

**CITY OF PLYMOUTH
AGENDA
SPECIAL COUNCILMEETING
MAY 5, 2015, 5:30 p.m.
PARKERS LAKE AND MEDICINE LAKE CONFERENCE ROOMS**

1. CALL TO ORDER

2. TOPICS

5:30 p.m. HRA Interviews (Parkers Lake Conf. Room)

6:00 p.m. Medicine Lake Water Level Study (Medicine Lake Conf. Room)

3. ADJOURN

**SPECIAL
COUNCIL MEETING**

May 5, 2015

To: City Council
From: Derek Asche, Water Resources Manager
Date: April 27, 2015
Item: Medicine Lake Water Level Study

Since 2009, there has been recurring concerns brought to the Bassett Creek Watershed Management Commission (Commission) by the City of Medicine Lake and the Association of Medicine Lake Area Citizens (AMLAC) regarding recreational impacts on Medicine Lake from late season water levels dropping too low for recreational activities. The City of Plymouth (via the Water Resources Fund) funds approximately 45% of the Commission resources (engineering, administration, legal, etc...) dedicated to responding to such concerns via annual assessments directed at the operating costs of the watershed.

The Bassett Creek Watershed has had an extensive and complex history of flooding and water management. Pre-1970 flooding in the Bassett Creek Watershed resulted in the Army Corps of Engineers (Corps) completing a study of flooding problems within the watershed. An outcome of this study was a plan to replace the Medicine Lake Outlet in 1996 as a cooperative project between the City of Plymouth, the Minnesota Department of Natural Resources (DNR), the Bassett Creek Watershed, and Hennepin County. Two issues were cited by City staff regarding the need to replace the previous Medicine Lake Outlet:

1. Water seepage during periods of low rainfall allowed the lake level to drop below the outlet level.
2. Development upstream of Medicine Lake discharges additional water into the lake and a new outlet is needed to minimize lake “bounce” after rain events.

Water level data from the 1970s to the mid-1990s from the DNR indicated that water levels were generally increasing (Figure 1) which supports staff’s conclusion that additional water was discharging to Medicine Lake. Initially, the Corps indicated there was potential for an adjustable or variable outlet structure which could lower water levels up to 2.5 feet to provide additional storage in the lake and to prevent flooding. Further analysis concluded an adjustable or variable outlet structure was not practical at this location and therefore, a fixed outlet structure was designed to reduce or eliminate seepage and mitigate the lake “bounce” after rain events to reduce flooding. Water level data from 1996 through 2014 indicate the current outlet structure appears to mitigate lake “bounce”. Additionally, Medicine Lake appears to be dependent upon precipitation to maintain water levels based on the correlation of precipitation (both snow and rain) to lake level (Figure 2).

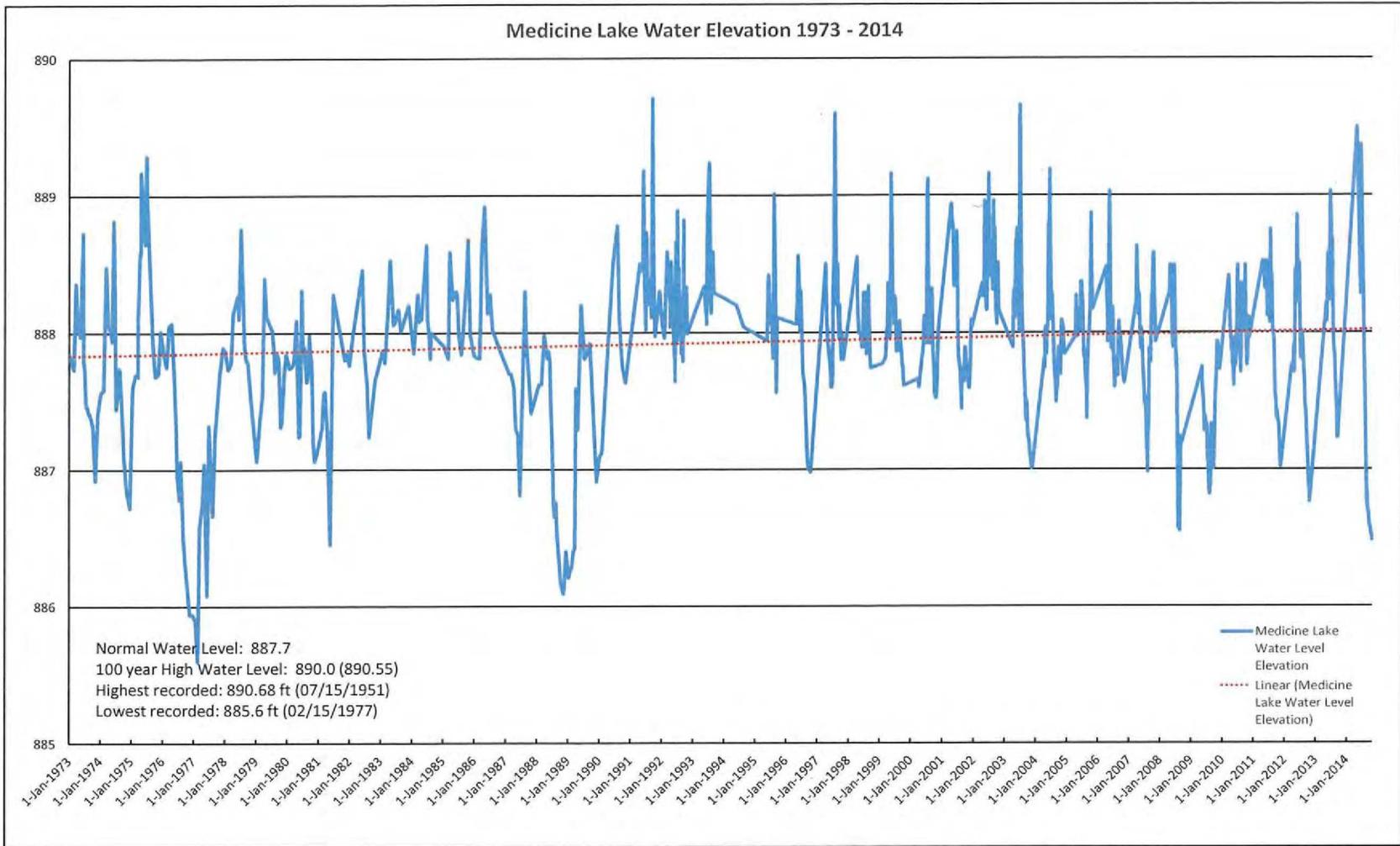
Low water levels can impact swimming and boating, among other activities, and the Commission responded with several memos and reports intended to explain how the water levels in Medicine

