Eco-Cultural Restoration of Wetlands at *Tl'chés* (Chatham Islands), British Columbia, Canada

by

Graham Roy Nicholas

B.Sc., British Columbia Institute of Technology, 2015

Project Submitted in Partial Fulfilment of the
Requirements for the Degree of
Master of Science

in the
Ecological Restoration Program
Faculty of Environment (SFU)
and
School of Construction and the Environment (BCIT)

SIMON FRASER UNIVERSITY
BRITISH COLUMBIA INSTITUTE OF TECHNOLOGY
2017

Approval

Name:	**Graham Roy Nicholas**
Degree:	**Master of Science**
Title:	**Eco-Cultural Restoration of Wetlands at *Tl'chés* (Chatham Islands), British Columbia, Canada**

Examining Committee: **Chair:** Dr. Leah Bendell
Faculty, SFU

Dr. Darcy Mathews
Senior Supervisor
Faculty, UVIC

Dr. Scott Harrison
Internal Examiner
Faculty, BCIT

Date Defended/Approved: April 24, 2017

Ethics Statement

The author, whose name appears on the title page of this work, has obtained, for the research described in this work, either:

a. human research ethics approval from the Simon Fraser University Office of Research Ethics

or

b. advance approval of the animal care protocol from the University Animal Care Committee of Simon Fraser University

or has conducted the research

c. as a co-investigator, collaborator, or research assistant in a research project approved in advance.

A copy of the approval letter has been filed with the Theses Office of the University Library at the time of submission of this thesis or project.

The original application for approval and letter of approval are filed with the relevant offices. Inquiries may be directed to those authorities.

Abstract

My research project examined the restoration possibilities for two culturally important wetland ecosystems at *Tl'chés* (Chatham Islands, British Columbia, Canada). The first wetland is a sacred bathing pool and holds cultural significance, the second is a remnant silverweed and springbank clover (*Potentilla anserine* ssp. *pacifica* and *Trifollium wormskjoldii*) root garden. These wetlands are necessary ecosystems for the wildlife on *Tl'chés* as wetlands are rare, but also an integral part of Songhees' cultural practices. My work was done at the invitation from elder *Súlhlima* (Joan Morris) who was one of the last resident of the islands and retains hereditary rights there, and Songhees Chief Ron Sam and band council. The goal of my project was to develop a restoration plan to restore the wetlands to pre-abandonment conditions, so cultural practices can continue, and to benefit the islands native plant and animal species. The project highlights the value of combining traditional ecological knowledge (TEK) and traditional resource and environmental management (TREM) practices with ecological restoration.

Keywords: Eco-cultural restoration; wetland ecosystems; traditional ecological knowledge (TEK); traditional resource and environmental management (TREM); estuarine root gardens; Songhees First Nation.

Dedication

This research project is dedicated to *Súlhlima*.

I will forever be grateful for the invitation and trust you gave me to work at your home and in such a culturally sensitive and important place to you. I'm so thankful to you for sharing and teaching me so much. I have learnt so much from you and have made a wonderful friend through this project. Your teachings, your generosity, your stories, your smile and your laugh will forever be kept in my mind and heart.

Acknowledgements

This restoration project originated from discussions with Songhees elder Joan Morris (*Súlhlima*) and Dr. Darcy Mathews of the University of Victoria about the goal to restore wetland ecosystems at *Tl'chés* (Chatham Islands, British Columbia), in the traditional territory of the Songhees First Nation. This project is being conducted at the invitation of Songhees Chief and Council, and *Súlhlima*. I would like to acknowledge and send my utmost thanks to Chief Ron Sam, Sounghees Council Members, and *Súlhlima* for allowing me to conduct research with them on their ancestral lands, I am forever grateful for the opportunity, trust, and support. To Wilfred George, thank you for sharing your knowledge of plants and the landscape with me.

I would like to thank my supervisors, Dr. Scott Harrison and Dr. Darcy Mathews for their guidance in the planning, development, and research of this project. Thank you Scott for wonderful conversations, support, and guidance along the way. Without Darcy, this restoration project would not have been possible, and I am so grateful for the opportunity you have given me, and for introducing me to *Súlhlima,* and so many others involved in this project. This project and the research and conversations along the way have solidified my interests and future goals in ecological restoration. I have learnt more than I ever expected, and I sincerely thank you for the opportunity, encouragement, and willingness to take me on as a graduate student.

I thank Dr. Nancy Turner for connecting me with Darcy. Without your help and introductions, I would not have been part of this amazing project. I also thank you for all your work and publications, truly an inspiration. In fact, my interests in plants began when my father gave me your *Food plants of Coastal First Peoples*. This book was my first introduction to plants and propagated the seed of learning and my interests in the environment. To Dr. Dana Lepofsky, thank you for the wonderful conversations, guidance, and for inviting me to join in meetings with your graduate students. The meetings have been a great place of ideas and discussions. To Fiona Hamersley-Chambers and Pamela Spalding, thank you for helping identify plants at *Tl'chés,* and for wonderful conversations and suggestions. I appreciate the knowledge you have shared with me.

I would like to thank Mark Salter for his generous support in providing boat transportation to the islands, and helping to facilitate so many aspects of this project. I've had a wonderful time meeting you, and discussing the project, thank you. Thanks to Ian Cesarec for providing boat transportation to and from the islands on several occasions throughout this project, you made so much possible. Your generosity in taking the time to patrol the islands is a wonderful contribution to the Songhees Nation.

To my grandparents Maureen and Roy, I can't thank you enough for all the support you have provided me over the years. You both have been such inspirations to me throughout my life, and have shaped the person I am today. Your contributions and careers in archaeology have shaped my interests and understanding in indigenous cultures.

To my parents Catherine and George, I don't know where to begin in thanking you. You both have provided me with endless support in pursuing my interests. Your careers have been a huge inspiration to my research — thank you for letting me explore your excavations growing up. Although I never studied archaeology, those early days of sifting through sediments, finding flakes has always been in my mind, and perhaps why I have pursued research with a cultural component. Thank you so much.

To the rest of my family and friends: Gordon, Colleen, Chris, Kristyn, Finn, Elsie, Dan, Geoff, Matthew, Lindsay, Claire, Frank, Alicia, Ron, Zoe, Edith, Lydia, Idora, Jim, Karen, Fenton, Mya, Chaco, Maurice, Yuri, Chelsa, and Rob, thank you all so much for everything over the years.

Finally, to my wife Melissa. You have been incredibly patient with me throughout my education. You have supported me, providing feedback and thoughtful discussions. I can't thank you enough for putting up with everything throughout this long process, and all the help along the way. You are truly a remarkable, loving person.

Table of Contents

List of Tables

List of Figures

Executive Summary

In the early 1960s, the Songhees First Nation left the archipelago of *Tl'chés* (Chatham Islands, British Columbia), located southeast of Victoria, to join the main reserve in Esquimalt. Since the Songhees' departure over 50 years ago, the landscape has undergone ecological degradation and change. Introduced invasive plants, and the cessation of Songhees' management practices and use of the wetland ecosystems, have resulted in issues that are threatening the ecological and cultural resilience and diversity of wetlands at *Tl'chés*. If left untreated, invasive plants will compete with native plant species for resources and space and undermine the ecological resilience of wetlands. Ecological resilience is the ability an ecosystem to withstand disturbances and persist in a state free of introduced disturbances (Apostol et al. 2006). Additionally, Songhees' cultural practices are at risk because invasive plants are competing with culturally salient plant species that also alter the hydrology of a sacred bathing wetland. This is a concern because cultural knowledge about the value of certain wetland plant species, and the practices associated with the use of the wetland as a cultural bathing pool, are at risk of being lost. If lost, the younger generations of Songhees people will not have future opportunities to engage with these wetland resources, and their associated cultural practices, language, and the land. Without traditional lands to manage and harvest resources, Songhees' knowledge of the environment, and their management and harvesting techniques, will continue to be threatened or lost. The goal of this restoration proposal is to provide both ecological and cultural restoration solutions, for the recent ecological changes evident at the wetlands on *Tl'chés*.

My research has been conducted at the invitation of Songhees elder *Súlhlima* (Joan Morris) to assess the current state of a sacred wetland, and develop prescriptions to restore the wetland to a pre-disturbed condition. *Súlhlima*'s expressed goal and vision for this project is to restore the wetland to the state it was in before the Songhees left *Tl'chés*, and to see her people return to the land. My proposed restoration plan will achieve this by targeting the invasive plant species for removal, by involving the Songhees in the implementation of the restoration treatments, and by incorporating traditional resource and environmental management techniques into the ongoing and long term management of the wetland. By removing unwanted invasive plants, coupled with the re-introduction of the management of the estuarine roots gardens and other traditionally important plant species, the wetland ecosystems will be restored to their pre-abandonment state.

CHAPTER 1: PLANNING PHASE

*"I'd like to see our people, our youth, get back to the land. The Sʔéləx*ʷ *always said that as long as you work the land and you're on a land, your future looks bright. Without the land, without the tə́ŋəx*ʷ *(earth/land/soil), you're lost because you need it to survive. And I believe that's what helped our people… People like my great grandparents and grandparents who were there, they lived off the land. You know, wildlife like the fowl and fish, sea urchins, crabs, clams, oysters. I always say we were rich, not money rich, but we were rich. We had food, a roof over our heads… This has always been by dream, how I grew up... I would like to see that for the youth, the children, that they get back to land, they need it to survive."*
(*Súlhlima*; Joan Morris, 2017)

1.0 Introduction

The wetland at *Tl'chés* that I am researching has long been a place of cultural and familial importance. *Súlhlima* identifies this as a sacred bathing wetland that is located behind the house that she grew up in. This wetland is a ritual site that *Súlhlima's* great grandfather Tom James (*Siaminthit*) and grandfather Ned Williams (both respected healers in the community) ritually bathed and purified themselves before conducting spiritual work (Joan Morris, pers. comm. 2017). The wetland remains a spiritually powerful and sacred place to *Súlhlima* and the Songhees people, and they have expressed great concern over the condition of this place. It is with *Súlhlima's* permission and her blessing that I share this information to develop a proposal for the restoration prescription outlined in this thesis.

The islands of *Tl'chés* have undergone decades of ecological degradation and change following the departure of the Songhees people from the landscape in the early 1960s. Since that time invasive plants have become established in all ecosystem types on the Islands (Gomes 2012). The environmental degradation resulting from invasive plant colonization and a lack of management of the wetland ecosystems on *Tl'chés* has had negative consequences for both biological diversity and cultural land use. Invasive plants threaten native plant diversity through direct competition for resources and space, which has the potential to reduce the quality and availability of culturally salient plants (Witousek et al. 1997; Reichard and White 2001; Levine et al. 2003; Jose et al. 2013). Each year invasive plants grow larger and produce and release seeds that build up in the soil or establish in new areas. This expands and prolongs invasive plant growth and imposes continual competitive pressure on native plants within a culturally sensitive wetland. Active restoration efforts to remove and suppress the spread of invasive plants is required to prevent the ecosystems at *Tl'chés* from becoming completely over-grown with invasive plants. Furthermore, the absence of the Songhees people, who no longer live there, has exacerbated invasive plant colonization by halting traditional wetland management practices. The absence of traditional management, coupled with the spread of invasive plants, has resulted in the degradation of a sacred cultural site and associated wetland ecosystem. The degradation also includes traditionally managed estuarine plant harvest areas ('estuarine root gardens') (Deur 2005).

My restoration plan addresses the mitigation of the colonization and spread of invasive plants in a tidally influenced freshwater wetland on West Chatham Island. I propose restoration techniques for controlling invasive plants that also includes both local traditional ecological knowledge (TEK) and practices associated with traditional resource and environmental management (TREM). An important reason for incorporating Songhees' TEK and TREM into the restoration plan is to record information regarding the early 20th-century historical ecological conditions of *Tl'chés* prior to the introduction of exotic invasive plant species. For this research, I worked with Songhees elder, *Súlhlima*, to gather oral histories and TEK to define a historical reference condition for the wetland.

My project is a plan to restore the tidal freshwater wetland to an historical early 20th-century state. The restoration plan details prescriptions to reduce all invasive plants from the wetland and around the associated watershed, and to encourage the resumption of Songhees' TREM techniques and cultural practices. To achieve the desired outcome of the project, I have:

1) Created a detailed restoration plan for a tidal freshwater wetland, estuarine root garden, and associated watershed;
2) Developed restoration objectives that incorporate local TEK and TREM practices; and

3) Proposed Songhees community involvement in the restoration and the long-term monitoring, and in the long-term maintenance/management of the wetlands.

This project contributes to the field of ecological restoration by illustrating the utility of incorporating TEK and TREM when restoring landscapes, by moving beyond its discussion and into practice. Most ecosystems are influenced by humans, and these influences should be acknowledged in the conduct of restoration (SER 2004). The collecting of information about Indigenous traditional knowledge and management practices, and including that knowledge in the restoration prescriptions for the wetland at *Tl'chés*, provides baseline data to establish an historical ecological reference condition. Collaboration with the Songhees Nation to implement the prescription plan is an important aspect of the restoration process. By working closely with *Súlhlima* to incorporate her values and TREM practices, meaningful partnerships are built, respect for Songhees' culture is expressed, and sound restoration techniques are implemented, all of which contribute to the success of the ecological and cultural restoration. My project does not put into opposition western ecological science and traditional knowledge, but instead, demonstrates the complementarity, emphasizing how the human aspect of the ecosystem should be respected and incorporated to help establish historical reference ecosystems for ecological restoration.

In addition to the restoration techniques that I propose, the process of reconnecting people to the land through restoration, encourages the Songhees to connect to their culture — and the plants, animals, language, places and stories associated with the land. As *Súlhlima* says, "If you're not on the land, you aren't going to survive." By survive, *Súlhlima* is referring to cultural survival. *Tl'chés* is a cultural landscape, where people have gained knowledge about their environment since time immemorial. TEK and TREM is learned and taught through cultural transmission — oral histories and stories, or learned by doing and observing (Carlson 1996; Berkes and Turner 2006; Lepofsky 2009; Fowler and Lepofsky 2011). The lives of Indigenous peoples are intricately connected to the land, and that is reflected in their culture (Anderson 1996; Turner 2005). When people are disenfranchised or otherwise disconnected from their traditional lands and resources, their ability to practice and pass down knowledge to the younger generations is at risk of being lost. A disconnect from the land and resources has had lasting detrimental effects on First Nations cultures (Turner and Turner 2005; Turner 2014). In order for a culture to survive and prosper the traditional lands of the people need to be available to carry forward the traditions of the culture. Without traditional lands to manage and harvest resources, Songhees' knowledge of the environment and their management and harvesting techniques will continue to be threatened or lost. This restoration prescription aims to assist with returning people to the land to continue traditional practices and to pass traditional knowledge to future generations, supporting cultural revitalization and continuity.

2.0 Background

2.1 Project Location

The focus of my research is a portion of a small archipelago 3.3 km across Baynes Channel from Oak Bay, off the southeastern tip of Vancouver Island, B.C., Canada (Fig.1). The archipelago is located where the Haro Strait and the Strait of Juan de Fuca meet, and is comprised of Discovery Island, and West and East Chatham Islands, along with a number of small islets. The islands are at 48°25'59.99" north latitude and 123°14'60.00" west longitude. Both West and East Chatham Islands and half of Discovery Island are part of the Songhees First Nation Indian Reserves No. 3 and 4, and make up approximately two thirds of the Songhees Nation reserve lands.

Figure 1. Location of Chatham Islands, B.C., *Tl'chés* (modified from GoogleEarth 2017).

These islands were first encountered by European explorers during the *Vancouver Expedition* led by Capt. George Vancouver from 1792–1794 (Walbran 1977). Chatham Islands were named in 1858 to honor the *HMS Chatham*, an escort ship to Capt. Vancouver's *HMS Discovery* during the Vancouver expedition (Walbran 1977). To the Songhees First Nation these islands are collectively known as *Tl'chés*, a Lekwungen Straits Salish word for "island" or "one island" (Mitchell 1968; Cuerrier et al. 2015). To *Súlhlima*, who was raised on *Tl'chés,* the name simply means "home" (Joan Morris, pers. comm. 2016).

Tl'chés is within the Southern Gulf Islands ecosection, in the Georgia-Puget Basin ecoregion, and part of the larger Georgia depression ecoprovince (Demarchi 2011). The islands are within the Coastal Douglas-fir moist maritime (CDFmm) zone, based on the biogeoclimatic ecosystem classification (BEC) system (Green and Klinka 1994). This ecoregion is characterized by mild winters, warm summers, and moderate precipitation resulting in ecosystems and species compositions not found anywhere else in the province (MacKenzie and Moran 2004; Demarchi 2011). The high diversity of ecosystem types at *Tl'chés* include: woodlands, rocky outcrops, coastal bluffs, Garry oak savannas, tidal salt marsh wetlands, intertidal mudflats, and ephemeral freshwater wetlands (Gomes 2012). Most of these ecosystems types, and other culturally managed ecosystems at *Tl'chés*, are in need of ecological restoration. Recent efforts have been made to research restoration possibilities of some of the ecosystems at *Tl'chés*, and efforts have been made to restore some of the camas meadows (Higgs 2005; Gomes 2012).

2.2 Songhees First Nation

The Songhees First Nation are a Northern Strait Salish people (Suttles 1990), originally a diverse group of extended families sharing a common Salish dialect called Lekwungen (Boas 1890; Duff 1969; Suttles 1974; Keddie 2003). Their traditional territory extends east to the San Juan Islands in Washington, north to Elk Lake on the Saanich Peninsula, west to Pedder Bay, and south to the present-day municipalities of Victoria, Oak Bay, Esquimalt, and Metchosin (Duff 1969; Keddie 2003; Lutz 2009). Prior to the establishment of Fort Victoria in 1843, villages were situated along the coastline, in every bay from Cordova Head to William Head, and one on Discovery Island (Suttles 1974). In 1876 the Indian Act split the Songhees into three separate bands and reserve lands; Esquimalt, Discovery Island, and the Songhees (Lutz 2009). The Discovery band later merged with the Songhees at their main reserve on the northwest shore of Victoria's Inner Harbour (Keddie 2003).

