8.0 Recommendations

In-lake improvement options and site-specific structural BMPs for were evaluated for feasibility and cost-effectiveness. It is important that all BMPs currently required by the BDWMO and member municipalities continue to be implemented in addition to those recommended below. The following BMP recommendations were developed in the course of this study while the implementation of structural and in-lake BMPs are usually given priority, it is important to note that source control through the implementation of nonstructural BMPs is crucial to protecting the water quality in Crystal and Keller Lakes.

Management Option III.14 is the recommended alternative to achieve the water quality goals in both lakes (see Figures 6-8 and 6-9). Implementation of this option involves structural BMPs to control external phosphorus sources in combination with in-lake BMPs to control internal phosphorus sources. The following sections summarize the structural, non-structural, and in-lake BMPs that are part of the recommended option.

8.1 Structural BMP Recommendations

Specific recommendations for structural BMPs are list below:

1. **Excavate Additional Storage Volume in Six Existing Ponds to Meet NURP Standards**

   Many of the detention basins in Burnsville and Apple Valley were constructed prior to the establishment of current MPCA (i.e., Protecting Water Quality in Urban Areas, 1989) and NURP (Nationwide Urban Runoff Program) design criteria. Therefore, upgrading 6 ponds in the Crystal and Keller Lake watersheds (see Figure 8-1 to identify upgraded ponds) to provide water quality treatment storage based on NURP-criteria for full-development watershed conditions will help reduce the annual external phosphorus load to Crystal and Keller Lakes.

2. **Construct Water Quality Treatment Ponds A7a-1**

   Runoff from a large portion (roughly 641 acres) of the areas tributary to Keller Lake enters the lake with little or no water quality treatment. Therefore, a regional water quality treatment ponds, designed to MPCA and NURP criteria, was simulated to treat a portion of the untreated tributary area (runoff from 51 percent of the untreated areas were routed to the proposed pond). The pond (Pond A7a-1) would be located in Lac Lavon Park at the southeast corner of Keller Lake. This 15.7-acre-foot water quality pond, which could be designed to have an average depth of 5 feet and a surface area of about 3.1 acres, would treat runoff currently being conveyed to the lake through the 60-inch storm sewer under Whitney Drive.

Figure 8-1 Recommended BMPs that are Part of Management Option III.14 for Crystal and Keller Lakes (3.76 MB)

3. **Upgrade Existing Pond in Redwood Park, Apple Valley into an Infiltration Basin**

   Discussions with City of Apple Valley staff indicate that the existing pond in Redwood Park could potentially be excavated down to granular material, thus increasing the basins infiltration capacity. The analysis of this BMP assumed that the existing Redwood Pond (Pond A1) would be excavated to meet NURP criteria and in doing so the infiltration rate for water levels below the normal pool would be increased to 0.12 in/hr (half the rate for hydrologic soil group B due to potential excavation limitations and future bottom siltation). Implementation of this BMP option would reduce the annual external phosphorus load to Keller Lake by 27 lbs. due to infiltration. The reduced phosphorus load impact on Keller Lake water quality is partially offset by a water load reduction to the lake of 81 acre-feet. While the in-lake total phosphorus concentrations in Keller Lake are not predicted to change significantly, the reduced water loading to the lake results in less runoff and phosphorus being discharged to Crystal Lake.

4. **Construction of Regional Infiltration Basins (Valley Middle School - Apple Valley & West Buckhill Park - Burnsville)**

   Regional infiltration basin locations were identified north of Valley Middle School in Apple Valley (A7a-2) and within West Buckhill Park in Burnsville (A13a-1). The individual basins were each sized to infiltrate 1 inch of runoff in 72 hours from the impervious areas within the respective watershed. As a result, infiltration basins A7a-2 and A13a-1 were modeled with storage volumes of 0.50 acre-feet and 0.42 acre-feet, respectively.

8.2 In-Lake BMP Recommendations

1. **Develop a macrophyte management plan to reduce the growth of the exotic weed curlyleaf pondweed (Potamogeton crispus) in Crystal and Keller Lakes.**

   Presence of the exotic macrophyte curlyleaf pondweed was detected during both the June and August surveys, but was found to be much more dense during the June survey. Curlyleaf pondweed grows tenaciously during early-spring, crowding out native species. It releases a small reproductive pod called a "turion" (which resembles a small pinecone) during late-June. The plant dies out during early-July. Curlyleaf pondweed may be detrimental for three reasons:

   - It tends to crowd out native aquatic macrophyte (i.e., lake weed) species.
   - Dense colonies of the weed may interfere with recreational activities on the lake.
   - After curlyleaf pondweed dies out in early-July, it may sink to the lake bottom and decay, causing oxygen depletion and exacerbating internal sediment release of phosphorus.

During the June macrophyte survey in Crystal Lake, curlyleaf pondweed was detected along the entire lakeshore. It was present in greatest density in the various bays of Crystal Lake.

The short-term recommendation to control nuisance curlyleaf pondweed growth is that annual mechanical harvesting be performed in Crystal and Keller Lakes. The harvesting is proposed to be conducted between late-April and late-May in order to harvest the curlyleaf prior to turion formation and die-back. Mechanical harvesting would reduce the internal load of phosphorus to the respective lake. Because only a maximum of 50 percent of the littoral zone can be harvested, and because of harvesting equipment limitations, there would be only minor impacts on the lakes' total phosphorus concentration (Crystal Lake would exhibit a 4 μg/L reduction while Keller Lake would experience a 6 μg/L reduction), and water clarity (Crystal Lake would exhibit a 0.1 meter improvement). There would be no significant improvement in Keller Lake as the result of harvesting. However, harvesting would improve the recreational and aesthetic uses of both lakes.

