Appendix A of OCP Bylaw 2142-2018

City of Terrace

Environmentally Sensitive Areas Strategy

July 2022

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Acknowledgements

The City of Terrace thanks all staff and the team at Diamond Head Consulting that contributed to the development of this Environmentally Sensitive Area Strategy. The City also recognizes and thanks private property owners that provided access to their properties to assess the condition of these natural areas.

Traditional Acknowledgement

The City of Terrace acknowledges that the City is on the Traditional Lands of the La xyuubm Tsimshian, Kitsumkalum and Kitselas, toyaxsuut nuusm.

Executive Summary

Terrace is a city rich in natural areas, ranging from large freshwater rivers to rugged coastal mountains. These areas provide habitat, water, and food resources to support healthy communities of plants and wildlife. They support high levels of biodiversity, as well as high-value recreation opportunities. While all natural areas provide benefits to the City and its inhabitants, some are considered more valuable and important to protect. These have been identified as Environmentally Sensitive Areas (ESAs).

With changes to City boundaries, increasing development-related pressures, and climate change, an update to the ESA Strategy was completed to ensure mapping and policy tools reflect today's landscape conditions and the needs of the City. This Strategy aligns with current Best Management Practices (BMPs), standards, and legislation to identify, protect, and enhance ESAs.

ESAs were identified through a review of background documents and datasets, as well as LiDAR and orthophoto analysis. Biologists completed field assessments at strategic locations to understand the range of values in the City. ESAs were then classified into two categories: Terrestrial ESAs and Riparian ESAs. Terrestrial ESAs consist of large forest stands, including old growth stands; areas with habitat for species and/or communities at risk; or areas that provide important aesthetic, recreational, or educational values including City owned parks. Riparian ESAs consist of watercourses and the lands immediately adjacent to them.

The City of Terrace protects ESAs through the designation of Development Permit (DP) Areas, as defined by the City's OCP. These ESA DP Areas ensure that the health, integrity, form, and function of natural areas are considered throughout the development process. This Strategy updates the DP Area to include all of Terrace, incorporates changes to the landscape over the past two decades, and clarifies requirements for development in ESAs.

A development permitting process has been established that provides the City with relevant information about the proposed development and ensures it will comply with the DP guidelines. DP guidelines were developed to help guide development while minimizing impacts on ESAs. The DP Area also provides an opportunity to restore previously degraded ESAs.

Photo 1. The City of Terrace is rich with freshwater rivers and forested mountainous terrain.

Definitions

Environmentally Sensitive Area (ESA): natural areas that support healthy native plant communities with high levels of biodiversity, habitat for species-at-risk, or are unusual or unique within a local or regional context.

Natural Boundary: whichever of the following is further from the center of a lake, river, stream or other body of water:

> The visible highwater mark where the presence and action of the water are so common and usual, and so long continued in all ordinary years, as to mark on the soil of the bed of the lake, river, stream, or other body of water a character distinct from that of its banks, in vegetation, as well as in the nature of the soil itself; or
>
> The boundary of the active floodplain, if any, of the lake, river, stream or other body of water.

Top of Bank (TOB): The top of bank is defined as the point closest to the boundary of the active floodplain of a stream where a break in the slope of land occurs such that the grade beyond the break is flatter than 3:1 at any point for a minimum distance of 15 m, measured perpendicularly from the break. Where a top of bank exists, riparian setbacks are measured back from this point.

Qualified Environmental Professional (QEP): is an individual that is a member of a professional body that has demonstrated expertise and knowledge in sensitive environments, ecosystems, and/or riparian management. A QEP is only considered as such for the portion of assessment that is within their area of expertise.

Watercourse: any natural or constructed channel with well-defined banks that gives direction to a current of flowing water for at least 6 months of the year.

Photo 2. A natural fish bearing watercourse (Spring Creek) featuring diverse riparian vegetation and large woody debris.

1 | Introduction to Environmentally Sensitive Areas

As a community, the City of Terrace is intimately connected with its surrounding natural environment. Terrace is framed by the confluence of the Skeena and Kitsumkalum Rivers and is characterized by an abundance of natural features, from rugged coastal mountains to productive freshwater rivers and large tracts of mature forests. The natural areas that surround Terrace are largely intact including the second-growth forests of Terrace Mountain to the north and provincial parks and Crown lands to the south. They support high levels of biodiversity, as well as high value recreation opportunities. These connected natural areas characterize the community and are highly valued by its residents.

The Skeena River bisects the City into two distinct areas. In this policy, the City's urban center is referred to as North Terrace. This area is largely developed but still supports a number of streams and natural forests. The lands south of the Skeena are referred to as South Terrace. This area includes the Northwest Regional Airport, cleared industrial lands, and large tracts of second-growth forested areas with numerous natural watercourses. The Skeena River, which divides North and South Terrace, provides migration and spawning habitat for many fish species. Other natural areas within the municipal boundaries such as Terrace Mountain, Howe Creek, and Ferry Island contribute to sustaining plant and wildlife diversity as well as providing residents with an abundance of recreational opportunities.

Photo 3. Unique bedrock plant community on Terrace Mountain.

Figure 1. The City of Terrace's municipal boundary is bisected by the Skeena River, dividing it into north and south.

1.1 The Benefits of Natural Areas

A healthy, protected, and integrated network of natural areas is increasingly recognized as a critical part of a sustainable and resilient City. Natural areas provide the habitat, water, and food resources needed to support a healthy and diverse community of plants and wildlife. Integrating natural areas within our cities provides residents with essential 'ecosystem services' which provide numerous benefits to the community (Figure 2). They help manage stormwater and reduce flooding by intercepting rainfall prior to it entering the stormwater system or nearby waterways. This interception slows runoff and supports groundwater recharge, improving water quality, and reducing the potential for flooding. Natural areas provide visual barriers and filter air and water, reducing pollution, dust, and noise. They provide cooling services to parks and adjacent urban areas, tempering the urban heat island effect through evapotranspiration and providing direct shade to paths, parks, and buildings.

Many of these ecosystem services will help us mitigate and adapt to the impacts of climate change, such as more intense rainfall and storm events, particularly in winter. Managing and protecting healthy natural areas helps enhance our resilience to these effects of climate change. Forested land also absorbs and stores carbon dioxide, sequestering it from the atmosphere.

Access to natural areas can improve the health and wellbeing of our citizens and provide economic benefits. Protected natural areas can offer accessible educational and recreational opportunities and are known to have a positive impact on mental health and wellness. Recreational opportunities can indirectly lead to nearby food concessions and eco-tourism ventures and attract residents and businesses to a community. Direct economic benefits of protecting natural areas include reduced cooling costs, reduced grey infrastructure costs and maintenance, and increasing nearby property values.

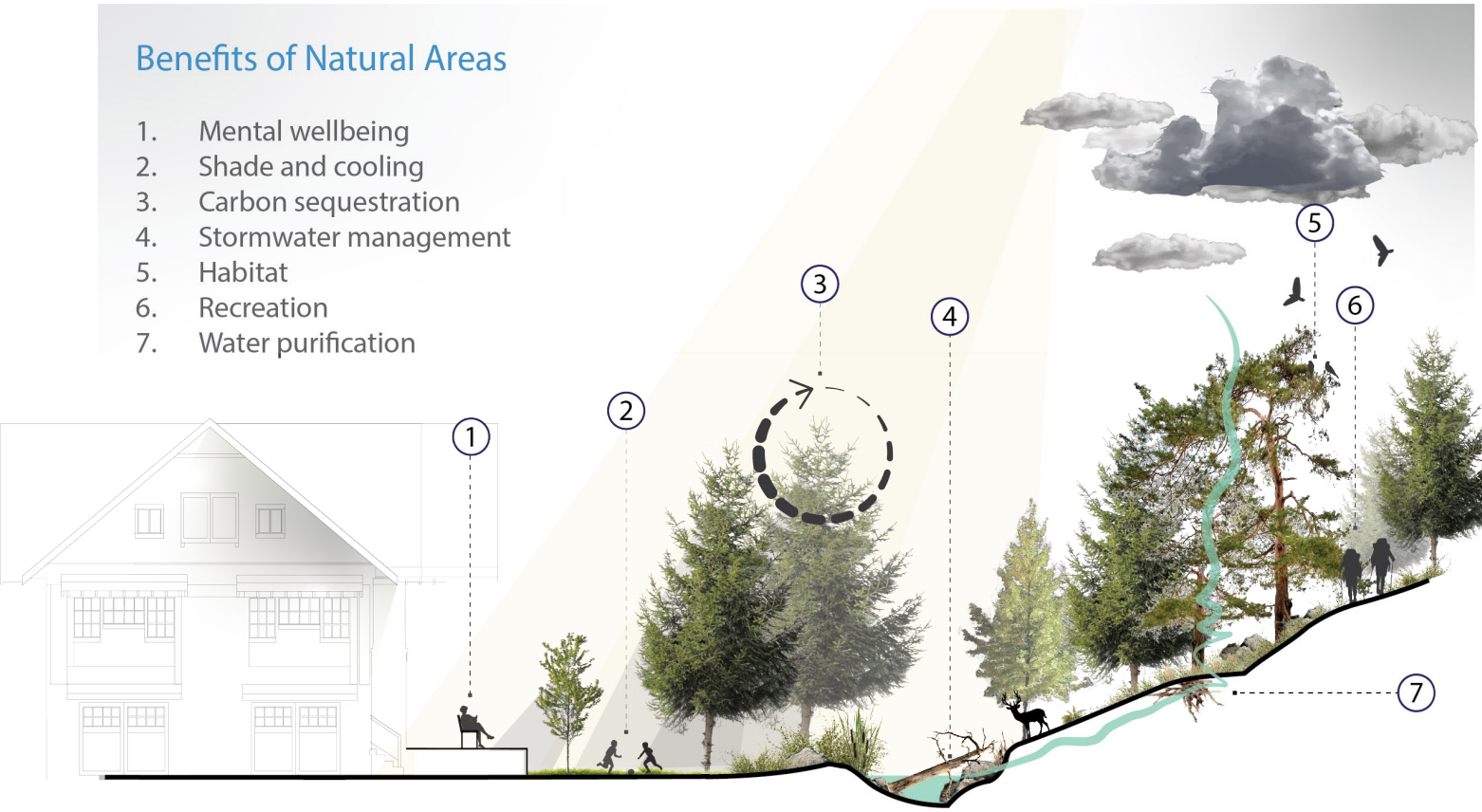

Figure 2. Natural areas provide numerous ecosystem services and benefits to the City of Terrace.

1.2 Environmentally Sensitive Areas in Terrace

While all natural areas provide benefits to the City, some are considered more valuable and important to protect. These are defined as Environmentally Sensitive Areas (ESAs). These ESAs include natural areas that support healthy native plant communities with high levels of biodiversity, habitat for species-at-risk, and/or are unusual or unique within a local or regional context. In the City of Terrace, the ESAs that have been identified for protection include old growth forests, watercourses and their riparian habitat, and habitat for rare or endangered wildlife and plant communities. In addition to ecological values, some areas that provide important aesthetic, recreational, or educational values have been included as ESAs, including City owned parks.

1.3 The Need for ESA Protection

The City of Terrace is a vibrant and growing community of nearly 13,000 people. It is the regional nexus for highway, rail, and air transportation routes. The City of Terrace's municipal boundaries include two distinct areas that are separated by the Skeena River. North Terrace includes 2,061 hectares of land in the valley floor of the Skeena and Kitsumkalum Rivers and the lower slopes of Terrace Mountain. This area is the oldest and most urbanised part of the City. South Terrace includes 3,897 hectares of land south of the Skeena River. This area includes the Northwest Regional Airport, Skeena Industrial Development Park Lands, a few parcels of private property, and large tracts of Crown land. This part of the City has been disturbed for commercial timber harvesting, the airport, and industrial development, but still contains large tracts of natural second-growth forests.

ESAs are sensitive to disturbances from human activity. There has been an increase in development pressures across the City of Terrace which threaten to impact these natural areas and the benefits they provide. As the City continues to develop, there is further degradation of ESAs from recreational use, unsanctioned activities, dumping, and unauthorized encroachment.

Climate change is also impacting the composition and health of natural ecosystems. Many species are unable to adapt to the increasingly frequent extreme weather events. Some pests and disease outbreaks have been more severe than normal, and they have been able to migrate outside of their historic native habitat ranges. Climate change and globalisation has also allowed some non-native species to establish and displace native species.

