

Assessment of Water Resources Sustainability in Otter Point, Shirley, and Jordan River

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2. EXECUTIVE SUMMARY

An assessment of water resources sustainability was commissioned by the Otter Point and Shirley Residents and Ratepayers Association (OPSRRA) for the communities of Otter Point, Shirley, and Jordan River, located on Southwest Vancouver Island, BC. The purpose of this project was to compile, analyze, and assess data in order to evaluate water resource sustainability in the three communities. The project objectives were to (a) create an ArcGIS map and geodatabase depicting wells, water licenses, watersheds, groundwater and aquifers (b) summarize and analyze the *Water Sustainability Act*, and (c) define information gaps in existing water resource data. Methods of analysis included compilation of spatial data related to water resources, summarization of relevant sections *Water Sustainability Act*, and identification of information gaps through analysis of acquired data. The GIS component comprised a static database and collection of URL linked layers, to allow of real time data to be viewed as it is continuously added or updated from the original sources. A literature review of aquifer studies was conducted to assess the extent of hydrogeological data in the study area. Non-spatial data were gathered from literature reviews and a field investigation of multiple water use allocations and distribution systems in the study region. A summarization and analysis of select sections of the newly instated *Water Sustainability Act* was completed. Sections were selected based on their relevance to the communities. Information gaps were identified via gap analysis of acquired data. Conclusions and recommendations for this project include conducting quantitative measurements of aquifer productivity during all seasons to confirm extrapolated information, providing citizens with ample information on the Act and its components, as well as obtaining additional data on climate, hydrometrics, and groundwater well lithology in order to conduct the most comprehensive assessment possible.

3. GLOSSARY OF TERMS

Technical terms relating to GIS:

Term	Definition
ASCII	Acronym for American Standard Code for Information Interchange. The de facto standard for the format of text files in computers and on the Internet that assigns a 7-bit binary number to each alphanumeric or special character. ASCII defines 128 possible characters.
Attribute Data	Tabular or textual data describing the geographic characteristics of features.
ArcGIS	A geographic information system (GIS) for working with maps and geographic information developed by ESRI Developer Network.
ArcMAP	GIS application used for all map-based tasks, including cartography, map analysis, and editing.
ArcToolbox	A user interface in ArcGIS used for accessing, organizing, and managing a collection of geoprocessing tools, models, and scripts.
Feature Classes	Collections of common features, each having the same spatial representation, such as points, lines, or polygons.
Geodatabase	Native data structure for ArcGIS and is the primary data format used for editing and data management using spatial datasets that represent generic GIS data models.
Geographic Information System	A system designed to capture, store, manipulate, analyze, manage, and present all types of spatial or geographical data.
Geoprocessing	Deriving new geographic information from existing datasets by application of analytic functions and documentation of results.
Geovisualization	Using various map views of underlying geographic information to support queries, analysis and editing of information.
Groundwater	Water stored in soil from infiltration of precipitation through voids in substrate.
Layer	Used to display geographic datasets in ArcMap, references a dataset and specifies how that dataset is portrayed using symbols and text labels.

Metadata	Information that describes the content, quality, condition, origin, and other characteristics of data or other pieces of information.
Orthophoto	An aerial photograph from which distortions owing to camera tilt and ground relief have been removed. An orthophoto has the same scale throughout and can be used as a map.
Projection	Based on a map projection such as transverse Mercator, Albers equal area, or Robinson, all of which provide various mechanisms to project maps of the earth's spherical surface onto a two-dimensional Cartesian coordinate plane.
Spatial Data	Series of parameters that define the coordinate system of the data.
Watershed	A basin-like terrestrial region consisting of all the land that drains water into a common terminus.

Definitions adapted from ERSI GIS Dictionary

Technical terms relating to *Water Sustainability Act*:

Term	Definition
Applicant	A person applying for an authorization, change approval, drilling authorization, transfer of an application, or abandonment of rights under an authorization.
Aquifer	A geological formation comprising permeable or fractured rock capable of storing, transmitting, and yielding groundwater.
Authorization	A licence or use approval.
Beneficial Use	To make use of water efficiently, in accordance with the regulations, during authorized times, in accordance with the authorization and/or the applicable provisions of this Act.
Comptroller	The Comptroller of Water Rights; a public service employee designated by the Minister of Environment. Comptrollers are typically senior staff members in a governmental organization associated with accounting and financial reporting.
Date of First Use	The date from which the comptroller, water manager or engineer is satisfied that the water in question has been used beneficially, in accordance with the regulations, in accordance with terms of use of the authorization, and on the

	appropriate property.
Debris	Mobile or scattered natural materials such as clay, silt, and rock fragments, or fragments of manmade materials from construction or demolition.
Engineer	A person specializing and/or educated in the design and construction of machines or structures, designated as an engineer.
Licence	Conditional or final licence; a type of permit given to a person authorizing a specific activity or set of activities.
Minister	The British Columbia Minister of Environment.
Owner/holder	A person who is entitled to the possession of, or has substantial interest in, land, a mine or undertaking in British Columbia.
Stream	A natural water course, modified or unmodified, or a natural water supply including but not limited to lakes, ponds, rivers, creeks, springs, ravines, gulches, wetlands, and glacier. Streams exclude aquifers.
Water Manager	A public service employee or class of public service employees, employee or class of employees of a government corporation appointed by the Minister to perform the duties of a water manager, as designated by the Act. Duties may originate under this Act or another piece of legislation.
Well	A manmade opening in the ground for the purpose of exploring groundwater, diverting groundwater, testing or measuring groundwater, recharging or dewatering an aquifer, remediation, monitoring, closed-loop geothermal well, or geotechnical well.
Well Cap	A cap or lid on a well put in place to prevent insects, wildlife, contaminants, debris, or other matter from entering the interior of the well.

Definitions adapted from the *Water Sustainability Act*

4. LIST OF ACRONYMS AND ABBREVIATIONS

- ALR: Agricultural Land Reserves
- CRD: Capitol Regional District
- DEM: Digital Elevation Model
- FITFIR: First in Time, First in Right
- GIS: Geographic Information System
- GPS: Global Positioning System
- ISO: International Organization of Standardization
- JDFEA: Juan de Fuca Electoral Area
- MOE: Ministry of Environment
- OCP: Official Community Plan
- OPSRRA: Otter Point and Shirley Residents and Ratepayers Association
- SWW: Sheringham Water Works
- US EPA: United States Environmental protection Agency
- USGS: United States Geological Survey
- UV (system): Ultraviolet
- WMS: Web Map Service
- WSA: Water Sustainability Act

5. INTRODUCTION

5.1. PURPOSE

An Assessment of Water Resources Sustainability was commissioned by the Otter Point and Shirley Residents and Ratepayers Association (OPSRRA) in order to address diminishing water security of three communities in the Juan de Fuca Electoral Area. The purpose of this project is to evaluate water resource sustainability in the communities of Otter Point, Shirley, and Jordan River, located on Southwest Vancouver Island, BC. The project comprised the creation of an ArcGIS map and geodatabase of identified water resources in the study region, an assessment of the 2016 *Water Sustainability Act*, and identification of information gaps as it relates to the project.

The necessity of this project arose from the increasing vulnerability of surface and groundwater in the study region. In recent years, pressures from new land development, industrial activity, resource extraction, and increasing drought caused by climate change have begun to place a strain on both natural and man-made water systems. The completion of this assessment allows for informed decisions to be made regarding future developments in the community, in order to protect the community's best interests. The water resource sustainability evaluation will facilitate both the stewardship and protection of the communities' water resources, as well as create a sense of ownership and responsibility among residents.

Otter Point, Shirley and Jordan River are predominantly rural communities comprising single family residences with large parcels of forest and agricultural land reserves (ALRs). Otter Point is a community adjacent to the District of Sooke and encompasses a land area of approximately

3,344 hectares with a population of approximately 1650 residents as of 2014, which is forecasted to rise to approximately 2,050 by 2018 based on annual average growth (CRD, 2014). The population of Shirley and Jordan River is estimated at approximately 680 residents as of 2011.

5.2. PROJECT SCOPE & DELIVERABLES

The scope of this project was delineated in the project objectives outlined by the sponsor. The project comprises completion of an ArcGIS map and an accompanying database of known water resources, a summary and analysis of the *Water Sustainability Act*, and identification of information gaps. This project spans a 42-week time period, with quarterly progress presentations.

The deliverables of the project to the sponsor were divided as follows:

- A centralized easily accessible, maintainable, and archivable water resources database
- An ArcGIS map of known water resources
- Identification of information gaps that may impact the water sustainability assessment
- A summary and analysis of the *Water Sustainability Act* relating to water resource sustainability in the three communities
- Project updates according to client timeline (See Appendix A)
- A final report to OPSRRA

5.3. OBJECTIVES

The following objectives were determined with guidance from the sponsor:

- Create a central ArcGIS database using Capital Regional District (CRD) protocols and guidelines to provide a GIS-based map with wells, water licenses, watersheds, groundwater and aquifers
- ArcGIS map will be compatible with existing CRD databases, and delivered to the community as an archivable and easily accessible product
- Define information gaps in existing water source data, and identify potential barriers to groundwater sustainability
- Review, evaluate and summarize the *Water Sustainability Act*, and determine whether the Act will ensure the sustainability of water resources for current and future communities
- Gather information to show the necessity of aquifer studies
- Produce a formal report on findings of project

6. PROJECT BACKGROUND

6.1. OTTER POINT AND SHIRLEY RESIDENTS AND RATEPAYERS ASSOCIATION

The Otter Point and Shirley Residents and Ratepayers Association (OPSRRA), established in 1992, is a registered non-profit society with an elected board of members representing approximately 3000 residents from the three rural communities of Otter Point, Shirley and Jordan River. Membership is restricted to property owners and residents within the boundaries of Otter Point, Shirley and Jordan River aged 18 years and over. Associate memberships are extended to individuals who do not meet the requirements. Membership is currently over 400 strong.

Communication with the public and members is done through monthly newsletters, regular meetings, and a website. The purpose of the society is to:

1. Ensure that development in the region maintains the best interests of residents
2. Co-operate with local government bodies to promote and advance the objectives of the society and communities
3. Examine government agencies' policies and performance
4. Promote community spirit and sense of identity/place through organizing and hosting community events and activities
5. Encourage citizens to run for public office (OPSRRA, 2016)

OPSRRA surveyed the communities in 2012, 2013 and 2015 to compile background information regarding water use and resources in the study area. Comment sections were made available to address specific concerns. The surveys addressed questions relating to water sources, shortages, source alternatives, and qualitative responses regarding safety, quality and supply of water in the

community. Concerns expressed by citizens in the survey responses included lack of legislation regarding watershed and water supply issues and protection of local wells. A localized approach to water governance is being considered to address potential legislative shortcomings. An alternative model could be incorporated, similar to the eleven-member citizen review committee used for Official Community Planning (OCP), focusing on a localized approach to land-use and advisory planning. Uncertainty lies in whether this approach would be approved by the Juan de Fuca Electoral Area (JDFEA) and the Capital Regional District (CRD) (OPSRRA, 2013).

6.2. STATUS OF WATER SUSTAINABILITY IN OTTER POINT, SHIRLEY, AND JORDAN RIVER

The communities of Otter Point, Shirley and Jordan River are contained within the Georgia Lowland geographic region, an area of low lying country (below 600 m elevation) which extends 280 km from the village of Sayward on the Johnson Strait to Jordan River, west of Victoria. This area is climatically unique and depends on groundwater as a major freshwater resource. Cyclonic storms, primarily in winter months, are principally responsible for precipitation in this region. Summer months are commonly dry in response to high pressure systems. The region experiences a rain shadow effect from the Olympic Peninsula. During the winter months, a surplus of rainwater ranging from 40-60cm is typically experienced; however, in summer months a moisture deficit ranging from 5 to 20 cm is common, and is a prime factor in water deficiency problems in the Georgia Lowland area.

Groundwater sources are relatively reliable in the study region, with year-round availability, low temperature variability, and low turbidity. Variations in river discharge, temperature, and turbidity limit river water as a main supply source in the study region. Additional sources of

freshwater come from distant inland lakes, damming of streams/rivers or undeveloped ground water aquifers (Ministry of Environment, n.d., p. 9.1.2). Groundwater levels in wells are affected by the amount of recharge the aquifer receives from recharge areas during the wet season. Groundwater and surface water are largely interconnected in the study region, and withdrawal from both above and below ground water reservoirs may impact neighbouring streams and wells. In coastal regions, excessive extraction of groundwater can lead to saltwater intrusion of the water table as ocean water infiltrates the sediments to replace freshwater reserves. As saltwater intrusion can create long-term damage to freshwater aquifers, caution should be taken to decrease or discontinue use of wells until aquifer recharge occurs, typically in the fall (Province of BC, 2015).

6.3. GEOGRAPHIC INFORMATION SYSTEMS (GIS)

As defined by ESRI, GIS is an organizational system that can be used to manage, analyze and present geographic information. Geographical information is represented by geographical datasets, each of which are capable of being modeled using simple generic data structures, analysed through a set of comprehensive tools, and presented to support several views. The three views that are best represented and most critical to proper application of ESRI ArcGIS are:

- Geodatabase, using spatial datasets that represent generic GIS data models (feature classes, rasters, topologies, networks, etc.),
- Geovisualization, using various map views of underlying geographic information to support queries, analysis and editing of information and,
- Geoprocessing (deriving new geographic information from existing datasets by application of analytic functions and documentation of results). (ESRI, 2004)

In this project, the database and ArcMap created have focused on the geodatabase view. The geoprocessing view was used to a lesser extent by compiling snapshot data of water resources in the study region and creating WMS live linked data layers to reduce the need to compile and manage the database. This will allow OPSRRA to focus on other geoprocessing actions such as analysis, modeling and cartography to further assess water resource sustainability.

6.4. WATER SUSTAINABILITY ACT

The *Water Sustainability Act (WSA)* is a modern piece of legislation administered by the Government of British Columbia, and is the central instrument in a large-scale effort to modernize the province's water laws. The *WSA* replaced British Columbia's historic *Water Act*, and the three regulations which fell within it: Water Regulation, Ground Water Protection, and Dam Safety. The *Water Act* exceeded 100 years of age at the time of succession, having been instated in 1909, and placed high emphasis on activities such as mining, forestry, and settling. As a result, it was significantly lacking in areas of environmental protection, an approach which is characteristic of those times (Province of British Columbia, 2016).

The *WSA* provides a legal framework to protect, utilize, and regulate water resources, as well as provide guidance and direction for water governance and management in British Columbia (Province of British Columbia, 2016). This framework will facilitate a modern approach to water resource stewardship, with a focus on environmentally responsible water use, extraction, and conservation. Of the many areas of improvement, the *WSA* has made significant updates in the following areas:

- Preservation of stream health and aquatic environments

- Consideration of water in decisions pertaining to development and land use change
- Regulation of groundwater use
- Regulation of distribution of water during times of scarcity
- Improvement of water security, use efficiency, and conservation
- Data management (measurements and reports)
- Facilitation of administration and governance to regulation-making authorities

(Government of BC, 2016)

The Act is applied through five regulations: Water Sustainability Regulation, Water Sustainability Fees, Rentals, and Charges Tariff Regulation, Groundwater Protection Regulation, Dam Safety Regulation, and Water District Regulation. The regulations hold important information for the domestic and industrial water user, as they define and enforce the legislation.

The WSA was officially implemented on February 29th, 2016. Due to the relative youth of this legislation, reviews and amendments were currently ongoing at the time this report's publication. However, once the legislation has been firmly established, this Act has the potential to move British Columbia forward in water resource governance and management.

7. MATERIALS AND METHODOLOGY

The methodology for this project was based upon both academic and applied principles. The acquisition, accumulation and compilation of data comprised the largest component of this project, followed by organization and analysis. The compilation aspect encompassed the creation of a water resources database in the form of a web-linked ArcGIS map and snapshot database. The WSA has been summarized and assessed for the local regions encompassed by OPSRRA. Information gaps have been identified by inventorying the collected information, and identifying areas which may require more information for more complete or detailed future analyses.

7.1. DECISION MAKING CRITERIA

Major and minor decisions were made using the following resources, criteria, and considerations:

- Objectives of the project
- Available time and project deadlines
- Needs of the sponsor
- Individual capabilities and educational experience
- Data quality and reliability
- Limits of data application
- Advice from project advisor and sponsor
- Sponsor networks and connections

Delineating criteria aided in the decision making process and helped to streamline and enhance progress and prioritization of work.

7.2. QUALITY CONTROL & QUALITY ASSURANCE

Several measures were taken to ensure the quality of the geodatabase and ArcMap. These included consultations with GIS experts and senior GIS administrators, in addition to thorough research and data acquisition. Standardization of data was addressed by accessing data from public government data servers, such as the BC Data Catalogue and the Federal Canvec data archive through Geogratis. Quality of the WSA summary was ensured through the study and optimal use of available resources. Each of the selected sections was read thoroughly and completely, and were analysed until a comprehensive understanding was achieved. Interpretation and correct phrasing of the section summaries was aided by Jennifer Smith, an instructor of Environmental Law in the Bachelor of Science in Environmental Science Program at Royal Roads University. The interpretation of the sections in terms of meeting community needs, as well as identification of information gaps, were discussed amongst the group members in order to gather as much input as possible and achieve a well-rounded analysis.

7.3. METADATA STANDARDS & REQUIREMENTS

Meeting CRD metadata standards was initially outlined as a requirement from OPSRRA, but upon further research and discussion with CRD GIS specialists, it was determined that meeting CRD standards was unnecessary unless unique data were created or developed from previously acquired data. Metadata standards for OPSRRA followed the document *CRD Information Technology and GIS Services: GIS Standards for External Agencies*. Acceptable formatting for created GIS data was outlined in ISO 19115.

The purpose of meeting these standards is to ensure data is interoperable by multiple GIS organizations, systems and users. Collaborative efforts derived from data sharing and use

between GIS users is a fundamental need that GIS practises have relied on to assess GIS standards.

7.4. DATA SOURCES & COLLECTION

The methodology for data acquisition was completed as follows:

- Identified and obtained GIS data resources by investigating municipal, regional, provincial, and international databases, as well as reviewing the existing data possessed by OPSSRA
- Identified and obtained the required information for each water resource
- Contacted local government (CRD) staff to obtain CRD GIS data standards
- Collected and organized data
- Obtained additional insight through site visits
- Assimilated data in a format compatible with the GIS platform

7.5. DATABASE CATALOGUE CREATION

The methodology of data compilation was completed as follows:

- Assigned attribute data (non-spatial information stored in a table linked with an identifier)
- Organized snap shot data and WMS layers in a logical fashion on both the ESRI ArcGIS platform and in the database
- Entered data into an ArcGIS platform and create layers based on wells, aquifers, and other water sources of focus
- Archived and stored data

- Primary Archive: ArcGIS using Geodatabase archiving
- Secondary Archive: USB drive
- Tertiary Archive: Secured PC in ASCII file format

7.6. WATER SUSTAINABILITY ACT ASSESSMENT

A summary of the relevant sections of the *WSA* preceded the analysis and interpretation of the Act in the context of the communities of Otter Point, Shirley, and, Jordan River.

General Approach:

- Summarization of the *WSA*
- Analysis of the *WSA*
- Interpretation of the *WSA* in terms of sustainable development in the region, and how the *WSA* will influence current residents

Summarization of the *WSA* was carried out using the following methodology:

- The structure and components of the *WSA* were assessed
- Sections most pertinent to the residents of Otter Point, Shirley, and Jordan River were selected
- Each relevant section was read and summarized, the information was then compiled in a central document
- Complete summarization of relevant *WSA* sections

Analysis of the WSA

- The aim of this section was to analyze the WSA and determine whether the Act will offer sufficient protection and regulation of the community's water resources, in terms of current and future needs
- An interpretation of the Act and how it might impact the residents of Otter Point, Shirley, and Jordan River was carried out

7.7. IDENTIFICATION OF INFORMATION GAPS

Information gaps in the water resource data were identified over the entire course of the project. This was done by conducting literature reviews pertaining to water resources in the study region. Information gaps were further identified during the compilation of GIS data for creation of the GIS map and database; applicable data layers with either a scarcity or absence of information contained within the study region were outlined. Additional information gaps were explored during the analysis of the WSA. This included identifying missing information which may be critical to performing a complete and thorough assessment. This identification of information gaps provided a framework for the Recommendations section of this report.

8. RESULTS & FINDINGS

The following section outlines results and findings based on compilation of the ArcGIS Map layer and geodatabase along with analysis of the *Water Sustainability Act* which were then used to identify information gaps.

8.1. GEOGRAPHIC INFORMATION SYSTEM (GIS) MAP

All data layers of interest were acquired from the DataBC Catalogue under the search topic “water resources” on April 29th 2016. The data were referenced as a WMS server or downloaded as a geodatabase file. The resulting layers were chosen first on title of the layer, then by the description.

8.1.1. Base Maps

The base maps used for the ArcGIS database are basic topographical maps of the study area. The base maps were provided by ESRI ArcGIS as a free downloadable GIS software package from their website.

8.1.2. Layers

The layers collected from DataBC number over 100. A complete list of the layers of interest used in the project can be found below. The layers are presented in ArcGIS format through WMS servers linked in ArcCatalogue with snap shot data references assembled in linked folders. Additional data sources included: Living Atlas of the World, ESRI Arc Hydro, Water and Environment Hub (WEHUB), Environment Canada (EC), Government of Canada Open Portal Data, Atlas of Canada, GeoConnections, GeoBase, Open Data Society of BC and the BC Ministry of Environment. The majority of the data from sources outside of DataBC were excluded, as they typically contained duplicate data already sourced in DataBC, were considered

to be irrelevant, or were incompatible with the database design. Please see Appendix II for a complete description of the data layers.