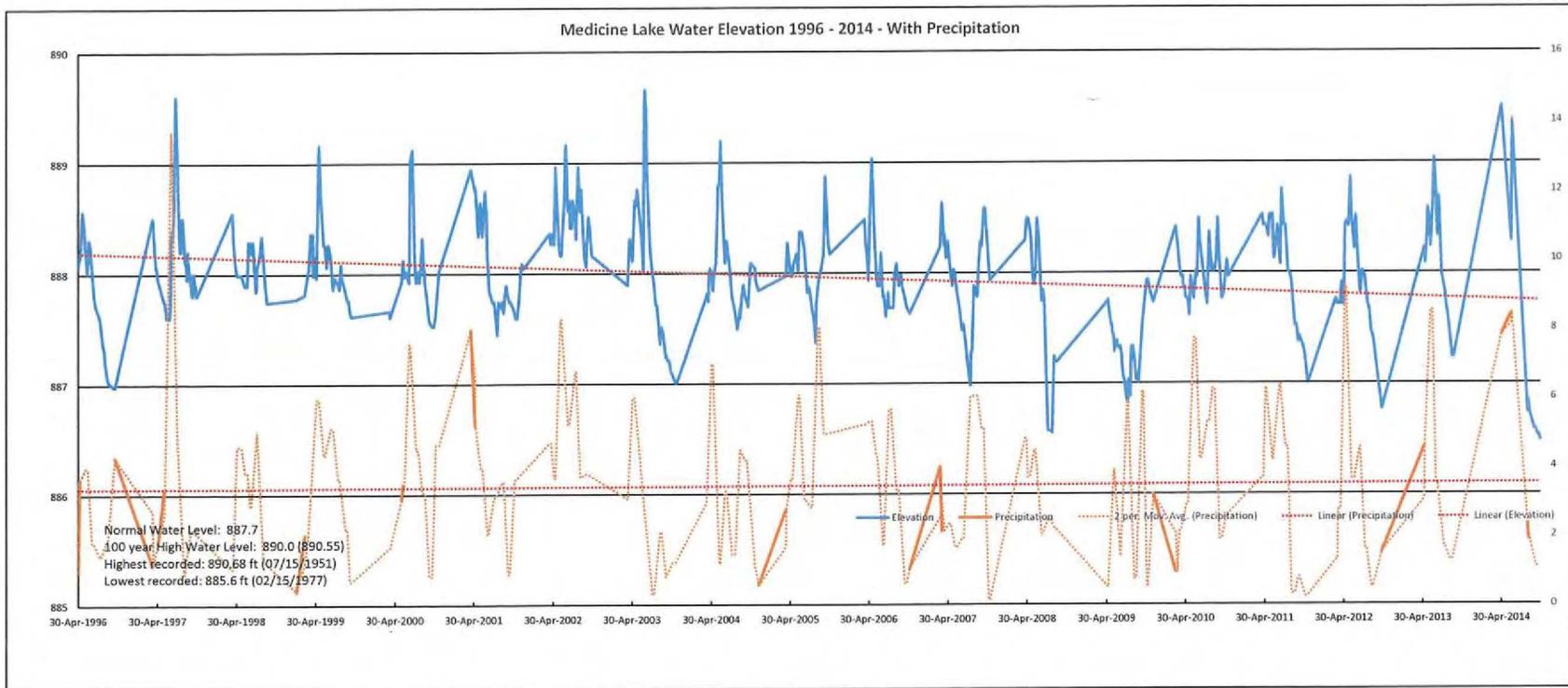
Lake function, however, this did not satisfy the concerns. In 2014, the Cities of Plymouth and Medicine Lake began discussing the possibility of partnering 50-50 on funding a study to further investigate water levels in Medicine Lake and what options, if any, could be completed to improve recreational opportunities in July, August, and September. Subsequently, a request for proposals (RFP) was developed cooperatively between our two Cities and submitted to three consultants for consideration. By default, Plymouth Water Resources staff has been coordinating the RFP and the selection process.

The RFP included seven options for investigation by the successful consultant pertaining to water levels in July, August, and September. Those options included modification to the outlet of Medicine Lake, modification of upstream structures draining to Medicine Lake, sprinkling and/or water appropriation regulations, dredging, the effect of late season (July, Aug, Sept) evaporation, the effect of water appropriations permits, and the effect of private wells.

The total cost of the Wenck Associates proposal is \$45,012 (copy attached). The cost for this study is not budgeted. A 50-50 partnership with the City of Medicine Lake to complete this study would require a City of Plymouth contribution of \$22,506. Although Water Resources staff has been coordinating this effort, they feel that this study and resulting expenditure is not appropriately funded from the Water Resources Fund since the lake level is a recreation issue. The cost for the study is not budgeted in any city fund or budget.

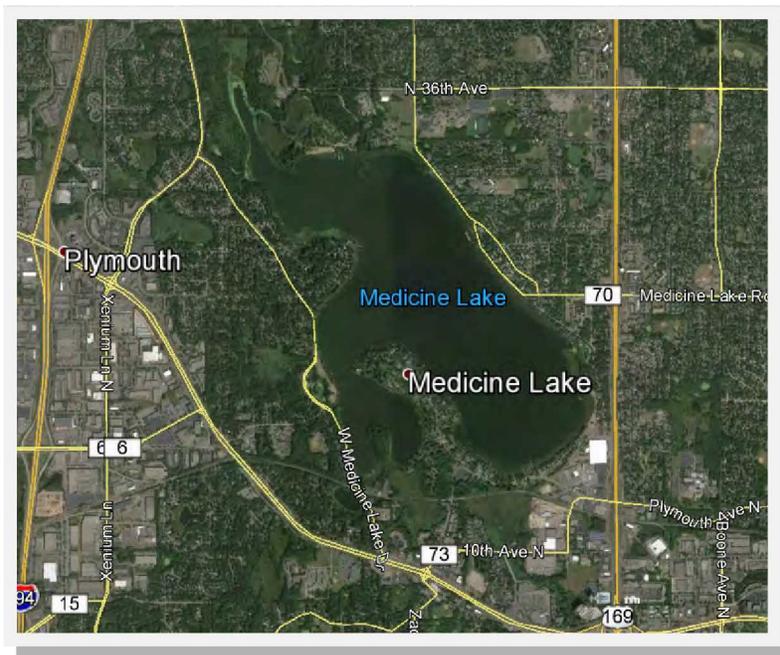
Attachment: Medicine Lake Water Level Investigation Feasibility Study - Wenck







