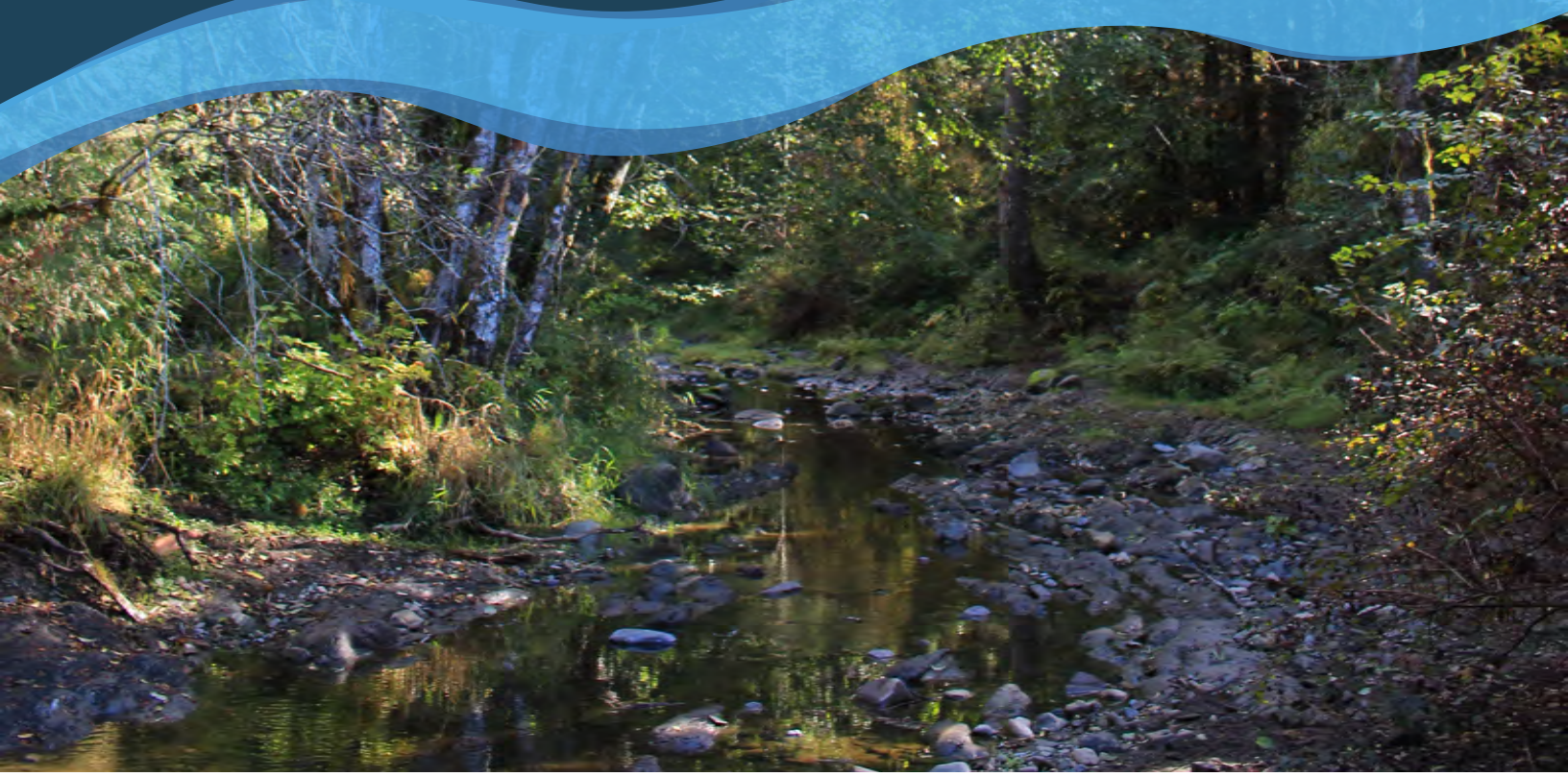
Ecological Accounting Process

French Creek Report

Year 2 of 2



Report prepared by the Mount Arrowsmith Biosphere Region Research Institute for the Regional District of Nanaimo as part of the Ecological Accounting Process Transition Strategy Partnership

March 2025

the partnership for water sustainability in bc

Regional District of Nanaimo

City of Nanaimo

Mount Arrowsmith Biosphere Region Research Institute

Municipality of North Cowichan

Vancouver Island University

Executive Summary

Natural assets provide numerous benefits to society, such as stormwater management, fish habitat and biodiversity, and public enjoyment. The Ecological Accounting Process (EAP) uses land assessment data for parcels to determine the financial value of natural assets. The value of a stream system cannot be determined by financial valuation alone, but the EAP can help inform the allocation of funds for maintenance and management, while also identifying areas of potential stream degradation to help optimize expenditures for conservation and restoration. In this case, the natural asset in question is French Creek.

Steps 1 through 6 of the EAP were completed for this report. This included: 1) determining the Natural Capital Asset (NCA) value, or the value of the stream system within the 34m riparian setback area on both sides 2) calculating a suggested annual budget for maintenance and management; 3) stating the riparian deficit (i.e. the risk or magnitude of stream degradation), as determined by the NCA value, which is expected to reflect the intensity of riparian land use impacts on the stream; 4 & 5) Step 4 involves quantifying the aspects of the riparian condition (impervious surface and vegetation cover) for the Inner Study Area (ISA; 34m setback) and Step 5 does the same for the Outer Study Area (OSA) which begins where the ISA ends and extends 200m; 6) the final step completed for this report concerns rainwater drainage, which was determined based on topographic mapping and site and aerial imagery observations in the absence of more specific drainage infrastructure data.

French Creek was chosen for an EAP analysis because it is considered an at-risk catchment and is experiencing increasing land use pressures. This report is the second in a two-year EAP project for French Creek. The year-one report included the first three steps of the EAP and determined that the total NCA value of French Creek ranges from $22.8 million to $33.5 million. With that, it was calculated that between $228,500 and $335,400 is the suggested baseline annual investment towards maintenance and management of the creek for the local government. Private landowners and stewardship groups contribute to and increase this investment because responsibility for protection of the natural commons is shared by all.

The year-two study further examined 5 focus areas along French Creek. A community advisory committee, comprised of representatives from various government and non-government organizations and private property owners with experience in stewardship and conservation efforts within the watershed, was assembled and consulted to determine focus areas. The committee recommended five locations of focus: Bell Lake, Dudley Marsh, Hamilton Marsh, French Creek Bridge Trails area, and French Creek Estuary. The first four were selected by the committee as focus areas that would benefit from conservation and restoration efforts, whereas the committee identified the French Creek Estuary as a priority focus area in need of more significant restoration.

The results of the EAP analysis reveal that the French Creek Estuary focus area has the highest NCA value and suggested maintenance and management (M&M) budget when standardized by the NCA area. The NCA value of the French Creek Estuary focus area is $55.90/m^2 (with a suggested M&M budget of $0.56/m^2) while the other focus areas range from $6.43-7.00/

m^2 (with a suggested M&M budget of \$0.06-0.07/m^2). This finding reflects the French Creek Estuary focus area's residential land uses, which are expected to increase the potential for stream degradation compared to the predominantly agricultural and rural land uses in the other focus areas. The ecosystem condition findings also point to more intensive land use in the French Creek Estuary focus area. This focus area had the most impervious surface coverage within both the ISA (7%) and the OSA (13%). This is compared to impervious surface area ranging from 0-2% in the ISA and 3-4% in the OSA for the other focus areas.

The suggested M&M budget, calculated through EAP, can serve as a tool to guide budgeting for initiatives outlined in the RDN's plans, such as the Estuary Management Plan as well as the Regional Strategy for Rainwater Management. This EAP analysis report can also be used as a baseline for future study and may be especially useful to assess the progress of management strategies into the future.

Foreword

French Creek lies within the traditional territories of Qualicum and Snaw-Naw-As First Nations where these Coast Salish Nations have inhabited and stewarded the lands long before colonization. The creek holds great cultural value and importance and continues to be a place for hunting, fishing, and gathering[1]. While the Ecological Accounting Process is a method that can be used to inform local government budgeting, it is intended to act as one component of a broad approach to enhance the health of the stream ecosystem. We acknowledge that the results of the EAP reflect the assessed financial value, and the process does not encompass all value perspectives about the stream.

