Technical and Cost Specification

Alterations to the 1980 Project
Clearwater River Chain of Lakes
Restoration Project

Submitted to
Clearwater River Watershed District

Prepared by
Wenck Associates, Inc.

July 2010

Technical and Cost Specification

Alterations to the 1980 Project Clearwater River Chain of Lakes Restoration Project

Wenck File #0002-148

Prepared for:

CLEARWATER RIVER WATERSHED DISTRICT
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July 2010

Wenck

I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineering under the laws of the State of Minnesota.

7-8-10

Norman C. Wenck — Registration No. 8946

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1.0 Purpose

The Clearwater River Watershed District (CRWD, District) implemented the 1980 Clearwater River Chain of Lakes Restoration Project (1980 Project) between 1980 and 1993. This $4.4 million project resulted in estimated phosphorus load reductions of over 41,000 pounds per year. This project has been maintained since 1993 using the 1980 Project Maintenance Fund.

Despite significant improvements in water quality throughout the CRWD, as the result of the 1980 Clearwater River Chain of Lakes Restoration Project, the Minnesota Pollution Control Agency (MPCA) determined that some of the same waters in the District do not meet newly established state standards for water quality. Specifically, 11 CRWD lakes were placed on the MPCA's list of impaired waters for nutrients. The Clearwater River between Clear Lake and Lake Betsy was also listed as impaired for Dissolved Oxygen (DO) and bacteria.

To date the CRWD has conducted TMDL studies for all impairments within its boundaries. Six lake-nutrient Total Daily Maximum Loads (TMDLs) and the bacteria TMDL for the Clearwater River have been approved by the EPA. Lake nutrient TMDLs are out for public comment for the remaining 5 lakes and 1 DO impairment in the Clearwater River.

The CRWD prepared a Watershed-wide Protection and Improvement Plan (TMDL Implementation Plan) which was approved by the MPCA in May 2010. In the TMDL Implementation Plan, the CRWD identified several projects and programs targeted to reach water quality goals. The CRWD is actively working towards meeting state standards by implementing these projects identified in the plan. To that end, grant applications for five of these projects have been submitted, two have been awarded to the CRWD to date.

The 1980 Project Maintenance Fund for the 1980 Clearwater River Chain of Lakes Restoration Project has a substantial fund balance and the potential use of these funds for the local match

required for grants is the subject of this Technical and Cost Specification. The Board of Managers of the CRWD directed the Engineer to prepare a Technical and Cost Specification for the potential funding of the CRWD's share of the five grant applications at their regular meeting dated June 8, 2010.

Since the activities required for the 1980 Project are considered outside normal and routine maintenance, this Technical and Cost Specification is prepared in accordance with MN Statute 103D.635. The potential activities discussed herein are considered necessary to attain the level of operating efficiency contemplated at the time of the original construction and implementation of the 1980 Clearwater River Chain of Lakes Restoration Project.

2.0 Introduction

2.1 BACKGROUND

The 1980 Project is detailed in the following paragraphs. The District submitted its original lake restoration grant application in October 1977. The project proposed to reverse the rapid cultural eutrophication of Clearwater Lake by reducing nutrients from inflowing streams. At that state, four sub-projects were proposed: (a) using wetlands as sediment and nutrient traps for stormwater runoff; (b) using agricultural lands to remove phosphorus from the hypolimnion of Lake Augusta; (c) placing aeration systems in Lake Betsy, Lake Louisa, Mill Pond and Lake Caroline; and (d) harvesting weeds from Clearwater Lake to remove phosphorus from bottom sediments. The original application also considered dredging, treating of bottom sediments to prevent phosphorus release, chemical treatment of plants, dilution or replacement of lake water, sealing of bottom sediments, aeration of Clearwater Lake, and doing nothing. The District found these approaches either too costly or ineffective.

The initial project saw wetland treatment systems as its backbone. The District modeled its original wetland treatment approach on 19 sites observed by the University of Minnesota and on EPA studies. The systems would combine physical, chemical and biological treatment. A series of ditches would dewater the upper levels of the marsh soil to promote aerobic biological activity. The waterlogged lower levels of soil would provide biological denitrification. The peat would adsorb solids in the influent water. Growing wetland plants would also use some of the phosphorus in the soils.

The other sub-projects of the original proposal were ultimately deleted and replaced. Initial funding for the Project was granted in 1980. At that time the total project budget was $2.4 million and there were six sub-projects, as follows: (a) Watkins (County Ditch 20) Wetland Treatment System, (b) Kingston Wetland Treatment System, (c) Annandale Wetland Treatment

System, (d) Lake Augusta Erosion Control Project, (e) Lake Augusta Hypolimnetic Treatment, and (f) Upper Lakes Reclamation. The District dropped weed harvesting from the final project because EPA would not support it. The District again looked at the hypolimnetic treatment of Lake Augusta and opted for alum treatment. It found alum treatment more cost effective. The District also added the Lake Augusta erosion control project to the first grant after severe erosion in a ravine leading to the lake threatened several homes. The public hearing for the Project was held in Annandale on September 10, 1980. At the public hearing, strong popular opposition was expressed toward the reclamation project, which would have entailed killing virtually all fish in the waters upstream from and including Lake Marie with the chemical rotenone (after which, desirable game fish would be restocked). Subsequently the reclamation project was deleted. Following special monitoring studies in the upstream lakes in 1983, two new projects involving hypolimnetic aeration and the removal of rough fish by mechanical means (netting) were introduced in place of the upper lakes reclamation and the hypolimnetic alum treatment of Lake Augusta.

The District constructed and implemented the above projects during the mid-1980s. The Lake Augusta Erosion Control Project was completed in 1982. The three wetland treatment systems – on County Ditch 20 downstream from Watkins; on the Clearwater River in Kingston Township; and on a tributary to Warner Creek that drains portions of Annandale – were constructed in 1984-1985. (Modifications to the wetland treatment systems were made in 1989.) Hypolimnetic aerators were installed in Lake Augusta and Lake Louisa in 1985 and in Lake Marie in 1986. Rough fish were aggressively netted in Lakes Louisa, Marie, and other upstream lakes during the period 1984-1988.

During the course of the Project there were three substantial additions. The first of these was the hydrologic isolation of an unexpected source of phosphorus – a wetland that had received raw wastewater from the dairy in Watkins for many years – which was discovered through the Project's monitoring program. Contrary to the behavior of natural wetlands, the Upper Watkins Wetland was exporting (rather than absorbing) phosphorus; and it was found to do so at the astonishing rate of about 30,000 pounds per year. The Upper Watkins Wetland Isolation was

added to the Project in 1983 and completed in 1984. The addition increased the total Project budget by $470,000. Of this amount, a federal Clean Lakes grant increase provided 50 percent, a special assessment levied against the dairy provided 48 percent, and the District provided 2 percent.

The second addition was the Nonpoint Source Pollution Abatement Project, initiated in 1985. This project had two parallel aims: first, to improve lake water quality by reducing nonpoint source pollution from the predominantly agricultural watershed; and second, to enhance agricultural efficiency and economy in the watershed by minimizing the loss of valuable nutrients from the land. Not surprisingly then, the project also came to have two names, the second one being the Tri-County Conservation Project.

A number of local, state, and federal agencies servicing the agricultural sector cooperated with the three main sponsors of the Clearwater Project in carrying out the Nonpoint Source Project. Chief among these were the Stearns, Meeker, and Wright Soil and Water Conservation Districts. A steering committee known as the Tri-County Conservation Committee was formed with representatives of these three districts plus the Clearwater River Watershed District. The Nonpoint Source Project increased the overall Project budget to $3.3 million.

The third major addition to the Clearwater Project augmented and extended the Tri-County Project beginning in 1990. It increased the overall Project budget to $4.4 million. Funding sources for the Tri-County Project and its extension included Clean Lakes grant funds, the Watershed District, the MPCA, and cooperating agency in-kind contributions and other local sources. Appendix A includes Table 2 - Summary of Project Activities from the 1981-1992 Final Evaluation Report, September 1993 prepared for the CRWD, and Table 13 from the same report which estimates the phosphorus load reductions accomplished by the Project.

2.2 GRANT APPLICATIONS

Grant applications have been submitted for the following five projects:

1. Reducing Phosphorus Loads to Lake Betsy by Protecting Willow Creek
2. Reducing Phosphorus Loads to Lakes through Targeted Agricultural Fertilizer Application
3. Lake Betsy Hypolimnetic Withdrawal and Irrigation Project
4. Watkins Stormwater Impoundment
5. Kingston Wetland Feasibility Study and Restoration

Copies of the recent grant applications are enclosed as Appendix B.

The Willow Creek grant has been awarded for a total grant amount of $70,900 and the Conservation Corps River Stabilization grant has been awarded for 40 crew days.

The District's share of the awarded grants and potential grants are shown below:

AWARDED PROJECTS		**CRWD SHARE**
a.	Willow Creek	$30,000
b.	CCM River Stabilization	$13,867

POTENTIAL PROJECT		**POTENTIAL CRWD SHARE**
a.	Targeted Fertilizer Application	$70,800
b.	Lake Betsy Hypolimnetic Withdrawal	$140,000
c.	Watkins Stormwater Impoundment	$293,976
d.	Kingston Wetland Restoration	$334,936

Revised 6-29-10

3.0 Technical Specifications

3.1 NEEDS

The TMDLs for the impaired waters have been completed and approved. The total phosphorus load reductions for each lake are listed below:

Impaired Water	Goal Pounds/Year	Reduction Required Pounds/Year
Albion Lake	365	3,510
Lake Augusta	279	124
Lake Betsy	2,868	19,175
Lake Caroline	3,668	1,974
Clear Lake	1,250	11,828
Henshaw Lake	262	3,461
Lake Louisa	1,499	4,285
Lake Marie	2,902	2,734
Scott Lake	2,088	14,148
Swartout Lake	314	6,019
Union Lake	323	182

There are significant challenges to achieve the required reductions and therefore reach the goals for the impaired lakes. A variety of techniques will be required to be employed.

Water quality monitoring has been performed since 1980 and identifies issues and progress within the District. The results of this comprehensive monitoring program are used to guide and develop water improvement projects.

3.2 TMDL IMPLEMENTATION PLAN

3.2.1 Estimated Costs

Table 1 presents the CRWD's conceptual implementation plan. While specific projects are not specified, the anticipated practices are presented, together with the targeted TMDL, unit cost estimate and estimated potential cost. It is anticipated that the completion of the plan will take several decades to reach the required goals.

TABLE 1
POTENTIAL TMDL IMPLEMENTATION PROJECTS

Practice	TMDL	Unit Cost	Units	Note	Qty	Cost
Promote Ag BMPs (P Testing and fertilizer application)	Nutrient, DO	$50,000	ls		1	$75,000
Replace Tile Intakes w/ Filters	Nutrient, DO, Bacteria	$500	per intake	*evaluate limestone/steel wool filter intakes to increase P removal	400	$200,000
Tile Intake Buffers	Nutrient, DO, Bacteria	$100	per intake		300	$30,000
Buffer Tributaries	Nutrient, DO, Bacteria	$350	ac		300	$105,000
Buffer Stream Banks	Nutrient, DO, Bacteria	$350	ac		200	$70,000
DO Augmentation for Clearwater River	DO		lf	*design and construct, operation		$500,000
Tile Discharge Management	Nutrient, DO, Bacteria	$130,000	ls	* Inventory, FS, design construct	1	$130,000
Riparian Pasture/ Grazing Management Grants	Nutrient, DO, Bacteria	$10,000	ea	*keep livestock out of stream	10	$100,000
Street Sweeping: Kimball, Southaven, Fairhaven & Watkins	Nutrient, DO, Bacteria	$40	per curb mile	* high efficiency, 55 curb miles for 15 years		1,125,000
Lakeshore Septic Upgrade Grants	Nutrient	$7,500	ea	All Impaired Lakes	130	$975,000
Lake shore restoration grants (Shore land Erosion)	Nutrient	$300	ea	*grants	300	$90,000
Shallow Lakes Management Plans for Marie, Clear, Swartout, Albion & Henshaw Lakes	Nutrient	$15,000	ea		5	$75,000
Carp Control	Nutrient	$25,000	average per year per lake	*Fish trap already installed at Louisa, harvesting under way in several impaired lakes (5 lakes, 6 yrs)	30	$750,000
Curly Leaf Pondweed Control	Nutrient			*Lake association cost, some cost share		$100,000
Lake Aeration	Nutrient			2 Existing aerators re-installed		$600,000
Alum dosing of Cleawater River upstream of Kingston	Nutrient, DO					$600,000
Hypolimnetic withdrawl (Betsy)	Nutrient					$350,000
Kingston Wetland Maintenance / Enhancement	Nutrient, DO					$250,000
South Haven Stormwater Enhancement	Nutrient, DO, Bacteria					$75,000
City of Kimball Stormwater Enhancement Per 2004 Kimball Area Stormwater Management Study	Nutrient, DO, Bacteria					$500,000
City of Watkins Stormwater Enhancement per 2006 Watkins Area Stormwater Management Study	Nutrient, DO, Bacteria					$800,000
Public Outreach	Nutrient, DO, Bacteria	$10,000	per year		10	$100,000
Implementation Project Management and Administration	Nutrient, DO, Bacteria	$30,000	per year		10	$300,000
Implementation Performance Monitoring, Recommendations for Adaptive Management	Nutrient, DO, Bacteria	$25,000	per year		10	$250,000
Implementation Engineering	Nutrient, DO, Bacteria	$15,000	per year		10	$150,000
T:\0002\127\[TMDL Implementation_FINAL.xls]August 08					**TOTAL:**	**$8,300,000**

3.3 REPLACEMENT PROJECTS

A Technical Memorandum dated January 31, 2008, enclosed as Appendix C, detailed a number of projects already completed as replacement projects for certain aspects of the 1980 Project. The recommendation of this memorandum was to amend the 1980 Project to include these replacement projects and are also included in this Technical and Cost Specification.

4.0 Recommendations

It is recommended that the 1980 Project be amended to include the activities described in the five grant applications discussed in Section 2, Introduction, and Section 3, Technical Specifications detailed in other sections of this document, as well as the replacement projects. These activities are considered necessary to attain the level of operating efficiency contemplated at the time of the original construction and implementation of the 1980 Project.

5.0 Certification

The additional activities described in Section 2 and other sections of this document are required to be implemented to fully achieve the purposes of the 1980 Project. The exact nature of the additional activities will be determined from on-going monitoring results, from design activities, further evaluation of techniques, available grant funding and cooperation of local entities on which projects or practices are implemented.

6.0 References

Wenck Associates, Inc. (January 2009) *Final Upper Watershed TMDL Studies for the Clearwater River Watershed District Part I & II* Prepared by Wenck on Behalf of the Clearwater River Watershed District.

Wenck Associates, Inc. (May 2010) *Draft Clearwater River Watershed District Five-Lakes Nutrient TMDL* Prepared by Wenck on Behalf of the Clearwater River Watershed District.

Wenck Associates, Inc. (May 2010) *Final Clearwater River Watershed District Protection and Improvement Plan (TMDL Implementation Plan).* Prepared by Wenck on Behalf of the Clearwater River Watershed District.

Appendix A

Summary of Project Activities Table

(Taken from 1981 – 1992 Final Evaluation Report of the 1980 Clearwater River Chain of Lakes Restoration Project)

TABLE 2

SUMMARY OF PROJECT ACTIVITIES

Clearwater River Chain of Lakes Restoration Project

Date	Activities
1980	Funding was granted by the Environmental Protection Agency (EPA) and the Minnesota Pollution Control Agency (MPCA) for the Clearwater River Chain of Lakes Restoration Project, with a total project budget of $2.4 million. Funding was 50 percent federal, 25 percent state, and 25 percent from special assessments on lakeshore and adjacent properties with deeded lake access.
1981-1992	Lake, stream and precipitation monitoring
1982	Lake Augusta Erosion Control Project completed
1982-84	Special monitoring in the Watkins area, eventually leading to development of the Upper Watkins Wetland Isolation Project, the addition of which brought total project budget up to $2.9 million.
Mid- 1982-83	Clear Lake Monitoring
Spring 1983	Special study to measure the physical-chemical release of phosphorus from bottom sediments in Lakes Louisa and Marie
Sept. 1984-88	Rough fish removal in the chain of lakes
Late 1984	Upper Watkins Wetland Isolation Project completed
Late 1984	Wetland Treatment Systems completed and put into operation near Watkins and Annandale
1985	Wetland Treatment System completed and put into operation near Kingston

TABLE 2 (Cont.)

SUMMARY OF PROJECT ACTIVITIES

Clearwater River Chain of Lakes Restoration Project

Date	Activities
1985	EPA and MPCA approval of additional funds to be used in a cooperative effort with Soil and Water Conservation Districts and other agencies to abate nonpoint source pollution. The project budget then totaled $3.3 million. The grant was extended to 1990.
1985-Sept. 1990	Nonpoint source pollution abatement programs
Nov. 1985	Installation of aeration equipment on Lakes Augusta and Louisa
May 1986	Installation of aeration equipment on Lake Marie
1989	Modifications were completed on the three Wetland Treatment Systems
July 1990	EPA and MPCA granted additional funding to extend Nonpoint Source Pollution Abatement Project to September 1993. Total project budget increased to $4.4 million.
1990-Sept. 1993	Nonpoint source pollution abatement programs continued.

