

**PHASE IV GIS-BASED SEDIMENT QUALITY DATABASE FOR THE
ST. LOUIS RIVER AREA OF CONCERN—WISCONSIN FOCUS**

Supplement to the Phase II/III Help Sections for Database Users

Submitted to:

Kate Angel
Wisconsin Coastal Management Program
Division of Intergovernmental Relations
Department of Administration
10th Floor Administration Building
101 East Wilson Street, P.O. Box 8944
Madison, WI 53708

Submitted by:

Judy L. Crane
Environmental Analysis and Outcomes Division
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155-4194

and

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

Through the:

St. Louis River Citizens Action Committee
394 Lake Avenue South, Suite 303B
Duluth, MN 55802

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FORWARD

The Phase IV geographic information system (GIS)-based sediment quality database for the St. Louis River Area of Concern (AOC)—Wisconsin focus represents a collaborative project between the St. Louis River Citizens Action Committee (CAC), Wisconsin Department of Natural Resources (WDNR), Minnesota Pollution Control Agency (MPCA), and Exa Data & Mapping Services, Inc. in conjunction with their subconsultants from Premier Environmental Services, Inc. and Searay Environmental. This project was funded by the Wisconsin Coastal Management Program (WCMP) and the National Oceanic and Atmospheric Administration (NOAA), Office of Ocean and Coastal Resource Management under the Coastal Zone Management Act, Grant # NA05NOS4191067, through a grant agreement with the St. Louis River CAC. In addition, the MPCA is contributing 60% of state matching funds to this project. This project will be completed by June 30, 2006.

This report was prepared by Dr. Judy Crane (MPCA) and Peggy Myre (Exa Data & Mapping Services, Inc.). Dr. Crane's time was used as part of the state match to the St. Louis River CAC's grant under award number WCMP 86003-006.07 from NOAA, U.S. Department of Commerce. The statements, findings, conclusions, and recommendations are those of the authors and do not necessarily reflect the views of NOAA, the Department of Commerce, or the MPCA.



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The Phase IV sediment quality databases include new sediment quality data for the Wisconsin side of the St. Louis River AOC, as well as data that were assembled from three earlier phases of the GIS-based sediment quality database project conducted by Dr. Crane (MPCA) and her consultants. These earlier projects were funded as follows:

- Phase I (completed September 30, 2003): Grant number GL97536301-1 (\$81,000) from the U.S. Environmental Protection Agency's (EPA) Great Lakes National Program Office (GLNPO) plus a 5% state match from the MPCA. MacDonald Environmental Sciences Ltd. (MESL) provided contractual assistance on this project.
- Phase II (completed December 22, 2004 as one component of a MPCA-Duluth grant to develop a comprehensive sediment management plan for the lower St. Louis River AOC): Grant number GL97540401-2 (\$40,000 of funds for the Phase II project) from GLNPO plus a 5% state match from the MPCA. MESL provided contractual assistance on this project.
- Phase III (completed December 31, 2005): Grant number MLSCP 306-28-06 (\$50,000) from Minnesota's Lake Superior Coastal Program (MLSCP) plus a 50% state match from the MPCA. MESL and Exa Data & Mapping Services, Inc. provided contractual assistance on this project.

Work products from Phases I through IV are either available on the MPCA's Contaminated Sediment Web page at: <http://www.pca.state.mn.us/water/sediments/studies-stlouis.html#assessment> or by contacting Dr. Crane at:

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

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LIST OF ABBREVIATIONS AND ACRONYMS

AOC	Area of Concern
BC	British Columbia
CAC	Citizens Action Committee
DL	Detection Limit
EPA	Environmental Protection Agency
F/P	Fluoranthene to Pyrene Ratio
FTP	File Transfer Protocol
GIS	Geographic Information System
GLNPO	Great Lakes National Program Office
GT	Greater Than
LT	Lower Than
MESL	MacDonald Environmental Sciences Ltd.
MLSCP	Minnesota's Lake Superior Coastal Program
MN	Minnesota
MPCA	Minnesota Pollution Control Agency
MS™	Microsoft™
NA	Not Available
ND	Not Detected
NOAA	National Oceanic and Atmospheric Administration
OLE	Object Linking and Embedding
P/A	Phenanthrene to Anthracene Ratio
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PEC	Probable Effect Concentration
PEC-Q	Probable Effect Concentration Quotient
P.O.	Post Office
QAPP	Quality Assurance Project Plan
SEH	Short Elliott Hendrickson
SQT	Sediment Quality Target
U.S.	United States
UTM	Universal Transverse Mercator
VBA	Visual Basic for Applications
WCMP	Wisconsin Coastal Management Program
WDNR	Wisconsin Department of Natural Resources
WI	Wisconsin

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A number of individuals assisted with the preparation of earlier phases of the GIS-based sediment quality database. These individuals have been acknowledged in the documentation that accompanied each phase of the database.

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Todd Biewen (MPCA) provided useful supervisory assistance and was instrumental in securing state match funding for Dr. Crane's position. Exa Data & Mapping Services, Inc.'s work was funded through a contract from the St. Louis River CAC, and they worked with two subconsultant companies to complete their tasks. The team members for the database component of this project were as follows:

St. Louis River CAC: Lynelle Hanson (Grant Manager)

MPCA: Judy Crane (Project Manager)

WDNR: Jim Killian and Nancy Larson (Project Collaborators)

Exa Data & Mapping Services Inc.: Peggy Myre (Consultant Team Manager), Stacy Larsen (Administrative Support)

Premier Environmental Services Inc.: Corinne Severn (Senior Database Manager), Laurel Menoche (Junior Database Manager)

Searay Environmental: Raymond Valente (Quality Assurance/Quality Control Manager)

Kate Angel was the WCMP Program Liaison to the St. Louis River CAC for this grant. The funding acknowledgments for this project were provided in the Forward of this report.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

The Phase IV geographic information system (GIS)-based sediment quality database for the St. Louis River Area of Concern (AOC)—Wisconsin focus represents a collaborative project between the St. Louis River Citizens Action Committee (CAC), Wisconsin Department of Natural Resources (WDNR), Minnesota Pollution Control Agency (MPCA), and Exa Data & Mapping Services, Inc. in conjunction with their subconsultants from Premier Environmental Services, Inc. and Searay Environmental. For this phase of the database, additional sediment quality data from the Wisconsin side of the AOC were added to the database based on the procedures documented in the Phase III Quality Assurance Project Plan (QAPP; Crane 2005a), as well as in the Phase IV project team roles and responsibilities report (Crane 2005b). These data consisted of mostly benthic invertebrate community data from throughout the Wisconsin side of the St. Louis River AOC, as well as some sediment chemistry data from Hog Island Inlet and Newton Creek in Superior, WI. Sediment remediation of the Hog Island Inlet/Newton Creek system was completed during the fall of 2005 through the use of Great Lakes Legacy Act funds. The post-remediation sediment chemistry data from this site were not available in time to add to the Phase IV database.

