



# DRINKING WATER WATERSHED PROTECTION

**Public Information Meeting**  
**October 23<sup>rd</sup> 2013**  
**Qualicum Beach, BC**



## PRESENTATION

### 1. DWWP update

- Program 1
- Program 2
- Program 3
- Program 4
- Program 5
- Program 6
- Program 7

### 2. Water Budget

- Background
- Overview
- Methodology
- Findings
- Conclusion

### 3. Watershed Management

- What & Why
- How & Who



## Introduction



**In 2008, residents voted to establish a Drinking Water and Watershed Protection Service...**

**Today, we are going to talk about where we are:**

- **DWWP program update**
- **Water Budget Study review**
- **Integrated Watershed Management Planning**



# Introduction: Partnerships

## Our program is founded on partnerships and collaboration

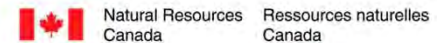
### Municipalities:



**The public:** residents, community associations, streamkeeper groups, professionals, students.



### Other governmental organizations:



### Other RDN departments:



Sustainability, Wastewater, Rec & Park

# Introduction: Program development

2008

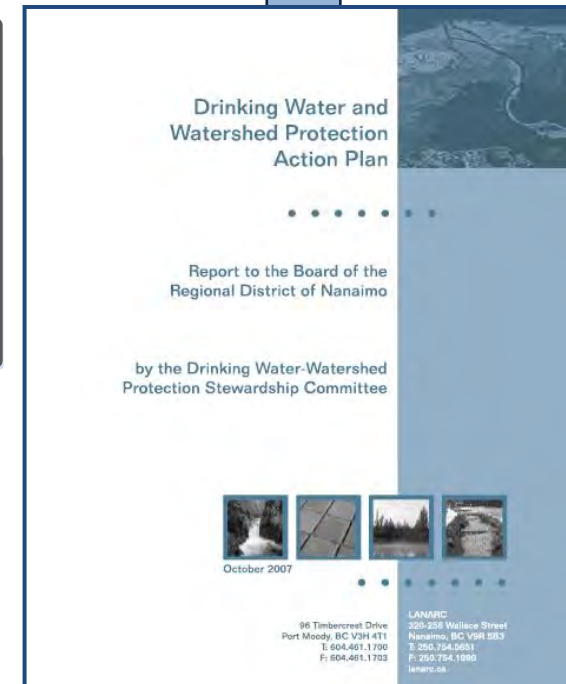
The RDN became the **first regional government in British Columbia to start a Drinking Water & Watershed Protection service**

2009-Present

The DWWP is guided by a **technical advisory committee** of experts from: forestry, hydrogeology, academia, community stewardship, fisheries, water services

The program is guided by the an **Action Plan** that outlines the key goals and objectives

## 7 Program Actions



# 1. DWWP Program Update



DRINKING WATER  
WATERSHED  
PROTECTION

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# DWWP update: Program 1

## Public Awareness and Involvement



Free Workshops

Websites

Community Booth

Home Visits

School Program



[www.TeamWaterSmart.ca](http://www.TeamWaterSmart.ca)



[www.RDNgetinvolved.ca](http://www.RDNgetinvolved.ca)

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# DWWP update: Program 1

## Public Awareness and Involvement

### School Program: Fieldtrips



**From the classroom....**



**To the watershed....**

**2014 – field trips for Gr. 4 & 5**

- Nanaimo River watershed
- Englishman River watershed

# PRESENTATION

# DWWP update: Program 2

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## Water Resources Inventory & Monitoring

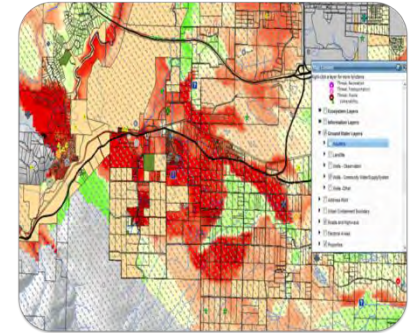
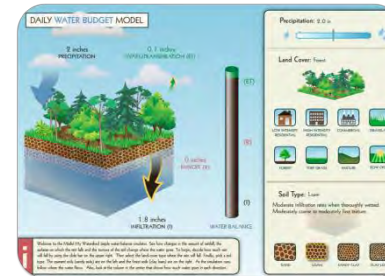
Water Budget Study

Water Map

Provincial Observation  
Well Network Expansion

Volunteer Well Level  
Monitoring

Community Watershed  
Monitoring





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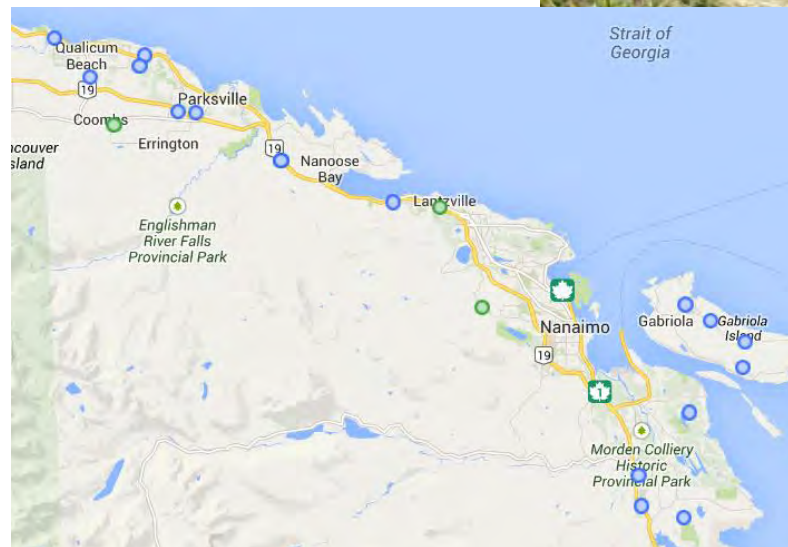
- What & Why
- How & Who

# DWWP update: Program 2

## Water Resources Inventory & Monitoring: Highlights

Provincial Observation  
Well Network Expansion

Groundwater  
monitoring



Volunteer Well Level  
Monitoring

# PRESENTATION

## DWWP update: Program 2

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### 2. Water Budget

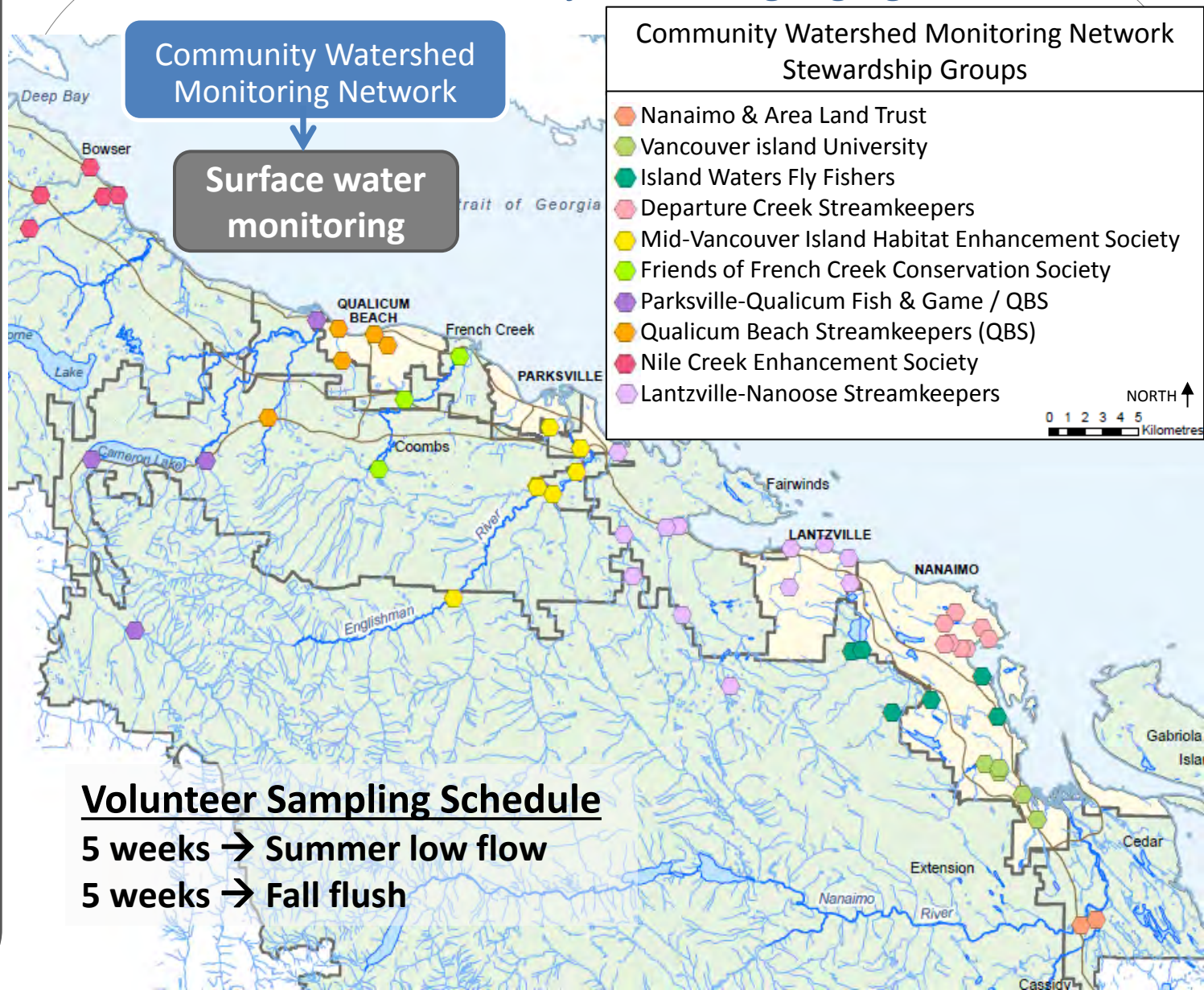
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## Water Resources Inventory & Monitoring: Highlights



## Volunteer Sampling Schedule

5 weeks → Summer low flow

5 weeks → Fall flush

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# DWWP update: Program 2

## Water Resources Inventory & Monitoring: Highlights

### Community Watershed Monitoring Network



BRITISH COLUMBIA Ministry of Environment REGIONAL DISTRICT OF NANAIMO DRINKING WATER PROTECTION

With participation from: Mid Vancouver Island Habitat Enhancement Society, Qualicum Beach Streamkeepers, Pansville Fish & Game, Nile Creek Enhancement Society, Friends of French Creek, Nanaimo Area Land Trust, Harbour City River Stewards, Island Waters Fly Fishers and Vancouver Island University

