QUALITY ASSURANCE PROJECT PLAN (QAPP):

GIS-BASED CONTAMINATED SEDIMENT DATABASE FOR THE ST. LOUIS RIVER AREA OF CONCERN

(Grant Number GL975363-01)

REVISION: 0

July 2001

Prepared by: Judy L. Crane
Environmental Outcomes Division
Minnesota Pollution Control Agency (MPCA)
520 Lafayette Road North
St. Paul, MN 55155-4194

Lanny Peisig, MPCA Supervisor
Judy Crane, MPCA Principal Investigator
James Joslyn, MPCA Quality Assurance (QA) Coordinator
Donald MacDonald, MacDonald Environmental Sciences Ltd. Project Manager
Anthony Kizlauskas, Great Lakes National Program Office (GLNPO) Project Officer
Louis Blume, GLNPO QA Officer

10 July 01
10 July 01
23 July 01
26 July 01
August 2, 2001
8/7/01
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>List of Tables</td>
<td>v</td>
</tr>
<tr>
<td>List of Figures</td>
<td>v</td>
</tr>
<tr>
<td>List of Abbreviations and Acronyms</td>
<td>vi</td>
</tr>
<tr>
<td>A PROJECT MANAGEMENT</td>
<td>1</td>
</tr>
<tr>
<td>1 Project/Task Organization</td>
<td>1</td>
</tr>
<tr>
<td>1.1 Purpose/Background</td>
<td>1</td>
</tr>
<tr>
<td>1.2 Roles and Responsibilities</td>
<td>1</td>
</tr>
<tr>
<td>1.2.1 MPCA Personnel</td>
<td>1</td>
</tr>
<tr>
<td>1.2.2 GLNPO Personnel</td>
<td>3</td>
</tr>
<tr>
<td>1.2.3 Consultant</td>
<td>4</td>
</tr>
<tr>
<td>2 Problem Definition/Background</td>
<td>7</td>
</tr>
<tr>
<td>2.1 Purpose/Background</td>
<td>7</td>
</tr>
<tr>
<td>2.2 Problem Statement and Background</td>
<td>9</td>
</tr>
<tr>
<td>2.2.1 Introduction</td>
<td>9</td>
</tr>
<tr>
<td>2.2.2 Site Description</td>
<td>9</td>
</tr>
<tr>
<td>2.2.3 Past Data Collection Activities</td>
<td>10</td>
</tr>
<tr>
<td>2.2.4 Intended Data Usages</td>
<td>18</td>
</tr>
<tr>
<td>3 Project/Task Description and Schedule</td>
<td>19</td>
</tr>
<tr>
<td>3.1 Purpose/Background</td>
<td>19</td>
</tr>
<tr>
<td>3.2 Description of the Work to be Performed</td>
<td>20</td>
</tr>
<tr>
<td>4 Quality Objectives and Criteria for Measurement Data</td>
<td>23</td>
</tr>
<tr>
<td>4.1 Purpose/Background</td>
<td>23</td>
</tr>
<tr>
<td>4.2 Specifying Quality Objectives</td>
<td>24</td>
</tr>
<tr>
<td>4.3 Specifying Measurement Performance Criteria</td>
<td>28</td>
</tr>
<tr>
<td>4.3.1 Precision</td>
<td>28</td>
</tr>
<tr>
<td>4.3.2 Bias</td>
<td>29</td>
</tr>
<tr>
<td>4.3.3 Accuracy</td>
<td>30</td>
</tr>
<tr>
<td>4.3.4 Representativeness</td>
<td>30</td>
</tr>
<tr>
<td>4.3.5 Comparability</td>
<td>31</td>
</tr>
<tr>
<td>4.3.6 Completeness</td>
<td>32</td>
</tr>
<tr>
<td>5 Special Training Requirements/Certification</td>
<td>32</td>
</tr>
<tr>
<td>5.1 Purpose/Background</td>
<td>32</td>
</tr>
<tr>
<td>5.2 Training</td>
<td>32</td>
</tr>
<tr>
<td>5.3 Certification</td>
<td>32</td>
</tr>
</tbody>
</table>
## TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Documentation and Records</td>
<td>33</td>
</tr>
<tr>
<td>6.1 Purpose/Background</td>
<td>33</td>
</tr>
<tr>
<td>6.2 Data Reporting Package Archiving and Retrieval</td>
<td>33</td>
</tr>
<tr>
<td>B MEASUREMENT DATA ACQUISITION</td>
<td>34</td>
</tr>
<tr>
<td>1 Data Acquisition Requirements (Non-Direct Measurements)</td>
<td>34</td>
</tr>
<tr>
<td>1.1 Purpose/Background</td>
<td>34</td>
</tr>
<tr>
<td>1.2 Acquisition of Non-Direct Measurement Data</td>
<td>34</td>
</tr>
<tr>
<td>2 Data Management</td>
<td>35</td>
</tr>
<tr>
<td>2.1 Purpose/Background</td>
<td>35</td>
</tr>
<tr>
<td>2.2 Data Validation</td>
<td>35</td>
</tr>
<tr>
<td>2.3 Data Transmittal</td>
<td>35</td>
</tr>
<tr>
<td>2.4 Data Reduction</td>
<td>35</td>
</tr>
<tr>
<td>2.5 Data Analysis</td>
<td>36</td>
</tr>
<tr>
<td>2.6 Data Tracking</td>
<td>36</td>
</tr>
<tr>
<td>2.7 Data Storage and Retrieval</td>
<td>36</td>
</tr>
<tr>
<td>C ASSESSMENT/OVERSIGHT</td>
<td>37</td>
</tr>
<tr>
<td>1 Assessment</td>
<td>37</td>
</tr>
<tr>
<td>1.1 Purpose/Background</td>
<td>37</td>
</tr>
<tr>
<td>1.2 Assessment Activities and Project Planning</td>
<td>37</td>
</tr>
<tr>
<td>1.2.1 Assessment of the Subsidiary Organizations</td>
<td>37</td>
</tr>
<tr>
<td>1.2.2 Assessment of Project Activities</td>
<td>38</td>
</tr>
<tr>
<td>1.3 Documentation of Assessments</td>
<td>38</td>
</tr>
<tr>
<td>1.3.1 Number, Frequency, and Types of Assessments</td>
<td>38</td>
</tr>
<tr>
<td>1.3.2 Assessment Personnel</td>
<td>38</td>
</tr>
<tr>
<td>1.3.3 Schedule of Assessment Activities</td>
<td>38</td>
</tr>
<tr>
<td>1.3.4 Reporting and Resolution of Issues</td>
<td>38</td>
</tr>
<tr>
<td>2 Reports to Management</td>
<td>39</td>
</tr>
<tr>
<td>2.1 Purpose/Background</td>
<td>39</td>
</tr>
<tr>
<td>2.2 Frequency, Content, and Distribution of Reports</td>
<td>39</td>
</tr>
<tr>
<td>2.3 Identify Responsible Organizations</td>
<td>39</td>
</tr>
</tbody>
</table>
TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>D DATA VALIDATION AND USABILITY</td>
<td>40</td>
</tr>
<tr>
<td>1 Data Review, Validation, and Verification Requirements</td>
<td>40</td>
</tr>
<tr>
<td>1.1 Purpose/Background</td>
<td>40</td>
</tr>
<tr>
<td>1.2 Data Reduction and Processing</td>
<td>40</td>
</tr>
<tr>
<td>2 Validation and Verification Methods</td>
<td>40</td>
</tr>
<tr>
<td>2.1 Purpose/Background</td>
<td>40</td>
</tr>
<tr>
<td>2.2 Process for Validating and Verifying Data</td>
<td>40</td>
</tr>
<tr>
<td>3 Reconciliation with Data Quality Objectives</td>
<td>41</td>
</tr>
<tr>
<td>3.1 Purpose/Background</td>
<td>41</td>
</tr>
<tr>
<td>3.2 Reconciling Results with DQOs</td>
<td>41</td>
</tr>
</tbody>
</table>

E REFERENCES | 42 |

APPENDIX A: Screening Criteria for BEDS/SEDTOX Co-occurrence Data
APPENDIX B: Screening Criteria for BEDS/SEDTOX Spiked Sediment Bioassay Data
APPENDIX C: MPCA GIS Data Catalog
APPENDIX D: Minnesota Planning Land Management Information Center
APPENDIX E: Minnesota Department of Natural Resources Data Deli
APPENDIX F: Vector Data and Raster Data Available from the Minnesota Department of Natural Resources
APPENDIX G: MPCA Spatial Data Storage Standards
APPENDIX H: Watershed Assessment, Tracking and Environmental Results (WATERS) Tool

DISTRIBUTION LIST

Lanny Peissig, MPCA (Supervisor)
Judy Crane, MPCA (Principal Investigator)
James Joslyn, MPCA (QA Coordinator)
Donald MacDonald, MacDonald Environmental Sciences Ltd. (Project Officer)
Anthony Kizlauskas, Great Lakes National Program Office (GLNPO) (Project Officer)
Louis Blume, GLNPO (QA Officer)
### LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-1</td>
<td>List of Studies Which Investigated Sediment Quality in the St. Louis River AOC since 1992</td>
</tr>
<tr>
<td>A-2</td>
<td>Matching Sediment Chemistry and Toxicity Data Set for the St. Louis River AOC</td>
</tr>
<tr>
<td>A-3</td>
<td>Work Tasks</td>
</tr>
</tbody>
</table>

### LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-1</td>
<td>General project organization chart</td>
</tr>
<tr>
<td>A-2</td>
<td>Map of the St. Louis River Area of Concern</td>
</tr>
</tbody>
</table>
LIST OF ABBREVIATIONS AND ACRONYMS

AOC       Area of Concern
As        Arsenic
AVS       Acid Volatile Sulfide
BEDS      Biological Effects Database for Sediments
BTEX      Benzene, Toluene, Ethylbenzene, and Xylene
CAC       Citizen’s Action Committee
CD        Compact Disk
CDF       Confined Disposal Facility
CERCLA    Comprehensive Environmental Response, Compensation and Liability Act
COD       Chemical Oxygen Demand
Cs        Cesium
DDT       Dichloro-diphenyl-trichloroethane
DO        Dissolved Oxygen
DQA       Data Quality Assessment
DQI       Data Quality Indicator
DQO       Data Quality Objective
DRO       Diesel Range Organics
EnPPA      Environmental Performance Partnership Agreement
EPA       Environmental Protection Agency
FIELDS    Fully Integrated Environmental Location Decision Support
GIS       Geographic Information System
GLNPO      Great Lakes National Program Office
GPS       Global Positioning System
H_a       Alternative Hypothesis
H_o       Null Hypothesis
Hg        Mercury
IJC       International Joint Commission
LaMP      Lakewide Management Plan
LUST      Leaking Underground Storage Tank
MDNR      Minnesota Department of Natural Resources
MESL      MacDonald Environmental Sciences Ltd.
MN        Minnesota
MPCA      Minnesota Pollution Control Agency
MSR       Management Systems Review
NOAA      National Oceanic and Atmospheric Administration
PAHs      Polycyclic Aromatic Hydrocarbons
Pb        Lead
PCBs      Polychlorinated Biphenyls
# LIST OF ABBREVIATIONS AND ACRONYMS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEC</td>
<td>Probable Effect Concentration</td>
</tr>
<tr>
<td>PEC-Q</td>
<td>Probable Effect Concentration Quotient</td>
</tr>
<tr>
<td>QA</td>
<td>Quality Assurance</td>
</tr>
<tr>
<td>QAPP</td>
<td>Quality Assurance Project Plan</td>
</tr>
<tr>
<td>QA/QC</td>
<td>Quality Assurance/Quality Control</td>
</tr>
<tr>
<td>RAP</td>
<td>Remedial Action Plan</td>
</tr>
<tr>
<td>RCRA</td>
<td>Resource Conservation and Recovery Act</td>
</tr>
<tr>
<td>R-EMAP</td>
<td>Regional Environmental Monitoring and Assessment Program</td>
</tr>
<tr>
<td>RPD</td>
<td>Relative Percent Difference</td>
</tr>
<tr>
<td>RSD</td>
<td>Relative Standard Deviation</td>
</tr>
<tr>
<td>SADA</td>
<td>Spatial Analysis and Decision Assistance</td>
</tr>
<tr>
<td>SEDTOX</td>
<td>Sediment Toxicity Database</td>
</tr>
<tr>
<td>SEM</td>
<td>Simultaneously Extractable Metals</td>
</tr>
<tr>
<td>SQG</td>
<td>Sediment Quality Guideline</td>
</tr>
<tr>
<td>SQT</td>
<td>Sediment Quality Target</td>
</tr>
<tr>
<td>SRM</td>
<td>Standard Reference Material</td>
</tr>
<tr>
<td>STORET</td>
<td>Storage and Retrieval Database</td>
</tr>
<tr>
<td>TCDD</td>
<td>Tetrachlorodibenzo-p-dioxin</td>
</tr>
<tr>
<td>TCDF</td>
<td>Tetrachlorodibenzo-p-furan</td>
</tr>
<tr>
<td>TMDL</td>
<td>Total Maximum Daily Load</td>
</tr>
<tr>
<td>TOC</td>
<td>Total Organic Carbon</td>
</tr>
<tr>
<td>U.S.</td>
<td>United States</td>
</tr>
<tr>
<td>USACOE</td>
<td>U.S. Army Corps of Engineers</td>
</tr>
<tr>
<td>USEPA</td>
<td>U.S. Environmental Protection Agency</td>
</tr>
<tr>
<td>VICS</td>
<td>Voluntary Investigation and Cleanup Sites</td>
</tr>
<tr>
<td>WDNR</td>
<td>Wisconsin Department of Natural Resources</td>
</tr>
<tr>
<td>WI</td>
<td>Wisconsin</td>
</tr>
</tbody>
</table>
A PROJECT MANAGEMENT

A1 PROJECT/TASK ORGANIZATION

A1.1 Purpose/Background

The U.S. Environmental Protection Agency’s (EPA) Great Lakes National Program Office (GLNPO) has funded a project by the Minnesota Pollution Control Agency (MPCA) to develop a geographic information system (GIS)-based contaminated sediment database for the St. Louis River Area of Concern (AOC). In order to ensure that a high quality database is assembled, it is essential that quality assurance/quality control (QA/QC) steps be adhered to while developing and populating the database. This document provides the Quality Assurance Project Plan (QAPP) which will be followed during this project. As part of the QAPP, a detailed work plan for this project is given in Section B.

The MPCA Principal Investigator will have overall responsibility for all phases of this project. The various quality assurance and management responsibilities of key project personnel are defined in the following section.

A1.2 Roles and Responsibilities

The overall lines of authority for this specific project can be found in Figure A-1. This chart includes all of the individuals discussed in the following subsections.

A1.2.1 MPCA Personnel

The MPCA staff associated with this project can be reached at the following address:

Environmental Outcomes Division
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155-4194
General Phone: 1-800-657-3864
Fax: 651-297-7709

<table>
<thead>
<tr>
<th>Person:</th>
<th>Responsibilities:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lanny Peissig, Supervisor (retiring 8/03/01)</td>
<td>Supervise Principal Investigator</td>
</tr>
<tr>
<td>Water Unit</td>
<td>Approve contract for technical services</td>
</tr>
<tr>
<td>Environmental Standards &amp; Assessment Section</td>
<td>Approve QAPP</td>
</tr>
<tr>
<td>Phone: 651-297-1781</td>
<td></td>
</tr>
<tr>
<td>Email: <a href="mailto:lanny.peissig@pca.state.mn.us">lanny.peissig@pca.state.mn.us</a></td>
<td></td>
</tr>
</tbody>
</table>
Figure A-1. General project organization chart.
Person: Judy Crane, Principal Investigator
Water Unit
Environmental Standards & Assessment Section
Phone: 651-297-4068
Email: judy.crane@pca.state.mn.us

Responsibilities:
Prepare single-source contract to MESL
Develop work plan and QAPP
Coordinate the collection of sediment quality data from government, tribal, and business sources
Meet with stakeholders from the St. Louis River AOC to obtain input on the database structure and applicability of GIS-based watershed information
Provide training on how to use and query the GIS-based database to interested stakeholders
Prepare quarterly progress reports to GLNPO
Oversee and approve contractor work products
Perform project and grant management tasks

James Joslyn, QA Coordinator
Biological Monitoring Unit
Environmental Monitoring & Analysis Section
Phone: 651-296-7387
Email: james.joslyn@pca.state.mn.us

Responsibilities:
Review and approve QAPP
Respond to QA/QC questions

A1.2.2 GLNPO Personnel

The GLNPO staff associated with this project are as follows:

Person: Anthony Kizlauskas, Project Officer
U.S. EPA GLNPO
17G
77 West Jackson Boulevard
Chicago, IL 60604
Phone: 312-353-8773
Fax: 312-353-2018
Email: kizlauskas.anthony@epamail.epa.gov

Responsibilities:
Coordinate grant requests
Review work plan and QAPP
Provide technical assistance, as needed
Review quarterly progress reports
Review draft and final copies of GIS-based contaminated sediment database
Person: Responsibilities:

Louis Blume, QA Officer
Same address as A. Kizlauskas
Phone: 312-353-2317
Fax: 312-353-2018
Email: blume.louis@epamail.epa.gov

Review and approve QAPP
Provide technical assistance for QA/QC questions

A1.2.3 Consultant

MacDonald Environmental Sciences Ltd. (MESL) is the MPCA’s consultant for this project. Any corrective actions to the GIS-based contaminated sediment database will be reported to the MPCA Principal Investigator. Project personnel at MESL may be contacted by the MPCA Principal Investigator, GLNPO Project Officer, GLNPO QA Officer, or MPCA QA Coordinator at any time to discuss QA/QC concerns.

Staff from MESL will be responsible for the following deliverables:

• Electronic file (in Microsoft™ Access ’97) of the GIS-based contaminated sediment database for the St. Louis River AOC;
• Electronic file of ArcView projects of the database (or other mutually agreed upon spatial analyst tools);
• Technical memorandum containing documentation of the database and accompanying spatial tools;
• Training workshop on how to use and query the GIS-based contaminated sediment database; and
• Technical memo containing a comparison of mean probable effect concentration quotients (PEC-Qs) for matching sediment chemistry and toxicity data from the St. Louis River AOC with other sites in the Great Lakes region and in North America.

The MESL staff associated with this project can be reached at the following address:

MacDonald Environmental Sciences Ltd.
2376 Yellow Point Road
Nanaimo, British Columbia V9X 1W5, Canada
General Phone: 250-722-3651
Fax: 250-722-3613
Email: sff-mesl@island.net
<table>
<thead>
<tr>
<th>Person:</th>
<th>Responsibilities:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Donald MacDonald, Project Manager  &lt;br&gt;Phone: 250-722-3631</td>
<td>Oversee the development and completion of all project deliverables to the MPCA  &lt;br&gt;Meet with stakeholders from the St. Louis River AOC to obtain input on the database structure and applicability of GIS-based watershed information  &lt;br&gt;Provide training on how to use and query the GIS-based database to interested stakeholders  &lt;br&gt;Provide quarterly progress reports to Principal Investigator</td>
</tr>
<tr>
<td>Dawn Smorong, Environmental Scientist  &lt;br&gt;Phone: 250-722-3612</td>
<td>Determine the availability of GIS-based watershed information  &lt;br&gt;Evaluate available spatial analyst tools  &lt;br&gt;Help incorporate the St. Louis River habitat plan into the GIS-based contaminated sediment database  &lt;br&gt;Create spatial overlays, for use in conjunction with the database  &lt;br&gt;Create CD-based ArcView projects of the database (or other spatial analyst tools)  &lt;br&gt;Prepare technical documentation of the spatial tools  &lt;br&gt;Conduct QA/QC checks of the database  &lt;br&gt;Help prepare training information on how to use and query the GIS-based database</td>
</tr>
</tbody>
</table>
**Person:** Rebekka Lindskoog, Database Coordinator  
Phone: 250-722-3612

**Responsibilities:**
- Evaluate available contaminated sediment database structures
- Conduct a preliminary evaluation of available sediment quality and fisheries data
- Populate the database with available sediment quality data and sediment quality target (SQT) values
- Prepare a help section in the database for users
- Help create database user interfaces for running canned queries
- Prepare technical documentation of the database
- Conduct QA/QC checks of the database
- Help prepare training information on how to use and query the GIS-based database
- Provide comparisons of the mean PEC-Qs for matching sediment chemistry and toxicity data from the St. Louis River AOC with other sites in the Great Lakes area and in North America.

**Person:** Megan Hanacek, Research Assistant  
David Sims, Research Assistant  
Phone: 250-722-3612

**Responsibilities:**
- Assist the Database Coordinator with populating the database with available sediment quality data and SQT values
- Conduct QA/QC checks of the database
- Provide comparisons of the mean PEC-Qs for matching sediment chemistry and toxicity data from the St. Louis River AOC with other sites in the Great Lakes area and in North America

**Person:** Mary Lou Haines, Vice President  
Phone: 250-722-3651

**Responsibilities:**
- Oversee the preparation of invoices and other business operations of MESL
A2 PROBLEM DEFINITION/BACKGROUND

A2.1 Purpose/Background

The St. Louis River estuary has been, and continues to be, of vital economic, environmental, and social importance to the area encompassing Cloquet, MN; Duluth, MN; and Superior, WI (Figure A-2). The middle and lower portions of the estuary support a variety of industrial, residential, and recreational activities. In addition, these areas provide essential habitats for aquatic organisms and aquatic-dependent wildlife species. The lower estuary culminates in the Duluth-Superior Harbor, which is one of the most heavily used ports in the Great Lakes basin. Historic and ongoing land use and water-related activities in the middle and lower portions of the estuary have contributed a variety of nutrients and chemicals to the St. Louis River.

In 1987, concerns over environmental quality conditions prompted the designation of the lower St. Louis River (i.e., from Cloquet, MN to its entrance to Lake Superior) as one of 43 Great Lakes AOCs (IJC, 1989). Remedial Action Plans (RAPs) have been established as the principal mechanisms for addressing concerns related to impaired uses in the most severely impacted geographic areas in the Great Lakes basin (i.e., AOCs). Specifically, the terms of the Great Lakes Water Quality Agreement necessitate the preparation of a RAP for each AOC. The RAPs are being prepared using a staged approach which includes:

- Stage I – Identify and assess use impairments, and identify the sources of the stresses from all media in the AOC;
- Stage II – Identify proposed remediation actions and their method of implementation; and,
- Stage III – Document evidence that impaired uses have been restored.

