The UNSODA Unsaturated Soil Hydraulic Database
Version 2.0

Attila Nemes, Marcel Schaap and Feike Leij
U.S. Salinity Laboratory
Riverside CA 92507, USA

INTRODUCTION

UNSODA is a database of unsaturated soil hydraulic properties and other soil information. This version 2.0 is essentially a compilation of data stored in Microsoft Access-97 database tables (**7**Microsoft Corporation, Box 97017, Redmond WA 98073, U.S.A.). Previously, UNSODA was distributed in a simple MS-DOS browser program which, as of January 1999, can no longer be used. In order to overcome this problem, we decided to make a Microsoft Access-97 version of UNSODA available. All data that were available in the "old" UNSODA program are contained in this database structure.

There are several advantages as well as drawbacks of having UNSODA's data in Access-97:

- Access-97 allows maximum flexibility towards the contents of the database
- Graphical support to the database is available for data presentation
- The user can extensively customize the appearance of the database
- A much better interface can be built using other programs; communication with other programs is easier
- The user needs the Access-97 program which is available in Microsoft Office professional edition
- A certain degree of experience with databases and database queries is required
- The database file is considerably larger and system requirements are higher. Besides the space required of the Access-97 program, UNSODA now requires 18 MB of disk space. Pentium based systems are advised.

The user will need to be able to independently use Access to benefit from version 2.0. A few further comments are given in the following.

DATABASE STRUCTURE

We offer the database "as is" with a minimum of functional queries and reports. In the following we give a brief overview of the database structure while assuming some experience with database programs. The user can write his or her own queries, define reports and output data as desired but, as said, this requires some experience or willingness to become familiar with Access-97.

The records in UNSODA are identified as soil codes. Basic soil properties, unsaturated hydraulic data and other information are stored in the database for each "code" (soil horizon). Data may be obtained in the laboratory (e.g., water retention from a soil core) or in the field (e.g., hydraulic conductivity of a soil horizon with the instantaneous profile method). The soil code is the unique identifier of a record in UNSODA, it relates all data tables. Further information on the types of data that are included may also be found in the manual of the previous version of UNSODA[1].

The database comprises several types of objects: database tables, queries and reports. Once the database main window is open, one can choose whether to display the list of tables, queries, forms, report, macros or modules by clicking on the appropriate tab. There are no forms, modules or visible macros coming with the database. Figure 1 is an example, how the list of tables will appear once the database is open.

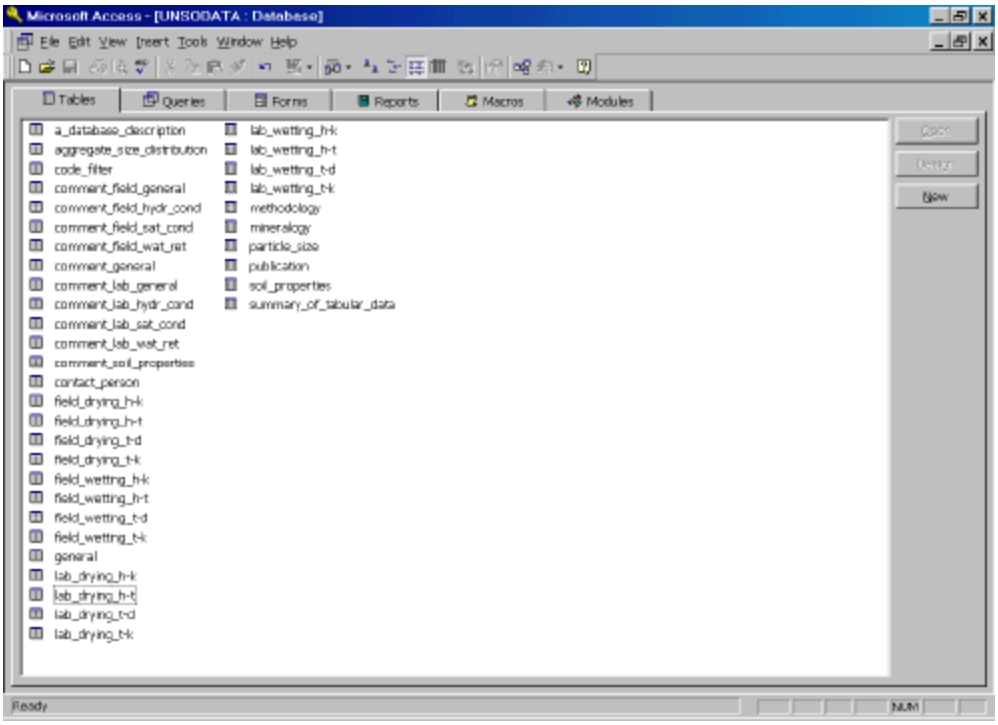

Figure 1. List of tables in the database window. Other objects (e.g. queries and reports) can be displayed the same way by selecting the appropriate tab.

