Climate-Informed Water Supply Planning and Communication Approaches in the Regional District of Nanaimo

October 2023

Prepared for

REGIONAL DISTRICT OF NANAIMO

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Executive Summary

This report summarizes work completed in 2022 to review current water supply planning practices in the Regional District of Nanaimo (RDN) region. It responds to recommendations of the RDN's Climate Action Technical Advisory Committee. Established in 2020, this committee was made up of local resident experts and elected officials. Its purpose was to provide advice and recommendations to the RDN Board of Directors on emerging climate issues and to update the RDN's strategy for community climate mitigation and adaptation. The first recommendation in its final report, the genesis for this this project, is as follows: "ensure water supply resilience, including effective integration of Natural Asset Management" (see RDN, 2021).

This report provides a high-level summary of generally accepted best practices developed specifically for this project. Within this context, it also summarizes current practices in the region, noting that water service providers both large and small operate independently and are responsible for governing and managing their own systems. As such, the intent is not to evaluate or assess any organization's approach or practices. It also documents current water allocation and licensing practices by the Provincial Government and how these have been adapted to respond to climate change. Finally, it offers a series of overarching observations and several recommendations to assist the RDN and its partners to support future supply planning.

Detailed supply profiles for the region's five local government water service providers can be found in Appendix 2, and summaries are provided in the body of the report.

Water Service Provision in the Region

In addition to dozens of very small private water systems, there are 16 larger and/or government water service providers in the region, as follows:

- three First Nation systems (Snaw-Naw-As, Snuneymuxw, and Qualicum Nations);
- four local government systems (Lantzville, Nanaimo, Parksville, Qualicum Beach);
- one regional district (RDN's nine water service areas);
- seven improvement districts; and,
- one large private water utility (EPCOR's French Creek service).

The five municipal providers alone jointly supply approximately 92% of the total water serviced population.

In addition, approximately 14% of the total census population are not water service provider customers. Most of these people live in rural areas and get their water from domestic wells, surface water sources, or small private systems.

Best Practices for Climate-Informed Water Supply Planning

A set of high-level best practices were developed for this project. This was done for two reasons. First and foremost, over the longer term, it is a resource that may assist water service providers with building supply resilience. Second, it provided a benchmark for the project team to review current supply planning.

The best practices are set out in full in Appendix 1. The following table lists the major headings.

Summary Table of Best Practices for Climate-Informed Water Supply Planning

Step	Best Practice
1.0	**Understand Supply**
1.1.1	**Groundwater**: Determine the long-term sustainable well capacity for supply wells
1.1.2	**Groundwater:** Detect changing conditions from groundwater chemistry sampling
1.2.1	**Surface water:** Collect data and information on water availability and climate
1.2.2	**Surface Water:** Assess the amount and timing of current and future water availability
1.2.2	**Surface Water:** Assess how much storage capacity is available to supplement natural flows
2.0	**Forecast Demand**
2.1	Measure water production and consumption
2.2	Assess historic bulk water production trends
2.3	Assess current and past customer water consumption
2.4	Assess and manage non-revenue water and system loss
2.5	Estimate future changes in the size of the service population
2.6	Forecast future water demand
3.0	**Plan and Manage for Resilience**
3.1	Use adaptive and risk-based planning practices
3.2	Plan for drought and emergencies
3.3	Explore alternative supply and/or storage options
3.4	Promote water use efficiency by residents and customers
4.0	**Communicate with Residents and Customers**
4.1	Increase awareness of supply, its value, constraints, and risks for users and decision makers
4.2	Make easy-to-understand information about water supply status publicly available

Provincial Water Allocation Management

The Provincial Government (through the Ministry of Forests' office in Nanaimo) issues water licences and approvals for surface and groundwater extraction in the region, including for municipal and other types of waterworks. Key observations include the following:

1. In the face of climate change, Ministry staff report that they are increasingly conservative and precautionary about issuing new licenses and approvals, particularly where requested withdrawal volumes are large.

2. In addition to authorizing new uses, the Province also has various authorities to regulate existing use during an emergency or chronic shortages resulting from seasonal drought or long-term climate change.

3. Groundwater allocation in BC only began with passage of the new *Water Sustainability Act* in 2016, so is a very new activity in comparison to surface water allocation.

4. There is not yet a “standard” approach to accounting for the impacts of climate change in Provincial allocation decisions.

5. Provincial ministries make significant investments in monitoring and hosting water data. However, access to additional local data and information could enhance the Province’s ability to make sustainable allocation decisions in the Nanaimo region.

Regional Trends in Supply Planning: Key Observations

Research conducted for this project yields nine key observations about water supply planning in the RDN region.

1. The region’s water managers recognize that climate change creates uncertainty, will impact drinking water supplies, and that preparation is required.

2. Drinking water providers in the Nanaimo region are already responding to the threat of climate change and are actively planning.

3. Water service providers in the region actively collaborate on supply planning and security.

4. Water service providers and the Provincial Government are working collaboratively to address information gaps and ensure a timely response to climate-related risks.

5. There is some misalignment between the best practices for climate-informed water supply planning developed for this project and the actual practices of water service providers in the region, particularly smaller providers.

6. There is an opportunity to explore a more coordinated, regional approach to water supply planning, management, and distribution, particularly in specific geographic areas.

7. There are additional opportunities to continue to reduce demand through new conservation programs and non-revenue water management.

8. There is growing interest in natural asset management, a development that should be advanced further.

9. In general, communication to the public about supply planning in the context of climate change is limited.

Conclusion and Recommendations

Based on these findings, the following recommendations for RDN and partners, implemented through the DWWP Program, may enhance future water supply planning in the region.

1. Through the DWWP Program, engage with the region’s smaller water service providers to determine what, if any, additional support with supply planning they require using the guidance provided by the best practices prepared for this project.

2. In collaboration with the region's water service providers and the Province, review the workplan established under the DWWP Program Action Plan 2.0 to determine if any modifications to actions under the Water Science and Information Theme are required.

3. Undertake a water service optimization study, focusing on the area from Nanoose to Little Qualicum including French Creek and the Englishman River system. This should include a detailed examination of the challenges in operating multiple water supplies and distribution systems that depend on the same sources and the opportunities to optimize through combined planning, administration and/or operations.

4. Provide additional support to water service providers to implement more advanced demand management practices. Section 7 provides specific examples.

5. Continue to inventory, manage, and protect natural assets in the region that directly influence water supply resilience in a changing climate, building on recommendations provided by the Municipal Natural Assets Initiative (2022).

6. Act as regional coordinator for water supply planning communications by developing content for the DWWP Program area of the RDN website and other targeted communications collateral.

1.0 Introduction

Residents living in the Regional District of Nanaimo (RDN) and its member water service providers are concerned about the potential impacts of the climate crisis on sustainable water supplies.

Water service providers both large and small operate independently and are responsible for governing and managing their own systems. However, since they often share water sources and have similar needs, there are many opportunities to collaborate.

The goal of this report is to summarize work completed in 2022 to review current water supply planning practices in the RDN region. It responds to recommendations of RDN's Climate Action Technical Advisory Committee (CATAC). Established in 2020, this committee was made up of local resident experts and elected officials. Its purpose was to provide advice and recommendations to the RDN Board of Directors on emerging climate issues and to update the RDN's strategy for community climate mitigation and adaptation. The first recommendation in its final report, the genesis for this project, is as follows: "ensure water supply resilience, including effective integration of Natural Asset Management" (see RDN, 2021).

This report provides a high-level summary of generally accepted best practices developed specifically for this project. Within this context, it also summarizes current practices in the region, noting that individual service providers are responsible for their own planning and governance. As such, the intent is not to evaluate or assess any organizations approach or practices. It also documents current water allocation and licensing practices by the Provincial Government and how these have been adapted to respond to climate change. Finally, it offers a series of overarching observations and several recommendations to assist RDN and its partners with future water supply planning efforts.

1.1 Limitations

This work is not a formal audit of any water service provider or of the Provincial Government's water supply planning approach, rigor, technical reliability, or predictive accuracy. Rather, it is a general review informed by interviews and examination of resources largely directed to the project team by service provider staff or from publicly accessible sources. Despite this, we are confident the report provides an objective and informed review of overarching planning practices across the region.

