British Columbia
Ministry of Energy and Mines

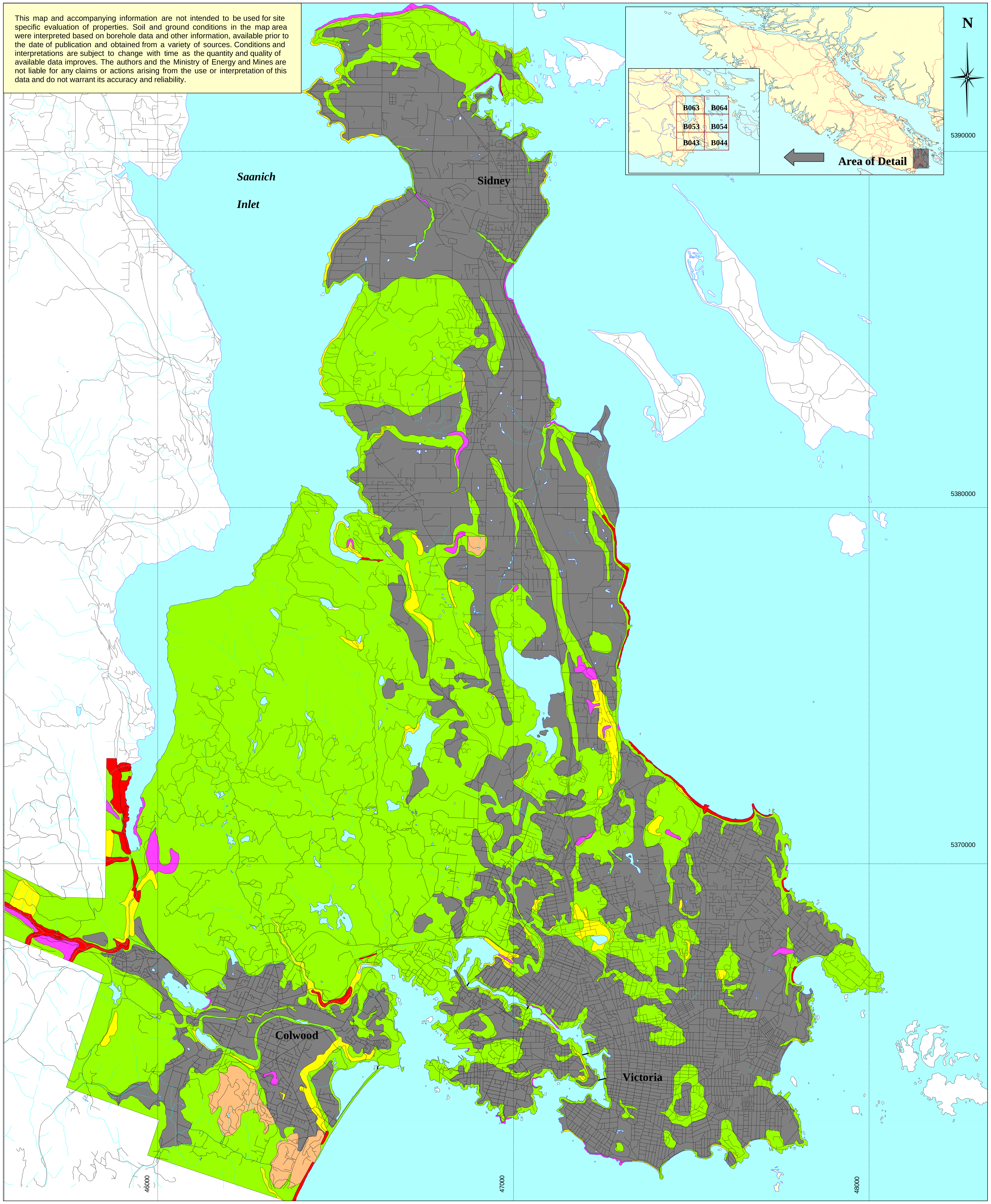
Geological Survey Branch

Geoscience Map 2000-3c

SEISMIC SLOPE STABILITY MAP OF GREATER VICTORIA

TRIM SHEETS 92B.043, 044, 053, 054, 063 & 064

By Eric J. McQuarrie, P. Eng., and Stephen M. Bean, P. Eng.,
Thurber Engineering Ltd.



INTRODUCTION

Seismic slope hazard mapping is intended to show relative susceptibility to earthquake-induced slope failures. This map is part of a larger earthquake hazard mapping project. Two companion earthquake hazard maps are published separately: an "Amplification of Ground Motion and Liquefaction Hazard Map" and a composite map showing all three hazards. Detailed descriptions of the methodology and the classification system used to prepare this seismic slope hazard map are provided in the Thurber Engineering Ltd. report entitled "Victoria Microzonation of Seismic Slope Hazards, Summary Report" to the Capital Regional District, dated January 23, 1998.

