

Phase III GIS-based Sediment Quality Database for the St. Louis River Area of Concern (AOC)— Minnesota Focus

Addendum to the Phase II Technical Documentation

Final Report

Submitted to:

Karla Sundberg
Minnesota Department of Natural Resources
Minnesota's Lake Superior Coastal Program
1568 Highway 2
Two Harbors, MN 55616

Submitted by:

Judy L. Crane¹ and Peggy L. Myre²

¹Minnesota Pollution Control Agency
Environmental Analysis and Outcomes Division
520 Lafayette Road North
St. Paul, MN 55155-4194
Email: judy.crane@pca.state.mn.us

²Exa Data & Mapping Services, Inc.
P.O. Box 232
Port Townsend, WA 98368

December 2005

MPCA Document Number: tdr-fg05-02

DISCLAIMER

Minnesota's Lake Superior Coastal Program

Name of Project: Phase III GIS-based Sediment Quality Database for the St. Louis River Area of Concern (AOC)—Minnesota Focus

Date of Publication: December 2005

Project No. 306-28-06

Contract No. A68008

This project was funded in part under the Coastal Zone Management Act, by the National Oceanic and Atmospheric Administration's (NOAA's) Office of Ocean and Coastal Resource Management, in cooperation with Minnesota's Lake Superior Coastal Program. In addition, the Minnesota Pollution Control Agency (MPCA) contributed over 50% of state matching funds to this project. This report has been reviewed and approved by Minnesota's Lake Superior Coastal Program. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the MPCA, Minnesota's Lake Superior Coastal Program, or by NOAA.



TABLE OF CONTENTS

| | <u>Page</u> |
|--|-------------|
| Disclaimer | ii |
| Table of Contents | iii |
| List of Tables | iv |
| List of Figures | iv |
| List of Acronyms and Abbreviations | v |
| Acknowledgments | vii |
| | |
| 1.0 Introduction | 1 |
| | |
| 2.0 Summary of Phase III Database Updates | 2 |
| 2.1 Audit of the Phase II Database Structure | 2 |
| 2.2 Inclusion of Benthic Invertebrate Community Data Fields | 2 |
| 2.3 New Sediment Quality Data Sets | 2 |
| 2.4 Addition of Query Options in the MS™ Access Database | 3 |
| 2.4.1 Overview of Query Generation | 3 |
| 2.4.2 Query Descriptions | 3 |
| 2.4.2.1 PAH Source Ratio List Sorted by Depth Interval | 3 |
| 2.4.2.2 Select all Chemistry Sorted by Location | 4 |
| 2.4.2.3 Benthic Invertebrate Community Data | 5 |
| 2.4.2.4 Samples Organized by Mean PEC-Q and Depth Interval | 5 |
| 2.4.2.5 Bioassay Data | 5 |
| 2.4.2.6 Comparison to Level I and Level II SQTs | 6 |
| 2.5 Updated Phase II Table and Figure | 6 |
| | |
| 3.0 Linkage of the Phase III Database with ArcMap | 8 |
| 3.1 Linkage with ArcMap 8.3 | 8 |
| 3.2 Linkage with ArcMap 9 | 8 |
| | |
| 4.0 Treatment of Nondetect Data | 11 |
| | |
| 5.0 Project Contact | 12 |
| | |
| References | 13 |
| | |
| Appendix A: Quality Assurance Comments of the Phase II GIS-based Sediment Quality Database for the St. Louis River AOC | |
| Appendix B: Screening Criteria for Evaluating Benthic Invertebrate Community Data Sets for the Phase III GIS-based Sediment Quality Database for the St. Louis River AOC | |
| Appendix C: List of Query Options in Query Manager Version 2.56 | |

LIST OF FIGURES

| <u>Figure</u> | | <u>Page</u> |
|---------------|--|-------------|
| 1 | Map of the St. Louis River AOC | 19 |
| 2 | Example linkage of the Phase III MS™ Access 2000 database query results for mean probable effect concentration quotient (PEC-Q) ranges with the Phase II ArcMap 9 map document for Ecological Features within the lower St. Louis River AOC..... | 20 |
| 3 | Project organization chart for the Phase III GIS-based sediment quality database project..... | 21 |
| 4 | Diagram showing the relationships between components of the MS™ Access 2000 sediment quality database | 22 |

LIST OF TABLES

| <u>Table</u> | | <u>Page</u> |
|--------------|---|-------------|
| 1 | Benthic Invertebrate Community Metrics for Individual Field Replicate Samples | 24 |
| 2 | Benthic Invertebrate Community Metrics for the Mean and Standard Deviation (SD) of Field Replicate Data..... | 26 |
| 3 | Benthic Invertebrate Community Metrics for the Sum of Field Replicate Samples | 28 |
| 4 | Summary of Data Sets Incorporated into the Phase III GIS-based Sediment Quality Database for the St. Louis River AOC..... | 30 |
| 5 | Detailed Description of Database Components | 34 |

LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---------|---|
| AOC | Area of Concern |
| As | Arsenic |
| AVS | Acid Volatile Sulfides |
| CERCLIS | Comprehensive Environmental Response, Compensation and Liability Information System |
| CN | Cyanide |
| DB | Database |
| DL | Detection Limit |
| DRO | Diesel Range Organics |
| DSN | Data Source Name |
| DW | Dry Weight |
| FK | Foreign Key |
| F/P | Fluoranthene to Pyrene Ratio |
| FTP | File Transfer Protocol |
| GIS | Geographic Information System |
| GT | Greater Than |
| HCB | Hexachlorobenzene |
| Hg | Mercury |
| ID | Identification |
| IJC | International Joint Commission |
| LDepth | Lower Depth Interval of a Sediment Core |
| LKP | Look-up |
| LRM | Logistic Regression Model |
| LT | Less Than |
| MDL | Method Detection Limit |
| MESL | MacDonald Environmental Sciences Ltd. |
| MLE | Maximum Likelihood Estimation |
| MLSCP | Minnesota's Lake Superior Coastal Program |
| MN | Minnesota |
| MPCA | Minnesota Pollution Control Agency |
| MS™ | Microsoft™ |
| NA | Not Available |
| NAD | North American Datum |
| ND | Nondetect |
| No. | Number |
| NOAA | National Oceanic and Atmospheric Administration |
| NR | Not Reported |
| NT | Not Toxic |
| OCS | Octachlorostyrene |
| ODBC | Open Database Connectivity |
| P/A | Phenanthrene to Anthracene Ratio |
| PAH | Polycyclic Aromatic Hydrocarbon |
| Pb | Lead |

LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|----------|--|
| PCB | Polychlorinated Biphenyl |
| PEC | Probable Effect Concentration |
| PEC-Q | Probable Effect Concentration Quotient |
| PK | Primary Key |
| PO | Post Office |
| PTBL | Table |
| QA | Quality Assurance |
| QA/QC | Quality Assurance/Quality Control |
| QM | Query Manager |
| QRY | Query |
| R-EMAP | Regional Environmental Monitoring and Assessment Program |
| SD | Standard Deviation |
| SEM | Simultaneously Extractable Metals |
| SLRIDT | St. Louis River Interlake/Duluth Tar |
| Sn | Tin |
| SQC | Sediment Quality Criteria |
| SQG | Sediment Quality Guideline |
| SQT | Sediment Quality Target |
| T | Toxic |
| TBT | Tributyltin |
| TCDD | Tetrachlorodibenzo-p-dioxins |
| TCDF | Tetrachlorodibenzofurans |
| TEF | Toxic Equivalency Factor |
| TOC | Total Organic Carbon |
| UDepth | Upper Depth Interval of a Sediment Core |
| U.S. EPA | United States Environmental Protection Agency |
| USFWS | United States Fish and Wildlife Service |
| UTM | Universal Transverse Mercator |
| VOCs | Volatile Organic Compounds |
| WA | Washington |
| WW | Wet Weight |

ACKNOWLEDGMENTS

The authors would like to take this opportunity to gratefully acknowledge the contributions of a number of individuals who assisted with the preparation of the Phase I and Phase II sediment quality databases which formed the basis for this project. These individuals were previously acknowledged in the Phase II Help Section for Database Users (Smorong and Crane 2004).

For the Phase III project, the following people provided assistance with either obtaining or providing sediment quality and/or fish tissue data: Nancy (Costa) Schuldt (Fond du Lac Band), Pat McCann (Minnesota Department of Health), Alina Heydt (Service Engineering Group), Annette Trowbridge (U.S. Fish and Wildlife Service), Susan Johnson, Andrew Streitz, Steve Hennes (Minnesota Pollution Control Agency; MPCA), Dan Breneman (Natural Resources Research Institute), and Carl Richards (Minnesota Sea Grant). Todd Goeks (NOAA), Steve Hennes (MPCA), Jay Field (NOAA), and Corinne Severn (Premier Environmental Services, Inc.) were instrumental in making the St. Louis River Interlake/Duluth Tar Superfund site data set available in NOAA's Query Manager Watershed database for the St. Louis River; these data were incorporated into the Phase III database. Todd Biewen (MPCA) provided helpful supervisory assistance for this project. Exa Data & Mapping Services, Inc.'s work was funded through a professional and technical services contract with the State of Minnesota, in which they worked with several subcontractor's to complete their tasks. The technical team members for this project were as follows:

MPCA: Judy Crane

Exa Data & Mapping Services, Inc.: Peggy Myre, Stacy Larsen

Premier Environmental Services, Inc.: Corinne Severn, Laurel Menoche

Searay Environmental: Raymond Valente

TerraStat Consulting Group: Lorraine Read

The draft report was reviewed by Karla Sundberg (Minnesota's Lake Superior Coastal Program; MLSCP), the Grants Specialist for this project. Clinton Little (MLSCP) reviewed the draft Phase III database products. Tricia Ryan and Pat Collins were the successive program managers to Minnesota's Lake Superior Coastal Program. The funding acknowledgments for this project are provided in the Disclaimer of this report.

Jennifer Holstad (MPCA) provided word processing and report production support.

This report should be cited as:

Crane, J.L. and P.L. Myre. 2005. Phase III GIS-based sediment quality database for the St. Louis River Area of Concern (AOC)—Minnesota focus. Addendum to the Phase II technical documentation. Minnesota Pollution Control Agency, Environmental Analysis and Outcomes Division, St. Paul, MN and Exa Data & Mapping Services, Inc., Port Townsend, WA. MPCA Document Number tdr-fg05-02.

CHAPTER 1

INTRODUCTION

The lower St. Louis River provides an important coastal resource to western Lake Superior (Figure 1). In particular, this transboundary waterway provides critical habitat to invertebrate, fish, and waterfowl species and also provides an economic venue for Great Lakes shipping and business in the Duluth-Superior Harbor. Contaminated sediments have contributed to several use impairments in the lower St. Louis River and were a factor in the International Joint Commission's (IJC) decision to designate the lower St. Louis River as one of 43 Areas of Concern (AOCs) in the Great Lakes basin (IJC 1989). Consequently, several sediment quality and fish tissue studies have been conducted in the lower St. Louis River AOC, particularly since 1990, to delineate the extent and magnitude of contaminants of potential concern and to assess the potential for ecological effects (Figure 2). Sediment quality issues in the Lower St. Louis River AOC are of interest to local and state agencies in Minnesota and Wisconsin, as well as to federal agencies, tribal groups, responsible parties, and other concerned stakeholders.

The Minnesota Pollution Control Agency (MPCA), with the contractual assistance of Exa Data & Mapping Services, Inc. and their subcontractors, have completed Phase III of a Geographic Information System (GIS)-based sediment quality database for the St. Louis River AOC (Crane 2005; Crane and Myre 2005). A diagram of the project team is provided in Figure 3. This phase of the database focused on the Minnesota side of the AOC. A history of the development of earlier phases of this sediment quality database is provided in the Phase II project reports (Smorong and Crane 2004; Smorong *et al.* 2004a,b). The purpose of this addendum report is to document technical details regarding new methods and procedures used to update the Phase II sediment quality database with new data sets to produce the Phase III sediment quality database. Database users should refer to the Phase II report documentation (Smorong and Crane 2004, Smorong *et al.* 2004a,b), in addition to the Addendum to the Phase II Help Section for Database Users (Crane and Myre 2005), when using either the Phase III Microsoft™ (MS™) Access 2000 sediment quality database or the Query Manager-compatible database files. The MS™ Access 2000 sediment quality database is also available in MS™ Access '97 format for those users lacking MS™ Access 2000 software. Instructions for obtaining the Phase III database files from the MPCA's File Transfer Protocol (FTP) site were provided in Chapter 4 of the Addendum to the Phase II Help Section for Database Users (Crane and Myre 2005). However, these files have since been moved to the following FTP site until the Phase IV database files become available during March 2006: <ftp://files.pca.state.mn.us/pub/sedimentDB/>. The updated web site for obtaining a free copy of the National Oceanic and Atmospheric Administration's (NOAA's) Query Manager version 2.56 software is:

[http://response.restoration.noaa.gov/topic_subtopic_entry.php?RECORD_KEY%28entry_subtopic%29=entry_id,subtopic_id,topic_id&entry_id\(entry_subtopic_topic\)=376&subtopic_id\(entry_subtopic_topic\)=5&topic_id\(entry_subtopic_topic\)=2](http://response.restoration.noaa.gov/topic_subtopic_entry.php?RECORD_KEY%28entry_subtopic%29=entry_id,subtopic_id,topic_id&entry_id(entry_subtopic_topic)=376&subtopic_id(entry_subtopic_topic)=5&topic_id(entry_subtopic_topic)=2).

CHAPTER 2

SUMMARY OF PHASE III DATABASE UPDATES

2.1 AUDIT OF THE PHASE II DATABASE STRUCTURE

Prior to beginning work on the Phase III sediment quality database, Peggy Myre (Exa Data & Mapping Services, Inc.) conducted an audit of the Phase II MS™ Access 2000 database. The results of her audit, as well as actions taken in regards to primary key (PK) assignments and evaluating relationships (in order to look for orphan records), are provided in Appendix A. In addition, she also deleted the database field “StationID_OLD” in the AVS_SEM table.

2.2 INCLUSION OF BENTHIC INVERTEBRATE COMMUNITY DATA FIELDS

Based on input from MPCA staff and stakeholders, benthic invertebrate community data fields have been added to the Phase III MS™ Access 2000 database (Tables 1 to 3). Most of these data fields were based on a Regional Environmental Monitoring and Assessment Program (R-EMAP) project, which entailed the most comprehensive benthic invertebrate community survey that has taken place in the St. Louis River AOC (Breneman *et al.* 2000; Crane *et al.* 2005). A screening form was developed to evaluate benthic invertebrate community data sets prior to adding them to the database (Appendix B).

These benthic data fields were not included in the Query Manager compatible database files. Query Manager has a limited capacity for including summary benthic invertebrate community data (e.g., abundance or biomass of major taxa) in its sediment bioassay table.

2.3 NEW SEDIMENT QUALITY DATA SETS

The Phase III MS™ Access 2000 database includes the sediment quality and fish tissue data contained within the Phase I and II databases, as well as 25 new data sets from the Minnesota side of the St. Louis River AOC (Table 4). Thirteen of these new data sets were obtained directly from NOAA’s Query Manager Watershed database for the St. Louis River. NOAA compiled this Watershed database as part of their Natural Resource Trustee activities for the St. Louis River Interlake/Duluth Tar Superfund site. New data were also added to the Phase III sediment quality database from the USS Superfund site (URS Corp. 2003), Minnesota Slip (Streitz and Johnson 2005), Kingsbury Bay (St. Louis River Natural Resource Trustees 2002; Service Engineering Group 2004), and several lakes near the St. Louis River bordering the Fond du Lac Reservation (Costa 2000, 2001, 2002, 2004). Benthic data from two large studies (Crane *et al.* 1997; Breneman *et al.* 2000, Crane *et al.* 2005) were added to the database. These data sets provided good spatial coverage of benthic invertebrate community populations along the Minnesota side of the St. Louis River AOC.

2.4 ADDITION OF QUERY OPTIONS IN THE MS™ ACCESS DATABASE

2.4.1 Overview of Query Generation

Another new feature of the Phase III MS™ Access '97 and 2000 sediment quality databases is the addition of several queries, of which the query output is recorded in the “Queries” section of each database. These queries were developed by Peggy Myre (Exa Data & Mapping Services, Inc.) as an extra feature for the benefit of a few MPCA staff (Myre 2005). As such, the queries are not very user friendly, although users with knowledge about MS™ Access will be able to adapt them for their own use. A user friendly query interface will be completed as part of the Phase IV MS™ Access 2000 sediment quality database. Several of the queries are composed of a series of queries, numbered in sequential order. Because each subsequent query calls the previous query, it is only necessary to run the final query (this results in each query being run in order). Each query step was saved so that the user could alter the criteria during each step, if desired.

All of the queries are in the database and start with the preface “Qry.” Instructions on how to run each query, the nomenclature used, and the assumptions made during the formation of each query are documented in each specific query description below. Several new query lookup lists were created in support of the queries so that they run more efficiently.