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[1]Leij, F. J., W. J. Alves, M. Th. van Genuchten, and J. R. Williams. 1996. Unsaturated Soil Hydraulic Database, UNSODA 1.0 User's Manual. *Report EPA/600/R-96/095*, U.S. Environmental Protection Agency, Ada, Oklahoma. 103 pp.

Tables. All the data in the database are stored in data tables. Tables are meant for storage of data on a permanent basis. Various operations are possible on the 36 original tables of UNSODA 2.0. By opening a table in 'design view', one will be able to see the entire structure of the table including the field names, data types and a description of the fields (Fig. 2). When the contents of a table are viewed in 'datasheet view', all entries in the table will be shown without restrictions (Figure 3)(For viewing selected data see the 'Queries' section below.). The table "a_database_description" summarizes the field names, data types and other details of all objects (tables, queries, reports).

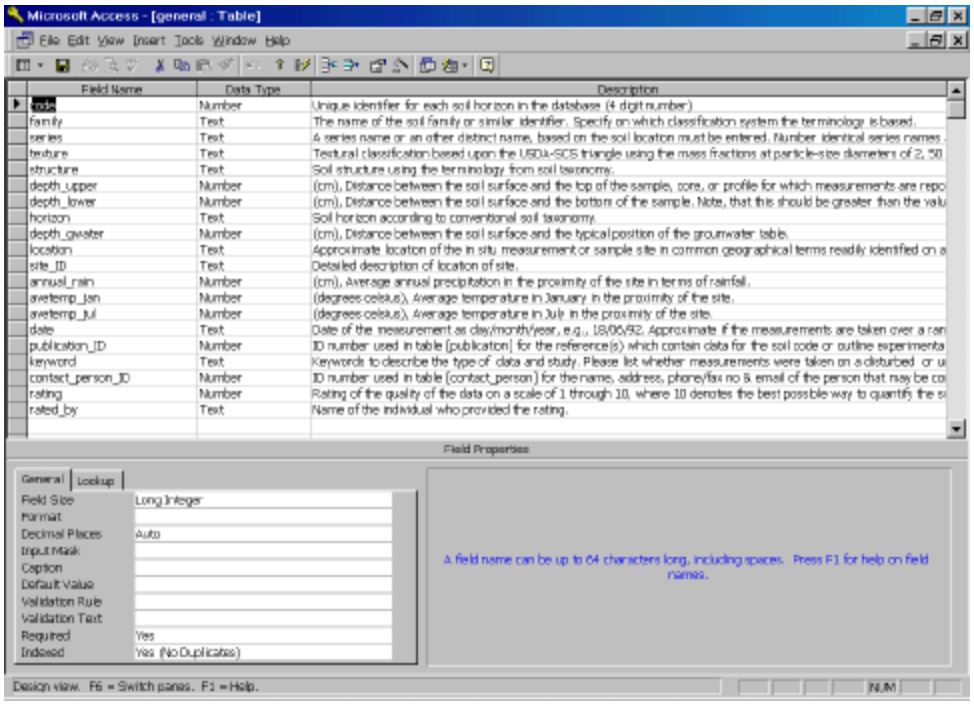


Figure 2. Design view of table "general". Field names, data types and field descriptions can be found in the upper section. The lower section shows more details about the currently selected (highlighted) field.

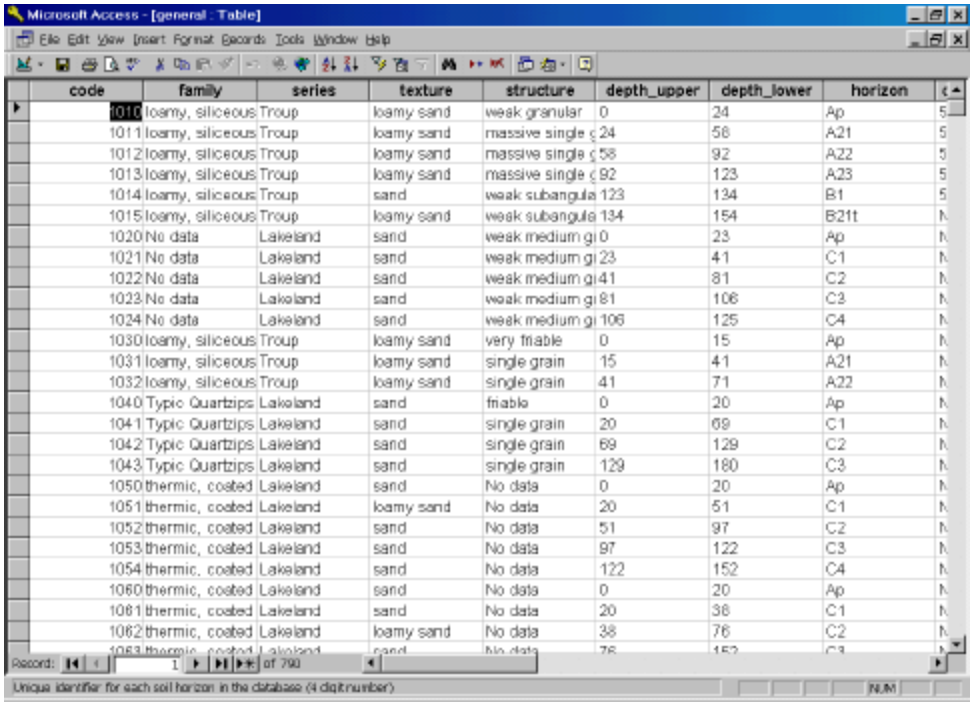


Figure 3. Datasheet view of table "general". Fields from Figure 2. can be identified as columns. Check the bottom of the screen for the total number of records.

