Ambient Database
Management System Documentation

Version 1.5
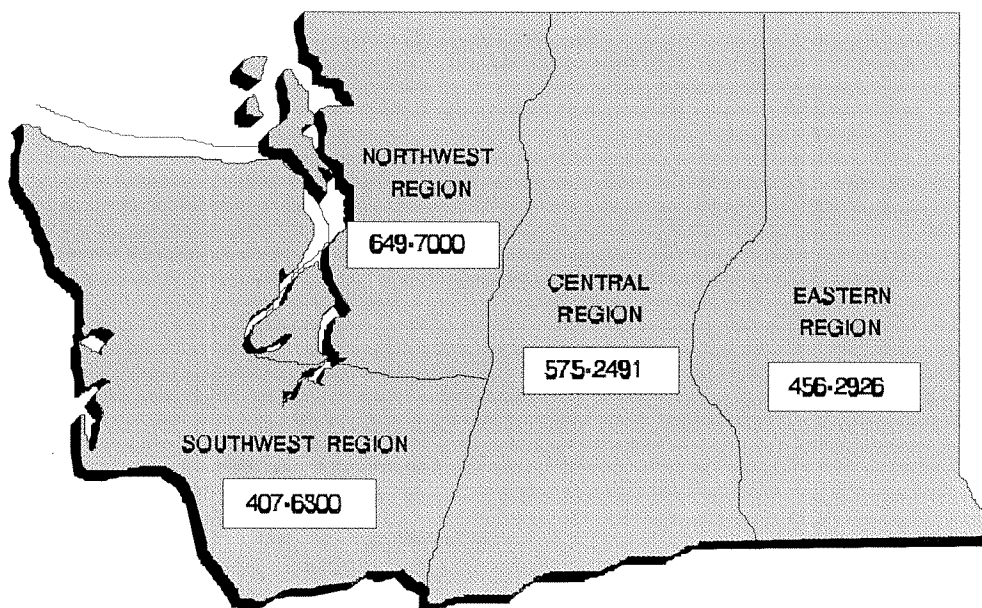
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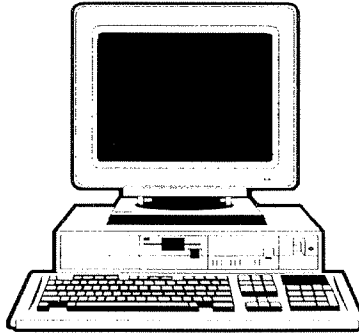
Ambient Database
Management System Documentation

Version 1.5

Prepared by:
Dave Hallock

Major Changes Since Version 1.0

- A "Precipitation" module has been added under "Data Retrieval" which matches precipitation data with water quality results for correlation and trend analysis.

- A procedure has been added under "Database Administrator" which exports data for a specified wateryear in World Wide Web-format and creates a station list with stations linked to the data.

- Procedures have been developed to handle miscellaneous data (*i.e.*, parameters not in the primary datatable, DPF_C). These results are added and retrieved in all the standard formats without special processing being required by the user.

Table of Contents

General Overview

The Ambient Monitoring Section's (AMS) Database Management System (DBMS) is a collection of data tables and programs which together form an "application" allowing menu-driven access to those data tables. The system was designed primarily to serve as a repository for the River and Stream and Marine Water Column Programs' ambient monitoring data. In addition to storing field and laboratory data, the system provides an evaluation of data quality, produces several reports, and provides for data retrievals in a number of formats. Most functions are menu-driven and available directly from the application. Some annual maintenance functions require loading and working within dBase®.

The DBMS was originally developed in dBase III+® in 1990 under contract with the Department of Information Services and Terry Syverson of SYX_SYSTEMS®. The programs were subsequently modified to take advantage of improvements offered by dBASE IV version 1.1®. Numerous other modifications have been made in-house.

The monitoring data are available for retrieval to anyone with access to EILS' local area network.

Using this Documentation

This documentation is intended to serve as both guidance for the general user and a repository of the technical details of the DBMS. Most users will find what they need in the "How to" sections. Individuals responsible for maintaining the data tables will find additional guidance in the "Annual Maintenance" sections. Systems administrators will need to refer to the "Technical Details" in the appendix. Menu items are explained in the appropriate "How to" section and also, briefly, in the "Menus" section.

Organization

The entire DBMS includes 45 data tables, most of which are temporary holding files or look-up tables. Data tables and their purpose and structure are discussed in the technical appendix. Critical data are contained in the following data tables.

CONTENTS	DATA TABLE
Current Freshwater (Most recent complete six years)	DPF_C
Current Marine (Most recent complete six years)	DPM_C
Historical Freshwater	DPF_H
Historical Marine	DPM_H
Field Remarks	DPREM
Quality Control Results	DQA_C
Station Descriptions	DSTADESC

Data tables and their associated index files are located on the following path.

P:\AMBIENT\DBMSDATA.

There are 59 program files which serve to provide a menu-driven system for managing the data There are an additional 70 miscellaneous programs and reports. The start-up program is ADM001.PRG. System managers will find the uncompiled programs in:

J:\AMBIENT\DBMSPROG.

Most users will not need access to uncompiled programs and will not need to load dBase®. The runtime version (dBase version 1.1®) is located in:

J:\AMBIENT\DBMSRUN.

The programs were recently modified and recompiled in a newer runtime version (dBase version 2.0®) to allow access by users without network access rights to the AMS data directory. Once version 2.0 is tested, the older version will be removed from the network. The newer version is located in

J:\AMBIENT\DBMSRUN2

Access Rights

Access rights are a LAN function which allow logged-in users specific levels of control of the contents of an individual directory or subdirectories. To retrieve data only, you must have read and scan access rights to the J:\AMBIENT\DBMSRUN and P:\AMBIENT\DBMSDATA directories and full rights to P:\AMBIENT\DBMSDATA\DATATMP. All members of the network group "ALL_EILS" have these rights. To modify data, in addition to the above, you need nearly full access rights to P:\AMBIENT\DBMSDATA. These rights are not automatically granted to everyone in EILS because of the possibility of data corruption. (Although passwords provide a level of protection within the DBMS, full access rights open up the possibility of corruption from DOS® or from within dBase® by a careless or malicious user. See "Error Messages and Future Improvements.") If you need to edit AMS's monitoring data, see the network or the DBMS administrator.

Starting the System

Regular users should have the network administrator set up a Windows® icon to start the system. Otherwise, the system may be started as described below:

The runtime version allows the DBMS to be loaded without loading dBase® first by entering the following commands at the DOS-prompt:

```
Version 1.1:    J:
                CD J:\AMBIENT\DBMSRUN
                RUNTIME ADM001
Version 2.0:    J:
                CD J:\AMBIENT\DBMSRUN2
                DBMS
```

Of course, you must first be logged on to EILS's LAN. You must also have the appropriate access rights to the DBMS directories.

Version 1.1 does not provide access to users without nearly full rights to the AMS data directory (see "Access Rights"). Version 2.0 requires more memory than version 1.1 and may not run under some Windows® configurations.

The system is password-protected. After entering "RUNTIME ADM001" (or "DBMS" in version 2.0) you will be prompted to enter a password. Lower-level passwords allow access to most data retrieval functions, mid-level passwords allow access to retrieval and data storage, and upper level passwords allow full access, including maintenance functions. Entering "Guest" (or simply pressing "Enter") at the password prompt loads the system with the lowest-level access. Higher level passwords are available from system administrators. Entering "Q" at the password prompt exits the system. If you fail to enter a valid password after two tries, the system will terminate.

After entering a correct password you will be rewarded with the Master Menu. Menu items to which you have access (as determined by your password) can be selected by pressing the first letter of the item or using the arrow keys to select the item and pressing the "Enter" key.

Leaving the System

The only graceful way to leave the DBMS is from the password prompt by entering "Q" or by twice entering an incorrect password. (Error messages often offer a less graceful way to exit by presenting a "Cancel/Ignore" message. Choosing "Cancel" will terminate the system.) The user can back out of menus by choosing "Exit" or by pressing the left or right arrow keys. Most actions offer one last chance to abort with a "Continue/Exit" menu. If you are forced out of the system due to a computer lock-up or power failure, please inform the system administrator because data tables that were open at the time may need to be re-indexed (see "Fewer Data Records Than Expected"). If this occurs while entering data, usually only the current record will be lost. Re-enter the system and "View" to see what records have been saved (see "How to Update Field Data," Step 8).

Menus

This section graphically displays each significant menu, lists the section of the documentation that discusses each entry, and briefly describes the function of each entry. Minor menus are not discussed here.

