Poplar River Turbidity Total Maximum Daily Load: Summary of Existing Water Quality Data and Information

Task Order No. 2006-47

Prepared for:

U.S. Environmental Protection Agency Region 5
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DISTRIBUTION

This document will be distributed to the following team members involved in this project from U.S. Environmental Protection Agency (USEPA) Region 5, the Minnesota Pollution Control Agency (MPCA), RTI International, ECT Incorporated, URS Corporation, and SEH Incorporated.

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1.0 Introduction

This task, Summary of Existing Water Quality Data and Information, is the first of two tasks that deal with existing water quality data and information. The purpose of this task is to identify and summarize all existing water quality data and information related to the Poplar River. Specifically, data and information related to impairment of the river's designated uses, and water quality criteria that may be valuable during development of the Poplar River Turbidity Total Maximum Daily Load (TMDL) are being summarized. The second task dealing with data and information will be the Data Assessment and Summary.

The Data Assessment and Summary task will determine whether the data and information are of sufficient quality to be used for TMDL development. This task also includes analysis of the data. Therefore, this report, as required for the Summary of Existing Water Quality Data and Information task, focuses on narrative descriptions of existing data and reports pertaining to the Poplar River.

2.0 Task Description

This summary identifies data sources, period of record, and existing data and information, including, but not limited to, parameters analyzed and the availability of results. Data sources considered for this task included MPCA and sources external to MPCA. Section I of the scope of work (SOW) identified sources of potential existing water quality data and information that were considered in the completion of this task. In addition to the sources identified in the SOW, the RTI Team contacted the University of Minnesota Library, Soil and Water Conservation District of Cook County, and Cook County Planning Department. The data sources summarized in this document may be used during TMDL development.

3.0 Data and Information Sources

The following reports were identified and summarized as part of this task:

- Lower Poplar River Watershed AUAR (Alternative Urban Areawide Review)
- Minnesota Pollution Control Agency Environmental Data Access database (2001-06)
- An Assessment of Representative Lake Superior Basin Tributaries 2002
- Precipitation data from Minnesota Climatology Working Group
- Lakesuperiorstreams.org - Link to Poplar River monitoring data, GIS data, photographs, and online interactive mapping program
- US Geological Survey website with Poplar River flow data from stream gage 04012500 that was located in the watershed and operated between 1913 and 1987
- Lake Superior Basin Plan (2003)
- North American Wetland Engineering and SE Group, Environmental Report for Lutsen Mountain, Cook County, Minnesota, October 18, 2005
- SE Group memorandum to Charles Skinner regarding the "Preliminary Summary, Poplar River Impairment Study." Dated October 13, 2005
- MPCA response letter for the review of the Environmental Report (2005)

- Selected Water Quality Characteristics of Minimally Impacted Streams from Minnesota's Seven Ecoregions (1993)
- 2006 Integrated Surface Water Quality Report
- Comprehensive Plan: Cook County Soil and Water Conservation District (2006)
- Guide to Stormwater Best Management Practices for Lutsen and Poplar River Watersheds (2002); and
- Cook County Local Water Management Plan (2006).

4.0 Approach

Gathering and evaluating existing data prior to TMDL development is an important step in the process of ensuring that the best available data are used to develop the TMDL. Using currently available data will improve the scientific validity of the TMDL while reducing redundancy and improving efficiency. With this in mind, the RTI Team has gathered existing data, reports, and other literature related to the Poplar River watershed and, in some cases, the larger North Shore area. We have identified potential sources of information by reviewing websites and contacting several organizations identified in the EPA SOW. The RTI Team has

1. Reviewed available websites, reports, and memoranda regarding the Poplar River watershed. The websites provided in the EPA SOW were accessed and searched for relevant data. In addition, search engines were used to search for scientific articles and reports related to the Poplar River, and the University of Minnesota Library was accessed to search for relevant scientific articles and graduate-level research documents, such as M.S. and Ph.D. thesis.
2. Contacted authors via telephone and e-mail to clarify questions the RTI Team had and requested additional data. In an attempt to identify additional sources of data, the RTI Team contacted Tim Nelson, Cook County Planner; Rebecca Wiinanem, Soil and Water Conservation District Planner; Tom Schaub, MPCA; and the Minnesota Extension Service. A request was made for additional information on our monthly call with the project team.
3. All of the data and information relevant to Poplar Creek or North Shore turbidity accessed via these search methods are listed in Section 3.0 and summarized in Section 5.0.

