Soames Creek Riparian Planting Restoration

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Abstract

Soames Creek, a creek in Coastal British Columbia, was impacted by heavy rainfall and slope failures during an atmospheric river in 2021. High water flows and debris redirected the stream channel, and in order to slow undercutting that put critical drinking water infrastructure at risk, the stream was channelized and armoured with riprap. During the installation of riprap, riparian vegetation in the project area was lost and not replanted. The main ecological goal of this project was to restore a portion of Soames Creek that was affected by the debris flow, flooding and armouring in 2021 through riparian area planting, including revegetating the riprap.

This project first identified the best vegetation for the current disturbed site conditions, through desktop review and site surveys. Following this review, a planting plan consisting of native plants suited for the for the disturbed site conditions and site goals was developed and sourced from a local nursery. Planting of the project area then took place. Site monitoring is recommended initially for plant survival, then for the long-term project success of restoring the riparian vegetation on site to increase ecological diversity and low-level canopy cover over the stream for aquatic species, and absorb moisture during periods of high stream flow and rainfall to better stabilize stream flows.

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1.0 Introduction

The Sunshine Coast in British Columbia (BC), has experienced a range of extreme weather events in recent years, with intense rain events, prolonged summer drought and intense heat expected to become a new normal due to climate change (Sunshine Coast Regional District, 2022). Streams are sensitive to these climatic changes, and each stream and watershed will react differently based on factors such as surrounding land-uses, topography, and hydrogeology.

Along with climatic disturbances, human disturbance and development such as clearing of forested lands for residential uses and changes in land use within watersheds can impact stream processes and flow rates, and exacerbate typical stream hazards, such as flooding and erosion (Ashmore and Church, 2001). This project proposes to restore a portion of Soames Creek in the Sunshine Coast Regional District, British Columbia that has been heavily disturbed by both climatic and human disturbances through riparian area planting. The lower reaches of Soames Creek have been disturbed by slope failure deposits, flashy water flows, invasive vegetation species, a previous fish hatchery and by water supply buildings and infrastructure.

In 2021, an atmospheric river event caused extremely high flows in Soames Creek. This rainfall event caused upstream slope erosion and carried a large volume of debris downstream. This debris caused a blockage which changed the alignment of the channel and begun undercutting the bank near an SCRD drinking water well pumphouse and put it at risk of collapse, as seen in Figure 1. Redirection of the creek via channel excavation and hardscaping with large angular boulders (riprap), occurred as emergency flood work.

Figure 1: Photo showing undercutting of bank near SCRD well pumphouse (SCRD, 2021)

The placing of the riprap resulted in the destruction of existing riparian vegetation in the impacted area as well as the channelization of the stream, which removed the natural floodplain in that specific reach of the creek. Figure 2 shows the process of channelizing the stream from during the flood, after the placement of riprap and the current conditions at the start of the project.

Invasive species on site have taken advantage of disturbed soils, and have the potential to outcompete native species in the revegetation of the site. Left unchecked, the invasive species in the riparian area could altered ecosystem function, which impacts all users of the site, including animals and humans (Steele, F., Coulthard, M., & Page, N., 2015).

Figure 2: Soames Creek in November 2021, December 2021 and February 2024, facing downstream, before restoration.

1.1 Location and Site Description

Soames Creek is a small creek on the Sunshine Coast, near Gibsons BC on the territory of the Sḵwx̱wú7mesh Nation (Figure 3). Soames Creek is mapped within the Coastal Western Hemlock, very dry, maritime (CWHxm1) biogeoclimatic zone. The CWH (Coastal Western Hemlock) zone occurs at low to mid elevation along coastal British Columbia and consists of a moderate climate of cool summers and mild winters. The project site is with the site modifier, xm1, representing “very dry, maritime” (Centre for Forest Conservation Genetics, n.d.), however, groundwater seeps at the site make low level areas of this site relatively wet. Soames Creek is a braided stream that flows approximately 1 km through a steep wooden ravine in Soames Hill Regional Park into the Pacific Ocean at Granthams Landing. Soames Creek is fed via rainwater runoff, groundwater seeps, and at the lower reaches near the project area, a decommissioned artesian well, making the soil at this

site relatively wet year-round. Soames Creek contains cutthroat trout (Oncorhynchus clarkii) and coastrange sculpin (Cottus aleuticus).

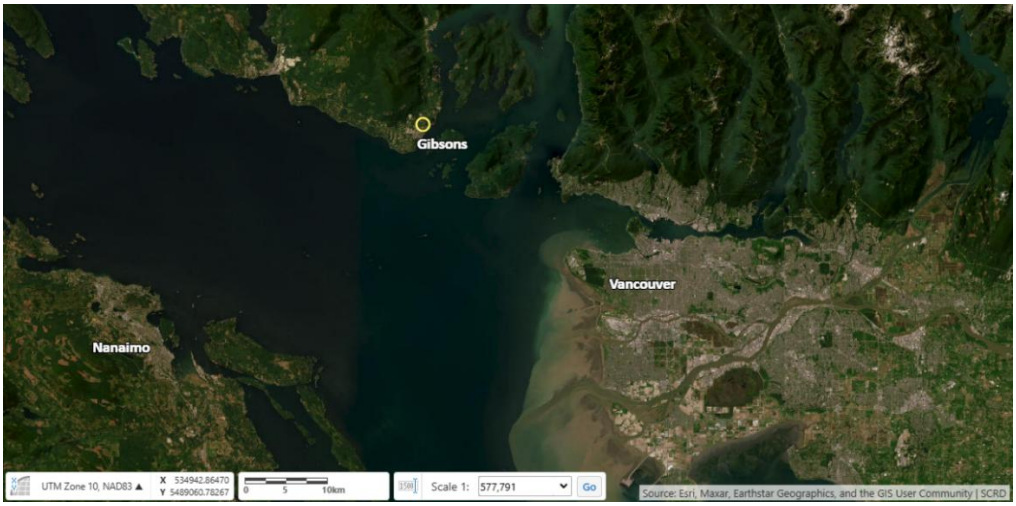

Figure 3: Context map of project area circled in yellow.