Master Menu

```
         A M B I E N T   D A T A   M A N A G E M E N T   S Y S T E M

      DATE                                                        TIME
      95/04/18                                                ▓▓▓▓▓▓▓▓

         ─────        MASTER MENU        ─────

         DATA ENTRY - FIELD SAMPLES
         FLOW DATA ENTRY
         LAB RESULTS - UPDATE PROCESS
         MISC REPORTS AND QC REVIEW
         DATABASE ADMINISTRATION FUNCTIONS
         SUMMARY STATISTICS CALCULATION
         MONTHLY WATER QUALITY STANDARDS REPORTS
         PC STORET UPLOAD
         DATA RETRIEVAL

         EXIT

              TERMINATE THIS PROGRAM AND GO TO LOGON SCREEN
```

MENU ENTRY	DOCUMENTATION SECTION	COMMON FUNCTION
Data Entry	Update Field Data	Field data entry
Flow Data Entry	Update Flow Data	Flow data entry
Lab Results+	Import Lab Results	Lab data upload
Miscellaneous Reports and QC+	Create Reports; Edit QC Codes	Several data dictionary-type reports; code and evaluate QC data
Database Administration	Annual Management	Annual maintenance tasks
Summary Statistics	Calculating Summary Statistics	Annual calculation of stats
Monthly Water Quality Standards Reports	Water Quality Standards Exceedences	Monthly reports to regions
PCSTORET Upload	Updating PCSTORET	Formats data for PCSTORET upload
Data Retrieval	Retrieve Data	Retrieves data in various formats

+documented sub-menu

Lab Results

```
          A M B I E N T   D A T A   M A N A G E M E N T   S Y S T E M

    DATE                                                              TIME
  95/04/18                                                        █████████

  ┌────────── MASTER MEN──────────────────────┐
  │ DATA ENTRY - FIELD SA │ IMPORT LAB RESULTS │
  │ FLOW DATA ENTRY       │ RESULTS EDIT       │
  │ LAB RESULTS - UPDATE  │ CORRECT DATA ERRORS│
  │ MISC REPORTS AND QC R │ CHECK COMPLETENESS │
  │ DATABASE ADMINISTRATI │ UPDATE PRIMARY DBs │
  │ SUMMARY STATISTICS CA │ TRANSFER RECORDS   │
  │ MONTHLY WATER QUALITY │                    │
  │ PC STORET UPLOAD      │ EXIT               │
  │ DATA RETRIEVAL        └────────────────────┘
  │
  │ EXIT

                         RETURN TO MAIN MENU
```

MENU ENTRY	DOCUMENTATION SECTION	COMMON FUNCTION
Import Lab Results	All menu items are discussed in the "How to Import Lab Data" section	Imports ASCII data file to a temporary dBase® file
Results Edit		Corrects common entry errors, checks for validity of entries
Correct Data Errors		Displays data for manual correction
Check Completeness		Counts results and compares to expected number of results
Update Primary DBs		Transfers valid records to primary data table
Transfer Records		Transfers non-valid records to holding data table

Miscellaneous Reports and Quality Control (QC) Review

```
          A M B I E N T    D A T A    M A N A G E M E N T    S Y S T E M

    DATE                                                              TIME
    95/04/18                                                      ▓▓▓▓▓▓▓▓▓

         ———       MASTE┌─────────────────────────────────────────┐
    DATA ENTRY - FIE    │     MISC REPORTS AND QC REVIEW           │
    FLOW DATA ENTRY     │  1. QC CODE REVIEW/UPDATE                │
    LAB RESULTS - UP    │  2. QC CODE REPORT                       │
    MISC REPORTS AND    │  3. FIELD QC SAMPLES RESULTS             │
    DATABASE ADMINIS    │  4. MISSING DATA REPORT                  │
    SUMMARY STATISTI    │  5. STATION DESCRIPTION REPORT           │
    MONTHLY WATER QU    │  6. DATA DICTIONARY REPORT               │
    PC STORET UPLOAD    │                                         │
    DATA RETRIEVAL      │▓▓EXIT▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓│
    EXIT                └─────────────────────────────────────────┘

                       EXIT THIS OPTION/PROGRAM
```

MENU ENTRY	DOCUMENTATION SECTION	COMMON FUNCTION
QC Code Review/Update	Edit QC Codes	View and edit QC codes of data failing requirements
QC Code Report	QC Report	Reports data failing QC requirements
Field QC Sample Results	Field QC Samples Results	Reports field QC data (dups and blanks) to file and hardcopy
Missing Data Report	Missing Data Report	Lists missing data for specified period and group of parameters
Station Description Report	Station Description Report	Lists descriptive data about all stations
Data Dictionary Report	Data Dictionary Report	Lists descriptive data about all parameters

How to Enter or Change Data

Update Field Data

Overview

Field data are entered into temporary data tables from data entry screens accessible by menus. If a systems failure occurs during data entry, entered data will be preserved in the temporary data table and can still be viewed, edited, printed, and updated to the primary data table. The final update, which occurs automatically upon exiting the data entry menus, converts barometric pressure in inches Hg to mm Hg, applies a correction factor for thiosulfate normality to measured oxygen concentrations, and calculates percent oxygen saturation based on pressure (or elevation), conductivity (or salinity), temperature, and concentration.

Because of these adjustments, field parameters should not be added directly to the primary data table (*i.e.*, outside the data entry screens). If corrections are required to any of these parameters, unit conversions, corrections, and possibly recalculation of oxygen saturation will have to be done by hand (see "How to Correct Data Errors").

Procedures

1. Go to the Master Menu (See "Starting the System").
2. Choose "Data Entry - Field Samples."
3. Choose "Freshwater" or "Marine."
4. Choose "Add" and enter the run- or flight-specific data: marine flight number/freshwater run, the first date of sampling, the sampler's initials, the last two digits of the van license plate, and, for freshwater, the oxygen correction factor (this should range from 9.5 to 10.5; if unknown, enter 10.0).
5. Stations should appear in the usual order sampled. (If they don't, inform the DBMS manager - see "Identifying Current Stations.") Choose "Enter Sample Data" or, if that station was not sampled, choose "Skip Station" and the next station should appear.
6. Enter data as appropriate. No fields are required, lab data can be imported with only a station date and depth. (Note: If a station is "skipped" entirely, the station and depth will not be stored and lab data can not be imported). Time of day is generally rounded to the nearest five minutes to be compatible with STORET. If temperature is to be skipped, enter "-9.9," otherwise, enter "0" or simply leave results blank. Station-specific comments may be entered. Run or flight-specific comments (for example, weather) are generally entered at the first station or stations.
7. At the end of each day of a freshwater run you will be given an option to enter data from QC samples. If you accidentally choose to enter data, tab through the data entry screen and choose "Exit" rather than "Continue" to abort the entry.
8. After entering the last station, choose "View" to double-check and correct station, QC, and "header" entry errors. Dates may also be corrected here. If a skipped station was

accidentally entered, press "CTRL-U" once to delete it (it will still appear unchanged on the screen, however). Pressing "CTRL-U" again will undelete the record.

9. When finished editing each view screen, press "CTRL-End" to exit. (If you press "Escape" the last record entered may not be saved.)
10. Choose "Print" and "QC Data" (freshwater only) then choose "Exit" to return to the main menu. Sample data will automatically be printed and all data entered will be uploaded to the appropriate data tables.
11. Review the printouts. Incorrect data, undeleted "skipped" stations, missing stations, etc., will have to be corrected manually (see "How to Correct Data Errors").

Update Flow Data

Flow data must be entered manually. New flow data can be entered through a menu system. Only stations and dates with no existing flow data are retrieved. Corrections to existing flow data must be made in dBase® (see "How to Correct Data Errors").

1. Go to the Master Menu (See "Starting the System").
2. Choose "Flow Data Entry."
3. Select the appropriate "Region." These refer to the four USGS regions in Washington. (each USGS region provides flow data independently), and data collected in-house, downloaded, obtained from miscellaneous sources, or not available.
4. Enter the date range of flow data to be updated. Generally, the entire wateryear is entered at one time.
5. If your entries are correct, choose "Continue" otherwise choose "Redo" or "Exit."
6. You should now see a list of stations, dates, flows (all 0), and remarks (all blank) for stations in the selected USGS region and dates in the selected range. Enter flows and any remarks codes.
7. When finished entering flows, press "CTRL-End" to exit. (If you press "Escape" the last flow you entered may not be saved.)

Import Lab Data

Overview

Lab data import procedures involve converting data to a temporary dBase® data table with one result per record, checking for valid stations, dates, and parameters, performing various QC evaluations (see "How to Edit QC Codes"), and combining lab data with already existing field records. (Field records **must** be entered first!)

Manchester Environmental Lab (MEL) currently provides routinely collected AMS data in a specific comma-delimited ASCII format from their Laboratory Information Management System (LIMS; see "Sample Reports and Forms") which can be uploaded to the DBMS without additional editing. A .DAT extension is required for data in this format. MEL provides the data files as attachments to e-mail. Data from other sources may be uploaded by the procedures

described below after conversion to the proper format. In addition to the LIMS format, the DBMS recognizes EPA's "SC-Card" format. (An .SC extension is required; see "Sample Reports and Forms.") Finally, data may be entered or manually imported directly into the lab results data table (LRESULTS.DBF) from within dBase®.