Once approved for use via the QAPP process, the data and information gathered as part of this task will be utilized to develop and support a variety of TMDL components, such as load allocations and waste load allocations, and to identify sources and seasonal trends.

5.0 Data and Information Summary

Data Source:	**MPCA Environmental Data Access database (MPCA EDA)**
Period of Record:	Data are available for the following monitoring stations: • S001-753 (Poplar River on Footbridge upstream of Lutsen Ski Hill, Lutsen, MN) includes data from 4/12/01 through 6/19/06. Collected by MPCA. • S000-261 (Poplar River between Foot Bridges at Lutsen Lodge) includes data from 7/25/73 through 7/24/06. Collected by MPCA. • 090060 (Poplar River 0.9 miles east of Tofte Mountain) includes data from 1975 through 1983. Collected by USFS Region 9. • 98LS007 (Poplar River approximately one-third of the way between S001-753 and S00-261) includes biologic data from 1998. Collected by MPCA. • MN0053252-SD-1 includes data for the point source discharge on the Poplar River from 1999 through 2006. Data collected by permittee.
Description:	Water quality data from lower Poplar River. Collected for the following programs/purposes: • Ambient trace metals program (S000-261) • Long-term trend monitoring (S000-261) • North Shore load project (S000-261 and S001-753) • Stream monitoring program (S000-261) • NPDES program (MN0053252-SD-1) • Development of regional biologic indices (98LS007) Monitoring site S001-753 is upstream of the impaired reach. Site S000-261 is downstream of the resort area. These sites are the MPCA monitoring locations used to conduct assessments of the lower Poplar River. Other sites are between S001-753 and S00-261. See Figure 1 for monitoring site locations. These data sets are robust and therefore are suitable for assessing instream loads, frequency of water quality criteria violations, and site specific relationships between TSS and turbidity.

MPCA Environmental Data Access database (continued)

