

allowance for beach and docking areas. Easements would be used for new developments. As an option, the cities could adopt a buffer ordinance as other cities in the metro area have done.

6.4.2.1 Advantages and disadvantages

The buffer zone easement is a good way to gain reductions in pollutant loading and to prevent future sources of pollutants from entering the lake through a low cost, non-structural format. The landowner would be made aware of this requirement up front. The disadvantages of the easements is additional work and expense for the cities. They are difficult to track and enforce. Without inspections, the buffers may not be maintained properly.

6.4.2.2 Estimated cost

The cost to the city for obtaining conservation easements may include the following:

Attorney time, clerk time, filing fees, postage and supplies.

Some periodic maintenance costs would be required for inspecting the sites to evaluate whether the easement area is being maintained as described in the easement and recording the results of the inspections. The Cities could use City staff to conduct inspections or could contract with the building inspector or other consultant.

Inspector 20 hours @ \$15/hour \$300 annual cost

Clerk/support 5 hours @ \$20/hour \$100 annual cost

6.4.3 Erosion control ordinance

The Pioneer-Sarah Creek Watershed Management Commission requires erosion & sediment control for construction sites. The Commission reviews and approves these plans which must include erosion and sediment control practices. However, it is up to the cities to ensure that the plans are implemented. This is usually accomplished through inspections. Some cities have taken steps to begin conducting inspections. This program should be ongoing. In order to have some enforcement power, the cities need an ordinance. The Watershed Commission has distributed a model erosion control ordinance for the cities to adopt. Adoption of this ordinance will provide the cities with more control and enforcement abilities to deal with erosion problems.

6.4.4 Construction site erosion control inspection program

Prior to 1995, the cities within the watershed did not have a program set up to conduct inspections of construction sites for erosion control. The sediment and erosion control plans approved by the Commission and city were often not properly implemented. This resulted at times in erosion of disturbed soils and sediment leaving the site. The cities have now contracted with their building inspector to start conducting inspections of the erosion controls on the site. This program will take some time to get up to its potential.

6.4.4.1 Advantages and disadvantages

Working with an inspector will take additional staff time and organization for the city. The inspection fees may be charged back to the developer/owner. The main advantage of conducting inspections is that the approved plans are more likely to be implemented and erosion controls maintained to prevent sediment from leaving the site and entering into Lake Sarah.

6.4.4.2 Estimated cost

The Cities can contract with the building inspector to conduct inspections. The costs should be charged to the developer landowner. There will also be cost to the city for developing and approving the ordinance.

6.4.5 Stormwater management ordinance

Similar to the erosion control requirements, the Commission and cities have stormwater management requirements. An ordinance is needed to ensure implementation of stormwater management practices. The Commission will be updating its stormwater management requirements. Cities will be required to adopt these or their own ordinances. The Commission will prepare a model ordinance for use by the cities.

6.4.5.1 Estimated cost

Will be similar to other ordinance adoption.

6.5 New Project Staff

To implement the many conservation initiatives suggested in this plan, additional staff must be hired. One part-time position is needed for a period of 2 years initially. This staff person would

be responsible for contacting landowners in the watershed to solicit participation in the various programs. This person would also be responsible for preparing newsletter/newspaper articles and brochures, helping to organize and implement the seminars and workshops.

The staff person could be housed in the offices of the Hennepin Conservation District or in the offices of another project cooperator. The staff person would assist project staff in operating the programs proposed in the Implementation Plan.

6.5.1 Estimated cost

Wages: \$12-\$14/hour 1/2 time for 2 years

1040 hours at \$12/hour + 1040 hours at \$14/hour = \$27040

Benefits: 12 % \$3245

Overhead 13%: \$3515

TOTAL: \$33,800

7.0 RECOMMENDATIONS

7.1 Priority Management Area A

7.1.2 Livestock exclusion and feedlot runoff management

- 1) Currently the dairy cattle have direct access to Lake Sarah. Livestock exclusion would be appropriate to control this source of pollution. It would be accomplished by fencing the cattle away from the lake.
- 2) Feed lot and milkhouse waste runoff- according to MPCA staff, the culvert which provided a direct connection of the waste pond to Lake Sarah has been plugged. Filtering of the runoff should be implemented. Vegetated buffer strips should be installed adjacent to the lake to treat runoff from the feedlot.

