



Review of Management Activities in Buttertubs Marsh and Buttertubs West Marsh

FOR

City of Nanaimo

BY

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Review of Management Activities in Buttertubs Marsh and Buttertubs West Marsh

1 Introduction

In this report we review the management plan of Buttertubs Marsh and describe how it can be unified with the recently devised management plan for the adjacent Buttertubs West Marsh. We will also review the existing objectives and tasks that are used to achieve the two goals of the Buttertubs Marsh management plan. Our review of objectives and tasks will draw upon the last decade of experience acquired by the management group, concerned citizens and researchers who have all contributed to the stewardship of this highly valued component of the City of Nanaimo.

The Buttertubs Marsh/ Buttertubs West Marsh complex (BMC) comprises an area of almost 55 ha. The BMC, as considered in this review, includes land adjacent to those defined as 'Buttertubs Marsh' in the management plan (Buttertubs Marsh Conservation Area Co-Management Steering Committee 2004), Figure 1. These adjacent lands include riparian areas along the Millstone River, the Ecogift lands of

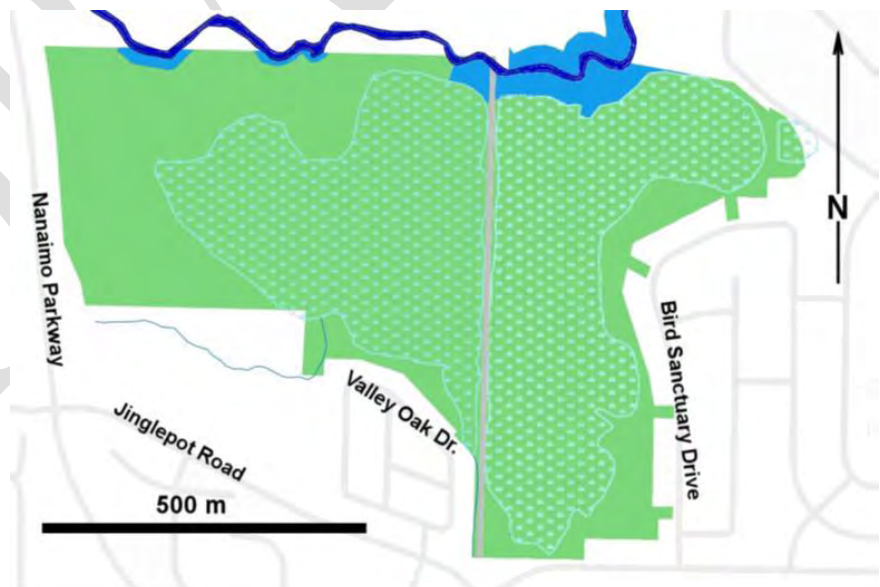


Figure 1: General characteristics of the Buttertubs Marsh Complex (BMC). Areas in Green are parks or conservation area within the complex. Dark blue indicates the Millstone River and light blue denotes riparian areas in the BMC complex. The water pipe which bifurcates the two marsh properties is shown as the vertical light grey line just to the right of center of the figure. Areas subject to regular inundation are shown as light blue stippling. This figure was adapted from the City of Nanaimo map server found online at maps.nanaimo.ca/nanaimomap/

Buttertubs West Marsh and parkland North and East of Valley Oak Drive. As of 2004 Buttertubs Marsh has been managed as a Conservation area by a co-management group. In 2011 The City of Nanaimo acquired the Buttertubs Marsh West property to be held with Ducks Unlimited Canada as Tenants in Common (Ducks Unlimited Canada and City of Nanaimo 2012).

Through the course of our review the team from Madrone Environmental Services (Madrone) met with representatives from the City of Nanaimo, the Nature Trust of British Columbia, the Buttertubs Marsh Liaison Committee, and researchers from Vancouver Island University. The observations and recommendations in this review are a reflection of the views of all these groups. This report can be divided into two components. The first is devoted to a review of how the Buttertubs Marsh management plan has succeeded and. The second section describes how adjacent lands, and Buttertubs Marsh West in particular, can be included in an overall management plan with Buttertubs Marsh, i.e., the BMC.

In order to focus on ways to implement and improve the existing Buttertubs Marsh management plan, this review will examine specific items listed as 'Tasks' in the management plan. The tasks will be rated to show the degree to which they were completed. Based on the task ratings and interviews with stakeholders in research and management in the BMC a suite of activities is proposed for a new monitoring program. The activities for the new monitoring program will include ongoing items under the tasks category of the management plan and new activities which provide the most information possible on ecosystem function and services, given the available budget.

2 Review of Management Goals and Objectives

2.1 The Buttertubs Marsh Management Plan.

The degree to which management objectives can be assessed for achievements and gaps, and to recommend improvements is dependent on an assessment of the tasks listed in the management plan. Appendix 1 Table A-1 shows each of the tasks and assigns a status to it based on field observations and stakeholder interviews made by staff from Madrone Environmental Services. In the original management plan management tasks were divided into ten categories to address the four management goals:

- 1** Property Administration and Planning
- 2** Protection

- 3 Additional Resource Inventories
- 4 Land Use Activities
- 5 Habitat Maintenance and Enhancement
- 6 Water Level Maintenance and Control
- 7 Wildlife Enhancement and Control
- 8 Exotic/Invasive Species Control
- 9 Domestic Dog and Cat Control
- 10 Trail and Facility Maintenance

Within these ten categories are 136 individual goals. An analysis of all tasks shows that since the inception of the Buttertubs Marsh management plan 78 (58%) have been completed, 24 (18%) are in progress and 34 (25%) have not been done. Almost two thirds of the tasks reside in just three of the categories: wildlife enhancement and control, exotic/invasive species control and trail/facility maintenance. The first two of these task groupings address the animals and plants in the Buttertubs Marsh ecosystem, the third task grouping addresses the way that humans interact with that ecosystem. Although a majority of wildlife management and control tasks have been achieved, the opposite is the case for tasks associated with management and control of exotic/invasive species. The trail/facility maintenance grouping of tasks has been overwhelmingly achieved. Almost 60% of all tasks achieved in the inception of the management plan are associated with trail and facility maintenance.

2.2 Property Administration and Planning

Eight of the nine the tasks associated with property administration and planning have been achieved. The success within this area reflects the active participation of an engaged stakeholder group and the continued guidance and support from staff from the City of Nanaimo, the Provincial Ministry of Forests, Lands and Natural Resource Operations, the Nature Trust of BC, and Ducks Unlimited Canada.

2.3 Protection

All of the tasks in this area have been accomplished. One significant achievement in protecting Buttertubs Marsh was the construction of fencing along the eastern boundary.

A more significant success was the acquisition of the West Marsh area, as documented in the Management Plan for Buttertubs Marsh West (Ducks Unlimited Canada and City of Nanaimo 2012). The West Marsh is a natural component of the Buttertubs Marsh complex and an important goal of this review is to integrate the management of the two marsh areas.

Although both Buttertubs and the West Marsh are henceforth to be managed as one entity, the nature of the acquisition of the West Marsh property necessitates a higher level of discretion in how it is managed. The West Marsh was acquired under the 'Ecological Gift' program administered by Environment Canada and monitored by the Canada Revenue Agency (Environment Canada 2011). The conditions of the Ecological Gift program allow land owners to transfer lands to governmental and non-governmental organizations for the purpose of preserving the ecological value of said land. In return both the donor and recipient can gain significant tax benefits to offset the cost of setting the land aside for preservation. A brochure from the Canada Revenue Agency describing the purpose and regulations governing the Ecogift program can be found as Appendix 3 (to be included in the final report).

