6. TERMS OF REFERENCE FOR WATER MANAGEMENT PLAN

6.1 Overview and Objectives

A preliminary water plan study of the South Cowichan region was jointly completed for the CVRD by WorleyParsons and Westland Resource Group. This study has provided information to support the development of a Water Management Plan for the area, and identifies issues that need to be addressed to ensure that water supply in South Cowichan meets future demand sustainability.

A phased approach is recommended towards development of the Water Management Plan, with major existing knowledge gaps being addressed as stand alone studies prior to development of the Plan. Recommended studies to be conducted prior to development of the Water Management Plan include:

- The acquisition of more detailed current surface water and groundwater withdrawal data is necessary to allow a better understanding of potential demand versus supply issues. This will require co-operation from major water users (improvement districts, etc.) and involvement from CVRD;
- A comprehensive, area-specific groundwater resource evaluation should be completed, which will culminate in the development of a numerical model that will establish detailed water budgets on an aquifer-by-aquifer basis. The groundwater resource evaluation and model development should take into account findings from MOE's aquifer vulnerability mapping project currently being completed, and use the model to refine understanding of local aquifer vulnerabilities;
- A comprehensive, baseline surface water quality monitoring program should be undertaken. This program should include, at a minimum, the collection of surface water samples on a quarterly basis from the area's key streams, lakes and reservoirs over a 1 to 2 year period. Prospective sampling locations should be identified through consultation with regional directors to identify potential areas of concern. Those locations for which the baseline program indicates possible water quality concerns could be incorporated in a longer-term monitoring program; and
- The potential effects of regional, national, and global pressures on population trend projections for the CVRD should be considered. Climate change could alter migration of people from areas experiencing water supply shortages or sea level increases. Economic upheavals and demographic shifts in Canadian society might also change housing choice and settlement patterns. The effects of such phenomena are difficult to anticipate and may increase the uncertainty in population trend projections for the CVRD.

Once these supplemental investigations and monitoring programs have been undertaken, a comprehensive Water Management Plan for the South Cowichan area should be developed to address issues raised by this preliminary study.

Completion of this Water Management Plan should result in the following tangible benefits:

- Enhanced understanding of local water issues;

- A workable management structure for each of Study Area's three watersheds over a 30-year planning horizon that represents the interests of all stakeholders; and
- A sense of balance between the future water needs of agriculture, a growing population, and the ecosystems of the South Cowichan area.

The scope of the Water Management Plan does not extend to regional water quality issues, except if they relate directly to water supply.

6.2 Spatial and Temporal Scope

The South Cowichan Water Management Plan will provide water management guidance across three watersheds in the Study Area during a thirty-year planning horizon.

It s recommended that the Water Management Plan should encompass a total area of 20,583 hectares, and will CVRD's Electoral Areas A and C in their entirety, and those parts of Electoral Areas B, D, and E that lie within the Shawnigan, Cowichan and Saanich Inlet watersheds (i.e. this project's Study Area). Even though some electoral area boundaries straddle watershed boundaries, the limited areal scope of this water plan will address most of the population's water supply demands and needs.

6.3 Issues Requiring Study and Stakeholder Consultation

This project examined current surface and groundwater supply and withdrawal rates with respect to land use practices, ecological requirements, and biophysical processes, and forecasts of future water demand based on estimates of future conditions. Issues were identified through discussions with key organizations and representatives. Perceptions of current water issues held by the wider community could not be fully explored with the resources available for this study. CVRD will need to address these gaps in information as they work to prepare the Water Management Plan for the South Cowichan area. These issues are described in the following sections.

6.3.1 Water Supply and Demand

Summer low flows in Lower Shawnigan Creek are currently detrimental to aquatic system health, and are due in part to having insufficient lake storage to support both domestic use and downstream needs in summer. Care is required to ensure that a balance between accumulating sufficient storage for domestic use while maintaining sufficient flow for aquatic system health is achieved.

Suggestions to increase summer storage in Shawnigan Lake by restricting flow past the dam in Lower Shawnigan Creek are controversial, since increased lake levels could affect lakeshore properties.

Agriculture would benefit from an increased availability of water for irrigation, particularly during dry summer months. Increased storage is encouraged where a water source, capable of providing sufficient, sustainable supply is available.

Climate change is likely to increase the incidence of summer droughts within the South Cowichan region. A warmer, drier climate will increase demand for water for domestic and agricultural use, as well as the

amount of water used to maintain ecosystem health. Care will be required to manage water supply to meet both human and ecosystem needs in a changing climate.

6.3.2 Regulatory Issues

Water management is a provincial responsibility. The Province's 'Living Water Smart' (LWS) Water Plan commits to achieving a 33 percent water efficiency target across British Columbia by 2020. LWS also commits the province to other actions to manage water more sustainably.

CVRD authority in water management is unclear, because local governments' ability to implement and enforce water use policies is limited by the present water governance structure in British Columbia.