The Phase IV sediment quality database is available to users in three different formats, which are available on the MPCA's ftp site at: <ftp://files.pca.state.mn.us/pub/sedimentDB/>. Each format is available as a zipped file, and users will need to unzip the file(s) before using them. The file options are as follows:

- **Microsoft™ (MS™) Access '97 sediment quality database file name:** STLR_SED_DB_PH4_97.zip. Only a few stakeholders lacking MS™ Access 2000 software will need to use this version of the database.
- **MS™ Access 2000 sediment quality database file name:** STLR_SED_DB_PH4_Finalb.zip.
- **Query Manager-compatible database files:** PhIV_STLR_SEDB_QM_Final.zip. See the instructions in Chapter 4 of the Phase III Addendum to the Phase II Help Section for Database Users (Crane and Myre 2005) for how to use these files with the National Oceanic and Atmospheric Administration's (NOAAs) free Query Manager 2.56 software.

NOTE: User's need to retain a master copy of the database file(s), as well as a "working file" in case they accidentally delete data from the "working file." In addition, compacting and repairing the MS™ Access 2000 version of the database needs to be done about twice per month if the database is used regularly. Every time you run a query or open/close a

table in MSTM Access 2000, the program saves it in a little bit of extraneous memory, until the program can easily double in size.

To compact and repair the database, conduct the following steps. First go to the menu item “Tool,” then “Database Utilities.” From the arrow off from the “Database Utilities,” select “Compact and Repair” database. The action will then run. If it was quick, then there was not much information to compact. If it was slow, then there was a large amount of extraneous information that needed to be reduced.

A new feature of the MSTM Access 2000 version of the Phase IV database is that it contains a user-friendly Query Interface that facilitates retrieval of sediment chemistry, sediment toxicity, and benthic invertebrate community data. In addition to the interface, there are a series of pre-defined queries that allow the more experienced user to edit the queries directly. This Supplement to the Phase II and III Help Sections for Database Users (Smorong and Crane 2004; Crane and Myre 2005) describes the use and output of the Query Interface, options for saving the data derived from the queries to other software, and directions for opening and editing the pre-defined queries. The Query Interface is not available in the MSTM Access ‘97 version of the database.

Almost all of the queries include the following database fields: StudyID, StationID, MESL_StationID, SampleID, and upper and lower sediment depth. In addition, most queries include geographical information for each station including the area, location description, and coordinates [latitude/longitude and Universal Transverse Mercator (UTM) coordinates] to enable importing the data into GIS software such as ArcMap 9.1. For further information and definitions of each field, see Table 2 of the Phase III Addendum to the Phase II Help Section for Database Users (Crane and Myre 2005). Conventions are used in this guide to highlight user input actions on the Query Interface. **Buttons** (enacted by one click of the mouse) are in bold italics. Drop-down menu headings (where the user clicks on the arrow and selects from a list of options) are underlined.

Web links to the project documentation cited in this report are provided in the References section. Additional information on the studies that were included, as well as excluded, from the Phase IV sediment quality database will be included in supplemental Technical Documentation that is in the process of being prepared for this project.

1.2 STARTING UP THE PHASE IV MSTM ACCESS 2000 DATABASE

Upon opening the Phase IV MSTM Access 2000 database, the Acknowledgments will automatically open. Users may need to display the full extent of the Acknowledgments for better viewing. In addition, the “page up” and “page down” keys can be used to view the entire Acknowledgments. When you click on ***Continue*** at the bottom of this form, it will automatically open up the start of the Query Interface (Figure 1), which prompts you to select from available queries. The available queries are organized by query type. When you

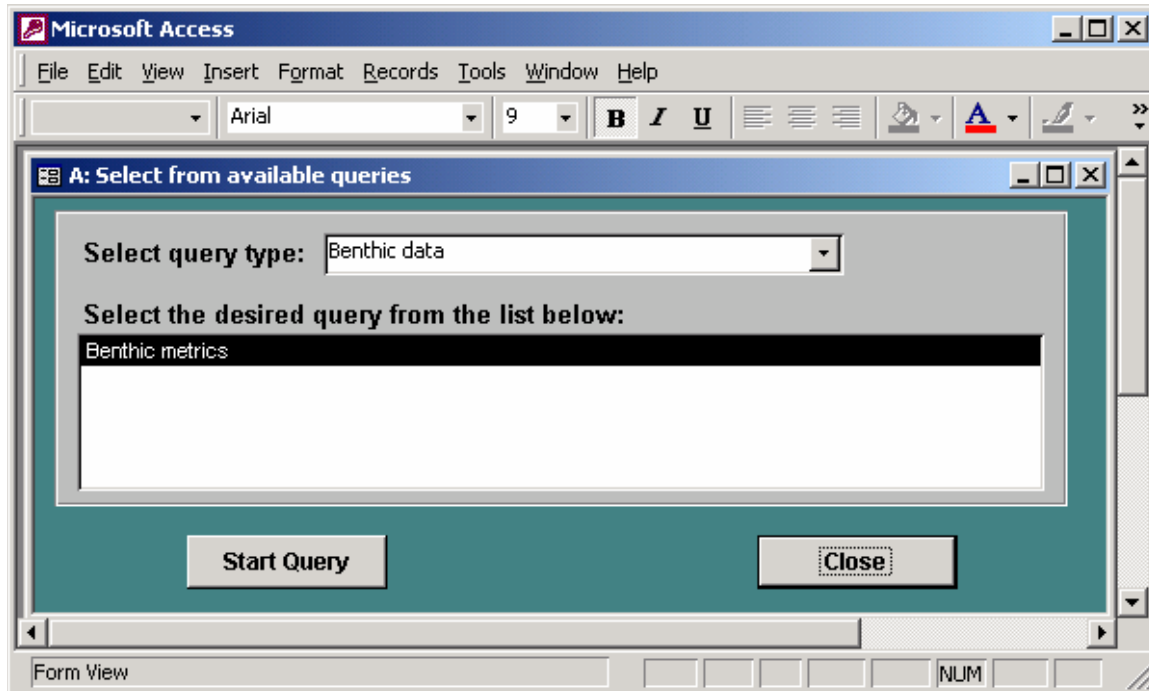


Figure 1. Opening screen of the Query Interface

click on the drop-down arrow from Select query type, there will be four available query type options, arranged alphabetically.

