



Drinking Water & Watershed Protection  
**WATERSHED SNAPSHOT REPORT 2010**

April, 2011

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# Table of Contents

Preface ..... 5

Region-wide Recommendations ..... 6

1.0 Big Qualicum River Watershed, Nile Creek, Thames Creek, Rosewall Creek..... 13

    Analysis ..... 13

    Recommendations..... 13

    Comments ..... 13

    Issues (Existing Confirmed Problems)..... 14

    Concerns (Existing, Unconfirmed Problems)..... 14

    Threats (Activities)..... 14

    Opportunities..... 14

    Information Gaps ..... 14

    Vulnerabilities..... 14

2.0 Little Qualicum..... 16

    Analysis ..... 16

    Recommendations..... 16

    Comments ..... 16

    Issues (Existing Confirmed Problems)..... 17

    Concerns (Existing, Unconfirmed Problems)..... 17

    Threats (Activities)..... 17

    Opportunities..... 17

    Information Gaps ..... 17

    Vulnerabilities..... 17

- 3.0 French Creek, Qualicum Beach and Parksville Uplands ..... 19
  - Analysis .....19
  - Recommendations.....19
  - Comments .....20
  - Issues (Existing Confirmed Problems).....20
  - Concerns (Existing, Unconfirmed Problems).....20
  - Threats (Activities).....20
  - Opportunities.....20
  - Information .....21
  - Vulnerabilities.....21
  
- 4.0 Englishman River .....23
  - Analysis .....23
  - Recommendations.....23
  - Issues (Existing Confirmed Problems).....23
  - Concerns (Existing, Unconfirmed Problems).....23
  - Threats (Activities).....24
  - Opportunities.....24
  - Information Gaps .....24
  - Vulnerabilities.....24
  
- 5.0 South Wellington to Nanoose .....26
  - Analysis .....26
  - Recommendations.....26
  - Issues (Existing Confirmed Problems).....27
  - Concerns (Existing, Unconfirmed Problems).....27
  - Threats (Activities).....27
  - Opportunities.....27
  - Information Gaps .....27
  - Vulnerabilities.....28

6.0	Nanaimo River Watershed and South Area A .....	30
	Analysis .....	30
	Recommendations.....	30
	Issues (Existing Confirmed Problems).....	31
	Concerns (Existing, Unconfirmed Problems).....	31
	Threats (Activities).....	32
	Opportunities.....	32
	Information Gaps.....	32
	Vulnerabilities.....	32
7.0	Gabriola Island .....	34
	Analysis .....	34
	Recommendations.....	34
	Issues (Existing Confirmed Problems).....	35
	Concerns (Existing, Unconfirmed Problems).....	35
	Threats (Activities).....	35
	Opportunities.....	35
	Information .....	36
	Vulnerabilities.....	36
8.0	Next Steps.....	37
9.0	Region-Wide Action Schedule .....	38
10.0	Watershed Specific Action Schedule.....	41
	Glossary .....	44

### Watershed Index Map



## Preface

In 2008, the Regional District of Nanaimo became the first regional government in British Columbia to start a *Drinking Water & Watershed Protection* service. With the support of the volunteer *Drinking Water & Watershed Protection* Stewardship Committee, and the assent of the electors, the program is now funded and being implemented. The goal of the *Drinking Water & Watershed Protection* Program is to help protect water resources by ensuring land use decisions reflect the need to protect water resources and by educating and empowering residents to protect water today and for the future.

### *The Drinking Water & Watershed Protection Program has 7 components:*

1. Public Awareness & Involvement
2. Water Resources Inventory and Monitoring
3. Land Planning and Development
4. Watershed Management Planning
5. Water Use Management
6. Water Quality Management
7. Climate Change

In 2010, the RDN embarked on an exercise to better understand the state of water resources in the Regional District in order to guide further implementation of the Program. The RDN consulted with local technical experts and the public in order to gather information to create a "snapshot" of water resources in the Region and help focus the programs. A series of events were organized to encourage participants to provide their local knowledge and expertise on water-related issues in spring 2010:

- Groundwater Professionals Meeting – including local well drillers and hydrogeologists (March 30, 2010)
- Technical Roundtable – including local water, resource management, biologists and land use professionals (May 18, 2010)
- Southern Community Workshop (June 16, 2010)
- Northern Community Workshop (June 17, 2010)
- Gabriola Island Community Workshop (June 24, 2010)

A key outcome of the consultation process was the creation of detailed community mapping and a database of water related issues, concerns, threats, opportunities, information gaps and sources, and vulnerabilities.

This '*Watershed Snapshot Report 2010*' extracts the highlights from the community outreach and mapping process. The *Snapshot Report* contains raw data that was obtained through the public consultation process. It is important to note that the information has **not** been vetted for accuracy or completeness, but rather is a synopsis of the feedback from participants. For each major watershed in the RDN, the report presents a summary analysis, key recommendations for actions, and records key themes from the workshops.

As well as providing valuable public information, this document will be used in support of focusing the next steps in the *Drinking Water & Watershed Protection Program*. The goal is to ensure that limited resources are used wisely by delivering the right program in the right place.

## Region-wide Recommendations

The primary body of this report communicates recommendations specific to each of the Region's seven (7) watershed study areas. In addition to these site-specific recommendations, Table 1 below communicates the recommendations that apply throughout the Region.

**Table 1: Region-wide Recommendations**

Priority Action	Notes
<b>Program 1: Public Awareness and Involvement</b>	
1. Develop an interactive website that allows easy access to water resource knowledge, and water stewardship resources.	<ul style="list-style-type: none"> <li>- Underway –The website will have a novice friendly interface with information on local water resources and stewardship and a library of technical reports. There will also be more detailed information on water resources, land use, and geographically referenced water related reports in an interactive GIS tool called 'RDN WaterMap'. For more information, visit <a href="http://www.rdn.bc.ca">www.rdn.bc.ca</a> and navigate from 'Water in the RDN' to 'Drinking Water and Watershed Protection Program'. RDN WaterMap is available from this page.</li> </ul>
2. Continue water conservation outreach activities	<ul style="list-style-type: none"> <li>- Outdoor use is the main discretionary water use – most effective to focus on changing outdoor watering behavior.</li> <li>- Foster an increased understanding of watershed values. People need to understand water in order to have the desire to protect it; a potential tool for this is to create a story for each river system.</li> <li>- Identify high water use areas and focus Community Based Social Marketing outreach there.</li> <li>- Include Living Water Smart Home Assessment (provincial program) in outreach materials and take to irrigation review site visits.</li> <li>- Include information on hazardous waste disposal and illegal dumping in Team WaterSmart educational resources.</li> <li>- Partner with Energy and Sustainability Department on outreach to the development community that promotes watershed protection.</li> </ul>



3. Develop and implement a strategy project for rainwater reuse.	<ul style="list-style-type: none"> <li>- Following from the RDN Innovative Options and Opportunities for Sustainable Water Use report.</li> <li>- Where possible, coordinate with Green Buildings initiatives and Energy &amp; Sustainability Department, including promoting rainwater harvesting through the Green Building Checklist.</li> <li>- A potential barrier to rainwater use is qualification for rainwater &amp; capture systems to be an appropriate water supply supported by banks for loan applications.</li> </ul>
4. School education programs	<ul style="list-style-type: none"> <li>- Continue watershed protection education in schools</li> </ul>
Priority Action	Notes
<b>Program 2: Water Resources Inventory and Monitoring</b>	
5. Develop indicators for assessing water resources, which can be monitored on a yearly basis across the Region to track state of water resources.	<ul style="list-style-type: none"> <li>- Could be part of the Regional Growth Strategy sustainability indicators. Need to be developed early in the program. Potential indicators include stream temperature, groundwater elevations, groundwater quality, surface water quality, volume of water extracted, etc.</li> <li>- Refer to the indicators developed as part of the State of Sustainability Report and Groundwater Indicators Research Project.</li> <li>- In areas where indicators show signs of concern, conduct further monitoring (ie., if surface water quality indicators are problematic, perform further monitoring of other parameters or benthic invertebrates) to better understand the issue</li> </ul>

<p>6. Develop Water Budgets for each of the seven (7) major watershed areas.</p>	<ul style="list-style-type: none"> <li>- See also Program 4.</li> <li>- A water budget “looks at how much water enters a watershed, how it’s stored and how much water leaves. It also looks at what we are doing on the land that impacts water quality and quantity and then this information helps us to determine how much water is available for human uses while ensuring there is still enough left for natural processes.”<sup>1</sup></li> <li>- A conceptual water budget model is first developed to obtain a basic understanding of the physical flow system.</li> <li>- An initial synthesizing of available data will be used to understand the way that water moves throughout the watershed. Various data sources include stewardship groups, DFO (e.g. Little Qualicum River flow monitoring), MOE, BCCF, etc.</li> <li>- Initial work will indicate where critical data gaps exist and identify how to fill these gaps.</li> <li>- Where possible, work with municipalities in development of water budgets.</li> <li>- Water budget work will be tiered. Budgets will start off simple and at a larger geographic scale. In priority areas, more complex assessments will be done at a smaller scale.</li> </ul>
<p>7. Refine water budgets</p>	<ul style="list-style-type: none"> <li>- The budgets will be refined as new data (such as water extraction information) is generated. In at-risk areas, detailed modeling may be needed in the future.</li> <li>- New data collection will involve partnerships with other organizations including stewardship groups, students (e.g. VIU), private land owners, including forestry, and other agencies such as MOE, VIHA, and municipalities.</li> </ul>

<sup>1</sup> Conservation Ontario, “*Integrated Watershed Management: Navigating Ontario’s Future – A Water Budget Overview*”, (October 2009). URL source: <[http://www.conservation-ontario.on.ca/watershed\\_management/reports/IWM\\_WaterBudgetOverview\\_Final\\_Jun2.pdf](http://www.conservation-ontario.on.ca/watershed_management/reports/IWM_WaterBudgetOverview_Final_Jun2.pdf)>, (November 2010).

