Calgary Metropolitan Region Board

Environmentally Sensitive Areas Background Study
Calgary Metropolitan Region Board

Approved Version, December 13, 2019

O2 Planning + Design

Project Intent

Environmentally Sensitive Areas (ESAs) are key landscape features, providing important ecosystem services to municipalities at regional and local scales. The stewardship of ESAs is essential to the long-term maintenance of ecosystem function and biological diversity of the region. These cherished and often irreplaceable natural places are worthy of retention or special care to maintain water quality, provide flood mitigation, retain natural habitats and diverse landscapes, and preserve other valued ecosystem functions and services.

- **Ecosystem functions** describe the underlying biotic and abiotic processes that sustain, maintain, and transform the landscape over time.
- **Ecosystem services** are those aspects of the landscape that provide direct benefit to humanity. Such services provide protection from disturbances and disasters, provide municipalities with clean drinking water, and provide residents with diverse opportunities for recreation and economic benefit.

ESAs are recognized as sensitive landscape features as their loss or degradation directly impacts ecosystem function. These areas have a disproportionate impact on the function of the regional landscape and require particular focus and attention during all stages of land use planning efforts. Areas may be 'sensitive' even if they are not presently at risk of loss or disturbance. Their designation is meant to inform municipal management decisions over time, not necessarily as a triage tool to direct immediate action. Thus, assessments of risk must be a component of the decision-making process during land use planning efforts, and in the ongoing monitoring and assessment of the health of the regional landscape.

The loss or degradation of an ESA produces meaningful impacts to ecosystem function and to the important ecosystem services which the region depends upon, directly impacting human society and economy. In the event of the absence of functioning ecosystems, municipalities must make costly infrastructure improvements to maintain the quality of life that would otherwise be provided by natural areas. As ecosystem services have been widely recognized as key components of healthy rural and urban systems, ESAs must be seen as cherished spaces which greatly contribute to the well-being of the region. The wise stewardship of these landscape features is necessary to preserve natural function, ensure healthy populations and maintain a sustainable balance as the Calgary Metropolitan Region continues to grow.

The suggested definitions, criteria, analytic approaches and policy recommendations contained in this document are intended to foster a shared regional language for the management of these important natural functions and services. The intent is not to dictate the approach or level of effort of each municipality, but to arrive at a shared framework for environmental stewardship that minimizes effort, maximizes the value of municipal planning processes, and encourages consistency across the region. Ensuring that municipalities focus their efforts on comparable measures allows for more efficient information sharing and enables cross-boundary collaborative stewardship. This framework enables municipalities to more effectively maintain the ecosystem functions and services that the region depends upon, aligning existing monitoring and management efforts towards the preservation of regionally important ecological values, and bringing regional consistency to the development process. Consequently, establishing this framework not only provides more robust and defensible land use planning but ensures more streamlined and consistent planning across municipal boundaries. The objective is to guide the conducting of rigorous assessments, within the means of varied municipalities, at the scale and level-of-detail appropriate to the plans they support.

Calgary Metropolitan Region Board Regulation

Section 9(1)(d) of the *Calgary Metropolitan Region Board Regulation* ("the Regulation") requires that the Growth Plan contain policies regarding ESAs. To this end, in May 2019 the Land Use Committee (LUC) approved a request by CMRB Administration to undertake a background study around ESAs. The purpose of this report is to inform the development of the Growth Plan and Servicing Plan. The outcomes of this study are not binding on the Growth Plan.

This ESA Background Study provides guidance towards the development of a cooperative regional framework to

support municipalities in planning for ESAs, particularly those that span jurisdictional boundaries. This background study also provides an overview of existing policies and approaches, supplemented by current established best practices, to inform a regional approach to policies regarding ESAs as required by the Regulation. This background study provides a clear definition, practical objectives, and recommended criteria for the assessment and identification of ESAs. Drawing on input from all Calgary Metropolitan Region Board (CMRB) partner municipalities, and informed by broader-scale provincial approaches, this collaborative effort establishes a regional framework for ESA assessment, and guides the development of the CMRB's Growth Plan to ensure wise stewardship of the region's irreplaceable environmental features. This background report is intended to inform the development of the integrated Growth Plan and Servicing Plan, but the following recommendations are not necessarily binding on either Plan.

Regional Context

Across the CMR, policy and management approaches vary considerably in the criteria used to identify ESAs and in the approaches used to ensure their preservation. Building a consistent regional framework across all member municipalities requires a change in this approach, by shifting the focus of all municipalities towards a shared set of environmental criteria. The ongoing development of the Growth Plan highlights the need for a shared regional understanding of the location and functional contribution of ESAs. A comprehensive spatial map of known and potential ESAs has not yet been compiled and this lack of knowledge impacts the wise stewardship and sustainable development of the region.

Municipalities throughout the CMR have universally recognized the importance of protecting natural systems within their boundaries, albeit using a variety of definitions and approaches to do so. The Province has similarly recognized the wide variety of values that natural systems provide and has conducted province-wide assessments and valuations of ecosystem services, as well as formally defining Environmentally Significant Areas (also referred to as ESAs). Municipal policies refer to both Environmentally Significant Areas and Environmentally Sensitive Areas, often interchangeably. Others speak specifically of Wetland Policy, River Valley Management, Urban Forests, and Environmental Sustainability. The broad intent of all such policies is to preserve and support the essential ecosystem functions and services provided by natural areas.

The Water Roadmap, developed by the water servicing technical advisory group, identifies an iterative path forward for how water, wastewater and stormwater may be addressed in the Growth and Servicing Plan. Member municipalities identify water quality as it relates to land use as a consideration of regional interest. Given that regional environmental systems provide services which support water quality, this study incorporates water quality into the ESA definition and its associated criteria to support CMR municipalities in addressing the water quality complexity of the Water Roadmap.

