MacHydro

Hydrologic Feasibility of Bench Wetland Restoration in the Upper Columbia Valley

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1 Executive Summary

Wetlands provide numerous ecosystem services, including helping mitigate the effects of climate change by taking up carbon and buffering the impacts of changing streamflow regimes. However, wetland numbers are decreasing globally, and are expected to decline further due to climate change. Within the Upper Columbia River Valley, an area that is internationally recognized for its important wetland ecosystems, wetlands have been drying out. This is mostly occurring within a region known as the bench, which is upslope of the Columbia River and runs north-south through the valley. To combat wetland loss, groups like the Columbia Wetland Stewardship Partners (CWSP) are working to restore these wetlands and improve their ability to hold water with the use of beaver dam analogues (BDAs), which mimic beaver dams. Little is known about the hydrology of these wetlands and understanding the feasibility of favorable water conditions is an important first step in ensuring long-term success.

In the current study, we develop a quantitative restoration feasibility index to help score wetlands based on their likelihood of long-term restoration success. We use publicly available data to develop an approach that can be modified for other areas. As wetlands within the benchlands of the Columbia Valley have been shown to be highly dependent on reliable water sources, the type of water source contributing to a wetland is the first contributing score, where intermittent streams are the lowest ranked, and larger streams are ranked higher. Measures of the contributing area and slope, which create a wetness index, are taken from a digital elevation model (DEM). And finally, measures for how dry a region might be, taken from climate data to simulate precipitation minus evapotranspiration (P-ET) were used. All these combined to provide the restoration feasibility index, which ranks wetlands as having low, moderate, high, or very high potential to be successfully restored. Of the 443 bench wetlands examined, 168 wetlands were found to have a low wetland restoration feasibility index, 153 had a moderate wetland restoration feasibility index, 74 had a high wetland restoration feasibility index, and 48 had a very high wetland restoration feasibility index. There were a few trends visible in the data, including an inclination for wetlands in the northern region to rank higher than those in the south, which is driven by a climatic gradient, as well as inflow source being the dominant driver of feasibility scores across the region, followed by the wetness index. The results of this study provide CWSP and others with an approach to help focus and prioritize restoration efforts.

2 Introduction

Due to the numerous services that wetlands provide, conserving and restoring wetlands is often seen as a nature-based approach to climate change mitigation (Taillardat et al., 2020). Hydrologically, wetlands can help buffer the impacts of climate change on river systems by mitigating peak flows (Ferreira et al., 2020; Phillips, 2017), increasing low flows (Kadykalo and Findlay, 2016), and reducing the risk of droughts (Wu et al., 2023). Further, wetlands are amongst the most productive ecosystems and through the sequestration of carbon can help mitigate climate change (Taillardat et al., 2020; Kayranli et al., 2010). However, despite the importance of wetlands in the fight against climate change, global wetland area has been reduced by more than half since 1900 (Davidson, 2015), and in North America, changes in climate may cause a further reduction in wetlands by 10% (Xu at al. 2024).

Within the Upper Columbia River Valley, the open water area has decreased by 16% between 1984 and 2019 (Hopkins et al., 2020), as wetlands dry out and are replaced by woody shrubs (Rodrigues et al., 2024). Within the benchlands of the Columbia Valley, wetlands have experienced several stressors that have reduced their historic extent, including forestry and draining for agriculture, ranching, and development (Personal Communication, Suzanne Bayley). Further, beavers have historically been active within the area, but many dams within the benchlands have been damaged and are incomplete, reducing the wetted area of wetlands from their historic extents (Leven et al., 2024).

Wetland restoration within the benchlands is underway in several capacities. BCWF has recently completed wetland restoration earth works along Sun Creek, a heavily cattle-impacted watershed near Canal Flats and CWSP has installed four beaver dam analogues on bench wetlands to increase the wetted area (Leven et al., 2024). However, as climate change will continue to impact wetlands in this region, it is important to assess how climate change might influence the success of future wetland restoration. Wetlands are intrinsically linked to the surrounding hydrology, so changes in the local climate can have large impacts on wetland form and function. Mountainous wetlands are often more sensitive to climatic variations, particularly when their water budgets rely heavily on precipitation for water inputs, or if they are groundwater driven within relatively small watersheds (Winter, 2000). In general, the smaller the contributing watershed or the smaller the wetlands surfaces, the more vulnerable the wetland is to the potential effects of climate change on surface water, groundwater, or precipitation pathways (Winter, 2000; Kim and Park, 2020).

To maximize the benefit of wetland restoration, it's important to understand the potential impacts of climate change to water bodies in the region to ensure that a wetland will be resilient in future climatic conditions. As wetland restoration has been employed across North America in recent years, attempts have been made to prioritize potential restoration areas using available datasets to identify characteristics with the potential to support wetland ecosystems (Hovath et al., 2018). Previous work in the benchland region has shown that surface water connectivity and climatic conditions may be primary drivers in the vulnerability of the bench wetlands (MacHydro, 2024), these factors should be considered in the development of a wetland restoration index in the region.

The purpose of this study is to develop a wetland restoration index for the benchlands in the Upper Columbia Valley using publicly available data sources. The restoration index will integrate several indices and data sources to represent connectivity, water source security, and climate sensitivity.

3 Study Area

The study area includes the bench wetlands on the eastern slopes of the Purcell Mountains between Canal Flats and Spillimacheen, BC, within the Rocky Mountain trench (Figure 1). The study area is defined as an upland area between approximately 785 m and 1871 m with a median elevation of 1063 m. The study area was delineated using elevation and topographic features in GIS and is approximately 668 km^2 and 100 linear km from N to S.

The study area is 88.8% forested with 50.2% falling in the IDFdk5 BEC zone (Columbia Dry Cool Interior Douglas-fir; Figure 2), 26.8% as MSdk (Dry Cool Montane Spruce), 13.2% IDFxk (Very Dry Cool Interior Douglas-fir), 5.6% as ICHmk5 (Interior Cedar – Hemlock Moist Cool), 4.0% as IDFdm2 (Kootenay Dry Mild Interior Douglas-fir), 0.2% ESSFdk2 (Columbia Dry Cool Engelmann Spruce – Subalpine Fir), and 0.01% MSdw (Dry Warm Montane Spruce).

Most of the study area has a NE aspect (29.2%) and almost none is considered truly flat (0.25%), while the remaining study area is split into the other aspects relatively evenly (between 5.95% to 16.1% each aspect). The area is not particularly steep, with 35.7% of the area having a slope of less than 10%, and 31.3% of the area with a slope of 11-20%.

Many 5th and 6th order streams originate in the Purcell Mountains and travel through the study area, including Spillimacheen River and Bugaboo, Horsethief, and Toby Creeks, though these do to intersect any of the wetlands in the area; Templeton River and Dunabr, Goldie, Driftwood, Salter, Marion, Wilmer, Hurst, Castor, Brady, Neave, and Rand Creeks are all smaller tributaries that intersect with wetlands in the study area.

Soils within the study area are predominantly comprised of loam and silty loam, with a minor amount of sandy loam and loamy sand and are well or rapidly draining. Depositional modes include glacial tills, glaciofluvial, and, to a lesser degree, fluvial and colluvial processes (BC Ministry of Environment, 1990). The study area is made up primarily of sedimentary rocks from the Proterozoic to Paleozoic Eras, including:

- Coarse clastic sedimentary rocks from the Neoproterozoic associated with the Horsethief Creek Group
- Conglomerate coarse clastic sedimentary rocks from the Neoproterozoic associated with the Toby Formation
- Quartzite, quartz, arenite sedimentary rocks are found in the throughout the study area from the Mesoproterozoic associated with the Mount Nelson Formation and in small slivers in the north from the Neoproterozoic to Lower Cambrian associated with the Cranbrook Formation
- Undivided sedimentary rocks containing siltsone, argillite, quartzite, and dolomite from the Mesoproterozoic associated with the Dutch Creek Formation
- Dolomitic carbonate rocks from the Mesoproterozoic associated with the Kitchener Formation in the south, from the Middle Silurian to Upper Ordovician associated with the Beaverfoot Formation in the north, and from the Upper Ordovician to Middle Silurian associated with the Beaverfoot and Mount Wilson Formations
- Limestone, marble, calcareous sedimentary rocks Middle to Upper Cambrian associated with the Lyell, Sullivan or Jubilee Formations
- Mudstone, siltstone, shale fine clastic sedimentary rocks from the Cambrian to Ordovician associated with the McKay group

Soil and geology data layers were provided by BC Data Catalogue.

Within the study area, there are several wetlands that are being explored for restoration efforts, as well as a couple which have already been restored with the use of beaver dam analogues to improve water retention (Leven et al., 2024). These wetlands include 11 selected for restoration and an additional reference wetland (Figure 3). The contributing factors driving the restoration feasibility of these individual wetlands are characterized in greater detail in this report to help guide existing restoration efforts.

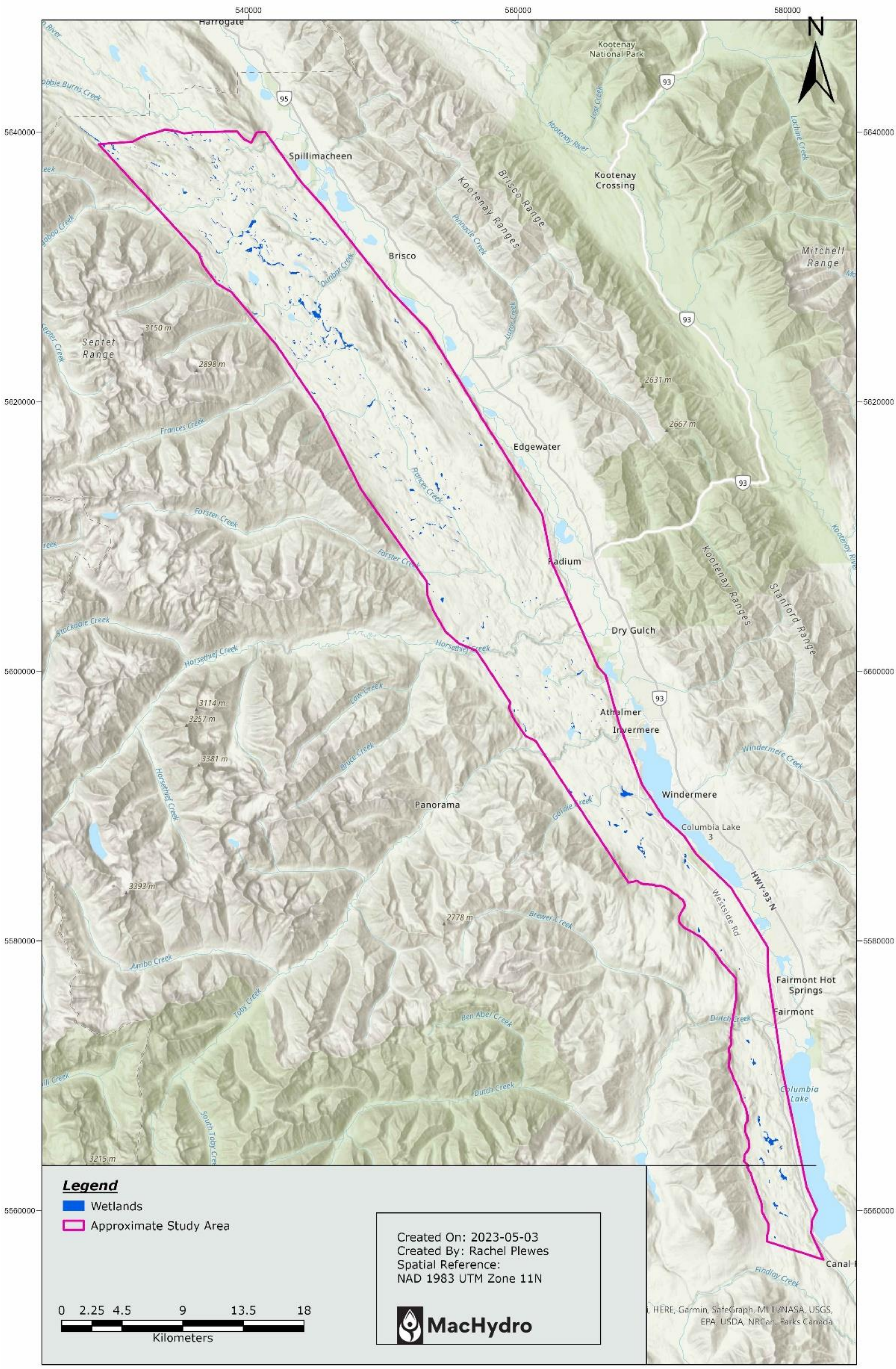

Figure 1. Study area showing the bench wetlands on the west side of the Rocky Mountain Trench ranging from Canal Flats to north of Spillimacheen, BC

