District of Saanich

State of Biodiversity Report

February 2023 - DRAFT

DIAMOND HEAD

Saanich

Table of Contents

Table of Figures

Land Acknowledgement

The District of Saanich lies within the territories of the lək̓ʷəŋən peoples represented by the Songhees and Esquimalt Nations and the W̱SÁNEĆ peoples represented by the W̱JOŁEŁP (Tsartlip), BOḰEĆEN (Pauquachin), SȾÁUTW (Tsawout), W̱SIḴEM (Tseycum) and MÁLEXEŁ (Malahat) Nations. The First Peoples have been here since time immemorial and their history in this area is long and rich.

The District of Saanich is proud that our name is derived from the W̱SÁNEĆ peoples. Saanich Council is committed to taking a leadership role in the process of healing wounds of the past and becoming a more just, fair, and caring society.

Acknowledgements

The District of Saanich would like to thank all involved in the process of developing the State of Biodiversity Report. This includes community members who volunteered their time to participate in the online StoryMap, technical experts for reviewing preliminary mapping layers, and volunteers on the Resilient Saanich Technical Committee (RSTC).

RSTC members and their specialities include:

Kevin Brown, Terrestrial ecology
Brian Emmette, Marine Ecology
Tim Ennis, Conservation Planning and Management
Purnima Govindarajulu, Conservation and Restoration Ecology
Stewart Guy, Conservation Planning and Management
Jeremy Gye, Urban Forestry
Tiffany Joseph, W̱SÁNEĆ Steward
Chris Lowe, Marine Ecology
Kear Pottris, Indigenous Knowledge
Tory Stevens, Terrestrial Ecology
Brian Wilkes, Aquatic Ecology
Bev Windjack, Landscape Architecture

In addition, District staff & council played an invaluable role in working with committee members and the project consultants. Council Liaisons included Rebecca Mersereau and Zac De Vries.

The State of Biodiversity report process was led by consultants from Diamond Head consulting including:

Cassandra Cummings, Project Manager, RPBio, PPP
Aubrey Butcher, Biologist, RPBio
Nguyet-Anh Nguyen, GIS Technician
Alexandra Welch, Junior Biologist
Mike Coulthard, Principal-in-Charge, RPBio, RPF
Alison Kwan, Biologist, RPBio
Vlad Romanescu, Senior GIS Technician
Austin Tahiliani, Junior Biologist, Arborist, BIT

Executive Summary

The District of Saanich is home to some of the rarest ecosystems in Canada. These include a long and rich marine foreshore, large productive lakes and wetlands, long river systems and a diversity of plant communities that support healthy wildlife populations. The natural areas in Saanich provide unique ecological characteristics and are home to many rare and threatened species. Saanich is characterized by these natural areas and its citizens are committed to protecting them for future generations.

The Resilient Saanich project will develop a policy framework for environmental protection in Saanich. This State of Biodiversity report provides an understanding of the current state of the District's natural areas and the elements that threaten their integrity. Natural areas and their characteristics have been mapped and analyzed using existing spatial layers and current technologies which will be shared with the public on SaanichMap and should be updated on a regular basis.

Key Takeaways from the State of Biodiversity Assessment:

Saanich is home to some of BC's most unique and rare ecosystems and species. Coastal Douglas-fir forests are regarded as the province's smallest and most at-risk climatic zone, and are some of the most biodiverse areas in Saanich. Garry oak ecosystems are a subset of these forests and support some of the most at risk plant communities and species in BC; however, **remaining Garry oak ecosystems ranked lower in the biodiversity ranking when compared to large intact Coastal Douglas-fir forests**. This is largely due to development, fragmentation, and historic and ongoing degradation.

Historic and ongoing development has resulted in declines in the size and distribution of many of Saanich's natural ecosystems. Many of the remnant ecosystems which remain were once much more abundant in Saanich and in the region.

Historic logging removed most of the original old growth forests. The majority of forests are less than 100 years old.

Natural areas cover 38.5% of Saanich. Collectively these provide a rich mosaic of habitats and ecosystem types, many of which are rare or unique.

43% of Saanich is classified as "Backyard Biodiversity". This includes areas that are not in a natural state but provide some habitat value. It includes a diversity of areas such as private backyards, agricultural fields, boulevards, and street trees. The extent of these areas highlights Saanich's opportunity to enhance biodiversity throughout the district.

Many valuable natural areas are protected in Saanich, however, a majority remain unprotected and at risk. Wetlands, lakes, and streams is the only Biodiversity Target Category which is entirely protected through legislation, parkland, and/or covenants.

Biodiversity in Saanich is becoming increasingly threatened. Some of these threats include development, loss of indigenous culture and practices, invasive species, pests, and recreational pressure. Climate Change will continue to cause dramatic changes to the growing environment which will cause plant community composition and wildlife population dynamics to change.

Many of the detailed characteristics of Saanich's natural areas are not fully understood or ground truthed. The mapping of natural areas and their canopy extent has been greatly improved but can be further improved through additional ground assessments. The level of disturbance and impacts of invasive plants is not well documented across the District.

Larger urban parks such as PKOLS (Mount Douglas Park), Swan Lake and Rithet's Bog stand out as biodiversity hotspots within the UCB. These parks and other similar parks provide important refuge for wildlife within the UCB.

The second phase of this initiative is to develop a Biodiversity Conservation Strategy which will provide a roadmap to protect and enhance natural assets through policy, operations, and public stewardship. Decisions for the future of Saanich will depend on how the district balances protecting and enhancing biodiversity while meeting the needs of citizens and providing access to nature. This can include looking at ways to increase connectivity between natural areas to help restore the functionality of ecosystems in Saanich. The findings from this assessment will inform the Biodiversity Conservation Strategy and act as a baseline description to guide future planning and policies.

Photo 1: View of the District of Saanich from Mount Tolmie.

Acronyms

BCCDC – British Columbia Conservation Data Centre
BEC – Biogeoclimatic Ecosystem Classification
CDF – Coastal Douglas-Fir
CRD – Capital Regional District
CRISP – Capital Region Invasive Species Partnership
DEM – Digital Elevation Model
DHC – Diamond Head Consulting
EDRR – Early Detection Rapid Response
ESA – Environmentally Sensitive Areas
GIS – Geographic Information System
ISMS – Invasive Species Management Plan
LiDAR – Light Detection and Ranging
MOF – Ministry of Forests
RSTC – Resilient Saanich Technical Committee
SAR – Species at Risk
SEI – Sensitive Ecosystem Inventory
TEM – Terrestrial Ecosystem Mapping
UCB – Urban Containment Boundary

1.0 Introduction

The District of Saanich is situated along the Pacific Ocean with a long marine foreshore. It contains numerous freshwater rivers and lakes, a diversity of forests and is home to some of the rarest ecosystems in Canada. It is also home to over 117,000 people, making it the most populous municipality on Vancouver Island. The citizens of Saanich value these natural assets and are committed to protecting them for future generations while providing housing and related infrastructure for a growing population.

The Resilient Saanich project aims to develop an environmental policy framework for environmental protection in Saanich that balances nature and the residents' needs. This State of Biodiversity report provides a baseline understanding of the current state of the District's natural areas and the threats to their integrity. Natural areas have been inventoried and mapped using existing datasets augmented by current technologies, providing a foundation for their management. The second phase of this initiative is to develop a Biodiversity Conservation Strategy which will provide a roadmap to protect and enhance natural assets through policy, operations, and public stewardship.

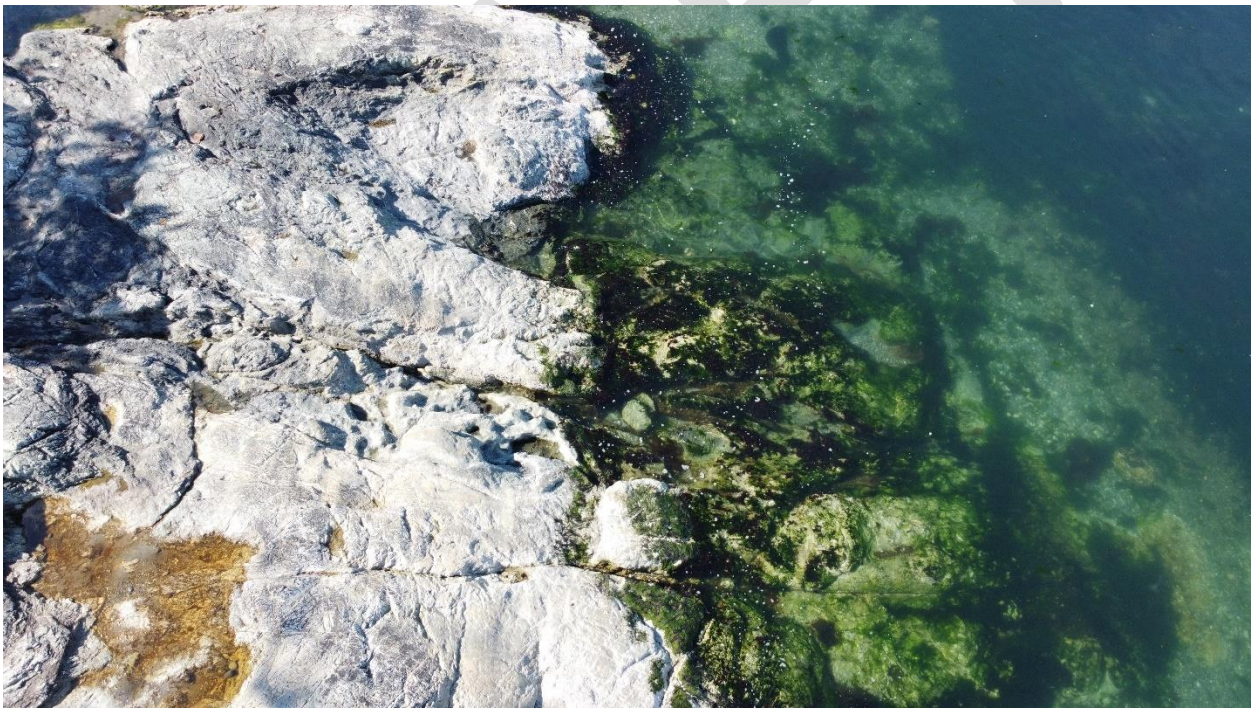

Photo 2: The District of Saanich is situated along the Pacific Ocean with a long marine foreshore.

1.1 What is Biodiversity and Why is it Important?

Biodiversity is a term used to describe the variety and variability of life on Earth. It encompasses every living thing on the planet, ranging from microorganisms to plants, animals, and fungi. Biodiversity is typically interpreted as the number of species that inhabit an area and can be used as an indicator of ecosystem health and integrity.

The natural areas in and surrounding the communities of Saanich are complex and provide many ecosystem services that benefit both humans and the broader community. Protecting and enhancing these natural assets ensures they will continue to provide these services and makes them more resilient to the threats of urban development and climate change. Natural areas provide visual barriers to infrastructure, reduce pollution, dust, and noise. Trees and shrubs capture and store atmospheric carbon dioxide through photosynthesis, sequestering carbon in the process. These trees and shrubs provide shade which can help cool nearby buildings and paved surfaces, thereby reducing indoor and outdoor air temperatures. This has been shown to decrease heat-related hospitalizations.[1] It has also been shown that access to natural areas is correlated with improved mental and physical health.[2]

Vegetation intercepts rainfall, reducing overland flow and the stress on stormwater management systems during heavy rainfall events. Watercourses and wetlands purify and retain water and provide critical habitat for terrestrial and aquatic species. They also act as reservoirs which can reduce flood impacts by retaining excess water during high rainfall events. Slowing and retaining rainfall through infiltration also serves to recharge groundwater which is a critical source of drinking water for many rural residents.

The State of the Urban Forest Report (currently in development) found that three-quarters of the District's tree canopy coverage is provided by natural areas.[3] Protecting these areas will ensure that they continue to provide these important services as the District continues to grow.

Photo 3: Biodiversity is the variety and variability of life on Earth and encompasses every living thing.

1.2 Stewardship in Saanich

The District of Saanich is within the territory of the Lək̓ʷəŋən peoples, known today as Songhees and Esquimalt Nations, and the W̱SÁNEĆ peoples. Collectively, these First Peoples have been stewarding the land since time immemorial. Their role as stewards of the land continues to be vital today. The District of Saanich recognizes that importance, entering into a Memorandum of Understanding (ÁTOL,NEUEL, "Respecting One Another") with the W̱SÁNEĆ Leadership Council formalizing their commitment to reconciliation and pursuing opportunities for collaboration.[4] In the spirit of this MOU, W̱SÁNEĆ (SENĆOŦEN) place names are placed in brackets after the English name, where names could be found in a published source.

Photo 4: Stewardship efforts have removed invasive species, replanted with native species, and set up fences to protect the plantings. Vegetation outside the fence show signs of heavy predation before establishment.

District staff, volunteers, and residents have been working together to reduce the presence of invasive species for the past two decades on private and public land. Awareness and stewardship have increased exponentially during this time, leading to successful initiatives such as the Saanich Pulling Together Volunteer Program, the Garry Oak Restoration Program, and the Capital Region Invasive Species Partnership (CRISP), among many others. For example, Saanich's Pulling Together group volunteers in more than 55 different parks and natural areas removing invasive species, planting native vegetation, planning and monitoring the progress of ecological restoration work, and educating others on the efforts being made to improve wildlife habitat while increasing biodiversity.[5] There are a variety of stewardship programs in the District of Saanich, for more information, see their website: https://www.saanich.ca/EN/main/community/natural-environment/resilient-saanich-environmental-policy-framework/resilient-saanich-environmental-stewardship-programs.html.

1.3 Resilient Saanich

The District of Saanich has embarked on a process to create an environmental policy framework, called "Resilient Saanich". The purpose of this framework is to address "current policy gaps in natural environmental objectives by developing plans, policies, bylaws, and strategies to support the vision of an environmentally conscious future". A Resilient Saanich Technical Committee (RSTC) was created to provide independent analysis and provide recommendations to help inform the development of Resilient Saanich. This volunteer committee consists of local environmental industry professionals which support District staff, council, and consultants with the framework.

The Resilient Saanich process began in 2020 with Milestone 1: Initiate, which focused on public engagement and the development of the project's principles, goals and objectives. Public engagement for this phase included a virtual public open house which introduced the Resilient Saanich process, outlined the draft vision, principles, goals and objectives, and provided a feedback form. Stakeholders and partners were also targeted through focus group sessions. The process has now proceeded to Milestone 2: Assess, which includes the development of a Climate Adaptation Strategy, Biodiversity Conservation Strategy, and Stewardship Program.

This State of Biodiversity report serves as the foundational technical document for developing the Biodiversity Conservation Strategy. Its purpose is to provide Saanich with a District-wide overview of the state of biodiversity. The next phase of this project will be to identify and prioritize ways to protect flora and fauna. This will be done by engaging Saanich citizens and staff, local experts, and First Nations.

Photo 5: Resilient Saanich Technical Committee members met with biologists from Diamond Head Consulting to visit key locations across Saanich.

2.0 Methodology

The information presented in this State of Biodiversity Report is based primarily on existing provincial, regional, and municipal datasets, and includes data collected by the public, such as through iNaturalist or provided by committee members. This information was supplemented and updated using LiDAR, recent orthophotos, and field visits to a representative sample of natural areas and watercourses. This data is presented on a series of maps. The main classification system used for natural areas is called Biodiversity Target Categories. These were determined during the Resilient Saanich process by the RSTC following interpretation of the Conservation Standards,[6] and are described in greater detail in Chapter 5.0 Biodiversity Target Categories. When possible, terminology from the Conservation Standards or the Standard Lexicon for Biodiversity Conservation was used to align with the RSTC methodology.[7;8]

2.1 Data Sources

A variety of spatial data sources were used for this analysis (Table 1). The spatial layers were sourced from provincial, regional, municipal, and volunteer datasets.

Table 1. Spatial layer data and respective source.

Municipal (Saanich)	Regional (CRD)	Provincial
Orthophoto 2021	2019 LiDAR-derived DEM	Terrestrial Ecosystem Mapping (TEM)
Orthophoto 2019	2019 LiDAR-derived DSM	Sensitive Ecosystem Inventory (SEI)
Municipal Boundary	2019 LiDAR-derived Hillshade	BC Conservation Data Centre (CDC)
Parcels	Land Cover	
Invasive Species (known occurrences)	Regional Parks	
Waterbody	Canopy cover	
Watercourse		
Storm Water		
Streets		
Trails		
Parks		
Zoning		
Environmentally Sensitive Areas (ESA)		

Data available from all sources were compiled into one geodatabase and analysed using ArcGIS Pro. This geodatabase was used to stratify natural ecosystems into polygons with similar plant community characteristics. The initial basis for these polygons was the provincial Terrestrial Ecosystems Management (TEM) data which is the most complete and consistent dataset covering the District of Saanich. These polygons were refined using the other datasets, LiDAR canopy analysis and data collected during field assessments.

2.1.1 Municipal Datasets

The District of Saanich provided important spatial data that was absent in the regional or provincial datasets. While regional and provincial datasets can provide complete and consistent information across the District, they lack the more detailed information that is best provided by the municipality and at a finer level of detail. The municipal spatial layers incorporated into this analysis include the most recent orthophoto (2021) as well as cadastral layers such as the municipal boundary, urban containment boundary, parcels, streets, trails, parks, and land use zoning. The District also provided detailed environmental layers including the spatial location of all freshwater waterbodies (e.g. creeks, ponds, and lakes) and municipal storm system connections across the District. Where available, the watercourse layers provided information on the characteristics of the watercourse. This includes whether it is natural or manmade, whether it is a constructed ditch or a natural creek, its sensitivity (red, yellow, or green coded), and the condition of engineered structures.

The District designates certain areas as Environmentally Sensitive Areas (ESAs). The ESA data identifies and maps areas in Saanich that are known to contain sensitive ecosystems, the marine shoreline, species at risk, and also includes remnant rare and endangered ecosystems and linkages between these areas.[9] This data was used to refine ecosystem polygons. The District also provided information on the distribution and abundance of invasive plant species which was used to understand the condition of natural areas.

2.1.2 Capital Regional District Datasets

LiDAR (Light Detection and Ranging) technology provides detailed spatial terrain and vegetation information. This is collected by emitting light through lasers from planes to determine the vertical and horizontal location of features. The CRD last flew LiDAR in 2019, which they then used to develop a number of spatial layers. Spatial layers developed and provided by the CRD included a Digital Elevation Model (DEM) and Digital Surface Model (DSM) which show accurate ground and surface features. LiDAR data from the CRD was also used to determine accurate tree canopy extents across the district. This data was used to identify the edges of forests and individual open grown trees. The canopy dataset also provides information on the composition of coniferous and deciduous trees and their heights.

2.1.3 Provincial Datasets

Three provincial datasets, the Sensitive Ecosystems Inventory (SEI) and Terrestrial Ecosystem Mapping (TEM), and BC Conservation Data Center (BCCDC), were used for this analysis. TEM is a standard used for medium to large scale mapping projects in British Columbia.[10] The TEM dataset provides stratification of a landscape into biogeoclimatic units, ecosystem units, and site units or site series. The TEM provides high-level information on a combination of ecological features including climate, physiography, surficial material, geology, soil, and vegetation. This information was available for all of the larger natural ecosystems in the District and was used as the foundation of this analysis. The primary information used from the TEM datasets include the BEC unit, site series, site codes (ecosystem type), and stand structure.

The SEI for East Vancouver Island and Gulf Islands is the first sensitive ecosystems inventory developed in British Columbia[11]. The SEI systematically identifies and maps ecologically significant and relatively unmodified sensitive terrestrial ecosystems. The purpose of this study was to support sustainable land use decisions and encourage wildlife conservation. As the Eastern Vancouver Island and Gulf Island SEI was the first to be developed in BC, the project methods predates provincial mapping standards. The SEI provides data on ecosystem types, dominant tree species, and approximate forest age. Since this is an inventory of sensitive ecosystems, it did not cover the entire District of Saanich, however, the information in this inventory was used to inform the stratification of ecological polygons.

The BCCDC is a provincial program dedicated towards conserving biodiversity and sharing scientific data and information on animals, plants, and ecosystems across BC. This program has a fully compiled list (based on current literature and expert advice) of all species and ecosystems with occurrences in BC. The BCCDC also contains a spatial database of where the location of at-risk species and ecosystems have been confirmed.

2.1.4 New datasets

New spatial layers were derived using those that were available. A combined dataset of all protected areas was developed which includes local and regional parks, as well as natural state covenants. It does not distinguish between natural area parks and urban parks.

A flow accumulation model was used to identify watercourses using the LiDAR-derived Digital Elevation Model (DEM) and hillshade layers from the CRD. This flow model was used to identify previously unmapped watercourses, ditches and other potential areas of overland flow and remnant creeks. It was also used to refine the locations of known watercourses. This dataset was also used to identify connected and disconnected lakes, wetlands, and pond features on a broad scale.

2.2 Ground Truthing

Ground-truthing was completed by registered professional biologists (RPBios) to confirm the accuracy of the spatial data and to better understand the ecological characteristics in the District. Site visits were completed from May 8th to May 10th and May 30th to June 3rd 2022, under warm, dry conditions. This study did not allow for comprehensive field assessments. A sample of locations were identified and visited to understand and create a representative understanding of biodiversity in Saanich. While this report includes all public and private lands within the District, only public lands were visited. Approximately 8% of ecosystem polygons were visited to assess either terrestrial and/or aquatic features (Figure 1). This also included some ground-truthing of watercourses identified through the flow accumulation model. The majority of these watercourses were not assessed.

Qualitative attributes such as condition or restoration opportunities were recorded in consultation with the RSTC and District Staff, using predetermined categories to maintain consistency. The majority of the natural areas in the District are forested, however, additional terrestrial habitats including coastal bluffs,

rock outcroppings and sparsely vegetated sites were also included in the inventory. Inventory data compiled included:

- Terrestrial habitat type
- Stand structural stage
- Tree species composition
- Average and maximum tree height and diameter
- Tree densities for each structural layer (stems/ha)
- Crown closure
- Soil texture, moisture, and nutrient regime
- BGC units to the site series level
- Dominant ground vegetation and cover
- Invasive species and coverage
- Stand condition
- Restoration opportunities
- Wildlife habitat features and observations
- Garry oak ecosystem characteristics
- Species at Risk observed
- Evidence of excessive deer browse
- Stand health concerns

The District of Saanich is home to a large diversity of wildlife species; however, a detailed wildlife survey was not conducted as part of the field verification and assessment. Detailed wildlife surveys require trapping and extended observation and could not be conducted in the scope of this project.