TABLE 13

ESTIMATED PHOSPHORUS LOAD REDUCTIONS

Clearwater River Chain of Lakes Restoration Project

Individual Project	Phosphorus Load Reduction (pounds per year)
Wetland Treatment Systems:	
County Ditch 20	1,000
Kingston	5,600
Annandale	750
Wetland Treatment Subtotal	**7,350**
Upper Lakes Projects:	
Lake Augusta Erosion Control	42
Lake Augusta Hypolimnetic Aeration	280
Upper Lakes Aeration and Fish Removal	1,800
Upper Lakes Subtotal	**2,122**
Upper Watkins Wetland Isolation	**30,000**
Nonpoint Source Pollution Abatement:	
Minimum Till	590
Ridge Till	170
CRP Filter Strip	1
Field Strip	55
Soil Testing	200
Nutrient Management	110
RIM Incentive	150
Animal Waste Control and Management	800
Nonpoint Source (Tri-County) Subtotal	**2,076**
RESTORATION PROJECT TOTAL	**41,548**

Note: Reductions for Wetland Treatment Systems, Lake Augusta Erosion Control, and Nonpoint Source Pollution Abatement depend on watershed's phosphorus export value; 1981-1992 average nonpoint export of 355 pounds per square mile per year assumed.

Appendix B

Grant Applications

- Reducing Phosphorus Loads to Lake Betsy by Protecting Willow Creek
- Lake Betsy Hypolimnetic Withdrawal and Irrigation Project
- Reducing Phosphorus Loads to Lakes through Targeted Agricultural Fertilizer Application
- Watkins Stormwater Impoundment
- Kingston Wetland Feasibility Study and Restoration

Reducing Phosphorus Loads to Lake Betsy by Protecting Willow Creek

Project Narrative Form FY10-1

FY 2010 Clean Water Fund
Water Quality Comprehensive Project Narrative

The entire narrative portion of the application should be no more than 3 pages in length and should include the following topics as section headings

Title: (10 words or less):

Reducing Phosphorus Loads to Lake Betsy by Protecting Willow Creek

Project Abstract (30 words or less):
Stormwater infiltration in the City of Kimball to reduce phosphorus loads to Lake Betsy and protect and improve nearby Willow Creek, a trout stream, from temperature and water quality impacts.

Overall Project Narrative (500 words or less): This section of the narrative should describe the level of project partners' coordination, cooperation and community support for the project, projects that have proven to be successful in similar circumstances or prior successful projects and the level of project partners' project management expertise and experience and any habitat benefits that may result from this project.

Stormwater runoff from the City of Kimball drains untreated into Willow Creek, a trout stream. Willow Creek is tributary to Lake Betsy, which is impaired by excess nutrients. The project proposed by the Clearwater River Watershed District (CRWD) targets phosphorus removal for Lake Betsy and protection of the Willow Creek trout habitat by infiltrating the 1.5-inch storm event off 428 acres in and around the City of Kimball.

The Minnesota DNR has identified that stormwater runoff from the City of Kimball is currently the biggest threat to trout habitat in Willow Creek. Currently stormwater runoff from the City discharges directly into Willow Creek, increasing temperatures, degrading water quality and threatening trout habitat. Infiltration of stormwater from the 1.5-inch event will recharge the shallow groundwater which feeds Willow Creek with cool water and will remove up to 90 percent of the annual total phosphorus load from the tributary area to the Creek and reduce loads to the nutrient-impaired Lake Betsy downstream. Runoff from the City will be routed into small temporary retention ponds and then infiltrated in sandy soils around the city through spray irrigation.

An 87% phosphorus load reduction is required for Lake Betsy to reach water quality goals. Because Lake Betsy is upstream of other lakes on the Clearwater River Chain of Lakes, meeting the load reduction goal to Lake Betsy is critical to

achieving water quality goals in five impaired lakes downstream and protecting the quality of the remaining lakes in the chain. It is estimated that this project will reduce phosphorus discharged to Willow Creek and Lake Betsy by 244 pounds annually, or about 3 percent of the 8,300 pound annual load reduction required for Lake Betsy. Because of the magnitude of the load reduction required by the TMDL, a wide variety of Best Management Practices is necessary across the watershed. Kimball is one of two urban areas tributary to Lake Betsy, making it a targeted area for load reduction in the TMDL. The proposed project addresses both habitat protection and nutrient load reduction to an impaired lake.

The Clearwater River Watershed District, the City of Kimball, Stearns County SWCD, Maine Prairie Township and the DNR are project cooperators. The City of Kimball will donate the land to be used for this project. A TAC comprised of representatives from each of these groups will be involved in final design and implementation.

Explain how this project will mitigate or prevent current or future water quality impairments.

An 87% phosphorus load reduction is required for Lake Betsy to reach water quality goals. Kimball is one of two urban areas tributary to Lake Betsy. The Minnesota DNR has identified stormwater runoff from the City of Kimball as the main threat to Willow Creek. The proposed project addresses both issues through one project.

Precipitation events of 1.5 inches or less represent 95% of the precipitation in the Twin Cities Metro Area, conveying 75% of the phosphorus runoff from urban areas. Best Management Practices targeting events of this size are ideal for controlling runoff volumes and also for improving water quality. By managing this water quality event, the project improves habitat for Willow Creek by maintaining more constant, lower temperatures and bringing baseflow in the creek closer to pre-settlement conditions. Further, phosphorus loads to Lake Betsy will also be reduced.

How will this project address the hydrologic function of the immediate affected watershed and keep water on the land?

In pre-settlement conditions, rainfall from small events naturally infiltrated into the sandy soils around Willow Creek. As the City of Kimball grew and impervious area increased, the less water infiltrated and more ran off to Willow Creek. The new impervious area not only increases the volume of runoff, but also the temperature of the runoff, and the total mass of nutrients exported from the landscape. Decreasing infiltration likely has decreased the baseflow of Willow Creek, amplifying the effects of high temperature runoff from the City. Infiltrating the stormwater will recharge the shallow groundwater, adding to the cool baseflow which sustains trout habitat in Willow Creek and reducing the volume of warm runoff.

Identify long-term inspections and maintenance needs of the project and how these activities will be accomplished.
The project will require operation, maintenance and inspection annually. The City of Kimball is a project cooperator and will provide operation and maintenance of the facility in conjunction with its existing spray irrigation system to dispose of wastewater, but on a different location.

Describe the coordination of this project with local groundwater plans.
Infiltration areas are located outside of wellhead protection areas.

Please indicate any permits this project will require. Identify the current stage of the permitting process.
The MPCA will require a SDS permit for the project. We will also convene a TAC including the City of Kimball, Stearns County SCWD and the Minnesota DNR fisheries and waters to collaborate on and approve final project design to ensure maximum project success and protection of the resources.

If the project participants choose to consider the conservation value of land where Clean Water Fund conservation practices will be installed as local match, please describe the valuation and application methods.
Not applicable.

If using Clean Water Funds for incentives to encourage landowners to install structural practices or to adopt land management practices that improve or protect water quality, please describe the LGU's adopted policy for evaluating the necessity, method of calculation, and effectiveness of the proposed incentives.
Not applicable.

Lake Betsy Hypolimnetic Withdrawal and Irrigation Project

Project Narrative Form FY10-1

FY 2010 Clean Water Fund
Water Quality Comprehensive Project Narrative

The entire narrative portion of the application should be no more than 3 pages in length and should include the following topics as section headings

Title: (10 words or less):

Lake Betsy Hypolimnetic Withdrawal and Irrigation Project

Project Abstract (30 words or less):
Nutrient rich water will be withdrawn from Lake Betsy's hypolimnion, permanently reducing the lake's internal load. The hyplimnetic water will provide an irrigation source for local farmers.

Overall Project Narrative (500 words or less): This section of the narrative should describe the level of project partners' coordination, cooperation and community support for the project, projects that have proven to be successful in similar circumstances or prior successful projects and the level of project partners' project management expertise and experience and any habitat benefits that may result from this project.

Lake Betsy is a 148 acre lake in Meeker County south of the city of Kimball. As an upstream lake in a series of lakes along the Clearwater River, Lake Betsy traps nutrients and sediment from the watershed and protects the water quality of downstream lakes. Lake Betsy suffers from severe algae blooms, and the recently-completed TMDL performed by the Clearwater River Watershed District (CRWD) for the lake estimates that an 87 percent reduction in total phosphorus load is necessary to consistently meet state water quality standards for nutrients. Modeling shows that reductions are needed from both watershed and internal loading sources to meet water quality standards.

Water quality in Lake Betsy is dominated by loads from the Clearwater River, but in 2 of the past 5 years annual average water quality in Lake Betsy has been worse than flow-weighted mean concentrations in the Clearwater River upstream, meaning that Betsy exports a significant phosphorus load to downstream lakes. Meeting the load reduction goal for Lake Betsy is critical to achieving water quality goals in 5 impaired lakes downstream.

The Lake Betsy Hypolimnetic Withdrawal and Irrigation Project would reduce internal load by pumping hypolimnetic water out of Lake Betsy and using the nutrient-rich water to irrigate agricultural fields near the lake. This will permanantly remove 480 pounds of phosphorus annually from Lake Betsy -

about 7 percent of the required internal load reduction - and reduce the amount of fertilizer applied by the adjacent landowners to those fields. The irrigated water will be applied so that excess water is infiltrated and does not runoff to the lake. Native soils will adsorb phosphorus from infiltrated water before it discharges back into the adjacent lake and river system.

To evaluate the cost effectiveness of the project, the CRWD will perform two years of monitoring on Lake Betsy: inlet and outlet monitoring of flow volume and water quality; weekly temperature and dissolved oxygen profiles; and biweekly nutrient profiles. This monitoring will update the detailed water and nutrient budget for the lake prepared for the TMDL, and allow the District to track changes in water quality in the lake and t in the hypolimnion volume and water quality. The land owners performing the irrigation will track the days and hours of pump operation and volume pumped from the lake. The monitoring and pumping data will be used to prepare a more refined estimate of phosphorus removal from the lake.

The CRWD will administer the project and perform the monitoring. The adjacent landowners are in favor of the project and agreements have already been reached with them, subject to project funding.

Explain how this project will mitigate or prevent current or future water quality impairments.

The Upper Watershed TMDL Studies for the CRWD determined that it will not be possible to achieve water quality goals for Lake Betsy without controlling the internal nutrient load. The internal nutrient load is more than one third of the total nutrient load to the lake. This project provides permanant and ongoing control of internal load.

The project will also reduce external load to Lake Betsy. The nutrient rich water from the lake will be applied to local agricultural fields. This will reduce the application of fertilizers in the immediate watershed of Lake Betsy and result in lower total phosphorus runoff concentrations to the lake.

Because of the flow-through nature of the Clearwater River Chain of Lakes, improving in-lake water qualtiy in Lake Betsy will improve water quality in downstream lakes, many of which are also impaired for nutrients.

How will this project address the hydrologic function of the immediate affected watershed and keep water on the land?

The hydrologic function of the immediate watershed to Lake Betsy should not be impacted by the proposed project. Depending on the amount of pumping it may be necessary to examine the drawdown effects on lake water levels. However,

the lake receives significant inflows from the river and also has a large contributing watershed.

This project may provide a benefit to the local hydrology. Using the lake water as an irrigation source could reduce the need for farmers to use groundwater from the aquifer for irrigation. The applied water will infiltrate and could serve as a recharge source to the shallow aquifer which discharges to the lake and river.

Identify long-term inspections and maintenance needs of the project and how these activities will be accomplished.

Equipment will be inspected annually and maintenance performed as necessary through the CRWD's annual inpsection and maintenance program. Lake Betsy is monitored monthly each year, and will be monitored weekly during the first two years to fine-tune operations and to optimize project success.

Describe the coordination of this project with local groundwater plans.

The proposed project would employ pumps to remove water from the hypolimnetic zone of Lake Betsy for use as an irrigation source on local fields. The water sprayed on fields will infiltrate and recharge the local shallow aquifers. Less water groundwater will be consumed for irrigation within the project area.

Please indicate any permits this project will require. Identify the current stage of the permitting process.

The proposed project would require several permits prior to construction. Minnesota Department of Natural Resources (DNR) permits may be required, including Work in Public Waters, Water Appropriations, and Partial Drawdown Waters Work permits. Discussions are ongoing with the DNR but the permits have not yet been obtained.

As is the case for all CRWD projects, we convene a technical advisory committee formed of members from all appropriate agencies to maximize project success.

If the project participants choose to consider the conservation value of land where Clean Water Fund conservation practices will be installed as local match, please describe the valuation and application methods.
Not applicable

If using Clean Water Funds for incentives to encourage landowners to install structural practices or to adopt land management practices that improve or protect water quality, please describe the LGU's adopted policy for evaluating the necessity, method of calculation, and effectiveness of the proposed incentives.
Not applicable

Minnesota Pollution Control Agency
520 Lafayette Road
St. Paul, MN 55155-4194

2009 Proposal Form

EPA Section 319(h)
Developmental, Education or Research Project Grant
and TMDL Implementation Grant

Proposal Deadline 4:30PM Wednesday, July 15, 2009

Location of the 2009 Section 319 Grant RFP: http://www.pca.state.mn.us/water/cwp-319.html

Submit a copy of the Proposal Form electronically via e-mail to: CWP-319.grant.program@pca.state.mn.us

Applying for: ☒ DER funds ☐ TMDL Implementation funds

If applying for both, use separate proposal forms for each proposal.

Project Title, Create a unique name that begins with the name of the impaired water body and includes the pollutant name. 50 character **maximum.**

Project Title: Lake Betsy Hypolimnetic Nutrient Reduction

Contact Information

Primary Contact Person: Merle Anderson

Organization: Clearwater River Watershed District Administrator

Street Address: Box 481

City: Annandale State: MN Zip: 55302

Phone: 320 - 274 - 3935 Fax: 320 - 274 - 3975 Email: pacma@frontiernet.net

Other Proposal Information:

Incentives:

☐ Check here if you are planning on using any of these funds for **additional** incentives. Name incentive program(s) being added to and describe additional water quality benefit(s):

Project Budget Projection

Grant Funds Requested (55%)	$170,000
Match - cash and in-kind (45%)	$140,000
Total Project Cost (100%)	$310,000

Timeline:

Project will be completed by December 31, 2013. (no later than August 31, 2014).

Organization Information

Describe the relevant qualifications of project staff that will ensure the success of this project. List any previous Section 319(h) grants you have received in the past three years and describe your performance level on them (was reporting done on time, was eLINK and STORET data entered by the deadline, was the project completed as described in the application and were all of the grant funds spent?).

The Clearwater River Watershed District was established in 1975 to comprehensively manage the water resources in the 159 square mile watershed. It includes portions of Meeker, Stearns, and Wright Counties in Central Minnesota, and the municipalities of Watkins, Kimball, and Annandale, as well as all or parts of various townships. The five-member Board of Managers oversees activities in the watershed, assisted by an administrator and assistant administrator and a contracted engineer. The District has undertaken a number of projects to improve conditions, including the several projects encompassing the Clearwater River Chain of Lakes Restoration Project, wetland restorations, aquatic vegetation and rough fish management, and promotion of agricultural BMPs. The District was awarded the DNR's Watershed District of the Year in 2004. District Engineer Norm Wenck has 45 years of experience in environmental and water resources engineering.

The District has not received Section 319 funds in the past three years.

Project Location

Watershed: Mississippi River - St. Cloud: Clearwater River

8 digit Hydrologic Unit Code: 07010203

Lat/long of project or center of project: 45.274975, -94.281321

What type of **waterbody** does it affect?

☐ Stream ☒ Lake ☐ River ☐ Other **Waterbody Name:** Lake Betsy 47-0042

Basin (Check all that apply)

☐ Lake Superior ☐ Lower Mississippi/Cedar ☒ Upper Mississippi ☐ Minnesota ☐ Rainy

☐ Red River ☐ Des Moines ☐ Missouri ☐ St. Croix ☐ Statewide

If applicable, attach map of project area to proposal.

Proposal Summary

Activities In 150 words or less, summarize the narrative.

Lake Betsy is a 148 acre lake in Meeker County south of the city of Kimball that is impaired by high nutrient concentration, including high internal phosphorus load. The Clearwater River flows through the lake, trapping nutrients from the upper watershed in the lake sediments. This project would pump nutrient-rich water from the lake hypolimnion and use it to irrigate a nearby farm field. Intensive monitoring will be completed to evaluate the effectiveness of the BMP in reducing internal load. Lake inflows and outflows will be monitored for flow and quality, while weekly temperature and dissolved oxygen profiles and bi weekly nutrient profiles will be taken to evaluate impact on lake water quality. Volume and timing of withdrawals will be tracked to estimate load reduction.

