Volume V

Watershed Issues Integration

District-Wide Recommendations

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A. District-Wide Recommendations

A.1. Introduction

There are many issues facing the MCWD that transcend subwatershed-scale and reach across the entire District. Discussions with the nine Regional Teams, local officials, citizens, and District staff have identified many of these issues. Other issues have arisen from technical findings. After nearly two and one half years of of gathering and evaluating data and constructing the water quality and quantity model, project staff have a unique perspective on many additional technical issues.

Each issue area includes a discussion of the issue and a recommendation to the MCWD on how to address it. Discussion of these issues is often also included in *Volume IV: Watershed Modeling and Discussion* in order to identify the breadth of the issue. The following is a compilation of major issues and recommendations that are most appropriately addressed on a District-wide scale.

A.2. Issue Identification and Recommendations

A.2.a. Lake Minnetonka

<u>Lake Minnetonka – Water Quality/Hydrologic Monitoring</u>

Much of the watershed monitoring needs identified by EOR based on results of the HHPLS (see Appendix: Nov. 21, 2002 memo to Hafner) have been implemented by the District through the authorization of five additional monitoring stations. Additional data collection should be focused on the direct drainage and minor drainage areas to the lake, since together these represent about 18,500 acres of land draining to the lake. Identification of runoff monitoring sites should become an integral part of the District's overall monitoring program, with watershed-wide coverage occurring as a result of rotating stations based on priority loading and representative site selection. Evaluation of the success of these stations in filling the need should occur after at least two years of monitoring is complete.

Recommendation: Additional water quality monitoring stations should be established for minor watersheds outletting to Lake Minnetonka. In particular, monitoring should be expanded to some of the Minor Watersheds that encompass lake/stream systems such as Classen Creek.

<u>Lake Minnetonka – Internal Loading and Intra-Lake Circulation</u>

Internal loading and intra-lake circulation data needs have not been adequately addressed. Some attention is being paid to internal load reduction on Jennings Bay through the *Jennings Bay Feasibility Study* funded by the District for 2003. However, the relationship of Jennings Bay internal load dynamics to the other bays has not been determined, and a need continues for additional data from other locations around the lake. The need for intra-lake circulation knowledge is paramount, since the movement of water from the upper portion of the lake to the outlet at Grays Bay seems to be a key factor in lake quality determination. For bays experiencing poor water quality (e.g., Jennings, Halsteds), water quality inputs including tributaries and direct runoff from the contributing watershed have been modeled. Outputs out of these bays, however, are poorly understood. The BATHTUB computer model, or a similar model, can be used as a tool to help define this critical behavior.

Recommendation - The District should begin a long-term effort to integrate data collection on watershed loading, internal Lake Minnetonka loading and in-lake circulation for development of a whole-lake model.

Lake Minnetonka – Comprehensive Lake-Wide Model

There are several bays (for example Crystal, Wayzata, and Spring Park) in Lake Minnetonka that are of exceptional quality. The preservation of these bays was identified as a high priority by many study participants. Similarly, there are at least two bays (Jennings and Halsteds) with very poor water quality. The range of water quality conditions within bays of Lake Minnetonka is governed by a number of different factors, including basin morphometry, watershed input, internal loading, and intra-lake circulation. A lake-wide model would take the guesswork out of defining the true source of phosphorus and help to better target Lake Minnetonka Management efforts.

Recommendation - A comprehensive lake wide model should be completed for Lake Minnetonka

Lake Minnetonka - Water Level Fluctuations

Users of the lake and residents around Lake Minnetonka stressed the importance of maintaining lake levels at an elevation that allows for recreational uses, yet is not so high as to trigger "no-wake" restrictions. The Dam Operation Plan mandates how the outlet control at Grays Bay will be operated to maintain lake levels up to the OHW. In contrast to lake residents, residents of the lower creek prefer a continual release of water from the lake, no matter what the lake level conditions are.

A minimum release of water would assure a continual Minnehaha Creek flow that would result in better water quality and improved biological conditions. Stagnant areas with low dissolved oxygen could be reduced with a continual flow of water. Minimum releases would mean, however, that a change in the current operating procedure for the dam would be needed, since low flow releases do not currently occur when the lake's water level falls below the historic outflow elevation. A low flow release could make up for the historic shallow groundwater seepage that has been lost because of development.