We would like to extend our gratitude to everyone who contributed to the development of this project. We are thankful to Tim Pringle and Kim Stephens from the Partnership for Water Sustainability in British Columbia for their ongoing mentorship, and to Erica Forssman and Murray Walters from the Regional District of Nanaimo for their collaborations and trust. We extend our gratitude to each of the members of the community advisory group, Gord Oliphant, Kaitlin Fader, Barb Riordan, Peter Law, Robin Robinson, Sandy Robinson, Ceri Peacey, Steve Adams, Ray Woroniak and Sacha Woroniak. We are grateful to Sandy and Robin Robinson for their generous collaborations in bringing forward information about previous stewardship expenditures on the Creek, Denise Foster from the Save Estuary Land Society for sharing resources and knowledge, and Vancouver Island University's Master of Community Planning student Andrew McKay for compiling background research on the creek.

1 Mount Arrowsmith Biosphere Region Research Institute. (2018). French Creek Estuary: Assessment of its Historical, Community, and Ecological Values. https://mabrri.viu.ca/sites/default/files/2018-french-creek-estuary-analysis.pdf

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List of Abbreviations

BC	British Columbia
DWWP	Drinking Water & Watershed Protection Program
EAP	Ecological Accounting Process
FFCCS	Friends of French Creek Conservation Society
FSA	Full Study Area
GIS	Geographic Information Systems
ISA	Inner Study Area
LiDAR	Light Detection And Ranging
MABRRI	Mount Arrowsmith Biosphere Region Research Institute
MVIHES	Mid-Vancouver Island Habitat Enhancement Society
M&M	Maintenance and Management
NCA	Natural Capital Asset
OSA	Outer Study Area
PWSBC	Partnership for Water Sustainability in BC
RAPR	Riparian Areas Protection Regulation
RDN	Regional District of Nanaimo
SPEA	Streamside Protection and Enhancement Area
VIU	Vancouver Island University
VRI	Vegetation Resources Inventory

Introduction

Developed by the Partnership for Water Sustainability in British Columbia (PWSBC), the Ecological Accounting Process (EAP) is a methodology to financially evaluate natural assets, primarily stream systems. The EAP uses GIS to delineate a stream system's setback area and identify abutting parcels. Using current land parcel valuations, EAP calculates an overall financial value of a 34m wide area on either side of the stream channel measured from the centre. 30m is the target setback area outlined in the Riparian Areas Protection Regulation as the Streamside Protection and Enhancement Area; the stream channel is 8m wide in calculations. One percentage of this total value is then recommended to be incorporated into annual maintenance and management budgeting by local governments and communities as a first step towards the mobilization of natural asset management. Refined through ten demonstration applications within local governments in British Columbia (BC), PWSBC is in a three-year process of transitioning the EAP to the Mount Arrowsmith Biosphere Region Research Institute (MABRRI) and Vancouver Island University (VIU) to house and apply this methodology.

The EAP is a process of up to seven steps that delivers a baseline picture of the health of stream systems with emphasis on riparian conditions. The first three steps concern baseline analysis, which generate the total financial value of the stream, suggest an annual maintenance and management budget, and state the riparian deficit, or the financial magnitude of land use intrusion influencing the ecological condition of the stream. It is posited that the financial values of parcels adjacent to the stream increase as the associated land uses become more extensive. EAP calculations to determine the NCA financial value reflect this reality. As development density increases near the stream, including parcels that intrude into the setback zone, there will be a higher NCA financial value, thus, warranting a greater budget for ecological maintenance and management.

Further steps of EAP review the OSA (200m upland zone) which lies adjacent to the 34m ISA. The methodology uses GIS, LiDAR and field work to examine the extent of impervious surface area and vegetation coverage, and to map rainwater pathways within both study areas. Together, these analyses deliver a general picture of the riparian health of the stream system and insight into areas that may warrant targeted attention. Ultimately, the EAP applies a land use perspective to evaluate how impacts to water pathways have altered stream health and provides a starting point to integrate natural assets into municipal asset management in the interest of mitigating ecological degradation.

Note that the terms stream system and stream are used interchangeably in this paper. For more information about the EAP, please refer to the Appendices.

EAP Strengths and Limitations

EAP methodology produces a financial case for protecting (maintaining and managing) a stream system based on the condition of its riparian ecosystem or zone in a land use context. Stream systems include wetlands, ponds, and riparian areas, including ephemeral and seasonal water bodies, flood plain areas, and constructed waterways such as ditches and fish habitat impoundments. The methodology aims to synthesize a single Natural Capital Asset (NCA) value that makes a financial case for riparian areas in an accessible format and provides a broader view of the health of the study area. The EAP provides a transferable metric to allocate annual budgeting and valuation of stream corridors. This methodology is designed to act as one tool of many to mobilize long-term natural asset management, incorporating a market-based estimate of financial worth, and a baseline annual maintenance and management budget.

The EAP pays particular attention to riparian areas adjacent to a stream at study sites. Measured from the centre of the stream, the ISA inner study area of 34m on each side of the stream aligns with the target Streamside Protection and Enhancement Area (SPEA), set out in the Riparian Areas Protection Regulation (RAPR)[2]. Analysis of the OSA or upland study area extends an additional 200m beyond the ISA. EAP valuations do not encapsulate the entire watershed.

The EAP applies spatial analysis to the stream channel and its supporting riparian areas as the backbone of the watershed. The strength of EAP quantitative findings is the level of (to the m^2) detail provided. EAP does not analyze water quality or attempt to model the financial value of ecological services that a stream system may provide.

The results and methodology of the EAP are transferrable by nature and can help local governments exercise oversight and account for continued care of waterways to ensure long-term watershed health. The EAP provides a baseline financial valuation and snapshot of the riparian health of the study areas; it does not provide direct recommendations on policy or funding approaches. Instead, EAP metrics should be considered alongside recommendations of Qualified Environmental Professionals and relevant ecological and riparian protection frameworks. The EAP can be used as a supportive tool, including, but not limited to upholding engineering standards protecting conservation areas, and refining the terms of development permit areas.

The EAP suggests that local government and community use 1% of the NCA calculation for regular maintenance and management budgeting. This percentage is a starting point in the interest of allocating funding for natural asset management. The percentage may be adjusted depending on the context. EAP calculations source data from BC Assessment records. EAP calculations reflect market values of parcels for a given year. Because the methodology aggregates assessed values for a large number of parcels, the NCA can be updated based on the percentage change in aggregate parcels assessments by property type and assessment area – see BC Assessment Maps which are published annually by BC Assessment.

2 Ministry of Forests. (2022, June 14). *Riparian Areas Protection Regulation (RAPR)*. Province of British Columbia. https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/fish/aquatic-habitat-management/riparian-areas-regulation

Typically, streams in local government jurisdictions lie in landscapes where parcel usage may include residential, commercial, institutional, industrial, agricultural, timber lands, and mineral extraction. The latter three categories of land uses are governed by BC legislation (Agricultural Land Commission Act, Forest Act, Private Managed Forest Land Act, Mineral Tenure Act) which influences assessed values. As a result, EAP uses Farm Credit Canada reports which provide market data about agricultural land sales by region. The EAP Partnership is working to find valuation methods to represent forest lands and mineral extraction lands at market values consistent with those used for other categories of land use.

Additionally, the EAP methodology uses up-to-date GIS and LiDAR data and is limited in cases where this data is not available.

The EAP aims to provide standardized and transferable financial valuations of natural assets, for use with other tools and frameworks to improve natural asset management in developed areas. The EAP suggests that the community's overall view of the worth of a stream can be calculated roughly from the amount of expenditure made by local government departments, stewardship groups, research entities such as MABRRI and PWSBC, external funders, etc. (Refer to Appendix C, Inventory of Expenditures: Local Government and Stewardship Group Contributions Towards French Creek). However, this may be a conservative estimate; EAP recognizes that stream systems contribute to community quality of life as expressed in social, cultural and ecological ideas about worth that cannot be evaluated financially including those focused on intrinsic nature.