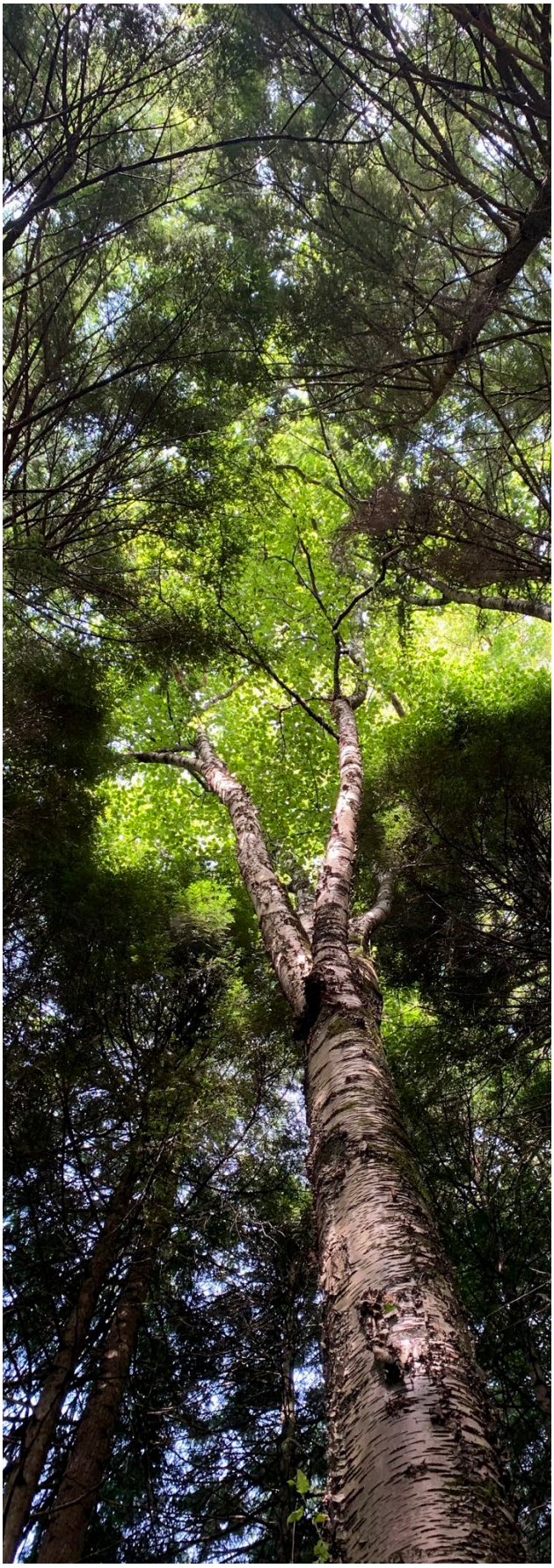

Photo 4. ESAs can help to mitigate the impacts of climate change, such stormwater absorption and shading from mature trees.

2 | ESA Management in Terrace

Terrace is committed to protecting its natural environment. In 1998, the City commissioned a study titled "Identification and Evaluation of Environmentally Sensitive Areas within the City of Terrace, B.C." This report identified ESAs within the City of Terrace and provided detailed information and management recommendations to protect these areas. This ESA report was used as a planning tool for managing these important natural features and functions. The City's landscape has evolved since this policy was adopted and it no longer accurately reflects the current day condition of natural areas in and surrounding the City. This 1998 study did not include the extensive lands that have since been added to the City boundaries including Ferry Island and South Terrace. In addition to changes to the City's landscape, new technologies such as LiDAR and updated provincial datasets are now available and help to accurately map ESAs.

The majority of the City's urban development has occurred in North Terrace within the original city limits. Apart from the airport and some industrial uses, South Terrace is less developed and is dominated by second-growth forests, reflecting the area's historical and present-day logging practices. Most of South Terrace is designated for future industrial development or is within the Agricultural Land Reserve.

The protection of Environmentally Sensitive Areas (ESAs) and the management of their associated benefits and risks is a priority for the City of Terrace as it continues to grow. The broad goal of this ESA update is to implement current best practices for identifying sensitive natural areas and protecting them through the development planning process. This ESA Strategy updates the mapping of ESAs and provides a Development Permit (DP) area planning framework that is consistent with current policies, including the Official Community Plan (OCP).

Photo 5. There is an abundance of second-growth forest in Terrace.

2.1 Policy Context for ESA Protection

Multiple municipal planning tools, plans, and strategies are available to manage ESAs in British Columbia. In the City of Terrace, the Official Community Plan (OCP) sets the direction for the city, which in turn informs City policies and strategies. These strategies are then implemented through planning tools such as bylaws and development permit areas (Figure 3).

Terrace's OCP recognizes the importance of protecting natural areas. It highlights the importance of maintaining and protecting natural parks and urban forests, protecting sensitive and significant environmental features, and providing access to the natural environment and traditional foods. One of four guiding principles of the OCP aims to:

> ***"...support our natural systems through the integration of natural vegetation within the City greenways. We will protect, preserve and enhance surrounding ecosystems through ecologically sensitive planning."***

This ESA Strategy is one of several strategies and plans that contribute to natural area management in the City of Terrace. The Parks and Recreation Master Plan provides guidance for protecting ESAs within parks while supporting recreational access to the natural environment. The Greater Terrace Agricultural Area Plan Report aims to support agriculture while ensuring it meets future needs and remains sustainable by protecting critical habitat and biodiversity. The Terrace 2050 Sustainability Strategy identifies "nature as identity and outdoor pursuit" as one of nine strategies towards a sustainable future. The Sustainability Strategy identifies issues of importance for the management of habitat and biodiversity in the City of Terrace. These include maintaining the health of riparian and aquatic systems, protecting remnant natural areas (forests and wetlands), and managing site-specific habitat features for wildlife and species-at-risk.

Under the Local Government Act, municipalities have the authority to designate DP Areas for the protection of the natural environment, its ecosystems, and biological diversity. The City of Terrace has been managing the development impacts to ESAs through a DP Area since 1998 when the report "Identification and Evaluation of Environmentally Sensitive Areas Within the City of Terrace BC" was completed. This strategy recognizes DP Areas as one of the strongest tools available to local governments to protect and manage sensitive natural areas on and adjacent to private lands.

When development occurs within ESAs without the issuance of a Development Permit, the City may use the Ticket Information Utilization Bylaw to issue fines and require DPs be applied for. As a condition of issuing enforcement-based DPs, Qualified Environmental Professional (QEP) may be required. These QEPs can assess the damage the unauthorized development caused and prescribe ways to return the ESA to the former state.

Figure 3. The ESA Strategy is one of several strategies and plans that manage natural areas in Terrace.

2.2 Vision and Intent of the ESA Strategy

This ESA strategy is consistent with and supports the vision adopted by the OCP. Specifically, it supports objective #6 of the Natural Environments, Outdoor Activities, and Access Community Goal to, "Design with Nature in Environmentally Sensitive Areas". The Terrace 2050, Our Strategy for Sustainability, the Greater Terrace Agricultural Area Plan Report, and the Parks and Recreation Master Plan all highlight the importance of biodiversity and natural area planning for a healthy, vibrant, and sustainable city. The Terrace OCP and 2050 Sustainability Strategy envision a future where "Terrace will prosper from its surrounding natural abundance through access to outdoor recreation, sustainable resource-based industry, full use of its agricultural potential & the ingenuity of its citizens."

The vision adopted in this ESA strategy is to:

"recognize, protect, and enhance environmentally sensitive natural areas that serve important ecological functions and provide aesthetic and recreational values to the community through ecologically sensitive planning".

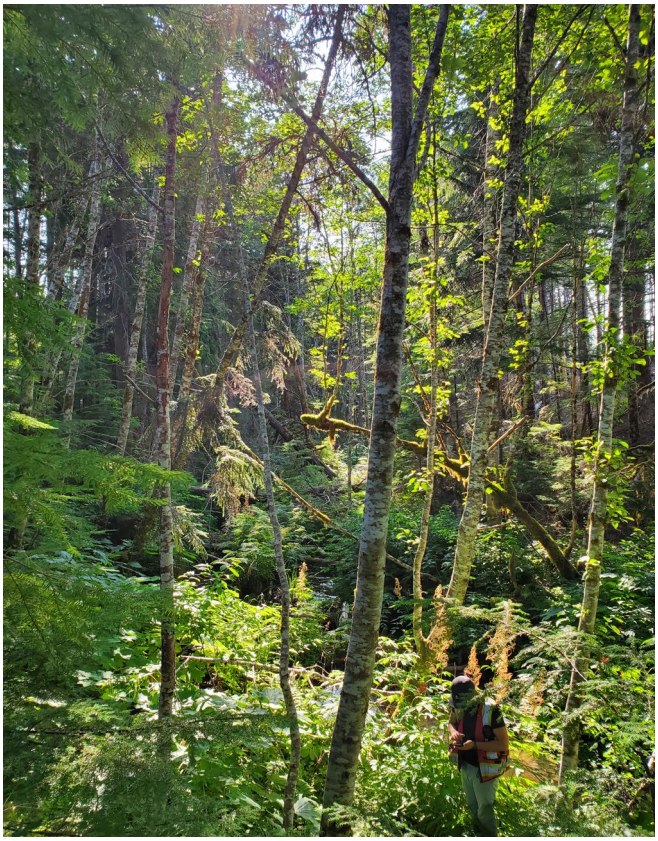

Photo 6. A young forest with lush and diverse understory.

Photo 7. Dog vomit slime mold (*Fuligo septica*) in a second-growth forest.

2.3 Goals for the ESA Strategy

1. Recognize and protect ESAs as natural areas that support high levels of biodiversity.

2. Protect ecological communities and species that are considered at risk.

3. Recognize new and emergent threats to ESAs, as well as new opportunities to protect and enhance them.

4. Recognize the social, cultural, and health benefits of providing access to natural areas for residents.

5. Recognize the role of natural areas to improve the City's resiliency to the impacts of climate change.

6. Raise public awareness of the importance of ESAs and encourage community stewardship of them.

7. Establish practical land development standards and guidelines that will protect ESAs.

8. Encourage the restoration of the natural environment on both private and public lands.

9. Work with other regulatory agencies to protect and enhance ESAs.

3 | Natural Areas in Terrace

The City of Terrace contains large tracts of mature forests and productive streams that are connected to adjacent natural areas. Examples include: Terrace Mountain to the north, provincial parks and Crown land to the south, and the Skeena and Kitsumkalum Rivers. These areas provide ecosystem services, support high levels of biodiversity, and provide access to nature for residents of and visitors to Terrace. The climate of Terrace is characterized by wet, snowy winters, and mild summers. It is located close to and is primarily influenced by the climate of the coast but does share some characteristics of the ecosystems found in the interior of British Columbia.

Terrace is located adjacent to the Skeena River and is characterized by a series of distinct terraces that were formed by glacial deposition and retreat. The Skeena and Kitsumkalum Rivers then cut down through these thick glacial deposits that filled the valleys, forming riverside cliffs with layers of glacial gravels and sands. These rivers migrated back and forth over time, forming the terraces that exist today. This unique topography includes several steep slopes interspersed with flat benches, creating a range of geotechnical conditions and microclimates.

Terrace has a rich history of working with and relying on its natural environment. The Tsimshian peoples have been utilizing the lands within and surrounding Terrace on the banks of the Skeena River since time immemorial. Through the 1780s and into the 1800s, the colonial era began, and fur trading and gold prospecting were the primary commercial activities. By 1905, George Little had donated the Grand Trunk Pacific Railway 9 acres of land so a new railway station could be developed around what has now become the core of Downtown Terrace. Terrace soon became a sawmill community and eventually a regional centre for forestry and wood processing. For decades, logging was the major industry in the City which has shaped and modified the surrounding landscape.

The following is a broad description of some of the defining ecosystem types and natural area features that exist within the City.

Photo 8. The Skeena River and Ferry Island.

3.1 Terrestrial Ecosystems

While most of North Terrace has been developed, large tracts of connected forests remain along watercourses, on Terrace Mountain, and throughout South Terrace. Within these forested natural areas, the unique topography of Terrace has created a diversity of sites ranging from dry upland forests to wet lowland, and floodplain areas associated with the Skeena and Kitsumkalum Rivers. Many of these natural areas were harvested in the past century and forestry continues to be an important industry in the region.