8.1.2.1. Freshwater Resources

Freshwater resources in the Juan de Fuca Electoral Area (JDFEA) have been well documented as the coastal area of the JDFEA has a large number of both provincial and national parks.

8.1.2.2. Surface Water

Surface water comes from a variety of sources (weather, glacial melt, ground water discharge areas, watersheds, etc.) and is defined as the top layer of a water body (USGS, 2016). GIS layers that encompass surface water present in the study area are listed below. The designation of ‘SS’ indicates data included in the snap shot database, and ‘WMS’ indicates data included in the web mapped server.

- Macro Reach Lines (50k) (SS and WMS)
- Stream Center Lines (50k) (SS and WMS)
- Dams (Public View) (SS and WMS)
- Environmental Remediation Sites (WMS)
- EAUBC Ecological Drainage Units (WMS)
- EAUBC Fresh Water Ecoregions (WMS)
- EAUBC Lakes (WMS)
- FWA Lakes (SS and WMS)
- FWA Linear Boundaries (SS and WMS)
- FWA Man Made Water Bodies (SS and WMS)
- FWA Named Point Features (SS and WMS)

- FWA Named Watersheds (SS and WMS)
- FWA Obstruction (SS and WMS)
- FWA Stream Direction (SS and WMS)
- FWA Water Resource Management Streams (SS and WMS)
- Streams with Water Allocation Restrictions (SS and WMS)
- Water Approval Points (WMS)
- Water Reserve Polygon (WMS)
- Sensitive and Protected Streams (WMS)
- Water User Communities (WMS)
- Drinking Water Source Points of Diversion (SS and WMS)
- Points of Diversion with Water Licence (SS and WMS)
- Points of Diversion without Water Licence (SS and WMS)
- Licence Springs (SS and WMS)

8.1.2.3. *Watersheds*

Watersheds are drainage regions separated by rivers, seas or basins which contribute to the overall flow of the watersheds outlet (USGS, 2016). Understanding a watershed can help identify problems with water quality and/or quantity in its respected drainage area. GIS layers that encompass watersheds present in the study area are listed below:

- Aquifer Feature Point (50k) (SS and WMS),
- BC Watersheds Group (3rd order and higher) (50k) (SS and WMS),
- Community Watershed Groups (SS and WMS),
- Environmental Monitoring Locations (SS and WMS),

- Macro Reach Lines (50k) (SS and WMS),
- Major Drainage Regions of BC (50k) (SS and WMS),
- Stream Center Lines (50k) (SS and WMS),
- Hydrology Hydrometric Watershed Boundary (SS and WMS),
- Hydrology Watershed Boundary (SS and WMS)
- Water Survey of Canada Sub-Sub Drainage Areas (SS and WMS).
- FWA Watershed groups (SS and WMS)
- FWA Watershed Assessment (SS and WMS)
- FWA Water sheds (SS and WMS)
- Water Officer Boundary (SS and WMS)
- Water Management Districts (SS and WMS)

8.1.2.4. *Groundwater*

Groundwater is defined as water accumulated in soil, sediments, or bedrock as a result of infiltration of water through voids, pore spaces, or fractures in the substrate. Once infiltration reaches a point where all available pore spaces are filled with water, it is said to be saturated. Groundwater flows through saturated layers of rock and substrate called aquifers, which are geologic formations that carry sufficient quantities of water that can be extracted and serve as a water supply (USGS, 2016). GIS layers that encompass the watersheds present in the JDFA are:

- Natural Aquifer Layer
- Data Ground Water Quality Stations Layer
- Non-TRIM Hydrology (SS)

- Hydrologic Low Flow Zones (SS and WMS)
- National Annual Run Off Isolines from 1961 to 1990 (SS)
- Geologic Fault Lines (SS and WMS)
- Aquifer Intrinsic Vulnerability (SS and WMS)
- BCA Ground Water Aquifer Classification (SS)
- BCA Ground Water Aquifers (SS and WMS)
- Ground Water Quality Zones (WMS)

8.1.2.5. *Wells and Water Works*

There are three main types of wells: driven shaft, bored hole, or dug hole. Wells provide a source of water for consumption, irrigation, industry or other purposes. A water works is an establishment that manages and provides a safe water supply via reservoirs, pipelines and/or conduits to those requiring water. GIS layers that encompass the wells and water works present in the study area are listed below:

- BC Government Active Observation Wells Layer (SS and WMS)
- BC Government Inactive Observation Wells Layer (SS and WMS)
- Borehole Log Lithology (public view) (SS and WMS)
- Ground Water Well Lithology (SS and WMS)
- Ground Water Well (spatial view with attribute info) (SS and WMS)
- Water Works Lines and Points (SS and WMS)

8.1.2.6. *Reservoirs and Restrictions*

Reservoirs encompass a variety of basins or structures built to contain water (NHD, 2016).

Restrictions regulate water removal, allocation and limits for water use on an individual,

community, and industrial level. GIS layers that encompass reservoirs and restrictions present in the study area are listed below:

- Regulated Private Water Utilities (SS and WMS)
- Water Allocation Restrictions (SS and WMS)
- Reservoir permits over Crown land (WMS)
- Streams with Water Allocation Restrictions (SS and WMS)
- Water User Communities (WMS)

8.2. NON-SPATIAL DATA

Non-spatial data refers to data that are not directly related to spatial coordinates as defined on the map and geodatabase.

8.2.1. Site Visit, March 29th 2016

OPSSRA community representative Brenda Mark planned and hosted a site visit to the communities of Otter Point, Shirley, and Jordan River. The tour featured a number of sites which demonstrated various water resource applications, and offered an excellent educational opportunity to enhance the team's understanding of water resources and their limitations.

Highlights of the site visit are outlined below.

8.2.1.1. JDFEA - Services Building

The CRD Services Building is located in the outskirts of Sooke, BC. A tour of the facility was given by the CRD representative, Iain Lawrence. One of the highlights included the rooftop rainwater collection system used for non-potable water. The rooftop collection system is used as a secondary source of water for the Services Building, with the primary source being trucked-in

potable water. During the interview with Iain Lawrence, the team learned that streams, rivers and creeks in the region have been mapped using aerial photo imagery (orthophotography), that has been converted to spatial data. In order for more accurate data to be obtained, GPS-based technology can be used to map the locations of these water resources. It was also discovered that if a well has not been used in over 10 years, it is required to be capped and decommissioned. Following the visit to the CRD Services building, residential developments were explored in the immediate vicinity. A new housing development block in Otter Point was investigated in regards to water supply issues. At time of development, a drilled well was able to provide an adequate water supply to meet residential needs; however, residents who have recently moved into this development are currently relying on trucked water. It appears (from this single example) that seasonal fluctuations of water supply were not taken into account during the development stage. The Gordon's Beach area was toured as an example of a community which has ample access to water resources, as extraction from a single well adequately supplies approximately 20 domestic dwellings. This example showcased to the team that there is potential for sufficient water capacity, depending on the aquifers existing in the study area.

8.2.1.2. Sheringham Water Works District

Dominique Bernardet graciously gave a tour of the pump house at Sheringham Water Works (SWW) which supplies residents in the community of Shirley with potable water. In 2011, the SWW implemented water restrictions and guidelines in accordance with CRD rules, which are now in force from May 1st to September 30th each year.

Protection of the Goudie Creek watershed is crucial for protecting the domestic drinking water of residents in Shirley serviced by SWW. As the Sheringham Water Works district is a community-

owned, non-profit undertaking, it does not have the resources required to purchase the land encompassing the Goudie Creek watershed outright, which is largely owned by the Western Forest Products (WFP). Turbidity had been a previous issue from the land use and logging operations alongside the creek, as silt and debris from logging operations created clogs in the filter and inlet. Negotiations between Western Forest Products and the SWW resulted in an agreement to extend the riparian boundary zone away from the creek further than the provincially-legislated boundary for logging activities.

Goudie Creek is dammed to ensure an adequate water supply, with maintenance performed regularly to remove excess sediments from the intake. There are three inputs into the creek, including a spring, and it is predicted to withstand a 3-year drought. From the intake, water is fed through a sand filter, membrane filter, and UV filters. Chlorine is added for disinfection.

8.2.1.3. Rooftop Rainwater Collection System

A tour of a residential rooftop rainwater collection system was graciously offered by a homeowner in the study area. Rainwater on this property was used in conjunction with other water sources and was primarily used for irrigation and non-potable water. Limitations on this type of water resource include clogged filters and infrastructure during the pollen season which prevents collection at that time of year. Abundant water storage and capacity are required when implementing a rooftop rainwater collection system. Additionally, the system requires regular maintenance, which is typically completed by the homeowner. Other considerations include initial start-up costs and infrastructure requirements. A rooftop rainwater collection system requires the following infrastructure:

- A catchment system for collecting rainwater (roof)

- A conveyance system (eaves troughs, pipes, downspouts) for transporting water to the collection system
- Storage system (cisterns, tanks) for future use
- Distribution system (plumbing)

Benefits of utilizing this water resource include its environmentally friendly and sustainable nature, which provides positive costs over the long term compared to transporting bulk water. Water collection infrastructure does not depreciate and provides a long service life for the user. This method is currently used worldwide as a solution to extreme drought conditions and to offset the effects of water resource limitations that are increasing due to climate change. Rain water collection can reduce the consumption of ground water, as this harvested rain water can be used for irrigation, toilet flushing, laundry, and as potable water. For the communities at hand, this collected water can be used to supplement water when there is a water shortage.

8.2.1.4. Residential Private Licence on a Spring / Creek (with Cistern)

Obtaining a private license for water from creeks, lakes, and rivers was another water resource option explored on the site visit. Water licences allow homeowners to divert surface water for domestic uses. The licences are important for assessing water supply and allocation demands for planning purposes. Water filtration and disinfection are routine techniques that need to be implemented to ensure safe domestic use from creeks.

8.2.1.5. Point no Point Resort Water Supply

Water for the Point no Point resort is sourced from Jacob Creek and the resort maintains and operates a water sanitation and disinfection complex on site. The water sourced to the resort facility is gravity fed, and additional systems for pressurizing water are not required; however, in

order to obtain enough pressure from the gravity fed system the water is required to be sourced from a region of higher elevation a long distance away from the resort. Activity by the logging industry is closely monitored to avoid turbidity in the water.

8.2.1.6. Bliss Spring at Jordan River

Bliss Spring currently services approximately eight residential dwellings. The rights of using the spring water community water license have been grandfathered. Water is sent for regular analysis with results submitted to the Vancouver Island Health Authority. Individual UV and chlorination systems are used by the residents to treat collected water.

8.2.1.7. Kemp Lake Water Works District - Juan de Fuca Electoral District

Mr. Keven Brehart provided the team with a discussion on water services provided to residents within the Kemp Lake Water Works District service area, which includes residents in the community of Otter Point. Kemp Lake Water Works currently services approximately 750 residents within their service area and does not have plans for expansion of this service. Water is withdrawn from the Kemp Lake watershed, treated and then distributed throughout the service area. Vulnerability of the watershed from anthropogenic influences or environmental contaminants is a continuous cause of concern. Water is sent for weekly analysis with results submitted to the Vancouver Island Health Authority. Disinfectant (chlorine) levels are tested daily. Water main flushing is required and performed annually. Currently, the Kemp Lake Water Works District is in the process of grant applications for aid in infrastructure costs for connection to the CRD water supply. The infrastructure foundation for connection to the CRD water supply is to begin in late 2016.

8.2.2. Aquifer Studies in the Area.

The *BC Aquifer Classification System* was developed in 1994 by the BC Ministry of Water, Land and Air Protection. This system of categorizing aquifers in the *Canadian Cordillera Hydrogeologic Region* was developed based on general hydrogeologic characteristics throughout British Columbia. (Wei et al., 2009). Raw data (including well records, water quality, and geology) were synthesized into a format easily retrievable and applicable to land planners, resource managers and the public for management and protection of groundwater resources. The *BC Aquifer Classification System* divides aquifers into nine classes as determined by vulnerability, level of development and priority. Hydrogeologic cross-sections are used to assist in identifying aquifer boundaries for classification purposes.

Aquifers were identified and characterized based on delineation of the spatial extent of individual aquifers, including >200 aquifers identified and studied on Vancouver Island between 1995 and 2007. Aquifer boundaries and classifications are typically described to the extent of the aquifer as a whole. Accurate delineation of the aquifer boundary and classification are limited by data availability; however, as additional data is collected the boundary and classification criteria become further refined. BC Aquifer classification maps are available from the BC Water Resources Atlas and from GeoBC, an online data repository of provincial geographic information.

From 2003 onward, the majority of water-bearing unconsolidated and bedrock aquifers were identified, mapped and classified in the Capital Regional District on Southern Vancouver Island, BC. A total of 24 aquifers were identified including 16 unconsolidated and 8 bedrock aquifers. Over 4170 well records, geologic and topographic maps were used to map and classify aquifers in conjunction with previous geological and hydrogeological studies. Subsurface details were

inferred through spatial correlation of well logs and surface topography (Kenny, 2004). Since the initial phase of the project, ongoing data on well locations and aquifers have been added to the CRD Natural Areas Atlas.

Productivity of aquifers in the CRD was found to be classified as low to moderate. The largest aquifer - a volcanic bedrock aquifer with low yields - was found in the Sooke / Metchosin region (Kenny, 2004). Aquifer 449 at Muir Creek is the highest yielding bedrock aquifer in the study region. The Goldstream and San Juan River aquifers are associated with a major flood plain and found to be highly productive (Kenny, 2004). In general, the yield of an aquifer increases based on proximity to surface water bodies (i.e. lakes and streams).

8.2.2.1. *Aquifer Vulnerability Studies*

The concept behind an 'intrinsic vulnerability' study is based on the natural protection of groundwater contamination from the environment. As previously described, aquifer vulnerability can be assessed by drawing on a number of resources. Included in these methods are *Process-Based* models, which rely on numerical modeling, *Statistical* methods which involve correlating water quality data to spatial variables, and the *Overlay and Index* approach which involves combining layers of mapped parameters that affect the level of vulnerability of an aquifer which can then be assigned an index value and presented as a spatially defined vulnerability index.

The DRASTIC method is an "Overlay and Index" method developed by the US EPA, and initiated by The Vancouver Island Water Resources Vulnerability Mapping Project in 2006 to better protect groundwater quality on Vancouver Island using decision making tools.

The DRASTIC method characterizes intrinsic vulnerability from qualitative indexing models to quantitative hydrological assessments with numerical modeling. The DRASTIC model takes into account seven factors or input parameters to assess intrinsic vulnerability: 1) Depth to water table; 2) Recharge (net); 3) Aquifer medium; 4) Soil Media; 5) Topography; 6) Impact of vadose zone; 7) Conductivity of aquifer (hydraulic). Each parameter is ranked (from 1-10) based on the relative ability of the parameter to protect groundwater as an attribute on a map layer. After each parameter is ranked the rankings are combined to create a final vulnerability index (VI) which can then be spatially mapped (Liggett, Lapcevic, & Miller, 2011). Included in this assessment are characteristics of the soil and unsaturated zone material, aquifer material, depth of aquifer, amount of recharge, slope and preferential pathways of the contaminant. This method was selected by the Vancouver Island Water Resources Vulnerability Mapping Project as it relays regional information and is easy to implement and use with available datasets. Assumptions of the model relate to simplifications regarding contaminant movement and pathways. The project was performed in a two stage process; the initial stage was a pilot studies performed in the Regional District of Nanaimo and Cowichan Valley Regional District. The second part of the project expanded to other parts of the island where necessary data for completing the project was available (Liggett, Lapcevic, & Miller, 2011).

8.2.3. Water Transport Companies

An ethical review process was completed in order to obtain information on the quantity of water that was being trucked into the communities of Otter Point, Shirley, and Jordan River.

Unfortunately, reliable solid data could not be obtained. Because these data were unobtainable, it was deemed a data gap.

8.2.4. Climate and Weather

Seasonal variations control the amount and type of precipitation which is responsible for the recharge of streams and groundwater resources in the study region. The highest annual precipitation levels occur in the winter months; the summer months are usually dry. Past weather and climate station data from the region were explored. The only federal weather station in the region collecting data was Sheringham Point. Historical data available from stations within a 25 km radius of the study region is detailed as follows:

- Muir Creek 1W; 1970 – 1986
- Sheringham Point; 1992 – present
- Point-No-Point; 1990 – 2005
- Sooke Otter Point; 1974 – 1977
- River Jordan; 1908 – 1972
- Victoria Marine; 1967 – 1992
- Sooke; 1970 – 1992
- Bears Creek; 1910 – 1971
- Milnes Landing; 1910 – 1956
- Cowichan; 1904 – 1925
- Sooke Saseenos 1976 – 1979
- Sooke Lake; 1903 – 1966
- Sooke Glinz Lake; 1983 – 1995
- East Sooke Anderson Cove; 1966 – 1980
- Becher Bay; 1956 – 1966

8.3. SUMMARY OF 2016 *WATER SUSTAINABILITY ACT*

Summaries of the most relevant sections of the *WSA* were completed to eliminate extraneous information and ensure the most important material was made available to the residents. The summaries can be found in Appendix I.

8.4. IDENTIFICATION OF INFORMATION GAPS

The following information gaps relating to water sustainability in Otter Point, Shirley, and Jordan River have been identified over the course of our research and through information provided by residents during the site visit. Recommendations for addressing information gaps are outlined in the discussion section.

9. DISCUSSION

9.1. SIGNIFICANCE OF ARCGIS MAP AND WATER RESOURCE DATABASE

GIS is a comprehensive planning tool which merges and integrates diverse datasets under a single accessible platform. GIS mapping tools allow users to access information on water resources and quantify capacity. Scientific data is required to assess how much water is available for domestic/commercial/industrial and recreational uses. The allocation of water resources and uses are spatially defined on a map at different scales which allows communities and decision makers to identify water demands and ensure water use remains sustainable. These tools provide a user-friendly way to visualize and communicate findings on current and future levels and to determine how these projects will affect water resources in the region. Suggestions can then be brought forward to the public, policy makers and government agencies. This allows decision makers to implement the best practices to manage water resources.

The application of a GIS map and database will allow the members of OPSRRA to spatially visualize and determine watershed boundaries and buffering criteria established in the OCPs for protecting watershed areas, streams and creeks and maintaining water quality criteria. Buffer zones can be added as a feature class into the GIS platform as a useful tool for proximity analysis regarding specified activities in relation to creeks, streams and watersheds. Analysis of aquifer vulnerability, using the DRASTIC method, can be applied using the information presented in the map. Current status of water resources and discharge rates can be evaluated based on hydrometric station data and well lithography logs. Additionally, patterns of water use can be identified and considered over a range of temporal and spatial ranges and applied to Official Community Plans and land use decisions.

ESRI ArcGIS offers a hydrology toolkit which can be used for hydrologic function analysis to model the movement of water. Concepts related to drainage systems and surface movement can be extrapolated using digital elevation models (DEM) and hydrologic information. Hydrology tools can be used to delineate watersheds, extract river profiles and identify stream networks. Stream ordering can also be performed by assigning a numeric order to links within a stream network (ESRI, 2011). Additional uses of hydrologic tools in ArcGIS include methods for identifying sinks, calculating flow and determining flow direction, which can also be used to model impacts from rerouting water flow.

9.2. ANALYSIS AND EVALUATION OF THE *WATER SUSTAINABILITY ACT*

While many resources pertaining to the *WSA* and the supporting regulations are available on the internet, the Act does not lend itself to readability. There is a significant language barrier between the *WSA* and the lay public created by the use of legal jargon, which may make necessary transitions, such as the licensing of a groundwater well, difficult to complete. This may create unnecessary delays in the achievement of sustainable and environmentally responsible water resource management. In addition to the technical language, the Act references several other pieces of legislation and their respective regulations, creating a convoluted document which requires a broad understanding of federal and provincial legislation. One solution is to provide residents with information on the *WSA* which removes inhibitory language, thereby increasing understanding and public education; this is one of the goals of this report. This type of resource also increases transparency between the individual, the Government of British Columbia, and the information provider (e.g.

OPSRRA). A clear understanding of the required course of action will also make for a smoother and more efficient transition to sustainable water use. However, for the most complete interpretation and assessment, consultation with a legal practitioner is strongly advised.

While the *WSA* does specify the legal requirements and responsibilities of domestic and industrial water users, the community water conservation strategies are left relatively vague. Conservation strategies can be found within the Act as community sustainability plans under the category of water sustainability. These plans advocate community engagement, but do not provide guidelines for structuring the plan itself or engaging community members. This lack of guidance and direction could lead to failed sustainability plan implementation attempts, doing more harm than good to public perception. Ideally, the Act would include a set of guiding principles akin to the International Organization for Standardization (ISO) 14001 series, which provides requirements, standards, and guidance to companies looking to implement environmental management systems. As this type of standardization is unlikely to become part of the *WSA* in the near future, it may be beneficial for OPSRRA to look into systems of sustainability plan implementation, much like those of the ISO 14001 series.

Drought and other water crises are becoming increasingly important issues as global climate change continues to exert pressures on natural systems. Strategies or guidelines for water management and conservation will become essential. The *WSA* provides information on community sustainability plans, requirements for changes in and about a stream, etc., which may help to prevent water crises; however, there is no mention of strategies to engage in once a water crisis has taken hold. While not all areas of British Columbia experience drought or water

scarcity, the communities of Otter Point, Shirley, and Jordan River, along with many others, do. To address this problem, the Act should create a set of measures for residents in high risk areas, detailing the course of action for when a drought, water scarcity, or water of an acceptable quality is ongoing. Once again, it is unlikely that these measures will appear in the Act in the near future; therefore, it is advisable for OPSRRA to create such measures and make them available to the residents of their respective communities.