Ultimately, the EAP is designed to serve as one tool in the toolkit of accounting for environmental components in local government planning to dedicate financial resources towards restoring and managing these natural assets. Additionally, it should be noted that while the EAP is a complementary framework to ecological service evaluation and the Natural Assets Initiative, it is not the same tool. The Natural Assets Initiative, formerly known as the Municipal Natural Asset Initiative, has been used by local governments to create inventories of their natural assets, using economic models to ascribe value to them based on an analysis of the services they provide to the community. The EAP assumes that the community understands that a natural asset has a range of financial and worth values, which depend on its health and function. The EAP values natural assets based on land parcel valuations, providing a first step in operationalizing regular natural asset management in settled areas. In summary, the Natural Assets Initiative creates an inventory of natural assets and an analysis of their services for ongoing management, whereas the EAP provides a tangible value to be applied to budgeting for the maintenance or restoration of natural assets. These two natural asset management tools are complementary.

This report is a second-year study of French Creek, taking a deeper look at smaller focus areas along the creek. To calculate a NCA value, it is best practice to use as many abutting parcels as possible to gain an average sample figure. In EAP methodology, a minimum value of 30 parcels can be used to gather this value, but a higher number of parcels is preferred in gathering an educated average value. In this study, a minimum of 50 parcels was used to calculate NCA values in order to gather as strong of a sample size as possible. In ensuring a strong sample size, this required a larger area in focus areas with parcels predominantly zoned as agricultural, managed forest land, or rural residential, which were larger in nature. This is evidenced in overlapping in some of the focus areas. More developed, residential-zoned areas typically had smaller parcels of larger concentrations, as seen in the French Creek Estuary Sample Area.

French Creek Background

French Creek is located on the East coast of Vancouver Island, situated within the Regional District of Nanaimo (RDN)'s Electoral Areas G, F, and C, to the north of Parksville and south of Qualicum Beach. It stems from tributaries throughout the forested highlands, 1080 metres above sea level, inland from Coombs and drains a watershed approximately 68km^2 and 17km long[3]. Beyond the forested headlands, French Creek flows through agricultural, rural residential, commercial, and industrial lands prior to reaching more dense residential development near the estuary where the creek meets the Salish Sea.

French Creek was chosen for an EAP analysis because it is considered an at-risk catchment and is experiencing increasing land use (subdivision and development) pressures. The EAP analysis for French Creek has been a two-year project with reporting completed for each year. The first year examined the entire creek to calculate a Natural Capital Asset (NCA) value, the suggested annual investment for the maintenance and management of the creek, and a statement of the riparian deficit based on the impact of land use on the conditions of the ISA. Based on the calculations, it was determined that the NCA value of French Creek ranges from $22.8 million to $33.5 million. Therefore, between $228,500 and $335,400 is the suggested baseline annual investment for maintenance and management (M&M) of the creek by the local government and collaborators.

To expand on the first year's analysis, a community advisory committee was assembled and consulted to determine focus areas to further explore possible opportunities for maintenance and management initiatives within the watershed. The community advisory committee was comprised of representatives from Friends of French Creek Conservation Society (FFCCS), RDN Parks, RDN Drinking Water and Watershed Protection (DWWP) program, Partnership for Water Sustainability in BC (PWSBC), Mid-Vancouver Island Habitat Enhancement Society (MVIHES), Hamilton Wetlands and Forest Preservation Society, Qualicum Beach Streamkeepers, Mosaic Forest Management, Mount Arrowsmith Biosphere Region and MABRRI. Based on their experience in stewardship and conservation efforts within the watershed, the group recommended five locations of focus: Bell Lake, Dudley Marsh, Hamilton Marsh, French Creek Bridge Trails area, and French Creek Estuary. The first four listed were identified for conservation whereas the French Creek Estuary was highlighted by the committee as a priority area of focus for restoration. The background report in Appendix G provides more insight into each focus area.

3 Ministry of Water, Land and Air Protection, & Ministry of Sustainable Resource Management. (2002). French Creek Watershed Study. https://www.env.gov.bc.ca/van-island/es/french_creek/pdf/French%20Creek%20Technical%20report%20April%202002.pdf

Figure 1: Map of French Creek Water Region

French Creek Water Region

French Creek Main Stream

French Creek Tributaries

Watercourse

Waterbodies

French Creek Water Region

Inner Study Area (34m from Midline)

Outer Study Area (234m from Midline)

January 2023

Methodology

This study involved performing EAP steps one through six for the following five focus areas within the French Creek watershed: Hamilton Marsh, Bell Lake, Dudley Marsh, French Creek Bridge Trail area, and the French Creek Estuary (Figure 2). The six steps of EAP that were completed provide the NCA value, a suggested baseline budget for the maintenance and management of the stream, as well as insight into the riparian deficit. Measures of the riparian condition, including impervious surfaces, vegetation heights, and drainage pathways help explain the magnitude of the riparian deficit. The steps are briefly outlined below and are described in more detail in Appendix B.

EAP Steps 1-6

Step 1: Calculation of the Natural Capital Asset (NCA) value

The NCA is the area (m²) of the setback zone (34m on each side of the stream measured from the centre of the stream channel) along a length of the stream system. EAP calculates the financial value of the NCA. EAP calculations secure parcel financial value data based on BC Assessment and Farm Credit Canada data. Farm Credit Canada values are used for agricultural parcels while BC Assessment data is used for all other parcels. EAP draws data about parcel identification number, civic address, area, zoning, etc. from local government and provincial databases.

EAP methodology defines the NCA area of a stream system as the 34m setback zone on both sides of the stream for some sample lengths (focus areas) or the entire stream. To calculate the financial value of the setback zone, EAP uses aggregated data of:

- the area of sample parcels abutting the stream system;
- the area of these parcels which intrudes into the setback zone;
- the financial value of the sample parcels;
- and the financial value of the intruding portion of these parcels.

The calculation to find the financial value of the NCA requires finding two proportions: a) the percentage of aggregate parcel area intruding into the setback zone; and b) the financial value of the same aggregation. It follows that b divided by a finds the $ per m² (Product) value of the parcels that intrude into the setback zone – the NCA. The final step simply multiplies the area of any setback zone of any length by the Product to get the NCA financial value.

The EAP methodology considers stream system management to be a shared (commons) responsibility involving private owners and public entities. To acknowledge this shared responsibility, the total NCA value is divided by two to reflect the following. Private owners contribute to stream protection by paying property taxes for parcel area they cannot use (develop). A portion of their parcel utility has been subsumed into the commons. Private owners may support stewardship works where the stream crosses their property. Local government and the community are involved in on-going M&M works and projects. EAP uses the M&M concept to refer to collaborative investment in protection of stream systems. The local government term for operations and management (O&M) refers to departmental expenditures. It is not used in

EAP reports. The Ecosystem Influence section of this report provides more discussion.

The results of the NCA calculations are provided in two tables: one that includes managed forest land and one that excludes it. The separation of forestry lands is provided to acknowledge the potentially inaccurate land assessment values in forestry areas as they do not include the timber value, nor the potential value when private forestry lands parcels can be rezoned for residential and other uses.

Step 2: Calculation of a suggested Maintenance and Management (M&M) budget

The suggested annual investment for the M&M of the stream is 1% of the NCA value calculated in the first step. This estimate reflects a typical M&M budget for capital assets, such as infrastructure. The result is the recommended investment that local governments could budget to maintain the stream's function, health and value to the community. Each focus area comprises 50 parcels of various sizes. To more accurately compare the focus areas, the methodology calculated average M&M budget per m² for each one. The result is the suggested baseline M&M budget for the local government.

Step 3: Stating the Riparian Deficit

As posited in the introduction, "as development density increases near the stream, including parcels that intrude into the setback zone, there will be higher NCA financial values." The riparian deficit interprets the NCA value in terms of the impact of land uses both within the ISA and OSA. These impacts accumulate and alter the riparian condition of the stream system. The NCA value, linked to assessed property values, typically will increase with the amount of development in a stream sample area, which in turn increases the riparian deficit and the M&M costs that could be necessary due to an increased risk of or actual degradation.