Coordinating the efforts of the many agencies involved in water management in the South Cowichan region, including the CVRD, MOE, Fisheries and Oceans Canada, non-governmental organisations, and Cowichan and Malahat First Nations, will be important when developing the Water Management Plan.

Official Community Plan policies support sustainable use of water, but these policies may not be supported by resource legislation and regulations.

6.3.3 Wastewater

Approximately 600 residential lots adjoin Shawnigan Lake. Municipal wastewater services in the South Cowichan region are limited, which means that most lakeshore residents rely on on-site sewerage systems to treat and disperse their domestic sewage. A study of water quality in Shawnigan Lake, undertaken in 2004 by MOE, identified water quality issues with respect to high fecal coliform levels. Coliform concentrations in the lake were found to be considerably higher than inflow concentrations, suggesting that bacterial contamination is reaching the lake through other pathways, such as infiltrating water exposed to malfunctioning on-site sewerage systems. Most Shawnigan Lake residents rely on lake water for daily domestic use. Poor lake water quality has a direct impact on domestic water supply.

Twelve of fifteen shellfish beaches in the Saanich Inlet are closed due to fecal contamination. Fecal coliform bacteria are present in surface runoff to Saanich Inlet in high concentrations during and after rainfall events. The only point-source discharge of sewage in the Inlet is located in Mill Bay.

Chemical contaminants, including metals and polycyclic aromatic hydrocarbons (PAH), occur in low concentrations in Lower Shawnigan Creek, where they are detrimental to aquatic system health.

6.3.4 Recreation

Recreational users disagree about optimum levels of Shawnigan Lake in the summer. For instance, water skiers prefer higher water levels to protect them from exposed gravel beds, whereas some residents prefer lower lake levels for their own recreational activities.

Recreational use of Shawnigan Lake has the potential to affect, and to be affected by, lake water quality. For instance, water quality, and hence water supply for domestic use, may be adversely affected by increased levels of hydrocarbons and other chemicals in the water column and surface microlayer

associated with an increased use of motorboats on the lake. Swimming, skiing, fishing, or kayaking in water of poor quality has the potential to adversely affect human health.

6.4 Ecological Issues - Research Needs

Many streams in the South Cowichan region support fish stocks, including Coho salmon, Steelhead salmon, and Rainbow and Cutthroat trout. Water management needs to maintain or enhance fish habitat and fish populations.

Shawnigan Lake supports an isolated population of native Kokanee salmon, Rainbow and Cutthroat trout, and Smallmouth bass that may be adversely affected if water quantity or quality in the Lake declines.

Riparian vegetation along lake margins and river and stream corridors plays an important role in maintaining water quality and providing shade to cool water and protect fish habitat and wildlife corridors. As the human population of South Cowichan grows, urban development will place pressure on riparian vegetation and the habitats it supports.

Ecological requirements (i.e. minimum flows) to maintain these habitats are poorly understood. CVRD will need to address this gap in information as they work to prepare the Water Management Plan.

6.5 Available Information

The following documents should be reviewed prior to preparing the final South Cowichan Water Management Plan:

- The South Cowichan Water Plan Study (this report);
- Findings from various supplemental environmental / hydrogeological assessments and stakeholder consultation exercises recommended by this report;
- Findings from MOE's groundwater vulnerability mapping project;
- The Cowichan Basin Water Management Plan;
- Official Community Plans for Electoral Areas in the Cowichan Valley Regional District; and
- 'Living Water Smart', British Columbia's Water Plan.

6.6 Deliverables

The South Cowichan Water Management Plan will provide water management guidance for components of the three watersheds that span five CVRD Electoral Areas. Although some issues are watershed-specific, many of the challenges to better managing the South Cowichan region's water resources are shared by all three watersheds, some of which straddle jurisdictional boundaries. It is considered appropriate one management plan will be created that includes all three watersheds in South Cowichan. It is anticipated that each watershed will have its own discrete section in the final plan, which will set out issues, goals, objectives, and actions, and an implementation strategy relevant to each watershed. Sections addressing the context, planning process, public input, regional issues, and water management

guidance common to all three watersheds may be contained in a single section. CVRD will need to determine the best way to present the water management plan to clearly display the process, issues, goals, actions, and implementation strategies relevant to each watershed in the South Cowichan region.

CVRD recognizes the need to develop a plan for the sustainable management of water in the three South Cowichan watersheds. Part 4 of the Water Act, which enables the Minister to order or designate an area for the purpose of preparing a management plan and sets out the provisions for preparing and implementing the plan, does not apply to South Cowichan.