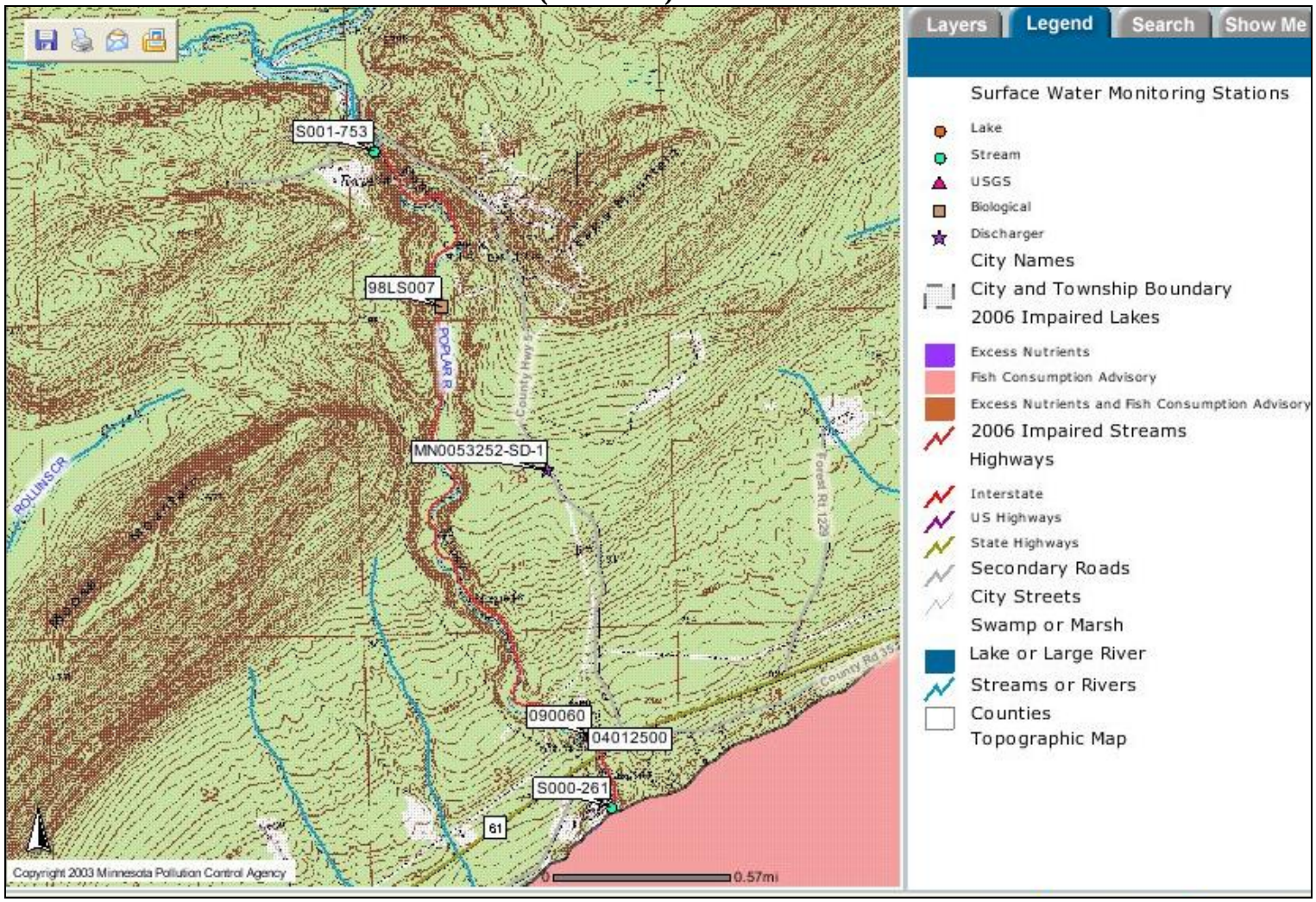

Figure 1. Locations of sampling sites in MPCA EDA.

MPCA Environmental Data Access database (continued)

Summary:

Sites S000-261, S001-753, and 090060 have been used to collect water quality data for a number of parameters and years. The following tables summarize the frequency (number per year) of data collection for several parameters.

Number of samples collected per year at station S000-261 (downstream).

Year	BOD_5	Transparency	D.O.	TKN	NO_3	pH	TP	TSS	Temp	Turb.	Fecal Colif.	E. Coli
1973	5			6					5	5	6	5
1974	13			14					13	13	15	13
1975	8			9					8	8	8	8
1980	1			1	1	1			1	1	1	
1981	6			6	7	6			6	8	6	
1983	1			1	1	1			1	1	1	
1984	7			8	7	7			7	7	8	
1986				1	1	1			1	1	1	
1987	2			8	8	8			8	8	8	
1989	1			1	1	1			1	1	1	
1990	5			8	5	5			5	5	8	
1992	1			1	1	1			1	1	1	
1993	7			6	8	8			7	7	7	
1994				2		2			2	2	2	2
1995				6		8					6	6
1997			2	2		1					2	1
1998			6	8		7	8				8	8
1999			2	2		2	2				2	2
2000			7	8		8	7				8	8
2001					19	18			18	18		17
2002			12	13	19	21	13		20	21	13	20
2003	4	4	16	17	14	21	17	4	21	19	17	22
2004			19	16	17	21	15		19	19	18	19
2005	4	4	17	18	6	15	17	4	19	20	19	15
2006			12	12			15		13	13	14	17

MPCA Environmental Data Access database (continued)

Number of samples collected per year at station S001-753 (upstream).

Year	CSMP Transparency	D.O.	TKN	NO_3	pH	Phosphorus	Suspended Sediment	Temperature	Turbidity
2001			18	19		17	18		17
2002	13	13	18	18	12	19	18	13	18
2003	12	10	14	15	10	15	14	10	14
2004	19	14	18	17	15	18	18	15	18
2005	11	12	6	6	12	12	12	12	8
2006	12	9			12	13	13	12	13

Number of samples collected per year at station 090060.