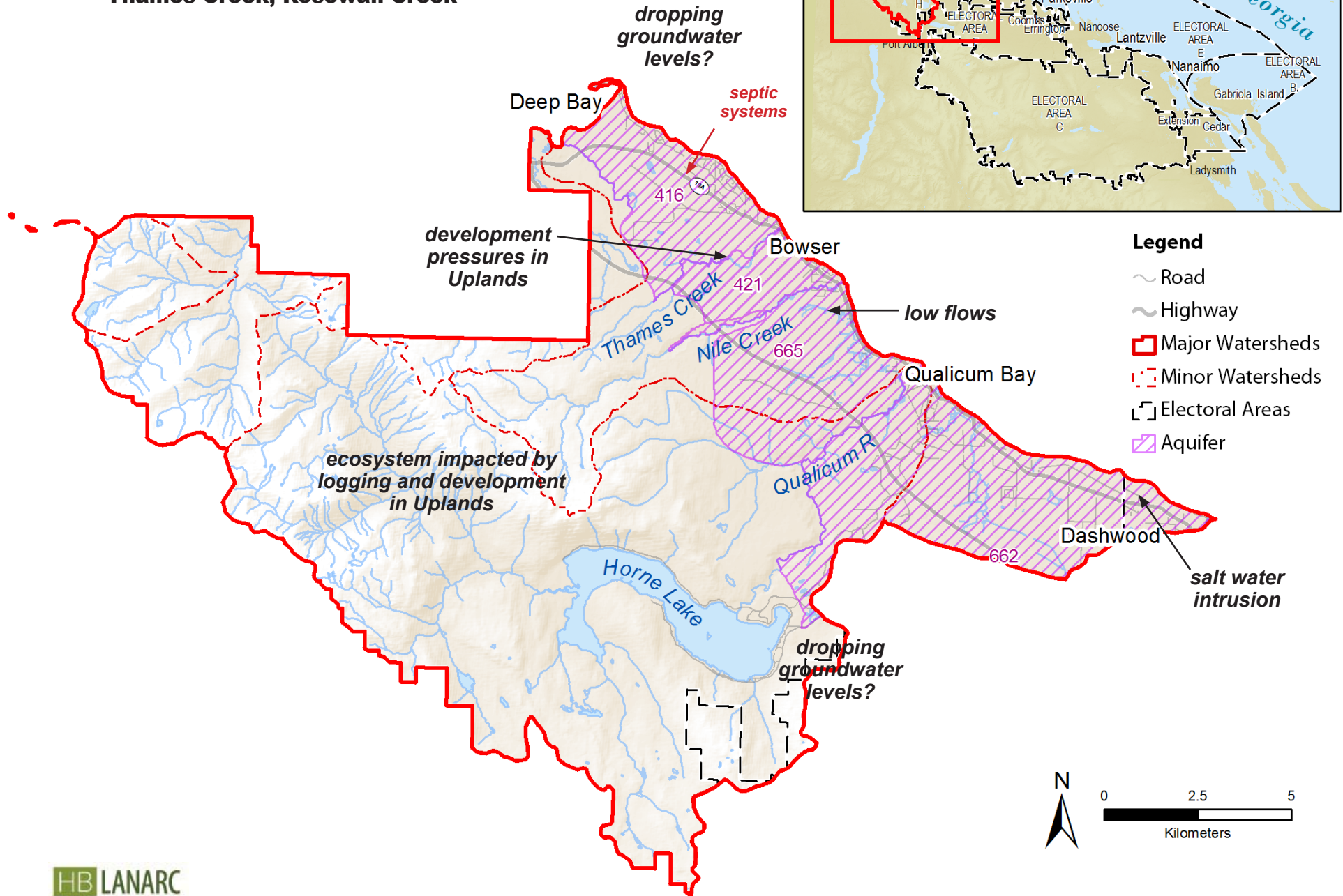
**Table 1: Region-wide Recommendations (continued)**

Priority Action	Notes
8. Better understand water extraction by collecting water use information on representative user groups e.g. golf courses, agriculture, commercial/industrial.	<ul style="list-style-type: none"> <li>- In serviced areas, extraction information could be obtained by surveys of users and/or water purveyors. In unserviced areas, metering volunteer representative users could provide a coarse indicator of typical water consumption.</li> <li>- Follow up on potential information regarding water usage in Gabriola Village (Islands Trust rezoning).</li> </ul>
9. Create central repository for storing river flow data (high and low), stream temperature, etc. Train and work with Stewardship Groups to monitor flows, stream temperature and install automated data collectors as needed on priority waterways.	<ul style="list-style-type: none"> <li>- Develop a program where information may be entered online – partners may include community mapping network, VIU students or RDN Information Services.</li> <li>- Encourage flow and temperature monitoring at multiple points (tributaries) in a stream system. Explore a data collection training program (VIU, MOE). If needed, automated loggers can assess stream flow and water temperature on a high-frequency basis. Work with other agencies (DFO, stream keepers) to select the most desired monitoring locations.</li> </ul>
10. Start groundwater level monitoring by working with major users.	<ul style="list-style-type: none"> <li>- Work with water suppliers and purveyors to collect and record water level (piezometric) data on a regular basis (static levels). Where possible, work with these groups to obtain daily extraction data. This could be accompanied with a training program to describe the rationale and importance of this monitoring. Expand to private wells where needed or feasible.</li> </ul>
11. Work with Ministry of Environment and local volunteers to monitor surface water quality in priority rivers, lakes and streams.	<ul style="list-style-type: none"> <li>- Develop a long-term partnership plan for the surface water quality monitoring program.</li> <li>- Contact stewardship groups and other volunteer coordinators including the DFO Salmon Enhancement Community Participation Program Community Advisors.</li> </ul>

<b>Program 3: Land Planning and Development</b>	
12. Strengthen Regional Growth Strategy language regarding protection of drinking water and watersheds.	<ul style="list-style-type: none"> <li>- Underway in current RGS review.</li> <li>- Work with Long Range Planning to raise awareness among the public of the interrelationships between growth management and watershed protection.</li> <li>- Work with RGS team to promote public input on the RGS at TWS events</li> </ul>
13. Adopt Low Impact Development Engineering (LID) standards with Development Services and Sustainability Departments and MOTI.	<ul style="list-style-type: none"> <li>- Approval officer is MOTI, and therefore coordination is required.</li> <li>- One of the challenges with LID outside of the lot level in electoral areas is that MOTI and their contractor is responsible for maintenance of drainage systems, and maintenance of LID features is outside of their traditional maintenance agreements. Promoting lot-level LID techniques may be more feasible.</li> </ul>
14. Update Landscape and Irrigation Design standards and bylaws. Include performance requirements for properly designed irrigation systems, soil depth, etc. to reduce water use.	<ul style="list-style-type: none"> <li>- Standards should address properly designed landscape and irrigation for water conservation.</li> <li>- Reduce requirement for permanent irrigation while recognizing need for establishment watering.</li> </ul>
15. Refine requirements for hydrogeological assessments for subdivision and development proposals. Information should be submitted in a format that is of value in providing an increased understanding of water resources in the Region.	<p>Use Groundwater Bylaws Toolkit as a resource, as well as the following suggestions:</p> <ul style="list-style-type: none"> <li>- Ensure assessments are current.</li> <li>- Include information on long-term cumulative impacts and capacity.</li> <li>- Consider mandatory testing of wells for submission with applications.</li> <li>- Establish minimum testing requirements that increase depending on size of development.</li> <li>- Work with Development Services to consider requiring higher standards for water conservation on at-risk aquifers (e.g., Yellowpoint, Parksville, Benson Meadows area aquifers, etc.)</li> </ul>
16. Consider requiring new development to include hydrological impact modeling using the Water Balance Model or other hydrological modeling tools.	<ul style="list-style-type: none"> <li>- Partner with the municipalities to move towards Integrated Rainwater Management (e.g. as in Beyond the Guidebook).</li> <li>- Look at options for retrofitting older developments to reduce hydrological impacts.</li> </ul>

<b>Program 4: Watershed Management Planning</b>	
17. Work with Development Services to develop bylaws addressing construction best management practices including sediment & erosion control, spill preparedness, etc.	<ul style="list-style-type: none"> <li>- Construction activities can have greater impacts on watershed health than the final land use.</li> <li>- Sediment and erosion control best practices has the potential to create real change in water quality and aquatic habitats.</li> </ul>
<b>Program 5: Water Use Management</b>	
18. Develop a voluntary Water Purveyor Working Group, to assist small water purveyors in the Region.	<ul style="list-style-type: none"> <li>- Development is underway with the Sustainable Infrastructure Society.</li> </ul>
19. Provide incentives for water conservation practices, both indoor and outdoor.	<ul style="list-style-type: none"> <li>- The RDN report Innovative Options and Opportunities for Sustainable Water Use provides guidance for this.</li> </ul>
20. Communicate building options for rainwater and gray water reuse in co-operation with BC Building Safety Branch and local Building Inspectors.	<ul style="list-style-type: none"> <li>- Upcoming Building Code changes may reduce barriers to water reuse.</li> </ul>
<b>Program 6: Water Quality Management</b>	
21. Outreach to residences / business / industry for aquifer protection in at-risk or vulnerable areas e.g. vulnerable aquifers, riparian areas.	<ul style="list-style-type: none"> <li>- Aquifer protection information would need to be developed.</li> <li>- There are currently outreach programs in place for riparian landowners including Living by the Water, Stewardship BC, Green Shores, The Land Conservancy, etc.</li> </ul>
22. Promote the Environmental Farm Plan program with agricultural community, and explore potential partnerships.	<ul style="list-style-type: none"> <li>- In coordination with outreach work in Program 1</li> </ul>
23. Move forward with 'WellSMART' and 'SepticSMART' education.	<ul style="list-style-type: none"> <li>- In coordination with outreach work in Program 1</li> </ul>
<b>Program 7: Climate Change</b>	
24. Work with MOE to develop a climate change monitoring program.	<ul style="list-style-type: none"> <li>- For example, snowpack monitoring on Arrowsmith.</li> </ul>