Tables are linked to each other in the database through fields which are equivalent, typically through the field named "code". For the network of relations between tables please consult the relationship window by selecting 'Relationships' from 'Tools' on the main menu, once the database is open. A fragment of the relationships between tables is shown in Figure 4.

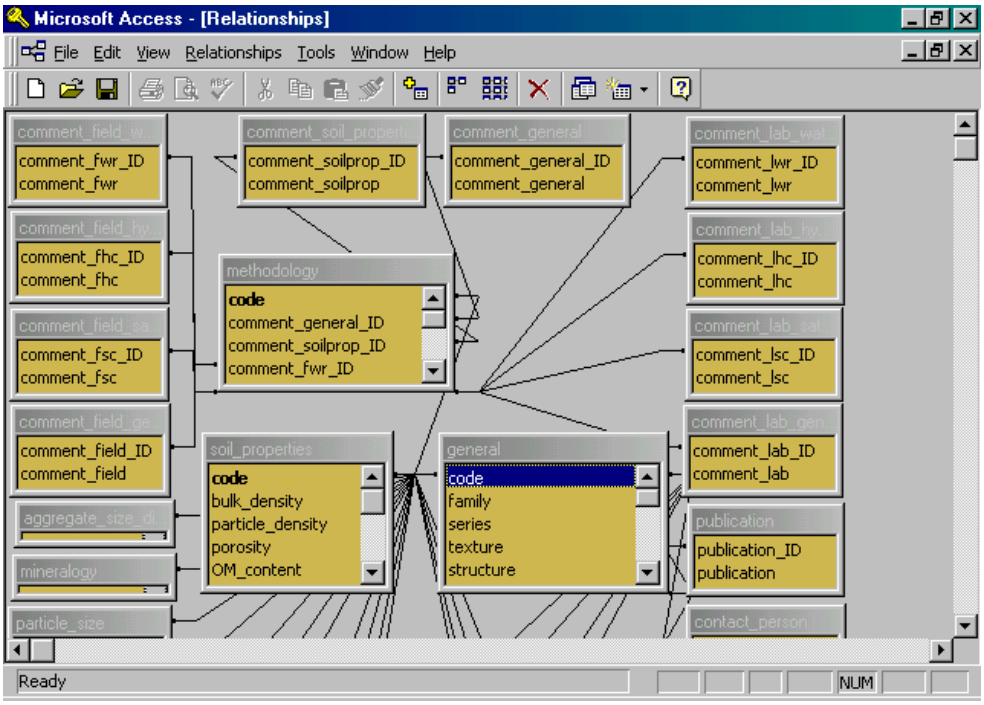


Figure 4. A fragment of the relationship window. Black lines indicate the linking fields between tables.

The main table of the database is the table "general", holding the basic information about the soil codes regarding their source, classification and environment. The table "soil properties" contains information on the results of physical and chemical analyses.Table "methodology" is a pointer table, which - through the defined "comment_ID" numbers - refers to the fields of the 10 different "comment" tables. General comments and comments on the applied methodology of the measurements can be retrieved though these tables. Tables "contact_person" and "publication" are referred to in a similar manner (through pointer numbers) from table "general" and contain source information related to the codes.

There are 19 tables containing tabular data, organized as data pairs. Field (8 tables) and laboratory (8 tables) soil hydraulic measurements tables hold the available data for both the drying and wetting cycle of the *h-2*, *h-K*, *2-K* and *2-D* relations. Another three tables contain data of measured particle-size distributions, aggregate-size distributions and soil minerals types using the same tabular arrangement. Figure 5 shows how data are stored in these tables.

Table "summary_of_tabular_data" summarizes the number of available data pairs in the above mentioned 19 tables for each soil code. This table can serve as a very useful source of information along with the other tables while making data selections.

Table "code_filter" is re-written every time when the query "filter_for_reports" is run. The purpose of this table is to restrict the three predefined reports, as those will only display codes which are listed in the existing table "code_filter". By default, this table is not restricted, i.e. all available codes are listed, and so reports will display all codes. See the 'Queries' section below for further information on the usage of this query, and the related table "code_filter".