Second, while it is hoped that water service providers across the region may also find the resources and advice offered useful, there is no intention to provide direction on their individual activities or planning practices.

2.0 Background to the Project

This section briefly describes background to the project.

2.1 Water Service in Regional District of Nanaimo

Table 1 lists water service providers in the region including governance arrangement and population. Section 4, below, describes bulk water sources and other aspects of supply planning.

Table 1: Water Service Providers in the Regional District of Nanaimo

Water Service Provider	Governance Arrangement	Estimated Population
Snaw-Naw-As Nation	First Nation Government	245•#
Snuneymuxw Nation	First Nation Government	709•#
Qualicum Nation	First Nation Government	82•#
City of Nanaimo	Local Government	99,863•
City of Parksville	Local Government	13,642•
Town of Qualicum Beach	Local Government	9,303•
Regional District of Nanaimo Service Areas (x9)	Local Government	7,500□
District of Lantzville	Local Government	3,817•
North Cedar Waterworks District	Improvement District	2,725□
Deep Bay Improvement District	Improvement District	1,300□
Qualicum Bay-Horne Lake Improvement District	Improvement District	1,100□
Bowser Waterworks District	Improvement District	825□
Little Qualicum Waterworks District	Improvement District	700□
Southwest Extension Waterworks District	Improvement District	225□
Williams Springs Waterworks District	Improvement District	very small
French Creek Water System (EPCOR)	Private Water Utility	4,000□

● 2021 Statistic Canada population; actual water serviced population may differ
populations listed for Indigenous Nations include on-reserve population only, not total population of Nation; on-reserve water serviced population may differ
□ estimate based on number of service connections multiplied by assumed occupancy rate.

A striking feature of Table 1 is the variety of service provision arrangements, both in terms of governance systems and size of service populations.

One implication is that different types of providers have very different capacities to undertake rigorous supply planning. For example, improvement districts do not have the same access to Provincial Government infrastructure grants that municipalities enjoy because of their governance structure (Province of BC, n.d.), so may face significant funding constraints.

Similarly, different sized organizations have obvious differences in capacity. To illustrate, Little Qualicum Waterworks District, among the smallest service providers in the region, has fewer than 300 service connections (or under 700 people). In comparison, the largest, City of Nanaimo serves a population approaching 100,000.

Looking at the population estimates in Table 1, another notable highlight is that the five local government water service providers jointly account for approximately 92% of the total water serviced population and 78% of the total region census population (170,367 people; Statistics Canada, 2021).

Approximately 15% of the total consensus population are not water service provider customers. Most of these people live in rural areas and get their water from domestic wells and surface water sources or other private sources. In these unserviced areas, individual users must be their own water manager. New development must prove available water supply without impact to existing users and environment. The Provincial Government oversees water entitlement by allocating source waters to non-domestic uses based on availability and determining when a source is fully allocated.

2.2 RDN Climate Action Technical Advisory Committee

As noted in the introduction, this project was initiated in response to a recommendation from RDN's Climate Action Technical Advisory Committee. This committee was established in 2020 and was made up of local experts in engineering, renewable energy, hydrology, resource management, land use planning, and other fields. Its purpose was to provide advice and recommendations to the RDN Board of Directors on emerging climate issues and to update the RDN's strategy for community climate mitigation and adaptation.

In November 2021, the RDN Board approved the committee's final report. The top three actions addressed water supply resiliency, removing barriers to climate action in policies and bylaws, and increasing support for home energy efficiency retrofits. The first recommendation, the genesis for this project, is as follows:

> *Ensure water supply resilience, including effective integration of Natural Asset Management*.
>
> (RDN, 2021)

The Climate Action Technical Advisory Committee's final report also provided the following supporting advice:

> *[The committee] recommends ensuring water services in which the RDN is involved (both current and any proposed for the future) and areas within the RDN not served by community water systems, have water supply resilience, including emergency back-up under expected future climate scenarios (an approximate 40–50-year time horizon). Renewable energy generation should be included where feasible.*
>
> *The RDN should also encourage all water purveyors within the RDN to adopt high quality, public-facing, climate informed water supply planning (if not already in place).*
>
> (RDN, 2021)

This report delivers the first phase of CATAC's recommended work plan:

> *Document state of supply planning across water purveyors and unserviced areas in the RDN* (RDN, 2022)

2.3 RDN's Drinking Water and Watershed Protection Program

A relatively unique feature of the region is the existence of RDN's Drinking Water and Watershed Protection (DWWP) Program. This service is delivered on behalf of RDN member municipalities and residents in Electoral Areas. It is tasked with helping protect and manage water resources under the following themes: water awareness and stewardship; water information and science; water-centric planning and policy support; and water collaboration. The program is administered by RDN's Regional and Community Utilities Department.

The DWWP Program has a broad mandate that goes far beyond drinking water supply planning. For example, it supports work in watershed protection, demand management, land and water use planning, and more.

RDN and its partners recently updated this program's strategic plan for the period from 2020 to 2030 and beyond under the *Drinking Water and Watershed Protection Action Plan 2.0* (RDN, 2020). The Plan supports water management through a lens of climate adaptation and resiliency. It outlines the continuation or launch of a range of actions that are relevant to supply planning and regional collaboration. For example:

- "Team WaterSmart", a community outreach initiative that promotes education and awareness about water resources and the benefits of conservation;
- groundwater monitoring through addition of new observation wells to the Provincial monitoring network and a community volunteer well monitoring program;
- development of water budgets through a phased program that studies specific watersheds and aquifers to improve understanding of long-term supply availability (see, for example, Waterline, 2013; Golder, 2020; WSP Golder, 2023);
- hydrometric and climate monitoring to gather local data on streamflow, stream level, precipitation, and snowpack in order to fill gaps in Federal and Provincial monitoring networks;
- development and early implementation of a Regional Strategy for Rainwater Management (2022), which, among several objectives, addresses the impact of climate extremes in the hydrological cycle;
- convening a Technical Advisory Committee to advise RDN on program implementation, made up of members from a broad range of interests and geographic locations in the RDN, including all the local government water service providers.

Note that this is only a sample of the range of programs and projects delivered under the DWWP Program. For more information, see www.rdn.bc.ca/drinking-water-and-watershed-protection.

Advice on project design and the findings of this report has been informed by input from the DWWP Technical Advisory Committee.

3.0 Best Practices for Climate-Informed Water Supply Planning

A set of high-level best practices were developed for this project. This was done for two reasons. First and foremost, over the longer term, it is a resource that may assist water service providers with building supply resilience. Second, it provided a benchmark for the project team to review current supply planning.

These best practices are set out in full in Appendix 1. This section provides a brief summary to provide context for the remainder of this report.

The best practices are based on generally accepted practices in the water utility industry. They are used by professionals in relevant fields (e.g., hydrology, hydrogeology, civil engineering, utility management, public administration) and/or common utility practices with evidence of success. They were developed through a combination of desktop research, consultation with technical experts, and input from service providers in the region. They are a collaborative effort and owned by all service providers in the region, both large and small.

They are organized into the four categories pictured below in Figure 1.

Figure 1: Organization of Best Practices for Climate-Informed Water Supply Planning

To ensure this resource is applicable to a range of service providers, the document also describes 'good practices' adjacent to the best practices. These consist of less onerous (or less data-intensive) approaches that may be more suitable for small water systems or organizations with less staff and budget capacity.

Table 2 sets out the best practice headings organized under the categories in the diagram above. Again, readers are referred to Appendix 1 for full technical detail.

