as the governing regulations for the municipality. However, if a municipality should choose not to participate in the implementation program, then the District shall adopt and enforce such rules and regulations as are necessary to implement the minimum standards of the comprehensive plan.

This policy is intended to serve two functions:
1. As a general guide for local authorities in preparing local plans and land use ordinances for approval by the Board of Managers, and

2. As a planning and regulatory mechanism that can be adopted by the Board of Managers if a local unit of government fails to secure approval.

PROCEDURES
1. APPROVAL OF LOCAL PLANS
1.1 Conformance of Local Water Plans Required
Within one year after the effective date of the last watershed plan affecting a city or township, or any amendment thereof, each local unit of government with jurisdiction over land located within the Watershed shall adopt or amend a local water management plan applicable to the development of such land so that the local water management plan and ordinances are in conformance with the minimum standards of the Comprehensive plan for the Coon Creek Watershed.

1.2 Submission of Plan and Ordinances
Within one year after the effective date of the last watershed plan affecting a city or township, or any amendment thereof, each local unit of government with jurisdiction over land located within the Watershed shall submit, in accordance with this policy, its local water management plan and any ordinances applicable to the development of land to the Watershed District for review and determination of whether the local water plan is in conformance with the minimum standards of the comprehensive plan for the Coon Creek watershed.

1.3 Setting of Hearing
After receipt of a local water plan and ordinances the District Administrator shall give notice of and set the date, time and place for a public hearing for consideration of the application, plan and ordinances. The public hearing shall be held within thirty days following receipt of the plan and ordinances.

1.4 Recommendation to the Board
Upon completion of the public hearing, the Administrator shall review the record of the hearing and shall, within thirty days following receipt of the plan and ordinances, submit a report to the Board of Managers setting forth proposed findings and a recommended order as to whether the local water plan and ordinances are in conformance with the minimum standards of the Comprehensive plan for the watershed.

1.5 Approval of the Local Water Plan
Upon receipt of the report of the District Administrator, the Board of Managers shall review the findings, conclusion and recommendations, and shall within thirty days following receipt of the plan and ordinances, issue an order certifying, certifying with conditions, or disapproving the local water plan and ordinances. If the local water plan and ordinances are disapproved the Board shall specify the changes necessary in order to secure Board approval.

1.6 Responsibility of Local Unit Upon Conditional Approval or Disapproval
Any City or township whose local water plan or ordinances have been disapproved or certified with conditions shall modify such plan or ordinances as is necessary to conform to the minimum standards of the Comprehensive plan for the watershed, the conditions attached to the conditional certification or specified changes. Within 120 days after entry of the Districts order disapproving, or approving with conditions, the local unit shall submit its modified plan and ordinances for review pursuant to the provisions of section 1.3 through 1.5 above.

1.7 Effect of Failure of Local Unit to Obtain District Approval of Local Water Plan and Ordinances
No person shall initiate any development, which requires local approval or receive and local approval for development of land within the District, without first obtaining Watershed District approval. A Watershed District development approval shall supersede any local decision if a local unit has not received approval of its local water plan and ordinances.

1.8 Effect on and Responsibilities of Local Unit Upon Approval
Watershed District approval of a local water plan and ordinances shall authorize such local unit to grant, to the extent it is authorized by state law or municipal ordinance, any permits or approvals of development within the watershed subject to District review.

1.9 Standards for Approval of Local Water Management Plans and Ordinances
Local water management plans and ordinances, and any parts thereof, shall be certified only if:

A. They are based upon a current and comprehensive inventory and analysis of the natural resources and land uses of the local unit prepared either by the local unit or any other source. The local unit may use the inventory provided by the District.

B. They include provisions which:

(1) Define the drainage areas and the volumes, rates and paths of stormwater runoff.

(2) Identify areas and elevations for stormwater storage adequate to meet the performance standards established in the Comprehensive plan.

(3) Define water quality and water quality protection methods adequate to meet the performance standards established in the Comprehensive plan.

(4) Identifies regulated areas

C. They provide that no application for development within the Watershed shall be determined to be complete by the local unit unless:

(1) It contains at least the information required by the District pursuant to policy 4.1: Permit Procedures; and

(2) It is consistent with the performance standards contained in the approved and adopted environmental ordinances of the local unit.

(3) They provide that no local permit shall be effective until the review procedures cited in policy 4.1: Permit Procedures have been completed;

D. They include a capital improvements program.

1.10 Submission and Review of Amendments to Certify Local Water Plans and Ordinances

A. Submission: No amendment to any approved local water management plan or ordinance shall be effective until the local unit shall have submitted such amendment to the Watershed District and such amendment has been approved by the Watershed District pursuant to section 1.5, or the Administrator has, pursuant to subsection B hereof, notified the local unit that such amendment does not affect the prior approval of then local management plan or ordinance.

B. Decision Not To Review: Within 15 days following receipt of any amendment to an approved LP, the Administrator shall determine whether the amendment raises substantial issues with respect to the conformance of the LP with the Comprehensive plan. If the Administrator determines no such substantial issue is raised, he shall certify such fact to the clerk of the local unit and such amendment shall thereupon take effect in accordance with it terms and applicable law.

C. Decision To Review: If the Administrator determines that the amendment raises substantial issues with respect to the conformance of the amended LP to the Comprehensive plan, the amended LP shall be reviewed pursuant to section 1.3 to 1.9 of this policy and the Administrator shall so inform the local unit.

2 MODIFICATION OR REVOCATION OF APPROVAL OF LOCAL WATER RESOURCE MANAGEMENT PLANS AND NOTICE THEREOF

2.1 Initiation

A. Any person may request the District to assess whether an approved local plan or ordinance is being implemented in accordance with the provisions of the District's Comprehensive plan. Such a request shall be in writing and shall specify the local unit acts which are alleged to be not in conformance with the Comprehensive plan by date, time, and other identifying characteristics.

B. If the District determines, at any time, that a local unit of government is not implementing and enforcing its approved plan or ordinance as is necessary to implement the Comprehensive plan, The District shall initiate proceedings pursuant to this section to revoke, suspend or modify the District approval of the local plan or ordinances.

2.2 Notice Of Hearing

Upon making a determination to initiate proceedings to revoke, suspend or modify District approval of a local plan or ordinance, the District shall give notice and conduct a public hearing in accordance with the provisions of section 1.3 above.

2.3 Recommendation of the Board of Managers

Upon completion of the public hearing, the Administrator shall review the record of the hearing and shall, within forty-five days following receipt of the plan and ordinances, submit a report to the Board of Managers setting forth proposed findings and a recommended order as to whether the local water plan and ordinances are in conformance with the minimum standards of the Comprehensive plan for the watershed.

2.4 Action by the Board

Upon receipt of the report of the District Administrator, the Board of Managers shall review the findings, conclusion and recommendations, and shall within sixty days following receipt of the plan and ordinances, issue a final order with respect to the revocation, suspension or modification of the District approval of the local water plan and ordinances. Upon determining that the local unit in not implementing its plan, ordinances or this plan, the District shall issue an order:

1. Revoking or suspending District approval of the local plan or land use ordinances;
2. Modifying such approval to impose any conditions necessary to ensure adequate District or local review of development within its jurisdiction; or
3. Taking any other action it deems necessary to ensure local cooperation in the implementation of the objectives of this plan.

2.5 Effect of Modification or Revocation of Approval

Revocation, suspension or modification of District approval of any local plan or ordinance shall have the same effect as if the local plan or ordinance had been disapproved or approved with conditions in the first instance as provided under section 1.7. Any revocation suspension or modification of District approval pursuant to this part shall remain in effect until otherwise ordered by the District

3. ADOPTION OF RULES AND REGULATIONS FOR UNAPPROVED AREAS

3.1 District Adoption of Rules and Regulations for Unapproved Areas

In the event that any local unit of government fails to obtain approval of its local water management plan or ordinances, the District shall adopt and enforce such rules and regulations as may be necessary to implement the minimum standards contained in the Comprehensive plan and as may be applicable to any such local government.

3.2 Preparation and Review of Rules and Regulations

The District shall prepare such rules and regulations which are consistent with and implement this plan for any local unit of government which fails to obtain approval under the Comprehensive plan. Said rules shall include those provisions necessary to implement the goals and objectives of the Comprehensive plan.

3.3 Public Hearing

The District shall conduct a public hearing to consider the proposed rules and regulations for unapproved areas.

3.4 Adoption of Rules and Regulations

Upon completion of the public hearing, the District shall revise and adopt said rules and regulations.

C O O N C R E E K W A T E R S H E D D I S T R I C T

POLICY & PROCEDURES MANUAL

Policy #:
Program: Planning, Programming & Budgeting
Policy Name: State and Regional Facilities - Water Plans

POLICY
To promote the conformance of federal, state and regional policies, plans, programs and regulations to the District's comprehensive plan.

To ensure the management practices on state and local lands and facilities are consistent with the comprehensive watershed management plan.

Within one year after approval of the District's Comprehensive, or amendments there to each State, Regional, and County facility within the District shall prepare and adopt a water management plan which is in substantial conformance with the Comprehensive plan for the Coon Creek watershed. Regional and County agencies operating facilities within the District are allowed the greatest degree of flexibility and discretion in the preparation of local water management plans, so long as the plans do not conflict with the goals and minimum requirements and standards of the District's Comprehensive plan

DEFINITIONS
Public Facility: Any Publicly owned or authorized land or facility that meets any of the following criteria:

Is classified as part of the state outdoor recreation system under MS 85,
Is part of a regional system under MS 473
Is authorized or chartered by the State of Minnesota

SOURCE
Minnesota Statutes 103B.235

GENERAL INFORMATION:
Publicly owned lands make up approximately 23% of the watershed and contribute significantly to its hydrology. While the District understands the legalities of requiring state and regional lands from conforming to watershed policy, the District believes that close coordination is required.

The Metropolitan Water Management Act (Minnesota Statutes 103B) is a legislative determination that management and protection of water and related land resource values in the Metropolitan area is a regional and statewide concern. That concern, however, does not exempt the effect of water coming from these lands or the need for water management on public lands within the watershed

This policy is intended to serve two functions:

1. As a general guide for land managers in preparing plans and programs consistent with the water management needs of the watershed, and
2. As an adopted framework for pursuing consistency and coordination in water management issues.

PROCEDURES

Elements of a Public Facility Plan: A public facility plan shall include at least, if applicable, the following:

A. A statement of the purpose and goal of the facility
B. A delineation of any areas of critical ecological importance
C. An existing land use map depicting the location, character, and intensity of existing land uses
D. A future land use map depicting planned or anticipated land uses, including the character and intensity of uses and a schedule of their development;
E. A detailed description of ongoing or planned building, construction or other similar activity, including projected dates of commencement and completion.
F. A definition of the drainage areas and the volumes, rates and paths of storm water runoff.
G. Identify areas and elevations for storm water storage adequate to meet the performance standards established in the Comprehensive plan.
H. Define water quality and water quality protection methods adequate to meet the performance standards established in the Comprehensive plan
I. Identifies regulated areas
J. Preparation of the Plan for Certification:

2.Each public facility shall prepare, with the assistance of District staff as may be available, a master plan in accordance with the previous section, and shall submit it to the Watershed District for review and determination of whether the plan is in substantial conformance with the comprehensive plan for the watershed

3. Recommendation of the Administrator: The District Administrator shall review the plan, together with the recommendation of the staff, and shall submit a report to the Board of Managers setting forth proposed findings and recommendations as to whether the facility plan is in substantial conformance.

4. Certification of Public Facility Plans: Within sixty days after receipt of the Administrator's report, the Board shall review the findings, and recommendations, and shall certify with conditions, or disapprove the facility plan. If the facility plan is disapproved the Board shall specify the changes necessary in order to secure Board approval.

5. Responsibility of Facility upon Approval or Disapproval: Any Facility whose water plan has been disapproved or certified with conditions shall modify such plan as is necessary to conform to the minimum standards of the Comprehensive plan for the watershed, the conditions attached to the conditional certification or specified changes. Within 120 days after entry of the Districts order disapproving, or approving with conditions, the facility shall submit its modified plan for review pursuant to this policy.

6. Amendments to the Facility Plan: Each state or regional facility and the District Board may propose Amendments to an approved facility plan from time to time. Such Amendments shall be approved in same manner as the original plan and such Amendments shall not require the revision or approval of the plan as a whole.

Public Involvement in the Planning Process

Original Planning Process

In January 2010 the District adopted the following planning process for development and adoption of the Comprehensive Watershed Management Plan. The process called for extensive participation by the public and representatives of the District's member cities.

	2010				**2011**
	Q1	Q2	Q3	Q4	Q1
Rule & Permit Requirements	*				
Plan Issues & Concerns	*				
Resource Trends & Implications	=====	*			
Issues & Concerns	===	=====	*		
Goals & Measures			=====	*	
Agency Review					*

Anticipating the Future – 2010 Projected Rule and Permit Revisions

In February 2010 the Board of Managers reviewed the following as probable changes to the rules governing both the Metropolitan Surface Water Management Planning and planning conducted as part of NPDES permit updates:

- Emphasize implementation
- Emphasize mapping and location of infrastructure and problems
- Incorporate or emphasize Minimum Impact Design standards (MIDS)
- Include Performance based measures
- Include methods for demonstrating success
- Begin to emphasize coordinated water planning
- Begin to emphasize varying levels of treatment for protection

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Initial Planning Issues and Concerns

Beginning in March 2010 the District engaged key stakeholders in surfacing key issues concerns and priorities. They were:

Board of Managers

- Enforcement: Effective and quick
- Getting ahead of key water quality concerns
- Water quantity versus water quality conflict – Working through these issues with State agencies
- Groundwater vs. Surface water connection – addressing factors that may be beyond the District's control

Board of Water & Soil Resources

- Showing status of progress – What has been completed

- Public Involvement Process – Include City environmental committees and neighborhood associations
- General schedule of O&M and Capital priorities and implementation – for use in grant applications
- Detailed water monitoring program – Include budget; key water bodies, party collecting data, type of data collected and trends
- Goals and objectives – reasonable and measurable

Minnesota Pollution Control Agency (MPCA)

- Adoption of Low Impact Design and Minimum Impact Design principals
- Goals for impaired waters
- Stormwater runoff goals and standards
- Implementation schedule and responsibilities
- Wetland functions and values assessment
- Wetland regulations consistent with MR 7050
- Monitoring program

Technical Advisory Committee

- Water Quality: Identify impairments and City involvement in TMDL development
- Lake management plans for other lakes
- Earth friendly ditch management
- Buffer strips
- Infiltration – groundwater effect
- Credit for ponds that infiltrate
- Coordination of monitoring for state/other permit reports
- Wetland Functions & Values Assessment
- Documentation of Information & Education collaboration efforts
- Documentation of District retrofit efforts
- Effect of mining/dewatering on surface waters
- Groundwater modeling standards

Involvement

The Board of Managers conducted an open and meaningful public participation process in the development of this Comprehensive Plan. Public involvement has entailed more than 25 meetings with citizens, District and municipal committees and staffs and a spectrum of activities ranging from informing or notifying the public about the planning process, to working collaboratively and cooperatively to share ideas and develop plan components.

Planning Advisory Committee

In February 2010 the District formed a Planning Advisory Committee (PAG). The PAG consisted of one or more members of all of the local agencies within the watershed. Invitations were extended all of the State agencies with which the District works or interacts or have authority to review the District's plan. The PAG met as a group four times as a group during the planning process. Involvement is shown below:

Invitee	3/30/10	7/14/10	10/6/10	4/27/11
Attendance	16	18	13	27

Local Agencies

Invitee	3/30/10	7/14/10	10/6/10	4/27/11
Anoka Conservation District	*	*		*
Anoka County	*	*	*	*
Andover	*	*	*	*
Blaine	*	*	*	*
Columbus				
Coon Rapids		*	*	*
Crooked Lake Area Association	*	*		*
Ham Lake	*	*	*	*
Fridley[1]			*	*
Spring Lake Park[1]				*
[1] Fridley and Spring Lake Park petitioned to become part of the District in August 2010. BWSR approved the petition in December 2011				

State Agencies

Invitee	3/30/10	7/14/10	10/6/10	4/27/11
BWSR	*	*	*	*
DNR	*	*	*	*
Met Council	*	*	*	*
MPCA		*	*	*
MnDOT	-			
MOA - Ag				
MDH - Health				

Other Groups and Participants

Group	Attendance	Date
Coon Rapids Sustainability Commission	8	8/12/10
Andover City Council	9	8/24/10
Blaine Park Board	9	8/24/10
Ham Lake Park & Tree Commission	8	9/15/10
Crooked Lake Area Association	6	9/16/10
Anoka Conservation District Board of Supervisors	6	9/20/10
Wetland Functions & Values Review Group	11	11/12/10

Merger with Six Cities WMO

In January 2011 the District was made aware that the Six Cities WMO was experiencing difficulty and may be dissolved by the BWSR. The Six Cities WMO did dissolve in March of that year leading to an approximately nine month process that ended with the BWSR ordering the inclusion of select lands formerly within the SCWMO to be included in the Coon Creek Watershed District in December of 2011.

At the completion of the merger it was the Districts' understanding that the BWSR would provide a supportive role and allow the CCWD a reasonable amount of time (1 year) to update its Comprehensive Plan. The merger process and the desire to include a comprehensive assessment of the water resources within the former SCWMO led to a major delay in completion of the Comprehensive Plan.

Necessary Adjustments to the Planning and Public Participation Process

Because the merger occurred late in the planning process a revised involvement process was required which involved personal briefings and individual meetings to surface issues and concerns and review goals and objectives. The adjusted process also relied heavily on the District's Technical Advisory Committee and Citizen Advisory Committee members to surface issues, concerns priorities and programs in the amended area and the programs and efforts currently underway to address them.

Reliance on Advisory Committees

During 2012 the District met with its Citizen Advisory Committee (including members from the 'new' area) on 10 different occasions. The Comprehensive Plan was the focus of 9 of those meetings.

The District attempted to parallel this process with the Technical Advisory Committee but substituted some of the group meeting for individual meetings or contacts.

Review of Rough Draft Plan as a Reality Check

On October 22, 2012, the Board approved the release of a rough draft of the District Comprehensive Plan for review by the District Citizen Advisory Committee (CAC) and Technical Advisory Committee (TAC). Copies of the plan were distributed to the:

Board of Managers	October 8
CAC	October 10
TAC	October 11

CAC and TAC had 14 week days to review and comment on the plan. The CAC reconvened to review the plan October 30. The TAC met to review the plan on October 31, 2013.

241 Comments needing responses were received on the Rough Draft Plan. This figure does not include the comments, suggestions and corrections concerning punctuation, word choice or formatting.

- 142 of the comments were accepted and the plan was changed or corrected.
- 80 comments received responses noting the comment and either clarifying or making note of the comment.
- 14 of the comments were actually questions.
- 12 comments addressed or revealed issues/concerns requiring some additional work

Advisory Committee Comments

<u>Implementation Specifics</u>: There were numerous requests and verbal comments for either:

a) More implementation specifics regarding budget or work plan level directives for the 10-year period
b) A clear(er) connection between the goals and outcomes through clarification of inputs, outputs and outcomes
c) Clarification at the Objectives level, noting means for achieving objectives, related activities, timeframes and milestones (Current plan takes this approach).

<u>At Present</u>
The rough draft plan identifies specific actions (identified by program) and repeats those actions in the implementation section and provides a time and estimated cost for implementation.

<u>The Board opted to</u>:
Leave as is: Implementation timing and effort are handled through program/ strategy/cost center descriptions. On the other hand, the State

(MPCA & BWSR) emphasis is on implementation and estimated costs. The 'Cost Center approach provides a closer immediate connection to District accounting and funding system.

Standards: An observed and noted fact was that the District's management principles and standards were not available in the rough draft. These principles and standards provide the basis and technical guidance for the best management practices used in the District and the need and reasonableness of the District's rule.

The absence of the standards was an oversight. The section needs to be included and updated to address water quality actions.

Mining: An issue that was addressed as needing consideration early in the planning process was mining and its effect on groundwater. The issue pertains primarily to Ham Lake but also could have significant bearing on Blaine and Andover where large amounts of material have been removed to balance sites for development and homes have been built around the edge of the resulting pond or lake. The issue stated in this manner is a land use/development concern and will never rank very high because the District avoids land USE allocation decisions and focuses instead on the required performance of a site to meet water quantity and quality needs.

However, when we consider the fact that most of the water filling these man-made lakes and ponds is ground water from the surficial/drift aquifer and that this water resource has been in steady decline, then creating additional open water bodies exposes this resource to additional, potentially significant loss through evapotranspiration. If we factor in the decline in humidity levels in the spring (lower than the southwest U.S. in early spring), we add an element leading to potentially significant seasonal loss.

At Present
The rough draft plan only brushes on the effects of mining and construction of impoundments through discussion of water balance and climate change

The Board opted to:
Include a special study that addresses exposed groundwater specifically and recommends actions and amendments to the Comprehensive Plan. Include in Plan a special study (SAMP) that specifically addresses the consequences of exposing the drift aquifer to loss from evapotranspiration.

Weather Stations: There was interest by the TAC in the identified need and value of establishing weather stations capable of assisting in identifying micro storms and variation within the watershed as early as possible. One member expressed interest in cost-sharing with the District.

<u>At Present</u>
The purchase of stations is not scheduled in the capital equipment portion of CIP.

<u>The Board opted to</u>:
Note interest and further evaluate specific need and value for stations through the CIP budget process. Note interest and further evaluate specific need and value for stations through the CIP budget process (Staff Recommendation).

Water Rates & Use of Grey Water: Several reviewers felt that a more full review and discussion of both of these items was warranted.

<u>At Present</u>
The rough draft plan discusses the basics of conservation pricing, where incrementally or in a block fashion, the user pays more the more water is used (marginal price increases with marginal cost) and because water rates/water supply is controlled by the cities, the plan proposes that the District conduct a study and act as a forum and catalyst for the cities to address water conservation through this method.

The rough draft plan does not address grey water specifically. Grey water use is a huge issue with regional and statewide implications. The rough draft plan, however, does address the need for cities to discuss re-use or harvesting options. To some parties this may be a distinction of no difference. However, "re-use" and harvesting offers many more options and scales of implementation from private cisterns and rain barrels to retrofitting parking lots and business campuses for landscape watering or other uses.

<u>The Board opted to:</u>
Leave as is: focus on conservation pricing and encouraging water re-use.

Board of Managers Action

On November 13, 2012 the Board reviewed and discussed comments on the Rough Draft Comprehensive Plan and directed staff to make the changes discussed and prepare the plan for release as a DRAFT at the December 12 meeting.

Review of Draft Plan

On December 12, 2012 the Board of Managers approved the DRAFT Comprehensive Watershed Management Plan for review and comment as required under M.S. 103B.231 Subd. 7.

Plan Review Period

The Draft Comprehensive Watershed Management plan was distributed to 27 individuals and agencies by January 16. The 60-day review and comment period ended March 18, 2013, however comments were received after that date and addressed.

Agency	Contact	Distribution	Comments Received	Total Comments
Andover	Dave Berkowitz	16-Jan	18-Mar	3
Anoka Conservation District	Chris Lord	17-Jan	11-Mar	0
Anoka County	Jon Olson	9-Jan		0
Anoka County Health & Env Services	Bart Biernat	1-Feb	15-Mar	5
Anoka County Highways	Andrew Witter	16-Jan		0
Anoka-Ramsey CC	Roger Freeman	16-Jan		0
Blaine	Jim Hafner	16-Jan	11-Apr	6
BWSR	Mary Peterson	15-Jan	18-Mar	58
Citizen	Bill Kurdziel	15-Jan		0
Citizen	Donna Bahls	9-Jan		0
Citizen	Jim Lindahl	14-Jan		0
Citizen	Jon Olson	9-Jan		0
Citizen	Linda Steinke	9-Jan		0
Citizen	Michael Von Wald	9-Jan		0
Citizen	Roger I Johnson	9-Jan		0
Columbus	Elizabeth Mursko	18-Jan		0
Coon Rapids	Bob Moberg	16-Jan	2-Apr	41
Crooked Lake Area Assoc	Gary Nereson	15-Jan	12-Mar	6
Fridley	Jim Kosluchar	16-Jan	16-Apr	1
Ham Lake	Tom Collins	16-Jan	23-Jan	107
MCES	Judy Sventek	15-Jan	18-Mar	1
MDA	Rob Sip	15-Jan		0
MDH	Art Persons	17-Jan		0
MDNR	Nick Proulx	15-Jan	18-Mar	8
MnDOT	Nick Tiedeken	15-Jan		0
MPCA	David L. Johnson	15-Jan	11-Mar	28
Spring Lake Park	Phil Gravel	16-Jan	6-Mar	9

General Summary of Comments

273 comments were received between January 23 and April 11, 2013. Thirteen individuals and agencies submitted written comments. Comments were tracked by author, section of the plan, comment, response and whether the comment would trigger a change in the draft document and whether or not that change had been made. Each comment was reviewed and determined to be either a:

1. Correction, clarification or edit
2. Comment or question
3. Suggestion or recommendation
4. Issue requiring additional discussion with stakeholders and/or research

The responses were later included in the written response to each reviewer. Responses were also evaluated as to whether they would be incorporated in to plan requiring changes to the draft plan. Changes are indicated by crossing out language to be deleted and underlining new language.

Corrections and Clarifications

Corrections and clarification include the following:

- **Corrections**: involve adding or subtracting information to increase accuracy
- **Clarifications**: involve adding or subtracting language to improve understanding
- **Edits**: involve items such as format, page numbering, type size
- **Format**: addresses sequence or layout of sections or the document as a whole.

Summary of Changes

The District received 183 corrections and clarifications. 93% of the clarifications edits and formatting were incorporated in to the plan. 40% of the clarifications were incorporated.

Comments and Questions

Comments and questions include the following:

- **Comments**: Usually a statement of fact or compliment
- **Questions**: Who, Why, When, etc.
    - closely associated with clarifications
    - All answered
- **Other**: Mostly guidance or comments

Summary of Changes

The District received 30 comments and questions on the Draft plan. Two of the questions and three of the other comments initiated changes in the draft plan in the form of reviewing existing language and making appropriate changes.

Suggestions and Recommendations

The District received 45 suggestions and recommendations and 1 request. Suggestions and recommendations included:

- **Recommendations & Suggestions**: Offerings of alternative

language, approaches, etc
- **Requests**: Specific requests to include, update, include data, topics, information, maps

Summary of Changes

Seventeen of the suggestions and recommendation were incorporated in to the plan. The remaining were not incorporated either because:
1. They were inconsistent or in direct conflict with the District's mission
2. They came too late in the planning process and would require further delay in adoption of the plan
3. They were presented or advocated in a manner that made them exclusive to other beneficial uses of water demanded in the watershed

Issues Requiring Additional Discussion and Review

The District received 13 comments addressing all or some aspect of issues critical to future management of water and related resources within the District. Four issues were identified and addressed in the comments:
1. Changes in Precipitation and Atlas 14
2. Partnerships and Collaboration
3. Conservation Drainage
4. Plan Length & Adopting the Executive & Plan Summaries as the controlling documents

Changes in Precipitation

The District received five comments specific to changes in precipitation and addressing the changes in storm sizes noted in the Draft of Volume 8 or Atlas 14 to be published by the National Oceanic and Atmospheric Administration (NOAA)

Comments ranged from encouragement to adopt the new precipitation numbers immediately to including the new numbers in the plan but adopting them after proper review and refinement by all of the affected local agencies.

Summary of Changes

The District concurred with the later of the above statements and after two meetings with the Technical Advisory Committee and one meeting with the Citizen Advisory Committee the District refined this issue from the original "Climate Change" to the more specific "Changes in Precipitation". Discussion addressed the fact that the Draft of Atlas that was available was for peer review and that, as of March 2013, new, refined, and high numbers, were expected to be published in April and that an Appendix addressing statistical analysis of climate change is expected in May. The retitling and change in approach better expressed the issue, was better supported by the data at hand and had a stronger operational aspect to it.

Specific District actions stemming from the comments include:
1. Publication of an "Advisory" for use until the final numbers is adopted.

2. Use of the new numbers, by the District, in reviewing permit applications where the 100 year flood plain elevation is critical to ensure the public health safety and welfare.
3. Continue discussions and review with City Engineers within the District in determining the most prudent approach in adopting or phasing in these numbers
4. Inform the public and elected officials of the changes and their significance or public safety, infrastructure construction and maintenance and performance of existing infrastructure

Partnerships and Collaboration

The District received four written comments concerning collaboration. Comments expressed the need for a clear explanation of partnerships or agreements and to describe role and relationships with other MS4s

The District received additional verbal comments along the same lines at the March 20, 2013 Technical Advisory Committee meeting. Staff redrafted the section and distributed the new section to both the Citizen and Technical Advisory Committees on April 4 and was reviewed and discussed at the April 10 meeting of the monthly Advisory Committee meetings.

Summary of Changes

The District's response was to rewrite of this section and specify the activities in which the District and other units of government benefit from partnering and collaborating and draft the principles and ethic for those partnerships and collaboration in a form that could be included in a Memorandum of Understanding.

Conservation Drainage

The District received one written comment concerning Conservation Drainage. The comment appeared to advocate a systemic approach and adoption of conservation drainage largely for wildlife concerns. Further it advocated this approach either through abandonment of the ditch system or construction of a multi-staged channel.

Summary of Changes

No changes to existing or proposed policy are planned for the following reasons:
First, the flat nature of the watershed and the traditionally high water table make efficient removal of water an essential element in flood control throughout the District. Adopting Conservation Drainage, as suggested in the comments, within most locations within the watershed would require either:

- Abandonment of the channel, through lack of maintenance, thereby decreasing the efficiency and increasing the time involved in removing water. The result would be an increase in the frequency and incidence of flooding on many lands within the watershed.
- A deepening and widening of the channel which would be an improvement under the drainage law and thereby require additional

costs for land acquisition and a petition from the adjacent landowners and benefited parties.

Second, the traditionally high water table in Anoka County has helped create approximately half to two-thirds of all the wetlands within the Seven County Metropolitan Area. Construction of a multi-stage channel in most places within the watershed would impact wetland and require mitigation, adding to the cost of construction.

Third, the estimated cost of land acquisition and construction within the increasingly urban lands of the District is approximately $62 to $91 million alone. This is cost prohibitive unless the State of Minnesota would share in a substantial portion of the cost.

Fourth, existing District policy is that in areas such as headwaters, where there are no lands up stream requiring drainage and that are not under cultivation are low priority for any maintenance. Upon discussing this proposal with the Board of Managers at the April 8 Board meeting, the Board indicated that they wished to leave the door open to conservation drainage should the right situation present itself.

Plan Length

The District received four written comments on the length of the plan indicating that it was too long and recommending making the Plan Summary the controlling document and making everything else and appendix. The District also received one comment indicating comfort with the length that comes with being "Comprehensive".

Summary of Changes

The District has indicated that it will seek to simplify the number of sections if it can appropriately references the increased number of appendices.

Public Hearing

Minnesota Statute 103B.231 Subd. 7 (c) requires the District to hold a public hearing on the draft plan after the 60-day review period of the draft plan.

On April 22, 2013 the Board of Managers convened a hearing on comments made on the Draft Comprehensive Watershed Management Plan. The Board of Managers and interested public were provided a staff report which included

- Background
- Issues and Concerns
- Options for Board Action and
- A Recommendation.

The staff report was augmented by a power point presentation at the hearing. Public notice of the hearing was published April 12 and 19 in the District's official paper and on the District's web site. The staff report was available to the public on April 19.

No Comments at Hearing

The meeting of the Board of Managers was called to order at 7:30 PM. The hearing was convened at 7:32 PM. A presentation was given noting the reason and nature of the Comprehensive Watershed Management Plan. A request for comments was made. No one was present for the hearing. The hearing closed at 7:38 PM.

Assessment of the Functional Capacity of Wetlands within the Coon Creek Watershed

Tim Kelly & Justin Hawley March

Goals

1. To assess wetland functional capacity within the watershed.

2. To use a tool based on HGM classification where time and cost prohibit establishing reference wetlands.

Objectives

1. To augment field determinations.
2. Functional Indices serve to identify level of function provided (High, Medium, Low).
3. To compare other wetlands in same HGM class.
4. Impacts to functions can be reevaluated under impact scenarios of variable conditions.
5. Mitigation goals can be defined by examining the combination of conditions that yield a high functional index.

Approach

The approach for assessing wetland functional capacity draws from Magee, D.W. & G.G. Hollands. 1998. A Rapid Procedure for Assessing Wetland Functional Capacity based on Hydrogeomorphic (HGM) Classification. Normandeau Associates Incorp. ENSR. This approach was selected in part because it was developed specifically to assess functional capacity in the glaciated northeast and Midwest (p. 11). It was also selected because of its ability to analyze functional capacity at multiple geographic scales and is therefore conducive to integration and consistency within and between programs.

Other advantages to this approach, as it applies to the Coon Creek Watershed were:
Its portability: the method can be used in any area accounted for in with the HGM classification (North America).
Its Modularity: More accurate data can easily be adapted into the inputs for greater localized assessment.

Process

1. Describe the Anoka Sand Plain/Anoka Lake Plain
2. Hydrogeomorphic Classes of Wetlands within the Watershed
3. Develop a List of Functions
4. Develop a Functional Profile for each HGM class
5. List Relevant & Appropriate Variable for Each Function
6. Document each Variable & Model Rationale
7. Use GIS Soils, NWI, Land Use, etc, to apply model

8. Fine Tune Procedure.

Definitions

Direct indicators of function Are variables which by themselves provide strong evidence that the potential functional capacity is high, obviating the need to further evaluating the wetland.

Functional capacity index (FCI) An index generated for each function, which indicates the potential degree (capacity) to which the wetland performs the function.

Indicators of Dysfunction Variables that obviate the need to further evaluate the wetland for a function.

Applications and Limitations of the Approach

This procedure is for use by trained wetland specialists who are competent and field experienced in discerning the landscape, soils, hydrology and plant identification and ecological indicators involving wetlands.

The functional indices generate by the models serve to identify the level of function provided by a given HGM classification based upon the magnitude of the score derived by the model. Comparison with other wetlands in the HGM class can be made based on the relationship between the functional index for the wetland being evaluated and the functional assessment data from other wetlands. Impacts to functions can be assessed by reevaluating the wetland under the impact scenario based on changes to less favorable variable conditions. Mitigation goals can be identified by examining the combination of variable conditions that yield high functional index; these variable conditions may serve as the design standards for a wetland restoration or creation.

Because of time and budget constraints, there was no opportunity to perform case studies on the reference wetland system within the watershed. As such, conditions and ranges were based on professional experience of Watershed and Conservation District staff and data from several thousand wetland delineations and assessments conducted between 1992 and 2010.

Use of Reference Wetland Data in Refining the Procedure

To refine this procedure, monitoring data from reference wetlands was used to verify or gain insight in to wetland processes and functions, and to clarify the variables and range of conditions which give rise to functional capacity.

In the past, most wetland assessment procedures have been based upon a combination of wetland functions and societal values, established by statutes which were written by legislators, environmentalists and informed lay persons (eg. MnRAM, WET & WEM). These earlier procedures have been based on existing literature and basic concepts of engineering, hydrology and ecology rather than upon research directed towards developing a reference data base in order to establish functions, variable and variable condition ranges. However, the Hydrogeomorphic Method (Brinson, 1993) is designed to be based on reference data and to transcend site and regional scales. The process for establishing and monitoring the reference wetlands within the around the Coon Creek watershed is best described in the Water Atlases published annually be the Anoka Conservation District.

Description of the Anoka Sand Plain/Anoka Lake Plain

The ecological setting of the watershed within the Anoka Sand Plain is addressed in detail in Appendix A (Tab 17, pages 2-6). To address ecosystem hierarchy we will use the National Framework of Ecological Units based on terms defined by Bailey (1995). The Ecological Classification System (ECS) is a method to identify, describe and map units of land with different capabilities to support natural resources. This is done by integrating climatic, geologic, hydrologic, topographic, soil and vegetation data.

ECS divides the landscape into a series of ecosystems that are nestled within one another in a hierarchy of spatial sizes. In Minnesota, the classification and mapping is divided into six levels of detail. These levels are:

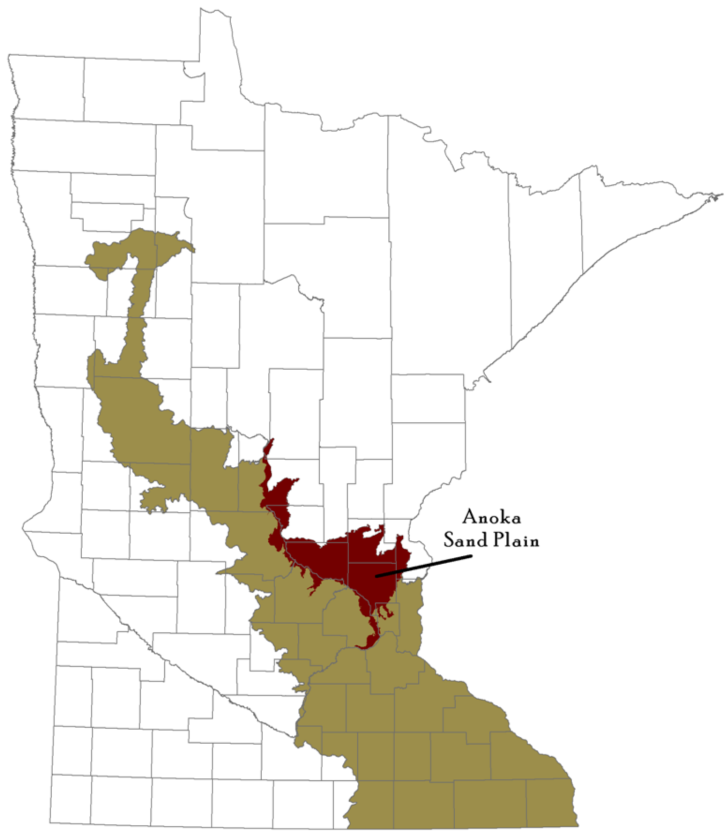
Level	**Name**
Province	Midwest Broadleaf Forest
Section	Minnesota and NE Iowa Moraine
Subsection	Anoka Sand Plain
Land type association	Anoka Lake Plain
Land types	Glacial Lake Hugo Lake Plain Glacial Lake Fridley Lake Plain Mississippi Sand Plain

Subsection - Anoka Sand Plain

The Anoka Sand Plain is approximately 1,960 square miles in size. It is a sand outwash plain formed by the retreat of the Superior Lobe of the Grantsburg Sub-lobe of the Late Wisconsin glaciers.

Outwash plains consist mainly of sandy and coarsely textured material of glaciofluvial origin; generally smooth, and where pitted is of generally low topographic relief.

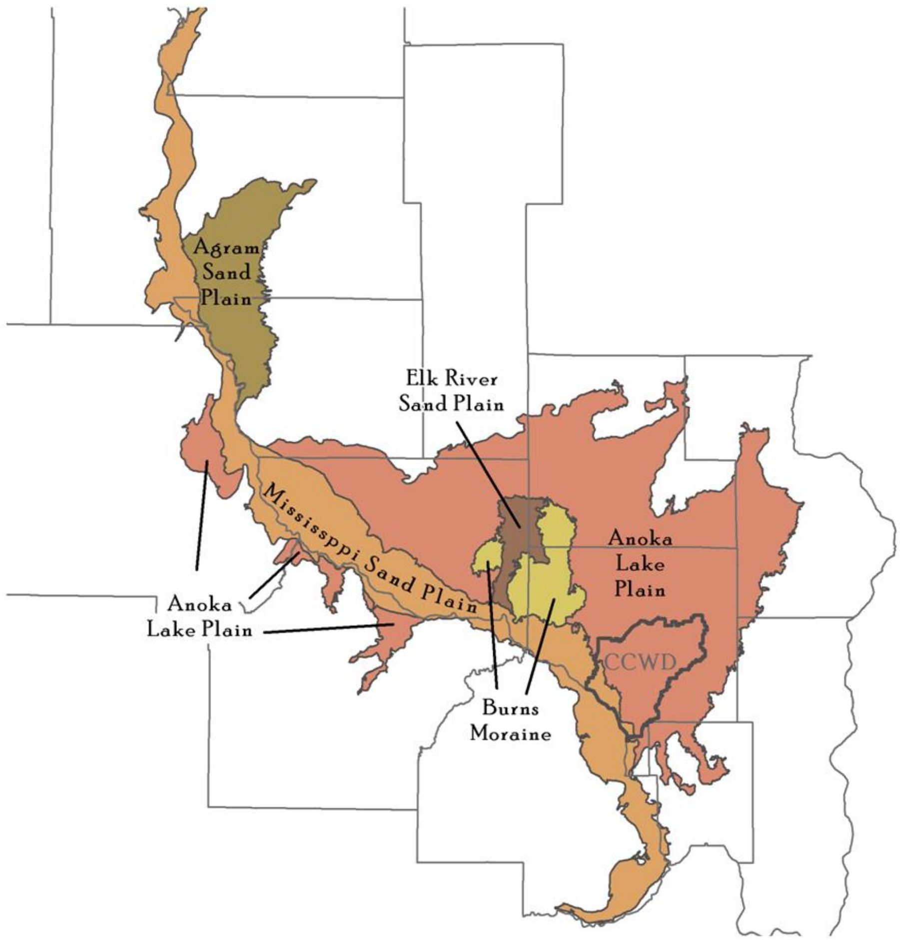
The Anoka Sand Plain consists of a flat, sandy lake plain along the Mississippi River.



Land Type Association: Anoka Lake Plain

Coon Creek Watershed is included in a portion of the Anoka Sand Plain known as the Anoka Lake Plain. The Anoka Lake Plain is a nearly level to gently rolling lake plain formed by melt water from the Grantsburg Sublobe. Some areas of the lake plain have been reworked by wind to form dunes.

The soils are primarily fine sands with organic and loamy and hemic hydric soils in depressions. The regional water table is very shallow, usually less than 15 feet below the surface with much of it exposed in the form of wetlands, lakes and streams.



Land Types

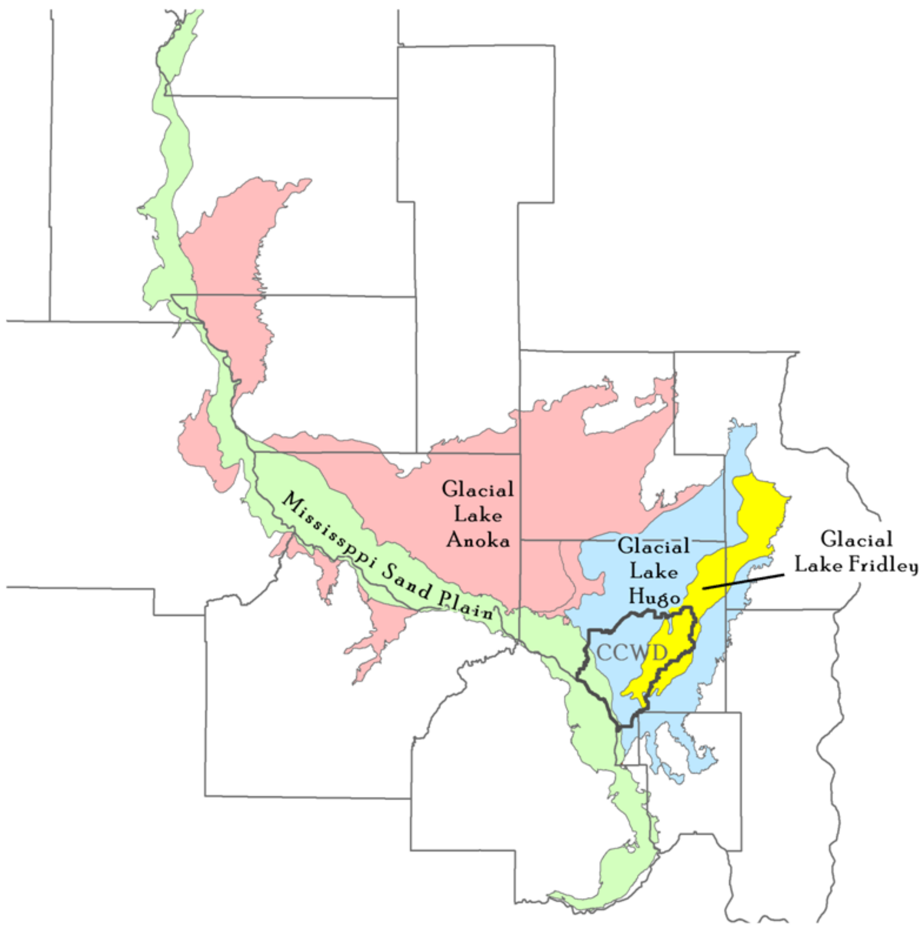
The basic character of the watershed landscape occurs in three geomorphic land types that contain distinctive landforms and landscape patterns (Glacial Lake Hugo, Glacial Lake Fridley and the Mississippi River Terrace).

<u>Glacial Lakes Hugo & Fridley</u>

These land types were formed from glacial melt water as the Grantsburg sublobe melted between 16,000 and 13,000 years ago. The melt waters formed a large outwash and lake plain. The outwash plain is mainly sandy or coarsely textured material of glaciofluvial material. An outwash plain is commonly smooth, and where pitted or contains depressions, generally is low in relief. The lake deposited sands across much of eastern part of the Anoka Sand Plain (Meyer, 1993).

<u>Mississippi Sand Plain</u>

A third land type, The Mississippi River Terraces provides a distinctive landscape formed by the Mississippi River. Here the erosion and down cutting created by the river is steep in some places in contrast to the smooth and flat landscape of the lake plains.