Medicine Lake Water Level Investigation Feasibility Study



A proposal prepared for
The City of Plymouth and Medicine Lake, Minnesota

Prepared by
Wenck Associates, Inc.
Maple Plain, Minnesota
763-479-4200



Wenck Associates, Inc.
1800 Pioneer Creek Ctr.
P.O. Box 249
Maple Plain, MN 55359-0249

(763) 479-4200
Fax (763) 479-4242
E-mail: wenckmp@wenck.com

November 7, 2014

Mr. Derek Asche
Water Resources Manager
City of Plymouth
3400 Plymouth Boulevard
Plymouth, MN 55447

Re: Request for Scope of Services, Medicine lake Water Level Investigation;

Dear Mr. Asche:

Thank you for the opportunity to submit the enclosed Scope of Services to investigate options to improve enjoyment of Medicine Lake during the months of July, August, and September with an emphasis on aquatic recreation. Wenck understands there are many dynamics associated with the enjoyment of Medicine Lake as a recreational resource for the City and residents. Wenck has assembled a team of professionals with key experience to provide superior service and results to the City.

Wenck values the relationship it has established with the City of Plymouth as its partner on several projects related to water resources restoration and water quality improvements including the Elm Creek restoration, Wood Creek channel stabilization, Plymouth Creek Pond design, Plymouth Creek restoration, and wetland monitoring.

We are eager to continue our relationship by assisting with this investigation, and we believe we are the best choice for this project for several reasons:

An experienced team with watershed-level evaluation at the core of our practice. The Wenck staff committed to this project has over 50 years of experience leading watershed, stream and lake restoration and is versed in a multitude of techniques for water quantity and quality management. This team provides a multifaceted approach to watershed investigation and analysis.

Lake and outlet modeling design and construction

The Wenck team has completed over 20 lake and reservoir water level feasibility studies to maximize a combination of recreational, water quality, water supply and flood control benefits. Four of the most interesting feasibility studies in the metro area have been on School Section Lake in the Browns Creek Watershed, Prior Lake, Mooney Lake and Lake Pulaski. These lakes are similar because they have limited capacity outlets, a high potential for shore and structure flooding and are highly used for water recreation. The analyses were done using recent periods of precipitation and evaporation to simulate the existing structure and proposed options. The

Mr. Derek Asche
City of Plymouth
Proposal for Medicine Lake Water Level Investigation
Page 3 of 10

Prior Lake outlet resulted in construction of a labyrinth weir to allow a maximum discharge at low head with a minimal structure footprint.

A history of developing cost effective feasibility studies that result in focused and cost effective solutions. Wenck has worked with many clients on several feasibility studies, specifically with the City on the Four Seasons Mall Water Quality Improvement and Elm Creek Stream Restoration feasibility studies. As District Engineer for municipalities, counties and watershed districts, we have a unique perspective and longtime experience that streamlines our evaluation of proposed options and considers the long term impacts to local residents and landowners.

A proven ability to deliver high-quality projects for a reasonable budget. In our past projects with the City, Wenck has worked hard to deliver quality products at reasonable prices for the agreed upon scope of work. Wenck has a long history of delivering projects on-time and on budget. We know that the timeline is critical for this project and we will meet the City's timeline.

Wenck proposes an additional Option H to investigate the feasibility of a lake level optimization model for Medicine Lake. Investigating the lake level optimization model would include the feasibility of incorporating real-time precipitation forecasting data from NOAA to provide risk assessment for flooding concerns versus recreational use.

We look forward to discussing these qualifications with you further. Our scope, budget and timeline are presented on the following pages. If you have any questions, or if you wish to arrange an interview, please contact me at your convenience.

On behalf of the 200-plus employee-owners of Wenck Associates, thank you again for this opportunity. If you have any questions or need further information, please feel free to contact me at (763) 479-4208 or ematthiesen@wenck.com.

Sincerely,

WENCK ASSOCIATES, INC.



Ed Matthiesen, PE, Principal

Project Personnel

Wenck Associates has assembled a team with experience in watershed assessment for hydrologic and hydraulic modeling. Brief biographies for each team member are presented below. Full résumés are available at your request.



Ed Matthiesen, PE, Principal – Project Manager and Water Resources Engineer

Mr. Matthiesen will serve as the senior water resources engineer. Mr. Matthiesen has 30 years of extensive experience in water resources and environmental engineering. His water resources experience includes being the District Engineer for three Twin Cities area watershed districts and four Joint Powers Associations, writing municipal comprehensive stormwater plans, outlet structure and storm sewer design, conducting evaporation studies, aquifer analysis, water quality protection plans, and developing computer hydrologic and hydraulic models. He was nominated by the Minnesota Chapter of the American Public Works Association for the national 2011 Water Resources Professional of the Year award by APWA.



Joel Toso, PhD, PH, PE, Principal – Water Resources Engineer

Mr. Toso will be a technical resource for the project. He has more than 28 years of experience with water resources engineering and has served as an instructor of applied hydrology and hydraulics at the University of Minnesota for more than 18 years. He is a professional hydrologist and professional engineer. A specific area of expertise is hydrologic analyses including water balance computations for lakes and reservoirs. Selected directly applicable projects include: 1) expertise witness provided for a legal case involving 20 years of historic lake level modeling, 2) hydrologic design of an 18-square-mile reservoir for the South Florida Water Management District, and 3) hydrologic investigations to determine alternatives for relieving high Devils Lake levels.