Table 2: Summary Table of Best Practices for Climate-Informed Water Supply Planning

Step	Best Practice
1.0	**Understand Supply**
1.1.1	**Groundwater**: Determine the long-term sustainable well capacity for supply wells
1.1.2	**Groundwater:** Detect changing conditions from groundwater chemistry sampling
1.2.1	**Surface water:** Collect data and information on water availability and climate
1.2.2	**Surface Water:** Assess the amount and timing of current and future water availability
1.2.2	**Surface Water:** Assess how much storage capacity is available to supplement natural flows
2.0	**Forecast Demand**
2.1	Measure water production and consumption
2.2	Assess historic bulk water production trends
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2.5	Estimate future changes in the size of the service population
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3.0	**Plan and Manage for Resilience**
3.1	Use adaptive and risk-based planning practices
3.2	Plan for drought and emergencies
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3.4	Promote water use efficiency by residents and customers
4.0	**Communicate with Residents and Customers**
4.1	Increase awareness of supply, its value, constraints, and risks for users and decision makers
4.2	Make easy-to-understand information about water supply status publicly available

4.0 Summary of Water Supply and Communication Approaches

This section summarizes findings from research conducted in mid-2022 into the status of water supply planning in the region. It provides a summary of the following water service providers' approach to planning:

- City of Nanaimo,
- District of Lantzville,
- City of Parksville,
- Town of Qualicum Beach, and
- RDN Water Service Areas.

At the end of the section, a summary of the supply planning status for smaller water service providers is also provided.

More detailed supply profiles on the local government service providers can be found in Appendix 2, along with the methodology used to collect this information.

4.1 District of Lantzville

Supply Type	Surface water and groundwater
Supply Source(s)	• Aquifers 215 and 213 • Nanaimo River via City of Nanaimo
Key Bulk Supply Infrastructure	• Five wells on the Harby Road Wellfield • One well in south foothills • Pipeline connection to City of Nanaimo

Observations:

- Most of District of Lantzville's supply is sourced from groundwater, with the majority of that from five wells on semi-confined coastal Aquifer 215. There are plans to add two more wells in the near future.
- In 2018 Lantzville entered into a water agreement with City of Nanaimo. This provides for an additional 1,360 cubic meters per day, if needed, from the latter's surface water sources. This establishes additional capacity for extension of Lantzville's current system to existing areas that are not currently serviced and for new development. This approach also provides emergency backup.
- Any proposed new large developments must find their own water sources to connect to the municipal supply. Typically, this would involve adding additional wells sourced from Aquifers 215 or 213 but sited at different elevations to avoid interference issues. Permission to add additional wells would be at the discretion of the Provincial Government.
- Results from Provincial Government well monitoring and other sources indicate that at least part of Lantzville's primary aquifer (Aquifer 215) is experiencing moderate to high stress, exacerbated by its small catchment area, limited recharge potential, and high density of wells.
- Pressure on aquifers has been relieved to some extent by the addition of surface water supply from City of Nanaimo.

- A Water Supply and Distribution System Study was completed by contracted engineers in 2015. This informed completion of a Water Master Plan in 2017, which included consideration of the potential impacts of climate change.
- Since completion of the 2017 Master Plan, significant changes have included addition of supply from City of Nanaimo and continued reductions in per capita demand. As a result, an update to the Master Plan is scheduled for 2023. This will examine potential impacts of long-term climate forecasts and changes to aquifers.
- Staff predict that the updated Master Plan will recommend increasing reservoir tank capacity to meet short term, seasonal spikes in demand expected because of warmer weather.

4.2 City of Nanaimo

Supply Type	Surface water only
Supply Source(s)	Nanaimo River (South Fork)
Key Bulk Supply Infrastructure	Jump Lake and South Fork Lake Reservoirs

Observations:

- In June 2022, City of Nanaimo finalized a robust, multi-year Water Supply Strategy process overseen by external engineering consultants (led by KWL, noting that members of that project team are also providing technical advice to this study).
- Current modelling, informed by evidence-based assumptions about climate change impacts, population growth, and maintaining ecological flows, indicates that supply is sufficient for 20 to 40 years (to a 2061 planning horizon).
- Results of this planning indicate that, at this time, there is no immediate need to expand either surface or groundwater supply capacity.
- This allows the City to focus on providing resilience to the core water infrastructure.
- In the more distant future, aquifers to the south of the City may be an option as a secondary source, as is the potential for aquifer storage and recovery. However, this remains conceptual, and no hydrological analysis has yet been undertaken.
- City of Nanaimo is already a partner in several water sharing agreements.
    - It has separate agreements in place to provide bulk water to Southwest Extension Improvement District, District of Lantzville, and Snuneymuxw First Nation; supplies are sufficient to continue to do so for the foreseeable future.
    - It has a reciprocal agreement with Harmac Pacific to share supply in the event of a short-term supply emergency (e.g., a natural catastrophe such as an earthquake).

4.3 City of Parksville

Supply Type	Surface water and groundwater
Supply Source(s)	• Aquifer 216 • Englishman River via Arrowsmith Dam and contributary sources
Key Bulk Supply Infrastructure	• 16 groundwater wells • Arrowsmith Dam and Englishman River Water Service

Observations:

- City of Parksville's water supply comes from two sources: groundwater and surface water.
- Sixteen (16) groundwater wells are situated along the southwest boundary of the City. These draw from Aquifer 216.
- Surface water comes from the Englishman River via Arrowsmith Dam and contributary sources. This is enabled through the Arrowsmith Water Services (AWS) and Englishman River Water Service (ERWS) joint ventures.
- Since commissioning of the ERWS Water Treatment Plant, surface water from the river is utilized more during wet weather months compared to the past. As less water is drawn from the groundwater source, wells show signs of recovery.
- Parksville's last water supply study was completed in 2011. Forecasts in that plan made explicit, quantified assumptions about both continued water use efficiency and the potential impacts of climate change on demand.
- Work on a new Water Use Planning and Management Study commenced in late 2023. This will incorporate updated demand and climate forecasts to the planning horizon of 2075. The objectives of this planning process include, but are not limited to:
    - undertake a comprehensive assessment of the City's potable water sources including capacity to meet future demands for potable water, storage options and strategies to preserve water quality;
    - develop plans for implementation of strategic measures to insure a redundant and resilient potable water system;
    - develop a water use master plan to identify and make recommendations to address current and future risks, including population growth and the impacts of climate change on Parksville's water system; and,
    - engage residents in the process and promote greater community understanding of water use, conservation, and management issues.

4.4 Town of Qualicum

Supply Type	Groundwater only
Supply Source(s)	• Aquifer 664 • Aquifer 217 (seasonally)
Key Bulk Supply Infrastructure	• Little Qualicum River Well Field (Aquifer 664) • Berwick Well Field (3 wells in Aquifer 217,1 well in newly mapped aquifer 125; only used seasonally)

Observations:

- Town of Qualicum Beach's water comes from two sources. The primary source is River Well Field. Berwick Well Field provides auxiliary supply.
- The River Well Field is comprised of five production wells and two monitoring wells located at the northwest corner of the Town's boundary. The well field draws water from deltaic deposits of the Little Qualicum River in Aquifer 664.
- The Berwick Well Field has four active production wells that provide approximately 30% of annual production. This is considered an auxiliary source, only used in peak summer season, then left to recharge over winter.
- Qualicum Beach continuously compiles data on the extent, behaviour, and recharge of the two aquifers it draws from. This is provided publicly in an annual report.
- Well performance trends in the River Well Field show a gentle upward trend in recent years, although it experienced historic lows during the 2023 drought. Staff attribute aquifer performance in recent years to timing of releases of stored water at Cameron Lake to support environmental flows and fish habitat in Little Qualicum River.
- In 2021, Town of Qualicum Beach began providing bulk water to RDN's French Creek service area via the Sandpiper Reservoir. This change was implemented to address aesthetic issues with water formerly supplied by RDN wells.
- Provincial observation well monitoring and other sources indicate stable levels over time in Aquifer 664 but did record yet record low levels in 2023 (see RDN, 2023). In Aquifer 217 stable to increasing levels have been observed over time, noting that below average levels were also recorded in 2023.
- Town staff assessment is that current groundwater supplies from the combined River/Berwick well system are more than sufficient to meet current demand, including supply to RDN's French Creek service area, and any future growth projected in the Official Community Plan to full community build out.
- Qualicum Beach continues to have an interest in the Arrowsmith Water Service along with RDN and City of Parksville. Qualicum Beach pays an annual maintenance fee and is contractually able to re-join agreement and draw limited amounts of water from Arrowsmith Dam based on a predetermined financial formula. However, the Town has no plans to tap into this supply any time in the foreseeable future, as groundwater sources are considered sufficient.
- Qualicum Beach's most recent water supply master plan was completed in 2002. Most recommendations in that plan were fully implemented. Key planning assumptions are updated regularly in-house by staff. While this master plan is now dated, staff do not believe there are sufficient drivers to justify the significant cost and effort required to complete a full update.