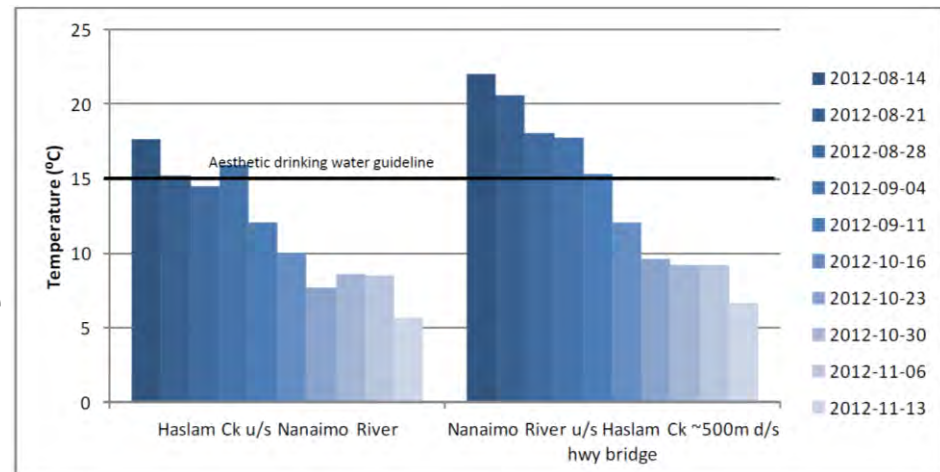
Regional District of Nanaimo  
Community Watershed Monitoring Network  
2012 Data Summary

Prepared by:  
Rosie Barick  
Environmental Impact Assessment Biologist  
Environmental Protection Division  
Ministry of Environment  
2000-4 Leboeuf Rd  
Nanaimo, BC V9T 6J9

[www.dwwp.ca](http://www.dwwp.ca)

## Measurements

- Temperature
- Turbidity
- Dissolved Oxygen
- Specific Conductance



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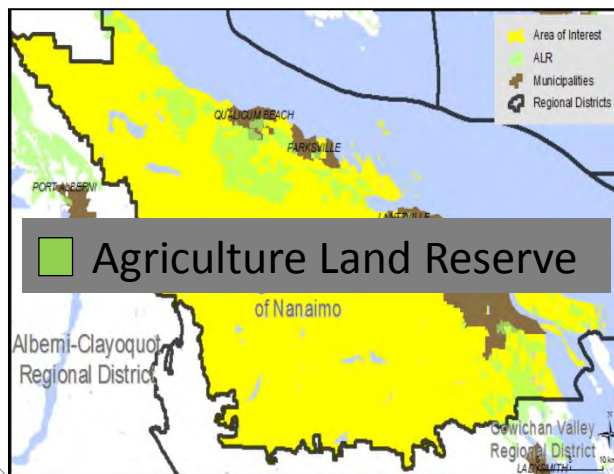
- What & Why
- How & Who



# DWWP update: Program 3

## Land Use Planning & Development

### Agricultural Water Demand Model



### Yellow Point Development Permit Area



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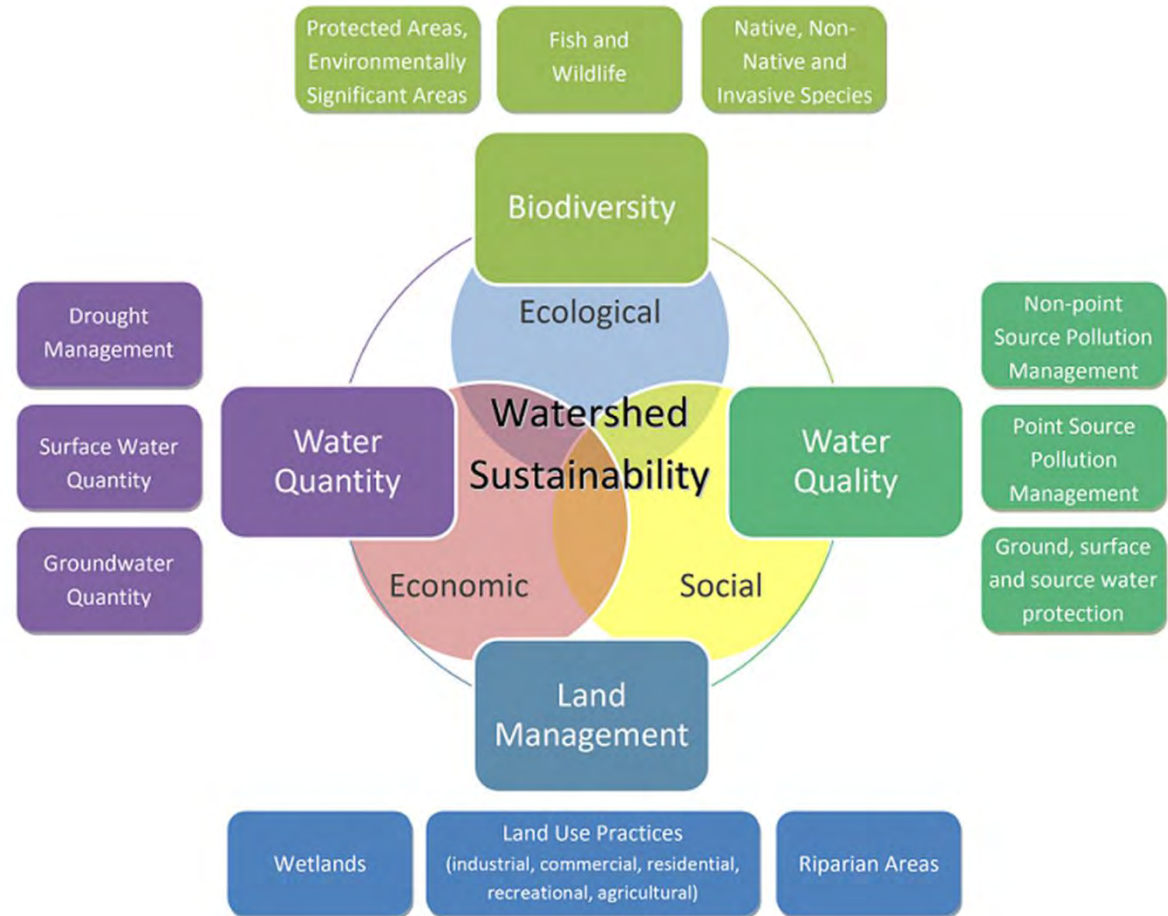
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# DWWP update: Program 4

## Watershed Management Planning



# PRESENTATION

# DWWP update: Program 5

## 1. DWWP update

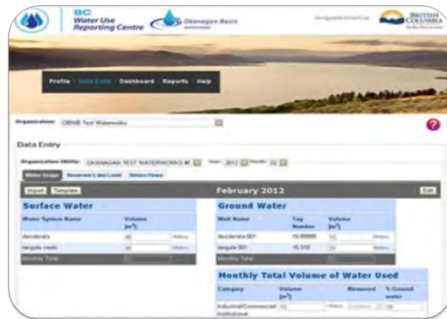
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## Water Use Management

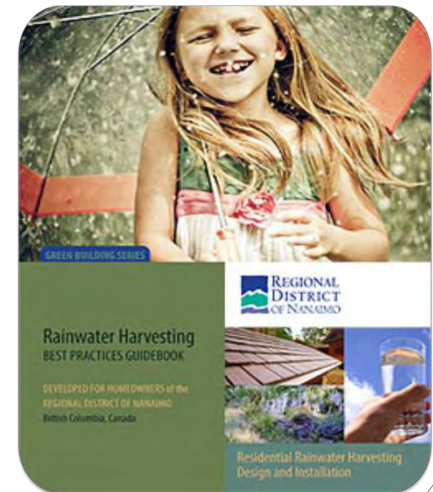
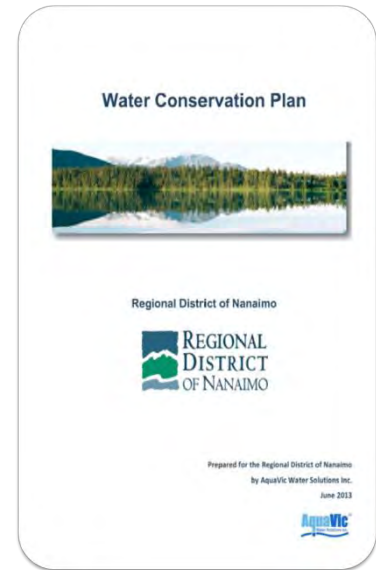
Water Conservation Plan

Toilet Replacement Rebate

Water Purveyor Working Group

Water Use Reporting Centre

Rainwater Harvesting Incentive & Guidebook



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# DWWP update: Program 5

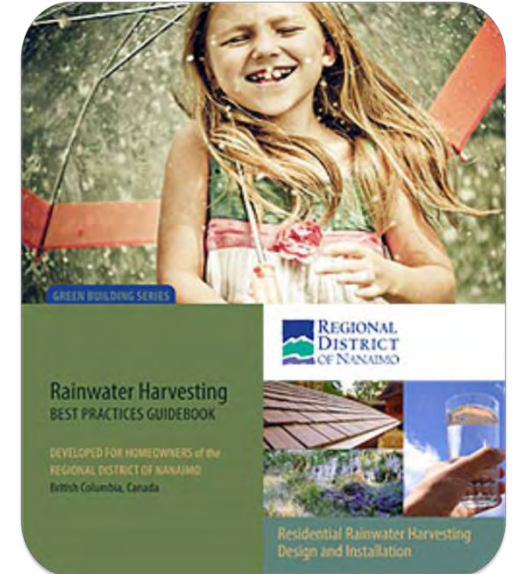
## Water Use Management



\$750 rebate  
for > 1000  
imperial  
gallons



## Rainwater Harvesting Incentive & Guidebook



*Storing winter/spring  
rainwater for summer usage  
takes pressure off aquifers &  
municipal supplies*

# PRESENTATION

# DWWP update: Program 6

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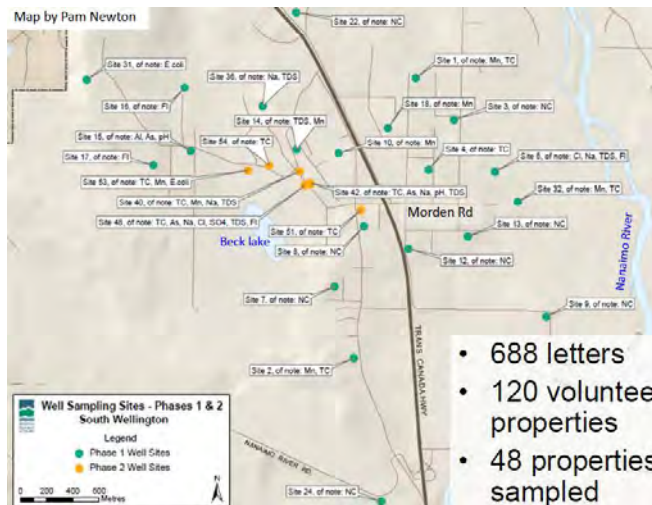
## 2. Water Budget

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- What & Why
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## Water Quality Management