The process proposed to develop the Water Management Plan should include the following broad components:

- Review and analysis of existing background material;
- Identification of representatives to be part of a forum of key stakeholders that will be engaged throughout the plan development process to identify issues, objectives, and actions, and to review the draft plan;
- Development of a public engagement strategy to identify the ways to engage the community throughout the plan preparation phase;
- Public consultation, in particular the creation and engagement of a key stakeholder forum and involvement of the wider community to gain an understanding of water related issues in the Study Area and build support for the plan;
- Preparation of presentation materials for public meetings, reports, and workshops;
- Maintenance of close working relationships with CVRD staff, and regular reporting to the CVRD Board or committees;
- In conjunction with the key stakeholder forum, development of a vision and goals for effectively managing water in each South Cowichan watershed. Public input on the vision and goals developed through the forum should be gathered;
- Drafting of the Water Management Plan, including technical studies as required, including identification of demand and supply options, development and comparisons of supply management alternatives to determine a preferred option, and development of objectives, actions, and an implementation strategy;
- Liaison with CVRD staff, the key stakeholder forum, the CVRD Board, committees, and the public to gain feedback on the draft plan;
- Revision of the draft Water Management Plan based on comments received, and preparation of final documents; and
- Presentation of the final Water Management Plan to the CVRD, key stakeholders forum, and general public.

The team responsible for preparing the Water Management Plan should be required to present the following information to CVRD upon completion of the project:

- One electronic copy of all background reports and technical studies;
- Copies of public involvement materials;
- Five hard copies and one electronic copy of the draft plan; and
- One print-ready copy, one electronic copy, and five hard copies of the final plan, including illustrations and maps.

Map files should be provided in digital format and be compatible with the Cowichan Valley Regional District Geographical Information System.

6.7 Proposed Timeline

The following timeline outlined in Table 43 below is proposed to develop of the Water Management Plan. This phased approach takes into account that the proposed Water Management Plan has a budget of approximately $100,000 per year.

Table 43 Proposed Timeline for Development of the Water Management Plan and Subsequent Work

Component	Who	Timeline
Groundwater Resource Evaluation and Model	Consultant	2009
Surface Water Quality Study	Consultant	2009-2010
Estimating Current Water Use	CVRD and Consultant	2010
Issues Requiring Study and Stakeholder Consultation	CVRD and Consultant	2010-2011
Draft Water Management Plan	Consultant	2011
Stakeholder Consultation and Finalization of Water Management Plan	CVRD and Consultant	2012
Groundwater and Surface Water Management Model	Consultant	2012
Long-term monitoring plan (surface water)	Consultant	2012-

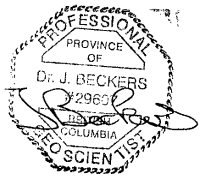
7. CLOSURE

We trust that this report satisfies your current requirements and provides suitable documentation of the tasks undertaken by this project. The study team of WorleyParsons and Westland Resource Group greatly appreciates having been given the opportunity to participate on this critical initiative.

If you have any questions or require further details, please contact the undersigned at any time.

Respectfully submitted:

WorleyParsons



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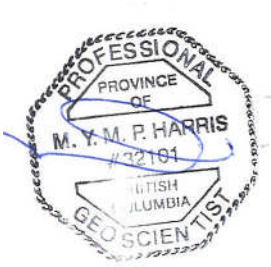

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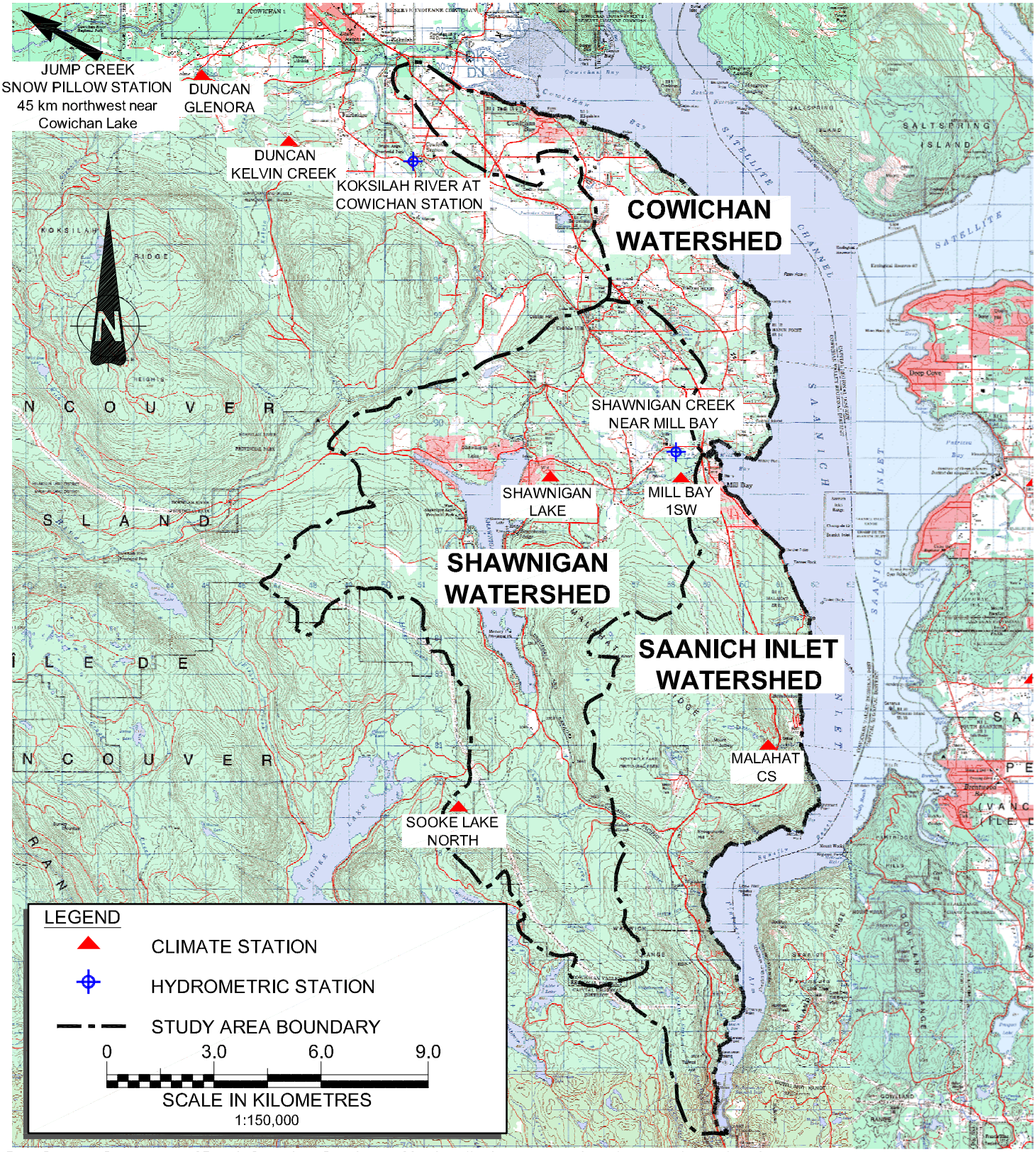
Figures