Procedures

1. Save MEL's e-mail attachment as a file.
2. Go to the Master Menu (See "Starting the System").
3. Choose "Lab Results-Update Process."
4. Choose "Import Lab Results." The default drive (A:\), may be changed by pressing "Enter." Select the drive, directory, and file saved in Step 1 and press enter to import. Data will be copied to LRESULTS.DBF.
5. Choose "Results Edit" and then "Lab Results Edit." This procedure corrects common label errors, identifies each result as marine, freshwater, or QC, and reports invalid stations and dates, and unrecognized parameter codes.
6. If errors were reported in Step 5, choose "Correct Data Errors" and "View." Results with errors will have one of the following entries in the "RFLG" column:

    A = Invalid station (doesn't match station in DSTADESC.DBF)
    B = No matching date in primary data table.
    C = No parameter code in data table.
    D = Date outside parameter method dates (in DPDESC.DBF)

    (A fifth code, "U," is also possible for records left over from a previous update--see Step 8.) Check errors against the field and lab hardcopies and correct errors as appropriate. If errors are in the primary data table or the QC data table, see "How to Correct Data Errors." Delete the error codes in the RFLG column and repeat Step 5.
7. Freshwater only: Choose "Check Completeness" to compare the expected number of results to the actual number in LRESULTS. Results are reported on the screen and saved to A:\MISSDATA.TXT. If the number of expected and actual results do not match, check the field data sheet and the hardcopy report from MEL to determine the cause. You may have to request MEL provide the additional data.
8. Choose "Update Primary Dbs" and "Process Exceedences." The first procedure copies records from LRESULTS to the appropriate record in the primary data table. (Lab QC results are copied to LQCRESUL). A "T" is placed in the RFLG field for updated records. The second procedure evaluates the various QC checks, reports results exceeding requirements, and deletes updated records from LRESULTS except for results analyzed over holding times. If you have results analyzed over holding times or if you choose not to process exceedences, you will have to manually delete updated records (which will still be flagged with a "U").
9. Choose "Transfer Records." This procedure copies records which were not updated due to errors (usually an unrecognized parameter code) to "holding" data tables not otherwise used by the DBMS. Freshwater records are copied to "FRESULTS" and marine records to MRESULTS (including marine QC results with a station number in the form QAMF*).

Import CTD Data

CTD data are marine water column profile data logged in ASCII format. All CTD data must first be processed and quality assured before entering them into the database. The basic program, 'EXTRACT' sequentially asks for CTD files (in standard *.CNV format) for the stations listed in each of four initialization files: MF1.INI, MF2.INI, MF3.INI and MF4.INI. Each initialization file corresponds to a particular marine flight (e.g., MF1.INI for marine flight #1) which is an ASCII listing of stations visited on only that flight. These initialization files are likely to change each year, as different stations are visited. The *.INI files can most easily be updated with the DOS edit command (e.g., EDIT MF1.INI), or with any word processor.

The 'EXTRACT' program searches through the CTD data for the specific values from relevant depths which must match the depths in the database where water samples were collected (typically 0, 10, and 30 meters). The program transfers one month of data at a time, therefore it must be executed 12 times to transfer an entire wateryear for one marine flight. The program creates a STORET-type file with a *.SC extension. This file can then be uploaded like lab data in the *.SC format (see "How to Import Lab Data") to pre-existing entries of field data in the data tables.

Edit QC Codes

Overview

Each entry in the data table has a data quality code associated with it. The process of updating the primary data table performs five automatic QC checks on the data and codes results exceeding specified limits:

1.   Results analyzed after the specified holding time are coded "9."
2.   Results exceeding 2 standard deviations of previous data for the same station and three month period are coded "6." Because approximately 5% of all results will exceed this limit, this does not automatically indicate bad data.
3.   Field duplicate results from the same batch with a pooled coefficient of variation greater than 15% are coded "6." (In this case, all results from a batch are potentially suspect; however, the cause is usually one bad duplicate pair.)
4.   Field duplicate results with a coefficient of variation greater than 20% are coded "6."
5.   TP and SRP will be coded "6" if SRP is greater than TP. Also, NO_2+NO_3, NH_3, and TPN will be coded "6" if $NO_2+NO_3+NH_3$ are greater than TPN.

Hardcopy reports are printed during the update process for data failing one of these automated checks (if requested). These data should be further evaluated manually, sometimes in consultation with the laboratory, and assigned the appropriate quality code, below. (Data retrievals generally only include data with quality codes from "1" through "4.")

0 - No data. (dBase®, like most databases, interprets a blank numeric field as a zero. Therefore, the quality code field is needed to differentiate between missing data and a null result.)
1 - No QC checks were exceeded. Also, all older data is coded "1."
2 - No secondary (manual) QC evaluation was performed.
3 - One or more QC checks were exceeded but the datum is considered acceptable after manual review.
4 - One or more QC checks were exceeded and the manual review was inconclusive.
5 - One or more QC checks were exceeded and the manual review indicates the datum is questionable.
6 - One or more QC checks were exceeded.
7 - Not Used.
8 - Not Used.
9 - The datum is not useable or holding times were exceeded.

Procedures

To replace results coded "6" with a code selected after manual review,

1. Go to the Master Menu (See "Starting the System").
2. Choose "QA/QC Reports/Views."
3. Choose "1. QC Code Review/Update"
4. Choose the appropriate "QC Exceedence" type. These are the five automated QC checks (see "How to Import Lab Results") that are the potential source(s) of the code "6." In practice, these should all be edited after each month's data are uploaded.
5. Enter the date range to be reviewed (usually one month).
6. Change the computer-assigned "6" to the appropriate code.
7. When finished entering quality codes, press "CTRL-End" to exit. (If you press "Escape" the last change you made may not be saved.)

Note: There are five possible causes of a "6" being automatically assigned (or a "9" in the case of a holding time exceedence). The cause(s) is stored in DQCODE.DBF (see "Technical Details, Data Table Descriptions.") If the quality code is changed under one "QC Exceedence" type, the new code will appear under the other types as well. Changing the quality code does not change entries in DQCODE.

Correct Data Errors

Once data are entered into the primary data tables, errors can not be corrected within the DBMS, but must be corrected manually (through dBase®). Because this presents the possibility of data corruption, correcting data errors should generally be left to the system administrators. Use caution when editing key fields (see "Technical Appendix"). Key fields are usually case-sensitive and must be entered exactly.

Procedures

1. Go to the dBase® "dot-prompt." (At the J:\ drive enter "dBase.")
2. Type "Set Directory to P:\AMBIENT\DBMSDATA."
3. Enter "Use *database* Order *index* Exclusive" where *database* refers to the location of the data being corrected and *index* refers to the ordering desired to most easily access the record being corrected. "Exclusive" locks out other users from the data table and allows making changes without having to lock each record individually. "Exclusive" and "Order *index*" are optional. Usually no index (*i.e.*, natural order), "STANO," or "DATE" are best; see "Data Table Structures" in the Technical Appendix for other indexes. The most common corrections and the corresponding databases are listed below:

TO:	ENTER:
Change a result:	USE DPF_C ORDER DATE (Use M instead of F for marine data; H instead of C for data more than six years old).
Change a comment:	USE DPREM ORDER DATE.
Edit a station:	USE DSTADESC ORDER STANO (see "Adding a New Station")
Change QC data:	USE DQA_C ORDER DATE

4. If records are ordered by date, enter "SEEK CTOD("yy/mm/dd")" to go to the date desired (CTOD means "character to date"). If ordered by station enter "SEEK *stano*" where *stano* the station number.
5. Enter "Browse" to view records and move the cursor to the record to be changed.
6. Tab to the field desired or press "F2" to switch to "Edit" (full-screen) mode.
7. Make the desired changes and press "CTRL-End" to exit. (Pressing "Escape" will abort the changes made.) To mark an entire record for deletion (or to unmark it if already marked) press "CTRL-U." To actually delete the record, enter "Pack" at the dot-prompt. (To add a new record, press "CTRL-Page Down" to go to the bottom of the data table, and arrow-down once.)

Cautions and Example

Caution #1: Station numbers, dates, and depths (for marine data) are key fields. If you change them in one data table, you may have to change them in several data tables, including, for example, DPF_C, DPREM, DQA_C (if it was a QC station), DQCODE (if there was a QC exceedence).

Caution #2: If you change dissolved oxygen, temperature, conductivity/salinity, or barometric pressure you will have to calculate oxygen saturation manually or with the BASIC program DOSATA.BAS (at J:\AMBIENT\DBMSPROG enter "BASICA DOSATA;" to return to DOS® enter "SYSTEM").

Example: Suppose the "Edit" procedure during the lab data import (see "Importing Lab Data") marks as "B" (meaning there is no matching record), all QC results for stations "QA E-1" and

"QA E-2" collected on May 2 and 3, respectively. Yet field records indicate these entries are correct: At the dot-prompt and in the data directory, enter "USE DQA_C EXCLUSIVE" and "Browse" to open and view the data table. Press "CTRL-End" to move to the bottom and the most recently entered records in the QC data table. Arrow- or page-up to the entries "QA E-2, 95/5/1" and "QA E-3, 95/5/2"(for example) and change "QA E-2" to "QA E-1," and "QA E-3" to "QA E-2."

Examples of other useful dot-prompt commands are listed below:

TO:	ENTER
Replace the RFLG field with blanks	Replace All RFLG With " "
Delete records with the station number "UNKNOW"	Delete For STANO = "UNKNOW"
Display temperatures greater than 21°C	Display STANO, DATE, TEMP for TEMP>21

How to Print Reports and Retrieve Data

This section discusses the contents of several pre-programmed reports and how to retrieve them (see "Print Reports"), as well as how to retrieve data (see "Retrieve Data").

