			Available Scale			Index Scores:					
						80-100	60-80	40-60	20-40	0-20	
Index Name:	**Metric Name:**	**Description:**	**Catchment**	**Major**	**Time Series**	**Least Impacted**		**Moderately Impacted**		**Heavily Impacted**	**Data Used**
Hydrology Component											
Perennial Cover		The amount of perennial cover remaining on the landscape	X	X	X	80 - 100% perennial cover remaining	60 - 80%	40 - 60% perennial cover remains	20 - 40%	0 - 20% perennial cover remains	• National Land Cover Dataset (2001, 2006, 2011)
Impervious Cover		% of catchments within a watershed that have greater than 4% impervious surface. (Score is the inverse of the percentage)	X	X	X	0.0 - 0.8 % of watershed covered by impervious surfaces	0.81 - 1.6%	1.61 - 2.4% of watershed covered by impervious surfaces	2.41 - 3.2%	3.21 - 100% of watershed covered by impervious surfaces	• National Land Cover Dataset (2001, 2006, 2011)
Water Withdrawal		Total consumptive permitted water use from surface and groundwater sources in catchment and upstream; as a percent of runoff from upstream area (5 year period of record)	X	X		0 - 20% of available runoff is allocated for permitted, consumptive water uses	20 - 40%	40 - 60% of available runoff is allocated for permitted, consumptive water uses	60 - 80%	80 - 100% of available runoff is allocated for permitted, consumptive water uses	• State Water Use Database - MN DNR permitted volume of use (excluding once-through power plants) • Minnesota County Well Inventory
Loss of Hydrologic Storage		Mean of Metrics	X	X		80 - 100	60 - 80	40 - 60	20 - 40	0 - 20	
Loss of Hydrologic Storage	**Altered Watercourses**	Ratio of straightened stream miles to total stream miles (natural + straightened) (Score is the inverse of the percentage)	X	X		80 - 100% of streams and rivers maintain their natural flow path	60 - 80%	40 - 60% of streams and rivers maintain their natural flow path	20 - 40%	0 - 20% of streams and rivers maintain their natural flow path	• Altered Watercourses (MPCA/MnGeo, 2012)
	Wetland Loss	Remaining wetland surface area as percent of total watershed area.	X	X		0 - 20% of watershed area converted out of wetlands	20 - 40%	40 - 60% of watershed area converted out of wetlands	60 - 80%	80 - 100% of watershed area converted out of wetlands	• USDA, NRCS - Soils Data (SSURGO/STATSGO) • USFWS, MN DNR – National Wetland Inventory (1980-1986 for Central and Norther MN – 2010-2014 for Southern MN)
Flow Variability		Degree of deviation from expected flow patterns based on historic stream gage records and Indicators of Hydrologic Alteration		X		0 - 20% Deviation from expected patterns	20 - 40%	40 - 60% Deviation from expected patterns	60 - 80%	80 - 100% Deviation from expected patterns	• USGS Stream gage network -30 year period of record • 5 flow pattern indicators based on the Indicators of Hydrologic Alteration http://conserveonline.org/workspaces/iha
Biology Component											
Terrestrial Habitat Quality		The quality of terrestrial habitat is based on its size, configuration and cover type. This index compares the amount of land that has high quality habitat to the amount of land that is low quality or less suitable for native animal species	X	X		80 - 100 The majority of the watershed contains habitat cover with high quality ranking	60 - 80	40-60 Median amount of and quality of habitat cover	20 - 40	0 - 20 Small amount of fragmented habitat cover with low quality rank	Model of Terrestrial Habitat Quality • National Land Cover Dataset(2001) • MN County Biological Survey -Biodiversity Significance; (2009) • Roads (MN DOT, 2010) • National Agricultural Statistics Service (2008); NASS Data Service