**Watershed #1**  
**Big Qualicum River Watershed, Nile Creek,**  
**Thames Creek, Rosewall Creek**



## 1.0 Big Qualicum River Watershed, Nile Creek, Thames Creek, Rosewall Creek

### Analysis

The two main priorities in this area are surface water flows and groundwater sustainability. The community is interested in maintaining surface water flows for ecosystem needs and improving our understanding of groundwater in order to better plan for the future. There is a great deal of concern regarding the sustainability of groundwater supply given current and future development. There is an interest in better understanding the aquifer, including direction of flow, and its sustainable yield. Very little is known about these aquifers. There is one observation well in aquifer 416, but limited knowledge of the surrounding aquifers. Low water tables create stress on local ecosystems, reduce drinking water supplies, and lead to salt water intrusion. There is already evidence of salt water intrusion in the Dashwood area. It is recommended to monitor aquifer levels to establish gradients and assess water quality in near-shore sites. It is also important to protect the highly vulnerable aquifer by promoting best practices to protect water quality in the rural community (reducing dumping, improving poorly functioning septic systems, etc.). There is currently a proposal in place to study the feasibility of a sewer system in the area. There are very active community stewardship groups in this community. There is likely potential to work with these groups on low flow monitoring.

### Recommendations

Priority Action	Notes
1. Develop a better understanding of aquifers and the impacts of extraction by monitoring groundwater levels in all aquifers in the watershed area. <ul style="list-style-type: none"> <li>- <b>1a)</b> Pursue low-cost monitoring opportunities, such as monitoring unused residential wells, to help gather information on unmonitored aquifers #421, 665, 661.</li> <li>- <b>1b)</b> Monitoring well to be installed in aquifer #662 (Qualicum River Village area)</li> <li>- <b>1c)</b> Survey groundwater quality in wells in coastal areas to identify salt water intrusion issues.</li> </ul>	

### Comments

- Groundwater levels seem stable now, but there are questions about sustainable yield.
- MOE confirmed a link between shellfish health and septic system performance. Environment Canada and the VIU Shellfish Research Centre have information on the impacts, which appear to be affecting algae growth.

### Issues (Existing Confirmed Problems)

1. Ecosystem impacts from logging and development, in Big Qualicum, Nile Creek, and Thames Creek (noted by DFO and stewardship groups)
2. Low rivers flows on Thames/Nile Creek likely affecting foreshore ecosystem
3. Salt water intrusion – Dashwood, noted in Flamingo Drive area

### Concerns (Existing, Unconfirmed Problems)

1. Development Impacts east of Bowser – concern over upland development and over-extraction of groundwater
2. Dropping Groundwater Elevations – Deep Bay Area – Lots of extraction (tree farm, private wells, agriculture, forestry, two waterworks, but no coordination of information, extraction)
3. Concern over contamination upstream in Qualicum River
4. Dropping groundwater elevations around Horne Lake

### Threats (Activities)

1. Illegal dumping over highly vulnerable aquifer
2. Recreational activities over highly vulnerable aquifer
3. Development – Bowser, Deep Bay, uplands
4. Septic Systems – affecting groundwater in recharge areas in Deep Bay, affecting shellfish

### Opportunities

1. Transfer Centre
2. Sewer system
3. Water Quality Monitoring – Streamkeepers

### Information Gaps

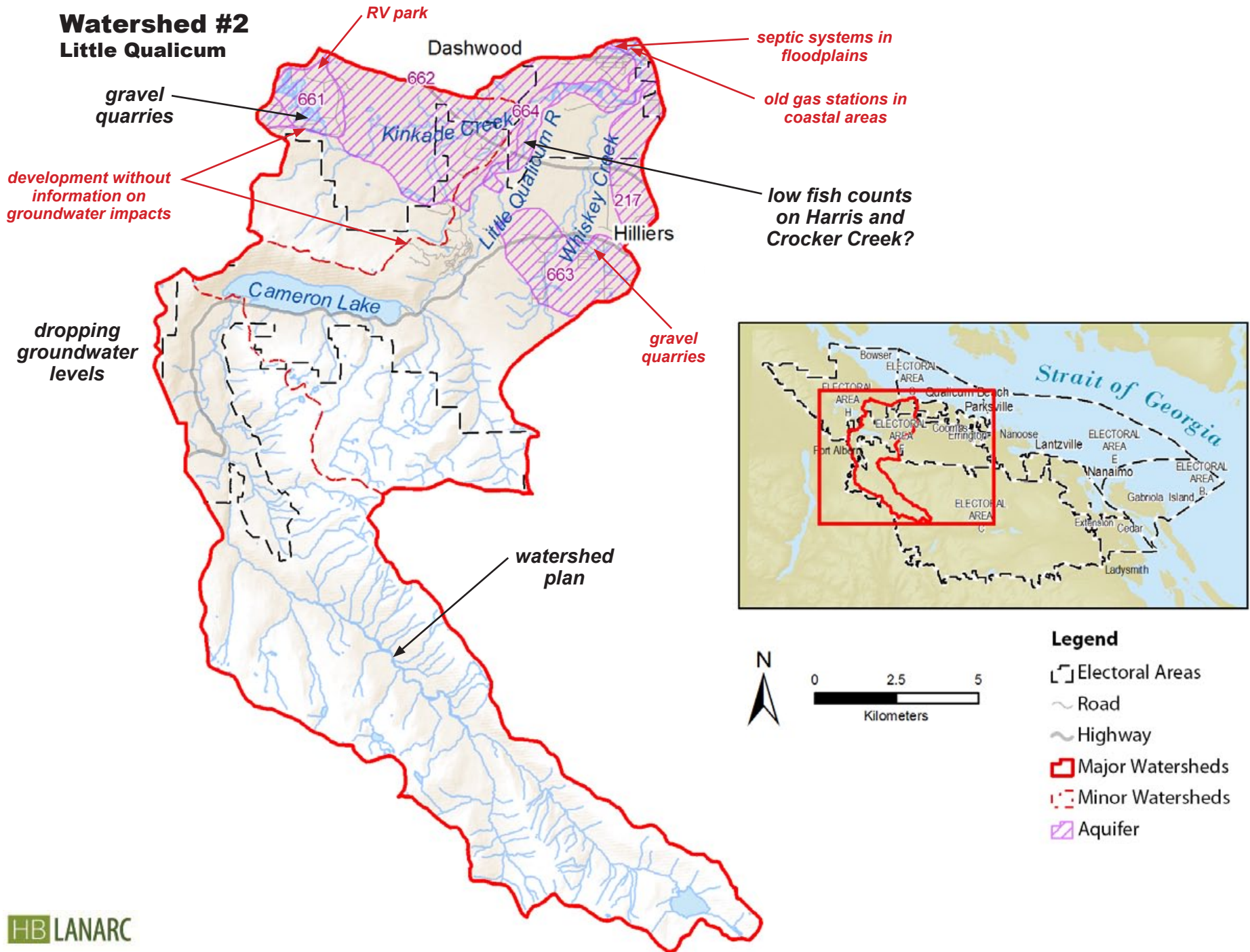
1. Aquifer recharge areas, direction of flow, carrying capacity noted multiple times
2. Big Qualicum – Groundwater/Surface Water Interaction
3. To better understand salt water intrusion, monitor aquifer levels to establish gradients, monitor water quality in near shore sites

### Vulnerabilities

1. Gainsberg swamp – sensitive ecosystem
2. Bowser is drawing from groundwater outflow – vulnerable to up-gradient impacts
3. Aquatic habitat in rivers (e.g., Nile Creek) – Coho and chum salmon require a base flow through summer for rearing habitat



**Watershed #2  
Little Qualicum**



## 2.0 Little Qualicum

### Analysis

There are a significant number of concerns regarding groundwater elevations in the upland areas in Spider Lake and Qualicum River Village. There is limited understanding of groundwater in these areas. There is very little development potential in the Spider Lake area, however there is significant development potential in Qualicum River Village. It is important to understand this aquifer’s ability to support current and future use. Developments such as the Little Qualicum River Estates highlight the importance of inter-jurisdictional communication and the need for hydrogeological assessments to better understand the impacts of extraction.

There is also an interest in protecting the Little Qualicum River, both on a larger scale through a watershed management plan and more directly through floodplain protection. There is an interest in protecting the floodplain from logging as well as from septic system contamination.

### Recommendations

Priority Action	Notes
1. Groundwater level monitoring <ul style="list-style-type: none"> <li>- <b>1a)</b> Spider Lake: Given its limited development potential, pursue low cost monitoring strategies in this area. Consider a volunteer residential monitoring program or look at potential of installing monitoring equipment in capped well in park (first, need to determine if it is the right aquifer)</li> <li>- <b>1b)</b> Qualicum River Estates area has significant development potential and an observation well is to be added in the area and to the MOE Observation Well Network in late 2010/early 2011.</li> </ul>	

### Comments

- Although there were concerns that the Spider Lake Mobile Home Park has the potential for significant impact groundwater levels, there are indications that there are not many permanent residents and therefore the park would not have a large impact.
- In Qualicum River Village, with the existing zoning, there is development potential for the population to double.