Print Reports

The "Water Quality Standards Exceedences" is the only pre-programmed report available to individuals with guest access to the system; other reports require higher access levels. To receive one of these reports, see a member of the AMS. All reports discussed below are sent directly to your computer's default printer.

QC Code Report

This report is the second choice under the main menu item "Miscellaneous Reports and QC Review" (See "Miscellaneous Reports and QC Review" under "Menus"). The report lists data exceeding the five automated QC checks in essentially the same report formats that are printed during "Process Exceedences" when importing lab data (see "How to Import Lab Data"). (The first choice under this menu is not a report, but allows on-screen editing of QC codes failing the automated evaluation.)

Field QC Samples Results

This report is the third choice under the main menu item "Miscellaneous Reports and QC Review" (See "Miscellaneous Reports and QC Review" under "Menus"). This is a large report which lists field duplicate results (sequential and split samples) and the coefficient of variation of duplicate

pairs by parameter. Field blank results are also reported. In addition to a printout, Lotus® files of QC results are also created (A:\QCDUPS.WKS and A:\QCBLANKS.WKS).

Missing Data Report

This report is the fourth choice under the main menu item "Miscellaneous Reports and QC Review" (See "Miscellaneous Reports and QC Review" under "Menus"). This option creates a text file (A:\MISSDATA.TXT) which lists missing results by station and date for the date range and parameter group (e.g., nutrients) selected. It is intended to be produced periodically to ensure all available data have been entered into the DBMS.

Station Description Report

This report is the fifth choice under the main menu item "Miscellaneous Reports and QC Review" (See "Miscellaneous Reports and QC Review" under "Menus"). This is a large report which lists all stations in the DSTADESC data table, as well as descriptive data (about four stations per page). It does not offer the option to produce a report for an individual station; however, station descriptions for individual stations can be produced under any data retrieval option which creates files (see "How to Retrieve Data").

Data Dictionary Report

This report is the sixth choice under the main menu item "Miscellaneous Reports and QC Review" (See "Miscellaneous Reports and QC Review" under "Menus"). This report lists all parameters, as well as descriptive information such as method dates, units, long and short names, etc. (one parameter per page). A more compact, though slightly less complete version of this report is produced under any data retrieval option which creates files (see "How to Retrieve Data").

Water Quality Standards Exceedences

This report is available under the main menu item "Monthly Water Quality Standards Reports." The report actually consists of three, separate one-page (usually) reports for each of Ecology's four regions for a selected year and month.

1. The "Historical Data Exceedence Report" lists all data exceeding approximately the 95th percentile of previous data for a given station and three-month period. In other words, this report lists unexpectedly high or low data

2. The "Fecal Coliform Bacteria Violations Report" lists geometric mean results exceeding fecal coliform geometric mean criteria (based on the last 12 months of results) and individual results exceeding the "10 percent not to exceed" criteria.

3. The "Water Quality Standards Violations Report" lists results exceeding criteria for temperature, oxygen, or pH. Results are compared to criteria for the water class and do not include stream-specific exceptions

Reports are sent to both the default printer and to text files on the A:\ drive (HIST_EXC.TXT, BACT_EXC.TXT, and STDS_EXC.TXT) for distribution via email.

Retrieve Data

Overview

This procedure will retrieve data in any of the formats listed below. Formats creating a file will also create a station description text file with a .HDR extension and the same name as the data file and a parameter description text file (PARAM.DOC). Stations are numbered by Water Resource Inventory Area (WRIA). If the station number of the station being investigated is not known, knowing the WRIA will limit your search.

REPORT	FORMAT
On-screen	(Editing is not allowed)
Hardcopy	Columnar printout (see sample under "Sample Reports and forms")
ASCII	Text file output in the same columnar format as the hardcopy retrieval, including headings
Lotus®	Lotus 1-2-3 Version 1A (WKS)®
dBase®	dBase III® or IV® database file
WQHYDRO©	ASCII columnar file specifically for import into WQHYDRO; often the best choice for import to other software

The following series of actions are performed on requested data regardless of the output option selected.

1. The requested stations and dates are copied to a temporary data table.
2. Fields without data are deleted. (Note: As a consequence, if only one result is present for a particular parameter, that parameter will be included, though marked as missing, for the entire range of data requested.)
3. Parameters that were not requested are deleted.
4. Missing data are coded "-99" (so as not to be confused with a null result). Missing data are not printed in the "hardcopy" and "ASCII" options and are converted to "999999" in the WQHYDRO option.
5. The data are displayed, the report printed or the file created, depending on the output option selected. A parameter description file ("PARAM.DOC") and a station description file (with the same name as the data file but a .HDR extension) are also created for output options other than "On-screen" and "Hardcopy."

Procedures

1. Go to the Master Menu (See "Starting the System").
2. Choose "Special Retrieval."
3. Choose "Freshwater," "Marine," or "flux."

4.   Select the parameter group desired. ("Conventional" excludes metals; hardness and flow are included in a "Metals" retrieval.)
5.   Select the station or range of stations desired. For rivers and streams, the first two digits of the station number refer to the Water Resource Inventory Area. For marine stations, the first three letters of the station number refer to the embayment. For a comprehensive list of monitored stations, see the most recent annual report.
6.   Select the range of quality codes desired. The default is 1 through 4. (See "How to Edit QC Codes" for a definition of the codes.)
7.   Choose "Process/Continue," "Redo Date Selection," or "Exit."
8.   Select the desired output option. Only one option may be selected; if more than one format is desired the retrieval process must be repeated.

Flux

In addition to the above formats, a flux option (mass per unit time) is provided which will calculate flux in kg/day and flux per square mile of watershed for a selected period, range of stations, and range of months. Flux based on ambient monitoring data, particularly when short time periods are selected, should not be considered "loads." A higher level password is required to access this option.

Precipitation

The "PRECIP" option under the Data Retrieval menu combines daily precipitation records from the ClimateData CD-ROM with results for a specified water quality constituent and produces a WQHYDRO-format text file as output. This option is useful for evaluating the correlation between precipitation and water quality and for accounting for variability in a time series prior to conducting trend analyses. The program will calculate the total precipitation for a specified number of days prior to the collection of each water sample, as well as the "Antecedent Precipitation Index." Prior to running "PRECIP," precipitation data should be extracted from the precipitation database in the provided dBase export format and the retrieval should include at least one month of data prior to the period of interest. The precipitation file should be copied to a hard drive in order to speed processing.

Annual Maintenance - Preparing for the Future

Three database management tasks are required prior to beginning a new WY's sampling: new stations need to be entered into the database, the sampling order established and entered, and QC stations selected.

Adding a New Station

New stations must be added to DSTADESC.DBF and EVAL_STA.DBF outside the DBMS, *i.e.*, from dBase®. To add a station,

1. Go to the dBase® "dot-prompt." (At the J:\ drive enter "dBase.")
2. Enter "Set Directory to P:\AMBIENT\DBMSDATA."
3. Enter "Use DSTADESC Order STANO Exclusive," "Append Blank," and "Edit."
4. Enter the station data. (See the "Technical Appendix" for a description of fields.)
5. Enter "CTRL-End" to save the entry and return to the dot-prompt.
6. Because some station data are maintained in the EVAL_STA data table, this data table must also be updated. Enter "Use EVAL_STA Exclusive" (which will close DSTADESC) and "Append from DSTADESC for STANO = *stano*" where *stano* is the station number to copy the station record from DSTADESC. "Browse" and "CTRL-Page Down" to go the record just appended and add any additional data. You can print out a worksheet for EVAL_STA stations missing lat/longs with the command "Report form EVALSTA2 for lat=" " to print. Mail updated EVAL_STA to the ISS GIS unit annually.

Identifying Current Stations for Data Entry

The flight number (marine stations) or the run and day (rivers and streams stations) and the sampling order of current stations must be identified for stations to appear in the proper order during field data entry. This information is stored in DSTADESC which must be edited after the last data are entered from a preceding wateryear and before data entry for the current wateryear.

1. Go to the dBase® "dot-prompt." (At the J:\ drive enter "dBase.")
2. Enter "Set Directory to P:\AMBIENT\DBMSDATA."
3. Enter "Use DSTADESC order STANO Exclusive.
4. Enter "SEEK stano" where stano is the number of the first station to be edited.
5. Enter "Browse Fields STANO, STANAME, RUN, DAY, ORDER
6. Replace RUN, DAY, and ORDER with the correct data.

The " YEARS" field in EVAL_STA should also be updated by inserting an 'X' in the proper column (the current wateryear minus 58) for current stations. For example, stations monitored in 1996 should have an 'X' in column 38 of the 'YEARS' field (96-58).

Selecting QC Stations

At the beginning of each WY, freshwater QC stations are selected randomly for the entire WY. A list of QC stations (A:\QC_STA.TXT) is produced by selecting "H" (ASS_RAND) from the Database Administration Menu. (Note: Current stations must first be identified. See "Identifying Current Stations for Data Entry.") The procedure will randomly select two QC stations for each run and each month. Both QC stations are not allowed to fall on the same day. Four QC stations

annually will be selected from each run to be submitted to the lab as field blanks, and two stations to be sampled sequentially. (Remaining QC stations will be sampled as field splits.) These criteria can be changed by editing the program ASSRAND2.PRG.