Kirby Templin, EIT – Water Resources Engineer

Mr. Templin has 3 years of experience in the fields of water resources and civil engineering. Mr. Templin graduated from the University of Minnesota-Twin Cities in 2011 with an MS in Civil Engineering with an emphasis in water resources engineering. Mr. Templin also received a certificate of stream restoration science and engineering from the University of Minnesota-Twin Cities in 2011. His project and technical experience includes: hydrologic and hydraulic modeling, water quality modeling, field data collection and processing, and geographic information systems (GIS) Services. Mr. Templin has experience using HydroCAD, XPSWMM, P8 Urban Catchment Model, Pondnet, HEC-RAS, ArcMap (GIS) and AutoCAD. Mr. Templin also has field experience with surveying, BMP inspections, and construction observation.



Eileen Weigel, EIT – Water resources Engineer

Ms. Weigel has three years of experience in the fields of water resources and environmental engineering. Ms. Weigel graduated from the University of Minnesota-Twin Cities in 2010 with an MS in Geological Engineering with an emphasis in water resources. Ms. Weigel also received a certificate of stream restoration from the University of Minnesota-Twin Cities in 2010. Her project and technical experience includes: hydraulic modeling, groundwater and surface water quality modeling and analysis, stream and lake restoration, soil and groundwater remediation, field data collection and processing, and geographic information systems (GIS) Services. Ms. Weigel has experience using the P8 Urban Catchment Model, HydroCAD, HEC-RAS, XP-SWMM, ArcMap (GIS), Pondnet and BATHTUB. Ms. Weigel also has field experience with surveying, BMP inspections, and construction oversight.

Project Understanding and Approach

It is our understanding that the City of Plymouth and Medicine Lake is interested in developing a feasibility study to retain water and improve the quality of recreational opportunities in Medicine Lake during July, August, and September of each year. The goal of the feasibility study is to evaluate options to improve enjoyment and aquatic recreation during the months of July, August, and September by maintaining sufficient water levels.

APPROACH

Wenck's approach to developing feasibility studies includes partnering and close communication with the City to obtain all available information and historical knowledge to fully investigate and evaluate the project options. This approach is highly effective while minimizing cost and assures that all possible project options have been evaluated thoroughly. Wenck will conduct the following scope of services during the development of the Feasibility Study:

SCOPE OF SERVICES

Option A. Modification to the Outlet of Medicine Lake

A modification to the outlet of Medicine Lake will be investigated by first obtaining as-built information for the existing outlet, quantifying lake discharge with available lake level monitoring data and then compare the lake discharge results with the results from the XPSWMM model. The outcome of the first step is to validate the relationship between the model and existing conditions, and how groundwater and evaporation losses are represented through model results. After validation of the model, modifications to the outlet can be investigated with the focus to maintain lake water levels during the months of July, August, and September. Lake level data and precipitation data will be reviewed to identify target drought year conditions and wet year conditions to evaluate the performance of proposed outlet modifications. The model will also be run with the Atlas 14 100-year precipitation event and 10 day snowmelt event to verify the regulatory floodplain.

The report evaluation of option A will include the following:

- Description of the Outlet Modification and Outcomes Pertaining to Lake Water Levels
- Schematic Which Depicts the Proposed Outlet Modification
- Cost Estimate for Outlet Modification and Annual Operations and Maintenance
- Permitting Requirements
- Comparison to Other Options
- Discussion for Implementation

Option B. Modification of Upstream Structures Draining to Medicine Lake

Modifications to upstream structures and stormwater systems will be investigated in a similar approach to the modification of Medicine Lake to maximize water yield, protect biological needs, and no increase in flood elevations. The initial steps will include obtaining and reviewing available information which includes storm sewer information, as-built information, water surface elevation monitoring data and validation of the XPSWMM model. Opportunities for

upstream modifications will be first identified within the watershed and second investigated to understand the outcomes on maintaining lake levels in the months of July, August, and September. Opportunities that will be investigated include the potential for increased storage which can be released to Medicine Lake when needed, and opportunities for the diversion of stormwater from new sources which can be limited to the months of July, August, and September. The performance of upstream modifications will be evaluated for the target drought and wet year conditions.

The evaluation of option B will include the following:

- Description of Upstream Modifications and Outcomes Pertaining to Lake Water Levels
- Figures Which Detail Upstream Modification Alternatives
- Cost Estimate of Alternatives for Upstream Stormwater System Modifications
- Permitting Requirements
- Comparison to Other Options
- Discussion for Implementation

Option C. Sprinkling and/or Water Appropriation Regulations

The study on the impact of sprinkling and/or water appropriation regulations on lake levels will involve reviewing existing regulations, and available data and knowledge of irrigation and water appropriation usage to estimate the impact on lake levels during the months of July, August, and September. If information is not available on water appropriation, a worst case scenario that is within reason can be developed to understand the extreme appropriation impacts on the lake levels.

The evaluation of option C will include the following:

- Description of Existing Sprinkling and/or Water Appropriation Regulations
- Discussion of Water Appropriation Impacts
- Cost Estimate of Water Appropriation Regulations for Review and Enforcement
- Permitting Requirements
- Comparison to Other Options
- Discussion for Implementation

Option D. Dredging

Dredging opportunities will be evaluated throughout the lake with focus on aquatic recreation during the months of July, August, and September. Dredging specific areas is an option that may improve some aquatic activities in general and as lake water levels decrease. Dredging options will be reviewed on the independent benefit and also the benefits in addition to other water level management practices that are investigated. Dredging will not be a solution to improve all aquatic activities but may be able to provide improved enjoyment for targeted activities.

The evaluation of option D will include the following:

- Description of Dredging Project Options and The Recreational Impacts
- Figures Which Detail Dredging Project Options

- Cost Estimate for Dredging Projects
- Permitting Requirements
- Comparison to Other Options
- Discussion for Implementation
- Discussion for Soil Sampling and/or Boring Compliance Requirements

Option E. Effect of Late Season (July, August, September) Evaporation on Water Levels in Medicine Lake

Evaporation at Medicine Lake will be analyzed by computational methods to estimate water losses during the months of July, August, and September. Water losses at Medicine Lake are likely primarily evaporation and groundwater, and also from lesser known impacts from water appropriation and other possible sinks. Multiple methods will be used to aid in quantifying water losses due to evaporation versus other losses such as groundwater, etc. Estimated groundwater levels from the metro area groundwater model will be evaluated for the Medicine Lake area to better understand the impacts of groundwater as it relates to the evaporation estimates. Previous data and studies on evaporation at Medicine Lake will also be reviewed if it is available.

