



DATE OF MEETING: November 26, 2020
TO: Local Trust Committees (Southern Region)
FROM: William Shulba, P.Geo, Senior Freshwater Specialist
Local Planning Services
COPY: Robert Kojima, Regional Planning Manager
SUBJECT: Southern Gulf Islands Groundwater Sustainability Strategy Update

REPORT SUMMARY

The intention of this report is to provide preliminary results of the Southern Gulf Islands Groundwater Sustainability Strategy with respect to the information involved, data generated, review process, update process, and next steps. Local trust committees should also consider if they wish to retain the project as a priority in the next fiscal year to proceed with a review of potential OCP and LUB amendments.

BACKGROUND

In March 2019 the Islands Trust Council declared a climate emergency in the Islands Trust Area, directing staff to include a central focus on equitable climate change mitigation, adaptation, and resilience into strategic planning.

The Policy Statement (policy 4.4.2) requires that Local Trust Committees and Island municipalities shall, in their official community plans and regulatory bylaws, address measures that ensure:

- neither the density nor intensity of land use is increased in areas which are known to have a problem with the quality or quantity of the supply of freshwater;
- water quality is maintained, and
- existing, anticipated and seasonal demands for water are considered and allowed for.

The Southern Gulf Island Local Trust Committees have identified groundwater resources as a priority in their Official Community Plans and as part of their approval of land-use applications over the past decades. Previous researchers have recommended actions with respect to an ecosystem vulnerability approach to groundwater sustainability strategy and the Province of BC supports deep collaboration in groundwater-focused projects at the local government level and are an external partner in this project.

In summer of 2019, five Local Trust Committees passed resolutions making the *Southern Gulf Islands Groundwater Sustainability Strategy* a top priority project and endorsing the project charter. GW Solutions of Nanaimo, B.C. was retained by Islands Trust in 2019/2020 fiscal year to undertake the main deliverables of the project.

The data collection was conducted over the 2019/20 fiscal and deliverables in the form of draft maps and reports were received by Islands Trust in June 2020. The project was reviewed by staff and peer reviewed from July to October 2020, and modifications to the methodology and mapping are currently being made based on those reviews.

ANALYSIS

Project Phases

The Groundwater Sustainability Strategy project is a multi-year project set out in several phases to accomplish goals of groundwater sustainability for the Islands Trust Area.

- Phase 0: Data and Information Inventory
- Phase 1: Groundwater Recharge Potential Mapping
- Phase 2: Groundwater Availability Assessment
- Phase 3: Groundwater Sustainability Planning

The Southern Gulf Islands Groundwater Sustainability Strategy project Phase 0, Phase 1, and Phase 2, which included defined objectives, deliverables, and review, were conducted in fiscal years 19/20 and 20/21 and are completed or will be completed early in 2021. In Phase 3, mapping will be integrated into local planning services as the final deliverables are received. LTCs should also consider if they wish to identify further work in the form of potential OCP and LUB amendments as Priority projects in fiscal 21/22.

Phase Objectives

Phase 0: Data and Information Inventory

- Inventory existing datasets that are required to assess groundwater recharge and availability; and
- Identify data gaps to be addressed in the future to improve understanding of groundwater availability.

Phase 1: Groundwater Recharge Potential Mapping

- Develop and run groundwater recharge potential spatial model for the Southern Gulf Islands; and
- Provide full and open access to groundwater recharge geospatial model including input data sets and output results for incorporation into Islands Trust mapping services.

Phase 2: Groundwater Availability Assessment

- Develop and run a spatial groundwater budget assessment for the Southern Gulf Islands; and
- Provide full and open access to groundwater budget data dashboard including input data sets and output results for utilization by Islands Trust planning team.

Phase 3: Groundwater Sustainability Planning

- Finalize mapping to manage water resources on the Southern Gulf Islands through an improved understanding of groundwater recharge and availability;
- Provide tools for planning staff to support advice to LTCs in consideration of development proposals and long range planning projects;
- Provide documentation and educational materials to increase groundwater literacy in island communities;
- Potential amendments to OCP and LUB.