## Issues (Existing Confirmed Problems)

1. Significant number of concerns regarding dropping groundwater elevations in Spider Lake and Qualicum River Village area (no monitoring wells, but hydrogeologists, well drillers, landowners report) – Aquifers 661 and 662 - no information on long terms effects of development in these areas
2. Qualicum Beach Observation wells – Dropping groundwater elevations reported

## Concerns (Existing, Unconfirmed Problems)

1. Low fish counts in Harris and Crocker Creek

## Threats (Activities)

1. RV Park near Spider Lake – very large land user and potentially has all year residents – potentially impacting water in Spider Lake area
2. Development without information on impacts – e.g., Spider Lake, Little Qualicum River Estates
3. Development without local authority input – e.g., Little Qualicum River Estates
4. Contamination Potential – Old gas stations in coastal areas
5. Mining Activities - Gravel Quarries at Spider Lake and Whiskey Creek – concerned about impacts on groundwater
6. Activity in flood plains – logging and septic fields
7. Potential commercial clear cutting on Whiskey Creek

## Opportunities

1. Monitoring well –potentially use Dashwood Firehall well
2. Work with property owners in Spider Lake area interested in monitoring private wells
3. Work with stewardship group to monitor water quality in critical fish streams
4. Watershed Plan for Little Qualicum River
5. Protection of LQR floodplain

## Information Gaps

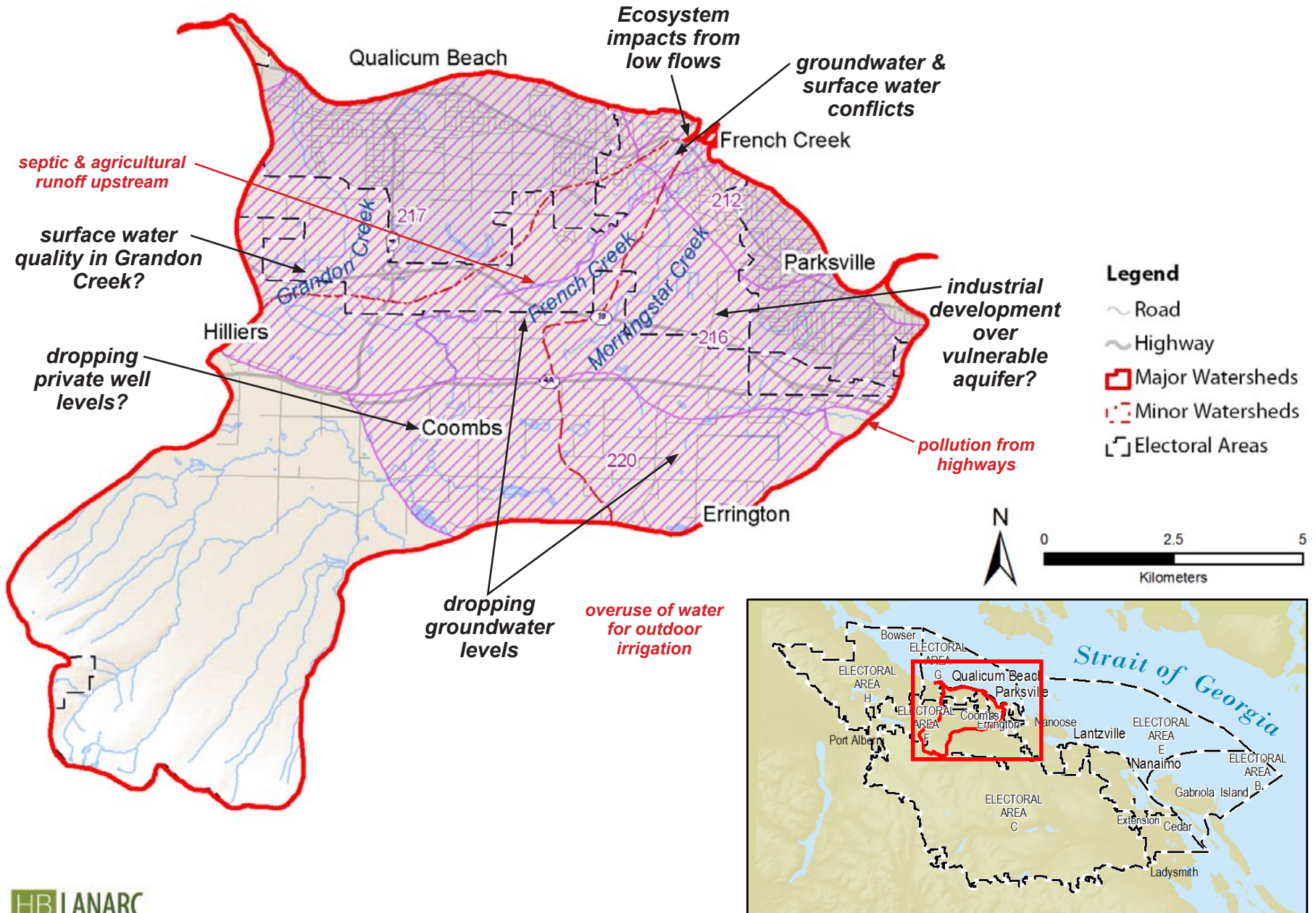
1. Surface Water and Groundwater Interactions and wetland dynamics in Whiskey Creek Area

## Vulnerabilities

1. Little Qualicum River – needs better upstream protection



### Watershed #3 French Creek, Qualicum Beach & Parkville Uplands



### 3.0 French Creek, Qualicum Beach and Parksville Uplands

#### Analysis

There is a significant concern over dropping groundwater elevations in the French Creek watershed and the Parksville-Qualicum aquifers. From 2000 to 2010 groundwater levels have dropped 5m in Aquifer 216. There is a consensus that we need to better understand groundwater and surface water interactions in this watershed. It is likely that these systems are connected. French Creek naturally has summer low flows, but there are concerns that it has unusually low flows in recent years, and that this will impact ecosystem health. There is a relatively high population in this area (approximately 10,000) and with further development and the effects of climate change it is likely that low flow conditions will worsen.

There are also concerns regarding the potential for contamination of the aquifers due to industrial and commercial activities on the land above vulnerable aquifers. It has been recommended to monitor heavily developed aquifers for water quality in addition to water levels, especially aquifer 220. There are concerns that there is significant development potential in unserved areas such as Coombs, off of Highway 4. There are also suggestions on how to improve groundwater stewardship in those areas. Grandon Creek has been noted as a nearby waterway which has the potential to be contaminated by nearby industrial uses. There is an interest in surface water quality testing on Grandon Creek in order to better understand the impacts. Septic systems and agricultural runoff are identified as threats to surface and groundwater quality in the rural headwaters and there is a need to promote rural best management practices. Urban development and runoff may be impacting water quality and it is suggested to create limits on impermeable surfaces to protect the watershed and promote practices that increase infiltration.

#### Recommendations

Priority Action	Notes
1. Pursue aquifer characterization for the Parksville/Qualicum aquifers in the French Creek watershed. Partner with other agencies (e.g. Geological Survey of Canada), municipalities and water suppliers in characterization and source water protection.	- Invite EPCOR, Qualicum Beach, City of Parksville to participate in this process.
2. Consider a Rural Water Quality Improvement Program to promote best management practices for septic systems and agriculture in this area.	- Partner with municipalities as it relates to Source Water Protection. Partner with Wastewater Services for promotion of BMPs with on-site systems.
3. Obtain information on groundwater quality in vulnerable aquifers in developed areas (e.g. aquifer 216)	- Obtain information on water quality in the developed, highly vulnerable aquifers. The City of Parksville currently monitors production wells in aquifer 216. Explore other potential data sources (e.g. EPCOR, etc.) to determine if there are impacts to groundwater quality caused by land uses over vulnerable aquifers.

## Comments

- Summer extractions from French Creek during low flows are potentially harmful to fish and aquatic ecosystem – look for opportunities to encourage MOE and groundwater legislation to manage extraction quantity and timing.

## Issues (Existing Confirmed Problems)

1. Parksville Aquifers – primarily aquifers 216 and 220, but also aquifer 217 have significantly declining water levels. This affects the municipal water supply wells and also private residential wells. Some private wells show dropping levels in the Coombs area.
2. French Creek low flows are causing ecosystem impacts
3. Groundwater and surface water conflicts
4. Private wells going dry (at least seasonally) in Coombs and vicinity

## Concerns (Existing, Unconfirmed Problems)

1. Impact of industrial development in Church Road area on vulnerable aquifer
2. Potential for contamination of EPCOR wells
3. Surface water quality in Grandon Creek
4. Runoff and flooding concerns

## Threats (Activities)

1. Overuse of water for outdoor watering in Town of Qualicum Beach
2. Industrial/Commercial Development in Coombs - Land use / highway configuration lends itself to strip development with large parcels. Lack of service makes this land most attractive to industry / unregulated commercial development. Since this is upstream of Parksville, potential impact to surface and groundwater is high
3. Urban Development – impermeable surfaces
4. Septic runoff into French Creek in upstream areas (Coombs)
5. Agricultural runoff into French Creek in upstream areas (Coombs)
6. Automobile pollution from highways
7. Automobile wrecking yards on Grandon Creek – automobiles potentially leaking contaminants that could impact surface and groundwater quality
8. The closed Qualicum Beach landfill south of Rupert Road (and its leachate monitoring wells)

## Opportunities

1. Promote smarter water systems (with precipitation sensors) for residences
2. Keep impermeable surface areas on properties as low as possible
3. Survey recharge areas (in detail) along highway 4; create signage, inventory land use and install monitoring wells

## Information

### Gaps

1. Groundwater/Surface Water Interactions
2. Need to better understand actual use for licensed surface water extractions and groundwater users
3. Identify recharge areas along Highway 4
4. Need to monitor heavily developed aquifers for water levels and water quality – e.g. aquifers 216, 209, and 220. Parksville currently monitors raw water quality in their production wells. Seek other potential sources of information on water quality in the area

### Sources:

1. City of Parksville rainfall gauge – community park and sewer monitor
2. Riparian Areas reports

## Vulnerabilities

1. Relatively vulnerable aquifers in watershed
2. Many users of water in area without a good understanding of interconnections
3. French Creek - Sensitive Stream Designation
4. Romney, Carey and Beach Creek