Importantly, the RAP process must embody a comprehensive ecosystem approach and include substantial citizen participation (MPCA and WDNR, 1992). The International Joint Commission (IJC), through a formal protocol agreement between Canada and the United States, was charged with reviewing the RAPs for each AOC and assuring that they met these basic criteria. To facilitate effective citizen participation, the St. Louis River Citizen Advisory Committee became the independent, nonprofit Citizens Action Committee (CAC) in 1997. The CAC has played an essential role in the further development and implementation of the RAP process.

To support environmental quality assessments, the IJC developed a set of criteria for evaluating use impairments at Great Lakes AOCs. As part of the Stage I RAP, the existing information on environmental conditions in the St. Louis River was assembled and compared to the IJC’s fourteen impaired use categories. The results of this assessment indicated that at least nine use impairments had occurred in the St. Louis River AOC (MPCA and WDNR, 1992). Additionally, two possible
St. Louis River Area of Concern

Figure A-2. Map of the St. Louis River Area of Concern.
impairments were indicated; however, additional data were needed to confirm their presence in the AOC (MPCA and WDNR, 1992). Many of the confirmed impairments were associated with sediment contamination in the St. Louis River watershed, including effects on sediment-dwelling organisms and other aquatic species, fish consumption advisories, and restrictions to dredging activities. The creation of a GIS-based contaminated sediment database will help track whether improvements have been made to designated use impairments.

A2.2 Problem Statement and Background

A2.2.1 Introduction

The St. Louis River is one of 42 current AOCs in the Great Lakes basin for which three-stage RAPs are being developed to address various use impairments (IJC, 1989). A number of point and nonpoint sources of nutrients and contaminants were identified in the Stage I RAP for the St. Louis River AOC (MPCA and WDNR, 1992). Prior to 1978, point sources of nutrients and contaminants were released from permitted discharges of industrial operations and municipal sewage treatment plants. Since 1978, most of the Minnesota industrial and municipal discharges located in the lower portion of the watershed have sent their wastewater to the Western Lake Superior Sanitary District for treatment and disposal. The City of Superior also operates a wastewater treatment plant which is located near the Superior Harbor Basin. As a result of these actions to consolidate the treatment of sanitary and industrial effluent, the water quality and fisheries of the St. Louis River system greatly improved during the 1980s (MPCA and WDNR, 1992). However, contaminated sediments remain as a major environmental problem in this AOC.

The nonpoint source of nutrients and contaminants to the St. Louis River AOC have not been fully documented. However, it is likely that the major nonpoint sources of environmental contaminants to the system include atmospheric deposition, landfills, storm water and urban runoff, unpermitted discharges, spills, and in situ contaminated sediments within the AOC. The release of contaminants into the water column from nonpoint sources contributes to the load of these chemicals deposited in the sediments.

A2.2.2 Site Description

The St. Louis River AOC includes the portions of the watershed from Cloquet, MN to the Duluth and Superior entries to Lake Superior (Figure A-2). Along much of its length, the St. Louis River flows through a landscape that is dominated by northern boreal forests. Upstream of the AOC boundaries, the river channel is characterized by shallow meanders and sandy gravel bars. Near Cloquet, MN, the character of the river changes abruptly as it starts its steep descent to Lake Superior (Fredrickson, 1998). This portion of the watershed is characterized by deeply incised river channels and canyons. Five dams have been constructed on this reach of the river to take advantage of the hydroelectric power generation potential associated with the increased river
gradient. These dams have resulted in the creation of six reservoirs downstream of Cloquet, including the Knife Falls, Potlatch, Scanlon, Thomson, Forbay, and Fond du Lac Reservoirs. While these reservoirs are relatively small and have limited water storage capacities, the flow and water level in the river downstream of the reservoirs are significantly affected by water releases from these facilities (MPCA and WDNR, 1992).

As the river approaches Lake Superior, the current dissipates and the water body takes on the character of a lake (Fredrickson, 1998). The St. Louis River estuary, which covers an area of approximately 12,000 acres, is comprised of numerous large bays, peninsulas, and islands. Some of the important natural features in the estuary include Spirit Lake, Pokegama Bay, Kimball’s Bay, St. Louis Bay, Duluth Harbor, Superior Bay, and Allouez Bay. Together, these areas support a wide variety of important fish, aquatic invertebrate, avian, and other aquatic-dependent wildlife species. Just prior to entering Lake Superior at the Duluth Ship Canal and at the Superior Entry, the river forms a large embayment which is protected by two long sandbars (i.e., Minnesota and Wisconsin Points). These sandbars form the longest natural freshwater sandbars in the world. Two inner spits, Rices Point and Conners Point, divide the port into inner and outer harbors. This unique geomorphology has created a natural harbor which has been dredged and modified since the mid-1800s to accommodate shipping traffic and commerce (Walker and Hall, 1976). The Duluth-Superior Harbor waterfront is currently 79 km long, with 27 km of dredged channels (Duluth Seaway Port Authority Web Site: http://www.duluthport.com/seawayfactsmetric.html).

A2.2.3 Past Data Collection Activities

The sediment data assembled to support Stage I of the RAP, and those data collected thereafter (Table A-1), indicate that several areas in the St. Louis River AOC are contaminated by a variety of chemicals. These determinations of contaminated areas were made by comparing the sediment chemistry data in the St. Louis River AOC with benchmark sediment quality guidelines (SQGs) that have been promulgated by other jurisdictions (Persaud et al., 1993; Smith et al., 1996). These tools were used because, at the time these studies were conducted, the MPCA did not have any numerical SQTs in place as they do now (Crane et al., 2000).

Sediment assessment projects in the reservoirs downstream of Cloquet, MN, and in the lower estuary, have subsequently been conducted to determine the spatial extent of contamination and to assess impacts to benthic biota and fish. The data that have been collected to support these assessments show that various contaminants occur in the reservoirs and lower estuary of the St. Louis River AOC. The most elevated contaminant found in the surficial sediments of the Thomson, Forbay, and Fond du Lac Reservoirs is mercury (Glass et al., 1990, 1998; Schubauer-Berigan and Crane, 1996), while elevated levels of PCBs and 2,3,7,8-TCDD (dioxin) have been
Table A-1. List of Studies Which Investigated Sediment Quality in the St. Louis River AOC since 1992

<table>
<thead>
<tr>
<th>Location</th>
<th>Sampling Year(s)</th>
<th>Toxicity Tests</th>
<th>Sediment Chemistry</th>
<th>Benthic Data</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duluth-Superior Harbor</td>
<td>1993</td>
<td>Amphipod, Midge, Microtox, Mutatox</td>
<td>Metals, Hg, PAHs, PCBs, TCDDs, TCDFs, Pesticides, Ammonia, TOC, Cs-137</td>
<td>No</td>
<td>Schubauer-Berigan &amp; Crane (1997)</td>
</tr>
<tr>
<td>USX Superfund Site</td>
<td>1993</td>
<td>Amphipod, Midge, Microtox, Mutatox</td>
<td>Metals, Hg, PAHs, Ammonia, Cyanide, Oil &amp; Grease, TOC, Phenol</td>
<td>No</td>
<td>MPCA (unpublished data)</td>
</tr>
<tr>
<td>Newton Creek/Hog Island Inlet</td>
<td>1993, 1994</td>
<td>Amphipod, Midge, Cladoceran, Fathead Minnow</td>
<td>Metals, Hg, DROs, PAHs, Oil &amp; Grease, Ammonia, Cyanide, TOC, Particle Size</td>
<td>Yes</td>
<td>Redman &amp; Janisch (1995)</td>
</tr>
<tr>
<td>Duluth-Superior Harbor</td>
<td>1994</td>
<td>Amphipod, Midge</td>
<td>SEM Metals, AVS, As, Pb, Hg, TCDDs, TCDFs, Pesticides, PAHs, PCBs, Ammonia, TOC, Tributyltin, Particle Size</td>
<td>Yes</td>
<td>Crane et al. (1997)</td>
</tr>
<tr>
<td>Lakehead Pipe Line (North of Hog Island Inlet)</td>
<td>1995</td>
<td>Amphipod, Midge, Cladoceran</td>
<td>Metals, Hg, DROs, PAHs, Oil &amp; Grease, Ammonia, TOC, Particle Size</td>
<td>No</td>
<td>Wenck Associates (1995)</td>
</tr>
</tbody>
</table>
Table A-1. Continued

<table>
<thead>
<tr>
<th>Location</th>
<th>Sampling Year(s)</th>
<th>Toxicity Tests</th>
<th>Sediment Chemistry</th>
<th>Benthic Data</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper St. Louis River; Thomson and Forbay Reservoirs</td>
<td>1995</td>
<td>No</td>
<td>Hg, methyl Hg, grain size</td>
<td>No</td>
<td>ENSR (1996)</td>
</tr>
<tr>
<td>St. Louis River AOC</td>
<td>1995, 1996</td>
<td>Amphipod, Midge, Microtox</td>
<td>SEM Metals, AVS, Hg, PAHs, TOC, Particle Size</td>
<td>Yes</td>
<td>Breneman et al. (In review) and USEPA (In prep.)</td>
</tr>
<tr>
<td>Duluth-Superior Harbor</td>
<td>1995, 1996</td>
<td>Amphipod, Midge, Cladoceran, Fathead Minnow, Lumbriculus Bioaccumulation</td>
<td>Metals, Hg, Ammonia Phosphorus, Cyanide, COD, TOC, Oil &amp; Grease, PCBs, PAHs, Pesticides, Particle Size</td>
<td>No</td>
<td>TMA (1996)</td>
</tr>
<tr>
<td>Vicinity of WLSSD, Duluth Harbor</td>
<td>1996</td>
<td>No</td>
<td>Toxaphene</td>
<td>No</td>
<td>MPCA (unpublished data)</td>
</tr>
<tr>
<td>Interlake/Duluth Tar Superfund Site</td>
<td>1996</td>
<td>Amphipod, Midge, Microtox</td>
<td>SEM Metals, AVS, PAHs, TOC, Metals, Hg, Ammonia, Cyanide, BTEX, Particle Size</td>
<td>Yes</td>
<td>IT Corporation (1997)</td>
</tr>
<tr>
<td>Slip C, Duluth Harbor</td>
<td>1997</td>
<td>No</td>
<td>Hg, Pb, PAHs, PCBs, TOC, Particle Size</td>
<td>No</td>
<td>Crane (1999a)</td>
</tr>
</tbody>
</table>
Table A-1. Continued

<table>
<thead>
<tr>
<th>Location</th>
<th>Sampling Year(s)</th>
<th>Toxicity Tests</th>
<th>Sediment Chemistry</th>
<th>Benthic Data</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minnesota Slip, Duluth Harbor</td>
<td>1998</td>
<td>No</td>
<td>Hg, Pb, PAHs, TOC</td>
<td>No</td>
<td>MPCA (unpublished data)</td>
</tr>
<tr>
<td>Duluth-Superior Harbor</td>
<td>1999</td>
<td>Lumbriculus</td>
<td>Hg, PAHs, PCBs, TOC</td>
<td>No</td>
<td>Crane (1999b)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Screening,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bioaccumulation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dakota Pier, Duluth Harbor</td>
<td>1999</td>
<td>No</td>
<td>Metals, Hg, PAHs, Ammonia,</td>
<td>No</td>
<td>MPCA (unpublished data)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cyanide, Sulfate, TOC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minnesota Slip, Duluth Harbor</td>
<td>1999</td>
<td>Amphipod, Midge</td>
<td>Metals, Hg, PAHs, PCBs,</td>
<td>No</td>
<td>Crane (1999c)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AVS, SEM, TOC, Particle Size</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower St. Louis River Estuary</td>
<td>1999</td>
<td>No</td>
<td>Toxaphene, Cs-137 Pb-210,</td>
<td>No</td>
<td>King (1999a)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TOC</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sediment Chemistry: As = arsenic; Cs = cesium; Hg = mercury; Pb = lead; PAHs = polycyclic aromatic hydrocarbons; PCBs = polychlorinated biphenyls; TCDDs and TCDFs = tetrachlorodibenzo-p-dioxins and -furans; DROs = diesel range organics; SEM = simultaneously extractable metals; AVS = acid volatile sulfides; BTEX = benzene, toluene, ethylbenzene, and xylene; TOC = total organic carbon; COD = chemical oxygen demand.
found in deeper sections of sediment cores from these reservoirs (Schubauer-Berigan and Crane, 1996).

Mercury and PAHs are widespread contaminants found in depositional areas of the lower St. Louis River estuary, whereas metals, PCBs, dioxins and furans, organochlorine pesticides, tributyltin, and diesel range organics (DROs) tend to be more localized contaminants (MPCA and WDNR, 1992; Redman and Janisch, 1995; Schubauer-Berigan and Crane, 1997; Crane et al., 1997; Crane, 1999a,b,c; Breneman et al., 2000). The sediments with the highest contaminant concentrations occur at two Superfund sites (i.e., USX and Interlake/Duluth Tar) in the inner Duluth Harbor (Schubauer-Berigan and Crane, 1997; IT Corporation, 1997). Other areas with elevated contaminant concentrations in the Duluth-Superior Harbor include Hog Island Inlet/Newton Creek in Superior, WI (Redman and Janisch, 1995), as well as several boat slips, areas adjacent to wastewater treatment plants, and other areas with historical sources of contaminants (Schubauer-Berigan and Crane, 1997; Crane et al., 1997; Crane, 1999a). Action is currently being taken by the MPCA and Wisconsin Department of Natural Resources (WDNR) to implement source control measures and to remediate contaminated sediments at several contaminated hot spot areas in the lower St. Louis River estuary.

Sediments from several hot spot sites in the AOC have been shown to be toxic to sediment-dwelling organisms and/or associated with alterations of benthic invertebrate community structure (Prater and Anderson, 1977; Redman and Janisch, 1995; Schubauer-Berigan and Crane, 1996, 1997; Crane et al., 1997; Crane, 1999b,c; Breneman et al., 2000). A broad-scale assessment of the relationship between surficial sediment characteristics and benthic community structure in the St. Louis River AOC was conducted in 1995 as part of a Regional Environmental Monitoring and Assessment Program (R-EMAP) project (Breneman et al., 2000). For the R-EMAP study, taxa richness was variable (i.e., 1 to 25 taxa) among randomly sampled sites within two habitat classes (i.e., <5.5 m and >5.5 m water depth). Oligochaetes were the most abundant taxa, whereas Chironomidae larvae provided a majority of the taxa richness with 43 genera. For the entire data set, the majority of variation in benthic community structure was attributed to water depth and distance from the headwaters (Breneman et al., 2000).

Fish consumption advisories are in effect for selected fish species in the St. Louis River AOC because of elevated concentrations of mercury found in the tissues of the fish. Most of these advisories limit fish consumption to one meal per week for the protection of human health (MDH, 1999); more restrictive advisories are in effect for women of child bearing age and young children. In addition, health advisories are also in effect for the consumption of carp and lake sturgeon due to elevated concentrations of PCBs found in the tissues of the fish (MDH, 1999).
Since the St. Louis River constitutes the second largest tributary to Lake Superior, the potential transport of sediment-associated contaminants to Lake Superior is of additional concern to many stakeholders. Based on a limited data set from a toxics loading study, King (1999b) determined that dieldrin, ΣDDT, total PCBs, and several PAH compounds had a net flux out of the Duluth-Superior Harbor to Lake Superior.

The St. Louis River AOC also contains relatively clean areas that provide important fisheries and wildlife habitat. These clean sites also represent reference areas for determining contemporary background levels of anthropogenic contaminants in the lower estuary. Clean areas were identified by comparing sediment chemistry data from sample sites to that from reference areas (such as remote lakes in northeast Minnesota). These data were also compared to Ontario’s Lowest Effect Level SQGs (Persaud et al., 1993). Numerical sediment quality targets (SQTs), recently adopted for use in the St. Louis River AOC, will now be used as the chemical benchmarks for assessing sediment chemistry data in the St. Louis River AOC (Crane et al., 2000). The Duluth-Superior Harbor shipping channels also contain substantial quantities of relatively clean materials that pass land-based application guidelines. Hence, dredged materials from the shipping channels are washed at the Erie Pier confined disposal facility (CDF) in Duluth, MN and the sand-sized particles are re-used for beach nourishment, habitat development, highway construction, and other beneficial uses [U.S. Army Corps of Engineers (USACOE), 1997].

Currently, matching sediment chemistry and toxicity test data from the studies listed in Table A-2 have been entered into a database developed for GL985604-01 (Development of Sediment Quality Targets for the St. Louis River AOC). The data had to meet the screening criteria listed in Appendices A and B before entry into the Sediment Toxicity (SEDTOX) database; in addition, staff from MESL conducted several quality assurance checks of the database (Crane et al., 2000).

The St Louis River AOC SEDTOX database does not include data on the vertical profile of sediment contamination, unless a toxicity test was done on the associated core section (IT Corp., 1997). In addition, this database does not include any information about benthological community surveys (Crane et al., 1997; Breneman et al., 2000), bioaccumulation studies (ASCl Corp., 1999), fisheries data [Pat Collins, Minnesota Department of Natural Resources (MDNR), personal communication, May 2000], or other biological data (Glass et al., 1998).

The MPCA has identified data management as an important agency goal. Thus, MPCA management and staff are committed to making MPCA-collected data more accessible to the public and stakeholders. In addition, the use of visual techniques for presenting complex data in understandable formats for lay audiences is also an important communication goal.
Table A-2. Matching Sediment Chemistry and Toxicity Data Set for the St. Louis River AOC

<table>
<thead>
<tr>
<th>Reference</th>
<th>Species</th>
<th>Medium</th>
<th>Duration</th>
<th>Endpoint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ankley et al. (1994)</td>
<td>Chironomus tentans</td>
<td>Bulk sediment</td>
<td>10-d</td>
<td>Growth (weight-mg)</td>
</tr>
<tr>
<td>Ankley et al. (1994)</td>
<td>Chironomus tentans</td>
<td>Bulk sediment</td>
<td>10-d</td>
<td>Percent survival</td>
</tr>
<tr>
<td>Ankley et al. (1994)</td>
<td>Chironomus tentans</td>
<td>Bulk sediment</td>
<td>10-d</td>
<td>Percent survival/normal &amp; UV</td>
</tr>
<tr>
<td>Ankley et al. (1994)</td>
<td>Chironomus tentans</td>
<td>Bulk sediment</td>
<td>10-d</td>
<td>Percent weight using UV light</td>
</tr>
<tr>
<td>Ankley et al. (1994)</td>
<td>Hyalella azteca</td>
<td>Bulk sediment</td>
<td>10-d</td>
<td>Growth (weight-mg)</td>
</tr>
<tr>
<td>Ankley et al. (1994)</td>
<td>Hyalella azteca</td>
<td>Bulk sediment</td>
<td>10-d</td>
<td>Percent survival</td>
</tr>
<tr>
<td>Ankley et al. (1994)</td>
<td>Hyalella azteca</td>
<td>Bulk sediment</td>
<td>10-d</td>
<td>Percent survival/normal &amp; UV</td>
</tr>
<tr>
<td>Ankley et al. (1994)</td>
<td>Lumbriculus variegatus</td>
<td>Bulk sediment</td>
<td>10-d</td>
<td>Growth (weight-mg)</td>
</tr>
<tr>
<td>Ankley et al. (1994)</td>
<td>Lumbriculus variegatus</td>
<td>Bulk sediment</td>
<td>10-d</td>
<td>Percent survival</td>
</tr>
<tr>
<td>Ankley et al. (1994)</td>
<td>Lumbriculus variegatus</td>
<td>Bulk sediment</td>
<td>10-d</td>
<td>Percent survival/normal &amp; UV</td>
</tr>
<tr>
<td>Ankley et al. (1994)</td>
<td>Lumbriculus variegatus</td>
<td>Bulk sediment</td>
<td>10-d</td>
<td>Percent weight using UV light</td>
</tr>
<tr>
<td>Crane et al. (1997)</td>
<td>Chironomus tentans</td>
<td>Bulk sediment</td>
<td>10-d</td>
<td>Percent survival</td>
</tr>
<tr>
<td>Crane et al. (1997)</td>
<td>Hyalella azteca</td>
<td>Bulk sediment</td>
<td>10-d</td>
<td>Percent survival</td>
</tr>
<tr>
<td>IT Corp. (1997)</td>
<td>Chironomus tentans</td>
<td>Bulk sediment</td>
<td>10-d</td>
<td>Growth (weight-mg)</td>
</tr>
<tr>
<td>IT Corp. (1997)</td>
<td>Chironomus tentans</td>
<td>Bulk sediment</td>
<td>10-d</td>
<td>Percent survival</td>
</tr>
<tr>
<td>IT Corp. (1997)</td>
<td>Hyalella azteca</td>
<td>Bulk sediment</td>
<td>10-d</td>
<td>Growth (weight-mg)</td>
</tr>
<tr>
<td>IT Corp. (1997)</td>
<td>Hyalella azteca</td>
<td>Bulk sediment</td>
<td>10-d</td>
<td>Percent survival</td>
</tr>
<tr>
<td>MPCA (1996)</td>
<td>Chironomus tentans</td>
<td>Bulk sediment</td>
<td>10-d</td>
<td>Percent survival</td>
</tr>
<tr>
<td>MPCA (1997a)</td>
<td>Chironomus tentans</td>
<td>Bulk sediment</td>
<td>10-d</td>
<td>Percent survival</td>
</tr>
<tr>
<td>MPCA (1997a)</td>
<td>Hyalella azteca</td>
<td>Bulk sediment</td>
<td>10-d</td>
<td>Percent survival</td>
</tr>
<tr>
<td>MPCA (1997a)</td>
<td>Photobacterium phosphoreum</td>
<td>Bulk sediment</td>
<td>30-min</td>
<td>Bioluminescence (EC50 expressed as % DW sediment)</td>
</tr>
</tbody>
</table>
Table 2. Continued

<table>
<thead>
<tr>
<th>Reference</th>
<th>Species</th>
<th>Medium</th>
<th>Duration</th>
<th>Endpoint</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPCA (1997a)</td>
<td><em>Photobacterium phosphoreum</em></td>
<td>Porewater</td>
<td>30-min</td>
<td>% Reduction in bioluminescence (relative to control)</td>
</tr>
<tr>
<td>MPCA (1997b)</td>
<td><em>Chironomus tentans</em></td>
<td>Bulk sediment</td>
<td>10-d</td>
<td>Growth (weight-mg)</td>
</tr>
<tr>
<td>MPCA (1997b)</td>
<td><em>Chironomus tentans</em></td>
<td>Bulk sediment</td>
<td>10-d</td>
<td>Percent survival</td>
</tr>
<tr>
<td>MPCA (1997b)</td>
<td><em>Hyalella azteca</em></td>
<td>Bulk sediment</td>
<td>10-d</td>
<td>Percent survival</td>
</tr>
<tr>
<td>MPCA (1997b)</td>
<td><em>Photobacterium phosphoreum</em></td>
<td>Bulk sediment</td>
<td>15-min</td>
<td>Bioluminescence (EC50 expressed as % DW sediment)</td>
</tr>
<tr>
<td>MPCA (1997b)</td>
<td><em>Photobacterium phosphoreum</em></td>
<td>Porewater</td>
<td>15-min</td>
<td>% Reduction in bioluminescence (relative to control)</td>
</tr>
<tr>
<td>Smith et al. (1992)</td>
<td><em>Chironomus tentans</em></td>
<td>Bulk sediment</td>
<td>10-d</td>
<td>Percent survival</td>
</tr>
<tr>
<td>Smith et al. (1992)</td>
<td><em>Daphnia magna</em></td>
<td>Bulk sediment</td>
<td>48-h</td>
<td>Percent survival</td>
</tr>
</tbody>
</table>
A2.2.4 Intended Data Usages

The GIS-based contaminated sediment database for the St. Louis River AOC will have many useful applications. The database will allow users to access data on sediment chemistry, physical parameters, and biological endpoints. In addition, users will be able to view the data spatially on maps, along with other GIS-related watershed information. This easy access to information will assist stakeholders with carrying out the three-phase sediment strategy of the St. Louis River RAP (MPCA and WDNR, 1995). The strategy includes sediment assessment, development of hotspot management plans, and remediation. The database will also further the goals of the Lake Superior Lakewide Management Plan (LaMP) by tracking the occurrence of critical pollutants.