Under the Ecological Gift program only very minor modifications can be made to designated land. It is noted in Environment Canada (2011) that the Ecological Gifts program

"...provides a way for Canadians who own ecologically sensitive land to protect nature and leave a legacy for future generations." In order to ensure the preservation of lands designated under the Ecological Gifts program Environment Canada considers a recipient to have changed the use of an ecological gift if the recipient:

- undertakes or tolerates any action that results in or could result in a diminution of the ecological condition or protection of the ecological gift;
- changes any of the terms of a conservation agreement (easement, covenant or real servitude); or
- fails to enforce the terms of the conservation agreements (easement, covenant or real servitude), which result in or could result in changes to the ecological condition of the property. "

The Buttertubs Marsh West management plan accounts well for such guidelines. The restrictions of the Ecological Gifts program should not, therefore, create an onerous burden on an amalgamated Buttertubs Marsh management plan. Indeed, the added

attention to ecological preservation will foster the extant goals that had been applied to Buttertubs Marsh in the 2004 management plan. Annual reviews of the Ecological Gift status of the West marsh property show that it continues to conform to all requirements set forth by Environment Canada, e.g., Bond (2014).

Another important aspect to tasks in this area is the integration of surrounding terrestrial and aquatic habitats into the effective area managed as part of the Buttertubs Marsh complex. Such areas include the riparian area surrounding the Millstone River, Valley Oak Park and Judson Brook. These lands form both boundaries and natural buffers for the marsh habitat. Such areas are important as a way of integrating more natural habitat into the urban environment.

2.4 Additional Resource Inventories

All of the tasks within this grouping are designated as in progress. This status, however, does not reflect a lack of devotion to these actions. Between 2004 and 2015 several inventory and monitoring tasks have been initiated in the Buttertubs Marsh complex. These activities have been fostered through the cooperation of the Buttertubs Marsh Committee with local stakeholders, governmental scientists and researchers from Vancouver Island University. Examples of such collaborative inventory/monitoring projects in the Buttertubs Marsh complex include;

- Western Painted Turtle (*Chrysemys picta*), e.g., Thorpe (2013),
- Virginia Rail (*Rallus limicola*),
- Amphibians and Snakes, e.g., (Wind 2014),
- Salmonids, e.g., (Gaboury and Kehler 2012),
- Songbirds, e.g., Demers (2013), and
- Small Mammals.

In addition to these monitoring projects considerable effort was dedicated to an inventory of plant species in Buttertubs Marsh in 2004. Given the effort being dedicated by these various groups there is sufficient capacity to ensure that significant changes in populations of species of concern will be detected to ensure continued responsible stewardship and management.

2.5 Land Use Activities

There has been a concerted effort to ensure that users of the Buttertubs Marsh complex are largely restricted to relatively low impact activities, e.g. nature walks and bird watching. Some conflict has arisen in that some members of the local community would like to see the trails in and around Buttertubs Marsh integrated into the regional parks system trail. There is some concern that this might exacerbate the existing difficulties in regulating the numbers of people engaged in activities such as jogging and biking. Inventory work on the use of the Buttertubs Marsh area has been conducted by Elizabeth Gillis and colleagues at Vancouver Island University (E. Gillis pers. comm).

Fall surveys conducted by this team demonstrate that between 2008 and 2014 approximately 7 to 13 people per hour make use of trails and facilities in the Buttertubs Marsh area. The vast majority of users have been engaged in walking and this percentage has been increasing every year from about 65% of users in 2008 to almost 80% of users in 2014. The number of runners has also increased from just under 10% in 2008 to approximately 15% in 2014. Persons walking dogs has always been a relatively small number and the proportion has been declining over the survey period, from about 10% of users in 2008 to under 5% in 2014.

One useful statistic arising from the survey is the breakdown of users by age groups. The surveys break down users into three categories: under 20, 'adult' and 'senior'. Seniors ranged between 25-45% of users in surveys, however, seniors only comprise 25% of the population of the city of Nanaimo (calculated as those over age 60 from Statistics Canada data online). This means that the intensity of use by seniors is usually much higher than would be suggested by their share of the population.

The high intensity of use by seniors is complemented by large numbers of adults with mobility and learning challenges. Although usage of the Buttertubs Marsh area by persons with disabilities was not included in surveys, this component of the user group is known to be significant to the management committee.

2.6 Habitat Maintenance and Enhancement

Just over half of the tasks in this objective were not completed. This area has proven to be challenging likely due to the logistical and financial challenges associated with mapping plants, devising management strategies, and implementing habitat modifications. In particular, management of reed canary grass and trees in the uplands habitats has proven

to be difficult. Clearing operations after trees have fallen pose a potential source of conflict. Public safety and protection of adjacent property must be balanced by the desire to provide opportunities for the creation of wildlife habitat in fallen and decaying trees, e.g., English Oaks. Furthermore many of the introduced tree species like Hawthorne and English Oaks could either be actively cut down and replaced with native species, e.g., Willows, Cottonwood, Pine and Douglas Fir, or simply allow such succession to occur naturally. The drawback of the former is cost and the latter is time.

Difficulties in habitat maintenance and enhancement may be exacerbated with the addition of the West Marsh area to the area managed under the Buttertubs Marsh management plan. Attention will need to be paid to the eutrophication that is occurring particularly in the growth of Hawthorn. It has been suggested by local naturalists that while the removal of Hawthorn would be a significant task at present, such removal will increase in cost and difficulty over the years and may become irreversible. A significant aspect to addressing this concern will be deciding how to maintain the marshy and aquatic characteristics of the West Marsh area. The conflict that may arise in this issue is that of maintaining obligations to manage water flow so as to protect human life and property while maintaining desired habitat characteristics in the Buttertubs Marsh complex.

2.7 Water Level Maintenance and Control

The question of how to manage water movement through the Buttertubs Marsh complex is the central one to ensuring the preservation of the aquatic nature of the marsh itself. There has been general success in maintaining water level at or near historic norms and the maintenance of water control structures has been adequate. A trickier issue will arise in decisions over how to manage natural alterations to water flow such as beaver dams. Given that climate change modelling suggests that Southeastern Vancouver Island is more likely to experience warmer and drier summer months in the coming years, it may be prudent to revisit the practice of removing beaver dams. Beaver dams may provide natural insurance against summer drying in the Marsh and may also help mitigate some of the undesirable habitat changes noted in the previous section. It may be necessary in the very near future to decide to what degree the management of the Marsh area should allow eutrophication and succession to progress versus the costs of dedicating human and financial resources to preserving aquatic features by artificial and natural means. The central question that must be answered is the relative risk to human life and property associated with preserving the aquatic nature of the marsh and the inherent variability that brings.

2.8 Wildlife Enhancement and Control

The majority of tasks in this area were devoted to the management of bird populations. Tasks assigned to promote the welfare of raptors have been accomplished since the inception of the management plan. Tasks dedicated to the control of 'nuisance' birds such as resident Canada Geese remain unachieved. Although there has been work done on the installation of a nesting platform for Osprey, this has had limited success in actually attracting the target species. It has been suggested by stakeholders that more attention be devoted to this task and the installation of nest boxes in general.