The four query type options are:

- Benthic data (one query),
- Bioassay data (one query),
- Other (six queries), and
- Sediment chemistry data (four queries).

These query types are discussed in Chapters 2 and 3, with a description of queries available both through the Query Interface and directly from the query objects area of MSTTM Access 2000.

1.3 SETTING UP THE CODE - TROUBLESHOOTING

The code generated for the Query Interface uses a program called VBA (Visual Basic for Applications). This code relies upon a series of reference libraries that must be selected for the code to work. If the Query Interface works properly as described in this Supplement, you do not have to refer to this section. If you are having trouble with the interface, close the database, and then re-open it by following these instructions.

First, press Alt and F11 to open the VBA code. Select the menu item Tools, and then References. Make sure you have the following references checked, and in the order

presented. If not, uncheck extraneous libraries, close the references list, re-open, and then check the correct libraries. You may not have the exact version of each library as listed below; check the most recent version that you have for the following references:

- Visual Basic for Applications,
- Microsoft Access 9.0 Object Library,
- OLE Automation,
- Microsoft DAO 3.6 Object Library,
- Microsoft ActiveX Data Objects 2.8 Library, and
- Microsoft ActiveX Data Objects Recordset 2.8 Library.

Once you have all the correct references checked and in the correct order, go to the menu item Debug and then select Compile STLR_SED_DB_PH4. Next, select File and Close and Return to MS™ Access. These steps should compile the code so that it will run correctly.

1.4 PRE-DEFINED QUERIES

The primary focus of this Supplement is to educate users about the Query Interface. There are, however, several pre-defined queries in the query objects part of the MS™ Access '97 and 2000 databases. To run one of these queries, simply double click on the query name. To edit it, open the query in Design Mode, by clicking on the Design button as shown below. Then you may change criteria, add fields, or perform other actions. For further information, consult a User's Guide for MS™ Access.



CHAPTER 2

QUERY DESCRIPTIONS

The query descriptions in this section are presented below by query type. Several of the queries access similar options to allow you to select by study, location, and depth interval. These global options will be described in this section, but are applicable to many of the data type-specific queries. There are also pre-defined queries available in the database; these are highlighted in the sections below as:

√ **Pre-Defined Query Note**

2.1 GLOBAL QUERY OPTIONS

Several of the queries will allow you to select data from the available studies, with only a list of the studies that have the particular data type you are interested in (Figure 2). To pick by study, you may highlight the studies from the top of the window, and click on the **Add Study** button. Alternatively, you may pick the **Add All** button to select all studies that contain samples of the data type in which you are interested. You may also remove one or all studies from your list of selected studies. Once you have selected one or many studies, click on the **Continue** button. If you do not select a study, then you will get an error message.

The other global option that will appear in many of the queries is to select from a list of Locations. This list is a unique list of the Area field in tblStation of the database (Crane and Myre 2005). The complete list of possible Areas as shown in Figure 3 is:

- Allouez Bay,
- Duluth Harbor,
- Duluth Harbor/Superior Bay,
- Lower St. Louis River,
- Lower St. Louis River watershed,
- NA – No location available for station,
- Negative Control – Bioassay negative control sample,
- Nemadji River,
- Reference – Reference station, specific location unknown,
- St. Louis Bay,
- Superior Bay, and
- Superior Bay/Allouez Bay.

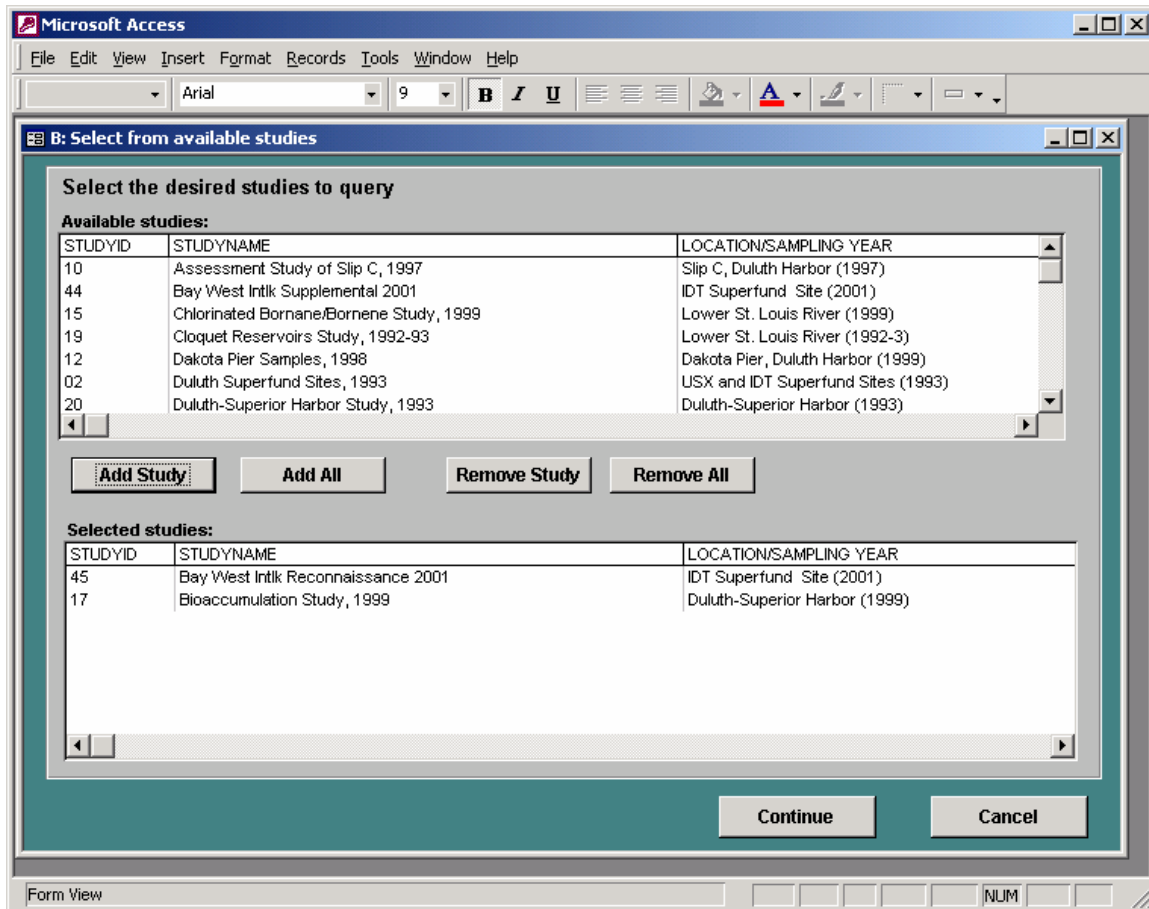


Figure 2. Select studies screen

You may pick particular locations, or select/remove All Locations. Many queries are organized by depth interval in the sediment. As noted in the explanation for depth intervals (sediment chemistry query), every sample is coded with one unique depth interval to allow for greater flexibility in conducting the queries. These intervals are pre-defined and include, in order of priority:

- ≥ 0 to ≤ 5 cm,
- ≥ 0 to ≤ 15 cm,
- ≥ 15 to ≤ 30 cm,
- ≥ 0 to ≤ 30 cm,
- ≥ 30 to ≤ 45 cm,
- ≥ 30 cm, and
- Other depths (including samples where either the upper or lower depth is unknown).

Thus, a sample with a depth interval of 2-4 cm would only be assigned to the 0-5 cm depth interval. It would not be assigned to the 0-15 cm or 0-30 cm categories since it can only be assigned to one depth interval. Users can take the results of these queries, download them

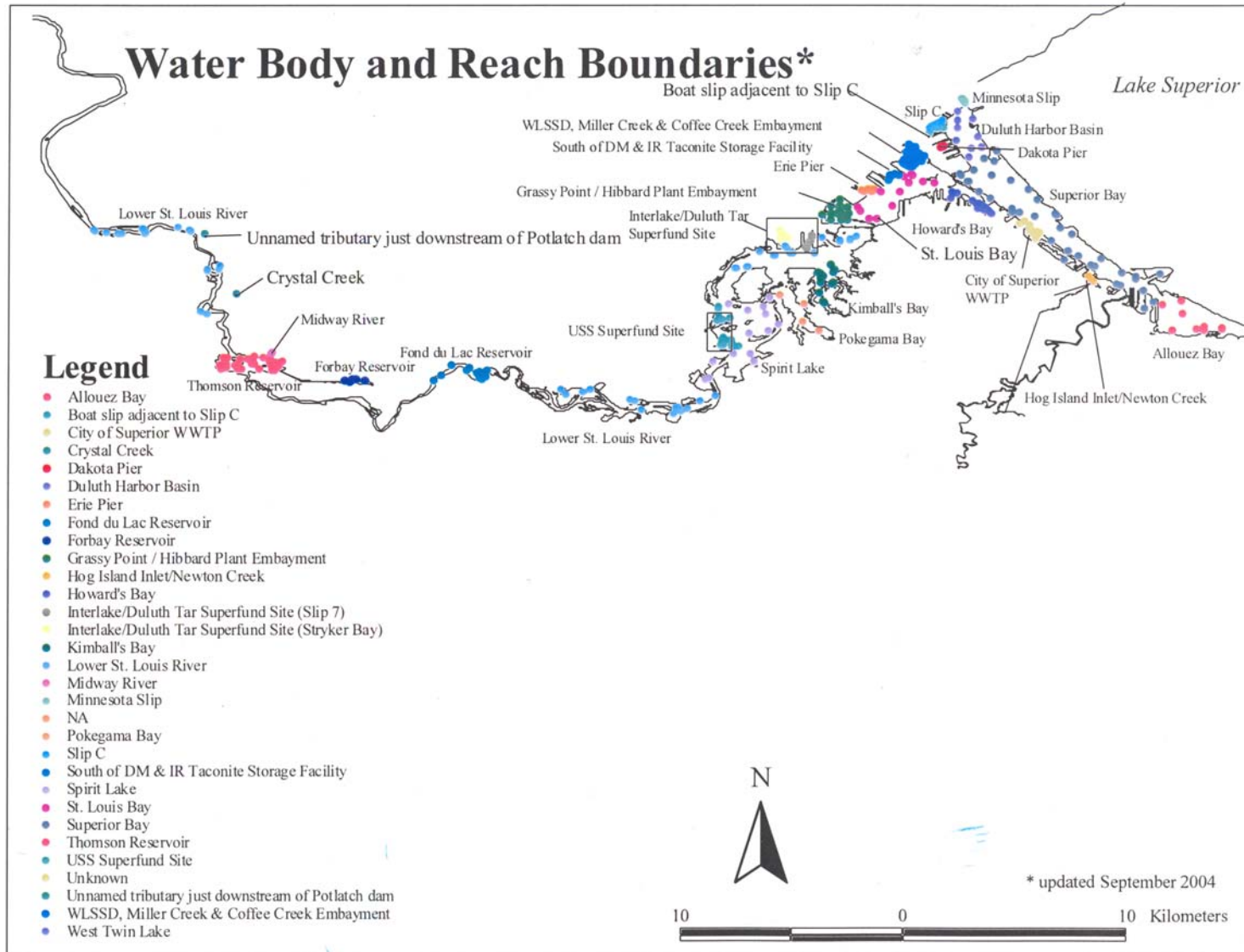


Figure 2. Water body and reach boundaries within the St. Louis River AOC where sediment quality samples have been collected

into a spreadsheet (e.g., Excel), and combine the results for further statistical analyses if they are interested in an inclusive list of samples in the 0-15 cm interval (i.e., combine the results of the 0-5 cm and 0-15 cm queries) or the 0-30 cm interval (i.e., combine the results of the 0-5, 0-15, 15-30, and 0-30 cm intervals).

2.2 BENTHIC QUERY

The query type of Benthic data currently has only one query (Benthic metrics). This query will select either summary statistics or replicate benthic invertebrate community data for selected studies, locations, and benthic metrics. From the start menu (Figure 1), highlight Benthic metrics and then click on **Start Query**.

After selecting **Start Query**, you will be prompted to pick one or many studies (Figure 2). Select the studies of interest, and then click on **Continue**. At this point, the benthic Data Preferences screen will open (Figure 4). The first step is to select locations, as described in the global options (Section 2.1).