In all of Terrace, there are approximately 3,114 hectares of forested natural areas (Table 1). As a result of historic logging, the remaining forested ecosystems are largely second-growth stands. These forests range from young, regenerating pole sapling forests to mature forests. Only about 4% of forests in the City are considered old growth (>240 years old). Coniferous trees include mainly lodgepole pine (*Pinus contorta*), western hemlock (*Tsuga heterophylla*), and amabilis fir (*Abies amabilis*) with mixed components of western redcedar (*Thuja plicata*) and Sitka spruce (*Picea sitchensis*). Deciduous trees found growing throughout Terrace include red alder (*Alnus rubra*), black cottonwood (*Populus balsamifera ssp. trichocarpa*), trembling aspen (*Populus tremuloides*), and paper birch (*Betula papyrifera*).

The ground vegetation found in these forests varies depending on the local climate and soil conditions. Common vegetation found growing on wetter and richer areas include devil's club (*Oplopanax horridus*), salmonberry (*Rubus spectabilis*), skunk cabbage (*Lysichiton americanus*), and lady fern (*Athyrium filix-femina*). Floodplain areas are typically dominated by willows (*Salix spp.*) and sedges (*Carex spp.*). Common vegetation in moist forests include oak fern (*Gymnocarpium Dryopteris*), devil's club, and/or blueberries (*Vaccinium alaskaense* and *Vaccinium ovalifolium*). Typical species found on drier sites with poor nutrient availability include kinnikinnick (*Arctostaphylos uva-ursi*), rattle-snake plantain (*Goodyera oblongifolia*), and a variety of mosses.

Table 1: Summary of natural areas by forest age in Terrace.

Forest stand age	Area (ha)	% of area
Young (<80 years)	1,684	54.7
Mature (80-240 years)	1,314	41.6
Old-growth (>240 years)	115	3.7
Total	3,114	100

Photo 9. Mature forest with a lush and diverse understory plant community.

Photo 10. Red squirrel (*Tamiasciurus hudsonicus*).

North Terrace

In North Terrace, the larger terrestrial ecosystems are associated with and connected to Terrace Mountain, Ferry Island, or follow watercourses that have been protected in the City. These are primarily coniferous forests that are mature in age (80+ years) with pockets of younger stands (Figure 4). The forest community on Ferry Island is distinct and unique in comparison to the rest of North Terrace. This area is wet and rich with a complex multi-storied forest associated with the floodplains of the Skeena River. It is dominated by black cottonwood trees, with mixed components of red alder, paper birch, Sitka spruce, and western redcedar.

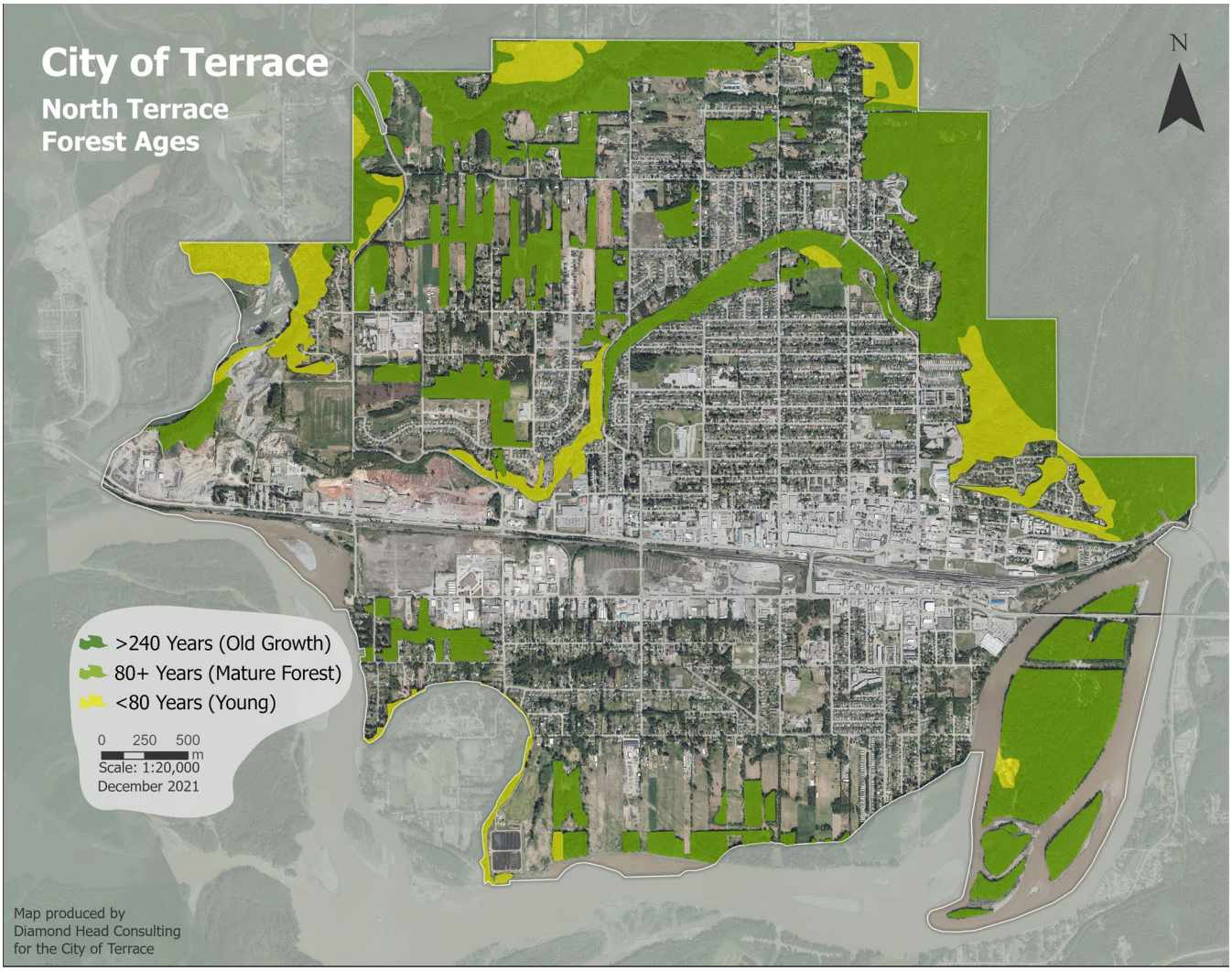

Figure 4. Location and ages of forests in north Terrace.

South Terrace

In South Terrace, the terrestrial ecosystems are largely connected and intact. Similar to North Terrace, these are primarily second-growth coniferous forests; however, many of these forests have been recently logged and are younger in age (<80 years). The remnant old-growth stands that exist in the City are found scattered throughout South Terrace (Figure 5).

Photo 11. Juvenile red-breasted sapsucker (*Sphyrapicus ruber*).

Figure 5. Location and ages of forests in south Terrace.

3.2 Riparian Ecosystems

The City of Terrace is uniquely characterized by the Skeena and the Kitsumkalum Rivers. In addition to these two significant fish-bearing rivers, the City contains numerous streams and wetlands supporting a diversity of fish species. The Skeena River and its tributaries provide important migration and spawning habitat for salmon and other fish species.

The City of Terrace Zoning Bylaw 2069-2014 defines watercourses as "any natural or constructed channel with well-defined banks that gives direction to a current of flowing water for at least 6 months of the year". Watercourses in British Columbia are often classified and protected based on whether or not they directly or indirectly provide valuable fish habitat, water, and nutrients. Watercourses are classified in this report based on fish-bearing status and their connectivity to each other.

Class A: Fish bearing watercourses.

Class AO: Seasonally fish bearing watercourses.

Class B: Provides significant water and nutrients to downstream fish habitat.

Class C: Disconnected, non-fish bearing watercourses.

The City of Terrace has almost 138 km of mapped streams and shorelines (Table 2). About half of these (63.2 km) are fish bearing, or seasonally fish bearing streams and classified as A or AO, respectively. Streams that do not directly support fish but are connected and support downstream fish habitat are classified as B. Streams classified as C support water flow but do not contribute to or support fish habitat.

There are constructed ditches found throughout the City adjacent to roads and developed areas for drainage control. The value of these ditches varies depending on their connectivity to natural steams. There are also smaller watercourses that have been partially culverted, leaving behind remnants of the undisturbed watercourses that once existed. Ponds and wetlands are not common in North Terrace, however, there are some large and significant wetlands in South Terrace.

Significant, fish bearing watercourses in the City of Terrace include: the Skeena River, Kitsumkalum River, Howe Creek, and Spring Creek in North Terrace (Figure 6); and Alwyn Creek, Mink Creek, and numerous unnamed watercourses in South Terrace (Figure 7).

The health of streams and the habitat they provide are intrinsically reliant on the forest communities found growing adjacent to them. These are known as riparian areas. As trees grow, their roots help stabilize watercourse banks while intercepting and cleaning water before it enters the stream. Every fall, deciduous trees lose their leaves which provides nutrients to the watercourse and soils in riparian areas. Tall trees along the edges of watercourses provide shade, keeping the water at a cool and liveable temperature for fish. As trees age, they fall into the watercourses creating instream complexity and habitat cover for fish. These adjacent forests also provide a buffer between developments and streams, helping to prevent erosion and mitigate the impacts of flooding which are increasing concerns for the City.

Table 2: Summary of mapped watercourse length and classification in the City of Terrace*.

Habitat type	Fish class	Length (km)
Watercourse/Stream	A/AO	63.2
	B	61.1
	C	2.1
Ponds and Wetlands (shoreline)	A/AO	6.1
	B	2.0
	C	0.3
Ditches	A/AO	0.6
	B	1.5
	C	1.1
TOTAL		138.0

* Note: Some watercourses may be unmapped, particularly ditches and class C waterbodies

Photo 12. An ephemeral fen in south Terrace connected to Mink Creek where growth is limited by intermittent highwater tables and dense clay soils that restrict root growth.

Ditches vs. Channelized Streams

The provincial *Riparian Areas Protection Regulation Technical Assessment Manual* defines ditches as "being manmade and straight and are not fed by headwaters or springs. They are constructed to drain property (they often form property boundaries) or roadways and while connected to natural streams they are not part of the natural historic drainage pattern". These require a narrower setback compared to streams.

Channelized streams are historic streams that have been moved by people, typically for development. These channelized streams form part of the historic natural drainage pattern and have larger intact headwaters or sources of groundwater. These require a wider setback and are protected in the same way that natural streams are.

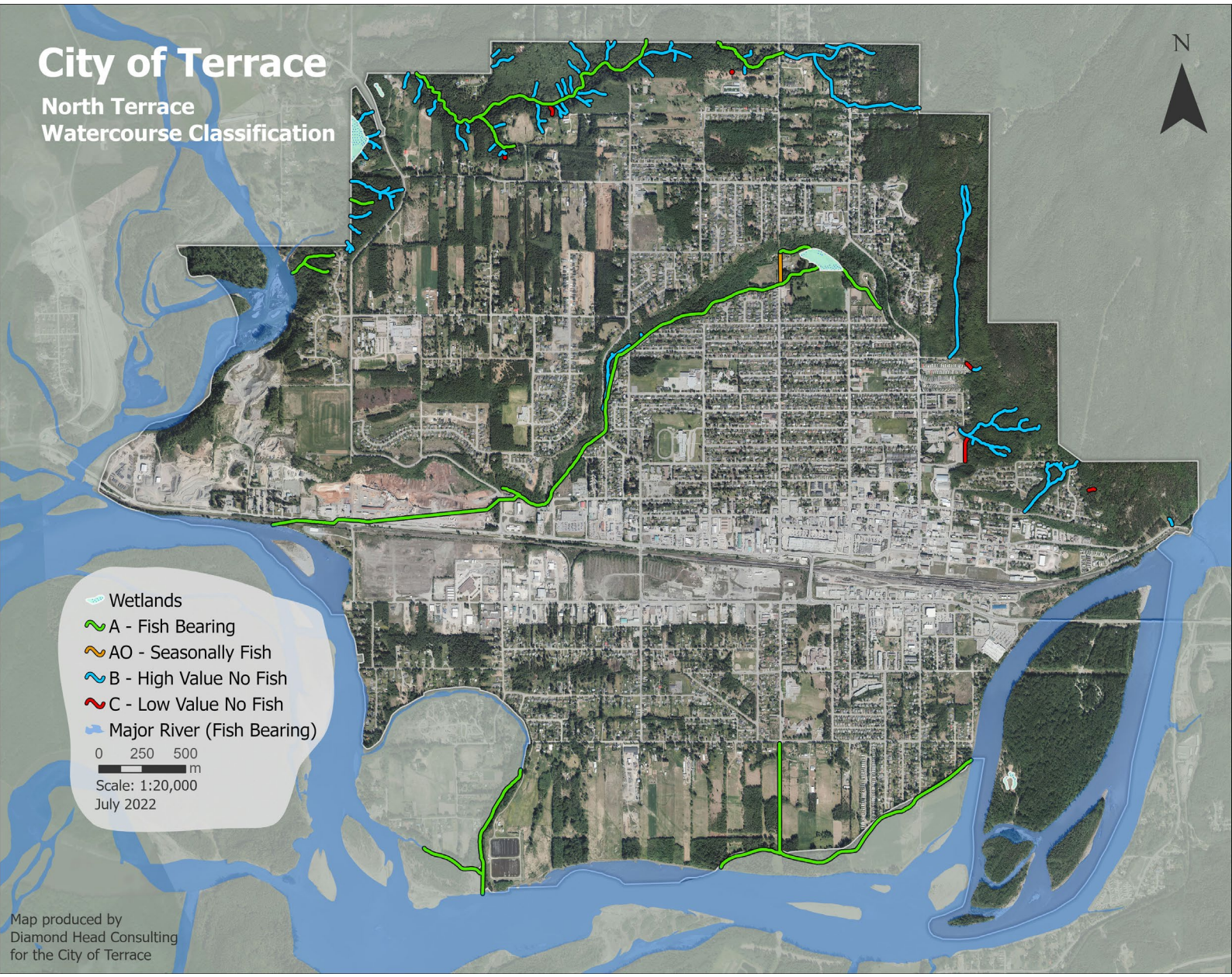

Figure 6. Location and fish classifications of watercourses in north Terrace.