Outcomes In 100 words or less, provide concise statement of deliverables/outcomes this project would achieve.

The Project will assess the cost-effectiveness of lake hypolimnetic withdrawal and irrigation as an internal phosphorus load management BMP, and evaluate its transferability to lakes in the Clearwater River Watershed District and elsewhere.

Nonpoint Concern Addressed by Project

☒ Listed 303(d) impairment (specify) Excess nutrients

☐ Other documented water quality problem: _____

☐ Other (explain) _____

Estimated Pollutant Reductions

☒ Phosphorus 300 lbs/yr

☐ Sediment _____ tons/yr

☐ Nitrogen _____ lbs/yr

☐ Other (list) _____

Project Plan Information

Indicate **page numbers** and **effective dates** of plans relating to this project:

For DER projects only - Minnesota's current Non-Point Source Management Plan: (also specify which action steps will be addressed): P. 4.2-151, Lakes Goal 4, Action Step 1 (support projects in local plans); Pp. 9-319-320, Agricultural Nutrients Goal 1, Action Steps 2 (education and outreach) and 4 (innovative BMPs)

Basin Plan for this Watershed: _____

Comprehensive Local Water Plan: _____

TMDL Implementation Plan: Clearwater River Watershed District Watershed-Wide Implementation Plan, page 4-5

Impaired Waters Research Symposium: _____

Project Partners

List all partners who will be involved in this project and amount of match they will be providing:

_____ Match _____

_____ Match _____

_____ Match _____

_____ Match _____

Project Narrative (2 page limit) See instructions.

Lake Betsy is a 148 acre lake in Meeker County south of the city of Kimball (see Figure 1). As an upstream lake in a series of lakes along the Clearwater River, Lake Betsy traps nutrients and sediment from the watershed and protects the water quality of downstream lakes. Lake Betsy suffers from severe algae blooms, and the recently-completed TMDL for the lake estimates that an 87 percent decrease in total phosphorus load is necessary to consistently meet state water quality standards for nutrients.

The Lake Betsy Hypolimnetic Withdrawal and Irrigation Pilot Project has two goals: to reduce internal load in Lake Betsy, and to evaluate the cost-effectiveness of this BMP and its transferability to other lakes.

Water quality in Lake Betsy is dominated by loads from the Clearwater River, but in 2 of the past 5 years annual average water quality in Lake Betsy has been *worse* than flow-weighted mean concentrations in the Clearwater River upstream of Lake Betsy. Betsy exports a significant phosphorus load to downstream lakes, so improving water quality in Lake Betsy would have a positive impact on water quality downstream.

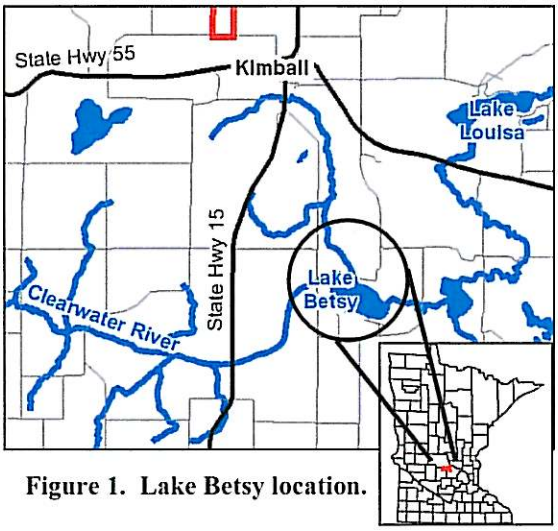

Figure 1. Lake Betsy location.

The proposed project to be constructed by the Clearwater River Watershed District would pump nutrient-rich water from the lake's hypolimnion for use in irrigating a nearby farm field. The proposed hypolimnetic withdrawal system would consist of a pump powered by a tractor power take off. The pump would be located in a manhole along the shoreline with an intake pipe anchored to the bottom running from the manhole approximately 1,200 feet to the deep portion of the lake (see Figure 2). This system would pump water out of the lake bottom from the intake pipe, through a pipe to a hose reel and travelling irrigation gun that would apply the water to fields surrounding the lake.

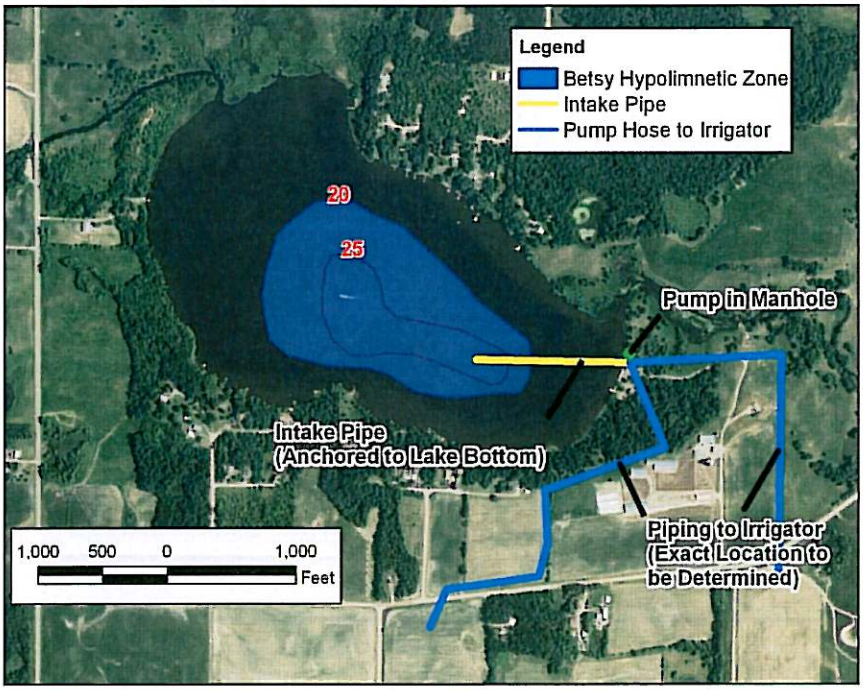

Figure 2. Lake Betsy proposed hypolimnetic withdrawal and irrigation pilot system.

A 55 hp pump would be needed to pump the water from the edge of the lake to the irrigation gun, a horizontal distance of up to 4,000 feet and a vertical height of about 80 feet, with enough pressure (100 psi) to operate the irrigation gun. It is estimated that pumping would occur about half the time from June to September, or about 60 days of pumping at a pumping rate of 400 gpm. At that rate an estimated 300 pounds of phosphorus would be removed from the lake annually.

EVALUATION

To evaluate the cost effectiveness of the BMP, the Clearwater River Watershed District will perform two years of detailed monitoring on Lake Betsy. The monitoring will consist of inlet and outlet monitoring of flow volume and water quality; weekly temperature and dissolved oxygen profiles; and biweekly nutrient profiles. This monitoring will update the detailed water and nutrient budget for the lake prepared for the TMDL, and allow the District to track changes in water quality in the lake and to track changes in the hypolimnion volume and water quality. The land owner performing the irrigation will track the days and hours of pump operation and volume pumped from the lake. The monitoring and pumping data will be used to prepare a more refined estimate of phosphorus removal from the lake.

Some questions to be explored in the two-year evaluation period include:

- How much pumping (volume, frequency, etc.) is necessary to optimize phosphorus removal? Must the entire hypolimnetic volume be removed?
- How much field area is required to service that volume?
- Is there an optimum schedule of operation (i.e. frequency of pumping, hours of operation) to manage the hypolimnion?
- What are the important variables affecting transferability?
- Are there other lakes in the District or the region that may be suitable for this type of BMP?

INFORMATION DISSEMINATION

The District will summarize data gathered each year during the two year evaluation period and post reports on its website. The District routinely submits its monitoring data to STORET. A final report will assess the effectiveness of the Pilot Project and make recommendations regarding its applicability in the District and elsewhere.

Success will be measured by the load of phosphorus removed from Lake Betsy. Two years' data may not be sufficient to show a measurable decrease in total phosphorus concentration in Lake Betsy due to effects of precipitation year, climate, and other variables that result in annual variations in water quality.

Success will also be measured by whether the project results can make a clear recommendation of the cost-effectiveness and transferability of this BMP.

SCHEDULE

This project is expected to be constructed in 2010, depending on funding availability, followed by two growing seasons of monitoring. If installed at the start of growing season in 2010, monitoring would occur in 2010 and 2011, with the final report in spring 2012. If funding precludes installation until later in 2010 or delays installation to 2011, then the final report would be expected in spring 2013.

Project Budget Detail

Table A: Project Tasks and Estimated Costs

Task #	Task Description	Requested Grant Amount	Match	Total Task Amount
1	Project design, management, and permitting	$10,000	$10,000	$20,000
2	Construction	$160,000	$120,000	$280,000
3	Monitoring and evaluation		$8,000	$8,000
4	Administration/ Semi Annual and Final Reports[1]		$2,000	$2,000
	Totals	$170,000	$140,000	$310,000

Table B: Project Costs by Budget Category

Budget Category	Requested 319 Grant Amount	Cash and In-Kind Match Amount	Total Category Amount	Match Source[2]
1. Administration (salary, fringe)[1]		$2,000	$2,000	District budget
2. Other Personnel and fringe				
3. Travel				
4. Supplies				
5. Equipment				
6. Contractual Services	$170,000	$138,000	$308,000	District budget
7. Cost Share				
8. Other (explain)				
Totals			$310,000	

1. There is a limit of ten percent (10%) for administration.
2. You cannot match federal dollars with federal dollars, even if it is over and above the required match.

Reducing Phosphorus Loads to Lakes through Targeted Agricultural Fertilizer Application

FY 2010 Clean Water Fund
Water Quality Comprehensive Project Narrative

The entire narrative portion of the application should be no more than 3 pages in length and should include the following topics as section headings

Title: (10 words or less):

Reducing Phosphorus Loads to Lakes through Targeted Agricultural Fertilizer Application

Project Abstract (30 words or less):
Provide cost share for farmers to test/ map soil phosphorus content for GPS-guided fertilizer application to reduce agricultural phosphorus runoff to 11 impaired watershed lakes.

Overall Project Narrative (500 words or less): This section of the narrative should describe the level of project partners' coordination, cooperation and community support for the project, projects that have proven to be successful in similar circumstances or prior successful projects and the level of project partners' project management expertise and experience and any habitat benefits that may result from this project.
Nutrient TMDLs completed for 11 impaired lakes in the Clearwater River Watershed District (CRWD) identified the need to reduce phosphorus load to the lakes by 25% to 95%. Because most of the watershed is in agricultural production, aggressive agricultural BMPs are necessary to achieve in-lake water quality standards, and will require widespread farmer participation.

Soil fertilizers are used throughout the watershed and are usually applied to fields at a standard rate, even though soil nutrient levels, soil type, and pH may vary significantly across the field. The proposed project is a field trial to demonstrate the feasibility and utility of systematic soil testing in reducing fertilizer application and thus phosphorus load in agricultural runoff. This approach can be applied throughout the agricultural areas of the state to cut down on fertilizer costs and reduce runoff of nutrients into adjacent water bodies.

Soil tests will be taken on a grid across up to 10,000 acres of critical cropland to determine the proper amount of fertilizer to be applied to each section of the field. The applicator will use the results of the soil tests and GPS technology to apply the precise amount of fertilizer in each grid of the fields. A 10% average reduction in fertilizer application rates was obtained on test plots in the area.

Field selection will be prioritized by (but not limited to) two location factors. First, the AGNPS model that the CRWD completed in the 1980's identified sensitive areas for agricultural runoff, based on proximity to water bodies, slope, and soil type, and those areas will be priority locations for the field trial. The second priority area will be that part of the upper watershed that drains to Lake Betsy, which exports a significant phosphorus load to downstream lakes. Improving Lake Betsy's water quality is critical to meeting goals in impaired waters downstream.

Monitoring will be conducted at drain tile outlets from selected fields. Samples will also be collected from tile outlets in fields that are not a part of the field trial to be used as background data for comparison. Crop yields will also be monitored.

The outcomes of the field trial are a reduction in phosphorus from fertilizer exported to impaired waters from cropland, and a quantification, evaluation, and publication of the load reduction achieved. The results of this field test will be publicized to encourage wider application of this technique.

This program, developed by an area farmer, has the support of local farmers and a local co-op. The SWCDs from Meeker, Stearns and Wright Counties, local farmers, a local co-op and the CRWD will partner to map soil phosphorus on participating farm fields. The CRWD will recruit participants, monitor and report water quality and crop yields. Participating land owners will pay for fertilizer and $2/ acre for application. Grant funds are requested for soil testing and GPS-aided application. SWCDs and agricultural co-ops will provide education and outreach both in the selection of fields and in the dissemination of information.

Explain how this project will mitigate or prevent current or future water quality impairments.

The current standard practice is to apply fertilizer at a standard rate across a field. When adequate phosphorus is available in the soil, the excess phosphorus runs off the land and into nearby waters. More precise fertilizer application will reduce the runoff of excess phosphorus that is currently impairing lakes in the watershed.

Reducing fertilizer applications is one component of a many pronged approach to improving water quality. Another crucial element is keeping soil and nutrients on the land through buffers, and other farming BMPs. The CRWD currently funds buffering and other BMPs over an above what CRP and RIM offers at $10,000 annually.

How will this project address the hydrologic function of the immediate affected watershed and keep water on the land?

This project will likely have little to no impact on watershed hydrology.

Identify long-term inspections and maintenance needs of the project and how these activities will be accomplished.
There are no long-term inspections and maintenance needs resulting from this project. However, the CRWD will track and report crop yields and water quality to assess project success. We intend the project to be a model for other watersheds to follow, and as such, reporting will serve as a template to be used by others. The reporting will also be completed such that it can be distributed to farmers in the area to gain support for widening the program in future years.

Describe the coordination of this project with local groundwater plans.
There is no specific coordination, but a reduction in overall fertilizer application will reduce the transport of fertilizer components to groundwater. Water quality modeling of the Clearwater River for the Dissolved Oxygen TMDL Study showed significant nitrogen concentrations in shallow groundwater that discharges to the Clearwater River. This is likely due to agricultural practices.

Please indicate any permits this project will require. Identify the current stage of the permitting process.
No permits are required for this project.

If the project participants choose to consider the conservation value of land where Clean Water Fund conservation practices will be installed as local match, please describe the valuation and application methods.
Not applicable.

If using Clean Water Funds for incentives to encourage landowners to install structural practices or to adopt land management practices that improve or protect water quality, please describe the LGU's adopted policy for evaluating the necessity, method of calculation, and effectiveness of the proposed incentives.
The project would pay for the soil testing and the "up" cost of using GPS-aided equipment to apply the fertilizer. Participating property owners would pay the cost of the fertilizer and a rate per acre representing the rate they would have to pay for "traditional" fertilizer application. The incentive to the participating property owners is the potential to reduce the amount of fertilizer required and thus lower their operating cost.

Minnesota Pollution Control Agency
520 Lafayette Road
St. Paul, MN 55155-4194

2009 Proposal Form

EPA Section 319(h)
Developmental, Education or Research Project Grant
and TMDL Implementation Grant

Proposal Deadline 4:30PM Wednesday, July 15, 2009

Location of the 2009 Section 319 Grant RFP: http://www.pca.state.mn.us/water/cwp-319.html

Submit a copy of the Proposal Form electronically via e-mail to: CWP-319.grant.program@pca.state.mn.us

Applying for: ☒ DER funds ☐ TMDL Implementation funds

If applying for both, use separate proposal forms for each proposal.

Project Title, Create a unique name that begins with the name of the impaired water body and includes the pollutant name. 50 character **maximum.**

Project Title: Clearwater River Watershed Fertilizer Field Trial

Contact Information

Primary Contact Person: Merle Anderson

Organization: Clearwater River Watershed District Administrator

Street Address: Box 481

City: Annandale State: MN Zip: 55302

Phone: 320 - 274 - 3935 Fax: 320 - 274 - 3975 Email: pacma@frontiernet.net

Other Proposal Information:

Incentives:

☐ Check here if you are planning on using any of these funds for **additional** incentives. Name incentive program(s) being added to and describe additional water quality benefit(s):

Project Budget Projection

Grant Funds Requested (55%)	$58,000
Match - cash and in-kind (45%)	$302,000
Total Project Cost (100%)	$360,000

Timeline:

Project will be completed by December 31, 2012. (no later than August 31, 2014).

Organization Information

Describe the relevant qualifications of project staff that will ensure the success of this project. List any previous Section 319(h) grants you have received in the past three years and describe your performance level on them (was reporting done on time, was eLINK and STORET data entered by the deadline, was the project completed as described in the application and were all of the grant funds spent?).

