Technical Memo

WENCK ASSOCIATES

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Subject: Status Report of E-Grade Project

This memo is a status report of work being undertaken for the Minnehaha Creek Watershed District Ecosystem Evaluation Program (E-Grade) project.

Since the last Technical Advisory Committee meeting, Wenck has been working through the literature and consulting with specialists in each field to preliminarily identify potential metrics for each ecosystem service provided by streams, wetlands, and deep and shallow lakes. The sections below discuss

- the Technical Memoranda: the research and results of that research;
- provide an overview of the preliminary metrics identified for each system;
- and next steps and schedule.

Technical Memos

We are in the process of drafting technical memoranda for the three systems (deep and shallow lakes, streams, and wetlands), combining deep and shallow lakes into one memorandum although the scoring systems will be different. We are also weighing whether the issue of scale merits a separate memo or would best be discussed in the context of each system. For example, when considering wetlands, E-Grade will assess individual wetlands, and then there are questions regarding wetlands in the watershed context: are there enough wetlands, are they the right mix of types, and are they in the locations most beneficial to providing the desired ecosystems services?

The technical memoranda will include the following sections:

- *Introduction and Background*
  - A brief overview of the program.
- *Ecosystem Services*
  - A description of the key ecosystem services provided by each feature
- *Metrics.*
  - This section is a description of the proposed metrics for each service. Some services may be assessed using multiple metrics, and certain metrics may be used to assess multiple services.
- *Example Calculations*
  - Existing data or, where data is not yet available, literature data will be used to demonstrate how each metric will be scored.

- *Benchmarking*
    - This section will describe how the metrics will be used to score the resources of concern.
- *Monitoring Needs*
    - This section is a discussion of the adequacy of existing data, sources or additional data, and potential modifications to the Research and Monitoring Department's Water Quality Monitoring Program that might be necessary to collect the essential data for all subwatersheds on a rotating and ongoing basis.
- *References*
    - This section will be an annotated bibliography of reference materials reviewed and used in the development of the E-Grade.

Preliminary Metrics

Lakes: Wenck is working on a number of metrics to determine their applicability and appropriateness for developing the ecosystem grade for deep and shallow lakes in the Minnehaha Creek Watershed District. Table 1 outlines the previously defined ecosystem services for deep and shallow lakes in the watershed. The tables are organized by each ecosystem function to be evaluated, the functions critical to providing those services, the metrics or indicators of health proposed to be utilized, and the status of the evaluation.

For nutrient cycling, two primary indicators were identified including water quality and zooplankton. Water quality will include eutrophication parameters and utilize studies completed by the MPCA for the lake standard evaluation as well as regional lake assessments. A zooplankton and sediment chemistry index is under evaluation.

For biodiversity, two primary indices were identified including the MNDNR's fish IBI and Submersed Plant Floristic Quality Index. Both of these indices are under development, so literature is not readily available to outline methodologies. Therefore, we are currently working with MNDNR staff to evaluate applicability to the E-Grade program. However, it appears both are good approaches for the program. A third parameter for consideration is the presence or absence of zebra mussels. Since there doesn't appear to be a good way to determine how the zebra mussels will impact the lakes, it appears a simple presence or absence is appropriate. We are investigating this further. Other invasive species are still under consideration or may be included in other indices. For example, Curly-leaf pondweed will affect the metrics in the Floristic Quality Index and is therefore included in the assessment.

The habitat diversity service still needs some evaluation into metrics which should be complete in February. The floristic quality index will likely provide the most information about habitat with the assumption that a high quality vegetation community will provide high quality habitat. We are working with the Minnesota DNR to determine if this can be further detailed. We are still evaluating shoreline condition, connectivity to other lakes, and habitat fragmentation.

Finally, we are evaluating recreational uses of the lake through the presence or absence of public access and water quality. These areas are still in development.

Table 1. Functions and potential metrics for deep lakes for the MCWD Ecosystem Evaluation Program.