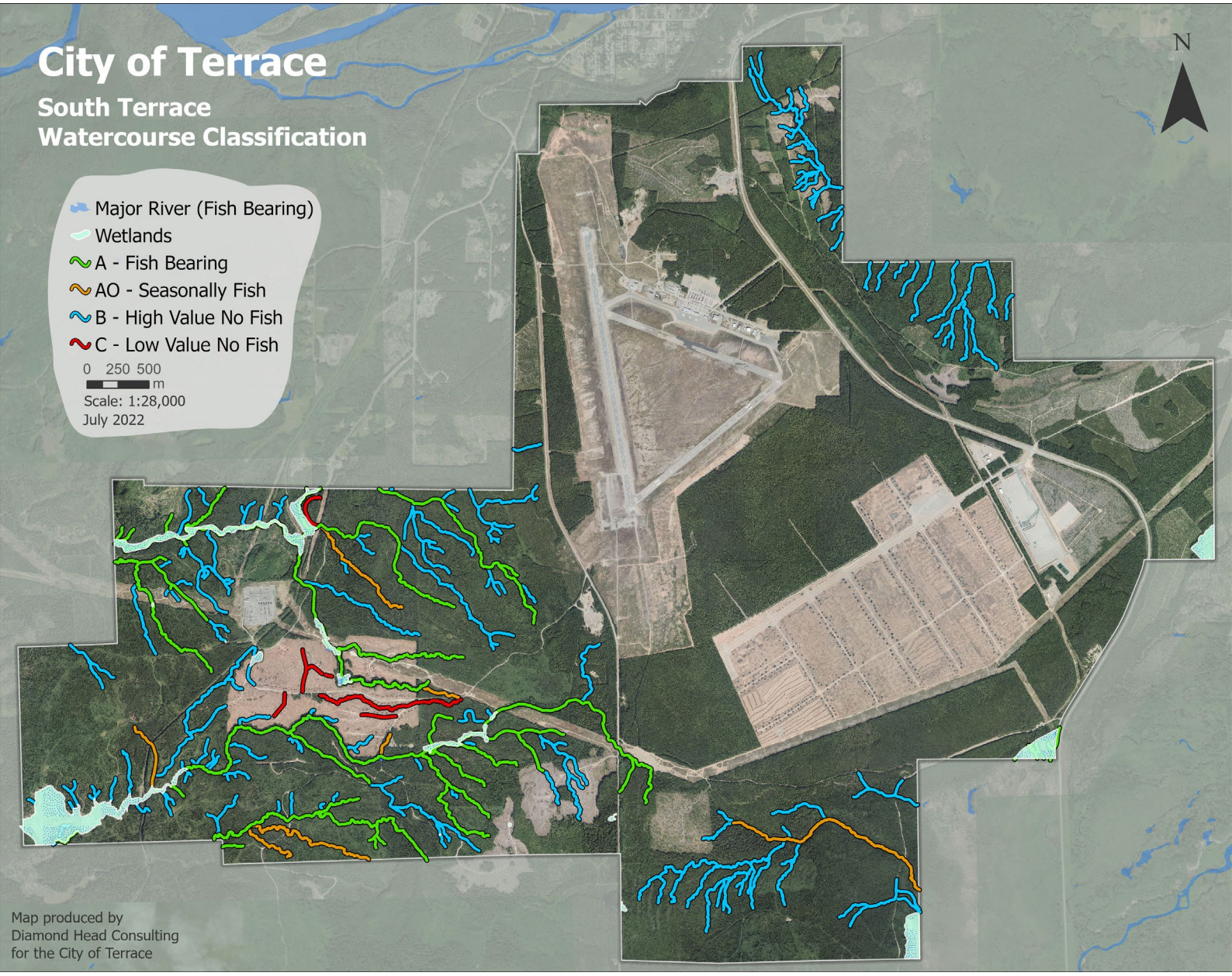

Figure 7. Location and fish classifications of watercourses in south Terrace.

3.3 Sensitive and At-Risk Species and Plant Communities

An important objective of this strategy is to protect ecological communities and species that are considered at-risk. Species of conservation concern (species-at-risk) are regulated by federal and provincial agencies. The federal government identifies species of special concern on Schedule 1 of the Species at Risk Act (SARA). The BC Conservation Data Centre tracks and ranks plants, animals, and ecological communities that are rare, threatened, or have declining populations. These species and ecosystems are classified as red, blue, or yellow which identifies how threatened they are (Table 3).

Table 3: Provincial description of at risk classification.

Provincial at risk classification	Description
Red	Species or ecosystems at risk of being lost (extirpated, endangered, or threatened)
Blue	Species or ecosystems of special concern
Yellow	Species or ecosystems that appear secure or at least risk of being lost

At the time of this ESA update, there were no records of red-listed species-at-risk documented by the BC Conservation Data Centre within the City. Table 4 includes a list of blue-listed species that have been identified within the City.

Table 4: Habitat description of blue-listed species-at-risk found in the City of Terrace.

Blue-listed species-at-risk found within the City of Terrace	Typical habitat of blue-listed species found within the City of Terrace
Short-eared owl (*Asio flammeus*)	▪ Occupy large, open areas with low vegetation such as meadows and marshes ▪ Primary prey includes small mammals
Great blue heron (*Ardea herodias fannini*)	▪ Forests, lakes, ponds and wetlands ▪ Forages in shallow waters
Bull trout (*Salvelinus confluentus*)	▪ Occupy relatively undisturbed watercourses with natural flows, clean gravels and deep pools
Band-tailed pigeon (*Columba fasciatus*)	▪ Moist forests with tall trees ▪ Forage for fruiting shrubs in the understory
Northern goshawk (*Accipiter gentilis*)	▪ Forests and riparian areas ▪ Prefers mature stands with dense canopies and open understory
American water shrew (*Sorex palustris*)	▪ Found along streams and other aquatic habitats ▪ Prefers areas with high vegetation, logs and rocks
Northern red-legged frog (*Rana aurora*)	▪ Occupies humid forests, ponds and streamsides; generally found in or near permanent sources of water

Northern Goshawk have been known to inhabit the City and is a provincial Blue-listed species, indicating it as a species of special concern. This raptor relies heavily on connected tracts of forests for breeding and foraging. Northern Goshawks have high fidelity to their nest and surrounding hunting areas, rarely leaving the area.

Terrace's natural landscape provides excellent habitat for this species, with its complex topography and connectivity to larger forests outside of municipal boundaries. This raptor nests primarily in mature and old-growth coniferous forests. Preserving these older connected forests will help support its populations.

Photo 13. A Northern Goshawk (*Accipiter gentilis),* photo from outside the City of Terrace).

Ecosystems-at-risk are plant communities that are extirpated, endangered, or threatened, or those of special concern. These communities were once abundant but are now at risk as many of them were lost to urban development or deforestation. Two ecosystems-at-risk are found in the City of Terrace (Table 5).

Species-at-risk are protected under federal and provincial legislation. In Cities, however, the responsibility lies with the municipality to determine which habitat areas are to be protected and how. Wildlife and habitat features such as raptor nests are protected under the *Wildlife Act*, *Species at Risk Act*, and *Migratory Bird Act*; however, these protections do not always extend to the surrounding habitat areas that these species rely on.

The location of species-at-risk and the features or processes that support them can be dynamic and change over time. For example, raptors nests and den locations can move, beavers will up new dams and lodges, and important wildlife trees can decay and fall. These sensitive species are best protected over time by preserving the large and intact ecosystems that exist in and around the City.

Table 5: Descriptions of ecosystems-at-risk in Terrace.

Red-listed ecosystems-at-risk found within the City of Terrace	Description and location of ecosystem at risk
Site Series 02 - Lodgepole Pine-Kinnikinnick	▪ Widely spaced lodgepole pine forests with thin morainal colluvial veneers over bedrock. ▪ Typically found on the upper slopes and ridge crests of Terrace Mountain.
Site Series 07 - Sitka Spruce-Salmonberry Wet Submaritime	▪ Highly productive with moist, regosolic soils. ▪ Limited to high bench floodplains next to larger streams and rivers that flood every few years. ▪ These stands often have high timber value and have been impacted by timber harvesting.

Photo 14. Example of a site series 02 community at risk found on Terrace Mountain.

Forests that contain ecological communities-at-risk are mapped in Figure 8 and Figure 9 based on field classification of site series and ranking by the Conservation Data Centre (CDC). Where forests are classified as a complex of ecological communities, the most sensitive one is mapped. Many forests lack the inventory information required to determine if they support any plant communities at risk. These are mapped as "data deficient."

Some ecological communities such as seasonally-flooded fens and wetlands found in the southwest of South Terrace are not listed as sensitive by the CDC. These areas are, however, unique within the surveyed area and are known to support species at risk.

Photo 15. Mink Creek in South Terrace.

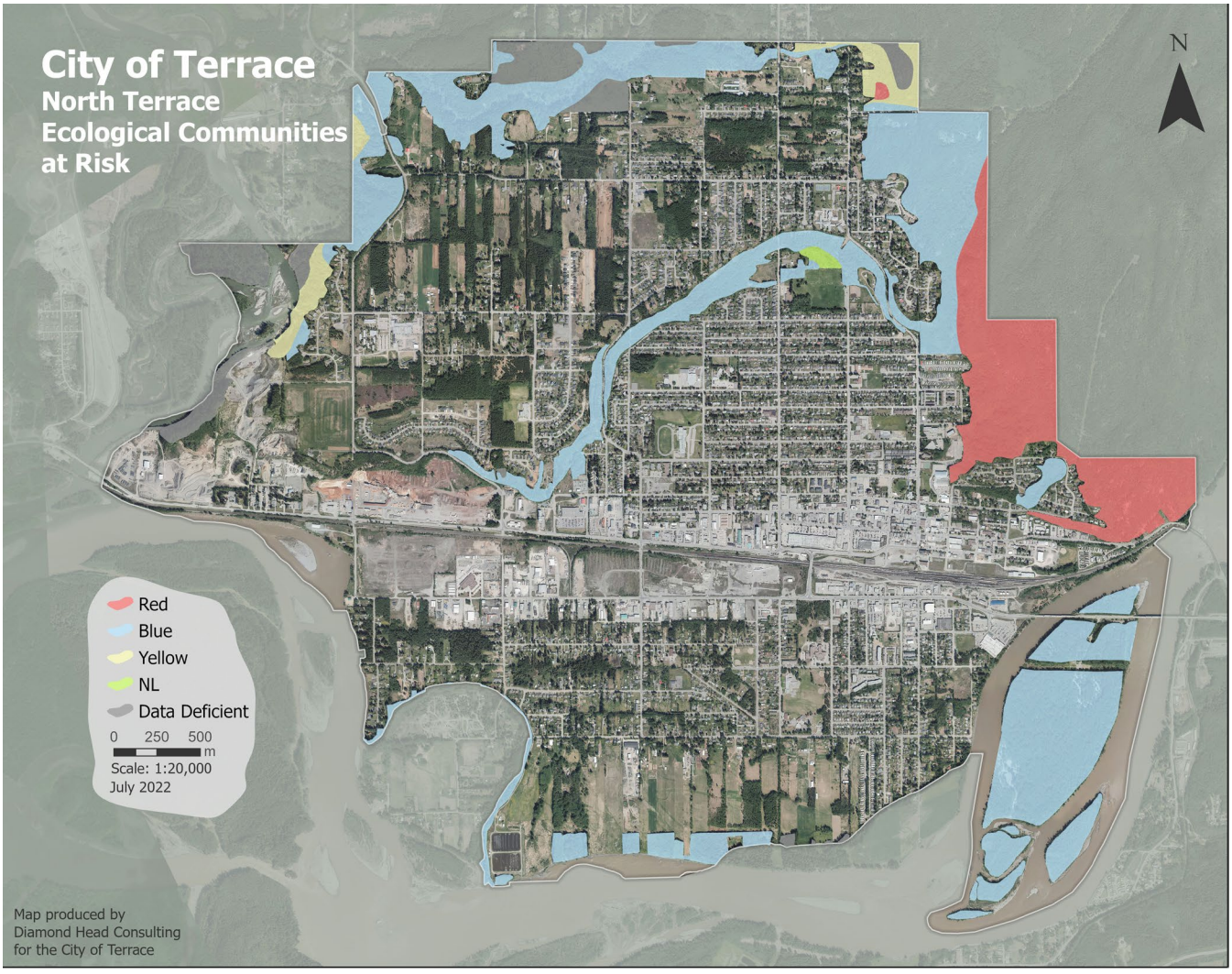

Figure 8. Locations of ecological communities at risk as defined by the Conservation Data Centre within identified Environmentally Sensitive Areas in north Terrace.