The project area is located in the creek's lower reach, indicated in Figure 4 within a yellow circle.

The Sunshine Coast Regional District (SCRD) has a water licence for an aquifer that is hydrologically connected to Soames Creek. Due to this connectivity, as part of the water licence, the SCRD manages Environmental Flow Needs (EFN) on Soames Creek, and must maintain adequate flow for the functioning of aquatic species (Associated Environmental, 2020). Within the broader site, Soames Creek has flow augmentation waterlines, a man-made weir and an active hydrometric station to monitor flow levels.

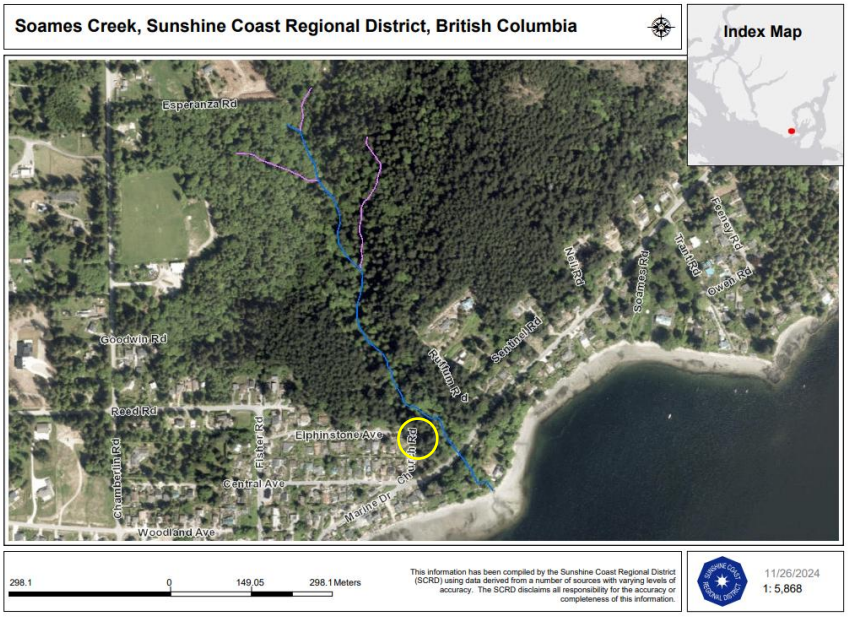

Figure 4: Context map of Soames Creek, with project area circled in yellow

1.2 Expected Outcomes

This project's goal is to enhance riparian habitat in and around an approximately 500m^3 area of Soames Creek through the replanting of native plants. To achieve and quantify reaching this goal, Ecological, Social and Economic objectives have been identified below. Achieving this goal ecologically would be indicated by an increase of native vegetation cover to absorb and mitigate "flashy" stream flows, contribute to shoreline stabilization, provide shade, habitat and nutrient drop to aquatic species and to increase overall biodiversity of the site to support bird and other terrestrial species. Social and Economic objectives of this project include the opportunities to educate SCRD staff on the importance of adaptation to climate change through restoration and riparian area protection for both water resource planning, natural asset management and economic sustainability.

Table 1: Expected Outcomes of Restoration

Objectives	Category	Actions
Restore a portion of Soames Creek that was affected by a debris flow, flooding and armouring in 2021 through riparian area planting. Complete recommendations of riparian area replanting as per the 2021 Soames Creek Environmental Assessment Report Increase species diversity on site	Ecological	1. Complete desktop study of project site, including historical photo and report review. 2. Conduct site visit and plant inventory. 3. Analysis of data to inform plant selection and creation of a planting plan 4. Source native plants from local nursery 5. Plant selected species according to observed site condition, site topography and planting plan 6. Return to site after the Summer season (2025) to determine plant survival rate and if necessary, replant.
Increase organizational knowledge of riparian areas	Social	1. Educate and work with SCRD staff to increase knowledge of riparian area planting for flood and drought mitigation.
Reduce the amount of maintenance and labour hours spent on maintaining this portion of Soames Creek	Economic	1. Select plants suitable for the location that can help stabilize the shoreline, slow water flow and reduce the need for ongoing work within the stream.

1.3 Project Timeline

This project was completed between February-December 2024, with monitoring occurring in 2025.

Table 2: Project Timeline 2024

Stage	Activity	J	F	M	A	M	J	J	A	S	O	N	D
Data Collection	Desktop research												
	Site visits and plant inventory												
	Plant selection												
Site Preparation	Planting plan and design												
Planting	Plantings and maintenance												

This project does not propose any in-stream works, however, the duration of planting was completed following "Standards and Best Practices for Instream Works" Guidelines for Reduced Risk Instream Work" (Ministry of Water, Land and Air Protection Ecosystem Standards and Planning Biodiversity Branch, 2004), in order to limit any potential disturbances. The proposed planting took place in November 2024 and was completed in one day.

2.0 Methods and Materials

2.1 Approach

The species of plants to be incorporated into the restoration planting plan were determined by a desktop review of historical site photos and reports, a review of existing nearby reference ecosystems, and site visits to the project area.

Historic Photo Review

Figure 5: Riparian vegetation growing in project area at the time of the 2021 flooding event (SCRD, 2021).

During the flooding in 2021, photos were taken of the event that shows the previous riparian vegetation that was still intact, even during the flooding. These photos were reviewed and analyzed to contribute to the creation of the planting plan by understanding the historical vegetation type and location. Figure 5 is a pre-riprap photo that depicts the type of plants that had the ability to grow on the site, as well as remain intact during the high stream flow event. The species that could be identified from the photo were red elderberry (*Sambucus racemosa),* big leaf maple (*Acer macrophyllum),* salmonberry (Rubus spectabilis) and western sword fern (*Polystichum munitum*). Due to the time of year, some species in the photo were unable to be identified. This is due to lack of identifiable leaves, flowers or fruit. Unfortunately, almost all riparian vegetation was lost during the placement of riprap in the immediate project area.