Other applications of the database include: determining the status and trends of sediment indicators, comparing sediment chemistry data to SQT values, analyzing environmental data as part of the MPCA’s Environmental Performance Partnership Agreement (EnPPA) requirements with the U.S. EPA, evaluating the economic and ecological benefits of sediment remediation, developing risk assessments at contaminated sediment sites, mapping contaminated sediment sites (pre- and post-remediation), highlighting data gaps and possible new areas of contamination, assisting with the development of a total maximum daily load (TMDL) for mercury in the St. Louis River, and assisting with the development of a multimedia approach for managing contamination along the Duluth waterfront. The framework of this GIS-based contaminated sediment database will also serve as a model that can be used by participants at other Great Lakes AOCs.

The results of this project will be used to educate the St. Louis River CAC and its Sediment Contamination Work Group, as well as the Harbor Technical Advisory Committee of the Metropolitan Interstate Committee. In addition, training workshops will be offered to stakeholders and MPCA staff to teach them how to use the GIS-based database. CD-based ArcView projects (or other spatial tools) will be developed. These projects will include the development of database user interfaces of commonly asked questions (e.g., print out a map of all the surficial sediment sites that have mercury data exceeding the Level I SQT value). This ease of use will allow local high schools and universities to incorporate the GIS-based database into their environmental science courses. In addition, outreach will be done to let Minnesota’s citizens know how environmental results are being achieved in the St. Louis River AOC. One conference presentation and possibly a peer-reviewed publication will be used to disseminate the results of this project.

Once the database is complete, it will be announced on the MPCA’s Contaminated Sediment Web page and by the distribution of a fact sheet. A no-cost CD version of the database will be available to stakeholders and regulators. The MPCA will take over the management and updating of the database (with MPCA-collected data) upon completion of this proposed project. The incorporation of any future sediment quality data collected by other agencies, tribes, and
businesses into the GIS-based database will depend on cooperative agreements and financial support from these organizations.

The MPCA is very interested in having a web-based application of the database developed as part of a future project. This would allow for additional links to: 1) the MPCA’s Site Response database for the location of Voluntary Investigation and Cleanup Sites (VICS) and Leaking Underground Storage Tank sites (LUST); 2) the MPCA’s air quality database; 3) the STORET database for water quality data; and 4) the Minnesota Department of Health’s fish tissue database. As part of this project, the MPCA will investigate whether in-house resources can be used to place a small portion of the contaminated sediment database on the MPCA’s Contaminated Sediments Web page (e.g., for a particular site or chemical such as mercury). A portion of the database would need to be converted from Access to either PowerBuilder or Oracle so that it would be compatible with the MPCA’s Unix Web site. This software upgrade would also allow greater security against computer hackers. Since a web-based application is an optional task, it will only be done if there is sufficient interest within the MPCA to do it.

A3 PROJECT/TASK DESCRIPTION AND SCHEDULE

A3.1 Purpose/Background

In order to move forward with the RAP process, a GIS-based contaminated sediment database is needed to integrate contaminated sediment, fisheries, and watershed information into an easily accessible format. The creation of this database, and associated GIS-mapping component, will enhance implementation of the ecosystem-based management approach for assessing and remediating contaminated sediments in the St. Louis River AOC (Crane et al., 2000).

The objectives of this project are to:

- Develop a contaminated sediment database for the St. Louis River AOC;
- Develop a GIS-based spatial mapping component to be used in conjunction with the database; and
- Provide training to stakeholders on the use and application of the GIS-based contaminated sediment database.

The following section will describe the work tasks to be conducted and the associated QA/QC goals, procedures, and timetables for completing tasks.
3.2 **Description of the Work to be Performed**

The MPCA and MESL will develop a user-friendly GIS-based contaminated sediment database in Microsoft Access™. Existing database structures will be reviewed for their applicability to this project. These databases include:

- GLNPO’s Contaminated Sediment Data Reporting Format;
- Biological Effects Database for Sediments (BEDS);
- Sediment Toxicity (SEDTOX) Database;
- Query Manager [National Oceanic and Atmospheric Administration (NOAA) database];
- STORET;
- MPCA’s databases for existing biological data;
- MDNR and WDNR databases or spreadsheet files for fisheries information (e.g., incidence of tumors, fin rot); and
- Minnesota Department of Health’s fish tissue database.

The St. Louis River AOC contaminated sediment database will improve on existing databases by providing sediment-related information in a central database format. The mapping tools (such as ArcView Spatial Analyst or NOAA’s Marplot software), to be used in conjunction with the database, will provide a powerful tool for stakeholders to use.

Stakeholder input will be sought on what kinds of data they want to see available in the database (e.g., incidence of fish tumors; chemical indicators such as mercury). Also, the budget constraints of this project may not allow for all the sediment-related data to be entered into the database. Thus, input from potential database users will be critical for setting priorities. We anticipate that stakeholders will put a high priority on populating the database with information from high-profile sites (e.g., the Interlake/Duluth Tar and USX Superfund sites). In addition, consensus will need to be reached on the priority by which various sediment indicator data (as described in Crane *et al.* 2000) should be entered into the database.

The GIS-based contaminated sediment database will most likely include the following components (depending on stakeholder input):

- **Contaminated Sediment Database Component:**
  - Sediment chemistry data [e.g., mercury, PAHs, PCBs, dioxins/furans, pesticides (e.g., DDT metabolites, toxaphene), metals, total organic carbon];
  - Physical parameter data (e.g., particle size);
  - Sediment toxicity test results for acute and chronic toxicity tests;
  - Tissue residue data for fish and invertebrates;
  - Other fisheries information (e.g., incidence of tumors, fin rot);
  - Benthological community data (i.e., for bottom feeding organisms);
• Level I and Level II SQT values (Crane et al., 2000);
• GIS locational data for each sampling site (according to the format given at http://www.epa.gov/glnpo/fund/ldp.html); and
• QA/QC data for each chemical, physical, and biological parameter.

• Additional database and spatial map “overlays” will include information on: watersheds, St. Louis River habitat plan, location of dredged areas, disposal sites, historical outfalls, and federally designated contaminated sites (i.e., CERLCA, RCRA, Superfund sites) (see Appendices C to H for GIS-related information that may be used for this project).

• CD-based ArcView projects of the database (or other spatial analyst tools) will be developed. These projects will utilize the contaminated sediment and fisheries data, digital topographic maps, and digital ortho imagery along the St. Louis River. This will include the development of database user interfaces (for “canned queries”) and geographical user interfaces (for greater search flexibility).

• As another component of the project, a help section will be added to the database, and technical documentation of the database will be prepared.

• Training on how to use and query the database will be provided to interested stakeholders in the Duluth area and at the MPCA office in St. Paul, MN.

The database will be designed so that data fields can be downloaded into the EPA’s National Sediment Inventory, STORET, and NOAA’s Query Manager. Thus, the St. Louis River data set will be broadly available to other contaminated sediment databases.

Specific work tasks (and responsible organizations for completing tasks) include the following:

• Prepare a professional/technical contract certification form and a single-source professional/technical contract for MESL, in the amount of $76,000, for work on this project. (MPCA)

• Develop a detailed work plan and QAPP. (MPCA)

• Evaluate available contaminated sediment database structures and spatial analyst tools and make recommendations for this project. (MESL; MPCA)

• Conduct a preliminary evaluation of sediment quality and fisheries data currently available for the St. Louis River AOC (and expected to be available by May 31, 2002). (MESL; MPCA)
• Determine the availability of GIS-based watershed information. (MESL; MPCA)

• Meet with stakeholders from the St. Louis River AOC (in Duluth, MN) to obtain input on the database structure, including specific data fields, and how the information can be best presented for their use. (MPCA; MESL)

• Populate the database with available chemical, physical (e.g., particle size), and bioeffects data (i.e., sediment toxicity, bioaccumulation, benthic community, and fisheries data), as well as with the SQTs adopted for the St. Louis River AOC. (MESL)

• Help incorporate the St. Louis River habitat plan into the GIS-based contaminated sediment database with the assistance of the Minnesota DNR, St. Louis River CAC, and the CAC’s contractors for the habitat plan. (MESL; MPCA)

• Prepare a help section in the database for users. (MESL)

• Create spatial overlays, for use in conjunction with the database, to provide information on: watershed parameters; habitat classifications, and location of dredged areas, disposal sites, historical outfalls (from U.S. EPA database), and federally designated contaminated sites (i.e., CERCLA, RCRA, Superfund sites; from U.S. EPA database). (MESL)

• Create CD-based ArcView projects of the database (or other spatial analyst tools). These projects will utilize the contaminated sediment and fisheries data, digital topographic maps, and digital ortho imagery along the St. Louis River. This will include the development of database user interfaces (for “canned queries”) and geographical documentation of the database and accompanying spatial tools. (MESL)

• Prepare technical documentation of the database and accompanying spatial tools. (MESL)

• Provide training on how to use and query the database to interested stakeholders in the Duluth area and at the MPCA office in St. Paul, MN. (MESL; MPCA)

• Provide comparisons of the mean PEC-Qs for matching sediment chemistry and toxicity data from the St. Louis River AOC with other sites in the Great Lakes area and in North America. This task will involve the use of MESL’s sediment toxicity database of matching sediment chemistry and toxicity data for freshwater sites in North America. (MESL)

• Present the results at a national conference and through other public forums. (MPCA; MESL)

A schedule of the major milestones for this project are given in Table A-3.


Table A-3. Work Tasks

<table>
<thead>
<tr>
<th>Project Milestones</th>
<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Project Start</td>
<td>10/2000</td>
</tr>
<tr>
<td>• Complete Preliminary Evaluation of Available Data and Mapping Tools</td>
<td>09/2001</td>
</tr>
<tr>
<td>• Stakeholder Meeting (Duluth, MN)</td>
<td>10/2001</td>
</tr>
<tr>
<td>• Develop Database Format for Bioeffects Data</td>
<td>11/2001</td>
</tr>
<tr>
<td>• Complete Data Entries to Contaminated Sediment Database</td>
<td>07/2002</td>
</tr>
<tr>
<td>• Complete CD-based ArcView Projects (or other Spatial Analyst Tools)</td>
<td>07/2002</td>
</tr>
<tr>
<td>• Complete Help Section and Technical Documentation</td>
<td>08/2002</td>
</tr>
<tr>
<td>• Database Training and Project End</td>
<td>09/2002</td>
</tr>
</tbody>
</table>

A4 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

A4.1 Purpose/Background

The purpose of this section is to document the Data Quality Objectives (DQOs) of the project. In addition, performance criteria will be established for the planning process and measurement system that will be employed in evaluating sediment quality and fisheries data collected from other sources for use in the GIS-based contaminated sediment database.

A4.2 Specifying Quality Objectives

The DQO Process is a series of planning steps based on the Scientific Method that is designed to ensure that the type, quality, and quantity of environmental data used in decision making are appropriate for the intended application. DQOs are qualitative and quantitative statements derived from outputs of each step of the DQO Process that:
• Clarify the intended use of the data;
• Define the type of data needed to support the decision;
• Identify the conditions under which the data should be collected; and
• Specify tolerable limits on the probability of making a decision error due to uncertainty in the data.

The DQO process consists of the following seven steps:

1. State the problem;
2. Identify the decision;
3. Identify inputs to the decision;
4. Define the study boundaries;
5. Develop a decision rule;
6. Specify limits on decision errors; and
7. Optimize the design for obtaining data.

Data Quality Indicators (DQIs) can be developed for a sampling activity through the use of the DQO process (USEPA, 1998).

For this project, the individual steps of the DQO process are listed below.

1. State the Problem

• The members of the project team were previously described in Section A1.2.
• The primary decision maker for this project is the MPCA Principal Investigator, who will solicit input from the contractor and expected data users.
• The description of contamination problems in the St. Louis River AOC was identified in Section A2.2.
• The financial resources available to carry out this project include GLNPO grant number GL975363-01 for $80,000 plus a state match of $4,211. In addition, staff support from the MPCA will be available for clerical and word processing assistance. The timeline for meeting major project deliverables is provided in Table A-3. The entire project will be completed by September 30, 2002.

2. Identify the Decision

• The principal study question is: what is the best approach for managing sediment quality and fisheries data collected from the St. Louis River AOC, in addition to GIS-based watershed information, so that the GIS-based contaminated sediment database will be of most use to the MPCA and stakeholders?
Alternative actions that could result from resolution of the principal study question include:

- Tracking of critical pollutants included in the Lake Superior LaMP;
- Facilitate efforts to reduce use impairments listed in the St. Louis River RAP;
- Provide a tool for the MPCA, MDNR, WDNR, and Fond du Lac Band to quantify the actual environmental results of their work (e.g., status and trends work, effectiveness of sediment remediation);
- Identify areas for possible sediment remediation based on the weight-of-evidence of sediment quality data;
- Provide sediment quality data for ecological and human health risk assessments in the St. Louis River AOC; and
- Provide a model for other Great Lakes AOCs to utilize for managing sediment quality and fisheries data with useful GIS information.

A decision statement for the St. Louis River AOC would be to ensure all possible sources of sediment quality data collected since 1991, and environmentally-related GIS information for the AOC, be evaluated for inclusion in the GIS-based contaminated sediment database.

Stakeholder input will be required for making multiple decisions about the inclusion of sediment quality and fisheries data, as well as GIS information, into the GIS-based database.

3. Identify Inputs to the Decision

To resolve the decision statement, available contaminated sediment database structures and spatial analyst tools will be evaluated. In addition, a preliminary evaluation of electronic sources of sediment quality and fisheries data currently available (and expected to be available by May 31, 2002) will be conducted. Finally, the availability of GIS-based watershed information will be assessed. Specific input to the decision statement is further described in Section A3.2.

4. Define the Boundaries of the Study

The characteristics that define the population of interest are the following components (depending on stakeholder input):

- Sediment chemistry data [e.g., mercury, PAHs, PCBs, dioxins/furans, pesticides (e.g., DDT metabolites, toxaphene), metals, total organic carbon];
- Physical parameter data (e.g., particle size);
- Sediment toxicity test results for acute and chronic toxicity tests;
- Tissue residue data for fish and invertebrates;
• Other fisheries data (e.g., incidence of tumors, fin rot);
• Benthological community data (i.e., for bottom feeding organisms);
• Level I and Level II SQT values (Crane et al., 2000);
• GIS locational data for each sampling site (according to the format given at http://www.epa.gov/glnpo/fund/ldp.html); and
• QA/QC data for each chemical, physical, and biological parameter.

The spatial boundary of the decision statement will be limited to:
• The geographic area of the St. Louis River AOC from Cloquet, MN to the Duluth, MN and Superior, WI entries to Lake Superior.
• The temporal boundary of the problem will be limited to a distinct period of time from 1991 to May 30, 2002. This time period was selected to correspond to MPCA sediment investigations recently funded by GLNPO and the U.S. EPA (in which QAPPs were prepared) and the availability of electronic data files. These data will be used to reflect the sediment quality conditions from which a decision can be made concerning future management actions in the St. Louis River.
• The scale of decision making will be based on the inclusion of known data sets and GIS information into the GIS-based contaminated sediment database. Strategic alliances with other organizations (MDNR, WDNR, Fond du Lac Band) and cooperation from potentially responsible parties will be sought for them to provide georeferenced sediment quality data to the Principal Investigator in a format that can readily be brought into the GIS-based contaminated sediment database.
• Potential practical constraints on the project include the following: inability to obtain electronic files of sediment quality and fisheries data, as well as GIS information, from designated sources, and a lack of funding to include all of the parameters and studies designated by stakeholders.

5. Develop a Decision Rule

• Concentrations of contaminants will be compared to their corresponding Level I and Level II SQTs. Multiple contaminants will be considered through the calculation of mean PEC-Qs.
• All of the available chemical and bioeffects data will be evaluated using a weight-of-evidence approach before making management decisions about contaminated sites.
• If...then statements for the decision rule will follow the sediment assessment framework and contingency table of Crane et al. (2000).
6. Specify Tolerable Limits on Decision Errors

- The decision errors and null hypothesis will depend on how the data in the GIS-based database are utilized (see Section A2.2.4). One example scenario is given below.
- For a sediment remediation scenario, the two decision errors are (i) deciding the weight-of-evidence data indicates the sediments are contaminated enough to warrant remediation when it truly does not, and (ii) deciding the weight-of-evidence data indicates the sediments are not contaminated enough to warrant remediation when it truly does.
  - The true state of nature for decision error (i) is that the area of interest does not need remediation.
  - The true state of nature for decision error (ii) is that the area of interest needs to be remediated.
- The potential consequences of each decision error are:
  - The consequences of deciding that the area of interest warrants remediation, when it truly does not, will be that the MPCA will have lost time and resources that could have been used to remediate more worthy sites.
  - The consequences of deciding that the area of interest does not warrant remediation, when it truly does, will be that aquatic biota, and possibly humans, may be exposed to unacceptable risks at this site.
- Decision error (ii) has more severe consequences since the risk of jeopardizing human health and ecological stability outweighs the consequence of lost resources and time spent evaluating the site.
- The null hypothesis (baseline condition) and the alternative hypothesis are as follows:
  - The baseline condition, or null hypothesis (H₀), is that the weight-of-evidence of available data indicates the sediments require remediation.
  - The alternative hypothesis (Hₐ) is that the weight-of-evidence of available data indicates the sediments do not require remediation.
- The false positive decision error occurs when the null hypothesis is rejected when it is true. The false negative decision error occurs when the null hypothesis is not rejected when it is false.
- The range of possible values of the parameter of interest, where the consequences of decision errors are relatively minor (gray region) must be specified on a case-by-case basis.

7. Optimize the Design

- The design of the GIS-based contaminated sediment database will be optimized by an up-front evaluation of other contaminated sediment database designs, available spatial analyst tools, and GIS-information, as well as stakeholder input.
A4.3 Specifying Measurement Performance Criteria

An important feature of the QAPP is that it links the data user’s quality objectives to verifiable measurement performance criteria. Since this study includes only pre-existing data, no measurement performance criteria will be established for the GIS-based database.

Data Quality Indicators (DQIs) are qualitative and quantitative descriptors used in interpreting the degree of acceptability or utility of data. The principal DQIs are precision, bias, representativeness, comparability, and completeness. Establishing acceptance criteria for the DQIs sets quantitative goals for the quality of data generated in the analytical measurement process. It will be beyond the scope of this project to list the project specific DQIs in the GIS-based database. However, the DQIs may be considered in terms of averaging analytical duplicate or field replicate data. A final decision on the use of DQIs will be made after soliciting stakeholder input (e.g., do they want analytical duplicate and file replicate data to be averaged, to be presented separately, or both options?).

A4.3.1 Precision

Precision is a measure of agreement among replicate measurements of the same property, under prescribed similar conditions. This agreement is calculated as either the range (R) or as the standard deviation (s). It may also be expressed as a percentage of the mean of the measurements, such as relative percent difference (RPD) or relative standard deviation (RSD) (for three or more replicates).

Field precision is assessed through the collection and measurement of field replicates at a rate of one replicate per ten analytical samples. This allows intralaboratory precision information to be obtained on sample acquisition, handling, shipping, storage, preparation, and analysis. Both samples can be carried through the steps in the measurement process together to provide an estimate of short-term precision. An estimate of long-term precision can be obtained by separating the two samples and processing them at different times or by different people and/or analyzed using different instruments.

For duplicate measurements, relative percent difference (RPD) is calculated as follows:

\[
\text{RPD} = \frac{D_1 - D_2}{(D_1 + D_2)/2} \times 100\%
\]

\( \text{RPD} = \) relative percent difference
\( D_1 = \) sample value
\( D_2 = \) duplicate sample value
For three or more replicates:

\[
\text{RSD} = \left( \frac{s}{x} \right) \times 100
\]

\text{RSD} = \text{relative standard deviation} \\
\text{s} = \text{standard deviation of three or more results} \\
\text{x} = \text{mean of three or more results}

Standard deviation is defined as follows:

\[
s = \left( \frac{1}{(n-1)} \sum (y_i - \text{mean } y)^2 \right)^{0.5}
\]

\text{s} = \text{standard deviation} \\
\text{y}_i = \text{measured value of the ith replicate} \\
\text{mean } y = \text{mean of replicate measurements} \\
\text{n} = \text{number of replicates}

**A4.3.2 Bias**

Bias is the systematic or persistent distortion of a measurement process that causes errors in one direction. Bias assessments for environmental measurements are made using personnel, equipment, and spiking materials or reference materials as independent as possible from those used in the calibration of the measurement system. When possible, bias assessments should be based on analysis of spiked samples rather than reference materials so that the effect of the matrix on recovery is incorporated into the assessment. A documented spiking protocol and consistency in following that protocol are important to obtaining meaningful data quality estimates. Spikes should be added at different concentration levels to cover the range of expected sample concentrations. For example, the use of spiked surrogate compounds for GC and GC/MS procedures for PCB congeners and PAH compounds, respectively, can be used to assess for bias.