Phase Methodology

Phase 1 Groundwater Recharge Potential Mapping

Groundwater recharge (including deep drainage and/or deep percolation) is a hydrologic process, where water moves downward from surface to subsurface and may consequently reach groundwater/aquifer. Groundwater recharge depends on several factors such as infiltration capacity and climate. The amount of water infiltrating to subsurface is different due to changes in topography, geology, biogeography and land-use/land cover and available water.

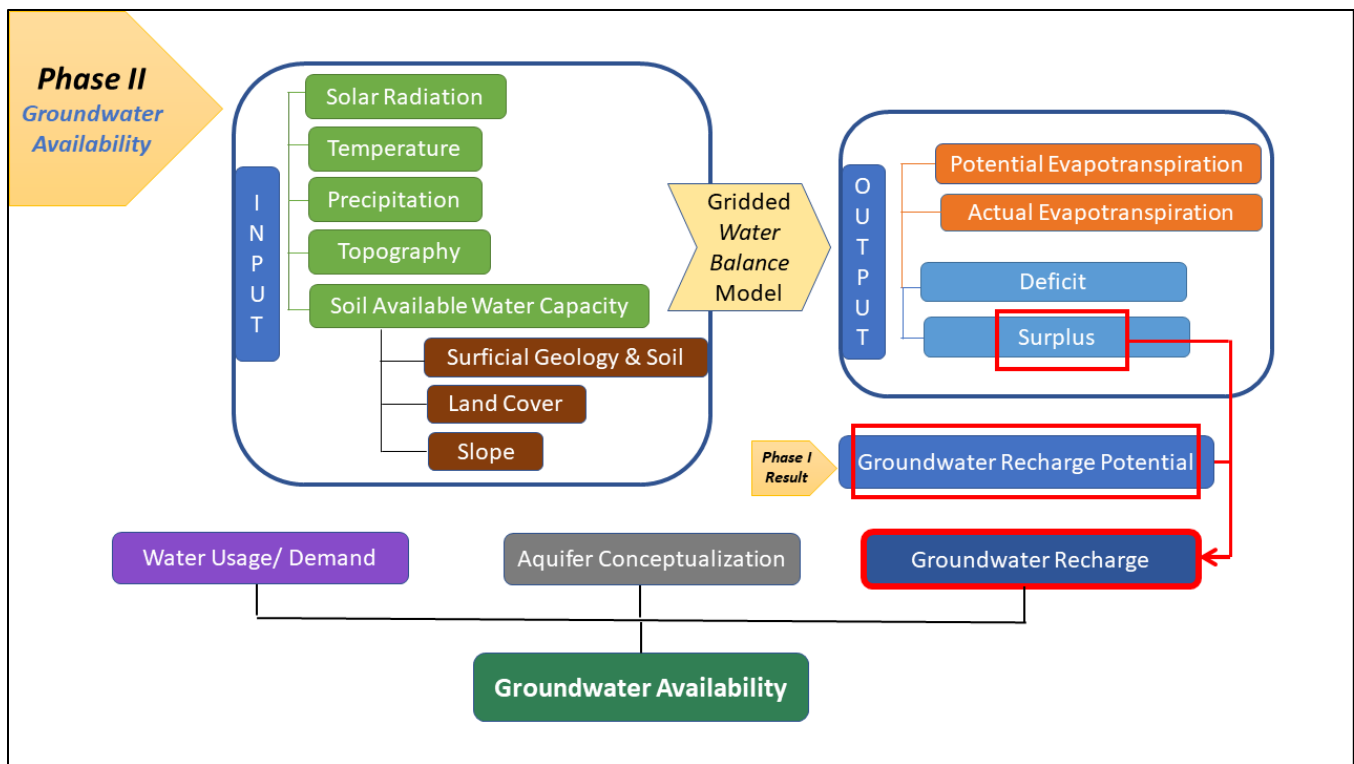
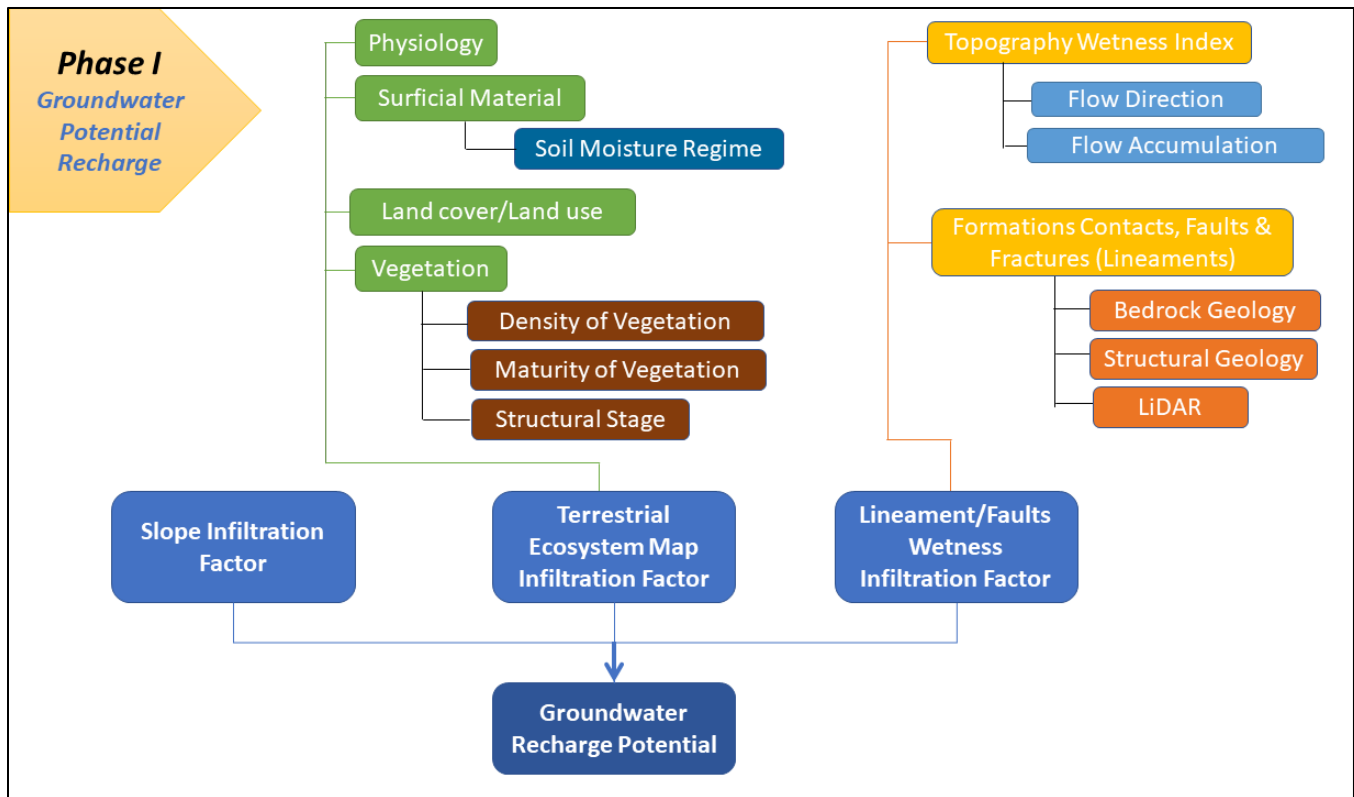
The project intends to spatially identify the intrinsic potential of the landscape to recharge groundwater and estimates the overall amount of groundwater available for use by humans and the environment. Across the Southern Gulf Islands, diffuse recharge is determined by the capability of Terrestrial Ecosystem units to infiltrate the available surface water into the ground. The capability of these units are defined based on the soil properties such as texture and moisture, land cover and vegetation. Localized recharge that mainly occurs in a bedrock dominant environment was addressed by the analysis of faults, geologic contacts, and landscape lineaments.