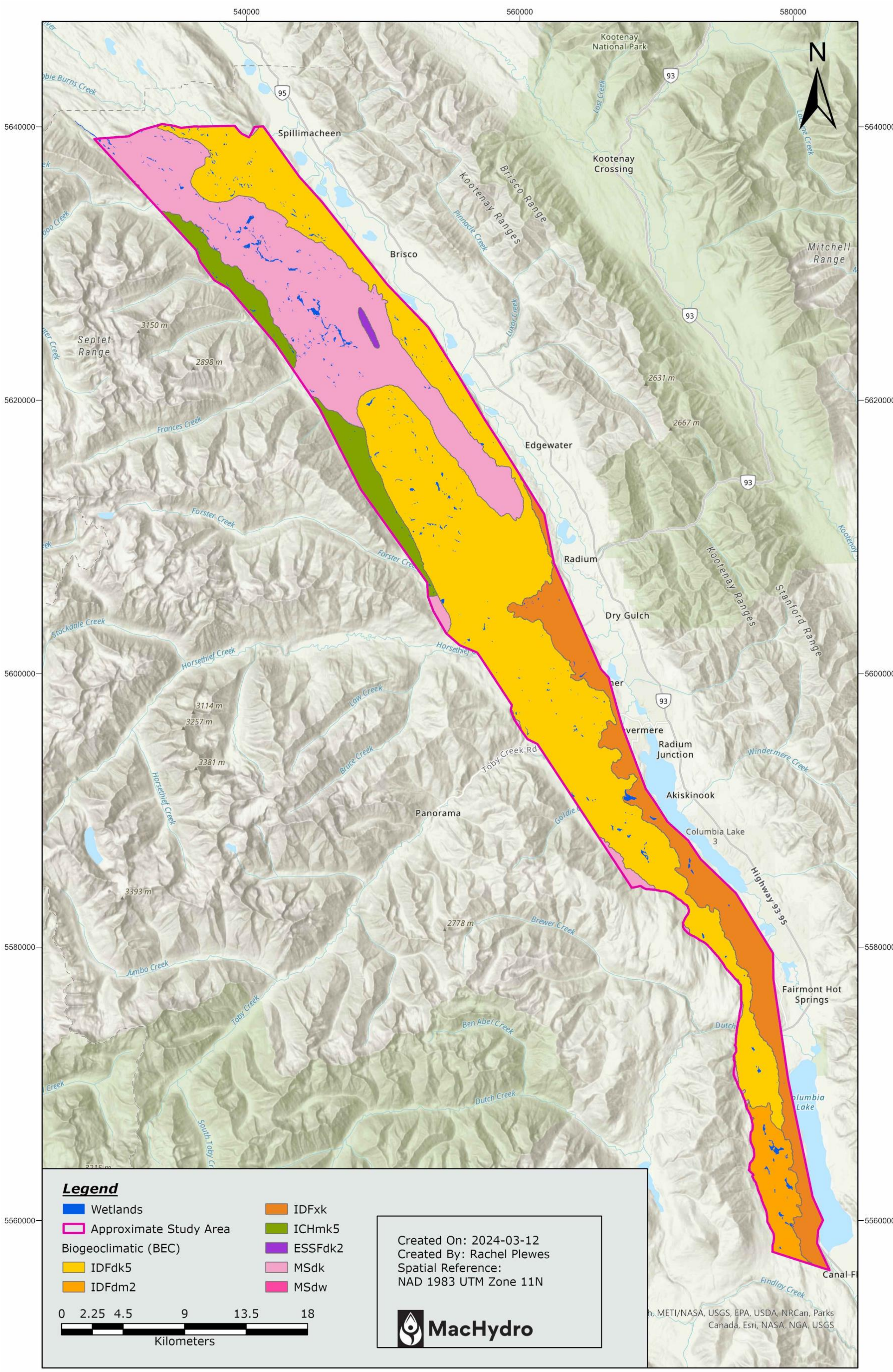

Figure 2. BEC zones within the study area, including IDFdk5 (Columbia Dry Cool Interior Douglas-fir), IDFdm2 (Kootenay Dry Mild Interior Douglas-fir), IDFxk (Very Dry Cool Interior Douglas-fir), ICHmk5 (Interior Cedar -- Hemlock Moist Cool), ESSFdk2 (Columbia Dry Cool Engelmann Spruce – Subalpine Fir), MSdk (Dry Cool Montane Spruce), and MSdw (Dry Warm Montane Spruce).

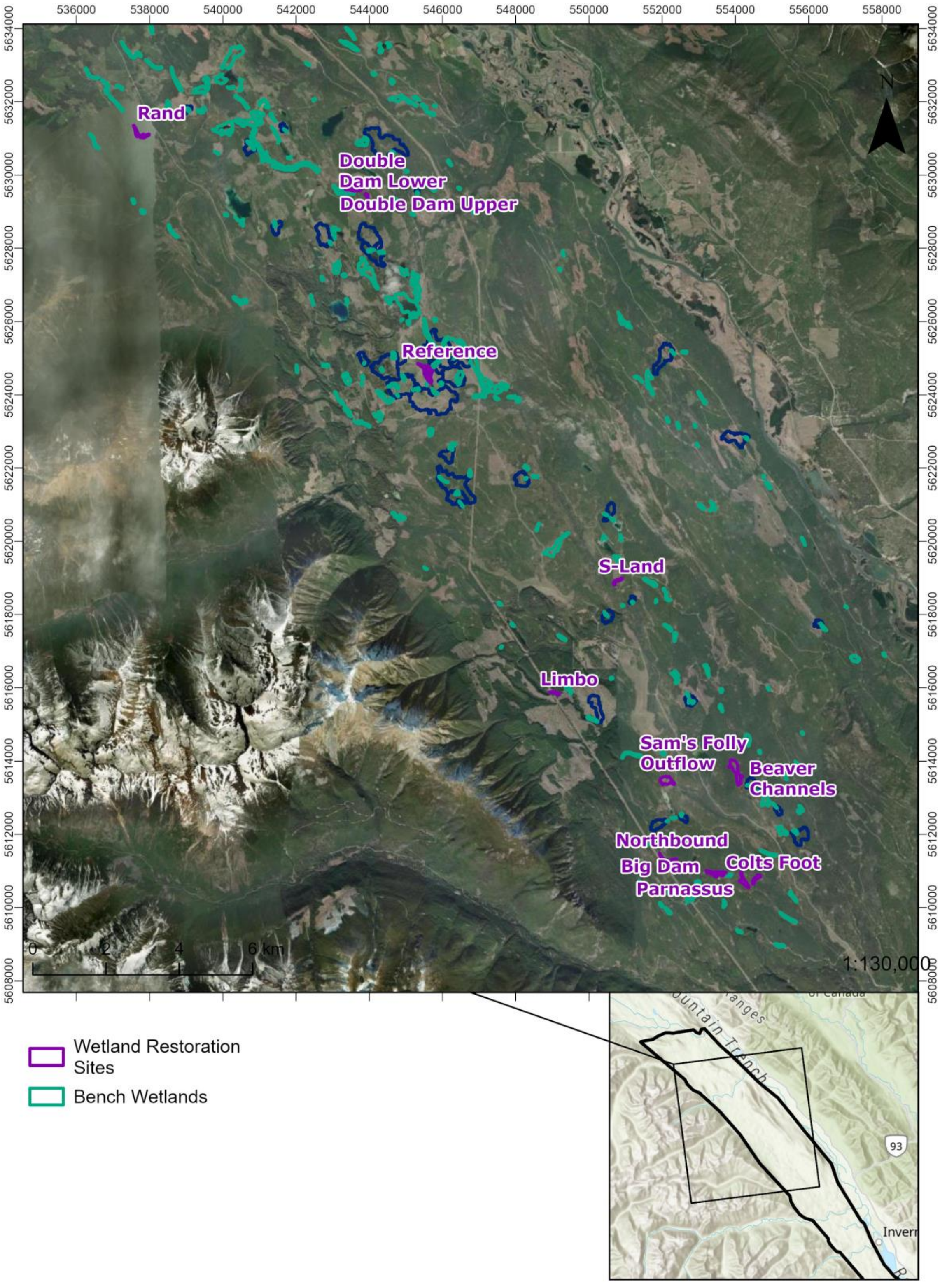

Figure 3 locations of restoration and reference wetlands explored in detail in the current study.

4 Methods

4.1 Data Sources

A digital elevation model (DEM) was downloaded using the elevatr R package (Hollister, 2023). Stream, lake, and wetland data were taken from Freshwater Atlas using the BC Data Catalogue; 443 wetlands bench wetlands were selected. Climate data were obtained from Daymet, which provides 1 km^2 gridded daily weather estimates, and evapotranspiration was obtained from Land Surface Evapotranspiration for Canada's Landmass (Wang, 2024) in 5 km^2 grids.

4.2 Wetness Index

The Topographic Wetness Index (TWI; Beven and Kirkby, 1979) is an estimate of where water will accumulate in an area based on slope and the upstream contributing area. This measure provides a relatively simplified understanding of where water is likely to accumulate, as it does not account for local geology, soil texture or permeability, or contributing sources, and assumes that surface and subsurface flows are primarily governed by topography. Typically, areas with a lower slope and higher contributing area will be more inclined to be wet, or have a higher wetness index, and will create conditions that are more conducive to support proper wetland form and function. Horvath et al. (2017) used TWI in their development of a potential wetland area indicator, and it has been used in other studies to identify wetlands (Lang et al., 2013; Curie et al., 2007).

The DEM was pre-processed using the breach depressions least cost method from Whitebox. The pre-processed DEM was used to calculate the mean wetness index for each bench wetland. The wetness index was calculated by determining the contributing area in m^2 and the average slope (radians) and inputting into the following equation:

$$WI = \ln(\mathrm{As}/\tan(\mathrm{Slope}))$$

Where As is the catchment area per unit contour length, estimated using a flow accumulation algorithm in the Hydrological Analysis toolbox and slope is measured in degrees and derived using the slope tool. To standardize values, the first quartile (< 5.4) was given a value of one, the second and third quartiles were given a value of 2, and the fourth quartile (> 6.5) was given a value of 3.