Ecosystem Service	Functions	Indicators/Metrics	Status
Flood Control	Watershed storage	TBD – Hydrology (2016-2017)	Lakes provide flood storage in watersheds, especially when they have controlled outlets. However, the role of a lake in overall flood storage will be evaluated under the Hydrology ecosystem service evaluation.
Nutrient Cycling	Nutrient sink, source, transformer	Water quality parameters (total phosphorus, chlorophyll-a, TSS (shallow lakes only) and Secchi depth	Lakes play a critical role in nutrient cycling in a watershed, typically acting as sinks for nutrients. Furthermore, the ecological health of the lake can be evaluated based on the standard eutrophication parameters of total phosphorus, chlorophyll-a, and Secchi depth. A significant amount of scientific evaluation of these parameters was completed as a part of the development of nutrient standards for lakes in Minnesota (MPCA 2007). These parameters will be used for evaluating the eutrophication health of the lakes; however actual break points will likely be based on state- or region-wide lake conditions. The scale is currently under development.
		Zooplankton (shallow lakes only)	Zooplankton, especially large Cladocera, can play a significant role in maintain water clarity in shallow lakes. We are currently investigating the use of zooplankton as an indicator of lake health.
		Sediment chemistry	This metric is still under evaluation.
Biodiversity	Resilient biological community	Fish IBI	Indices of Biological Integrity (IBIs) are currently in development for Minnesota lakes by the Minnesota DNR based on previous work (Drake and Pereira 2002; Drake and Valley 2005) conducted by DNR staff. The MNDNR is currently adapting this approach for lake assessment and is applying the indices by lake class (Schupp 1992). We are currently working with Jacquelyn Bacigalupi to develop these scores for lakes in the test subwatershed. However scoring and metrics currently need to be completed by MNDNR. We are currently working with DNR to develop scores for lakes in the test subwatershed.
		Floristic Quality Index	Several plant multimetric indices have been developed for inland wetlands (Wilcox et al.,2002; Miller at al., 2006; Rothrock et al.,2008). Nichols et al. (2000) proposed a multimetric index for Wisconsin lake macrophyte communities based on metrics such as maximum depth of plant growth, percent littoral area vegetated, diversity, taxa richness and relative frequencies of sensitive species. Based on identified shortcomings in these approaches, Radomski and Perleberg (2012) developed an aquatic macrophyte integrity index for Minnesota lakes.

Ecosystem Service	Functions	Indicators/Metrics	Status
			We are currently working with Paul Radomski and Donna Perleberg to apply their index to lakes in the test subwatersheds and evaluate their usefulness in assessing the ecological health of the lakes.
		Zebra mussel presence or absence	Zebra mussels can alter the ecological condition of lake ecosystems by altering the food web. However, quantifying these impacts and determining if the zebra mussel infestation will reach sufficient densities to affect the food web is difficult. We are currently further investigating indices for determining zebra mussel impacts. It may be that the metric will be simply a presence or absence notation until the potential impacts are better understood.
Habitat Diversity	Fish, macroinvertebrate, and wildlife habitat	Floristic Quality Index	See above. It is assumed that a high quality vegetation community in the lake littoral zone results in high quality fish habitat. Furthermore, lake fringe wetlands are included in the wetland evaluation for habitat services.
		Shoreline Development Index	This metric is still under evaluation.
		Connectivity (# of culverts, dams, etc.)	This metric is still under evaluation.
		Fragmentation	This metric is still under evaluation.
Public Recreation	Access	Public access	The presence or absence of public access (boat ramp, fishing pier, marinas, swimming beach) is a good indicator of providing recreational services.
	Water Quality	Eutrophication and bacteria	See Nutrient cycling above.
Drinking Water Supply	Ground-water recharge	TBD – Groundwater Lake level trends Monitoring well elevations (2016-2017)	Lakes may provide significant groundwater recharge to regional aquifers. However, this will be further evaluated under the groundwater ecosystem services assessment.

S*treams*. Wenck has identified several potential metrics to be considered in developing the ecosystem grade for streams. Table 2 outlines the previously defined ecosystem services for streams in the watershed.

For nutrient cycling, the primary indicator is expected to be water quality. Water quality is implicit in the Macroinvertebrate and Fish Indices of Biotic Integrity, and still being explored is whether other indicators of water quality should be considered and which would be most appropriate.

For biodiversity, the two primary indices will be the Macroinvertebrate Index of Biotic Integrity (M-IBI) and the Fish Index of Biotic Integrity (F-IBI). Both of these indices are well-established and are benchmarked to the ecoregion. These data are available at multiple locations in the subwatersheds of focus in the first phase of E-Grade.