Photo 6: Natural areas throughout the District were visited by Registered Professional Biologists to confirm their site characteristics and to collect additional relevant information.

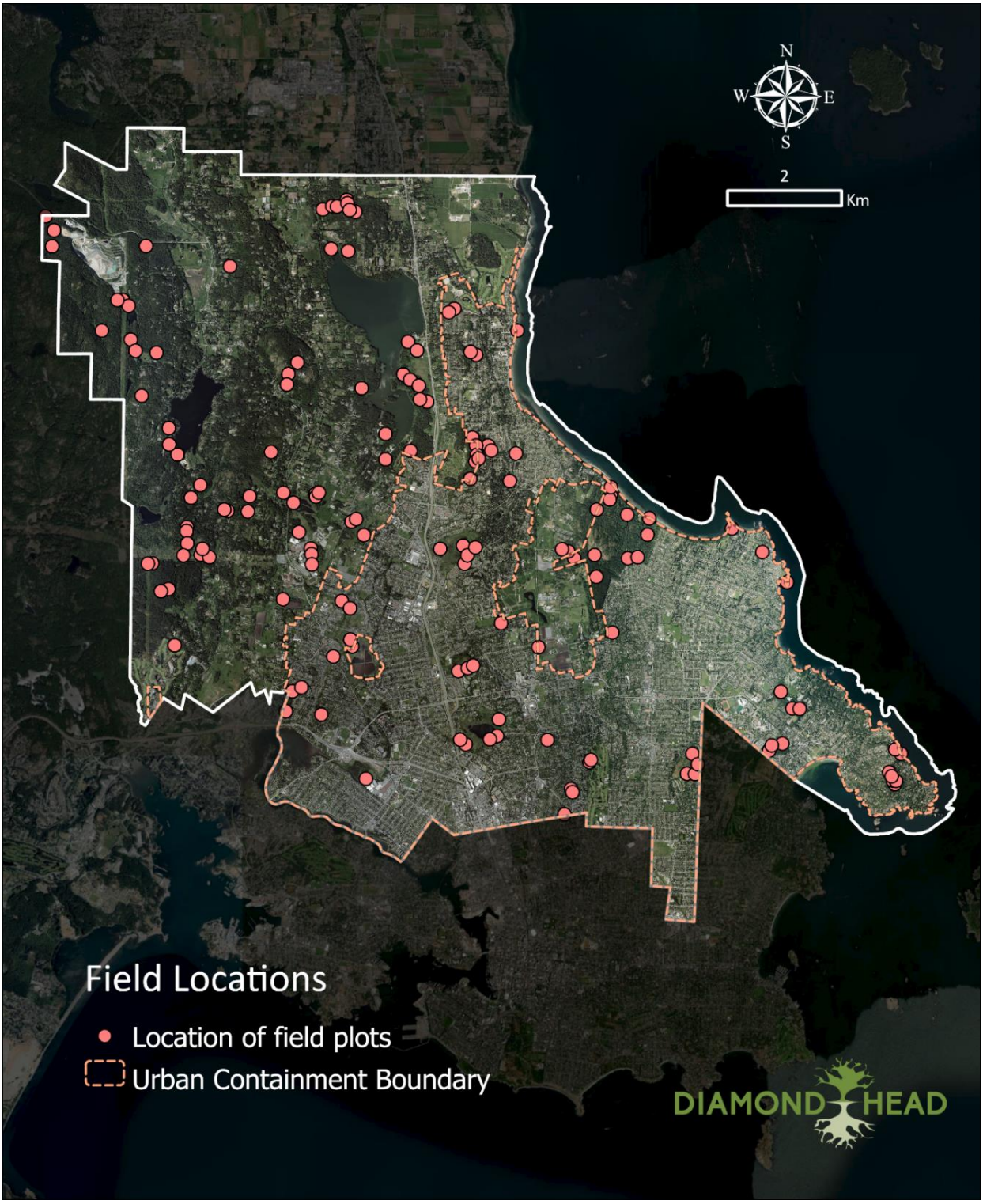

Figure 1. Location of field plots visited by 3 Registered Professional Biologists from Diamond Head Consulting. Site visits were completed from May 8th to May 10th and May 30th to June 3rd, 2022.

2.3 Expert Review

District Staff, RSTC, and technical experts from the District of Saanich reviewed the spatial layers using an ArcGIS Online web application (webapp, Figure 2). Through this webapp, reviewers were able to access a variety of spatial layers (i.e. Provincial TEM/SEI, Saanich's ESA, LiDAR, orthophotos, and DHC field verification plots). Webapp access was provided to District Staff and RSTC members directly. Technical experts were provided access at the discretion of the RSTC.

To focus on comments and feedback that could be used to update the spatial data, a list of recommended topics was provided to the reviewers. The comments and feedback were incorporated into the spatial data, where applicable. While comments outside of recommended topics were accepted, their incorporation into the project could not be guaranteed.

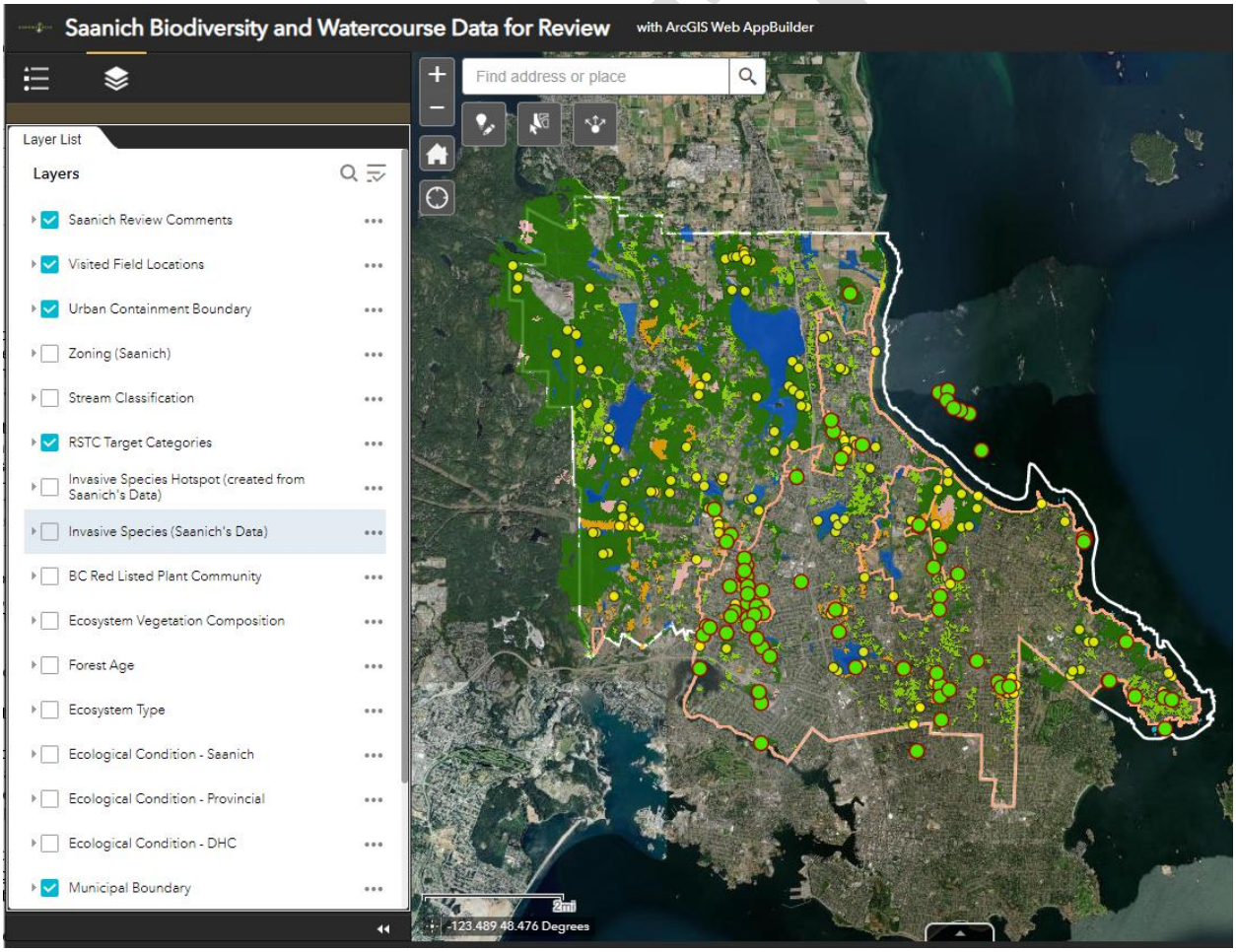

Figure 2. ArcGIS web application was used to collect feedback from District Staff, RSTC members, and selected experts.

2.4 Ecological Condition Assessment

An ecological condition assessment was planned by the RSTC to be a part of this assessment. It was intended to follow the methods of the Standard for Mapping Ecosystems at Risk in British Columbia. This methodology uses a set of criteria to assign a condition rating to a natural area. The criteria for each condition rating is summarised in Appendix 1. Ecosystem polygons are assigned a class of excellent, good, fair, or poor based on the age and type of vegetation found on site, level of anthropogenic disturbances and artificial structures, soil disturbances, cover of invasive (alien) species, and fragmentation.[12]

While some of the necessary spatial data was available for this classification, it was not consistently available for all areas of the District. The location of some invasive species have been mapped across the district but not for all areas. It has mainly been recorded on a site-by-site basis, when staff identifies invasive species and records it with the District. Soil disturbances and understory vegetation cover data is not consistently available, and so using existing spatial data may underestimate the degradation in some areas. In addition, there was some concern that the methods employed in the Standard for Mapping Ecosystem at Risk in British Columbia are less relevant in an urban context, where site degradation can be higher, and an understanding of site condition may be more useful on a less stringent scale to better differentiate between the condition of different locations.

Given these concerns with the consistency of available data, an ecological condition assessment was not finalized as part of this project. However, aspects of a condition assessment were incorporated into the biodiversity ranking (see section 2.5). This helps to reach the goals stated in the RSTC terms of reference to understand current biodiversity, help direct future protection and restoration efforts, and develop a baseline to understand future conditions.[13] This report also identifies data gaps that can be addressed through future studies in section 0, to further these goals through future projects.

Photo 7: Henderson's shooting-star are often found in Garry oak meadows in Saanich.

2.5 Biodiversity Analysis

The refined spatial data was analysed to understand the state of biodiversity in Saanich. A ranking methodology developed by DHC was used as a consistent approach to compare biodiversity across the District. The level of biodiversity that a natural area can support is difficult to measure as it is affected by many complex and dynamic factors. In general, areas that support high levels of biodiversity include those that are large, connected to other natural areas, and provide a variety of habitat features including cover habitat, forage, and water.

Measuring the exact number of species that inhabit an area is challenging as the vast majority of them are small such as insects and microbiota. To compare areas and understand the relative levels of biodiversity across the district, a list of higher-order wildlife was analysed. A species guild was compiled and lists the wildlife that could potentially inhabit Saanich if the District was in a natural state. For this process, it is impossible to account for all species that exist at the lower levels of the food chain, such as invertebrates and microbiota. The species guild process assumes that the larger and more visible species are indicators that the species lower on the food chain also exist. This list includes 251 species of mammals, birds, amphibians and reptiles. It is assumed that the presence of these species is an indicator of the numerous species lower on the same food chain. Each natural habitat type was ranked out of 100 relative to each other based on the number of these species that would be expected to inhabit them (Table 2). The final ranking was rounded out to the closest multiplier of 5.

Table 2. Baseline Biodiversity Ranking for each Habitat type.

Habitat	Baseline Biodiversity Rank
Broadleaf forest	100
Mixed forest	100
Wetland	100
Lake	100
Marine	100
Shrub	70
Coniferous forest	55
Urban trees	30
Agriculture	30
Grass	10
Herb	10

To account for the influences of urban development (such as fragmentation, noise, invasive species, and disturbance), modifiers were applied to this base ranking within each habitat polygon. Patches of habitat that are closely connected were grouped to calculate their collective size. The ranking of these areas was then modified to reflect the size and fragmentation of each patch area (Table 3).

Table 3. Biodiversity ranking multiplier based on patch size.

Patch Size (ha)	Multiplier
>50	1.0
25-50	0.9
10-25	0.8
2-10	0.6
0.5-2	0.5
0.1-0.5	0.2
<0.1	0.1

The interface zone that links aquatic and terrestrial ecosystems is known as riparian habitat. These areas are known to support higher levels of biodiversity due to their proximity to water. Riparian areas within each habitat type were identified and multiplied by a modifier to reflect their influence on biodiversity (Table 4).

Table 4. Biodiversity ranking multiplier based on proximity to riparian habitat.

Watercourse Classification	Width of Influence	Multiplier
Rivers and streams Lakes and Wetlands Marine foreshore	30 m	1.5
Ditches	5 m	1.2

The final biodiversity ranking provides a relative measure of which areas in the City support the greatest diversity of species. The highest-rated areas are generally larger in size, provide access to forage, protective cover and water.

3.0 Natural features of Saanich

3.1 Climate

The Biogeoclimatic Ecosystem Classification System (BEC) provides a framework for understanding how ecosystems develop in BC. At the regionals level, BEC zones classify the province into areas with similar climatic conditions. The District of Saanich is within the Coastal Douglas-fir (CDF) zone. It has the driest and mildest climate and is considered the most at-risk BEC zone in BC.[14] This growing environment, productive soils and access to freshwater and marine environments has made Saanich home to some of BC's most rare and unique plant communities. It is largely considered a hotspot for biodiversity.

3.2 Topography

The topography of Vancouver Island was shaped by glacial processes during the last ice age. The retreat of glaciers over the last 14,000 years has created the distinct mix of scoured rocky knolls, undulating hills, and flat lowlands common across Saanich today.[15] These topographical features are distinct components of Saanich's landscape, including PKOLS (Mount Douglas), Mount Tolmie, and Mount Work. Elevations on the Saanich peninsula range from 449 m at the summit of Mt Work,[16] to sea level along the east boundary of the District along the Salish Sea. Glacial retreat has left behind 350 ha of freshwater lakes, the largest of which is Elk/Beaver Lake (XEOL,XELE~~K~~) at 229 ha. As a coastal community, Saanich is also characterized by 29 km of coastline which features a mix of sandy and pebble beaches and exposed sedimentary rock. Figure 3 illustrates the topography of Saanich through a digital elevation model (DEM).

Photo 8: The retreat of glaciers over the last 15,000 years has created the distinct mix of scoured rocky knolls, undulating hills, and flat lowlands common across Saanich today.

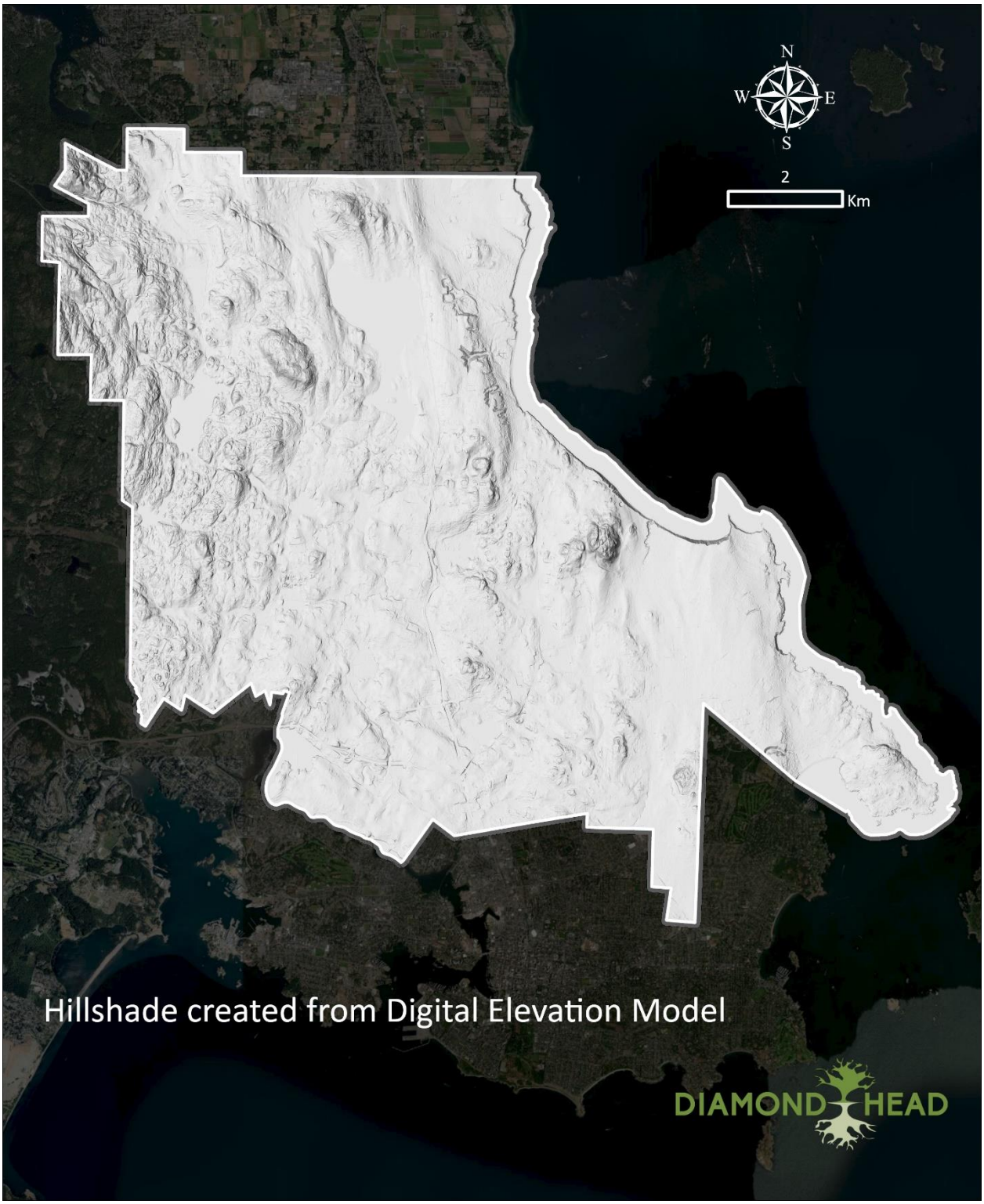

Figure 3. Digital Elevation Model of Saanich. This model can be used to develop contours and shows elevation across Saanich. It was derived from LiDAR and provided by the CRD.

3.3 Aquatic Systems

Water is a critical element for all life on Earth. Whether it is flowing through Beaver Lake or passing over a rocky outcrop on its way into the headwaters of the Colquitz River, water shapes our landscapes and the ecosystems that have evolved there. The District is home to a wealth of freshwater and marine ecosystems which provide habitat for aquatic life and for terrestrial life that rely on this valuable resource. Aquatic ecosystems range in scale from small, ephemeral wetlands and seasonally flooded fields to lakes and rivers that meander through urban areas. These water systems support some of the highest levels of biodiversity in the region and are among the most susceptible to change. The importance of water in Saanich is highlighted by the W̱SÁNEĆ concept of ÁTOL, mutual respect for the rights of others with life, including water.

A watershed is a specific geographic area which collects rainfall and snowmelt and channelizes that water through watercourses. These watercourses direct the water into the ocean or into smaller bodies of water such as lakes. Within Saanich, watersheds can be small, like the Revan's Creek watershed, or large such as the Colquitz Creek watershed (Figure 4). While water flowing down a river can be seen and mapped, complicated networks of subsurface flow can be more challenging to quantify. This can include vast stores of water stored within aquifers. Streams and rivers can also carry considerable amounts of underground water through hyporheic flow. The above and below ground flow and storage of water is critical for supporting biodiversity in the District.

Figure 4: Stylized illustration of Saanich's many watersheds.[17]

There are several aquifers which lie beneath the District including the Wark-Colquitz, Karmutsen, Cordova Bay and the North Central Saanich Aquifers.[18] The province has records of nearly 3,000 wells on these aquifers, though this extends to neighbouring municipalities and districts as well. These aquifers and wells have been mapped by the Province. An examination of the complex relationship between these stores of groundwater, their interface with the above-ground flow, and anthropogenic impacts on these was not included as part of this assessment. Groundwater upwellings, through springs and wetlands can be important sources of freshwater for wildlife and can sustain wetland and stream health through dry periods of the year. These underground sources of water can be threatened by the landscape level loss of permeable surfaces, overuse, changes to groundwater flow such as through earthquakes or drilling, and climactic shifts resulting in less rainfall to recharge these aquifers.

3.3.1 Freshwater lakes and wetlands

Saanich has approximately 350 ha of lakes, ponds and reservoirs, and 31 ha of wetlands (Figure 5). These water features provide habitat for aquatic and terrestrial species and are significant contributors to Saanich's overall biodiversity. Large lakes like Elk/Beaver Lake (XEOL,XELE~~K~~), Prospect Lake, and Swan Lake support open-water habitat for mergansers (*Mergus merganser*), buffleheads (*Bucephala albeola*), and Canada geese (*Branta canadensis*), while wetlands in the transition zone between the shore provide space for beavers (*Castor canadensis*), river otters (*Lontra canadensis*), and western-painted turtles (*Chrysemys picata bellii)* to thrive. Predatory birds such as bald eagles (*Haliaeetus leucocephalus*), great blue herons (*Ardea heroidas*) and even red-winged blackbirds (*Agelaius phoeniceus*) feed on small mammal, fish and/or insect prey living amongst shoreline reeds and shrubs.

The ecological significance of these aquatic habitats in Saanich shouldn't be underestimated. Up to 1/3 of all bird species ever recorded in British Columbia were observed at Panama Flats which is a unique old-field floodplain, over a period of two years.[19]

Photo 9: Wetlands are home to high levels of biodiversity.