After you select locations, pick a Selected metric from the drop-down list. The benthic code, the description of the metric, and the metric category is shown while you pick one, sorted by category and metric. After you select a metric, the choice of units specific to that metric will show up in the Selected units drop-down list. Once you have picked a metric and an applicable unit, you can choose either the summary statistics data (i.e., mean, standard deviation, and sum of the replicates), or the replicate data (Crane and Myre 2005) from the check boxes at the bottom of the window (Figure 4). When you are satisfied that you have made a choice from all options, click on the **Show Results** button. The query, called QryBenthicData2, will run, showing results sorted by Area, Location Description, StudyID, StationID, and SampleID. Suggestions for options to save these data, or export the data to another software program, are provided in Section 3.0 of this Supplement.

- √ **Pre-Defined Query Note:** There is also a query with output similar to the benthic query that you may edit directly in Design mode. It is called QryBenthicData, and is available under the Query objects of the database.

2.3 BIOASSAY QUERY

The query type of Bioassay data currently has only one query (Bioassay results). This query will select summary bioassay data for selected studies, locations, bioassay test species, media, and endpoints. From the start menu (Figure 1), highlight Bioassay results and then click on **Start Query**.

After selecting **Start Query**, you will be prompted to pick one or many studies (Figure 2). Select the studies of interest, and then click on **Continue**. At this point, the bioassay Data Preferences screen will open (Figure 5). The first step is to select locations, as described in the global options (Section 2.1).

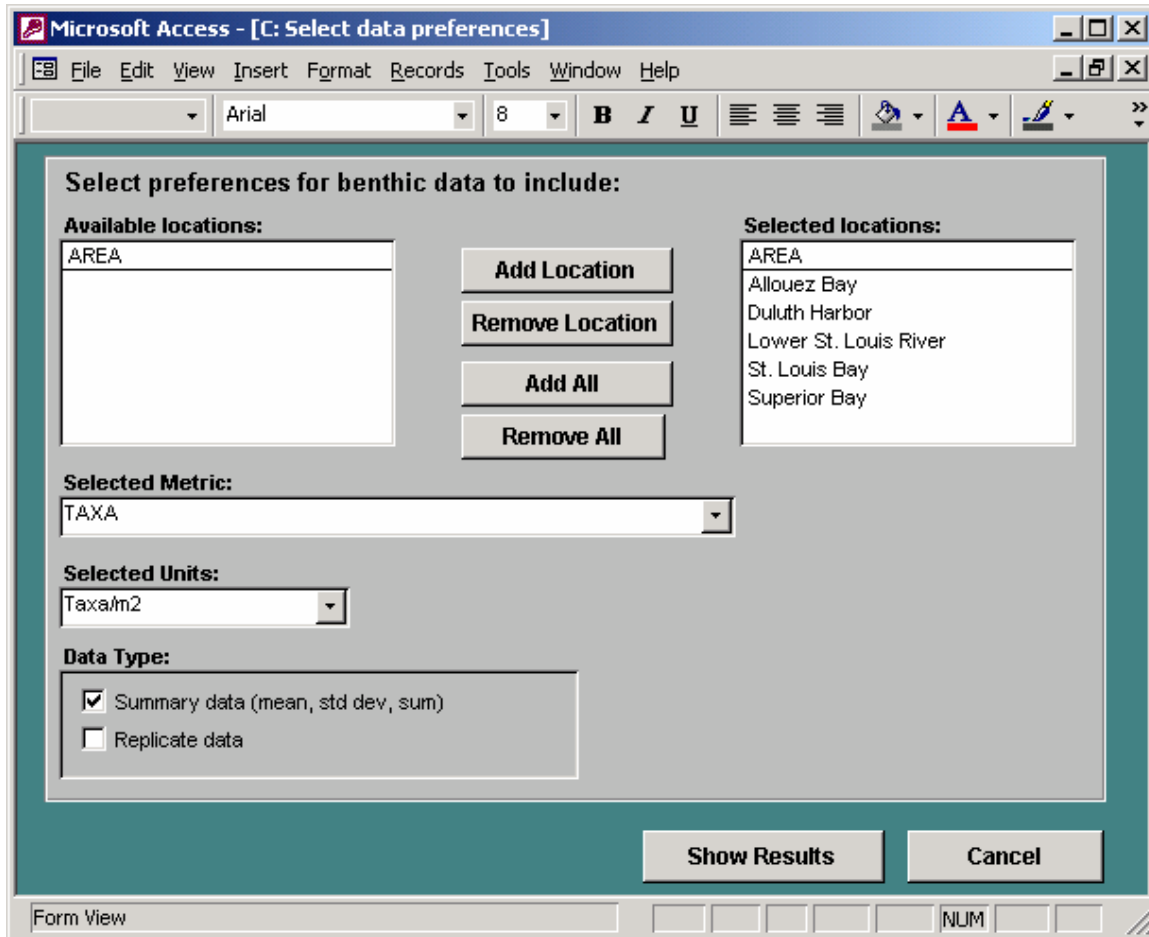


Figure 4. Benthic invertebrate community preferences screen

After you select locations, pick a Selected Species from the drop-down list. After you select a species, the choice of medium and endpoints specific to that species will show up in the Selected Medium/Endpoint drop-down list. When you are satisfied that you have made a choice from all options, click on the **Show Results** button.

The query, called QryBioassay2, will run, showing results sorted by Species, Endpoint, Toxicity code (MESL_TOXIC), StudyID, StationID, and SampleID. Suggestions for options to save these data, or export the data to another software program, are provided in Section 3.0 of this Supplement.

- √ **Pre-Defined Query Note:** There is also a query with output similar to the bioassay query that you may edit directly in Design mode. It is called QryBioassayData, and is available under the Query objects of the database.