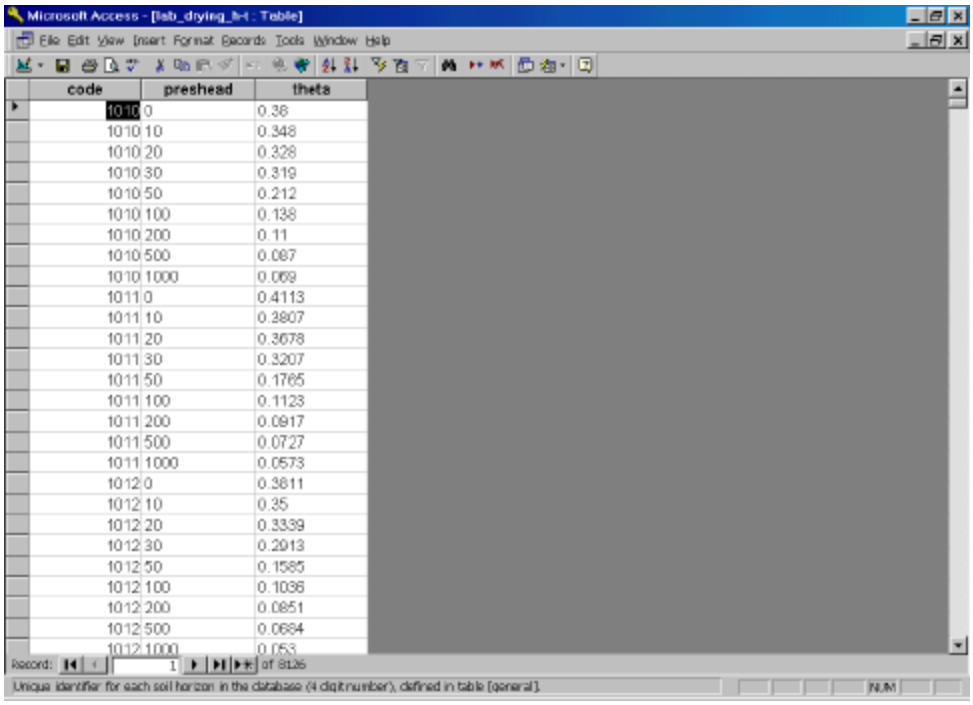


Figure 5. Example for the soil hydraulic data organized in datapairs. Note, that the number of rows for one particular "code" in these tables, matches the number of available datapairs, when there is existing measured data. ("No data" is indicated for the code, when there are no entries.)

Queries. The aim of queries is to be able to look up data by specifying certain criteria. A query can display all the information of multiple tables, or only a selected part of them when restricting criteria are set in the 'design view' of the query. When data are modified in the underlying table(s), results of a query will appear according to the new tables, even when the query was created and/or last saved before the modifications in the tables took place. Thus, queries have dynamic results depending on the actual contents of the underlying tables. An example of a restricting query is given in Figure 6 in design view.