As urbanization fragments Saanich's natural landscape, smaller aquatic ecosystems have become significant contributors to preserving biodiversity. These spaces act as refuges for small mammals, insects, and birds that need to rest and feed while they travel. Even smaller waterbodies in neighbourhoods and on golf courses act as linkages supporting the greater ecological network in Saanich.

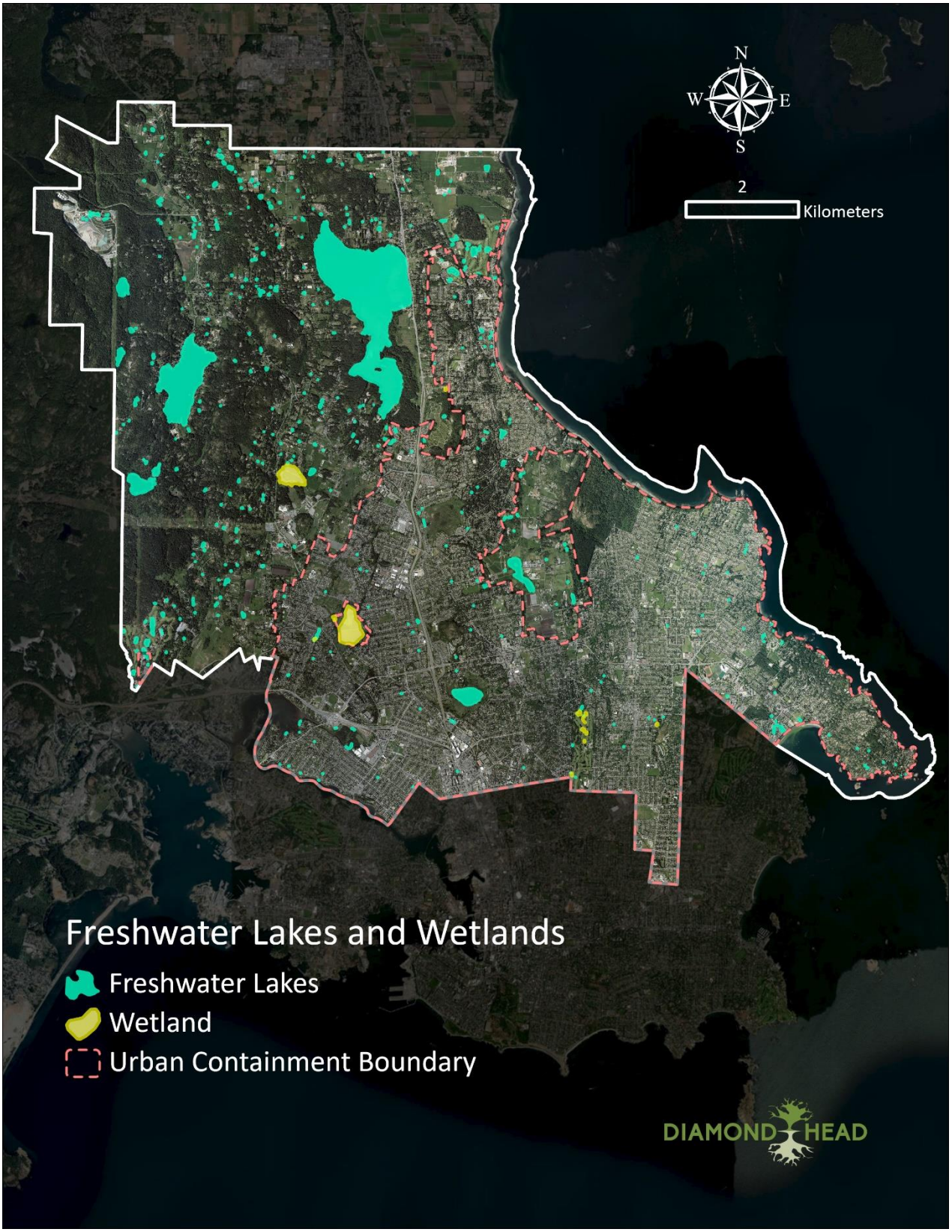

Figure 5. Map showing freshwater lakes and wetlands in Saanich.

3.3.2 Watercourses

As a lowland coastal community, Saanich is home to a vast network of watercourses (Figure 6). It has over 300 km of verified rivers, streams, ditches, creeks and brooks and another 93 km of unverified watercourses identified using LiDAR. These watercourses have been shaped over time, by both natural processes as well as by farmers of the 18th and 19th centuries. In the western half of the District, the bulged rocky slopes of Mount Work create channels for rainfall to collect and flow downstream into creeks, lakes, and eventually, the ocean. These watercourses are generally non-linear with numerous smaller tributaries. In the east, many watercourses in Saanich's rich farming areas have been historically channelized and culverted for drainage and irrigation.

Photo 10: Recent channel restoration in Cuthbert Holmes Park .

Today, many of the creeks in the urbanized parts of Saanich have been lost to development or consolidated as part of the District's stormwater network, with over 550 km of culverts. There are several creeks including Bowker Creek, Douglas Creek, Swan Lake Creek, Durrance Creek, Tod Creek, Noble Creek, and Durrell Creek that provide high value habitat for fish populations and provide connectivity through Saanich's urban areas. Most of these flow within the Colquitz Watershed, a basin that covers nearly all of Saanich.

The Colquitz River is fed by Elk/Beaver Lake (XEOL,XELE~~K~~) and flows south before outflowing through Culbert Holmes Park and into the Gorge. These fish-bearing creeks and their tributaries provide valuable fish habitat features such as large woody debris, eddies and pools, and natural substrates that support protected salmonids like Coho (*Oncorhynchus kisutch*), Rainbow trout (*Oncorhynchus mykiss*), and Cutthroat trout (*Oncorhynchus 19larkia*), as well as prickly sculpin (*Cottus asper*), smallmouth bass (*Micropterus dolomieu*), three-spine stickleback (*Gasterosteus aculeatus*), and brown and black catfish (*Ameiurus nebulosus, Ameiurus melas* respectively).

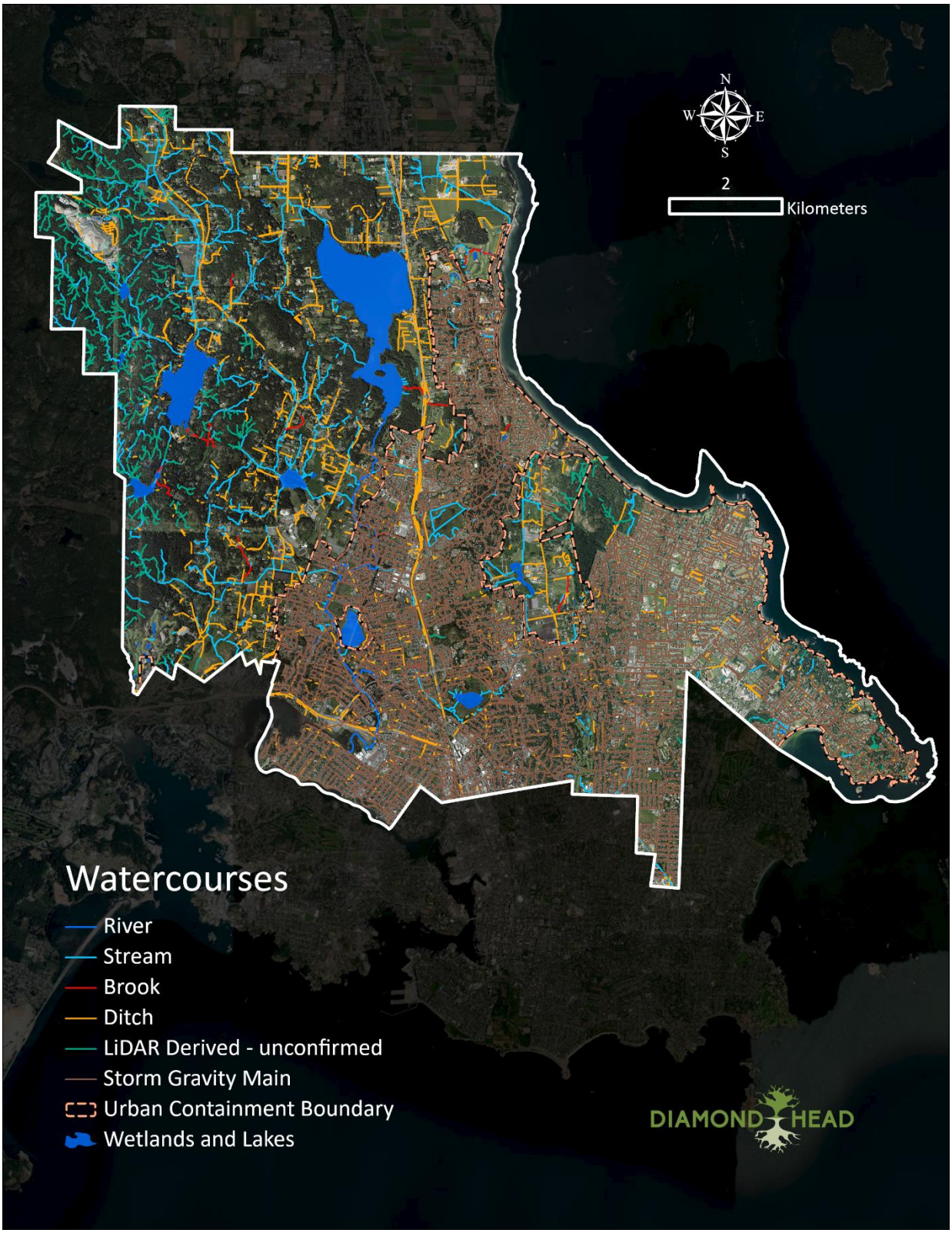

Figure 6. Location of known and predicted watercourses within the District of Saanich, as well as stormwater infrastructure within the urban containment boundary.

3.3.3 Marine Shoreline

The District's 29 km of marine shorelines are some of the most popular natural places in Saanich. Locals flock to these areas on warm summer days to enjoy the beaches and scenery. However, humans are not the only ones who treasure these places. Hundreds of species, including several species-at-risk and migratory birds, inhabit the coastal sand, rocky bluff, and intertidal ecosystems that line Saanich's marine shoreline.

These shorelines are rich and dynamic areas that attract species from, terrestrial, marine, and freshwater environments (Figure 7). Saanich's marine shorelines are highly diverse, ranging from coastal sand ecosystems inhabited by silky beach pea (*Lathyrus littoralis*) and large-headed sedges (*Carex macrocephala*) to sparsely vegetated rocky bluffs populated by mosses and herbs. The intertidal ecosystems are inhabited by sea stars (*Asteroidea* spp.), sea asparagus (*Salicornia* spp.), black oyster catchers (*Haematopus bachmani*), as well as large marine mammals like sea lions (*Otariinae* spp.). The complex interactions that occur over this ecological gradient make the marine shoreline one of the most biodiverse areas in Saanich.

High recreational use, development, and invasive species threaten the integrity of these highly sensitive ecosystems. The popularity of coastlines in Saanich cause humans and dogs to trample over sensitive vegetation that can take years to recover. Macoun's meadowfoam (*Limnanthes macounii*), and bearded owl clover (*Triphysaria versicolor*) are both examples of small, red-listed species which grow on vernal maritime meadows. These habitats frequently overlap with high value recreation sites and are susceptible to tramping. Encroachment from invasive species like English ivy (*Hedera helix*), Himalayan blackberry (*Rubus armeniacus*), and gorse (*Ulex europaeus*) outcompete native plants in these sensitive areas. Other common invaders of coastal sand ecosystems include the European (*Ammophila arenaria)* and American (*Ammophila breviligulata*) beachgrasses, which quickly establish deep roots and inhibit the movement of sand in this naturally dynamic environment. This can encourage nearby forest vegetation to establish which can eliminate coastal sand ecosystems entirely.

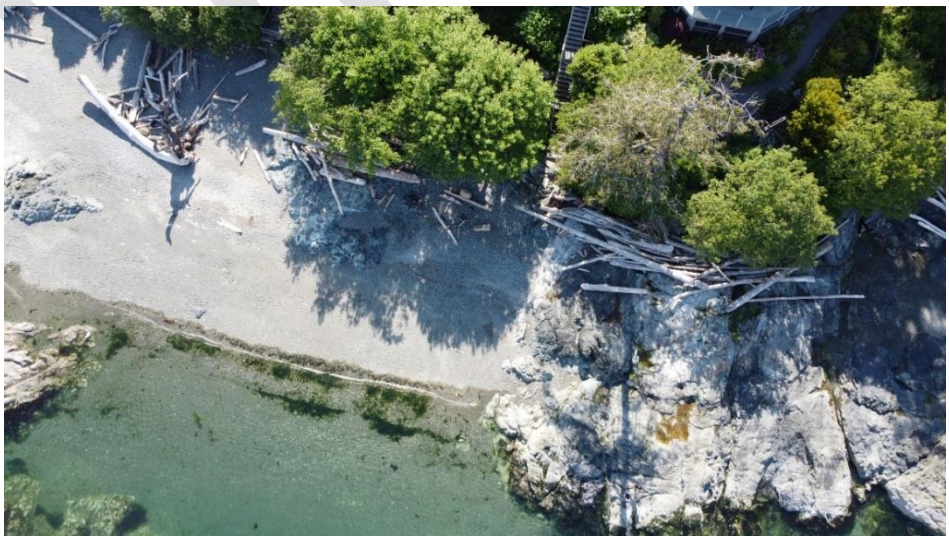

Photo 11: A variety of terrestrial and marine species are found across the biodiverse gradients of shorelines.

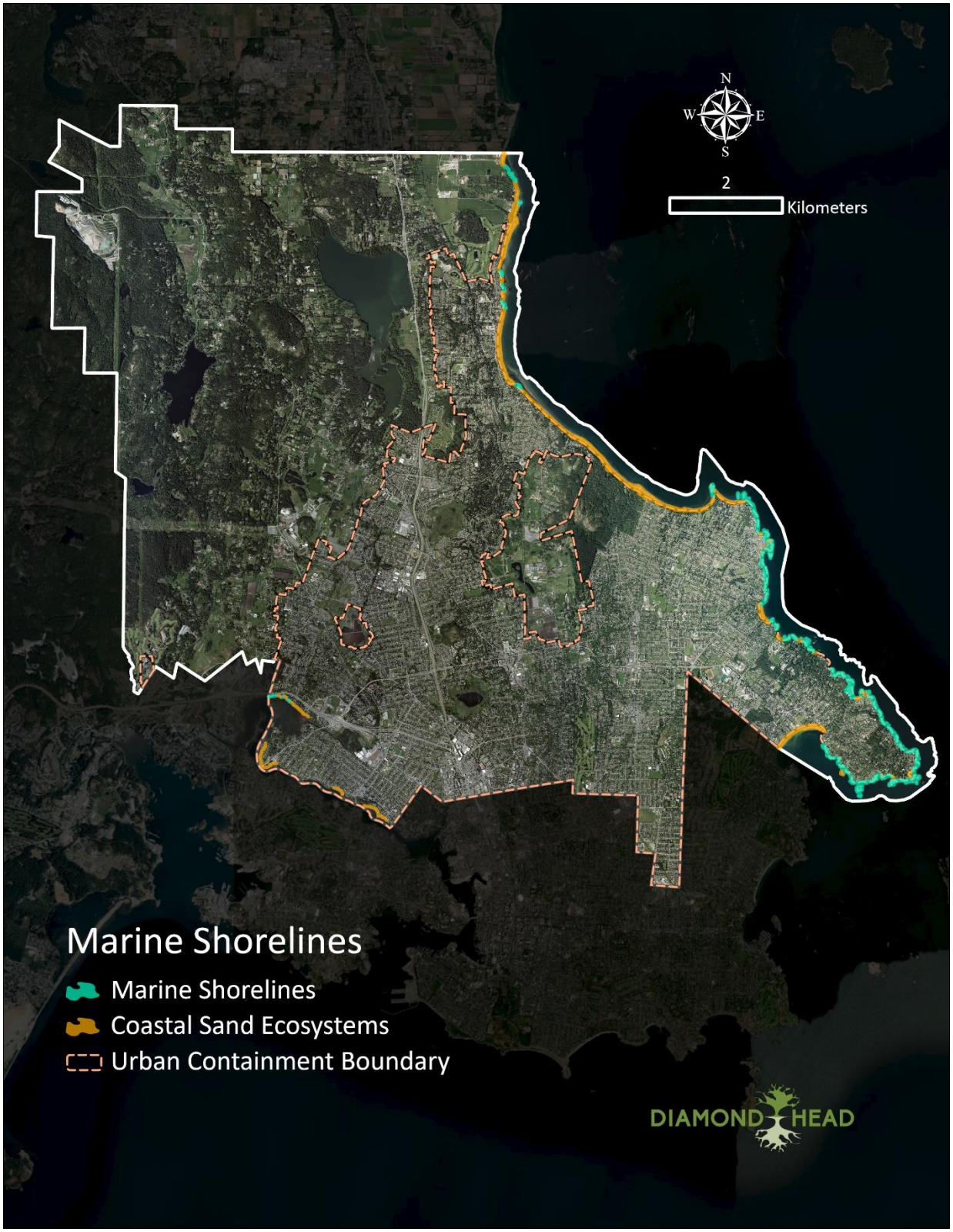

Figure 7. Map showing coastal sand ecosystems and other marine shorelines in Saanich.

3.4 Terrestrial Systems

3.4.1 Forests

Forested stands cover approximately 30% of the land in Saanich. Intact areas are scattered across the District and broken up by urbanized areas, farmland, and infrastructure. Most forests in Saanich are less than 150 years old, owing to a long history of logging that has eliminated nearly all old-growth trees in the District (Figure 8). Approximately 2% of forests still contain trees that are old growth. Many of these old growth trees are located in protected areas such as PKOLS (Mount Douglas Park), Elk/Beaver Lake Regional Park, and Mount Work Regional Park (Figure 9).

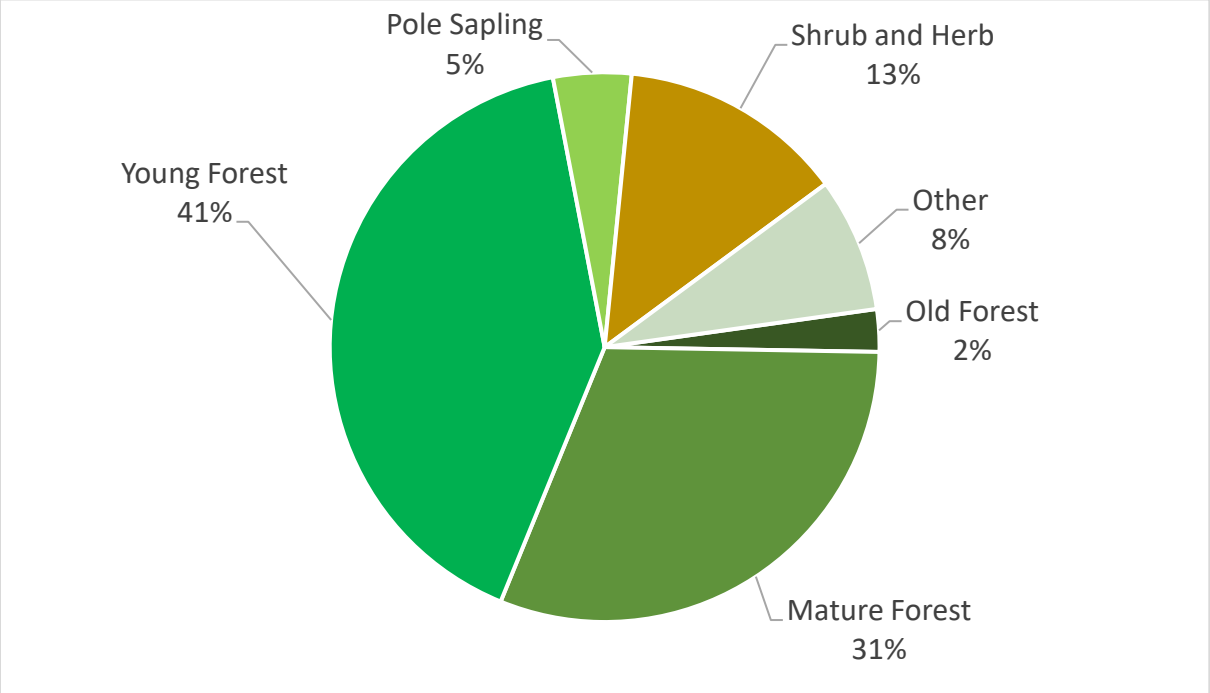

Figure 8. Natural area breakdown by stand age.

This logging history also contributes to the large proportion of mature and young forests across the District. These remaining mature forests (31%) and young forests (41%) are a significant portion of the forests and trees many residents see across the District today. Logged areas that are left to naturally regenerate into forests begin as very dense and uniform pole sapling forests with very limited understories. As these trees age, the structure of the forest canopy becomes more diverse. Understory vegetation establishes, some trees decay and fall, and new trees begin to grow. Together, these features create a complex forest structure and habitats that support high levels of biodiversity.

Shrub and herb ecosystems are characterized by irregular tree canopies and well-developed shrub and herbaceous layers. Many of these shrub and herb ecosystems are located within highly productive marsh and wetland areas such as Rithet's Bog and Swan Lake, portions of Garry oak ecosystems such as on PKOLS (Mount Douglas). However, some shrub and herb ecosystems are attributed to frequently disturbed utility rights-of-way.