Alteration of the dam operation could also occur on the high flow end, with more water held back from Minnehaha Creek during high water periods. This end of the operation change would result in decreased peaks and flashiness, even though a similar volume might ultimately be released.

A re-evaluation of the Grays Bay operating plan could include input from the HHPLS model results on changing watershed hydrology for both the upper and lower watershed. That is, it could assess the long-term hydrologic changes likely to result as development proceeds. Increased development usually means more runoff, less infiltration and shallow groundwater flow, and flashier runoff conditions. The HHPLS model could be used to determine how these changes will affect water moving into and potentially out of the lake under varying conditions, as well as downstream implications, such as flooding potential and improved operation of the Lake Nokomis flexible weir under variable flow conditions. It could also answer such questions as time of travel from Grays Bay to the Mississippi River under differing flow scenarios and the effects of multiple high flow events (multiple peaks, higher volumes, timing, and event separation). See the "pulse" graph in *Volume IV, Section L.3.c. Special Subwatershed Issues* for more information.

Finally, maintenance of the Grays Bay structure has been raised as an issue. It is difficult to obtain accurate flow measurements over the dam due to frequent clogging and timing of cleaning. During the flow model calibration procedure, it was found that for a particular lake elevation, there could be discrepancy of up to 50% due to restriction caused by debris. Proper maintenance of the structure is essential, and would be even more important in assuring reliability if the operation changed to allow a minimum flow release. See *Volume IV, Section J.6 Lake Minnetonka Direct Drainage, Recommendations* for more information regarding debris clogging at the dam.

Recommendation - The Grays Bay dam operating plan should be amended, if possible, to minimize water level fluctuations and improve the in-stream flow regime of Minnehaha Creek. Key Elements of this assessment include:

1. *Using XPSWMM Model, complete water balance analysis of Lake Minnetonka Basin for dry, wet and normal precipitation year conditions.*

2. *Check/reset rating curve (stage-discharge) for Grays Bay Dam*

3. *Evaluate low flow maintenance options for Minnehaha Creek below Grays Bay Dam.*

4. *Evaluate role that upstream storage plays in attenuating lake level bounce.*

<u>Lake Minnetonka - Eurasian Watermilfoil</u>

The occurrence of dense stands of Eurasian Watermilfoil (milfoil) in Lake Minnetonka was identified by many as a major problem on the lake. Efforts to control this nuisance aquatic plant were found to be under way in the watershed by the Lake Minnetonka Conservation District (LMCD), the Lake Minnetonka Association (LMA) and the Three Rivers Park District (TRPD). Since there is so much on-going effort to address this problem, members of the Regional Teams addressing this issue suggested that the District's role should be one of secondary support rather than primary controller. Secondary support would include coordination of water level determination for minimizing milfoil growth, information sharing and distribution, and potential financial support.

Recommendation: *The District should support the on-going Eurasian Watermilfoil control programs under way by other agencies.*

A.2.b. The Need for Good Surface Water Management (SWM)

MCWD TMDL Process

Good surface water management (SWM) is the key to holding down loads as the watershed develops, no matter what type of development occurs. This fact applies to low density hobby farms, as well as multi-family housing. The load analyses that were done as part of the watershed and lake basin goal setting all assumed that no net increase in load would occur between now and the year 2020. For this to actually occur, the District needs to have a comprehensive SWM program and to coordinate its activities with local surface water management efforts. The District staff and Board, along with city staff and elected officials, need to be educated on good SWM techniques to assure that development and re-development do not lead to increased pollution loads.

The methods available to hold load levels at current levels are many, but they all begin with good local and District SWM plans that incorporate a mix of regulations, education, effectiveness assessment (data collection, program monitoring) and public interaction. Integral to this approach is the solution of existing problems. The HHPLS identified many existing water quality and quantity problems. Addressing these problems is essential to the achievement of water quality goals and the reduction in flood damage from high water levels. The TMDL-like process that the HHPLS followed resulted in some goal recommendations for water bodies. Through a "performance-based" process, load limits needed to achieve these recommended water quality goals can be determined. Some of the load limits needed for lakes within the District have already been determined. The new modeling tools available to the District and the recommended water quality goals allow the District to expand upon the HHPLS work and develop performance based standards as a routine part of its planning and regulatory activities.