Historical Report Review

An Environmental Site Assessment Field Report was completed by a Registered Professional Biologist (R.P. Bio) consultant for the Sunshine Coast Regional District at the time of the flooding event to support the emergency flood work within the stream. The report reviewed a proposed engineering plan for armouring the infrastructure and rerouting of the stream. The R.P. Bio suggested all invasive vegetation to be removed and end hauled, and all cleared native vegetation to be stored on site and replanted. The Environmental Assessment Report completed at the time of the flooding event, as well as additional photographs, can be found in Appendix A.

Interviews with SCRD infrastructure staff shared that at the time of the armouring, it was not possible for native vegetation on site to be stored on site and replanted, possibly due to the extent of the armouring and other in-stream works that were planned for the site in the years that followed (S Bandara, personal communication, February 2024). An objective of this project is to complete the recommendations of the report and re-establish riparian area vegetation. Through historical photo reviews, species that were once part of the riparian vegetation can be replanted.

Reviews of other restoration projects in similar ecosystems and impacted by similar disturbance regimes were reviewed. For planting plans related to vegetated riprap, a guide from Rideau Valley Conservation Authority, 2020, was considered and applied. A restoration plan of Miami Creek in the Fraser Valley Regional District looked to restore a channelized portion of a stream via removal and vegetating of riprap to dissipate stream flow and increase site ecological complexities (Fraser Valley Conservancy, 2020), which was applied to this project as well as future recommendations for this site.

On site Vegetation Survey

The site was visited on July 29, 2024 and four locations were chosen where one meter by one meter sample plots were completed to identify the existing vegetation and canopy cover. The locations for these observations were chosen based on visual inspection of the site during the initial site survey. Two plots were within, and two plots were outside of the project area. The sites chosen for the plots all had unique types of plant cover and soil/substrate conditions.

- Plot 1 surveyed the West side of the stream, which has been heavily disturbed and armored with riprap, with an abundant monoculture of young red alder (*Alnus rubra*) growth between rocky substrate.
- Plot 2 was primarily grass and forbs growth with limited mature shrubs and trees.
- Plot 3 was located upstream of the project site where established riparian vegetation was abundant, with relatively natural soil conditions
- Plot 4 was located downstream of the project site and consisted of large second growth trees and established undergrowth, not visibly impacted by the armouring upstream

The plots/quadrat were measured with a one metre measuring tape. Plants within the sample plots were quantified by occurrence (whether it was present or absent) and combined coverage (through visual estimation) and recorded by hand and later digitized. Plant species within the sample plots were identified using the reference book “Plants of Coastal British Columbia” (Pojar, 1994) and online resources, such as iNaturalist, as well as knowledge from the site surveyors. Plant observations were recorded within a field notebook and later digitized. See Figure 6 for locations of

each plot. All field notes can be found in Appendix B. General canopy coverage of the site was estimated based on visual observation.

The observations were completed by Sierra Rempel and Sandi Bandara RP. Bio, Sunshine Coast Regional District.

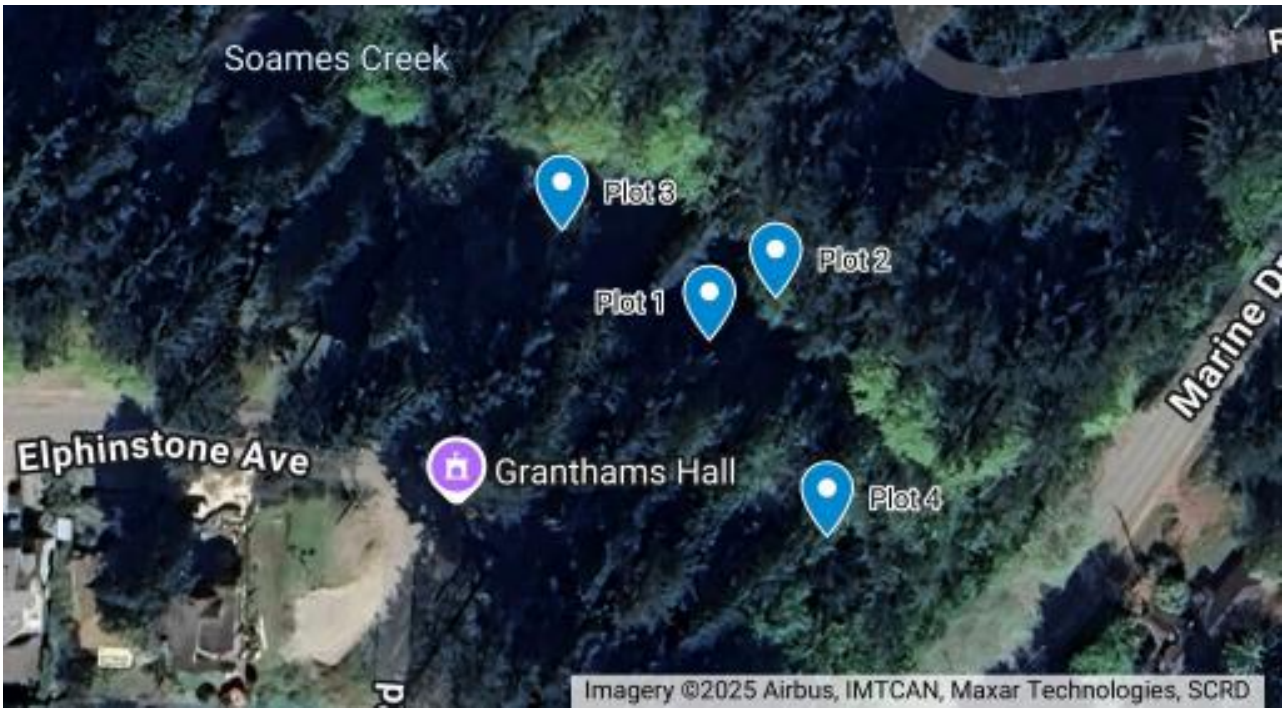

Figure 6: Site Vegetation Survey Plot Locations

Planting Plan Development

Plant species were chosen based on the on-site vegetation survey, historical photos and with use of the BC *Field Guide for Site Identification and Interpretation for the Vancouver Forest Region (Green & Klinka, 1994)* and *Riparian Restoration Guidelines (Ministry of Environment, 2008)* Considerations were as follows, based on species abilities to:

- Provide canopy cover for shade
- Provide a food source such as leaf and insect drop
- Stabilize the banks
- Absorb water during high water flow
- For the west side of the stream, ability to grow on or between riprap with little soil
- For the east side of the project area, ability to grow in wet conditions
- Be sourced locally within the project timeframe
- Be nursery stock
- Contain 10% coniferous trees
- Over 50% be fruit bearing

Restoration Planting

Restoration planting of the project area was completed by hand in the project area as indicated in the planting plan in Appendix C. Restoration work included the removal of invasive species from

the project area, the thinning of existing alders and planting of native species nursery stock. A Registered Professional Biologist reviewed the planting and work plan, and the Ministry of Environment and Climate Change was notified via email of the work occurring. The proposed riparian habitat restoration work took place in December 2024 and was completed in 1 day.

2.2 Areas of Concern and Mitigation Strategies

Erosion and sediment laden run off

The risk of erosion and sedimentation is highest when periods of intense rainfall coincide with active construction. These risks are minimized as work was completed by hand and during dry conditions and low water flow. No additional fill or soil was brought on site.

Vegetation disturbance

The project area is a recently disturbed site with little native vegetation. Existing native vegetation was incorporated into the planting plan and preserved. Invasive species existing on site were removed by hand where possible.

Revegetating Riprap

Large angular cobbles were utilized along the scoured bank, and no plants were initially planted between them at the time of the armouring in 2021. Rideau Valley Conservation Authority's Vegetated Rip-Rap guide suggests that cobbles should be moved by hand and vegetation be planted within the gaps. As no geotextile fabric was used for the armouring, plants should be able to root into the soil below (Rideau Valley Conservation Authority, 2020). Native plants that are suited to the project area and have deep root systems were chosen.

Environmental Monitoring

An adaptive management plan and monitoring program is currently being developed for Soames Creek by the SCRD, as a provincial requirement of a water licence on a hydrologically connected aquifer. Due to this ongoing work, Soames Creek is highly monitored and reported on internally at the SCRD and as necessary to the province (S. Bandara, personal communication, 2024).

An R.P. Bio reviewed the planting plan and work plan to assure that the project was developed and completed in compliance with laws (including the Water Sustainability Act, Fisheries Act), requirements and Best Management Practices, to provide practical advice on environmental management issues and to observe, record and report if required. Photo monitoring will capture existing conditions prior to the start of work and become reference materials in the future.

3.0 Results

3.1 Site Survey Results

The site survey identified the vegetation that was currently established in the project area, as well as what vegetation was growing in the upstream and downstream riparian area near the site. The project site and surrounding area is second growth, and mostly forb and grass dominated. The most common site was observed as successional Stage "Pioneer Seral," as per classification in

Field Manual for Describing Terrestrial Ecosystems (2010), due to the high levels of human disturbances.

In general, canopy cover in the project area is abundant. The slopes that make up the ravine where Soames Creek flows are abundant with big leaf maples, Douglas-fir (*Pseudotsuga menziesii*) and western redcedar *(Thuja plicata)* that make up the canopy cover at great heights. However, little overhanging stream cover was observed in the project area, due to lack of shoreline riparian vegetation. Invasive species have established in the disturbed areas, due to the lack of intentional planting following the placement of the riprap. Overall, the project area has few mature trees and shrubs establishing without intervention, and many herbaceous invasive species.

Soil substrate in the less disturbed area consisted of moist sandy-loam soil, with many large boulders on or near the surface. It is uncertain which boulders were naturally occurring, and which were deposited during the realignment of the stream. Groundwater levels are very close to the surface in this area, and an artisian well near the site creates heavily saturated soil, which flows via both a PVC pipe and through subsurface flow, into Soames Creek (Associated Environmental, 2020).

Full site survey notes and photos can be found in Appendix B.

Plot 1

Plot 1 was located on the western side of the project area. The site has been heavily disturbed, with a substrate of angular cobble. The vegetation at this site was mostly herbaceous, with the only tree species present being young alder, approximately 0.5-0.75metres (m) tall. Some invasive herbs were seen, including fox glove (*Digitalis purpurea),* herb robert *(Geranium robertianum).* and periwinkle *(Vinca minor)*. The constraints of the flowing stream on one side of the plot and significant extent of the cobble at this site limits the connectivity to other vegetated areas nearby. The inability for plants to spread naturally due to spatial constraints, and lack of soil presence may result in species typically found in this biogeoclimatic zone to not become established without planting intervention. Figure 7 shows the rocky substrate and limited soil, with the small ferns emerging through the riprap along the streambed.

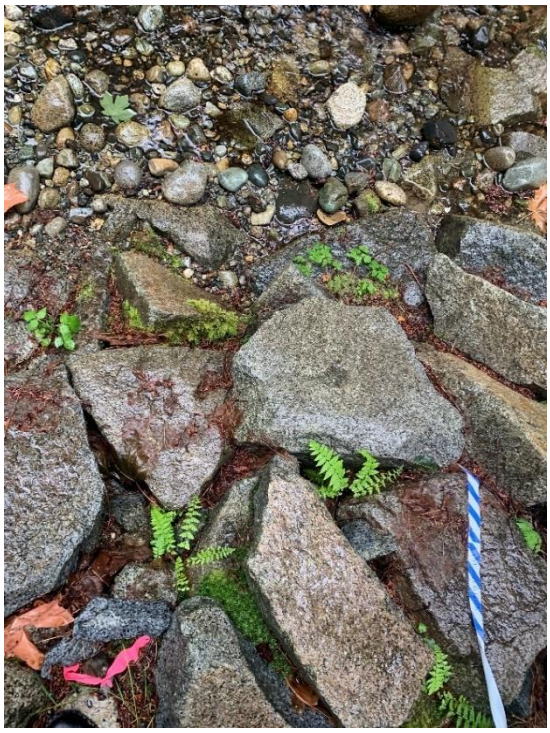

Figure 7: Plot 1, with rocky substrate and limited soil, with small ferns poking through.