Hydrogeomorphic Classes of Wetlands within the Watershed

The descriptions below are based upon Brinson (1993). The classifications have three component parts:

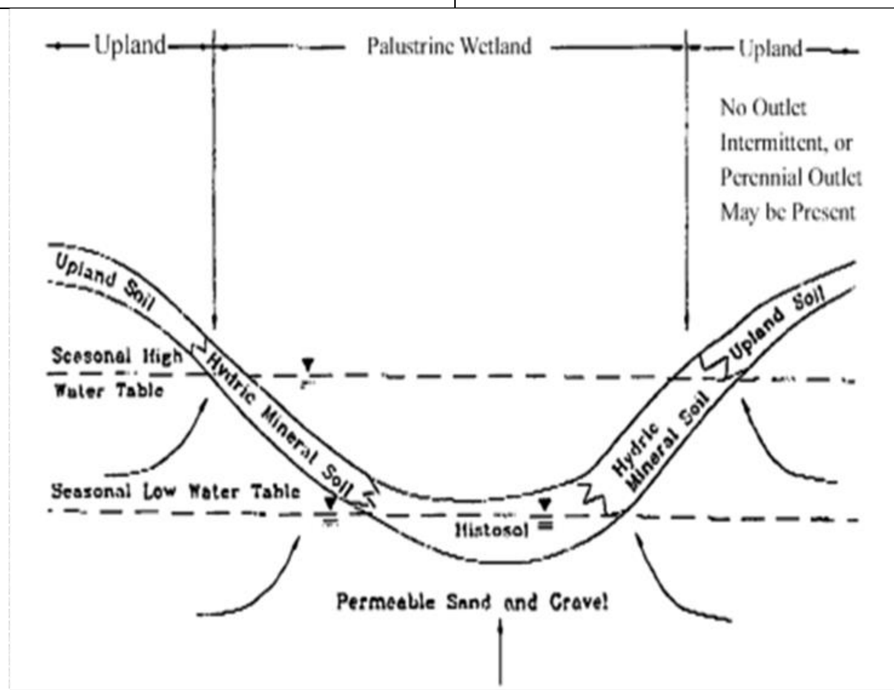
1. Geomorphic setting
2. Water Source
3. Transport and hydrodynamics

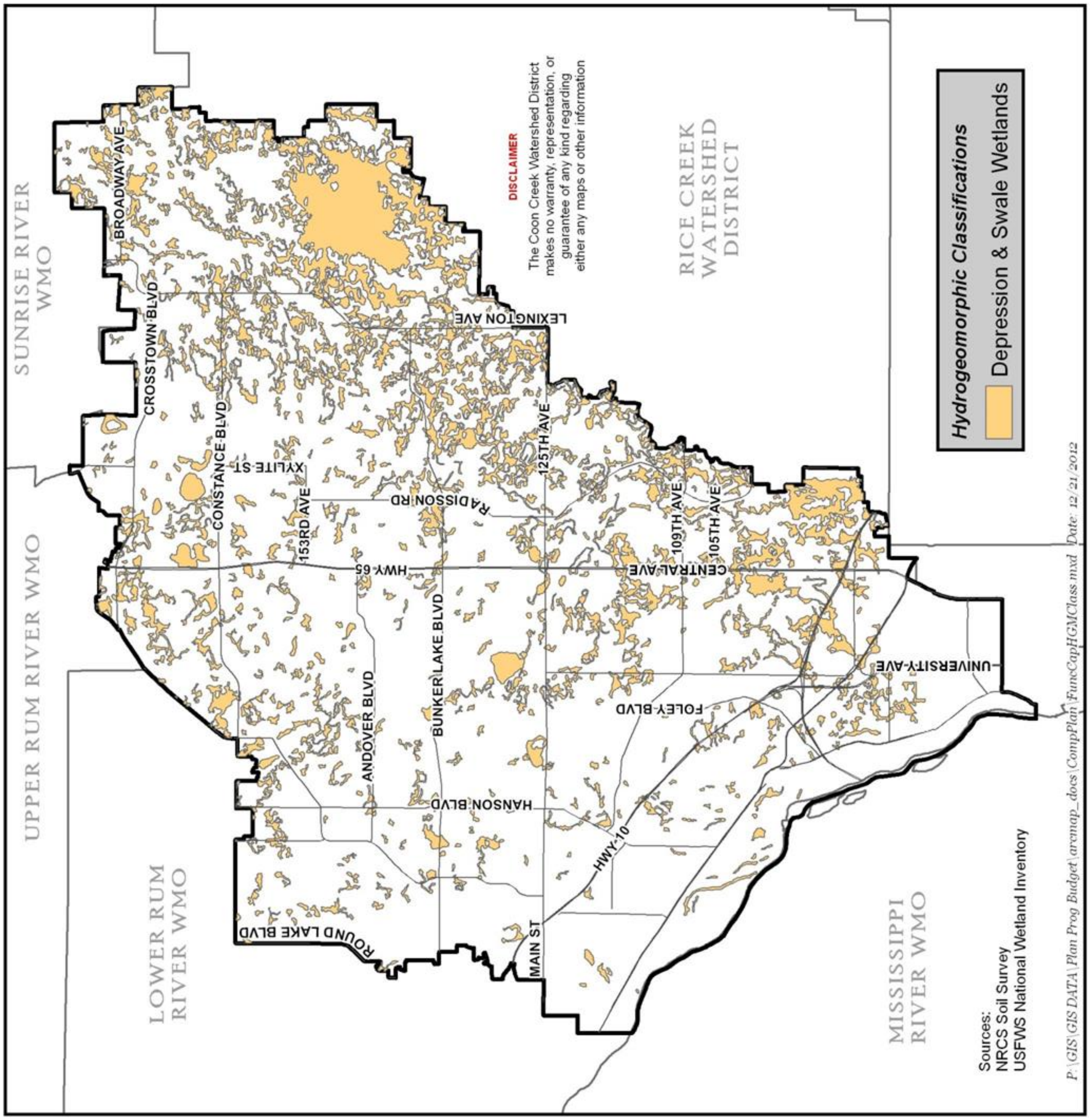
There are six Hydrogeomorphic classes of wetland within the Coon Creek watershed. They are:

1. Depression and Swale Wetlands
2. Lacustrine Fringe Wetlands
3. Floodplain/Riverine Wetlands
4. Flats
    a. Mineral Soil Flats
    b. Organic Soil Flats
    c. Slope Wetlands

Depression & Swale Wetlands

Characteristic	Description
Landscape Position	Depressions
Soils	Blomford Isan Isanti Marsh
Primary Water Source	Groundwater
Hydroperiod	Permanently flooded Seasonally flooded Semi-permanently flooded




Hydrogeomorphic Classifications
Depression & Swale Wetlands
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RICE CREEK WATERSHED DISTRICT
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MISSISSIPPI RIVER WMO
BROADWAY AVE
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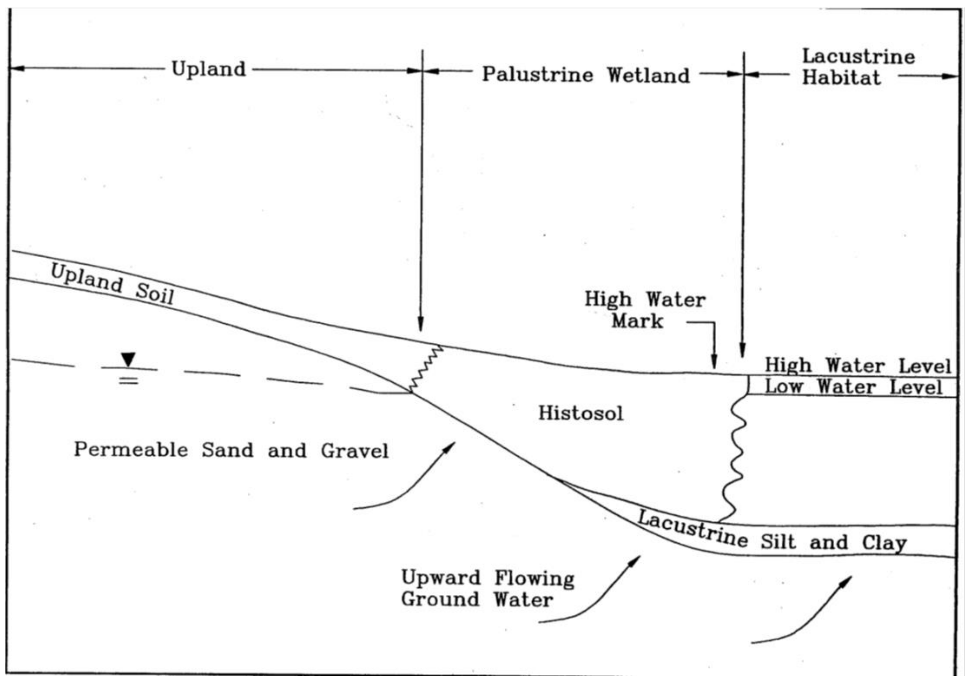
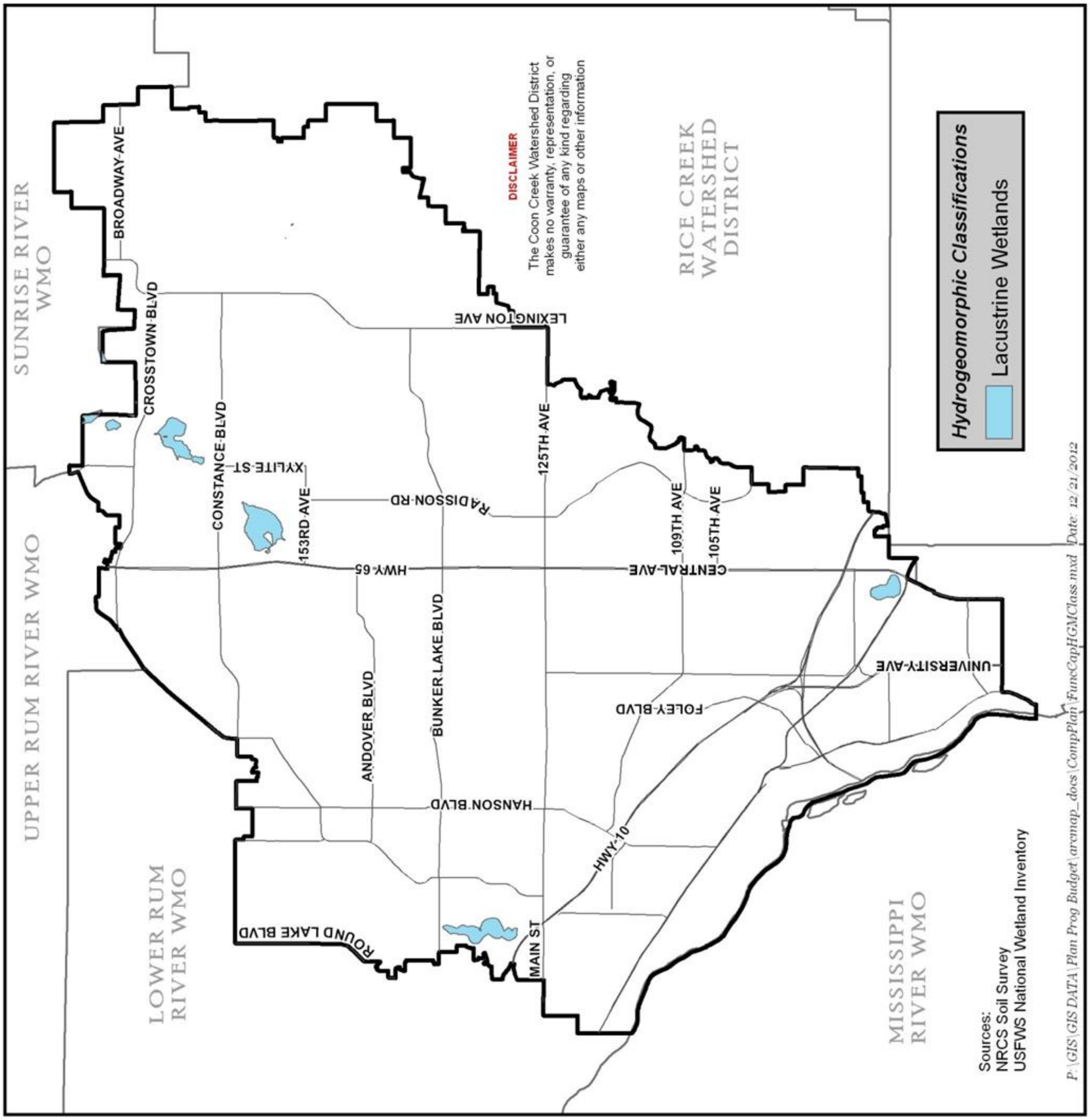
UNIVERSITY AVE
FOLEY BLVD
HANSON BLVD
HWY 10
ROUND LAKE BLVD
MAIN ST
Sources:
NRCS Soil Survey
USFWS National Wetland Inventory
Date: 12/21/2012

Lacustrine Wetlands

Characteristic	Description
Landscape Position	Lake Marsh Shrub Swamp Fringe
Soils	Unconsolidated Bottom Adjacent to Lakes
Primary Water Source	Lateral flow from Lake
Hydroperiod	Permanent Semi-Permanently Flooded

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Lacustrine Wetlands
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Sources:
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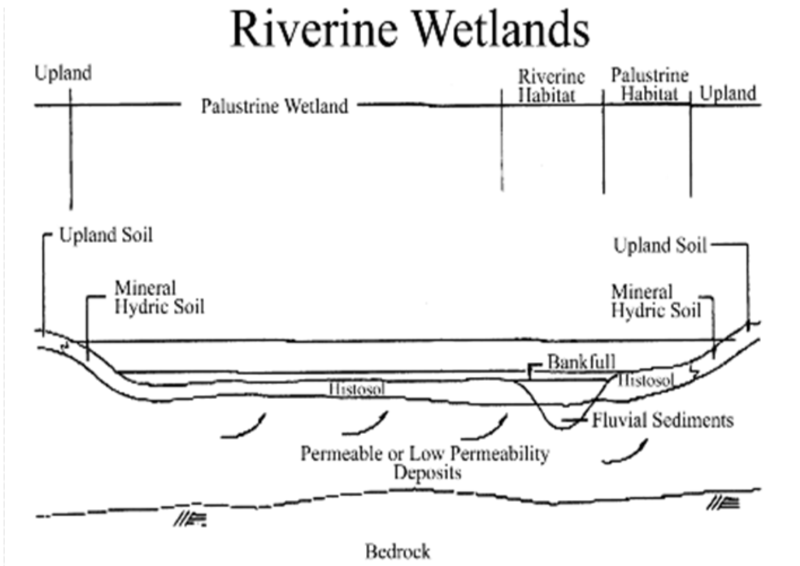
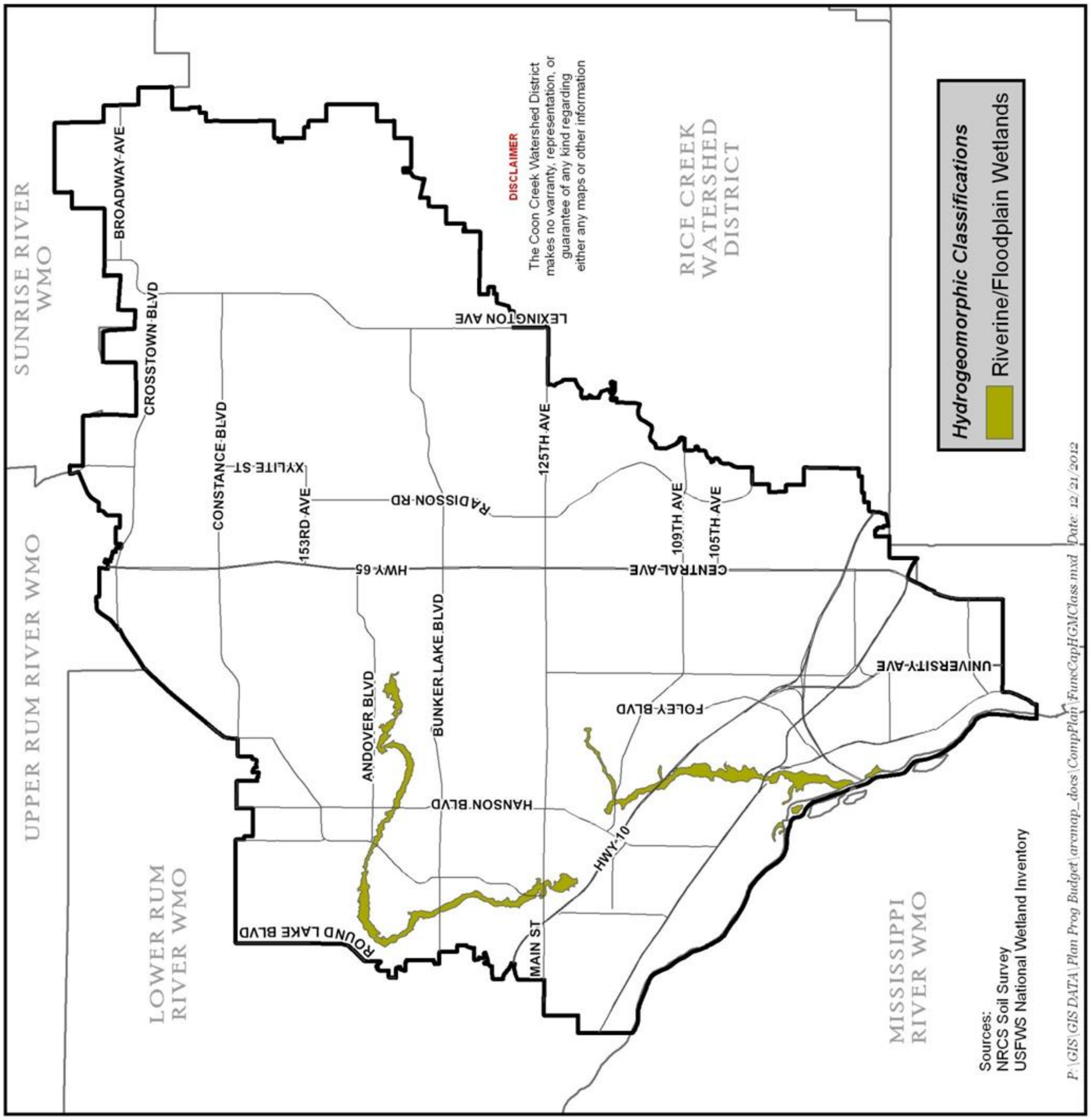
Riverine/ Floodplain Wetlands

Characteristic	**Description**
Landscape Position	Floodplains
Soils	Alluvial
Primary Water Source	Overbank Flow
Hydroperiod	Permanent Semi-Permanently Flooded

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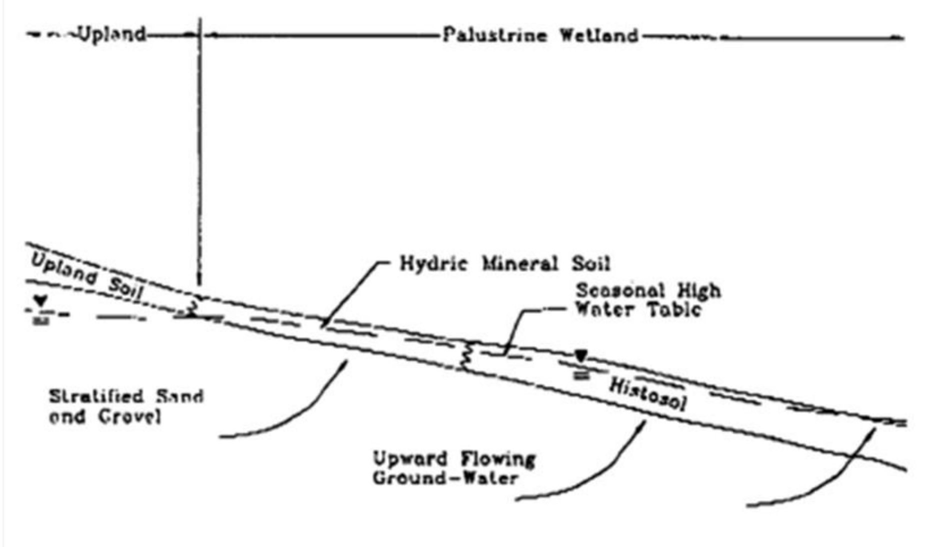
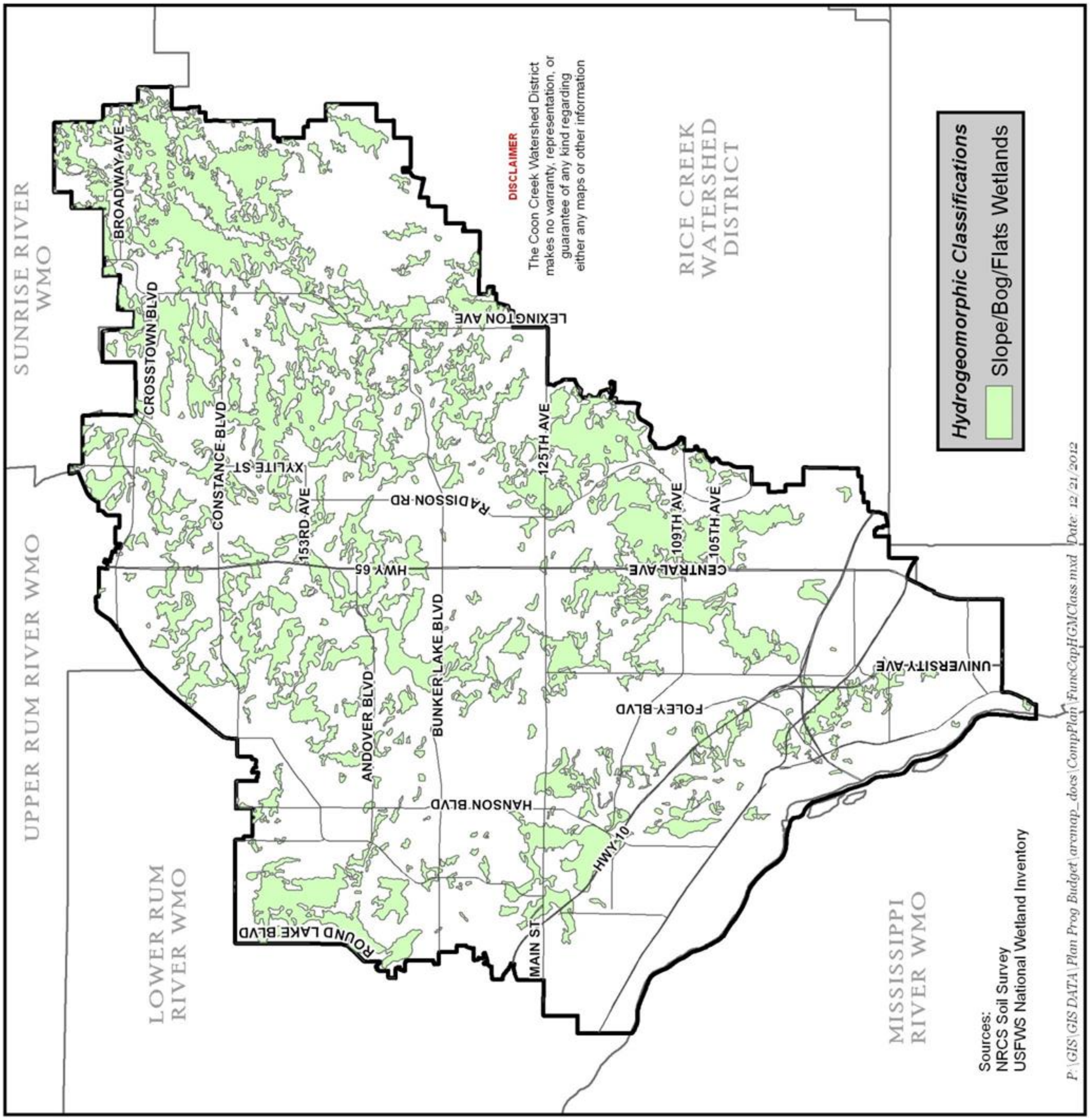
Slope/Bog/Flats Wetlands

Characteristic	Description
Landscape Position	Glacio-Lacustrine Sequences
Soils	Cathro Kratka Markey Millerville Rifle Rondeau Seelyville
Primary Water Source	Groundwater, Precipitation Overland Flow
Hydroperiod	Seasonally flooded Saturated Seasonally Saturated

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Sources:
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Functions Performed by Hydrogeomorphic Classes

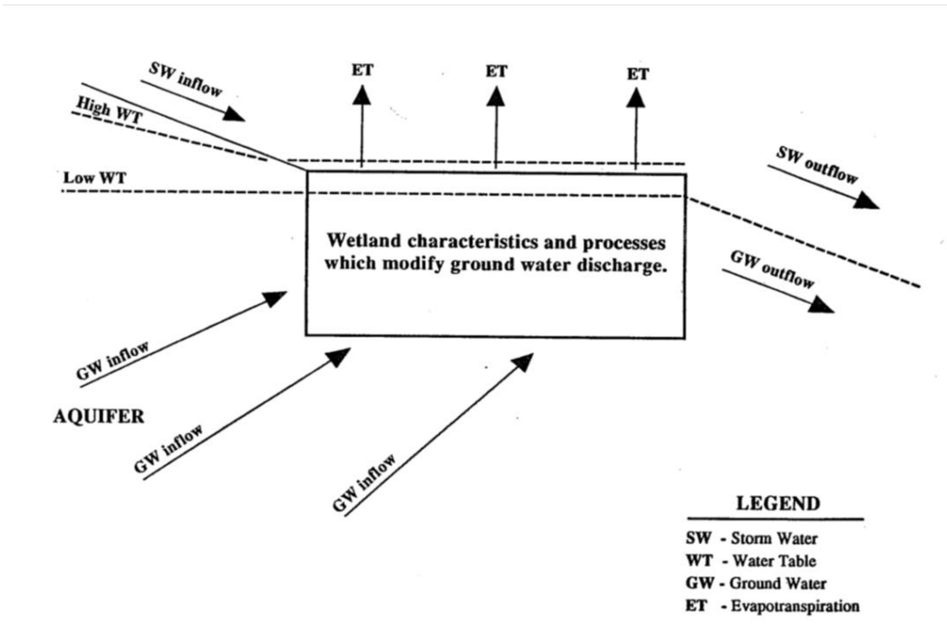
The functions that the Hydrogeomorphic classes of wetlands have the potential to perform are listed and described below. Direct measurement and quantification of most of these functions is possible but would be costly and time consuming and/or require long term monitoring. The models developed for each function, however, are based on variables having high predictive value, and therefore provide a means for assessing functional capacity.

1. Modification of Ground Water Discharge
2. Modification of Ground Water Recharge
3. Storm and Flood Water Storage
4. Modification of Stream Flow
5. Modification of Water Quality
6. Contribution to Abundance & Diversity of Wetland Vegetation
7. Contribution to Abundance & Diversity of Wetland Fauna

It is noted that many of these functions may at times detract from as well as contribute to societal values. This analysis is to assess the public benefits of wetland functions rather than those aspects that detract from public benefits.

Modification of Ground Water Discharge

Is the capacity of a wetland to influence the amount of water moving from ground to surface water.

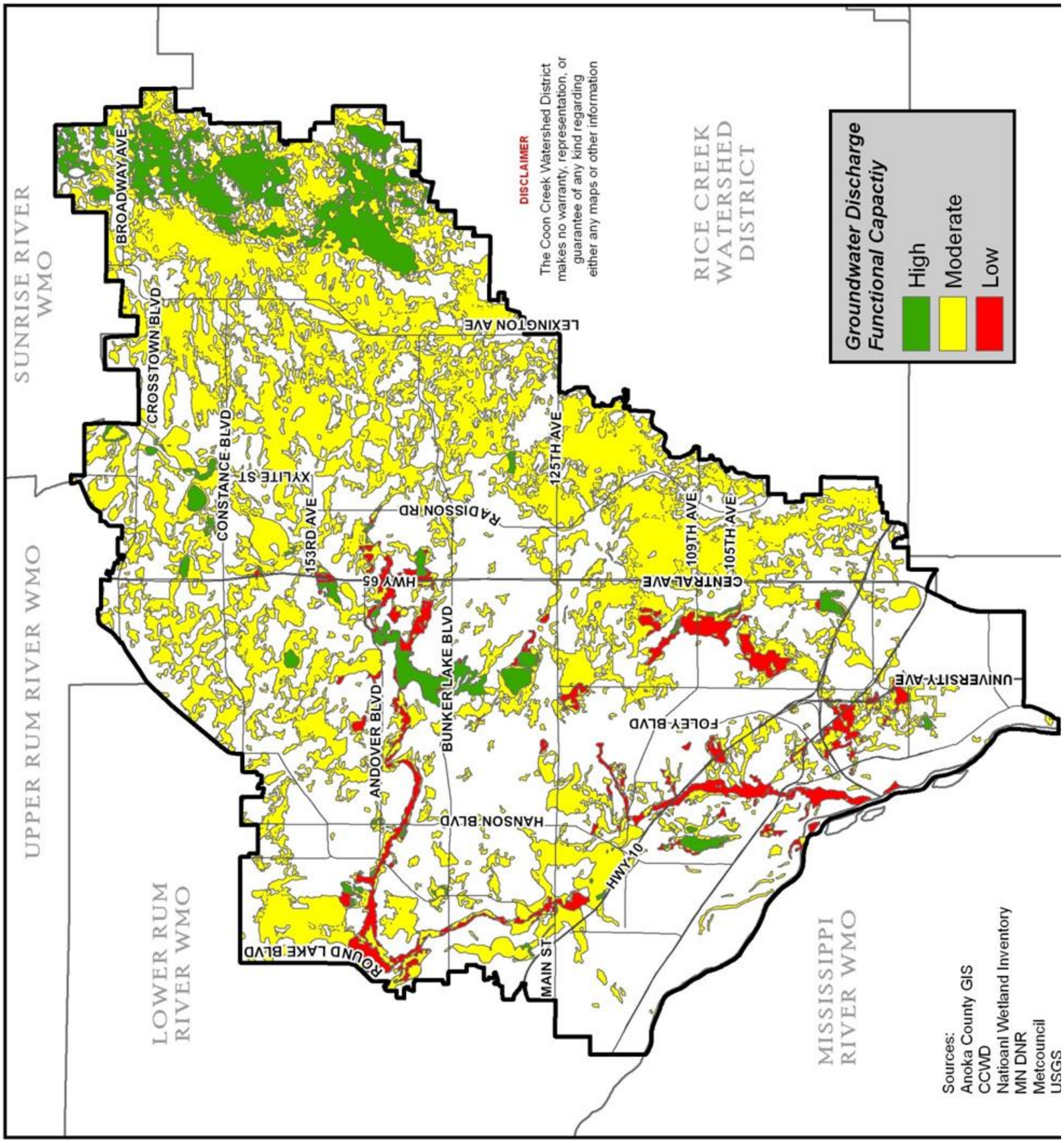


Wetland Characteristics & Processes Modifying Ground Water Discharge:

- Inlet/Outlet Class

- pH
- Surficial Geological Deposits of Wetland
- Wetland Water Regime
- Soil Type

Variable	Depression/ Swale	Lacustrine	Bogs/ Peatlands	Floodplain
Inlet/Outlet Class	X		X	X
pH	X		X	X
Surface Geology	X		X	X
Water Regime	X		X	X
Soil Type	X		X	X


Groundwater Discharge
Functional Capactiy
High
Moderate
Low
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Sources:
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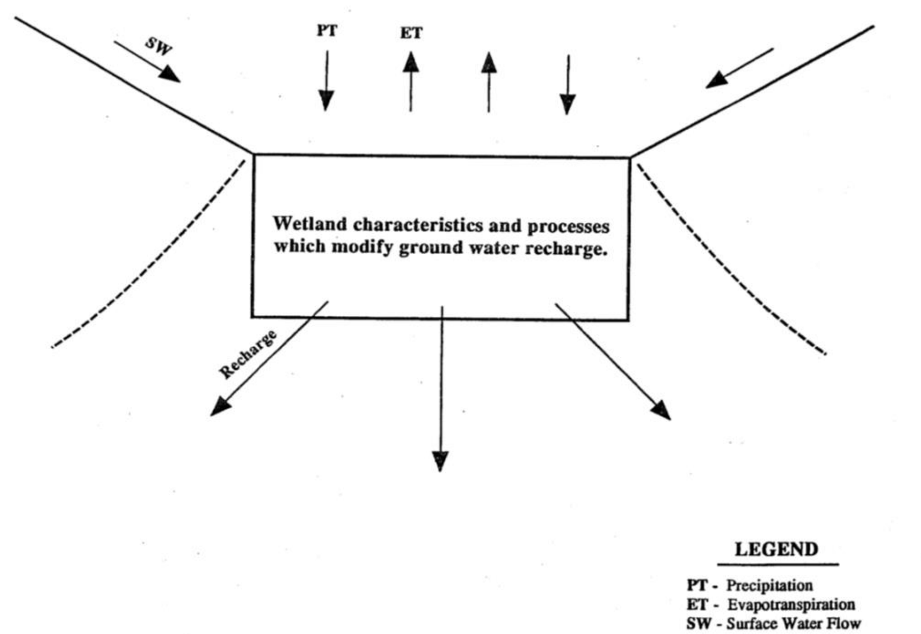
CCWD
Natioanl Wetland Inventory
MN DNR
Metcouncil
USGS

Modification of Ground Water Recharge

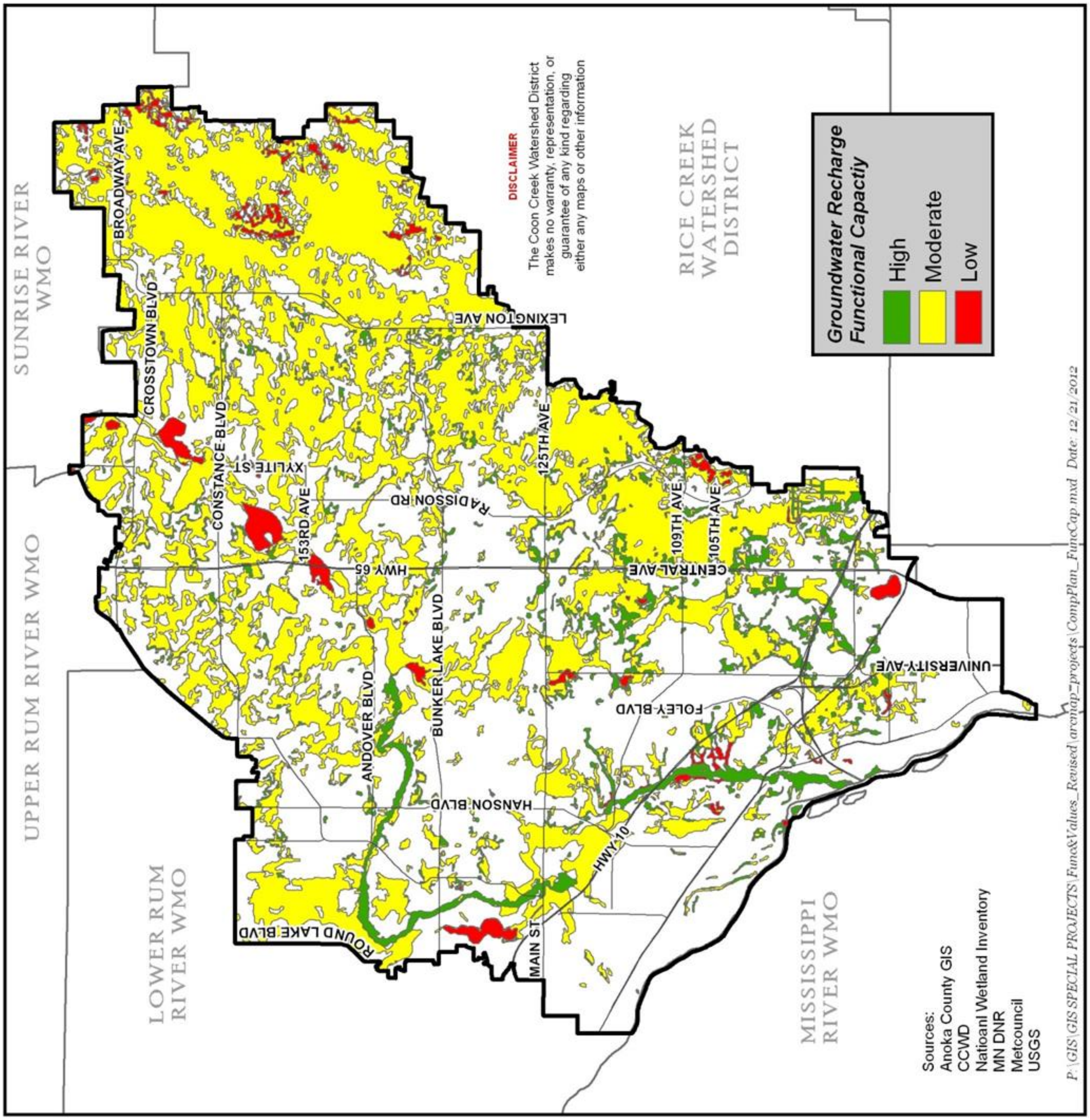
Is the capacity of a wetland to influence the amount of water moving from surface water to ground water.



Characteristics & Processes Modifying Ground Water Recharge:

- Inlet/Outlet Classification
- pH
- Surficial Geological Deposits of Wetland
- Wetland Water Regime
- Soil Type

Variable	Depression/ Swale	Lacustrine	Bogs/ Peatlands	Floodplain
Inlet/Outlet Class	X	X	X	X
pH	X	X	X	X
Surface Geology	X	X	X	X
Water Regime	X	X	X	X
Soil Type	X	X	X	X


Groundwater Recharge Functional Capactiy
High
Moderate
Low
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SUNRISE RIVER WMO
UPPER RUM RIVER WMO
LOWER RUM RIVER WMO
RICE CREEK WATERSHED DISTRICT
MISSISSIPPI RIVER WMO
BROADWAY AVE
CROSSTOWN BLVD
CONSTANCE BLVD
XYLITE ST
153RD AVE
RADISSON RD
HWY 65
LEXINGTON AVE
125TH AVE
109TH AVE
105TH AVE
CENTRAL AVE
UNIVERSITY AVE
FOLEY BLVD
ANDOVER BLVD
BUNKER LAKE BLVD
HANSON BLVD
HWY 10
ROUND LAKE BLVD
MAIN ST
Sources:
Anoka County GIS
CCWD
Natioanl Wetland Inventory
MN DNR
Metcouncil
USGS
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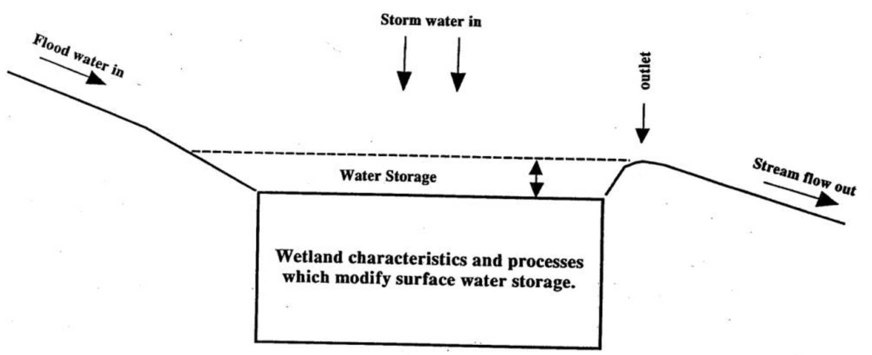
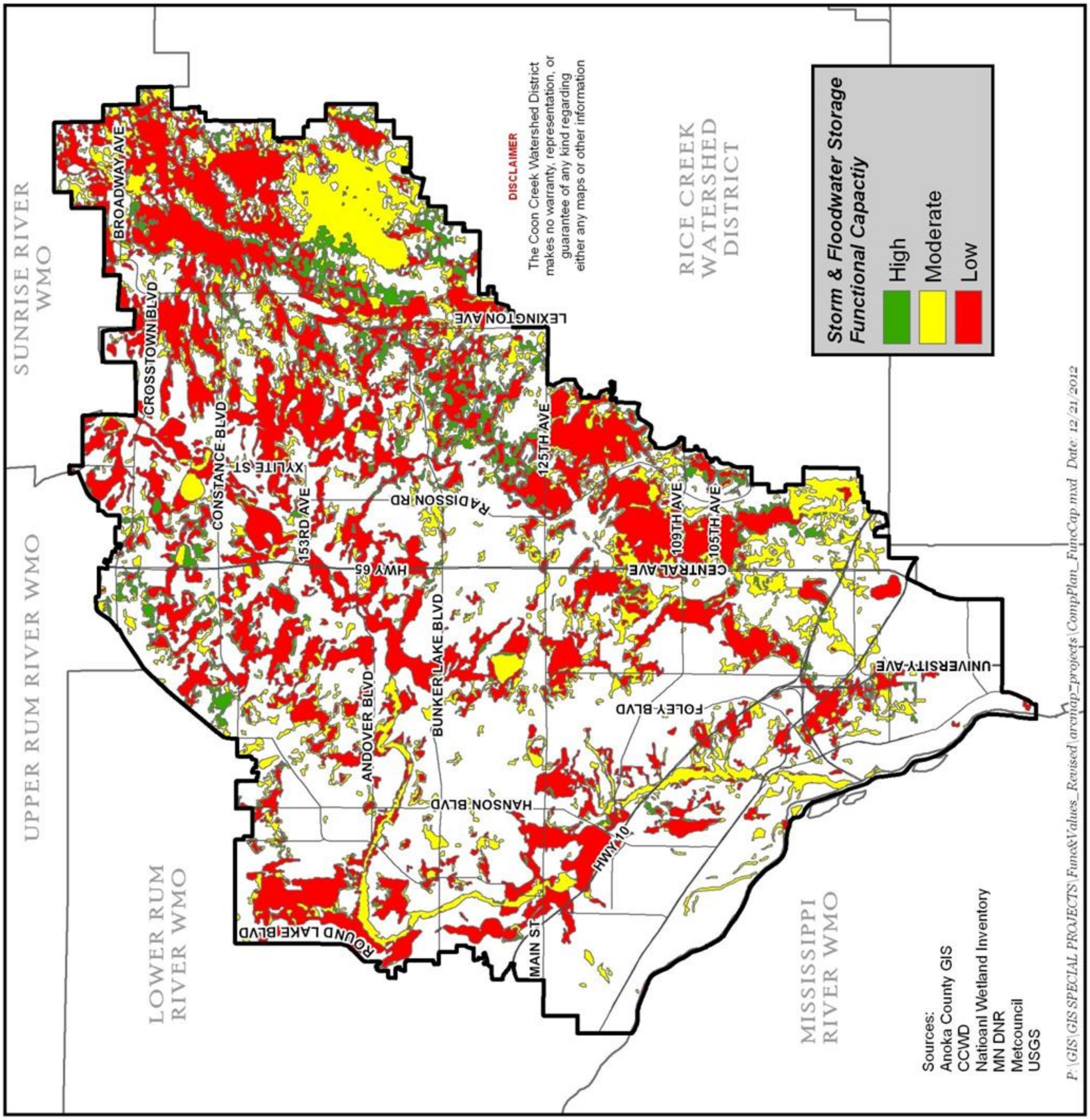
Storm and Flood Water Storage The storage of inflowing water from storm events, resulting in detention and retention of water on the wetland surface.



<u>Characteristics & Processes Modifying Storm & Flood Storage:</u>

- Inlet/Outlet Classification
- Degree of Outlet Restriction
- Basin Topographic Gradient
- Water Regime
- Surface Water Fluctuations
- Wetland to Watershed Areas Ratio
- Vegetation Density & Dominance

Variable	Depression/ Swale	Lacustrine	Bogs/ Peatlands	Floodplain
Inlet/Outlet Class	X		X	X
Outlet Restriction				
Topographic Gradient	X		X	X
Water Regime	X		X	X
Water Fluctuation	X	X	X	X
Wetland/ Watershed Ratio	X	X		X
Veg Density & Dom	X	X	X	X



Storm & Floodwater Storage Functional Capactiy
High
Moderate
Low
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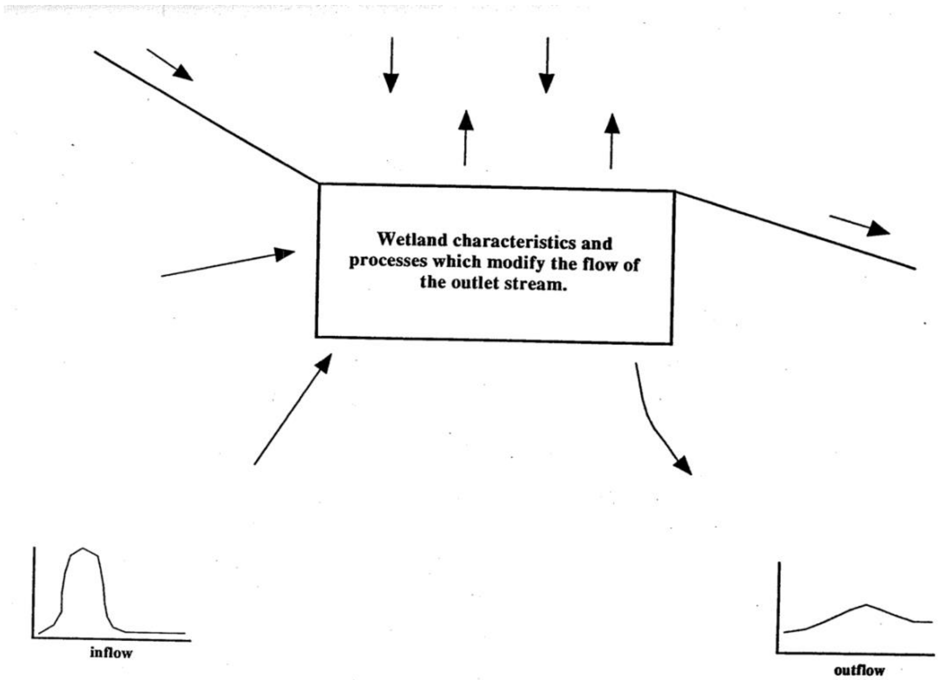
Modification of Stream Flow The modification of inflow hydrology by the wetland to produce the outlet stream's hydrology.