4.3 Inflow Index

Connection to a water source has been shown to be important in determining wetland resilience along the benchlands in the Columbia Valley (MacHydro, 2024). To evaluate source connection, the DEM was used in determining wetland inflows, and from there Freshwater Atlas Stream Network data was used to characterize the inflows based on their type and stream order. Each category was assigned a value from one to five depending on how strong a water source it was. The categories developed are outlined in Table 1. Distinguishing classifications of small lakes and wetlands are challenging and dependent on depth in British Columbia, whereby lakes with a depth of less than two meters would be considered a wetland (Warner, and Rubec, 1997). Freshwater Atlas originally defined 349 lakes, the vast majority of which were under a hectare in area. In the absence of any depth information, for the purposes of this study we only considered lakes with a surface area of >1 ha to have the potential to be deep enough to be classified as a true lake, while all others were an open water extension of the attached wetland. Like the Wetness Index, the Water Source Index does not consider sub surface flow pathways as separate from surface, there is also no way to track springs using existing data.

Table 1 Inflow sources and corresponding values.

Inflow Source	Value
Isolated	1
Intermittent Stream	2
Minor Stream (stream order<1)	3
Lake	4
Major Stream (stream order>1)	5

4.4 P – ET Score

Water demands on a wetland vary across the region, as was illustrated in Millions et al. (2024). To incorporate climate-driven water availability and demands, a dryness index was developed subtracting evapotranspiration (ET) from precipitation (P). Annual precipitation data were acquired through DayMet (Thornton et al., 2025) using the Single Pixel Extraction Tool to obtain observations from 2003-2022 for 1 km^2 grid cells. Evapotranspiration was acquired from Land Surface Evapotranspiration for Canada's Landmass (Wang, 2024) observations from 2003-2022 at a 5 km^2 resolution. To characterize a simple water balance on the wetlands, precipitation (P) minus evapotranspiration (ET) was used to create a dryness index. To standardize values, the first quartile was given a value of one (< 144.5 mm), the second and third quartiles were given a value of 2, and the fourth quartile (> 241 mm) was given a value of 3.

4.5 Wetland Restoration Feasibility Index

To develop an index of the relative ability of each wetland to succeed at collecting and holding water to provide adequate wetland form and function, the Wetness Index, Water Source Index, and Dryness Index were summed. This gives slightly higher weight to existing connections to water sources as an existing water source is more important in wetland formation than the climate or potential for water to accumulate in an area. Scores were then categorized as having very high, high, moderate, or low restoration feasibility (Table 2).

Table 2 Restoration feasibility based on cumulative index score.

Index Score	Restoration Feasibility
3-5	Low
<5-7	Moderate
<7-9	High
<9-11	Very High

5 Results and Discussion

5.1 Inflow Index

179 of the bench wetlands are isolated giving them an inflow index of one out of five, 103 had an intermittent source giving them a score of two out of five, 48 had a minor source (stream order of 1) with and inflow score of three out of five, 18 wetlands had an inflow score of four out of five due to their lake source, and 95 had the highest inflow score of five as they had a major water source (stream order >1; Figure 4).

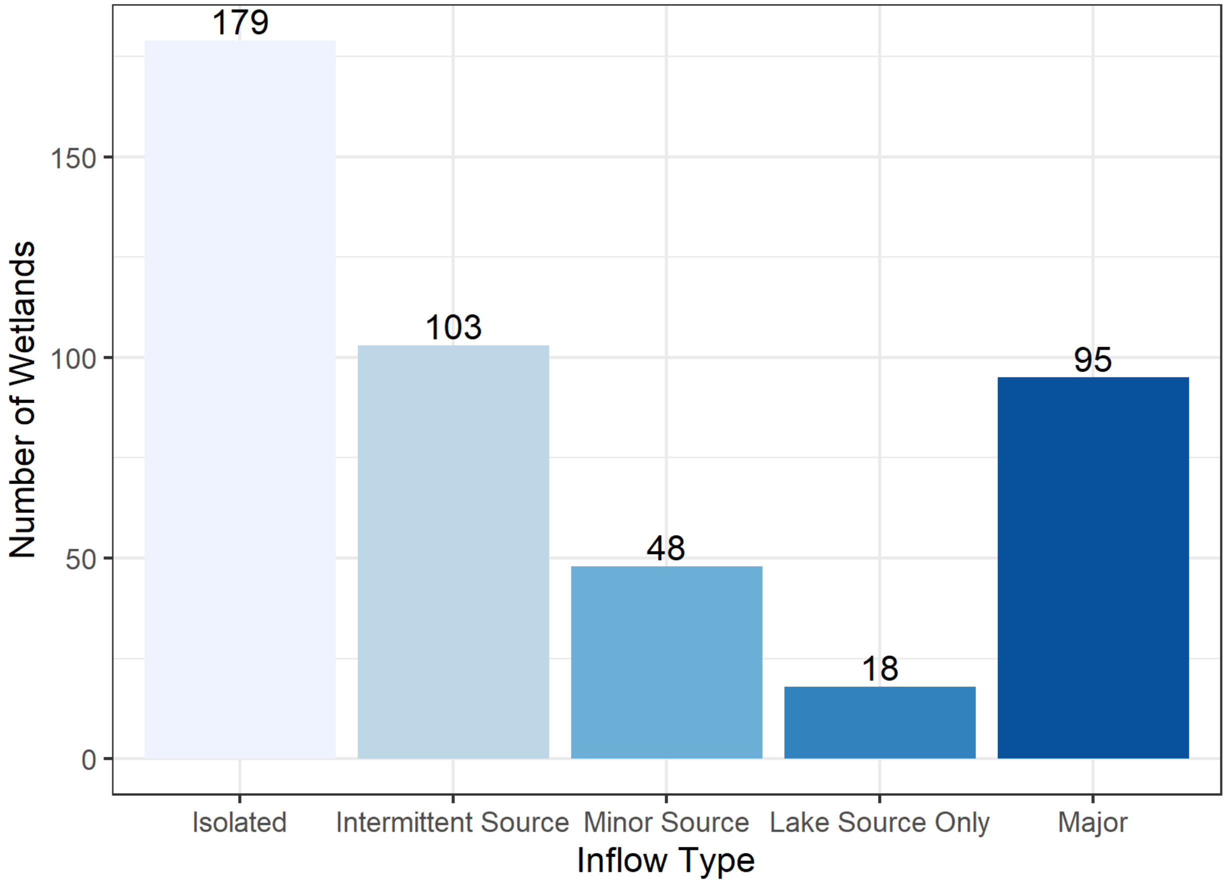

Figure 4 Distribution of wetland inflow sources in the bench wetland study area.

5.2 Wetness Index and P-ET Score

Due to the way wetlands were binned based on their distribution, both the wetness index and the P-ET score follow the same bell curve distribution (Figure 5). 111 wetlands had a wetness index of one out of three, 221 had a wetness score of two out of three, and 11 had the highest wetness score of three out of three. Similarly, 111 wetlands had a P-ET score of one out of three, 221 had a P-ET score of two out of three, and 11 had the highest P-ET score of three out of three.

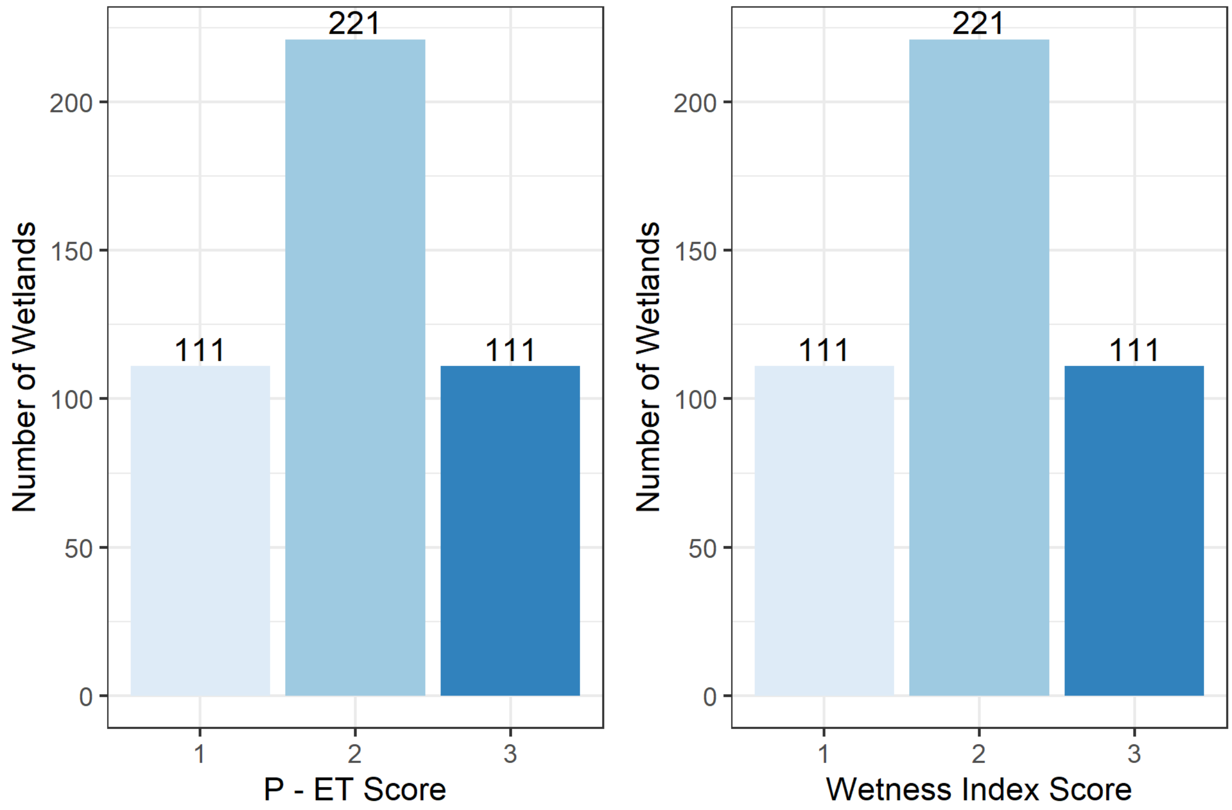

Figure 5 Distribution of wetland P-ET (left) and Wetness Index (right) scores.

5.3 Wetland Restoration Feasibility Index

168 wetlands had a low wetland restoration feasibility index, 153 had a moderate wetland restoration feasibility index, 74 had a high wetland restoration feasibility index, and 48 had a very high wetland restoration feasibility index (Figure 6).