All of the queries include the fields StudyID, MESL StationID, SampleID, udepth, ldepth, as well as coordinates (latitude/longitude and UTM coordinates) to enable importing the data into ArcMap. In addition, StationID was also imported since the field MESL Station ID is not unique to each station (but is unique to each sample).

In the documentation below, *query* and *table* names are noted in italics, and field names are underlined. As a reminder to users, a number of user-friendly sediment quality queries (Appendix C) are available in NOAA’s Query Manager 2.56 software that can be used in conjunction with the Phase III Query Manager-compatible database files.

2.4.2 Query Descriptions

2.4.2.1 PAH Source Ratio List Sorted by Depth Interval

The polycyclic aromatic hydrocarbon (PAH) Source Ratio query series is prefaced by “QryPAHSource.” To create a table of PAH source ratios sorted by depth interval, it is only necessary to run the final query “*QryPAHSource2_CalcRatios*.” A description of each query and any associated assumptions is listed below.

QryPAHSource1_SelectData: This query selects all samples with the two relevant PAH source ratios [i.e., phenanthrene/anthracene (P/A) and fluoranthene/pyrene (F/P)]. A P/A ratio <10 and F/P ratio >1.0 have been shown to be indicative of pyrogenic (i.e., combustion) sources of PAHs (Budzinski *et al.* 1997). A P/A ratio >10 is indicative of petrogenic (i.e., petroleum-based) inputs (Budzinski *et al.* 1997). The chemical concentration value that is queried is the field MESL C Calc, containing the full value for data reported above detection, and one-half the

reported detection limit for data reported below detection. It restricts the selection to records with reported concentrations (no missing values), and excludes samples that do not pass the Level II sediment quality target (SQT) benchmark for data reported as below detection (MESL_EXCLUDE_HIGH ND <> "X"). In addition, it excludes samples that do not fall within one of the desired depth intervals. A lookup table was created for each unique combination of upper and lower depth in the sample table, so that depth intervals could be redefined. Currently, in the table *lkp - QryDepthBin*, the depth intervals are:

- ≥ 0 to ≤ 5 cm,
- ≥ 0 to ≤ 15 cm,
- ≥ 0 to ≤ 30 cm,
- ≥ 15 to ≤ 30 cm,
- ≥ 30 to ≤ 45 cm, and
- ≥ 30 cm.

Note: if samples fell outside of these definitions (e.g., 25-40 cm), the depth interval code was given an "X" and these samples were excluded from the query. A sort order was added to the lookup table so that the final results would sort by depth interval in the order provided above.

QryPAHSource1_SelectData_Crosstab: This query takes the selected data from the first query, checks to make sure that there are no missing PAHs for any particular sample, and then formats them so that the PAHs are reported across the top of the table in separate columns. The depth interval and coordinates are also carried forward.

QryPAHSource2_CalcRatios: This query is the final (and only necessary) query that is run to generate a table of PAH source ratios for each sample, sorted by depth interval. It derives the PAH values from the previous cross-tab query. The PAH source ratios are reported to three significant digits.

2.4.2.2 Select All Chemistry Sorted by Location

QrySelect ChemData: This single query simply extracts all of the sediment chemistry data, and sorts the data by the Area field (e.g., Allouez Bay, Duluth Harbor, Lower St. Louis River, Lower St. Louis River watershed, Nemadji River, St. Louis Bay, and Superior Bay). The field LOCDESC is used to describe the specific station location. The chemical concentration value that is queried is the field MESL C CALC, containing the full value for data reported above detection, and one-half the reported detection limit for data reported below detection. It restricts the selection for records with reported concentration (no missing values), and excludes records that do not pass the Level II SQT criteria for data reported as below detection (MESL_EXCLUDE_HIGH ND <> "X"). After Area, the data are sorted by StudyID, StationID, SampleID, and Chemcode.

There are two ways of editing this query:

- Edit the selected metric or unit in Design Mode: Open the query in Design Mode, and then type in the chemcode or other variable in the Criteria row.

- Using Filters: In Design Mode, remove all of the variables in the Criteria row. Then run the query so it is in DataSheet mode. This change will bring up all of the data records. Then the user can filter the data on specific fields using the “Filter by Selection” or “Filter by Form” buttons. See MS™ Access documentation on how these functions work (<http://support.microsoft.com/kb/304263/EN-US/>).

2.4.2.3 Benthic Invertebrate Community Data

QryBenthicData: This single query simply extracts all of the mean benthic invertebrate community data (mean, standard deviation, and sum) for a specific metric of the category “Taxonomic Group.” The query is currently set-up to query the metric “Total Abundance” with the units of organisms/m². As with the chemistry data query, there are two ways of editing this query:

- Edit the selected metric or unit in Design Mode. Open the query in Design Mode, and edit the field directly using the specific options in the table *lkp – BENTHOSMETRICS*.
- In Design Mode, remove all of the variables in the Criteria row. Then run the query so it is in DataSheet mode. This will bring up all of the data records. Then the user can filter the data on Category or Metric using the “Filter by Selection” or “Filter by Form” buttons. See MS™ Access documentation on how these functions work (<http://support.microsoft.com/kb/304263/EN-US/>).

2.4.2.4 Samples Organized by Mean PEC-Q and Depth Interval

QryPEC_QI: This query selects all samples with a calculated mean PEC-Q (< -99999), and retrieves them linked to both depth interval (as described in the PAH query), and by mean PEC-Q classification. A new lookup table (*lkp – QryPEC_Class*) was generated that relates a unique mean PEC-Q to a risk classification based on the intervals of <0.1 (low), ≥ 0.1 to ≤ 0.6 (moderate), and >0.6 (high). These classifications are also selected as part of this query. Note the user can change either the depth interval or the risk classification for this query by editing the lookup tables directly, and then re-running the query.

QryPEC_QI_Crosstab: This query organizes the data selected above by depth interval, and then notes the risk classification for each sample. The actual output format will depend on the kind of map that is to be generated from the data. Coordinate information are also selected to aid in the mapping exercise.

2.4.2.5 Bioassay Data

QryBioassay: This single query simply extracts all of the sediment toxicity data, and sorts the data by Species, Endpoint, and MESL Toxicity code. Other fields selected (including the standard fields) include the Effect value (Effectval), the control-adjusted effects value (Ctrladj), the originally reported significance (Sigeffect), the TestID, and the medium of the test (e.g., sediment, elutriate, etc.). Negative control data are excluded from the query. As with the other data selection queries, there are two ways of editing this query:

- Edit the selected metric or unit in Design Mode. Open the query in Design Mode, and then type in the chemcode or other variable in the Criteria row.
- Using Filters – In Design Mode, remove all of the variables in the Criteria row. Then run the query so it is in DataSheet mode. This will bring up all of the data records. Then the user can filter the data on specific fields using the “Filter by Selection” or “Filter by Form” buttons. See MS™ Access documentation on how these functions work (<http://support.microsoft.com/kb/304263/EN-US/>).

2.4.2.6 Comparison to Level I and Level II SQTs

The queries that compare surficial sediment chemistry to corresponding Level I and Level II SQTs are prefaced by “QrySQT.” To create a table of surficial samples and chemicals that show if the chemical is lower than (LT) or greater than (GT) the SQTs, it is only necessary to run the final query “QrySQT1&2_Union Crosstab.” This query organizes the samples by depth interval; a description of each query and any associated assumptions is provided below.

QrySQT1: This query selects all surficial samples (upper depth = 0 cm) and chemicals, and compares the values with the corresponding Level I SQTs. The chemical concentration value that is queried is the field MESL C CALC, containing the full value for data reported above detection, and one-half the reported detection limit for data reported below detection. It restricts the selection for records with reported concentration (no missing values), and excludes records that do not pass the Level II SQT benchmark for data reported as below detection (MESL_EXCLUDE_HIGH ND <>”X”). The data that are retrieved are linked and sorted by depth interval, then by StudyID, StationID, SampleID, and Chemcode.

QrySQT2: This query selects all samples and chemicals, and compares the values with the Level II SQTs, in the same way as *QrySQT1*.

QrySQT1&2_Union: This is a Union query, which merges the first two queries together.

QryPEC_Q1_Crosstab: This query takes the merged data, and pivots the results (crosstab query) so that the Level I and Level II SQT exceedances are in separate columns.

2.5 UPDATED PHASE II TABLE AND FIGURE

Some documentation in the Phase II Help Section for Database Users (Smorong and Crane 2004) was updated to account for the addition of benthic invertebrate community data in the Phase III database. Figure 1 (Diagram showing the relationships between database components) and Table 1 (Detailed Description of Database Components) from the aforementioned Phase II document have been updated with similar caption titles in this Addendum document as Figure 4 and Table 5, respectively. For Figure 4, Peggy Myre (Exa Data & Mapping Services, Inc.) added primary key (PK) and foreign key (FK) designations to several fields. Since the MS™ Access sediment quality database is a relational database, the database consists of several tables that can be linked together to facilitate retrieval of the data. Every record in a table must have a primary key that differentiates it from every other record in the table. Primary keys may consist of a single attribute or multiple attributes in combination. For chemistry data, the primary key

fields are SiteID, StudyID, StationID, SampleID, Labrep, and Chemcode (Figure 4). The foreign key numbering system allows one to group the keys together into unique foreign keys. Thus, the primary key of one table is used in another table to establish a relationship. For example, for the chemistry table (ptbl – CHEM):

- FK1 describes the foreign key ‘Chemcode’ that relates the look-up (lkp) table CHEMDICT;
- FK2 describes the foreign key ‘Qualcode’ that relates to lkp – QUALIFY;
- FK3 describes the foreign key ‘Chemcode’ that relates to lkp – SQC; and,
- FK4 describes the foreign key group (SiteID+StudyID+StationID+SampleID+Labrep) that relates to parent table ptbl – SAMPLE.

These fields were designed to be consistent with fields used in NOAA’s Query Manager 2.56 software.

CHAPTER 3

LINKAGE OF THE PHASE III DATABASE WITH ARCMAP

3.1 LINKAGE WITH ARCMAP 8.3

Users with ArcMap 8.3 should follow the directions in Section 5.3 of the Phase II Help Section for ArcView Users (Smorong *et al.* 2004a) for how to link the MS™ Access 2000 database to the Phase II ArcMap 8.3 map documents.

3.2 LINKAGE WITH ARCMAP 9

The MPCA now uses ArcMap 9 instead of ArcMap 8.3, so MPCA users will need to save the Phase II ArcMap 8.3 map documents to ArcMap 9. The directions in Section 5.3 of the Phase II Help Section for ArcView Users (Smorong *et al.* 2004a) will not work for users trying to link the MS™ Access 2000 database to the Phase II ArcMap 9 map documents. The below instructions should rectify this situation. The following directions provide step-by-step instructions for linking the MS™ Access 2000 database with the ArcMap 9 map documents.

I. Create an ODBC Connection to the Database

This section will enable the database to be connected to other programs, via a communication protocol called **ODBC** (Open Database Connectivity). The actual steps will vary somewhat depending on the Operating System in use. Instructions have been provided for users who use either Windows 2000 or Windows XP (very similar).

1. From the START menu, go to Settings/Control Panel.
2. From Control Panel, select “Switch to Classic View” (for MPCA staff) and double-click on the Administrative Tools option.
3. From Administrative Tools, double-click on the Data Sources (ODBC) tool. This step will open the ODBC Data Source Administrator dialogue box.
4. The user will now need to set up a new User Data Source Name (DSN). From the User DSN tab (should be first tab), highlight **MS Access Database** and then click on the **Add...** button.
5. Next, open a dialogue box called Create New Data Source and “Select a driver for which you want to set up a data source.” Highlight **Microsoft Access Driver (*.mdb)** and then click on the button **Finish**.
6. A dialogue box called ODBC Microsoft Access Setup should now appear.
7. Next, enter a Data Source Name. This can be any name the user recognizes, like “St Louis River Database.” The user can also add a Description, but this is optional.
8. After entering a Data Source Name, go to the center of the dialogue box where it says ‘Database.’ Click on the button labeled **Select...**
9. This opens a dialogue box called Select Database and allows the user to browse to the location of the St Louis River database. Browse through the directories until the file is located; all *.mdb files should show up on the left window of the dialogue box.

When the correct file is located, highlight the name in the left window, and then click on the **OK** button.

10. The user should now be back to the ODBC Microsoft Access Setup dialogue box. The Data Source Name (top of the dialogue box) should be successfully related to the correct Database (middle of the dialogue box). If this is the case, click **OK**.
11. The user should now be back in ODBC Data Source Administrator, where the user's Data Source Name should appear in the list of User Data Sources. If this is correct, then click **OK**. Next, close the other Control Panel windows and continue to Step II.

***NOTE:** Users only have to do this ONCE to connect their database. Thus, every time they open their ArcMap map document, the database will already have an ODBC connection and be ready to connect to ArcMap.*

II. Make a Connection to a Phase II ArcMap Map Document

12. Open an ArcMap 9 map document of interest (e.g., ContaminatedAreas.mxd).
13. Open ArcCatalog by clicking on the ArcCatalog button on the standard toolbar. Select "Database Connections" in the left window table.
14. In ArcCatalog, in the right window under the 'Contents' tab, there should be an option called "Add OLE DB Connection." Double click on this option.
15. A dialogue box called Data Link Properties will open up (under the tab 'Provider'). Highlight Microsoft OLE DB Provider for ODBC Drivers, and then click on the button **Next>>**.
16. The 'Connection' tab will appear and the user will need to "Specify the source of the data." Click on the down arrow from the drop-down list at the top of the dialogue box to view the Data Source Name set-up in Step I. Select the data source.
17. Here it is useful to click on the **Test Connection** button. This step will ensure that the ODBC connection is working properly. If the test connection succeeds, click on **OK**. If not, the database was probably not set-up properly in Step I.
18. The user should now be back in ArcCatalog since a new "OLE DB Connection" has been created. This connection will be highlighted. The user will now be prompted for a new name (the user can edit the name OLE DB Connection). The Data Source Name the user selected before will not be automatically assigned to the OLE DB Connection name. Re-name "OLE DB Connection" to the same or similar name as was used for the Data Source Name. The user is now ready to import data into ArcMap.

***NOTE:** Once the user has set-up a database connection in ArcCatalog, he/she does not have to repeat this step; ArcCatalog will recognize the connections made previously and will re-connect each time it is opened. IF, however, the user makes new queries or tables, he/she will have to Refresh the connection by right-clicking on the connection in ArcCatalog and selecting 'Refresh.'*

19. While still in ArcCatalog, double-click on the new database connection. The contents of the database will open up, and the user will see all of the tables (with a preface of "lkp" or "ptbl") and all of the queries (with the preface of "Qry"). The user can import either tables or queries into ArcMap.

***NOTE:** The ‘Type’ will all be ‘ACCESS Table’ regardless of whether it is a table or query object in the database. ArcCatalog treats these similarly.*

20. In order to import tables into ArcMap, geospatial coordinates must be present. Therefore, only the Station table, and any queries with station locations, can be brought into the users ArcMap map document.
21. First, start with the Station table by dragging the ptbl – Station table and dropping it into the ArcMap Layers window (left window). As a result of this action, the tab will change from “Display” to “Source.”
22. Right-click on the ‘ptbl – STATION’ table icon, and then select **Display XY Data** (this can also be done through the Tools menu).
23. Next, specify the fields for the X and Y coordinates. Under the headings for X Field and Y Field, enter “X-coord” and “Y-coord”, respectively. Click **OK**. Note: if this step does not work, try specifying “Longitude” for the X Field and “Latitude” for the Y Field.
24. The station locations should now appear as points on the top layer of the ArcMap map document. Since missing coordinates are coded as -9, points that appear to be located far away from the area of interest denote stations with missing geospatial coordinates. In case this step does not work, and the user is using a version of MS™ Access newer than the 2000 version, the user will need to truncate the Field Name column in the Access table to 8 characters or less. ArcMap may also encounter problems with spaces and unique characters in Access Field Names. All spaces will be removed from the Field Names in the Phase IV MS™ Access 2000 database.
25. The user can also drag and drop a query from ArcCatalog to ArcMap, and add them following the same **Display XY Data** step as above.

***NOTE:** If the user brings a query into his/her ArcMap map document and tries to view the data, this might be a slow process considering that the queries have to be run each time they are viewed in ArcMap. There is another option to save the query data out as a separate table, so that the process of working with the data are faster. These optional steps are provided below.*

26. After importing the table or query into ArcMap, right-click on the table and select **Data/Export**. This will export the connected query into a *.dbf file, which will be directly imported (rather than linked to) to the users ArcMap map document.
27. Choose ‘All records’ and then either type in, or browse, to determine the location of where to store the new file. The user can re-name the file, or keep it as the same name as the query. Note that the file is automatically given the extension *.dbf. Click **OK**.
28. The user will then be prompted if he/she wants to add the new *.dbf file to his/her ArcMap map document. Click on **Yes**.
29. To add the stations to the users view, follow the same steps given above to **Display XY Data**. The points and underlying data will appear to be exactly the same as the layer linked from Access, but the data will refresh more quickly as the queries do not have to be run in the database each time the view is refreshed in ArcMap.