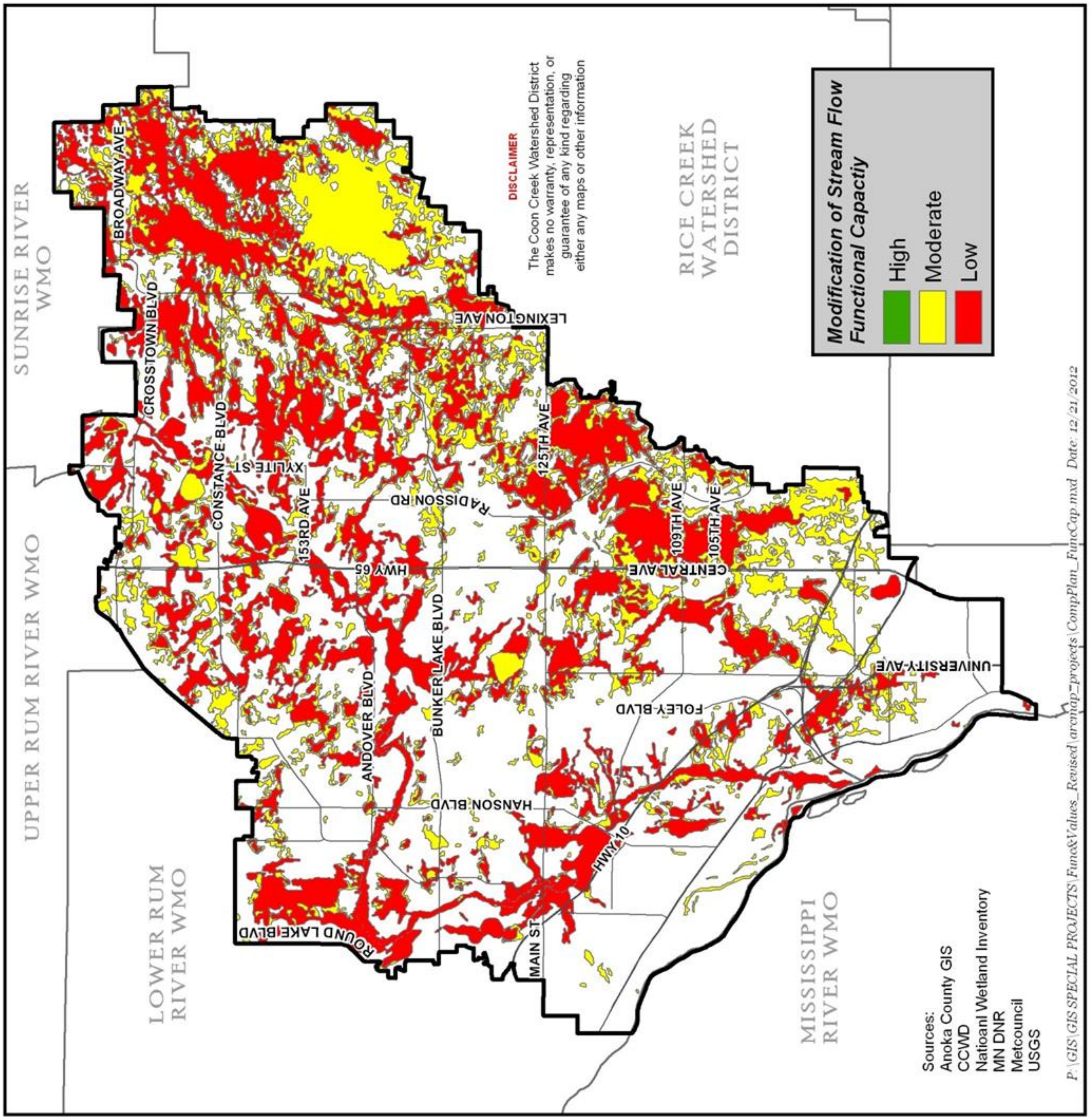


Characteristics & Processes Modifying Stream Flow:

- Inlet/Outlet Classification
- Degree of Outlet Restriction
- Basin Topographic Gradient
- Water Regime
- Surface Water Fluctuations
- Wetland to Watershed Areas Ratio
- Vegetation Density & Dominance
- Frequency of Overbank Flooding
- Soil Type
- pH
- Surficial Geological Deposits of Wetland

Variable	Depression/ Swale	Lacustrine	Bogs/ Peatlands	Floodplain
Inlet/Outlet Class	X		X	X
Outlet Restriction	X		X	
Topographic. Gradient	X		X	X
Water Regime	X	X	X	X
Water Fluctuation	X	X	X	X
Wetland/	X	X	X	X

Watershed Ratio				
Veg Density & Dom	X	X	X	X
Frequency of Overbank Flooding				X
Soil Type	X		X	X
pH	X		X	X
Surficial Geological Deposits	X		X	X


Modification of Stream Flow Functional Capactiy
High
Moderate
Low
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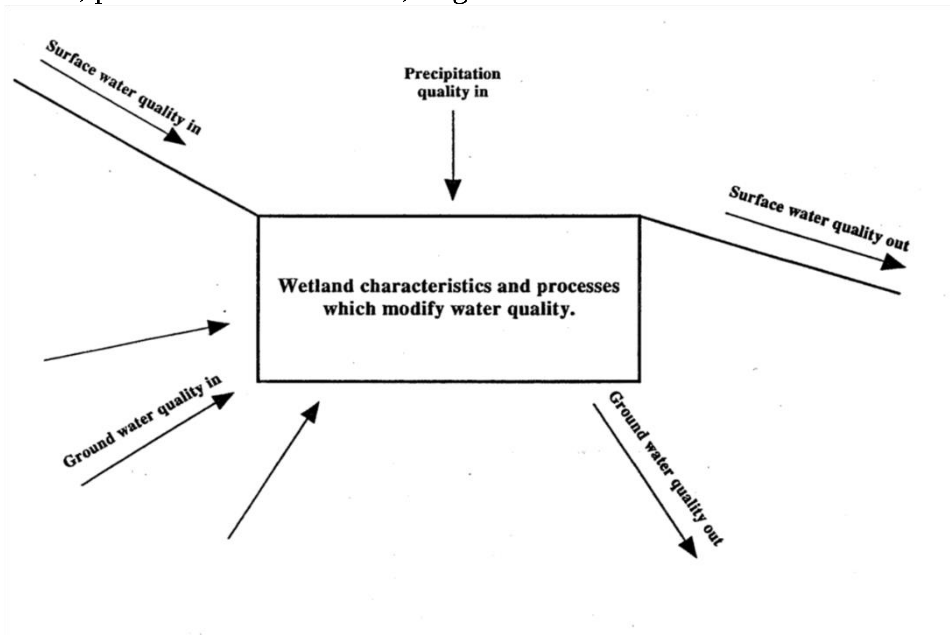
Modification of Water Quality

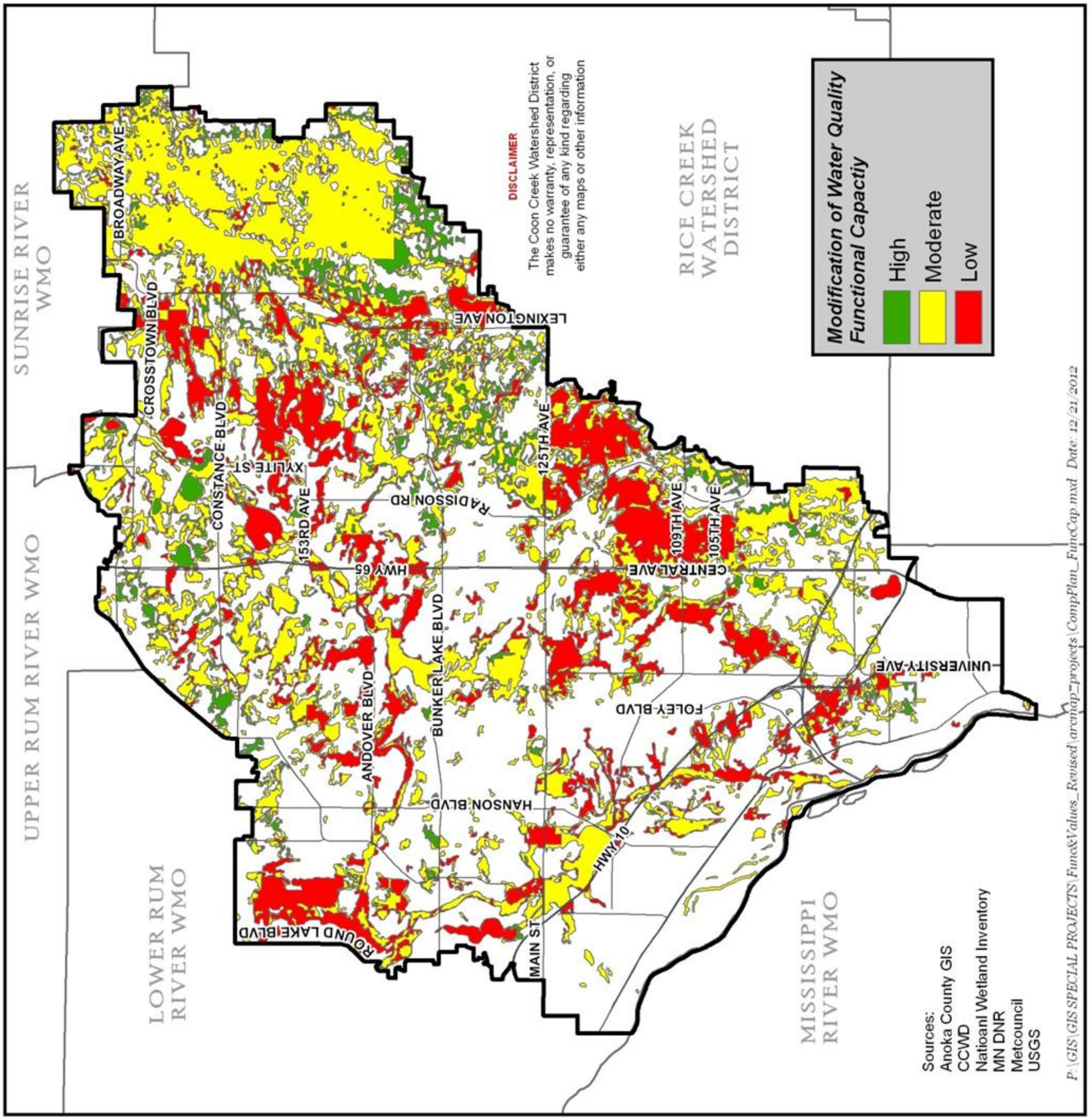
Removal of suspended and dissolved solids from surface water and dissolved solids from surface and groundwater, and conversion into other forms, plant or animal biomass, or gases.



Characteristics & Processes Modifying Water Quality:

- Wetland Land Use
- Degree of Outlet Restriction
- Inlet/Outlet Type
- Cover Distribution
- Soil Type

Variable	Depression/ Swale	Lacustrine	Bogs/ Peatlands	Floodplain
Wetland Land Use	X	X	X	X
Degree of Outlet Restriction	X		-	
Inlet/Outlet Class	X		-	
Cover Distribution	X	X	X	X
Soil Type	X	X	X	X


Modification of Water Quality
Functional Capactiy
High
Moderate
Low
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RICE CREEK WATERSHED DISTRICT
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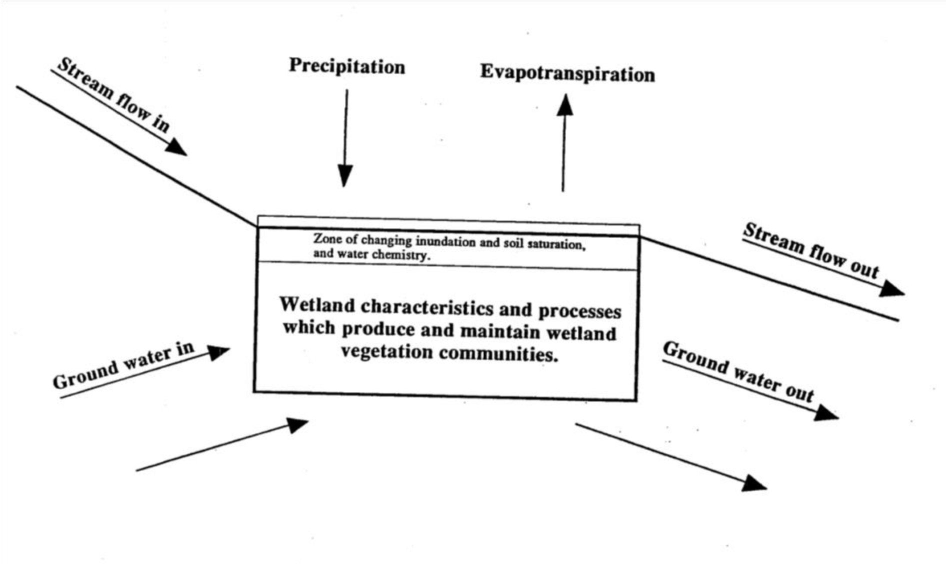
Contribution to Abundance & Diversity of Wetland Vegetation

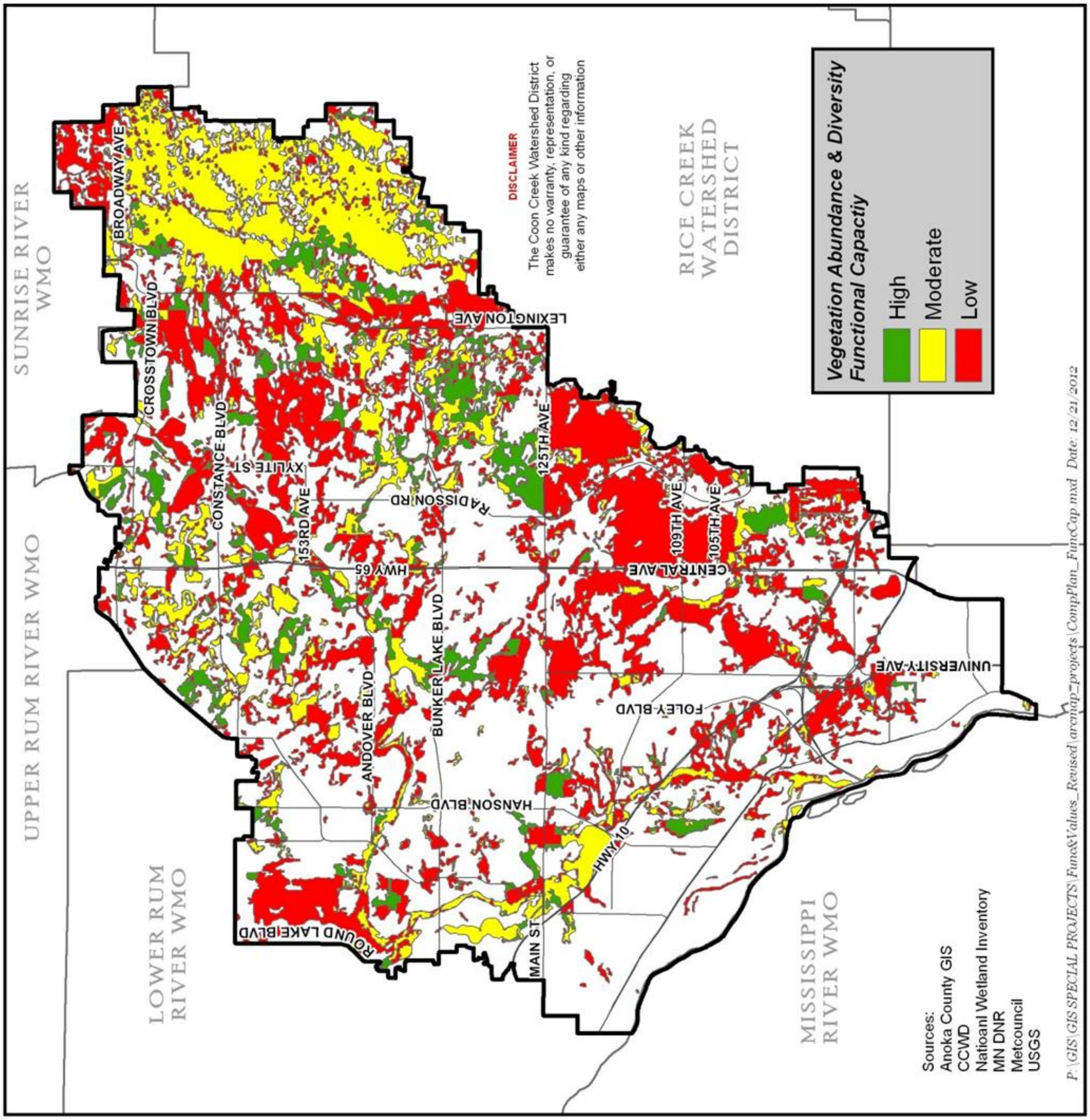
The capacity of a wetland to produce an abundance and diversity of hydrophytic plant species individually or as part of a group of wetlands in a local landscape.



<u>Characteristics & Processes Producing & Maintaining Wetland Vegetation</u>:

- Plant Species Diversity
- Vegetation Density/Dominance
- Wetland Juxtaposition

Variable	Depression/ Swale	Lacustrine	Bogs/ Peatlands	Floodplain
Plant Species Diversity	X	X	X	X
Vegetation Density/ Dominance	X	X	X	X
Wetland Juxtaposition	X	X	X	X


Vegetation Abundance & Diversity Functional Capactiy
High
Moderate
Low
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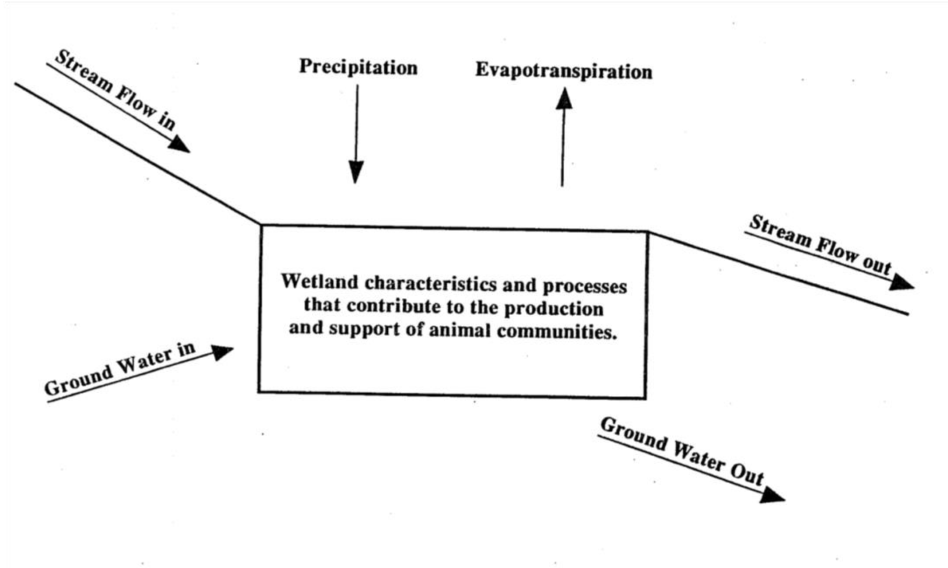
Contribution to Abundance & Diversity of Wetland Fauna

The capacity of a wetland to support large and/or diverse populations of animal species that spend part or all of their life cycle in wetlands, individually or as part of a mosaic of wetlands within a local landscape.

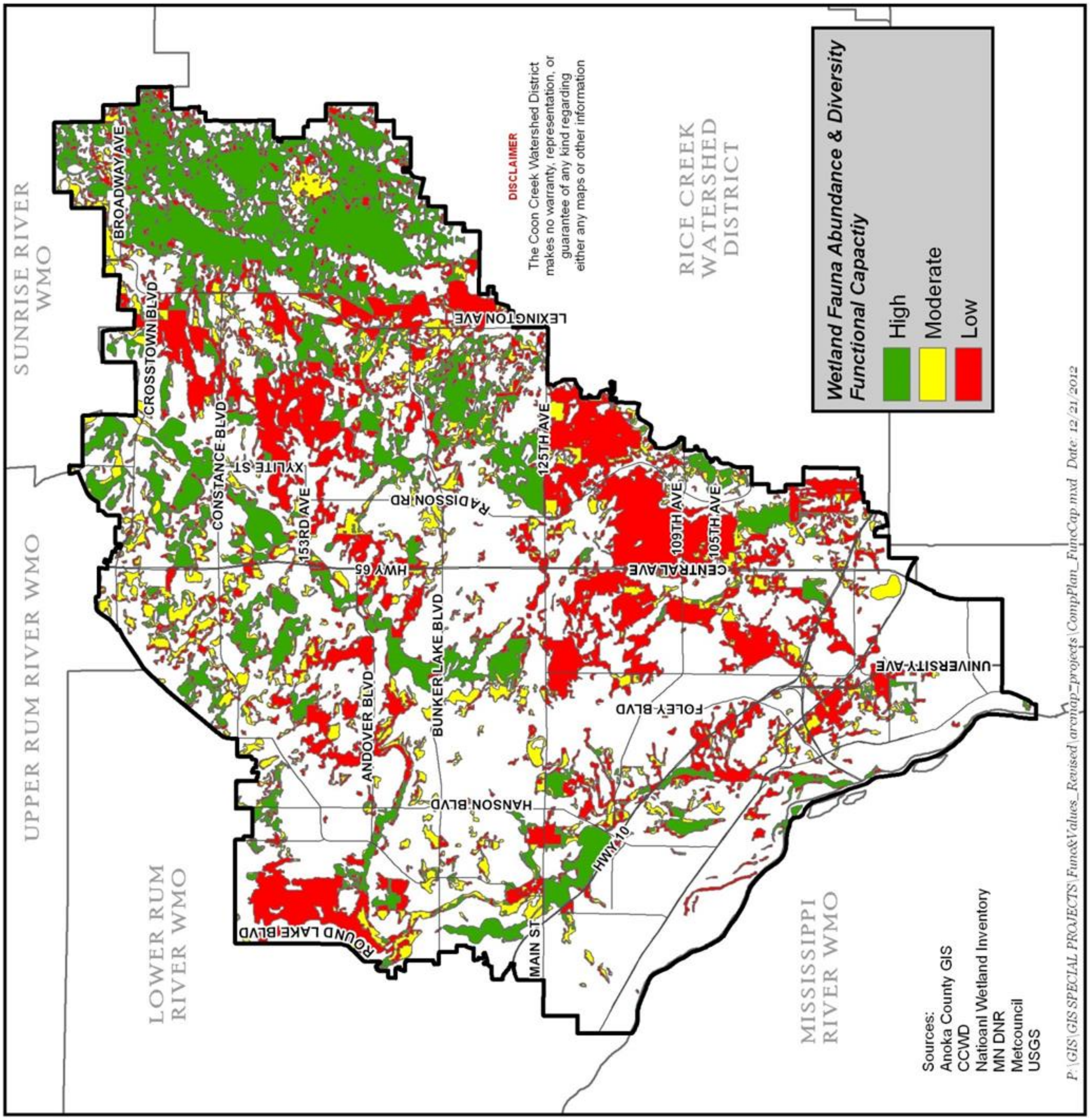


Characteristics & Processes Producing & Supporting Wetland Fauna:

- Watershed Land Use
- Wetland Land Use
- Wetland Water Regime
- Number of Wetland Types & Relative Proportions
- Vegetative Interspersion
- Number of Layers
- Percent Cover
- Interspersion of Vegetative Cover & Open Water
- Size
- Wetland Juxtaposition

Variable	**Depression/ Swale**	**Lacustrine**	**Bogs/ Peatlands**	**Floodplain**
Watershed Land Use	X	X	X	X
Wetland Land Use	X	X	X	X
Wetland Water Regime	X	X	X	X
Number of Wetland Types & Relative Proportions	X	X	X	X
Vegetative Interspersion	X	X	X	X

Number of Layers	X	X	X	X
Percent Cover	X	X	X	X
Interspersion of Vegetative Cover & Open Water	X	X	X	X
Size	X	X	X	X
Wetland Juxtaposition	X	X	X	X


Wetland Fauna Abundance & Diversity Functional Capactiy
High
Moderate
Low
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FINDINGS

The functional assessment has found the following:

Augmenting Field Work

The functional capacity assessment presented in this report has been of moderate assistance in augmenting field work during the 2011 and 2012 field seasons. The majority of field work remains in the determination of "Jurisdictional Wetland" using the Federal Manual. Under the current policy framework of the Wetland Conservation Act, the issues of sustainability, or relative value/importance of any given wetland basin, are trumped by the regulatory issue of the determining the presence and extent of jurisdictional wetland and the quantity of direct or indirect impact on that basin.

Determination of the Level of Function

The determination of the level of function has been most helpful at the watershed and subwatershed scale in discerning patterns, needs and the geographic aspect of demand and need.

Comparing Wetlands

The Coon Creek Watershed District has, as of yet, encountered a situation where comparison of the functional capacity of wetlands, let alone wetlands within the same HGM Class, has been a factor in a wetland regulatory or management decision.

The Wetland Conservation Act program emphasizes the quantity or acreage of wetland impacted and required to be replaced. Functional Capacity is a concept that has more bearing in discussions of sustainability or a management framework that emphasizes the utility of the resource in providing benefits, goods and services.

Evaluating Impacts to Functional Capacity

At present, the Wetland Conservation Act does not regulate the "degree" of impact, impacts to functional capacity, or impacts to the beneficial services that may be provided by the given wetland. The Wetland Conservation Act regulates filling and draining, both direct, easily measurable impacts. This is a strength of the wetland law and regulations. The legal and regulatory criteria are easy to measure and easy to administer and defend. They are conducive to a set of yes or no findings that can be supported by measurable findings and data that can be verified in the field.

However, as landscapes and landscape processes evolve and the biological, geological and chemical factors which combine to create what we identify as wetlands change, the question of sustainability and degree of service will surface and the question of whether it is "worth" avoiding all areas which meet the technical criteria will be raised. It is in this context that the degree to which a wetland is capable of performing certain tasks which provide benefits will be most helpful.

Defining Management and

The Coon Creek Watershed District has found the HGM method extremely beneficial in defining management and mitigation goals. The CCWD began

Mitigations Goals

using the HGM method to classify and discuss wetlands in 2004. The framework has proven extremely beneficial in evaluating problem and disturbed wetlands and providing a framework for evaluating the probable success of proposed wetland mitigation sites and in describing why older mitigation sites have failed or been less successful.

Management Challenges

1. Setting standards on acceptable impact levels for wetlands while taking other factors, such as long term goals, into account.

2. Providing adequate information about how resources function so that management can make informed choices.

3. Managing and monitoring activities and impacts to ensure that situations don't change in a manner that may adversely affect the quality of the area.

Potential Approach to Setting Standards

The approach, consistent with the functional capacity analysis, would specify three wetland categories. These categories would correspond to wetland of low, medium and high quality and/or function. In addition, there is an implied fourth category in the middle of the continuum of wetlands that are degraded but restorable (modified category 2). These potentially restorable wetlands are category 2 wetlands and receive the same level of regulatory protection as other category 2 wetlands.

Category 1 Wetlands

These wetlands support minimal wildlife habitat, and minimal hydrologic and recreational functions. They also do not provide critical habitat for endangered or threatened species or contain rare, threatened or endangered species.

These wetlands are often hydrologically isolated, and have low species diversity, no significant habitat or wildlife use, little or no upland buffers, limited potential to achieve beneficial wetland values, and/or have a predominance of non-native species. Category 1 wetlands should be considered 'Limited Value Resources Waters' (Class 7) under the MPCA Rule 7050.

These wetlands should be considered to be a resource that has been so degraded or with such limited potential for restoration or of such low functionality that no social or economic justification can be made and lower standards of avoidance and minimization should be made.

Category 2 (Modified) Wetlands

These wetlands constitute a broad middle category that supports moderate wildlife habitat or hydrologic or recreational functions, but also includes wetlands which, while degraded, have a reasonable potential for reestablishing compromised wetland functions.

Category 2 Wetlands These wetlands support moderate wildlife habitat or hydrological or recreational functions and as wetlands are dominated by native species but generally without the presence of, or habitat for, rare, threatened or endangered species. Category 2 wetlands constitute a broad middle category of "good" quality wetlands. These wetlands can be considered "warm water habitat" streams (Class 2D, 3D, 4C, 5 and 6 waters) and therefore can be considered a functioning, diverse, healthy water resource that has ecological integrity and human value. Some Category 2 wetlands may be relatively lacking in human disturbance and can be considered to be naturally or moderate quality; others may have been Category 3 wetlands in the past but have been disturbed "down to" Category 2 status.

Category 3 Wetlands These wetlands provide superior habitat, or superior hydrologic or recreational functions. They are typified by high levels of diversity, a high proportion of native species, and/or high functional capacity. Category 3 wetlands include wetlands which contain, or provide habitat for, threatened or endangered species, are high quality mature forested wetlands, vernal pools, bogs, fens or which are scarce regionally and/or statewide.

Wetland Tiered Aquatic Life Uses

Minnesota is working to revise its water quality standards (MN Rule Chapter 7050) to incorporate a tiered aquatic life use (TALU) framework for rivers and streams. It does not appear that that MPCA plans to develop separate 'Wetland Aquatic Life Use' standards. The Watershed District will follow the MPCA development of TALU standards and evaluate the 3 categories identified here while the District works through the Watershed Restoration and Protection Plan (WRAPP).

Special Wetland Uses

Subscript	Special Use	Description
A	Recreation	Wetlands available to the public with known recreational uses.
B	Education	Wetlands with known educational uses such as nature center, schools
C	Bird Habitat	Wetlands that provide important breeding and nonbreeding habitat for birds (wildlife management areas, parks, nature centers)
D	T & E Habitat	Wetlands that provide habitat for endangered and threatened species.
E	Flood Storage	Wetlands located in landscape positions such that they have flood retention functions.
F	Water quality Improvement	Wetlands located in landscape positions such that they can perform water quality improvement functions for lakes, streams, other wetlands or the Mississippi River

Potential Wetland Tiered Aquatic Life Uses for specific landscape positions and plant communities

HGM class	**HGM Subclass**	**Plant community**	**Category 1**	**Category 2 (modified)**	**Category 2**	**Category 3**
Depressions & Swales	All		**To Be Developed**			
Lacustrine	All					
Floodplain/ Riverine	All					
Flats	Mineral					
	Organic					
	Slope					

Potential Hydrologic Stressors for Consideration:

1. Ditching
2. Dike/Ditch Plug
3. Weir
4. Stormwater
5. Point Source
6. Fill
7. Road or Rail Road Bed
8. Dredge disposal
9. Dewatering/Shallow Wells
10. Other

Potential Habitat Alteration Stressors for consideration:

1. Mowing
2. Grazing
3. Clear Cutting
4. Selective Cutting
5. Woody & Brush Removal
6. Sedimentation
7. Toxic Pollution
8. Aquatic Bed/Emergent Removal
9. Dredging
10. Nutrient Enrichment

Coon Creek Watershed District

Wetland Functional Assessment Using HGM

Interagency Wetland Group

3/7/12

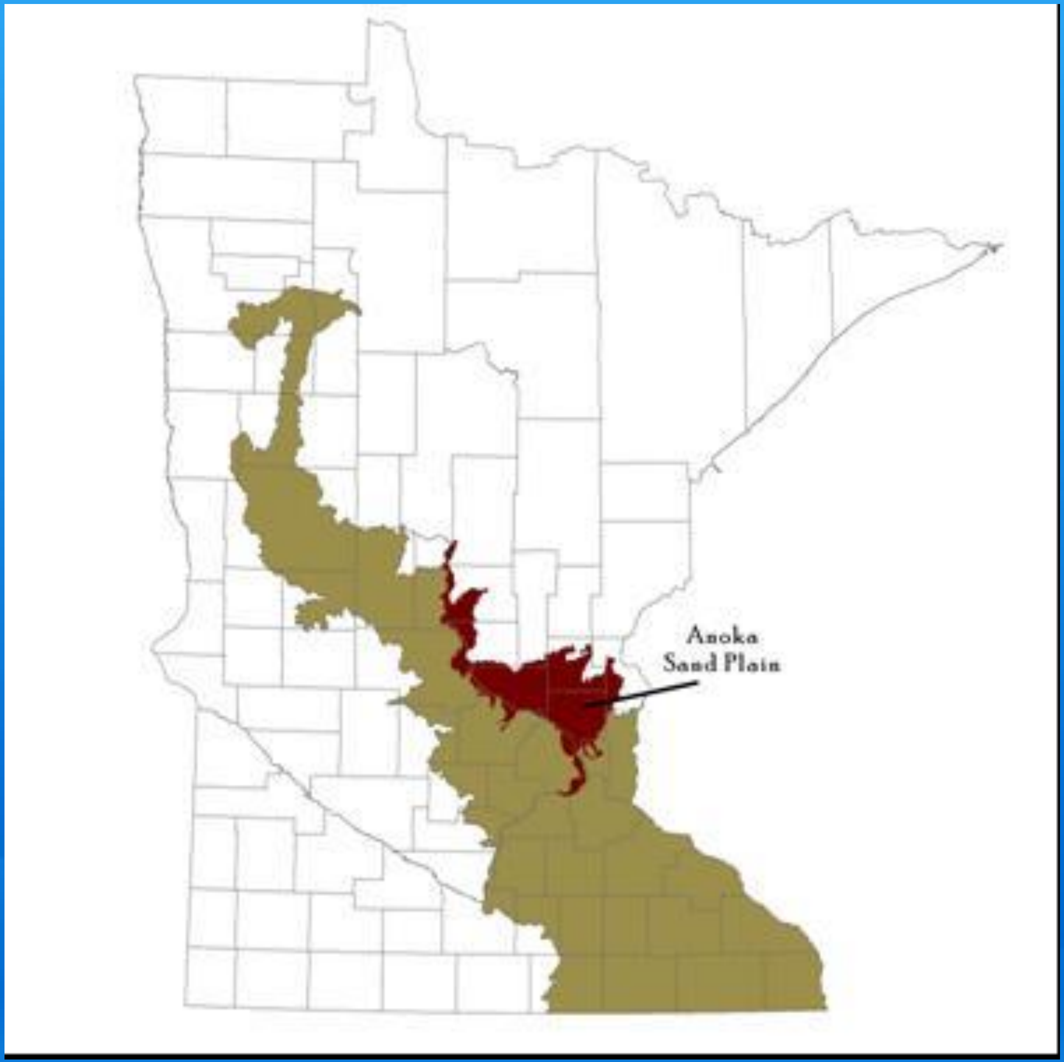
Tim Kelly, Coon Creek Watershed District
Justin March, Flat Rock Geographics

Agenda

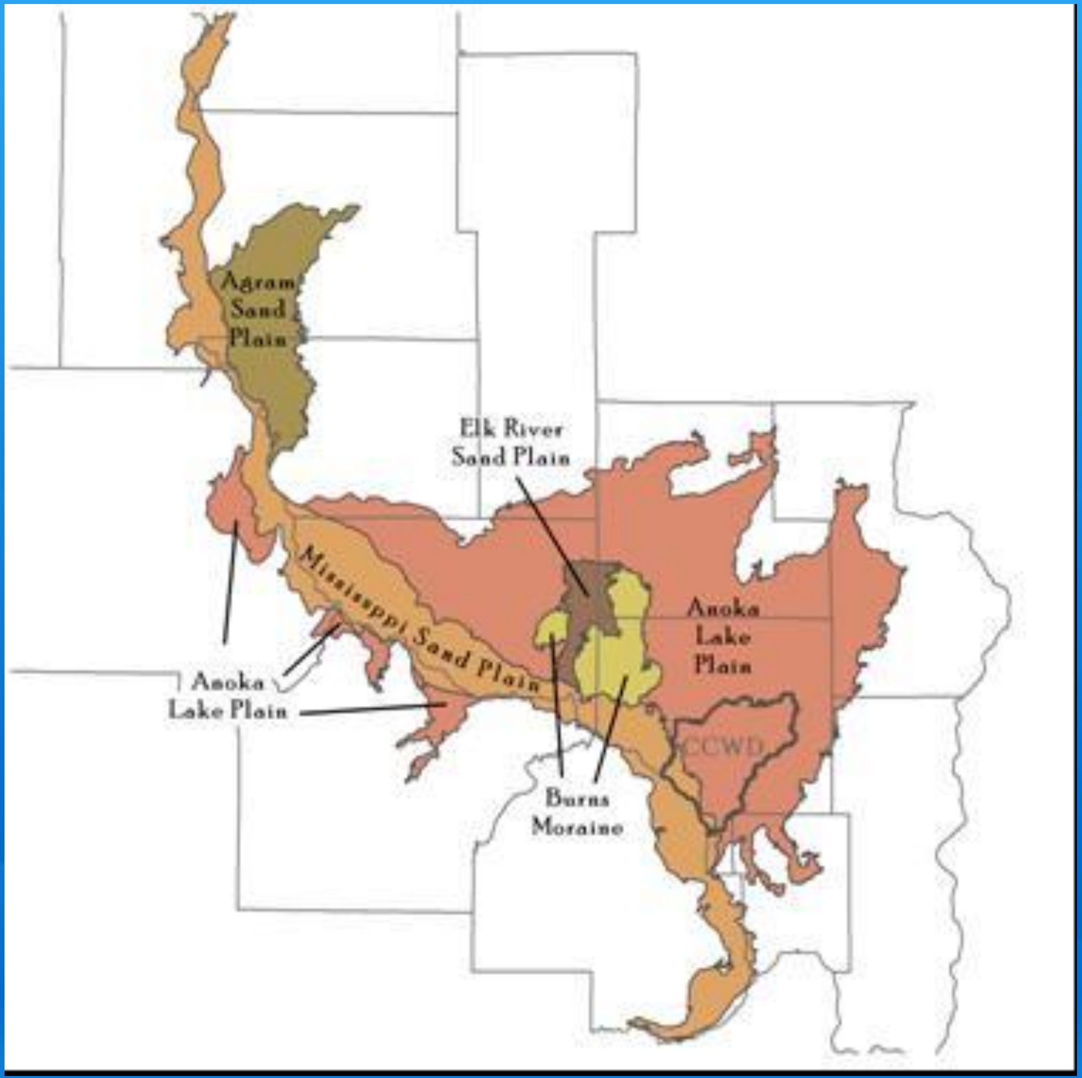
1. Coon Creek Watershed
2. Coon Creek Watershed District
3. Objectives
4. Approach & Methodology
5. Applications
6. Evaluation of Approach
7. Questions

1. Coon Creek Watershed

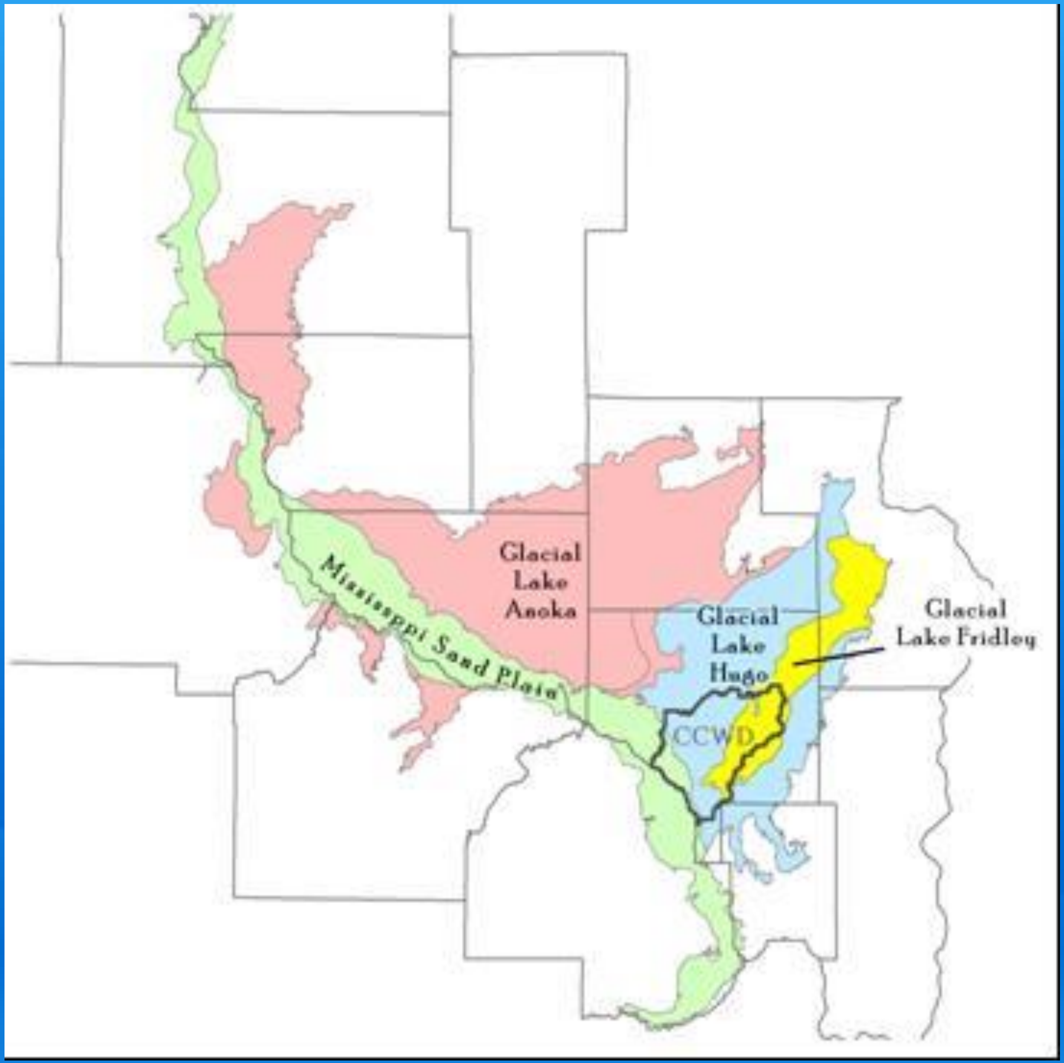
Subsection - Anoka Sand Plain

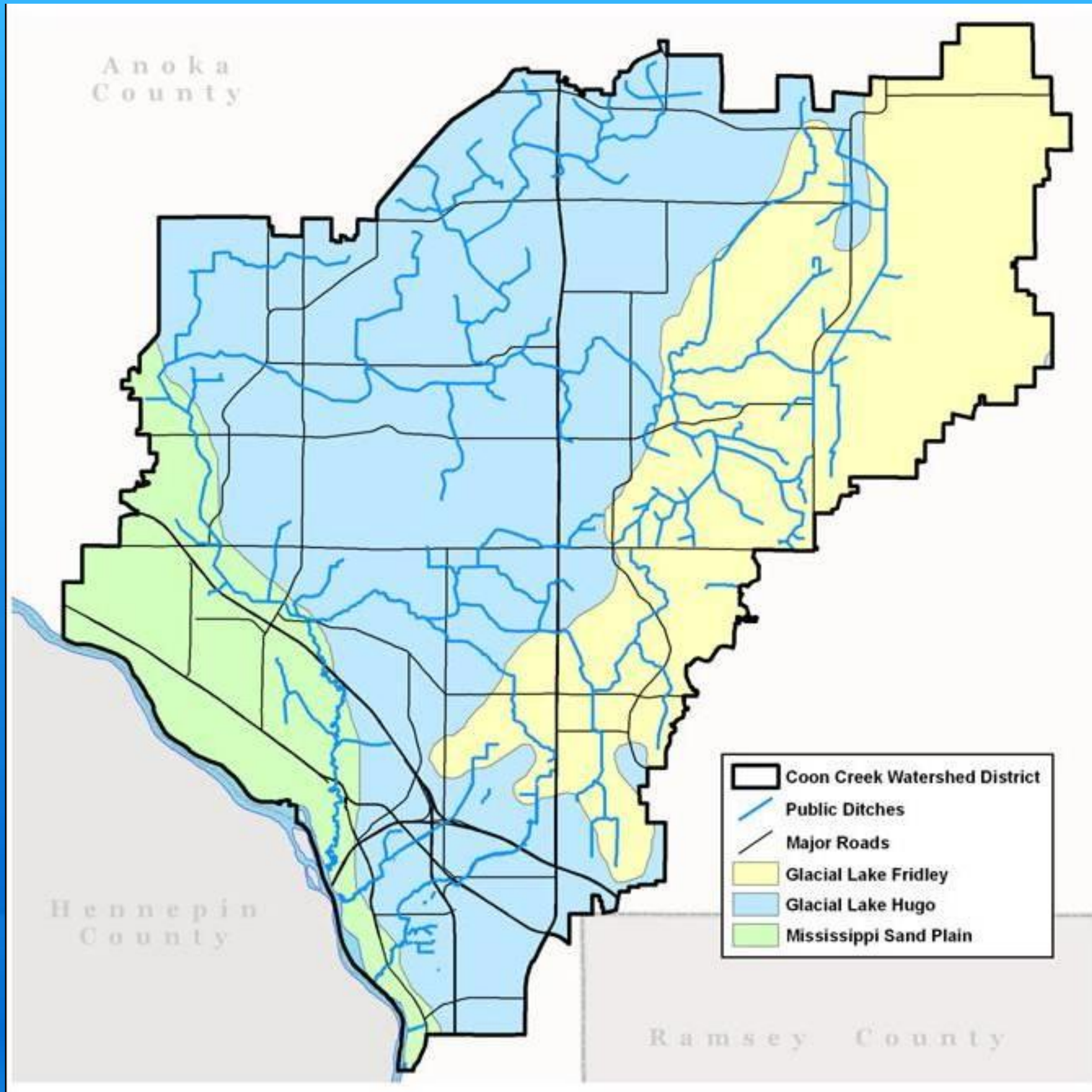


Land Type Association: Anoka Lake Plain



Land Sub-Types: Glacial Lakes & Mississippi Sand



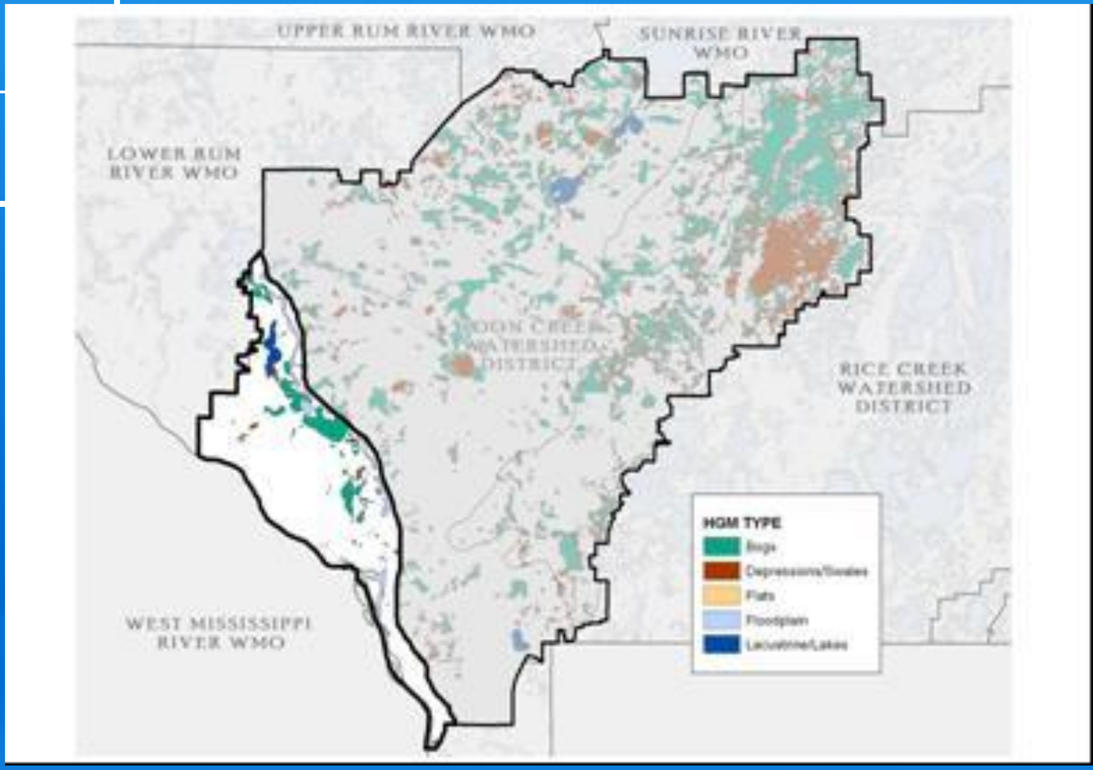

Anoka County
Hennepin County
Ramsey County
Coon Creek Watershed District
Public Ditches
Major Roads
Glacial Lake Fridley
Glacial Lake Hugo
Mississippi Sand Plain