The evaluation of option E will include the following:

- Description Quantifying Evaporation and Detailing the Methodologies Used to Estimate the Evaporation
- Cost Estimate, if Any, As it Relates to Evaporation
- Permitting Requirements, if Any, As it Relates to Evaporation
- Comparison to Other Options, if Any, As it Relates to Evaporation
- Discussion on Influence of Evaporation as it Relates to Aquatic Recreation

Option F. Effect of Water Appropriations Permits on Water Levels in Medicine Lake

Option F will build on the review and understanding of existing water appropriation regulation as detailed by Option C. Increased regulation will be discussed and the ultimate estimated effect on water levels for the months of July, August, and September will be evaluated.

The evaluation of option F will include the following:

- Description of Increased Appropriation Regulation and Effect on Water Levels
- Cost Estimate, As it Relates to Increased Regulation
- Permitting Requirements, As it Relates to Increased Regulation
- Comparison to Other Options
- Discussion for Implementation

Option G. Effect of Private Wells on Water Levels in Medicine Lake

The locations and quantity of private wells within the Medicine Lake watershed will be reviewed along with any available data to aid in understanding the effect of the private wells on lake levels. If well usage data is unavailable, worst case scenarios can be established to quantify potential impacts of the private wells. A worst case can assume all water usage directly influences the lake water level. The lake level decrease due to private wells can be simply

evaluated as the well usage volume estimate over the surface area of the lake. The magnitude of the estimated decrease can be compared to other sources of water losses, such as evaporation, to determine the overall impact and influence the private wells may have on the water levels of Medicine Lake.

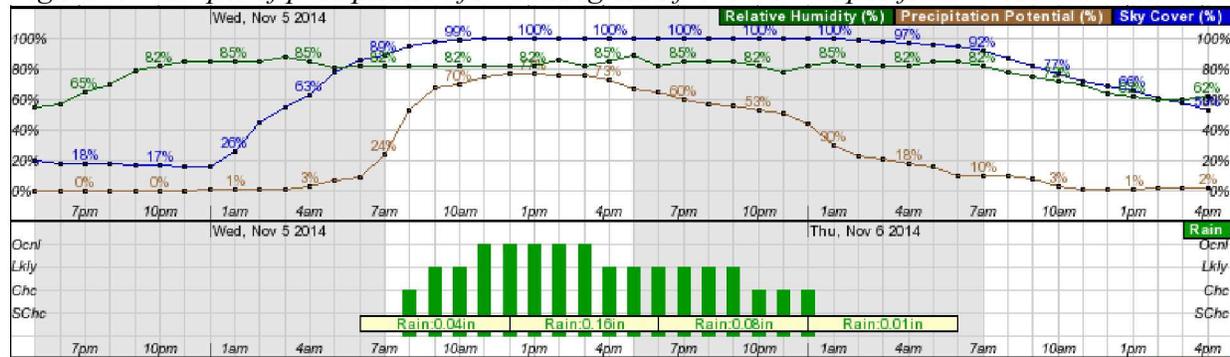
The evaluation of option F will include the following:

- Description of Private Well Usage and Potential Influence and Impact of Medicine lake
- Cost Estimate, If Any, As it Relates to Private Wells
- Permitting Requirements, As it Relates to Private Wells
- Comparison to Other Options
- Discussion for Implementation

Option H. Other options as it applies to stated goal

As an optional task, we propose to investigate the feasibility of building a lake outlet operation probabilistic model to optimize lake levels using NOAA precipitation forecasting data specific to Medicine Lake as shown below. From a phone conversation with State Climatologist Pete Boulay, there appears to be sufficient forecasting accuracy and data precision within the Medicine Lake watershed within 48 hours to manage lake levels within a risk tolerance for flooding concerns versus recreational use. Figure 1 is an example of available forecasting data from NOAA which may be useful in developing a real-time risk probabilistic model to optimize Medicine Lake water levels.

Figure 1. Example of precipitation forecasting data from NOAA specific to Medicine Lake Area.



The evaluation of option H will include the following:

- Description of the Probabilistic Model to Optimize Lake Levels
- Cost Estimate for Implementation of the Probabilistic Model and Annual Operations and Maintenance
- Permitting Requirements
- Comparison to Other Options
- Discussion for Implementation

Cost Estimate and Timeline

Table 1 outlines Wenck’s proposed costs to complete the Medicine Lake Water Level Investigation Feasibility Study. All work will be completed on a time and materials basis not to exceed a project total of \$45,012.

Table 1. Proposed cost estimate for completing the Medicine Lake Water Level Investigation Feasibility Study.

Task	Description	Total
A	Modification to the outlet of Medicine Lake	\$ 8,405
B	Modification of upstream structures draining to Medicine Lake	\$ 6,702
C	Sprinkling and/or water appropriation revulations	\$ 4,066
D	Dredging	\$ 5,728
E	Effect of late season (July, Aug, Sept) evaporation on water levels in Medicine Lake	\$ 5,598
F	Effect of water appropriations permits on water levels in Medicine Lake	\$ 4,215
G	Effect of private wells on water levels in Medicine Lake	\$ 4,577
H	Other options as it applies to stated goal	\$ 5,723
TOTAL		\$ 45,012

Hourly rates for specific professional services are as follows:

Professional I: Kirby Templin, E.I.T.	\$88.00
Professional I: Eileen Weigel, E.I.T.	\$96.00
Professional IV: Ed Matthiesen, P.E, and Joel Toso, P.E.	\$190.00

Table 2 outlines our proposed timeline for completing the Medicine Lake Water Level Investigation Feasibility Study.

Table 2. Proposed timeline for completing the Medicine Lake Water level Investigation Feasibility Study.

