Technical Memo

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To: MCWD Board of Managers

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Subject: E-Grade Development Update

The purpose of this memo is to provide an update on the development of the E-Grade program, focusing on deep and shallow lakes.

E-Grade and the Ecosystems Approach

In 2014 the MCWD Board of Managers adopted the policy "In Pursuit of a Balanced Urban Ecology in the Minnehaha Creek Watershed" that described the Minnehaha Creek Watershed as “part of an intricate urban ecological system of natural and man-made parts” and that “A healthy natural environment is in everyone’s best interest.” This policy will guide and inform future planning and programming in the watershed. But, what makes a healthy watershed? How do we define good lake quality? What actions should be taken to preserve the best of our resources, and improve those that can be better? How can we measure progress in protecting and improving this complex system?

There are many different ways of evaluating the health of water resources. A common approach is to select a few representative metrics and manage the resources and the surrounding watershed to those metrics. While these simple metrics can generally reflect conditions in the water resources and watershed, they do not adequately measure how the interconnected community of organisms and environment that is our watershed ecosystem actually works and responds to disturbance and management. To do this, we must look at the watershed through the lens of its ecosystem and ecosystem services.

An **ecosystem** is a dynamic complex of plant, animal, and microorganism communities and the nonliving environment interacting as a functional unit. Humans are an integral part of ecosystems. Ecosystems can vary greatly in size; a tidal pool and an ocean basin can both be ecosystems. **Ecosystem services** are the benefits people obtain from ecosystems. Ecosystems start with fundamental ecological processes and through interim and final ecosystem services lead to the outputs from which humans directly derive goods and benefits.

All of us are responsible for assuring those ecosystems services are protected and maintained to sustain the ecological health of our communities. The lakes, streams, wetlands, and groundwater that MCWD is charged to protect and improve are integral to that ecological health. E-Grade was developed to help us understand how well those waters are providing those ecosystem services and the steps the District and its partners can take to ensure those services continue to benefit future generations.

E-Grade is more than a report card. While it is a measure of watershed health and environmental change, it is also a tool to help identify and prioritize management policies and actions. Are we undertaking the right projects in the right places? An important component of E-Grade is the identification of potential stressors and their impacts as well as opportunities afforded by development, redevelopment, and partnerships. How will development in a subwatershed potentially impact the ecological conditions of nearby wetlands? How can redevelopment be tailored to mitigate the impacts of previous development on an adjacent stream?

E-Grade will also more effectively communicate the watershed's condition to the public and stakeholders. The Program will assess and report watershed health through the use of environmental indicators or metrics that will serve as the basis for project and program targeting and as the measures of environmental change.

Staff, the TAC, and Wenck have been working over the past year in fleshing out E-Grade and collecting data. In the process diagrammed in Figure 1, we have completed step one, and have completed step two for deep and shallow lakes, wetlands, and streams. We are in step three for deep and shallow lakes, and will be reviewing the available data and proposed breakpoints and grading with the TAC at its November 12, 2015 meeting. Once we have an agreement about the approach to establishing the breakpoints and scores, we will move on to wetlands and streams.