9.2.1. Water Licensing Process

The water licensing process is detailed in sections 7 and 8 of the WSA. For ease of use, application for a water licence can be completed online at the FrontCounter BC website. The application is directed to a Water Manager at the Ministry of Forests, Lands and Natural Resource Operations, who reviews the application for a licence. The terms and conditions typically associated with water licences include:

- The name and location of the stream from which water is to be taken or stored
- The location of the stream
- The licence's priority date
- The water usage intention
- The maximum water quantity that may be stored
- When the water may be used (time of year)
- Property information
- Authorization to construct works to divert and convey water from the stream to the area where it will be used
- Other clauses that explain special terms for a particular authorization

9.2.2. Requirements for Groundwater Users

Water licences, fees, and rentals must be obtained for groundwater that is diverted and used for non-domestic purposes. Licences clarify the legal water use limits, as well as the rights of the user. Well owners who use water for domestic purposes are exempt from licensing and paying provincial water fees. Water must be used beneficially, and its use must comply with regulations of groundwater protection. A person who is authorized to divert water is required to make beneficial use of water; this is explained in section 30 of the *WSA*. The user may be required to submit a declaration outlining their intended water usage to the Water Manager, and may also need to complete a water conservation audit.

9.2.3. Strengths and Weaknesses of the Act

The *WSA* is a modern piece of legislation that replaced British Columbia's historic *Water Act*. While the *WSA* has maintained many elements of the *Water Act*, new policies and areas requiring attention, such as water sustainability and groundwater protection, have been introduced. With updated language and new sections, the Act is farther reaching overall. Clear standards, processes, responsibilities and expectations for managing British Columbia's water, as well as methods of protecting drinking water from contamination, were developed within the Act. However, there are both strengths and weaknesses to this contemporary piece of legislation.

Amongst the strengths, compliance and the consequences of non-compliance are emphasized by imposing fines and orders. These consequences are enforced under the Act and its five regulations. The determination of hydraulic connectivity between the streams, aquifers, and streams is another advancement, as it promotes the collection of diverse data, and increases the

quality of decisions made in the hydrogeological field. The potential impacts of water diversion from a stream or aquifer are considered, and now require an authorization for any works that involve changes in and about a stream. Within the Act, emphasis is placed on using water beneficially and efficiently, which may help to foster positive water use behaviours.

One of the most significant developments in the WSA was the creation of a process for communities to develop regional water plans. These plans must include stakeholder consultation; while stakeholder involvement is important, the Act fails to outline a community consultation process for permits regarding water extraction in a shared community area.

The “first in time, first in right” (FITFIR) system is described in section 22 of the WSA, where the precedence of rights is set out. FITFIR is a priority of rights system, where licences with earlier dates have full allocation of water over newer licences. This information is important for first time owners in the community, as it could present a challenge in terms of obtaining access to a stream or aquifer for household water. When faced with issues like droughts or flooding, this archaic system would not be sustainable for the communities.

9.3. ANALYSIS OF INFORMATION GAPS

The following section outlines information gaps as determined throughout the course of the project, which were identified as preventing complete water resource sustainability assessments in the study region.

9.3.1. GIS Layer Information Gaps

General information gaps in the database come from non-standardized recording techniques that non-governmental organizations utilize. The presence of non-standardized third party methodologies, recording techniques, and general practices becomes an issue when attempting to address the water resource sustainability of the study area. If all information was standardized it would be straight-forward to interpret and assess missing information in areas of interest. For example, well lithology compilation and recording appears sporadic. With over 2000 documented wells, only 500 were determined to contain depth of water information and only 300 contained lithology characteristics. In combination, approximately 200 wells had both characteristics defined in the metadata. To address this concern, bylaws could be put in place, outlining the format in which information is to be recorded and reported to the CRD.

9.3.2. Rooftop Rainwater Collection

The number of domestic residences or public and commercial spaces utilizing rooftop rainwater collection systems is not centrally documented. Currently there is no requirement for registration of rooftop collection systems with local, regional, provincial or federal government authorities. Additionally, there are an unknown number of households relying on multiple water sources (e.g. combination of trucked water, rooftop rainwater collection, and groundwater wells).

As the collection of rooftop rainwater within the communities is not documented, a recommendation is for OPSRRA to survey residents the communities to collect quantifiable data which can be represented as a GIS map layer in the database provided. Additionally, the amount of water collected over the course of the wet season from rooftop collection systems are valuable data for further water sustainability assessments.

9.3.3. Spatial Coordinates

Locations of creeks, streams and rivers in the study region have largely been interpolated from orthophotos which inherently have error built in based on projections. Physical investigations (e.g. GPS recording) will facilitate more accurate assessments of these resources.

Physical investigations should be carried out to gain accurate spatial coordinates of all rivers, creeks and streams in the region, in order to facilitate land use planning

9.3.4. Aquifer studies in the region

In areas where little is known of specific aquifer properties, aquifer productivity is largely extrapolated from aquifers with similar characteristics in the area. The inferred knowledge from this approach can be useful for developing an approximation of assessments of local aquifers in areas that are not well studied. However, it should be noted that inferred assessments of aquifers do not replace actual testing of aquifer characteristics for determinations of the resource (Wei, Allen, Kohut, Grasby, Ronneseth, & Turner, 2009).

Seasonal water fluctuations in well capacity are largely unknown throughout the study area. Water discharge data retrieved from the well lithology records represent a static quantity, typically recorded upon initial drilling of the well. By regularly measuring and quantifying capacity of well water in the study regions and linking this information to climate data, determinations of when and where groundwater supplies are likely to be most stressed can be realized.

Aquifer areas underlain by unfractured bedrock typically yield limited water capacity and may not yield enough supply for domestic users. Of major concern to users of groundwater in the study region are issues relating to the quantity and quality of groundwater supply. Included in

these concerns are conflicts which may arise between property owners relying on groundwater supply where interference, or drawdown effects, may occur between neighbouring wells.

Additional attention needs to be given to well water withdrawals resulting in reductions to the base flow of water to nearby creeks and rivers with pre-existing water allocation licences (Kenny, 2004).

Identification and classification of aquifers is a critical step in understanding and protecting groundwater resources in conjunction with community education on water conservation, water management and best practices. Local planning and developments are dependent on aquifer studies for managing, protecting and preserving groundwater resources.

Knowledge of aquifer and groundwater resources is limited in British Columbia by a lack of comprehensive studies in many areas. A quantitative assessment of groundwater availability in the study region is critical in order to make a complete assessment of water resources available to the communities of Otter Point, Shirley and Jordan River. Performing comprehensive studies of aquifer productivity in the communities will allow for better land use decisions and water resource allocations based on measurable parameters that are continuously changing.

A full investigation of aquifer assessment and characterization is recommended for the study area, in response to gaps in information records, the likelihood of seasonal droughts and scarcity of known resource data. In order to achieve a full assessment of aquifer status, a combination of geological mapping, groundwater modelling and hydrogeological assessments should be performed to form a complete inventory of aquifers and status of said aquifers. Increased groundwater monitoring will be necessary to compare, extrapolate and predict water resource

assessments in the future and in response to changing weather patterns. In order to complete a full assessment, tools including remote sensing and hydrometric data should be implemented. In order to complete accurate assessments of aquifer vulnerability and productivity using modeling approaches, abundant data and time variant data (seasonal) are required. The scope of the report, *Aquifers of the Capital Regional District*, was to identify and classify aquifers within the CRD and was not expanded to describe aspects of regional or local hydrology, including rate and direction of groundwater flow. Further areas of groundwater recharge and rates of recharge were not considered (Kenny, 2004). Future research endeavours are required to characterize these aspects of aquifers contained within the study region. These studies are critical for providing residents and decision makers with the appropriate tools for allocating water resources in our study area. A key recommendation of this report is that these studies are carried forward in a timely and ongoing manner that is able to encompass seasonal variability and climate change scenarios.

Following completion of the aquifer inventory, a number of recommendations have been outlined by the CRD, including presentation of findings to representatives of local municipalities, stewardship groups and stakeholders. In addition, mapped and classified aquifers should be available online through the CRD Natural Areas Atlas as a public resource (Kenny, 2004). Education and conservation practices should be promoted to increase local water stewardship and proper well maintenance, operation and abandonment and to ensure regular testing is maintained for water quality purposes (Kenny, 2004).

9.3.5. Identifying Aquifer Vulnerability

Groundwater contamination can be linked to many anthropogenic and natural sources. Contamination of groundwater by industries such as agriculture, mining and logging, and other non-point pollutant sources, is a concern that requires groundwater monitoring on a regular basis. Natural groundwater contamination can also occur from coastal water intrusion and weathering of bedrock deposits. Aquifer vulnerability studies should be carried out in the study region and interpolated using the DRASTIC method as described above.

9.3.6. Drought Information

Observation wells are located throughout British Columbia to inform the public on drought conditions. The *British Columbia Drought Information Portal* was established to give real-time monitoring data on drought conditions throughout the province. Hydrographical data is plotted in the 7-day average streamflow map and is updated on a weekly basis. The information provided shows the percent of streamflow compared to historical medians and reported as a percentage. However, there are no station wells in the study region; the nearest observation well is located in Port Renfrew (Province of BC, 2016).

Observation wells should be located and monitored within the study region with hydrographical data updated and made available to the public from The *British Columbia Drought Information Portal* on a weekly basis.

9.3.7. Regional Hydrological and Meteorological Data Collection

There is only one climate station, Sheringham Station which is currently reporting precipitation and climate data in the study region. Water resource management requires significant hydrological and meteorological data in order to properly assess the quantity and quality of water

supply. The study region consists of several microclimates with atmospheric conditions and precipitation differing from region to region and varying significantly from surrounding areas. Applications which make use of extracted water resources will be significantly impacted by the effects of global climate change, and thorough monitoring of hydrometric and meteorological climate data needs to be accomplished to track such impacts. In order to gain a better understanding of watershed and aquifer recharge areas in the study region, extra collection of data is required from hydrologic and climate stations.

9.3.8. Water Use Demands

In order to gain a broader understanding of sustainable water allocations in the study region, further water use assessments should be considered. A demand assessment should be conducted in order to quantify industrial and domestic uses of water within a specific aquifer. A water sustainability assessment can also be undertaken to examine social behaviors surrounding domestic, institutional and industrial water use and management.

9.4. IMPACT OF FUTURE DEVELOPMENT ON WATER RESOURCE SUSTAINABILITY

Community access to water resource data is a crucial element in assessing water sustainability in this region. The data collection and impact analysis is especially relevant for new residents moving into the area.

9.4.1. Otter Point, Shirley, and Jordan River Community Development Plans

Official Community Plans (OCP) are comprehensive bylaws assembled and created by communities in dialogue with elected commission and committee members within the Juan de Fuca electoral district. OCPs provide communities with growth strategies and address proposed land use, development, protection and servicing requirements. The goal of a formal OCP is to

reflect community values in regards to growth and development within each outlined region.

Each community plan consists of subsets of the following information:

- Inventory of geography, species, ecosystems, and protection objectives
- Residential and green space development policies
- Long term community policies and development strategies (CRD, 2016)

There are two OCPs encompassed in the study region of interest, adopted at the time of completion of this report. These are:

- Otter Point, OCP Bylaw #3819, adopted on October 8th 2014
- Shirley and Jordan River, OCP Bylaw #3717, adopted on June 13th 2012

Review of the Shirley and Jordan River bylaw #4001 "Official Community Plan for Shirley - Jordan River, Bylaw No. 1, 2016" began on April 19th 2016, and will be set to replace the existing bylaw at the time of approval.

Several aspects of the Official Community Plans are related to water resources, and are applicable to further assessments of water sustainability. These include Housing Demand, Development Potential, Community Water Systems and Sewage Disposal, Public Access to Water / Right-of-Way, Drinking Water and Infrastructure Goals and Objectives, Surface Water and Ground Water Supplies and Objectives (CRD, 2014).

The Otter Point Official Community Plan has cited protection of a safe and clean supply water supply as an objective relating to community growth and sustainability. Included in this objective is sourcing alternative water supplies, pursuing rainwater capture, and promoting water conservation and groundwater / wellhead protection. The OCP has outlined future developments

in the Otter Point region. Developments should not deplete or contaminate existing wells and should recognize the importance of potable water for agricultural activity (CRD, 2014).

Objectives regarding watercourses, wetland and riparian rights are further outlined in the OCP to protect streams and watercourses by creating a 30-meter buffer from the high water mark, in which ecosystems are kept in their natural state. The OCP outlines 51% of the plan area as Rural Lands, allowing for the application of low density development in order to protect groundwater recharge areas. Subdivision applications are required to include a letter from a community water system manager, stating that either the proposed development can be provided with potable water or that individual wells have sufficient capacity, as determined by a qualified professional, to provide residents with adequate water supply. The OCP states that all residents and users that rely on groundwater supply conserve water and that developments are required to protect groundwater supply and not deplete or contaminate existing wells during development stages (CRD, 2014).

The objectives of the Official Community Plan of Shirley and Jordan River (3717) specify the protection of natural water systems by ensuring that development does not contribute to soil erosion and increased surface water run-off. The long-term viability of potable water is to be protected from pollution and contamination. Section 4.5 of the *Development Approval Application Process* states that all developments are to protect lakes, watercourses and tributaries by not allowing the discharge of sediments or effluents into the water system. Stream crossings are to be located to minimize disturbance to natural systems. If temporary watercourse allocations or diversions are undertaken, streams must be rerouted through their original channels. The Development Approval Process designates protection of riparian areas, watercourses and wetlands (CRD, 2012).

9.4.2. CRD Regional Growth Strategy for the Juan de Fuca Electoral Area

The Regional Growth Strategy aims to keep urban settlement compact, to protect rural community integrity, to manage natural resources and environment sustainability, and to protect regional green/blue spaces in the region. The strategy also aims to build more complete communities, improve housing affordability, strengthen the regional economy, reduce greenhouse gas emissions, and increase transportation choices.

The CRD growth management strategy for the coastal communities of Otter Point and Shirley was designated to have strong rural characteristics, and give the residents rural lifestyle options. The regional growth strategy uses the supply of water as a means to contain urban sprawl. Sooke, and the Sooke Harbour and Basin, will act as an urban containment boundary through development of a centre that will provide the rural communities with water. This development will encourage population increase and development in a confined, contained manner, and limit urban sprawl into Otter Point and Shirley.

9.4.3. Climate Change

Groundwater demand decreases as the supply of municipal water increases; however, demand for groundwater is expected to increase with future increases in population, as well as climate change. Climate change impact on groundwater supply is largely determined by changes in the duration of dry summer months (Kenny, 2014).

10. CONCLUSIONS & RECOMMENDATIONS

Managing the ArcGIS Map and database will greatly benefit OPSRRA and the communities of Shirley, Jordan River and Otter Point, with only minor maintenance being required. The benefits of using and updating ArcMap as a learning tool outweigh the practical costs of allowing the product to become outdated. Only with interpretation of existing data, and creation of new data, will the map and database continue to be of benefit to OPSRRA into the future.

The WSA states that water can be diverted for domestic use with authorization. The authorized person is required to make “beneficial use of water”, which is explained in Section 30 of the Act. The issues pertaining to beneficial use will be explored in terms of water sustainability in the area, as well as other parts of the Act, and their applicability. For a complete legal analysis of the WSA, it is advisable to seek interpretation from a lawyer. For residents looking for more information regarding residential wells and the WSA, the Province of British Columbia’s website or BC Services may be consulted.

Addressing information gaps as outlined in the discussion is a key recommendation of the report, as it will increase the chances of successful monitoring and management of water resources.

Water plays a crucial role in shaping societies, behavior, and lifestyle. Sustainability takes into account future generations, and recognizes the limitations of living in a finite system. With current issues such as climate change and population growth, there is a need to ensure that the study region has a sustainable supply of water. For this to be accomplished, better watershed-based management practices are required. These should take into account the natural hydrogeological systems, the hydrological cycle, climate change, and human activities.

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12. APPENDICES

12.1. APPENDIX I – SUMMARY OF THE *WATER SUSTAINABILITY ACT*

Installment 1

Part 1 – Interpretation and Application

Section 2 Water use purposes

Water may be diverted from a stream or aquifer for the following purposes:

- Conservation
- Domestic
 - Drinking water, food preparation, sanitation, fire prevention, providing water to animals or poultry kept for household use or as pets, and irrigation of a garden not exceeding 1000m²
- Industrial
- Irrigation
- Land improvement
 - Protect land; recreational facility, park, or protected area; reclamation, drainage, or improvement of land; project of similar nature
- Mineralized water
 - Bottling and commercial distribution, or commercial bathing pools
- Mining
 - Recovery of minerals or for movement of earth, sand, gravel, or rock

- Oil and gas
- Power
- Storage
- Waterworks

The purposes and accompanying definitions can be found in the *WSA*, Part 1.

Section 3 Water Protection Act

The *WSA* does not authorize anything prohibited by the *Water Protection Act* (WPA). The WPA is a piece of legislation administered by the Government of British Columbia that works to protect water resources by reconfirming the Province's ownership over surface and groundwater. The WPA defines limits for bulk water removal and prohibits large-scale diversion of water to out of province locations (Province of British Columbia, 2016).

Part 2 – Licensing, Diversion and Use of Water

Section 6 Use of water

1. A person must not divert water or use diverted water from a stream or aquifer unless:
 - a. The person hold authorization for the diversion/use or use
 - b. The diversion/use is authorized under the regulations
2. A person is not prohibited from
 - a. Diverting, storing, and beneficially using water for extinguishing a fire. The diverted water must be restored immediately after the fire is extinguished, or
 - b. Diverting water in order to conduct a water quality or water quantity test

3. A person is not prohibited from diverting and beneficially using water in accordance with applicable regulations, unless stated otherwise by section 135.
 - a. From a stream for domestic purposes or mineral prospecting
 - b. From an aquifer for mineral prospecting
4. In accordance with the regulations, a person may divert, store, and beneficially use groundwater from an aquifer for domestic purposes, unless:
 - a. Stated otherwise in section 135 (6)
 - b. This section does not apply based on aquifer regulations under section 136.

Section 7 Rights acquired under authorizations

1. Licence holders are permitted to do the following provided by the licence:
 - a. Divert and beneficially use the quantity of water designated by the licence
 - b. Construct, maintain, and operate works and related works necessary for proper diversion or use of the water. The works must be authorized by the licence.
 - c. Make changes to the stream and surrounding area in order to facilitate diversion, construction, maintenance, or operation of the works in paragraph (b).
 - d. Conserve wildlife by constructing fences, screens, and fish/game guards across streams
2. Use approvals allow the licence holder to do anything from subsection (1) as specified by the use approval (for the period/times of use)

Section 8 Rights and permissions subject to the Act

1. The Act and its regulations are held over the rights of an authorization, the terms and conditions of the authorization, the orders of the comptroller, the water manager, an engineer, and all holders who have authorization and rights with precedence.
2. Permission given under a change approval is subject to the Act and its regulations, as are the terms and conditions of the approval, the orders of the comptroller, the water manager, or an engineer, authorization holders, and those change approval holders whose approvals were issued before the date of the change approval.
3. Permission given under a permit is subject to the Act and its regulations, as are the terms and conditions of the permit, and the orders of a comptroller, water manager, or engineer.
4. Permission given under a drilling authorization is subject the Act and its regulation, as are the terms and conditions of the drilling authorization and the orders of a comptroller, water manager, or engineer.

Section 9 Licences

1. The comptroller or water manager has the power to issue a license for the diversion or use of water for one or more purposes to any of the following persons or parties:
 - a. A land or mine owner
 - b. A certificate of public convenience and necessity holder, issued under the *Public Utilities Act* or the *Utilities Commission Act* or the *Water Utility Act*
 - c. A municipality, regional district, improvement district, development district, or water users' community
 - d. The Federal or Provincial government

- e. A commission, board, or person with charge over the administration of Crown land or an undertaking thereon, or a mine, administered by the Provincial or Federal government or a ministry, department, branch, or subdivision thereof
- f. The Greater Vancouver Water District or similarly districts incorporated by an Act
- g. British Columbia Hydro and Power Authority

Section 10 Use approvals

1. The comptroller or water manager may issue an approval for the diversion or use of water from a stream or aquifer (not exceeding 24 months). This authorization may be issued for one or more water use purposes for the following persons or parties:
 - a. The provincial or federal government
 - b. Another person
2. This use approval must not authorize:
 - a. The diversion or use of water exceeding the prescribed amount of water
 - b. The diversion or use of water for a use other than the prescribed
 - c. The construction, maintenance or use of the prescribed works
3. The use approval may authorize a person to divert water for use in relation to an appurtenancy specified in the use approval

Section 11 Changes in and about a stream

1. The comptroller, water manager, or engineer has the authorization to issue an approval to any of the following persons or parties to make changes in and about a stream:
 - a. The provincial or federal government

- b. Another person
2. The changes to the stream many only be made in conformance with:
 - a. The terms and conditions of a change approval
 - b. The regulations
 - c. The terms and conditions of an authorization
 - d. An order

Section 15 Environmental flow needs

1. The environmental flow needs of a stream must be considered, except in relation to an exemption, when deciding on the approval of an application for water diversion and/or use. These considerations must be made for the stream itself, as well as the receiving aquifer.
2. In order for an application regarding environmental flow needs to be considered:
 - a. The applicant must provide the information and report of assessments as directed by the decision maker for the purposes of subsection (b)
 - b. The decision maker must determine the environmental flow needs of the stream in question in accordance with any applicable regulations
3. In reference to section (2)(a), a specific assessment and accompanying report completed by a qualified person may be required by the decision maker.
4. Despite subsection (1), the environmental flow needs of any stream that may be affected may be taken into account if the needs are expected to affect the granting of the application.