Data Source: Government of British Columbia Geophysics Map http://webmap.em.gov.bc.ca/mapplace/minpot/geophysics.asp
Basemap Source: National Topographic Servic Map Sheets: 92-b-13, 92-b-5, 92-b-14, 92-b-11, 92-b-6 & 92-b-12

Infrastructure & Environment

COWICHAN VALLEY REGIONAL DISTRICT
SOUTH COWICHAN WATER STUDY PLAN

STUDY AREA &
ENVIRONMENT CANADA CLIMATE STATIONS

WorleyParsons
resources & energy

2009-02-11	date		edited by	KM	drawn by	MH	app by

PROJECT NUMBER: V19830100

FIGURE: 1

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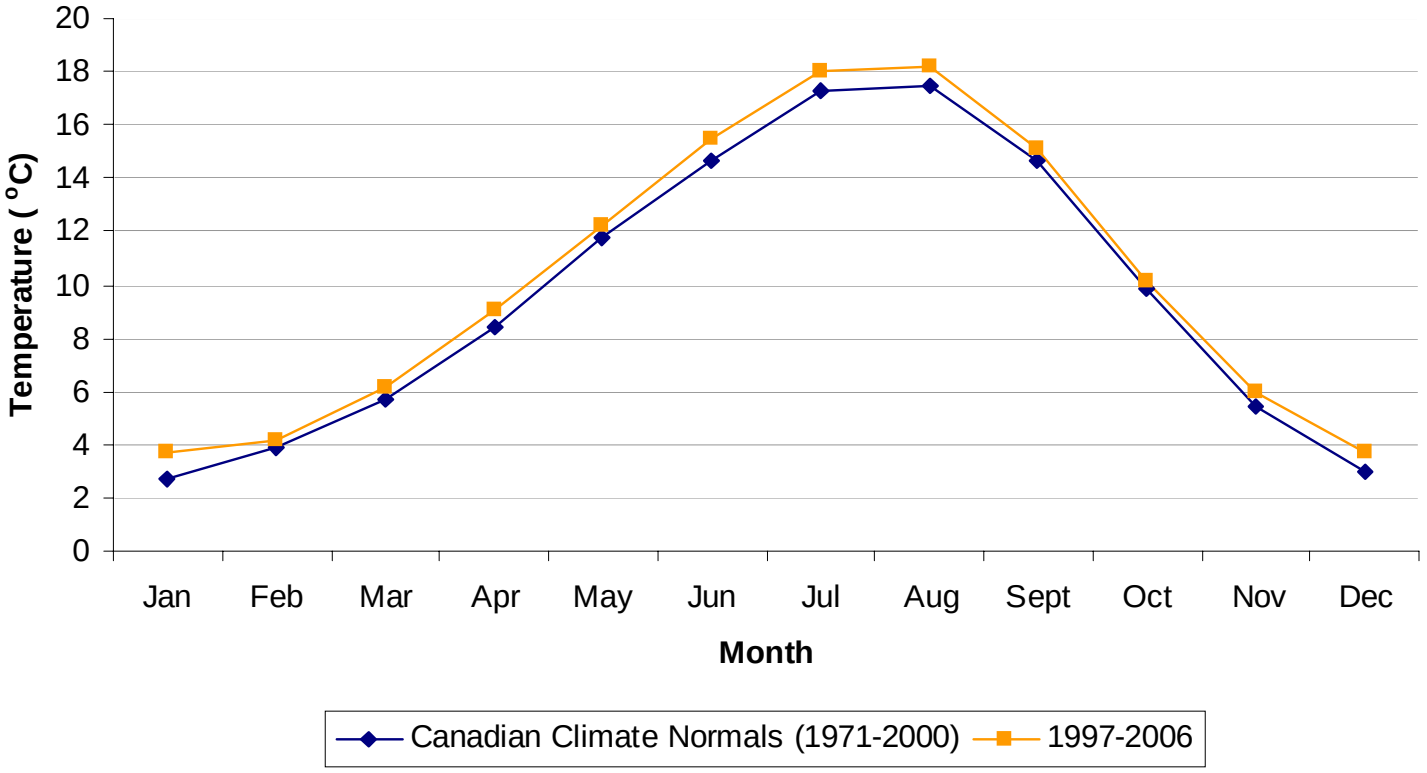