Photo 16. A wetland in South Terrace.

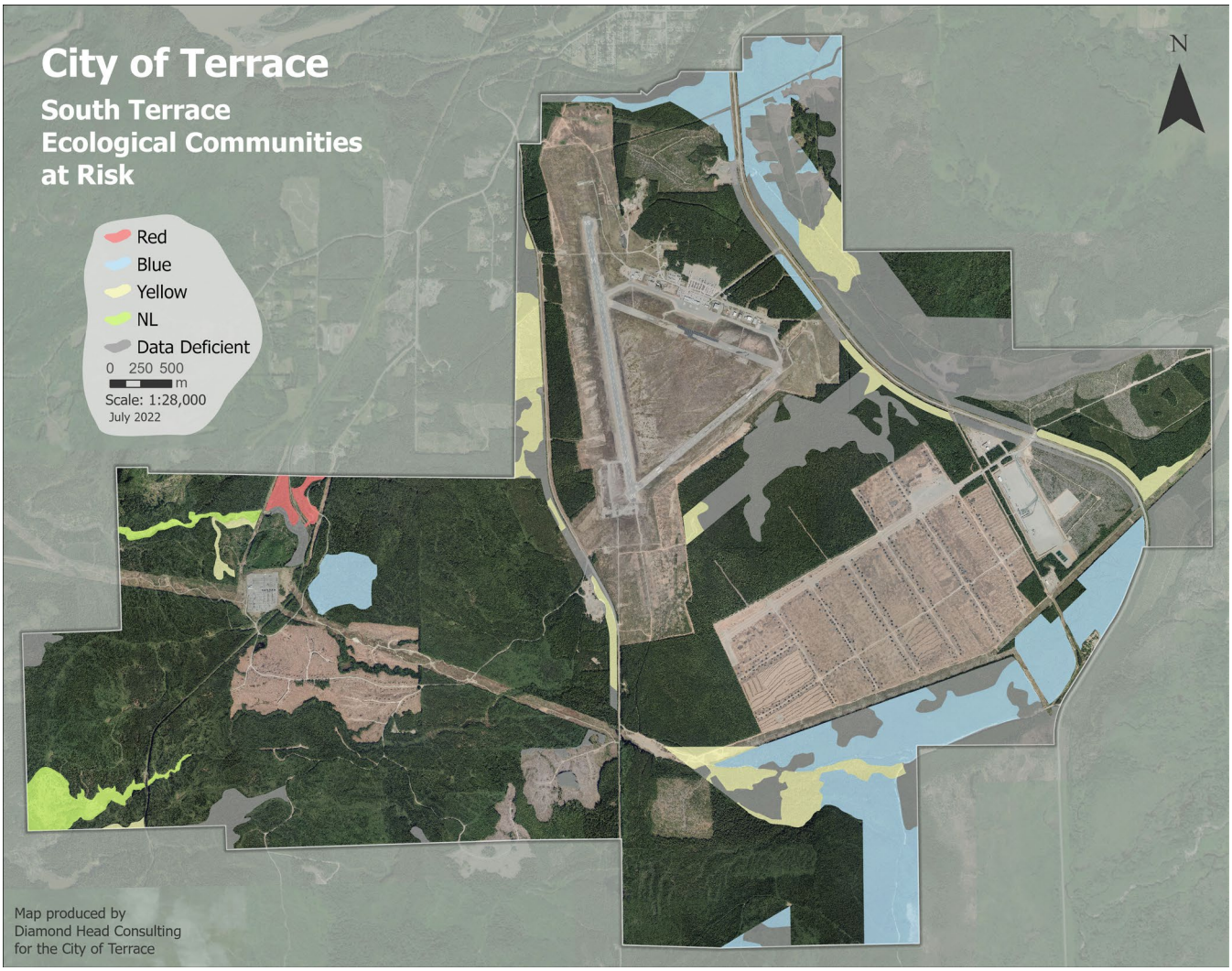

Figure 9. Locations of ecological communities at risk as defined by the Conservation Data Centre within identified Environmentally Sensitive Areas in south Terrace.

4 | Identifying ESAs

Natural areas are found throughout the City of Terrace. This Strategy identifies which natural areas are considered ESAs and provides guidelines for protecting them during development.

Natural areas were identified as ESAs if they met at least one of the following conditions:

- Watercourses and their riparian setback areas,
- Old-growth forest (240+ years),
- Remaining connected mature forests (80+ years) in North Terrace,
- Areas with habitat for species-at-risk,
- Rare or endangered plant communities, or
- Forests that provide important aesthetic, recreational, or educational values.

Natural areas were identified through a review of local policy and regional policies and studies, as well as LiDAR and orthophoto analysis. All areas within the City boundary, on both public and private land, were included in this analysis and the condition of select sites were confirmed through ground truthing. Provincially and municipally available datasets were used to identify natural areas with similar ecology as well as streams and wetlands. Orthophotos and light detection and ranging (LiDAR) were used to refine natural areas polygons, watercourse locations, and to identify previously undocumented watercourses.

A team of qualified environmental professionals conducted field visits to 180 locations in July 2021. Ground truthing was not exhaustive for all forests and watercourses, however, strategic locations were targeted to gain an understanding of the range of natural features in the City. No archaeologically significant sites were identified at the time of this field investigation. No public, First Nations, or other stakeholder consultation was conducted to identify ESAs.

ESAs in Terrace are broadly defined into two categories: Terrestrial or Riparian (Figure 10 & 11).

4.1 Terrestrial ESA Designation

Terrestrial ESAs consists of high-value sensitive forested habitats including old-growth stands, red-listed plant communities, and habitat for species-at-risk. Forests that provide important aesthetic, recreational, or educational values that are zoned as parkland were also included. Disconnected natural areas with development potential and zoned as such were not designated as ESAs. In North Terrace, mature connected forest stands were designated as ESAs due to their value within this highly urbanized area.

Photo 17. Streams and their riparian areas are complex ecosystems that provide habitat for a variety of species.

4.2 Riparian ESA Designation

Riparian ESAs includes both watercourses and their associated riparian plant communities, referred to as riparian protection areas herein. Riparian protection areas were established for all "protected watercourses". Protected watercourses include natural and constructed features that support fish or convey water to downstream fish habitat. Watercourses that are protected include those that are classified as:

A - Fish bearing

AO - Seasonally Fish Bearing, and

B - Streams that support downstream fish habitat.

Watercourses that are not connected to fish bearing watercourses or fish habitat and highly ephemeral ditches are not considered riparian ESAs.

Riparian ESAs consist of the watercourses and the adjacent terrestrial lands (riparian protection areas), regardless of land use. The extent of the riparian protection areas associated with each stream is dependent on the size of the stream, its classification, and the characteristics of its stream banks (Table 6).

Watercourses, their location, and classification have been identified as well as possible using current technology and field verification. The location of some watercourses may not have been mapped accurately or may change in the future. As Terrace continues to receive information on watercourses and their riparian areas, the City may choose to maintain updated online maps through TerraMap, Terrace's online mapping software. Unmapped watercourses located within City boundaries that meet the definition of Class A, AO or B may still be protected as part of this DP process.

Table 6: Description of riparian protection areas required for watercourses based on their type and classification.

Watercourse type	Watercourse classification	Riparian Protection Area
Natural and channelized watercourses	Class A/AO	Furthest of 30 m from natural boundary or 10 m from TOB
	Class B	Furthest of 15 m from natural boundary of 5 m from TOB
Ditches	Class A/AO/B	5 m from TOB
Wetlands	Class A/AO/B	30 m from natural boundary

Natural Boundary: The natural boundary of a stream is defined as whichever of the following is farther from the center of the stream:

a. The visible highwater mark of a stream where the presence and action of the water are so common and usual, and so long continued in all ordinary years, as to mark on the soil of the bed of the stream a character distinct from that of its banks, in vegetation, as well as in the nature of the soil itself; or

b. The boundary of the active floodplain, if any, of the stream.

Top of Bank (TOB): The top of bank is defined as "the point closest to the boundary of the active floodplain of a stream where a break in the slope of land occurs such that the grade beyond the break is flatter than 3:1 at any point for a minimum distance of 15 m, measured perpendicularly from the break."

Photo 18. Biologists completing an assessment of an ESA area.

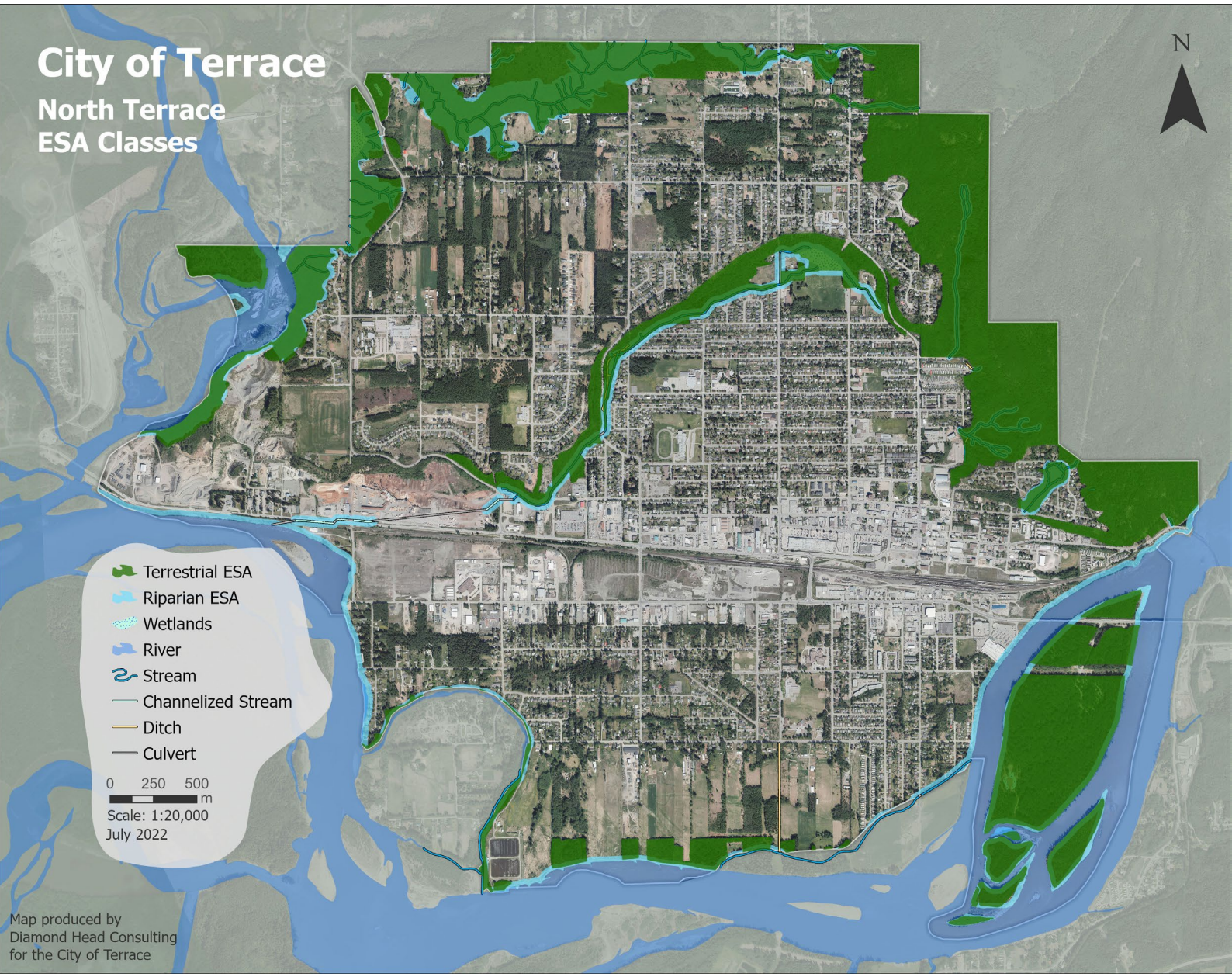

Figure 10. Terrestrial and Riparian ESAs in north Terrace.