The Minnesota Stream Habitat Assessment (MSHA) is proposed as one component of assessing habitat diversity services. This has the advantage of being a standardized assessment tool that is widely in use across the state. This tool evaluates the physical characteristics of the stream and various forms of habitat. We are still investigating whether it would be valuable to bring into this metric an assessment of stream stability to gauge whether a stream's existing habitat has the potential to be destabilized or degraded, or if issues of stability have already impacted habitat. Some potential metrics include fluvial geomorphic assessments, or simpler methods such as Rosgen's Bank Erosion Hazard Index or Pfankuch's Channel Stability Assessment.

Finally, we are evaluating recreational uses of streams through the presence or absence of public access to the water through a boat or canoe access, and/or access to the stream vicinity such as the presence or absence of a trail for viewing. These areas as well as some measures of aesthetics are still in development.

Table 2. Functions and potential metrics for streams for the MCWD Ecosystem Evaluation Program.

Ecosystem Service	Functions	Indicators/Metrics	Status
Flood Control	Conveyance	TBD - Hydrology (2016-2017)	Some of the questions raised during this phase that will be explored in later discussions of hydrology include maintenance of biological base flow; flow regime-ecological response relationships considering a recent area of hydrologic and flow studies called ELOHA - Ecological Limits of Hydrologic Alteration; and research done assessing the relationship between acres of wetland in subwatersheds and flow conditions in the subwatershed's streams.
Nutrient Cycling	Nutrient sink, source, transformer	Water quality parameters	Water quality is implicit in the M-IBI and F-IBI in the various metrics related to species tolerance and community composition. Other aspects of water quality are still under evaluation.
Biodiversity	Resilient biological community Recreational use (hunting and fishing)	Macroinvertebrate IBI Fish IBI	These metrics are well-established and supported by MPCA and DNR research and benchmarked to the ecoregion and will be a primary component of the overall stream health score.
Habitat Diversity	Fish, macroinvertebrate, and wildlife habitat	Minnesota Stream Habitat Assessment (MSHA) Fluvial geomorphology assessments	The MSHA is a well-established metric that is benchmarked both to the ecoregion and statewide. We are still investigating whether it would be valuable to bring into the metrics stream stability as measured in the fluvial geomorphology assessments or another metric such as Rosgen's Bank Erosion Hazard Index (BEHI).
Recreation	Access	Public Access Hydrology	Access would be measured by presence/absence of a public access. Still under discussion is whether hydrology and the maintenance of base flow for canoeing and kayaking would be valuable for this measure.
	Aesthetics	Stream Visual Assessment	This metric is under development. Some aspects of aesthetics might be access for viewing such as the presence/absence of public property or trails for viewing, or the condition of streambanks or buffers.
Drinking Water Supply	Groundwater recharge	TBD - Groundwater (2016-2017)	This metric is still under development.

Wetlands. Wenck has identified several potential metrics to be considered in developing the ecosystem grade for wetlands. Table 3 outlines the previously defined ecosystem services for wetlands in the watershed.

Most of the focus is on the data already available in MCRAM and MPCA's Floristic Quality Assessment. Wenck is also reviewing The Nature Conversancy's wetland evaluation tool applied in Wisconsin. The wetland metrics in MCRAM are mixed between stressors and ecosystem services, so Wenck is trying to tease out the appropriate measures, simplify the metrics and incorporate the floristic quality index.

Wenck is also investigating biogeochemical indicators of nutrient cycling, however the science on this topic appears young. The EPA is currently working on developing wetland soil indicators, however, they appear to still be working on the concept.

Table 3. Functions and potential metrics for wetlands for the MCWD Ecosystem Evaluation Program.