CHAPTER 4

TREATMENT OF NONDETECT DATA

The treatment of nondetected data was discussed in Section 5.1 of the Phase II Technical Documentation (Smorong *et al.* 2004b). The GIS-based sediment quality database was designed with four data treatment options for censoring nondetected data:

- Substitute nondetected values with one-half the detection limit;
- Delete nondetected values;
- Substitute nondetected values with the detection limit; and
- Exclude nondetected values with high detection limits.

Nondetects are also labeled as left-censored data since their values lie somewhere to the left of the detection limit threshold. Users should be aware that bias may be introduced into the results when the above data treatment options are used. Users interested in better approaches for analyzing censored data should consider using maximum likelihood estimation (MLE), imputation, or the Kaplan-Meier method (Helsel 2005a). MLE solves a “likelihood equation” to find the values for mean and standard deviation that are most likely to have produced both nondetect and detected data (Helsel 2005a). Imputation methods fill in values for censored or missing observations without assigning them all the same value (Helsel 2005a). Kaplan-Meier is a nonparametric method designed to incorporate data with multiple censoring levels and does not require specification of an assumed distribution (Helsel 2005a). Additional information about these methods is available in Helsel (2005a,b).

CHAPTER 5

PROJECT CONTACT

For further information about the Phase III MS™ Access '97/2000 or Query Manager-compatible sediment quality databases for the St. Louis River AOC—Minnesota focus, contact Judy Crane at:

Judy L. Crane, Ph.D., Research Scientist 3
Environmental Analysis and Outcomes Division
MPCA
520 Lafayette Road North
St. Paul, MN 55155-4194
Ph: 651-297-4068
Fax: 651-297-7709
Email: judy.crane@pca.state.mn.us

Documents from the Phase III project will be posted on the MPCA's Contaminated Sediments Web page at: <http://www.pca.state.mn.us/water/sediments/studies-stlouis.html#assessment> . Users will be notified when the Phase IV MS™ Access '97/2000 and Query Manager-compatible sediment quality databases for the St. Louis River AOC—Wisconsin focus, as well as the updated Phase IV ArcMap 9 map documents, have been completed by the spring of 2006.

REFERENCES

- ASCI Corporation. 1996. Results of chronic toxicity testing with whole sediment samples from IT Corporation – Interlake project. Prepared by ASCI Corporation, ASCI-Duluth Environmental Testing Division, Duluth, MN for International Technology (IT) Corporation, St. Paul, MN.
- ASCI Corporation. 2000. Results of ten-day *Hyaella azteca* and *Chironomus tentans* toxicity tests with sediment samples for Fond du Lac Office of Water Protection received October 23, 2000. Prepared by ASCI Corporation, Duluth, MN for Fond du Lac Reservation, Cloquet, MN.
- ASCI Corporation. 2003. Results of ten-day *Hyaella azteca* and *Chironomus tentans* toxicity tests with sediment samples for Fond du Lac Office of Water Protection sediments received December 6, 2002. Prepared by ASCI Corporation, Duluth, MN for Fond du Lac Reservation, Cloquet, MN.
- Bay West. 2001a. (from NOAA's St. Louis River Watershed database; reference citation unavailable)
- Bay West. 2001b. (from NOAA's St. Louis River Watershed database; reference citation unavailable)
- Breneman, D., C. Richards, and S. Lozano. 2000. Environmental influences on benthic community structure in a Great Lakes embayment. *J. Great Lakes Res.* 26:287-304.
- Budzinski, H., I. Jones, J. Bellocq, C. Pierard, and P. Garrigues. 1997. Evaluation of sediment contamination by polycyclic aromatic hydrocarbons in the Gironde estuary. *Marine Chem.* 58:85-97.
- Costa, N. 2000. Quality assurance project plan for sediment quality assessment of reservation lakes. Assistance ID No. GL-97504801-0. Fond du Lac Reservation, Office of Water Protection, Cloquet, MN.
- Costa, N. 2001. Final report. Sediment quality assessment of reservation lakes. GLNPO # GL-97504801-0. Fond du Lac Reservation, Cloquet, MN.
- Costa, N. 2002. Quality assurance project plan for Phase II sediment quality assessment. Assistance ID No. GL2001-047. Fond du Lac Reservation, Office of Water Protection, Cloquet, MN.
- Costa, N. 2004. Final project report. Phase II sediment quality assessment. GLNPO # GL-2001-047. Fond du Lac Reservation, Cloquet, MN.

- Costa, N., M. Watkins, E. Zabel, and P. McCann. 2001. Fond du Lac/Grand Portage fish consumption advisory project. Minnesota Department of Health, St. Paul, MN in collaboration with Fond du Lac Band of Lake Superior Chippewa and Grand Portage Band of Lake Superior Chippewa.
- Crane, J.L. 1997. Toxicity test results of sediment samples collected in 1993 from the Interlake/Duluth Tar and USX Superfund sites. MPCA technical memorandum sent March 25, 1997 to Steve Hennes, Brenda Winkler, John Betcher, Frank Wallner, and Eric Dott. Minnesota Pollution Control Agency, Water Quality Division, St. Paul, MN.
- Crane, J.L. 2005. Quality assurance project plan (QAPP): Phase III GIS-based sediment quality database for the St. Louis River Area of Concern. Minnesota Pollution Control Agency, Environmental Analysis and Outcomes Division, St. Paul, MN. MPCA Document Number tdr-fg04-05. (<http://www.pca.state.mn.us/publications/tdr-fg04-05.pdf>)
- Crane, J.L. and P.L. Myre. 2005. Phase III GIS-based sediment quality database for the St. Louis River Area of Concern (AOC). Addendum to the Phase II help section for database users. Minnesota Pollution Control Agency, Environmental Analysis and Outcomes Division, St. Paul, MN and Exa Data & Mapping Services, Inc., Port Townsend, WA. (<http://www.pca.state.mn.us/publications/tdr-fg05-01.pdf>)
- Crane, J.L., M. Schubauer-Berigan, and K. Schmude. 1997. Sediment assessment of hotspot areas in the Duluth/Superior Harbor. U.S. Environmental Protection Agency, Great Lakes National Program Office, Chicago, IL. EPA-905-R97-020. (<http://www.pca.state.mn.us/water/sediments/94mudpuppy.pdf>)
- Crane, J.L., C. Richards, D. Breneman, S. Lozano, and J.A. Schuldt. 2005. Evaluating methods for assessing sediment quality in a Great Lakes embayment. Aquatic Ecosystem Health Manage. 8:1-27.
- Crane, J.L., D.D. MacDonald, C.G. Ingersoll, D.E. Smorong, R.A. Lindskoog, C.G. Severn, T.A. Berger, and L.J. Field. 2000. Development of a framework for evaluating numerical sediment quality targets and sediment contamination in the St. Louis River Area of Concern. U.S. Environmental Protection Agency, Great Lakes National Program Office, Chicago, IL. EPA 905-R-00-008. (<http://www.pca.state.mn.us/water/sediments/sqt-slraoc.pdf> and <http://www.pca.state.mn.us/water/sediments/sqt-tables.pdf>)
- Crane, J.L., D.D. MacDonald, C.G. Ingersoll, D.E. Smorong, R.A. Lindskoog, C.G. Severn, T.A. Berger, and L.J. Field. 2002. Evaluation of numerical sediment quality targets for the St. Louis River Area of Concern. Arch. Environ. Contam. Toxicol. 43:1-10.
- Di Toro, D.M., J.A. McGrath, and D.J. Hansen. 2000. Technical basis for narcotic chemicals and polycyclic aromatic hydrocarbon criteria. I. Water and tissue. Environ. Toxicol. Chem. 19:1951-1970.

- Field, L.J., D.D. MacDonald, S.B. Norton, C.G. Ingersoll, C.G. Severn, D. Smorong, and R. Lindskoog. 2002. Predicting amphipod toxicity from sediment chemistry using logistic regression models. *Environ. Toxicol. Chem.* 21:1993-2005.
- Helsel, D.R. 2005a. More than obvious: Better methods for interpreting nondetect data. *Environ. Sci. Technol.* 39:419A-423A.
- Helsel, D.R. 2005b. Nondetects and data analysis. Statistics for censored environmental data. Wiley-Interscience, Hoboken, NJ. 250 pp.
- IJC (International Joint Commission). 1989. Great Lakes water quality agreement of 1978 (as amended by Protocol signed November 18, 1987). International Joint Commission, Windsor, ON. (<http://www.ijc.org/rel/agree/quality.html>)
- IT (International Technology). 1993. (from NOAA's St. Louis River Watershed database; reference citation unavailable)
- IT. 1994. (from NOAA's St. Louis River Watershed database; reference citation unavailable)
- IT. 1996. (from NOAA's St. Louis River Watershed database; reference citation unavailable)
- IT. 1997. (from NOAA's St. Louis River Watershed database; reference citation unavailable)
- IT Corporation. 1997. Remedial investigation data report, sediment operable unit, St. Louis River/Interlake/Duluth Tar site. Volume 1 of 5. Prepared by IT Corp., St. Paul, MN for the Interlake Corporation, Lisle, IL.
- IT. 1998. (from NOAA's St. Louis River Watershed database; reference citation unavailable)
- IT. 1999. (from NOAA's St. Louis River Watershed database; reference citation unavailable)
- Krueger, G. 1998. Superfund site assessment/brownfield activities in Minnesota. Quality assurance project plan. Minnesota Pollution Control Agency, Site Assessment Program, St. Paul, MN.
- MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems. *Arch. Environ. Contam. Toxicol.* 39:20-31.
- McCann, P. 2001. Quality assurance project plan. Grand Portage/Fond du Lac fish consumption advisory project. Grant #X00562101-1. Minnesota Department of Health, St. Paul, MN.
- MPCA (Minnesota Pollution Control Agency). Unpublished data. Sediment quality data collected from the Interlake/Duluth Tar and USX Superfund sites during September 1993. Minnesota Pollution Control Agency, St. Paul, MN.

- MPCA. Unpublished data. Sediment quality data collected from reference sites at the St. Louis River Interlake/Duluth Tar Superfund site during 2001. Minnesota Pollution Control Agency, Environmental Outcomes Division, St. Paul, MN.
- Myre, P.L. 2005. Draft user guide. Query descriptions developed for the GIS-based sediment quality database for the St. Louis River Area of Concern. Rev. October 11, 2005. Prepared by Exa Data & Mapping, Inc., Port Townsend, WA for Minnesota Pollution Control Agency, Environmental Analysis and Outcomes Division, St. Paul, MN.
- Service Engineering Group. 2000. (from NOAA's St. Louis River Watershed database; reference citation unavailable)
- Service Engineering Group. 2001a. (from NOAA's St. Louis River Watershed database; reference citation unavailable)
- Service Engineering Group. 2001b. (from NOAA's St. Louis River Watershed database; reference citation unavailable)
- Service Engineering Group. 2004. Remedial design/response action plan. St. Louis River/Interlake/Duluth Tar site remediation sediment operable unit. Prepared by Service Engineering Group, St. Paul, MN for XIK Corporation, Honeywell International, Inc., and Domtar Inc.
- Service Engineering Group. Unpublished data. Sediment chemistry data files for sediment samples collected from Stryker Bay and Slip 7 during 2003 and 2004. Service Engineering Group, St. Paul, MN.
- Service Engineering Group. Unpublished data. Sediment chemistry data files for sediment samples collected from the Cross Channel, Erie Pier, Kingsbury Bay, and Tallas Island areas of the lower St. Louis River Area of Concern (AOC) during 2004. Service Engineering Group, St. Paul, MN.
- Smorong, D.E. and J.L. Crane. 2004. Phase II GIS-based sediment quality database for the St. Louis River Area of Concern (AOC). Help section for database users. MacDonald Environmental Sciences Ltd., Nanaimo, BC and Minnesota Pollution Control Agency, Environmental Analysis and Outcomes Division, St. Paul, MN. MPCA Document Number tdr-fg04-01. (<http://www.pca.state.mn.us/publications/tdr-fg04-01.pdf>)
- Smorong, D.E., C.L. Mackenzie, and J.L. Crane. 2004a. Phase II GIS-based sediment quality database for the St. Louis River Area of Concern (AOC). Help section for ArcView users. MacDonald Environmental Sciences Ltd., Nanaimo, BC and Minnesota Pollution Control Agency, Environmental Analysis and Outcomes Division, St. Paul, MN. MPCA Document Number tdr-fg04-02. (<http://www.pca.state.mn.us/publications/tdr-fg04-02.pdf>)

- Smorong, D.E., C.L. Mackenzie, J.L. Crane, D.D. MacDonald, L.J. Fisher, and C.A. Huntington. 2004b. Phase II GIS-based sediment quality database for the St. Louis River Area of Concern (AOC). Technical documentation. MacDonald Environmental Sciences Ltd., Nanaimo, BC and Minnesota Pollution Control Agency, Environmental Analysis and Outcomes Division, St. Paul, MN. MPCA Document Number tdr-fg04-03. (<http://www.pca.state.mn.us/publications/tdr-fg04-03.pdf>)
- St. Louis River Natural Resource Trustees. 2002. Fish exposure and injury study workplan for the St. Louis River/Interlake/Duluth Tar site. St. Louis River Natural Resource Trustees (composed of several state/federal government and tribal entities located in the Great Lakes basin). (<http://www.pca.state.mn.us/publications/reports/stlouisriver-interlake-fishstudy.pdf>)
- Streitz, A. and S. Johnson. 2005. Detailed investigation of the Minnesota Slip featuring laser induced fluorescence. Minnesota Pollution Control Agency, Remediation Division, Duluth, MN. MPCA Document Number tdr-g1-01. (<http://www.pca.state.mn.us/publications/tdr-g1-01.pdf>)
- Swartz, R.C., D.W. Schults, R.J. Ozretich, J.O. Lamberson, F.A. Cole, T.H. DeWitt, M.S. Redmond, and S.P. Ferraro. 1995. Σ PAH: A model to predict the toxicity of polynuclear aromatic hydrocarbon mixtures in field-collected sediments. Environ. Toxicol. Chem. 14:1977-1987.
- URS Corporation. 2003. Former Duluth Works tier II risk assessment work plan. Prepared by URS Corporation, Franklin, TN for U.S. Steel, Pittsburgh, PA.
- U.S. Fish and Wildlife Service (USFWS). Unpublished data. Tissue residue data for mercury and PAHs analyzed from fish collected from the St. Louis River/Interlake/Duluth Tar Superfund site (Stryker Bay, Keene Creek/Slip 7), Kingsbury Bay, and North Bay during 2001 and 2002. U.S. Fish and Wildlife Service, Bloomington, MN.
- van den Berg, M., L. Birnbaum, A.T.C. Bosveld., B. Brunström, P. Cook, M. Feeley, J.P. Giesy, A. Hanberg, R. Hasegawa, S.W. Kennedy, T. Kubiak, J.C. Larsen, F.X. Rolaf van Leeuwen, A.K.D. Liem, C. Nolt, R.E. Peterson, L. Poellinger, S. Safe, D. Schrenk, D. Tillitt, M. Tysklind, M. Younes, F. Waern, and T. Zacharewski. 1998. Toxic equivalency factors (TEFs) for PCBs, PCDDs, PCDFs for humans and wildlife. Environ. Health Perspectives 106:775-792.
- WDNR (Wisconsin Department of Natural Resources). 2003. Consensus-based sediment quality guidelines. Recommendations for use and application. Interim guidance. Wisconsin Department of Natural Resources, Contaminated Sediment Standing Team, Madison, WI. WT-732 2003. (http://dnr.wi.gov/org/aw/rr/technical/cbsqg_interim_final.pdf)

West Central Environmental Consultants. 2004. Minnesota Slip site sediment sampling and analysis plan. Prepared by West Central Environmental Consultants, Morris, MN for Minnesota Pollution Control Agency, Duluth, MN.

