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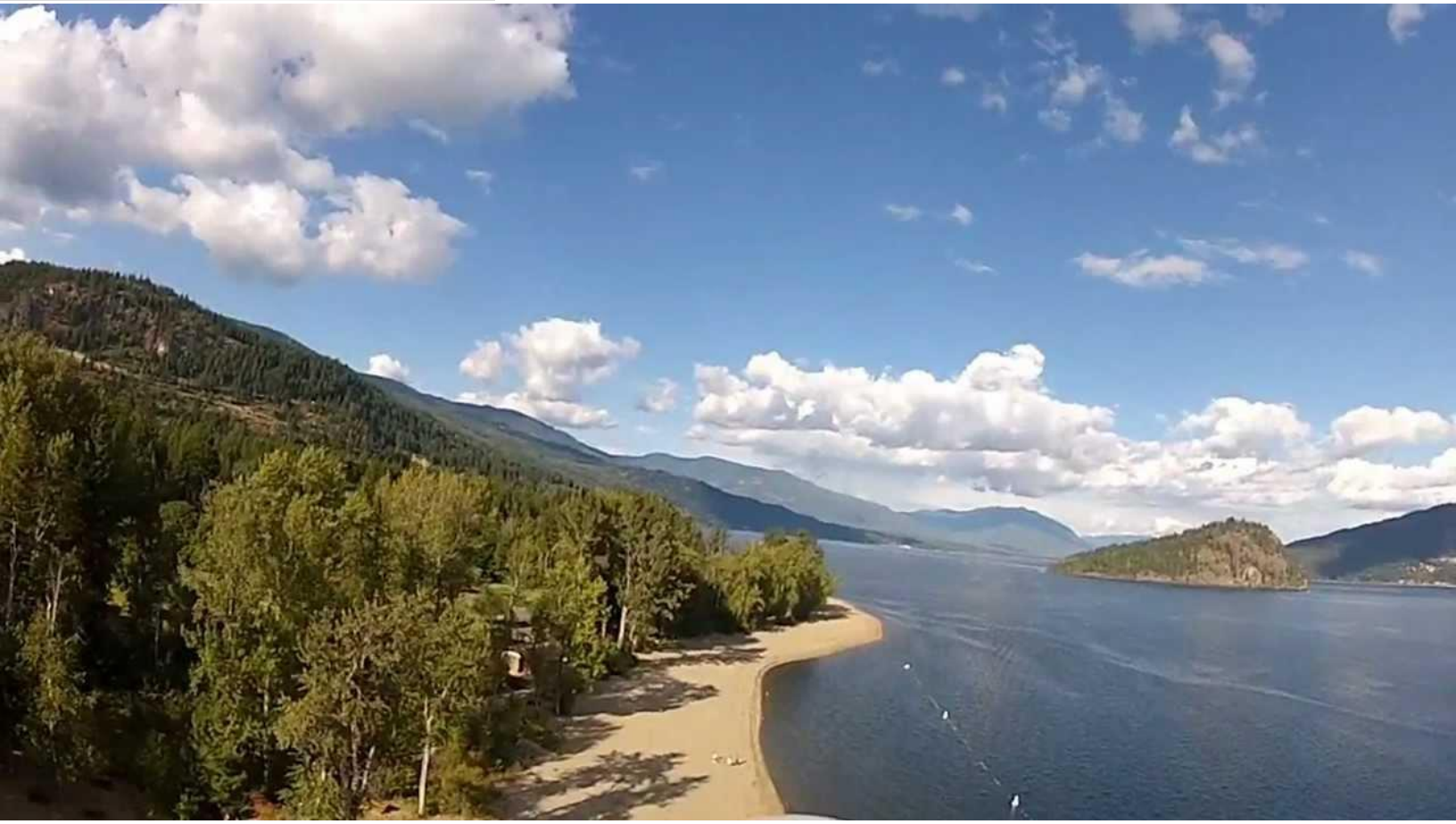

Columbia Shuswap Regional District

Scotch Creek Water Study 2018

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July 19, 2018

File: 0476.0072.10

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Appendices

1 Introduction

In 2007, Urban Systems completed the Scotch Creek Water Study for the CSRD. The report was completed in a response to the need for a safe and reliable water source for the Scotch Creek community. Currently, there are multiple private systems in the area, many of which, fail to meet Interior Health water quality standards. The report identified these existing systems and their shortcomings. It made design assumptions related to populations, and design flows, and proposed a new system based on these assumptions. Sources of water were also evaluated in the report. The report provided a large basis of information for the CSRD.

Currently, there is a renewed interest in constructing a Phase 1 system to address water quality issues and to encourage development in the Scotch Creek area. The primary interest of the CSRD is to provide good quality water to areas that have poor water quality now. Although there is a also a need for a community sewer system in the area, investigating solutions for sustainable implementation and delivery of a community sewer system is beyond the scope of this report. During the water system design stage, additional consideration should be given to the potential locations of community sewer system infrastructure to avoid potential conflicts.

The CSRD established an advisory committee and retained Urban Systems to review the master water plan that was completed in 2007. This report summarizes the findings. It provides updated populations, demands, and a comparison of source options. These findings were used to complete a conceptual design of the system, and provide a cost estimate with cost recovery options.

1.1 Background Information

Previous documents have been referenced during this project and are listed below. Brief summaries of each document are provided in Appendix 1-1.

- Scotch Creek/Lee Creek Zoning Bylaw No. 825, CSRD, 2017
- Community Sewer System and Water Plan for Scotch Creek Area ‘F’, Opus DaytonKnight, 2013
- Scotch Creek Water Study, Urban Systems, 2007
- Hydrogeological Assessment of the Impact of Septic Effluent on the Scotch Creek Aquifer, Golder Associates, 1998
- Hydrogeological Assessment – Proposed Residential Subdivision, Piteau Associates, 2004
- Electoral Area ‘F’ (North Shuswap) Official Community Plan Bylaw No. 830, CSRD, 2009
- Scotch Creek Water Utility Study Update, Civic Utilities Ltd., 2009
- Source of Water Supply for Scotch Creek, Civic Utilities Ltd., 2006
- CSRD Subdivision Servicing Bylaw No. 641, CSRD, 2014
- Technical Memorandum No. 3 - Hydrogeological Assessment for Scotch Creek, Piteau Associates, 2013
- Water System Acquisition Strategy, CSRD, 2011

1.2 Vision and Goals

Having a vision provides focus, especially with complex projects. It provides a clear common picture of the future. The Vision and goals proposed in this section are to be used as a tool for decision making for the various options that are being considered. A Vision also inspires action, and could be used to rally the community, as community buy-in and assent are needed for the community water system to become a reality.

