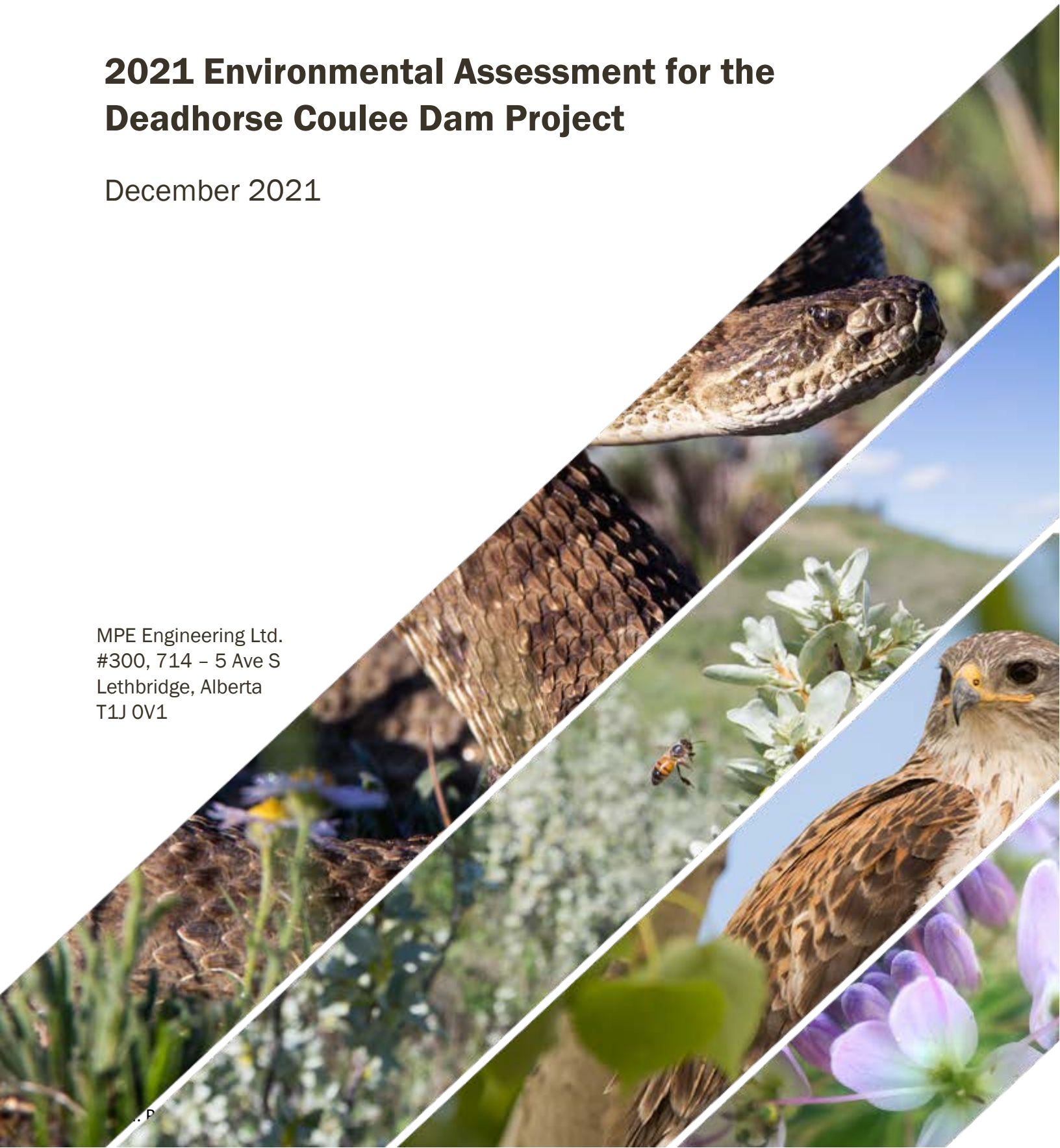
BearTracks Environmental Services

2021 Environmental Assessment for the Deadhorse Coulee Dam Project

December 2021



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1 Introduction

Bear Tracks Environmental Services (2015) Ltd. (Bear Tracks) was retained by MPE Engineering Ltd. (MPE) to conduct an Environmental Assessment (EA) for the proposed Deadhorse Coulee Dam (hereafter 'the project'), located near Enchant, Alberta. The environmental assessment included both a desktop and field level surveys.

The objective of the desktop assessment was to provide a course-level screen of the biophysical characteristics (terrestrial and aquatic) of the project location to determine any environmental constraints or sensitivities. The results of the desktop assessment were used to scope further field investigations (i.e., surveys) as well as identify important environmental features or biota that may warrant further consideration prior to project development. The objective of the field assessment was to verify results of the desktop assessment (e.g., habitat, vegetation, etc.) and determine additional environmental sensitivities that may be a concern for project development.

2 Project Description

The project is located in TWP 013 – RGE 018 – W4M within the Municipal District of Taber, approximately 4.5 km south-east of the hamlet of Enchant, Alberta. The project will include the construction of two primary dams which will create a reservoir from the ponding of the Bow River Irrigation District (BRID) main canal. The main dam is approximately 300 m in length and is located on the east end of the project within SE 23-13-18 W4M. The north dam is 5200 m in length and intersects through several quarter sections (NW/SW 26, SW/SE 34, NW 27, NE 28-13-18 W4M) and aids in containing the reservoir to the north. Several other smaller berm/dam structures are proposed in Section 22 to aid in containment of water in the SW part of the reservoir. The proposed reservoir will cover an area of 416 ha and store approximately 18,500 ac-ft of water (MPE 2019). Project construction is anticipated to occur in 2023 at the earliest and should be completed by 2028.

3 Study Area

Currently, the exact flood zone of the reservoir has been estimated. Quarter sections potentially within the flood zone were used as the study area for both the desktop and field assessments. The study area is 983 ha in size, encompassed 15 quarter sections and included SW/SE 34, NW/NE/SW/SE 27, NW/SW 26, NW/NE/SE 22, and NW/NE/SW/SE 23-13-18 W4M (Figure 1). One quarter section, SW 27-13-18 W4M is municipal lease land while the remaining quarter sections are under private ownership. The study area was selected to evaluate environmental considerations that may be directly affected by project

construction. The area surrounding the study area (up to 1000 m) was also evaluated to assess potential sensitive wildlife conditions that may be indirectly impacted.

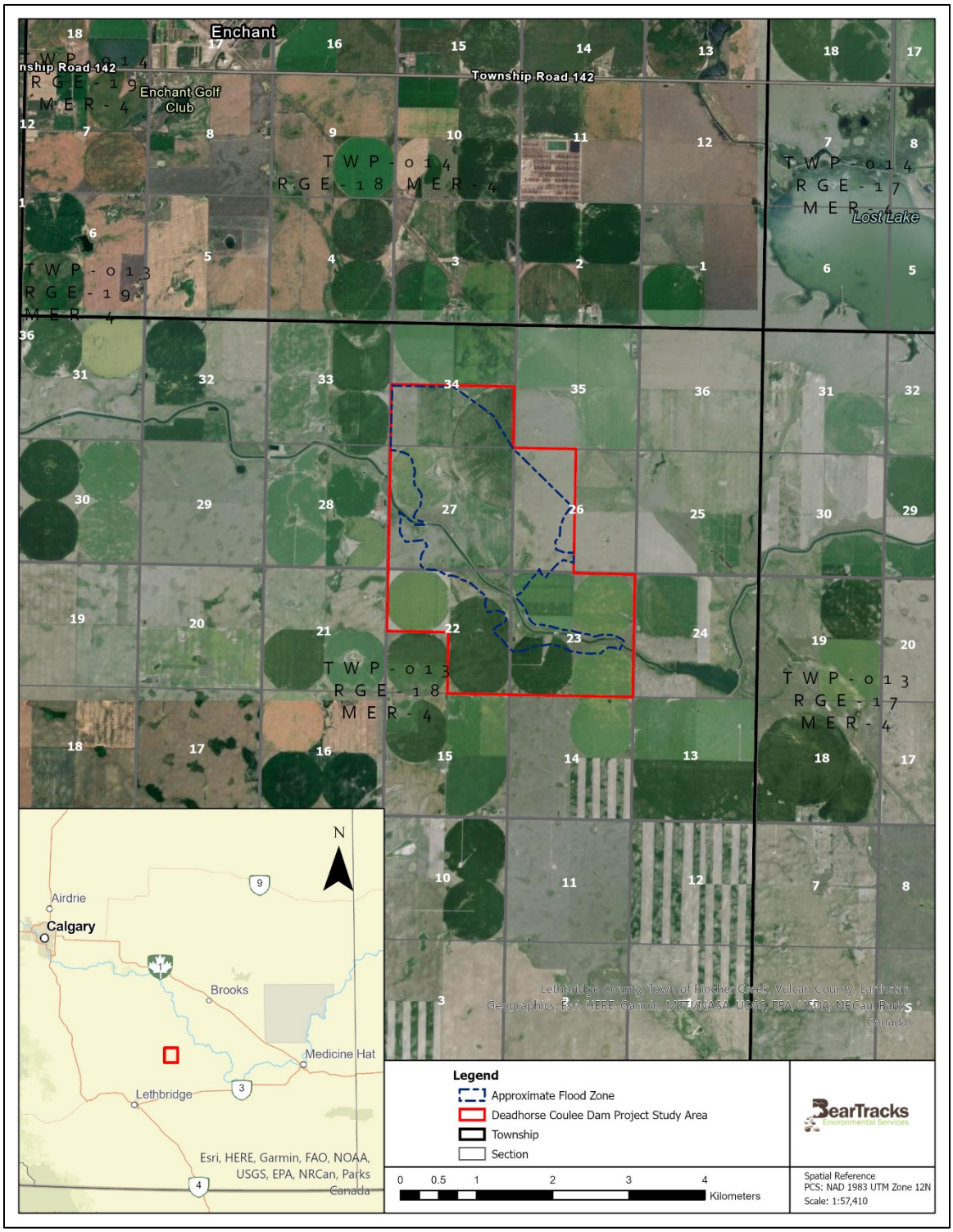

Figure 1. Deadhorse Coulee Dam Project study area and approximate flood zone of the proposed reservoir.

4 Desktop Assessment

4.1 Methods

4.1.1 Desktop Review

Multiple resources were reviewed to determine the biophysical characteristics and potential environmental sensitivities or constraints associated with the proposed project site. Each resource is summarized in Table 1.

Table 1. Resources reviewed for the desktop assessment and description/information provided by each.

Resource	Description and Information Provided
Alberta Soil Information Viewer (AEP 2021a)	The Alberta Soil Information Viewer is an online tool that allows users to search soil information from the Agricultural Region of Alberta Soil Inventory Database (AGRASID). Information provided includes soil and landform type. This viewer was used to determine the soil and landform type within the project study area.
Alberta Conservation Information Management System (Alberta Parks 2021)	The Alberta Conservation Information Management System (ACIMS) database was searched for natural ecological communities and sites, specifically rare plant occurrences. Search area included the township (13-18 W4M) that the project study area is located.
Alberta Wild Species General Status Listing (GOA 2017a)	The Alberta Wild Species General Status Listing is a compilation of the status of wildlife in Alberta. This status is the province's general status evaluation system. The general status for historically and potentially occurring species with the project study area was reviewed.
Committee on the Status of Endangered Wildlife in Canada (GOC 2021a)	The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) is an advisory panel for the Minister of Environment and Climate Change Canada that assess the status of wildlife species at the risk of extinction. The COSEWIC statuses of historically and potentially occurring species within the project study area was reviewed.
Environmentally Significant Areas (Alberta Parks 2014)	The geospatial data (shapefile) for the Environmentally Significant Areas (ESA) was reviewed using ArcGIS to determine the ESA scores for the quarter sections within the project study area. The ESA indicates areas that are important for biological diversity, soil and water or that may have

Resource	Description and Information Provided
	rare or unique elements that may require special management.
Fish and Wildlife Information System (AEP 2021c)	The Fish and Wildlife Internet Mapping Tool (FWIMT) was used to identify wildlife species of management concern that have been previously observed within a 3.2 kilometer radius from the project study area (AEP 2021b) and to identify the ranges of sensitive wildlife species that may overlap with the project area. The ranges provided in FWIMT specifically include the provincial distribution of several species considered to have special status in Alberta (GOA 2017a), as well as species listed under the Alberta *Wildlife Act*, and the federal *Species at Risk Act* (*SARA*). FWIMT was also used to search for fish species that have been documented in the BRID main canal and reservoirs nearby. A more detailed search of the Fish and Wildlife Management Information System (FWMIS) was also conducted to identify specific locations of wildlife and wildlife features observed historically within 1 km of the project study area (AEP 2021c), which is the maximum setback for wildlife features as per the MSSC (GOA 2021).
Grassland Vegetation Inventory (AEP 2019)	The Grassland Vegetation Inventory (GVI) is a comprehensive geospatial dataset (geodatabase) that delineates biophysical, anthropogenic, and land inventory in southern Alberta's White Area. With the use of ArcGIS, the GVI was mapped for the project study area to determine the main land cover types that may be impacted by the project.
Important Bird Areas (Bird Studies Canada 2015)	The Important Bird Areas (IBAs) of Canada database was searched for potential IBAs near or within the project study area. IBAs are sites that support threatened bird species, large groups of birds, and bird species that have range or habitat restrictions. IBAs have international significance for bird conservation and are identified using standardized criteria.
Master Schedule of Standards and Conditions (GOA 2021)	The Master Schedule of Standards and Conditions (MSSC) identifies conditions that apply to formal dispositions applications approved under the *Public Lands Act*, the *Mines and Minerals Act*, and Geophysical Regulations. The MSSC was reviewed to

Resource	Description and Information Provided
	determine applicable conditions for the project in order to mitigate potential environmental impacts.
Natural Regions and Subregions of Alberta (Alberta Parks 2015)	A framework which describes the climatic, physiographic, vegetation, soil, wildlife, and land use attributes for each Natural Region and Subregion of Alberta. The document was reviewed to provide the ecological setting for the project study area.
Pronghorn Migration Corridors (Mitchell 1980; Suitor 2011; Suitor 2009)	Pronghorn (*Antilocapra americana*) migration pathways in Alberta based on a research study by Suitor (2011) which consisted of GPS collar data from 2003 to 2007. A second dataset is included, which was provided by Mitchell (1980) summarizing historical pronghorn movement paths in Alberta. With the use of ArcGIS, the dataset was reviewed in relation to the project study area.
Sensitive Species Inventory Guidelines (GOA 2013)	The Sensitive Species Inventory Guidelines (SSIG) is a compilation of inventory guidelines for a number of wildlife species in Alberta, with focus on pre-development surveys. This document was reviewed to determine the future survey effort for the project to verify findings of the desktop assessment.
Species at Risk Public Registry (GOC 2021b)	The Species at Risk (SAR) Public Registry provides all documents relating to the species listed under the *Species at Risk Act* (*SARA*). The SAR registry was reviewed to determine the statuses of the historically and potentially occurring species within the project study area.

4.1.2 Geospatial Review

In order to identify potential habitat impacted by the project, broad land cover within the project study area boundary was digitized with the use of current and historic satellite imagery and ArcGIS Pro (version 2.6.3; ESRI Inc 2020). Land cover categories used in the classification included cropland, hayland, tame, native prairie, woodland, wetlands, watercourses, and infrastructure (Table 2). The GVI dataset (AEP 2019) was used as a guide to assist in land cover classification. Minimum polygon size classified was 0.02 ha and total area for each land cover type was calculated to hectares (ha).

Other provincial geospatial data was mapped in ArcGIS for the project study area such as ESA scores (Alberta Parks 2014), pronghorn migration corridors (Mitchell 1980; Suitor 2011; Suitor 2009), and FWMIS (AEP 2021c).

Table 2. Land cover types used for classification within the project study area.

Land Cover Type	Description
Cropland	Land previously broken, seeded to annual agronomic species (e.g., canola, wheat, etc.).
Hayland	Land previously broken, seeded to agronomic species used for livestock forage production (e.g., alfalfa, brome, etc.).
Infrastructure	Human development. Includes farmyards, roads, road right-of-ways (ditches),
Tame	Land previously broken, seeded to agronomic plant species. Typically used for grazing livestock (e.g., tame pasture) but can include areas not used by livestock (e.g., grass strips between cropland).
Native Prairie	Undisturbed grassland typically used for grazing livestock.
Woodland	Trees and tall shrubs.
Wetlands	Ephemeral, temporary, seasonal, semi-permanent, and permanent waterbodies (open water, marsh, lakes, etc.). Includes dugouts.
Watercourses	Ephemeral, intermittent, and permanent watercourses. Includes man-made watercourses such as canals.