The Clearwater River Watershed District was established in 1975 to comprehensively manage the water resources in the 159 square mile watershed. It includes portions of Meeker, Stearns, and Wright Counties in Central Minnesota, and the municipalities of Watkins, Kimball, and Annandale, as well as all or parts of various townships. The five-member Board of Managers oversees activities in the watershed, assisted by an administrator and assistant administrator and a contracted engineer. The District has undertaken a number of projects to improve conditions, including the several projects encompassing the Clearwater River Chain of Lakes Restoration Project, wetland restorations, aquatic vegetation and rough fish management, and promotion of agricultural BMPs. The District was awarded the DNR's Watershed District of the Year in 2004. District Engineer Norm Wenck has 45 years of experience in environmental and water resources engineering.

The District has not received Section 319 funds in the past three years.

Project Location

Watershed: Mississippi River - St. Cloud: Clearwater River

8 digit Hydrologic Unit Code: 07010203

Lat/long of project or center of project: 45.314237, -94.299088

What type of **waterbody** does it affect?

☐ Stream ☒ Lake ☐ River ☐ Other

Waterbody Name:

Clear Lake	47-0095
Lake Betsy	47-0042
Union Lake	86-0298
Scott Lake	86-0297
Lake Louisa	86-0282
Lake Marie	73-0014

Basin (Check all that apply)

☐ Lake Superior ☐ Lower Mississippi/Cedar ☒ Upper Mississippi ☐ Minnesota ☐ Rainy

☐ Red River ☐ Des Moines ☐ Missouri ☐ St. Croix ☐ Statewide

If applicable, attach map of project area to proposal. (attached)

Proposal Summary

Activities In 150 words or less, summarize the narrative.

Agricultural runoff is a significant source of nutrients to the Clearwater River and impaired lakes in the watershed. Fertilizers are generally applied to fields at a standard rate, even though soil nutrient levels, soil type, and pH may vary significantly across the field.

The proposed field trial includes systematic soil tests on up to 3,000 acres of critical cropland to determine the proper amount of fertilizer to be applied to each field. The applicator will use GPS to apply the correct amount of fertilizer in each grid of the fields based on the results of the soil tests.

Monitoring will be conducted at drain tile outlets from selected fields. Samples will also be collected from two tile outlets in fields that are not a part of the field trial to be used as background data for comparison. The results will be publicized to encourage wider application of this technique.

Outcomes In 100 words or less, provide concise statement of deliverables/outcomes this project would achieve.

This field trial will demonstrate the feasibility and utility of systematic soil testing in reducing fertilizer application and thus phosphorus load in agricultural runoff. This technology can be implemented throughout the agricultural areas of the state to cut down on fertilizer costs and reduce runoff of nutrients into adjacent water bodies.

The outcomes of the field trial are a reduction in phosphorus from fertilizer exported to impaired waters from cropland, and a quantification, evaluation, and publication of the load reduction achieved.

Nonpoint Concern Addressed by Project

☒ Listed 303(d) impairment (specify) Excess nutrients

☐ Other documented water quality problem: _____

☐ Other (explain) _____

Estimated Pollutant Reductions

☒ Phosphorus	50-100 on study acreage, significantly more if applied watershed wide	lbs/yr
☐ Sediment		tons/yr
☐ Nitrogen		lbs/yr
☐ Other (list)		

Project Plan Information

Indicate **page numbers** and **effective dates** of plans relating to this project:

For DER projects only - Minnesota's current Non-Point Source Management Plan: (also specify which action steps will be addressed): Pp. 9-319-320, Agricultural Nutrients Goal 1, Action Steps 2 (education and outreach) and 4 (innovative BMPs)

Basin Plan for this Watershed: _____

Comprehensive Local Water Plan: _____

TMDL Implementation Plan: Clearwater River Watershed District Watershed-Wide Implementation Plan, page 4-4 – 4-5

Impaired Waters Research Symposium: _____

Project Partners

List all partners who will be involved in this project and amount of match they will be providing:

Property owners	Match	Cost of fertilizer
	Match	
	Match	

Project Narrative (2 page limit) See instructions.

Modeling performed as part of the Clearwater River Watershed District lake TMDLs indicates that a significant portion of phosphorus loading to the six impaired lakes in the upper watershed is from external sources. Runoff from the direct watershed makes up 33% of the total phosphorus budget for Clear Lake, 45% for Lake Betsy, and 66% for Union Lake. To meet the goal for in-lake phosphorus concentrations, it will be necessary to reduce the external phosphorus load to Clear Lake by 80%, Lake Betsy by 84%, and Union Lake by 36%. Reducing the external phosphorus loads to these three lakes will also benefit the Clearwater River and downstream impaired lakes, which receive large loads of phosphorus discharged from the upstream lakes.

A significant source of nutrients to the Clearwater River and impaired lakes in the watershed is runoff from cropland. The runoff often contains high concentrations of phosphorus that enters the receiving water and is detrimental to water quality. While phosphorus is naturally present at varying levels in cropland soils, fertilizers are often applied to crop fields to aid in crop development and increase crop yields. In some cases, the application of fertilizer increases the amount of phosphorus in the soil to concentrations that are in excess of the level at which crops can uptake the fertilizer. Since it is not used by the crop, the excess phosphorus runs off from crop fields into adjacent water bodies. Fertilizers are generally applied at a standard rate across a crop field, even though nutrient levels, soil type, and pH may vary significantly across the field. This may lead to fertilizer being under applied in some areas and over applied in others..

It is possible to refine fertilizer application by conducting soil tests on a grid and applying varying amounts of fertilizer to different areas of the field based on the soil test results. Literature and practitioners that use GPS to conduct soil testing and site specific fertilizer application typically are able to reduce the overall amount of fertilizer applied. Besides cost savings, site-specific fertilizer application potentially reduces the amount of excess phosphorus available to run off into downstream waters.

The ideal range of phosphorus for crop uptake in agricultural fields is 25-30 ppm. Past soil testing conducted by the Consumer's Co-Op in Litchfield, MN has shown that phosphorus concentrations in soils in the watershed often are in the 35-45 ppm range, and in some cases may be as high as 200 ppm in soils that are over fertilized. By using site specific fertilizer application, phosphorus concentrations could be maintained closer to the ideal range of 25-30 ppm, which would reduce the excess phosphorus available for runoff.

According to the Co-Op, site-specific fertilizer application could potentially reduce the amount of fertilizer applied by an average of 10%. It could be assumed that the amount of phosphorus available for export from agricultural fields could also be reduced by an average of 10%, which would represent a significant reduction in the phosphorus export to the Clearwater River and impaired lakes. This research grant proposes to quantify the amount of actual reduction achieved by applied this site-specific method to 3,000 acres of cropland in the upper Clearwater River Watershed District.

PROJECT TASKS

The Co-Op provided a list of potential landowners in the upper watershed to be used as a starting point for the field trial (Figure 1). Selected landowners throughout the upper watershed would be contacted by the Co-Op to determine their interest in the study, and additional fields would be evaluated and selected prior to the start of the project until the goal of 3,000 acres on which to conduct the field trial is obtained.

One of the factors considered during field selection would be location in relation to water bodies. The AGNPS model that the District completed in the watershed in the 1980's identified sensitive areas for

agricultural runoff, based on proximity to water bodies, slope, and soil type. Fields that are in sensitive areas identified by the AGNPS model will be considered for the field trial. Field size will also be taken into consideration, since larger fields offer more value per unit cost. Fields that have received heavy applications of manure from dairy or hog operations in the past will also be considered, since these fields often have excess concentrations of phosphorus in the soil. Since the selected crop fields would most likely be in a corn to soybean rotation, and fertilizer is only applied when the field is planted in corn, soil testing would only occur on fields where corn is scheduled to be planted during that year.

After fields are selected, a sampling grid would be set up based on field size. According to the sampling protocol, fields larger than 20 acres would be sampled on a 2.2 acre grid. Fields smaller than 20 acres are typically sampled every 2 acres or in at least ten locations.

Additional soil tests outside of the grid would also be taken in the vicinity of tile intakes. Since soils in the vicinity of tile intakes are generally higher in organic material and nutrients than soils in other areas of the field, the additional tests would likely indicate that fertilizer application is typically not necessary in these areas. Since tile intakes often run directly into downstream waters, reducing fertilizer application rates in these areas would be more likely to have an immediate benefit on reducing external loading of phosphorus.

A soil sample would be collected at each point on the sampling grid. Soil samples would be analyzed for phosphorus, potassium, zinc, sulfur, pH, and organic matter. The results from the soil tests at each point would be used to determine the correct amount of each type of fertilizer to apply in each grid.

GPS technology would be used by the fertilizer applicator to apply fertilizer at the correct rate to each grid in the crop field. Typically, fertilizers applied to the crops include phosphorus, potassium, sulfur, and lime, which is used to adjust the pH in the soil to maximize nutrient uptake. The proposed grant funds would pay for the cost of GPS-aided application and the property owner would pay for the cost of the fertilizer.

As part of the soil testing effort, the Co-Op would provide a report and map showing the results of the soil sample analysis for each grid and the suggested fertilizer application rate.

MONITORING & EVALUATION

To assist in the evaluation of the field trial, monitoring would be conducted at drain tile outlets from fields that are a part of the field trial. Samples would also be collected from tile outlets in similar fields that are not a part of the field trial for comparison. Samples would be analyzed for total phosphorus and soluble phosphorus. Samples would be collected six times throughout the season, focusing especially on time periods following precipitation events. The total load of fertilizer applied using site specific rates would be calculated and compared to the load that would have been applied using standard application rates. Data would be analyzed to determine if any link could be made between fertilizer application, soil phosphorus level, field sensitivity, and runoff concentration.

INFORMATION DISSEMINATION

Information about the project and its findings will be included in the District's newsletter, and periodic press releases made to local papers and trade journals as well as made available to local SWCDs and co-ops. A final report will be completed and submitted as part of these grant activities

SCHEDULE

This program is expected to be completed in 2010 and 2011, depending on property owner enrollment in the program.

Project Budget Detail

Table A: Project Tasks and Estimated Costs

Task #	Task Description	Requested Grant Amount	Match	Total Task Amount
1	Soil testing	$30,000		$30,000
2	GPS aided fertilizer application, 3000 acres	$15,000		$15,000
3	Monitoring, engineering and evaluation	$13,000		$13,000
4	Fertilizer, 3000 acres		$300,000	$300,000
4	Administration/ Semi Annual and Final Reports[1]		$2,000	$2,000
	Totals	$58,000	$302,000	$360,000

Table B: Project Costs by Budget Category

Budget Category	Requested 319 Grant Amount	Cash and In-Kind Match Amount	Total Category Amount	Match Source[2]
1. Administration (salary, fringe)[1]		$2,000	$2,000	District budget
2. Other Personnel and fringe				
3. Travel				
4. Supplies				
5. Equipment				
6. Contractual Services	$58,000		$58,000	
7. Cost Share		$300,000	$300,000	Property owners
8. Other (explain)				
Totals	$58,000	$302,000	$360,000	

1. There is a limit of ten percent (10%) for administration.
2. You cannot match federal dollars with federal dollars, even if it is over and above the required match.

Watkins Stormwater Impoundment

FY 2010 Clean Water Fund
Water Quality Comprehensive Project Narrative

The entire narrative portion of the application should be no more than 3 pages in length and should include the following topics as section headings

Title: (10 words or less):

Watkins Stormwater Impoundment

Project Abstract (30 words or less):
The project will construct an impoundment and limestone treatment system for stormwater runoff from the City of Watkins prior to discharge into the Clearwater River and Lake Betsy.

Overall Project Narrative (500 words or less): This section of the narrative should describe the level of project partners' coordination, cooperation and community support for the project, projects that have proven to be successful in similar circumstances or prior successful projects and the level of project partners' project management expertise and experience and any habitat benefits that may result from this project.

The Clearwater River Watershed District (CRWD) prepared the Watkins Area Stormwater Management Study in 2006 to identify opportunities to improve stormwater management in and around the City of Watkins. Several potential options to reduce downstream phosphorus load export were identified and more fully explored in the CRWD Upper Watershed Lakes Nutrient TMDL. Runoff and phosphorus load from the City of Watkins is conveyed to the Clearwater River, which is impaired for bacteria and dissolved oxygen. The River flows through Lake Betsy downstream of Watkins, and the TMDL identified the need to reduce direct watershed phosphorus loading to the lake by 84%. Because Lake Betsy is upstream of several other impaired lakes on the Clearwater River Chain of Lakes, meeting the load reduction goal for Lake Betsy is critical to achieving water quality goals in 5 impaired lakes downstream.

The proposed project is the construction of an impoundment on a 20-acre CRWD-owned parcel of land northeast of the city to treat runoff discharged from the city's storm drainage system. The impoundment would be created by constructing an earthen dike across the creek that runs west to east across the parcel. Two subwatersheds totalling 740 acres of urban and agricultural land drains through this creek to a nearby ditch. A sheet pile weir with a V-notch outlet point would control discharge from the impoundment. The impoundment is sized to store runoff form the 0.5 inch event, which would provide an annual nutrient

removal efficiency of 25%. The impoundment would also potentially provide some removal of bacterial load from the agricultural land and biological oxygen demand currently stressing the Clearwater River.

The filter consists of 3/4 inch to 3 inch diameter limestone wrapped in geotextile fabric and staked in place at the outlet of the structure. As the water passes through the filter, the phosphorus comes in contact with and binds to the calcium in the limestone, and is removed from the water.

The project will also create up to 20 acres of shallow and deep water wetland habitat that will provide waterfowl and other wildlife for nesting and subsistence habitat.

The CRWD has successfully constructed V-notch weirs elsewhere in the watershed and had success in improving water quality. In addition, a limestone filter has been used in another project in the CRWD, Segner Pond, with success. The CRWD has purchased the land on which the impoundment would be created at a cost of $105,000.

Explain how this project will mitigate or prevent current or future water quality impairments.

The proposed impoundment will provide approximately eight acre-feet of peak retention and an estimated phosphorus load reduction of 147 pounds annually. In addition, a limestone treatment filter wil be included to aid in phosphorus removal. The impoundment would continue to provide this reduction in phosphorus load for an estimated 15 to 20 years without requiring maintentance. Removal of the total phosphorus load from the City of Watkins watershed would benefit to Lake Betsy, an impaired basin located downstream.

How will this project address the hydrologic function of the immediate affected watershed and keep water on the land?

The project creates a ponding/retention area to collect storm events. The V-notch weir would allow for controlled overflow during larger storm events, decreasing sedimentation and reducing total phosphorus load to downstream waterbodies.

Identify long-term inspections and maintenance needs of the project and how these activities will be accomplished.

The CRWD inspects all of its capital projects annually and performs necessary maintenance through its existing inspection and maintenance program. Based on sedimentation rates in other similar projects, sediment removal will be required every 15 to 20 years. Other maintenance may include correction of any erosion issues and potential replacement of the V-notch weir, and periodic replacement of the limetone filter material.

Describe the coordination of this project with local groundwater plans.
The project would not impact groundwater or local groundwater plans.

Please indicate any permits this project will require. Identify the current stage of the permitting process.

The project may require permits under WCA from BWSR/ Meeker County, the DNR, and the US Army Corps of Engineers. Regardless of whether permits are required, the CRWD convenes technical advisory committees of representatives from these agencies to gather input and review plans during the final design process to maximize the success of the project.

If the project participants choose to consider the conservation value of land where Clean Water Fund conservation practices will be installed as local match, please describe the valuation and application methods.

Not applicable.

If using Clean Water Funds for incentives to encourage landowners to install structural practices or to adopt land management practices that improve or protect water quality, please describe the LGU's adopted policy for evaluating the necessity, method of calculation, and effectiveness of the proposed incentives.

Not applicable.

Minnesota Pollution Control Agency
520 Lafayette Road
St. Paul, MN 55155-4194

2010 Proposal Form

EPA Section 319(h)
Development, Education or Research Project Grant
and TMDL Implementation Grant

Proposal Deadline 4:30PM Friday, May 21, 2010

Location of the 2010Section 319 Grant RFP: http://www.pca.state.mn.us/water/cwp-319.html

Submit a copy of the Proposal Form electronically via e-mail to: CWP-319.grant.program@pca.state.mn.us

Applying for: DER funds (Choose one): ☐ Development ☐ Education ☐ Research

☒ **TMDL Implementation funds**

If applying for more than one, use separate proposal forms for each proposal.

Project Title

Create a unique name that begins with the name of the impaired water body and includes the pollutant name **(50-character maximum, including spaces).**

Project title: Watkins Area Storm Water Filtration Project

Contact Information

Primary contact person: Dennis Loewen

Organization: Clearwater River Watershed District Assistant Administrator

Street address: Box 481

City: Annandale State: MN Zip: 55302

Phone: 320 - 274 - 3935 E-mail: pacma@frontiernet.net

Other Proposal Information:

Incentives:

☐ Check here if you are planning on using any of these funds for **additional** incentives. Name incentive program(s) being added to and describe additional water quality benefit(s):

Project Budget Projection

Grant Funds Requested (55%)	$ 351,906
Match - cash and in-kind (45%)	$ 293,976
Total Project Cost (100%)	$ 645,882

Timeline:

Project is planned to start around: May 2011 (Contract signature) Project will be completed on: August 31, 2015 (O&M)
(no later than August 31, 2015)

Organization Information

Describe the relevant qualifications of project staff that will ensure the success of this project. List any previous Section 319(h) grants you have received in the past three years and describe your performance level on them (was reporting done on time, was eLINK and STORET data entered by the deadline, was the project completed as described in the application and were all of the grant funds spent?).

