The British Columbia
Ministry of Environment and Parks
Thematic Mapping Geographic Information System

CAPAMP

—— Volume 1 ——

Data entry and validation procedures for soil, agriculture capability, surficial geology and the all purpose entity

MOEP MANUAL 10

CAPAMP VOLUME 1

British Columbia Ministry of Environment and Parks
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DATA ENTRY AND VALIDATION PROCEDURES FOR SOIL, AGRICULTURE CAPABILITY, SURFICIAL GEOLOGY AND THE ALL PURPOSE ENTITY

MOEP Manual 10

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Victoria, B.C.

Summer, 1987

Canadian Cataloguing in Publication Data

Kenk, E. (Evert), 1951-
CAPAMP volume 1

(MOEP manual, ISSN 0835-9180 ; 10)

Includes index.
Bibliography: p.
ISBN 0-7726-0704-4

1. CAPAMP (Information retrieval system) 2. Information storage and retrieval systems - Natural resources. I. Sondheim, M. (Mark), 1950- . II. Quesnel, H. (Harold), 1952- . III. British Columbia. Surveys and Resource Mapping Branch. Program, Contracts and Development Section. IV. Title. V. Title: British Columbia Ministry of Environment and Parks thematic mapping geographic information system. VI. Title: Data entry and validation procedures for soil, agriculture capability, surficial geology and the all purpose entity. VII. Series.

HC117.B7K46 1987 025'.063337 C87-092171-1

PREFACE

As an analytical, production mapping system, CAPAMP is of world class stature. Many large mapping systems handling resource data deal principally with questions of inventory, not complex interpretations. CAPAMP has excelled in the provision of analytical capability, partly because a number of Ministry of Environment and Park's projects required such sophistication, and partly because the technical capacity to provide it has either been available or has quickly evolved. The fact that CAPAMP has been so successful on real projects is a credit to the entire Ministry. Four reasons stand out as contributing to CAPAMP's success.

1) The first and perhaps most important reason is that the purpose of the system, principally to produce interpretive products which are scientifically and technically defensible, has been clear since the beginning. This has helped to ensure that the technical requirements to do the job could be defined and instituted.

2) The resource professionals, planners, and managers throughout government who have been using the system have been very keen to produce first rate products with it; their enthusiasm has contributed to a spirit of cooperation with the CAPAMP operations and development staff.

3) The CAPAMP staff has proved to be particularly effective. They have approached use of the system in a very professional manner, with a systems perspective of the projects, excellent programming style, and full documentation.

4) The system has continued to receive a high level of support and understanding from Ministry of Environment and Parks' management. A significant point here has been the recognition that such technology can alter, fundamentally and favourably, not only the way work is done but also the end products of the work.

Mr. W.A. Benson, Director,
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ACKNOWLEDGEMENTS

The CAPAMP system is operated by the Ministry of Environment and Parks, with technical support from the British Columbia Systems Corporation. Art Benson from the Ministry and Mike Rose from the Systems Corporation played significant roles in initiating the system and having the vision to see its utility. Seminal ideas also grew out of discussions with the following Ministry personnel: Evert Kenk, Dr. John Wiens, Dr. Narender Nagpal, Peter Lewis, and Terje Vold. On the technical side, Gary Cooney, Chris Grant, Richard Hunt, and Lorne Dunn, all from the B.C. Systems Corporation, were centrally involved in establishing CAPAMP as a viable system. Virtually all algorithm implementation has been carried out by Boyd Porteous and Peter Friesen of the Surveys and Resource Mapping Branch. Also from the Branch are the group responsible for production level activity: Rick Thompson, Ron Muir, Loyd Houston, Ron Cuthill, and their staff. PAMAP Graphics Ltd. of Victoria has helped maintain the system; as well, they have developed major extensions to CAPAMP capabilities.

CAPAMP has been used to generate a large number of interpretive products following scientific, discipline based logic developed by a number of professionals working with Branch technical staff. These professionals are responsible for the scientific integrity of the algorithms; as well, they must ensure that the final products meet the requirements of the project and that any limitations imposed by the data or the interpretive logic are well understood. Those professionals involved in CAPAMP interpretive product development include: Herb Luttmerding, Bob Maxwell, Udo Wittneben, John Jungen, Evert Kenk, Dr. John Wiens, Phil Epp, Dr. Narendar Nagpal, Peter Lewis, Terje Vold, Tom Chamberlin, Tony Hamilton, Eric Lofroth, Ralph Archibald, Ron Kot, Ron Kowall, Bruce Thomson, Don Howes, Dennis Demarchi, Brian Fuhr, Herb Langin, Rick Trowbridge, Ron Bertrand, John Schildroth, Erich Schultz, Dave Sands, Hally Hoffmeyr, and Phil Christie.

This document has been reviewed and approved by Herb Luttmerding, the Provincial Soils Correlator, by Don Howes, the Provincial Surficial Geology Correlator, and by John Jungen, the Provincial Agricultural Capability Correlator.

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PURPOSE OF THIS DOCUMENT

This document serves as a resource professional user's guide to the Computer Assisted Planning, Assessment and Map Production (CAPAMP) system, operated by the Surveys and Resource Mapping Branch, British Columbia Ministry of Environment and Parks. The necessary background is provided to undertake and successfully complete a resource project, making use of the automated analytical and map and report generation capabilities of the CAPAMP system. Detailed instructions, including attribute definitions and allowable codes, are given for completing the CAPAMP input data forms for soil, agriculture capability, surficial geology, and the All Purpose Entity resource themes. How to edit all such data, using automated validation procedures, is fully explained. (Specifications for other themes are discussed in a companion volume to this, "CAPAMP Volume 2, British Columbia Ministry of Environment and Parks Thematic Mapping System, Data Entry and Validation Procedures for Wildlife, Biogeoclimatic, and Forest Cover.") Introductory sections provide an overview of the CAPAMP system, describing the system structure, function and support facilities. Recommendations concerning CAPAMP data collection, input, and analysis are made, as are examples of some of the past uses of CAPAMP by resource professionals.

WHO MAY USE CAPAMP

Use and operation of the system are under the authority of the Director of the Surveys and Resource Mapping Branch, Ministry of Environment and Parks. All those wishing to use CAPAMP should send correspondence to the director. However, questions concerning technical feasibility may be addressed to the Head of the Development Unit within the Branch. Although CAPAMP has been designed specifically to meet the needs of those natural resource scientists and managers working for the provincial government, others are encouraged to inquire about use. Projects may involve the input and analysis of new resource map data, resource data used in previous CAPAMP projects, or data transferred from other systems. Listings of map data already on CAPAMP, and available for immediate report or interpretive map production, are available from the Head of the Branch's Thematic Mapping Unit. The numerous interpretive products which have been produced from CAPAMP to date are generally available from MAPS BC, also part of the Branch.

HOW TO USE THIS DOCUMENT

First read the following sections which provide an overview of CAPAMP, recommendations concerning CAPAMP project design and coordination, and examples of CAPAMP use. Next read the glossary and the general introduction to the documentation format, outlining the structure of the detailed specifications. Then read and follow the data entry and validation procedures in the section(s) describing the map theme or themes applicable to your project. Even if your project is using validated map theme data already entered into CAPAMP, the procedures are still useful as the source for definitions of the attributes, classes, allowable values and units of measurement.

AN OVERVIEW OF THE CAPAMP SYSTEM

Government Overview

Within the government of British Columbia there are five major computer aided mapping systems: two in the Ministry of Environment and Parks, two in the Ministry of Forests and Lands, and one in the Ministry of Energy, Mines and Petroleum Resources. The systems are used for a variety of purposes. One of the systems in Forests and Lands is concerned primarily with the update and summarization of forest cover maps, whereas the other is applied to the capture of cadastral data. Energy, Mines and Petroleum Resources uses their system for the recording of mineral claims. Within Environment and Parks, the base mapping system is oriented toward the collection of planimetry, topography, and cadastre. The second Environment and Parks system is designed to deal with thematic mapping applications; it is referred to as CAPAMP, for Computer Assisted Planning, Assessment, and Map Production. Most of the work on CAPAMP has been project specific, aimed at producing a wide variety of interpretive products from natural resource mapping.

System Structure

The CAPAMP system resides on an InterVax 751, running current versions of VMS and IGDS/DMRS, and linked to three LSI workstations. In order to make the system more amenable to analysis, a FATR (Fortran Attribute Transformation Routine) subsystem was implemented. FATR makes it easy to: extract data from one DMRS database as well as from other files; report on or analyze the data for a variety of interpretations using Fortran; and load new attribute data into the DMRS database and other external files. FATR was developed jointly by Ministry of Environment and Parks and B.C. Systems Corporation staff. In order to be able to perform polygon generalization and multi-theme overlays (with links to the database maintained), GRDCON software was purchased from PAMAP Graphics of Victoria. During this time, modifications to FATR were also carried out by PAMAP. Future enhancements to the computer hardware and software are not likely to have any impact on the data descriptions contained herein.

CAPAMP Input

Highly standardized data used as input into the system are associated with the following themes: soils, agricultural capability, surficial geology, wildlife habitat, biogeoclimatic zones and ecosystems, and forest cover. Many other kinds of data such as climate zones, watershed divides, Agricultural Land Reserves, and land use boundaries may also be entered. CAPAMP data may be derived from traditional mapping programs, from other computer mapping systems, from classification of satellite imagery, or from analyses of digital elevation models.

Products and their Development

The maps and reports which are generated by the CAPAMP system include: soil sensitivity to acidification; water irrigation requirements; open slope landslide hazard rating following timber harvesting; suitability for grizzly bear habitat; capability for moose and deer; tree species selection for reforestation; areas with favourable benefit - costios associated with raspberry cultivation; and over forty other interpretations. To produce such project oriented products from the input data, it is necessary to devise algorithms applicable to the study area consisting of if-then-else statements, mathematical equations, and other logical constructs.

The logic for each algorithm usually results in anywhere from 200 to 1200 lines of Fortran code. These algorithms are typically developed by a small project team. In addition to systems analysts, the team generally includes someone who was involved with the initial data collection and one or more professionals with expertise in the interpretations to be made. Thus, the emphasis with CAPAMP is to produce a series of project specific interpretive maps and reports, tailor made for a variety of users in Environment and Parks and elsewhere in government.

Project Flow

The project flow with CAPAMP proceeds through a number of steps, commencing with the assembly of a project team and the creation of a project plan. All of the data within CAPAMP are entered typically on a mapsheet basis. For each bounded area, or polygon, a series of data items may be entered on coding sheets or by using a computer terminal. Also entered may be additional data not directly related to a polygon, such as the detailed characteristics of specific soils, commodity prices, allowable risk levels, and the like. The data are then passed through a series of edit and validation routines. Meanwhile the logic for the interpretive algorithms is defined and the required computer programs are developed and tested. Some of the algorithms may have already been implemented on previous projects. After the data and algorithms are deemed acceptable, the final tables and maps are generated. On large projects the entire exercise may first proceed on a pilot area. All the algorithms are fully documented from a systems perspective. Official professional signoffs are required for all algorithms and many of the maps output from the system. CAPAMP may be viewed as a sophisticated tool for use in a variety of ways. For some projects it is seen as a last step, where the final interpretive products are produced. Quite often however, it is seen as an integral part of an entire study. In this capacity the professional user may find CAPAMP helpful for producing a series of intermediate products germane to an exploratory analysis of the issues at hand.

Support Structure

To support the users of CAPAMP and their requirements, four groups can be recognized. (1) The first consists of the Thematic Mapping and Data Control Units within the Surveys and Resource Mapping Branch and Datamat Services Ltd. The Thematic Mapping Unit undertakes the graphic input and edit, execution of interpretive algorithms, and production of all final output. The Data Control Unit ensures that attribute data on coding forms are key entered correctly onto magnetic tape by Datamat. (2) The second support group is comprised of personnel from the Development Unit of the Surveys and Resource Mapping Branch. This unit helps establish detailed project requirements and advises on the creation and implementation of the logic for the various interpretations and reports. As well, the unit is responsible for writing, testing, and documenting all Fortran code for analysis programs. Personnel from this group typically spearhead new CAPAMP developments. (3) The responsibility for the integrity of both the graphic and attribute data rests with professional resource personnel, including agrologists, foresters, terrain specialists and the like. Thus, these individuals provide significant support to end s of CAPAMP, such as planners, managers, and other professionals, who are not involved in the data compilation stage. (4) The fourth support group consists of the B.C. Systems Corporation, the Computing Services Branch of Ministry of Environment and Parks, PAMAP Graphics, and Intergraph Canada. Personnel from these agencies are responsible for general system services including maintenance.

RECOMMENDATIONS FOR PROJECT DESIGN AND COORDINATION

Although projects utilizing CAPAMP may have very different objectives and end-products, they always pass through three identifiable stages: project planning, data collection and compilation, and algorithm development and map design. Success through these stages depends in part on a clear understanding of the project's purpose and scope. Thorough project planning followed by continuous project coordination is required to make certain that project objectives are fully met, without untimely delays. Particularly since CAPAMP projects frequently involve a number of different people, a strong commitment to good project management will help ensure an efficient use of time and resources.

Project Planning Stage

The Surveys and Resource Mapping Branch uses a series of project planning forms to aid in specifying project requirements. These include the Units involved, the time estimates to complete the project, scheduling, and a list of products. These forms are controlled by the Program Planning and Evaluation Unit within the branch. The planning forms must be signed by the Director of the Branch prior to the commencement of any CAPAMP related, project activity. If any changes to the project requirements are made after it has commenced, all members of the project team (see below) must be made fully aware of them. Any major changes must be approved by the Director of the Branch.

A team is established of project participants; it consists of personnel from the requesting agency and the Surveys and Resource Mapping Branch. Requesting agency participants generally include one or more planners, scientists, or other professional level personnel. From the Branch comes a CAPAMP systems analyst, a representative from the Thematic Mapping Unit, and frequently a biophysical specialist with relevant expertise. This team reviews the requirements; outlines preferred methods of data collection where appropriate, as well as coding and validation needs; defines the type and logic of all interpretations to be made; and assesses the validity of all resulting products. In short, the team is responsible for all technical aspects of the project.

After project acceptance, a user can be expected to be in contact with three different groups within the Surveys and Resource Mapping Branch. Data forms are obtained from personnel in the Data Control Unit. Once the forms are completed, they are returned to the Data Control Unit. Interaction with the Thematic Mapping Unit deals with graphics entry, editing of either graphics or attribute data, running algorithms, and producing final maps and reports. Development Unit personnel are responsible for the development, testing, and implementation of all algorithms, typically carried out with other professional staff as appropriate.

A philosophical comment regarding the nature of a map may be in order here. A map consists of data describing regions of a geographically referenced surface. A hardcopy map may reflect a subset of this data, or some kind of interpretation of the data. That is, data which is entered into a computer mapping system does not necessarily correspond in a one-to-one fashion with data which is displayed on an output product. In fact, where the final products are only summary reports, computer files for entry into spreadsheets, and the like, a project may not involve any paper maps as output at all. It may even be that paper maps are not used as input either, if the data source is digital satellite imagery or digital topography for example. These distinctions between input and output and between data and paper products should be kept in mind during the project planning stage.

Data Collection and Compilation Stage

Mapping data for a project may come from a variety of sources, including new field mapping, existing paper and digital maps, satellite imagery, digital topography, and other computer models and files. If new mapping is required, published methods for field collection are to be used where possible. Guidance on the use of satellite imagery and digital topography within the CAPAMP environment may be obtained from the Head of the Development Unit, Surveys and Resource Mapping Branch. Regardless of the sources of data, the project team must ensure that the project objectives can be met by collection of an appropriate set of variables, and that the level or intensity of data collection support the scale of map presentation. These and other issues are discussed in more detail below.

Early in a project's life cycle it is imperative that a consensus is reached on the geographic boundaries of the project, on the scale of mapping, and on the base map to be used. This last issue can be a source of serious complications. Consider a map which was compiled from very recent photography. If a final interpretive product is to have an existing base map (derived from older photography) as background, there may be discrepancies between the locations of confluences, stream banks, and the like, brought about by either natural or man-made changes in the landscape. Another project might involve overlaying two or more maps, each of which may has been compiled on a different base. The resultant map may not be valid if the original sets of polygons are not positionally correct with respect to one another. Frequently, such problems can be circumvented or minimized.

A separate concern with base maps involves project areas which span more than a single mapsheet. Consider a watershed study in which the area of interest is mostly on one sheet but partly on an adjoining sheet. It is preferred that for all graphics and attribute data entry, the watershed be treated as occupying portions of two mapsheets. Treating all projects in terms of mapsheets simplifies file management activity and reduces manual drafting requirements. However, in certain situations it is possible to make a new, non-standard, base map covering the whole watershed, with all data entry based on the new map.

If a project involves changing the scale of a map, the users should be aware of several potential problem areas. When a map is enlarged, the linework will appear more angular, positional errors on the map will be enlarged, and the resulting product may imply by its scale a higher degree of accuracy than it warrants. A reduction of scale can have the opposite affects, but the degree of complexity and the number of polygons may become unreasonably high, and any labels may become difficult to read. Amalgamation of polygons will help relieve this complexity, although undersized polygons may still result and mapsheet border matching may become disrupted, depending upon the amalgamation method used. The greater the scale change, the more likely it is that such effects will be significant. However, changes in scale by a factor of two, either getting larger or smaller, generally lead to quite acceptable products.

The size and shape of polygons must also be considered. The smallest polygon displayed on any map, regardless of scale, should generally be no less than one-half a square centimeter in size on the paper or mylar. Similarly, long thin polygons may be difficult to read if they are less than 3 mm across. If very small units are common in the project area, then a larger mapping scale should be considered, more general mapping units should be used, or polygons should be amalgamated through software before final production.

The question of map reliability is pertinent to CAPAMP input. The term generally refers to content accuracy as opposed to positional accuracy. Most original thematic maps have content accuracies for major categories ranging from 65% to 85%. It is recommended that the mapper not try to compensate for a high degree of landscape variability by making the attribute data associated with each polygon as complicated as the data forms allow. More detailed characteristics often have higher error rates. (These comments refer to content accuracy on an area basis; little work has been done on the accuracy of boundary placement.) Thus, taking agricultural capability mapping as an example, the capability class ratings can be expected to be more reliable than the subclass values (D. Moon, personal communication). The implication of this line of thinking is that on some mapping projects it may not be fully justified to produce highly complex maps, unless the sampling is particularly dense. Ideally, surveys should follow statistical principles and be carried out in accordance with a bona fide experimental design. Of course, this is not always practical to do. Mappers are encouraged to discuss their mapping methodology and expected reliability with personnel with statistical expertise, before commencement of a project.

On most projects, the mapper must consider how to handle inclusions. The CAPAMP data forms allow for a maximum of three components (mapping units) to be recorded for each polygon. It is not uncommon for more than three mapping units to occur in a polygon, resulting in unrecorded inclusions. Generally, the area occupied by inclusions is added to the most similar recorded component. In order to better represent a polygon for most interpretations in terms of three components, it may be desirable to record a mapping unit occupying less area than the three most extensive mapping units if it is very dissimilar and would likely influence the interpretation of that polygon. The areas occupied by the remaining inclusions are then added to their most similar recorded components. (Other relevant comments may be found in the Glossary under Decile and Polygon Component.)

Another aspect of map compilation relates to the method of handling two or more themes on a given project. Both soils and surficial geology attributes may be required to meet project objectives. The two themes could be mapped completely independently of one another, with different data forms and different polygons for each theme. Alternatively, two different sets of forms could be employed, but only one set of polygons; that is, the polygons for the two themes are completely coincident. A third and final option requires only one set of forms and one set of polygons. Should the project demand principally surficial geology data with only a few soils variables needed, the soils data could be entered as user defined variables on the surficial geology form. This method is preferred only where there are so few soils items, that they are unlikely to be useful by themselves. The advantages to having single sets of polygons and forms include: simpler file management, less paper work, easier editing, the minimization of base related problems, and reducing potential overlay problems (see below).

An initial project step centres on the choice of attributes to be collected. The mapper should be aware of the interpretations to be made from the data, so as to ensure that all required data are collected. On one hand it is important that the data collection proceed efficiently. On the other, it may be of value to include additional data so that a fairly full description of the landscape is available for any future analysis. Because of the high cost of attempting to add data after a project is over, relatively complete descriptions are preferred, but not mandatory. CAPAMP data forms are used for all attribute data input into CAPAMP, following the coding instructions described in this manual. Note that on some projects it may be possible to enter the data using a computer terminal instead of coding forms.

Validation routines, which check all standard attribute data for legitimate codes or values and correct justification, are available for each theme. Validation reports summarizing the potential errors encountered are produced. These validation reports are used as a tool to aid in editing the data input. Validation routines must be in place for all attributes for which data is collected. For the user defined (dummy) variables, the CAPAMP systems analysts write error checking routines, based on allowable values provided by the user. The mapper is expected to review carefully all validation reports and to make any required modifications to the database.

All data collection should be as consistent as possible throughout the project. If percent sand is of interest, it should be collected for all areas of the study area and for all soil or material depths. It is recognized that only a relatively small number of samples will have undergone laboratory determination. Other values must be estimated, guided by professional judgment and the values of other attributes in the database. If this estimation can be specified in an algorithm type of format, a variable can be left blank and completed through development and execution of the algorithm. Of course, the data used by the algorithm must be consistently available. Where this kind of approach seems practical, it should be discussed in detail with the CAPAMP systems analysts. The overriding reason to have such consistency in the database is that without it many interpretive algorithms could fail or give spurious results.

Maps to be input should receive a thorough edit of the linework before being digitized to ensure completeness and positional accuracy of lines. Border matching between mapsheets (if required) should be thorough. The linework to be digitized should be neat, clean and free from ambiguity. It is recommended that linework be digitized from a mylar to avoid paper stretch problems. Coding or polygon numbering is not recommended prior to the map digitizing stage because an automated polygon numbering system is usually used. Having the numbers generated automatically prevents the user from inadvertently assigning the same polygon number to two different polygons; it also makes the workstation operation more efficient. Should a user wish to provide the numbers beforehand, so as to allow the entry of data onto coding forms immediately, he or she should discuss it with the CAPAMP personnel on the project team. After map digitizing and prior to polygon coding the user should edit the resultant linework for accuracy.

Algorithm Development and Map Design Stage

For any given project, one or more algorithms must be developed to analyze the map data and any associated files. The algorithms produce reports and control the graphics output. These reports typically include specific statistics about each polygon, as well as summary statistics for the entire mapsheet, specific watersheds, elevation zones, or other partitions of the landscape relevant to the project objectives. If the project falls on two or more mapsheets, reports can be designed which examine the total project area. The graphics control provided by the algorithms includes: the design of a polygon label related to each polygon's evaluation, the choice of which polygons (or classes of polygons) to display, and decisions regarding the merging of polygons with like evaluations. For selected, special projects it is also possible to control patterning of polygons as well as colour output.

Automated overlay capability is available for projects involving more than one map theme with access to the attribute data bases of each theme for multi-theme interpretations. Up to ten map themes may be overlayed in one operation. Previous to overlay, the nature of each theme's linework should be reviewed to ensure that the cartographic quality of the final map product will be maintained. For example, two maps with complex non-coincident linework may result in an output map with an unacceptable level of complexity and an excessive number of undersized polygons. This may not be of concern if output consists only of summary tables or reports. In addition, the nature of the interpretive algorithm being applied to the resultant overlay may alleviate this effect by amalgamation of polygons.

In many cases the required end-product is clearly understood from the beginning of the project. At times however, an algorithm may give unexpected results. When this happens, a user may wish the algorithm to be modified, or in extreme cases, it may be necessary to develop a completely different algorithm. For example, a user may be looking for all polygons which meet certain criteria; if the criteria are too stringent, no polygons may be indicated. In such a situation the user may want to relax the requirements, list the major constraints for each polygon, or simply produce a different product altogether. As discussed previously, with some projects it is recognized from the beginning that the analysis is primarily exploratory in nature, and that the algorithms are very likely subject to change. In such situations the graphics and reporting requirements should be made as simple as possible. Furthermore, it is recommended that on larger projects involving multiple mapsheets, a pilot area be chosen for full testing of the algorithms and the map output.

Quite often it is desirable to apply an algorithm developed on one project area to another. Occasionally this is valid. Frequently however, the algorithm must be modified to take account of differences in either the databases for the two areas or the climatic and physiographic processes which are operating in the two areas. Thus, it is imperative that the existing algorithm and the project databases be reviewed in detail before it is decided to use the algorithm in the new project area.

Another aspect of the map which should be specified at this stage is the layout and content of the map legend. It is the responsibility of the professional personnel defining the algorithm logic to design the map legend as well. Additionally, they must ensure that any changes in an algorithm are reflected in the map legend, as required. The legend must contain the names of those individuals responsible for the data compilation, the algorithm design, the algorithm implementation, and the overall integrity of the final product. Further details about map legends and examples from previous projects may be obtained from the Head of the Thematic Màpping Unit.

Just as with the maps entered into CAPAMP, the question of the reliability of all output products should be considered. There are two aspects to this. The first relates to the testing of the algorithm to ensure that it is doing precisely what it was intended to do. Testing should occur for a variety of conditions and for more than one mapsheet, where applicable. The more difficult issue concerns field evaluation. There exist three categories of algorithms in this respect. (1) For some algorithms, such as defining drainage conditions or wildlife habitat classes, it may be fairly easy to carry out limited field work or to interpret air photos or satellite images to a sufficient degree to build confidence in the final product. If time permits this can be done formally, following a statistically valid, experimental design. (2) An algorithm may be statistically based such that confidence limits or other measures of reliability are directly part of the polygon assessment. For example, falling into this category is an algorithm defining the likelihood of landslide occurrence following logging operations, applied in the Norrish-Cascade Watershed (Howes and Sondheim, 1986). (3) For many algorithms the only practical assumption that can be made is that the best approach was taken given the data available, but that the results are unqualified as to reliability. Examples of this are potential irrigation requirements on eastern Vancouver Island (Nagpal, Sondheim and Wallis, 1986) and surface soil erosion potential in the lower Fraser Valley (Vold, Sondheim and Nagpal, 1985).

Associated with all final products must be algorithm documentation and several sign-offs. The documentation includes: a general description of the product and the logic used to produce it, a detailed discussion of the Fortran algorithm, and the Fortran source code. The professional and technical staff involved with the algorithm development must provide their signatures on a document indicating that to the best of their ability they believe the algorithm to be scientifically defensible and technically correct. As well, the names printed on the legend, as described above, should be assumed to be equivalent to actual signatures.

EXAMPLES OF THE USES OF CAPAMP

Following are concise descriptions of some types of analyses performed on CAPAMP to meet specific project requirements. The examples portray the diverse range of potential applications of the system.

Examples: Typical Single Theme Products

Many projects have involved the output of single theme products to meet their objectives. These outputs range from simple derivatives of the data base such as drainage or texture maps derived from the soil theme to complicated interpretations such as potential soil erosion, where climate data was included as user specified variables in the soil theme. As example, the Ministry of Forests and Lands was undertaking a Unit plan of the Nelson Watershed slated for logging. They required a number of interpretive maps derived from the input themes of surficial geology and soils. Programmed algorithms were developed to provide interpretive maps of potential aggregate sources and terrain hazards from the surficial geology theme. The soil theme was interpreted to generate maps indicating brush hazard and species selection for reforestation.

Example: Generalization of Maps

At the request of the regional Fish and Wildlife Branch, a project was undertaken to convert forest cover maps to a product suitable for evaluation of deer and moose habitat. Digital data provided by the Ministry of Forests and Lands was interpreted using a programmed algorithm which converted the detailed forest cover data into more generalized classes related to deer and moose habitat. This data was then presented in map form, showing the generalized polygons with labels tailored to the users' need for quick evaluation of the polygon.

Example: Integration of CAPAMP with External Analytical Procedures

In the Norrish-Cascade Study undertaken at the request of the Recreational Fisheries and Water Management Branches, the surficial geology theme was interpreted and analyzed with an external landslide data file using SAS (a statistical analysis package) utilities outside of the CAPAMP environment. The purpose was to define the potential of landslide activity for the mapped polygons. Some of the programs for this project were developed to extract specific variables from the surficial geology database for tabular and external file output to aid in the development of SAS analysis. Results from the external analysis were used in CAPAMP to derive maps rating the surficial geology polygons for natural mass movement, likelihood of clearcut landslides occurring and the likelihood of clearcut landslide debris entering the stream system (see Figure 1).

Example: Multi-theme Analysis with Coincident Polygons

The Vancouver Island Detail Survey undertaken by the Surveys and Resource Mapping Branch at the request of a number of government agencies, including the Ministries of Agriculture and Fisheries, Forests and Lands and the Agriculture Land Commission, involved the detailed collection of both soils and agriculture capability data. Because of the inherent correlation between soils and agricultural capability, it was decided to map a single set of polygons, applicable to both themes. This resulted in two adjacent polygons having the identical soils

FIGURE 1
EXAMPLE OF A CAPAMP INTERPRETATIVE SLOPE HAZARD MAP

Explanation of Map Notation

Natural mass movement rating (see **A**) — Clearcut landslide rating (see **B**) — Potential introduced landslide debris rating (see **C**)

• 3+:H-L

This symbol indicates that (1) natural landslides have occurred within this polygon (• symbol); (2) there is a moderate likelihood that rapid mass movements and/or slumps will occur following clearcut operations (3 + symbol); and, (3) if a landslide should occur, there is a high likelihood that the landslide debris will impact upon the stream system and possibly, be deposited into a lake (H-L symbol).

A NATURAL MASS MOVEMENT RATING

Symbol	Description
•	Indicates that at least one or more shallow rapid mass movements and/or slumps in unconsolidated material in a natural setting has initiated within the polygon.

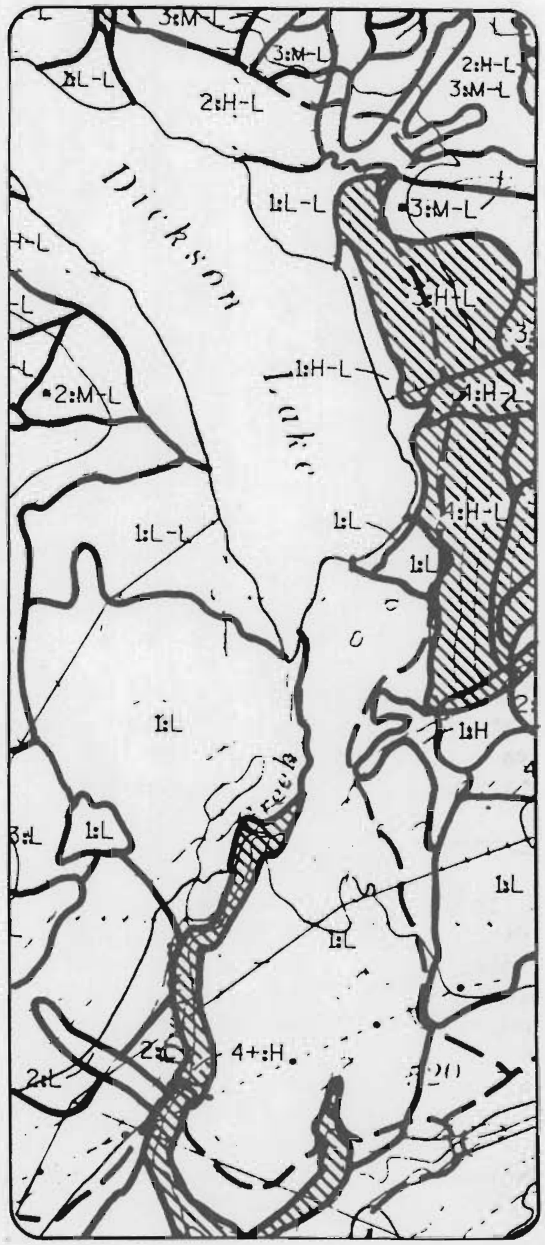
B CLEARCUT LANDSLIDE RATING

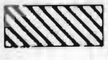
Symbol	Description
4	Terrain polygons that have a high likelihood of clearcut rapid mass movements occurring following clearcut operations (≥0.100 failures per hectare).
3	Terrain polygons that have a moderate likelihood of clearcut rapid mass movements occurring following clearcut operations (≥0.05 to <0.100 failures per hectare).
2	Terrain polygons that have a low likelihood of clearcut rapid mass movements occurring following clearcut operations (≥0.010 to <0.05 failures per hectare).
1	Terrain polygons that have a very low likelihood of clearcut rapid mass movement occurring following clearcut operations (<0.0100 failures per hectare).
+	Terrain polygons that have a moderate likelihood of clearcut slumps occurring following forestry operations (≥0.05 to <0.10 failure per hactare).

C POTENTIAL INTRODUCED LANDSLIDE DEBRIS RATING

Potential introduced landslide debris is a qualitative rating of the likelihood of clearcut landslide debris entering the stream system if a landslide should occur within a terrain polygon. The stream system includes stream order one and two channels, and gullies.

Symbol	Description
H	There is a high likelihood of landslide debris impacting upon the stream system, if a clearcut landslide (i.e. rapid mass movement, slump) should occur in these terrain polygons. (Most of the clearcut rapid mass movements and slumps occurring in these areas are expected to impact upon the stream system).
M	There is a moderate likelihood of landslide debris impacting upon the stream system, if a clearcut landslide (i.e. rapid mass movement, slump) should occur in these terrain polygons. (Some of the clearcut rapid mass movements and slumps in unconsolidated materials occurring in these areas are expected to impact upon the stream system).
L	There is a low likelihood of landslide debris impacting upon the steam system, if a clearcut landslide (i.e. rapid mass movement, slump) should occur in these terrain polygons. (Few of the clearcut rapid mass movements and slumps occurring in these areas are expected to impact upon the stream.)
-L	This symbol is used to modify the potential introduced landslide debris rating and indicates that landslide derived debris may be deposited into a lake.





Terrain polygons covered by this pattern represent those areas that have a clearcut landslide rating of 4 and a potential introduced landslide debris rating of H (High) or M (Moderate), or areas that have a clearcut landslide rating of 3 and a potential introduced landslide debris rating of H (High).

data or the identical agricultural capability ratings (but not having both types of data identical). However, it happened so infrequently that these polygons were not amalgamated when the individual themes were output. Coincident polygons made it simpler to check the relationship between the two sets of data for each polygon, ensuring that they corresponded appropriately. Also, a potential irrigation requirements algorithm, calculating water volume, employed the capability data to determine arable land and the soils (and climate) data to calculate the required water depth.

Examples: Multi-theme Analysis with True Overlay

At the request of the Waste Management Branch, soil map data was analyzed for the Okanagan Water Quality Project to evaluate the problem of phosphorus loading from diffuse sources into Okanagan Lake. A programmed algorithm to interpret each soil for the rate of phosphorus transmission was developed. Then the soil polygons were overlayed with distance to water and zoning polygons to produce maps and reports defining the quantity and source areas of current and potential phosphorus loading from septic tanks into Okanagan Lake.

In the Kimsquit Coastal Grizzly Bear Habitat Study, overlay techniques were utilized to analyze a number of map themes input for the Kimsquit River watershed. At the request of the Wildlife Branch a variety of tabular outputs useful for assessing the condition of present grizzly bear habitat for future management considerations were generated. The input maps for overlay included: Ecological Units, Forest Cover, New Cut Block Areas, Human Disturbance Areas, and Home Range Zones. Included in the output were tabular statistics of: home ranges within hierarchically defined ecological units, overall home range versus forest cover, forest cover in new cut blocks, and seasonal and overall home range in human disturbance areas.

Examples: Spreadsheets

The Langley Land Evaluation Pilot Project was undertaken at the request of the Ministry of Agriculture and Food. The project interpreted the soil and agricultural capability themes for the polygon's suitability for raspberry production. This was overlayed with land use and Agriculture Land Reserve boundaries to identify areas best suited for raspberry farming. An interactive, spreadsheet-like program allowed the user to input economic factors such as the costs for land improvements for each limiting factor, interest rates, amortization periods and the price of raspberries. This allowed agriculture economists to see the affect to the marginal agricultural areas of shifts in the market value of raspberries or in interest rates, using scenarios predicting returns for best and moderate farming practices. These statistics were useful to economists in forecasting critical values that the market would have to sustain when recommending lands for conversion.

The objective of the Bulkley Valley Sub-regional Moose Management Plan, undertaken by the Planning and Assessment Branch, was to evaluate the impacts of alienating Crown lands for agriculture use to the limited amount of moose winter range. CAPAMP was used to provide potential moose population in the year 1990 given the land base defined by various scenarios. The theme maps analyzed included Tenure Group, present vegetation, generalized agricultural capability, areas slated for disposition, and a derived map indicating potential moose habitat enhancement areas. An interactive program incorporating spreadsheets housing the above data allowed the user to determine moose carrying capacity for selected parameters.

GLOSSARY

Alphanumeric Character

These characters include numeric, alphabetic, and special characters. The numeric characters are the ten digits 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. The alphabetic characters include the twenty-six upper case letters of the alphabet, the twenty-six lower case letters of the alphabet. The special characters are the blank character and the following twenty characters: * # % @ : ; , . ? ! ' " ( ) + - = < > /

Biophysical Mapping Unit

A class or value of a categorical system used to classify the surface of the earth in terms of material, form, and/or process, as related to biological or physical landscape characteristics. Soils, agricultural capability classes, forest cover types, habitats and ecosystems are all examples of biophysical mapping units.

Coding Field

The space allocated for entering data for a given item on a data form. Each coding field has associated with it a computer variable name and a field label.

Component

See Polygon Component

Computer Variable Name

A five or six character abbreviation used in the CAPAMP database to represent attributes. The abbreviation is used for all data storage, retrieval, and analysis.

Copy Key

A fifteen character code on the soil cartographic form, equivalent to a Soil Key and used when the soil cartographic attribute data corresponding to an existing soil are to be copied into the database for the new soil being described on the form. Fields which contain data on the current form are not overridden by new values associated with the soil referenced by the Copy Key. For soil horizon or layer data to be copied as well as site data, a one character Copy Key field, pertaining to each layer, must also be used. (This is explained in more detail in the description of the form.) By using the Copy Key fields and only entering exceptions on a soil cartographic form, significant time savings can be gained.

Copy Polygon

A four character code on the Wildlife Habitat Polygon form, equivalent to a polygon number, and used when the attribute data for a previous polygon are to be copied for the current polygon. Other than the polygon number itself, differences in values between the polygons are not allowed if the Copy Polygon field is filled. It is used as a labour saving device at the time of data entry.

Decile

The areal fraction, in tenths, of a map polygon assumed to be covered by a polygon component. The integers 1 through 9 are used to represent the area, in tenths, from 1/10 (10% of polygon area) to 9/10 (90% of polygon area). A "0" (zero) is used to represent 10/10 (100% of polygon area). The deciles for a polygon always sum to 10, with inclusions most commonly incorporated with their most similar recorded mapping unit.

Dominant

The most common value of a categorical variable describing the areal distribution of a polygon or biophysical mapping unit. Anywhere from 50% to 100% of the area is characterized by the dominant value. Where a subdominant value is also given, the dominant usually refers to 60% to 70% of the area. Note that the coding forms do not include fields for the percentages pertaining to the dominant and subdominant values. (Also see Subdominant.)

Dummy Variable

A non-standard variable, usually utilizing free format coding fields, that is defined by the user for a specific project. The user defines the attribute associated with the variable, the variable type, the variable justification, the variable format, and the set of allowable values or codes for the variable. The values for the variables are coded in data fields labelled as "Dummy Variable" or "User Specified".

Field

A synonym for coding field. (See Coding Field.)

Field Label

The label on the coding form adjacent to or near the coding field and identifying the attribute.

Fixed Format

A type of data formatting where specific characters must be entered into each part of the coding field. The position of each character of the data element is directly connotative.

Floating Point Number

A non-integer number whose value consists of a whole number plus a decimal fraction. A decimal is required as part of the number, even where the fraction is zero.

Format

A description of a field indicating: the number of spaces it occupies; whether it is left justified, right justified, or fixed for each character; and whether it is to be filled with an alphanumeric entry, a floating point number, or an integer number.

Integer Number

The character set consisting of the whole or natural numbers only. Zero and negative whole numbers are also included.

Left Justified

A type of data formatting where the data is entered in the most left-hand spaces of the coding field. If for example the field length is 6 and the letters to be entered are ACK, then left justification would appear as follows: ACK___. Normally, alphanumeric fields are left justified.

Mean

The average value of a continuous variable throughout the year, unless otherwise stated in the variable description in this document. The mean may reflect professional judgement if there are only a small number of samples available on which to base the estimate, or if the samples are poorly distributed with respect to location or time.

Over-defined Variable

A variable whose coding field consists of the whole or partial coding fields of two or more contiguous variables of smaller field length. For example, consider the variables X and Y whose fields, each two characters long, are adjacent to one another in the database. Another variable, Z, may exist which is defined as a four character field occupying the same space as X and Y together. In this example characters one and two define X entirely, and as well, define the first two characters of Z; similarly, characters three and four are associated with Y and also the last two characters of Z. SOIL KEY on the soil cartographic form is an example of an over-defined variable.

Polygon

An area on a map, corresponding directly to an area on the earth's surface, assumed to be relatively homogenous with respect to a set of differentiating, mapping criteria. Usually a polygon must differ from adjacent polygons with respect to a least one of the original mapping criteria. A polygon derived through a subset of the original data, or through an interpretation, may appear identical to its neighbours unless further processing has been performed on the map to eliminate this situation.

Polygon Number

A unique number used to link the graphics on a mapsheet to the associated attribute data. Normally the polygon numbers are assigned automatically by the computer software at the time of graphics data capture. Because of both significantly lower error rates and more efficient use of the graphics workstation, automated polygon number assignment is preferred to manual assignment. Typically, polygons on a mapsheet are numbered from 1 to the total number of polygons on that mapsheet.

Polygon Component

A constituent of a map polygon whose corresponding ground area is characterized by a distinctive mapping unit. Note that the term component refers to the mapping unit within the polygon, the corresponding decile, and any other associated variables in the polygon database. Within the database a polygon may contain from one to three components, in order of dominance. A component must occupy at least 5% of the polygon area in order to be recorded. If on the ground, a polygon contains more than three components, then either it should be mapped in more detail if feasible or, if it is not, the remaining components must be ignored. Commonly, unrecorded inclusions may occupy from 0% to 25% of the area, with 15% to 20% being typical. See Data Collection and Compilation Stage (above) for further discussion.

Project

A specific study associated with a given geographic area. Most data entry and analysis in the CAPAMP environment are performed on a project basis. Project identification codes are unique and are assigned by CAPAMP operations personnel.

Range

The lower and upper bounds of a variable associated with a polygon or a biophysical unit such as a soil. Because the number of samples collected or measured is often low by statistical standards, estimates for the range are based on professional judgement taking into account measured values and familiarity with the study area and landscape processes. In a statistical context, the lower and upper bounds may be treated as the 95% confidence limits.

Right Justified

A type of data formatting where the data is entered in the most right-hand space of the coding field. Right justification would appear as follows: ____115. Normally, numeric fields are right justified.

Schema

A representation of a computer database consisting of the computer variable name, the variable formatting, a brief description of the attribute represented by the variable, and a brief set of notes indicating the database structure.

Soil Key

A unique, fifteen character code for a soil, consisting of the project identification code, the soil name code, and association and phase code(s). The Soil Key is used to link the soil polygon and soil cartographic files.

Standard Deviation

A measure of variability around the mean for a continuous variable. Where the sample size is sufficiently large, the formula SQRT(Sum(X_i - Mean)^2 / (n-1)) may be used, where X_i is an individual value and n is the sample size. Where the sample size is small, but the mapper feels that the range can be reasonably estimated, the standard deviation can be defined as 0.25 * (Upper Bound - Lower

Bound). By this approach, if the coarse fragment content is assumed to vary from 30% to 10%, the standard deviation is calculated as 5%. (See also Mean and Range.)

Subdominant

The second most common value of a categorical variable associated with the areal distribution of a polygon or biophysical mapping unit. At most the subdominant value pertains to 50% of the area. More typically, 30% to 40% of the area is characterized by the subdominant value. If a subdominant field is left blank, it implies that the dominant field value describes at least 75% of the area.