While a great deal of consensus exists across municipalities in their focus on riparian areas, wetlands, river systems, source water areas and highly diverse ecosystems, differing terminology and specification has made it difficult to align municipal efforts across the region. As many of these landscape features span municipal boundaries, a regional framework is needed which ensures consistency and interoperability, with municipalities collecting and incorporating spatial data on the same set of features using a common framework. This regional framework ensures that municipalities identify and manage ESAs in a coordinated fashion, allowing for a shared understanding of the regional landscape and the effective stewardship of its important ecosystem services.

Municipalities vary in the spatial context of the natural systems functioning within their boundaries, the economic and social drivers for development of their lands, and their capacity for environmental management (in terms of staffing availability, subject matter expertise and availability of spatial data describing the location, condition and function of environmental features). A one-size-fits-all approach to establishing ESA criteria is therefore unrealistic.

To this end, this study identifies a range of criteria that can lead to the identification of an area as Environmentally Sensitive, and a variety of potential methods and approaches that can be used to assess these criteria. Municipalities must adopt the approaches which best reflect their capacity to manage the unique set of landscape features that fall within their boundaries. This proposed framework, and the tools identified within it, provides a

sound and practical approach that ensures all municipalities contribute to the identification and management of regionally important environmental features in a consistent and regionally relevant manner. As noted above, the outcomes of the study are intended to inform the development of the Growth Plan and Servicing Plan and are not binding on either Plan.

Recommended ESA Definition

Environmentally Sensitive Areas (ESAs) are key natural components of the regional landscape, providing essential ecosystem functions and services. These include flood mitigation, drinking water supply, maintenance of regional biodiversity, preservation and connectivity of unique habitats and landscapes, and provision of culturally and economically valued resources and opportunities.

Recommended ESA Objectives

The identification and assessment of potential ESAs is a critical aspect of sustainable development in the region. As natural systems are difficult and often impossible to replace once lost, the delineation and preservation of key environmental features is essential to preserve the natural functioning of the region. The identification and assessment of existing ESAs is the first step to the stewardship of these features. The management strategies taken to maintain these areas depends on the risk or vulnerability of each area, whether from human development, invasive species, erosion, or other external disturbances. As these factors change over time in response to conditions and context, the ongoing assessment of relative risk must be an ongoing task that extends beyond the identification and initial assessment of regional ESAs.

The objective of this study is to support sustainable regional land-use planning and development over time by identifying areas that require special management considerations during the land use planning process. This effort must align with existing provincial approaches but reflect the unique local context of the region at a scale appropriate for inter-municipal planning. All municipalities in the CMR already work towards this goal to greater or lesser extents. This study aims to ensure that a consistent approach is adopted that allows municipalities to better coordinate and streamline this process.

ESA identification is used to ensure awareness of the fulsome set of potentially valuable areas, to guide more detailed assessment. ESA assessment aims to confirm potential ESAs and highlight regionally important natural features for preservation, including those that may span municipal boundaries, providing a framework for collaborative municipal stewardship of ecosystem functions and services.

Recommended ESA Criteria

Well-defined criteria provide a clear and consistent approach to identifying and assessing ESAs, simplifying the management process for municipalities, and communicating the requirements for responsible and sustainable development to private enterprise. Four key criteria encompass the range of valued ecosystem functions and services occurring in the region, from water quality provision to flood mitigation to biodiversity preservation. More specific sub-criteria highlight the variety of nuanced factors within the CMR that contribute to the provision of ecosystem functions and services. High-level and detailed-level identification methodologies have been recommended for the various sub-criteria based on existing data and established best practices (see Appendix A). These methodologies are provided as examples which, through consultation with subject-matter experts, may be improved or modified to align with emerging best practices.

These approaches reflect different timing and levels of effort for ESA identification, with high-level identification occurring as a desktop exercise using readily available data during the development of statutory Area Structure Plans, while detailed-level identification occurs through additional analysis and ground-truthing often during the development of non-statutory Outline Plans or prior to subdivision.

The definition, objectives, and criteria for ESA assessment outlined in this background study were developed through an iterative review process with key stakeholders, the CMRB's Technical Advisory Groups (TAGs) comprised of municipal environmental planning staff, and the CMRB's Land Use Committee. They are intended to provide clarity, consistency and flexibility in implementation to ensure that relevant and practical data are collected over the life of the CMRB's Growth Plan. As municipalities vary in their environmental context and their management capacity, these criteria were developed to ensure that the varied municipalities share a common focus for the regional management of Environmentally Sensitive Areas.

The higher-level criteria that should be used to identify and assess Environmentally Sensitive Areas are:

1. Areas maintaining the provision of water quality and quantity throughout the Region and providing protection against drought and flooding events.
2. Areas providing habitat for identified local species of interest, designated species of conservation concern (SCC), or identified focal species groups.
3. Areas providing rare, unique, or biologically diverse ecosystems or unique landforms.
4. Areas contributing to other important ecosystem functions or services at regional or local scales.

ESA Policy, Implementation and Monitoring Opportunities

The following opportunities are intended for consideration by the Growth Plan consultant and are not binding to the development of the Growth Plan itself. The list below reflects concerns and practical considerations that have arisen from discussions with TAG members and municipal experts during the development of this background study.

- It is recommended that all Municipal Development Plans (MDPs) prepared by CMR municipalities adopt a shared, formal definition of ESAs in accordance with the Criteria.

- It is recommended that all MDPs to establish a desktop-based process for identifying potential ESAs during the development of Area Structure Plans, and a rigorous fieldwork-based process to confirm and refine potential ESAs during the development of finer-scale non-statutory plans, or prior to subdivision. These assessments must quantify the function of confirmed ESAs, in alignment with the Criteria and Sub-Criteria.

- It is recommended that a spatial map of potential and confirmed ESAs across the region be created to support responsible development planning and stewardship of the region's environmental resources. Given the complexity of developing this map, this work would be undertaken after the completion of the Growth Plan as part of future studies.

- In the absence of a fulsome inventory of confirmed ESAs, it is recommended that TAG develop a list of high-level and readily available spatial data to support the consideration of regional ESAs during the development of the Growth Plan.