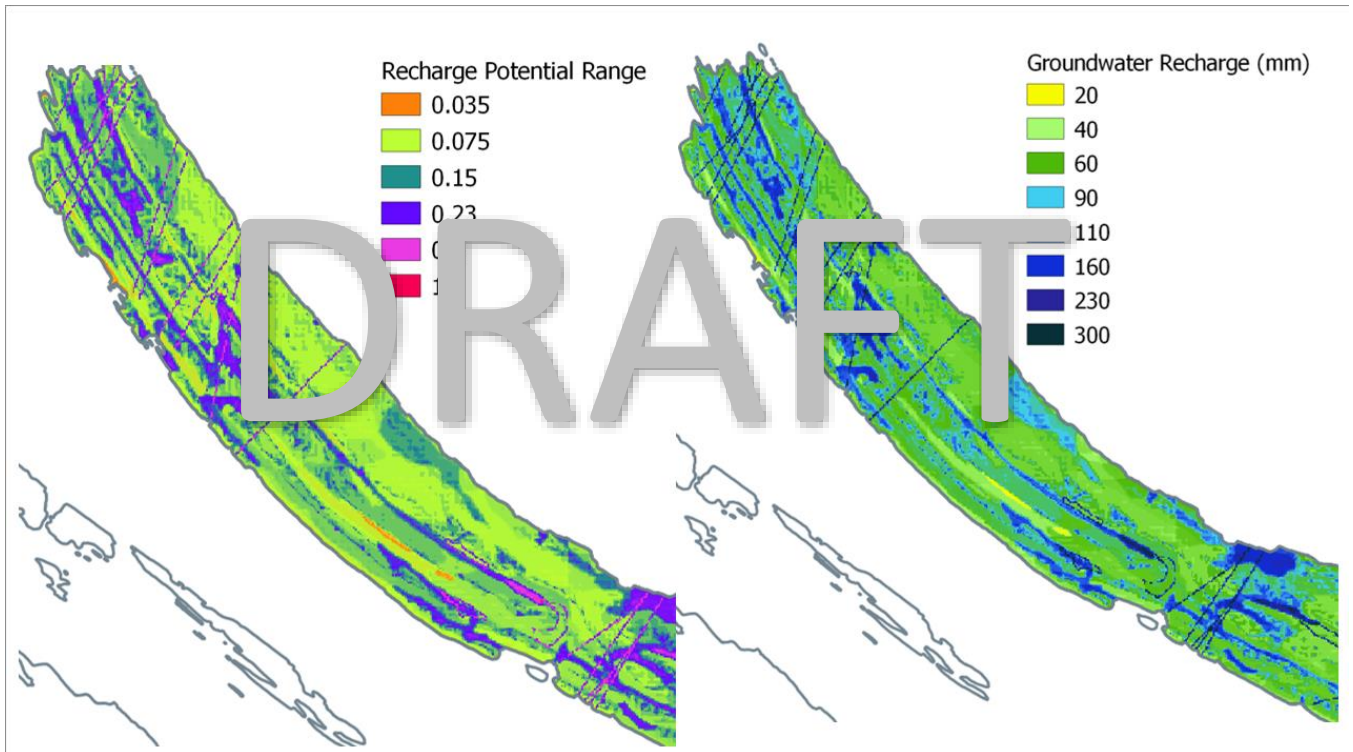
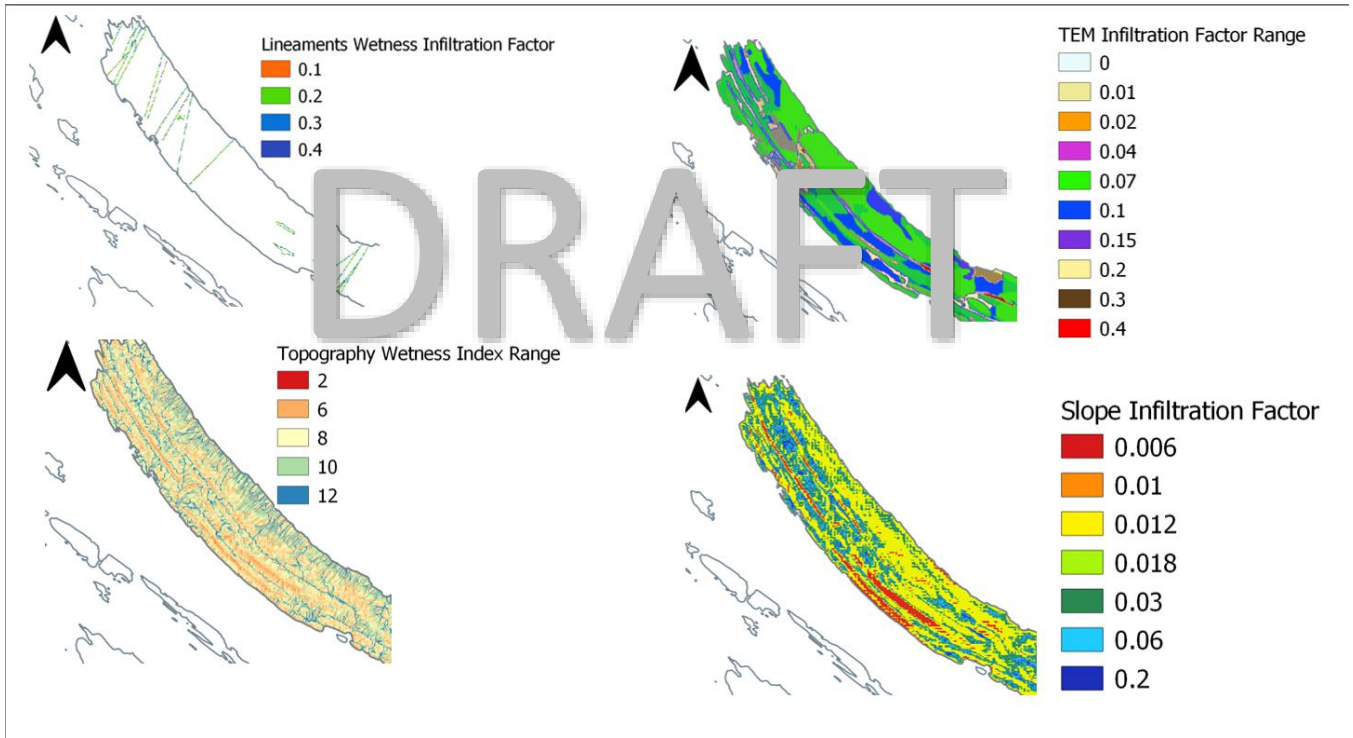
The ground capacity to allow for groundwater recharge has been calculated at a 20 m x 20 m grid scale organized into categories with low (less than 15%), moderate (15 - 23%), good (23 - 50%) and high (more than 50%) recharge potential. When considering how much rainfall is available to be potentially recharged using downscaled climate data, the amount of groundwater recharge ranges between 20 and 300 mm/year per grid cell.