Year	NH4	Color	D.O.	TN	NH3	TKN	NO2	NO2+NO3	PO4	Residue	Solids	Stream Stage	Temp.	Turbidity
1975	4	3		2	2		1	3	3			1	6	3
1976		1		1	1			1	1					1
1977	16	11		11	11	5		11	11	2	9	7	8	11
1978	18	12	6	11	11	11		11	12	8		6	11	12
1979	20	11	9	11	11	11		11	11	9		7	14	11
1980	16	8	8	8	8	8		8	8	7		1	10	8
1981	6	5	3	5	4	5		5	5	5		2	7	5
1982	12	5	7	6	6	6		7	7	6			11	6
1983		3	3					3	3	3			6	3

	MPCA Environmental Data Access database (continued) Site **MN0053252-SD-1** is the only permitted discharger on the lower Poplar River. Average monthly, minimum weekly average and maximum weekly average are reported in the MPCA EDA for TSS and flow. The data sheet on MPCA EDA also reports monthly average loads. Site **98LS007** was used as a monitoring location for biological data in 1998. Water chemistry, fish, and invertebrate data were collected to assist in the development of regional IBI scores.
Availability:	http://www.pca.state.mn.us/data/edaWater/index.cfm
Data Source:	**Lower Poplar River: Alternative Urban Areawide Review**
Period of Record:	Summary of historical data combined with a description of current conditions and assessment of potential future conditions.
Description:	Report provides a qualitative assessment of current conditions related to land use, zoning, future development, watershed description, fisheries data, wildlife data, and aquatic habitat.
Summary:	Pertinent sections of this report include a review and synopsis of the WEPP modeling, review of existing MPCA water quality and fisheries data, soil descriptions, field assessment and review of slumping in the watershed and neighboring watersheds, and photographs of slumps. There is also a good discussion on fish population, barriers to fish travel, and natural reproduction as they relate to designated uses of the river.
Availability:	http://www.co.cook.mn.us/zoning/index.html#LPRW
Data Source:	**Climatology Working Group**
Period of Record:	1/1/1973–10/31/2006: Minnesota High Density Network 12/11/1895–11/7/06; sporadic readings from 1895 through 1918; after 1918 recordings are fairly consistent. NWS
Description:	Continuous precipitation data (1973–current) Precipitation, temperature, and snow (sporadic data beginning 1895, relatively continuous data since 1920s).
Summary:	Daily precipitation, temperature max, temperature min, and snowfall for Lutsen Station, Cook County MN. The site also provides climate normals for temperature, precipitation, snow, and growing season.
Availability:	http://www.climate.umn.edu

Data Source:	**An Assessment of Representative Lake Superior Basin Tributaries 2002**
Period of Record:	Representative of 2002
Description:	Summary of water quality trends and analysis of intensive 2002 survey. Data include • Economic summary of region • Watershed description and characteristics (land use percentages, stream length, stream gradient, watershed area) • Stream flow data at downstream location from April 2002 to December 2002 • Instream mercury data (5/2002–10/2002, 18 samples) • Flow weighted means for TP, TSS, chlorides, and TN at upper and lower stations • Fishery data, including juvenile steelhead, small mouth bass, rainbow trout 1981-1983 and 2000-2002 • Comparison of historical data sets to investigate trends in water quality Report included spatial data compatible with Environmental Systems Research Institute's (ESRI) geographic information system (GIS). The purpose of this data according to the MPCA Lake Superior Basin metadata abstract is to, "serve as a screening tool for the relative ranking of watershed health in seven (7) digit watersheds within the Minnesota portion of the Lake Superior Basin. The polygons used in this data set are a subset of the original state-wide coverage of "Minnesota Watersheds" distributed through the Minnesota Department of Natural Resources. Parameters used in the relative watershed health comparison are based on a United States Forest Service (USFS) assessment methodology called the East-wide Watershed Assessment Protocol."
Summary:	Note: This report contains information on several North Shore watersheds; however, this data summary focuses on the Poplar River. The lower Poplar River station had much higher concentrations of TSS and TP than the Upper Poplar River station during wet weather events and similar concentrations during dry weather periods. There was a decrease in juvenile steelhead (no reproduction since 1994), increase in small mouth bass, and no negative impact on rainbow trout observed. This trend was not identified on other, less impacted North Shore watersheds. Historical data analysis indicates that TP and TSS have increased between 1973 and 1975 and in 2002. This data may be useful for comparing the Poplar River to similar less impacted sites.
Availability:	http://www.pca.state.mn.us