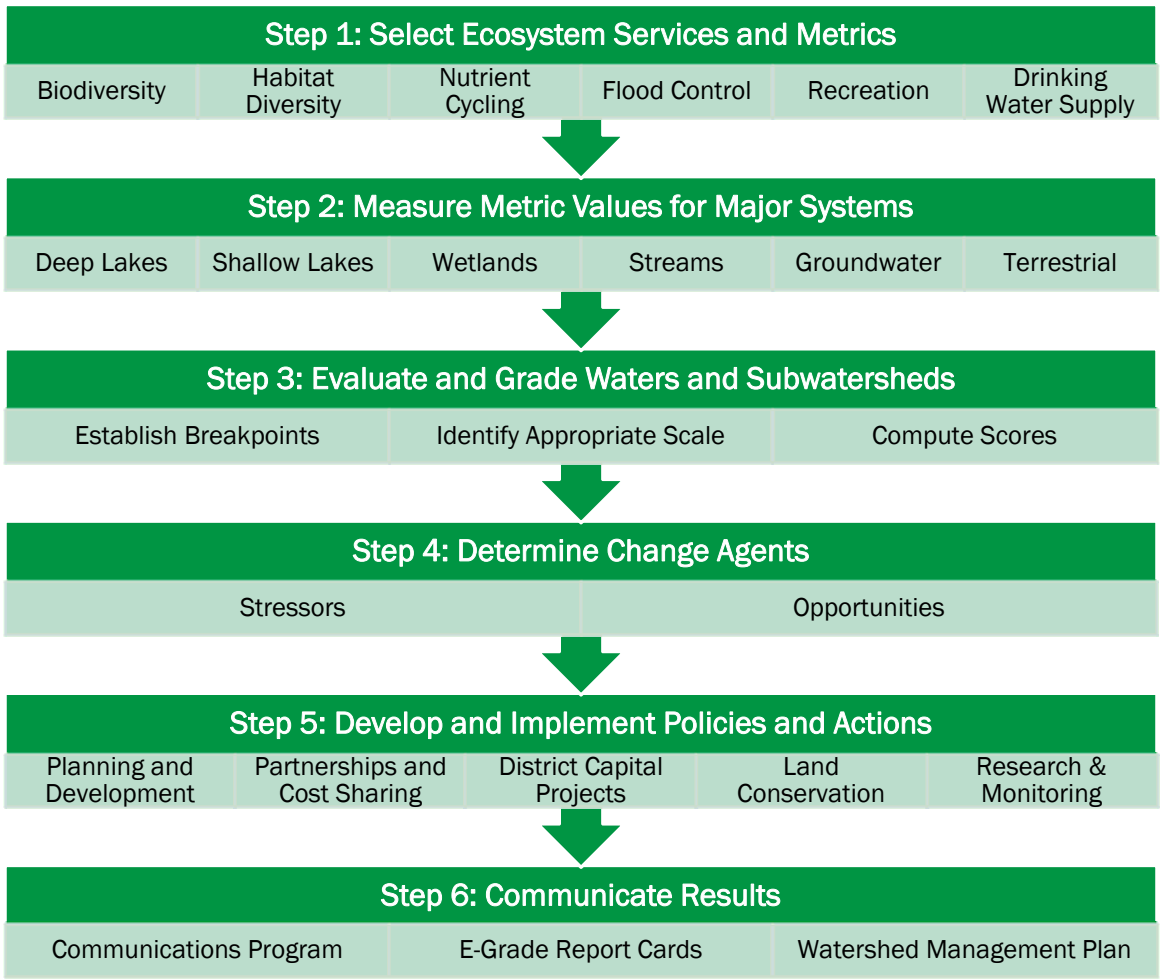

Figure 1. The E-Grade approach.

The Biodiversity Example for Lakes

While some of the ecosystem services are still in development until we obtain statewide datasets, the evaluation of biodiversity of lakes is the furthest along and presents a good example of how the evaluation and grading process will work.

The first step is to define biodiversity. Biodiversity can simply be defined as the variety and abundance of species within a community. An ecosystem which is species-rich and functionally diverse is more resilient and adaptable to stress and perturbations than one in which the range of species is limited. In a system where species are limited, the loss or temporary reduction of any one could disrupt a complex food chain with serious effects on other species in that same system. The ecosystem service value of biodiversity is that the more diverse an ecosystem, the more stable it is, the more productive it tends to be, and the better it is able to withstand environmental stress.

The ecosystem grade for biodiversity for lakes is proposed to be scored using two primary indices developed by the Minnesota DNR, including an Index of Biotic Integrity for fish and species richness and the Floristic Quality Index for submerged aquatic vegetation (Table 1). Because the background and mechanics of these tools can be complex, we are going to focus on the process of developing grades and not the background of these tools.

Table 1. Deep and shallow lakes indicators and metrics.

Ecosystem Service	Indicator	Tool/Metric
Biodiversity	Fish Community	Fish Index of Biotic Integrity (F-IBI) score
	Vegetation Community	Floristic Quality Index (FQI) score
		Plant richness

Vegetation Community

Since these tools are currently being developed by the DNR to support the TMDL program and identify impaired biological communities, the DNR has currently defined only three conditions: Exceptional, Impacted, and Impaired (Tables 2 and 3).