VISION FOR SCOTCH CREEK COMMUNITY WATER SYSTEM

1. The water system provides safe & reliable drinking water to the community.
2. The water system is affordable and financially sustainable.
3. There is an equitable approach to financing the capital and operating costs, with a user-pay and full cost recovery approach.
4. The system meets current CSRD and engineering standards.
5. The system is environmentally sustainable and reflects a conservation mindset. For example, the system is sized in a way that is practical and supports growth but is not oversized.
6. Having safe drinking water improves the vibrancy and health of the community, allowing other community priorities and aspirations to be realized and creating a sustainable community for generations to come.

PROJECT GOALS

It is critical that the water system project achieve the following:

1. Pass the public assent process for CSRD acquisition and financing.
2. Receive government funding.
3. Move forward to construction in the near future.
4. Have a low risk of issues that will impact its success (e.g. technical, approvals, cost, schedule, land acquisition).

2 Key Design Criteria

This section provides a summary of some of the design criteria and assumptions that have been made to develop the conceptual cost estimates for the water system options that have been assessed. These assumptions have been made based on:

- The overarching goals listed in Section 1;
- A review of past reference documents and assumptions; and
- Current legislation and best practices.

The water system will be designed based on the Maximum Day Demand (MDD). MDD is the volume of water used by a water system on the highest usage day of the year. A system needs to be sized to pump/treat this flow/volume of water to keep up with use on that day (typically in late July /early August). Population and flow use estimates will be based on the Official Community Plan (OCP), released by the CSRD. The water system will have elevated storage to provide adequate system pressure per municipal standards. It will provide adequate fire flow while maintaining a minimum system pressure. The system will also provide safe drinking water that meets Interior Health requirements. The water system design will use information from the water system in the Saratoga subdivision. This system provides water for approximately 140 users. It currently operates to IHA standards and is owned and operated by the CSRD.

These assumptions will need to be reviewed when the project moves forward to design and more detailed information is available.

2.1 Water Quantity & System Sizing

- Water usage estimates were approached in a variety of ways in the background reports
- It is difficult to accurately estimate future water use
- It is also important to not overestimate water usage as the systems sizing should be practical and feasible, and oversizing could limit the ability to move forward with a community water system.
- The intent of the approach used in the current study was to estimate overall water usage rather than focus on individual properties
- For context the following table shows the estimates included in previous reports:

Report	Urban Systems - 2007	Civic - 2009	Opus DaytonKnight - 2013
MDD (L/s)	122	107	124

2.1.1 Number of Parcels and Users

The number of lots (parcels), and number of water system connections (users) affect the project water use, construction cost estimates, and affordability of the system:

- Need to know number of connections/users to estimate the water use
- Need to know number of services for the construction cost estimate– these represent significant costs, particularly for larger services which require a chamber with backflow preventer & water meter
- Need to know number of parcels and number of users for cost recovery calculations – this has a significant impact on affordability

The following numbers have been based on the CSRD OCP and zoning bylaw mapping, information from Interior Health on the number of connections, and orthophotos/general imagery of the area. It is important not to focus too much on whether the numbers are exactly accurate at this point. **The intent is to be in the correct range for the water use, number of services, and cost recovery calculations. The numbers can be refined at the design stage if the numbers below need to be adjusted for specific parcels.**

In Scotch Creek, there are a number of complicating factors:

- There are existing large developments that are shared interest or strata parcels. This means that there are a number of users on one parcel, and a larger water service will be required. This includes:
  - Caravan's West – 2 parcel/382 existing users (shared interest)
  - Captain's Village Marina, 84 parcels/84 users (strata)
- There are a number of proposed large developments that are anticipated to be strata parcels, including:
  - Osprey Landing – currently 1 parcel/1 user – but 160 parcels/users proposed (strata)
  - Doubletree – currently 1 parcel/1 user – but 66 parcels/users proposed (strata)
  - Trailblazers RV – currently 1 parcel/1 user – but 200 users proposed
  - Franks Campground – currently 1 parcel/1 user – but 130 parcels/users proposed (strata)

For the purposes of this report it has been assumed that these developments will proceed; however, they may not all proceed as noted, and the zoning and approval processes need to be completed.

- The above developments total 1026 connections (500 existing plus 526 proposed). Whether these parcels are included or excluded in the service area, water use calculations, and parcel/user rates has a significant impact. Having more users on the water system is beneficial
- The number of vacant other properties also needs to be considered. As will be noted in subsequent sections, a parcel tax is collected on vacant properties. Occupied/connected properties are also charged a user fee.

The following tables provide a summary of the number of parcels and users in the proposed Phase 1 and future service areas. The proposed service areas are shown in Figure 2-1. **The intent is to be in the correct range for the water use, number of services, and cost recovery calculations. The service area boundary can also be updated at the design stage with respect to specific parcels.**

For Phase 1, the proposed service area (service area 1) was essentially determined by identifying a trunkmain route that will supply water and fireflows to the main/central community, and parcels along this main corridor.

The system could be expanded in the future to other areas of the community (service area 2). The Copper Cove Road parcels have been excluded from the initial cost calculations (service area 3) as they are at an elevation that is higher than what can be serviced by the proposed system and will require a separate pressure zone. The system could be expanded in the future to service this area through a booster pump system.

The Ultimate service area includes the capacity to service the Hilliam Frontage Road parcels on Little Shuswap Indian Band IR#4 (LSIB), if they would like service in the future. Further discussion with LSIB is recommended prior to design regarding this potential connection and population/water use assumptions.

Approximately 94% of parcels are occupied in service area 1, compared to 60% of service area 2. In both service areas, occupied and unoccupied parcels were identified. Occupied parcels refer to parcels that contain structures on them and are assumed to require a water service. Unoccupied parcels refer to parcels which would not require a service connection.

