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DEMDESS USER MANUAL 1993 UPDATE

DANUBE EMISSIONS MANAGEMENT DECISION SUPPORT SYSTEM

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by

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ACRONYMS

A.I.D.	Agency for International Development (Washington, D.C.)
DEMDESP	Danube Emissions Management Decision Support Project
DEMDESS	Danube Emissions Management Decision Support System
EPDRB	Environmental Program for the Danube River Basin
IS01	cyanide destruction
PAL	Paradox® Application Language
PR01	primary treatment (mechanical sedimentation)
PR02	enhanced primary treatment (mechanical sedimentation assisted by chemical coagulation)
SAS01	single-stage conventional activated sludge
SAS02	two-stage conventional activated sludge
USAID	United States Agency for International Development (overseas missions)
WASH	Water and Sanitation for Health Project

PREFACE

This manual is an update of the first DEMDESS user manual, which was published in July 1992. The 1993 edition reflects changes and improvements made to DEMDESS during the past year. Consequently, the user should refer to the 1993 version of the manual instead of the 1992 edition.

Chapter 1

INTRODUCTION

1.1 What Is DEMDESS?

DEMDESS stands for the *Danube Emissions Management Decision Support System*. It is 1.) a computer-based system of databases that contain information on water quality, dischargers, emissions, regulatory standards, hydrologic structure, and similar topics regarding the Danube River; and 2.) an array of programs for analyzing these data.

1.2 Purpose of DEMDESS

DEMDESS is a tool designed to support informed decision-making regarding the control of emissions in Danubian countries. Its focus is on controlling emissions from industrial and municipal point sources through evaluating the economic, financial, institutional, and stream quality impacts of various policy options (such as constructing treatment facilities, selecting effluent criteria and stream quality standards, providing subsidies for construction, and imposing fines and taxes on wastewater emissions).

1.3 Institutional Background

DEMDESS was developed by A.I.D.'s WASH (Water and Sanitation for Health) Project in cooperation with four Danubian countries: Bulgaria, Hungary, Romania, and Slovakia. The system is a product of the DEMDESP (Danube Emissions Management Decision Support Project), which began in September 1991. The WASH Project, which is sponsored by A.I.D.'s R&D/Office of Health, received funding from the Europe Bureau/Office of Development Resources: Environment and Natural Resources Division to carry out the assignment.

1.4 Stylistic Conventions

This manual uses the following stylistic conventions:

- Curly braces indicate a Paradox® menu selection (e.g., {Script} {Play}).
- Italics indicate Paradox® vocabulary and terminology (e.g., *Debugger*) the first time it appears in the text.
- A key press is shown between < > symbols (e.g., <F2>).
- Capital letters indicate a PAL (Paradox® Application Language) command (e.g., VIEW), a table name (e.g., PARMTABL), or a table field name (e.g., PARMCODE).

Chapter 2

PRINCIPLES BEHIND DEMDESS

2.1 Background

The conceptual design and scope of DEMDESS were discussed and agreed upon by officials of Bulgaria, Hungary, Romania, and Slovakia in a workshop held in Visegrad, Hungary, in December 1991. This was followed by a concept paper in January 1992, which outlined the data requirements and scope of a DEMDESS "target system" in accordance with discussions at the Visegrad workshop. Subsequently, WASH assisted each country in transferring data into DEMDESS, and in developing applications of DEMDESS in accordance with the scope and level of detail of available data.

The application of DEMDESS in the Yantra basin was described at a wrap-up workshop in Dubravka, Slovakia, in May 1992, hosted by the Slovak Commission on the Environment and USAID. In attendance were officials of the four original participating countries; representatives of Austria, Croatia, Slovenia, and Yugoslavia; and representatives of potential donors (USAID, the World Bank, the European Bank for Reconstruction and Development [EBRD], the United States Environmental Protection Agency [EPA], and the European Community [EC], which is providing a program coordination unit for the multidonor-sponsored Environmental Program for the Danube River Basin [EPDRB]). Discussion at the wrap-up workshop included possible future extensions of DEMDESS in terms of additional river basins, additional types of users, and additional types of applications.

The conceptual framework of DEMDESS, the strategic and policy options it can address, and its future possibilities are presented in Chapter 5 of WASH Field Report No. 374, "Point Source Pollution in the Danube Basin, Volume I." This chapter is reprinted in Appendix A of this manual.

2.2 Organization of DEMDESS

Figure 1 shows the organization of DEMDESS's tables into six subsystems in three general categories: institutional, emissions, and environmental. The grouping of the tables into these subsystems is for illustrative purposes only; subsystems are not defined entities within Paradox®, but rather are a convenience adopted herein for describing DEMDESS. The six subsystems and the data they contain are as follows.

1. *Regulatory Subsystem*: The fines, taxes, and water quality standards for both treated effluent and ambient stream quality.

2. *Institutional Subsystem*: The public agencies or authorities responsible for emissions management.

3. *Emissions Subsystem*: Industrial and municipal dischargers, their wastewater emissions, and associated water supply data.

4. *Treatment Subsystem*: The costs, effluent characteristics, and parameters for economic and financial analysis of wastewater treatment plants.

5. *Reach Subsystem*: The description of river networks, including the connectivity between reaches, the sequence in which reaches should be analyzed for water quality modeling, stream flow data, and cross-references to the hydrologic sequencing data for participating countries.

6. *Water Quality Subsystem*: The monitoring data on ambient stream quality and coefficients for stream quality modeling.

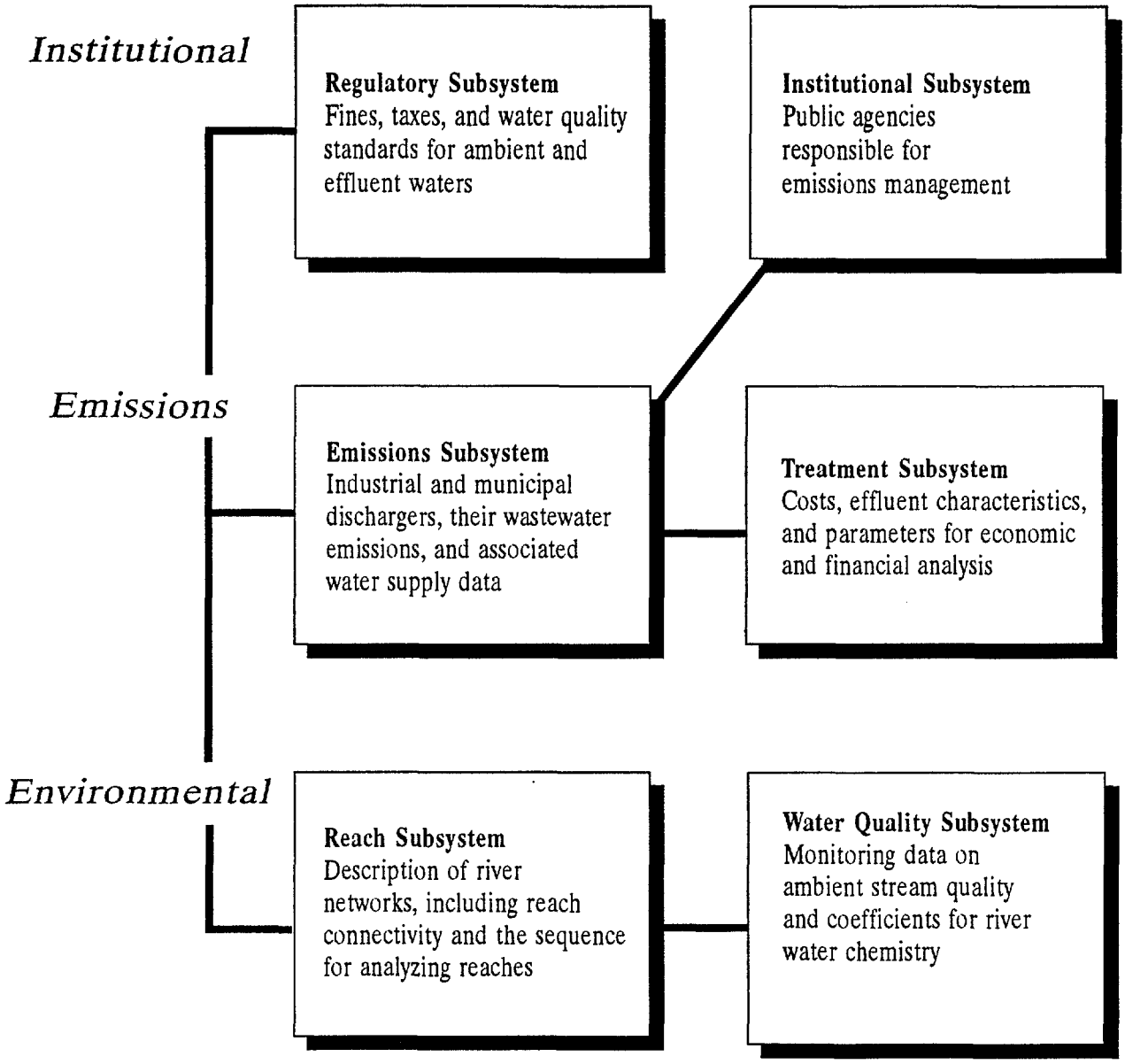

Figure 1

Organization of DEMDESS

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Chapter 3

EXPERT VERSUS USER-FRIENDLY DEMDESS

The core of DEMDESS is the framework of tables that define the water quality, regulatory, treatment, and hydrologic aspects of the area under study. Using this core, two types of DEMDESS are available: the User-friendly and the Expert versions.

The User-friendly DEMDESS provides pull-down menus that offer features such as predesigned reports on emissions taxes and fines, country-specific routines for importing data files, and canned routines for routing pollutant loads, graphing water quality profiles, and so on.

The Expert DEMDESS (with which the user manipulates the tables directly through Paradox®) offers a wealth of features that can be used to answer specific questions about DEMDESS data, including the following:

1) *Query-by-Example*, for asking questions and making calculations with tables quickly;
2) *PAL programming language*, for developing programs, which in Paradox® are referred to as *scripts*;
3) *The Report Writer*, for developing customized reports; and
4) *The Graph Designer*, for graphing table data easily.

Chapter 4

USING DEMDESS

4.1 Computer Requirements

DEMDESS has been implemented using Paradox® (version 4.0)[1], a commercially available information management software package distributed by Borland International, Inc. Paradox® runs on PC-compatible computers with 286, 386, or 486 processors. For efficient use of DEMDESS, the minimum requirements are a 386SX/12 MHz processor, 2 MB of memory, and 100 MB of hard disk space for a countrywide database. At a small additional cost, the recommended configuration is a 486 50 MHz processor, 4 MB memory, and 200 MB of hard disk space. An ink-jet or laser-jet printer for graphic output is also recommended.

In transferring data from country databases into DEMDESS, other software programs have been written in BASIC, but the computer requirements for these programs are less restrictive than those for Paradox®.

4.2 DEMDESS Ownership and Distribution

USAID purchased copies of Paradox® and distributed them to users in the four countries participating in the DEMDESS project.

DEMDESS's software and database structures are owned in full by USAID and each participating environment ministry in the user countries. These software and database structures may be distributed by any of the owners, subject to Paradox® licensing restrictions. The licensing and distribution requirements for Paradox® are defined by Borland International.

The User-friendly DEMDESS uses Paradox® 4.0 Runtime software, which allows unlimited distribution for each Paradox® developer that has an original copy of the Runtime software. Each user country has been provided with a copy of Paradox® Runtime so that it can distribute the User-friendly DEMDESS to an unlimited number of users.

The Expert DEMDESS uses the full Paradox® 4.0. Use of the full version requires that a separate licensed copy of the software be installed on each PC on which Paradox® is to be run. Three copies of the full Paradox® 4.0 have been provided to each country, enabling three PCs in each country to use the Expert DEMDESS.

The data used in each user country's implementation of DEMDESS are the property of the respective country's environment ministry or other agency providing that data. Data in DEMDESS may be distributed by the owners or by others with the owners' permission.

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[1] Paradox® is a registered trademark of Borland International, Inc.

Paradox® can be purchased through many retail and mail order software companies, or directly through Borland International at one of the following telephone numbers:

- United States (408) 461-9000
- Canada (416) 229-6000
- UK 0734 320022
- Australia (02) 953-9500

NOTE: As with any computer software application, anytime you think you are in danger of losing data that you have not previously backed up, take a moment to back up the entire DEMDESS system. Ideally, you should back it up to floppy disks, so that even if a "disaster" were to occur on the hard disk, DEMDESS would not be lost. Backing up the system provides another important operational advantage as well: it allows you to feel free to experiment with queries and edits without having to worry that you will "break" something. DEMDESS is not a "canned" system in which the user is protected from mistakes; it is an open system that allows the user great freedom to test many different options. Backing up the system, therefore, is critical. If you do not know how to back up using DOS (or other backup utilities), find someone to teach you how.

4.3 Installing DEMDESS

DEMDESS includes a self-installation program that quickly copies and decompresses the system onto your C: drive. To install DEMDESS, follow the steps below:

1. Insert the diskette labeled "Install-Batch file" into the B: drive.
2. At the DOS prompt, type B: and then press <Enter>.
3. At the B: prompt, type DINSTALL and press <Enter>.
4. The program will first install the Paradox® Runtime module.
   Select the options appropriate for your system.
5. The program will then ask you to insert Backup Diskette #1. Insert the diskette labeled DEMDESS Backup Disk #1 and press any key to continue.
6. Depending on the amount of data in your country's version, you may be instructed to insert more backup diskettes. Continue as directed.
7. The program will then ask you to insert the diskette with the Batch file. Insert the original Install-Batch file diskette and press any key to continue.

8. A message will appear indicating that you have successfully installed the system.

NOTE: DEMDESS automatically installs into the following subdirectories:

c:\Demdess
c:\Demdess\Cfg
c:\Demdess\Workshop

If these subdirectories do not already exist on your system, they will be created by the DEMDESS installation program.

4.4 Running DEMDESS

DEMDESS can be run in two ways: as a stand-alone "runtime" program (in the User-friendly version of DEMDESS only) or as a Paradox® script.

To run the runtime version, first switch to the following DEMDESS subdirectory:

C:

cd\DEMDESS

At the DOS prompt, type:

Pdoxrun filename

Where filename = "DEMDESSB" for Bulgaria

"DEMDESSH" for Hungary

"DEMDESSS" for Slovakia, and

"DEMDESSR" for Romania.

To run DEMDESS as a Paradox® script, first load Paradox® by typing "Paradox" at the DOS prompt. Once in Paradox®, select {Script} {Play}. At the prompt, type filename (as defined above) and then press <Enter>.

4.5 Getting around in DEMDESS

The following guidelines will enable you to move around in DEMDESS:

- Use the arrow keys to move around in tables, the *Editor*, and so on.
- Use the <Tab> key to move quickly between fields in tables or *query forms*.
- If you are using a mouse, click on the scroll bars to move quickly in tables or queries.
- Press <F1> at any time for help.
- Press <F2>, the "Do_it!" key, to process a *query*, save and leave the Editor, process a sort, and so on.
- In a query, press <F3> and <F4> to move between multiple query forms.

4.6 The DEMDESS Menu

DEMDESS has nine main menu options:

Emissions: Used to access the emissions table and report on emissions violations, taxes, and fines.

WQ: Used to access the ambient water quality table and the water quality sites table. This is the menu to choose if you want to plot water quality profiles along a stretch of river or plot water quality over time at a station.

Reach: Used to edit the Reach file and report on rivers or on hydrologic structure.

Regs: Used to edit water quality standards, taxes, fines, and permits, and to report on water quality standards, tax schedules, fine schedules, and permits.

Treat: Used to edit waste treatment costs and pollutant removal characteristics, and report on waste treatment costs and characteristics.

Lookup: Used to edit and report on the following lookup tables: parameters, industries, and currency.

Analyses: Used to perform cumulative loadings analysis, loadings profile plots, and treatment policy analysis.

Utilities: Used to back up, restore, or export files.

Leave: Used to exit DEMDESS.

Table 1 provides a detailed breakdown of the DEMDESS menus, submenus, and their purpose.