As re-development occurs, the District should look for retrofit opportunities to incorporate good SWM where it has not existed before. Finally, the SWM effort should also acknowledge that good SWM is the first step in assuring the protection of groundwater, which is an essential drinking water source for the citizens of the District.

Recommendation: *The District needs to coordinate its SWM efforts with those of the local units of government to assure that no net increase in future nonpoint source loads occurs and that flooding problems are prevented. The District then must similarly work with local units and private developers and individuals with a performance based approach to reduce loads where they are currently causing receiving water problems.*

BMP Information

An important follow-up to the previous issue is the availability of good technical information upon which to base actions. The suite of best management practices, or BMPs, is very large, but often details on the application parameters and effectiveness of specific BMPs are not available to the person in the field selecting and applying the practices. In response to this need, several manuals of BMPs have been produced, including one in which the District cooperated (*Minnesota Urban Small Site BMP Manual*). Unfortunately, these materials often do not get into the hands of personnel designing and installing BMPs because of the complex nature of the assistance material.

One solution to this proposed by several Regional Teams is the customization of BMP assessments by topical area extracted from the District's existing manual, supplemented with any new information that has become available. The topical areas for which these supplemental tools could be prepared include erosion control, homeowner guidelines, shoreland stabilization, public works, use of "natural" areas, golf course management, channel stabilization, farm management, road construction/maintenance, animal waste management, and surface water management for development and re-development. Providing this information in smaller topical hand-outs would hopefully be less cumbersome, and therefore more useable.

Recommendation: The District should evaluate currently available technical assistance information on BMPs and pursue methods to make it more readily available to those in need of it.

Effective Use of BMPs

Providing information on BMPs is only the first step. The effective use of them is the critical step that needs to occur to positively impact runoff. The District has long advocated that all runoff to receiving lakes, bays and creeks should be pre-treated to some degree. This would typically include such measures as detention/settling, filtration through vegetated swales, rain gardens, buffers or greenways, infiltration, and good housekeeping (for example, pavement sweeping and litter control). Opportunities to incorporate these BMPs into development and re-develop occur frequently and should not be missed.

For example, every road construction or repair project in the District should incorporate runoff control to prevent untreated road runoff from discharging to receiving waters without pre-treatment. Similarly, infiltration will not work everywhere, but if conditions are right, it should be encouraged as a first step in runoff control. Filtration can be a substitute where soils impede infiltration. "Low impact development" approaches mimic the natural behavior of water even as development occurs, and limiting imperviousness via city ordinance is an effective way to promote infiltration.

Essential to continued effectiveness of BMPs is the follow-up operation and maintenance. Simply installing a BMP will not assure its continued performance. The primary failure of BMPs is the lack of on-going maintenance. Ironically, many BMPs that perform according to design will degrade over time. For example, ponds settle particles from runoff, and eventually become stagnant, filled-in, eutrophic and ineffective. Maintenance of existing structural BMPs needs to be emphasized.

The use of native vegetation, greenways, floodplains, open space, shoreland and other natural corridors is an environmentally sensitive way to improve overall water quantity and quality management. Prior to development, a natural runoff condition existing and pristine waters were the norm. The alteration of flow patterns and introduction of increased runoff changed this natural condition and resulted in adverse receiving water impacts. Where possible, attempting to mimic the natural condition can only result in improved surface and groundwater quality.

Recommendation: *The District should use and encourage BMPs that are proven to be effective and that best mimic the natural conditions that occurred prior to development of the watershed.*

A.2.c. Water Quantity and Flood Control

Use of HHPLS Model

One of the major products of the HHPLS is the flow model (XP-SWMM) that was developed and calibrated for the entire watershed. This model provides an excellent tool that can be used to aid in the decision-making and planning processes.