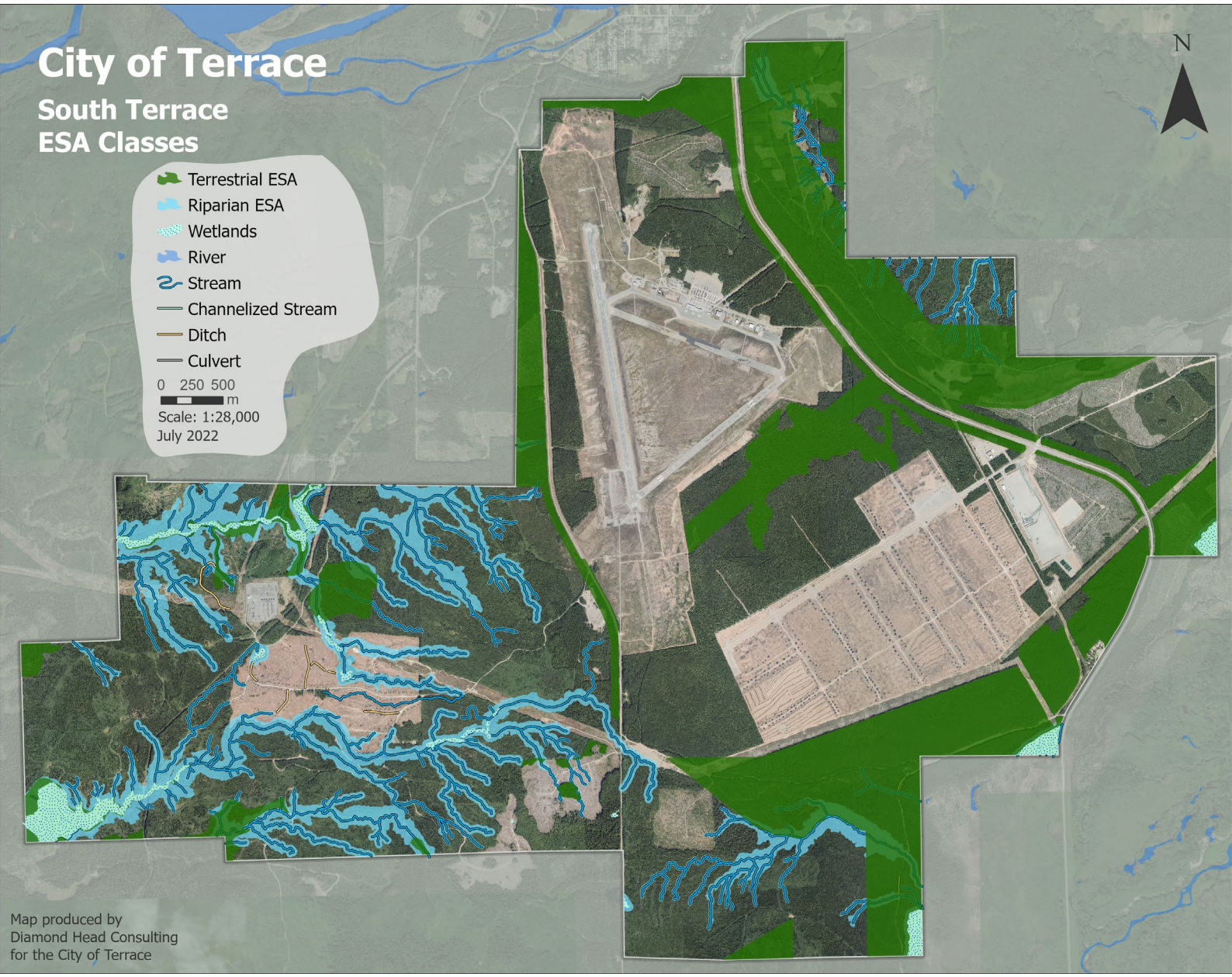

Figure 11. Terrestrial and Riparian ESAs in south Terrace.

5 | Protecting ESAs - The Development Permit Process

The City of Terrace protects ESAs through the designation of Development Permit (DP) Areas as defined by the City's OCP. These ESA DP Areas protect sensitive ecological features from activities that meet the definition of Development specified in Section 5.3. Development that is proposed within ESA DP Areas, requires that a development permit application be submitted to the City. This application must show that the development meets the objectives and guidelines of the DP and is minimizing the development's impact on the natural environment.

Photo 19. Northern red-legged frog (*Rana aurora*) , a-blue listed species.

5.1 ESA Development Permit Areas

The two types of ESAs have been defined and are protected within this Development Permit (DP) Area; Terrestrial ESAs and Riparian ESAs (Figures 13 & 14).

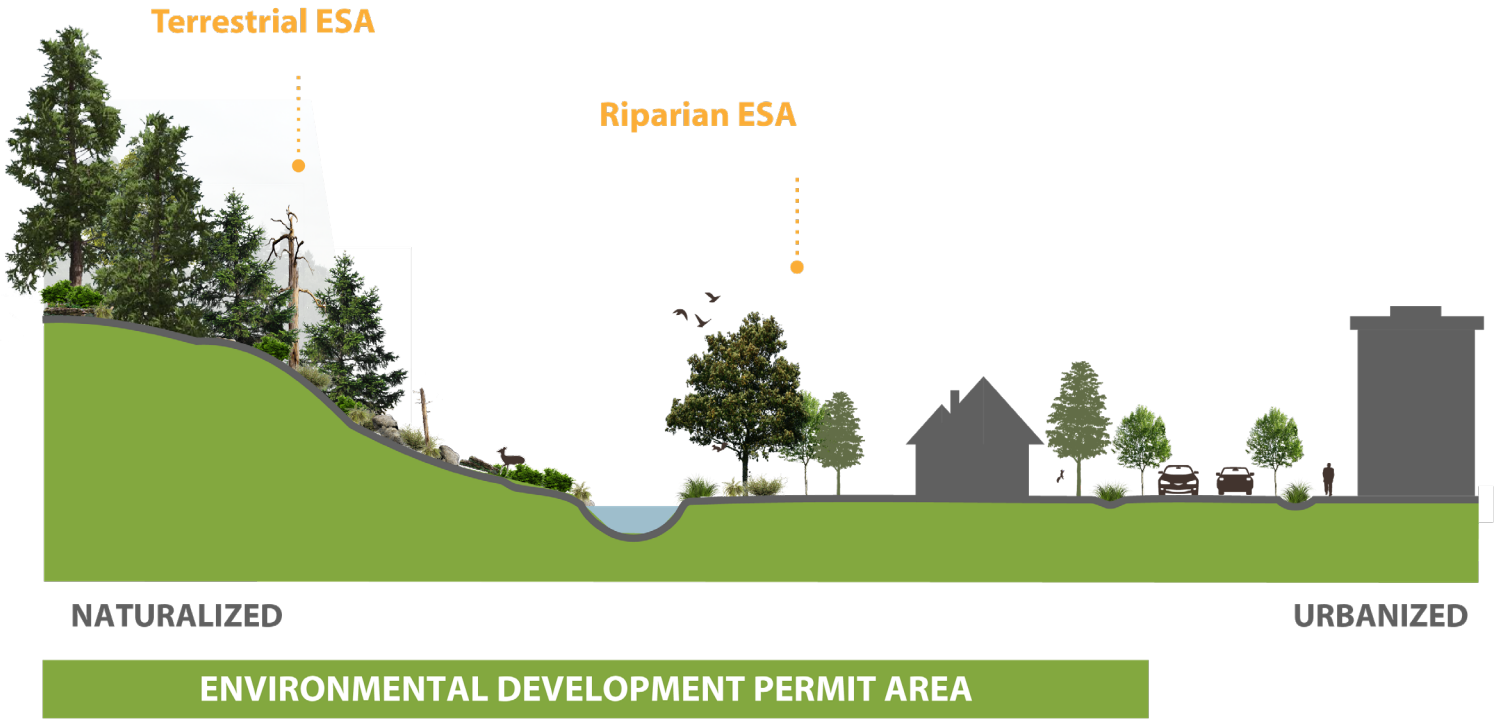

Figure 12: Illustration of Terrestrial and Riparian ESA areas.

Figure 13. Terrestrial ESA Development Permit Area in Terrace.

Figure 14. Riparian ESA Development Permit Area in Terrace.

5.2 ESA Development Permitting Process

The development permitting process requires developers to submit an ESA Development Permit (DP) application to the City for review. ESA DP Areas are not intended to exclude development, but rather provide the City with the opportunity to modify development plans and activities to minimize impacts to these natural areas. The following ESA development permit process is required when development is proposed in this DP area:

1. Confirm project location and ESA designation and sensitivities with City planners to determine if the planned activities trigger a DP application.
2. If planned activities require a DP application, the applicant will submit the application form and materials required by the City of Terrace and pay the relevant application fee.
3. The applicant may be required to submit professional reports prepared by Qualified Environmental Professionals (QEPs). Additional reports may include but are not limited to geotechnical studies, arborist reports, windfirm boundary assessments, riparian protected area assessments, and restoration plans. These additional reports may also be required as a condition of issuing the DP.
4. The City may approve of the proposed activity, request additional information or modifications to the application, or reject it depending on the findings of the review.
5. As part of the DP review and approval process, the project may be subject to permitting requirements by the City and other regulatory agencies. These requirements may include but are not limited to restoration and enhancement, monitoring and maintenance, application of specific mitigation measures, conveyance of the ESA or a restrictive covenant, and security or bonding. These additional permitting requirements may also be required as a condition of issuing the DP.

This development permitting process is intended to be a cooperative process between City staff, developers, and QEPs. Qualified Environmental Professional reports will be used to identify potential impacts that the proposed development may have on the ESA. QEP expertise and experience is required to verify the location and condition of ESA and to recommend detailed protection and restoration options that will satisfy the objectives and guidelines of this DP policy.

Qualified Environmental Professional (QEP) Requirements

All consultants preparing environmental impact assessments for ESA DP applications must have a professional designation and demonstrate their competence in a relevant area of expertise. "Qualified Environmental Professional (QEP)" is an individual that is a member of a professional body that has demonstrated expertise and knowledge in sensitive environments, ecosystems, and/or riparian management. A QEP is only considered as such for the portion of assessment that is within their area of expertise.

A QEP must be registered and in good standing with an appropriate professional organization constituted under an Act, acting under that association's code of ethics and is subject to disciplinary action by that association. The City may require the QEP to provide evidence of training and accreditations. QEPs may include but are not limited to professionals in good standing from the College of Applied Biology, the Association of Professional Foresters, the Engineers and Geoscientists of BC, and the BC Institute of Agrologists.

Photo 20. Kinnikinnick *(Arctostaphylos uva-ursi)* is a common groundcover shrub in Terrace.

5.3 Development Classification

Activities considered to be development will be required to go through the DP process. The following are examples of activities that are considered development for this DP process. Under some circumstances, some of these activities may be considered exempt by City staff.