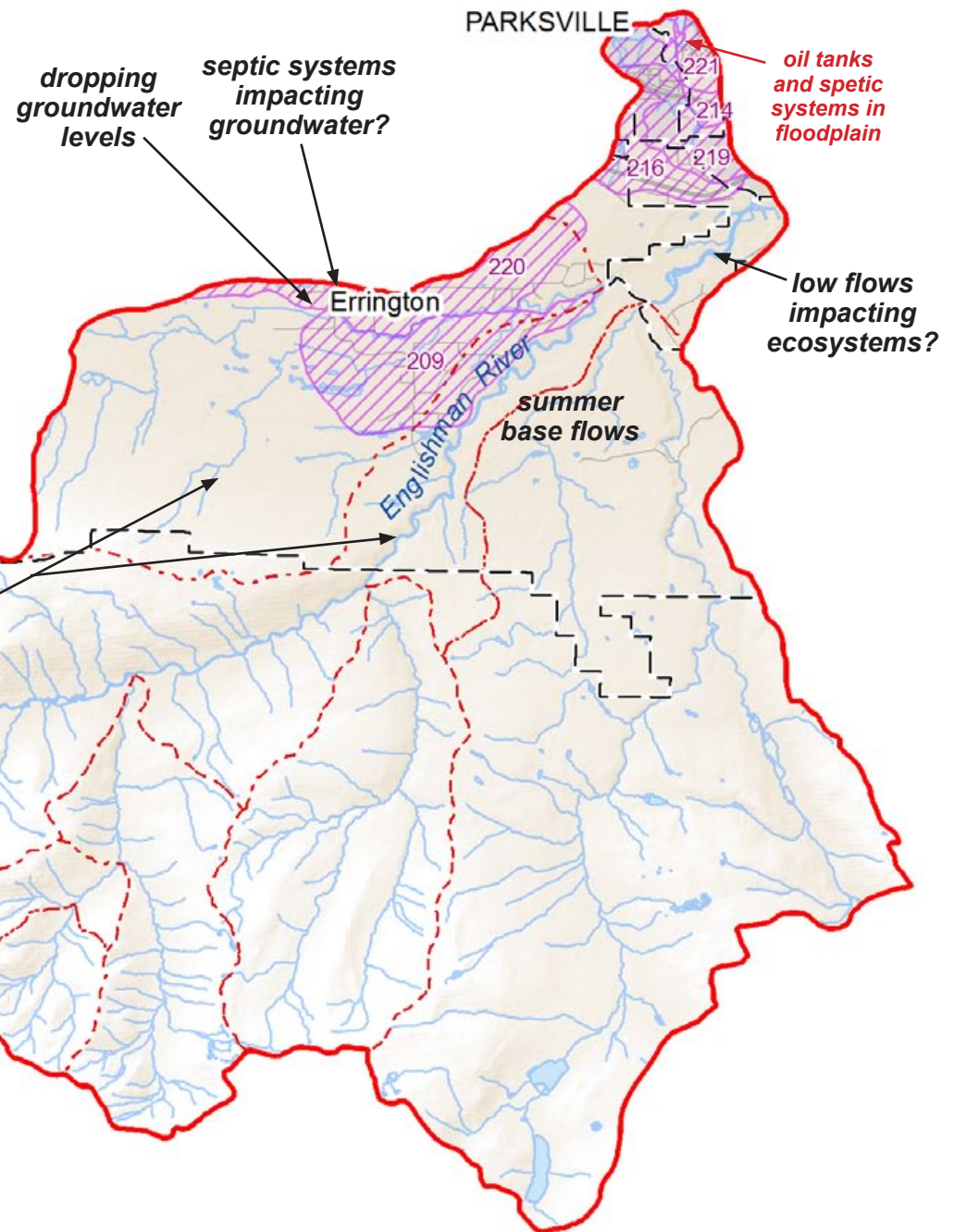
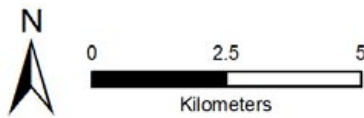
## Watershed # 4 Englishman River



### Legend

- ~ Road
- ~ Highway
- ▭ Major Watersheds
- - - Minor Watersheds
- ⌈ Electoral Areas
- ▨ Aquifer

*agricultural activity on Morrison Creek affecting water quality in Englishman River*





## 4.0 Englishman River

### Analysis

The Englishman River is a major water supply source for the local community. It is also a valuable fisheries river. Groundwater plays a key role in summer low flows in the river and there is an interest in better understanding this relationship and maintaining sufficient summer low flows for ecosystem health. Septic systems and agricultural activities are potential threats to surface and groundwater quality in the rural portions of the watershed (e.g., Morrison Creek). In this area, there are concerns regarding overuse of water for outdoor watering as well as the cosmetic use of pesticide and herbicide in urban areas. The northern portion of this watershed includes part of aquifer 220, which is showing declining water levels.

### Recommendations

Priority Action	Notes
1. Work with partners to better understand groundwater-surface water interactions.	- Partners include MVIHES, Geological Survey of Canada, etc.
2. Determine if there is a need for an ongoing water quality survey of the tributaries and main-stem of the river to protect the source of the local water supply.	- Full spectrum testing is currently done by the City of Parksville. If interested, partner with municipalities and water suppliers in further source water protection.
3. Consider a Rural Water Quality Improvement Program Pilot Project to promote best management practices for septic systems, fuel storage and agriculture in this area.	- Partner with municipalities as it relates to Source Water Protection, and Wastewater Services for on-site systems.

### Issues (Existing Confirmed Problems)

1. Agricultural activities on Morrison Creek affecting water quality in Englishman River
2. Groundwater levels dropping in wells in Errington area (aquifer 220)

### Concerns (Existing, Unconfirmed Problems)

1. Cosmetic pesticide and herbicide use polluting groundwater
2. Unregulated water license users are over-extracting
3. Ecosystem impacts – MOE believe 10% of Mean Annual Discharge (MAD) is acceptable for rearing fish
4. Onsite septic systems in Errington impacting groundwater

### Threats (Activities)

1. Overuse of groundwater for outdoor water use in the summer
2. Septic Systems in floodplains in Parksville
3. Oil Tanks in floodplains of Englishman in Parksville
4. Logging in watershed
5. Transfer of water out of watershed to surrounding communities through the Arrowsmith Water Service
6. Abandoned Parksville landfill in the Englishman River flood plain

### Opportunities

1. Reduce poor industrial, commercial and institutional irrigation practices
2. Pulse flow opportunities to facilitate fish migration (RDN, City of Parksville, DFO)
3. Keep forests intact in watersheds and recharge areas

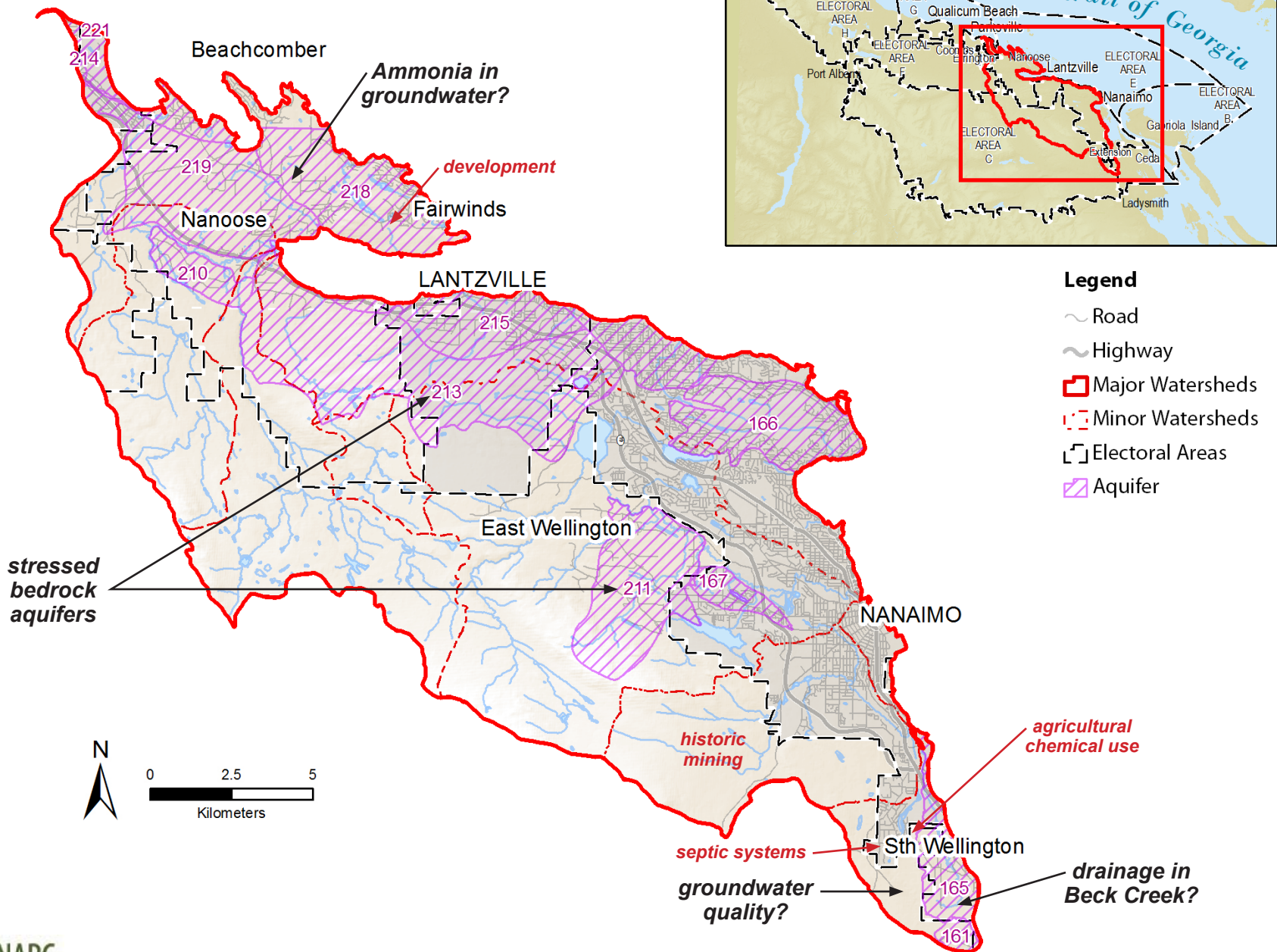
### Information Gaps

1. Groundwater and Surface Water Interactions
2. Impact of climate change on water supplies
3. Publically available information on groundwater quality from private wells (e.g., Errington)
4. Need to understand consumption by different land uses prior to setting priorities
5. Information on actual use of large private water users (e.g., irrigation, golf courses, industrial, resorts)