Table 2. Floristic Quality Index category scoring for deep and shallow lakes.

MnDNR Threshold FQI Scores			Narrative Description
Classification	Deep	Shallow	
Exceptional	>32.4	>30.9	High species diversity often comprised of native intolerant species
Impacted	18.7-32.3	17.8-30.9	Moderate species diversity and a mixed assemblage of tolerant and intolerant species
Impaired	<18.6	<17.8	Low species diversity with a community often comprised of non-native and/or intolerant species

Fish Community

Because lakes express a high level of variability, they were divided into groups for lakes that should have similar fish communities based on physical factors. In 1992, a DNR biologist, Dennis Schupp, statistically classified Minnesota's lakes into 44 distinct groups based on limnologic variables. The DNR has further grouped these into higher-level Lake Classification Groups (Table 3). The Fish Index of Biotic Integrity breakpoints for scoring and determining impairment status vary based on DNR Lake Classification Group (Table 4).

Table 3. DNR Lake Classification Group (LCG) descriptions.

Lake Classification Group	Schupp's Lake Class	Lake Classification Group Description
Group 2	22, 23, 24, 25, 27	Generally, deep lakes with high shoreline complexity (SDI) that are typically less than 80% littoral.
Group 4	28, 29, 30, 31, 32	Compared to LCG 2 these lakes on average are smaller, have intermediate littoral area, have less shoreline complexity (typically rounder basins). They also typically have a low trophic status, low phosphorus levels, and clearer water compared to LCG2.
Group 5	33, 34, 35, 36, 37, 39	Central and Northern MN lakes of shallow to moderate depths (mostly littoral). Generally, naturally eutrophic lakes with lots of vegetation and soft sediment.
Group 7	38, 41, 42, 43	Shallowest lakes typically consisting of > 80% littoral area. Primarily in the southern half of the state. Excludes winterkill lakes (w/in 10 years) and riverine lakes

Table 4. MnDNR Fish IBI category scoring by Lake Class Group.

MnDNR Threshold IBI Scores				
Classification	**Group 2**	**Group 4**	**Group 5**	**Group 7**
Exceptional	>64	>59	>61	>54
Impacted	45-64	38-59	24-61	36-54
Impaired	≤45	≤38	≤24	≤36

Since it may be useful for management purposes to understand which lakes may be considered Impaired, but are not the absolute worst, we propose subdividing the Impaired classification into an Impaired category and a Degraded category. Impaired lakes do not meet state standards, but with a little work, could be improved to meet that standard. Degraded lakes show severe stress and may take substantial effort to make any improvement.

While we do not have the statewide plant database yet from the DNR, we do have it for the fish scores. We used this database to develop this additional category for the lake fish communities (Table 5).

Table 5. MnDNR Fish IBI category score ranges with an added category.
Note: Lake Class Group 4, 5 and 7 follow MnDNR breakpoints only.

MnDNR Threshold IBI Scores					
Classification	Group 2	Group 4	Group 5	Group 7	Narrative Description
Exceptional	>64	>59	>61	>54	Community structure and species composition are near reference conditions. The most relatively pristine communities.
Impacted	45-64	38-59	24-61	36-54	The community is beginning to show signs of anthropogenic disturbance.
Impaired	35-45	≤38	≤24	≤36	The community shows obvious signs of anthropogenic disturbance.
Degraded	≤35	N/A	N/A.	N/A	In comparison to other lakes of the same LCG, this community is among the most disturbed.

The categorization and breakpoints will be discussed by the TAC at the November 12, 2015 meeting. The breakpoints shown above may change as the grading system is further developed. Using the draft breakpoint tables above, the potential condition scores of the studied lakes in the target subwatersheds are shown in Table 6.

Table 6. Scoring and condition of fish and vegetation communities.