- Construction of, alteration to, or addition of a building or other structure, including but not limited to:
  - Demolition of existing structures;
  - New building construction;
  - Building additions;
  - Construction of, addition to, or alteration of accessory buildings and structures including pools, decks, sheds, retaining walls, and other structures
- Alteration of lands, including but not limited to:
  - Site clearing and removal of trees and/or vegetation;
  - Site grading or removal and deposition of soils or gravel;
  - Creation of impervious or semi-impervious surfaces, including but not limited to roads, parking areas, or trails.
  - Installation, construction, or alteration of:
    - Flood or erosion protection works;
    - Fences, patios, docks, wharves, or bridges; and
    - Drainage, hydro, water, sewer, or other utilities
  - New landscaping, with an exemption for specific landscaping activities
- Subdivision of lands
- Rezoning of lands

5.4 DP Application Submission Requirements

In addition to a completed Development Permit Application, City staff may also request the following:

1. A QEP report which includes the following information:
   a. Name(s) and qualifications of the Qualified Environmental Professional (i.e. RPBio, RPF, PEng);
   b. Summary of current site conditions;
   c. Maps of the location of ESAs, natural features, nests, invasive plant species and any other site characteristics relevant to the ESA;
   d. Location of watercourses, top of bank, and the riparian protected area as defined under the DP:
   e. Summary of the planned development concept;
   f. Recommendations to ensure that ESAs are protected throughout the development process;
   g. Location and type of degradation and opportunities for restoration;
2. A restoration plan that is approved by a QEP and contains the following information:
   a. Location and description of degradation such as encroachment, invasive species infestation or clearing;
   b. Description of restoration required to restore the area to a natural and healthy plant community.
   c. Maintenance and monitoring requirements for a 3-year period, requiring at least 80% plant survival.

Photo 21. Honey bee hives adjacent to a natural forest in North Terrace

5.5 Development Permit Area Objectives

The intent of this ESA DP is to ensure that development occurs in a manner that protects the health, integrity, form and function of these important natural areas. The following are objectives to guide the DP process.

1. **Protect ESAs from the impacts of land development**
   - Ensure watercourses and high value forests are protected and remain connected.
   - Assess development activity on lots with an ESA designation to minimize impacts to nearby ESAs.
2. **Maintain the integrity of natural water drainage**
   - Consider natural hydrology in development plans including overland, groundwater flow, and the impact of more frequent and intense storm events related to climate change could have on drainage.
   - Encourage alternative green infrastructure such as, bioswales and rain gardens in development plans.
   - Assess and mitigate any impacts development could have on watercourses and riparian areas and encourage opportunities for restoration if historic degradation has occurred.
3. **Manage ESAs following provincial best management practices and current scientific knowledge**
   - Ensure Provincial Legislation and most recent Provincial Best Management Practices (BMPs) are followed for development projects within or in proximity to ESAs.
   - Use science-based information to inform permitting decisions regarding land development and ESA impacts.
4. **Encourage the restoration and enhancement of ESAs on both private and public lands**
   - Encourage the restoration and enhancement of the natural environment that will improve the integrity of ESAs and ecological network within the City of Terrace.
5. **Protect the integrity of park areas with high scenic and recreational value**
   - Manage parks and public areas to preserve naturalized areas and wildlife habitat.
   - Recognize the health and spiritual attributes parks and recreation areas have on community wellbeing.
6. **Encourage public understanding and stewardship of ESAs**
   - Protect ESA areas that support community climate change resiliency.
   - Promote education opportunities on publicly owned ESA areas where possible.
   - Educate owners of private properties with ESA designations to the sensitivities of these areas and the Development Permit process.

Photo 22. Terrace uses a cooperative process to protect natural areas during development.

5.6 ESA Development Guidelines

Development permit guidelines provide measures necessary to protect and manage ESAs during development. Table 7 provides guidelines that apply to both Terrestrial and Riparian ESA areas.

On some properties, both Terrestrial ESAs and Riparian ESAs may overlap. While most guidelines are applicable to both Terrestrial and Riparian ESAs, there are some that only apply to Riparian ESAs.

Table 7: Terrestrial and Riparian ESA Development Permit guidelines.

Development Guideline	Description
Minimize the impact of land development on ESAs	
1. Locate development and infrastructure away from ESAs	▪ Locate development footprints and infrastructure as far away as possible from ESAs. If located within an ESA, minimize the footprint size of any development.
2. Minimize the alteration of natural grades, and impacts associated with the deposition of fill or removal of soils	▪ Maintain the natural grade of the land unless the area is subject to flooding. ▪ Implement erosion and sediment control measures to ensure exposed soils do not impact ESAs. ▪ Incorporate measures to protect existing habitat from unstable slopes associated with current or historic development activity.
3. Establish a transition area between ESAs and development	▪ Provide a transition area between the ESA and structures, infrastructure, and impervious surfaces. Tree retention or planting, stormwater management, nature-scaping, and trails in these areas are encouraged.
4. Protect trees and native understory vegetation in ESAs	▪ Retain and protect trees and understory vegetation within ESAs. ▪ Protect the critical roots of trees in ESAs from development impacts. ▪ Retain and protect dead standing wildlife trees that do not pose a risk to people or property.
5. Selective trimming or clearing may be permitted in ESAs in some instances with support from a QEP and/or City staff	▪ Trees in ESAs that are identified as posing a high risk may be removed or modified subject to support from a QEP and/or City staff. ▪ Removal of select trees in ESAs for view enhancement purposes may be permitted subject to support from a QEP and/or City staff.
6. Install protective fencing around the ESA	▪ Install temporary fencing around the ESA for the entirety of construction.
7. Protect raptors nests	▪ If any raptors nests are identified, they must be protected following the provincial "*Guidelines for Raptor Conservation during Urban and Rural Land Development in British Columbia* (2013)", or an updated version if one is released.
8. Protect habitat for species-at-risk	▪ Protect and enhance identified critical habitat for federally and provincially listed species-at-risk.
9. Schedule development activities to minimize risks to ESAs and restrict construction work during sensitive timing windows	▪ Bird nests are protected in accordance with the *Wildlife Act*, and M*igratory Birds Convention Act*. The nests of raptors such as bald eagle, peregrine falcon, osprey, and various owls are protected year-round. Active nests of all other birds cannot be removed or disturbed during the nesting season, March 1 to August 31.
10. Minimize light and window impacts to birds	▪ Consider use of light reduction techniques such as directing light away from the ESA, and reducing spill lighting. ▪ Building design should consider reducing glass and transparent surfaces to reduce the potential for bird collision.
11. Avoid the introduction of invasive plant species to ESAs and eradicate any existing invasive plant species	▪ All invasive plant species identified on site must be eradicated. Care must be taken to ensure they are not spread into the ESA. Follow BMPs to manage any invasive species found on site. ▪ Avoid the introduction of new invasive plants on site by cleaning equipment before they arrive on site, monitoring for illegal dumping of yard waste, and ensuring any soil deposits are free of invasive plant fragments and seeds. ▪ Dispose of all invasive plant material at an appropriate facility.

Development Guideline	Description
Maintain the integrity of the natural hydrology for stormwater events	
12. Preserve and restore natural drainage patterns	▪ Avoid or mitigate changes to natural drainage patterns including surface and groundwater volumes and flows, and rates of infiltration and recharge. ▪ Locate development away from recharge/discharge areas including wetlands. ▪ Maintain or enhance base flows to nearby watercourses.
13. Minimize impervious surfaces and promote natural filtration	▪ Incorporate absorbent landscaping and encourage the permeability of grassed and landscaped areas adjacent ESAs by protecting and re-using native topsoil, preventing compaction during construction, and aerating or loosening compacted soils. ▪ Minimize paved features in ESAs such as parking lots and paved trails. Use permeable trail materials where feasible.
14. Direct rainwater and surface run-off towards green stormwater management infrastructure	▪ Incorporate green infrastructure wherever appropriate such as bioswales, rain gardens, or stormwater ponds as part of site stormwater management.
15. Prevent the release of sediment laden water and pollutants into ESAs	▪ Incorporate erosion and sediment control BMPs to prevent sediment from entering nearby watercourses and ESAs. ▪ Incorporate stormwater infrastructure to minimize the long-term pollution impacts from surface run-off to ESAs associated with the development.

Photo 23. The Skeena River and its tributaries provide important spawning habitat for Sockeye Salmon and other salmonids.

5.7 Additional Riparian ESA Development Guidelines

In addition to the guidelines in Table 7 that apply to all ESA areas, there are some additional sensitivities which must be considered for Riparian ESA area (Table 8).

Table 8: Additional guidelines that apply to Riparian ESAs.

Development guideline	Description
Minimize the impact of land development on ESAs	
Design all culverts and bridges over fish bearing and seasonally fish bearing watercourses to be fish passable	▪ Use clear span bridges or open-bottomed stream crossings whenever feasible ▪ Incorporate fish baffles or other BMPs to support fish passage in enclosed crossings.
Minimize the crossing of watercourses and their riparian areas	▪ Minimize road, utility, and other crossings of riparian ecosystems. Where crossings are necessary, design them to be narrow and perpendicular to riparian areas.
Assess options to restore degraded watercourse channels and/or daylight culverts that connect to natural streams	▪ Consider the feasibility of daylighting or restoring any sections of a stream that is currently channelized or runs through a culvert. Prioritize connected watercourses with potential to expand fish habitat.
All work in and around a stream must meet the requirements of the *Water Sustainability Act*	▪ Instream work requires either a notification or change approval application be submitted by a QEP under section 11 of the *Water Sustainability Act* and approved by the Ministry of Forests, Lands, Natural Resource Operations and Rural Development.

Photo 24. A wetland in South Terrace. Development should be designed to minimize impacts to wetlands and their riparian areas.

Photo 25. Terrace's natural areas provide an abundance of recreational opportunities.

5.8 Guidelines to Integrate ESAs and Parkland

Areas identified as parkland have been included as ESA areas in this Strategy. As many ESAs exist within or adjacent to parkland, the provision of recreational values must be balanced against environmental sensitivities. Guidelines in Table 9 protect ESAs within existing parkland but also apply when new parkland is created as part of development.

Table 9: Guidelines to Integrate ESAs and parkland.

Protect the integrity of park areas with high scenic and recreational value	
Locate trails away from the most sensitive ESAs and design to be low impact	▪ Locate trails away from the most sensitive ESAs and minimize the removal of mature trees. ▪ Use permeable materials for trails in ESAs, as much as feasible. ▪ Place signage, use fencing, or natural obstructions to prevent unauthorized trail creation and off-trail access. ▪ Protect some large ESAs with minimal trail access to avoid fragmenting large, continuous natural areas.
Minimize disturbance of ESAs in parkland	▪ Trails, parking, washrooms, and other park facilities should have a limited footprint in ESA areas.
Add educational park signage at strategic locations	▪ Consider installing educational signage at key locations where the public interacts with ESAs. These should explain the sensitivity of the ESA, protection measures, and restoration work on site.
Locate public parkland development in less sensitive ESAs	▪ Locate new parkland development in ESAs designated for parkland which don't meet other ESA criteria, such as younger stands without red listed species or other sensitive features.

6 | Opportunities for Protection and Enhancement

The proximity of natural areas and development in the City of Terrace creates edges vulnerable to human impacts. The restoration of degraded areas is important to ensure forest and riparian edges are healthy and resilient. Common sources of degradation include encroachment of land use, clearing of trees, trampling of ground vegetation, and the establishment of invasive species. Where ESAs have been degraded, restoration efforts should prioritize the removal of all non-native materials, the restoration of soil conditions, and planting of an ecologically suitable and diverse plant community free of invasive plant species.

Through the ESA DP process, opportunities for restoration may be required as a condition of the DP. The following are summaries of some common sources of degradation and considerations for their restoration.

6.1 Invasive Species Removal

Invasive species are plants or animals that have been introduced into a region from elsewhere in the world and have the potential to negatively affect the integrity of natural areas. Invasive species proliferate quickly and outcompete existing vegetation communities without the natural predators or pathogens from their native habitat. These invasive species not only aggressively spread, but can also be difficult to eradicate once established. In addition, invasive species can have significant social and/or economic impacts, such as causing poisonings and damaging infrastructure.

Controlling the spread of invasive species, specifically invasive plants, is vital to protect ESAs. Within the City of Terrace, invasive plant species are uncommon compared to the denser and more highly urbanized regions of British Columbia. This pristine nature of Terrace should be maintained and further protected through the ESA strategy. An exhaustive invasive species inventory was not conducted as part of this update; however, the following invasive plants were identified in the City:

- **Yellow archangel** *(Lamiastrum galeobdolon)* – found as an escaped ornamental from gardens.
- **Common tansy** *(Tanacetum vulgare)* – common along roadways.
- **Bohemian/Japanese Knotweed** *(Reynoutria* (formerly *Fallopia*) *japonica, Reynoutria bohemica)* – widely regarded as one of the most invasive species worldwide.
- **Norway Maple** *(Acer platanoides)* – escaped ornamental with invasive potential.

The Northwest Invasive Plant Council (NWIPC) also has a list of 60 invasive alien plants that are targeted for management in the region (http://nwipc.org/plants). The City of Terrace recommends that citizens keep a look out for these species and to do their part in helping keep invasive species under control.