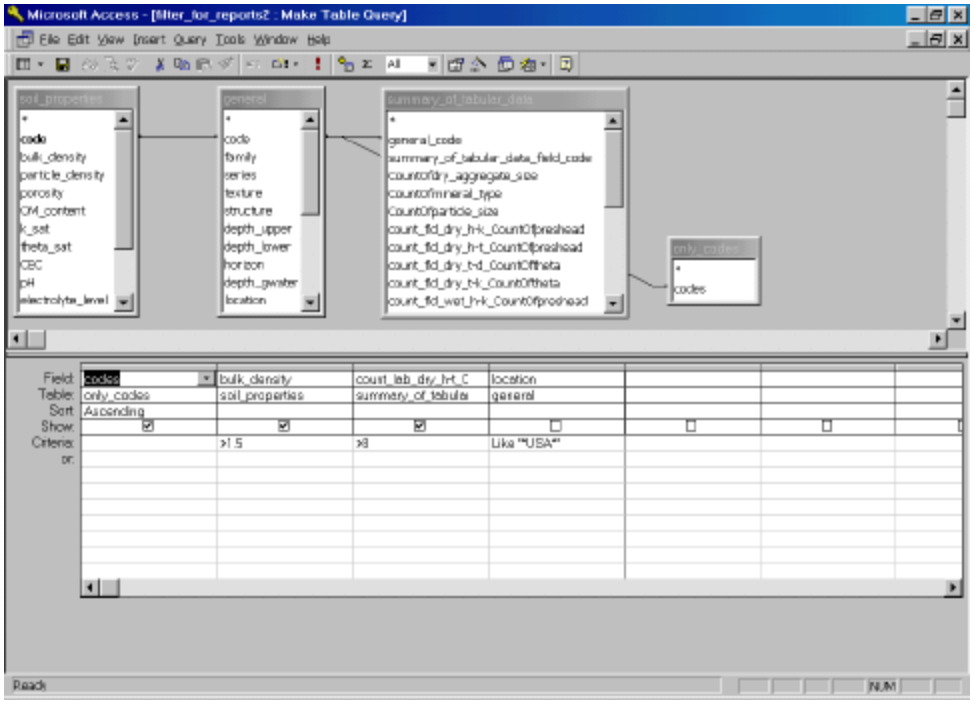
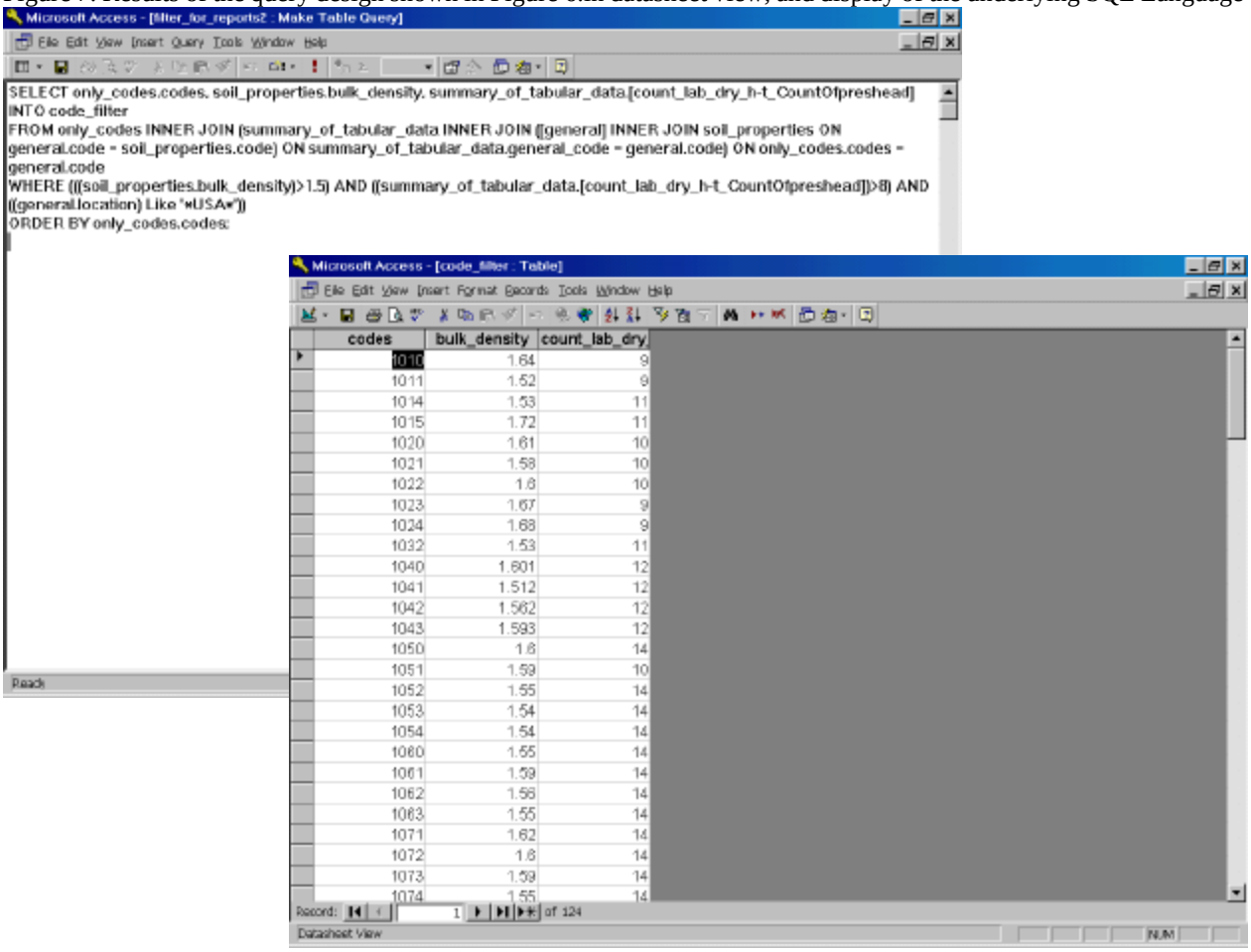


Figure 6. The design view of a query. Included tables and their linkage are displayed in the upper section. Fields for display and/or selection criteria can be listed in the lower section. Note the missing tick mark at field "location".

The user can write his or her own queries, define reports and output data as desired. The database can be searched by first selecting the targeted data tables and then specifying fields and constraints on the values of these fields. Tables can be introduced to a query any time by selecting 'Show Table' from 'Query' on the main menu in the query's design view. The upper part of this window illustrates the database structure; the various tables are connected through the 'code' number and by the 'comment_ID' numbers where applicable. In case a newly introduced table is not automatically linked to the others, make sure to link it manually by dragging the linking field to its equivalent in an other table. Open any existing queries in design view first to make any desired changes. Once the query restrictions are set, the query results can be viewed in the query's 'datasheet view', which has a similar look as the datasheet view of a table. Figure 7 shows the results of the query design shown in Figure 6. Please compare, and notice, that a field can be used to restrict the data when, in the meantime, that is not selected for display (field "location"). One is able to follow and study the underlying SQL (Structured Query Language) script any time by switching to the 'SQL view' of the query (Figure 7). Query results - as well as contents of tables - can be extracted as text, MS Excel, HTML formatted or as other database formats.