4.5 Regional District of Nanaimo Water Service Areas

RDN Water Service Areas

Water Service Area	Year Established	Water Source	Number of Connections
Decourcey	1998	Groundwater (1 well; Aquifer 162)	5
River's Edge	2003	Groundwater (2 wells; Aquifer 219)	157
French Creek	1980	Groundwater (Aquifer 217 supplied via Town of Qualicum Beach)	239
Melrose Terrace	2005	Groundwater (1 well; Aquifer 663)	28
Nanoose Bay	2005	Groundwater (5 wells in use; Aquifer 1098) supplemented from Englishman River	2,532*
San Pareil	1999	Groundwater (2 wells; Aquifer 221)	291
Surfside	1986	Groundwater (2 wells; Aquifer 664)	39
Westurne Heights	2016	Groundwater (1 well; Aquifer 663)	17
Whiskey Creek	2011	Groundwater (1 well; Aquifer 663)	126

* Includes 64 commercial, institutional, and multi-family residential connections

Observations:

- RDN has nine water service areas, ranging in size from five connections (Decourcey) to 2,532 connections (Nanoose Bay). All water service areas are supplied exclusively by groundwater except Nanoose Bay, which receives supplementary supply from Arrowsmith Dam via the Englishman River Water Service, a joint venture between the RDN and City of Parksville, operated by the latter.
- In most cases, RDN independently owns and operates all of its bulk supply infrastructure, with two exceptions: French Creek and Nanoose.
    - As of 2021, the French Creek water service area is supplied by Town of Qualicum Beach via the Sandpiper reservoir. RDN continues to own and operate key transmission and distribution infrastructure.
    - Nanoose Bay, the largest water service area by an order of magnitude, is supplied by both RDN wells and the Englishman River Water Service.
- Provincial observation well monitoring and other sources indicate that some aquifers that RDN depends on are potentially under stress, particularly those in the Little Qualicum, French Creek, and Nanaimo River regions. Further investigation into supply and demand for these areas is currently underway and prioritized under the DWWP Program.
- With the exception of the Nanoose system, RDN does not have formal master plans for its water service areas because they are all fully built out or nearly built out based on current projections in Official Community Plans. As a result, there are no pending plans for major expansion of supply or distribution networks.[1] Supply is considered sustainable with current population and demand levels, barring ongoing management of localized challenges. Staff are aware of the threats posed by climate change, continue to monitor supply status, and anticipate there will be sufficient time to adapt should supply conditions change.

[1] Note that planning is underway at River's Edge (formerly called the Englishman River System) due to water quality concerns with management of aquifer withdrawals. RDN proposes to install an additional four to six wells that will allow each one to be pumped at a slower rate.

4.6 Small Water Service Providers

Table 3: Water Sources for Small Water Service Providers in the RDN Region[2]

Water Service Provider	Water Source(s)
Bowser Waterworks District*	Groundwater; 4 wells; Aquifer 416
Deep Bay Improvement District*	Groundwater; 7 wells; Aquifer 416
French Creek Water System (EPCOR)*	Groundwater; 16 wells; Aquifers 216 and 217
Little Qualicum Waterworks District	Surface water; Little Qualicum River
North Cedar Waterworks District*	Groundwater; 3 wells; Aquifer 161
Qualicum Bay-Horne Lake Improvement District*	Groundwater; 3 wells; Aquifer 662
Qualicum Nation	Qualicum Bay Horne Lake Improvement District
Snaw-Naw-As Nation	Groundwater; Aquifer 215
Snuneymuxw Nation	City of Nanaimo
Southwest Extension Waterworks District	City of Nanaimo
Williams Springs Waterworks District	Groundwater

* attended 23 June 2022 virtual focus group (see Appendix 2 for details)

This section provides a brief overview of water supply planning amongst the region's smaller water service providers.

Small water providers that have water supplied entirely by another provider were not part of the study group, as water supply planning practices are managed by the source water provider. Invitations to participate in the focus group were extended to all providers with their own water sources and participation was voluntary.

Observations below are based primarily on a focus group conducted on 23 June 2022 with the water service providers marked with an asterisk (*) in Table 3 and also informed by a literature review and other desktop research as detailed in Appendix 2.

- Small service providers in the region are generally optimistic about supply security, particularly in the medium term (e.g., 10-to-20-year time horizons).
- At the same time, they indicate that they are aware of the potential threats of climate change and keep a close eye on indicators such as aquifer levels.
- Service providers in the north of the region that depend on Aquifers 416 and 662 are most confident, as all indicators point to those sources being in very healthy states.
- Confidence is lower in the French Creek and North Cedar Improvement District riverside wells areas, where there are more users and less long-term certainty about aquifer production (see, for example, WSP Golder, 2023). In the short term, operators are responding by monitoring and, in some cases, adjusting well operations.
- Water service providers report that their customers express limited interest in the potential impacts of climate. They also report that interest in water use efficiency is mixed - some customers actively conserve, others do not.
- Generally, capacity to undertake expensive, long-term supply planning through external consultants is limited. For some providers, this means relying on third party

[2] Note that small private water systems, including larger strata properties with their own water supply and treatment systems, were not assessed individually, but are considered generally as part of the Provincial water allocation process as discussed in Section 5; information on Williams Springs Waterworks District, a very small service provider in the Nanoose area, was not readily available for this study.

information sources (e.g., studies completed by developers seeking approvals for developments on the same aquifers) or on regional studies completed by the RDN DWWP. There may be future opportunities to leverage DWWP Program resources to assist smaller providers with supply planning based on the guidance provided by the best practices prepared for this project.

- However, some providers have completed recent and robust operational studies. For example, EPCOR French Creek Water System just undertook an operational study that included a review of aquifer status and, at time of writing, is completing a supply and demand study.
- Formal water sharing arrangements already exist, including the following:
    - City of Nanaimo provides bulk water services to Snuneymuxw Nation, Lantzville, and Southwest Extension Waterworks District;
    - Qualicum Bay Horne Lake Improvement District provides bulk water services to Qualicum Nation;
    - Qualicum Bay-Horne Lake Improvement District and Bowser Waterworks District have a reciprocal agreement to provide water to each other in the event of an emergency or planned shutdown via a bulk supply connection.
- Some service providers are more active in water demand management than others. Improvement districts in the north of the region admit that motivation can be limited given the strength of supply. Others have more pressure to conserve, especially in the summer when watering restrictions are sometimes elevated to include lawn watering bans. However, all the systems we contacted are fully metered, charge by volume, follow the regional watering restrictions system, and market the regional DWWP Program's Team WaterSmart resources to their customers.

Table 4 on the following page summarizes each service provider's supply source and key infrastructure.

Table 4: Summary of Water Supply Sources and Bulk Infrastructure in the RDN Region

Water Service Provider	Supply Type	Supply Source	Key Bulk Supply Infrastructure
Qualicum Nation	Groundwater	Aquifer 662	QBHL Improvement District
Snaw-Naw-As Nation	Groundwater	Aquifer 215	Wells
Snuneymuxw Nation	Surface water	Nanaimo River (South Fork)	City of Nanaimo
City of Nanaimo	Surface water	Nanaimo River (South Fork)	Jump Lake and South Fork Lake Reservoirs
District of Lantzville	Surface water and groundwater	• Aquifers 215 and 213 • Nanaimo River	• 6 wells • Pipeline connection to City of Nanaimo
City of Parksville	Surface water and groundwater	• Aquifer 216 • Englishman River	• 16 groundwater wells • Arrowsmith Dam via ERWS
Town of Qualicum	Groundwater	• Aquifer 664 • Aquifer 217 and 1250 (seasonally)	• Little Qualicum River Well Field • Berwick Well Field (seasonally)
RDN Decourcey WSA	Groundwater	Aquifer 162	1 well
RDN River's Edge WSA	Groundwater	Aquifer 219	2 wells
RDN French Creek WSA	Groundwater	Qualicum Beach	Qualicum Beach
RDN Melrose Terrace WSA	Groundwater	Aquifer 663	1 well
RDN Nanoose Bay WSA	Surface water and groundwater	• Aquifer 1098 • Englishman River	• 5 wells in use • Arrowsmith Dam via ERWS
RDN San Pareil WSA	Groundwater	Aquifer 221	2 wells
RDN Surfside WSA	Groundwater	Aquifer 664	2 wells
RDN Westurne Heights WSA	Groundwater	Aquifer 663	1 well
RDN Whiskey Creek WSA	Groundwater	Aquifer 663	1 well
Bowser Waterworks District	Groundwater	Aquifer 416	4 wells
Deep Bay Improvement District	Groundwater	Aquifer 416	7 wells
French Creek Water System (EPCOR)	Groundwater	Aquifers 216 and 1250	16 wells
Little Qualicum Waterworks District	Surface water	Little Qualicum River	Surface intake
North Cedar Waterworks District	Groundwater	Aquifer 161	3 wells
Qualicum Bay-Horne Lake (QBHL) Improvement District	Groundwater	Aquifer 662	3 wells
Southwest Extension Waterworks District	Surface water	Nanaimo River (South Fork)	City of Nanaimo