Table 1

DEMDESS Menu Structure

MENU SELECTION			PURPOSE
Emissions			
	Database		
		Dischargers	Edit discharger reporting forms
		Emissions Protocols	Edit emissions protocol forms
		Cities	Edit city emissions table
		Feedlots	Edit feedlot emissions table
		Rebuild	Rebuild the DEMDESS emissions tables
	Reports and Graphs		
		Taxes	Compile report of emissions taxes by industry
		Fines	Compile report of emissions fines by industry
		Violations	Determine emissions violations and report on results
		Emissions Stats	Report minimum, maximum, and average for all water quality parameters by discharger
WQ			
	Data		
		WQ Station Edit	Edit water quality stations table
		Protocol	Perform data entry/edit of WQ protocol forms
		Reach File Link	Link WQ stations to Reach file
		Rebuild - Warning!	Rebuild the water quality tables
	Reports and Graphs		
		Profile Plot	Plot a water quality profile
		Station Plot	Plot water quality at a station

continued

Table 1 (continued)

MENU SELECTION			PURPOSE
		Violations	Determine and report on WQ violations
		QA/QC Report	Report minimum, maximum, and average values for each WQ parameter
Reach			
	Data		
		Reach File Edit	Edit the Reach file
		Rebuild	Rebuild the Reach file
	Reports		
		Rivers Report	Compile Reach file report of rivers
		Hydro Report	Compile Reach file hydrologic structure report
Regs			
	Data		
		WQ Standards	Enter and edit in-stream and emissions standards
		Reach File Link	Link WQ standards to Reach file
		Taxes	Enter and edit tax information
		Fines	Enter and edit fines information
		Permits	Enter and edit emissions permits information
	Reports		
		WQ Standards	Compile report of in-stream and emissions standards
		Taxes	Compile report of tax schedules
		Fines	Compile report of fines schedules
		Permits	Compile report of emissions permits
Treat			
	Data		
		Costs	Enter and edit waste treatment costs
		Characteristics	Compile waste treatment plant pollutant removal characteristics

continued

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Table 1 (continued)

MENU SELECTION			PURPOSE
	Reports		
		Cost Reports	Compile report of waste treatment cost
		Characteristics	Compile treatment characteristics report
Lookup			
	Data		
		Parameters	Enter and edit WQ parameters data
		Currency	Enter and edit currency conversion data
		Industrial Sectors	Enter industrial sector codes
	Reports		
		Parameters	Compile WQ parameters report
		Currency	Compile currency conversion report
		Industrial Sectors	Compile industrial sector codes report
Analyses			
	Cumulative Loading Analysis		
		Setup and Run	Run loading analysis
		View Results Table	View table of routing results
		View Loading Profile Table	View loading profile table
		View Loading Profile Plot	View graph of loading profile
	Pollutant Concentration Routing		
		Setup and Run	Run concentration routing analysis
		View Concentration Profile Plot	View graph of pollutant concentration routing
		View Concentration Profile Table	View table of routine results
	Treatment Policy		
			Perform treatment policy analysis

continued

Table 1 (continued)

MENU SELECTION			PURPOSE
Utilities			
	Backup		
		Hard Disk	Send zip DEMDESS files to C:DEMDESS.zip, CFG.zip, and WORKSHOP.zip
		Floppy	Back up DEMDESS files to B:\DEMDESS.zip
	Restore		
		Hard Disk	Restore zipped DEMDESS files from C:\ to C:\DEMDESS\
		Floppy	Restore DEMDESS files from floppies in B:
Leave			
	To Paradox		
			If running DEMDESS as a script under Paradox, this option will exit back to Paradox
	To DOS		
			Exits to DOS

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4.7 Enhancing the User-Friendly DEMDESS

The User-friendly DEMDESS was created in the *Paradox® Application Workshop*. You can use the Application Workshop to add new specialized features to DEMDESS. Before you begin to work with the Application Workshop, be sure to back up your DEMDESS subdirectories (to do so, use the *Utilities* option on the DEMDESS main menu).

To activate the Application Workshop, select the *System* marker that is located at the far left of the main menu bar. (The System marker looks like three horizontal lines stacked on top of each other.) Then select {Utilities} {Workshop} from the pull-down menu. On the next screen, select {Application} {Open}. A window will appear with a list of the applications available. Select {DEMDESS} and {OK} to continue.

The DEMDESS menu bar will appear across the top of the screen. This screen will allow you to change the menu bar, change the actions of the menu selections, or add new options to the system. The example below will lead you through a basic Application Workshop activity. For detailed information, consult the Paradox® Application Workshop manual.

Example: Adding a new feature to the DEMDESS menu.

Let us assume that you have developed a script that models dissolved oxygen concentrations. To add the script to DEMDESS, first locate where you would like to place the menu option. This particular script should go under the Analyses menu. Select {Analyses}. On the pull-down menu, select {New}. Then, select {Action} from the *Menu Insert* box. A *Menu Definition* box will appear. At the Keyword prompt, type the name of the option you wish to appear on the DEMDESS menu, e.g., "Model DO." At the Description prompt, type a short description of the function. In DEMDESS, this will appear in the lower left of the screen.

Move down to the *Action* box (using <Tab>) and select the {Select} button. A list of the different actions will appear. Highlight the {Play a Script} action and select {OK}. In the *Select Script* window, use the scrollable list to select the name of your script. Press <Enter>. You will return to the Menu Definition box. Select {OK}. Your new feature will now appear on the DEMDESS menu. To save your work, select {Application} {Finish}.

Chapter 5

DEMDESS DATABASE DESIGN

The power of DEMDESS is in its database design. DEMDESS is designed to integrate the many components of water quality and emissions decision-making in a way that provides powerful yet easily implemented analyses. It is essential to understand the DEMDESS database design in order to use it effectively. The key dimensions of the design are its central organizing concepts and data table structures.

5.1 Central Organizing Concepts

Three key central organizing concepts are used throughout DEMDESS: the way parameter values are stored using a common parameter code (PARMCODE), the use of a single standard river network called the Reach file (RCHFILE), and the separation of DEMDESS into six major subsystems. The latter concept was discussed in detail in Chapter 2; parameter value storage and the Reach file are described below.

Each parameter value (such as BOD_5) is stored in a single record with an associated PARMCODE. This technique allows the user a great deal of flexibility because it places no practical limit on the amount of data that can be stored; i.e., the user may continue to add parameters as he or she uses the system because DEMDESS uses no predefined sets of parameters. Having a common parameter table means that each parameter value in DEMDESS has the same parameter code throughout (for BOD_5, the PARMCODE = 1, pH = 24, and so on). For instance, emissions, in-stream water quality, standards, taxes, fines, and permit limits for BOD_5 will all reference PARMCODE = 1.

The Reach file (RCHFILE) is a powerful river hydraulic network. With links built into emissions and in-stream water quality, it enables data to be put together into a single river network for routing, modeling, and so on.

5.2 The DEMDESS Data Table Contents

Each DEMDESS table contains an important building block for decision-making. Also, each table is designed to work with other tables ("link") to provide answers to questions. It is necessary to understand what each table contains and how each table links with other tables. Table 2 contains a brief description of the primary tables in DEMDESS, and Figure 2 contains schematics of the major linkages between them. Chapter 7 provides a detailed description of each data element in each DEMDESS table.

DEMDESS users must understand in practice and principle the implications of data and links in their specific implementation of DEMDESS. Just as important, users must understand the

implications of missing data or links. For instance, in order to compute fines, the following data must be loaded and linked within DEMDESS: emissions data, emissions standards, and the fines schedule. If one piece is missing, incomplete, or improperly linked, the fines computations will be incomplete.

Table 2
Primary DEMDESS Tables

1. Regulatory Subsystem
   a. WQSTDESC - Water Quality STandards DESCription, containing a general description of each emission or in-stream standard contained in DEMDESS.
   b. WQSTDS - Water Quality STandarDS, containing the parameter concentrations associated with emission or in-stream standards.
   c. TAXES - schedule of TAXES for emissions.
   d. FINES - schedule of FINES for emission violations.
   e. PERMITS - Specific limits for emission PERMITS.

2. Emissions Subsystem
   a. DISCHX - DISCHarger records, defining characteristics for each polluter, such as industrial group, population, river location, etc.
   b. EMISSX - EMISSions data, containing emissions concentrations for dischargers.

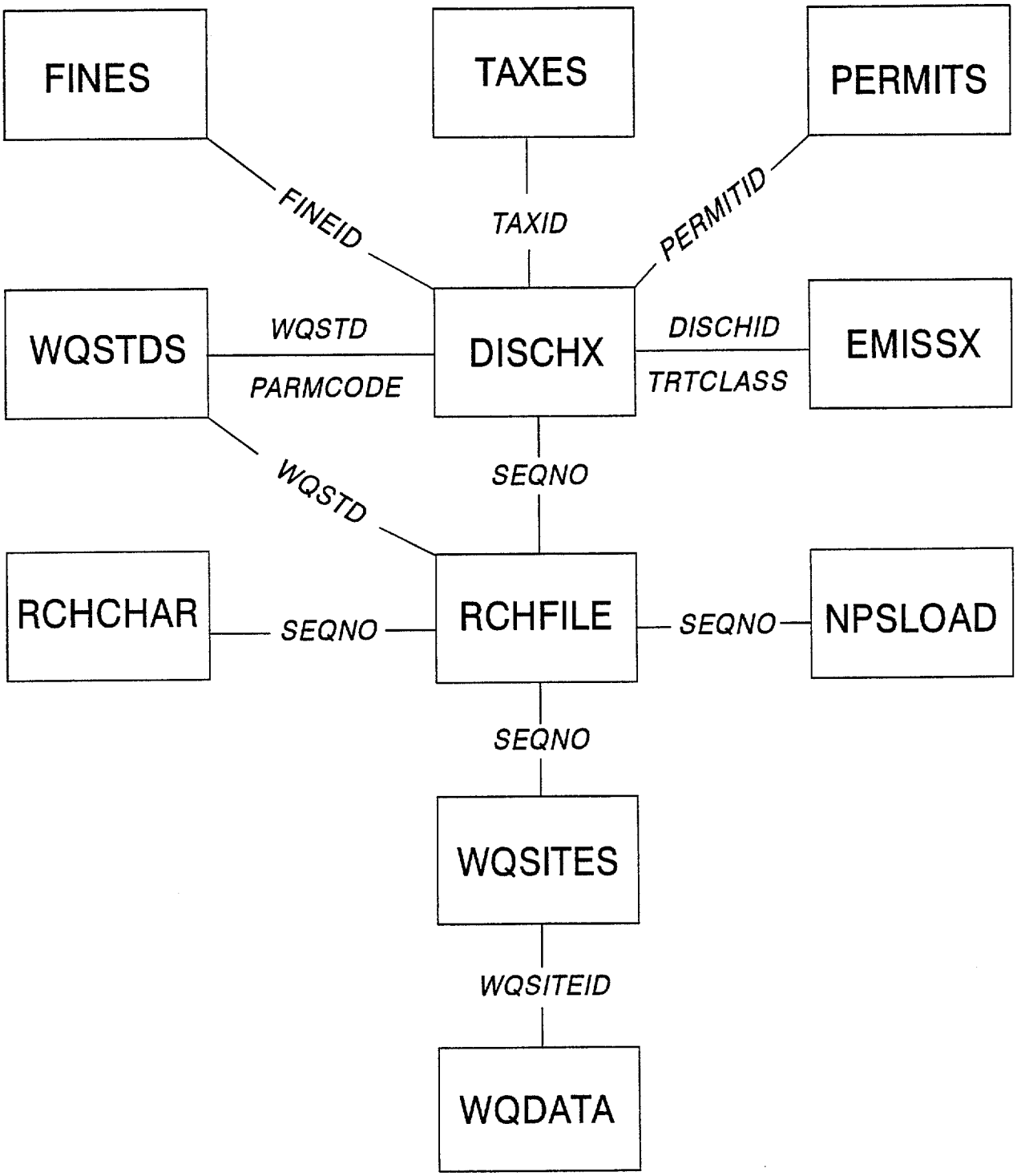
3. Treatment Subsystem
   a. TPCHR - Treatment Plant CHaRacteristics, defining pollutant removal characteristics for treatment plants.
   b. TPCST - Treatment Plant CoSts, defining capital and O&M costs for treatment plants.
   c. CURRCNVT - CURRency CoNVerT table, providing exchange rates and country-specific labor, energy, and materials cost indexes.

4. Reach Subsystem
   a. RCHFILE - the ReaCH FILE river hydraulic network, tied primarily to DISCHn and WQSITES.

5. Water Quality Subsystem
   a. WQSITES - Water Quality SITES, containing one record describing each in-stream monitoring site.
   b. WQDATA - Water Quality DATA, containing the measured in-stream concentrations.

6. General Lookup Tables
   a. PARMTABL - PARaMeter TABLe, containing the common parameter codes used in EMISSn, WQDATA, TAXES, FINES, PERMITS, and WQSTDS.
   b. INDCODES - INDustrial CODES, containing descriptions of industrial groups identified in DISCHn.

NOTE: There can be many additional lookup tables as needed. These tables are a primary technique to ensure consistency in data values entered in DEMDESS.



NOTE: Boxes represent tables; connecting lines denote linking fields.

Figure 2

DEMDESS Table Structure

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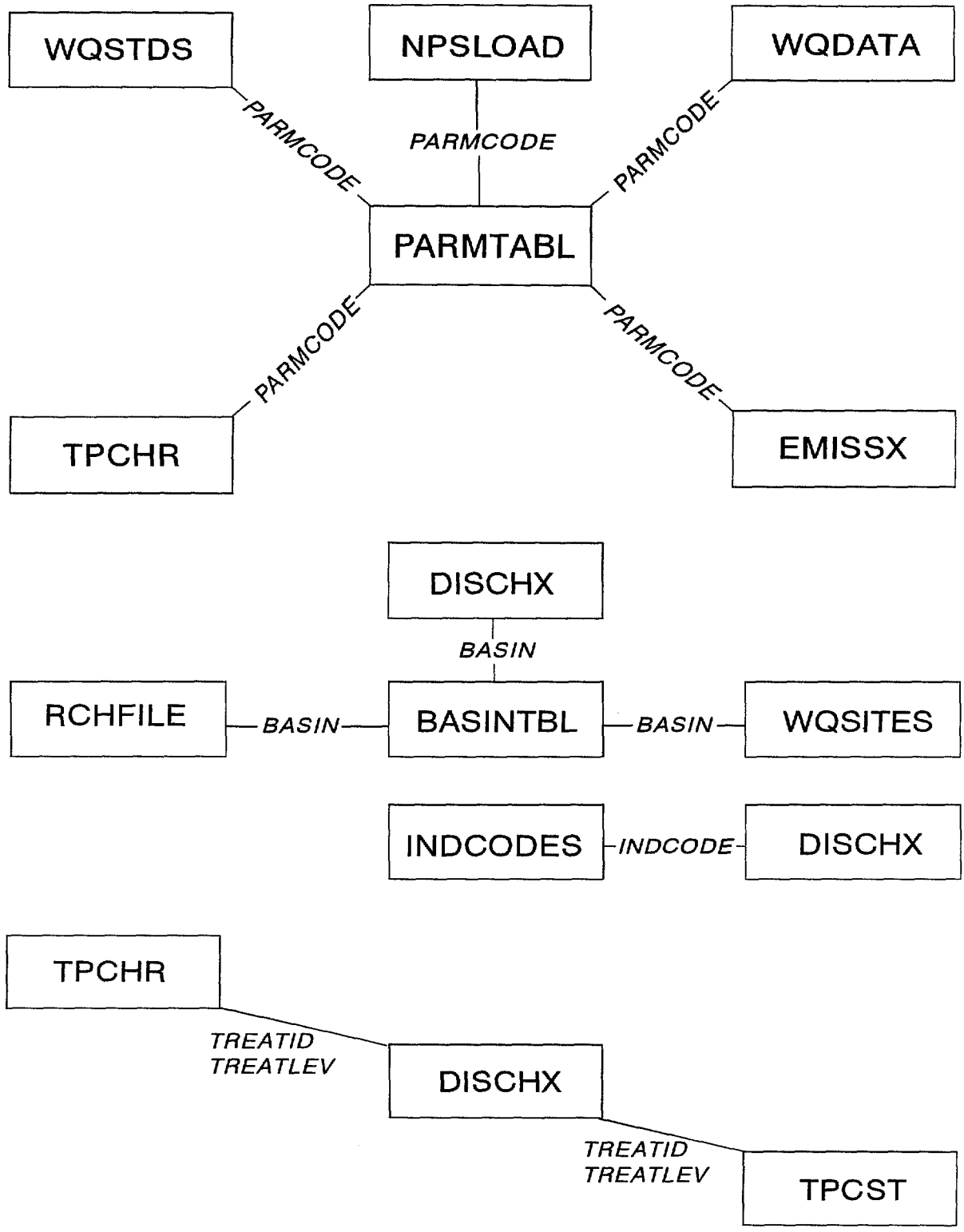

Figure 2 (continued)

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Chapter 6

DEMDESS SUBSYSTEMS

6.1 Regulatory Subsystem

The Regulatory Subsystem contains information on in-stream standards, emission standards, tax and fine schedules, and emission permit limits. The in-stream and emission standards are contained in the WQSTDS and WQSTDESC tables. The taxes, fines, and permits are contained in the TAXES, FINES, and PERMITS tables.

The WQSTDESC table contains one record for each set of standards, e.g., in-stream standards for Class I rivers. The WQSTDS table contains one record for each parameter limit. For example, it will contain a record for the in-stream limit for BOD_5 for Class I rivers. The primary link variable for these tables is WQSTD. This variable links these two tables and provides the link to WQSITES, DISCHX, and RCHFILE. Additionally, the WQSTDS table links to PARMTABL to identify the parameter limit value. For emissions limits, WQSTDS is used when general limits apply to a group of dischargers, for instance, when all municipalities have the same general limits or industries are required to meet the same limits, such as Best Available Treatment (BAT).

The PERMITS table is an alternative to the general emission limits contained in WQSTDS and is used when the emission limits are determined individually for each discharger, such as when limits are determined using waste load allocation methodologies.

In general, the TAXES table is used for emission tax computations, in which a tax is levied for a given quantity of pollutant and/or emission flow, regardless of whether the emission is in violation. A typical example would be a tax on quantity of flow discharged. The TAXES table contains the TAXID variable as the link to the DISCHX table. The PARMCODE variable links to PARMTABL to identify the parameter being taxed.