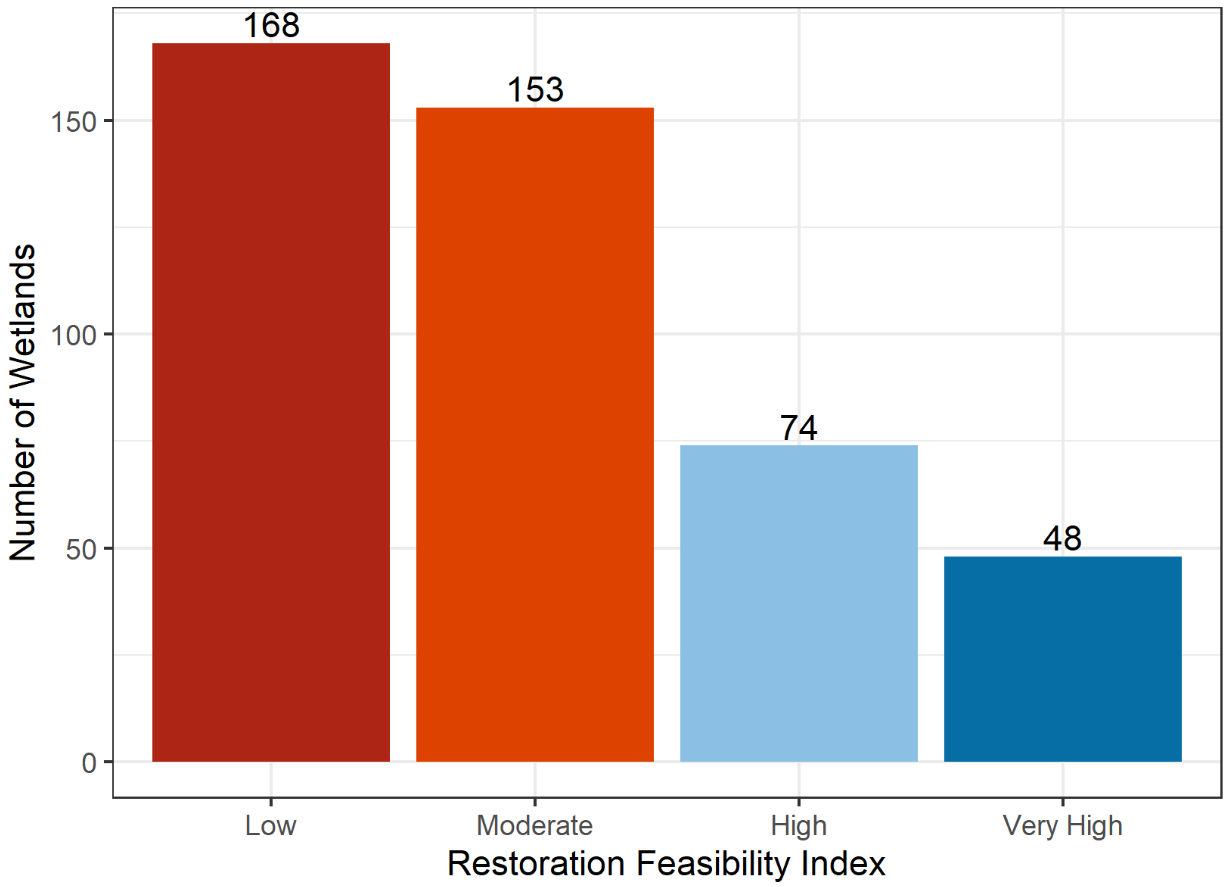

Figure 6 distribution of Wetland Restoration Feasibility Index values for the bench wetlands.

There are some regional trends evident in the data where the wetlands with very high restoration values are primarily found in the northern regions of the study area, with increasing frequency towards the north (Figure 7), and the furthest south a wetland is with a very high restoration feasibility is near Invermere (Figure 8). This appears to be largely driven by P-ET, as the further north regions are wetter (Figure 9), whereas the more southern extent of the study area is drier (Figure 10). This may also explain the greater number of wetlands in general in the northern reach, as the further southern areas are not wet enough to support wetlands.

Wetlands with very high wetland restoration scores have high values in all the contributing scores, where they have strong inflow connectivity, a large contributing area, and are relatively damp. The opposite is true of wetlands with low restoration feasibility scores, which are isolated, have small contributing areas, and are relatively dry. Of the wetlands in the moderate and high restoration feasibility categories, the inflow source is the primary driver of the score, followed by wetness index, but only to a small degree which is not statistically significant, as seen in (Figure 11). This is likely due to all the of the factors being linked to a certain degree, with topography and moisture impacting inflow. However, due to the heavier weighting of the inflow score, isolated wetlands versus those with connections to larger streams or lakes drive different restoration feasibility scores.

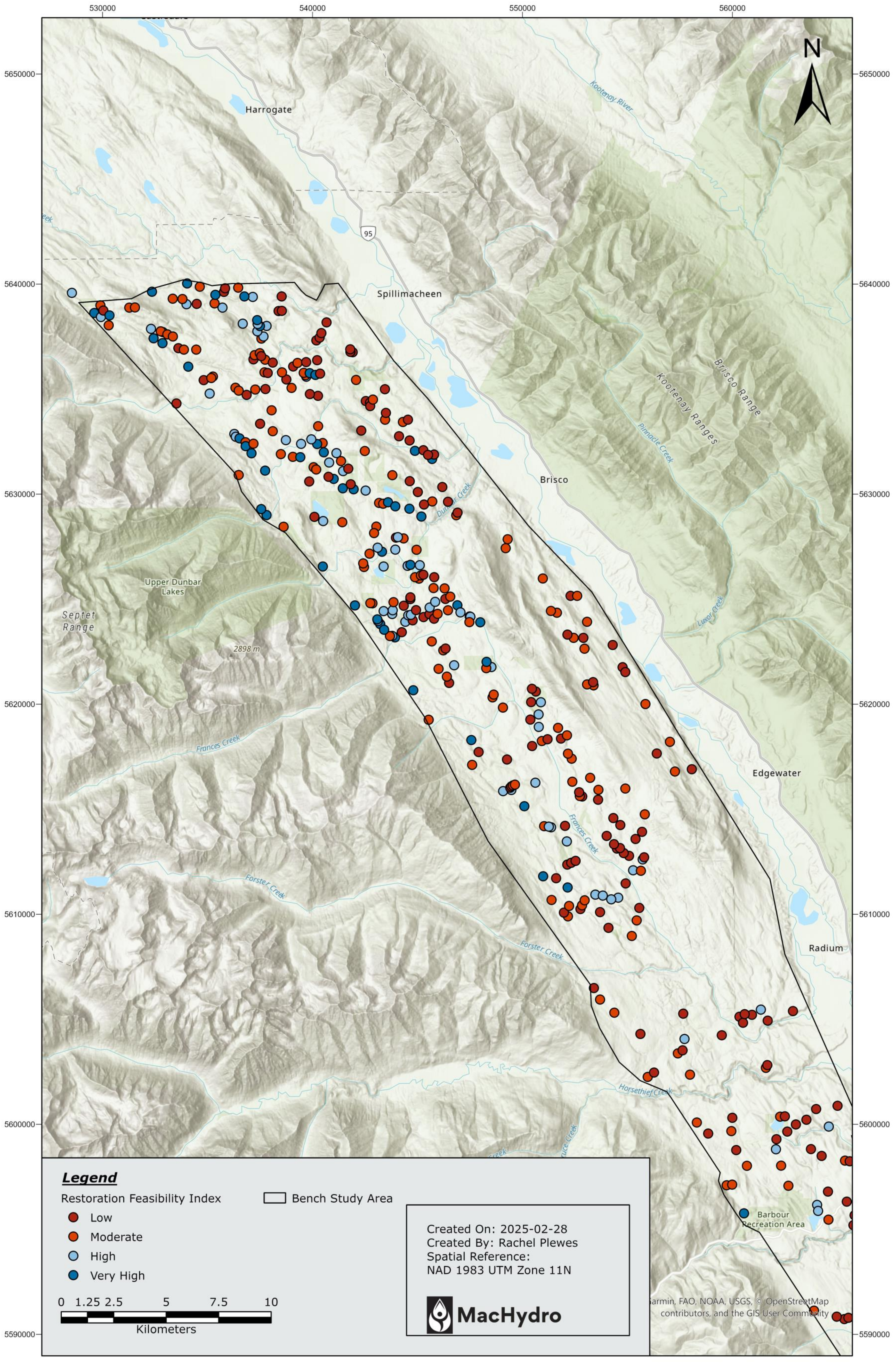

Figure 7. Restoration Feasibility Index values for wetlands in the northern region of the study area showing low feasibility (red), moderate feasibility (orange), high feasibility (light blue), and very high restoration feasibility (dark blue).

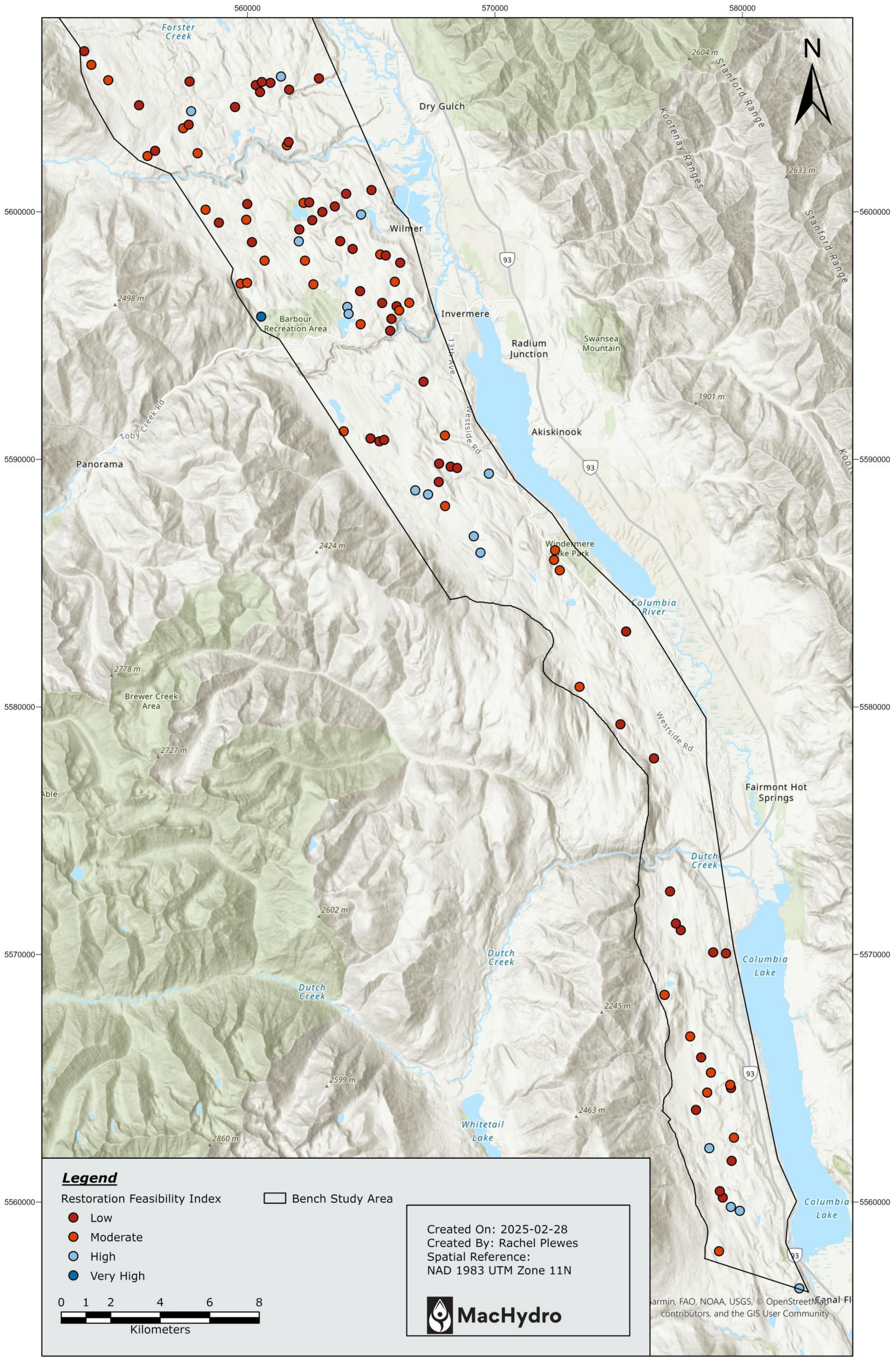

Figure 8. Restoration Feasibility Index values for wetlands in the southern region of the study area showing low feasibility (red), moderate feasibility (orange), high feasibility (light blue), and very high restoration feasibility (dark blue).