Based on a focus area, the following methodological steps investigate the riparian extent in both the ISA and OSA to describe aspects of its condition, including the presence of impervious surfaces, vegetation cover, and rainwater pathways.

Steps 4 and 5: Riparian conditions in the Inner Study Area (ISA) and Outer Study Area (OSA)

Step four quantifies and describes the riparian conditions of the segments of the abutting parcels and commons area in the ISA. Step five does the same for study areas of adjacent parcels in the OSA, extending 200 metres from the outer edge of the ISA on either side. The riparian conditions investigated for these steps include impervious surfaces, vegetation cover and constructed as well as unaltered drainage conditions.

For this study, impervious surface area was analyzed using a desktop examination of 2022 aerial photographs of the study area. Using the air photos, the impervious surfaces were manually identified and defined for parcels influencing both the ISA and OSA. Then, the total percentage of impervious areas was calculated.

The research process studied vegetation cover through the use of Light Detection And Ranging (LiDAR) and Vegetation Resources Inventory (VRI), both sourced from the province of BC,

to determine the varying heights of vegetation within the study area. Detailed LiDAR data was available for much of the stream; however, for the upper reaches of the stream within the more forested and agricultural areas, data from the VRI was relied upon. While this data was readily available, it is not as detailed. The VRI displays the data for vegetation heights as an average across areas often larger than the parcel areas within the study area. This resulted in less detailed data for each parcel in the portion of the study area where specific tree canopy height data was not available. The LiDAR data was analyzed using the VRI vegetation cover height classification ranges which were then described in 3 groups: short, medium, and tall. Table 1 displays the height ranges for each grouped vegetation height classification used for this study.

Table 1: Vegetation Cover Height Classification Ranges and Description

VRI Vegetation Cover Height Classification Range (m)[4]	Description
0	Short
0.1 – 10.4	
10.5 – 19.4	Medium
19.5 – 28.4	
28.5 – 37.4	Tall
37.5 – 46.4	
46.5 – 55.4	
55.5 – 64.4	
64.5+	

EAP methodology looks beyond the ISA of 34 metres to gain a wider view of any influences that may be affecting French Creek within the watershed, such as subdivision and development that affects riparian assets including rainwater pathways. The data provided in these steps could help inform future priority areas for maintenance and management initiatives.

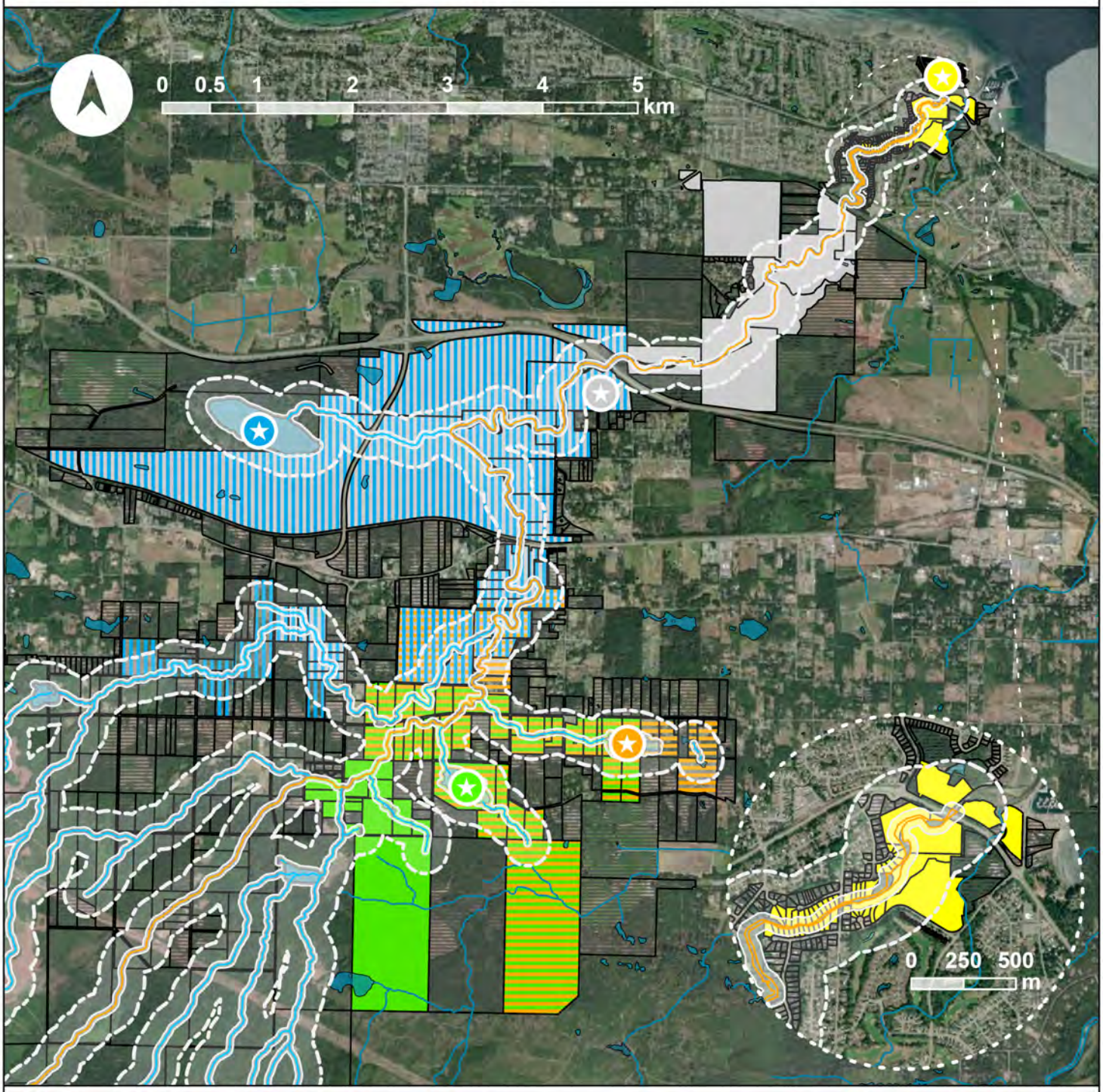
Step 6: Rainwater Pathways

The final step performed in this study was an overview of rainwater pathways. Typically for this step, local government drainage mapping would be reviewed to understand to what extent natural rainwater pathways are being disrupted by built drainage infrastructure, such as ditching. However, the RDN does not have drainage information available so to complete this step, the GIS analyst developed a map of the topography of the study area. The map identifies the 10 and 20 metre contours in the inner and outer study areas to illustrate how the water may naturally drain through the study area. This, in addition to the information regarding the riparian conditions and impervious surfaces, may provide some insight about where maintenance and management initiatives could potentially occur along French Creek.

4 British Columbia Ministry of Forests, Lands and NRO. (2019). VRI Relational Data Dictionary (version 5.0) [Report]. Ministry of Forests, Lands and NRO. Retrieved from https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/stewardship/forest-analysis-inventory/data-management/standards/vegcomp_poly_rank1_data_dictionaryv5_2019.pdf

Figure 2: French Creek Focus Areas Overview

Focus Areas Overview



Note: The map illustrates the 50 closest abutting parcels used in the analysis for each focus area. 50 parcels were selected to create an average value that could be applied for parcel areas not included in the analysis, including parcels with no available data on BC Assessment. Drainage and rainwater pathways were analyzed by how they may be altered within the study area; the map does not correspond to the drainage pattern of the watershed.

Results

Ecosystem Valuation

Analyses were performed for each focus area using data from 50 abutting parcels for each. Some focus areas overlapped; in those cases, the same parcel was used for more than one focus area calculation. For this reason, the data are not summed but are addressed by individual focus area. To learn more about the ecosystem valuation for the entirety of French Creek, please refer to the *Ecological Accounting Process Report for French Creek: Year 1 of 2*[5].

Table 2 shows the zoning groups of the parcels abutting the stream within each focus area, based on the RDN's zoning groups. The prevalent zoning type was agriculture. Agricultural land accounted for 80% of the parcels in the Hamilton Marsh focus area, 100% of parcels in the Bell Lake focus area, 76% of parcels in the French Creek Bridge Trail and Invasive Hogweed focus area, and 0% in the French Creek Estuary focus area. In contrast, the French Creek Estuary focus area was predominantly (98%) zoned for residential suburban use, reflecting its denser residential development compared to the other focus areas.