Potential use of the model includes such things as:

- Verification of the Grays Bay Dam operation and assessment of the impacts of operation changes
- Better prediction of the timing, magnitude, peaks and volume of upstream and downstream flows in response to events
- More accurate understanding of in-creek and bypass structures (such as in-creek dams vs. Nokomis as example of a bypass structure, see *Volume IV, Section L.3.c. Special Subwatershed Issues*)
- Improved forecasting and scenario analysis of water level changes for a dry or wet period based on specific conditions
- Better in-depth analysis of erosion in Minnehaha Creek for different flow rates from the dam (alone) or combined flows (dam plus local stormwater)
- Evaluation of the effects of various runoff events, such as back-to-back 100-year storms or critical snowmelt, on upstream (Lake Minnetonka) and downstream (Minnehaha Creek) areas

Recommendation: *The MCWD should transform the model results of the HHPLS into an everyday operation tool to address some of the questions that were beyond the scope of this study.*

Flood Prevention

Flooding is often an unfortunate result of urbanization. A case in point was the flooding in late summer of 2002, which occurred as the result of several large storms occurring before the previous event was thoroughly drained or infiltrated away. The 2002 floods point to the need for the District to use the HHPLS model framework to run numerous scenarios for different climatic and flow conditions. The limited scope of the HHPLS did not allow for modeling of every possible event scenario. The HHPLS model runs showed that generally, widespread and serious flooding does not appear to be a problem in the upper watershed, nor will it be for the foreseeable future. This does not mean, as evidenced by the 2002 flooding, that high water will not cause periodic problems somewhere in the watershed. In fact, the largest threat does not come from rainfall, but rather the critical event for generating high flows in the upper watershed is the 100-year, 10-day snowmelt event.

Recommendation: *The tools developed for the HHPLS should be used to evaluate more precipitation and runoff scenarios to assure that proper precautions are taken to avoid flooding.*

Basin-wide Flood Insurance Mapping

One option available to the Minnehaha Creek Watershed District, which was not available at the start of the HHPLS project, is the ability to create and maintain basin-wide flood insurance maps in partnership with FEMA (Federal Emergency Management Agency). Traditionally, the updating of flood insurance maps was the responsibility of municipalities. MCWD had anticipated that cities could choose to use the hydrologic and hydraulic model and data created as part of the HHPLS project as a foundation of a request to FEMA to remap their community. The additional tasks that a city would need to undertake would be use of the XP-SWMM model now accepted by FEMA, review of the data by Minnesota Department of Natural Resources, and, finally, submittal of the proper application forms to FEMA. However, FEMA has recently created a program titled Cooperating Technical Partners (CTP) which encourages flood insurance map revisions on a regional basis. FEMA's goal through this program is to create local maps with the most up-to-date technical information. Regional agencies, such as watershed districts and counties, now qualify for this program. In return FEMA is willing to participate by contributing funds towards specific remapping activities, providing technical support, and training.

Advantages of MCWD acting as a regional partner in FEMA's flood mapping program:

- Refinement of Zone A (100-year flood plain) boundaries, especially in areas where FEMA flood boundaries are approximated.
- Consistent, up-to-date technical information (hydrologic, hydraulic, and GIS) would be applied to flood maps on a district-wide basis.
- Consistency between MCWD flood boundaries and FEMA flood boundaries.
- FEMA is more likely to grant funds for remapping on a regional basis than on a local basis.
- Creation of digital flood maps for Carver County portion of MCWD. Digital maps are soon to be available for Hennepin County.
- MCWD would be involved in all future flood map maintenance and amendments.

Recommendation: *The MCWD should pursue becoming a Cooperating Technical Partner with FEMA, and work with communities within the watershed to update their FEMA floodplain maps based on the HHPLS results.*

<u>Landlocked Basins</u>

Many landlocked basin drainage systems occur within the watershed (identified in Figure IV.Appendix.1-1). Although these basins have had occasional problems associated with them, they generally function without flooding or water quality problems. In fact, introducing an outlet to these areas could lead to new problems down-gradient from the outlet where problems do not currently exist. Unless a current problem exists or is anticipated for the future, these basins should be left in their natural condition.