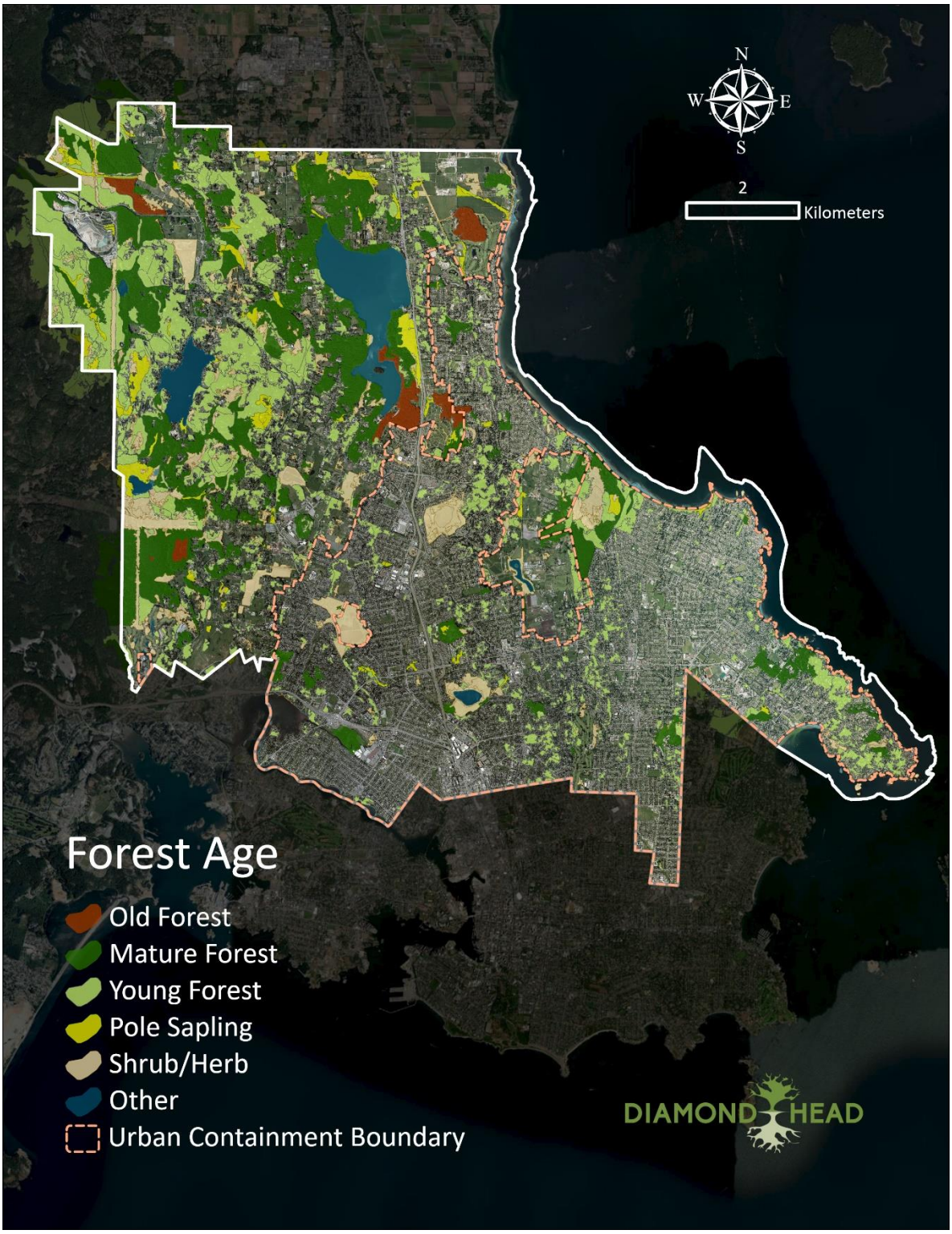

Figure 9. Forest age categories ranging from pole sapling (~<20 years old) to old forest (>250 years old). Non forested shrub and herb are included, which have the potential to become forests in the future.

Forests have been separated into similar areas based on the composition of tree species. The most common forest type found in Saanich are mixed stands of both conifer and deciduous species which cover 15.6% of the District's total area. These stands are varied and included mix of native tree species. Common coniferous species include Douglas-fir (*Pseudotsuga menziesii*), western redcedar (*Thuja plicata*), western hemlock (*Tsuga heterophylla*), grand fir (*Abies grandis*), and lodgepole pine (*Pinus contorta*). Common deciduous species include black cottonwood (*Populus trichocarpa*), red alder (*Alnus rubra*), Garry oak (*Quercus garryana*), arbutus (*Arbutus menziesii*), bitter cherry (*Prunus virginiata*), paper birch (*Betula papyrifera*), trembling aspen (*Populus tremuloides*), and cascara (*Rhamnus purshiana*). High concentrations of mixed forest are found in Cadboro Bay, Blenkinsop, and in rural Saanich between Prospect and Elk/Beaver Lakes (XEOL,XELE~~K~~).

Coniferous forests are the second most common forest type in Saanich, covering 11% of Saanich's total area. Most of these forests are composed of a tall, single-aged canopy of Douglas-fir with western redcedar and western hemlock growing in below them. Due to historic dry conditions, western hemlocks have not become well established in Saanich. Western redcedars, grand firs, and Douglas-firs have historically thrived but are suffering from prolonged droughts in recent years. All three have experienced crown dieback, while Western Redcedars and grand fir have seen higher removal rates due to death and increased susceptibility to pests. While grand firs are a prominent species that are establishing under Douglas-fir in many nutrient-rich areas, they are also struggling to establish in many Saanich parks. The remaining coniferous stands are largely composed of lodgepole pine, a climate-resilient species that will continue to occupy dry and nutrient-poor sites. Significant coniferous stands in Saanich are found in PKOLS (Mount Douglas) Park, at the south end of Elk/Beaver Lake (XEOL,XELE~~K~~), and along the west side of the District on Mount Work.

Photo 12: Most coniferous stands in Saanich are composed of a tall, single-aged, codominant layer of Douglas-fir

Forests dominated by deciduous tree species make up 3.2% of Saanich's total land cover. These stands are found across both the urbanized and rural areas of the District. About one third area are younger in age and composed of pioneer species that readily establish on disturbed sites including red alder, black cottonwood, bitter cherry, paper birch and cascara. These young stands tend to be dense and mature quickly providing valuable organics and woody debris to these ecosystems. Approximately two thirds of these are Garry Oak ecosystems which are considered at risk. These forests are typically more open with a mix of other tree species including arbutus (*Arbutus menziesii*). They are often found associated with drier sites but can have rich ground vegetation. Deciduous stands are commonly found surrounding riparian areas at Swan Lake, Rithet's Bog, and Blenkinsop Lake, among many other smaller lakes, ponds, and streams. Southwestern Vancouver Island icons – Garry oak and arbutus, can be found in clusters or individually on dry, rocky outcrops at Vic Derman Park, Cedar Hill Park, Knockan Hill Park, and Mount Tolmie Park.

In addition to natural forest stands, trees growing within urbanised areas provide a sizable contribution to the District's overall canopy cover (Figure 10). Urban trees cover 1,613 ha or 14.2% of the Districts land base. They are found along streets, on private property, and in otherwise unprotected greenspaces across Saanich. Urban trees are highly variable in species, age, and size. Many have been planted and managed by landowners or the District while others have established naturally. In the urban landscape, the canopies of trees are rarely contiguous. They are fragmented by streets and buildings, and often surrounded by impervious surfaces that limit their growth. These trees however are a valuable component of the overall urban forest landscape. They act as important linkages to the natural ecosystems found across the landscape. Wildlife use these urban trees to rest, gather food and nesting material, and travel from one place to another.

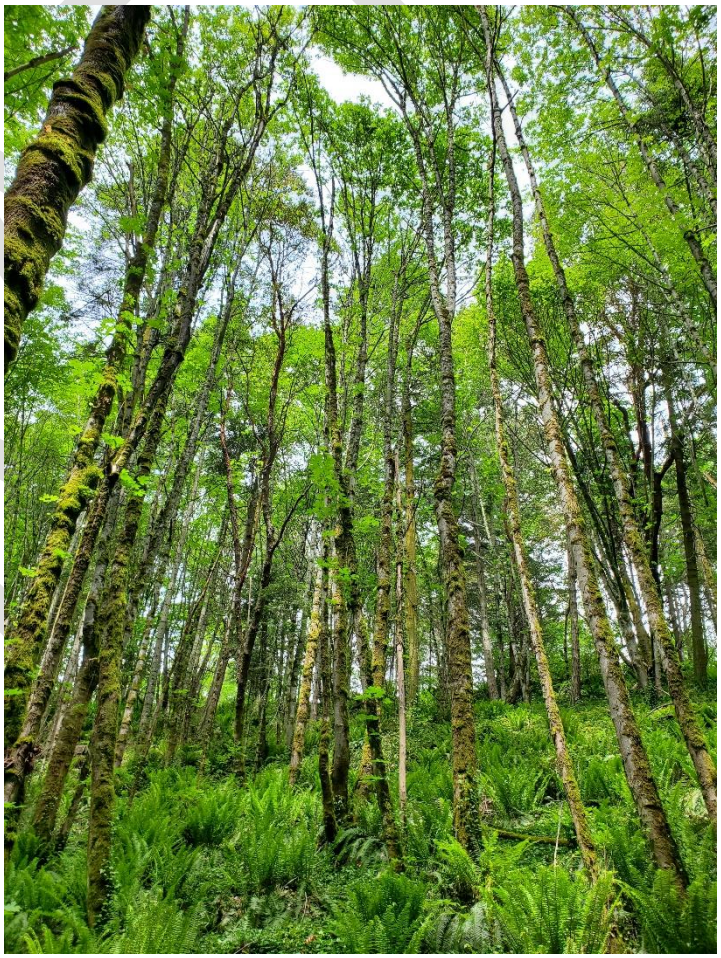

Photo 13: Young deciduous stands play a significant role for wildlife as they mature.

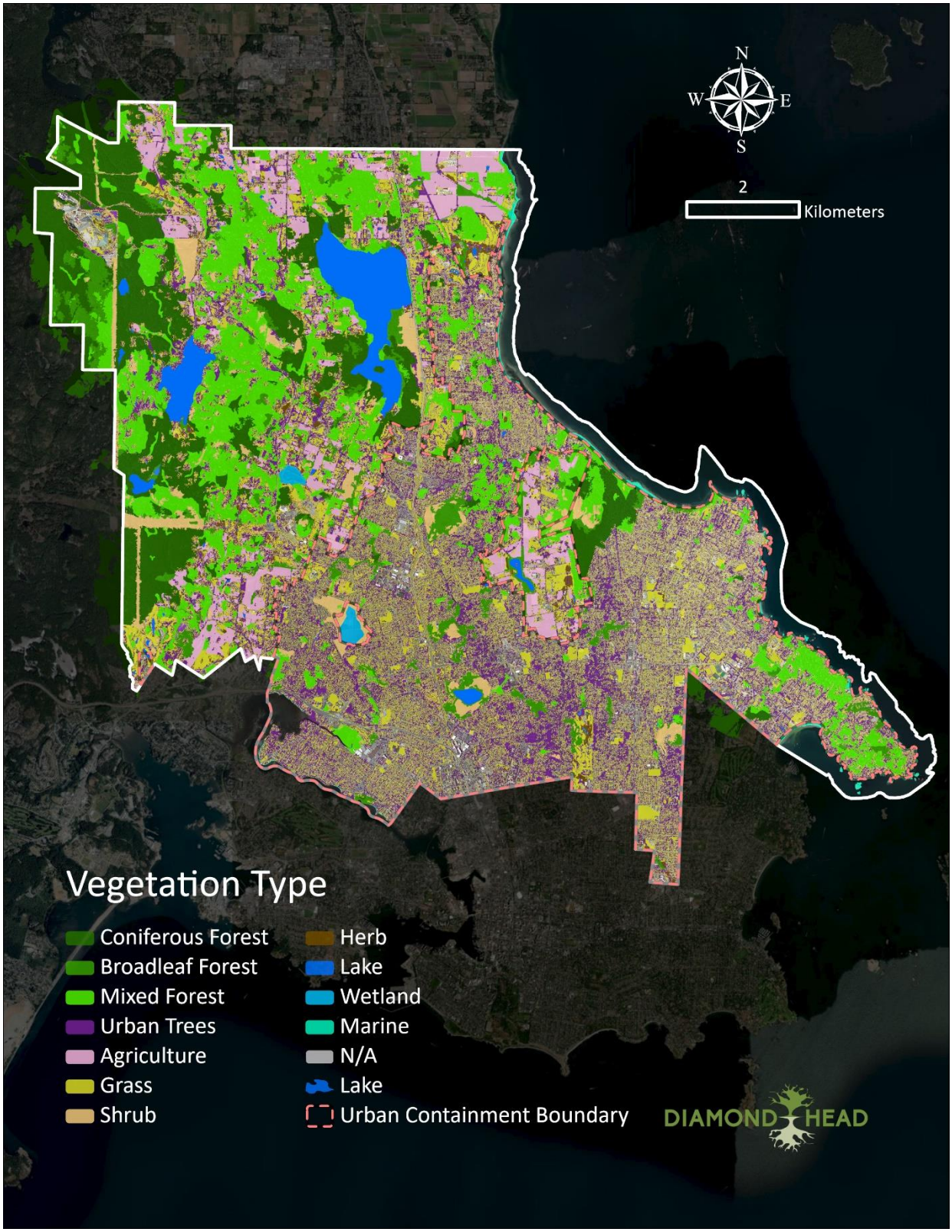

Figure 10. Forest and vegetation types found across Saanich.

3.5 Species and Ecosystems at Risk

Saanich is home to many rare and threatened species and ecosystems. These species are tracked by the BC Conservation Data Centre (BCCDC), which maintains a colour-coded list of species and ecosystems which are at risk of being lost (Red), of special concern (Blue), or secure or not at risk (Yellow). Natural areas in Saanich provide unique ecological characteristics. Many of the plant communities are considered at risk of being extirpated, threatened, or endangered (Figure 11). Formally endangered species are protected federally through the *Species At Risk Act*, but this registry is non-exhaustive, has limited applicability outside of federal lands (only applying to migratory bird species at risk and aquatic species on private lands), and does not protect ecosystems at risk. Some of these ecosystems are protected through parks and land covenants; however, many remain unprotected by legislation.

3.5.1 Coastal Douglas-Fir ecosystems

The Coastal Douglas-fir (CDF) biogeoclimatic zone is the province's smallest climatic zone and generally considered the most at-risk. The CDF is restricted to low elevations along coastal areas of the Salish Sea. It lies within the rain shadow of Vancouver Island and Olympic Mountains, resulting in a unique combination of warm, dry summers and mild, wet winters. The CDF zone faces strong pressures from urban development due to its terrain and favorable weather conditions. This pressure is continuing to threaten the integrity of its natural ecosystems. Where natural areas remain, they are often disconnected from one another and unprotected by formal means. The protection of these CDF ecosystems is important to preserve the ecological and cultural values not only in the Salish Sea, but on a global scale.

Photo 14: A young coniferous forest surrounds a mature Douglas-fir tree in Mount Work Regional Park.

Of the 48 distinct plant communities found growing in the CFD zone, 45 are classified as being Red or Blue list by the BCCDC. This illustrates the extent to which this zone has been degraded (Figure 11). These plant communities are highly diverse and include Douglas-fir forests, Garry oak woodlands, rocky arbutus outcrops, herbaceous meadows, and coastal sand ecosystems. The variety of habitats in these ecosystems attracts thousands of wildlife species, making the CDF the most biodiverse bioclimatic zone in the province. These ecosystems host over 280 provincially listed species, 24 of which are imperilled worldwide. Unfortunately, only 11% of the CDF is protected by provincial, regional, or municipal parks,[20] leaving many of these important natural areas at risk of being degraded further.

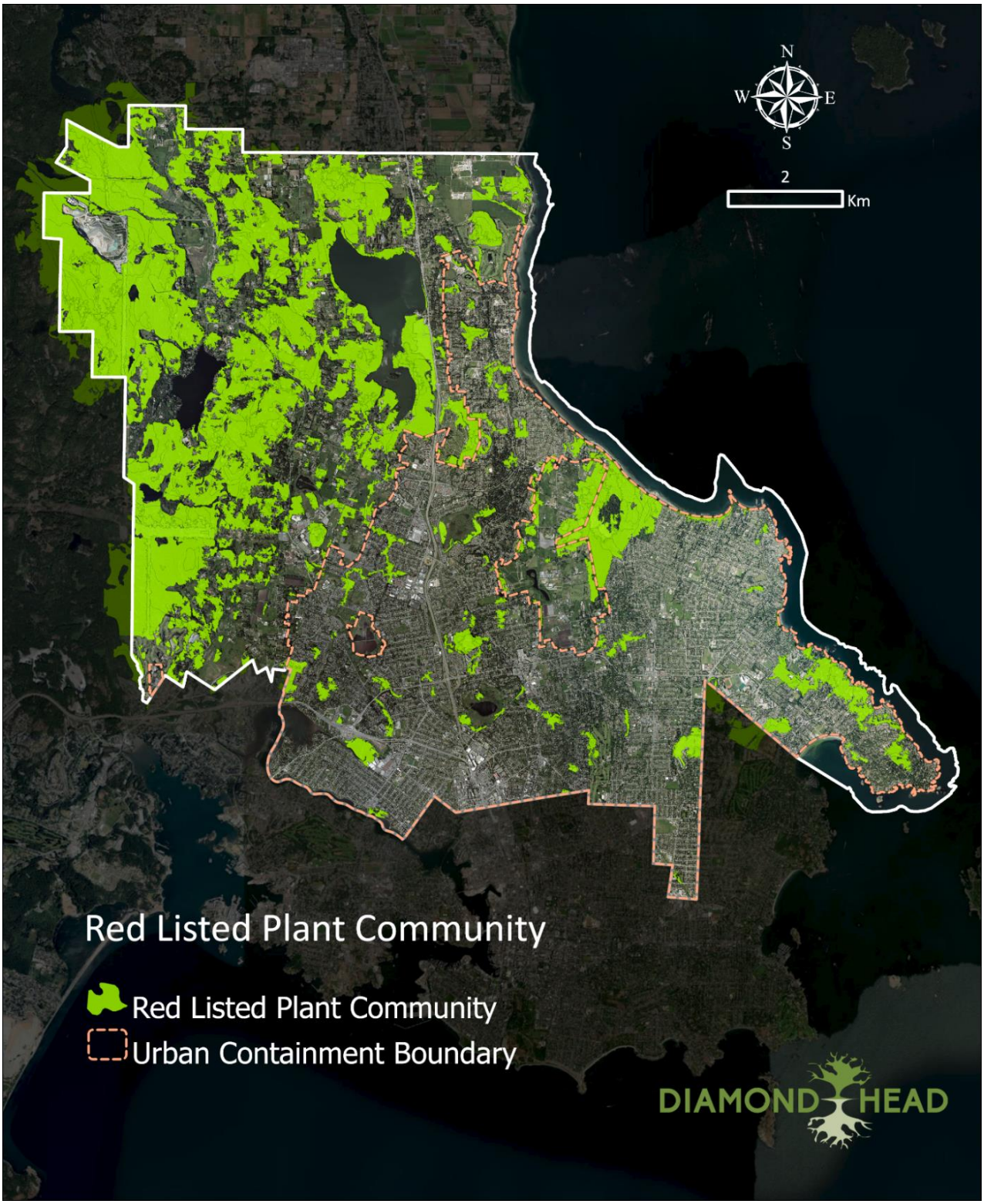

Figure 11. Distribution of red listed plant communities in Saanich.

Beyond the ecological significance of these ecosystems, there is a rich history of use by Indigenous peoples in coastal Douglas-fir ecosystems. Coast Salish nations have traditionally used these lands and relied on the diversity of culturally significant plants that they provide. Plants like camas (*Camassia leichtlinii*) are a cornerstone of many Coast Salish nations' traditions and are a key component of their current and historical ways of life.

3.5.2 Garry Oak Ecosystems

Garry Oak ecosystems are some of Saanich's most treasured natural places. They are a reminder of the bounty this landscape once provided, a reflection of human relationships with the land, and a window into what successful conservation and stewardship can look like.

Garry Oak ecosystems were once much more plentiful. Historical climate records show that the extent of their distribution was greatest around 8,000 years ago,[21] when they covered much of the land on southeastern Vancouver Island. Changes in the climate since then have favoured the encroachment of Douglas-fir forests. Indigenous peoples relied heavily on a variety of food, medicines, and tools harvested from Gary Oak forests. They made use of small-scale fires to clear underbrush and competitor species to maintain these open woodland meadows and the services they provided. These ecosystems may not exist today without this repeated burning by Indigenous peoples.

Studies show that these areas were burned as frequently as every six years, which is much more frequent than naturally caused wildfires caused by lightning on average every 90-145 years.[22] These ecosystems are as dependent on humans for their integrity as humans are dependent on them. Mature Garry oak trees have deep roots that help them to survive surface fires which help to control the younger encroaching Douglas-firs. Native Garry oak-associated plant species like camas, sea blush, and buttercup (among many others) have also evolved and adapted to this regular occurrence of low intensity surface fires. Their presence today is a reminder of their historic connection with first nations people.

Photo 15: Camas is a one of the most recognizable flowers in Garry oak ecosystems and has a long history of use by Indigenous peoples.

Garry oak trees and their associated ecosystems are home to more plant species than any other in coastal British Columbia. Many of the plants found there occur nowhere else in Canada. These plant communities support over 150 animal species and over 800 insect species which are specifically associated with Garry oak trees.[23] These ecosystems once blanketed southern Vancouver Island, though only small pockets now remain. Garry oak ecosystems cover only 250 ha or 2.2% of Saanich, with only 40% of them protected as parkland or under a covenant. Significant examples can be found at Knockan Hill Park, Christmas Hill Nature Sanctuary, and Mount Tolmie Park.

Photo 16: Garry oak meadows are some of Saanich's most treasured and unique natural spaces.

Since the 1850s, pressures from land development, the invasion of non-native plant species, and fire suppression have restricted Garry oak ecosystems to fringe areas and continue to threaten their existence today (Figure 12). These ecosystems are now mostly found on dry rocky outcrops where the terrain is less suitable for urban development.

Rapidly spreading invasive species like Scotch broom, daphne, Himalayan blackberry, English ivy, and orchard grass pose serious threats to these sensitive ecosystems. In addition to outcompeting native species for light, space, and water, invasive species can also change the chemical composition of the soil, which can make the restoration of these Garry oak ecosystems challenging. Fire suppression has played

a role in allowing these plants to invade Garry oak ecosystems. Over 100 Garry oak ecosystem species are at risk of extinction, which emphasizes the need to protect and restore these ecosystems where they still exist. Dedicated volunteers like those of the District of Saanich's "Pulling Together" program have helped care for these delicate places since 1999 through the removal of invasive species, planting of native trees and shrubs, and educating the public about ecosystem restoration.