Stream Species Quality		Index score based on Observed/Expected ratio of aquatic invertebrate, fish, and mussel species sampled in statewide stream surveys.		X		80 - 100% of sites meet the reference condition for O/E ratio	60 - 80%	40 - 60% of sites meet the reference condition for O/E ratio	20 - 40%	0 - 20% of sites meet the reference condition for O/E ratio	• MPCA - Fish and Aquatic Invertebrate IBI assessment surveys, (2016) • MN DNR Statewide Mussel Survey (2016)

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Stream Species Quality	**Fish (IBI Based)**	Average of IBI samples within catchment. Index value based on the percentage above or below IBI threshold, i.e., index score of 50 = threshold IBI.	X	X		80 - 100 Catchment mean of IBI sites scores exceed IBI thresholds	60 - 80	40 - 60 Score of 50 indicates average site score = fish IBI threshold	20 - 40	0 - 20 Catchment mean of IBI site scores is below threshold	• MPCA - Fish IBI assessment surveys (2016)
	Invertebrate (IBI Based)	Average of IBI samples within catchment. Index value based on the percentage above or below IBI threshold, i.e., index score of 50 = threshold IBI.	X	X		80 - 100 Catchment mean of scores above IBI thresholds,	60 - 80	40 - 60 Score of 50 indicates site score = invert IBI threshold	20 - 40	0 - 20 Catchment mean of scores below IBI thresholds,	• MPCA - Aquatic Invertebrate IBI assessment surveys (2016)
	Mussel Quality	Mussel site quality scores (0-100) based on mean of catch per unit effort (CPUE), % live, recruitment, tolerance.	X	X		80 - 100 Mean mussel site quality score	60 - 80	40 - 60 Mean mussel site quality score	20 - 40	0 - 20 Mean mussel site quality score	• MN DNR Statewide Mussel Survey (2016)
Animal Species Richness		Mean of: 1. Mean species count of breeding birds, ranked 0-100 2. Mean species counts of mussels, ranked 0-100 3. Mean fish species counts, ranked 0-100 4. Mean aquatic invertebrate species counts, ranked 0-100		X		80 - 100 Highest mean number of species present in a watershed	60 - 80	40 - 60 Median number of species present	20 - 40	0 - 20 Lowest mean number of species present in a watershed	• Breeding Bird Survey results (1995 -2008) • Mussel Survey Database (MN DNR, 1989-2008) • IBI Stream Survey database (MPCA 1996 -2006)
At-Risk Animal Species Richness		Mean of: 1. Mean count of SGCN breeding bird species 2. Mean species count of SGCN mussels, 3. Mean species count of SGCN fish (no aquatic invertebrates on SGCN list at this time.)		X		80 - 100 Highest number of SGCN species present	60 - 80	40 - 60 Moderate number of SGCN species present	20 - 40	0 - 20 Lowest number of SGCN species present.	• Listed Species of Greatest Conservation Need (MN DNR Wildlife Conservation Strategy 2006) • Breeding Bird survey results (1978-2008) • MN DNR Mussel Survey Database (1989-2008) • MPCA IBI Stream Survey database (1996 -2006)
Connectivity Component											
Terrestrial Habitat Connectivity		Area of potential connections between habitat patches weighted by the "permeability" of the land use between the patches based on computer modeling.		X		80 - 100 100 score - a large patch of continuous high quality habitat	60 - 80	40 - 60 The average amount and quality habitat with some connections	20 - 40	0 - 20 low quality isolated habitat.	• 2001 National Land Cover Dataset; • MN County Biological Survey - Areas of Biodiversity Significance; • Roads • National Agricultural Statistics Service (2007); • Terrestrial Habitat Quality Index results
Aquatic Connectivity		Density of dams, bridges and culverts per total miles of stream	X	X		80 - 100 Lowest density of structures disrupting aquatic connectivity	60 - 80	40 - 60 Moderate density of structures disrupting aquatic connectivity	20 - 40	0 - 20 Highest density of structures disrupting aquatic connectivity	• National Dam Inventory (COE, 2008) • MDOT Bridge and Culvert Inventory • 1:24,000 Streams (MN DNR, 2009)