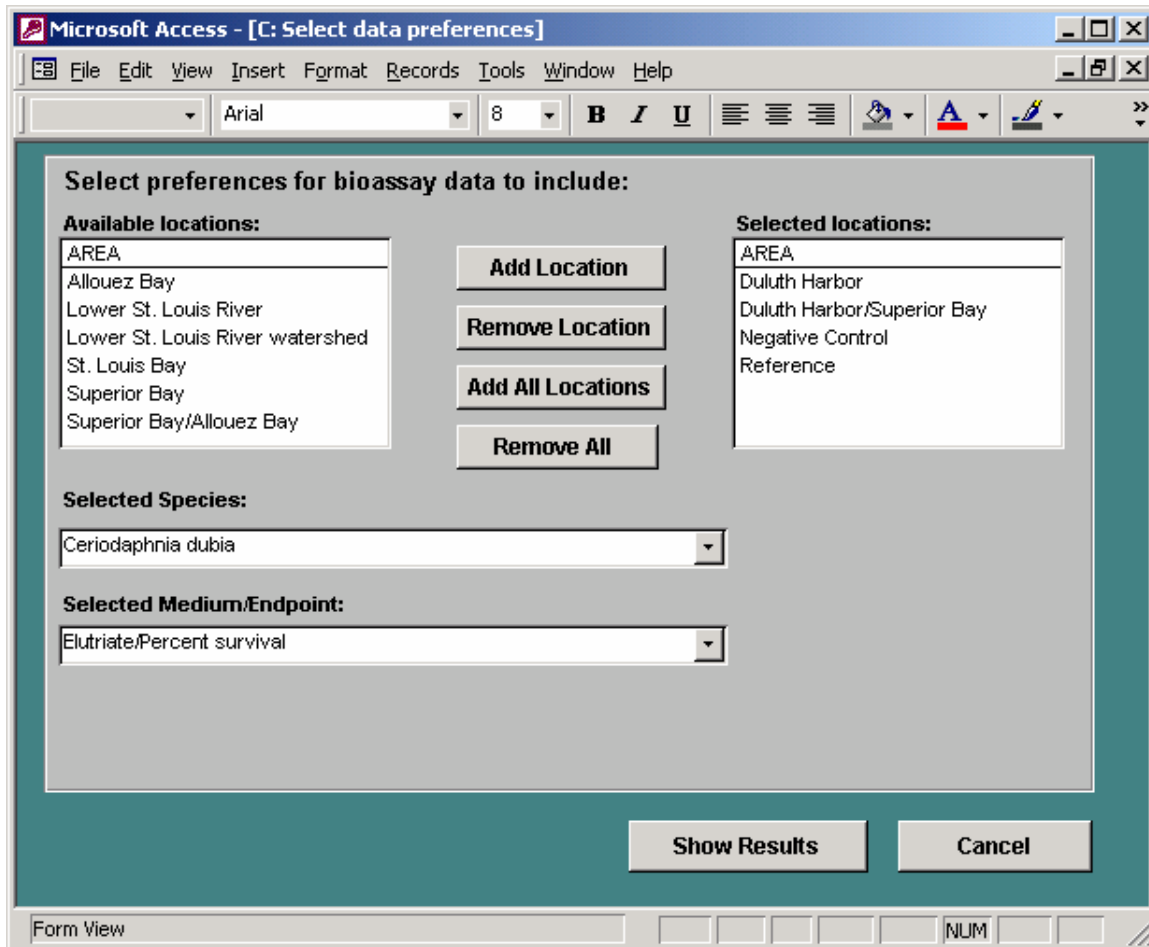


Figure 5. Bioassay preferences screen

2.4 OTHER QUERIES

There are a series of other queries that summarize the database content, and also provide information on the calculation of mean probable effect concentration quotients (PEC-Qs; Crane *et al.* 2000, 2002). Each query is run by first highlighting the query, and then selecting *Start Query*. These queries are described in the following subsections.

2.4.1 Study Names and Reference Documents

The output of this query will show all of the references associated with each study, sorted by StudyID and document number.

2.4.2 Station Count by Area and Location Description

This query counts all of the stations for each geographical area and location descriptions.

2.4.3 Matching Chemistry/Bioassay Samples with Test and Toxicity Data

This query retrieves all samples that have matching sediment chemistry and bioassay data, unless the bioassay data includes the Microtox[®] test. The results include the station and sample information, as well as bioassay information including the species, endpoint, medium, effects value, and toxicity significance.

2.4.4 Sample Count by Data Type

This query (which may take a minute or two to run, depending on your computer size), lists how many sediment chemistry, bioassay, and benthic invertebrate community samples each study contains.

2.4.5 PEC Chemical Classes

There are two queries that provide information on the classes of chemicals [i.e., total polycyclic aromatic hydrocarbons (PAHs), total polychlorinated biphenyls (PCBs), and/or reliable metals (arsenic, cadmium, chromium, copper, lead, nickel, and zinc)] that were used to calculate individual class PEC-Qs. The first of these queries (PEC chemical classes – all samples) shows a list of all of the samples that fall within one of the specified depth intervals, the associated mean PEC-Q, and an indication of a Yes or No for each chemical class. The final field shows the number of chemical classes (1, 2, or 3) that were used to calculate the mean PEC-Q. The results are sorted by depth interval, StudyID, StationID, and SampleID.

The second of the PEC chemical class queries is PEC chemical classes – sample count by depth interval. This query provides, for each depth interval, the number of samples that had mean PEC quotients calculated from one (1), two (2), or all three (3) chemical classes.

2.5 SEDIMENT CHEMISTRY QUERIES

There are four queries available for this data type. Each query is run by first highlighting the query, and then selecting *Start Query*. These queries are described in the following subsections.

2.5.1 Select Chemistry Data

This query will select chemistry data for selected studies, locations, and chemical groups. After selecting *Start Query*, you will be prompted to pick one or many studies (Figure 2). Select the studies of interest, and then click on *Continue*. At this point, the sediment chemistry Data Preferences screen will open (Figure 6). The first step is to select locations, as described in the global options (Section 2.1). After you select locations, pick one or more depths, in the same manner as locations, from the Available depths drop-down list; you may add or remove depth intervals. As explained in the Help button, every sample is coded with a depth interval category, allowing you to select or exclude samples within each category.