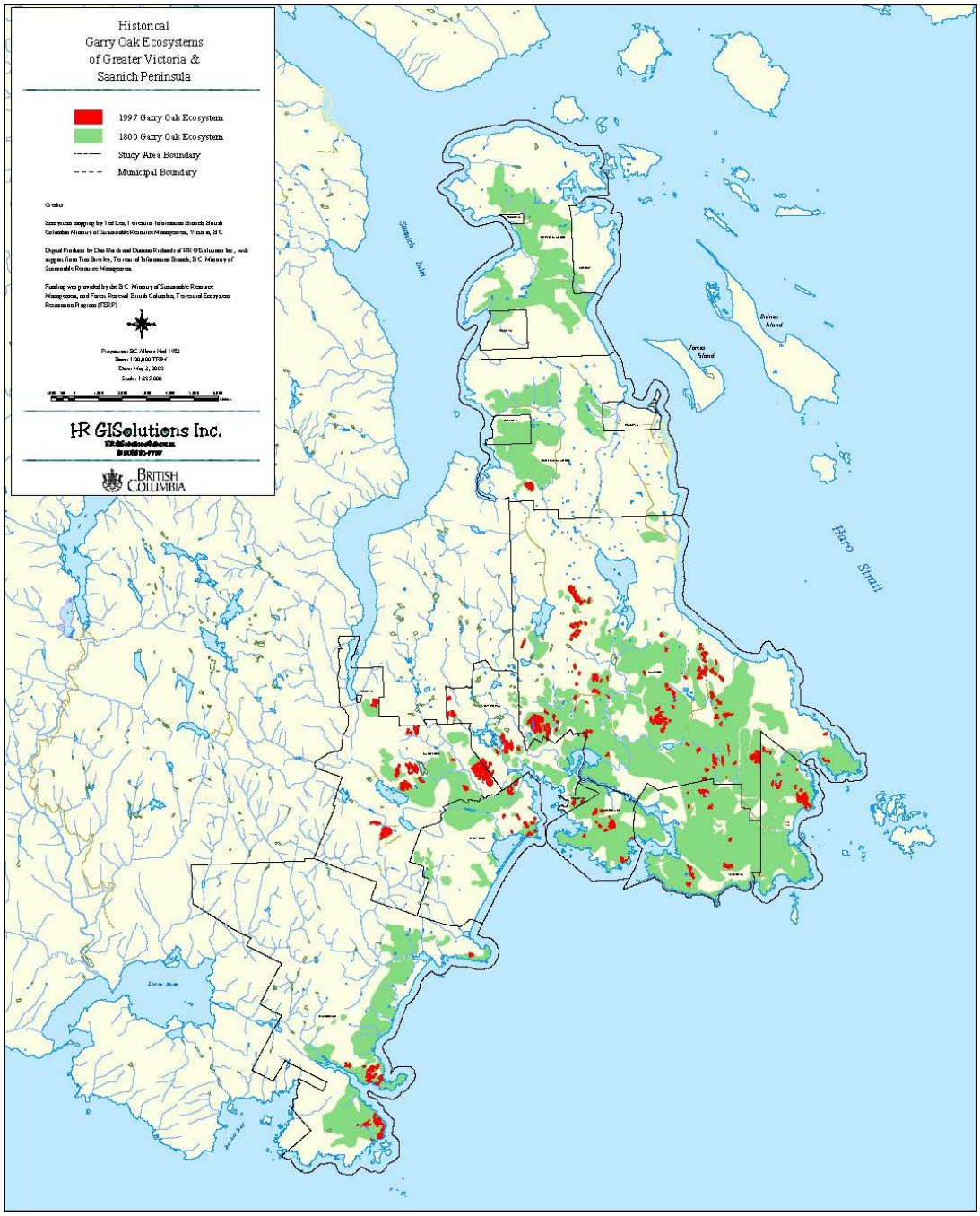

Figure 12. Map of historic (1800) and recent (1997) occurrences of Garry Oak in the Saanich. This map was developed for Garry Oak Ecosystem Restoration Team (GOERT).[24]

3.5.3 Species at risk

The District of Saanich is home to many rare animals and plant species. Preserving biodiversity requires that these endangered species have the habitat they require to survive on the landscape. There are numerous and often compounding reasons for a species to become endangered. Some species at risk (SAR) may have always naturally occurred in low numbers. Others may be living at the edges of their survivable range. Many have been reduced by human caused impacts such as habitat loss for land development and climate change. There are 150 occurrences of red or blue listed plants, animals, macrofungi, lichens that have been recorded by the BCCDC in Saanich (Table 5).

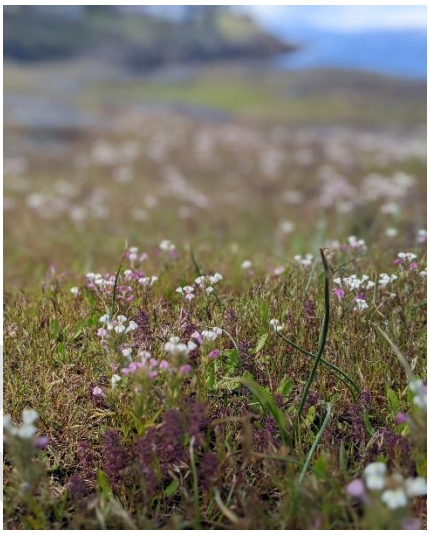

Photo 17: Bearded owl clover is a small, red-listed plant found in Saanich.

Table 5. Examples of plant and animal species at risk that have been confirmed to live in the District of Saanich.

Common Name	Species Name	Clade	BCCDC Listing	Typical Habitats found within the District	Major Threats
Bearded owl clover[25]	*Triphysaria versicolor ssp. versicolor*	Vascular Plant	Red, COSEWIC Endangered	Habitat specialist- occupies vernally moist meadows and seeps in maritime regions. Restricted to shallow soils over bedrock along coastal areas. Seven known populations in Canada, all in Saanich or Victoria.	• Habitat loss, degradation • Exotic plant invasion • Grazing
Oregon (Western) branded skipper (*Oregonia* subspecies)[26]	*Hesperia Colorado oregonia*	Invertebrate	Red, COSEWIC Endangered	Occupies sparsely vegetated areas, including coastal sand and gravel spits, and Garry oak habitats. Exposed ground, dry, and well drained soils, or short turf grass and bunchgrasses. Historical occurrence in Rithets Bog, last recorded 1956	• Pesticides (i.e. Btk spraying for gypsy moths) • Habitat loss, degradation • Fire suppression • Invasive species

Purple sanicle[27]	*Sanicula bipinnatifida*	Vascular Plant	Red, COSEWIC Treatened	Occurs in open Garry oak meadows, at low elevations (generally <30 m above sea level). 20 verified populations in BC, majority in parkland.	• Recreational impacts (trampling, fragmentation) • Invasive species • Development
Sharp-tailed snake[28]	*Contia tenuis*	Reptile	Red, COSEWIC Endangered	Inhabit open canopy woodlands dominated by Arbutus and/or Garry oak. Eight populations are known in BC, three on the Saanich Peninsula.	• Climate/range limited (northern limit of its range) • Habitat loss, degradation • development
Threaded vertigo[29]	*Nearctula sp.*	Invertebrate	Blue, COSEWIC Special Concern	Moist deciduous and mixed-wood forests at low elevations. Older riparian forests containing groves of large maples with ferns and shrubs in moist and rich sites.	• Habitat loss, fragmentation and degradation • Development • Hydrology drainage changes • Climate change • Invasive species
Western screech owl (*Kennicotti* subspecies)[30]	*Megascops kennicottii kennicottii*	Bird	Blue, COSEWIC Threatened	Found in lower elevation wooded environments, often along riparian areas. 11 breeding territories were known in the Cadboro Bay area in 1979, no records are available since.	• Habitat loss • Potential intraspecific interactions with barred owls (*Strix varia*) which have expanded their range into southwestern BC.
Yellow montane violet (*Praemorsa* subspecies)[31]	*Viola praemorsa ssp. Praemorsa*	Plant	Red, COSEWIC Endangered	Garry oak woodlands and maritime meadows. Low elevation (<30 m) herb dominated ecosystems	• Invasive species • Altered fire regimes • Human activity (e.g. trampling)

3.5.4 Migratory Birds

The Saanich peninsula is within the Pacific Flyway – one of the most important migration routes for migratory waterfowl in North America. This migratory route extends from southern Mexico to the arctic, along the pacific coast of North America. Millions of waterfowl congregate in deltas, lakes, and wetlands, taking up temporary residence or stopping to rest during migration. Many of Saanich's birds travel back and forth from Mexico, Central, and South America. These neotropical migrants include warblers, swifts, nighthawks, thrushes, vireos and many more. Saanich also plays host to many species which breed in the Arctic and travel south to overwinter. This includes many sea ducks, loons, grebes, raptors and owls. Just north of Saanich, the Sidney Channel is recognized as an Important Bird Area in Canada for its global significance in supporting congregatory species.[32]

Photo 18: Western grebes (*Aechmophorus occidentalis*) are an at-risk migratory species that use the Pacific Flyway.

4.0 iNaturalist data

iNaturalist is an online social network application that allows people to share information about the types and locations of species they identify. Their mission is to engage the public with nature, generate high-quality biodiversity data, and synthesize that data into tools such as their computer vision model. iNaturalist is available as a website accessible by computer or as an application for phones and tablets. Users can record their own observations, get help with species identifications, collaborate with others to collect biodiversity information for a common purpose, or access the observational data collected by other iNaturalist users.

Data stored on the site are mainly utilized by the public, scientists and experts, and teachers. Users can assess observations and recommend, confirm, or dispute a species identification. The more information (time, location, photos) given in an observation will allow it to be eligible for 'Research Grade' status. This high-quality data status means that multiple users have confirmed an observation's species identification and the data is accurate enough to be used for scientific research.
Fwester
Within iNaturalist, over 4,115 different species of plants, fungi, and wildlife have been observed in Saanich. This includes 1,426 species of plants, 1,187 species of insects and arachnids, 245 species of birds, and 30 species of mammals. The following subsections shows areas with the highest number of iNaturalist observations in the District. All species are not equally represented by this data. Observations are likely biased towards species that are most common, colourful, or charismatic. These maps represent the areas that are open to the public and most frequented by nature enthusiasts.

4.1 Native Species

The unique blend of a freshwater lake, wetland, and forest habitat at Swan Lake makes it a popular spot for viewing local wildlife (Figure 13). This park is evidently a hotspot for birdwatching as 74 of the 91 animal species observed there are birds. The most common species include mallards (*Anas platyrhynchos*), golden-crown sparrows (*Zonotrichia atricapilla*), Anna's hummingbirds (*Calypte anna*), American coots (*Fulica americana*), and spotted towhees (*Pipilo maculatus*). Similarly, the wetland and old field habitat found at Panama Flats is another common place for birdwatching. 90% of the animal species inventoried there are birds. Observations of native animal species are more commonly made in parks compared to developed areas due to their accessibility to the public. This highlights the important role that parks play for providing access to nature.

Photo 19: Spotted towhees are among Saanich's most common birds.

PKOLS (Mount Douglas Park) and Mount Tolmie Park are some of Saanich's most popular natural parks. iNaturalist observations of native plants in these two parks is much higher than other areas in Saanich. Common observations here reflect the most ubiquitous and eye-catching trees and plants of our region, including Garry oak, licorice fern, arbutus, sword fern, Douglas-fir, white fawn lily, and dull Oregon-grape. Outside of PKOLS (Mount Douglas Park) and Mount Tolmie Park, recorded species are generally concentrated in other protected and publicly accessible areas such as Swan Lake and Christmas Hill.

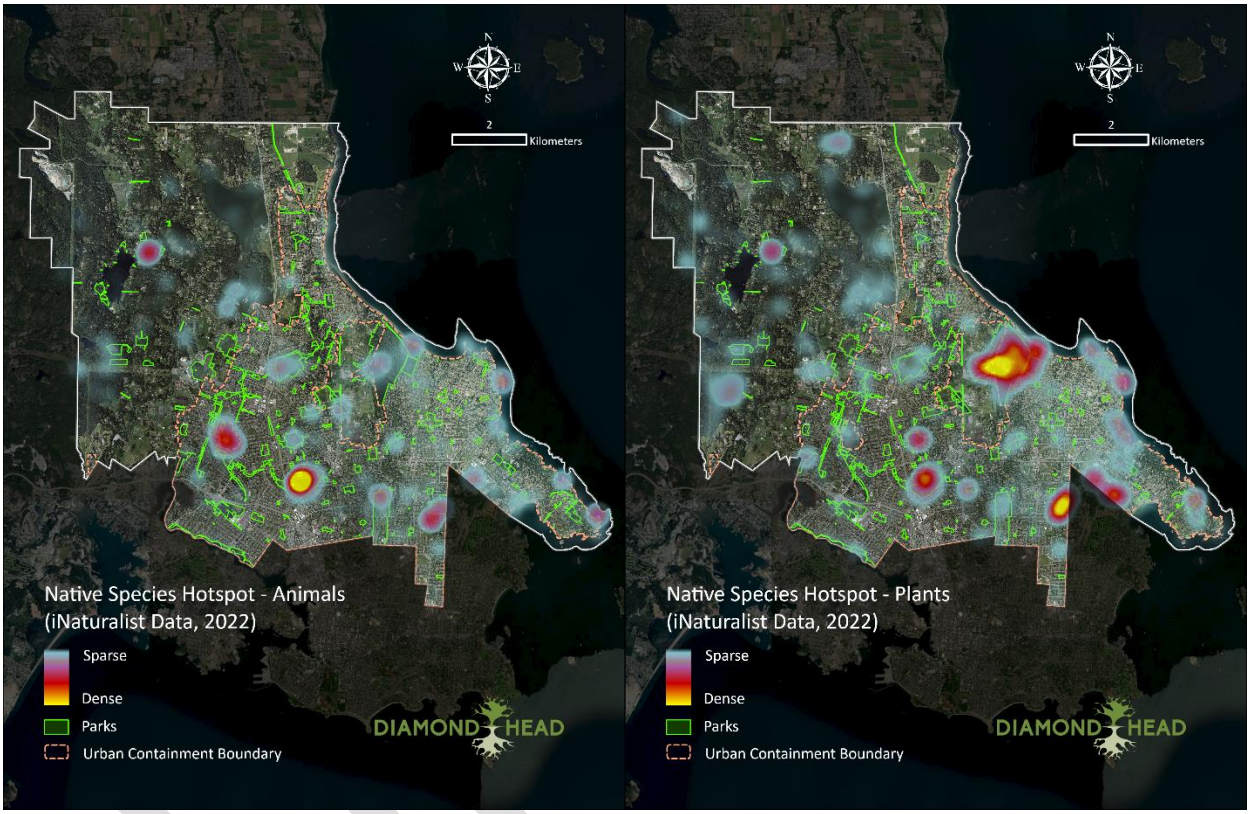

Figure 13. Native animal (left) and plant (right) species observation hotspots from iNaturalist data.

4.2 Threatened Species

Saanich is home to many threatened plant and animal species, many of which have been observed and recorded in iNaturalist (Figure 14). A significant portion of the threatened animal species observed in Saanich are great blue herons, which are a familiar and easily recognized bird in the region. This species has been most commonly observed in the aquatic habitats at Swan Lake, Panama Flats, and Glencoe Cove-Kwatsech Park. Saanich is also home to many other threatened animal species, including transient trumpeter swans, barn swallows, and western painted turtles.

Plant species such as Pacific yew (*Taxus brevifolia*) are declining across the west coast, whereas black/beach knotweed (*Polygonum paronychia*) is a blue-listed species with only one iNaturalist observation from 2022, and no records in the BCCDC in Saanich. Pressures from land development,

competition, and climate change threaten the longevity of these species in Saanich. High concentrations of Pacific yew for example have only been recorded in Saanich at PKOLS (Mount Douglas Park). This species grows slowly in the understory of mature coastal forests. It's bright red berries provide an important food source for wildlife. This population in PKOLS (Mount Douglas Park) is critical for keeping this species present in the District. Similarly, a small population of the red-listed yellow montane/canary violet (*Viola praemorsa*) exists in among the Garry oak meadows at Playfair Park. This species has only been observed here and at Bear Hill Regional Park and relies on these protected areas for its survival in the District. Along the foreshore, Glencoe Cove-Kwatsech Park provides unique habitat for a population of the red-listed bearded owl-clover. This species lives among the grassy meadows in this park and is the only population of its kind in Saanich.

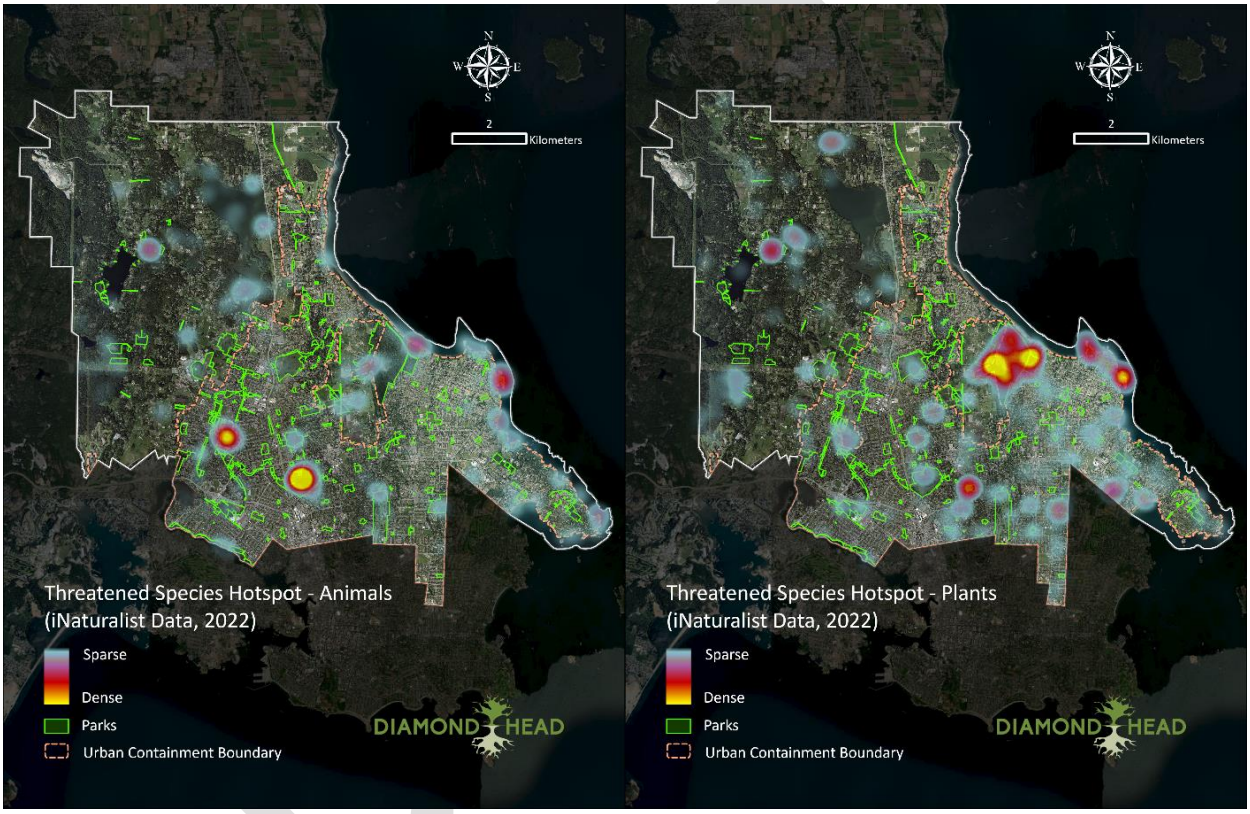

Figure 14. Threatened animal (left) and plant (right) species observation hotspots from iNaturalist data.

4.3 Invasive Species

Invasive species of plants and animals are pervasive throughout Saanich but concentrated mainly in urbanized areas (Figure 15). Many observations of invasive animal species have been made at Swan Lake, illustrating this habitat's suitability for eastern gray squirrels, European wall lizards, and American bullfrogs. As a foraging species, eastern gray squirrels take advantage of the diverse habitat types surrounding Swan Lake and have made themselves long-time residents of the park. Similarly, European wall lizards can be found basking in the pockets of rocky habitat. Swan Lake also boasts the highest concentration of American bullfrogs, likely due to extensive wetland habitat found there.

Photo 20: Wall lizards are a commonly found invasive animal in Saanich.

Panama Flats is another wetland complex with many observations of common non-native animal species including house sparrows and eastern cottontail rabbits. Further east, European wall lizards are well established between Cedar Hill Road and Shelbourne Street, likely owing to a mix of greenspace and paved surfaces in this neighbourhood. Visitors to Mount Tolmie Park and the University of Victoria have catalogued many introduced species, which include commonly observed occurrences of eastern gray squirrels, Indian peafowl and eastern cottontail rabbits.

Mount Tomie Park has the greatest number of iNaturalist observations of invasive plant species in Saanich. Of the 66 species observed here in 2022, Scotch broom, red deadnettle, and spurge laurel were the most commonly recorded. Similarly, PKOLS (Mount Douglas Park) is a hotspot for Scotch broom observations, having over double the number of observations compared to English holly, orchard grass, creeping buttercup, and English ivy. At Swan Lake, the showy bittersweet nightshade is the most commonly recorded invasive species, followed by creeping buttercup, English hawthorn, and red deadnettle.