ERWS: Englishman River Water Service
WSA: Water Service Area

5.0 Provincial Water Allocation Management

This section provides a brief overview and observations about the Provincial Government's role in water supply planning in the Nanaimo region.

The 16 water service providers in the region listed in Table 4 collectively provide drinking water to about 86% of the region's population. The remaining 14% (nearly 24,000 people) mostly live in rural areas, and get their water from domestic wells, surface water sources adjacent to properties, or small private systems.

The Provincial Government (through the Ministry of Forests' regional office in Nanaimo) issues water licences and approvals. Water licences and approvals allow people to divert, use or store surface water or groundwater, or to make changes in and about a stream. These are issued under the authority of the *Water Sustainability Act* and the Water Sustainability Regulation (2016), which sets out rules and guidance for the allocation of both surface water and groundwater.

Water allocation is a complex regulatory process involving technical, policy, and regulatory dimensions.[3] The Province acts as regulator of water use for not only the municipal and other water service providers already discussed, but also other users across the region, large and small. This includes agriculture, commerce, industry, natural resources development, power production, storage, and water supply.

Domestic surface water users (people who draw their household water from streams and lakes) are not required to obtain a licence under the *Water Sustainability Act* but may do so at their own discretion. However, most of the households in the region that do not receive water from a service provider rely on their own wells. Use of groundwater for domestic purposes is not currently licensed under the Act.

Figure 2, below, shows existing water licences of all kinds for a portion of the region, and illustrates that there are hundreds of authorized water users, noting that this map does not show domestic surface water users that choose not to get a licence and the more numerous domestic groundwater users that cannot get a licence.

The map illustrates that the Province has a key role in regulating the use not only of the water service providers that this report focuses on, but also the use of many other players in the region.

The licensing process starts with the submission of an application by a potential new licensee. Applications undergo a technical review to make sure there is sufficient water at the source to issue a licence without affecting the existing water rights of others or harming aquatic ecosystems. Other agencies, affected landowners, and licensees are typically notified and given the chance to provide information and First Nations with territorial or treaty interests in the area are consulted (Province of British Columbia, 2023g).

[3] A full review of how the Province approaches this task (or other responsibilities related to water management) is outside of the scope of this project. However, additional information on this topic can be found at https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/water-licences-approvals

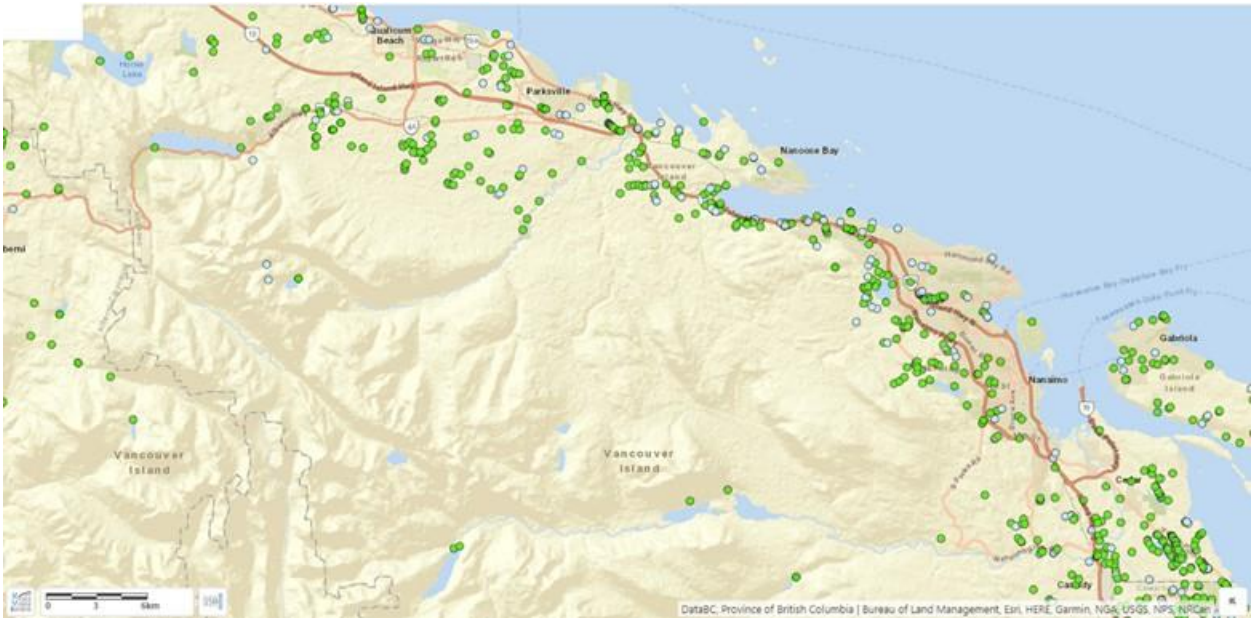

Figure 2: Existing Water Licences in Regional District of Nanaimo
Source: BC Water Resources Atlas (2023)

The Provincial statutory decision maker (currently a staff person in the Ministry of Forests in Nanaimo) decides whether to approve the licence. The decision maker takes many factors into account. Some of the deciding factors are mandatory under the *Water Sustainability Act*, such as considering environmental flow needs. The decision maker may refuse part or all of the application, require additional information and assessments, or grant all or part of the application and issue either a conditional or a final licence.

At least five specific observations about the Ministry of Forest's approach to water allocation are particularly important in the context of this report.

First, in the face of climate change, Ministry staff report that they are increasingly conservative and precautionary about issuing new licenses and approvals, particularly where requested withdrawal volumes are large. They note, for example, that there has been significant cultural change in the organization since passage of the new *Water Sustainability Act* in 2016 and that they are advised to be conservative by senior leadership. This is reflected, for example, in the fact that many streams on the east coast of Vancouver Island are "fully recorded", meaning that new licenses are typically no longer issued from these sources.

Second, in addition to authorizing *new* uses, the Province also has various authorities to regulate *existing* use during an emergency or chronic shortages resulting from seasonal drought or long-term climate change. Examples of regulatory tools available to do this include:

- temporary protection orders under Division 5 of the Act that allow the Province to curtail use to protect critical environmental flows or fish;
- section 30 of the Act requires that anyone who diverts water must make "beneficial use" of it, which means using the water as efficiently as practicable, and for the purpose(s) specified by the license or approval;

- for chronic shortages, the Province can work with users to create Water Sustainability Plans under Division 4 of the Act. This could result in various management responses, for example including metering licensed use, reducing the maximum quantity of water that can be diverted, or restricting groundwater activities.

Put simply, the Province can intervene if water supply is at risk of deterioration, or if fish are at risk, in a particular stream or aquifer, or across the region broadly. It can do so as an emergency response or through a more deliberate, collaborative, longer-term planning approach.

Third, groundwater allocation in BC only began with passage of the new *Water Sustainability Act* in 2016, so is a very new activity in comparison to surface water allocation. Prior to 2016, all groundwater use in the Province was unlicensed. Ministry staff are still developing procedures and policy to adjudicate, approve, and regulate both existing and new non-domestic groundwater use. This challenge is compounded by the fact that it is often difficult to assess the yield of an aquifer. As such, focus on groundwater allocation is relatively young, although data collection efforts by the Province and others in recent years is contributing to a growing body of knowledge about the status of groundwater resources.