Hydrogeomorphic Classes in Coon Creek Watershed

1. Bogs
2. Depression and Swale Wetlands
3. Flats
4. Riverine Wetlands
5. Lacustrine Fringe Wetlands

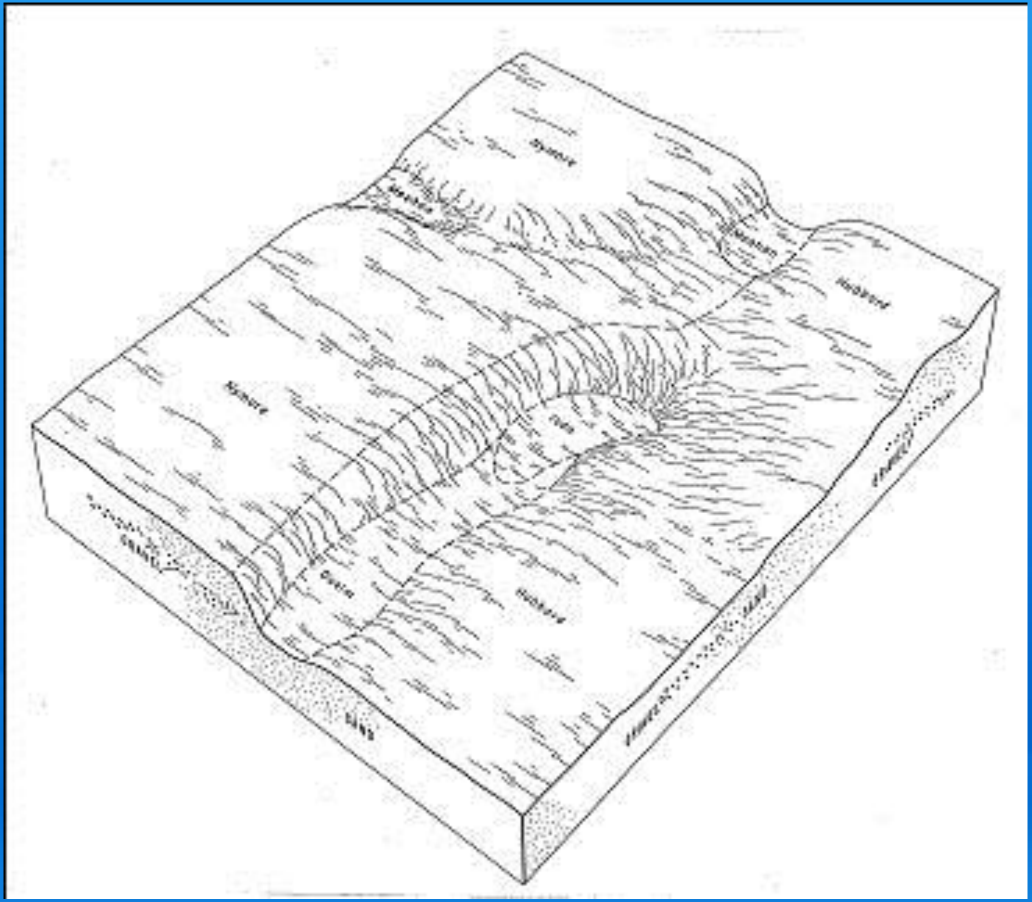
Mississippi Sand Plain

HGM class	Acres
Bogs	571
Depressions	76
Flats	7
Riverine	295
Lacustrine	120



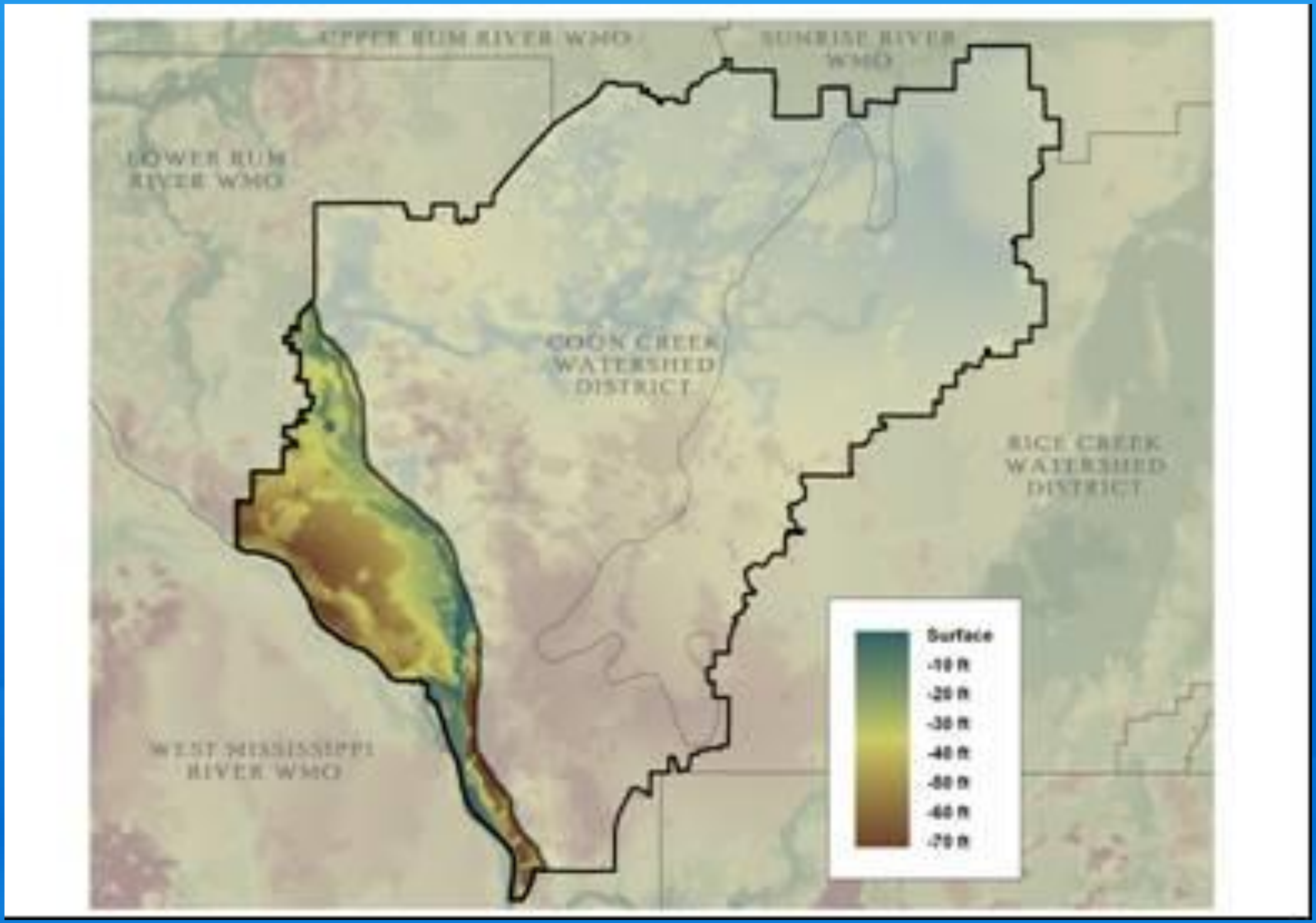
Mississippi Sand Plain - Landscape

Nearly level to gently sloping outwash plain that is dissected by drainageways leading to the Mississippi River



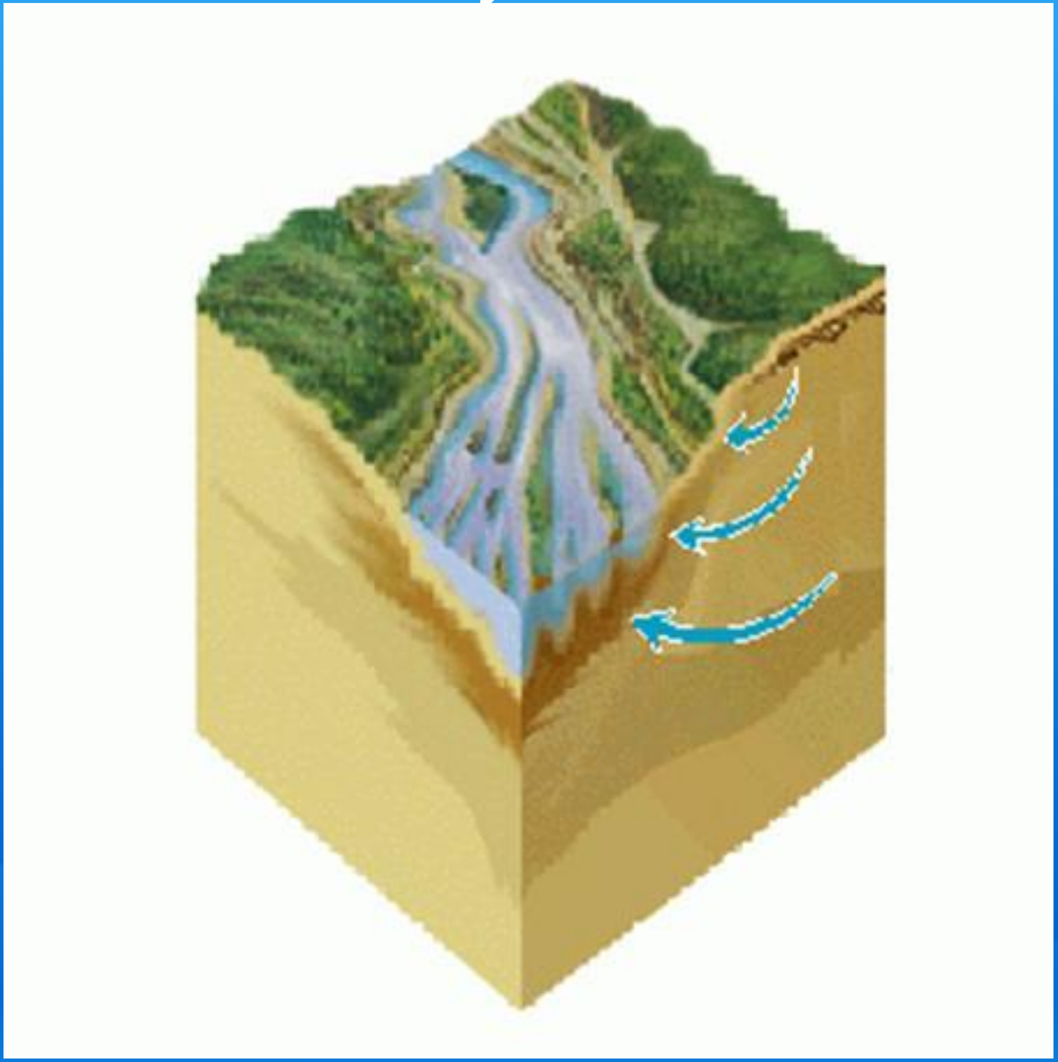
Mississippi Sand Plain – Water Source

Water table is at or near surface



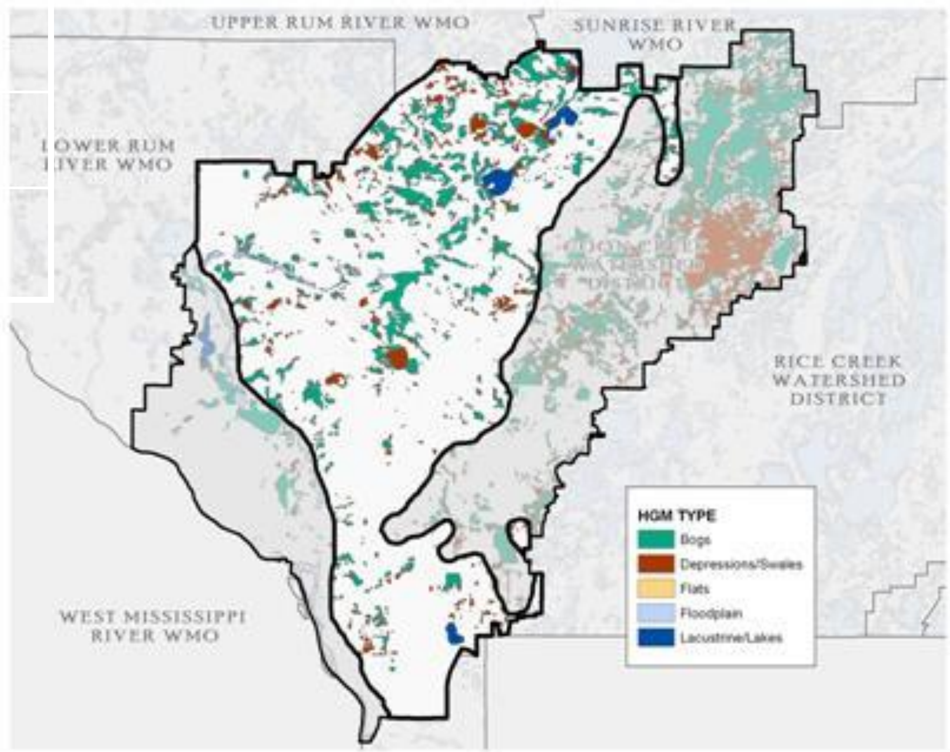
Mississippi Sand Plain – Water Movement

86% are seasonally flooded or drier



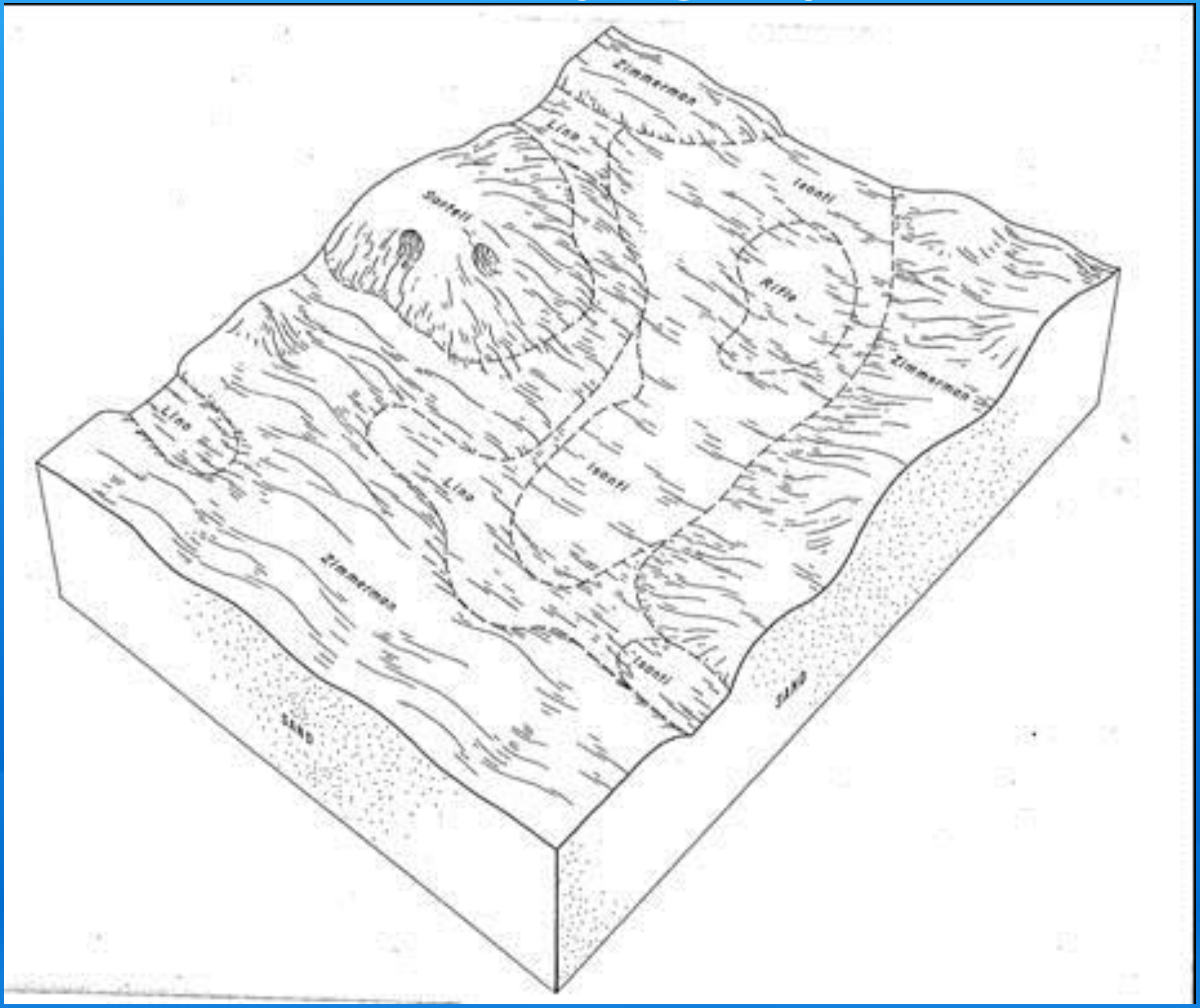
Glacial Lake Hugo

HGM class	Acres
Bogs	3482
Depressions	1557
Flats	8
Riverine	143
Lacustrine	361



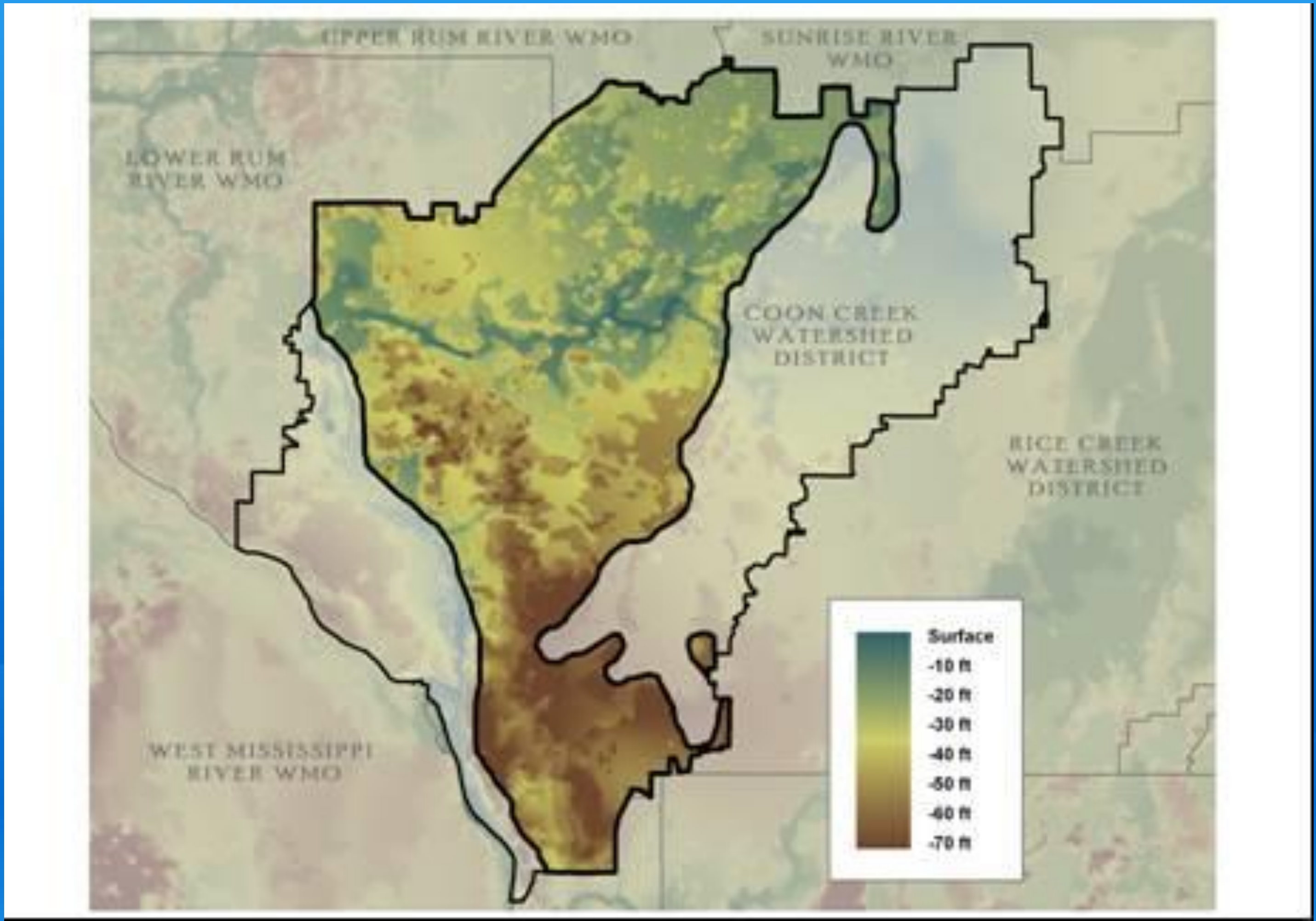
Lake Hugo - Landscape

Small flats & low lying depressions



Lake Hugo – Water Source

Water table is at or near surface in most low lying areas in the north

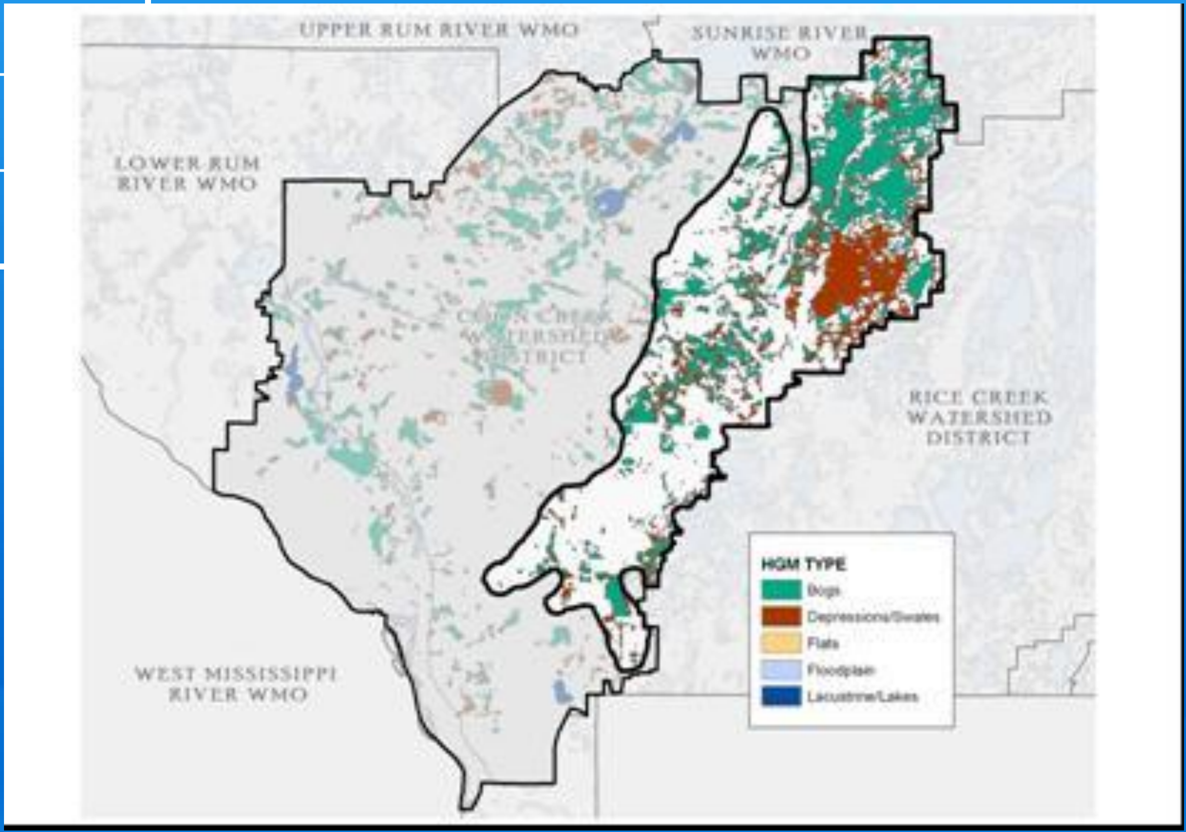


Lake Hugo – Water Movement

91% are seasonally flooded or drier

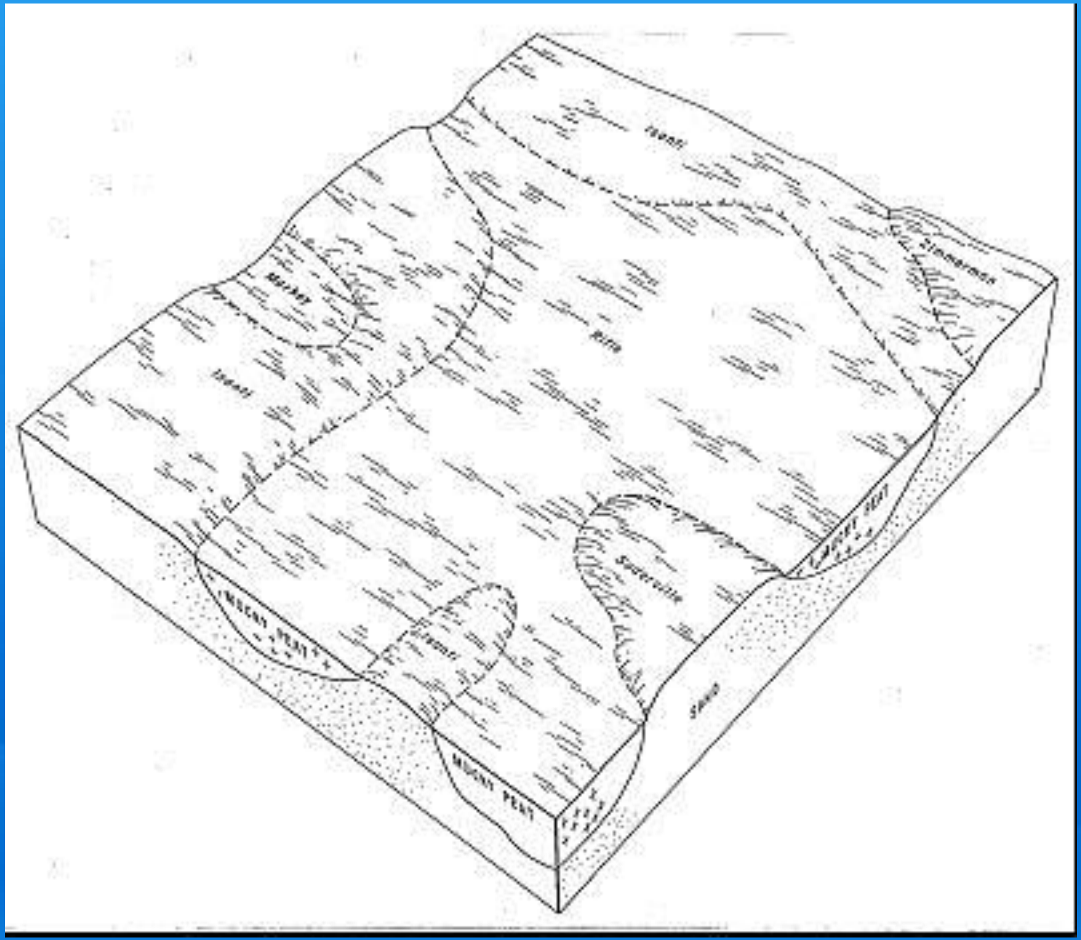
Lake Fridley

HGM class	Acres
Bogs	4547
Depressions	3403
Flats	0
Riverine	0
Lacustrine	33



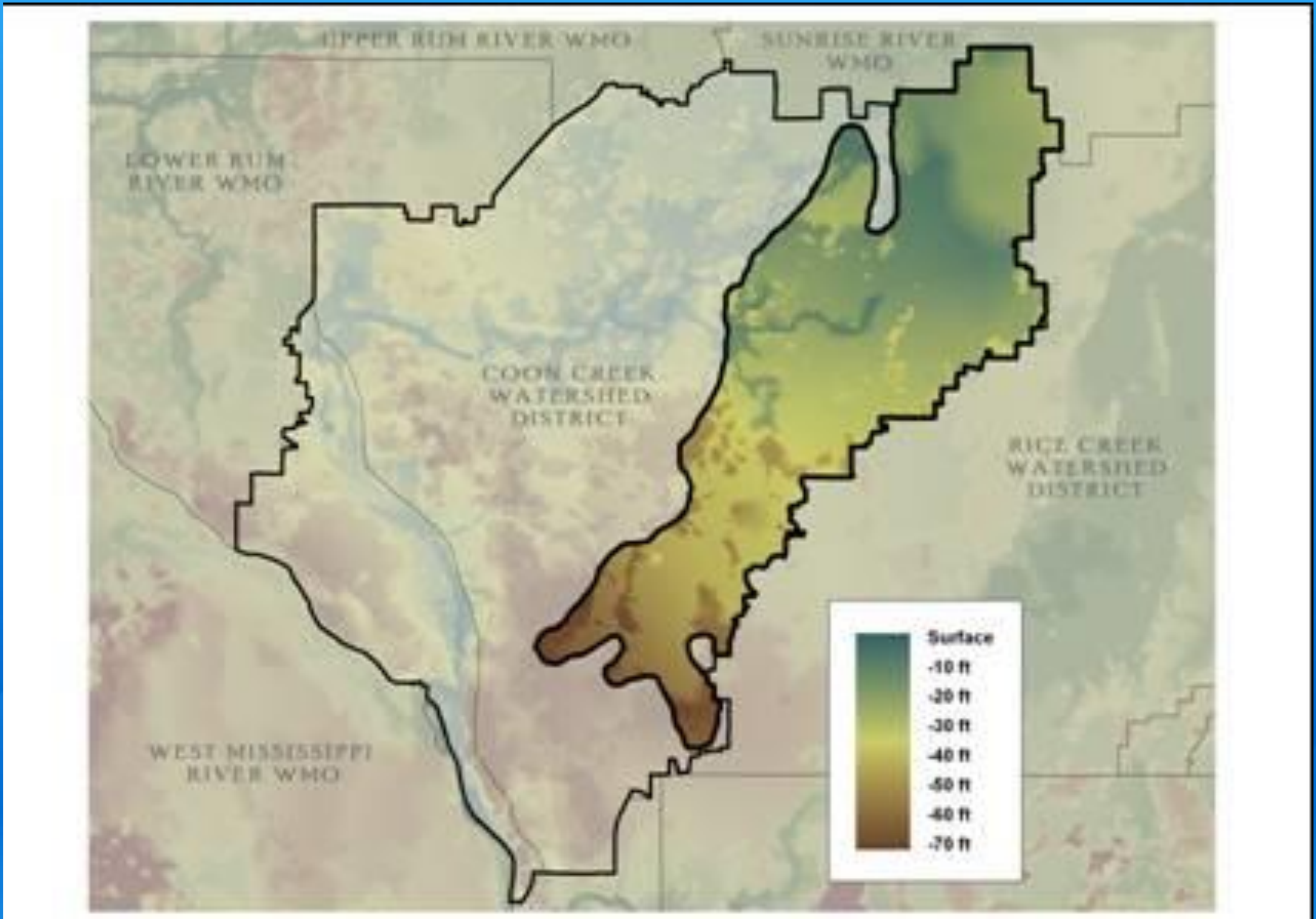
Lake Fridley - Landscape

Large level boggy flats with
small sandy upland islands



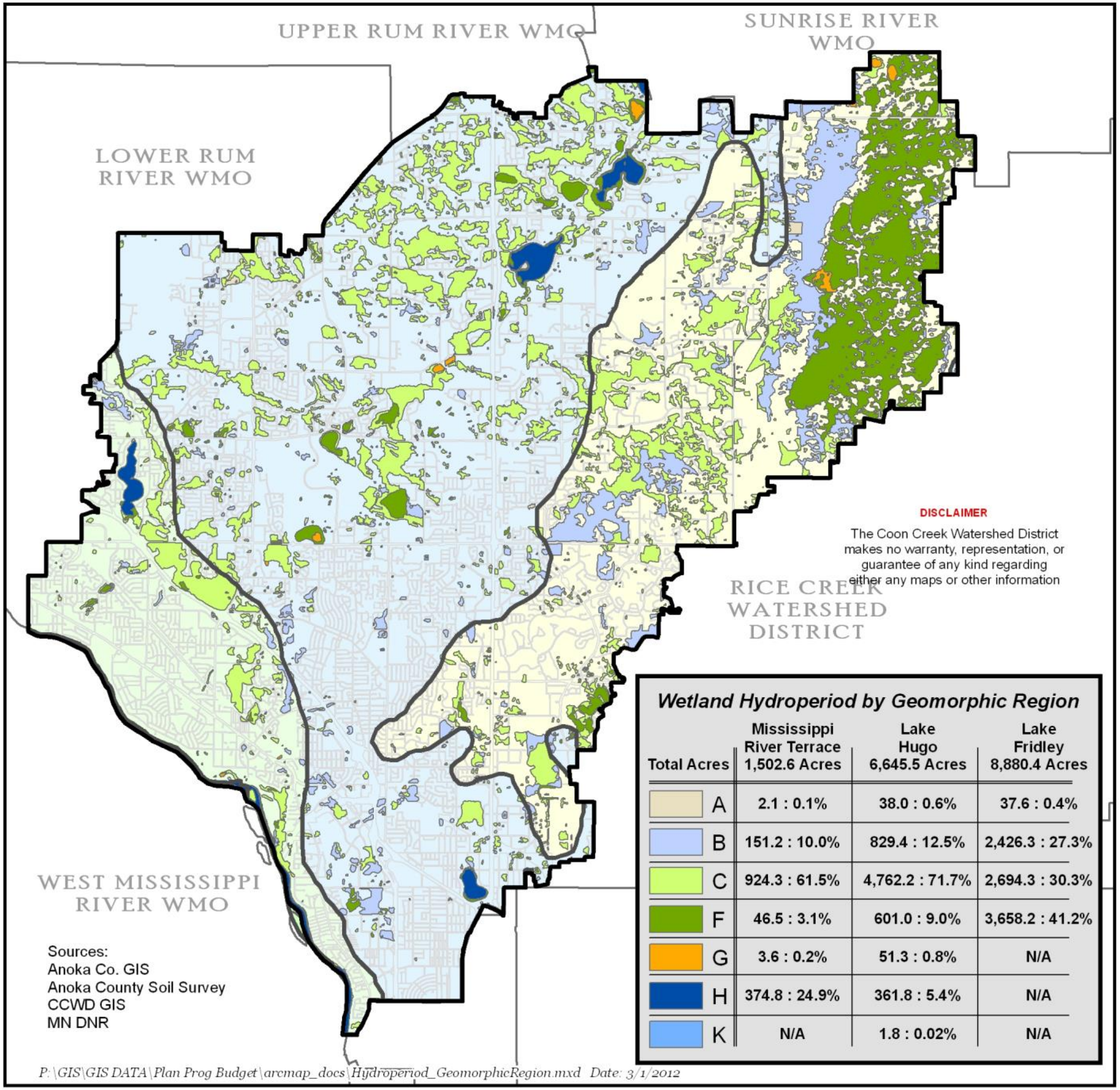
Lake Fridley – Water Source

Water table is at or near surface



Lake Fridley – Water Movement

57% are seasonally flooded or drier



Wetland Hydroperiod by Geomorphic Region

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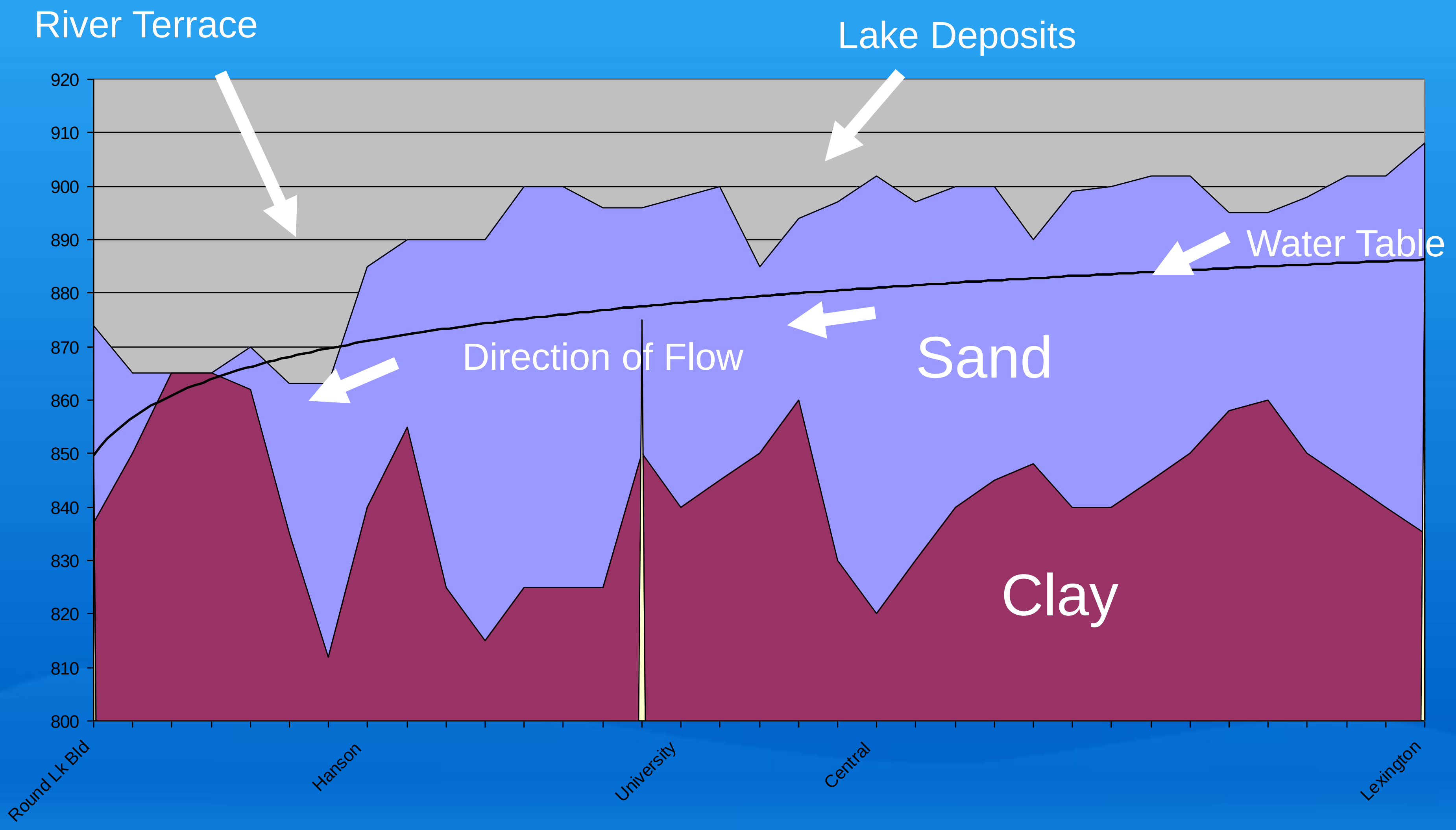
C	924.3 : 61.5%	4,762.2 : 71.7%	2,694.3 : 30.3%
F	46.5 : 3.1%	601.0 : 9.0%	3,658.2 : 41.2%
G	3.6 : 0.2%	51.3 : 0.8%	N/A
H	374.8 : 24.9%	361.8 : 5.4%	N/A
K	N/A	1.8 : 0.02%	N/A

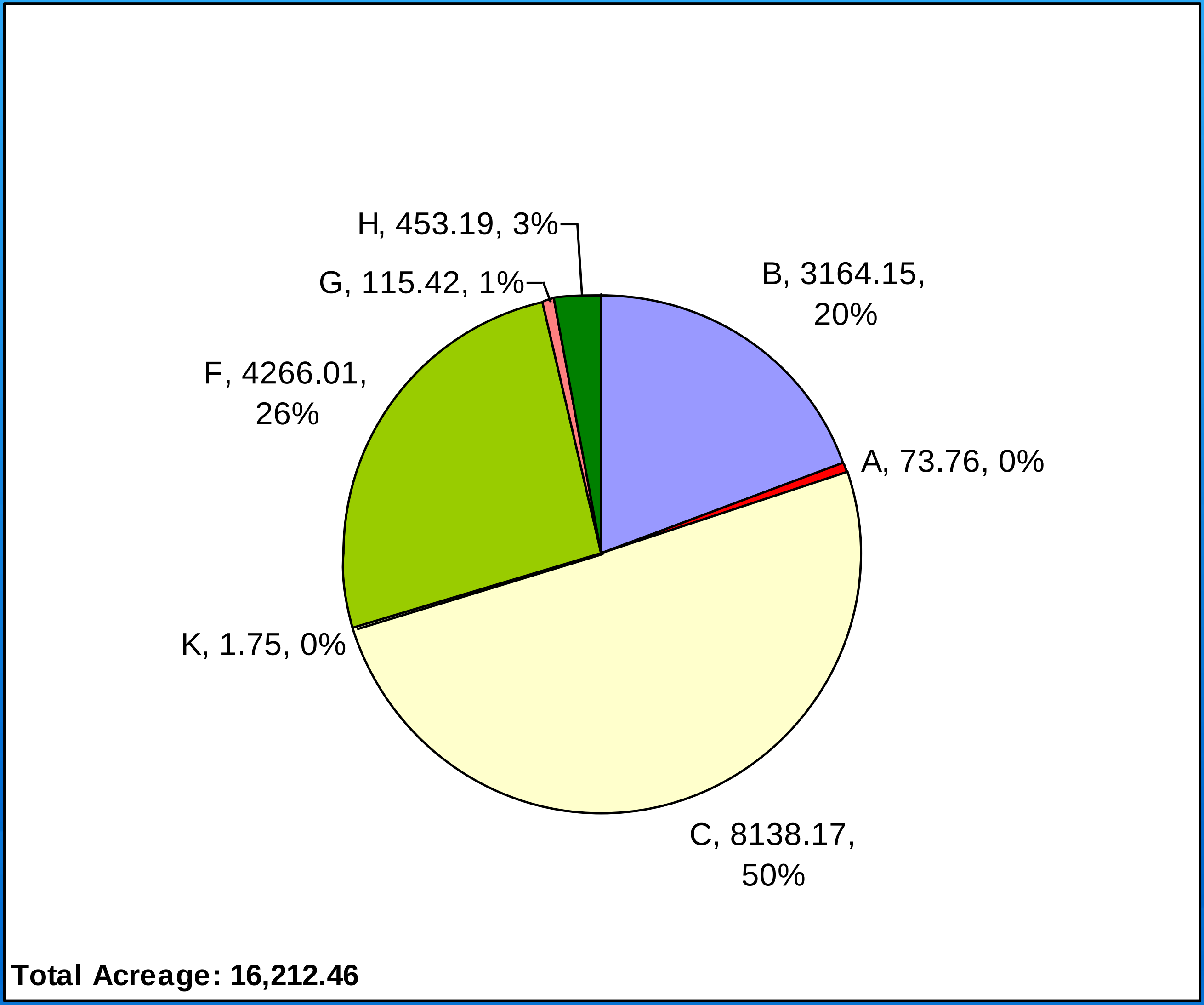
Generalized Profile

(Upper 120 ft)