Task	Completion Date
Draft Feasibility Report	January 21, 2015
Final Feasibility Report	January 30, 2015

City of Plymouth

City Council Study Session
Medicine Lake Water Level Investigation
May 5, 2015

Derek Asche, Water Resources Manager

Medicine Lake

- Second largest lake in Hennepin County by acreage
- Stakeholders include:
 - The United States Army Corps of Engineers
 - The Minnesota Department of Natural Resources
 - Hennepin County
 - Bassett Creek Watershed
 - Three Rivers Park District
 - Cities of Plymouth and Medicine Lake
 - Lakeshore owners and area residents
- 252 total lakeshore properties (131 in Plymouth, 121 in Medicine Lake)

Medicine Lake Water Level Investigation

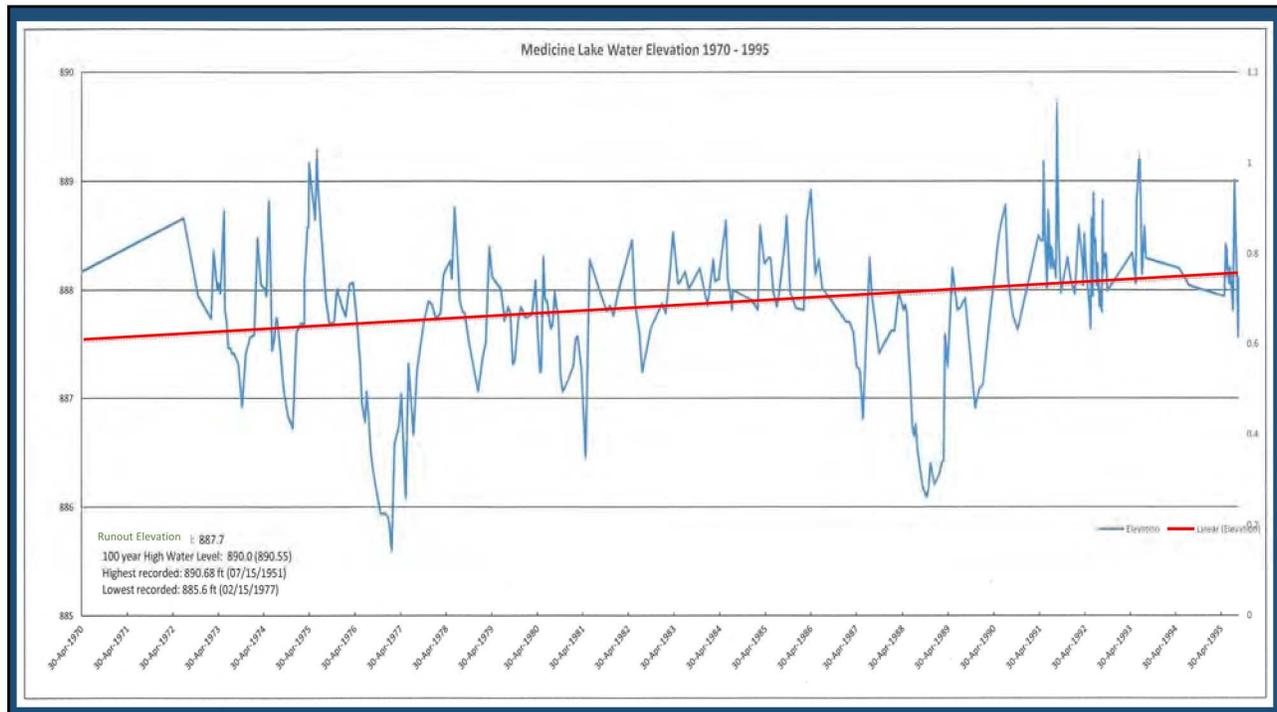
- Complaints of low water levels during July, August, and September which can impact recreation on the lake
- This proposal is to investigate the potential to maintain water levels in Medicine Lake in July, August, and September closer to the current run-out elevation
- Portions of Medicine Lake riparian area are shallow amplifying the problem.
- Consideration of DNR requirements to modify run-out elevations
- This investigation may or may not return viable options and there is no guarantee any improvements or changes within the watershed will be made.

Medicine Lake Water Level Investigation

- This proposal was developed by the Cities of Plymouth and Medicine Lake and would investigate options to improve recreational opportunities on Medicine Lake in July, August, and September.
- Options included for investigation are:
 - Medicine Lake outlet modification
 - Modification of upstream structures
 - Sprinkling/water appropriation review
 - Dredging
 - Effect of private well use
 - Effect of late season (July, Aug, Sept) evaporation