4.1.3 Site Visit

A site visit by Bear Tracks biologists along with MPE staff was conducted on January 12th, 2021. The purpose of the site visit was to view the location of the proposed project and take photographs of the landscape. Potential sensitivities or concerns encountered during the scout was also photographed. All pictures collected during the site visit are in Appendix A – Site Photographs. It is important to note that no ground-truthing or surveying to confirm the information collected in the desktop assessment occurred during the site visit.

4.2 Results

4.2.1 Ecological Setting, Soils, and Landforms

The project is located within the Dry Mixedgrass Natural Subregion within the Grassland Natural Region of Alberta (Alberta Parks 2015). This subregion is the driest in Alberta and is characterized by level to gently rolling landscapes, cut by coulees and valleys. Grazing occurs on approximately 55% of the area, while approximately 35% is cultivated and used for dry-land farming. Oil and gas development is extensive throughout the subregion. The Dry Mixedgrass Subregion contains significant areas of native prairie in the southeast and

central parts of the subregion. The dominant native vegetation of the subregion is drought tolerant and include grasses such as blue grama (*Bouteloua gracilis*) and needle and thread grass (*Hesperostipa comata*). June grass (*Koeleria macrantha*) and western wheatgrass (*Pascopyrum smithii*) are also common, with a variety of forbs such as moss phlox (*Phlox hoodii*), pasture sage (*Artemesia frigida*) and dotted blazingstar (*Liatris punctata*) (Alberta Parks 2015).

The Dry Mixedgrass Subregion is dominated by brown chernozemic and solonetzic soils, with parent material dominated by glacial till (Adams et al. 2013). As the project is located in the Vauxhall Plain ecodistrict of the subregion, it is characterized by relatively thick glacial tills (Adams et al. 2013). A more detailed search using the Alberta Soil Information Viewer (AEP 2021a) indicated that the project study area falls within 1 soil map unit (CFMA1). This soil map unit contains orthic brown chernozem on medium textured (L, SiCL, CL) materials over medium (L, CL) or fine (C) textured till (CFD) and orthic brown chernozem on medium textured (L, CL) till (MAB). The soil polygon within the project study area may include soils that are strongly contrasting from the dominant or co-dominant soils. The project study area has an undulating, high relief landform with a limiting slope of 4% (U1h). See Appendix B – Background Information Review Search Results for the query report.

4.2.2 Land Cover

The majority of the project study area has been previously disturbed, primarily through agricultural practices. The most dominant land cover within the 983 ha project study area is irrigated and non-irrigated cropland which accounts for 76.5% of the total area (751.7 ha) (Table 3, Figure 2). All remaining land cover types were in smaller proportions when compared to cropland. Some features important to wildlife that are present within the project study area include wetlands and native prairie. The second largest land cover was wetlands which accounted for 79.6 ha of the project study area (8.1%). Man-made wetlands (i.e., dugouts) were present but were in small proportion (0.4 ha). Native prairie was also present within the study area, accounting for 5.6% of the area (55 ha) and was primarily located in SW 27-13-18 W4 and in areas adjacent to the canal. The BRID main canal was the only watercourse classified in the desktop assessment and accounted for 2.1% of the project study area. Tame and hayland land cover made up 4.6% and 1.7% of the project study area, respectively. Finally, infrastructure such as developed roads (and right-of-ways) and farmyards accounted for 1.4% of the area. No woodland land cover was classified due to polygons being below the minimum polygon size used for delineating land cover. However, sporadic trees and tall shrubs are visible within the project study area at a finer scale. See Appendix A – Site Photographs for examples of each land cover type.

Table 3. Area and percentage of land cover types within the project study area from the Desktop Assessment.

Land Cover Type	Project Lands		Flood Zone (Approximate)	
	Area (ha)	Percent of Project Study Area (%)	Area (ha)	Percent of Flood Zone (%)
Cropland	751.7	76.5	306.5	63.9
Hayland	16.4	1.7	6.6	1.4
Infrastructure	13.7	1.4	9.1	1.9
Native Prairie	55.0	5.6	34.1	7.1
Tame	45.1	4.6	34.0	7.1
Watercourse (canal)	20.6	2.1	16.5	3.4
Wetland	79.6	8.1	72.6	15.1
Wetland (dugout)	0.4	0.05	0.4	0.1
Total	982.6	100	479.8	100

The proposed project flood zone is anticipated to permanently impact approximately 479.8 ha (48.9%) of the project study area, the majority of which encompasses cropland, accounting for 306.5 ha (63.9 %) of habitat loss within the projected flood zone. Though cropland cover is expected to experience the greatest loss as a result of project works, other habitats within the flood zone area are expected to be disproportionately impacted in relation to their total land cover (Table 3). The majority (72.6 ha) of total wetland habitat in the project area (79.6) is anticipated to be impacted, though it only accounts for 15.1% of the project flood zone; similar trends in habitat loss are anticipated for all other land cover types identified during the assessment. Native prairie and tame pasture, each of which account for 7.1% of the total flood zone is anticipated to be impacted, as well as human infrastructure (1.9%), man-made watercourses/canals (3.4%), and man-made wetlands/dugouts (0.1%).

4.2.3 Rare Plants

The review of the ACIMS database revealed no sensitive element occurrences (rare plants) or communities that have been previously documented within the township encompassing the project study area (13-18-W4M). Furthermore, the project does not fall within any rare plant ranges as identified through FWIMT. Results of the ACIMS search are provided in Appendix B – Background Information Review Search Results.

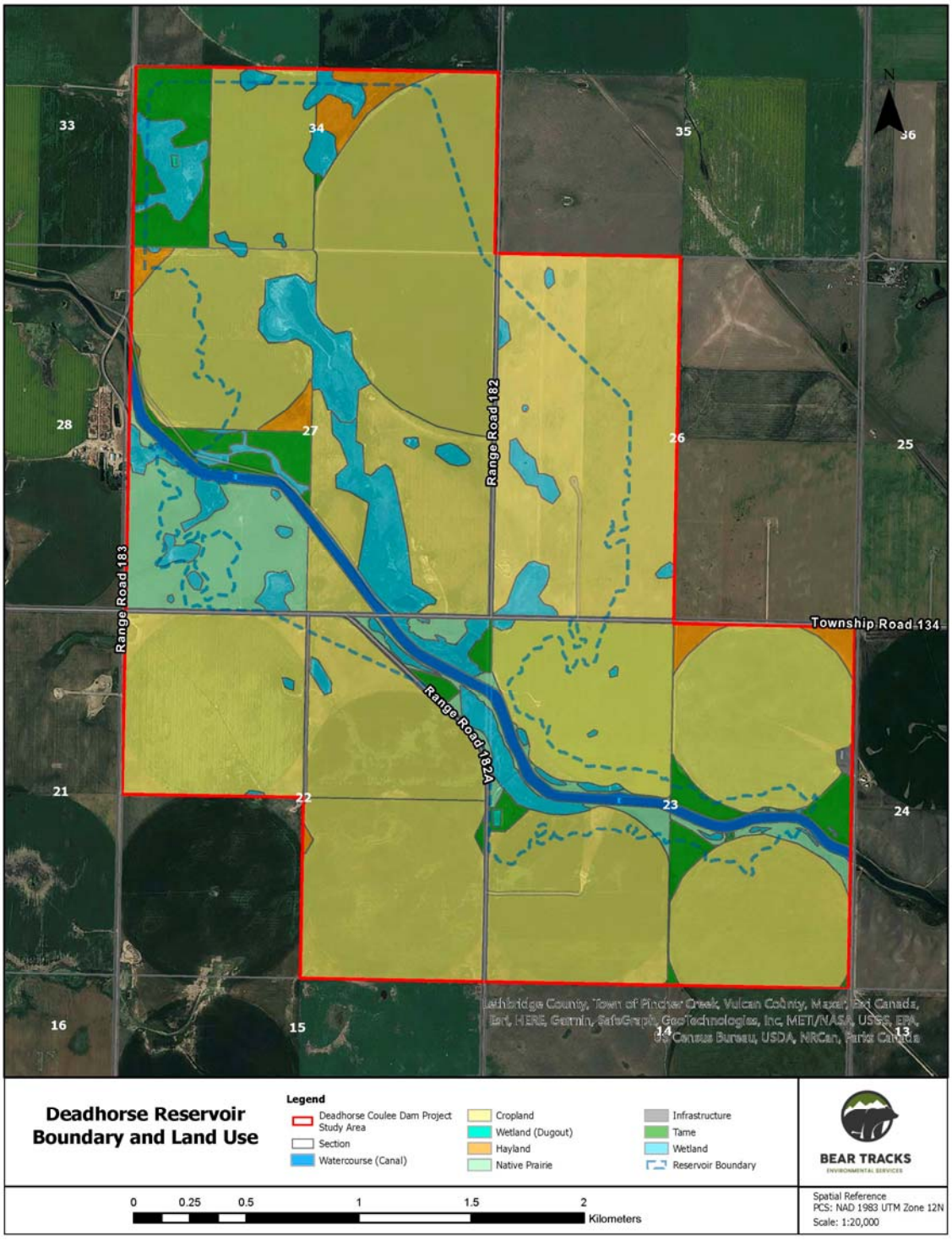

Figure 2. Land cover types delineating within the project study area.

4.2.4 Wildlife

Based on the FWIMT search results, the project study area is located within the ranges of five sensitive wildlife species or groups (Appendix B – Background Information Review Search Results). The sensitive species ranges that overlap the project study area include: burrowing owl (*Athene cunicularia*), sensitive raptor (ferruginous hawk [*Buteo regalis*], golden eagle [*Aquila chrysaetos*], prairie falcon [*Falco mexicanus*]), and sharp-tailed grouse (*Tympanuchus phasianellus*). The FWIMT search also indicated 11 wildlife species of concern that have been historically observed within 3.2 kilometers of the project study area boundary. This included one amphibian, one mammal, and nine avian species. Of these species, two are listed as 'Endangered' and two as 'Threatened' under federal or provincial legislation (e.g., *SARA*, *Wildlife Act*). The remaining species are listed as 'Special Concern' under legislation or has an Alberta General Status of 'Sensitive'. Sensitive species historically observed in proximity to the project are summarized in Table 4 which includes the provincial and federal status associated with each species.

Table 4. Species of concern historically observed in proximity (3.2 km) of the project study area centroid and sensitive species ranges (indicated by asterisk) that overlap the project study area.

Common Name	Latin Name	Species Status			
		AB General Status[1]	WA[2]	COSEWIC[3]	SARA[4]
Birds					
Black-necked stilt	*Himantopus mexicanus*	Sensitive	-	-	-
Burrowing owl	*Athene cunicularia*	At Risk	Endangered	Endangered	Endangered
Chestnut-collared longspur	*Calcarius ornatus*	At Risk	-	Endangered	Threatened
Ferruginous hawk	*Buteo regalis*	At Risk	Endangered	Threatened	Threatened
Golden eagle	*Aquila chrysaetos*	Sensitive	-	Not at Risk	-
Great blue heron	*Ardea herodias*	Sensitive	-	-	-
Loggerhead shrike	*Lanius ludovicianus*	Sensitive	Special Concern	Threatened	Threatened
Long-billed curlew	*Numenius americanus*	Sensitive	Special Concern	Special Concern	Special Concern
Prairie falcon	*Falco mexicanus*	Sensitive	Special Concern	Not at Risk	-
Sharp-tailed grouse	*Tympanuchus phasianellus*	Sensitive	-	-	-
Sora	*Porzana carolina*	Sensitive	-	-	-
Sprague's pipit	*Anthus spragueii*	Sensitive	Special Concern	Threatened	Threatened
Mammals					

Common Name	Latin Name	Species Status			
		AB General Status[1]	WA[2]	COSEWIC[3]	SARA[4]
American badger	*Taxidea taxus*	Sensitive	Data Deficient	Special Concern	Special Concern
Amphibians					
Great plains toad	*Anaxyrus cognatus*	Sensitive	Special Concern	Special Concern	Special Concern

1 - Government of Alberta. 2017. Alberta Wild Species General Status Listing - 2015. Available at: https://open.alberta.ca/dataset/ad0cb45c-a885-4b5e-9479-52969f220663/resource/763740c0-122e-467b-a0f5-a04724a9ecb9/download/sar-2015wildspeciesgeneralstatuslist-mar2017.pdf
2 - Province of Alberta. 1997. Wildlife Act. Wildlife Regulation. Alberta Regulation 143/1997. Published by Alberta's Queen's Printer. Available at: http://www.qp.alberta.ca/documents/Acts/W10.pdf
3 - Government of Canada. 2021. Committee on the Status of Endangered Wildlife in Canada. Available at: https://www.canada.ca/en/environment-climate-change/services/committee-status-endangered-wildlife.html
4 - Government of Canada. 2002. Species at Risk Act. S.C. 2002., c. 29. Published by the Minister of Justice at: https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html

The query of the FWMIS database resulted in three historic wildlife features within 1000 m of the project study area boundary, including one burrowing owl nest that was active for two years in 1991 and 1992, and two coyote (*Canis latrans*) dens found in 2009. Twenty-seven (27) wildlife species have been historically observed within 1000 m of the project study area, of which, three are of concern in Alberta. These species included long-billed curlew, burrowing owl, and great plains toad. These species were observed at the burrowing owl nest location within SW 25-13-18 W4M (Figure 3).

No pronghorn migration corridors are within 1000 m of the project study area, based on the Suitor (2009) dataset. The nearest pronghorn migration corridors are approximately 9.4 km northeast and 17.4 km east of the project (Figure 4). These migration corridors are historic pathways summarized by Mitchell (1980). No pronghorn observations within 1000 m of the project have been previously reported to FWMIS.

4.2.5 Fish

No fish surveys within the BRID main canal have been reported to FWMIS. A FWIMT search of the Little Bow Lake Reservoir was conducted to supplement potential fish species that may occur in the BRID canal as the Little Bow Lake Reservoir is 20 km upstream of the canal. As the canal is connected to the Little Bow Lake Reservoir, there is potential for these fish in the reservoir to also occur in the canal. A total of 13 fish species have been inventoried within the reservoir (Table 5; Appendix B – Background Information Review Search Results). All of these species have a 'Secure' Alberta general status.

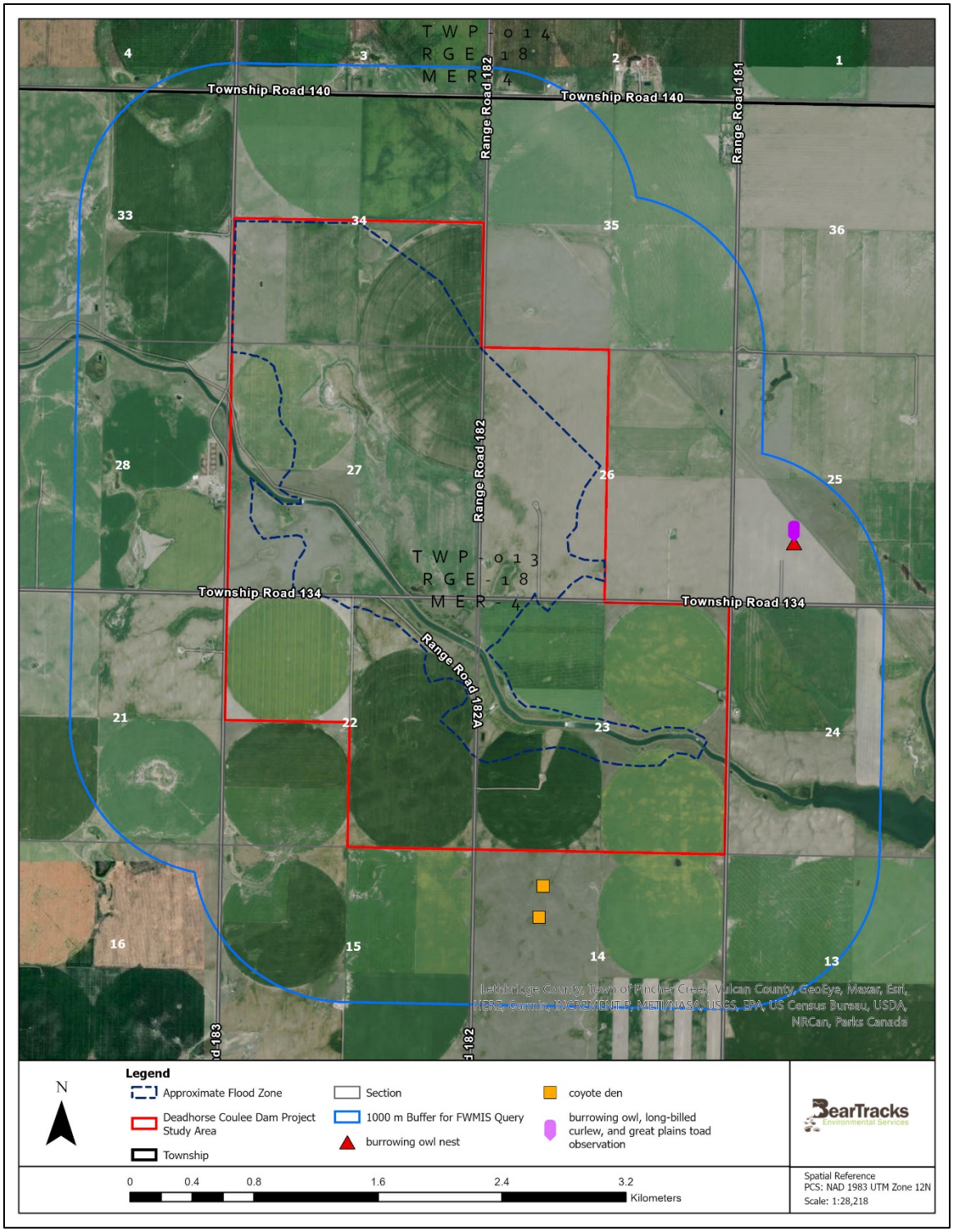

Figure 3. Wildlife features (nests/dens) and species of concern observed historically within 1000 m of the project study area.