Long-term recommendations include the set up of an experimental plot to evaluate the impact of lime application on selectively reducing curlyleaf pondweed. The experiment would apply the lime or alum + lime during spring (about mid-May). It is hypothesized that this would reduce undesirable effects on other native aquatic plant species. The experiment could be used to assess application impacts on macrophytes and the longevity of the treatment. If results are positive, management of the curlyleaf pondweed through an in-lake alum + lime application could be performed on a larger portion of the lake's littoral zone and may eliminate the need for annual mechanical harvesting. An alum + lime application would also stabilize alum floc and control the recycle of sediment-bound phosphorus in both Crystal and Keller Lakes. This combination would not only benefit the main basin of the Crystal Lake but would also significantly reduce the in-lake phosphorus concentration in Keller Lake, Mystic Bay, Maple Island Bay, Bluebill Bay, and Buckhill Bay, all of which have exhibited algal bloom problems.

2. Resume Operation of the FeCl3 Treatment System

Resuming the operation of the $FeCl_3$ treatment system would require a new system configuration be selected. The ideal configuration would involve a near surface intake with discharge to Keller Lake (Alternate 2 listed in Section 6.2.2.2.6). This would reduce the likelihood of odor problems because the water being discharge would not have low oxygen levels. Assuming past operation of the system was responsible for the macrophyte shift from curlyleaf pondweed to stringy pondweed and a $FeCl_3$ dose of 8.8 mg Fe/L, resumed operation would significantly reduce the summer average total phosphorus concentration in Keller Lake to 50 μg/L (see Table 6-4a). This phosphorus concentration translates to a 1.5 meter summer average Secchi disc transparency in

Keller Lake (an 0.6 meter improvement for full-development conditions). The predicted water quality is a long term estimated and assumes continued operation every summer. As the result of the improve water quality in Keller Lake, the water quality in Crystal Lake would also improve.

Locations of structural and in-lake BMP recommendations are shown on Figure 8-1. Table 6-8 lists the costs and water quality benefits associated with the recommended BMPs. The water quality benefits are also illustrated in Figures 6-8 and 6-9 relative to the BDWMO's water clarity goal. The estimated capital cost of this BMP combination is $860,000, with an annual operation and maintenance cost of $112,400. This results in an annualized cost of roughly $187,357 to cover the capital cost and the annual cost associated with future excavation, annual curlyleaf pondweed harvesting, chemicals, and maintenance of the facilities.

8.3 Nonstructural BMP Recommendations

It is not possible to effectively model the effects of nonstructural BMPs, but studies have shown that they are effective at reducing phosphorus loads. The results of this study have shown that existing wetlands and ponds will be effective at removing large diameter particles and the associated phosphorus from stormwater runoff after completion of proposed development. However, soluble phosphorus and phosphorus associated with extremely small particles may not be effectively removed. Therefore, source control (reduction of particles and phosphorus deposited on site) will be extremely important in the Crystal Lake watershed to reduce the mass of phosphorus in the runoff, and to prevent degradation of the lake. Examples of effective nonstructural BMPs that would be appropriate for the Crystal Lake watershed include:

1. The State of Minnesota has recently passed legislation placing a limitation on the use of fertilizers containing phosphorus in the seven-county metro area. This legislation is set to become effective in 2004 and will allow the use of fertilizers containing phosphorus if a soils test indicates warrant it. The impacts of the fertilizer phosphorus limitation were included in the recommended Management Option (III.14).

2. Require wet detention for all new or redeveloped properties, where applicable. Skimming devices to trap floating material should also be included at the outlet of all wet detention ponds. This has been accomplished with implementation of the BDWMO's Water Quality Management Policy, but should be strictly followed to minimize variances as much as possible.

3. Continue the existing street sweeping program. The Cities of Apple Valley, Burnsville, and Lakeville have implemented a stringent street sweeping program, which includes an early-spring sweeping, a late-fall sweeping, and additional sweepings as needed. Since the development

planned for construction along the I-35 corridor will have fairly large impervious areas (from high-density residential and industrial/commercial developments), it would be prudent to increase the sweeping frequency in those areas once development is completed.

4. Continue public education programs to inform the residents of the Crystal Lake watershed of ways to reduce phosphorus loading through proper handling of yard fertilizers and wastes, pet wastes, soaps and detergents.

5. Encourage industrial/commercial areas to institute good housekeeping practices, including appropriate disposal of yard wastes, appropriate disposal of trash and debris, appropriate storage and handling of soil and gravel stockpiles.

6. Continue to discourage the feeding of waterfowl at shoreline areas around Crystal and Keller Lakes. Waterfowl feces can add a significant amount of dissolved phosphorus to a lake or pond. Of course lake shorelines provide essential nesting and feeding habitat for some waterfowl. However, the habit of leaving bread scraps and other food for waterfowl encourages a large number to congregate and nest. This seems to happen most often at shoreline parks, where large numbers of people and large expanses of short grass attract unusually large numbers of waterfowl. Continuing to prohibit the feeding of waterfowl on public shorelands may reduce the number of waterfowl congregating on the lake.

7. Require vegetated buffers between yards and the shore of Crystal and Keller Lakes. Vegetated buffers are effective at trapping suspended solids and nutrients from runoff. Requiring/encouraging vegetated buffers between yards and the lake will reduce the amount of phosphorus from yard runoff, and will prevent shoreline erosion. Vegetated buffers also discourage waterfowl from nesting and feeding on yards adjacent to the lake. Carolyn Dindorff of the Hennepin County Conservation Department has published a booklet which describes beneficial natural plants for shoreline landscaping; copies of this book could be kept on hand at the city offices for use by lakeshore homeowners. Vegetated buffers need not be overgrown and weedy; Dindorff's book has many examples of attractively landscaped shoreline buffers.