Some of the landlocked depressions contain wetlands or vernal pools, while others quickly lose water to infiltration or evapotranspiration. Maintaining existing hydrology and functions of these depressions will minimize potential downstream flooding and pollutant loading to receiving waters. This can be achieved through a combination of infiltration and volume control practices in the watershed as development occurs, along with specific management practices of the landlocked depressions. Management strategies recommended for landlocked basins include:

a. Design of 2-stage, drop outlet facilities that mimic natural conditions by maximizing bounce, retention, and infiltration in the basin. Where sensitive wetlands are present (wetlands designated as "preserve" in the Functional Assessment of Wetlands), stormwater pollutant loading and increases in bounce should not exceed MN Stormwater Advisory Group guidelines. These outlet structures would also include controlled emergency overflow and drawdown maintenance gates.
b. Incorporation of very low maintenance infiltration enhancement techniques in the basin (such as infiltration gravel trenches, perforated tubes, or subsoil unconnected drain tiles) to ensure long-term performance.
c. Vegetation management to promote deep-rooted natural species, capillary suction and evapotranspiration at all hydrologic regimes in the basin.

Recommendation: *Landlocked basins should be preserved and managed to maximize infiltration, bounce, and retention.*

Landlocked basins are particularly sensitive to additional stormwater volumes. As development occurs, special emphasis should be given to volume control regulation within all subwatersheds containing or draining to landlocked basins and/or pocket wetlands. Simple runoff volume management techniques like rain gardens, infiltration swales, or dry ponding are strongly recommended in those areas to mimic natural watershed hydrology and control the runoff volumes discharged into landlocked basins. Local soils and groundwater issues (see Figure V.B-18 Infiltration Potential) should be considered at the design and review (permitting) phase to assess the suitability, placement, and sizing of these runoff volume reduction techniques.

Recommendation: Volume control standards should be implemented in all subwatersheds draining to or containing landlocked depressions.

Areas containing smaller landlocked depressions in the watershed help reduce watershed impacts by minimizing downstream discharge rates, volumes, and transfer of sediment loads. Their preservation is important to minimize development impacts to downstream water bodies. To the extent possible, it is recommended that the smaller landlocked pockets in the watershed be retained, or their function be retained as the area develops.

Recommendation: Small landlocked pockets occurring within the watershed should be identified and preserved.

Infiltration in Minnehaha Creek

The flow modeling and groundwater assessment both noted the importance of the role of infiltration in the behavior of Minnehaha Creek, but uncertainty remains over how and where this occurs. It was found that the creek runs dry in certain areas, and that a loss or gain of 5 to 10 cfs could take place along the creek. This could become a very important factor in considering the role of baseflow for ecological integrity. The collection of better data in specific locations of suspected creek infiltration or exfiltration would be very beneficial to overall understanding of creek behavior.

Recommendation: The District should incorporate into its Monitoring Program the collection of flow data in Minnehaha Creek that would better define the relationship of the creek to groundwater.

A.2.d. Setting of Lake/Bay Goals

Need for Specific Goals

Many of the lakes and bays within the watershed had water quality goals established in the District's 1997 Watershed Management Plan. However, many other waterbodies were not assigned a goal. The HHPLS effort was patterned after the federal and state TMDL (total maximum daily load) program within which goals are established to quantify the need for specific load reductions. The HHPLS conducted analyses for most lakes and bays within the District, and formulated a list of recommended goals for each of them. This effort was often complicated by the lack of water quality data on the waterbody in question. To remedy this, the Regional Teams estimated conditions through watershed and lake modeling, and passed on the recommended goal with a companion recommendation to collect some data to document the current condition.

Recommendation: *Water quality goals should be established for every lake and bay in the watershed to update the District's 1997 plan, with consideration of both existing and 2020 conditions. Data should be collected for waterbodies where data do not currently exist.*

A.2.e. Targeted Data Collection

<u>Adequate Data to Draw Conclusions</u>

To properly asses the condition of water bodies and the effectiveness of watershed management efforts, an adequate database is needed. The District has had a data collection program for many years and has collected very valuable information. There is a need, however, to occasionally evaluate that effort and perhaps re-focus at least part of the program on emerging needs.

Other sections of the HHPLS contain more details on the specific data needed, but in summary, a need has been identified for data on the following areas:

- Internal loading is a big unknown for many of the eutrophic lakes and bays, but is likely a significant source of phosphorus for many of these water bodies.
- Intra-lake circulation data are needed to document the interactions among the various bays of Lake Minnetonka and to properly build an in-lake model of Lake Minnetonka.
- The role that wetlands play as water moves through the watershed and the quality of that water is poorly understood; better understanding of this function and the role of ditches will lead to a more realistic expectation for the role of wetlands in water management.