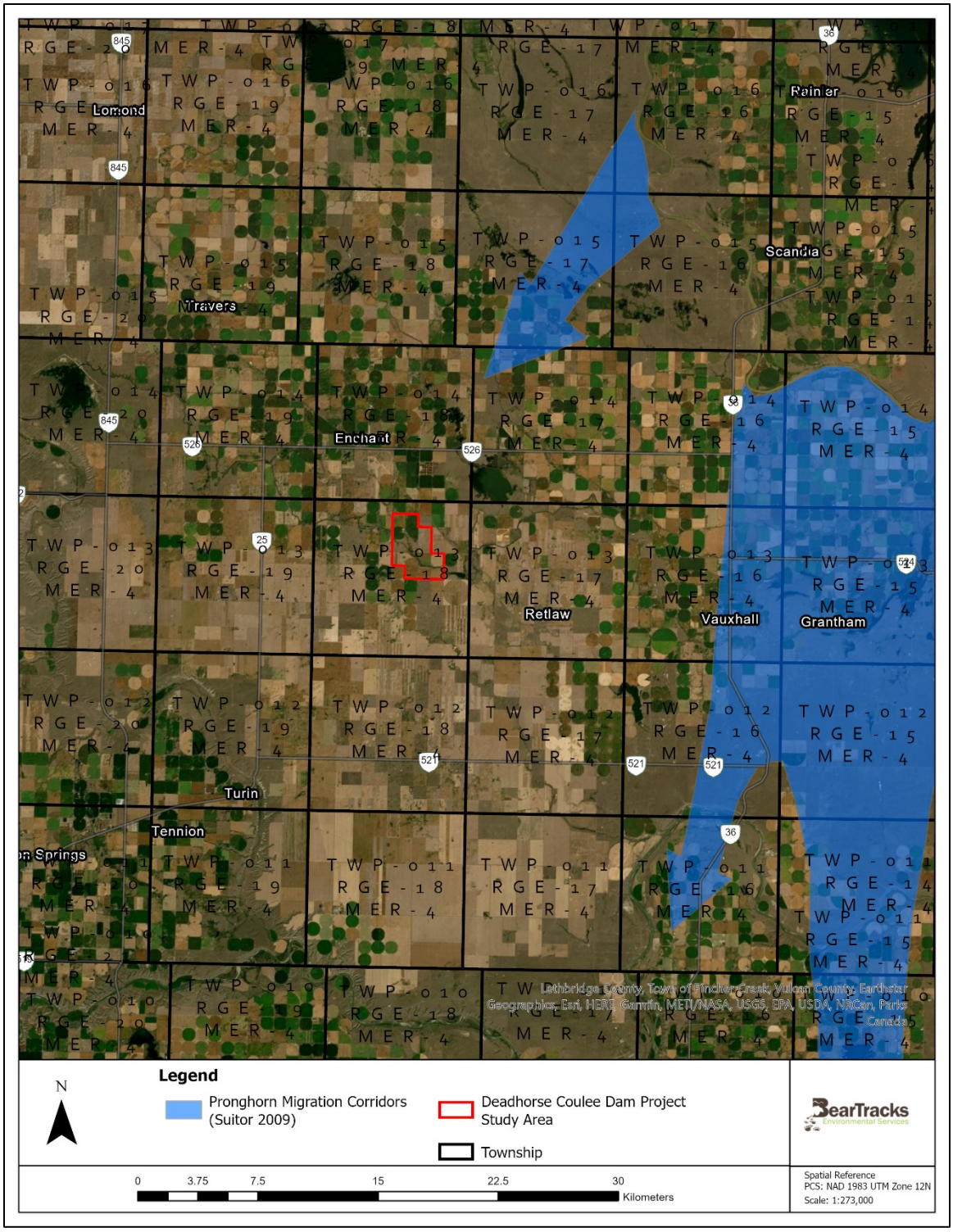

Figure 4. Pronghorn migration corridors from (Suitor 2009; Suitor 2011; and Mitchell 1980) in relation to the project study area.

Table 5. Fish species previously observed in the Little Bow Lake Reservoir.

Common Name	Latin Name	Species Status			
		AB General Status[1]	WA[2]	COSEWIC[3]	SARA[4]
Brown trout	*Salmo trutta*	Exotic/Alien	-	-	-
Burbot	*Lota lota*	Secure	-	-	-
Cisco	*Coregonus artedi*	Secure	-	-	-
Lake trout	*Salvelinus namaycush*	Secure	-	-	-
Lake whitefish	*Coregonus clupeaformis*	Secure	-	-	-
Longnose sucker	*Esox lucius*	Secure	-	-	-
Northern pike	*Onchorhynchus mykiss*	Secure	-	-	-
Rainbow trout	*Coregonus artedi*	Secure/ introduced or stocked/ hybridized	-	-	-
Spottail shiner	*Notropis hudonius*	Secure	-	-	-
Walleye	*Sander vitreus*	Secure	-	-	-
White sucker	*Catostomus commersoni*	Secure	-	-	-
Yellow perch	*Perca flavescens*	Secure	-	-	-

4.2.6 Environmental Management Areas

Environmentally Significant Areas (ESA)

Environmentally Significant Areas are evaluated relative to four broad criteria (for each quarter section); these include (1) focal species, species groups, or their habitats; (2) rare, unique, or focal habitat; (3) ecological integrity; and (4) contribution to water quality and quantity. These criteria have multiple sub-criteria (Fiera 2014). In order to be deemed as an ESA, a quarter section must receive a summed score of greater than 0.189. None of the quarter sections received a score of greater than 0.189 and had an ESA score of 0.074 or less (Figure 5).

Important Bird Areas (IBAs)

No IBAs were within 1000 m of the project study area boundary. The nearest IBA is McGregor Lake and Travers Reservoir (AB016) located approximately 18 km west of the project study area (Bird Studies Canada 2015).

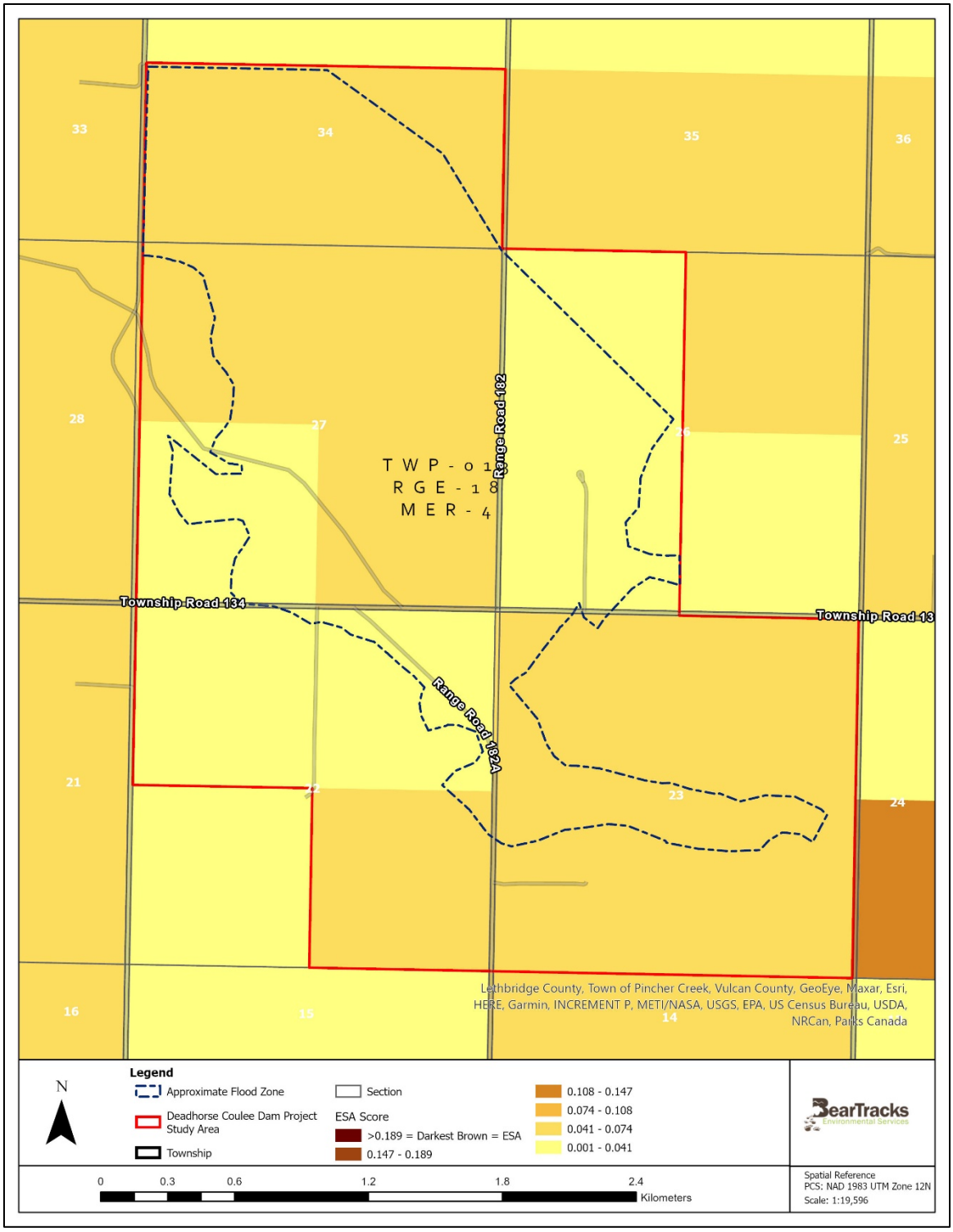

Figure 5. Environmentally Significant Areas (ESA) scores within the project study area.

Protected Areas

No provincial or federal parks, protected areas (e.g., ecological reserves, natural areas, wilderness areas), or wildlife sanctuaries are within the project study area.

4.2.7 Waterbodies and Watercourses

During the desktop land cover classification, a total of 46 potential wetlands were delineated covering 8.1% of the project study area (Figure 2). These wetlands occurred within native and cultivated land cover and included wetlands that were uncultivated and previously cultivated. The wetlands ranged in water permanence, with several wetlands appearing to have permanence of seasonal or higher. Other waterbodies observed within the project study area included four man-made dugouts. To verify the permanence of these wetlands, a formal field assessment following the Alberta Wetland Classification System (ESRD 2015) is required.

The only watercourse observed within the project study area was the BRID main canal which is a man-made watercourse.

4.2.8 Regulations

Based on the desktop assessment, the project will be subject to provincial and federal environmental legislation. Guidelines, protocols, and conditions with respect to these legislations will need to be considered during project planning and construction (Table 6).

Table 6. Regulations applicable to the project.

Regulations	Description
Provincial	
Public Lands Act (Province of Alberta 2000a)	• Manages public land in Alberta, including waterbodies and watercourses.
Water Act (Province of Alberta 2000b)	• Manages and protects rivers, streams, lakes, and wetlands. The act regulates activities conducted in and around surface water and groundwater.
Weed Control Act (Province of Alberta 2008)	• Specifies the duties for individuals, local authorities, and levels of government within the province on the management and control of prohibited noxious weeds.
Wildlife Act (Province of Alberta 1997)	• Prohibits the disturbance or destruction of a house, nest, or den of wildlife listed under the act.
Federal	
Fisheries Act (GOC 1985)	• Manages fish and fish habitat protection and pollution.

Regulations	Description
Migratory Birds Convention Act (GOC 1994)	• Protects migratory birds, eggs and nests for species listed under the act.
Species at Risk Act (GOC 2002)	• Protects endangered and threatened species under the act as well as their critical habitat.

4.3 Desktop Summary

The project appears to be within a relatively low risk area as the majority of the project study area has been previously developed for agriculture, where cropland accounts for over 75% of the land cover. However, there are multiple environmental sensitivities that could be considered as perceived risks for the project:

- The permanent alteration of overall habitat within the project study area from upland to aquatic could impact terrestrial wildlife and vegetation communities.
- Sensitive land cover and wildlife habitat, such as native prairie and wetlands, are present in the project study area. Native prairie and wetlands provide important habitat for many flora and fauna, including species at risk.
- Multiple sensitive wildlife breeding ranges overlap the project, and sensitive wildlife and wildlife features (e.g., nests, dens) have been observed historically within 1000 m of the project.
- Fish and fish habitat may be affected by project development as fish from the Little Bow Lake Reservoir, upstream of the project, may occur in the BRID canal.

5 Field Assessment

5.1 Methods

Following completion of the desktop assessment, field assessments were conducted by Bear Tracks over several site visits from March 2nd to September 30th in order to verify desktop information, as well as collect current biological inventory data for the project. Surveys conducted as part of the field assessment are summarized below.

5.1.1 Vegetation Surveys

Baseline vegetation surveys were completed, in conjunction with rare plant surveys, on June 2nd and August 16th, 2021, in order to verify land cover in the Project area, as well as document invasive weed species of concern and rare vascular plants potentially occurring in the project area. Surveyors conducted a meander search on foot throughout areas of native prairie within the project study area, noting land cover, weeds, and any rare plant species. In instances where a rare plant or controlled weed species was identified, additional

site information was collected in relation to the occurrence, including: the physical location of the occurrence, size and extent of the population, and specific habitat attributes associated with the occurrence (e.g., community species composition).

5.1.2 Wildlife Surveys

Winter wildlife/mammal surveys were completed on March 2nd, 2021 during the recommended survey period (December 1st to March 31st) (GOA 2013). Surveys were conducted at pre-determined transect locations along roads and trails within the project study area (Figure 6). Mammals, as well as any other wildlife species detected by sight, sound, or sign (i.e. tracks, scat, hair, feathers), were recorded at each transect location. Any habitat features observed (i.e. burrows, dens, nests) were also documented and subsequently re-visited during general wildlife surveys in the spring.

Sharp-tailed grouse surveys were completed on April 13th and April 29th to 30th, 2021 to document potential sharp-tailed grouse breeding/lekking activity in the project study area. The assessment was conducted during the recommended survey period for sharp-tailed grouse (mid-March to early/mid-May) following the SSIG (GOA 2013). Surveys were completed at pre-determined locations along roads and trails in the study area (Figure 6), with additional focus on areas of suspected native prairie. Areas that could not be surveyed due to access restrictions were visually inspected with the aid of binoculars. All wildlife species encountered at transect locations were recorded.

An auditory amphibian survey was completed on April 27th, 2021, during which biologists stopped at pre-determined survey locations along roads and trails in the study area and listened for calling amphibians (Figure 7). The survey was conducted following the SSIG (GOA 2013). In addition, AudioMoth (1.1.0) ARU's were deployed at three locations adjacent to wetlands to allow for continuous monitoring of amphibians and other riparian species near these habitat features. Any amphibians heard were recorded (in addition to other incidental species picked up on the recordings), and supplemental information including direction and approximate distance from the survey point and number of individuals were documented1.1.0. The locations of deployed units are shown in Figure 7.

Additional wildlife assessments were completed on June 2nd, 3rd, and June 25th, 2021 in order to document breeding birds, raptors, mammals, and burrowing owls, as well as identify other sensitive wildlife species and/or sensitive habitat features that may occur within or in proximity to the project. The timing of the assessments coincided with the typical breeding and nesting period for grassland birds (May 15th – July 1st), raptors (May 1st – June 30th), and burrowing owl (May 15th – July 15th) (GOA 2013). Breeding bird point counts were completed at pre-determined locations in the study area, with at least one point at the corner of every quarter section (Figure 7). At each point, the surveyor conducted a

five-minute point count, during which all species heard or observed were noted; the number of individuals, age, and sex was also documented. A call playback survey for burrowing owl was completed in conjunction with BBS, during which surveyors broadcasted the burrowing owl call at approximately every second location as per the SSIG to adequately cover the entire project area. If any owls were heard the surveyor would try to pinpoint the location of the return call. In addition, any burrows encountered during site visits deemed suitable for burrowing owl were visually inspected for evidence of use by owls (ie whitewash, rodent bones, pellets, etc at the entrance to the burrow). During the completion of all surveys, scans were conducted to identify raptors and potential raptor nesting locations. All potential nesting features (ie trees, anthropogenic features, etc) were further inspected for potential raptor nests. Areas that could not be surveyed due to access restrictions were visually inspected with the aid of binoculars. All GPS location of wildlife, features, and concerns were recorded in UTM Zone 12U NAD83.