(<http://www.pca.state.mn.us/water/sediments/slipsite-samplingplan.pdf>)

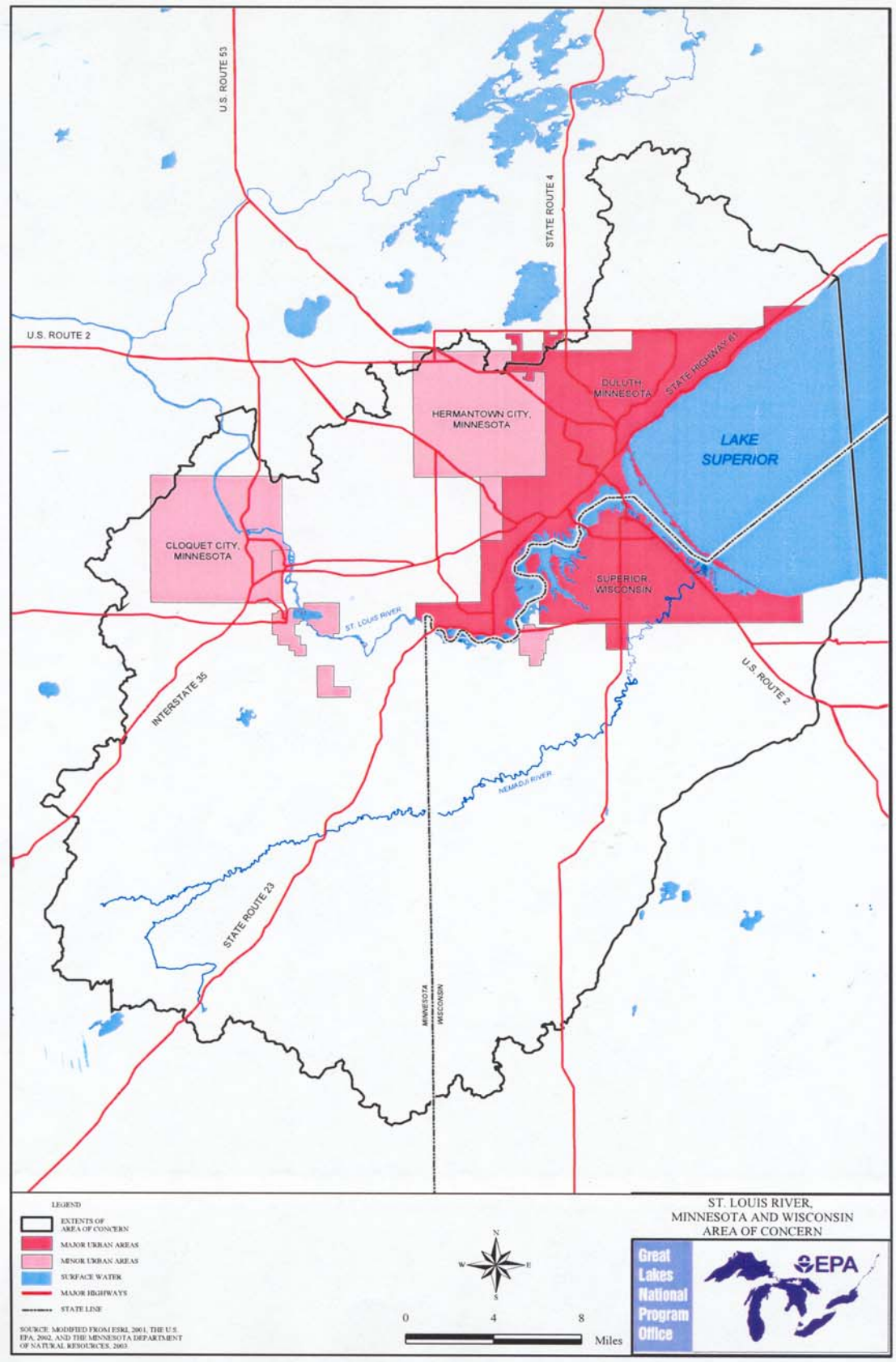


Figure 1. Map of the St. Louis River AOC.

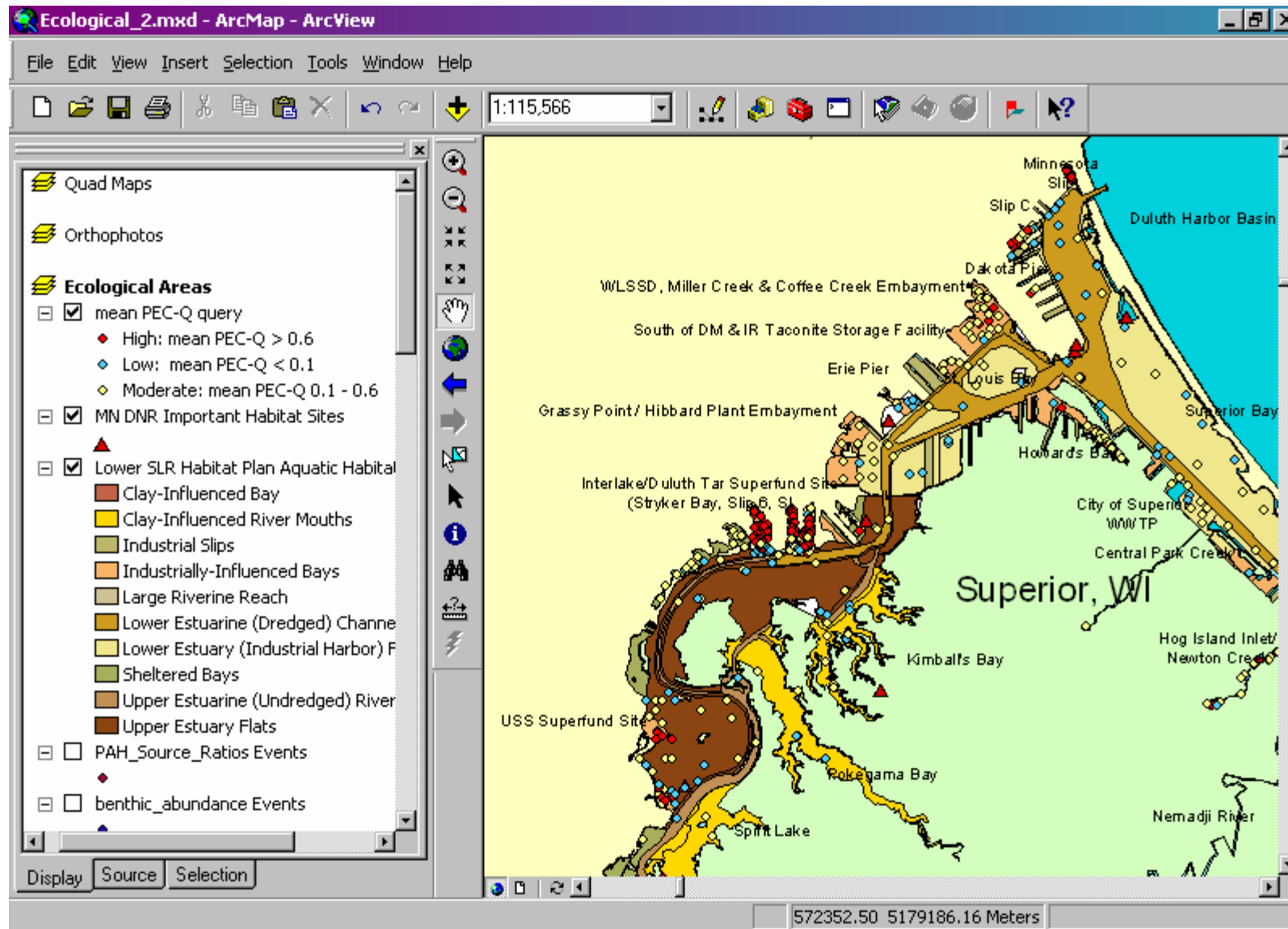


Figure 2. Example linkage of the Phase III MS™ Access 2000 database query results for mean probable effect concentration quotient (PEC-Q) ranges with the Phase II ArcMap 9 map document for Ecological Features within the lower St. Louis River AOC.

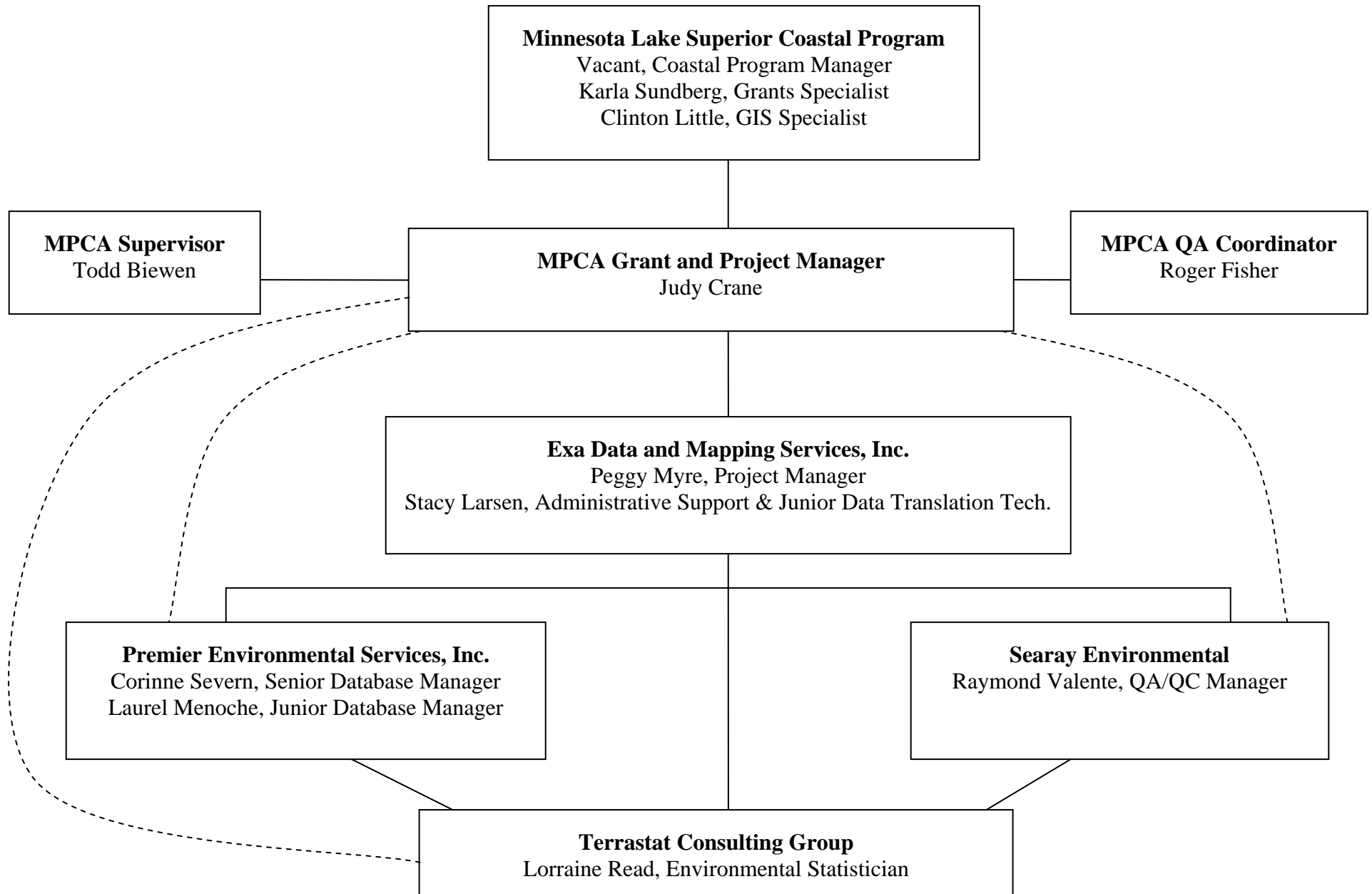


Figure 3. Project organization chart for the Phase III GIS-based sediment quality database project.

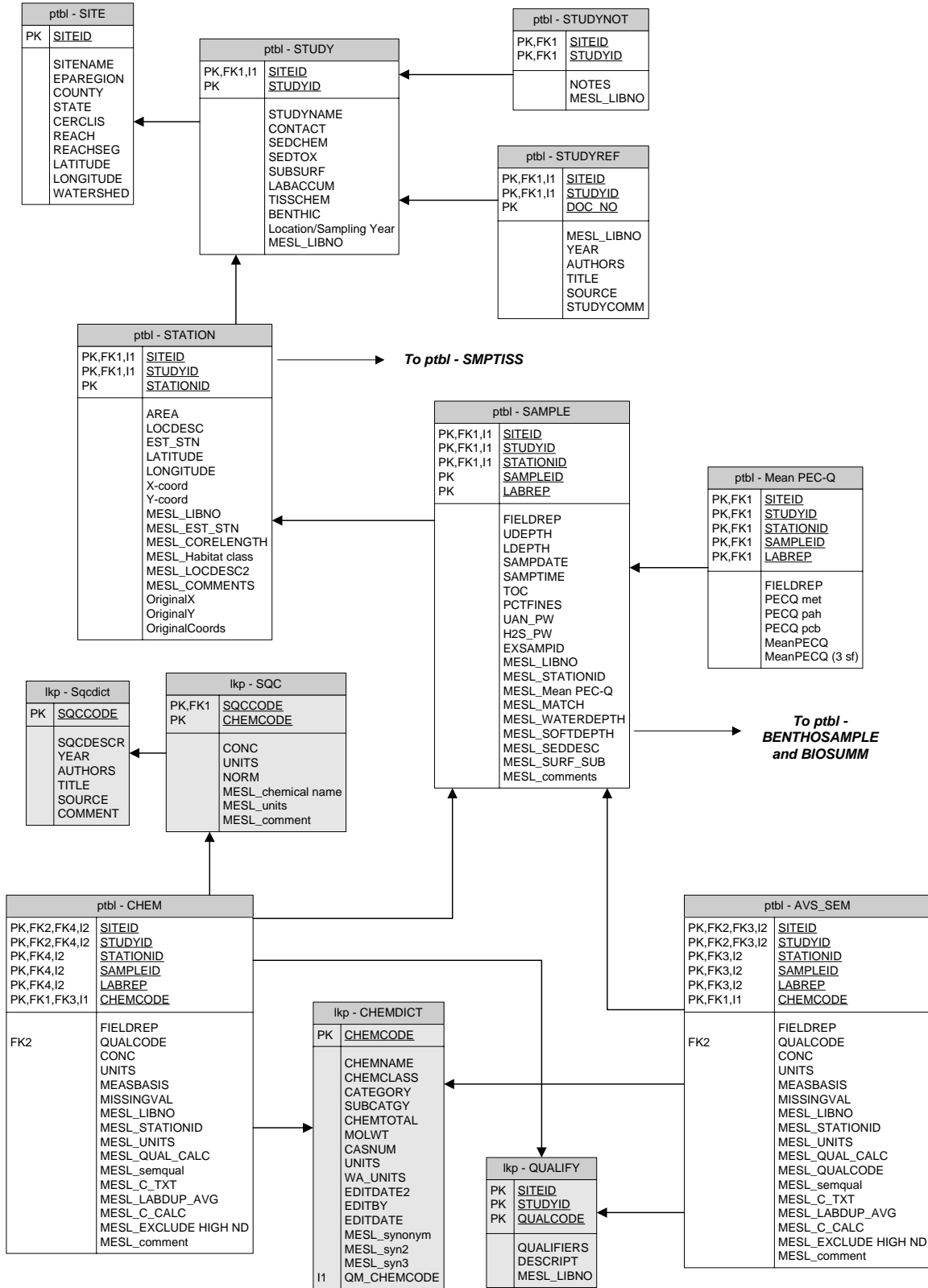


Figure 4. Diagram showing the relationships between components of the MS™ Access 2000 sediment quality database.

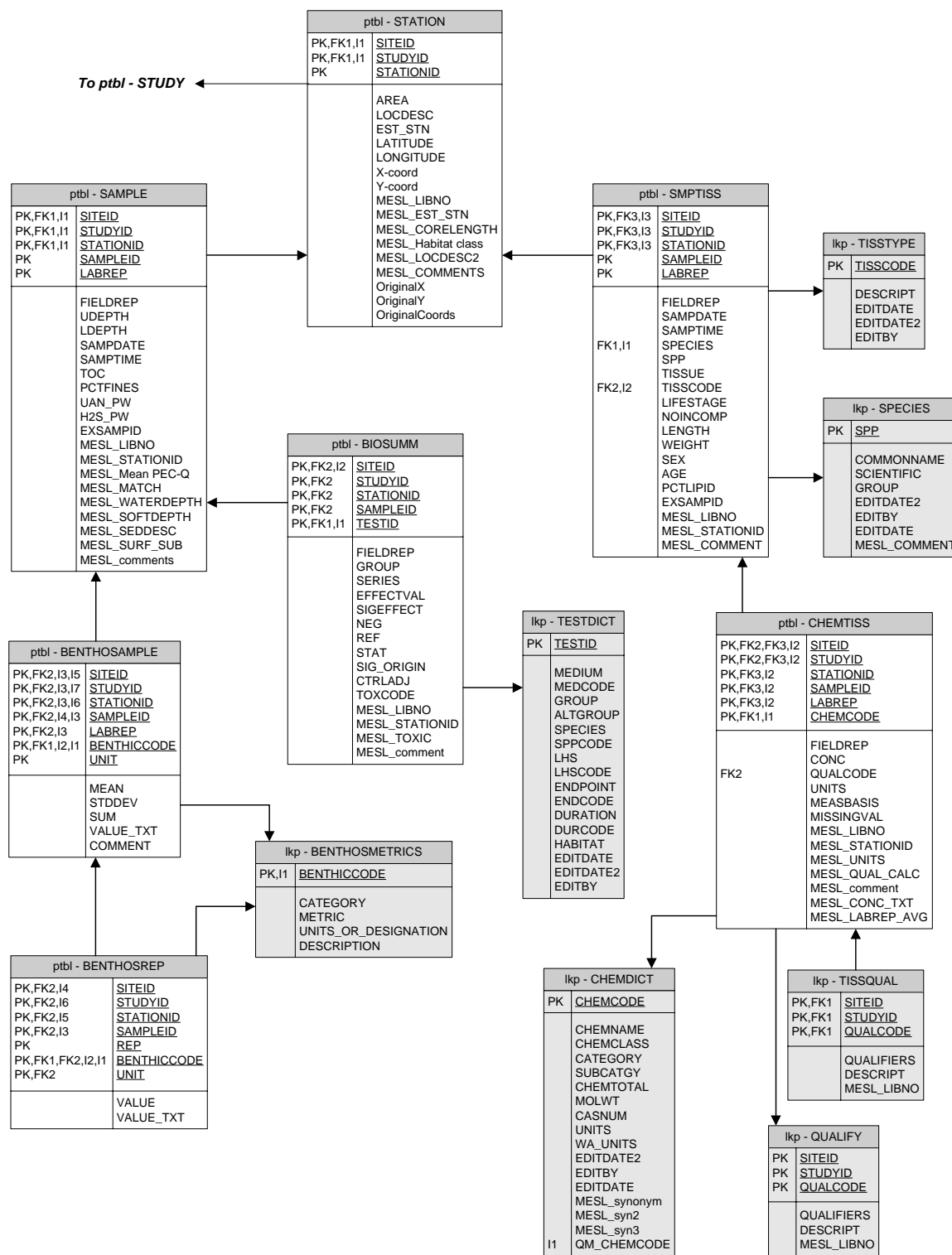


Figure 4. Continued.