At present, Ministry staff rely extensively on the judgment of qualified professionals and internal operational procedures to make decisions related to granting water licenses (e.g., by comparing total licensed volume on an aquifer to the assumed recharge rate).

However, this is an active area of policy and technical guidance development. For example, the Groundwater Protection Regulation Guidance Manual was recently completed (Province of BC, 2019). This provides industry and professionals with a topically organized summary of requirements of the *Water Sustainability Act* and the Groundwater Protection Regulation and Provincial Government policies associated with these requirements. It also summarizes applicable portions of the *Drinking Water Protection Act* and Health Hazard Regulation. It deals with matters such as well construction, operation, and maintenance and how to protect wells and aquifers in the face of future development and changing hydrological conditions.

Similarly, a two-year project recently began to develop guidance and policy for setting extraction limits on aquifers to guide staff's licensing decisions. This could result in aquifers becoming "fully subscribed" in the same way many streams in the region already are, meaning additional water licenses may not be granted.

Fourth, there is not yet a "standard" approach to accounting for the impacts of climate change in Provincial allocation decisions. In the interim, Ministry staff continue to rely on tools and methods such as those already mentioned (e.g., judgment of qualified professionals; rules of thumb such as licensed use as a percent of aquifer recharge rates or mean annual discharge of a stream; etc.).

Water licensing staff in the Vancouver Island Region also refer to Water Allocation Plans developed in the 1990s through early 2000s.[4] These plans review how much water was assumed to be available, when they were written, within specific streams. This includes consideration of environmental flow requirements for fish and the existing and potential

[4] See https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/water-planning/water_allocation_englishman_river.pdf

demands of users. These plans have not been updated in nearly two decades and so do not reflect changing information on impacts of climate change on water availability, limiting their utility.

We expect that this will continue to be an active area of policy and technical guidance development in the next decade, including, for example, through the recently announced Provincial Watershed Security Strategy (Province of BC, 2022).

Fifth, at the provincial scale, ministries make significant investments in monitoring and hosting water data. However, access to additional local data and information could enhance the Province's ability to make sustainable allocation decisions in the Nanaimo region.

A sample of current and relevant Provincial monitoring and policy initiatives include the following:

- maintaining the Provincial Groundwater Observation Well Network to collect, interpret and report information about groundwater quantity and chemistry (see Province of British Columbia, 2023a);
- The B.C. Lake Monitoring Network, including Brannen Lake, Long Lake, Diver Lake, Cameron Lake, and Spider Lake in the Nanaimo region (see Province of British Columbia, 2023b);
- Snow surveys through automated weather stations and manual survey sites (see Province of British Columbia, 2023c);
- the Provincial Hydrology Program, which manages the collection of surface water quantity data, primarily river levels and surface water flow (see Province of British Columbia, 2023d).
- maintaining water rights databases including the Water Licence Search Tool (see Province of British Columbia, 2023e);
- hosting the BC Water Resources Atlas, a digital compendium of information related to the water resources of BC, such as watersheds, water quantity and quality monitoring sites, aquifers, water wells and flood protection works (see Province of British Columbia. 2023f);
- work underway to replace the legacy Environmental Management System (EMS) with a new, modernized repository for environmental monitoring data including water quality data;
- new operational and technical guidance on groundwater allocation as discussed in above (see, for example, Province of British Columbia, 2019 and Province of British Columbia, 2022).

Despite this substantial investment, the realities of climate change and the new requirements imposed by the regulation of groundwater allocation create the need for more and better data and information for decision making. Examples that would be useful mentioned by Provincial staff include the following:

- additional observation wells for the Provincial Groundwater Observation Well Network;
- hydraulic connectivity assessments that delineate interactions between key aquifers and nearby streams; and,
- location-specific climate changes assessments (e.g., impact of changes in the timing of snowpack melt; impact of extreme precipitation events on aquifer recharge).

Opportunities for the Province and water service providers in the Nanaimo region to collaborate further in this area are discussed in Section 7, below.

In sum, like the region's water service providers, the Provincial Government is responding to the imperatives posed by climate change. This includes, for example, regulating groundwater use for the first time, making significant investments in data collection and hosting, and developing new policy and operational guidance on water allocation. Since 2016, new tools have also become available under the *Water Sustainability Act* that significantly bolster ability to respond to both acute and long-term water shortages, should these materialize.

At the same time, it is also apparent that additional work is required to better understand the cumulative effect of all water use in specific aquifers and the implications for whether new licensed use should be approved. As well, there is still uncertainty about how to account for the impact of climate change in allocation decisions, an area where the Province is already investing in new technical and policy guidance. Finally, while there is already significant effort in data collection, additional information would support optimal decision making.

Note also that in addition to Provincial efforts to regulate groundwater use, RDN also independently requires developers to demonstrate proof of water via a preliminary hydrogeological assessment for all new development and rezoning applications in unserviced areas under its Policy B1.21 (RDN, 2019a). Policy B1.21 came into effect in 2011 and was revised and updated in 2019. The site-specific assessments referenced in this policy must be performed by a qualified professional with competency in hydrogeology. They must demonstrate that water needs for proposed parcels or uses can be met, while minimizing impact on existing users, hydraulically connected streams, and long-term health of the aquifer. Specifically for residential uses, assessments must confirm availability of 3.5 cubic metres per day, year-round, per parcel so there will be sufficient supply to support future demands.[5]

The next section turns attention to overarching observations from the research completed for this project.

[5] For more information on RDN's Policy B1.21, see https://rdn%2Dpub.escribemeetings.com/filestream.ashx?DocumentId=7779

6.0 Key Observations

Based on the research summarized above, we offer nine key observations about water supply planning in the RDN region.

First, the region's water managers recognize that climate change creates uncertainty, will impact drinking water supplies, and that preparation is required. A recurring theme from the representatives we spoke to for this project is that, despite having high-level climate projections, they do not know exactly what will happen in the future to key local parameters such as timing of precipitation, aquifer levels, summer temperature, and duration of snowpack.

There are specific aquifers and surface water sources in the region where there is more uncertainty about the long-term implications of climate change. This includes the Arrowsmith system on the Englishman River, aquifers in the French Creek area (see WSP Golder, 2023) and, to a somewhat lesser extent, aquifers in the Nanoose area (see Golder 2020). There are also discrete locations with smaller populations outside of water serviced areas that face specific supply security challenges (e.g., Yellow Point, south of City of Nanaimo; see RDN, 2011).

Importantly, however, none of these locations will come as a surprise to anyone who is active in supply planning in the region, and in each case, responses are already underway or planned, leading to the next key observation.

Second, drinking water providers in the Nanaimo region are already responding to the threat of climate change and are actively planning for the future.

Larger water service providers have recently completed robust master planning (e.g., (e.g., City of Nanaimo, 2020; District of Lantzville, 2017). Others are about to embark on comparable processes (e.g., City of Parksville, 2022b).

Consistent with the best practices guidance developed for this project (see Section 3.0) and standard industry practice for master supply planning, these plans have the following characteristics:[6]

- long planning time horizons (e.g., 40+ years);
- incorporate assumptions about climate change into both supply and demand projections based on best currently available information;
- develop supply forecasts based on scenario analysis that considers a range of possible outcomes, including conservative ones (e.g., "worst case");
- work completed by reputable, 3rd party qualified professionals with local knowledge (again, some of whom are also advisors to this project);
- explicitly acknowledge and account for uncertainty.[7]

As well, in the geographic areas listed above with known constraints or more acute uncertainty, the following activities are already underway:

[6] Or, in the case of City of Parksville, can be expected to have these features based on the scope of work specified in procurement documentation (see City of Parksville, 2022b).
[7] See, for example, Koers and Associates Engineering (2015) or City of Nanaimo (2020).