- The remaining influence of closed wastewater treatment plants (WWTPs) is not fully known. Although anecdotal evidence exists that phosphorus-enriched sediment from them still causes problems, the details of this impact are unknown; further study is needed.
- Alum addition to various lakes in the watershed has had mixed results; it seems to be added without full knowledge of the source of phosphorus in the lake/bay. Better data are needed on the long-term effectiveness before alum addition continues.

Targeted data collection is the only way to quantify the behavior of water as it moves through the watershed. When monitoring programs are in the planning phase, the goals of the monitoring should be clearly stated, and the program should be evaluated based on whether or not the data can answer the questions that were set out to be answered.

Recommendation: *The District should supplement its routine data collection program with additional data collection to address the questions raised above.*

A.2.f. Institutional Coordination

Basin-Wide Linkage

The upper and lower parts of the watersheds are closely linked and cannot operate independently of each other, since the actions and needs of each affect the other. This is one of the key findings of the entire HHPLS. To assure effective overall watershed management, the impacts of planning and program implementation must be viewed from a holistic point of view. The HHPLS modeling now provides a tool to enable the District to accomplish this approach relative to quantity assessment. Continued use of this tool and development of alternative scenarios is essential. In addition, the determination of management priorities needs to be done on a watershed-wide basis with all factors considered. Different political and public priorities vary by location within the watershed. For example, some might want immediate attention to a specific bay improvement, others development of BMP assistance, and yet others effective erosion control regulation.

Recommendation: *The District should use all available tools to integrate its decision making over the entire watershed.*

Institutional Improvements

There are many governmental and private entities involved in water resource management within the boundaries of the District. Since no single entity can do everything that needs to be done, cooperation among these entities is imperative to maximize results while minimizing expenditures. Cooperative ventures involving the District were suggested often as a means to improve overall watershed management while holding down costs. For example, cooperative efforts between the District and LMCD should be used for boat traffic, litter and waste control, invasive species control (milfoil, zebra mussels, curly-leaf pondweed), and water level control. Efforts such as these can be used to leverage limited funds for maximum results.

Recommendation – The District should coordinate closely with other water management organizations and local units of government to the extent possible to avoid redundancy and manage water resources more effectively.

Effective Regulatory Programs

Regulatory programs are an essential component of an effective watershed management program. A well structured and fair set of regulations is needed for orderly development to occur, since District personnel cannot be at all locations within the watershed to monitor activities. Even areas that are routinely thought of as well protected through regulation, such as wetlands and floodplains, need to be monitored for proper implementation and overall regulatory effectiveness. Although new protective programs are not needed, the improved implementation of existing ones does need to occur. One needs only to look at erosion control to see the validity of this statement.

Recommendation: *The District should conduct periodic regulatory assessments to evaluate its existing program(s) for effectiveness.*

A.2.g. Education

Education Program Viability

Education is a key to solving many of the water related issues in the watershed, yet many of the education vehicles of yesterday are the victims of budget-cutting today. Recent cuts in the Hennepin Conservation District, University of Minnesota-Extension, and the statewide Project NEMO, to name just a few, mean that fewer resources than ever are available to educate public officials, homeowners and businesses about good water management. To maximize its resources, the District should identify target populations and structure education programs specifically for them. Potential tools include demonstration projects, topical BMP manuals, school and adult education programs, participation in water-based events, and informational brochures.

Recommendation: *The District should maintain or even increase its educational program to assure that a continuing message of good water management is heard throughout the watershed.*

A.2.h. Nuisance Management

Geese and Carp Management

Geese and carp continue to contribute to water quality problems, and control of the situation does not appear imminent. Although focused efforts in the past have attempted to control these nuisances, it does not appear that they were entirely successful, nor that they will reach an effective level in the future. The District could play an important role in providing technical assistance on the nature of the problem, and which controls work and do not work. The District could also continue its moderate control efforts on a location-by-location basis, as it has done with Painter Creek and occasional lakes.

Recommendation: *The District should continue to monitor the occurrence of nuisance geese and carp, provide technical assistance, and respond to control needs on a priority basis.*

A.2.i. Potential Boundary Changes

Boundary Verification

The HHPLS identified several potential changes in the MCWD boundary based on current flow conditions. Specific changes were noted in the Southdale Shopping Center (see *Volume IV, Section L.3.a. Minnehaha Creek Subwatershed Boundaries*) and Maple Plain areas (see *Volume IV, Section A.3.a. Painter Creek Subwatershed Boundaries*). To better reflect the actual area contributing to flow within the District, it should pursue formal boundary changes based on the new information it has.