The Clearwater River Watershed District was established in 1975 to comprehensively manage the water resources in the 159 square mile watershed. It includes portions of Meeker, Stearns, and Wright Counties in Central Minnesota, and the municipalities of Watkins, Kimball, and Annandale, as well as all or parts of various townships. The five-member Board of Managers oversees activities in the watershed, assisted by an Administrator and Assistant Administrator and a contracted District Engineer. The District has undertaken a number of successful projects to improve water quality. Several capital and education projects to target non-point source pollution were undertaken as part of the Clearwater River Chain of Lakes Restoration Project through which the CRWD set a water quality goal for Clearwater Lake, and achieved the goal through implementation of wetland restorations, aquatic vegetation and rough fish management, and promotion of agricultural BMPs.
The CRWD recently secured grants from the MCPA for watershed-wide TMDL studies. The CRWD has 7 approved TMDLs, one pending de-list, and 6 TMDLs approaching public notice as well as an approved TMDL Implementation Plan. Further, we have undertaken the update of our comprehensive plan early to dovetail into the TMDL Implementation Process. The CRWD has already implemented several elements of the TMDL Implementation Plan including expansion of our existing monitoring program to fill data gaps identified in the TMDL, by beginning a small scale version of the targeted fertilizer application project, and by designing several other projects designed to meet load reduction goals. The CRWD has successfully leveraged existing funding and programs towards implementation of TMDLs and improving water quality in the past. The District was awarded the DNR's Watershed District of the Year in 2004. District Engineer Norm Wenck has 45 years of experience in environmental and water resources engineering, he is supported by a staff of water resource professionals at Wenck Associates.

The District has not received Section 319 funds in the past three years.

Project Location

Watershed: Mississippi River - St. Cloud: Clearwater River

12-digit hydrologic unit code: 07010203

Lat/long of project or center of project: 45 19.05, -94 24.23

Lake Betsy	47-0042
Union Lake	86-0298
Scott Lake	86-0297
Lake Louisa	86-0282
Lake Marie	73-0014
Lake Caroline	86-0281
Lake Augusta	86-0284

What type of **waterbody** does it affect?

☒ Stream ☒ Lake ☒ River ☐ Other: **Waterbody name:** Clearwater River 07010203-549

Basin (Check all that apply)

☐ Lake Superior ☐ Lower Mississippi/Cedar ☒ Upper Mississippi ☐ Minnesota ☐ Rainy
☐ Red River ☐ Des Moines ☐ Missouri ☐ St. Croix ☐ Statewide

If applicable, attach map of project area to proposal.

Proposal Summary

Activities (In 150 words or less, summarize the narrative.)

The proposed project includes constructing two non-point source runoff treatment systems to treat agricultural and urban runoff from 6,500 acres in and near the City of Watkins to assist in achieving TMDL nutrient load reductions. The project targets load reductions necessary to Lake Betsy and the Clearwater River, but because of the flow through nature of the Clearwater River Chain of Lakes, but also provides load reductions to 5 other impaired lakes downstream. The proposed project targets a phosphorus load reduction of 796 pounds of phosphorus removal annually through filtration of soluble phosphorus and settling of particulate phosphorus. The filtration area will be created though the installation of a dike and creation of a limestone filtration area to treat agricultural runoff, while the retention basin will treat urban runoff from the City of Watkins.

Outcomes (In 100 words or less, provide **concise statement of deliverables/measureable outcomes** this project would achieve.)

The proposed Watkins Area storm water filtration project will remove an estimated 796 pounds of phosphorus per year, which is ten percent of the identified required watershed load reduction identified in the Lake Betsy TMDL. The project outcomes will be measured through on-going water quality monitoring to determine the effectiveness maintenance of the constructed features. Given the projects location in the City of Watkins, it also provides the opportunity to educate urban residents about non-point source runoff management.

Nonpoint Concern Addressed by Project

- ☒ Listed 303(d) impairment (specify): Nutrients
- ☒ Other documented water quality problem: Clearwater River, DO and Bacteria Impairment
- ☐ Other (explain): _____

Estimated Pollutant Reductions

☒ Phosphorus	796	lbs/yr
☐ Sediment		tons/yr
☐ Nitrogen		lbs/yr
☐ Other (list): Bacteria, NBOD	Unquantified	

Project Plan Information

Indicate **page numbers** and **effective dates** of plans relating to this project:

For DER projects only - Minnesota's current Non-Point Source Management Plan: (also specify which Milestone (action steps) will be addressed):

Basin Plan for this Watershed:

Comprehensive Local Water Plan: Clearwater River Watershed District Comprehensive Plan, July 2003

TMDL Implementation Plan: Clearwater River Watershed District Watershed-Wide Implementation Plan, page 4-4 – 4-5

Impaired Waters Research Symposium:

Project Partners

List all partners who will be involved in this project and amount of match they will be providing:

Clearwater River Watershed District — Match:

— Match:

— Match:

— Match:

Project Narrative (2 page limit - See instructions for narrative.)

The Clearwater River Watershed District (CRWD) completed a watershed-wide TMDL study, resulting in 7 final TMDLs, one pending de-list, 6 TMDLs approaching public notice, and an approved Watershed-Wide TMDL Implementation Plan. The CRWDs TMDL Implementation plan calls for aggressive phosphorus, oxygen demand and bacteria load reductions for agricultural and urban areas alike, about 80% in the upper watershed.

The Clearwater Chain of Lakes is a flow-through system on the Clearwater River. As such, water quality in the upper watershed impacts not only upper watershed lakes, but all lakes. Due to the flow-through nature of this system, the TMDL Implementation plan prioritizes implementation projects in the upper watershed, or the Clearwater River's headwaters drainage area. This project is located in the District's headwaters, and further targets one of only two urban areas in the watershed, critical for meeting water quality goals.

This project targets a 796 pound annual phosphorus reduction by treating soluble phosphorus in agricultural non-point source runoff through limestone filtration, and urban-generated non-point source particulate phosphorus through settling. This represents 10% of the non-point source phosphorus load reduction to Lake Betsy, impaired for nutrients. While providing additional benefits for the Clearwater River in terms of reduction in oxygen demand and bacteria and also provides additional load reductions to 5 downstream lakes.

Runoff from the 6,500 acre drainage to be treated is comprised of agricultural and urban sources. It represents about 60% of the drainage area to the DO and bacteria impaired Clearwater River, and about 15% of the drainage area to nutrient impaired Lake Betsy.

Monitoring conducted through the TMDL showed that the areas agricultural phosphorus runoff is primarily soluble during the summer months, and so any capital projects targeting phosphorus load reduction, must target soluble phosphorus. Urban sources however generate particulate phosphorus throughout the growing season, requiring that both soluble and particulate phosphorus be targeted. As such, the project uses one piece of land owned by the CRWD to target runoff from both sources using filtration and settling.

The CRWD will administer the project, coordinate with stakeholders including the City of Watkins, area farmers, Stearns County and Stearns County SWCD, as well as the DNR and local school district. The CRWD will contract with its District Engineer for project design and retain a licensed contractor for construction. The contractor will be selected through the CRWD's standard bidding process. The CRWD will coordinate with its Partners and District Engineer to complete effectiveness monitoring and report results in its Annual Water Quality Monitoring and TMDL Implementation Progress Report.

The CRWD purchased this parcel of land several years ago as it was identified both the Watkins Area Stormwater Management Study (by CRWD 2004) and the approved TMDL Implementation Plan as a key area for managing urban runoff in the City of Watkins. Through the TMDL and Implementation planning process, it was determined that the area could be used for dual purposes to treat both urban runoff and to treat the larger agricultural drainage area north of Watkins.

The Watkins Area Storm Water Filtration Project will include multiple features to treat both urban runoff from the City of Watkins as well as agricultural runoff from the surrounding watershed. The first feature will be the East Filtration Area. The East Filtration Area will include constructing a dike along an existing ditch on the east side of the property that will force storm water flows through a constructed limestone filtration feature. The storm water runoff will filter through the limestone which will remove phosphorus, including the SRP, and exit downstream of the dike into the ditch via a drain tile. The constructed berm will be designed to capture approximately 70 percent of the storm water flows which is essentially equivalent to the 1.25" storm event. The design of the dike will allow for over-flow bypass of larger runoff events into the existing ditch. Pre-treatment will be included in the project design to maximize the life of the project.

The second portion of the project, or West Filtration Area, will include off-line storm water pond and a smaller filtration area. The West Filtration Area will capture urban runoff from the City of Watkins and route the storm water that currently flows into a small stream into a constructed off-line storm water pond. The storm water pond will include an outlet structure and a smaller version of

the limestone filtration area. The volume of urban runoff from Watkins is smaller than the agricultural area flows captured by the East Filtration Area, but will still remove a significant amount of phosphorus from the storm water. The West Filtration Area will also be designed to capture and treat 70 percent of the storm water flows, equivalent to the 1.25' storm event.

The planned schedule is to construct the project within 6 months of signing the contract for the grant. Operation and maintenance, including vegetative maintenance and follow up monitoring will be conducted for the remainder of the grant period. Reporting on project progress and monitoring results will be done in the CRWD's Annual Water Quality Monitoring and Implementation Progress Report. Interim milestones such as design and construction completion, and load reductions will be reported here. Further, project evaluations will be incorporated as well as recommendations to improve on future designs for soluble phosphorus removal projects. These reports will be made available at the CRWD's website.

Several impaired water bodies are located downstream of the proposed project, including the Clearwater River, Lake Betsy, Scott Lake, Lake Louisa, Lake Marie, Lake Caroline, and Lake Augusta. The project provides 10% of the required watershed load reduction to Lake Betsy at a cost of $43 per pound of phosphorus removed over a 20 year life cycle for the project.

The District will use the grant funds from the project for the construction of the East and West Filtration Areas. The District will provide in-kind labor in terms of project coordination, design engineering, follow up monitoring and operation and maintenance for the project. The CRWD also owns the land (though this is not counted as match per terms of this grant).

To maximize the impact of the project, the CRWD will use it as a demonstration area to educate residents about the value of water resource management. CRWD will coordinate with the Watkins Area School District to create education curriculum for students including installing native plantings, worksheets and lecture material to facilitating an understanding of how the system works to improve water quality and possibly some rudamentary water quality monitoring.

Project Budget Detail

Table A: Project Tasks and Estimated Costs

Task #	Task description	Requested grant amount	Match	Total task amount
1	Construction of the Filtration Areas	$351,906		$351,906
2	Engineering, Permitting & Project Admin		$87,976	$87,976
3	Operation and Maintenance (4 years)		$60,000	$60,000
4	Preliminary Data Collection		$25,000	$25,000
5	Education and Outreach		$25,000	$25,000
6	Follow-up Monitoring (4 years)		$96,000	$96,000
	Totals	$351,906	$293,976	$645,882

Table B: Project Costs by Budget Category

Budget Category	Requested 319 Grant Amount	Cash and In-Kind Match Amount	Total Category Amount	Match Source[2]
1. Administration (salary, fringe)[1]		$40,000.00	$40,000.00	CRWD Labor
2. Other Personnel and fringe		$35,000.00	$35,000.00	CRWD Labor
3. Travel			$ 0.00	
4. Supplies			$ 0.00	
5. Equipment[3]			$ 0.00	
6. Contractual Services	$351,906.00	$218,976.00	$570,882.00	CRWD Funds

7. Cost Share		$0.00	$ 0.00	
8. Other (explain):			$ 0.00	
			$ 0.00	
		$0.00	$ 0.00	
Totals	$351,906.00	$293,976.00	$645,882.00	

1. There is a limit of ten percent (10%) for administration.
2. You cannot match federal dollars with federal dollars, even if it is over and above the required match.
3. All equipment purchases must be pre-approved by MPCA and EPA.

Kingston Wetland Feasibility Study and Restoration

Minnesota Pollution Control Agency
520 Lafayette Road
St. Paul, MN 55155-4194

2010 Proposal Form

EPA Section 319(h)
Development, Education or Research Project Grant
and TMDL Implementation Grant

Proposal Deadline 4:30PM Friday, May 21, 2010

Location of the 2010Section 319 Grant RFP: http://www.pca.state.mn.us/water/cwp-319.html

Submit a copy of the Proposal Form electronically via e-mail to: CWP-319.grant.program@pca.state.mn.us

Applying for: DER funds (Choose one): ☐ Development ☐ Education ☐ Research

☒ **TMDL Implementation funds**

If applying for more than one, use separate proposal forms for each proposal.

Project Title

Create a unique name that begins with the name of the impaired water body and includes the pollutant name **(50-character maximum, including spaces).**

Project title: Kingston Wetland Feasibilty Study and Restoration

Contact Information

Primary contact person: Dennis Loewen

Organization: Clearwater River Watershed District Assistant Administrator

Street address: Box 481

City: Annandale State: MN Zip: 55302

Phone: 320 - 274 - 3935 E-mail: pacma@frontiernet.net

Other Proposal Information:

Incentives:

☐ Check here if you are planning on using any of these funds for **additional** incentives. Name incentive program(s) being added to and describe additional water quality benefit(s):

Project Budget Projection

Grant Funds Requested (55%)	$ 404,300
Match - cash and in-kind (45%)	$ 334,936
Total Project Cost (100%)	$ 739,236

Timeline:

Project is planned to start around: May 1st, 2011 Project will be completed on: August 31st, 2015
(no later than August 31, 2015)

Organization Information

Describe the relevant qualifications of project staff that will ensure the success of this project. List any previous Section 319(h) grants you have received in the past three years and describe your performance level on them (was reporting done on time, was eLINK and STORET data entered by the deadline, was the project completed as described in the application and were all of the grant funds spent?).

The Clearwater River Watershed District was established in 1975 to comprehensively manage the water resources in the 159 square mile watershed. It includes portions of Meeker, Stearns, and Wright Counties in Central Minnesota, and the municipalities of Watkins, Kimball, and Annandale, as well as all or parts of various townships. The five-member Board of Managers oversees activities in the watershed, assisted by an Administrator and Assistant Administrator and a contracted District Engineer. The District has undertaken a number of successful projects to improve water quality. Several capital and education projects to target non-point source pollution were undertaken as part of the Clearwater River Chain of Lakes Restoration Project through which the CRWD set a water quality goal for Clearwater Lake, and achieved the goal through implementation of wetland restorations, aquatic vegetation and rough fish management, and promotion of agricultural BMPs.
The CRWD recently secured grants from the MCPA for watershed-wide TMDL studies. The CRWD has 7 approved TMDLs, one pending de-list, and 6 TMDLs approaching public notice as well as an approved TMDL Implementation Plan. Further, we have undertaken the update of our comprehensive plan early to dovetail into the TMDL Implementation Process. The CRWD has already implemented several elements of the TMDL Implementation Plan including expansion of our existing monitoring program to fill data gaps identified in the TMDL, by beginning a small scale version of the targeted fertilizer application project, and by designing several other projects designed to meet load reduction goals. The CRWD has successfully leveraged existing funding and programs towards implementation of TMDLs and improving water quality in the past. The District was awarded the DNR's Watershed District of the Year in 2004. District Engineer Norm Wenck has 45 years of experience in environmental and water resources engineering, he is supported by a staff of water resource professionals at Wenck Associates.

The District has not received Section 319 funds in the past three years.

Project Location

Watershed: Mississippi River - St. Cloud: Clearwater River

12-digit hydrologic unit code: 07010203

Lat/long of project or center of project: 45.314237, -94.299088

Clearwater River 07010203-549

Lake Betsy	47-0042
Union Lake	86-0298
Scott Lake	86-0297
Lake Louisa	86-0282
Lake Marie	73-0014
Lake Caroline	86-0281
Lake Augusta	86-0284

What type of **waterbody** does it affect?

☒ Stream ☒ Lake ☒ River ☐ Other: **Waterbody name:**

Basin (Check all that apply)

☐ Lake Superior ☐ Lower Mississippi/Cedar ☒ Upper Mississippi ☐ Minnesota ☐ Rainy
☐ Red River ☐ Des Moines ☐ Missouri ☐ St. Croix ☐ Statewide

If applicable, attach map of project area to proposal.

Proposal Summary

Activities (In 150 words or less, summarize the narrative.)

Design and implement a restoration of the dissolved oxygen (DO)-impaired Clearwater River and it's 460 acre riparian Kingston Wetland Complex to improve main channel DO concentrations, reduce the seasonal export of soluble phosphorus to 6 nutrient impaired and 2 high value recreational lakes downstream while improving the systems existing assimilative capacity by 20% for particulate phosphorus, improving wetland and main-stem channel habitat, and connecting the recreational corridor between the upper and lower watershed. To optimize design, the CRWD will collect hydrology, water quality and topographical data to construct a hydrologic and hydraulic model of the upper watershed and the Kingston Wetland. This model will be used in concert with a QUAL-2K model originally developed for the DO TMDL to design and implement the project to maximize water quality benefits. Monitor and report on effectiveness, and use the project to increase education and outreach.