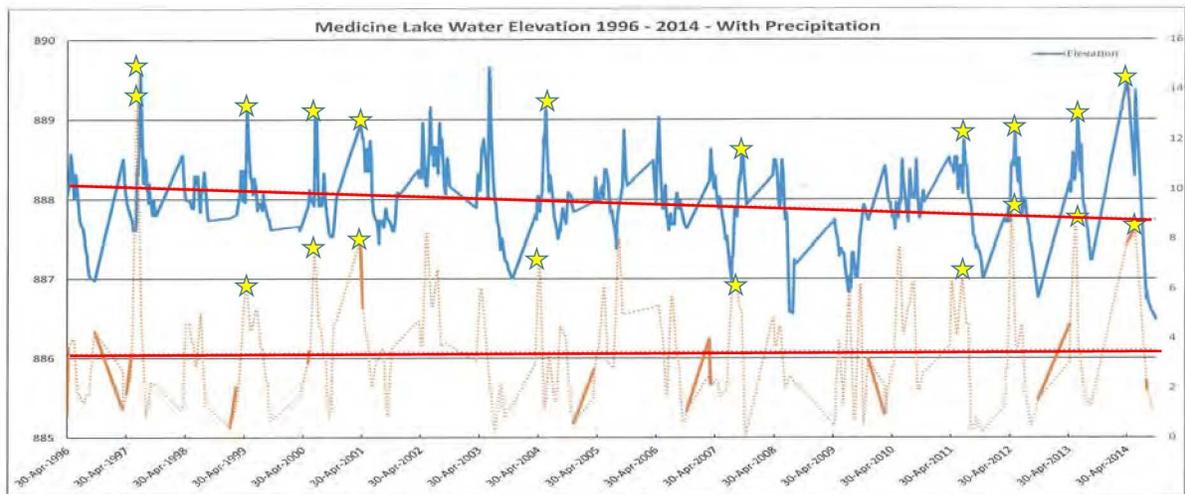
Water Level History

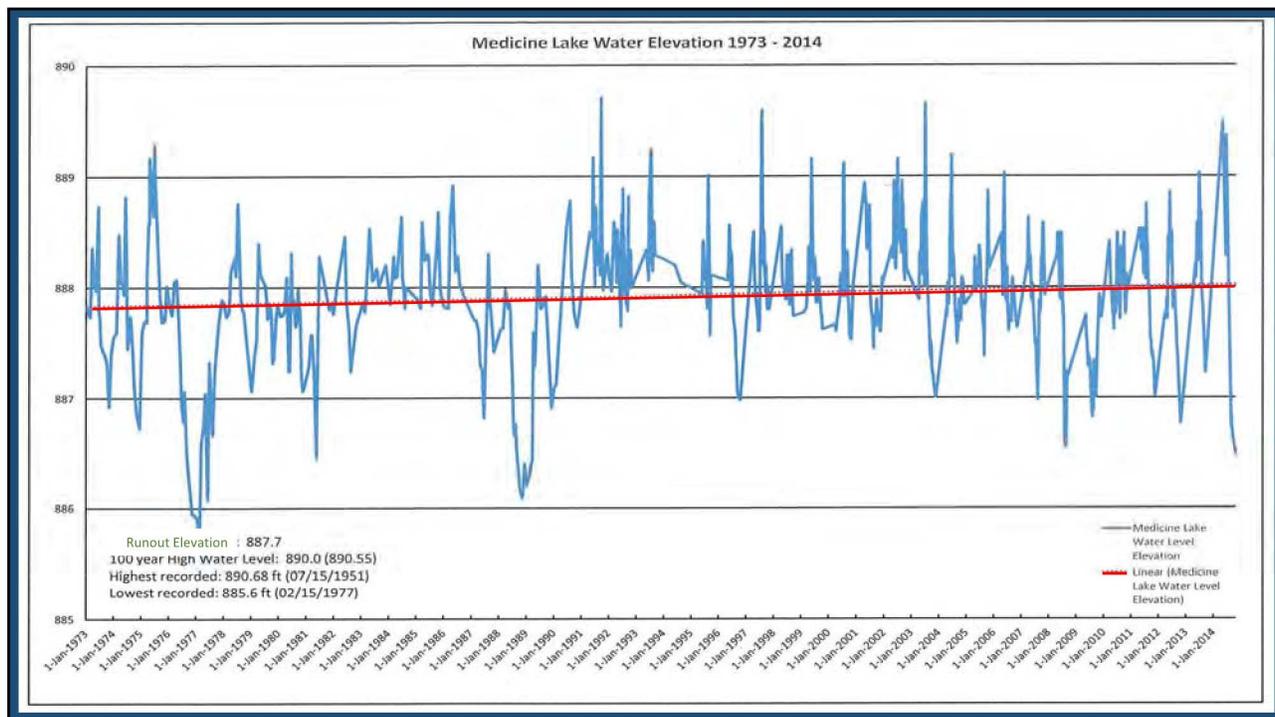
- Flooding in Bassett Creek Watershed prior to 1970
 - United States Army Corps of Engineers (USACOE)
 - Study on flooding within the Bassett Creek Watershed
 - A portion of the investigation included Medicine Lake Outlet



Water Level History

- Flooding in Bassett Creek Watershed prior to 1970
 - United States Army Corps of Engineers (USACOE)
 - Study on flooding within the Bassett Creek Watershed
 - A portion of the investigation included Medicine Lake Outlet
 - The Medicine Lake Outlet was replaced in 1996
 - Fixed Weir
 - Reduce or eliminate seepage through the existing dam
 - Minimize flooding after heavy rain events





Variable/Adjustable Weir Option

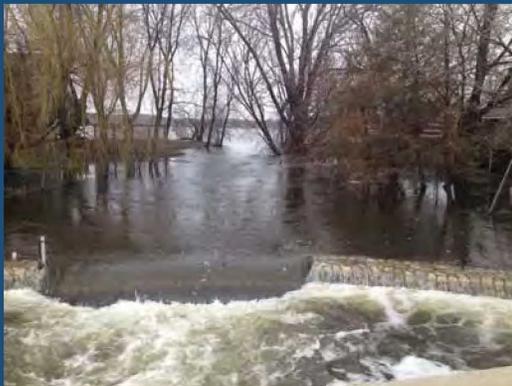
- USACOE reviewed a variable/adjustable outlet control option in concert with the fixed weir option in 1995
 - A variable/adjustable option would provide for stoplogs or gates which could draw the lake level down 2.5 feet from the run-out elevation to accommodate for heavy rains or spring snow melt.
 - An operation plan and flood warning system was also recommended.
 - Further review by the USACOE indicated an adjustable weir and operation plan was not practical at this location.
 - Lake Minnetonka, Prior Lake, and Lake Nokomis have adjustable outlets

Variable/Adjustable Weir Option

- Lake Nokomis adjustable weir
 - Lake Nokomis weir cited as a comparable to the request for Medicine Lake
 - Aquatic invasive species prevention by preventing Minnehaha Creek from back-flowing into Lake Nokomis
 - Continuously below run-out elevation for 9 years
 - Downward trend in water levels
 - Minneapolis Park and Recreation Board is the only property owner involved
 - No existing flooding issues
 - Project cost \$107,000 in 2012 and replaced an existing adjustable weir installed in 2001

Existing flooding concerns Medicine Lake Water Level 889.5

Medicine Lake Outlet – April 30, 2014



2840-2870 Evergreen – April 30, 2014



Existing flooding concerns Medicine Lake Water Level 889.03

Medicine Lake Outlet – June 20, 2013



2840 Evergreen Lane – June 20, 2013



Existing flooding concerns Medicine Lake Water Level 889.03

City of Medicine Lake – June 20, 2013
227 Peninsula Road



Topographic – City of Medicine Lake



Funding

- The cost of the Medicine Lake Water Level Investigation is \$45,012
- The cost is currently proposed to be split 50-50 between the Cities of Plymouth and Medicine Lake
- Cost to each municipality is \$22,506
- The City of Medicine Lake has approved funding
- This is not identified in either the 2015 Recreation or Water Resources Budget

Options

- Fund and complete the investigation as a cost share between the Cities of Plymouth and Medicine Lake
- Request the Bassett Creek Watershed complete the study. This proposed investigation is different than previous requests to the watershed.
- Take no action on the investigation

Lake Outlet Dams



PERMIT REQUIREMENTS TO CHANGE RUNOUT ELEVATIONS

The following steps are not all-inclusive but do list *essential* permit application requirements, under Minnesota Statutes 103G, for changing the runout elevation of a dam.