- It is recommended that the CMRB develop a well-maintained regional database of potential and confirmed ESAs over time, with clear standards for data collection and dissemination, to provide a consistent and fulsome inventory of important environmental features. This regional database would aggregate municipal spatial data to identify potential regional ESAs using agreed upon criteria, providing municipalities with a shared understanding of the regional context. This database would be used to inform municipal planning processes and could be used to develop of spatial map of regional assets.

- It is recommended that the CMRB investigate implementation and monitoring options for the creation and maintenance of such a regional database. Completing this work at the regional scale, in collaboration with experts and key stakeholders, could:

  o Ensure an ongoing effort is made to update, critique, and improve spatial environmental data.

- o Provide a forum to develop, critique, and update spatial environmental datasets (such as wetland and watercourse inventories, land cover datasets, wildlife habitat, and human footprint and disturbance impacts), to align with regional definitions and standards.
- o Encourage contributions to municipal and provincial inventories and observation databases from citizen groups, academic institutions, consultants and other subject matter experts.
- o Identify lists of species of local importance and their habitat requirements.
- o Maintain and improve the spatial dataset of all identified ESAs, their management status, and associated data regarding their function.

Recommended Specific ESA Criteria/Sub-criteria Descriptions

The following detailed sub-criteria reflect more nuanced aspects of the higher-level criteria. They reference the particular set of ecosystem functions and services which are provided by landscape features captured by the sub-criteria. This set of sub-criteria reflect the recommendations of the TAG groups, as well as current best and most appropriate practices and approaches for the CMR.

1. Areas maintaining the provision of water quality and quantity, and providing source water protection or protection against drought and flooding events:
    a. Presence of functional riparian areas adjacent to watercourses:
        i. Intact riparian areas provide: filtration of overland flow, reduction of inputs of fertilizer and other pollutants into rivers and other water bodies; dissipation of flood energy (force, height and volume); bank stabilization.

        Ecosystem service: flood mitigation, water quality, maintenance of biodiversity, food provision, moderation of water temperature, climate change resiliency

        Ecosystem function: disturbance regulation, water regulation, soil retention, nutrient regulation, supporting habitat, raw materials, provision of shade and shelter

    b. Catchment areas of large wetlands or wetland complexes:
        i. Wetlands provide water filtration and storage, contribute to groundwater recharge, delay the overland movement of water during flooding, and retain water during droughts.

        Ecosystem service: flood mitigation, water quality, maintenance of biodiversity, food provision, moderation of water temperature, climate change resiliency

        Ecosystem function: disturbance regulation, water regulation, soil retention, nutrient regulation, supporting habitat, raw materials, provision of shade and shelter

    c. Presence of well-functioning natural or naturalized floodplains:
        i. Undeveloped floodplains allow flood waters to spread over a large area, reducing energy of flows and reducing peak flows downstream. This reduces potential damage to infrastructure and communities and improves channel stability.

        Ecosystem service: flood mitigation, maintenance of ecosystems and biodiversity, climate change resiliency

        Ecosystem function: disturbance regulation, water regulation, soil retention, nutrient regulation, supporting habitat, food provision, raw materials, provision of shade and shelter

2. Areas providing habitat for identified native species of interest, designated species of conservation concern (SCC), or identified focal species groups:
    a. Area provides habitat for identified native species of interest:

> i. Habitat loss is one of the main threats to the long-term survival of identified native species of interest and their habitat may require special management considerations.
>
> b. Area provides habitat for designated species of conservation concern:
>> i. Habitat loss is one of the main threats to the long-term survival of identified provincial or federal species of conservation concern and their habitat may require special management considerations.
>
> c. Area provides habitat for identified focal species groups:
>> i. Habitat that supports a large range of species is important for the long-term maintenance of biodiversity in the region:
>>
>> Ecosystem service: maintenance of biodiversity, pollination of crops and natural vegetation, control of pests, dispersal of seeds and translocation of nutrients, climate change resiliency
>>
>> Ecosystem function: nutrient regulation, pollination, biological control, genetic resources

3. Areas providing rare, intact, or biologically diverse ecosystems or unique landforms:
   a. Presence of biologically diverse ecosystems:
      i. Biological diverse ecosystems perform many ecosystem functions and provide numerous ecosystem services. Highly diverse systems are more resilient to disturbance.

      Ecosystem service: Soils formation and protection, nutrient storage and cycling, pollution breakdown and absorption, climate change resiliency, maintenance of ecosystems and biodiversity, recovery from unpredictable events, invasive weed suppression, food provision, medicinal resources, wood products, ornamental plants

      Ecosystem function: Breeding stocks, population reservoirs, future resources, diversity in genes, species and ecosystems

   b. Rare ecosystems:
      i. Rare ecosystems are unique and irreplaceable landscapes whose preservation will ensure a representative and complementary regional ecological network.

      Ecosystem service: maintenance of biodiversity, food provision

      Ecosystem function: supporting habitats, raw materials, genetic resources

   c. Areas where intact ecosystems occur:
      i. Highly intact ecosystems are more resilient to change, and as a result, are more likely to maintain their full range of ecological processes. Intact ecosystems are considered to be critical for the persistence of a broad range of flora and fauna than highly impacted habitats.