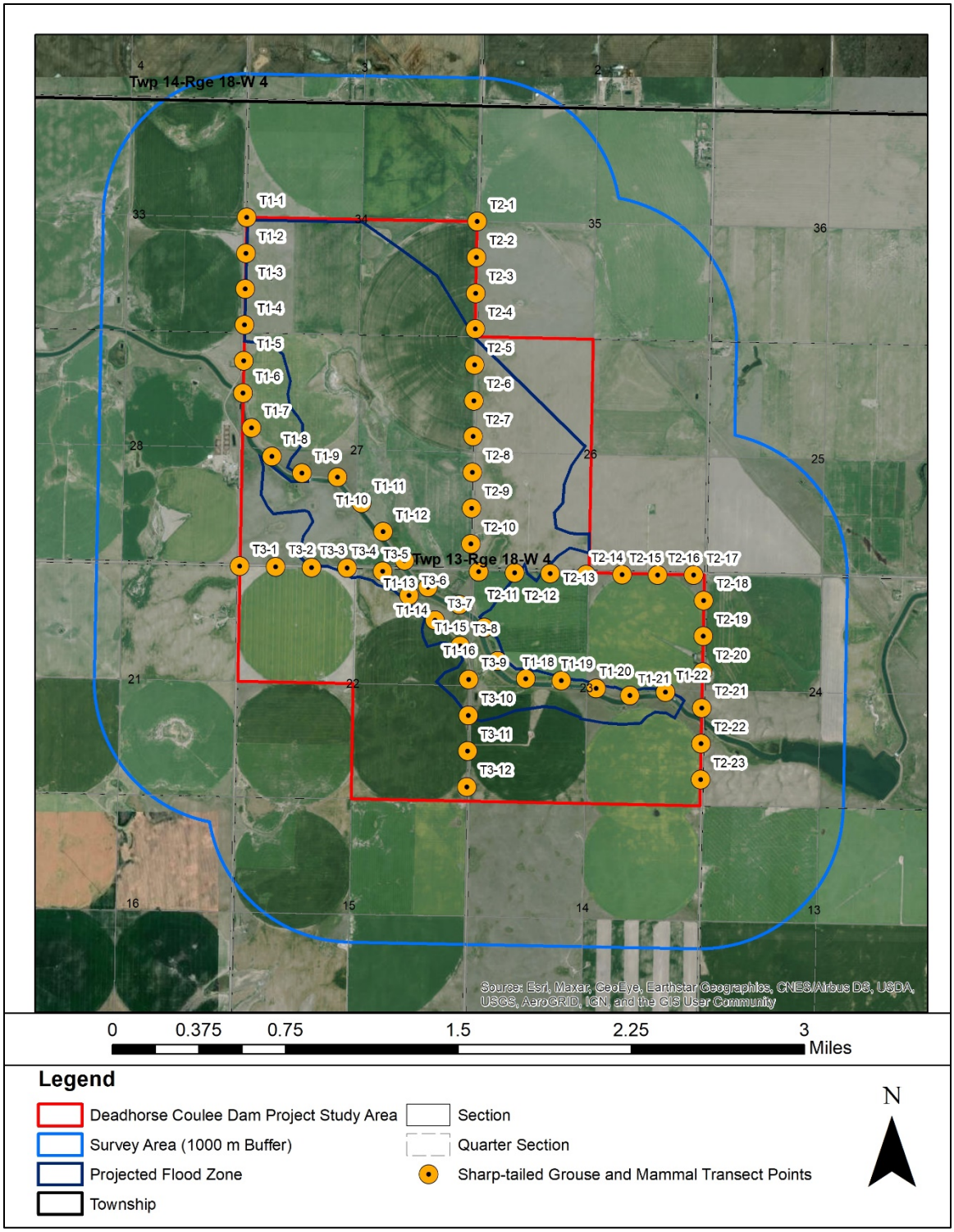

Figure 6. Location of winter wildlife and sharp-trailed grouse transect locations in the project study area and the 1000 m survey area buffer.

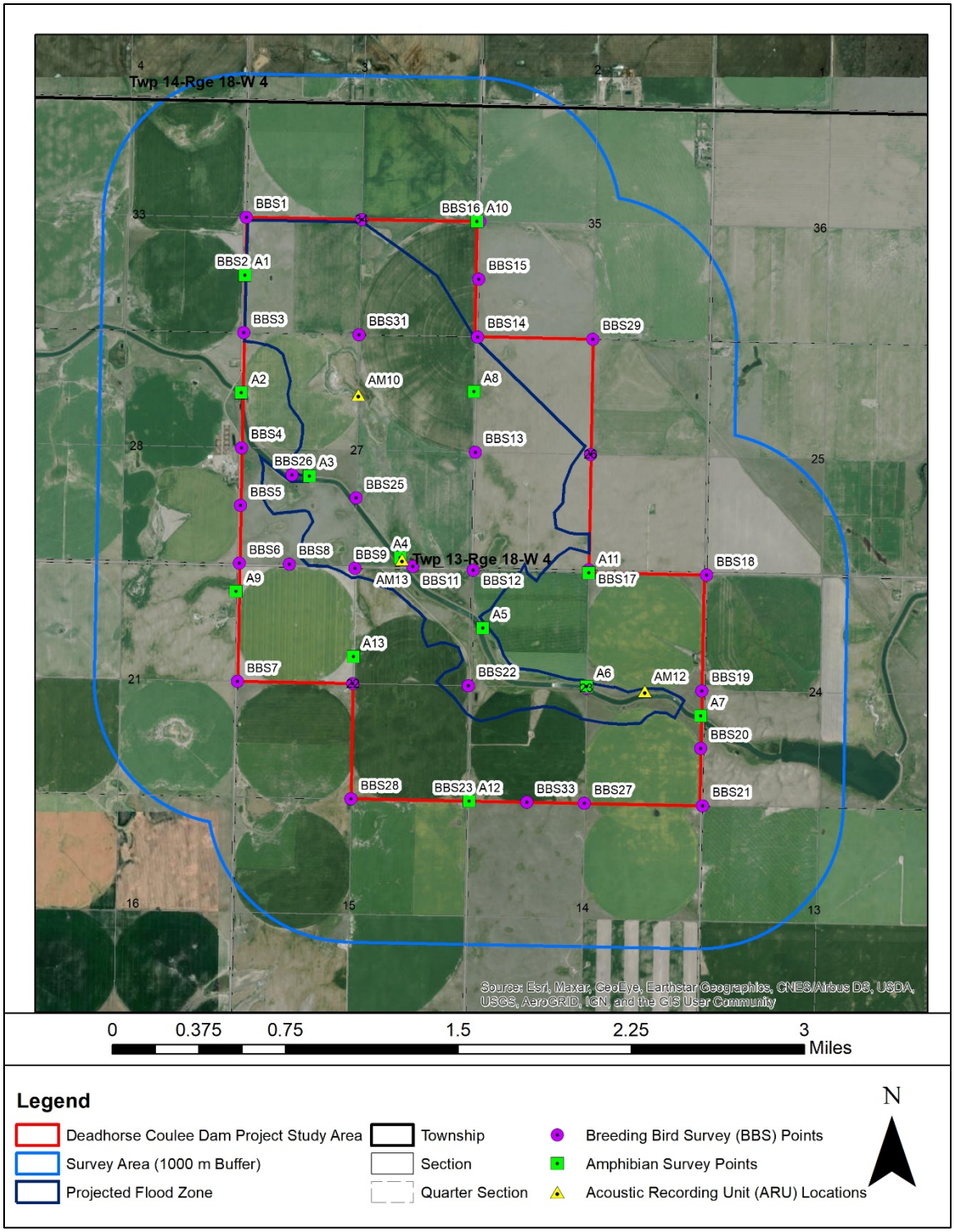

Figure 7. Location of breeding bird and amphibian call survey points in the project study area and the 1000 m survey area used for raptor nests.

5.1.3 Waterbodies and Watercourses

As the project will lead to the eventual loss of numerous wetlands, a Wetland Assessment Impact Report (WAIR) was completed for the project. Site-specific information for the WAIR was collected for each wetland identified within the project area in order to adequately classify and delineate these features. Site visits to assess potentially impacted wetlands within the Projects projected flood zone occurred over several site visits in September by an authenticating professional. Wetlands were classified (class, form, type) and their boundaries delineated following the Alberta Wetland Identification and Delineation Directive (GOA 2015). Wetland specific information relevant to a WAIR was also collected during the site visits as required, which included Alberta Wetland Rapid Evaluation Tool – Actual (ABWRET-A) and supplemental wetland information such as wildlife/fish use of the wetlands and dominant vegetation species/vegetation communities within the wetlands.

The WAIR report will be finalized independently of this report and submitted for Water Act approvals prior to the start of construction.

5.1.4 Fish and Fish Habitat

A site visit to assess fish habitat throughout the existing canal systems was completed in November, 2021 by a Qualified Aquatic Environmental Specialist (QAES). The assessments were completed in November which allowed for a reduced flow in the canals, making the fish habitat assessment easier to complete and with greater accuracy to the condition of subsurface habitats.

The assessments were completed at several representative locations along the canal to better describe overall habitat conditions within the canal system. Characteristics of the bed and substrate composition, bank shape, vegetation cover, and features of the canals that have potential to affect fish habitat was documented. This information was further used to assess rearing, spawning, and migration habitat quality and value for fish potentially utilizing the canals.

Refer to the QAES Assessment Report attached (Appendix E for a detailed description of methods used during the QAES assessment.

5.2 Results

5.2.1 Vegetation Surveys

Land cover within the project study area was verified during the field assessment to be dominated by agronomic/ introduced vegetation species. Native vegetation species were found in several small areas of remaining native grasslands within the study area, primarily

along the canal, in addition to a relatively large parcel approximately 100 acres in size in the SW of section 27.

Ninety-eight (98) vascular plant species were identified during the assessment (Appendix C - Plant Species List). Of these, nine have a subnational conservation status ranking (S-rank) of S3 (somewhat vulnerable), one has an S-rank of S3S4 (somewhat vulnerable and/or uncommon), seven have an S-rank of S4 (uncommon but apparently secure), one is ranked as S4S5 (uncommon/potentially secure), 73 are ranked as S5 (secure), 20 are exotic with an S-rank of SNA, and one species has an S-rank of SNR (not ranked). No provincial or federally listed plant species were identified during field surveys, and no provincially tracked or watched species were documented.

Several weed species of management concern were confirmed within the project study, including bull thistle (*Cirsium vulgare*), flixweed (*Descurainia sophia*), prickly lettuce (*Lactuca serriola),* creeping thistle (*Cirsium arvense*), perennial sow-thistle (*Sonchus arvensis*), lamb's quarters (*Chenopodium album*), kochia (*Kochia scoparia*), tall buttercup (*Ranunculus acris*), white sweet-clover (*Melilotus alba*), yellow sweet-clover (*Melilotus officinalis*), common goat's-beard (*Tragopogon dubius*), and common dandelion (*Taraxacum officianale*). Both perennial sow-thistle and tall buttercup are designated as 'Noxious' under the Alberta *Weed Control Act* (Province of Alberta 2008).

5.2.2 Wildlife Surveys

A total of 90 wildlife species, including 80 avian, two (2) amphibian, and eight (8) mammalian species, were documented during wildlife surveys in 2021 (Appendix D). Of these, two species are listed as "Endangered', under federal or provincial legislation: the ferruginous hawk and the chestnut-collared longspur. The ferruginous hawk is listed as 'Threatened' under both the Alberta *Wildlife Act* (GOA 2017b) and federal *Species at Risk Act* (*SARA*) (GOC 2021b). The chestnut-collared longspur has been designated as 'Endangered' by COSEWIC (GOC 2021a) and "Threatened" under *SARA* (GOC 2021b). Both the ferruginous hawk and the chestnut-collared longspur are designated "At Risk" under the General Status of Alberta Wild Species document (GOA 2017a).

In addition to the chestnut-collared longspur and ferruginous hawk, the bank swallow (*Riparia riparia*), barn swallow (*Hirundo rustica*) and thick-billed longspur (*Rhynchophanes mccownii*) are also listed as "Threatened" under *SARA* (GOC 2021b). The bank swallow and thick-billed longspur are "Threatened" under COSEWIC, while the barn swallow is "Special Concern" (GOC 2021a). The bank swallow has been designated as "Sensitive" under the Alberta General Status document, and the barn swallow and thick-billed longspur are designated as "May be at Risk" (GOA 2017a). The plains spadefoot (*Spea bombifrons***)**, long-billed curlew, and western wood-pewee (*Contopus sordidulus*),

also have an Alberta General Status of "May be at Risk" (GOA 2017a). Additionally, the long-billed curlew is ranked "Special Concern" under the Alberta *Wildlife Act* (GOA 2017b), COSEWIC (GOC 2021a), and *SARA* (GOC 2021b). The prairie falcon is also listed as "Special Concern" through the Alberta *Wildlife Act* (GOA 2017b) and as "Sensitive" under the Alberta General Status document (GOA 2017a). Both the evening grosbeak (*Coccothraustes vespertinus*) and the Baird's sparrow are ranked "Special Concern" under COSEWIC (2021a) and *SARA* (2021b), while the Baird's sparrow (*Centronyx bairdii*), is also considered "Sensitive" through the Alberta General Status document (GOA 2017a).

A further eight species recorded during the 2021 wildlife surveys are "Sensitive" under the Alberta General Status document (GOA 2017a) and include the Baltimore oriole (*Icterus galbula*), black-necked stilt, common yellowthroat (*Geothlypis trichas*), eastern kingbird (*Tyrannus tyrannus*), Forster's tern (*Sterna forsteri*), least flycatcher (*Empidonax minimus*), sora, and American badger. The American badger is "Data Deficient" under the Alberta *Wildlife Act* (GOA 2017b) and is ranked as "Special Concern" by both COSEWIC (GOA 2017a) and *SARA* (GOC 2017b). A complete list of wildlife observed during the field surveys and their provincial and federal rankings is provided Appendix D – Wildlife Species Table.

Eight mammalian species were observed in the project study area during the winter wildlife/mammal surveys and general wildlife assessment. All mammals documented are 'Secure' species, with the exception of the American badger. It does not appear that ungulate winter range is present in the study area due to the high level of anthropogenic disturbance and lack of adequate winter cover.

No sharp-tailed grouse or their sign (scat, feathers, lek sites, etc.) were observed during targeted surveys for the species. While some small areas of suitable sharp-tailed grouse habitat are present within native grassland areas of the Project, the lack of connected suitable habitat and the lack of sightings indicates that this species is not prevalent in the Project area and will likely not be impacted by development activities.

Two amphibian species, including plains spadefoot and boreal chorus frog, were recorded during the amphibian surveys. One plains spadefoot was detected calling near the large wetland in NW 27-13-18 W4M. Several Boreal chorus frogs were also heard calling from wetlands, dugouts, and from the BRID canal throughout the study area, both on deployed ARU's and during breeding bird surveys.

No burrowing owls or evidence of their presence (e.g., pellets and/or whitewash at burrows, feathers) were observed during the wildlife surveys. While some suitable habitat was present where Richardson's ground squirrel burrows were recorded within areas of

grassland land cover, the study area generally does not provide suitable habitat for burrowing owl.

Raptor nesting habitat present within the study area is associated with trees and tall shrubs located along the canal, road right-of-ways, and in nearby farmyard shelterbelts. One active ferruginous hawk nest (FEHA1) was observed in a tree along Range Road 183, in the northwest corner of the project study area (Table 7; Figure 8). Two Swainson's hawk (*Buteo swainsoni*) nests were also documented. One of the nests (SWHA2) was located on the south side of the canal, approximately 200 m east of Range Road 182 in NE 22-13-18 W4M, while the other (SWHA1) was located approximately 800 m north of the project study area on the north side of Township Road 140. A great-horned owl (*Bubo virginianus)* nest (GHOW1) was found approximately 50 m north of the canal in NE 22-13-18 W4M. Although suitable raptor nesting habitat is scarce within the Project, various raptor species are actively breeding and nesting in the area.