Table 1. Benthic Invertebrate Community Metrics for Individual Field Replicate Samples

| Benthic Metric | Units or Designation |
|---|---|
| <p>Taxonomic Group</p> <ul style="list-style-type: none"> Amphipoda abundance Chironomidae abundance Coenagrionidae abundance Coleoptera abundance Corixidae abundance Crustacea abundance Diptera abundance Dytiscidae abundance Ephemeroptera abundance Hemiptera abundance Mollusca abundance Odonata abundance Oligochaeta abundance Plecoptera abundance Polychaeta abundance Sphaeriidae abundance Tanytarsini abundance Trichoptera abundance Non-insect abundance total abundance total taxa Stream index abundance: Ephemeroptera, Plecoptera, and Trichoptera Wetland index abundance: Ephemeroptera, Trichoptera, Sphaeriidae, and Odonata | <ul style="list-style-type: none"> no. of organisms/m² or percent no. of organisms/m² or percent no. of organisms/m² or percent no. of organisms/m² or percent no. of organisms/m² or percent no. of organisms/m² or percent no. of organisms/m² or percent no. of organisms/m² or percent no. of organisms/m² or percent no. of organisms/m² or percent no. of organisms/m² or percent no. of organisms/m² or percent no. of organisms/m² or percent no. of organisms/m² or percent no. of organisms/m² or percent no. of organisms/m² or percent no. of organisms/m² or percent no. of organisms/m² or percent no. of taxa/m² no. of organisms/m² or percent no. of organisms/m² or percent |
| <p>Behavioral Group</p> <ul style="list-style-type: none"> burrower abundance climber abundance clinger abundance | <ul style="list-style-type: none"> no. of organisms/m² or percent no. of organisms/m² or percent no. of organisms/m² or percent |
| <p>Functional Group</p> <ul style="list-style-type: none"> collector abundance grazer abundance predator abundance shredder abundance | <ul style="list-style-type: none"> no. of organisms/m² or percent no. of organisms/m² or percent no. of organisms/m² or percent no. of organisms/m² or percent |

Table 1. Continued

| Benthic Metric | Units or Designation |
|--|---|
| <p>Habitat Preference* taxa associated with erosional habitats taxa associated with depositional habitats</p> | <p>percent percent</p> |
| <p>Mechanism engulfer abundance filterer abundance gatherer abundance scraper abundance</p> | <p>no. of organisms/m² or percent no. of organisms/m² or percent no. of organisms/m² or percent no. of organisms/m² or percent</p> |
| <p>Mobility non-mobile abundance mobile abundance</p> | <p>no. of organisms/m² or percent no. of organisms/m² or percent</p> |
| <p>Tolerance tolerance abundance</p> | <p>no. of organisms/m² or percent</p> |
| <p>Trophic Group carnivore abundance detritivore abundance herbivore abundance omnivore abundance</p> | <p>no. of organisms/m² or percent no. of organisms/m² or percent no. of organisms/m² or percent no. of organisms/m² or percent</p> |

Notes:

no. = number

* Habitat preference data are only available for the 1995 R-EMAP samples (Breneman *et al.* 2000; Crane *et al.* 2005).

Percentage abundance measurements represent a percentage of the total abundance.

Percentage taxa measurements represent a percentage of the total number of taxa.

Table 2. Continued

| Benthic Metric | Units or Designation |
|--|---|
| <p>Habitat Preference* mean/SD taxa associated with erosional habitats mean/SD taxa associated with depositional habitats</p> | <p>percent percent</p> |
| <p>Mechanism mean/SD engulfer abundance mean/SD filterer abundance mean/SD gatherer abundance mean/SD scraper abundance</p> | <p>no. of organisms/m² or percent no. of organisms/m² or percent no. of organisms/m² or percent no. of organisms/m² or percent</p> |
| <p>Mobility mean/SD non-mobile abundance mean/SD mobile abundance</p> | <p>no. of organisms/m² or percent no. of organisms/m² or percent</p> |
| <p>Tolerance mean/SD tolerance abundance</p> | <p>no. of organisms/m² or percent</p> |
| <p>Trophic Group mean/SD carnivore abundance mean/SD detritivore abundance mean/SD herbivore abundance mean/SD omnivore abundance</p> | <p>no. of organisms/m² or percent no. of organisms/m² or percent no. of organisms/m² or percent no. of organisms/m² or percent</p> |
| <p>Benthic Classification** Multimetric Classification Discriminant Function Analysis</p> | <p>Low Impact, Indeterminant, High Impact Low Impact, High Impact</p> |

Notes:

SD = standard deviation

no. = number

* Habitat preference data are only available for the 1995 R-EMAP samples (Breneman *et al.* 2000; Crane *et al.* 2005).

** Benthic classification data are only available for the 1995 R-EMAP samples collected from the lower St. Louis River estuary and harbor (i.e., excludes the reservoir samples; Crane *et al.* 2005).

Percentage abundance measurements represent a percentage of the total abundance.

Percentage taxa measurements represent a percentage of the total number of taxa.

Table 3. Benthic Invertebrate Community Metrics for the Sum of Field Replicate Samples

| Benthic Metric | Units or Designation |
|---|---------------------------------|
| Taxonomic Group | |
| sum Amphipoda abundance | no. of organisms/m ² |
| sum Chironomidae abundance | no. of organisms/m ² |
| sum Coenagrionidae abundance | no. of organisms/m ² |
| sum Coleoptera abundance | no. of organisms/m ² |
| sum Corixidae abundance | no. of organisms/m ² |
| sum Crustacea abundance | no. of organisms/m ² |
| sum Diptera abundance | no. of organisms/m ² |
| sum Dytiscidae abundance | no. of organisms/m ² |
| sum Ephemeroptera abundance | no. of organisms/m ² |
| sum Hemiptera abundance | no. of organisms/m ² |
| sum Mollusca abundance | no. of organisms/m ² |
| sum Odonata abundance | no. of organisms/m ² |
| sum Oligochaeta abundance | no. of organisms/m ² |
| sum Plecoptera abundance | no. of organisms/m ² |
| sum Polychaeta abundance | no. of organisms/m ² |
| sum Sphaeriidae abundance | no. of organisms/m ² |
| sum Tanytarsini abundance | no. of organisms/m ² |
| sum Trichoptera abundance | no. of organisms/m ² |
| sum Non-insect abundance | no. of organisms/m ² |
| sum total abundance | no. of organisms/m ² |
| sum Stream index abundance: Ephemeroptera, Plecoptera, and Trichoptera | no. of organisms/m ² |
| sum Wetland index abundance: Ephemeroptera, Trichoptera, Sphaeriidae, and Odonata | no. of organisms/m ² |
| Behavioral Group | |
| sum burrower abundance | no. of organisms/m ² |
| sum climber abundance | no. of organisms/m ² |
| sum clinger abundance | no. of organisms/m ² |
| Functional Group | |
| sum collector abundance | no. of organisms/m ² |
| sum grazer abundance | no. of organisms/m ² |
| sum predator abundance | no. of organisms/m ² |
| sum shredder abundance | no. of organisms/m ² |

Table 3. Continued

| Benthic Metric | Units or Designation |
|---|--|
| <p>Mechanism</p> <ul style="list-style-type: none"> sum engulfer abundance sum filterer abundance sum gatherer abundance sum scraper abundance <p>Mobility</p> <ul style="list-style-type: none"> sum non-mobile abundance sum mobile abundance <p>Tolerance</p> <ul style="list-style-type: none"> sum tolerance abundance <p>Trophic Group</p> <ul style="list-style-type: none"> sum carnivore abundance sum detritivore abundance sum herbivore abundance sum omnivore abundance | <ul style="list-style-type: none"> no. of organisms/m² no. of organisms/m² no. of organisms/m² no. of organisms/m² <ul style="list-style-type: none"> no. of organisms/m² no. of organisms/m² <ul style="list-style-type: none"> no. of organisms/m² <ul style="list-style-type: none"> no. of organisms/m² no. of organisms/m² no. of organisms/m² no. of organisms/m² |

Notes:

no. = number

Table 4. Summary of Data Sets Incorporated into the Phase III GIS-based Sediment Quality Database for the St. Louis River AOC

| Reference | Location | Sampling Year(s) | DESCRIPTION OF DATA AND DATA TYPES | | | | |
|--|--|------------------|---|--------------------|--------------|----------------------|-------------------------|
| | | | Sediment Chemistry | Toxicity Test Data | Benthic Data | Bioaccumulation Data | Total Number of Samples |
| ASci Corporation (1996) | St. Louis River Interlake/Duluth Tar (SLRIDT) Superfund site | 1996 | Grain size, ammonia, SEM metals, AVS, metals, PAHs | Yes | No | No | 16 |
| Bay West (2001a) | SLRIDT Superfund site | 2001 | TOC, solids, grain size, metals, PAHs and other semi-volatiles, volatiles | No | No | No | 34 |
| Bay West (2001b) | SLRIDT Superfund site | 2001 | TOC, grain size, solids, cyanide, metals, PAHs and other semi-volatiles, volatiles, dioxins/furans, organo-metals, PCBs | Yes | No | Yes | 47 |
| Breneman <i>et al.</i> (2000); Crane <i>et al.</i> (2005)* | Minnesota side of the St. Louis River AOC | 1995; 1996 | SEM metals, AVS, Hg, PAHs, TOC, particle size | Yes | Yes | No | 306 |
| Costa (2000, 2001); ASci Corporation (2000) | Reservation lakes near St. Louis River: Big Lake, Deadfish Lake, Lost Lake, Joe Martin Lake, Pat Martin Lake, Perch Lake, Rice Portage Lake, Simian Lake, Sofie Lake, Third Lake, and West Twin Lake | 2000 | PCBs, Pb, Hg, total solids, total volatile solids, particle size | Yes | No | No | 104 |
| Costa <i>et al.</i> (2001) and McCann (2001) | St. Louis Bay and upper St. Louis River | 2000 | No | No | No | Yes | 99 |

Table 4. Continued

| Reference | Location | Sampling Year(s) | DESCRIPTION OF DATA AND DATA TYPES | | | | |
|---|---|------------------|---|--------------------|--------------|----------------------|-------------------------|
| | | | Sediment Chemistry | Toxicity Test Data | Benthic Data | Bioaccumulation Data | Total Number of Samples |
| Costa (2002, 2004); ASci Corporation (2003) | St. Louis River and reservation lakes listed for Costa (2000, 2001) | 2002 | Pb, Hg, methyl Hg, PCBs, particle size, total solids, total volatile solids (methyl Hg was also analyzed on archived reservation lake samples collected in 2000 as part of Phase I study; Costa 2001) | Yes | No | No | 21 |
| Crane <i>et al.</i> (1997)* | Minnesota side of the lower St. Louis River AOC | 1994 | SEM metals, AVS, As, Pb, Hg, TCDDs, TCDFs, PAHs, PCBs, Ammonia, TOC, particle size | Yes | Yes | No | 225 |
| IT (1993) | SLRIDT Superfund site | 1993 | TOC, ammonia, cyanide, moisture, solids, metals, PAHs, volatiles | No | No | No | 22 |
| IT (1994) | SLRIDT Superfund site | 1994 | PAHs | No | No | No | 1 |
| IT (1996) | SLRIDT Superfund site | 1996 | Grain size, ammonia, cyanide, solids, sulfate, TOC, metals, PAHs, volatiles | No | No | No | 56 |
| IT (1997) | SLRIDT Superfund site | 1997 | Solids, ammonia, cyanide, moisture, TOC, metals, PAHs, volatiles | No | No | No | 6 |
| IT (1998) | SLRIDT Superfund site | 1998 | Grain size, solids, specific gravity, TOC, metals, PAHs | No | No | No | 26 |
| IT (1999) | SLRIDT Superfund site | 1999 | Grain size, pH, solids, specific gravity, TOC, metals, SEM metals, PAHs | No | No | No | 656 |

Table 4. Continued

| Reference | Location | Sampling Year(s) | DESCRIPTION OF DATA AND DATA TYPES | | | | |
|---|--|------------------|--|--------------------|--------------|----------------------|-------------------------|
| | | | Sediment Chemistry | Toxicity Test Data | Benthic Data | Bioaccumulation Data | Total Number of Samples |
| MPCA (unpublished data files - 1993); Crane (1997) | USX Superfund site | 1993 | PAHs, phenol, metals, Hg, ammonia, CN, oil & grease, TOC (matching sediment chemistry/toxicity data were previously added to the database) | Yes | No | No | 41 |
| MPCA (unpublished data - 2001) | SLRIDT Superfund site: Reference sites | 2001 | TOC, moisture, metals, PAHs and other semi-volatiles, volatiles | No | No | No | 20 |
| Service Engineering Group (2000) | SLRIDT Superfund site | 2000 | TOC, volatiles | No | No | No | 17 |
| Service Engineering Group (2001a) | SLRIDT Superfund site | 2001 | Grain size, moisture | No | No | No | 256 |
| Service Engineering Group (2001b) | SLRIDT Superfund site | 2001 | Grain size, pH, solids, TOC, conductivity, alkalinity, sulfate, metals, PAHs and other semi-volatiles, volatiles, organo-metals | No | No | No | 100 |
| Service Engineering Group (2004) and unpublished data | SLRIDT Superfund site: Stryker Bay and Slip 7 | 2003; 2004 | PAHs, PCBs, metals, Hg, cation exchange capacity, organic matter, pH, total Kjeldahl nitrogen, total nitrogen, phosphorus, TOC, total solids | No | No | No | 52 |
| Service Engineering Group (2004) and unpublished data | Tallas Island, Kingsbury Bay, Erie Pier, Cross Channel | 2004 | PAHs, PCBs, pesticides and herbicides, metals, Hg, nitrate/nitrite, phosphorus, pH, TOC, organic matter, % solids | No | No | No | 31 |

Table 4. Continued

| Reference | Location | Sampling Year(s) | DESCRIPTION OF DATA AND DATA TYPES | | | | |
|---|---|------------------|--|--------------------|--------------|----------------------|-------------------------|
| | | | Sediment Chemistry | Toxicity Test Data | Benthic Data | Bioaccumulation Data | Total Number of Samples |
| St. Louis River Natural Resource Trustees (2002); USFWS (in preparation) | SLRIDT Superfund site (Stryker Bay, Keene Creek/Slip 7); North Bay, Kingsbury Bay | 2001; 2002 | No | No | No | Yes | 180 |
| Streitz and Johnson (2005); West Central Environmental Consultants (2004); Krueger (1998) | Minnesota Slip | 2004 | PAHs, PCBs, DROs, metals, Hg, boron, particle size, TOC, bulk density | No | No | No | 14 |
| URS Corp. (2003); report in preparation | USS Superfund site | 2003 | PAHs, PCBs, DROs, dioxins/furans, carbazole, dibenzofuran, OCS, HCB, VOCs, metals, Hg, AVS, SEM, CN, TOC, ammonia, particle size | No | No | No | 41 |
| URS Corp. (2003); MPCA split samples | USS Superfund site | 2003 | PAHs, PCBs, DROs, dioxins/furans, carbazole, dibenzofuran, OCS, HCB, VOCs, metals, Hg, AVS, SEM, CN, TOC, ammonia, particle size | No | No | No | 16 |

As = Arsenic; AVS = acid volatile sulfides; CN = cyanide; DRO = diesel range organics; HCB = hexachlorobenzene; Hg = mercury; OCS = octachlorostyrene; PAH = polycyclic aromatic hydrocarbons; Pb = lead, PCBs = polychlorinated biphenyls; SEM = simultaneously extractable metals; TCDD = tetrachlorodibenzo-p-dioxins; TCDF = tetrachlorodibenzofurans; TOC = total organic carbon; VOCs = volatile organic compounds.