      Ecosystem service: maintenance of biodiversity, habitat connectivity, generation and renewal of soils and natural vegetation, pollination, food provision, pest control

      Ecosystem function: supporting habitats, raw materials, genetic resources, disturbance regulation, water regulation, soil retention, nutrient retention, pollination, provision of shade and shelter

   d. Areas where regionally, provincially or nationally recognized landforms are present:

> i. These unique landforms are considered to be exceptional examples of landscape diversity and may support important or unique ecological communities, species, and populations.
>
> Ecosystem service: maintenance of ecosystems and biodiversity, cultural services
>
> Ecosystem function: supporting habitats, raw materials, genetic resources

4. Areas that significantly contribute to other important ecosystem functions or services at regional or local scales:
   a. Important connectivity corridors, shelterbelts and steppingstones between core areas:
      > i. Landscape connectivity allows the maintenance of subpopulation genetics, the re-establishment of extirpated populations in isolated habitats, and the linking of habitat types for species with varied life histories.
      >
      > Ecosystem service: maintenance of ecosystems and biodiversity
      >
      > Ecosystem function: supporting habitats, nutrient distribution, genetic resources, colonization

   b. Important natural resources (plant products, forage, food sources):
      > i. Important natural resources provide economic and cultural services which benefit regional industries and should be managed to ensure that use does not compromise the access to or quality of such resources.
      >
      > Ecosystem service: provisioning services
      >
      > Ecosystem function: raw materials, genetic resources

   c. Ecotourism and unique recreational opportunities:
      > i. Unique landforms, environments and biological entities provide important economic contributions, drawing visitors to the region and providing unique experiences to regional populations.
      >
      > Ecosystem service: cultural services, recreational services, educational services

   d. Culturally important landforms
      > i. Historic, cultural or spiritual valuation of unique landscapes and landforms preserve heritage and act as educational opportunities, acting to maintain the regional identity over time.
      >
      > Ecosystem service: cultural services, educational services

APPENDIX A

Recommended ESA Sub-criteria with Measures and Methods

As described in the section above the following sub-criteria are intended to provide guidance to municipal partners in assessing the environmental sensitivity of landscape features in their unique context. The majority of these measures and methods are already in use across many municipalities of the Calgary Metropolitan Region, but a consistent regional framework for ESA management has not yet been achieved.

Sub-criteria examples are split into high level desktop approaches using readily available spatial datasets (conducted during initial planning stages such as Area Structure Plans) and detailed level field approaches requiring greater subject matter expertise and inventory effort (which can be conducted during the initial stages of development of subdivisions, Outline Plans, Conceptual Schemes, or Site Development Plans). These sub-criteria are neither exhaustive nor prescriptive and should be revised and updated by subject matter experts as a more comprehensive understanding of the ecosystem function of the regional landscape is developed. Proposed datasets listed below are representative of commonly available appropriate data and are not prescriptive nor exhaustive. Municipalities are encouraged to incorporate comparable data into their assessment processes, to reflect improvements in understanding. Assessments must always be conducted by qualified professionals.

1. Areas maintaining the provision of water quality and quantity throughout the region and providing protection against drought and flooding events.

Sub-criteria	High Level Desktop Assessments (ASP Scale)	Detailed Field Assessments (Non-Statutory / Outline Plan Scale)
1.1. Presence of functional riparian areas adjacent to watercourses	**Measure**: Presence of a native vegetation community, adjacent to a watercourse, whose ecological functions of water retention and filtration have not been lost or highly impaired due to rural or urban development, resource extraction or agricultural purposes. **Methods**: 1. Use NRCan/CanVec stream network (Natural Resources Canada 2019a, 2019) to identify where watercourses occur. Ortho imagery and drainage modelling via LiDAR DEM can supplement CanVec layers. 2. Use vegetation layer (GVI (Alberta Environment and Parks (AEP) 2016), Municipal layers, ABMI (Alberta Biodiversity Monitoring Institute 2010), ACIMS (Alberta Parks 2017)) to identify where native vegetation communities are present adjacent to watercourse. 3. Overlay ABMI human footprint and NRCan/CanVec road etc. layers to identify areas with minimal human footprint.	**Measure**: Presence of a healthy riparian community adjacent to watercourse. ● Contiguous size ● Bank Stability ● Overland flow distance **Methods**: 1. Identify presence of watercourse and classify as per provincial classification system (Alberta Agriculture and Forestry 2016). 2. Identify riparian community and delineate. 3. Complete Cows and Fish riparian health assessment (Adams and Hale 2009).

Sub-criteria	High Level Desktop Assessments (ASP Scale)	Detailed Field Assessments (Non-Statutory / Outline Plan Scale)
1.2. Catchment areas of large wetlands or wetland complexes	**Measure**: Presence of wetlands over a certain size, or a wetland complex of nearby wetlands over a certain size. **Methods**: 1. Use NRCan/CanVec waterbody (Natural Resources Canada 2019) and Alberta Merged Wetland Inventory (Alberta Environment and Parks (AEP) 2017), by using historic and present day ortho imagery to identify potential inaccuracies and data gaps. 2. Identify wetland complexes using buffers or cost-distance methods to select large aggregations of wetlands.	**Measure**: Presence of a wetland that scores an 'a', 'b', or 'c' on the provincial ABWRET-A evaluation, or those wetlands which score highly in the surface water storage, sediment & toxicant retention & stabilization, Phosphorus retention, nitrogen retention, organic nutrient export ABWRET-A functional components. **Methods**: 1. Complete ABWRET-A for each wetland and submit to Province for results (Government of Alberta 2016a).
1.3. Presence of well-functioning natural or naturalized floodplains	**Measure**: Presence of a watercourse-adjacent floodplain dominated by natural or naturalized land cover. **Methods**: 1. Use NRCan/CanVec stream network (Natural Resources Canada 2019) to identify where watercourses occur and floodway/flood fringe/inundation mapping where available. Historic and present day ortho imagery, LiDAR DEM and contour maps will provide additional tools to delineate flood plain extents. 2. Use vegetation layer (GVI/ACIMS/Municipal layers) to identify where native vegetation communities are present (Alberta Environment and Parks (AEP) 2016, Alberta Parks 2017) adjacent to watercourse and where human footprint is present (ABMI human footprint layer (Alberta Biodiversity Monitoring Institute n.d.) or equivalent).	**Measure**: Presence of a watercourse-adjacent floodplain dominated by natural or naturalized land cover. **Methods**: 1. Identify presence of watercourse and classify as per provincial classification system (Alberta Agriculture and Forestry 2016). 2. Refer to provincial flood hazard mapping, inundation mapping, or develop own mapping. 3. Field work to confirm if undeveloped (lacking hard infrastructure, such as riprap, houses, roads, bridges, or intact meander belt).