Lake	Lake Group	Fish IBI Score	Fish Condition	Lake Morphometry	Vegetation Species Richness	FQI Score	Vegetation Condition
Schutz	2	22.8	Degraded	Deep	5	9.4	Impaired
Zumbra	2	44.5	Impaired	Deep	13	19.1	Impacted
Parley	7	52.5	Impacted	Shallow	3	6.9	Impaired
West Auburn	2	20.3	Degraded	Deep	11	16.0	Impaired
East Auburn	2	20.3	Degraded	Deep	5	11.2	Impaired
Steiger	2	28.9	Degraded	Deep	11	18.4	Impaired
Wassermann	2	37.3	Impaired	Deep	6	11.4	Impaired
Piersons	2	44.8	Impaired	Deep	21	26.8	Impacted
Harriet	2	42.2	Impaired	Deep	11	15.7	Impaired
Nokomis	2	42.8	Impaired	Deep	10	15.5	Impaired
Calhoun	2	41.9	Impaired	Deep	16	22.0	Impacted
Cedar	2	48	Impacted	Deep	20	25.5	Impacted
Lake of the Isles	7	40.9	Impaired	Deep	13	17.5	Impaired

Developing the Lake Grade

This scaling and grading process will be completed for all six ecosystem services, and the resulting grades used to establish an overall grade for the lake. As an example of what the final output might be, hypothetical grades for two lakes are shown in Tables 7 and 8. Note that as we continue with this process we will be working with the Communications Department to develop the grading nomenclature, such as letter grades, numbers, stars, etc. that will be used instead of Impaired, Degraded, etc.

Table 7. Hypothetical grade for fictional Green Lake.

Ecosystem Service	Grade	Description	Management Actions
Biodiversity	Impaired	The biodiversity of the fish community is impaired because of limited number of plant species, high levels of intolerant and nonnative fish	Improve water quality by implementing WQ and volume reduction BMPs in the lakeshed
Habitat Diversity	Impaired	Habitat is limited by low species diversity and highly developed shorelines	Naturalize shoreline where possible, management of invasive aquatic vegetation
Nutrient Cycling	Degraded	Total phosphorus is high leading to frequent algae blooms	Improve water quality by implementing WQ and volume reduction BMPs in the lakeshed
Flood Control	Supporting	The lake provides flood control through a controlled outlet	Promote volume management in the lakeshed
Recreation	Degraded	The plant community is dominated by invasive species that impede navigation and swimming	Management of invasive aquatic vegetation
Drinking Water Supply	Supporting	Connections to the groundwater support aquifer recharge	No specific actions
Overall Grade	Impaired		Seek partnership projects, do aquatic vegetation management, increase education and awareness

Table 8. Hypothetical grade for fictional Blue Lake.

Ecosystem Service	Grade	Description	Management Actions
Biodiversity	Exceptional	The lake demonstrates high species richness the plant community and is dominated by intolerant native fish species	Protect water quality by requiring reductions in or no increase in TP, TSS, volume to the lake
Habitat Diversity	Supporting	While some development is limiting shoreline habitat, plant diversity is supporting both water fowl and fish habitat	Limit vegetation removal on naturalized shorelines, spot treat any invasive vegetation to prevent spread
Nutrient Cycling	Supporting	Total phosphorus concentrations are below state standards and the lake is able to assimilate the phosphorus	Protect water quality by requiring reductions in or no increase in TP, TSS, volume to the lake
Flood Control	Impaired	Some flooding issues exist downstream and the lake could provide some flood protection	Implement volume reduction BMPs in the lakeshed
Recreation	Exceptional	The plant community is of moderate density and does not break the surface except in areas less than 2 feet in depth	Spot treat any invasive vegetation to prevent spread
Drinking Water Supply	Supporting	Connections to the groundwater support aquifer recharge	No specific actions
Overall Grade	Exceptional		Protection – regulations, voluntary BMPs

Next Steps

Referring back to Figure 1, once the breakpoints and grading systems are established and scored, we will move on to step 4, Determine Change Agents, which includes both potential stressors and opportunities.

We will also begin discussions on how to roll the individual water features up into a subwatershed grade as well as how the upland, groundwater, and hydrology systems will be scored and incorporated into the subwatershed grade.