Plot 2

Plot 2 was located on the eastern bank of Soames Creek, and which was heavily disturbed by vegetation removal and compaction during the flooding in 2021, but was not armoured with any materials. There is limited mature shrub and tree vegetation at this site compared to all other sites

surveyed. Red alder, pacific ninebark (*Physocarpus capitatus)* and salmonberry *(Rubus spectabilis)* were the bulk of trees and shrubs at this site. The herbaceous layer was abundant in both native and invasive species, including foam flower *(Tiarella cordifolia*), which indicates wet soils. Approximately 5% of the site was covered by invasive Yellow archangel and another 5% by Yellow loostrife. Figure 8 shows the site and associated plants.

Figure 8: Herbaceous plants seen at Plot 2.

Plot 3

Plot 3 was located upstream of the project area and was mostly dominated by established native shrubs, including salmonberry, stink current *(Ribes bracteosum)* and red-oiser dogwood (*Cornus sericea*). However, 80% of the plot coverage, specifically on and near the ground was dominated by invasive English ivy. The established shrubs gave indication of the types of plants that would thrive downstream in the project area. The root systems of these plants act as anchors to the riparian area and shoreline of Soames Creek in this area.

Plot 4

Plot 4 was located downstream of the project site, within a second-growth, successional stage Young Seral, as per Field Manual for Describing Terrestrial Ecosystems (2010). It appeared to have not been impacted by the flooding event in 2021. This plot saw mature western redcedar, huckleberry, salmonberry and a variety of ferns. Just outside the plot, as seen in Figure 9, young big leaf maples were abundant. This site gave indication of what the future stages of succession could look like in the project area, after either extended period of time or the riparian area planting was to take place. This plot had invasive species, such as English ivy, but overall had a positive representation of the biogeoclimatic zone and the expected plant species.

Figure 9: Plot 4, as viewed from across Soames Creek.

3.2 Restoration Planting Results

Species

New plantings are based on the project area of approximately 500m^2, with a density of approximately 1 new tree/shrub/herb per 5m^2 of area, to a total of 99 new plants. Some species, including bigleaf maple and red elderberry, were unavailable at the time of plant purchase. Additional species were substituted, considering the values that would have been added by the unavailable plants, such as leaf drop and fruit production.

Table 3: Species chosen for restoration planting.

QTY	Size (Gallon)	Common Name	Species	Layer
4	5	Red Cedar	Thuja plicata	Tree (Conifer)
3	5	Douglas Fir	Pseudotsuga menziesii	Tree (Conifer)
20	1	Red-oiser Dogwood	Cornus sericea	Shrub
10	2	Pacific ninebark	Physocarpus capitatus	Shrub
15	2	Salmonberry	Rubus spectabilis	Shrub
10	1	Hooker's Willow	Salix hookeriana	Shrub
10	1	Thimbleberry	Rubus parviflorus	Shrub
10	1	Braken Fern	Pteridium aquilinum	Herb
15	1	Sword Fern	Polystichum munitum	Herb

Plantings

Nursery stock was ordered from NATS Nursery in Langley B.C. Plants were delivered to the project site and planted on December 19, 2024. Plantings were hand dug and planted by an SCRD field crew of four, using shovels and existing soil on site. The field crew referenced the planting plan (Appendix C) and adapted to site conditions where necessary (for example, where large rocks made it unable to dig). High density, larger diameter stock of shrub and herb plants were planted in areas free of invasive species, giving them the best opportunity to root and establish without the competition of invasives (Stewardship Center of BC, 2013).

Planting occurred within the project area to the top-of-bank, and no impact to the stream occurred during the work. Standards and Best Practices for Instream Works (2004), were followed and applied to this project, including:

- Work was completed outside the stream channel
- Erosion and sediment control measures were followed, such as scheduling work to avoid wet, rainy, or windy periods
- Minimize disturbances to existing vegetation on stream banks
- Complete the works as quickly as possible once they are started
- Use of existing access routes to the project area

Invasive Species

The invasive species found on site were not noxious weeds under the BC Weed Control Act,, and thus could be removed by hand and disposed of at a local composting facility (British Columbia Invasive Species Council, 2023).

Thinning of Alders

The West side of the project area was prolific with young alder shoots. In order to encourage plant diversity and reduce competition, alders were thinned through cutting with hand cutters in December when plants were dormant. The alders that were thinned were not used as staking elsewhere on the site, as most were less than 0.75m tall and thinner than 5cm, which is the recommended size for successful staking (Ministry of Forests, 2001).

Vegetating Riprap

Soames Creek was channelized using small angular cobble as armouring. Similar restoration projects have included re-vegetating riprap areas in order to increase the stability of the armouring through plant roots, absorb moisture during times of high-water flows and provide habitat within the riparian area (Rideau Valley Conservation Authority, 2020). The planting plan was developed to achieve this. Cobble was moved by hand until soil was seen. Plants were then placed within the gaps, where feasible. No additional soil was used, as it was expected that any heavy winter rain would wash the soil into the creek.

Before and after the vegetation planting can be seen in Figure 10, below.

Figure 10: Before and after site photo

4.0 Discussion

4.1 Site Survey Discussion

The survey of the project area gave insight into the ecological conditions of the site following the emergency flood work completed in 2021. The plots outside the project area, Plot 3 (upstream of the riprap) and Plot 4 (downstream of the riprap), appeared to have not been impacted by the flooding in 2021, and were not as heavily disturbed as the plots within the project area. Plots 1 and 2, within the project area, were both heavily disturbed in order to protect the well pumphouse building and have not rebounded in the same way that Plot 3 and 4 did. The project area had low overall biodiversity and reflected a grass-forb plant community, with few native species having been established following the riprap installation. Overall, the vegetation and site survey provided the necessary information on existing vegetation, number of invasives and soil condition to create and execute a planting plan in the project area.