Section 16 Mitigation measures

1. If the proposed diversion or use of water, and/or subsequent changes in or about a stream are likely to have significant adverse effects on water quality, quantity, or aquatic ecosystems of a stream, stream channel, or aquifer, the decision maker may:
 - a. Require a proposal addressing mitigation of the predicted effects, meeting the prescribed criteria (if any)
 - b. Impose terms and conditions which require the implementation of the proposed mitigation measures (under section 14(1))
2. If the effects in subsection (1) cannot be addressed or fully addressed by the proposed mitigation measures, other mitigation measures taken on a different part of the stream/aquifer may be imposed under s. 14(1). This may include taking compensatory mitigation measures.
3. Compensatory mitigation measures may be required on a different stream/aquifer.

Section 17 Sensitive streams mitigation

1. If the stream in question is a sensitive stream, the decision maker:
 - a. May require prescribed plans, specifications, reports of assessments, or other information from the applicant
 - b. Must apply the recommended criteria in the grant application decision
2. Mitigation measures for adverse impacts on protected fish populations must be included in the application for the activity in question.
3. The application may be granted by the decision maker only:
 - a. If satisfied that:

- i. Any adverse impact on the sustainability of protected fish populations in the stream is expected to be insignificant.
 - ii. The proposed mitigation measures would ensure that the activities would likely not have a significant adverse impact on protected fish populations in the stream.
 - iii. The compensatory mitigation measures will enhance or facilitate the enhancement of another aquatic ecosystem, therefore fully compensating the adverse effects on protected fish populations in the original stream
 - b. If the decision maker requires the implementation of the proposed mitigation measures, or Compensatory mitigation measures as per the circumstances of paragraph (a) and (a)(iii)
4. An application may be refused by the decision maker if an alternative source of water is reasonably available to the applicant

Section 21 When final licence may be issued

1. A final licence in succession of a conditional licence may be issued to the applicant (under s. 12) by the comptroller or a water manager. The licence authorizing the diversion and use of water must be for beneficial use, as determined by the decision maker, when:
 - a. The work is completed by the licensee
 - b. The designated time period for completing the work expires, and the decision maker determines the unfinished works are not required.
2. The final licence replaces the conditional licence, and the conditional licence therefore expires

Section 22 Precedence of rights

1. The rights exercisable under an authorization for the diversion of water from a stream have precedence over the right of other authorization holders diverting water from:
 - a. The stream
 - b. A tributary of the stream
 - c. An aquifer likely to be connected with the stream
2. The exercisable rights described in subsection (1) that have precedence from the same date are prioritized according to the ranking described in subsection (7)
3. The exercisable rights have equal precedence if they have the same date and are for the same water use purpose
4. The rights concerning the diversion of water from an aquifer have precedence over other authorization holders according to date
5. The rights of authorizations sharing the same date are given precedence based on the rankings in subsection (7).
6. The rights described in subsection (4) have equal precedence when issued on the same date and for the same water use purpose.
7. Water use purposes are ranked, from highest to lowest, as follows:
 - a. Domestic
 - b. Waterworks
 - c. Irrigation
 - d. Mineralized water
 - e. Mining
 - f. Industrial

- g. Oil and gas
 - h. Power
 - i. Storage
 - j. Conservation
 - k. Land improvement
8. Despite subsections (1) to (6), a person operating under section 6(4) has deemed rights with precedence under those subsections if the deemed rights were established under an authorization that:
- a. Sets the date of first use of water as the date of precedence
 - b. Authorizes the use of the greater:
 - i. 2000L of water per day for a private dwelling
 - ii. The amount of water used for domestic purposes
9. Despite subsections (1) to (8), an order under s. 86 (1) or (3), the environmental flow needs, as quantified by the comptroller, of the stream take precedence over the aforementioned rights
- a. Under any authorization issued in relation to any body of water mentioned in subsection (1)
 - b. Over any person mentioned in subsection (8)
10. Despite subsections (1) to (9), an engineer enforcing the precedence of rights set out in subsection (9) must not prohibit a person from divert the water if it is for essential household use.
11. Essential household use is defined as 250L of water per day, for the purpose of
- a. Drinking, food preparation, and sanitation

- b. Providing water to animals and poultry kept
 - i. For household use
 - ii. As pets

Section 23 Thirty-year review of licence terms and conditions

1. This section applies to licences that:
 - a. Were issued for an unlimited period or has at least 30 years remaining in its term on or before the Act has come into force (February 29, 2016)
 - b. Were issued for an unlimited period of time or a term exceeding 30 years after the Act has come into place

However, this section does not apply to licences:

- c. Issued for a power/power related purpose or storage purpose on or after October 23, 2003
 - d. Issued under the Industrial Development Act
 - e. That was issued following a review or was reviewed under the Water Use Plan (December 1998)
2. A licence holder to which this section applies must comply with written order of the comptroller or water manager's request for a review of the terms and conditions of the licence
 - a. For a licence issued on or before February 29 2016, anytime 30 years after that date, or anytime 30 years after the review of this section, should it occur
 - b. For a licence issued after February 29 2016, any time 30 years after the licence has been in effect, or anytime 30 after the review of this section, should it occur
3. Under a direction listed in subsection (2), a licence holder must provide

- a. The information, plans, specifications, and reports of assessments as specified by the decision maker
 - b. The consents for the decision maker to verify the aforementioned information
4. The decision maker may require a specified assessment and a report thereof to be performed by a qualified person
5. The purpose of a review may be found in sections 12 (1)(b), (2), and (3)
6. The terms and conditions of a licence may be reviewed by the decision maker, who will take into account
 - a. The best available technology in terms of water use efficiency and conservation
 - b. Best practices for water use efficiency and conservation
 - c. Any additionally acquired knowledge of stream flows or aquifer conditions
 - d. Climate change
 - e. The licence holder's use of water
 - f. The use, operation, and maintenance of works
 - g. Prescribed factors
7. In completing a review under this section, the decision maker has the authority to amend the terms and conditions of the licence for the purposes of increasing the efficiency of water use and/or conservation, by
 - a. Reducing the rate of water diversion
 - b. Altering the times of water diversion, use, or storage
 - c. Constructing, altering, installing, replacing, repairing, maintaining, improving, sealing, deactivating, decommissioning, or removing any works as seen fit
 - d. Adopting more efficient practices

8. If the changes outlined in this section significantly alter the terms and conditions of the original licence, the decision maker may substitute it for a new licence, where the new licence would have the same rights and precedence as the original
9. Directions given under subsection (2) are final and may not be appealed

Section 24 Permits over Crown land

1. Crown land is land, that may or may not be covered in water, that is vested in the government. The comptroller or water manager (or engineer, in the case of a change of approval/drilling authorization) may change the approval/drilling authorization to allow for the issue of one or more Crown land permits). The comptroller, water manager, or engineer must have the compliance of the authorizer of the holder before making any changes. Therefore, Crown land can be repurposed and divided by issuing multiple permits for the diversion and use of water.
2. A person must not construct, maintain or operate works, or flood Crown land unless:
 - a. The person holds a permit under this section (s. 24).
 - b. The person has the authority to do conduct these activities under another enactment.

Section 25 Transfer of authorization, change approval or permit

1. Authorizations, change approvals, or permits belonging to any land, mine, or undertaking, can be transferred to another disposition of the land, mine or undertaking.
2. An owner of land, a mine, or an undertaking must give written notice the transfer to the comptroller or water manager before the disposition is completed. The owner may make

a transfer only with an authorization, change approval, or permits belonging to the land, mine, or undertaking in question.

3. A transmission or other disposition of land may occur with the proper authorization, change approval or permit belonging to the representative thereof. Written notice of this transmission or disposition must be given to the comptroller or water manager before completing the disposition or as soon as practicable after it has taken place.

Section 28 Appointment of rights under licences

1. Land comprising more than one parcel owned by different persons under a single licence or permit issued in relation to the licence, may have the rights granted and duties imposed of the licence/permit distributed amongst the owners of the parcels of land by the comptroller or water manager.
2. The land described above (subsection 1) is subject to having one or more new licences and related permits issued by the decision maker in compliance with the terms and conditions set out by the decision maker. The new parcel(s) and/or permit(s) are subject to the rights granted and duties imposed as listed in subsection 1.
3. The licences and permits described above (subsection 2) have the same precedence as the original licence or permit.

Section 30 Beneficial Use

1. Beneficial use must be made of diverted water by the person who diverts the water.
2. The licensee must submit a signed beneficial use declaration (see subsection 3 for contents of declaration) to the comptroller, water manager, or engineer as the discretion of the comptroller, water manager, or engineer.

3. The declaration must state:
 - a. Whether the licensee has:
 - i. Beneficially used the authorized quantity of water
 - ii. Complied with the licence's terms and conditions
 - b. Include the necessary information, references, or consents required to verify the information as required by the decision maker
 - c. Present the statement in the format required by the decision maker
4. The licensee may be required under subsection 2 to provide a water conservation audit that meets the requirements of the regulations.
5. If the beneficial use declaration and water conservation audit do not meet the requirements of the decision maker, the decision maker may order the licensee to take action to meet the required level of efficiency and water use conservation, by providing specific actions.
6. Information, references, and consents verifying the information in the declaration must be provided upon request by the comptroller, water manager, or engineer. This information may be requested from the following persons
 - a. The water use approval holder
 - b. A person who uses, stores, and diverts the water
 - c. A person who uses water for flow tests, or who uses groundwater
7. The decision maker may take the following actions in order to inquire into or confirm the beneficial use of water:
 - a. Obtain public personal information and/or government water records related to a person or to the person's use of water

- b. Verify the information collected under this subsection or subsection 3 or 6 by relating it to personal information by referencing it to public personal information or government water records
8. The comptroller may publish the declaration of beneficial use and the verification information provided in subsection 6.
9. Directions given under subsections 2 and 6 are final and un-appealable.

Section 32 Licensee's right to expropriate land

1. The licensee has the right to expropriate (take possession of and divest the title of private owner) land for required/authorized construction, maintenance, improvement or operation of works.
2. Under subsection (1), holders of licences that authorize the diversion of water for domestic or waterworks purposes have the right to expropriate land that would help prevent water pollution of the diverted water.
3. Additional to subsections (1) and (2), the holder of a licence which authorized the construction/use of a dam has the right to expropriate the land that has been flooded, or would be flooded, by dam construction at the dam's full capacity.
4. Expropriations made under section 32 must be made in accordance to the regulations, and the expropriator must provide compensation to the owner of the expropriated land. The amount of the compensation must be determined in accordance with the regulations.
5. A person/land owner must not interfere with the expropriation of land which would result in the prevention of the licensee from maintaining, operation, using or improving authorized works.

Section 33 Licensee's rights when owner refuses compensation

1. If:
 - a. Compensation is awarded for expropriated land
 - b. The amount of the award is offered to the owner of the expropriated land, and
 - c. The land owner does not execute and deliver the required transfer to the licensee

The licence is then determined to be the attorney of the owner in order to execute the transfer on the owner's behalf.

2. The licensee must then be registered as the land owner or holder by the registrar, only if the licensee:
 - a. Pays the compensation or the amount payable at that time to the comptroller, that has not been accepted by the land owner
 - b. Files with the registrar:
 - i. The executed transfer/instrument
 - ii. A copy of the compensation award, and
 - iii. An affidavit proving both the compensation payment to the comptroller and the failure of the land owner to execute the transfer/instrument, and
 - c. Pays the applicable fees under the *Land Title Act* to the registrar.

Section 39 Water reservations

1. If the Lieutenant Governor in Council advises:

- a. To permit a specified person to investigate a stream or aquifer for specified water use purpose.
- b. To arrange a water supply for a proposed waterworks, irrigation or power systems from a stream or aquifer of a specified person's project
- c. To ensure the water is available to the benefit of the Crown, or
- d. To retain water in a stream or aquifer as a reserve

The Lieutenant Governor may reserve water, in whole or in part, in the stream or aquifer in question that is being diverted/used under the Act, except as designated in sections 6(2), (3), or (4). Eligible water may be unrecorded or unreserved, and is not used in agriculture.

2. The minister must publish a record of the reservation made under the subsection (1) in the Gazette.
3. A reservation may be established under subsection (1):
 - a. In relation to all unrecorded water that became unrecorded by expiry, abandonment, or cancellation of all or part of the authorized rights during the existence of the reservation.
 - b. In relation to a specific quantity of water that became unrecorded by expiry, abandonment, or cancellation of all or part of the authorized rights under subsection (4) (c) during the existence of the reservation
4. The Lieutenant Governor in council may provide that reserved water may be acquired under a licence, under subsection (1) or a subsequent order under the following circumstances:

- a. For reservation under subsection (1) (a) or (b) by the specified or authorized person under the specified person for the water to be used as applicable in the specified water use purposes, waterworks, irrigation, power system, or project.
 - b. For reservation by the Crown or a person authorized by the Crown.
 - c. For reservation under subsection (1) (a), (b) or (c) for another purpose by any person, under the condition that the licence must be issued (under this paragraph) at a later date of precedence than rights of any other licence referred to in paragraph (a) or (b) of this subsection.
 - d. For reservation under subsection (1) (d) for use by a specified person with whom the Lieutenant Governor in Council finds the water use purpose consistent with the purposes of reservation.
5. A reservation established in subsection (1) may be cancelled by the Lieutenant Governor in Council. The date of cancellation must not be earlier than 30 days after the date of publication under subsection (6) (a).
6. Notice of cancellation with a specified date of effectiveness must be published under subsection (5)
 - a. In the Gazette, and
 - b. In the water district's newspaper or a newspaper that circulates that district (the district being respective to the location of the stream or aquifer) under paragraph (a) of this section
7. Applications for water reserved under subsection (5) may be accepted between the publication of the notice of cancellation and the effective date of cancellation.

Authorization of the application must not be given a date of precedence previous to the effective date of cancellation.

Section 42 Issue of a new licence

If a licence is acquired by:

- a. A regional district under section 309 (1.1) of the *Local Government Act*
- b. An improvement district under section 749 of the *Local Government Act*
- c. A municipality under section 31 (2) of the *Community Charter*

The comptroller may issue a new licence authorizing the diversion or use of water for any purpose required by a district or municipality in place of the original, but having the same precedence.

Part 4 – Enforcement

Division 1 — Powers

Section 89 Right of access to land and premises by authorized persons

1. The following persons are permitted to enter any land or premises for the purpose of exercising authority (powers or performing duties) under the Act or another enactment:
 - a. The comptroller, water manager, engineer, or a person working under the direction thereof
 - b. An officer, drinking water officer, or water bailiff
 - c. An employee or officer of a municipality, regional/improvement/development district or water users' community

- d. Water or electricity supply licence holders
2. The authorized person must not use their authority to enter a private dwelling , except with the consent of the occupant, or as authorized by a warrant
3. The authorized person may call on the assistance of a peace officer
4. The peace officer may accompany the authorized person onto the premises and assist the person in exercising their authority

Section 90 Entry warrant

1. The entrance onto land or premises is necessary for the purposes of the Act, a warrant may be issued authorizing any of the following persons access to the land or premises, including a private dwelling:
 - a. The comptroller, water manager, engineer, drinking water officer or an officer
 - b. A person authorized by the comptroller or water manager
 - c. A person given direction by the Minister to prepare a proposed water sustainability plan (s. 72 (1)(c) and s. 89)

Section 91 Power of comptroller to authorize actions

1. If a person fails to comply with an order issued by the comptroller, water manager, or engineer, the comptroller may authorize the government or another person to complete the order. The person to whom the order was directed is liable for the costs accrued.
2. Any reasonable expenses may be recovered from the liable person.
3. If the order is carried out by the government under subsection (1), the costs accrued by the government become a debt to the government by the liable person. This debt may be recovered in accordance of s. 98.

4. The comptroller may authorize an action to mitigate “imminent and significant risk or hazard to public safety, the environment, land or other property” (para. 91(4), if in the public interest. Any of the following actions may be authorized without limitation to eliminate the risk:
 - a. Construct, alter, install, replace, repair, maintain , improve, seal, deactivate, decommission, or remove a work
 - b. Makes changes in and about a stream
 - c. Divert water
 - d. Engage the services from or require a report from a person authorized by the regulations in relation to the required services
 - e. Any action reasonably required
5. If any of the above actions in subsection (4) were necessary because the liable person failed to comply with an order, the associated costs become a debt to the government by the liable person.
6. A person authorized by the comptroller may enter land or premises at any reasonable time, and may take with them any other person’s equipment in order to carry out the things they were authorized to do under this section.
7. The authority in the above section, subsection (6), must not be used to enter a private dwelling, except with the permission occupant or as authorized by a warrant.

Section 94 Suspension and cancellation of rights and permissions

1. Rights granted to the holder of an authorization, change approval permit, or drilling authorization may be suspended or cancelled in part or in whole by the comptroller or water manager in any of the following situations:

- a. The holder fails to construct the authorized works within the specified time
 - b. The holder fails to comply with this Act and its regulations
 - c. The holder fails to comply with a term or condition
 - d. The holder fails to comply with an order given by an officer or water bailiff
 - e. The holder presents an untrue financial statement (material misstatement) or misrepresentation in the application for the authorization, change approval permit, or drilling authorization
 - f. The title of the holder is cancelled or terminated, or the termination is the result of a statute or the exercise of statutory authority
 - g. In the case of a licence, the licensee fails to make beneficial use of water for three successive years
 - h. In the case of a license, the licensee makes a material misstatement or misinterpretation of beneficial use
 - i. In the case of a use approval, the holder makes a material misstatement or misinterpretation in required information
 - j. In the case of an authorization, the holder fails to pay the amount due to the government for two years past the due date
 - k. In the case of an authorization, the holder fails to pay a water bailiff's fees or expenses for 180 days past the due date
2. A decision maker may propose a suspension of rights of a permit, change approval, or drilling authorization. The decision maker must provide three day's written notice of the proposed suspension. However, if the situation is considered urgent, the suspension may take place immediately without a hearing on verbal notice only.

3. The decision maker may propose to cancel a permit, change approval, or drilling authorization. The decision maker must give notice of the cancellation proposal to the following:
 - a. Everyone who has notified the comptroller/water manager of the individual/entity that has ownership or association with the land the permit, change approval, or drilling authorization belongs to; unless paragraph (b) applies
 - b. Circulate a publication in a local newspaper (which covers the area in which the land is located) for three consecutive weeks. This applies to land consisting of more than six parcels
4. In the case of a proposed cancellation of a permit, change approval, or drilling authorization that is does not belong to the land, notice of cancellation must be delivered to the holder of the authorization, and every person who has notified the comptroller/water manager of the holder of the authorization
5. If an objection is filled against the suspension or cancellation within 30 days after notice is given, the decision maker decides whether the objection deserves a hearing. The hearing may take place orally, in person or electronically.
6. The hearing referred to in subsection (5) may be held in any combination in person, by writing, or electronically.
7. Apart from whether a hearing is held, the decision maker must
 - a. Determine whether the grounds for the objection are justifiable
 - b. Make the most advisable decision
8. If the proposed suspension or cancellation is based on an engineer or officer's report

- a. The engineer/officer found the authorized works in question unfit or unsuitable for use
 - b. In the case of an authorization: the engineer/officer found no indication of beneficial use of water
9. In the case of these findings, the holder of the permit, change approval, or drilling authorization must prove to the decision maker his or her compliance
10. In the case of a partial cancellation, the decision maker may provide a substitute permit, change approval, or drilling authorization in compliance with the prescribed terms and conditions and the same precedence as the original authorization
- a. In the case of a licence
 - i. The licence may be conditional or a modified conditional licence
 - ii. A final or modified final licence
 - b. In the case of a use approval, change approval, or drilling authorization, or the modified versions thereof

However, the holder of these authorizations does not obtain or retain rights that have been cancelled.

11. The cancellation of rights, in part or in full, is final and may not be appealed.

Division 2 — Administrative Penalties

Section 99 Administrative monetary penalties

1. The actions authorized under this Division may be taken in accordance with the regulations if the comptroller is finds that a person has
 - a. Overstepped a prescribed provision of this Act under the regulations

- b. Failed to comply with an order issued under this Act
- c. Failed to comply with a term or condition of an authorization, change approval, permit, or drilling authorization

The findings are based on a balance of probabilities.

2. A person under such circumstances may have a notice of administrative penalty delivered to them by the comptroller
 - a. Identifying the breach or failure as determined by the comptroller
 - b. Asserting a monetary penalty not greater than the prescribed amount, and
 - c. Requiring the person to pay the penalty detailed in the notice
3. The following must be considered in the determination of the amount of an administrative penalty:
 - a. Previous administrative penalties issued to
 - i. The person
 - ii. The person, whether acting as an individual, or as an officer, director, or agent in a corporation, and
 - iii. If the person is an officer, director, or agent in a corporation
 - b. The significance and magnitude of the situation
 - c. The significance and extent of the adverse impacts on the environment/rights of other people caused by the misdoing
 - d. Repetition or continuity of the misdoing
 - e. Whether the misdoing was deliberate
 - f. If the person received economic benefit from the misdoing
 - g. The efforts, if any, of the person to correct the situation

- h. Prescribed matters
4. A person given notice of an administrative monetary penalty is subject to the penalty as follows:
 - a. If the person admits to the misdoing, as outlined by the comptroller, in writing
 - b. If the time limit for appealing the notice has elapsed without the commencement of an appeal
 - c. If the person is found to be subject to the administrative monetary penalty as the final determination of an appeal
 5. The penalty must be paid to the government within the prescribed time period after the penalty is imposed.