The Province of British Columbia manages invasive species through the Early Detection Rapid Response (EDRR) process (Figure 17). This process is used to find, identify, and systematically eradicate or control new invasive species before they become established and dispersed.

Photo 26. Devil's club (*Oplopanax horridus*, left) and western red-cedar (*Thuja plicata,* right) in a healthy natural area.

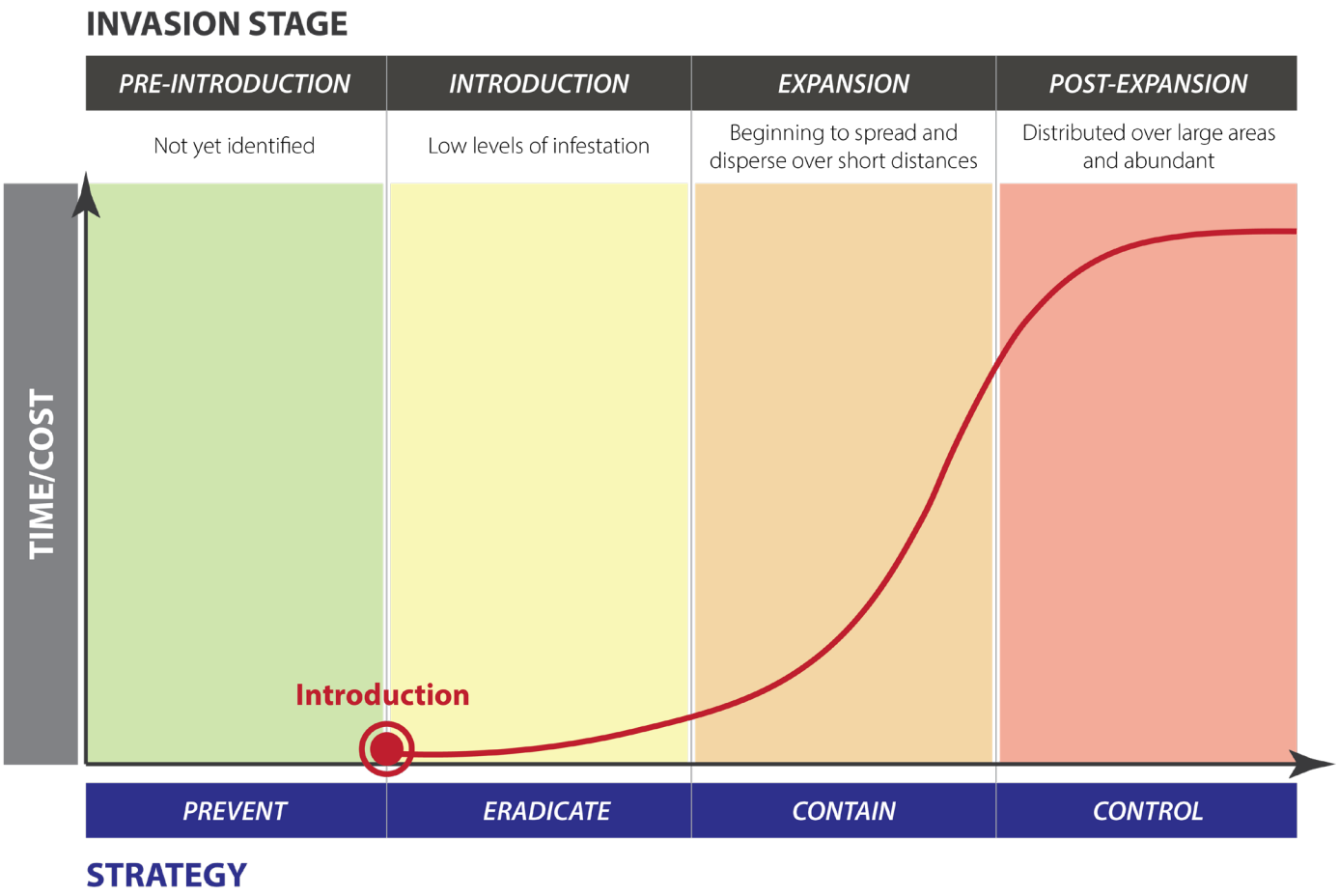

Figure 15. Graphic illustrating the treatment cost associated with the four stages of invasion.

As invasive species become more established, their impact on the landscape increases, as do the costs associated with their management. Local eradication of invasive species requires cooperation between the City and private landowners as it needs aggressive and repeated treatments. Some of the following measures can be taken by citizens to help prevent the spread of invasive plants:

- **Education** – Many invasive plant species continue to be sold as seed packets or garden ornamentals. Research garden plants before purchasing to avoid buying invasive species.
- **Awareness** – Watch out for invasive plants on the property and remove or report them when identified.
- **Disposal** – Be careful composting invasive plants and do not dump household or garden waste into natural areas. Proper disposal is required to help prevent invasive spread.

Following removal of invasive plant species, native plants that can establish quickly should be replanted. This can reduce or prevent re-establishment of invasive species. Each invasive plant species has specific management methods. These species-specific management methods are referred to as BMPs and contain resources for spread prevention and control methods.

Additional resources to learn about these species and how to remove them can be found at the Invasive Species Council of BC **bcinvasives.ca**.

Photo 27. Norway maple (*Acer platanoides*) is an escaped ornamental that has the potential to spread in Terrace.

6.2 Soil Restoration and Slope Stabilization

Restoration plans must consider soil conditions. A soil's ability to support a plant community depends on soil nutrient and moisture levels, soil texture, coarse fragment content, compaction, and organic matter content. Different plant species have specific thresholds for soil conditions. Compacted soils should be scarified down to a depth of 50 cm. Soils poor in organic matter should be enhanced by adding native organic mulch. Grading should restore a natural state which supports the natural hydrology of the area.

Slope failures are often a natural source of disturbance, however, human activities such as development, removal of trees and vegetation, or changes to hydrology can exacerbate these events. Highly unstable slopes can be revegetated through restoration techniques such as wattle fencing, which helps to anchor soils using deep rooted species.

Photo 28. Single-story, young forest with low diversity.

6.3 Terrestrial Restoration

There are several sources of historical ecological degradation within the City of Terrace. These include urban encroachment, slope failures, and the effects of historic logging. Urban encroachment can be mitigated through revegetation and the installing of exclusion fencing and signage. Many areas within Terrace were historically logged and have regenerated naturally or through tree planting. Some of these new young forests have become even-aged and dense with closed canopies that limit sunlight reaching the forest floor. In these areas, structural diversity is low and understory growth is limited. These areas can benefit from targeted efforts to open the canopy and introduce diversity through understory planting.

6.4 Riparian Restoration

The watercourses in Terrace are complex and typically located within deeply incised ravines and gullies, especially in South Terrace. Many of these ravines and gullies are characterized by unstable slopes. The DP process provides an opportunity to improve watercourses and their riparian areas. Restoration opportunities include the removal of encroaching structures and replanting with native species.

Riparian habitat can be enhanced by implementing measures that stabilize streambanks, increase shade to moderate water temperatures, support leaf litter and insect drop. Instream habitat can be improved by increasing channel complexity with natural materials (e.g. root wads, logs). For steep sites located adjacent to a watercourse, erosion control measures (e.g. silt fencing) will help protect water quality. Once restoration is complete, areas with exposed soils should be covered with organic mulch, wood chips, or re-seeded with native species.

Photo 29. Multi-storied and diverse forest with canopy gaps in Lakelse Lake Park.

6.5 Recommended Plants for Restoration

Restoration and enhancement opportunities typically include the removal of non-native materials and invasive species, the provision of healthy soils and planting a native plant community. Planting design should focus on creating diverse and resilient ecosystems. Choosing plants for restoration should consider the availability of sunlight and the soil's nutrient and moisture conditions. For sites impacted by invasive species, plants should be planted at high densities. Most plants grow best in groups as this avoids unnecessary competition between species. For successful planting, plants should be sourced from a reputable nursery and be healthy and free of disease or insect damage.

Recommended deciduous trees:

- Red alder (*Alnus rubra*)
- Paper birch (*Betula papyrifera*)
- Trembling aspen (*Populus tremuloides*)
- Black cottonwood (*Populus balsamifera ssp. trichocarpa*)
- Sitka Mountain Alder/Green alder (*Alnus viridis*)

Recommended coniferous trees:

- Sitka/white spruce (*Picea sitchensis/Picea sitchensis x glauca*)
- Lodgepole Pine (*Pinus contorta*)
- Western redcedar (*Thuja plicata*)
- Western hemlock (*Tsuga heterophylla*)
- Amabilis fir (*Abies amabilis*)

Recommended shrubs:

- Douglas maple (*Acer glabrum var. douglasii*)
- Alaskan blueberry (*Vaccinium alaskaense*)
- Oval-leaved blueberry (*Vaccinium ovalifolium*)
- High-bush cranberry (*Viburnum edule*)
- Red elderberry (*Sambucus racemosa*)
- False azalea (*Menziesia ferruginea*)
- Salmonberry (*Rubus spectabilis*)
- Nootka rose (*Rosa nutkana*)
- Thimbleberry (*Rubus parviflorus*)

Recommended ferns:

- Oak fern (*Gymnocarpium dryopteris*)
- Lady fern (*Athyrium filix-femina*)

6.6 Preserving and Enhancing Connections

The City of Terrace is surrounded by and intrinsically connected to natural areas including Terrace Mountain and the coast mountain range, Lakelse Lake, and Hai Lake-Mount Herman Provincial Parks, and numerous connected watercourses that flow through it, most notably the Skeena River. A diversity of habitat types and features are required for various stages of species' life cycles. Protecting the identified ESAs will provide these core areas for habitat; however, species also need to be able to move through these areas to access these different habitat types and promote genetic diversity within their population.

Historic development within cities have not considered connectivity for wildlife. This has resulted in fragmented islands of habitat and barriers to wildlife migration and movement. While it is critical to protect these remaining corridors, it is possible to re-establish this important wildlife infrastructure. The easiest method to restore connectivity for terrestrial species in a developed area is through the restoration of riparian habitat along watercourses during redevelopment. This protects bands of natural areas along watercourses while simultaneously improving instream habitat. These corridors can be further enhanced through the daylighting of culverted streams and historical stream channels and the removal of barriers to fish passage.

Photo 30. Lodgepole pine needles and cones.

7 | Monitoring for Success

This Strategy aims to protect, restore, and where possible, enhance environmentally sensitive natural areas within the City. Monitoring the success of this strategy will ensure it is effective and will identify any gaps in the policy. Continued monitoring of ESA condition will allow the City to detect changes to ecological function caused by other factors such as climate change. Evaluating and tracking changes to ecosystems can be accomplished through monitoring of ecological indicators. These indicators include the presence and abundance of certain species as well as natural attributes that can be quantified.

7.1 Canopy Cover

Canopy cover is the surface area covered by trees. Monitoring canopy cover within ESAs is a common indicator used to track changes to the forest over time. Canopy cover within areas designated as ESA should remain unchanged. Measuring canopy coverage would help confirm if these ESAs remain protected.

7.2 Invasive Species

Invasive species presence and coverage are indicators of habitat degradation and disturbance. These species are often found along edge habitat at the interface of urban development and protected areas. This is largely due to continued disturbance along these edges and seed spread facilitated by vehicles, dumping, and people. Since there are relatively low levels of invasive species in the City, tracking their spread and abundance within ESAs and natural areas is a good indicator of ecosystem health.

Photo 31: Japanese knotweed is a highly invasive plant.

7.3 Indicator Wildlife Species

The presence of certain wildlife species can be as indicators of ecosystem health. Keystone species should be selected. These are species whose presence is important for numerous other species in an ecosystem. Recommended species to monitor are outlined in Table 10.

Table 10: Recommended indicator species and monitoring methods.

Habitat type	Indicator species	Survey method
Freshwater river	Cutthroat trout (*Oncorhynchus clarkii*)	Minnow Traps/Snorkel survey
Wetlands	Common yellowthroat (*Geothlypis trichas*)	Singing birds
Shrub communities	Spotted towhee (*Pipilo maculataus*)	Singing birds
Dry coniferous forests	Brown creeper (*Certhia Americana*)	Singing birds
Moist coniferous forests	Barred owl (*Strix varia*)	Singing birds
Deciduous forests	Ruby-crowned kinglet (*Regulus calendula*)	Singing birds

Photo 32. Barred owl (*Strix varia*), is a keystone indicator species.

THE CITY OF TERRACE