Subfield

A field which is part of another, larger field. (See Over-defined Variable.)

User Specified Variable

A synonym for dummy variable. (See Dummy Variable.)

Documentation Format For Data Entry Procedures

Data entry procedures are described separately for each CAPAMP data form. For each form, coding fields are described using the following information. The coding field description will consist of a field label (in bold print) and a field format description. A verbal description of the field and any subfields will follow the coding field description. For users interested in the computer variable names and more detailed formatting information, a copy of the database schema is included in Appendix A.

The format statement for a field lists the number of spaces on the coding form, the type of characters to be used, and a code designating the placement of the value in the field. The three types of characters referenced in this document are:

1. **AN** - an alphanumeric character,
2. **I** - an integer number, and
3. **F** - a floating point number.

Almost all alphabetic characters are left-justified in the coding fields and all numeric characters are right-justified. Most alphabetic codes are entered as upper case. Exceptions to these rules are clearly indicated. Left-justification, right-justification, and fixed format are indicated by the abbreviations **L**, **R**, and **X**, respectively. For certain single space coding fields, justification is not relevant and this is indicated by a "-". The format statement is enclosed in square brackets. Where it is necessary to include two or more field format descriptions when describing a coding field, they will be separated by a comma.

A few computer variables refer to computer calculated values or variables utilized by programming staff. Although not essential for completing the form, these are described in order to enhance the users understanding of the system.

The verbal description of the coding field is a definition and/or description of the data entered into the coding field. The verbal description contains a list of all the acceptable codes for the specific field.

An example of a coding field description and its explanation is as follows:

POLYGON [4,I,R]
NO.

An integer from 1 to 2000 indicating the unique polygon number within a map sheet and/or project. The number is assigned by the Thematic Mapping Unit or the user.

. . . . Explanation of Example . . . .

POLYGON - label on the form adjacent to or near the coding field and
NO. identifying the attribute

[4,I,R] - the coding field is four spaces long, the data must be integer characters, and the data must be right-justified

"An integer ... or the user" - a general description of the coding field, including the attribute definition, and type of allowable codes

CAPAMP INPUT - SOIL POLYGON

Introduction

The CAPAMP INPUT - SOIL POLYGON form is used for entering specific soil polygon data for soil maps. This form is used to identify the Soil Keys (codes for soils- see Glossary), corresponding slope classes, and polygon specific phases found within the identified polygon. The information in the soil polygon file, for up to three soils per polygon, is linked through the Soil Key to the soil site and horizon attribute information in the soil cartographic file. The form is usually used in conjunction with the soil cartographic form described in a later section of this document. An extensive field of user specified dummy variables also allows entry of numerous project specific attributes.

The Form

The form is two-sided and will allow the input of up to 6 polygons, 3 on each side (Figure 2). Each block is designed for coding the soil polygon data for one CAPAMP map polygon and each block utilizes identical codes. One block of coding fields is described in complete detail.

In the upper right-hand corner of the front of the form is the label, MAP SHEET NO., followed by an underlined area. The user enters the National Topographic System (NTS) or the British Columbia Geographic System (BCGS) map reference number to aid in manually sorting and storing the completed forms. This information is for the convenience of key entry personnel, CAPAMP production staff, and the user.

<u>A user coding historic data from biophysical soil association maps should refer to Appendix B for special instructions regarding CAPAMP input.</u>

Coding Field and Attribute Descriptions

TRANS. [4,AN,L]
ID.

A four character computer transaction code which is utilized when data is loaded into the CAPAMP database. The value ADPP is entered into the data field when the form is printed and appears on all soil polygon forms; do not enter any data in this field.

POLYGON [4,I,R]
NO.

An integer from 1 to 2000 indicating the unique polygon number within a map sheet and/or project area. The number is assigned be either the Thematic Mapping Unit or the user. Assignment by the former (using a software utility) is preferred upon completion of entering polygon linework into the system.

Polygon [-,F,R]
Area

This variable, the polygon area (km^2), does not appear on the form. It is

FIGURE 2
EXAMPLE OF SOIL POLYGON FORM

CAPAMP INPUT – SOIL POLYGON

MAP SHEET NO. ______________

TRANS. ID. | POLYGON NO. | PROJECT ID. | NO. OF PITS | SLOPES | POLYGON PHASES

A D P P | 5 | 9 | 15 | 1 2 3 D U D U D U 18 | 1 2 3 24

DUMMY VARIABLES

87 88 89 90 91 92

76 77 78 79 80 81 82 83 84 85 86

51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50

33 37 41 45 49 53 57 61 65 69 73 77 81

TRANS ID. | DOM. CODE | DECILE | SOIL Name AS P1 P2

A D P A | 15 | 16 | 17 20 22 24

TRANS. ID. | POLYGON NO. | PROJECT ID. | NO. OF PITS | SLOPES | POLYGON PHASES

A D P P | 5 | 9 | 15 | 1 2 3 D U D U D U 18 | 1 2 3 24

DUMMY VARIABLES

87 88 89 90 91 92

76 77 78 79 80 81 82 83 84 85 86

51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50

33 37 41 45 49 53 57 61 65 69 73 77 81

TRANS ID. | DOM. CODE | DECILE | SOIL Name AS P1 P2

A D P A | 15 | 16 | 17 20 22 24

TRANS. ID. | POLYGON NO. | PROJECT ID. | NO. OF PITS | SLOPES | POLYGON PHASES

A D P P | 5 | 9 | 15 | 1 2 3 D U D U D U 18 | 1 2 3 24

DUMMY VARIABLES

87 88 89 90 91 92

76 77 78 79 80 81 82 83 84 85 86

51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50

33 37 41 45 49 53 57 61 65 69 73 77 81

TRANS ID. | DOM. CODE | DECILE | SOIL Name AS P1 P2

A D P A | 15 | 16 | 17 20 22 24

Province of British Columbia Ministry of Environment and Parks

ENV 1952

calculated by software when polygon boundaries have been completely entered into the system.

Polygon [-,F,R]
Perimeter

This variable, the polygon perimeter (km), does not appear on the form. It is calculated by software when polygon boundaries have been completely entered into the system.

PROJECT [6,AN,L]
ID.

Project code assigned in consultation with Thematic Mapping Unit for each user project. Usually the user decides on the Project ID code and informs the Thematic Mapping Unit. Each project has a unique code.

NO. OF [3,I,R]
PITS

Number of soil profile descriptions, within the polygon, that are stored in the British Columbia Soil Information System (Sondheim, Vold and Quesnel, 1983). The maximum value is 127.

SLOPES

This space is used to code the dominant(D) and subdominant(U) slope classes (Canada Soil Survey Committee, 1978) for each soil in the polygon. These values must correspond with the soils described in the SOIL field on the right side of the form. This correspondence can be in one of two ways. (1) The first dominant and first subdominant slope class describe the slope of the first soil, the second dominant and subdominant class relate to the second soil, and the third dominant and subdominant class correspond to the third soil. If only one soil is present, then only one dominant and one subdominant slope class values can be given. Similarly, two soils can have two sets of slope clasclass values, one set for each soil. (2) Where all soils are assumed to have the same dominant and subdominant slope class, then only the first dominant and subdominant slope classes need be entered.

Should a soil within a polygon occupy two distinct areas characterized by very different slopes, then the soil must be entered twice, once for the first dominant and subdominant slope class and a second time for the second dominant and subdominant slope class. Alternatively, the soil is entered onnce but the corresponding dominant and subdominant slope class values are chosen to take into account the full slope class distribution of the soil within the polygon.

The dominant and subdominant slope classes are defined in terms of the relative proportion of the polygon occupied by the soil(s), implying that the dominant slope class occurs in an equal or greater area of the polygon for a given soil, compared to the subdominant slope class. Thus, the dominant and subdominant slope classes should not be treated as the lower and upper bounds of a range.

1 [1,AN,-],[1,AN,-]

D | U

This space is used to code the dominant(D) and subdominant(U) slope classes of the most dominant soil in the polygon. These values must correspond to the first soil described in the SOIL field (DOM.CODE of 1).

The following are the allowable slope class codes:

Slope class codes	CSSC slope class	Percent slope	Slope class codes	CSSC slope class	Percent slope
1	1	0-0.5	6	6	16-30
2	2	0.5-2.5	7	7	31-45
3	3	2.5-5	8	8	46-70
4	4	6-9	9	9	71-100
5	5	10-15	0	10	>100

2 [1,AN,-],[1,AN,-]

D | U

This space is used, if necessary, to code the dominant(D) and subdominant(U) slope classes of the second most common soil in the polygon. These values must correspond to the second soil described in the SOIL field (DOM.CODE of 2). The codes are identical to those listed for the slope classes of the first soil.

3 [1,AN,-],[1,AN,-]

D | U

This space is used, if necessary, to code the dominant(D) and subdominant(U) slope classes of the third most common soil in the polygon. These values must correspond to the third soil described in the SOIL field (DOM.CODE of 3). The codes are identical to those listed for the slope classes for the first soil.

POLYGON PHASES

This field is generally used for coding phases which are applicable to the whole polygon and do not correspond on a one-to-one basis with the soil(s) of the polygon. The latter phases are described in the SOIL field. The polygon phases should be established by prior arrangement with the Provincial Soil Correlator and the CAPAMP systems analysts. Examples of polygon phases are defined in Canada Soil Survey Committee (1978). If prior arrangements are made with the CAPAMP systems analysts, POLYGON PHASES can be used as soil phases for a project area. The phases in this case are required to have a one-to-one correspondence with the individual soils in the polygon.

1 [3,AN,L] or [1,AN,-],[1,AN,-],[1,AN,-]

This field is for coding the first polygon specific phase and can be coded in two ways as indicated by the coding formats. The first way is to use the field for a three character phase code. The second way is to use the field for three, single character phases. The different ways of coding this field cannot be used interchangeably within a single project.

2 [3,AN,L] or [1,AN,-],[1,AN,-],[1,AN,-]

This field is for coding the second polygon specific phase. The coding format is the same as for polygon phase one.

3 [3,AN,L] or [1,AN,-],[1,AN,-],[1,AN,-]

This field is for coding the third polygon specific phase. The coding format is the same as for polygon phase one.

DUMMY VARIABLES

Dummy, or user specified variables (see Glossary) represent coding fields where the user defines project specific variables. These variables should be defined and used after consultation with the CAPAMP systems analysts. Consultation is necessary to establish project specific data items, standard attribute definitions, and allowable codes. It is essential that the project specific variables be consistently used throughout a project and that these variables are consistently coded with respect to character type, coding field(s), and field justification.

The multi-layer field labels on the form represent the original computer programming where multi-space variables had to be rigidly defined (these variables are indicated in Appendix A). Although the rigid multi-space variables can still be used, the current programming is more flexible.

From one to 50 alphanumeric characters can be used, in any combination, for user specified variables. For example, the user could define 10 variables of 5 character length that are all right-justified numeric variables. In this example, the user would enter the first variable in the fields labelled "1" to "5" such that the last data character would be under label "5".

TRANS. ID. [4,AN,L]

A four character computer transaction code which is utilized when data is loaded into CAPAMP. This label appears to the right of the dummy variable coding fields. The value ADPA is entered into the data field when the form is printed and appears on all soil polygon forms. This computer transaction code indicates that data specific to the individual soils of the polygon is to be entered.

DOM.CODE [1,AN,-]

This field is used for entering the dominance code corresponding to each soil entered into the SOIL coding field. The soil which occupies the largest area in the polygon is assigned dominance code 1. The second and third soils in terms of area occupied, if present, are assigned dominance codes 2 and 3, respectively. Code 1 is entered into the top line of the field while codes 2 and 3, if necessary, are entered in the middle and bottom lines, respectively.

DECILE [1,AN,-]

The decile fraction of the polygon represented by each soil, in terms of area occupied, is coded here. The allowable codes include numbers 0 to 9, with "0" (zero) representing 100 percent. The deciles for complex polygons must total 10. The decile spaces for the second and third soils are left blank, where appropriate, when less than three soils are entered for the polygon.

SOIL

These fields are for coding from one to three soils. (The nine characters of each SOIL field, preceded by the six characters of the Project ID, form the Soil Key.) The top line of the field is for coding the soil which either occupies the largest area in the polygon or is the only soil in the polygon. The middle and bottom lines are for coding, if necessary, the second and third largest soils, respectively.

Name [3,AN,L]

The soil name code is entered here. It consists of a symbol up to three characters long. A maximum of three unique soils can be coded for each polygon. The Provincial Soil Correlator should be contacted when selecting the abbreviations for this field. In general, each soil within a project area requires a unique code for Name.

AS [2,AN,R]

The soil association component number code is entered here. This field, as defined, is required only for entering historic data from biophysical soil association maps (refer to Appendix B). The number code can be up to 2 characters long. If historical data is not being entered, this field may be used as an additional soil phase in the same manner as P1 or P2. If this field is used for phase, it should be left-justified.

P1 [2,AN,L]

The first soil phase code. A symbol of up to two characters long can be coded and it must correspond to the soil coded in the Name field. Soil phase codes (P1 and P2) should be developed in conjunction with the Provincial Soil Correlator to ensure consistency between projects.

P2 [2,AN,L]

The second soil phase code. A symbol of up to two characters long can be coded and it must correspond to the soil coded in the Name field.

Database or Attribute Report

Table I is a partial listing of a Soil Polygon Attribute Report. This type of report lists the attribute data stored in the soil polygon file by project area or map. The format and labels are very similar to the input data form. The report also shows the polygon area and perimeter as calculated by CAPAMP. This example report also contains values for user specified variables 1, 2, 80, and 81 as per the original rigidly defined format. The attribute report is used to compare the computer database with the original coded forms to ensure accuracy of key entry. The listing is also used in conjunction with validation reports (see below). Desired corrections and/or revisions can be indicated on the report and returned to Thematic Mapping Unit for revision.

Validation Routines

The validation routines test the general validity of the soil polygon data. The routines are designed as a tool for editing the input data. Although a number of validations are applicable to all soil projects, it is advisable to establish project specific validation requirements with the CAPAMP systems analysts before data coding begins. The validation routines check to ensure that the polygon number is not a duplicate of previously entered polygons, that the sum of the component deciles equals 10, and that the standard codes are legal. Simple statistics on the number of observations are calculated. User specified dummy variable codes can be validated if prior arrangements are made with the CAPAMP systems analysts. Simple statistics can also be calculated for user specified variables if prior arrangements are made as above.

The following specific validation routines are applied to the input soil polygon data:

1. the data set is checked for non-unique and omitted polygon numbers;
2. all character fields are checked for legal entries;
3. slopes are checked for valid codes, that they correspond to a soil, that a subdominant slope is matched by a corresponding dominant slope, and that blank entries correspond to soils for which no slope is required;
4. the polygon phases are checked to ensure blank entries correspond to soils for which no phase is required (not required on all projects);
5. the soil dominance codes are checked to ensure that they are numbered consecutively;
6. the second and third deciles are corrected to zero if soil dominance codes are blank;
7. the deciles are checked to ensure that they sum to 10;
8. simple descriptive statistics, if required, are calculated for numeric dummy variables;
9. Soil Keys, areas, and polygon numbers are sorted and tabulated;
10. during the sorting and tabulating, the data is checked to ensure that the soil name is not blank, the project ID is not blank, the Soil Keys are unique within polygons, the polygon number(s) are not unreasonably large (miscoded polygon number), and polygon area has been calculated.

Tables II to V illustrate sections of a validation report. Table II shows a sample listing of errors found by the validation routines. The listing indicates the polygon number, the field where the error occurs, and the current entry. Most of these error messages are self-explanatory. Note that this error listing contains messages concerning duplicate polygon numbers and error messages for project specific validation involving user specified dummy variables 1, 2, 80, and 81 as defined in the original rigid formatting.

Table III gives a sample listing of simple statistics for a numeric user specified dummy variable. This example gives simple statistics for project specific, dummy variable 80 (original fixed formatting, see Appendix A), climatic moisture deficit (CLI MOIS DEF). The table for simple statistics includes variable name, number of blank entries, number of zero entries, the mean value, the median value, the lowest value, the second lowest value, the highest value, and the second highest value. The polygon numbers corresponding to the last four items are listed in brackets. The bottom section of the table gives a sample of the type of error message one would receive if no data had been entered into a field. Similar listings for checking user specified dummy variables on a project specific basis can be developed by prior arrangement with the CAPAMP systems analysts.

Table IV is a listing of all the Soil Keys and associated areas found for the map sheet. The first column indicates each unique combination of soil, and phase(s) found on the map. The second column indicates, for all polygons, the area (hectares) occupied by each Soil Key, the percent of the total area, and the number of polygons in which the Soil Key was found. The third and fourth columns indicate the same information for pure and complex polygons, respectively. The end of the table gives summary information with respect to the total number of unique Soil Keys found on this map, the total number of occurrences of all Soil Keys on this map, the total number of soil polygons on the map, and the total area (hectares) occupied by the Soil Keys on the map. This type of information can be used by the user when deciding if a soil phase has sufficient area to justify a new soil name.

Table V is a listing of the polygon numbers associated with each Soil Key on the map sheet. This listing provides a reference list for users to refer back to specific polygons for making data corrections or modifications.

Project Specific use of Dummy Variables and Validation Routines

The users are encouraged to discuss project specific output with respect to the formatting of the reports. User specified output can be arranged after consultation with the CAPAMP systems analysts.

This section provides a few examples of the use of dummy variables and project specific validation. These examples may be useful for the user by suggesting ways in which these features may be used for their project(s).

A recently completed detailed soil survey utilized dummy variables 1, 2, 80, and 81 (original rigid formatting) to record type of survey, climatic area, climatic moisture deficit, and growing season precipitation, respectively. The Polygon Phases were designed to specifically indicate the percent coarse fragments corresponding to each soil in the polygon. The following project specific validation routines were developed:

1. the character fields of user specified dummy variables were checked to ensure that all fields contained blanks or right-justified digits;
2. the dominance codes, slope values, and sum of deciles were checked to ensure that legal values were entered and corresponded to the specific soils of the project;
3. user specified dummy variables 1, 2, 80, and 81 were checked for project specific legal values (Tables II-III);
4. summary statistics were generated and tabulated for dummy variable 80 (Table III);
5. a project specific error message was produced for dummy variable 80 (Table III).

Two project specific validation routines which compared data between CAPAMP files were also developed for the detailed soil survey. The first validation routine cross checked the slope classes, percent coarse fragments, and soil classification data (accessed through the soil name/phase) on the soil polygon file with the topographic, stoniness, wetness, and organic ratings of the agricultural capability file. This provided the user with a cross-reference to ensure that comparable data was being collected and entered, in a consistent manner, in two different data files. The second validation routine produced a listing of Soil Keys and the corresponding polygon numbers for which there was no corresponding soil cartographic file. This provided the user with a reference list which indicated necessary data additions or revisions and indicated the polygons where changes were required. Information concerning these routines and others can be obtained through the CAPAMP systems analysts.

TABLE I
SOIL POLYGON ATTRIBUTE DATA


```
##############################################################################################
POLY  PRO   PITS   SLOPES     POLY PHASES              DOM.  DEC   ----SOIL----      AREA (KM2):    0.0232
NO    ID           DU DU DU    1  2  3                 CODE        NA  AS P1 P2      PERIM (KM):    0.6960
----  ----  ----   --------   -----------              ----  ---   --- -- -- --
  43  VID-1        1          C0                        1     7    MT
                                                        2     3    MT     SO

INP::----+----1----+----2----+----3----+----4----+----5

DV ::01            200

##############################################################################################

POLY  PRO   PITS   SLOPES     POLY PHASES              DOM.  DEC   ----SOIL----      AREA (KM2):    0.0421
NO    ID           DU DU DU    1  2  3                 CODE        NA  AS P1 P2      PERIM (KM):    0.9806
----  ----  ----   --------   -----------              ----  ---   --- -- -- --
  44  VID-1        47         C02                       1     0    QL     G

INP::----+----1----+----2----+----3----+----4----+----5

DV ::01            200

##############################################################################################

POLY  PRO   PITS   SLOPES     POLY PHASES              DOM.  DEC   ----SOIL----      AREA (KM2):    0.0270
NO    ID           DU DU DU    1  2  3                 CODE        NA  AS P1 P2      PERIM (KM):    0.7739
----  ----  ----   --------   -----------              ----  ---   --- -- -- --
 328  VID-1        42         C42                       1     7    QL     CO
                                                        2     3    QL     MC

INP::----+----1----+----2----+----3----+----4----+----5

DV ::01            200

##############################################################################################

POLY  PRO   PITS   SLOPES     POLY PHASES              DOM.  DEC   ----SOIL----      AREA (KM2):    0.0148
NO    ID           DU DU DU    1  2  3                 CODE        NA  AS P1 P2      PERIM (KM):    0.5786
----  ----  ----   --------   -----------              ----  ---   --- -- -- --
 329  VID-1        24         C2                        1     0    ST

INP::----+----1----+----2----+----3----+----4----+----5

DV ::01            200
```

TABLE II

POLYGON VALIDATION ERROR REPORT

TABLE OF ERRORS UNCOVERED BY PVALID ROUTINE, RELEASE 2.0 MARCH 1986

```
(Standard Attribute Errors)
POLYGON:   47  - ERROR - NO VALUE HAS BEEN ENTERED FOR THE FIRST DOMINANT SLOPE
POLYGON:  147  - ERROR - ONE OR MORE OF THE SLOPE FIELDS CONTAINS AN ILLEGAL CHARACTER
POLYGON:  148  - ERROR - FOR SLOPE 2, THERE EXISTS A SUBDOMINANT VALUE, BUT NO DOMINANT VALUE
POLYGON:  149  - ERROR - FOR SLOPE 3, THERE EXISTS A SUBDOMINANT VALUE, BUT NO DOMINANT VALUE
POLYGON:  150  - ERROR - A VALUE FOR SLOPE 2 EXISTS, YET A SECOND SOILKEY HAS NOT BEEN ENTERED
POLYGON:  151  - ERROR - A VALUE FOR SLOPE 3 EXISTS, YET A THIRD SOILKEY HAS NOT BEEN ENTERED
POLYGON:  152  - ERROR - THREE SOILKEYS EXIST, BUT ONLY SLOPES ONE AND TWO HAVE BEEN ENTERED
POLYGON:   47  - ERROR - NO VALUE HAS BEEN ENTERED FOR THE FIRST POLYGON PHASE
POLYGON:   48  - ERROR - DECILES SUM TO   8
POLYGON:   49  - ERROR - THE FIRST SOIL DOMINANCE CODE MUST EQUAL TO 1. IT EQUALS 2
POLYGON:   50  - ERROR - THE SECOND SOIL DOMINANCE CODE MUST EQUAL TO 2 OR BLANK. IT EQUALS 1
POLYGON:   51  - ERROR - THE THIRD SOIL DOMINANCE CODE MUST EQUAL TO 3 OR BLANK. IT EQUALS 2
POLYGON:   52  - ERROR - THE SECOND SOIL DOMINANCE CODE IS BLANK BUT THE THIRD IS NOT.
***** ERROR  - - SOIL NAME BLANK FOR OCC : 2  POLYGON NO :  217 *****
***** ERROR  - - PROJECT ID BLANK FOR OCC : 1  POLYGON NO :  218 *****
***** ERROR  - - SOILKEYS NOT UNIQUE WITHIN POLYGON NO :  219 *****
***** ERROR  - - GREATER THAN 8000 POLYGONS ENCOUNTERED *****
***** ERROR  - - AREA FOR POLYGON 220 IS <= ZERO ***** PROGRAM TERMINATING *****
***** ERROR  --- DUPLICATE POLYGON NUMBER : 221
***** ERROR  --- MISSING POLYGON NUMBER : 215
(Example User Specified Dummy Variable Errors)
***** ERROR ***** POLYGON:  216 ***** ILLEGAL VALUE OR BLANK FOR PDP02: 3 :
***** ERROR ***** POLYGON NUMBER :  217 ***** PDP01 EQUALS : 3 : IT MUST EQUAL 1, 0, OR BLANK *****
***** ERROR ***** POLYGON NUMBER :  217 ***** PDP12 EQUALS : 3 : IT MUST EQUAL N OR BLANK *****
***** ERROR ***** POLYGON:  225 ***** 1ST CHARACTER OF PDP80 MUST BE +, -, OR BLANK. PDP80 EQUALS: 200 :
***** ERROR ***** POLYGON:  226 ***** ILLEGAL VALUE FOR PDP80: 2000: (4 CHARACTERS IN LENGTH)
***** ERROR ***** POLYGON:  223 ***** ILLEGAL VALUE OR BLANK FOR PDP81:9000
```

TABLE III

DUMMY VARIABLE INFORMATION FOR SOIL POLYGON FORM

TABLE LISTING SIMPLE STATISTICS FOR NUMERIC VARIABLES (POLYGON DATA)

VARIABLE NAME	# OF BLANKS # OF ZEROS	MEAN MEDIAN	LOWEST 2ND LOWEST	(POLYGON) (POLYGON)	HIGHEST 2ND HIGHEST	(POLYGON) (POLYGON)
CLI MOIS DEF	2	-194.17	-200.00	(1)	-175.00	(126)
	0	-200.00	-200.00	(2)	-175.00	(125)

POLYGON: 47 - NOTE - CLI. MOIS. DEF. IS BLANK

POLYGON: 48 - NOTE - CLI. MOIS. DEF. IS BLANK

. . . . .

TABLE LISTING SIMPLE STATISTICS FOR NUMERIC VARIABLES (POLYGON DATA)

********** VARIABLE: PDP81 --- NO OBSERVATIONS!! **********

TABLE IV
SUMMARY OF SOIL KEY INFORMATION

TABLE LISTING SOILKEYS FOUND ON THIS MAP AND ASSOCIATED STATISTICS

FIGURES SHOWN ARE : AREA OCCUPIED BY SOILKEY, % OF TOTAL AREA, AND NUMBER OF POLYGONS IN WHICH FOUND.

SOILKEY	------ALL SOILKEYS-----			-----PURE SOILKEYS-----			---COMPLEX SOILKEYS----		
VID-3 AB	1420.29ha(	19.10%)	62	1204.53ha(	16.20%)	44	215.76ha(	2.90%)	18
VID-3 AB G	49.34ha(	0.66%)	4	0.00ha(	0.00%)	0	49.34ha(	0.66%)	4
VID-3 AB G L2	9.85ha(	0.13%)	2	0.00ha(	0.00%)	0	9.85ha(	0.13%)	2
VID-3 AB L2	4.96ha(	0.07%)	1	0.00ha(	0.00%)	0	4.96ha(	0.07%)	1
VID-3 AB S	2.45ha(	0.03%)	1	2.45ha(	0.03%)	1	0.00ha(	0.00%)	0
VID-3 AR	7.62ha(	0.10%)	1	7.62ha(	0.10%)	1	0.00ha(	0.00%)	0
VID-3 BD S	0.54ha(	0.01%)	1	0.54ha(	0.01%)	1	0.00ha(	0.00%)	0
VID-3 BO	9.09ha(	0.12%)	2	2.93ha(	0.04%)	1	6.16ha(	0.08%)	1
VID-3 BO G	6.16ha(	0.08%)	1	0.00ha(	0.00%)	0	6.16ha(	0.08%)	1
VID-3 BO G MD	4.79ha(	0.06%)	1	4.79ha(	0.06%)	1	0.00ha(	0.00%)	0
VID-3 BO MD	9.33ha(	0.13%)	1	0.00ha(	0.00%)	0	9.33ha(	0.13%)	1
VID-3 CA	23.24ha(	0.31%)	10	9.66ha(	0.13%)	6	13.58ha(	0.18%)	4
VID-3 CA G	17.35ha(	0.23%)	1	0.00ha(	0.00%)	0	17.35ha(	0.23%)	1

. . . . . .

TOTAL NUMBER OF UNIQUE SOILKEYS FOUND ON THIS MAP IS: 68
TOTAL NUMBER OF OCCURRENCES OF ALL SOILKEYS ON THIS MAP IS: 447

TOTAL NUMBER OF SOIL POLYGONS ON THIS MAP IS: 329
TOTAL AREA ON THIS MAP OCCUPIED BY ALL SOILKEYS IS: 7434.29

TABLE V
SUMMARY OF POLYGONS FOR EACH SOIL KEY

TABLE LISTING POLYGON NUMBERS ASSOCIATED WITH EACH SOILKEY

VID-3 AB		---	18 27 28 30 34 40 67 81 82 83 88 90 91 112 118 119 120 121 122 138 143 147 159 162 163 164 165 169 171 173 178 181 183 196 199 206 213 226 228 230 233 244 246 254 257 262 263 265 266 267 268 273 291 300 311 312 314 321 322 326 327 328
VID-3 AB	G	---	35 112 136 216
VID-3 AB	G L2	---	35 85
VID-3 AB	L2	---	172
VID-3 AB	S	---	208
VID-3 AR		---	176
VID-3 BD	S	---	276
VID-3 BO		---	145 255
VID-3 BO	G	---	145
VID-3 BO	G MD	---	232
VID-3 BO	MD	---	117
VID-3 CA		---	20 32 52 205 224 280 281 290 293 313
VID-3 CA	G	---	93

CAPAMP INPUT - SOIL CARTOGRAPHIC FILE

Introduction

The soil cartographic form is used to code depth and non-depth data for every unique combination of soil name, association, and soil phase(s) in the project area, including non-soils. This information is used to create the database for the soils and non-soils identified on the soil polygon forms. The database is linked to the polygon file via the Soil Key on the soil cartographic form and the project ID and SOIL fields on the soil polygon form. A limited number of dummy variables allows entry of project specific variables.

The purpose of the soil cartographic file is to store attribute data describing the range of chemical and physical properties assssociated with each soil in a project area. This data is used in conjunction with the soil polygon file to produce user specified interpretive products. The data for each Soil Key in the soil cartographic file is usually derived from a number of representative site and profile descriptions stored in the British Columbia Soil Information System. Thus, the soil cartographic file provides the range of characteristics which may be encountered for each soil.

If possible for a given project, a valid data entry should be provided for each attribute on the cartographic file form, for each soil defined. If a project does not require such a comprehensive database to meet project requirements it is then mandatory to define a subset of the attributes for which data will be provided for each soil. This will ensure that interpretive algorithms applied to that project will be accessing a consistent database.

Some of the fields described below are based on laboratory measurements. Such measurements are expected to have been made following the preparation and method techniques listed in B.C. Soil Information System, Volume III-Data Entry Procedures for Soil Laboratory Forms (Quesnel and Sondheim, 1983).

The Form

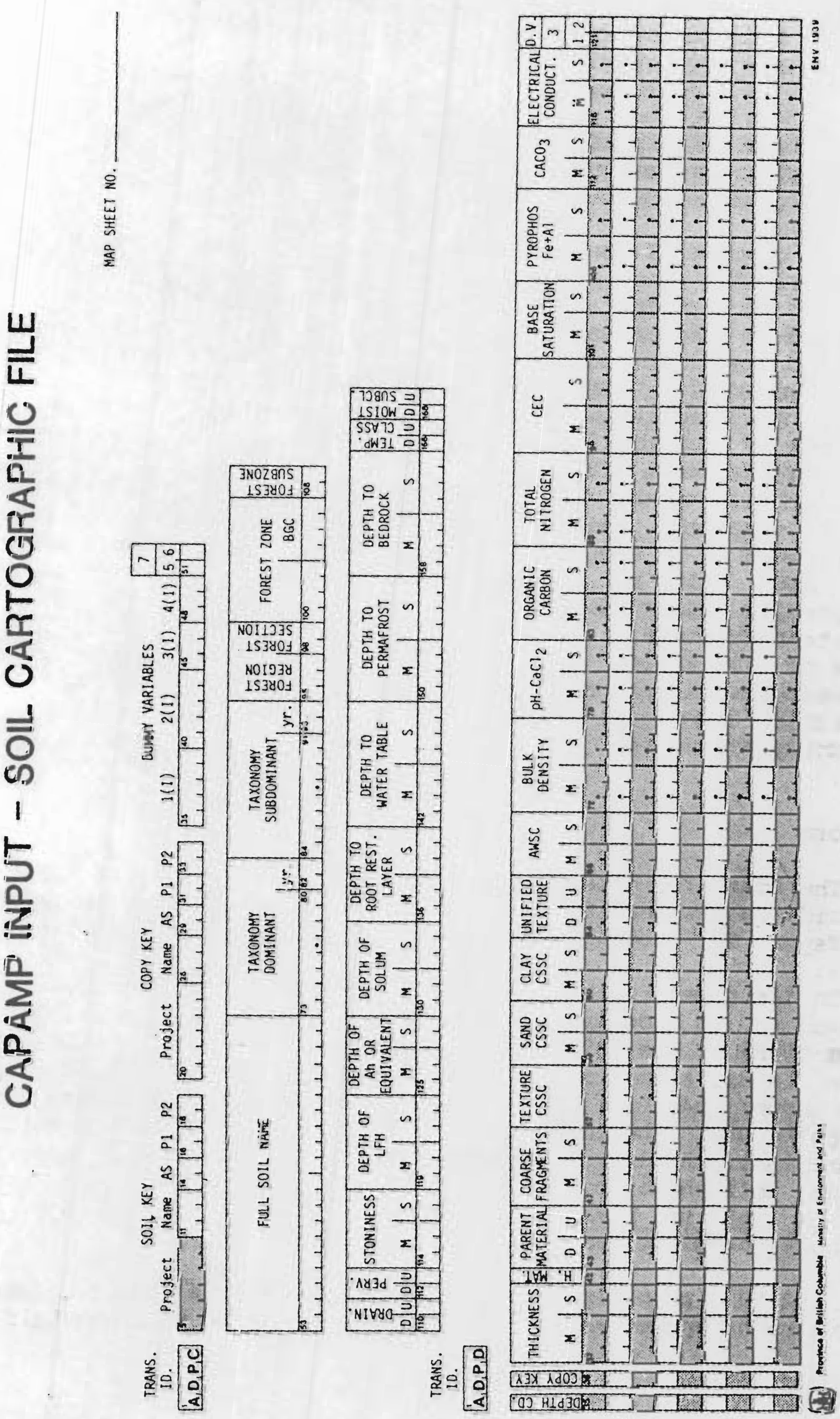
The form for entering Soil Cartographic data is two-sided (Figure 3). Each side is designed for input of the soil cartographic data for a single Soil Key. The coding fields for one side will be described in complete detail.

On the upper right-hand side of the form is the label, MAP SHEET NO., followed by an underlined area. The user enters the National Topographic System (NTS) or the British Columbia Geographic System (BCGS) map reference number to aid in manually sorting and storing the completed forms.

The upper half of the form is for coding soils information of a non-horizon nature. The lower half is for entering depth or horizon specific information. A maximum of 9 horizons (or layers) can be described for any soil or soil-phase combination. Conventions have been established to indicate that the user either did not find or did not consider a given soil attribute, as described in the following three rules:

1. A "0" (zero) is entered to signify that a numeric variable has a value of approximately zero. (A value smaller than one-half of the

FIGURE 3
EXAMPLE OF SOIL CARTOGRAPHIC FILE FORM



smallest non-zero entry allowable in the field is recorded as zero. For example, if the true value for STONINESS is 0.4 percent, a value of zero is entered; a true value of 0.5 to 1.4 should be rounded to 1.) For many variables, such as STONINESS or DEPTH OF LFH, this rule is equivalent to the mapper stating that a given characteristic was looked for but not found.

2. A blank or "-1" indicates that the user did not consider a given attribute for that particular soil. (Note that on output a "-1" entry is equivalent to a blank or an unused field).

3. A "-2" is entered when a DEPTH TO variable, such as bedrock in DEPTH TO BEDROCK, is not present. As with "0", this implies that the mapper did not find the characteristic for that soil, when following normal soil mapping procedures.

Most attributes on the form are described in terms of a mean value and a standard deviation. The purpose is to provide a range for the attribute, where the upper value is calculated as the mean plus two standard deviations and the lower value is calculated as the mean minus two standard deviations.

Due to the complex nature of biophysical soil association definitions (often including two or more distinct soils), attribute definition becomes difficult unless only the dominant soil is described. Thus if biophysical soil association mapping is being entered into CAPAMP, it is recommended that it be converted to a soil series type of representation. The user entering historic data from biophysical soil association maps should refer to Appendix B for special instructions regarding CAPAMP input.

Coding Field And Attribute Descriptions

TRANS. ID. [4,AN,L]

A four character computer transaction code which is utilized when data is loaded into CAPAMP. The value ADPC was entered into the data field when the form was printed and appears on all soil cartographic file forms.

SOIL KEY

This field is for entering the project identification code, soil name code, and phase code(s). The Provincial Soil Correlator should be contacted in regard to selecting the appropriate soil and phase codes. This field links the CAPAMP soil cartographic file to the soil polygon file, thus, the Soil Key must be the same as that used on the Soil Polygon file.

Project [6,AN,L]

Project code (maximum of 6 alphanumeric characters) assigned in consultation with the Thematic Mapping Unit for each user project. Each project should have a unique code and the code must be the same as that used on the Soil Polygon file.

Name [3,AN,L]

The soil name code. An abbreviation of up to three alphanumeric characters is entered for each soil cartographic file. The code must be the same as that used on the Soil Polygon file.

AS [2,AN,R]

The soil association component number code. This field, as defined, is required only for entering historic data from biophysical soil association maps (refer to Appendix B). The number code can be up to 2 characters long. If historical data is not being entered, this field may be used as an additional soil phase in the same manner as P1 or P2. If this field is used for phase it should be left-justified. The code must be same as that used on the Soil Polygon file.

P1 [2,AN,L]

The first soil phase code. A symbol of up to two characters long is coded here. It is specific to the soil coded in the Name field and must be the same as that used on the Soil Polygon file.

P2 [2,AN,L]

The second soil phase code. A symbol of up to two characters long is coded here. It is specific to the soil coded in the Name field and must be the same as that used on the Soil Polygon file.

COPY KEY

This field is utilized only when a soil cartographic record is being created which has minor attribute differences from a previously entered record. The record to be copied could be for the same project area or for a previously entered project area. When this field is used, all data for the previously entered soil cartographic file is duplicated in the new file except where data additions and/or modifications are indicated by the user by entries in the appropriate coding field(s). If the user wishes to leave certain fields in the new soil cartographic file blank, where data exists in the original file, a reverse slash "\" should be entered into the appropriate alphanumeric field, or a "-1" into the appropriate numeric field. Fields with the same values are left blank. The use of Copy Key saves the user considerable time when entering data for several similar soils. However, care must be taken when using Copy Key to ensure that those fields which are being consistently filled for the project are completed, either indirectly by the Copy Key, or directly through entry on the form.

To use Copy Key, the user enters the complete 15 character SOIL KEY of the soil to be copied.

Project [6,AN,L]

Project identification code (maximum of 6 alphanumeric characters) of the Soil Key for the soil to be copied.

Name [3,AN,L]

The soil name code. An abbreviation of up to three characters is entered for the soil name in the Soil Key of the soil to be copied.

AS [2,AN,L]

The soil association number code. An abbreviation of up to two characters is entered for the soil association (or phase) of the Soil Key of the soil to be copied.

P1 [2,AN,L]

The first soil phase code. An abbreviation of up to two characters is entered for the first soil phase of the Soil Key of the soil to be copied.

P2 [2,AN,L]

The second soil phase code. An abbreviation of up to two characters is entered for the second soil phase of the Soil Key of the soil to be copied.

DUMMY VARIABLES [5,I,R],[5,I,R],[3,I,R],[3,I,R],{[1,AN,-],[1,AN,-] or [2,AN,L]}

This section of the form is for entering non-horizon dummy variables. Dummy or user specified variables (see Glossary) represent coding fields where the user defines project specific variables. These variables should be defined and used after consultation with the CAPAMP systems analysts. Consultation is necessary to establish project specific data items, standard attribute definitions, and allowable codes. It is essential that the project specific variables be consistently used throughout a project and that these variables are consistently coded with respect to character type, coding field(s), and field justification. The first two integer fields have maximum allowable values of 32767. The next two integer fields have maximum allowable values of 127. The last two fields are alphanumeric and can be used either as two, single-character fields or as a two-character, left-justified field, as indicated by the format statement.

FULL SOIL NAME [20,AN,L]

The complete soil name (and phase(s) or variant) is entered. This will commonly be the full soil series or soil association name.

TAXONOMY [8,AN,X],[2,AN,R]
DOMINANT |yr.

The dominant soil classification and version (year) is coded here. The dominant entry refers to the soil classification that occupies the largest area for the soil being described. The entry consists of three parts. The first four spaces are used for entering the abbreviation for the dominant soil subgroup. In this case, the abbreviation is right-justified to the period. A period occupying one space has been entered when the form was printed. The period plus the next three spaces are used for entering the abbreviation for the dominant soil great group. The final two spaces (under yr.) are for entering the year the soil classification being used was accepted or published and identifies the version being coded.

For example, a Gleyed Humo-Ferric Podzol from the 1978 classification would be entered as follows: GL.HFP|78. The codes and descriptions are listed in Appendix C. The user should refer to Canada Soil Survey Committee (1978) for a complete description and explanation of the codes used.

TAXONOMY SUBDOMINANT |yr. [8,AN,X],[2,AN,R]

The subdominant soil classification is entered here. The subdominant entry refers to the soil classification that occupies the second largest area for the soil being described. The entry consists of three parts. The first four spaces are used for entering the abbreviation for the subdominant soil subgroup. A period occupying one space has been entered when the form was printed. The period plus the next three spaces are used for entering the abbreviation for the subdominant soil great group. The final two spaces (under yr.) are for entering the year the soil classification being used was accepted or published and identifies the version being coded. The codes are entered in the same manner as TAXONOMY DOMINANT and are described in Appendix C.

FOREST REGION [3,AN,L]

The Ministry of Environment and Parks vegetation region code. For example, the Interior Wet Belt forest region would be entered as IWB. Refer to Appendix D for the list of allowable codes.

FOREST SECTION [2,AN,R]

The Ministry of Environment and Parks vegetation section code. For example, the Castlegar section of the Interior Wet Belt forest region would be entered as 2. Refer to Appendix D for the list of allowable codes.

FOREST ZONE | BGC [8,AN,L] (Ministry of Environment and Parks, Biophysical Vegetation coding)

or

----, [4,AN,L] (Ministry of Forests and Lands, Biogeoclimatic coding)

This field is coded in one of two ways depending on the ecological classification system used. The first coding method (first format statement) is to use the entire eight space field to enter the Ministry of Environment and Parks vegetation zone code. For example, the Subalpine Engelmann Spruce-Alpine Fir Zone would be entered as SAES|ALF. Refer to Appendix D for the list of allowable codes.

The second coding method uses the last four spaces of the coding field, under the label BGC, to enter the code for the Ministry of Forests and Lands biogeoclimatic zone. The first four spaces are left blank. For example, the Engelmann Spruce-Subalpine Fir zone would be entered as ____ESSF. Refer to Appendix E for the list of allowable codes.

FOREST [2,AN,L]
SUBZONE

The Ministry of Forests and Lands biogeoclimatic subzone code or the Ministry of Environment and Parks vegetation subzone code is entered here. For example, the Very Dry Central Parkland subzone of the Engelmann Spruce-Subalpine fir zone would be entered as GP. Refer to Appendices D and E for the list of allowable codes.

DRAIN. [1,AN,-],[1,AN,-]
D|U

The soil drainage class code (Ministry of Environment and Parks, 1987). The most frequent or dominant drainage class code, in terms of the soil being described, is entered in the first space under D. The subdominant drainage code, if applicable, is entered in the second space under U.

The following codes are used:

Code	Class
R	rapidly drained
W	well drained
M	moderately well drained
I	imperfectly drained
P	poorly drained
V	very poorly drained

PERV. [1,AN,-],[1,AN,-]
D|U

The soil perviousness class code (Ministry of Environment and Parks, 1987). The most frequent or dominant perviousness class code, in terms of the soil being described, is entered in the first space under D. The subdominant perviousness code, if applicable, is entered in the second space under U.