Permit Application. A permit application must be signed by a majority of riparian owners requesting a permanent change in runout elevation.

Flowage Easements. Purchase or donation of flowage easements and consent from *all* owners of riparian land abutting the lake, as well as any connected waters that would also be affected, are required.

Environmental Assessment. An environmental assessment must be prepared that documents impacts on wetland habitat, fish spawning areas, waterfowl and songbird nesting areas, as well as strategies to address shore erosion due to wave action and winter ice push.

Engineering. Engineering plans must be prepared that show the proposed physical changes to the dam.

Hydrology/Hydraulics. A hydrologic/hydraulic analysis must identify anticipated changes in lake levels and stream flows.

Surveys. Surveys must be prepared that show all shoreland and existing development that would be affected by the proposed change. These surveys must identify compliance with shoreland ordinance standards for both the existing and proposed runout in terms of lot size, structure and sewer system setback, and structure and sewer system elevations above the highest proposed water elevation.

Outlet Dam Maintenance

DNR Waters owns and maintains more than 300 lake outlet dams in Minnesota. The primary goals for dam maintenance are to protect existing shoreland owners' rights and downstream owners' rights to water available within natural precipitation variations.

Maintenance involves ensuring that each dam is safe and functional, operates at the authorized runout elevation, and provides free-flowing conditions. Inspections of dams are conducted to ensure that the stop logs are at the authorized setting, to repair or replace damaged or worn equipment, and to remove obstructions as necessary.

Historical Operation of Outlet Dams

Most lake outlet dams, which were built in the 1930s to conserve water, *generally* feature several 5-foot-wide openings, called bays, with provisions to add and remove wooden stop logs. The runout level of a dam depended on the number of stop logs placed in each bay. Stop logs were managed by local observer/operators at each lake for 10-12 years after the dams were built. When precipitation suddenly (and unpredictably) returned to normal and above normal, flooding occurred around many lakes resulting in claims for damages by lakeshore property owners. It became apparent that stop log operation by local observers could not maintain uniform lake levels.

Thereafter, department engineers inspected each dam, examined the shore of the affected lake, and analyzed all water level records and other available information about each lake. A decision was then made to set an authorized stop log level for each dam. The goal was to set the stop logs at an elevation that would retain as much water as possible yet eliminate complaints of high water and the associated claims of damage from flooding. The authorized stop log setting is maintained by DNR Waters as the legal runout elevation.



Outlet dam.

Lake Outlet Dams

Changing a Runout Elevation



DNR maintenance specialist replacing wooden stop logs with steel channels at the Island Lake outlet dam in Crow Wing County (photograph by Ron and Judy Rolfe).

It is the goal of DNR Waters to maintain existing flows and water level conditions at lakes with outlet dams to the maximum feasible extent. However, shoreland owners on a lake may have varied and differing opinions about “desirable” lake water levels. Proposals to change water levels are difficult to accomplish due to legal, environmental, and financial realities (see details in sidebar on page 1).

Potentially serious consequences may result from changing a runout elevation, such as navigation problems, shore erosion, water quality degradation, ice damage, and flooding. Changing a runout to solve a problem may create new problems that are unacceptable to other owners or to future owners. Regardless of the runout elevation of a lake, water levels will fluctuate because of variations in precipitation, which cannot be controlled.

Legal Considerations

Unauthorized tampering with set runouts is an ongoing problem at dams in Minnesota. According to Minnesota Statutes Chapter 103G, it is unlawful to change the runout elevation of a dam without prior permit authorization from the DNR. Persons found to be responsible for unauthorized changes to a dam are subject to criminal enforcement action. Along with the criminal action is the potential of lawsuits brought by aggrieved shoreland owners for flooding, lack of access, or downstream damages due to flow changes resulting from the illegal tampering.

The state cannot legally alter a stop log elevation in response to individual requests because of high or low water level conditions. To raise a runout would cause water to cover land it did not previously cover, which may be a “taking” of land without compensation. It is unconstitutional for government to take private property without due process. DNR Waters’ position and legal obligation is to maintain the authorized stop log setting and allow water levels to fluctuate in response to precipitation that falls within a lake’s watershed.

A formal permit process exists for those shoreland owners who may wish to pursue a permanent change in runout elevation (see sidebar, page 1). It must be clearly understood that no permit decision by the DNR is required until complete information is provided by the applicant(s). Costs associated with design, engineering, flowage easements, and structural improvements are the responsibility of the applicant(s), or a local governmental unit acting on behalf of the applicant(s).

©2004 State of Minnesota, Department of Natural Resources. Prepared by DNR Waters.

DNR Contact Information

DNR Information Center



DNR Waters website lists Area Hydrologists:
www.dnr.state.mn.us/waters

DNR Waters in St. Paul:
500 Lafayette Road
St. Paul, MN 55155-4032
(651) 296-4800

Twin Cities: (651) 296-6157
Minnesota toll free: 1-888-646-6367
Telecommunication device for the deaf (TDD): (651) 296-5484
TDD toll free: 1-800-657-3929

This information is available in an alternative format on request. Equal opportunity to participate in and benefit from programs of the Minnesota Department of Natural Resources is available regardless of race, color, national origin, sex, sexual orientation, marital status, status with regard to public assistance, age, or disability. Discrimination inquiries should be sent to Minnesota DNR, 500 Lafayette Road, St. Paul, MN 55155-4031; or the Equal Opportunity Office, Department of the Interior, Washington, DC 20240.