4.2 Restoration Results

The goal of the project was is to enhance riparian habitat in and around an approximately 500m^3 area of Soames Creek through the replanting of native plants. The project goal was achieved through the following objectives:

Ecological Objective
Restore a portion of Soames Creek that was affected by a debris flow, flooding and armouring in 2021 through riparian area planting. Complete recommendations of riparian area replanting as per the 2021 Soames Creek Environmental Assessment Report Increase species diversity on site

Figure 11: A March 2025 site visit shows budding shrubs, and a 99% plant survival rate.

The project successfully reviewed, surveyed and replanted riparian area vegetation at a portion of Soames Creek with native vegetation that will provide streamside canopy cover, and increase the overall species diversity in the area. The success of the planting for the purpose of bank stabilization should be assessed in the future, as the roots establish, and rain events occur. An indicator of success is the physical stabilization of the creek and banks through times of high stream flow. As of March 2025, there is an estimated 99% survival rate of the planted vegetation.

The planting completed the recommendations described in the 2021 Soames Creek Environmental Report.

Social Objective
Increase organizational knowledge of riparian areas

The project involved multiple SCRD staff members from throughout the Infrastructure Department, including utility engineering, environmental, strategic initiatives and capital projects. The replanting of the site gave a hands-on learning opportunity to staff to apply to future projects. Knowledge was shared on the project's purpose, the type of vegetation being planted and why, and how staff can apply their learnings to future projects.

Economical Objective
Reduce the amount of maintenance and labour hours spent on maintaining this portion of Soames Creek

While this objective is still outstanding, it is expected that the increase in riparian vegetation, once established, will assist in bank stability and help to moderate high flow of the creek. This objective can be measured through the flow data collected via the onsite hydrometric station over the years, and through the amount of staffing hours spent managing flow or flooding levels. An overall indicator of this objective being completed would be an increase in the stability of discharge (flow) volumes recorded by the hydrometric station, even during periods of intense rainfall. Changes to flow data that is monitored as part of the EFN management should consider the newly established vegetation if any changes are recorded.

4.3 Constraints to Restoration

Soames Creek is bordered by privately owned properties that currently consist of residential development, and it is possible that invasive species on site, slope failures upstream and change in flow regimes are a result of changes in land use of neighbouring properties. Ongoing invasive species management will be required to fully remove all invasive species in the long term. With neighbouring residential development, the potential for reintroduction of invasive species is high (Steele, F. et al., 2015). Land alterations, including the clearing of vegetation and additions of impervious surfaces on neighbouring properties has the potential to impact the flow regimes on site by increasing the quantity, quality and speed of stormwater being introduced to Soames Creek.

Additionally, the SCRD does not have a dedicated service to watershed and ecological management, thus making restoration projects such as this one difficult to achieve without a designated service and budget.

5.0 Recommendations

5.1 Site Photographs

Photos of the restoration site were taken before, directly after, and should be taken 1 year after the planting. Photos should be taken upstream from beside the weir structure, and looking downstream from the footbridge, to maintain consistency for easy comparisons. Photos will be stored in the SCRD database for future reference.

Figure 12: Site photograph taken from the footbridge looking downstream, during a March 2025 site visit.

5.2 Replanting Monitoring

Ongoing monitoring of the site should be completed as newly planted vegetation becomes established. Visual monitoring of the site can be completed by SCRD staff during routine checks of the water infrastructure on site, which happens in early spring, and is ongoing through the summer. In order for plantings to be deemed successful, 80% of plants must survive. If more than 20% die over one year, replanting will be required (Ministry of Environment, 2008). After the summer growing season, any plants needing to be replanted should be done so after the dry summer season. Photos should be taken during this monitoring as described above.

5.3 Invasive Species Management

Ongoing invasive species management will be required to fully remove all invasive species. Any newly found invasive plants should be removed as soon as possible. Without a vigorous approach, on site English Ivy and yellow archangel will continue to spread. Education for landowners on invasive species management and proper disposal should be considered in the future.

5.4 Instream Works

From a hydrological perspective, the channelization of Soames Creek that occurred during the placement of riprap will continue to have an impact on creek flows. This channelization and armouring of the streams' banks have cut off the streams access to a natural floodplain and instead funnels high water flow within a smaller area. Downstream of the project area, Soames Creeks has access to a more natural floodplain, as no built infrastructure is in that area or at risk of flooding or erosion.

It is recommended that the streamside structure, the well pumphouse, be removed, and the riprap be dismantled and the shoreline softened with large woody debris, to allow for a portion of the

natural floodplain to be restored. Fish habitat, such as a back channel or pool suitable for fish rearing could be created through this work. It would be anticipated that this action could result in a less 'flashy' water flow overall and eliminate the need for ongoing maintenance and monitoring work to ensure the integrity of the structure.

6.0 Acknowledgements

This project was supported by the Sunshine Coast Regional District, with specific support from Sandi Bandara and Remko Rosenboom. Additional thanks to Lauren Lacey, Kao Lawrie and Jeremy Maerkl.

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Appendix A

FSCI Biological Consultants

Environment Site Assessment/Monitoring
Field Report

Date:	Oct 20 and 27, 2021 Dec 7,8,9,10, 13, 2021	**Time:**	N/a	**Wx:**	N/a	**Air Temp:**	N/a
Crew:	D. Bates J. Wilson	**Client:**	SCRD			**Water Temp:**	N/a

Location: Soames Creek at SCRD well

Location(s):	**1.** Soames Creek near Marine Drive	UTM:	464199	E	5473619	N
	2.	UTM:		E		N
	3.	UTM:		E		N
	4.	UTM:		E		N

Purpose(s):

1. Review changes in Soames Creek placing well building at risk
2. Provide a professional opinion on remediation and creek channel relocation near the building
3. Provide an opinion on cause of large sediment loading
4. Provide an opinion and monitor sediment, erosion control and overall works as it pertains to environmental protections.