The following codes are used:

Code	Class
R	rapidly pervious
M	moderately pervious
S	slowly pervious

STONINESS [3,I,R],[2,I,R]
M | S

The percent of the total soil volume, including pore space, occupied by cobbles and stones (>7.5 cm in diameter) in the upper 25 cm of the mineral soil. The mean stoniness is entered in the first three spaces under M. The standard deviation is entered in the last two spaces under S. The values must be whole numbers. A "0" (zero) is entered if cobbles and stones are not present. The coding field is left blank if this attribute is not considered for the project. The maximum allowable values for mean and standard deviation are 100% and 99%, respectively. However, realistic values are considerably less. (A mean value of 100% implies no pore space, or in other words, solid rock.) See further comments in the Coarse Fragment definition.

DEPTH OF [3,I,R],[3,I,R]
LFH

M | S

The depth or thickness, in centimeters, of the combined LFH horizons. The mean depth is entered in the first three spaces under M. The standard deviation is entered in the last three spaces under S. A "0" (zero) is entered if LFH horizons are not present; the coding field is left blank if this attribute is not considered in the description of the soil. The maximum values for mean and standard deviation are 300 cm and 127 cm, respectively.

DEPTH OF [3,I,R],[2,I,R]
Ah OR
EQUIVALENT
M | S

The depth or thickness, in centimeters, of the Ah horizon or its equivalent (e.g. Ap). The mean depth is entered in the first three spaces under M. The standard deviation is entered in the last two spaces under S. A "0" (zero) is entered if this type of horizon is not present; the field is left blank if this attribute is not considered for the soil. The maximum values for mean and standard deviation are 300 cm and 99 cm, respectively.

DEPTH OF [3,I,R],[3,I,R]
SOLUM
M | S

The depth, in centimeters, of the solum. The solum is defined as the combined depth of all A and B horizons including A, B, AB, BA, BC, and CB mineral horizons. The mean depth is entered in the first three spaces under M. The standard deviation is entered in ththe last three spaces under S. A "0" (zero) is entered if a solum is not present. A "-2" is entered if the soil is not described to the bottom of the solum; the coding field is left blank if this attribute is not considered for the project. The maximum values for mean and standard deviation are 500 cm and 127 cm, respectively.

DEPTH TO [3,I,R],[3,I,R]
ROOT REST.
LAYER
M | S

The depth, in centimeters, to a root restricting layer. The root restricting layer is defined as thdepth to a soil layer which restricts, but does not necessarily stop, the penetration of roots. A root restricting layer results in no greater than 'few' roots. Examples would include many types of pans, cemented horizons, indurated sands and gravels, extremely compact materials and certain layers of chemical concentrations such as salts, some bedrock conditions, and soil layers exhibiting saturation (Ministry of Environment and Parks, 1987). The mean depth is entered in the first three spaces under M. The standard deviation is entered in the last three spaces under S. A "-2" is entered if a root restricting layer is not present within the described soil depth or the coding field is left blank if it is not considered for the project. The maximum values for mean and standard deviation are 999 cm and 127 cm, respectively.

DEPTH TO [4,I,R],[4,I,R]
WATER TABLE
M | S

The depth, in centimeters, to the estimated average water table depth over the year. The mean depth is entered in the first four spaces under M. The standard deviation is entered in the last four spaces under S. In the absence of more precise data, it is assumed that two standard deviations above and below the mean water table depth represents the estimated annual upper and lower limits of the water table and that one standard deviation above and below the mean water table reflects a better estimate of the upper and lower limits of the water table during the growing season. Note, in the later case the mean ean is just used to represent the midpoint between the upper and lower watertable values. A "-2" is entered if a water table is not present within the described soil depth; the coding field is left blank if the attribute is not considered for the project. The maximum values for mean and standard deviation are 9999 cm and 9999 cm, respectively.

DEPTH TO [4,I,R],[4,I,R]
PERMAFROST
M | S

The depth, in centimeters, to a permanently frozen layer. The mean depth is entered in first four spaces under M. The standard deviation is entered in the last four spaces under S. A "-2" is entered if a permafrost layer is not present within the described soil depth or the field is left blank if the attribute is not considered for the project. The maximum values for mean and standard deviation are 9999 cm and 9999 cm, respectively.

DEPTH TO [4,I,R],[4,I,R]
BEDROCK
M | S

The depth, in centimeters, to a bedrock layer. The mean depth is entered in the first four spaces under M. The standard deviation is entered in the last four spaces under S. A "-2" is entered if a bedrock layer is not present within the described soil depth; the coding field is left blank if the attribute is not being considered for the project. The maximum values for mean and standard deviation are 9999 cm and 9999 cm, respectively.

TEMP. [1,AN,-],[1,AN,-]
CLASS
D|U

The soil temperature class code (Canada Soil Survey Committee, 1978). The dominant temperature class code, in terms of the soil being described, is entered in the first space under D. The subdominant temperature class code, if applicable, is entered in the second space under U.

The following codes are used:

Code	Class
A	extremely cold
B	very cold
C	cold
D	cool
E	mild

MOIST [1,AN,-],[1,AN,-]
SUBCL.
D|U

The soil moisture subclass code (Canada Soil Survey Committee, 1978). The dominant soil moisture subclass code, in terms of the soil being described, is entered in the first space under D. The subdominant soil moisture subclass code, if applicable, is entered in the second space under U.

The following codes are used:

Code	Definition
A	xeric
B	arid
C	subarid
D	semiarid
E	subhumid
F	humid
G	perhumid
H	subaquic
I	aquic
J	per aquic

TRANS. [4,AN,L]
ID.

A four character computer transaction code which is utilized when data is loaded into the CAPAMP database. The value ADPD was entered into the data field when the form was printed and appears on all soil cartographic file forms. It is used only where horizon or depth data is entered into the computer.

DEPTH CD. [1,AN,-]

The depth code for each layer. Each layer or horizon, for which data is being entered, is numbered consecutively starting with 1 for the surface horizon or layer (top line) down to a maximum of 9 (bottom line). Do not omit any numbers when assigning this code.

COPY KEY [1,AN,-]

This Copy Key is used in conjunction with the main Copy Key at the top of the form. When a soil cartographic file is to be copied as indicated by the upper Copy Key, the lower Copy Key is used to identify those horizons or layer(s) from the original soil that are to be copied, and the horizons or layer(s) within the new soil to where the data is to be copied. For example, if the second layer in the original file is to be copied to the third layer of the new file, the number 2 is entered on the third line of this coding field. If this coding field is left blank, the only data that will be entered into this layer in the new file is data manually entered in the appropriate depth fields on the form for the new file. The Copy Key can also be used where only slight differences exist between a layer in the new soil and a layer in a pre-existing soil. In this case, the user would indicate the layer to be copied in this field as well as the necessary changes in the appropriate coding fields. It is also permissible to copy a layer from the original soil into more than one layer in the new soil. This could occur if there are two or more layers in the new soil that are similar to one layer in an old soil and only minor additions or modifications are necessary for each of the new layers. The user should note that the layers or horizons to be copied, do not need to be numbered consecutively.

If the user wishes to leave certain fields in the new soil cartographic file blank, where data exists in the original file, a reverse slash "\" should be entered into the appropriate alphanumeric field, or a "-1" into the appropriate numeric field. Fields with the same values are left blank.

THICKNESS [3,I,R],[2,I,R]

M | S

The thickness, in centimeters, of a horizon or layer. The mean thickness is entered in the first three spaces under M. The standard deviation of thickness is entered in the last two spaces under S. The values must be whole numbers. The maximum values for the mean and standard deviation are 999 cm and 99 cm, respectively.

H. MAT. [1,AN,-]

The general type of horizon or layer material.
The following 13 codes are used:

Code	Definition
A	mineral A horizons
B	mineral B horizons
C	mineral C horizons
F	fibric horizons
H	humic horizons
I	indurated layer/horizon
J	anthropogenic layer
L	LFH horizons
M	mesic horizons
O	organic (general) layers (not LFH)
R	bedrock
W	water
Z	frozen layer

Note: Only one horizon material may be entered even though the horizon/layer may meet requirements of more than one, e.g. an indurated layer that is also a B horizon. Where this occurs the code should be entered which is more likely to be of value to soil interpretations; in the example just given, "I" would be entered, not "B".

PARENT MATERIAL D | U [2,AN,L], [2,AN,L]

The soil parent material code. The first two spaces under D, are used to enter the standard surficial geology symbols for genetic material and qualifying descriptor of the dominant parent material (Howes and Kenk, 1987). The genetic material is entered into the first space and the qualifying descriptor, if applicable, is entered into the second space. The last two spaces under U, are used to enter the genetic material and qualifying descriptor, if appropriate, for a subdominant parent material. The subdominant genetic material symbol is entered into the third space and the qualifying descriptor, if necessary, is entered into the last space.
The following codes are used:

Genetic Materials

Code	Term
A	anthropogenic materials
C	colluvium
D	weathered bedrock
E	eolian deposits
F	fluvial sediments
I	ice
L	lacustrine sediments

M	morainal materials (till)
O	organic materials
R	bedrock
U	undifferentiated materials
V	volcanic materials
W	marine sediments

Qualifying Descriptors(inorganic materials)

A	active
G	glacial
I	inactive

Qualifying Descriptors(organic materials)

B	bog
F	fen
S	swamp

COARSE FRAGMENTS [3,I,R],[2,I,R]
M | S

The fraction, as a percent, on a volume basis, of the total soil (including pore space) occupied by coarse fragments (>2.0 mm in diameter). The mean coarse fragment content is entered in the first three spaces under M. The standard deviation of the coarse fragment content is entered in the last two spaces under S. The values must be whole numbers. A "0" (zero) is entered if coarse fragments are not present. The maximum allowable values for the mean and standard deviation are 100% and 50%, respectively.
Comment: As stated above, coarse fragment content is determined as the percent coarse fragments by volume of the whole soil including matrix (<2.0 mm in diameter) and pore space. Thus, a soil composed of coarse fragments with no matrix will not have a mean value of 100% due to the presence of voids. As a guide, the densest state of packing of uniform spheres would represent a coarse fragment content of approximately 74%. Most soils have coarse fragment contents significantly less than this. For example, a soil consisting of loosely packed sand and gravel in equal proportions, and with no organic matter, has a coarse fragment content of approximately 30%; if it is densely packed, the same material has a coarse fragment content of about 40%. Values greater than 40% for a soil imply a very gravelly material such as colluvium or certain fluvial or glaciofluvial deposits.

TEXTURE [4,AN,L]
CSSC

The standard soil texture abbreviations as given by the Canada Soil Survey Committee (1978).
The following codes are used:

Code	Class	Code	Class
S	sand	LS	loamy sand
VCS	very coarse sand	LVCS	loamy very coarse sand
CS	coarse sand	LCS	loamy coarse sand
MS	medium sand	LMS	loamy medium sand
FS	fine sand	LFS	loamy fine sand
VFS	very fine sand	LVFS	loamy very fine sand
SL	sandy loam	L	loam
VCSL	very coarse sandy loam	SCL	sandy clay loam
CSL	coarse sandy loam	SC	sandy clay
MSL	medium sandy loam	SI	silt
FSL	fine sandy loam	SIL	silt loam
VFSL	very fine sandy loam	SICL	silty clay loam
CL	clay loam	C	clay
SIC	silty clay	HC	heavy clay

SAND [2,I,R],[2,I,R]
CSSC
M | S

The sand content (Canada Soil Survey Committee, 1978), as a percent, of the less than 2 mm fraction of the soil. The mean sand content is entered in the first two spaces under M. The standard deviation of the sand content is entered in the last two spaces under S. The values must be whole numbers. A "0" (zero) is entered if sand-sized particles are not present. The maximum allowable values for the mean and standard deviation are 99% and 50%, respectively. A value of 100% is entered as 99%.

CLAY [2,I,R],[2,I,R]
CSSC
M | S

The clay content (Canada Soil Survey Committee, 1978), as a percent, of the less than 2 mm fraction of the soil. The mean clay content is entered in the first two spaces under M. The standard deviation of the clay content is entered in the last two spaces under S. The values must be whole numbers. A "0" (zero) is entered if clay-sized particles are not present. The maximum allowable values for the mean and standard deviation are 99% and 50%, respectively. A value of 100% is entered as 99%.

UNIFIED [2,AN,L],[2,AN,L]
TEXTURE or
D | U [4,AN,L]

The symbol for the Unified Soil Classification System (The Asphalt Institute, 1978). The first two spaces are used to enter the symbol for the dominant Unified texture and the last two spaces are used to enter the subdominant Unified texture. These variables are also over-defined to a single variable as indicated above.

The following codes are used:

Code	Description
GW	well-graded gravels or gravel-sand mixtures, little or no fines
GP	poorly graded gravels or gravel-sand mixtures, little or no fines
GM	silty gravels, gravel-sand-silt mixtures
GC	clayey gravels, gravel-sand-clay mixtures
SW	well-graded sands or gravelly sands, little or no fines
SP	poorly graded sands or gravelly sands, little or no fines
SM	silty sands, sand-silt mixtures
SC	clayey sands, sand-clay mixtures
ML	inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
CL	inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
OL	organic silts and organic silt-clays of low plasticity
MH	inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
CH	inorganic clays of high plasticity, fat clays
OH	organic clays of medium to high plasticity, organic silts
PT	peat and other highly organic soils

Note: As described above, the use of Unified texture is limited to coding the single two character codes listed above. In the complete Unified texture classification a number of four character codes, each comprised of two of the above listed codes, also exist. If on a given project the use of the four character codes is required, the dominant and subdominant can be treated as a single four character field.

AWSC [2,I,R],[2,I,R]

M | S

The available water storage capacity, in centimeters per meter, of the soil. Quantitatively, it is the depth of water held in the soil between 1/3 atmosphere (field capacity) and 15 atmospheres (the permanent wilting point). The mean available water storage capacity is entered in the first two spaces under M. The standard deviation of the available water storage capacity is entered in the last two spaces under S. The values must be whole numbers. The maximum allowable values for the mean and standard deviation are 40 cm/m and 20 cm/m, respectively.

BULK [3,I,R],[3,I,R]
DENSITY

M | S

The bulk density, in units of 0.001 * kilograms per cubic meter (i.e., grams per cubic centimeter), of the whole soil including coarse fragments and pores. The mean soil bulk density is entered in the first three spaces under M. The standard deviation of the soil bulk density is entered in the last three spaces under S. The maximum allowable values for the mean and standard deviation are 2.50 gm/cm^3 and 1.00 gm/cm^3, respectively. The decimal place is indicated on the form.

The user is cautioned that the validation routines are programmed for threshold values of bulk density which flag potential errors in the data (see Validation Routines, this chapter). First, bulk densities must be greater than 2.65 times the mean COARSE FRAGMENT content (in percent) divided by 100. Secondly, the following are the minimum bulk densities expected for soils with the following coarse fragment contents. These minimum values are based on a loose or very porous interstitial matrix having a bulk density of 0.9 gm/cm^3. Note these values are to be used as a guide only. Soils with little or no interstitial matrix (the less than 2mm fraction) such as gravel terraces may have bulk densities less than those indicated as minimum values.

Percent Coarse Fragments	Minimum Bulk Density	Percent Coarse Fragments	Minimum Bulk Density
5	0.99	40	1.60
10	1.08	45	1.69
15	1.16	50	1.78
20	1.25	55	1.86
25	1.34	60	1.95
30	1.43	65	2.04
35	1.51	70	2.13

pH-CaCl2 [3,I,R],[2,I,R]

M | S

The pH measured in 0.01 M CaCl2. The mean pH is entered in the first three spaces under M. The standard deviation of the pH is entered in the last two spaces under S. The maximum allowable values for the mean and standard deviation are 12.7 and 3.0, respectively. The decimal place is indicated on the form.

ORGANIC CARBON [3,I,R],[3,I,R]

M | S

The organic carbon content, as a percent. Percent organic carbon content can be estimated by dividing the percent organic matter content by 1.7. The mean organic carbon content is entered in the first three spaces under M. The standard deviation of the organic carbon content is entered in the last three spaces under S. A "0" (zero) is entered if soil carbon is not present. The maximum allowable values for the mean and standard deviation are 60.0% and 12.7%, respectively. The decimal is indicated on the form.

TOTAL NITROGEN [3,I,R],[3,I,R]

M | S

The total nitrogen content, as a percent. The mean total nitrogen content is entered in the first three spaces under M. The standard deviation of the total nitrogen content is entered in the last three spaces under S. A "0" (zero) is entered if soil nitrogen is not present. The maximum allowable values for the mean and standard deviation are 7.00% and 1.27%, respectively. The decimal is indicated on the form.

CEC [3,I,R],[3,I,R]

M | S

The cation exchange capacity as measured in a 1 N ammonium acetate (pH 7.0) extract. It is expressed as milli-equivalents of cations required to balance the negative charge of 100 gm of soil at pH 7.0. The most abundant exchangeable cations include calcium, magnesium, potassium, sodium, hydrogen, aluminum and hydroxyaluminum. The mean cation exchange capacity (meq/100 gm) is entered in the first three spaces under M. The standard deviation (meq/100 gm) of the cation exchange capacity is entered in the last three spaces under S. The values must be whole numbers. A "0" (zero) is entered if the soil does not have a measurable cation exchange. The maximum allowable values for the mean and standard deviation are 500 meq/100 gm and 127 meq/100 gm, respectively.

BASE SATURATION [3,I,R],[2,I,R]

M | S

The percent base saturation. It is defined as the percentage of total cation exchange capacity occupied by the basic calcium, magnesium, sodium and potassium cations. The mean base saturation is entered in the first three spaces under M. The standard deviation of the base saturation is entered in the last two spaces under S. The values must be whole numbers. A "0" (zero) is entered if the soil does not have a measurable base saturation. The maximum allowable values are 110% and 50%, respectively.

PYROPHOS Fe+Al [3,I,R],[3,I,R]

M | S

The iron and aluminum content, as a percent, determined using a 0.1 M sodium pyrophosphate solution. The mean pyrophosphate iron and aluminum content is entered in the first three spaces under M. The standard deviation of the pyrophosphate iron and aluminum content is entered in the last three spaces under S. A "0" (zero) is entered if the soil does not contain a measurable concentration of extractable iron and aluminum. The maximum allowable values for the mean and standard deviation are 9.00% and 1.27%, respectively. The decimal is indicated on the form.

$CACO_3$ [2,I,R],[2,I,R]
M | S

The calcium carbonate equivalent, as a percent. It is an approximate measure of the free lime (carbonate) in the soil by weight of the total soil. The mean calcium carbonate equivalent is entered in the first two spaces under M. The standard deviation of the calcium carbonate equivalent is entered in the last two spaces under S. The values must be whole numbers. A "0" (zero) is entered if the soil does not contain a measurable calcium carbonate equivalent. The maximum allowable values for the mean and standard deviation are 99% and 50%, respectively.

ELECTRICAL [3,I,R],[2,I,R]
CONDUCT.
M | S

The electrical conductivity, in millisiemens per centimeter, as measured in a water-saturated paste. This is a measure of the salinity (salt content) of the soil. The mean electrical conductivity is entered in the first three spaces under M. The standard deviation of the electrical conductivity is entered in the last two spaces under S. A "0" (zero) is entered if the soil does not have a measurable electrical conductivity. The maximum allowable values for the mean and standard deviation are 50.0 mS/cm and 9.9 mS/cm, respectively. The decimal is indicated on the form.

D.V. [2,AN,L or R]
3 or
1 2 [1,AN,-],[1,AN,-]

Horizon or layer specific dummy variables. Dummy or user specified variables (see Glossary) represent coding fields where the user, defines project specific variables. These variables should be defined and used after consultation with the CAPAMP systems analysts. Consultation is necessary to establish project specific data items, standard attribute definitions, and allowable codes. It is essential that the project specific variables be consistently used throughout a project and that these variables are consistently coded with respect to character type, coding field(s), and field justification. This section of the form allows the user to define two single-space dummy variables (Dummy Variables 1 and 2) or one two-space dummy variable (Dummy Variable 3) relevant to each layer. For example, if the user wanted to define 2 variables, each of 1 character length, the first variable would be entered in the first space under label "1" and the second variable would be entered in the second space under label "2".

Database or Attribute Report

Table VI is a partial listing of a Soil Cartographic Attribute Report. This type of report lists the attribute data stored in the cartographic file by project identification code. The labels and formatting are very similar to the input data form. This listing also shows values for the project specific attributes defined by the non-depth dummy variables 1 through 6 and by a depth specific, 2 character dummy variable. The attribute report is used to compare the computer database with the original source data to ensure accuracy of key entry. It is also used in conjunction with validation reports (see below). Desired data additions and/or corrections can be indicated on this listing and returned to Thematic Mapping Unit for revision. The user should note the "-1" values in this report. This value indicates that data for these fields was not collected for the soil and the entries are equivalent to blank data fields.

Validation Routines

The validation routines test the general validity of the soil cartographic data. The routines are designed as a tool for editing the data input. Codes are checked to ensure that they are legitimate and simple statistics on numeric variables are calculated. If prior arrangements are made with the CAPAMP systems analysts, project specific dummy variable codes can be validated and simple statistics can be calculated.

The standard validation routines, as applied to all projects, check certain non-depth (non-horizon) and depth (horizon) fields. The following non-depth fields are checked for legitimate codes:

1. the dominant and subdominant soil taxonomy;
2. the dominant and subdominant soil drainage class;
3. the dominant and subdominant soil perviousness class;
4. the dominant and subdominant soil temperature class;
5. the dominant and subdominant soil moisture subclass.

The following depth fields are checked for legitimate codes:

1. the horizon material;
2. the dominant and subdominant parent material;
3. the CSSC texture;
4. the dominant and subdominant Unified texture.

Each layer is required to have an entry for horizon material and, with the exception of horizon materials R or W, each layer coded must have a mean thickness. As indicated under the instructions for entering bulk density information, the validation routines also check for consistency between bulk density values and coarse fragment contents.

Tables VII to XIII show sections of a validation report. The report is abbreviated in terms of content because of the potentially voluminous nature of certain tables. All features of this type of report are illustrated, however.

Table VII shows a sample listing of errors found by the validation routines for non-depth, standard coded variables. The errors are sorted by variable and by Soil Key. The error message lists the Soil Key, the variable field, the current value, and a self-explanatory message. At the end of the table, a summary of the validation analysis occurs. The summary indicates the number of soils examined, the number of blank entries for certain variables, and some information on non-depth, dummy variables.

Table VIII is an error listing for non-depth, dummy variables for which project specific variables and validation routines have been developed. The errors are sorted by variable and by Soil Key. The format for errors is the same as that used in Table VII. At the end of the table is a summary of the number of soils examined and the number of blank entries for specified dummy variables.

Table IX is a listing of simple statistics and error messages for non-depth, standard numeric variables. For each variable, the user is given the variable name, the number of less than zero entries, the number of greater than or equal to zero entries, the number of zero entries, the mean value, the median value, the lowest value (Soil Key reference), the second lowest value (Soil Key reference), the highest value (Soil Key reference), the second highest value (Soil Key reference), the number of -2 entries, the number of -1 entries (i.e. blank), and a bar chart plot of all the values for the variable. The less than zero (-1 or -2) entries include both the blank fields for which data was not collected (-1) and the fields for which the attribute was looked for but not found (-2). The reference Soil Keys are included to enable the user to quickly reevaluate data entries if it is thought that the values are erroneous or improbable. The bar chart is specific for each variable and for each validation analysis. The minimum and maximum (non-negative) values are used to determine the endpoints of the bar chart. The bar chart is then divided into one hundred equal positions. For each position along the bar chart, the frequency of occurrence is indicated in three ways. A zero value is indicated by a "_", a frequency between 1 and 9 is indicated by the corresponding number, and a frequency of greater than 10 is indicated by a "^". If the lowest and highest values are the same, instead of a bar chart, the following message is printed: "NO VARIATION - ALL VALUES ARE EQUAL". The intent of the bar chart is to show extreme values or groupings. This should help to warn the user of the occurrence of erroneous or improbable values. The error messages at the end of the table indicate Soil Key, current value, and a self-explanatory comment.

Table X gives a sample listing of simple statistics for four, project specific, numeric, non-depth, dummy variables. The dummy variables are the mean and standard deviation of coarse gravel content in the upper 25 cm (CO_GR_0-25-M;CO_GR_0-25-S) and the mean and standard deviation of the universal soil loss "K" values (K_FACTOR-M;K_FACTOR-S). The table of simple statistics includes the same values and formatting as Table IX. The table also has a sample error message for a validated dummy variable 3 (soil management group).

Table XI is an error listing for standard coded, depth variables. The errors are sorted twice, using different criteria, to aid the user. The first error sort is by variable with one exception. Since the validation checks for a horizon thickness value whenever horizon material is entered, error messages relevant to both coding fields occur together to aid the user's error correction. Otherwise, the error messages are sorted in the order of occurrence on the form. The second sort is by Soil Key combined with depth within each Soil Key. Each error message indicates the Soil Key, the depth code, the variable field, the current value, and a self-explanatory message. A summary at the end of the table indicates the number of depths examined, the number of blanks for certain standard coding fields, the number of blank dummy variable fields, and the number of each type of horizon material.

Table XII lists a sample of the simple statistics for standard, numeric, depth variables. The output contains statistics for all depth variables. The values and formatting are the same as for Tables IX and X except for three features. For each variable, the statistical analysis is stratified into three groups - all horizons, the organic horizons (L,O,F,M,H), and the inorganic horizons (A,B,C,I). The "all horizons" group includes more than a simple combination of the values for the other two groups, as it also includes J, R, W, and Z horizons. For example, the -2 values for all horizons can be greater than the -2 values for the other two groups combined due to the presence of R layers. The data is stratified in this manner in order to accommodate general differences in bulk density and other properties while the user is evaluating the data. The user should note that the bar chart is specific to each variable, each grouping within the variable, and for each validation analysis, as explained earlier. The second feature is the Soil Key which indicates the corresponding depth with a ":" followed by the depth code. The third feature of this table is a series of error and warning messages, at the end of the table, which indicates inconsistencies between bulk densities and coarse fragment contents. The format for the warning messages is the same as the format for previously described error messages.

Table XIII lists the error messages and simple statistics for a depth specific, dummy variable. In this example, dummy variable 3 has been defined as percent fine sand. The validation routine checks this field to ensure that it contains a valid code. The formatting for the error messages and the statistical analysis is the same as described for Tables XI and XII.

Project Specific Use Of Dummy Variables And Validation Routines

This section provides a few examples of the use of dummy variables and project specific validation. These examples may be useful for a user by suggesting ways in which these features may be used for their project(s).

A recently completed detailed soil survey utilized project specific, non-depth, dummy variables 1 through 6 to record the following information: the soil erosion K value, the soil management group, the mean value for percent coarse gravel, the standard deviation for percent coarse gravel, the flood hazard, and the type of water table. The same soil survey utilized project specific depth Dummy Variable 3 to record the percent coarse sand for each depth. Project specific validation routines were developed which checked the dummy variables for legal codes as provided by the user and also generated simple statistics for specified numeric dummy variables.

Sample user specified validation output for this project has been described as part of the last section. Tables VII, VIII, and X contain information pertaining to use of the non-depth dummy variables. The first two tables indicate the number of blank entries and the error analysis for allowable codes for these variables. The third table provides simple statistics. Table XIII provides an error analysis and simple statistics for the depth specific dummy variable 3.

TABLE VI
SOIL CARTOGRAPHIC FILE ATTRIBUTE DATA

C A P A M P I N P U T - S O I L C A R T O G R A P H I C F I L E

18-APR-1985

PROJECT I. D. : VID-1

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* *

-----SOIL-KEY------					DUMMY VARIABLES 7				
PROJ	NA	AS	P1	P2	1(I)	2(I)	3(I)	4(I)	56
VID-1	AR				-1	14	0	-1	MP

FULL SOIL NAME
ARROWSMITH

---FULL SOIL NAME---	TAX DOM	YR	TAX SD	YR	FOR REG	FOR SEC	FOR ZONE BGC	FOR SUB
ARROWSMITH	TY.M	78					CDF	

DRAIN D	DRAIN U	PERV D	PERV U	COB+ST M	COB+ST S	-DEPTH- --LFH-- M	S	-DEPTH --AH-- M	S	-DEPTH- -SOLUM- M	S	-DEPTH- --RRL-- M	S	DEPTH TO- WAT.TABLE M	S	DEPTH TO- PERMFROST M	S	DEPTH TO- BEDROCK M	S	TEMP CLAS D	TEMP CLAS U	MOIST SUBCL D	MOIST SUBCL U
V		M		0	-1	-1	-1	-1	-1	160	10	-2	-1	35	17	-1	-1	-2	-1	E		I	J

DEP	THICK- --NESS M	S	H M T	PARNT --MAT D	U	COARSE -FRAGS M	S	TEXT CSSC	SAND- -CSSC M	S	CLAY- -CSSC M	S	UNIF- -TEXT D	U	AWSC M	S	BULK--- DENSITY M	S	PH---- -CACL2 M	S	ORGANIC -CARBON M	S	TOTAL-- NITROGN M	S	--CEC-- M	S	BASE-- SATURN M	S	PYROPH- --FE+AL M	S	CACO3 M	S	ELECT- CONDUC M	S	D V 3 1	2
1	15	1	M	O		0	-1		-1	-1	-1	-1	PT		15	2	15	3	48	2	380	40	200	6	160	17	78	10	-1	-1	-1	-1	-1	-1		
2	20	1	M	O		0	-1		-1	-1	-1	-1	PT		20	2	35	4	46	2	440	40	190	6	147	17	61	10	-1	-1	-1	-1	-1	-1		
3	15	2	M	O		0	-1		-1	-1	-1	-1	PT		20	2	45	5	52	1	460	50	195	22	145	7	80	10	-1	-1	-1	-1	-1	-1		
4	30	2	M	O		0	-1		-1	-1	-1	-1	PT		20	2	-1	-1	52	1	480	50	200	22	142	7	65	10	-1	-1	-1	-1	-1	-1		
5	40	3	M	O		0	-1		-1	-1	-1	-1	PT		20	2	-1	-1	53	1	500	50	200	22	142	7	77	10	-1	-1	-1	-1	-1	-1		
6	40	3	M	O		0	-1		-1	-1	-1	-1	PT		20	2	-1	-1	54	1	520	20	220	44	148	4	58	10	-1	-1	-1	-1	-1	-1		

VID-1 AR

TABLE VI (cont'd)

* *

-----SOIL-KEY------				
PROJ	NA	AS	P1	P2
VID-1	CO			

DUMMY VARIABLES 7				
1(I)	2(I)	3(I)	4(I)	56
3005	7	0	-1	MP

FULL SOIL NAME
: COWICHAN :

---FULL SOIL NAME---	TAX DOM	YR	TAX SD	YR	FOR REG	FOR SEC	FOR ZONE BGC	FOR SUB
COWICHAN	HU.LG	78	O.HG	78			CDF	

DRAIN D	DRAIN U	PERV D	PERV U	COB+ST M	COB+ST S	-DEPTH- --LFH-- M	-DEPTH- --LFH-- S	-DEPTH --AH-- M	-DEPTH --AH-- S	-DEPTH- -SOLUM- M	-DEPTH- -SOLUM- S	-DEPTH- --RRL-- M	-DEPTH- --RRL-- S	DEPTH TO- WAT.TABLE M	DEPTH TO- WAT.TABLE S	DEPTH TO- PERMFROST M	DEPTH TO- PERMFROST S	DEPTH TO- BEDROCK M	DEPTH TO- BEDROCK S	TEMP CLAS D	TEMP CLAS U	MOIST SUBCL D	MOIST SUBCL U
P		S		0	-1	-1	-1	27	5	70	10	50	5	80	40	-1	-1	-2	-1	E		H	I

DEP	THICK- --NESS M	THICK- --NESS S	HMT	PARNT --MAT D	PARNT --MAT U	COARSE -FRAGS M	COARSE -FRAGS S	TEXT CSSC	SAND- -CSSC M	SAND- -CSSC S	CLAY- -CSSC M	CLAY- -CSSC S	UNIF- -TEXT D	UNIF- -TEXT U	AWSC M	AWSC S	BULK--- DENSITY M	BULK--- DENSITY S	PH---- -CACL2 M	PH---- -CACL2 S	ORGANIC -CARBON M	ORGANIC -CARBON S	TOTAL-- NITROGN M	TOTAL-- NITROGN S	--CEC-- M	--CEC-- S	BASE-- SATURN M	BASE-- SATURN S	PYROPH- --FE+AL M	PYROPH- --FE+AL S	CACO3 M	CACO3 S	ELECT- CONDUC M	ELECT- CONDUC S	DV3 1	DV3 2
1	27	5	A	W		0	-1	SIL	14	5	26	6	ML	CL	22	3	100	6	52	4	74	20	84	15	33	10	40	7	-1	-1	-1	-1	-1	-1		7
2	3	1	A	W		0	-1	SIL	9	3	25	6	ML	CL	22	3	100	6	51	4	7	2	9	3	15	5	33	4	-1	-1	-1	-1	-1	-1		3
3	20	2	B	W		0	-1	SICL	15	3	31	10	ML	CL	21	3	142	5	56	5	6	2	3	1	25	3	90	5	-1	-1	-1	-1	-1	-1		2
4	20	2	B	W		0	-1	SICL	8	2	28	10	ML	CL	21	3	144	5	57	5	4	1	2	1	22	3	90	5	-1	-1	-1	-1	-1	-1		5
5	15	2	C	W		0	-1	SIL	13	3	27	4	ML	CL	21	3	145	4	62	5	3	1	2	1	21	2	100	10	-1	-1	-1	-1	-1	-1		1
6	15	2	C	W		0	-1	SIL	19	3	24	4	ML	CL	21	3	146	4	64	5	2	1	2	1	20	2	100	10	-1	-1	-1	-1	-1	-1		1

VID-1 CO

TABLE VII
ERRORS UNCOVERED BY VALIDATION ROUTINES FOR NON-DEPTH,
STANDARD CODED VARIABLES (SOIL CARTOGRAPHIC FILE)

```
TABLE LISTING ERRORS AND NUMBER OF BLANKS FOR NON-DEPTH (NON-HORIZON), CODED VARIABLES (CARTOGRAPHIC FILE)

ERRORS LISTED BY VARIABLE
***** SOILKEY: VID-2 KH       DOMINANT TAXONOMY =    0.HG , AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 KH   CO  DOMINANT TAXONOMY =    0.HG , AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 FB       SUBDOM. TAXONOMY =   GL.HFB, AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 FB   G   DOMINANT DRAINAGE = 0, AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 RY       SUBDOM. DRAINAGE = 0, AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 QL       DOMINANT PERVIOUSNESS = P, AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 QL   G   SUBDOM. PERVIOUSNESS = P, AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 SM   PD  DOMINANT TEMPERATURE = F, AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 QN       SUBDOM. TEMPERATURE = F, AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 QN   CO  DOMINANT MOISTURE = T, AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 QN   CO  SUBDOM. MOISTURE = T, AN ILLEGAL VALUE *****

ERRORS LISTED BY SOIL
***** SOILKEY: VID-2 FB       SUBDOM. TAXONOMY =   GL.HFB, AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 FB   G   DOMINANT DRAINAGE = 0, AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 KH       DOMINANT TAXONOMY =    0.HG , AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 KH   CO  DOMINANT TAXONOMY =    0.HG , AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 QL       DOMINANT PERVIOUSNESS = P, AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 QL   G   SUBDOM. PERVIOUSNESS = P, AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 QN       SUBDOM. TEMPERATURE = F, AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 QN   CO  DOMINANT MOISTURE = T, AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 QN   CO  SUBDOM. MOISTURE = T, AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 RY       SUBDOM. DRAINAGE = 0, AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 SM   PD  DOMINANT TEMPERATURE = F, AN ILLEGAL VALUE *****

TOTAL # OF OBSERVATIONS (SOILS) BEING EXAMINED IS:  313

# OF BLANK DOMINANT TAXONOMY VALUES IS:                 7
# OF BLANK SUBDOMINANT TAXONOMY VALUES IS:             62
# OF BLANK DOMINANT DRAINAGE VALUES IS:                17
# OF BLANK SUBDOMINANT DRAINAGE VALUES IS:            100
# OF BLANK DOMINANT PERVIOUSNESS VALUES IS:            17
# OF BLANK SUBDOMINANT PERVIOUSNESS VALUES IS:        275
# OF BLANK DOMINANT TEMPERATURE CLASS VALUES IS:       18
# OF BLANK SUBDOMINANT TEMPERATURE CLASS VALUES IS:   313
# OF BLANK DOMINANT MOISTURE SUBCLASS VALUES IS:      220
# OF BLANK SUBDOMINANT MOISTURE SUBCLASS VALUES IS:   226

# OF BLANK FULL SOIL NAME VALUES IS:                    0

# OF BLANK FOREST REGION VALUES IS:                   313
# OF BLANK FOREST SECTION VALUES IS:                  313
# OF BLANK FOREST ZONE VALUES IS:                      14
# OF BLANK FOREST ZONE - BGC VALUES IS:                14
# OF BLANK FOREST SUBZONE VALUES IS:                  313

# OF DUMMY VARIABLE 1 VALUES LESS THAN ZERO IS:       261
# OF DUMMY VARIABLE 2 VALUES LESS THAN ZERO IS:         2
# OF DUMMY VARIABLE 3 VALUES LESS THAN ZERO IS:        45
# OF DUMMY VARIABLE 4 VALUES LESS THAN ZERO IS:        55
# OF BLANK DUMMY VARIABLE 5 VALUES IS:                  5
# OF BLANK DUMMY VARIABLE 6 VALUES IS:                 96
# OF BLANK DUMMY VARIABLE 7 VALUES IS:                  5
```

TABLE VIII
ERRORS UNCOVERED BY VALIDATION ROUTINES FOR NON-DEPTH,
DUMMY VARIABLES (SOIL CARTOGRAPHIC FILE)

TABLE LISTING ERRORS AND NUMBER OF BLANKS FOR NON-DEPTH (NON-HORIZON), NON-STANDARD, CODED VARIABLES (CARTOGRAPHIC FILE)

ERRORS LISTED BY VARIABLE

```
***** - - SOILKEY: VID-2 KH       DUMMY VARIABLE 5 =  , AN ILLEGAL CODE *****
***** - - SOILKEY: VID-2 KH   CO  DUMMY VARIABLE 5 =  , AN ILLEGAL CODE *****
***** - - SOILKEY: VID-2 FB       DUMMY VARIABLE 5 =  , AN ILLEGAL CODE *****
***** - - SOILKEY: VID-2 FB   G   DUMMY VARIABLE 5 =  , AN ILLEGAL CODE *****
***** - - SOILKEY: VID-2 RY       DUMMY VARIABLE 6 = 0, AN ILLEGAL CODE *****
***** - - SOILKEY: VID-2 QL       DUMMY VARIABLE 6 = 0, AN ILLEGAL CODE *****
***** - - SOILKEY: VID-2 QL   G   DUMMY VARIABLE 6 = N, AN ILLEGAL CODE *****
***** - - SOILKEY: VID-2 SM   PD  DUMMY VARIABLE 6 = N, AN ILLEGAL CODE *****
***** - - SOILKEY: VID-2 QN       DUMMY VARIABLE 6 = N, AN ILLEGAL CODE *****
***** - - SOILKEY: VID-2 QN   CO  DUMMY VARIABLE 6 = 0, AN ILLEGAL CODE *****
***** - - SOILKEY: VID-2 QN   CO  DUMMY VARIABLE 2 =  -1 , AN ILLEGAL VALUE *****
***** - - SOILKEY: VID-2 QN   CO  DUMMY VARIABLE 3 =  -1 , AN ILLEGAL VALUE *****
```

ERRORS LISTED BY SOIL

```
***** - - SOILKEY: VID-2 FB       DUMMY VARIABLE 5 =  , AN ILLEGAL CODE *****
***** - - SOILKEY: VID-2 FB   G   DUMMY VARIABLE 5 =  , AN ILLEGAL CODE *****
***** - - SOILKEY: VID-2 KH       DUMMY VARIABLE 5 =  , AN ILLEGAL CODE *****
***** - - SOILKEY: VID-2 KH   CO  DUMMY VARIABLE 5 =  , AN ILLEGAL CODE *****
***** - - SOILKEY: VID-2 QL       DUMMY VARIABLE 6 = 0, AN ILLEGAL CODE *****
***** - - SOILKEY: VID-2 QL   G   DUMMY VARIABLE 6 = N, AN ILLEGAL CODE *****
***** - - SOILKEY: VID-2 QN       DUMMY VARIABLE 6 = N, AN ILLEGAL CODE *****
***** - - SOILKEY: VID-2 QN   CO  DUMMY VARIABLE 6 = 0, AN ILLEGAL CODE *****
***** - - SOILKEY: VID-2 QN   CO  DUMMY VARIABLE 2 =  -1 , AN ILLEGAL VALUE *****
***** - - SOILKEY: VID-2 QN   CO  DUMMY VARIABLE 3 =  -1 , AN ILLEGAL VALUE *****
***** - - SOILKEY: VID-2 RY       DUMMY VARIABLE 6 = 0, AN ILLEGAL CODE *****
***** - - SOILKEY: VID-2 SM   PD  DUMMY VARIABLE 6 = N, AN ILLEGAL CODE *****
```

```
TOTAL # OF OBSERVATIONS (SOILS) BEING EXAMINED IS:     313

# OF BLANK VALUES FOR FLOOD HAZARD (D.V.5) IS:           5
# OF BLANK VALUES FOR TYPE OF WATER TABLE (D.V.6) IS:   96
# OF BLANK VALUES FOR MNGMNT. GROUP CODE (D.V.2) IS:     2
# OF BLANK VALUES FOR % COARSE FRAGMENTS (D.V.3) IS:    45
```

TABLE IX
SIMPLE STATISTICS AND ERROR MESSAGES FOR NON-DEPTH,
STANDARD NUMERIC VARIABLES (SOIL CARTOGRAPHIC FILE)

```
TABLE LISTING SIMPLE STATISTICS FOR SOIL CARTOGRAPHIC, NON-DEPTH (NON-HORIZON), STANDARD NUMERIC VARIABLES

VARIABLE NAME    # OBS (>=0)    MEAN      LOWEST        (KEY)              HIGHEST        (KEY)
#<0 (UNKNOWN)    # OF ZEROES    MEDIAN    2ND LOWEST    (KEY)              2ND HIGHEST    (KEY)

CB+ST_0-25-M        289         6.81        0.00     ( VID-2 AR      )      55.00      ( VID-2 RY  R    )
     24              76         5.00        0.00     ( VID-2 AR  SO  )      55.00      ( VID-2 RY  L3R  )

#-2=   0; #-1=  24; BAR(>=0): ^^_^_^_4_^^_^_^_1_^2_^_3_^-2_______4_26___2_6_2_5____________________________________2

CB+ST_0-25-S        266         2.52        0.00     ( VID-2 AR      )      10.00      ( VID-2 RY  R    )
     47              53         2.00        0.00     ( VID-2 AR  SO  )      10.00      ( VID-2 RY  L3R  )

#-2=   0; #-1=  47; BAR(>=0): ^________^________^________^________^________^__________________5________1_____2___5

LFH-M               292         4.96        0.00     ( VID-2 AR      )       9.00      ( VID-2 SM  PD   )
     21               4         5.00        0.00     ( VID-2 AR  SO  )       9.00      ( VID-2 SM  COPD )

#-2=   2; #-1=  19; BAR(>=0): 4_________2_________6_________^_________^_________^_________^_________^________4____8

LFH-S               287         2.09        1.00     ( VID-2 CA      )       4.00      ( VID-2 DA  MC   )
     26               0         2.00        1.00     ( VID-2 CA  CO  )       4.00      ( VID-2 DA  MC   )

#-2=   0; #-1=  26; BAR(>=0): ^_____________________________^_____________________________^_____________________________^

PERMAFROST-M          0
    313

#-2=   0; #-1= 313; BAR(>=0): __________________________________________________________________________________________

PERMAFROST-S          0
    313

#-2=   0; #-1= 313; BAR(>=0): __________________________________________________________________________________________

***** ERROR - SOILKEY: VID-2 QN   CO   DEPTH TO ROOT REST.:  -100. IT MUST BE -2 OR >=0 *****
***** ERROR - SOILKEY: VID-2 QN   CO   DEPTH TO WATER TABLE:  -100. IT MUST BE -2 OR >=0 *****
***** ERROR - SOILKEY: VID-2 QN   CO   DEPTH TO BEDROCK:  -150. IT MUST BE -2 OR >=0 *****
```