2.9 Exotic/Invasive Species Control

In this task area there has been significant progress in tasks associated with the management and control of Scotch Broom, Himalayan Blackberry, Reed Canary Grass and Tansey Ragwort. There has been a continued and concerted effort to remove or thin stands of these species when possible and replace them with native species. Control of Purple Loosestrife and Yellow Iris, however, has fallen short of expectations. Part of the lack of success in dealing with some invasive plants may arise from inherent difficulties in mapping the locations of stands of those associated with aquatic or semi-aquatic habitats.

Managing populations of introduced animal species such as Pumpkinseed Sunfish, American Bullfrog, and Eastern Cottontail Rabbits has proven to be more difficult to achieve. These animals are highly mobile. Removal of such creatures from an area like Buttertubs Marsh in one season is likely to be met with influxes of new individuals in following seasons or years. Eastern Grey Squirrels are also now commonly seen in the Buttertubs Marsh area. The summary of user group observations by VIU RMOT students (E. Gillis pers. comm.) shows that between 2008 and 2014 sightings of Eastern Grey Squirrels in Buttertubs Marsh has increased from one being spotted every five hours to just under one per hour. This trend is unlikely to reverse in the foreseeable future. The likelihood of effective removal of these animals is thus quite low given the near limitless seed population that exists outside the boundaries of Buttertubs Marsh.

2.10 Domestic Dog and Cat Control

Significant effort and success has been achieved in the control of negative effects that domestic dogs and cats may have on wildlife and habitat in Buttertubs Marsh. Observations of dogs, both on and off leash, and cats in Buttertubs Marsh have all declined

between 2008 and 2014 which is a good barometer of the degree of success in achieving these tasks

2.11 Trail and Facility Maintenance

This group of tasks was, by far, the most numerous in the management plan, 52 in all. Forty five of the assigned tasks in this area have been successfully achieved (almost 90%). The high quality of facilities and trails in Buttertubs Marsh is a good indicator of the degree of effort that has been devoted to this group of tasks. The two goals of creating lifetime memberships and the establishment of a kiosk as means of generating funds were not achieved.

3 Management Plan Achievements and Recommendations for Future Work

3.1 Assessment of the Buttertubs Marsh Management Plan

The Buttertubs Marsh management plan has 2 overarching goals and within each of those goals 3 objectives to focus on for meeting that goal:

- Goal 1: Maintain and, where possible, enhance plant and animal resources of the conservation area;
 - Objective 1: Provide wildlife habitat
 - Objective 2: Control exotic, invasive plant and animal species
 - Objective 3: Gradually increase wildlife habitat and species biological diversity
- Goal 2: Provide for compatible public recreational and educational use of the area;
 - Objective 4: Provide controlled public access
 - Objective 5: Provide wildlife and nature viewing opportunities
 - Objective 6: Provide public education opportunities

Given the assessment of tasks from the original management plan it is clear that both goals have been achieved. Some attention should be devoted to the objective of controlling exotic and invasive plant and animal species in Buttertubs Marsh. Much of the

recommendations will focus on ways to decide which invasive species to focus on and how to measure progress on that control work. Significant achievements have been made in the realm of monitoring animal species. This monitoring work can be used as an index to assess the success of Buttertubs Marsh management in the future. A new objective to foster the achievement of Goal 1 in the future will be establishing linkages between the management committee and researchers engaged in this monitoring work.

3.2 Assessment of the Buttertubs Marsh West Management Plan

The management plan for Buttertubs Marsh West has been in effect for only a few years. Much of the West Marsh management plan is dominated by the conditions of the Ecological Gift designation of the property. Nonetheless, the management plan for Buttertubs Marsh West is similar in its goals to the Buttertubs Marsh management plan, with the addition of a third goal of cooperative management. Given the sensitivity of the management committee to the restrictions imposed on management policy by the Ecological Gift designation of the west marsh, it would seem appropriate that the goal of cooperative management be extended to the management plan for the whole of the Buttertubs Marsh complex. A cooperative management approach has already been established *de facto* for the whole of the Buttertubs Marsh complex. It seems appropriate, therefore to simply recognize this and extend cooperative management as a *de jure* goal for the whole of the Buttertubs Marsh complex.

Many of the monitoring activities on animals would be more appropriately dealt with at the scale of the Buttertubs Marsh/West Marsh complex. Plant monitoring and control efforts directed towards invasive species will be very important for West Marsh in order to preserve its ecological value. One new task for the management committee, therefore, will be to review priorities for exotic and invasive species and how these may be dealt with differentially or similarly in Buttertubs Marsh and West Marsh.

4 Recommendations

4.1 Goals

As a means of integrating the management of both components of The Buttertubs Marsh complex, the goals of the management plan should be added to by extending co-management as an explicit goal. As an example of how the management goals could be integrated the

statement from the original management plan could simply be reworded as below (additions in **bold**):

- Goal 1: Maintain and, where possible, enhance plant and animal resources of the conservation area
 - Objective 1: Provide wildlife habitat
 - Objective 2: Control exotic, invasive plant and animal species
 - Objective 3: Gradually increase wildlife habitat and species biological diversity
 - Objective 4: Conservation of ecological values in West Marsh to maintain integrity of Ecogift designation

- Goal 2: Provide for compatible public recreational and educational use of the area
 - Objective 5: Provide controlled public access
 - Objective 6: Provide wildlife and nature viewing opportunities
 - Objective 7: Provide public education opportunities

- Goal 3: Cooperative Management
 - Objective 8: Ducks Unlimited Canada and the City of Nanaimo will hold title on the West Marsh property as “Tenants in Common” and manage the West Marsh property through a management agreement and management plan. The City of Nanaimo may in the future continue to refine management of the West Marsh Property.
 - Objective 9: The principle of cooperative management will include consulting with the other stakeholders on the Buttertubs Marsh management committee to integrate monitoring work, enhancement activities, and control of invasive species between Buttertubs Marsh and West Marsh.

4.1.1 Revision of Current Activities

An immediate task for the management committee will be to consider the management tasks in the old management plan that were not achieved, i.e, items marked red in the table in Appendix 1. In their consideration it may be useful to decide to;

- keep such tasks as is and redouble efforts to achieve them,
- alter the task in such a way as to render it achievable,
- drop these tasks from the management plan and devote resources to achievable tasks.

4.1.2 Addition of New Tasks

Even if all the tasks listed as unachieved were dropped from the management plan there would still be 102 tasks remaining to pursue. Given the limited resources of the management committee it would be unrealistic to extend these tasks too far. Indeed, many of the tasks left unachieved were rendered so by the relatively large resources of time, money, paid work and volunteer labour that many would require. Any new tasks assigned to the management plan will therefore need to be sensitive to the capital and human resources available to the management committee.

The most important consideration that will weigh into almost all extant and new tasks is that of water in the Marsh. Significant work is already underway to assess how changes in water level will affect the marsh habitat as well as the plant and animal species there. It may serve the committee well to develop an index of water levels, and persistence. for annual review ;

- New Task 1: Consider which tasks in the old management plan should be modified or dropped,
- New task 2: Develop indexes for water levels and persistence in the marsh area to contrast interannual changes and identify long-term changes in habitat.
- New Task 3: Evaluate the potential of leaving beaver dams in place as a means of preventing dewatering in West Marsh and mitigation of climate change effects.
- New Task 4: Create a priority list of invasive plants that can be removed or reduced in biomass using cost effective means. This should augment extant control efforts dedicated to Scotch Broom, Loosestrife and Yellow Iris.
- New task 5: Assess the cost and benefits if removing Hawthorn in West Marsh area and replacement with indigenous species like grasses and willows.
- New Task 6: Develop a liaison sub-committee to coordinate monitoring activities on species of management interest in the Marsh with VIU biology faculty. The subcommittee can prepare annual reports to review the following:

- volunteer hours dedicated to monitoring,
 - species being monitored and trends,
 - exploration of funding opportunities blending in-kind volunteer support with academic research, and
 - opportunities for ecosystem and habitat level research and monitoring.
- New Task 7: Develop policies to address eutrophication and succession in the Buttertubs Marsh complex. These two processes are a natural part of change in the habitat and the committee should consider to what degree resources should be spent to slow these changes.
 - New Task 8: Develop an integration policy to address how the Buttertubs Marsh complex will be part of the general Nanaimo Parks greenway.