Data Source:	**www.lakesuperiorstreams.org**
Period of Record:	3/28/2006–November 2006
Description:	Maps, photographs, stage, flow, conductivity, turbidity, precipitation, and MPCA water chemistry parameters
Summary:	This site includes links to MPCA water quality and flow data that is a subset of what is available through the MPCA Environmental Data Access Database. These data are identified as being collected by MPCA. The MPCA water chemistry file has data for the upstream (S001-753) and downstream station (S000-261) for temperature, D.O. conductivity, chlorides, turbidity, transparency, TSS, TVS, total solids, pH, ANC, ortho-P, TP, TN, and NO_3+NO_2. These data include many of the same constituents as the MPCA data summarized previously (see MPCA Environmental Data Access database entry) and are a subset of the MPCA data set. These data cover a shorter time period and have fewer reported parameters. Continuous data also exist for the Poplar River and includes stage, flow, temperature, conductivity, and turbidity. These data were collected from March 26, 2006 through November 26, 2006. Continuous data is reported at 30 minute increments and is collected near the lower golf course bridge. This site is approximately 0.5 km downstream from MPCA station S000-261.
Availability:	http://www.lakesuperiorstreams.org

<table>
<tr><td>Data Source:</td><td>Lake Superior Basin Plan</td></tr>
<tr><td>Period of Record:</td><td>Published in 2003; includes data and analysis using existing data.</td></tr>
<tr><td>Description:</td><td>Narrative description of current status of the Lake Superior Basin and recommended future actions. This report provides a framework of current conditions, current activities, and recommended actions for the Minnesota watersheds within the Lake Superior Basin.</td></tr>
<tr><td>Summary:</td><td>The Poplar River is mentioned twice within the Lake Superior Basin Plan. The Poplar River is undergoing intensive development pressure due to resort growth and increased tourism, and it is listed for turbidity and mercury.

This report provides substantial background information, qualitative analysis, and planning-related information, but little quantitative data related to the turbidity listing and impairment.</td></tr>
<tr><td>Availability:</td><td>http://www.pca.state.mn.us/publications/reports/lakesuperior-basinplan.pdf</td></tr>
<tr><td>Data Source:</td><td>USGS Water Data for Poplar River at Lutsen Mountain (Station 04012500)</td></tr>
<tr><td>Period of Record:</td><td>10/1/1912 – 9/30/1961, daily flow; 4/25/1913 – 5/22/1987, Peak flow</td></tr>
<tr><td>Description:</td><td>Flow data</td></tr>
<tr><td>Summary:</td><td>Daily flow data for USGS gage at Lutsen Mountain, MN near MN61

Location and Description:
Latitude 47°38'23" Longitude 90°42'31" NAD27
Cook County, Minnesota, Hydrologic Unit 04010101
Drainage area: 112 square miles
Datum of gage: 697.89 feet above sea level NGVD29.

Available Data:
<table>
<tr><th>Data Type</th><th>Begin Date</th><th>End Date</th><th>Count</th></tr>
<tr><td>Peak streamflow</td><td>1913-04-25</td><td>1987-05-22</td><td>43</td></tr>
<tr><td>Daily Data</td><td></td><td></td><td></td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td></td><td>
<table>
<tr><td>Discharge, cubic feet per second</td><td>1912-10-01</td><td>1961-09-30</td><td>11535</td></tr>
<tr><td>Daily Statistics</td><td></td><td></td><td></td></tr>
<tr><td>Discharge, cubic feet per second</td><td>1912-10-01</td><td>1961-09-30</td><td>11535</td></tr>
<tr><td>Monthly Statistics</td><td></td><td></td><td></td></tr>
<tr><td>Discharge, cubic feet per second</td><td>1912-10</td><td>1961-09</td><td></td></tr>
<tr><td>Annual Statistics</td><td></td><td></td><td></td></tr>
<tr><td>Discharge, cubic feet per second</td><td>1913</td><td>1961</td><td></td></tr>
</table>
</td></tr>
<tr><td>Availability:</td><td>http://waterdata.usgs.gov/mn/nwis/nwisman/?site_no=04012500&agency_cd=USGS</td></tr>
<tr><td>Data Source:</td><td>North American Wetland Engineering and SE Group, <u>Environmental Report</u> for Lutsen Mountain, Cook County, Minnesota, October 18, 2005</td></tr>
<tr><td>Period of Record:</td><td>Prepared in 2005 using existing data.</td></tr>
<tr><td>Description:</td><td>Comprehensive report prepared for Lutsen Mountain by the consulting team of North American Wetland Engineering and the SE Group in response to environmental concerns related to the Poplar River.</td></tr>
<tr><td>Summary:</td><td>The report provides a review of data pertaining to a proposed development in the lower Poplar River watershed and addresses other environmental concerns that were expected to arise during the permitting process. The most useful section of the report describes the WEPP modeling undertaken by Lutsen Mountain Resorts. Section 7 describes the model used, a cursory review of the theory behind the model, model application, and model results. In addition, the model results were used in conjunction with observed data to estimate and differentiate between potential sources in the watershed.