TABLE X

SIMPLE STATISTICS AND ERROR MESSAGES FOR NON-DEPTH, DUMMY NUMERIC VARIABLES (SOIL CARTOGRAPHIC FILE)

TABLE LISTING SIMPLE STATISTICS FOR SOIL CARTOGRAPHIC, NON-DEPTH (NON-HORIZON), DUMMY NUMERIC VARIABLES

VARIABLE NAME #<0 (UNKNOWN)	# OBS (>=0) # OF ZEROES	MEAN MEDIAN	LOWEST 2ND LOWEST	(KEY) (KEY)	HIGHEST 2ND HIGHEST	(KEY) (KEY)
CO_GR_0-25-M	268	7.62	0.00	(VID-2 BY)	25.00	(VID-2 GA VG)
45	47	7.00	0.00	(VID-2 BY G)	25.00	(VID-2 ST R)
CO_GR_0-25-S	258	2.88	0.00	(VID-2 CN)	6.00	(VID-2 RY R)
55	39	3.00	0.00	(VID-2 CN ID)	6.00	(VID-2 RY L3R)
K_FACTOR-M	52	0.11	0.02	(VID-2 SL)	0.50	(VID-2 FT ID)
261	0	0.05	0.02	(VID-2 SL G)	0.50	(VID-2 FT)
K_FACTOR-S	52	0.03	0.01	(VID-2 QU)	0.05	(VID-2 SH ID)
261	0	0.02	0.01	(VID-2 QU CO)	0.05	(VID-2 SH G LO)

CO_GR_0-25-M: #-2= 0; #-1= 45; BAR(>=0): ^__^___^___4___1___^___^___^___^___3___^_______^___^_______^___________4_______^____________2

CO_GR_0-25-S: #-2= 0; #-1= 55; BAR(>=0): ^_______________^_______________^_______________^_______________^_______________^_________^

K_FACTOR-M: #-2= 0; #-1= 261; BAR(>=0): 5_^___7_2_______6__________3_________3_________1__________2___________________1______2_____2

K_FACTOR-S: #-2= 0; #-1= 261; BAR(>=0): ^______________________^____^

***** ERROR - SOILKEY: VID-2 KH CO SOIL MANAGEMENT GROUP = -2. IT MUST BE >0. *****

TABLE XI
ERRORS UNCOVERED BY VALIDATION ROUTINES FOR STANDARD
CODED DEPTH VARIABLES (SOIL CARTOGRAPHIC FILE)

TABLE LISTING ERRORS, # OF BLANKS, AND # OF OBS. FOR EACH H.MAT. TYPE FOR DEPTH (HORIZON), CODED VARIABLES (CARTOGRAPHIC DATA)

```
ERRORS LISTED BY VARIABLE
***** SOILKEY: VID-2 KH       DEPTH CODE: 5 HORIZON MATERIAL MUST BE FILLED. IT HAS BEEN LEFT BLANK. *****
***** SOILKEY: VID-2 KH       DEPTH CODE: 5 THICKNESS-M =  -1. IT MUST BE >0 WITH H.MAT. NOT=  R, OR W. *****
***** SOILKEY: VID-2 KH   CO  DEPTH CODE: 6 HOR. MAT. = N, AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 FB       DEPTH CODE: 5 HORIZON MATERIAL MUST BE FILLED. IT HAS BEEN LEFT BLANK. *****
***** SOILKEY: VID-2 FB   6   DEPTH CODE: 3 PARENT_MATERIAL-DOMINANT = T , AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 RY       DEPTH CODE: 4 PARENT_MATERIAL-SUBDOMINANT = GF, AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 QL       DEPTH CODE: 4 TEXTURE_CSSC = FLS , AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 QL   6   DEPTH CODE: 5 TEXTURE_CSSC =    M, AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 SM   PD  DEPTH CODE: 5 TEXTURE_CSSC = FLS , AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 QN       DEPTH CODE: 2 UNIFIED_TEXTURE-DOMINANT = PG, AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 QN   CO  DEPTH CODE: 4 UNIFIED_TEXTURE-SUBDOMINANT = LC, AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 QN   CO  DEPTH CODE: 5 UNIFIED_TEXTURE-SUBDOMINANT = LC, AN ILLEGAL VALUE *****

ERRORS LISTED BY DEPTH (HORIZON)
***** SOILKEY: VID-2 FB       DEPTH CODE: 5 HORIZON MATERIAL MUST BE FILLED. IT HAS BEEN LEFT BLANK. *****
***** SOILKEY: VID-2 FB   6   DEPTH CODE: 3 PARENT MATERIAL-DOMINANT = T , AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 KH       DEPTH CODE: 5 HORIZON MATERIAL MUST BE FILLED. IT HAS BEEN LEFT BLANK. *****
***** SOILKEY: VID-2 KH       DEPTH CODE: 5 THICKNESS-M =  -1. IT MUST BE >0 WITH H.MAT. NOT=  R, OR W. *****
***** SOILKEY: VID-2 KH   CO  DEPTH CODE: 6 HOR. MAT. = N, AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 QL       DEPTH CODE: 4 TEXTURE_CSSC = XFS , AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 QL   6   DEPTH CODE: 5 TEXTURE_CSSC =    M, AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 QN       DEPTH CODE: 2 UNIFIED_TEXTURE-DOMINANT = PG, AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 QN   CO  DEPTH CODE: 4 UNIFIED_TEXTURE-SUBDOMINANT = LC, AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 QN   CO  DEPTH CODE: 5 UNIFIED_TEXTURE-SUBDOMINANT = LC, AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 RY       DEPTH CODE: 4 PARENT MATERIAL-SUBDOMINANT = GF, AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 SM   PD  DEPTH CODE: 5 TEXTURE_CSSC = XFS , AN ILLEGAL VALUE *****

TOTAL # OF OBSERVATIONS (DEPTHS) BEING EXAMINED IS:     313

# OF BLANK HORIZON MATERIAL VALUES IS:                   11
# OF BLANK DOMINANT PARENT MATERIAL VALUES IS:           53
# OF BLANK SUBDOMINANT PARENT MATERIAL VALUES IS:      1052
# OF BLANK TEXTURE CSSC VALUES IS:                      379
# OF BLANK DOMINANT UNIFIED TEXTURE VALUES IS:          345
# OF BLANK SUBDOMINANT UNIFIED TEXTURE VALUES IS:       997

# OF BLANK DUMMY VARIABLE 1 VALUES IS:                  966
# OF BLANK DUMMY VARIABLE 2 VALUES IS:                  584
# OF BLANK DUMMY VARIABLE 3 VALUES IS:                  584

# OF 'L' (LFH) VALUES FOR HORIZON MATERIAL IS:          275
# OF 'O' (ORGANIC) VALUES FOR HORIZON MATERIAL IS:        0
# OF 'F' (FIBRIC) VALUES FOR HORIZON MATERIAL IS:         0
# OF 'M' (MESIC) VALUES FOR HORIZON MATERIAL IS:         17
# OF 'H' (HUMIC) VALUES FOR HORIZON MATERIAL IS:          0
# OF 'A' (MINERAL) VALUES FOR HORIZON MATERIAL IS:      277
# OF 'B' (MINERAL) VALUES FOR HORIZON MATERIAL IS:      788
# OF 'C' (MINERAL) VALUES FOR HORIZON MATERIAL IS:      106
# OF 'I' (INDURATED) VALUES FOR HORIZON MATERIAL IS:      0
# OF 'R' (BEDROCK) VALUES FOR HORIZON MATERIAL IS:       28
# OF 'W' (WATER) VALUES FOR HORIZON MATERIAL IS:          0
# OF 'J' (ANTHROPOGENIC) VALUES FOR HOR. MATERIAL IS:     8
# OF 'Z' (FROZEN) VALUES FOR HORIZON MATERIAL IS:         0
```

TABLE XII
SIMPLE STATISTICS AND ERROR MESSAGES FOR STANDARD,
NUMERIC, DEPTH VARIABLES (SOIL CARTOGRAPHIC FILE)

TABLE LISTING SIMPLE STATISTICS FOR SOIL CARTOGRAPHIC, DEPTH (HORIZON), STANDARD NUMERIC VARIABLES

```
HOR._MAT.    VARIABLE NAME    # OBS (>=0)    MEAN      LOWEST        (KEY)          HIGHEST       (KEY)
             #<0 (UNKNOWN)    # OF ZEROES    MEDIAN    2ND LOWEST    (KEY)          2ND HIGHEST   (KEY)

  ALL        THICKNESS-M      1517           22.07     1.00   (VID-2 MY   6  :1)    100.00   (VID-2 W        :1)
                 32              0           20.00     1.00   (VID-2 MY  L3  :1)    100.00   (VID-2 SS  2    :1)

#-2=  0; #-1=  32; BAR(>=0):26^^^^^^^^^^^2^^^^9^^^5^^^^^^^^^^^^^31^2^37^258_^1_2_8__14^___2___4_______1________1________^

L,O,F,M,H    THICKNESS-M       331            9.68     1.00   (VID-2 MY   6  :1)     90.00   (VID-2 MT   T   :4)
                  0              0            5.00     1.00   (VID-2 MY  L3  :1)     80.00   (VID-2 AR  2    :3)

#-2=  0; #-1=   0; BAR(>=0):26^^^^4^__51___1__4__7___1_^_3______4___13____3___1___2___1___1________1________1

A,B,C,I      THICKNESS-M      1162           24.58     3.00   (VID-2 FT      :1)    100.00   (VID-2 W        :1)
                  9              0           25.50     3.00   (VID-2 FT   6  :1)    100.00   (VID-2 SS  2    :1)

#-2=  0; #-1=   9; BAR(>=0):5^^^^^^^^^^2^^^^9^^^5^^^^^^^^^^^_^31^2^36^258_^1_2_7__14^________3________________________6

  ALL        THICKNESS-S      1474            8.55     1.00   (VID-2 CA      :1)     35.00   (VID-2 BO  WC   :7)
                 75              0            8.00     1.00   (VID-2 CA  CO  :1)     35.00   (VID-2 BO  MD   :7)

#-2=  0; #-1=  75; BAR(>=0):^_^__^__^__^__^__^__^__^__^__^__^__^__^__^__^4__^9__^__^__6__9___2__^__3___5__4__2________1__6

L,O,F,M,H    THICKNESS-S       314            3.28     1.00   (VID-2 CA      :1)     34.00   (VID-2 MT  SOT  :3)
                 17              0            2.00     1.00   (VID-2 CA  CO  :1)     30.00   (VID-2 MT   T   :4)

#-2=  0; #-1=  17; BAR(>=0):^_^__^__^__6__3____4____9_____1__________________7_1_____________________2_________1

A,B,C,I      THICKNESS-S      1150            9.95     1.00   (VID-2 FT      :2)     35.00   (VID-2 BO  WC   :7)
                 21              0           10.00     1.00   (VID-2 FT   6  :2)     35.00   (VID-2 BO  MD   :7)

#-2=  0; #-1=  21; BAR(>=0):^_^__^__^__^__^__^__^__^__^__^__^__^__^__^__^4__^9__^__^__5__9___2__^__3___5__4____________6

  ALL        CACO3-M             0
               1549

#-2=  0; #-1=1549; BAR(>=0):______________________________________________________________________________________
```

```
L,O,F,M,H      CACO3-M              0
                   331

#-2=  0; #-1= 331; BAR(>=0):___________________________________________________________________________________________

A,B,C,I        CACO3-M              0
                  1171

#-2=  0; #-1=1171; BAR(>=0):___________________________________________________________________________________________

***** LIKELY ERROR - SOILKEY: VID-2 BD   A    DEPTH CODE: 1  B._DEN.-M & C._FRAG.-M. IMPLY BIG VOIDS OR B.D. OF FINES <0.9 *****
***** LIKELY ERROR - SOILKEY: VID-2 BD   G LO DEPTH CODE: 2  B._DEN.-M & C._FRAG.-M. IMPLY BIG VOIDS OR B.D. OF FINES <0.9 *****
***** LIKELY ERROR - SOILKEY: VID-2 BE        DEPTH CODE: 2  B._DEN.-M & C._FRAG.-M. IMPLY BIG VOIDS OR B.D. OF FINES <0.9 *****
***** LIKELY ERROR - SOILKEY: VID-2 BE   G    DEPTH CODE: 2  B._DEN.-M & C._FRAG.-M. IMPLY BIG VOIDS OR B.D. OF FINES <0.9 *****
***** ERROR -- SOILKEY: VID-2 BY   G    DEPTH CODE: 2  B._DEN.-M MUST BE >= 2.65 * C._FRAG.-M / 100 ; IT IS NOT. *****
***** ERROR -- SOILKEY: VID-2 BY   G    DEPTH CODE: 3  B._DEN.-M MUST BE >= 2.65 * C._FRAG.-M / 100 ; IT IS NOT. *****
```

TABLE XIII

VALIDATION ROUTINE ERRORS AND SIMPLE STATISTICS FOR DEPTH, DUMMY VARIABLES (SOIL CARTOGRAPHIC FILE)

TABLE LISTING ERRORS AND SIMPLE STATISTICS FOR DUMMY VARIABLE 3 FOR DEPTH DATA (CARTOGRAPHIC FILE)

```
***** SOILKEY: VID-2 AR   SO   DEPTH CODE: 3 DUMMY VARIABLE 3 = -1, AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 AR   SOT  DEPTH CODE: 4 DUMMY VARIABLE 3 = -1, AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 CN   G    DEPTH CODE: 2 DUMMY VARIABLE 3 = -1, AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 CN   G    DEPTH CODE: 3 DUMMY VARIABLE 3 = -1, AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 CN   G    DEPTH CODE: 4 DUMMY VARIABLE 3 = -1, AN ILLEGAL VALUE *****
***** SOILKEY: VID-2 CN   G    DEPTH CODE: 5 DUMMY VARIABLE 3 = -1, AN ILLEGAL VALUE *****
```

HOR._MAT.	VARIABLE NAME #<0 (UNKNOWN)	# OBS (>=0) # OF ZEROES	MEAN MEDIAN	LOWEST 2ND LOWEST	(KEY) (KEY)	HIGHEST 2ND HIGHEST	(KEY) (KEY)
ALL	FINE SAND	926	12.06	0.00	(VID-2 AR :1)	40.00	(VID-2 BE WC :3)
	584	8	11.00	0.00	(VID-2 AR :2)	40.00	(VID-2 BE S :3)

```
#-2=   0; #-1= 584; BAR(>=0): 8___^__^_^__^_^__^_^__^_^__^_^__^_^__^_5__9_^__^_^____4___7__^________8_9______6_4____4_____6___7
```

HOR._MAT.	VARIABLE NAME #<0 (UNKNOWN)	# OBS (>=0) # OF ZEROES	MEAN MEDIAN	LOWEST 2ND LOWEST	(KEY) (KEY)	HIGHEST 2ND HIGHEST	(KEY) (KEY)
L,O,F,M,H	FINE SAND	200	12.94	0.00	(VID-2 AR :1)	40.00	(VID-2 BE WC :3)
	123	6	12.00	0.00	(VID-2 AR :2)	40.00	(VID-2 BE S :3)

```
#-2=   0; #-1= 123; BAR(>=0): 6___7___^__^_^__6_8__6_7__3_^__8__^_8_3____^__9_^____2_______4__________2__________________6__6
```

HOR._MAT.	VARIABLE NAME #<0 (UNKNOWN)	# OBS (>=0) # OF ZEROES	MEAN MEDIAN	LOWEST 2ND LOWEST	(KEY) (KEY)	HIGHEST 2ND HIGHEST	(KEY) (KEY)
A,B,C,I	FINE SAND	690	11.79	0.00	(VID-2 AR SOT :1)	40.00	(VID-2 BE LO :4)
	450	2	10.00	0.00	(VID-2 AR T :2)	36.00	(VID-2 FT ID :4)

```
#-2=   0; #-1= 450; BAR(>=0): 2___^__^_^__^_^__^_^__^_^__^_^__^_^__^_2__9_^__9_^___2___7__^_________8_6______6_4____4________1
```

CAPAMP INPUT - AGRICULTURE CAPABILITY

Introduction

This form is used for entering agricultural capability ratings and associated data for maps into CAPAMP. All input codes and associated definitions are described in complete detail in Kenk and Cotic (1983). The reader should refer to this document for a complete description of all codes used on this form.

This section of the document will describe the CAPAMP INPUT - AGRICULTURE CAPABILITY form, describe the codes and their format, and describe available validation procedures.

It should be recognized that on projects which include data collection of both soils and agricultural capability, there is not necessarily any direct correspondence between the soils in a polygon and either the unimproved or improved capability ratings in the polygon. (See Nagpal, Sondheim, and Wallis (1986) for a brief discussion of this.) Nevertheless, it is possible to develop a validation routine which checks for general correspondence between the soils and agricultural capability data. (See Friesen and Jungen (1987) for an example of this, as applied to the east coast of Vancouver Island.)

The Form

The form for entering Agriculture Capability data is two-sided with six blocks of coding fields (Figure 4). Each block of code is designed for the input of the agricultural capability data for one CAPAMP map polygon. One block of coding fields will be described in complete detail.

On the right-hand side of the form just below the form title is the label, MAP SHEET NO., followed by an underlined area. The user enters map reference information in this space to aid in sorting or storing the completed forms.

Coding Field And Attribute Descriptions

Trans. [4,AN,L]
ID

A four character computer transaction code which is utilized when data is loaded into the CAPAMP database. The value ADAC was entered into the data field when the form was produced and appears on all agriculture capability forms; do not enter any data in this field.

Polygon [4,I,R]
No.

An integer from 1 to 2000 indicating the unique polygon number within a map sheet and/or project area. The number is assigned by the Thematic Mapping Unit or the user. Assignment by the former is preferred upon completion of the entry of polygon linework into the system.

FIGURE 4
EXAMPLE OF AGRICULTURE CAPABILITY FORM

CAPAMP INPUT - AGRICULTURE CAPABILITY

MAP SHEET NO. ________________

Trans. ID [1] A D A C   Polygon No. [5]   Project ID [9]   No. of Observ. [15]

UNIMPROVED CAPABILITY CLASS								
1			2			3		
Cap. Class #	Decile	Subclass	Cap. Class #	Decile	Subclass	Cap. Class #	Decile	Subclass
18			24			30		

IMPROVED CAPABILITY CLASS								
1			2			3		
Cap. Class #	Decile	Subclass	Cap. Class #	Decile	Subclass	Cap. Class #	Decile	Subclass
36			42			48		

DUMMY VARIABLES										
						11		12		
1(F)	2(I)	3(I)	4(I)	5(I)	6(I)	7	8	9	10	
54	62	67	70	73	76	79				

Trans. ID [1] A D A C   Polygon No. [5]   Project ID [9]   No. of Observ. [15]

UNIMPROVED CAPABILITY CLASS 1 2 3 Cap. Class # Decile Subclass 18 24 30
IMPROVED CAPABILITY CLASS 1 2 3 Cap. Class # Decile Subclass 36 42 48
DUMMY VARIABLES 1(F) 2(I) 3(I) 4(I) 5(I) 6(I) 11 12 7 8 9 10 54 62 67 70 73 76 79

Trans. ID [1] A D A C   Polygon No. [5]   Project ID [9]   No. of Observ. [15]

UNIMPROVED CAPABILITY CLASS 1 2 3 Cap. Class # Decile Subclass 18 24 30
IMPROVED CAPABILITY CLASS 1 2 3 Cap. Class # Decile Subclass 36 42 48
DUMMY VARIABLES 1(F) 2(I) 3(I) 4(I) 5(I) 6(I) 11 12 7 8 9 10 54 62 67 70 73 76 79

Province of British Columbia   Ministry of Environment and Parks   ENV 1938

Project [6,AN,L]
ID

Project identification code assigned in consultation with the Thematic Mapping Unit for each user project. Usually the user decides on the Project ID code and informs the Thematic Mapping Unit. Each project should have a unique code.

No. of [3,I,R]
Observ.

Number of site descriptions, within the polygon, that are stored in the British Columbia Soil Information System. The maximum allowable value is 127.

Polygon [-,F,R]
Area

This variable, the area (km^2) of the polygon, does not appear on the form. It is calculated by the computer when the polygon line work has been completely entered into the system.

Polygon [-,F,R]
Perimeter

This variable, the length (km) of the polygon perimeter, does not appear on the form. It is calculated by the computer when the polygon line work has been completely entered into the system.

UNIMPROVED CAPABILITY CLASS

This section of the polygon coding block is used for entering the unimproved agricultural capability data. It will accommodate agriculture capability ratings for a maximum of three polygon components, with one rating for each component. The respective coding fields for each polygon component are indicated by the numbers "1" to "3" which appear in the space below the heading UNIMPROVED CAPABILITY CLASS. The coding instructions for all three polygon components are identical, with the exception that the capability class for the first component is never left blank. Coding instructions for the first polygon component (under heading "1") will be given. If second and third polygon components do not exist, the coding fields are left blank.

Cap. [1,AN,-]
Class

Ø |

This space is used to indicate that the agricultural capability rating is for an organic soil or to indicate a tree fruit rating. This field is left blank when a standard agriculture capability rating for a mineral soil is being coded.

The following codes are used:

Code	Term
O	organic soil
*	tree fruit rating

Cap. Class [1,AN,-]

|_

The agriculture capability class code for component 1. The allowable codes include the characters 1 to 7. An "X" is placed in this space if the component represents a non-agricultural area such as a parking lot.

Decile [1,AN,-]

The decile fraction of the polygon area represented by the first polygon component. The allowable codes include numbers 0 to 9, with "0" (zero) representing 100 percent.

Subclass [1,AN,-],[1,AN,-],[1,AN,-]

The agriculture capability subclass(es) for the polygon component are entered here. A maximum of three subclasses per polygon component may be entered. The subclasses should be entered in order of importance, from the left. When agriculture capability maps are generated, only the first two subclasses are indicated on the map. If the capability class is rated as any value between 2 and 7, at least one subclass must be listed.

The following codes are used:

Code	Subclass
A	soil moisture deficiency
B	wood in profile
C	adverse climate
D	undesirable soil structure/or low perviousness
E	erosion
F	fertility
H	depth of organic soil over bedrock or rockiness
I	inundation
L	degree of decomposition - permeability
N	salinity
P	stoniness
R	solid bedrock and/or rockiness
T	topography
W	excess water
Z	permafrost
BLANK	no subclass rating assigned

IMPROVED CAPABILITY CLASS

This section of the polygon coding block is used for entering the improved agricultural capability data. This section will accommodate agriculture capability ratings for a maximum of three polygon components, with one rating per component. The respective coding fields for each polygon component are indicated by the numbers "1" to "3" which appear in the space below the heading IMPROVED CAPABILITY CLASS. The data in this section represents the improved ratings for the corresponding polygon components in the unimproved section of the coding block. This section is completed, even if all the polygon components contain unimprovable class six or seven soils where the improved ratings are identical to the unimproved ratings. The coding instructions for all three components are identical, with the exception that the capability class value for the first component must always be filled. Coding instructions for the first component (under heading "1") will be given. If second and/or third polygon components do not exist, their respective coding fields are left blank.

Cap. Class [1,AN,-]

O |

This space is used to indicate that the agricultural capability rating refers to an organic soil or to indicate a tree fruit rating. The field is left blank when a standard agriculture capability rating for a mineral soil is being coded.

The following codes are used:

Code	Term
O	organic soil
*	tree fruit rating

Cap. Class [1,AN,-]

|_

The improved agriculture capability class code for component 1. The allowable codes include numbers 1 to 7 where agricultural capability ratings have been assigned. An "X" is placed in this space if the component represents a non-agricultural area such as a parking lot.

Decile [1,AN,-]

The decile fraction of the polygon area represented by the first polygon component. The allowable codes include numbers 0 to 9 with 0 representing 100 percent.

Subclass [1,AN,L],[1,AN,L],[1,AN,L]

The improved agriculture capability subclass(es) for the polygon component are entered here. A maximum of three subclasses per component may be entered. The subclasses should be entered in order of importance. When the agriculture capability maps are generated, only the first two subclasses are indicated on the map. The allowable codes are identical to those for the unimproved ratings discussed earlier. Unless the improved capability class is 1 or X, at least one subclass must be given.

DUMMY VARIABLES [8,F,R],[5,I,R],[3,I,R],[3,I,R],[3,I,R],[3,I,R], {[1,AN,-],[1,AN,-],[1,AN,-],[1,AN,-] OR [2,AN,L],[2,AN,L]}

Dummy, or user specified, variables (see Glossary) represent coding fields for which the user may define project specific values. These variables should be defined and used after consultation with the CAPAMP systems analysts. Consultation is necessary to establish project specific standard attribute definitions and allowable codes. It is essential that the project specific variables be consistently used throughout a project and that these variables are consistently coded with respect to character type, coding field(s), and field justification. The first field is for a real number data entry up to eight characters long including the decimal point. The second field (the first integer field) has an allowable maximum value of 32767. The next four integer fields have allowable maximum values of 127. The last four fields are alphanumeric and can be used as two character, left-justified fields, or as four single character fields.

Database or Attribute Report

Table XIV is a partial listing of an Agriculture Capability Attribute report. It lists the attribute data stored in the agriculture capability file. The labels and formatting are very similar to the input data form. This listing shows the polygon area and perimeter as calculated by CAPAMP. This listing is used to compare the database with the original source data to ensure accuracy of key entry. The listing is also used in conjunction with validation reports (see below). Desired data additions and/or corrections can be indicated on this listing and returned to Thematic Mapping Unit for revision.

Validation Routines

The validation routines test the general validity of the agriculture capability data. The routines are designed as a tool for editing the input data. These routines check to ensure that the polygon number is not a duplicate of previously entered polygons, the sum of the polygon component deciles equals 10, and that the class and subclass codes are legal. Simple statistics on the number of observations are calculated. The codes for user specified variables can be validated if prior arrangements are made with the CAPAMP systems analysts. Simple statistics can also be calculated for user specified variables if prior arrangements are made with the CAPAMP systems analysts.

The following specific validation routines are applied to the input agriculture capability data:

1. for every polygon, at least one unimproved and one improved rating must be present;
2. for each capability class rating the subclasses are checked for allowable or missing codes (classes 1 and X do not have subclasses whereas all other classes must have at least one subclass);
3. all capability class variables are checked to insure that they are legal values;
4. all capability subclass variables for inorganic soils are checked to insure that they are legal codes;
5. all capability subclass variables for organic soils are checked to insure that they are legal codes;
6. all subclass entries are checked to ensure left-justification of entries.

Table XV shows a listing of the possible validation error messages. The listing indicates the polygon number, the field where the error occurs, the current entry, and the list of allowable codes. The error messages are self-explanatory. Note that this listing contains error messages for duplicate polygon numbers and for project specific validation involving dummy variables 9 and 10. These dummy variables were used to indicate dominant and subdominant land use.

At the bottom of the error listing, is an example of the simple statistics. This example gives simple statistics for the variable, No. of Observ. The table for simple statistics includes variable name, number of entries less than zero, number of observations greater than zero, the number of zero entries, the mean value, the median value, the lowest value, the second lowest value, the highest value, and the second highest value. This type of information can also be calculated for numeric dummy variables.

TABLE XIV
AGRICULTURE CAPABILITY ATTRIBUTE DATA

```
  CAPAMP THEME TWO - AGRICULTURE ATTRIBUTE DATA                          18-APR-1986   PAGE:    40
MAP: CAPAMP_DB:92F026,DBS
**************************************************************************************************
 POLY       PRO          NO                                                   AREA (KM2):     0.3900
 NO         ID           OBSERV                                               PERIM (KM):     4.4022
 ----       ------       ---
  118       VID-3

 UNIMPROVED CAPABILITY CLASS        IMPROVED CAPABILITY  CLASS
    1          2          3          1          2          3
CAP D SUB  CAP D SUB  CAP D SUB  CAP D SUB  CAP D SUB  CAP D SUB
CLS E CLS  CLS E CLS  CLS E CLS  CLS E CLS  CLS E CLS  CLS E CLS                DUMMY VARIABLES     1112
0 . C ...  0 . C ...  0 . C ...  0 . C ...  0 . C ...  0 . C ...      1        2   3   4   5   6  78910
--- - ---  --- - ---  --- - ---  --- - ---  --- - ---  --- - ---   -------- -- -- --- --- --- --- -----
  5 7 T      7 3 T                 5 7 T      7 3 T                                                  F


**************************************************************************************************
 POLY       PRO          NO                                                   AREA (KM2):     0.0509
 NO         ID           OBSERV                                               PERIM (KM):     1.5866
 ----       ------       ---
  119       VID-3

 UNIMPROVED CAPABILITY CLASS        IMPROVED CAPABILITY  CLASS
    1          2          3          1          2          3
CAP D SUB  CAP D SUB  CAP D SUB  CAP D SUB  CAP D SUB  CAP D SUB
CLS E CLS  CLS E CLS  CLS E CLS  CLS E CLS  CLS E CLS  CLS E CLS                DUMMY VARIABLES     1112
0 . C ...  0 . C ...  0 . C ...  0 . C ...  0 . C ...  0 . C ...      1        2   3   4   5   6  78910
--- - ---  --- - ---  --- - ---  --- - ---  --- - ---  --- - ---   -------- -- -- --- --- --- --- -----
  3 0 A                            2 0 TD                                                            F


**************************************************************************************************
 POLY       PRO          NO                                                   AREA (KM2):     0.2149
 NO         ID           OBSERV                                               PERIM (KM):     4.2049
 ----       ------       ---
  120       VID-3

 UNIMPROVED CAPABILITY CLASS        IMPROVED CAPABILITY  CLASS
    1          2          3          1          2          3
CAP D SUB  CAP D SUB  CAP D SUB  CAP D SUB  CAP D SUB  CAP D SUB
CLS E CLS  CLS E CLS  CLS E CLS  CLS E CLS  CLS E CLS  CLS E CLS                DUMMY VARIABLES     1112
0 . C ...  0 . C ...  0 . C ...  0 . C ...  0 . C ...  0 . C ...      1        2   3   4   5   6  78910
--- - ---  --- - ---  --- - ---  --- - ---  --- - ---  --- - ---   -------- -- -- --- --- --- --- -----
  3 8 AW     4 2 W                 2 9 DT     2 1 WD                                                 F

**************************************************************************************************
```

```
POLY       PRO        NO                                                      AREA (KM2):     0.0649
NO         ID         OBSERV                                                  PERIM (KM):     1.3605
----       ------     ---
 121       VID-3

UNIMPROVED CAPABILITY CLASS        IMPROVED CAPABILITY  CLASS
  1          2          3          1          2          3
CAP D SUB  CAP D SUB  CAP D SUB  CAP D SUB  CAP D SUB  CAP D SUB
CLS E CLS  CLS E CLS  CLS E CLS  CLS E CLS  CLS E CLS  CLS E CLS                DUMMY VARIABLES     1112
O . C ...  O . C ...  O . C ...  O . C ...  O . C ...  O . C ...      1        2   3   4   5   6  78910
--- - ---  --- - ---  --- - ---  --- - ---  --- - ---  --- - ---   -------- -- -- --- --- --- --- -----
0 7 5 W    0 5 5 W               0 3 0 W                                                           F

********************************************************************************************************
POLY       PRO        NO                                                      AREA (KM2):     0.0067
NO         ID         OBSERV                                                  PERIM (KM):     0.3865
----       ------     ---
 122       VID-3

UNIMPROVED CAPABILITY CLASS        IMPROVED CAPABILITY  CLASS
  1          2          3          1          2          3
CAP D SUB  CAP D SUB  CAP D SUB  CAP D SUB  CAP D SUB  CAP D SUB
CLS E CLS  CLS E CLS  CLS E CLS  CLS E CLS  CLS E CLS  CLS E CLS                DUMMY VARIABLES     1112
O . C ...  O . C ...  O . C ...  O . C ...  O . C ...  O . C ...      1        2   3   4   5   6  78910
--- - ---  --- - ---  --- - ---  --- - ---  --- - ---  --- - ---   -------- -- -- --- --- --- --- -----
  7 0 T                            7 0 T                                                         F

********************************************************************************************************
POLY       PRO        NO                                                      AREA (KM2):     0.1442
NO         ID         OBSERV                                                  PERIM (KM):     1.7768
----       ------     ---
 123       VID-3

UNIMPROVED CAPABILITY CLASS        IMPROVED CAPABILITY  CLASS
  1          2          3          1          2          3
CAP D SUB  CAP D SUB  CAP D SUB  CAP D SUB  CAP D SUB  CAP D SUB
CLS E CLS  CLS E CLS  CLS E CLS  CLS E CLS  CLS E CLS  CLS E CLS                DUMMY VARIABLES     1112
O . C ...  O . C ...  O . C ...  O . C ...  O . C ...  O . C ...      1        2   3   4   5   6  78910
--- - ---  --- - ---  --- - ---  --- - ---  --- - ---  --- - ---   -------- -- -- --- --- --- --- -----
  X 0                              X 0                                                             F
```

TABLE XV
ERRORS AND SIMPLE STATISTICS FOR
AGRICULTURE CAPABILITY DATA

TABLE OF ERRORS UNCOVERED BY AVALID ROUTINE

***** ERROR ***** POLYGON NUMBER : 2: ***** ORG.CODE EQUALS : X: IT MUST EQUAL O, *, OR BLANK *****
***** ERROR ***** POLYGON NUMBER : 4: ***** CAP.CLASS EQUALS : 0: IT MUST EQUAL 1,2,3,4,5,6,7,X (OR BLANK IF NOT COMP. 1)
***** ERROR ***** POLYGON NUMBER : 4: ***** DECILE EQUALS : 0: IT MUST EQUAL 0 TO 9 (OR BLANK IF COMP. NOT FILLED)
***** ERROR ***** POLYGON NUMBER : 4: ***** SUBCLASS EQUALS : 0: IT MUST EQUAL A,B,C,D,E,F,H,I,L,N,P,R,T,W,Z OR BLANK
***** ERROR ***** POLYGON NUMBER : 10: ***** IMPROVED RATING MISSING *****
***** ERROR ***** POLYGON NUMBER : 10: ***** CAPABILITY CLASS EQUALS : 8: IT MUST BE BETWEEN 1 AND 7 OR X *****
***** ERROR ***** POLYGON NUMBER : 157: ***** GROUP 2 UNIMPROVED SUBCLASSES MUST NOT BE BLANK WHEN CAP CLASSES >1 *****
***** ERROR ***** POLYGON NUMBER : 157: FOR UNIMPROVED DECILE SUM TO 0 AND 2ND AND 3RD CAP CLASSES NOT BLANK *****
***** ERROR ***** POLYGON NUMBER : 158: FOR UNIMPROVED - DECILES SUM TO 5 *****
***** ERROR ***** POLYGON NUMBER : 158: FOR IMPROVED - DECILES SUM TO 17 *****
***** ERROR ***** POLYGON NUMBER : 27: ***** ADP09 EQUALS: : AN ILLEGAL VALUE *****
***** ERROR ***** POLYGON NUMBER : 27: ***** ADP10 EQUALS: : AN ILLEGAL VALUE *****

VARIABLE NAME	# OBS (>=0)	MEAN	LOWEST	(KEY)	HIGHEST	(KEY)
#<0 (UNKNOWN)	# OF ZEROES	MEDIAN	2ND LOWEST	(KEY)	2ND HIGHEST	(KEY)
NO OF OBS	163	0.00	0.00	(1)	0.0	(1)
0	163	0.00	0.00	(1)	0.0	(1)

***** ERROR --- DUPLICATE POLYGON NUMBER : 1
***** ERROR --- DUPLICATE POLYGON NUMBER : 1

CAPAMP INPUT - TERRAIN (Surficial Geology)

Introduction

This form is used for entering terrain (surficial geology) polygon data into CAPAMP. It is used to input both general polygon data and component specific data for the identified polygon. The data on this form is used to create the terrain attribute database for the terrain map being described. Three fields of dummy variables allow entry of project specific polygon, component, and stratigraphic variables. The standard terrain (surficial geology) codes are described in detail in Howes and Kenk (1987). Additional information concerning CAPAMP terrain programming can be found in Porteous and Kenk (1985) and Porteous (1985).

The Form

The form for entering terrain data is two-sided (Figure 5). Each side of the form is designed for input of the terrain data for one polygon. The coding fields for one side of the form will be described in complete detail.

On the right-hand side of the form just below the form title is the label, Map No., followed by an underlined area. The user enters map reference information in this space to aid in sorting or storing the completed forms.

Coding Field and Attribute Descriptions

POLYGON DATA

This section of the form is for entering data applicable to the entire polygon. (Data specific to polygon components or stratigraphic units is entered in the following sections of the form.)

TRANS [4,AN,L]
I.D.

A four character computer transaction code which is utilized when data is loaded into the CAPAMP database. The value ADTP was entered into the data field when the form was produced and appears on all terrain polygon forms; do not enter any data in this field.

POLYGON [4,I,R]
NO.

An integer from 1 to 2000 indicating the unique polygon number within a map sheet and/or project area. The number is assigned by the Thematic Mapping Unit or the user. Assignment by the former is preferred upon completion of entering polygon linework into the system.

FIGURE 5
EXAMPLE OF TERRAIN (SURFICIAL GEOLOGY) FORM

CAPAMP INPUT – TERRAIN

Map No. ____________

POLYGON DATA

TRANS I.D.	POLYGON NO.	PROJECT I.D.	NO. OF OBS.	ELEVATION (m) R1	ELEVATION (m) R2	ASPECT (°az) R1	ASPECT (°az) R2	SLOPE POS.	BEDROCK 1	BEDROCK 2	BEDROCK 3	BEDROCK 4
A D T P												

DUMMY VARIABLES

87 88 89 90 91 92

76 77 78 79 80 81 82 83 84 85 86

51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50

COMPONENT DATA

Comp. Dom. Code	Decile	SLOPE (°) 1	SLOPE Delim.	SLOPE 2	DRAIN-AGE 1	DRAIN-AGE Delim.	DRAIN-AGE 2	MODIFYING PROCESSES 1: C	Sub 1	Sub 2	Q D 1	Q D 2	MODIFYING PROCESSES 2: C	Sub 1	Sub 2	Q D 1	Q D 2	MODIFYING PROCESSES 3: C	Sub 1	Sub 2	Q D 1	Q D 2	DEPTH TO IMPERMEABLE LAYER (m) 1	DEPTH TO IMPERMEABLE LAYER (m) 2

DUMMY VARIABLES

23

19 20 21 22

13 14 15 16 17 18

1 2 3 4 5 6 7 8 9 10 11 12

SIMPLE UNIT DATA

Strat. Ord. Code	STANDARD TEXTURE 3	2	1	UNIFIED TEXTURE 1	2	GEN. MAT. C	Sub	QUAL. DESC. 1	2	SURF. EXP. 1	2	3	THICKNESS (m) R1	R2	ROUNDNESS	COMPACTION	PERMEABILITY	INDURATION

DUMMY VARIABLES

28

23 24 25 26 27

16 17 18 19 20 21 22

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

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PROJECT I.D. [6,AN,L]

Project code assigned in consultation with the Thematic Mapping Unit for each project. Usually the user decides on the Project ID code and informs the Thematic Mapping Unit. Each project should have a unique code.

NO. OF OBS. [3,AN,R]

The number of ground truth observation points in the polygon. The maximum allowable value is 127.

Polygon Area [-,F,R]

The polygon area (km^2). This variable does not appear on the form. It is calculated by software when the polygon line work has been completely entered into the system.

Polygon Perimeter [-,F,R]

The polygon perimeter (km). This variable does not appear on the form. It is calculated by software when the polygon line work has been completely entered into the system.

ELEVATION (m)

This field is used to indicate the elevation range within a polygon.

R1 [4,I,R]

The lowest elevation (meters) in the polygon. Allowable codes include the integers from 0 to 9999. Validation routines establish minimum and maximum limits for provincial elevation ranges, sea level to 4663 respectively.

R2 [4,I,R]

The highest elevation (meters) in the polygon. Allowable codes are as for R1, above.

ASPECT (^{o}az)

These fields (R1, R2) are used to indicate the azimuth (orientation) of a polygon which is measured in degrees (0^o-359^o). In the case of a polygon with level, or near level ground, which has no discernable aspect,the code 999 is entered in this field.

R1 [3,AN,R]

The aspect of polygons that are only orientated in one direction is entered in this field. Polygons that are made up of multiple aspects are measured in a clockwise direction such that the aspect entered in this field represents the starting aspect of this measurement. Allowable codes include the integers from 0 to 359.

R2 [3,AN,R]

This field is only used for those polygons that have multiple aspects. The value entered in this field represents the end aspect of a polygon which has been measured in a clockwise direction (see R1 above). Allowable codes include the integers numbers from 0 to 359.

SLOPE [2,AN,L]
POS.

The slope position referring to the position of the polygon in relation to the surrounding slope (above and/or below).

The codes for the slope position are:

Code	Term*
CR	crest
UP	upper slope
MD	mid slope
LW	lower slope
TO	toe
DP	depression
LV	level

* For definition of terms, refer to Ministry of Environment and Parks (1987).

BEDROCK

This field is for coding bedrock types as defined by Owens et al. (in prep). The user may enter up to four bedrock types. They should be indicated in order of maximum to minimum areal occurrence within the polygon.

1 [2,AN,L]

The first or most commonly occurring bedrock type.

The following codes are used:

Code	Term (with example rock types)
Metamorphic Type	
MN	foliate, medium to coarse, granular (gneiss)
MT	foliate, medium to coarse, platy (schists)
MF	foliate, fine (phylitte, slate)

MG	non-foliate, medium to coarse (granulite, some quartzite)
MH	non-foliate, fine (hornfels, some quartzite)
MK	calcareous (marble, scarn)

Plutonic Type

PA	acid (granite, syenite)
PB	basic (gabbro, pyroxenite, dunite)
PI	intermediate (quartz diorite, diorite)

Sedimentary type

SC	clastic, coarse (conglomerate, breccia)
SI	clastic, medium (sandstone)
SF	clastic, fine (siltstone, claystone, shale)
SK	calcareous (limestone, dolomite)
SN	chemical, non-calcareous (chert, gypsum)
SO	organic, carbonaceous (coal)

Volcanic type

VA	acid (rhyolite, dacite)
VI	intermediate (andesite)
VB	basic (basalt)
VG	glass (obsidian, pumice)
VC	pyroclastic (breccia, tuff)

2 [2,AN,L]

The second most commonly occurring bedrock type. The allowable codes are the same as for bedrock type one.

3 [2,AN,L]

The third most commonly occurring bedrock type. The allowable codes are the same as for bedrock type one.

4 [2,AN,L]

The fourth most commonly occurring bedrock type. The allowable codes are the same as for bedrock type one.

DUMMY VARIABLES

This section of the coding form allows the user to define dummy variables applicable to the entire polygon. Dummy or user specified variables (see Glossary) represent coding fields where the user defines project specific variables. These variables should be defined and used after consultation with the CAPAMP systems analysts. Consultation is necessary to establish attribute definitions and allowable codes. It is essential that the project specific variables be consistently used throughout a project and that these variables are consistently coded with respect to character type, coding field(s), and field justification. The multi-layer field labels represent the original version of programming where multi-space variables had to be rigidly defined (these variables are indicated in

Appendix A). Although the rigid multi-space variables can still be used, the present programming is more flexible.

Up to 50 alphanumeric characters can be used, in any combination, for user specified variables. For example, the user could define 10 variables of 5 character length that are all right-justified numeric variables. In this example, the user would enter the first variable in the fields labelled "1" to "5" such that the last data character would be under label "5". This procedure would be repeated for the remaining 9 variables with the last data character of each variable entered in the fields labelled "10", "15", "20", "25", "30", "35", "40", "45", and "50".