Numerous nests of other avian species were documented during the assessment. Three black-billed magpie nests (*Pica hudsonia*) (BBMA 1, BBMA2, and SN4) were observed, none of which were active at the time of surveys. In addition, a mallard (*Anas platyrhynchos*) nest (MALL1) and an unidentified songbird nest (GN1) were documented in the project study area. The remaining nests recorded were stick nests that were inactive at the time of surveys. Two cliff swallow (*Petrochelidon pyrrhonota*) colonies (CLSWCol1 and CLSWCol2) were found under bridges spanning the canal; one on Range Road 183 and the other on Range Road 181. Based on the number of avian species documented and observance of active breeding displays, it can be assumed that numerous grassland bird species are actively breeding and nesting in the Project area.

One medium-sized mammal burrow (Burrow1) was found in NW 27-13-18 W4M, however no identifying tracks or scat could be found. All wildlife features found during the 2021 wildlife surveys are listed in Table 7 and shown in Figure 8.

Table 7. Wildlife features observed during surveys for the project.

Feature ID	Feature	Species	Status	UTM (Zone 12U, NAD 83)	
				Easting	Northing
BBMA1	Nest	Black-billed magpie	Inactive	401595	5551320
BBMA2	Nest	Black-billed magpie	Inactive	401720	5551322
Burrow1	Burrow	Unknown	Unknown	400549	5552965
CLSWCol1	Nest/Colony	Cliff swallow	Active	400356	5552622
CLSWCol2	Nest/Colony	Cliff swallow	Active	403616	5550288
FEHA1	Nest	Ferruginous hawk	Active	400420	5553170
GHOW1	Nest	Great-horned owl	Active	401787	5551224

Feature ID	Feature	Species	Status	UTM (Zone 12U, NAD 83)	
				Easting	Northing
GN1	Nest	Unknown	Unknown	400419	5553506
MALL1	Nest	Mallard	Active	401579	5551327
SN1	Nest	Unknown	Inactive	401187	5554619
SN2	Nest	Unknown	Inactive	403675	5554134
SN3	Nest	Unknown	Inactive	401607	5551327
SN4	Nest	Black-billed magpie	Inactive	401595	5551320
SN5	Nest	Unknown	Inactive	401777	5551173
SN6	Nest	Unknown	Inactive	401961	5550892
SWHA1	Nest	Swainson's hawk	Active	401244	5554623
SWHA2	Nest	Swainson's hawk	Active	401942	5550995

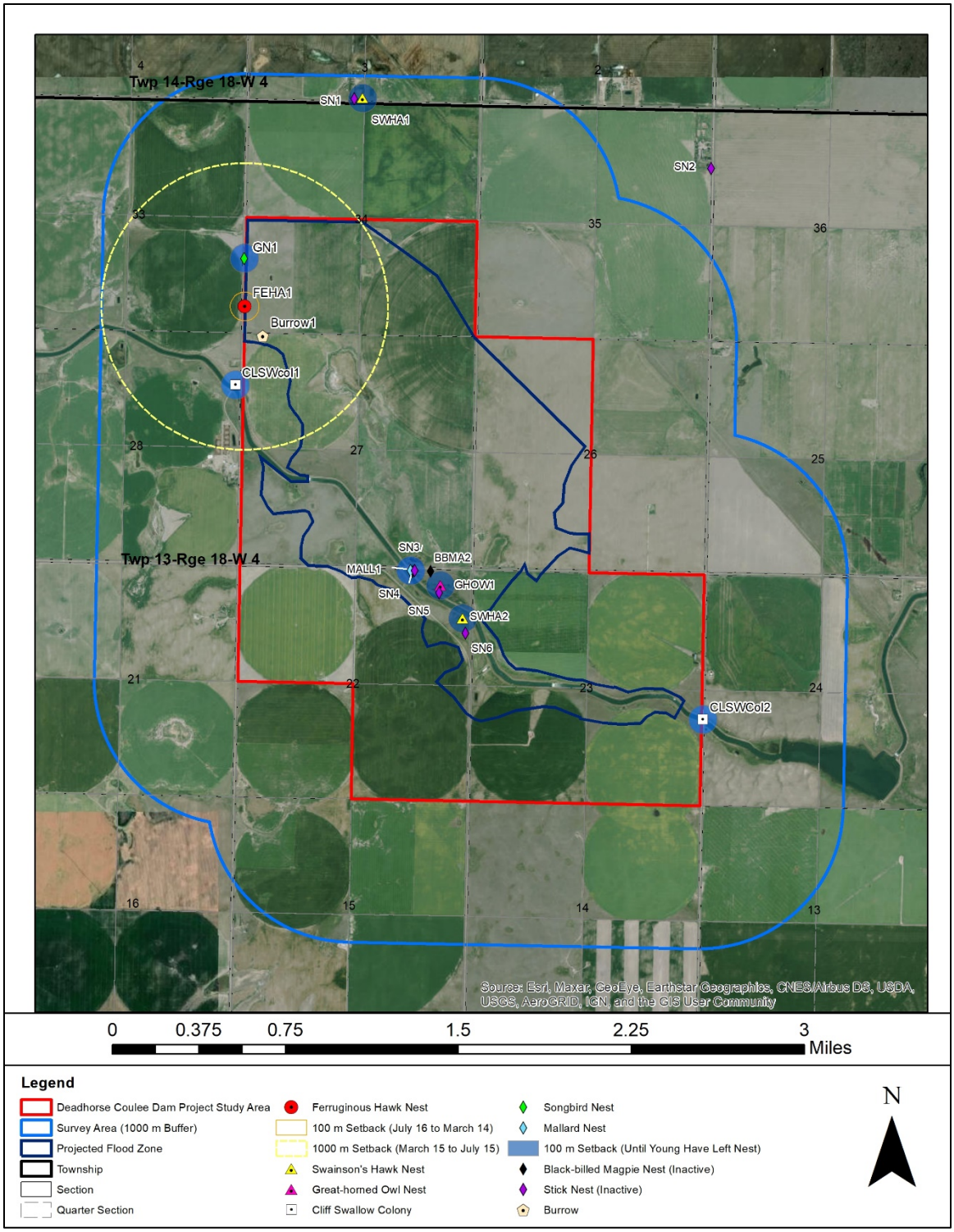

Figure 8. Wildlife features found during wildlife surveys and associated setbacks.

5.2.3 Waterbodies and Watercourses

As indicated by the results of the desktop assessment (Section 4.2.7), the project will be impacting numerous wetlands of various states of permanency. A Wetland Assessment and Impact Report (WAIR) was completed to field verify water features, including temporary, seasonal, semi-permanent, and permanent wetlands, that will be encroached upon or otherwise impacted as a result of project development. In total, 23 wetlands of varying classes were field verified, as opposed to the original 46 presumed wetlands identified during desktop exercises (Table 8), leading to a total of 51.55 ha of wetlands being impacted by the flood zone, or 10.7% of the total flood zone. The WAIR will be completed as a separate document for submission for Water Act approvals.

Table 8. Field verified wetlands, associated wetland class, and wetland size impacted by flood zone.

Wetland Identifier	Wetland Class (AWCS)	Area (ha)
Wetland 1	M-G-II; M-G-III; M-G-IV; W-B-V	29.04
Wetland 2	M-G-II	0.99
Wetland 3	M-G-II; M-G-III	1.58
Wetland 4	M-G-II	0.17
Wetland 5	M-G-II	0.14
Wetland 6	M-G-II	0.33
Wetland 7	M-G-II	2.03
Wetland 8	M-G-III	0.48
Wetland 9	M-G-III	0.24
Wetland 10	S-S-III; M-G-IV; W-B-V	3.35
Wetland 11	S-S-III	0.16
Wetland 12	S-S-III; M-G-III	0.20
Wetland 13	M-G-II	0.01
Wetland 14	M-G-III; M-G-IV; W-B-V	1.25
Wetland 15	M-G-II	0.13
Wetland 16	M-G-II	0.57
Wetland 17	M-G-II; M-G-III	0.92
Wetland 18	M-G-II; W-B-V	3.59
Wetland 19	M-G-III	0.10
Wetland 20	M-G-II; M-G-III; W-B-V	5.75
Wetland 21	M-G-III; W-B-V	0.32
Wetland 22	M-G-III	0.18
Wetland 23	M-G-III	0.02
Total		**51.55**

5.2.4 Fish and Fish Habitat

As indicated by the results of the desktop assessment (Section 4.2.5) a QAES assessment was required to characterize fish habitat quality within portions of the BRID canal system anticipated to be impacted by project works. A QAES assessment was completed in

November 2021 and can be found in Appendix E. This document has been completed as a separate document and will be used to supplement the Department of Fisheries and Oceans application for development.

Five locations along the existing canal system were surveyed. At each location, the biologist assessed channel/canal characteristics (max depth, bed material, and substrate composition) and instream submergent and emergent vegetation. Features of the canal which have the potential to affect fish habitat were described at each site, including but not limited to flood signs, instream cover, riparian vegetation characteristics, and any other applicable information. Using this information, fish habitat quality was evaluated for rearing, spawning, and overwintering habitat and given a rating of excellent, moderate, and poor/nil.

Overall spawning habitat for salmonids was rated low to nil at all 5 locations. Spawning habitat was generally low to moderate for broadcast or small substrate bottom spawners (ie yellow perch, walleye, and northern pike) if they are able to access these locations during the spawning period. Rearing habitat was generally rated as low given low forage and cover limitations and would be generally limited to flow conditions. Overwintering habitat was also generally rated as low to nil given low to zero flow during the winter months. It is also unlikely that the canal currently supports Species at Risk as it is unlikely that bull trout would migrate downstream from upstream reservoirs of the Bow River.

It was determined that creation of the reservoir will likely be favorable for spawning, rearing, and overwintering of numerous fish species, and will also aid in migration of fish which are likely unable to migrate upstream currently given the numerous 4+ m drops at 45 degree gradient.

Detailed results of the assessment can be found in the attached report.

5.3 Discussion

Based on the habitat conditions, sensitive habitat features, and species present during the field assessment, numerous wildlife species are likely to be impacted by development activities, including grassland birds, wetland/riparian birds, raptors, and amphibians. Much of the presumed disturbance will be in the form of habitat loss from the projected flood area, and not the result of direct impacts due to earth works and dam construction.

Of the total projected wetted area (479.8 ha), approximately 327.5 ha (68%) consist of cropland, 51.55 ha (10.7%) of wetland, 34.1 ha (7.1%) of native prairie, and 34.0 ha (7.1%) of tame pasture habitats that will be lost. Anthropogenic features, including approximately 9.1 ha (1.9%) of infrastructure, 16.5 ha (3.4%) of man-made water channels (canal), and

0.4 ha (0.1%) of man-made wetlands/dugouts occurring in proposed flood zone are expected to be lost as a result of project works. The majority (88.2%) of land cover expected to be impacted by flooding is comprised of non-native habitat types. Though altered landscapes, such as cropland and tame pasture/hayland, may still support native biota, species richness is significantly less when compared to native grassland ecosystems (Javorek et al. 2006). Furthermore, habitat quality is degraded in these areas, as the availability of resources required for breeding, foraging, and for cover, is limited (Javorek et al. 2006). Impacts to local terrestrial wildlife habitat quality and quantity are therefore not anticipated to be significant.

Although not quantified, the development of the reservoir will create approximately 479.8 ha of open water habitat that will be utilized by a variety of species for during various portions of their life cycle. The newly created reservoir is anticipated to create habitat for waterfowl and shorebird breeding and migration, breeding and overwintering for amphibians, breeding for wetland dependent passerine species, and year-round habitats supporting the life cycles of numerous fish species.

Disturbance of vegetation, including native and tame grasslands, shrubs, and trees in the project footprint during certain periods of the year (i.e., spring and early summer) has the potential to disrupt breeding and nesting activity of grassland and wetland/riparian bird species in the area, and may lead to nest abandonment, nest destruction, and incidental take. A number of species documented during survey activities are protected under the federal *Migratory Birds Convention Act* (*MBCA*) which prohibits the destruction of nests of specified avian species. Although not typically utilized for nesting as much as other habitat types, cultivated lands are also utilized by ground nesting avian species such as grassland passerines and waterfowl. For this reason, the timing of construction and flooding are important considerations in mitigating potential impacts on these species. Birds in the area generally breed between April 15th and August 15th (GOC 2018), with species such as burrowing owl breeding even earlier (April 1st to August 15th). It is therefore recommended that project construction and reservoir flooding take place outside of the breeding bird period, to appropriately mitigate negative effects to nesting birds.

Several species of raptors, and several raptor nests, were documented in the project study area during the field assessment, including the ferruginous hawk. Ferruginous hawks are ground-squirrel specialists, and typically are associated with large tracks of native prairie. Approximately 40% of lands within 1 km of the nest will be lost, which are primarily cultivated habitats typically not heavily utilized by ground-squirrels. It is presumed that these lands would not be the primary foraging grounds for these hawks and impacts to prey availability should be minimal. As per the SSIG guidelines (GOA 2013), the nesting sites of ferruginous hawk are considered to be active, with a corresponding protective

development buffer, up until a period of two years of inactivity; after which protective timing constraints and associated setbacks no longer apply. It is therefore recommended that the activity of the nest (FEHA1) be monitored prior to construction, to determine nest activity during subsequent nesting periods. If the nest remains active prior to construction and flooding of the reservoir, obtaining a permit from AEP for the translocation of the nest to a suitable location (tree or newly erected nest platform at least 1000 m from the project and in an area with high prey availability) may be warranted to offset the disturbance of this sensitive habitat feature.

One Swainson's hawk nest and one great-horned owl nest were also identified within the project area (Figure 8). These features are also anticipated to be directly affected by project development. However, these raptor species tend to be more generalist in nature and will utilized a variety of landscapes for foraging. It is recommended that construction take place in the fall or winter, outside of the breeding/nesting/fledging season. Swainson's hawks and great-horned owls are 'Secure' in Alberta and a 100 m setback is recommended for nests during the nesting season, until the young have fledged. It is also recommended that a raptor nest survey be repeated prior to construction to ensure no additional raptors have established nests within the project area or will be impacted by active construction. As one of the two Swainson's hawk nests documented during the field assessment is located 800 m north of the project study area, no additional mitigation is recommended for this nest.

Multiple black-billed magpie nests (inactive at the time of survey) were observed within, and immediately adjacent to, the project area (Figure 8). As the black-billed magpie is within the Corvidae family, it is not included within the *MBCA* and is considered a non-license animal under the Alberta *Wildlife Act*. The nests of these species are therefore not protected provincially or federally. However, it is still recommended that best management practices be applied, whereby the removal of trees and nests should be conducted outside the breeding and nesting period for birds in the region, to ensure no birds are harmed in the process (as well as to prevent the accidental take of other bird nests in these areas).

Areas of suitable burrowing owl habitat (e.g., grassland, flat to rolling topography, ground squirrel burrows [GOA 2013]) are present but scarce in the project area, and no burrowing owls or sign of burrowing owl activity was observed during the field assessment. While the likelihood of burrowing owls occupying the project footprint is low given the extent of cultivation in the project area, the project does fall within burrowing owl range, and burrowing owls have been historically documented in the vicinity. It is therefore recommended that dam construction and flooding take place from August 16th to March 31st, after the breeding and nesting period for the species.

Two species of amphibians were observed within the project study area. In addition, the project is located within sensitive amphibian range, with suitable habitat (e.g., wetlands and dugouts with emergent vegetation) present. As waterbody setbacks (e.g., 100 m) cannot be accommodated due to the nature of the project, alternative mitigation is recommended to minimize impacts to amphibians. It is recommended that silt fencing be installed around the work site to prevent amphibians from entering the work area. Silt fencing should be inspected by a qualified biologist to ensure correct installation. Any amphibians trapped by the silt fence should be removed and relocated by a qualified biologist. Open excavations should be inspected daily for trapped amphibians, and if any amphibians are found, they should be relocated by a qualified biologist. A spill contingency plan should also be in place, and all equipment and trucks should be equipped with spill kits. Fuel should be stored at least 100 m from waterbodies and hazardous materials should be stored in designated areas.

If draining of waterbodies are to occur, draining should be timed when amphibians are least likely to be present either in an active (e.g., breeding) or inactive (e.g., torpor) state (Randall et al. 2018). In the prairies, amphibians typically congregate in wetlands to breed between the April and June, where they metamorphosize between sensitive life stages (GOA 2013). Young typically disperse from ponds in late summer and may potentially use ponds to overwinter in. It is therefore recommended draining activities, if required, occur in late summer/early fall to avoid disturbance to breeding and overwintering amphibians. Should drainage occur during an alternative period, an amphibian salvage plan should be developed in consultation with AEP to ensure that impacts to amphibians are mitigated. During the post-construction phase of the project, amphibians could be attracted to the constructed reservoir. Design considerations that would benefit amphibian species using these areas would include avoiding constructing steep side slopes in the reservoir which may trap amphibians (Randall et al. 2018).