Similar to all Indigenous groups in the Pacific Northwest, the Songhees are strongly connected to their environment, harvesting resources and modifying and managing ecosystems to support their populations (Suttles 2005). The knowledge and experience about the use and management of environmental resources that Indigenous peoples amassed is the result of thousands of years of occupation of the land. In learning by "doing," that is, accumulating knowledge and practice over many generations, and by experimenting or observing with what works and what does not, the knowledge gained was passed down from generation to generation (Carlson 1996; Turner and Berkes 2006; Lepofsky 2009). Local environments dictate resource availability and the ability for humans to use them. Technologies for hunting, fishing, and gathering developed in conjunction with the knowledge of environments and the species useful for human consumption and medicinal and utilitarian purposes.

Wetland ecosystems are an integral part of the cultural landscape used by the Songhees and other Indigenous groups, not only in British Columbia but across North America. Waterfowl, mammals, plant species, and water are harvested from wetland sites (Barnett 1955; Suttles 1974, 1990). As Nicholas (1998:720) notes, wetlands are:

> …. important components of many different environments owing to high values for resource diversity, productivity, and reliability—factors that also made them distinct and economically important places in past human landscapes. While wetlands were but one part of the larger landscape occupied by hunting and gathering peoples, the cultural activities associated with them are important in providing a representative view of past land-use practices because some subsistence or ceremonial activities took place only there. Attention to wetland settings may also help to correct misconceptions about their role in human history.

This speaks to the importance of incorporating a more holistic approach to ecological restoration, one that recognizes the conjunction of ecological and cultural values — both critical components of this restoration project.

2.3 Social and Community Engagement

Community engagement is often a component of a restoration plan, and this is particularly relevant when working on First Nations lands. There is risk of project failure if adequate or meaningful engagement with the communities directly or indirectly affected by the project is not provided (Gayton 2001; Egan et al. 2011). Neglecting to adequately consult or involve the people whose land, or neighbouring lands, where you are planning to work can result in a lack of support for the project (Reyeys 2011). After-the-fact consultations or involvement can also be seen as a form of disrespect to both indigenous and non-indigenous communities. It is the responsibility of the restoration team to be aware of the ownership of a landscape, and provide meaningful communication with the stakeholders from the beginning, during implementation, and in the post-restoration phases of projects.

The *Tl'chés* wetland restoration project would not be possible without the support from Songhees Chief and Council, and particularly from *Súlhlima*. As such, this restoration plan aims to take a collaborative approach by incorporating local traditional Songhees' knowledge into the plan. This project has the ultimate end goal of facilitating the Songhees to return to *Tl'chés*. This will be achieved through training any interested Songhees community members in the processes and steps of restoration, and by involving them in the pre-planning, implementation phases, and post-restoration monitoring and maintenance of the wetland watershed. Being involved in the restoration may also create more opportunities for the Songhees to visit *Tl'chés* more frequently, and thus re-connect to this cultural landscape. It is the vision of *Súlhlima* to see her people and youth getting back to this landscape, for revitalization of cultural traditions and practices (Joan Morris, pers. comm. 2017). *Súlhlima* says that she sees too much "disconnect" today from the traditional foods and the land. The restoration project outlined here provides one avenue to help make opportunities available for Songhees participation in traditional resource and environmental management, which is an important part of cultural revitalization.

Community engagement through the involvement and participation of Songhees community members will help build capacity for continued maintenance and monitoring of the wetland restoration site, and for future restoration projects in Songhees' territory. This will be achieved by teaching community members about the process of ecological restoration and the steps involved; teaching members about invasive plant species identification and appropriate removal techniques for various plant species; teaching the importance of wetland ecosystems locally, and from a landscape perspective; teaching about the importance and necessity of pre- and post-restoration monitoring and data collection; and training for the continued maintenance required for this restoration project to be successful. These important capacity building skills and training opportunities will be taught at the beginning of the project, and throughout the implementation phases of the proposed restoration prescriptions. The goal will be to provide the Songhees with adequate training and skills to continue with the restoration prescriptions and continued monitoring and maintenance of this restoration project. The skills learnt can then be used to continue restoration activities throughout *Tl'chés* and other Songhees lands.

2.4 Tl'chés: A Cultural Keystone Place and Landscape

There are two common concepts recognized for determining the cultural importance of specific settings relative to their value to the larger landscape. These concepts are called *Cultural Keystone Places* (CKP) and *Cultural Landscapes*. *Cultural keystone places* are defined by Cuerrier et al. (2015) as:

> "A given site or location with high cultural salience for one of more groups of people and which plays, or has played in the past, an exceptional role in a people's cultural identity, as reflected in their day to day living, food production and other resource based activities, land and resource management, language, stories, history, and social and ceremonial practices."

Cultural landscapes are defined by Birnbaum (1994) as:

> "A geographic area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values."

Based on these two definitions, *Tl'chés* is considered both a cultural landscape and a cultural keystone place, and is one of the archetypal CKPs cited in Cuerrier at al. (2015). The long list of culturally salient plant species, evidence of culturally managed landscapes, the presence of village sites, cultural sites, and oral histories associated with the islands all define *Tl'chés* as both a cultural landscape and a cultural keystone place.

The Chatham and Discovery islands are part of the ancestral lands of the Songhees and have played a vital role in Songhees' culture and livelihood for thousands of generations. The long history of human occupation is reflected in the oral histories of the Songhees people (Gomes 2012; Joan Morris, pers. comm. 2017). The "Origin of Salmon," a well-known story throughout Lukwungen and Coast Salish culture, is associated with *Tl'chés (Appendix A*). Several stages of occupation and abandonment on these islands have occurred throughout the past and into contemporary times (Gomes 2012; Joan Morris, pers. comm. 2016). During the smallpox epidemic of 1862–1863, that killed thousands of Indigenous people throughout Vancouver Island, *Tl'chés* provided a refuge for the Songhees (Duff 1969; Keddie 2003; Lutz 2009). Having *Tl'chés* as a refuge enabled the Songhees population and culture to rebound from a low population of 100 individuals in the 1900s, to over 500 in recent years (Higgs 2005; Lutz 2009). The last Songhees families moved away from *Tl'chés* to join the main Esquimalt reserve in the early 1960s as a result of their water well drying up (Gomes 2012; Joan Morris, pers. comm. 2017).

Ecological, archaeological, and ethnographic evidence of past Songhees occupation and intensive resource management is present on the landscape today. For example, there are numerous cultural features and archaeological sites situated throughout the islands (Darcy Mathews, pers. comm. 2017). Features include culturally modified trees (CMTs, also known as harvest trees), shell middens, clam gardens, estuarine root gardens, fish traps, stone tool and manufacturing debris, burial cairns, and old house depressions and village sites (Darcy Mathews, pers. comm. 2016). Currently, archaeological excavations and investigations are being undertaken by Dr. Darcy Mathews, University of Victoria, to further document and understand the deep human and ecological history of *Tl'chés*. Initial archaeological and ethnoecological research results suggest periods of intense inhabitation over the past three millennia, with two large village sites on West Chatham potentially supporting a large number of people for such a small island. Forest composition, soil charcoal, and fire scars on veteran savannah-born trees (Garry oak) also suggest intense long-term ecosystem management using fire (Darcy Mathews, pers. comm. 2017). Fire is an integral component of many landscapes and is known to have been a frequent and effective land and resource management practice used by the Songhees, and other Indigenous groups in the Pacific Northwest (Boyd 1999; Senos et al. 2006; Pellatt and Gedalof 2014; Hoffman et al. 2016)

As *Tl'chés* is a cultural landscape and a CKP, the process of restoration of the landscape to the desired historical reference condition ideally should incorporate the local Indigenous human component into the restoration plan, and the traditional land management practices. *Tl'chés* has been an integral part of the Songhees' cultural landscape since time immemorial, and today provides the opportunity for all Songhees, including younger and future generations, to re-connect to their ancestral land and revitalize their culture through practicing traditional land management (Higgs 2005; Gomes 2012 2013; Joan Morris, pers. comm. 2017).

2.5 The Tl'chés Wetland Restoration Site

The focus of my restoration plan is a freshwater marsh located on the northern tip of West Chatham Island (Fig. 2). My research was initiated at the invitation of Songhees Chief Ron Sam, the Band Council, and *Súlhlima*, who holds hereditary rights to this wetland. As previously mentioned, the marsh is a sacred site for the Songhees Nation. The wetland was used as a sacred bathing pool, reserved for the "healers" of the Songhees community, and is part of Joan's cultural heritage as she is a direct descendent of the healer's lineage. Her ancestors used this wetland for ceremonial and ritual practices, and this fact makes restoration very personal and important to *Súlhlima* (Joan Morris, per. comm. 2017).

Freshwater wetlands are a scarce ecosystem type at *Tl'chés*. I recorded four during field visits in the summer and fall of 2016, and winter 2017 (all currently dry up in the summer). The scarcity of freshwater sources on these islands makes restoration a priority for the animal and wetland obligate plant species, and for the cultural practices specifically associated with this sacred freshwater wetland site, and associated estuarine root garden wetland.

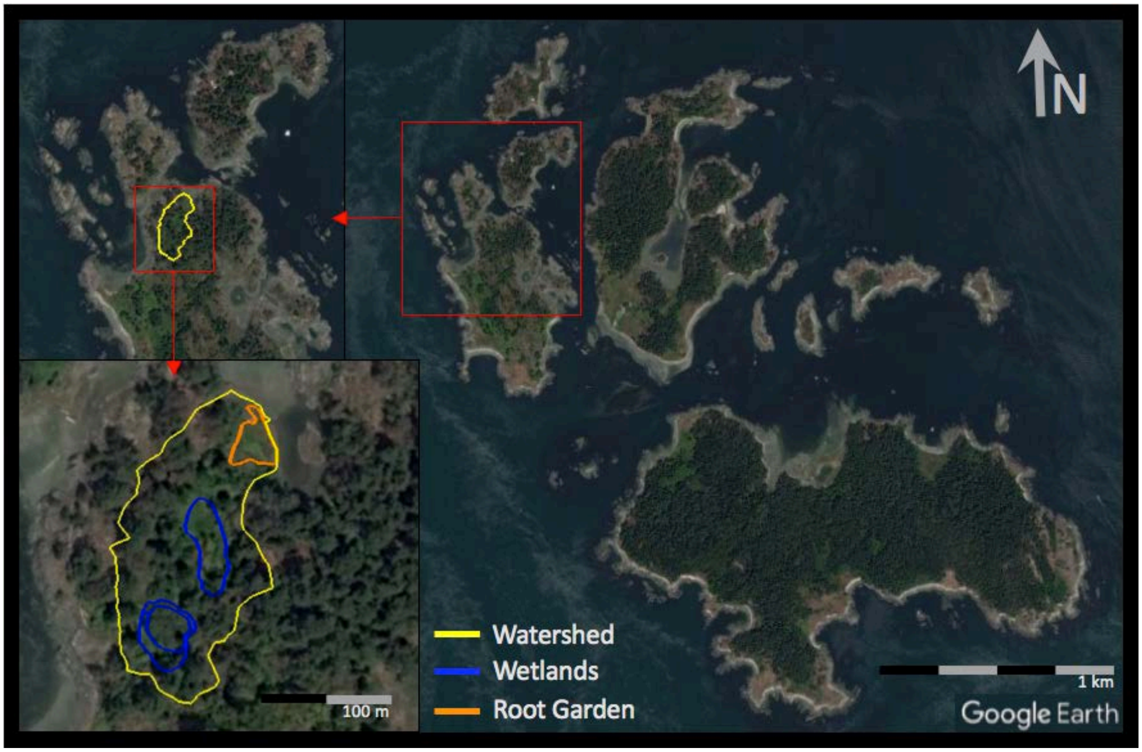

Figure 2. Location and outline of restoration site at *Tl'chés* (modified from GoogleEarth 2017).

I specifically chose to develop a restoration plan for this wetland site for four reasons:

1) the cultural and spiritual significance of it, and the associated plant species it contains; 2) the high degree of invasive plant colonization in and surrounding the wetland;

3) the environmental services — water storage, carbon sequestration, breeding and foraging habitat for wildlife it provides locally; and

4) the scarcity of freshwater sources on the islands.

The wetland watershed is 0.73 ha and consists of two shallow wetlands (560 m^2 and 300 m^2), and a remnant estuarine springbank clover (*Trifolium wormskioldii*) and Pacific silverweed (*Potentilla anserine* ssp. *pacifica*) (Fig. 2). The wetlands are defined by bedrock outcrops to the east and west sides and open at the ends, with the northern seaward end gradually sloping into the estuarine root garden. The two wetlands are connected by a shallow depressed band of slough sedge (*Carex obnupta*), Scouler's willow (*Salix scouleriana*), and red-osier dogwood (*Cornus stolonifera*). The wetland receives the majority of water from precipitation and surface runoff from the surrounding area (ombrotrophic). Salt water enters the wetland during high winter tides, and through salt spray. The wetland is currently ephemeral, drying up in the summer drought months. However, based on discussions with *Súlhlima*, as recently as the 1950s the wetland previously retained water year round, as the ceremonial practices associated with the wetland were held throughout the year. It is unclear if the current ephemeral condition is the result of changing climatic conditions (hotter longer summers, reduced annual precipitation), invasive plant encroachment (plant water uptake increased), native plants encroachment, drainage through the substrate, or a combination of these factors.

My restoration plan focuses on removing invasive plants and reducing overabundant native plant species within and surrounding the wetlands. Invasive plants are identified as one of the largest threats to the ecological and cultural integrity of the wetland ecosystems at *Tl'chés*. Invasive plants threaten native biodiversity through direct competition with native plants, threaten ecological services, and can alter the hydrology of wetlands (Polster et al. 2006; Clewell and Aronson 2013). Another consideration to address is the absence of the Songhees people, along with their traditional management practices. To fully restore this once intensively managed landscape, Songhees presence and use of the wetlands needs to be restored in conjunction with the other proposed restoration treatments.

The direct competition that invasive plants have with native food plants and ecosystems are of concern because only five percent of the Songhees' ancestral land base that was used traditionally for food systems is available today (Corntassel and Bryce 2012). *Tl'chés* is the best remaining example of Lekwungen landscape management. Remnant root gardens and culturally salient plants are still present throughout the islands today, but are at risk of being lost due to the pressures of invasive plant encroachment and competition, and from the absence of traditional management practices to the landscape by the Songhees. Additionally, the absence of native plant harvesting by the Songhees would enable native plants to grow larger and uptake more water. Therefore, an additional component of this restoration plan is the restoration of certain plant species associated with wetland ecosystems, such as Pacific silverweed and springbank clover. This wetland watershed has been influenced through multi-generations of use and management involving burning, weeding, harvesting, and bathing. To fully restore this ecosystem to the ‘original’ condition, the TREM practices of the Songhees need to be re-introduced to the landscape, or other practices that mimic the outcomes of the TREM practices that have influenced this landscape for millennia.

3.0 Current Conditions of the Wetlands

In this section I discuss the current status of the wetlands at *Tl’chés*. I describe the classification of the wetland, mapping methods used to record vegetation communities, soil types and characteristics, and the current hydrological condition. Results of my sampling are discussed within each section.

3.1 Inventory Sampling Methods and Results

3.1.1 Wetland Classification

Classification of this wetland follows the guidelines and detailed descriptions of wetland types, provided by the *Wetlands of British Columbia: A Field Guide to Identification* (MacKenzie and Moran 2004), and *The Canadian Wetland Classification System* (National Wetlands Working Group 1997), with wetland class descriptions from *Wetlands* (Mitsch and Gosselink 2015). I conducted field surveys to gather data pertinent to the classification of the wetland on 7 August and 21 October 2016, and 13 – 18 February 2017.

Based on the classification guidelines and descriptions provided by the literature, the wetland fits best into the overarching estuarine marsh realm. It can be further classified into the estuarine meadow (Ed) class (MacKenzie and Moran 2004), and as a tidal freshwater wetland (Mitsch and Gosselink 2015). Estuarine meadows occur in the high intertidal supratidal zones of estuaries, where tidal flooding occurs less frequently than daily (i.e., high winter tides), and is tempered by freshwater mixing (i.e., precipitation) (MacKenzie and Moran 2004). A tidal freshwater marsh is a type of wetland that occurs adjacent to tidal systems, is influenced mostly by freshwater, and receives saline water only during extreme high tides or storm surges (National Wetlands Working Group 1997; Mitsch and Gosselink 2015). Such wetlands combine features of both salt marshes and freshwater swamps/marshes, acting in many ways as salt marshes but with increased diversity in biota due to the reduction of salt stress (Mitsch and Gosselink 2015). This wetland type has a closed nutrient cycle that depends little on inputs from outside the system (i.e., it is not connected to a river system) (Mitsch and Gosselink 2015).

The *Tl'chés* wetland is mostly ombrotrophic, receiving all freshwater from precipitation and surface runoff from the surrounding catchment. There is potential for ocean water to infiltrate during high winter tides and storm surges. The wetland is ~ 25 m from the ocean to the north. I recorded surface and groundwater salinity readings as oligosaline (weakly to slightly brackish), (*see 3.1.5 Hydrology*). This saltwater influence may occur from groundwater intrusion, high winter tides, or atmospheric salt spray. The vegetation communities in the wetland reflect plant species tolerable to brackish water.

3.1.2 Vegetation

Pre-project inventory sampling was conducted in July, August and October 2016, and February 2017 to gather information on the percent cover, and the extent of area occupied by native and non-native plant species in and surrounding the project area. The data collected will be used to determine the current baseline vegetation, and create a detailed species distribution map. The detailed species map will be used in the development of restoration prescription logistics, and for pre and post restoration treatments monitoring.

I sampled vegetation within the wetland on 7 August 2016. I established three, 40-m transects running north to south within the wetland, at a compass bearing of 164°. A north-to-south transect bearing was selected to maximize the number of plots per transect. I established nine plots along each transect with a total of 27 plots established. The starting plot and subsequent spacing among plots was established using a random number generator. Spacing range was 3 to 7 m. I hammered wooden stakes into the substrate to establish permanent plot markers. Plot stakes were marked with a transect number and a letter was assigned to each stake (e.g., Tran01A, Tran01B, etc.). I also attached orange flagging tape to each stake, and a waypoint recorded for each plot using a handheld global positioning system (GPS) unit. A 1-m^2 quadrate was used for each plot. I estimated the percent cover of each plant species within each plot. If a plant species was unidentifiable in the field, the plant was recorded as “unknown,” and a photograph taken to identify the species at a later date. I took photographs of each plot for pre- and post-restoration comparisons. I also recorded coarse woody debris, amphibians, bare ground, and “things-of-interest” (i.e., wolf dug holes), within the plots.