- 688 letters
- 120 volunteer properties
- 48 properties sampled

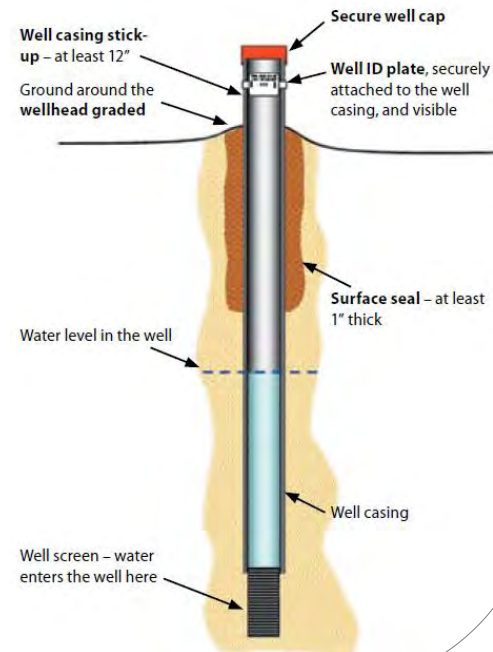


## 2011 Volunteer Well Water Quality Survey



## Rural Water Quality Stewardship Program

No.	Rebate Item
1	Well Cap
2	Surface Seal
3	Well Casing Stick-up
4	Well deactivation
5	Water Quality Testing





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# DWWP update: Program 7

## Adapting to Climate Change



- **Sustainability** - ensure sustainable aquatic ecosystems with intact riparian vegetation and adequate instream flows.
- **Adaptability** - find ways to do more in-season management of water that is based on real time data.
- **Collaboration** - public processes at the watershed level that develop information and inform decision-making in a public way
- **Efficiency** - conservation of water and more efficient use

## 2. Water Budget Study



DRINKING WATER  
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# Water Budget Study

## 7 Water Regions within the RDN:



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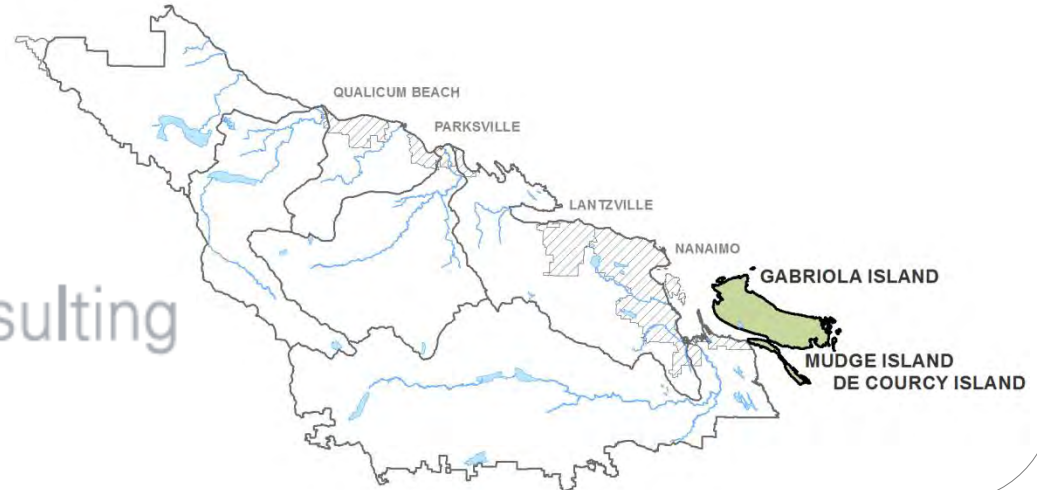
- What & Why
- How & Who



# Water Budget Study

## • Gabriola, Mudge, & Decourcey Water Budget Project Report

Prepared by:



## • Vancouver Island Water Budget Project Report

Prepared by:



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# Water Budget Study: Background

## → Project Goal

To improve understanding of regional water resources by:

- Identifying water stores
- Estimating how much water they hold
- Characterizing how water moves between the stores
- Identifying water stores under stress

## → Justification

The Water Budget Project was specifically developed to.....

- ✓ Meet the goal of the DWWP program:  
**[to ensure that we have a sufficient, safe and sustainable supply of water]**
- ✓ Address the direction of the 2010 Snapshot Report:  
**[to ensure sufficient clean water for human, environmental, and economic needs]**

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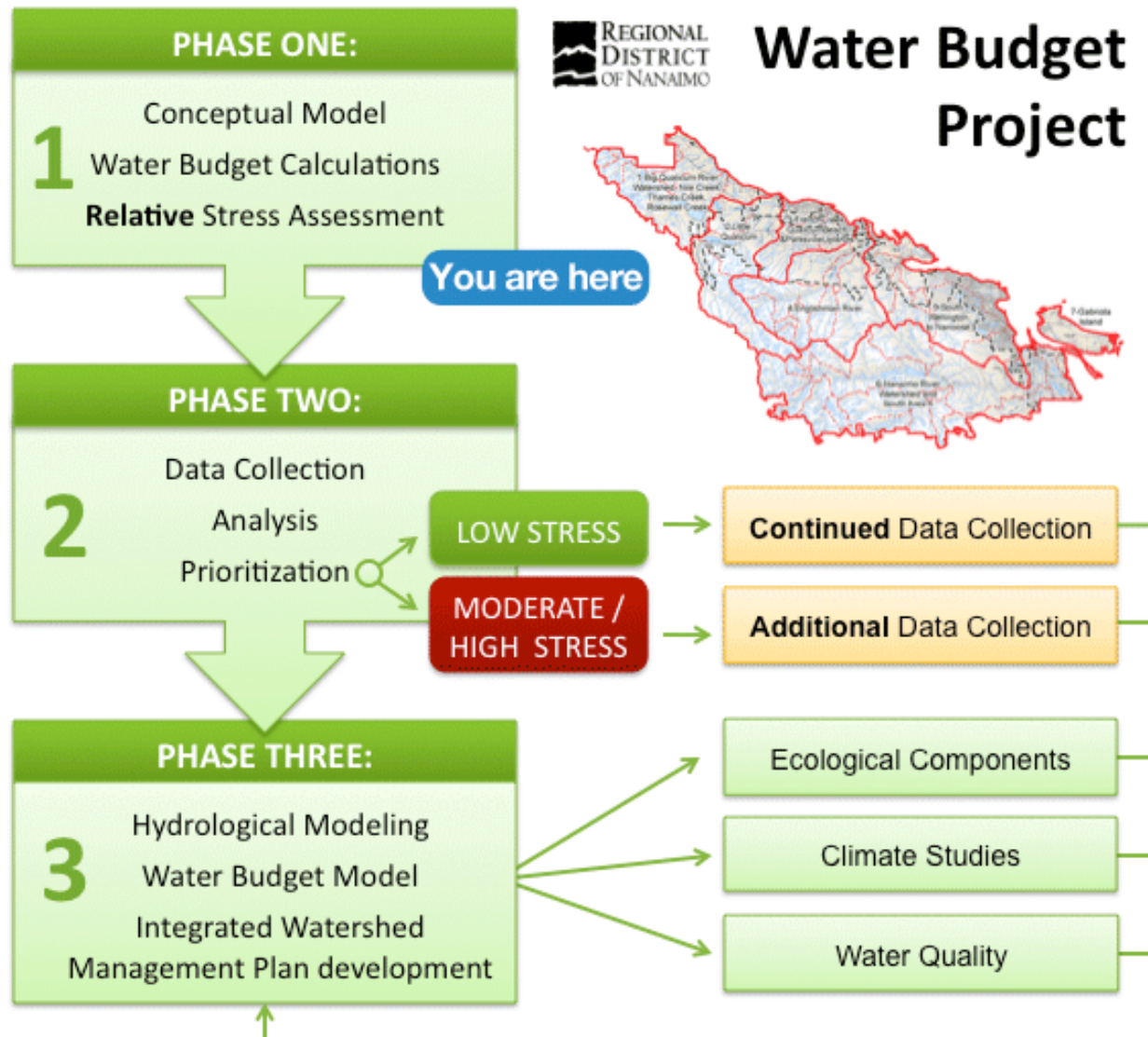
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# Water Budget Study: Project overview



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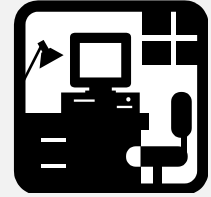


# Water Budget Study: methodology

1.

Desk study:

- resource mapping
- Data compilation



2.

Data collection:

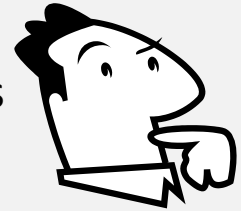
- Water level monitoring
- Pump tests
- Geological logging



3.

**Conceptual model development**

- Based on physical characteristics
- Current scientific understanding



4.

**Water budget calculation**

$$= \text{INPUT} - \text{OUTPUT} + \Delta \text{STORAGE}$$

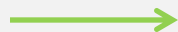


↓  
(Rainfall, US gain)

↓  
(ET, DS loss, abstraction)



5.

**Stress assessment**

- Low Stress  surplus
- Moderate Stress  balance
- High Stress  deficit



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# Water Budget Study: methodology

## Conceptual model development

Example.....

Groundwater flow

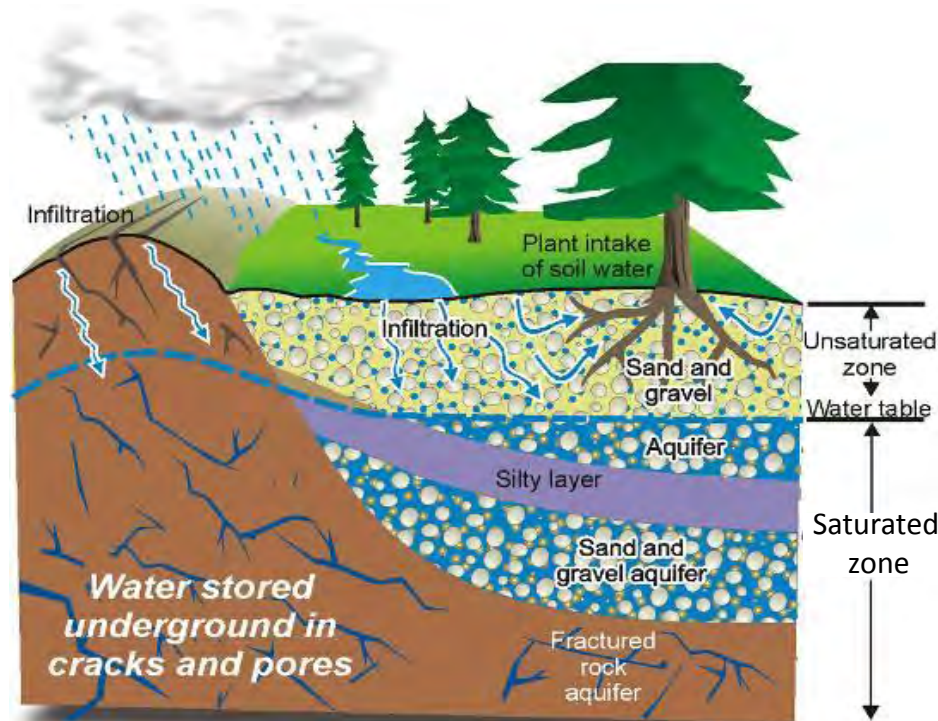


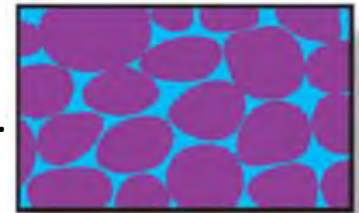
Photo Credit: Natural Resources Canada

1.