The modeling section provides an overview of the modeling. It does not include model input data files, sensitivity analyses for important parameters, justification or discussion of important model input parameters, and information on the range of sediment detachment predicted by the model.</td></tr>
<tr><td>Availability:</td><td>Available in hard copy from MPCA.</td></tr>
</table>

Data Source:	**SE Group memorandum to Charles Skinner regarding the "Preliminary Summary, Poplar River Impairment Study." Dated October 13, 2005.**
Period of Record:	Prepared in 2005 using existing data.
Description:	Preliminary summary of SE Group findings regarding its analysis and field efforts related to characterizing the sediment loading in the lower Poplar River.
Summary:	The contents of this memorandum summarize the analysis and characterization completed by the SE Group related to the sources of sediment loading to the lower Poplar River. The memorandum summarizes existing data, SE Group field work, and SE Group WEPP modeling. The Poplar River information is compared to information in other North Shore tributaries. All of the conclusions, information, data, and other documentation included in this memorandum are included in the Environmental Report prepared by the SE Group for Lutsen Mountain.
Availability:	Available in hard copy from MPCA.
Data Source:	**MPCA Letter to Lutsen Mountain regarding comments on the Lutsen Mountain Environmental Report, dated October 18, 2005.**
Period of Record:	Letter provides MPCA's comments on the Environmental Report prepared by SE Group for Lutsen Mountain Resorts. Report is dated October 18, 2005. Response letter is dated January 2006.
Description:	MPCA letter to Charles Skinner and Thomas Ryder regarding a report prepared by the SE Group and North America Wetland Engineering for Lutsen Mountain. The four (4) page letter provides MPCA comments on the report and is authored by Cynthia Kahrmann, Supervisor, Northeast Watershed Unit.
Summary:	The letter provides the following comments, questions, and concerns that MPCA has with the Environmental Report: • Lutsen Mountain needs to document the method for insuring impervious surface limits; • Climatic changes should be incorporated into the WEPP modeling. For example, the 100-year storm increased from 4.9" to 5.2" when post 1961 data are used; • WEPP model predicts erosion from different land use types, but does not seem to include upland channel and gully erosion; • Watershed changes such as land use changes (forested to ski run) and snowmaking were not considered when assessing "natural" slumping on water quality; and • MPCA does not agree with conclusions drawn in the Environmental Report regarding the color of the stream

	affecting turbidity measurements. In addition, several other technical errors were identified by MPCA. These errors affected the readability of the report, but did not affect conclusions drawn by the SE Group.
Availability:	Available in hard copy from MPCA.
Data Source:	**Selected Water Quality Characteristics of Minimally Impacted Streams from Minnesota's Seven Ecoregions, 1993**
Period of Record:	1970-1992 for conductivity, pH, TSS, ammonia, NO_2+NO_3, total phosphorus, fecal coliform, temperature, turbidity, and BOD_5
Description:	Average water quality characteristics for each ecoregion in Minnesota
Summary:	Annual average, annual median, summer average, and summer median values for each water quality constituent listed above for each ecoregion in Minnesota. The Poplar River is in the Northern Lakes and Forest Ecoregion. Data from STORET were used in this evaluation. Relatively unimpacted sites that had monitoring data were identified. These data were used to develop averages and may be representative of levels achievable from other water bodies in the ecoregion.
Availability:	http://www.pca.state.mn.us/publications/tdr-g1-03.pdf
Data Source:	**2006 Integrated Surface Water Quality Report**
Period of Record:	Water years 2004 and 2005
Description:	Combined 305(b) and 303(d) reports
Summary:	Summary as related to Poplar River Insufficient data to report trends related to TSS Designates Poplar River from Superior Hiking Trail to Lake Superior as impaired River ID# is 04010101-613
Availability:	http://www.pca.state.mn.us/publications/wq-s7-50.pdf