MPCA, 1997

CCWD Hydroperiod



2. Coon Creek Watershed District

Established 1959, Amended 2011

107 Square Miles

7 Cities

Coon Creek Watershed District

1. Watershed District
2. Ditch Authority
3. Water Management Organization
4. WCA LGU
5. MS4

3. Objectives

Objectives

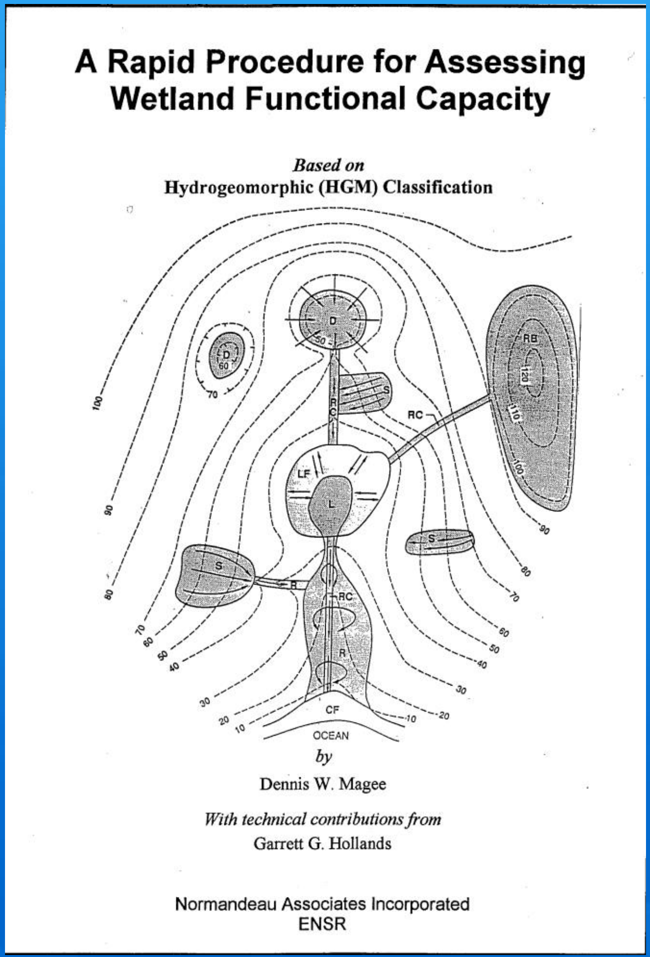
1. To assess functional capacity
2. To assess level of function
3. To augment field determinations
4. To examine the combination of conditions that yield a high functioning mitigation site
5. To evaluate impact scenarios of variable conditions

4. Approach and Methodology

Approach

Goal:

An HGM based tool where time and cost prohibit establishing reference wetlands


A Rapid Procedure for Assessing Wetland Functional Capacity

Based on
Hydrogeomorphic (HGM) Classification

by
Dennis W. Magee

With technical contributions from
Garrett G. Hollands

Normandeau Associates Incorporated
ENSR

Method

1. Identify wetland assessment areas (WAAs) and physical separation criteria.

2. Inventory select conditions (landscape, hydrologic, soils, vegetation variables).

3. Information from the inventory is applied to the models

1. ID Wetland Assessment Areas Using HGM

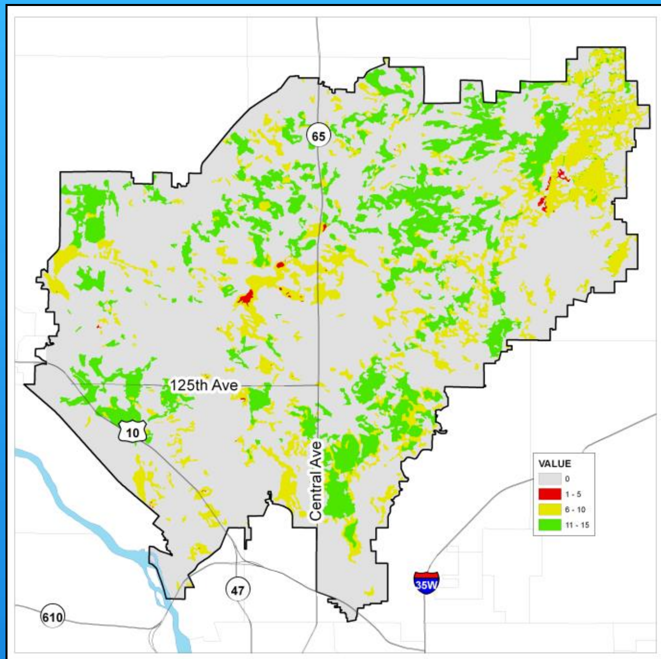
Landscape Position

Soils

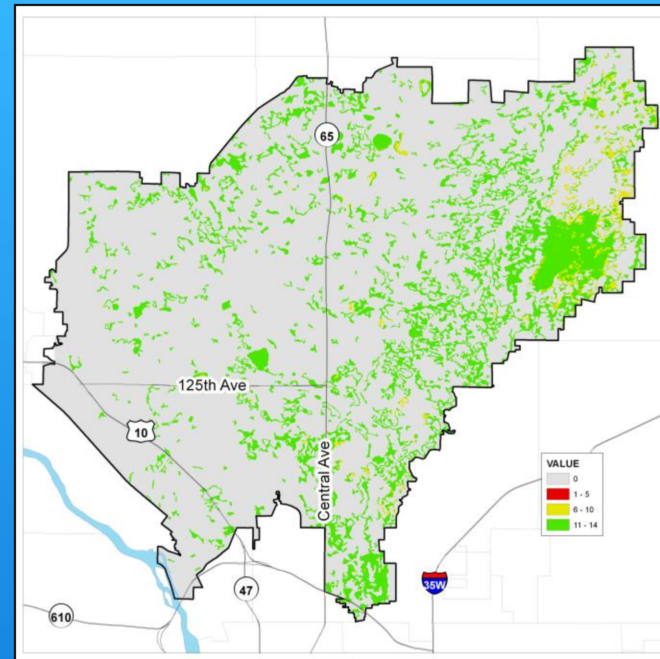
Primary Water Source

Hydroperiod

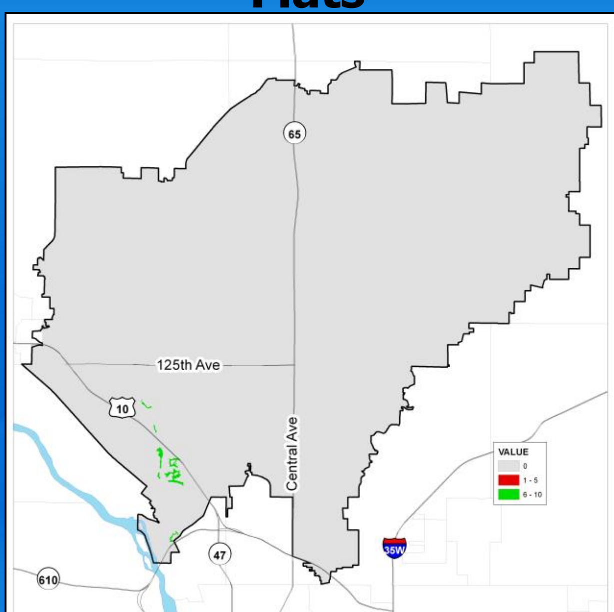
Bogs



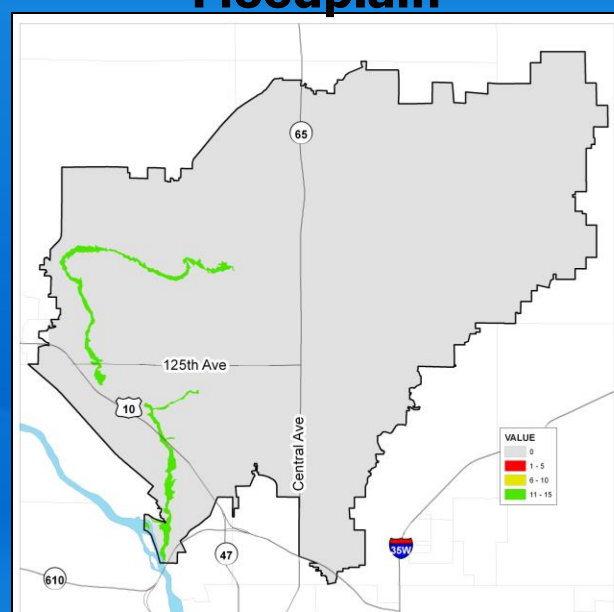
Depressions/Swales



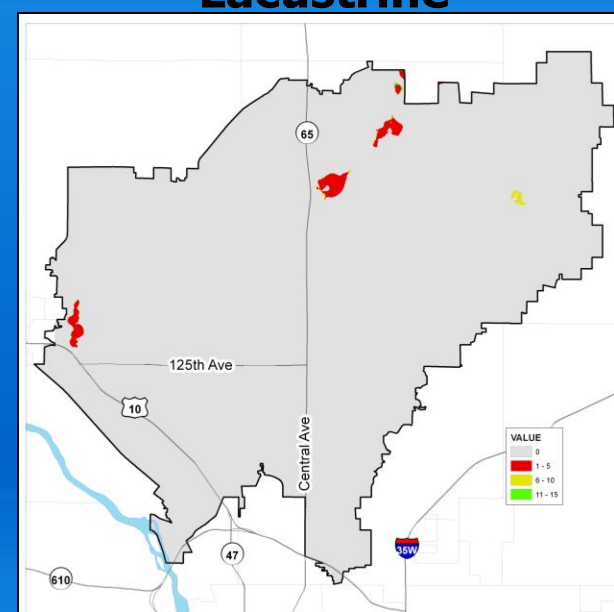
Flats



Floodplain

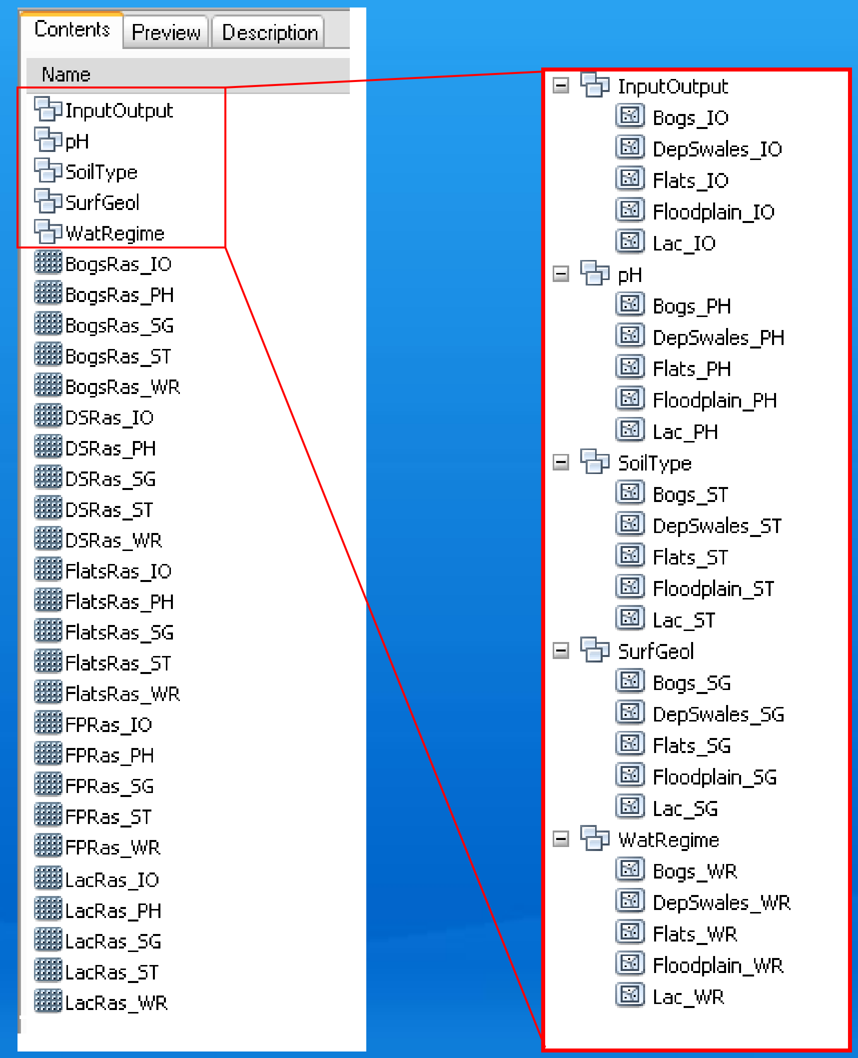


Lacustrine

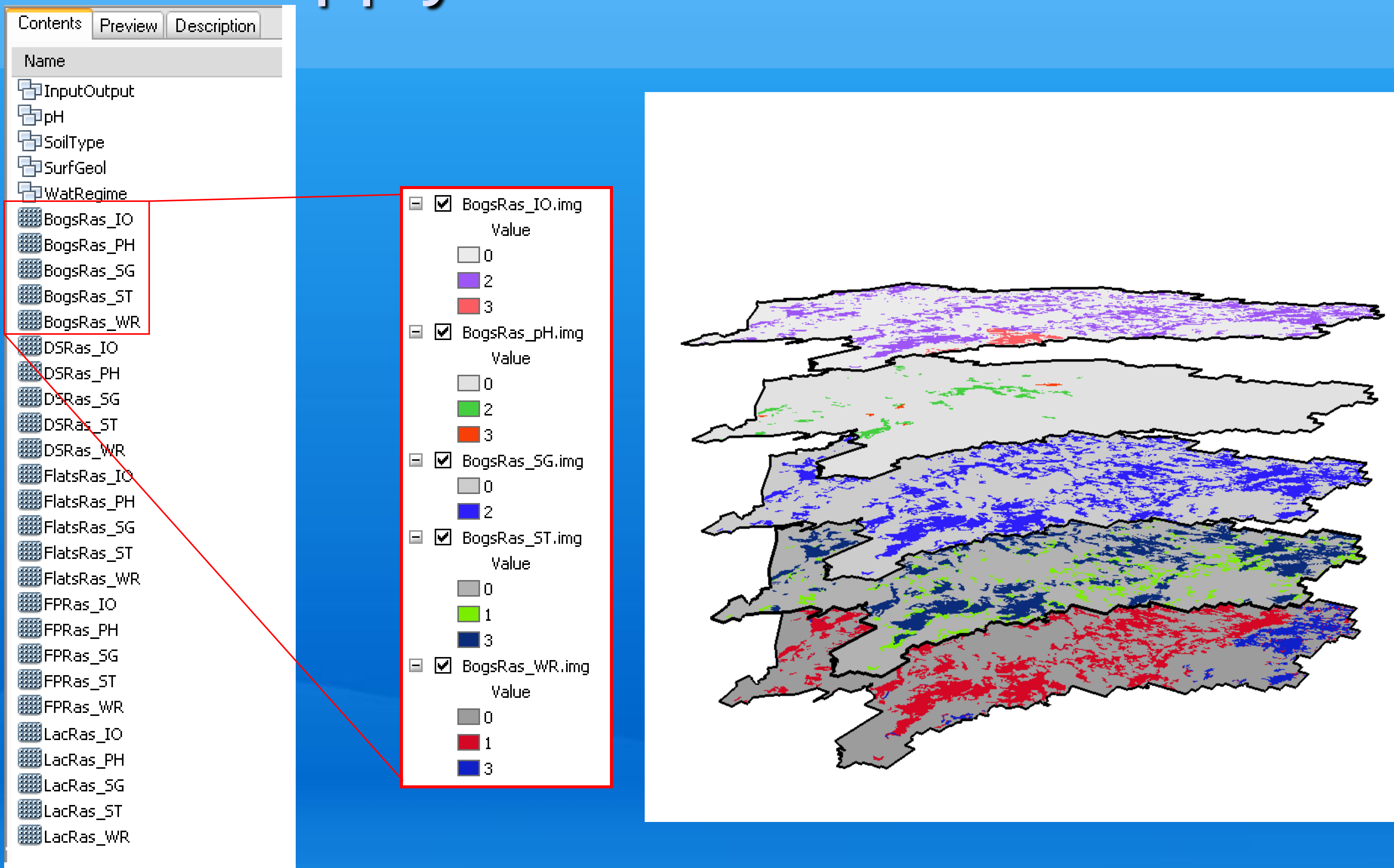


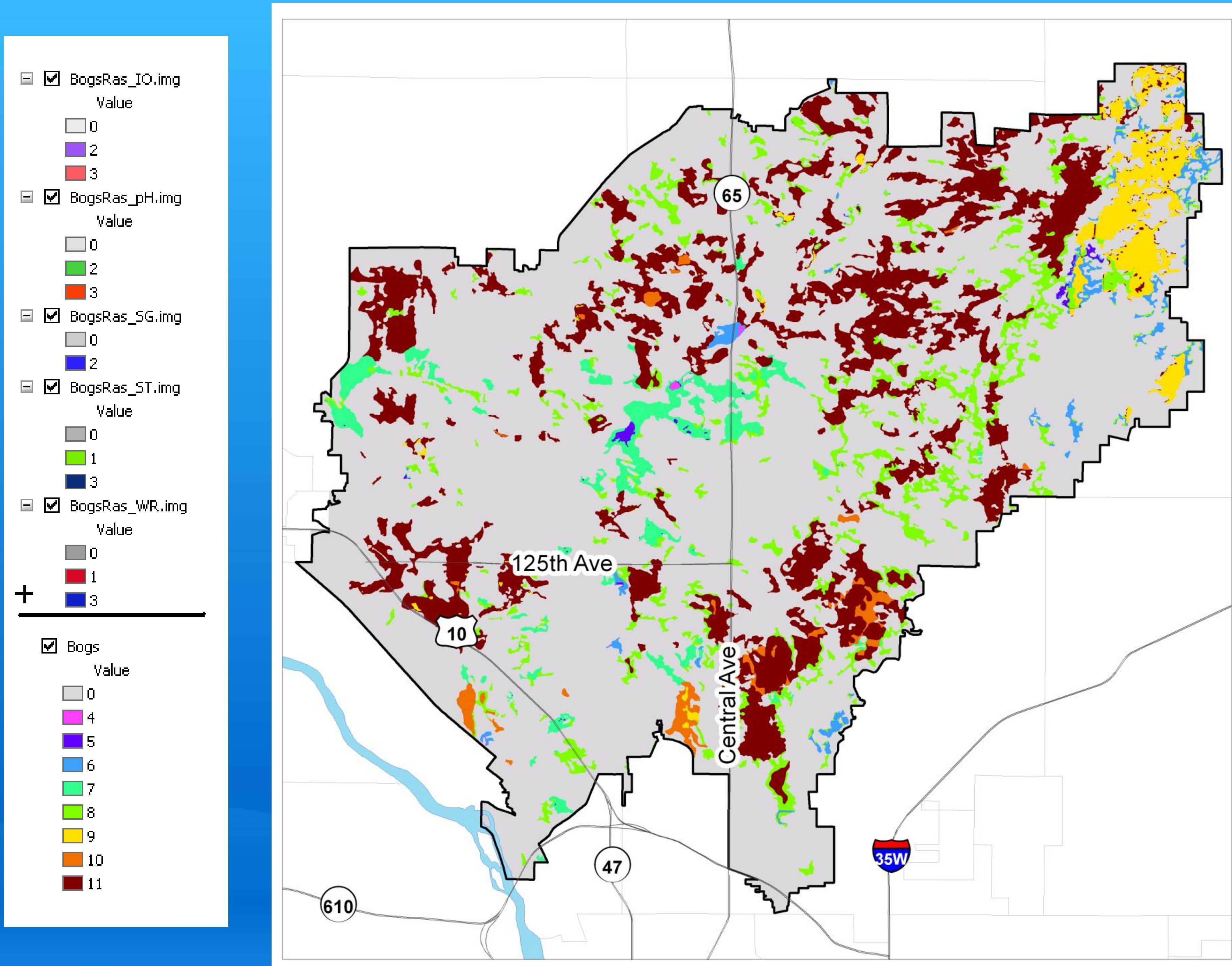
2 Inventory Variables Influencing Functional Capacity

- Landscape Variables
- Hydrologic Variables
- Soil Variables
- Vegetation Variables

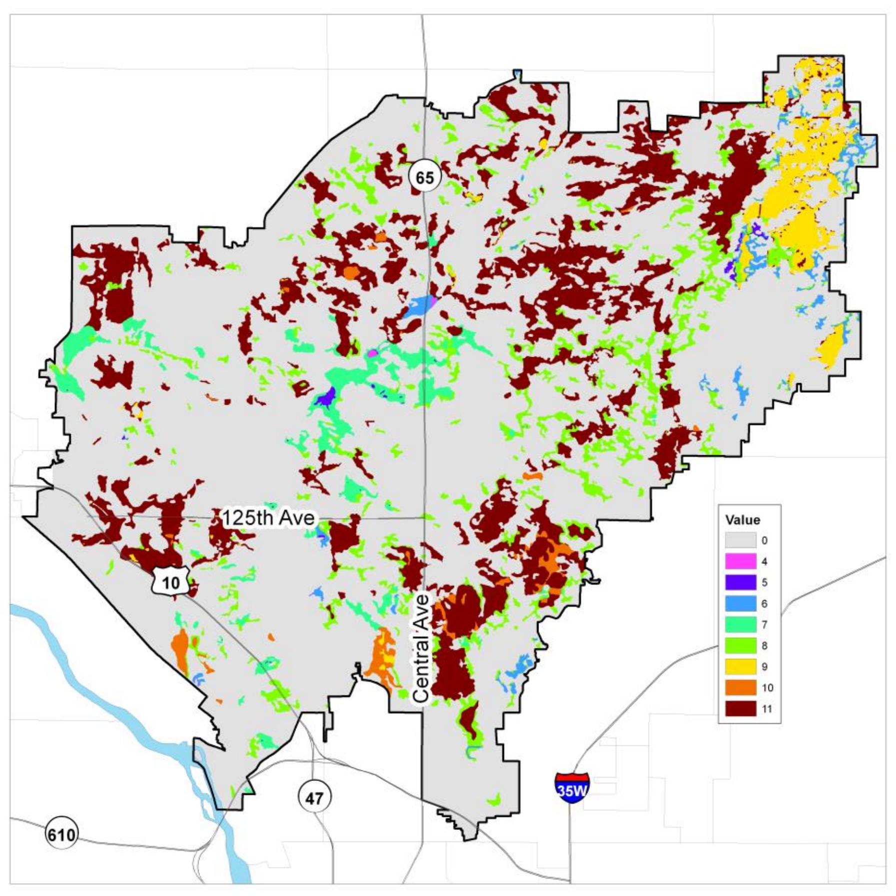


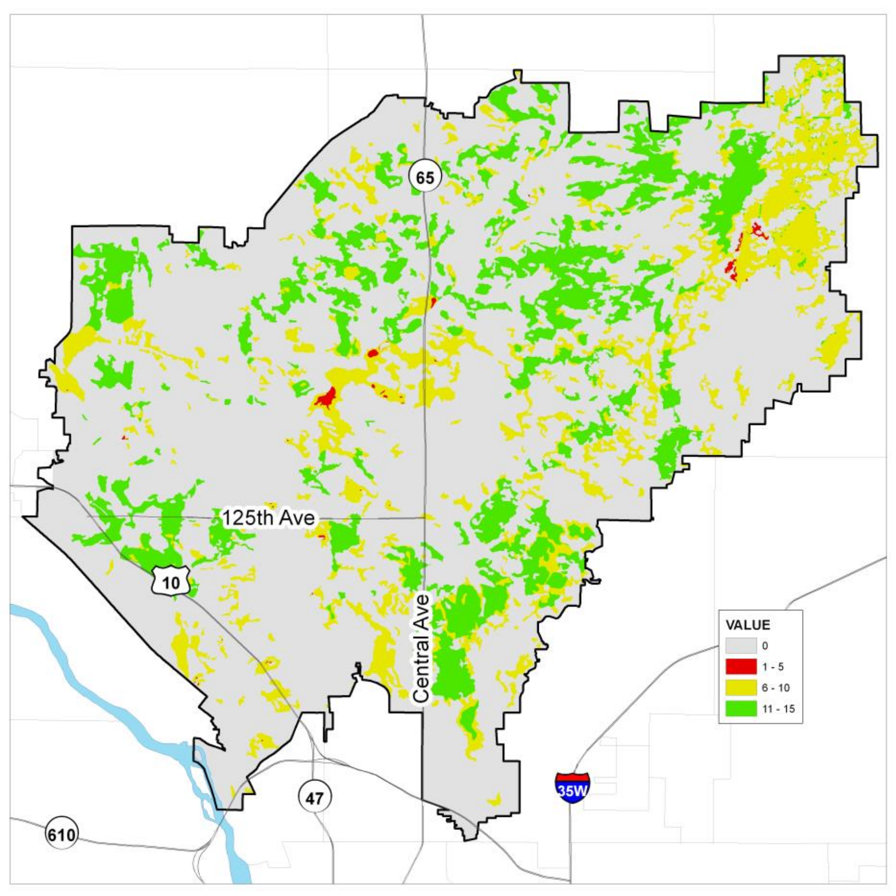
3. Apply Variables to Models



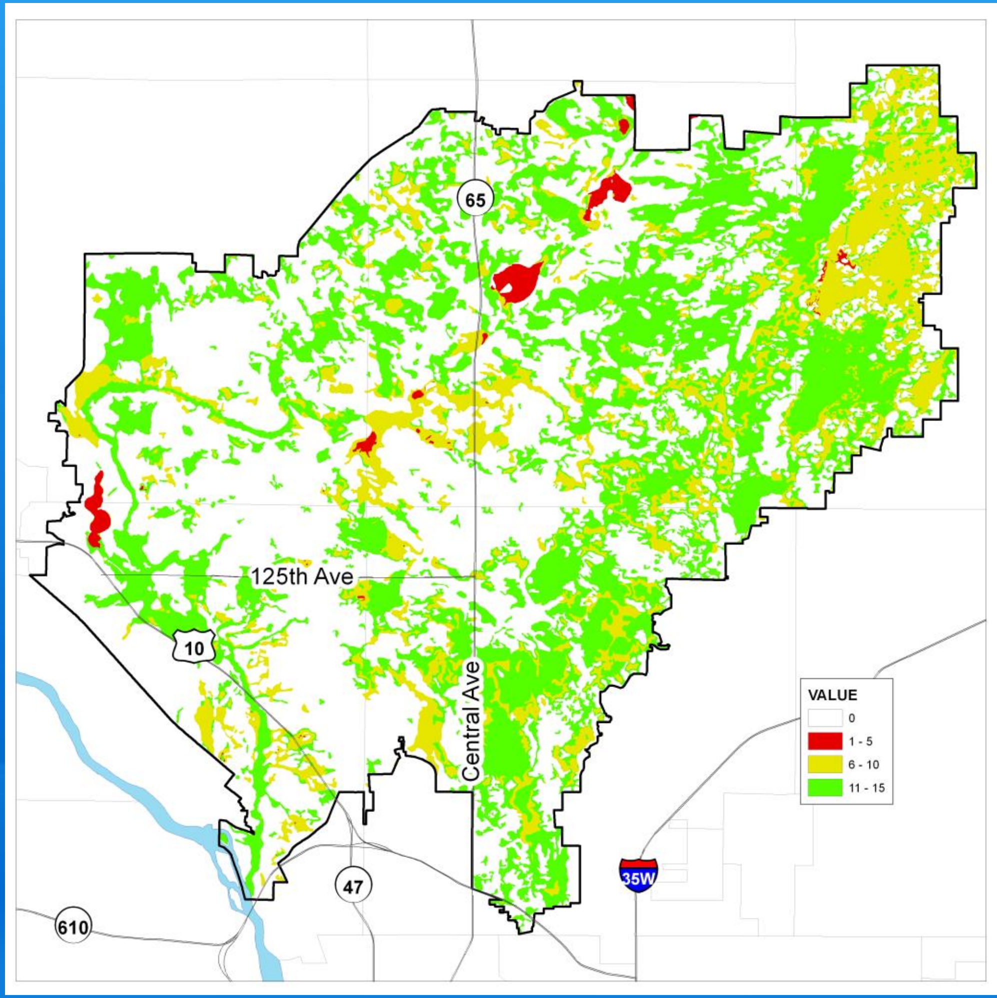

BogsRas_IO.img
Value
0
2
3
BogsRas_pH.img
Value
0
2
3
BogsRas_SG.img
0
2
BogsRas_ST.img
Value
0
1
3
BogsRas_WR.img
Value
0
1
3
Bogs
Value
0
4
5
6
7
8
9
10
11
65
125th Ave
10
Central Ave
47
610
35W

Reclassification
Low / Medium / High





Functional Capacity: *Ground Water Discharge*



Functional Analyses :

- Modification of **Ground Water Discharge**

  (5 inputs)

- Modification of **Ground Water Recharge**

  (6 inputs)

- **Storm and Flood Water Storage**

  (7 inputs)

- Modification of **Stream Flow**

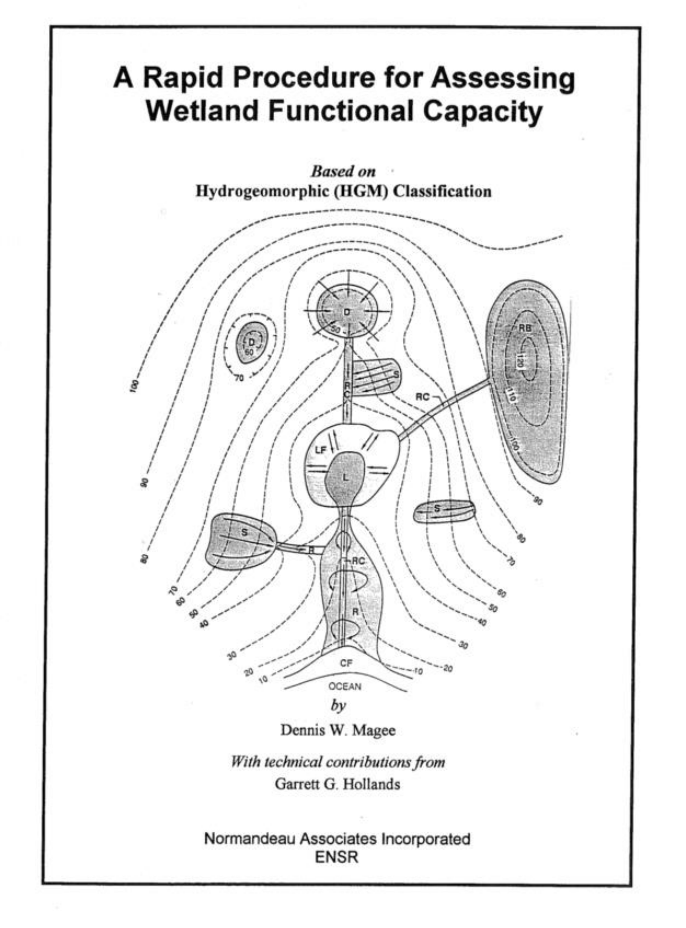
  (GW Recharge x Storm & Flood Water Storage)

- Modification of **Water Quality**

  (6 inputs)

- Contribution to Abundance and Diversity of **Wetland Vegetation** ***(5 inputs)***

- Contribution to Abundance and Diversity of **Wetland Fauna** ***(11 inputs)***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5. Applications

Direct Applications

- Augment field determinations
- Design of wetland mitigation Sites
- ID Dysfunctions
- ID Probability of Physical Sustainability

Indirect Uses

- Identify level of function provided
- Compare other wetlands or habitat types in same HGM class
- Role in assessing demand for and value of beneficial uses

6. Strengths & Weaknesses

Strengths

- Uses an existing system
- Has intuitive appeal to managers
- Gives useful results
- Simple and inexpensive to implement

Strengths

- Adaptable to planning and management processes
- Gives consistent results
- Provides objective criteria for evaluating different wetland types and landscapes
- Cover the range of wetland functional types

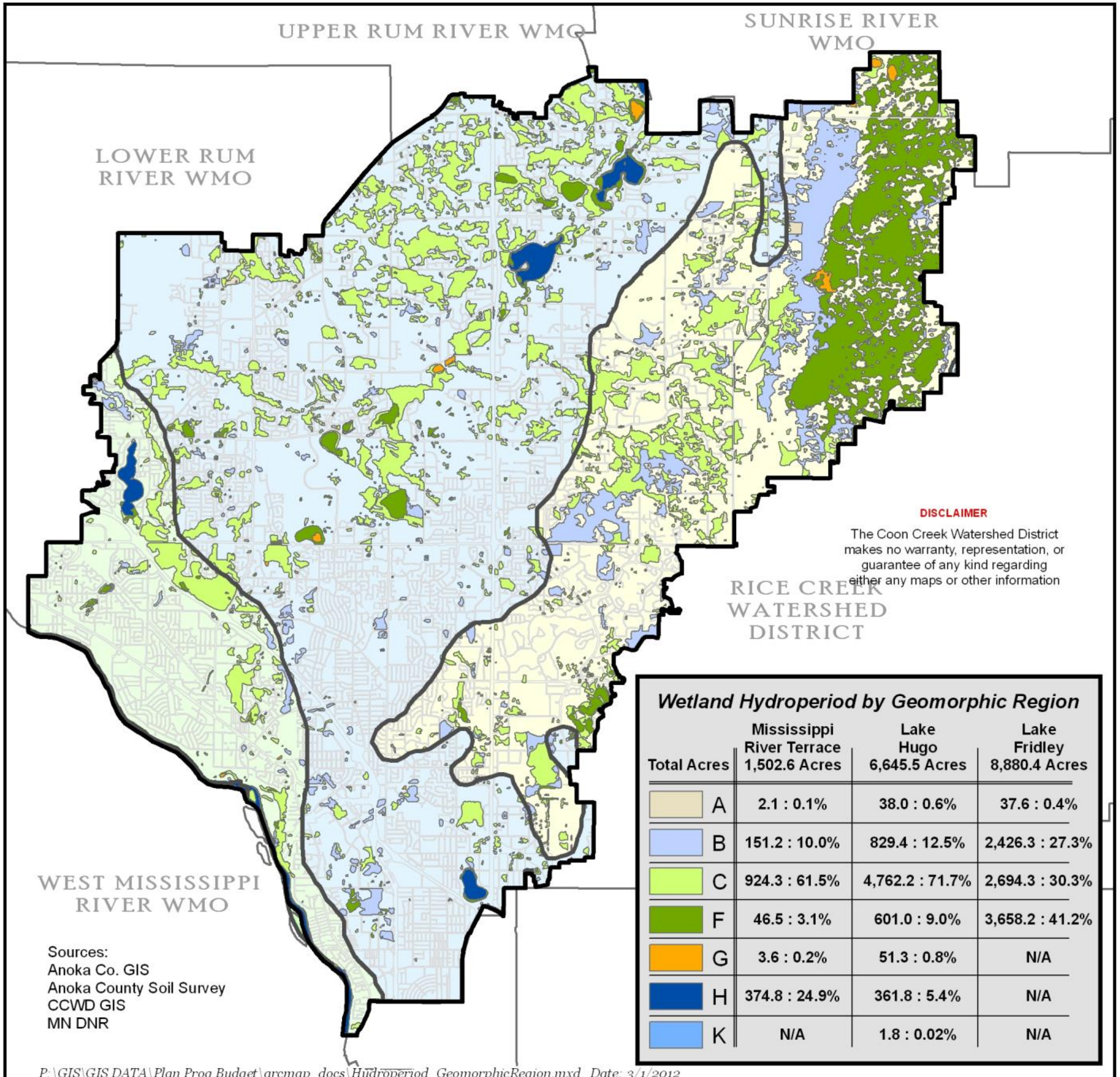
Strengths

- Assimilates existing and future information
- Transforming technical information into a format that can be applied in delineation, functional assessment, and restoration of wetlands

Conclusions

- Scalable: Survey area size and dimension does not effect outcome.
- Portable: Method can be used in any area accounted for in the HGM classification.
- Modular: More accurate data can easily be adapted into the inputs for greater localized assessment.

Questions



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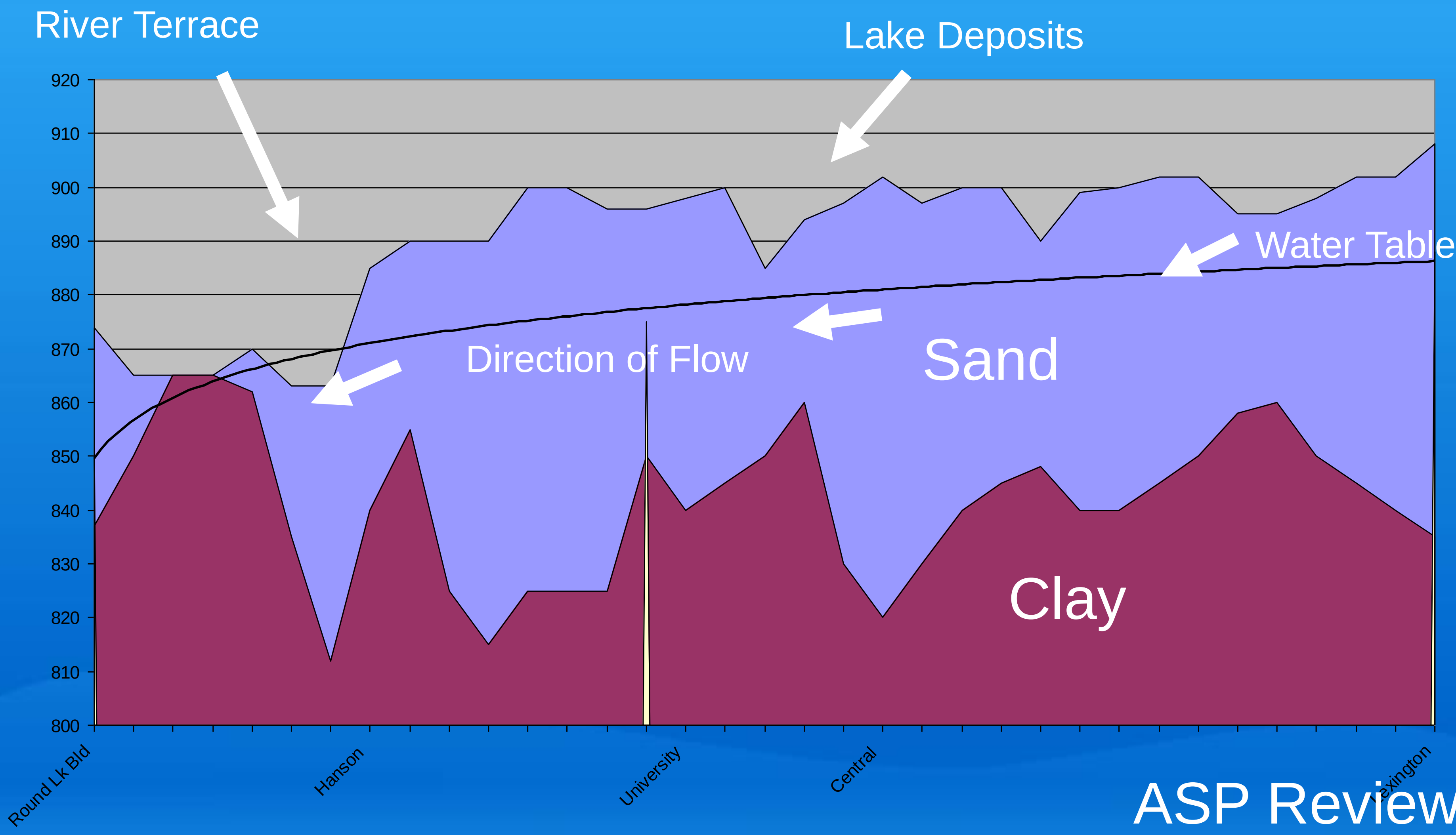
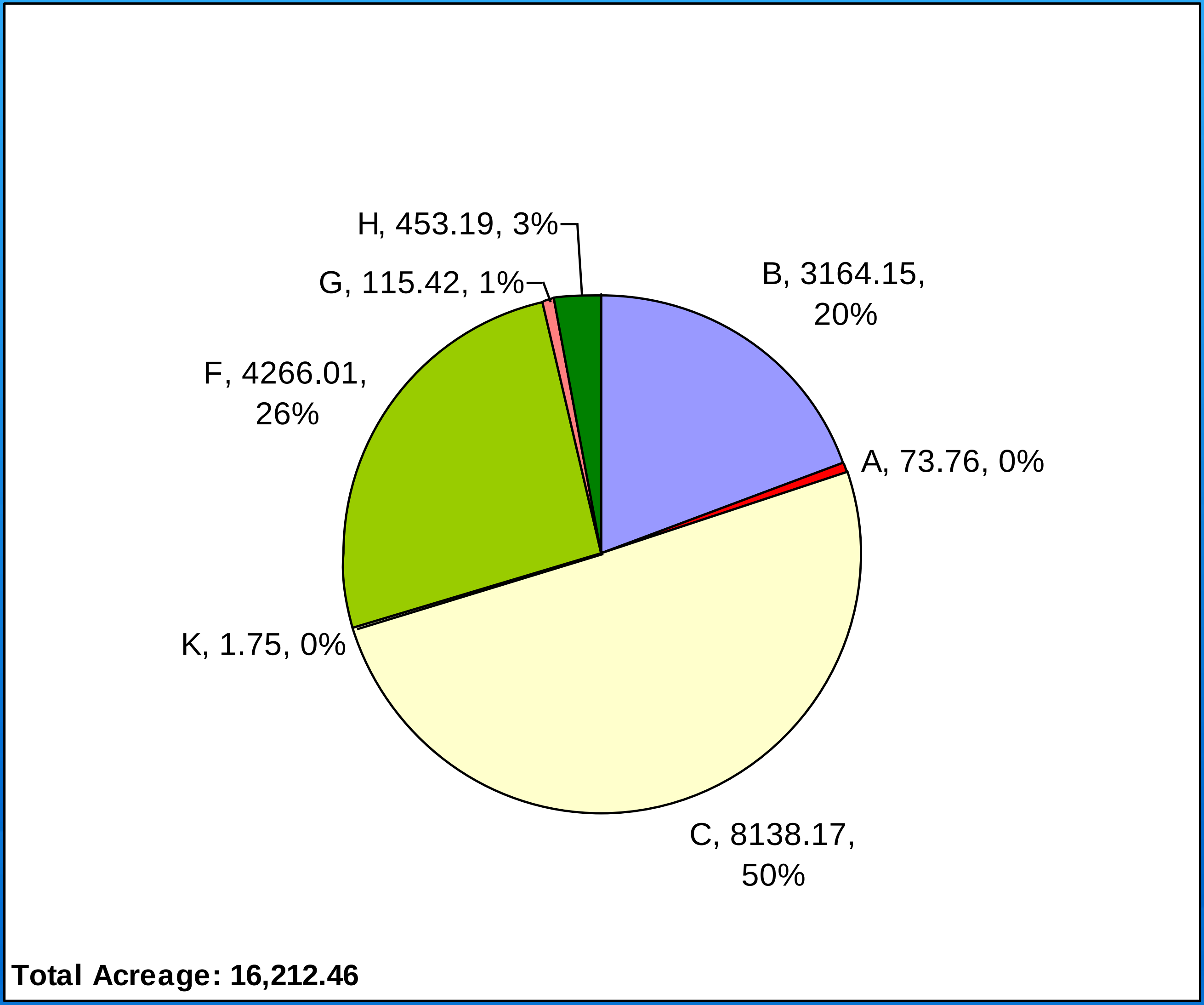
(Upper 120 ft)



ASP Review

MPCA, 1997

CCWD Hydroperiod



Hydrogeomorphic Wetland Classes found in Coon Creek

Hydrogeomorphic Classes in Anoka Sand Plain

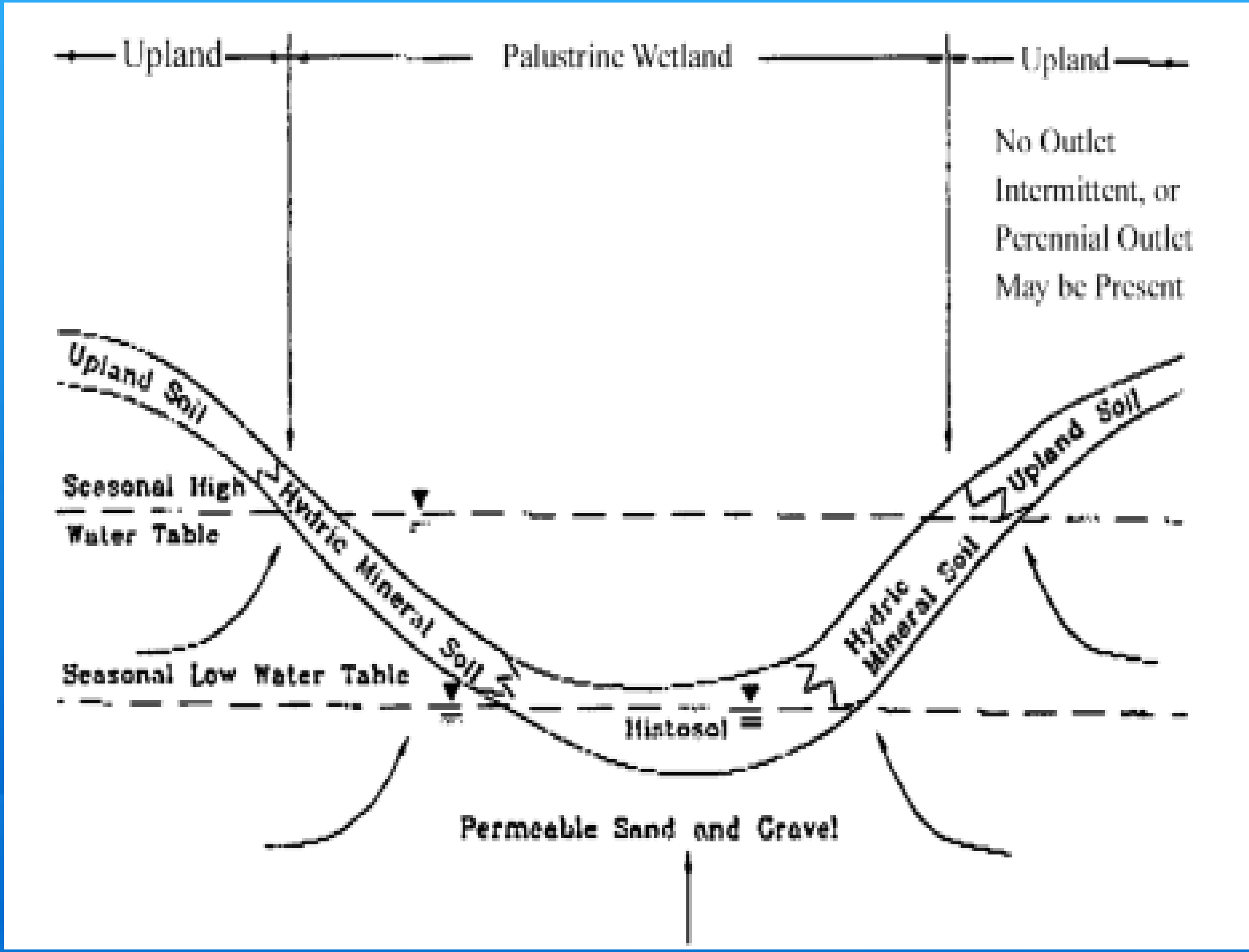
1. Depression and Swale Wetlands
2. Riverine Wetlands
3. Slope Wetlands
4. Organic Soil Flats
5. Mineral Soil Flats
6. Lacustrine Fringe Wetlands