Division 4 — Offences

Section 106 General offences

1. Section 5 of the *Offence Act* does not apply to this Act or its regulations.
2. A person who performs the following is deemed to have committed an offence:
 - a. Wilfully hinders or interrupts
 - i. The individual holding an authorization, change approval, permit, or drilling authorization
 - ii. A person acting on behalf of the aforementioned person in subparagraph (i)

In the lawful exercise of a right granted under this Act.
 - b. Without lawful authority,
 - i. Diverts water from a stream or aquifer

- ii. Makes changes to a stream and/or the surrounding area
 - iii. Wilfully destroys, damages, or interferes with the authorized works of a licence/authorization holder
 - iv. Lays a pipe or constructs a ditch or other conduit in order to connect to the works of an authorized person
 - v. Constructs, maintains, operates, or used water works
 - vi. Interferes, damages, or obstructs free access to a fire hydrant
 - vii. Carries water for others as a business
 - c. Wilfully destroys a notice from an applicant, engineer, water officer, or water bailiff
 - d. Fails to act in accordance with applicable regulations
 - e. Destroys, injures, or tampers with
 - i. Works
 - ii. Any type of measuring device, structure, appliance, etc. belonging to/put in place by a licence/authorization holder or a government employee
- 3. A person who performs the following is deemed to have committed an offence:
 - a. Diverts or uses water contrary to the water use purposes outline in s. 6 (1), except under sections 6 (2), (3), (4), or another order
 - b. Fails to restore stream flow to its diverted channel for the purposes of firefighting, as per s. 6 (2)(a)
 - c. Diverts recorded water from a stream or aquifer for mineral prospecting, or from a stream used for domestic purposes for any use other than essential household functions; unless the diversion is authorized

- d. Diverts unrecorded water from a stream or aquifer for the same purposes as mention in subsection (3) (c)
- e. Diverts or stores water from a groundwater aquifer under s. 6 (4) when that section does not apply to that person by regulations restricting access to groundwater sources
- f. Diverts, stores or uses water when prohibited by a regulation under s. 135
- g. Diverts more than the allocated amount of water as outlined in a licence or use approval
- h. Diverts water for a purpose not outlined in the licence or use approval
- i. Diverts water when prohibited in the person' licence or use approval
- j. Constructs, operates, or uses water works which
 - i. Are not authorized by the licence, use approval, change approval, permit, drilling authorization, or by another enactment
 - ii. Are not constructed, operated, or used in accordance with applicable regulations
- k. Fails to comply with the terms and conditions in relation to a sensitive stream
- l. Fails to provide the necessary information and reports for a 30-year licence review under s. 23
- m. Fails to provide the necessary information and reports directed under s. 23 (3)
- n. Floods, constructs, operates, or maintains works on Crown land without the adequate authorization to do so
- o. Fails to give notice of a transfer or disposition of land, mine, or undertaking as required under s. 25

- p. Breaches or fails to construct, operate, inspect, maintain or repair works as required by s. 29
 - q. Fails to deactivate or decommission works as or when required under s. 29
 - r. Fails to make beneficial use of the diverted water.
4. A person who performs the following is deemed to have committed an offence:
- a. Fails to submit a beneficial use declaration within the allotted time period
 - b. Fails to provide the necessary information or results of a water conservation audit
 - c. Fails to take adequate measures as listed under s. 30 (5)
 - d. Fails to provide information when directed to do so under s. 30 (6)
 - e. Fails to provide the necessary information or results of a water conservation audit within the allotted time period
 - f. Fails to comply with the terms and conditions regarding an abandonment of rights authorization under s. 31
 - g. Interferes with another licensee's works, or prevents them from tending to their works on land owned by the interfering person, thereby acting in contrary to s. 32 (5)
 - h. Fails, as the land owner on which the works are occurring, to give notice before interfering with works as per s. 34
 - i. Fails to adequately attempt to expropriate land as required in an emergency by s. 35 (3)
 - j. Fails to adhere to joint construction or use of works under s. 36
 - k. Fails to comply with the terms of conditions of a joint use of works under s. 36 as mentioned in subparagraph (4) (j)

- l. Fails to comply with the terms and conditions of an extension of rights authorized under s. 37
 - m. Fails to pay the amount owing to the water bailiff in the allotted time period, as outline in s. 38 (4)
 - n. Contravenes s. 46 by introducing foreign matter into a stream
 - o. Performs activities for which the person is not qualified, in relation to wells, well pumps or well heads
 - p. Fails to comply with well construction and decommissioning restrictions after penetrating an aquifer
 - q. Fails to comply with the regulations in relation to
 - i. Constructing, decommissioning, deactivating, or disinfecting a well
 - ii. Installing, maintaining, repairing, removing, or testing a well pump or wellhead, including flow tests
 - r. Fails to provide proof of qualifications as required under s. 51 (1)
 - s. Fails to secure the adequate amount of liability insurance as required per s. 51 (2)
 - t. Fails to provide proof of liability insurance required under s. 51 (1) or (3)
5. A person who performs the following is deemed to have committed an offence:
- a. Fails to control or give notice of an artesian well under construction as per s. 52
 - b. Fails to control an artesian well by obtaining a qualified or professional well driller, or by failing to ensure the driller adequate stops the flow of an artesian well as specified in s. 53
 - c. Fails to cap or cover a well, or removes the cap or cover from a well for purposes other than those outlined in s. 54 and s. 54 (3)

- d. Fails to replace a well cap or cover as per s. 54 (4)
 - e. Fails to fasten, or to remove, an identification plate to a well or well head when required in s. 54 (4)
 - f. Destroys, injures, or tampers with an well or wellhead identification plate
 - g. Fails to decommission or deactivate a well when required by s. 56
 - h. Fails to maintain, retain, produce or submit the necessary information in the form of a well report when required under s. 57
 - i. Operates a well in a manner conflicting the well operations outlined in s. 58
 - j. Performs an unauthorized drilling activity
 - k. Contravenes s. 59 by introducing foreign matter into a well
 - l. Fails to cause to take and analyze a ground water sample when required under s. 63
 - m. Tampers with a groundwater sample required by s. 63
 - n. Fails to submit the groundwater analysis results as required by s. 63
 - o. Contravenes, in a non-wilful manner, an order issued by the comptroller, water manager, or engineer given directly or indirectly through a water bailiff or officer
 - p. Fails to retain the necessary information required to be kept under s. 116 (1)
 - q. Fails to keep records for the prescribed period of time as per s. 116 (1)
 - r. Fails to produced records when required by s. 116 (2) (a)
 - s. Fails to provide records to the indicated person under s. 11 (2) (b)
 - t. Fails to install works and prepare/submit reports contrary to s. 116 (3)
 - u. Knowingly disregards s. 166 (5)
6. A person who performs the following offences is liable for conviction to:

- a. One or both of a fine not exceeding \$200, 000 or imprisonment for no longer than 6 months (in the case of a one-off offence)
- b. One or both of a fine not exceeding \$200, 000 per each day of continued offence or imprisonment for no longer than 6 months (in the case of continuous offences)

Part 5 – General

Section 114 Administration

1. A public service employee may be designated the Comptroller of Water Rights by the Minister
2. A public service employee may be designated as a Deputy Comptroller of Water Rights by the Minister
3. The Minister may designate
 - a. A public service/government corporation employee as an assistant water manager
 - b. A class of public service/government corporation employees as assistant water managers
4. The Minister may designate those individuals/entities mention in subsection (3) paragraphs (a) and (b) to perform duties and exercise powers which may be restricted in the designation
5. The comptroller may designate any of the following as an engineer under this Act:
 - a. A public service employee
 - b. An employee of a government corporation

The appointee must be a professional engineer, geoscientist, or holder of a limited licence under the Engineers and Geoscientists Act

6. The comptroller may designate
 - a. A public service/government corporation as an officer
 - b. A class of public service/government corporation employees as officers
7. Any designation established under this section must be in writing
8. This Act allows the comptroller to exercise any power or perform any duty to a water manager, engineer, or officer
9. This Act allows the water manager to exercise any power or perform any duty to a water manager, engineer, or officer

Part 6 – Regulations

Section 124 General regulation-making powers

1. The Lieutenant Governor in Council may make regulations authorized under this Act, as per s. 41 of the Interpretation Act
2. The Minister may make regulations authorized under this Act, as per s. 41 of the Interpretation Act
3. Subsections (1) and (2) are not limited by the authority given under the provisions of this Act
4. A regulation under this Act made by the Lieutenant Governor in Council or the Minister may do one or more of the following:

- a. Specify the individual/entity responsible for meeting the prescribed requirement
 - b. Exempt an individual/entity on specified terms and conditions from a requirement of this Act
 - c. Make different regulations for different classes of individuals, entities, activities, natural features and resources, etc. and establish classes for that purpose
 - d. Designate an area by any method that adequately describes the area
 - e. Require a person to enlist a qualified person to perform audits, studies, and assessments/assessment reports
 - f. Establish criteria for the audits, studies, and assessments/assessment reports referred to in paragraph (e)
 - g. Advise or delegate a discretion or matter to the comptroller, water manager, engineer, water officer or person prescribed for the purposes of administration and governance regulations
 - h. Determine that a breach/contravention of a regulation is an offence
 - i. Prescribe penalties for contravention of a regulation, including:
 - i. A penalty not exceeding those authorized under s. 106 (6)
 - ii. A penalty not exceeding those authorized under s. 107 (2)
5. The Lieutenant Governor in Council may make regulations
- a. Defining words or phrases not included in the definitions of this Act
 - b. Respecting any matter contemplating regulations, other than regulations established by the Minister

6. Regulations under this Act may
 - a. Adopt the codes or standards of a provincial, national or international standards association
 - b. Appoint, grant powers to, and establish functions of public officers to administer the codes or standards adopted as per paragraph (a)
 - c. Exempt individuals/entities from all or part of the adopted codes or standards

Installment 2

Part 3- Protecting Water Resources

Division 1-Water Objectives Section 43

- a. Considerations when developing, amending, or adopting community plans can be found in Part 25 of the Regional Growth Strategies of *the Local Government Act*.
- b. Municipal considerations for water objectives in amending, adopting, or developing official community plans under Part 26 [*Planning and Land Use Management*] of the *Local Government Act* or Part XXVII [*Planning and Development*] of the *Vancouver Charter*.
- c. Trust committee considerations for water objectives in amending, adopting, or developing official community plans under section 29 [*land use and subdivision regulation*] of the *Islands Trust Act*.
- d. Prescription of a person or entity that considers specified water objectives when developing and amending plans under prescribed enactments.

Division 2- Stream Protection

Section 45 No new dams on protected rivers

1. Bank-to-bank dams should not be constructed on protected rivers by any person.
2. A comptroller or a water manager must not issue or amend an authorisation, change approval or permit to authorize bank-to-bank dam construction. *Section 45 (2)*
3. This section does not apply to dams that were authorised under the Water Act before 15th March 1997.
4. This section applies despite any other enactment.
5. This section does not apply to a dam authorized by a licence, permit or approval that was issued under the *Water Act* prior to March 15 1997.

Section 46 The prohibition on introducing foreign matter into stream

1. Unless authorised or under exception as per subsection (2), a person must not:
 - a. Introduce debris, refuse, carcasses, human or animal waste, pesticides, fertilizers, contaminants or other foreign material into the stream, a stream channel, or an area adjacent to a stream. *Section 46 (1) a*
 - b. A person must not cause or allow the foreign material into a stream, a stream channel, or an area adjacent to a stream in such a manner that it causes adverse impacts to:
 - c. The stream or stream channel
 - d. Existing uses of water from the stream
 - e. The property of riparian owners on the stream
 - f. An aquifer that is hydraulically connected to the stream or the existing water uses on that aquifer
 - g. The aquatic ecosystem of the stream *Section 46 (1) b*
2. Subsection (1) does not apply to:
 - a. A forest practice where section 46 [*protection of the environment*] under the *Forest and Range Practices Act* applies
 - b. As prescribed

Section 47 Remediation orders in relation to foreign matter in stream

1. An engineer may order a person who introduces debris refuse, carcasses, human or animal waste, pesticides, fertilizers, contaminant or other material into a stream to:
 - a. Stop the introduction of foreign material into the stream, the stream channel, or an area adjacent to the stream. *Section 47 (1) a*
 - b. Remove the introduced foreign material into the stream, the stream channel, or an area adjacent to the stream, or a stream that is connected to an aquifer. *Section 47 (1) b*
 - c. Take measures to mitigate, or remediate the effects from the introduction of foreign material. *Section 47 (1) c*
2. If the engineer finds that the effects of the introduction of foreign material cannot be remediated, the engineer can:
 - a. Order the person who introduced foreign material to take compensatory mitigation measures, in place of or supplemental to, other remediation measures on another part of the stream. *Section 47 (2) a*
3. The comptroller or water manager may authorize the government or another person to take action necessary to comply with an order under subsection (1) of this section (47). A person who introduced foreign matter into the stream, the stream channel, or the area adjacent to the stream is liable to the government for the cost of complying to with the order if the following apply:
 - a. If the person subject to an order convened in section 46 (1) fails to comply with the order within the specified time. *Section 47 (3) a*
 - b. If the person who introduced the foreign material cannot be located, or identified *Section 47 (3) b*
 - c. If the comptroller or the water manager sees that there was failure to remediate or mitigate the material, resulting in the immediate harm or damage to anything referred to in Section 46 (1) (c) to (g). *Section 47 (3) c*
4. Any expense reasonably incurred from any exercise under *Section 47 (3)*, maybe charged to the person whom the order was directed to (unless that person was acting on behalf of the government) *Section 47 (4)*

5. Remediation work carried out by, or on behalf of the government, the costs are a debt due to the government by the person who was issued an order, money owing may be recovered in accordance to *section 98 [recovery of amounts owing for work performed]*. *Section 47 (5)*

Division 3-Wells and Groundwater Protection

Section 49 Restrictions on constructing or decommissioning wells and related activities

1. The restriction on constructing or decommissioning wells and related activities are detailed in this part of the Act, and are subject to *Section 50* and *Section 49 (1)*
2. *Section 49* applies to individuals who **constructs, decommissions, deactivates, and disinfects wells**.
 - a. This individual must comply with the applicable regulations, and must be a qualified well driller, or act under direct supervision of specific individuals mentioned in this act.
3. This section also points out how it is not applicable to certain persons, and activities as pointed out under *section 83 [plan regulations — restrictions on groundwater activities]* or *137 [minister's regulations restricting groundwater activities]*, subsection (2) (b) or (c)
4. It also looks at the restrictions respecting well pumps and flow tests, proof of qualifications and insurance, controlling artesian flow during construction, controlling flowing artesian well, and information regarding well caps or well covers.

Section 54 Well caps or well covers

1. A well cap or well cover on a well must be secured in accordance with regulations.
 - a. This can be done by the person who drills a well or alters a well [*Section 54 (1) a*],
 - b. as well as a person who owns a well that does not have a well cap or well cover secured on the well [*Section 54 (1) b*].
2. If a well owner does not comply with *Section 47 (1) b* and the owner of the land where the well is located does not know who owns the well, the owner of that land must secure a well cap or well cover in accordance with the regulations.

3. A person must not remove the well cap or well cover from a well except when carrying out activities that require temporary removal of the well cap or well cover e.g:
 - a. Inspecting, disinfecting, maintaining, repairing, developing, and other work associated with the well.
 - b. Work to do with the well pump
 - c. Testing flow of the well
 - d. Measuring water level
 - e. Taking water samples
 - f. Other similar activities
4. A person who temporarily removes a well cap or well cover must replace the cap, or cover as soon as practicable after completing the work, this must be done in accordance with the regulations. *Section 54 (4)*
5. A person must not destroy injure or tamper with a well cap or well cover *Section 54 (5)*

Section 55 Well identification

As stated in *Section 55(1)*, the act defines the requirements for the owner of the well, the water supply system and the requirements on identifying wells.

1. Well identification plates or wellheads are attached by people responsible for drilling, or altering a well in accordance with the regulations.
2. The person who attaches an identification plate, must submit a report in accordance to with the regulation.

Section 56-Decommissioning or Deactivating wells.

This section looks at the decommissioning or deactivating wells.

1. A well is considered in service:
 - a. If the well is used regularly, or on a periodic basis
 - b. If the well is kept as a water backup supply
2. A well is not in service:
 - a. If the well is not used regularly, or on a periodic basis
 - b. In prescribed circumstances

3. If a well is not in service, the well owner must ensure the well is deactivated or decommissioned by person authorized in section 49 [*restrictions on constructing or decommissioning wells and related activities*] of this Act. This should be carried out as soon as possible.
4. If a deactivated well is not in service in a prescribed period, the well owner must ensure that it is decommissioned by person authorized in section 49 [*restrictions on constructing or decommissioning wells and related activities*] of this Act. This should be carried out as soon as possible.
5. If the owner of the land which the well is located does not know who owns the well, the owner of this land must comply to subsection (3) and (4).

Section 57 Well reports

Regulations pointed out in section 57 refer to a person that constructs, and installs a well. As well as a person who carried out well flow tests, and well decommissioning. A daily log containing the prescribed information about the said well must be completed. The person referred to in this section is required to complete and submit a log and report required from actions that they carry out, at the direction of an officer, engineer or a drinking water officer. This person must also submit a copy of the report to the well owner.

Section 58 Well operation

A person must operate a well in accordance with the regulations, and any directions given by an engineer in respect to the well.

1. A person must operate a well in a manner that causes or is likely to cause contamination of saline water to the aquifer, adjacent aquifers, or a stream that is connected to the aquifer.
2. A person must not operate a well in a manner that causes or is likely to cause a significant adverse impact to the quality of water in the aquifer, adjacent aquifers, or a stream that is connected to the aquifer. A person must not operate a well in a manner that causes or is likely to cause a significant adverse impact to the existing uses made of the water diverted from a well that divers water from an aquifer, adjacent aquifers, or a stream that is connected to the aquifer.

3. Subsection (2) does not apply to a well made for groundwater remediation purposes, or with respect to an activity prescribed for that well.
4. Prosecutions under section 106 (5) (i) [*general offences*], it is not necessary to show that introduced foreign water (saline water, contaminated water, sea water), continued to cause or likely to cause significant adverse impact on the quality of water in the aquifer, adjacent aquifers, or a stream that is connected to the aquifer. This applies to the existing uses made of the water diverted from a well that divers water from an aquifer, adjacent aquifers, or a stream that is connected to the aquifer.

Section 59 Prohibition on introducing foreign matter into well

1. As person must not introduce, allow, or cause any of the following to be introduced to a well:
 - (a) Refuse
 - (b) Carcasses
 - (c) Human or animal waste
 - (d) Pesticides or fertilizers
 - (e) A prescribed matter or substance
 - (f) Another contaminant, such as clay, silt, rock or other similar material, or other materials that could cause significant adverse impact on:
 - (i) The quality of water:
 - (A) In the well
 - (B) In another well that is joined to the same aquifer
 - (C) In another aquifer
 - (D) In a stream that is hydraulically connected the aquifer mentioned in clause (B) and(C)
 - (ii) The existing use of water from:
 - (A) In the well
 - (B) In another well that is joined to the same aquifer
 - (C) In another aquifer
 - (D) In a stream that is hydraulically connected the aquifer mentioned in clause (B) and(C)

2. Subsection (1) of this section does not apply to:
 - (a) A well owner who has a proper operation, disinfection, maintenance, repair, deactivating or decommissioning of a well as pointed out in regulations.
 - (b) Wells made for remediation purposes
 - (c) Activities that are authorized or required as part of an enactment
 - (d) Prescribed activities that are carried out in accordance to terms and conditions set out by the regulation
 - (e) Prescribed contaminant, matter or substance
3. Prosecutions under section 106 (5) (k) [*general offences*], it is not necessary to show that introduced foreign water (saline water, contaminated water, sea water), continued to cause or likely to cause significant adverse impact on the quality of water in the aquifer, adjacent aquifers, or a stream that is connected to the aquifer. This applies to the existing uses made of the water diverted from a well that divers water from an aquifer, adjacent aquifers, or a stream that is connected to the aquifer.

Section 60 Remediation orders in relation to foreign matter in well

1. An engineer may order a person mentioned in Section 58(2) or 59 (1)
 - (a) To stop the introduction of anything, contaminant, matter or substance into a well
 - (b) To remove anything; contaminant, matter or substance that was introduced into a well
 - (c) To take measures as directed by the engineer, to remediate or mitigate the effects of the introduction of the above mentioned foreign material into a well
2. If the engineer finds that the effects of the introduction of foreign material cannot be remediated, the engineer can order the person who introduced foreign material to take compensatory mitigation measures in place of or supplemental to other remediation measures on a different part of the aquifer where the introduction was made. *Section 60 (2)*
3. If the engineer cannot ascertain who introduced the foreign material into the well, the engineer may make an order against the well owner. *Section 60 (3)*

4. If the engineer cannot ascertain who introduced the foreign material into the well, or the well owner, the engineer may make an order under subsection (1) or (2) against the owner of the land where the well is located. *Section 60 (4)*
5. The comptroller or water manager may authorize the government or another person to take action necessary to comply with an order under subsection (1) of this section. The person whom the order was directed to is liable for the costs to the government, or another person, as applicable, in order to comply to the order if: *Section 60 (5)*
 - a. The person who introduced foreign matter into the well and is subject to subsection (1), (2), (3), and (4) fails to comply with that order.
 - b. The comptroller or the water manager considers that the failure to comply would result in harm or damage to the aquifers water, in another aquifer or in a stream that is hydraulically connected.
6. Any expense incurred from any exercise by the other person, unless that person is action on behalf of the government, maybe recovered from the person liable, and may be recovered using section 98 *Section 60(6)*
7. If work is carried out by, or on behalf of the government the costs are a debt due to the government by the person who was issued an order, money owing ay be recovered in accordance to *section 98 [recovery of amounts owing for work performed]. Section 60 (7)*
8. This section does not limit section 91 [*power of comptroller to authorize actions*] or section 93 [*powers of engineers and officers*].