**A4.3.3 Accuracy**

Accuracy is a measure of the closeness of an individual measurement, or the average of a number of measurements, to the true value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that result from sampling and analytical operations.

Accuracy in the field is assessed through the adherence to all sample handling, preservation, and holding times. In order to assure the accuracy of the analytical procedures, an environmental sample will be randomly selected from each sample shipment received at the laboratory, and spiked with a known amount of the analytes to be evaluated. In general, a sample spike will be included in every set of 20 samples tested on each instrument. The spike sample will then be
analyzed. The increase in concentration of the analyte observed in the spiked sample, due to the addition of a known quantity of the analyte, compared to the reported value of the same analyte in the unspiked sample determines the percent recovery. The percent recovery for a spiked sample is calculated according to the following formula:

$$\% R = 100\% \times \frac{S-U}{C_{sa}}$$

Where:
- $\% R$ = percent recovery
- $S$ = measured concentration in spiked sample
- $U$ = measured concentration in unspiked sample
- $C_{sa}$ = actual concentration of spike added

For situations where a standard reference material (SRM) is used in addition to a matrix spike:

$$\% R = 100\% \times \frac{C_m}{C_{srn}}$$

Where:
- $\% R$ = percent recovery
- $C_m$ = measured concentration of SRM
- $C_{srn}$ = actual concentration of SRM

A4.3.4 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is a qualitative term that should be evaluated to determine whether in situ and other measurements are made and physical samples collected in such a manner that the resulting data appropriately reflect the media and phenomenon measured or studied.

For field data, representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the field sampling plan is followed and that proper sampling techniques are used. Representativeness in the laboratory is ensured by using the proper analytical and toxicity testing procedures; meeting sample holding times; and analyzing and assessing laboratory duplicates for the chemistry samples.

A4.3.5 Comparability

Comparability is the qualitative term that expresses the confidence that two data sets can contribute to a common analysis and interpolation. Comparability must be carefully evaluated to establish whether two data sets can be considered equivalent in regard to the measurement of a specific variable or groups of variables. In a laboratory analysis, the term comparability focuses
on method type comparison, holding times, stability issues, and aspects of overall analytical quantitation.

There are a number of issues that can make two data sets comparable, and the presence of each of the following items enhances their comparability:

- Two data sets should contain the same set of variables of interest;
- Units in which these variables were measured should be convertible to a common metric;
- Similar analytical procedures and quality assurance should be used to collect data for both data sets;
- Time measurements of certain characteristics (variables) should be similar for both data sets;
- Measuring devices used for both data sets should have approximately similar detection levels;
- Rules for excluding certain types of observations from both samples should be similar;
- Samples within data sets should be selected in a similar manner;
- Sampling frames from which the samples were selected should be similar; and
- Number of observations in both data sets should be of the same order or magnitude.

These characteristics vary in importance depending on the final use of the data. The closer two data sets are with regard to these characteristics, the more appropriate it will be to compare them. Large differences between characteristics may be of only minor importance, depending on the decision that is to be made from the data.

**A4.3.6 Completeness**

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. Field completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. Laboratory completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project.

The calculation for percent completeness is as follows:

\[
\%C = 100\% \times \left( \frac{V}{n} \right)
\]

- \(\%C\) = percent completeness
- \(V\) = number of valid measurements
- \(n\) = number of measurements planned
A5 SPECIAL TRAINING REQUIREMENTS/CERTIFICATION

A5.1 Purpose/Background

The purpose of this section is to ensure that any specialized training requirements necessary to complete this project are known and described below. In addition, the procedures are described in enough detail to ensure that specific training skills can be verified, documented, and updated as necessary.

A5.2 Training

Training, as described here, is limited to appropriate training in:

- Microsoft Access™, Fully Integrated Environmental Location Decision Support (FIELDS) software, and Spatial Analysis and Decision Assistance (SADA) software: MPCA Principal Investigator
- Microsoft Access™: MESL Database Coordinator (R. Lindskoog), Environmental Scientist (D. Smorong), Research Assistant (M. Hanacek), and Vice-President (M.L. Haines)

A5.3 Certification

ArcView Certification from ESRI: MESL Environmental Scientist (D. Smorong)

A6 DOCUMENTATION AND RECORDS

A6.1 Purpose/Background

Sufficient metadata will be provided in the GIS-based contaminated sediment database to verify the quality of the data. This evaluation could include information about the sampling and analysis of environmental samples, sample management records, test methods, QA/QC reports, and data handling records.

A6.2 Data Reporting Package Archiving and Retrieval

The MPCA will retain hard copies of data reports for five years after which time it will be sent to the Minnesota Records Center for 30 years. When that time period is up, the Center will contact the MPCA to check if they want to retain the information. If not, the files will be turned over to the Minnesota Historical Society. They will retain the files they are interested in and dispose of the other files. The MPCA does not have a policy in place for the archival of electronic data files.
B DATA ACQUISITION

B1 DATA ACQUISITION REQUIREMENTS (NON-DIRECT MEASUREMENTS)

B1.1 Purpose/Background

Only previously collected sediment quality data will be included in the GIS-based contaminated sediment database for the St. Louis River AOC. These data include the results of various sediment chemistry and particle size analyses, sediment toxicity tests, benthological community surveys, sediment bioaccumulation tests, and fish surveys. In addition, GIS information will be obtained from established government sources.

B1.2 Acquisition of Non-Direct Measurement Data

A search for matching sediment chemistry and toxicity data from the St. Louis River AOC was previously conducted as part of GLNPO grant number GL985604-01 (Development of Sediment Quality Targets for the St. Louis River AOC) (Crane et al., 2000). The data were evaluated by MESL for acceptability into the SEDTOX database according to the guidelines given in Appendices A and B. The acceptable matching sediment chemistry and toxicity data were entered into a Microsoft Access database, which was finalized in September 2000. The studies and corresponding toxicological benchmarks included in the St. Louis River SEDTOX database are given in Table A-2.

The acquisition of more recent sediment quality data will be sought from other staff within the MPCA, MDNR, WDNR, Fond du Lac Band, and the potentially responsible parties for the Interlake/Duluth Tar and USX Superfund sites. Due to the limited budget of this project, collaboration will be sought from the above entities to provide electronic copies of their data in a format readily accessible to the new GIS-based contaminated sediment database.

Both internal staff input and stakeholder input will be solicited to develop the order of priority by which data will be entered into the GIS-based contaminated sediment database. Based on the resources available for this project, first priority will probably be given to studies conducted by the MPCA as part of GLNPO or U.S. EPA grants.

The possible order by which data generated by the MPCA will be entered into the database is as follows:

- Minnesota Slip Sediment Remediation Scoping Project (Crane, in preparation);
- Slip C Sediment Remediation Scoping Project (Crane, 1999);
- R-EMAP study (Breneman et al., 2000 and unpublished data);
- Bioaccumulation Study (ASci Corp., 1999);
- Toxaphene Study (King, in preparation);
• 1994 Sediment Survey of Hot Spot Areas in the Duluth-Superior Harbor (Crane et al., 1997);
• 1993 Sediment Survey of the Duluth/Superior Harbor (Schubauer-Berigan and Crane, 1997); and
• Cloquet Reservoirs Study (Schubauer-Berigan and Crane, 1996).

The entry of other sediment quality and fisheries data into the database is dependent on no-cost assistance from other agencies and the Fond du Lac Band.

B2 DATA MANAGEMENT

B2.1 Purpose/Background

This section will present an overview of all mathematical operations and analyses performed on raw data to change their form of expression, location, quantity, or dimensionality. For this project, these operations include data validation, transmittal, reduction, analysis, management, storage, and retrieval.

B2.2 Data Validation

The screening criteria for the BEDS/SEDTOX co-occurrence data and spike sediment bioassay data will be adapted for validating data sets to be included in the GIS-based contaminated sediment database. All data sets will be checked number for number prior to translation into the database.

B2.3 Data Transmittal

Data transmittal occurs when data are transferred from one person or location to another or when data are copied from one form to another. Some examples of data transmittal are copying raw data from a notebook onto a data entry form for keying into a computer file and electronic transfer of data over a computer network. The MPCA Principal Investigator will verify the transmittal of electronic data files to MESL. It is beyond the scope of this project to hand enter hard copy results of data into the GIS-based database.

B2.4 Data Reduction

Data reduction includes all processes that change the number of data items. For the toxicity tests and bioaccumulation studies, data reduction will involve taking the arithmetic mean of replicate data (e.g., number of surviving organisms). For the analytical results, data reduction will probably involve calculating the arithmetic mean and standard deviation of field replicates and laboratory duplicates. Some data reduction (to be determined) will be necessary for the benthological data in order to save space in the database.
B2.5 Data Analysis

Data analysis will involve calculating the mean PEC-Qs for sites with matching sediment chemistry and toxicity data from the St. Louis River AOC. The range of mean PEC-Qs will be compared to other sites in the Great Lakes area and in North America. This task will involve the use of MESL’s sediment toxicity database of matching sediment chemistry and toxicity data for freshwater sites in North America.

B2.6 Data Tracking

The MPCA Principal Investigator and MESL staff will track the status of entering data into the GIS-based contaminated sediment database.

B2.7 Data Storage and Retrieval

The MPCA will retain all the analytical and bioeffects data packages in the project files for this study. The time period for storage of MPCA files was given in Section A6.2.
C ASSESSMENT/OVERSIGHT

C1 ASSESSMENT

C1.1 Purpose/Background

During the planning process, many options for data fields, database structure designs, data reduction procedures, and GIS-based watershed information will be evaluated for possible inclusion in the GIS-based contaminated sediment database. In order to ensure that the population of the database with sediment quality data and use of GIS information are conducted as planned, a process of evaluation and validation is necessary. This section of the QAPP describes the internal and external checks necessary to ensure that:

- All elements of the QAPP are correctly implemented as prescribed;
- The quality of the data included in the database is adequate; and
- Corrective actions, when needed, are implemented in a timely manner and their effectiveness is confirmed.

The most important part of this section is documenting all planned internal assessments of the GIS-based contaminated sediment database. The MESL Project Manager will initiate internal assessments.

C1.2 Assessment Activities and Project Planning

C1.2.1 Assessment of the Subsidiary Organizations

Two types of assessments of the Contractor can be performed as described below.

- **Management Systems Review (MSR).** A form of management assessment, this process is a qualitative assessment of an organization to establish whether the prevailing quality management structure, policies, practices, and procedures are adequate for ensuring that the type and quality of data needed are obtained. The MSR is used to ensure that sufficient management controls are in place and carried out by the organization to adequately plan, implement, and assess the results of the project.

- **Readiness Reviews.** A readiness review is a technical check to determine if all components of the project are in place so that work can commence on a specific phase.

It is anticipated that a readiness review of the Contractor, by the MPCA Principal Investigator, will be sufficient for this project.
C1.2.2 Assessment of Project Activities

For this project, it is anticipated that surveillance will be the primary assessment technique of project activities by the Contractor. This will most readily occur by the Project Manager of MESL.

C1.3 Documentation of Assessments

C1.3.1 Number, Frequency, and Types of Assessments

The MESL Project Manager and MPCA Principal Investigator will only conduct general surveillance types of assessments as work products are completed or questions arise.

C1.3.2 Assessment Personnel

The Contractor will provide internal verification of data that are translated from data files to the GIS-based contaminated sediment database.

C1.3.3 Schedule of Assessment Activities

No external audits, by the MPCA, will be conducted for this project. External audits, by the GLNPO QA Officer, are up to his discretion.

C1.3.4 Reporting and Resolution of Issues

Any audits or other assessments that reveal findings of practice or procedure that do not conform to the written QAPP need to be corrected as soon as possible. For noncritical deviations, they need to be informed by the next business day.

Corrective actions should only be implemented after approval by the MPCA Principal Investigator. If immediate corrective action is required, approvals secured by telephone from the MPCA Principal Investigator should be documented in an additional memorandum.

For noncompliance problems, a formal corrective action program will be determined and implemented at the time the problem is identified. The person who identifies the problem will be responsible for notifying the MPCA Principal Investigator, who in turn will notify the GLNPO Project Officer. Implementation of corrective actions will be confirmed in writing through the same channels.

Any nonconformance with the established quality control procedures in the QAPP will be identified and corrected in accordance with the QAPP. The GLNPO Project Officer, or his designee, will issue a nonconformance report for each nonconformance condition.
These corrective actions are performed prior to release of the GIS-based database from the contractor. The corrective actions will be documented in a memorandum to the MPCA Principal Investigator.

C2 REPORTS TO MANAGEMENT

C2.1 Purpose/Background

This section will identify the frequency and distribution of reports issued to inform management of the status of the project, including QA/QC issues.

C2.2 Frequency, Content, and Distribution of Reports

The MPCA Principal Investigator will submit quarterly reports to the GLNPO Project Officer for the quarters ending on September 30, 2001; December 31, 2001; March 31, 2002; June 30, 2002; and September 30, 2002. The contractor will need to submit a short project update to the MPCA Principal Investigator by September 30, 2001; December 31, 2001; March 31, 2002; June 30, 2002; and September 30, 2002. The progress updates can be sent to the MPCA Principal Investigator via email and need to document progress on tasks identified in the contractor’s contract with the MPCA. In addition, any problems encountered should be documented, and plans for the next quarter need to be mentioned.

C2.3 Identify Responsible Organizations

Any serious QA problems needing immediate decisions will be discussed orally between MPCA personnel and contract staff, with such discussions denoted in writing; these problems will be noted in the quarterly reports to the GLNPO Project Officer.

The contractor will document QA procedures (e.g., data verification) conducted for the project as part of a technical memorandum to the MPCA documenting the database and spatial tools.
D  DATA VALIDATION AND USABILITY

D1  DATA REVIEW, VALIDATION, AND VERIFICATION REQUIREMENTS

D1.1  Purpose/Background

The purpose of this section is to state the criteria for deciding the degree to which each data item has met its quality specifications as described in Section B. The potential effect that each deviation from the QAPP may have on the usability of the associated data item, its contribution to the quality of the reduced and analyzed data, and its effect on the decision should be estimated.

D1.2  Data Reduction and Processing

Checks on data integrity evaluate the accuracy of “raw” data and include the comparison of important events and the duplicate rekeying of data to identify data entry errors.

Data reduction is an irreversible process that involves a loss of detail in the data and, for this project, will involve averaging across space (e.g., averaging results from analytical duplicates). Analytical results for sediment samples will be calculated and reported on a dry weight basis.

Any manipulations of the data (e.g., normalization of organic chemical data to TOC, comparisons of sediment chemistry data to Level I and Level II SQTs, or summary statistics of chemical parameters for different depth intervals) will be double-checked that the formulas were set up correctly.

D2  VALIDATION AND VERIFICATION METHODS

D2.1  Purpose/Background

The purpose of this section is to describe, in detail, the process for validating (determining if data satisfy QAPP-defined user requirements) and verifying (ensuring that conclusions can be correctly drawn) project data. The amount of data validated is directly related to the DQOs developed for the project.

D2.2  Process for Validating and Verifying Data

Since all of the sediment quality and fisheries data, as well as GIS-based watershed information, will come from other sources, it is beyond the scope of this project to validate all of these data. The MPCA have already validated data collected as part of their GLNPO and EPA grants of the past ten years (per the requirements of the respective QAPPs for each project).
For this project, the transfer of data to the GIS-based contaminated sediment database will be validated to ensure that no transcription errors are made. The MPCA Principal Investigator will respond to any contractor questions to verify the data.

D3 RECONCILIATION WITH DATA QUALITY OBJECTIVES

D3.1 Purpose/Background

The purpose of this section is to outline and specify, if possible, the acceptable methods for evaluating the results obtained from the project. This section includes scientific and statistical evaluations of data to determine if the data are of the right type, quantity, and quality to support their intended use.

D3.2 Reconciling Results with DQOs

Data quality assessment (DQA) follows the data validation and verification steps. As such, DQA determines how well the validated data can support their intended use. The MPCA Principal Investigator will evaluate the data to determine if it will meet the data quality objectives specified in Section A4.
E  REFERENCES


ASci Corporation. 1999. Summary of test results determining potential mercury, PAH and PCB bioaccumulation by *Lumbriculus variegatus* exposed to St. Louis Bay sediment samples. ASci Corporation, Duluth, MN.


Fredrickson, B. 1998. Proposal to designate the St. Louis River as an American Heritage River area. Minnesota Pollution Control Agency, Duluth, MN.


King, P. 1999a. Quality assurance project plan (QAPP): Analysis of sediment cores to assess toxaphene in the St. Louis River. Revision: 0. Environmental Outcomes Division, Minnesota Pollution Control Agency, St. Paul, MN.

King, P. 1999b. Lake Superior/Duluth-Superior Harbor toxics loading study. Environmental Outcomes Division, Minnesota Pollution Control Agency, St. Paul, MN.


MPCA. 1997a. Results of the 1995 St. Louis River Area of Concern Regional Environmental Monitoring and Assessment Program. Ten-day toxicity test reports with *Hyalella azteca* and *Chironomus tentans*. Monitoring and Assessment Section, Minnesota Pollution Control Agency, St. Paul, MN.

MPCA. 1997b. Results of the 1996 St. Louis River Area of Concern Regional Environmental Monitoring and Assessment Program. Ten-day toxicity test reports with *Hyalella azteca* and *Chironomus tentans*. Monitoring and Assessment Section, Minnesota Pollution Control Agency, St. Paul, MN.
MPCA and WDNR (Wisconsin Department of Natural Resources). 1992. The St. Louis River system remedial action plan. Stage One. Minnesota Pollution Control Agency, St. Paul, MN and Wisconsin Department of Natural Resources, Madison, WI.

MPCA and WDNR. 1995. The St. Louis River system remedial action plan. Progress report. Minnesota Pollution Control Agency, St. Paul, MN and Wisconsin Department of Natural Resources, Madison, WI.


USEPA. In preparation. Regional Environmental Monitoring and Assessment Program (R-EMAP) surveying, sampling, and testing: 1995 and 1996 sampling results. Office of Research and Development, U.S. Environmental Protection Agency, Duluth, MN.


APPENDIX A

SCREENING CRITERIA FOR BEDS/SEDTOX CO-OCCURRENCE DATA
APPENDIX A

SCREENING CRITERIA FOR BEDS/SEDTOX

CO-OCCURRENCE DATA
*Must be Present

Reference: ____________________________ Reference Number: ________________

1*. Does data set contain matching sediment chemistry and biological effects? (i.e., biological and chemical data collected from the same location at the same time)
   NO ____ UNACCEPTABLE
   YES ____ Page Reference(s):

2. What is the location of sampling site(s)? Collection Date? Page ref. for site description?

3. Freshwater ____ Estuarine ____ Marine ____ Salinity ___

I Sediment Chemistry
4*. Is there at least 1 non-toxic sample?
   NO ____ UNACCEPTABLE
   YES ____ Number of non-toxic: _____ Number of toxic: _____

5. Was bioassay conducted on unique ____ or composite ____ samples.
   Number of replicates? _____ Size of composite area? _______

6. What chemistry data has been collected? (i.e., metals, PAHs, pesticides, pH, DO, TOC...)
   Metals ____ PCBs ____ pH ____ TOC ____
   PAHs ____ Pesticides ____ DO ____ AVS ____

7. Are detection limits below the respective ERLs or TELs?
   NO ____ UNACCEPTABLE YES ____
8. Are total metal concentrations measured?
   NO ___ SEM metals may not be included.
   YES ___ SEM metals may be included.

9. Collection instrument ________________ ;   Sediment depth ________________.

10*. What type of sediment was used:
     Bulk Sediment ___ (Sediment with porewater)
     Porewater ___ (Extract porewater from sediments and expose water column species)
     Organic Extract ___ (Sediment extracted with organic solvent and expose liquid form) OTHER TOXICITY DATA ALSO NEEDED
     Elutriate ____ (Sediments with water, mixed, settled and exposed water column species) UNACCEPTABLE

11*. What type of toxicity test was conducted? Length of test? ______________________
     Static ___ (Water, sed-no change)
     Static Renewal ___ (Water, sed-some water change)
     Flow-Through ___ (Water, sed-water flowing through)

12*. Are appropriate analytical procedures used to determine total concentrations of the analytes in bulk sediment samples? What method(s) were used?
     (Metals: partial digestion, analysis of elutriates or extracts are unacceptable.)