Depression & Swale Wetlands

Characteristic	Description
Landscape Position	Depressions
Soils	Blomford Isan Isanti Marsh
Primary Water Source	Groundwater
Hydroperiod	Permanently flooded, Seasonally flooded, Semi-permanently flooded

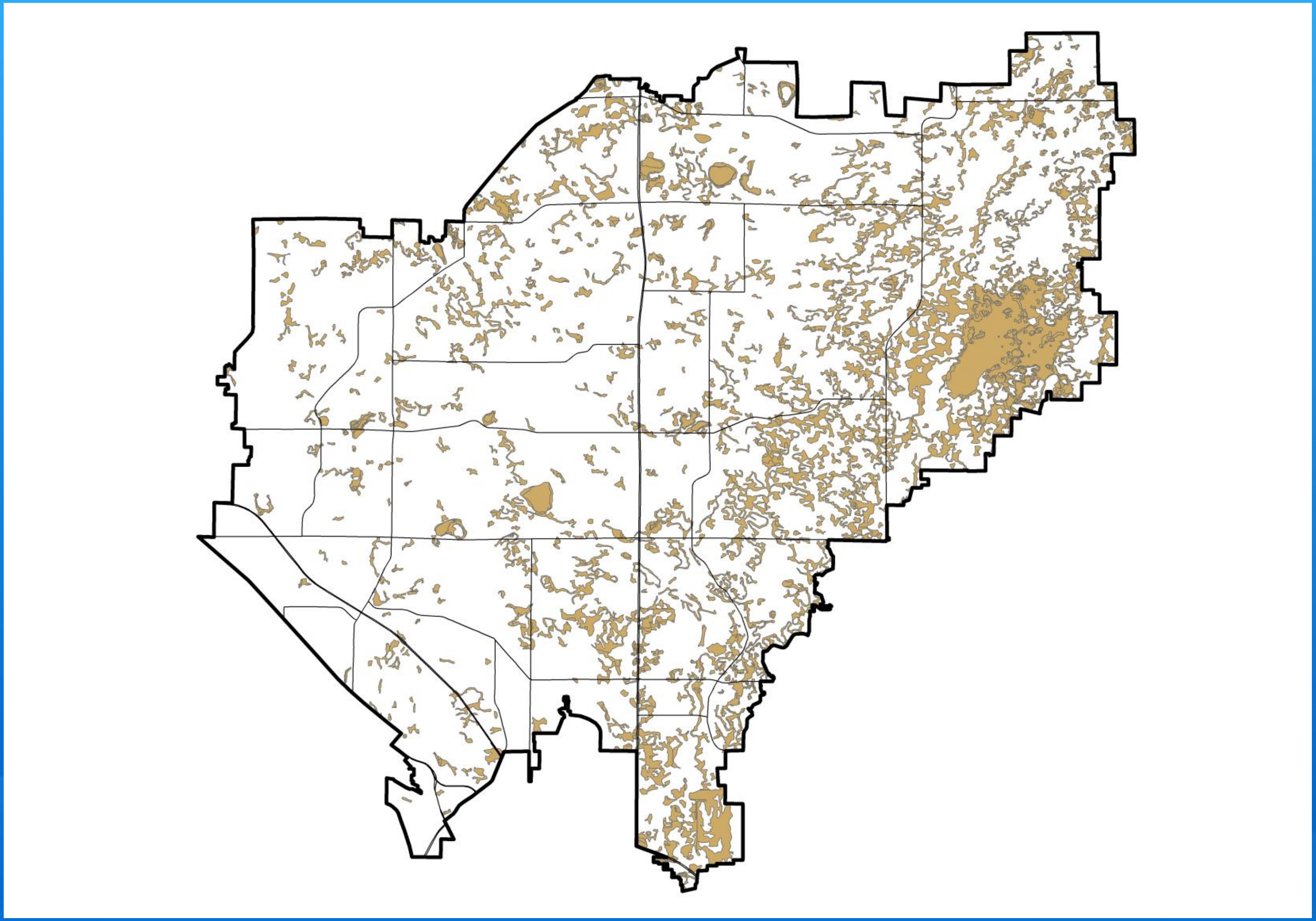
HGM Classes

Depressional Wetlands



HGM Classes

Depressional Wetlands

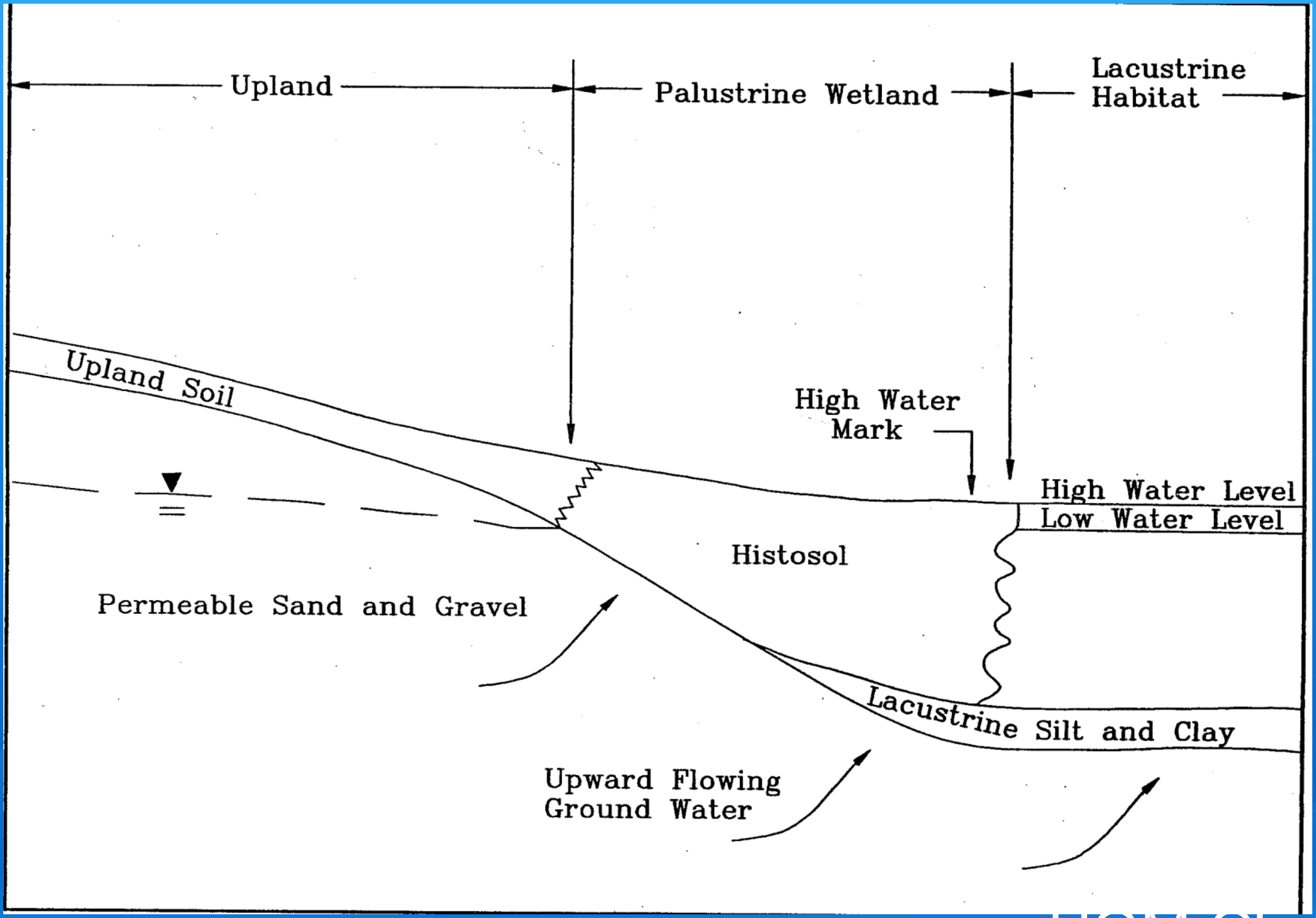


HGM Classes

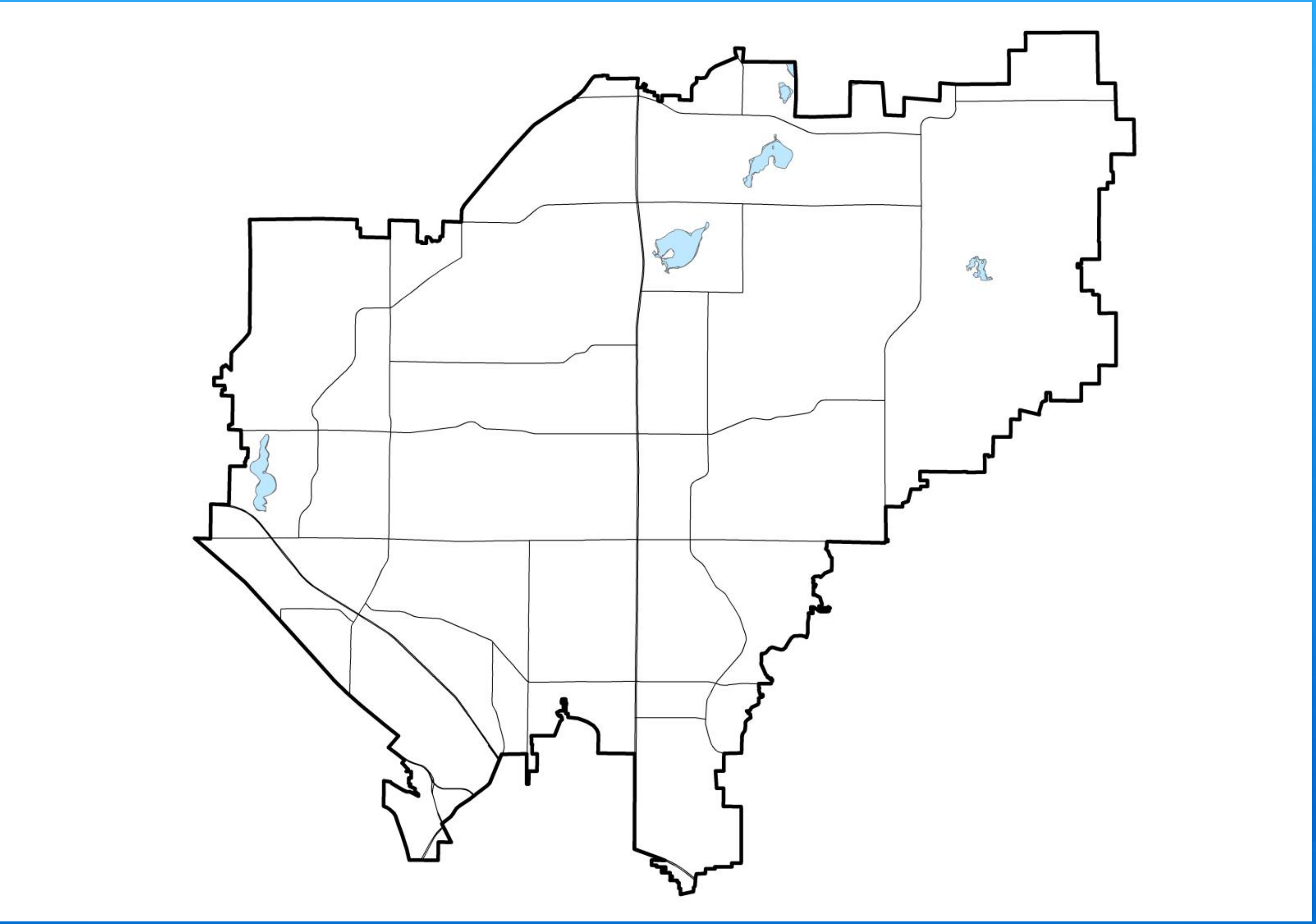
Lacustrine Wetlands

Characteristic	Description
Landscape Position	Lake, Marsh, Shrub Swamp Fringe Gentle Slopes
Soils	Unconsolidated Bottom Adjacent to Lakes
Primary Water Source	Lateral flow from Lake
Hydroperiod	Permanent or Semi-Permamently Flooded

Lacustrine Wetland



Lacustrine Wetland

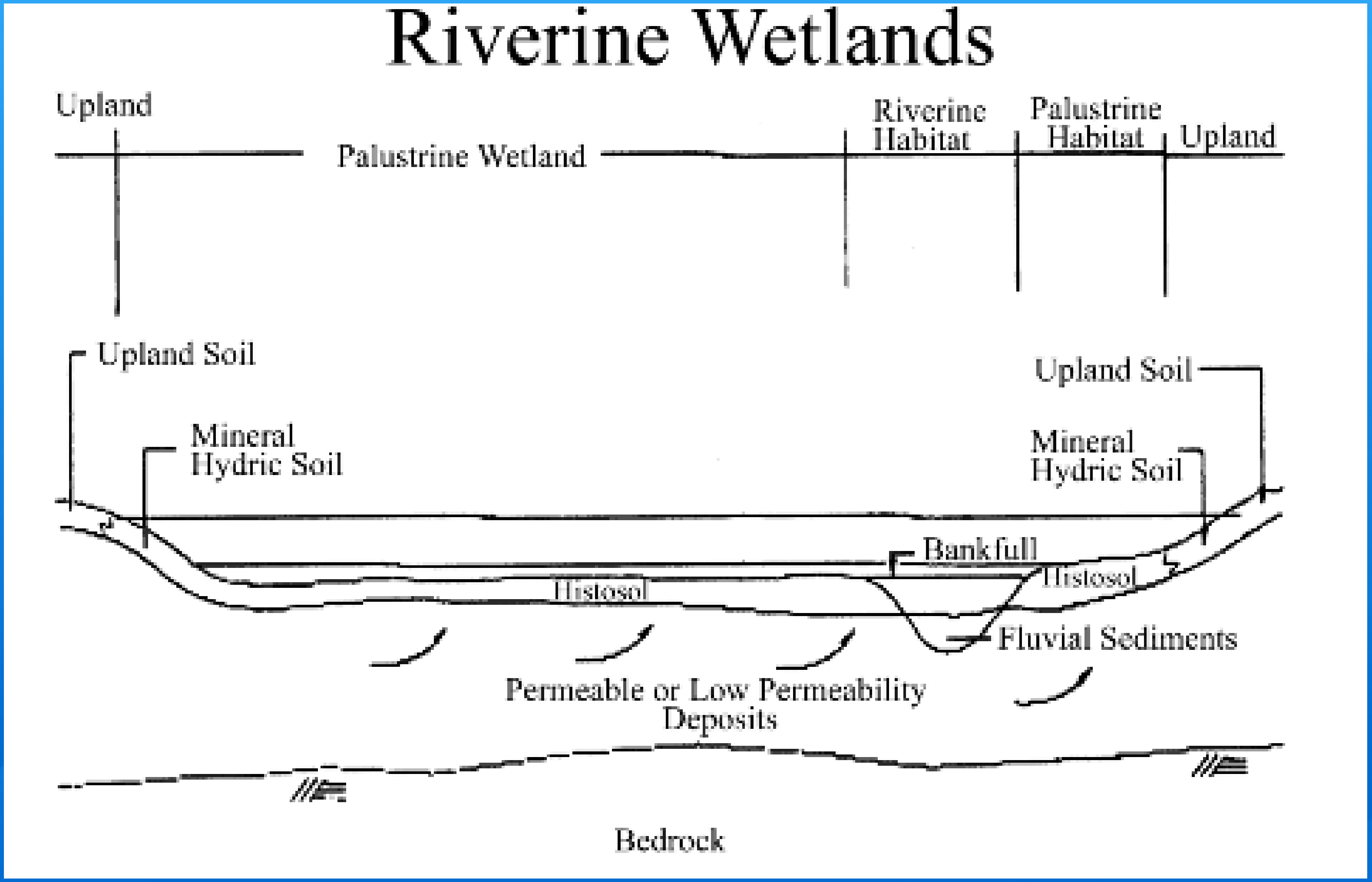


HGM Classes

Riverine/Floodplain Wetlands

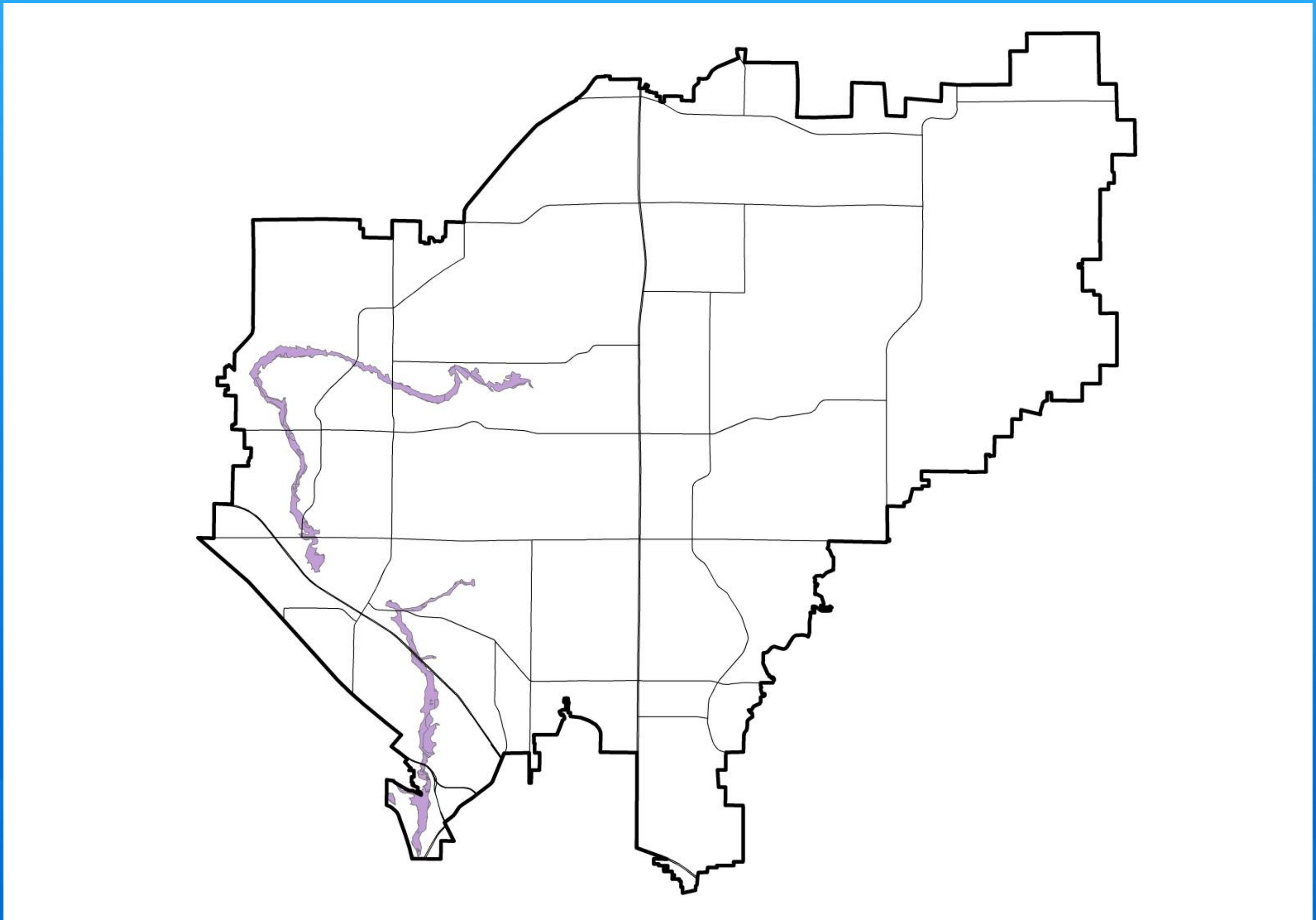
Characteristic	Description
Landscape Position	Floodplains
Soils	Alluvial
Primary Water Source	Overbank Flow
Hydroperiod	Permanent or Semi-Permanently Flooded

Riverine/Floodplain Wetlands



HGM Classes

Riverine/Floodplain Wetlands

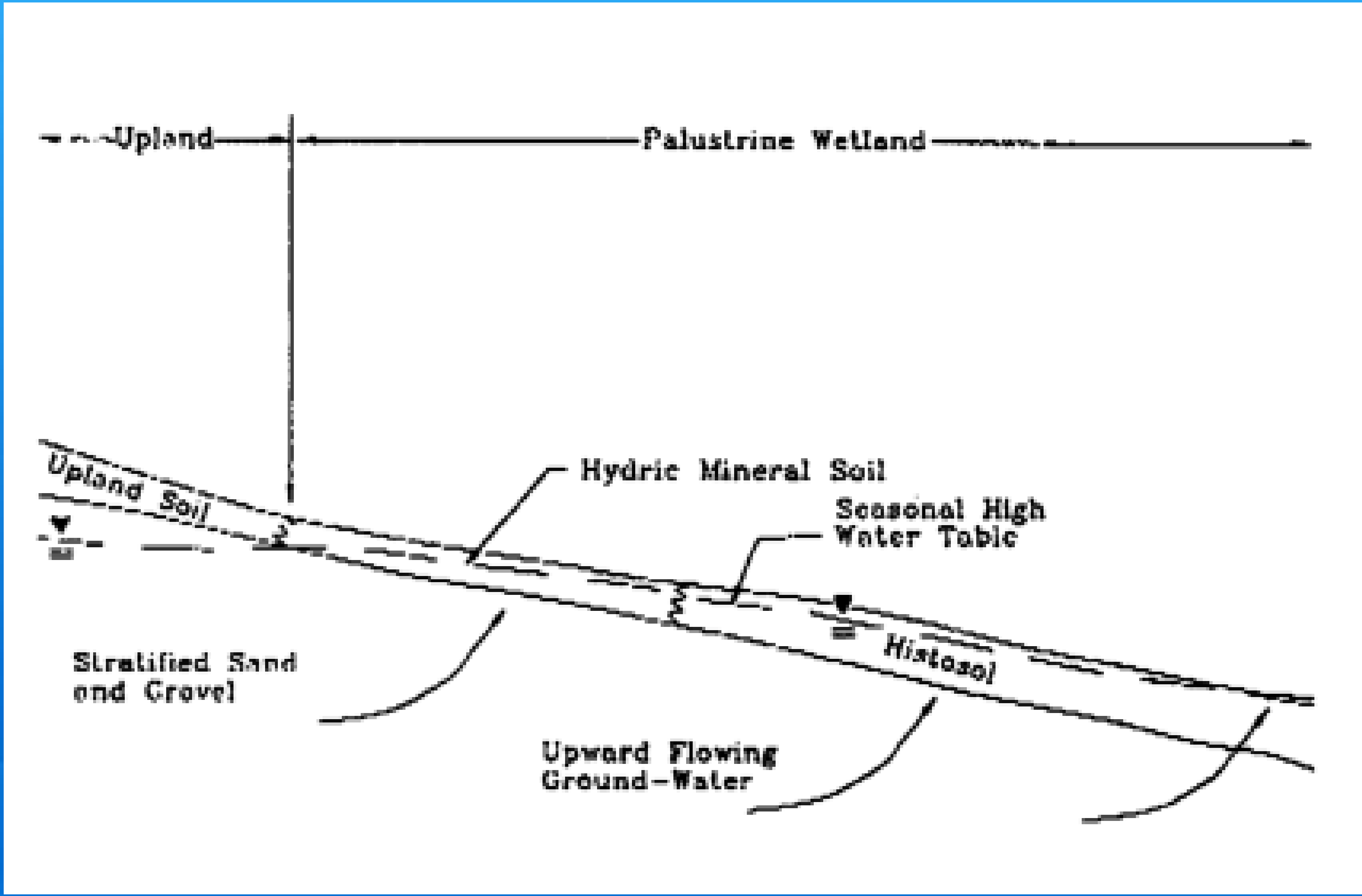


HGM Classes

Slope/Bog/Flats Wetlands

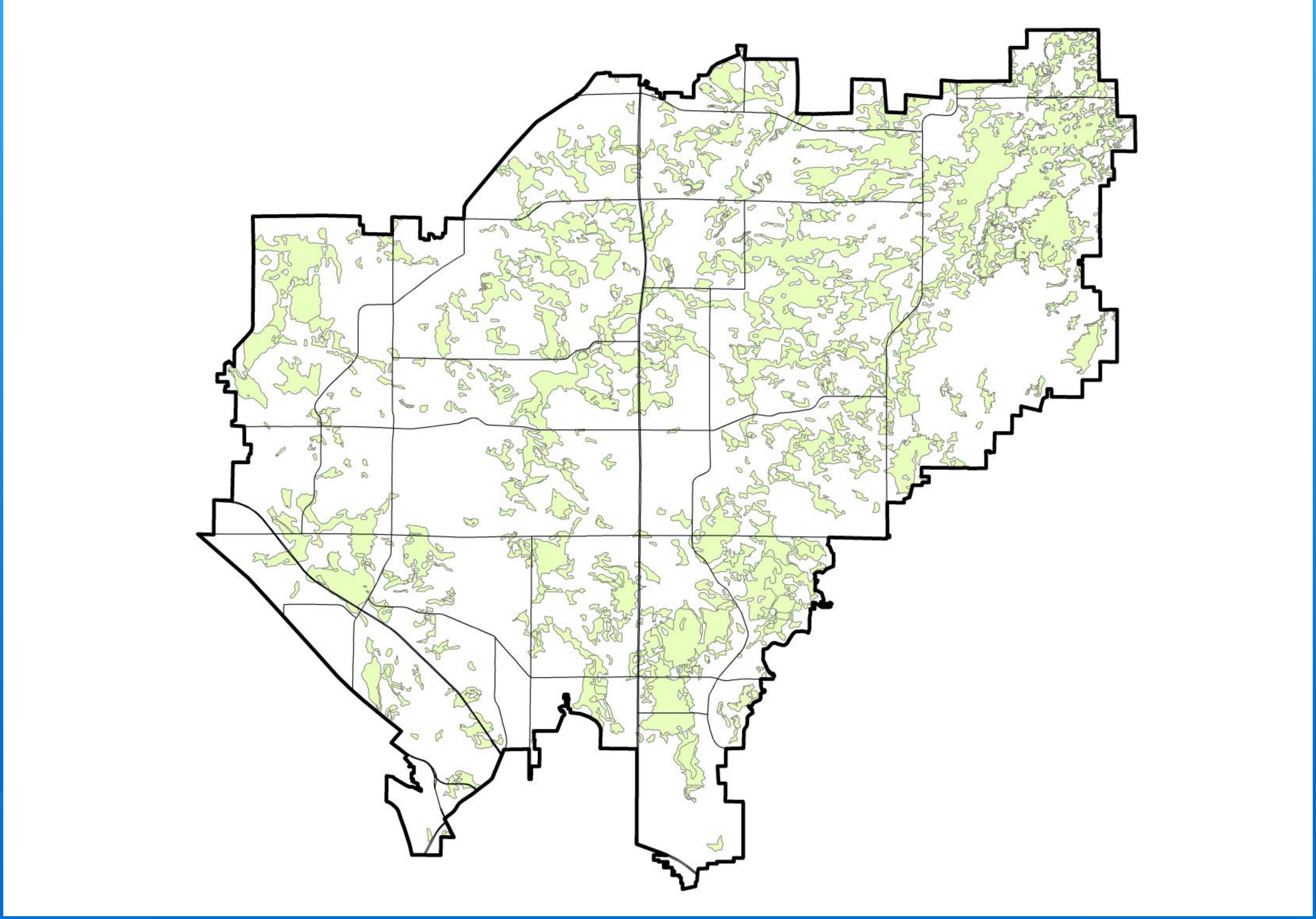
Characteristic	Description
Landscape Position	Glacio-Lacustrine Sequences
Soils	Cathro, Kratka, Markey Millerville, Rifle, Rondeau Seelyville
Primary Water Source	Groundwater, Precipitation, Overland Flow
Hydroperiod	Seasonally flooded, Saturated, Seasonally Saturated

Slope/Bog/Flats Wetlands



HGM Classes

Slope/Bog/Flats Wetlands



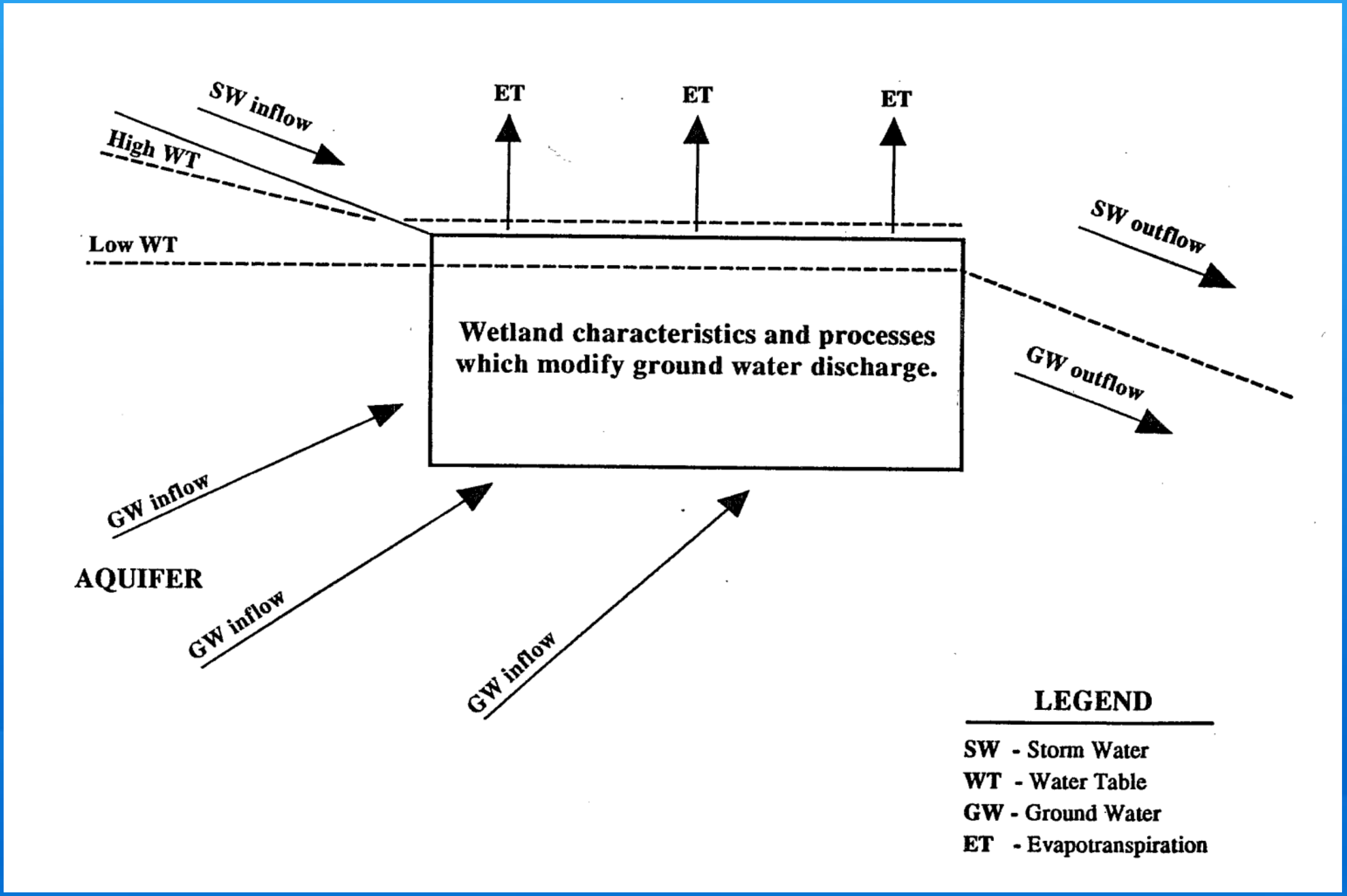
HGM Classes

Functions Performed by Hydrogeomorphic Classes

Functions Performed by HGM Classes within Coon Creek Watershed

1. Modification of Ground Water Discharge
2. Modification of Ground Water Recharge
3. Storm and Flood Water Storage
4. Modification of Stream Flow
5. Modification of Water Quality
6. Contribution to Abundance & Diversity of Wetland Vegetation
7. Contribution to Abundance & Diversity of Wetland Fauna

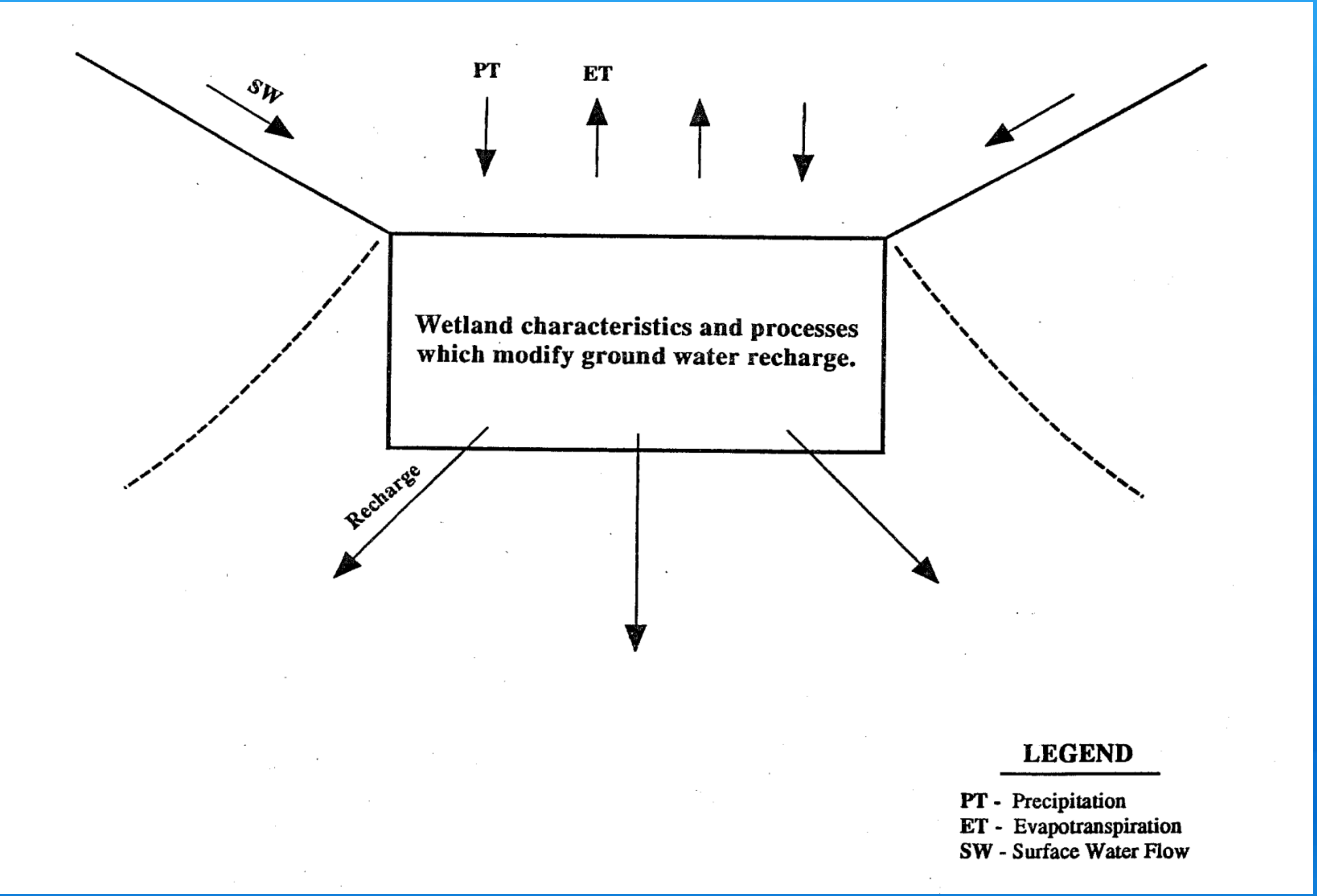
Modification of Ground Water Discharge



Characteristics & Processes Modifying Ground Water Discharge

- Inlet/Outlet Class
- pH
- Surficial Geological Deposits of Wetland
- Wetland Water Regime
- Soil Type

Modification of Ground Water Recharge



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- Surficial Geological Deposits of Wetland
- Wetland Water Regime
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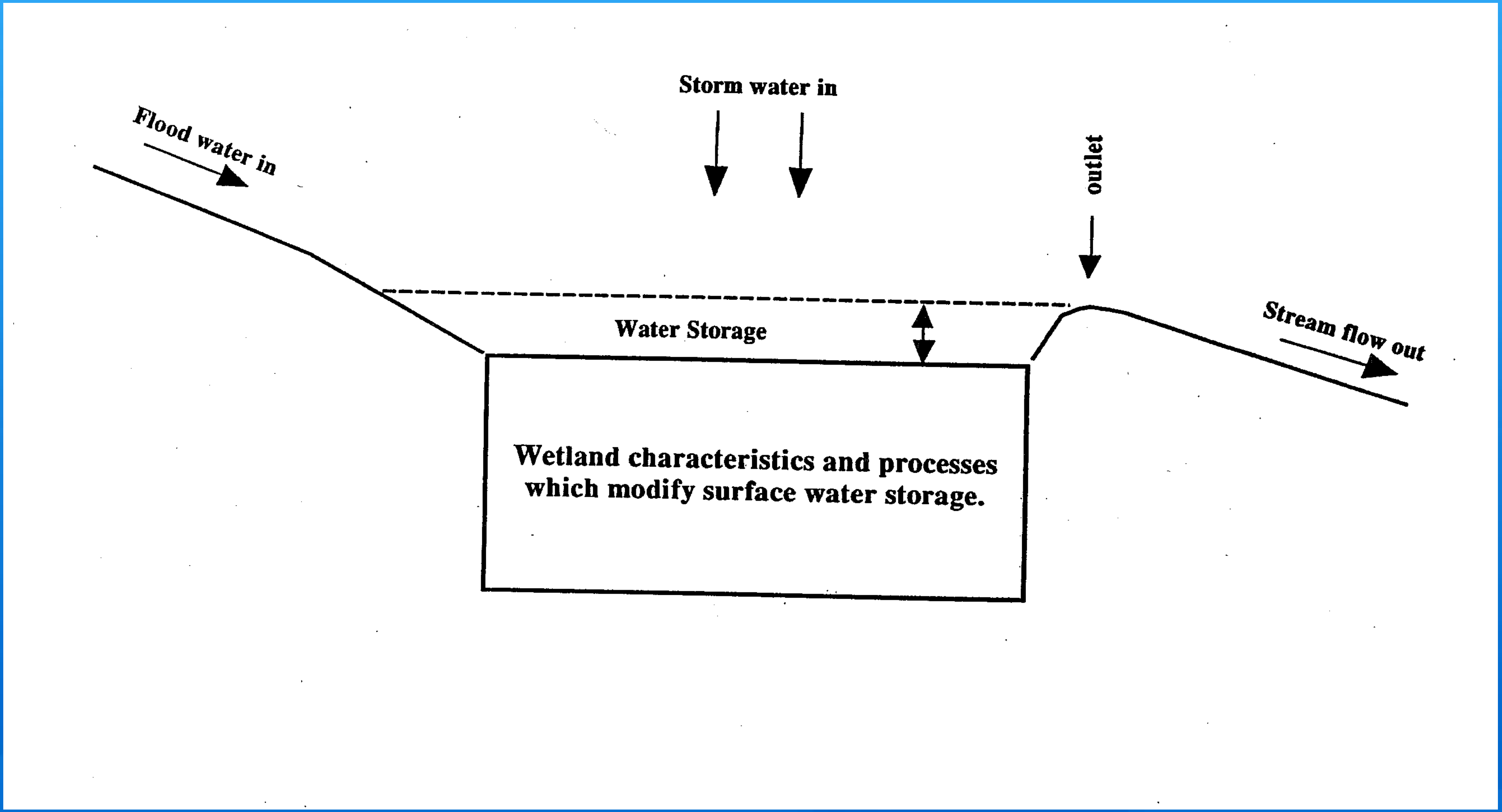
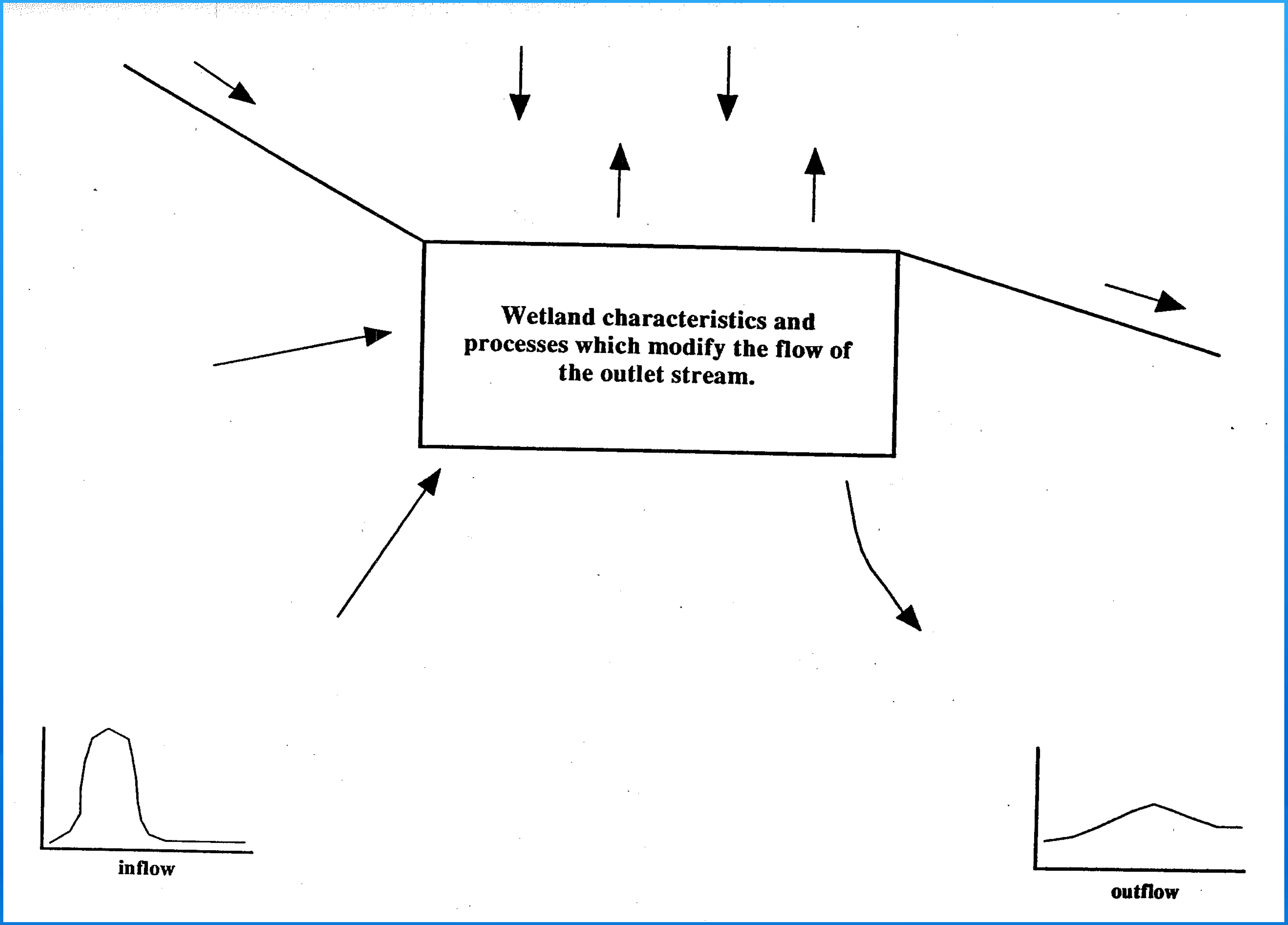
Storm and Flood Water Storage



Characteristics & Processes Modifying Storm & Flood Storage

- Inlet/Outlet Classification
- Degree of Outlet Restriction
- Basin Topographic Gradient
- Water Regime
- Surface Water Fluctuations
- Wetland to Watershed Areas Ratio
- Vegetation Density & Dominance