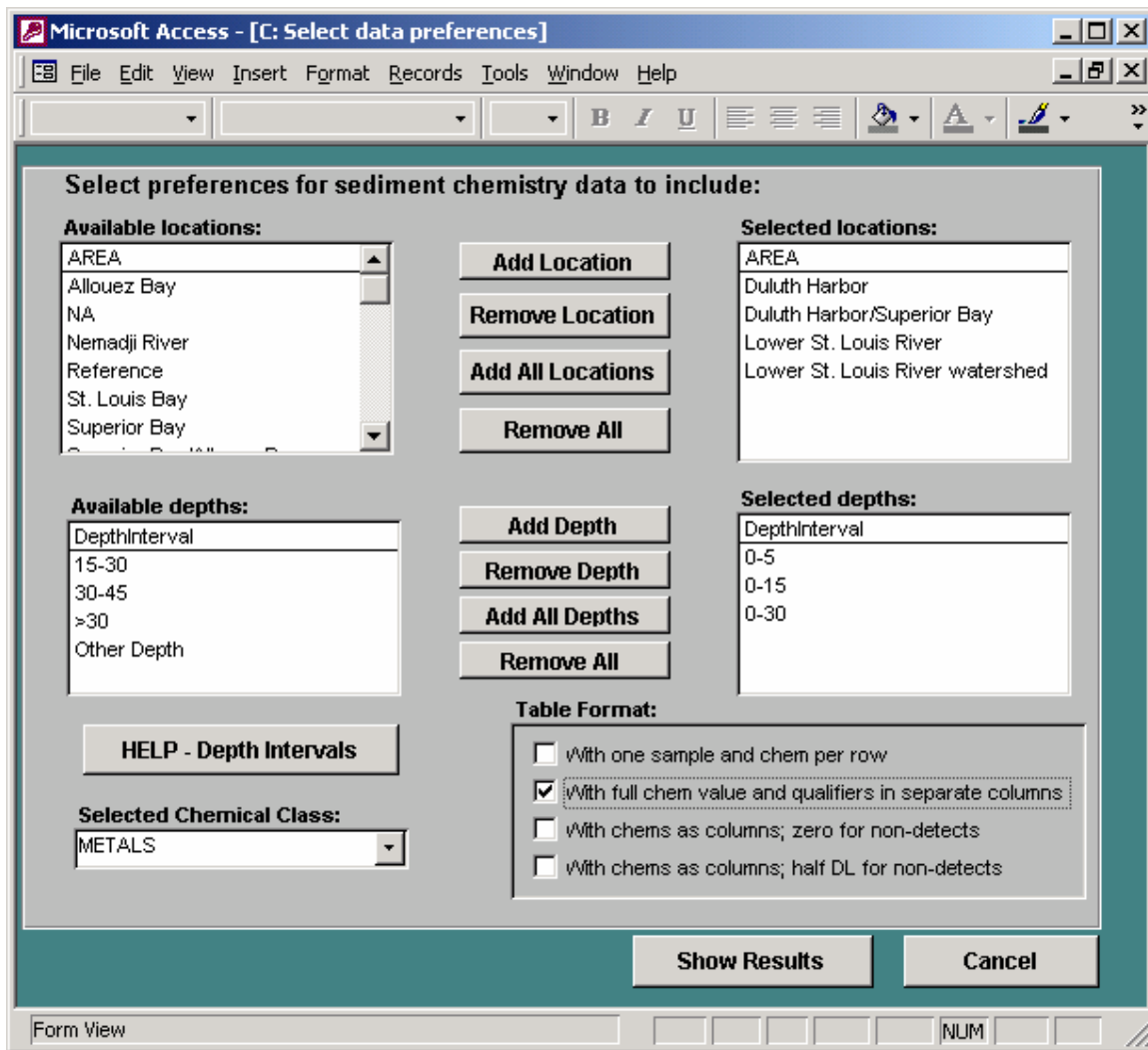


Figure 6. Sediment chemistry preferences screen

The final step is to choose one chemical class from the Selected chemical class drop-down list. When you are satisfied that you have made a choice from all options, you now can choose from one of four table formats. Each of these four check-box selections will result in quite different tables. The four options are:

- With one sample and chemical per row,
- With full chemical values and qualifiers in separate columns,
- With chemicals in columns, zero used for non-detects, and
- With chemicals in columns, one-half of the detection limits used for non-detects.

When you select “With one sample and chem per row,” the results will be a query (QrySelectChemDataV2), with one column each for chemical parameters, reported results, qualifiers, and the field MESL_C_CALC (values reported below detection are included at

one-half of the detection limit; Crane and Myre 2005). Missing data and nondetected values with a detection limit greater than the corresponding Minnesota Level II sediment quality target (SQT; Crane *et al.* 2000, 2002) are excluded from the output.

- √ **Pre-Defined Query Note:** To see an example of this output, you may run QrySelectChemData (Section 3.1). You may edit this query directly in Design mode.

When you select “With full chem value and qualifiers in separate columns,” the output will result in a **table** called qtbl_ChemWide. Because the table already exists, you will be asked if it is acceptable to delete the existing table and overwrite it with the new results. The only circumstance when you would not want to overwrite the table is if you have run a query previously and wanted to save those results. In this case, you would copy the table to another name, and then re-run the new sediment chemistry query. For more information, and to understand the differences between the table output as compared to the query output, see Section 3.2 of this Supplement.

This table is formatted so that every chemical is in a column, and the qualifier for that chemical is in the column next to it. The column heading for each chemical concentration includes the unit (e.g., LEAD_PPM), and the qualifier column includes the chemical code (e.g., LEAD_Q). In some cases, you might not automatically know what the chemical name is from the chemical code; in this case, refer to the lkp – CHEMDICT table for definitions of the chemical codes (Smorong and Crane 2004). It is likely that not every chemical for the chemical group selected was measured in every sample. If that chemical was not measured in a particular sample, the field is filled with -888. Missing data and nondetected values result with a detection limit greater than the Level II SQT are excluded from the output.

If you select “With chems as columns; zero for non-detects,” it will also result in the same table (qtbl_ChemWide). In this case, both the chemical code and unit are in the column heading (e.g., PCD2378_ngPERkg). The cells contain the reported value, except for values reported as below detection (which are filled with zeros). Missing data and nondetected value results with a detection limit greater than the Level II SQT are excluded from the output.

Finally, if you select “With chems as columns; half DL for non-detects,” it will again result in the same output table (qtbl_ChemWide). Both the chemical code and unit are in the column heading (e.g., ANTHRACENE_PPb). The cells contain the reported value except for values reported as below detection, which are filled with one-half of the reported value (MESL_C_CALC). Missing data and nondetected value results with a detection limit greater than the Level II SQT are excluded from the output.

Please note that if you select a large amount of data from the database (i.e., multiple studies, locations, depths, and a chemical group with many parameters such as PCB congeners), the queries may take several minutes to run.

2.5.2 PAH Source Ratios Summary

This query extracts data for four PAHs, then calculates two sets of PAH ratios. After selecting **Start Query**, you will be prompted to pick one or many studies (Figure 2). Select the studies of interest, and then click on **Continue**. The query (QryPAHSource2_CalcRatios) will run with all of the data from the selected studies. The results show the ratios of 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-derived) sources of PAHs (Budzinski *et al.* 1997).

For this query, 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 SQT criteria 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 (e.g., "Other").

- √ **Pre-Defined Query Note:** The PAH quotient query is generated from several different queries and are available directly for the user. To see a description of the queries, please see Section 3.0.