Proposed Phase 1 (service area 1)	***Parcels***	***Users***
Scotch Creek Phase 1 existing occupied properties	176	639
Saratoga	106	143
Subtotals:	282	**782**
Currently unoccupied but in Scotch Creek Phase 1 service area (parcels in phase 1, users in future):	10	10
Subtotals:	**292**	792
Potential nearby extensions to service area (all currently unoccupied)*:	389	588
Totals:	**681**	**1380**

* *this includes Osprey, Trailblazers, Doubletree, Franks campground, Zinck Road parcels*

Little Shuswap Lake Indian Band
Scotch Creek IR#4

Chappell Road
Allan Road
Leopold Road
Leopold Road
Squilax-Anglemont Road
Copper Cove Road
Pressure Zone 2
Pressure Zone 1
Squilax-Anglemont Road
Beatty Road
Kenwood Gate
Squilax-Anglemont Road
Ancient Creek Lane
Cardy Drive
Logan Road
Hilliam Road
Butters Road
Saratoga Road
Webb Road
Butters Road
Imal Road
Santa Road
South Ashe Crescent
The Crescent
Decdar Road
Ashe Road
Squilax-Anglemont Road
Jordan Way
Morgan Drive
Scotch Creek Wharf Road
Express Point Road
Pine Grove Road
Crescent
Express Point
Express Point Road
Express Point Road
Captains Village Way
Acton Place
Scotch Creek Wharf Road
Hilliam Frontage Rd
Zinck Road

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CSRD
COLUMBIA SHUSWAP REGIONAL DISTRICT

Columbia Shuswap Regional District
Scotch Creek Water Study

Proposed Future Service Areas

Legend

- Phase 1 Water Main
- Phase 2 Water Main
- Pressure Zone Boundary
- Service Area 1 – proposed Phase 1 Service Area (including Saratoga Service Area)
- Service Area 2 – proposed future pressure zone 1 service area
- Service Area 3 – potential future pressure zone 2 service area
- Exempt from Loan Repayment Service Area

0 100 200 400 600
Metres

N

Coordinate System:
NAD 1983 UTM Zone 11N

Scale:
1:8,000
(When plotted at 22"x34")

Data Sources:
Data provided by -

Project #:	0476.0072.10
Author:	JC
Checked:	LC
Status:	
Revision:	A
Date:	2018 / 7 / 19

URBAN systems

FIGURE 2-1

Future (service area 2)	Parcels	Users
Phase 1 occupied properties	176	639
additional occupied parcels in full service area	388	434
Subtotals:	*564*	*1073*
currently unoccupied but in Phase 1 service area:	10	10
currently unoccupied in full service area:	400	701
Totals:	**974**	**1784**
Saratoga	106	143
Totals:	***1080***	**1927**

2.1.2 Water Use

A number of approaches were compared for calculating the maximum day demand. It was determined that the following assumptions provide a reasonable estimate.

- Saratoga water use is approximately 4300 L/unit/day – this consistent with CSRD Subdivision Servicing Bylaw (SSB) of 4500 L/lot/day and lower than previous estimates of 6300 L/lot/day which were based on the SSB at the time
- Commercial use is anticipated to be similar to residential use, and there are no industrial users. Also, the bulk of parcels in Scotch Creek based on the OCP are residential (75%, by area). Water service connections will be sized relative to their end uses of water.
- 4500 L/user/d has been applied to all users for system sizing – water use per user may be higher or lower for some users, but this is suitable for overall sizing
- Note we have assumed 4500 L/lot/d = 4500 L/unit/d = 4500 L/user/d (not 4500 L/person/d).
- A reasonable amount of community growth has been considered in the calculations:
  - 40 L/s is 770 users/units at 4500 L/user/d. At 2.5 people/unit = 1920 people
    - *This is approximately the existing number of occupied users in the proposed Phase 1 service area (including Saratoga)*
  - 60 L/s is 1150 users/units at 4500 L/user/d. At 2.5 people/unit = 2880 people
  - 90 L/s is 1728 users at 4500 L/lot/d (4320 people)
    - *This is about 40 years growth at 2% /year from the existing number of people*

The following table shows the maximum day demand that has been used for system sizing and the cost estimates. Please note that the cost estimates have been completed at a conceptual level, so these assumptions should be reviewed and adjusted during the design stage. Also, MDD is used mainly to size the source, treatment, and pumping infrastructure, so modest changes to the MDD will have a marginal effect on the overall costs. Additional growth could also be accommodated in the future through the implementation of water conservation measures.

Scenario	MDD (L/s)
Phase 1	40-60
Ultimate	60-90*

2.1.3 Fire Flows

The distribution system was modelled in WaterCAD to determine pipe sizes and available fireflows throughout the system. This was completed at a conceptual level, and the layout and watermain sizing should be confirmed during the project design.

The worst case condition for sizing watermains is supplying maximum day demand and the required fireflow with the system pumps off (i.e. power failure condition). In order to take a cost effective and sustainable approach to the watermain sizing, a somewhat reduced fireflow target was used compared to past studies for the *initial* water modelling (see table below). The purpose of this initial water modelling was to determine appropriate watermain sizing for the preparation of the cost estimates. Additional work is required to refine the watermain sizing and pipe layout.

As will be noted in Section 4, the watermains will be a significant portion of the capital cost of the new water system. It is important that they appropriately sized for future conditions, to avoid needing to upsize key sections in the future. That said, it would be possible increase fireflows in the future (i.e. phase the construction) through the addition of looping. The fireflow assumptions also have a significant impact on reservoir size and cost, and as will be noted in future sections, the reservoir construction can be phased. Reducing the reservoir size is also beneficial because it reduces water age.

Other items should be considered in the water distribution system design:

- The Scotch Creek fire department has shuttle accreditation, and therefore doesn't rely on just the main distribution system to provide fire protection (e.g. a lake hydrant could be used);
- Sprinklers and other fire protection measures could be included in buildings to reduce fireflow requirements;
- The elevation of the reservoir. The original study recommended a reservoir height of 427 m. The proposed new Saratoga Reservoir will be much higher for siting/geography reasons. This means there

is potential for greatly improved fireflows with smaller pipe sizes. The CSRD is also planning to include a high pressure hydrant above the PRV station in the Saratoga reservoir design.

Significantly higher fireflows than the target will be achieved in many areas with the proposed watermain sizing. Assuming that the reservoir is sited at the elevation proposed for Saratoga, the fireflows will be more than adequate.