2. Areas providing habitat for identified local species of interest, designated species of conservation concern (SCC) or identified focal species groups.

Sub-criteria	High Level Desktop Assessments (ASP Scale)	Detailed Field Assessments (Non-Statutory / Outline Plan Scale)
2.1. Area that provides habitat for identified native species of interest	**Measure**: Native vegetation patch that meets key habitat requirements. Presence of important habitat features that are known breeding, roosting, or foraging sites, or overwintering areas. **Methods**: 1. Municipalities to identify which species are of local interest. 2. Determine key habitat the species requires (breeding/stopover, key habitat characteristics) and develop list of key habitat criteria for use in Detailed Level. 3. Use vegetation layer (GVI/FWMIS/municipal data) to identify where this habitat or landscape feature occurs (Alberta Environment and Parks (AEP) 2016, Alberta Environment and Parks 2019). Ortho imagery may be used to supplement and validate data. 4. Build regional dataset by referring to existing information (regional and local studies, provincial data) and requesting information from AEP wildlife biologists.	**Measure**: Native vegetation patch that meets key habitat requirements. Presence of important habitat features that are known breeding, roosting, or foraging sites, or overwintering areas. **Methods**: 1. Complete field surveys to identify if key habitat exists and general/targeted wildlife or vegetation surveys to identify species and/or features that are present. 2. Identify if the site has the potential to have important habitat features or has an area identified in the regional dataset. 3. Identify which general or targeted wildlife surveys are required based on habitat available. 4. Complete minimum number of surveys identified in the Sensitive Species Survey Guidelines (Alberta Environment and Sustainable Resource Development (AESRD) 2013) to identify if features are present.
2.2. Area provides habitat for designated species of conservation concern	**Measure**: Presence of: ● An Important Bird Area (Bird Studies Canada (BSC) 2012); ● Ramsar wetlands (The Ramsar Convention 2019); ● Designated critical habitat/Emergency Orders under Species at Risk Act (including aquatic habitat) (Government of Canada 2002), provincial Key Wildlife Biodiversity Zone (Alberta Environment and Parks 2019)	**Measure**: ● Observed Designated SCC in conjunction with breeding behaviour, or significant foraging/stopover/wintering location. ● Provincial Sensitive Species ranges and either contains (or likely contains) suitable habitat for that species or has observations of that species. **Methods**: ● Use GIS to determine if any of these are in the regional area.

Sub-criteria	High Level Desktop Assessments (ASP Scale)	Detailed Field Assessments (Non-Statutory / Outline Plan Scale)
	and area is dominated by natural cover; • Provincial Key Wildlife Habitat (Piping Plover waterbodies, Trumpeter Swan waterbodies, Greater Short-Horned Lizard Habitat, Ord's Kangaroo Habitat, Grizzly Bear Zone, Mount Goat and Sheep Areas, Colonial Nesting Birds) (Government of Alberta n.d.) and area is undeveloped; • Within provincial sensitive species ranges and either contains (or potentially contains) suitable habitat for that species OR has historical observations of that species (FWMIS/ACIMS), or Class A and B watercourses, fish-bearing water bodies (Government of Alberta 2012b) with previous observations of fish species of conservation concern (Alberta Environment and Parks 2019), or appropriate habitat for specie of conservation concern in the range. **Methods**: 1. Use GIS to determine if any of these are in the regional area. 2. Provincial/federal datasets: IBA (Bird Studies Canada (BSC) 2012), Ramsar (The Ramsar Convention 2019), SARA (Government of Canada 2002), AEP Key Wildlife Biodiversity Zones, AEP wildlife sensitivity datasets(Government of Alberta n.d.), ESAs (Fiera Biological Consulting Ltd. 2014), LAT, FWMIS (Alberta Environment and Parks 2019), ACIMS (Alberta Parks 2017).	• Use provincial/federal datasets: IBA (Bird Studies Canada (BSC) 2012), Ramsar (The Ramsar Convention 2019), SARA (Government of Canada 2002), AEP Key Wildlife Biodiversity Zones, AEP wildlife sensitivity datasets(Government of Alberta n.d.), ESAs (Fiera Biological Consulting Ltd. 2014), LAT, FWMIS (Alberta Environment and Parks 2019), ACIMS (Alberta Parks 2017). • Complete general/targeted wildlife or vegetation surveys to add to species observations.
2.3. Area that provides habitat for	**Measure**: Quarter section that meets the minimum number of species	**Measure**: Habitat patch that meets the criteria for the focal species group.

Sub-criteria	High Level Desktop Assessments (ASP Scale)	Detailed Field Assessments (Non-Statutory / Outline Plan Scale)
identified focal species groups	observed within one focal species group. ● Use Provincial ESA waterfowl and amphibian groups, adjusting species to be more region specific where needed (Fiera Biological Consulting Ltd. 2014). ● Create other species groups: mammals, fish, grassland and forest birds, or raptors. **Methods**: 1. Region to identify focal species groups. 2. Use vegetation layer (GVI (Alberta Environment and Parks (AEP) 2016), ABMI (Alberta Biodiversity Monitoring Institute 2010), Municipal layers) to identify where native vegetation communities are present and remove impermeable built areas. 3. Modelled habitat suitability identifies the area as likely to contain a sufficient number of focal group species.	**Methods**: 1. Identify if focal group habitat exists on the site. 2. Identify which general or targeted wildlife surveys are required based on habitat available. 3. Complete minimum number of surveys identified in the Sensitive Species Survey Guidelines (Alberta Environment and Sustainable Resource Development (AESRD) 2013). 4. Determine if the minimum number of species for a focal species guild is observed within a specific habitat patch.