Section 63- Water analyses for new or altered wells

1. If a well is drilled, or is altered, the person responsible for the activity carried out, must in accordance with the regulations *Section 63 (1)*:
 - (a) Take or cause to be taken a sample of the ground water in the well and
 - (b) Cause the sample to be analyzed.
2. Water for domestic use must comply with the *Drinking Water Protection Act*, the sampling and the analyses of the ground water must also comply with requirements under that Act.

3. A person who is required by regulation in *Section 63 (1)* to have samples analysed must submit a copy of the results of the analyses to:
 - (a) The comptroller
 - (b) The well owner
 - (c) An official, if directed to do so by the water manager, engineer, an office, or a drinking water officer
4. Subject to section 11(4) [*delivery and publication of documents and information*], the comptroller must publish results received by the comptroller (sunder subsection 3).

Division 4-Water Sustainability Plans

Section 65 Order designating area for planning processes.

This section points out how the minister can designate an area for the purpose of water sustainability plan development. The minister will consider a plan that prevents and addresses;

- (A) Conflict between water users,
- (B) Conflict between the needs of water users and environmental flow needs,
- (C) Risks to water quality, or
- (D) Risks to aquatic ecosystem health. The minister's plan for the area will assist in identifying restoration measures that relate the aquatic ecosystem, and other prescribed circumstances.

Section 65- Order designating area for planning process

This section states how the minister (by request or by the minister's own initiative, or order) may establish a process for the development of proposed a water sustainability plan. If the minister considers the plan will assist in preventing or addressing: Conflict between water users, Conflict between the needs of water users and environmental flow needs, risks to water quality, or Risks to aquatic ecosystem health. The minister's plan for the area will assist in identifying restoration measures that relate the aquatic ecosystem, and other prescribed circumstances [As translated from (*Section 65 (1) to (4)*).

Section 66- Order establishing plan development process

This section explores a how the minister may establish (by order) the process by which a proposed water sustainability plan for a plan area is to be developed (*Section 66 (1)*). An order under this subsection may designate the government or another person as the person responsible for proposing a plan. If the government is the responsible person, they can establish the term reference for the plan, which is subject to approval by the minister (*Section 66 (1) to (3)*).

Section 67- Order limiting planning process or recommendation

The minister (by order) may limit issues to be considered in the development process of the water sustainability plan, or the recommendations that may be made in the plan to address issues considered. (*Section 67 (1) a to b*). An order under this section may state water sustainability recommendations that may not be specified in any regulation or Act, or order under this Act, or any regulations or order under this or any other Act.

Section 68- Content of plan terms of reference

1. This section looks at what a proposed water sustainability plan must include, these include the plan's:
 - a. Purpose
 - b. Scope
 - c. Issues to be addressed
 - d. The organizational structure description that would support the development of the proposed plan
 - e. Estimate of the financial, human and other resources required for the development process, as well as a description of the funding commitments and committed sources of other resources identified in the estimate;
 - f. Process for public and stakeholder communications and consultations, and any prescribed minimum requirements
 - g. The plan must include a process for consultations with the government throughout the plan development process if the responsible individual is a person other than the government
 - h. Time limit for completion of the proposed plan
 - i. Any other prescribed information (*Section 68 (1) a to i*)

2. The terms of reference may include:
 - a. Considerations relating to water in a stream, groundwater and surface water runoff (not in a stream)
 - b. Land uses, or resource use that affect the water mentioned above
3. The terms and references established by a proposed plan may be amended during the plan development process, with subject to approval of the minister, these are subject to subsection (4) below.

Subsection (1) and (2) may apply in relation to a proposed amendment.

4. The minister, by order, may extend the time set out in the terms of reference in the proposed plan, even if the previously mentioned plan has expired.

Section 70- Information to be considered

In preparing a proposed water sustainability plan the responsible person must make sure that consideration is given to any prescribed information, or prescribed records.

Section 71- Notice to affected persons

This section applies if the person responsible for a water sustainability plan finds that the sustainability plan might have recommendations that would negatively impact the rights of: an authorization holder; a change approval holder; a drilling authorization holder, and applicant for authorization; change approval or drilling authorization; a riparian owner; a person holding a right in relation to the use of land or resources, or the plan physically affects the land of a land owner. If any of the above were to occur, the responsible person must give notice in accordance to section 117 [*delivery and publication of documents and information*]. (Section 71 (1) to(3))

Section 72-Powers for development of plan

A minister can make orders for the purposes of developing a proposed water sustainability plan. The order may require a person who diverts or uses water from a stream or aquifer in the water sustainability plan, or engaged in a land resource activity that affects the sustainability if the quality or quantity of water in that water source to give the responsible person, or their representative the information relate to that diversion, or use of land or resource activity.

This section points out the relevant information that must be given to the responsible person, or the representative (e.g.: contact information, information on water diversion or use etc.). This section also points out the powers the responsible person holds, such as investigations, tests, surveys, and collection of relevant public information. The responsible person or their representative, and persons working under the direction of the responsible person or representative are covered under section 89 [*right of access to land and premises by authorised persons*]. The minister can give power to the responsible person to establish limits or conditions under the order as well as other authorisations.

Section 73 Plan Content

This part of the act captions what must be included in a water sustainability plan. A water sustainability plan has to include a description of the plan area, issue that were considered in the planning process, as well as stakeholder and public communication, and consultations carried out in the planning process.

Notifications that were provided to potentially affected individuals have to be included in the plan; the description of the notification, and summary of any concerns. The plan must also include recommendations for measures to address issues, and the rationale for those recommendations.

A description of the plan implications, and the responsibility of plan implementation has to be included in the plan, not forgetting the financial, human, and resource estimate for plan implementation.

Section 79 Plan Regulation- Reduction of Water Rights

1. For the purposes of a water sustainability plan, the Lieutenant Governor in Council may direct a comptroller or a water manager to
 - a. amend the terms and conditions of licences that were identified in the regulation, regardless of the rights under those licences.
 - b. cancel licences identified in the regulation.
2. A regulation must
 - a. Identify the licences, that are subject to the regulation, specifically by class
 - b. Set out a method to calculate the reduction in water quantity to each of the licences

3. The precedence of the rights of the licence holder to the quantity of water they can divert after reduction in subsection (1) is unaffected by the water quantity reduction.

Section 83 Plan regulation- Restriction on groundwater activities

1. The lieutenant Governor in council, by applicable regulation to all or part o the plan area, may restrict or prohibit or impose requirements on individuals carrying out the following:
 - a. Constructing a well
 - b. Installing well pumps
 - c. Conducting flow tests
 - d. Performing other activities that have to do with a well or groundwater
2. Restriction in a regulation under subsection 1 may include a requirement that a person holding a drilling authorization in order to carry out one or more activities that were mentioned in section 62 (1) [*drilling authorizations*].
3. Without limiting subsection (1), a regulation may require the comptroller or a water manager to amend or cancel drilling authorizations,

Division 5-Temporary Protection Order

Section 86- Declarations of significant water shortages

1. If the minister considers one or more streams in an area to have fallen, or is at risk for falling below their environmental flow threshold, the minister may declare a significant water shortage through a temporary order. (*Section 86, (1)*)
2. This order must specify the length of term of the order, which may not exceed 90 days. . (*Section 86, (2)*)
3. Regardless of an order made, or it being expired in subsection (1), if the Lieutenant Governor in Council considers that one or more streams in an area have fallen or are facing a risk of falling below their environmental flow threshold, the Lieutenant Governor in Council may make an order declaring a significant shortage in the area in the order. . (*Section 86, (3)*)
4. When an order under subsection (3) comes into force, an order under subsection (1) of the same designated area expires. (*Section 86, (4)*)

5. An area designated under subsection (1) or (3) is also applicable in Section 124 (4)
(d) [*general regulation-making powers*]. (Section 86, (5))

Section 87 Critical environmental flow protection orders

If an enforced order is issued for section 86 (1) or (3), the comptroller must determine the critical environmental flow threshold for each stream in accordance to the regulation and other acts. If the comptroller considers more than one stream in an area under an order under section 86 (1) or (3) applies under the description in subsection (1), the comptroller may determine the critical environmental flow threshold while considering the ecosystem of the stream. enforcement will depend on the critical environmental flow threshold. An order under subsection (1) is final and may not be appealed to the appeal board. (Section 87, 3).

An order under section 86 (1) or (3) is final, and may not be appealed to the appeal board. This order and the implementation of the precedence pointed out in the *precedence of rights* in section 22 (9) apply, despite the rights of any person diverting or using water from the stream or aquifer that is hydraulically connected to the stream.

Part 7-Transitional Provisions

Section 138 Transition-power purposes

1. A person who holds a licence (as mentioned in section 19 [*licences for power purposes*] of the *Water Act*) may apply to the comptroller or a water manager for an extension of the term of licence of up to 10 years to account for any project term, as defined in section 19, that occurred under their licence. This is applicable for individuals with licences on the date the *Water Sustainability Act* comes into force. (Section 138, (1)).
2. Section 19 (6) does not apply to an application authorized under subsection (1) of this section. (Section 138, (2)).

Section 140 Transition-Ground water licensing

1. A person who is diverting, using, or storing water from an aquifer in a manner that is not described in section 6 (4) [*use of water-excluded groundwater users*] may continue to divert,

store and use water from that aquifer when section 6 comes into force for that purpose as follows:

- a. If the person applied for authorization on or before the date that applies to the person by the regulation under *subsection (2) (c)*, or until the date a decision is made on the application.
- b. If the person fails to apply for an authorization on or before the date that applies to the person by regulations under *subsection (2) (c)*.

Subsection 2 of Section 140 states that the Lieutenant Governor in Council may make regulations that:

- a. Establish application procedures for individuals described in *subsection 1 (a)*
 - b. Establish the purposes of section 22, the method for determining the precedence date of an authorization that was issued to an individual that was described in *subsection 1 (a)*
 - c. Provide application of the provisions in Part 2 [*Licensing, Diversion and Use of Water*] to individuals that were described in subsection (1).
2. The Lieutenant Governor in Council may make regulations despite sections 12 [*application and decision maker initiative procedures*], 13 [*objections to applications and decision maker initiatives*], 14 [*powers respecting applications and decision maker initiatives*], 17 [*sensitive stream mitigation*], 18 [*quick licensing procedures*] and 22 [*precedence of rights*], these regulations can
- a. Establish application procedures and requirements for persons described in subsection (1) of this section
 - b. Establish methods for determining the precedence date of an authorization issue to a person that was mentioned in subsection (1) (a), and for the purpose of section 22
 - c. Provide for the application of provisions of Part 2 [*Licensing, Diversion and Use of Water*] to individuals that were described in subsection (1)
3. Despite the precedence of the rights that fall under authorizations in effect (on the date issued) in accordance with the regulations in this section, the method for determining the precedence date of an authorization for the purposes stated in subsection (2) may provide rights to a

person to have precedence from the person's date of first use for a specified water use purpose of a specified amount of water from the aquifer.

4. On, and after the date a regulation applies to a person, the person is liable for the applicable fees, rentals or charges for the water diverted from the aquifer, and used in accordance to the authorization.

12.2. APPENDIX II: DESCRIPTION OF GIS LAYERS

The information in this appendix was obtained and directly quoted from the BC Data Catalogue. Descriptions of the WMS and snap shot database layers are provided below, along with the publisher, license, object name, lineage statements, current progress, and a live link to the relative data layer in the BC Data Catalogue.

BC Aquifers

Intrinsic Aquifer Vulnerability

Published by the Ministry of Environment - Water Protection and Sustainability

Licensed under Open Government License - British Columbia

Description: Spatial layer intended to describe the intrinsic vulnerability of the groundwater

Status: Ongoing

Comments: Aquifer vulnerability is a spatial layer that describes the intrinsic vulnerability of the groundwater. Intrinsic vulnerability means that it is based on hydrogeologic characteristics alone and does not consider the existing type of land use or nature of the potential contaminants. In assessing an aquifer's vulnerability, the contaminant is assumed to be introduced at, or very near, the land surface. The methods used to describe vulnerability include: DRASTIC and Aquifer Vulnerability Index (AVI). This spatial layer has polygonal features.

Object Name:

WHSE_WATER_MANAGEMENT.GW_AQUIFER_VULNERABILITY_POLY

<https://catalogue.data.gov.bc.ca/dataset/drastic-aquifer-intrinsic-vulnerability>

Ground Water Aquifer Classification

Published by the Ministry of Environment - Water Protection and Sustainability

Licensed under Open Government License - British Columbia

Description: Polygon features represent developed ground water aquifers in BC (that have been mapped). Most aquifer boundaries are delineated based on geology, hydrology and topographic information. Some aquifer boundaries stop at the border of BC mapsheet boundaries due to resource or data constraints at the time of mapping. Spatial layer intended to identify developed aquifers, where ground water is vulnerable, the productivity of the aquifer and the demand in a specific aquifer, to assist in the management and protection of the ground water resource.

Status: Ongoing

Lineage Statement: For the aquifer coverages, raw data such as well records, water quality data, reports, air photographs, and geologic maps are used to interpret the aquifers in a study area. The aquifer coverages are mostly interpretive.

Object Name:

WHSE_WATER_MANAGEMENT.GW_AQUIFERS_CLASSIFICATION_SVW

Ground Water Aquifer

Published by the Ministry of Environment - Water Protection and Sustainability

Licensed under Open Government License - British Columbia

Comments: Polygon features represent developed ground water aquifers in BC (that have been mapped). Most aquifer boundaries are delineated based on geology, hydrology and topographic information. Some aquifer boundaries stop at the border of BC mapsheet boundaries due to resource or data constraints at the time of mapping. Spatial layer intended to identify developed aquifers, where ground water is vulnerable, the productivity of the aquifer and the demand in a specific aquifer, to assist in the management and protection of the ground water resource.

Status: Ongoing

Lineage Statement: For the aquifer coverages, raw data such as well records, water quality data, reports, air photographs, and geologic maps are used to interpret the aquifers in a study area. The aquifer coverages are mostly interpretive.

Object Name:

WHSE_WATER_MANAGEMENT.GW_AQUIFERS_CLASSIFICATION_SVW

<https://catalogue.data.gov.bc.ca/dataset/ground-water-aquifers>

Ground Water Quality Zones

Published by the Ministry of Environment - Water Protection and Sustainability

Licensed under Open Government License - British Columbia

Comments: Polygon features showing:

- ground water quality zones of hardness concentrations,
- zones which have been impacted by human activities from NPS of pollution,

- total dissolved solids,
- total alkalinity concentrations,
- Chlorine concentrations,
- Specific conductance values, and
- Nitrate-Nitrogen concentrations.

The layers do not represent current or historic conditions. Retained for demonstration purposes.

Do not use for any practical purpose. Spatial layers intended to provide specific ground water chemistry information to assist in the management and protection of the ground water resource.

Status: Ongoing

Lineage Statement: Ground water well locations are identified onto well cards by well drillers as part of the drilling process. There is no statutory requirement for well drillers to submit these records to the Government of British Columbia, therefore not all ground water wells are represented in this dataset. It is uncertain the percentage of wells that are represented, but the best estimate is around 50%. The dataset is in a constant state of update and does not stay static for any length of time. Accuracy is defined by one of five codes (see SOURCE_ACCURACY attribute description).

Object Name: WHSE_WATER_MANAGEMENT.GW_HARDNESS_POLY

Comments: A spatial layer that shows the hardness concentration in milligrams per litre in groundwater.

https://catalogue.data.gov.bc.ca/dataset?q=GROUND+WATER+Quality+zones&sort=score+desc%2C+record_publish_date+desc

BC Hydro Metric Stations

Active Hydrometric Stations Layer

Published by the Ministry of Environment - Knowledge Management

Licensed under Open Government License - British Columbia

To identify existence and locations of active hydrometric stations

Comments: Active Hydrometric stations spatial view

(ENVCAN_ACT_HYDMETRIC_STN_SVW) expose the active hydrometric stations in BC.

The Water Survey of Canada maintains hydrometric (streamflow and water level) records for 2400 hydrometric stations in British Columbia and Yukon for which over 500 are active at present

Status: Ongoing

Lineage Statement: Spatial view of active stations, sourced from active/discontinued dataset

WHSE_ENVIRONMENTAL_MONITORING.ENVCAN_HYDROMETRIC_STN_SP

Object Name:

WHSE_ENVIRONMENTAL_MONITORING.ENVCAN_ACT_HYDMETRIC_STN_SVW

<https://catalogue.data.gov.bc.ca/dataset/hydrometric-stations-active>

Discontinued Hydrometric Stations Layer

Published by the Ministry of Environment - Knowledge Management

Licensed under Open Government License - British Columbia

Comments: To identify existence and locations of discontinued hydrometric stations.

Discontinued Hydrometric stations spatial view (ENVCAN_DIS_HYDMETRIC_STN_SVW)
expose the discontinued hydrometric stations in BC. The Water Survey of Canada maintains
hydrometric (streamflow and water level) records for 2400 hydrometric stations in British
Columbia and Yukon for which over 500 are active at present.

Status: Ongoing

Lineage Statement: Spatial view of discontinued stations, sourced from active/discontinued
dataset WHSE_ENVIRONMENTAL_MONITORING.ENVCAN_HYDROMETRIC_STN_SP

Object Name:

WHSE_ENVIRONMENTAL_MONITORING.ENVCAN_DIS_HYDMETRIC_STN_SVW

<https://catalogue.data.gov.bc.ca/dataset/hydrometric-stations-discontinued>

BC Watershed Atlas**Aquatic Point Feature (50k)**

Published by the Ministry of Environment - Knowledge Management

Licensed under Open Government License - British Columbia

Comments: Aquatic Features including Falls, Cascades and springs based on the 1:50,000 scale Canadian National Topographic Series of Maps. Resource inventory mapping, regional land use mapping.

Status: Completed

Lineage Statement: Planimetric positional data represents a structuring of digitally scanned federal NTS 1:50, 000 hydrographic mylar separates. DATA SOURCE SIZE : 1 NTS 1:50, 000
Mapsheet GEO COVERAGE: Full coverage of province

Object Name: WHSE_FISH.WDIC_AQUATIC_FEATURE_POINT_SVW

<https://catalogue.data.gov.bc.ca/dataset/wsa-aquatic-features-50-000>

Watershed Group (50k)

Published by the Ministry of Environment - Knowledge Management

Licensed under Open Government License - British Columbia

Comments: The 246 Watershed Groups of BC based on the 1:50,000 scale Canadian National Topographic Series of Maps.

Status: completed

Lineage Statement: Planimetric positional data represents a structuring of digitally scanned federal NTS 1:50, 000 hydrographic mylar separates. DATA SOURCE SIZE: 1 NTS 1:50, 000
Mapsheet GEO COVERAGE: Full coverage of province

Object Name: WHSE_FISH.WDIC_WATERSHED_GROUP_POLY

<https://catalogue.data.gov.bc.ca/dataset/wsa-bc-watershed-groups-50-000>

Community Watersheds - Current

Published by the Ministry of Environment - Water Protection and Sustainability

Licensed under Open Government License - British Columbia

Comments: Boundaries (polygons) of areas designated as community watershed by government - that are all or part of the drainage area that is upslope of the lowest point from which water is diverted for human consumption by a licensed waterworks, if satisfied that, to protect the water that is diverted for human consumption, the area requires special management that is not otherwise provided for under this regulation or other enactment: to conserve the quality, quantity and timing of water flow; or to prevent cumulative hydrological effects that would have a material adverse effect on the water . Supercedes the '(DEPRECATED) BC Community Watersheds' dataset BC_COMMUNITY_WATERSHEDS. A digital representation of the boundaries of designated Community Watersheds, along with attribute information.

Status: Ongoing

Object Name: WHSE_WATER_MANAGEMENT.WLS_COMMUNITY_WS_PUB_SVW

<https://catalogue.data.gov.bc.ca/dataset/community-watersheds-current>

Environmental Monitoring System Results - All

Published by the Ministry of Environment - Knowledge Management

Licensed under Access Only

Comments: EMS is the ministry's primary monitoring data repository. The system was designed to capture data covering physical/chemical and biological analyses performed on water, air, solid waste discharges and ambient monitoring sites throughout the province. It also contains related quality assurance data. Samples are collected by either ministry staff or permittees under the Environmental Management Act and then analyzed in public or private sector laboratories.

Status: Ongoing

Object Name:

WHSE_ENVIRONMENTAL_MONITORING.EMS_SAMPLE_RESULTS_RESTRICTED

<https://catalogue.data.gov.bc.ca/dataset/bc-environmental-monitoring-system-results-all>

Macro-Reaches (50k)

Published by the Ministry of Environment - Knowledge Management

Licensed under Open Government License - British Columbia

Comments: Stream Macro-Reaches delineated through interpretation of Topographic features from the 1:50,000 scale Canadian National Topographic Series of Maps.

Quantify some aspects of hydrology and fish habitat, and to compare different regions of the province.