7.2 Priority Management Area B

7.2.1 Wetland restoration

Treatment of water in Dance Hall Creek can be accomplished by restoring the 30 acre wetland north of Highway 55. The restoration would allow for settling and removal of pollutants prior to

entering the lake. Since this area was used as pasture for many years, some nutrients may be released if the area is flooded. An investigation as to the feasibility of treating it with alum prior to restoration is recommended.

Because this wetland has been and still is used as pasture, it has received substantial nutrient loading from cattle waste. Additional investigation as to the feasibility of treating the area with alum prior to flooding the wetland is needed. Phosphorus inactivation using alum may be successful in preventing these nutrients from entering the lake.

An alum treatment would raise the cost of the project. This costs could be controlled using spent lime from waste water treatment. The spent lime contains aluminum hydroxide complexes which will adsorb phosphates. Tests have shown that the spent lime is far from saturated with phosphates and has a lot more capacity to adsorb. This method also makes use of a waste material, preventing the need to find a disposal site. Additional investigation would be needed prior to implementing any phosphorus inactivation.

7.3 Priority Management Area C

7.3.1 NURP pond

A treatment pond has been constructed to treat runoff from part of a new development which drains to Lake Sarah. However, runoff from agricultural (row crop) land is now tiled directly to the pond and into the lake. The existing pond was sized for 6 acres of the development and not for the majority of the drainage area (43 acres), which is the agricultural land. Expansion of the pond to meet NURP standards will provide treatment for the agricultural land draining to the Lake. The estimated phosphorus removal efficiency is 63%. A two-cell pond is being considered and would result in improved removal efficiency. The Commission has designated \$8000 to contribute toward this pond expansion and the developer will provide the remaining funds (approximately \$12000).

7.4 Priority Management Area D

7.4.1 Feedlot runoff management and livestock exclusion

Livestock exclusion in this case would be more difficult because the cattle graze on both sides of the creek. This is a small, intermittent creek which is tiled to Dance Hall Creek. Livestock exclusion may be best accomplished by routing the creek in a pipe so that the livestock does not

have direct access to the water. Other runoff management techniques should be investigated for this area.

The feasibility of these projects will depend partially upon how long the landowner will continue farming. There is pressure to develop the land.

7.5 Priority Management Area E

7.5.1 Wetland restoration and enhancement

A partially drained type 2/3 wetland exists on the north side of County Road 11. Loretto Creek runs through this wetland. Loretto Creek has been ditched as it runs through a wetland surrounded by residential property. The Creek has been cleaned out in the past as evidenced by spoil piles alongside the Creek. Restoring this wetland will help provide treatment from the subwatershed which is primarily agricultural with some rural residential and commercial land use. Restoring the wetland will spread the water over a large area to allow settling of sediments and plant uptake of nutrients. Restoration of this wetland would result in pollutant removal due to settling and biological uptake by plants. Because of the proximity of adjacent homes, the restoration would be accomplished by creating a dike or series of dikes in the ditch at the downstream end of the wetland. Berms would have to be constructed around part of the wetland to protect residential property. Openings in the spoils deposited along the ditch from a past ditch cleaning would be created to allow the water to flow out into the wetland. Additionally, some deeper areas would be created by excavation. The purpose of these is both for aesthetics and wildlife as well as to create some settling areas.

7.6 Priority Management Area F

7.6.1 Vegetated buffer strips

Vegetated buffer strips should be installed along the creeks, especially in areas where row crops are grown up to the creek. Sites with significant erosion problems should be stabilized.