Figure 7. Results of the query design shown in Figure 6.in datasheet view, and display of the underlying SQL Language



script. A total of 124 records were found in accordance with the query specifications. Please note, that - even when it is not displayed (missing tick mark in Figure 6), the field "location" is used to restrict the search.

There is a predefined query ("filter_for_reports") as the first approach for a selection of data to be reported. The three available predefined reports (to be detailed later in the "Reports" section) will output all or part of the general or tabular data according to the criteria that the user specified within the "filter_for_reports" query. Access-97 offers great flexibility to include different combinations of fields,

similarly to that, shown in Figure 6. However, in the case of this query the field "codes" from table "only_codes" should always be included in the query as that field determines the soil codes to be outputed by the three predefined reports. Running the query, when prompted while deleting table "code_filter", choose 'Yes' to proceed (Figure 8); a new table will be created in this way and the reports are restricted accordingly. In order to get all the soil codes back to the report, run query "filter_for_reports" again without any restrictions.

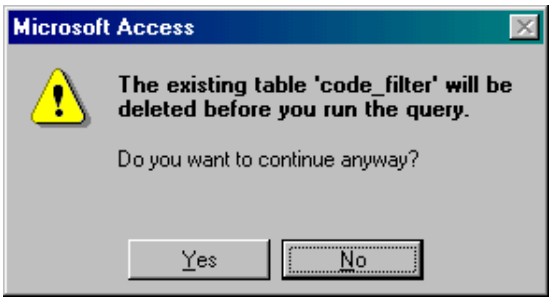


Figure 8. Screen message while deleting table.

As objects within Access-97 can be copied and/or renamed, one can make use of existing objects to make them the basis of new objects. When attempting to copy the predefined query, the user has to consider that the type of this query is 'make table query' which is specified to write ('make') the table "code_filter". If you copy the predefined query, change the query type (to 'select query') or change the preset name for the new table to be created by the copied query by selecting 'Query' from the main menu in the query's design view (Figure 9). This is necessary to avoid an unintended overwriting of the table "code_filter".

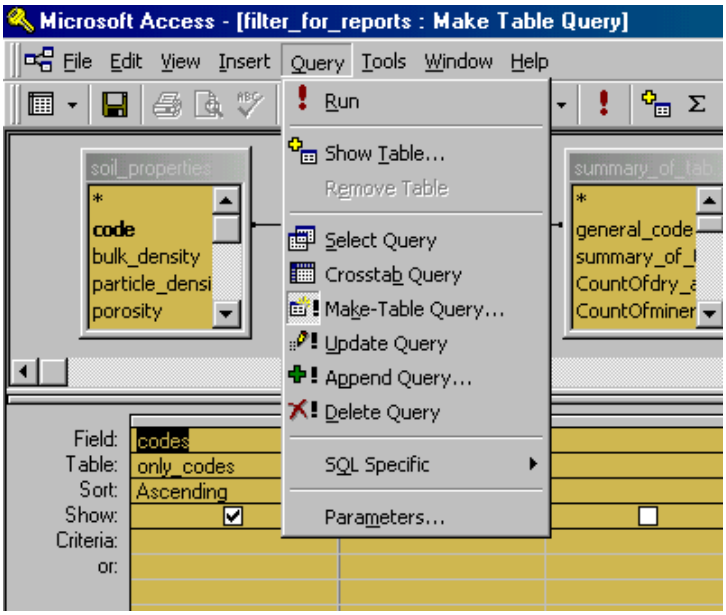


Figure 9. Changing the type of a query.

Reports. The purpose of reports is to output contents of selected fields from one or more tables and/or queries in a format defined by the writer of the report. Customized formatting is possible to match all needs. Reports however, can only be viewed or printed but not edited. Reports are based on an underlying SQL query, which can be found and edited by selecting "Properties" from "View" on the main menu in the design view of a report. Selected fields can than be placed, sized, grouped on one or more pages of a report as desired by the user.

This module includes three predefined options for the user to specify the types of data that should be reported: "general_report", "tabular_data", and "tabular_data_with_graphics". All three predefined reports are linked to table "codes_filter" and thus are restricted by the results of the query "filter_for_reports" (see section "Queries"). Only soil codes that match the query specifications of "filter_for_reports" will be reported. The default initial query is not restricted, thus information for, as of May 1999, all 790 codes will be reported. The number of codes can be limited with the "filter_for_reports".

Consult the queries section above for details on this predefined query. Please note that navigating the reports module might take a bit of time, and - depending on the complexicity of the report - some computers may not have enough memory to display the report

"General_report" summarizes all the available information about the source of the selected codes, physical and chemical properties of those, comments and/or keywords on the methodology of measurements and a summary about the number of datapairs available in the soil hydraulic data tables. When printing this report, expect two printed pages per soil code. (i.e. the default (unrestricted) report prints on 1580 pages). The report will print a cover page with a number indicating the number of reported codes, and two pages are devoted for the formatted, printable information of each code (Figure 10).