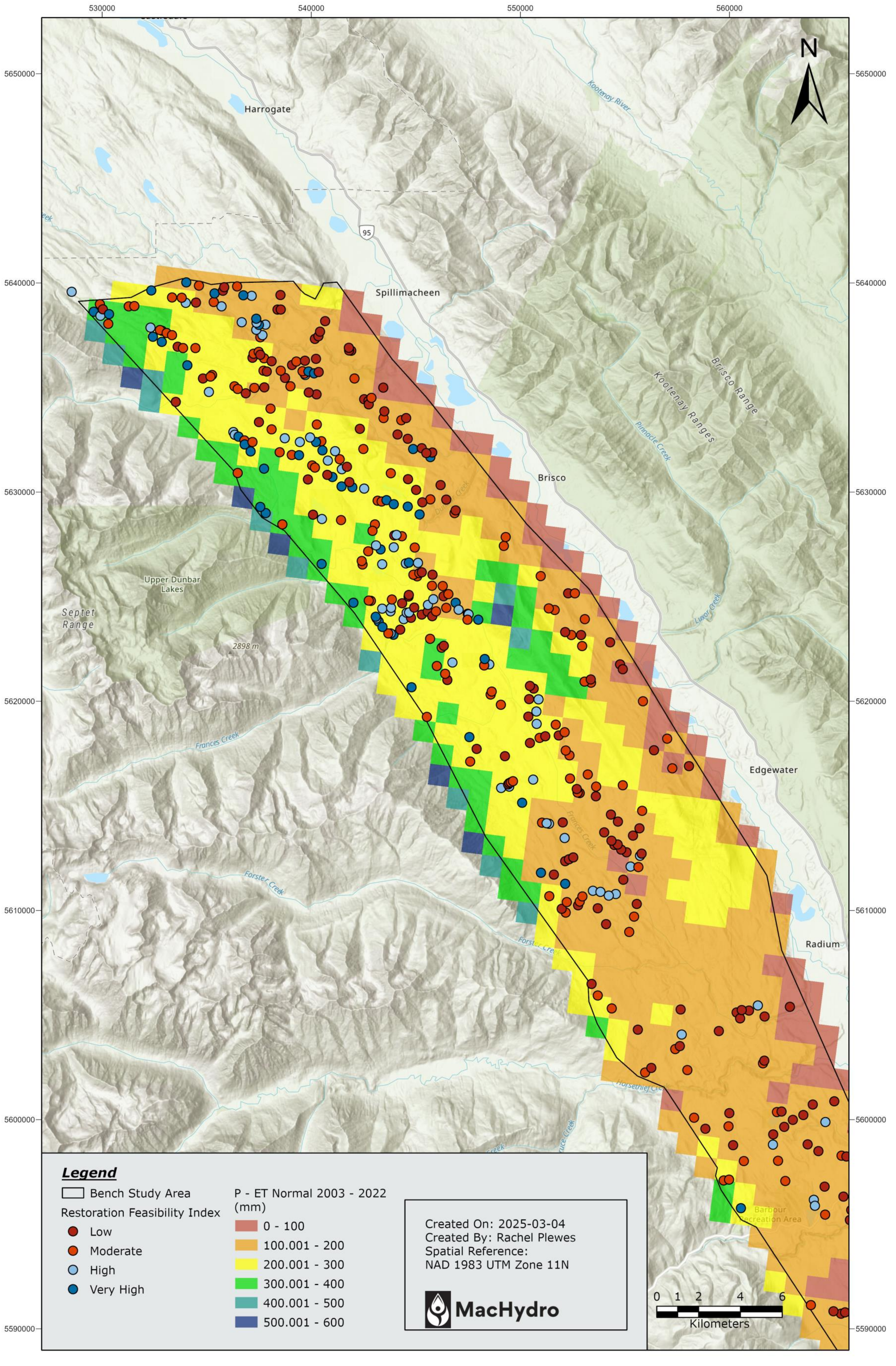

Figure 9. Heat map showing P-ET values for the northern region of the study area from the lowest values (0-100; red) to the highest values (>500-600; blue).

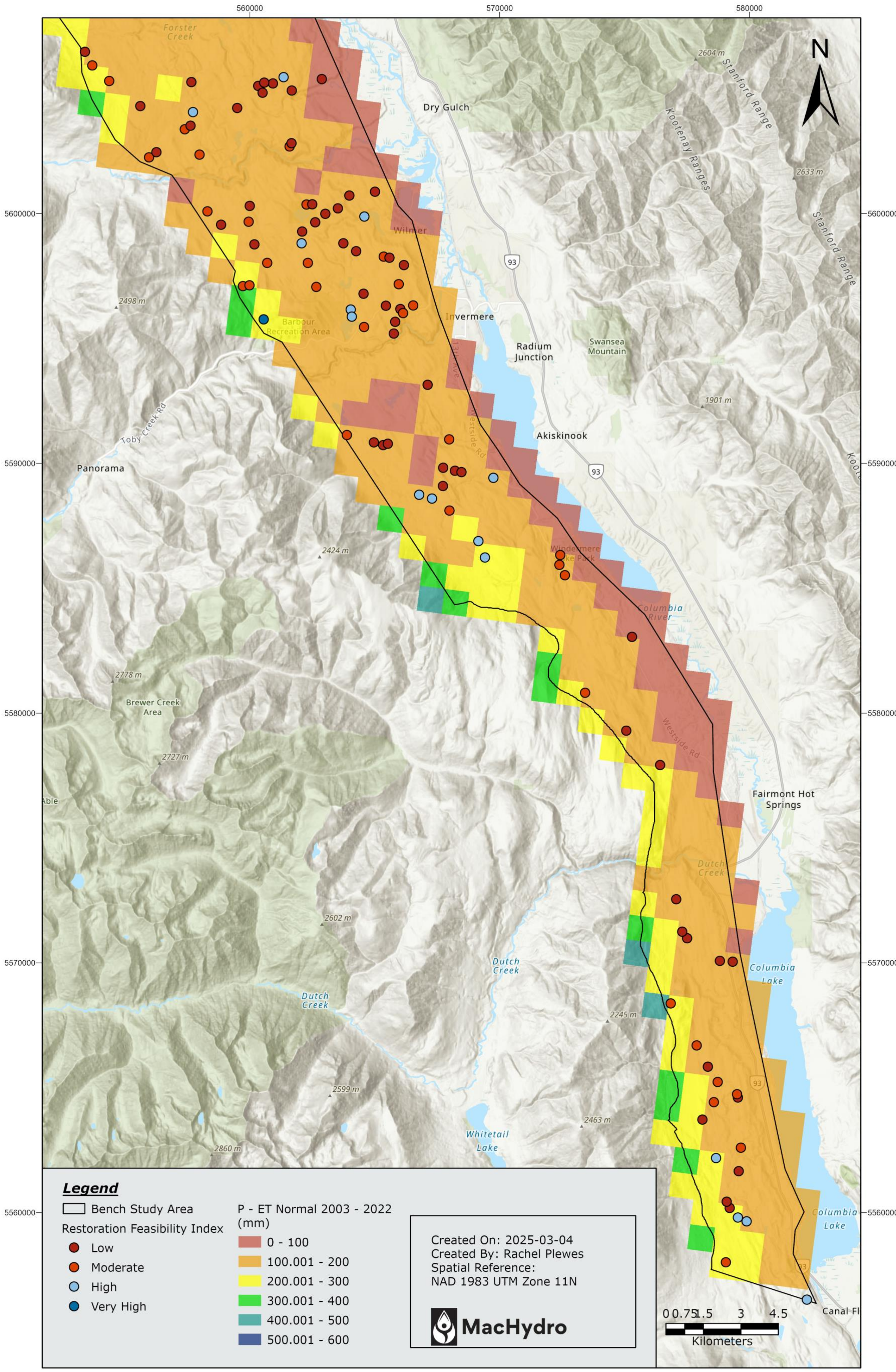

Figure 10. Heat map showing P-ET values for the southern region of the study area from the lowest values (0-100; red) to the highest values (>500-600; blue).

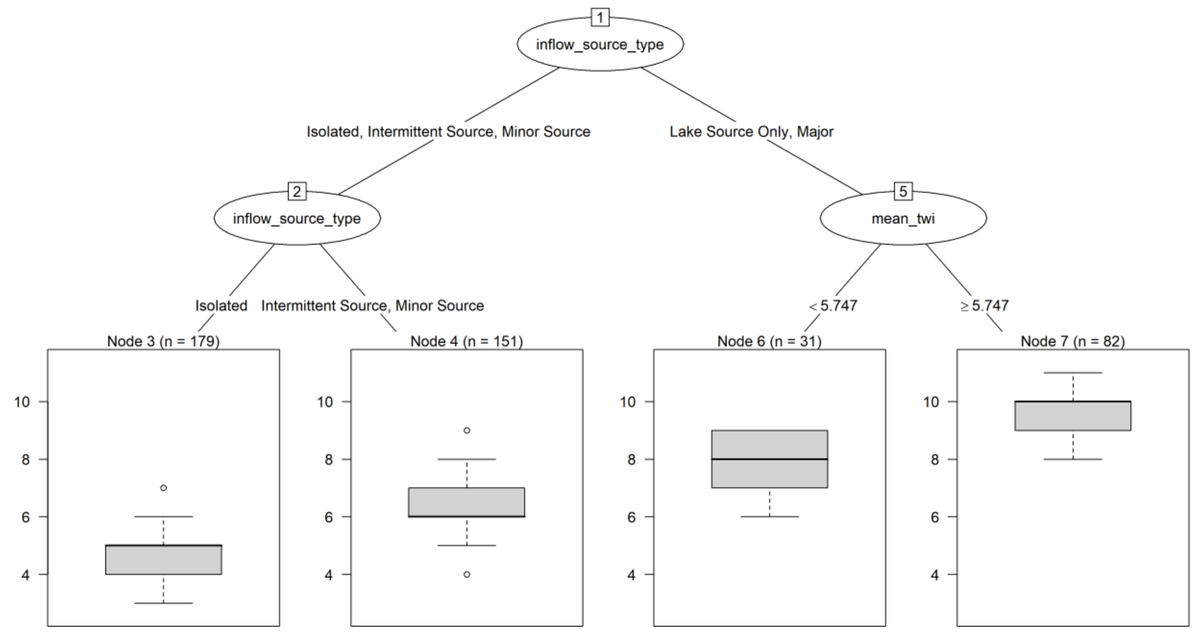

Figure 11 Classification and Regression Tree (CART) with Wetland Restoration Feasibility Index as the response variable.

5.4 Existing or Proposed Wetland Restoration Projects

Eleven potential restoration wetlands and one reference wetland were examined by CWSP for the purpose of restoration works, primarily involving the use of beaver dam analogues (Leven, 2024). The restoration feasibility scores are provided in the following section, as well as a review of the individual scores driving the index value of each wetland. In general, the P-ET score varied the most (with scores ranging from one to three out of three) whereas the wetness score was generally relatively high, as was the inflow score except in the case of Beaver Channels (Figure 12).