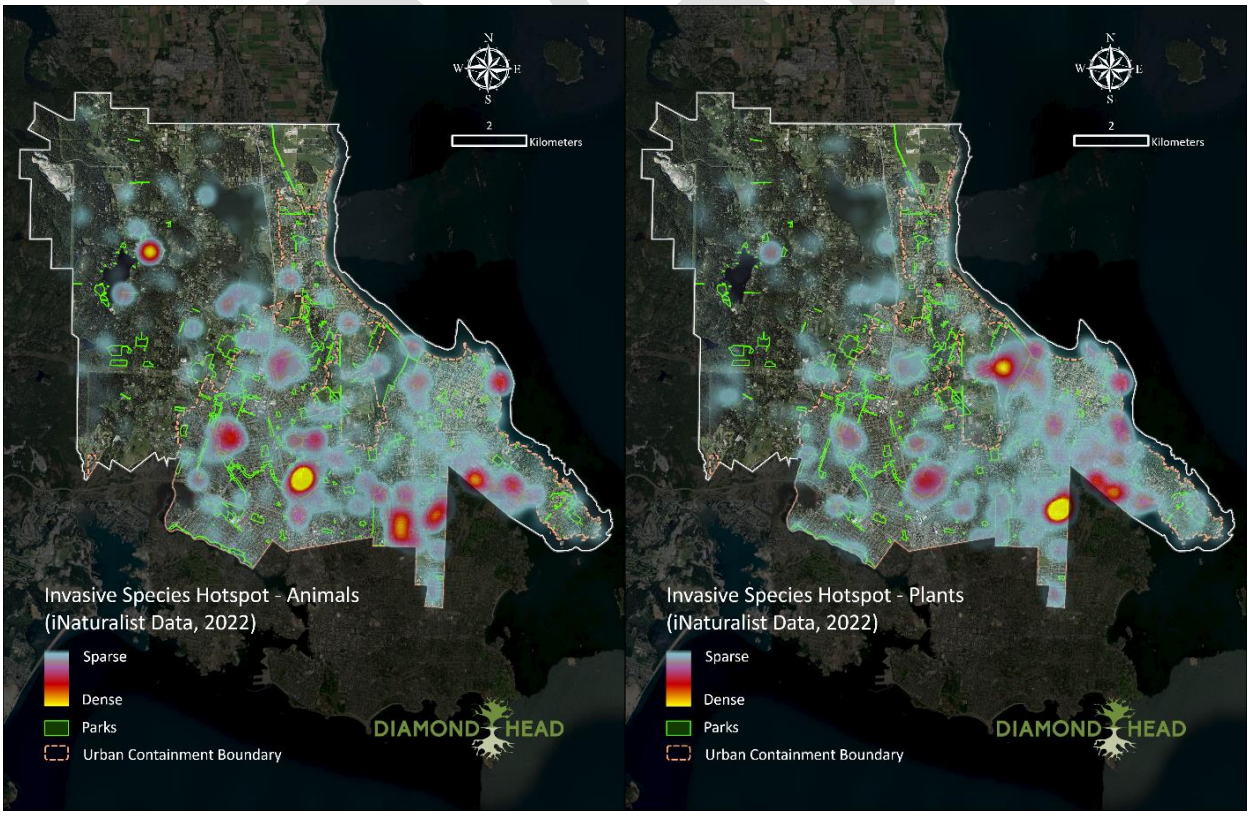

Figure 15. Location of invasive animal (left) and plant (right) species observations from iNaturalist in Saanich.

5.0 Biodiversity Target Categories

The Resilient Saanich Technical Committee has identified eight types of habitat elements that will be used when discussing biodiversity conservation in Saanich. These are called “Target Categories” but are not meant to relate to a goal or objective. These Target Categories have been applied to all pervious areas of the district and include habitats ranging from sensitive natural areas to backyards and playing fields (Figure 16). While conservation methods and ecological sensitivities vary across these Target Categories, each plays a role in conserving and enhancing biodiversity across the district. The following sections define the eight Target Categories.

5.1 Coastal Douglas-fir Forests

Coastal Douglas-fir forests (described in detail in section 3.5.1) are part of the smallest and most at-risk forest type in the province.[33] Expansive human development across this forest type’s range has led to dramatic declines in its distribution. In Saanich, most of these remaining forests are within parks and protected areas, though some remnant stands exist scattered throughout the district on private land. Coastal Douglas-fir forests cover approximately 2,729 ha which represents 23.8% of the District.

Photo 21: Coastal Douglas-fir forests are among Canadas most at risk forests.

5.2 Garry Oak Ecosystems

Garry oak ecosystems (described in section 3.5.2) are among the most recognizable and cherished ecosystems in the District. Vegetation in these areas is characterized by a well-developed herbaceous layer, with an irregular canopy of trees including Garry oaks. These ecosystems thrive in the unique climate of Southern Vancouver Island and the Gulf Islands and were maintained through Indigenous land management practices. Since the removal of cultural burning and extensive development in the area, few Garry oak ecosystems remain in Saanich. These ecosystems cover 251 ha which represents only 2.2% of land in the District.

5.3 Greenspace

Greenspace includes large, pervious areas in Saanich that are primarily grass and used for recreation. This includes four golf courses, and one cleared area at the south end of Prospect Lake. The greenspace category covers 164 ha which represents 1.4% of land in the District. These exist mostly on private land. One of the golf courses is publicly owned and operated.

5.4 Backyard Biodiversity – Rural & Urban

The rural classification of this category applies to lands outside of the Urban Containment Boundary (UCB), while areas within the UCB are considered urban. Urban backyard biodiversity areas are generally characterized by smaller parcels and denser housing while larger parcels and significantly more agricultural land are more common in rural areas.

Photo 22: Green space includes turf grass and landscaped areas.

These backyard biodiversity categories include private land ranging from small backyards to agricultural fields and hedgerows. They also include pervious public land such as street trees, boulevards, playing fields and urban parks. Vegetation in these areas typically includes turf grasses, ornamental landscaping and street trees. Urban backyard biodiversity areas cover 2,698 ha representing 23.8% of the District. Rural backyard biodiversity areas cover 2,167 ha representing 19.1% of land in the District.

5.5 Wetlands, Lakes and Hydroriparian Streams

Aquatic ecosystems and their associated riparian habitat support some of the highest levels of biodiversity in Saanich. Wetlands of all kinds are included in this classification, including bogs, seasonal ponds, lakes, streams, and forested swamps. Riparian systems are terrestrial habitats that exist next to these ecosystems and are influenced by their hydrology. These areas cover approximately 667 ha which represents 5.9% of the District.

5.6 Coastal Sand Ecosystems

Coastal Sand Ecosystems include the terrestrial portion of sand-dominated beaches, spits, and dunes. These areas are generally characterized by sparsely vegetated or herbaceous ecological communities and any associated forest, bluff, and wetland communities. The structure of these ecosystems relies on the influence of both the marine and terrestrial realms and the dynamic nature of this transition zone. Due to the limited range in which these ecosystems occur, they cover only 39 ha, which represents 0.3% of the District. The majority (98%) of these ecosystems occur outside of protected areas.

Photo 23: Native beach pea found in coastal ecosystems.

Photo 24: Few of Saanich's coastal sand ecosystems are protected. This an example of a recently restored coastal sand dune system.

5.7 Marine Shorelines

Marine Shorelines include the areas along the marine-terrestrial transition zone that are not considered coastal sand ecosystems. These ecosystems include rock outcrops, coastal bluffs, intertidal marshes, and estuaries. The foreshore, intertidal and subtidal zones are included in this target category. These ecosystems are variable across Saanich, ranging from sparsely vegetated bedrock to rich marshland in estuaries. Many species at risk inhabit these areas. These areas cover a small area covering only 28 ha, which represents 0.2% of the District.

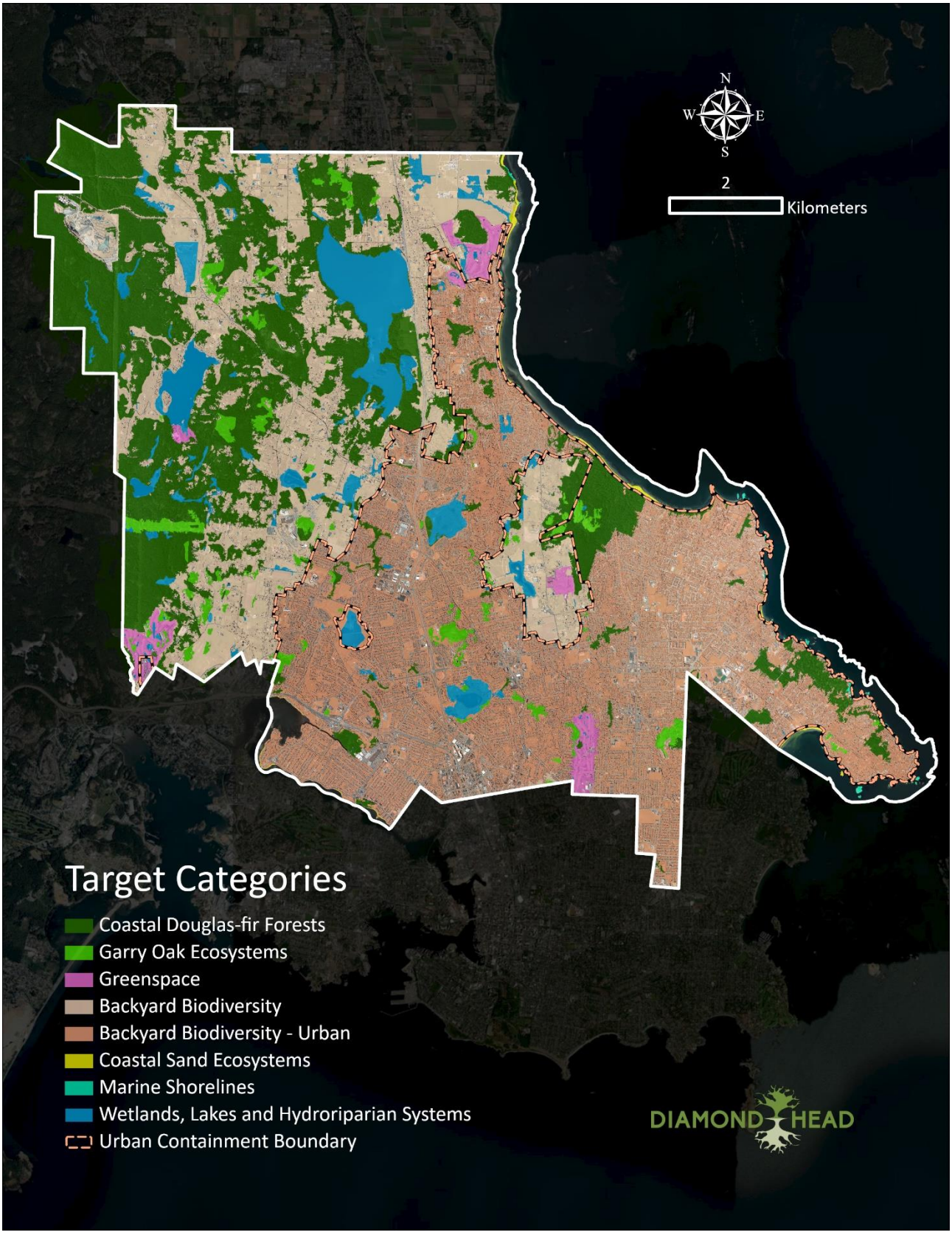

Figure 16. Biodiversity Target Categories.

6.0 Impervious Surfaces

Surfaces which do not allow water to pass through are considered impervious. These include buildings, roads, parking lots sidewalks and other artificial structures. Measuring the extent of impervious surfaces helps to understand the impacts that urban areas have on biodiversity. Rainfall on natural areas and other pervious surfaces allows water in infiltrate into the groundwater. This allows groundwater recharge, removes pollutants, and increases the base flow of watercourses. Impervious surfaces prevent water from entering the ground, and instead moves it across the landscape as runoff. This flushes pollutants into streams, reduces groundwater, and can have significant effects on stream health and morphology.[34]

LiDAR and GIS processing of CRD layers was used to identify impervious surfaces across the District. It was found that impervious surfaces account for a total of 15.8% of the District's land area. There is, however, a large variation across the district (Figure 17). Within the UCB, impervious surfaces account for 29.5% of the land area. Outside of the UCB, only 4.8% of the land cover is impervious. In all areas, over half of impervious surfaces consist of roads and buildings.

Photo 25: Impervious surfaces can reduce water infiltration and fragment the landscape.

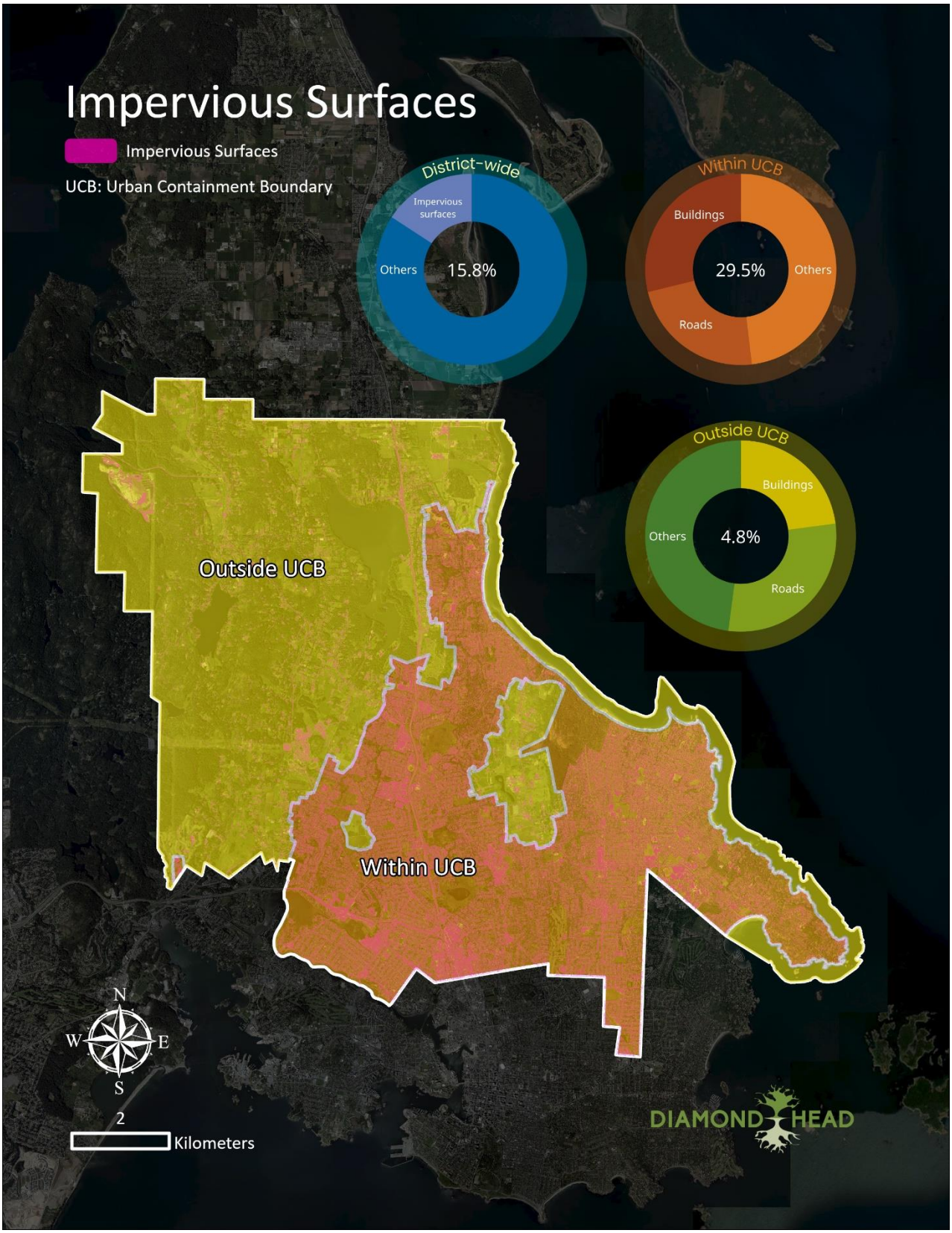

Figure 17. Map showing location of impervious surfaces in Saanich, within and outside the UCB.

7.0 Biodiversity Ranking

The final biodiversity ranking in Saanich provides a relative comparison of which areas in the District are likely to support the greatest diversity of species (Figure 18). The areas that rank the highest are typically large in size, with refuge areas located away from urban development and which have access to forage, shelter and water. Access to water in particular is very important. Even fragmented and small riparian areas next to watercourses can often support higher levels of biodiversity compared to larger natural areas that are separated from water sources.

Photo 26: Pacific sideband (*Monadenia fidelis*).

In Saanich, the urban containment boundary (UCB) tends to separate areas which generally ranked higher or lower in the biodiversity ranking. This is due to the fragmentation of natural areas by urban development within the UCB. Habitat areas tend to be smaller and fragmented with higher levels of disturbance. Larger urban parks such as PKOLS (Mount Douglas Park), Swan Lake and Rithet's Bog stand out as biodiversity hotspots within the UCB. These parks and other similar parks provide important refuge for wildlife within the UCB. Cuthbert Holmes Park is ranked as medium biodiversity value, but likely acts as a stepping stone for that area, particularly for birds and flying insects.

Heavily treed residential areas with mature, closed canopies such as the Cadboro Bay neighbourhood support higher levels of biodiversity compared to more recently developed areas with younger, more spread-out boulevard trees. In comparison, areas outside of the UCB in rural Saanich features larger tracts of contiguous forest and agricultural land with less development. The greatest concentration of highly rated natural area exists in the large tracks of natural forests in the northwest part of the District.

Many of the remaining Garry oak ecosystems in Saanich are found in smaller fragmented natural areas surrounded by development. Many of these areas have been disturbed from their natural state. Their fragmentation, small size, and often lack of water sources cause them to be ranked lower. These important ecosystems provide specific habitat for many species at risk but do not necessarily support a high number of species in their current condition. They are critical for supporting species at risk but do not provide the size and diversity of habitat found in the large, continuous tracts of forest and riparian areas in more rural areas of Saanich.

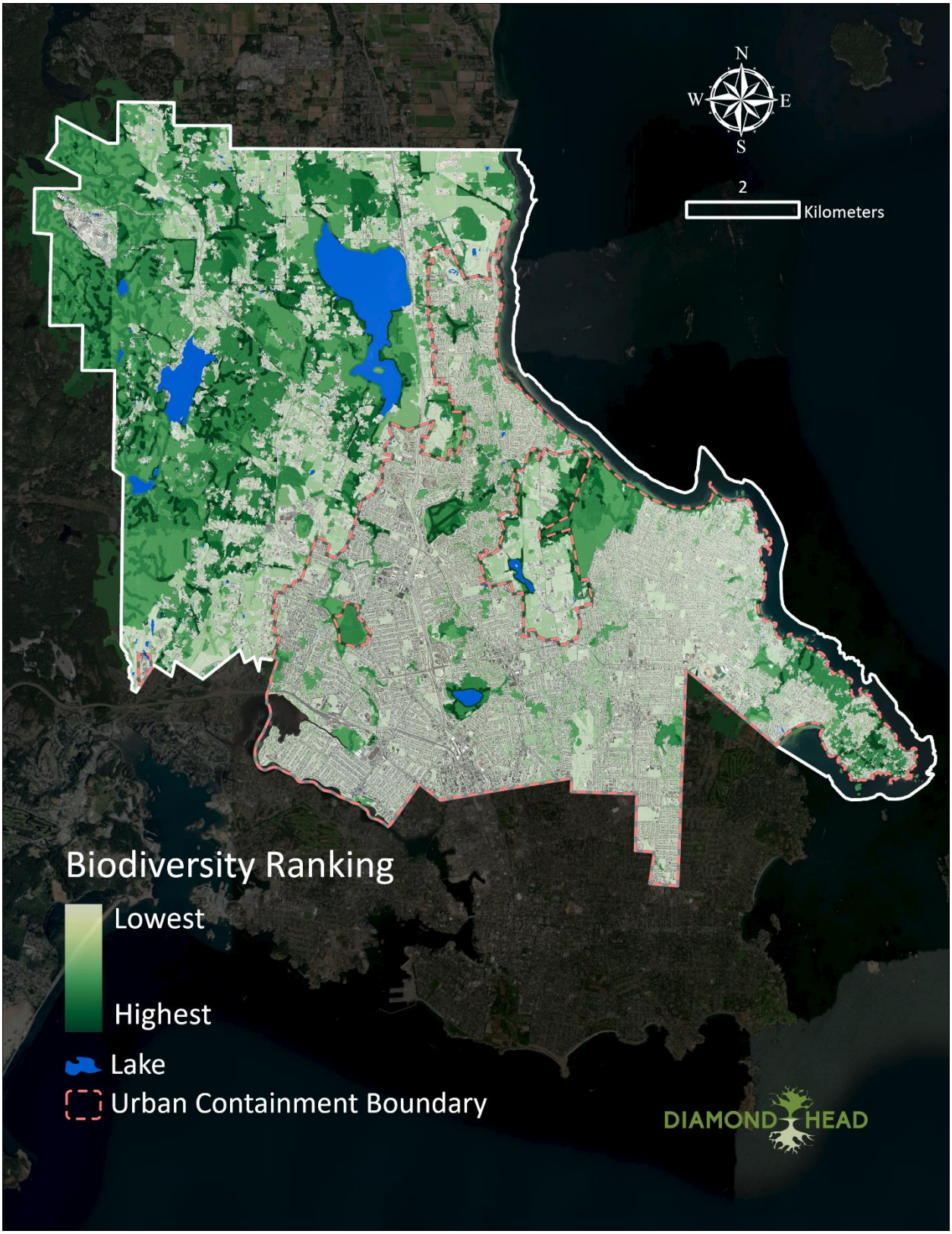

Figure 18. Natural areas throughout the District have been ranked based on their relative capacity to support biodiversity. This ranking incorporates habitat type, patch size, fragmentation, and proximity to freshwater.

8.0 Protected Areas

There is a total of 1,758 hectares of protected land within the District of Saanich (Figure 19). These are protected under a combination of jurisdictions including municipal and regional parks and conservation areas, as well as privately owned lands with natural state covenants. For this assessment, all parkland was considered protected, this includes natural area parks as well as urban parks, some of which provide natural areas. Protected areas are critical for preserving biodiversity across the District. Understanding where these protected areas are, how they are protected, and how they contribute towards biodiversity will help prioritise planning and resources for this Strategy. Preserving biodiversity within the District requires that more areas be strategically protected focusing on the highest value areas and those that provide important connectivity corridors.