### Vulnerabilities

1. Estuary – sensitive ecosystem vulnerable to contamination (e.g., from stormwater outfalls)
2. Arrowsmith Water Service Intake on River – Community Watershed
3. Englishman River - Sensitive Stream Designation – Vulnerable aquatic ecosystems

### Watershed #5 South Wellington to Nanoose



## 5.0 South Wellington to Nanoose

### Analysis

This area is a mix of rural and urban development including the District of Lantzville, the City of Nanaimo, the Nanoose Peninsula, and South Wellington. Comments included in this snapshot are focused primarily on the Electoral Area lands. Located close to the urban area of Nanaimo, these Electoral Area lands contain a significant amount of recent residential development with a large footprint.

This region has a large number of bedrock aquifers. There are concerns that many of these aquifers, especially in the northern half of the region (e.g., 218 - Nanoose, 213 – Superior Road area, 213 – Benson Meadows area), are under stress. Many of the suggestions focus on water conservation including the development of irrigation guidelines, encouragement of xeriscaping, promotion of rainwater use to reduce water consumption, and reduction of impermeable surfaces (to help promote recharge). Many of the areas that are most greatly impacting groundwater quantity may not face financial barriers to water conservation (Benson Meadows, Lantzville, Fairwinds) – and therefore it will be important to identify the best tactics for reducing water use in these communities

The impact of septic fields and agricultural chemical use on groundwater quality is mentioned in the Benson Meadows and South Wellington area. There is a high density of shallow dug wells and septic systems in the South Wellington area which has the potential to affect groundwater quality. There is also an interest in better understanding the impacts of historical activities (mining, contaminated sites) on the quality of groundwater in this area.

### Recommendations

Priority Action	Notes
1. Implement a groundwater quality (nitrates, bacteria, chemicals) monitoring study in South Wellington and Cassidy	<ul style="list-style-type: none"> <li>- Monitoring should target areas with a high density of septic systems</li> <li>- In addition to monitoring groundwater, potentially conduct water quality testing in ditches and streams</li> <li>- South Wellington extends into part of Watershed 6.</li> </ul>
2. Include high water use neighbourhoods in a <i>Community Based Social Marketing</i> (CBSM) Pilot Project.	<ul style="list-style-type: none"> <li>- Target neighbourhoods might include Fairwinds, Benson Meadows.</li> </ul>

## Issues (Existing Confirmed Problems)

1. Dropping groundwater levels, stressed bedrock aquifers – Benson Meadows (aquifer 211), Superior Road/Westwind Drive (Aquifer 213)
2. Water supply issues in Lantzville

## Concerns (Existing, Unconfirmed Problems)

1. Poor groundwater quality due to concentration of wells and septic fields as well as agricultural chemical use in South Wellington
2. Groundwater Quality – Ammonia in Nanoose – interest in identifying source
3. Drainage issues - Beck Lake/Beck Creek – Beck Creek no longer drains properly
4. Salt intrusion in Lantzville along Dickinson Road

## Threats (Activities)

1. Increased development in Nanoose
2. Golf course impact on water quantity and degradation of water quality (Fairwinds/Nanoose)
3. Agricultural Chemical Use - South Wellington
4. Development of large homes – large homes=high water use
5. Mining – Need to better understand impacts on water quality (e.g., South Wellington area)
6. On-Site septic system failures and poor maintenance (e.g., Benson Meadows, South Wellington)

## Opportunities

1. Explore the development of septic maintenance/inspection regulations
2. Increase education with respect to water conservation
3. Work with the Province to promote water conservation opportunities in the Building Code
4. Broaden discussion to include First Nations
5. Partner with schools to educate on climate change and water use
6. Develop irrigation guidelines to prevent overuse
7. Partner with nurseries, garden clubs, and BCLNA to encourage xeriscaping
8. Increase permeable surfaces in urban areas

## Information Gaps

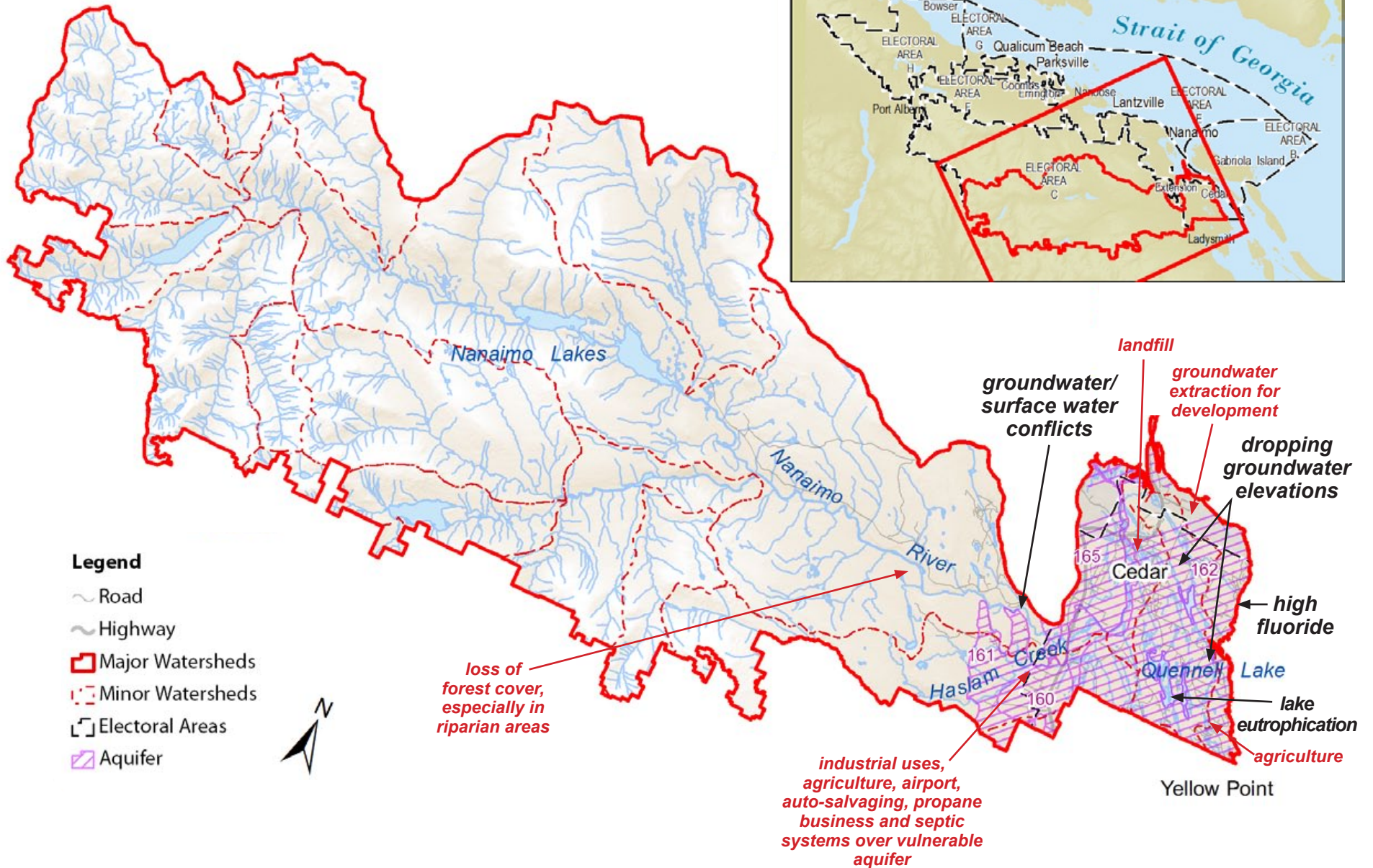
1. Need an observation well in aquifer 219
2. Fill information gaps with climate data from elementary school network run by UVIC, City of Parksville rainfall gauge (P/W yard), and other sources
3. Contaminated Sites

## Vulnerabilities

1. Lots of bedrock aquifers in this area - wells – react quickly to rain and impacted by land use
2. Coastal Douglas Fir Ecosystem and wetlands
3. Rural land – limits to well and septic capacity



## Watershed #6 Nanaimo River Watershed and South Area A



## 6.0 Nanaimo River Watershed and South Area A

### Analysis

The Nanaimo River watershed is currently primarily rural with some areas of urbanization and industrial activity. This watershed has the potential for significant growth in the future. The two main concerns in the area are groundwater supply in the Yellow Point Aquifer, and groundwater quality in the Cassidy aquifer. From 2000 to 2010 groundwater levels in the Yellow Point aquifer have dropped an average of 13m. Some of the residents in the area that are not in the North Cedar Improvement District (NCID) water service area rely on bulk water deliveries or rainwater catchment for water supplies in the later summer months. The Yellow Point aquifer was ranked as the second highest priority aquifer on Vancouver Island by the Ministry of the Environment in a recent review of the Observation Well Network due to its low productivity, increasing population, and significantly dropping groundwater elevations. There is also evidence of salt water intrusion in this aquifer along the coast. Residents have expressed concerns over the ability of this aquifer to support any future development.