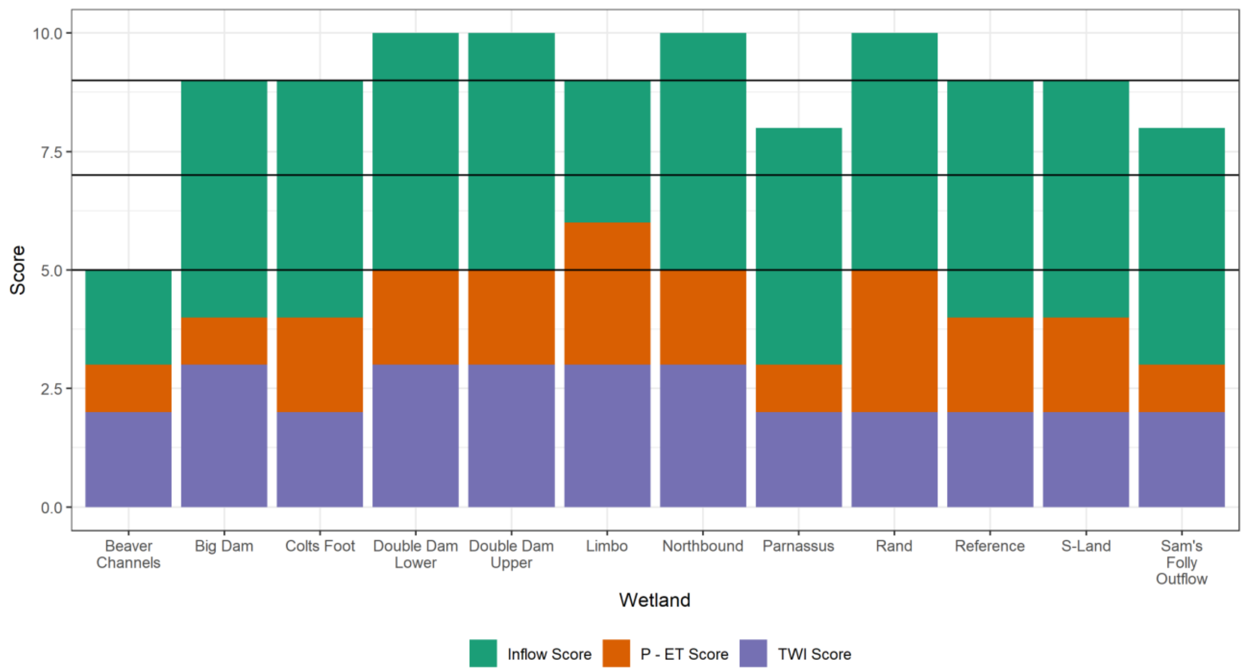

Figure 12 Wetland Restoration Feasibility Index for the proposed or existing restoration wetlands being studied by CWSP.

5.4.1 Beaver Channels

The Beaver Channels wetland, which is the site of two constructed beaver dam analogues that were installed in 2024 to retain water in two wetland area, had a restoration feasibility score of five out of eleven, giving it a low feasibility for successful restoration (Figure 13). This is the lowest score of any of the proposed restoration sites being investigated by CWSP, though it is still reasonably good for restoration purposes as it is not isolated and has a moderate wetness score. The lower score is primarily due to the low P-ET score, as it is in a drier, hotter region, as well as a lower inflow score as the inflow stream is characterized as ephemeral. Due to the intermittent nature of the stream, it will be interesting to see how well the restoration efforts are at storing water throughout the dry season.

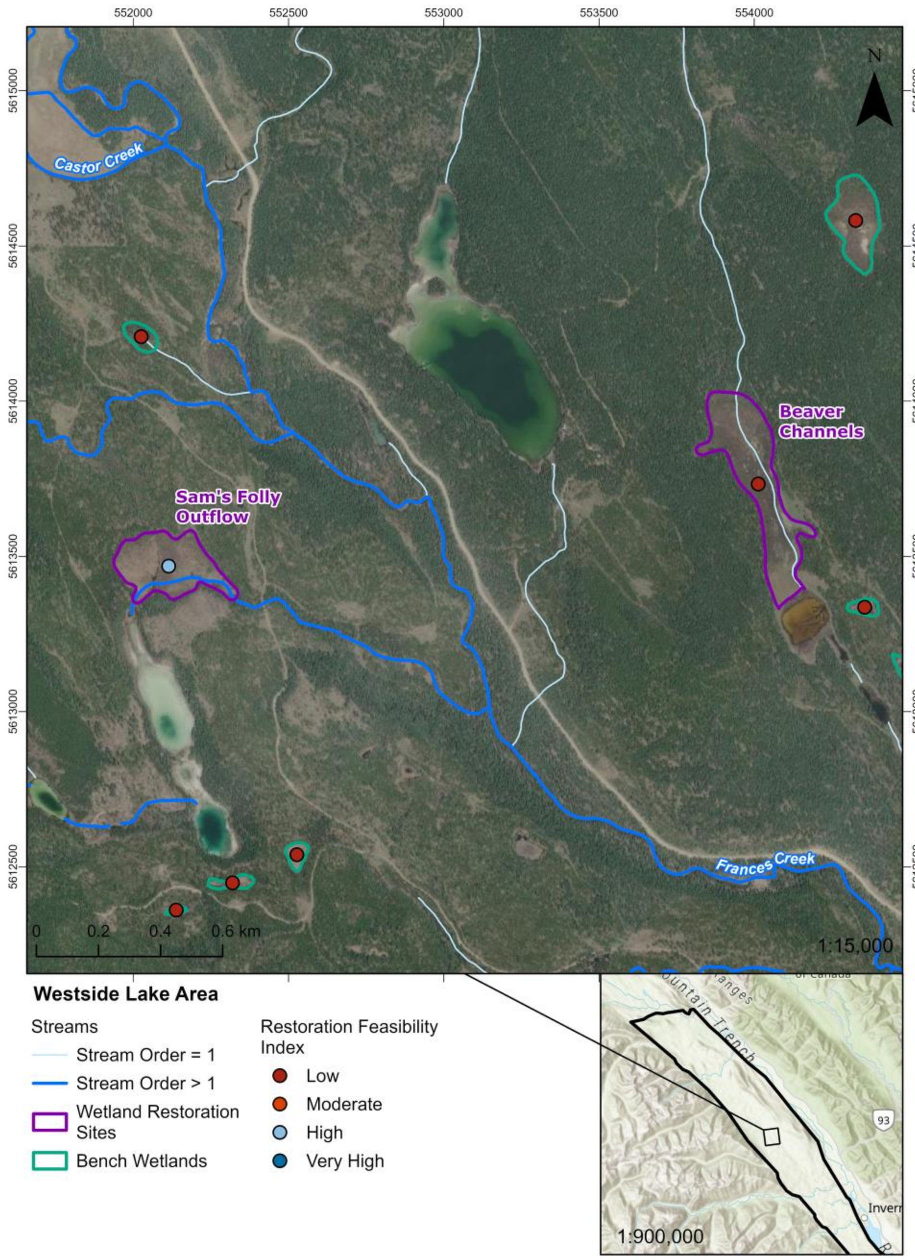

Figure 13 Location and corresponding restoration feasibility index scores of the wetlands Beaver Channels (low) and Sam's Folly (high).

5.4.2 Sam's Folly

Sam's Folly had a restoration feasibility score of eight out of eleven, giving it relatively high feasibility for successful restoration (Figure 13). The inflow score is the highest possible, and the wetness index was a two out of three, but the P-ET score was the lowest possible, similar to Beaver Channels, as this is a relatively dry region. The high evapotranspiration and low precipitation of this region will be the greatest challenge that this wetland faces for restoration purposes, but increases water storage capacity will help improve moisture in and around the wetland.

5.4.3 Northbound

The Northbound wetland had a restoration feasibility score of ten out of eleven, giving it very high feasibility for successful restoration (Figure 14). The inflow and wetness index scores were the highest possible, and the P-ET score was two out of three.

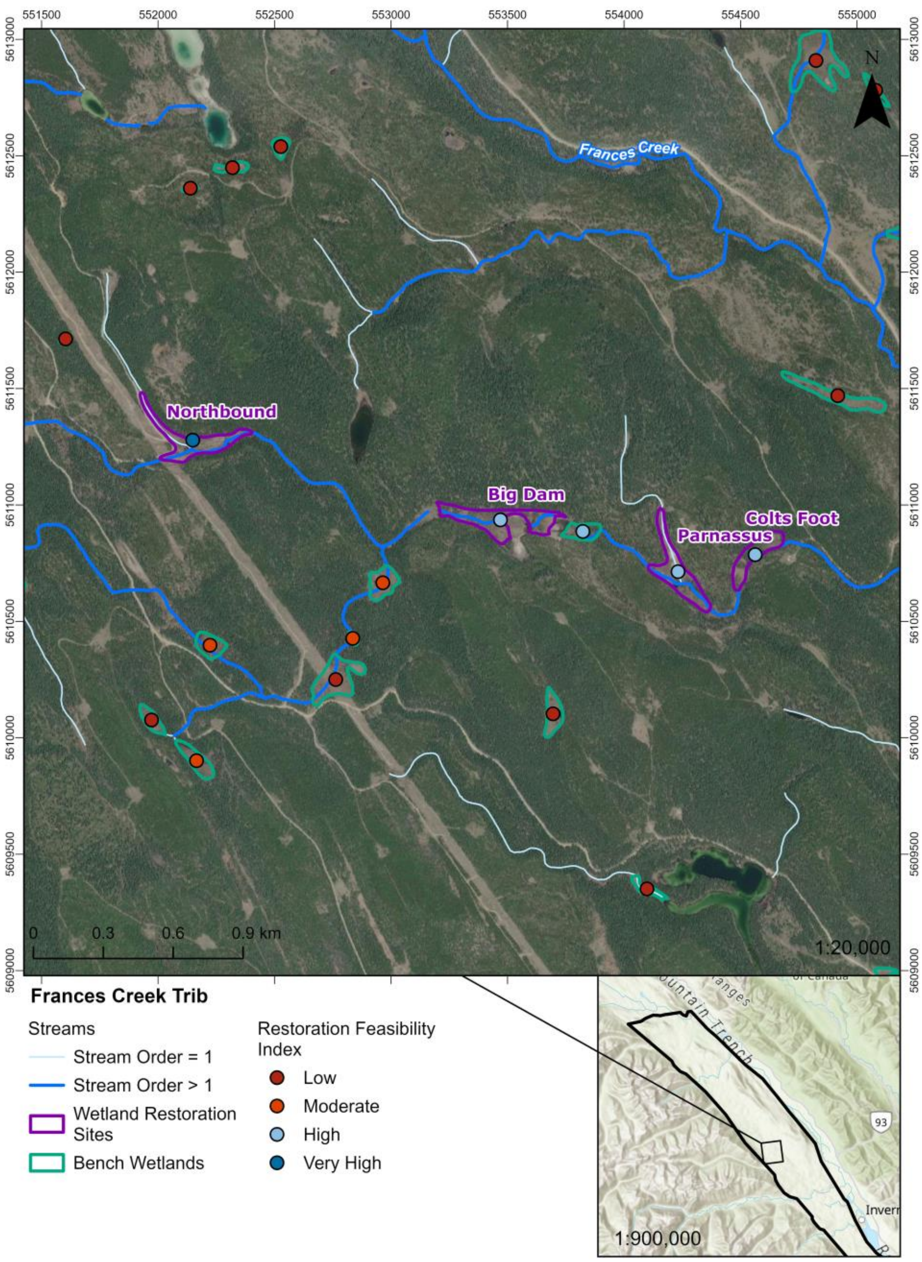

Figure 14 Location and corresponding restoration feasibility index scores of the wetlands Northbound (very high), Big Dam (high), Parnassus (high), and Colts Foot (high).

5.4.4 Big Dam

Big Dam had a restoration feasibility score of nine out of eleven, giving it relatively high feasibility for successful restoration (Figure 14). The inflow score and wetness scores were the highest possible, but the P-ET score was the lowest possible. The high evapotranspiration and low precipitation of this region will be the greatest challenge that this wetland faces for restoration purposes but increases water storage capacity will help improve moisture in and around the wetland.