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Riparian Connectivity		Amount of riparian area with development or agricultural cropland (within 200 meters of perennial streams and ditches or in FEMA Floodplain)	X	X		0 - 20% of riparian area in developed or agricultural land uses	20 - 40%	40 - 60% of riparian area in developed or agricultural land uses	60 - 80%	80 - 100% of riparian area in developed or agricultural land uses	• National Land Cover Data; Developed land classes (2001) • National Agricultural Statistics Service; Row Crop Classes (2007) • 200 M Buffer of 1:24,000 Streams (MN DNR, 2009) • Floodplain (Federal Emergency Management Agency, ongoing)
Geomorphology Component											
Soil Erosion Potential		Mean erodibility of soils weighted by slope (K value * slope factor)	X	X		80 - 100 Very few to no erodible soils	60 - 80	40 - 60 Much of watershed has erodible soils	20 - 40	0 - 20 Soils are highly erodible	• SSURGO Soils Database - K-factor (erodibility) • STATSGO Soils Database (Where SSURGO data is incomplete) • 10 Meter Digital Elevation Model (DEM)
Pollution Sensitivity of Near-Surface Materials		Area weighted average sensitivity to pollution infiltrating upper 10 feet of soil and surficial geologic layers.	X	X		80 - 100 Least vulnerable ranking	60 - 80	40 - 60 Moderate vulnerability ranking	20 - 40	0 - 20 Most vulnerable ranking	• MN Hydrogeology Atlas - Pollution Sensitivity of Near Surface Materials: HG-02 (Adams, R., MN DNR, 2016) http://www.dnr.state.mn.us/waters/programs/gw_section/mapping/platesum/mha_ps-ns.html
Climate Water Balance		Deviation from balance of precipitation and evapotranspiration; moisture excess/deficit.		X		80 - 100 0-1.5” annual deficit of excess in balance of precipitation & transpiration	60 - 80 1.5-3”	40 - 60 3-4.5” annual deficit or excess in balance of precipitation & transpiration	20 - 40 4.5-6”	0 - 20 6-7”annual deficit or excess in balance of precipitation & transpiration	• Precipitation - Evapotranspiration 30 year trend data (MN Climatology 1961-1990)
Water Quality											
Localized Pollution Sources		Mean of Metrics	X	X		80 - 100	60 - 80	40 - 60	20 - 40	0 - 20	
Localized Pollution Sources	**Animal Units**	Density of agricultural animals within the watershed. Index values based on linear scaling where the 95th percentile of catchment density was used as a 0 threshold (95th percentile = .75 AU/acre)	X			80 - 100 Lowest density of animal units	60 - 80	40 - 60 Moderate density of animal units	20 - 40	0 - 20 Highest density of animal units. 0 value index score >= 0.75 AU/acre	• MPCA - Permitted Feedlot database (2014) .https://www.pca.state.mn.us/quick-links/feedlots
	Potential Contaminants	Density of potential contaminants within watershed. Index values based on linear scaling where the 95th percentile of catchment density was used as a 0 threshold (95th percentile = 1.87 sites/sq km)	X			80 - 100 Lowest denisty of potential contaminants	60 - 80	40 - 60 Moderate density of potential contaminants	20 - 40	0 - 20 Highest density of potential contaminants. 0 value index score >= 1.87 sites/square km	• MPCA - Program sites (What's in my neighorhood) databse (2014).

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Localized Pollution Sources	**Superfund Sites**	Density of Superfund sites within watershed. Index values based on linear scaling where the 95th percentile of catchment density was used as a 0 threshold (95th percentile = 0.323 sites/sq km)	X			80 - 100 Lowest density of superfund sites. If any sites present max score = 90. Score of 100 = no sites present	60 - 80	40 - 60 Moderate density of superfund sites	20 - 40	0 - 20 Highest density of superfund sites. 0 value index score >= 0.323 sites/suare km	• MPCA - Program sites (2014).
