CHAPTER 5.0

CONCLUSIONS

Project findings relevant to Asylum Lake Policy and Management Council interests in Asylum and Little Asylum Lakes are presented here. These relate to critical findings and considerations for future management.

- There are nearly 1,633 acres of land surrounding these lakes that are topographically situated to drain to these lakes. However, it appears that US-131 creates a physical barrier to surface drainage such that only 661 acres, all to the east of this highway, drain to the lake via stormsewers, surface channels or direct overland flow.
- Stormwater pollutant inputs from stormsewered areas to the west and north of Asylum Lake constitute the largest source of external loading that can be managed through controls. Large land areas that drain to the lake via overland flow are mostly pervious and covered with vegetation of some type.
- Only four stormwater inlets (two to each lake) appear to be directly discharging stormwater to the lake. Other stormwater outfalls to the east of Asylum Lake and north of Little Asylum Lake appear to be separated by extensive wetland complexes.
- Asylum Lake and Little Asylum Lake are largely isolated from downstream Cherry Creek and Willow Lake. Under normal precipitation conditions, very little water flows out of Little Asylum Lake.
- Groundwater inflow is the predominant source of inflowing water to Asylum Lake. Conversely, nearly all water exits Little Asylum Lake via groundwater.
- Water quality conditions in both lakes suggest these systems can be characterized as eutrophic based on phosphorus, chlorophyll *a* and secchi disk measurements.
- Rapid onset of anoxia (depleted oxygen supplies) even before the onset of temperature stratification is evidenced by field measurements of dissolved oxygen with depth in Asylum Lake. This occurs following both spring and fall turnover. The entire bottom waters of this lake below the thermocline are largely devoid of oxygen in late summer. These conditions are attributable to organically enriched sediments that exert a high sediment oxygen demand on overlying waters. Such conditions are common in highly eutrophic systems.
- Due to its shallow nature, Little Asylum Lake does not tend to thermally stratify during the summer due to complete mixing driven by ambient winds. This limits the extent of anoxic conditions. Under ice cover, however, this shallowness and the extensive shoreline wetlands and rooted aquatic macrophytes appear to deplete oxygen supplies in the upper waters likely via plant respiration.
- High TP and TN concentrations in sediment samples suggest significant retention and accumulation of these materials. This is corroborated by mass balance calculations indicating that more than 70% of the phosphorus that enters Asylum Lake remains within the lake. This is closer to 100% retention in Little Asylum Lake.
- Internal recycling of nutrients via sediment release is evident from bottom sample data in both lakes, but more severe in Asylum Lake during extended periods of temperature stratification. During spring and fall turnover, excess TP and SRP released into the bottom waters in summer become available for uptake and conversion to biomass following seasonal turnover. Future alum treatments could address this condition but not before stormwater loading is corrected.
- Some heavy metals, most notably mercury, are found in lake water and bottom sediments. Those associated with stormwater loading could be addressed via stormwater controls. Mercury is not likely manageable as the greatest source to these lakes is probably atmospheric deposition.

- High counts of *E. coli* bacteria were measured in wet weather stormwater flows into both lakes. Very low counts were noted at in-lake stations during seasonal (non-wet weather) sampling. These observations suggest that stormwater controls established to reduce nutrient loading will likely address concerns with bacterial loads.
- The littoral plant communities of these lakes are moderately diverse. Eurasion water milfoil and purple loosestrife are invasive species in Asylum Lake. Curly leaf pondweed is the predominant invasive aquatic macrophyte in Little Asylum Lake. Cost factors for management will likely dictate decisions made to control these species.
- The most pressing water quality/watershed management issue is controlling stormwater loads from highly developed storm sewered drainage areas, principally for Asylum Lake.