3. Areas providing rare, intact, or biologically diverse ecosystems or unique landforms.

Sub-criteria	High Level Desktop Assessments (ASP Scale)	Detailed Field Assessments (Non-Statutory / Outline Plan Scale)
3.1. Presence of biologically diverse ecosystems	**Measure**: Diversity tends to increase with natural patch size. Modelled species habitat for a wide set of species provides an estimate of species richness. **Methods**: 1. Municipalities may wish to adopt a minimum size threshold to reduce the impact of edge effects. A common assumption is the larger the patch size, the more	**Measure**: Areas where a high number of native species are observed. **Methods**: 1. General and targeted wildlife field surveys; 2. Detailed vegetation surveys (vegetation community mapping and detailed vegetation list as part of rare plant surveys).

Sub-criteria	High Level Desktop Assessments (ASP Scale)	Detailed Field Assessments (Non-Statutory / Outline Plan Scale)
	diverse an area is. This assumes that wildlife species diversity will also be higher in native vegetation communities. 2. Use ABMI all species richness dataset (which presents relative species richness across Province), clip out region, determine the relative species richness classes, and select areas which fall within the top quantile of those classes.	
3.2. Areas providing rare or unique ecosystems	**Measure**: Meets the following: ● Within the Provincial Threatened and Endangered Plant Ranges with suitable habitat for the identified species (Government of Alberta n.d.). ● Presence of Rare ecological communities (Alberta Parks 2017). ● Presence of unique ecosystems identified by the municipality. **Methods**: 1. Overlay Provincial Threatened and Endangered Plant Ranges layer (Government of Alberta n.d.) with vegetation layers (GVI (Alberta Environment and Parks (AEP) 2016) etc.) and ABMI human footprint (Alberta Biodiversity Monitoring Institute n.d.) (or other disturbance datasets, accounting for successful restoration efforts) to ID if suitable habitat exists. 2. Overlay ACIMS data (Alberta Parks 2017) to see where RECs occur within the region. 3. Overlay identified unique ecosystems identify by the municipality.	**Measure**: Meets the following: ● Within the Provincial Threatened and Endangered Plant Ranges with observations of the species (Government of Alberta n.d.). ● Presence of rare ecological communities (Alberta Parks 2017). ● Presence of unique habitats identified by the municipality. ● Presence of A/B/C value wetlands determined by ABWRET-A (Government of Alberta 2016a). **Methods**: ● Complete orthophoto interpretation to delineate vegetation communities and identify areas that may provide rare or unique habitat. ● Complete early and late season rare plant surveys. ● Identify any Threatened and Endangered plants and delineate the area that they occur in. ● Identify any rare ecological communities and delineate area. ● Identify any unique habitats and delineate area.

Sub-criteria	High Level Desktop Assessments (ASP Scale)	Detailed Field Assessments (Non-Statutory / Outline Plan Scale)
3.3. Areas where intact ecosystems occur	**Measure**: Presence of: 1. Intact terrestrial vegetation communities. Municipalities may wish to adopt a minimum size threshold to reduce the impact of edge effects. 2. Intact lentic vegetation communities. Municipalities may wish to adopt a minimum size threshold to reduce the impact of edge effects. **Terrestrial Methods**: 1. Remove ABMI human footprint (Alberta Biodiversity Monitoring Institute n.d.) and provincial linear features from vegetation layers (Alberta Biodiversity Monitoring Institute 2010, Alberta Environment and Parks (AEP) 2016). 2. Remove any hydrography polygons (wetlands, rivers etc.). 3. Remove any vegetation polygons that are disturbed. 4. Identify any vegetation polygons remaining. 5. Municipalities may wish to adopt a minimum size threshold to reduce the impact of edge effects. **Lentic Methods:** 1. Using ABMI, GVI and other available wetland inventories to identify lentic wetlands (Alberta Biodiversity Monitoring Institute 2016, Alberta Environment and Parks (AEP) 2016, 2017). 2. Identify any lentic wetlands, removing any wetlands where known disturbances occur (dams, roads, stormwater management) or; 3. Wetlands of any size within natural, but not necessarily	**Measure**: ● Intact terrestrial vegetation communities: rated "healthy" as per rangeland health assessment or Cows and Fish assessment (Adams and Hale 2009) or is a reference community described by rangeland guides (Government of Alberta 2019a) or; ● Intact lentic vegetation communities: wetlands rated as "Healthy" using the appropriate Wet Meadow IBI assessment (Government of Alberta 2016b). **Methods**: 1. Complete vegetation community mapping with plots to determine if vegetation community matches the reference community description. 2. Wetlands rated as "Healthy" using the appropriate Wet Meadow IBI assessment (Government of Alberta 2016b).

Sub-criteria	High Level Desktop Assessments (ASP Scale)	Detailed Field Assessments (Non-Statutory / Outline Plan Scale)
	native, terrestrial vegetation patches. 4. Municipalities may wish to adopt a minimum size threshold to reduce the impact of edge effects.	
3.4. Areas where regionally, provincially or nationally recognized landforms are present	**Measure**: Presence of significant landforms. **Methods**: 1. Overlay region with provincial and federal significant landforms layer (Alberta Parks 2014) and any landform feature deemed significant by the Region.	**Measure**: Presence of significant landforms. **Methods**: 1. Overlay region with provincial and federal significant landforms layer (Alberta Parks 2014) and any landform feature deemed significant by the Region.

4. Areas that significantly contribute to other important ecosystem functions or services at regional or local scales.

Sub-criteria	High Level Desktop Assessments (ASP Scale)	Detailed Field Assessments (Non-Statutory / Outline Plan Scale)
4.1. Important connectivity corridors, shelterbelts and steppingstones between core areas	**Measure:** Areas with high frequency of wildlife usage (may include seasonal usage). **Methods**: 1. Wildlife/Vehicle Collision data. 2. Intact native vegetation located between known habitat areas.	**Measure:** Areas with high frequency of wildlife usage (may include seasonal usage). **Methods**: 1. Circuitscape Models showing likelihood of wildlife movement. 2. Field assessment. 3. Wildlife Cameras.
4.2. Important natural resources (plant products, food sources)	**Measure:** Area contains sustainable resources of economic importance. **Method**: Industry and provincially sourced resource data.	**Measure:** Area contains sustainable resources of economic importance. **Method**: Ground-truthing and stakeholder input during outline plan stages.