Water in rock fractures

2.



Water between grains



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# Water Budget: VI Conceptual model development

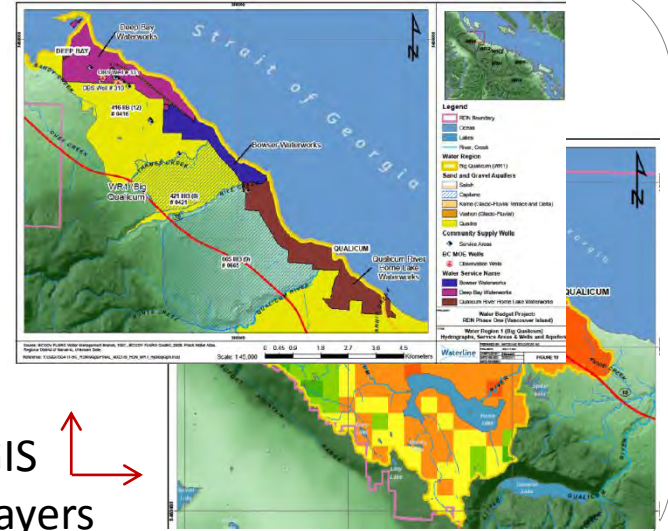
GIS based approach:

- Topography maps
- Climate data
- Land cover maps
- Geological maps
- Water level
- Aquifer properties

A

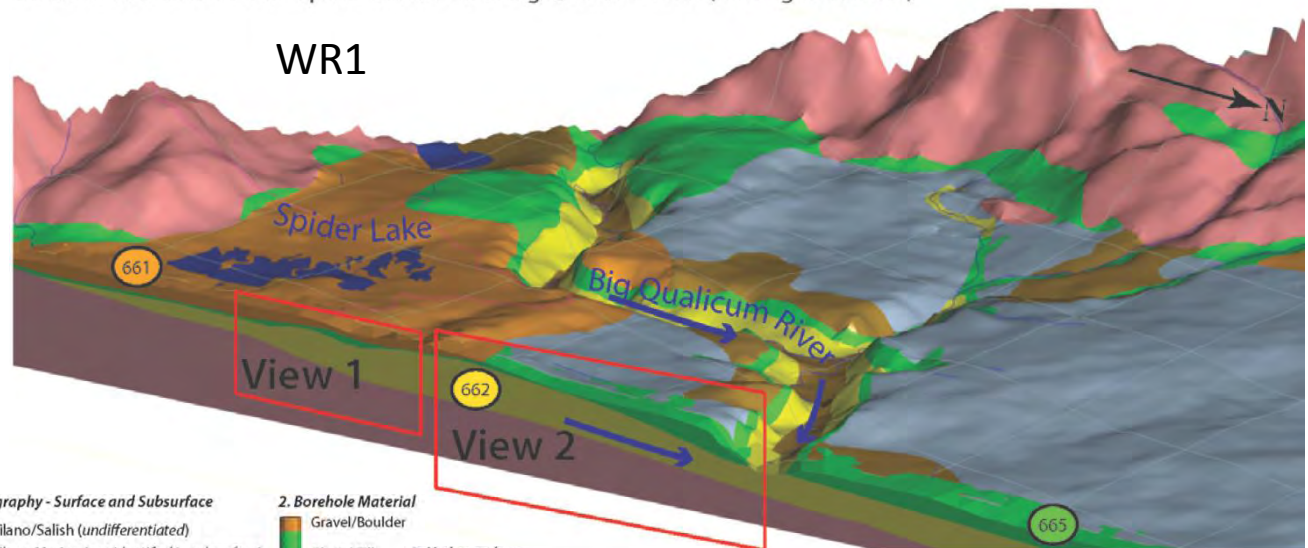
B

GIS Layers



3D Geomodel section from Spider Lakes area to Big Qualicum River (looking southwest)

C



### 1. Hydrostratigraphy - Surface and Subsurface

- Capilano/Salish (undifferentiated)
- Capilano Marine (not identified in subsurface)
- Vashon (Kame Delta)
- Vashon/Capilano (undifferentiated)
- Quadra Sand
- Pre-Quadra (not identified in above model)
- Bedrock/Colluvium

### 2. Borehole Material

- Gravel/Boulder
- Glacial Till
- Sand
- Water Level
- Silt/Clay
- Glacial Till
- Bedrock

### 3. Hydrogeology

- 661 Mapped Aquifer Number (Colour relates to Hydrostratigraphic Unit)
- Flow Direction
- Piezometric Line



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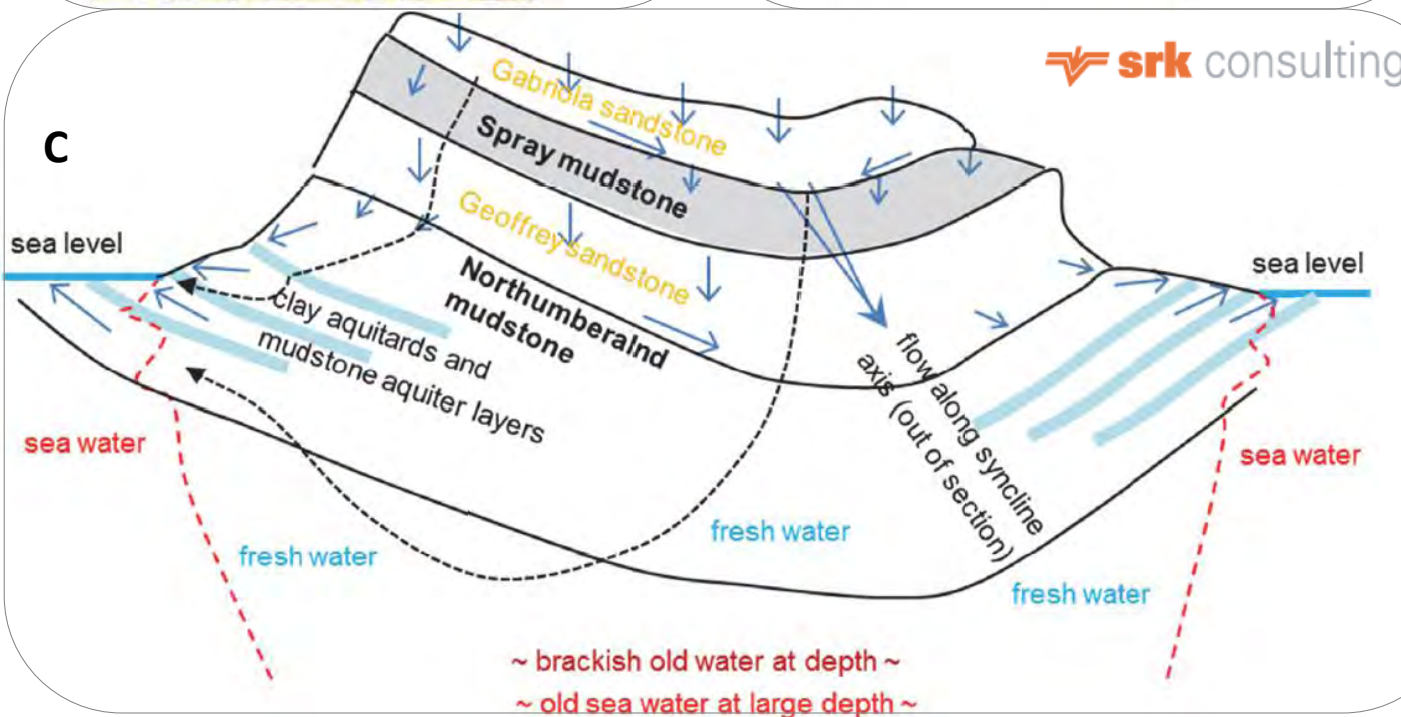
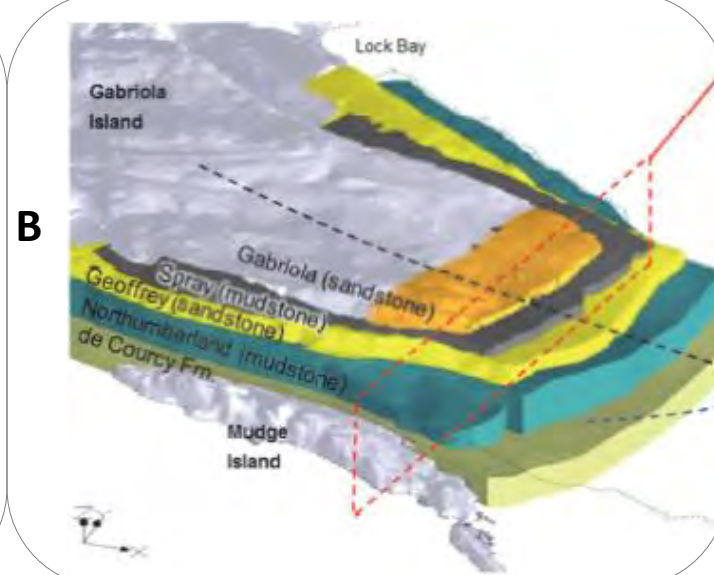
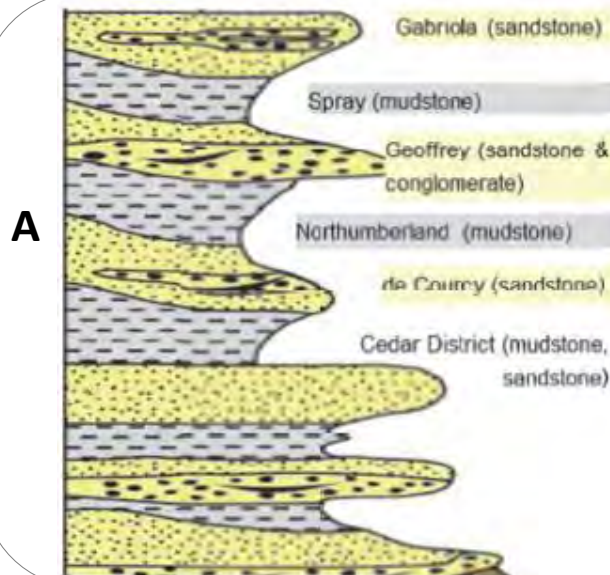
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# Water Budget: Gab conceptual model development