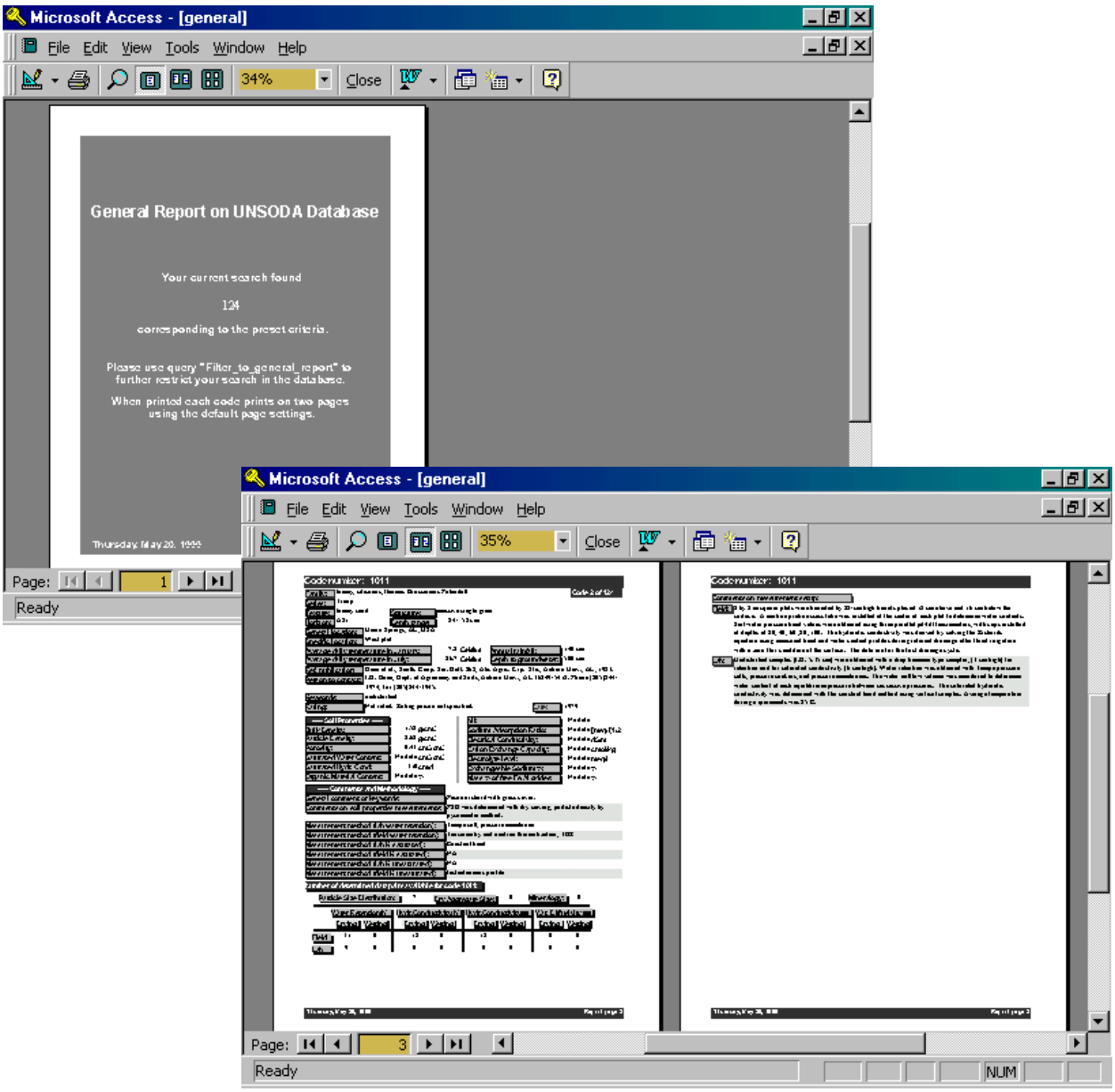


Figure 10. Report "general_report": the cover page and information about one soil code.

The same restrictions (i.e. matching the query specifications of query "filter_for_reports") apply for the other two predefined reports also. These reports summarize the hydraulic properties (*h-2*, *h-k*, *2-k* and *2-D*), particle-size distribution, aggregate-size distribution and mineralogy data of the soil codes in a tabular format. Reports "tabular_data" and "tabular_data_with_graphics" report on exactly the same data, but the latter provides some graphical overview of the soil hydraulic data, which is easier to comprehend (Figure 11). A disadvantage of using the report with graphics is that it is slower. When printing the report "tabular_data", expect 2-3 printed pages for each code. Printing the report with graphical support, expect 5-6 pages for each code, some of which are partly empty - depending on data availablility.
New, customized reports can be created by any user with some experience and/or using either the program's help or the Microsoft Access Manual.