4.3.	Ecotourism and unique recreational opportunities	**Measure:** Area supports valued recreational activities. **Methods:** Stakeholder input, social media geofenced posts and tweets.	**Measure:** Area supports valued recreational activities. **Method:** Stakeholder input during outline plan stages.
4.4.	Culturally important landforms	**Measure:** Heritage lands, historic First Nations cultural centres. **Method:** Stakeholder consultation, TEK inventories, provincially designated sites, Historic Resource Value (HRV) Inventory highly valuable classes.	**Measure:** Heritage lands, historic First Nations cultural centres. **Method:** Ground truthing through assessment of archaeological potential, detailed interviews with First Nations.

APPENDIX B

Definitions:

ABMI: The Alberta Biodiversity Monitoring Initiative tracks changes in Alberta's wildlife and their habitats from border to border, and provides ongoing, relevant, scientifically credible information on Alberta's living resources.

AMWI: The Alberta Merged Wetland Inventory is a generalized, merged product of 35 component wetland inventories that utilized different types of source data from different years, different data capture specifications and different classifications. Considerable variation in the level of detail and accuracy is present in this dataset.

Ecosystem: A community or group of living organisms that live in and interact with each other in a specific environment.

Ecosystem function: The biological, geochemical and physical processes and components that take place or occur within an ecosystem.

Ecosystem services: (also referred to as "ES") Are the benefits that humans receive from nature including provisioning (e.g. food, fuel, fibre, fresh water), regulating (e.g. air quality, climate regulation, erosion control, water quality), and supporting services (e.g. production of oxygen, soil formation, resiliency). A breakdown of types of ecosystem services is available on the FAO site: http://www.fao.org/ecosystem-services-biodiversity/background/provisioning-services/en/

Biological diversity (or biodiversity): The variability among living and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems.

Habitat: The resources and conditions present in an area that produce occupancy, including survival and reproduction, by a given organism. Habitat is organism-specific; it relates the presence of a species, population, or individual (animal or plant) to an area's physical and biological characteristics. Habitat implies more than vegetation or vegetation structure; it is the sum of the specific resources that are needed by organisms.

Important habitat feature: A specific element within habitat that is integral to the life history of a species, such as: established Bank Swallow colony, Sharp-Tailed Grouse lek, Ferruginous Hawk or other sensitive raptor nest, Great Blue Heron rookery, snake hibernacula, bat hibernacula/roost, trout spawning habitat.

Human Footprint: The ABMI defines human footprint as the visible alteration or conversion of native ecosystems to temporary or permanent residential, recreational, agricultural or industrial landscapes. The definition includes all areas under human use that have lost their natural cover for extended periods of time, such as cities, roads, agricultural fields, and surface mines. It also includes land that is periodically reset to earlier successional conditions by industrial activities such as forestry cutblocks and seismic lines.

Intact: Intactness is an indicator of "the absence of human modification of the habitat" (Theobald 2013: 1859). Landscapes with high levels of intactness are considered to have higher retention of (historical) ecological structure, composition, and function (Hak and Comer 2017). An intact ecosystem has the following characteristics:

- It is free from substantial anthropogenic fragmentation, such as urban development, cultivation, roads, pipelines, powerlines, clearcuts and industrial activities.

- It is free from substantial human influence for periods that ensure that it is formed by naturally occurring ecological processes, including fires, wind and pests.

- It contains only naturally seeded native plants and supports viable populations of those species.

- It is large enough to be resilient to edge effects and to survive most natural disturbance events.

Local species of interest: Species or species groups designated by region or municipality as species of management priority.

Floodplain: The identified 1:100 year floodway and the adjacent flood fringe.

Focal wildlife species groups: Groups or guilds that have life requisites encompassing other species, ecosystems, and/or processes; their use in conservation efforts therefore represents not only their own life histories, but a range of species, ecosystems and/or processes as well.

Riparian Area: Riparian areas are transitional areas between upland and aquatic ecosystems. They have variable width, extend above and below ground, and perform various functions. These lands are influenced by, and exert an influence on, associated water bodies, including alluvial aquifers and floodplains. Riparian lands usually have soil, biological and other physical characteristics that reflect the influence of water and other hydrological processes.

Natural: Natural ecosystem is a community of living and non-living organisms, where each component interacts together as a unit through biological, physical and chemical processes. The distinctiveness of natural ecosystems is that they are purely natural and their formations are not in any way influenced by human activity.

Naturalized: Naturalization is a process of ecological restoration that involves returning an altered or degraded site to a more natural condition through the use of trees, shrubs and flowers that are native to the area.

Source watershed: the source watershed generally includes the watershed area upstream of a water supplier's intake. It is delineated by the boundaries of drainage basins that supply streams, lakes, and reservoirs that serve as source water.

TEK: Traditional Ecological Knowledge describes indigenous and other forms of traditional knowledge regarding the sustainability of local resources.

Undeveloped: Undeveloped, or raw, land has no utilities, no structure or pre-defined building site and no intra-parcel roads. It lacks all the components of urban, rural or agricultural development.

Water: The Water Act defines water to mean all water on or under the surface of the ground, whether in liquid or solid state.

Water body: The Water Act defines a water body as any location where water flows or is present, whether or not the flow or the presence of water is continuous, intermittent or occurs only during a flood, and includes but is not limited to wetlands and aquifers.

Watercourse: A natural channel or depression in which water flows regularly or intermittently.

Wetland Complex: A hydrologically connected aggregation of wetlands which function together to provide ecosystem services for the surrounding landscape.

Citations:

Adams, B. W., and G. Hale. 2009. Riparian Health Assessment for Streams and Small Rivers.