I initially conducted the wetland perimeter and watershed vegetation mapping on 21 October 2016, with additional mapping conducted between the 13 and 18 February 2017. I used a pedestrian mapping method to record the invasive and native plants. The extent of invasive plants was mapped using the “tracklines” and “waypoints” functions on a handheld GPS. This was done by walking along the perimeter of a species, plotting waypoints at the edge of the plant perimeter. I entered the data into Basecamp and GoogleEarth, and created colour polygons to visually represent the extent of mapped invasive and native plants. Only the native plants that had clustered populations were delineated with colour polygons and alphabetical “placemarker” labels were added to indicate the location of individual native plants (Fig. 3). I used an area calculator to determine the total area of the polygons that invasive plants represented on the landscape (*section 3.2.1 Invasive plants)*.

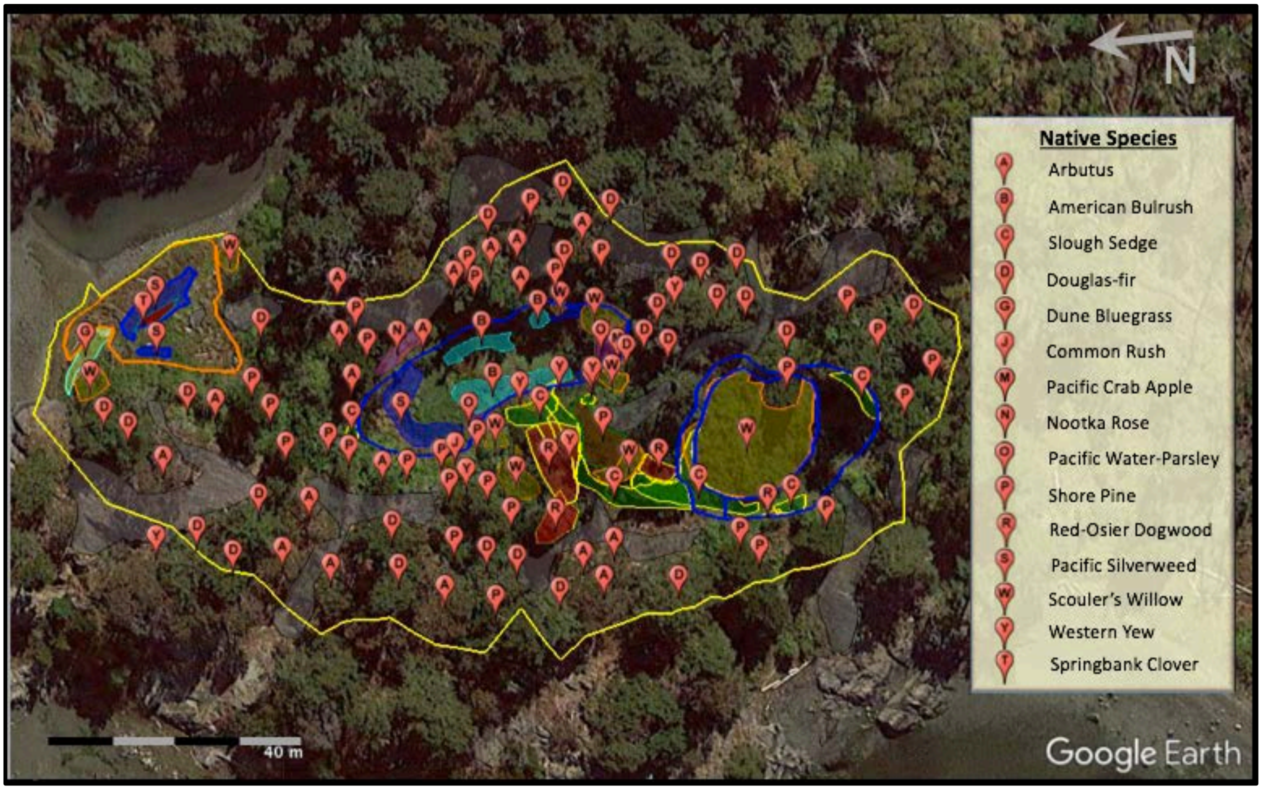

Figure 3. Mapped locations of native plants in the wetland restoration site (modified from GoogleEarth 2017).

3.1.3 Soils

I collected five soil cores on 21 October 2016. I used a five cm diameter soils auger to extract the cores. Cores were extracted in 15 cm deep increments. All samples were placed in plastic bags and given an alphabetical label with depth recorded (e.g., A-0"-6", B-6"-12"). Coring samples were taken to a depth of 2 m. The soil organic layer is on average 60 cm deep, with deep (>2 m) marine clay deposits underlying. The organic layer is a rich peaty humus soil type. Mottled rust colouring is present in the upper clay layer indicating seasonal water level fluctuations (Mitsch and Gosselink 2015).

3.1.4 Hydrology

I recorded water data on 21 October 2016, and 13 February 2017, with a YSI hand-held multi-parameter meter. The variables recorded were temperature (C^{o}), pH, salinity (ppt), and dissolved oxygen (D.O.%). The multi-parameter meter was cleaned and calibrated in the lab with calibration solution, and D.O. was calibrated to field conditions prior to taking samples. In October two samples were taken in standing water, and the third was taken from the hole created from soil coring. In February, three samples were recorded within the larger wetland, and one in the smaller wetland (Table 1).

Table 1. Water sampling results.

	21 OCTOBER, 2016				*12 FEBRUARY, 2017*				
Sample #	**1**	**2**	**3***	**Avg.**	**1**	**2**	**3**	**4**	**Avg.**
C^O	11.1	11.6	10.4	**11.03**	4.2	4.7	5.6	3.7	**4.55**
PH	5.51	5.91	6.08	**5.83**	5.74	5.72	5.91	5.34	**5.67**
SAL. (PPT)	7.2	6.4	6.2	**6.6**	0.37	0.35	0.36	0.21	**0.32**
D.O. (%)	60	55	65	**60**	21.5	22.1	15	34	**23.15**

Water sampling results indicate that pH range of 5.67 – 5.83 is in the typical range of rain water (Campbell et al. 2006). Salinity readings indicate variations between the October 2016 (6.6 sal. ppt.) and February 2017 (0.32 sal. ppt.) sampling dates. This variation can be attributed to the timing of the samples being recorded. In October the rains had just begun with very little water yet filling up the wetland, resulting in more concentrated salts in the water. In February there had been much precipitation throughout the winter, resulting in more “flushing” and diluted salts.

3.2 Stressors

Stressors in ecological restoration are defined as any factor that are contributing to an ecosystem being damaged, destroyed, degraded, or transformed (i.e., pollutants, fragmentation, climate, invasive plants, human land-use patterns and alterations) (SER 2004; Apostol 2006). The most prominent stressors at the wetland restoration site are invasive plants, and changes in hydrology. This section explains why invasive plants are a concern, details the extent of invasive plants within and surrounding the wetlands, and the potential effects the plants are having on the hydrology of the wetlands. The focus of this project is to address the issue of invasive plants. The topic of water and hydrology is an issue that should be researched further. Water is a limiting factor in terms of the wetland ecosystems, but also if the Songhees Nation plan to re-settle the islands in the future. In the past these islands supported hundreds of people with three large village sites, and the main reason why the islands were abandoned was due to water shortages (Joan Morris pers. comm. 2017). Baseline data on water has been recorded and will be measured prior to the implementation of any restoration treatments proposed in this plan.

3.2.1 Invasive Plants

Invasive plants are one of the greatest threats to native plant and animal diversity, second only to habitat loss and degradation (Reichard and White 2001). Invasive plants out compete native plants, change plant community structure, reduce biological diversity, modify key ecosystem services and processes, and cause economic and cultural losses (Witousek et al., 1997; Westbrooks 1998; Levine et al. 2003; Jose et al. 2013).

Invasive plants are a threat at *Tl'chés.* Invasive plants—especially Himalayan blackberry (*Rubus armeniacus*), but also English ivy (*hedera helix*), common hawthorn (*Crataegus monogyna*), English holly (*Ilex aquifolium*), lamb's quarters (*Chenopodium album*), brass buttons (*Cotula cornopifolia*), and agronomic grass species such as sweet vernalgrass (*Anthoxanthum odoratum*), and common velvet-grass (*Holcus lanatus*), which are the most abundant invasive plant species in the watershed (Fig. 4). These species are well established within and throughout the wetland perimeter and watershed. Within the wetland, vegetation transects data reveal that native plant cover is 56.22%, and invasive plant cover is 43.76% (Fig. 5). Invasive plants have colonized 2,607 m^2 of the 0.728 ha watershed, making up 36% of the total watershed area (Table 2).

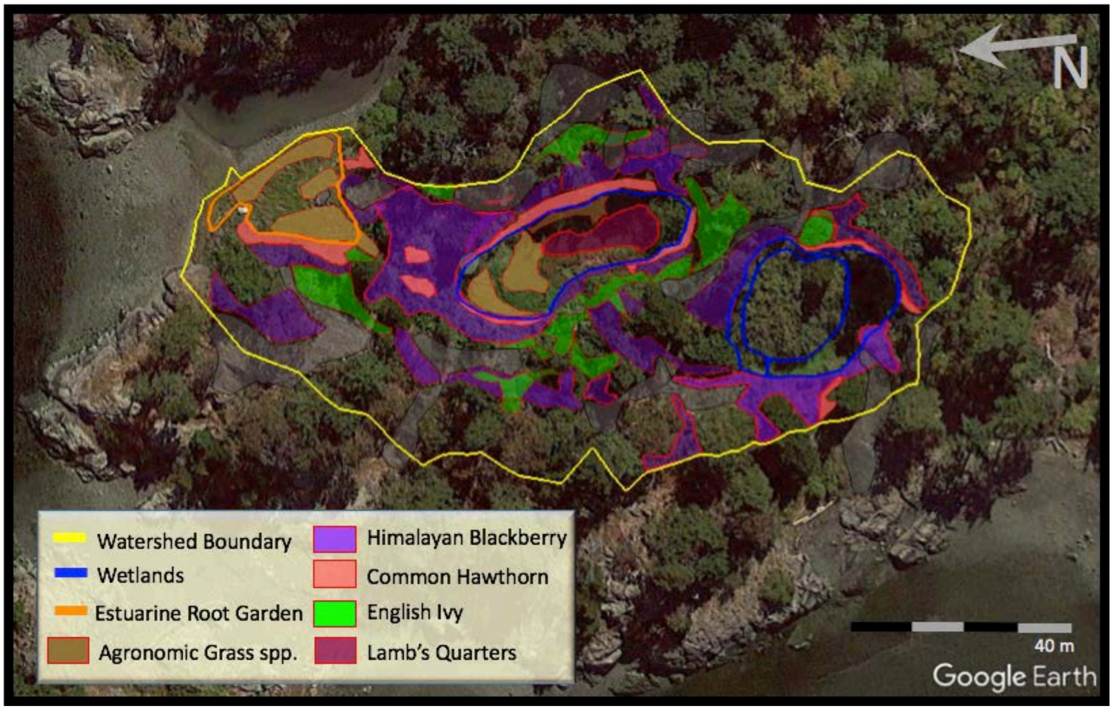

Figure 4. Mapped extent of invasive plants in the restoration site (modified from GoogleEarth 2017).

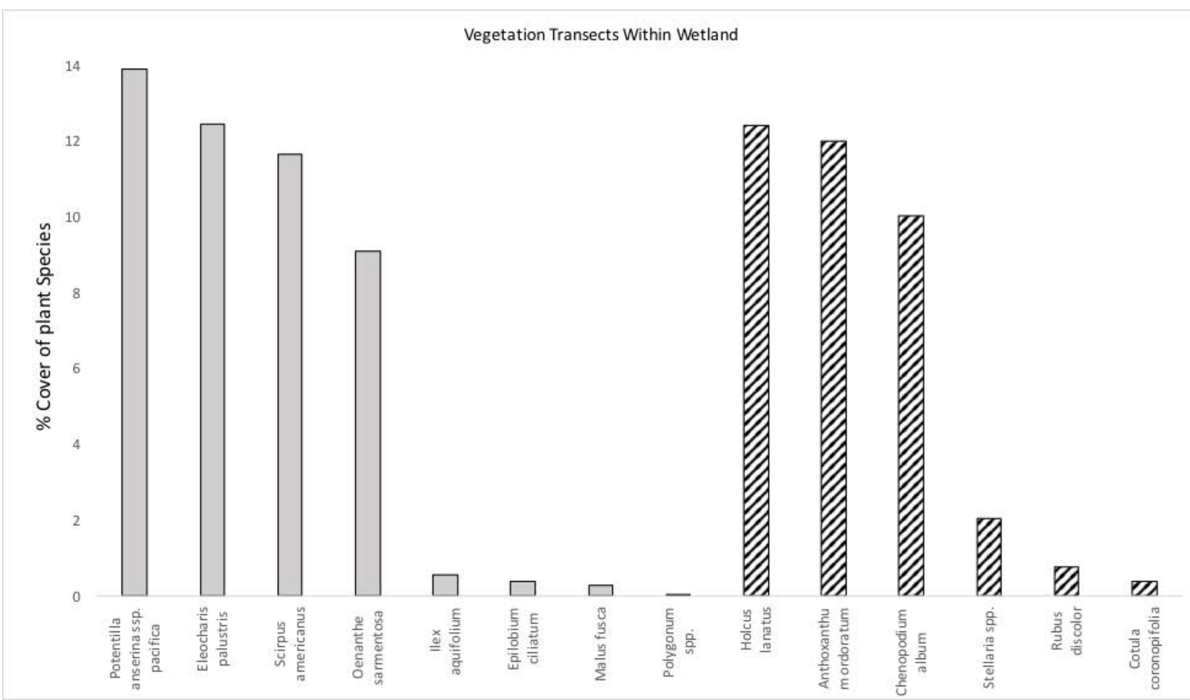

Figure 5. Vegetation transects calculating percent cover of native and invasive plant species within the wetland depression.

Table 2. Area covered by invasive plants in restoration site.

Wetland watershed	**7,280 m^2 (0.728 ha)**	
Invasive plants	**Area covered (m^2)**	**% of watershed invaded**
Himalayan Blackberry	1548 m^2	21.3 %
English Ivy	501 m^2	6.9 %
Agronomic grasses	308 m^2	4.2 %
Common Hawthorn	240 m^2	3.3 %
Lamb's quarters	110 m^2	1.5 %
Total Invasive plants	**2607 m^2**	**36 %**

Blackberry is the most abundant invasive plant in the watershed, and is of particular concern in relation to water. Blackberry has an excessive root system that enables the plant to access moisture that other shrubs cannot, and can store more water in the roots (Caplan and Yeaky 2010). Blackberry can tolerate prolonged periods of fresh and brackish water flooding, up to 40 days of flooding, followed by rapid new growth after submergence (ISCBC 2014; Gaire et al. 2015). Without actively removing invasive plants, the infestation will persist, continually causing competition for space and resources with native plants (Gaire et al. 2015). Fortunately at *Tl'chés*, these can be successfully eliminated and controlled by manual removals using basic hand tools (shovels, clippers, rakes, etc.). Successfully eradicating invasive plants from within the wetland watershed will require many treatments over several years. Continued monitoring and follow-up treatments are needed to remove any newly sprouted plants from the remnant roots and seedbank in the soil. There will always be the threat of re-introduction of invasive plant seeds from animal vectors and humans visiting the islands. Birds are effective seed vectors that consume large quantities of fruits from the surrounding landscape, and deposit the seeds through excrement (Dennehy et al. 2011). A continued presence of people managing invasive plants and the landscape will be required to completely eradicate invasive plants from *Tl'chés.* This plan aims to train interested Songhees community members in this process, and the long-term maintenance and management of the wetland restoration site.

3.2.2 Hydrology

The *Tl'chés* watershed is 0.72 ha (7,251 m^2). The majority of water inputs come from precipitation. Given the close proximity of the wetlands to the ocean (25 m), and the low gradient between the estuarine root garden and the wetlands edge, high winter tides have the potential to input saline ocean water into the system.

The ability for the wetlands to hold water year round is an expressed concern (Joan Morris, pers. comm. 2017). At present the *Tl'chés* wetlands are no longer holding water year round, contrary to the oral histories that indicate the presence of water year round. Four possible reasons that account for this change are:

1) the absence of human activity from the island over the last 50 years have enabled native and invasive vegetation to dominate, grow larger, and slowly infill the wetland, reducing water holding capacity;
2) the establishment of invasive plants within and around the wetland perimeter has increased the rate of water usage and loss through evapotranspiration, reducing water available year round;
3) the possibility that seismic activity has altered the bedrock catchment area, creating a "leak" in the substrate, thereby altering water holding capacity; and
4) a combination of changing climates, invasive plants colonization, and the absence of human management that collectively have contributed to the reduction of water retention in the summer months.

This project is not intended to determine which factors are responsible for the changes evident in the historical accounts. However, by gathering current hydrological baseline conditions we will be able to compare current hydrologic conditions to post-restoration treatments over time. This will enable us to see how much change the removals of invasive plants have on the annual water-holding capacity.

4.0 Justification for Restoration

Wetland ecosystems (including bogs, fens, marshes, swamps, and estuaries) are among the most ecologically diverse, resource abundant, and productive ecosystems in the world (Gosselink and Maltby 1990; Williams 1990; Mitsch and Gosselink 2015; Ramsar 2016). Wetlands provide a disproportionate amount of ecosystem services relative to size and extent on the landscape, and the value of the ecosystem services provided are estimated at US$14 trillion annually (Mackenzie and Moran 2004; DeGroot et al. 2006).

Marshes are some of the most heavily used wetland types by wildlife for the diverse range of palatable vegetation and aquatic organisms found within (Mackenzie and Moran 2004; Mitsh and Gosselink 2015). Tidal marshes represent some of the most hydrologically dynamic and nutrient-rich ecosystems (MacKenzie and Moran 2004). More birds use tidal freshwater marshes than any another marsh type, and are favoured by most waterfowl, amphibians, and semi-aquatic mammals as the ecosystem provides good security cover, breeding habitat, and food sources (Mackenzie and Moran 2004; Mitsch and Gosselink 2015).