Data Source: Environment Canada - Meteorological Service of Canada

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COWICHAN VALLEY REGIONAL DISTRICT
SOUTH COWICHAN WATER STUDY PLAN

AVERAGE MONTHLY TEMPERATURE

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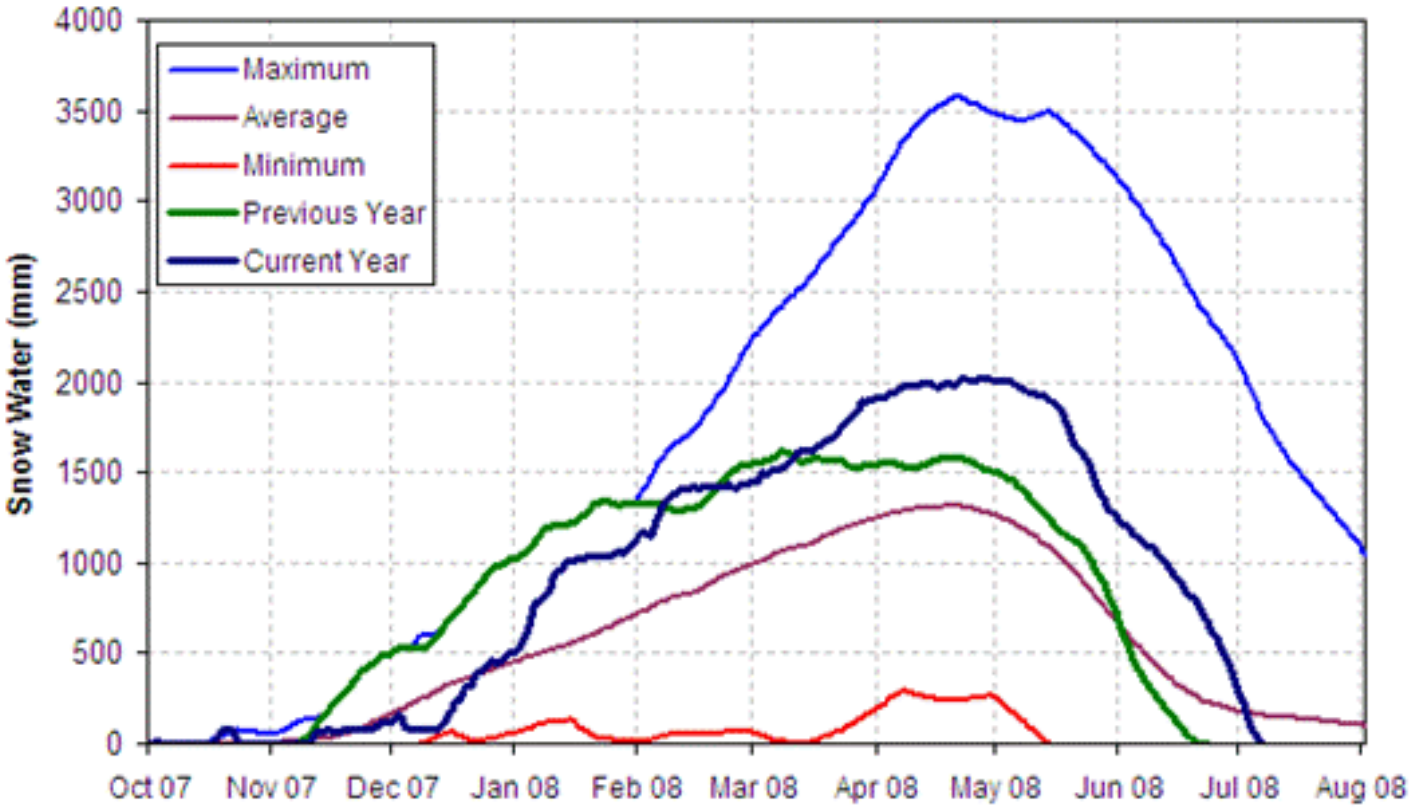