- Parksville, in collaboration with RDN under the Englishman River Joint Venture Management Board, is in the process of initiating a updated supply planning commencing in 2023, that will review yield of Arrowsmith Dam as well as the City's long-term supply strategy generally (see City of Parksville, 2022a).
- RDN, on behalf of the municipal partners under the DWWP Program, is wrapping up the French Creek Water Budget Phase 3 study with WSP Golder Consulting (2023). Building on earlier work (GW Solutions, 2020 and Waterline, 2013), this project developed and calibrated a three-dimensional numerical groundwater flow model to develop refined water budgets for the French Creek region. It identified aquifers that are currently under stress and modelled future scenarios, including ones that accounted for varying impacts of climate change.
- In 2020, the Refined Water Budget (Phase 3) for Nanoose was also completed under the DWWP Program. This analysis, informed by climate change projections, provides a basis for the RDN and partners to identify and implement planning measures to manage water resources and groundwater withdrawals in this area (Golder, 2020).
- Various protective measures have been implemented in the Yellow Point Area. For example, RDN's Yellow Point Aquifer Development Permit Area requires that all new dwelling units within this area have rainwater harvesting equipment installed as a means of water conservation (see RDN, 2011).

Third, water service providers in the region actively collaborate on supply planning and security. This provides a basis for future cooperation should circumstances change, for example in the event of deterioration of a particular stream or aquifer. Most prominently, RDN leads regional partnerships through the DWWP Program and specifically through its Regional Water Purveyor Working Group and Technical Advisory Committee. These provide forums for matters such as identifying gaps in understanding of water resources and addressing them through technical studies, developing regional water use efficiency programs, implementing standardized watering restrictions, reviewing monitoring programs, and more.

Also, there are already several tangible water sharing arrangements in place that mitigate short-term supply risk (e.g., in the event of an emergency) and, for now, avoid the need to exploit new develop new water supply sources and infrastructure. Specific examples include the following:

- City of Nanaimo provides bulk water to District of Lantzville, Snuneymuxw First Nation, and Southwest Extension Improvement District;
- City of Nanaimo and Harmac Pacific have a reciprocal agreement to share supply in the event of a short-term supply emergency;
- Town of Qualicum Beach provides bulk water to RDN's French Creek service area;
- Parksville, Qualicum Beach, and RDN share interest in the Arrowsmith Water Service; both Parksville and RDN currently withdraw from this system via the Englishman River Water Service; and,
- Qualicum Bay-Horne Lake Improvement District and Bowser Waterworks District have a reciprocal agreement to provide water to each other in the event of an emergency or planned shutdown via a service interconnection.

Fourth, water service providers and the Provincial Government are working collaboratively to address information gaps and ensure a timely response to climate-related risks.

Water service providers routinely monitor key supply source performance indicators, consistent with standard industry practice, some of which is required under Provincial regulation (such as the *Drinking Water Protection) Act)* and some of which is done voluntarily. This can include water quality, well performance, dam level, and hydrometric data, among other parameters. For example, Town of Qualicum Beach records well performance results and reports results to Town Council from time to time (Weir, 2021). Similarly, City of Parksville records snowpack, rainfall, dam levels and hydrometric gauge data for the Arrowsmith/Englishman River system and makes this information available publicly on the City website (City of Parksville, 2023).

As discussed above, water service providers also collaborate through the DWWP Program to support (and fund) data collection and technical studies of mutual or regional interest. See the list provided in section 2.3 for current examples. Many additional projects are planned for the current decade under the *Drinking Water and Watershed Protection Action Plan 2.0* including, for instance, supporting enhanced snowpack modelling, additional water budget modelling, and continuing the volunteer observation well network to mention just a sample (see RDN, 2020, p.39).

As noted in Section 5, the Provincial Government also undertakes many initiatives and programs to improve availability of and access to water data, information, and guidance in order to support its own water allocation responsibilities and water management efforts by other agencies. Additional projects are planned for the future.

Fifth, there is some misalignment between the best practices for climate-informed water supply planning developed for this project and the actual practices of water service providers in the region, particularly smaller providers.

As noted above, larger providers typically undertake formal master planning. The City of Nanaimo has just completed such a project. Lantzville, Parksville, and RDN's Nanoose service area have completed formal plans within the past decade or so. Lantzville and Parksville are initiating concrete projects to update these plans imminently. These projects are completed by third party qualified professionals, employ robust climate forecasts for supply modelling, and have long study time horizons consistent with the best practices developed for this project.

In contrast, smaller water service providers typically do not have formal master plans with long planning horizons for their systems. Instead, planning tends to be less formal, more dependent on third party information sources (e.g., studies from developers), and undertaken by in-house staff. This is certainly in great measure due to staffing and resource constraints.

The following factors may mitigate this misalignment:

- local factors such as static population growth projections in official plans (e.g., in many of RDN's Water Service Areas);

- service providers may assess their supplies to be very robust based on their professional opinion and reliable information (e.g., improvement districts in the north of the region);
- smaller providers have simpler options available to them in the event of a supply crisis - for example, trucking water to a community of a few hundred people is viable during an event such as an unusually long and acute seasonal drought.

Nevertheless, there may be opportunities for small water providers to work more closely with the regional DWWP Program on collaborative approaches to shared supply planning challenges. This is discussed further in Section 7.

Sixth, there is an opportunity to explore a more coordinated, regional approach to water supply planning, management, and distribution, particularly in specific geographic areas.

In depth assessment of current administrative and governance arrangements for regional water supply is out of the scope of this project. However, the following observations plainly emerged out of the analysis:

- Water service providers in the region, particularly in the Nanoose, French Creek, and Little Qualicum areas, are located very close geographically. In some cases, they already share supply, such as the Englishman River Water Service and Town of Qualicum providing water to RDN's French Creek area.
- There is already a history of strong cooperation between water service providers through the DWWP Program and other forums.
- There are likely already cumulative impacts taking place in some aquifers because of withdrawal both for waterworks and for other purposes. This will likely be exacerbated by climate change.
- Population growth and land development continues throughout the region, and additional supply will be required in the future to meet this new demand.
- Water supply planning and decision making is currently fragmented across multiple local governments and water purveyors.
- There are likely opportunities for cost efficiencies and economies of scale by working together on water supply planning, administration, and operations.

As a result, we recommend undertaking a water service optimization study. This should include a detailed examination of the challenges in operating multiple water supplies and distribution systems that depend on the same sources and the opportunities to optimize through consolidating planning, administration and/or operations.[8]

With respect to geographic scope, we recommend starting with the area north of Lantzville and south of Qualicum Bay Horne Lake Waterworks (i.e., from Nanoose to Little Qualicum including French Creek and the Englishman River system). As such, the following water service providers would be partners to the study: EPCOR French Creek, City of Parksville, City of Qualicum Beach, Little Qualicum Improvement District, and RDN.

[8] For an example of a comparable study recently completed in British Columbia with broadly similar circumstances, see the Salt Spring Island Water Service Optimization Study, prepared by INNOVA Strategy Group (2020).

Depending on the preferences of these partners, the proposed study could be overseen by RDN (e.g., under the DWWP Program), by an appropriate Provincial Government agency (e.g., the Ministry of Municipal Affairs) or by another trusted third party.

Seventh, there are additional opportunities to continue to reduce demand through new conservation programs and non-revenue water management.

Water conservation effort is quite consistent across the region. All water service providers make use of Team WaterSmart educational programs and incentives developed through the DWWP Program. They collaborate to develop and follow the regional watering restrictions system (see RDN, 2022) and they are all fully metered and charge by volume.

These foundational measures combined with the regional cooperation already happening in demand management through the DWWP Program provides a basis for additional efforts. However, the region's service providers currently depend very heavily on restrictions and pricing to manage demand. Most do not have their own water conservation plans, and plans that do exist tend to be dated.

Coordinating water demand management through the DWWP Program has many benefits including cost efficiency through economies of scale and regional consistency. At the same time, based on experience with other jurisdictions across Canada, some opportunities are probably not being fully exploited, some of which would be implemented at the local service provider level and some of which would best be implemented regionally.