The FINES table is used in conjunction with the WQSTDS or PERMITS tables to identify and compute emission fines when emissions exceed allowable limits. The EMISSX table is first compared with WQSTDS or PERMITS to determine emission violations. Fines are then computed for each parameter in violation that is also contained in the FINES table. FINES links to DISCHX through the FINEID variable.

6.2 Emissions Subsystem

Baseline emissions data are contained in the DISCHX and EMISSX tables. DISCH1 and EMISS1 are used as the working set of emissions data. DISCH2 through 9 and EMISS2 through 9 store alternatives to the baseline data. DISCHn and EMISSn are used to denote any given set of DISCH and EMISS scenarios, from X through 9. The data records in the tables

DISCHX and EMISSX contain several data fields that are used to route wastewater flows through industrial pretreatment, municipal wastewater treatment, and disposal. In general, a municipal wastewater collection system may serve many industries, and each industry may or may not pretreat its own wastewater. Industries may discharge treated or untreated wastewater into a river, they may practice land disposal of the effluent, or they may discharge into a municipal collection system for subsequent treatment in a municipal wastewater treatment plant. For these and other flow-routing options, the fields or variables in the tables DISCHX and EMISSX that determine flow routing are shown in Figure 3.

In Figure 3, the following variables from Table DISCHX are shown in relation to DEMDESS's primary industrial and municipal emissions flow-routing options. These options are built from a combination of the DISCHX and EMISSX tables.

DISCHID and TREATCLASS

The discharger ID and the flow-path number (TREATCLASS) together specify a single flow stream to be routed. A single industrial discharger may have more than one wastewater stream to be treated; for example, a stream requiring chemical treatment and a stream susceptible to biological treatment. Similarly, a municipality may be divided into existing or potential service areas for more than one wastewater treatment plant.

PTID and PTLEV

For an industrial pretreatment facility, PTID and PTLEV link to the fields TREATID and TREATLEV in the tables TPCHR and TPCST, to specify the cost curves and removal efficiencies for the plant. PTID is used to identify a plant-specific set of cost/efficiency data (with PTID = DISCHID), while TREATLEV is used to identify a generalized set of cost/efficiency data. Either one (PTID or PTLEV) or both of the fields can be given for a discharger, provided that a corresponding matching pair (TREATID and/or TREATLEV) is given in the records for TPCHR and TPCST.

TPID and TPLEV

For a municipal wastewater treatment plant, TPID and TPLEV link to the fields TREATID and TREATLEV in the tables TPCHR and TPCST, in the same manner as do the fields PTID and PTLEV. For an industrial discharger, TPID and TPLEV describe treatment given before discharge to a river.

DISCHID-TO

The discharger ID for a municipal treatment plant. For a municipal discharger record, DISCHID = DISCHID-TO. For an industrial discharger record, DISCHID-TO links to the appropriate value of DISCHID for the municipal treatment plant.

REACH

The river reach into which the treated or untreated wastewater is discharged. The values for the river basin code, reach segment number, and river kilometers from the downstream

end of the segment should be given for all dischargers for use in data retrievals on total emissions by river basin or river reach.

In Figure 3, the following variables from Table EMISSX are shown in relation to DEMDESS's primary industrial and municipal emissions flow-routing options. As noted above, these options are built from a combination of the DISCHX and EMISSX tables.

DISCHID, TREATCLASS, and PARMCODE

A set of records is required for each discharger (DISCHID) and flow stream (TREATCLASS), with each record giving the data value for a given water quality parameter (PARMCODE).

DISCHTYPE

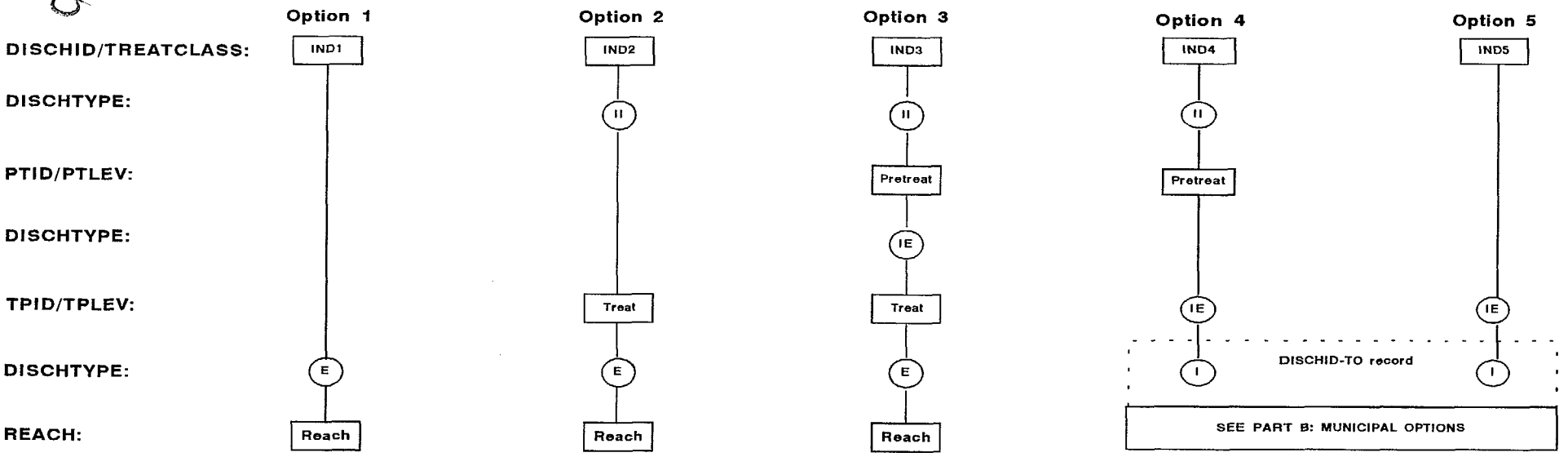
Sets of records by DISCHID, TREATCLASS, and PARMCODE may also be given to describe the location in the flow routing where the parameter values apply. Values for DISCHTYPE (see Figure 2) include the following:

- II Industrial influent before treatment
- IE Industrial effluent to municipal sewers
- ME Municipal effluent, not including industrial effluent
- I Combined industrial and municipal influent to a municipal wastewater treatment plant
- E Emission to a river, with or without treatment

As shown in Figure 3, DISCHTYPE is the primary indicator for flow-routing options that the user wants to consider. These include five options for routing industrial emissions, and four options for routing municipal emissions. The purpose of the software design is to permit for each option computation of the appropriate flow routings, influent and effluent quantities, characteristics, treatment costs, emissions to rivers, and loads removed by treatment. The options shown correspond to the following requirements:

1. Each discharger described in DISCH1 has one set of emissions records in EMISS1, corresponding to the scenario and flow-routing option selected by the user. It is assumed that these emissions records represent a copy, an extrapolation, or an averaging of records representing historical or periodic emissions obtained from the EMISSX table. In all of these cases, the records must have a value of DISCHTYPE that is either "E" for emissions to a river, "IE" for industrial effluent, or "ME" for municipal effluent.
2. A script (programmed procedure) is used to add industrial and municipal emissions ("IE" and "ME") to calculate "I," the combined influent to a municipal wastewater treatment plant. Similarly, a script is used to calculate the costs for pretreatment and treatment facilities, and to create new treated-effluent records (DISCHTYPE = "E").

A. INDUSTRIAL EMISSIONS OPTIONS



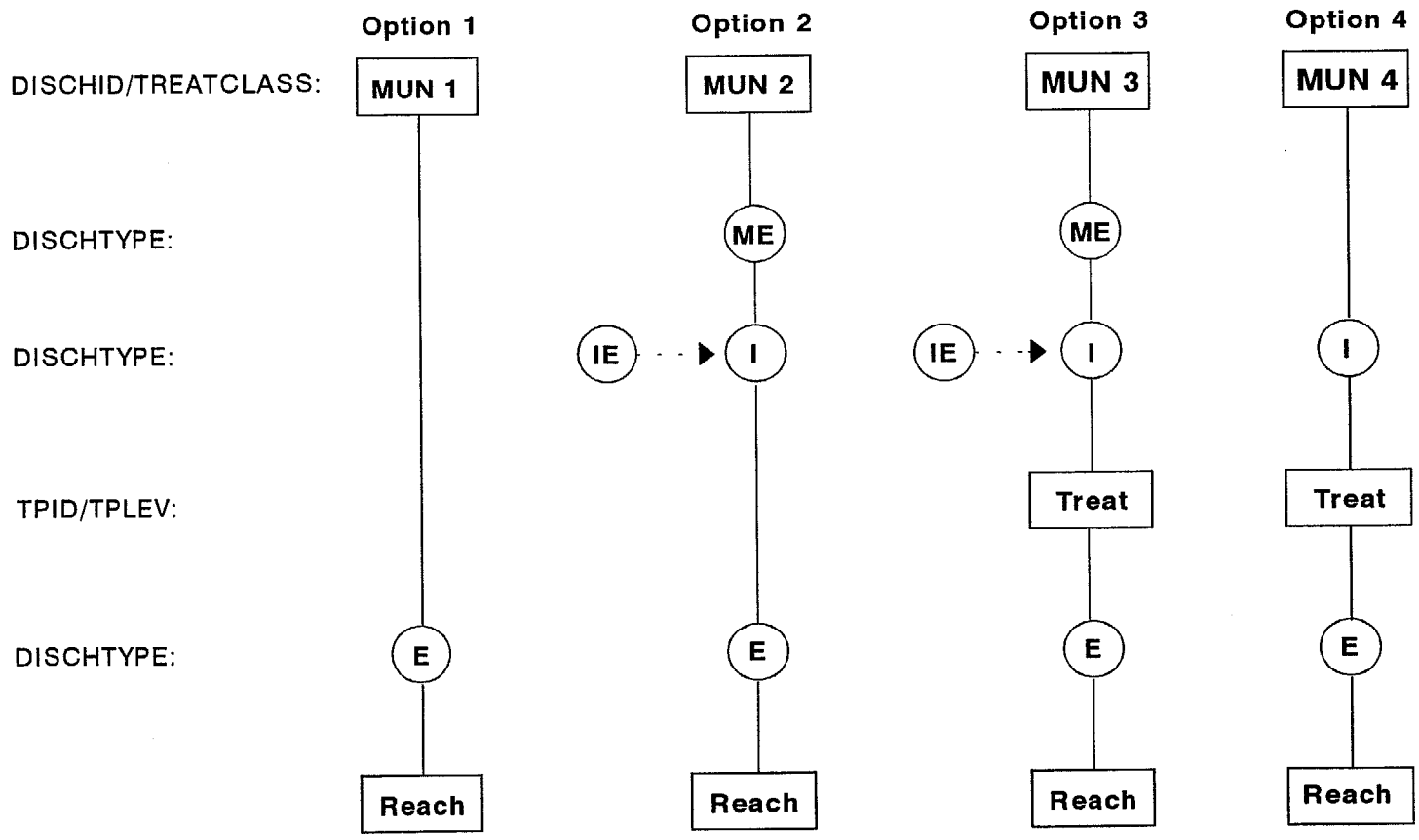
Option	DISCHTYPE in EMISSX table: Given	Changed to	Computed	DISCHID-TO in DISCHX table
1. No Treatment	E	–	–	Blank
2. Treatment	E	II	E	Blank
3. Pretreat/treat	E	II	IE, E	Blank
4. Pretreat/to Mun. WWTP	IE	II	IE	MUN 2,3 (See Part B)
5. To Municipal WWTP	IE	–	–	MUN 2,3 (See Part B)

Option	Pretreatment Comps: PTID/PTLEV	Cost, Comp.	Treatment Comps: TPID/TPLEV	Cost Comp.	Reach
1. No Treatment	Blank	No	Blank	No	Given
2. Treatment	Blank	No	Given	Yes	Given
3. Pretreat/treat	Given	Yes (Sum)	Given	Yes (Sum)	Given
4. Pretreat/to Mun. WWTP	Given	Yes	Blank	No	Blank
5. To Municipal WWTP	Blank	No	Blank	No	Blank

Figure 3

Definition Sketch: Flow-Routing Options

B. MUNICIPAL EMISSIONS OPTIONS



Option	DISCHTYPE in EMISSX Table: Given	Changed to	Computed	Treatment Comps: TPID/TPLEV	Cost Comp
1. No Treatment	E	–	–	Blank	No
2. Sum, No Treatment	M E	–	I, E	Blank	No
3. Sum, Treat	M E	–	I, E	Given	Yes
4. Treat	E	I	E	Given	Yes

Figure 3 (continued)

3. The fields QTOT and QCAP in the discharger record in DISCH1 contain the average daily flow and required treatment capacity associated with the scenario and flow-routing option. For existing facilities to be expanded or upgraded under the given scenario, the capacity QCAP and treatment level (PTLEV and/or TPLEV) are stored in the same discharger record in the table DISCHX.

6.3 Treatment Subsystem

The Treatment Subsystem of DEMDESS consists of three Paradox® tables named TPCHR, TPCST, and CURRCNVT. These databases define various treatment levels (technologies) applicable to the treatment of emissions. The pollutant removal efficiencies or residual pollutant concentrations for each treatment level are specified and used to compute treated effluent concentrations. Coefficients in generalized cost equations and unit costs are also defined, for use in computing capital and annual costs.

Table TPCHR defines the treatment characteristics (efficiencies) for various treatment levels (technologies), and Table TPCST defines the constants and variables for cost functions for the same treatment levels. Table CURRCNVT contains the data to enable the user to convert costs expressed in different country currencies. These three tables and their use are discussed below.

6.3.1 Treatment Characteristics

The fields in TPCHR are described below.

TREATID

The user-defined code for TREATID is optional, and this field would normally be blank when the user wants to use generalized data on removal efficiencies. For wastewater treatment plants for which the removal efficiencies are known, TREATID is used to link the associated record in Table TPCHR with the corresponding discharger record in Table DISCHX using the TPID field.

TREATLEV

The designations in TREATLEV (Treatment Level) represent various treatment levels or technologies both for industrial and municipal applications. This field is also used in the TPCST table as the key field. The treatment level NONE represents base conditions without treatment and may represent a scenario alternative for certain sources. Other levels are treatment such as single-stage conventional activated sludge (SAS01) or cyanide destruction (IS01). Treatment level designations applicable to industrial wastewater are preceded with the letter "I." The user can add other treatment levels and technologies. The TREATLEV field links with the TPLEV field in the table DISCH1.

PARMCODE

PARMCODE (Parameter Code) contains the codes for various parameters, such as BOD_5 (1) and suspended solids (4). PARMCODE is defined under the Emissions Subsystem.

EFFLCONC

EFFLCONC (Effluent Concentration) gives the absolute value of the pollutant in mg/L that remains in the effluent. This method of describing treatment efficiency is generally applicable to industrial wastewater treatment systems. (For example, effluent concentrations of heavy metals primarily depends on treatment process pH rather than influent concentration). If you want to specify EFFLCONC, leave the PCTEFFL field blank.

PCTEFFL

PCTEFFL (Percent Effluent) gives the ratio of the parameter remaining in the effluent compared with the influent level. For parameters that are unaffected by treatment, the ratio is 1.0. This type of indicator is common for municipal wastewater treatment plants.

DATASRC

DATASRC (Data Source) gives the reference from where the efficiency data are taken.

6.3.2 Treatment Costs

The Treatment Subsystem includes the coefficients for a set of functions for each treatment level with the flow parameters QTOT (Average Daily Flow) or QCAP (Plant Capacity) in the DISCHX table as the (input) variable. The outputs of the equations are

- estimated construction cost;
- annual material and supplies cost;
- annual energy use; and
- annual personnel requirements.

The functions reside in PAL scripts, but the constants and variables for the functions are given in Table TPCST. TPCST also contains data for financial analysis and sludge production functions, which also reside in PAL scripts. The fields used in TPCST and the related functions are described below.

TREATLEV

Treatment Level, as in the TPCHR table.

TREATDESC

TREATDESC (Treatment Description) briefly describes treatment levels or technologies.

DATASRC

Data Source.

CURRENCY

CURRENCY defines the type of currency that applies to the costs used. USD under the CURRENCY field defines that cost output in United States dollars.

CSTDATE

CSTDATE (Cost Date) refers to the date for which the costs are valid. All costs in one table should be valid for one date, although the date itself can be approximate, such as 1991 or 6/1991 (mid-1991). In the example above, the cost data are valid for mid-1992; therefore, 6/1992 is entered.

A, B

A is the coefficient of proportionality and B is the exponent of economy of scale in the Construction Cost Formula $C = A\ Q^{\wedge B}$, where C represents cost in 1,000 currency units and Q represents flow in 1,000 cmd. (Q represents average daily flow or plant capacity and has the same units in all formulas).

I, J

I is the coefficient of proportionality and J is the exponent of economy of scale in the Annual Material and Supplies Cost Formula $S = I\ (QA)^{\wedge J}$, where S represents the cost in 1,000 currency units per year and QA represents the average flow over the planning period.

K, L

K is the coefficient of proportionality and L is the exponent of economy of scale in the Annual Energy Consumption Formula $KWH = K(QA)^{\wedge L}$, where KWH represents 1,000 kilowatt-hours per year. The cost is computed by multiplying consumption with the local energy cost that resides in the CURRCNVT table.

H, M

H is the coefficient of proportionality and M is the exponent of economy of scale in the Annual Labor Formula $L = H(QA)^{\wedge M}$, where L represents person-hours per year. The annual labor cost is computed by multiplying person-hours with the local labor cost per hour that resides in the CURRCNVT table.