The NCA values for the five French Creek focus areas are displayed in Tables 5 and 6. These values represent the financial worth of the stream system. The results reveal that the NCA values per metre of stream were considerably lower for the more rural, predominately agricultural areas than for the French Creek Estuary. More specifically, the NCA values per metre for Hamilton Marsh, Bell Lake, Dudley Marsh, and French Creek Bridge Trail and Invasive Hogweed focus areas were about 20-25% of that of French Creek Estuary. The areas with lower NCA values were areas largely composed of land uses that generally have less dense development, such as agriculture and forestry. In contrast, French Creek Estuary had the highest NCA value and is primarily zoned for residential/suburban use. These values support the riparian deficit concept, where a higher NCA value is an indicator of increased development that could impact stream health and its value to the community.

In terms of the suggested M&M budget, the French Creek Estuary focus area has the highest budget of the five focus areas, at $23.81 per metre (or $0.56/$m^2$). In comparison, the M&M budgets of the other five focus areas range from $4.75 - $6.06 per metre ($0.06-$0.07/$m^2$) including Managed Forest and Cut Timber; when excluding Managed Forest and Cut Timber the range is $4.58 – $5.79 per metre ($0.05-$0.07/$m^2$).

These findings further support the conclusions of the first-year EAP Report for French Creek which found that the suburban residential parcels along the creek were the greatest contributor to the total NCA value, despite making up the smallest land area[4]. Suburban residential parcels tend to have a higher assessed value compared to rural areas suggesting a greater impact on the neighbouring stream as reflected in the NCA value and indicated M&M budget.

5 Mount Arrowsmith Biosphere Region Research Institute. (2024). Ecological Accounting Process Report for French Creek Year 1 of 2. https://www.rdn.bc.ca/sites/default/files/inline-files/EAP%20French%20Creek%20Final%20Report%20-%20Year%201%20-%202023-2024.pdf

Suburban areas typically have more parcels per hectare and a smaller development footprint compared to areas committed to agriculture and forestry. In suburban areas numerous parcels and developments are abutting or adjacent to a stream. They can disrupt the natural riparian area through their impervious surfaces (e.g., driveways or roofs), alterations to vegetation cover, and constructed drainage infrastructure. While forestry, agricultural, and rural areas typically have larger parcels with lower assessed value, and less development and impervious surfaces per area, they still have potential influences on the stream that should also be examined, such as runoff of sediment and contaminants[6]. The next section will further explore the conditions of the riparian area to provide a deeper understanding of potential impacts to the stream.

Table 2: Focus Area Parcel Summary (Including Managed Forest and Cut Timber)

Zoning Group		Bell Lake		French Creek Bridge Trail and Invasive Hogweed	French Creek Estuary and Area	
Total Abutting Parcels	50	50	50	50	50	
Agriculture	40	50	47	38	-	
Commercial/Industrial/Institutional	6	-	-	7	1	
Forestry/Resource	-	-	1	-	-	
Residential Rural	1	-	2	2	-	
Residential Suburban	3	-	-	3	49	
Agricultural Land Reserve	39	47	45	35	0	
Farm Designation	9	9	7	10	0	
Managed Forest Land and Cut Timber	8	1	2	10	0	
Stream Length through Parcel Area (km)	10.4	8.1	7.9	12.7	2.4	
		Bell Lake		French Creek Bridge Trail and Invasive Hogweed	French Creek Estuary and Area	Weighted Average of Abutting Parcels
Weighted Average Parcel Area of Abutting Parcels (ha)	18.5*	10.6*	11.6*	22.5*	0.6	12.8
Weighted Average Parcel Value per m^2 of Abutting Parcels ($ CAD)	11.9**	12.3**	12.5**	9.6**	111.8	31.6

6 Ministry of Environment. (2014). Water Quality Assessment and Objectives for the French Creek Community Watershed Technical Report. https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-objectives/wqo_tech_french_creek.pdf

*Average parcel sizes without inclusion of Managed Forest and Cut Timber is 7.3 m^2 for Hamilton Marsh, 7.9 m^2 for Bell Lake, 6.0 m^2 for Dudley Marsh, and 10.9 m^2 for French Creek Bridge Trail and Invasive Hogweed.
** Average parcel value per m^2 without inclusion of Managed Forest and Cut Timber is $14.1 for Hamilton Marsh, $12.5 for Bell Lake, $13.0 for Dudley Marsh, and $11.9 for French Creek Bridge Trail and Invasive Hogweed.

Table 3: NCA Summary Table (Including Managed Forest Lands)

NCA Summary Table					
Group	Stream Length (m)		Natural Commons Asset Values		
			Total $ ($)	$ per m ($/m)	$ per m2 ($/m2)
A - Hamilton Marsh	10,837.40	50	6,588,340.96	607.93	7.04
B - Bell Lake	11,472.95	50	5,951,278.69	518.72	6.43
C - Dudley Marsh	11,246.00	50	5,342,193.91	475.03	6.43
D - French Creek Bridge Trail and Invasive Hogweed	13,297.18	50	6,727,538.83	505.94	6.58
E - French Creek Estuary and Area	2,351.81	50	5,599,359.99	2,380.88	55.90
Weighted Averages				613.93	7.63

Table 4: NCA Summary Table (Excluding Managed Forest Lands)

NCA Summary Table					
Group	Stream Length (m)		Natural Commons Asset Values		
			Total $ ($)	$ per m ($/m)	$ per m^2 ($/$m^2$)
A - Hamilton Marsh	6,600.20	42	3,821,748.93	579.04	6.52
B - Bell Lake	11,432.71	49	5,788,893.50	506.34	5.86
C - Dudley Marsh	11,049.89	48	5,200,298.13	470.62	6.17
D - French Creek Bridge Trail and Invasive Hogweed	8,039.19	40	3,679,682.66	457.72	4.97
E - French Creek Estuary and Area	2,351.81	50	5,599,359.99	2,380.88	55.90
Weighted Averages				610.28	7.52

Table 5: Maintenance and Management Budget (including Managed Forest Lands)

Maintenance and Management Budget				
Group	NCA Total ($)	M&M ($)	M&M($) per m	M&M ($) per m^2
A - Hamilton Marsh	6,588,340.96	65,883.41	6.09	0.07
B - Bell Lake	5,951,278.69	59,512.79	5.19	0.06
C - Dudley Marsh	5,342,193.91	53,421.94	4.75	0.06
D - French Creek Bridge Trail and Invasive Hogweed	6,727,538.83	67,275.39	5.06	0.07
E - French Creek Estuary and Area	5,599,359.99	55,993.60	23.81	0.56

Table 6: Maintenance and Management Budget (excluding Managed Forest Lands)