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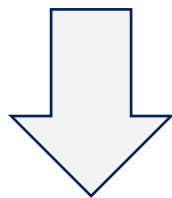
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- What & Why
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# Water Budget Study

## Water Budget Calculations

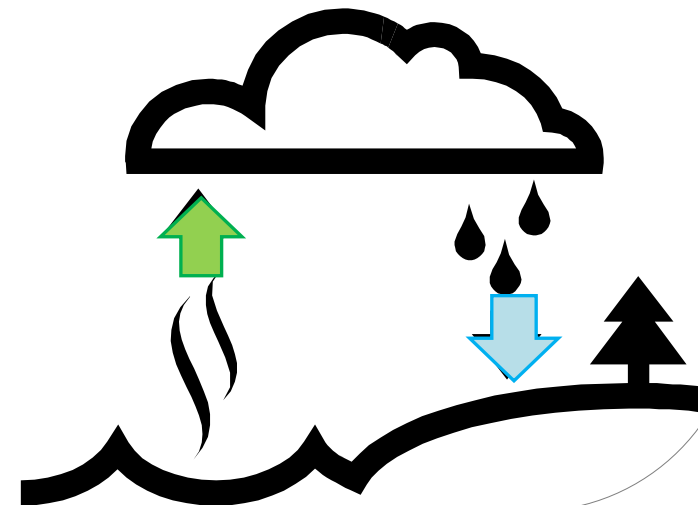
Accounting.....



for water.....

$$= \text{input} - \text{output} + \nabla \text{storage}$$

(rainfall) (evaporation)



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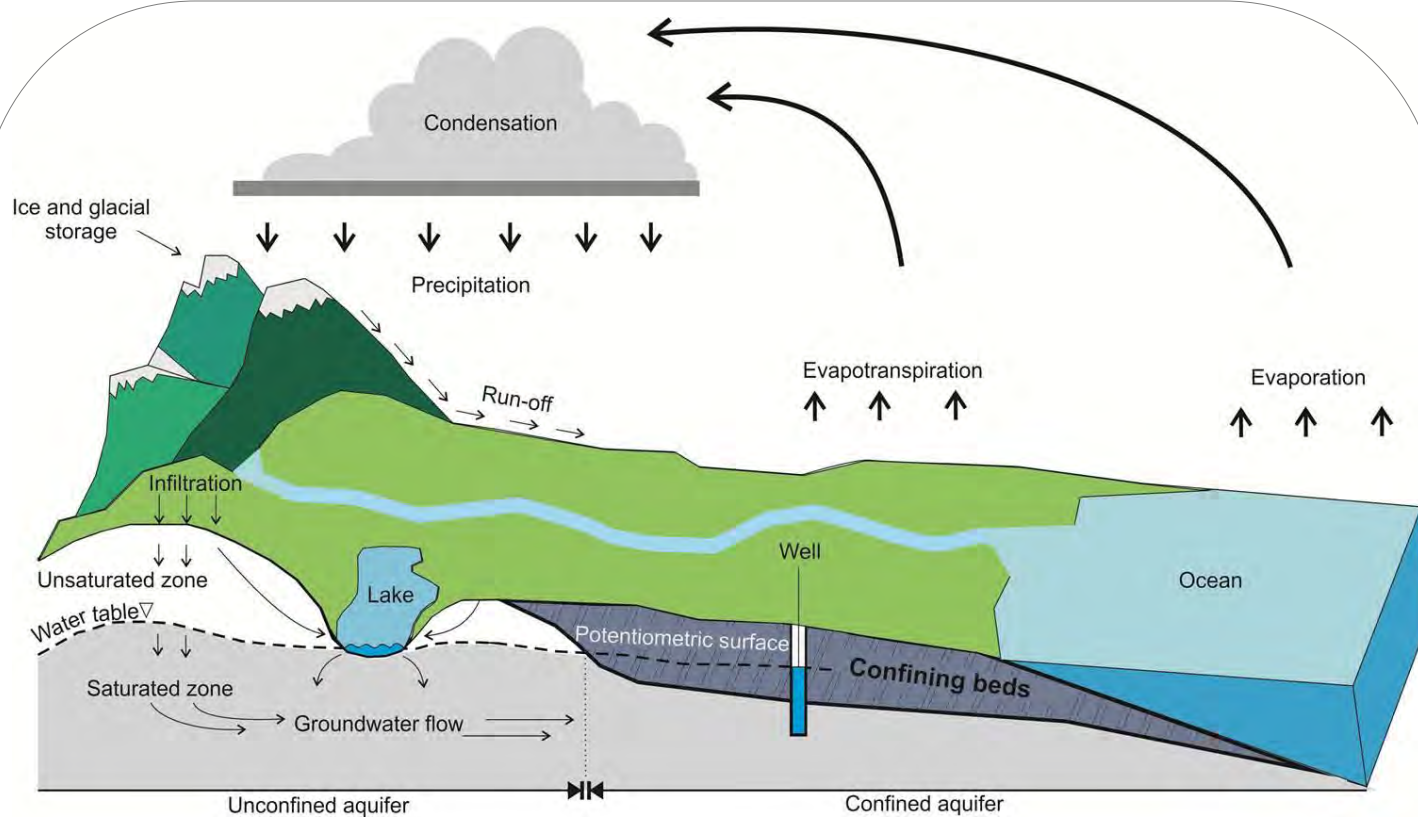
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# Water Budget Study



+ Inputs	- Outputs	▽ Change in storage
rainfall	Evaporation & transpiration	Snowpack
surface water inflow	Surface water outflow	Soil zone
groundwater inflow	Groundwater outflow	Streams, rivers, reservoirs
imported water	Exported water	Aquifers

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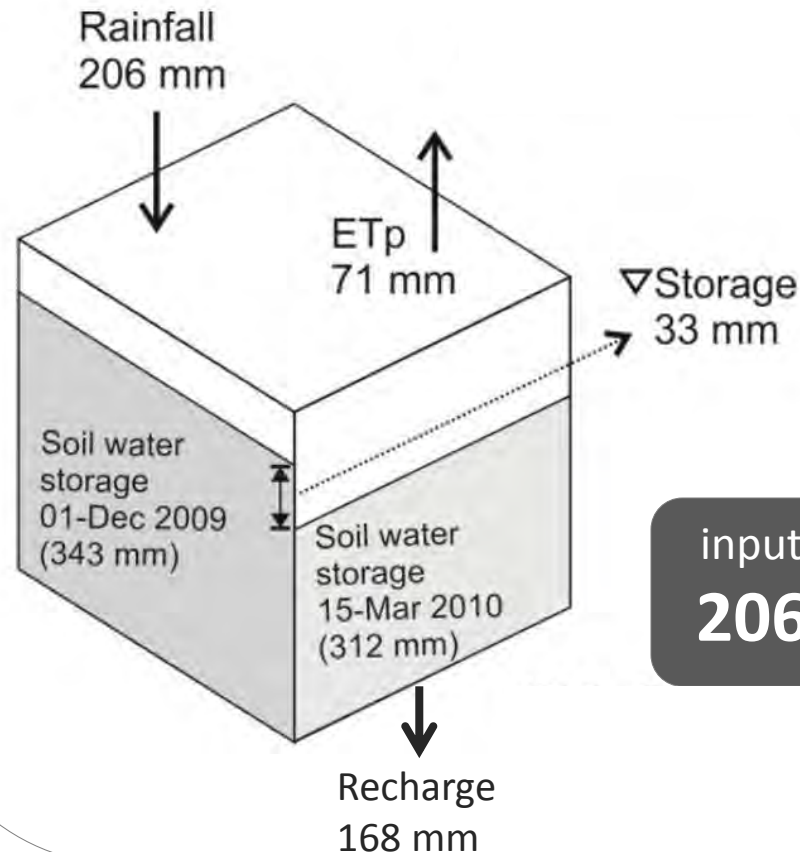
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# Water Budget Study

Example.....

## RECHARGE calculation



input	output	loss	balance
206	- 71	+ 33	= 168

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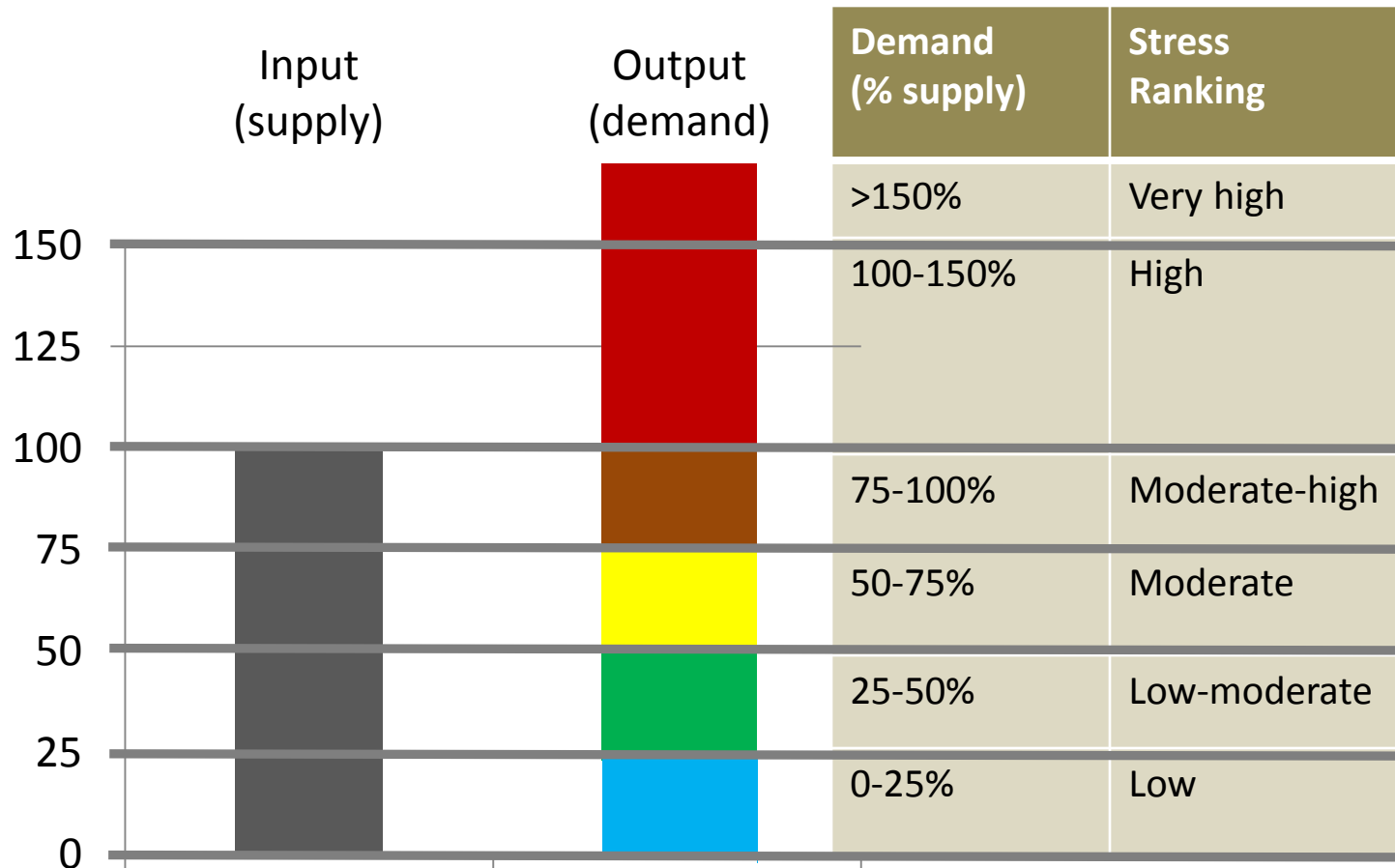