Annual Maintenance - Wrapping Up the Past

Data management at the end of a WY involves three groups of tasks. The first group are those tasks required to ensure the DBMS is complete and accurate; these are discussed in the first four sub-headings, below. The second group consists of updating other databases (PCSTORET and STORET). The third group includes database tasks related to annual reporting.

Checking for Missing Data

Missing data should be reported and evaluated during each monthly update (see "How to Update Field Data"), however, it is a good idea to check the database annually for blocks of missing data. This is particularly important for parameters that are not collected routinely at all stations, for example metals. A report of missing data is provided by the DBMS under the menu selections "Miscellaneous Reports and QC Review" and "Missing Data Report." (See "Missing Data Report" in this documentation.) This report only evaluates data missing from the primary data table. Extraneous parameters stored in FRESULTS or MRESULTS are not evaluated (See "How to Import Lab Data"). One method of identifying all missing data is to complete the PCSTORET update and print out data reports for all stations for manual review.

Batch Editing of Quality Codes

As discussed under "How to Edit QC Codes," data exceeding one or more of the automated QC evaluations are assigned a temporary quality code of "6." The quality of these data should be evaluated monthly and the data assigned a final quality code. However, in case some data coded "6" were overlooked, the program PQ6REPL.PRG should be run annually (menu selections "Data Administration" and "B"). This program replaces quality codes of "6" in the time period selected with a "3" (datum acceptable) if only the standard deviation QC check was exceeded, otherwise with a "2" (no manual quality review). The program reports replacements made in A:\PQ6LIST.TXT

Maintaining the Current and Historical Data Tables

In order to keep the database from becoming large and slow, current data (defined as the last six complete years plus the current year) are kept in DPF_C and DPM_C and historical data in DPF_H and DPM_H. Once the data from the previous WY are complete, data for the oldest WY in the current data table should be moved to the historical data table. This can be done by

selecting "F" (ROLLOVER.PRG) under "Database Administration." As a safety precaution, the current datatable must be "packed" manually to actually remove the records marked for deletion.

Calculating Summary Statistics

The data table DQDEF DBF contains maximum and minimum values and quarterly means and standard deviations for each station based on data in the current data table (DPF_C and DPM_C, see "Maintaining the Current and Historical Data Tables"). These statistics are used in the automated QC checks (see "How to Edit QC Codes"), the monthly water quality exceedence reports (see "Water Quality Standards Exceedences" under "How to Create Reports") and elsewhere. After the current data tables are updated each year, these statistics need to be recalculated by selecting "Summary Statistics Calculations" from the main menu. This procedure takes a long time, I recommend it be run overnight.

Updating Web Pages

AMS's River and Stream web pages consist of a main page (WQMSRIV.htm) which is linked to additional pages:

1) A statewide map of Washington's Water Quality Management Areas (WQMA; WQMS_ALL.htm). This map is linked to a page for each WQMA (e.g., WQMS_PEO.htm) which includes a map (e.g. WQMS_PEO.gif) and a list of monitored rivers and streams as well as lakes. Recently monitored river and stream stations are linked to the most recent complete wateryear's data.

2) A list of stations and years sampled (WQMSR_L2.HTM). This list is also linked to data files for stations monitored the previous year (WQMSR_##.HTM).

These pages must be updated at the end of each wateryear. The map (gif) files must be updated manually in ArcView or Freelance. The WQMA pages with lists of stations and lakes can be updated with the Access program "J:\AMBIENT\DMBSPROG\RIV_LAKE.MDB." This program uses EVAL_STA.DBF and LAKEDESC.DBF directly; conversion to Access datatables is not necessary but these files must be up to date. To update the station list and the actual data pages, under "DATABASE ADMINISTRATOR," select item "C - Reporting" and then "Station History - HTML (FW)" (or Marine). The program will automatically create a new station list and one data file for each station for the wateryear selected. These files will be sent to the A> drive, so have a diskette ready. (Note: The "YEARS" field in EVAL_STA.DBF must be up to date. See "Identifying Current Stations for Data Entry.")

This disk can then be delivered to Ecology's Web Page manager (Bob Monn) or the files can be zipped and sent as an email attachment.

Updating PCSTORET

PCSTORET is a FORTRAN-based PC version of EPA's STORET database. The program was written by Ray Peterson at EPA Region X, but is unsupported. PCSTORET contains river and stream, marine, and groundwater data. At present, this database is used primarily for hardcopy reports and by Ecology's Water Quality Program for 305(b) reporting.

Adding a Station to PCSTORET

The first step to adding a station to PCSTORET is to create the station header file. A template for this file can be created by entering the station in EVAL_STA.DBF and DSTADESC.DBF (see "Adding a New Station" under "Annual Maintenance"). Additional data required by STORET can be entered in the template produced by EVAL_STA.PRG. A STORET-format text file can then be created by selecting "I" ("PCSTORET Station") under "Data Administration." The more fields that are completed in the station data tables, the more complete this template will be. Numbers and characters that need to be edited in the template are marked by "#" and "!," respectively. An example template and explanation of fields is shown below:
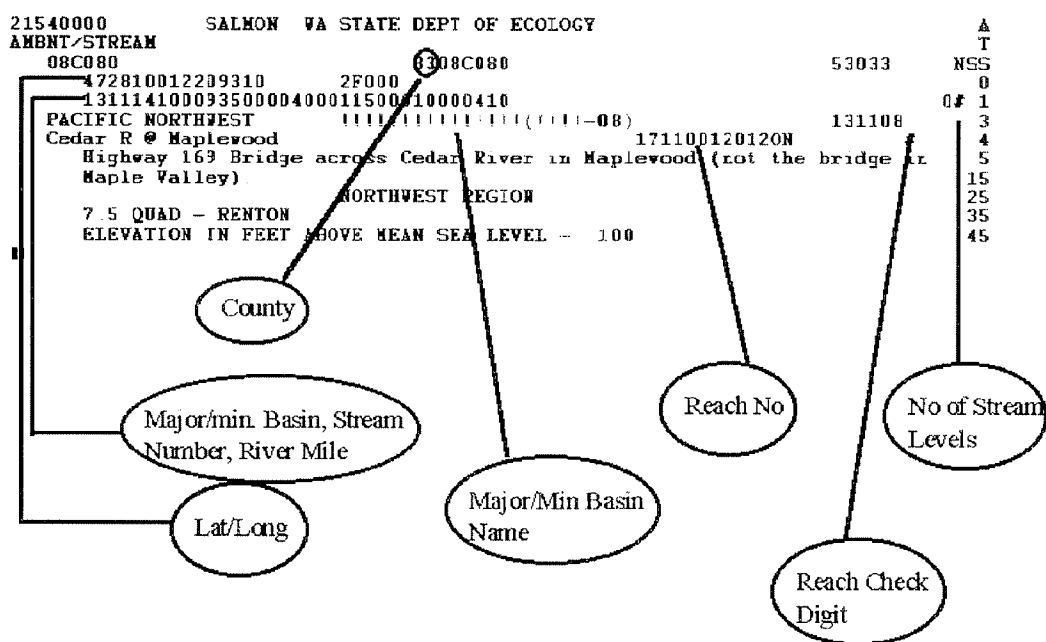
Note: **For PCSTORET, row "5" should be "05;" for STORET, rows should be numbered as shown.**

Each entry must begin in exactly the right column and row. For example, the reach check digit must be in the 74th column of the seventh row. STORET provides a form to ensure the data are properly coded (see "Sample Reports and Forms"), however, if the station file is computer-generated and carefully edited, the columns should align properly. Because PCSTORET stores marine, eastern, and western Washington data in different data tables, separate files must be created for stations in WRIAs < 30 and WRIAs ≥ 30.

Most of the station data needed are straightforward, however, some are difficult to determine. Major and minor basins are most readily determined from other nearby stations. If this is not possible, they may be found on microfiche kept with AMS's active files. The river reach and check digit for most stream segments can be found in the WordPerfect® file "M:\REACH.WP5." The reach for stations just outside a listed segment can be reported as "OFF" rather than "ON," meaning "off the reach." As a last resort, in STORET, entering the command "%PRNTRCH" will prompt for a reach number and then display name, maximum and minimum lat/long, check digit, etc. A reach may be identified this way through trial and error. (Note: STORET requires the station's lat/long be between the maximum and minimum lat/long of the reach.)

Once the station file is created, I recommend updating stations to STORET before PCSTORET (See "Adding Stations to STORET") because STORET has more complete error checking. To add a station to the PCSTORET database, enter the PCSTORET system (for example, from the network menu) and select option "1" ("STWQJ") from the PCSTORET menu. Then enter the following in response to a series of questions (Note: You must use capitol letters): "K" for keyboard, "F" for file, "C:\MSG.TXT" (or some other name for the message file), "A:\STATION.TXT" (or whatever name was given the station file discussed above), "P:\STORET\DATA\WESTERN" (or "Eastern" or "Marine"), "Y" to run in accelerated mode, your initials, the PCSTORET password, "0" to report errors only, and "Y" to "perform extract file processing." After the update is complete, review the message file for errors. Some stations or parameters may need to be re-run.