As part of this phase, three-dimensional hydrogeological conceptual models were created. These models were built on data from over 1700 groundwater well drilling reports stored in the GWELLS provincial database. These data were extracted, cleaned, and standardized, in particular for information related to fractures (depth and yield).

As part of this phase, groundwater regions, also known as groundwater management units, were delineated based on drainage areas, bedrock geology, mapped aquifers, structural geology and the distribution and characteristics of water wells. A total of 48 groundwater regions have been defined for the Southern Gulf Islands.

Deliverables are to provide a spatial representation of groundwater recharge potential and overall use. Below are examples of the deliverables of the project, highlighting the northern tip of Galliano Island.





Phase 2: Groundwater Availability

To quantify the amount of groundwater available within groundwater regions, a methodology has been developed based on the climate variables, groundwater recharge potential, estimated water demand/usage, and three-dimensional island hydrogeological models.

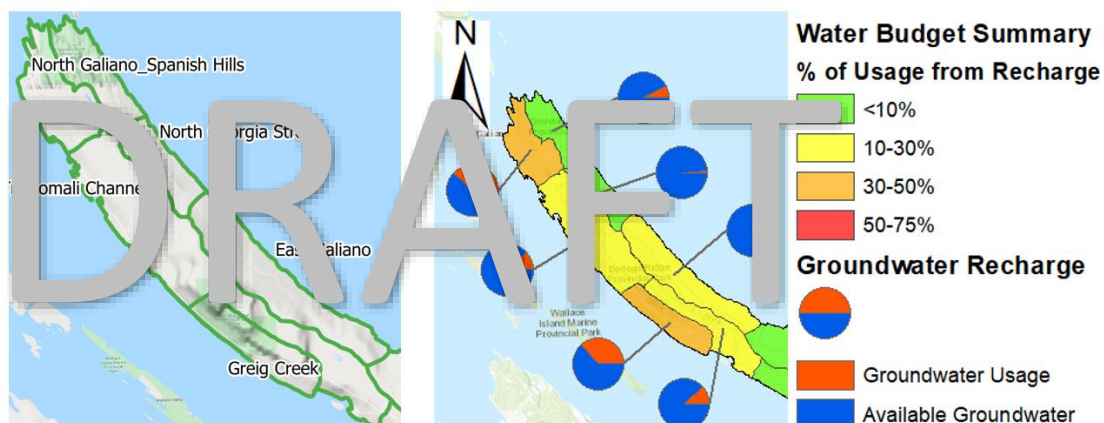
To characterize aquifers and groundwater use, GW Solutions extracted, cleaned, and standardized information related to fractures from the provincial groundwater wells database GWELLS. Over 3000 wells were listed within the Southern Gulf Islands with approximately 1700 providing information on both fracture depth and estimated fracture yield per fracture. Driller reported groundwater yield information was extracted from 83% of the wells. These yields were classified and approximately 40% of the wells reports yields less than 2 USgpm (US gallons per minute), 40% of the wells reported yields between 2 to 15 USgpm, and 10 % greater than 15 USgpm. These values were used with land-use per parcel from BC Assessment to determine the amount of water that is being used by each parcel.

Surface water removal was estimated from basic information about the water licenses such as license status, refused applications, pending, expired, current, cancelled, active applications, abandoned, and abandoned applications, expiry date, granted volume and its corresponding unit and purpose. The water balance model required the estimation of monthly and yearly water withdrawal volumes.

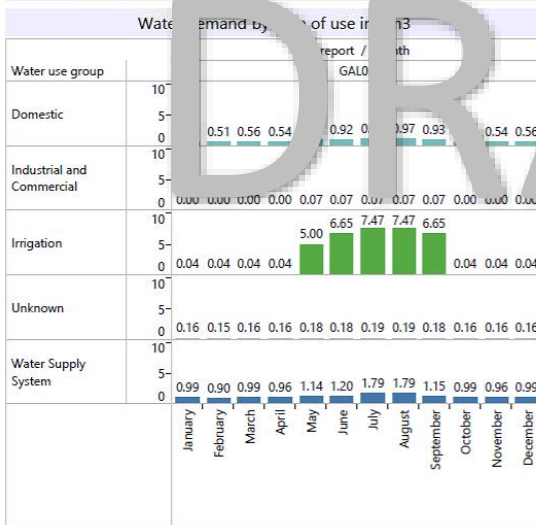
Based on the information presented in the GWELLS database and the type of water use for each well, the wells were classified into the following categories: Water Supply System, Test Well, Private Domestic, Observation Well, Irrigation, Commercial and Industrial, Other and Unknown Well Use. Unfortunately, the GWELLS database does not include all wells because reporting to the Province was voluntary until implementation of the Water Sustainability Act in 2016.

The GWELLS database does not include information on pumped volumes, only potential yields. Water usage for surface water and groundwater sources has been estimated since actual usage data is very poorly measured. In order to estimate the water usage data from the BC Assessment land-use cadastral parcel map, GWELLS database, and water service areas regulated by VIHA.