COMPONENT DATA

This section of the form describes entry of data applicable to the specific polygon components. The user can enter up to three separate components per polygon. As an example, if the terrain polygon is dominantly till blanket, with colluvial veneer and minor steep rock outcrops (Mb/Cv/Rs), component 1 refers to Mb, component 2 refers to Cv and component 3 refers to Rs. Component one, two, and three data are entered into the upper, middle, and lower coding lines, respectively. The coding instructions for all three components are identical. Coding instructions for the first component will be given.

Each component can have a value entered independently for each field. Alternatively, for the second and third components, other than the Component Dominance Code and the Decile, fields may be left blank if their values are identical to those provided for the first component; in this case the values for the first component will be replicated in the database for the second and/or third components, as appropriate. If data is not recorded for certain fields in components two or three, and the field(s) are not considered to be duplicates of the corresponding fields of component one, a "-2" (numeric) or "?" (alpha) should be entered.

Comp. Dom. Code [1,AN,-]

The dominance code corresponding to each terrain component. The terrain component which occupies the largest area is assigned dominance code 1 (Mb in above example). The second and third largest areal components, if present, are assigned dominance codes 2 and 3, respectively (Cv and Rs in above example). Code 1 is entered into the top line of the field. Codes 2 and 3, if necessary, are entered into the middle and bottom lines of the field, respectively. A component must have a component dominance code to be considered as valid.

Decile [1,AN,-]

The decile fraction of the polygon area represented by each terrain component. The allowable codes include numbers 0 to 9, with "0" (zero) representing 100 percent. The space is never left blank for the first component. If second or third components exist, a decile must be entered.

SLOPE (^{o})

The slope angle (in degrees) of a component of the polygon.

1 [2,AN,R]

The first slope angle for a component. The value for a component with only one slope angle is entered in this field. If the component has a range or two distinct slope angles, the smaller slope angle for the component is entered in this field. The allowable codes include numbers from 0 to 99.

Delim. [1,AN,-]

The slope delimiter used to identify if a component is made up of two distinct slopes or a range of slopes. If a component has two distinct slopes, a comma "," is entered in this field. Alternatively, if the component has a range of slopes, a dash "-" is used. This coding field is left blank when a component is only made up of one slope.

2 [2,AN,R]

The second slope angle for a component. This coding field is left blank if the component has only one slope. If the component has a range or two distinct slope angles, the largest slope angle for the component is entered in this field. The allowable codes include numbers from 0 to 99.

DRAIN-AGE

The type of drainage classes that occur within a terrain polygon component.

1 [1,AN,-]

The first drainage class for a component, or the value for a component that has only one drainage class. If a component has a range of drainage classes, the user enters either the driest or wettest drainage class, based on areal extent. Thus, if the component is dominated by drier drainages, the driest drainage is entered first, and vice versa for wet. The other end of the range is entered under drainage 2 (see below). If the polygon has two distinct classes of drainage present, the most extensive drainage class on an area basis is entered in this field.

The following codes are used:

Code	Term*
R	rapidly drained
W	well drained
M	moderately well drained
I	imperfectly drained
P	poorly drained
V	very poorly drained

* For a complete definition of terms, refer to Ministry of Environment and Parks (1987).

Delim. [1,AN,-]

The drainage delimiter used to distinguish if a component is made up of two distinct drainage classes or a range of drainage classes. If a component is made up of two distinct drainage classes, a comma "," is entered in this field. Alternatively, if the component has a range of drainage classes present, a dash "-" is entered. This field is left blank where the component can be characterized by only one drainage class.

2 [1,AN,-]

The second drainage class for a component. If two distinct drainage classes occur within the component, the less extensive class (on an area basis) is entered in this field. However, if the component is made up of a range of drainage classes, the driest or wettest drainage class is entered depending upon which drainage class was entered in drainage field 1 (see above). If the driest drainage class was entered in drainage field 1, then the wettest drainage class is entered in this field and vice versa for the wettest class. This coding field is left blank when only one drainage class is present in the component. The allowable codes are the same as the first drainage.

MODIFYING PROCESSES

This field is for entering up to three geological processes that are or have been modifying the terrain component. The areas for each modifying process are indicated by the numbers "1" to "3" which appear in the line below the heading MODIFYING PROCESSES. The coding instructions for all three modifying processes are identical. Coding instructions for the first modifying process (under heading "1") will be given.

1 [1,AN,-]
C

The following codes may be entered for the first component in the box labelled C under modifying process 1.

Code	Term*
	Erosional Processes
V	gullying
P	piping
K	karst processes
	Fluvial Processes
E	meltwater channels
B	braiding rivers
J	anastomosing rivers
M	meandering rivers
I	irregularly sinuous rivers
	Mass Movement Processes
R	rapid mass movement

F	failing (slow mass movement)
A	avalanching (snow)
	Periglacial and Permafrost Processes
C	cryoturbation
N	nivation
S	solifluction
X	permafrost processes
Z	periglacial processes (general)
	Other Geological Processes
D	deflation
W	washed
H	kettled
U	inundated terrain

* For a complete definition of terms, refer to Howes and Kenk (1987).

1 Sub | 1 | 2 [1,AN,L],[1,AN,L]

Up to two subcodes of the first modifying process for component one may be entered in boxes labelled SUB 1 and SUB 2. The subcodes are usually project specific. The user should develop the codes after consultation with the CAPAMP systems analysts and the Provincial Correlator for terrain (surficial geology).

1 |Q D 1|2 [1,AN,L],[1,AN,L]

The qualifying descriptors of the first modifying process for component one are entered under boxes QD 1 and QD 2. The qualifying descriptors are used to supply additional information about the status (active, inactive) or the mode of operation (glacial) of the modifying geologic process. Up to two terms may be entered in these spaces.

The following codes may be used:

Code	Term*
A	active
I	inactive
G	glacial

* For a complete definition of terms, refer to Howes and Kenk (1987).

DEPTH TO IMPERMEABLE LAYER (m)

This field indicates the depth of one or two impermeable layers, if applicable, for each component. An impermeable layer is a pedogenic horizon or a geological stratum which significantly restricts the downward movement of water when compared to the overlying material. It commonly results in a permanently or intermittently perched water table.

__1__ [2,AN,R]

The depth (in meters and tenths of a meter) to the upper-most impermeable layer, for a component. If the component has only one depth to an impermeable layer, it is entered in this field. Depths are recorded in tenths of a meter using the decimal indicated on the form. A "-1" is coded to indicate depths greater than or equal to 10 m. The allowable codes include numbers from 0.0 to 9.9.

__2__ [2,AN,R]

The depth (in meters) to the deeper impermeable layer, for a component. If the component has only one impermeable layer, this coding field is left blank. The allowable codes are the same as for the upper-most impermeable layer.

DUMMY VARIABLES

This section of the coding form allows the user to define dummy variables applicable to the terrain polygon components. Dummy or user specified variables (see Glossary) represent coding fields where the user defines project specific variables. <u>These variables should be defined and used after consultation with the CAPAMP systems analysts and the Provincial Terrain (Surficial Geology) Correlator. Consultation is necessary to establish attribute definitions and allowable codes.</u> It is essential that the project specific variables be consistently used throughout a project and that these variables are consistently coded with respect to character type, coding field(s), and field justification. The multi-layer field labels represent the original version of programming where multi-space variables had to be rigidly defined (these variables are indicated in Appendix A). Although the rigid multi-space variables can still be used, the present programming is more flexible.

Up to 12 alphanumeric characters can be used, in any combination, for user specified variables. For example, the user could define 2 variables of 3 and 7 character lengths, respectively. In this example, the user would enter the first variable in the fields labelled "1" to "3" such that the first data character would be under label "1". The second user specified variables would be entered in the fields labelled "4" to "10". Spaces "11" and "12" would be left blank.

SIMPLE UNIT DATA

This section of the form is for entering data applicable to the specific stratigraphic units within the terrain polygon components. The user can enter up to six separate stratigraphic units per terrain polygon. The stratigraphic units must correspond to the components described under the previous section of the form. The data for this section is linked to the component data via the Strat. Ord. Code field (see below). The coding instructions for all six stratigraphic units are identical and thus only the coding instructions for the first stratigraphic unit will be given.

Strat. Ord. Code [1,AN,-]

The stratigraphic order code. The codes are entered sequentially, starting on the top line of the field corresponding to the first polygon component. The codes consist of the numbers 1 (upper stratigraphic unit) through to 6 (lowest stratigraphic unit). The second sequence of codes, would correspond to the second polygon component, if present. Each stratigraphic unit is coded in a similar manner. The third sequence of codes (starting with a third 1), would correspond to the third polygon component. For example, a coding sequence of "1", "2", "1", "2", "3" would indicate a polygon with two components, the first component made up of two stratigraphic layers and the second component consisting of three stratigraphic layers.

This would be the case for the example terrain polygon symbol:

Mb / Cv Rs / Mb / Rs	where Mb and Rs make up component one and correspond to stratigraphic units 1 and 2, respectively. Cv, Mb, and Rs make up component two and correspond to the latter stratigraphic units 1, 2, and 3, respectively.

STANDARD [1,AN,R],[1,AN,R],[1,AN,R]
TEXTURE or
3|2|1 [3,AN,R]

The standard terrain texture(s). Texture refers to the size and roundness of particles and to the sorting within the mass of sediment, indicating the physical properties of a surficial material. The field allows the user to enter up to three textures. The dominant, secondary, and tertiary standard terrain textures, found in a stratigraphic unit, are entered under labels "1", "2", and "3", respectively. The database stores each texture separately and as a grouping, as indicated by the last format statement. Note that if only one texture is given, the first and second spaces are left blank; similarly, if two texture codes are provided, the first space remains blank.

The following lower case codes may be used:

Code	Term*
b	boulders
k	cobbles

p	pebbles
g	gravel
s	sand
$ (dollar sign)	silt
c	clay
f	fines**
m	mud
a	blocks
r	rubble
x	angular fragments
d	mixed fragments
y	shelly
Organic Terms	
e	fibric
u	mesic**
h	humic

*For a complete definition of terms, refer to Howes and Kenk (1987).
** Fines is a historic pre-1987 term, no longer in use. Historically (pre-1987) the code for mesic was "m".

UNIFIED TEXTURE [2,AN,L],[2,AN,L] or [4,AN,L]

1 | 2

The Unified Soil Classification texture for a stratigraphic unit. The Unified Soil Classification System is a method for classifying soils (and surficial materials) for engineering purposes. It is based upon texture for relatively coarse soils, but for those soils where the fines affect the behavior, it is also based on plasticity - compressibility characteristics (see references for a complete explanation). The field allows the user to enter up to two textures. The first unified texture for a stratigraphic unit is entered in the first two spaces under the label "1". The second unified texture is entered in the last two spaces under the label "2". The second code is used for the double symbol classifications as indicated in the codes below. The database stores each texture separately, and as a grouping, as indicated by the last format statement.

The following codes are used:

Code	Term*
GW	well-graded gravels or gravel-sand mixtures, little or no fines
GP	poorly graded gravels or gravel-sand mixtures, little or no fines
GM	silty gravels, gravel-sand-silt mixtures
GC	clayey gravels, gravel-sand-clay mixtures
SW	well-graded sands or gravelly sands, little or no fines
SP	poorly graded sands or gravelly sands, little or no fines
SM	silty sands, sand-silt mixtures
SC	clayey sands, sand-clay mixtures
ML	inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity

CL	inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
OL	organic silts and organic silt-clays of low plasticity
MH	inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
CH	inorganic clays of high plasticity, fat clays
OH	organic clays of medium to high plasticity, organic silts
PT	peat and other highly organic soils

Double Symbol Classifications

GPGC	poorly graded gravel with clay
GWGC	well graded gravel with clay
GWGM	well graded gravel with silt
GCGM	clayey gravel with silt
GPGM	poorly graded gravel with silt
SWSM	well graded sand with silt
SWSC	well graded sand with clay
SPSC	poorly graded sand with clay
SPSM	poorly graded sand with silt
SCSM	clayey sand with silt
CLML	loam clay with silts

* Reference: American Society for Testing and Materials (1985) and The Asphalt Institute (1978).

GEN. MAT. [1,AN,-]

C

The genetic or surficial material for each stratigraphic unit, entered in the box coded C. The surficial material is the main criteria used to subdivide the land surface into terrain units and is classified according to its mode of origin.

The following codes are used:

Code	Term*
A	anthropogenic materials
C	colluvium
D	weathered bedrock
E	eolian materials
F	fluvial sediments
I	ice
L	lacustrine sediments
M	morainal materials (till)
O	organic materials
R	bedrock
S	soprolite (historical term, pre-1987)
U	undifferentiated materials (historical term, pre-1987)
V	volcanic materials
W	marine sediments

* For a complete definition of terms, refer to Howes and Kenk (1987).

GEN. [1,AN,-]
MAT.
|Sub

The genetic or surficial material subcode for a stratigraphic unit. Subcodes are used to give more specific definition of the surficial materials. For example, a number of subcodes could be used to distinguish two or more different types of till. The codes are project specific with numeric values 1 through 9 plus 0 (representing 10) and are defined by the user in conjunction with the CAPAMP systems analysts.

QUAL. [1,AN,L][1,AN,L]
DESC.
1|2

The qualifying descriptors for genetic materials. Qualifying descriptors may be used to indicate: (1) whether the mode of origin is presently active or inactive; (2) whether certain material types (e.g. fluvial, lacustrine, and marine) were deposited in association with glacier ice; and (3) to classify organic materials. Up to two qualifying descriptors may be entered in this field.

The following codes are used:

Code	Term*
Inorganic materials*	
A	active
I	inactive
G	glacial
Organic Materials**	
B	bog
F	fen
S	swamp

*For a complete definition of terms, refer to Howes and Kenk (1987).
**These are historical (pre-1987) codes, no longer in use.

SURF. [1,AN,L],[1,AN,L],[1,AN,L]
EXP. or
1|2|3 [3,AN,L]

The surface expression code(s) for stratigraphic unit one. Surface expression describes the configuration of the land surface. Up to three terms may be coded. The first, second, and third surface expressions are entered under labels "1", "2", and "3", respectively. The database stores each surface expression separately and as a grouping, as indicated by the last format statement, which represents all surface expressions as a single attribute.

The following lower case codes are used:

Code	Term*
a	apron, moderate slope (15 to 26°)
b	blanket (≥ 1 meter in depth)
c	cone (> 15°)
d	depression
f	fan (0-15°)
h	hummocky (irregular slope configuration, >15°)
j	gentle slope (3 to 15°)
k	moderately steep slope (26 to 35°)
l	level (historical, pre-1987 term, no longer in use)
m	rolling (parallel slopes, 3 to 15°)
p	plain (includes level, 0 to 3°)
r	ridged (parallel slopes, 15 to 35°)
s	steep slope (> 35°)
t	terrace
u	undulating (irregular slope configuration, 3 to 15°)
v	veneer (≤ 1 meter in depth)
w	mantle (historical, pre-1987 term, no longer in use)

* For complete definition of terms refer to Howes and Kenk (1987), and Ryder and Howes (1984).

THICKNESS (m)

This field is for indicating the thickness of a stratigraphic unit.

R1 [4,I,R]

The thickness of a stratigraphic unit (in meters and tenths of a meter). If it is desired to enter a thickness range, the minimal thickness is coded here. Allowable codes include numbers from 0.0 to 999.9. The decimal is indicated on the form.

R2 [4,I,R]

The maximum thickness, in meters, for the stratigraphic unit. Allowable codes include numbers from 0.0 to 999.9.

ROUNDNESS [1,AN,-]

The roundness of coarse fragment clasts found within the stratigraphic unit. Clast roundness refers to the relative degree of roundness or angularity (curvature of corners and edges) of rock fragments greater than 2 mm in diameter.

The following codes are used:

Code	Term*
A	angular
N	subangular

O	subrounded
R	rounded

* For a definition of terms, refer to Appendix F.

COMPACTION [1,AN,-]

The degree of compaction of the material comprising the stratigraphic unit. Compaction is defined as the natural density for coarse materials (cohesionless) and the consistency (material strength) of cohesive materials (American Society for Testing and Materials, 1985).

The following codes are used:

Code	Term*
Cohesionless Materials	
L	loose
D	dense
Cohesive Materials	
V	very soft
S	soft
F	firm
H	hard
T	very hard

* For a definition of terms, refer to Appendix F.

PERMEABILITY [1,AN,-]

The permeability of the surficial material in the stratigraphic unit. Permeability refers to the potential of a surficial material to transmit water internally. It is influenced by such characteristics as texture, porosity, cracks, organic matter content, shrink-swell potential and degree of compaction.

The following codes are used:

Code	Term*
R	rapidly permeable
M	moderately permeable
S	slowly permeable

* For a definition of terms, refer to Ministry of Environment and Parks (1987).

INDURATION [1,AN,-]

The induration or degree of cementation within the surficial material of the stratigraphic unit. Induration refers to the resistance to crushing of a specimen which does not slake (crumble) in water. On a project specific basis, if required, the extent (continuity) of induration or type of cementing agent can be recorded as a project specific attribute using dummy variable fields.

The following standard codes are used:

Code	Term*
W	weakly cemented
M	moderately cemented
S	strongly cemented
I	indurated

* For a definition of terms, refer to Cementation in Ministry of Environment and Parks (1987).

DUMMY VARIABLES

This section of the coding form allows the user to define dummy variables applicable to the each stratigraphic unit. Dummy or user specified variables (see Glossary) represent coding fields where the user defines project specific variables. These variables should be defined and used after consultation with the CAPAMP systems analysts and the Provincial Terrain (Surficial Geology) Correlator. Consultation is necessary to establish project specific data items, standard attribute definitions, and allowable codes. It is essential that the project specific variables be consistently used throughout a project and that these variables are consistently coded with respect to character type, coding field(s), and field justification. The multi-layer field labels represent the original version of programming where multi-space variables had to be rigidly defined (these variables are indicated in Appendix A). Although the rigid multi-space variables can still be used, the present programming is more flexible.

Up to 15 alphanumeric characters can be used, in any combination, for user specified variables. The use of dummy variables is described in more detail under the Polygon Data and Component Data sections above.

Database or Attribute Report

Table XVI is a partial listing of a Terrain Attribute Report. It lists the attribute data stored in the terrain file by project area or map sheet. The labels and formatting are very similar to the input data form. This listing shows the polygon area and perimeter as calculated by CAPAMP. This listing also shows values for polygon dummy variables 5, 6, 7, 8, 51, and 52 (original rigid formatting); for component dummy variables 1, 2, and 3; for simple unit dummy variables 1, 2, and 3; and for modifying process subcodes. This listing is used to compare the database with the source data to ensure accuracy of key entry. It is also used in conjunction with validation reports (see below). Desired data additions and/or corrections can be indicated on this listing and returned to the Thematic Mapping Unit for revision.

Validation Routines

The validation routines and computer programming details are documented in Porteous (1985). The following is a summary of this document. The validation routines verify the project identification code, check all standard terrain mapping codes, and print database and error reports. The validation reports are designed as a tool for editing the input data. Project specific dummy variable codes can be validated if prior arrangements are made with the CAPAMP systems analysts. The validation routines consist of three main subroutines which verify polygon data, component data, and simple unit data.

The following polygon specific validation routines are applied to the input terrain data:

1. the elevation ranges are checked to ensure that they are within the minimum and maximum limits for the province (0 to 4663 m);
2. the number of observations per site are checked to ensure they are blank or between 0 and 127, unless more detailed information is available indicating a smaller range should exist;
3. the aspect range values are checked to ensure that values are blank or between 0 and 359;
4. the bedrock type codes are checked for legal values;

The following component specific validation routines are applied to the input terrain data:

1. the component dominance codes are checked to ensure that the numbers are legal values and that the order is sequential;
2. the decile codes are checked to ensure that the values are between 0 and 9 and that they total 10 (100%);
3. the slope field is checked for allowable values (0-90^{o}), to ensure that at least one value is entered, that single value entries occur in field 1, that field 2 values are present if the delimiter is entered, and that field 2 entries have an associated delimiter;
4. the drainage field is checked for legal codes, to ensure that at least one value is entered, that single value entries occur in field 1, that field 2 values are present if the delimiter is entered, and that field 2 entries have an associated delimiter;
5. the modifying process code(s) are checked for legal values and to ensure that the values have been entered into field 1, or fields 1 and 2, where less than three codes are entered;
6. the qualifying descriptor(s) are checked to ensure that they have a corresponding modifying process, that their codes are legal, and that single entries occur in field 1;
7. the modifying process subcodes, if used, are checked to ensure that they have a corresponding modifying process, that their codes are legal (if prior arrangements are made with the CAPAMP Systems Analysts), and that single entries occur in field 1;
8. the depths to an impermeable layer are checked for valid entries and to ensure that single value entries occur in field 1.

The following specific simple unit validation routines are applied to the input terrain data:

1. the stratigraphic order code is checked to ensure that the first code is a "1", that the codes are legal, and that codes occurring in sequence(s) are sequential;
2. the standard texture codes are checked for legal values and to ensure that fields 1 and 2 are filled before field 3, where less than three entries are made;
3. the Unified texture(s) are checked to ensure that single entries occur in field 1, that field 1 and 2 have legal entries, and that field 2 entries have a corresponding field 1 entry;
4. the genetic material codes are checked to ensure that there is a corresponding stratigraphic order code and that the codes are legal;
5. the genetic material subcodes, if used, are checked to ensure that they have a corresponding genetic material and that their codes are legal (if prior arrangements are made with the CAPAMP Systems Analysts);
6. the qualifying descriptors are checked to ensure that there is a corresponding genetic material, that the codes are legal, and that only field 1 is used for single entry values;
7. the surface expression is checked to ensure that legal codes are used and that fields 1 and 2 are used before field 3, where less than three entries are made;
8. the roundness, compaction, permeability, and induration codes are checked for legal values;
9. the thickness entries are checked for legal values.

Table XVII shows a sample listing of errors found by the validation routines. The listing indicates the polygon number, the component or simple unit number where required, the field where the error occurs, the current entry where applicable, and a self-explanatory error message. Note that this error listing contains error messages for project specific validation including modifying process subcodes and component dummy variables 9, 16, 19, and 20.

Project Specific Use Of Dummy Variables And Validation Routines

This section will provide a few examples of the use of dummy variables and project specific validation. These examples may be helpful for individual users by suggesting ways in which these features may be used for their project(s).

A recently completed detailed terrain survey utilized polygon dummy variables 5, 6, 7, 8, 51, and 52 to record two types of land use, two additional bedrock variables, and two landslide features, respectively. Component dummy variables 1, 2, and 3 were used to describe land use associated with landslides. Simple unit dummy variables 1, 2, and 3 were used to refine the definitions of standard terrain textures. Modifying process subcodes were utilized to record additional data related to rapid mass movement. Examples of these data entries are shown in Table XVI.

A second terrain survey utilized component dummy variables 9, 16, 19, and 20 to describe vegetation subzone, dominant aspect associated with the vegetation landscapes, and two vegetation landscape descriptors, respectively. The modifying process subcodes were used to indicate additional data concerning rapid mass movement and flooding for modifying process codes R and Q, respectively.

Validation routines were developed to verify the project identification code, to check all standard mapping codes, to check project specific dummy variable codes, to print an enhanced database report, and to print an error report. The following project specific validation routines were developed:

1. the polygon and simple unit dummy variables were checked to ensure blank entries (for this project these coding fields were not used);
2. the component dummy variables 9, 16, 19, and 20 were checked for project specific legal codes and project specific error messages were generated (Table XVII);
3. the modifying process subcodes were checked to ensure that subcodes had a corresponding modifying process, that only modifying processes R and Q had subcodes, that single entry values were entered in field 1, that the subcodes were project specific legal values, and that project specific error messages were generated (Table XVII).

Information concerning these routines and others can be obtained through the CAPAMP systems analysts.

TABLE XVI
TERRAIN ATTRIBUTE REPORT

```
 CAPAMP THEME THREE - TERRAIN ATTRIBUTE DATA                                                      17-JUL-1985    PAGE:     1

*********************************************************************************************************************************
POLY    PROJ    OBS   ELEVATION   ASPECT     SLOPE     BEDROCK                                            AREA (KM2):  0.51676
 NO      ID            R1    R2    1   2      POS    T1 T2 T3 T4                                          PERIM (KM):  3.78124
----   ------   ---   ----:----   ---:---     --     --:--:--:--
  1    NORCAS                     220 285             PI

INP::----+----1----+----2----+----3----+----4----+----5
DV ::0000NC30

COMPONENT DATA
              SLOPE     DRAINAGE    MODIFYING PROCESS     DPTH TO
DOM.   DEC      D          D          1     2     3       IMPERM.          DUMMY VARIABLES
CODE            E          E        CSBQD CSBQD CSBQD     LAYER
              1 L 2      1 L 2       1212  1212  1212     1    2
 -      -    --:-:--     -:-:-      -----:-----:-----     ---:---        INP::----+----1--
 1      8    38 - 25     R          Rb
 2      2

SIMPLE UNIT DATA
STRAT   STDRD   UNIF.   GEN   QUAL   SURF.    THICKNESS      RND   COMP   PERM    IND         DUMMY VARIABLES
ORDER    TEX     TEX    MAT   DESC    EXP.
CODE     321     D U    C S    12     123     R1      R2
 -       ---    --:--   - -    --     ---    -----:-----      -      -      -       -       INP::----+----1----+
 1                      R              s
 1                      C              va

*********************************************************************************************************************************
POLY    PROJ    OBS   ELEVATION   ASPECT     SLOPE     BEDROCK                                            AREA (KM2):  0.07894
 NO      ID            R1    R2    1   2      POS    T1 T2 T3 T4                                          PERIM (KM):  1.88271
----   ------   ---   ----:----   ---:---     --     --:--:--:--
  2    NORCAS                     230                 PI

INP::----+----1----+----2----+----3----+----4----+----5
DV ::0000C030

COMPONENT DATA
              SLOPE     DRAINAGE    MODIFYING PROCESS     DPTH TO
DOM.   DEC      D          D          1     2     3       IMPERM.          DUMMY VARIABLES
CODE            E          E        CSBQD CSBQD CSBQD     LAYER
              1 L 2      1 L 2       1212  1212  1212     1    2
 -      -    --:-:--     -:-:-      -----:-----:-----     ---:---        INP::----+----1--
 1      8    36 - 12     R          Rb
 2      2

SIMPLE UNIT DATA
STRAT   STDRD   UNIF.   GEN   QUAL   SURF.    THICKNESS      RND   COMP   PERM    IND         DUMMY VARIABLES
ORDER    TEX     TEX    MAT   DESC    EXP.
CODE     321     D U    C S    12     123     R1      R2
 -       ---    --:--   - -    --     ---    -----:-----      -      -      -       -       INP::----+----1----+
 1                      C              a                                                          ar
 1                      R              s

 CAPAMP THEME THREE - TERRAIN ATTRIBUTE DATA                                                      17-JUL-1985    PAGE:     2

*********************************************************************************************************************************
POLY    PROJ    OBS   ELEVATION   ASPECT     SLOPE     BEDROCK                                            AREA (KM2):  0.08606
 NO      ID            R1    R2    1   2      POS    T1 T2 T3 T4                                          PERIM (KM):  1.33752
----   ------   ---   ----:----   ---:---     --     --:--:--:--
  3    NORCAS                     225                 PI

INP::----+----1----+----2----+----3----+----4----+----5
```

TABLE XVI (cont'd)

```
DV ::0000C030

COMPONENT DATA
               SLOPE      DRAINAGE    MODIFYING PROCESS    DPTH TO
DOM.    DEC      D            D         1     2     3      IMPERM.        DUMMY VARIABLES
CODE             E            E       CSBQD CSBQD CSBQD     LAYER
               1 L 2        1 L 2      1212  1212  1212     1   2
 -       -     --:-:--      -:-:-     -----:-----:-----    ---:---      INP::----+----1--
 1             17           W

SIMPLE UNIT DATA
STRAT   STDRD   UNIF.    GEN    QUAL    SURF.    THICKNESS     RND    COMP    PERM    IND          DUMMY VARIABLES
ORDER    TEX     TEX     MAT    DESC    EXP.
CODE     321     D U     C S     12     123     R1      R2
 -       ---    --:--    - -     --     ---    -----:-----     -       -       -       -       INP::----+----1----+
 1                       F       6      a                                                          sg

*************************************************************************************************************
POLY    PROJ     OBS    ELEVATION    ASPECT    SLOPE    BEDROCK                              AREA (KM2):  0.16492
 NO      ID              R1   R2      1   2     POS    T1 T2 T3 T4                           PERIM (KM):  4.11900
----    ------   ---    ----:----    ---:---    --     --:--:--:--
  4     NORCAS                       300               PI

INP::----+----1----+----2----+----3----+----4----+----5
DV ::0401NC30

COMPONENT DATA
               SLOPE      DRAINAGE    MODIFYING PROCESS    DPTH TO
DOM.    DEC      D            D         1     2     3      IMPERM.        DUMMY VARIABLES
CODE             E            E       CSBQD CSBQD CSBQD     LAYER
               1 L 2        1 L 2      1212  1212  1212     1   2
 -       -     --:-:--      -:-:-     -----:-----:-----    ---:---      INP::----+----1--
 1       8     40 - 01      R         Rt                                   21
 2       2

SIMPLE UNIT DATA
STRAT   STDRD   UNIF.    GEN    QUAL    SURF.    THICKNESS     RND    COMP    PERM    IND          DUMMY VARIABLES
ORDER    TEX     TEX     MAT    DESC    EXP.
CODE     321     D U     C S     12     123     R1      R2
 -       ---    --:--    - -     --     ---    -----:-----     -       -       -       -       INP::----+----1----+
 1                       F              sa
 1                       R              s
```

TABLE XVII
TERRAIN VALIDATION ERROR REPORT

TABLE OF ERRORS UNCOVERED BY TVALID ROUTINE

```
***** POLYGON:    1 NUMBER OF GROUND OBSERVATIONS = 130, AN ILLEGAL VALUE *****
***** CHECK POLYGON:    2 ELEVATION IS ILLEGAL VALUE FOR PROVINCE? *****
***** CHECK POLYGON:    3 ILLEGAL VALUE FOR ASPECT (IN DEGREES)? *****
***** POLYGON:    4 BEDROCK TYPE CODE 1 MM, AN ILLEGAL VALUE *****
***** POLYGON:    5 COMPONENT 2 DOMINANCE CODE AN ILLEGAL VALUE *****
***** CHECK POLYGON:    5 SLOPE VARIABLES? *****
***** CHECK POLYGON:    5 DRAINAGE VARIABLES? *****
***** POLYGON:    6 COMPONENT 2 DECILE CODE = A AN ILLEGAL VALUE *****
***** CHECK POLYGON:    7 DECILES DO NOT TOTAL 100% *****
***** POLYGON:    8 COMPONENT 1 REQUIRES A SLOPE DELIMITER *****
***** POLYGON:    8 COMPONENT 2 REQUIRES A SECOND SLOPE (IN DEGREES) *****
***** POLYGON:    9 COMPONENT 1 SLOPE (IN DEGREES) RANGE 2 = 0, AN ILLEGAL VALUE *****
***** POLYGON:   10 COMPONENT 1 REQUIRES A DRAINAGE DELIMITER *****
***** POLYGON:   11 COMPONENT 2 REQUIRES A SUBDOMINANT DRAINAGE *****
***** POLYGON:   12 COMPONENT 1 DRAINAGE RANGE 2 CODE N, AN ILLEGAL VALUE *****
***** POLYGON:   13 COMPONENT 2 / DELIMITER IS AN ILLEGAL CODE *****
***** POLYGON:   14, MODIFYING PROCESS 2 VALUES IN WRONG FIELD(S) *****
***** POLYGON:   15, MODIFYING PROCESS 3 VALUES IN WRONG FIELD(S) *****
***** POLYGON:   16 COMPONENT 1 MODIFYING PROCESS 2 "G", AN ILLEGAL VALUE *****
***** CHECK POLYGON:   17 MODIFYING PROCESS 1 QUALIFYING DESCRIPTOR FIELDS? *****
***** POLYGON:   17 COMPONENT 2 MODIFYING PROCESS 2 QUALIFYING DESCRIPTOR = W, AN ILLEGAL VALUE *****
***** POLYGON:   18 QUALIFYING DESCRIPTOR FOR MODIFYING PROCESS 2 CODED IN WRONG FIELD *****
***** POLYGON:   19 COMPONENT 1 DEPTH TO IMPERMEABLE LAYER RANGE 1 = -2, AN ILLEGAL VALUE *****
***** CHECK POLYGON:   20 COMPONENT 2 DEPTH TO IMPERMEABLE LAYER VALUES? *****
***** POLYGON:   20 FIRST STRATIGRAPHIC ORDER CODE IS AN ILLEGAL VALUE *****
***** POLYGON:   21 SIMPLE UNIT 4 STRATIGRAPHIC ORDER CODE "4", AN ILLEGAL VALUE *****
***** POLYGON:   22 SIMPLE UNIT 1 STANDARD TEXTURE CODE "  q", AN ILLEGAL VALUE *****
***** POLYGON:   23 SIMPLE UNIT 3 STANDARD TEXTURE CODES WRITTEN IN ILLEGAL FIELDS (OUT OF ORDER) *****
***** POLYGON:   23 SIMPLE UNIT 2 UNIFIED TEXTURE CODE "GL", AN ILLEGAL VALUE *****
***** POLYGON:   24 SIMPLE UNIT 1 UNIFIED TEXTURE CODE "OL", AN ILLEGAL VALUE *****
***** POLYGON:   24 SIMPLE UNIT 2 CHECK UNIFIED TEXTURE CODES (FIELDS OUT OF ORDER)? *****
***** POLYGON:   25 SIMPLE UNIT 1 MUST HAVE A GENETIC MATERIAL *****
***** POLYGON:   25 SIMPLE UNIT 1 GENETIC MATERIAL "T", AN ILLEGAL VALUE *****
***** CHECK POLYGON:   26 SIMPLE UNIT 1 NO GENETIC MATERIAL FOR LISTED SUBCODE? *****
***** POLYGON:   26 SIMPLE UNIT 2 GENETIC MATERIAL SUBCODE "O", AN ILLEGAL VALUE *****
***** CHECK POLYGON:   26 SIMPLE UNIT 1 QUALIFYING DESCRIPTOR WITH NO MATERIAL?  *****
***** CHECK POLYGON:   26 SIMPLE UNIT 2 QUALIFYING DESCRIPTOR WITH NO MATERIAL? *****
***** POLYGON:   26 SIMPLE UNIT 1 QUALIFYING DESCRIPTOR "F", AN ILLEGAL VALUE *****
***** POLYGON:   26 SIMPLE UNIT 1 QUALIFYING DESCRIPTOR "C", AN ILLEGAL VALUE *****
***** POLYGON:   26 SIMPLE UNIT 3 QUALIFYING DESCRIPTOR "R", AN ILLEGAL VALUE *****
***** CHECK POLYGON:   27 SIMPLE UNIT 1 QUALIFYING DESCRIPTORS WRITTEN IN ILLEGAL FIELDS (OUT OF ORDER)? *****
***** POLYGON:   28 SIMPLE UNIT 2 SURFACE EXPRESSION "L", AN ILLEGAL VALUE *****
***** CHECK POLYGON:   29 SIMPLE UNIT 2 SURFACE EXPRESSION CODES WRITTEN IN ILLEGAL FIELDS (OUT OF ORDER)? *****
***** POLYGON:   30 SIMPLE UNIT 2 ROUNDNESS CLASS "S", AN ILLEGAL VALUE *****
***** POLYGON:   30 SIMPLE UNIT 3 COMPACTION CLASS "F", AN ILLEGAL VALUE *****
***** POLYGON:   30 SIMPLE UNIT 3 PERMEABILITY CLASS "V", AN ILLEGAL VALUE *****
***** POLYGON:   30 SIMPLE UNIT 3 INDURATION CLASS "P", AN ILLEGAL VALUE *****
***** CHECK POLYGON:   10, ILLEGALLY CODED DUMMY VARIABLE FIELDS? *****
```

(PROJECT SPECIFIC ERRORS)

```
***** VALIDATION PROGRAM TERMINATED ***** CALL DATA CONTROL TO CORRECT PROJECT ID CODES
***** POLYGON:    1, ILLEGAL PROJECT I.D. CODE *****
***** POLYGON:    6 COMPONENT 1 MODIFYING PROCESS 2 "G", AN ILLEGAL VALUE *****
***** POLYGON:    9 MODIFYING PROCESS 1 SUBCODE "f", AN ILLEGAL VALUE *****
***** POLYGON:    9 MODIFYING PROCESS 2 SUBCODE "A", AN ILLEGAL VALUE *****
***** POLYGON:   10 ILLEGAL SUBCODES, NO MODIFYING PROCESS 1 *****
***** POLYGON:   10 MODIFYING PROCESS 2 SUBCODE 2 IN WRONG FIELD *****
***** CHECK POLYGON:   12 COMPONENT 2 DUMMY VARIABLES WRITTEN IN WRONG FIELDS? *****
***** POLYGON:   12 DUMMY VARIABLE "6", AN ILLEGAL VALUE *****
***** POLYGON:   13 DUMMY VARIABLE "EW", AN ILLEGAL VALUE *****
***** POLYGON:   14 DUMMY VARIABLE "  S", AN ILLEGAL VALUE *****
***** POLYGON:   14 DUMMY VARIABLE "H3A", AN ILLEGAL VALUE *****
```

CAPAMP INPUT - ALL PURPOSE ENTITY

Introduction

This form is used for entering polygon databases for non-standard map themes, for which standard coding forms do not exist. (If such data is being collected in conjunction with, or is otherwise associated with data on standard coding forms, the dummy variables on these forms may be used, should space permit.) Examples of this type of information would be zoning maps, legal boundary maps, and watershed boundaries. This form requires information on polygon numbers, theme type, and user specified variables.

The Form

The all purpose entity form is one-sided (Figure 6). Each form is designed for the input of user specified variables required for the input of non-standard themes, for up to 25 map polygons per form. Each coding form utilizes user defined codes for the coding fields. There are a limited number of standard coding fields on the form, which will be described in complete detail.

On the right-hand side of the form just below the form title are the labels, Map Number, PAGE, and OF, followed by underlined areas. The user enters map reference and manual record information to aid in sorting or storing the completed forms. This information is for the convenience of the user and key entry personnel. The data in CAPAMP is organized by Project ID and map sheet number.

The form has four fields which contain information for internal computing purposes only and are not of relevance to the user. These fields will not be described in this document. These fields occur in the columns labelled with superscript numbers 1-10, 15-20, 23-29, and 80-81. Please ignore these fields when utilizing the form; do not enter any information in these fields.

Coding Field and Attribute Descriptions

Polygon [4,I,R]
Number

An integer from 1 to 2000 indicating the unique polygon number as assigned by the Thematic Mapping Unit or the user.

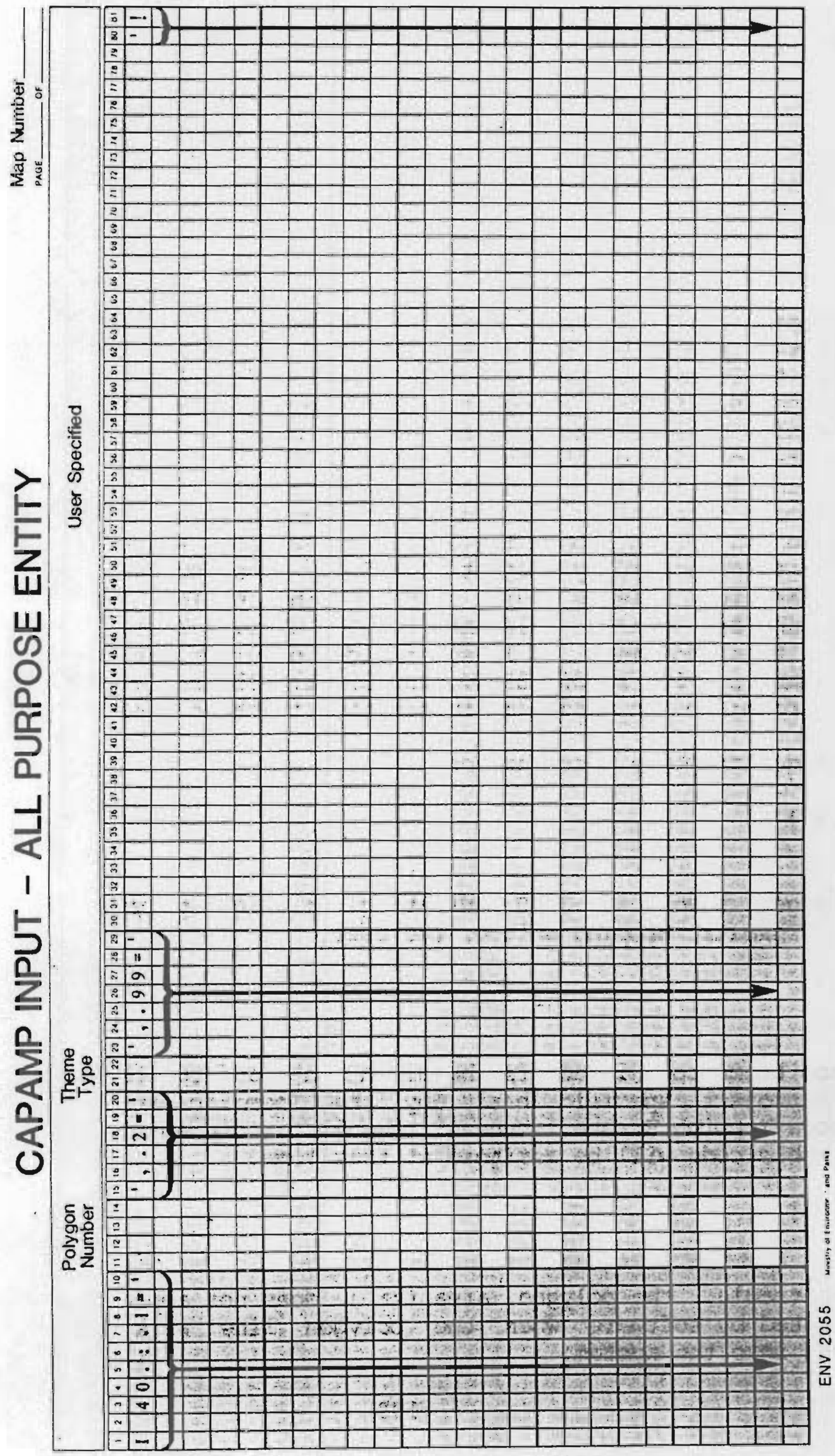
Theme [2,AN,L]
Type

The map theme code is entered here. A non-standard theme code is assigned on a project specific basis by the Thematic Mapping Unit, Surveys and Resource Mapping Branch, whenever the all purpose entity form is used. An acceptable code will be assigned at that time.

Polygon [-,F,R]
Area

This variable, the polygon area (km^2), does not appear on the form. It is calculated by software when the polygon line work has been completely entered into the system.

FIGURE 6
EXAMPLE OF ALL PURPOSE ENTITY FORM



Polygon [-,F,R]
Perimeter

This variable, the polygon perimeter (km), does not appear on the form. It is calculated by software when the polygon line work has been completely entered into the system.

User Specified [1-50,AN,L or R or -]

This field is for entering user specified variables. These variables are developed after consultation with the CAPAMP systems analysts to define appropriate codes and coding rules. The format statement indicates the range of possible variable sizes. Specific variable use will not be discussed in this document because they will vary with each project and because this form should only be used after consultation with the CAPAMP systems analysts. The database can accept variables with up to 50 alphanumeric characters. The use of these variables is similar to that of dummy variables.

For example, the user could define 10 right-justified variables, each being 5 characters in length. In this example, the user would code the first variable in spaces labelled "30" to "34" with the last data character in the space labelled "34". The next 9 variables would be coded in the spaces labelled "35" to "39", "40" to "44", "45" to "49", "50" to "54", "55" to "59", "60" to "64", "65" to "69", "70" to "74", and "75" to "79", respectively. The last characters for these variables would be entered in the fields labelled "39", "44", "49", "54", "59", "64", "69", "74", and "79", respectively.