13. Is a dilution series used?
    NO ___ YES ___ UNACCEPTABLE

14*. Are measured dry weight contaminant concentrations reported? Conversion from wet weight to dry weight concentration may occur ONLY if data on moisture or TOC are provided. Nominal concentrations are unacceptable.
    NO ___ UNACCEPTABLE    YES ___ Page reference(s):
II BIOEFFECTS

15*. Do toxicity tests employ appropriate laboratory procedures? (ASTM: E1367, E1611, E1706)
   NO ___ UNACCEPTABLE  YES ____

b Have the following been recorded during testing?
   Temperature ____;  pH ____;  Hardness ____;  Conductivity ____;
   Salinity ____;  DO ____;  Alkalinity ____;  Ammonia ____.

c Does DO Remain above 60% Needed for Marine
   40% Needed for Fresh Water
   NO ____ UNACCEPTABLE

d  Temperature______

e Is Temperature within natural range, fluctuate less then 3°C, and have a time weighted average
   within 1°C of selected temp?
   YES ____  NO ____  UNACCEPTABLE  Range__________

f Do Hardness, alkalinity, pH, or ammonia vary more than 50% (for freshwater samples)?
   NO ____  YES ____  UNACCEPTABLE
   Range:  DO __________;  Alk __________;  pH __________;  NH₃________

g Have Salinity levels in porewater been adjusted (for marine samples)?
   NO ____  YES ____  UNACCEPTABLE  Range__________

h List procedure reference(s) or brief details:

   _____________________________________________________________

16*. Were biological responses compared to the control ___ or reference ___ sites?
   List the Control and Reference sites?  Positive Control __________.
   reference = uncontaminated site within the same waterbody or watershed; control = uncontaminated site outside the
   tested water body

   _____________________________________________________________

17*. Have sediment samples used for biological testing been frozen?
   NO __________  YES ___ If yes both biological and chemical testing must be performed after
      thawing sediments.

b Have sediment samples been stored for more than eight (8) weeks prior to biological testing?
   NO ___ YES ___ UNACCEPTABLE
   What was the holding time? _____.
c  Are appropriate procedures used for collecting, handling, and storage of sediments?
NO ___ YES ___ List procedures reference(s) or brief details:

18. Identify species used in toxicity testing. Identify organism sources.

19. What life stage were the test species at the start of the test?
   (Hyalella azteca 7-14 day old; Chironomus tentans third-instar larvae; Chironomus riparius
   second instar or younger; Daphnia magna 5 days old; Ceriodaphnia dubia <24h old; Hexagenia
   spp. 3-4 months old; Tubifex tubifex adult; Diporeia spp. juveniles)

20. Organism acclimation time _______________.

21. What percentage of the control survived?
   Mean range ______
   70% for (Chironomus riparius, Chironomus tentans)
   80% for (Hexagenia spp., Daphnia magna, Ceriodaphnia dubia, Hyalella azteca)
   90% for (Diporeia spp., Tubifex tubifex, Polychaetous annelids, marine amphipods, others)
   NO ___ UNACCEPTABLE

22. Reference Samples
   Survival ______ %
   Conc. Less than TEL and ERLs? YES ___ NO ___
   Grain size ____, % sand ____, % silt ____, % clay _____

23. BENTHIC COMMUNITY ANALYSIS
   a  Is there a benthic community abundance analysis?
      NO ___ YES ___ List taxa (e.g., amphipod, sponges,...) Upon which the analysis focuses:

   b* Do each of the sites within a sampling area have the same general characteristics (i.e., same
      depth of overlying water, same salinity in overlying water, etc.)?
      NO ___ UNACCEPTABLE  YES ___ Briefly list details:
III  STATISTICAL ANALYSIS

24. Are appropriate statistical procedures reported?
   NO __     YES __     List procedure reference(s):

   ________________________________________________________________

Additional Notes/Comments:

   ________________________________________________________________

   ________________________________________________________________

   ________________________________________________________________
APPENDIX B

SCREENING CRITERIA FOR BEDS/SEDTOX SPIKED SEDIMENT BIOASSAY DATA
APPENDIX B

SCREENING CRITERIA FOR BEDS/SEDTOX
SPIKED SEDIMENT BIOASSAY DATA

*Must be Present

Reference: ____________________________ Reference Number: ______________

1*. Does data set contain matching sediment chemistry and biological effects (i.e., biological and chemical data collected from the same location at the same time).
   NO _____ UNACCEPTABLE
   YES _____ Page Reference(s):

2. What is the location of sampling site(s)? Collection Date?
   Page Ref. for site description?

3. Freshwater ____  Estuarine ____  Marine ____  Salinity ____

I Sediment Chemistry

4*. Is there at least 1 non-toxic sample?
   NO ____
   YES ____ Number of non-toxic: ____  Number of toxic: ____

5. Was bioassay conducted on unique ____ or composite ____ samples.
   Number of replicates? ____  Size of composite area?

6. What chemistry data has been collected? (i.e., metals, PAHs, pesticides, pH, DO, TOC...)
   Metals ____  PCBs ____  pH ____  TOC ____
   PAHs ____  Pesticides ____  DO ____  AVS ____

7. Are detection limits below the respective ERLs or TELs?
   NO ____  UNACCEPTABLE  YES ____
8. Are total metal concentrations measured?
   NO       SEM metals may not be included.
   YES       SEM metals may be included.

9. What are the conditions in the bioassay chamber? (i.e., TOC, AVS, Grain size, NH₃, and H₂S).
   TOC__; AVS__; Grain size__; NH₃__; H₂S__; Salinity__

10. Collection instrument ________________ ; Sediment depth ____________ ;

11*. What type of sediment was used:
    Bulk Sediment __
    (Sediment with porewater)
    Porewater __
    (Extract porewater from sediments )
    Organic Extract __
    (Sediment extracted with organic solvent and expose liquid form)
    Elutriate __
    (Sediments with water, mixed, settled and exposed water species)

12. What type of toxicity test was conducted?
    Static __ (Water, sed-no change)
    Static Renewal __ (Water, sed-some water change)
    Flow-Through __ (Water, sed-water flowing through)

13*. Are appropriate analytical procedures used to determine total concentrations of the analytes in bulk sediment samples? What method(s) were used?
    (Metals: partial digestion, analysis of elutriates or extracts are unacceptable.)

14*. Are measured dry weight contaminant concentrations reported? Conversion from wet weight to dry weight concentration may occur ONLY if data on moisture or TOC are provided. Nominal concentrations are unacceptable.
    NO __ UNACCEPTABLE       YES __ Page reference(s):

15*. Is the equilibrium adjustment period (i.e., time between spiking and initiation of the biological test) reported (24-h min. for metals; ~1-wk min. for organics)?
    NO __ UNACCEPTABLE       YES __ List details:
II BIOEFFECTS

16*. Do toxicity tests employ appropriate laboratory procedures? (ASTM: E1367, E1611, E1706).
   a. NO __ UNACCEPTABLE YES____
   b. Have the following been recorded during testing?
      Temperature ____;  pH ____;  Hardness ____;  Conductivity ____;  Salinity ____;  DO __
   c. Does DO Remain above 60% __ Needed for Marine 40% __ Needed for Freshwater NO __ UNACCEPTABLE
   d. Temperature ____
   e. Is temperature within natural range, fluctuate less then 3°C, and have a time weighted average within 1°C of selected temp?
      YES __ NO __ UNACCEPTABLE Range ____
   f. Do hardness, alkalinity, pH, or ammonia vary more than 50% (for freshwater samples)?
      NO __ YES ____ UNACCEPTABLE
      Range: DO ___________;  Alk ___________;  pH ___________;  NH₃ ___________
   g. Is Salinity within species tolerance (for marine samples)?
      YES __ NO __ UNACCEPTABLE Range ____
   h. List procedure reference(s) or brief details:

17*. Were biological responses compared to the control __ or reference __ sites?
   List the Control and Reference sites? Positive Control _____
   reference = uncontaminated site within the same waterbody or watershed; control = uncontaminated site outside the tested water body

18*. Have sediment samples used for biological testing been frozen?
   a. NO __ YES ____ If yes both biological and chemical testing must be performed after thawing sediments.
   b. Are appropriate procedures used for collecting, handling, and storage of sediments?
      NO __ YES ____ List procedures reference(s) or brief details:
19. Identify species used in toxicity testing. Source of Species?

20. What life stage were the test species at the start of the test? 
   (Hyalella azteca 7-14 day old; Chironomus tentans third-instar larvae; Chironomus riparius second instar or younger; 
   Daphnia magna 5 days old; Ceriodaphnia dubia <24h old; Hexagenia spp. 3-4 months old; Tubifex tubifex Adult; 
   Diporeia spp. juveniles)

21. Organism acclimation time ____________________

22*. What percentage of the control survived? 
   Mean range _____  
   70% for (Chironomus riparius, Chironomus tentans) 
   80% for (Hexagenia spp., Daphnia magna, Ceriodaphnia dubia, Hyalella azteca) 
   90% for (Diporeia spp., Tubifex tubifex, Polychaetous annelids, marine amphipods, others) 
   NO __ UNACCEPTABLE

23*. Reference samples 
   Survival _____ % 
   Conc. less than TEL and ERLs? YES ____ NO __
   Grain size ________; % sand ; % silt ; % clay __

24. BENTHIC COMMUNITY ANALYSIS 
   a Is there a benthic community abundance analysis? 
   NO __ YES __ List taxa (e.g., amphipod, sponges...) upon which the analysis focuses:

   b* Do each of the sites within a sampling area have the same general characteristics (i.e., same 
   depth of overlying water, same salinity in overlying water, etc.)? 
   NO __ UNACCEPTABLE YES __ Briefly list details:

25. Are end points (e.g., effects on embryonic development, early survival growth, reproduction, 
   adult survival, biomass, density, diversity, avoidance, lesions...) reported? 
   NO __
   YES ____ List endpoint(s):
III  STATISTICAL ANALYSIS
26. Are appropriate statistical procedures reported?
  NO __  YES __  List procedure reference(s):

Additional Notes/Comments:
APPENDIX C

MPCA GIS DATA CATALOG
GIS at MPCA

GIS Coordination and Planning

- Regional GIS Coordinators

GIS Training and Assistance

- Learn how to prepare your ArcView projects for the new servers
- MPCA ArcView GIS Users
- Certified Trainers in Minnesota
- ESRI Virtual Campus
- FAQ - Coming soon!

GIS Data
Two general themes emerged from the 1999 MPCA GIS Data Needs Assessment. The first was that MPCA GIS users want access to GIS data from a consistent central location, with clear and consistent file naming schemes and a standard coordinate system. The second was the overwhelming desire of MPCA staff to see, in geographic terms, everything the Agency knows about a particular area or site.

The following links are intended to keep staff up-to-date on GIS data availability within MPCA.

- GIS Data Available at MPCA
- Who is responsible for MPCA’s GIS layers?
- What GIS layers is MPCA developing?
- What GIS layers is MPCA getting from external sources?
- GIS Data Needs Assessment
- MPCA’s Spatial Data Storage Standards

This document was last updated March 26, 2000
MPCA, 520 Lafayette Road, St. Paul, MN 55155-4194
Phone: 651-296-6300, 800-657-3864; 24-hour emergency number: 651-649-5451 or 800-422-0798
TTY: 651-282-5332, TTY 24-hour emergency number: 651-297-5353 or 800-627-3529
# MPCA GIS Data Catalog

## Data Available on the MPCA GIS Data Server (U:)

As of January 13, 2000 data is available to St. Paul office. Work on replicating data to regional servers is in progress. For information on how to map U: to get to the GIS data server, go here.

## MPCA GIS Home

### MPCA Environmental Monitoring

<table>
<thead>
<tr>
<th>Layer Description</th>
<th>Layer Name</th>
<th>Tiling Scheme</th>
<th>Data Structure</th>
<th>Metadata</th>
</tr>
</thead>
<tbody>
<tr>
<td>305B Assessed Streams</td>
<td>305saln2</td>
<td>State</td>
<td>Shape file path = u:\samba_ac\shapelib\305saln2</td>
<td>Full</td>
</tr>
<tr>
<td>Ground Water Monitoring Stations</td>
<td>gwmsxpt3</td>
<td>State</td>
<td>No Library. Path = u:\samba_ac\pcalib\state\mn\gwmsxpt3</td>
<td>Full</td>
</tr>
</tbody>
</table>

### MPCA Sites

<table>
<thead>
<tr>
<th>Layer Description</th>
<th>Layer Name</th>
<th>Tiling Scheme</th>
<th>Data Structure</th>
<th>Metadata</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facilities</td>
<td>facilt2</td>
<td>State</td>
<td>No Library. Path = u:\samba_ac\pcalib\state\mn\facilt2</td>
<td>Full</td>
</tr>
</tbody>
</table>

### Scanned Maps and Imagery

<table>
<thead>
<tr>
<th>Layer Description</th>
<th>Layer Name</th>
<th>Tiling Scheme</th>
<th>Data Structure</th>
<th>Metadata</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital Orthophotos (State, 1991)</td>
<td></td>
<td>County</td>
<td>Files. St. Paul path example: u:\samba_ac\pcasdoq\o4809715.nwc On CD in regions</td>
<td>Full</td>
</tr>
<tr>
<td>Digital Orthophotos (7-County Metro, 1997)</td>
<td></td>
<td>County</td>
<td>Files. St. Paul path example: u:\samba_ac\pcamdooq\3834nw.tif Not available in Regional offices. Index shape file at u:\samba_ac\shapelib\qq7cipy4.shp</td>
<td>Full</td>
</tr>
<tr>
<td>1:24,000 Digital Raster Graphics (no collars)</td>
<td>drgncim3</td>
<td>Q024k</td>
<td>Files. St. Paul path example: u:\samba_ac\pcasdrg\q024k\q3834\drgncim3.tif On CD in Regions</td>
<td>Full-Lite</td>
</tr>
<tr>
<td>1:100,000 Digital Raster Graphics (no collars)</td>
<td>drgncim2</td>
<td>Q100k</td>
<td>Files. St. Paul path example: u:\samba_ac\pcasdrg\q100k\q3518\drgncim2 On CD in Regions</td>
<td>Full-Lite</td>
</tr>
<tr>
<td>1:250,000 Digital Raster Graphics (no collars)</td>
<td>drgncim1</td>
<td>Q250k</td>
<td>Files. St. Paul path example: u:\samba_ac\pcasdrg\q250k\q2758\drgncim1 On CD in Regions</td>
<td>Full-Lite</td>
</tr>
</tbody>
</table>
### Land Cover

<table>
<thead>
<tr>
<th>Layer Description</th>
<th>Layer Name</th>
<th>Tiling Scheme</th>
<th>Data Structure</th>
<th>Metadata</th>
</tr>
</thead>
<tbody>
<tr>
<td>International Coalition Land Use/Land Cover</td>
<td>lulcxy3</td>
<td>County, Q024k</td>
<td>Library</td>
<td>Full-Lite</td>
</tr>
<tr>
<td>Standardized 30m Land Cover</td>
<td>luc90ra3</td>
<td>State</td>
<td>Path name: u:\samba_ac\pcalib2\state\mn\indowrg3</td>
<td>Full-Lite</td>
</tr>
<tr>
<td>LandSat-Based Land Use-Land Cover (Raster)</td>
<td>lusatra3</td>
<td>County</td>
<td>Path example: u:\samba_ac\pcalib2\county\aitk\lusatra3</td>
<td>Full-Lite</td>
</tr>
<tr>
<td>LandSat-Based Land Use-Land Cover (Vector)</td>
<td>lusatpy3</td>
<td>County</td>
<td>No library. Path example: u:\samba_ac\pcalib2\county\aitk\lusatpy3</td>
<td>Full-Lite</td>
</tr>
<tr>
<td>Original Land Survey Bearing Trees</td>
<td>btreept3</td>
<td>County</td>
<td>Library</td>
<td>Full-Lite</td>
</tr>
<tr>
<td>PLS Corners with Presettlement Vegetation Information</td>
<td>btvegpt3</td>
<td>County</td>
<td>Library</td>
<td>Full-Lite</td>
</tr>
<tr>
<td>Presettlement Vegetation</td>
<td>prvegpy1</td>
<td>County, Q100k</td>
<td>Library</td>
<td>Full-Lite</td>
</tr>
</tbody>
</table>

### Hydrography

<table>
<thead>
<tr>
<th>Layer Description</th>
<th>Layer Name</th>
<th>Tiling Scheme</th>
<th>Data Structure</th>
<th>Metadata</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Watershed Index</td>
<td>wsh81ne3</td>
<td>State</td>
<td>Library</td>
<td>Full-Lite</td>
</tr>
<tr>
<td>Watershed Basins (1995)</td>
<td>bas95ne3</td>
<td>State, County, Q100k</td>
<td>Library</td>
<td>Full-Lite</td>
</tr>
<tr>
<td>National Wetlands Inventory Polygons</td>
<td>nwixxpy3</td>
<td>County, Q024k</td>
<td>Library</td>
<td>Full-Lite</td>
</tr>
<tr>
<td>National Wetlands Inventory Lines</td>
<td>nwixxln3</td>
<td>County</td>
<td>Library</td>
<td>Full-Lite</td>
</tr>
<tr>
<td>National Wetlands Inventory Points</td>
<td>nwixxpt3</td>
<td>County</td>
<td>Library</td>
<td>Full-Lite</td>
</tr>
<tr>
<td>DLG Lakes and Wetlands</td>
<td>dglkpy2</td>
<td>County</td>
<td>Library</td>
<td>Full-Lite</td>
</tr>
<tr>
<td>DLG Streams</td>
<td>dlgstln2</td>
<td>County</td>
<td>Library</td>
<td>Full-Lite</td>
</tr>
<tr>
<td>DNR 24K Lakes</td>
<td>dnrkpy3</td>
<td>Q024k</td>
<td>Library</td>
<td>Full-Lite</td>
</tr>
<tr>
<td>DNR 24K Streams</td>
<td>dnrstln3</td>
<td>Q024k</td>
<td>Library</td>
<td>Full - Lite</td>
</tr>
<tr>
<td>FEMA Floodways</td>
<td>fldwpy3</td>
<td>County</td>
<td>No library. Path examples: u:samba_ac\pca\lib\county\aitk\fldwpy3</td>
<td>Full - Lite</td>
</tr>
</tbody>
</table>

**Geology, Ground Water and Soils**

<table>
<thead>
<tr>
<th>Layer Description</th>
<th>Layer Name</th>
<th>Tiling Scheme</th>
<th>Data Structure</th>
<th>Metadata</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well Locations (CWI) - Calculated</td>
<td>wwpptcpt2</td>
<td>State</td>
<td>No Library. Path = u:samba_ac\pca\lib\state\mn\wwp(ptcpt2). Shape file also</td>
<td>Full</td>
</tr>
<tr>
<td>Well Locations (CWI) - Field Verified</td>
<td>wwpftpt3</td>
<td>State</td>
<td>No Library. Path = u:samba_ac\pca\lib\state\mn\wwpftpt3. Shape file also</td>
<td>Full</td>
</tr>
<tr>
<td>Well Locations (CWI) - Associated Tables</td>
<td>n/a</td>
<td>n/a</td>
<td>Path = u:samba_ac\tables\cwi</td>
<td>Info</td>
</tr>
<tr>
<td>Geomorphology</td>
<td>landfne2</td>
<td>County, Q100k</td>
<td>Library</td>
<td>Full - Lite</td>
</tr>
<tr>
<td>Geomorphology - Cartographic Arcs</td>
<td>landfln2</td>
<td>County</td>
<td>Library</td>
<td>Full - Lite</td>
</tr>
<tr>
<td>Ecological Classification System Subsections</td>
<td>ecssbne2</td>
<td>State</td>
<td>Library</td>
<td>Full - Lite</td>
</tr>
</tbody>
</table>

**Topography**

<table>
<thead>
<tr>
<th>Layer Description</th>
<th>Layer Name</th>
<th>Tiling Scheme</th>
<th>Data Structure</th>
<th>Metadata</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 Meter Digital Elevation Model</td>
<td>dem30im3</td>
<td>County</td>
<td>Grid. Path example: u:samba_ac\pca\lib\county\aitk\dem30im3</td>
<td>Full - Lite</td>
</tr>
<tr>
<td>1:250,000 Digital Elevation Model</td>
<td>dem25im1</td>
<td>State</td>
<td>Grid. Path example: u:samba_ac\pca\lib\state\mn\dem25im1</td>
<td>Full - Lite</td>
</tr>
<tr>
<td>Shaded Relief - 30m B/W (Grid)</td>
<td>shbw3im3</td>
<td>County</td>
<td>Grid. Path example: u:samba_ac\pca\lib\county\aitk\shbw3im3</td>
<td>Full - Lite</td>
</tr>
<tr>
<td>Shaded Relief - 30m B/W (TIF)</td>
<td>shbw3im3</td>
<td>County</td>
<td>Files: Path example: u:samba_ac\pca\lib\county\aitk\shbw39m3.tif</td>
<td>Full - Lite</td>
</tr>
<tr>
<td>Shaded Relief from 30m DEM (Grid)</td>
<td>shr30im3</td>
<td>County</td>
<td>Grid. Path example: u:samba_ac\pca\lib\county\aitk\shr30im3</td>
<td>Full - Lite</td>
</tr>
<tr>
<td>Shaded Relief from 30m DEM (TIF)</td>
<td>shr30im3</td>
<td>County</td>
<td>Files: Path example: u:samba_ac\pca\lib\county\aitk\shr30im3.tif</td>
<td>Full - Lite</td>
</tr>
</tbody>
</table>

**Transportation**

<table>
<thead>
<tr>
<th>Layer Description</th>
<th>Layer Name</th>
<th>Tiling Scheme</th>
<th>Data Structure</th>
<th>Metadata</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOT Roads</td>
<td>dotrdln3</td>
<td>County, Q100k</td>
<td>Library</td>
<td>Full - Lite</td>
</tr>
<tr>
<td>----------------</td>
<td>----------</td>
<td>---------------</td>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>County State-Aid Highways</td>
<td>aidrdrt3</td>
<td>Q100k</td>
<td>Library</td>
<td>Full - Lite</td>
</tr>
<tr>
<td>Interstate and Trunk Highways</td>
<td>majrdrt3</td>
<td>Q100k</td>
<td>Library</td>
<td>Full - Lite</td>
</tr>
<tr>
<td>DLG Roads</td>
<td>dlgrdln2</td>
<td>Q100k</td>
<td>Library</td>
<td>Full - Lite</td>
</tr>
</tbody>
</table>

**Control Back to top**

<table>
<thead>
<tr>
<th>Layer Description</th>
<th>Layer Name</th>
<th>Tiling Scheme</th>
<th>Data Structure</th>
<th>Metadata</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 1/2 Minute (24K) Quadrangle Index</td>
<td>q024ine4</td>
<td>State</td>
<td>Library</td>
<td>Full - Lite</td>
</tr>
<tr>
<td>1 by 1/2 Degree (100K) Quadrangle Index</td>
<td>q100ine4</td>
<td>State</td>
<td>Library</td>
<td>Full - Lite</td>
</tr>
<tr>
<td>2 by 1 Degree (250K) Quadrangle Index</td>
<td>q250ine4</td>
<td>State</td>
<td>Library</td>
<td>Full - Lite</td>
</tr>
</tbody>
</table>

**Public Land Survey Back to top**

<table>
<thead>
<tr>
<th>Layer Description</th>
<th>Layer Name</th>
<th>Tiling Scheme</th>
<th>Data Structure</th>
<th>Metadata</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section Level Public Land Survey</td>
<td>plsscne3</td>
<td>State, County, Q100k</td>
<td>Library</td>
<td>Full - Lite</td>
</tr>
<tr>
<td>PLS Township-Range Boundaries</td>
<td>twprgne3</td>
<td>State</td>
<td>Library</td>
<td>Full - Lite</td>
</tr>
<tr>
<td>Control Point Generated PLS</td>
<td>pls40ne3</td>
<td>County</td>
<td>No Library. Path example: u:samba_ac\pcalib2\county\aitk\pls40ne3</td>
<td>Full - Lite</td>
</tr>
<tr>
<td>Mathematically Divided PLS Sections</td>
<td>plsdvne2</td>
<td>County, Q100k</td>
<td>Library</td>
<td>Full - Lite</td>
</tr>
<tr>
<td>Public Land Survey Control Points</td>
<td>corrpt3</td>
<td>County</td>
<td>No Library. Path example: u:samba_ac\pcalib2\county\aitk\corrpt3</td>
<td>Full - Lite</td>
</tr>
</tbody>
</table>