Outcomes (In 100 words or less, provide **concise statement of deliverables/measureable outcomes** this project would achieve.)

The restoration meets the entire SOD load reduction for the Clearwater River, and targets 1,970 lb/yr in TP load reduction to Lake Betsy. These improvements will help the Clearwater River meet the state dissolved oxygen standard and help 6 nutrient-impaired lakes downstream meet state standards, while protecting water quality in Clearwater and Grass Lakes, two high-value recreational lakes. The project will also target providing improved habitat in the restored wetland and channel, and connect the recreational corridor between the upper agricultural watershed and the lower recreational lakes area for canoeing. The present river system is not conducive to recreational use.

Nonpoint Concern Addressed by Project

- ☒ Listed 303(d) impairment (specify): DO
- ☒ Other documented water quality problem: Nutrients in downstream lakes
- ☐ Other (explain): _____

Estimated Pollutant Reductions

☒ Phosphorus	1,970	lbs/yr
☐ Sediment		tons/yr
☐ Nitrogen		lbs/yr
☒ Other (list): Dissolved Oxygen	100% of required SOD Reduction	

Project Plan Information

Indicate **page numbers** and **effective dates** of plans relating to this project:

For DER projects only - Minnesota's current Non-Point Source Management Plan: (also specify which Milestone (action steps) will be addressed): _____

Basin Plan for this Watershed: _____

Comprehensive Local Water Plan: Clearwater River Watershed District Comprehensive Plan, July 2003

TMDL Implementation Plan: Clearwater River Watershed District Watershed-Wide Implementation Plan, page 4-4 – 4-5

Impaired Waters Research Symposium: _____

Project Partners

List all partners who will be involved in this project and amount of match they will be providing:

Clearwater River Watershed District (Engineering, Design, Monitoring, O&M)	Match: $334,936
	Match:
	Match:
	Match:

Project Narrative (2 page limit - See instructions for narrative.)

TThe purpose of the Kingston Wetland Feasibility Study and Restoration Project is to design and implement a restoration of the Clearwater River and its riparian Kingston Wetland to improve dissolved oxygen concentrations in the DO impaired Clearwater River, reduce nutrient loads to impaired lakes, connect a recreational corridor, and improve riverine and wetland habitat.

Improvements in DO will be achieved by mitigating sediment oxygen demand in the wetland complex. The TMDL identifies a reduction of 60% of the SOD for the wetland, this project targets that entire reduction. The project also targets a 1,970 lb/yr TP reduction to Lake Betsy and other 5 other nutrient impaired lakes by preventing soluble phosphorus export from the riparian wetland. Improving the system will protect its existing phosphorus assimilative capacity, and will help 6 nutrient-impaired lakes downstream to meet their water quality standards, while protecting Clearwater and Grass Lakes, two high value recreational lakes. The Clearwater River Watershed District also seeks to improve the riparian wetland and main channel habitat by restoring the system to a pre-agrarian condition, and engage local stakeholders by involving them in a technical advisory process, re-establish a recreational corridor of the Clearwater River through this restoration to connect the upper agricultural watershed with the downstream recreational lakes area. Further, the CRWD seeks to use the restoration to educate residents by distributing and posting educational material and including the project on it's annual watershed tour.

The Kingston Wetland Complex is a riparian wetland of the Clearwater River Chain of Lakes. The Clearwater River is impaired for bacteria and dissolved oxygen, the main driver of the DO impairment is sediment oxygen demand in the Kingston Wetland as well as the altered hydrology of the complex.

Historically, the Clearwater River was straightened and ditched through the wetland facilitate drainage of fields for agriculture. In the early 1980s, the Clearwater River Watershed District undertook a project in the Kingston Wetland Complex to restore the wetland's assimilative capacity for phosphorus and improve water quality in downstream lakes. The project was part of the Clearwater River Watershed Districts Clearwater Chain of Lakes Restoration Project, through which lake water quality in Clearwater Lake was improved from 400 ug/L to 40 ug/L average summer surface TP.

The original Kingston Wetland Project included a dike constructed around the wetlands perimeter to route the Clearwater River to the edges of the wetland to allow it to filter through the wetland and back into the main channel. A perpetual easement was secured on the property through the Clearwater Chain of Lakes Restoration Project. The project was designed to remove particulate phosphorus by restoring some hydrology to the wetland. The project was successful over the past 30 years, improving water quality in all the downstream lakes. Today, Clearwater Lake meets or exceeds state nutrient standards. However, the CRWD has expanded water quality goals through the TMDL process. The CRWD has 7 approved TMDLs, a pending de-list, 6 TMDLs awaiting public comment, and an approved TMDL Implementation Plan. The TMDL Implementation plan identifies the need to target additional phosphorus filtration in the Kingston Wetland to meet standards in 6 impaired lakes, as well as the need to target low DO in the Clearwater River. This project targets those goals.

Today the wetland still acts as a sink for particulate phosphorus and is somewhat protective of water quality in downstream lakes. However, the wetland sediments exert oxygen demand and reduce dissolved oxygen in the main channel. Wetland sediments also, at times, export soluble phosphorus to downstream lakes.

This restoration will restore the wetland/ main channel as close as possible to pre-agrarian hydrology by re-meandering the low flow channel through the wetland complex, allowing high flows to access the floodplain. This option reduces the main channel low flow exposure to sediment oxygen demand and soluble phosphorus export in the wetland, while maintaining the assimilative capacity of particulate phosphors in higher flows. The concept design will also result in condition that is closer to native landscape providing wetland and riverine habitat to support a broader range of species. Further, by restoring the main channel and meander to a pre-agrarian condition, the river goes from being a ditch through a wetland, to a significant recreational resource in terms of canoeing.

The project will be considered successful if the following specific targeted outcomes are achieved:

- The main stem of the Clearwater River meets DO concentrations 50 % of the time (the DO TMDL requires both a 60% reduction in SOD and a 60% reduction in watershed loads, this project targets the SOD reduction.)
- Annual nutrient loads are from upstream to downstream of the project are reduced by 20%, achieving 24% of the load reduction required for Lake Betsy, and smaller but still significant load reductions to Scott Lake, Lake Louisa, Lake Marie, Lake Caroline, and Lake Augusta (All nutrient impaired lakes with approved TMDLs and implementation plans or TMDL's pending approval).
- Wetland and riverine habitat is restored to support a wider range of wildlife
- Recreational opportunities in the Clearwater River are enhanced by the restoration, providing a corridor to connect the upper agricultural watershed with the lower recreational lakes watershed. Kiosks are installed to mark the project and educate users about the impacts of ditching on water quality and habitat, and specifically the evolution of the Kingston Wetland through the various stages and it's roll in protecting downstream water quality.
- Local partners are engaged to cooperate in the project.

Significant data collection and modeling are required to optimize design. The Clearwater River Watershed District will administer the project which involves collecting 1 year of monitoring data which will include wetland/ main channel and groundwater hydrology and water quality. CRWD will also work with the District Engineer to construct a hydrologic and hydraulic model of the upper watershed and collect topographic data for the wetland. Hydrology and hydraulics model will be used in conjunction with the existing QUAL-2K model constructed to set the DO TMDL to optimize design. CRWD will design and construct the work. A contractor will be retained for construction through the CRWDs standard bidding process. The work will be done through a combination of in-kind staff labor, and consultant/ contractor time, and grant dollars.

Following implementation of the project, the CRWD will monitoring the results of the project, collecting inflow and outflow data. Flow, total and soluble phosphorus, suspended sediment and dissolved oxygen will be monitored. CRWD will also conduct habitat evaluations of the system before and after the restoration to track effectiveness.

Project Budget Detail

Table A: Project Tasks and Estimated Costs

Task #	Task description	Requested grant amount	Match	Total task amount
1	Data Collection & Modeling	$45,000	$62,288	$100,288
2	Engineering & Design	$300	$45,976	$52,268
3	Stakeholder Work and Education Component	$4,000	$5,992	$9,992
4	Construction	$355,000	$81,000	$436,000
5	Project Operation and Maintenance (4 year life of project)	$0	$60,000	$60,000
6	Follow up monitoring	$0	$73,680	$73,680
	Totals	$405,300	$334,936	$739,236

Table B: Project Costs by Budget Category

Budget Category	Requested 319 Grant Amount	Cash and In-Kind Match Amount	Total Category Amount	Match Source[2]
1. Administration (salary, fringe)[1]		$8,800.00	$8,800.00	District Labor
2. Other Personnel and fringe		$40,000.00	$40,000.00	
3. Travel			$ 0.00	
4. Supplies			$ 0.00	
5. Equipment[3]			$ 0.00	
6. Contractual Services	$404,300.00	$286,136.00	$690,436.00	District Funds
7. Cost Share			$ 0.00	
8. Other (explain):			$ 0.00	
			$ 0.00	
			$ 0.00	
Totals	$404,300.00	$334,936.00	$739,236.00	

1. There is a limit of ten percent (10%) for administration.
2. You cannot match federal dollars with federal dollars, even if it is over and above the required match.
3. All equipment purchases must be pre-approved by MPCA and EPA.

Clearwater River Watershed District
May 2010

319 Grant Application

Title: Kingston Wetland Feasibility Study & Restoration

Activities (150 words):
Design and implement a restoration of the dissolved oxygen (DO)-impaired Clearwater River and it's 460 acre riparian Kingston Wetland Complex to improve main channel DO concentrations, reduce the seasonal export of soluble phosphorus to 6 nutrient impaired and 2 high value recreational lakes downstream while improving the systems existing assimilative capacity by 20% for particulate phosphorus, improving wetland and main-stem channel habitat, and connecting the recreational corridor between the upper and lower watershed. To optimize design, the CRWD will collect hydrology, water quality and topographical data to construct a hydrologic and hydraulic model of the upper watershed and the Kingston Wetland. This model will be used in concert with a QUAL-2K model originally developed for the DO TMDL to design and implement the project to maximize water quality benefits. Monitor and report on effectiveness, and use the project to increase education and outreach.

Outcomes (100 words):
The restoration meets the entire SOD load reduction for the Clearwater River, and targets 1,970 lb/yr in TP load reduction to Lake Betsy. These improvements will help the Clearwater River meet the state dissolved oxygen standard and help 6 nutrient-impaired lakes downstream meet state standards, while protecting water quality in Clearwater and Grass Lakes, two high-value recreational lakes. The project will also target providing improved habitat in the restored wetland and channel, and connect the recreational corridor between the upper agricultural watershed and the lower recreational lakes area for canoeing. The present river system is not conducive to recreational use.

Project Narrative (2 page limit):

The purpose of the Kingston Wetland Feasibility Study and Restoration Project is to design and implement a restoration of the Clearwater River and its riparian Kingston Wetland to improve dissolved oxygen concentrations in the DO impaired Clearwater River, reduce nutrient loads to impaired lakes, connect a recreational corridor, and improve riverine and wetland habitat.

Improvements in DO will be achieved by mitigating sediment oxygen demand in the wetland complex. The TMDL identifies a reduction of 60% of the SOD for the wetland, this project targets that entire reduction. The project also targets a 1,970 lb/yr TP reduction to Lake Betsy and other 5 other nutrient impaired lakes by preventing soluble phosphorus export from the riparian wetland. Improving the system will protect its existing phosphorus assimilative capacity, and will help 6 nutrient-impaired lakes downstream to meet their water quality standards, while protecting Clearwater and Grass Lakes, two high value recreational lakes. The Clearwater River Watershed District also seeks to improve the riparian wetland and main channel habitat by restoring the system to a pre-agrarian condition, and engage local stakeholders by involving them in a technical advisory process, re-establish a recreational corridor of the Clearwater River through this restoration to connect the upper agricultural watershed with the downstream recreational lakes area. Further, the CRWD seeks to use the restoration to educate residents by distributing and posting educational material and including the project on it's annual watershed tour.

The Kingston Wetland Complex is a riparian wetland of the Clearwater River Chain of Lakes. The Clearwater River is impaired for bacteria and dissolved oxygen, the main driver of the DO impairment is sediment oxygen demand in the Kingston Wetland as well as the altered hydrology of the complex.

Historically, the Clearwater River was straightened and ditched through the wetland facilitate drainage of fields for agriculture. In the early 1980s, the Clearwater River Watershed District undertook a project in the Kingston Wetland Complex to restore the wetland's assimilative capacity for phosphorus and improve water quality in downstream lakes. The project was part of the Clearwater River Watershed Districts Clearwater Chain of Lakes Restoration Project, through which lake water quality in Clearwater Lake was improved from 400 ug/L to 40 ug/L average summer surface TP.

The original Kingston Wetland Project included a dike constructed around the wetlands perimeter to route the Clearwater River to the edges of the wetland to allow it to filter through the wetland and back into the main channel. A perpetual easement was secured on the property through the Clearwater Chain of Lakes Restoration Project. The project was designed to remove particulate phosphorus by restoring some hydrology to the wetland. The project was successful over the past 30 years, improving water quality in all the downstream lakes. Today, Clearwater Lake meets or exceeds state nutrient standards. However, the CRWD has expanded water quality goals through the TMDL process. The CRWD has 7 approved TMDLs, a pending de-list, 6 TMDLs awaiting public comment, and an approved TMDL Implementation Plan. The TMDL Implementation plan identifies the need to target additional phosphorus filtration in the Kingston Wetland to meet standards in 6 impaired lakes, as well as the need to target low DO in the Clearwater River. This project targets those goals.

Today the wetland still acts as a sink for particulate phosphorus and is somewhat protective of water quality in downstream lakes. However, the wetland sediments exert oxygen demand and reduce dissolved oxygen in the main channel. Wetland sediments also, at times, export soluble phosphorus to downstream lakes.

This restoration will restore the wetland/ main channel as close as possible to pre-agrarian hydrology by re-meandering the low flow channel through the wetland complex, allowing high flows to access the floodplain. This option reduces the main channel low flow exposure to sediment oxygen demand and soluble phosphorus export in the wetland, while maintaining the assimilative capacity of particulate phosphors in higher flows. The concept design will also result in condition that is closer to native landscape providing wetland and riverine habitat to support a broader range of species. Further, by restoring the main channel and meander to a pre-agrarian condition, the river goes from being a ditch through a wetland, to a significant recreational resource in terms of canoeing.

The project will be considered successful if the following specific targeted outcomes are achieved:

- The main stem of the Clearwater River meets DO concentrations 50 % of the time (the DO TMDL requires both a 60% reduction in SOD and a 60% reduction in watershed loads, this project targets the SOD reduction.)
- Annual nutrient loads are from upstream to downstream of the project are reduced by 20%, achieving 24% of the load reduction required for Lake Betsy, and smaller but still significant load reductions to Scott Lake, Lake Louisa, Lake Marie, Lake Caroline, and Lake Augusta (All nutrient impaired lakes with approved TMDLs and implementation plans or TMDL's pending approval).
- Wetland and riverine habitat is restored to support a wider range of wildlife
- Recreational opportunities in the Clearwater River are enhanced by the restoration, providing a corridor to connect the upper agricultural watershed with the lower recreational lakes watershed. Kiosks are installed to mark the project and educate users about the impacts of ditching on water quality and habitat, and specifically the evolution of the Kingston Wetland through the various stages and it's roll in protecting downstream water quality.
- Local partners are engaged to cooperate in the project.

Significant data collection and modeling are required to optimize design. The Clearwater River Watershed District will administer the project which involves collecting 1 year of monitoring data which will include wetland/ main channel and groundwater hydrology and water quality. CRWD will also work with the District Engineer to construct a hydrologic and hydraulic model of the upper watershed and collect topographic data for the wetland. Hydrology and hydraulics model will be used in conjunction with the existing QUAL-2K model constructed to set the DO TMDL to optimize design. CRWD will design and construct the work. A contractor will be retained for construction through the CRWDs standard bidding process. The work will be done through a combination of in-kind staff labor, and consultant/ contractor time, and grant dollars. Following implementation of the project, the CRWD will monitoring the results of the project, collecting inflow and outflow data. Flow, total and soluble phosphorus, suspended sediment and dissolved oxygen will be monitored. CRWD will also conduct habitat evaluations of the system before and after the restoration to track effectiveness.

Appendix C

Technical Memorandums dated

- January 31, 2008
- February 4, 1994
- October 14, 1992
- August 12, 1992

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TECHNICAL MEMORANDUM

TO: Board of Managers
Clearwater River Watershed District

FROM: Wenck Associates, Inc.
Engineers for the District

DATE: January 31, 2008

SUBJECT: 1980 Clearwater River Chain of Lakes Project

This memorandum has been prepared in response to discussion at the District's December 26, 2007 workshop concerning the 1980 Clearwater River Chain of Lakes Restoration Project (1980 Project) and replacement projects for the aerators originally installed in Lakes Louisa, Marie, and Augusta. Table 1 summarizes the projects that were part of the Clearwater River Chain of Lakes Restoration Project. The total phosphorous load reduction was estimated to be 41,548 pounds in 1993. The three aerators came to the end of their useful life in the early 1990s and it was decided to replace them with projects of like impact on Clearwater Lake.