Adding Data to PCSTORET

Adding data records to stations that have already been entered into the PCSTORET database is relatively straightforward. There are four steps:

1. Retrieve the data from the DBMS to an ASCII file in SC-Card format.
2. Check the ASCII file for common errors.
3. Upload the ASCII file to PCSTORET.
4. Associate PCSTORET parameters with stations.

Retrieve the Data

1. Go to the Master Menu (see "Starting the System").
2. Choose "PC STORET"
3. Choose "Freshwater" or "Marine" and select the desired parameter type. Usually "Conventional" and "Metals" should be retrieved separately. Miscellaneous parameters, including non-metals parameters in FRESULTS.DBF are also retrieved under the "Metals" parameter type (see "Import Lab Data").
4. Choose the appropriate geographic area. Freshwater data must be retrieved separately for eastern and western Washington because PCSTORET stores these results in separate data tables.

5. Enter the desired dates (usually a full wateryear) and parameter codes (usually 1 to 4; see "How to Edit QC Codes" for definitions). A full wateryear of data may take up to a half hour to download. The data file will be created on your local H:\ drive and named according to the retrieval requested. For example, "EAST_ALL.SC" will contain data for all parameters from eastern Washington stations. The first line in the ASCII file contains agency information. All other lines are data lines.

Check the ASCII File

The file created by the DBMS's PC STORET retrieval should be checked in a text editor for errors (if Word® or WordPerfect® are used, be sure to save the file as a text file). There are two common errors. The first occurs when no lab number is stored in the DBMS and results in a line ending in "P8,,". A global search in the text editor for two commas will find these. Delete "P8,," but be sure the line still ends in a comma (another comma should precede the "P8").

The second common error is a result being assigned two remarks codes. PCSTORET can only store one remark code for each result and will return an error if two exist. (Note: The retrieval program was recently modified to only return the first remark code for fecal coliform bacteria, but this error may still occur under other parameters.) A global search for common remark pairs may prevent an error during the upload (e.g., JU, UJ, KJ, JK, XJ, JX). Delete the less important of the two codes.

Upload the ASCII File

The next step is to actually upload the ASCII file(s). (Note: All responses to PCSTORET must be in capitol letters.)

1. At P:\STORET, enter STARTBT to load the FORTRAN module (BTRIEVE) and bring up the PCSTORET menu (or choose PCSTORET from the network menu).
2. Enter "2" to store data, "K" for Keyboard, and "F" for message file.
3. Enter a file name for the message file, e.g., C:\MSG1.TXT. Note: You will receive an obtuse error message if you do not have enough disk space for the file, which can get quite large.
4. Enter the name of the data file (e.g., H:\EAST_ALL.SC) and "1" for "SC Card" format.
5. Enter the path and name of the PCSTORET data table to be updated (either P:\STORET\DATA\MARINE, ...\EASTERN, or ... \WESTERN).
6. Enter "Y" (accelerated mode), your initials, the password, "0" (error messages only), and "Y" (to ignore calculated parameter flag).
7. Data processing should now begin. Watch for errors and review the message file identified in Step 3. If there is an error for a few stations, you should correct the error and upload those stations separately rather than uploading the entire file again. Uploading the entire file will result in an error message for every parameter that already exists in the PCSTORET database. (To change an existing PCSTORET result, see "Other PCSTORET Hints.")
8. Enter "15" to remove the FORTRAN module from memory and quit PCSTORET.

Associate Parameters with Stations

The last step is to instruct PCSTORET to determine which parameters are associated with which stations ("Parameter Mask"). If this is not done, new stations and new parameters at previously existing stations can not be retrieved. Select "4" (PCMASK) and answer questions as under "Upload the ASCII File."

Other PCSTORET Hints

1. If data are not being retrieved: Run the parameter masking module (see "Associate Parameters with Stations").

2. To delete or change a station entry: Create a station file (see "Adding a Station to PCSTORET") and change "NSS" at the end of the third line to "CXS" if the data in the file represent a change or "DSS" to delete the station entirely.

3. To delete a data record: Upload to PCSTORET (see "Adding Data to PCSTORET") a line describing the agency, following by the station, date/time, and, for marine stations, DMdepth, followed by DEL. For example:

    AC,A=21540000,UK=SALMON,USER=WASH DEPT ECOLOGY 360 407-6681
    SC,BUD006,9210261030,DM04,DEL,

4. To change a data record: Upload the data as described under "Adding Data to PCSTORET" except insert a "C" between the "P" and the parameter number:
    AC,A=21540000,UK=SALMON,USER=WASH DEPT ECOLOGY 360 407 6681
    SC,23B070,9210261030,PC671,0.008J,

5. If a PCSTORET data table can't be used: After a system crash, and at other mysterious times, a PCSTORET data table may get left (and locked) open. To close it, leave PCSTORET (menu item "15"), re-enter PCSTORET, and enter DBRESET at the DOS-prompt.

6. To retrieve data from PCSTORET: Select "EZRET" (menu item "6") and respond to the questions as appropriate. This procedure will create an ASCII file on the A:\ drive. To print the file, enter "PRINT A:*filename*" (whatever filename you gave it) at the DOS-prompt.

Updating STORET

STORET uses essentially the same file formats and procedures as PCSTORET to upload station and data files and to correct station and data errors.

Adding a Station to STORET

1. Create a station file, as described under "Adding a Station to PCSTORET" except that eastern, western, and marine stations do not need to be entered into separate files. (If you combine PCSTORET station files, be sure to delete the extra agency line at the top of the second file). Add the following two lines to the top of the file:

    ?START
    ?01

2. Log onto STORET: The number is 1-800 445-2795 and the configuration is E,7,1,H,D. Enter or select IBMPSI, TSO - NCC, RKJ (our user id), the password, and "*" in response to the next four questions (to accept the defaults).

3. Upload the station file: Enter "TERM LINESIZE(132)," then "E *filename* NEW NONUM" where *filename* is something like "STATIONS.TXT." Upload the stations file created above (it need not have the same name as *filename*) using the ASCII protocol of your modem software. This takes five or ten minutes if there are a number of stations. After uploading, press "Enter," then enter "Save" and "End."

4. Test-run the file: Enter "%STORE *filename* PRTY(4)" to submit the file. Enter "SDSF" to go to the jobs status area. Once in SDSF, entering "I" will display the jobs status. Record the *job number* (e.g., "RKJ34") and note the number under "POS." The higher this number, the longer the wait until the job is run. If you forget the *job number*, enter "O" to list outstanding jobs.

5   Check for errors: After the job has run (usually a matter of minutes but you may need to log off and come back later), in the job status area (SDSF) enter "S *job number*" to list messages. Mostly, this is a large file of gibberish, errors are listed at the bottom. To get there, enter "Bottom," then "Up" as necessary to reach the error listing. STORET checks for valid reach numbers, compares lat./long. to reach boundaries, etc. There are likely to be errors at first, particularly if you are not certain you have the correct reach number or check digit. If there are errors, leave STORET (enter "End" to leave SDSF, and "Logoff" to leave STORET), correct the station file and repeat Steps 1 through 5.

6. Submit the file for uploading: Once there are no errors in the test run, enter "%STORE *filename* FINAL." Record the *job number* (as in Step 4) and logoff. Final jobs are run every Friday night.

7. Check the upload: The following Monday, log on to STORET and check for errors, as in Step 5. Enter "End" to leave SDSF and "Browse" to review the data for selected stations and parameters (see "Other STORET Hints").

Adding Data to STORET

Data are updated exactly the same as station information except the second line in the data file should be "?04" rather than "?01" (See "Adding a Station to STORET," Step 1). It may take an hour or more to upload an entire WY of data over the modem.

Other STORET Hints

1. For help: The general number is (800) 424-9067 (STORET@epamail.epa.gov) and Joyce Boyd, our account contact, is at (202) 260-2489 (JLB@epaibm.rtpnc.epa.gov).

2. To view data: Enter "Browse" at the ready-prompt. The process is relatively straightforward. Our agency number is 21540000. One quirk: If STORET can't find the station you are asking for, try going to "First Station" first, then choose "Next Station" and enter the station number again.). Your modem software can probably print or capture displayed data to a file, if desired.

3. "Password Expired:" If the STORET account is not used for a month, the next time you log on and enter the correct password, you will be required to enter a new password to replace the old one. If you have not logged on in several months, the account will be frozen and you will have to call EPA (Joyce Boyd) to reset it. I recommend you log on monthly to avoid this hassle.

4. When you first long on, "IBMPSI" will echo twice (*i.e.*, "IIBBMMPPSSII") if your modem's "local echo" is set to "on." Ignore this; all other entries behave normally.

River and Stream Annual Report

Annual reporting of river and stream data consists primarily of a description of the ambient monitoring program, a small amount of basic summary-type analyses, and a compilation of data collected over the previous wateryear. Analysis and reporting tasks have been automated to a certain extent, as discussed below.

Maps

A map of Washington's rivers and streams with current stations numbered and marked by symbols can be produced using dBase®, Lotus®, and Freelance®. The procedure is somewhat complicated to explain because it involves three different software packages, however, most steps are menu-driven. Although GIS-produced maps are superior in quality, the following procedure can be used by anyone to produce an adequate map in about an hour. In addition, the final product can be customized in readily-available presentation software packages such as Freelance® or PowerPoint®. There are three basic steps:

1. Retrieve a station list from dBase®. Database Administration Menu item "D" (MAP) creates a Lotus® file of stations sampled during the selected WY, along with latitudes and longitudes (A:\MAP.WKS). This list of stations can also be printed and saved as an ASCII file (A:\MAP.TXT). This is handy as a key to the map.