4.1.3 Additional Monitoring Work / Stoplight Diagram

Annual reviews already provide excellent coverage of important factors describing the state of the Marsh and successes of management work. The following scoresheet is proposed to be used as an addendum to the annual review to provide a visual synthesis of improvements and deteriorations. This visual aid may help identify issues most acutely in need of management attention. Items in this table are not exhaustive and an additional task could be assigned to a subcommittee to consider quantifiable indexes that could be added to the stoplight diagram. Any of the examples below will involve dedication of new human and/or financial resources and thus would require close scrutiny for the prospect of monitoring work being carried out consistently and to a high standard in the long-term. Examples include;

- measurements of water quality, e.g., temperature, pH, nutrient loading,
- Counts of various bird species, e.g., Osprey and Virginia Rails or counts of bird functional groups, e.g., raptors and waterfowl. These counts could be derived by local volunteers and could also be adapted from Christmas Bird Count results
- Measurement of marsh area inundated at maximum and minimum extent and the persistence of these phases, particularly low water during the summer.

Table 1: Proposed stoplight diagram to visualize trends in biological assessment data in Buttertubs Marsh.

	Negative	Neutral	Positive
Number of bird species in VIU banding survey (annual total compared to previous year)	decrease>10		increase>10
Count of songbird species increasing or decreasing in banding survey	>50% decreasing		>50% increasing
Count of Geese	>50% increasing		>50% decreasing
Western Painted Turtle census (annual total compared to previous year)	decrease>10%		increase>10%
Salmon observed spawning in Millstone Rive reaches adjacent to Marsh (annual total compared to previous year)	decrease>10%		increase>10%
Annual average users per hour from VIU surveys	decrease>10%		increase>10%
Cumulative number of dogs and cats observed per hour (annual total compared to previous year)	increase>10%		decrease>10%
Estimated trend in Purple Loosestrife	increase>25%		decrease>25%
Estimated trend in Common Hawthorn	increase>25%		decrease>25%
Estimated trend in Scotch Broom	increase>25%		decrease>25%
Estimated trend in Himalayan Blackberry	increase>25%		decrease>25%
Estimated trend in Tansy Ragwort	increase>25%		decrease>25%
Estimated trend in Knotweed	increase>25%		decrease>25%
Estimated trend in Reed Canary Grass	increase>25%		decrease>25%
Estimated trend in Eastern Cottontail Rabbit	increase>25%		decrease>25%
Estimated trend in American Bullfrog	increase>25%		decrease>25%
Estimated trend in Eurasian Collared Dove	increase>25%		decrease>25%
Estimated trend in Eastern Grey Squirrel	increase>25%		decrease>25%

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APPENDIX 1

**Tasks from the Buttertubs Marsh
Management Plan and Their Progress
as of Oct. 2015**

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Table 1: Tasks from the Buttertubs Marsh management plan and their progress as of Oct. 2015

Colour Code

RED	INCOMPLETE / DECLINING
YELLOW	IN PROGRESS / NO CHANGE
GREEN	COMPLETED / IMPROVING

SECTION	SECTION NAME	TASK	STATUS
2.1	Property Administration and Planning	Organize three meetings each year, send out notices to confirm meetings,	GREEN
		Review annual report	RED
		Review rights of way	GREEN
		Plan up-coming year's activities	GREEN
		Review progress of identified activities	GREEN
		Review progress of activities & submit written reports for annual report	GREEN
		Prepare annual report for December meeting	GREEN
		Annual application for property tax reduction	GREEN
		Review all signed agreements & rights-of-way	GREEN
2.2	Protection	Purchase West Marsh	GREEN
		Establish fence or other visible boundary marker along east property line	GREEN
		Review encroachments, vegetation removal, unauthorized plantings, etc.	GREEN
		Do not renew expired agreement between TNT and property owners at 133, 137, 141 & 145 Bird Sanctuary Drive	GREEN
2.3	Additional Resource Inventories	Develop a resource inventory and monitoring program	YELLOW
		Birds	YELLOW
		Mammals	YELLOW
		Amphibians	YELLOW
		Reptiles	YELLOW
		Fish	YELLOW
		Insects and other Invertebrates	YELLOW
		Red and Blue Listed Fauna	YELLOW
		Red and Blue Listed Flora	YELLOW
		Wildlife Trees	YELLOW
2.4	Land Use Activities	Restricted to low impact recreational and educational endeavours	GREEN
2.5	Habitat Maintenance and Enhancement	Monitor vegetation in shallows and on nesting islands to determine timing for minor clearing	GREEN
		plan minor clearing operations	GREEN

		carry out minor clearing operations	
		Map Reed Canary Grass distribution and determine potential to replace with sedge meadow	
		Determine potential to increase open shallow water habitat	
		Monitor expansion of cattail & yellow iris from ground and aerial photos for planning control	
		Plan major modifications	
		Carry out major modifications	
		Develop a wetland vegetation survey protocol	
		Carry out wetland vegetation survey	
		Develop long term upland vegetation enhancement plan with annual objectives	
		Implement upland vegetation enhancement plan	
		Increase riparian shrub & tree habitat	
		Increase deciduous & mixed deciduous-evergreen woodland	
		develop protocol for an upland plant survey and vegetative cover mapping	
2.6	Water Level Maintenance and Control	North dyke annual maintenance	
		Pave overflow spillway to reduce erosion of core and stabilise surface	
		Remove beaver dam material from in front of marsh outlet debris grating	
		West dyke annual maintenance	
		Resurvey both staff gauges , re-set them to standard map/survey datum for the area and use standard metric scales for both	
		Review development plans for surrounding area to ensure supplementary water sources of runoff and seepage maintained	
		Maintain water at current level until thorough marsh resource & vegetation surveys undertaken & data analysed	
2.7	Wildlife Enhancement and Control	Develop nest box educational program	
		Conduct nest box educational program	
		Monitor & maintain nest boxes	
		Install perching poles for raptors	
		check perching poles for vandalism	
		check perching poles condition	
		Install Osprey nest pole	
		check Osprey nest pole for vandalism	
		check Osprey nest pole condition	
		Evaluate use of duck nesting baskets and locations critical to survival of young	
		Check condition and replace duck feeding and nesting signs as required	
		Develop a study to evaluate annual duck production over a 5-year period; carry out study	
		Canada Goose egg adding program	
		Check & replace, as required, stucco wire wrapped around trees to protect from beaver	