Alberta Agriculture and Forestry. 2016. Alberta Timber Harvest Planning and Operating Ground Rules Framework for Renewal. Government of Alberta.

Alberta Biodiversity Monitoring Institute. 2010. Land Cover 2010. abmi.ca.
Alberta Biodiversity Monitoring Institute. 2016. Predictive Landcover 3.0. https://abmi.ca/home/data-analytics/da-top/da-product-overview/Advanced-Landcover-Prediction-and-Habitat-Assessment--ALPHA--Products/Predictive-Landcover-3.0.html.

Alberta Biodiversity Monitoring Institute. 2017. Species Richness. https://abmi.ca/home/data-analytics/da-top/da-product-overview/GIS-Biodiversity-Data/Richness.html.

Alberta Biodiversity Monitoring Institute. (n.d.). Human Footprint. https://abmi.ca/home/data-analytics/da-top/da-product-overview/Human-Footprint-Products.html.

Alberta Environment and Parks. 2019. Fish and Wildlife Management Information System.

Alberta Environment and Parks (AEP). 2016. Grassland Vegetation Inventory. https://geodiscover.alberta.ca/geoportal/catalog/search/resource/fullMetadata.page?uuid=%7BD3AB901-8EC0-4589-9335-C1E50AE05992%7D.

Alberta Environment and Parks (AEP). 2017. Alberta Merged Wetland Inventory.
https://geodiscover.alberta.ca/geoportal/catalog/search/resource/fullMetadata.page?u
uid=%7BA73F5A 1-4677-4731-B3F6-700743A96C97%7D.

Alberta Environment and Sustainable Resource Development (AESRD). 2013. Sensitive Species Inventory
Guidelines. https://open.alberta.ca/publications/sensitive-species-inventory-guidelines.

Alberta Parks. 2014. Significant Landforms of Alberta. Alberta Environment and Sustainable Resource
Development.

Alberta Parks. 2017. Alberta Conservation Information Management System.

Bird Studies Canada (BSC). 2012. Canadian Important Bird and Biodiversity Areas. https://www.ibacanada.ca/.

Coulon, A., J. F. Cosson, J. M. Angibault, B. Cargnelutti, M. Galan, N. Morellet, E. Petit, S. Aulagnier, and A. J. M.
Hewison. 2004. Landscape connectivity influences gene flow in a roe deer population inhabiting a
fragmented landscape: an individual-based approach. Molecular Ecology 13:2841–2850.

Environmental Protection Agency. 2019. Rare Ecosystems in the Conterminous US.
https://enviroatlas.epa.gov/enviroatlas/DataFactSheets/pdf/Supplemental/RareEcosystems.pdf.

Fiera Biological Consulting Ltd. 2014. Environmentally Significant Areas in Alberta: 2014 Update.

Government of Alberta. n.d. Wildlife Sensitivity Maps. https://www.alberta.ca/wildlife-sensitivity-maps.aspx.

Government of Alberta. 2012a. Stepping Back from the Water: A Beneficial Management Practices Guide for New
Development Near Water Bodies in Alberta's Settled Region. Government of Alberta.

Government of Alberta. 2012b. Code of practice for pipelines and telecommunication lines crossing a water body.
https://open.alberta.ca/publications/2478000.

Government of Alberta. 2013. Alberta Wetland Policy. Edmonton.

Government of Alberta. 2015. Digital Flood Hazard Mapping.
https://geodiscover.alberta.ca/geoportal/catalog/search/resource/details.page?uuid=%7B41C92445
1244-4985-99F8-CEE0C090B839%7D.

Government of Alberta. 2016a. Guide to the Alberta Wetland Rapid Evaluation Tool - actual (ABWRET-A) for the
Boreal and Foothills Natural Regions. Edmonton, AB: Alberta Environment and Parks.

Government of Alberta. 2016b. Alberta Wetland Restoration Directive. Edmonton, AB: Alberta Environment and
Parks.

Government of Alberta. 2019a. Range Health. https://www.alberta.ca/range-health.aspx.

Government of Alberta. 2019b. Alberta Public Lands Glossary of Terms:32.

Government of Canada. 2002. Species at Risk Act. Pages 1–103 S.C. 2002, c.29.

Hak, J. C., and P. J. Comer. 2017. Modeling landscape condition for biodiversity assessment - Application in
temperate North America. Ecological Indicators 82:206–216.

Huxel, G. R., and A. Hastings. 1999. Habitat Loss, Fragmentation and Restoration. Restoration Ecology 7:309–315.

Kirk, D. A., A. C. Park, A. C. Smith, B. J. Howes, B. K. Prouse, N. G. Kyssa, E. N. Fairhurst, and K. A. Prior. 2018. Our
use, misuse, and abandonment of a concept: Whither habitat? Ecology and Evolution 8:4197–4208.

Natural Resources Canada. 2019. National Hydro Network. https://open.canada.ca/data/en/dataset/a4b190fe-
e090-4e6d-881e-b87956c07977.

Natural Resources Canada. 2019a. Lakes, rivers and glaciers in Canada - CanVec Series.
https://open.canada.ca/data/en/dataset/9d96e8c9-22fe-4ad2-b5e8-94a6991b744b.

Natural Resources Canada. 2019b. National Road Network. https://open.canada.ca/data/en/dataset/3d282116
e556-400c-9306-ca1a3cada77f.

Nel, J. L., D. J. Roux, G. Maree, C. J. Kleynhans, J. Moolman, B. Reyers, M. Rouget, and R. M. Cowling. 2007. Rivers
in peril inside and outside protected areas: a systematic approach to conservation assessment of river
ecosystems. Diversity and Distributions 13:341–352.

Sekercioglu, C. 2010. Ecosystem functions and services. Pages 45–72 Conservation Biology for All.

The Ramsar Convention. 2019. Ramsar Wetlands Canada. https://www.ramsar.org/wetland/canada.

Theobald, D. M. 2013. A general model to quantify ecological integrity for landscape assessments and US
application. Landscape Ecology 28:1859–1874.