* Sediment chemistry and sediment toxicity data were added to previous phases of the sediment quality database.

Table 5. Detailed Description of Database Components

| Table Name | Field Name | Data Type | Field Size | Table Description / Field Description |
|----------------------------|----------------------|----------------|------------|---|
| lkp - BENTHOMETRICS | | | | |
| | BENTHICCODE | Text | 4 | Code for benthic parameter. |
| | CATEGORY | Text | 25 | General category or grouping for the benthic parameter. |
| | METRIC | Text | 50 | Measurement of the benthic parameter. |
| | UNITS_OR_DESIGNATION | Text | 50 | Possible units or designation for the parameter. |
| | DESCRIPTION | Text | 200 | Description of the benthic parameter. |
| lkp - CHEMDICT | | | | |
| | CHEMCODE | Text | 10 | Chemical code. |
| | CHEMNAME | Text | 45 | Chemical name. |
| | CHEMCLASS | Text | 8 | Chemical class. |
| | CATEGORY | Text | 8 | Query Manager field. |
| | SUBCATGY | Text | 10 | Query Manager field. |
| | CHEMTOTAL | Text | 10 | Query Manager field. |
| | MOLWT | Number, Double | 8 | Molecular weight of chemical. |
| | CASNUM | Text | 24 | Chemical abstract services number. |
| | UNITS | Text | 6 | Units of chemical concentration. |
| | WA_UNITS | Text | 6 | Query Manager field. |
| | EDITDATE2 | Text | 8 | Query Manager field. |
| | EDITBY | Text | 15 | Query Manager field. |
| | EDITDATE | Date/Time | 8 | Query Manager field. |
| | MESL_synonym | Text | 150 | Synonym for chemical name. |
| | MESL_syn2 | Text | 150 | Synonym for chemical name. |
| | MESL_syn3 | Text | 150 | Synonym for chemical name. |
| | QM_CHEMCODE | Text | 50 | Equivalent chemcode for Query Manager. |

Table 5. Continued

| Table Name | Field Name | Data Type | Field Size | Table Description / Field Description |
|---------------------------|-----------------|----------------------|------------|---|
| lkp - QryDepthBin | | | | Lookup table used to classify data into sediment depth bins. |
| | UDEPTH | Number, Single | 4 | Upper sampling depth (cm). |
| | LDEPTH | Number, Single | 4 | Lower sampling depth (cm). |
| | SORTORDER | Number, Long Integer | 4 | Used in queries to sort results by depth bin. |
| | DEPTHBIN | Text | 15 | Sediment depth bin category used in queries. |
| lkp - QryPEC_Class | | | | Lookup table used to classify data into risk categories. |
| | MESL_Mean PEC-Q | Number, Single | 4 | A unique list of PEC quotients from sediment quality database, rounded to 3 significant digits. |
| | CLASSIFICATION | Text | 20 | Classification of risk. |
| lkp - QUALIFY | | | | Lookup table for sediment chemistry qualifiers (QUALCODE). |
| | SITEID | Text | 4 | Site ID code (from Query Manager). |
| | STUDYID | Text | 2 | Study ID code. |
| | QUALCODE | Text | 5 | Qualifier code for concentration value, modified to be compatible with Query Manager (all ND data has a "U" in this field). |
| | QUALIFIERS | Text | 30 | Qualifier code for concentration value, as designated in report. |
| | DESCRIPT | Text | 80 | Description of the meaning of the qualifier, as indicated in the original report or data file. |
| | MESL_LIBNO | Text | 50 | MESL - library number. |
| lkp - SPECIES | | | | Lookup table for tissue samples species type (SPP). |
| | SPP | Text | 5 | Species code. |
| | COMMONNAME | Text | 25 | Common name. |
| | SCIENTIFIC | Text | 40 | Scientific name. |
| | GROUP | Text | 25 | Query Manager field. |
| | EDITDATE2 | Text | 8 | Query Manager field. |
| | EDITBY | Text | 15 | Query Manager field. |
| | EDITDATE | Date/Time | 8 | Query Manager field. |
| | MESL_COMMENT | Text | 50 | MESL - comments. |

Table 5. Continued

| Table Name | Field Name | Data Type | Field Size | Table Description / Field Description |
|-----------------------|--------------------|-----------------|------------|--|
| lkp - SQC | | | | |
| | | | | Sediment Quality Criteria: Level I and Level II SQTs (Crane <i>et al.</i> 2000) and SQGs (WDNR 2003). |
| | SQCCODE | Text | 10 | Code for Sediment Quality Criteria (see lkp - Sqcdict for a description of the codes). |
| | CHEMCODE | Text | 10 | Chemical code (defined in lkp - chemdict). |
| | CONC | Number, Double | 8 | Chemical concentration. |
| | UNITS | Text | 6 | Units of SQC is reported in. |
| | NORM | Text | 2 | Indicates measurement basis SQC are reported in. |
| | MESL_chemical name | Text | 50 | MESL - chemical name. |
| | MESL_units | Text | 50 | MESL - units. |
| | MESL_comment | Text | 100 | MESL - comments. |
| lkp - Sqcdict | | | | |
| | | | | Lookup table for Sediment Quality Criteria references (SQCCODE). |
| | SQCCODE | Text | 10 | Code for Sediment Quality Criteria. |
| | SQCDESCR | Text | 90 | Description of the SQCCODE. |
| | YEAR | Text | 4 | Year of publishing for study reporting the sediment quality criteria. |
| | AUTHORS | Text | 160 | Authors for study reporting the sediment quality criteria. |
| | TITLE | Text | 160 | Title of the study reporting the sediment quality criteria. |
| | SOURCE | Text | 160 | Source (location) for study reporting the sediment quality criteria. |
| | COMMENT | Text | 160 | Comments. |
| lkp - SQCPAIRS | | | | |
| | | | | Lookup table for identifying Sediment Quality Criteria pairs. |
| | PAIRNAME | Text | 50 | High and low Sediment Quality Criteria (how Query Manager will reference the pair). |
| | SQCLOW | Text | 10 | SQCCODE of low Sediment Quality Criteria. |
| | SQCHIGH | Text | 10 | SQCCODE of high Sediment Quality Criteria. |
| | LOW_NAME | Text | 8 | Low Sediment Quality Criteria (how Query Manager will reference the SQC). |
| | HIGH_NAME | Text | 8 | High Sediment Quality Criteria (how Query Manager will reference the SQC). |
| | SORT_ORDER | Number, Integer | 2 | Query Manager field. |

Table 5. Continued

| Table Name | Field Name | Data Type | Field Size | Table Description / Field Description |
|-----------------------|------------|-----------|------------|---|
| lkp - TESTDICT | | | | Lookup table for toxicity test dictionary (TESTID). |
| | TESTID | Text | 12 | Code describing the bioassay. |
| | MEDIUM | Text | 15 | Medium used in toxicity test (e.g., bulk sediment or pore water). |
| | MEDCODE | Text | 2 | Code used to indicate medium used in toxicity test. |
| | GROUP | Text | 20 | Group of organism used in toxicity test (e.g., bacteria or amphipod). |
| | ALTGROUP | Text | 20 | Group of organism used in toxicity test - alternate. |
| | SPECIES | Text | 40 | Species used in toxicity test. |
| | SPPCODE | Text | 3 | Code used to indicate species used in toxicity test. |
| | LHS | Text | 10 | Life stage of organism used in toxicity test. |
| | LHSCODE | Text | 1 | Code used to indicate life stage of organism used in toxicity test. |
| | ENDPOINT | Text | 30 | Endpoint of toxicity test (e.g., growth or survival). |
| | ENDCODE | Text | 2 | Code used to indicate endpoint of toxicity test. |
| | DURATION | Text | 10 | Duration of toxicity test. |
| | DURCODE | Text | 4 | Code used to indicate duration of toxicity test. |
| | HABITAT | Text | 2 | Query Manager field. |
| | EDITDATE | Date/Time | 8 | Query Manager field. |
| | EDITDATE2 | Text | 8 | Query Manager field. |
| | EDITBY | Text | 15 | Query Manager field. |
| lkp - TISSQUAL | | | | Lookup table for tissue chemistry qualifiers (QUALCODE). |
| | SITEID | Text | 4 | Site ID code (from Query Manager). |
| | STUDYID | Text | 2 | Study ID code. |
| | QUALCODE | Text | 5 | Qualifier code for concentration value, modified to be compatible with Query Manager (all ND data has a "U" in this field). |
| | QUALIFIERS | Text | 30 | Qualifier code for concentration value, as designated in report. |
| | DESCRIPT | Text | 80 | Description of the meaning of the qualifier, as indicated in the original report or data file. |
| | MESL_LIBNO | Text | 50 | MESL - library number. |

Table 5. Continued

| Table Name | Field Name | Data Type | Field Size | Table Description / Field Description |
|-----------------------|----------------|----------------|------------|--|
| lkp - TISSTYPE | | | | Lookup table for tissue sample tissue types (TISSCODE). |
| | TISSCODE | Text | 6 | Tissue type code. |
| | DESCRIPT | Text | 50 | Description of tissue type. |
| | EDITDATE | Date/Time | 8 | Query Manager field. |
| | EDITDATE2 | Text | 8 | Query Manager field. |
| | EDITBY | Text | 15 | Query Manager field. |
| ptbl - AVS_SEM | | | | Sediment chemistry results for Acid Volatile Sulfides and Simultaneously Extracted Metals (units of $\mu\text{mol/g}$). |
| | SITEID | Text | 4 | Site ID code (from Query Manager). |
| | STUDYID | Text | 2 | Study ID code. |
| | STATIONID | Text | 10 | Station ID code (this is the MESL_STATIONID, unless it exceeded 6 characters, then the QM_STATIONID was substituted). |
| | SAMPLEID | Text | 6 | Sample ID code. |
| | FIELDREP | Text | 2 | Identifies field replicate samples (samples collected in close proximity). |
| | LABREP | Text | 2 | This field will not be populated (lab dups will be averaged and the MESL_LABREP_AVG field identifies these averaged results). |
| | CHEMCODE | Text | 10 | Chemical code (defined in lkp - CHEMDICT). |
| | QUALCODE | Text | 5 | Qualifier code for concentration value, modified to be compatible with Query Manager (all ND data has a "U" in this field). |
| | CONC | Number, Double | 8 | Chemical concentration (dry weight basis). |
| | UNITS | Text | 6 | Units of chemical concentration. |
| | MEASBASIS | Text | 2 | Measurement basis - dry weight (DW). |
| | MISSINGVAL | Yes/No | 1 | 'Yes' indicates a missing value (i.e., not reported, not sampled, lost, etc; -9 entered in CONC field). |
| | MESL_LIBNO | Text | 20 | MESL - library number. |
| | MESL_STATIONID | Text | 50 | MESL - station ID (retains the Station ID code as it appears in the original datafiles and/or reports). |
| | MESL_UNITS | Text | 7 | MESL - units of concentration value. |
| | MESL_QUAL_CALC | Text | 10 | MESL - qualifier code for concentration value - used for calculation purposes (NUM - value, U - less than detect value; X - do not include in calculations). |

Table 5. Continued

| Table Name | Field Name | Data Type | Field Size | Table Description / Field Description |
|-------------------------------|----------------------|----------------|------------|--|
| ptbl - AVS_SEM (cont.) | | | | Sediment chemistry results for Acid Volatile Sulfides and Simultaneously Extracted Metals (units of $\mu\text{mol/g}$). |
| | MESL_QUALCODE | Text | 5 | MESL - qualifier code for concentration value, as designated in report, with modifications. |
| | MESL_semqual | Text | 50 | MESL - qualifier code to indicate whether to use SEM metal conc. or total metal conc. (B entered in this field indicates that both are measured, therefore do not use the SEM result.) |
| | MESL_C_TXT | Text | 50 | MESL - concentration value represented in a text field (nondetected results include a "<"). |
| | MESL_LABDUP_AVG | Yes/No | 1 | MESL - indicates if results for laboratory duplicate samples were averaged. |
| | MESL_C_CALC | Number, Double | 8 | MESL - concentration value represented in a number field (nondetected results included as 1/2 the detection limit). |
| | MESL_EXCLUDE HIGH ND | Text | 50 | MESL - X entered in this field indicates a nondetected result with a detection limit greater than the Level II SQT. |
| | MESL_comment | Text | 250 | MESL - comments. |
| ptbl - BENTHOSAMPLE | | | | Benthic infaunal data including mean, standard deviation, and summary data. |
| | SITEID | Text | 4 | Site ID code (from Query Manager). |
| | STUDYID | Text | 2 | Study ID code. |
| | STATIONID | Text | 10 | Station ID code (this is the MESL_STATIONID, unless it exceeded 6 characters, then the QM_STATIONID was substituted). |
| | SAMPLEID | Text | 6 | Sample ID code. |
| | LABREP | Text | 2 | This field will not be populated, necessary to link to sample table. |
| | BENTHICCODE | Text | 4 | Benthic code, linked to lkp - BenthosMetrics. |
| | UNIT | Text | 10 | Unit for the benthic metric. |
| | MEAN | Number, Single | 4 | Mean value. |
| | STDDEV | Number, Single | 4 | Standard deviation of the mean value. |
| | SUM | Number, Single | 4 | Abundance sum for the sample. |
| | VALUE_TXT | Text | 35 | Text result value (if applicable). |
| | COMMENT | Text | 35 | Comment |

Table 5. Continued

| Table Name | Field Name | Data Type | Field Size | Table Description / Field Description |
|--------------------------|-------------|----------------|------------------------------------|---|
| ptbl - BENTHOSREP | | | | Benthic infaunal replicate data. |
| | SITEID | Text | 4 | Site ID code (from Query Manager). |
| | STUDYID | Text | 2 | Study ID code. |
| | STATIONID | Text | 10 | Station ID code (this is the MESL_STATIONID, unless it exceeded 6 characters, then the QM_STATIONID was substituted). |
| | SAMPLEID | Text | 6 | Sample ID code. |
| | REP | Text | 2 | Replicate designator. |
| | BENTHICCODE | Text | 4 | Benthic code, linked to lkp - BenthosMetrics. |
| | UNIT | Text | 10 | Unit for the benthic metric. |
| | VALUE | Number, Single | 4 | Numeric result. |
| VALUE_TXT | Text | 35 | Text result value (if applicable). | |
| ptbl - BIOSUMM | | | | Sediment toxicity test and bioaccumulation test results. |
| | SITEID | Text | 4 | Site ID code (from Query Manager). |
| | STUDYID | Text | 2 | Study ID code. |
| | STATIONID | Text | 10 | Station ID code (this is the MESL_STATIONID, unless it exceeded 6 characters, then the QM_STATIONID was substituted). |
| | SAMPLEID | Text | 6 | Sample ID code. |
| | FIELDREP | Text | 2 | Identifies field replicate samples (samples collected in close proximity). |
| | TESTID | Text | 12 | Code describing the bioassay (see lkp - TESTDICT table for a description of the codes). |
| | GROUP | Text | 2 | Query Manager field. |
| | SERIES | Text | 2 | Associates control sample results with test results. |
| | EFFECTVAL | Number, Double | 8 | Toxicity test result (e.g., percent survival). |
| | SIGEFFECT | Yes/No | 1 | Toxic (-1) or Not toxic (0). |
| | NEG | Yes/No | 1 | Negative control sample? Yes (-1) or No (0). |
| | REF | Yes/No | 1 | Reference sample? Yes (-1) or No (0). |
| | STAT | Yes/No | 1 | Identifies sample used to determine significance (T/NT) - ND results (i.e., growth endpoint not measured because of low survival) from SQT database added as NOT TOXIC. |
| | SIG_ORIGIN | Text | 50 | Original significance designations - from Query Manager. |