Data Source: Ministry of Environment Water Stewardship Division

Infrastructure & Environment

COWICHAN VALLEY REGIONAL DISTRICT
SOUTH COWICHAN WATER STUDY PLAN

JUMP CREEK SNOW PILLOW DATA

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FIGURE: 3

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CENOZOIC

Quaternary Deposit

Miocene to Pliocene
- ALERT BAY VOLCANICS — *Basaltic Volcanic Rocks*

Upper Eocene to Oligocene
- CARMANAH GROUP — *Undivided Sedimentary Rocks*

Eocene to Oligocene
- MOUNT WASHINGTON PLUTONIC SUITE — *Quartz Dioritic Intrusive Rocks*

Paleocene to Eocene
- CLAYOQUOT PLUTONIC SUITE — *Undivided Intrusive Rocks*
- FLORES VOLCANICS — *Calc-alkaline Volcanic Rocks*

Middle Devonian to Upper Devonian
- METCHOSIN IGNEOUS COMPLEX - *Includes* SOOKE GABBRO, HIGH-LEVEL GABBROS, METCHOSIN FORMATION - SHEETED DYKES — *Basaltic Volcanic Rocks, Diorite to Gabbroic Intrusive Rocks*

MESOZOIC

Upper Cretaceous
- NANAIMO GROUP — *Undivided Sedimentary Rocks*

Middle Jurassic to Lower Cretaceous
- KYUQUOT GROUP — *Undivided Sedimentary Rocks*

Cretaceous
- QUEEN CHARLOTTE GROUP — *Undivided Sedimentary Rocks*

Jurassic to Cretaceous
- LEECH RIVER COMPLEX - SURVEY MOUNTAIN VOLCANICS — *Undivided Volcanic Rocks, Metasediments,*

Lower Jurassic
- HARBLEDOWN FORMATION — *Mudstone,Siltstone, Shale Fine Clastic Sedimentary Rocks*
- BONANZA GROUP — *Calc-alkaline Volcanic Rocks*

Lower Jurassic to Middle Jurassic
- ISLAND PLUTONIC SUITE — *Granodioritic Intrusive Rocks, Feldspar Porphyritic Intrusive Rocks*

Triassic
- MOUNT HALL GABBRO AND BUTTLE LAKE GROUP — *Dioritic to Gabbroic Intrusive Rocks*

Triassic to Cretaceous
- PACIFIC RIM COMPLEX — *Undivided Sedimentary Rocks*

Middle Triassic to Upper Triassic
- VANCOUVER GROUP - DAONELLA BEDS (INFORMAL) & KARMUTSEN FORMATION — *Undivided Sedimentary Rocks, Marine Sedimentary Volcanic Rocks With small amounts of Mudstone, Siltstone, Shale Fine Clastic Sedimentary Rocks, Basaltic Volcanic Rocks*
- VANCOUVER GROUP - PARSON BAY FORMATION — *Limestone, Slate, Siltstone, Argillite*
- VANCOUVER GROUP - QUATSINO FORMATION — *Limestone, Marble, Calcareous Sedimentary Rocks*

PALEOZOIC

Upper Devonian
- SALTSPRING PLUTONIC SUITE — *Granodiorite Intrusive Rocks*

Paleozoic to Jurassic
- WESTCOAST CRYSTALLINE COMPLEX — *Undivided Intrusive Rocks*

Mississippisan to Lower Permian
- BUTTLE LAKE GROUP - *Includes* FOURTH LAKE FORMATION - MOUNT MARK FORMATION - NANOOSE COMPLEX - ST MARYS LAKE FORMATION — *Undivided Sedimentary Rocks, Chert, Siliceous Argillite, Silicic'astic Rocks, Limestone, Bioherm/Reef, Coarse Clastic Sedimentary Rocks*

Middle Devonian to Upper Devonian
- SICKER GROUP - *Includes* - NITINAT FORMATION - DUCK LAKE FORMATION - MCLAUGHLIN RIDGE FORMATION — *Basaltic Volcanic Rocks, Undivided Volcanic Rocks, Volcaniclastic Rocks, Calc-alkaline Volcanic Rocks*

COWICHAN WATERSHED

SHAWNIGAN WATERSHED

SAANICH INLET WATERSHED

N

0 3.0 6.0 9.0

SCALE IN KILOMETRES
1:150,000

Source: British Columbia Ministry of Environment
Surficial Geology of Vancouver Island Map

Infrastructure & Environment

COWICHAN VALLEY REGIONAL DISTRICT
SOUTH COWICHAN WATER STUDY PLAN

BEDROCK GEOLOGY

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2009-02-11 date	KM edited by	OTHERS drawn by	JB app by	PROJECT NUMBER: V19830100	FIGURE: 4