	Wastewater Treatment Plants	Separate scores were calculated for Phosphorus, Nitrogen and BOD discharge yields. Scores based on linear scaling of loads using the 95th yield value. Final metric score calculated by averaging the individual effluent scores	X			80 - 100 Lowest relative yield of effluent entering surface waters from discharge permit sites	60 - 80	40 - 60 Moderate relative yield of effluent entering surface waters from discharge permits	20 - 40	0 - 20 Greatest relative yield of effluent entering surface waters from discharge permit sites	• MPCA - National Pollution Discharge Elimination System (NPDES) permit database, municipal and industrial wastewater treatmetn plant monitoring yields (2014).
	Open Pit Mines	Score based on percent of watershed surface area disturbed by open pit mine activities. Index scores based on linear scaling where 15% disturbance within a single watershed = 0 index value	X			80 - 100 Lowest level of disturbance from surface mining activities	60 - 80	40 - 60 Moderate level of disturbance from surface mining activities	20 - 40	0 - 20 Highest level of disturbance from surface mining activities. 0 value score >= 15% of watershed area disturbed	• MN DNR Lands and Minerals - areal extent of surface mine land disturbance (pits, tailings, basins) (2014).
	Septic Systems	Density of domestic wells per catchment. Domestic well used as proxy for a septic system (assume home not using municipal services). Index scores based on linear scaling where 95th percentile of catchement density used as 0 threshold (95th percentile = 15.59 domestic wells/sq km)	X			80 - 100 Lowest density of domestic wells/septic systems per catchment	60 - 80	40 - 60 Moderate density of domestic wells/septic systems per catchment	20 - 40	0 - 20 Highest density of domestic wells/septic systems per catchment. 0 value score >= 15.59 domestic wells/sq km	• Minnesota Geological Survey/Minnesota Department of Health - County Well Inventory (2014).
Non- Point Source Pollution		Combined value based on: 1. Percent of 200 m riparian area in impervious surface 2. rate of application of agricultural chemicals per acre		X		80 - 100 Least non-point source risk	60 - 80	40 - 60 Moderate non-point source risk	20 - 40	0 - 20 Highest non-point source risk	• Impervious Cover Satellite Data (Univ. of MN 2000) • National Agricultural Statistics Service, county chemical and nutrient application rates resampled to watershed boundaries (2007).
Non- Point Source Pollution	**Phosphorus Risk from Uplands**	Raster based landscape assessment of phosphorus delivery risk from uplands. Raster estimates potential risk by combining slope, k-factor, and land class based nutrient export values	X	X		80 - 100 Lowest risk of phosphorus delivery from uplands	60 - 80	40 - 60 Moderate risk of phosphorus delivery from uplands	20 - 40	0 - 20 Highest risk of phosphorus delivery from uplands	• SSURGO/STATSGO Soils database - K-factor (2016) • MN DNR - 03M DEM (LiDAR derived elevation) • USDA, NASS - Crop Data Layer (2015)
Assessments		Percentage of streams and lakes assessed that were found to be impaired. (Same water body may be assessed multiple times for different impairment types.)		X		0 - 20% of water body assessments found impairments	20 - 40%	40 - 60% of water body assessments found impairments	60 - 80%	80 - 100% of water body assessments found impairments	• MPCA - Water Quality Assessment Database (2014)

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Assessments	**Aquatic Life**	Percentage of streams and lakes assessed that were found to be impaired for the Aquatic Life designated use.	X	X		0 - 20% of water body assessments found impairments	20 - 40%	40 - 60% of water body assessments found impairments	60 - 80%	80 - 100% of water body assessments found impairments	• MPCA - Water Quality Assessment Database (2014)
	Aquatic Recreation	Percentage of streams and lakes assessed that were found to be impaired for the Aquatic Recreation designated use	X	X		0 - 20% of water body assessments found impairments	20 - 40%	40 - 60% of water body assessments found impairments	60 - 80%	80 - 100% of water body assessments found impairments	• MPCA - Water Quality Assessment Database (2014)
	Aquatic Consumption	Percentage of streams and lakes assessed that were found to be impaired for the Aquatic Consumption designated use	X	X		0 - 20% of water body assessments found impairments	20 - 40%	40 - 60% of water body assessments found impairments	60 - 80%	80 - 100% of water body assessments found impairments	• MPCA - Water Quality Assessment Database (2014)