7.7 Priority Management Area G

7.7.1 Conservation tillage

Conservation tillage practices should be promoted throughout the watershed, especially in areas adjacent to the drainageways and streams.

7.7.2 Horse Stables and Backyard Livestock Management

Through education and networking, pollutant loading from these sources may be reduced.

7.7.3 Grassed Waterways

Areas were identified where installation of grassed waterways would help reduce pollutant loading from cropland. These areas drain to tiles and ditches and eventually to Lake Sarah.

7.7.4 Tile Inlet filters

Tile inlets can be a direct source of sediments and attached nutrients to the creeks and ditches flowing to Lake Sarah. Erosion of soil into the tile lines can be controlled by keeping a vegetated area around the inlet which will trap sediments before they can reach the inlet. These areas should be a minimum of 20' in diameter.

7.7.5 Construction site erosion and sediment control

Much of the watershed is being converted from agricultural uses to residential. While the area is being developed, construction site erosion and sedimentation is a major concern and potential pollutant load to the lake. Each city should have an erosion control ordinance. The cities are presently working to improve their enforcement of erosion control requirements. Assistance from watershed residents in reporting erosion problems would help the cities and the Commission to stop erosion problems before they have impacted a lake. Area citizens should report any erosion and/or sedimentation problem, especially when sediment is entering a drainageway, wetland, lake or stream, to the City in which it is located. The city can use its enforcement power to correct the problem.

7.7.6 Stormwater management ordinance

The Commission currently requires stormwater detention (NURP) ponds for a limited number of developments based upon size and density. These requirements must be updated to current standards. The cities which currently do not have a stormwater management ordinance should adopt an ordinance or adopt a model ordinance prepared by the Commission.

7.7.7 Education

Education on best management practices may lead to improvements in how the land is managed and will result in fewer pollutants entering the lake. This will be accomplished through initiation of a watershed-wide best management practice education program. The program will involve development of a watershed specific brochure or newsletter. The publication will discuss best management practices that can be implemented specific to the land uses in the watershed. The publication will also identify estimated costs and sources of funding to complete the best management practices. The publication will be mailed to residents in the watershed. Four to six news articles will be drafted for submittal to local papers. These articles will also discuss best management practices and refer the reader to a contact for additional information.

7.7.8 Wetland restoration

There are several other areas in the watershed where wetlands could be restored. Additional investigation of these areas is needed.

7.8 Priority Management Area H

7.8.1 Education and homeowner best management practices

The areas with lake shoreline can be the most direct contributors of pollutants to the lake. Education as to proper lawn management techniques and other homeowner BMPs should be promoted through the use of workshops, newspaper articles and newsletters. The education program discussed under priority management area G would also be used for area H. However, a separate publication would be developed which discusses best management practices specific to lakeshore property owners. News articles for submittal to local newspapers and the LSIA newsletter will also be prepared.

7.8.2 Erosion control

Erosion control practices should be implemented along the shoreline where significant erosion problems are occurring. Buffer strips should be established along the shoreline to prevent erosion, both from upland runoff and wave action.

7.8.3 Phosphorus inactivation

Two to three years after some of the above practices have been implemented to control the major sources of pollutants to Lake Sarah, a treatment may be needed to control internal loading of phosphorus to the lake. This is a high cost treatment which would require additional analysis.

8.0 MONITORING

In order to assess the effectiveness of the implemented projects, a monitoring program is needed. Depending upon the specific projects that will be implemented, some monitoring above and below the site may occur. The extent of the monitoring will be much less than the original study so that the majority of the funds can be directed to lake restoration. A specific monitoring program will be developed as projects are proposed and implemented.