General Site Description:

1. Debris jam at the access bridge near the well building resulted in channel avulsion, pushing channel towards the building.
2. Evidence of large volume of mobile bedload and debris, infilling the channel and causing small debris jam.
3. Large upslope bank failures resulting in large movement of sediments comprised of sands and small gravels, Large sediment at mouth of the southern tributary. Banks have failed contributing mobile sands and gravels,
4. MOTI culvert at Marine Drive is infilled at the inlet reducing capacity. Backwatering occurring accelerating bedload build-up.

Comments/Observations:

Channel will require excavation of sediment wedge/deposition and realigning the stream channel so that the flows are within the origin channel.

ARYA Engineering has provided a plan to move the stream channel away from the building and steep slope. Plan includes weirs near the building to reduce the grade, dissipate energy to reduce area scour near the building. The exposed banks near the building will be armoured.

Preliminary Mitigation/Prescription:

Engineering plan in place and accepted by Regulator.

Additional mitigation include:

- Sediment control along the access road where activity is expected to increase potentially mobile materials (mud).

- In channel works to be completed as quickly as feasible. In the event sediment loading exceeds allowable limits, works will be slowed or curtailed in order for the water to clear.
- All invasive vegetation will be removed and end hauled.
- Cleared native vegetation will be stored near the work site and replanted.
- Excess bedload materials will be removed and placed out of the active channel.
- All spill materials including a kit must be onsite and accessible.
- If needed trash pump and channel isolation for pump around.
- All permits and signage must be onsite and available for EM and Compliance and Enforcement personnel from BC (MoE, FLNRORD) and/or Canada (DFO).
- Encouraged to complete in channel task as fast as feasible to limit instream works.

Photos Attached: **Yes** X **No** ☐
Reviewed by: D. Bates

Photo 1: Soames Creek at the SCRD well building. An upslope failure (October) and extreme highwater events (November) has resulted in the creek channel infilling and the channel avulsing, eroding the area around the well building creating unstable and unsafe conditions for the structure.

Photo 2: The area of slope/bank failure in a Soames Creek tributary, located above the well building. The result is significant large wood debris and bedload input into Soames Creek mainstem, resulting in the channel avulsing (changing directions) and forming numerous debris jams.

Photo 3: The main access road to be used for the reconstruction/excavation of the creek channel. The roads presents the greatest risk for sediment input. The access road was lined with hay bales and eventually capped. Once complete the hay was broken apart and used to cover the road to limit the possibility of sediment transport during poor weather.

Photo 4: Newly excavated channel. This is the original channel that was infilled following the upstream "events". The works and engineering design required re-establishing the original channel, located away from the building and infrastructure.

Photo 5: Finished channel above and below the SCRD well building. The channel, along the slope on the right bank was armoured and a series of weirs build within the channel to reduce the grade and help dissipate stream energy.

Site Assessment/Completion
Inspection Report

Date: Dec 14/2021 **Site Review by:** D. Bates

Location: Strait of Georgia ☐ Sechelt Inlet ☐

Address and/or PID:

Soames Creek - SCRD well infrastructure building - Work complete

Type of Disturbance

		Yes	No	N/a	Comments
1	Shoreline protection works completed?	☒	☐	☐	As designed
2	Clearing and removal of stable protection riparian vegetation?	☒	☐	☐	As designed
3	Construction of impervious structures	☐	☒	☐	
4	Clearing and removal of invasive plants within riparian setback?	☒	☐	☐	End hauled
5	Plantings of coastal shrub and ground cover as recommended?	☐	☐	☒	

Comments:

Completed

MOTI had contractor clear culvert.
J. Wilson (EM) on site.

Appendix B

Site Survey Notes
July 25, 2024, 3:30pm
Cloudy, Rain. 16 degrees Celsius

Plot 1 – West Rocky Shore
Coordinates: 49.41416, -123.49339

Species Recorded:

Layer	Common Name	Species	Percentage of Cover
Tree	Alder	*Alnus rubra*	40%
Shrub	Red elder	*Sambucus racemosa*	2%
Shrub	Salmonberry	*Rubus spectabilis*	1%
Herb	Lady fern	*Athyrium filix-femina*	5%
Herb	Sword fern	*Polystichum munitum*	2%
Herb	Braken fern	*Pteridium aquilinum*	5%
Herb	Fox glove	*Digitalis purpurea*	1%
Herb	Herb Robert	*Geranium robertianum*	10%
Herb	Periwinkle	*Vinca minor*	10%
Herb	Wintergreen	*Gaultheria procumbens*	2%
Herb	Sedges	*Carex*	5%
Moss	Electric cat tail moss	*Ptilidium ciliare*	5%

Table B1: Species recorded at Plot 1.

Site Photos:

Figure B1: Site 1, facing South

Figure B2: Site 1, Facing Northeast

Plot 2 – East Shore
Coordinates: 49.41421, -123.49324

Species Recorded:

Layer	Common Name	Species	Combined Percentage of Cover
Tree	Red alder	*Alnus rubra*	20%
Shrub	Pacific ninebark	*Physocarpus capitatus*	2%
Shrub	Salmonberry	*Rubus spectabilis*	10%
Herb	Foxglove	*Digitalis purpurea*	1%
Herb	Wood avens	*Geum urbanum*	10%
Herb	Sword fern	*Polystichum munitum*	5%
Herb	Lady Fern	*Athyrium filix-femina*	2%
Grass	Perennial ryegrass	*Lolium perenne*	10%
Herb	Yellow archangel	*Lamium galeobdolon*	5%
Herb	Foam flower	*Tiarella trifoliata*	1%
Herb	Yellow loosestrife	*Lysimachia vulgaris*	5%
Grass	Sedges	*Carex spp.*	15%

Table B2: Species recorded at Plot 2.