E&CPCT

E&CPCT (Engineering and Contingency) represents costs such as engineering, a contingency allowance, and any other costs associated with construction that are not normally included in the construction cost bid by a contractor. This cost is represented as a percentage of the construction cost. The sum of construction cost C and E&CPCT represents the capital construction cost (or investment). Practices in each country may result in a different percentage for E&CPCT. For example, turnkey design/construct contracts versus phased contracts would contain some of the engineering cost within the construction cost. Therefore, the percentage should be determined by the user to reflect local conditions. In any case, capital construction cost should include all contractors' costs of construction, including overhead and profit; costs of land, relocation, and right-of-way and easement acquisition; design engineering, field exploration, and engineering services during construction; administrative and legal services; start-up costs such as operator training; and interest during construction. Contingency allowances consistent with the level of complexity and detail of the cost estimates should be included.

SUBSIDYPCT

SUBSIDYPCT (Subsidy Percentage) is the percentage of the capital cost that may be paid by subsidies from the national government.

INTRATE

INTRATE (Interest Rate) represents the discount rate or opportunity value of money as used in standard engineering economics; it is expressed as annual percent. INTRATE is used in PAL functions that capitalize annual costs or annualize capital costs.

YRSAMORT

YRSAMORT (Years Amortization) represents the planning period in years. YRSAMORT is used in PAL functions that capitalize annual costs or annualize capital costs over the planning period. In the examples in Table 4, the service lives of facilities are assumed to be equal to the planning period, and therefore salvage value or replacement cost has been ignored to simplify the examples. More detailed economic and financial analysis should be used where justified.

SLUDGEP

SLUDGEP is the coefficient of proportionality in the formula SLD = (SLUDGEP)(QA), where SLD represents tons of dry solids per year. The formula is applicable to activated sludge processes, and the coefficient depends on the type of activated sludge process used. This field is included in Table TPCST because the ultimate disposal of sludges (transportation, landfilling, land application, and so on) is a secondary but major cost item.

SLUDGEQ

SLUDGEQ is the coefficient of proportionality in the formula SLC = (SLUDGEQ)(QA), where SLC represents tons of sludge cake or liquid per year from the facility. The coefficient depends on the degree of sludge dewatering achieved by the facility and addition of sludge conditioning chemicals, which also contribute to the solids. SLUDGEQ and SLUDGEP are related so that (SLUDGEQ)(% SOLIDS) = (SLUDGEP).

6.3.3 Local Cost Computations and Conversions

In those cases where costs are computed in one currency (as in examples where U.S. cost functions are used), conversion to local currency is done by using the appropriate data in Table CURRCNVT. Annual cost items of labor and energy are first computed in person-hours and kilowatt-hours, respectively. The local costs for these items are computed by using local rates rather than converting costs.

It should be noted that when cost functions from other countries are used, they should be adjusted by using appropriate indexes prior to inputting data into Table TPCST. The default values are based on U.S. costs and should be eventually replaced by local costs. The recommended approach is development of local coefficients and exponents for the cost functions indexed to a recent date. (The definition of cost functions requires at least two cost data points, but more are desirable.) The fields in the CURRCNVT table are described below.

CURRENCY

CURRENCY lists the name of currency for each country (e.g., U.S. dollars, leva, etc.).

VALUE

VALUE gives the ratio of the country currency to the U.S. dollar. This should be based on free-market values.

YEAR

YEAR gives the date for which the VALUE is valid.

COUNTRY

COUNTRY gives the country letter code (U, B, etc.).

COUNTRY-NAME

COUNTRY-NAME spells out the applicable country name.

LABORCOST

LABORCOST gives the local labor cost in local currency per hour. This cost should reflect actual market value, and subsidies to labor, such as housing, should be added to compute actual cost in an economic analysis.

ENERGYCOST

ENERGYCOST gives the local cost per 1,000 kilowatt-hours. The cost should be actual cost without subsidies. (Actual costs are necessary in a true economic analysis, although subsidized costs can be used in a cash flow analysis if the subsidies are expected to be long-term.)

MATLCOST

MATLCOST (Materials Cost) converts the annual cost of supplies and materials in the base currency into local currency units, and thus combines the effect of the exchange rate with an index of local cost of materials.

6.4 Reach Subsystem

The RCHFILE is the DEMDESS river network and is a central organizing component of DEMDESS. Its structure is based on the U.S. EPA River Reach File design, which has been developed and tested over many years.

RCHFILE defines the hydraulic structure of the river network and is designed to place water quality sites and emissions on the river so that hydraulic routing relationships are analytically available for analysis. RCHFILE combined with these links permits basic reporting and analysis functions, such as river profile plots and cumulative loadings computations. More advanced capabilities also are possible, such as water quality modeling and risk analysis.

The RCHFILE has a three-level hierarchical river network identifier:

1. The BASIN code, which identifies the major basin that the river is in,
2. The SEG (segment), which identifies the specific river, and
3. the KM (kilometer), which denotes the distance from the downstream end of the river.

With these three identifiers, any point on any river or stream can be uniquely identified, such as a water quality monitoring site or discharger.

One RCHFILE record exists for each "piece" of river, generally from confluence to confluence. An additional identifier, the SEQNO (hydraulic sequence number) provides much of the routing capabilities. SEQNO is the order in which the RCHFILE records should be processed in order to route the network from upstream to downstream. The RCHFILE routing structure is carefully designed so that no matter the size or complexity of the network, only one RCHFILE needs to be processed at a time. This means that the entire Danube basin could be processed in DEMDESS without regard to memory, providing enough disk space is available.

Examples using the RCHFILE routing algorithms are contained in several DEMDESS applications, including CUMLOAD.sc, RCHROUT.sc, and NEWROUTE.sc; the user is encouraged to study these scripts to best understand the RCHFILE routing techniques. These and other scripts are listed in Chapter 8.

Slovakia, Hungary, Bulgaria, and Romania all have standardized river kilometer networks that have been successfully converted into fully functioning RCHFILEs. Nothing suggests that the river networks of the other Danubian countries cannot be converted so that eventually the DEMDESS RCHFILE could serve as a single integrated Danube River network.

6.5 Water Quality Subsystem

The basic Water Quality Subsystem consists of two tables: WQSITES and WQDATA. WQSITES contains one record for each sampling site with a unique 10-character WQSITEID and links to the RCHFILE and WQSTDS. The Reach file link places the site at the proper place on the river; this link is essential to evaluate water quality samples properly in relation to other sites, dischargers, and the river network as a whole. The link to WQSTDS enables the user to identify in-stream sample results that are out of compliance with water quality standards.

The WQDATA table contains in-stream sample values with one record for each parameter value. The primary links are to WQSITES and PARMTABL. The WQDATA organization permits any number of sample results for any number of parameters to be stored. The WQSITES is essential to link the analysis result to the site. The PARMTABL link identifies the specific parameter measured, e.g., BOD_5.

A secondary table, not used much yet, is NPSLOAD, which contains nonpoint-source (NPS) loadings. This table is similar to the Emissions Subsystem, except for NPS loadings.

Chapter 7

DATABASE DICTIONARY

The DEMDESS database dictionary consists of descriptions of all data elements in each DEMDESS table, in alphabetical order. You should reference this dictionary to make sure you retain the DEMDESS database design while using the system, particularly when adding or updating data and enhancing DEMDESS. Developers of DEMDESS applications will find this dictionary useful as a reference when designing, implementing, and testing software.

Table: DISCHX.db

Field	Format	Units	Description
DISCHID	A10		User-defined unique identifier of a discharger
TREATCLASS	A15		Flow-stream path number, linked to the emissions record in Table EMISSX
SEQNO	N		Reach sequence number, used for routing
TAXID	A10		Identifier of tax record in Table TAXES
FINEID	A10		Identifier of fines record in Table FINES
WQSTD	A5		Identifier of effluent quality standard record in WQSTDS
PERMIT	A30		Identification code of discharge permit
PERMITDATE	D		Date of permit
COUNTRY	A1		B=Bulgaria, H=Hungary, R=Romania, S= Slovakia
INDCODE	N		Industry code in Table INDCODES
DISCHID-TO	A10		For an industrial discharger, the DISCHID of the municipal treatment plant
BASIN	N		River basin ID number (see Table RCHFILE)
SEG	N		River segment number within a river basin
KM	N	km	River kilometer, from downstream end of segment
POP	N		Population
QTOT	N	cmd	Average daily flow, for municipalities; includes industrial, residential, infiltration/inflow, etc.
IALTID	N		Discharger ID in country's originating database
NAME	A55		Name and description of discharger
NAMEC	A55		Name in Cyrillic

Field	Format	Units	Description
TPID	A10		Identifier of wastewater treatment plant location
TPLEV	A5		Identifier of treatment level record in Table TPCST
PTID	A10		Identifier of pretreatment plant location
PTLEV	A5		Identifier of pretreatment level in Table TPCST
KM1	N	km	Cross-reference to river location using hydrologic sequence logic used within a particular country
KM2	N	km	KM1 is river km on the Danube from the downstream end, and KM2,...,KM7 are river km on lower-order tributaries of the Danube
KM3	N	km	" "
KM4	N	km	" "
KM5	N	km	" "
KM6	N	km	" "
KM7	N	km	" "
KM8	N	km	" "
PROVINCE	A20		Province code or name for querying database
BASINAUTH	A20		River basin authority
INSPECTORATE	A20		Inspectorate name
RNGAUTH	A20		Regional authority
WTRAUTH	A20		Water supply or water resources authority
MUNAUTH	A20		Municipal authority
PERMITAUTH	A20		Authority issuing the discharge permit

Field	Format	Units	Description
QCAP	N	cmd	Existing capacity of wastewater treatment plant, either pretreatment or treatment, depending on INDCODE (-22 for municipalities)
QPEAK	N	cmd	Peak hydraulic flow into the wastewater treatment plant
DAYSOP	N	days	Days per year of operation
HRSOP	N	hours	Average hours per day of operation
QRES	N	cmd	Residential flow
QNONRES	N	cmd	Nonresidential flow
QIND	N	cmd	Total industrial flow entering a municipal plant
COLL-LENGTH	N	km	Length of sewers in the collection system
STREET-LENGTH	N	km	Length of streets in a municipality
PCTSEWERED	N	%	Percentage of population served by a municipal collection system
WTRSPPLYID	A10		Identification code for the water supply authority
WTRSPPLYID-TO	A10		Discharger ID of entity that receives effluent as its supply
WTRSPPLYTYPE	A1		User identification of type of supply (surface supply, groundwater supply, treated, etc.)
WTRSPPLYBASIN	N		River basin identifier in RCHFILE
WTRSPPLYSEG	N		River segment identifier in RCHFILE
WTRSPPLYKM	N	km	River kilometer, from downstream end of reach

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Table: EMISSX.db

Field	Format	Units	Description
DISCHID	A10		Identification code of the discharger
TREATCLASS	A15		Flow-path number of the discharger
PARMCODE	N		Parameter code number from Table PARMTABL
DISCHTYPE	A2		Flow-routing code
DATE	A6	(yymmdd)	Date when the sample was taken
TIME	A4	(hhmm)	Time when the sample was taken
VALUE	N	varies	Value of the water quality parameter
DATASRC	A6		Data source identification code
QCCODE	A6		Quality control code

Table: FINES.db

Field	Format	Units	Description
FINEID	A10		Fine identification number
WQSTD	A3		Water quality standard code
PARMCODE	N		Parameter code
FINE	N	see "FINEUNIT"	Value of fine
FINEUNIT	A6		Currency units for fine

Table: NPSLOAD.db

Field	Format	Units	Description
COND	A5		Flow condition (summer, low flow, etc.)
SEQNO	N		Hydrologic sequence number
BASIN	N		Basin number
SEG	N		Segment number
KM	N	km	River kilometer, from downstream end of segment
PARMCODE	N		Parameter code as in Table PARMTABL
LOADKGD	N	kg/d	NPS pollutant load
DISCHID	A10		Discharger identification number

Table: PARMTABL.db

Field	Format	Units	Description
PARMCODE	N*		Parameter code
PARMNAME	A25		Parameter name
ROMPARM	N		Romanian conversion code
PCODE-S-COE	N		Slovakian conversion code
PCODE-B-R-MOE	N		Bulgarian routine data conversion code
PCODE-B-S-JANTRA	N		Bulgarian Yantra special study conversion code
KOMP	A7		Hungarian conversion field #1
PCODE-HUNGARY	A3		Hungarian conversion field #2
PCODE-SLOVAKIA	A2		Slovakian conversion field

Table: PERMITS.db

Field	Format	Units	Description
PERMIT	A10		Identification code of the discharge permit
PARMCODE	N		Parameter code as in PARMTABL
TREATCLASS	N		Treatment class or flow path as in DISCHX table
PERMITAUTH	A20		Permitting authority
PERMITLIMIT	N	see "UNITS"	Permit limit (or bottom of range)
PERMITLIMIT2	N	see "UNITS"	Permit limit (top of range)
UNITS	A4		Units for permit limits

Table: RCHCHAR.db

Field	Format	Units	Description
COND	A10		Flow condition
SEQNO	N		Hydrologic sequence number
BASIN	N		Basin code
SEG	N		Segment number
KM	N	km	River kilometer, from downstream end of segment
FLOW	N	cmd	Stream flow
VEL	N	m/sec	Stream velocity

Table: RCHFILE.db

Field	Format	Units	Description
BASIN	N		The numerical code designation for the major river basin
SEG	N		The segment number of the reaches; all reaches of a given river have the same SEG value
KM	N	km	The river kilometer of the downstream point of the reach
TYPE	A1		The reach type code: S = start T = terminal R = regular
USBASIN1	N		The BASIN code of the main-stem upstream reach
USSEG1	N		The SEG code of the main-stem upstream reach
USKM1	N	km	The KM value of the main-stem upstream reach
USBASIN2	N		The BASIN code of the tributary upstream reach
USSEG2	N		The SEG code of the tributary upstream reach
USKM2	N	km	The KM value of the tributary upstream reach
DSBASIN	N		The BASIN code of the reach downstream
DSSEG	N		The SEG code of the reach downstream
DSKM	N	km	The KM value of the reach downstream
CBASIN	N		The BASIN code of the downstream complement reach; i.e., the other reach entering the downstream junction

Field	Format	Units	Description
CSEG	N		The SEG code of the downstream complement reach
CKM	N	km	The KM value of the downstream complement reach
LEV	N		The stream level of the reach
J	N		The LEV value of the reach downstream
SEQNO	N		The hydrologic sequence number; important for sorting in hydrologic order
SEGL	N	km	The length of the reach in kilometers
WQSTATUS	N		The current water quality status; links to WQSTDS
LOWQ	N	m^3/s	The low flow value for the reach
COUNTRY	A1		The country code for the reach
PROVINCE	N		The province code for the reach
PKM	N	km	Path km—not used
RCHNAME	A30		The name of the river
RCHNAMEC	A40		River name in Cyrillic
RCHJUNCDESC	A16		A description of the junction at the downstream end of the reach
BPATTERN	A20		Used for display of schematic diagrams of the river network; sort by SEQNO to use
KM1	N	km	River kilometer values; see entries in DISCHX
KM2	N	km	River kilometer values; see entries in DISCHX
KM3	N	km	River kilometer values; see entries in DISCHX
KM4	N	km	River kilometer values; see entries in DISCHX

Field	Format	Units	Description
KM5	N	km	River kilometer values; see entries in DISCHX
KM6	N	km	River kilometer values; see entries in DISCHX
RIVERNO	A7		Bulgarian river number
JUNCRIVNO	A7		Bulgarian junction river number
DIR	A1		Tributary direction
DAREA	N	ha	Drainage area
USLAT	A6	ddmmss	Upstream latitude
USLON	A6	ddmmss	Upstream longitude
DSLAT	A6	ddmmss	Downstream latitude
DSLON	A6	ddmmss	Downstream longitude
USLATN	N	degrees	Upstream latitude, numeric
USLONN	N	degrees	Upstream longitude, numeric
DSLATN	N	degrees	Downstream latitude, numeric
DSLONN	N	degrees	Downstream longitude, numeric
KMINPUT	N	km	Bulgarian junction kilometer

Table: TAXES.db

Field	Format	Units	Description
TAXID	A10		Tax identification number
WQSTD	A3		Water quality standard code
PARMCODE	N		Parameter code
TAX	N	see "TAXUNIT"	Value of tax
TAXUNIT	A6		Unit basis for the tax (e.g., kg, m^3, etc.)