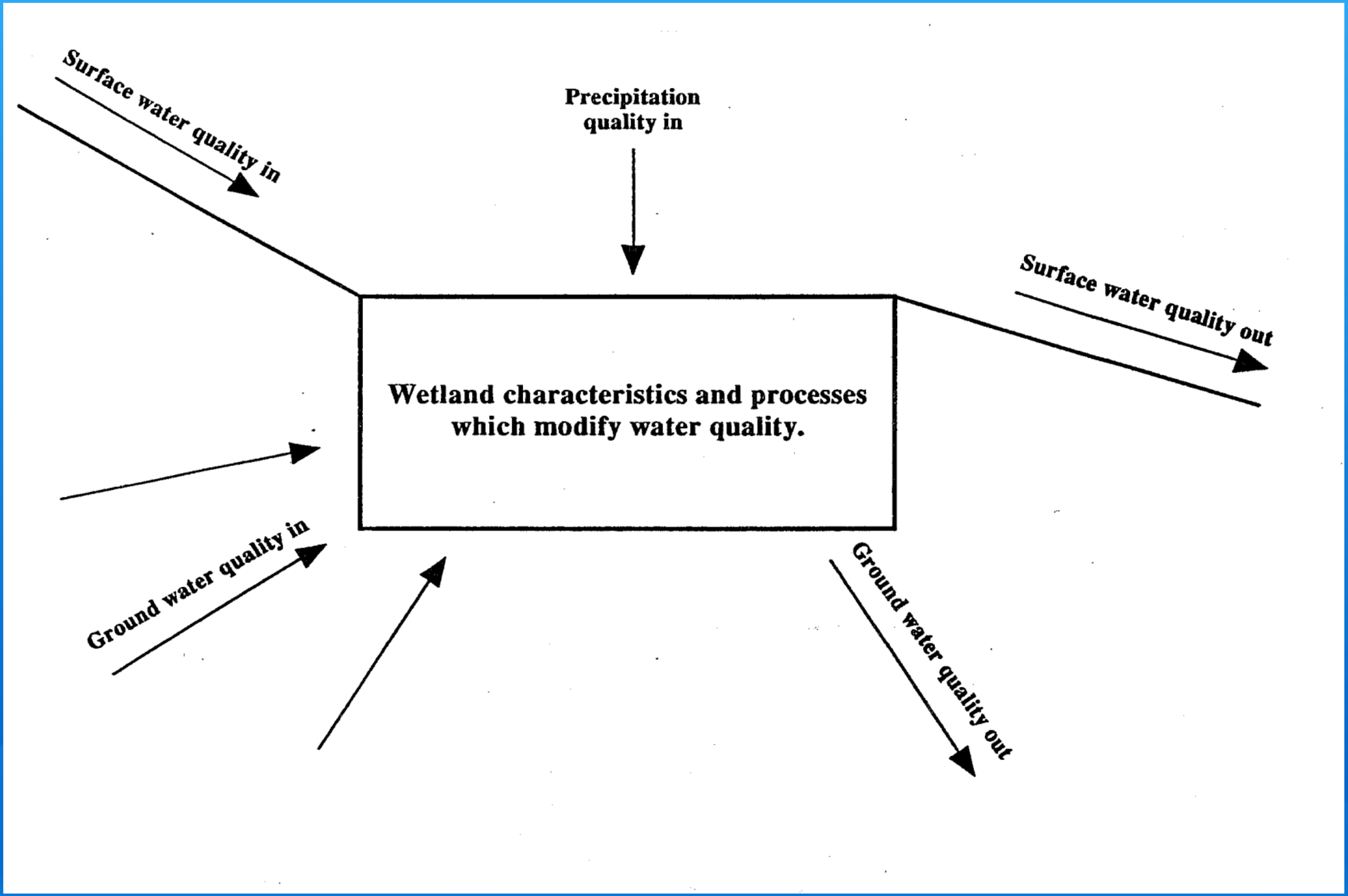
Modification of Stream Flow



Characteristics & Processes Modifying Stream Flow

- Inlet/Outlet Classification
- Degree of Outlet Restriction
- Basin Topographic Gradient
- Water Regime
- Surface Water Fluctuations
- Wetland to Watershed Areas Ratio
- Vegetation Density & Dominance
- Frequency of Overbank Flooding
- Soil Type
- pH
- Surficial Geological Deposits of Wetland

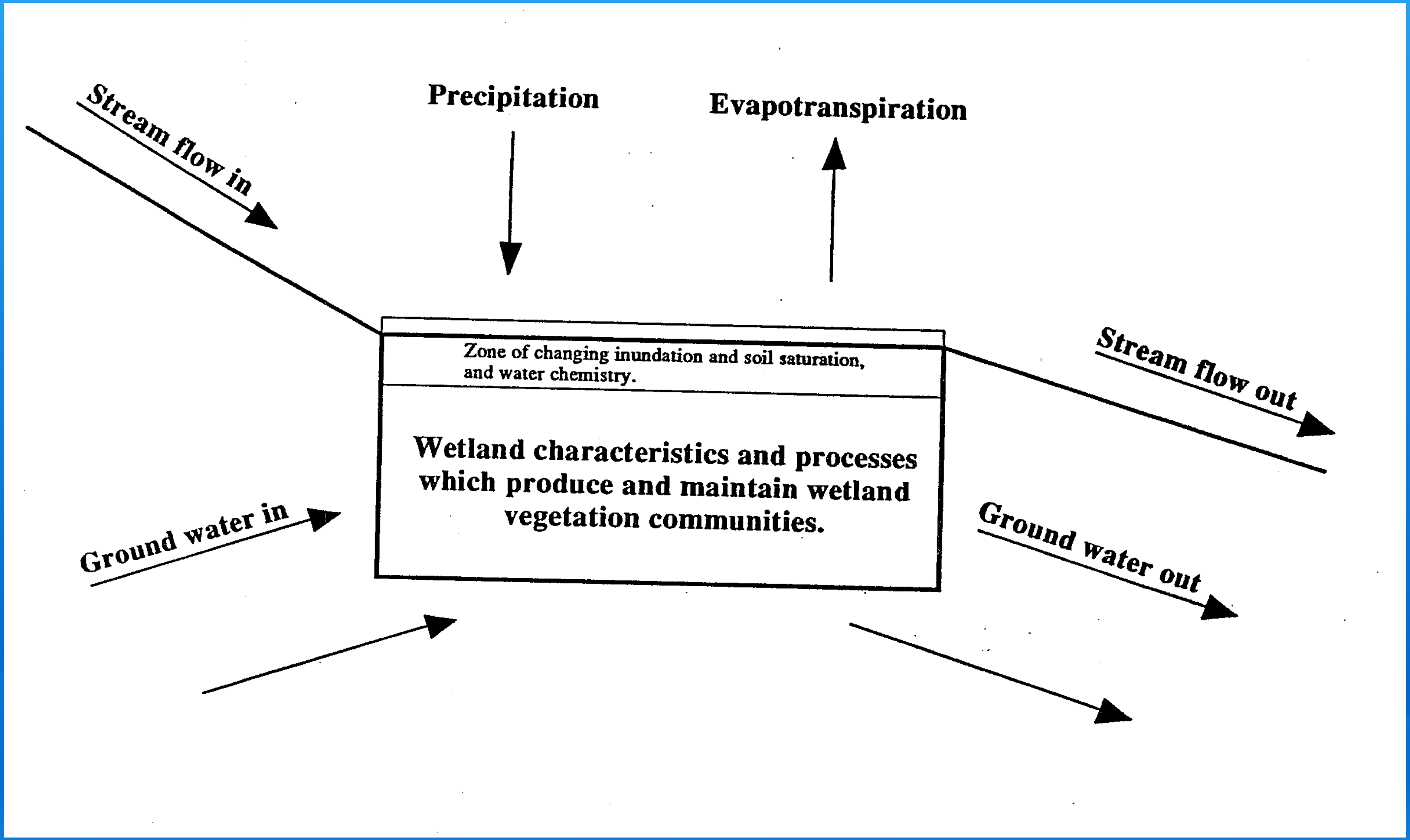
Modification of Water Quality



Characteristics & Processes Modifying Water Quality

- Wetland Land Use
- Degree of Outlet Restriction
- Inlet/Outlet Type
- Cover Distribution
- Soil Type

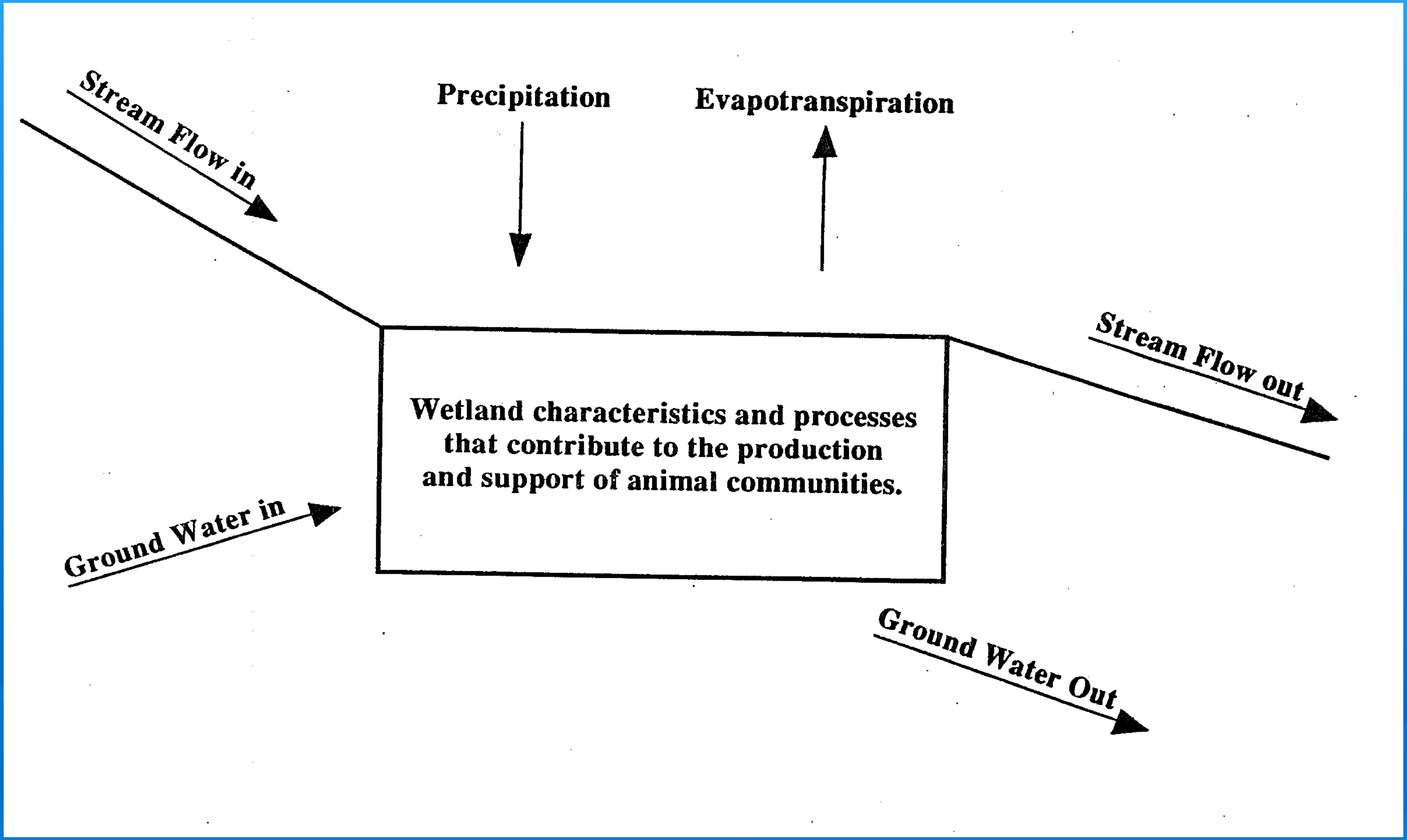
Contribution to Abundance & Diversity of Wetland Vegetation



Characteristics & Processes Producing & Maintaining Wetland Vegetation

- Plant Species Diversity
- Vegetation Density/Dominance
- Wetland Juxtaposition

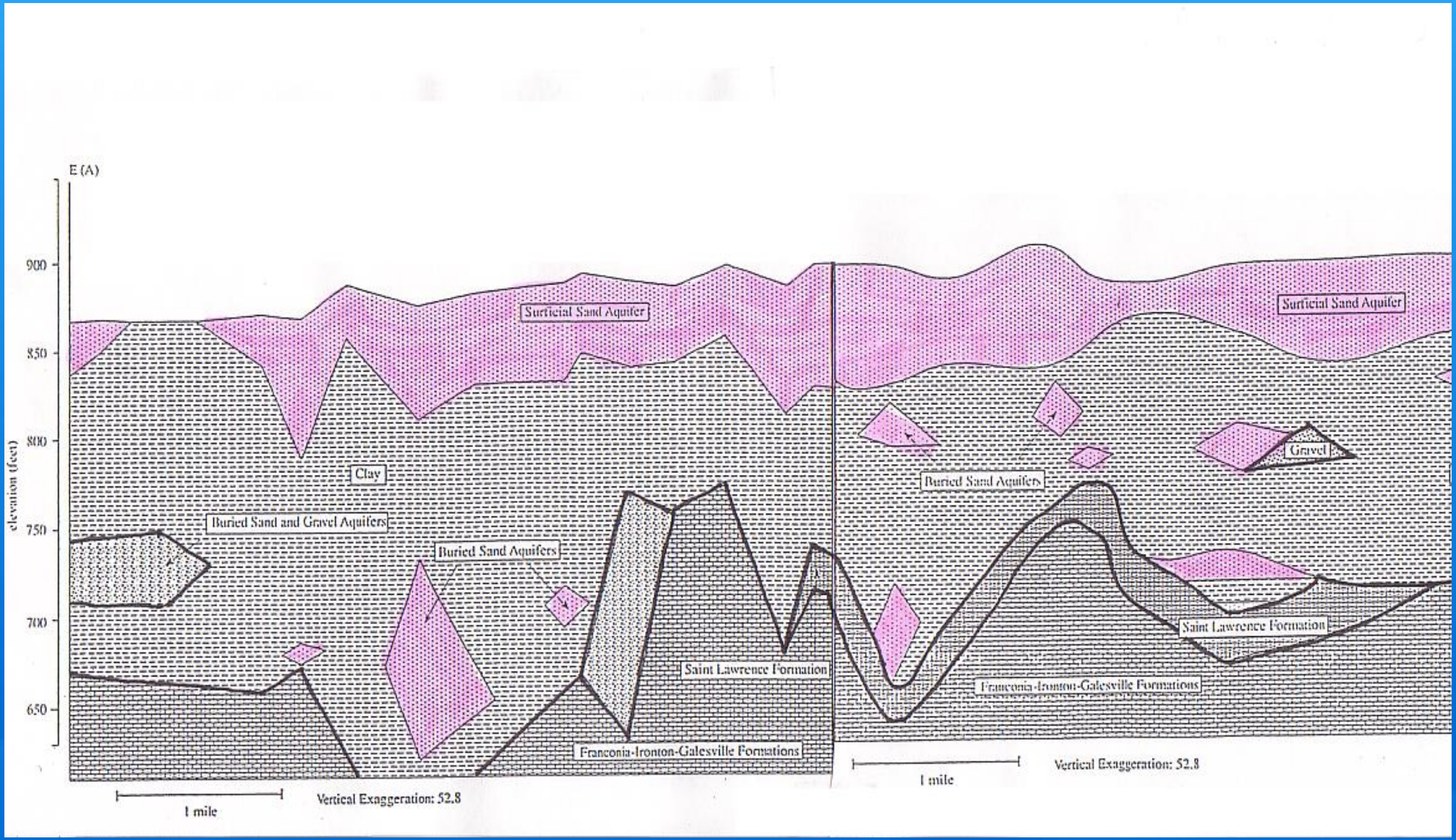
Contribution to Abundance & Diversity of Wetland Fauna



Characteristics & Processes Producing & Supporting Wetland Fauna

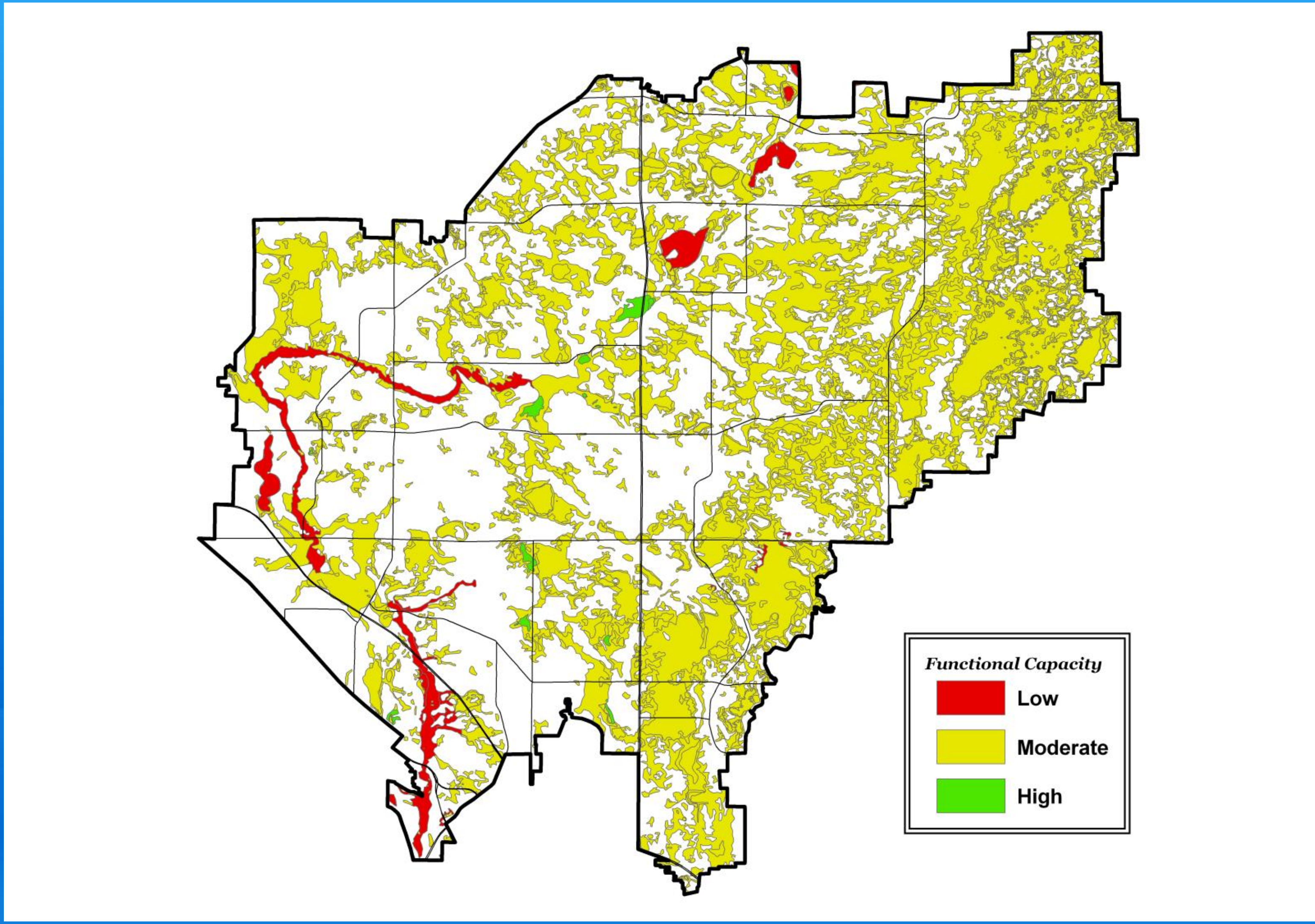
- Watershed Land Use
- Wetland Land Use
- Wetland Water Regime
- Number of Wetland Types & Relative Proportions
- Vegetative Interspersion
- Number of Layers
- Percent Cover
- Interspersion of Vegetative Cover & Open Water
- Size
- Wetland Juxtaposition