Ecosystem Service	Functions	Indicators/Metrics	Status
Flood Control	Watershed storage	TBD – Hydrology (2016-2017)	To be determined during hydrology investigation.
Nutrient Cycling	Nutrient sink, source, transformer	Sediment chemistry	Most of the literature reviewed to date links vegetative quality to water quality in wetland systems (Craft et al. 2006). However, EPA is currently working on indicators of wetland function based on soils and water quality data. Wenck is currently researching these efforts to determine their applicability to the E-Grade project.
Drinking Water Supply	Groundwater recharge	TBD - Groundwater (2016-2017)	To be determined during groundwater investigation.
Biodiversity	Resilient biological community	Vegetative diversity (FQA)	Wenck is proposing the use of Minnehaha Creek's wetland Routine Assessment Method (MCRAM) with MPCA's Floristic Quality Assessment (Milburn et al. 2007) to determine the floristic health of the wetland.
Habitat diversity	Vegetative diversity	Vegetation diversity/quality (FQA)	See vegetative diversity above. The assumption here is that good vegetative diversity will result in good habitat diversity. This assumption is being further explored.
	Fish, macroinvertebrate and wildlife habitat	Connectivity	The connectivity of the wetlands will be measured using GIS and data from MCRAM. Measurement parameters are currently under investigation.
		Size	The size of the wetland can be a major factor in determining the wetlands ability to provide habitat. A scaling metric using GIS and MCRAM is in development to grade this component.

Status

Future Steps.

- We are working with the DNR and MPCA on the application of these indices listed below. We hope to have the details worked out with the agencies over the next month.
    - The application of the fish IBI and submersed vegetation IBI in lakes;
    - Applying MCRAM and Floristic Quality Assessments in wetlands;
    - Applying IBIs and habitat assessments in streams.

- We will also be focusing on finalizing the metrics for the other services to bring to the TAC for discussion. Our intention is to bring this information to the TAC for review in March and April.

Schedule.

- At our current pace, it is likely that lakes will be completed on schedule and streams and wetlands will be completed ahead of schedule.
    - While we hoped to have the metrics for lakes worked out by the end of 2014, there is still some work to do to finalize the metrics.
    - We are also ahead of schedule on streams and wetland, which are not scheduled to be completed until summer of 2016.
    - We already have held meetings for wetlands and streams, which were not originally scheduled until spring 2015.

Ecosystem Evaluation Program Communication Plan

2/9/15 - DRAFT

Purpose Statement

The MCWD's current lake grading system which is based on three factors – phosphorus, chlorophyll and clarity – only gives us a partial snapshot of a lake's health. It does not consider the various functions of a water body, such as flood control and habitat, which are indicators of a healthy ecosystem. Also, the current system only assesses lakes and does not differentiate between deep and shallow lakes which have very different characteristics and functions.

To promote greater understanding of the overall health of the lakes, streams and wetlands in the watershed, MCWD is embarking on an Ecosystem Evaluation Program (E-Grade).

Under this new program, which is still under development, waterbodies and other ecological features in the District will be evaluated for their performance of the following functions:

- Flood control
- Nutrient cycling
- Biodiversity
- Habitat diversity
- Recreation
- Drinking water supply

MCWD will initially assess four categories of waterbodies:

- Deep lakes
- Shallow lakes
- Streams
- Wetlands

Three more ecological features will be added in the future: Land use, groundwater and hydrology. MCWD will use a graded scale to assess the waterbodies and other ecological features that will result in a comprehensive report card about the overall health of the ecosystem. The data will allow the District to better identify high-need areas for improvement or protection, and focus its management strategies in these areas. It will also help the public understand the various factors that impact the health of a water body or ecological feature.

Program Timeline

In 2014 the District began collecting the additional data required for the new E-grade program in three subwatersheds: Lower Minnehaha Creek, Schutz Lake and Six Mile Marsh. Detailed reports on the health of these subwatersheds based on this data will be released by the fall of 2017 along with a peer-reviewed paper to be published in a scientific journal. The eight

remaining subwatersheds in the District will be evaluated and graded on a three-year rotation, with the next reports to be released in 2019 and 2022.