**Administrative Features Back to top**

<table>
<thead>
<tr>
<th>Layer Description</th>
<th>Layer Name</th>
<th>Tiling Scheme</th>
<th>Data Structure</th>
<th>Metadata</th>
</tr>
</thead>
<tbody>
<tr>
<td>County Boundaries (hybrid)</td>
<td>ctybdne2</td>
<td>State</td>
<td>u:samba_ac\pcalib2\state\mn\ctybdne2</td>
<td>Full - Lite</td>
</tr>
<tr>
<td>Geographic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Names Information System

<table>
<thead>
<tr>
<th>Layer Description</th>
<th>Layer Name</th>
<th>Tiling Scheme</th>
<th>Data Structure</th>
<th>Metadata</th>
</tr>
</thead>
<tbody>
<tr>
<td>DNR Regions</td>
<td>dnrrgne2</td>
<td>State</td>
<td>Library</td>
<td>Full - Lite</td>
</tr>
<tr>
<td>DNR Scientific and Natural Areas</td>
<td>snaxxpy3</td>
<td>State</td>
<td>Library</td>
<td>Full - Lite</td>
</tr>
</tbody>
</table>

### Land Ownership

<table>
<thead>
<tr>
<th>Layer Description</th>
<th>Layer Name</th>
<th>Tiling Scheme</th>
<th>Data Structure</th>
<th>Metadata</th>
</tr>
</thead>
<tbody>
<tr>
<td>DNR Land Ownership</td>
<td>Indowrg3</td>
<td>County</td>
<td>No Library. Path example: u:samba_ac\pcalib2\county\aitk\Indowrg3</td>
<td>Full - Lite</td>
</tr>
<tr>
<td>GAP Stewardship (Dissolved)</td>
<td>gapdipy2</td>
<td>County</td>
<td>Library</td>
<td>Full - Lite</td>
</tr>
</tbody>
</table>

### Climate

<table>
<thead>
<tr>
<th>Layer Description</th>
<th>Layer Name</th>
<th>Tiling Scheme</th>
<th>Data Structure</th>
<th>Metadata</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precipitation Average (1961-1990)</td>
<td>mnprrng1</td>
<td>State</td>
<td>Library</td>
<td>Full - Lite</td>
</tr>
<tr>
<td>Temperature Average (1961-1990)</td>
<td>mntemng1</td>
<td>State</td>
<td>Library</td>
<td>Full - Lite</td>
</tr>
</tbody>
</table>

### Demographics

<table>
<thead>
<tr>
<th>Layer Description</th>
<th>Layer Name</th>
<th>Tiling Scheme</th>
<th>Data Structure</th>
<th>Metadata</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor Civil Divisions (Cities and Towns)</td>
<td>mcd90ne2</td>
<td>State</td>
<td>Library</td>
<td>Full - Lite</td>
</tr>
<tr>
<td>MCDs for Demographic Analysis</td>
<td>mcd90rg2</td>
<td>State</td>
<td>Library</td>
<td>Full - Lite</td>
</tr>
<tr>
<td>Legislative Boundaries</td>
<td>legisne2</td>
<td>State</td>
<td>Library</td>
<td>Full - Lite</td>
</tr>
<tr>
<td>Political Boundaries</td>
<td>politpy2</td>
<td>County</td>
<td>No Library. Path example: u:samba_ac\pcalib2\county\aitk\politypy2</td>
<td>Full - Lite</td>
</tr>
<tr>
<td>Census Blocks</td>
<td>blockpy2</td>
<td>County</td>
<td>No Library. Path example: u:samba_ac\pcalib2\county\aitk\blockpy2</td>
<td>Full - Lite</td>
</tr>
<tr>
<td>Census Block Centroids</td>
<td>blockpt2</td>
<td>County</td>
<td>No Library. Path example: u:samba_ac\pcalib2\county\aitk\blockpt2</td>
<td>Full - Lite</td>
</tr>
<tr>
<td>Census Block Groups</td>
<td>blgrpyp2</td>
<td>County</td>
<td>No Library. Path example: u:samba_ac\pcalib2\county\aitk\blgrpyp2</td>
<td>Full - Lite</td>
</tr>
<tr>
<td>Census Block Group Centroids</td>
<td>blgrppt2</td>
<td>County</td>
<td>No Library. Path example: u:samba_ac\pcalib2\county\aitk\blgrppt2</td>
<td>Full - Lite</td>
</tr>
</tbody>
</table>
Zero Population Blocks | bgzropy2 | County | No Library. Path example: u:\samba_ac\pcalib2\county\aitk\bgzropy2 | Full - Lite

What you need to know about the GIS data server...

Mapping to the GIS Data Server
To access MPCA's central GIS data resources you must complete the following steps. In the St. Paul office, map U: to the Unix file server (Path = "\sludge\gislib", Connect As = "samba", Password = "samba"). You will have to re-enter the password ("samba") each time you login. Instructions for regional offices comming.......

Document describing in detail how to map U: (currently just St. Paul office).

As of Jan. 3rd, 2000 we are in the process of replicating this data to the regional office servers where it will be housed on VOL2 under the gislib subdirectory. Regional office users will need to map U: to this area.

In order to use the Arc/Info "librarian" structure of these data sets within ArcView, you will need to run a script in ArcView to set three environment variables. (As of Jan. 3rd, 2000 this script was not part of the ArcView start up script in the network installation of ArcView.) The script should read as follows:

    System.SetEnvVar ("ARCHOME", "u:\samba_ac\arclib")
    System.SetEnvVar ("PCALIB2", "u:\samba_ac\pcalib2")
    System.SetEnvVar ("PCALIB1", "u:\samba_ac\pcalib1")

The Tiling schemes
Tiling schemes are ways of cutting up very large GIS layers into small chunks for easier data management and faster access and draw times. PCA uses several different tiling schemes, including the entire state as a tile, county tiles, 1:24,000 (7 1/2 minute) quadrangles tiles and 1:100K quadrangle tiles. Data that is in a "library" format may be accessed one tile at a time by adding a theme using a path to a single tile, or it can be accessed in as a "library" which allows the entire coverage to be added, but permits drawing off only the tiles you need using the "area of interest" tool.

The Data Structure
Data sets on the MPCA GIS data server exist in a variety of formats, all of which can be read from ArcView. These formats include Arc/Info coverages (that are often, but not always in "librarian" format), grids, and image formats (e.g. TIFs).

ArcView reads and uses an Arc/Info "coverage" in basically the same way it uses an ArcView shape file. However, when a GIS layer is in an Arc/Info "library" format, ArcView can employ some added functionality. Libraries allow ArcView users to add state-wide coverage of a data set as one theme but permit display of only a small portion of that theme by using the "area of interest" tool. Users can change their area of interest on the fly. To add a library layer as a theme, click on "libraries" instead of "directories" in the Add Theme dialog box. (Note: you must have environment variables mapped to see the libraries. See above.)

In some cases data is tiled but is not in librarian format. Thus no library layer is available. In such cases an example of a path to a tile is given (Aitken County is used as the example).

Grids and images can also be read directly from ArcView, but may require specific ArcView extensions.
"Shape file also" indicates that the layer is also available in ArcView shape file format under u:samba_ac\shapelib.

The Layer Names
Layer names for data sets housed on the MPCA GIS data server must follow the Minnesota DNR GIS Data Storage Standards. Under these standards, the first 5 letters of the layer name uniquely identify the theme, the next two letters identify the topology present, and the final character (a number) indicates the general scale class of the layer.

Topology codes are as follows:

<table>
<thead>
<tr>
<th>Topology Code</th>
<th>Topology</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>pt</td>
<td>point</td>
<td>Single point locations</td>
</tr>
<tr>
<td>ln</td>
<td>line</td>
<td>Line features</td>
</tr>
<tr>
<td>py</td>
<td>polygon</td>
<td>Area feature</td>
</tr>
<tr>
<td>ra</td>
<td>raster</td>
<td>Thematic raster data set</td>
</tr>
<tr>
<td>ne</td>
<td>network</td>
<td>Combinations of area and line features</td>
</tr>
<tr>
<td>lk</td>
<td>link</td>
<td>Combinations of line and point features</td>
</tr>
<tr>
<td>rg</td>
<td>regions</td>
<td>Arc/INFO regions data structure</td>
</tr>
<tr>
<td>rt</td>
<td>dynamic</td>
<td>Linear features georeferenced by distance</td>
</tr>
<tr>
<td></td>
<td>segmentation</td>
<td>along length</td>
</tr>
<tr>
<td>im</td>
<td>image</td>
<td>Non-thematic raster data sets (image files)</td>
</tr>
</tbody>
</table>

Scale Classes:

<table>
<thead>
<tr>
<th>Scale Range</th>
<th>Name</th>
<th>Scale Code</th>
<th>Application Type/Extent</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>400K-20000K</td>
<td>State</td>
<td>1</td>
<td>Statewide mapping of summary data</td>
<td>The most generalized and least (positionally) accurate data.</td>
</tr>
<tr>
<td>80K-400K</td>
<td>Planning</td>
<td>2</td>
<td>County Level Mapping County Level Planning Landscape Modeling</td>
<td>Very generalized. Not appropriate for locational measurement. Often includes simplified attribute schemes.</td>
</tr>
<tr>
<td>10K-80K</td>
<td>Resource</td>
<td>3</td>
<td>Watershed Planning Landscape Modeling</td>
<td>Moderately (positionally) accurate data. Locational measurement can be performed with caution.</td>
</tr>
<tr>
<td>&gt;10K</td>
<td>Site</td>
<td>4</td>
<td>Site-specific resource and facility management</td>
<td>The most (positionally) accurate data available.</td>
</tr>
</tbody>
</table>

The Metadata
Metadata is basically data about data. It is documentation that explains what is in a particular GIS layer, including the content, quality, accuracy, completeness and lineage. It should be used to determine if a layer is appropriate for a give use (e.g. is it accurate enough to analyze proximity to well heads within 50 ft.?).

MPCA GIS data sets **must** follow the Minnesota Geographic Metadata Guidelines. Because metadata is critical to determining the appropriate use of a GIS data set, GIS data should not be made available on MPCA's central data server **without accompanying metadata on this data catalog page**. "Full" metadata follows the Minnesota guidelines completely. "Lite" metadata, where available, includes only a subset of the full metadata guidelines.

Note: Much of the data on the MPCA GIS data server was copied from DNR in November of 1999. While the data is static as of that date, the metadata links point to metadata on DNR's Data Deli site which may be updated after that date to reflect changes to the data at DNR.
What GIS Data is MPCA Developing?

As a result of the 1999 GIS Data Needs Assessment, MPCA staff defined the GIS layers for which MPCA is the data steward. This page will keep MPCA staff up-to-date on the development status of these GIS layers and will indicate when layers are included in the MPCA Core GIS Data Repository.

For information about who is responsible for MPCA's GIS layers, go here.

For information on GIS layers from external sources go here.

<table>
<thead>
<tr>
<th>MPCA GIS Layers - Data Development Status</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>GIS Layer Name</td>
<td>Priority Score</td>
</tr>
<tr>
<td>305B Assessed Waters</td>
<td>63</td>
</tr>
<tr>
<td>Surface Water Monitoring Stations</td>
<td>59</td>
</tr>
<tr>
<td>Feedlots</td>
<td>45</td>
</tr>
<tr>
<td>Facilities</td>
<td>38</td>
</tr>
<tr>
<td>7050 Classified Waters</td>
<td>37</td>
</tr>
<tr>
<td>Remediation Sites</td>
<td>37</td>
</tr>
<tr>
<td>Surface Water Discharge Outfall Locations</td>
<td>34</td>
</tr>
<tr>
<td>Ground Water Monitoring Stations / Wells</td>
<td>34</td>
</tr>
<tr>
<td>Intermittent/Perennial Streams and Ditches</td>
<td>29</td>
</tr>
<tr>
<td>Leaking Petroleum Storage Tanks</td>
<td>21</td>
</tr>
<tr>
<td>Clean Water Partnership Project Sites</td>
<td>20</td>
</tr>
<tr>
<td>Biological Monitoring Sites</td>
<td>20</td>
</tr>
<tr>
<td>Stacks</td>
<td>20</td>
</tr>
<tr>
<td>Landfills / Solid Waste Facilities</td>
<td>19</td>
</tr>
<tr>
<td>Ambient Air Quality Monitoring Sites</td>
<td>17</td>
</tr>
<tr>
<td>Site Assessment &quot;Potential Sites&quot;</td>
<td>15</td>
</tr>
<tr>
<td>Drinking Water Intakes</td>
<td>8</td>
</tr>
<tr>
<td>Category</td>
<td>Notes</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Drinking Water Intakes</td>
<td>GIS layer exists, but with lower positional accuracy (generated from PLS geocodes and Sectic). No metadata.</td>
</tr>
<tr>
<td>Land Application Sites</td>
<td>Have PLS descriptions for roughly 25% of these. Should meet accuracy needs once converted to GIS. No metadata.</td>
</tr>
<tr>
<td>Spills</td>
<td>Emergency Response folks collect about 2500 locations per year. General coordinates exist for some, only county centroids for others. No metadata.</td>
</tr>
<tr>
<td>Registered Storage Tanks</td>
<td>No coordinate information in the database. Apparently GPS data exists.</td>
</tr>
</tbody>
</table>

* Weighted priorities are based on ranking first through fifth priorities of each of the respondents to the GIS data priorities survey. A complete description of this methodology can be found in Section 7 of the GIS Data Needs Assessment.

This document was last updated January 14, 2000
MPCA, 520 Lafayette Road, St. Paul, MN 55155-4194
Phone: 651-296-6300, 800-657-3864; 24-hour emergency number: 651-649-5451 or 800-422-0798
TTY: 651-282-5332, TTY 24-hour emergency number: 651-297-5353 or 800-627-3529
What GIS Data is MPCA Getting from External Sources?

As a result of the 1999 GIS Data Needs Assessment, MPCA staff defined the GIS layers they would like to have available, for which MPCA is not the data steward. Some of these desired GIS layers currently exist, while others do not. This page will keep MPCA staff up-to-date on the acquisition status of these GIS layers and will indicate when layers are included in the MPCA Core GIS Data Repository.

For information about who is responsible for MPCA's GIS layers, go [here](#).

For information on GIS layers developed by MPCA go [here](#).

<table>
<thead>
<tr>
<th>Non-MPCA GIS Layers - Needs Assessment Comments and Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Desired GIS Layer</strong></td>
</tr>
<tr>
<td>Buildings</td>
</tr>
<tr>
<td>Best Management Practices sites (BMPs)</td>
</tr>
<tr>
<td>Census Tracts</td>
</tr>
<tr>
<td>Cities and Civil Townships (MCDs)</td>
</tr>
<tr>
<td>Climatic data</td>
</tr>
<tr>
<td>Counties</td>
</tr>
<tr>
<td>Conservation Reserve Program (CRP) lands</td>
</tr>
<tr>
<td>DRGs</td>
</tr>
<tr>
<td>Ecoregions, Ecological Classification System</td>
</tr>
<tr>
<td>Elevation information, DEMs, Slope, Hypsography, &quot;Contours&quot;, Elevation benchmarks</td>
</tr>
<tr>
<td>Geology</td>
</tr>
<tr>
<td>Ground water data Aquifers</td>
</tr>
<tr>
<td>Dataset</td>
</tr>
<tr>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>Ground water model and data from Dept. of Defense</td>
</tr>
<tr>
<td>Ground Water Sensitivity, Ground Water Susceptibility</td>
</tr>
<tr>
<td>GDT Dynamap (sp?) 2000</td>
</tr>
<tr>
<td>Hydro, National Hydrographic Data Set (NHD)</td>
</tr>
<tr>
<td>Lakes</td>
</tr>
<tr>
<td>Lakesheds</td>
</tr>
<tr>
<td>Land Use</td>
</tr>
<tr>
<td>Land Use/Cover</td>
</tr>
<tr>
<td>LARS (Local Govt. Annual Reporting System)</td>
</tr>
<tr>
<td>Legislative Districts</td>
</tr>
<tr>
<td>Marchner Pre-settlement Vegetation.</td>
</tr>
<tr>
<td>Natural Heritage Sites, County Biologic Atlas</td>
</tr>
<tr>
<td>Parcels</td>
</tr>
<tr>
<td>Photography, DOQs, Air photos, Imagery, Satellite data</td>
</tr>
<tr>
<td>PLS</td>
</tr>
<tr>
<td>Protected Waters Inventory (PWI)</td>
</tr>
<tr>
<td>Public Water Supply (PWS)</td>
</tr>
<tr>
<td>River Miles</td>
</tr>
</tbody>
</table>
| Corps? | DOT data available on GIS data server (U:)
DOT
GDT
TLG

Want major highways, all other highways, township roads and even city streets. We have major highways now, would like all roads, or as many as we can get (e.g. township roads)
We need detailed city street layers in Nad83/UTM in order for us to do wellhead protection and emergency response work.
Interested in vehicle miles traveled data for understanding air pollution
Need up-to-date streets layer, with ALL streets for address matching and for general reference.

Satellite Imagery | Would like to have some multi-spectral satellite imagery

Sandborn (spelling) maps | These maps are on microfiche at PCA. They are historical maps of city features. Someday we’d like to have digital and rectified.

Sewered and unsewered communities | Rochester office was working on this for South district.

Socioeconomic | Would like various socioeconomic data, e.g. population trends, income, property values, etc.

Soils | Would like soils state-wide
Want soils data, hydrologic soils in particular

Storm water network | Would like storm water drainage network. This is probably municipal data

Springs | We have some spring locations data for 7-county metro area.

Tribal Lands | Tribes?
Some tribal boundaries are in legal dispute. This is a very complicated issue where often seek advice from the Attorney General’s office. Gery Blaha has worked with this issue and can provide some insight.

Water Flow gauging stations | USGS has water flow gauging stations and data for them. Carrie and Susanne Maed should know about these.
Also, DNR has flood warning gauges.

From Carol Sinden: USGS continuous record gauging station data are available, but staff here also need info/data on USGS partial record gauging stations, which I don't believe USGS has compiled location data for into a GIS format. We work with a 22 year old (1977) publication and do a lot of detective work to find data. We must access the partial record data through USGS staff or their ADAPS database, which few of us know how to use. We're working on getting some training on this.

Water level
Surface water levels | DNR Water Div.
Would like surface water level data that I think DNR has.

Water supply,
Public water supply | Health Dept.
Health has given us public water supply locations collected by address or just ZIP codes (see Paul Trapp for more info).

Watersheds | DNR
Avialable on GIS data server (U:)

Watershed Management Organization (WMO) boundaries | BWSR

Water Appropriation Permits, Water Appropriation Database, SWUDS Irrigation wells. | DNR (Jim Japs?)
Health (Bruce Olsen)
Would like data for irrigation wells. DNR regulates them. Contact there is Sean Hunsaker (6-509). This GIS data set tracks location and Unique well # for water appropriation permits (over million gallons per year). Derived points form TRSQQQ mostly. Shap file with 2 legend files.

Wetlands, NWI | DNR, LMIC, USFWS
Avialable on GIS data server (U:)

Wells, County Well Index, MPCA monitoring wells | County Well Index (CWI) developed by Dept. of Health in conjunction with Minnesota Geologic Survey (MGS).
Want county well index from actual county because it is usually significantly more up-to-date than the final MGS version (which is 1997).
<table>
<thead>
<tr>
<th>Wisconsin Data</th>
<th>Wisconsin</th>
<th>Would like watersheds, roads, cities (even small), counties.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZIP Codes</td>
<td>LMIC ?</td>
<td>Once projects end, where will the data go. We want access to it. Want to get the data we paid Mankato State to create. (note: Cis Berg and John Rongstedt are contacts there)</td>
</tr>
</tbody>
</table>

*This document was last updated January 14, 2000*

MPCA, 520 Lafayette Road, St. Paul, MN 55155-4194

Phone: 651-296-6300, 800-657-3864; 24-hour emergency number: 651-649-5451 or 800-422-0798

TTY: 651-282-5332, TTY 24-hour emergency number: 651-297-5353 or 800-627-3529
APPENDIX D

MINNESOTA PLANNING LAND MANAGEMENT INFORMATION CENTER
Land Management Information Center

The Land Management Information Center at Minnesota Planning offers services to improve the effective use of geographic information in Minnesota.

NEW

New GIS products: Epplviewer 2000 provides handy free software to view aerial photos and topographic maps; the Minnesota.data collection offers a wide range of geographic data sets.

- Preliminary results from the Minnesota GIS/LIS Consortium’s recent online survey of GIS data needs.
- Soils data: Find out what's available for Minnesota.
- Digital elevation data: Upgraded DEMs now available for entire state.
- Updated Hudson DRG: Download a file created from the revised topographic map.
- GeoGateway: Search regional data centers that distribute digital geographic data about Minnesota and neighboring regions.
- County orthophotos: Download county DOQs at 10-meter resolution.

SERVICES

- Coordination services: LMIC works with state, local and federal governments, professional associations, nonprofit organizations and the private sector to coordinate activities related to geographic information technology and data development.
- Data services: LMIC identifies data needs, promotes standards, develops and integrates data, serves as a state archive, provides geographic data to the public, and offers data, maps and other visualization services over the Internet.
- Project services: LMIC consults with clients to design and implement projects that use geographic information technology to meet mapping, analysis, planning and decision-making needs.
- Technology services: LMIC conducts research, development and evaluation of geographic information technology and promotes the transfer of effective geospatial technology in Minnesota.

COORDINATION SERVICES

Sharing data and expertise, and developing common standards through the Governor's Council on Geographic Information and other state and national groups.

- Governor's Council on Geographic Information: Looking for ways to improve Minnesota's geographic information through public policy and communication.
- Global coordination: Within Minnesota, the Land Management Information Center works with the MetroGIS, Minnesota GIS/LIS Consortium and Minnesota Information Policy Council. Nationally,
LMIC cooperates with the National States Geographic Information Council and other federal agencies.

- State's GIS profile: Read about the status of geographic information policy, technology and coordination in Minnesota in this comprehensive report prepared for the National States Geographic Information Council.
- County GIS contacts: Use these contacts to help find geographic information for each of Minnesota's 87 counties.

Back to top

DATA SERVICES

A single point of contact for geographic data, including data directories, interactive data searches and public access to data, maps and visualization services over the Internet.

- Geographic Data Clearinghouse: Find geographic data, much of it free online, browse data descriptions and document your own data.
- Minnesota Geographic Data Catalog 2000: Information about GIS data distributed by LMIC and other state and federal agencies.
- Datamnet: Explore an online information system containing socioeconomic data about Minnesota.
- Base maps for the 1990s: Learn about the status of new conventional and digital map products from the U.S. Geological Survey.
- Minnesota Land Use and Cover: Explore Minnesota's land development patterns through an interactive map.
- Standards for GIS users: Learn about tools for effective data documentation, sharing and use.