2.8	Exotic/Invasive Species Control	Map current distribution and density of exotic/invasive species	
		Monitor expansion and interspersions of Yellow Iris with Cattail	
		Mechanically remove Yellow Iris if indicated by study	
		Map location of Purple Loosestrife	
		Remove & BURN Purple Loosestrife flower heads only	
		Monitor for signs of beetle damage on leaves of plants	
		Thin Common Hawthorn and inter-plant with native seed & berry-bearing tree species	
		Remove Scotch Broom from north and west dykes	
		Remove Scotch Broom from along east trail as labour force permits	
		In east and south areas, remove Scotch Broom in sections and replace with native trees and shrubs suitable for specific sites; add large quantities of humus material before planting to enrich soil; plant Red Alder where suitable	
		Lightly prune Himalayan Blackberry where it is a suitable barrier plant	
		Shade out Himalayan Blackberry with native trees such as Big Leaf Maple or Aspen	
		Pull or dig out Tansy Ragwort before plants go to seed; leave plants on-site REMOVE ANY SEED HEADS & BURN	
		Plant appropriate native trees along edge of marsh to shade out Reed Canary Grass	
		Remove weedy plants especially along north dyke and Buttertubs Drive entrance until seed bank exhausted	
		Protect individual plants with anchored wire collars; protect larger areas with anchored rabbit exclusion fencing	
		Monitor Eastern Cottontail population and impacts	
		Monitor Pumpkinseed Sunfish	
		Remove Bullfrog egg masses	
		Remove Bullfrog adults	
Conduct Bullfrog impact assessment			
Develop Bullfrog educational brochure and educational signage			
2.9	Domestic Dog and Cat Control	Enforce no pet policy to control domestic cat and dog impacts	
		Develop and implement educational program regarding effects from dogs and cats on wildlife, especially birds	
2.10	Trail and Facility Maintenance	check for structural soundness of dead oaks on west dyke	
		check for structural soundness of dead Lombardy Poplar on east side of marsh	
		trim hazard trees to leave as wildlife snag or fell away from trails and leave to decay on site	
		leave debris from dead or dying trees on site	
		check for structural soundness of, and promptly repair minor damage to, viewing towers	
		check for structural soundness of, and promptly repair minor damage to, benches	
		check for structural soundness of, and promptly repair minor damage to, wooden gates	
		Promptly effect emergency repairs and clean-up	

Inform Committee of required emergency repairs and clean-up activities within 24 hours	
Review potential hazard situations , particularly of dead trees	
Promptly effect maintenance of minor hazards	
Cut back tall grass and lightly prune blackberry vines by trails	
Repair minor surface erosion on trails	
Maintain drainage culverts on east and south trails	
Fill in puddles on North and West Dyke	
Add bark mulch to East and South Trails	
Add crushed gravel to North and West Trails	
Upgrade East trail : widen, resurface, clean out ditches and culverts, clear grass and shrubbery on trail	
Redesign portions of East trail subject to inundation and seepage in the winter	
Redesign middle section of South trail to harden edges, e.g., with cement and sandbags	
Extend culvert by South trail to accommodate widening	
Redesign duck feeding area at North end to minimize erosion and aid access between upland area and water by ducks and people	
Remove grass from South and East trails and trim from edges	
Cut brush on sides of trails in a series of steps to both retain greenway and provide a sense of open space	
Standardize signs especially at wildlife viewing areas, trail markers and for interpretive information	
Cover signs in clear acrylic	
maintain wildlife area signs at each access point & replace as required	
maintain bird nesting area signs within the marsh & replace as required	
post new Conservation Area signs at main entrances	
Maintain odometric signs	
Post and maintain city bylaw signs at entrances	
Maintain interpretive kiosk signs	
Replace kiosk signs at north end and adjacent to miner's cottage	
Develop alternate access plan in case west dyke access is blocked	
Repair minor damage to chain link fence at northern boundary	
Review use of chain link fence at northern boundary and assess replacement alternatives	
Install chain link fence on eastern boundary	
Upgrade pedestrian pass throughs	
Install/maintain garbage cans at main entrances to marsh	
Develop old barn foundation as covered shelter for outdoor classroom & shelter from the elements	
Develop miner's cottage as interpretive centre and meeting room	
Develop self- guided tour brochure and numbered signs; print and install signs; print and distribute brochures	
develop slide show about the ecology and history of the marsh	
Develop poster series about Buttertubs and the importance of wetlands	

develop series of 'Did you know?' fact sheets about the marsh	
Develop video about wetlands using Buttertubs as an example	
Formalize warden program	
Warden to monitor Conservation Area and submit completed site inspection form	
Review submitted form in timely fashion & action any works required	
Season or Life Membership/Pass	
Operate small kiosk(s) beside miner's cottage and/or north end of marsh	
Publish History Document of Management Plan & Bird List	

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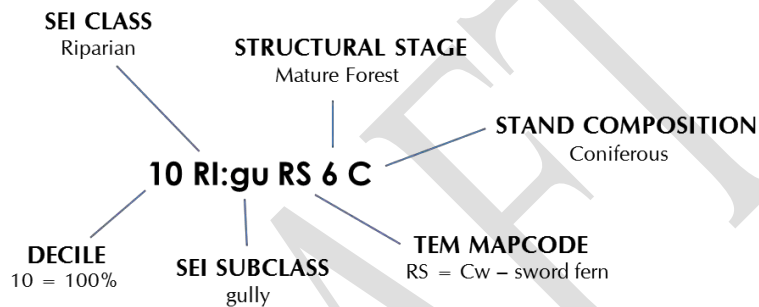
APPENDIX 2

Methodology

DRAFT

Methodology

Digital format aerial imagery (ortho-photography) from 2009, 2012 and 2014, supplied by the City of Nanaimo (CoN), was used to identify and map ecological features in the Buttertubs Marsh and West Marsh project area. Each polygon was mapped at a scale of 1:2,000 or better, and a set of polygons (linework drawn around SEI and OIE features) was produced. Ecosystem polygons were assigned up to three ecosystem mapcodes, each comprising a quantified proportion of the polygon area using deciles that add to 100%. The detailed labels were then converted to the broader SEI class and subclass labels. In the final product, both the TEM and SEI labels are provided. The final label looks similar the below example of an SEI/TEM label:



The majority of the linework was based on the 2014 images; however, all three image sets were used to create the final product. The 2009 images were taken in the fall/winter, and deciduous vegetation had died back. This was helpful for determining stand composition, as well as for mapping the shallow water areas within the marsh. In addition, the 2009 and 2012 imagery was taken at a higher resolution than the 2014; the imagery could be viewed at a much smaller scale (1:1000 or less), which allowed for more accurate linework between similar ecosystems.

Labelling

As mentioned above, the first step in the polygon labeling process was to apply standardized provincial TEM codes to each polygon component. TEM labels are applied first because they are more detailed than SEI. The TEM is then translated into the broader SEI class and subclass categories. SEI Class and Subclass labels were only applied to applicable polygons (i.e. not every polygon was an SEI). Table 1 provides a summary of the TEM and SEI classes and subclasses that were mapped by Madrone for the Buttertubs Marsh and West Marsh area.

Structural stage and stand composition information was added where applicable. Structural stages range from 1 (non-vegetated and sparsely vegetated) to 7 (old forest), and were assigned based on the dominant structure.