Description	Initial Fireflow Target	Achieved Fireflow Range
Single Family Residential	60 L/s	>80
Commercial	90 L/s	>110
Institutional	90 L/s	n/a

During the design of the distribution system, it will be important to review the system configuration in detail. This should consider:

- The available budget
- Key pipe sections (e.g. downstream of the reservoir) and whether an upsizing is preferable so that higher fireflows can be achieved in the future
- Opportunities to phase the system and add looping in the future to increase fireflows if desired
- The reservoir elevation and PRV station design / setpoints
- Consideration of the potential for high pressures, and high velocities/flows in sections of the distribution system.

2.1.4 Reservoir Storage

The reservoir storage was calculated based on the Master Municipal Construction Documents (MMCD) Design Guideline Manual, which is a best practice guideline referenced for the design, tendering and construction of municipal projects. The following formula was followed:

$$Total\ Storage\ Volume = A + B + C$$

$Where;$

$A = Fire\ Storage\ (from\ Fire\ Underwriters\ Survey\ guide)$

$B = Equalization\ Storage\ (25\%\ of\ Maximum\ Day\ Demand)$

$C = Emergency\ Storage\ (25\%\ of\ A + B)$

The fire storage was calculated based on Water Supply for Public Fire Protection, FUS, 1999. The fireflow specified in the previous section (60 L/s and 90 L/s) corresponded to a required duration of flow. The duration, along with the flow, was used to size the fire protection storage of the reservoir

This results in the recommended storage volumes shown in the following table.

Scenario	Reservoir Volume (m^3)
Existing Phase 1 (MDD 60 L/s, fireflow 60 L/s)	1500-2000
Future (MDD 90 L/s, fireflow 90 L/s)	3000-3200

It is recommended that the reservoir is constructed in phases (two cells with 1500 m^3 each). Note that this is a smaller reservoir than what was proposed in past studies, but will provide a reasonable storage volume for operation of the water system and fire protection, supplemented with shuttle service from the lake. A dedicated watermain is proposed to the reservoir and will reduce water age problems associated with the system, in conjunction with good reservoir design.

Also for context, the existing Saratoga reservoir is 90 m^3, and funding for a new upper 250 m^3 reservoir has been received. The lower reservoir would be abandoned as part of this proposed project.

The draft design of the Saratoga reservoir (by Gentech) indicates a proposed top water level (TWL) of 439.5 m. This has been set based on the elevation of a suitable site. The desired reservoir TWL is 427 m (based on the 2007 Urban Systems report and limiting pressures to a range that will not cause excessive water use or damage to equipment). A pressure reducing valve will therefore be required.

2.2 Water Treatment

2.2.1 Surface Water (Shuswap Lake)

- Previous studies recommended filtration as this was required for a surface water source at that time.
- Filtration deferral is now an accepted option as Shuswap Lake is a considered a high quality, low turbidity source.
- Filtration has not been included in current estimates based on CSRD's current discussions with Interior Health, and the monitoring results from other water systems on the lake which have shown that the water quality is suitable without filtration. It has been assumed that UV disinfection and chlorination will be used. This conclusion is corroborated by the performance of the existing Saratoga water system.
- Chlorination is recommended for all water systems (4-log viral CT assumed)
- A dedicated main to the reservoir has been included for 4-log viral CT, and system residual control

2.2.2 Groundwater

- Past studies from Piteau and water quality testing of the well on the Doubletree property indicate that the groundwater quality is acceptable without treatment
- Chlorination is recommended for all water systems (4-log viral CT assumed)
- A dedicated main to the reservoir has been included for 4-log viral CT, and system residual control

Groundwater options are discussed further in Section 3. There are concerns regarding the potential impact of septic systems on the water quality, which could impact treatment requirements in the future. The proposed well locations are anticipated to be upgradient of the community, which should lessen the potential need for additional treatment beyond chlorination.

3 Water System Options

Several options were considered and decisions were made regarding the preferred approach to a community water system for Scotch Creek. The following options were considered:

1. The expansion Saratoga water system to include the entire Scotch Creek area (i.e. one centralized water system)
2. A separate water system for the Scotch Creek area. This included the review and comparison of options for:
   a. the water source (surface water or groundwater) and its location
   b. the reservoir location

The following tables provide a general comparison of these options. The overarching water system Vision, and project goals were also considered in this comparison.

3.1 Overall Water System Options

3.1.1 Centralized System with Saratoga

Pros	Cons
The system has been shown to reliably provide safe drinking water. This includes both: • The source/treatment process • The operation and maintenance of the system by the CSRD	
Low risk from a technical perspective • intake and WTP requirements are known, single supply location will reduce capital and O&M costs as there will be less required equipment • reservoir site has been assessed → *potential to use this as rationale for funding the Scotch Creek water system as project can be shovel ready relatively quickly*	
Economies of scale for cost recovery of capital & O&M – will reduce long-term costs to community. Increasing the number of users will result in a system that is more affordable and financially sustainable.	Concern regarding equity from Saratoga water users. Need to assess contribution to existing system per CSRD policies.

Pros	Cons
Best/only surface water intake option per previous study	Some public concern regarding proximity of STP outfall; however, existing testing at Saratoga WTP has shown water quality is excellent
Saratoga system has received funding for upgrades which could be leveraged for a larger Scotch Creek project → *potential to use this as rationale for funding the Scotch Creek water system to increase priority and urgency*	Potential to delay Saratoga upgrades as do not know when/if Scotch Creek funding would be received. Puts pressure on funding application and assent process
Better source protection/control than dual systems with multiple intakes, or surface and groundwater sources. Less potential for conflict /impact from community effluent disposal location	
More efficient to operate/maintain a single water system. Reduced impact on the environment and footprint on the foreshore (if one surface water intake and WTP rather than two). *Design will include redundant equipment (e.g. pumps) and back-up power increase reliability*	

Separate Scotch Creek System

Pros	Cons
Saratoga system upgrades could be completed independently of Scotch Creek project	Lose potential to reduce costs for Saratoga users through economies of scale.
Some desktop studies regarding high yield wells have been completed by Piteau, and there are smaller wells drilled in area that show water quality /quantity should be suitable. Piteau report suggests wells should be 30 L/s each, spaced a minimum of 100 m apart to avoid interference.	The development of larger wells will trigger a review under the BC Environmental Assessment Act (≥ 75 L/s). This process is anticipated to take at least two years, and could therefore delay the project schedule. The process would be used to identify valued environmental components (e.g. other wells and water source in the area, habitat, birds), and confirm that the development and operation wells will not impact them. *There are also Risk that groundwater development will not be successful. Risk of impact of septic systems to water quality. Risk of interference with other existing wells/Scotch Creek. There are a number of unknowns to consider*
The groundwater quality may be suitable for chlorination as the sole source of disinfection (without UV, reducing the treatment plant cost).	The Piteau report recommends confirming that adequate in-ground filtration is provided through monitoring once the wells have been developed. Therefore it is also possible that UV disinfection will be required for the groundwater source option given the vulnerability of the aquifer. This could add to project costs in the future.
The Roan site has been identified as a potential reservoir location	A new reservoir site would need technical review including field investigations (e.g. survey, geotechnical) and land acquisition/permitting – which will take more time than the Saratoga reservoir site
Could establish a small service area and phase system	May not be as likely to secure government funding May be difficult to proceed with subsequent phases and benefit entire community. *Risk that economies of scale will not be realized, and project will not advance*