2. In Lotus®, import A:\MAP.WKS into P:\AMBIENT\DBMSDATA\MAPMASTE.WK1, edit the data and save the plot using the macros provided in the spreadsheet.

3. In Freelance®, combine the plot produced in Step 2, above, with P:\AMBIENT\DBMSDATA\MAPMASTE.DRW (a digitized map of streams in Washington) according to the directions shown on the screen with the DRW file.

For more detail on this, see Dave Hallock.

Station List

A list of stations and years sampled can be produced for either freshwater or marine stations by selecting item "C" (Reporting) under "Database Administration." Currently, this option prints landscape in 16.67cpi line-printer mode. The program, ANN002.PRG, can be modified to print to a file by changing the words "To Print" in lines 186 (freshwater) and 199 (marine) to "To File *filename*."

Data Printout

Data may be printed out for all stations for the selected WY either from PCSTORET (see "Other PCSTORET Hints," Number 6, or the DBMS (see "How to Retrieve Data"). The PCSTORET retrieval typically takes several pages for each station, because it includes all parameters ever measured at that station, even though many of the parameters may have no data for the selected WY. The DBMS retrieval also has its disadvantages. It is not currently programmed to report data for parameters that are not in the main data table (primarily dissolved metals - see "How to Import Lab Data" for further explanations). Also, if all stations are retrieved as a group, the DBMS printout will also include parameters without data. (This problem does not occur in the DBMS when stations are reported individually.)

Summary Statistics

A report of six-year summary statistics by quarter for each station and each parameter can be produced by selecting item "C" (Reporting) under "Database Administration" (see "Calculating Summary Statistics"). Currently, this option prints landscape in 16.67cpi line-printer mode. The program ANN002.PRG can be modified to create an ASCII file, if desired.

Data Analysis Programs

There are several programs designed to assist with the data analysis portion of the annual report. Specifically, these programs perform the tedious task of counting and reporting results greater

than criteria at specific stations. (Note: Counts are based on a comparison to the criteria for a station's stream class and do not include exemptions for specific stations. Exemptions for temperatures in eastern Washington streams are common.)

The programs discussed below are not part of the menu-driven DBMS and must be run from dBase's® dot-prompt. They will be found in the J:\AMBIENT\DBMSPROG directory. All programs require that data for the WY being evaluated be copied (from DBF_C.DBF) to a separate file (e.g., WY94.DBF) in order to speed processing. Some minor editing of the programs (in any text editor) may be desirable. For example, the names of data files and output files are hard-coded with the number of the current WY ("94" in the examples below) and could be updated in subsequent wateryears.

ANNRPTEX.PRG uses WY94.DBF to fill in EXCEED94.DBF with the total number of samples, the number exceeding the water quality criteria, and the percent of exceedences for temperature, oxygen, pH, and fecal coliform bacteria at each station. Individual bacteria results are compared to both the "10% not to exceed" criteria and to the geometric mean criteria. (GEOMN30.PRG will calculate the geometric mean of every two consecutive samples. See WAC 173-201A-060, item (3).) Current stations must first be copied to EXCEED94.DBF. (Delete existing records with "Zap," then "Append From WY94.")

EXC_RPT.PRG reports the data in EXCEED94.DBF to the file EXCEED.TXT. With minor changes, ANNRPTEX.PRG and EXC_RPT.PRG can be modified to count criteria exceedence over the last six years so that current results can be compared to historical averages.

TPTSS.PRG lists the total number of samples and the number exceeding a specified level of total phosphorus and total suspended solids for each station. The specified levels are hard-coded into the program but can be easily changed. Results are reported in TPTSS.TXT. TURBMAX.PRG finds the maximum turbidity and total suspended solids for each station and reports results to TURBMAX.TXT.

Errors, Error Messages, and Future Upgrades

What to Do When You Find an Error

If you experience an error, please print the screen ("Shift-Print Scrn") and make a note of what you were doing when the error occurred. Give this information to the DBMS administrator. Most error messages consist of an error statement, the offending line of code, and three courses of action: "Cancel", "Ignore," and "Suspend." If you aren't sure which choice is best, choose "Cancel." This will end the program and return you to DOS® (or Windows®, or even the dBase® dot-prompt, depending on how you started the program).

Insufficient Memory (in Windows®)

You may encounter this Windows® message if you are trying to run dBase® or a runtime version (see "Starting the System") from within Windows®. You (or your CIC) can try reconfiguring Windows® and your computer's memory allocation. If that is unsuccessful, try putting the command "SET DOS16M=:4M" in your AUTOEXEC.BAT file. If you prefer, you can exit Windows® and run the programs directly from DOS®.

"Can't open *.win file"

For some reason, temporary dBase® windows files saved to network drives appear corrupted to dBase® when it later tries to read them. Most, if not all, code was changed to save these files to a local directory (C:\WINDOWS\TEMP) and this error message should be rare. This is one time where it is safe to choose to "Ignore" the error. However, please inform the DBMS administrator if you see this message.

"Access Denied" or "File in Use by Another"

Either of these messages could mean that you do not have the necessary rights to the network directory being accessed. The network or DBMS administrator can set you up with the necessary rights. The second message could also mean just what it says: someone else is using the file (some operations lock the data file to everyone else). If you have previously successfully performed the procedure you were attempting when the error occurred, cancel and try again later.

Fewer Data Records Than Expected

Rarely, data table indexes can get corrupted (see "Leaving the System"). When this happens, the first sign may be an apparent lack of data in the data table. The DBMS administrator can re-index all data tables by choosing option "E," "Reindex" in the Database Administration menu.

Lab and Marine Field QC Data

The DBMS was not originally programmed to manage or evaluate laboratory QC data (which were not available until recently) or marine field QC samples. Lab QC data are stored in LQCRESUL.DBF and marine field QC data in MRESULTS.DBF. However, neither data table is evaluated or incorporated into reports by the DBMS. This is a potential area for a future upgrade.

Multiple Users

A few operations require that files be opened "exclusively," locking out other network users. Although originally designed for network operation, subsequent modifications have not always

been careful to allow multiple users of a data table whenever possible (see "Access Denied or File In Use By Another"). A high-priority future upgrade will review program code to allow multiple users as often as possible. If possible, the upgrade will provide a more graceful warning and exit Procedure than the error: "File in Use By Another."

The Year 2000

When the year changes from 1999 to 2000, the database management system will no longer function properly. Data storage and retrieval procedures currently assume the two digit prefix of the year is "19." The "19" is stored internally but is not automatically displayed or printed in programmed forms and reports. Prior to December 31, 1999, the code must be overhauled to specifically require entry of the century when entering and retrieving data, or else the system should be migrated to a different platform (such as Access) and this correction made as part of the migration. The former will require several weeks work, the latter probably months. However, the latter option will provide additional benefits, such as a common and supported platform.

Sample Reports and Forms

Sample Manchester Environmental Laboratory LIMS Format Data File (*.DAT)

(Fields are lab number, QC type, station number, depth sampled, STORET parameter code, remark code, date sampled, time sampled, date analyzed, and result.)

```
096100,,13A060,,P31616,S,19950226,0825,19950227,27
096100,,13A060,,P610,U,19950226,0825,19950306,.01
096100,REP1,13A060,,P610,U,19950226,0825,19950306,.01
096100,,13A060,,P630,,19950226,0825,19950306,.709
096100,REP1,13A060,,P630,,19950226,0825,19950306,.73
096100,,13A060,,P671,,19950226,0825,19950227,.011
096100,,13A060,,P665,,19950226,0825,19950307,.032
096100,REP1,13A060,,P665,,19950226,0825,19950307,.052
096100,,13A060,,P100021,,19950226,0825,19950307,.818
096100,REP1,13A060,,P100021,,19950226,0825,19950307,.817
096100,,13A060,,P530,,19950226,0825,19950301,10
096100,,13A060,,P82079,,19950226,0825,19950227,6.1
096101,,23A070,,P31616,,19950226,0940,19950227,30
096101,,23A070,,P610,,19950226,0940,19950306,.025
096101,,23A070,,P630,,19950226,0940,19950306,.852
096101,,23A070,,P671,,19950226,0940,19950227,.012
096101,,23A070,,P665,,19950226,0940,19950307,.047
096101,,23A070,,P100021,,19950226,0940,19950307,.994
096101,,23A070,,P530,,19950226,0940,19950301,18
096101,,23A070,,P82079,,19950226,0940,19950227,11
096102,,22A070,,COND,,19950226,1110,19950306,49.7
096102,,22A070,,P31616,,19950226,1110,19950227,1
096102,,22A070,,P610,U,19950226,1110,19950306,.01
096102,,22A070,,P630,,19950226,1110,19950306,.146
096102,,22A070,,P671,U,19950226,1110,19950227,.005
096102,,22A070,,P665,,19950226,1110,19950307,.013
096102,,22A070,,P100021,,19950226,1110,19950307,.175
096102,,22A070,,P530,,19950226,1110,19950301,6
096102,,22A070,,P82079,,19950226,1110,19950227,6.2
096103,,20B070,,P31616,,19950226,1335,19950227,1
096103,,20B070,,P610,U,19950226,1335,19950306,.01
096103,LMX1,20B070,,P610,,19950226,1335,19950306,70.6
096103,,20B070,,P630,,19950226,1335,19950306,.079
096103,,20B070,,P671,U,19950226,1335,19950227,.005
096103,LMX1,20B070,,P671,,19950226,1335,19950227,102.2
096103,,20B070,,P665,,19950226,1335,19950307,.014
096103,,20B070,,P100021,,19950226,1335,19950307,.108
096103,,20B070,,P530,,19950226,1335,19950301,11
096103,,20B070,,P82079,,19950226,1335,19950227,8.5
```