Validation Routines, Attribute Reports, and Error Reports

Validation routines can be developed on a project specific basis. Requirements should be discussed with the CAPAMP systems analysts when the user specified variables are being designated for this form. At that time, the user has input concerning the type and format of attribute and error reports. The user can also discuss the possibility of obtaining special output such as tabulated land use areas or special data summaries. Because of the project specific nature of these outputs, examples of these outputs will not be presented in this document. The user should contact the systems analysts for examples of output from other projects which may be similar.

APPENDIX A

DATABASE SCHEMA

```
;
;  DMRS DATABASE SCHEMA SUPPORTING THE FOLLOWING BASE THEME MAPS:
;
;       SOIL POLYGON,
;       SOIL CARTOGRAPHIC,
;       AGRICULTURAL CAPABILITY,
;       TERRAIN
;
;
;  FORMAT OF ATTRIBUTES IS SPECIFIED AS FOLLOWS:
;
;   F=AN(SIZE) ,AN=ALPHANUMERIC,SIZE=# OF CHARACTERS
;   F=I(SIZE)  ,I=INTEGER,SIZE=MAXIMUM VALUE
;   F=F,       ,F=FLOAT POINT,SIZE=DOUBLE PRECISION
;   F=G(A,C)   ,OVER DEFINES ATTRIBUTES STARTING AT ATTRIBUTE A THRU TO C
;               MUST BE CONTIGUOUS CHARACTERS
;
;
RE=10
RA=100
PAR=0
GRA=0
DWE=0
/
;
1
;SOIL_POLYGON -  SOIL POLYGON ENTITY AND ITS ATTRIBUTES (THEME ONE)
;
   .1  PPONO                 F=I(32767)   ;POLYGON NUMBER
   .2  PPIDC                 F=AN(6)      ;PROJECT ID CODE
   .3  PNPIT                 F=I(127)     ;NUMBER OF SOIL PITS IN BCSIS
   .4  PAREA                 F=F          ;AREA OF POLYGON
   .5  PPERI                 F=F          ;PERIMETER OF POLYGON
   .6  PSL1D                 F=AN(1)      ;DOMINANT SLOPE - 1ST SOILKEY
   .7  PSL1U                 F=AN(1)      ;SUBDOMINANT SLOPE - 1ST SOILKEY
   .8  PSL2D                 F=AN(1)      ;DOMINANT SLOPE - 2ND SOILKEY
   .9  PSL2U                 F=AN(1)      ;SUBDOMINANT SLOPE - 2ND SOILKEY
   .10 PSL3D                 F=AN(1)      ;DOMINANT SLOPE - 3RD SOILKEY
   .11 PSL3U                 F=AN(1)      ;SUBDOMINANT SLOPE - 3RD SOILKEY
   .12 PPH11                 F=AN(1)      ;PHASE 11
   .13 PPH12                 F=AN(1)      ;PHASE 12
   .14 PPH13                 F=AN(1)      ;PHASE 13
   .15 PPHA1                 F=G(12,14)   ;PHASE 1
   .16 PPH21                 F=AN(1)      ;PHASE 21
   .17 PPH22                 F=AN(1)      ;PHASE 22
   .18 PPH23                 F=AN(1)      ;PHASE 23
   .19 PPHA2                 F=G(16,18)   ;PHASE 2
   .20 PPH31                 F=AN(1)      ;PHASE 31
   .21 PPH32                 F=AN(1)      ;PHASE 32
```

```
.22 PPH33       F=AN(1)      ;PHASE 33
.23 PPHA3       F=G(20,22)   ;PHASE 3
.24 PDP01       F=AN(1)      ;DUMMY VARIABLE 1
.25 PDP02       F=AN(1)      ;DUMMY VARIABLE 2
.26 PDP03       F=AN(1)      ;DUMMY VARIABLE 3
.27 PDP04       F=AN(1)      ;DUMMY VARIABLE 4
.28 PDP05       F=AN(1)      ;DUMMY VARIABLE 5
.29 PDP06       F=AN(1)      ;DUMMY VARIABLE 6
.30 PDP07       F=AN(1)      ;DUMMY VARIABLE 7
.31 PDP08       F=AN(1)      ;DUMMY VARIABLE 8
.32 PDP09       F=AN(1)      ;DUMMY VARIABLE 9
.33 PDP10       F=AN(1)      ;DUMMY VARIABLE 10
.34 PDP11       F=AN(1)      ;DUMMY VARIABLE 11
.35 PDP12       F=AN(1)      ;DUMMY VARIABLE 12
.36 PDP13       F=AN(1)      ;DUMMY VARIABLE 13
.37 PDP14       F=AN(1)      ;DUMMY VARIABLE 14
.38 PDP15       F=AN(1)      ;DUMMY VARIABLE 15
.39 PDP16       F=AN(1)      ;DUMMY VARIABLE 16
.40 PDP17       F=AN(1)      ;DUMMY VARIABLE 17
.41 PDP18       F=AN(1)      ;DUMMY VARIABLE 18
.42 PDP19       F=AN(1)      ;DUMMY VARIABLE 19
.43 PDP20       F=AN(1)      ;DUMMY VARIABLE 20
.44 PDP21       F=AN(1)      ;DUMMY VARIABLE 21
.45 PDP22       F=AN(1)      ;DUMMY VARIABLE 22
.46 PDP23       F=AN(1)      ;DUMMY VARIABLE 23
.47 PDP24       F=AN(1)      ;DUMMY VARIABLE 24
.48 PDP25       F=AN(1)      ;DUMMY VARIABLE 25
.49 PDP26       F=AN(1)      ;DUMMY VARIABLE 26
.50 PDP27       F=AN(1)      ;DUMMY VARIABLE 27
.51 PDP28       F=AN(1)      ;DUMMY VARIABLE 28
.52 PDP29       F=AN(1)      ;DUMMY VARIABLE 29
.53 PDP30       F=AN(1)      ;DUMMY VARIABLE 30
.54 PDP31       F=AN(1)      ;DUMMY VARIABLE 31
.55 PDP32       F=AN(1)      ;DUMMY VARIABLE 32
.56 PDP33       F=AN(1)      ;DUMMY VARIABLE 33
.57 PDP34       F=AN(1)      ;DUMMY VARIABLE 34
.58 PDP35       F=AN(1)      ;DUMMY VARIABLE 35
.59 PDP36       F=AN(1)      ;DUMMY VARIABLE 36
.60 PDP37       F=AN(1)      ;DUMMY VARIABLE 37
.61 PDP38       F=AN(1)      ;DUMMY VARIABLE 38
.62 PDP39       F=AN(1)      ;DUMMY VARIABLE 39
.63 PDP40       F=AN(1)      ;DUMMY VARIABLE 40
.64 PDP41       F=AN(1)      ;DUMMY VARIABLE 41
.65 PDP42       F=AN(1)      ;DUMMY VARIABLE 42
.66 PDP43       F=AN(1)      ;DUMMY VARIABLE 43
.67 PDP44       F=AN(1)      ;DUMMY VARIABLE 44
.68 PDP45       F=AN(1)      ;DUMMY VARIABLE 45
.69 PDP46       F=AN(1)      ;DUMMY VARIABLE 46
.70 PDP47       F=AN(1)      ;DUMMY VARIABLE 47
.71 PDP48       F=AN(1)      ;DUMMY VARIABLE 48
```

```
.72 PDP49        F=AN(1)      ;DUMMY VARIABLE 49
.73 PDP50        F=AN(1)      ;DUMMY VARIABLE 50
.74 PDP51        F=G(24,25)   ;DUMMY VARIABLE 51
.75 PDP52        F=G(26,27)   ;DUMMY VARIABLE 52
.76 PDP53        F=G(28,29)   ;DUMMY VARIABLE 53
.77 PDP54        F=G(30,31)   ;DUMMY VARIABLE 54
.78 PDP55        F=G(32,33)   ;DUMMY VARIABLE 55
.79 PDP56        F=G(34,35)   ;DUMMY VARIABLE 56
.80 PDP57        F=G(36,37)   ;DUMMY VARIABLE 57
.81 PDP58        F=G(38,39)   ;DUMMY VARIABLE 58
.82 PDP59        F=G(40,41)   ;DUMMY VARIABLE 59
.83 PDP60        F=G(42,43)   ;DUMMY VARIABLE 60
.84 PDP61        F=G(44,45)   ;DUMMY VARIABLE 61
.85 PDP62        F=G(46,47)   ;DUMMY VARIABLE 62
.86 PDP63        F=G(48,49)   ;DUMMY VARIABLE 63
.87 PDP64        F=G(50,51)   ;DUMMY VARIABLE 64
.88 PDP65        F=G(52,53)   ;DUMMY VARIABLE 65
.89 PDP66        F=G(54,55)   ;DUMMY VARIABLE 66
.90 PDP67        F=G(56,57)   ;DUMMY VARIABLE 67
.91 PDP68        F=G(58,59)   ;DUMMY VARIABLE 68
.92 PDP69        F=G(60,61)   ;DUMMY VARIABLE 69
.93 PDP70        F=G(62,63)   ;DUMMY VARIABLE 70
.94 PDP71        F=G(64,65)   ;DUMMY VARIABLE 71
.95 PDP72        F=G(66,67)   ;DUMMY VARIABLE 72
.96 PDP73        F=G(68,69)   ;DUMMY VARIABLE 73
.97 PDP74        F=G(70,71)   ;DUMMY VARIABLE 74
.98 PDP75        F=G(72,73)   ;DUMMY VARIABLE 75
.99 PDP76        F=G(24,26)   ;DUMMY VARIABLE 76
.100 PDP77       F=G(27,29)   ;DUMMY VARIABLE 77
.101 PDP78       F=G(30,32)   ;DUMMY VARIABLE 78
.102 PDP79       F=G(33,35)   ;DUMMY VARIABLE 79
.103 PDP80       F=G(36,39)   ;DUMMY VARIABLE 80
.104 PDP81       F=G(40,43)   ;DUMMY VARIABLE 81
.105 PDP82       F=G(44,47)   ;DUMMY VARIABLE 82
.106 PDP83       F=G(48,52)   ;DUMMY VARIABLE 83
.107 PDP84       F=G(53,57)   ;DUMMY VARIABLE 84
.108 PDP85       F=G(58,65)   ;DUMMY VARIABLE 85
.109 PDP86       F=G(66,73)   ;DUMMY VARIABLE 86
.110 PDP87       F=G(24,29)   ;DUMMY VARIABLE 87
.111 PDP88       F=G(30,35)   ;DUMMY VARIABLE 88
.112 PDP89       F=G(36,44)   ;DUMMY VARIABLE 89
.113 PDP90       F=G(45,53)   ;DUMMY VARIABLE 90
.114 PDP91       F=G(54,63)   ;DUMMY VARIABLE 91
.115 PDP92       F=G(64,73)   ;DUMMY VARIABLE 92
.116 PDP93       F=G(24,53)   ;DUMMY VARIABLE 93
.117 PDP94       F=G(54,73)   ;DUMMY VARIABLE 94
.118 PSTAT       F=I(127)     ;STATUS ATTR. FOR CORR/RELINK
.119 PLB01       F=AN(5)      ;LABEL VARIABLE 1
.120 PLB02       F=AN(5)      ;LABEL VARIABLE 2
.121 PLB03       F=AN(5)      ;LABEL VARIABLE 3
```

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   .122 PLB04              F=AN(5)       ;LABEL VARIABLE 4
   .123 PLB05              F=AN(5)       ;LABEL VARIABLE 5
   .124 PLB06              F=AN(5)       ;LABEL VARIABLE 6
   .125 PLB07              F=AN(5)       ;LABEL VARIABLE 7
   .126 PLB08              F=AN(5)       ;LABEL VARIABLE 8
   .127 PLB09              F=AN(5)       ;LABEL VARIABLE 9
   .128 PLB10              F=AN(5)       ;LABEL VARIABLE 10
   .129 PLB11              F=G(119,120);LABEL VARIABLE 11
   .130 PLB12              F=G(121,122);LABEL VARIABLE 12
   .131 PLB13              F=G(123,124);LABEL VARIABLE 13
   .132 PLB14              F=G(125,126);LABEL VARIABLE 14
   .133 PLB15              F=G(127,128);LABEL VARIABLE 15
   .134 PLB16              F=G(119,125);LABEL VARIABLE 16
   .135 PLB17              F=G(126,128);LABEL VARIABLE 17
   .136 PLB18              F=G(119,121);LABEL VARIABLE 18
   .137 PLB19              F=G(122,124);LABEL VARIABLE 19
   .138 PLB20              F=G(125,128);LABEL VARIABLE 20
   .139 PLB21              F=G(119,122);LABEL VARIABLE 21
   .140 PLB22              F=G(123,128);LABEL VARIABLE 22
   .141 PLB23              F=G(119,123);LABEL VARIABLE 23
   .142 PLB24              F=G(124,128);LABEL VARIABLE 24
   .143 PLB25              F=G(119,128);LABEL VARIABLE 25
;
;       SOIL KEYS
;
   .144 PSODO1             F=AN(1)          ;SOIL DOMINANCE CODE
   .145 PDECI1             F=AN(1)          ;DECILE INDICATOR
;
   .146 PNAME1             F=AN(3)          ;SOIL NAME CODE
   .147 PASSC1             F=AN(2)          ;SOIL ASSOCIATION COMPONENT CODE
   .148 PPHC11             F=AN(2)          ;SOIL PHASE CODE1
   .149 PPHC21             F=AN(2)          ;SOIL PHASE CODE2
   .150 PDKEY1             F=G(146,147)     ;OVERLAY NAME AND ASSOCIATION
   .151 PONAP1             F=G(146,149)     ;OVERLAY NAME,ASSOC. AND PHASES
   .152 POASP1             F=G(147,149)     ;OVERLAY ASSOCIATION AND PHASES
   .153 POVPH1             F=G(148,149)     ;OVERLAY PHASES
;
   .154 PSODO2             F=AN(1)          ;SOIL DOMINANCE CODE
   .155 PDECI2             F=AN(1)          ;DECILE INDICATOR
;
   .156 PNAME2             F=AN(3)          ;SOIL NAME CODE
   .157 PASSC2             F=AN(2)          ;SOIL ASSOCIATION COMPONENT CODE
   .158 PPHC12             F=AN(2)          ;SOIL PHASE CODE1
   .159 PPHC22             F=AN(2)          ;SOIL PHASE CODE2
   .160 PDKEY2             F=G(156,157)     ;OVERLAY NAME AND ASSOCIATION
   .161 PONAP2             F=G(156,159)     ;OVERLAY NAME,ASSOC. AND PHASES
   .162 POASP2             F=G(157,159)     ;OVERLAY ASSOCIATION AND PHASES
   .163 POVPH2             F=G(158,159)     ;OVERLAY PHASES
;
   .164 PSODO3             F=AN(1)          ;SOIL DOMINANCE CODE
```

```
   .165 PDECI3            F=AN(1)          ;DECILE INDICATOR
   .166 PNAME3            F=AN(3)          ;SOIL NAME CODE
   .167 PASSC3            F=AN(2)          ;SOIL ASSOCIATION COMPONENT CODE
   .168 PPHC13            F=AN(2)          ;SOIL PHASE CODE1
   .169 PPHC23            F=AN(2)          ;SOIL PHASE CODE2
   .170 PDKEY3            F=G(166,167)     ;OVERLAY NAME AND ASSOCIATION
   .171 PONAP3            F=G(166,169)     ;OVERLAY NAME,ASSOC. AND PHASES
   .172 POASP3            F=G(167,169)     ;OVERLAY ASSOCIATION AND PHASES
   .173 POVPH3            F=G(168,169)     ;OVERLAY PHASES
;
   .174 PSOIL1            F=G(144,149)
   .175 PSOIL2            F=G(154,159)
   .176 PSOIL3            F=G(164,169)
;
;      FLAG VARIABLES ARE EQUIVALENT TO LABEL VARIABLES; HOWEVER,
;      FOR THE USER THEY DIFFER.  THE LATTER ARE USED TO HOUSE
;      POLYGON LABELS, WHEREAS THE FORMER ARE USED AS FLAGS TO
;      CONTROL GRAPHIC OUTPUT (E.G. DISPLAY ONLY THOSE POLYGONS
;      WITH FLAG VARIABLE 1 EQUAL TO '1').
;
   .177 PFL01             F=AN(1)      ;FLAG VARIABLE 1
   .178 PFL02             F=AN(1)      ;FLAG VARIABLE 2
   .179 PFL03             F=AN(1)      ;FLAG VARIABLE 3
   .180 PFL04             F=AN(1)      ;FLAG VARIABLE 4
   .181 PFL05             F=G(177,178);FLAG VARIABLE 5
   .182 PFL06             F=G(179,180);FLAG VARIABLE 6

SOIL CART. ATTRIBUTES ENTITY

SOIL_ATTRIBUTES  P=0 DF ='SOILCART.E2'  OCC=1000

  ENTITY UNIQUE IDENTIFIER (KEY) = SOIL KEY

.1   DUMMY1  F=AN(1)  ;DUMMY NOT USE
.2   DUMMY2  F=AN(1)  ;DUMMY NOT USE
.3   DUMMY3  F=AN(1)  ;DUMMY NOT USE
.4   DUMMY4  F=AN(1)  ;DUMMY NOT USE

.5   PPIDC   F=AN(6)  ;PROJECT ID CODE
.6   PNAME   F=AN(3)  ;SOIL NAME CODE
.7   PASSC   F=AN(2)  ;SOIL ASSOCIATION COMPONENT CODE
.8   PPHC1   F=AN(2)  ;SOIL PHASE CODE1
.9   PPHC2   F=AN(2)  ;SOIL PHASE CODE2
.10  PDKEY   F=G(6,7) ;OVERLAY NAME AND ASSOCIATION
.11  PSKEY   F=G(5,9) ;SOIL KEY
.12  PONAP   F=G(6,9) ;OVERLAY NAME,ASSOC. AND PHASES
.13  POASP   F=G(7,9) ;OVERLAY ASSOCIATION AND PHASES
.14  POVPH   F=G(8,9) ;OVERLAY PHASES

  SOIL ATTRIBUTES (.15-.58)
```

```
.15 PNAMF    F=AN(20)     ;SOILS NAME IN FULL
.16 PSUGD    F=AN(4)      ;TAXONOMY DOMINANT SUB GROUP
.17 PDOTD    F=AN(1)      ;DOT AS A DELIMITER - DOMINANT
.18 PGRGD    F=AN(4)      ;TAXONOMY DOMINANT GREAT GROUP
.19 PTAXD    F=G(16,18)   ;TAXONOMY OF DOMINANT SOIL
.20 PTYRD    F=AN(2)      ;YEAR OF TAXONOMY - DOMINANT
.21 PSUGU    F=AN(4)      ;TAXONOMY SUBDOMINANT SUB GROUP
.22 PDOTU    F=AN(1)      ;DOT AS A DELIMITER - SUBDOMINANT
.23 PGRGU    F=AN(4)      ;TAXONOMY SUBDOMINANT GREAT GROUP
.24 PTAXU    F=G(21,23)   ;TAXONOMY OF SUBDOMINANT SOIL
.25 PTYRU    F=AN(2)      ;YEAR OF TAXONOMY - SUBDOMINANT
.26 PFRRG    F=AN(3)      ;FOREST REGION
.27 PFRSN    F=AN(2)      ;FOREST SECTION
.28 PFRZY    F=AN(4)      ;FOREST ZONE DUMMY
.29 PBFRZ    F=AN(4)      ;FOREST ZONE - BIOGEOCLIMATIC
.30 PFRZO    F=G(28,29)   ;FOREST ZONE
.31 PFRSZ    F=AN(2)      ;FOREST SUBZONE - BIOGEOCLIMATIC
.32 PDRAD    F=AN(1)      ;DRAINAGE DOMINANT
.33 PDRAU    F=AN(1)      ;DRAINAGE SUBDOMINANT
.34 PPERD    F=AN(1)      ;PERVIOUSNESS DOMINANT
.35 PPERU    F=AN(1)      ;PERVIOUSNESS SUBDOMINANT
.36 PSTOM    F=I(100)     ;STONINESS MEAN
.37 PSTOS    F=I(99)      ;STONINESS S.D.
.38 PDLHM    F=I(300)     ;DEPTH OF LFH MEAN
.39 PDLHS    F=I(127)     ;DEPTH OF LFH S.D.
.40 PDAHM    F=I(300)     ;DEPTH OF AH (OR EQUIVALENT) MEAN
.41 PDAHS    F=I(99)      ;DEPTH OF AH (OR EQUIVALENT) S.D.
.42 PDSOM    F=I(500)     ;DEPTH OF SOLUM MEAN
.43 PDSOS    F=I(127)     ;DEPTH OF SOLUM S.D.
.44 PDRRM    F=I(999)     ;DEPTH TO ROOT RESTRICTING LAYER MEAN
.45 PDRRS    F=I(127)     ;DEPTH TO ROOT RESTRICTING LAYER S.D.
.46 PDWTM    F=I(9999)    ;DEPTH TO WATER TABLE MEAN
.47 PDWTS    F=I(9999)    ;DEPTH TO WATER TABLE S.D.
.48 PDPRM    F=I(9999)    ;DEPTH TO PERMAFROST MEAN
.49 PDPRS    F=I(9999)    ;DEPTH TO PERMAFROST S.D.
.50 PDRXM    F=I(9999)    ;DEPTH TO BEDROCK MEAN
.51 PDRXS    F=I(9999)    ;DEPTH TO BEDROCK S.D.
.52 PTEMD    F=AN(1)      ;SOIL TEMPERATURE CLASS DOMINANT
.53 PTEMU    F=AN(1)      ;SOIL TEMPERATURE CLASS SUBDOM.
.54 PMOID    F=AN(1)      ;SOIL MOISTURE SUBCLASS DOMINANT
.55 PMOIU    F=AN(1)      ;SOIL MOISTURE SUBCLASS SUBDOM.
.56 PDM01    F=I(32000)   ;DUMMY VARIABLE 1
.57 PDM02    F=I(32000)   ;DUMMY VARIABLE 2
.58 PDM03    F=I(127)     ;DUMMY VARIABLE 3
.59 PDM04    F=I(127)     ;DUMMY VARIABLE 4
.60 PDM05    F=AN(1)      ;DUMMY VARIABLE 5
.61 PDM06    F=AN(1)      ;DUMMY VARIABLE 6
.62 PDM07    F=G(60,61)   ;DUMMY VARIABLE 7
```

APPENDIX A (cont'd)

SOIL DEPTH ATTRIBUTES ENTITY

3. SOIL_DEPTHS P=2 DF='SOILCART.E3' OCC=5300

ENTITY UNIQUE IDENTIFIER (KEY) = SOIL DEPTH CODE (SOIL 1,2 OR 3)
ALTERNATE KEY =THICKNESS MEAN

```
.1   PSDCO   F=AN(1)      ;SOIL DEPTH CODE
```

DEPTH ATTRIBUTES (.2-.38)