Numerous wetlands of varying classifications were documented in the project study area. Due to the nature of the project, avoidance of these waterbodies is not feasible. Appropriate topsoil stripping and soil handling should be conducted during excavation within wetlands, if applicable, in order to minimize wind and water erosion, as well as reduce weed establishment. As there will be wetland loss, there will be a requirement for paid compensation for wetland replacement as per the Alberta Wetland Mitigation Directive (AEP 2018). Erosion and sediment control measures should also be implemented when working near the BRID canal system, as fish species may be present in the channel. The *Fisheries Act* (GOC 1985) prohibits the harmful alteration, disruption, or destruction of fish and associated habitat. Project-specific mitigations related to fish species in the area should be adhered to as outlined in the QAES report for the project.

5.4 Conclusions and Recommendations

Upon completion of the project, habitat in the project area will be altered from a largely terrestrial landscape to an aquatic one. The majority of the project footprint is highly disturbed (cultivated) and is of relatively low habitat value to wildlife. However, areas of tame and native grasslands, trees/shrubs, and wetland habitat support a diversity of plant and wildlife species. The proposed project will decrease the amount of available grassland habitat for some species, particularly grassland birds, as well as treed habitat for prairie raptors, and to an extent, wetland habitat for some riparian birds and amphibians. Though there may be some short-term displacement of wildlife throughout the construction process, long-term impacts to wildlife and suitable habitats as a result of reservoir flooding are not anticipated to be significant. The application of appropriate environmental mitigation strategies during project planning and construction will reduce the likelihood of adverse impacts to wildlife and other environmental receptors. In summary, the following mitigation should be considered:

- Vegetation disturbance (e.g., mowing, stripping, tree removal, etc.) in upland habitats should occur from September 1st to April 1st to avoid the breeding bird window in this region of Alberta.
- Vegetation and/or soil disturbance in and around wetlands and draining of wetlands should occur in the fall prior to the winter to avoid sensitive time periods for breeding or overwintering amphibians. Works conducted in the month of September would generally avoid timeframes associated with breeding and or overwintering activities.
- A 1000 m setback is required for ferruginous hawk nests between the period of March 15th and July 15th, and a 100 m setback should be maintained between July 16th and March 14th. Construction activities should adhere to these timelines and buffers where appropriate if the nest is still deemed active.
- Monitoring of the ferruginous hawk nest should occur every two years, prior to construction. If nest remains active, consultation with AEP may be required to develop appropriate steps for the translocation of the nest.
- Silt fence and open trenches should be inspected for trapped amphibians daily when works are occurring within 100 m of wetland habitats. If relocation is required, amphibians should be moved by a qualified biologist.
- A spill contingency plan should be in place and fuel/hazardous material should be stored 100 m from waterbodies.
- Weed control measures should be in place as per the *Weed Control Act* to control the spread and establishment of prohibited and noxious weeds in and around the project.

- Topsoil stripping and soil handling measures must be in place during construction/excavation and should minimize wind and water erosion and reduce the establishment of weeds.
- Complete a Department of Fisheries and Oceans *Request for Review* prior to construction
- Conduct appropriate Environmental Site Assessments to ensure contaminated sites have been remediated prior to flooding.
- The area is within a Yellow Decontamination Zone (GoA 2021), therefore develop a decontamination plan for all equipment and potential exposure areas.
- Develop a Sediment and Erosion Control and Clean and Dirty Water Plan for the management of all water during each phase of construction.
- Develop a detailed ECO Plan which includes fish handling.
- Acquire regulatory permits and approvals.
- Obtain FRL for fish removal and relocation for isolations or fish removal from pooled areas where required.

6 Signature

The undersigned has personally inspected the subject property and considered relevant factors and influences pertinent within the scope of the assessment.

The undersigned has no past, present, or contemplated interest in the assessed property.

I have reviewed the information as submitted and completed this report in conformity with the Code of Ethics and the Duties of Professional Biologists.

Respectfully Submitted:

<Original signed by>

Brook Skagen, B.Sc., P.Biol.
Bear Tracks Environmental Services (2015) Ltd.

Reviewed by:

<Original signed by>

Darryl Jarina, B.Sc., P.Biol.
Bear Tracks Environmental Services (2015) Ltd.

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Appendix A – Site Photographs

Photo 1: Great-horned owl nest (GHOW1) observed in the proposed project area (12U 401787E 5551224N).

Photo 2: Swainson's hawk nest (SWHA2) observed in the proposed project area (12U 401942E 5550995N).

Photo 3: Ferruginous hawk observed at active nest FEHA1 (12U 400420E 5553170N) in the proposed project area.

Photo 4: Example of cropland cover in the proposed project area.

Photo 5: Example of limited native grassland cover in the proposed project area.

Photo 6: Example of hayland cover in the proposed project area.

Photo 7: Example of canal habitat in the proposed project area.

Photo 8: Example of limited treed habitat in the proposed project area.

Photo 9: Example of burrows observed within the proposed project area.

Photo 10: Example of wetland habitat in the proposed project area.

Appendix B – Background Information Review Search Results

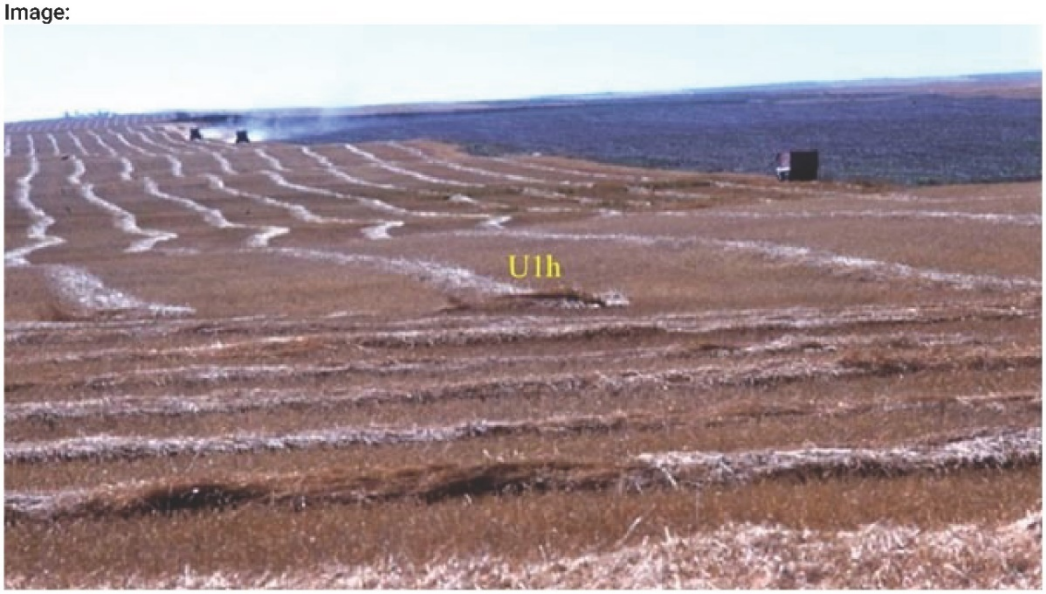
Alberta Agriculture and Forestry

Report on Soil Polygon: 1818

Variable	Value
POLY_ID	1818
Map Unit Name	CFMA1/U1h
Landform	U1h - undulating - high relief
LSRS Rating (Spring Grains)	4M(10)

Landscape Model Descriptions:
Orthic Brown Chernozem on medium textured (L, SiCL, CL) materials over medium (L, CL) or fine (C) textured till (CFD).
Orthic Brown Chernozem on medium textured (L, CL) till (MAB).
The polygon may include soils that are not strongly contrasting from the dominant or co-dominant soils (1).
Undulating, high relief landform with a limiting slope of 4% (U1h).

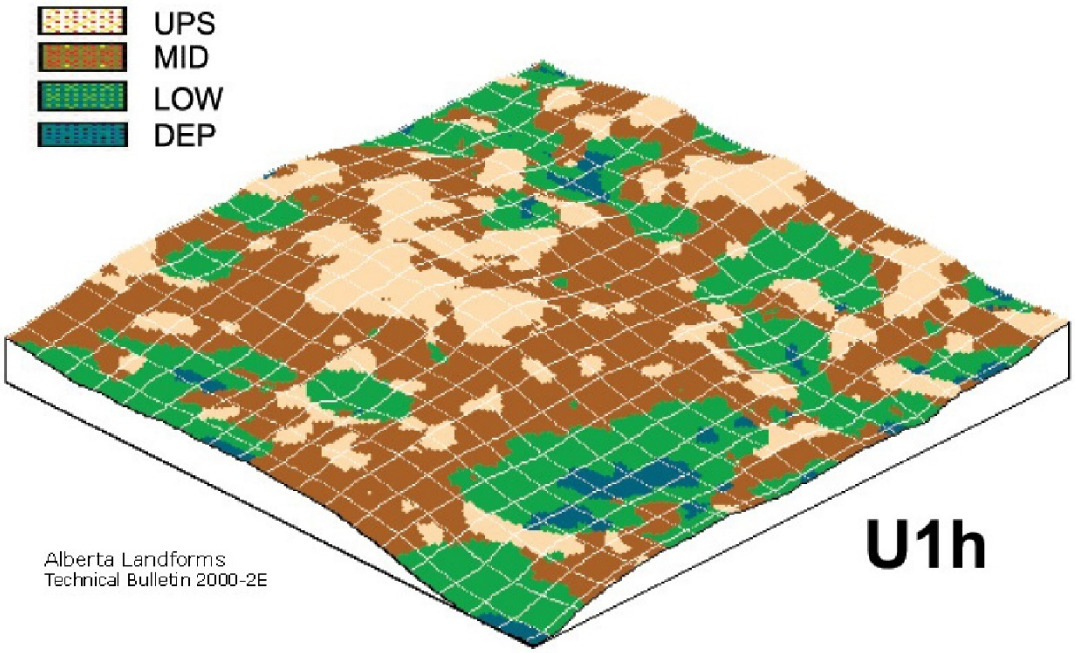
Image:



1/28/2021 Generated by the Alberta Soil Information Viewer 1 of 3

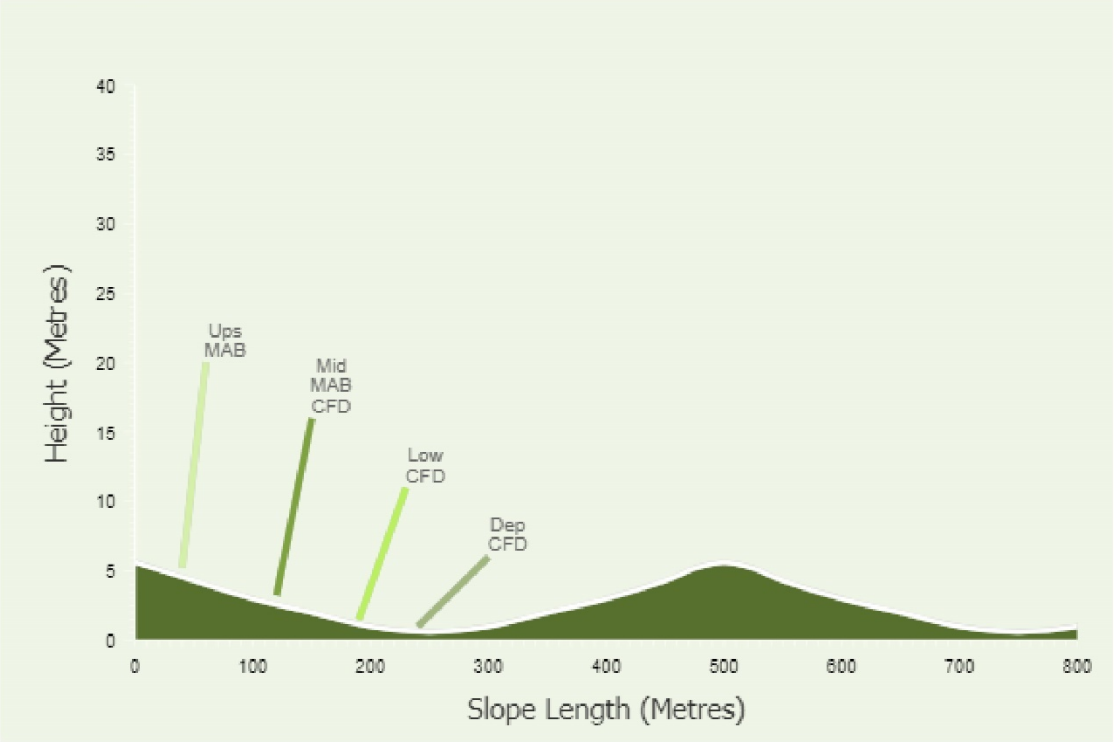
Alberta Agriculture and Forestry

Landform Model:

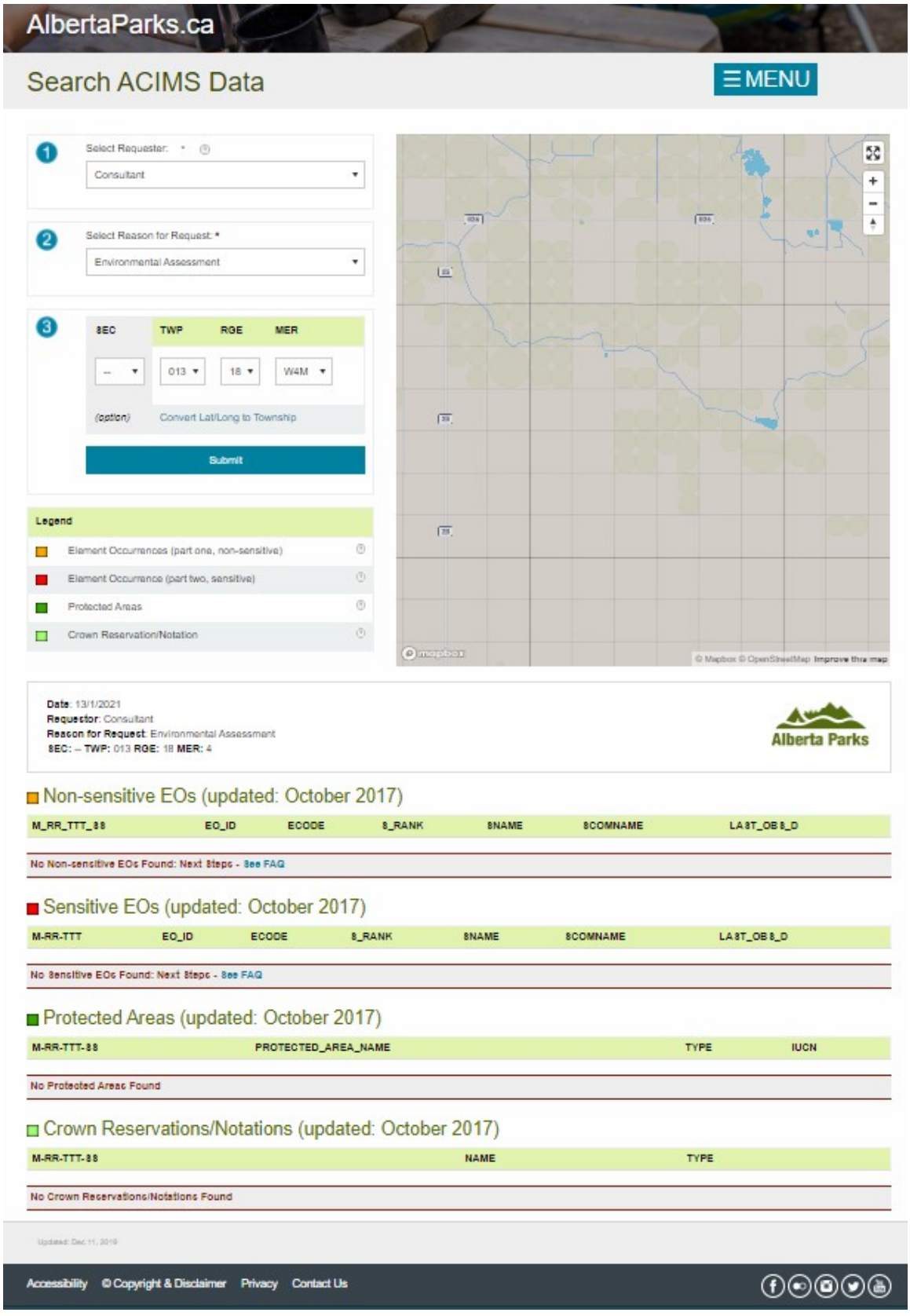


Alberta Agriculture and Forestry

Landform Profile:



1/28/2021 Generated by the Alberta Soil Information Viewer 3 of 3



AlbertaParks.ca

Search ACIMS Data

☰MENU

1 Select Requester: *
Consultant

2 Select Reason for Request: *
Environmental Assessment

3 SEC TWP RGE MER
-- 013 18 W4M
(option) Convert Lat/Long to Township
Submit

Legend
Element Occurrences (part one, non-sensitive)
Element Occurrence (part two, sensitive)
Protected Areas
Crown Reservation/Notation

Date: 13/1/2021
Requestor: Consultant
Reason for Request: Environmental Assessment
SEC: -- **TWP**: 013 **RGE**: 18 **MER**: 4

Alberta Parks

Non-sensitive EOs (updated: October 2017)

M_RR_TTT_SS	EO_ID	ECODE	S_RANK	SNAME	SCOMNAME	LASTOBSD
No Non-sensitive EOs Found: Next Steps - See FAQ						

Sensitive EOs (updated: October 2017)

M-RR-TTT	EO_ID	ECODE	S_RANK	SNAME	SCOMNAME	LASTOBSD
No Sensitive EOs Found: Next Steps - See FAQ						

Protected Areas (updated: October 2017)

M-RR-TTT-SS	PROTECTED_AREA_NAME	TYPE	IUCN
No Protected Areas Found			

Crown Reservations/Notations (updated: October 2017)

M-RR-TTT-SS	NAME	TYPE
No Crown Reservations/Notations Found		

Updated: Dec 11, 2019

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Alberta Environment and Parks

Fish and Wildlife Internet Mapping Tool (FWIMT)

(source database: Fish and Wildlife Management Information System (FWMIS))

Species Summary Report

Report Date: 13-Jan-2021 12:09

Species present within the current extent

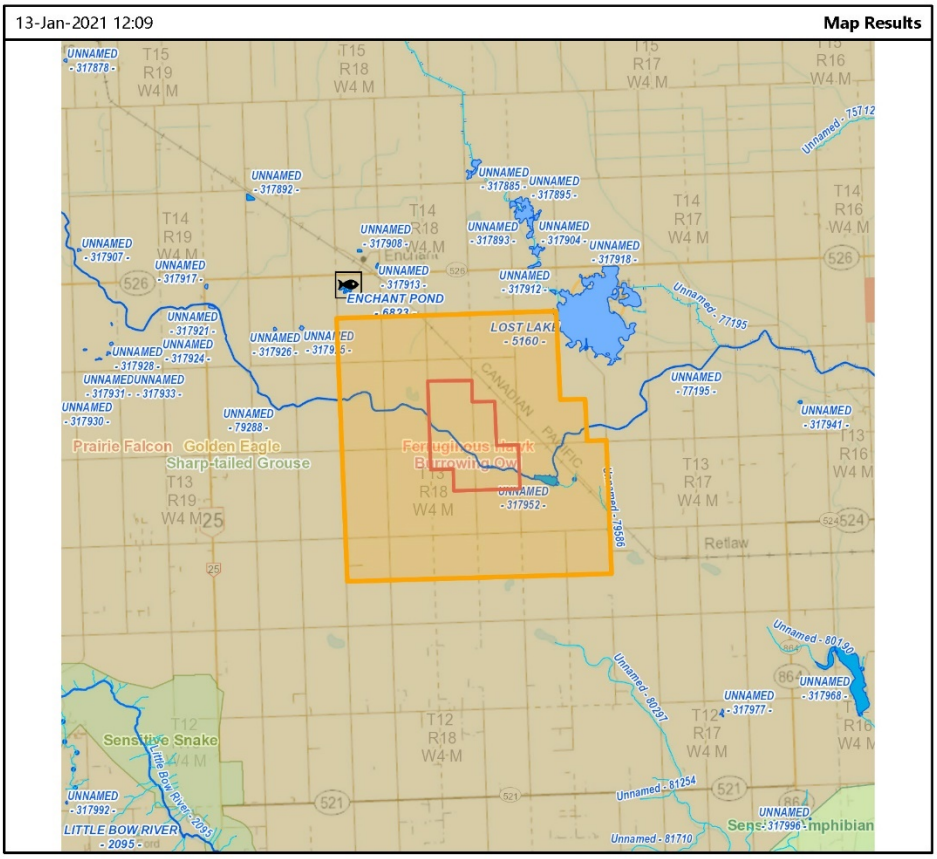
Fish Inventory	Wildlife Inventory	Stocked Inventory
	BADGER	No Species Found in Search Extent
	BLACK-NECKED STILT	
	BURROWING OWL	
	CHESTNUT-COLLARED LONGSPUR	
	FERRUGINOUS HAWK	
	GREAT BLUE HERON	
	GREAT PLAINS TOAD	
	LOGGERHEAD SHRIKE	
	LONG-BILLED CURLEW	
	SORA	
	SPRAGUE'S PIPIT	

Buffer Extent

Centroid (X,Y)	Projection	Centroid (Qtr Sec Twp Rng Mer)	Radius or Dimensions
687946, 5551527	10-TM AEP Forest	SW 26 13 18 4	10147, 9975 meters

Contact Information

For contact information, please visit:
https://www.alberta.ca/fisheries-and-wildlife-management-contacts.aspx



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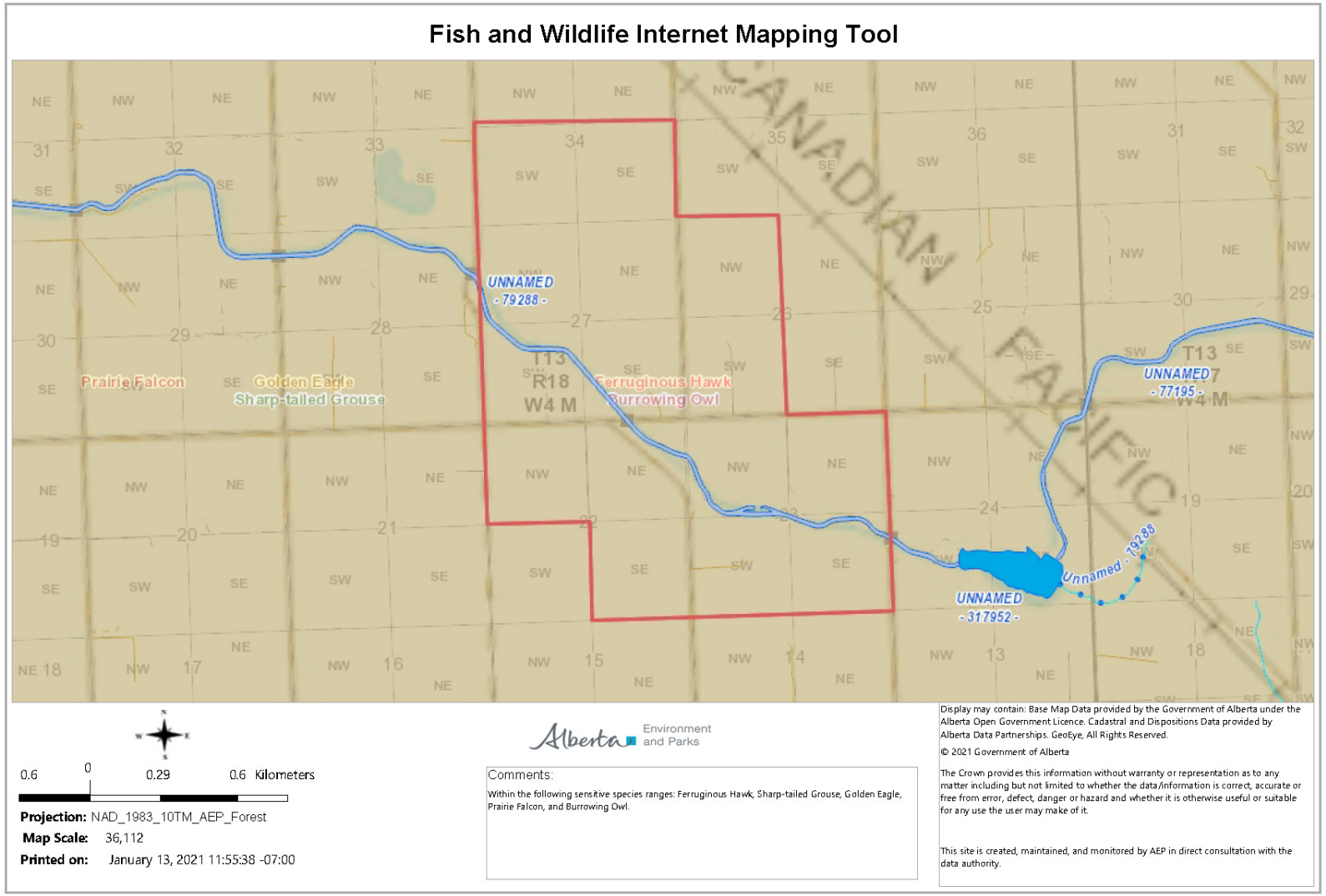
Fish and Wildlife Internet Mapping Tool
UNNAMED
- 79288 -
Prairie Falcon
Golden Eagle
Sharp-tailed Grouse
Ferruginous Hawk
Burrowing Owl
T13
R18
W4 M
UNNAMED
- 77195 -
Unnamed - 19288
UNNAMED
- 317952 -
CANADIAN PACIFIC
0.6 0 0.29 0.6 Kilometers
Projection: NAD_1983_10TM_AEP_Forest
Map Scale: 36,112
Printed on: January 13, 2021 11:55:38 -07:00
Alberta Environment and Parks
Comments:
Within the following sensitive species ranges: Ferruginous Hawk, Sharp-tailed Grouse, Golden Eagle, Prairie Falcon, and Burrowing Owl.
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This site is created, maintained, and monitored by AEP in direct consultation with the data authority.

Alberta Environment and Parks

Fish and Wildlife Internet Mapping Tool (FWIMT)

(source database: Fish and Wildlife Management Information System (FWMIS))

Species Summary Report

Report Date: 03-Feb-2021 11:26

Species present within the current extent

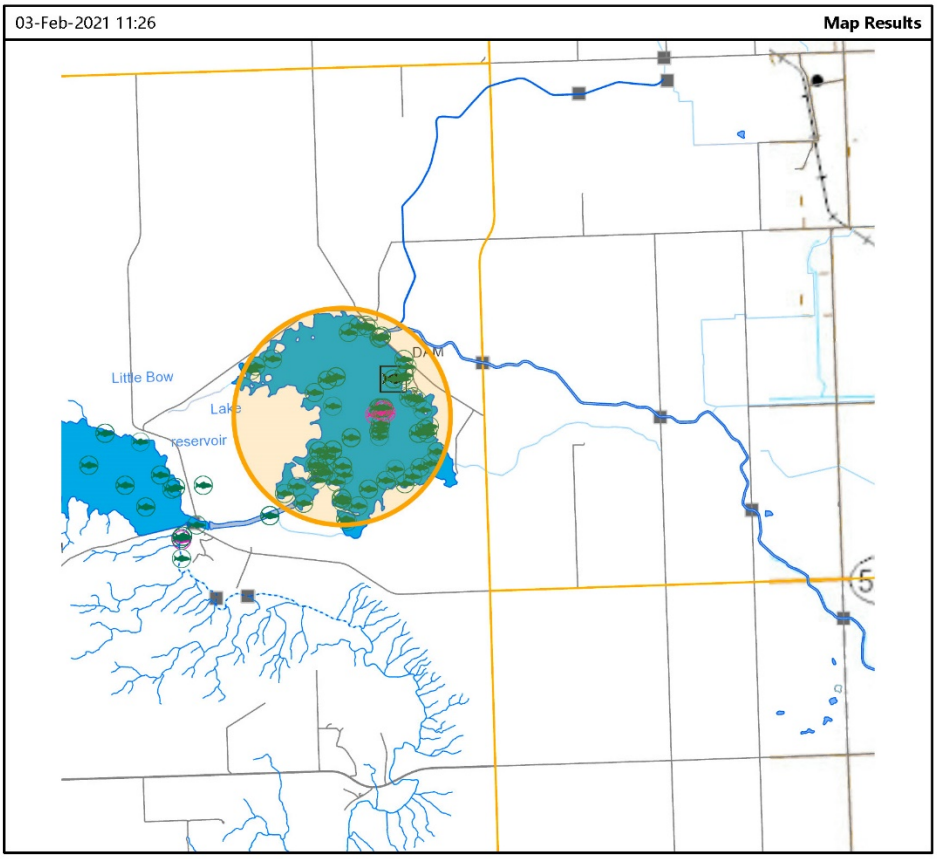
Fish Inventory	Wildlife Inventory	Stocked Inventory
BROWN TROUT	AMERICAN WHITE PELICAN	WALLEYE
BURBOT	BARN SWALLOW	
LAKE TROUT	BREWER'S SPARROW	
LAKE WHITEFISH	CHESTNUT-COLLARED LONGSPUR	
LONGNOSE SUCKER	EASTERN KINGBIRD	
NORTHERN PIKE	GREAT BLUE HERON	
RAINBOW TROUT	MCCOWN'S LONGSPUR	
SPOTTAIL SHINER	SPRAGUE'S PIPIT	
TROUT-PERCH		
TULLIBEE (CISCO)		
WALLEYE		
WHITE SUCKER		
YELLOW PERCH		

Buffer Extent

Centroid (X,Y)	Projection	Centroid (Qtr Sec Twp Rng Mer)	Radius or Dimensions
665511, 5560556	10-TM AEP Forest	SW 28 14 20 4	2 kilometers

Contact Information

For contact information, please visit:
https://www.alberta.ca/fisheries-and-wildlife-management-contacts.aspx



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Appendix C - Plant Species Table

Common Name	Latin Name	S-Rank
Forbs		
Alfalfa	*Medicago sativa*	SNA
Balsam groundsel	*Packera paupercula*	S5
Broomweed	*Gutierrezia sarothrae*	S5
Bull thistle	*Cirsium vulgare*	SNA
Canada goldenrod	*Solidago canadensis*	S5
Common dandelion	*Taraxacum officinale*	SNA
Common goat's-beard	*Tragopogon dubius*	SNA
Common yarrow	*Achillea millefolium*	S5
Cow cress	*Lepidium campestre*	SNA
Creeping thistle	*Cirsium arvense*	SNA
Creeping white prairie aster	*Symphyotrichum falcatum*	S5
Curled dock	*Rumex crispus*	SNA
Curly-cup gumweed	*Grindelia squarrosa*	S4S5
Cushion cactus	*Coryphantha vivipara*	S3
Dotted blazingstar	*Liatris punctata*	S5
Early cinquefoil	*Potentilla concinna*	S4
Flixweed	*Descurainia sophia*	SNA
Fremont's goosefoot	*Chenopodium fremontii*	S2
Golden aster	*Heterotheca villosa*	S5
Golden bean	*Thermopsis rhombifolia*	S5
Golden dock	*Rumex maritimus var. fueginus*	S5
Kochia	*Kochia scoparia*	SNA
Lamb's-quarters	*Chenopodium album*	SNA
Littleleaf pussytoes	*Antennaria microphylla*	S5
Low goldenrod	*Solidago missouriensis*	S5
Moss phlox	*Phlox hoodii*	S5
Narrow-leaved hawkweed	*Hieracium umbellatum*	S5
Narrow-leaved milk vetch	*Astragalus pectinatus*	S5
Oak-leaved goosefoot	*Chenopodium salinum*	S5
Pasture sagewort	*Artemisia frigida*	S5
Perennial sow-thistle	*Sonchus arvensis*	SNA
Prairie coneflower	*Ratibida columnifera*	S4
Prairie rocket	*Erysimum asperum*	S3
Prairie sagewort	*Artemisia ludoviciana*	S5
Prairie selaginella	*Selaginella densa*	S5
Prickly lettuce	*Lactuca serriola*	SNA
Samphire	*Salicornia rubra*	S5
Scarlet mallow	*Sphaeralcea coccinea*	S5
Silverweed	*Potentilla anserina*	S5
Skeletonweed	*Lygodesmia juncea*	S5
Slender blue beardtongue	*Penstemon procerus*	S5
Spear-leaved goosefoot	*Monolepis nuttalliana*	S5