Wetlands are considered the "kidneys of the landscape," providing such ecosystem services as: carbon sequestration, water filtration, water storage, recharge groundwater, flood control, climate stabilizers, and breeding and foraging habitat for plant and animal species (Delesalle and Brokenshire 1998; Staveren et al. 2006; Dordio, et al. 2008; Mitsch and Gosselink 2015; Howard et al. 2017). These ecosystems are also considered "biological supermarkets" for the rich diversity in flora and fauna supported that contributes to the food chain and supports unique habitat types for plant and animal species, particularly species whose populations are threatened in the Pacific Northwest (Mackenzie and Moran 2004; Mitsch and Gosselink 2015). In British Columbia the majority of wildlife and fish species will use wetlands at some point in their life history (Mackenzie and Moran 2004).

There are many social values associated with wetland ecosystems for both indigenous and non-indigenous peoples. These include landscape aesthetics, recreational, tourism, wildlife viewing “hotspots” for bird enthusiasts, hunting opportunities, heritage and historical value, and educational opportunities such as archaeological and scientific research (Mercer 1990; Williams 1990; Ramsar 2016).

Despite the ecological, social, and cultural importance, wetlands are under severe threat worldwide (Ramsar 2016). The majority of loss of wetlands is caused by the draining of wetlands for agriculture, encroachment from urban and industrial development, changes in hydrology, and the spread and establishment of invasive plants (Williams 1990; Batzer and Baldwin 2012; Mitsch and Gosselink 2015). Global assessments indicate that between 64 – 76% of the world’s wetlands have been lost since the year 1900 (Ramsar 2016). In the Fraser Lowland and parts of Vancouver Island, B.C., an estimated 70% of original wetland areas have been lost or destroyed (Staveren et al. 2006).

A strong justification for the restoration of the *Tl’chés* wetland can be made on the basis of both the ecological value and cultural value. In the following sections I present qualitative information and quantitative data that support the restoration of the tidal freshwater marsh at *Tl’chés*.

4.1 Ecological Value

The *Tl’chés* tidal freshwater marsh is one of only four identified freshwater wetlands on the two Chatham Islands. Restoring this wetland will help to improve or preserve freshwater sources for the Island’s flora and fauna that require water throughout various life stages. Based on my field observations, this wetland has a higher diversity of unique plant species within and surrounding the marsh compared to the other four freshwater wetlands on the archipelago (e.g., Western yew (*Taxus brevifolia*), American bulrush (*Schoenoplectus americanus*), Pacific crab apple (*Malus fusca*), Pacific water-parsley (*Oenanthe sarmentosa*), Springbank clover, Slough sedge, Scouler’s willow, and Nootka rose (*Rosa nutkana*). There are provincially at-risk and regionally rare plant species identified growing within and surrounding this wetland, such as the S-1 (red-listed, critically imperiled) American bulrush (*Schoenoplectus americanus*), and locally rare springbank clover. The American bulrush species is well established, making up 17% of the total wetland area in the larger wetland. In the estuarine root garden there is a population of Springbank clover, a species that has essentially been locally extirpated from around Victoria despite at one time being a widely and intensively managed species (Fiona Hamersley-Chambers, pers. comm. 2017). This wetland watershed also has the potential to accommodate endangered species such as Macoun's meadow-foam (*Limnanthes macounii*) that depends on wet depression landform types, as there are two recorded sub-populations on West Chatham (BCCDC 2014).

4.2 Cultural Value

For Indigenous peoples, wetlands have helped facilitate a large component of various cultural practices in the past, the present, and for continuation in the future. The importance of wetlands to Indigenous peoples can be directly related to the rich diversity of provisioning plant and animal resources found within them (Menotti 2012). Wetland resources have been used for food, medicinal, and utilitarian purposes, and the wetlands are also a reliable harvesting area (Nicholas 2007). Wetlands also hold spiritual and ceremonial value to Indigenous peoples, which is the case with the Coast Salish people more broadly (Suttles 1974), and this wetland specifically.

This wetland has considerable importance to the Songhees people according to *Súlhlima* who holds hereditary rights to the wetland. *Súlhlima* comes from a family lineage of healers or shamans. Her ancestors had exclusive rights to carry out ceremonial bathing practices, such as healing, coming-of-age, and mortuary rituals. These purifying bathing rituals are required at all times of the year because the social circumstances surrounding the need for a bathing ceremony could occur at any time. This justifies the examination of the effects that increased vegetation establishment is having on water supply throughout the year — particularly in the summer drought months. For *Súlhlima*, the main consideration for restoring this wetland is its designation as a sacred site, but also to enable the younger generations of Songhees to reconnect to the land to benefit from the plants and animals associated with the wetland watershed (Joan Morris, pers. comm. 2017).

There are additional cultural reasons that support the justification for restoration. Numerous plant species found within this wetland are traditionally used for ceremonies, medicines, utilitarian purposes, and for food (see *Appendix B* for complete list of species). The western yew tree is one example of a plant species required for several ceremonial bathing rituals, and was also prized for its durability as the preferred wood for carving digging sticks (Turner and Bell 1971; Turner and Hebda 2012). In mortuary ceremonies, yew branches are used for ritual cleansing of the relatives of the deceased or the witnesses from the cemetery (Jenness 1934). Yew was also used in the ritual purification ceremony for rites of passage, both for boys seeking spirit power, and for girls undergoing menstrual seclusion. In both ceremonies, smooth black stones and Pacific yew tree boughs are rubbed on the body as part of the purification ritual (Mathews 2014). Some food plants (i.e., springbank clover, Pacific silverweed) are no longer available to the Songhees today. This is due either to urban and industrial development that has destroyed or altered optimal plant growing habitat, or restricted access to traditional food lands are restricted (e.g. common municipal and provincial parks, or private property) (Corntassel and Bryce 2012).

Within the wetland watershed restoration site there are remnant patches of both springbank clover and Pacific silverweed, and seven mature yew trees growing in the perimeter.
In summary, the social and cultural consequences of not controlling the presence and spread of invasive plants are 1) the potential loss of a ceremonially important environment; 2) the extirpation of salient plants used for food (e.g., springbank clover and Pacific silverweed), and for medicinal and utilitarian purposes (western yew, Schouler's willow, slough sedge); and 3) the ultimate loss of an environment where cultural knowledge and identity have been supported and transmitted from generation to generation.

5.0 Desired Future Conditions

The desired future conditions for the wetland restoration at *Tl'chés* are proposed on the basis of suggestions from *Súlhlima*. Other sources of relevant information have been gathered from available literature pertinent to *Tl'chés*, from plant species information from the BEC system, and from local TEK and TREM of *Súlhlima* and the Songhees Nation. Regional literature on TEK and TREM practices associated with estuarine roots gardens, wetlands, and resource harvesting of other First Nations groups in the Pacific Northwest was also consulted.

5.1 Reference Systems

A reference ecosystem serves as a model for planning a restoration project, and helps evaluate the success of a project once treatments have been implemented (SER 2006). Prior to creating the goals and objectives for a restoration plan, it is important to define a reference ecosystem, site, or condition first (Apostol 2006). Having a well-defined reference site or condition will provide a target to work towards for the restoration goals and objectives. If there is no target ecosystem or condition defined for the project goals to work towards, then success of the treatments will be difficult to measure.

Reference ecosystems or conditions can be derived from many sources: written descriptions, early land surveys, old photographs, pioneer journals, oral histories, archaeological records, paleoecological evidence, and TEK (Anderson 2005; Apostol 2006; Senos et al. 2006). Restoration ecologists and ecological practitioners have been slow to accept and consider TEK in restoration planning (Higgs 2005; Senos et al. 2012). However, it is necessary to recognize the influences Indigenous peoples have had on landscapes, and to consider that all natural ecosystems are culturally influenced in some manner (SER 2006). Past Indigenous resource management practices are responsible for some of the ecosystems in existence today such as Garry oak ecosystems and clam gardens (Deur and Turner 2005; Pellatt and Gedalof 2014; Turner 2014). The utility of this approach will be emphasized for this restoration plan. TEK and TREM, along with the input and values of the Songhees First Nation and *Súlhlima*, and more general Indigenous environmental views have been incorporated throughout the planning and implementation of this restoration.

The reference condition for this project is based on plant species assemblages pre-dating the abandonment of the islands in the early 1960s. Pre-abandonment vegetation assemblages at

Tl'chés will be ones absent of introduced invasive Eurasian plant species. An additional component of restoring this site to a pre-abandonment condition will be through re-connecting the Songhees and TREM practices to the wetland vegetation, and the associated estuarine root garden. TREM activities associated with managing root gardens include: fertilizing, digging, weeding, transplanting, and harvesting (Deur 2005; Turner et al. 2013). The practices of managing root gardens, and the harvesting of wetland and riparian plants, will need to be re-introduced to the landscape to effectively restore this ecosystem, and associated cultural practices.

5.2 Interviews

On 17 February 2017, Darcy Mathews and I conducted an interview of *Súlhlima* at the Songhees Wellness Centre, 1100 Admirals Rd, Victoria, B.C. The interview audio was recorded to transcribe the interview into text, and for accuracy. We addressed the questions to *Súlhlima*, and Songhees ethnobotanist/archaeologist Wilfred George was in attendance and contributed. The purpose of the interview was to learn and understand what the islands were like when *Súlhlima* lived there, and to understand her desired outcomes for the wetlands and *Tl'chés*. I asked questions directly related to the wetlands to understand and document the changes that have occurred in her lifetime (interview questions in *Appendix C*). Information gathered from the interview has been used throughout this report to develop the reference conditions, desired future outcomes and goals, and information regarding Songhees' culture as it pertains to the wetlands. This research has required a Certificate of Ethics Approval from the University Research Ethics Board through the Office of Research Ethics at SFU (*Appendix D*).

5.3 Estuarine Root Gardens and Traditional Resource Management

The reconnection of the Songhees peoples to this landscape by managing root gardens, harvesting plants, and carrying forward cultural practices, is a major project goal. This section presents the traditional practices associated with managing a traditional estuarine root garden, and the benefits of continually harvesting plant resources from within the wetland watershed. Some of the traditional practices and management techniques will be incorporated into this restoration plan. A detailed table of plants and their traditional uses can be found in *Appendix B.*

An estuarine root garden is an area of land in the intertidal zone that is deliberately modified to increase the optimal growing area and increase production of edible root and rhizomatous plants, such as springbank clover and Pacific silverweed (Fig. 6) (Deur 2005; Turner 2015). Root gardens are a form of Indigenous horticulture, sharing similar end goals of modern agriculture, but differing in appearance and organization. This difference in appearance of gardens resulted in the early explorers disregarding this as a form of agricultural technology, describing the gardens as purely 'natural' landscape features (e.g., Garry oak savannahs, springbank clover gardens) (Deur 2005; Deur et al. 2013).

Figure 6. Edible rhizomes of Pacific silverweed (right); dense patch of Pacific silverweed in the estuarine root garden. Photos: G.R. Nicholas 2017.

The management of a traditional root gardens is similar to modern gardening and agricultural practices. Traditional management and harvest techniques include: clearing the land of rocks and debris, transplanting propagules, fertilizing and modifying soils, improving irrigation and drainage, and clearing and weeding out competing or undesirable plants (Turner and Kuhnlein 1982; Deur 2005; Fowler and Lepofsky 2011; Turner 2015). Digging sticks are constructed for harvesting, and are usually made out of Pacific yew trees or other hard durable wood (Pojar and MacKinnon 2011; Turner and Cocksedge 2001; Turner and Hebda 2012). During the harvest,digging sticks are plunged into the ground and leveraged back to loosen up the soil and expose the roots (Fowler and Lepofsky 2011). This form of digging not only enables the people to better harvest the roots and rhizomes, but also “tills” the soil, thereby benefiting plant growth by loosening up soils (Fowler and Lepofsky 2011). Care is always taken to return smaller plants and any root bits back to the ground to ensure crops are available for a later date (Turner 2005).

Much care and ownership went into maintaining root gardens in the past (Turner and Kuhnlein 1982; Turner 2015). The remnant estuarine root garden within the restoration site will have traditional garden maintenance techniques incorporated into this proposed restoration plan. The first step will be to remove any encroaching invasive and unwanted shrub and grass species, followed by implementing the practices discussed mentioned above to the site. The final goal is to have a functional estuarine root garden to regularly harvest from, and to teach the younger generation of Songhees about this cultural practice, and have traditional foods available.

Other resource management techniques associated with some of the plants present in the wetlands and watershed include: coppicing willows trees to encourage optimal growth to harvest the bark to make reef nets; and harvesting of sedge and bulrush species for basket making, housing materials, floor mats, and duck decoys. Western yew branches are harvested to make digging sticks, wedges, harpoons, and the boughs for cultural bathing ceremonies, and the bark was collected for medicinal purposes. Pacific water-parsley was used as a medicinal plant (Deur 2005; Fowler and Lepofsky; Pojar and Mackinnon 2011; Turner 2015). With regular harvest, plant populations are kept smaller, reducing the demand of water resources. Continual harvest of these plants is recommended as part of this restoration plan.

5.4 Traditional Fire Management at Tl'chés

Prescribed burning is a traditional management practice that has been carried out by Indigenous cultures around the world for millennia (Boyd 1999; Lepofsky et al. 2000; Ford 2003; McGregor et al. 2012; Hoffman et al. 2016). The practice of prescribed burning was part of a cultural fire regime that deliberately manipulated the composition, structure, function, and production of certain habitats and cultural resources (Boyd 1999; Senos et al. 2006). The cultural fire regime included alternate seasonal burning set at varying intervals and intensities, burning at different locations or repeat locations over time, with a range of natural and artificial controls such as time of day, wind, slope, fuels, humidity and moisture on site, and location of natural fire breaks on the landscape (Anderson 1999; Senos et al. 2006). Fire had many benefits to the landscape and local resources, and prescribed burning was commonly done to manipulate local ecosystems to increase the productivity of economically important plants, to control unwanted plants or pests, and for promoting forage for game animals to be hunting (Anderson 1999; Turner 1999; Beckwith 2004; Senos et al. 2006; Lepofsky and Lertzman 2008).

The use of fire by the Indigenous people of the Pacific Northwest is well documented in ethnoecological research and literature, and this practice was an integral part of Strait Salish TREM largely defining the landscapes surrounding present day Victoria, B.C. (Turner 1999; Senos et al. 2006; Lepofsky and Lertzman 2008; Pellatt and Gedalof 2014). Frequent low intensity ground clearing fires were set to maintain Garry oak savannahs and grasslands by preventing tree encroachment, and to promote geophyte production (Beckwith 2005; Turner 2014). Starting with European colonization and the continued government control over natural resources, fire suppression replaced prescribed burning, as fire was deemed a destructive and negative disturbance threatening the livelihoods and economic interests of the new settlers (Hardy and Arno 1996; Boyd 1999; Brown et al. 2004; Pellatt et al. 2015). The cessation of regular low intensity burning on the landscape and other traditional management practices in the Strait Salish territory, has led to a shift in ecosystem and forest structure marked by an increase in tree encroachment and the reduction of the dominant Garry oak savannah ecosystems that existed in the area (GOERT 2013; Pellatt et al. 2015).

The importance of fire from both an ecological and cultural perspective and the influence that fire has had on the landscape at *Tl'chés*, is an important consideration when seeking to understand the ethnoecological history of the Islands. Although fire is not a component of this restoration prescription, it is an important consideration for future restoration works aiming restore *Tl'chés* and revitalize Songhees' cultural practices. The complete fire record at *Tl'chés* is currently not well known, however, given the intensive use of fire in the greater Strait Salish territory and the presence of fire evidenced on the landscape at *Tl'chés* suggests that prescribed burning would have been an important management tool on *Tl'chés*. The present forest composition, numerous fire-scarred trees, and the ubiquity of charcoal in soil profiles and in the archaeological record are congruent with the surrounding landscapes of Greater Victoria where the use of fire has been well documented (Turner 1999; Lepofsky et al. 2000; Beckwith 2004; Darcy Mathews pers. comm. 2017).

In addition to prescribed burning as a management tool in forest and savannah ecosystems, fire was also used in wetland ecosystem management (Ford 2003; McGregor et al. 2012; Hoffman et al. 2016). Given the extensive fire regime documented across Strait Salish territory and the evidence suggesting prescribed burning at *Tl'chés*, it is possible that fire management would have extended to include the wetlands at *Tl'chés*. The wetlands and surrounding watershed a may have been burned as part of the larger landscape as several fire scarred Douglas-fir trees are present surrounding the wetlands. Though fire is not a part of the current project, restoring the Indigenous practice of prescribed burning could be a cost effective restoration treatment method, and could be done in conjunction with a larger landscape scale burning. Fire would help reduce invasive plant biomass, and reduce the overall volume of plant species in the wetland watershed. Further research into restoring the cultural fire regime at *Tl'chés* should be undertaken in the future.

6.0 Ecological Trajectory

The ecological trajectory for any wetland site in the absence of human influence will follow the classical hydrarch succession of a wetland into a terrestrial ecosystem (Fig. 7) (Mitsch and Gosselink 2015). In this successional scenario, annual water draw-down provides the opportunity for plant species to germinate and occupy new fringe areas (Van der Valk 1981; Mitsch and Gosselink 2015). The wetlands will eventually be dominated by introduced agronomic grass species, blackberry, and hawthorn, annually dropping leaf litter and slowly building up with soil (Ballantine and Schneider 2009). The perennial and deciduous wetland plants and other plant species surrounding the wetland annually go into senescence, dropping leaves and transferring their energy into their root systems for winter dormancy. This process of dropping leaves inputs organic matter into the wetlands, and build soil gradually over many years. Soil will gradually infill the wetlands, continually supporting more terrestrial species, which slowly reduces the water holding capacity, and eventually changes the ecosystem type to a terrestrial system (Mitsch and Gosselink 2015). The invasive and native vegetation within and surrounding the wetlands have long life stages (e.g., blackberry, English ivy, hawthorn, Douglas-fir, Scouler's willow), and once populations are well established (which is this case in this these wetlands), the plants self-maintain by releasing seeds and self-propagate through vegetative shoots (Gaine et al. 2015). With increases in plant size and number of plants in the wetland, plant biomass being inputted into the system increases annually, increasing the ability for soils to develop. Over time the depression will fill in with more soil, reducing water holding capacity, and accommodate more terrestrial plant species. Eventually the wetland will evolve into a more terrestrial ecosystem.