2014 - June 2016:	Development of 1st Set of Ecological Features
2016 - 2017:	Development of 2nd Set of Ecological Features
Fall 2017:	Release of Subwatershed E-Grade Reports – Group 1
Late Fall 2017:	Local Subwatershed meetings
2016 - 2019:	Data Collection
Fall 2019:	Release of Subwatershed E-Grade Reports – Group 2
Late Fall 2019:	Local subwatershed meetings
2019 - 2021:	Data Collection
Fall 2022:	Release of Subwatershed E-Grade Reports – Group 3
Late Fall 2022:	Local Subwatershed meetings
Spring 2023:	Release of 1st Watershed E-Grade Report
Late Spring 2023:	State of Watershed Open House

Subwatersheds Group 1	Subwatersheds Group 2	Subwatersheds Group 3
Lower Minnehaha Creek Schutz Lake Six Mile Marsh	Dutch Lake Gleason Lake Langdon Lake Long Lake Creek Painter Creek Upper Minnehaha Creek	Christmas Lake Lake Minnetonka Lake Virginia

Goals

1. Increase awareness and understanding of the new grading system and its performance measures
2. Increase understanding of how the new grading system will help the District better target its water quality improvement projects and programs in the District's comprehensive water resources management plan
3. Increase awareness of the timeline for phasing in the new system
4. Increase awareness of how the public can help improve the health of an ecosystem

Desired Outcomes

1. Increased support among District stakeholders for the Ecosystem Evaluation Program
2. Increased understanding and awareness of the many features and services that comprise a healthy ecosystem
3. Increased credibility of the District and its methods among its stakeholders

4. Enact behavior changes among community members that help address issues specific to a water body

Target Audiences

- Lake and stream associations within MCWD
- Property owners within MCWD
- Interested residents within MCWD
- Business community (e.g. marinas, realtors)
- Partner agencies (e.g., TRPD, MRPB, LMCD)
- Elected city and county officials and staff
- State agencies (e.g., MPCA, BWSR, DNR)
- Internal stakeholders (staff, Board, CAC)
- Scientific and academic community
- Local watershed districts

Messages

1. New evaluation program results in a holistic assessment of the health of an entire ecosystem
    a. Current lake grades only evaluate water clarity and give a narrow view of a water body's health
    b. New program will consider six ecosystem functions – flood control, nutrient cycling, biodiversity, habitat diversity, recreation, and drinking water – resulting in a more comprehensive evaluation
2. Additional data will help District target its resources in high need areas
    a. Data will be used to inform the direction and scope of MCWD's 2017 Comprehensive Water Resources Management Plan update
    b. Data will help District be more effective in its water quality improvement efforts
3. New program will rotate among subwatersheds for maximum efficiency
    a. District will use existing staff to examine all of the District's subwatersheds on a ten year cycle, covering a group of subwatersheds every three years
    b. The District will continue to regularly monitor all water bodies in the District for standard parameters (water quality, phosphorus, chlorophyll) through the first 10-year cycle
    c. The full watershed will be graded every 10 years, recognizing the protracted rate of lake grade fluctuations
4. New program ensures scientifically sound data to inform District decisions
    a. The program was developed in conjunction with a variety of agencies and technical experts
    b. District plans to publish two peer-reviewed papers in scientific journals

Outreach Timeline

- February/March 2015 – Introduction
  - 1-page brochure (distributed at comp plan kickoff meeting)
  - Informational web page
  - President's/Manager's columns to local newspapers
- Spring/Summer 2015 – Rollout of details to stakeholders
  - Incorporate E-grade messaging into comp plan communications with committees, etc.
  - Send letters with 1-page brochure to stakeholder list
  - Presentations to target audiences
    - City Council meetings
    - Lake and stream association meetings
    - Partner agencies (e.g. TRPD, MPRB, LMCD)
    - MAWD, BWSR Academy, U of M Water Resources Conference
    - Watershed Partners
  - Meetings with stakeholders (e.g. marina operators, realtors)
- Fall 2017, 2019, 2022 – Release subwatershed report
  - News release
  - Local subwatershed meetings
  - One-page summary for each subwatershed posted on website and distributed to target audiences
  - Incorporate data into interactive map on website
  - Placed news stories, columns in local newspapers
  - Local city/neighborhood newsletter submissions
- After each 10-year cycle
  - Distribute professionally produced booklet on the state of the watershed
    - Post on website
    - Mailings to target audiences
    - Digital distribution via Splash
    - Promote on social media
  - State of the Watershed Open House event
  - Full suite of outreach tactics including
    - News release
    - News conference
    - Placed news stories, columns in local papers
    - Articles in local magazines (e.g. Lake Minnetonka Magazine)
    - Articles for City, Lake, Stream and Neighborhood Association newsletters