8.1 Private Land Regulation

8.1.1 Municipal

Natural state covenants are registered agreements that can be a municipal requirement for the approval of some development applications. The covenant is legally binding and remains in perpetuity for the property, unless new terms are agreed upon by the District and landowner. Natural state covenants are used by the District to protect sensitive ecosystems, plants, and wildlife. These agreements protect entire natural areas and their respective features. As part of the terms, the covenanted area is to remain undisturbed and, in some cases, restoration may be required. Any proposed activities must follow the terms of the covenant agreement and may also require written permission from the District of Saanich. Covenants are often issued as part of environmental development permit areas. The District does not currently have any environmental development permit areas.

8.1.2 Provincial

The province relies largely on municipalities to regulate environmental protection on private land. It does, however, have legislation in place to protect certain aspects of the natural environment. One significant piece of legislation includes the Riparian Areas Protection Regulation (RAPR), which requires the protection of watercourses and a minimum functioning riparian area, called a Streamside Protection and Enhancement Area (SPEA). The SPEA (i.e. the vegetation, soils, and natural features that contribute to a watercourse's form and function) are protected from development and developmental impacts. There are some weaknesses to this legislation. One weakness is that RAPR applies to watercourses that provide fish habitat or significant flow or nutrients to fish habitat. It does not protect watercourse that are not connected to fish habitat. It does not protect against all land uses including agriculture. It also doesn't require restoration of degraded areas.

The Water Sustainability Act (WSA) a Provincial act that protects all watercourses and groundwater sources, regardless of fish status, and includes the regulation of instream works. It is the main enforcement mechanism of RAPR, outside of municipal Development Permit Areas. The watercourses and their riparian areas which are protected by these legislations were not included in Figure 18.

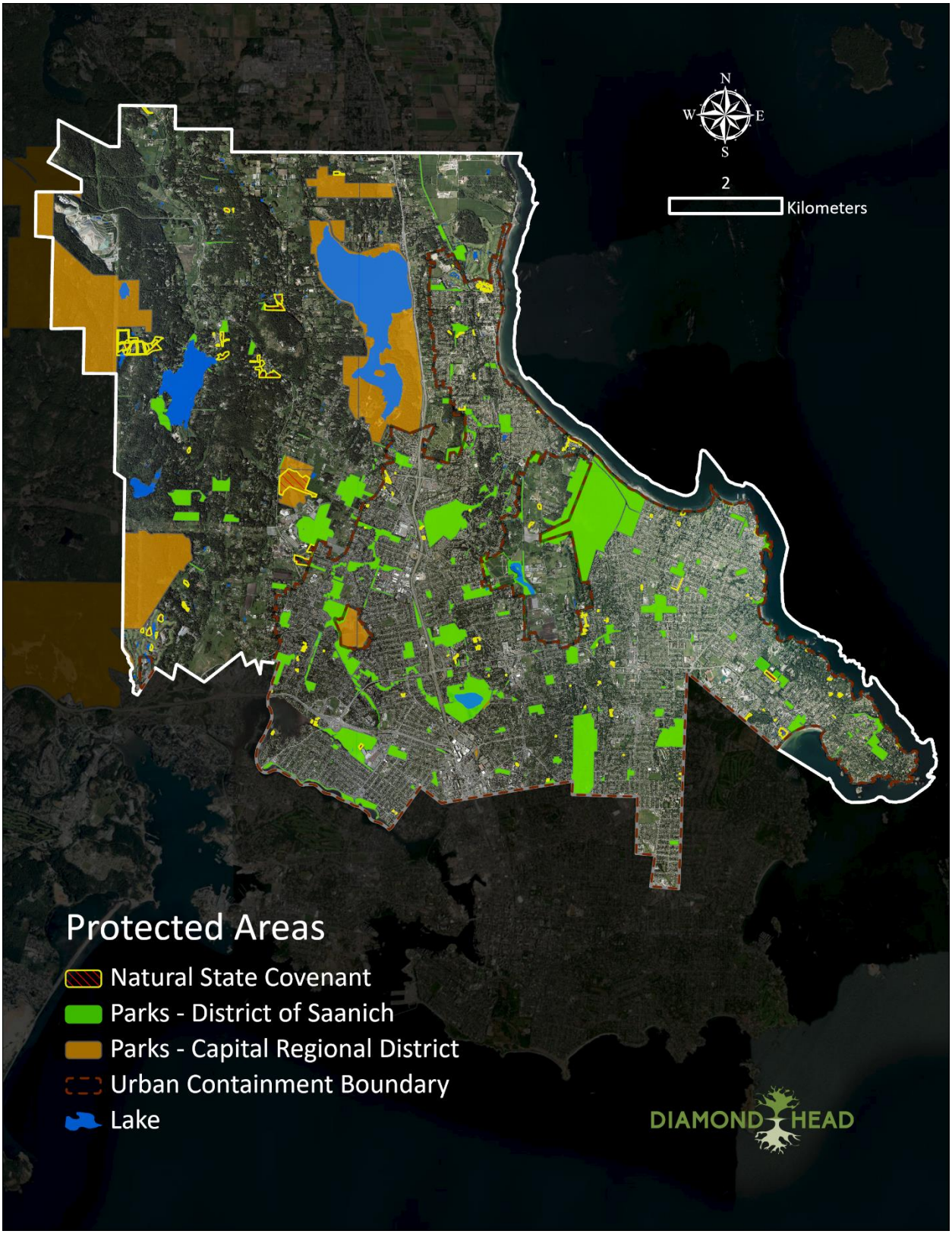

Figure 19. Location of lands protected under natural state covenants, District of Saanich Parks, and Capital Regional District Parks.

It is important to note that some additional legal protections exist outside of restrictive land covenants and parkland. They are, however, often limited in enforcement and/or applicability. These include federal or provincial regulations which protect specific habitat features such as nests, trees, or certain wildlife species. For example, the *Migratory Bird Regulation* (2022) federally protects migratory birds and their nests; however, this act only protects active nests (with some exceptions) and enforcement is largely left up to the municipality. Similarly, the federal *Fisheries Act* (2019) protects fish and fish habitat. In freshwater systems, this is largely done through enforcement of the provincial Riparian Areas Protection Regulation (RAPR). In marine systems, fish and fish habitat (including terrestrial riparian habitat i.e. shorelines) are technically protected; however, actual guidelines and enforcement may be inconsistently applied across jurisdictions. Tools exist for municipalities to expand on these protections beyond land acquisition and will be explored in the upcoming Biodiversity Conservation Strategy.

Photo 27: Many marine shorelines along Saanich are not protected as parkland.

8.2 Summary of Findings

There are many high-value natural areas that remain unprotected in Saanich (**Figure 20**). These are found on a variety of lands including private property, right of ways, and industrial sites. The biodiversity analysis has highlighted areas in Saanich that have the capacity to support high levels of biodiversity but remain unprotected. These include much of the north-western part of Rural Saanich. These are typically lower-density neighbourhoods with older and continuous forests.

The mapping of Biodiversity Target Categories illustrates the variability found in protected and unprotected habitat types across the District. As an example, the majority (63.2%) of wetlands, lakes and hydroriparian streams are protected. This is in large part due to the environmental legislation that applies to watercourses. Garry oak ecosystems are the second most protected biodiversity category, with 40% of these ecosystems currently protected. Coastal sand ecosystems are the least protected target category in Saanich, with only 1.8% of sand ecosystems occurring in protected areas, leaving 98.2% of these ecosystems unprotected. Other marine shorelines are also poorly protected, with only 8.9% of marine habitats occurring on protected land.

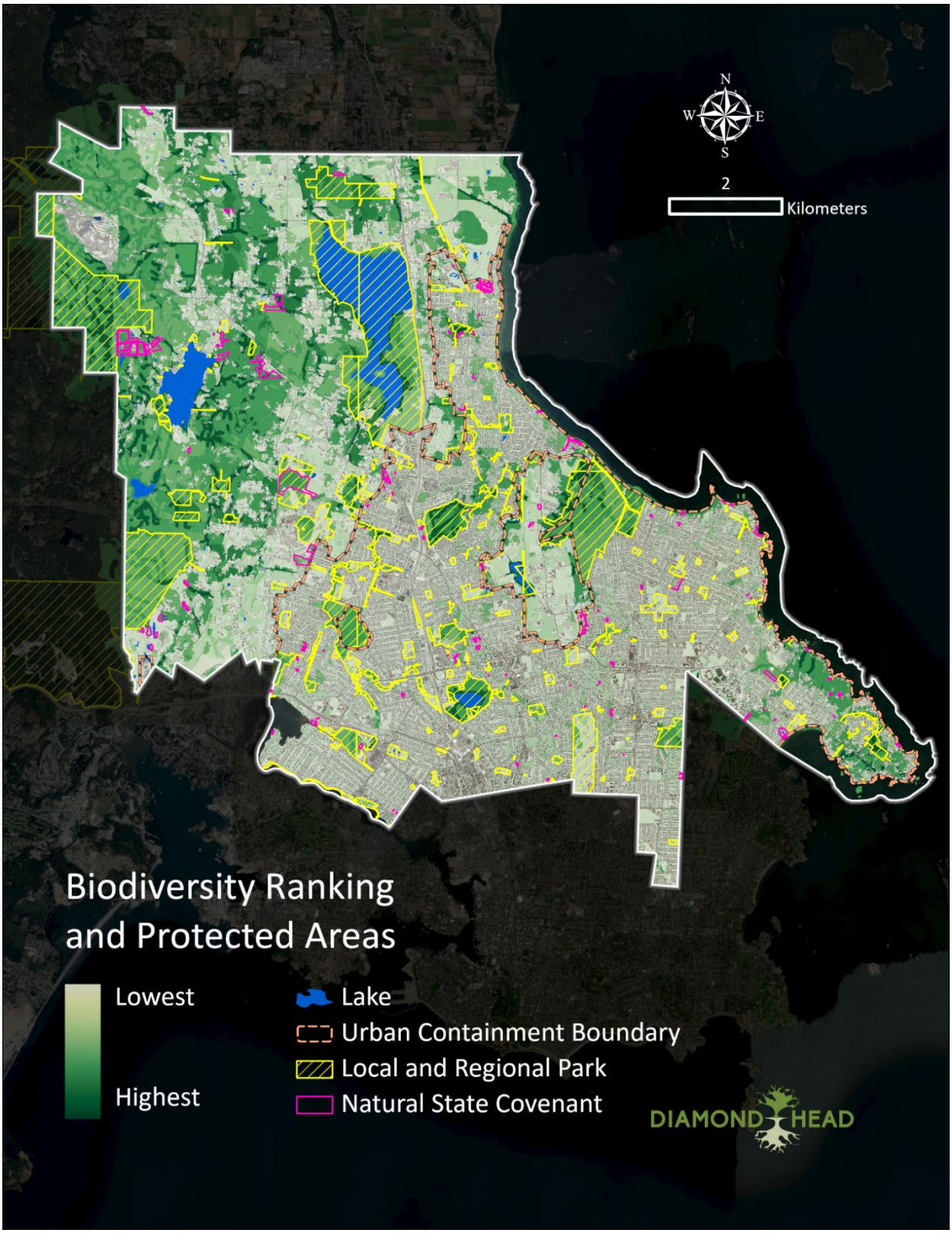

Figure 20. Location of protected lands and findings from the biodiversity ranking. This map highlights areas of high biodiversity value that could be vulnerable to development or other disturbances.

9.0 Threats to Biodiversity

There are numerous threats to the integrity of natural areas. These can include direct permanent impacts such as the clearing of natural features for urban development, indirect impacts from human activity such as the establishment of invasive species, as well as natural threats such as wildfires. Often, these threats are interconnected and compounding such as the effect on plant stress caused by climate change, which can increase the susceptibility and spread of diseases. Urban development may lead to increased disturbance and fragmentation, which can facilitate the spread of invasive species. Some of these impacts are permanent while others can be mitigated through restoration.

9.1 Residential and Commercial Development

The expansion of urban growth can result in distinct and permanent changes to Saanich's landscape. Intense urban development has been concentrated in specific regions mainly within the Urban Containment Boundary (UCB). Dense urban development is limited outside of the UCB, easing development pressure in more rural areas. While this benefits the natural environment outside the UCB, it comes at the expense of habitat within the UCB. The State of the Urban Forest Report (in development) identifies historic trends in tree loss. Urbanizing neighbourhoods including Saanich Core, Shelbourne and Tillicum have experienced increasing tree loss over time, despite having some of the lowest existing canopy in the District.[35] This trend is likely explained by ongoing infill development in this area.

Land development affects biodiversity across the landscape through direct habitat loss, fragmentation and urban interface effects. Direct habitat loss is the most impactful disturbance caused by development. This can include converting natural areas into new developments, clearing areas for parking lots and infrastructure, or even removal of a backyard tree.

Photo 28: Roads and trails can fragment habitat for small wildlife with limited mobility.

Habitat fragmentation occurs when large, contiguous tracts of a natural area are split into smaller pieces. This can vary in scale as well as the effects it has on various species. Smaller species that have limited mobility can be negatively affected by smaller features such as trails and roads. Larger areas of clearing can create wide separations between natural areas. The ability for species to move across these areas depends on their mobility and their tolerance for urban environments. Flying animals can make use of fragmented areas better than land-based animals. Venturing across urban landscapes can make smaller creatures more vulnerable to predation.

Fragmentation can exacerbate the effects caused by urban development by increasing the number of interface edges around a natural area. As the patch size of a natural area decreases, the influence of urban disturbances can have greater affects on it. These impacts are called edge effects and include disturbances such as noise, lighting, invasive species spread and encroachment. On a smaller scale, this can include understory trampling caused by off-leash dogs and park visitors or the spread of invasive plant seeds on clothing.

9.2 Climate Change & Severe Weather

Climate change is altering the growing conditions for plants and trees across the province. The BC Ministry of Forests classifies our province's forests into biogeoclimatic (BEC) zones. These are geographic areas that share a similar climate, vegetation, and soil types. Climate modelling is predicting that these zones will shift over time as climatic conditions change. These shifts are generally predicted to result in these zones shifting upward in latitude and elevation. Based on these models, the Coastal Douglas Fir zone (CDF) which currently cover much of southeastern Vancouver Island and the Gulf Islands is expected to move to higher elevations along the coast by 2040.[36] The dominant tree species in the CDF Zone (Douglas-fir and western redcedar) are already experiencing the impacts of drought in our region. These effects will only become more pronounced with the further influence of climate change. As models look further into the future, by 2070 these forests will be limited to higher elevations in the Gulf Islands (such as Mt. Maxwell and Mt. Tuam on Salt Spring Island). The District of Saanich and other low-lying areas currently classified as CDF are expected to shift to a novel, undescribed BEC type by 2040.

As climate change progresses, the southern, coastal areas of BC will experience warmer weather, though the effect will be moderated by the ocean and not as pronounced as inland areas of BC. Nighttime lows are anticipated to increase at a greater rate than daytime highs. The gap between daily high and low temperatures is anticipated to decrease during the winter and increase in the summer. Precipitation is also projected to increase annually, which is also likely to arrive as more frequent heavy rain events and not evenly occurring over the year.[37] This can have implications for capacity of stormwater systems and streams, which will have no convey flashier and heavier rainfall events. Seasonal flow through watercourses is expected to change, likely affecting fish habitat.

9.2.1 Sea Level Rise

Changes to sea levels have occurred over time due to a variety of causes. These include isostatic rebound, where the land moves vertically following the expansion and retreat of glaciers, and physical changes such as thermal expansion as water warms. Changes to the volume of water in our oceans directly affects sea levels. In general, sea level has risen along most of BC's coasts over the past century, outpacing isostatic rebound.[38] Sea level rise is expected to cause localized flooding and erosion of low-lying areas including coastal dunes, wetlands and beaches. Another phenomenon called coastal squeeze occurs when human-made buildings and infrastructure restrict the landward retreat that would otherwise naturally occur in response to rising sea levels. Coastal squeeze can lead to smaller and more degraded intertidal zones and terrestrial habitats along the coasts where manmade structures have been constructed too close to the foreshore.

Photo 29: Saanich is a coastal community with low-lying areas which are vulnerable to rising sea levels.

9.3 The invasion of non-native and other problematic species and genes

9.3.1 Invasive species

Invasive species are plants and animals introduced from other regions which have the potential to negatively impact ecosystems and the native species that depend on them. While not all introduced species are considered harmful, invasive species can establish quickly and spread rapidly in new areas and outcompete existing vegetation communities and wildlife.

Photo 30: Scotch broom (*Cytisus scoparius*) is among the most problematic invasive species on the south coast.

The District of Saanich has developed and maintains an inventory for 13 noxious weeds which are sporadically found across the District. Saanich's Invasive Species Management Plan aims to improve its inventory of invasive species in partnership with community groups, educational institutions, the Coastal Invasive Species Committee (CIPC), the Capital Region Invasive Species Partnership (CRISP), the Province, and volunteers. In comparison to data from iNaturalist, Saanich's data has fewer observations but are distributed more evenly across the region (Figure 21). iNaturalist data is generally concentrated in parks and other community gathering places. This can cause it to overrepresent the presence of invasives in these areas.

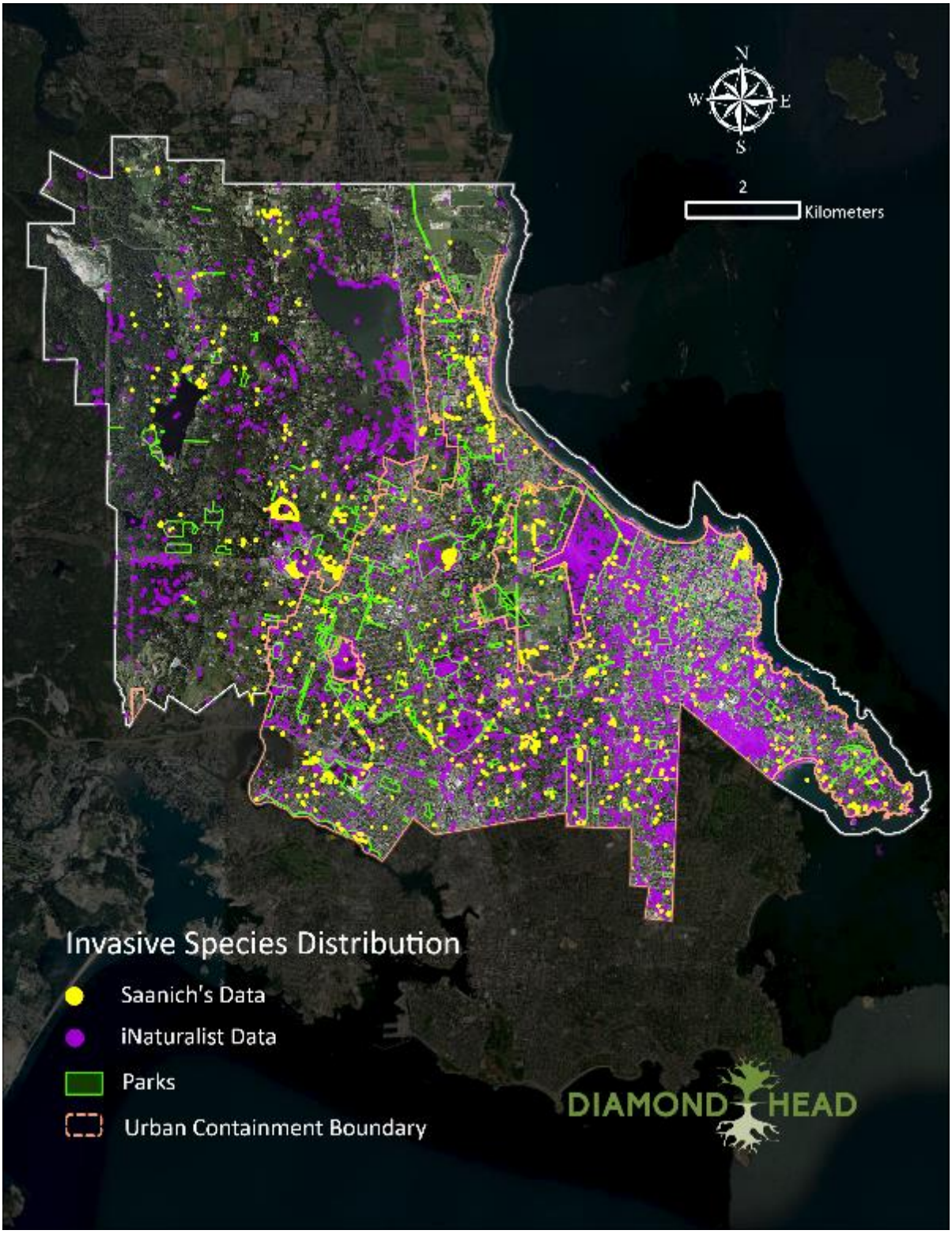

Figure 21. Invasive species have been mapped by the District or by the public using iNaturalist. It is likely that the true distribution of invasive species is far greater than either of these datasets shows.

Photo 31: English ivy (*Hedera helix*) is a common invasive species in Saanich.

Invasive plants and animals have been identified as one of the greatest threats to biodiversity.[39] They often require repeated aggressive treatment to eradicate them once established. Common invasive species found in Saanich include provincially recognized Early Detection Rapid Response (EDRR) species such as knotweeds, garlic mustard, giant hogweed, lesser celandine, purple loosestrife, and blessed milk thistle (Table 6). Saanich has committed to increasing resources to control invasive species focusing on those that pose high ecological or human health risks.

EDRR is a provincial approach for managing invasive species. As invasive species become established across the landscape, they become increasingly harder to eradicate, control, and manage. The EDRR approach addresses the increasingly higher time and costs associated with eradicating established invasive species and places priority on the species that are (a) not yet present in BC, and (b) species that are present in BC but at an extremely limited extent. These are actively managed with the goal of eradication.