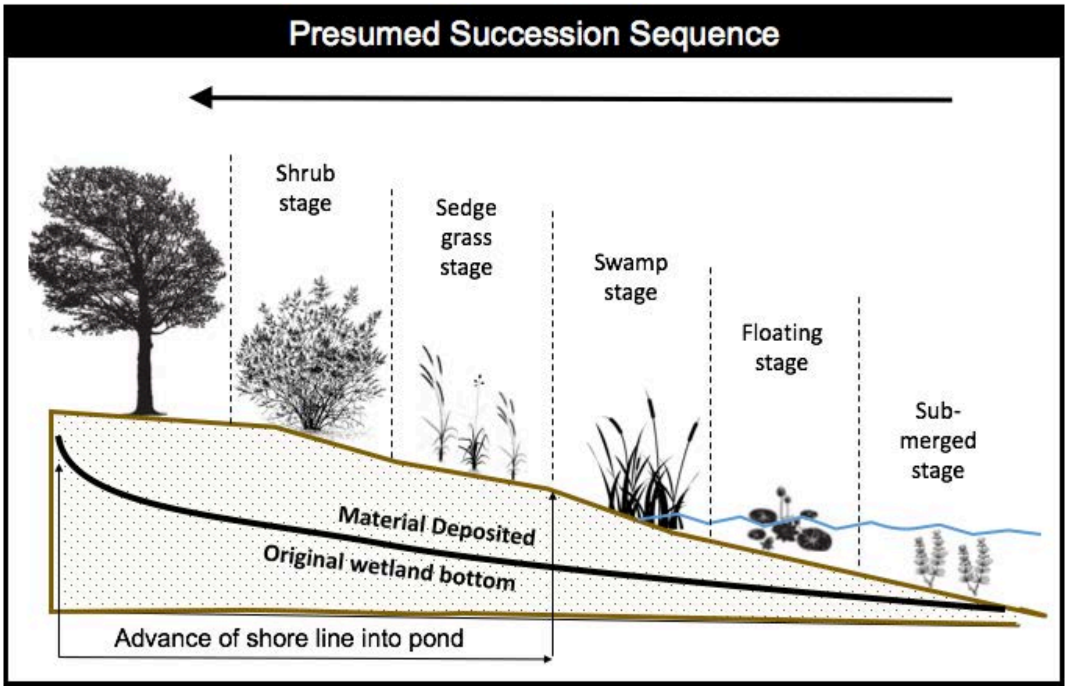

Figure 7. Classical hydrarch succession at the edge of a wetland (modified from Mitsch and Gosselink 2015).

Currently the wetland ecosystems at *Tl'chés* are on an ecological trajectory of prolonged degradation from invasive plants that are altering native plant compositions and hydrology. *Súlhlima* recalls how this wetland has changed over her lifetime. In the past these wetlands were regularly used for bathing and ceremonial purposes which had the effect of disrupting plant growth and soil development. The estuarine root garden plants (i.e., silverweed and springbank clover) may eventually be outcompeted by grass species, particularly springbank clover as it may be susceptible to competition from grass species (Fiona Hamersley-Chambers pers. comm. 2017), and will eventually become extirpated from the salt marsh (Fig. 8). When estuarine root gardens are not managed through TREM practices, competing plants encroach and eventually dominate the system (Deur 2005).

Figure 8. Estuarine root garden in study are at *Tl'chés (within dashed circle).* Native and invasive grasses are compteting with Pacific silverweed and springbank clover. Photo: G.R. Nicholas 2017.

There are two main restoration treatments needed in order to get this wetland to the condition that *Súlhlima* remembers, and back on the desired ecological trajectory. The first treatment will be to remove all the non-native plant species from within and surrounding the wetlands. The identified non-native plant species are not part of the native plant community and should be eliminated from the ecosystem in order to restore the wetland to a pre-European condition. The dominant invasive plant species (i.e., blackberry, hawthorn, English ivy, lamb's quarters, and agronomic grass species) are all prolific species that revegetate through seeds and vegetative propagation methods, that can consume large amounts of water, are competitive for space and resources with native species (Caplan and Yeaky 2010; ISCBC 2014; Gaire et al. 2015). If the non-native invasive plants are not removed, the negative influence they have on the wetlands will continue to persist, and the ecological trajectory of the wetland will continue as a heavily invaded and degraded landscape that is gradually moving to a more terrestrial ecosystem (Mitsch and Gosselink 2015). The second treatment will be to reduce the number of native trees and shrubs around the perimeter of the wetland. There are numerous deciduous and coniferous trees and shrubs surrounding the wetlands, most of which are young saplings or densely clustered populations of trees. In the past, Songhees TREM practices such as regular harvesting and potentially frequent low intensity burnings, would have removed the understory vegetation and maintained small populations and sizes of plant species. In other words, past Songhees wetland use of and TREM practices over millennia have directly influenced the ecological trajectory of the wetlands. In the absence of Songhees people at *Tl'chés*, plant species have been left unmanaged, and the wetlands are gradually moving towards terrestrial ecosystems, and if left untreated, will continually become more invaded and degraded. By addressing the invasive plants, and revitalizing Songhees TREM practices and presence on the landscape, the wetlands will be restored to the condition it was in prior to Songhees abandonment. Continued presence through use and on-going post-restoration maintenance will be required to ensure the desired ecological trajectory of these wetlands continues into the future.

7.0 Climate Change

The extent to which climate change will alter wetland ecosystems is not yet fully researched or understood. Possible effects include changes in hydrologic regimes (hydroperiods), increased heat stress from warmer average ambient temperatures, increased diseases and vectors, increased flooding, sea-level rise, and an increase in the spread of exotic plant and animal species, all of which could have negative effects on wetland watersheds (Erwin 2008). In low-lying coastal areas of British Columbia, there is a risk of sea-level rise as global mean sea-levels are predicted to increase 18 to 59 cm by 2100 (IPCC 2007; Lemmen et al. 2008; Walker and Sydneysmith 2008). Climatic conditions in the province are predicted to change with an increase in mean temperature of 2 to 7˚C by 2080, and more frequent and extreme weather events will occur (Walker and Sydneysmith 2008). Major hydrological changes with increased precipitation in the winter and spring, and hotter summers with increased drought, will also occur (Jensen 2005; IPCC 2007; Lemman et al. 2008; Madsent and Willcox 2012). All of these changes alter the reorganization of ecosystems, including changes in vegetation communities and species diversity (Brubaker 1998; Gavin et al. 2001). It is probable that the wetlands at *Tl'chés* are susceptible to climate change in four ways: 1) the proximity and low elevation to the ocean make the wetland susceptible to sea-level rise and increased salinity; 2) the reliance of water sources from precipitation, and the projected drier summer months that may result in the wetland being ephemeral indefinitely; 3) the small size of the water-holding basin of the wetland will be affected by prolonged droughts in the summer months; and 4) the current establishment of invasive plants currently growing there, and the accumulating seed bank in the soils, will continually put competitive pressure on the native vegetation for resources and space.

8.0 Restoration Prescription and Treatments

The primary goal of this project is to restore the wetlands to the pre-abandonment condition prior to the 1960s. Removing all invasive plants, and reducing the overabundant native plants within and surrounding the wetlands, will achieve this. The restoration plan will reduce water uptake from vegetation so that the wetlands will retain water for longer periods of time throughout the summer months. Secondary goals are to re-connect the Songhees people to the wetlands by implementing TREM practices to the estuarine root garden, and to encourage the harvesting of plants within and surrounding the wetland as part of cultural restoration and revitalization.

8.1 Metrics-of-Success

Success for this project is defined by three outcomes: 1) a 95% reduction of all invasive and non-native plants within the wetlands and watershed; 2) the retention of water within the wetlands throughout the summer months; and 3) the reconnection of the Songhees people to the wetlands to engage in TREM practices and harvesting of plants. Success of these outcomes will be determined: 1) through monitoring and comparison of pre and post restoration treatments conditions by measuring the extent of invasive plants in the watershed;

2) by recording the duration of water held in the wetlands; and 3) by documenting the use of the wetlands by the Songhees Nation over time.

8.2 Goals and Objectives

Goal 1: Restore the wetlands to pre-1960s abandonment conditions.

- ***Objective 1.1* –** Remove > 95% of the 2,271 m^2 of invasive plants from 1.5 acres of wetland perimeter and watershed by 31 July 2017.
    - ***Action 1.1.1*** – Manually cut down and remove Himalayan blackberry, English ivy, English holly, common hawthorn and European birch above ground biomass and roots from wetland perimeter using hand tools.
- ***Objective 1.2* –** Remove > 95% of the 238 m^2 of invasive plant biomass from within the 881 m^2 wetland depressions by 31 August 2017.
    - ***Action 1.2.1*** – Manually dig out and remove lamb's quarters, brass buttons, and grass species from within the wetland depressions using hand tools.
- ***Objective 1.3* –** Follow up invasive plant removal treatments in wetland depressions, perimeter, and watershed by 30 September 2017.
    - ***Action 1.3.1*** – Identify, map, and manually remove any newly sprouted or missed target invasive plants from the perimeter and within the wetland.

Goal 2: Restore native plant community in the estuarine root garden wetland to a pre-abandonment era.

- ***Objective 2.1* –** Remove > 95% of the 180 m^2 of invasive plants from the 356 m^2 estuarine root garden wetland by 31 August 2017.
    - ***Action 2.1.1*** – Manually dig out and remove grass species biomass and roots from wetland perimeter using hand tools.
    - ***Actions 2.1.2*** – Top and girdle the two birch trees, to kill the trees, but create wildlife trees to benefit native animal species.
- ***Objective 2.2* –** Follow up invasive plant removal treatments in root garden wetland by 30 September 2017

- ***Action 2.2.1*** – Identify, map, and manually remove any newly sprouted target invasive plants from the perimeter, and within the wetland.

Goal 3: Dispose of all invasive plants biomass removed from wetland watershed.

- ***Objective 3.1*** – Mulch and burn biomass in conjunction with the invasive plant removals between June and September 2017.
    - ***Action 3.1.1*** – Mulch removed invasive plants biomass using a gas-powered mulcher/shredder, and burn on site in metal barrels, or double-bag mulched invasive plant biomass and transfer by boat to mainland, then to a landfill.

Goal 4: Re-introduce traditional Songhees' resource and environment management techniques to the wetlands, as part of long term post-restoration maintenance.

- ***Objective 4.1*** – Encourage Songhees community members to harvest and manage the root gardens and other plant resources in the wetlands starting in September 2017.
    - ***Action 4.1.1*** – Manage the root garden by removing unwanted plants, aerating soil by digging, and harvest edible roots of springbank clover and Pacific silverweed.
    - ***Action 4.1.2*** – Harvest plant materials from sedges, bulrush, willow, dogwood, crabapples, and water parsley from within the wetland and perimeter, as needed.

Goal 5: Reconnect Songhees youth and community members back to the traditional lands through restoration activities, maintenance, and education.

- ***Objective 5.1*** – Enlist Songhees community members to carry out *Goals 1 - 4.*
    - ***Actions 5.1.1*** – Encourage Songhees youth and community members to participate in the restoration, and to continue the maintenance and monitoring.

9.0 Permits

The restoration site in on Songhees First Nations Reserve Land (No. 4), and is considered common band land. A letter of support from the Songhees Chief and Council has been submitted (*Appendix E).* Permission to research on a sacred Songhees site has been granted by *Súlhlima*.

10.0 Budget

The budget presented in *Appendix F* reflects the anticipated costs for the first and second year of this project.

CHAPTER 2: IMPLEMENTATION PHASE

11.0 Detailed Restoration Treatments

The initial invasive plant removal treatments along the perimeter and within the watershed can be implemented at any time of the year. I recommend the initial removal of aboveground blackberry biomass begin in February when other species are dormant, and to begin removing the dead blackberry canes to improve access for subsequent removals. Work in the spring is not proposed in order to avoid nesting birds (Bennett 2007). Removals will start again in June to dig out all invasive plants. Treatments within the wetland will not begin until the wetland has dried up (i.e., July - August). Follow-up treatments to remove newly sprouted invasive plants, or roots and plants that were missed should be done a month after the initial removal treatments. The proposed TREM activities should continue in the estuarine root garden for as long as there is interest from the Songhees to carry out the traditional practices of tending and harvesting.

Manual removal methods using basic hand tools such as clippers, rakes and shovels, will be used for the restoration. Mechanical removal treatments are labour intensive, but effective treatments (Gaire et al. 2015). Hand removal treatment is the most appropriate method for this site compared to using heavy machinery and chemical herbicide treatments for five reasons: 1) logistics of moving large equipment to the island; 2) relatively small size of the project site area, thereby making manual removals realistic and feasible; 3) sensitive cultural significance of the wetland and associated plants, some that will be harvested and consumed for foods and medicines; 4) sensitivity of animal species (amphibians) that use the wetland for varying life stages to chemical herbicide; and 5) inclusion of Songhees community members to participate in the restoration to fulfill Goal 5.

Removal treatments will be implemented in three phases (Phase A, B, C), with specific, ordered treatment plots (Plot 1, 2, 3, etc.) (Fig. 9). Phases and treatment plots are based on access (e.g., removal of all of blackberry to easily all areas), and timing of water draw-down in the wetlands. In general, the wetland perimeter areas will be treated first (Phase A), followed by the wetland depression (Phase B), and finally the root garden (Phase C). Different "staging" areas will be delineated for each phase. Breaking-up the work plan into multiple phases with several manageable treatment plots will keep the removal treatments organized, and on a small enough scale that the volunteers and workers are not overwhelmed and discouraged. In addition, this will enable the treatments to be easily repeated and monitored in subsequent years.

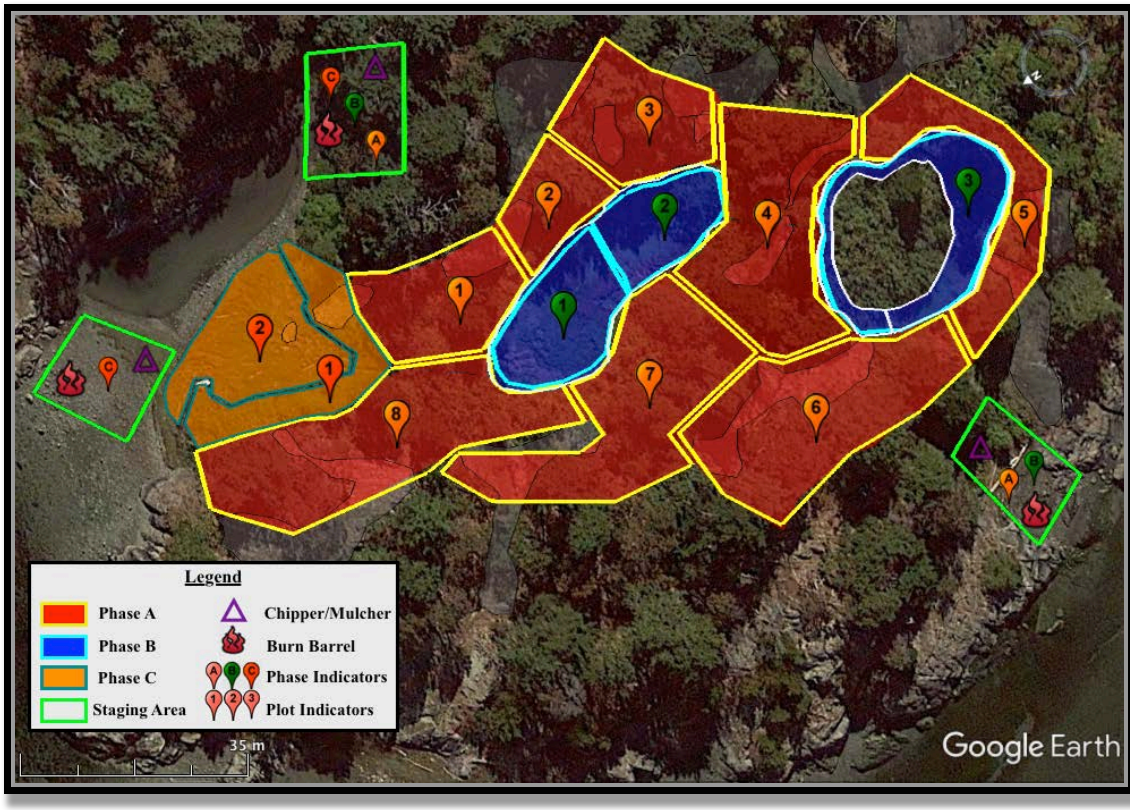

Figure 9. Proposed order of invasive plant removals (modified from GoogleEarth 2017).

11.1 Removal Methods

This section details the proposed methods for removing each target plant species, and the tools and safety equipment required.

Tools and Equipment Required:

i. ***Tools***: Shovels, rakes, pitchfork, mattocks loppers, hand pruners, hand saws, and tarps.

ii. ***Personal safety equipment***: Safety glasses, sturdy rubber or work boots, gloves (thick leather gloves when working with blackberry), and long sleeve shirts and pants.

Methods for Blackberry Removal:

Step 1: Use loppers or hand pruners to cut main blackberry canes (ISCBC 2014). Leave 10 cm of cane remaining in the ground. Leaving a 10 cm long cane will enable workers to locate the roots for removal in *Step 2*. Remove all above ground biomass from surrounding shrubs and trees with hands, rakes or pitchforks. Pile removed plant material onto tarps to move to designated area.

***Step 2*:** Locate blackberry stalks and dig out the root crown using shovels or mattocks (Gaire et al. 2015). Ensure all blackberry roots have been removed from the ground (ISCBC 2014). Care should be taken to avoid damaging the roots of native plants. Pile all removed roots and canes onto tarps and move to designated area.

Methods for common hawthorn and English holly:

***Step 1*:** Use loppers, hand pruners or saws to cut off branches, then cut main stalk as close to the soil as possible (ISCBC 2014). Mash the rooted stalk with a hammer to "frill" it and damage the cambium (Polster et al. 2006). Pile all removed material onto tarps and move to designated area.

***Step 2*:** For holly, pound a wooden stake into the ground beside the removed plant. Mark with flagging tape. A visual marker will ensure re-growth can be monitored, and re-treated in the years following. Repeat removals are required until the root system has been exhausted.

Methods for English ivy:

***Step 1*:** Begin pealing the vines out of the soil and off the native vegetation using hands (ISCBC 2014). English ivy can pull out relatively easily from the soil, and from tree trunks. For trees engulfed in ivy, begin by cutting the vines at the base of tree (GOERT 2002). Hold the base of the cut vine tight in your hand, and begin pulling it away from the tree. The vine should pull away from the bark. Pull away as much of the vine off the tree possible (GOERT 2002). For trees that have ivy growing high up, a ladder will be required to remove all ivy biomass from the tree. Pile all biomass onto tarp and move to designated area.