Back to top

PROJECT SERVICES

We will design a solution to fit your planning needs. Call for an estimate.

- GIS services: Learn about what the Project Services team has to offer you.
- Project examples: Explore some of our projects.
- Telephone exchange service area map: Order the June 2000 update with new area codes; download the free GIS files.
- County land use and cover maps: Order printed color wall maps from LMIC.

Back to top

TECHNOLOGY SERVICES

Tracking changes in geographic information technology and helping Minnesota use them effectively through EPPL7 and EPIC for Windows.

- EPPL7 for DOS: Examine this geographic information system for
the desktop computer.
- **EPIC for Windows**: Learn about a new Windows-based geographic information system for local planners.

Back to top

Land Management Information Center 651-296-1211
658 Cedar St. lmic@mnplan.state.mn.us
St. Paul, MN 55155 www.lmic.state.mn.us
APPENDIX E

MINNESOTA DEPARTMENT OF NATURAL RESOURCES
DATA DELI
Welcome to the Minnesota Department of Natural Resources GIS Data Deli, an internet-based spatial data acquisition site that allows users to download raw computer-readable data for use in their Geographic Information System (GIS), image processing system, or traditional database environment. The site includes links to extensive and summary level data descriptions (metadata) to support our users.

This site does not enable you to compose or view maps on-line. Visit the main DNR website for online mapping applications. To uncover additional GIS data, visit the Minnesota GeoGateway.

Note: The interactive portions of the site make extensive use of javascript and java so a version 4 browser, either Netscape Communicator/Navigator or Microsoft Internet Explorer, is required. One notable exception is Netscape Communicator 4.6 which has a broken java environment. Version 4.61 works fine.

To use the data present on this site, you must own or have rights to software that is capable of reading the data files. The data on this site is primarily targeted for ARCVIEW® and ARC/INFO® the most commonly used GIS software products in Minnesota. All users must have the capability to uncompress PKZIP format archives.

We hope that you find the site useful!

Contents © 1999. Minnesota Department of Natural Resources
questions@deli.dnr.state.mn.us
The GeoGateway lets you customize your search in four different areas:

- **Nodes**: Simultaneously search one or more data sources from around the state, region and country.
- **Keywords**: Enter up to four keywords or phrases to specify the type of data desired.
- **Location (optional)**: Identify the geographic area you are interested in by selecting from the menus or drawing on a map.
- **Time Period (optional)**: Specify the time period for the data you want.

The GeoGateway search returns titles of data sets that match your selection criteria. Each title links you to a detailed description of the data, called metadata, which includes the most important facts about the data and information on how to obtain a copy. Data often can be downloaded directly through the metadata.

To begin, click on the Nodes tab and set your search criteria. Review your work anytime by clicking on the View/Print tab.

This search engine is powered by MetaStar Gateway.
Data Deli Search Interface

MAP OPTIONS
- browse map
- select by county
  - 1:24,000 quad
- select by area/point

MAP CONTROLS
- zoom in
- pan
- zoom out
- state

THEME CATEGORIES
- All Layers

AVAILABLE LAYERS
- 100K DRGs Without Collars
- 1:250000 Scale Digital Elevation Model
- 24K DRGs Without Collars

HOME HELP METADATA STATUS

data deli
Contents © 1999, Minnesota Department of Natural Resources
METADATA INDEX (BY THEME CATEGORY)
This index page last updated on: 05/04/2001 12:50:30 PM
Index Contains 52 Layers

Control Administrative Features Public Land Survey Ownership Land Cover Hydrography
Topography Geology and Soils Transportation Facilities Land Imagery Scanned Maps

Control back to top

Public Land Survey (PLS) Control Points (cornrpt3) Full Lite
7 1/2 Minute Quadrangle Index (q024ine) Full Lite
1 by 1 Degree (100K) Quadrangle Index (q100ine) Full Lite
2 by 1 Degree (250K) Quadrangle Index (q250ine) Full Lite

Administrative Features back to top

Hybrid County Boundaries (ctybdne2) Full Lite
DNR Regions (dnrrgne2) Full Lite
MN DNR Scientific and Natural Areas (snaxxpy3) Full Lite
State Park Statutory Boundaries (stprkne3) Full Lite
Geographic Names (1999 Version) (gnisxpt3) Full Lite

Public Land Survey back to top

Control Point Generated PLS (pls40ne3) Full Lite
Section Level Public Land Survey (plsscne3) Full Lite
PLS Town-Range Boundaries (twprgne3) Full Lite

Ownership back to top

GAP Stewardship (Dissolved) (gapdipy2) Full Lite
GAP Stewardship (gapstpy2) Full Lite
DNR Land Ownership (lndowr3) Full Lite

Land Cover back to top

Original Land Survey Bearing Trees (breept3) Full Lite
PLS Corners with Presettlement Vegetation Information (btvegpt3) Full Lite
Common Forest Inventory (CSA) ShapePolys (ccsa1py3) Full Lite
Common Forest Inventory (CSA) (ccsa1rg3) Full Lite
Forest Inventory (csaxxpy3) Full Lite
International Coalition Land Use/Land Cover (lulcxpy3) Full Lite
LandSat-Based Land Use-Land Cover (Vector) (lusatpy3) Full Lite
LandSat-Based Land Use-Land Cover (Raster) (lusatra3) Full Lite
Presettlement Vegetation (prvegpy1) Full Lite

Hydrography back to top

Watershed Basins (1995) (bas95ne3) Full Lite
DLG Hydrography lake and wetland - polygons (dlgkpy2) Full Lite
DLG Streams (dlgstln2) Full Lite
DNR 24K Lakes (dnrlkpy3) Full Lite
DNR 24K Streams (dnrstln3) Full Lite
FEMA Floodways (flw Wynpy3) Full Lite
National Wetlands Inventory Lines (nwixxln3) Full Lite
National Wetlands Inventory Points (nwixxpt3) Full Lite
National Wetlands Inventory Polygons (nwixxpy3) Full Lite
Major Watershed Index (wshw3i3) Full Lite
Minnesota Watersheds (mnwshp3) Full Lite

Topography back to top

1:250,000 Scale Digital Elevation Model (dem25im1) Full Lite
30 Meter Digital Elevation Model (dem30im3) Full Lite
Metro Region Elevation Contours (hypsoln3) Full Lite
Metro Region Spot Elevations (hypsopt3) Full Lite

Geology and Soils back to top

Ecological Subsections of Minnesota (ecssbne2) Full Lite
Geomorphology of Minnesota - Cartographic Arcs (landfnn2) Full Lite
Geomorphology of Minnesota (landfne2) Full Lite
SSURGO Soils (surgopy3) Full Lite
Minnesota Aeromagnetic Data (aeromagx) Full Lite
Land Type Associations of Minnesota (ecsltpy2) Full Lite

Transportation back to top

County State-Aid Highways (aidhyrt3) Full Lite
DOT Roads (dotdln3) Full Lite
Interstates and Trunk Highways (majrdrt3) Full Lite

Facilities back to top

State Forest Roads (stfrdln4) Full Lite

Land Imagery back to top

USGS Digital Orthophoto Quad (DOQ) (doq03im4) Full Lite

Scanned Maps back to top

1:250,000 Digital Raster Graphic - Collars Removed (drgncim1) Full Lite
1:100,000 Digital Raster Graphic - Collars Removed (drgncim2) Full Lite
1:24,000 Digital Raster Graphic - Collars Removed (drgncim3) Full Lite
ArcView Resources

Welcome to the Minnesota Department of Natural Resource's ArcView GIS Resources WWW Page! This page was developed distribution of ArcView GIS Resources to DNR Staffers and to the general GIS public.

All of these resources are provided free of charge and accordingly, are not warranted for any specific use. We do strive to pro software tho' and we would appreciate any comments that you may have.

There are a number of resources available from this page. Select from the following links

- **ArcView Extensions**
  - Updated: 1/5/01
  - A Collection of DNR created or customized extensions to make life easier...

- **ArcView Field Guides and Training Materials**
  - Updated: 4/28/99
  - The Field Guide is a collection of ArcView Tip-Sheets that have been develop staffers. Training materials are available for classes and workshops developed personal.

- **Tim's Tips for ArcView**
  - New: 4/28/99
  - Tim's tips are short, 1 to 2 page, text articals covering a variety of helpful full Arc and tricks.

Currently, this page is being maintained by Tim Loesch, DNR MIS Bureau geek. If you have any comments or would like to c page please contact me at:

tim.loesch@dnr.state.mn.us
(612) 296-0654

---

DNR Information Center
500 Lafayette Road
St. Paul, MN 55155-4040
driving directions

Phone: 651-296-6157 or 888-MINNDNR
TTY: 651-296-5484 or 800-657-3929
For DNR Info: info@dnr.state.mn.us
Site Comments: webmaster@dnr.state.mn.us

Contents © 1996-2001 Minnesota Department of Natural Resources. All rights reserved.
APPENDIX F

VECTOR DATA AND RASTER DATA AVAILABLE FROM THE MINNESOTA DEPARTMENT OF NATURAL RESOURCES
Volume 1: Vector Data

ADMIN, BWCA Wilderness, 1999 (poly) ........................................ bwcawpy3
ADMIN, Communities (MCD), 1990 (poly) ........................................ mcd90py3
ADMIN, Counties (line and poly) .................................................. ctybdpy2
ADMIN, County Seats (point) ...................................................... ctysept2
ADMIN, DNR Administrative Regions (poly) ..................................... dnrrgpy2
ADMIN, DNR Fisheries Areas, 1997 (poly) ........................................ fiase7py2
ADMIN, DNR Forestry Areas, 1999 (poly) ......................................... dofarpy2
ADMIN, DNR State Forests, 1999 (poly) .......................................... stforsp3
ADMIN, DNR State Parks, 1999 (poly, point) ..................................... stprkp3
ADMIN, DNR Scientific and Natural Areas, 1999 (poly) ....................... snaxxy3p
ADMIN, DNR Waters Areas (poly) ................................................ dwarpy1
ADMIN, DNR Wildlife Admin Areas, 1997 (poly, line) ......................... wia97py2
ADMIN, Geographic Names Information System (USGS) ...................... gnis_py3
ADMIN, Legislative Districts, 1990 (poly and line) .......................... legispy2
ADMIN, National Forests, 1999 (poly) .......................................... nitfors3
ADMIN, National Wildlife Refuges, 1999 (poly) ............................... nwrxxy3p
ADMIN, USGS 1:24K quads (poly) ............................................... q24qpy4
ADMIN, USGS 1 degree quads (poly) ............................................ q1degpy4
ADMIN, USGS 1:100K quads (poly) ............................................. q100qpy4
ADMIN, USGS 1:250K quads (poly) ............................................. q250qpy4
ADMIN, State Boundary ............................................................... statepy2
ADMIN, USFWS Waterfowl Production Areas (poly) .......................... wpabdp2
ADMIN, Voyagers National Park, 1999 (poly) ................................... vopnpy2
APRI, Conservation Reserve Program, 1997 (poly) ............................. crp97py3
CENSUS, Populated Places, GNIS (point) ...................................... plpxpt3
ECO, ECS Subsections, 1999 (poly) .............................................. ecssbpy2
ECS, Marschener Original Vegetation (DNR) (poly) ........................... prvepgyp
GAP, Stewardship by Admin Agency, 1999 (poly) ............................. gapdpy2
GEOL, Geomorphology of Minnesota (DNR), 1996 ............................. landfpy3
HYDRO, Lakes, USGS 100K DLG (line and poly) .............................. dlgldkln2
HYDRO, Major Watersheds, 1995 (BAS95PY2) (poly, line) ................... whs81py3
HYDRO, Major Rivers (USGS 100K) (line) ..................................... riverln2
HYDRO, Streams, USGS DLG 100K (line) ...................................... digstln2
HYDRO, Watershed Basins, 1995 (poly) ........................................ bas95py3
LINE, Airport Runways (MNDOT), 1999 (line) .................................. airptln3
LINE, Pipelines (MNDOT), 1999 (line) .......................................... pipeeln2
LINE, Railroads (MNDOT), 1999 (line) ........................................... railrln3
PLS, Sections (poly, line, point) ................................................ plescyp3
PLS, Townships (poly, line) ....................................................... twprgyp3
RESERVATION, American Indian, 1999 (poly) ................................ resergr3
RESERVATION, Military, Federal, 1999 (poly) ................................ milipty3
ROAD, City Streets (MNDOT), 1997 (line) ..................................... mdcrldn3
ROAD, County Roads (MNDOT), 1997 (line) ................................... ctyrdn3
ROAD, Federal and State Highways (MNDOT), 1997 (line) .................... mjdrldn3
ROAD, Ramps and access (MNDOT), 1997 (line) ............................... rmpcldn3
ROAD, State Forest (DNR), 2000 (line) ........................................... strdfny3
ROAD, Township Roads (MNDOT), 1997 (line) ................................ trpldln3
SOIL, Cumming & Grygal Soils and Lands (UM) (poly) ...................... cumgrpy1
SOIL, STATSGO Soils (USDA) (poly) ............................................. stsgrysp
WELL, County Well Index (MGS), 1999 ........................................... cvixxpt3

Volume 2: Raster Data

GEOL, Shaded Relief from 1:24K ................................................... shr30im3
GEOL, Digital Elevation Model, 1:24K .......................................... dem30im3
LAND, Land Use (DNR 8-class composite), 1990 .............................. luc90ra3
NWI, MN Wetlands Poster reclassification ................................... mniwtetra3
NWI, Circular 39 reclassification ............................................... nwic39ra3
NWI, Base (raw) classification.................................................... nwicora3
APPENDIX G

MPCA SPATIAL DATA STORAGE STANDARDS
MPCA Spatial Data Storage Standards

This Spatial Data Storage Standards document describes specifications and procedures for storing spatial data within the Minnesota Pollution Control Agency. Its purpose is to define a consistent storage framework that will allow easy use of MPCA's spatial data by a variety of users with a variety of applications and spatial data needs. This document is not a data collection standard. It does provide specifications for documenting the collection of spatial data, but does not dictate any specific collection methods. Data collection methods should be defined based on MPCA positional accuracy needs as well as available staffing and financial resources.

At present (version 2.0) this document provides specifications for a standard coordinate system and datum, procedures for storing point data vs. line and polygon data, and coding specifications for point data (e.g. Delta). Eventually a more detailed set of data storage standards should be developed along the lines of the Department of Natural Resources' GIS Data Storage Standards (Ver. 4.2, March 1, 1999).

Notes:

- This document is in draft form, pending the final approval of EPA's Latitude/Longitude Data Standard (from which many of the codes in this standard are derived).
- This document is the result of an Agency wide review process in September and October of 1999.

This document was last updated March 13, 2000
MPCA, 520 Lafayette Road, St. Paul, MN 55155-4194
Phone: 651-296-6300, 800-657-3864; 24-hour emergency number: 651-649-5451 or 800-422-0798
TTY: 651-282-5332, TTY 24-hour emergency number: 651-297-5355 or 800-627-3529
Spatial Data Storage Standards

Minnesota Pollution Control Agency

Draft Version 2.0

January 14, 1999

Notes:
- This document is in draft form, pending the final approval of EPA's Latitude/Longitude Data Standard (from which many of the codes in this standard are derived).
- This document is the result of an Agency wide review process in September and October of 1999.

Replaces
Locational Data Policy
Information Coding Standards
Version 1.0, April 2nd, 1996
Acknowledgements

This document has been developed based on three principal sources, the EPA’s Latitude/Longitude Data Standard (in preliminary approval as of January 12, 2000); MPCA’s Locational Data Policy, Information Coding Standards (Version 1.0, April 2, 1996, which is base on an EPA standard), and the DNR’s GIS Data Storage Standards (Version 2.4, March 1, 1999). Additionally, a variety of input for this document has been received from MPCA GIS staff and the MPCA Data Administrator’s Work Group. Maintenance of this document is the responsibility of the MPCA GIS Database Administrator.
# Table of Contents

<table>
<thead>
<tr>
<th>Section 1:</th>
<th>Introduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section 2:</td>
<td>Standard Coordinate Scheme</td>
</tr>
<tr>
<td>Section 3:</td>
<td>GIS vs. Non-GIS Data Storage Formats</td>
</tr>
<tr>
<td>Section 4:</td>
<td>Metadata</td>
</tr>
<tr>
<td>Section 5:</td>
<td>Coding Specifications for Locational Data Bases</td>
</tr>
</tbody>
</table>
1.0 Introduction

What is this document?
This document is intended to describe specifications and procedures for storing spatial data within the Minnesota Pollution Control Agency. Its purpose is to define a consistent storage framework that will allow easy use of MPCA’s spatial data by a variety of users with a variety of applications and spatial data needs. This document is not a data collection standard. It does provide specifications for documenting the collection of spatial data, but does not dictate any specific collection methods. Data collection methods should be defined based on MPCA positional accuracy needs as well as available staffing and financial resources.

At present (version 2.0) this document provides specifications for a standard coordinate system and datum, procedures for storing point data vs. line and polygon data, and coding specifications for point data (e.g. Delta). Eventually a more detailed set of data storage standards should be developed along the lines of the Department of Natural Resources’ GIS Data Storage Standards (Ver. 4.2, March 1, 1999).

How is it different than the 1996 MPCA Locational Data Policy (LDP)?
The 1996 Locational Data Policy was developed primarily to be used with Project DELTA. Thus it focussed primarily on storing data in tabular (non-GIS) data base formats. The 1996 LDP borrowed heavily from the EPA’s locational data policy. At that time, Agency spatial data sharing efforts focussed mainly on MPCA’s reporting requirements to EPA. Additionally, the 1996 LDP was written at a time when MPCA had no central GIS data or staff.

The 1999 Spatial Data Storage Standards were developed to be used with all MPCA spatial data. While the primary focus of spatial data now involves GIS formats, tabular (non-GIS) formats of spatial data are also addressed within these standards, and Delta is still an important focal point. The 1999 standards borrow from the 1996 LDP as well as existing official state standards and guidelines and the DNR’s GIS Data Storage Standards. Additionally, data sharing efforts have changed from having a primary focus on EPA to having a primary focus on MPCA staff, other state agencies and the Minnesota GIS community as a whole, with EPA being a secondary focus. These standards were developed in conjunction with central GIS staff as part of an agency-wide spatial data management plan.
2.0 Standard Coordinate Scheme

The standard coordinate scheme for storing geographic coordinates within MPCA will be as follows:

Coordinate system: UTM zone 15 (extended)
Datum: North American Datum of 1983 (NAD83)
Spheroid: GRS1980
Units: Meters

GIS data sets should be stored in “double precision” (a term referring to the amount of space the software allows for storing each coordinate).

The UTM coordinate scheme is basically the de-facto coordinate scheme for all state agencies in Minnesota. Additionally, it has been officially sanctioned as a standard for GIS data exchange among state agencies (IRM Standard 17, Version 1, http://www.ot.state.mn.us/ot_files/handbook/standard/std17-1.html).

Latitude/Longitude:
Because MPCA must report data to EPA in latitude/longitude coordinates, some databases and applications may benefit from including functions that can convert coordinates on the fly. It may also be beneficial to store coordinates in lat/long in addition to UTM. Lat/long coordinates should be stored in decimal degree format and not degrees, minutes, seconds.

Note on WGS84:
WGS84 is a world wide datum. NAD83 was basically adopted as the North American portion of WGS84. While minute differences exist between the two, for purposes of GPS data collection at MPCA, the two can be used interchangeably. However, it is preferred that GPS data be collected using NAD83 to reduce confusion.
3.0 GIS vs. Non-GIS Data Storage Formats

In addition to raster data, geographic data sets have traditionally been stored in three different topological structures; points, lines and polygons. Current technology allows the storage of GIS data in more sophisticated structures. Some examples within ESRI’s software environment include networks, regions and TINs. For the most part, GIS technology has optimized the functionality of these data structures to the point that they are no longer of any practical use in a traditional tabular database. The only exception to this is simple point data.

Because of this, all MPCA spatial data that does not represent simple points (e.g. lines and polygons), should be stored only in GIS format. This is a change from the earlier point and line storage capabilities of Delta (which were never used). Attribute information, of course, may be stored in any format desired.
4.0 Metadata

What is Metadata?
Metadata literally means data about data. This type of database documentation may explain things such as the source, currency or quality of a data set. Metadata helps people using geographic information determine if a data set meets their needs or is appropriate for a particular use. Because of this, metadata is an important component of any data sharing effort, but it can also greatly benefit the data producing organization. For example, as personnel change, undocumented data may lose their value. New staff may have little understanding of the contents of and uses for a data set and may find they cannot trust results generated from these data. Additionally, a lack of knowledge about a data set may lead to duplication of effort. Good metadata will increase the value of a data set and give users of the data the knowledge to determine if they are using the data appropriately.

What are the Minnesota Geographic Metadata Guidelines?
In 1995 the GIS Standards Committee of the Minnesota Governor’s Council on Geographic Information (GC) began developing a set of metadata guidelines. The "Minnesota Geographic Metadata Guidelines" were based on the Content Standards for Digital Geospatial Metadata developed by the Federal Geographic Data Committee (FGDC). The GC Standards Committee; however, attempted to simplify the federal standard somewhat in an effort to meet the needs of Minnesota’s GIS community. Many users had expressed a concern that the federal standard was too complicated and difficult to implement. The GC GIS Standards Committee has since conducted several workshops and obtained considerable feedback on the Minnesota Guidelines. These guidelines have been officially sanctioned by the state (IRM Guideline 17-1.2).

The Guidelines consist of seven sections:

1. Identification Information
2. Data Quality Information
3. Spatial Data Organization Information
4. Spatial Reference Information
5. Entity and Attribute Information
6. Distribution Information
7. Metadata Reference Information

Who’s Responsibility is Metadata?
For any given data set, the creation of metadata is ultimately the responsibility of the data steward. However, in practice it is a joint effort involving those with knowledge of the data (subject matter experts), the MPCA program data base administrator, and MPCA’s GIS data base administrator. The GIS Data base administrator is responsible for providing training and guidance to those who wish to create MGMG compliant metadata. Software tools and educational handouts exist to aid metadata developers. These can be obtained from the GIS DBA. The content of the metadata, however, must come from the data steward and other subject matter experts.
5.0 Coding Specifications for Data Bases with Coordinates

In order to determine if a particular data set is suitable for a particular use, one must understand something about the source of the data and its accuracy. Since locational data within MPCA may be collected by many people using many collection methods, a number of data descriptor fields have been developed to help keep track of the source and quality of MPCA’s locational data. Following are guidelines for fields that should be used for this purpose. They apply to both data sets in GIS format (ArcView “shape” files and ArcInfo “coverages” as well as data sets that are not in GIS format (e.g. Delta).