The Cassidy aquifer is a large aquifer that is highly vulnerable to contamination. In the Cassidy area, there is a strong concern that land uses including wrecking yards, airport activities, fuel storage, forestry, trailer parks, on-site systems, and landfills could impact the groundwater quality in this vulnerable aquifer.

Surface water is also a concern in this watershed. Small lakes in the Yellow Point area face eutrophication, possibly caused by septic systems or agricultural runoff. There is an interest in better understanding the groundwater and surface water interactions between the Nanaimo River and the Cassidy aquifer. This interaction is particularly important for protecting base flows in the Nanaimo River and maintaining the health of the estuary.

### Recommendations

Priority Action	Notes
1. Work with Development Services to strengthen the OCP to require a more rigorous approach to determining long term water supply for new development that protects the resource.	- Underway as part of the Area A OCP update
2. Monitor groundwater levels in private wells in Yellow Point.	<ul style="list-style-type: none"> <li>- Develop volunteer private well monitoring program</li> <li>- Determine if information on lake levels would be helpful in assessing aquifer health. This information may be collected by BC Conservation Foundations or other organizations.</li> </ul>
3. Install and monitor new observation well in Yellow Point aquifer.	- To be added to Provincial Observation Well Network



Priority Action	Notes
4. Obtain information on groundwater quality in vulnerable aquifers in developed areas that have industrial land uses (e.g. Cassidy).	- The Airport may be interested in working together for this program as they may already have a monitoring program in place.
5. Rural Water Quality Program target/pilot project area – Yellow Point, South Wellington, Cassidy.	- Potential pilot project areas in South Wellington, Cassidy (due to high density wells and septic systems) and in Yellow Point to address lake eutrophication.
6. Groundwater quality monitoring study in South Wellington, Cassidy.	<ul style="list-style-type: none"> <li>- High density wells and septic systems over vulnerable Cassidy aquifer.</li> <li>- In addition to monitoring groundwater, potentially conduct water quality testing in ditches and streams</li> </ul>

### Issues (Existing Confirmed Problems)

1. Groundwater/Surface Water Conflicts in Nanaimo River
2. Surface water quality concerns - Eutrophication of small lakes in Yellowpoint area
3. Groundwater quantity issues in Yellowpoint Aquifer: Dropping groundwater levels in private wells, many wells go dry, salt water intrusion in foreshore, dropping levels in OBS well
4. Groundwater quality issues in Yellowpoint Aquifer – high fluoride

### Concerns (Existing, Unconfirmed Problems)

1. Over extraction of groundwater in Yellowpoint Aquifers
2. Potential impacts of septic disposal on both ground and surface water
3. Cassidy –potentially dropping groundwater levels
4. Surface Water Quality concerns due to agriculture
5. Groundwater contamination in the Cassidy aquifer due to Industrial Commercial uses

## Threats (Activities)

1. Forestry and development – loss of permeable surfaces and forest cover, especially in riparian areas
2. Regional Landfill – contamination potential
3. Agricultural Runoff – impacts surface water quality especially in smaller lakes and creeks
4. Industrial Activities:
  - Industrial activities and auto salvaging operation in South Wellington area over vulnerable aquifer
  - Airport – Industrial Commercial development use over vulnerable aquifer
  - Propane tanks – buried from old propane business in Cassidy area
5. Development:
  - Oceanview – large extractions for recreation from low producing aquifer
  - Any further extraction from low producing Yellowpoint Aquifer may be unsustainable
  - Residential Development in Cassidy – concerns over increased extraction
  - Increased impermeable surfaces
6. On-site systems – Cassidy (trailer parks, especially), NCID, Cedar Rd near river – flood during rainy season

## Opportunities

1. Explore the development of septic maintenance regulations
2. Central disposal location for electronic and other hazardous waste so it doesn't end up in landfill
3. Work with realtors to obtain and share water resource information
4. Allow roof collection and cistern storage for water supplies
5. Evaluate new methods/equipment for agricultural watering
6. Work with Ducks Unlimited to explore data sets for Becks Creek

## Information Gaps

1. Nanaimo River- groundwater and surface water interactions
2. Water Quality Monitoring – both ground and surface water
3. Need to obtain information on actual extractions of surface water and groundwater (including agricultural use)

## Vulnerabilities

1. Cassidy aquifer is highly vulnerable
2. Yellowpoint aquifer is very low producing

## Watershed #7 Gabriola Island

*dropping  
groundwater  
levels*

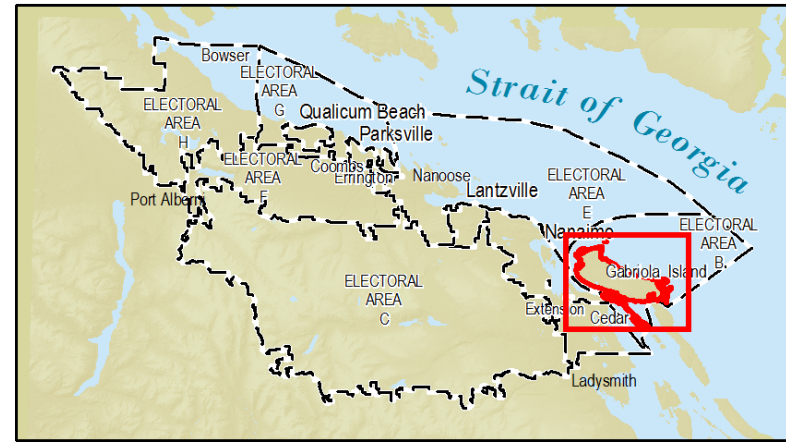
*increased  
development  
and extraction*

*salt water  
intrusion along  
foreshore*

*bulk water  
extraction*

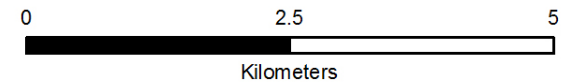
*high density  
wells and  
septics*

*groundwater  
quality  
concerns?*



### Legend

- Road
- Highway
- Major Watersheds
- Minor Watersheds
- Electoral Areas
- Aquifer



## 7.0 Gabriola Island

### Analysis

Gabriola Island is largely rural with water supplies provided primarily via private wells in aquifers that rely on rainwater recharge. Precipitation in the form of rain is the only source of water on Gabriola Island. Gabriola Island is unique from the remainder of the Regional District in that the Island has limited natural water storage capacity. In the rest of the Regional District, winter precipitation is stored in the mountains in the form of snow. On Gabriola, aquifers are the only significant natural water storage available. Due to the low coastal elevation, there is no opportunity for snowpack accumulations and storage.

There are significant concerns about the availability of groundwater. Currently, many private wells go dry in summer months and due to unreliable groundwater supplies, many residents rely on rainwater harvesting as their primary (potable and non-potable) water supply. There is a concern that there is not enough groundwater available in aquifers to support further growth based on current zoning. In addition to this, commercial groundwater extraction for bulk water sales raises questions associated with the long term sustainability of the aquifers and issues related to equity of supply to neighbouring properties.

There are also concerns regarding groundwater quality in this area. There are no sewer services on the Island and residents are concerned that failing/poorly maintained or high density septic systems will impact neighbouring wells. The density of lots with individual wells and septic disposal is one of the highest in the RDN Electoral Areas. There are also naturally occurring chemicals in the groundwater in some areas (Boron, Fluoride) that exceed Canadian Drinking Water Quality standards.

There is a great deal of interest in better understanding the availability of groundwater and aligning this with further development. There is also an interest in enabling and supporting rainwater collection as a water source. There is an active citizens’ group – the Gabriola Groundwater Management Society – that is interested in partnering with the RDN for groundwater protection initiatives.

### Recommendations

Priority Action	Notes
1. Develop groundwater monitoring strategy to better understand water levels. <ul style="list-style-type: none"> <li>- <b>1a)</b> Install observation well in the Village</li> <li>- <b>1b)</b> Monitor water levels in volunteer private wells</li> </ul>	
2. Develop a program to obtain well records and locate wells.	
3. Rural Water Quality Program	

## Issues (Existing Confirmed Problems)

1. Limited groundwater supply– many private wells go dry in the summer
2. Dropping groundwater levels – in particular, north side of Island
3. Saltwater Intrusion along foreshore
4. Groundwater quality – high Boron, Fluoride, pH

## Concerns (Existing, Unconfirmed Problems)

1. Dropping groundwater elevations – locally around commercial extraction
2. Dropping groundwater elevations – concern of over-extraction of groundwater across the Island
3. Groundwater quality –bacteria concerns due to high density septic systems and wells
4. Groundwater quality – potential for lowered water tables to increase certain chemical concentrations
5. Future groundwater supply – Aquifers may not be able to accommodate current development potential

## Threats (Activities)

1. Increased population growth
2. Bulk water extraction
3. Septic systems –poorly functioning and failed systems, as well as too high density with wells
4. Development – dropping groundwater levels, ditches, and tree clearing on hills will prevent recharge
5. Deep drilling, hydrofracturing

## Opportunities

1. Explore the development of septic maintenance regulations
2. Work with the Province to provide water conservation opportunities in the Building Code
3. Allow/require rainwater harvesting using cisterns – allow with Building Codes and building permits
4. Identify groundwater availability
5. Support homeowners with knowledge on how to measure well levels, identify salinity, know when they're over pumping, and when to stop pumping
6. Education on groundwater protection
7. Work with Gabriola Groundwater Management Society
8. New development should require permeable paving
9. Gabriola folklife and village water usage information (Islands Trust rezoning)

## Information

### *Sources:*

- Ecosensitive Mapping
- Islands Trust Fund Board – Regional Conservation Plan

### *Gaps:*

- Need an observation well in the Village area
- Need to align vulnerability and groundwater availability maps to inform zoning

## Vulnerabilities

1. Aquifers may not be able to accommodate significant population growth
2. Rising sea level due to climate change
3. Vulnerable to drought

## 8.0 Next Steps

The key recommendations from this 'Watershed Snapshot' will be integrated into the overall *Drinking Water & Watershed Protection* program.