***Step 2*:** Use a shovel to dig out the roots of ivy, and pile onto tarp and haul to designated area.

Methods for lamb's quarters and Brass buttons:

***Step 1*:** Grab the main stalk of the plant as low to the soil as possible with hands, and pull out plant and root system entirely. Pile all removed plant material on tarp, and move to designated area.

11.2 Disposal Methods

All removed plant materials will be mulched using a gas powered chipper and mulcher machine. Two options for removing biomass from the island include burning the mulched material in metal barrels or on the beach, or hauling away the material off the island by boat to the landfill. The landfill disposal method will increase the budget for this project.

i. Equipment needed: Gas powered chipper/mulcher, gasoline, motor oil, burlap sacks, canvas tarps metal barrel(s), and metal screen (1/4 inch).

ii. Safety equipment needed: First aid kits, ear protection, safety glasses, gloves, spill-kits, rubber totes to store gasoline and oil containers, fire extinguishers, buckets, shovels and rakes.

11.3 Logistical Challenges/ Site Limitations

There are several logistical challenges with implementing restoration of the wetland. The most challenging aspect of the restoration is that the site is located on an island with no utilities, services, or infrastructure. All materials and personnel need to be transported to the site by boat, which limits on the size of equipment that can be used in the restoration. If the option of removing the invasive biomass from the island to the mainland landfill is implemented, the cost of the project will increase. Removing all the invasive biomass from the island will require all plant material to be double bagged in plastic garbage bags (ISCBC 2014), boated across Baynes Channel to the Oak Bay marina, and then transported to the landfill.

For cultural reasons, all work at *Tl'chés* needs to end around 1400 hours, and all personnel need to be off the islands by 1500 hours.

11.4 Potential Negative Effects of Restoration

Restoration activities can have unintended negative effects on the area being restored. Pulling and digging out plants will disturb soils, opening them up for invasive seeds to establish (Polster et al. 2006). Digging out invasive plants can damage the roots of native plants, and gas-powered equipment or machinery can potentially pollute the environment or compact soils, and increase the risk of fire. Proper care will be taken to minimize the damage cause by implementing the proposed restoration treatments. This section will identify the potential negative effects of this restoration plan will have on the landscape.

11.4.1 Environmental Concerns

The restoration treatments have the potential to affect native vegetation by damaging roots and trampling, disrupt soils, introduce pollution, increase the risk of fire, and potentially disrupt nesting birds and amphibians. Care will be taken when digging out invasive plant roots to avoid damage to the native plant roots. All volunteers will be taught the proper removal techniques and identification of target and non-target species. Digging out roots can also disturb and expose soils to erosion and support the re-invasion of invasive plants. Minimal soil disturbance is the goal to avoid excessive damage.

There is also the potential for petroleum products to contaminate the soils through the spilling of gasoline and oil when the chipper/mulcher equipment is in use; spill kits will be on site. Preventative measures to avoid spills will also involve having the mulching equipment on an impervious rubber mat, and storing all gas and oil cans in plastic totes. To prevent the risk of fires from hot equipment, and when burning biomass, fire extinguishers and water buckets will be on site, metal screens will be placed over the burn barrel, and the barrel will be placed on rocky substrate nearest the ocean. To prevent the possible spread of invasive plants or soil pathogens from dirty footwear and equipment, boots and equipment will be cleaned and disinfected prior to travelling to the island.

11.4.2 Archaeological Concerns

When working in a cultural landscape that has many recorded and unrecorded archaeological sites, proper care needs to be taken to avoid any damage to archaeological materials. Archaeological sites in B.C. such as shell middens, culturally modified trees, and burial cairns, to highlight a few, are protected in the province under the B.C. Heritage Conservation Act, through the Ministry of Forests, Lands, and Natural Resources Operations (FLNRO), and although the *Act* does not have jurisdiction on First Nations reserve lands, these sites are valued by the community. The restoration team has a responsibility to be aware of, or determine if the restoration site has any recorded archaeological sites or other cultural deposits or features that could be damaged as part of the restoration work.

No archaeological sites have been recorded within the *Tl'chés* study area. However, several unrecorded burial cairns, shell middens, stone tool materials, and CMTs have been identified close to and within the watershed. Additionally, there is the possibility for wetsite deposits such as preserved organic cultural materials in the study area, this could include digging stick tips, buried wooden posts demarcating family root garden plots, and basketry materials. Proper care and attention will be taken when digging out invasive plant roots. Personnel trained in identifying archaeological features and artifacts will be on site during this process.

CHAPTER 3: POST-IMPLEMENTATION PHASE

12.0 Monitoring Plan

The monitoring plan for this restoration project will focus on measuring the success of vegetation removal treatments (native and non-native/invasive), and the effects that the reduction of plants have on hydrology (water levels). Vegetation monitoring will provide information on the success of the removal treatments, including possible missed plants, or areas that need re-treatment. Monitoring water levels will help evaluate if removing invasive plants has had an improvement on water retention for longer periods over the summer months. Monitoring will be done once annually, and should be continued for a minimum of five years. Monitoring can be conducted by anyone trained in the steps noted in this monitoring section. Songhees members will be trained in all aspects of restoration treatments, monitoring procedures, encouraged to take over the monitoring program. The sections below outline the detailed monitoring plan for each targeted variable.

12.1 Vegetation

Vegetation monitoring will evaluate the success of the removal treatments from the three phases (A, B, C), of the restoration treatments. Phases A and C (treatments in wetland perimeter, watershed, and estuarine root garden), will follow the same method for assessing the current extent of invasive plants (*Section 3.1.2*). This involves walking around the perimeter of the invasive plants, and mapping the extent of the species within each treatment plot with a handheld GPS unit. The monitoring data will then be uploaded to a mapping program, polygons delineated, and then compared to the pre-restoration baseline invasive plant extent on the landscape. Phase B (treatments within the wetland), will be monitored using the previously established transects and vegetation plots (*Section 3.1.2*). Using a 1x1 m quadrate, percent cover of all plant species in the plot will be recorded. Post-restoration monitoring for the transects should be done following the removal treatment, and again before the next treatment is scheduled the following year.

Success of the treatments will be evaluated by comparing the post-restoration monitoring results to the pre-restoration baseline conditions. For vegetation, success will be achieved if over 95% of invasive plants are removed during the first two years of treatments.

12.2 Hydrology

Hydrological monitoring will require measuring water levels within the wetland. Monitoring will evaluate whether or not the vegetation removal treatments are having an effect on maintaining water in the wetland longer (i.e., not drying up as fast in the summer months). This will be evaluated by comparing baseline data on drying times from year to year from pre and post-restoration treatments. This monitoring will require someone to visit the island once a week at minimum during the summer months, and record the day of the month that the wetland dries up. Alternatively, a remote field camera could be installed along with a water gauge to photograph the daily water levels. This will require someone to collect the photograph data monthly, and reduce the number of trips over to the island. A piezometer or water level gauge should be installed in the wetland to provide consistent monitoring. Climatic weather data will also need to be monitored to record summer precipitation and temperature values.

12.3 Monitoring Schedule

Table 3. Seasonally appropriate vegetation (**V**), and hydrology (**H**) monitoring schedule

Phase	*June*	*July*	*Aug.*	*Sept.*	*Oct.*
A	**V**	**V**	**V**	**V**	**V**
B	**H**	**V, H**	**V, H**	**V, H**	**H**
C		**V**	**V**	**V**	

13.0 Maintenance

Follow-up treatments and maintenance to the treatment areas in phases A, B, and C will be a critical component of this restoration plan. Restoration requires multiple treatments over several years to be successful. After the first and second years since removal treatments have been implemented, it is highly recommended that people continue to visit the wetland site on a regular schedule, to remove any newly sprouted invasive plants and measure water levels. If this is not done regularly, un-removed invasive plants, or newly germinated plants from the seed bank in the soil will grow large again and prologue the problem, making restoration time consuming and expensive once again.

An additional component of the on-going maintenance required for this restoration plan will be the continued implementation of TREM practices coupled with the harvesting of the identified valued cultural plants. Having a continuous practice of Songhees harvesting the wetland watershed will ensure the human component is restored to the landscape, and the ecosystem maintained as it had been since time-immemorial.

14.0 Next Steps

The wetland restoration plan outlined in this document is specific to one wetland watershed on West Chatham Island. However, other wetland ecosystems at *Tl'chés* can use this plan as the initial framework to guide restoration. Some areas and components of the wetlands will require additional research (e.g., hydrology, wildlife, climate, archaeology) to fully understand additional components, and to answer questions still present about the ecological history of this wetland watershed. Invasive plant removals and regular maintenance, monitoring, and TREM should continue throughout the island on a regular basis. A continued presence of Songhees community members working at resorting *Tl'chés* will ensure that the landscape is free of unwanted vegetation and that the ecosystems are tended to, as it had been for thousands of year

Literature Cited

Anderson, M.K. 1996. Tending the wilderness. *Restoration & Management Notes* 14:2.

Anderson, M.K. 1999. The fire, pruning, and coppice management of temperate ecosystems for basketry material by California Indian tribes. *Human Ecology*. 27(1): 79-113.

Anderson, M.K. 2005. Tending the wild: Native American knowledge and the management of California's natural resources. University of California Press, Berkeley, California.

Apostol, D. 2006. Ecological restoration. Pages11-25 in D. Apostol and M. Sinclair (eds), Restoring the Pacific Northwest ecosystems: the art and science of ecological restoration in Cascadia. Island Press, Washington, DC.

Barnett, H.G. 1955. The Coast Salish of British Columbia. *Studies in Anthropology*. No.4. University of Oregon Monographs. Eugene, OR.

Ballantine, K. and R. Schneider. 2009. Fifty-five years of soil development in restored freshwater depressional wetlands. *Ecological Applications*. 19(6), pp 1467-1480.

Batzer, D.P. and A.H. Baldwin. 2012. Wetland habitats of North America: ecology and conservation concerns. Oakland, CA: University of California Press.

Beckwith, B.R. 2004. The queen root of this clime: ethnoecological investigations of blue camas (Camassia quamash, C. leichtlinii*; Lilaceae*) landscapes on southern Vancouver Island, British Columbia. Ph.D. dissertation, University of Victoria, Victoria, B.C.

Bennett, M. 2007. Managing Himalayan blackberry in western Oregon riparian areas. *Extension Services*. Corvallis, OR: Oregon State University.

B.C. Conservation Data Centre (BCCDC). 2014. Occurrence Report Summary, Shape ID: 2132, Macoun's meadow-foam. B.C. Ministry of Environment. Available: http://delivery.maps.gov.bc.ca/ess/sv/cdc, (accessed Jan 24, 2017).

B.C. Conservation Data Centre (BCCDC). 2017. Conservation Status Report: *Limnanthes macounii*. B.C. Ministry of Environment. Available: http://a100.gov.bc.ca/pub/eswp/ (accessed Jan 17, 2017).

Birnbaum, C.A. 1994. Preserving cultural landscapes: planning, treatment and management of historic landscapes. Preservation Briefs (36). National Parks Service, U.S. Department of the Interior. Available online at https://www.nps.gov/tps/how-to-preserve/briefs/36-cultural-landscapes.htm, (accessed October 2016).

Boas, F. 1890. Second general report on the Indians of British Columbia. 60th report of the British Association for the Advancement of Science for 1890: 562-715.

Boyd, R. 1999. Indians, fire and the land in the Pacific Northwest. Corvallis, OR: Oregon State University Press.

Brown, R.T., J.K. Agee and J.F. Franklin. 2004. Forest restoration and fire: principles in the context of place. *Conservation Biology*, Vol. 18, No. 4.

Brubaker, L. 1998. Vegetation history and anticipating future vegetation change. Pages 41-6. in J.K. Agee and D.R. Johnson (eds), Ecosystem management for parks and wilderness. Seattle, WA: University of Washington Press.

Campbell, N.A., J.B. Reece, M.R. Taylor and E.J. Simon. 2006. Biology: concepts and connections. 5th Ed. San Francisco, CA: Pearson Education Inc.

Carlson, R.L. 1996. Introduction to early human occupation in British Columbia. Pages 3-20 in R.L. Carlson and L.D. Bona (eds), Early human occupation in British Columbia. Vancouver, BC: UBC Press.

Clewell, A.F. and J. Aronson. 2013. Ecological restoration: principles, values, and structure of an emerging profession. Washington, DC: Island Press.

Corntassel, J. and C. Bryce. 2012. Practicing sustainable self-determination: Indigenous approaches to cultural restoration and revitalization. *The Brown Journal of World Affairs* 18(2).

Cuerrier, A., N.J. Turner, T.C. Gomes, A. Garibaldi and A. Downing. 2015. Cultural keystone places: conservation and restoration in cultural landscapes. *Journal of Ethnobiology* 35(3): 427.

De Groot, R.S., M.A.M. Stuip, C.M. Finlayson and N. Davidson. 2006. Valuing wetlands: guidance for valuing the benefits derived from wetland ecosystem services. Ramsar Technical Report No. 3/CBD Technical Series No. 27. Ramsar Convention Secretariat, Gland, Switzerland & Secretariat of the Convention on Biological Diversity, Montreal, Canada.

Delesalle, B. and B. Brokenshire. 1998. Understanding wetlands: a wetland handbook for British Columbia's' interior. Kamloops, BC: Ducks Unlimited Canada.

Demarchi, D.A. 2011. The British Columbia ecoregion classification. Ecosystem Information Section. Victoria, BC: Ministry of Environment.

Dennehy, C., E.R. Alverson, H.E. Anderson, D.R. Clements, R. Gilbert and T.N. Kaye. 2011. Management strategies for invasive plans in Pacific Northwest prairies, savannas, and oak woodlands. *Northwest Science*. Vol.85, No. 2.

Deur, D.M. 2005. Tending the garden, making the soil: Northwest Coast estuarine gardens as engineered environments. Pages 296-327 in D.M. Deur and N.J. Turner (eds), Keeping it living: traditions of plant use and cultivation on the northwestern coast of North America. Seattle, WA: University of Washington Press.

Deur, D.M. and N.J. Turner. 2005. Keeping it living: traditions of plant use and cultivation on the northwestern coast of North America. Seattle, WA: University of Washington Press.

Deur, D., N.J. Turner, A. Dick, D. Sewid-Smith and K. Recalma-Clutesi. 2013. Subsistence and resistance on the British Columbia coast: Kingcome village's estuarine gardens as contested space. *BC Studies*. (179), 13-37, 255-256.

Dordio, A., A.J.P. Carvalha and A.P. Pinto. 2008. Wetlands: water "living filters"? Pages 15-72 In: R.E. Russo (ed), Wetlands: ecology, conservation and restoration. New York. NY: Nova Science Publishers, Inc.

Duff, W. 1969. The Fort Victoria treaties. *BC Studies* (3)3-57.

Egan, D., E.E. Hjerpe and J. Abrams. 2011. Why people matter in ecological restoration. Pages 1–19 in D. Egan, E.E. Hjerpe and J. Abrams (eds.), Human dimensions of ecological restoration: integrating science, nature and culture. Washington, DC: Island Press.

Erwin, K.L. 2008. Wetlands and global climate change: the role of wetland restoration in a changing world. *Wetlands Ecology and Management* 17(1).

Ford, R.I. 2003. Ethnoecology serving the community: a case study from Zuni Pueblo, New Mexico. Pages 71 – 87 in V.D. Nazarea (ed), Ethnoecology: situated knowledge/located lives. Tucson, AZ. The University of Arizona Press.

Fowler, C.S. and D. Lepofsky. 2011. Traditional resource and environmental management. Pages 285-304 in E.N. Anderson, D.M. Pearsall, E.S. Hunn and N.J. Turner (eds), Ethnobiology. Hoboken, NJ: Wiley-Blackwell.

Gaire, R., C. Astley, M.K. Upadhyaya, D.R. Clements and M. Bargen. 2015. The biology of Canadian weeds. 154. Himalayan blackberry. *Canadian Journal of Plant Science*. 95: 1-14.

Garibaldi, A. 2009. Moving from model to application: cultural keystone species reclamation in Fort McKay, Alberta. *Journal of Ethnobiology* 29(2): 323-338.

Gavin, D.G., J.S. McLachlan, L.B. Brubaker and K.A. Young. 2001. Postglacial history of subalpine forests, Olympic Peninsula, Washington, USA; The Holocene 11: 177-188.

Gayton, D.V. 2001. Groundwork: Basic concepts of ecological restoration in British Columbia. Southern Interior Forest Extension and Research Partnership, Kamloops, BC. SIFERP Series 3.

Garry Oak Ecosystem Recovery Team (GOERT) 2002. Best practices for invasive species management in Garry oak and associated ecosyetsm: Engligh ivy (*Hedera helix*). Available online at: http://www.goert.ca/documents/Best_Practices_for_Ivy_revised.pdf (Accessed April 2017).

Garry Oak Ecosystem Recovery Team (GOERT) 2011. Restoring British Columbia's Garry oak ecosystems: principles and practices. Available online at: http://www.goert.ca/documents/restorationbooklet/GOERT-restoration-booklet-all.pdf, (accessed October 2016).

Garry Oak Ecosystem Recovery Team (GOERT) 2013. Best management practices for Garry oak & associated ecosystems. Victoria, B.C. Available at: http://www.goert.ca/documents/GOERT-BMPs.pdf (accessed May 2017).

Gomes, T.C. 2012. Restoring Tl'chés: an ethnoecological restoration study in Chatham Island, British Columbia, Canada. Master's Thesis. University of Victoria, Victoria, BC.

Gomes, T.C. 2013. Novel ecosystems in the restoration of cultural landscapes of Tl'chés, West Chatham Island, British Columbia, Canada. *Ecological Processes* 2:15.

Green, R.N. and K. Klinka. 1994. A field guide to site identification and interpretation for the Vancouver forest region. Victoria, BC: British Columbia Ministry of Forests.

Hardy, C.C. and S.F. Arno. 1996. The use of fire in forest restoration. General Technical Report. United States Department of Agriculture. Forest Service. Ogden, UT. Intermountain Research Station.

Higgs, E. 2005. The two-culture problem: ecological restoration and the integration of knowledge. *Restoration Ecology* 13: 159-164.