Table 2 summarizes the phosphorous removal rates at each site, as well as at Clearwater Lake. The table also includes completed replacement projects, along with each project's estimated phosphorous removal rates and estimated District expense.

It is estimated that facilities for the removal of 1,088 pounds of phosphorous per year from Clearwater Lake, have been implemented in the various projects described in Table 2 at an estimated District expense of approximately $2,500,000.

It should be noted that although the 1980 Project was amended to include the replacement projects outlined in the Wenck memos to the Board of Managers dated August 12, 1992, October 14 1992, December 8, 1993, January 12, 1994, February 4, 1994 included in Appendix A, not all of the projects were necessary to replace the aerators. A combination or portions of the projects were necessary to replace the phosphorous removal capacity of the aerators.

It appears that the projects listed in Table 2 fulfill the District's obligation to replace the aerator capacity and the 1980 Project should be amended to include the above-mentioned projects.

Table 1
Summary of 1980 Clearwater River Chain of Lakes Restoration Project

Individual Project	Phosphorous Load Reduction (Pounds Per Year)	
	Planned	**Estimated in 1993**
Wetland Treatment Systems		
County Ditch 20	600	1,000
Kingston	2,200	5,600
Annandale	300	750
Wetland Treatment Subtotal	**3,100**	**7,350**
Upper Lakes Projects		
Lake Augusta Hypolimnetic Aerator	1,000	280
Lake Louisa Hypolimnetic Aerator		190
Lake Marie Hypolimnetic Aerator	1,000	110
Louisa/Marie Mechanical Fish Removal		1,500
Lake Augusta Erosion Control Project	50	42
Upper Lakes Subtotal	**2,000**	**2,122**
Upper Watkins Isolation Project	**30,000**	**30,000**

Non Point Source Pollution Abatement	Number of Operations	Estimated 1993 Acres	
Minimum Till	42	1,649	500
Ridge Till	10	619	170
CRP Filter Strip	4	6	1
Field Strip	5	247	55
Soil Testing	11	1,393	200
Nutrient Management	19	640	110
Rim Incentive	12	402	150
Animal Waste Control and Management	5	969	860
Nonpoint Source Subtotal	**108**	**5,925**	**2,046**
RESTORATION PROJECT TOTAL			**41,518 pounds/year**

Table 2
Summary of Aerator Replacement Projects

AERATOR PROJECTS	Phosphorous Removal at Site (Pounds Per Year)	Estimated Phosphorous Removal from Clearwater Lake (Pounds Per Year)
Louisa	190	112
Marie	110	65
Augusta	1,000	910
Aerator Subtotal	**1,300**	**1,087**

COMPLETED REPLACEMENT PROJECTS	Estimated Expense	Phosphorous Removal at Site (Pounds Per Year)	Estimated Phosphorous Removal from Clearwater Lake (Pounds Per Year)
1997 Clearwater River Fish Trap	$30,000	500	200
1997 Buffer Incentive	$30,000	500	200
1999 Master Sewer Plan	$65,000	0	0
2000-01 North Clear Lake Wetland	$52,000	575	236
2001 Nistler Sedimentation Basin	$28,000	65	27
2001 Poole Feedlot Controls	$24,000	100	40
Hidden River Wastewater Project	$510,000	22	22
Rest-A-While Shores Wastewater Project	$115,000	6	2
Clearwater Harbor Wastewater Project	$1,500,000	61	61
2008 Segner Pond	$146,000	2,000	300
TOTAL	**$2,500,000**	**3,829 pounds/ year**	**1,088 pounds/year**

MEMORANDUM

TO: Board of Managers
Clearwater River Watershed District

FROM: Wenck Associates, Inc.

DATE: February 4, 1994

SUBJECT: Lake Augusta Aerator Replacement and
Wetland Treatment System Cost Comparison

---

1. The Board of Managers faces a decision on whether or not to replace the Lake Augusta aerator. This memorandum presents additional information relevant to this decision.

2. Previously the idea was raised that constructing additional wetland treatment systems might be more cost-effective than replacing the Augusta aerator. Earlier cost comparisons included the cost per unit of phosphorus load reduction, calculated by dividing each system's total lifetime phosphorus load removal into the total cost (capital plus operation and maintenance) - i.e., the "dollars per pound of phosphorus removed". However, the load reduction was counted at the location of each system (aerator or wetland treatment system), not in any particular lake.

3. An alternative comparison is presented here that is based on the effective load reduction in Clearwater Lake, rather than at the system locations. Clearwater Lake has by far the greatest public usage of any lake in the watershed, and it is the prime reason for the lake restoration project undertaken by the District.

4. The effect of a phosphorus load reduction far upstream from Clearwater Lake is not as great as the same reduction right at the lake. The main reason for this is the presence of the upstream chain of lakes.

5. The effect of the upstream lakes has to do with the natural tendency of every lake to "retain" a portion of its incoming phosphorus load. The retained phosphorus settles out of the water (mainly as dead algae) and thereafter resides in the bottom sediments of the lake. This is also the reason why the average phosphorus concentration in a lake is generally much lower than in its tributaries. For example, during the years 1981 through 1985, the average total phosphorus concentration in Lake Betsy (summer surface concentration) was 508 micrograms per liter (ug/l), compared with 944 ug/l for the Clearwater River at Highway 15.

6. For current conditions the average load retentions for the upper lakes individually are as follows:

Betsy	20%
Scott	12%
Louisa-Marie	19%
Caroline	14%
Augusta	16%

To illustrate this, if Lake Betsy receives a 5,000-pound phosphorus loading in a given year, then the lake retains 1,000 pounds (20%) and passes 4,000 pounds (80%) on to Scott Lake. Ignoring the minor tributaries, Scott Lake then retains 480 pounds (12% of 4,000 pounds) and passes 3,520 pounds (78% of 4,000 pounds) on to Lakes Louisa and Marie. After continuing through Lakes Louisa, Marie, Caroline, and Augusta, the original upstream loading of 5,000 pounds is reduced to 2,050 pounds (41% of the original 5,000 pounds) as it enters Clearwater Lake. In other words, the phosphorus load retention for the upper lakes as a whole is 59%.

7. What does this have to do with the effectiveness of upstream phosphorus load reductions? Here it is: just as loads are reduced because of retention in lakes, so are load reductions. In the example above, if the loading received by Lake Betsy is reduced by 1,000 pounds to 4,000 pounds, then the resulting loading to Clearwater Lake (41% of 4,000 pounds) is 1,640 pounds, which is only 410 pounds less than Clearwater Lake's loading in the example above. In other words, the 1,000-pound upstream load reduction is effectively reduced by 59% (the overall retention of the upper lakes) to a 410-pound load reduction for Clearwater Lake. The retention in the lakes affects the loads and load reductions alike.

8. Table 1 attached compares the cost-effectiveness from the viewpoint of Clearwater Lake of the Lake Augusta aerator and five potential wetland treatment systems. This comparison is based on a 10-year lifetime. The "at-project" load reductions and the costs have been presented to the Managers already in previous memorandums. The "in-Clearwater Lake" load reductions for those systems upstream of all the upper lakes are each 59% of their at-project reductions (this applies to all but the first and last systems in Table 1). The potential South Haven wetland treatment system is directly upstream from Lake Augusta, so only Lake Augusta's phosphorus retention affects its load reduction. Since the Lake Augusta aerator is in Lake Augusta, whether or not the lake's own retention affects this system's load reduction is arguable; Table 1 reflects half of Lake Augusta's retention.

9. From the viewpoint of Clearwater Lake, the systems in Table 1 have costs per pound of phosphorus removed ranging from $40 (for the Augusta aerator) to $150 (for the upstream Willow Creek wetland treatment system). From this comparison, the cost-effectiveness of the Lake Augusta aerator is similar to that of several of the potential wetland treatment systems, and in fact is the best of all the systems considered.

10. Prior to the restoration project some of the upper lakes experienced winter fish kills. Although Lake Augusta is not one of the lakes for which fish kills have been documented, aeration's beneficial effect of preventing fish kills should be considered.

TABLE 1

Comparison of Cost Per Pound of Phosphorus Load Reduction for Clearwater lake

Clearwater River Watershed District

System	10-Year Phosphorus Reduction (lb)		Project Cost		Cost per Pound of Phosphorus Removed from Clearwater Lake
	At Project	In Clearwater Lake	Capital	10-Year Maintenance	
South Haven W.T.S.	2710	2280	$90,000	$30,000	$50
Clear Lake W.T.S.	3610	1480	$130,000	$30,000	$110
Willow Creek South W.T.S.	6270	2570	$100,000	$30,000	$50
Willow Creek North W.T.S.	4280	1750	$80,000	$30,000	$60
Willow Creek Upstream W.T.S.	1800	740	$80,000	$30,000	$150
Lake Augusta Aerator	4200	3860	$70,000	$80,000	$40

Environmental
. Engineers

Wenck

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WENCK ASSOCIATES, INC.
MEMORANDUM

TO: Clearwater River Watershed District
Board of Managers

FROM: Glen A. Sanders

DATE: October 14, 1992

RE: Wetland Treatment Systems
Wenck File #0002-01-07

As requested by the Clearwater River Watershed District, Wenck Associates, Inc. has identified five wetland areas within the Watershed District that could be utilized as wetland treatment systems.

The wetlands selected for this study are 40 acres or larger and located on a major tributary entering a lake upstream of Clearwater Lake. The size of the wetland and its watershed areas were calculated to determine the amount of phosphorus reduction that could be obtained in an average rain year.

Enclosed is a figure showing the wetland and watershed area for each treatment site and a table showing the estimated construction cost and the estimated phosphorus reduction cost per pound over a 20 year period.

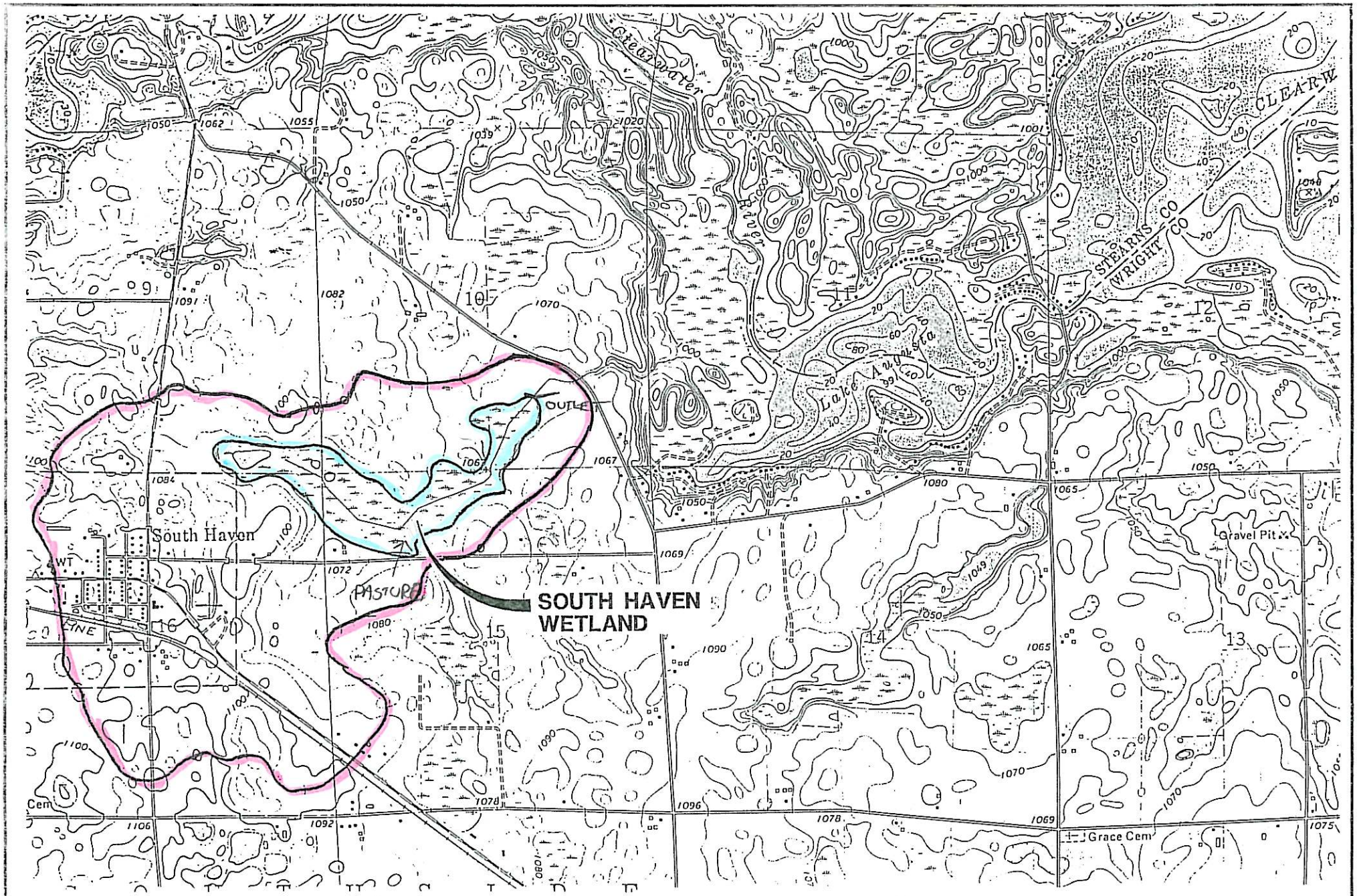
In addition to the construction cost there would be overall expenses estimated at between $30,000 and $40,000 covering administration, legal cost, engineers report, appraisal report and public hearings. This cost would be incurred if one system was constructed or if all five were constructed.

TABLE 1

Clearwater River Watershed District
Summary of Potential Wetlands

Wetland Location	Area Acres	Estimated Construction Cost	Estimated 20 year Phosphorus Reduction	Cost per Pound of Phosphorus Removed
1. South Haven	80	$90,000	5,420 lbs.	$30.00
2. Clear Lake	195	$130,000	7,220 lbs.	$27.00
3. Willow Creek South	40	$80,000	12,540 lbs.	$12.00
4. Willow Creek North	45	$80,000	8,560 lbs.	$17.00
5. Willow Creek Up Stream	115	$100,000	3,600 lbs.	$45.00

WRIGHT COUNTY T121N, R28W



CLEARWATER RIVER WATERSHED DISTRICT

Wetland Treatment Systems

Wenck

Wenck Associates, Inc. 1800 Pioneer Creek Ctr.
Environmental Engineers Maple Plain, MN 55359

OCT 1992

Fig. 1

TABLE 2

Clearwater River Watershed District
South Haven Wetland
Construction Cost Estimate

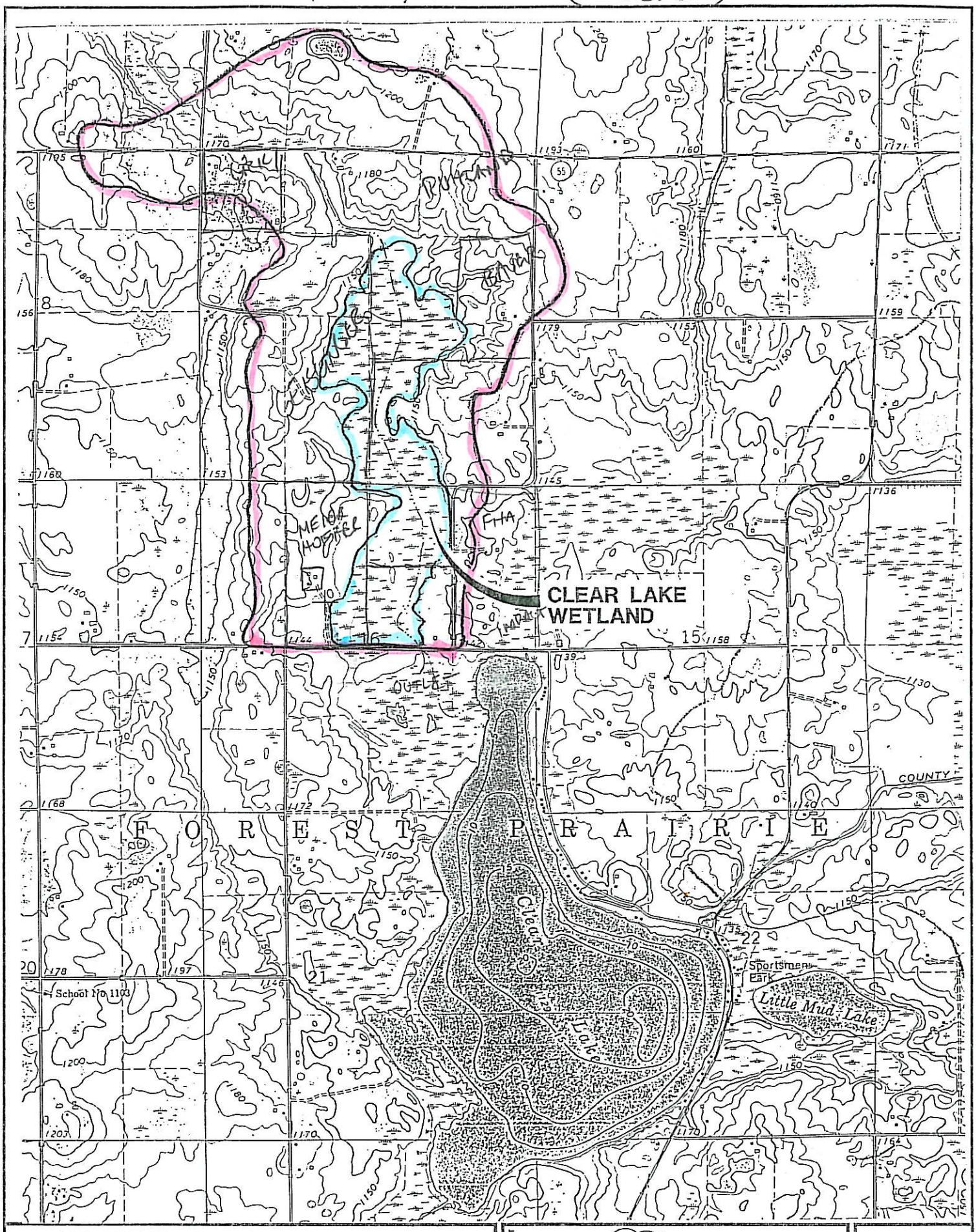
1.	Easement acquisition 80 acre @ 300 =	$24,000
2.	Control structure (sheet pilling, basin sedimentation)	$50,000
3.	Engineering	
	A. Preliminary Survey (Aerial Survey Easements)	$ 5,000
	B. Structure Design, Plans and Specifications, Bids	$ 5,000
	C. Construction Oversite	$ 3,000
	D. Project Coordination (DNR - Corp of Eng. Public Hearings)	$ 3,000
	TOTAL	$90,000

Construction Cost	=	$ 90,000
Maintenance $15,000 every 5 years	=	$ 60,000
20 Yr. Cost		$150,000

Estimated phosphorus reduction 20 yr. = 5420 lbs.