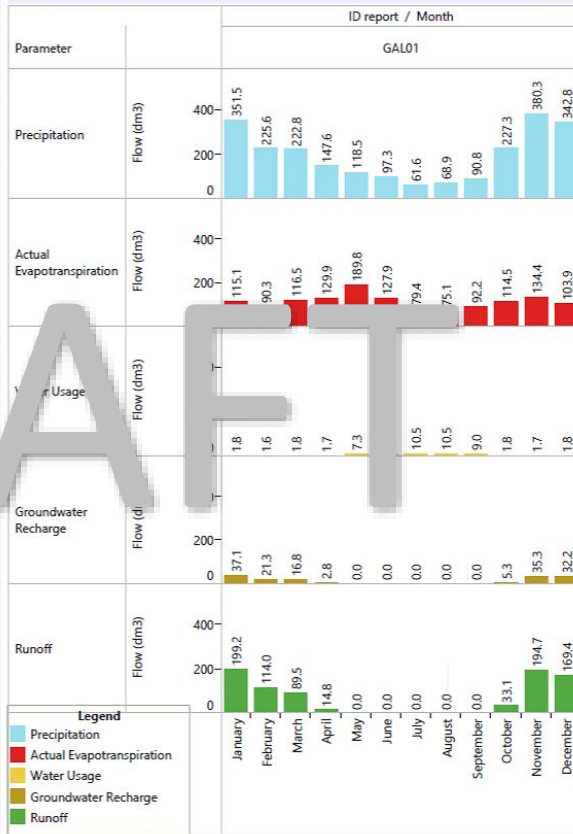
This approach to understanding groundwater availability, a balance between estimates of the aquifer recharge to estimates of water demand, has resulted in the percentage of groundwater usage relative to aquifer recharge for each groundwater region. It reveals that groundwater usage reaches up to 75% of the groundwater recharge in some areas of the Southern Gulf Islands. This likely creates stress on environmental needs and/or can result in water conflicts.



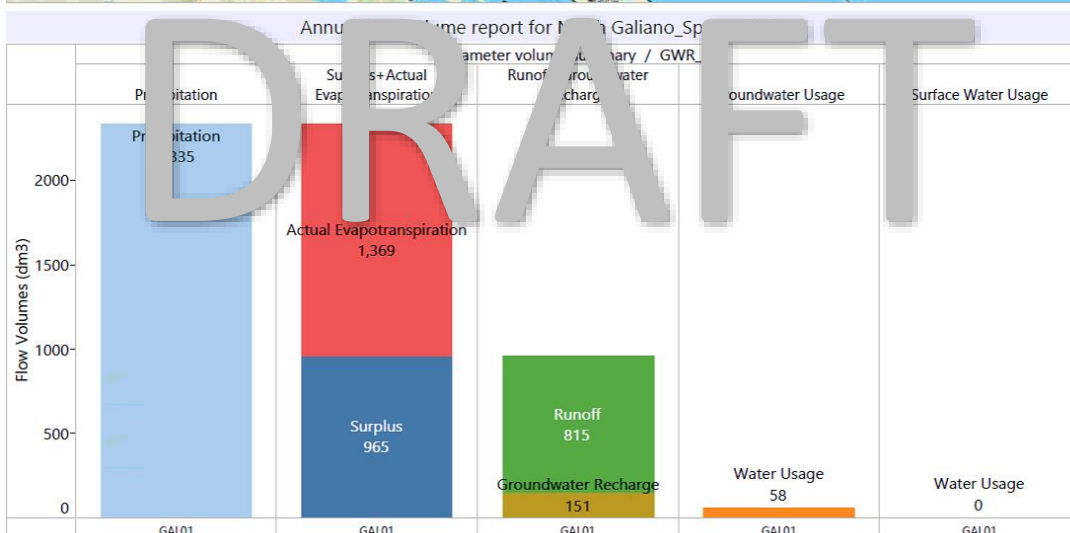
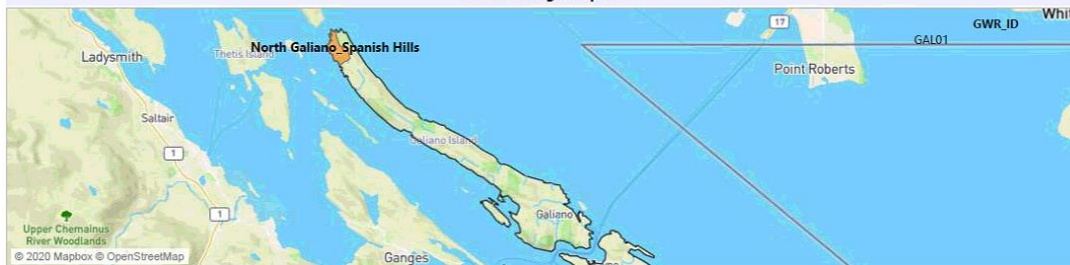
Water budget report for the watershed: North Galiano_Spanish Hills



Water budget summary for North Galiano_Spanish Hills watershed



Water budget report



Consultation

Due to the complexity and scope of the Project, Islands Trust Senior Freshwater Specialist identified in the Project Charter that a review is required to ensure the applicability and efficacy of the Project.