3.2 Detailed Water System Options

The following detailed options were reviewed and compared. The following sections provide general assumptions and commentary regarding the options. Cost estimates are provided in Section 4.

3.2.1 Saratoga Expansion - Phase 1

{Consolidated System with Saratoga Intake & Saratoga Reservoir}

As discussed in Section 3.1.1, there are many benefits to this option.

- From a technical perspective this system is well understood, and can be completed in a straightforward and timely manner
- A water licence amendment will be required for the intake
- Have assumed that majority of watermains will be constructed along the trail to reduce road restoration costs. This resulted in a savings in the order of $400-500k in the cost estimate. The location of infrastructure will need to be further evaluated to avoid conflicts with other existing infrastructure and minimize costs.
- The construction cost could be reduced by decreasing the size of the reservoir. For example, there is a savings of approximately $900k if the reservoir size is decreased to 1000 m^3

Overall this is the preferred option because:

- **There would be long-term efficiency in having a centralized system (i.e. lower O&M costs)**
- **It has the lowest capital cost;**
- **This option is the most shovel-ready and therefore the most likely to be successful in terms of a grant application**

3.2.2 Saratoga Expansion – Full Service Area

{Consolidated System with Saratoga Intake & Saratoga Reservoir}

- This option shows the estimate for constructing the full water system in one phase
- The costs are quite high due to the extent of the distribution system, however there would be a higher number of users to pay for the system.
- A reservoir volume of 3000 m^3 has been assumed; however, this could be reduced/phased to reduce the initial cost
- Some of other infrastructure (e.g. pumps, water treatment equipment) could also be reduced in size to reduce initial cost as this infrastructure has a shorter life and would need to be replaced before all users are connected to the system.

3.2.3 Wharf Road Intake & Roan Reservoir – Separate System, Phase 1

- Previous study recommended Saratoga site as best intake location in area
- Wharf Road Park has also been considered to provide the community with the conceptual cost of a separate Scotch Creek water system using a surface water intake
- The estimate assumes that there is adequate space at the CSRD Wharf Road park, and that there will be no land acquisition costs with this option
- Will need to undertake specific siting study for intake and consider STP outfall location (similar to Saratoga site considerations, assumed to be acceptable in terms of water quality)
- Have assumed will need to upgrade power from highway to site for 3-phase (for UV disinfection system)
- As this would be a new intake/water treatment plant site, the cost estimate allows for:
  - General site work (e.g. clearing/grubbing, grading, landscaping, fencing)
  - Site piping and valves
  - A new building (larger than Saratoga where the existing building can be used/expanded)
  - Power upgrades to get 3-phase power to the WTP for the UV disinfection system
- The estimate also includes a dedicated watermain from the WTP to the Roan reservoir, and a 1500 m^3 reservoir. The dedicated main is a significant cost given the distance to the reservoir compared to the proximity of the Saratoga intake to the Saratoga reservoir.
- The watermain connection to the community from the reservoir is a considerable distance and adds a significant cost to this option compared to the Saratoga reservoir location. A larger watermain is required due to the distance/headloss, and is needed meet fireflow targets.

The following figure provides the dimensions of the Park for general context.

Wharf Road Park Property information, retrieved from CSRD Mapping Software

3.2.4 Doubletree Wells & Saratoga Reservoir – Separate System, Phase 1

{Separate reservoir adjacent to Saratoga Reservoir}

The Doubletree site owners have completed previous investigations regarding the water supply for their development and the Scotch Creek area, and have been in discussion with CSRD regarding the use of their property for a groundwater source. Another site in the area could also be selected. The concept and assumptions for this option build on previous work that has been completed.

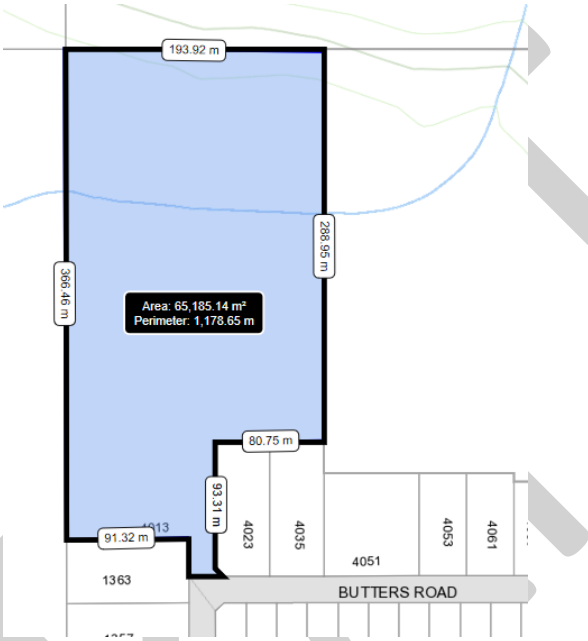
In particular, the "Technical Memorandum No. 3 – Hydrogeological Assessment for Scotch Creek" (Piteau Associates, October 2013) has been referenced. This document provides a summary of previous groundwater studies in the area, and states the following:

- A withdrawal rate of 120 L/s would represent approximately 20% of the aquifer flow
- The aquifer is considered highly vulnerable to contamination, and the direction of flow is from the north towards the south, so it is considered prudent to position effluent-to-ground disposal areas down-gradient of any wells. Wells should be located within the northern portion of the aquifer.
- In order to achieve the desired yield, multiple wells (at least 4 @30 L/s each) will be required.
    - *For a 90 L/s MDD, 4 wells would provide MDD with 33% redundancy. The number of wells and redundancy should be confirmed during the design.*
- The minimum recommended well casing diameter is 300 mm, and wells will be approximately 60 m deep.
- To minimize the potential for interference, wells should be spaced a minimum of 100 m apart, perpendicular to the direction of flow in the aquifer.
- Chlorination will likely be required, and field investigation will be required during the first few months of operation to demonstrate that the aquifer provides suitable filtration.