Sample PCSTORET/STORET Data File (*.SC)

AC,A=21540000,UK=SALMON,USER=WASH DEPT ECOLOGY (206) 586-6104,
SC,57A150,9405030950,P1118,5U,P1065,1U,P1040,1.42,P1090,96.9,P1025,0.298P,
SC,$,P1049,0.209,P978,30U,P8,186155,P71900,0.001K,
SC,61A070,9405040725,P1094,4.3P,P1113,3U,P1114,20U,P1119,6.7P,P71900,0.001K,
SC,$,P1074,10U,P1065,1U,P1040,1.7,P1090,3.55,P1025,0.047P,P1049,0.097P,
SC,$,P978,30U,P8,186165,P1118,5U,
SC,31A070,9405091315,P1118,5U,P1065,1U,P1040,1,P1090,1.21P,P1025,0.04U,
SC,$,P1049,0.046P,P978,30U,P8,196002,P71900,0.002P,
SC,61A070,9406081015,P1094,5.2,P1113,0.04P,P1114,0.6,P1118,5U,P1119,2.4,
SC,$,P71900,0.001K,P978,30U,P1074,1U,P8,236165,
SC,57A150,9407060955,P71900,0.001P,P1065,1U,P1040,0.496P,P1090,58,
SC,$,P1025,0.15P,P1049,0.18P,P978,30U,P8,276155,P1118,5U,
SC,61A070,9407070730,P71900,0.002P,P1065,1U,P1040,1.46,P1090,2.2P,
SC,$,P1025,0.04U,P1049,0.046P,P978,30U,P8,276165,P1118,5U,
SC,31A070,9407111300,P71900,0.001U,P1065,1U,P1040,1.14,P1090,1.6P,
SC,$,P1025,0.042P,P1049,0.16P,P978,30U,P8,286002,P1118,5U,
SC,61A070,9408030710,P1094,7.1U,P1113,3U,P1114,20U,P1119,3.5U,P71900,0.001U,
SC,$,P8,316165,
SC,57A150,9409061000,P71900,0.001U,P1065,1U,P1040,0.4P,P1090,22.3,
SC,$,P1025,0.04U,P1049,0.12P,P978,30U,P8,366155,P1118,5U,
SC,61A070,9409070740,P1094,4.2P,P1113,15U,P1114,20U,P1119,3.8P,P71900,0.002P,
SC,$,P1065,1U,P1040,1.71,P1090,2.5P,P1025,0.065P,P1049,0.11P,P978,30U,
SC,$,P8,366165,P1118,5U,
SC,31A070,9409121220,P71900,0.002P,P1065,1U,P1040,0.951,P1090,1U,P1025,0.04,
SC,$,P1049,0.02U,P978,30U,P8,376002,P1118,5U,

Sample Hardcopy Report

Station No.: 34B110
Water Body No.: WA-34-1020

SF PALOUSE R @ PULLMAN

Water Class: A
River Mile: 22.20

Latitude: 46 43 58.0
Longitude: 117 10 48.0

Date	Time	Temp (C)	Flow (CFS)	Conduc-tivity (umhos)	Oxygen (mg/L)	Oxygen Satur. (%)	pH (units)	Suspend Solids (mg/L)	TPN (mg/L)	NH3+NH4 Nitrog. (mg/L)	Total Phosph. (mg/L)	Dissol. Ortho P (mg/L)	Turbid-ity (NTU)	Fecal Colif. (#/100ml)	NO2+NO3 Nitrog. (mg/L)
94/10/10	0815	9.5	4.0	735	7.1	67.1	7.8	2.0	8.260	0.010 K	2.930	2.630	7.4	79	7.680
94/11/07	0805	5.2	22.0	437	9.0	76.1	7.6	3.0	6.750	0.270	0.904	1.070	11.0	600 J	5.650
94/12/05	0805	0.2	25.0	429	11.4	84.9	7.8	8.0	4.850	0.092	0.756	0.706	15.0	540	2.940
95/01/09	0735	2.0	68.0	324	11.5	90.8	7.6	213.0	3.660	0.318		0.508	150.0	19000 J	3.010
95/02/06	0810	5.4	80.0	243	10.7	90.7	7.6	29.0	7.670	0.181	0.369	0.258	39.0	54	6.110
95/03/06	0815	2.1	44.0	303	11.8	92.1	7.7	11.0	7.410	0.372	0.380	0.309	22.0	1000 J	6.440
95/04/03	0810	6.7	38.0	315	10.3	90.7	7.7	14.0	6.930	0.173	0.422	0.273	16.0	32	6.400
95/05/02	0820	10.8	26.0	391	9.2	90.3	7.4	7.0				0.622	6.8	240	
95/06/05	0620	16.4	8.0	412	6.6	72.5	7.8	19.0	4.060	0.086	1.430	0.906	9.1	2100 J	3.430
95/07/10	0530	19.0	18.0	632	6.2	70.8	7.4	71.0	6.520	0.054	1.470	1.500	35.0	5600 J	4.870
95/08/07	0745	16.1	59.0	194	5.3	58.4	7.5	175.0	1.380	0.138	0.522 J	0.482	85.0	14000	0.612
95/09/05	0500	15.8		658	5.3	56.7	7.9								

Remarks codes: U,K - Below reporting limits; B - analyte found in blank; X - many background organisms; J - Estimate; S - Spreader colony.

Sample PCSTORET/STORET Station Form

STORET WATER QUALITY FILE—STATION LOCATION STORAGE

AGENCY CARD (A CARD)

AGENCY CODE (Left Justify)

(Blank)

UNLOCK AFTER (days)

UNLOCKING KEY (Left Justify)

INDIVIDUAL STORING DATA, NAME, LOCATION, AGENCY, TELEPHONE (Optional Comments — will not be stored)

(Blank)

CON-TROL CODE

LOCK AFTER — YR MO

STATION TYPE CARD (T CARD)

(Left Justify)

A STRING OF VALID COMBINATIONS OF STATION TYPE CODES SEPARATED BY SLASHES

STATION CARD (S CARD)

PRIMARY STATION CODE (Left Justify)

(Blank)

STATION ALIASES

(1) SECONDARY STATION CODE (Left Justify)

(2) SECONDARY STATION CODE (Left Justify)

(3) SECONDARY STATION CODE (Left Justify)

FIPS CODES — STATE COUNTY

CON-TROL CODE

(Blank)

LATITUDE/LONGITUDE CARD (HEADER CARD Ø)

LATITUDE (Zero Fill) — dd mm sss

LONGITUDE (Zero Fill) — ddd mm sss

(Blank)

P C / D

TOTAL STATION DEPTH

(Blank)

RM/ CARD (HEADER CARD 1)

TERM MAJ BASIN / TERM MIN BASIN / TERM STREAM NO.

LEVEL 1 MILES

LEVEL 2 INDEX

LEVEL 2 MILES

LEVEL 3 INDEX

LEVEL 3 MILES

LEVEL 4 INDEX

LEVEL 4 MILES

LEVEL 5 INDEX

LEVEL 5 MILES

LEVEL 6 INDEX

LEVEL 6 MILES

LEVEL 7 INDEX

LEVEL 7 MILES

LAST LEVEL USED

RM/ CARD (HEADER CARD 2)

TERM MAJ BASIN / TERM MIN BASIN / TERM STREAM NO.

LEVEL 8 INDEX

LEVEL 8 MILES

LEVEL 9 INDEX

LEVEL 9 MILES

LEVEL 10 INDEX

LEVEL 10 MILES

LEVEL 11 INDEX

LEVEL 11 MILES

LEVEL 12 INDEX

LEVEL 12 MILES

(Blank)

MAJOR/MINOR BASIN CARD (HEADER CARD 3)

STATION LOCATION MAJOR BASIN NAME

STATION LOCATION MINOR BASIN NAME

LOCATION BASIN CODES — Major Minor Sub

(Blank)

LOCATION DESCRIPTION CARD (HEADER CARD 4)

LOCATION OF SITE: LANDMARK NAMES, ETC

REACH CODING — ON/OFF

REACH NUMBER

MILES ON REACH

C K

(Blank)

SORT NO.

EPA Form 7500-24 (Rev. 8-83) Previous edition is obsolete.

PAGE 1 OF 2

DESCRIPTIVE PARAGRAPH CARDS (HEADER CARD 5)

DESCRIPTION (7-78)

SORT NO (Blank)

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