Recommendation: *The District should incorporate the District boundary changes discovered during the HHPLS.*

Memorandum

Date: November 21, 2002

To: Jim Hafner, Senior Technician, Minnehaha Creek Watershed District

From: Cecilio Olivier, EOR Project Manager, HHPLS

Re: Monitoring plan recommendations

This memo is in response to your request for recommendations regarding the Hydrodata monitoring program. Throughout the process of the HHPLS, we have identified several gaps in the Hydrodata that, if filled in, would complement the existing monitoring program and help the District in future model calibration efforts. We include recommendations for water quantity and quality data collection, as well as precipitation.

Water Quantity and Quality Monitoring Sites

The District has expressed interest in completing the Lake Minnetonka BATHTUB model, and the Board has approved funding for five additional auto-samplers to help gather this data. Each continuous flow monitoring location should be accompanied by an auto-sampler for flow-weighted water quality data collection. Based on current modeling data gaps, we recommend the following locations for these monitoring stations:

1. *Six Mile Creek at Highway 7*. There is likely backflow at this location; therefore, a device that is able to measure reverse flow would be necessary. A Doppler reverse flow meter would serve this purpose, and would help quantify flow and pollutant loads entering Halsteds Bay from the Six Mile Creek watershed.

2. *Long Lake Creek outlet*. From existing monitoring data, it appears that the creek picks up a substantial amount of pollutants between the Long Lake outlet and the current downstream monitoring site at Fox St. A continuous flow monitoring site at the creek outlet into Tanager Bay would provide pollutant loading information from this relatively large watershed into Lake Minnetonka.

3. *Gleason Lake Creek outlet.* Substantial pollutant loads enter Wayzata Bay from the Gleason Lake Creek watershed, which includes the watershed for Hadley Lake. An

estimate of these loadings can be obtained with a monitoring site located at the outlet of Gleason Lake Creek into Wayzata Bay.

4. *Dutch Lake Creek*. Quantifying the pollutant loading from Dutch Lake Creek would assist in the overall understanding of the pollutant dynamics of Jennings Bay, a bay already identified by the District as being a priority issue.

5. *Classen Creek*. Classen Creek flows into Stubbs Bay, a Lake Minnetonka bay of relatively poor water quality. Quantifying this input will help in the development of a management approach.

In addition to these five sites, we have identified the following data gaps regarding existing continuous flow monitoring sites:

1. *Painter Creek*. There is a need for reliable continuous flow data, as well as a flow-weighted water quality sampler to accompany the continuous flow meter already there. Due to the variability of pollutant concentrations, we recommend that weekly water quality grab samples be replaced by flow-weighted sampling to achieve a more reliable computation of annual pollutant loads. The lack of flow-weighted water quality data for a period of three years or more translated into very poor calibration of the HSPF model that was ultimately abandoned in favor of a less data demanding model.

2. *Grays Bay*. Current discharge estimates at the Grays Bay outlet are skewed due to the frequent clogging of screens at the outlet by debris. A high capacity, steel cable, skimmer would help prevent clogging and allow for a more accurate flow estimate. Water quality sampling at the outlet, preferably weekly, is necessary to separate the pollutant loads in Minnehaha Creek that originate in Lake Minnetonka from loads originating below Grays Bay dam.

3. *Browndale Dam*. Continuous flow data at this site should be continued. Similar to the situation at the Painter Creek site, these flow data should be complemented with flow-weighted water quality sampling data. Having these continuous flow and flow-weighted water quality data, along with similar data from the WOMP site downstream of Lake Hiawatha, will provide a more complete comprehension of the creek dynamics in the lower watershed.