The maps are intended to provide basic regional data for land use planning, community planning and emergency response planning. Although this map can be used with other criteria to help planners select potential areas for development, avoid geologically vulnerable areas and to prioritize seismic upgrading programs, this map does not replace the need for site-specific geotechnical evaluations.

METHODOLOGY

The seismic slope hazard map is based on a compilation of existing subsurface data, previous slope stability assessments, bedrock geology and surficial geology maps, topographic data, and airphoto interpretation. Limited field observations were made at representative sites as well as sites flagged during airphoto interpretation as potentially unstable. Stability analyses were conducted on twelve different slope models including typical or simplified slopes found throughout the Victoria area as well as specific, complex slope models where more detailed information was available. The stability analyses determined both the static factor of safety and the yield acceleration (the intensity of seismic motions that would cause a slope failure).

SEISMIC SLOPE HAZARD CLASSIFICATION SYSTEM

The seismic slope hazard map uses a 5 class system (very low, low, moderate, high and very high) based primarily on the yield accelerations determined from the stability analyses. The general criteria for soil slopes using yield acceleration were as follows:

HAZARD RATING	YIELD ACCELERATION (g = acceleration due to gravity)	PROBABILITY OF SLOPE FAILURE (in 50 years)
Very Hig	less than 0.05g	greater than 62%
High	0.05g to 0.15 g	16 to 62%
Moderate	0.15g to 0.25g	8 to 16%
Low	greater than 0.25g	less than 8%
Very Low	n/a	n/a

Rock slopes were considered more qualitatively. The two most common rock types in Greater Victoria are relatively stable with relatively low relief, thus were generally given a low hazard rating. The potential for boulder ravelling or very small rock falls exists throughout much of these hilly areas, particularly during an earthquake, but overall such rock hazards are of relatively minor regional impact and can only be identified by site specific assessments. A low hazard rating is a reflection of the relative overall slope stability hazard and does not imply that a structure located at the base of a steep bedrock slope within such an area is safe since the map is not intended to identify hazards on a lot by lot basis.

The Mount Finlayson/Malahat/Goldstream River area consists of steeper terrain, greater relief, and much weaker bedrock creating steeply eroded valley terrain that poses considerably greater terrain hazards. Bedrock also has a direct influence on the slope stability at the north end of the Saanich Peninsula where northward dipping bedding in the sedimentary bedrock forms potential failure surfaces for the overlying colluvium.

The study, as a rule, does not consider stability hazards created by cuts or fills for roads or developments because such conditions are constantly changing and are usually at a scale that requires a detailed, site-specific assessment. Exceptions to this rule pertain primarily to areas where there has been large scale alterations to the natural terrain. In such cases, a natural hazard rating has been given along with a second rating pertaining to the areas altered by development (i.e. L(H*)) means a low seismic slope hazard naturally but several areas of anthropogenically-caused high hazard identified).

The slope hazard classes do not consider subaqueous failures that may occur along the coastline or the shores of lakes since slope conditions below the water cannot be assessed by airphotos and are not included on the T.R.I.M. maps. Polygons along the coastline refer to the seismic slope hazard above the high water level. A low rating does not necessary mean the slope should be safe during an earthquake since a subaqueous failure could impact the slope above the shoreline.

LIMITATIONS OF THIS MAP

The map is intended for regional purposes only, such as land use and emergency response planning and should not be used for site specific evaluations, property assessments or approving suitability for development. Responsibility for independent conclusions, interpretations or decisions by those using this map, lie with the user, including decisions to either purchase or sell land.

This map has been prepared in accordance with generally accepted hazard mapping practices. The map boundaries are based primarily on a slope map prepared from T.R.I.M. data, airphoto interpretation, regional surficial and bedrock geology maps and available site specific assessments or investigations. As such, the level of detail is not consistent across the entire map area or even within any given portion of the map area. Those areas where a site assessment has been conducted will have been mapped and analysed in much greater detail than other areas. The boundaries of each map polygon are approximate only, particularly where less detailed information was available. Also, each polygon has been given a rating that is considered representative of the relative seismic slope hazard but may often contain smaller areas with both higher and lower hazard ratings.

There is a practical limit to the size of potential slope failures that can be considered in a regional mapping study. Small failures caused by locally steeper terrain, not readily apparent on the slope map, or pockets of colluvium on a steep rock slope, cannot be identified at this scale. As a rule, the seismic slope hazard ratings do not consider hazards caused by cuts, fills, or other anthropogenic alterations to the natural terrain. Exceptions to this rule have been noted

Hazard Rating
(Probability of Seismically-induced Slope Failure in 50 yrs.)

- Very Hig (>62%)
- High (16-62%)
- Moderate (8-16%)
- L(H*) see text
- Low (<8%)
- Very Low (n/a)

UTM Projection NAD83
Compilation Scale 1:20,000

Cartography by
Axys Environmental Consulting Ltd., 1999.

1 0 1 2 3 km