Table: TPCHR.db

Field	Format	Units	Description
TREATID	A10		Identifier for specific wastewater treatment plant
TREATLEV	A5		General treatment level
PARMCODE	N		Parameter code as in Table PARMTABL
EFFLCONC	N	mg/L	Effluent concentration
PCTEFFL	N	%	Percent effluent discharged
DATASRC	A6		Data source code

Table: TPCST.db

Field	Format	Units	Description
TREATID	A10		Identifier for specific waste treatment plant
TREATLEV	A5		General treatment level
TREATDESC	A60		Treatment description
DATASRC	A6		Data source code
CURRENCY	A3		Currency units
A	N		Cost function coefficient (see Section 6.3.1 of this manual)
B	N		(See Section 6.3.1 of this manual)
I	N		(See Section 6.3.1 of this manual)
J	N		(See Section 6.3.1 of this manual)
K	N		(See Section 6.3.1 of this manual)
L	N		(See Section 6.3.1 of this manual)
H	N		(See Section 6.3.1 of this manual)
M	N		(See Section 6.3.1 of this manual)
E&CPCT	N		(See Section 6.3.1 of this manual)
SUBSIDYPCT	N		(See Section 6.3.1 of this manual)
INTRATE	N		(See Section 6.3.1 of this manual)
YRSAMORT	N		(See Section 6.3.1 of this manual)
SLUDGEP	N		(See Section 6.3.1 of this manual)
SLUDGEQ	N		(See Section 6.3.1 of this manual)

Table: WQDATA.db

Field	Format	Units	Description
WQSITEID	A10		Site identification code
PARMCODE	N		Parameter code
SAMPDATE	A6	yymmdd	Sample date
SAMPTIME	A4	hhmm	Sample time
LOCCODE	A1		Location code
QCCODE	A6		Quality control code
VALUE	N		Measured value
VAL-RMK	A1		Remark

Table: WQSITES.db

Field	Format	Units	Description
SEQNO	N		Sequence number
WQSITEID	A10		Site identification code
DATASRC	A6		Data source
BASIN	N		Basin number
SEG	N		River segment
KM	N	km	River kilometer
PROVINCE	A10		Province name
REGION	A10		Region name
COUNTRY	A1		Country name
STATYPE	A6		Station type
AGENCY	A10		Agency name
STARTDATE	A6	yymmdd	Start date for monitoring record

Field	Format	Units	Description
ENDDATE	A6	yymmdd	End date for monitoring record
WQSTADESC	A80		Description of location of WQ station
WQSTADESCC	A55		Description of location in Cyrillic
WQSTD	A3		Water quality standard code

Table: WQSTDS.db

Field	Format	Units	Description
WQSTD	A3		Water quality standard
PARMCODE	N		Parameter code
WQSTDVAL	N		Standard value (bottom of range)
WQSTDVAL2	N		Standard value (top of range)
UNITS	A4		Units for standard

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Chapter 8

DEMDESS PROGRAM SUMMARIES

DEMDESS programs are of two general types:

1. Utility functions, especially conversion and loading of country-specific emissions and water quality databases.

2. Applications, such as water quality profiles and loadings analyses.

Some programs are stand-alone applications, while others are a combination of many subsidiary programs. DEMDESS applications are usually developed in a prototyping mode and then combined into a "driver" script to make one complete application. A completed application can then be readily incorporated into the User-friendly DEMDESS.

This section contains brief summaries of many DEMDESS programs. Because DEMDESS is an evolving system with new programs being developed on a continuing basis, this section should be viewed as the starting point for collecting DEMDESS programs. It is hoped that DEMDESS developers will continue to add to this section.

Developers should be able to use this section to do the following:

1. Find existing DEMDESS programs that can be used as building blocks for enhancing existing applications or for building new applications.

2. Determine which applications may need to be changed if they modify a database structure.

Each program summary contains a brief description of the program and its associated "objects." These objects include queries, scripts, databases, reports, and graph settings used by the program, as well as other objects that in turn use the program.

8.1 Bulgaria

1. Function Description

- Primary object (driver): BDCNVT.sc
- Primary functions: Converts Bulgarian emissions data to DEMDESS
- Author: Tim Bondelid, February 1993
- Country: Bulgaria
- DEMDESS data needed: RCHFILE.db, DISCHX.db, EMISSX.db, WQSITES.db
- External data needed: CITYDSCH.db, FEEDLOT.db, ECONSECT.db, BULGDSCH.db, DSCHPROT.db
- Comments: none

2. List of Objects

Object	Description
BCITYCNV.sc	Converts CITYDSCH.db to DEMDESS format. Uses RCHFILE.db, CITYDSCH.db, DISCHX.db, EMISSX.db.
BFEEDCNV.sc	Converts FEEDLOT.db to DEMDESS format. Uses RCHFILE.db, FEEDLOT.db, DISCHX.db, EMISSX.db.
BDSCHCNV.sc	Converts BULGDSCH.db to DEMDESS format. Uses CITYDSCH.db, ECONSECT.db, RCHFILE.db, BULGDSCH.db, DISCHX.db, EMISSX.db.
BPROTCNV.sc	Converts emissions protocol forms to DEMDESS format. Uses EMISSX.db, DSCHPROT.db.
BDADDST.sc	Adds WQSTDS to DISCHX.db. Uses DSCHPROT.db, DISCHX.db.
GETSEQD.sc	Assigns RCHFILE SEQNOS. Uses RCHFILE.db, WQSITES.db, DISCHX.db.

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): BUL91LOD.sc
- Primary functions: Converts BULL.91 data to DEMDESS
- Country: Bulgaria
- Author: Tim Bondelid
- DEMDESS data needed: WQDATA.db
- External data needed: BULL91.txt
- Comments:

2. List of Objects

Object	Description
BULL91.txt	
WQDATA.db	Water quality data

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): CORRESP.sc
- Primary functions: Loads BULL91 site identification numbers into WQSITES
- Country: Bulgaria
- Author: Tim Bondelid
- DEMDESS data needed: WQSITES.db
- External data needed: CORRESP.txt
- Comments:

2. List of Objects

Object	Description
WQSITES.db CORRESP.sc	Water quality sites

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): DATACONV.sc
- Primary functions: Converts Bulgarian water quality data into DEMDESS format; creates the WQSITES and WQDATA tables
- Country: Bulgaria
- Author: John P. Tippett, January 1993
- DEMDESS data needed: none
- External data needed: HSAR1.dbf, HSAR2.dbf
- Comments: none

2. List of Objects

Object	Description
HSAR1.db	Paradox® version of HSAR1.dbf. Errors and dates corrected.
HSAR2.db	Paradox® version of HSAR2.dbf. Errors and dates corrected.
CONVHSAR.sc	Imports Bulgarian HSAR files into Paradox® format. Uses HSAR1.db, HSAR2.db, WQDATA.db, WQSITES.db, FIXCHAR.sc.
FIXCHARS.sc	Fixes extraneous characters in HSAR files.
SITEUPDT.sc	Updates WQSITES from HSAR files. Uses QHSAR1.sc, QHSAR2.sc, WQSITES.db.
DATAUPDT.sc	Updates WQDATA from HSAR files. Uses HSAR1.db, HSAR2.db, WQDATA.db.
QHSAR1.sc	Queries for unique WQSITE numbers in HSAR1. Uses HSAR1.db.
QHSAR2.sc	Queries for unique WQSITE numbers in HSAR2. Uses HSAR2.db.

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): DWMRG.sc and PWMRG.sc
- Primary functions: Converts POPOZOV data to DEMDESS
- Country: Bulgaria
- Author: Tim Bondelid
- DEMDESS data needed: PARMTABL.sc, EMISSNS.sc, DDATA.db, DSITES.db
- External data needed:
- Comments:

2. List of Objects

Object	Description
PARMTABL.sc	Parameter table
EMISSNS.sc	
DSITES.sc	
DDATA.db	

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): FILLIN.sc
- Primary functions: Fills in BOD_5 and TSS emission records for municipal dischargers that do not have them
- Country: Bulgaria
- Author: Tim Bondelid
- DEMDESS data needed: EMISS1.db, DISCH1.db, FILLIN1.db, FILLIN2.db
- External data needed:
- Comments:

2. List of Objects

Object	Description
EMISS1.db	Emissions scenario number one
DISCH1.db	Discharger scenario number one
FILLIN1.sc	
FILLIN2.sc	
FILLIN2a.sc	

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): FILLMLOD.sc
- Primary functions: Makes the MLOD1 table for use in RCHFILE
- Country: Bulgaria
- Author: Tim Bondelid
- DEMDESS data needed: RCHFILE.db, DISCH1.db, TRTPLCY1.db
- External data needed:
- Comments:

2. List of Objects

Object	Description
RCHFILE.db	Reach file
DISCH1.db	Discharger scenario number one
TRTPLCY1.db	Treatment policy number one

3. Examples of option screens, output, etc.

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1. Function Description

- Primary object (driver): PLOTOUT.sc
- Primary functions: Produces 11 plots for treatment policy example
- Country: Bulgaria
- Author: Max Clark
- DEMDESS data needed: PLOT1.db - PLOT11.db , PLOT7BA4.db
- External data needed:
- Comments:

2. List of Objects

Object	Description
PLOT1.db - PLOT11.db , PLOT7BA4.db	Tables to plot
PLOT1.sc - PLOT11.sc , PLOT7BA4.sc	Queries to create plot tables
PLOT1.g - PLOT11.g , PLOT7BA4.g	Graph files for graphing plot tables

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): PLOTS.sc
- Primary functions: Creates plots for Yantra basin
- Country: Bulgaria
- Author: Tim Bondelid
- DEMDESS data needed:
- External data needed:
- Comments:

2. List of Objects

Object	Description
PLOTEMP.sc	Empties plot tables
PLOT1a.sc, PLOT1b.sc, -1c, -2a, -2b, -2bx, -345, -345a, -3a, -4a, -4, -5a, -6, -7a, -7b, -7c, -7d, -7e, -7f, -8a, -8b, -9a, -9b, -10a, -10b, -11bx	Query scripts to create plots

3. Examples of option screens, output, etc.

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1. Function Description

- Primary object (driver): RFMAKEH.sc
- Primary functions: Makes Reach file from index file in Hungary
- Country: Hungary, Bulgaria
- Author: Tim Bondelid, April 1992
- DEMDESS data needed: none
- External data needed: RCHBAK.db
- Comments: Modified January 1993, to use Bulgarian standard river km network

2. List of Objects

Object	Description
RCHBAK.db	Data entry for river kilometers
RCHFILE.db	Full Reach file

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): TRTPLCY.sc
- Primary functions: Runs the four-step treatment policy analysis
- Country: Bulgaria
- Author: Tim Bondelid
- DEMDESS data needed:
- External data needed:
- Comments:

2. List of Objects

Object	Description
TRTPLCT1.sc, TRTPLCY1b.sc, -2, -3 ,-3a ,-4 ,-5	Treatment policy scripts

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): YANTRA.sc
- Primary functions: Runs treatment policy example for Yantra basin and plots out results
- Country: Bulgaria
- Author: Tim Bondelid
- DEMDESS data needed: See summaries for subscripts
- External data needed:
- Comments:

2. List of Objects

Object	Description
TRTPLCY.sc	Runs the treatment policy analysis
PLOTS.sc	Creates plots for Yantra basin
PLOTOUT.sc	Produces 11 plots

3. Examples of option screens, output, etc.

8.2 Hungary

1. Function Description

- Primary object (driver): CONVEMTP.sc
- Primary functions: Updates Hungarian EMISSX with EMISTEMP data
- Country: Hungary
- Author: John P. Tippett
- DEMDESS data needed: EMISSX.db, EMISTEMP.db
- External data needed:
- Comments:

2. List of Objects

Object	Description
EMISSX.db	Emissions table.
EMISTEMP.db	Temporary emissions update data.
QEMISSX.sc	Query inserts EMISTEMP.db into EMISSX.db.

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): CREATDCX.sc
- Primary functions: Creates DISCHX.db from SZNYIPAR.db, SZIPAR.db, etc.
- Country: Hungary
- Author: John P. Tippett, February 1993
- DEMDESS data needed:
- External data needed: SZNYIPAR.db, SZIPAR.db, SZNYTELE.db, SZITELE.db
- Comments:

2. List of Objects

Object	Description
SZNYIPAR.db	Industrial discharge information
SZIPAR.db	Industrial discharge information, yearly summaries
SZNYTELE.db	Municipal discharge information
SZITELE.db	Municipal discharge information, yearly summaries
QRECENT.sc	Calculates most recent year for yearly information
QRECENT2.sc	Calculates most recent year for yearly information
QRECENT3.sc	Calculates most recent year for yearly information
DISCHX.db	

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): DASIGNH.sc
- Primary functions: Assigns Hungarian DISCHX records to RCHFILE
- Country: Hungary
- Author: Tim Bondelid
- DEMDESS data needed: RCHFILE.db, DISCHX.db
- External data needed:
- Comments:

2. List of Objects

Object	Description
RCHFILE.db	Reach file table
DISCHX.db	Discharger table

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): EMISLODH.db
- Primary functions: Converts Hungary emissions databases to DEMDESS structures
- Country: Hungary
- Author: Tim Bondelid
- DEMDESS data needed: EMISSX.db, PERMITS.db, DISCHX.db, PARMTABL.db
- External data needed: SZNYTELE.db
- Comments:

2. List of Objects

Object	Description
EMISSX.db	Emissions table
PERMITS.db	Permits table
DISCHX.db	Discharger table
PARMTABL.db	Parameter table
SZNYTELE.db	Municipal discharger information

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): HCNVT1.sc
- Primary functions: Converts Hungarian emissions data to DEMDESS
- Country: Hungary
- Author: Tim Bondelid
- DEMDESS data needed:
- External data needed: SZNYTELE.db, SZNYIPAR.db
- Comments:

2. List of Objects

Object	Description
SZNYTELE.db	Municipal discharge information
SZNYIPAR.db	Industrial discharge information
EMISTEMP.db	

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): HWQDATA.sc
- Primary functions: Converts Vituki WQ data to DEMDESS structure
- Country: Hungary
- Author: Tim Bondelid, April 1992
- DEMDESS data needed: WQSITES.db
- External data needed: 08FF10,-11,-12,-15,-16,-17,-18,-19,-20,-22,-30,-33,-39,-41, 42,-44
- Comments:

2. List of Objects

Object	Description
08FF10.dbf - 08FF44.dbf	Vituki WQ data files
KATALOG.db	Catalog of WQ sites

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): KOMPGET.sc
- Primary functions: Pulls out KOMP spellings from Hungarian Emissions database
- Country: Hungary
- Author: Tim Bondelid
- DEMDESS data needed:
- External data needed: SZNYTELE.db, KOMPLIST.db
- Comments:

2. List of Objects

Object	Description
SZNYTELE.db KOMPLIST.db	Municipal discharger information

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): RFMAKEH.sc
- Primary functions: Makes RCHFILE.db from KM index file in Hungary
- Country: Hungary
- Author: Tim Bondelid
- DEMDESS data needed: RCHFILE.db
- External data needed:
- Comments:

2. List of Objects

Object	Description
RCHFILE.db	Reach file

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): ROUTLOAD.sc
- Primary functions: Routes Danube loads using RCHFILE
- Country: Hungary
- Author: Tim Bondelid
- DEMDESS data needed: RCHFILE.db
- External data needed:
- Comments: This routine may now be available in a newer version

2. List of Objects

Object	Description
RCHFILE.db	Reach file

3. Examples of option screens, output, etc.

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8.3 Romania

1. Function Description

- Primary object (driver): DASSIGNR.sc
- Primary functions: Assigns reach numbers to discharger sites
- Country: Romania
- Author: Tim Bondelid
- DEMDESS data needed: RCHFILE.db
- External data needed: ARGES.db
- Comments:

2. List of Objects

Object	Description
RCHFILE.db	Reach file
ARGES.db	Arges basin discharger data

3. Examples of option screens, output, etc.

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1. Function Description

- Primary object (driver): DISCH1R.sc
- Primary functions: Makes DISCH1 table for Romania
- Country: Romania
- Author: Tim Bondelid
- DEMDESS data needed: DISCHX.db, EMISSQ1.db, EMISSQ2.db, DISCH1.db
- External data needed:
- Comments:

2. List of Objects

Object	Description
GETSEQNO.sc	Updated seqnos in WQSITES.db and DISCHX.db
DISCHX.db	Discharger table
EMISSQ1.db	
EMISSQ2.db	
DISCH1.db	Discharger scenario number one

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): EMISRLD2.sc
- Primary functions: Supplements data for DISCHX in Romania
- Country: Romania
- Author: Tim Bondelid
- DEMDESS data needed: RCHSEGS2.db, DISCHX.db, INDCODES.db
- External data needed:
- Comments:

2. List of Objects

Object	Description
RCHSEGS2.db	
DISCHX.db	Discharger table
INDCODES.db	Industrial Codes table

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): EMISRLD3.sc
- Primary functions: Makes EMISSX.db table from EMISSROM.db merged with PARMTABL.db
- Country: Romania
- Author: Tim Bondelid
- DEMDESS data needed: EMISSX.db
- External data needed:
- Comments:

2. List of Objects

Object	Description
EMISSX.db	Emissions table
EMISMRG1.sc	Queries EMISSROM.db and PARMTABL.db

3. Examples of option screens, output, etc.

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1. Function Description

- Primary object (driver): EMISRLOD.sc
- Primary functions: Acts as DEMDESS load program for EMISSX data
- Country: Romania
- Author: Tim Bondelid
- DEMDESS data needed: DISCHX.db, EMISSROM.db
- External data needed:
- Comments:

2. List of Objects

Object	Description
J_AGPARM.db J_AGRA.db EMISSROM.db	

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): RFMAKER.sc
- Primary functions: Makes RF from KM index file in Romania
- Country: Romania
- Author: Tim Bondelid
- DEMDESS data needed: RCHFILE.db, ROMRCHIN.db
- External data needed:
- Comments:

2. List of Objects

Object	Description
RCHFILE.db	Reach file
ROMRCHIN.db	Table to hold user parameters
ROMRCHIN.f1	Form to get user parameters