5.4.5 Parnassus

Parnassus had a restoration feasibility score of eight out of eleven, giving it relatively high feasibility for successful restoration (Figure 14). The inflow score is the highest possible, but the P-ET score was the lowest possible, and as the wetland is located on a tributary to the main channel the wetness score was lower than the surrounding wetlands with a score of two out of three. The high evapotranspiration and low precipitation of this region will be the greatest challenge that this wetland faces for restoration purposes, but increases water storage capacity will help improve moisture in and around the wetland.

5.4.6 Colts Foot

The Colts Foot wetland had a restoration feasibility score of nine out of eleven, giving it relatively high feasibility for successful restoration (Figure 14). The inflow score is the highest possible, and both the wetness index and P-ET scores were two out of three.

5.4.7 Lower and Upper Double Dam

Lower and Upper Double Dam both have very high a restoration feasibility scores of ten out of eleven, with only the P-ET score losing a point from the maximum value (Figure 15).

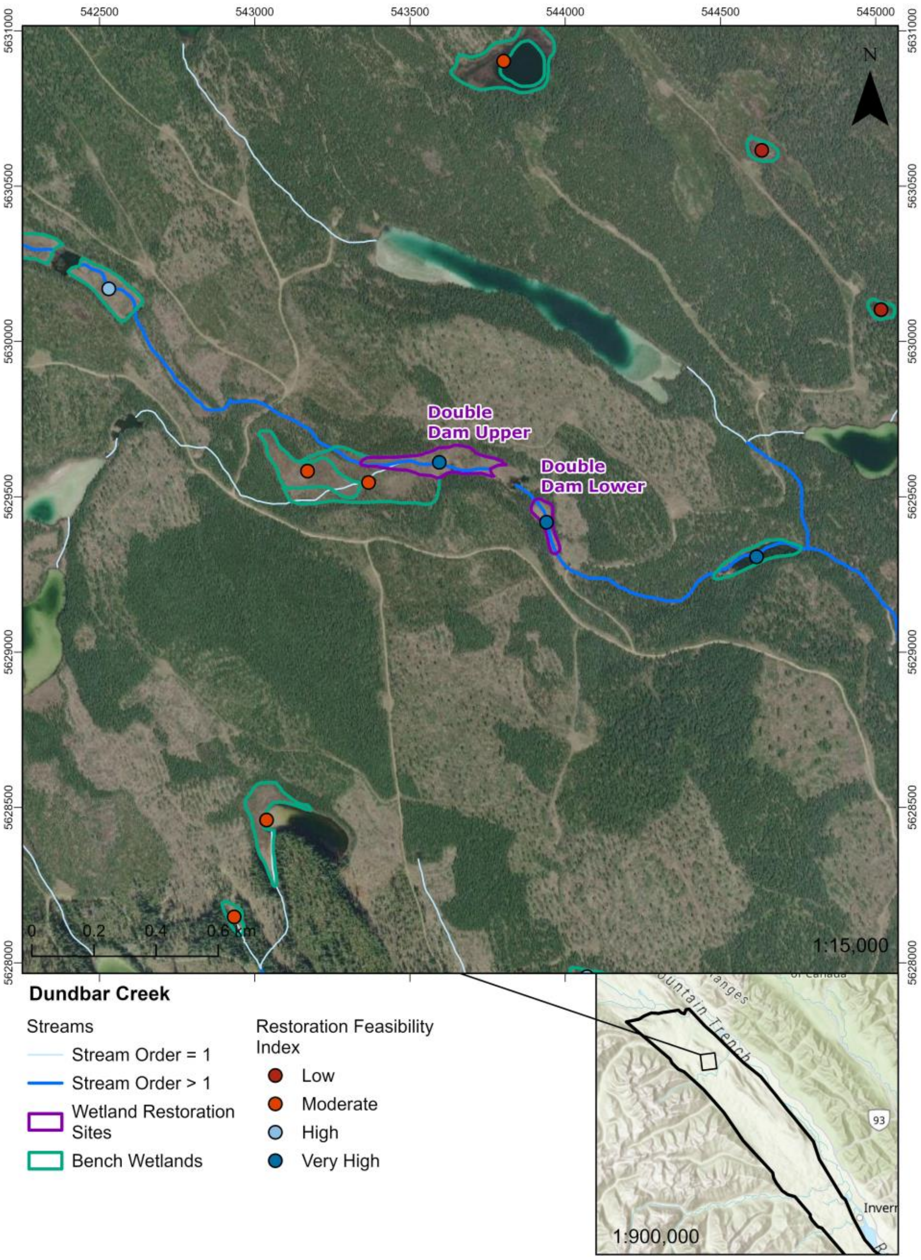

Figure 15 Location and corresponding restoration feasibility index scores of the Upper and Lower Double Dam wetlands (both very high).

5.4.8 Limbo

The Limbo wetland had a restoration feasibility score of nine out of eleven, giving it relatively high feasibility for successful restoration (Figure 16). The inflow score is relatively low compared to the other restoration wetlands with a score of three out of five, whereas both the wetness index and P-ET scores were the highest possible.

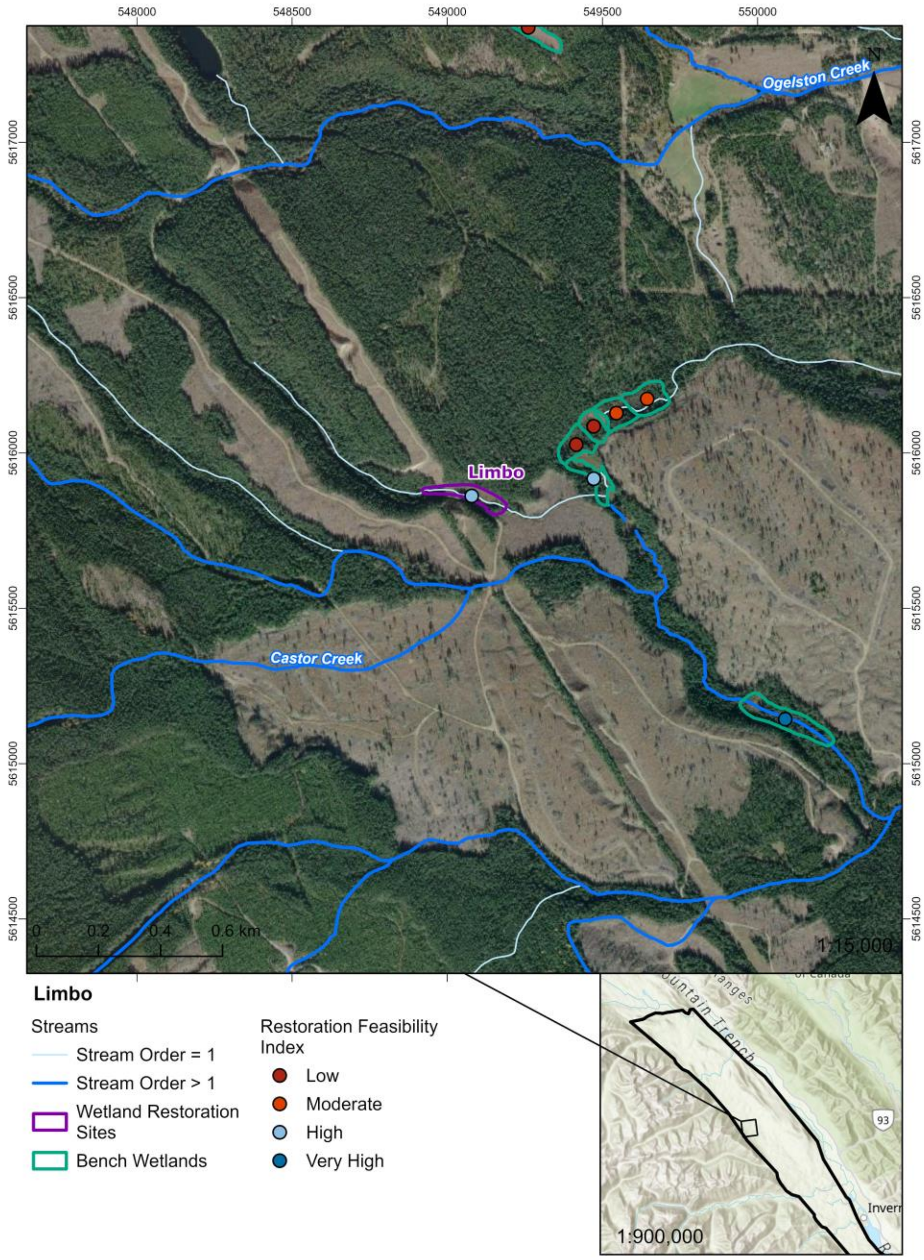

Figure 16 Location and corresponding restoration feasibility index score of the Limbo wetland (high).

5.4.9 Rand

The Rand wetland has a very high restoration feasibility score of ten out of eleven, with only the wetness score losing a point from the maximum value (Figure 17).

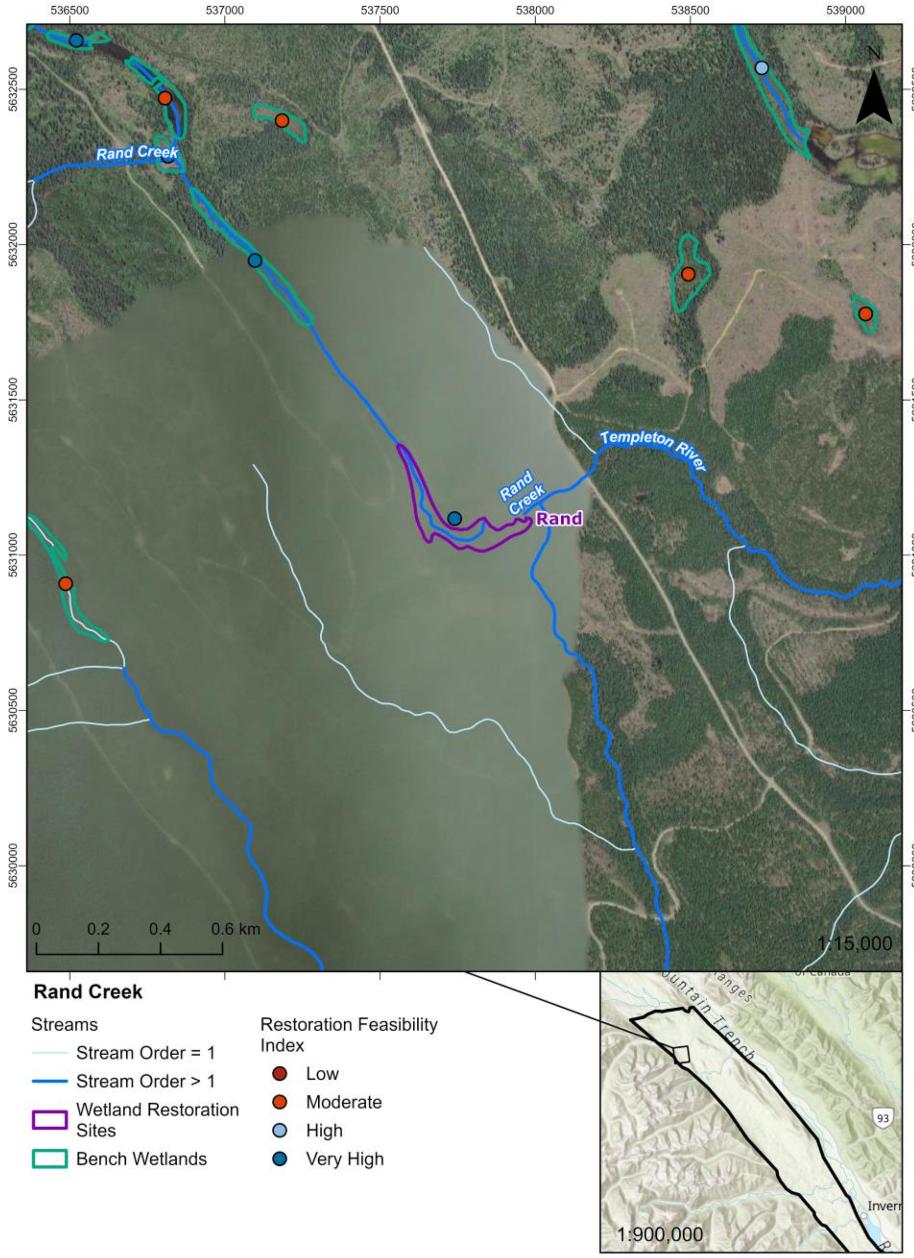

Figure 17 Location and corresponding restoration feasibility index score of the Rand wetland (very high).