Table 1: TEM and SEI Classes and Subclasses mapped within the Buttertubs and West Marsh study area

TEM Mapcode	Ecosystem Unit	Brief Description	Typical Structural Stages Mapped
Forested units			
RF (06)	CwBg - foamflower	gentle slope, lower slope receiving position, deep medium - textured soil, richer nutrient regime	2, 3, 4, 5, 6, 7
CD (08)	Act - Red osier dogwood	active floodplain, medium bench, deep, medium - textured soil	2, 3, 4, 5, 6
CW (09)	Act - willow	active floodplain, low bench, deep coarse - textured soil	2, 3, 4, 5, 6
RC (11)	Cw – skunk cabbage	'depression to flat, forested swamp, poorly drained , deep, medium - textured soil	2, 3, 4, 5, 6, 7
RV (12)	Cw – vanilla leaf	gentle slope, lower slope receiving position, deep, medium - textured soils, richer nutrient regime	2, 3, 4, 5, 6, 7
Non-forested and anthropogenic units			
Wm05	Cattail	Common throughout the Coast at low elevations in subzones with warm summers. They occur most commonly in protected lake embayments and potholes or even roadside ditches, where the surface substrate remains saturated for most of the growing season.	2, 3a, 3b
Wm06	Great bulrush	Occur widely in subzones with warm and dry summers. Wave-exposed lake embayments with significant water movements, and grassland potholes with occasional substrate exposure, are the most common locations. Usually adjacent to open water in wetland mosaics and can sometimes be found in complex with the Wm05	2, 3a, 3b
Ws50	Pink spirea – Sitka sedge	Common at low elevations in basins, gullies and margins of waterbodies and peatlands. These sites experience prolonged saturation and brief early-season flooding	2, 3a, 3b
Ww	Shallow-water (Aquatic) Wetland	Aquatic wetlands are shallow waters dominated by rooted, submerged, and floating aquatic plants. These communities are always associated with permanent still or slow-moving water bodies, such as shallow potholes or deeper ponds and lakes. Shallow-water sites are usually permanently flooded; they may become exposed during extreme drought years. Shallow-water communities most commonly occur where standing water is less than 2 m deep in midsummer.	2c
CF	Cultivated Field	A flat or gently rolling, non-forested, open area that is subject to human agricultural practices (including plowing, fertilization and non-native crop production) which often result in long-term soil and vegetation changes.	1, 2, 3

ES	Exposed Soil	Any area of exposed soil that is not included in any of the other definitions. It includes areas of recent disturbance, such as mud slides, debris torrents, avalanches, and human-made disturbances (e.g., pipeline rights-of-way) where vegetation cover is less than 5%.	1
RI	River	A watercourse formed when water flows between continuous, definable banks. The flow may be intermittent or perennial. An area that has an ephemeral flow and no channel with definable banks is not considered a river	Not applicable
SEI Class	SEI Subclass	Brief Description	Typical Structural Stages Mapped
RI: Riparian		Ecosystems associated with and influenced by freshwater	
RI	ff: fringe	Narrow band near ponds or lake shorelines, or streams with no floodplain	2b, 2d, 3a, 3b, 4, 5, 6, and 7
RI	fm: medium bench	Medium bench floodplain terraces	4, 5, and 6
RI	fl: low bench	Low bench floodplain terraces	2b, 3a, and 3b
RI	ri: river	Large river watercourses including gravel bars	Not applicable
WN: Wetland		Terrestrial – freshwater transitional areas.	
WN	ms: marsh	Graminoid or forb-dominated nutrient-rich wetlands	2b
WN	sp: swamp	Shrub or tree-dominated wetlands	2b, 3a, 3b, 4 and 5
WN	sw: shallow water	Permanently flooded, water less than 2m deep at mid-summer.	2c

Field Verification

On completion of the draft mapping, field verification was conducted to confirm polygon labels, linework, and associated condition. On July 22nd, 2015, Dave Preikshot, Tania Tripp and Jennifer McEwen visited the site. During the field verification of the mapping, observations were recorded directly onto the draft field maps. Information gathered during the field surveys included site characteristics, presence of invasive species, and level of disturbance. For those areas where access was not possible for field verification, we relied on the air photo interpretation. Once fieldwork was complete, the polygon interpretations (linework) and polygon labels were revised using ArcGIS10.1.

It should be noted that several of the polygons surrounding Buttertubs Marsh were not representative of the map codes that were used to create the label. This was the result of extensive disturbance and/or alteration to the ecosystem, particularly due to the introduction of non-native trees (predominantly English oak) and history of clearing. Because standardized map codes are to be used, the recommendation of Del Meidinger, ecosystems ecologist, was to use the map code that the ecosystem could represent if in a natural, undisturbed state, or what it is capable of becoming. Observations made in the field were added to the “comments” field in the database.



PROJECT: Management Plan
Buttertubs Marsh and West Marsh

ASSESSED BY: Tania Tripp, M.Sc., R.P.Bio. &
David Preikshot, Ph.D.

LOCATION:
Nanaimo, BC

MAP SCALE:
1:50,000

CLIENT:
City of Nanaimo

MAPPING DATE:
November 09, 2015

DRAWN BY:
Johnathan Mack

DOSSIER NO:
15.0118

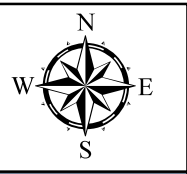
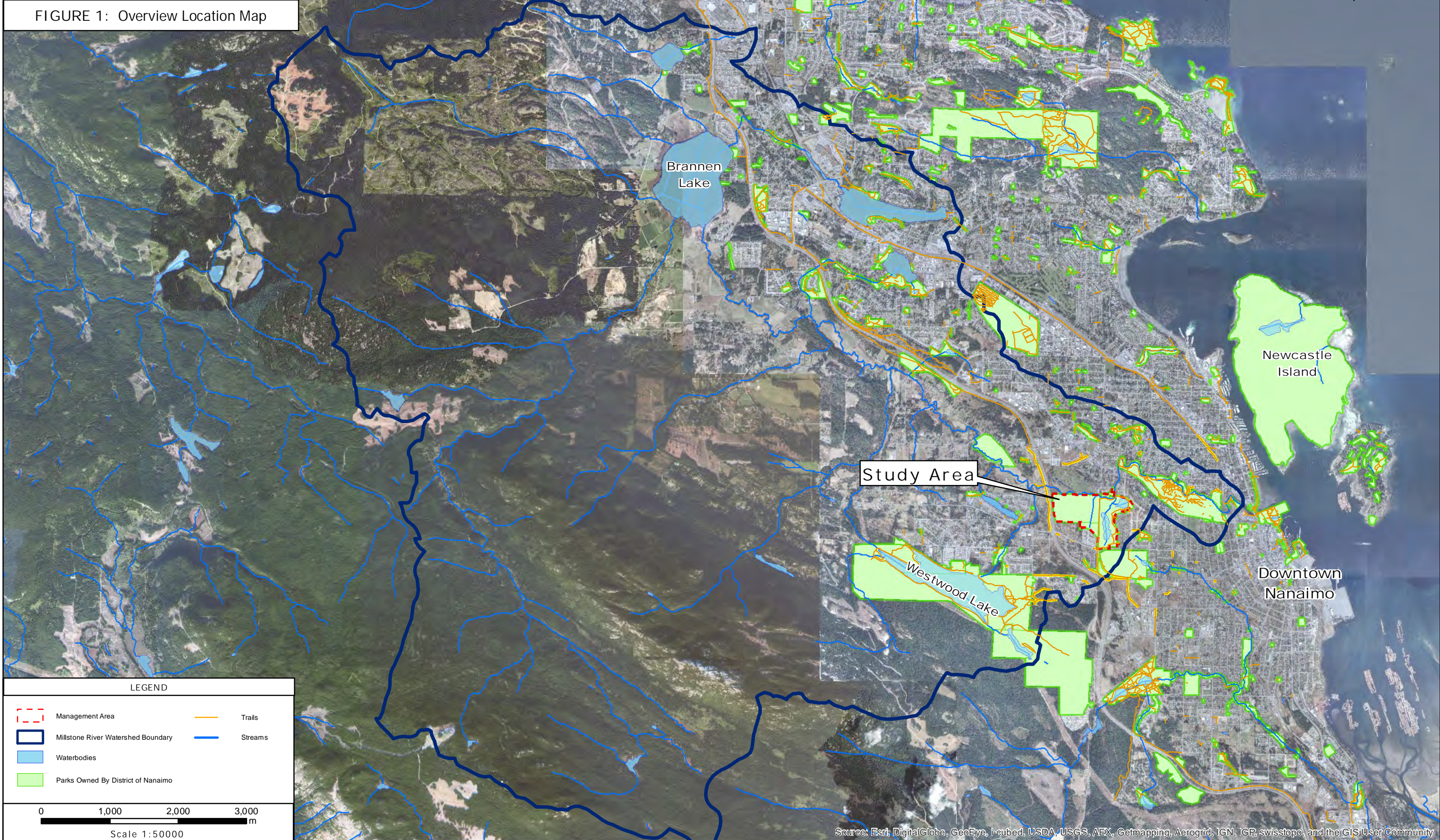