Table 5. Continued

| Table Name | Field Name | Data Type | Field Size | Table Description / Field Description |
|-------------------------------|----------------|----------------|------------|---|
| ptbl - BIOSUMM (cont.) | | | | Sediment toxicity test and bioaccumulation test results. |
| | CTRLADJ | Number, Double | 8 | Control adjusted result (test result/control result*100). |
| | TOXCODE | Text | 1 | Query Manager field. |
| | MESL_LIBNO | Text | 50 | MESL - library number. |
| | MESL_STATIONID | Text | 50 | MESL - Station ID (retains the Station ID code as it appears in the original datafiles and/or reports). |
| | MESL_TOXIC | Text | 2 | Toxic (T), Not toxic (NT), or ND (growth endpoint not measured because of low survival). |
| | MESL_comment | Text | 250 | MESL - comments. |
| ptbl - CHEM | | | | Chemistry results for sediment samples. |
| | SITEID | Text | 4 | Site ID code (from Query Manager). |
| | STUDYID | Text | 2 | Study ID code. |
| | STATIONID | Text | 10 | Station ID code (this is the MESL_STATIONID, unless it exceeded 6 characters, then the QM_STATIONID was substituted). |
| | SAMPLEID | Text | 6 | Sample ID code. |
| | FIELDREP | Text | 2 | Identifies field replicate samples (samples collected in close proximity). |
| | LABREP | Text | 2 | This field will not be populated (lab dups will be averaged and the MESL_LABREP_AVG field identifies these averaged results). |
| | CHEMCODE | Text | 10 | Chemical code (defined in lkp - CHEMDICT). |
| | QUALCODE | Text | 5 | Qualifier code for concentration value, modified to be compatible with Query Manager (all ND data has a "U" in this field). |
| | CONC | Number, Double | 8 | Chemical concentration (dry weight basis). |
| | UNITS | Text | 6 | Units of chemical concentration. |
| | MEASBASIS | Text | 2 | Measurement basis - dry weight (DW). |
| | MISSINGVAL | Yes/No | 1 | 'Yes' indicates a missing value (i.e., not reported, not sampled, lost, etc; -9 entered in CONC field). |
| | MESL_LIBNO | Text | 20 | MESL - library number. |
| | MESL_STATIONID | Text | 50 | MESL - station ID (retains the Station ID code as it appears in the original datafiles and/or reports). |
| | MESL_UNITS | Text | 7 | MESL - units of concentration value. |

Table 5. Continued

| Table Name | Field Name | Data Type | Field Size | Table Description / Field Description |
|----------------------------|----------------------|----------------|------------|--|
| ptbl - CHEM (cont.) | | | | Chemistry results for sediment samples. |
| | MESL_QUAL_CALC | Text | 10 | MESL - qualifier code for concentration value - used for calculation purposes (NUM - value, U - less than detect value; X - do not include in calculations). |
| | MESL_semqual | Text | 50 | MESL - qualifier code to indicate whether to use SEM metal conc. or total metal conc. (B entered in this field indicates that both are measured, therefore do not use the SEM result.) |
| | MESL_C_TXT | Text | 50 | MESL - concentration value represented in a text field (nondetected results include a "<"). |
| | MESL_LABDUP_AVG | Yes/No | 1 | MESL - indicates if results for laboratory duplicate samples were averaged. |
| | MESL_C_CALC | Number, Double | 8 | MESL - concentration value represented in a number field (nondetected results included as 1/2 the detection limit). |
| | MESL_EXCLUDE HIGH ND | Text | 50 | MESL - X entered in this field indicates a nondetected result with a detection limit greater than the Level II SQT. |
| | MESL_comment | Text | 250 | MESL - comments. |
| ptbl - CHEMTISS | | | | Chemistry results for tissue samples. |
| | SITEID | Text | 4 | Site ID code (from Query Manager). |
| | STUDYID | Text | 2 | Study ID code. |
| | STATIONID | Text | 10 | Station ID code (this is the MESL_STATIONID, unless it exceeded 6 characters, then the QM_STATIONID was substituted). |
| | SAMPLEID | Text | 6 | Sample ID code. |
| | FIELDREP | Text | 2 | Identifies field replicate samples (samples collected in close proximity). |
| | LABREP | Text | 2 | Not populated (lab dups will be averaged and the MESL_LABREP_AVG field identifies these averaged results). |
| | CHEMCODE | Text | 10 | Chemical code (defined in lkp - chemdict). |
| | CONC | Number, Double | 8 | Chemical concentration (wet weight basis). |
| | QUALCODE | Text | 5 | Qualifier code for concentration value, as designated in report (see lkp_TISSQUAL table for a description of the codes). |
| | UNITS | Text | 6 | Units of chemical concentration. |
| | MEASBASIS | Text | 2 | Measurement basis - wet weight (WW). |

Table 5. Continued

| Table Name | Field Name | Data Type | Field Size | Table Description / Field Description |
|--------------------------------|-----------------|----------------|------------|--|
| ptbl - CHEMTISS (cont.) | | | | Chemistry results for tissue samples. |
| | MISSINGVAL | Yes/No | 1 | 'Yes' indicates a missing value (i.e., not reported, not sampled, lost, etc; -9 entered in CONC field). |
| | MESL_LIBNO | Text | 20 | MESL- library number. |
| | MESL_STATIONID | Text | 50 | MESL- Station ID (retains the Station ID code as it appears in the original datafiles and/or reports). |
| | MESL_UNITS | Text | 7 | MESL - units of concentration value. |
| | MESL_QUAL_CALC | Text | 10 | MESL - qualifier code for concentration value - used for calculation purposes (NUM - value, U - less than detect value; X - do not include in calculations; UX - less than MDL, DL unknown). |
| | MESL_comment | Text | 250 | MESL - comments. |
| | MESL_CONC_TXT | Text | 50 | MESL - concentration value represented in a text field (nondetected results include a "<"). |
| | MESL_LABREP_AVG | Yes/No | 1 | MESL - indicates if results for laboratory duplicate samples were averaged. |
| ptbl - Mean PEC-Q | | | | Mean Probable Effect Concentration-Quotients (Mean PEC-Q). |
| | SITEID | Text | 4 | Site ID code (from Query Manager). |
| | STUDYID | Text | 2 | Study ID code. |
| | STATIONID | Text | 10 | Station ID code (this is the MESL_STATIONID, unless it exceeded 6 characters, then the QM_STATIONID was substituted). |
| | SAMPLEID | Text | 6 | Sample ID code. |
| | FIELDREP | Text | 2 | Identifies field replicate samples (samples collected in close proximity). |
| | LABREP | Text | 2 | This field will not be populated (lab dups will be averaged and the MESL_LABREP_AVG field identifies these averaged results). |
| | PECQ met | Number, Double | 8 | PEC quotient for metals. |
| | PECQ pah | Number, Double | 8 | PEC quotient for PAHs. |
| | PECQ pcb | Number, Double | 8 | PEC quotient for PCBs. |
| | MeanPECQ | Number, Double | 8 | Mean PEC quotient (as calculated). |
| | MeanPECQ (3 sf) | Number, Double | 8 | Mean PEC quotient (3 significant figures). |

Table 5. Continued

| Table Name | Field Name | Data Type | Field Size | Table Description / Field Description |
|----------------------|-----------------|----------------|------------|--|
| ptbl - SAMPLE | | | | Sediment sample information. |
| | SITEID | Text | 4 | Site ID code (from Query Manager). |
| | STUDYID | Text | 2 | Study ID code. |
| | STATIONID | Text | 10 | Station ID code (this is the MESL_STATIONID, unless it exceeded 6 characters, then the QM_STATIONID was substituted). |
| | SAMPLEID | Text | 6 | Sample ID code. |
| | FIELDREP | Text | 2 | Identifies field replicate samples (samples collected in close proximity). |
| | LABREP | Text | 2 | This field will not be populated (lab dups will be averaged and the MESL_LABREP_AVG field identifies these averaged results). |
| | UDEPTH | Number, Single | 4 | Upper sampling depth (cm). |
| | LDEPTH | Number, Single | 4 | Lower sampling depth (cm). |
| | SAMPDATE | Text | 8 | Sample date (YYYYMMDD). |
| | SAMPTIME | Text | 5 | Sample time. |
| | TOC | Number, Single | 4 | Total organic carbon (%). |
| | PCTFINES | Number, Single | 4 | Percent fines (sand + clay), the micron diameter used to define PCTFINES is <53 µm, unless otherwise noted in the MESL_comments field. |
| | UAN_PW | Number, Single | 4 | Unionized ammonia in pore water. |
| | H2S_PW | Number, Single | 4 | Hydrogen sulfide in pore water. |
| | EXSAMPID | Text | 30 | Original station ID reported in study or data file. |
| | MESL_LIBNO | Text | 50 | MESL - library number. |
| | MESL_STATIONID | Text | 50 | MESL - station ID (retains the Station ID code as it appears in the original datafiles and/or reports). |
| | MESL_Mean PEC-Q | Number, Single | 4 | MESL - Mean PEC-Q (3 significant figures). |
| | MESL_MATCH | Text | 50 | MESL - indicates if the sample has matching sediment chemistry and toxicity data. |
| | MESL_WATERDEPTH | Text | 50 | MESL - water depth at the point of sediment sampling (m). NR = not reported. |
| | MESL_SOFTDEPTH | Text | 50 | MESL - soft sediment depth (m). NR = not reported. |
| | MESL_SEDDDESC | Text | 255 | MESL - sediment description (have included the sediment description if this data was available electronically). NA = not available. |
| | MESL_SURF_SUB | Text | 50 | MESL - indicates if the sample is designated as surficial or sub-surface, according to NOAA's Query Manager rules. NA indicates that the sampling depth was not specified. |
| | MESL_comments | Text | 255 | MESL - comments. |

Table 5. Continued

| Table Name | Field Name | Data Type | Field Size | Table Description / Field Description |
|-----------------------|------------|-----------------|------------|---|
| ptbl - SITE | | | | |
| | | | | Site Identification (Query Manager table). |
| | SITEID | Text | 4 | Site ID code (from Query Manager). |
| | SITENAME | Text | 40 | Descriptive name for site (from Query Manager). |
| | EPAREGION | Number, Integer | 2 | Region for site location; 11 for Canada (from Query Manager). |
| | COUNTY | Text | 25 | County where site is located (from Query Manager). |
| | STATE | Text | 2 | State where site is located (from Query Manager). |
| | CERCLIS | Text | 12 | CERCLIS number for site (from Query Manager). |
| | REACH | Text | 8 | Reach number for site (from Query Manager). |
| | REACHSEG | Text | 11 | Reach segment number for site (from Query Manager). |
| | LATITUDE | Number, Double | 8 | General latitude for site location (from Query Manager). |
| | LONGITUDE | Number, Double | 8 | General longitude for site location (from Query Manager). |
| | WATERSHED | Text | 20 | Watershed name for site location (from Query Manager). |
| ptbl - SMPTISS | | | | |
| | | | | Tissue sample information. |
| | SITEID | Text | 4 | Site ID code (from Query Manager). |
| | STUDYID | Text | 2 | Study ID code. |
| | STATIONID | Text | 10 | Station ID code (this is the MESL_STATIONID, unless it exceeded 6 characters, then the QM_STATIONID was substituted). |
| | SAMPLEID | Text | 6 | Sample ID code. |
| | FIELDREP | Text | 2 | Identifies field replicate samples (samples collected in close proximity). |
| | LABREP | Text | 2 | Not populated (lab dups will be averaged and the MESL_LABREP_AVG field identifies these averaged results). |
| | SAMPDATE | Text | 8 | Date sample collected (YYYYMMDD). |
| | SAMPTIME | Text | 5 | Time sample collected. |
| | SPECIES | Text | 5 | Species from which the tissue sample was collected (see the lkp_SPECIES table for a description of the codes). |
| | SPP | Text | 5 | Species code (see the lkp_SPECIES table for a description of the codes). |
| | TISSUE | Text | 30 | Tissue type analyzed (see the lkp_TISSTYPE table for a description of the codes). |
| | TISSCODE | Text | 6 | Tissue type code (see the lkp_TISSTYPE table for a description of the codes). |

Table 5. Continued

| Table Name | Field Name | Data Type | Field Size | Table Description / Field Description |
|-------------------------------|----------------|-----------------|------------|---|
| ptbl - SMPTISS (cont.) | | | | Tissue sample information. |
| | LIFESTAGE | Text | 1 | Lifestage of the organism at the time of sampling. |
| | NOINCOMP | Number, Integer | 2 | Number of individuals in a composite sample. |
| | LENGTH | Number, Single | 4 | Length (cm) of individual organisms collected for tissue analysis. |
| | WEIGHT | Number, Single | 4 | Weight of individual organisms collected for tissue analysis. |
| | SEX | Text | 1 | Sex of individual organisms collected for tissue analysis. |
| | AGE | Number, Integer | 2 | Age of individual organisms collected for tissue analysis. |
| | PCTLIPID | Number, Single | 4 | Percent lipids (%). |
| | EXSAMPID | Text | 15 | Query Manager field. |
| | MESL_LIBNO | Text | 50 | MESL- library number. |
| | MESL_STATIONID | Text | 50 | MESL- Station ID (retains the Station ID code as it appears in the original datafiles and/or reports). |
| | MESL_COMMENT | Text | 255 | MESL - comments. |
| ptbl - STATION | | | | Station information (sediment and tissue samples). |
| | SITEID | Text | 4 | Site ID code (from Query Manager). |
| | STUDYID | Text | 2 | Study ID code. |
| | STATIONID | Text | 10 | Station ID code (this is the MESL_STATIONID, unless it exceeded 6 characters, then the QM_STATIONID was substituted). |
| | AREA | Text | 50 | Waterbody (corresponds with 'DB_AREA' theme in GIS projects). |
| | LOCDESC | Text | 50 | Reach (corresponds with 'Location Description' theme in GIS projects). |
| | EST_STN | Text | 50 | Code indicating how the geographic coordinates were obtained (R = reported; P = plotted in GIS based on a map from the report; E = estimated using site descriptions from report; U = unknown). |
| | LATITUDE | Number, Double | 8 | Geographical coordinates (decimal degrees). |
| | LONGITUDE | Number, Double | 8 | Geographical coordinates (decimal degrees). |
| | X-coord | Number, Double | 8 | Geographical coordinates (UTM Zone 15 NAD83 datum). |
| | Y-coord | Number, Double | 8 | Geographical coordinates (UTM Zone 15 NAD83 datum). |
| | MESL_LIBNO | Text | 50 | MESL - library number. |
| | MESL_EST_STN | Text | 50 | MESL - description of how the geographic coordinates were obtained. |

Table 5. Continued

| Table Name | Field Name | Data Type | Field Size | Table Description / Field Description |
|-------------------------------|------------------------|----------------|------------|---|
| ptbl - STATION (cont.) | | | | Station information (sediment and tissue samples). |
| | MESL_CORELENGTH | Text | 50 | MESL - core length (units are in meters). Note that this field has only been populated when the information has been readily available (electronic format). |
| | MESL_Habitat class | Text | 50 | MESL - relevant to R-EMAP studies only (STUDYID 04 & 06). Codes: 1 = Shallow area; 2 = Channel; 3 = Reservoir. |
| | MESL_LOCDISC2 | Text | 50 | MESL - additional station location descriptions. |
| | MESL_COMMENTS | Text | 150 | MESL - comments. |
| | ORIGINALX | Number, Single | 4 | Draft: Originally reported X coordinate. |
| | ORIGINALY | Number, Single | 4 | Draft: Originally reported Y coordinate. |
| | ORIGINALCOORDS | Text | 50 | Draft: Original coordinate system. |
| ptbl - STUDY | | | | Study names and the types of data associated with each study. |
| | SITEID | Text | 4 | Site ID code (from Query Manager). |
| | STUDYID | Text | 2 | Study ID code. |
| | STUDYNAME | Text | 40 | Study name. |
| | CONTACT | Text | 40 | Contact person/agency. |
| | SEDICHEM | Yes/No | 1 | Indicates if the study has surficial sediment chemistry data incorporated in the database. |
| | SEDTOX | Yes/No | 1 | Indicates if the study has sediment toxicity data incorporated in the database. |
| | SUBSURF | Yes/No | 1 | Indicates if the study has sub-surface sediment chemistry data incorporated in the database. |
| | LABACCUM | Yes/No | 1 | Indicates if the study has bioaccumulation test data incorporated in the database. |
| | TISSCHEM | Yes/No | 1 | Indicates if the study has tissue chemistry data incorporated in the database. |
| | BENTHIC | Yes/No | 1 | Indicates if the study has benthic infaunal data incorporated in the database. |
| | Location/Sampling Year | Text | 40 | Location and sampling year. |
| | MESL_LIBNO | Text | 50 | MESL - library number. |

Table 5. Continued

| Table Name | Field Name | Data Type | Field Size | Table Description / Field Description |
|------------------------|------------|-----------|------------|---|
| ptbl - STUDYNOT | | | | Study notes. |
| | SITEID | Text | 4 | Site ID code (from Query Manager). |
| | STUDYID | Text | 2 | Study ID code. |
| | NOTES | Memo | 0 | Notes. |
| | MESL_LIBNO | Text | 50 | MESL - library number. |
| ptbl - STUDYREF | | | | Bibliographic references for each study. |
| | SITEID | Text | 4 | Site ID code (from Query Manager). |
| | STUDYID | Text | 2 | Study ID code. |
| | DOC_NO | Text | 50 | Unique document number. |
| | MESL_LIBNO | Text | 50 | MESL - library number. |
| | YEAR | Text | 4 | Publish year for report. |
| | AUTHORS | Text | 160 | Authors of the report. |
| | TITLE | Text | 180 | Title of the report. |
| | SOURCE | Text | 160 | Source (locations). |
| STUDYCOMM | Text | 160 | Comments. | |

APPENDIX A

**QUALITY ASSURANCE COMMENTS OF THE PHASE II GIS-BASED
SEDIMENT QUALITY DATABASE FOR THE ST. LOUIS RIVER AOC**

APPENDIX A

QUALITY ASSURANCE COMMENTS OF THE PHASE II GIS-BASED SEDIMENT QUALITY DATABASE FOR THE ST. LOUIS RIVER AOC

BY PEGGY MYRE, EXA DATA & MAPPING SERVICES, INC., MARCH 9, 2005

I. Primary Key (PK) Assignments

1. Added PK to ptbl – STUDY (SiteID+StudyID) – OK.
2. Attempted to add PK to ptbl – STUDYNOT, but there were 2 notes w/out StudyIDs (general notes on summed fields), and also multiple note records (duplicates) for StudyID 15 (2), 16 (2), and 32 (3). Assume these notes can be concatenated into final single studynot for each study? See table Dup-StudyNot

RESOLUTION: Concatenated duplicate notes into one memo field for 3 studies (15, 16, 32). I did not delete the documentation-style notes, but added artificial StudyIDs (XX and YY). I assigned a primary key (SiteID+StudyID).