# Water Budget Study



## Stress Assessments: VI

Calculation of the **% of supply** that is **demanded**  
*(Based on Summer Conditions)*



# Water Budget Study

## Stress Assessments: VI

### Surface Water

(Outputs)

$$\text{Surface Water Stress (\%)} = \frac{\text{Consumptive Demand} + \text{Minimum Conservation Flow}}{\text{Natural Water Supply} + \text{Storage}} \times 100$$

(Inputs)

**IN:** estimated river  
flow

**IN:** Licensed storage for managed reservoirs &  
Average water level variation on lakes and wetlands

Watershed	Average Natural River Flow Supply (million m <sup>3</sup> )	Storage (million m <sup>3</sup> )	Conservation Flow (10% of MAD) (million m <sup>3</sup> )	Licensed Demand (million m <sup>3</sup> )	Allocation Stress	Stress Level
Nanoose Creek	0.6	0.0	0.7	0.02	120%	High

**OUT:** 10% of average annual discharge (flow)

**OUT:** industrial, municipal, domestic, agricultural

# Water Budget Study

## Stress Assessments: VI

Groundwater

$$\text{Aquifer Stress (\%)} = \frac{\text{GWout (Outputs)}}{\text{GWin (Inputs)}} \times 100$$

**IN:** recharge from rainfall +  
seepage from overlaying aquifer +  
lateral recharge

Aquifer Tag No.	Aquifer Lithology	Potential Groundwater-Surface water or Aquifer to Aquifer Interaction	MOE Obs Well	Seas. Fluc.	Long Term Fluc.	WL Trend (up or down)	Total Est. AQ. Rec. (TRin) (Rp/l + Rmb)	Est. Ann. Disch to Cr. & Down Grad Aquifer (Tc out)	Ground Water Use Estimate (ANTHout)	Total Out [TcOut + ANTHout]	Stress Anal. % GW Use of the avail. AQ. Rec.	Relative Stress Assess.
			ID	(m)	(m)	U/D	(m <sup>3</sup> /yr)		(m <sup>3</sup> /yr)	(m <sup>3</sup> /yr)	(%)	Lo, Mod, Hi
219	Quadra	Nanoose Creek, Ocean	392, 393	?	?	L	1.6E+08	1.56E+07	2.8E+08	1.83E+07	11	Lo

**OUT:** loss to downstream creek or aquifer +  
human demand (abstractions)



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# Findings: Water Stress Assessment



## GI: 13 Sub-regions

**5 deficit regions**

→ (July – Aug)

**1 deficit region**

→ (Apr – Sept)

(demand > supply)

## VI: 43 Sub-regions

23 { **10 Low stress**  
**7 Low/Mod stress**  
**6 Mod stress**

20 { **11 Mod/High stress**  
**6 High stress**  
**3 V.High stress**

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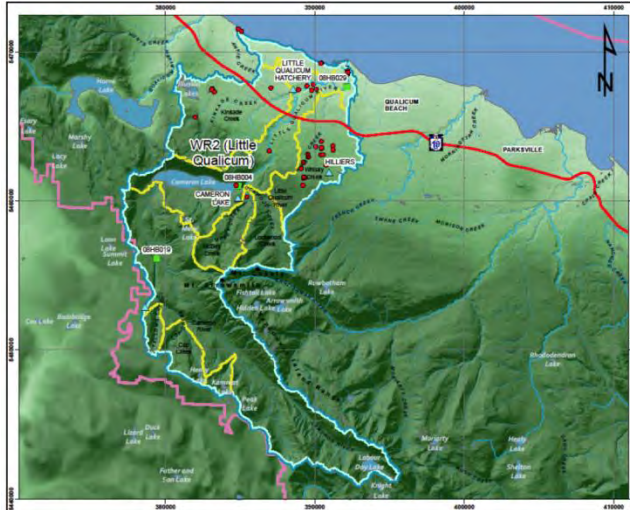
### 3. Watershed Management

- What & Why
- How & Who



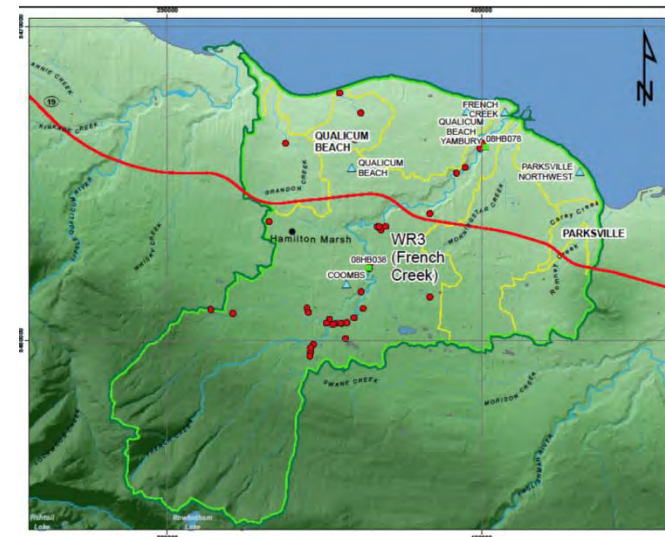
## Findings: Vancouver Island

### WR2: Little Qualicum



- Fifth largest water region
- area of approximately 259 km<sup>2</sup>
- Two hydrometric stations
- six climate stations
- ~42 surface water diversion points
- ~387 wells

### WR3: French Creek



- One of the smallest water regions
- area of approximately 121 km<sup>2</sup>
- Two hydrometric stations
- five climate stations
- ~68 surface water diversion licenses
- ~895 wells

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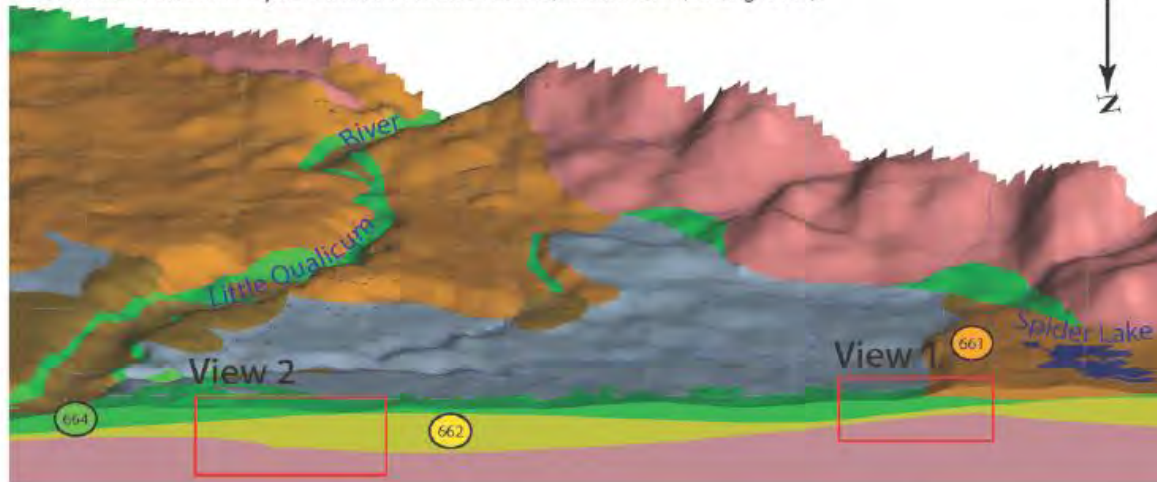
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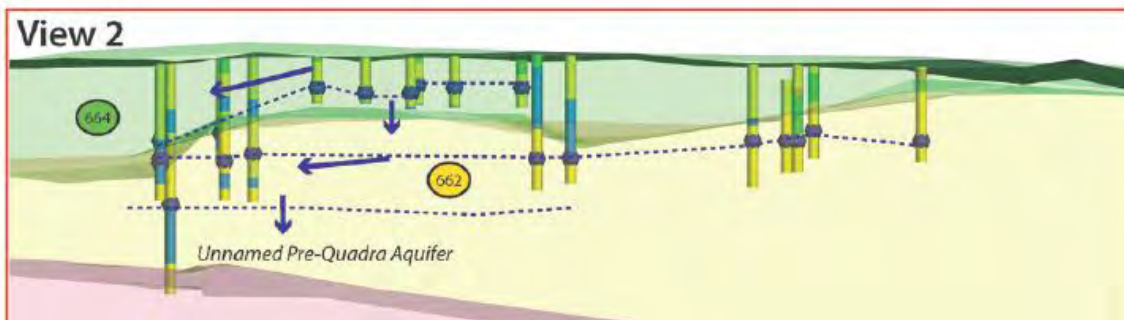
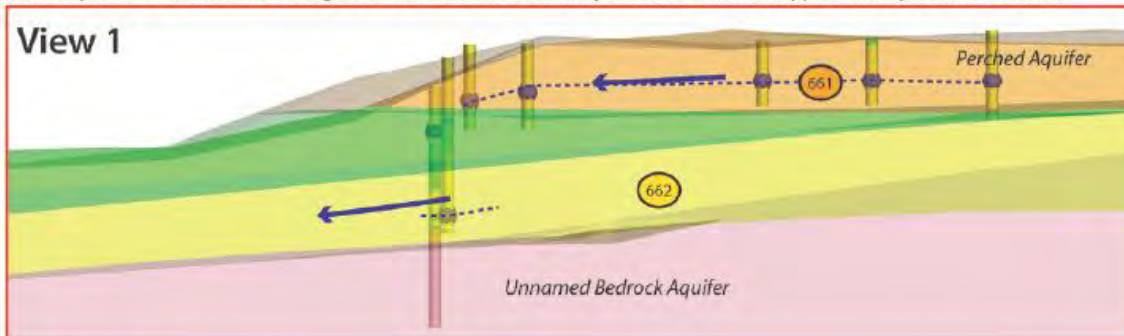
# Findings: Vancouver Island

3D Geomodel section from Spider Lakes area to lower Little Qualicum River (looking south).