Table 6. Invasive plant species occurring in the District of Saanich.[40]

Prevent	Eradicate	Contain	Control
Kudzu (*Pueraria lobata. var. Montana)*	Knotweeds *(Fallopia spp)*	Yellow Flag Iris (*Iris pseudacorus)*	Scotch Broom (*Cytisus scoparius*)
Carpet Burweed (*Soliva sessilis)*	Garlic Mustard (*Alliaria petiolate)*	Gorse (*Ulex europaeus)*	English Ivy (*Hedera helix*)
	Giant Hogweed (*Heracleum mantegazzianum)*	Poison Hemlock (*Conium maculatum)*	English Holly *(Ilex aquifolium)*
	Spotted Knapweed (*Centaurea maculosa)*	Purple Loosestrife (*Lythrum salicaria)*	Daphne / Spurge Laurel (*Daphne laureola)*
	Blessed Milk Thistle (*Silybum marianum)*	Golden Willow (*Salix alba var. vitellina)*	Himalayan Blackberry (*Rubus armeniacus*)
	Policeman's Helmet (*Impatiens glandulifera)*		English Hawthorn (*Crataegus monogyna*)
	Scotch Thistle *(Onopordum acanthium)*		Periwinkle (*Vinca major, V. minor*)
	Shiny Geranium *(Geranium lucidum)*		

Parks is currently leading the response to manage invasive species. Saanich developed an Invasive Species Management Strategy (ISMS) in 2015 with the goal:

> *To prevent establishment of new invasive species and reduce, reduce, control and mitigate the effects of established invasive species on natural ecosystems, human health and the economy.*

The ISMS addresses invasive species management on public and private land, staff roles and responsibilities, priorities, actions, community stewardship, partnerships, and resources. This comprehensive program includes preventing the introduction of and eradicating new invasive species, and the containment and/or control of the spread of established invasive species.

Many of these undesirable plant species arrived in the region through various forms of transportation such as visitors, birds, wildlife, trains, and boats. Others were purposefully planted in landscapes. The District is actively managing over 600 invasive plant sites on park and public land. Most treatment efforts utilize manual and mechanical removal by hand or machine. Chemical treatment is not used frequently and only if best management practice (BMP) recommends them. Of the few species where chemical treatment is recommended to prevent their spread, spot spray or hand painted treatments are used with regulated herbicides. Information on the use of pesticides as well as invasive species fact sheets can be found on the District's Invasive Species Webpage. CRISP maintains a Regional Priority Invasive Plant Status list which Saanich adapts for management planning.

Invasive animal species require a multi-faceted approach including new or amended regulations, the promotion of educational materials, community partnerships, and participation in regional initiatives. Some examples include Saanich's participation in the regional strategy for Canada Geese (goose egg addling) and the development of an educational program to raise awareness of American Bullfrogs. The CRD is exploring additional measures including a potential cull of the goose population. The Animals Bylaw was amended to address animal conflicts involving rabbits and deer. Together, these actions are part of a comprehensive approach to reduce new occurrences and spread of invasive species within the District of Saanich. Examples of invasive and local wildlife management species are found in Table 7.

Table 7. Invasive animal species occurring in the District of Saanich.

Invasive wildlife management	Local wildlife management
Eastern Grey Squirrel (*Sciurus carolinensis*)	Columbia Black-tailed Deer
European Fire Ants (*Myrmica rubra)*	Non-migratory Canada Goose
American Bullfrog (*Lithobates catesbeianus*)	Feral Cats
Green Frog (*Lithobates clamitans*)	Rabbits
European Wall Lizard (*Podarcis muralis*)	
European Starling (*Sturnus vulgaris)*	

9.3.2 Pests and Diseases

Disease, pests and the stress or mortality they can cause are natural parts of ecosystem dynamics. At natural levels these agents of change can improve biodiversity. They can create small stand openings, wildlife trees and often can provide a food source for predators. At unnatural levels however pests and diseases can cause significant negative impacts to ecosystems.

There is a wide range of diseases and pests which threaten our forests and wildlife. An example of the impact these can have on our landscape is the white pine blister rust (*Cronartium ribicola*), which is regarded as one of the most damaging tree pathogens in BC. The western white pine (*Pinus monticola*) was once a dominant species of southern interior BC forests and a component of forests across Vancouver Island. A history of logging, mountain pine beetle and the spread of white pine blister rust has resulted in the widespread loss of this species across our landscape over the last 100 years. Some estimates state the range of this species has been reduced by 90%[41]. This pathogen was introduced to BC in the early 1910s and 1920's through seedling importations from Europe and Eastern North America.[42] The disease subsequently spread throughout the west coast, resulting in widespread mortality. White pine is now uncommon in our region.

Photo 32: Deer are natural herbivores that have reached unnatural population levels in the District.

White-nose syndrome is a disease affecting bat populations which were first detected in New York in 2006. Since then, this fungus has spread across North America, killing over 6 million bats in eastern North America.[43] *Pseudogymnoascus destructans*, the fungus responsible for this disease presents as a white, powdery substance on the affected bats' nose, ears, wings and or tail. The pathogen causes behavioural changes resulting in unusual activity, such as flying during the daytime in the winter and spending time outside of the hibernaculum. This results in a loss of fat supply during the winter and can cause widespread mortality at a hibernaculum (80-90%). Currently, this pathogen has not been identified in BC but has been found in Washington since 2016. In Canada, the fungus has been confirmed in Manitoba, New Brunswick, Newfoundland and Labrador, Nova Scotia, Ontario, Prince Edward Island, Quebec and Saskatchewan.[44] As of July 2022, white-nose syndrome had not been detected in BC, but was anticipated it was only a matter of time before it appeared[45]. Early detection and rapid response programs are key to preventing new pathogens from becoming established in BC.

Pests and diseases are not limited to introduced species but can also naturally occur in our ecosystems. Examples of these can be species such as the mountain pine beetle (*Dendroctonus ponderosae*) which is a natural component of BC's forests but was responsible for affecting millions of hectares of inland forests between 1999 and 2015.[46] In Saanich, the Columbian black-tailed deer (*Odecoileous hemionus columbianus*) is an example of a naturally occurring species which has become a pest species in some areas. These deer have been able to adapt to human settlements, and now are a common sight in Saanich. Black-tailed deer are herbivores and primarily browse grasses and forbs but will also eat many tree saplings. Urban feeding, lack of predation and abundant food opportunities has allowed the population to thrive in Saanich, impacting tree regeneration and understory vegetation throughout the landscape.

Photo 33: Homemade sign asking residents not to feed deer.

9.4 Human impacts

Humans have had direct impacts on natural areas which range in scale, from leaving a pet unattended to complex societal issues such as the removal of Indigenous land management techniques and non-point source pollution in waterways. Many of these influences are challenging to solve due to their scale, complexity and limited resources. They can be classified into acute or diffuse impacts depending on their temporal scale.

Photo 34: Degraded understory vegetation and stream banks caused by understory trampling and other disturbances.

Acute threats to biodiversity are those where a single management decision or action has an immediate impact on biodiversity. These can include hydrological changes such as the construction of dams and reservoirs, landfills and mines. In marine habitats, this can includes oil and chemical spills, where a single event can drastically impact ecosystems.

Diffuse impacts on biodiversity include those which are spatially small and not necessarily caused by a single event. Understory trampling for example caused by off-leash dogs may not result in an immediate loss of understory, however, over time the cumulative impacts can drastically alter an ecosystem.

Larger scale impacts can include non-point source nutrient loading and pollution into watercourses. These can include minor chemical spills, fertilizer runoff, as well as outdated septic systems, all of which often result in low quantities of pollutants seeping into waterways.

9.5 Loss of Traditional Ecological Knowledge and Practices

Land stewardship and management by the W̱SÁNEĆ, Lək̓ʷəŋən and Xwsepsum/Esquimalt peoples has shaped plant and animal communities across the peninsula and is perhaps most exemplified through the creation and maintenance of Garry oak ecosystems. Over centuries, these ecosystems were maintained and expanded through periodic burning to remove shrubs and trees, increasing habitat for edible root crops.[48] Removing this important cultural practice from the landscape has resulted in the widespread loss of Garry oak ecosystems in natural areas, which has now been accelerated by many other impacts such as development and land conversion. The removal of cultural burning from Garry oak Ecosystems as well as the loss of traditional ecological knowledge has had a major impact on biodiversity in Saanich.

Photo 35: First Nations have traditional ecological knowledge of the forests, shorelines, and marine ecosystems in Saanich that has been acquired over thousands of years.

10.0 Data gaps and Limitations

The biodiversity analysis was completed using available GIS datasets. The findings of this analysis are reliant on the accuracy of municipal, regional, and provincial datasets. It is recommended that these datasets be refined and updated as more accurate information becomes available. Errors, mistakes, and missing data was noted within these provided datasets, which is not uncommon. These errors included linework inaccuracies, codes that are found and used in adjacent BEC zones, inconsistent use of non-natural codes, and inconsistencies in the level of detail between polygons in the same dataset. DHC has corrected some errors and inconsistencies, but due to the number of errors and budget limitations, the corrections were not comprehensive. The District has been working to further refine these datasets to remove errors and improve linework, and plants to continue to make improvements.

The analysis made use of data that covers all natural areas in the District. Some site-specific data is available and provides a high level of detail but was not used as they do not cover the entire District. Field verification was conducted to confirm the accuracy of the data used in analysis and to supplement some areas where data may have been absent. Time and budget limited the number of field verifications and was not comprehensive across the entire District. Only public lands were visited as part of these field visits. Of a total of 1821 polygons, 152 (8%) were visited. This analysis does not identify areas for restoration.

A detailed wildlife survey was not completed as part of the State of Biodiversity report due to the amount of time and resources required. A species guild system was used, which builds on higher-order wildlife that may be found within the District. This approach assumes that if higher order species are present (e.g. red-legged frog (*Rana aurora*), or black bear (*Ursus americanus*) then the lower order species and habitat are also present to support these higher-order species.

Species and plant communities at risk are critically valued in Saanich. The majority of natural areas in Saanich are either classified as red-listed plant communities or have the ability to support plant and wildlife species at risk. For this reason, this information was not included in the biodiversity analysis as it would have no effect to differentiate them.

A flow accumulation model was run for the District. This is a LiDAR model that predicts flow patterns based on detailed ground data from the LiDAR-derived hillshade and DEM layers. This created a new detailed inventory of LiDAR-derived watercourses. Some of these have been identified by the District, while others have not been confirmed. This model identifies a large number of potential watercourses that remain unconfirmed. It is expected that this layer is to be refined and updated on an ongoing basis.

Appendix 1 Summary of SEI condition classes

Table 8. Summary definition of SEI condition classes:

Class	Definition
Excellent	a. Typical climax vegetation. b. No anthropogenic disturbances or changes to natural disturbance regimes have altered the EO (including fire exclusion or flood control), no vegetation or soil removal has occurred. Forested ecological communities are generally late seral vegetation. Wetland and riparian communities have intact hydrologic regimes. There is minimal influence of domestic grazing. c. No alien species occur at the site. d. No artificial structures occur at the site. e. There is little or no internal fragmentation (< 5%) of the occurrence.
Good	a. Typical mature seral vegetation. b. For forested communities, there has been no soil removal or disturbance to soil surface; little or no influence of old road beds or skid tracks, no construction evidence, old selection harvesting only, minimal changes to natural disturbance regimes (including fire exclusion or flood control). Forested ecological communities are late seral or mature, or younger if originating from natural disturbance. Wetland and riparian communities have largely intact hydrologic regimes. There is a low-moderate influence of domestic grazing. c. Minor cover of alien species (<5% except <20% in grasslands) may occur at the site. Some earlier successional species occur. d. Some artificial structures may occur at the site (< 2% of total area of occurrence). e. There is little or no internal fragmentation (<5%) of the occurrence.
Fair	a. Anthropogenic disturbances and changes to natural disturbance regimes have occurred. Forested ecological communities are young seral stages after harvesting. There is a moderate to high influence of domestic grazing in grassland ecological communities. There may be significant alterations to the hydrologic regime in wetlands and riparian ecosystems. b. Significant cover of alien species occurs (5-20% in forests and riparian systems, up to 60 % in grasslands). Most of the plants in grassland communities are early successional species. c. Some artificial structures may be present (less than 10% of total area). d. There is minor internal fragmentation (<5%) of the EO.
Poor	a. Significant anthropogenic disturbances have occurred, particularly the removal or disturbance of soil materials and vegetation. There are significant alterations to the hydrologic regime of wetlands and riparian ecosystems. b. Alien species may dominate a vegetation layer or may total more than 20% (>60% for grasslands) cover overall. c. Significant artificial structures occur (>10% of total area of occurrence). d. The element occurrence is fragmented by artificial structures or barriers.

Appendix 2 Endnotes

[1] Sarah B. Henderson et al., "Analysis of Community Deaths during the Catastrophic 2021 Heat Dome: Early Evidence to Inform the Public Health Response during Subsequent Events in Greater Vancouver, Canada," *Environmental Epidemiology* 6, no. 1 (February 2022): e189, https://doi.org/10.1097/EE9.0000000000000189.

[2] Margarita Triguero-Mas et al., "Natural Outdoor Environments and Mental and Physical Health: Relationships and Mechanisms," *Environment International* 77 (April 2015): 35–41, https://doi.org/10.1016/j.envint.2015.01.012.

[3] "State of the Urban Forest in Saanich" (District of Saanich, In Development).

[4] "ÁTOL,NEUEL Memorandum of Understanding," December 3, 2021, https://www.saanich.ca/assets/News~and~Events/Documents/%C3%81TOL,NEUEL%20MOU.pdf.

[5] "Resilient Saanich: Environmental Stewardship Programs," https://www.saanich.ca, accessed February 2, 2023, https://www.saanich.ca/EN/main/community/natural-environment/resilient-saanich-environmental-policy-framework/resilient-saanich-environmental-stewardship-programs.html.

[6] Annette Stewart, Ari Cornman, and Arlyne Johnson, "Open Standards for the Practice of Conservation" (Conservation Measures Partnership, 2020).

[7] Nick Salafsky et al., "A Standard Lexicon for Biodiversity Conservation: Unified Classifications of Threats and Actions," *Conservation Biology* 22, no. 4 (2008): 897–911, https://doi.org/10.1111/j.1523-1739.2008.00937.x.

[8] Stewart, Cornman, and Johnson, "Open Standards for the Practice of Conservation."

[9] Moraia Grau, "Additional Environmentally Significant Areas Mapping Project Phase 3," 2014, https://www.saanich.ca/assets/Community/Documents/Environment/ESA%20Mapping%20%20Phase%20III%20Report%20Final.pdf.

[10] "Standard for Terrestrial Ecosystem Mapping in British Columbia," 1998, https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/nr-laws-policy/risc/tem_man.pdf.

[11] Peggy Ward et al., "Sensitive Ecosystem Inventory: East Vancouver Island and Gulf Islands," 320, 1998, https://a100.gov.bc.ca/pub/acat/documents/r2124/SEI_4206_rpt1_1111625239116_8be42252200c4f0283b18cac66eed366.pdf.

[12] Ministry of Environment Ecosystems Branch, "Standard for Mapping Ecosystems at Risk in British Columbia," December 5, 2006, https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/conservation-data-centre/standard_for_mapping_ecosystems_at_risk.pdf.

[13] Resilient Saanich Technical Committee, "Resilient Saanich Terms of Reference for the State of Biodiversity Consult Team," March 2, 2022.

[14] Government of Canada, "Priority Places for Species at Risk - Canada.Ca," accessed December 21, 2022, https://environmental-maps.canada.ca/CWS_Storylines/index-ca-en.html#/en/priority_places-lieux_prioritaires#19-10.1-southwest-british-columbia.

[15] "Cordova Bay Local Area Plan," accessed January 27, 2023, https://www.saanich.ca/assets/Community/Documents/Planning/LAP~Updates/LAP-Cordova-Bay-proposed-plan-web2.pdf.

[16] "Mount Work Regional Park," accessed January 27, 2023, https://www.crd.bc.ca/parks-recreation-culture/parks-trails/find-park-trail/mount-work.

[17] "Watersheds," https://www.saanich.ca, accessed January 27, 2023, https://www.saanich.ca/EN/main/community/natural-environment/watersheds.html.

[18] "Groundwater Wells and Aquifers - Province of British Columbia," accessed January 25, 2023, https://apps.nrs.gov.bc.ca/gwells/aquifers.
[19] Cobble Hill Organics et al., "Panama Flats Concept Plan," February 17, 2014, https://www.saanich.ca/assets/Parks~Recreation~and~Community~Services/Documents/Panama-Flats-Concept-Plan-2014.pdf.
[20] Judith Cullington and Adam Taylor, "Conservation Planning in Coastal Douglas-Fir Ecosystems: A Quick Guide for Local Government," July 2013, https://www.cdfcp.ca/wp-content/uploads/2022/02/CDFCP_Local_Government_Conservation_Planning_Guide_low_res-2.pdf.
[21] Marlow G. Pellatt and Ze'ev Gedalof, "Environmental Change in Garry Oak (Quercus Garryana) Ecosystems: The OccurrenceEvolution of an Eco-Cultural Landscape," *Biodiversity and Conservation* 23, no. 8 (July 1, 2014): 2053–67, https://doi.org/10.1007/s10531-014-0703-9.
[22] Jonathan D. Bakker, Ellen Jones, and Carson B. Sprenger, "Evidence of a Historical Frequent, Low-Severity Fire Regime in Western Washington, USA," *Canadian Journal of Forest Research* 49, no. 6 (June 2019): 575–85, https://doi.org/10.1139/cjfr-2018-0354.
[23] Garry Oak Ecosystem Recovery Team, "Why Are They Important?," 2023, https://goert.ca/about/why-are-they-important/.
[24] "What Remains of Garry Oak Ecosystems?," accessed January 25, 2023, https://goert.ca/about/what-remains/.
[25] COSEWIC, "COSEWIC Assessment and Status Report on the Bearded Owl-Clover (Triphysaria Versicolor) in Canada," 2011, https://www.registrelep-sararegistry.gc.ca/virtual_sara/files/cosewic/sr_triphysaire_versicolore_bearded_owl_clover_0912_e.pdf.
[26] "Oregon Branded Skipper,Hesperia Colorado Oregonia," n.d.
[27] Ministry of Environment, "Conservation Status Report: Sanicula Bipinnatifida," Government, B.C. Conservation Data Centre, November 7, 2022, https://a100.gov.bc.ca/pub/eswp/.
[28] COSEWIC, "COSEWIC Assessment and Status Report on the Sharp-Tailed Snake (Contia Tenuis) in Canada," 2009, https://publications.gc.ca/collections/collection_2011/ec/CW69-14-200-2010-eng.pdf.
[29] COSEWIC, "COSEWIC Assessment and Status Report on the Threaded Vertigo (Nearctula Sp). in Canada," 2010, https://www.registrelep-sararegistry.gc.ca/virtual_sara/files/cosewic/sr_Threaded%20Vertigo_0810_e1.pdf.
[30] COSEWIC, "COSEWIC Assessment and Update Status Report on the Western Screech-Owl (Otus Kennicottii), Macfarlanei Subspecies, Kennicottii Subspecies, in Canada," 2002, https://www.sararegistry.gc.ca/virtual_sara/files/cosewic/sr_western_screech_owl_e.pdf.
[31] COSEWIC, "COSEWIC Assessment and Update Status Report on the Yellow Montane Violet (Viola Praemorsa Ssp. Praemorsa) in Canada," 2007, https://publications.gc.ca/collections/collection_2008/ec/CW69-14-53-2008E.pdf.
[32] Important Bird Areas Canada, "Sidney Channel IBA," accessed February 7, 2023, https://www.ibacanada.ca/site.jsp?siteID=BC047.
[33] "Taking Nature's Pulse: The Status of Biodiversity in British Columbia," accessed January 27, 2023, http://www.biodiversitybc.org/assets/pressReleases/BBC_summary_Final.pdf.
[34] "Impacts of Impervious Surfaces on the Environment," accessed December 1, 2022, https://www.ijesi.org/papers/Vol(4)5/E045027031.pdf.
[35] "State of the Urban Forest in Saanich."
[36] Centre for Forest Conservation Genetics, *ClimateBC Map: A Interactive Platform for Visualization and Data Access*, July 22, 2022, July 22, 2022, https://www.climatewna.com/ClimateBC_Map.aspx.
[37] Faron Anslow et al., "Indicators of Climate Change for British Columbia," Government, accessed December 22, 2022, https://www2.gov.bc.ca/assets/gov/environment/research-monitoring-and-reporting/reporting/envreportbc/archived-reports/climate-change/climatechangeindicators-13sept2016_final.pdf.
[38] Anslow et al.

[39] *Bending the Curve of Biodiversity Loss*, Living Planet Report 2020 (Gland: WWF, 2020).
[40] District of Saanich, "Invasive Species Management Strategy," Invasive Species, April 15, 2013, https://www.saanich.ca/assets/Parks~Recreation~and~Community~Services/Documents/InvasiveSpeciesManagementStrategy.pdf.
[41] United States Department of Agriculture, "Return of the King: Western White Pine Conservation and Restoration in a Changing Climate | Rocky Mountain Research Station," accessed November 30, 2022, https://www.fs.usda.gov/rmrs/return-king-western-white-pine-conservation-and-restoration-changing-climate.
[42] Richard S. Hunt, "History of Western White Pine and Blister Rust in British Columbia," *The Forestry Chronicle* 85, no. 4 (August 1, 2009): 516–20, https://doi.org/10.5558/tfc85516-4.
[43] "White-Nose_syndrome_fact_sheet_march_2017.Pdf," accessed November 30, 2022, https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/wildlife-wildlife-habitat/wildlife-health/wildlife-health-documents/white-nose_syndrome_fact_sheet_march_2017.pdf.
[44] "White-Nose Syndrome," accessed November 30, 2022, https://www.whitenosesyndrome.org/where-is-wns.
[45] CWHC-RCSF Canadian Wildlife Health Cooperative - Réseau canadien pour la santé de la faune, "WNS Reports and Maps," accessed February 7, 2023, http://www.cwhc-rcsf.ca/white_nose_syndrome_reports_and_maps.php.
[46] Ministry of Forests, "The 1999-2015 Mountain Pine Beetle Outbreak - Province of British Columbia" (Province of British Columbia), accessed November 30, 2022, https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-health/forest-pests/bark-beetles/mountain-pine-beetle/responding-to-the-1999-2015-outbreak.
[48] Brenda Costanzo et al., "Restoring British Columbia's Garry Oak Ecosystems - Principles and Practices," 2011, https://goert.ca/wp/wp-content/uploads/GOERT-Restorating-BC-GOE-2011.pdf.