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): ROMWQLOD.sc
- Primary functions: Serves as DEMDESS load program for WQ data
- Country: Romania
- Author: Tim Bondelid
- DEMDESS data needed: WQSITES.db, WQDATA.db
- External data needed: AG_SEC2.db, AG1_DATE.db
- Comments:

2. List of Objects

Object	Description
WQSITES.db	Water quality sites
WQDATA.db	Water quality data
AG_SEC2.db	
AG1_DATE.db	

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): TXTCODL.sc
- Primary functions: Makes text version of Romanian Codul numbers in RCHFILE
- Country: Romania
- Author: Tim Bondelid
- DEMDESS data needed: RCHFILE.db
- External data needed:
- Comments:

2. List of Objects

Object	Description
RCHFILE.db	Reach file

3. Examples of option screens, output, etc.

8.4 Slovakia

1. Function Description

- Primary object (driver): DASSIGNS.sc
- Primary functions: Assigns reach numbers from KM index file in Slovakia
- Country: Slovakia
- Author: Tim Bondelid
- DEMDESS data needed:
- External data needed: SRT.db
- Comments:

2. List of Objects

Object	Description
SRT.db	

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): DISCHCNV.cs
- Primary functions: Converts Slovakia Discharger file to DISCH1 table and EMISS1 table
- Country: Slovakia
- Author: Tim Bondelid
- DEMDESS data needed: DISCHX.db, DISCH1.db
- External data needed: VSTUP.db
- Comments:

2. List of Objects

Object	Description
DISCHX.db	Discharger table
DISCH1.db	Discharger scenario number one
VSTUP.db	
SEGMRG.sc	Queries DISCH1.db and RCHFILE.db

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): RFMAKES.sc
- Primary functions: Makes RCHFILE.db from KM index file in Slovakia
- Country: Slovakia
- Author: Tim Bondelid
- DEMDESS data needed: RCHFILE.db
- External data needed: HNISTRA.txt
- Comments:

2. List of Objects

Object	Description
HNISTRA.txt	Slovakia KM index file
RCHFILE.db	Reach file

3. Examples of option screens, output, etc.

8.5 All User Countries

1. Function Description

- Primary object (driver): CUMLOAD.sc
- Primary functions: Computes load percent and cumulative loads
- Country: All
- Author: Tim Bondelid
- DEMDESS data needed: RCHFILE.db, DISCH1.db, CUMLODIN.db, INDCODES.db
- External data needed:
- Comments:

2. List of Objects

Object	Description
CUMLOAD1.sc	Queries EMISS1.db, DISCH1.db, EMISPARM.db, INDCODES.db
CUMLOAD2.sc	Queries DISCH1.db, INDCODES.db
CUMLOAD3.sc	Queries CUMLOAD.db
CUMLOAD4.sc	Queries CUMLOAD.db
CUMLOAD5.sc	Queries RCHFILE.db
CUMLODIN.sc	Table to hold user parameters
CUMLODIN.f1	Form to get user parameters
EMISPARM.sc	Queries EMISSX and PARMTABL.db

3. Examples of option screens, output, etc.

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1. Function Description

- Primary object (driver): DEMWQLIB.sc
- Primary functions:
- Country: All
- Author: Tim Bondelid
- DEMDESS data needed:
- External data needed:
- Comments:

2. List of Objects

Object	Description
DEMWQ.sc	
DEMWQ1.sc	Uses WQPROF.sc
DEMWQ2.sc	Uses WQPROFS.sc
DEMWQCP.sc	
DEMWQCP1.sc	

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): GETESTAT.sc
- Primary functions: Reports emissions statistics by discharger
- Country: All
- Author: John P. Tippett
- DEMDESS data needed: EMISS1.db, DISCH1.db, PARMTABL.db, INDCODES.db, BASINTABL.db, STATLIST.db, REPTSPEC.db
- External data needed:
- Comments:

2. List of Objects

Object	Description
QGETSTAT.db	Queries EMISS1, DISCH1, PARMTABL, INDCODES, BASINTBL
GETSPEC.sc	Includes queries QINDLU, QBASLU, QINSLU, QPROLU, QRCHLY, QDCHLU, QPARLU (to make lookup tables)
STATLIST.db	
REPTSPEC.db	Holds user report specifications
REPTSPEC.f1	Input form for report specifications

3. Examples of option screens, output, etc.

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1. Function Description

- Primary object (driver): GETEVFIN.sc
- Primary functions: Reports emissions violators and associated fines
- Country: All
- Author: John P. Tippett
- DEMDESS data needed: DISCH1, WQSTDS, EMISVIOL, FINES, BASINTABL, REPTSPEC
- External data needed:
- Comments:

2. List of Objects

Object	Description
GETEVIOL.sc	Determines emission violations; uses EMISVIOL.db, WQSTDS.db, DISCH1.db
GETSPEC.sc	Includes queries QINDLU, QBASLU, QINSLU, QPROLU, QRCHLY, QDCHLU, QPARLU (to make lookup tables)
QGETFINE.sc	Queries EMISVIOL.db, FINES.db, WQSTDS.db, DISCHX.db, PARMTABL.db, INDCODES.db, BASINTABL.db; calculates fines
REPTSPEC.db	Holds user report specifications
REPTSPEC.f1	Input form for report specifications

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): GETFandT.sc
- Primary functions: Reports fines and taxes by discharger
- Country: All
- Author: John P. Tippett
- DEMDESS data needed: DISCH1.db, TAXES.db, INDCODES.db, BASINTABL.db, REPTSPEC.db
- External data needed:
- Comments:

2. List of Objects

Object	Description
GETSPEC.sc	Includes queries QINDLU, QBASLU, QINSLU, QPROLU, QRCHLY, QDCHLU, QPARLU (to make lookup tables)
QGETFINE.sc	Queries EMISVIOL.db, FINES.db, WQSTDS.db, DISCH1.db, PARMTABL.db, INDCODES.db, BASINTABL.db; calculates fines
QGETTAX.sc	Queries DISCH1, TAXES, INDCODES, BASINTABL; calculates taxes
QGETF&T.sc	Queries FINE2, TAX2
REPTSPEC.db	Holds user report specifications
REPTSPEC.f1	Input form for report specifications

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): GETFINES.sc
- Primary functions: Determines fines for emissions violators
- Country: All
- Author: John P. Tippett
- DEMDESS data needed: REPTSPEC.db, FINELIST.db
- External data needed:
- Comments:

2. List of Objects

Object	Description
QGETFINE.sc	Queries EMISVIOL.db, FINES.db, WQSTDS.db, DISCH1.db, PARMTABL.db, INDCODES.db, BASINTABL.db; calculates fines
GETSPEC.sc	Includes queries QINDLU, QBASLU, QINSLU, QPROLU, QRCHLY, QDCHLU, QPARLU (to make lookup tables)
REPTSPEC.db	Holds user report specifications
REPTSPEC.f1	Input form for report specifications
FINELIST.db	Table of fines by discharger

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): GETSEQNO.db
- Primary functions: Updates SEQNOS in WQSITES and DISCHX
- Country: All
- Author: John P. Tippett
- DEMDESS data needed: RCHFILE.db, WQSITES.db, DISCHX.db
- External data needed:
- Comments:

2. List of Objects

Object	Description
RCHFILE.db	Reach file
WQSITES.db	Water quality sites
DISCHX.db	Discharger table

3. Examples of option screens, output, etc.

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1. Function Description

- Primary object (driver): GETTAXES.sc
- Primary functions: Produces summary report of taxes by industry
- Country: All
- Author: John P. Tippett
- DEMDESS data needed: ROUTSPEC.db, TAXLIST.db
- External data needed:
- Comments:

2. List of Objects

Object	Description
GETSPEC.sc	Includes queries QINDLU, QBASLU, QINSLU, QPROLU, QRCHLY, QDCHLU, QPARLU (to make lookup tables)
QGETTAX.sc	Queries DISCH1, TAXES, INDCODES, BASINTABL; calculates taxes

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): GETWQDAT.sc
- Primary functions: Reports on WQDATA file
- Country: All
- Author: John P. Tippett
- DEMDESS data needed: WQDATA.db, WQSITES.db, REPTSPEC.db
- External data needed:
- Comments:

2. List of Objects

Object	Description
REPTSPEC.db	Holds user report specifications
REPTSPEC.f1	Input form for report specifications
QGETWQ.sc	Queries WQSITES.db

3. Examples of option screens, output, etc.

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1. Function Description

- Primary object (driver): GETWVIOL.sc
- Primary functions: Reports ambient WQ violations
- Country: All
- Author: John P. Tippett
- DEMDESS data needed:
- External data needed:
- Comments:

2. List of Objects

Object	Description
GETSPEC.sc	Includes queries QINDLU, QBASLU, QINSLU, QPROLU, QRCHLY, QDCHLU, QPARLU (to make lookup tables)
QWQVIOL.db	Queries WQDATA, WQSITES, RCHFILE, WQSTDS, PARMTABL, DISCH1
REPTSPEC.db	Holds user report specifications
REPTSPEC.f1	Input form for report specifications

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): INVENTRY.sc
- Primary functions: Produces inventory of data in DEMDESS
- Country: All
- Author: Tim Bondelid
- DEMDESS data needed: DISCHX.db, EMISSX.db, RCHFILE.db, WQDATA.db, WQSITES.db, WQSTDS.db, FINES.db, TAXES.db, TPCHR.db, TPCST.db
- External data needed:
- Comments:

2. List of Objects

Object	Description
DISCHX.db	Discharger table
EMISSX.db	Emissions table
RCHFILE.db	Reach file
WQDATA.db	Water quality data
WQSITES.db	Water quality sites
WQSTDS.db	Water quality standards
FINES.db	Fines table
TAXES.db	Taxes table
TPCHR.db	Treatment plant characteristics
TPCST.db	Treatment plant costs

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): LOADCMP.sc
- Primary functions: Computes loads
- Country: All
- Author: Tim Bondelid
- DEMDESS data needed: DISCH1.db, INDCODES.db, EMISS1.db, PARMTABL.db
- External data needed:
- Comments:

2. List of Objects

Object	Description
LOADCMP1.sc	Queries DISCH1.db, INDCODES.db, EMISS1.db, PARMTABL.db
LOADCMP2.sc	Queries LOADCMP1.db

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): NEWROUTE.sc
- Primary functions: Routes pollutant loads
- Country: All
- Author: John P. Tippett
- DEMDESS data needed: EMISSX, DISCHX, RCHFILE, PARMTABL, ROUTSPEC
- External data needed:
- Comments:

2. List of Objects

Object	Description
SETDFLTS.sc	Plays QMAXMIN.sc query
QPARLU.sc	Creates parameter lookup table
QROUTE1.sc	Queries EMISSX, DISCHX, RCHFILE, RCHCHAR, PARMTABL
QROUTE2.sc	Queries QROUTE1, NPSLOAD, RCHCHAR, RCHFILE, PARMTABL
QMERGE.sc	Insert query; merges RCHFILE in with DISCHARGERS
QROUTE.sc	Extracts results to be graphed from the routing results file
WQPROF.sc	Determines ambient WQ profile
PREPGRAF.sc	Interpolated between records in the WQPROF file to give a continuous (1 km increment) file to be graphed
PREPGRF2.sc	As above, but for file QROUTE1
QCOMBINE.sc	Combines ambient WQ profile data with routing data so that they can be graphed simultaneously

3. Examples of option screens, output, etc.

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1. Function Description

- Primary object (driver): NVPRNMRG.sc
- Primary functions: Merges WQ stat descriptions into WQSITES
- Country: All
- Author: Tim Bondelid
- DEMDESS data needed: WQSITES.db
- External data needed: NPVRM.db
- Comments:

2. List of Objects

Object	Description
WQSITES.db NPVRM.db	Water quality sites

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): SHOWMENU.sc
- Primary functions: Shows menu for selecting parameters, industry groups
- Country: All
- Author: Tim Bondelid
- DEMDESS data needed:
- External data needed:
- Comments:

2. List of Objects

Object	Description

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): WQPROF.sc
- Primary functions: Extracts reach segments from basin
- Country: All
- Author: Tim Bondelid
- DEMDESS data needed: WQPROFIN.db, PARMTABL,db, RHCFILE.db
- External data needed:
- Comments:

2. List of Objects

Object	Description
RCHSEGS.sc	Query of RCHFILE.db
WQPROF1.sc	Query of WQSITES.db, RCHFILE.db, WQDATA.db
WQPROF2.sc	Query of WQSITES.db, RCHFILE.db, WQDATA.db
WQPROF3.sc	Query of WQDATA.db and PARMTABL.db
RCHFILE.db	Reach file
WQPROFIN.db	Holds user input
WQPROFIN.f1	Form to get user parameters
WQPROFIN.f2	Form to get user parameters
PARMTABL.db	Parameter table

3. Examples of option screens, output, etc.

1. Function Description

- Primary object (driver): WQSPRED.sc
- Primary functions: Makes spreadsheet of WQ data
- Country: All
- Author: Tim Bondelid
- DEMDESS data needed: WQDATA.db, WQSITES.db, RCHFILE.db
- External data needed:
- Comments:

2. List of Objects

Object	Description
WQPROF3.sc	Query of WQSITES.db, RCHFILE.db, and WQDATA.db
WQSPRED1.sc	Query of WQSITES.db, RCHFILE.db, and WQDATA.db
WQSPRED2.sc	Query of WQSPRED1.db, WQSPRED2.db

3. Examples of option screens, output, etc.

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Chapter 9

A PARADOX® PRIMER FOR DEMDESS USERS

9.1 Introduction

This section introduces you to the basics of using Paradox® and the Paradox® Application Language (PAL) in the context of DEMDESS applications. Several hints and "tricks" are covered that should be helpful in designing your own DEMDESS routines. Please refer to the Paradox® documentation for detailed assistance.

9.2 Scripts

"Programs" in Paradox® are called scripts and are written in PAL. PAL scripts can be written to lengthy processing tasks, interact with users, display graphs, and for many other functions. The Editor (see *Paradox® User's Guide*, Chapter 12) is essentially a word processor for writing PAL scripts.

9.2.1 Using the Editor

Select {Script} {Edit} {New} to open a blank window for writing a new script. Enter a name for the script at the prompt.

Select {Script} {Edit} {Open} to edit an existing script. Enter the name of the script to edit at the prompt. If you do not know the name of the script, press <Enter> to see a list of all scripts in the current subdirectory. Use the arrow keys to move around or press a letter to move the cursor to scripts starting with that letter.

When you have completed writing a script, press <F2> to save it and exit the Editor. To exit without saving your changes, press <F10> and select {Cancel} {Yes}.

9.2.2 Playing a Script

To play a script, select {Script} {Play} from the main menu. Type the name of the script or press <Enter> and use the list to select the name. To see the actions of a script as it plays, select {Script} {Showplay}.

9.2.3 Debugging

When developing a script, it is often necessary to locate and remove errors in the code. This process is called "debugging." The Paradox® Debugger allows you to step through your script one line at a time. You can enter the Debugger in two ways: 1) if your script stops playing due to an error, you will be prompted whether to cancel or debug; and 2) you can run the Debugger by pressing <Alt-F10>. (The PAL Debugger is discussed in Chapter 10 of the *PAL Programming Guide*.)

9.3 PAL Programming

PAL Programming is covered in depth in both the *PAL Reference Guide* and the *PAL Programmer's Guide*. The following text covers several key commands and tricks that will be helpful to beginner DEMDESS programmers.

9.3.1 VIEW vs. EDIT

Both the VIEW and EDIT commands bring up the specified table as an image on the screen. Use VIEW when you want to read information from a table. Use EDIT when you also want to write information in a table.

9.3.2 CLEAR vs. CLEARALL

CLEAR clears off the PAL "canvas"; i.e., the screen background where output is written. CLEARALL, on the other hand, removes all image windows from the screen, including queries.

9.3.3 Making Comments

It is a very good idea to put comments into your scripts as you are programming. In PAL, comments must be preceded by a semicolon. Comments are allowed on the same line as code, as long as they are preceded by a semicolon.

9.3.4 SCAN... ENDSCAN

The SCAN loop steps through each record in a table, each time executing the code inserted between the SCAN and ENDSCAN statements. This is a very useful tool for performing an

operation on all records in a table. In the example below, the value "B" is assigned to the [country] field for each record in the table DISCHX.

```
Example:      edit "DISCHX"
SCAN
    [country] = "B"
ENDSCAN
```

9.3.5 FOR... ENDFOR

The FOR loop executes a sequence of commands for a specified number of times. The code to be repeated is placed between the FOR and ENDFOR statements. In the example below, the final value of "x" is 10.

```
Example:      x = 0
FOR x FROM 1 to 10
    x = x + 1
ENDFOR
```

9.3.6 WHILE... ENDWHILE

The WHILE loop continues to execute the statements between WHILE and ENDWHILE until a specified condition is met. In the example below "x < 10" is the condition. The final value of x will be 9.

```
Example:      x = 0
WHILE x < 10
    x = x + 1
ENDWHILE
```

9.3.7 LOCATE

The LOCATE command is used to locate records in a table quickly. The syntax for the LOCATE command is as follows:

```
LOCATE "String1" "String2" ...
```

The command searches for the first record where the first field in the table equals "String1," the second field equals "String2," and so on. If a matching record is found, the record pointer moves to that record and the variable RETVAL becomes "true." Issuing the command LOCATE NEXT "String1"... will find the next matching record.