FIGURE 1: Overview Location Map



LEGEND

	Management Area		Trails
	Millstone River Watershed Boundary		Streams
	Waterbodies		
	Parks Owned By District of Nanaimo		

0 1,000 2,000 3,000 m

Scale 1:50000

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



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David Preikshot, Ph.D.

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MAP SCALE:
1:5,000

CLIENT:
City of Nanaimo

MAPPING DATE:
September 15, 2015

DOSSIER NO:
15.0118

DRAWN BY:
Johnathan Mack

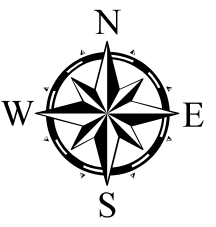
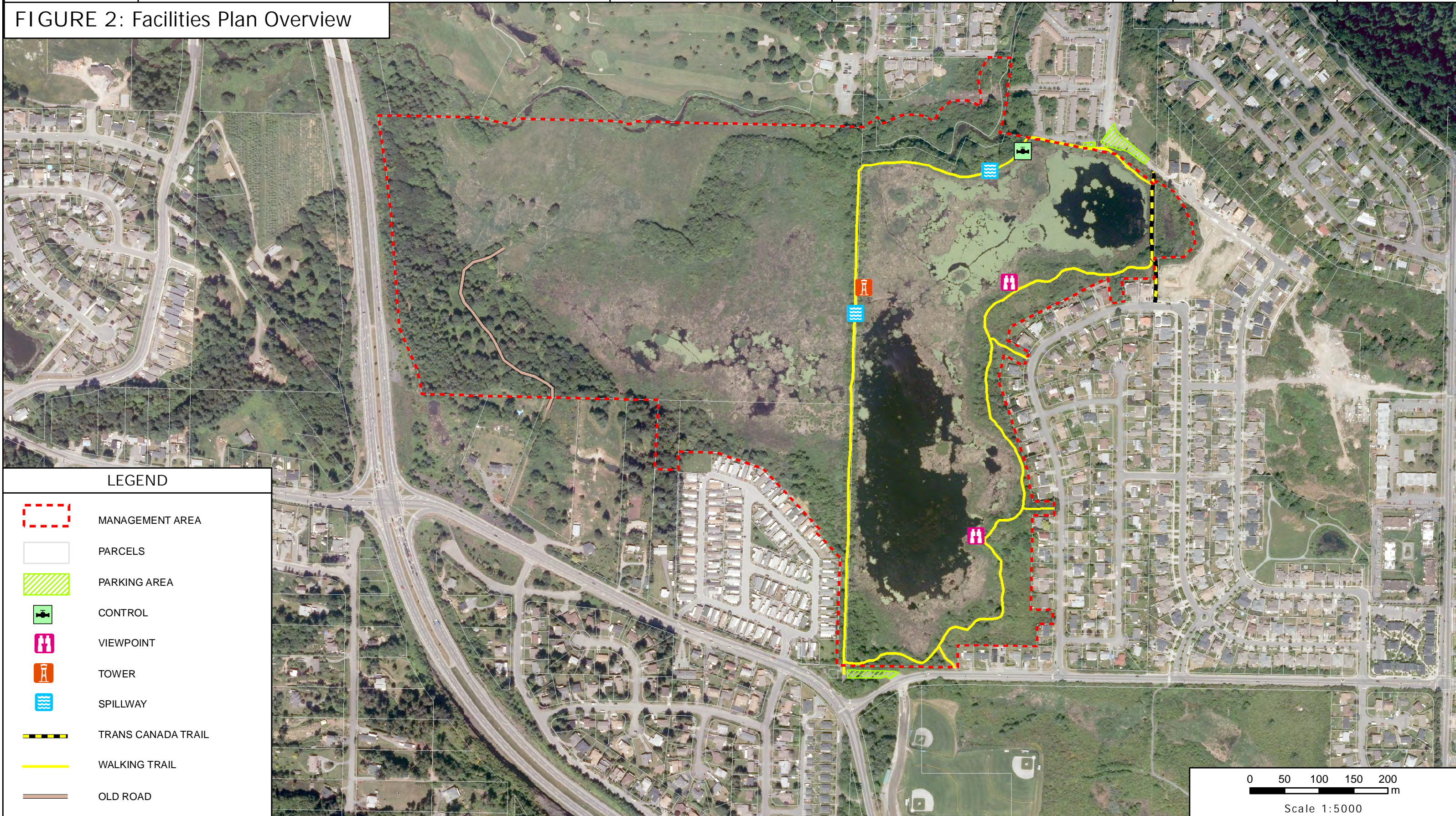








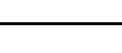



FIGURE 2: Facilities Plan Overview



LEGEND

-  MANAGEMENT AREA
-  PARCELS
-  PARKING AREA
-  CONTROL
-  VIEWPOINT
-  TOWER
-  SPILLWAY
-  TRANS CANADA TRAIL
-  WALKING TRAIL
-  OLD ROAD