**WR2:**  
**Little**  
**Qualicum**

Close-up view of 3D model showing borehole materials and transparent Geovolumes (approximately 200m-thick slice)



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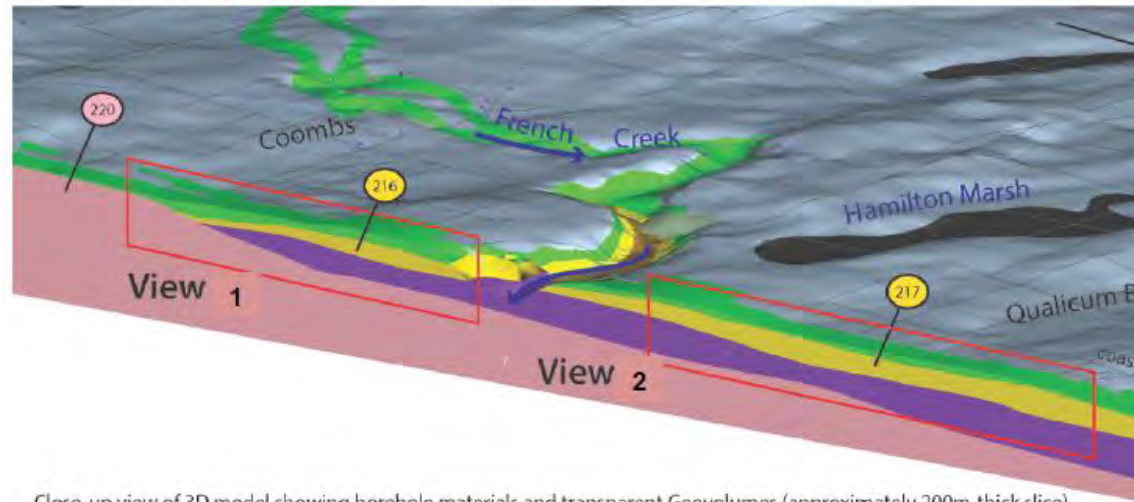
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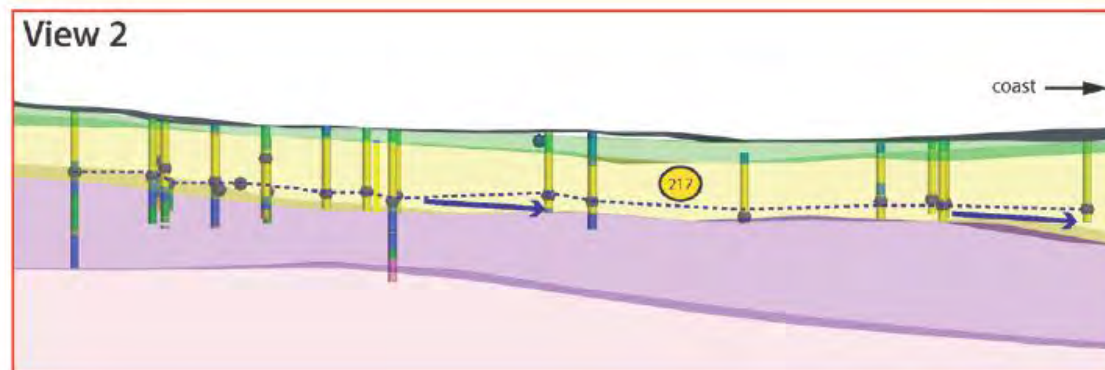
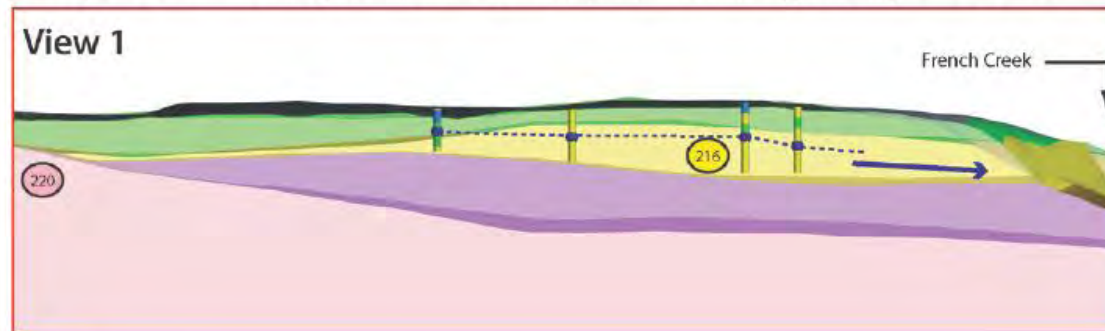
- What & Why
- How & Who

## Findings: Vancouver Island

3D Geomodel section from the Coombs area to Qualicum Beach and the coast (looking southwest).



Close-up view of 3D model showing borehole materials and transparent Geovolumes (approximately 200m-thick slice)



## WR3: French Creek

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### 3. Watershed Management

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- How & Who



# Findings: Vancouver Island

## WR2: Little Qualicum

Table 16: WR2 (LQ) – Surface Water Stress Analysis

Watershed	Average Natural River Flow Supply (million m <sup>3</sup> )	Storage (million m <sup>3</sup> )	Conservation Flow (10% of MAD) (million m <sup>3</sup> )	Licensed Demand (million m <sup>3</sup> )	Allocation Stress	Stress Level
Little Qualicum River	18.89	4.85	13.46	0.20	58%	Moderate

**Surface water:** moderate stress, little qualicum

Table 20: Summary of Water Budget and Stress Analysis – WR2 (LQ)

Aquifer Tag No.	Aquifer Lithology	Potential Groundwater-Surface water or Aquifer to Aquifer Interaction	MOE Obs Well	Seas. Fluc.	Long Term Fluc. (PDO)	WL Trend (up or down)	Total Est. AQ. Rec. (TRin) (Rp/l + Rmb)	Est. Ann. Disch to Cr. & Down Grad Aquifer (Tc out)	Ground Water Use Estimate (ANTHout)	Total Out [TcOut + ANTHout]	Stress Anal. % GW Use of the avail. AQ. Rec.	Relative Stress Assess.
			ID	(m)	(m)	U/D	(m <sup>3</sup> /yr)	(m <sup>3</sup> /yr)	(m <sup>3</sup> /yr)	(m <sup>3</sup> /yr)	(%)	Lo, Mod, Hi
662	Quadra	Ocean, LQ	391	2.50	0.80	U	3.2E+07	0.0E+00	1.22E+06	1.22E+06	4	Lo
661	Kame	Spider LK, Home?	?	?	?	?	1.9E+07	1.2E+07	4.13E+04	1.17E+07	65	Mod
664	Salish	Ocean, LQ	389	3.00	?	D	3.7E+07	0.0E+00	1.39E+06	1.39E+06	4	Lo
663	Kame (Vashon Gf) top of Whiskey Cr.	Whiskey Cr., LQ	?	?	?	?	3.8E+07	2.9E+07	1.08E+05	2.92E+07	81	Mod-Hi
217	Quadra	LQ and Ocean	?	?	?	?	7.2E+06	4.9E+06	4.42E+05	5.32E+06	87	Mod-Hi

**Groundwater:** 2 low stress, 1 moderate & 2 moderate-high stress

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# Findings: Vancouver Island

## WR3: French Creek

Table 26: WR3 (FC) – Relative Surface Water Stress Assessment Results

Watershed	Average Natural River Flow Supply (million m <sup>3</sup> )	Storage (million m <sup>3</sup> )	Conservation Flow (10% of MAD) (million m <sup>3</sup> )	Licensed Demand (million m <sup>3</sup> )	Allocation Stress	Stress Level
French Creek	1.40	0.11	1.75	0.10	123%	High

**Surface water: high stress, French Creek**

Table 30: Summary of Water Budget and Stress Analysis – WR3 (FC)

Aquifer Tag No.	Aquifer Lithology	Potential Ground Water-Surface water or Aquifer to Aquifer Interaction	MOE Obs Well	Seas. Fluc.	Long Term Fluc.	WL Trend (up or down)	Total Est. AQ. Rec. (TRin) (Rp/l + Rmb)	Est. Ann. Disch to Cr. & Down Grad Aquifer (Tc out)	Ground Water Use Estimate (ANTHout)	Total Out [TcOut + ANTHout]	Stress Anal. % GW Use of the avail. AQ. Rec.	Relative Stress Assess.
			ID	(m)	(m)	U/D	(m <sup>3</sup> /yr)		(m <sup>3</sup> /yr)	(m <sup>3</sup> /yr)	(%)	Lo, Mod, Hi
220	Haslam	FC	287		9.1	D	6.4E+06	5.1E+05	2.2E+06	2.7E+06	42	Lo-Mod
216	Quadra	FC	314	1.60	3.60	D/L	4.5E+07	3.8E+07	4.1E+06	4.5E+07	100	Hi
217	Quadra	FC and Ocean	321, 325, 303	5	12	D/L	8.3E+06	2.5E+06	4.7E+06	1.1E+07	133	Hi
212	NG	Ocean	NA	NA	NA	NA	8.8E+05	0.0E+00	5.0E+05	5.0E+05	58	Mod

**Groundwater: 1 low-moderate stress, 1 moderate & 2 high stress**

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## Findings: Vancouver Island

### WR2: Little Qualicum recommendations

- Observation wells in aquifers 661, 663 & 217
- Summer surface flow measurement McBey Creek, Lockwood Creek & Whiskey Creek
- Lake level monitoring on Illusion Lake and Spider Lake

### WR3: French Creek recommendations:

- Observation well in aquifer 212
- Summer surface flow measurements at Morning Star Creek, Grandon Creek & Carrey Creek

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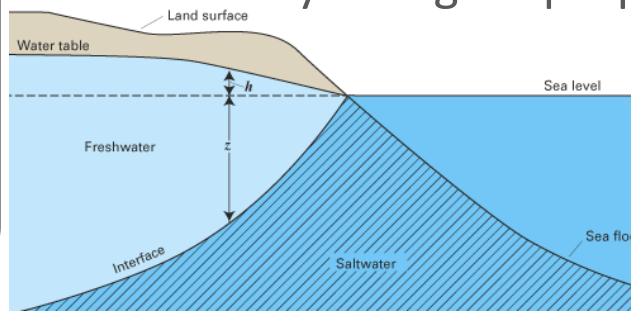


## Findings: data gaps

### Author recommendations:

1. Mandatory **well log** submission
2. Standardization of **aquifer testing**
3. Increase **well observation** network
4. Reactivation of **stream gauging** (WSC)
5. Increase **saline intrusion monitoring**
6. Improve Water Budget **calculation parameters**

- Gabriola → water use data from survey
- Hydrological properties





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## Conclusion



***The Phase One Water Budgets provide the most comprehensive collation of information on the region's water resources that has been made available to date***

- Results are **purely conceptual** and not intended for water management decision making or policy development
- Large degree of **uncertainty** due to lack of data
- Highlights data gaps and need for **increased monitoring**
- Stepping stone for the future!