3. Attempted to add PK to ptbl – STUDYREF, but there are duplicates which should be addressed. Possibly there are multiple references grouped into one StudyID? See table Dup-StudyRef.

RESOLUTION: The MESL_LIB_NO was also not a unique Document Number. Added a Document Number so could start tracking the unique documents in relation to each Study. Assigned Document Numbers for existing studies by modifying current MESL_LIB_NO (e.g., SED/1398-1, SED/1398-2, etc.). Assigned a primary key (SiteID+StudyID+Doc_No) and related it to tblStudy.

4. Added PK to ptbl – STATION successfully (SiteID+StudyID+StationID).
5. Added PK to ptbl – SAMPLE and ptbl – SMPTISS successfully (SiteID+StudyID+StationID+SampleID+LabRep).
6. Copied duplicate CHEM records to table Dup-Chem for discussion (TBT – Sn).
RESOLUTION: Added TBT_SN to lkp – CHEMDICT. Was able to create primary key in ptbl – CHEM (SiteID+StudyID+StationID+LabRep+Chemcode). NOTE: Consider that eventually this project should have compatible dictionaries with NOAA QM (note empty fields in lkp – CHEMDICT that could be populated from QM’s Chemdict file).
7. Added PK to ptbl – CHEMTISS successfully (SiteID+StudyID+StationID+SampleID+LabRep+ChemCode).
8. Added PK to ptbl – AVS_SEM successfully (SiteID+StudyID+StationID+SampleID+LabRep+ChemCode).
9. Added PK to ptbl – Mean PEC-Q successfully (SiteID+StudyID+StationID+SampleID+LabRep).
10. Attempted to add PK to ptbl – BIOSUMM using QM key fields (SiteID+StudyID+SampleID+TestID), but there are duplicates - see table Dup-Biosumm. These are probably the classic bioassay duplicate problem of multiple batches (therefore multiple negative control samples) for one study and TestID. SampleIDs for these

control samples should be modified for uniqueness. It is possible that the intended structure is to include the Series field, but I could not find the key field description for the Biosumm table in the Technical documentation or the User Guide.

RESOLUTION: I added unique control samples for multiple series for StudyID 06, created PK for Biosumm and was able to relate it to ptbl – SAMPLE.

11. Attempted to add PK to lkp – QUALIFY (see dup-Qualcode table). It looks like there was both U and < that were noted as U, probably should be merged into 1 records (Qualifiers = “U, <”). No problem with PK for any other lookup tables.

RESOLUTION: I was able to concatenate the two duplicate records and then make PK.

II. Check/Enforce Relationships (looking for orphan records)

1. Relationships between Study and StudyNot/StudyDup not 1:1 for duplicate reasons cited above.
2. No relationship in database between Study and Station? I added one and enforced relationship – everything OK.
3. Relationship between Station and Sample OK.
4. Temporarily made a unique key including units in Chem. Was able to create and enforce relationship between Sample and Chem, so no problems.
5. All ChemCodes in Chem table are represented in ChemDict.
6. Oddly, the Smpstiss table was related to the Sample table rather than to the Station table. Two studies have both sed chem and tiss chem data, but the SampleIDS are clearly different so this is an error. I changed this relationship and enforce the relationship (no problems).
7. Able to create and enforce relationship between Smpstiss and Chemtiss – all OK.
8. All species and tisscodes are represented in lookup tables from Smpstiss – all OK.
9. All chemcodes in chemtiss represented in Chemdict – all OK.
10. One sediment chemistry qualifier definition missing (see Table MissQual).

RESOLUTION: Added qualifier to table.

11. Sample – Biosumm relationship OK.
12. All TestIDs in Biosumm represented in TestDict.
13. Relationship between Sample and AVS_SEM is OK.
14. All Chemcodes in AVS_SEM table are represented in ChemDict.
15. Relationship between Sample and PEC-Q table is OK.

APPENDIX B

**SCREENING CRITERIA FOR EVALUATING BENTHIC INVERTEBRATE
COMMUNITY DATA SETS FOR THE PHASE III GIS-BASED SEDIMENT
QUALITY DATABASE FOR THE ST. LOUIS RIVER AOC**

APPENDIX B

**SCREENING CRITERIA FOR EVALUATING CANDIDATE BENTHIC
INVERTEBRATE COMMUNITY DATA SETS FOR THE PHASE III GIS-BASED
SEDIMENT QUALITY DATABASE FOR THE ST. LOUIS RIVER AOC**

BENTHIC INVERTEBRATE COMMUNITY CRITERIA:

MESL Library #:

Date Printed:

First or Second Screener (or Combined):

Names of Screeners if the benthic invertebrate community data were evaluated during a different time period than the rest of the data set:

Phase III Database Screeners:

First Screener's Name:

Date of First Screen:

Second Screener's Name:

Date of Second Screen:

Phase IV Database Screeners:

First Screener's Name:

Date of First Screen:

Second Screener's Name:

Date of Second Screen:

1. Were standard operating procedures, documented guidance, or references used to collect, sort, preserve, and identify benthic invertebrates?
Page reference:

2a. What QA/QC procedures were followed (e.g., list number of replicates/site)?
Page reference:

2b. Were minimum data quality objectives met (i.e., stated in report)? Provide details.
Page reference:

2c. If there are any indications that QA/QC procedures were insufficient and/or the data quality objectives were not met, indicate decisions made relative to these deficiencies. Note: for details regarding rationale/decisions, see the DECISION-MAKING SUMMARY worksheet.

Ancillary information

1. Did the study design include one or more reference and/or training sites (i.e., low/high impacted sites)?
Page reference:

2. Were benthic invertebrates sampled in close proximity to sites where sediment samples were collected for sediment chemistry, physical measurements, toxicity tests, and/or bioaccumulation studies?
Page reference:

3. What sampling device was used to collect benthic invertebrate samples and what was the surface area of it?
Page reference:

4. Were water depth, sediment particle size, and TOC measured?
Page reference:

5. What was the taxonomic resolution for identifying benthic invertebrates?
Page reference:

6. Were deformities in Chironomid larvae observed (i.e., deformities in mouthpart structures)?
Page reference:

7. What kind of benthic metrics were determined from the study (e.g., taxonomic categories, trophic level associations, functional feeding groups, behavioral mechanisms)?
Page reference:

8. Were the data statistically analyzed to determine benthic community impairment (or lack of it)?
Page reference:

APPENDIX C

LIST OF QUERY OPTIONS IN QUERY MANAGER VERSION 2.56

APPENDIX C

LIST OF QUERY OPTIONS IN QUERY MANAGER VERSION 2.56

The following information on available sediment query options in Query Manager version 2.56 was obtained from NOAA's web site at:

[http://response.restoration.noaa.gov/topic_subtopic_entry.php?RECORD_KEY%28entry_subtopic%29=entry_id,subtopic_id,topic_id&entry_id\(entry_subtopic_topic\)=101&subtopic_id\(entry_subtopic_topic\)=5&topic_id\(entry_subtopic_topic\)=2](http://response.restoration.noaa.gov/topic_subtopic_entry.php?RECORD_KEY%28entry_subtopic%29=entry_id,subtopic_id,topic_id&entry_id(entry_subtopic_topic)=101&subtopic_id(entry_subtopic_topic)=5&topic_id(entry_subtopic_topic)=2)). The type of query options are defined for all data types, sediment bioassay data, surficial sediment chemistry data, subsurface sediment chemistry data, and tissue chemistry data. Note that the MPCA's Query Manager-compatible database files are set-up so that users can chose to perform some of the queries with either the MPCA's sediment quality targets (SQTs; Crane *et al.* 2000, 2002) or the Wisconsin Department of Natural Resources sediment quality guidelines (SQGs; WDNR 2003). In contrast, these values are not expressly set-up in NOAA's Query Manager St. Louis River Watershed database that is available from their web site; instead, the consensus-based sediment quality guidelines (MacDonald *et al.* 2000) are provided, in addition to several marine/estuarine guideline values. Thus, users wanting to make comparisons to the Minnesota SQTs and Wisconsin SQGs should use the MPCA's Query Manager-compatible database files.

ALL DATA TYPES

- **Station Location by Study:** Shows station locations for selected studies.
- **Study Notes:** Brings up notes on the selected studies.
- **Study Reference:** Lists the reference citation for each study, if available.

SEDIMENT BIOASSAY

- **Station Location by Study:** Shows station locations for selected studies for sediment bioassay data.
- **Test Endpoints, Toxic/ Non-toxic Sample:** Shows toxic and non-toxic samples for selected endpoint or all endpoints.
- **Test Response Value Ranges:** Shows toxic and non-toxic samples and test response values in three user-defined ranges for the selected test endpoint.
- **Control-normalized Response Value Ranges:** Shows toxic and non-toxic samples and control-normalized test response values (ratio of test sample response to control response) in three user-defined ranges for the selected test endpoint.

SEDIMENT CHEMISTRY (SURFACE)

[upper depth = 0 and lower depth < 30.5 cm or 12 inches]

- **Station Location by Study:** Shows station locations for selected studies for sediment chemistry data
- **Concentration Ranges:** Identifies samples in three user-defined concentration ranges for selected studies for a selected chemical.

- **Sediment Quality Guideline (SQG) Pair: One Chemical:** The user selects from a list of 11 paired sediment quality guidelines and selects an individual chemical from the list of chemicals available for the selected guideline pair. Each sample is classified into one of three ranges defined by the guideline pair concentrations for the selected chemical.
- **SQG Pair: All Chemicals:** Determines the number of chemicals that exceed a user-selected SQG pair of low and high concentrations. The column with the lower concentration SQG represents the number of chemicals that exceeded the lower SQG but not the higher SQG. The column with the higher concentration SQG represents the number of chemicals that exceeded the higher SQG.
- **Compare to Selected Sediment Quality Guidelines:** Identifies samples in two ranges defined by the selected SQG concentration for a selected chemical.
- **Number of Chemicals in a Sample Exceeding Selected Guideline:** The user selects one SQG from the library of SQGs in the database and the results show the number of chemicals measured in a sample for the selected SQG and the number of those chemicals that exceeded the SQG.
- **Mean/Maximum SQG Quotients by Sample for Selected Guideline:** Determines the number of chemicals measured in a sample for the selected SQG or and the mean and maximum SQG quotient (ratio of the chemical concentration to the SQG concentration) for each sample for selected studies. The sum of SQG ratios and the standard deviation of SQG ratios for each sample are also calculated.
- **Select Multiple Chemicals:** Provides the user with data for selected chemicals and studies in a spreadsheet format, with columns for each chemical selected. User may select individual chemicals from the entire list of chemicals measured in selected studies, by chemical class, or by chemicals for a selected SQG. The user may also create or use a chemical list.
- **MultiChem SQG Quotients for selected SQG:** Provides the user with data for selected chemicals and studies in a spreadsheet format, with columns for each chemical selected. Instead of concentrations, however, the output table displays the ratio of the chemical concentration to its respective SQG concentration.
- **Sum PAH toxic unit model:** Calculates PAH toxic unit values according to three models: the U.S. EPA PAH toxic unit model Final Chronic Value (Di Toro *et al.* 2000) U.S. EPA PAH toxic unit model Final Acute value (Di Toro *et al.* 2000), and the Sum PAH model (Swartz *et al.* 1995). The user selects which model result to plot in MARPLOT and low and high ranges for the model chosen. The values for all three models are calculated and included in the output table.
- **Logistic regression model (LRM) probability of toxicity:** Logistic regression model (LRM) estimates the probability of toxicity for each sample based on the maximum (Pr_Max1) or the average (Pr_Avg1) probability from 37 individual chemical logistic regression models for marine amphipod 10-d survival endpoints (Field et al 2002).
Note: this query only applies to marine and estuarine data sets.

SEDIMENT CHEMISTRY (SUBSURFACE)

Subsurface sediment chemistry query output includes all sediment core samples (including the surface core segment) and also any sample that has an upper depth below the surface or has a

core length greater than 30.5 cm (12 inches). The user is also given the option to include all surface and subsurface sediment samples.

The subsurface queries are identical to their surface sediment query counterpart, except for the Maximum Concentration Ranges query. This query shows the maximum concentration for each station over all core segments in three user-defined ranges for the selected chemical.

- **Station Location by Study:** Shows station locations for selected studies for sediment chemistry data
- **Concentration Ranges:** Identifies samples in three user-defined concentration ranges for selected studies for a selected chemical.
- **SQG Pair: One Chemical:** The user selects from a list of 11 paired sediment quality guidelines and selects an individual chemical from the list of chemicals available for the selected guideline pair. Each sample is classified into one of three ranges defined by the guideline pair concentrations for the selected chemical.
- **SQG Pair: All Chemicals:** Determines the number of chemicals that exceed a user-selected SQG pair low and high concentrations. The column with the lower concentration SQG represents the number of chemicals that exceeded the lower SQG but not the higher SQG. The column with the higher concentration SQG represents the number of chemicals that exceeded the higher SQG.
- **Maximum Concentration Ranges:** Identifies samples in three user-defined concentration ranges for selected studies for a selected chemical. The range classification is based on the maximum concentration for the core if the core contains more than one sample. The output column, "Maxconc," is the highest concentration of all the samples taken at a given station.
- **Mean/Maximum SQG Quotients by Sample for Selected Guideline:** Determines the number of chemicals measured in a sample for the selected SQG and/or the mean and maximum SQG quotient (ratio of the chemical concentration to the SQG concentration) for each sample for selected studies. The sum of SQG ratios and the standard deviation of SQG ratios for each sample are also calculated.
- **Select Multiple Chemicals:** Provides the user with data for selected chemicals and studies in a spreadsheet format, with columns for each chemical selected. User may select individual chemicals from the entire list of chemicals measured in selected studies, by chemical class, or by chemicals for a selected SQG. The user may also create or use a chemical list.
- **MultiChem SQG Quotients for selected SQG:** Provides the user with data for selected chemicals and studies in a spreadsheet format, with columns for each chemical selected. Instead of concentrations, however, the output table displays the ratio of the chemical concentration to its respective SQG concentration.
- **Sum PAH toxic unit model:** Calculates PAH toxic unit values according to three models: the U.S. EPA PAH toxic unit model Final Chronic Value (Di Toro *et al.* 2000) U.S. EPA PAH toxic unit model Final Acute value (Di Toro *et al.* 2000), and the Sum PAH model (Swartz *et al.* 1995). The user selects which model result to plot in MARPLOT and low and high ranges for the model chosen. The values for all three models are calculated and included in the output table.

- **Logistic regression model (LRM) probability of toxicity:** Estimates the probability of toxicity for each sample based on the maximum (Pr_Max1) or the average (Pr_Avg1) probability from 37 individual chemical logistic regression models for marine amphipod 10-d survival endpoints (Field *et al.* 2002). *Note: this query is not applicable to freshwater sediments.*

TISSUE CHEMISTRY

- **Station Location by Study:** Shows station locations for selected studies for tissue chemistry data
- **Concentration Ranges for all Samples for a Chemical:** Identifies samples in three user-defined concentration ranges for all tissue samples for a selected chemical. Allows for specification by taxonomic group or species and tissue type.
- **Select Multiple Chemicals:** Provides the user with data for selected chemicals and studies in a spreadsheet format, with columns for each chemical selected. User may select individual chemicals from the entire list of chemicals measured in selected studies, by chemical class, or by chemicals for a selected SQG. The user may also create or use a chemical list.
- **Mean Concentration by Location:** Calculates the mean tissue concentration for all samples of the selected species (or taxonomic group) and tissue type collected from the same location on the same date. Lipid-normalized concentrations are also calculated.
- **Tissue Residue Risk to Human Health:** Determines cancer risk or non-cancer risk to human health based on EPA or FDA guidelines.
- **Dioxin Toxic Equivalency:** Calculates the 2,3,7,8-TCDD (dioxin) toxic equivalency concentration for dioxin, furan, and PCB congeners based on the selected set of toxic equivalency factors (TEFs) for fish, birds, or mammals (van den Berg *et al.* 1998).