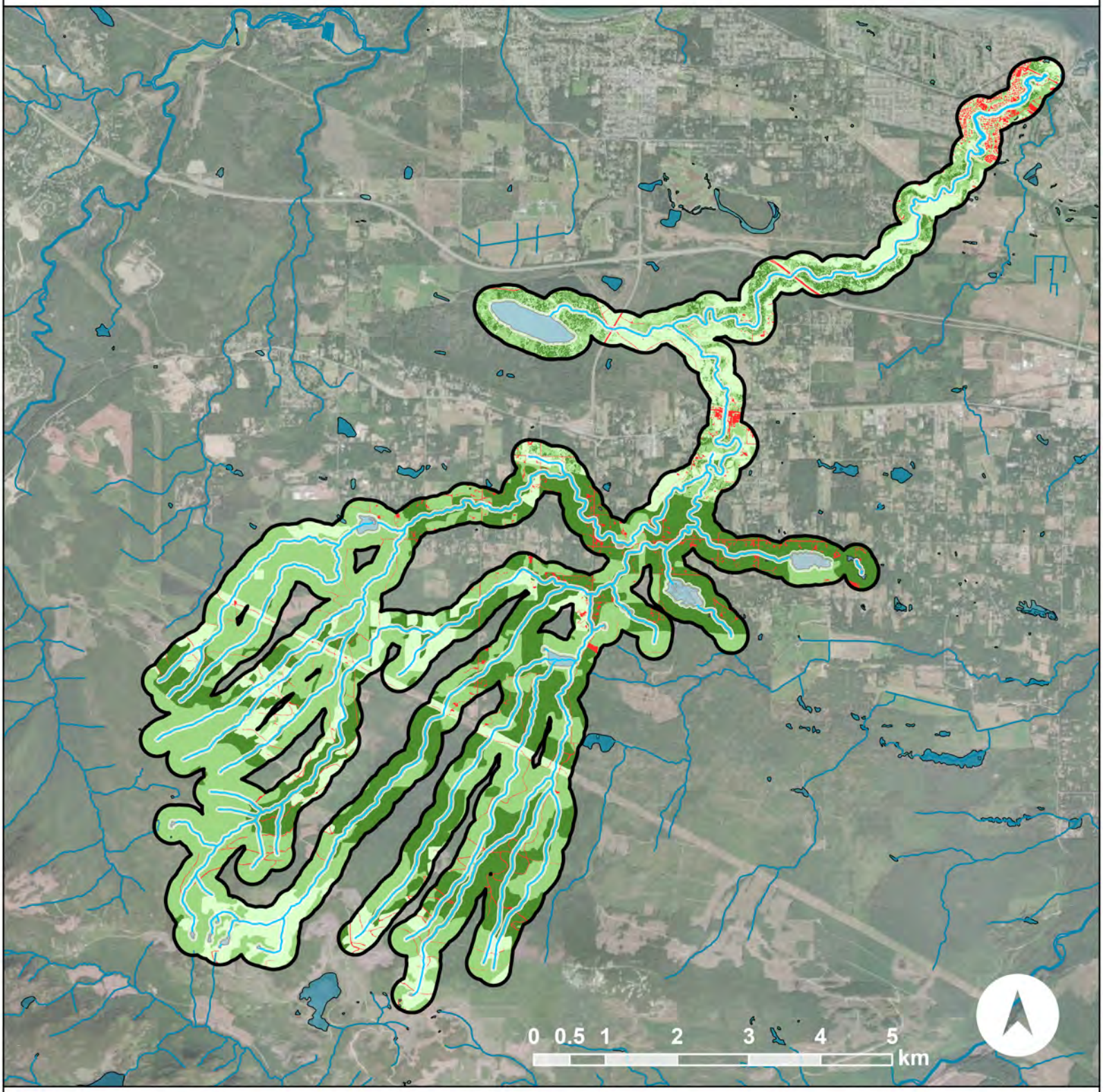
Maintenance and Management Budget				
Group	NCA Total ($)	M&M ($)	M&M ($) per m	M&M ($) per m^2
A - Hamilton Marsh	3,821,748.93	38,217.49	5.79	0.07
B - Bell Lake	5,788,893.50	57,888.94	5.06	0.06
C - Dudley Marsh	5,200,298.13	52,002.98	4.71	0.06
D - French Creek Bridge Trail and Invasive Hogweed	3,679,682.66	36,796.83	4.58	0.05
E - French Creek Estuary and Area	5,599,359.99	55,993.60	23.81	0.56

Ecosystem Condition

Steps 4 and 5 of the EAP analysis provided further description of the riparian deficit through the lens of impervious surfaces and vegetation cover in the Inner and Outer Study Areas (ISA and OSA). Impervious surfaces are areas that water cannot pass through, such as buildings, while vegetation cover refers to the height of the tree canopy measured using LiDAR. Table 7 provides an overview of the results of the impervious surface analysis, including the total area of impervious surfaces and the percentage of impervious area in the abutting parcels of each focus area. Tables 8 and 9 present the data of the vegetation heights for the segments of parcels in the ISA and Full Study Area respectively. The vegetation map (Figure 3) illustrates the canopy heights throughout the entire study area. It is important to note that the impervious surface and vegetation data provided in tables 7, 8, and 9 refers only to the abutting parcels and does not include data that is not within a land parcel, such as municipal roadways.

Figure 3: French Creek Vegetation and Impervious Areas

French Creek Vegetation and Impervious Areas



French Creek Tributaries
Watercourse
Waterbodies
Inner Study Area (34m from Midline)
Outer Study Area (234m from Midline)
Impervious Areas
Height Category
Short
Medium
Tall

February 2025

Figure 3 highlights the areas of more dense development and impervious surfaces in the lower half of the watershed, concentrated near the community of Coombs along Highway 4A and the French Creek community near the estuary and Highway 19A. Previous research conducted in 2002 found similar results, noting that more concentrated impervious areas were located near the estuary and the Coombs community. Using a different methodology, where impervious surface area was estimated based on the typical impervious surface cover for various land uses, the study concluded that the entire watershed had approximately 4.6% impervious surface. Although the results from the 2002 watershed study cannot be directly compared to the findings of the EAP report, they do show similar areas of higher impervious surface coverage. The *French Creek Watershed Study* also classified the percentage of impervious surface area of a watershed; streams were rated as impacted at 10% impervious surface area and degraded when impervious surface area reached 25%[7,8]. While the EAP study does not examine the entire watershed, the findings from the impervious surface analysis can be interpreted using this classification to assess their potential impact on stream health.

The riparian conditions, including impervious surfaces, vegetation, and drainage, will be discussed below in relation to each focus area (sample) based on observed data gained from the site visit as well as from EAP steps four through six of the broader focus areas each of which comprise 50 parcels abutting the creek.

As mentioned in the Strengths and Limitations section, four of five samples are predominantly rural. Because the data for each focus area was calculated with 50 parcels, the rural samples, which have numerous large parcels, extended over a greater area than intended. As a result, the data illustrating the ratio of vegetation and impervious surfaces in the samples extends beyond what would be considered the focus area, resulting in some overlaps. For example, the focus area of Hamilton Marsh extends to the south and overlaps with the French Creek Bridge Trails and Invasive Hogweed focus area due to their proximity. Similarly, Bell Lake and Dudley Marsh samples overlap in areas due to their proximity. Please refer to the French Creek Vegetation map (Figure 3) to view the detailed vegetation and impervious surface areas for the entire creek and the Focus Area Maps (Appendix F) to view the study areas of each.

7 Schueler, T. (1994). The Importance of Imperviousness. Watershed Protection Techniques, 1(3).

8 Ministry of Water, Land and Air Protection, & Ministry of Sustainable Resource Management. (2002). French Creek Watershed Study. https://www.env.gov.bc.ca/van-island/es/french_creek/pdf/French%20Creek%20Technical%20report%20April%202002.pdf

Table 7: Impervious Area Summary of Abutting Parcels in the Full Study Area (FSA = OSA+ISA) and the Inner Study Area (ISA)

	Abutting Parcels	FSA Total Area (m^2)	FSA	Percent of FSA (%)	ISA Total Area (m^2)	ISA Impervious Area (m^2)	Percent of ISA (%)
Hamilton Marsh	50	4,555,423	133,457	3	806,437	2,945	0
Bell Lake	50	3,391,617	118,092	3	874,648	8,829	1
Dudley Marsh	50	2,990,626	105,561	4	802,264	14,760	2
French Creek Bridge Trail and Invasive Hogweed	50	5,512,115	137,856	3	971,003	5,793	1
French Creek Estuary and Area	50	271,062	35,119	13	87,024	5,665	7
Total Creekshed	250	16,720,843	530,086	1*	3,541,376	37,992	1*

*Total percent of Outer Study Area (OSA) and Inner Study Area (ISA) is representative of the percent of the entire creekshed and not additive.