For more details

and to

download the complete reports

VISIT:

[www.rdnwaterbudget.ca](http://www.rdnwaterbudget.ca)

The screenshot shows the homepage of the RDN Water Budget Project website. At the top, there is a navigation bar with links for Home, Introduction, News, Vancouver Island, Gulf Islands, Water for Agriculture, and Water 101. The main content area is titled "Welcome!" and features a "What's New" section with public info sessions in Nanaimo and Parksville. A "Recently Posted" section includes articles about geology and the DWWP program. A central diagram titled "Water Budget Project" shows three phases: Phase One (Conceptual Model, Water Budget Calculations, Relative Stress Assessment), Phase Two (Data Collection, Analysis, Prioritization), and Phase Three (Hydrological Modeling, Water Budget Model, Integrated Watershed Management Plan development). The diagram also lists data collection methods (Continued and Additional) and components (Ecological, Climate, Water Quality). A "Learn more about the Project" link is provided at the bottom.

Report  
Download



The thumbnail displays the cover of the report "Water Budget Project: RDN Phase One (Gabriola, DeCourcy & Mudge Islands)". It is prepared for the Regional District of Nanaimo. The cover features the RDN logo and a map of the region highlighting the three islands. At the bottom, it lists the consulting firms: SRK Consulting (Canada) Inc. and Thunder Engineering Ltd., along with the report number ICR010-000 and the date April 2013.



now  
what?

tomorrow

yesterday

# 3. Integrated Watershed Management Planning



DRINKING WATER  
WATERSHED  
PROTECTION

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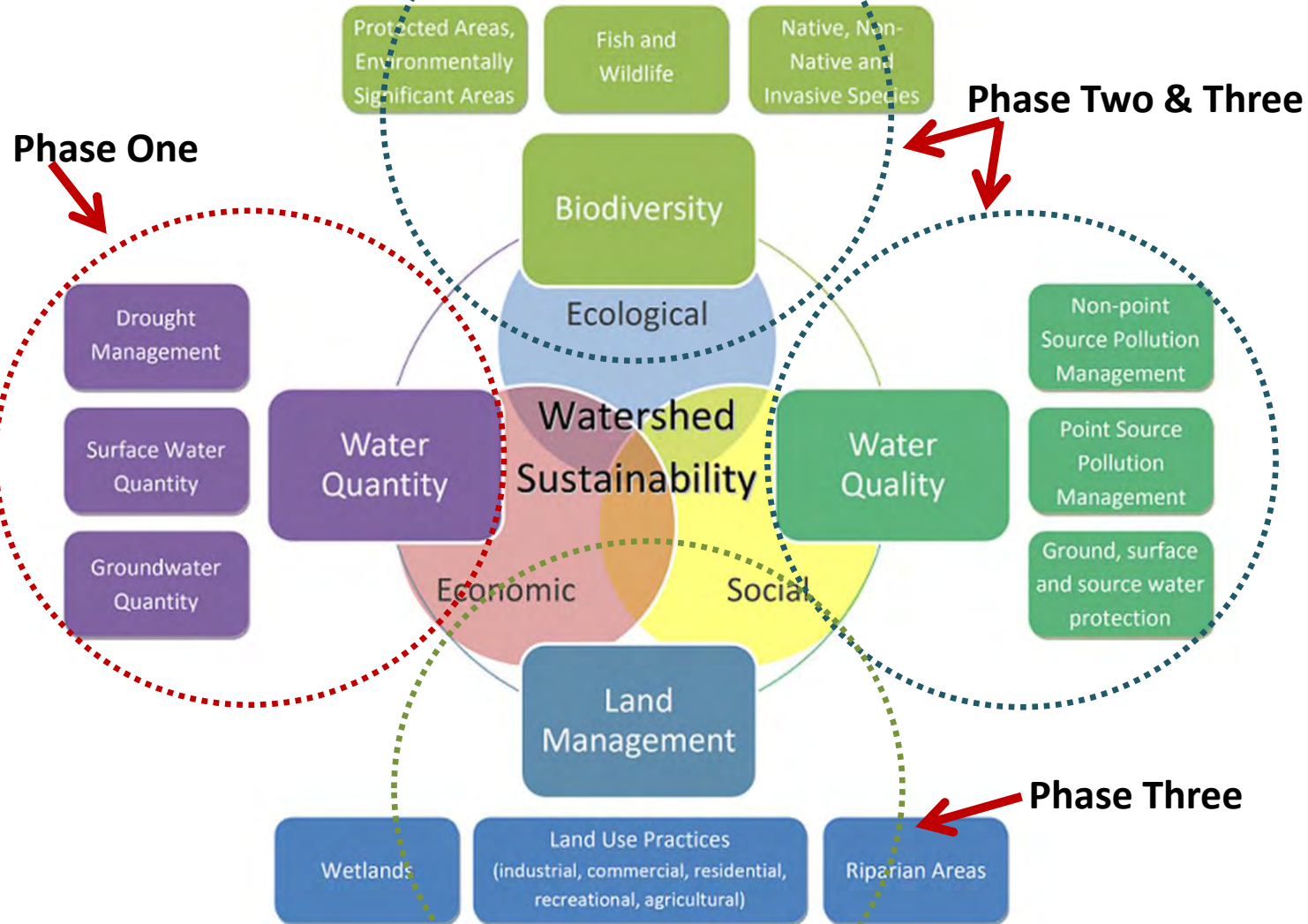
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# Integrated Watershed Management Planning

## WHAT is a Integrated Watershed Management Plan?



*It considers all human and environmental aspects of a watershed*

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# Integrated Watershed Management Planning

## WHY is it needed?

- Land use activities such as forestry, mining, agriculture, urbanization, fisheries and recreation all impact water resources



- Water resource problems are reaching global proportions; how we manage our water and how our neighbors manage theirs has an impact on all of us



- There is a wide variety of processes that affect the hydrological cycle; only managing one aspect is mismanagement. A holistic approach is the only way forward

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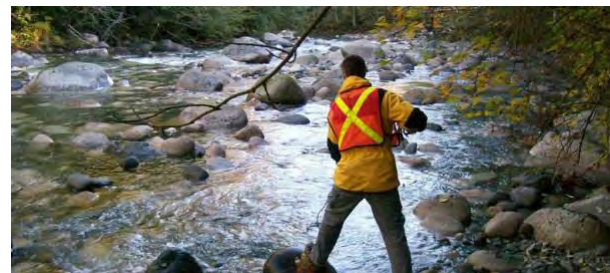
- What & Why
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# Integrated Watershed Management Planning

## HOW? *What does a planning framework include?*

1. Identification of **river basin areas** (water regions)
2. Identification of **water resources** (surface and ground water)
3. Identification of **measurement** parameters (chemical/ecological/social)
4. Identification of **protected areas** (forests, parks, fisheries)
5. Assess **current state** (i.e. poor, good, high) → **WHAT**
6. Reasons for **not achieving** good status → **WHY**
7. **Action plan** to achieve good status/improve → **HOW**



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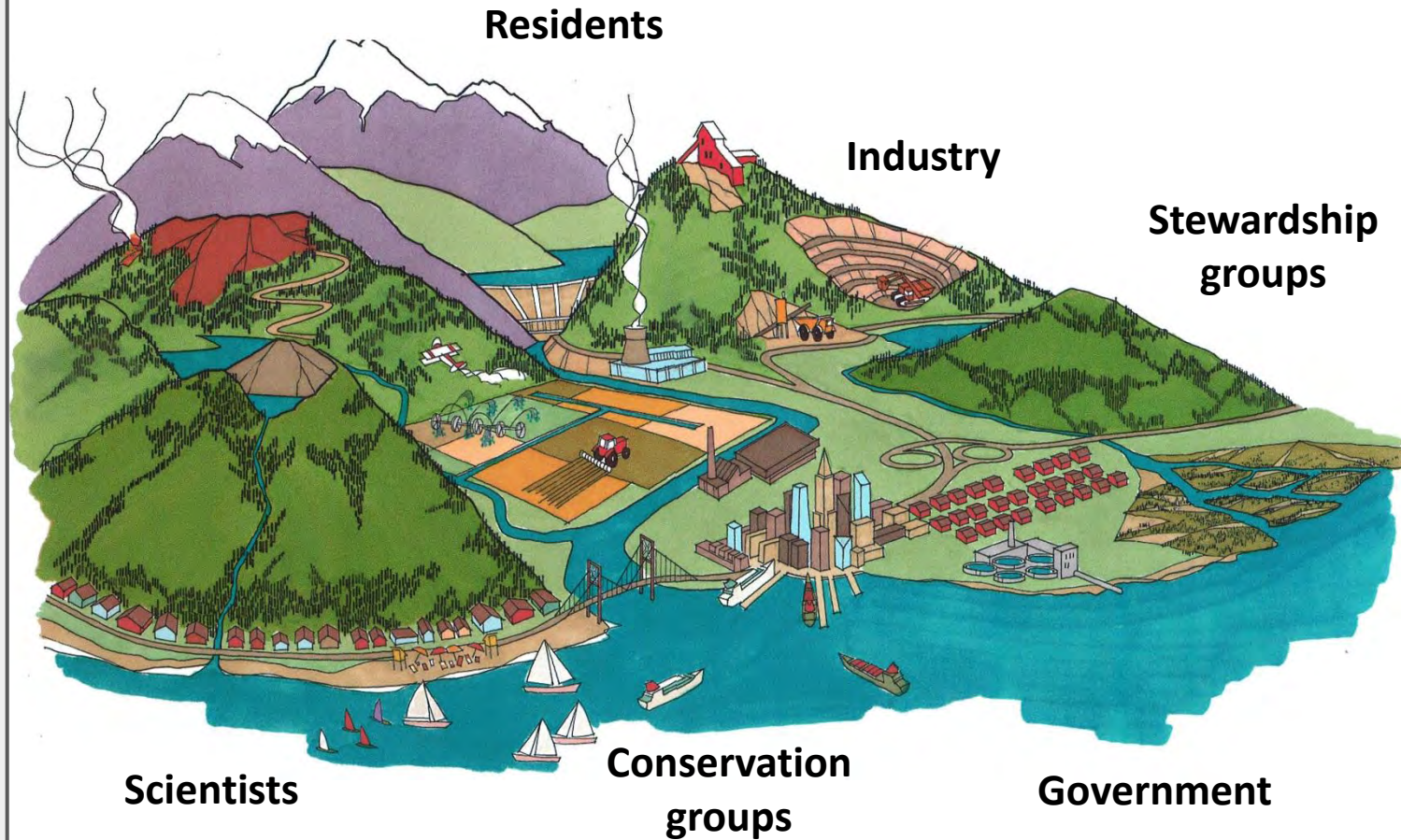
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# Integrated Watershed Management Planning

## WHO?



*A key component to the success of these plans is public input...you live in the watershed! You know it best*





## Where do we go from here?



In your opinion:

- what are the priority watershed issues?
- who is responsible for watershed management?
- what do you think the DWWP program should focus on?



DRINKING WATER  
WATERSHED  
PROTECTION

Thank You!