```
.2   PTHIM   F=I(999)     ;THICKNESS MEAN
.3   PTHIS   F=I(99)      ;THICKNESS S.D.
.4   PHORI   F=AN(1)      ;HORIZON MATERIAL TYPE:A,B,C,F,M,H,L,
.5   PPAMD   F=AN(2)      ;PARENT MATERIAL DOMINANT
.6   PPAMU   F=AN(2)      ;PARENT MATERIAL SUBDOMINANT
.7   PPCFM   F=I(100)     ;PERCENT COARSE FRAGMENTS(>2MM) MEAN
.8   PPCFS   F=I(50)      ;PERCENT COARSE FRAGMENTS (>2MM) S.D.
.9   PTEXD   F=AN(4)      ;TEXTURE-CSSC
.10  PSANM   F=I(99)      ;PERCENT CSSC SAND MEAN
.11  PSANS   F=I(99)      ;PERCENT CSSC SAND S.D.
.12  PCLAM   F=I(99)      ;PERCENT CSSC CLAY MEAN
.13  PCLAS   F=I(99)      ;PERCENT CSSC CLAY S.D.
.14  PUNID   F=AN(2)      ;TEXTURE-UNIFIED DOMINANT
.15  PUNIU   F=AN(2)      ;TEXTURE-UNIFIED SUBDOMINANT
.16  PUNIF   F=G(14,15)   ;TEXTURE-UNIFIED
.17  PAWSM   F=I(60)      ;AVAILABLE WATER STORAGE CAPACITY MEAN
.18  PAWSS   F=I(60)      ;AVAILABLE WATER STORAGE CAPACITY S.D.
.19  PBUDM   F=I(250)     ;BULK DENSITY MEAN(*.01)
.20  PBUDS   F=I(100)     ;BULK DENSITY S.D.(*.01)
.21  PPHCM   F=I(127)     ;PH.CACL2 MEAN(*.01)
.22  PPHCS   F=I(30)      ;PH-CACL2 S.D.(*.01)
.23  PORCM   F=I(600)     ;ORGANIC CARBON PERCENT MEAN(*.1)
.24  PORCS   F=I(127)     :ORGANIC CARBON PERCENT S.D.(*.1)
.25  PTONM   F=I(700)     ;TOTAL NITROGEN MEAN(*.01)
.26  PTONS   F=I(127)     ;TOTAL NITROGEN S.D.(*.01)
.27  PCECM   F=I(500)     ;CEC PH7 - NH4OAC MEAN
.28  PCECS   F=I(127)     ;CEC PH7 - NH4OAC S.D.
.29  PBASM   F=I(110)     ;BASE SATURATION MEAN
.30  PBASS   F=I(50)      ;BASE SATURATION S.D.
.31  PPFAM   F=I(900)     ;PYROPHOS. EXTRAC. FE+AL MEAN(*.01)
.32  PPFAS   F=I(127)     ;PYROPHOS. EXTRAC. FE+AL S.D.(*.01)
.33  PCACM   F=I(99)      ;CACO3 EQUIVALENT MEAN
.34  PCACS   F=I(99)      ;CACO3 EQUIVALENT S.D.
.35  PELCM   F=I(500)     ;ELECTRICAL CONDUCTIVITY MEAN(*.1)
.36  PELCS   F=I(99)      ;ELECTRICAL CONDUCTIVITY S.D.(*.1)
.37  PDDO1   F=AN(1)      ;DUMMY VARIABLE 1
.38  PDDO2   F=AN(1)      ;DUMMY VARIABLE 2
.39  PDDO3   F=G(37,38)   ;DUMMY VARIABLE 3
;
```

APPENDIX A (cont'd)

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;
9
;AGR_POLYGON - AGRICULTURAL POLYGON ENTITY AND ITS ATTRIBUTES (THEME 2)
;
;
   .1  APONO          F=I(32767)   ;POLYGON NUMBER
   .2  APIDC          F=AN(6)      ;PROJECT ID CODE
   .3  ANOBS          F=I(127)     ;NUMBER OF OBSERVATIONS IN POLYGON
   .4  ASTAT          F=I(127)     ;STATUS ATTR. FOR CORR/RELINK
   .5  AAREA          F=F          ;POLYGON AREA
   .6  APERI          F=F          ;POLYGON PERIMETER
   .7  AOMC1          F=AN(1)      ;ORGANIC OR FRUIT CODE 1
   .8  ACCC1          F=AN(1)      ;CAPABILITY CLASS CODE1
   .9  ADEC1          F=AN(1)      ;DECILE INDICATOR 1
   .10 ACS11          F=AN(1)      ;CAPABILITY SUBCLASS11
   .11 ACS12          F=AN(1)      ;CAPABILITY SUBCLASS12
   .12 ACS13          F=AN(1)      ;CAPABILITY SUBCLASS13
   .13 AOMC2          F=AN(1)      ;ORGANIC OR FRUIT CODE 2
   .14 ACCC2          F=AN(1)      ;CAPABILITY CLASS CODE2
   .15 ADEC2          F=AN(1)      ;DECILE INDICATOR 2
   .16 ACS21          F=AN(1)      ;CAPABILITY SUBCLASS21
   .17 ACS22          F=AN(1)      ;CAPABILITY SUBCLASS22
   .18 ACS23          F=AN(1)      ;CAPABILITY SUBCLASS23
   .19 AOMC3          F=AN(1)      ;ORGANIC OR FRUIT CODE3
   .20 ACCC3          F=AN(1)      ;CAPABILITY CLASS CODE3
   .21 ADEC3          F=AN(1)      ;DECILE INDICATOR 3
   .22 ACS31          F=AN(1)      ;CAPABILITY SUBCLASS31
   .23 ACS32          F=AN(1)      ;CAPABILITY SUBCLASS32
   .24 ACS33          F=AN(1)      ;CAPABILITY SUBCLASS33
   .25 AIOC1          F=AN(1)      ;IMPROVED ORGANIC OR FRUIT CODE 1
   .26 AICC1          F=AN(1)      ;IMPROVED CAPABILITY CLASS CODE1
   .27 AIDC1          F=AN(1)      ;IMPROVED DECILE INDICATOR 1
   .28 AIS11          F=AN(1)      ;IMPROVED CAPABILITY SUBCLASS11
   .29 AIS12          F=AN(1)      ;IMPROVED CAPABILITY SUBCLASS12
   .30 AIS13          F=AN(1)      ;IMPROVED CAPABILITY SUBCLASS13
   .31 AIOC2          F=AN(1)      ;IMPROVED ORGANIC OR FRUIT CODE 2
   .32 AICC2          F=AN(1)      ;IMPROVED CAPABILITY CLASS CODE2
   .33 AIDC2          F=AN(1)      ;IMPROVED DECILE INDICATOR 2
   .34 AIS21          F=AN(1)      ;IMPROVED CAPABILITY SUBCLASS21
   .35 AIS22          F=AN(1)      ;IMPROVED CAPABILITY SUBCLASS22
   .36 AIS23          F=AN(1)      ;IMPROVED CAPABILITY SUBCLASS23
   .37 AIOC3          F=AN(1)      ;IMPROVED ORGANIC OR FRUIT CODE 3
   .38 AICC3          F=AN(1)      ;IMPROVED CAPABILITY CLASS CODE3
   .39 AIDC3          F=AN(1)      ;IMPROVED DECILE INDICATOR 3
   .40 AIS31          F=AN(1)      ;IMPROVED CAPABILITY SUBCLASS31
   .41 AIS32          F=AN(1)      ;IMPROVED CAPABILITY SUBCLASS32
   .42 AIS33          F=AN(1)      ;IMPROVED CAPABILITY SUBCLASS33
   .43 ADP01          F=F          ;DUMMY VARIABLE 1
   .44 ADP02          F=I(32767)   ;DUMMY VARIABLE 2
   .45 ADP03          F=I(127)     ;DUMMY VARIABLE 3
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   .46 ADP04                    F=I(127)     ;DUMMY VARIABLE 4
   .47 ADP05                    F=I(127)     ;DUMMY VARIABLE 5
   .48 ADP06                    F=I(127)     ;DUMMY VARIABLE 6
   .49 ADP07                    F=AN(1)      ;DUMMY VARIABLE 7
   .50 ADP08                    F=AN(1)      ;DUMMY VARIABLE 8
   .51 ADP09                    F=AN(1)      ;DUMMY VARIABLE 9
   .52 ADP10                    F=AN(1)      ;DUMMY VARIABLE 10
   .53 ADP11                    F=G(49,50)   ;DUMMY VARIABLE 11
   .54 ADP12                    F=G(51,52)   ;DUMMY VARIABLE 12
 ;
   .55 ALB01                    F=AN(5)      ;LABEL VARIABLE 1
   .56 ALB02                    F=AN(5)      ;LABEL VARIABLE 2
   .57 ALB03                    F=AN(5)      ;LABEL VARIABLE 3
   .58 ALB04                    F=AN(5)      ;LABEL VARIABLE 4
   .59 ALB05                    F=AN(5)      ;LABEL VARIABLE 5
   .60 ALB06                    F=AN(5)      ;LABEL VARIABLE 6
   .61 ALB07                    F=G(55,56)   ;LABEL VARIABLE 7
   .62 ALB08                    F=G(57,58)   ;LABEL VARIABLE 8
   .63 ALB09                    F=G(59,60)   ;LABEL VARIABLE 9
   .64 ALB10                    F=G(55,57)   ;LABEL VARIABLE 10
   .65 ALB11                    F=G(58,60)   ;LABEL VARIABLE 11
   .66 ALB12                    F=G(55,58)   ;LABEL VARIABLE 12
   .67 ALB13                    F=G(55,60)   ;LABEL VARIABLE 13
;
   .68 AFG01                    F=AN(1)       ;FLAG VARIABLE 1
   .69 AFG02                    F=AN(1)       ;FLAG VARIABLE 2
   .70 AFG03                    F=AN(1)       ;FLAG VARIABLE 3
   .71 AFG04                    F=AN(1)       ;FLAG VARIABLE 4
   .72 AFG05                    F=G(68,69)    ;FLAG VARIABLE 5
   .73 AFG06                    F=G(70,71)    ;FLAG VARIABLE 6
;
4
;TER_POLYGON - TERRAIN POLYGON ENTITY AND ITS ATTRIBUTES (THEME THREE)
;
   .1  TPONO                    F=I(32767)   ;POLYGON NUMBER
   .2  TPIDC                    F=AN(6)      ;PROJECT ID CODE
   .3  TGRTR                    F=AN(4)      ;NUMBER OF GROUND TRUTH OBS. POINTS !N
   .4  TAREA                    F=F          ;AREA OF POLYGON
   .5  TPERI                    F=F          ;PERIMETER OF POLYGON
   .6  TPEL1                    F=I(32767)   ;ELEVATION OF POLYGON R1
   .7  TPEL2                    F=I(32767)   ;ELEVATION OF POLYGON R2
   .8  TASP1                    F=AN(3)      ;ASPECT OF POLYGON R1 !NUMERIC
   .9  TASP2                    F=AN(3)      ;ASPECT OF POLYGON R2 !NUMERIC
   .10 TSLPO                    F=AN(2)      ;SLOPE POSITION OF POLYGON
   .11 TBRK1                    F=AN(2)      ;BEDROCK TYPE 1
   .12 TBRK2                    F=AN(2)      ;BEDROCK TYPE 2
   .13 TBRK3                    F=AN(2)      ;BEDROCK TYPE 3
   .14 TBRK4                    F=AN(2)      ;BEDROCK TYPE 4
   .15 TDP01                    F=AN(1)      ;DUMMY VARIABLE 1
   .16 TDP02                    F=AN(1)      ;DUMMY VARIABLE 2
```

```
.17 TDP03          F=AN(1)      ;DUMMY VARIABLE 3
.18 TDP04          F=AN(1)      ;DUMMY VARIABLE 4
.19 TDP05          F=AN(1)      ;DUMMY VARIABLE 5
.20 TDP06          F=AN(1)      ;DUMMY VARIABLE 6
.21 TDP07          F=AN(1)      ;DUMMY VARIABLE 7
.22 TDP08          F=AN(1)      ;DUMMY VARIABLE 8
.23 TDP09          F=AN(1)      ;DUMMY VARIABLE 9
.24 TDP10          F=AN(1)      ;DUMMY VARIABLE 10
.25 TDP11          F=AN(1)      ;DUMMY VARIABLE 11
.26 TDP12          F=AN(1)      ;DUMMY VARIABLE 12
.27 TDP13          F=AN(1)      ;DUMMY VARIABLE 13
.28 TDP14          F=AN(1)      ;DUMMY VARIABLE 14
.29 TDP15          F=AN(1)      ;DUMMY VARIABLE 15
.30 TDP16          F=AN(1)      ;DUMMY VARIABLE 16
.31 TDP17          F=AN(1)      ;DUMMY VARIABLE 17
.32 TDP18          F=AN(1)      ;DUMMY VARIABLE 18
.33 TDP19          F=AN(1)      ;DUMMY VARIABLE 19
.34 TDP20          F=AN(1)      ;DUMMY VARIABLE 20
.35 TDP21          F=AN(1)      ;DUMMY VARIABLE 21
.36 TDP22          F=AN(1)      ;DUMMY VARIABLE 22
.37 TDP23          F=AN(1)      ;DUMMY VARIABLE 23
.38 TDP24          F=AN(1)      ;DUMMY VARIABLE 24
.39 TDP25          F=AN(1)      ;DUMMY VARIABLE 25
.40 TDP26          F=AN(1)      ;DUMMY VARIABLE 26
.41 TDP27          F=AN(1)      ;DUMMY VARIABLE 27
.42 TDP28          F=AN(1)      ;DUMMY VARIABLE 28
.43 TDP29          F=AN(1)      ;DUMMY VARIABLE 29
.44 TDP30          F=AN(1)      ;DUMMY VARIABLE 30
.45 TDP31          F=AN(1)      ;DUMMY VARIABLE 31
.46 TDP32          F=AN(1)      ;DUMMY VARIABLE 32
.47 TDP33          F=AN(1)      ;DUMMY VARIABLE 33
.48 TDP34          F=AN(1)      ;DUMMY VARIABLE 34
.49 TDP35          F=AN(1)      ;DUMMY VARIABLE 35
.50 TDP36          F=AN(1)      ;DUMMY VARIABLE 36
.51 TDP37          F=AN(1)      ;DUMMY VARIABLE 37
.52 TDP38          F=AN(1)      ;DUMMY VARIABLE 38
.53 TDP39          F=AN(1)      ;DUMMY VARIABLE 39
.54 TDP40          F=AN(1)      ;DUMMY VARIABLE 40
.55 TDP41          F=AN(1)      ;DUMMY VARIABLE 41
.56 TDP42          F=AN(1)      ;DUMMY VARIABLE 42
.57 TDP43          F=AN(1)      ;DUMMY VARIABLE 43
.58 TDP44          F=AN(1)      ;DUMMY VARIABLE 44
.59 TDP45          F=AN(1)      ;DUMMY VARIABLE 45
.60 TDP46          F=AN(1)      ;DUMMY VARIABLE 46
.61 TDP47          F=AN(1)      ;DUMMY VARIABLE 47
.62 TDP48          F=AN(1)      ;DUMMY VARIABLE 48
.63 TDP49          F=AN(1)      ;DUMMY VARIABLE 49
.64 TDP50          F=AN(1)      ;DUMMY VARIABLE 50
.65 TDP51          F=G(15,16)   ;DUMMY VARIABLE 51
.66 TDP52          F=G(17,18)   ;DUMMY VARIABLE 52
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.67 TDP53            F=G(19,20)    ;DUMMY VARIABLE 53
.68 TDP54            F=G(21,22)    ;DUMMY VARIABLE 54
.69 TDP55            F=G(23,24)    ;DUMMY VARIABLE 55
.70 TDP56            F=G(25,26)    ;DUMMY VARIABLE 56
.71 TDP57            F=G(27,28)    ;DUMMY VARIABLE 57
.72 TDP58            F=G(29,30)    ;DUMMY VARIABLE 58
.73 TDP59            F=G(31,32)    ;DUMMY VARIABLE 59
.74 TDP60            F=G(33,34)    ;DUMMY VARIABLE 60
.75 TDP61            F=G(35,36)    ;DUMMY VARIABLE 61
.76 TDP62            F=G(37,38)    ;DUMMY VARIABLE 62
.77 TDP63            F=G(39,40)    ;DUMMY VARIABLE 63
.78 TDP64            F=G(41,42)    ;DUMMY VARIABLE 64
.79 TDP65            F=G(43,44)    ;DUMMY VARIABLE 65
.80 TDP66            F=G(45,46)    ;DUMMY VARIABLE 66
.81 TDP67            F=G(47,48)    ;DUMMY VARIABLE 67
.82 TDP68            F=G(49,50)    ;DUMMY VARIABLE 68
.83 TDP69            F=G(51,52)    ;DUMMY VARIABLE 69
.84 TDP70            F=G(53,54)    ;DUMMY VARIABLE 70
.85 TDP71            F=G(55,56)    ;DUMMY VARIABLE 71
.86 TDP72            F=G(57,58)    ;DUMMY VARIABLE 72
.87 TDP73            F=G(59,60)    ;DUMMY VARIABLE 73
.88 TDP74            F=G(61,62)    ;DUMMY VARIABLE 74
.89 TDP75            F=G(63,64)    ;DUMMY VARIABLE 75
.90 TDP76            F=G(15,17)    ;DUMMY VARIABLE 76
.91 TDP77            F=G(18,20)    ;DUMMY VARIABLE 77
.92 TDP78            F=G(21,23)    ;DUMMY VARIABLE 78
.93 TDP79            F=G(24,26)    ;DUMMY VARIABLE 79
.94 TDP80            F=G(27,30)    ;DUMMY VARIABLE 80
.95 TDP81            F=G(31,34)    ;DUMMY VARIABLE 81
.96 TDP82            F=G(35,38)    ;DUMMY VARIABLE 82
.97 TDP83            F=G(39,43)    ;DUMMY VARIABLE 83
.98 TDP84            F=G(44,48)    ;DUMMY VARIABLE 84
.99 TDP85            F=G(49,56)    ;DUMMY VARIABLE 85
.100 TDP86           F=G(57,64)    ;DUMMY VARIABLE 86
.101 TDP87           F=G(15,20)    ;DUMMY VARIABLE 87
.102 TDP88           F=G(21,26)    ;DUMMY VARIABLE 88
.103 TDP89           F=G(27,35)    ;DUMMY VARIABLE 89
.104 TDP90           F=G(36,44)    ;DUMMY VARIABLE 90
.105 TDP91           F=G(45,54)    ;DUMMY VARIABLE 91
.106 TDP92           F=G(55,64)    ;DUMMY VARIABLE 92
.107 TDP93           F=G(15,44)    ;DUMMY VARIABLE 93
.108 TDP94           F=G(45,64)    ;DUMMY VARIABLE 94

.109 TLB01           F=AN(5)       ;LABEL VARIABLE 1
.110 TLB02           F=AN(5)       ;LABEL VARIABLE 2
.111 TLB03           F=AN(5)       ;LABEL VARIABLE 3
.112 TLB04           F=AN(5)       ;LABEL VARIABLE 4
.113 TLB05           F=AN(5)       ;LABEL VARIABLE 5
.114 TLB06           F=AN(5)       ;LABEL VARIABLE 6
.115 TLB07           F=G(109,110);LABEL VARIABLE 7
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.116 TLB08              F=G(111,112);LABEL VARIABLE 8
.117 TLB09              F=G(113,114);LABEL VARIABLE 9
.118 TLB10              F=G(109,111);LABEL VARIABLE 10
.119 TLB11              F=G(112,114);LABEL VARIABLE 11
.120 TLB12              F=G(109,112);LABEL VARIABLE 12
.121 TLB13              F=G(109,114);LABEL VARIABLE 13
;
.122 TFL01              F=AN(1)      ;FLAG VARIABLE 1
.123 TFL02              F=AN(1)      ;FLAG VARIABLE 2
.124 TFL03              F=AN(1)      ;FLAG VARIABLE 3
.125 TFL04              F=AN(1)      ;FLAG VARIABLE 4
.126 TFL05              F=G(122,123);FLAG VARIABLE 5
.127 TFL06              F=G(124,125);FLAG VARIABLE 6
;
;  TERRAIN COMPONENT ATTRIBUTES
;
;
;    COMPONENT 1 ATTRIBUTES (.128-.175)
;
.128 TC1DC               F=AN(1)     ;COMPONENT 1 DOMINANCE CODE
.129 T1DEC               F=AN(1)     ;COMPONENT 1 DECILE INDICATOR
.130 T1SD1               F=AN(2)     ;COMPONENT 1 SLOPE IN DEGREES 1 !N
.131 T1SDL               F=AN(1)     ;COMPONENT 1 SLOPE DELIMITER
.132 T1SD2               F=AN(2)     ;COMPONENT 1 SLOPE IN DEGREES 2 !N
.133 T1DR1               F=AN(1)     ;COMPONENT 1 DRAINAGE CODE 1
.134 T1DDL               F=AN(1)     ;COMPONENT 1 DRAINAGE DELIMITER
.135 T1DR2               F=AN(1)     ;COMPONENT 1 DRAINAGE CODE 2
.136 T1MP1               F=AN(1)     ;COMPONENT 1 MODIFYING PROCESS CODE1
.137 T1S11               F=AN(1)     ;COMP.1 MODIFYING PROCESS SUBCODE11
.138 T1S12               F=AN(1)     ;COMP.1 MODIFYING PROCESS SUBCODE12
.139 T1Q11               F=AN(1)     ;COMP.1 M.P. QUAL. DESCRIPTOR CODE11
.140 T1Q12               F=AN(1)     ;COMP.1 M.P. QUAL. DESCRIPTOR CODE12
.141 T1MP2               F=AN(1)     ;COMPONENT 1 MODIFYING PROCESS CODE2
.142 T1S21               F=AN(1)     ;COMP.1 MODIFYING PROCESS SUBCODE21
.143 T1S22               F=AN(1)     ;COMP.1 MODIFYING PROCESS SUBCODE22
.144 T1Q21               F=AN(1)     ;COMP.1 M.P. QUAL. DESCRIPTOR CODE21
.145 T1Q22               F=AN(1)     ;COMP.1 M.P. QUAL. DESCRIPTOR CODE22
.146 T1MP3               F=AN(1)     ;COMPONENT 1 MODIFYING PROCESS CODE3
.147 T1S31               F=AN(1)     ;COMP.1 MODIFYING PROCESS SUBCODE31
.148 T1S32               F=AN(1)     ;COMP.1 MODIFYING PROCESS SUBCODE32
.149 T1Q31               F=AN(1)     ;COMP.1 M.P. QUAL. DESCRIPTOR CODE31
.150 T1Q32               F=AN(1)     ;COMP.1 M.P. QUAL. DESCRIPTOR CODE32
.151 T1DI1               F=AN(2)     ;COMP.1 DPH TO IMPERMEABLE LAYER R1 !
.152 T1DI2               F=AN(2)     ;COMP.1 DPH TO IMPERMEABLE LAYER R2 !
.153 T1D01               F=AN(1)     ;COMPONENT 1 DUMMY VARIABLE 1
.154 T1D02               F=AN(1)     ;COMPONENT 1 DUMMY VARIABLE 2
.155 T1D03               F=AN(1)     ;COMPONENT 1 DUMMY VARIABLE 3
.156 T1D04               F=AN(1)     ;COMPONENT 1 DUMMY VARIABLE 4
.157 T1D05               F=AN(1)     ;COMPONENT 1 DUMMY VARIABLE 5
.158 T1D06               F=AN(1)     ;COMPONENT 1 DUMMY VARIABLE 6
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 .159 T1D07                 F=AN(1)       ;COMPONENT 1 DUMMY VARIABLE 7
 .160 T1D08                 F=AN(1)       ;COMPONENT 1 DUMMY VARIABLE 8
 .161 T1D09                 F=AN(1)       ;COMPONENT 1 DUMMY VARIABLE 9
 .162 T1D10                 F=AN(1)       ;COMPONENT 1 DUMMY VARIABLE 10
 .163 T1D11                 F=AN(1)       ;COMPONENT 1 DUMMY VARIABLE 11
 .164 T1D12                 F=AN(1)       ;COMPONENT 1 DUMMY VARIABLE 12
 .165 T1D13                 F=G(153,154);COMPONENT 1 DUMMY VARIABLE 13
 .166 T1D14                 F=G(155,156);COMPONENT 1 DUMMY VARIABLE 14
 .167 T1D15                 F=G(157,158);COMPONENT 1 DUMMY VARIABLE 15
 .168 T1D16                 F=G(159,160);COMPONENT 1 DUMMY VARIABLE 16
 .169 T1D17                 F=G(161,162);COMPONENT 1 DUMMY VARIABLE 17
 .170 T1D18                 F=G(163,164);COMPONENT 1 DUMMY VARIABLE 18
 .171 T1D19                 F=G(153,155);COMPONENT 1 DUMMY VARIABLE 19
 .172 T1D20                 F=G(156,158);COMPONENT 1 DUMMY VARIABLE 20
 .173 T1D21                 F=G(159,161);COMPONENT 1 DUMMY VARIABLE 21
 .174 T1D22                 F=G(162,164);COMPONENT 1 DUMMY VARIABLE 22
 .175 T1D23                 F=G(153,164);COMPONENT 1 DUMMY VARIABLE 23
;
;    COMPONENT 2 ATTRIBUTES (.176-.223)
;
 .176 TC2DC                 F=AN(1)       ;COMPONENT 2 DOMINANCE CODE
 .177 T2DEC                 F=AN(1)       ;COMPONENT 2 DECILE INDICATOR
 .178 T2SD1                 F=AN(2)       ;COMPONENT 2 SLOPE IN DEGREES 1 !N
 .179 T2SDL                 F=AN(1)       ;COMPONENT 2 SLOPE DELIMITER
 .180 T2SD2                 F=AN(2)       ;COMPONENT 2 SLOPE IN DEGREES 2 !N
 .181 T2DR1                 F=AN(1)       ;COMPONENT 2 DRAINAGE CODE 1
 .182 T2DDL                 F=AN(1)       ;COMPONENT 2 DRAINAGE DELIMITER
 .183 T2DR2                 F=AN(1)       ;COMPONENT 2 DRAINAGE CODE 2
 .184 T2MP1                 F=AN(1)       ;COMPONENT 2 MODIFYING PROCESS CODE1
 .185 T2S11                 F=AN(1)       ;COMP.2 MODIFYING PROCESS SUBCODE11
 .186 T2S12                 F=AN(1)       ;COMP.2 MODIFYING PROCESS SUBCODE12
 .187 T2Q11                 F=AN(1)       ;COMP.2 M.P. QUAL. DESCRIPTOR CODE11
 .188 T2Q12                 F=AN(1)       ;COMP.2 M.P. QUAL. DESCRIPTOR CODE12
 .189 T2MP2                 F=AN(1)       ;COMPONENT 2 MODIFYING PROCESS CODE2
 .190 T2S21                 F=AN(1)       ;COMP.2 MODIFYING PROCESS SUBCODE21
 .191 T2S22                 F=AN(1)       ;COMP.2 MODIFYING PROCESS SUBCODE22
 .192 T2Q21                 F=AN(1)       ;COMP.2 M.P. QUAL. DESCRIPTOR CODE21
 .193 T2Q22                 F=AN(1)       ;COMP.2 M.P. QUAL. DESCRIPTOR CODE22
 .194 T2MP3                 F=AN(1)       ;COMPONENT 2 MODIFYING PROCESS CODE3
 .195 T2S31                 F=AN(1)       ;COMP.2 MODIFYING PROCESS SUBCODE31
 .196 T2S32                 F=AN(1)       ;COMP.2 MODIFYING PROCESS SUBCODE32
 .197 T2Q31                 F=AN(1)       ;COMP.2 M.P. QUAL. DESCRIPTOR CODE31
 .198 T2Q32                 F=AN(1)       ;COMP.2 M.P. QUAL. DESCRIPTOR CODE32
 .199 T2DI1                 F=AN(2)       ;COMP.2 DPH TO IMPERMEABLE LAYER R1 !
 .200 T2DI2                 F=AN(2)       ;COMP.2 DPH TO IMPERMEABLE LAYER R2 !
 .201 T2D01                 F=AN(1)       ;COMPONENT 2 DUMMY VARIABLE 1
 .202 T2D02                 F=AN(1)       ;COMPONENT 2 DUMMY VARIABLE 2
 .203 T2D03                 F=AN(1)       ;COMPONENT 2 DUMMY VARIABLE 3
 .204 T2D04                 F=AN(1)       ;COMPONENT 2 DUMMY VARIABLE 4
 .205 T2D05                 F=AN(1)       ;COMPONENT 2 DUMMY VARIABLE 5
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 .206 T2D06              F=AN(1)       ;COMPONENT 2 DUMMY VARIABLE 6
 .207 T2D07              F=AN(1)       ;COMPONENT 2 DUMMY VARIABLE 7
 .208 T2D08              F=AN(1)       ;COMPONENT 2 DUMMY VARIABLE 8
 .209 T2D09              F=AN(1)       ;COMPONENT 2 DUMMY VARIABLE 9
 .210 T2D10              F=AN(1)       ;COMPONENT 2 DUMMY VARIABLE 10
 .211 T2D11              F=AN(1)       ;COMPONENT 2 DUMMY VARIABLE 11
 .212 T2D12              F=AN(1)       ;COMPONENT 2 DUMMY VARIABLE 12
 .213 T2D13              F=G(201,202);COMPONENT 2 DUMMY VARIABLE 13
 .214 T2D14              F=G(203,204);COMPONENT 2 DUMMY VARIABLE 14
 .215 T2D15              F=G(205,206);COMPONENT 2 DUMMY VARIABLE 15
 .216 T2D16              F=G(207,208);COMPONENT 2 DUMMY VARIABLE 16
 .217 T2D17              F=G(209,210);COMPONENT 2 DUMMY VARIABLE 17
 .218 T2D18              F=G(211,212);COMPONENT 2 DUMMY VARIABLE 18
 .219 T2D19              F=G(201,203);COMPONENT 2 DUMMY VARIABLE 19
 .220 T2D20              F=G(204,206);COMPONENT 2 DUMMY VARIABLE 20
 .221 T2D21              F=G(207,209);COMPONENT 2 DUMMY VARIABLE 21
 .222 T2D22              F=G(210,212);COMPONENT 2 DUMMY VARIABLE 22
 .223 T2D23              F=G(201,212);COMPONENT 2 DUMMY VARIABLE 23
;
;    COMPONENT 3 ATTRIBUTES (.224-.271)
;
 .224 TC3DC              F=AN(1)       ;COMPONENT 3 DOMINANCE CODE
 .225 T3DEC              F=AN(1)       ;COMPONENT 3 DECILE INDICATOR
 .226 T3SD1              F=AN(2)       ;COMPONENT 3 SLOPE IN DEGREES 1 !N
 .227 T3SDL              F=AN(1)       ;COMPONENT 3 SLOPE DELIMITER
 .228 T3SD2              F=AN(2)       ;COMPONENT 3 SLOPE IN DEGREES 2 !N
 .229 T3DR1              F=AN(1)       ;COMPONENT 3 DRAINAGE CODE 1
 .230 T3DDL              F=AN(1)       ;COMPONENT 3 DRAINAGE DELIMITER
 .231 T3DR2              F=AN(1)       ;COMPONENT 3 DRAINAGE CODE 2
 .232 T3MP1              F=AN(1)       ;COMPONENT 3 MODIFYING PROCESS CODE1
 .233 T3S11              F=AN(1)       ;COMP.3 MODIFYING PROCESS SUBCODE11
 .234 T3S12              F=AN(1)       ;COMP.3 MODIFYING PROCESS SUBCODE12
 .235 T3Q11              F=AN(1)       ;COMP.3 M.P. QUAL. DESCRIPTOR CODE11
 .236 T3Q12              F=AN(1)       ;COMP.3 M.P. QUAL. DESCRIPTOR CODE12
 .237 T3MP2              F=AN(1)       ;COMPONENT 3 MODIFYING PROCESS CODE2
 .238 T3S21              F=AN(1)       ;COMP.3 MODIFYING PROCESS SUBCODE21
 .239 T3S22              F=AN(1)       ;COMP.3 MODIFYING PROCESS SUBCODE22
 .240 T3Q21              F=AN(1)       ;COMP.3 M.P. QUAL. DESCRIPTOR CODE21
 .241 T3Q22              F=AN(1)       ;COMP.3 M.P. QUAL. DESCRIPTOR CODE22
 .242 T3MP3              F=AN(1)       ;COMPONENT 3 MODIFYING PROCESS CODE3
 .243 T3S31              F=AN(1)       ;COMP.3 MODIFYING PROCESS SUBCODE31
 .244 T3S32              F=AN(1)       ;COMP.3 MODIFYING PROCESS SUBCODE32
 .245 T3Q31              F=AN(1)       ;COMP.3 M.P. QUAL. DESCRIPTOR CODE31
 .246 T3Q32              F=AN(1)       ;COMP.3 M.P. QUAL. DESCRIPTOR CODE32
 .247 T3DI1              F=AN(2)       ;COMP.3 DPH TO IMPERMEABLE LAYER R1 !
 .248 T3DI2              F=AN(2)       ;COMP.3 DPH TO IMPERMEABLE LAYER R2 !
 .249 T3D01              F=AN(1)       ;COMPONENT 3 DUMMY VARIABLE 1
 .250 T3D02              F=AN(1)       ;COMPONENT 3 DUMMY VARIABLE 2
 .251 T3D03              F=AN(1)       ;COMPONENT 3 DUMMY VARIABLE 3
 .252 T3D04              F=AN(1)       ;COMPONENT 3 DUMMY VARIABLE 4
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.253 T3D05              F=AN(1)        ;COMPONENT 3 DUMMY VARIABLE 5
.254 T3D06              F=AN(1)        ;COMPONENT 3 DUMMY VARIABLE 6
.255 T3D07              F=AN(1)        ;COMPONENT 3 DUMMY VARIABLE 7
.256 T3D08              F=AN(1)        ;COMPONENT 3 DUMMY VARIABLE 8
.257 T3D09              F=AN(1)        ;COMPONENT 3 DUMMY VARIABLE 9
.258 T3D10              F=AN(1)        ;COMPONENT 3 DUMMY VARIABLE 10
.259 T3D11              F=AN(1)        ;COMPONENT 3 DUMMY VARIABLE 11
.260 T3D12              F=AN(1)        ;COMPONENT 3 DUMMY VARIABLE 12
.261 T3D13              F=G(249,250);COMPONENT 3 DUMMY VARIABLE 13
.262 T3D14              F=G(251,252);COMPONENT 3 DUMMY VARIABLE 14
.263 T3D15              F=G(253,254);COMPONENT 3 DUMMY VARIABLE 15
.264 T3D16              F=G(255,256);COMPONENT 3 DUMMY VARIABLE 16
.265 T3D17              F=G(257,258);COMPONENT 3 DUMMY VARIABLE 17
.266 T3D18              F=G(259,260);COMPONENT 3 DUMMY VARIABLE 18
.267 T3D19              F=G(249,251);COMPONENT 3 DUMMY VARIABLE 19
.268 T3D20              F=G(252,254);COMPONENT 3 DUMMY VARIABLE 20
.269 T3D21              F=G(255,257);COMPONENT 3 DUMMY VARIABLE 21
.270 T3D22              F=G(258,260);COMPONENT 3 DUMMY VARIABLE 22
.271 T3D23              F=G(249,260);COMPONENT 3 DUMMY VARIABLE 23
;
;
;    SIMPLE UNIT 1 ATTRIBUTES (.272-.321)
;
;
.272 T1STC              F=AN(1)       ;S.U.1 STRATIGRAPHIC ORDER CODE
.273 T1TX3              F=AN(1)       ;S.U.1 TEXTURE3 (STANDARD)
.274 T1TX2              F=AN(1)       ;S.U.1 TEXTURE2 (STANDARD)
.275 T1TX1              F=AN(1)       ;S.U.1 TEXTURE1 (STANDARD)
.276 T1TEX              F=G(273,275);S.U.1 TEXTURE - ALL THREE
.277 T1UND              F=AN(2)       ;S.U.1 TEXTURE UNIFIED DOMINANT
.278 T1UNU              F=AN(2)       ;S.U.1 TEXTURE UNIFIED SUBDOMINANT
.279 T1UNF              F=G(277,278);S.U.1 TEXTURE UNIFIED
.280 T1GMT              F=AN(1)       ;S.U.1 GENETIC MATERIAL
.281 T1GMS              F=AN(1)       ;S.U.1 GENETIC MATERIAL SUBCODE !N
.282 T1QD1              F=AN(1)       ;S.U.1 QUALIFYING DESCRIPTOR 1
.283 T1QD2              F=AN(1)       ;S.U.1 QUALIFYING DESCRIPTOR 2
.284 T1SX1              F=AN(1)       ;S.U.1 SURFACE EXPRESSION 1
.285 T1SX2              F=AN(1)       ;S.U.1 SURFACE EXPRESSION 2
.286 T1SX3              F=AN(1)       ;S.U.1 SURFACE EXPRESSION 3
.287 T1SXP              F=G(284,286);S.U.1 SURFACE EXPRESSIONS
.288 T1TR1              F=I(32767)    ;S.U.1 THICKNESS, RANGE 1
.289 T1TR2              F=I(32767)    ;S.U.1 THICKNESS, RANGE 2
.290 T1RND              F=AN(1)       ;S.U.1 CLAST ROUNDNESS
.291 T1CMP              F=AN(1)       ;S.U.1 COMPACTION
.292 T1PER              F=AN(1)       ;S.U.1 PERMEABILITY
.293 T1IND              F=AN(1)       ;S.U.1 INDURATION
.294 T1V01              F=AN(1)       ;S.U.1 DUMMY VARIABLE 1
.295 T1V02              F=AN(1)       ;S.U.1 DUMMY VARIABLE 2
.296 T1V03              F=AN(1)       ;S.U.1 DUMMY VARIABLE 3
.297 T1V04              F=AN(1)       ;S.U.1 DUMMY VARIABLE 4
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.298 T1V05                    F=AN(1)       ;S.U.1 DUMMY VARIABLE 5
.299 T1V06                    F=AN(1)       ;S.U.1 DUMMY VARIABLE 6
.300 T1V07                    F=AN(1)       ;S.U.1 DUMMY VARIABLE 7
.301 T1V08                    F=AN(1)       ;S.U.1 DUMMY VARIABLE 8
.302 T1V09                    F=AN(1)       ;S.U.1 DUMMY VARIABLE 9
.303 T1V10                    F=AN(1)       ;S.U.1 DUMMY VARIABLE 10
.304 T1V11                    F=AN(1)       ;S.U.1 DUMMY VARIABLE 11
.305 T1V12                    F=AN(1)       ;S.U.1 DUMMY VARIABLE 12
.306 T1V13                    F=AN(1)       ;S.U.1 DUMMY VARIABLE 13
.307 T1V14                    F=AN(1)       ;S.U.1 DUMMY VARIABLE 14
.308 T1V15                    F=AN(1)       ;S.U.1 DUMMY VARIABLE 15
.309 T1V16                    F=G(294,295);S.U.1 DUMMY VARIABLE 16
.310 T1V17                    F=G(296,297);S.U.1 DUMMY VARIABLE 17
.311 T1V18                    F=G(298,299);S.U.1 DUMMY VARIABLE 18
.312 T1V19                    F=G(300,301);S.U.1 DUMMY VARIABLE 19
.313 T1V20                    F=G(302,303);S.U.1 DUMMY VARIABLE 20
.314 T1V21                    F=G(304,305);S.U.1 DUMMY VARIABLE 21
.315 T1V22                    F=G(306,308);S.U.1 DUMMY VARIABLE 22
.316 T1V23                    F=G(294,296);S.U.1 DUMMY VARIABLE 23
.317 T1V24                    F=G(297,299);S.U.1 DUMMY VARIABLE 24
.318 T1V25                    F=G(300,302);S.U.1 DUMMY VARIABLE 25
.319 T1V26                    F=G(303,305);S.U.1 DUMMY VARIABLE 26
.320 T1V27                    F=G(306,308);S.U.1 DUMMY VARIABLE 27
.321 T1V28                    F=G(294,308);S.U.1 DUMMY VARIABLE 28
;
;    SIMPLE UNIT 2 ATTRIBUTES (.322-.371)
;
;
.322 T2STC                    F=AN(1)       ;S.U.2 STRATIGRAPHIC ORDER CODE
.323 T2TX3                    F=AN(1)       ;S.U.2 TEXTURE3 (STANDARD)
.324 T2TX2                    F=AN(1)       ;S.U.2 TEXTURE2 (STANDARD)
.325 T2TX1                    F=AN(1)       ;S.U.2 TEXTURE1 (STANDARD)
.326 T2TEX                    F=G(323,325);S.U.2 TEXTURE - ALL THREE
.327 T2UND                    F=AN(2)       ;S.U.2 TEXTURE UNIFIED DOMINANT
.328 T2UNU                    F=AN(2)       ;S.U.2 TEXTURE UNIFIED SUBDOMINANT
.329 T2UNF                    F=G(327,328);S.U.2 TEXTURE UNIFIED
.330 T2GMT                    F=AN(1)       ;S.U.2 GENETIC MATERIAL
.331 T2GMS                    F=AN(1)       ;S.U.2 GENETIC MATERIAL SUBCODE !N
.332 T2QD1                    F=AN(1)       ;S.U.2 QUALIFYING DESCRIPTOR 1
.333 T2QD2                    F=AN(1)       ;S.U.2 QUALIFYING DESCRIPTOR 2
.334 T2SX1                    F=AN(1)       ;S.U.2 SURFACE EXPRESSION 1
.335 T2SX2                    F=AN(1)       ;S.U.2 SURFACE EXPRESSION 2
.336 T2SX3                    F=AN(1)       ;S.U.2 SURFACE EXPRESSION 3
.337 T2SXP                    F=G(334,336);S.U.2 SURFACE EXPRESSIONS
.338 T2TR1                    F=I(32767)    ;S.U.2 THICKNESS, RANGE 1
.339 T2TR2                    F=I(32767)    ;S.U.2 THICKNESS, RANGE 2
.340 T2RND                    F=AN(1)       ;S.U.2 CLAST ROUNDNESS
.341 T2CMP                    F=AN(1)       ;S.U.2 COMPACTION
.342 T2PER                    F=AN(1)       ;S.U.2 PERMEABILITY
.343 T2IND                    F=AN(1)       ;S.U.2 INDURATION
```

```
.344 T2V01                F=AN(1)      ;S.U.2 DUMMY VARIABLE 1
.345 T2V02                F=AN(1)      ;S.U.2 DUMMY VARIABLE 2
.346 T2V03                F=AN(1)      ;S.U.2 DUMMY VARIABLE 3
.347 T2V04                F=AN(1)      ;S.U.2 DUMMY VARIABLE 4
.348 T2V05                F=AN(1)      ;S.U.2 DUMMY VARIABLE 5
.349 T2V06                F=AN(1)      ;S.U.2 DUMMY VARIABLE 6
.350 T2V07                F=AN(1)      ;S.U.2 DUMMY VARIABLE 7
.351 T2V08                F=AN(1)      ;S.U.2 DUMMY VARIABLE 8
.352 T2V09                F=AN(1)      ;S.U.2 DUMMY VARIABLE 9
.353 T2V10                F=AN(1)      ;S.U.2 DUMMY VARIABLE 10
.354 T2V11                F=AN(1)      ;S.U.2 DUMMY VARIABLE 11
.355 T2V12                F=AN(1)      ;S.U.2 DUMMY VARIABLE 12
.356 T2V13                F=AN(1)      ;S.U.2 DUMMY VARIABLE 13
.357 T2V14                F=AN(1)      ;S.2 DUMMY VARIABLE 14
.358 T2V15                F=AN(1)      ;S.U.2 DUMMY VARIABLE 15
.359 T2V16                F=G(344,345);S.U.2 DUMMY VARIABLE 16
.360 T2V17                F=G(346,347);S.U.2 DUMMY VARIABLE 17
.361 T2V18                F=G(348,349);S.U.2 DUMMY VARIABLE 18
.362 T2V19                F=G(350,351);S.U.2 DUMMY VARIABLE 19
.363 T2V20                F=G(352,353);S.U.2 DUMMY VARIABLE 20
.364 T2V21                F=G(354,355);S.U.2 DUMMY VARIABLE 21
.365 T2V22                F=G(356,358);S.U.2 DUMMY VARIABLE 22
.366 T2V23                F=G(344,346);S.U.2 DUMMY VARIABLE 23
.367 T2V24                F=G(347,349);S.U.2 DUMMY VARIABLE 24
.368 T2V25                F=G(350,352);S.U.2 DUMMY VARIABLE 25
.369 T2V26                F=G(353,355);S.U.2 DUMMY VARIABLE 26
.370 T2V27                F=G(356,358);S.U.2 DUMMY VARIABLE 27
.371 T2V28                F=G(344,358);S.U.2 DUMMY VARIABLE 28
;
;    SIMPLE UNIT 3 ATTRIBUTES (.372-.421)
;
;
.372 T3STC                F=AN(1)      ;S.U.3 STRATIGRAPHIC ORDER CODE
.373 T3TX3                F=AN(1)      ;S.U.3 TEXTURE3 (STANDARD)
.374 T3TX2                F=AN(1)      ;S.U.3 TEXTURE2 (STANDARD)
.375 T3TX1                F=AN(1)      ;S.U.3 TEXTURE1 (STANDARD)
.376 T3TEX                F=G(373,375);S.U.3 TEXTURE - ALL THREE
.377 T3UND                F=AN(2)      ;S.U.3 TEXTURE UNIFIED DOMINANT
.378 T3UNU                F=AN(2)      ;S.U.3 TEXTURE UNIFIED SUBDOMINANT
.379 T3UNF                F=G(377,378);S.U.3 TEXTURE UNIFIED
.380 T3GMT                F=AN(1)      ;S.U.3 GENETIC MATERIAL
.381 T3GMS                F=AN(1)      ;S.U.3 GENETIC MATERIAL SUBCODE !N
.382 T3QD1                F=AN(1)      ;S.U.3 QUALIFYING DESCRIPTOR 1
.383 T3QD2                F=AN(1)      ;S.U.3 QUALIFYING DESCRIPTOR 2
.384 T3SX1                F=AN(1)      ;S.U.3 SURFACE EXPRESSION 1
.385 T3SX2                F=AN(1)      ;S.U.3 SURFACE EXPRESSION 2
.386 T3SX3                F=AN(1)      ;S.U.3 SURFACE EXPRESSION 3
.387 T3SXP                F=G(384,386);S.U.3 SURFACE EXPRESSIONS
.388 T3TR1                F=I(32767)  ;S.U.3 THICKNESS, RANGE 1
.389 T3TR2                F=I(32767)  ;S.U.3 THICKNESS, RANGE 2
```

```
.390 T3RND             F=AN(1)        ;S.U.3 CLAST ROUNDNESS
.391 T3CMP             F=AN(1)        ;S.U.3 COMPACTION
.392 T3PER             F=AN(1)        ;S.U.3 PERMEABILITY
.393 T3IND             F=AN(1)        ;S.U.3 INDURATION
.394 T3V01             F=AN(1)        ;S.U.3 DUMMY VARIABLE 1
.395 T3V02             F=AN(1)        ;S.U.3 DUMMY VARIABLE 2
.396 T3V03             F=AN(1)        ;S.U.3 DUMMY VARIABLE 3
.397 T3V04             F=AN(1)        ;S.U.3 DUMMY VARIABLE 4
.398 T3V05             F=AN(1)        ;S.U.3 DUMMY VARIABLE 5
.399 T3V06             F=AN(1)        ;S.U.3 DUMMY VARIABLE 6
.400 T3V07             F=AN(1)        ;S.U.3 DUMMY VARIABLE 7
.401 T3V08             F=AN(1)        ;S.U.3 DUMMY VARIABLE 8
.402 T3V09             F=AN(1)        ;S.U.3 DUMMY VARIABLE 9
.403 T3V10             F=AN(1)        ;S.U.3 DUMMY VARIABLE 10
.404 T3V11             F=AN(1)        ;S.U.3 DUMMY VARIABLE 11
.405 T3V12             F=AN(1)        ;S.U.3 DUMMY VARIABLE 12
.406 T3V13             F=AN(1)        ;S.U.3 DUMMY VARIABLE 13
.407 T3V14             F=AN(1)        ;S.U.3 DUMMY VARIABLE 14
.408 T3V15             F=AN(1)        ;S.U.3 DUMMY VARIABLE 15
.409 T3V16             F=G(394,395);S.U.3 DUMMY VARIABLE 16
.410 T3V17             F=G(396,397);S.U.3 DUMMY VARIABLE 17
.411 T3V18             F=G(398,399);S.U.3 DUMMY VARIABLE 18
.412 T3V19             F=G(400,401);S.U.3 DUMMY VARIABLE 19
.413 T3V20             F=G(402,403);S.U.3 DUMMY VARIABLE 20
.414 T3V21             F=G(404,405);S.U.3 DUMMY VARIABLE 21
.415 T3V22             F=G(406,408);S.U.3 DUMMY VARIABLE 22
.416 T3V23             F=G(394,396);S.U.3 DUMMY VARIABLE 23
.417 T3V24             F=G(397,399);S.U.3 DUMMY VARIABLE 24
.418 T3V25             F=G(400,402);S.U.3 DUMMY VARIABLE 25
.419 T3V26             F=G(403,405);S.U.3 DUMMY VARIABLE 26
.420 T3V27             F=G(406,408);S.U.3 DUMMY VARIABLE 27
.421 T3V28             F=G(394,408);S.U.3 DUMMY VARIABLE 28
;
;    SIMPLE UNIT 4 ATTRIBUTES (.422-.471)
;
;
.422 T4STC             F=AN(1)        ;S.U.4 STRATIGRAPHIC ORDER CODE
.423 T4TX3             F=AN(1)        ;S.U.4 TEXTURE3 (STANDARD)
.424 T4TX2             F=AN(1)        ;S.U.4 TEXTURE2 (STANDARD)
.425 T4TX1             F=AN(1)        ;S.U.4 TEXTURE1 (STANDARD)
.426 T4TEX             F=G(423,425);S.U.4 TEXTURE - ALL THREE
.427 T4UND             F=AN(2)        ;S.U.4 TEXTURE UNIFIED DOMINANT
.428 T4UNU             F=AN(2)        ;S.U.4 TEXTURE UNIFIED SUBDOMINANT
.429 T4UNF             F=G(427,428);S.U.4 TEXTURE UNIFIED
.430 T4GMT             F=AN(1)        ;S.U.4 GENETIC MATERIAL
.431 T4GMS             F=AN(1)        ;S.U.4 GENETIC MATERIAL SUBCODE !N
.432 T4QD1             F=AN(1)        ;S.U.4 QUALIFYING DESCRIPTOR 1
.433 T4QD2             F=AN(1)        ;S.U.4 QUALIFYING DESCRIPTOR 2
.434 T4SX1             F=AN(1)        ;S.U.4 SURFACE EXPRESSION 1
.435 T4SX2             F=AN(1)        ;S.U.4 SURFACE EXPRESSION 2
```

```
.436 T4SX3          F=AN(1)        ;S.U.4 SURFACE EXPRESSION 3
.437 T4SXP          F=G(434,436);S.U.4 SURFACE EXPRESSIONS
.438 T4TR1          F=I(32767)     ;S.U.4 THICKNESS, RANGE 1
.439 T4TR2          F=I(32767)     ;S.U.4 THICKNESS, RANGE 2
.440 T4RND          F=AN(1)        ;S.U.4 CLAST ROUNDNESS
.441 T4CMP          F=AN(1)        ;S.U.4 COMPACTION
.442 T4PER          F=AN(1)        ;S.U.4 PERMEABILITY
.443 T4IND          F=AN(1)        ;S.U.4 INDURATION
.444 T4V01          F=AN(1)        ;S.U.4 DUMMY VARIABLE 1
.445 T4V02          F=AN(1)        ;S.U.4 DUMMY VARIABLE 2
.446 T4V03          F=AN(1)        ;S.U.4 DUMMY VARIABLE 3
.447 T4V04          F=AN(1)        ;S.U.4 DUMMY VARIABLE 4
.448 T4V05          F=AN(1)        ;S.U.4 DUMMY VARIABLE 5
.449 T4V06          F=AN(1)        ;S.U.4 DUMMY VARIABLE 6
.450 T4V07          F=AN(1)        ;S.U.4 DUMMY VARIABLE 7
.451 T4V08          F=AN(1)        ;S.U.4 DUMMY VARIABLE 8
.452 T4V09          F=AN(1)        ;S.U.4 DUMMY VARIABLE 9
.453 T4V10          F=AN(1)        ;S.U.4 DUMMY VARIABLE 10
.454 T4V11          F=AN(1)        ;S.U.4 DUMMY VARIABLE 11
.455 T4V12          F=AN(1)        ;S.U.4 DUMMY VARIABLE 12
.456 T4V13          F=AN(1)        ;S.U.4 DUMMY VARIABLE 13
.457 T4V14          F=AN(1)        ;S.U.4 DUMMY VARIABLE 14
.458 T4V15          F=AN(1)        ;S.U.4 DUMMY VARIABLE 15
.459 T4V16          F=G(444,445);S.U.4 DUMMY VARIABLE 16
.460 T4V17          F=G(446,447);S.U.4 DUMMY VARIABLE 17
.461 T4V18          F=G(448,449);S.U.4 DUMMY VARIABLE 18
.462 T4V19          F=G(450,451);S.U.4 DUMMY VARIABLE 19
.463 T4V20          F=G(452,453);S.U.4 DUMMY VARIABLE 20
.464 T4V21          F=G(454,455);S.U.4 DUMMY VARIABLE 21
.465 T4V22          F=G(456,458);S.U.4 DUMMY VARIABLE 22
.466 T4V23          F=G(444,446);S.U.4 DUMMY VARIABLE 23
.467 T4V24          F=G(447,449);S.U.4 DUMMY VARIABLE 24
.468 T4V25          F=G(450,452);S.U.4 DUMMY VARIABLE 25
.469 T4V26          F=G(453,455);S.U.4 DUMMY VARIABLE 26
.470 T4V27          F=G(456,458);S.U.4 DUMMY VARIABLE 27
.471 T4V28          F=G(444,458);S.U.4 DUMMY VARIABLE 28
;
;    SIMPLE UNIT 5 ATTRIBUTES (.472-.521)
;
;
.472 T5STC          F=AN(1)        ;S.U.5 STRATIGRAPHIC ORDER CODE
.473 T5TX3          F=AN(1)        ;S.U.5 TEXTURE3 (STANDARD)
.474 T5TX2          F=AN(1)        ;S.U.5 TEXTURE2 (STANDARD)
.475 T5TX1          F=AN(1)        ;S.U.5 TEXTURE1 (STANDARD)
.476 T5TEX          F=G(473,475);S.U.5 TEXTURE - ALL THREE
.477 T5UND          F=AN(2)        ;S.U.5 TEXTURE UNIFIED DOMINANT
.478 T5UNU          F=AN(2)        ;S.U.5 TEXTURE UNIFIED SUBDOMINANT
.479 T5UNF          F=G(477,478);S.U.5 TEXTURE UNIFIED
.480 T5GMT          F=AN(1)        ;S.U.5 GENETIC MATERIAL
.481 T5GMS          F=AN(1)        ;S.U.5 GENETIC MATERIAL SUBCODE !N
```

APPENDIX A (cont'd)

```
.482 T5QD1              F=AN(1)       ;S.U.5 QUALIFYING DESCRIPTOR 1
.483 T5QD2              F=AN(1)       ;S.U.5 QUALIFYING DESCRIPTOR 2
.484 T5SX1              F=AN(1)       ;S.U.5 SURFACE EXPRESSION 1
.485 T5SX2              F=AN(1)       ;S.U.5 SURFACE EXPRESSION 2
.486 T5SX3              F=AN(1)       ;S.U.5 SURFACE EXPRESSION 3
.487 T5SXP              F=G(484,486);S.U.5 SURFACE EXPRESSIONS
.488 T5TR1              F=I(32767)    ;S.U.5 THICKNESS, RANGE 1
.489 T5TR2              F=I(32767)    ;S.U.5 THICKNESS, RANGE 2
.490 T5RND              F=AN(1)       ;S.U.5 CLAST ROUNDNESS
.491 T5CMP              F=AN(1)       ;S.U.5 COMPACTION
.492 T5PER              F=AN(1)       ;S.U.5 PERMEABILITY
.493 T5IND              F=AN(1)       ;S.U.5 INDURATION
.494 T5V01              F=AN(1)       ;S.U.5 DUMMY VARIABLE 1
.495 T5V02              F=AN(1)       ;S.U.5 DUMMY VARIABLE 2
.496 T5V03              F=AN(1)       ;S.U.5 DUMMY VARIABLE 3
.497 T5V04              F=AN(1)       ;S.U.5 DUMMY VARIABLE 4
.498 T5V05              F=AN(1)       ;S.U.5 DUMMY VARIABLE 5
.499 T5V06              F=AN(1)       ;S.U.5 DUMMY VARIABLE 6
.500 T5V07              F=AN(1)       ;S.U.5 DUMMY VARIABLE 7
.501 T5V08              F=AN(1)       ;S.U.5 DUMMY VARIABLE 8
.502 T5V09              F=AN(1)       ;S.U.5 DUMMY VARIABLE 9
.503 T5V10              F=AN(1)       ;S.U.5 DUMMY VARIABLE 10
.504 T5V11              F=AN(1)       ;S.U.5 DUMMY VARIABLE 11
.505 T5V12              F=AN(1)       ;S.U.5 DUMMY VARIABLE 12
.506 T5V13              F=AN(1)       ;S.U.5 DUMMY VARIABLE 13
.507 T5V14              F=AN(1)       ;S.U.5 DUMMY VARIABLE 14
.508 T5V15              F=AN(1)       ;S.U.5 DUMMY VARIABLE 15
.509 T5V16              F=G(494,495);S.U.5 DUMMY VARIABLE 16
.510 T5V17              F=G(496,497);S.U.5 DUMMY VARIABLE 17
.511 T5V18              F=G(498,499);S.U.5 DUMMY VARIABLE 18
.512 T5V19              F=G(500,501);S.U.5 DUMMY VARIABLE 19
.513 T5V20              F=G(502,503);S.U.5 DUMMY VARIABLE 20
.514 T5V21              F=G(504,505);S.U.5 DUMMY VARIABLE 21
.515 T5V22              F=G(506,508);S.U.5 DUMMY VARIABLE 22
.516 T5V23              F=G(494,496);S.U.5 DUMMY VARIABLE 23
.517 T5V24              F=G(497,499);S.U.5 DUMMY VARIABLE 24
.518 T5V25              F=G(500,502);S.U.5 DUMMY VARIABLE 25
.519 T5V26              F=G(503,505);S.U.5 DUMMY VARIABLE 26
.520 T5V27              F=G(506,508);S.U.5 DUMMY VARIABLE 27
.521 T5V28              F=G(494,508);S.U.2 DUMMY VARIABLE 28
;
;    SIMPLE UNIT 6 ATTRIBUTES (.522-.571)
;
;
.522 T6STC              F=AN(1)       ;S.U.6 STRATIGRAPHIC ORDER CODE
.523 T6TX3              F=AN(1)       ;S.U.6 TEXTURE3 (STANDARD)
.524 T6TX2              F=AN(1)       ;S.U.6 TEXTURE2 (STANDARD)
.525 T6TX1              F=AN(1)       ;S.U.6 TEXTURE1 (STANDARD)
.526 T6TEX              F=G(523,525);S.U.6 TEXTURE - ALL THREE
.527 T6UND              F=AN(2)       ;S.U.6 TEXTURE UNIFIED DOMINANT
```

```
.528 T6UNU        F=AN(2)        ;S.U.6 TEXTURE UNIFIED SUBDOMINANT
.529 T6UNF        F=G(527,528);S.U.6 TEXTURE UNIFIED
.530 T6GMT        F=AN(1)        ;S.U.6 GENETIC MATERIAL
.531 T6GMS        F=AN(1)        ;S.U.6 GENETIC MATERIAL SUBCODE !N
.532 T6QD1        F=AN(1)        ;S.U.6 QUALIFYING DESCRIPTOR 1
.533 T6QD2        F=AN(1)        ;S.U.6 QUALIFYING DESCRIPTOR 2
.534 T6SX1        F=AN(1)        ;S.U.6 SURFACE EXPRESSION 1
.535 T6SX2        F=AN(1)        ;S.U.6 SURFACE EXPRESSION 2
.536 T6SX3        F=AN(1)        ;S.U.6 SURFACE EXPRESSION 3
.537 T6SXP        F=G(534,536);S.U.6 SURFACE EXPRESSIONS
.538 T6TR1        F=I(32767)     ;S.U.6 THICKNESS, RANGE 1
.539 T6TR2        F=I(32767)     ;S.U.6 THICKNESS, RANGE 2
.540 T6RND        F=AN(1)        ;S.U.6 CLAST ROUNDNESS
.541 T6CMP        F=AN(1)        ;S.U.6 COMPACTION
.542 T6PER        F=AN(1)        ;S.U.6 PERMEABILITY
.543 T6IND        F=AN(1)        ;S.U.6 INDURATION
.544 T6V01        F=AN(1)        ;S.U.6 DUMMY VARIABLE 1
.545 T6V02        F=AN(1)        ;S.U.6 DUMMY VARIABLE 2
.546 T6V03        F=AN(1)        ;S.U.6 DUMMY VARIABLE 3
.547 T6V04        F=AN(1)        ;S.U.6 DUMMY VARIABLE 4
.548 T6V05        F=AN(1)        ;S.U.6 DUMMY VARIABLE 5
.549 T6V06        F=AN(1)        ;S.U.6 DUMMY VARIABLE 6
.550 T6V07        F=AN(1)        ;S.U.6 DUMMY VARIABLE 7
.551 T6V08        F=AN(1)        ;S.U.6 DUMMY VARIABLE 8
.552 T6V09        F=AN(1)        ;S.U.6 DUMMY VARIABLE 9
.553 T6V10        F=AN(1)        ;S.U.6 DUMMY VARIABLE 10
.554 T6V11        F=AN(1)        ;S.U.6 DUMMY VARIABLE 11
.555 T6V12        F=AN(1)        ;S.U.6 DUMMY VARIABLE 12
.556 T6V13        F=AN(1)        ;S.U.6 DUMMY VARIABLE 13
.557 T6V14        F=AN(1)        ;S.U.6 DUMMY VARIABLE 14
.558 T6V15        F=AN(1)        ;S.U.6 DUMMY VARIABLE 15
.559 T6V16        F=G(544,545);S.U.6 DUMMY VARIABLE 16
.560 T6V17        F=G(546,547);S.U.6 DUMMY VARIABLE 17
.561 T6V18        F=G(548,549);S.U.6 DUMMY VARIABLE 18
.562 T6V19        F=G(550,551);S.U.6 DUMMY VARIABLE 19
.563 T6V20        F=G(552,553);S.U.6 DUMMY VARIABLE 20
.564 T6V21        F=G(554,555);S.U.6 DUMMY VARIABLE 21
.565 T6V22        F=G(556,558);S.U.6 DUMMY VARIABLE 22
.566 T6V23        F=G(544,546);S.U.6 DUMMY VARIABLE 23
.567 T6V24        F=G(547,549);S.U.6 DUMMY VARIABLE 24
.568 T6V25        F=G(550,552);S.U.6 DUMMY VARIABLE 25
.569 T6V26        F=G(553,555);S.U.6 DUMMY VARIABLE 26
.570 T6V27        F=G(556,558);S.U.6 DUMMY VARIABLE 27
.571 T6V28        F=G(544,558);S.U.6 DUMMY VARIABLE 28

END
```

APPENDIX B

PROCEDURE TO INPUT HISTORICAL BIOPHYSICAL SOIL ASSOCIATION MAPS INTO CAPAMP

PROBLEM: The map symbols on reconnaissance soil maps commonly represent soil association components. These components are commonly composed of two distinct soil individuals. The CAPAMP Soil Cartographic File allows the description of only one distinct soil individual per Soil Key. Thus, within the CAPAMP environment, the notion of a soil is analogous to that of a soil series, regardless of the scale of mapping. This necessitates the conversion of soil association components into a CAPAMP acceptable form such that each soil individual has a unique Soil Key. Soil associations are defined using four distinct types of soil individuals:

i) the modal soil individual,

ii) phases of the modal soil individual,

iii) a non-modal soil individual defined in relation to the existing modal soil individual,

iv) a non-modal soil individual not defined in relation to the existing modal soil individual.

GUIDELINES: Specific guidelines have been developed for determining the appropriate Soil Keys to be used in CAPAMP for each of the four distinct types of soil individuals making up soil association descriptions. The Barrett soil association description (Table XVIII), as defined for the Manson River - Fort Fraser project, will be used as an example for determining the appropriate Soil Keys to be entered on the SOIL POLYGON forms and to be described on the SOIL CARTOGRAPHIC FILE forms.

1) Soil Key for the modal soil individual.

This is the central concept of the association, and is usually the most frequently occurring "Most Common Soil". In the case of the Barrett soil association, the well to moderately well drained O.GL is the modal soil individual and is given the symbol BA on the map legend. The 15 character Soil Key for CAPAMP for the modal soil individual consists of the project identification code in the first six spaces (MNRFFR for the Manson River - Fort Fraser project), followed by BA, followed by seven blanks. Thus, BA is left justified in the Name field, and the Association and Phase fields are left blank.