Examples of additional measures that would be implemented at the water service provider level include:

- conservation oriented water pricing (see, for example, Brandes, Renzetti and Stinchcombe, 2010);
- improved water use accounting including robust assessments of per capita demand and non-revenue water (see, for example, Heberger, Donnelly, and Cooley, 2016);
- improved management of non-revenue water including reducing system loss (see, for example, American Water Works Association, 2009); and
- developing water service provider-specific efficiency plans (see, for example, Maddaus, Maddaus, and Maddaus, 2014),

Examples of additional measures that would likely be best implemented at the regional level, probably through the DWWP Program, include:

- providing regional support through best practice guidance and building communities of practice for the measures listed above;[9]

[9] Note, for example, that the DWWP Action Plan 2.0 already commits to support water service providers with development of their own water conservation plans and with setting, tracking, and reporting on conservation targets (see RDN, 2020, p. 26).

- refinement of regional watering restrictions framework, potentially including best practice "mornings only" or "one day per week" watering (see, for example, Finley and Basu, 2020);[10]
- in addition to the resources and outreach already offered under Team WaterSmart, developing more targeted resources that focus on specific end users such as the commercial/industrial/institutional sector, gardeners, or high-volume residential users (again, consistent with emerging North American best practice).

Eight, there is growing interest in natural asset management, a development that should be advanced further. While much of the analysis above has focused on engineered infrastructure, it is also important to point out that, by considering natural assets within asset management processes, water service providers can decrease costs, increase levels of service, and enhance their ability to adapt to climate change (Asset Management BC, 2019). With respect to water supply specifically, taking a landscape perspective regarding natural assets is a means to maintain base flows to streams and aquifers.

Natural assets such as wetlands, forests, and streams store rainwater, reduce flooding, and thereby offset, complement, or in some cases eliminate the need for engineered solutions. Furthermore, they can often do so at lower costs as most natural assets have limited capital costs, can have lower operating costs, and may be more resilient to the effects of climate change than engineered alternatives (Asset Management BC, 2019).

RDN and member local governments have already undertaken recent work in this area. For example, in 2019 RDN, City of Nanaimo and the Partnership for Water Sustainability B.C. completed the Millstone River ecological accounting process to inform future decisions on corporate asset management planning (Partnership for Water Sustainability in BC, 2019).

Similarly, RDN is working with the Municipal Natural Assets Initiative to develop a natural asset inventory in the region and document steps local governments can take toward a robust natural asset management initiative. In late 2022, a summary of inventory results was released, along with recommendations for next steps. These recommendations provide useful future direction, grouped under three headings:

1. strengthen natural asset management at an organization-wide level;
2. possible actions for the further development of the inventory;
3. steps to a full natural asset management project (MNAI, 2022).

Opportunities for promotion of natural asset management will be discussed further in Section 7, below.

[10] Note, for example, that Metro Vancouver and member local municipalities have a "mornings only" regional lawn watering regulations framework that limits watering to the morning hours only on specified days (see, Metro Vancouver, 2020). More limiting frameworks of this kind are significantly more likely to reduce demand (see Finley and Basu, 2020).

Ninth, in general, communication about supply planning in the context of climate change is limited.

Virtually all communication from service providers about water supply status and planning happens through municipal websites. In some cases, there is little or no information posted publicly. In other cases, what is online is highly technical in nature (e.g., links to planning documents from engineering firms, dam outflow curves, etc.).

Part of the explanation for this is that water service providers have limited resources for communications and education and as inferred above, rely heavily on DWWP Program communications on watershed sustainability to fill this role.

Many of the interviewees we spoke to also told us that they are not hearing elevated concerns from their customers about water supply planning in the context of climate change. Instead, customers tend to worry about more immediate matters such as bills, leaks, service interruptions, and status of watering restrictions. As a result, these are the areas where communication effort tends to focus.

In contrast, RDN staff indicate that residents and area stakeholders do frequently ask about sustainability of water supplies, including the impact of climate change. Given the DWWP Program's already prominent role in watershed communication, this is a natural area for RDN to continue and extend future action.

With these key observations in mind, the next section provides a conclusion and recommendations.

7.0 Conclusion and Recommendations

This section provides a summary of findings before offering several recommendations for RDN and partners to consider.

Advantages

Given the realities and imperatives imposed by climate change, the region enjoys the following advantages and opportunities for future water supply planning:

- The region's water managers are aware of the threats imposed by climate change and are actively responding in a variety of ways as documented throughout this report.
- Larger water service providers are investing in formal water supply planning, having recently completed major projects, currently commissioning projects, or preparing to launch projects imminently. These are generally consistent with the best practices for climate-informed planning prepared for this project as documented in Appendix 1.
- Water service providers are already collaborating in many ways as evidenced by effort under the DWWP Program and the various supply sharing agreements in place across the region.
- Water managers are investing in closing information gaps where they exist as evidenced by the numerous monitoring programs funded by the Provincial Government and the studies and monitoring underway or planned under the DWWP Program.
- The Provincial Government is preparing for climate change through, for example, developing new operational policy, funding monitoring programs, creating new tools to manage existing use if required, and, since 2016, regulating the use of groundwater for the first time.

The unique role played by the DWWP Program merits specific mention in terms of how it positions the region to respond to climate change. No other regional district in BC has a watershed protection function with taxation authority comparable in scope or longevity, putting RDN very far ahead of other communities. Based on our experience working with jurisdictions across Canada, we are aware that other places look to RDN as a model. In particular, the importance of the program's sustainable funding model, in the form of the annual parcel tax, must be stressed, along with the fact that this funding has historically been leveraged well to attain significant additional resources (e.g., from the Province) and volunteer effort. As well, the importance of the program for creating a partnership and communication forum that directly advances regional water sustainability must be emphasized.[11]

Challenges

The region faces the following challenges with future water supply planning:

- Due to obvious staffing and resource constraints, planning by smaller water systems tends to be more informal and more dependent on third party sources compared to that of larger providers.
- Water demand management opportunities are not fully exploited.

[11] For a detailed review of the DWWP Program's past performance, see Econics (2018).

- Communication about water supply planning and climate change tends to be limited and ad hoc. Water service providers indicate they have limited resources and interest to increase effort in this area.
- There are specific locations where there is more uncertainty about future supply including the Arrowsmith system on the Englishman River, aquifers in the French Creek and Nanoose areas, and discrete places outside of water serviced areas (e.g., Yellow Point), noting that these issues are well known and that enhanced management efforts or data collection is already underway in each case.
- Provincial Government water allocation is hampered by the following limitations:
    - there is no standard approach to addressing impacts of climate change in allocation decision making;
    - having specific additional data and information in realms such as hydraulic connectivity, timing of snowpack melt, and impact of extreme precipitation events could enhance ability to make sustainable allocation decisions;
    - the cumulative effect of all existing use on water supply, including unregulated domestic use, and how this might affect future allocation decisions, is not well understood.

Recommendations

Based on these findings, the following recommendations for RDN and partners may enhance future water supply planning in the region.

1. Through the DWWP Program, engage with the region's smaller water service providers to determine what, if any, additional support with supply planning they require based on the guidance provided by the best practices prepared for this project.

2. In collaboration with the region's water service providers and the Province, review the workplan established under the DWWP Program Action Plan 2.0 to determine if any modifications to actions under the Water Science and Information Theme are required.
    a. Specific opportunities include those listed in Section 5 of this report, and recommendations from Golder (2020) and WSP Golder (2023) related to groundwater availability in the Nanoose and French Creek areas.
    b. Noting that additional information and data generated by these projects would enhance the Province's ability to meet its obligations under the *Water Sustainability Act*, Provincial funding contributions should be invited.

3. Undertake a water service optimization study for the northern part of the region, (known as the Oceanside area). This should include a detailed examination of the challenges in operating multiple water supplies and distribution systems that depend on the same sources and the opportunities to optimize through consolidated planning, administration and/or operations.

4. Provide additional support to water service providers to implement more advanced demand management practices.
    a. At the regional level, options include refining regional watering restrictions and developing more targeted programs under Team WaterSmart.
    b. To support work at the water service provider level, the DWWP Program could also provide best practice resources and build communities of practice around: conservation-oriented water pricing; improved water use accounting; improved management of non-revenue water; and tools that would assist water-service providers to develop their own specific efficiency plans.

5. Continue to inventory, manage, and protect natural assets in the region that directly influence water supply resilience in a changing climate, building on recommendations provided by the Municipal Natural Assets Initiative (2022).

6. Act as regional coordinator for water supply planning communications by developing content for the DWWP Program area of the RDN website and other targeted communications collateral.

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