The Commission and Hennepin Parks will continue to monitor the water quality of Lake Sarah. Parameters monitored include; transparency, total phosphorus, chlorophyll *a*, dissolved oxygen and temperature profiles, ammonia nitrogen, nitrate + nitrite, total Kjeldahl nitrogen, alkalinity, and chloride. The Citizen Lake Monitoring Program volunteer will also be recording Secchi disk transparency. Lake levels are recorded by a lake resident volunteer. The Commission will continue to monitor Sarah Creek, the outlet of Lake Sarah. Continuous flow monitoring will be conducted and storm event and non-event samples will be analyzed for multiple parameters.

9.0 COST BENEFIT ANALYSIS

The cost of lake restoration can be considerable. Table 7 lists implementation practices, cost level, cooperators and potential sources of funding. Cost estimates for completing the recommended practices are shown in Table 8. Total phosphorus, total suspended solids, and total nitrogen removal estimates are also included in table 8. Individual project costs range from \$300 to \$156,000. Total costs range from \$324,000 to \$745,000 depending upon which projects

are implemented. To help determine if a project is financially feasible, the cost of not restoring the lake should also be considered. As water quality degrades, losses will occur to the City, the lakeshore property owners, the lake users and the community.

Dzuik (1993) reported some estimates of the finances a fishable lake brings to a community.

	<u>Amount per Acre</u>	<u>Total for Lake Sarah</u>
Consumer purchases	\$687/acre	\$379,224
Value added	\$501/acre	\$276,552

The lake also may impact employment at an estimate of 16.5 jobs /1000 acres.

As a lake deteriorates, its use is lowered and there is a reduction in consumer purchases related to the lake use.

The University of Maine conducted research on the affects of water quality on lake property values (James, H.L. et. al., 1995). Specifically, property values were related to Secchi disk transparency. The researchers found that for a one meter improvement in transparency, property values increased from \$18-\$50 per foot lake frontage.

For a decrease of one meter in transparency, a loss in property value of \$65 - \$140 per foot lake frontage was found. A 10 - 20% change in property values was found. For Lake Sarah, this could potentially equate to a decrease in property value of approximately \$1,950,000 - \$4,200,000 (average of \$13,500 - \$29,000 per home) based on an estimated 30,000 feet of usable lake frontage. Conversely, an improvement of one meter in transparency could result in an increase in property values of \$540,000 - \$1,500,000 (average of \$3700 - \$10,400 per home).

Table 7. Implementation Practices and Potential Cooperators

Practices	Cost	Sources of funding/cooperators
Wetland Restoration- Loretto Creek	Moderate	cooperate with landowner, MPCA, Met Council, DNR
Wetland Restoration/ treatment Dance Hall Creek	Low - Moderate	Wetland Banking- Henn. County, RIM, MPCA, Private Organizations
NURP pond expansion	Low - Moderate	Project funds, developer, Hennepin Parks (land)
Livestock Exclusion at lake	Low	CFSA, in-kind labor, MPCA
Livestock Exclusion at creek	Moderate-High	CFSA, in-kind labor, MPCA, Met Council
Vegetated Buffer Strips & Grassed Waterways, tile filters	Low - Moderate	CFSA, HCD, NRCS, Met Council
Education	Low - Moderate	MPCA, Local grants, Hennepin Extension
Erosion Control Ordinance	Low	Watershed, Cities, HCD
Stormwater Management Ordinance	Low	Watershed, Cities, HCD
Soil Testing	Low	landowner, MPCA, Extension
Conservation Tillage	Low	in-kind, farmer, CFSA, HCD, Land Stewardship
Shoreline and Streambank Erosion Control	Low - Moderate	homeowner, BWSR, HCD, DNR
Horse Stable and Backyard Livestock Management	Low	HCD, NRCS
Phosphorus Inactivation	High	MPCA, LSIA, Watershed

MPCA- Minnesota Pollution Control Agency
DNR- Department of Natural Resources
BWSR- Board of Soil and Water Resources
HCD- Hennepin Conservation District
CFSA- Consolidated Farm Services Agency
RIM- Reinvest in Minnesota
NRCS- Natural Resources Conservation Service
Met Council- Metropolitan Council