9.3.8 SWITCH

The SWITCH command is identical to the CASE statement in many other programming languages. SWITCH is used to choose between multiple courses of action, based on the value of "condition." The syntax for the SWITCH command is as follows:

```
SWITCH
    CASE condition1: actions1
    CASE condition2: actions2
    (and so on..)
    OTHERWISE: action3
ENDSWITCH
```

Example:

```
country = "United States"
SWITCH
    CASE country = "Romania": ccode = "R"
    CASE country = "Bulgaria": ccode = "B"
    CASE country = "Hungary": ccode = "H"
    CASE country = "Slovakia": ccode = "S"
    OTHERWISE: ccode = "?"
ENDSWITCH
```

In the example, the resulting value for ccode is "?"

9.3.9 MOVETO

The MOVETO command is most commonly used in two ways:

1. Moving to a particular field in a table.

   Example: MOVETO FIELD "Country"

2. Moving to a particular record in a table.

   Example: MOVETO RECORD 12 -or-

   MOVETO RECORD nrecords("DISCHX")

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9.4 Queries

A query is a powerful Paradox® tool used to ask questions about a table or multiple tables. To create a query, select {Ask} from the main menu. At the prompt, type in the name of a table. A query form (a one-row representation of the table) will appear on the screen. You ask questions about the table by placing various codes or examples in the form (see Section 9.4.4 below). To process the query, press <F2> (the Do_it! key). When playing a *query script* in PAL, you must first play the query and then execute it with the Do_it! command. The results of the query will appear in a table called ANSWER.

9.4.1 The Check

To include a field in the ANSWER table, you must place a check in it. To place a check, go to the field and press <F6>. To check all fields, press <F6> in the first column of the query form. Checks will then appear in all fields.

9.4.2 Selection Criteria

When you enter *selection criteria* in a field, only records that meet those criteria will be sent to the ANSWER table. Below are some examples of selection criteria:

Criteria	Description
<= 5	entries less than or equal to 5
<5, >1	entries between 5 and 1
Bulgaria	entries equal to "Bulgaria"(Queries are case-sensitive!)
DISCH..	entries beginning with DISCH
kg or g	entries equal to "kg" or "g"

9.4.3 Querying More Than One Table

Querying several tables is similar to querying one table, except for the following:

1. You fill out a query form for each table.
2. You use *example elements* to tell Paradox® how the data in the tables are linked.

9.4.4 Example Elements

Tables in a multiple query are linked by common fields that must contain the same type of data (i.e., the field type must be the same—A10, N, D, etc). To link fields between tables, type the same example element in each field. To type an example element, you must first press <F5>. Example elements will appear highlighted in a gray block.

An example element also serves as a variable that holds the values for the field. Consequently, the example element can be used to perform calculations, insert new records based on old ones, and so on.

9.4.5 Calc Statements

Calc statements let you calculate a new value (numerical or string) and place it in a new field. Below are some examples of calc statements.

The syntax of the calc statement is as follows:

CALC function AS newfield

where "newfield" is the name of a new field.

The function part of the calc statement can take on many forms. Some examples are listed below (words in boldface represent example elements):

CALC 5 * **load** AS newload
CALC **city** + ", Georgia" AS citystate
CALC **km** / **hours** AS kph

9.4.6 Tilde Variables

Tilde variables allow you to pass an outside value into a query as a selection criterion. Tilde variables consist of the name of the PAL variable preceded by a tilde "~." Say, for example, that the string "Bulgaria" was assigned to the variable "Country." If the tilde variable ~Country was then placed in a query field (of the same data type), only records with the element "Bulgaria" would be selected. Figure 4 shows a query for two tables: "INFO1" and "PARMTABL". Notice that the "COUNTRY" field is selected with a check and that it contains "Hungary" as a selection criterion. The "YEAR" field is also selected and has "greater than 1990" as a selection criterion.

The "PARMCODE" field contains the example element **code**. In the second table, "PARMTABL," **code** is also placed in the "PARMCODE" field. This creates a link between the two tables, based on the common field "PARMCODE." In this case, the link was created so that the parameter name "PARMNAME" could be displayed instead of just the parameter code "PARMCODE."

```
≡ View  Ask  Report  Create  Modify  Image  Forms  Tools  Scripts  Exit

[■]                          Query INFO1                                [ ]
TEMP2 | COUNTRY      | YEAR       | VALUE | PARMCODE
      | √ Hungary    | √ > 1990   | √     | code
      1 of 1

                          Query PARMTABL
PARMTABL | PARMCODE | PARMNAME
         | code     | √ ~pname
```

Figure 4: Example of Multiple-Table Query

Finally, note the tilde variable ~pname in the "PARMNAME" field. The query will retrieve only records for which "PARMNAME" is equal to the string stored in the variable "pname."

9.4.7 The Insert Query

An *insert query* is used to insert values into a table from other tables. To create an insert query, type "insert" in the first column of the receiving table. Use example elements to link in the fields from the other tables.

9.4.8 Creating "OR" Conditions

The query form allows you to enter multiple lines to form "OR" conditions. In Figure 5, the query will select either records with

Country = "Bulgaria" and "Parmcode" = 22

OR

Country = "Hungary" and "Parmcode" = 19.

NOTE! When creating "OR" queries with multiple tables, do not use the same example element name on more than one row. Say, for example, that **code** is used to connect the Parmcode field in two tables (in line one). On line two, the example element for that same link must be different, such as **code2.**

```
≡ View  Ask  Report  Create  Modify  Image  Forms  Tools  Scripts  Exit

╓[■]═══════════════════════ Query \INFO2
═══════════════════════[↑]═╕
\INFO2 |          COUNTRY          |     PARMCODE     |      VALUE
 |▲
       |√ Bulgaria                  |√ 22              |√
 |■
       |√ Hungary                   |√ 19              |√
 |▒
       |                            |                  |
```

Figure 5: Example of an "OR" Query

9.4.9 Saving/Modifying a Query

Queries can be saved to a file and played again, just like a script. To save a query, select {Script} {QuerySave}. Type in the name of the query at the prompt. When you play the query script, the query forms will be placed on the screen. To execute the query, you must press <F2>.

You can edit a saved query in two ways:

1) Play the query script. The query forms will be placed on the screen and you can edit them as normal.

2) Edit the query script with the PAL Editor. When you edit the script in this fashion, it will appear different from the standard query form. It is important to keep the structure of the query intact by making sure that all the "|" characters line up.

9.4.10 Renaming the ANSWER Table

When playing queries within a PAL script, it is a good idea to rename the ANSWER table immediately. Otherwise, when another query is processed, the ANSWER table will be overwritten. To rename a table in PAL, use the RENAME command:

RENAME "tablename" "newname"

To rename a table from the main menu, select {Tools} {Rename} {Table}. Enter the table name at the first prompt and the new name at the second prompt.

9.5 Reports

Paradox® *reports* can be used both to format output and as a calculation tool. To create a report, select {Report} {Design} from the main menu. At the prompt, type in the name of the table you wish to report on. (Reports in Paradox® must be associated with a table.)

Press <Enter> and select an *Unused Report* from the report list. At the next prompt, type a name for the report. This name will be shown at the top of the report. Press <Enter> and select between a *Tabular* and *Free Form* report. (Tabular reports are appropriate for most DEMDESS applications. See page 149 in the *Paradox® User's Guide* for a complete explanation.) Press <Enter> again to enter the *Report Designer*.

In the Report Designer, you lay out fields and enter headings to create a report format. The text below discusses a few commands and tricks to make designing your report easier. Refer to Chapter 8 of the *Paradox® User's Guide* for a complete discussion of reports.

9.5.1 Placing a Field

To place a field, select {Field} {Place} {Regular}. Use the scrollable list to select a field to place. Use the arrow keys to move to the placement location. Press <Enter> to place the field.

9.5.2 Placing a Calculated Field

A *calculated field* lets you perform calculations on the values in an existing field to come up with a new value. The new values are not stored in the table; they are just shown on the report. To place a calculated field, select {Field} {Place} {Calculated}. At the Expression prompt, enter a calculation expression. Table fields in the expression are represented inside brackets "[ ]." Some example expressions are as follows:

```
[load_day] / 24
(32 + [time] * [dist]) / 10
"DR. " + [name]
```

There are other types of calculated fields, including summary fields. See Chapter 8 of the *Paradox® User's Guide* for details.

9.5.3 Bands

Bands are a key feature of the Paradox® Report Designer. There are four kinds of bands: *report bands, page bands, group bands*, and *table bands*. Think of the bands as stacked layers of a report. On the screen, bands show up as a thin horizontal line running across the entire screen.

When you first view an unused report, the table band will contain each of the fields in the table. When the report is printed, everything in the table band will be printed **for each record in the table**. Consequently, one small report form allows you to report all the data in the table.

Group bands are used to group the data in the report by a specific field. You may have multiple nested group bands in a report. See Chapter 8 in the *Paradox® User's Guide* for a full description of using group and other types of bands.

9.5.4 Deleting a Line

Press <Ctrl Y> to delete the line the cursor is on. You must be all the way to the left of the report for <Ctrl Y> to work.

9.5.5 Lookup Tables

Lookup tables allow you to join other tables into your report. There are three requirements for using a lookup table:

1) The report table and the lookup table must share a common field.

2) Every keyed field in the lookup table must have a paired field in the report table.

3) The lookup table must have at least one key field.

To link in a lookup table, select {Field} {Lookup} {Link}. At the prompt, type in the name of the lookup table. Paradox® will then ask you to identify matching fields for each keyed field in the lookup table.

When complete, the name of the lookup table will now be present in the field placement list. To place a lookup field in the report, select the lookup table name. A new scrollable list will appear with the field names in the lookup table. Select a field and continue as normal.

9.5.6 Deleting Tables

When you delete a Paradox® table, all of its associated tables and forms will also be deleted. If instead you want to empty a table but still keep the report, select {Table} {Empty} from the main menu.

9.5.7 Outputting Reports

To output a report, select {Report} {Output}. At the prompt, type in the name of the report. In the next window, select the report to output. In the final window, select the output device: {Screen}, {Printer}, or {File}.

To output only a portion of a report, select {RangeOutput} in place of {Output}.

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9.6 Forms

Paradox® forms can be used both to display data and to receive input from users. To create a form, select {Form} {Design}. At the prompt, type the name of the associated table. Then, use the scrollable list to select a form. As with reports, a form cannot exist independently of a table.

The *Form Designer* works similarly to the Report Designer. In addition, you can change screen colors by selecting {Style}{Color} {Area}. The Form Designer also allows you to move blocks of text by selecting {Area} {Move}. See page 16 in the *Paradox® User's Guide* for detailed information on form design.

9.6.1 Using a Form to Get Input Parameters

A form can be used as a quick and easy way to obtain information from users. One way to do this is by creating a *one-record input table*. There are three steps to creating the input table:

1) Create a table with field names that correspond to input data.

2) Design a form from that table.

3) Insert the following code into your PAL script:

```
edit "tablename"      (insert your table name)
pickform 1            (or the appropriate number for your form)
wait record
    Prompt "Press <F2> when done"
until "F2"
do_it!
```

This code will bring the form up onto the screen and allow users to input data. The data will all be stored in one record in the table "tablename." When the user presses <F2>, the program will continue.

9.6.2 Adding Lookup Tables and Defaults

You can add lookup tables, default values, and other similar features to your input form. These features are accessed by selecting {Modify}{Edit}. At the prompt, type the lookup table name. You will then enter *Edit Mode*. Select {ValCheck} {Define} from the menu. The list that appears will allow you to set these features for each field. Once a lookup table is defined, it can be activated in form view by pressing <F1>.

Appendix A

THE DANUBE EMISSIONS MANAGEMENT DECISION SUPPORT SYSTEM (DEMDESS)†

This chapter provides an overview of the structure and status of DEMDESS and its potential uses as a decision support tool. The following topics are discussed: a general water quality management framework for large river basins; the design of DEMDESS and the information that can be stored and analyzed using the system; the principal clients and users of DEMDESS; and the status of DEMDESS in each of the four study countries. The *User Manual* provides more detailed information on the structure of DEMDESS.

A.1 The Need for Emissions Management

The need for emissions management can be best described by defining the relationship of emissions management to the overall water quality management framework. Figure 5.1 presents in graphic form the three subsystems within a water quality management framework, which is applicable to the Danube River basin or any other large river basin. The three subsystems, in summary, are as follows:

- **The Emissions Subsystem:** This subsystem includes all point and nonpoint sources of emissions, such as municipal, agricultural, and industrial wastewater, treated effluent, stormwater, and groundwater.
- **The Environment and Impact Subsystem:** This subsystem includes the environment and other entities that are affected by the emissions. Water quality and quantity and water uses are the major concerns in this subsystem.
- **The Institutional Subsystem:** This subsystem includes all the organizations and individuals that together define the rules and physical interventions by which the emissions subsystem is controlled.

The three subsystems are highly interrelated, and the interrelationships occur at a large number of physical points and other interfaces. For example, thousands of diverse upstream pollutant sources impact the water quality at a given river section, and the regulations and organizations

† **NOTE:** This appendix is reprinted from Chapter 5 of WASH Field Report No. 374, "Point Source Pollution in the Danube Basin, Volume I," July 1992. It describes the use and status of DEMDESS during phase one of the DEMDESS project, from September 1991 to July 1992.

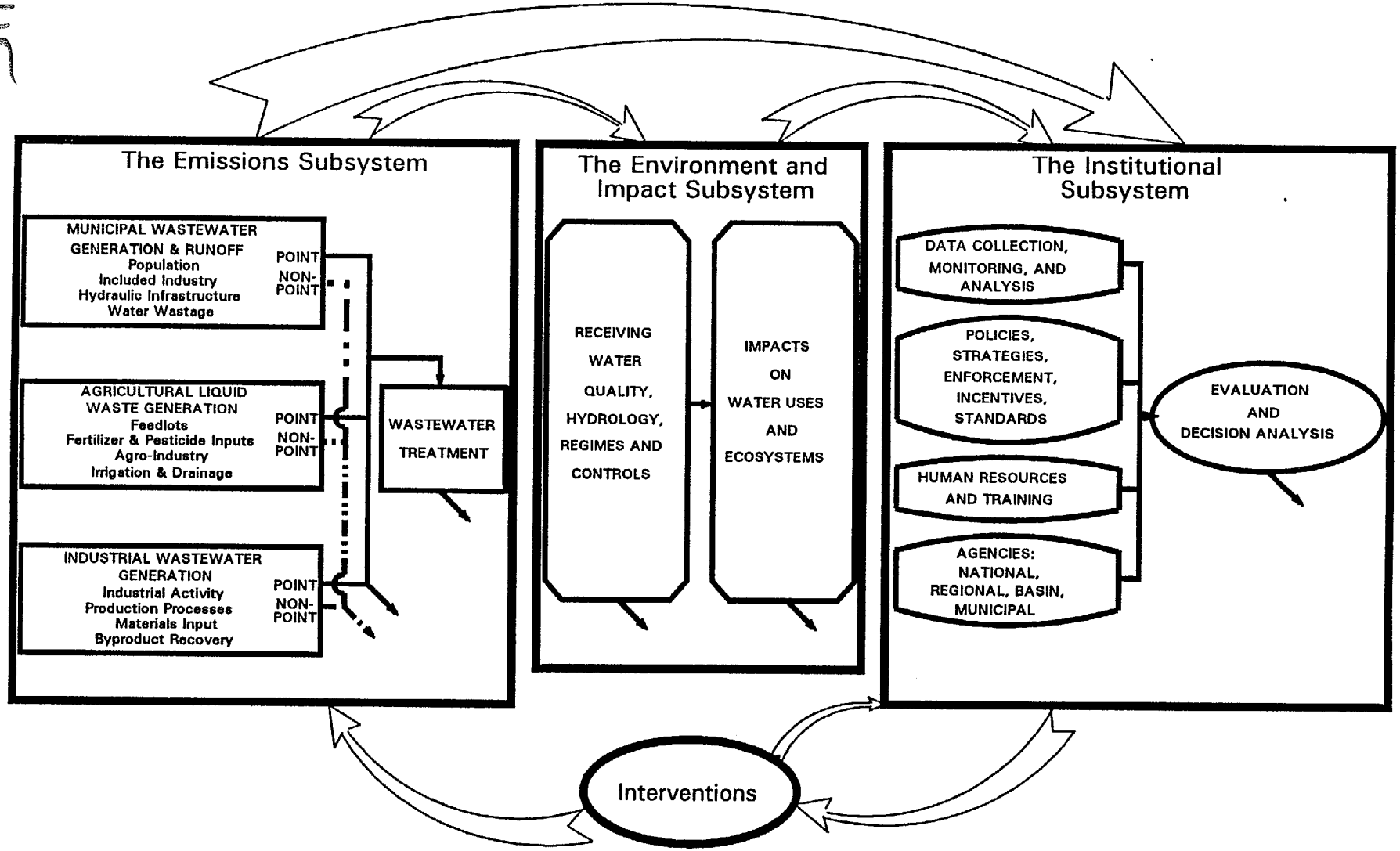

Figure A.1

Water Quality Management Framework

that control either the sources or the water use are many. Formulating regulatory policies, planning technical interventions, and organizing related institutions in such a large and complex system require a decision support system. A decision support system is and information system that is designed to assist decision makers. It does so by presenting to them the best available and most relevant information on which to base their decisions. It does not make decisions, and it will inevitably omit certain judgmental aspects that cannot easily be made explicit or reduced to formal analysis. However, it combines large amounts of basic data, technical procedures for analyzing those data, the processing power of modern computers, and efficient techniques for presenting information in easily understandable form.