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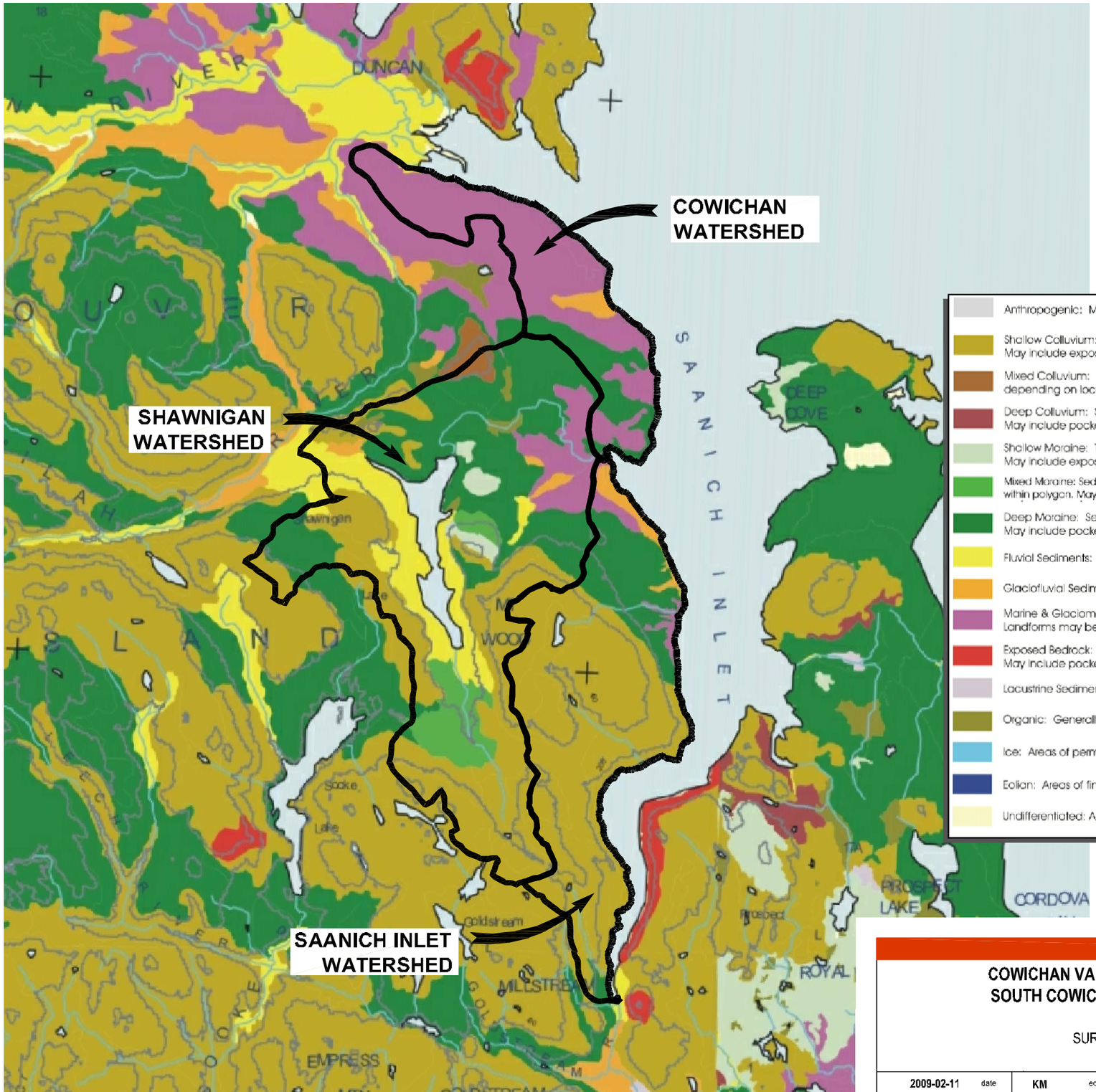

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SCALE IN KILOMETRES
1:150,000

- Anthropogenic: Man-made deposit such as mine tailing
- Shallow Colluvium: Sediments are Generally less than 1m thick overlaying bedrock. May include exposed rock, deeper colluvium or pockets of till.
- Mixed Colluvium: Sediments estimated to be less than or more than 1m thick over bedrock depending on location within polygon. May include pockets of till or perched glaciofluvial deposits
- Deep Colluvium: Sediments are generally thicker than 1m overlying bedrock. May include pockets of till or perched glaciofluvial sediments.
- Shallow Moraine: Tills generally less than 1m thick overlying bedrock. May include exposed bedrock, deeper till pockets of colluvium.
- Mixed Moraine: Sediments estimated to be less then or more than 1m thick over Bedrock depending on location within polygon. May include pockets of Colluvium or Perched Glaciofluvial deposits
- Deep Moraine: Sediments are generally thicker than 1m overlying bedrock. May include pockets of colluvium or perched glaciofluvial sediments
- Fluvial Sediments: Typically formed of sand and gravel worked by the river over the last few melania
- Glaciofluvial Sediments: Sand and gravel deposits related to outwash from previous glaciations
- Marine & Glaciomarine: Marine sediments including clayey silt deposits and intertidal (Littoral) deposits of sand and gravel. Landforms may be raised relative to current shoreline.
- Exposed Bedrock: Bedrock outcrops with little or not (<10 cm) sediment covering them. May include pockets of shallow colluvium or till.
- Lacustrine Sediments: Generally silt and fine sand, stratified deposits from old lakes, or on exposed floors of seasonal lakes.
- Organic: Generally refers to sediments resulting from thick accumulations of vegetation in wetlands such as peat bogs, fens & swamps.
- Ice: Areas of permanent snow & ice
- Eolian: Areas of fine sand transported by wind.
- Undifferentiated: A layered sequence of surficial sediments not possible to map separately