5.4.10 Reference

The reference wetland had a restoration feasibility score of nine out of eleven, giving it a high feasibility for successful restoration (Figure 18). The inflow score is the highest possible, and both the wetness index and P-ET scores were two out of three.

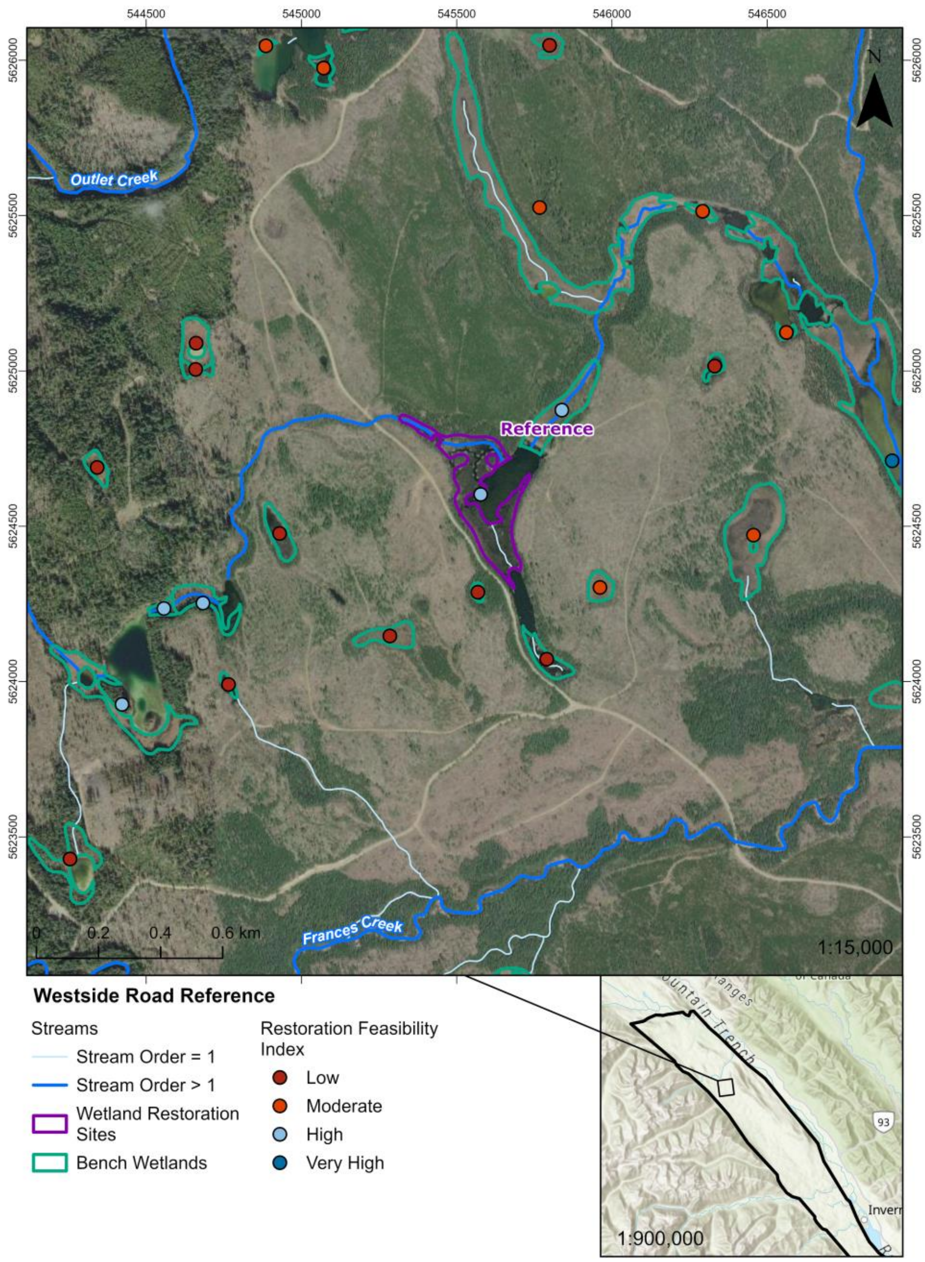

Figure 18 Location and corresponding restoration feasibility index score of the Reference wetland (high).

5.4.11 S-Land

The S-Land wetland, which is the site of two constructed beaver dam analogues that were installed in 2024, had a restoration feasibility score of nine out of eleven, giving it a high feasibility for successful restoration (Figure 19). The inflow score is the highest possible, and both the wetness index and P-ET scores were two out of three.

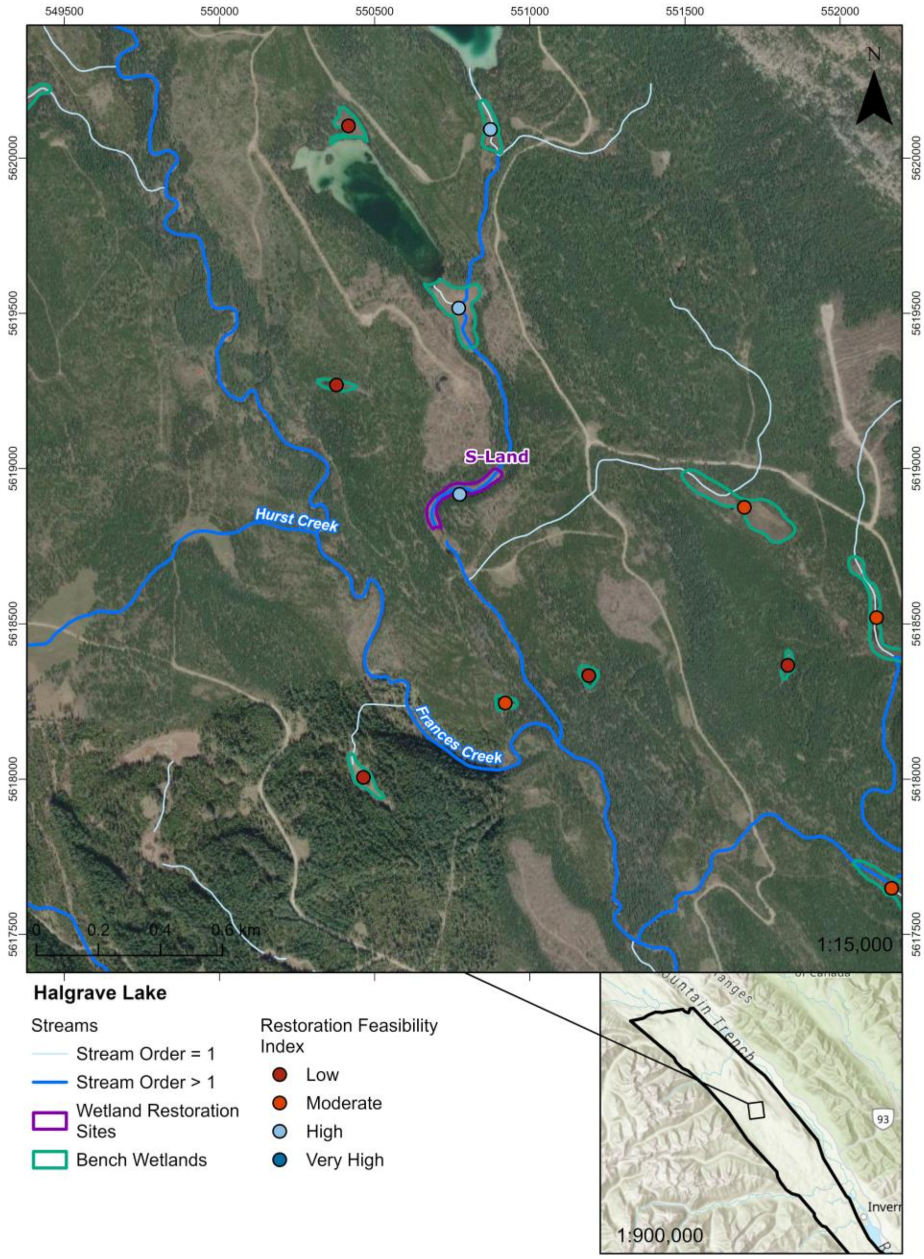

Figure 19 Location and corresponding restoration feasibility index score of the S-Land wetland (high).

6 Discussion and Recommendations

6.1 Discussion

We developed a quantitative restoration feasibility index for wetlands within the Benchlands of the Upper Columbia River Valley. The index values were derived from publicly available data and can help practitioners prioritize wetland restoration efforts. We provide index scores for eleven wetlands that are being investigated for restoration efforts or which have already been restored, as well as one reference wetland for comparison purposes, and provide insights into their individual scores and what challenges there might be in restoring these wetlands. Of these wetlands, Beaver Channels had the lowest score due primarily to the ephemeral nature of its inflow source. All the other proposed restoration wetlands received a high or very high restoration feasibility scores and are ideal candidates for restoration efforts. A summary of feasibility by restoration site is provided in Table 3.

Table 3 Feasibility score for each of the restoration sites.

Site Name	Restoration Feasibility Index
Beaver Channels	Low
Big Dam	High
Coltsfoot	High
Double Dam Lower	Very High
Double Dam Upper	Very High
Limbo	High
Northbound	Very High
Parnassus	High
Rand	Very High
Reference	High – not actually being restored
S-Land	High
Sam’s Folly Outflow	High

6.2 Study Limitations

There are some limitations to this approach. The index scores are intended to provide a high-level desktop review of wetland restoration potential but should not be used in lieu of site visits and fieldwork. Ground truthing the index scores is critical as water sources are important and in the absence of understanding underlying geology and underground flows, stream connectivity and order provides indicator of inflow source. As such, the index does not appropriately account for shallow or deep groundwater sources, and is also reliant on the accuracy of the Freshwater Atlas, which is not always up to date due to landscape and hydrologic changes.

While this approach can be modified to suit other regions, it is currently designed to represent the Benchland region of the Upper Columbia River Valley, and scores are all relative to each other. As many wetlands have already been lost in the region, the values exist relative to each other at the current time and do not represent historic values.

6.3 Recommendations

Due to the strong linkages between inflow sources, topography, and climate conditions, our recommendations are to:

- Use the wetland restoration feasibility scores provided in this study to prioritize wetland restoration efforts;
- Ground truth results and visit wetlands to ascertain restoration feasibility;
- Do not attempt to restore isolated wetlands where there is no waterbody connection, unless ground truthing shows a reliable water source, particularly in the southern region, and;
- Use isotope analysis to determine source water for a range of wetlands across the study region through a targeted field study.

7 Closing

The Upper Columbia River bench wetlands are experiencing number of pressures and are decreasing both in surface area and number. As such, there are several restoration efforts being aimed to improve water retention in these wetlands. This study develops a wetland restoration feasibility index to help guide restoration efforts and make prioritization possible.

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