Hoffman, K.M., D.G. Gavin, K.P. Lertzman, D.J. Smith and B.M. Starzomski. 2016. 13,000 years of fire history derived from soil charcoal in a British Columbia coastal temperate rain forest. *Ecosphere* Vol.7(7).

Howard, J., A. Sutton-Grier, D. Herr, J. Kleypas, E. Landis, E. Mcleod, E. Pirdgeon and S. Simpson. 2017. Clarifying the role of coastal and marine systems in climate mitigation. *Frontiers in Ecology and the Environment* 15(1): 42-50.

Intergovernmental Panel on Climate change (IPCC). 2007. Regional Climate Projections. Pages 1-43 in S.D. Solomon, M. Qin, Z. Manning, M. Chen, K. Marquis, B.M. Tignor and H.L. Miller (eds), Climate change 2007: The physical science basis. Contribution of working group I to the fourth assessment report of the intergovernmental panel on climate change. Cambridge, UK: Cambridge University Press.

Invasive Species Council of British Columbia (ISCBC). 2014. Invasive species toolkit for local Government: information for local Government, developers and real estate professional.

Williams Lake, BC: Invasive Species Council of British Columbia.

Invasive Species Council of British Columbia (ISCBC). 2014. Himalayan blackberry *Rubus armeniacus*. TIPS factsheet. Available at: http://bcinvasives.ca/documents/Himalayan_Blackberry_TIPS_Final_08_06_2014.pdf (Accessed April 2017).

Jenness, D. 1934. Origin of salmon Coast Salish field notes, Unpublished. Original Manuscript (No. 1103.6) in Ethnology Archives, National Museum of Civilization, Ottawa, ON.

Jensen, C.A. 2005. A hydrologic assessment of using low impact development to mitigate the impacts of climate change in Victoria, BC, Canada. Master's Thesis, Victoria, BC: University of Victoria.

Jose, S., H.P. Singh, D.R. Batish, R.K. Kohli and S. Bardhan. 2013. Invasive plant ecology. Boca Raton, FL: CRC Press.

Keddie, G. 2003. Songhees pictorial: a history of the Songhees people as seen by outsiders, 1790-1912. Victoria, BC: Royal BC Museum.

Kimmerer, R. 2011. Restoration and reciprocity: the contributions of traditional ecological knowledge. Pages 257-276 in D. Egan (ed), Human dimensions of ecological restoration: integrating science, nature, and culture, The science and practice of ecological restoration. Washington, DC: Island Press.

Lemmen, D.S., F.J. Warren and J. Lacroix. 2008. Synthesis. Pages 1-20 in D.S. Lemmen, F. Warren, J. Lacroix and E. Bush (eds), From impacts to adaptation: Canada in a changing climate 2007. Ottawa, ON: Government of Canada.

Lepofsky, D., D. Hallett, K. Lertzman, R. Mathews, A. McHalsie and K. Washbrook. 2000. Pages 218-239 in D.M. Deur and N.J. Turner (eds), Keeping it living: traditions of plant use and cultivation on the northwestern coast of North America. Seattle, WA: University of Washington Press.

Lepofsky, D. and K. Lertzman. 2008. Documenting ancient plant management in the northwest of North America. *Botany*, Vol.86. 129-145.

Lepofsky, D. 2009. The past, present, and future of traditional resource and environmental management. *Journal of Ethnobiology* 29(2): 161-166.

Levine, J.M., M. Vila, C.M. D'Antonio, J.S. Dukes, K. Grigulis and S. Lavorel. 2003. Mechanisms underlying the impacts of exotic plant invasions. *Proceedings of the Royal Society B*. 775-781.

Lutz, J.S. 2009. *Makúk*: *A new history about aboriginal-white relations.* Vancouver, BC: UBC Press.

Madsen, T. and N. Willcox. 2012. When it rains, it pours: global warming and the increase in extreme precipitation from 1948 to 2011. Washington DC: Environment Virginia Research & Policy Center.

MacKenzie, W.H. and J.R. Moran. 2004. Wetlands of British Columbia: a guide to identification. Resource Branch, Land Management Handbook. No. 52. Victoria, B.C: British Columbia Ministry of Forests.

Mathews, D. 2014. Funerary ritual, ancestral presence, and the Rocky Point ways of death. Ph.D. dissertation. Victoria, BC: University of Victoria.

McGregor, S., Lawson, V., Christophersen, P., Kennett, R., J. Boyden, P. Bayliss, A. Liedloff, B. McKaige, and A.N. Andersen. 2010. Indigenous wetland burning: Conserving natural and cultural resources in Australia's' world heritage-listed Kakadu National Park. Human Ecology, Vol, 38, No.6. pp.721-729.

Menotti, F. 2012. Wetland archaeology and beyond: theory and practice. New York, NY: Oxford University Press.

Mitchell, M. 1968. A dictionary of Songish, dialect of Straits Salish. Victoria: BC.

Mitsch, W.J. and J.G. Gosselink. 2015. Wetlands, 5th Edition. Hoboken, NJ: John Wiley & Sons, Inc.

Warner, B.G. and C.D.A. Rubes.1997. The Canadian wetland classification system, 2nd Edition. Wetlands Research Centre. Waterloo, ON: University of Waterloo.

Nicholas, G.P. 1998. Wetlands and hunter-gatherers: a global perspective. *Current Anthropology* 39(5): 720–731.

Nicholas, G.P. 2007. Prehistoric hunter-gathers in wetland environments: theoretical issues, economic organization and resource management strategies. Pages 46-62 in M. Lillie and S. Ellis (eds.), Wetland archaeology and environments: Regional issues, global perspectives. Oxford, UK: Oxbow Books.

Pellatt, M.G. and Z. Gedalof. 2014. Environmental change in Garry oak (*Quercus garryana*) ecosystems: the evolution of an eco-cultural landscape. *Biodiversity and Conservation* 23 (8): 2053-2067.

Pellatt, M.G., M.M. McCoy and R.W. Mathews. 2015. Paleoecology and fire history of Garry oak ecosystems in Canada: implications for conservation and environmental management. *Biodiversity and Conservation*, Vol. 24, Issue 7, pp. 1621-1639.

Pojar, J. and A. MacKinnon. 2004. Plants of the Pacific Northwest Coast: Washington, Oregon, British Columbia and Alaska. Vancouver, BC: Lone Pine International.

Polster, D., J. Soll and J. Myers. 2006. Managing northwest invasive vegetation. Pages 374–392 in D. Apostol and M. Sinclair (eds), Restoring the Pacific Northwest ecosystems: the art and science of ecological restoration in Cascadia. Washington, DC: Island Press.

Ramsar 2016. An introduction to the convention on wetlands. 5th Edition. Gland, Switzerland: Ramsar Convention Secretariat.

Reichard, S.H. and P. White. 2001. Horticulture as a pathway of invasive plant introductions in the United States: most invasive plants have been introduced for horticultural use by nurseries, botanical gardens, and individuals. *BioScience* 51 (2): 103-113.

Reyeys, J.E. 2011. Public participation and socioecological resilience. Pages 79 – 92 in D. Egan, E.E. Hjerpe and J. Abrams (eds.) Human dimensions of ecological restoration: integrating science, nature and culture. Washington, DC: Island Press.

Senos, R., F. Lake, N.J. Turner and D. Martinez. 2006. Traditional ecological knowledge and restoration in the Pacific Northwest. Pages 393-426 in D. Apostol and M. Sinclair (eds), Restoring the Pacific Northwest ecosystems: the art and science of ecological restoration in Cascadia. Washington, DC: Island Press.

Society for Ecological Restoration International Science & Policy Working Group. 2004. The SER international primer on ecological restoration. www.ser.org and Tucson: Society for Ecological Restoration International.

Suttles, W.P. 1974. Economic life of the Coast Salish of Haro and Rosario Straits. New York, NY: Garland Publishing Inc.

Suttles, W.P. 1990. *Central Coast Salish*. Pages 454-480 in, W.P. Suttles (ed), Handbook of North American Indians. Vol.7: Northwest Coast. Washington, DC: Smithsonian Institution.

Suttles, W. 2005. Coast Salish resource management: Incipient agriculture? Pages 181-193 in D.M. Deur and N.J. Turner (eds), Keeping it living: traditions of plant use and cultivation on the northwestern coast of North America. Seattle, WA: University of Washington Press.

Staveren, JV, D. Groff and J. Goodridge. 2006. Freshwater wetlands. Pages 150-172 in D. Apostol and M. Sinclair (eds), Restoring the Pacific Northwest ecosystems: the art and science of ecological restoration in Cascadia. Washington, DC: Island Press.

Turner, N.J. and M.A.M. Bell. 1971. The ethnobotany of the Coast Salish Indians of Vancouver Island. *Economic Botany* 25(1): 63-104.

Turner, N.J. 1999. “Time to burn”: traditional use of fire to enhance resource production by Aboriginal peoples in British Columbia. Pages 185-218 in R. Boyd (ed), Indians, fire and the land in the Pacific Northwest. Corvalis, OR. Oregon State University Press.

Turner, N.J. and W. Cocksedge. 2001. Aboriginal use of non-timber forest products in northwestern North America. *Journal of Sustainable Forestry* 13(3-4).

Turner, N.J. 2005. Earth's blanket: traditional teachings for sustainable living. Vancouver BC.: Douglas & McIntyre.

Turner, N.J. and K.L. Turner. 2005. "Where our women used to get the food": cumulative effects and loss of ethnobotanical knowledge and practice; case study for coastal British Columbia. *Botany* 86: 103-115.

Turner, N.J. and F. Berkes. 2006. Coming to understanding: developing conservation through incremental learning in the Pacific Northwest. *Human Ecology* 34:495–513.

Turner, N.J. and R.J. Hebda. 2012. Saanich Ethnobotany: culturally important plants of the *WSÁNEC* people. Victoria, BC: Royal BC Museum Publishing.

Turner, N.J., D. Deur and D. Lepofsky. 2013. Plant Management Systems of British Columbia's First Peoples. *BC Studies*. No. 179: 107-133.

Turner, N.J. 2014. Ancient pathways, ancestral knowledge: ethnobotany and ecological wisdom of Indigenous peoples of northwest North America, Volumes 1 and 2. Montreal, QB: McGill's University Press.

Van der Valk, A.G. 1981. Succession in wetlands: a Gleasonian approach. *Ecology*. Vol.62, No. 3. Pp. 688-696.

Vitousek, P.M., C.M. D'Antonio, L.L. Loope, M. Rejmanek and R. Westbrooks. 1997. Introduced species: a significant component of human-caused global change. *New Zealand Journal of Ecology.* Vol.21, No.1.

Walbran, J.T. 1977. British Columbia coast names. 1592–1906. Their origin and history. Vancouver, BC: J.J Douglas Ltd.

Walker, I.J. and R. Sydneysmith. 2008. British Columbia. Pages 329-386 in D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush (eds), From impacts to adaptation: Canada in a changing climate 2007. Ottawa, ON: Government of Canada.

Westbrooks, R. 1998. Invasive plants, changing the landscape of America: fact book. Washington, DC: Federal Interagency Committee for the Management of Noxious and Exotic Weeds (FICMNEW).

Williams, M. 1990. Understanding wetlands. Pages 322- 352 in M. Williams (ed), Wetlands: a threatened landscape. Cambridge, MASS: Basil Blackwell Ltd.

APPENDICES

APPENDIX A: Origin of Salmon

Jenness, Diamond (1934) The Saanich Indians of Vancouver Island. Unpublished manuscript, Royal British Columbia Museum, pp. 1-10.

Once there were no seals and the people were starving […] Two brave youths said to each other, "Let us go and see if we can find any salmon." They embarked in their canoe and headed out to sea, not caring in what direction they travelled. They journeyed for three and a half months. Then they came to a strange country. When they reached the shore a man came out and welcomed them, saying, "You have arrived." "We have arrived," the youths answered, though they did not know where they were. They were given food to eat, and after they had eaten their host led them outside the house and said, "Look around and see what you can see." They looked around and saw smoke from **q'xmín** (Indian consumption plant) that the steelhead, sockeye, spring and other varieties of salmon were burning, each for itself, in their houses.

The youths stayed in the place about a month. Their hosts then said to them, "You must go home tomorrow. Everything is arranged for you. The salmon that you were looking for will muster at your home and start off on their journey. You must follow them." So the two youths followed the salmon; for three and a half months they travelled, day and night, with the fish. Every night they took **q'xmín** and burned it that the salmon might feed on its smoke and sustain themselves. Finally they reached Discovery Island (**Ktces,;** ***Tl'chés***), where they burned **q'xmín** all along the beach; for their hosts had said to them, "Burn **q'xmín** along the beach when you reach land, to feed the salmon that travel with you. Then, if you treat the salmon well, you will always have them in abundance." Now that they had plenty of salmon at Discovery Island they let them go to other places - to the Fraser River, Nanaimo, etc. Because their journey took them three and a half months, salmon are now absent on the coast for that period. The coho said to the other salmon, "You can go ahead of us, for we have not yet got what we wanted from the lakes." That is why the coho is always the last of the salmon.

The young men now had salmon, but no good way of catching them. The leaders of the salmon, a real man and woman, taught them how to make **sxw!l!7** (purse nets), and how to use **q'xmín.** They also told the young men how their people should dress when they caught the salmon, and that they should start to use their purse net in July, when the berries were ripe. So today, when the Indians dry their salmon they always burn some **q'xmín** on the fire (or on top of the stove); and they put a little in the fish when they cook it. Also, when they cut up the salmon, before inserting the knife they pray to the salmon, that they may always be plentiful.

APPENDIX B:
Plant species uses table

Plant Species	**Traditional uses**	**Prevalence in watershed (L/M/H)**[1]
Pacific yew *Taxus brevifolia*	A prized species by all coastal First Nations. Heavy, tough durable wood. Named “bow plant” and “wedge plant” by different groups. ***Utility**:* Bows, wedges, clubs, paddles, digging sticks, adze handles, harpoon shafts, spears, fish hooks, halibut clubs, mat-swing needles, awls, dip-net frames, knives, dishes, spoons, boxes, dowels and pegs, drum frames, snowshoes, canoe-spreaders, bark scrappers, fire tongs, and combs. *Medicinal:* Bark used as an anti-cancer agent (*taxol*). ***Consumption:*** Needles were smoked. Fleshy berries eaten in small quantities – too many were said to make a woman sterile. ***Ceremonial:*** Bows used to scrub body for cleansing ceremonies, or spiritual work.	**M**
Scouler’s willow *Salix scouleriana*	***Utility**:* Peeled bark, split inner tissue into thin strands, and twisted into long rope. Rope for fishing lines, reef-nets, gill-nets, purse-nets, duck-nets. Bark used to “shingle” baskets. Tumplines, slings, and harpoon lines from bark. Young branches as fish weirs.	**H**
Shore pine *Pinus contorta*	***Utility**:* Cordage out of roots. Peeled sheets of bark as splints for broken limbs. Pitch for waterproofing canoes and baskets. Arrow shafts. Adhesive. Protective coating on Indian-hemp fishing nets.	**H**

	***Medicinal**:* Pitch and bark used medicinally. Gum applied to wounds. Poultice for heart pain, rheumatism, and made into tea for tuberculosis.	
Douglas-fir *Pseudotsuga menzisii*	***Utility**:* Wood for fuel, spear handles, harpoon shafts, spoons, dip-nets poles, harpoon barbs, fire tongs, salmon weirs, caskets, halibut and cod hooks. Pitch used for sealing joints, caulking canoes and water vessels. *Medicinal:* Medicinal salves for wounds and skin irritations. Torches.	**H**
Arbutus *Arbutus menziesii*	***Consumption**:* Cooked the red papery bark with camas bulbs to colour them pink. Small quantities of berries were eaten. ***Medicinal**:* Leaves and bark tea for colds, stomach problems, post-child contraceptive, and in ten-ingredient tea for tuberculosis and spitting up blood	**H**
Nootka rose *Rosa nootkatensis*	***Utility**:* Branches put in steaming pits, cooking baskets, and root-storage pits. ***Consumption**:* Leaves for food flavouring. Tender spring shoots eaten. Fruits eaten occasionally by some groups. Outer rind of fruit eaten raw. Young tender shoots peeled and eaten in spring. ***Medicinal**:* Branches or bark strips boiled to make tea used as eyewash to treat cataracts or enhance eyesight. Mashed leaves as poultice for sore eyes or abscess. Chewed leave applied to bee stings. Ripe hips steeped, mashed and fed to babies with diarrhea.	**L**
Oregon grape *Mahonia aquifolium*	***Utility**:* Bright bark used as a dye for baskets.	**L**

	Consumption: Berries eaten raw, or mashed, boiled and mixed with other types of berries for drying. Now berries made into jams and jellies. *Medicinal:* Berries used for liver, gall-bladder and eye problems. One Salish woman noted eating berries in quantity was only known antidote for shellfish poisoning. ***Ceremonial:*** Burning boughs during ceremonies	
Red-Osier dogwood *Cornus stolonifera*	***Utility:*** Branches used for salmon spreaders and basket rims. ***Consumption:*** Berries eaten by interior nations, and smoked by eastern nations. ***Medicinal:*** Bark used for tea	**M**
Slough sedge *Carex obnupta*	***Utility:*** Popular basket material for finely woven baskets. Mats and mattresses	**M**
American bulrush *Schoenopluctus*	***Utility:*** Basket materials. Mats and mattresses	**M**
Pacific silverweed *Potentilla anserine* ssp. *pacifica*	***Consumption****:* Important food sources. Rhizomes eaten – grew with springbank clover. Steamed in pit cooks. Dried for preservation. ***Medicinal:*** Tea made and drank as purgative. Boiled with other species and made into poultice. Root juice applied to inflamed eyes.	**M/H**
Springbank clover *Trifollium wormskjoldii*	***Consumption****:* Long, fleshy rhizomes eaten – very important food source. Dried and preserved for winter food. Steamed in pit cooks. Eaten dipped in grease	**L**
Pacific water-parsley *Oenanthe sarmentosa*	***Consumption****:* Stems eaten. Roots eaten coked or raw.	**M**

	Medicinal: Purgative. Roots chewed or soaked in water and drank for stomach disorders and headaches. Childbirth medicine to shorten labour.

[1]Prevalance of species assed through vegetation sampling.

References

Deur, D.M. 2005. Tending the garden, making the soil: Northwest Coast estuarine gardens as engineered environments. Pages 296-327 in D.M. Deur and N.J. Turner (eds), Keeping it living: traditions of plant use and cultivation on the northwestern coast of North America. Seattle, WA: University of Washington Press.