These descriptive fields are extremely important when data collection or editing is being done by a variety of people or MPCA programs. However, even for data sets with only one data collector or editor, the fields are still important if a number of data collection methods exist. For complete databases with a uniform data collection methods, it is not necessary to include all of these fields if full MGMG compliant metadata (see Section 4) is available for the data set.

Note that future implementation of ESRI’s Spatial Database Engine (SDE) and Oracle’s Spatial Data Cartridge may cause us to modify these fields in some manner.

**Coding Specification for Data Bases with Coordinates**

1. X Coordinate
2. Y Coordinate
3. Horizontal Datum
4. Point Description (Optional)
5. Method of Coordinate Collection
6. Source Scale Denominator (Conditional)
7. Date Of Coordinate Collection
8. Date of Coordinate Collection Qualifier
9. Coordinate Source Type (Optional)
10. Coordinate Source Organization (Optional)
11. MPCA Program Area Code
12. Vertical Measure (Elevation) (Optional)
13. Vertical Datum (Conditional)
14. Vertical Measure Method (Conditional)
Name: X Coordinate  
(EPA Equivalent = Longitude Measure)

Definition: The value for the X coordinate (easting) in UTM Zone 15, NAD83, meters.

Datatype: Delta = NUMBER (10, 4)  
ESRI Covers & Shape Files = Double Precision

Notes: The number of significant digits provided in the coordinate value is NOT an indication of the positional accuracy of the coordinate.

Values: For Minnesota, the X coordinate will range from roughly 180,000 to 770,000

Name: Y Coordinate  
(EPA Equivalent = Latitude Measure)

Definition: The value for the Y coordinate (northing) in UTM Zone 15, NAD83, meters.

Datatype: NUMBER (11,4)  
ESRI Covers & Shape Files = Double Precision

Notes: The number of significant digits provided in the coordinate value is NOT an indication of the positional accuracy of the coordinate.

Values: For Minnesota, the Y coordinate will range from roughly 4,800,000 to 5,500,000
Name: **Horizontal Datum**  
(EPA Equivalent = Horizontal Reference Datum Name (or Code))

**Definition:** The reference system used for defining the coordinates.

**Datatype:** CHAR (12)

**Notes:** For WGS84, enter the value of NAD83 in North America

**Values:**
- “NAD27”
- “NAD83”
- “NAD83 (96)” (note: this is the HARN)  
  Note: new datums will become available in the future (e.g. terrestrial datum, etc.)

Name: **Point Description**  
(EPA Equivalents = Location Comments Text (which is a free text field)  
Also note: Reference Point Text (or Code) (which has a fixed domain and is slightly different))

**Definition:** Free-form text providing a brief description of exactly what this point coordinate represents.

**Datatype:** CHAR (50)

**Notes:** Optional but recommended

**Values:** Free text, examples include:
- “At entrance to Site driveway from County Road 18”
- “NE corner of site property”
Name: Method of Coordinate Collection
(EPA Equivalent = Horizontal Collection Method Text (or Code))

Definition: The code describing the original method used to collect the coordinates. This represents the primary source of the data.

Datatype: CHAR (4)

Notes: Delta derives a positional accuracy rating for a few collection method/map scale combinations. It doesn’t store this information, it just calculates on the fly for display.

Positional Accuracy:
NOTE: We do not have an element that describes horizontal positional accuracy. Our idea was to be able to derive it from the collection method, since it is not realistic to expect that everyone entering data into Delta will be capable of accurately entering an estimate of horizontal positional accuracy.

Note: Where codes are missing, those element values do not appear in that standard.

<table>
<thead>
<tr>
<th>Original Delta Code</th>
<th>Proposed EPA Standard Code</th>
<th>Proposed MPCA Standard Code</th>
<th>Value</th>
<th>Note: These values will need to be synchronized with EPA Latitude/Longitude Data Standard when it is finalized. In order to allow more detail, we have added a forth character to the MPCA code. We are able to map them back to the EPA codes. EPA codes can be found at <a href="http://www.epa.gov/6706/edrdq/drap/PVDISPERMISSIBLE_VALUE_VW_QUERYLIST?P_VD_ID=227&amp;P_RECORD_TYPE_CD=VD&amp;Z_START=1&amp;Z_ACTION=Begin+Search">http://www.epa.gov/6706/edrdq/drap/PVDISPERMISSIBLE_VALUE_VW_QUERYLIST?P_VD_ID=227&amp;P_RECORD_TYPE_CD=VD&amp;Z_START=1&amp;Z_ACTION=Begin+Search</a></th>
</tr>
</thead>
<tbody>
<tr>
<td>COORD_COLL_CENTRAL METH</td>
<td>COORD_COLL_CENTRAL METH EPA</td>
<td>COORD_COLL_CENTRAL METH MPCA</td>
<td></td>
<td>Values denoted with a strikethrough are being eliminated from the MPCA standard even though they appear in the preliminary EPA standard, because it is unclear what the code means. EPA has not provided any code definitions with its preliminary standard.</td>
</tr>
<tr>
<td>A1 001 0010 Address Matching – House/Building Number</td>
<td>001 0010 Address Matching – House/Building Number</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A3 003 0030 Address Matching – Street Centerline Address Range</td>
<td>003 0030 Address Matching – Street Centerline Address Range</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A4 004 0040 Address Matching – Nearest Intersection of Roads</td>
<td>004 0040 Address Matching – Nearest Intersection of Roads</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2 002 Address Matching – Block Face</td>
<td>002 Address Matching – Block Face</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A5 005 Address Matching – Primary Name</td>
<td>005 Address Matching – Primary Name</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A6 006 Address Matching – Digitized</td>
<td>006 Address Matching – Digitized</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>007 0070 Address Matching – Other</td>
<td>007 0071 Address Matching – Other</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Z1 026 0260 ZIP Code Centroid</td>
<td>026 0260 ZIP Code Centroid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>038 0380 ZIP+2 Centroid</td>
<td>038 0380 ZIP+2 Centroid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>037 0370 ZIP+4 Centroid</td>
<td>037 0370 ZIP+4 Centroid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C1 008 0080 Census – Block 1990 Centroid</td>
<td>008 0080 Census – Block 1990 Centroid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C2 009 0090 Census – Block Group 1990 Centroid</td>
<td>009 0090 Census – Block Group 1990 Centroid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C3 010 0100 Census – Block Tract 1990 Centroid</td>
<td>010 0100 Census – Block Tract 1990 Centroid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 011 0110 Census – Other</td>
<td>011 0110 Census – Other</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>030</td>
<td>0300</td>
<td>Interpolation – Digital Map Source (TIGER)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----</td>
<td>-----</td>
<td>------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>030</td>
<td>0301</td>
<td>Interpolation – Digital Map Source - USGS 1:24,000 DRG (Digital Raster Graphic)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I3</td>
<td>020</td>
<td>Interpolation – Satellite Imagery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>032</td>
<td>0320</td>
<td>Interpolation – MSS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>031</td>
<td>0310</td>
<td>Interpolation – SPOT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>033</td>
<td>0330</td>
<td>Interpolation – TM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I2</td>
<td>019</td>
<td>Interpolation – Photo</td>
<td></td>
<td></td>
</tr>
<tr>
<td>019</td>
<td>0190</td>
<td>Interpolation – Photo - 1991 USGS DOQ (Digital Orthophoto Quad)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>019</td>
<td>0191</td>
<td>Interpolation – Photo - 1997 Met. Council DOQQ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I1</td>
<td>018</td>
<td>Interpolation – Map</td>
<td></td>
<td></td>
</tr>
<tr>
<td>018</td>
<td>0180</td>
<td>Interpolation – Map USGS 1:24,000 DRG (Digital Raster Graphic)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I1</td>
<td>018</td>
<td>Interpolation – Map USGS 1:100,000 DRG (Digital Raster Graphic)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IO</td>
<td>021</td>
<td>Interpolation – Other</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| 024 | 0240 | Public Land Survey - Section |
| P1  | 023  | Public Land Survey – Quarter Section |
| 034 | 0340 | Public Land Survey – Eight Section |
| 035 | 0350 | Public Land Survey – Sixteenth Section |

| L1  | 022  | Loran-C |
| 025 | 0250 | Classical Surveying Techniques |
| 013 | 0130 | GPS Carrier Phase Kinematic Relative Position |
| 012 | 0120 | GPS Carrier Phase Static Relative Position |
| 014 | 0140 | GPS Code (Pseudo Range) Differential |
| 015 | 0150 | GPS Code (Pseudo Range) Precise Position |
| 016 | 0160 | GPS Code (Pseudo Range) Standard Position (SA Off) |
| 017 | 0170 | GPS Code (Pseudo Range) Standard Position (SA On) |
| 029 | 0290 | GPS, with Canadian Active Control System |
| 028 | 0280 | GPS – Unspecified |

| 027 | 0270 | Unknown |
Name: Source Scale Denominator
(EPA Equivalent = Source Map Scale Number)
(FGDC Equivalent = Source Scale Denominator)

Definition: The denominator of the representative fraction of the source map scale. (For example, on a 1:24,000-scale map, the Source Scale Denominator is 24000.)

Datatype: INTEGER (7)

Notes: Mandatory if source is hard-copy. Should not be used if source was a digital product, unless the on-screen scale is collected for each point in heads up digitizing – and – the on-screen scale does not exceed the nominal scale and resolution capabilities of the source data set.

Values: Examples:
“24000” – for a 1:24,000 paper quad map
“1200” – for “100 scale” map (1 inch = 100 feet, or 1:1200)
Name: Date of Coordinate Collection  
(EPA Equivalent = Data Collection Date)

Definition: The date on which, to the best of the Agency’s knowledge, the coordinates were obtained. (note: need clarification w/ EPA standard as to data capture date versus data content date).

Datatype: Y2K COMPLIANT DATE FORMAT  
Note: Some data base software products support specific data formats while others do not. For example, Oracle uses a MMDDYYYY format for its DATE field type. These formats may differ from one software product to another. For this reason, no specific date format is mandated in this standard. The format must be Y2K compliant however. When using a software product that does not support a specific date format, the YYYYMMDD format should be used. This is a standard followed by EPA, FGDC and other prominent organizations.

Notes: For Delta, a “dummy date” will not be adopted. At a minimum, a year should be provided and the month and day may be entered as “01”. Delta assumes all two-digit years entered are in the current century. That is, 4/6/97 may be entered to represent a collection date of April 6, 1997. From the date 01/01/2000 forward, data collected in the 20th century (1900s) must be entered as YYYY rather than YY so the system does not default to a 21st century date.

Values:  
Year (Y) >=1900  
Month (M) 01-12  
Day (D) 01-31

Name: Date of Coordinate Collection Qualifier  
No EPA equivalent

Definition: A code indicating the level of precision the Agency ascribes to the Date of Coordinate Collection.

Datatype: CHAR (2)

Notes: For Delta, no value will be defaulted into the Date of Coordinate Collection Qualifier.

Values:  
<table>
<thead>
<tr>
<th>Delta Code</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>03</td>
<td>Actual Date</td>
</tr>
<tr>
<td>01</td>
<td>Before this Date</td>
</tr>
<tr>
<td>02</td>
<td>After this Date</td>
</tr>
<tr>
<td>04</td>
<td>Unknown</td>
</tr>
</tbody>
</table>
**Name:** Coordinate Source Type  
(EPA Equivalent = Coordinate Data Source Name (or Code))

**Definition:** A code indicating the type of organization that collected or otherwise provided the coordinates.

**Datatype:** CHAR (4)

**Values:**

Note: EPA Standard has a code for each EPA region and each state. We will only include those of interest to MPCA.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>COORD_SOURCE_TYPE</td>
<td>COORD_SOURCE_EPA</td>
<td>COORD_SOURCE_MPCA</td>
<td></td>
</tr>
<tr>
<td>2 027 0270</td>
<td>019 0190</td>
<td>Minnesota (State of)</td>
<td>Minnesota (State of)</td>
</tr>
<tr>
<td></td>
<td>038 0380</td>
<td>Iowa</td>
<td>Iowa</td>
</tr>
<tr>
<td></td>
<td>046 0460</td>
<td>North Dakota</td>
<td>North Dakota</td>
</tr>
<tr>
<td></td>
<td>055 0550</td>
<td>Wisconsin</td>
<td>Wisconsin</td>
</tr>
<tr>
<td>1 093 0930</td>
<td>082 0820</td>
<td>EPA Region</td>
<td>EPA Region</td>
</tr>
<tr>
<td>6 084 0840</td>
<td>086 0860</td>
<td>Tribe</td>
<td>Tribe</td>
</tr>
<tr>
<td></td>
<td>085 0850</td>
<td>Private</td>
<td>Private</td>
</tr>
<tr>
<td></td>
<td>083 0830</td>
<td>Other</td>
<td>Other</td>
</tr>
<tr>
<td>9 0831 0870</td>
<td>081 0810</td>
<td>Dun &amp; Bradstreet</td>
<td>Dun &amp; Bradstreet</td>
</tr>
<tr>
<td>U 087 0870</td>
<td>085 0850</td>
<td>County/Local Government</td>
<td>County/Local Government</td>
</tr>
</tbody>
</table>

Note: Use if Source Organization Name is “MPCA.”
<table>
<thead>
<tr>
<th>Name:</th>
<th>Coordinate Source Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No EPA equivalent</td>
</tr>
<tr>
<td>Definition:</td>
<td>The name of the organization providing the coordinates. Often will be “MPCA” if the coordinates were directly determined or generated by MPCA staff (e.g., via GPS, digitizing, or address matching), and not by a source outside the Agency.</td>
</tr>
<tr>
<td>Datatype:</td>
<td>CHAR (30) Nullable, but staff are by convention required to use “MPCA” if data is collected by MPCA staff.</td>
</tr>
<tr>
<td>Notes:</td>
<td>Does not have to be an MPCA Hub database organization.</td>
</tr>
<tr>
<td>Values:</td>
<td>Examples Include:</td>
</tr>
<tr>
<td></td>
<td>Hennepin County</td>
</tr>
<tr>
<td></td>
<td>EPA Region 5</td>
</tr>
<tr>
<td></td>
<td>Barr Engineering</td>
</tr>
</tbody>
</table>
Name: MPCA Program Area Code  
   This field is not used. It is a remnant of the old MPCA LDP. Should probably be eliminated.
No EPA Equivalent

Definition: The MPCA Program Area which collected the locational data.

Datatype: CHAR (2)

Notes: The DELTA default value is the program to which the data entry staff inputting the data is assigned in the MPCA staff assignment table. If an MPCA staff member inputs data collected by another program, the defaulted program code must be changed to reflect the actual program which collected the data.

Values:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW</td>
<td>Ground Water/Solid Waste - Solid Waste Program</td>
</tr>
<tr>
<td></td>
<td>Ground Water/Solid Waste - Ground Water Monitoring &amp; Assessment Program</td>
</tr>
<tr>
<td></td>
<td>Ground Water/Solid Waste - Site Response Program</td>
</tr>
<tr>
<td></td>
<td>Ground Water/Solid Waste - Site Assessment Program</td>
</tr>
<tr>
<td>TS</td>
<td>Hazardous Waste - Tank and Spills Program</td>
</tr>
<tr>
<td>HW</td>
<td>Hazardous Waste - Hazardous Waste Program</td>
</tr>
<tr>
<td>WQ</td>
<td>Water Quality - Nonpoint Source Pollution Program</td>
</tr>
<tr>
<td></td>
<td>Water Quality - State Disposal System Program/National Pollution Discharge Elimination System Permit Program</td>
</tr>
<tr>
<td>AQ</td>
<td>Air Quality (All programs)</td>
</tr>
</tbody>
</table>
### Vertical Measure (Elevation)

**Name:** Vertical Measure (Elevation)
(EPA Equivalent = Vertical Measure)

**Definition:** The measured value of elevation (i.e. altitude), in meters, above or below its reference datum.

**Datatype:** Delta = NUMBER (8,4)

**Values:**

### Vertical Datum

**Name:** Vertical Datum
(EPA Equivalent = Vertical Reference Datum Name (or Code))

**Definition:** The level surface of reference from which elevation is measured.

**Datatype:** CHAR (6)

**Notes:** Required for all vertical measurements.

**Values:**

```
“NGVD29” = National Geodetic Vertical Datum of 1929
“NAVD88” = North American Vertical Datum of 1988
```
Name: **Vertical Measure Method**
(EPA Equivalent = Vertical Collection Method Text (or Code))

**Definition:** A code indicating a vertical measurement method of collection.

**Datatype:** CHAR (4)

**Notes:** Required for all vertical measurements.

ECOS standard has a “Vertical Accuracy Measure” element that we do not have. We will need to derive that information from the value of this field for the same reasons used for deriving the horizontal positional accuracy from the Method of Coordinate Collection element.

**Values:**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>009</td>
<td>0090</td>
<td>Altimetry</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>001</td>
<td>0010</td>
<td>GPS Carrier Phase Static Relative Position</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>002</td>
<td>0020</td>
<td>GPS Carrier Phase Kinematic Relative Position</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>003</td>
<td>0030</td>
<td>GPS Code (Pseudo Range) Differential (DGPS)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>004</td>
<td>0040</td>
<td>GPS Code (Pseudo Range) Precise Position</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>005</td>
<td>0050</td>
<td>GPS Code (Pseudo Range) Standard Position (SA Off)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>006</td>
<td>0060</td>
<td>GPS Code (Pseudo Range) Standard Position (SA On)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>010</td>
<td>0100</td>
<td>Precise Leveling - Benchmark</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>011</td>
<td>0110</td>
<td>Leveling-Non-Benchmark Control Points</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>012</td>
<td>0120</td>
<td>Trigonometrical Leveling</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>013</td>
<td>0130</td>
<td>Photogrammetric</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>007</td>
<td>0070</td>
<td>Classical Surveying Techniques</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>014</td>
<td>0140</td>
<td>Topographic Map Interpolation</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>008</td>
<td>0080</td>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX H

WATERSHED ASSESSMENT, TRACKING AND ENVIRONMENTAL RESULTS (WATERS) TOOL
WATERS
Watershed Assessment, Tracking & Environmental Results

WATERS is a tool that unites water quality information previously available only on individual state agency homepages and at several Environmental Protection Agency (EPA) websites. State and federal water quality managers, as well as interested citizens, can use WATERS to quickly identify the status of individual waterbodies of interest to them. It can also be used to generate summary reports on all waters of a state. Click on the map below to find detailed water quality information.

WATERS uses Enviromapper, the Agency's standard mapping application, to display this information. The National Hydrography Dataset, or NHD, is the nationally consistent waterbody network that serves as the foundation and common “language” for this surface water analysis and display.

WATERS links several databases in one place to provide information on:

- the uses that waterbodies have been designated for, such as drinking water supply, recreation, or fish protection. These designated uses are part of a state’s water quality standards, provide a regulatory goal for the waterbody and define the level of protection assigned to it. This information is also available through the Water Quality Standards Database.

- those waterbodies listed by the state as impaired under Section 303(d) of the Clean Water Act, and for those waterbodies, the status of control actions known as Total Maximum Daily Loads or TMDLs (calculations of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant’s sources). This information is also available through the Total Maximum Daily Loads (TMDL) Tracking System.
Currently only the TMDL Tracking System and the Water Quality Standards Database are linked to the NHD and WATERS.

**The next release of WATERS will include:**
- Drinking water intakes
- Recreational beaches
- No discharge zones
- Water quality monitoring stations (STORET)
- Non-point source projects (GRTs)

Other water information that may eventually be included in WATERS include:
- Water quality assessments from Section 305(b) of the Clean Water Act
- Facility outfall locations
- Source water protection boundaries
- Fish consumption advisories
- Water related National Priority List (NPL) locations
- Total Maximum Load delineation boundaries
- Combined sewer overflows

- **Additional status information**
- **WATERS architectural blueprint**

---

EPA HOMEPAGE / OFFICE OF WATER / HOTLINES / COMMENTS / SEARCH
Environmental Protection Agency’s Office of Water

Email: OW-General@epamail.epa.gov

http://www.epa.gov/waters/
EnviroMapper for Water

Welcome to EnviroMapper for Water! EnviroMapper for Water is a web-based Geographic Information System (GIS) application that dynamically displays information about bodies of water in the U.S. This interactive tool allows you to create customized maps portraying the nation's surface waters along with a collection of environmental data. If you have a web browser, then you can generate maps using EnviroMapper for Water! The application can be used to view environmental information from the national level down to community level (within one mile), and provides the ability to pan, zoom, label and print maps. You also can link to text reports after identifying a specific waterbody of interest. Always wondered about the health of a river near where you live? Now you can find out by creating a map using EnviroMapper for Water.

NOTICE: To view impaired waters and designated use information your map window must be about 17 miles across or less. Either use the "Zoom" button on the right-hand side of the application or use the "Zoom in by geography" function at the bottom to go directly into your city or zip code. Click on the image below to launch EnviroMapper for Water. Click here for help using EnviroMapper for Water.

News: Designated use information is available for the following states:
Arizona, Colorado, Delaware, Iowa, Illinois, Missouri, Mississippi, New Mexico, North Dakota, South Dakota, West Virginia.

The Office of Water is planning to make more waterbody information available over the next year. Several programs are currently in the process of adding
additional data layers for the next release of EnviroMapper for Water. Click here for an update on the status of new data layers.

EPA HOMEPAGE / OFFICE OF WATER / HOTLINES / COMMENTS / SEARCH
Environmental Protection Agency's Office of Water

Email: OW-General@epamail.epa.gov

Revised: Thursday, April 12, 2001 17:28:16
http://www.epa.gov/waters/enviromapper/
Mapping Water Quality Standards - Designated Uses

The map below displays the States whose designated use information is available for mapping by using the EnviroMapper for Office of Water. This map will be updated as more States’ water quality standards/designated use information becomes available.

The following map shows States available and pending State approval for query and display through the EnviroMapper for Office of Water.

EnviroMapper for Office of Water

This interactive Geographic Information System (GIS) application uses the National Hydrography Dataset (NHD) and displays water quality standards/designated use information that has been linked to the NHD stream network. The EnviroMapper for Office of Water allows users to view spatial data at the National, State, and county levels, as well as utilize GIS functionality, such as displaying multiple spatial layers, zooming, panning, displaying latitude and longitude, and identifying features.