Site Photos:

Figure B3: Area of Plot 2, facing East

Figure B4: Area of Plot 2, facing East

Plot 3 – Upstream Site
Coordinates: 49.41431, -123.4937

Layer	Common Name	Species	Percentage of Cover
Shrub	Salmonberry	*Rubus spectabilis*	20%
Shrub	Stink Current	*Ribes bracteosum*	5%
Shrub	Red-oiser Dogwood	*Cornus sericea*	50%
Herb	Sword fern	*Polystichum munitum*	20%
Herb	English Ivy	*Hedera helix*	80%

Table B3: Species recorded at Plot 3.

Site Photo:

Figure B5: Plot 3, Facing Northeast

Plot 4 – Downstream Site
Coordinates: 49.41388, -123.49313

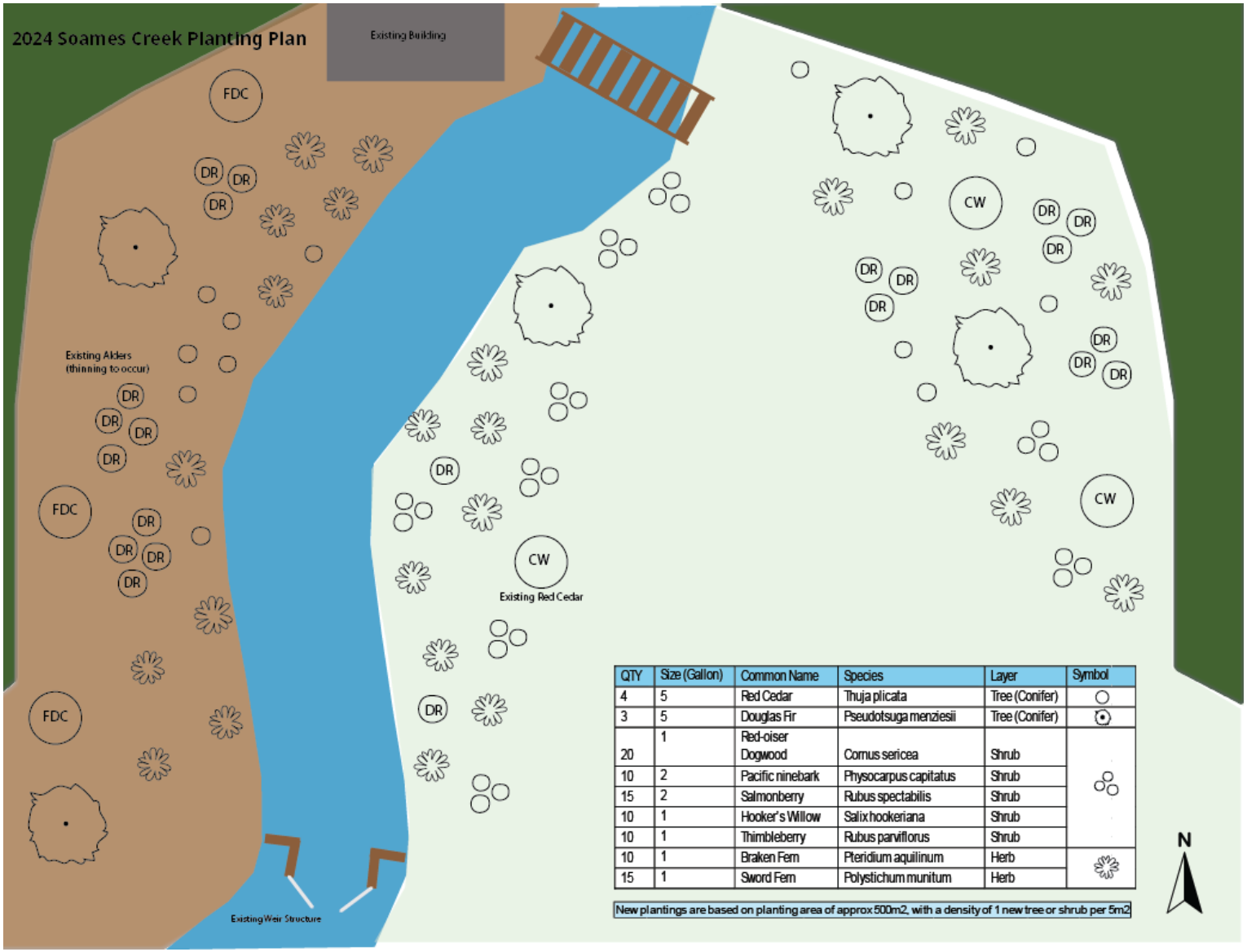
Layer	Common Name	Species	Combined Percentage of Cover
Tree	Western Red Cedar	*Thuja plicata*	70%
Shrub	Huckleberry	*Vaccinium parvifolium*	10%
Shrub	Salmonberry	*Rubus spectabilis*	20%
Moss	Oregon beaked moss	*Kindbergia oregana*	15%
Herb	Braken fern	*Pteridium aquilinum*	20%
Herb	Lady fern	*Athyrium filix-femina*	10%
Herb	English ivy	*Hedera helix*	50%

Table B4: Species recorded at Plot 4.

Site Photo:

Figure B6: Site of Plot 4, facing West

Appendix C



QTY	Size (Gallon)	Common Name	Species	Layer	Symbol
4	5	Red Cedar	Thuja plicata	Tree (Conifer)	○
3	5	Douglas Fir	Pseudotsuga menziesii	Tree (Conifer)	⊙
20	1	Red-oiser Dogwood	Cornus sericea	Shrub	
10	2	Pacific ninebark	Physocarpus capitatus	Shrub	
15	2	Salmonberry	Rubus spectabilis	Shrub	
10	1	Hooker's Willow	Salix hookeriana	Shrub	
10	1	Thimbleberry	Rubus parviflorus	Shrub	
10	1	Braken Fern	Pteridium aquilinum	Herb	
15	1	Sword Fern	Polystichum munitum	Herb	

New plantings are based on planting area of approx 500m2, with a density of 1 new tree or shrub per 5m2