2.5.3 Mean PEC-Q Summary

This query will summarize the mean PEC-Q for each sample, and reports them organized by depth interval and mean PEC-Q risk classification. A 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; Crane *et al.* 2000, 2002). These classifications are also selected as part of this query.

After selecting **Start Query**, you will be prompted to pick one or many studies (Figure 2). Select the studies of interest, and then click on **Continue**. The query (QryPEC_Q2_Crosstab) will run with all of the data from the selected studies, and it is organized by Area, StudyID, StationID, and SampleID. The risk classifications are reported for three unique depth intervals in the following order of priority: 0-5 cm, 0-10 cm, and 0-15 cm. For example, samples included in the 0-5 cm depth interval are excluded from the other two depth intervals. The query excludes samples with no mean PEC-Q reported.

- √ **Pre-Defined Query Note:** The mean PEC-Q query is generated from several different queries and is available directly for the user. To see a description of the queries, please see Section 3.0.

2.5.4 Sediment Chemistry Results Compared to Minnesota SQTs

This query compares surface sediment chemistry data to the corresponding Level I and II SQTs for the state of Minnesota, by showing if each value is lower than (LT) or greater than

(GT) the corresponding SQT. After selecting **Start Query**, you will be prompted to pick one or many studies (Figure 2). Select the studies of interest, and then click on **Continue**. The query (QrSQT1&2_Union_Crosstab) will run with all of the data from the selected studies organized by Area, StudyID, StationID, and SampleID.

The query selects all surface samples (upper depth = 0 cm) and chemicals with corresponding 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 concentrations (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"). The data that are retrieved are linked and sorted first by depth interval, then by StudyID, StationID, SampleID, and Chemcode. The Level I and Level II SQT exceedences are shown as separate columns at the end of the query.

Please note that the Wisconsin sediment quality guidelines (WDNR 2003), as well as the Minnesota SQTs (Crane *et al.* 2000, 2002), are available in the Query Manager-compatible database files for this project. Users can take advantage of the many user-friendly queries NOAA has developed to retrieve sediment chemistry data compared to corresponding Wisconsin sediment quality guidelines or Minnesota SQTs.

CHAPTER 3

PRE-DEFINED QUERIES AND DATA EXPORT OPTIONS

The pre-defined queries are discussed throughout this Supplement (see Section 1.4). Additional description, however, especially for multiple queries, would be useful for the user (Section 3.1). The Query Interface results in either new tables or queries. The differences between these outcomes, and guidance for exporting these data to other software programs (e.g., spreadsheets, GIS), are discussed in Section 3.2.

3.1 PRE-DEFINED QUERIES

The pre-defined queries available for the user to open, run, and edit include:

- QryBenthicData,
- QryBioassayData,
- QrySelectChemData,
- PAH source ratio query (multiple queries), and
- Mean PEC-Q query (multiple queries).

You may run or edit any of these queries, as described in Section 1.4. The last two queries, however, are actually 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 has been saved so that the user could alter the criteria during each step, if necessary.

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.

QryBenthicData - This single query simply extracts all of the mean benthic community data (mean, standard deviation, and sum) for a specific metric. Currently, the category selected is Taxonomic Group, the metric Total Abundance, with the unit of organisms/m² (org/m²).

There are two ways of editing this query. First, you may edit the selected metric or unit in Design Mode. Open the query in Design Mode, and then edit the field directly using the specific options in the table lkp – BENTHOSMETRICS. Second, 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 2000 documentation on how these functions work.

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 (sediment, elutriate, etc.). You may edit or filter the query as described for QryBenthicData above.

QrySelectChemData - This single query simply extracts all of the sediment chemistry data, and sorts the data by the Area_field (Crane and Myre 2005). 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 concentrations (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.

PAH Source Ratios - The 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 "QryPAHSource1_CalcRatios." A description of each query and any associated assumptions is listed below.

- **QryPAHSource1_aSelectData** - This query selects all samples with the four relevant PAH compounds (i.e., phenanthrene, anthracene, fluoranthene, and pyrene). 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 SQT criteria 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.
- **QryPAHsource1_aSelectData_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.
- **QryPAHSource1_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.

Mean PEC-Q Query – This series of mean PEC-Q queries is prefaced by "QryPEC_Q1." To create a table of mean PEC-Qs with risk classifications, it is only necessary to run the final query "QryPEC_Q1_Crosstab." A description of each query and any associated assumptions is listed below.

- **QryPEC_Q1** – This query selects all samples with a calculated mean PEC-Q ($<> -99999$), and retrieves them linked to both depth interval (as described in 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 categories of <0.1 (low), ≥ 0.1 to ≤ 0.6 (moderate), and >0.6 (high; Crane *et al.* 2000, 2002). These classifications are also selected as part of this query. Note: the user can change either the depth code or the risk classification for this query by editing the lookup tables directly, and then re-running the query.
- **QryPEC_Q1_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 is also selected to aid in the mapping exercise.

3.2 OPTIONS FOR SAVING AND EXPORTING QUERY OUTPUT

Most of the queries developed for the Query Interface result in a Query object; only the Sediment Chemistry query results in a table (qtbl_ChemWide; Section 2.5.1). The difference between a query and a table is that a query is a virtual table – it is created from data stored in permanent tables on your hard drive. You can open a table and modify the field names or types; a query generates a set of data each time it is run. You may export data into a file outside of MSTM Access 2000 for either type of object; instructions for this feature are provided below.

Save table data - The advantage of a table is that it is more permanent, you can save a table that you have created, and then create further queries from that table. For example, if you want to save your results when you create the qtbl_ChemWide from the Query Interface, you can save it to a new name, and then the table will be there for future analysis sessions. To rename the output in qtbl_ChemWide, right click the name in the Tables window, Copy the table, and Paste it with a new name. See the user documentation for MSTM Access 2000 for further information.

Generate table data - If you want to generate a table from any of the queries, simply open the query in Design Mode, go to the menu item Query, and select Make-table query. When you run this query, it will create a table that you can name and save in your own database.

Exporting data – If you want to export the results of your query or table into Excel, choose the menu item File, then select Export. You have a wide variety of options (Excel, dbase, text). For using in GIS, either dbase or text is generally the preferred option; see GIS documentation for further information.

CHAPTER 4

PROJECT CONTACT

For further information about the Phase IV MST™ Access '97/2000 or Phase IV Query Manager-compatible sediment quality databases for the St. Louis River AOC, contact Dr. 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

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