2) Soil Key for phases of the modal soil individual.

Two types of phases of the modal soil individual are represented by unique Soil Keys. The first type includes all non-taxonomic soil phases of the modal soil individual used as functional units designed according to the purpose of the survey. Established soil phases of this type are given in Table XIX. The second type, provided just for the purpose of developing required Soil Keys for distinct individual soils, is a bookkeeping "taxonomic" phase based on Subgroups of the Great Group to which the modal soil individual belongs.

In the case of the Barrett soil association the O.GL (lithic phase) represents an example of the first type of phase and is given the Soil Key MNRFFRBA___L1__ with L1 representing a lithic phase, 10 to 100 cm in depth. Such phases are to be composed of one or two letters or one letter followed by a digit. Codes for phases used, but not listed in Table XVII, are to be cleared through the Soil Correlator to promote as much consistency as possible. The Soil Correlator will maintain an up-to-date listing of phases in use.

Using the Barrett soil association as an example (see end of appendix), the possible "taxonomic" phases include the subgroups listed in the Gray Luvisol great group of which the O.GL, which is the modal soil individual of Barrett, is a member. Soil Keys for the taxonomic phases are designated by the project identification code and name code for the modal soil individual followed by an integer in the Association field as follows:

SUBGROUP	SOIL KEY
Orthic Gray Luvisol	MNRFFRBA__1____
Dark Gray Luvisol	MNRFFRBA__2____
Brunisolic Gray Luvisol	MNRFFRBA__3____
Podzolic Gray Luvisol	MNRFFRBA__4____
Solonetzic Gray Luvisol	MNRFFRBA__5____
Fragic Gray Luvisol	MNRFFRBA__6____
Gleyed Gray Luvisol	MNRFFRBA__7____
Gleyed Dark Gray Luvisol	MNRFFRBA__8____
Gleyed Brunisolic Gray Luvisol	MNRFFRBA__9____
Gleyed Podzolic Gray Luvisol	MNRFFRBA_10____
Gleyed Solonetzic Gray Luvisol	MNRFFRBA_11____
Gleyed Fragic Gray Luvisol	MNRFFRBA_12____

Therefore, the Dark Gray Luvisol in the Barrett soil association component BA 2 would be represented by the Soil Key MNRFFRBA__2____ and the Gleyed Gray Luvisol in the Barrett soil association components BA 7 and BA 9 would be represented by the Soil Key MNRFFBA_7____. Note that the digit used in the Soil Key is equivalent to the position of the relevant subgroup within the appropriate great group listing. As an added example, if the modal soil individual was a Terric Mesisol and a Soil Key was required for a Typic Mesisol, the digit would be 1, or for a Terric Fibric Mesisol, it would be 7.

The taxonomic phase is used only when the soil individual (subgroup) is not equivalent to a soil individual which can be defined in relation to existing soil names. For example, the soil for the BR.GL in the Barrett description can be represented as BA 3, but is not because it is a previously defined soil individual (i.e. the Deserters modal soil individual).

3) Soil Key for non-modal soil individuals defined in relation to existing soil names.

This includes soil individuals in the association description which are equivalent to soil individuals in other associations for which Soil Keys determined as above already exist. The BR.GL in the Barrett soil association is equivalent to the modal soil individual in the Deserters soil association, also mapped on the same project; thus the same Soil Key, MNRFFRD________, applies. The E.DYB in the Barrett soil association is the same as a taxonomic phase in the Crystal soil association, again part of the same project, and hence the Soil Key MNRFFRCR__2____ is used. If the soil already exists as part of a project previously entered into CAPAMP, a new Soil Key should be established. The new Soil Key should consist of the current project identification code and the same name, association, and phase codes as used on the already existing soil. (Use of the Copy Key fields simplifies doing this.)

4) Soil Key for non-modal soil individuals not defined in relation to existing soil names.

This case includes soil individuals in the association description for which Soil Keys cannot be determined by one of the previous methods. In effect, it represents an unnamed soil individual. The Soil Keys for these soil individuals will be of the form ##V ##, where each # is a digit from 0 to 9, and where ##V and ## refer to the name and association fields, respectively. In the Barrett soil association the HU.LG is handled in this way. During the procedure of converting the Manson River - Fort Fraser soil legend, the soil was given the Soil Key MNRFFR3V_06____. The 3 is assigned to the project by the Soil Correlator to prevent the creation of the same Soil Key for different soil individuals. The 06 indicates that in the process of converting the soil associations in the Manson River - Fort Fraser project area into Soil Keys compatible for use in CAPAMP, the HU.LG was the 6th soil individual of this type encountered. For each project a table of such Soil Keys is to be maintained, indicating its description in terms parent material, forest zone, and soil classification (taxonomy), and in which soil association it occurs for future correlation between projects.

Thus, the Soil Keys compatible with CAPAMP for the Barrett soil association are:

SOIL SYMBOL		SOIL KEYS										
		Proj.	Name	As	P1	P2		Proj.	Name	As	P1	P2
BA 1	=	MNRFFR	BA									
BA 2	=	MNRFFR	BA				+	MNRFFR	BA	2		
BA 3	=	MNRFFR	BA				+	MNRFFR	D			
BA 4	=	MNRFFR	BA				+	MNRFFR	CR	2		
BA 5	=	MNRFFR	BA				+	MNRFFR	BA		L1	
BA 6	=	MNRFFR	BA		L1		+	MNRFFR	BA			

BA 7 = MNRFFR¦BA ¦ ¦ ¦ + MNRFFR¦BA ¦ 7¦ ¦

BA 8 = MNRFFR¦BA ¦ ¦ ¦ + MNRFFR¦3V ¦06¦ ¦

BA 9 = MNRFFR¦BA ¦ 7¦ ¦ + MNRFFR¦BA ¦ ¦ ¦

The Soil Key is composed of the following fields: Project, Name, AS, P1 and P2. The position of the codes is important when filling out the Polygon or Cartographic file forms. Note that for the conversion of reconnaissance mapping the AS field is reserved for the designation of "taxonomic" phases and non-modal soil individuals not defined by existing soil names. Up to two phases (P1 and P2) can be used to distinguish different soil individuals. For the conversion of existing detail mapping, the AS field as used for reconnaissance map conversion is not required, and can be used as a third phase, if required. Project codes are to be confirmed with the Thematic Mapping Unit.

SOIL POLYGON FORMS:

Once the soil association components in the reconnaissance soil legend have been converted into a CAPAMP acceptable form such that each soil individual has a unique Soil Key, completion of the SOIL POLYGON FORMS can take place. Note that the SOIL POLYGON FORM allows input of only three soil individuals (Soil Keys) per polygon whereas existing reconnaissance soil maps may have polygon symbols representing up to three association components, which in turn, may represent up to six Soil Keys. These six Soil Keys must be reduced to the three Soil Keys which best represent the soil polygon for interpretive purposes. In doing the contraction of Soil Keys, the concepts of non-limiting similar and dissimilar soils or non-soils and limiting dissimilar soils or non-soils should be kept in mind when judging what percentage combination of three Soil Keys best represents the original polygon symbol.

For each project area converted to CAPAMP in this manner, a Project File should be maintained containing the project identification code; the project area involved (NTS description); and one completed copy (as example) of:

i) Soil Polygon File Form

ii) Soil Cartographic File Form

iii) Agriculture Capability File Form

indicating which dummy variables were used, their definition, and a description of any entries which are not coded according to standard procedure. The Project File is the responsibility of the Project Coordinator and a copy is to be maintained with the CAPAMP systems analysts.

TABLE XVIII
BARRETT Soil Association - BA

Barrett soils are widespread throughout the Subboreal white spruce - alpine fir forest zone in the Nechako Plateau physiographic region. They have developed in deep, compact, often drumlinized, gravelly, moderately fine textured, neutral basal till deposits. Surface layers are sometimes somewhat coarser textured, particularly in the vicinity of ice marginal channels which occur with varying frequency. Slopes in the undulating to rolling landscape usually vary between 2 and 30% and elevations range between 730 and 1065 m asl.

Barrett soils are generally gravelly loam or gravelly clay loam in texture, but surface textures in a few areas are gravelly sandy loam due to disintegration of stagnant ice. The coarse fragment content is usually between 20 and 30%. Usually, the upper soil horizon is 20 to 50 cm thick, slightly acid, friable and grayish in color. It is underlain by a brownish-gray, clay accumulation horizon 20 to 40 cm thick which is moderately to slowly pervious. Relatively unweathered, commonly neutral parent material occurs at depths of 100 cm or less. A mor layer between 2 and 5 cm thick is present on the soil surface. The usual classification is Orthic Gray Luvisol.

Soil Assoc.	Most Common Soil		Less Common Soil		
Component	Classification	Drainage	Classification	Drainage	Comments
BA 1	Orthic Gray Luvisol	well to mod. well	--	--	Consists dominantly of the most common soil as described above.
BA 2	Orthic Gray Luvisol	well to mod. well	Dark Gray Luvisol	well to mod. well	Less common soil has an organically enriched surface horizon (Ah) due to occurrence under relatively open deciduous vegetation on low elevation, south and west facing aspects.
BA 3	Orthic Gray Luvisol	well to mod. well	Brunisolic Gray Luvisol	well to mod. well	Less common soil has a yellowish-brown surface horizon indicating more intense leaching and weathering due to a climatically wetter environment.
BA 4	Orthic Gray Luvisol	well to mod. well	Eluviated Dystric Brunisol	well to rapid	Less common soil has no or only a weakly developed clay accumulation horizon due to having developed in a somewhat coarser textured material at and near the soil surface.
BA 5	Orthic Gray Luvisol	well to mod. well	Orthic Gray Luvisol (lithic phase)	well	Less common soil is shallower than 1 m to bedrock.
BA 6	Orthic Gray Luvisol	well	Orthic Gray Luvisol	well to mod. well	Soil shallower than 1 m to bedrock is more common than the deeper soil.

TABLE XVIII (cont'd)

Soil Assoc. Component	Most Common Soil Classification	Drainage	Less Common Soil Classification	Drainage	Comments
BA 7	Orthic Gray Luvisol	well to mod. well	Gleyed Gray Luvisol	imperfect	Less common soil periodically contains excess moisture due to a temporary, perched water table and/or location in a moisture receiving landscape position. It is mottled in the subsoil.
BA 8	Orthic Gray Luvisol	well to mod. well	Humic Luvic Gleysol	poor to very poor	Less common soil usually contains excess moisture due to a permanently high water table. It is gleyed and usually depressional in relation to the most common soil.
BA 9	Gleyed Gray Luvisol	imperfect	Orthic Gray Luvisol	well to mod. well	Mottled soil with periodic excess moisture due to a temporary, perched water table and/or location in a moisture receiving landscape position is more common than the usual soil.

TABLE XIX
CODES USED FOR RECOGNIZED SOIL PHASES

Code	Phase	Brief Definition
	Slope:	
1	level	0 - 0.5%
2	nearly level	0.5 - 2%
3	very gentle slopes	2 - 5%
4	gentle slopes	6 - 9%
5	moderate slopes	10 - 15%
6	strong slopes	16 - 30%
7	very strong slopes	31 - 45%
8	extreme slopes	46 - 70%
9	steep slopes	70 - 100%
10	very steep slopes	> 100%
	Water Erosion:	
W1	slightly water-eroded	Up to 25% of original A horizon eroded.
W2	moderately water-eroded	Approximately 25 to 75% or original A horizon eroded.
W3	severely water-eroded	More than 75% of original A horizon eroded.
W4	gullied land	Land dissected by deep gullies.
	Wind Erosion:	
D1	wind-eroded	Approximately 25 to 75% of original A horizon eroded.
D2	severely wind-eroded	More than 75% of original A horizon eroded.
D3	blown-out land	Most of original solum eroded.
	Soil Deposition:	
OB	overblown deposition	Significant deposit of wind-blown material.
OW	overwash deposition	Significant deposit of water-eroded material.
	Stoniness (fragments >15 cm diameter)	
S1	non-stony	<0.01% of surface, stones >30 m apart.
S2	slightly stony	0.01 to 0.1% of surface, stones 10 to 30 m apart.
S3	moderately stony	0.1 to 3% of surface, stones 2 to 10 m apart.
S4	very stony	3 to 15% of surface, stones 1 to 2 m apart.
S5	exceedingly stony	15 to 50% of surface, stones 0.1 to 1 m apart.
S6	excessively stony	>50% of surface, stones <0.1 m apart.
	Rock Outcrop	
R1	non-rocky	<2% of surface, >75 m apart.
R2	slightly rocky	2 to 10% of surface, 25 to 75 m apart.
R3	moderately rocky	10 to 25% of surface, 10 to 25 m apart.
R4	very rocky	25 to 50% of surface, 2 to 10 m apart.
R5	exceedingly rocky	50 to 90% of surface, <2 m apart.
R6	excessively rocky	>90% of surface is bedrock.
	Lithic Phases	
L1	variable lithic	10 to 100 cm deep
L2	deep lithic	50 to 100 cm deep
L3	shallow lithic	10 to 50 cm deep
PT	peaty phase	Mineral soil with >15 cm of organic matter on surface.

APPENDIX C

OUTLINE OF CANADIAN SYSTEM OF SOIL CLASSIFICATION ABBREVIATIONS FOR SUBGROUPS

Order	Great Group	Subgroup	Code
Brunixsolic	Melanic Brunisol	Orthic Melanic Brunisol	O.MB
		Eluviated Melanic Brunisol	E.MB
		Gleyed Melanic Brunisol	GL.MB
		Gleyed Eluviated Melanic Brunisol	GLE.MB
	Eutric Brunisol	Orthic Eutric Brunisol	O.EB
		Eluviated Eutric Brunisol	E.EB
		Gleyed Eutric Brunisol	GL.EB
		Gleyed Eluviated Eutric Brunisol	GLE.EB
	Sombric Brunisol	Orthic Sombric Brunisol	O.SB
		Eluviated Sombric Brunisol	E.SB
		Duric Sombric Brunisol	DU.SB
		Gleyed Sombric Brunisol	GL.SB
		Gleyed Eluviated Sombric Brunisol	GLE.SB
	Dystric Brunisol	Orthic Dystric Brunisol	O.DYB
		Eluviated Dystric Brunisol	E.DYB
		Duric Dystric Brunisol	DU.DYB
		Gleyed Dystric Brunisol	GL.DYB
		Gleyed Eluviated Dystric Brunisol	GLE.DYB
Chernozemic	Brown	Orthic Brown	O.B
		Rego Brown	R.B
		Calcareous Brown	CA.B
		Eluviated Brown	E.B
		Solonetzic Brown	SZ.B
		Gleyed Brown	GL.B
		Gleyed Rego Brown	GLR.B
		Gleyed Calcareous Brown	GLCA.B
		Gleyed Eluviated Brown	GLE.B
		Gleyed Solonetzic Brown	GLSZ.B
	Dark Brown	Orthic Dark Brown	O.DB
		Rego Dark Brown	R.DB
		Calcareous Dark Brown	CA.DB
		Eluviated Dark Brown	E.DB
		Solonetzic Dark Brown	SZ.DB
		Gleyed Dark Brown	GL.DB
		Gleyed Rego Dark Brown	GLR.DB
		Gleyed Calcareous Dark Brown	GLCA.DB
		Gleyed Eluviated Dark Brown	GLE.DB
		Gleyed Solonetzic Dark Brown	GLSZ.DB

Order	Great Group	Subgroup	Code
	Black	Orthic Black	O.BL
		Rego Black	R.BL
		Calcareous Black	CA.BL
		Eluviated Black	E.BL
		Solonetzic Black	SZ.BL
		Gleyed Black	GL.BL
		Gleyed Rego Black	GLR.BL
		Gleyed Calcareous Black	GLCA.BL
		Gleyed Eluviated Black	GLE.BL
		Gleyed Solonetzic Black	GLSZ.BL
	Dark Gray	Orthic Dark Gray	O.DG
		Rego Dark Gray	R.DG
		Calcareous Dark Gray	CA.DG
		Solonetzic Dark Gray	SZ.DG
		Gleyed Dark Gray	GL.DG
		Gleyed Rego Dark Gray	GLR.DG
		Gleyed Calcareous Dark Gray	GLCA.DG
		Gleyed Solonetzic Dark Gray	GLSZ.DG
Cryosolic	Turbic Cryosol	Orthic Turbic Cryosol	O.TC
		Brunisolic Turbic Cryosol	BR.TC
		Regosolic Turbic Cryosol	R.TC
		Gleysolic Turbic Cryosol	GL.TC
	Static Cryosol	Orthic Static Cryosol	O.SC
		Brunisolic Static Cryosol	BR.SC
		Regosolic Static Cryosol	R.SC
		Gleysolic Static Cryosol	GL.SC
	Organic Cryosol	Fibric Organic Cryosol	FI.OC
		Mesic Organic Cryosol	ME.OC
		Humic Organic Cryosol	HU.MC
		Terric Fibric Organic Cryosol	TFI.OC
		Terric Mesic Organic Cryosol	TME.OC
		Terric Humic Organic Cryosol	THU.OC
		Glacic Organic Cryosol	GC.OC
Gleysolic	Humic Gleysol	Orthic Humic Gleysol	O.HG
		Rego Humic Gleysol	R.HG
		Fera Humic Gleysol	FE.HG
		Solonetzic Humic Gleysol	SZ.HG
	Gleysol	Orthic Gleysol	O.G
		Rego Gleysol	R.G

Order	Great Group	Subgroup	Code
		Fera Gleysol	FE.G
		Solonetzic Gleysol	SZ.G
	Luvic Gleysol	Orthic Luvic Gleysol	O.LG
		Humic Luvic Gleysol	HU.LG
		Fera Luvic Gleysol	FE.LG
		Fragic Luvic Gleysol	FR.LG
		Solonetzic Luvic Gleysol	SZ.LG
Luvisolic	Gray Brown Luvisol	Orthic Gray Brown Luvisol	O.GBL
		Brunisolic Gray Brown Luvisol	BR.GBL
		Podzolic Gray Brown Luvisol	PZ.GBL
		Gleyed Gray Brown Luvisol	GL.GBL
		Gleyed Brunisolic Gray Brown Luvisol	GLBR.GBL
		Gleyed Podzolic Gray Brown Luvisol	GLPZ.GBL
	Gray Luvisol	Orthic Gray Luvisol	O.GL
		Dark Gray Luvisol	D.GL
		Brunisolic Gray Luvisol	BR.GL
		Podzolic Gray Luvisol	PZ.GL
		Solonetzic Gray Luvisol	SZ.GL
		Fragic Gray Luvisol	FR.GL
		Gleyed Gray Luvisol	GL.GL
		Gleyed Dark Gray Luvisol	GLD.GL
		Gleyed Brunisolic Gray Luvisol	GLBR.GL
		Gleyed Podzolic Gray Luvisol	GLPZ.GL
		Gleyed Solonetzic Gray Luvisol	GLSZ.GL
		Gleyed Fragic Gray Luvisol	GLFR.GL
Organic	Fibrisol	Typic Fibrisol	TY.F
		Mesic Fibrisol	ME.F
		Humic Fibrisol	HU.F
		Limno Fibrisol	LM.F
		Cumulo Fibrisol	CU.F
		Terric Fibrisol	T.F
		Terric Mesic Fibrisol	TME.F
		Terric Humic Fibrisol	THU.F
		Hydric Fibrisol	HY.F
	Mesisol	Typic Mesisol	TY.M
		Fibric Mesisol	FI.M
		Humic Mesisol	HU.M
		Limno Mesisol	LM.M
		Cumulo Mesisol	CU.M
		Terric Mesisol	T.M
		Terric Fibric Mesisol	TFI.M

APPENDIX C (cont'd)

Order	Great Group	Subgroup	Code
		Terric Humic Mesisol	THU.M
		Hydric Mesisol	HY.M
	Humisol	Typic Humisol	TY.H
		Fibric Humisol	FI.H
		Mesic Humisol	ME.H
		Limno Humisol	LM.H
		Cumulo Humisol	CU.H
		Terric Humisol	T.H
		Terric Fibric Humisol	TFI.H
		Terric Mesic Humisol	TME.H
		Hydric Humisol	HY.H
	Folisol	Typic Folisol	TY.FO (old code)
		Hemic Folisol	HE.FO
		Humic Folisol	HU. FO
		Lignic Folisol	LI.FO
		Histic Folisol	HI.FO
Podzolic	Humic Podzol	Orthic Humic Podzol	O.HP
		Ortstein Humic Podzol	OT.HP
		Placic Humic Podzol	P.HP
		Duric Humic Podzol	DU.HP
		Fragic Humic Podzol	FR.HP
	Ferro-Humic Podzol	Orthic Ferro-Humic Podzol	O.FHP
		Ortstein Ferro-Humic Podzol	OT.FHP
		Placic Ferro-Humic Podzol	P.FHP
		Duric Ferro-Humic Podzol	DU.FHP
		Fragic Ferro-Humic Podzol	FR.FHP
		Luvisolic Ferro-Humic Podzol	LU.FHP
		Sombric Ferro-Humic Podzol	SM.FHP
		Gleyed Ferro-Humic Podzol	GL.FHP
		Gleyed Ortstein Ferro-Humic Podzol	GLOT.FHP
		Gleyed Sombric Ferro-Humic Podzol	GLSM.FHP
	Humo-Ferric Podzol	Orthic Humo-Ferric Podzol	O.HFP
		Ortstein Humo-Ferric Podzol	OT.HFP
		Placic Humo-Ferric Podzol	P.HFP
		Duric Humo-Ferric Podzol	DU.HFP
		Fragic Humo-Ferric Podzol	FR.HFP
		Luvisolic Humo-Ferric Podzol	LU.HFP
		Sombric Humo-Ferric Podzol	SM.HFP
		Gleyed Humo-Ferric Podzol	GL.HFP
		Gleyed Ortstein Humo-Ferric Podzol	GLOT.HFP

APPENDIX C (cont'd)

Order	Great Group	Subgroup	Code
		Gleyed Sombric Humo-Ferric Podzol	GLSM.HFP
Regosolic	Regosol	Orthic Regosol	O.R
		Cumulic Regosol	CU.R
		Gleyed Regosol	GL.R
		Gleyed Cumulic Regosol	GLCU.R
	Humic Regosol	Orthic Humic Regosol	O.HR
		Cumulic Humic Regosol	CU.HR
		Gleyed Humic Regosol	GL.HR
		Gleyed Cumulic Humic Regosol	GLCU.HR
Solonetzic	Solonetz	Brown Solonetz	B.SZ
		Dark Brown Solonetz	DB.SZ
		Black Solonetz	BL.SZ
		Alkaline Solonetz	A.SZ
		Gleyed Brown Solonetz	GLB.SZ
		Gleyed Dark Brown Solonetz	GLDB.SZ
		Gleyed Black Solonetz	GLBL.SZ
	Solodized Solonetz	Brown Solodized Solonetz	B.SS
		Dark Brown Solodized Solonetz	DB.SS
		Black Solodized Solonetz	BL.SS
		Dark Gray Solodized Solonetz	DG.SS
		Gray Solodized Solonetz	G.SS
		Gleyed Brown Solodized Solonetz	GLB.SS
		Gleyed Dark Brown Solodized Solonetz	GLDB.SS
		Gleyed Black Solodized Solonetz	GLBL.SS
		Gleyed Dark Gray Solodized Solonetz	GLDG.SS
		Gleyed Gray Solodized Solonetz	GLG.SS
	Solod	Brown Solod	B.SO
		Dark Brown Solod	DB.SO
		Black Solod	BL.SO
		Dark Gray Solod	DG.SO
		Gray Solod	G.SO
		Gleyed Brown Solod	GLB.SO
		Gleyed Dark Brown Solod	GLDB.SO
		Gleyed Black Solod	GLBL.SO
		Gleyed Dark Gray Solod	GLDG.SO
		Gleyed Gray Solod	GLG.SO

[1] Expert Committee on Soil Survey (1987).

APPENDIX D

MINISTRY OF ENVIRONMENT AND PARKS, BIOPHYSICAL VEGETATION CODES

I. Vegetation Sections By Region

Code	Region	Code	Sections	Description/location
B	Boreal	1	Peace River	Fort St. John area
		2	Wapiti	southeastern area of Boreal Region near Murray and Wapiti Rivers
		3	Stikine River	Dease Lake and upper and middle Stikine River drainage
DI	Dry Interior	1	Ashcroft	Ashcroft and Kamloops area
		2	Big Bar	Fraser River Valley in the Big Bar to Williams Lake area
		3	Williams Lake	Williams Lake and middle Chilcotin River area
		4	Bridge Lake	Bridge Lake and upper Bonaparte River area
		5	Vernon	Okanagan Valley area
		6	Cranbrook	Rocky Mountain Trench south of Columbia Lake
		7	Radium Hot Springs	middle Kootenay River Valley, White River and Elk River Valleys
		8	Invermere	Windermere Lake area
		9	Spillimacheen River	Spillimacheen River area and upper Kootenay River Valley
IC	Inner Coast	1	Malahat	southern Vancouver Island and southern Gulf Islands
		2	Quadra	east coast of Vancouver Island, Gulf Islands and adjacent mainland
		3	Toba Inlet	front range of the Coast Mountains east of Vancouver Island, Howe Sound; Toba, Bute and Knight Inlet areas
		4	Lillooet River	Lillooet, Elaho, Squamish, Homathko and Toba River drainages; alpine fir is common in valley bottom areas
		5	Hazelton	Hazelton area; may extend to the Iskut River
IWB	Interior Wet Belt	1	Creston	Creston area
		2	Castlegar	Castlegar area
		3	Grand Forks	north and east of Grand Forks area; may include valleys east of the Okanagan Valley
		4	Salmon Arm	Salmon Arm area
		5	Trout Lake	south and west of Revelstoke
		6	Revelstoke	north of Revelstoke, both to the east and west
		7	Morkill River	Fraser River Valley north of McBride
OC	Outer Coastal	1	Hecate	Hecate lowlands, northern Vancouver Island and possibly along mainland between these areas, and the west coast of the Queen Charlotte Islands
		2	Kitimat	mountainous terrain east of Prince Rupert area
		3	Terrace	Terrace area
		4	Cedarvale	Cedarvale - Seven Sisters Mountain area
		5	Nass	Nass River area
		6	Nootka	west coast of Vancouver Island

Code	Region	Code	Sections	Description/location
SB	Subboreal	1	Prince George	Prince George area
		2	Willow River	Willow River area east of Prince George
		3	Parsnip	the Parsnip River area
		4	Omineca	Omineca Mountain area northwest of Prince George; alpine fir is sporadic in the lower zone
		5	Aleza Lake	Aleza Lake area north of Prince George, western hemlock is located in topoedaphic areas on north aspects within the lower zone

II. Vegetation Regions, Zones and Subzones for British Columbia[1]

Code	Vegetation Region	Code	Vegetation Zone	Code	Vegetation Subzones
B	Boreal	BwS	Boreal White Spruce	a[2]	Black spruce
				b	(Jack pine)[3]
		SAeS-alF	Subalpine Engelmann Spruce - Alpine Fir	a	Forested
				b	Krummholz
		SAalF	Subalpine Alpine Fir	a	Forested
				b	Krummholz
		At	Alpine Tundra		(subzones not determined)
DI	Dry Interior	IBG	Interior Bunch Grass		(subzones not determined)
		ID	Interior Rocky Mountain Douglas-fir[4]	a	Lodgepole pine
				b	Ponderosa pine
				c	Western larch - ponderosa pine
				d	Rocky Mountain juniper - Rocky Mountain Douglas-fir
				e	Paper birch - trembling aspen
		IwS	Interior White Spruce		(subzones not determined)
		SAeS-alF	Subalpine Engelmann Spruce - Alpine fir	a	Lodgepole pine (-whitebark pine)
				b	Krummholz
				c	Rocky Mountain Douglas-fir - lodgepole pine
		At	Alpine Tundra		(subzones not determined)

APPENDIX D (cont'd)

Code	Vegetation Region	Code	Vegetation Zone	Code	Vegetation Subzones
IC	Inner Coast	CgF-wC	Coastal Grand fir - Western Red Cedar		(subzones not determined)
		CwH	Coastal Western Hemlock		(subzones not determined)
		CwH-aF	Coastal Western Hemlock - Pacific Silver Fir	a b	Coast Douglas-fir Western Red Cedar
		SAmH-aF	Subalpine Mountain Hemlock - Pacific Silver Fir		(subzones not determined)
		SAmH	Subalpine Mountain Hemlock		(subzones not determined)
		SAmH-alF	Subalpine Mountain Hemlock - Alpine Fir	a b	Forested Krummholz
		At	Alpine Tundra		(subzones not determined)
IWB	Interior Wet Belt	IgF-wC	Interior Grand Fir - Western Red Cedar		(subzones not determined)
		IwC	Interior Western Red Cedar	a b c	Rocky Mountain Douglas-fir Lodgepole pine - Engelmann spruce - Alpine fir Ponderosa pine - Rocky Mountain Douglas-fir
		IwH-wC	Interior Western Hemlock - Western Red Cedar	a b c	Rocky Mountain Douglas-fir - lodgepole pine - western larch Lodgepole pine - Engelmann spruce - alpine fir Ponderosa pine - Rocky Mountain Douglas-fir
		IwH	Interior Western Hemlock	a b	Lodgepole pine Lodgepole pine - Engelmann spruce - alpine fir
		IwC-wS	Interior Western Red Cedar - White Spruce		(subzones not determined)
		SAeS-alF	Subalpine Engelmann Spruce - Alpine Fir	a b	Lodgepole pine Krummholz

APPENDIX D (cont'd)

Code	Vegetation Region	Code	Vegetation Zone	Code	Vegetation Subzones
				c	Rocky Mountain Douglas-fir - lodgepole pine
		SAmH	Subalpine Mountain Hemlock		(subzones not determined)
		At	Alpine Tundra		(subzones not determined)
OC	Outer Coastal	CwH-aF	Coastal Western Hemlock - Pacific Silver Fir	a	Western red cedar
				b	Yellow cedar
				c	Alpine fir
				d	Yellow cedar - western red cedar
		CwH-wC	Coastal Western Hemlock - Western Red Cedar		(subzones not determined)
		SAmH-aF	Subalpine Mountain Hemlock - Pacific Silver Fir	a	Forested
				b	Krummholz
		At	Alpine Tundra		(subzones not determined)
SB	Subboreal	SBwS-alF	Subboreal White Spruce - Alpine Fir	a	Rocky Mountain Douglas-fir - lodgepole pine
				b	Paper birch - lodgepole pine
				c	Rocky Mountain Douglas-fir - paper birch - lodgepole pine
		SBhS-alF	Subboreal Hybrid Spruce - Alpine Fir		(subzones not determined)
		SAeS-alF	Subalpine Engelmann Spruce - Alpine Fir	a	Forested
				b	Krummholz
		At	Alpine Tundra		(subzones not determined)

[1]This table lists all Vegetation Regions, Zones and Subzones studied to date by Ministry of Environment and Parks within British Columbia. All Zones and Subzones do not necessarily occur throughout a Region. Future updated versions will be available from the Head, Vegetation Sensitivity Unit, Ministry of Environment and Parks, Victoria.

[2]Although codes are indicated as lower case letters, they are entered as upper case on coding forms.

[3]Tentative, northeastern part of province has not been surveyed.

[4]Name may later be changed to Interior Douglas-fir Zone with a revision of Taylor and MacBryde (1977).

APPENDIX E

MINISTRY OF FORESTS AND LANDS, BIOGEOCLIMATIC UNITS OF BRITISH COLUMBIA

Code	Zone	Code	Subzone	Code	Variant
AT	Alpine Tundra	a[1]	Coastal		
		b	Subcontinental		
		c	Very Dry Southern		
		d	Dry Southern		
		e	Moist Interior		
		f	Dry Southern Cordilleran		
		g	Wet Interior		
		h	Wet Central Interior		
		i	Dry Central Interior		
		j	Dry Central Subcontinental		
		k	Oceanic		
		l	North Coastal		
		m	Central Continental		
		n	Northern Continental		
		o	Dry Rocky Mountain		
		p	Moist Rocky Mountain		
BWBS	Boreal White	a	Northern	1[2]	Fort Nelson Lowland
	and Black			2	Liard Plain
	Spruce	b	Montane		
		c	Moist Cool Southern		
		d	Moist Cold Southern		
		e	Cordilleran		
CDF	Coastal	a	Drier		
	Douglas-fir	b	Wetter		
CWH	Coastal Western	a	Drier Maritime	1	Vancouver Island
	Hemlock			2	Pacific Ranges
		b	Wetter	1	Windward Submontane Maritime
				2	Windward Montane Maritime
				3	Leeward Submontane Maritime
				4	Leeward Montane Maritime
				5	Southern Submaritime
				6	Central Submaritime Lower
				7	Central Submaritime Upper
		c	Drier Submaritime	1	Southern
				2	Central
		d	Hypermaritime	1	Southern
				2	Outer Central Coast
				3	Inner Central Coast
		e	Queen Charlotte Islands	1	Submontane
				2	Montane
		f	Northern Drier Maritime	1	Low Elevation

Code	Zone	Code	Subzone	Code	Variant
				2	High Elevation
		h	Mid-Coast Drier Transitional	1	(wetter)
				2	(drier)
				3	(transitional)
		i	Central Wetter Maritime	1	Western Low Elevation
				2	Western High Elevation
				3	Eastern Transitional
		j	Northern Wetter Maritime		
ESSF	Engelmann Spruce-Subalpine Fir	a	Dry Southern Cordilleran Forested		
		ap	Dry Southern Cordilleran Parkland		
		b	Wet Forested		
		bp	Wet Parkland		
		c	Moist Southern Forested		
		cp	Moist Southern Parkland		
		d	Very Dry Southern Forested	1, 2, 3, 4 (unnamed)	
		dp	Very Dry Southern Parkland		
		e	Dry Southern Forested	1	Thompson Plateau
				2	Okanagan Highlands
		ep	Dry Southern Parkland		
		f	Subcontinental Forested		
		fp	Subcontinental Parkland		
		g	Very Dry Central Forested		
		gp	Very Dry Central Parkland		
		h	Wet Cold Central Forested	1	Lower Cariboo Mountains
				2	Upper Cariboo Mountains
				3	Rocky Mountains
		hp	Wet Cold Central Parkland		
		i	N.W. Transitional Forested		
		ip	N.W. Transitional Parkland		
		k	Northern Continental Forested		
		kp	Northern Continental Parkland		
		l	West Central Transitional Forested		
		lp	West Central Transitional Parkland		
		m	Moist Central Forested	1	Shuswap Highlands
				2	Cariboo-Monashee Mountains
		n	Moist Northern Forested		
		np	Moist Northern Parkland		
		o	Moist Rocky Mountain Forested		
		op	Moist Rocky Mountain Parkland		
		u	Wet Central Upper Forested		
		w	Wet Central Forested		

Code	Zone	Code	Subzone	Code	Variant
ICH	Interior Cedar -Hemlock	a	Moist Southern	1	Lower Columbia - Kootenay
				2	Upper Columbia - Kootenay
		b	Wet		
		c	Moist Cool Southern	1	Elk River
				2	West Kootenay - Kickinghorse
		d	Moist Warm Southern		
		e	Cool Semi-moist	1	Shuswap Highland
				2	Fraser Plateau
				3	Canim Lake
		f	Very Wet Northern		
		g	Northwestern Transitional	1	Upper Nass Basin
				2	Lower Nass Basin
				3	Hazelton
				4	Meziadin - Bell-Irving
				5	Iskut - Stikine
		h	Wet Central	1	Quesnel Lake
				2	Cariboo River
		j	Moist Northern		
		k	Wet Northern		
		m	Moist Central	1	Thompson River
				2	Shuswap River d r
		v	Western Wet Montane		
		w	Western Wet Submontane		
IDF	Interior Douglas-fir	a	Very Dry Submontane	1	Thompson Plateau
				2	Bonaparte River
				3	Okanagan
				4	Fraser River
		b	Very Dry Montane	1	Thompson PLateau
				2	East Fraser Plateau
				3	Okanagan
				4	(unnamed)
				5	Chilcotin
		c	Dry Submontane	1	Thompson Plateau
		d	Dry Montane	1	Thompson Plateau
				2	Okanagan
		e	Subcontinental	1	Southern
				2	Central
		f	Dry Southern Montane		
		g	Dry Cordilleran	1	Windermere Lake
				2	S. Rocky Mountain Trench
				3	Kootenay - Columbia
		i	(unnamed)		

APPENDIX E (cont'd)

Code	Zone	Code	Subzone	Code	Variant
		j	Semi-moist	1	Shuswap Highlands
				2	Okanagan
MS	Montane Spruce	a	Dry Southern Cordilleran		
		b	Dry	1	Thompson Plateau
				2	Okanagan Highlands
				3	North Okanagan
				4	(Unnamed)
		c	Very Dry Southern		
		d	Very Dry Central		
MH	Mountain Hemlock	a	Maritime Forested		
		ap	Maritime Parkland		
		b	Submaritime Forested		
		bp	Submaritime Parkland		
		c	Oceanic Forested		
		cp	Oceanic Parkland		
		d	Coastal Forested		
		dp	Coastal Parkland		
		e	Transitional Forested		
		ep	Transitional Parkland		
PPBG	Ponderosa Pine-Bunchgrass	a	Very Dry N. Shrub Steppe	1	Kamloops
				2	Douglas Lake
				3	Osoyoos
		b	Very Dry S. Shrub Steppe		
		c	Dry S. Montane Savannah		
		d	Very Dry Forested	1	Northern
				2	Southern
		e	Plateau Grasslands		
		f	Princeton Very Dry Forested		
		g	Very Dry Cool N. Shrub Steppe		
SBS	Sub-Boreal Spruce	a	Very Dry Southern	1	Fraser Plateau
				2	Entiako River
		b	Dry Cool Southern		
		c	Moist Central		
		d	Dry Cool Central		
		e	Moist Cool Central	1	Babine Lake
				2	Fraser Basin
		f	Very Wet Rocky Mountain		
		g	Moist Rocky Mountain		
		h	Dry Rocky Mountain		

APPENDIX E (cont'd)

Code	Zone	Code	Subzone	Code	Variant
		i	Moist Cold Central		
		j	Wet Cool Central	1	Willow River
				2	Williston Lake
				3	Sukunka River
		k	Dry Warm Southern	1	Fraser Plateau
				2	Southern Fraser Basin
				3	Northern Fraser Basin
		l	Dry Warm Central		
		m	Moist		
		n	Wet Cold Northern		
		o	Dry Cold Northern		
SWB	Spruce-Willow-Birch	a	Southern Drier Forested		
		as	Southern Drier Scrub		
		b	Southern Moister Forested		
		bs	Southern Moister Scrub		

Note: This list is current as of publication date. Future updates will be available from Research Branch, Ministry of Forests and Lands.

[1]Although codes are indicated as lower case letters, they are entered as upper case on coding forms.

[2]Codes for variants have been included for users wishing to code these values in a dummy variable field.

APPENDIX F

ADDITIONAL DEFINITIONS OF TERRAIN (SURFICIAL GEOLOGY) TERMS

Code	Term	Definition
	Roundness[1]	
A	angular	particles have sharp edges and relatively plane sides with unpolished surfaces
N	subangular	particles are similar to angular description but have rounded edges
O	subrounded	particles have nearly plane sides but have well-rounded corners and edges
R	rounded	particles have smoothly curved sides and no edges
	Compaction	
	Cohesionless Materials	
L	loose	unconsolidated sediments in which the particles are loosely packed (e.g. glaciofluvial gravels)
D	dense	unconsolidated sediments in which the particles are closely packed (e.g. basal tills, pre-loaded (by ice) Quaternary sediments).
	Cohesive Materials[1]	
V	very soft	thumb will penetrate soil more than 1 in. (25 mm)
S	soft	thumb will penetrate soil about 1 in. (25 mm)
F	firm	thumb will indent soil about 1/4 in. (6 mm)
H	hard	thumb will not indent soil but readily indented with thumbnail
T	very hard	thumb nail will not indent soil

[1] Source: Annual Book of ASTM Standards (1985), American Society for Testing and Materials.

LITERATURE CITED

American Society for Testing and Materials. 1985. Annual Book of ASTM Standards - Section 4, Construction. Volume 04.08 - Soil and Rock; Building Stones. Easton, MD, U.S.A. pp. D2488.

Canada Soil Survey Committee. 1978. Subcommittee on Soil Classification. The Canadian System of Soil Classification. Can. Dep. Agric. Publ. 1646. Supply and Services Canada, Ottawa, Ont. 164 pp.

Expert Committee on Soil Survey, 1987. The Canadian System of Soil Classification-Revised 1987. Agriculture Canada, Ottawa, Ont.

Friesen, P.G. and J. R. Jungen. 1987. CAPAMP Documentation for Soil and Agriculture Capability Correspondence Check. B.C. Ministry of Environment, Victoria, B.C.

Howes, D and E. Kenk (Eds). 1987. Terrain Classification System for British Columbia. (Revised Edition). Recreational Fisheries and Surveys and Resource Mapping Branches, B.C. Ministry of Environment, Victoria, B.C.

Howes, D. and M.W. Sondheim. 1986. Quantitative Definitions of Stability Classes as Related to Post-Logging Clearcut Landslide Occurrence. Proceedings of the 10th B.C. Soil Science Workshop. B.C. Ministry of Forests and Lands, Victoria, B.C.

Kenk, E. and I. Cotic. 1983. Land Capability Classification for Agriculture in British Columbia. MOE Manual 1. B.C. Ministry of Environment, Surveys and Resource Mapping Branch and B.C. Ministry of Agriculture and Food, Soils Branch. Kelowna, B.C. 62 pp.

Ministry of Environment and Parks. 1987. Describing Ecosystems in the Field, Second Edition. B.C. Ministry of Environment and Parks, Victoria, B.C. 325pp.

Nagpal, N.K., M.W. Sondheim and C.H. Wallis. 1986. Computer-Assisted Mapping of Irrigation Water Requirements for Vancouver Island Based on Soil and Agricultural Capability Survey Data. Can. J. Soil Sci. 66: 471-480.

Owens, E.A., D.E. Howes, and C.P. Lewis. (in prep.) Physical Shore-Zone Classification. B.C. Ministry of Environment and Parks.

Porteous, B.C. 1985. CAPAMP Algorithm Documentation: Terrain Validation Subroutines. B.C. Ministry of Environment, Surveys and Resource Mapping Branch, Development Unit. Victoria, B.C. 28 pp. plus Appendices A-E.

Porteous, B.C. and E. Kenk. 1985. CAPAMP Documentation: Terrain Attribute Dictionary. B.C. Ministry of Environment, Surveys and Resource Mapping Branch, Development Unit. Victoria, B.C. 23 pp. plus appendices.

Quesnel, H. and M. Sondheim, 1983. B.C. Soil Information System - Volume 3 - Data Entry Procedures for Soil Laboratory Forms. B.C. Ministries of Forests and Environment, Victoria B.C.

Ryder, J.M. and D.E. Howes. 1984. Terrain Information, A User's Guide to Terrain Maps in British Columbia. B.C. Ministry of Environment. Victoria, B.C. 16 pp.

Sondheim, M. W., T. Vold and H. Quesnel. 1983. B.C. Soil Information System-Volume 2 - Data Entry Procedures for Ecosystem Description Forms. B.C. Ministries of Forests and Environment, Victoria, B.C.

Taylor, R. L. and B. MacBryde. 1977. Vascular Plants of British Columbia; A Descriptive Resource Inventory. Tech. Bull. No. 4. Univ. of British Columbia Press, Vancouver.

The Asphalt Institute. 1978. Soils Manual for the Design of Asphalt Pavement Structures. Manual Series No. 10. The Asphalt Institute. College Park, Maryland, U.S.A. 238 pp. (including ASTM-2488, Description of Soils (Visual Manual Procedure))

Vold. T., M. W. Sondheim and N. K. Nagpal. 1985. Computer Assisted Mapping of Soil Erosion Potential. Can. J. Soil Sci. 65: 411-418.