- *If not, then UV disinfection may be required. This has not been included in the cost estimate.*

The following figure provides the dimensions of the Doubletree property. The siting of 4-5 wells with the above criteria would require further review from both a hydrogeological perspective, and to prevent encumbering the proposed development on the property. Other sites in this vicinity could be considered for all/some of the wells.

Doubletree Property information, retrieved from CSRD Mapping Software



The estimate for this option includes:

- Drilling and development of three 30 L/s wells (for an MDD of 60 L/s, this provides 50% redundancy)
- The infrastructure needed for three well sites (piping, valves, electrical supply/kiosk, sampling stations, blow-offs, fencing, etc.)
- A single WTP at one of the well sites with a chlorination system
- A dedicated supply main to the Saratoga reservoir
- A 1500 m3 reservoir at the Saratoga site or a proximate location.
- An allowance for the BC Environmental Assessment process and groundwater investigations that will be required. A groundwater licence will also be required in accordance with the BC Water Sustainability Act and BC Groundwater Protection Regulation.

  As stated in Section 3.1.2, the development of larger wells will trigger a review under the BC Environmental Assessment Act (≥ 75 L/s). This process is anticipated to take at least two years, and could therefore delay the project schedule. The process would be used to identify valued

environmental components (e.g. other wells and water source in the area, habitat, birds), and confirm that the development and operation wells will not impact them.

- The estimate for this option does not include the decommissioning of existing wells and water systems as property owners may want to retain these wells/intakes for irrigation purposes.
  - *For the centralized surface water option this will provide the benefit of reducing water use from the community water system;*
  - *For a separate groundwater system, this becomes much more complicated with potential for impacts to both water quality (source protection control) and quantity (interference between wells)*

3.2.5 Roan Wells & Roan Reservoir – Separate System, Phase 1

An estimate has also been prepared for developing a groundwater source and reservoir on the Roan property.

- The well costs are estimated to be the same as the Doubletree property.
- The length of the dedicated main is reduced with this option
- The watermain connection to the community back from the reservoir is also a considerable distance and adds a significant cost to this option compared to the Saratoga reservoir location. A larger watermain is required due to the distance/headloss, and is needed to meet fireflow targets. It may be possible to construct the watermain along the trail to reduce project costs. The potentially difficult terrain/slope from the reservoir needs to be considered in the construction costs. This is unknown at this time as the site has not been reviewed/investigated.
- The construction of the reservoir will require the assessment of a new site including survey, geotechnical & hazard/terrain review, archaeological review, and environmental review. It will also require negotiations with the property owner, a right-of-way and legal survey. This will affect the project schedule.
- The reservoir will also require the development of a new site including roads/drainage, piping/valves, fencing, SCADA, and power/controls which adds to the estimated cost.
- An allowance for land acquisition costs has been included in the estimate but is unknown at this time.

4 Cost Estimates

Class C cost estimates have been prepared and include a 25% contingency allowance and an allowance of 15% for engineering/consulting. A Class C estimate is prepared with limited site information, and is based on probable conditions affecting the project. It represents the summation of all identifiable project component costs. It is used for program planning and to establish a more specific definition of client needs and to obtain approval in principle. A contingency allowance of 25% plus engineering and other allowances is appropriate for this class of estimate.

The cost estimates are in 2018 Canadian dollars, and include an allowance for inflation of 3% per year for 2 years (i.e. assumes construction in 2020). The appropriateness of this inflation allowance should be considered in conjunction with the project funding, financing and scheduling.

A detailed breakdown of the cost estimates is included in Appendix 4-1. Please note that special architecture has not been included for the water treatment plants, and basic site landscaping/restoration has been included.

4.1 Construction Costs

The following table provides a summary of the construction costs estimated for the options presented in Section 3.

	OPTION 1 Phase 1 - Saratoga Intake / Saratoga Reservoir	OPTION 2 Phase 1 - Wharf Road Intake/Roan Reservoir	OPTION 3 Phase 1 - Doubletree wells / Saratoga Reservoir	OPTION 4 Phase 1 - Roan wells / Roan Reservoir	OPTION 5 Ultimate (Service Area 2) - Saratoga Intake / Saratoga Reservoir
	Central System with Saratoga	*Separate water system for Scotch Creek*	*Separate water system for Scotch Creek*	*Separate water system for Scotch Creek*	*Central System with Saratoga*
General Requirements	$ 380,000	$ 570,000	$ 495,000	$ 575,000	$ 960,000
Watermains	$ 2,370,725	$ 2,548,725	$ 2,548,725	$ 3,624,975	$ 9,004,675
Source and Treatment	$ 1,852,500	$ 3,810,000	$ 2,755,000	$ 2,485,000	$ 2,177,500
Dedicated Main (included in source and treatment amount)	*$ 495,000*	*$ 1,657,500*	*$ 495,000*	*$ 225,000*	*$ 495,000*
Reservoir	$ 1,610,000	$ 2,120,000	$ 2,120,000	$ 2,515,000	$ 3,465,000
Subtotal All Sections	*$ 6,213,225*	*$ 9,048,725*	*$ 7,918,725*	*$ 9,199,975*	*$ 15,607,175*
25% Contingency	$ 1,298,000	$ 2,262,000	$ 1,980,000	$ 2,300,000	$ 3,647,000
Sub-total	*$ 7,511,225*	*$ 11,310,725*	*$ 9,898,725*	*$ 11,499,975*	*$ 19,254,175*
15% Engineering/Consulting	$ 872,000	$ 1,697,000	$ 1,485,000	$ 1,725,000	$ 2,633,000
Subtotal	*$ 8,383,225*	*$ 13,007,725*	*$ 11,383,725*	*$ 13,224,975*	*$ 21,887,175*
Inflation (2 years at 3%)	$ 510,538	$ 792,170	$ 693,269	$ 805,401	$ 1,332,929
Estimated Capital Cost (Rounded)	**$ 8,900,000**	**$ 13,800,000**	**$ 12,100,000**	**$ 14,000,000**	**$ 23,200,000**

Notes:

- A savings of approximately $900k to Option 1 could be realized by reducing reservoir from 1500 to 1000 m³
- Option 1 includes a deduction of $1.488 M for Saratoga funding. The estimate without this deduction is $11.1 M which is still less than other non-centralized options
- Option 5 includes a deduction of $1.488 M for Saratoga funding. The estimate without this deduction is $25.4 M
- Option 5 includes 380 water services, based on approximate counts of existing occupied properties in the full service area (approximately 1000 users)
- The Option 5 total cost could also be reduced by decreasing the reservoir size
- A cost allowance for decommissioning existing water systems and wells has not been included and is assumed to be at property owner's expense
- **Water meters have been included for the larger services with backflow preventers, but NOT for individual users at this time. This was excluded at this time to reduce the initial capital cost, but may be completed at a later date in accordance with the CSRD Water System Acquisition Strategy. The CSRD will implement a Water Conservation Plan for the community to minimize water use.**

4.2 Cost Recovery Calculations

4.2.1 Background

The CSRD has a number of policies that are part of the Water System Acquisition Strategy that will need to be applied in the development of the project and have been considered in the cost recovery calculations. The approach to cost recovery should be consistent with these policies and be:

- Equitable
- Transparent / accountable
- Efficient to administer
- Limit risk/uncertainty
- Sustainable

A couple of these key policies are referenced below.

Water User Rates

To ensure the long-term viability of its water systems, the CSRD must ensure its water user rates reflect the true value of safe, reliable water. To promote sustainability, the CSRD's water user rates should recover the full cost of providing water (i.e., the rates should cover operations and maintenance costs, rate-funded capital, and contributions to reserves for long-term capital replacement). These rates should be designed to recover these costs fairly across water user groups. In order to minimize any substantial increases in usage rates, the CSRD may consider phasing in rates over time.

Policy No. 25:

(a) The CSRD will introduce uniform water user rates to recover the full cost of providing safe, reliable water.

(b) The CSRD will consider phasing in rate increases over multiple years to help mitigate the impact on water users.

Existing Properties Connecting to a CSRD Water System

The CSRD needs to establish a fee for a contribution to capital reserve for properties outside the service area that wish to connect to a CSRD water system. Funds collected will assist with required future capital upgrades. The contribution to capital reserve account is ten times the current parcel tax for each respective water system. This ten multiplier of the parcel tax will be based on the number of connections, as in the case of a trailer park, or the number of residences, as in the case of a multi-unit building.

> ***Policy No. 34:***
>
> *a) Existing properties applying to connect to a CSRD water system shall pay a contribution into the respective water system's Capital Reserve Fund for future capital infrastructure at a rate of 10 times the current parcel tax of the respective water system, based on the number of residences and/or businesses on the property, in addition to the established connection fee.*
>
> *b) In extenuating circumstances, the Board may deviate from this formula to calculate the contribution to a capital reserve account.*

Policy 34 has been applied in the past when a parcel/development connects to an existing water system. The intent of this is to recognize the contributions of the existing/past property owners in the water system, by requiring an initial contribution to reserves.

This is different than the proposed Scotch Creek water system which is a large expansion instead of new water system on its own; therefore, the CSRD is considering recommending Policy 34 not apply to Phase 1.

It would however be considered in the future when new parcels connect to the water system.

4.2.2 Water System - Initial Connection and Annual Fees

There are a number of costs relating to the construction of a water system, and these costs are recovered through charges to property owners benefitting from the water system.

The beneficiaries include:

- An unoccupied parcel – as the value of the property will be higher and there is increased development potential if there is the potential to connect to a community water system
- A water user who is connected to the water system and using the water. **Note that in this case, all users in the service area will be required to connect to the new water system.**

The costs and typical cost recovery approach are summarized in the following table.

Item	Cost Recovery Approach
Water service from house to property line; Decommissioning former water system & its components	Property owner's expense
Water service from property line to watermain	Initial Connection Fee ($2,000)
Initial water system construction cost	Annual Parcel Tax/User Fee
Operation & Maintenance Expenses	Annual User Fee
Infrastructure repairs & replacement	On-going contribution through Parcel Tax/User Fee

4.2.3 Preferred Solution and Calculations

A meeting was held with the Scotch Creek Water Advisory Committee to review a draft of the report, and it was agreed that Option 1 (Phase 1 expansion of the Saratoga water system) was the preferred solution for moving forward with a community water system in accordance with the Vision and Goals presented in Section 1 of this report.

In order to complete the following cost recovery calculations, it has been assumed that:

- The preferred approach is a central water system / expansion of the Saratoga water system with a capital cost of $8,900,000 being incurred.
- That a new service area will be created for the surcharge of the loan repayment for the new Scotch Creek infrastructure and user fees/parcel tax
- Calculations have been based on receipt of a senior government grant of 73%
- The CSRD will finance the remainder of the construction cost with the Municipal Finance Authority, with a 20-year amortization at 3%/year, and a 3% capitalization rate sinking factor of 0.037215708.
- There are 106 parcels, and 143 users in the existing Saratoga water system (this includes Copper Island RV Park)
- Water system annual expenses will be similar to the Saratoga expenses (and have been adjusted based on the number of users depending on the option).
- Note that the calculations are in 2018 dollars and are based on current expenses. Water system rates will be increased over time. Currently user fees are increased on an annual basis by 2%, and parcel taxes are increased every 5 years.
- The Saratoga users should not pay for the loan for the expanded water system and will not be included in the new service area for the loan repayment.

- Captain's Village Marina will be in the service area and will contribute $550,000 to the project cost upon connection to the water system based on their agreement with the Comptroller/CSRD. In order to be equitable and recognize this contribution, the CSRD is considering waiving the loan repayment portion of the user fee for this property.
- The parcel tax will be $185/year
- Users fees will be collected to pay for annual expenses and loan repayment (range of $550-$750 anticipated)
- Existing Saratoga users will benefit from the economies of scale of the larger water system (i.e. annual expenses per user are lower with additional users)
- A metered rate based on water meter reading will not be charged at this time but may be considered in the future once all users have meters.