0 50 100 150 200
m
Scale 1:5000



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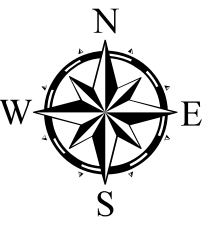
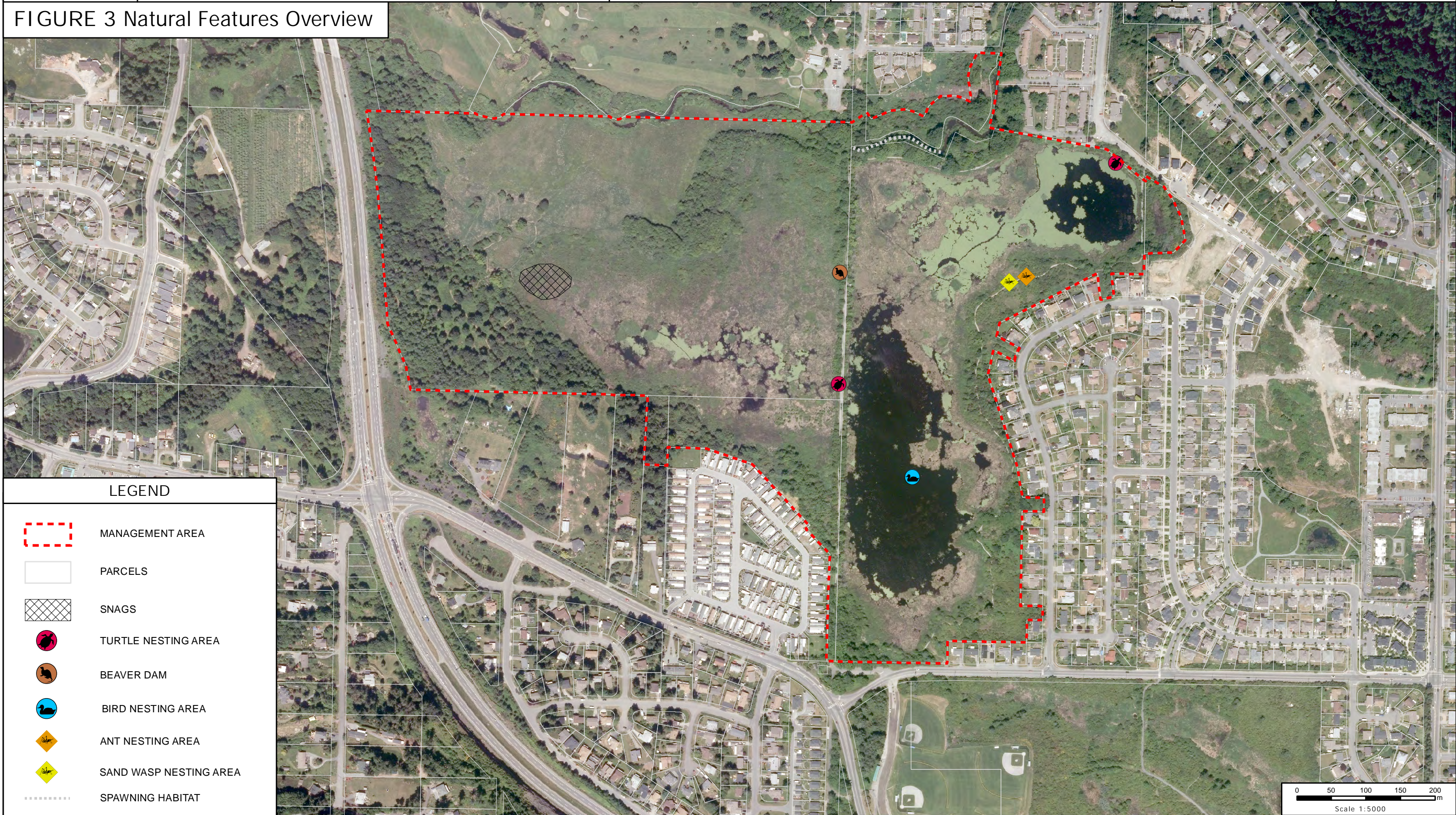


FIGURE 3 Natural Features Overview



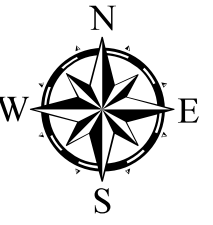


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Buttertubs Marsh and West Marsh

LOCATION:
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CLIENT:
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15.0118



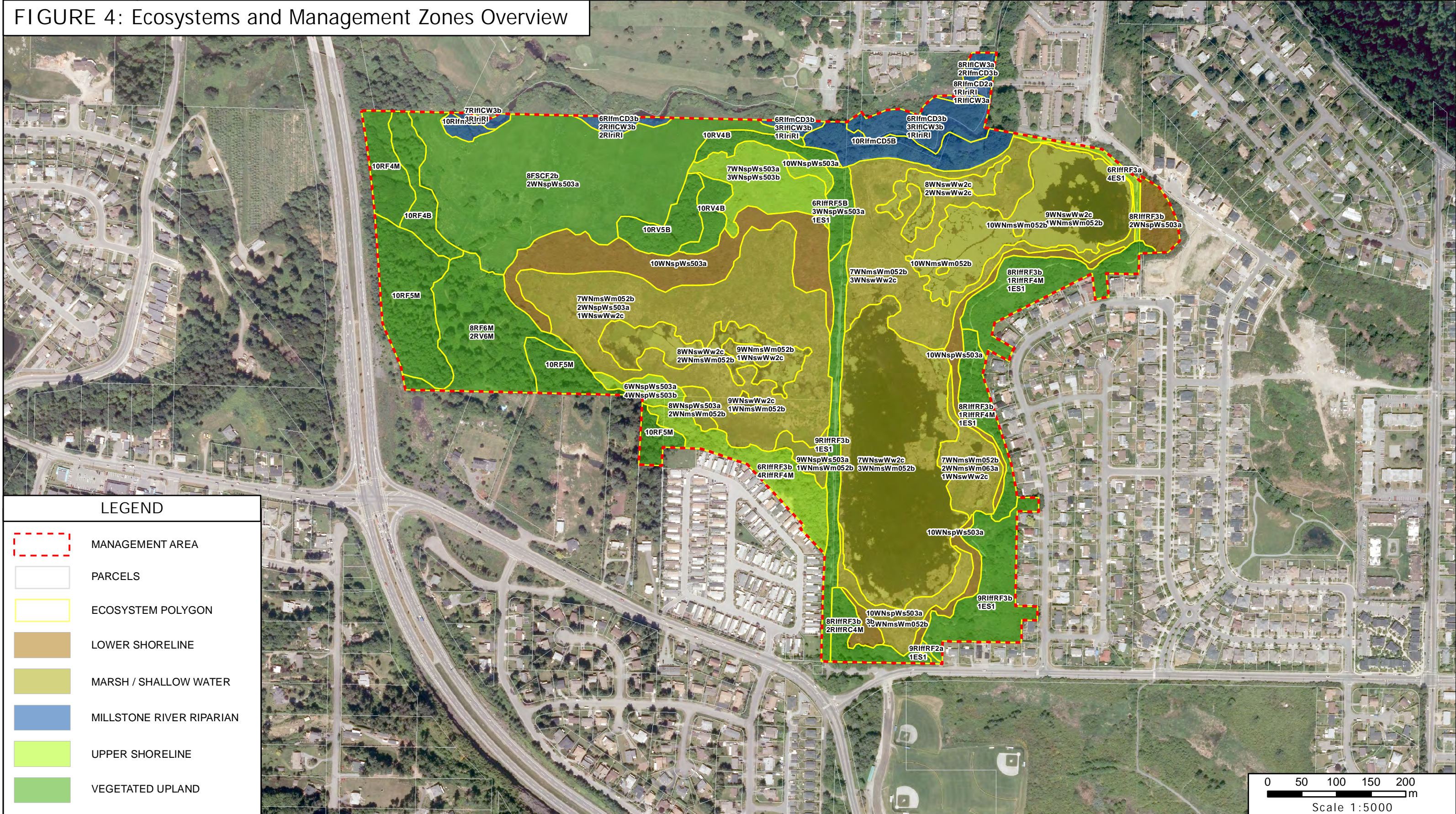
ASSESSED BY: Tania Tripp, M.Sc., R.P.Bio. &
Jennifer McEwen, M.Sc., A.Sc.T., B.I.T.

MAP SCALE:
1:5,000

MAPPING DATE:
September 15, 2015

DRAWN BY:
Johnathan Mack

FIGURE 4: Ecosystems and Management Zones Overview





APPENDIX 3

Ecogift Brochure

(to be included in the final report)