Table 8: Vegetation Summary of Abutting Parcels in the Inner Study Area (ISA)

		Hamilton Marsh	Bell Lake	Dudley Marsh	French Creek Bridge Trail and Invasive Hogweed	French Creek Estuary and Area
Parcels	Total Abutting Parcels	50	50	50	50	50
	ISA Total Area (m^2)	806,437	874,648	802,264	971,003	87,024
Short Vegetation (m^2)	LiDAR	145,967	26,706	0	219,646	23,387
	VRI	1,156	1,346	6,411	519	0
	Total	147,123	28,052	6,411	220,165	23,387
	% of ISA	18	3	1	23	27
Medium Vegetation (m^2)	LiDAR	267,062	65,947	0	388,965	46,762
	VRI	12,690	102,756	126,490	5,599	0
	Total	279,752	168,702	126,490	394,564	46,762
	% of ISA	35	19	16	41	54

Tall Vegetation (m^2)	LiDAR	154,476	37,632	0	214,096	11,210
	VRI	216,698	430,790	475,559	129,933	0
	Total	371,174	468,422	475,559	344,030	11,210
	% of ISA	46	54	59	35	13
*Total percent of Inner Study Area (ISA) is representative of the percent of the entire creekshed and not additive. Note: The above percentages are not inclusive of water bodies or areas of impervious surfaces and therefore may not add to 100%						

Table 9: Vegetation Summary of Abutting Parcels in the Full Study Area (FSA = OSA + ISA)

		Hamilton Marsh	Bell Lake	Dudley Marsh	French Creek Bridge Trail and Invasive Hogweed	French Creek Estuary and Area
Parcels	Total Abutting Parcels	50	50	50	50	50
	FSA Total Area (m^2)	4,555,423		2,990,626	5,512,115	271,062
Short Vegetation (m^2)	LiDAR	1,556,447	243,075	0	2,136,320	67,458
	VRI	108,813	53,550	65,326	52,715	0
	Total	1,665,260	296,625	65,326	2,189,035	67,458
	% of FSA	37	9	2	40	25
Medium Vegetation (m^2)	LiDAR	1,556,447	198,321	0	1,723,857	128,610
	VRI	144,663	472,468	810,204	56,289	0
	Total	1,701,111	670,789	810,204	1,780,147	128,610
	% of FSA	37	20	27	32	47
Tall Vegetation (m^2)	LiDAR	609,887	75,614	0	916,064	39,875
	VRI	754,269		1,829,354	482,491	0
	Total	1,364,156		1,829,354	1,398,555	39,875
	% of FSA	30	62	61	25	15
Note: The above percentages are not inclusive of water bodies or areas of impervious surfaces and therefore may not add to 100%						

Bell Lake

The Bell Lake focus area is entirely composed of parcels zoned for agriculture use. The lake itself is located on rural residential parcels, viewable from Grafton Road, and impervious surfaces include rural roads, driveways, and roofs, some of which encroach within the ISA. Ground truthing and aerial maps revealed that some of the vegetation surrounding the lake

appears to have been cleared. Ditching was apparent along Grafton and Station Roads where the stream would flow from the lake to the main stem of French Creek.

The data from the entire Bell Lake focus area revealed that, within the abutting parcels, 1% of the ISA and 3% of the Full Study Area (FSA) exhibited impervious surface cover, which may suggest that the impervious surfaces do not have a significant impact on the health of the stream through this area. Vegetation coverage consisted of 62% tall, 20% medium, and 9% short vegetation which suggests supportive riparian conditions along this focus area[9]. Regarding drainage, the land surrounding Bell Lake is moderately flat. The tributary that flows from Bell Lake passes through agricultural land before reaching the main stem of French Creek. Water pathways may be disrupted by impervious surfaces of roads and residential uses as well as by ditching along the rural roads through this stretch.

In summary, the drainage and vegetation data suggest that the Bell Lake focus area is predominantly covered by tall vegetation. However, ground truthing and aerial imagery revealed that the tributary from Bell Lake to French Creek is somewhat exposed as it flows through agricultural lands. The clearing of vegetation and agricultural land use within the study area could potentially pose a risk to the health of French Creek. For example, the relatively low vegetation in some parts of the riparian area could result in lower soil moisture during the hotter, drier, summer months[10]. Furthermore, ditching along the roads intersecting with the stream may concentrate runoff from the roads before entering the stream.

Dudley Marsh

Dudley Marsh is located within a conservation land parcel in which there are no impervious surfaces within the 31-hectare parcel. Shrubs and forest surround the marsh within the conservation area which is bounded by agricultural land, rural roads, and buildings associated with agriculture and residential use. From Dudley Marsh to the main stem of French Creek, the stream passes through agricultural land, some of which appears to have been cleared of vegetation.

The results of the analysis of the abutting parcels in the Dudley Marsh focus area revealed that 2% of the ISA and 4% of the FSA is impervious surface. Both the ISA and FSA being less than 10% impervious surface may suggest little impact to the stream. In the outer study area, 61% of the vegetation was classified as tall (compared to 59% in the ISA), suggesting an environment that supports riparian health in this area[9]. Similar to Bell Lake, Dudley Marsh is situated in the lowlands of the watershed which has less variation in elevation. It drains to French Creek on the northwest side of the parcel through Dudley Creek across agricultural lands.

The riparian conditions of Dudley Marsh, located on a 31-hectare conservation area since 1982, have been maintained. Like Bell Lake focus area, potential threats to the stream in this area

9 The Partnership for Water Sustainability in BC. (2022). Saratoga Miracle Beach—A Natural Commons in the Comox Valley Regional District: Using the Ecological Accounting Process to Establish the 'Financial Case for Water Assets.'

10 Ministry of Water, Land and Air Protection, & Ministry of Sustainable Resource Management. (2002). French Creek Watershed Study. https://www.env.gov.bc.ca/van-island/es/french_creek/pdf/French%20Creek%20Technical%20report%20April%202002.pdfpg 8

are related to the rural residential and agricultural land uses that have low vegetation cover throughout the riparian ecosystem that may impact stream health and habitat. Ditching along rural roads and farmland can disrupt natural rainwater paths by concentrating runoff into ditches.

Hamilton Marsh

Hamilton Marsh is directly surrounded by 360 hectares of woodlands, suggesting a more intact riparian ecosystem in this area. The tributary then runs through more recently logged forest lands prior to reaching the main stem of French Creek. Upstream from this intersection, the main stem of French Creek runs through the community of Coombs, agricultural lands, and below Highway 4A where the FSA has areas of lower vegetation and increased impervious surfaces and ditching.

The data from the EAP steps 4 and 5 revealed that, within the abutting parcels, 0% of the ISA and 3% of the FSA is impervious surface which may suggest that it does not have a significant impact to the stream in this area. As mentioned, the greatest concentration of impervious surface in the outer study area in this focus area is the community of Coombs where the creek crosses below Highway 4A. In addition, the vegetation mapping shows that the FSA consists of 30% tall, 37% medium, and 37% short vegetation. The focus area sees a higher percentage of shorter vegetation in the FSA (37%) than in the ISA (18%). However, a continuous area of vegetation is visible beyond the ISA which could further support the riparian environment. The areas of shorter vegetation in the FSA are to the west of Hamilton Marsh on the opposite side of Highway 4, which could be reflective of the more recent logging and agriculture in the area. The area surrounding Hamilton Marsh up to its entry into the main stem of French Creek shows a substantial forest with predominantly medium to tall canopy coverage (>10.5m).

In terms of drainage, there is a slight elevation change sloping into Hamilton Marsh and a steeper elevation change near its entry to the main stem of French Creek. Natural rainwater pathways may be disrupted through ditching and culverts along and below the three highways which transect this focus area: Highway 4, Highway 4A and Highway 19. Within the focus area, the concentration of impervious surface near the creek's crossing with Highway 4A may impact the streams health at and downstream from this area.

French Creek Bridge Trails and Invasive Hogweed

From Hamilton Marsh and the Coombs community, the stream flows to the French Creek Bridge Trails Area. Similar to the area surrounding Hamilton Marsh, this area is primarily Managed Forest Lands. During the site visit, recent logging and reforestation were apparent in the FSA. As well, there was significant elevation change sloping to the creek upstream of the Highway 19 bridge.

Data from the broader focus area showed that, within the abutting parcels, the ISA has 23% short vegetation (Tables 8 and 9) while the FSA has 40% short vegetation. This could indicate greater alteration of the natural riparian ecosystem, potentially due to forestry and agriculture uses that typically remove vegetation. In terms of drainage, the creek upstream from Highway 19 is bordered by steeper hills which have been logged and replanted in recent years. This may suggest a compromised riparian condition in the area draining into the creek upstream of Highway 19. While the FSA has a shorter canopy cover, there are few impervious surfaces (3% of FSA) that would potentially impact the stream. Furthermore, the *Riparian Areas Protection Act* and forestry

management practices are evident in the more intact riparian areas surrounding the stream.