4.2.4 Potential Rates

The parcel tax and user fees were calculated for three options:

- Option A – base option. Includes Scotch Creek phase 1 with 176 parcels and 639 users.
- Option B – full service area, with 564 parcels, and 1073 serviced users. For this option it has been assumed that a 73% grant will be received, but this may not be realistic

Please note that:

- **The following calculations are a simplified version of the potential rates for single family residential user. If this project proceeds, CSRD Bylaw 5744 would apply, and Schedule A would be updated to include the Scotch Creek water system.**
- **The number of parcels/users is approximate and should be confirmed.**
- **The CSRD finance department needs to review these calculations and the distribution between the parcel tax and user fees may need to be adjusted. The purpose of the numbers provided below is to provide a general indication of the potential charges**

The following table provides a summary of the calculations.

Item (Note 2)	Option A Phase 1 Service Area	Option B Ultimate System (Note 3)
Capital Cost	$ 8,900,000	$ 23,000,000
Loan Amount	$ 1,850,000	$ 5,710,000
Annual Costs (Loan Repayment & Annual Expenses)	$ 439,000	$ 788,000
Parcels / Users (including Saratoga)	282 / 782	670 / 1216
Parcel Tax + User Fee (Saratoga, Captain's Village Marina) (Note 1)	185 + 414 ≈ $ 600	185 + 341 ≈ $ 525
Parcel Tax + User Fee (Scotch Creek) (Note 1)	185 + 545 ≈ $ 750 (Note 4)	185 + 604 ≈ $ 800
Anticipated annual payment range	***$ 600 - 750***	***$ 525 - 800*** *(Note 3)*

Note 1 – for parcel with one user (e.g. single family parcel)
Note 2 – does not include initial connection fee, or initial contribution to reserves (if applicable)
Note 3 – this includes a significant grant amount that may not be received
Note 4 - $545 is $414 plus a loan amount of approximately $131

The calculations show that:

- **The Option A costs for a typical one parcel/one user property are in the range of charges on other CSRD water systems like Saratoga and Sorrento**
- If 73% funding could be received for the ultimate service area, the charges would also be reasonable; however, this level of grant funding is not anticipated.

For comparison, the current parcel tax and user fees for other comparable CSRD water systems are as follows:

	User Fee	Parcel Tax	Total
Anglemont	$ 700	$ 530	$ 1,230
Sorrento	$ 371	$ 179	$ 550
Macarthur/Reedman	$ 530	$ 236	$ 766
Sunnybrae	$ 486	$ 324	$ 810
Saratoga	$ 521	$ 185	$ 706

5 Community & Agency Input

- *Summary regarding advisory committee and community open house to be added after community open house July 26, 2018*
- *Purpose of this section to demonstrate process, and whether there is support for project*
- *Add Appendix 6-1 with committee member list, terms of reference, comments, survey results, photos, support letters*

6 Potential Schedule & Next Steps

The following next steps are anticipated for moving this project forward. A tentative schedule is shown to provide an idea of the length of time that would be required to complete the project if senior government funding is received.

The last step in the CSRD water system acquisition process (just before detailed design and construction) is public assent. It is initiated once all the preliminary engineering is completed and project funding has been secured.

Public assent can be accomplished through a referendum, formal public assent or an alternative approval process where if less than 10% of electors petition against the proposal it is considered successful. A referendum requires a majority vote 50% + 1 in favor in order to pass while a formal petition requires 50% + 1 vote yes as well as at least 50% of the total assessment, the decision as to which process is used will be determined by the CSRD Board of Directors.

Working with an advisory committee that represents the demographics, interest and geography of a community and conducting broad community engagement in determining broad and sufficient support for a community water system solution is imperative in achieving success.

As noted, the public assent process would not be completed until after a grant has been received and project costs are confirmed.

Please also note that there will be opportunities for refinement of the project scope and design during the preliminary design and detailed design stages. Obtaining funding is a first key step to advancing the work.

- Community open house — July 26, 2018
- CSRD Board meeting — August 16, 2018
  - Letter of support for funding application
  - Loan authorization bylaw
  - Service area establishment bylaw
- Funding application — August 29, 2018
- Receipt funding — unknown, assume spring 2019
- Preliminary design — spring 2019
- Referendum / assent process — summer 2019
- Detailed design — fall 2019
- Tendering — fall 2019/early winter 2020
- Construction — 2020

7 Conclusions & Recommendations

1. Saratoga system expansion is the preferred approach as a result of consultation with the advisory committee for a number of reasons:

    - Lowest capital cost
    - Lowest O&M costs
    - Least risk and unknowns from a technical perspective
    - Best option from a schedule perspective and ability to proceed with grant application, assent process, and design/construction
    - Ability to leverage existing Saratoga funding and reduce overall costs to community through economy of scale.
    - Best option from a sustainability and environmental perspective (e.g. source protection)

2. A phased approach to construction of the water system is preferred. The Phase 1 service area should maximize the number of users.

3. Feedback on the preferred solution should be obtained from the community

4. The CSRD should apply for funding in August 2018 for Phase 1. Applications to future funding programs should be considered in the future when there is demand/interest in expanding the system.

5. A smaller reservoir could be considered if full funding not received to minimize costs; however, community members have expressed a desire to ensure sufficient fire protection is included, and should be engaged to determine whether there is a willingness to pay for increased storage.

6. The following items should be considered during the design stage:

    - Refinement of the service area
    - Distribution system design to optimize fireflows
    - Potential future location of community sewer system infrastructure, and best location for watermains to minimize construction costs and future conflicts during construction

Appendix 1-1

Previous Document Summaries

- Scotch Creek/Lee Creek Zoning Bylaw No. 825, CSRD, 2017
- Community Sewer System and Water Plan for Scotch Creek Area 'F', Opus DaytonKnight, 2013
- Scotch Creek Water Study, Urban Systems, 2007
- Hydrogeological Assessment of the Impact of Septic Effluent on the Scotch Creek Aquifer, Golder Associates, 1998
- Hydrogeological Assessment – Proposed Residential Subdivision, Piteau Associates, 2004
- Electoral Area 'F' (North Shuswap) Official Community Plan Bylaw No. 830, CSRD, 2009
- Scotch Creek Water Utility Study Update, Civic Utilities Ltd., 2009
- Source of Water Supply for Scotch Creek, Civic Utilities Ltd., 2006
- CSRD Subdivision Servicing ByLaw No. 641, CSRD, 2014
- Technical Memorandum No. 3 - Hydrogeological Assessment for Scotch Creek, Piteau Associates, 2013
- Water System Acquisition Strategy, CSRD, 2011

Appendix 4-1

Detailed Breakdown of Cost Estimates

Service Area Figures (CSRD)

Appendix 5-1

Community Input Documentation