A decision support system enhances the effectiveness of decision makers in three ways. First, it relieves them of time-consuming and technically demanding data reduction tasks, thus allowing them to focus directly on the key aspects of the decisions they are called on to make. Second, it employs sophisticated analytic methods to explore the implications of information, implications that might otherwise be missed. Third, it organizes and presents findings in forms that are easily and readily understood.

A.2 The Design of DEMDESS

The Danube Emissions Management Decision Support System (DEMDESS) is designed to assist decision makers who are concerned at some level with affecting the discharge of pollutants into the Danube River or its tributaries. It is intended to be a part of a larger decision support system that covers the entire field of water quality management in the Danube River basin (perhaps eventually all water management, or even all environmental management). Although it is closely related in concept to these broader concerns, its immediate focus is the direct or indirect discharge of pollutants, a topic that has received less attention in some countries than ambient water quality conditions, health effects, and other major aspects of water quality management.

Policies designed to achieve an appropriate level of water pollution control for the Danube River and the Black Sea must focus primarily on limiting discharges or emissions of pollutants into the Danube and its tributaries. Nonconservative pollutants can be assimilated and conservative and nonconservative pollutants can be diluted, but assimilation and dilution cannot be the cornerstones of pollution control policy because they have only a limited capability to reduce pollution damage. Reduction of emissions must be the main instrument of pollution control policy, and emissions themselves are the strategic variables in DEMDESS.

Although its focus is emissions, DEMDESS must address all the subsystems of the water quality management framework (Figure 5.1) to be an effective decision support system. The framework reflects the ways in which emissions are generated, the effects they produce, and the institutional control subsystem through which water quality can be managed. Full implementation of a decision support system encompassing all of the subsystems of this conceptual framework will present to decision makers the full implications of the pollution control policy and investment options among which they may choose. Interventions such as

constructing wastewater treatment plants are initiated according to a certain regulatory policy. Such policies and their application must consider pollution effects and costs. For example, regulations to require a uniform standard of biological treatment for all municipal wastewaters in a country would have immense cost implications and would not necessarily achieve desired water quality in all waters at minimum cost. Alternatives to such a policy must be evaluated, and DEMDESS is a useful tool for doing this.

A decision support system can help in the formulation of cost-effective policies by estimating water quality and the economic and financial impacts of various options. Another significant policy issue is phasing of interventions. Interventions that provide the highest pollution reduction for investment should be identified by a decision support system and given high priority. The interventions need not always be structural or "end-of-pipe," however. Nonstructural interventions are often the most effective solution. For example, effluent standards that address key pollutants, backed up by monitoring and enforcement, will affect in-factory procedures for waste management, as well as treatment decisions, and may also induce changes in processes. Taxing (or removing subsidies on) certain raw materials, such as metals, would encourage their recovery in industrial processes, and they would then be less likely to end up in wastewater emissions.

DEMDESS is designed to be "data driven." It can store and analyze a large database to represent existing conditions. Using the existing database as the departure point, DEMDESS can simulate and analyze various regulatory and technical emissions control scenarios in terms of water quality and economic and financial impacts under today's conditions and expected future conditions.

DEMDESS was developed using the commercially available relational database application development program, Paradox®, which was chosen because of its compatibility with other database software (e.g., dBASE® and SQL®), its analytic power, its economy in use of computer memory, and its reporting capabilities. The program consists of data tables, queries (which express the questions asked of the data), and scripts (which define queries and computations on the data with a simple programming language).

The design of DEMDESS is described in block diagram form in Figure 5.2. The *User Manual* should be referred to for a more detailed and technical overview. DEMDESS consists of six subsystems: Reach, Emissions, Treatment, Water Quality, Regulatory, and Institutional. The six subsystems are more detailed and specific breakdowns of the subsystems of the framework presented in Figure 5.1, except for the Reach File, which defines the river network.

The Reach Subsystem is central to the design and operation of DEMDESS. It alphanumerically defines every river segment in terms of its basin (Danube) and subbasins (tributaries to the Danube and their tributaries), and it also defines stations on the river segments, in kilometers. The Reach Subsystem is the "conduit" that connects various subsystems, for example, by bringing together for comparison the cumulative emissions load at a given river reach and station, the resultant water quality, the relevant in-stream water quality regulation, and the regulatory authority. The Reach Subsystem can also be used to connect DEMDESS to other data systems, such as in-stream hydrologic and water quality models and databases.

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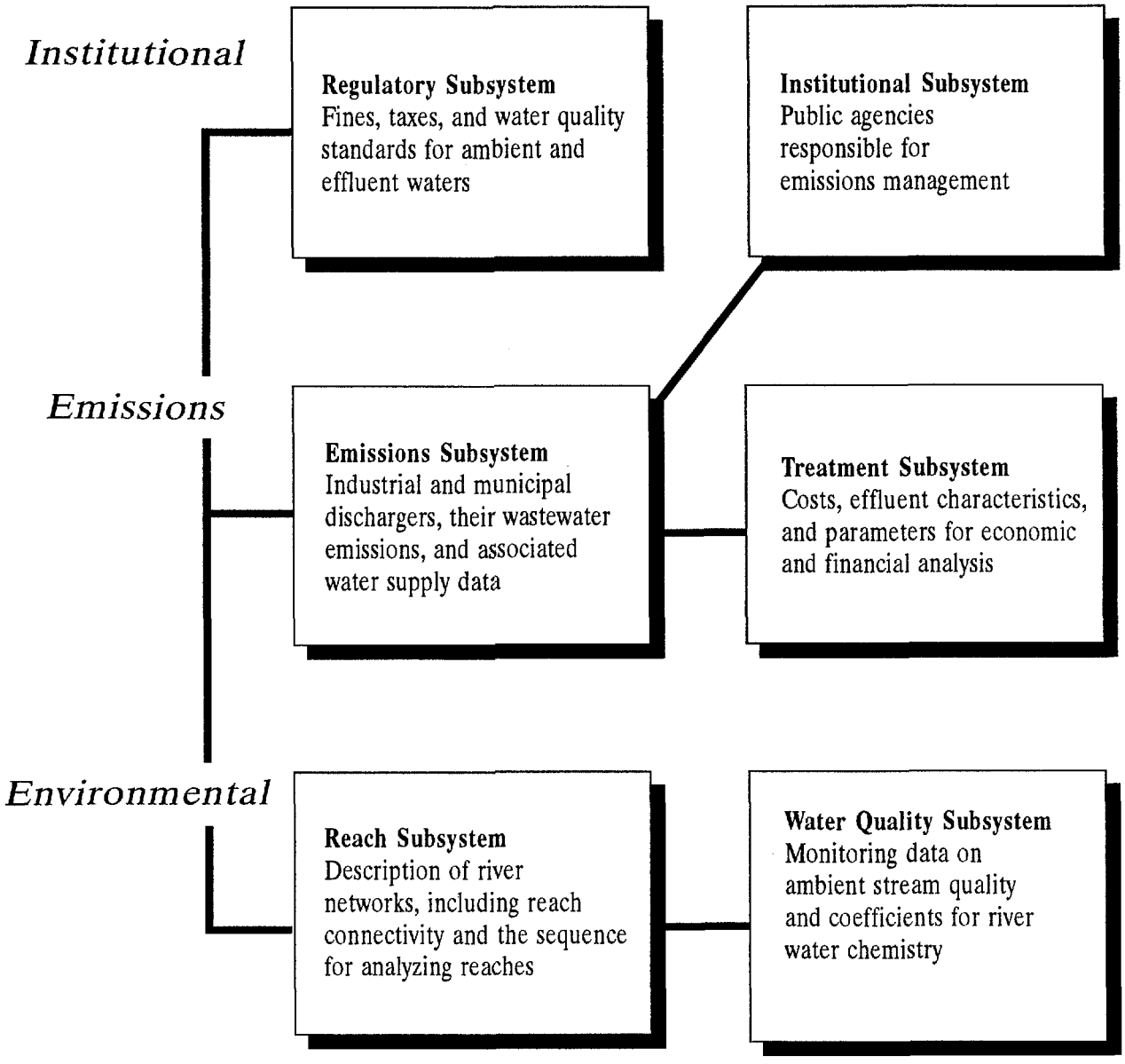

Figure A.2

Organization of DEMDESS

The Emissions Subsystem contains data on emissions, such as type, pollution parameter, quantity, and sampling date, and emission sources, such as industrial sector, location, and size (population, sales). Scenarios can be developed by selecting or adding to existing emissions. The Water Quality Subsystem contains in-stream monitoring data, monitoring sites, and water quality modeling coefficients. The Treatment Subsystem contains data on treatment efficiency and coefficients for cost and economic and financial functions. The Regulatory Subsystem contains water quality and discharge standards and data on related fines and taxes. The Institutional Subsystem contains data on control authorities, such as river basin authorities, and is connected to the Emissions Subsystem. Institutional data are also included in other subsystems.

DEMDESS provides the results of a regulatory and technical intervention scenario in terms of modified emissions quality, in-stream quality, and financial costs. Costs can be given individually for each pollution source or all sources, or they can be aggregated by sector. Per capita costs and sectoral costs can be provided to evaluate the regional or national economic impacts of scenarios. These analytic features are built with the query and scripting (programming) features of Paradox®.

As noted, DEMDESS is a data-driven system, and the effort that goes into programming analytic procedures is only a fraction of the effort needed for data collection and development. The analytic questions that are answered by DEMDESS currently are limited in number and constitute a demonstration of the kinds of questions that can be handled. The flexibility, adaptability, and simplicity of the query and scripting features are important to the enhancement and future utilization of the system. Also, DEMDESS currently focuses on limited areas of the water quality management framework, but with the above-described Reach Subsystem and scripting capabilities, it has the inherent capability to link easily to many other areas of water quality management.

A.3 The Decision Makers and the Users

The term *clients* is used to denote those decision makers who are likely to benefit from the information provided by DEMDESS. Potential clients exist at many levels in the water quality control hierarchy. Among them are policymakers, planners, and regulators. Each of these potential client types has specific information needs, which are often quite different from those of other potential clients. (A fourth client type, facility and system managers, is likely to require information that is more site specific and operationally oriented than is that provided by DEMDESS.) Potential clients and their information requirements may be characterized as follows:

- **Policymakers** in any of the four participating countries within which DEMDESS has been implemented: These policymakers include legislators and the top officials of the pollution control ministries in the four countries. The effectiveness of such policymakers will be greatly enhanced if they can request information on and be shown the effects of various alternative policies that are available to them. Also

included in this category are international organizations, such as the Danube Commission and EPDRB.

Policymakers, whether in the ministries or the legislature, will be assisted by a decision support system that identifies and compares the widest possible range of practically available policy options. One of the significant shortcomings of most policymaking institutions is that they have too narrow a focus or definition of options. DEMDESS can assist policymakers in considering a broad range of policy options. Examples of such policy options include standard setting and enforcement by fines, effluent charges, subsidies, and compliance scheduling.

Policymakers are primarily interested in data with a high degree of aggregation, particularly for formulating policies at the national level. DEMDESS can provide information with a high degree of aggregation.

- **Planners** in any of the four participating countries: In this context, planners are those individuals whose role is to achieve established policy goals to the maximum extent possible, given available resources. Quite often, planning in the water quality management sector is organized on a river basin level, reflecting the substantial interdependencies within a basin and the lesser water quality interdependencies between a basin and the areas outside it. Thus, planners will most often be found within river basin or regional organizations in the four countries, although they may also be found at the subregional (subbasin) level. International donor and lending agencies are also included in this category of potential DEMDESS clients because they, too, are interested in the evaluation of specific potential development projects.

  Planners examine investment and other strategic options below the policy level. They implement policies in a national, regional, local, or basin context. Planners require greater disaggregation and greater detail than do policymakers, but less detail than is required by regulators. Unlike policymakers, they seek information about site-specific dischargers and facilities. Unlike regulators, they need not see detailed information about the operation of existing dischargers and facilities.

- **Regulators** in any of the four participating countries: The role of a regulator is to attain compliance with established rules, whether ambient, performance (discharge), or design standards, or other rules. Regulators will most often be found at the local level, usually as agents of regional or national regulatory agencies. Regulation necessarily occurs on a site-specific, thus local, basis.

  In order to serve a diverse mix of decision makers who call on DEMDESS intermittently as they need information, an entity must exist to maintain DEMDESS on a continuous basis. The term *user* denotes this entity. At least one system user must exist in each country. The responsibilities of the people in such a group include assembling and assessing data, maintaining the database, interacting with decision makers, formulating new queries, and expanding and improving the system. In each country, there should be a primary user, which would also be the focal point for both

national and international coordination of the system. This would be an office within the ministry of the environment or its equivalent. While it may perform some of the functions through a subcontract with an institute or other technical entity, the ministry must maintain positive control of DEMDESS. This primary user may have multiple clients at the national and lower levels.

As agreed at the Institutionalization Workshop (see Appendix A), the functions of the primary user should include the following:

- responding to policy changes by the parent ministry
- establishing topics and procedures for regular reporting by other users in the country
- providing public information
- responding to requests for special reports
- providing technical assistance and training for other users in the country
- establishing default data
- conducting ongoing system development
- protecting legal ownership and sensitivity of information

Other users (an office within, or serving, a regional or basin authority, for example) are likely to be closely associated with a single client, but they may provide services for other clients on request.

A.4 General and Country-Specific Status of DEMDESS

The structure of DEMDESS is now initially specified and incorporated into a framework of Paradox® data tables, queries, and scripts. However, before DEMDESS can be used in a specific application (whether at the river basin, country, or international level), the application-specific data that are to be analyzed must be added to the basic structure. In other words, the basic DEMDESS structure is similar to a set of mathematical equations that contain variable names and relationships but no values for those variables. The user must add all of the empirical information needed to apply DEMDESS to a specific situation or purpose.

The DEMDESS structure will no doubt be expanded and linked to other decision support systems in the future, as DEMDESS is called on by decision makers at all levels to answer additional questions. It will also be applied to an increasing number of geographic areas, in its current form and as it is expanded. At present, implementation of DEMDESS has been initiated in one demonstration river basin in each of four Danubian countries (Bulgaria, the CSFR, Hungary, and Romania). The degree of implementation in each of the basins differs, largely due to differences in data availability among the four sites. In each case, the river basin chosen for initial demonstration purposes was one that had a number of water quality problems, so that the application would be valuable in itself. However, the river basins were

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chosen as well because better data were available for them than for some other basins in each country. The demonstration applications can thus be useful not only for setting emissions control priorities within the subject basins but also for setting data collection priorities elsewhere in each country and for exploring policy options more completely than would be possible on a countrywide basis.

A.4.1 Bulgaria

The Yantra River basin was chosen to be the initial demonstration basin in Bulgaria. It was also the initial application within which the DEMDESS structure evolved, as WASH team members and their Bulgarian colleagues created the concrete implementation of the DEMDESS conceptual framework developed earlier in the project. Work began in November 1991, and the results of an intensive, special data collection effort in the basin were incorporated. Thus, the data used in this application are unusually complete. Consequently, the Yantra application is the most developed and the most completely tested of the four demonstrations.

The pollution parameters currently included in the Yantra application are BOD and total suspended solids (TSS). Current ambient and emissions standards are included. A limited policy analysis comparing alternative levels of taxes (effluent charges) and fines (for exceeding standards) was conducted at the request of the Bulgarian Ministry of the Environment, which must soon recommend new levels to the legislature.

Bulgaria has made a major commitment to use DEMDESS as a primary tool for water quality management. Existing water quality data systems are to be converted to DEMDESS, which will now be the official water quality management database for the country. All Bulgarian streams and basin boundaries were digitized as part of the DEMDESP in order to facilitate this changeover.

A.4.2 CSFR (Slovak Republic)

The Slovak Commission on the Environment chose the Nitra River basin as its demonstration basin. Work to implement this decision began in February 1992. The Slovak water quality database is a high-quality one, and software routines to convert that information into Paradox® files have been written and the conversion accomplished. Work on the incorporation of the Slovak institutional parameters (fines and standards) is now in process. The system has been demonstrated for about 30 technical experts from Slovak water agencies. Although it is not yet ready to support client requests, the Slovakian application is well advanced.

A.4.3 Hungary

The Altalar River basin was chosen as the demonstration basin in Hungary. This choice was made in April 1992. Consequently, DEMDESS implementation in this basin has just begun. Fines and water quality standards information have been entered into the database, but other pertinent data have yet to be entered. Obviously, use of the DEMDESS system by Hungarian clients lies in the future.

A.4.4 Romania

The Arges River basin was chosen as the demonstration basin in Romania. Work began in February 1992 on this application. Water quality data collection in Romania was spotty until 1992. However, a new system for data collection and maintenance was designed and implemented in 1992, and future prospects are encouraging. Software for converting the Romanian water quality data, as they accumulate, into Paradox® format has been written. Although only limited sample data have yet been entered in this application, the system will be ready to receive and utilize data as the new data collection system makes them available. No client analyses have been performed in Romania, and none will be performed soon, due to the lack of reliable water quality and emissions data.

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