French Creek Estuary

In the French Creek Estuary Area, the creek flows through residential areas, then beneath Highway 19A before entering the Salish Sea. During the site visit to the Estuary focus area, observations were made of several invasive plants in the area. Additionally, it was noted by community partners that the estuary has been altered from its natural state by the presence of a dike and a neighbouring marina.

According to the GIS and desktop analysis of the abutting parcels, the ISA is covered 7% by impervious surfaces, while the FSA has 13%, suggesting potential impacts from these surfaces in this area. In comparison to the previously mentioned focus areas, the Estuary Focus Area contains less tall vegetation (13% in ISA and 15% in FSA) and more medium vegetation (54% in ISA and 47% in FSA). In addition, the elevation slopes down from the residential areas into the creek. This, coupled with ditching and constructed drainage that are typical of more urban residential areas could impact stream health from this point and beyond.

Summary

Overall, the focus area with the highest percentage of impervious surfaces was the French Creek Estuary which consisted of 7% (5,665m^2) impervious surfaces and 13% tall vegetation cover in the ISA and 13% (35,119m^2) impervious surfaces and 15% tall vegetation in the FSA. As mentioned, the French Creek Estuary area also has the highest NCA value which supports the concept that with an increase in development and more impervious surface area, the more strain on the watershed and the more investment that may be required for the maintenance and management of the stream. Relative to the French Creek Estuary Area, the other four focus areas have less impervious surfaces, ranging from 0-2% in the ISA and 3-4% in the FSA. The other areas also have more tall vegetation coverage, ranging from 35-59% in the ISA and 25-62% in the OSA.

Ecosystem Influence

French Creek has been a significant focus of stewardship groups and the local government. Previous expenditures from the past ten years have been quantified to provide insight into the stream's inherent social picture of worth and to provide context into the M&M budgets suggested through the EAP. In the Year 1 EAP Analysis of French Creek, the total suggested baseline M&M budget was $335,432 (including Managed Forest Land and Cut Timber) or $228,550 (excluding Managed Forest Land and Cut Timber) for the local government. To acknowledge the idea that natural commons are a shared responsibility, private landowners and stewardship organizations might contribute to and increase the recommended M&M budget. The results of the Year Two study revealed that the focus area with the greatest suggested annual M&M budget per metre of stream is French Creek Estuary at $23.81/metre ($55,993.60), while the lowest is Dudley Marsh at $4.75/metre ($53,421.94).

French Creek has numerous stewardship groups leading and supporting restoration and conservation work along the creek, including but not limited to: Friends of French Creek Conservation Society, Hamilton Wetlands and Forest Preservation Society, Arrowsmith

Naturalists, Save Estuary Land Society, and Parksville Qualicum Beach Fish and Game Association. These stewardship groups together with government and other non-profit organizations have funded and dedicated volunteer hours to projects amounting to approximately $5.8 million over the past decade (Appendix C). Averaged over the ten years, that amounts to approximately $579,297 annually. A significant portion of this total (approx. $5.1 million) stems from the purchase of the land now preserved as the French Creek Estuary Nature Preserve. This example alone emphasizes the value of the creek and estuary to the community, where private donations and multiple funding supports were provided to purchase the property to be held as a nature preserve. In addition to this, stewardships groups have been involved in a variety of restoration and conservation projects from Dudley Marsh to the estuary. These projects include, but are not limited to, fish counts, water quality measuring, bank restorations, tire wear toxin monitoring, invasive species removal, volunteer fish hatchery operations, and planting of native plants.

Likewise, RDN Parks and RDN Drinking Water and Watershed Protection (DWWP) have contributed to the maintenance and management of the creek from the local government role. Projects have included fish habitat assessment, water quality monitoring and risk assessment, watershed performance targeting, the creation of the French Creek Estuary Nature Preserve Management Plan, and more. These projects amounted to approximately $348, 242. Divided over the ten years, this is an average of about $34,824 annually over the past ten years.

According to the previous expenditures, the community stewardship groups have exceeded the suggested budget calculated in the EAP analysis, highlighting their commitments in restoration and conservation efforts along French Creek. While the RDN spending has not reached the EAP's suggested M&M budget, the inventory of historical spending is approximate and based on data available at the time of the study. Furthermore, it may not account for some funding, such as that provided for the purchase of the Nature Preserve, which was included in the stewardship inventory. Based on the Nature Preserve Management Plan and other projects, it is clear that the RDN plans to continue dedicating resources to the restoration and conservation of French Creek. Overall, the combined efforts of the local government and stewardship groups over the past ten years have resulted in an average annual spending consistent with the suggested budget determined in the Year 1 EAP Report of French Creek. This underscores the shared responsibility for the creek's stewardship.

Practical Applications

Of the five focus areas selected for the French Creek Year Two EAP analysis, four were identified by community partners as priorities for conservation, while the French Creek Estuary was highlighted as an area requiring significant restoration. The EAP analysis revealed complementary findings in that the Estuary area had a greater NCA value and suggested M&M budget per metre of stream length. This aligns with the fact that the Estuary area has denser development and more concentrated land uses that could potentially degrade the stream. These conditions of the Estuary area are also reflected in the increased impervious surface, lower vegetation, and ditching that typically accompanies more developed residential neighbourhoods.

In contrast, the focus areas in the upper watershed, which community groups identified as suitable for conservation, showed relatively lower NCA values and M&M budgets. This is likely due to their land uses that have less intrusion on the stream. Of these areas noted for conservation, Hamilton Marsh and French Creek Bridge Trails, which overlap in some areas, have less tall vegetation throughout their FSAs. Additionally, these focus areas are exposed to impervious surfaces and constructed drainage along three highways: Highway 19, Highway 4, and Highway 4A, which could impact stream health[11]. While the Estuary area is a more obvious focus for restoration, these findings from the other focus areas may help the local government and stewardship groups prioritize additional sites for conservation efforts.

The jurisdictional boundaries along French Creek may complicate the RDN's ability to implement policies or strategies for maintenance and management in the upper reaches of the stream where ALR and private forestry lands are more abundant abutting the stream. Although the Estuary is the primary focus area identified as a priority for restoration, there are potential conservation and maintenance opportunities in the upper to middle watershed. However, these areas have provincial oversight through the ALR and as Managed Forest Lands. While these areas are not as impacted by dense development, there are still factors that could degrade the stream riparian condition through loss of vegetation and the altering of natural drainage pathways. There could be an opportunity in these areas for further conservation efforts, such as education the use of land use planning tools like for landowners along the creek about land use impacts to the stream, covenants, or the acquisition of lands for preservation similar to efforts at Dudley Marsh and more recently with the Estuary Nature Preserve[12].

As shown in the inventory of previous expenditures (Appendix C), the estuary has been a focus of local government and conservation groups. Most recently, in 2024, the RDN released the draft French Creek Estuary Nature Preserve Management Plan. The suggested M&M budget calculated through the EAP can serve as a tool to guide budgeting for initiatives outlined in the Estuary Management Plan as well as the Regional Strategy for Rainwater Management.

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11 Ministry of Environment. (2014). Water Quality Assessment and Objectives for the French Creek Community Watershed Technical Report. https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-objectives/wqo_tech_french_creek.pdf

12 Regional District of Nanaimo. (1999). Electoral Area "F" Official Community Plan Bylaw No. 1152. https://www.rdn.bc.ca/dms/documents/planning/electoral-area-f---errington,-coombs-&-hilliers/official-community-plan/area_f_official_community_plan_complete_text_document.pdf

Likewise, the suggested M&M can support community groups' funding applications while also reinforcing their priority in restoring the estuary.

Lastly, this methodology can act as a foundation for future study. This EAP analysis reports on the state of the creek at this moment in time. It can be used as a baseline for future study. Having a well-defined process will allow for comparable analyses in the future, which will help evaluate progress on conservation and management strategies.