CHAPTER 7

CONCLUSIONS

The following conclusions can be made from the literature survey and research:

- The amount and type of information required to produce a geotechnical map, will depend on the purpose, content and scale of the map. Regional scale geotechnical maps can be divided into special or general purpose maps. Special purpose maps are produced if information is evaluated for a specific purpose and usually only covers one component of engineering geology such as the grade of weathering, where general purpose maps are produced to provide information on many aspects of engineering geology for a variety of planning and engineering purposes. Most of these maps are comprehensive in content, depicting all the principal components of the engineering geological environment, where on one map sheet areas classified as units based on the uniformity of their engineering geological conditions are shown. In terms of scale, regional engineering geological information could be presented on a 1:10 000 or 1:50 000 scale, where a 1:10 000 scale can be regarded as a large and medium scale map, and the 1:50 000 scale is regarded as a medium scale map (Dearman, 1991).

- The accuracy of information gathered for a regional geotechnical map, based on the principle of the land facet approach (three test pits per area of similar geology and landform, SAIEG, 1997), will depend on the following factors: 1) the scale of the base map used (1:10 000 or 1:50 000), 2) the complexity of the terrain mapped, in terms of geology and landform (a complex terrain will require more test pits to cover all the different land facets), 3) the scale of the final map (a medium scale of 1:50 000 is recommended as most of South Africa is covered by 1:50 000 topocadastral and other theme maps, Price, 1981).

- A need for the provision of rapid and accurate engineering geological information will always exist for broad planning and development purposes. The identification of land to satisfy the growing demand for infrastructure and housing development on a regional scale is necessary. It is therefore important to identify land that is suitable for cost effective urban development, environmentally sustainable, with a relatively low natural hazard risk as well as to target reserves of construction materials to prevent sterilisation.

- Factors that should be taken into consideration during regional geotechnical mapping is defined and the identification in the field and from laboratory tests and the implications of these factors on development are described. The terrain evaluation criteria included geotechnical factors (expansive soils, collapsible soils, compressible soils, dispersive soils, excavatability problems, inundation, pseudokarst, shallow water table, sinkhole formation and slope instability), existing and potential construction material sources (clays, fine and coarse aggregate) and environmental considerations (siting of cemetery sites, waste disposal sites and ground based sanitation systems).

- The development of geotechnical maps and their associated classification systems, previously and currently being used in South Africa and the application of these different systems, was reviewed in terms of there purpose, classification and the presentation of data. Orthophotograph 2528CD08 was used to present all the different geotechnical classification systems, which aided with the comparison of the different system and the presentation of information on a map. The revision of each classification system and the compilation of maps based on the different systems, made it clear that these classifications systems range from simple to very complex. No one classification system can be regarded as being better than the other, due to the fact that each of these classifications systems was designed for a specific purpose. Although it was found during the application and comparison of the different systems, that the geotechnical classification system developed by Partridge *et. al.* (1993) was the most simplified and practical method to use for the classification of terrain for urban planning and development purposes.

- The standardised methodology and procedures used by the Council of Geoscience for regional geotechnical mapping follows a systematic approach and can be divided into the following phases: 1) Data gathering or desk study, including the accumulation and interpretation of existing data, such as the compilation of a landform map based on the land facet approach, 2) Reconnaissance survey, assuring that data gathered during the desk study is accurate by field checking and provisionally locating test pit positions based on accessibility considerations, 3) Field mapping, during which test pits are excavated and each individual soil layer in each profile are described according to the MCCSSO method proposed by Jennings *et al.* (1973), 4) Laboratory testing of disturbed soil samples to determine material and engineering properties of the various soil horizons by means of foundation indicator tests. Undisturbed soil samples may also be tested for specific problems, although this is not standard procedure for regional geotechnical mapping. 5) Compilation of the final geotechnical map showing areas with similar geotechnical properties, are based on the soil profiles, laboratory results, landforms and geology. The presentation of the engineering geological information is based on the specific geotechnical classification system used; 6) Reporting of the data in the form of a report or explanation accompany the geotechnical map. The report should explain the methodology used, reason for the map and include a discussion of the conditions found during the mapping exercise.

- Special reference is made to the geotechnical classification system developed by Zawada (2000) for the Council of Geoscience and this was also applied to the Rietvlei Dam 2528CD map sheet in order to determine the applicability of this system for regional geotechnical mapping on a 1:50 000-scale. This classification system could be applied to create a geotechnical map that is of value for a variety of land-uses. Certain shortcomings were identified during the application and evaluation of the system and recommendations are made to modify and eventually simplify the geotechnical classification system to be of more use. The following were applied:

- Geotechnical factors were only ranked in terms of overall significance to land use issues, excluding the classification of the ranked list into groups having critical and subcritical status, to simplify the system.

- Only those geotechnical factors (10) of the 13 geotechnical factors considered during geotechnical mapping were presented on the Rietvlei Dam 1:50 000-scale geotechnical map, to prevent confusion.

- A classification system was developed to distinguish between areas potentially favourable, less favourable and unfavourable for the development of single storey houses. The different geotechnical factors and their severity classes were individually evaluated for each numbered geotechnical area and placed in terms of these three development categories in the table of geotechnical factors. Those geotechnical factors that may pose an environmental constraint for developments are indicated by hatching in the Table of Geotechnical Factors. Geotechnical factors classified as an environmental constraint, are based on criteria normally taken into consideration during investigations for waste disposal sites, cemetery sites and ground based santitation systems.

- The choice of colour assigned to each 'number of geotechnical area', presented in the 'table of geotechnical factors', is decided on by the mapper. The colour of the most problematic geotechnical factor (primary factor) in terms of land-use for the specific 'number of geotechnical area' as specificly allocated to that geotechnical factor, is used and not according to the geotechnical factor first on the ranked list. Other geotechnical factors (secondary factors) present for that area are indicated by specific allocated coloured hatching codes. Each geotechnical factor with severity classes, specific allocated colour codes and hatching is presented in 'Geotechnical factors: Explanation and severity classes' on the map.

- The shade of colour depends on the severity class of the geotechnical factor, with the darkest colour assigned to the most severe class (for example Exc5, is dark green) and the lightest colour assigned to the least severe class (for example Exc3, is light green). This reduces the number of tables that need to be read and the complexity of the system. The specific colour and/or hatching assigned to each 'number of geotechnical area' is presented in the 'table of geotechnical factors'.

- The development potential and environmental constraint of geotechnical areas are presented on a 1:100 000-scale complimentary map. This will provide useful information to the town planner and/or developer and hereby improve the utilization of the map. Geotechnical areas are classified as areas of different development potential. A distinction is made between areas which are favourable (yellow), less favourable (orange) and unfavourable (red) for development of single storey houses, as shown in the 'Table of Geotechnical Factors'. Those geotechnical areas that may pose an environmental constraint are indicated by hatching.

- Each geotechnical area has a unique number listed in the Table of Geotechnical factors, as well as a superscript number linked to the specific colour code. Permeability was not taken into account with the colour coding, but can be read from the 'Table of Geotechnical Factors'.

After the above mentioned modifications to the geotechnical classification system of Zawada (2000) which is currently being used by the Council for Geoscience (CGS), it is clear that the system is much more simplified, understandable and provide more useful information. This map is now of use, not only to the engineering geologist but as well to the town planner and/or developer, regarding poor and good areas for potential development (zonation map) and areas not suitable for the facilitation of waste disposal sites, cemetery sites and ground based sanitation systems.

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