Geologic Cross – Section of Coon Creek Watershed

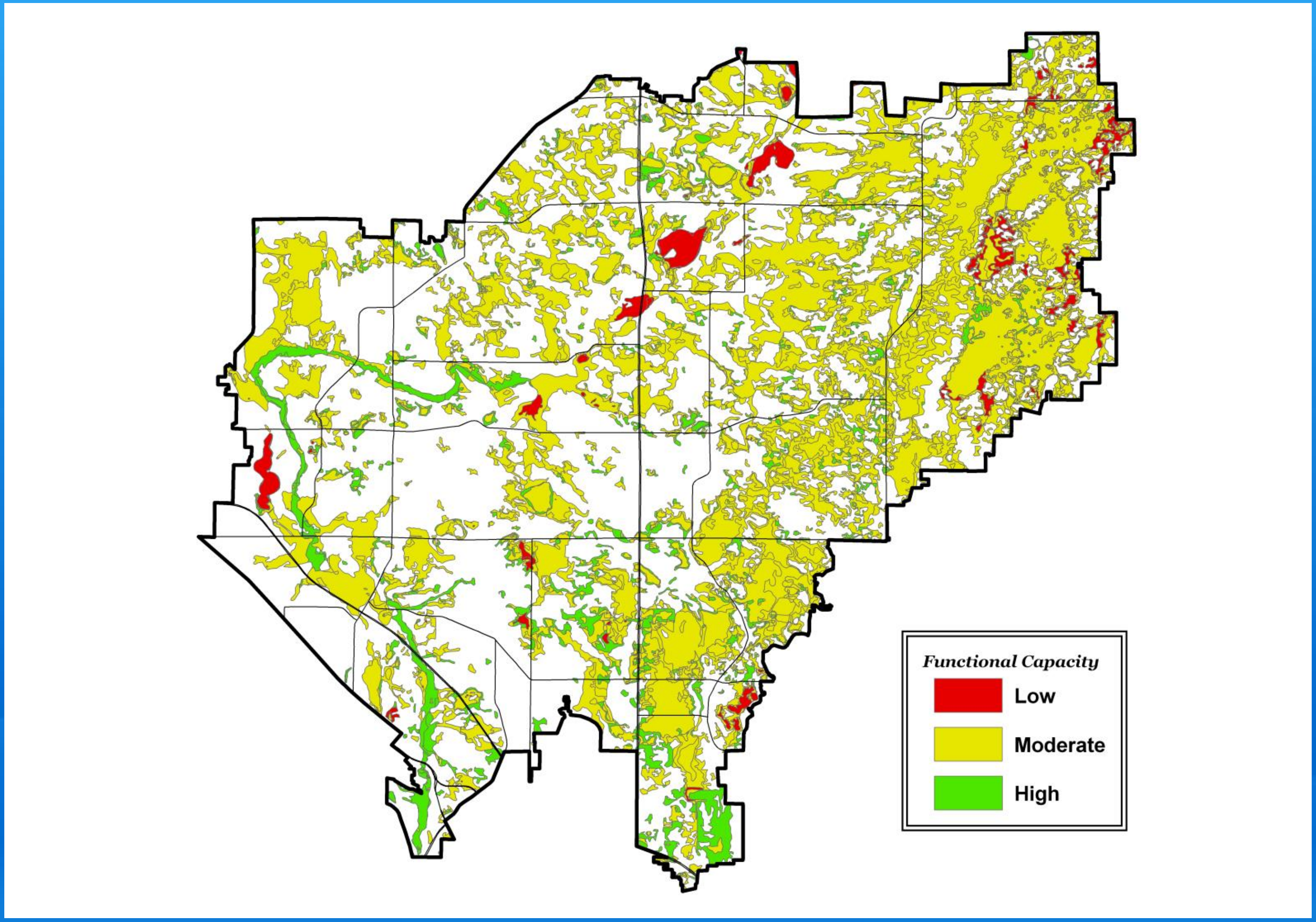


Functional Models

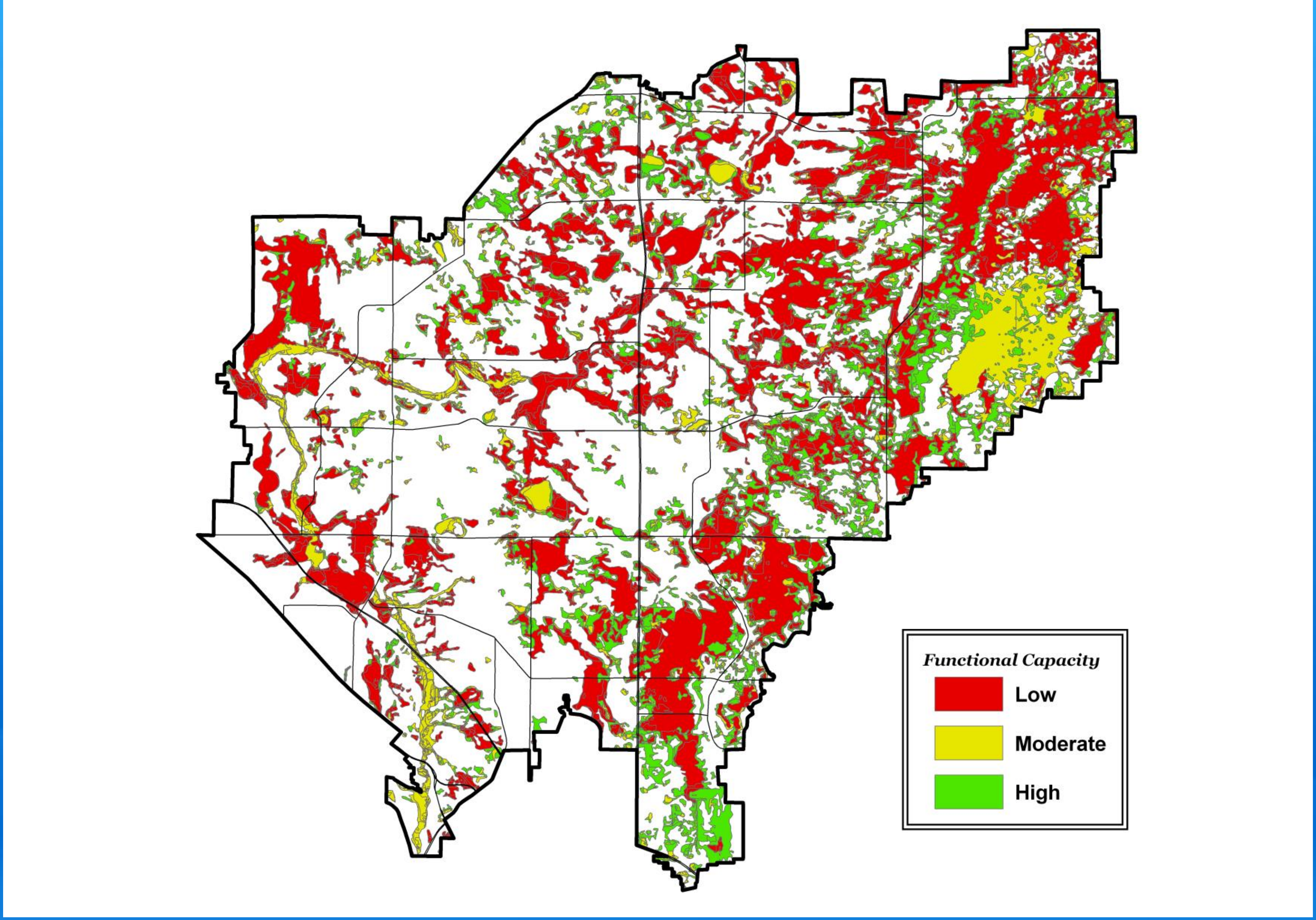
Modification of Ground Water Discharge



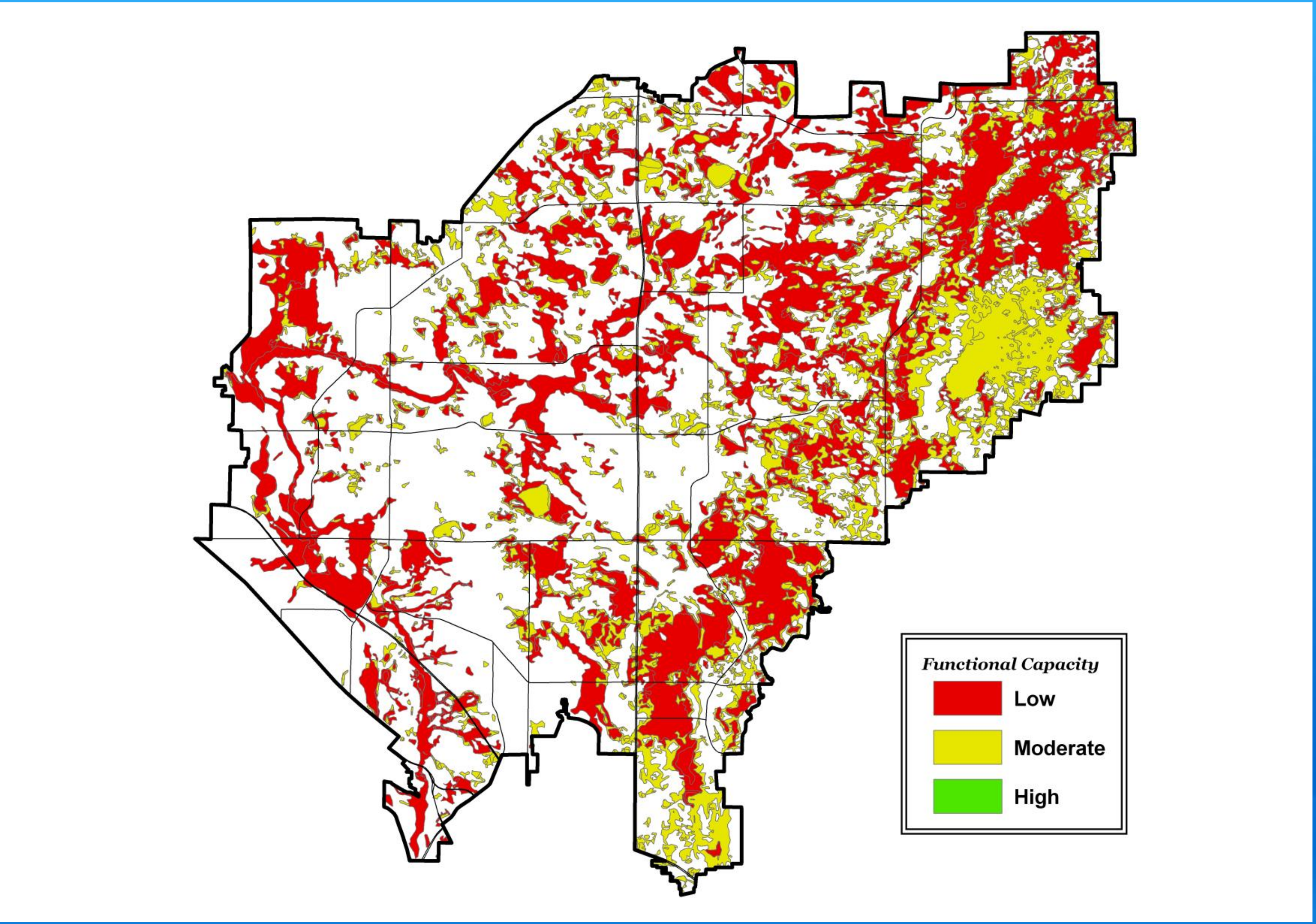
Modification of Ground Water Recharge



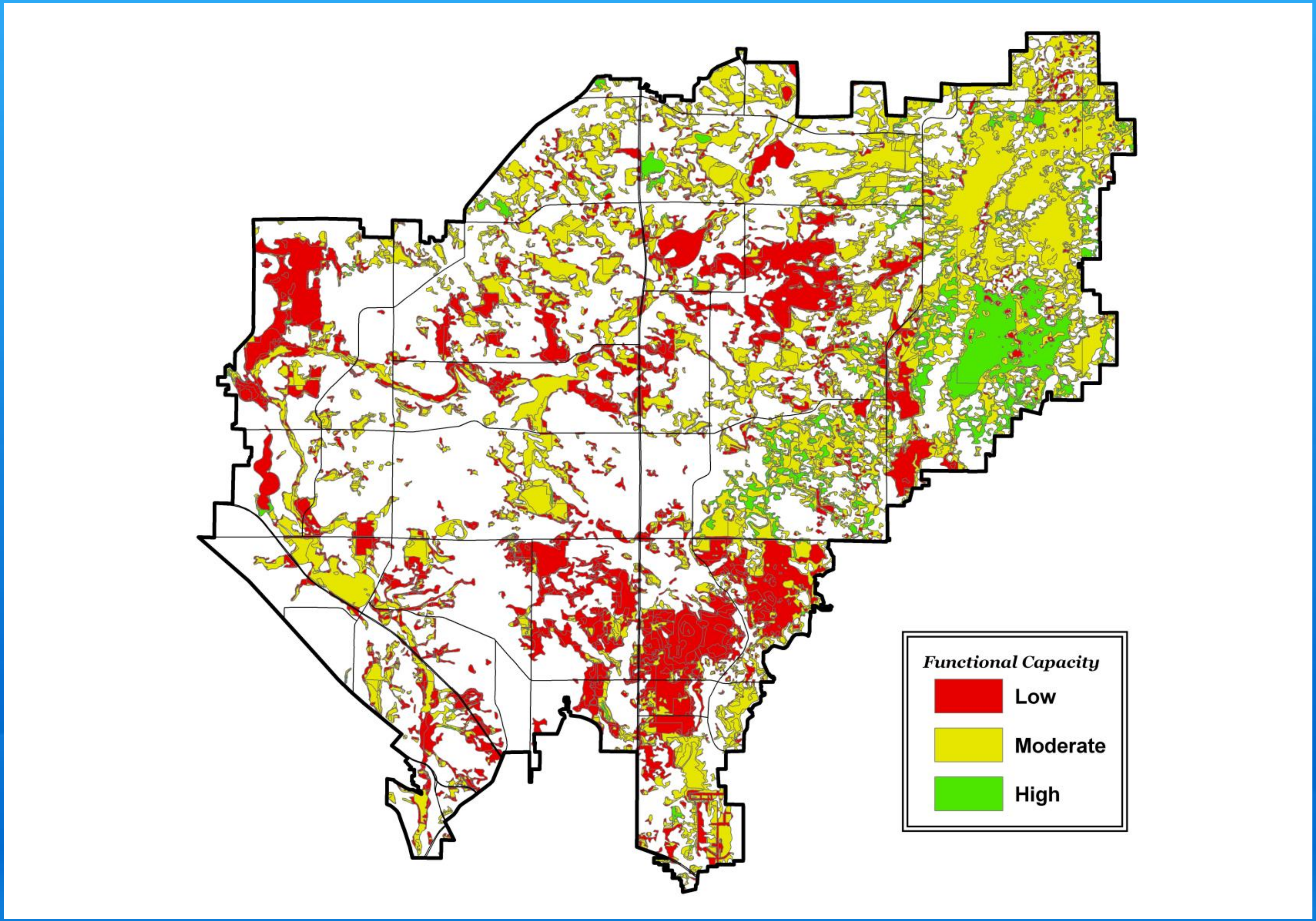
Storm & Flood-Water Storage



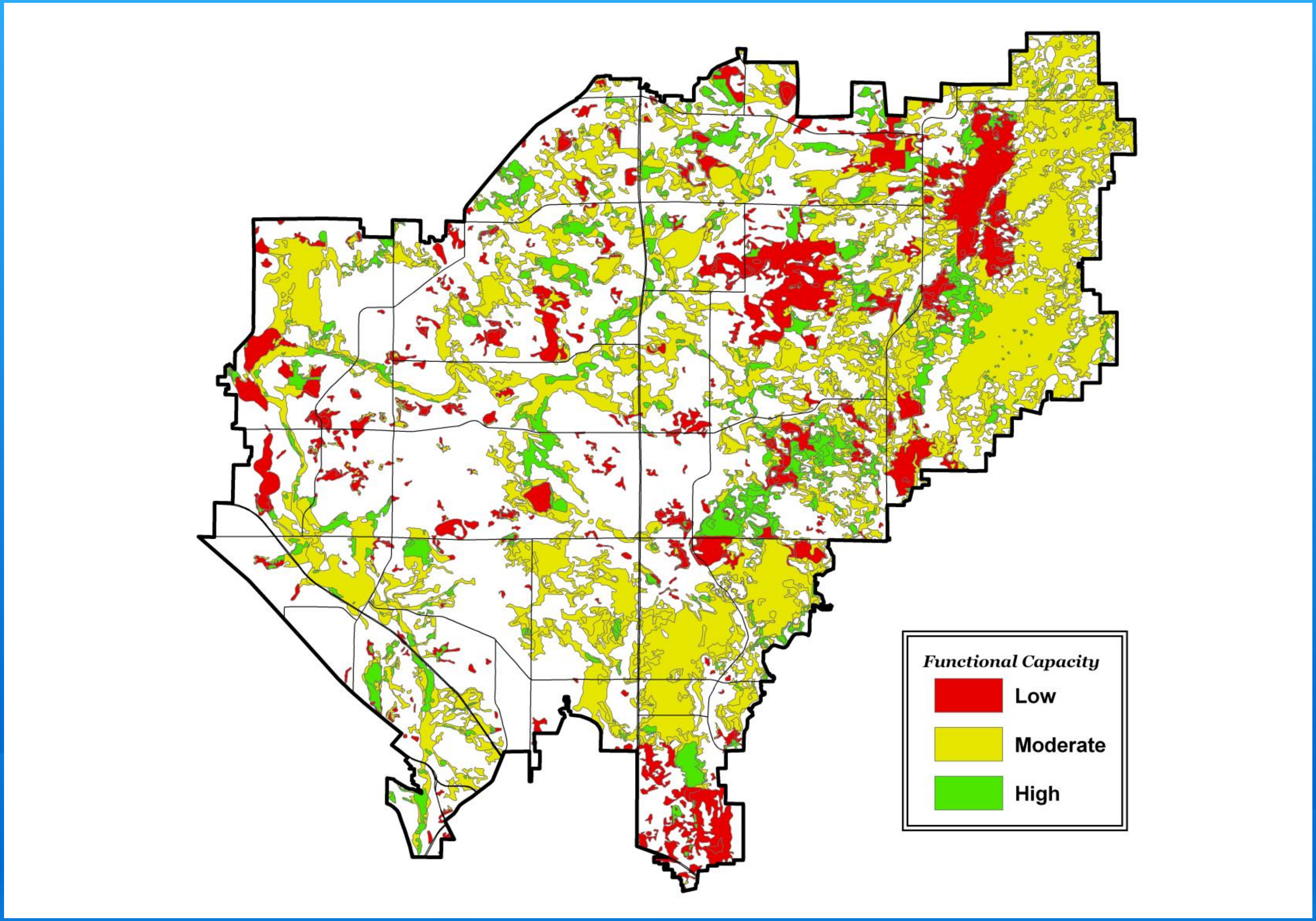
Modification of Stream Flow



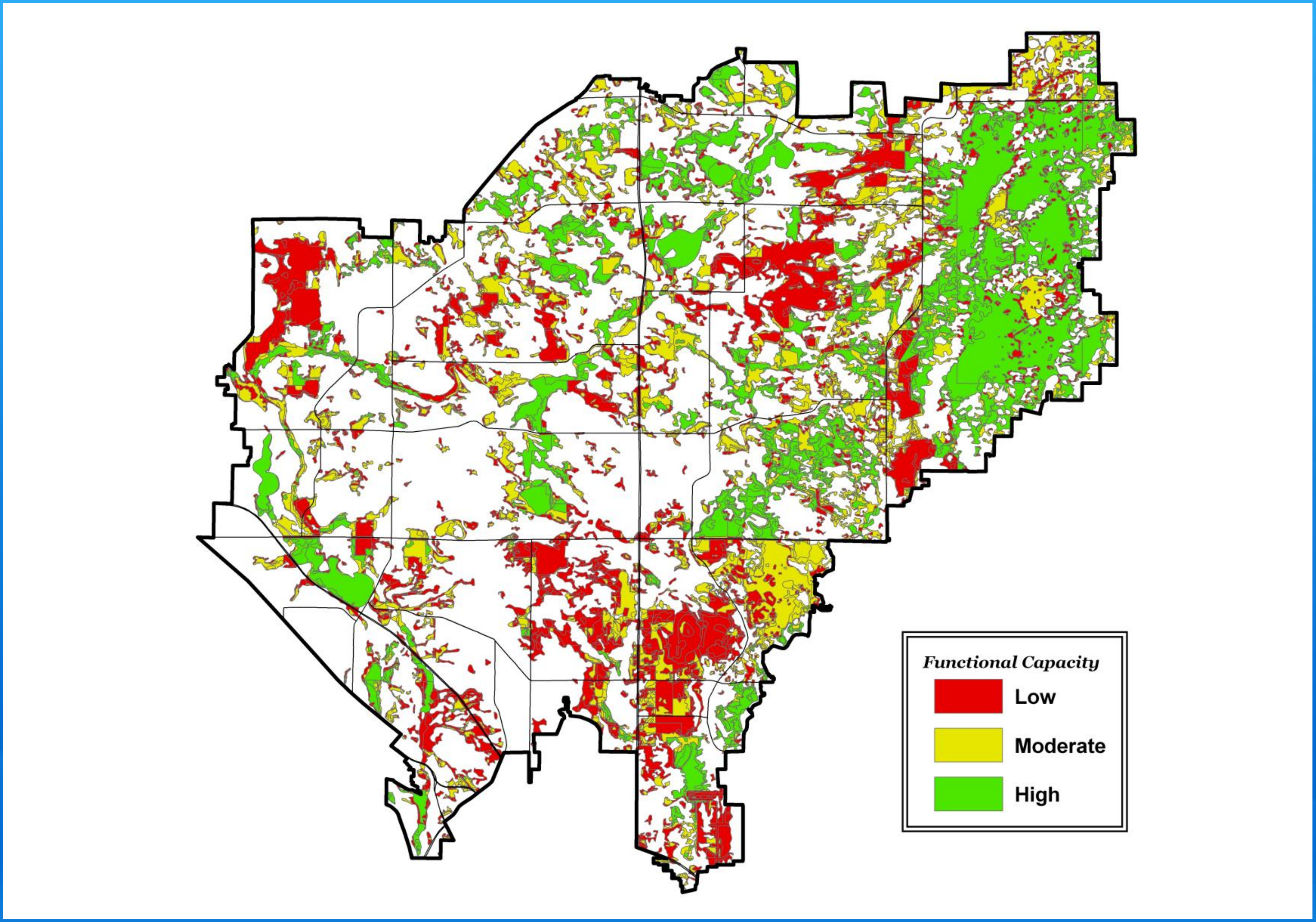
Modification of Water Quality



Wetland Vegetation

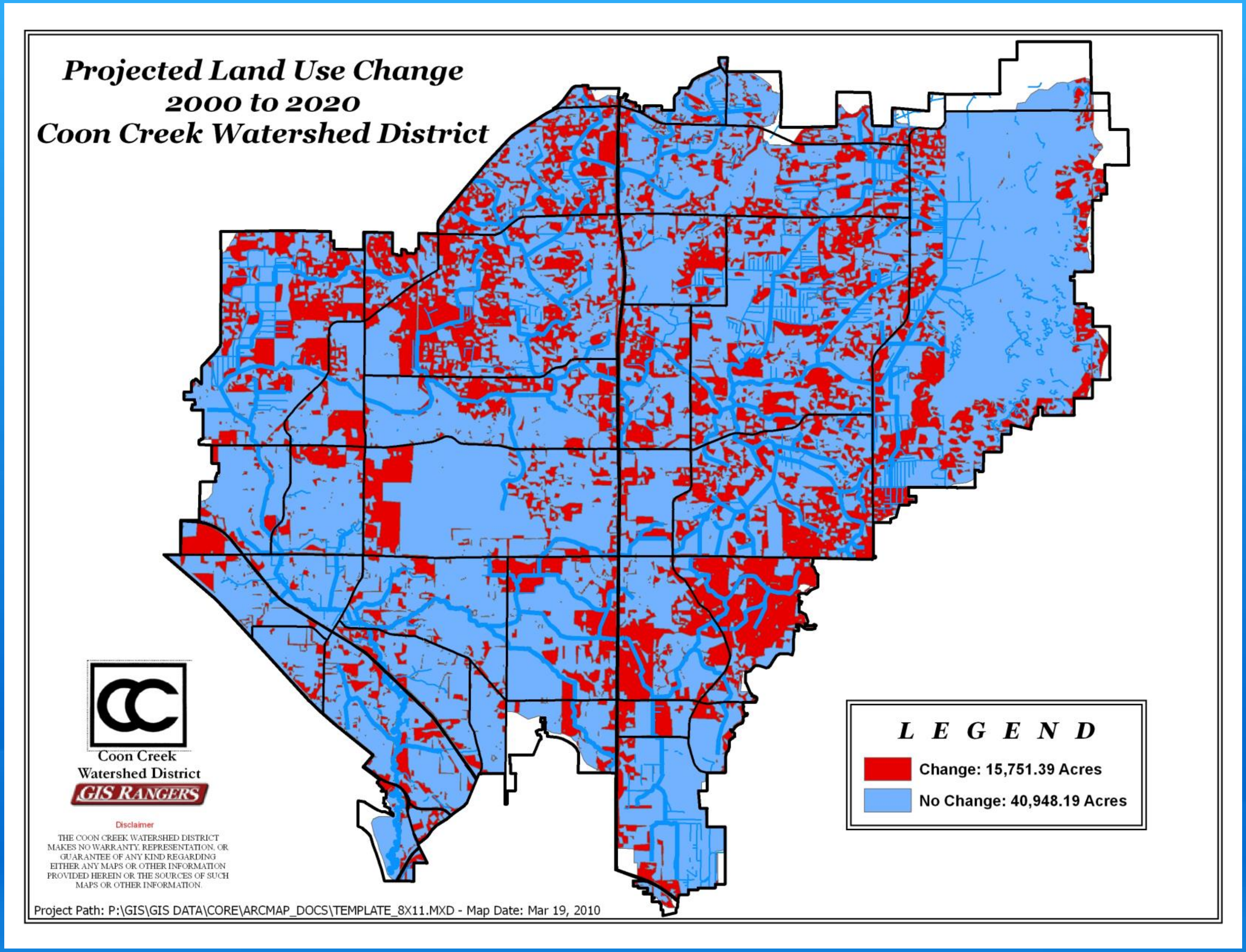


Wetland Fauna

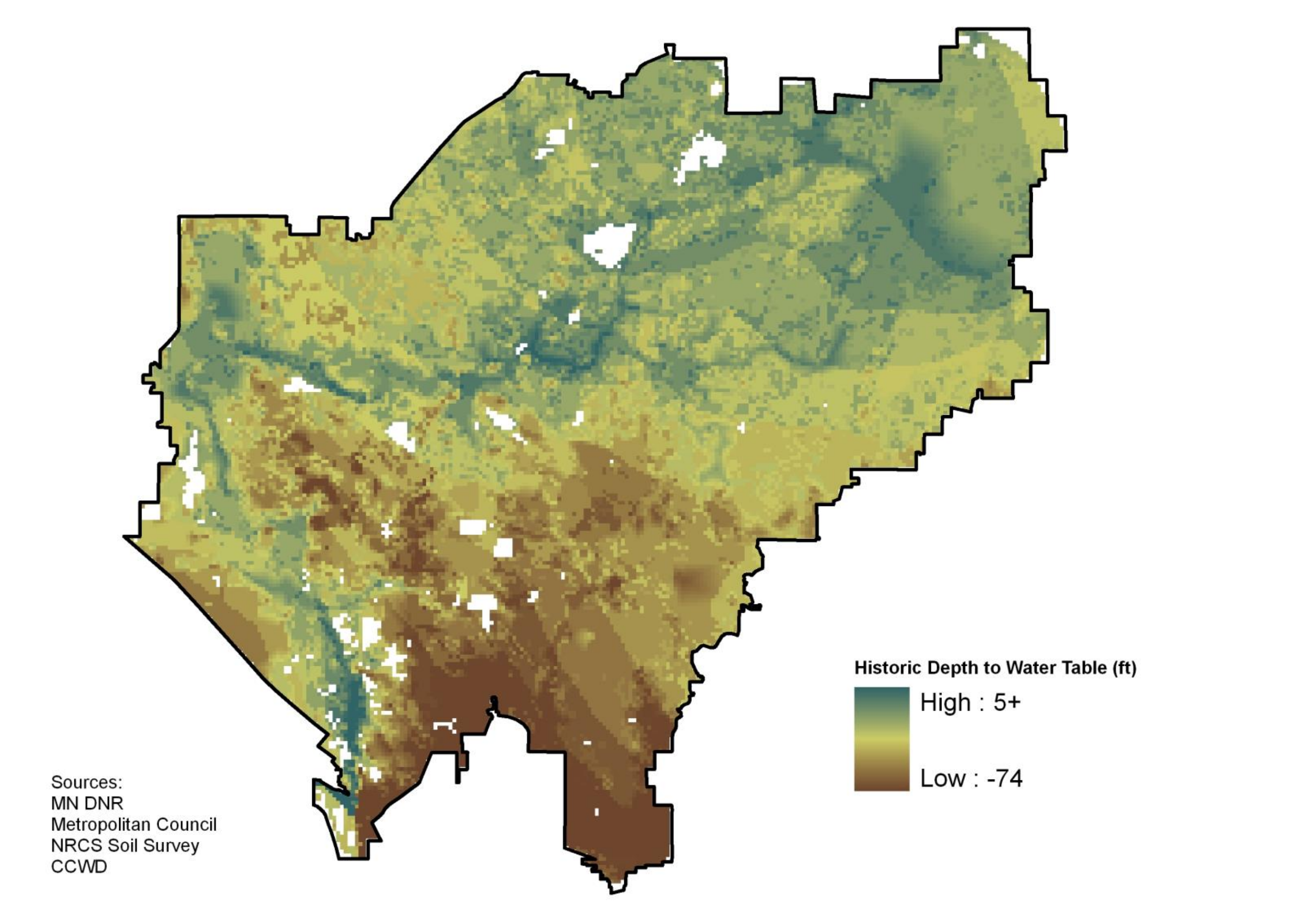


Changes in Wetland Processes & Conditions

Changes in Landscape & Land Use



Surficial Groundwater Elevation change 1978 to 2008



CCWD, 2010

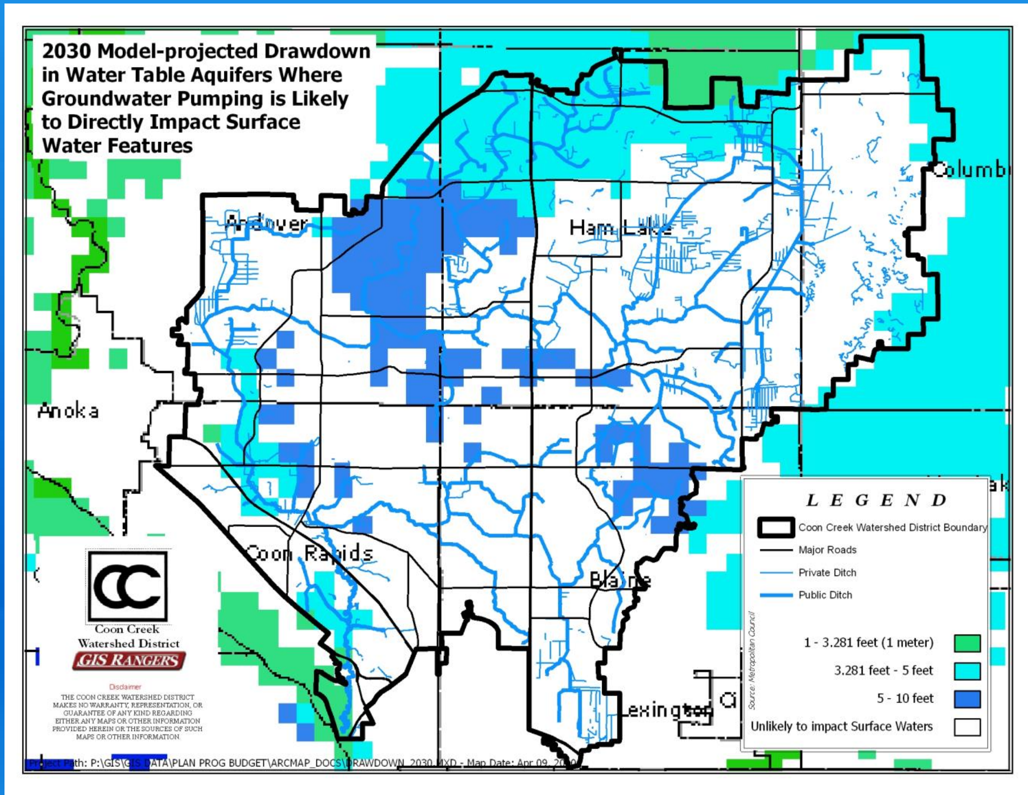
Changes in Hydrology and Hydroperiod

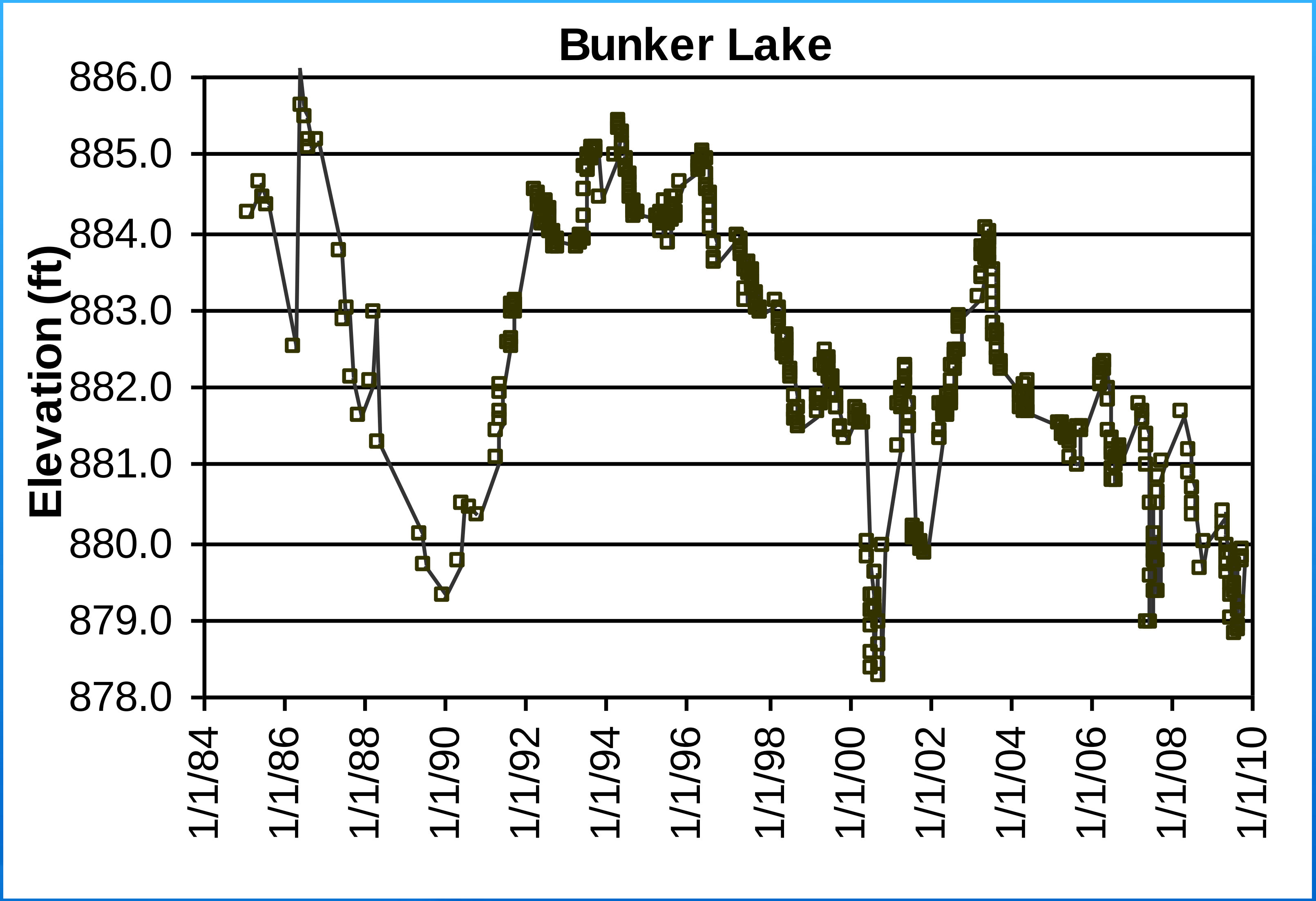
Drying out of landscape

Loss of wetlands with hydroperiods:

- Temporarily flooded (A)
- Saturated (B)

8,375 acres (52%)

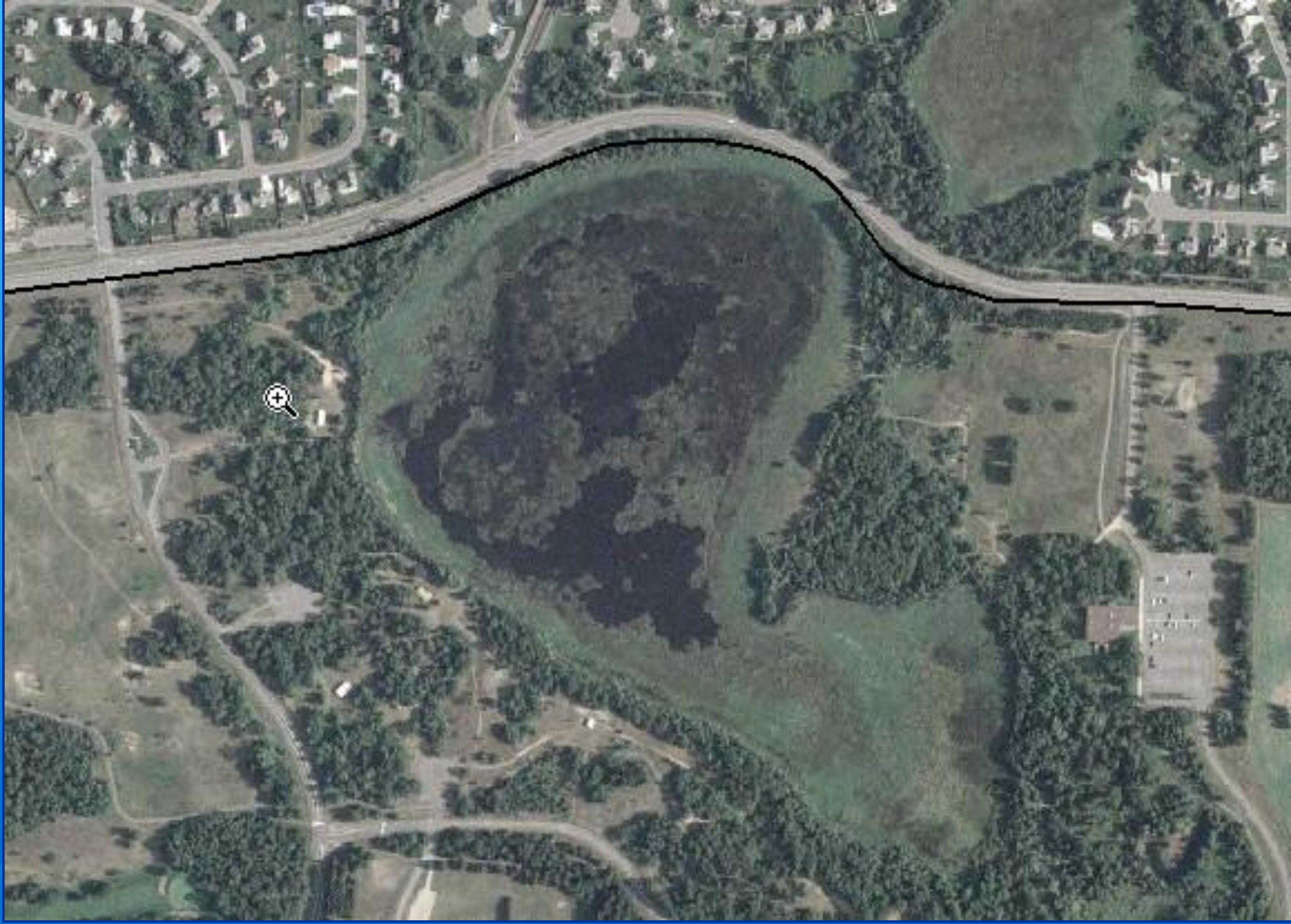




Bunker Lake
Elevation (ft)
886.0
885.0
884.0
883.0
882.0
881.0
880.0
879.0
878.0
1/1/84
1/1/86
1/1/88
1/1/90
1/1/92
1/1/94
1/1/96
1/1/98
1/1/00
1/1/02
1/1/04
1/1/06
1/1/08
1/1/10


ARK
SHADOWBROOK WEST PARK
116
137TH LN
REDWOOD ST NW
SYCAMORE ST NW
COUNTY PKWY A
BUNKER LAKE
BUNKER HILLS REGIONAL PARK
COUNTY PKWY D
COUNTY PKWY B

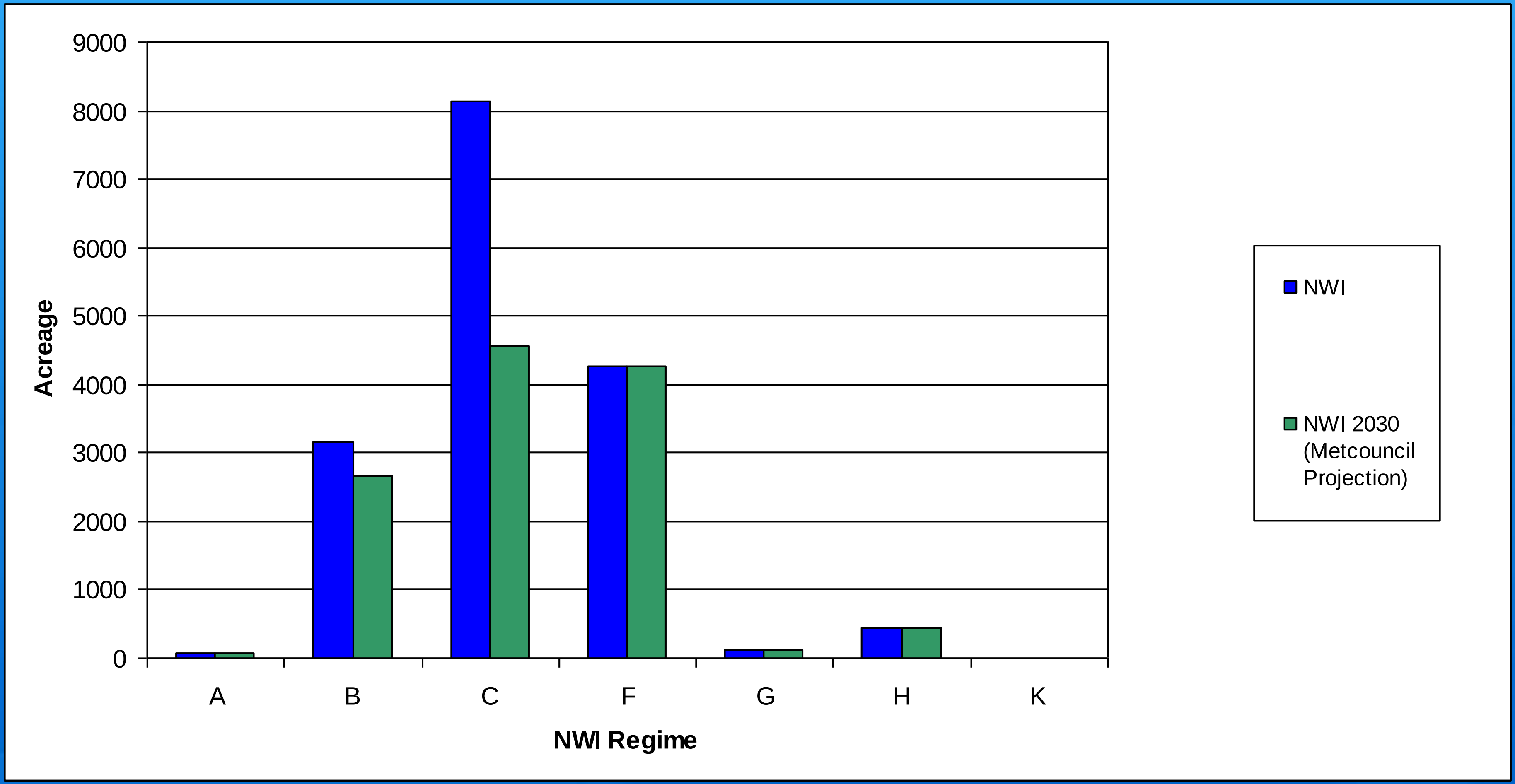
2001



2003

2008

Change in Wetlands



Changes in Soils

- Organic soils
  - – decomposing
  - – becoming hydrophobic

- Land subsidence

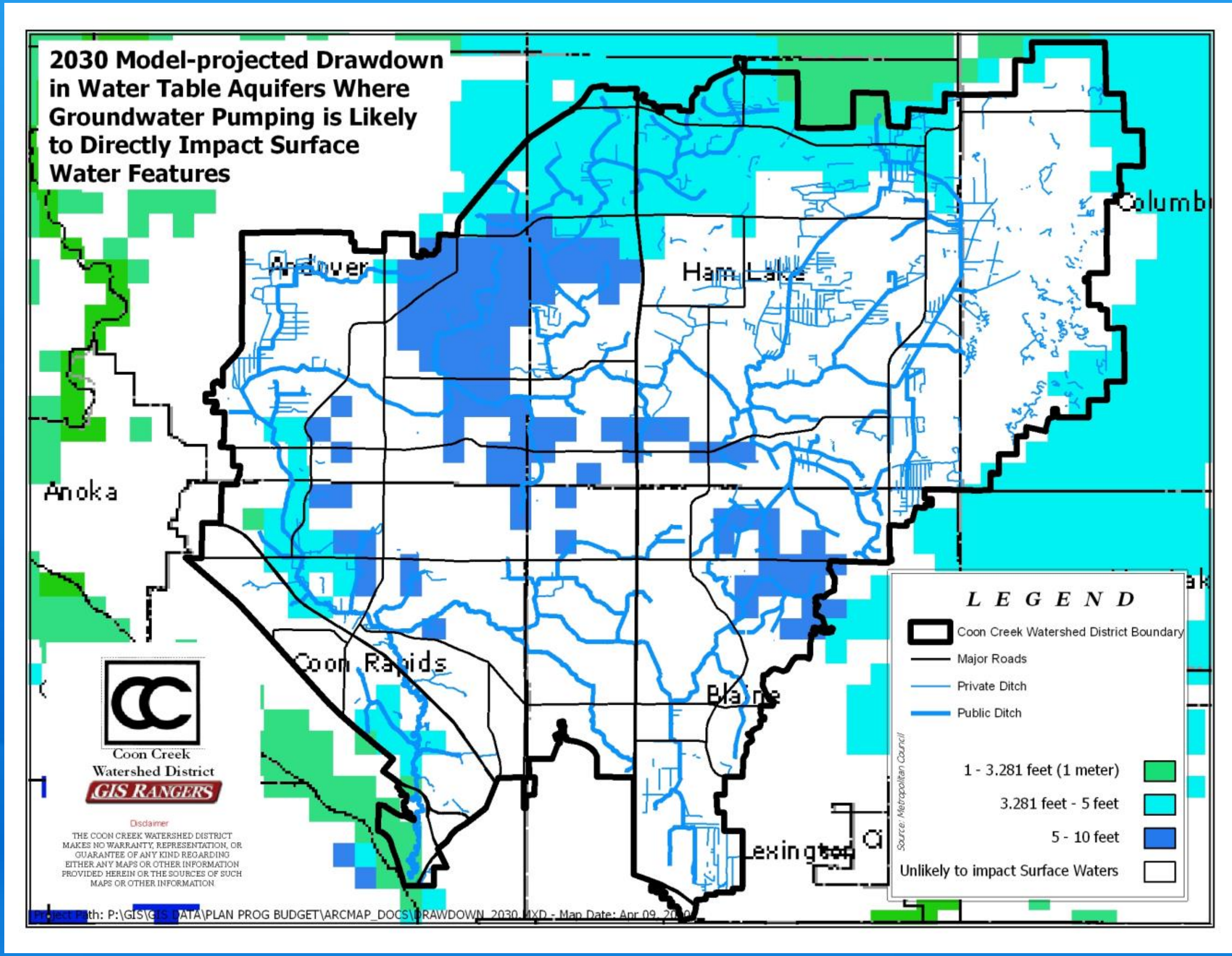
Changes in Vegetation

Increased occurrence of invasive species

Increased colonization of upland species

Changes in Wetlands

- Probable loss of 52% of wetland stock
- 8,375 acres



A Summary of Current Wetland Conditions and Capability (Functional Capacity?)

- Biological Diversity
- Biotic Integrity and Resilience
- Human Needs and Uses

Management Situations & Opportunities

- Allocating and Planning for Wetland Resources
- Inventory of Management Situations and Settings
- Identifying the Consequences of Management Actions
- Matching Ecosystem Management Goals with Landscape Opportunities

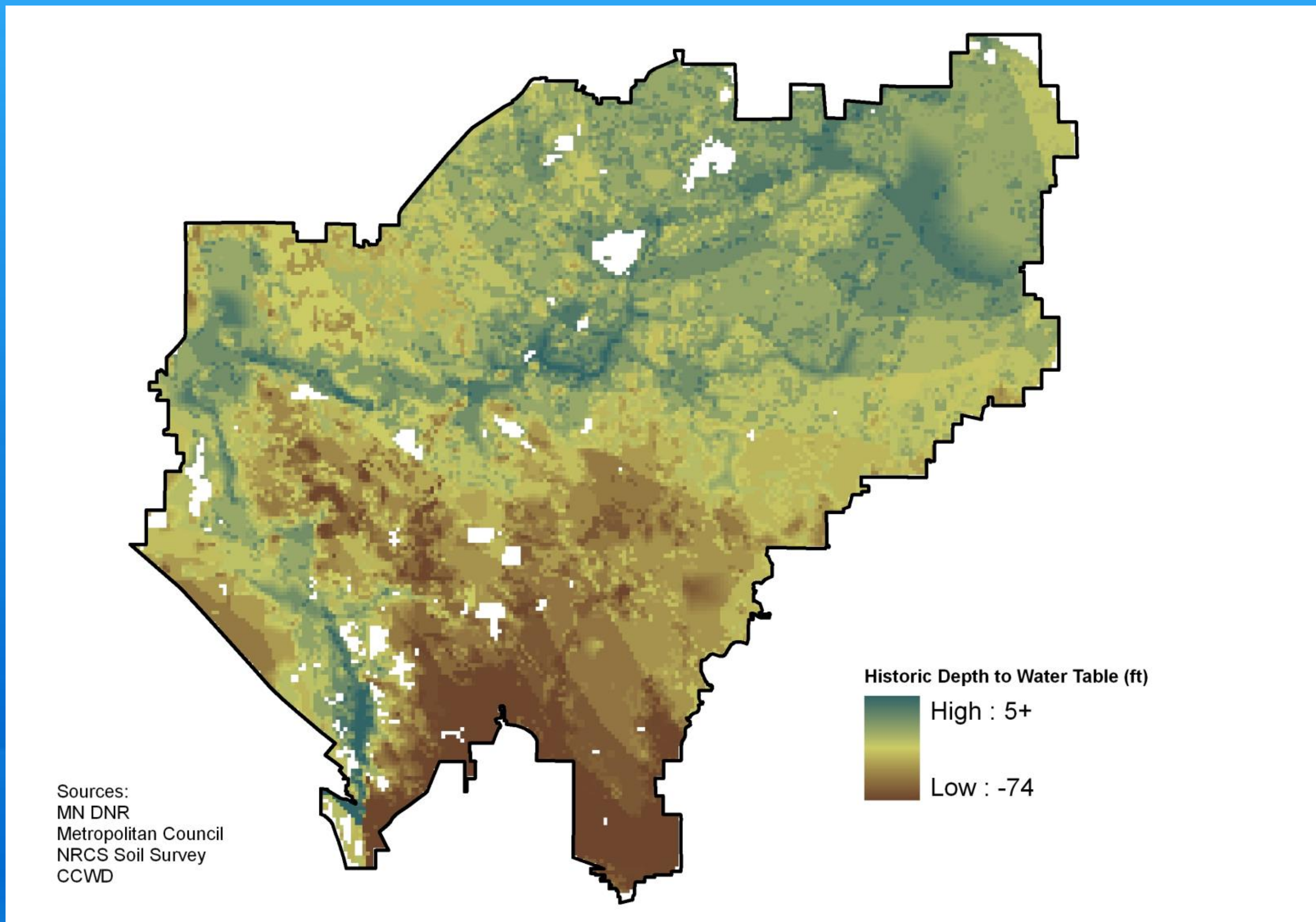
Tools to Achieve Results

Tools

- Planning and Land Use
- Regulatory
- Technical
  - Hydrology, Hydroperiod and Hydrodynamics
  - Soils
  - Vegetation
- Mechanical
- Chemical
- Biological
- Fire

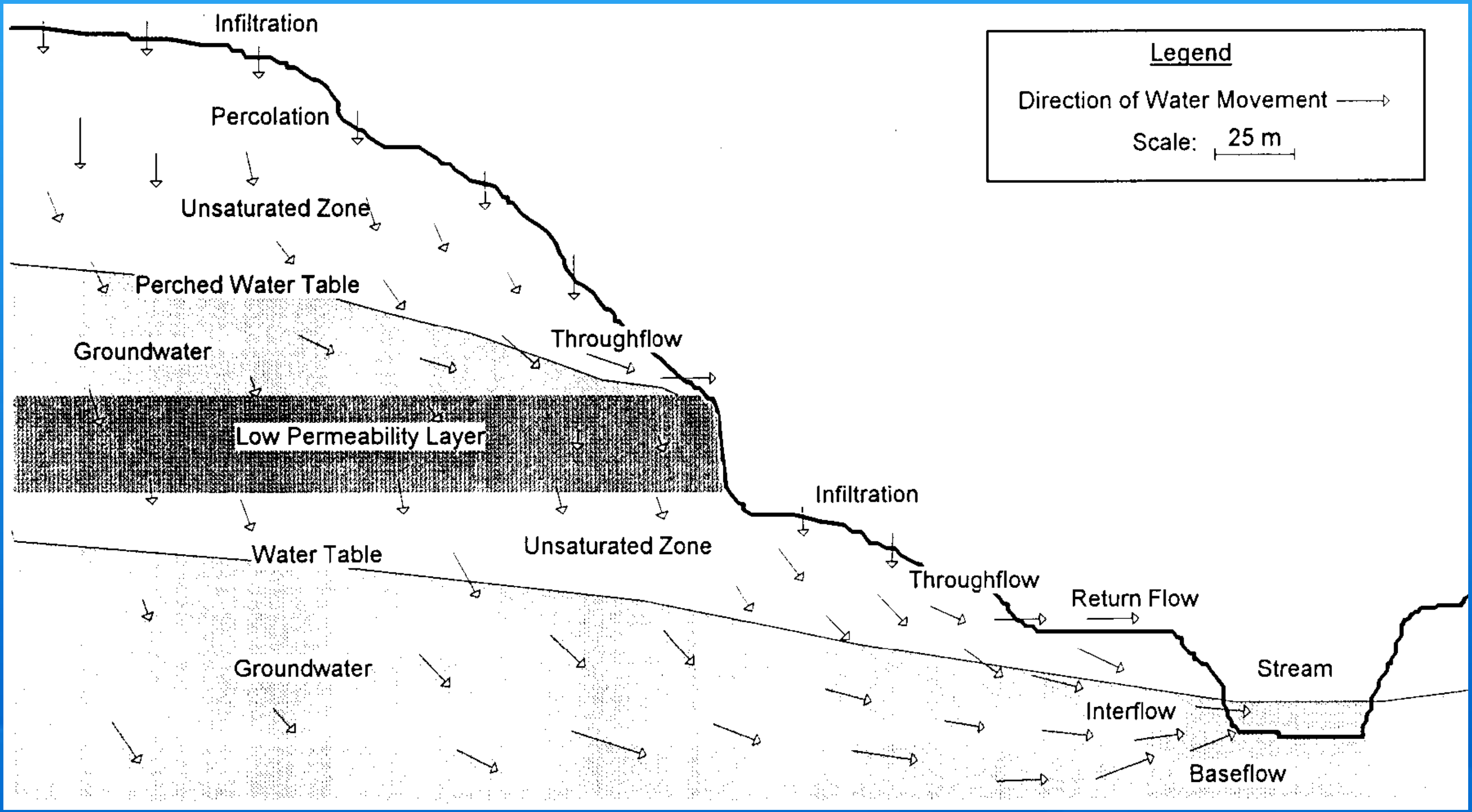
Research Needs

Surficial Groundwater Elevation change 1978 to 2008



CCWD, 2010

Potential Water Sources



Functional Assessment Variables

Landscape Variables

- Size
- Wetland Juxtaposition
- Regional Scarcity
- Watershed Land Use

Hydrologic Variables

- Surface Water Level Fluctuations of the Wetland
- Frequency of Overbank Flooding
- pH
- Surficial Geologic Deposit under Wetland
- Wetland Land Use
- Wetland Water Regime
- Basin Topographic Gradient

Hydrologic Variables

- Degree of Outlet Restriction
- Ratio of Wetland Area to Watershed Area
- Inlet/Outlet Class
- Nested Piezometer Data
- Relationship of a Wetland’s Substrate Elevation to Regional Piezometric Surface
- Evidence of Sedimentation

Soil Variables

- Soil Type

Vegetation Variables

- Dominant Wetland Type
- Number of Wetland Types & Relative Proportions
- Vegetation Density/Dominance
- Vegetative Interspersion
- Number of Layers & Percent Cover
- Plant Species Diversity
- Cover Distribution
- Interspersion of Vegetation Cover to Open Water
- Stream Sinuosity
- Presence of Islands

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Management Challenges

1. Setting standards on acceptable impact levels for wetlands while taking other factors, such as long term goals, into account
2. Providing adequate information about how resources function so that management can make informed choices
3. Managing and monitoring activities and impacts to ensure that situations don't change in a manner that may adversely affect the quality of the area.

Tenets of Situational and Adaptive Management

1. Wetlands differ according to their physical, social and managerial settings. This means that ecosystems and people are inseparable, unpredictable and evolve together.
2. Focuses on ecosystem sustainability (maintenance of the natural processes and self-referencing nature of the resource.
3. Considers the capability of, or degree to which, a resource can self-reference as an opportunity defining the need for management intervention.
4. Involves consideration of the lasting effects of a resources use as well as short term effects on the resource. This will involve deliberate experimentation to gain new knowledge.
5. Involves being explicit about expected processes and outcomes, and collecting information to compare expectations, outcomes and consequences.
6. Is an on going process involving changing and adapting actions and plans.
7. Involves using monitoring and inventory information to assess the effects of management actions on ecosystem health.
8. Involves collaboration between research and management.
9. Involves using public participation and collaboration in consideration of local management objectives and local conditions.

APPENDIX H: Definitions

Term	Definition
Adjacent	Bordering, contiguous, or neighboring. Wetlands separated from other waters of the District by man-made dikes or barriers, spoil banks, and the like are "adjacent wetlands."
Applicant	A property owner or agent of a property owner who has filed an application for a stormwater management permit.
Aquifer	A geologic formation, group of formations or part of a formation composed of rock, sand or gravel capable of storing and yielding groundwater to wells and springs.
Assist	A measurable effort that requires separate scheduling of time and/or expenditure.
Best Management Practice (BMP)	Structural device, measure, facility or activity that helps to achieve stormwater management control objectives at a designated site. Schedules of activities, prohibitions of practices, general good house keeping practices, pollution prevention and educational practices, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants directly or indirectly to stormwater, receiving waters, or stormwater conveyance systems. BMPs also include treatment practices, operating procedures, and practices to control site runoff, spillage or leaks, sludge or water disposal, or drainage from raw materials storage.
Board	The Board of Managers of the Coon Creek Watershed District
Buffer Strip	A vegetated area bordering a stream that exists or is established to protect a stream system. Alteration of this vegetated area is strictly limited. A natural buffer for a stream or ditch system shall consist of a natural strip of land extending along the side(s) of a stream or lake, wetlands, floodplains, or slopes. The natural buffer shall begin at the edge of the stream bank of the active channel.
Building	Any structure, either temporary or permanent, having walls and a roof, designed for the shelter of any person, animal, or property, and occupying more than 100 square feet of area.
Channel	A natural or artificial watercourse with a definite bed and banks that conducts continuously or periodically flowing water.

Term	Definition
Control Measure	A practice or combination of practices to control erosion and attendant pollution.
Dedication	The deliberate appropriation of property by its owner for general public use.
Detention	The temporary storage of storm runoff in a stormwater management practice with the goals of controlling peak discharge rates and providing gravity settling of pollutants.
Developer	A person who undertakes land disturbance activities.
District	The Coon Creek Watershed District
Drainage Easement	A legal right granted by a landowner to a grantee allowing the use of private land for stormwater management purposes.
Drainage sensitive uses	Drainage Sensitive Uses are those land uses that require less than saturated conditions to grow or for the land to be used and therefore are dependent upon the subsurface, lateral effect of drainage ditches to remove water.
Erosion and Sediment Control Plan	A plan that is designed to minimize the accelerated erosion and sediment runoff at a site during construction activities.
Extreme Fluctuations	Means changes in the volume, elevation or timing of the discharge or storage of water that can result in adverse impact to the biogeochemical character of the receiving resource.
Floodplain	The area adjoining a watercourse, water basin or wetland that have been or may be covered by a regional flood.
Floodway	The channel of a watercourse, the bed of water basins and wetlands, and those portions of the adjoining floodplains that are reasonably required to carry and discharge floodwater and provide water storage during a regional flood.
Flow Velocities	A condition where the rate of volume of water flowing exceeds the design capability of the conveyance system.
Function	The biogeochemical processes that sustain the wetland at the site and landscape levels. Specifically the geomorphic setting, water source and hydrodynamics that contribute to sustaining wetlands.

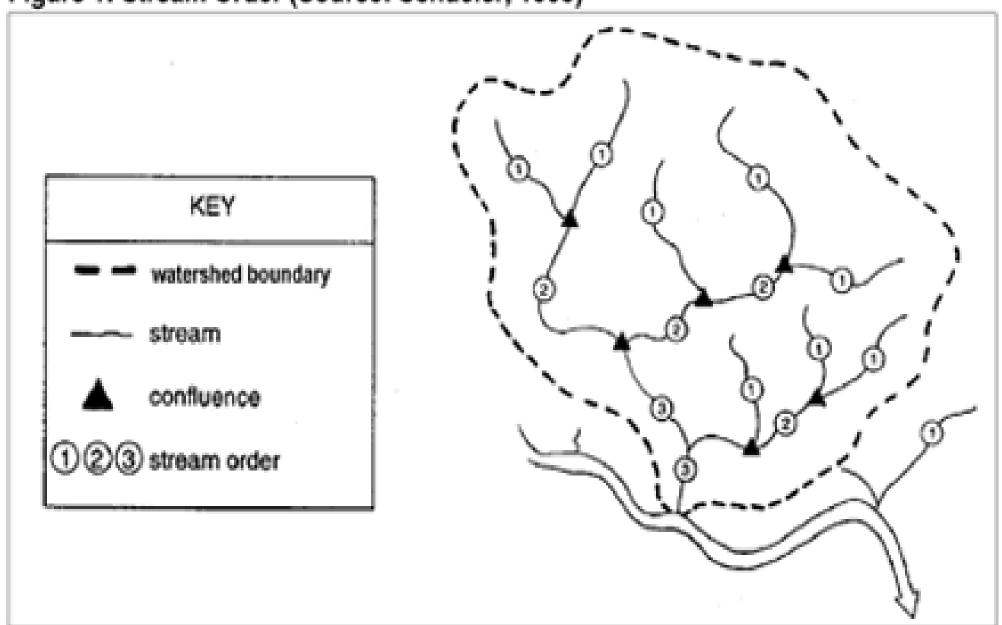
Term	Definition
High Infiltration Soils	Soils with infiltration rates greater than 6 inches per hour. These soils have high infiltration rates even when they are thoroughly wetted. These consist chiefly of deep, well to excessively drained sands and gravels. These soils have a high rate of water transmission, so water passes through them readily but the soils have low runoff potential.
Hydric Soil	Soils that are saturated, or ponded long enough during the growing season to develop anaerobic conditions in the upper part.
Hydrologic Soil Group (HSG)	A Natural Resource Conservation Service classification system in which soils are categorized into four runoff potential groups. The groups range from A soils, with high permeability and little runoff production, to D soils, which have low permeability rates and produce much more runoff.
Illicit Connections	Any drain or conveyance, whether on the surface or subsurface, which allows an illegal discharge to enter the storm drain system including but not limited to any conveyances which allow any non-storm water discharge including sewage, process wastewater, and wash water to enter the storm drain system and any connections to the storm drain system from indoor drains and sinks, regardless of whether said drain or connection had been previously allowed, permitted, or approved by an authorized enforcement agency or, Any drain or conveyance connected from a commercial or industrial land use to the storm drain system which has not been documented in plans, maps, or equivalent records and approved by an authorized enforcement agency.
Illicit Discharge	Any direct or indirect non-storm water discharge to the storm drain system, except as exempted. Illicit discharges may include discharges from illicit connections with measurable flow during dry weather containing pollutants or pathogens.
Improvement or Ditch Improvement	Any activity which deepens straightens or increases the "as constructed" capacity of a ditch. This may include the grading, digging, cutting, scraping, or excavating of soil, placement of fill materials, paving, construction, and substantial removal of vegetation.
Incidental Aid	Aid not requiring separate scheduling or expenditure. Not counted or reported as an "assist" in planning, budgeting, or reporting activities.
Infiltration	The process of percolating stormwater into the subsoil.
Infiltration Facility	Any structure or device designed to infiltrate retained water to the subsurface. These facilities may be above grade or below grade.

Term	Definition
Land Disturbance Activity	Any activity which changes the volume or peak flow discharge rate of rainfall runoff from the land surface. This may include the grading, digging, cutting, scraping, or excavating of soil, placement of fill materials, paving, construction, substantial removal of vegetation, or any activity which bares soil or rock or involves the maintenance, repair, improvement, diversion or piping of any natural or man-made watercourse.
Landowner	The legal or beneficial owner of land, including those holding the right to purchase or lease the land, or any other person holding proprietary rights in the land.
Maintenance Agreements	A legally recorded document that acts as a property deed restriction, and which provides for long-term maintenance of storm water management practices.
Managers	The Board of Managers of the Coon Creek Watershed District
Maximum Extent Practicable (MEP)	Within the limits of available technology and the practical and technical limits of a site and project, an applicant has reduced discharge of pollutants from stormwater to the maximum extent practicable (MEP) when the Board finds that he/she has made a good faith effort in meeting the following requirements: 1. The proposed plan is capable of being done from an engineering point of view. 2. The proposed plan is in accordance with accepted engineering standards and practices. 3. The proposed plan is consistent with reasonable requirements of the public health safety and welfare. 4. The proposed plan is environmentally preferred based on a review of social, economic and environmental impacts, and 5. It would create no unusual problems.
Municipality	City or township wholly or partly within the district.
Nonpoint Source Pollution	Pollution from any source other than from any discernible, confined, and discrete conveyances, and shall include, but not be limited to, pollutants from agricultural, silvicultural, mining, construction, subsurface disposal and urban runoff sources.
One Hundred-Year Floodplain	The area of land adjacent to a stream that is subject to inundation during a storm event that has a recurrence interval of 100 years, or a 1% chance of occurring in any given year. In Coon Creek Watershed it is equivalent to a 5.9 inch rainfall in a 24 hour period.
One Year Event	A storm event that has a 99% chance of occurring in any given year. In Coon Creek Watershed it is equivalent to a 2.3 inch rainfall in a 24 hour period.

<table>
<tr><th>Term</th><th>Definition</th></tr>
<tr><td>Person</td><td>Any individual, firm, corporation, partnership, franchisee, association, or governmental entity.</td></tr>
<tr><td>Plan</td><td>A document approved at the site design phase that outlines the measures and practices used to control stormwater runoff at a site.</td></tr>
<tr><td>Pollutant</td><td>Anything which causes or contributes to pollution including nonpoint source pollution and discharges from illicit connections. Pollutants may include, but are not limited to: paints, varnishes, and solvents; oil and other automotive fluids; non-hazardous liquid and solid wastes and yard wastes; refuse, rubbish, garbage, litter, or other discarded or abandoned objects, rules, and accumulations, so that same may cause or contribute to pollution; floatables; pesticides, herbicides, and fertilizers; hazardous substances and wastes; sewage, fecal coliform and pathogens; dissolved and particulate metals; animal wastes; wastes and residues that result from constructing a building or structure; and noxious or offensive matter of any kind.</td></tr>
<tr><td>Public Waters</td><td>Waters of the state as defined in Minnesota statutes, section 103G.005, subdivision 15.</td></tr>
<tr><td>Recharge</td><td>The replenishment of underground water reserves.</td></tr>
<tr><td>Relevant Reach</td><td>That portion of the stream course and floodplain that would experience an increase in stage as a result of floodplain fill.</td></tr>
<tr><td>Repair or Ditch Repair</td><td>Any activity which returns a ditch or conveyance system to its "as constructed" elevation or slope. This may include the grading, digging, cutting, scraping, or excavating of soil, placement of fill materials, paving, construction, or substantial removal of vegetation.</td></tr>
<tr><td>Retention Facility/Infiltration Basin</td><td>A permanent or man-made structure, including wetlands, that provides for the storage of stormwater runoff by means of a permanent pool of water. Retention facilities have no outlet structure and water is typically lost through infiltration to ground water or through evaporation and/or transpiration.</td></tr>
<tr><td>Role</td><td><table>
<tr><td colspan="3">All public and private ditches within the watershed fulfill one or more of the following roles:</td></tr>
<tr><th>Role</th><th>Function</th><th>Definition</th></tr>
<tr><td>Agricultural drainage</td><td>To remove water from the soil profile to enable crop growth.</td><td>All first and second order ditches that serve agricultural purposes</td></tr>
<tr><td>Storm water conveyance</td><td>To route stormwater from urbanized</td><td>All first and second order ditches that</td></tr>
</table></td></tr>
</table>

Term	Definition		
		areas, the public ditches will be preserved, repaired and maintained for conveying stormwater and potentially as greenways.	serve to route stormwater from urbanized areas.
	Collector system	To serve as the outlet for other ditches (public and private) and extended hydrographs and/or increases in the duration of elevated flows occur the ditches	All third order streams within the watershed.
	Trunk drainage system	To serve as the outlet for other ditches (public and private) and extended hydrographs and/or increases in the duration of elevated flows occur the ditches will be managed as a trunk drainage system	All fourth and fifth order streams
Sediment	Solid matter carried by water, sewage or other liquids.		
Shall	Is mandatory and not permissive		
Shallow/Surficial Aquifer	An aquifer in which the permeable medial (sand and gravel) starts at the land surface or immediately below the soil profile.		
Significant Material Change	Changes to grading, drainage, erosion control or other plans reviewed by the Watershed District that 1 exhibit an identifiable or measurable change or difference from prior reviewed or submitted plans. The material change is significant if it results or can result in an adverse impact to property or resources not previously identified.		

Term	Definition
Stop Work Order	An order issued which requires that all construction activity on a site be stopped.
Stormwater	Any surface flow, runoff, and drainage consisting entirely of water from any form of natural precipitation, and resulting from such precipitation.
Stormwater Management	The use of structural or non-structural practices that are designed to reduce storm water runoff pollutant loads, discharge volumes, and/or peak flow discharge rates.
Stormwater Pollution Prevention Plan (SWPPP)	A document which describes the Best Management Practices and activities to be implemented by a person or business to identify sources of pollution or contamination at a site and the actions to eliminate or reduce pollutant discharges to Stormwater, Stormwater Conveyance Systems, and/or Receiving Waters to the Maximum Extent Practicable.
Stormwater Runoff	Flow on the surface of the ground, resulting from precipitation.
Stormwater Treatment Practices (STPs)	Measures, either structural or nonstructural, that are determined to be the most effective, practical means of preventing or reducing point source or nonpoint source pollution inputs to stormwater runoff and water bodies.

Term	Definition
Stream Order or ordering	A classification system for streams based on stream hierarchy. The smaller the stream, the lower its numerical classification. For example, a first-order stream does not have tributaries and normally originates from springs and/or seeps. The approach consists of systematically ordering the branches and tributary streams. The extent of branching is an indication of the size and extent of the drainage network of the watershed. It influences the timing of peaks at a given point in the watershed as well as water quality. **Figure 1: Stream Order (Source: Schueler, 1995)** 
Streams	Perennial and intermittent watercourses identified through site inspection and US Geological Survey (USGS) maps. Perennial streams are those which are depicted on a USGS map with a solid blue line. Intermittent streams are those which are depicted on a USGS map with a dotted blue line.
Structure	Anything manufactured, constructed or erected which is normally attached to or positioned on the land, including portable structures, earthen structures, roads, parking lots and paved storage areas.
Total Maximum Daily Load (TMDL)	A Total Maximum Daily Load, or TMDL, is a regulation designed to improve water quality by controlling the amount of a pollutant entering a water body.
Undue hardship	The owner cannot make reasonable use of their property.

Term	Definition
Water Quality Volume (WQv)	The storage needed to capture and treat 90% of the average annual stormwater runoff volume. Numerically (WQv) will vary as a function of long term rainfall statistical data.
Watercourse	A permanent or intermittent stream or other body of water, either natural or man-made, which gathers or carries surface water.
Watershed	An area of common drainage.
Welfare	An act or thing that tends to improve, benefit, or contribute to the safety or well-being of the general public, or benefit the inhabitants of the watershed district.
Wetland Functions	The biogeochemical processes that sustain the wetland at the site and landscape levels.
Wetland or Jurisdictional Wetland	An area that is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions, commonly known as hydrophytic vegetation.