Source: British Columbia Ministry of Environment Surficial Geology of Vancouver Island Map

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COWICHAN VALLEY REGIONAL DISTRICT
SOUTH COWICHAN WATER STUDY PLAN

SURFICIAL GEOLOGY

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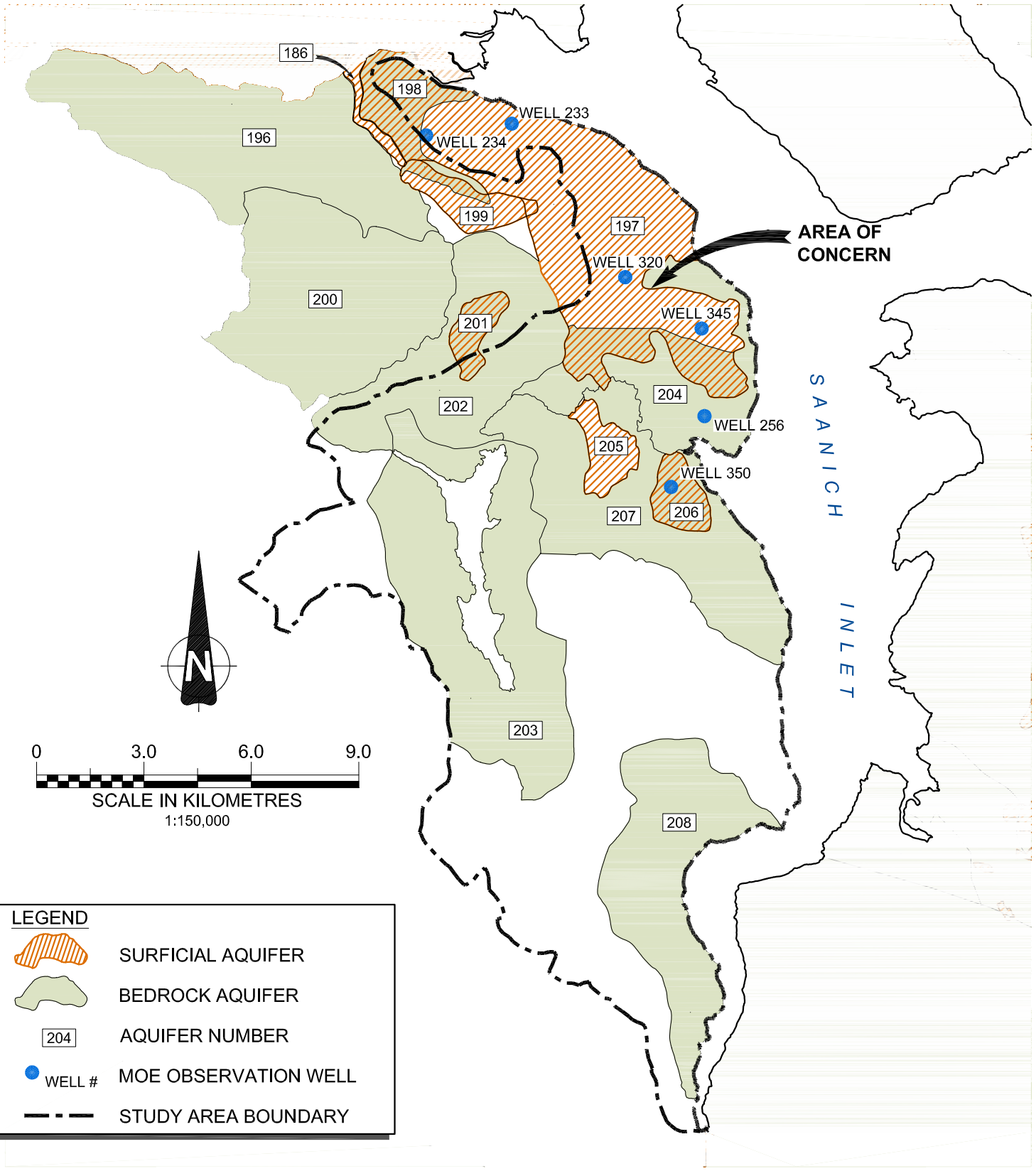
FIGURE: 5

FILE: J:\1976-1995\V19830100_Cowichan District - Water Plan Study\DRAWINGS\FIGURES\FIGURE 5.dwg Issued By: Victoria CAD



Source: British Columbia GeoBC Science & Information Branch (MOE)

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COWICHAN VALLEY REGIONAL DISTRICT
SOUTH COWICHAN WATER STUDY PLAN

MAPPED AQUIFERS AND OBSERVATION WELLS

WorleyParsons
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FIGURE: 6

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