Cost per pound of phosphorus reduction = $30.00

T 121 N, R 30 W (MEEKER)



CLEARWATER RIVER WATERSHED DISTRICT

Wetland Treatment Systems

Wenck

Wenck Associates, Inc. 1800 Pioneer Creek Ctr.

OCT 1992

Fig. 2

SHEET PILE WEIR

TABLE 3

Clearwater River Watershed District
Clear Lake Wetland
Construction Cost Estimate

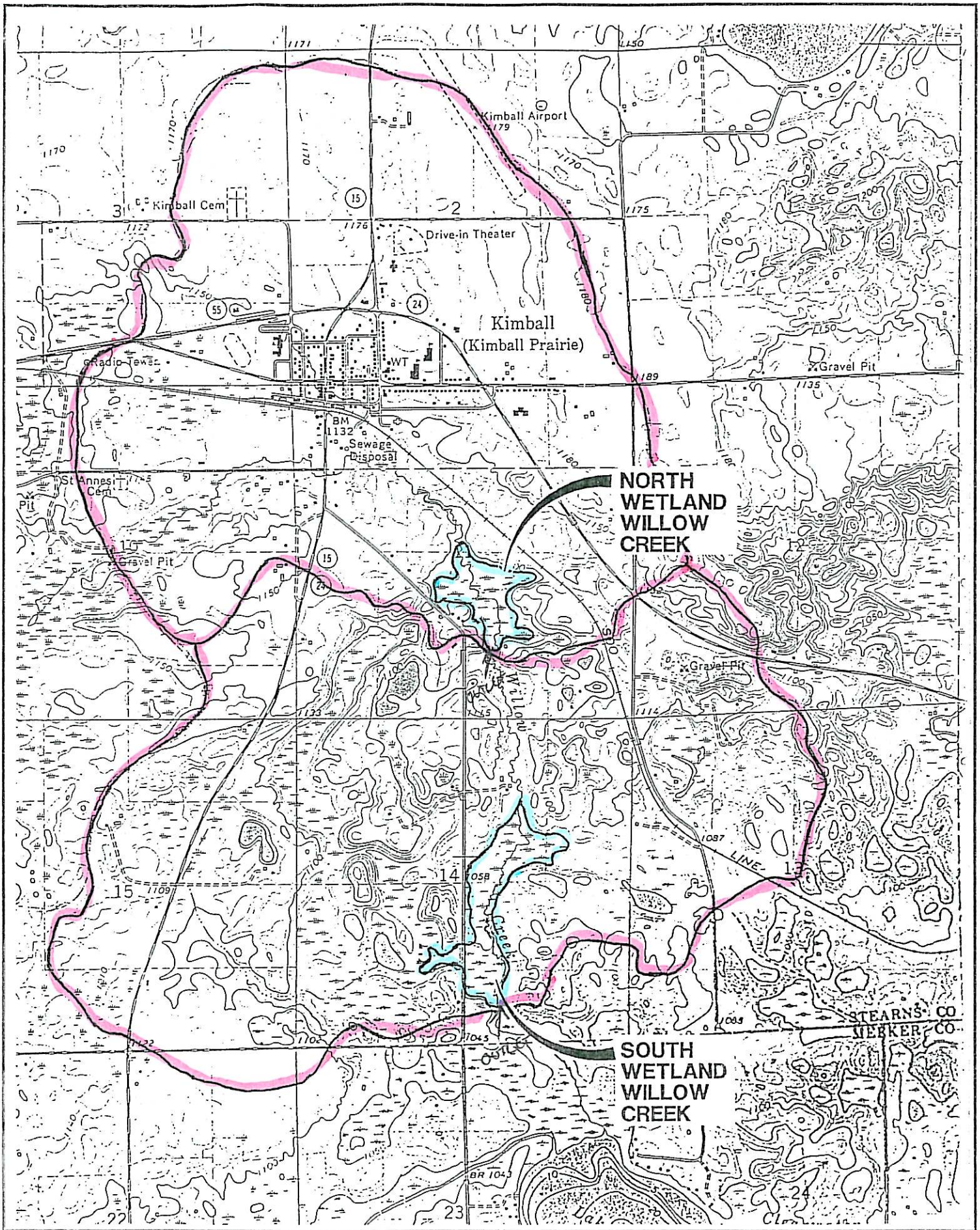
1.	Easement acquisition 195 acre @ 300 =	$ 60,000
2.	Control structure (sheet pilling, basin sedimentation)	$ 50,000
3.	Engineering	
	A. Preliminary Survey (Aerial Survey Easements)	$ 8,000
	B. Structure Design, Plans and Specifications, Bids	$ 5,000
	C. Construction Oversite	$ 3,000
	D. Project Coordination (DNR - Corp of Eng. Public Hearings)	$ 4,000
	TOTAL	$130,000

Construction Cost	=	$ 130,000
Maintenance $15,000 every 5 years	=	$ 160,000
20 Yr. Cost		$190,000

Estimated phosphorus reduction 20 yr. = 7220 lbs.

Cost per pound of phosphorus reduction = $27.00

T 121 N, R 29 W (STEARNS)



CLEARWATER RIVER WATERSHED DISTRICT

Wetland Treatment Systems

Wenck

Wenck Associates, Inc. 1800 Pioneer Creek Ctr.
Environmental Engineers Maple Plain, MN 55359

OCT 1992

Fig. 3

TABLE 4

Clearwater River Watershed District
Willow Creek Wetland
Construction Cost Estimate

Up-stream End

1.	Easement Acquisition 115 acre @ $300	$ 34,000
2.	Control Structure (sheet pilling, basin sedimentation)	$ 50,000
3.	Engineering (A,B,C,D)	$ 16,000
	TOTAL	$100,000

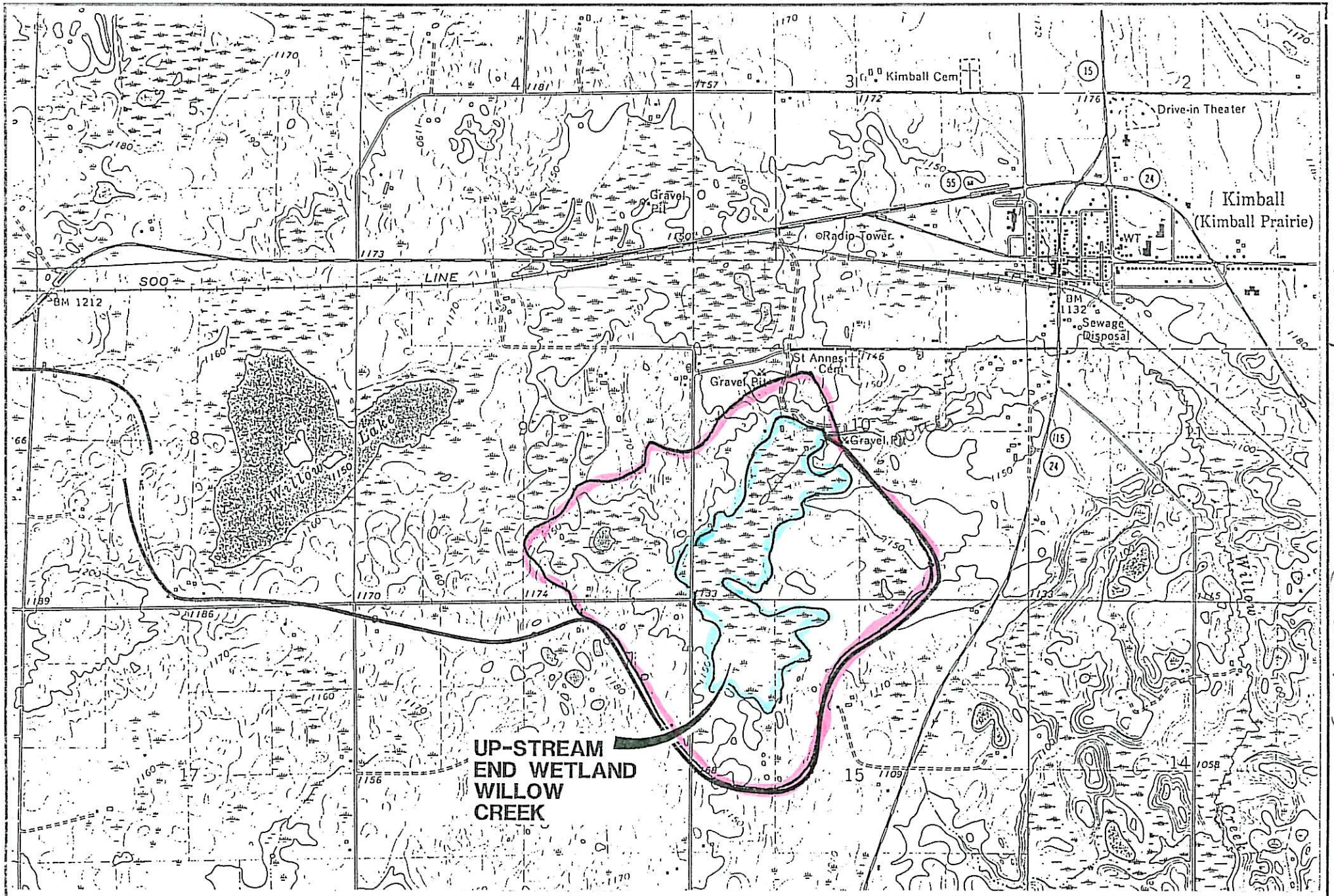
North

1.	Easement Acquisition 45 acre @ $300	$14,000
2.	Control Structure (sheet pilling, basin sedimentation)	$50,000
3.	Engineering (A,B,C,D)	$16,000
	TOTAL	$80,000

South

1.	Easement Acquisition 40 acre @ $300	$14,000
2.	Control Structure (sheet pilling, basin sedimentation)	$50,000
3.	Engineering (A,B,C,D)	$16,000
	TOTAL	$80,000

20 Year Cost		20 Year (Phosphorus/lb.)	Cost/Per/lb.
Up-stream End	= $160,000	3,600	$45/lb
North	= $140,000	8,560	$17/lb
South	= $140,000	12,540	$12/lb
North & South	= $280,000	17,180	$16/lb
North, South and Upstream	= $440,000	18,340	$24/lb



T121N, R29W (STEARNS)

CLEARWATER RIVER WATERSHED DISTRICT

Wetland Treatment Systems

Wenck

Wenck Associates, Inc. 1800 Pioneer Creek Ctr.
Environmental Engineers Maple Plain, MN 55359

OCT 1992

Fig. 4

WENCK ASSOCIATES, INC.

MEMORANDUM

TO: Clearwater River Watershed District
Board of Managers

FROM: Wenck Associates, Inc.

DATE: August 12, 1992

RE: Aerators in Lakes Louisa, Marie, and Augusta
Wenck File #0002-08-01

The hypolimnetic aerators in Lakes Louisa, Marie, and Augusta are of concern because the Augusta and Louisa systems presently require major repairs or replacements in order to operate as intended. The Board of Managers therefore directed Wenck Associates to investigate the aeration systems' costs and benefits, so that sound decisions can be made concerning these systems. Based on a review and analysis of pertinent data, we offer the following observations:

1. The aerators have substantially reduced wintertime phosphorus concentrations in the near-bottom waters of all three lakes. The lakes thereby benefit because at spring overturn, the thorough, top-to-bottom mixing that occurs carries substantially less phosphorus up from the bottom to the surface water, where the phosphorus encourages algal growth. The wintertime, near-bottom phosphorus concentration reductions have ranged from 60 to 70 percent in Lakes Louisa, Marie, and Augusta.

2. The above concentration reductions imply loading reductions of approximately 300 pounds of phosphorus per year in lakes Louisa and Marie (combined), and 400 pounds per year in Lake Augusta. These loading reductions were calculated by multiplying the average concentration reduction (0.31 milligrams per liter for both Louisa-Marie and Lake Augusta) by one tenth of each lake's total volume (a rough estimate of the volume of near-bottom water affected by the concentration reductions). For lakes Louisa and Marie, the combined load reduction of 300 pounds per year equals the original estimate for these systems (1984 Monitoring Report, Appendix G, page G-12). For Lake Augusta, however, the load reduction is about one fourth of that originally estimated for the system (1,500 pounds per year; 1984 Monitoring Report, Appendix H, page H-7). It is suspected that the Lake Augusta aerator has never achieved the originally specified oxygen transfer rate of 1,300 pounds per day (1984 Monitoring Report, Appendix H, page H-6).

3. For the 10-year period 1992-2001 (inclusive), the total of the projected aeration system costs is $763,000, including the major equipment replacements as well as electricity and routine maintenance costs. With these expenditures, the average annual costs for this period would be about $76,000 per year. Based on the total phosphorus load reduction of 700 pounds per year for the three lakes combined, the cost per unit load reduction is on the order of $100 per pound of phosphorus. It is difficult to make exact comparisons, but the unit cost for the wetland treatment systems must be less than one tenth of the above. On the other hand, phosphorus load reduction unit costs for urban lakes would be $300 to $400 per pound of phosphorus, based on a 1981 report on the Minneapolis Chain of Lakes (costs updated to 1992 assuming 5-percent annual inflation).

4. The calculated improvements in lake transparency for the lakes extending from Louisa through Clearwater Lake that are attributable to the three aeration systems are on the order of 1 percent. This is because phosphorus loadings from the watershed (external loadings) continue to be dominant, far exceeding internal phosphorus loadings. The true magnitude of the external phosphorus loadings was unforseen at the start of the lake restoration project. Data form the U.S. Environmental Protection Agency (National Eutrophication Survey) and the Minnesota Pollution Control Agency indicated an external phosphorus loading of approximately 10,000 pounds per year (original Grant Application, Table 1). The external loadings actually observed during the years 1981-1990 ranged from about 3,000 to 180,000 pounds per year; the median loading was 70,000 pounds per year (Draft 1981-1991 Final Evaluation Report, Table 9). However, the average loading for the years 1987-1989 was 5,000 pounds per year and for the period 1987-1990 the average increased to 25,000 pounds, caused by high rainfall in 1990 and some washouts in the Kingston Wetland. Thus the effectiveness of measures (such as the aerators) that aim at internal load reductions cannot be nearly so great as originally envisioned.

5. Lakes Louisa and Marie in the past reportedly experienced winterkills, which decimate the game fishery and effectively boost the populations of rough fish such as carp and bullhead. This was a secondary reason for installing aerators in these two lakes. The prevention of winterkill is a function of the Louisa and Marie aerators that cannot be quantified in the same manner as phosphorus load reductions.

JBE/aec