It is very important to point out that these outlet monitoring stations involve <u>only a portion of the data necessary to complete the BATHTUB modeling effort</u>. A more complete understanding of the intra-lake circulation patterns among the various bays of Lake Minnetonka is equally as important. As part of our July 23, 2001 submittal entitled *"An Evaluation of In-Lake/Watershed-Based Phosphorus Loadings from Painter Creek Watershed and Jennings Bay"* (see attachment), we identified the need to conduct a drogue/bromide tracer study to determine the circulation patterns in the lake. The "Jennings Bay Expert Panel" later recognized the importance of good intra-lake circulation data to assess water quality in Jennings Bay and the rest of Lake Minnetonka. We recommend that this type of monitoring be considered as part of the 2003 monitoring effort. Additionally, data regarding internal loading in the poorer quality bays are lacking.

Secondary Monitoring Issues

We have also identified several data gaps that are not directly related to the completion of the BATHTUB model; but rather they involve other emerging watershed issues:

1. *St. Bonifacius growth*. This is a rapidly growing area of the watershed, and several options exist that would help identify this region's contribution to the total runoff and loads originating in the Six Mile Creek watershed. One option is to increase the frequency of monitoring at the Lunsten Lake outlet monitoring station. With weekly stage and water quality monitoring data, the flow and pollutant input originating between Lunsten Lake and Six Mile Creek's outlet into Halsteds Bay would be quantified. This area includes St. Bonifacius in addition to the wetlands associated with Parley Lake. A second option is to monitor the ditch that drains St. Bonifacius and runs along the south side Highway 7 before entering Mud Lake.

2. *Southdale Mall drainage*. It is presently unclear to which watershed the runoff from Southdale Mall flows. One source identifies that it all flows into the Nine Mile Creek Watershed, while other available information seems to indicate that only high flows go into Nine Mile Creek and low, base-flows enter Minnehaha Creek through Pamela Park. Southdale Mall is a substantial area with a large impervious surface. In addition to influencing the creek model, the flow details have implications regarding Watershed District boundaries.

3. *Painter Creek wetlands*. Both the Regional Team process and the Expert Panel identified the need for good data to define whether the large number of wetlands within the Painter Creek watershed are sources or sinks of phosphorus. In response to this, the District installed two new, limited stations within the basin. The data from these stations should be examined to determine whether the data collected are providing the needed information. Adjustments should be made if data collection is not meeting the objective of defining wetland phosphorus behavior.

4. *Gleason Lake inlet*. The Gleason Lake Management Plan, along with Regional Team 3 of the HHPLS, have both identified a data gap with respect to loadings into Gleason Lake. The current monitoring site is at the Gleason Lake outlet. A site at the lake inlet would help to better quantify pollutant loadings to this highly eutrophic lake.

5. *Lake Hiawatha-Minnehaha Creek interaction*. The extent of the short-circuiting of Minnehaha Creek as it flows through Lake Hiawatha is currently unknown. This information would improve the Minnehaha Creek model, in addition to providing more accurate information regarding the removal and origin of pollutant loads in and downstream of Lake Hiawatha.

Lake Water Quality

We recommend an expanded lake water quality monitoring program to include the collection of at least some data on each lake that has a suggested water quality goal from the Regional Team process. This would allow the District to make more informed decisions when establishing lake water quality goals in the future.

Precipitation

Tipping buckets should preferably have their own data loggers, in order to avoid data losses. Additionally, we feel that these stations should not be moved around the District, but rather be permanent data gathering sites. In this manner, a long-term record of precipitation at several sites will be collected, in conjunction with continuous flow and water quality data. Rain gauges should be located at or in the vicinity of all of the continuous flow monitoring stations discussed in the first section of this memo. An exception is Dutch Lake Creek, since a rain gauge at the Painter Creek site would be applicable to Dutch Lake Creek as well.

Recommended rain gauge locations, to accompany continuous flow monitoring sites:

Six Mile Creek at Highway 7
Long Lake Creek
Gleason Lake Creek
Classen Creek

Additional recommended rain gauge locations:

Minnehaha Creek at Browndale Dam
MCWD office in Deephaven
Lake Minnewashta

This list assumes that there is a rain gauge associated with the WOMP site. If this is not the case, we recommend another gauge at that location.

We also feel that additional precipitation data collected by volunteers spread out across the watershed would be helpful. If 22 sites were established, a station could exist approximately every four square miles, and would allow a better understanding of the spatial variability in precipitation throughout the District.

Thank you for the opportunity to comment on recommendations for the Hydrodata monitoring program. Please feel free to contact me with any further questions.

Sincerely,

Cecilio Olivier