“Technical Services” budget for this project were carried over to fiscal year 2020/21 to retain groundwater consultants to provide professional reviews of the Project. In addition, several organizations, agency staff, and researchers supplied peer reviews at no cost to the project.

Reviews of the project were requested by:

- Hornby Water Stewardship,
- Salt Spring Island Watershed Protection Alliance,
- Provincial Staff Hydrogeologists,
- Dr. Diana Allen of Simon Fraser University,
- Dr. John Cox of Mount Royal University,
- Mr. Allan Daikin P.Eng, (Elanco Enterprises),
- Mr. Allan Kohut P.Eng, (Hy-Geo Consulting),
- Mr. Mike Wei P.Eng, (Hydro Geo Logic Consulting),
- Western Water Associates, and
- Dr. James Henderson P.Geo.

In July 2020, Islands Trust received peer reviews of the Project from the Hornby Water Stewardship, Salt Spring Island Watershed Protection Alliance, Provincial Hydrogeologists, Dr. Diana Allen of Simon Fraser University, and Dr. John Cox of Mount Royal University.

Islands Trust retained groundwater professionals Allan Daikin P.Eng, Allan Kohut P.Eng, Mike Wei P.Eng, Western Water Associates, and Dr. James Henderson P.Geo to provide professional reviews of the Project and all peer and professional reviews have since been received by the Senior Freshwater Specialist.

The intentions of the review are:

- to update the GW Solutions Project report to Islands Trust;
- to refine the recharge potential mapping methodology to be applied to the Southern Gulf Islands, and to Denman, Hornby, and Gabriola in FY20/21; and
- to coordinate sharing of groundwater expertise, information and knowledge.

Several reviewers acknowledged that GW Solutions has done a lot of work and brought good value to the Islands Trust. The Hornby Water Stewardship described the report as a “*fascinating read*” and described the approach as providing a promising understanding of the health of groundwater supplies in any Gulf Island. Others stated that the report provided a lot of very useful information to Islands Trust.

There were several common themes and recommendations among the reviews regarding the reporting of the project including but not limited to:

- improvements to the GW Solutions report readability and approachability,
- data errors and data limitations,
- increased study on the geological environments of the area,
- more focus on the Terrestrial Ecosystem Mapping,
- further investigation of the hydrogeology of groundwater discharge regions as they relate to surface water, and

- more explanation of the water balance methodology.

The review was mostly technical in nature and provided direction to improve the methodology and outcomes and the project team is currently working through the details to implement changes.

Timeline

The following timeline is a basic overview of the progress of the project and identification of timing of next steps.

Project Initialization Report	February 28, 2019
Master Project Charter	July 2, 2019
Request for Proposal	October 10, 2019
Contract Awarded	November, 2019
Project Deliverables	March 2020
Updated Draft Report	May, 2020
Peer (Volunteer) Reviews	June – July 2020
Professional (Contracted) Reviews	August – November 2020
Contractor Procurement	November 2020
Preliminary Staff Report	November 2020
Deliverables Finalization	January – February 2021
Final Report	March 2021

NEXT STEPS

1. Consultant finalization of the *Islands Trust Groundwater Recharge Mapping project* to address the recommendations of the peer review of the Southern Gulf Islands Groundwater Sustainability Strategy project.
2. The final draft of the project deliverables including groundwater recharge maps, groundwater assessment maps, and technical report in early 2021 for a final review before delivery to LTCs and presentation to the public.
3. Implementation through integration of mapping and data into routine review of land use applications and long range planning projects. This would be similar to how sensitive ecosystem data, slope hazard and other mapping data currently considered during application reviews.
4. LTC consideration of retaining the project as a Top Priority in fiscal year 21/22 to review options and consider potential amendments to bylaws. This could include amendments to OCP policies, amendment of existing development permit areas or establishment of new development permit areas, or amendment to existing regulations or establishment of new regulations for water storage or conditions of use. There is potential for the project to be conducted concurrently for more than one LTC in the region.

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