RDN staff will use the input to refine – refocus – the budget allocations for programs and projects in the upcoming years. The input will also allow programs to be focused on key geographic areas – places where either problems or opportunities warrant priority action.

As the RDN, its residents, and its watersheds are constantly changing, the RDN intends to create a living document to solicit public input on an ongoing basis to help guide the *Drinking Water & Watershed Protection* program in future years.

## 9.0 Region-Wide Action Schedule

Table 1 provides a summary of the *Priority Actions* that have come forward through the 2010 work with stakeholders and the community. These actions will be the focus of the *Drinking Water Watershed Protection Action Plan* for the next three years. A review of these priorities and related implementation progress will be held regularly, with community input, as the program unfolds.

**Table 1: Region-wide Actions**

Priority Action	2011			2012			2013		
<b>Program 1: Public Awareness and Involvement</b>									
1. Develop an interactive website that allows easy access to water resource knowledge, and water stewardship resources.	Ongoing								
2. Continue outreach activities – focus on outdoor water conservation.									
3. Develop and implement a strategy for rainwater reuse.									
4. School education programs.									
Priority Action	2011			2012			2013		
<b>Program 2: Water Resources Inventory and Monitoring</b>									
5. Develop indicators for assessing water resources, which can be monitored on a yearly basis across the Region to track the health of water resources.									
6. Develop Water Budgets for each of the seven (7) major watershed areas.									
7. Refine water budgets.									
8. Better understand water extraction by collecting water use information on representative user groups e.g. golf courses, agriculture, commercial/industrial.									
9. Create central repository for storing river flow data (high and low), stream temperature, etc. Train and work with Stewardship Groups to monitor flows and install automated data collectors as needed on priority waterways.									
10. Start groundwater level monitoring by working with major users.									
11. Work with the Ministry of Environment and local volunteers to monitor surface water quality in priority rivers, lakes, and streams.									



**Table 1: Region-wide Actions (Continued)**

Priority Action	2011		2012		2013	
<b>Program 3: Land Planning and Development</b>						
12. Strengthen Regional Growth Strategy language regarding protection of drinking water and watersheds.	■	■				
13. Adopt Low Impact Development Engineering standards with Development Services and Sustainability Departments and MOTI.				■	■	■
14. Update Landscape and Irrigation Design standards and bylaws. Include performance requirements for properly designed irrigation systems, soil depth, etc. to reduce water use.			■	■	■	
15. Refine requirements for aquifer and surface water assessments for subdivision and development proposals. Information should be submitted in a format that is of value in providing an increased understanding of water resources in the Region.				■	■	■
16. Consider requiring new development to include hydrological impact modeling using the Water Balance Model or other hydrological modeling tools.				■	■	■
<b>Program 4: Watershed Management Planning</b>						
17. Work with Development Services to develop bylaws addressing construction best management practices including sediment & erosion control, spill preparedness, etc.				■	■	
<b>Program 5: Water Use Management</b>						
18. Develop a voluntary Water Purveyor Working Group, to assist small water purveyors in the Region.	■		■	■	■	■
19. Provide incentives for water conservation practices, both indoor and outdoor.			■	■	■	■
20. Communicate building options for rainwater and grey water reuse in cooperation with the BC Building Safety Branch and local building inspectors.				■	■	

**Table 1: Region-wide Actions (Continued)**

Priority Action	2011			2012			2013		
<b>Program 6: Water Quality Management</b>									
21. Outreach to residences / business / industry for aquifer protection in at-risk or vulnerable areas e.g. vulnerable aquifers, riparian areas.									
22. Promote the Environmental Farm Plan program with agricultural community, and explore potential partnerships.									
23. Move forward with 'WellSMART' and 'SepticSMART' education.									
<b>Program 7: Climate Change</b>									
24. Work with MOE to develop a climate change monitoring program.									

## 10.0 Watershed Specific Action Schedule

Table 2 provides a summary of the *Watershed Specific Actions* that have come forward and will be the focus in each of these seven (7) areas over the next three years.

**Table 2: Watershed Specific Actions**

Priority Action	2011		2012				2013			
Watershed 1: Big Qualicum, Nile, Thames, Rosewall										
1. Develop a better understanding of aquifers and the impacts of extraction by monitoring groundwater levels in all aquifers in the watershed area.										
a) Pursue low cost monitoring opportunities, such as monitoring unused residential wells, to help gather information on unmonitored aquifers #421, 665, 661.										
b) Monitoring wells to be installed in aquifer 662 (Qualicum River Village area)										
c) Survey groundwater quality in wells in coastal areas to identify salt water intrusion issues.										
Watershed 2: Little Qualicum										
1. Groundwater level monitoring:										
a) Spider Lake: Given its limited development potential, pursue low cost monitoring strategies in this area. Consider a volunteer residential monitoring program or look at potential of installing monitoring equipment in capped well in park (first, need to determine if it is the right aquifer).										
b) Qualicum River Estates Area: has significant development potential and an observation well is to be added in the area and to the MOE Observation Well Network in late 2010/early 2011.										

**Table 2: Watershed Specific Actions (Continued)**

Priority Action	2011				2012				2013			
Watershed 3: French Creek, Qualicum Beach and Parksville Uplands												
1. Pursue aquifer characterization for the Parksville/Qualicum aquifers in the French Creek watershed. Partner with other agencies (e.g. Geological Survey of Canada), municipalities and water suppliers in source water protection.	■	■	■	■	■	■	■	■				
2. Consider a Rural Water Quality Improvement Program Pilot Project to promote best management practices for septic systems and agriculture in this area.					■	■	■	■	■	■	■	■
3. Obtain information on groundwater quality in vulnerable aquifers in developed areas (e.g. Aquifer 216).			■	■								
Watershed 4: Englishman River												
1. Work with partners to better understand groundwater-surface water interactions.	■	■	■	■	■	■	■	■				
2. Consider a Rural Water Quality Improvement Program Pilot Project to promote best management practices for septic systems, fuel storage and agriculture in this area.					■	■	■	■	■	■	■	■
Watershed 5: South Wellington to Nanoose												
1. Implement a groundwater quality monitoring study in South Wellington (nitrates, bacteria, chemicals) and Cassidy.		■	■	■								
2. Include high water use neighbourhoods in a <i>Community Based Social Marketing</i> (CBSM) Pilot Project.			■	■	■	■	■	■	■	■	■	■
Watershed 6: Nanaimo River and South Area A												
1. Work with Development Services to strengthen the OCP to require a more rigorous approach to determining long term water supply for new development that protects the resource.	■											
2. Monitor groundwater levels in private wells in Yellow Point.			■	■	■	■	■	■	■	■	■	■
3. Install and monitor new observation well in Yellow Point.	■	■	■	■	■	■	■	■	■	■	■	■
4. Obtain information on groundwater quality in vulnerable aquifers that have industrial land uses (e.g. Cassidy).			■	■	■	■	■	■	■	■	■	■

**Table 2: Watershed Specific Actions (Continued)**

Priority Action	2011				2012				2013			
Watershed 6 (Continued): Nanaimo River and South Area A												
5. Rural Water Quality Improvement Program target/pilot project area – Yellow Point, South Wellington, Cassidy.												
6. Implement a groundwater quality monitoring study in South Wellington and Cassidy.												
Watershed 7: Gabriola Island												
1. Develop groundwater monitoring strategy to better understand water levels. a) Install observation well in the Village												
b) Monitor water levels in volunteer private wells.												
2. Develop a program to obtain well records and locate wells.												
3. Rural Water Quality Program												

## Glossary

**Concern (existing, confirmed problem)** – Problems that people are concerned may exist, but that are currently unconfirmed. For example, in the maps they may be denoted as '*Dropping groundwater elevations?*', '*groundwater quality?*', '*ecosystem impacts?*'.

**Hydrogeological assessment** – An assessment of the characteristics of the aquifer and its ability to accommodate the additional groundwater demand proposed by a development.

**Issue (existing, confirmed problem)** - Problems that currently exist, or can be reasonably predicted to be a problem in the near term if trends continue. For example, in the maps they may be denoted as '*Dropping groundwater elevations?*', '*low flows?*', '*ecosystem degradation?*'.

**Threat (Based on human activity)** – Activities on the landscape that, if managed improperly, may cause an issue to occur in the future. For example, *Waste disposal, chemical use, handling practices, development.*

**Vulnerability** - Areas that are particularly sensitive to human impacts and where mismanagement would lead to a greater risk to human and/or environment health. Vulnerable areas are usually based on the geology and lay of the land. – *e.g. Wellhead areas, surface water intake areas, vulnerable aquifers, recharge areas, ecologically sensitive areas.*

**Water Budget** – A *water budget* looks at how much water enters a watershed, how it's stored and how much water leaves. It also looks at what we are doing on the land that impacts water quality and quantity and then this information helps us to determine how much water is available for human uses while ensuring there is still enough left for natural processes.<sup>2</sup>

<sup>2</sup> Conservation Ontario, "*Integrated Watershed Management: Navigating Ontario's Future – A Water Budget Overview*", (October 2009). URL source: <[http://www.conservation-ontario.on.ca/watershed\\_management/reports/IWM\\_WaterBudgetOverview\\_Final\\_Jun2.pdf](http://www.conservation-ontario.on.ca/watershed_management/reports/IWM_WaterBudgetOverview_Final_Jun2.pdf)>, (November 2010).