Status: Completed

Lineage Statement: Planimetric positional data are line segments whose end points originate as points marked on streams on 1:50K NTS mapsheets. Following the geo-referencing of these end points to the BC Watershed Atlas 50K Stream centreline network and the application of the ESRI Dynamic Segmentation Model the two the end points for each line segment, with designated linear measures, are used to create a macro-reach (event arc) from an exact trace of the stream channel between the two end points. Full coverage of the province

Object Name: WHSE_FISH.WDIC_MACRO_REACH_LINE_SVW

<https://catalogue.data.gov.bc.ca/dataset/bc-macro-reaches-50-000>

Major Drainage Regions of BC (50k)

Published by the Ministry of Environment - Knowledge Management

Licensed under Open Government License - British Columbia

Comments: The Nine Major Drainage Areas of BC based on the 1:50,000 scale Canadian National Topographic Series of Maps

Status: Completed

Lineage Statement: Planimetric positional data represents a structuring of digitally scanned federal NTS 1:50, 000 hydrographic mylar separates. DATA SOURCE SIZE : 1 NTS 1:50, 000
Mapsheet GEO COVERAGE: Full coverage of province

Object Name: WHSE_FISH.WDIC_WATERSHED_POLY_DRAIN_SVW

<https://catalogue.data.gov.bc.ca/dataset/wsa-the-major-drainage-regions-of-bc-50-000>

Stream Centre Line Network (50K) Layer

Published by the Ministry of Environment - Knowledge Management

Licensed under Open Government License - British Columbia

Comments: Resource inventory mapping, regional land use mapping

Status: Completed

Lineage Statement: Planimetric positional data represents a structuring of digitally scanned federal NTS 1:50, 000 hydrographic mylar separates. DATA SOURCE SIZE : 1 NTS 1:50, 000
Mapsheet GEO COVERAGE: Full coverage of province

Object Name: WHSE_FISH.WDIC_WATERBODY_STREAM_LINE_SVW

<https://catalogue.data.gov.bc.ca/dataset/wsa-stream-centreline-network-50-000>

Environmental Remediation Sites

Published by the Ministry of Environment - Environmental Emergencies and Land Remediation

Licensed under Access Only

Comments: A layer containing data on known and potentially contaminated properties in British Columbia. A site is contaminated if its land, water and/or sediment are unsuitable for particular uses from waste that exceeds environmental quality standards. The Site Registry records information about environmental conditions for sites that have been screened investigated or cleaned up since the recording of site maintenance began.

Status: Ongoing

Lineage Statement: Formally WHSE_WASTE.SITE_ENV_REMEDIATION_SITES_SVW

Object Name: WHSE_WASTE.SITE_ENV_RMDTN_SITES_SVW

<https://catalogue.data.gov.bc.ca/dataset/environmental-remediation-sites>

Dams**Public View**

Published by the Ministry of Forests, Lands and Natural Resource Operations - Water

Management

Licensed under Open Government License - British Columbia

Comments: Province-wide SDE spatial view displaying dam locations. The public view displays a subset of the attribute data. Spatial view intended to display the location of dams in the province, along with the attributes deemed accessible to the public. View to be used primarily within the IMAP application. (Public users) Containing 14 attributes attached to the dams, revealing: Identification through; the dam name and file number (D-number). Licensing information obtained by using the Point code. Location of the Dam within BC using; District, Precinct and Region. Dam description with; Category, Type and Function. Physical Characteristics through; Height, Crest elevation and length. Ownership of the dam established with the Dam owner. NOTE: null geometries are NOT included.

Status: Ongoing

Lineage Statement: Spatial view created by joining selected arcs from spatial layer WHSE_WATER_MANAGEMENT.WLS_WATER_LICENSED_WRK_LINE_SP tagged with the 'D-file' number (e.g. twrk_tag lk 'D*') with attribute view WHSE_WATER_MANAGEMENT.WRIS_DAMS_BASE_VW by TWRK_TAG/DAM_FILE_NO.

Object Name: WHSE_WATER_MANAGEMENT.WRIS_DAMS_PUBLIC_SVW

<https://catalogue.data.gov.bc.ca/dataset/bc-dams-public-view>

EAUBC**Freshwater Ecoregion**

Published by the Ministry of Environment - Knowledge Management

Licensed under Access Only

Comments: Ecological Aquatic Units of British Columbia (EAU BC) is a hierarchical classification of BC's freshwater ecosystems. EAU BC classifies freshwater systems at three spatial scales - Freshwater Ecoregions, Ecological Drainage Units, and River and Lake Ecosystems - based on measurable environmental features, processes and biological data.

Freshwater Ecoregions are defined based on zoogeographic patterns in fish recolonization following the last glacial recession. Five Freshwater Ecoregions are identified in BC.

ECOREGION is a spatial layer representing Freshwater Ecoregions which are defined based on zoogeographic patterns in fish recolonization following the last glacial recession. Five Freshwater Ecoregions are identified in BC.

Status: Completed

Object Name:

WHSE_LAND_AND_NATURAL_RESOURCE.EAUBC_ECOREGIONS_SP

<https://catalogue.data.gov.bc.ca/dataset/eaubc-freshwater-ecoregion>

Ecological Drainage Units

Published by the Ministry of Environment - Knowledge Management

Licensed under Access Only

Comments: Ecological Drainage Units (EDU's) are nested within Freshwater Ecoregions and take into account zoogeographic, climatic, and physiographic patterns that define freshwater systems. Ecological Drainage Units represent distinct major drainage basins that contain unique assemblages of native B.C. freshwater fish. Thirty-six Ecological Drainage Units are identified in BC. Ecological Drainage Units are nested within Freshwater Ecoregions and take into account zoogeographic, climatic, and physiographic patterns that define freshwater systems. Ecological Drainage Units incorporate the known distribution of native freshwater fishes in BC. Thirty-six Ecological Drainage Units are identified in BC.

Status: Completed

Object Name:

WHSE_LAND_AND_NATURAL_RESOURCE.EAUBC_ECO_DRAINAGE_UNITS_SP

<https://catalogue.data.gov.bc.ca/dataset/eaubc-ecological-drainage-units>

Lakes

Published by the Ministry of Environment - Knowledge Management

Licensed under Access Only

Comments: River and Lake Ecosystem Types nest within both Ecological Drainage Units and Freshwater Ecoregions. They are therefore defined by zoogeographic, physiographic and climatic patterns but also take into account more localized physical habitat and dominant environmental processes that shape freshwater ecosystems. The units of analysis for lake ecosystems in BC are at a scale of 1:50,000. Biological information is sparse at this scale of the classification and is therefore not explicitly used to delineate ecosystem types. However, fish assemblages can be inferred for each Ecosystem Type based on the Ecological Drainage Unit it is nested within. Twelve Lake Ecosystem Types are identified in BC.

Status: Completed

Object Name: WHSE_LAND_AND_NATURAL_RESOURCE.EAUBC_LAKES_SP

<https://catalogue.data.gov.bc.ca/dataset/eaubc-lakes>

Rivers

Published by the Ministry of Environment - Knowledge Management

Licensed under Access Only

Comments: River and Lake Ecosystem Types nest within both Ecological Drainage Units and Freshwater Ecoregions. They are therefore defined by zoogeographic, physiographic and climatic patterns but also take into account more localized physical habitat and dominant environmental processes that shape freshwater ecosystems. The units of analysis for river ecosystems in BC are at a scale of 1:50,000. Biological information is sparse at this scale of the classification and is therefore not explicitly used to delineate ecosystem types. However, fish

assemblages can be inferred for each Ecosystem Type based on the Ecological Drainage Unit it is nested within. Eleven River Ecosystem Types and twenty-three River Ecosystem Sub-Types are identified in BC. In total, 18,100 watershed units are used in the classification of River Ecosystem Types.

Status: Completed

Object Name: WHSE_LAND_AND_NATURAL_RESOURCE.EAUBC_RIVERS_SP

<https://catalogue.data.gov.bc.ca/dataset/eaubc-rivers>

Freshwater Atlas

Watershed Type Codes

Published by the Ministry of Forests, Lands and Natural Resource Operations - GeoBC

Licensed under Open Government License - British Columbia

Comments: A lookup table can be used to explain the watershed type codes in the Assessment Watersheds layer.

Status: Ongoing

Lineage Statement: Automated, mathematical and statistical algorithms were applied against the TRIM I stream network and the TRIM I elevation surface model.

Object Name: WHSE_BASEMAPPING.FWA_WATERSHED_TYPE_CODES

Comments: Contains all watershed type codes and a plain english description of them.

<https://catalogue.data.gov.bc.ca/dataset/freshwater-atlas-watershed-type-codes>

Waterbody Type Codes

Published by the Ministry of Forests, Lands and Natural Resource Operations - GeoBC

Licensed under Open Government License - British Columbia

Comments: Links the waterbody type codes used in the waterbody layers with an English description used to categorize waterbody features. This code table is used as a look-up table for the waterbody type codes in the Freshwater Atlas waterbody layers.

Status: Ongoing

Lineage Statement: Automated, mathematical and statistical algorithms were applied against the TRIM I stream network and the TRIM I elevation surface model.

Object Name: WHSE_BASEMAPPING.FWA_WATERBODY_TYPE_CODES

<https://catalogue.data.gov.bc.ca/dataset/freshwater-atlas-waterbody-type-codes>

Lakes

Published by the Ministry of Forests, Lands and Natural Resource Operations - GeoBC

Licensed under Open Government License - British Columbia

Comments: All lake polygons for the province. This spatially-based information is typically used in allocation decisions, boundary definitions, planning processes and environmental monitoring, by internal and external stakeholders.

Status: Ongoing

Lineage Statement: Automated, mathematical and statistical algorithms were applied against the TRIM I stream network and the TRIM I elevation surface model.

Object Name: WHSE_BASEMAPPING.FWA_LAKES_POLY

<https://catalogue.data.gov.bc.ca/dataset/freshwater-atlas-lakes>

Stream Directions

Published by the Ministry of Forests, Lands and Natural Resource Operations - GeoBC

Licensed under Open Government License - British Columbia

Comments: Points with rotations that indicate downstream flow direction. Can be displayed with arrow symbols to show flow direction. There is one point at the upstream end for each stream network feature. This feature layer is used for display purposes to show stream flow direction. Directional arrowheads for use with web mapping applications only. Arrowheads are in various sizes for scale dependant display. Arrowhead orientation is based on the vertex order of the referenced linear element.

Status: Ongoing

Lineage Statement: The upstream end points of each stream network feature were extracted and a downstream direction to the next vertex was calculated. This value is stored as an attribute in the feature attribute table.

Object Name: WHSE_BASEMAPPING.FWA_STREAM_DIRECTIONS_SP

<https://catalogue.data.gov.bc.ca/dataset/freshwater-atlas-stream-directions>

Linear Boundaries

Published by the Ministry of Forests, Lands and Natural Resource Operations - GeoBC

Licensed under Open Government License - British Columbia

Comments: All bank edges (of rivers, lakes, and wetlands), delimiter edges, glacier edges, and administrative boundary edges. These are the linear features that makeup the polygonal waterbodies. This spatially-based information is typically used in allocation decisions, boundary definitions, planning processes and environmental monitoring, by internal and external stakeholders. Contains all bank edges (of rivers, lakes and wetlands), delimiter edges, glacier edges and administrative boundary edges. Does not contain multipart geometries. Spatial type: simple line.

Status: Ongoing

Lineage Statement: Automated, mathematical and statistical algorithms were applied against the TRIM I stream network and the TRIM I elevation surface model.

Object Name: WHSE_BASEMAPPING.FWA_LINEAR_BOUNDARIES_SP

<https://catalogue.data.gov.bc.ca/dataset/freshwater-atlas-linear-boundaries>

Stream Network

Published by the Ministry of Forests, Lands and Natural Resource Operations - GeoBC

Licensed under Open Government License - British Columbia

Comments: Flow network arcs (observed, inferred and constructed). Contains no banks, coast or watershed boundary arcs. Directionalized and connected. Contains heirarchial key and route identifier

This spatially-based information is typically used in allocation decisions, boundary definitions, planning processes and environmental monitoring, by internal and external stakeholders.

Contains only flow network arcs (observed, inferred and constructed flows). Contains no banks, coast or watershed boundary arcs. Does not contain multipart geometries. Spatial geometry: simple line

Status: Ongoing

Lineage Statement: Automated, mathematical and statistical algorithms were applied against the TRIM I stream network and the TRIM I elevation surface model.

Object Name: WHSE_BASEMAPPING.FWA_STREAM_NETWORKS_SP

<https://catalogue.data.gov.bc.ca/dataset/freshwater-atlas-stream-network>

Water Resource Management Streams

Published by the Ministry of Forests, Lands and Natural Resource Operations - Water Management

Licensed under Access Only

Comments: Province-wide SDE layer displaying the Freshwater Atlas Stream Network streams that are either reserved or have been designated as Water Reserves, First Nations Treaty Lands Water Reserves, Sensitive Streams, or Protected Rivers. Layer intended to display the location of Freshwater Atlas Stream Network streams that are either reserved or have been designated as Sensitive Streams or Protected Rivers. Used for reviewing water use proposals. WATER RESOURCE MGMT LINE is a province-wide SDE layer displaying the Fresh Water Atlas Stream Network streams that are either reserved or have been designated as Sensitive Streams or Protected Rivers.

Status: Ongoing

Object Name:

WHSE_WATER_MANAGEMENT.WLS_WATER_RESOURCE_MGMT_LINE

<https://catalogue.data.gov.bc.ca/dataset/water-resource-management-streams>

Watershed Groups

Published by the Ministry of Forests, Lands and Natural Resource Operations - GeoBC

Licensed under Open Government License - British Columbia

Comments: Polygons delimiting the watershed group boundary, which is a collections of drainage areas. In-land groups will contain a single polygon, coastal groups may contain multiple polygons (one for each island). This spatially-based information is typically used in allocation decisions, boundary definitions, planning processes and environmental monitoring, by internal and external stakeholders. Contains polygons delimiting the watershed group boundary which is a collection of drainage area basins. In-land groups will contain a single polygon, coastal groups may contain multiple polygons (one for each island) i.e., this is a multipart polygon feature.

Spatial geometry: multipart polygon

Status: Ongoing

Lineage Statement: Automated, mathematical and statistical algorithms were applied against the TRIM I stream network and the TRIM I elevation surface model.

Object Name: WHSE_BASEMAPPING.FWA_WATERSHED_GROUPS_POLY

<https://catalogue.data.gov.bc.ca/dataset/freshwater-atlas-watershed-groups>

Watersheds

Published by the Ministry of Forests, Lands and Natural Resource Operations - GeoBC

Licensed under Open Government License - British Columbia

Comments: All fundamental watershed polygons generated from watershed boundary lines, bank edges, delimiter edges, coastline edges, and administrative boundary edges. This spatially-based information is typically used in allocation decisions, boundary definitions, planning Contains all

watershed polygons generated from principal watershed boundary lines, bank edges, delimiter edges, coastline edges and administrative boundary edges, following the 1:50K datamodel. May contain multipart geometries. Spatial type: multipart geometry processes and environmental monitoring, by internal and external stakeholders.

Status: Ongoing

Lineage Statement: Automated, mathematical and statistical algorithms were applied against the TRIM I stream network and the TRIM I elevation surface model.

Object Name: WHSE_BASEMAPPING.FWA_WATERSHEDS_POLY

<https://catalogue.data.gov.bc.ca/dataset/freshwater-atlas-watersheds>

Manmade Waterbodies

Published by the [Ministry of Forests, Lands and Natural Resource Operations](#) - [GeoBC](#)

Licensed under [Open Government License - British Columbia](#)

Comments: All manmade waterbodies, including reservoirs and canals, for the province. This spatially-based information is typically used in allocation decisions, boundary definitions, planning processes and environmental monitoring, by internal and external stakeholders.

Contains all manmade waterbody polygons for the province including reservoirs and canals.

Does not contain multipart geometries. Spatial type: simple polygon.

Status: Ongoing

Lineage Statement: Automated, mathematical and statistical algorithms were applied against the TRIM I stream network and the TRIM I elevation surface model.

Object Name: **WHSE_BASEMAPPING.FWA_MANMADE_WATERBODIES_POLY**

<https://catalogue.data.gov.bc.ca/dataset/freshwater-atlas-manmade-waterbodies>

Named Point Features

Published by the [Ministry of Forests, Lands and Natural Resource Operations - GeoBC](#)

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Comments: Named point features (both fresh and marine) such as points of land, etc. Point names included as an attribute. This spatially-based information is typically used in allocation decisions, boundary definitions, planning processes and environmental monitoring, by internal and external stakeholders. Contains point features (both fresh and coastal) and associated names.

Does not contain multipart geometries. Spatial geometry: point.

Status: Ongoing

Lineage Statement: Automated, mathematical and statistical algorithms were applied against the TRIM I stream network and the TRIM I elevation surface model.

Object Name: **WHSE_BASEMAPPING.FWA_NAMED_POINT_FEATURES_SP**

<https://catalogue.data.gov.bc.ca/dataset/freshwater-atlas-named-point-features>

Named Watersheds

Published by the Ministry of Forests, Lands and Natural Resource Operations - GeoBC

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Comments: All named watershed polygons. This spatially-based information is typically used in allocation decisions, boundary definitions, planning processes and environmental monitoring, by internal and external stakeholders. Contains all watersheds of named rivers and the associated name details. There are approximately 12 000 named watersheds in BC. This contains multipart geometries. Spatial geometry: multipart polygon.

Status: Ongoing

Lineage Statement: Automated, mathematical and statistical algorithms were applied against the TRIM I stream network and the TRIM I elevation surface model.

Object Name: WHSE_BASEMAPPING.FWA_NAMED_WATERSHEDS_POLY

<https://catalogue.data.gov.bc.ca/dataset/freshwater-atlas-named-watersheds>

Obstructions

Published by the Ministry of Forests, Lands and Natural Resource Operations - GeoBC

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Comments: Water obstacles (rapids, falls, etc). This spatially-based information is typically used in allocation decisions, boundary definitions, planning processes and environmental monitoring, by internal and external stakeholders.

Status: Ongoing

Lineage Statement: Automated, mathematical and statistical algorithms were applied against the TRIM I stream network and the TRIM I elevation surface model.

Object Name: WHSE_BASEMAPPING.FWA_OBSTRUCTIONS_SP

<https://catalogue.data.gov.bc.ca/dataset/freshwater-atlas-obstructions>

Rivers

Published by the Ministry of Forests, Lands and Natural Resource Operations - GeoBC

Licensed under Open Government License - British Columbia

Comments: All double line river polygons for the province. This spatially-based information is typically used in allocation decisions, boundary definitions, planning processes and environmental monitoring, by internal and external stakeholders. Contains all double line river polygons in the province. Does not contain multipart geometries. Spatial type: simple polygon

Status: Ongoing

Lineage Statement: Automated, mathematical and statistical algorithms were applied against the TRIM I stream network and the TRIM I elevation surface model.

Object Name: WHSE_BASEMAPPING.FWA_RIVERS_POLY

<https://catalogue.data.gov.bc.ca/dataset/freshwater-atlas-rivers>

Assessment Watersheds

Published by the Ministry of Forests, Lands and Natural Resource Operations - GeoBC

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Comments: Assessment Watersheds are mesoscale aquatic units designed to replace the 3rd order 1:50K watersheds. Assessment Watersheds are based on groupings of fundamental watersheds using FWA watershed code and local code, with a target size of between 2,000ha and 10,000ha. This spatially-based information is typically used in allocation decisions, boundary definitions, planning processes and environmental monitoring, by internal and external stakeholders. Contains an aggregate of watershed polygons in an attempt to create a standard "assessment sized" watershed suitable for analytical purposes. This layer mimics the 1:50K 3rd order watershed polygon layer. May contain multipart geometries. Spatial type: multipart polygon.

Status: Ongoing

Lineage Statement: Automated, mathematical and statistical algorithms were applied against the TRIM I stream network and the TRIM I elevation surface model.

Object Name: WHSE_BASEMAPPING.FWA_ASSESSMENT_WATERSHEDS_POLY

<https://catalogue.data.gov.bc.ca/dataset/freshwater-atlas-assessment-watersheds>

Geology Faults

Published by the Ministry of Energy and Mines - BC Geological Survey

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Comments: Digital file containing faults line coverage for British Columbia. Faults are identified by a type attribute. Geology compiled at 1:100,000 scale as part of the B.C. Ministry of Energy and Mines, Geological Survey Branch mineral potential project, 1994-1996. Original coding revised and rationalized in 2001-2002 by D.G. MacIntyre, updated and revised in 2002-2004 by N.W.D. Massey. New mapping completed after 1996 is being added to this file through the BCGeologyMap project, lead by Yao Cui. Related data sets are Geology Bedrock and Quaternary Alluvium and Cover

Status: Completed

Object Name: WHSE_MINERAL_TENURE.GEOL_FAULT_LINE

<https://catalogue.data.gov.bc.ca/dataset/geology-faults>

Ground Water Wells**Borehole Log Lithology Public View**

Published by the Ministry of Environment - Environmental Emergencies and Land Remediation

Licensed under Access Only

Comments: Contains data on lithology, hydraulic conductivity and water levels, taken from borehole logs. This layer is a point feature and available to Public.

SITE_BOREHOLE_LITHOLOGY_SVW contains data on lithology, hydraulic conductivity and water levels, taken from borehole logs. This layer is a point feature and available to Public.