Data Source:	**Comprehensive Plan: Cook County Soil and Water Conservation District (SWCD)**
Period of Record:	Approved 2006
Description:	10-year planning document required by Minnesota State regulations that focuses on SWCD goals and needs related to helping local units of government with land use management planning and natural resource protection.
Summary:	The Cook County Local Water Management Plan is a planning document for the county Soil and Water Conservation District. The document provides a description of the county that includes population growth and development trends, geologic and soils data, concerns and goals of the county SWCD, general problems, high priority problems, solutions, and previous accomplishments. Overall, it provides a comprehensive look at water quality and land use/development issues within Cook County and efforts of the SWCD to mitigate these problems. Document contains no water quality data. Does provide list of nonpoint source projects funded through the SWCD within Cook County.
Availability:	http://www.co.cook.mn.us/sw/COMPREHENSIVE_PLAN_2006.pdf
Data Source:	**Guide to Stormwater Best Management Practices for Lutsen and Poplar River Watersheds**
Period of Record:	Developed in June 2002
Description:	Document describing best management practices for stormwater runoff (including construction and site development practices) useful for reducing nonpoint source pollution.
Summary:	Manual describing proper use, maintenance, and effects of using structural best management practices and proper site design guidelines on stormwater control. A section of the document provides an overview of pollutants associated with stormwater. This document was designed to be a resource to developers so that stormwater pollution could be decreased during the development phase. No data are included with the document, but it may provide a reference local developers could use during implementation of any required TMDL actions.
Availability:	http://www.co.cook.mn.us/sw/Lutsenpoplarriver.pdf

Data Source:	**Cook County Local Water Management Plan**
Period of Record:	Based on existing data, covers 2006 – 2012
Description:	Planning document for Cook County that discusses goals and objectives related to water resources and water quality issues.
Summary:	The Cook County Local Water Management Plan is a planning document for the county. It is very similar to the Cook County SWCD Comprehensive Plan. The document provides a description of the county that includes population growth and development trends, geologic and soils data, concerns and goals of the county, general problems, high priority problems, solutions, and previous accomplishments. Overall, it provides a comprehensive look at water quality and land use/development issues within Cook County and efforts to mitigate these problems. Document contains no water quality data and only general descriptions of problems associated with the pollutants of concern in the Poplar River. No site-specific or detailed information regarding the Poplar River is included in this report.
Availability:	http://www.co.cook.mn.us/sw/wp/LWMPlanapprvd12-13-05.pdf

6.0 Data Gaps

The RTI Project Team believes that existing data and reports related to the Poplar River, augmented by currently scheduled field work, will provide sufficient information for qualitative and quantitative analyses required for the TMDL. Water quality, physical characteristics, and biological data have been collected from the Poplar River periodically over the past four decades (i.e., since the 1970s). These data and information will likely provide insight into trends within the watershed, current water quality issues, and their impact on biological resources. In addition, a computer model has been developed for the lower Poplar River. Although these data and information exist and may be potentially useful, they have not been evaluated using the criteria specified in the project QAPP. If some of the available information summarized in this report does not meet the project QAPP criteria, data gaps may exist.

The predictive WEPP model developed by Lutsen Mountain and their consultants is a potentially useful tool for assessing sources and loads to the river; however, the existing report does not provide sufficient information for a comprehensive review. For example, the modeling report does not document model input files, input parameters, range of output for 30-year simulation, and sensitivity analysis. This lack of information may constitute a “data gap” if this information is unavailable to the RTI Team, or if it does not exist. A complete analysis of the WEPP model will be conducted during task 4. The task 4 review and QAPP guidelines will be used to determine whether the model is useful for TMDL development.