Deur, D.M. and N.J. Turner. 2005. Keeping it living: traditions of plant use and cultivation on the northwestern coast of North America. Seattle, WA: University of Washington Press.

Deur, D., N.J. Turner, A. Dick, D. Sewid-Smith and K. Recalma-Clutesi. 2013. Subsistence and resistance on the British Columbia coast: Kingcome village's estuarine gardens as contested space. *BC Studies*. (179), 13-37, 255-256.

Fowler, C.S. and D. Lepofsky. 2011. Traditional resource and environmental management. Pages 285-304 in E.N. Anderson, D.M. Pearsall, E.S. Hunn and N.J. Turner (eds), Ethnobiology. Hoboken, NJ: Wiley-Blackwell.

Pojar, J. and A. MacKinnon. 2004. Plants of the Pacific Northwest Coast: Washington, Oregon, British Columbia and Alaska. Vancouver, BC: Lone Pine International.

Suttles, W. 2005. Coast Salish resource management: Incipient agriculture? Pages 181-193 in D.M. Deur and N.J. Turner (eds), Keeping it living: traditions of plant use and cultivation on the northwestern coast of North America. Seattle, WA: University of Washington Press.

Turner, N.J. and M.A.M. Bell. 1971. The ethnobotany of the Coast Salish Indians of Vancouver Island. *Economic Botany* 25(1): 63-104.

Turner, N.J. 2005. Earth's blanket: traditional teachings for sustainable living. Vancouver BC.: Douglas & McIntyre.

Turner, N.J. and R.J. Hebda. 2012. Saanich Ethnobotany: culturally important plants of the *WSÁNEC* people. Victoria, BC : Royal BC Museum Publishing.

Turner, N.J. 2014. Ancient pathways, ancestral knowledge: ethnobotany and ecological wisdom of Indigenous peoples of northwest North America, Volumes 1 and 2. Montreal, QB: McGill's University Press.

APPENDIX C:
Interview questions

About Tl’chés

1. What does *Tl’chés* mean to you personally?
2. How important is *Tl’chés* to you, and to Songhees?
3. What is you hope/dream for *Tl’chés*?
4. How do you see ecological restoration helping cultural-restoration?
5. What do you hope I accomplish with this research?
6. Do you remember any animals at *Tl’chés*?
    a. Do you remember birds/frogs/snakes, small mammals (mice, voles)?
        i. What is the importance/significance of some of these animals?
7. What are your thoughts about the wolf?
8. Are there any plants that aren’t available to the Songhees these day?
9. Do you remember people managing root gardens, or talking about root gardens (clover)?

About wetlands specifically

1. How important is the bathing pool to you/ Songhees & your culture?
2. What do you want to see the wetland restore to?
    a. Why do you think we should restore the wetland?
    b. If they aren’t restored, what do you think would happen?
    c. Do you want to see Songhees using this wetland in the future?
    d. Would you be comfortable with people harvesting plants from the wetlands in the future? Or would you rather them go elsewhere to harvest plants?
3. When do you think this wetland stopped being used for ceremony and bathing?
4. Do you remember any plants from the wetland?

a. What plants are really important for either food/ceremony/materials?

b. After moving off *Tl'chés*, were there any plants that were not available for your family?

5. Do you remember people managing the wetlands?

    a. How would people manage/maintain them?

6. Was the bathing pool used for drinking water as well?
7. Was there water in the pool year-round? Or did it sometimes dry up?
8. Was the drinking water on the island at all salty?
9. Do you remember any additional stories/information about the bathing pools?

APPENDIX D

Ethics Approval

Board of Record
Simon Fraser University

8888 University Drive, Burnaby, BC V5A 1S6

SIMON FRASER UNIVERSITY

Certificate of Ethical Approval for Harmonized Minimal Risk Behavioural Study

Also reviewed and approved by:

University of Victoria ☒

Principal Investigator:	Primary Appointment:	Board of Record Approval Reference #:
Graham Nicholas	**Simon Fraser University**	**2016s0527**

Study Title: **Combining traditional ecological knowledge and resource management with ecological restoration, to restore sacred wetlands at Tl'ches (Chatham Islands, B.C. Canada)**

Study Approved: **Nov-29-2016** Expiry Date: **Nov-29-2017**

Research Team Members: Leah Bendell (Faculty Supervisor); Darcy Mathews; Scott Harrison

Sponsoring Agencies:

Documents Included in this Approval:

Study Details	2016 November 19
Consent Form	2016 November 19
Interview Questions	2016 November 19

This ethics approval applies to research ethics issues only and does not include provision for any administrative approvals required from individual institutions before research activities can commence.

The Board of Record (as noted above) has reviewed and approved this study in accordance with the requirements of the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS2, 2014).

The "Board of Record" is the Research Ethics Board designated on behalf of the participating REBs involved in a harmonized study to facilitate the ethics review and approval process. In the event that there are any changes or amendments to this approved protocol, please notify the Board of Record.

Board of Record Research Ethics Board Representative

Name: Dina Shafey **Title:** Associate Director, ORE

Signature: Dina Shafey

Digitally signed by Dina Shafey
DN: cn=Dina Shafey, o=Simon Fraser University, ou=Office of Research Ethics, email=dshafey@sfu.ca, c=CA
Date: 2016.11.29 13:15:14 -08'00'

Date: Nov-29-2016

Page 1 of 1

APPENDIX E

Permission letter for research from Songhees Chief Ron Sam

To the Office of Research Ethics at Simon Fraser University:

RE: Application number **2016s0527**

We, the Songhees First Nation, give Graham Roy Nicholas permission to conduct research on our traditional lands of Tl'chés (Chatham Islands).

This research involves investigating wetland ecosystems on Chatham Islands for the purpose of creating a restoration prescription to address environmental damage and degradation. This research will involve working closely with Elder Joan Morris to incorporate Songhees traditional ecological knowledge and values.

I, Chief Ron Sam, on behalf of the Songhees First Nation, approve Graham Roy Nicholas's research regarding wetland restoration on Chatham Islands.

1100 Admirals Road Victoria, BC V9A 2P6 Phone 250-386-1043 Fax 250-386-4161

APPENDIX F:
Budget

Year 1 (2017 -2018)

Labour costs

Category	Detail	Rate/Hour-Day	total cost
Travel	Boat operator and fuel - Travel Oak Bay Marina to Tl'ches: 30 days	$100 /Day	$3,000
Salaries and Wages	Songhees Cultural Worker/Monitor. Archaeological and cultural monitor: 30 days	$100 /Day	$3,000
Salaries and Wages	Restoration practitioner - project management - monitoring - report development: 30 days	$200/Day	$6,000
Salaries and Wages	Volunteer labour - invasive removals	In-kind	In-kind
			Total: $12,000

Equipment costs

Category	Details	Price and Quantity	total cost
Safety gear	Safety glasses	20 @ $5.98	$120.00
Safety gear	Gloves	20 @ $6.99	$140.00
Safety gear	Insect repellent	2 @ $11.83	$26.85
Safety gear	First aid kit	2@ $89.54	$179.10
Safety gear	Fire extinguisher	2 @ $78.40	$156.80
Safety gear	Spill containment mat	1 @ $98.55	$98.55
Safety gear	Spill kit	2 @ $66.00	$122.00
			Total: $843.30
Equipment	Chipper/mulcher	$1,040.50	$1,040.50
Tools	Shovels	8 @ $12.99	$104.00
Tools	Hard rakes	8 @ $19.99	$160.00
Tools	Loppers	8@ $21.98	$175.85
Tools	Hand pruners	6 @ $26.99	$161.95
Tools	Pruning shears	2 @ $25.99	$52.00
Tools	Pole pruner	1 @ 98.55	$98.55
Equipment	Canvas tarps	4 @ $49.99	$200.00
Equipment	Burlap sacks (10/pack)	20 @ $8.50	$170.00
Equipment	Gas can	1 @ $12.29	$12.29
Equipment	Cable (6ft steel)	1 @ $56.99	$56.99

Equipment	Padlock	1@ $ 19.95	$19.95
Equipment	Motor oil	5 L @ $19.59	$19.59
Equipment	Fuel Budget	$200.00	$200.00
			Total: $2,471.67
Consumables	Water jugs - 7 gal.	2 @ $41.31	$82.62
Consumables	Daily food budget	30 days @ $40.00	$1,200.00
			Total: $1,282.62
Contingency	Contingency fund (unforeseeable); 10% of project costs		**Total: $1,660**
			Project total costs: $18,257.59
			Year 1 Grand Total: $18,257.59 + 12% tax ($2,191) = $20,448.59

Year 2 (2018 - 2019)

Labour costs

Category	Detail	Rate/Hour-Day	total cost
Travel	Boat operator and fuel - Travel Oak Bay Marina to Tl'ches: 20 days	$100 /Day	$2,000
Salaries and Wages	Songhees Cultural Worker/Monitor. Archaeological and cultural monitor: 20 days	$100 /Day	$2,000
Salaries and Wages	Restoration practitioner - project management - monitoring - report development: 20 days	$200/Day	$4,000
Salaries and Wages	Volunteer labour - invasive removals	In-kind	In-kind
			Total: $8,000

Equipment costs

Category	Details	Price and Quantity	total cost
Safety gear	Safety glasses	20 @ $5.98	$120.00
Safety gear	Gloves	20 @ $6.99	$140.00
Safety gear	Insect repellent	2 @ $11.83	$26.85
Safety gear	Fire extinguisher	2 @ $78.40	$156.80
Safety gear	Spill containment mat	1 @ $98.55	$98.55
Safety gear	Spill kit	2 @ $66.00	$122.00
			Total: $664.20
Equipment	Canvas tarps	4 @ $49.99	$200.00
Equipment	Burlap sacks (10/pack)	20 @ $8.50	$170.00

Equipment	Motor oil	5 L @ $19.59	$19.59
Equipment	Fuel Budget	$200.00	$200.00
			Total: $589.59
Consumables	Water jugs - 7 gal.	2 @ $41.31	$82.62
Consumables	Daily food budget	30 days @ $40.00	$1,200.00
			Total: $1,282.62
			Project total costs: $10,536.41
			Year 2 Grand Total: $10,536.41 + 12% tax ($1,264.37) = $11,800.78

APPENDIX G:
Participant Interview Consent Form

Application number: 2016s0527

Study Title:

Eco-cultural restoration of wetlands at

Tl'chés (Chatham Islands, British Columbia, Canada).

You are invited to participate in a study entitled "Combining traditional ecological knowledge and resource management with ecological restoration to restore sacred wetlands at Tl'chés (Chatham Islands, British Columbia, Canada)" that is being conducted by Graham Nicholas for a Master of Science thesis at Simon Fraser University (SFU) and the British Columbia Institute of Technology (BCIT)

Who is conducting the study?

Principal investigator:

Graham Nicholas is a MSc. candidate in the joint masters program in Ecological Restoration in the Faculty of Environment at Simon Fraser University, and the School of Construction and Environment at the British Columbia Institute of Technology. He can be contacted for further questions via email at gnichola@sfu.ca, telephone at (778) 999-5885.

Faculty supervisors:

Graham Nicholas is under the supervision of Dr. Darcy Mathews (UVIC) and Dr. Scott Harrison (BCIT). You may contact them at dmathews@uvic.ca (250) 472-4941, or sharrison47@bcit.ca(604) 432-8322.

As a graduate student, Graham will be conducting his research as part of his thesis requirements for a Master of Science degree in the Ecological Restoration program. Information gathered from participants will be used in accessing background information and traditional knowledge to the wetlands at Chatham Islands, to be used in creating a restoration plan.

Why should you take part in this study?

This project is committed to providing guidance in the restoration of cultural and ecological features in Chatham Islands and within the Songhees First Nation territories, revitalizing traditional ecological knowledge on the landscape, and reversing trends of biodiversity and cultural loss. Combining community active participation is an integrative research approach, and this study will hopefully initiate innovative processes for restoration in Chatham Islands. The objectives of this study are to generate a better understanding of environmental change, the role of traditional knowledge for restoration, and to develop restoration strategies for the wetland ecosystems in Chatham Islands. Your input will greatly benefit this study, as your knowledge of the landscape will help identify goals of this project, and the best methods to restore the wetlands.

Importance of this Research

This research will be carried out in partnership with the Songhees community in order to satisfy the needs and interests of this First Nation regarding restoration in their traditional territory in Chatham Islands. This research will also address the growing need for incorporating traditional ecological knowledge to the field of ecological restoration. The aim is to show how building partnerships and working with First Nations from the beginning of a project, will render the project more successful in the long term.

Voluntary Participation

You are being asked to voluntarily participate in this study because of your importance to the community as a respected and knowledgeable person in providing important information about Chatham Islands and/or traditional plant use, wetland importance, or as a leader/influential person in shaping the future of the Songhees First Nation. You have the right to refuse to participate in this study. If you wish to participate, you may choose to withdraw from the study at any time without any consequences. Any information that you provide to Graham Nicholas can be withdrawn from the study, should you choose. Participants will be given 1-3 weeks to review the interview transcripts to ensure no information is in them, which the participants wish to not be shared.

Study Procedures - What is involved

If you agree to voluntarily participate in this research, your participation will include a 1-2 hour interview with main investigator, Graham Nicholas, and possibly Joan Morris and Darcy Mathews, at your convenience. The interviews involve a list of set questions, but will be semi-structured and open-ended, like a conversation, and will be recorded in audio for accuracy. All recorded material will be held in confidentiality if requested, and all information gathered will be secured on password locked electronic files. Location of interviews will be determined by location availability, and your availability to conduct the interview.

Inconvenience

Participation in this study may cause some inconvenience to you, including the time required for the interviews and for reviewing responses and outcomes of the research.

Potential Risks

There are some potential risks to you by participating in this research and they include fatigue in answering questions, or emotional distress in remembering past memories. To prevent or to deal with these risks I will be extremely careful to monitor people's state and energy during interviews and possible field outing. If field visits to Chatham Islands occur, life jackets will always be provided to participants and, trained and experienced personnel with appropriate navigation equipment will operate boats. Cultural knowledge is very important to me, and if at any time you feel your answers to questions should be kept out of the records, notify Graham and he will not include this information. Participants will be given 1-3 weeks to review the interview transcripts to ensure no information is in them, which the participants wish to not be shared.

Benefits of participating

The potential benefits of your participation in this research include recognition for your contribution to cultural ecological knowledge within the community and in the study of ecological restoration. This research is important to society in providing a clearer understanding of how traditional knowledge systems could support healthier and more sustainable ways of life, and promote restoration of areas that could be managed for the benefit of future generations. Research on traditional food systems of production and management, and the connections with environmental sustainability are relatively new; therefore, this research will contribute to the state of knowledge about the social and ecological roles of key food plant species, their habitats, and applications to the restoration of wetlands.

Voluntary Participation and Withdrawal

Your participation in this research must be completely voluntary. If you do decide to participate, you may withdraw at any time without any consequences or any explanation. If you do withdraw from the study your data will be included with or without your name removed in the study, following your wishes. A verbal agreement might be obtained, followed by a written note describing the agreement to ensure understanding. Participants will be given 1-3 weeks to review the interview transcripts to ensure no information is in them, which the participants wish to not be shared.

Confidentiality

All possible steps will be taken to remove your identity from the data and reports generated. All information obtained from interviews will be kept confidential. However, it must be noted that I, Graham Nicholas, cannot prevent other knowledgeable individuals from guessing or learning who the participants are. All data will be stored on password locked electronic files.

If you the participant wishes to remain anonymous, simply state this to Graham Nicholas, and

sign here: ____.

If anonymity is **not** required by you the participant, then please sign here:

____.

Dissemination of Results

It is anticipated that the results of this study will be shared with others through a thesis submitted as part of a Masters degree, and possibly through presentations at scholarly meetings, class presentations, internet, published article, chapter or book, newspaper, radio or TV, and directly to participants involved. If you wish to keep some information private, simply state what information would like to keep private during the interview. Participants will be given 1-3 weeks to review the interview transcripts to ensure no information is in them, which the participants wish to not be shared.

Disposal of Data

If participants give their written and oral permission, data from this study will be retained on password secured computers until the project is completed (minimum of two years). Data may be deposited in archives at SFU and BCIT, and at the Songhees Lands Office. If participants wish their data to be destroyed, this will be done through shredding of interview notes and deleting files from all computers. Participants will be given 1-3 weeks to review the interview transcripts to ensure no information is in them, which the participants wish to not be shared.

Future use of Participant Data

Interview data may be used for future studies beyond the two year minimum that the data will be stored at SFU and BCIT. Written consent to use the data will have to be acquired from the author (Graham Nicholas), and the participants (Joan Morris and Wilfred George). The duration that the Songhees First Nation will retain the interview data, will be dependent on them. If you wish to disallow this, please circle your decisions here:

YES (I am ok with future studies using the information I have provided for this study)

NO (I am not ok with future studies using the information I have provided for this study)

Your signature below indicates that you understand the above conditions of participation in this study and that you have had the opportunity to have your questions answered by the researchers.

Audio Recording of Interview

I agree to having the interview recorded by an audio recording device to ensure accuracy of information provided: Analysis (__) Dissemination (__) ____________ (Participant initials)

Who can you contact if you have questions about this study?

You can contact Graham Nicholas directly by email: Gnichola@sfu.ca, by phone: 778-999-5885, at any time.

Contact for Complaints

If you have any concerns about your rights as a research participant and/or your experiences while participating in this study, you may contact Dr. Jeffrey Toward, Director, Office of Research Ethics jtoward@sfu.ca *or 778-782-6593*

Future Contact

May I, Graham Nicholas, contact you in the future to participate in future studies?

Please circle: **YES / NO, Participant initials: ___________________________**

Participant Consent and Signature

Taking part in this study is entirely up to you. You have the right to refuse to participate in this study. If you decide to take part, you may choose to pull out of the study at any time without giving a reason and without any negative impact on your [examples should be relevant to the participant and could include references to employment, class standing, access to further services from the community center, day care, etc.].

- *Your signature below indicates that you have received a copy of this consent form for your own records.*
- *Your signature indicates that you consent to participate in this study.*
- *You do not waive any of your legal rights by participating in this study.*

____

Participant Signature (or Parent or Guardian Signature) | Date (yyyy/mm/dd)

____

Printed Name of the Participant (or Parent or Guardian) signing above