Status: Completed

Object Name: WHSE_WASTE.SITE_BOREHOLE_LITHOLOGY_SVW

<https://catalogue.data.gov.bc.ca/dataset/borehole-log-lithology-public-view>

Lithology of Ground Water Wells

Published by the Ministry of Environment - Water Protection and Sustainability

Licensed under Open Government License - British Columbia

Comments: Point features showing the lithology of ground water wells in BC. (This layer is an instantiation of the spatial view GW_WATER_WELLS_LITHOLOGY_SVW.) NOTE: When choosing to download this GIS dataset below, there can be errors when trying to download the entire province. The large file size is a problem for the default file format (shapefile). If you need to download the entire province, please choose a different file format (e.g. ESRI File Geodatabase). If you need to download in shapefile format, please use an area of interest (AOI). Spatial layer intended to show lithologies at locations of wells which have been drilled, dug or driven in the province, to assist in the management and protection of the groundwater resource.

Status: Ongoing

Lineage Statement: Ground water well locations are identified onto well cards by well drillers as part of the drilling process. There is no statutory requirement for well drillers to submit these records to the Government of British Columbia, therefore not all ground water wells are represented in this dataset. It is uncertain the percentage of wells that are represented, but the best estimate is around 50%. The dataset is in a constant state of update and does not stay static for any length of time. Accuracy is defined by one of ten codes (see SOURCE_ACCURACY attribute description).

Object Name:

WHSE_WATER_MANAGEMENT.GW_WATER_WELLS_LITHOLOGY_SP

<https://catalogue.data.gov.bc.ca/dataset/lithology-of-ground-water-wells>

Ground Water Wells (Spatial View, with attribute info)

Published by the Ministry of Environment - Water Protection and Sustainability

Licensed under Open Government License - British Columbia

Comments: Point features showing the location of ground water wells in BC joined with attributes and information from the WELLS database. Artesian wells are flowing wells at the time of drilling. Spatial view intended to show location and other attributes of wells which have been drilled, dug or driven in the province, to assist in the management and protection of the groundwater resource.

Status: Ongoing

Lineage Statement: Ground water well locations are identified onto well cards by well drillers as part of the drilling process. There is no statutory requirement for well drillers to submit these records to the Government of British Columbia, therefore not all ground water wells are represented in this dataset. It is uncertain the percentage of wells that are represented, but the best estimate is around 50%. The dataset is in a constant state of update and does not stay static for any length of time. Accuracy is defined by one of ten codes (see SOURCE_ACCURACY attribute description).

Object Name: WHSE_WATER_MANAGEMENT.GW_WATER_WELLS_WRBC_SVW

<https://catalogue.data.gov.bc.ca/dataset/ground-water-wells-spatial-view-with-attribute-info>

Hydrology

Hydrology: Hydrometric Watershed Boundaries

Published by the Ministry of Environment - Knowledge Management

Licensed under Open Government License - British Columbia

Comments: Watershed boundary delineated for Canada-BC hydrometric stations. Currently, watersheds were delineated using 1:50,000 scale boundaries in 1996, and many watersheds encompass entire drainages, instead of just the upstream watersheds. Note - Not yet available, but we are in the process of generating BC hydrometric station upstream watersheds using updated base data, using the following method: Within BC, watershed boundaries are based on the 1:20,000-scale Freshwater Atlas fundamental watersheds, and trimmed using the BC TRIM DEM used to approximate the height-of-land at the station locations. Outside of BC, but within

Canada, watershed boundaries were approximated using Canada CDED DEM data for delineation (no "stream burning" was used) and some manual editing of boundaries was done to approximately match hydrology data after the fact. Within U.S.A., the USGS Watershed Boundary Dataset was used (at the best scale available for each drainage) to delineate the watershed boundary, with the watershed trimmed using the USGS National Elevation Dataset to approximate the height-of-land when necessary. Spatial layer intended to display hydrometric station. watershed boundaries.

Status: Under development

Object Name:

WHSE_WATER_MANAGEMENT.HYDZ_HYD_WATERSHED_BND_POLY

<https://catalogue.data.gov.bc.ca/dataset/hydrology-hydrometric-watershed-boundaries>

Hydrology: Low Flow Zones

Published by the Ministry of Environment - Knowledge Management

Licensed under Open Government License - British Columbia

Comments: Zones of homogeneous low flow characteristics. Spatial layer intended to display low flow zones. LOW FLOW ZONES POLY SP represents the zones of homogeneous low flow characteristics.

Status: Completed

Lineage Statement: Low flow zones delineated as part of report titled 'British Columbia Streamflow Inventory - 1998' by H. Coulson & W. Obedkoff.

Object Name: WHSE_WATER_MANAGEMENT.HYDZ_LOW_FLOW_ZONES_POLY

<https://catalogue.data.gov.bc.ca/dataset/hydrology-low-flow-zones>

Hydrology: 100 Year Peak Flow Isolines

Published by the Ministry of Environment - Knowledge Management

Licensed under Open Government License - British Columbia

Comments: 100 year peak flow isolines in cubic metres per second (m³/s) for 100 square kilometre watersheds and 100 year return period. Spatial layer intended to display 100-year peak flow isolines.

Status: Completed

Lineage Statement: Isolines delineated as part of report titled 'British Columbia Streamflow Inventory - 1998' by H. Coulson & W. Obedkoff.

Object Name:

WHSE_WATER_MANAGEMENT.HYDZ_100YEAR_PEAK_FLOW_LINE

<https://catalogue.data.gov.bc.ca/dataset/hydrology-100-year-peak-flow-isolines>

Non-TRIM Hydrography View

Published by the Ministry of Forests, Lands and Natural Resource Operations - Water Management

Licensed under Open Government License - British Columbia

Comments: Province-wide spatial view showing licensed water sources (streams and lakes), under the Water Act, (current and historical), not captured (displayed) on TRIM base mapping (or Freshwater Atlas base mapping). Spatial view intended to keep track of licensed sources not on TRIM.

Status: Ongoing

Object Name:

WHSE_WATER_MANAGEMENT.WLS_NON_TRIM_HYDRGRPH_LINE_SVW

<https://catalogue.data.gov.bc.ca/dataset/non-trim-hydrography-view>

Hydrologic Zone Boundaries of British Columbia

Published by the Ministry of Environment - Knowledge Management

Licensed under Open Government License - British Columbia

Comments: Zones that represent areas of homogeneous hydrologic and geomorphological characteristics. To estimate streamflows, flooding, annual runoff.

Status: Completed

Lineage Statement: Hydrologic zone boundaries were digitized from 1:600,000 hardcopy maps. Coastline & islands were copied from 1:50K BC WSA. Linework updated January 2003. Polygons & Regions built September 20, 2004. Boundaries accuracy is +/- 1 kilometre based on hydrologic maps, graphical plots, & previous definitions.

Object Name: WHSE_WATER_MANAGEMENT.HYDZ_HYDROLOGICZONE_SP

<https://catalogue.data.gov.bc.ca/dataset/hydrology-hydrologic-zone-boundaries-of-british-columbia>

Points of Diversion

Drinking Water Sources (Surface Water PODs)

Published by the Ministry of Forests, Lands and Natural Resource Operations - Water Management

Licensed under Open Government License - British Columbia

Comments: Province-wide SDE spatial layer displaying consumptive water license points of diversion for drinking water systems. In the context of this layer, Drinking Water Systems means two or more water licenses for domestic purposes at a single POD; and/or a water license(s) for any other purpose indicating a water diversion and distribution system supplying water directly to residences and/or buildings for human consumption. This layer is an instantiation of the spatial view WLS_BC_POD_DRINKING_SOURCES_SVW. Spatial layer intended to display the location of water rights points of diversion for drinking water systems, as licensed under the Water Act.

Status: Ongoing

Lineage Statement: Spatial view created by SQL query for consumptive purposes on

WHSE_WATER_MANAGEMENT.WLS_POD_LICENSE_SP.

Object Name:

WHSE_WATER_MANAGEMENT.WLS_BC_POD_DRINKNG_SOURCES_SP_SVW.

<https://catalogue.data.gov.bc.ca/dataset/drinking-water-sources-surface-water-pods>

BC Points of Diversion with and without Water License Information

Published by the Ministry of Forests, Lands and Natural Resource Operations - Water

Management

Licensed under Open Government License - British Columbia

Comments: Province-wide SDE spatial layer displaying water license points of diversion joined with license information. This layer contains a record for each water license on each Point of Diversion that exists in the province (each Point of Diversion can have multiple licenses). For each record, some basic information about the water license is included. Note: In the dataset, the water license quantity units are reported as a 2-letter code. MS = cubic meters per second; MD = cubic meters per day; MY = cubic meters per year; TF = a unit shown against non-consumptive purposes (e.g. land improvement, conservation) for which the total flow of the stream is authorized to pass through the licensed works. No water is diverted from the stream. Spatial layer intended to display the location of water rights points of diversion, as licensed under the Water Act, along with the license information.

Status: Ongoing

Lineage Statement: Spatial view created by joining spatial layer

WHSE_WATER_MANAGEMENT.BC_POINTS_OF_DIVERSION with attribute table

WHSE_WATER_MANAGEMENT.GOAT_POD_LICENSES by TPOD_TAG/PNTS_CODE.

Results of spatial view then instantiated into spatial layer

WHSE_WATER_MANAGEMENT.WLS_POD_LICENSE_SP. Records without a captured point of diversion to join to, are placed into the table

WHSE_WATER_MANAGEMENT.WLS_POD_LICENSE_EXCEPTIONS_VW.

Object Name: WHSE_WATER_MANAGEMENT.WLS_POD_LICENSE_SP

<https://catalogue.data.gov.bc.ca/dataset/bc-points-of-diversion-with-water-license-information>

Regulated Private Water Utilities

Published by the Ministry of Forests, Lands and Natural Resource Operations - Water Management

Licensed under Access Only

Comments: This points layer displays the general locations of regulated private water utilities across the province of British Columbia. A private water utility under the Water Utility Act is a person/business who owns or operates equipment or facilities for the delivery of domestic water service to five (5) or more persons or to a corporation for compensation. Private water utilities are usually created by developers to serve rural land development where community water

service is required for subdivision approval and where there is no other water purveyor in the area that can provide service.

Status: Ongoing

Object Name:

WHSE_WATER_MANAGEMENT.WLS_RGLTD_PRIVATE_WTR_UTIL_SP

<https://catalogue.data.gov.bc.ca/dataset/regulated-private-water-utilities>

Reservoir Permits Over Crown Land

Published by the Ministry of Forests, Lands and Natural Resource Operations - Water Management

Licensed under Open Government License - British Columbia

Comments: Province-wide SDE spatial layer displaying the approximate extent and providing the elevation of designated permitted power-storage reservoir areas over crown lands, along with water license attributes. This layer is an instantiation of the spatial view

WLS_RESERVOIR_PMT_LICENSEE_SVW. Spatial layer intended to display the extent and elevation of designated permitted power-storage reservoir areas over crown lands. Only the crown lands within the depicted resevoir areas are designated by the permit. The areas defined by this data set do not constitute a legal definition and are intended to be used only as a method to identify potential conflicts of interest and raise awareness regarding land use rights in these areas.

Status: Completed

Lineage Statement: Created by ILMB Nanaimo, using the provincial TRIM 25m DEM raster to define areas impacted by the maximum permitted level of reservoirs. The TRIM 25m DEM has a reported accuracy of +/- 5m and is based on mean sea level as established by the Geodetic Survey of Canada.

Object Name:

WHSE_WATER_MANAGEMENT.WLS_RESERVOIR_PMT_LICENSEE_SP

<https://catalogue.data.gov.bc.ca/dataset/reservoir-permits-over-crown-land>

Water Licenses

Licensed springs

Published by the Ministry of Forests, Lands and Natural Resource Operations - Water Management

Licensed under Open Government License - British Columbia

Comments: Province-wide SDE spatial layer displaying water points of diversion on licensed springs, joined with license information. This layer is an instantiation of the spatial view WLS_POD_LICENSE_SOURCES_SVW. Spatial layer intended to display the location of water rights points of diversion on licensed springs, as licensed under the Water Act, along with the license information.

Status: Ongoing

Lineage Statement: Spatial view created for WRBC WMS layer conversion. It joins the geometry and attributes in the WLS_POD_LICENSE_SP table to source information from SOURCES. WLS POD LICENSE SP is the result of an INNER join between BC_POINTS_OF_DIVERSION and GOAT_POD_LICENSES.

Object Name: WHSE_WATER_MANAGEMENT.WLS_POD_LICENSE_SOURCES_SP

<https://catalogue.data.gov.bc.ca/dataset/licensed-springs>

ILRR – Water Licenses

Published by the Ministry of Forests, Lands and Natural Resource Operations - GeoBC

Licensed under Access Only

Comments: According to conditions provided by the license, a water license may permit a holder to divert and use a specified quantity of water; store water; construct, maintain and operate the works necessary for the proper diversion, storage, carriage, distribution and use of the water or the power produced from it; alter or improve a stream or channel; and construct cross-stream fences, screens and fish or game guards for the purpose of conserving fish or wildlife. Legal Reference: Water Act - Ch. 483. Intended to display the location of water data associated with water rights authorized under the Water Act.

Status: Ongoing

Object Name:

WHSE_LEGAL_ADMIN_BOUNDARIES.ILRR_WATER_ACT_INTRSTS_SVW

<https://catalogue.data.gov.bc.ca/dataset/ilrr-water-license>

Water Licensed Works - Lines and Points

Published by the Ministry of Forests, Lands and Natural Resource Operations - Water Management

Licensed under Open Government License - British Columbia

Comments: Province-wide SDE layer showing linear works associated with a Water License.

Layer intended to display the location of linear works, as licensed, under the Water Act.

Status: Ongoing

Lineage Statement: Dataset created by digitizing from hardcopy maps, and now updated nightly based on newest data edits.

Object Name:

WHSE_WATER_MANAGEMENT.WLS_WATER_LICENSED_WRK_LINE_SP

Object Name:

WHSE_WATER_MANAGEMENT.WLS_WATER_LICENSED_WRK_LOC_SP

<https://catalogue.data.gov.bc.ca/dataset/water-licensed-works-points>

<https://catalogue.data.gov.bc.ca/dataset/water-licensed-works-lines>

Water Resource Management

Streams with Water Allocation Restrictions

Published by the Ministry of Environment - Knowledge Management

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Comments: This dataset displays streams that have water allocation restrictions on them. Used for reviewing water use proposals to help identify streams that have allocation restrictions on them. Data quality not suitable for making legal decisions. This data has been derived from source datasets. Some water allocation restriction points did not match with existing stream network lines resulting in some restricted streams not being identified and other streams being falsely identified. Estimated accuracy of 95%. This dataset is based on water allocation restriction point data from a snapshot in time. It is only periodically updated. This dataset is based off of a stream network and does not include water bodies. In place of waterbodies are 'skeleton' lines connecting inflow and outflow through a waterbody. Further research is required to identify the exact restriction status of a stream.

Status: Completed

Data Quality

Object Name: WHSE_WATER_MANAGEMENT.WLS_STREAM_RESTRICTIONS_SP

<https://catalogue.data.gov.bc.ca/dataset/streams-with-water-allocation-restrictions>

Water Allocation Restrictions Views

Published by the Ministry of Forests, Lands and Natural Resource Operations - Water Management

Licensed under Open Government License - British Columbia

Comments: Province-wide spatial view showing the most downstream point of a stream, as determined by Water Stewardship Division staff, to have a current or potential water allocation concern. Spatial view intended to display the location of water sources designated as having a water allocation restriction.

Status: Ongoing

Object Name:

WHSE_WATER_MANAGEMENT.WLS_WATER_RESTRICTION_LOC_SVW

<https://catalogue.data.gov.bc.ca/dataset/water-allocation-restrictions-view>

Water Management Districts

Published by the Ministry of Forests, Lands and Natural Resource Operations - Water Management

Licensed under Open Government License - British Columbia

Comments: Water Stewardship Division, Water Management administrative areas. Water Districts are jurisdictional areas established by the WATER REGULATIONS. Layer intended to show jurisdictional areas within BC for WSD Water Management administrative purposes.

Status: Complete

Object Name:

WHSE_ADMIN_BOUNDARIES.LWADM_WATMGMT_DIST_AREA_SVW

<https://catalogue.data.gov.bc.ca/dataset/water-management-districts>

Water Officer Boundaries for Vancouver Island

Published by the Ministry of Forests, Lands and Natural Resource Operations - Regional Operations - South Coast

Licensed under Open Government License - British Columbia

Comments: Spatial dataset showing the area of responsibilities for Water Officers on Vancouver Island. This dataset shows the area of responsibility for the assigned Water Officer on Vancouver Island

Status: Ongoing

Object Name:

REG_LEGAL_AND_ADMIN_BOUNDARIES.WATER_OFFICER_BNDRY_VI_POLY

<https://catalogue.data.gov.bc.ca/dataset/water-officer-boundaries-for-vancouver-island>

Water Resource Management Streams

Published by the Ministry of Forests, Lands and Natural Resource Operations - Water Management

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Comments: Province-wide SDE layer displaying the Freshwater Atlas Stream Network streams that are either reserved or have been designated as Water Reserves, First Nations Treaty Lands Water Reserves, Sensitive Streams, or Protected Rivers. WATER RESOURCE MGMT LINE is a province-wide SDE layer displaying the Fresh Water Atlas Stream Network streams that are either reserved or have been designated as Sensitive Streams or Protected Rivers. Layer intended to display the location of Freshwater Atlas Stream Network streams that are either reserved or have been designated as Sensitive Streams or Protected Rivers. Used for reviewing water use proposals.

Status: Ongoing

Object Name:

WHSE_WATER_MANAGEMENT.WLS_WATER_RESOURCE_MGMT_LINE

<https://catalogue.data.gov.bc.ca/dataset/water-resource-management-streams>

Water Resource Management Locations – Sensitive Streams and Protected Rivers

Published by the Ministry of Forests, Lands and Natural Resource Operations - Water Management

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Comments: Province-wide SDE layer displaying point features that are at the mouths of streams that have been designated as Sensitive Streams or Protected Rivers. Layer intended to display the

location of the mouths of streams that have been designated as Sensitive Streams or Protected Rivers. Used for reviewing water use proposals. WATER RESOURCE MGMT POINT is a province-wide SDE layer displaying point features that are at the mouths of streams that have been designated as Sensitive Streams or Protected Rivers.

Status: Ongoing

Object Name:

WHSE_WATER_MANAGEMENT.WLS_WATER_RESOURCE_MGMT_POINT

<https://catalogue.data.gov.bc.ca/dataset/water-resource-management-locations-sensitive-streams-and-protected-rivers>

Water Approval Points

Published by the Ministry of Forests, Lands and Natural Resource Operations - Water Management

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Comments: The location (point) where an approval has been requested to conduct works in the vicinity of a water source. Water Approvals are issued under the Water Sustainability Act and are issued as either a Section 10 for Short Term Use of Water or a Section 11 for Changes in and about a Stream, depending on the type of proposed works. The Act and the Water Sustainability Regulation describe the type of works that are covered under each type of approval. To identify locations for approvals that are issued under the Water Sustainability Act. This is the layer that

provides the data for the Water Sustainability Act Approvals (FLNRO) - Section 10 and 11 Locations in iMapBC.

Status: Ongoing

Object Name: WHSE_WATER_MANAGEMENT.WLS_WATER_APPROVALS_SVW

<https://catalogue.data.gov.bc.ca/dataset/water-approval-points>

Water Reserve Polygon

Published by the Ministry of Forests, Lands and Natural Resource Operations - Water Management

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Comments: Province-wide SDE polygon layer displaying areas in which water is reserved (First Nation Treaty Lands; Biodiversity, Mining and Tourism Areas; Columbia Valley Springs; Landslide Hazard Areas; Wildland Areas). Layer intended to display the location of areas in which the water is reserved. Used for reviewing water use proposals

Status: Ongoing

Object Name: WHSE_WATER_MANAGEMENT.WLS_WATER_RESERVES_POLY

Comments: WATER RESERVES POLY is a province-wide SDE layer displaying areas in which the water is reserved

<https://catalogue.data.gov.bc.ca/dataset/water-reserve-polygons>

Water Survey of Canada Sub-Sub-Drainage Areas

Published by the Ministry of Environment - Knowledge Management

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Comments: Atlas of Canada 1,000,000 National Frameworks Data, Hydrology - Drainage Areas (WSC sub-sub drainage areas) from the Natural Resources Canada GeoGratis website. The dataset has been clipped to drainage areas within or adjacent to B.C. For use in showing the 4th level drainages (sub-sub-drainages) in the national Drainage Area Framework and for use in determining the Water Survey of Canada alphanumeric codes that are used in hydrometric station numbering.

Status: Completed

Lineage Statement: Downloaded from Natural Resources Canada GeoGratis website (<http://geogratias.gc.ca/api/en/nrcan-rncan/ess-sst/30b33615-6dda-51a5-a9dd-308802714a28.html>) and clipped to the area around B.C, then re-projected to BC Albers projection. Some attribute fields were removed, and other attribute field names were changed.

Object Name:

WHSE_IMAGERY_AND_BASE_MAPS.DRP_SUB_SUB_DRAINAGES_1M_SP

<https://catalogue.data.gov.bc.ca/dataset/water-survey-of-canada-sub-sub-drainage-areas>

Water Users Communities

Published by the Ministry of Forests, Lands and Natural Resource Operations - Water Management

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Comments: General locations of active Water Users' Communities in BC. A Water Users' Community is a public corporate body incorporated under Section 51 of the Water Act and to which the Comptroller of Water Rights has issued a Certificate of Incorporation. A spatial view showing the location (with basic attributes) of all active water users' communities in BC.

Status: Ongoing

Object Name:

WHSE_WATER_MANAGEMENT.WUC_WATER_USER_COMMUNITIES_SVW

<https://catalogue.data.gov.bc.ca/dataset/water-users-communities>