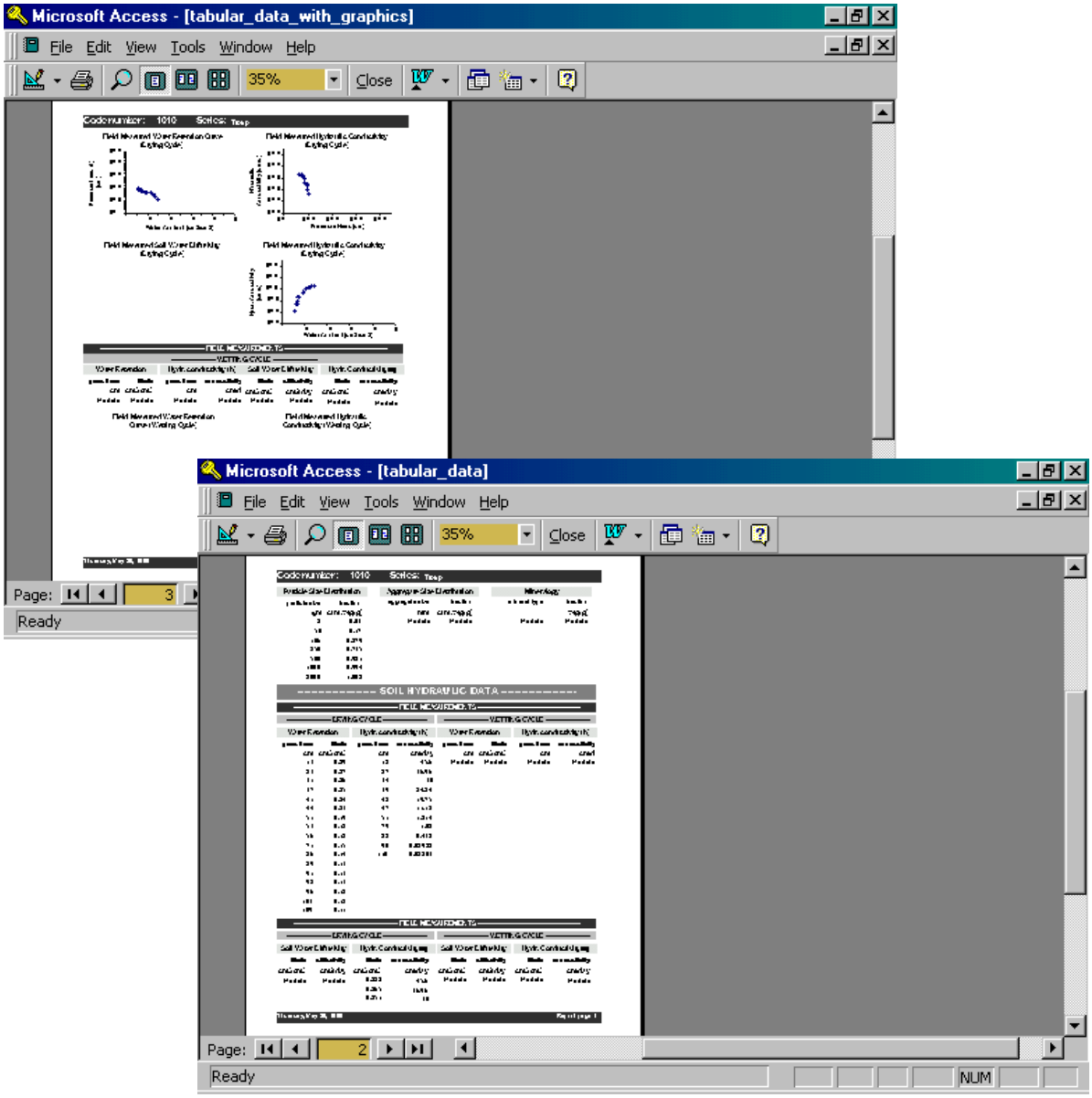


Figure 11. Examples for the output of reports "tabular_data" (foreground) and "tabular_data_with_graphics" (background).

Hidden objects. There are a number of hidden objects like tables, queries and reports in the database. The user will not see these objects unless the proper option is selected to allow viewing hidden objects as well. These objects are used to help build other objects, therefore should not be changed for an optimal performance.

MISCELLANEOUS

Presently we offer a limited graph support in report "tabular_data_with_graphics", however, an experienced user can modify the database structure to include a better graph support through OLE linkage of Access and MS Excel or MS Graph.

Please further note, that the objects (tables, queries, reports) of the database are not 'write-protected'. This allows further addition of data, but handling of the objects requires attention in order to avoid loss of information. Use of unique code number for new data entries is required in the database. Please check for pre-existing code numbers when you intend to enter new codes.

The database, as of May 1999, requires 18 MB of disk space. While storing or transporting the file compressed, it requires ~4MB disk space. We recommend the installation of the full version of Microsoft Access-97 as that allows the maximum performance of the database, however - with certain functions disabled (e.g. ability to export tables or query results to text or MS Excel files) - it runs well using the 'standard' installation as well.

We are interested in your feedback, any improvements or additions to the database structure, however, we are unable to provide user support beyond this document. Inexperienced users are probably better off with using the future Windows browser.

We wish you success using the database!