Star-flowered Solomon's-seal	*Maianthemum stellatum*	S5
Tall buttercup	*Ranunculus acris*	SNA
Tufted fleabane	*Erigeron caespitosus*	S5
Wavy-leaved thistle	*Cirsium undulatum*	S3
Western dock	*Rumex occidentalis*	S5
Western fairy candelabra	*Androsace occidentalis*	S3
Western sea-blite	*Suaeda calceoliformis*	S5
White sweet-clover	*Melilotus albus*	SNA
Wild licorice	*Glycyrrhiza lepidota*	S4
Yellow sweet-clover	*Melilotus officinalis*	SNA
Grasses and Grass-Likes		
Blue grama	*Bouteloua gracilis*	S5
Common cattail	*Typha latifolia*	S5
Common scouring-rush	*Equisetum hyemale*	S5
Creeping spike-rush	*Eleocharis palustris*	S5
Crested wheatgrass	*Agropyron cristatum*	SNA
Foxtail barley	*Hordeum jubatum*	S5
Great bulrush	*Schoenoplectus acutus var. acutus*	S5?
Intermediate wheatgrass	*Thinopyrum intermedium*	SNA
June grass	*Koeleria macrantha*	S5
Kentucky bluegrass	*Poa pratensis*	S5
Needle-and-thread	*Stipa comata*	S5
Nuttall's salt-meadow grass	*Puccinellia nuttalliana*	S5
Parry’s sedge	*Carex parryana*	S3
Plains muhly	*Muhlenbergia cuspidata*	S4
Plains reed grass	*Calamagrostis montanensis*	S5
Prairie onion	*Allium textile*	S5
Reed canary grass	*Phalaris arundinacea*	S5
Rough hair grass	*Agrostis scabra*	S5
Saltgrass	*Distichlis spicata*	S4
Sandberg bluegrass	*Poa secunda*	S5
Scratch grass	*Muhlenbergia asperifolia*	S3
Slender wheat grass	*Agropyron trachycaulum*	S5
Small bottle sedge	*Carex utriculata*	S5
Small-fruited bulrush	*Scirpus microcarpus*	S5
Smooth brome	*Bromus inermis*	SNA
Smooth wild rye	*Elymus glaucus*	S4
Softstem bulrush	*Scirpus validus*	S5
Sweetgrass	*Hierochloe odorata*	S5
Sun sedge	*Carex inops ssp. heliophila*	S5
Three-square rush	*Schoenoplectus pungens*	S4
Timothy	*Phleum pratense*	SNA
Water sedge	*Carex aquatilis*	S5
Western wheat grass	*Pascopyrum smithii*	S5
Wild oat	*Avena fatua*	SNA
Wire rush	*Juncus balticus*	S5
Shrubs		
Buckbrush	*Symphoricarpos occidentalis*	S5

Choke cherry	*Prunus virginiana*	S5
Nuttall's atriplex	*Atriplex nuttallii*	SNR
Narrow-leaf willow	*Salix exigua*	S3S4
Prairie rose	*Rosa arkansana*	S5
Prickly rose	*Rosa acicularis*	S5
Snowberry	*Symphoricarpos albus*	S5
Thorny buffaloberry	*Shepherdia argentea*	S3
Winter-fat	*Krascheninnikovia lanata*	S5
Trees		
Narrowleaf cottonwood	*Populus angustifolia*	S3
Plains cottonwood	*Populus deltoides*	S3

Appendix D – Wildlife Species Table

Common Name	Latin Name	Species Status			
		AB General Status[1]	WA[2]	COSEWIC[3]	SARA[4]
Amphibians					
Boreal Chorus Frog	*Pseudacris maculate*	Secure	-	-	-
Plains Spadefoot	***Spea bombifrons***	**May Be at Risk**	-	**Not at Risk**	**No Status**
Birds					
American Avocet	*Recurvirostra americana*	Secure	-	-	-
American Coot	*Fulica americana*	Secure	-	Not at Risk	-
American Crow	*Corvus brachyrhynchos*	Secure	-	-	-
American Goldfinch	*Spinus tristis*	Secure	-	-	-
American Robin	*Turdus migratorius*	Secure	-		
American Wigeon	*Anas americana*	Secure	-	-	-
Baird's Sparrow	***Ammodramus bairdii***	**Sensitive**	-	**Special Concern**	**Special Concern**
Baltimore Oriole	***Icterus galbula***	**Sensitive**	-	-	-
Bank Swallow	***Riparia riparia***	**Sensitive**	-	**Threatened**	**Threatened**
Barn Swallow	***Hirundo rustica***	**May Be at Risk**	-	**Special Concern**	**Threatened**
Black-Billed Magpie	*Pica hudsonia*	Secure	-	-	-
Black-Capped Chickadee	*Poecile atricapillus*	Secure	-	-	-
Black-Necked Stilt	***Himantopus mexicanus***	**Sensitive**	-	-	-
Blue Jay	*Cyanocitta cristata*	Secure			
Blue-Winged Teal	*Anas discors*	Secure	-	-	-
Brewer's Blackbird	*Euphagus cyanocephalus*	Secure	-	-	-
Brown-Headed Cowbird	*Molothrus ater*	Secure	-	-	-
Bufflehead	*Bucephala albeola*	Secure	-	-	-
California Gull	*Larus californicus*	Secure	-	-	-
Canada Goose	*Branta canadensis*	Secure	-	-	-
Chestnut-Collared Longspur	***Calcarius ornatus***	**At Risk**	-	**Endangered**	**Threatened**
Cinnamon Teal	*Anas cyanoptera*	Secure	-	-	-
Clay-Colored Sparrow	*Spizella palida*	Secure	-	-	-

Common Name	Latin Name	Species Status			
		AB General Status[1]	WA[2]	COSEWIC[3]	SARA[4]
Cliff Swallow	*Petrochelidon pyrrhonota*	Secure	-	-	-
Common Grackle	*Quiscalus quiscula*	Secure	-	-	-
Common Raven	*Corvus corax*	Secure	-	-	-
Common Yellowthroat	***Geothlypis trichas***	**Sensitive**	-	-	-
Double-Crested Cormorant	*Phalacrocorax auritus*	Secure	-	Not at Risk	-
Eastern Kingbird	***Tyrannus tyrannus***	**Sensitive**	-	-	-
European Starling	*Sturnus vulgaris*	Exotic	-	-	-
Evening Grosbeak	***Coccothraustes vespertinus***	**Secure**	-	**Special Concern**	**Special Concern**
Ferruginous Hawk	***Buteo regalis***	**At Risk**	**Endangered**	**Special Concern**	**Threatened**
Forster's Tern	***Sterna forsteri***	**Sensitive**	-	**Data Deficient-**	-
Franklin's Gull	*Leucophaeus pipixcan*	Secure	-	-	-
Gadwall	*Anas strepera*	Secure	-	-	-
Gray Catbird	*Dumetella carolinensis*	Secure	-	-	-
Gray Partridge	*Perdix perdix*	Exotic	-	-	-
Great Horned Owl	*Bubo virginianus*	Secure	-	-	-
Greater Yellowlegs	*Tringa melanoleuca*	Secure	-	-	-
Green-Winged Teal	*Anas crecca*	Secure	-	-	-
Horned Lark	*Eremophila alpestris*	Secure	-	-	-
House Finch	*Carpodacus mexicanus*	Secure	-	-	-
House Sparrow	*Passer domesticus*	Exotic	-	-	-
House Wren	*Troglodytes aedon*		-	-	-
Killdeer	*Charadrius vociferus*	Secure	-	-	-
Lapland Longspur	*Calcarius lapponicus*	Secure	-	-	-
Least Flycatcher	***Empidonax minimus***	**Sensitive**	-	-	-
Lesser Scaup	*Aythya affinis*	Secure	-	-	-
Lincoln’s Sparrow	*Melospiza lincolnii*	Secure	-	-	-
Long-Billed Curlew	***Numenius americanus***	**May Be at Risk**	**Special Concern**	**Special Concern**	**Special Concern**
Mallard	*Anas platyrhynchos*	Secure	-	-	-
Marbled Godwit	*Limosa fedoa*	Secure	-	-	-
Marsh Wren	*Cistothorus palustris*	Secure	-	-	-

Common Name	Latin Name	Species Status			
		AB General Status[1]	WA[2]	COSEWIC[3]	SARA[4]
Merlin	*Falco columbarius*	Secure	-	Not at risk-	-
Mourning Dove	*Zenaida macroura*	Secure	-	-	-
Nelson's Sharp-Tailed Sparrow	*Ammodramus nelsoni*	Secure	-	Not at Risk	-
Northern Harrier	*Circus cyaneus*	Secure	-	Not at Risk	-
Northern Pintail	*Anas acuta*	Secure	-	-	-
Northern Shoveler	*Anas clypeata*	Secure	-	-	-
Prairie Falcon	***Falco mexicanus***	**Sensitive**	**Special Concern**	**Not at Risk**	**No Status**
Redhead	*Aythya americana*	Secure	-	-	-
Red-Winged Blackbird	*Agelaius phoeniceus*	Secure	-	-	-
Ring-Billed Gull	*Larus delawarensis*	Secure	-	-	-
Rock Pigeon	*Columba livia*	Exotic	-	-	-
Savannah Sparrow	*Passerculus sandwichensis*	Secure	-	-	-
Say's Phoebe	*Sayornis saya*	Secure	-	-	-
Sora	***Porzana carolina***	**Sensitive**	**-**	**-**	**-**
Spotted Sandpiper	*Actitis macularius*	Secure	-	-	-
Swainson's Hawk	*Buteo swainsoni*	Secure	-	-	-
Thick-Billed Longspur	**Rhynchophanes mccownii**	**May Be At Risk**	-	**Threatened**	**Threatened**
Tundra Swan	Cygnus columbianus	Secure	-	-	-
Vesper Sparrow	*Pooecetes gramineus*	Secure	-	-	-
Western Kingbird	*Tyrannus verticalis*	Secure	-	-	-
Western Meadowlark	*Sturnella neglecta*	Secure	-	-	-
Western Wood-Pewee	*Contopus sordidulus*	**May Be At Risk**	-	-	-
Willet	*Tringa semipalmata*	Secure	-	-	-
Wilson's Phalarope	*Phalaropus tricolor*	Secure	-	-	-
Wilson's Snipe	*Gallinago gallinago*	Secure	-	-	-
Yellow-Headed Blackbird	*Xanthocephalus xanthocephalus*	Secure	-	-	-
Yellow Warbler	*Setophaga petechia*	Secure	-	-	-
Mammals					
American Badger	***Taxidea taxus***	**Sensitive**	**Data Deficient**	**Special Concern**	**Special Concern**
Coyote	*Canis latrans*	Secure	-	-	-
Mule Deer	*Odocoileus hemionus*	Secure	-	-	-
Muskrat	*Ondatra zibethicus*	Secure	-	-	-

Common Name	Latin Name	Species Status			
		AB General Status[1]	WA[2]	COSEWIC[3]	SARA[4]
Nuttal's Cottontail	*Sylvilagus nuttalli*	Secure	-	-	-
Richardson's Ground Squirrel	*Spermophilus richardsonii*	Secure	-	-	-
White-Tailed Deer	*Odocoileus virginianus*	Secure	-	-	-
White-Tailed Jackrabbit	*Lepus townsendii*	Secure	-	-	-

1 - Government of Alberta. 2017. Alberta Wild Species General Status Listing - 2015. Available at: https://open.alberta.ca/dataset/ad0cb45c-a885-4b5e-9479-52969f220663/resource/763740c0-122e-467b-a0f5-a04724a9ecb9/download/sar-2015wildspeciesgeneralstatuslist-mar2017.pdf

2 - Province of Alberta. 1997. Wildlife Act. Wildlife Regulation. Alberta Regulation 143/1997. Published by Alberta's Queen's Printer. Available at: http://www.qp.alberta.ca/documents/Acts/W10.pdf

3 - Government of Canada. 2021. Committee on the Status of Endangered Wildlife in Canada. Available at: https://www.canada.ca/en/environment-climate-change/services/committee-status-endangered-wildlife.html

4 - Government of Canada. 2002. Species at Risk Act. S.C. 2002., c. 29. Published by the Minister of Justice at: https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html

Appendix E – Fish Habitat Assessment Report

Bow River Irrigation District: Deadhorse Reservoir Project

Qualified Aquatic Environmental Specialist – Fish Habitat Assessment

November 2021

Prepared for:
BearTracks Environmental Services Ltd.

Prepared by:
Northern Resource Analysts Ltd.

Document Number: 2021603706

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Appendix A: Photo Plates

1.0 INTRODUCTION

The Bow River Irrigation District (BRID) is investigating the development of a reservoir of approximately 21,000 acre ft to be constructed within the existing main irrigation canal system network within 27 and 23 13-18 W4M, just north of an unnamed reservoir (WBID 317952), and 16 km west of the Town of Vauxhall, Alberta. In addition to storing water for use in drought conditions, a reservoir at this location would improve operation of the main canal, including reducing the amount of spill back to the river. The BRID noted that this proposed reservoir would benefit the BRID much like Badger Reservoir did in the 1980's.

The Project team identified priority sections where potential for reservoir location (the Project) to occur within the BRID utilizing sufficient topography and geotechnically sound locations. Northern Resource Analysts Ltd (Northern) in collaboration with BearTracks Environmental Services Ltd (BearTracks) were retained to conduct an Aquatic Habitat Assessment for the Project. This assessment is to support planning given planning is preliminary at this time.

This document summarizes an assessment completed in November 2021, to support submissions to regulators (Fisheries and Oceans Canada [DFO]) and a Water Act Application), to advise site-specific planning for instream and immediate upland activities.

1.1 Background Information

1.1.1 Literature

Background Project literature includes local knowledge, best management practices, guidelines, regulatory discussions and regulatory documents, including but not limited to:

- FWMIS FWIMT Database (GoA 2021[1]);
- Emails and site discussions with BearTracks;
- DFO's Pathways of Effects (DFO 2018[2]);
- DFO's Measures to Protect Fish and Fish Habitat Mitigation (DFO 2019a[3]);
- Guide to Watercourse Crossings (Government of Alberta [GoA] 2000[4]); and,
- Alberta Lakes: Little Bow Lake Reservoir (University of Alberta 2021[5])

[1] GoA 2021. Fish and Wildlife Information Management System. Fish and Wildlife Internet Mapping Tool. https://www.alberta.ca/fisheries-and-wildlife-management-information-system.aspx
[2] DFO 2018. Pathways of Effects. Webpage. December 5, 2018) https://www.dfo-mpo.gc.ca/pnw-ppe/pathways-sequences/index-eng.html
[3] DFO 2019a. Measures to Protect Fish and Fish Habitat. August 28, 2019). https://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures-eng.html
[4] GoA 2000. Guide to the Code of Practice for Watercourse Crossings, Including Guidelines for Complying with the Code of Practice (Archived).
[5] University of Alberta. 2021. Alberta Lakes. Accessed January 2021. http://albertalakes.ualberta.ca/?page=lake&region=4&lake=119

1.1.2 Site Information

The Project is located within the existing BRID Canal System, in southcentral Alberta, south and southwest of Enchant, Alberta. The area is located in high density cropland and rangeland of the Grasslands region of Alberta (Natural Regions Committee 2006[6]).

The Project is located approximately 30 km downstream of the Little Bow Lake Reservoir (LBLR), and 600 m upstream from an unnamed reservoir WBID 317952.

The LBLR includes the species outlined in Table 1 as per FWMIS (GoA 2021), and University of Alberta's Little Bow Lake Reservoir (2021) website. Table 1 also includes species within the McGregor Lake Reservoir (MLR), Travers, Little Bow River (LBR), and upstream Caresland Bow River Headwater Canal (CBRHC). As per Bryski (pers comm 2021[7]), paraphrased, "Fish species from the LBLR and upstream of the LBLR, have the potential to occur in the BRID. In addition, Prussian Carp (Carassius gibelio) was found in the MLR upstream, with potential for migration downstream into the LBLR and subsequently downstream into the BRID."

With the above comment made by AEP, an assumption can be made that there may be potential for fish from LBLR to migrate downstream to the BRID, and therefore, can also be assumed that fish upstream of the LBLR can also migrate down and enter the BRID. Confirmed Species at Risk which occur upstream of the LBLR includes Bull Trout (Salvalinus Confluentus) which are listed as At Risk in Alberta (GoA 2021[8]) and Threatened in COSWIC and SARA (GoC 2021[9]). Connectivity only has the potential to exist from upstream during overflow periods, or fish being transported by animals or humans from one waterbody to another.

Fishing permits[10] are issued each year with suspected fishing occurring in the BRID canal system, although no confirmation of fishing at or near the Project and no records were found regarding fishing in the unnamed reservoir. No data was obtained during the literature review or in discussions with AEP or BRID personnel on known fish species occurrences in the BRID.

Objectives of the instream flow needs and fisheries objectives for the Bow River watershed including the BRID, include "ensuring that larval, juvenile and adult life stages of the fish community are prevented from

[6] Natural Regions Committee 2006. Natural Regions and Subregions of Alberta. Compiled by D.J. Downing and W.W. Pettapiece. Government of Alberta. Pub. No. T/852.
[7] Bryski M. 2021. Email communications with Bryski (AEP Operations) regarding potential fish species presence in the BRID irrigation canal system. Email January 11, 2021.
[8] Government of Alberta. Wildlife Species of Alberta Search. https://extranet.gov.ab.ca/env/wild-species-status/default.aspx
[9] Government of Canada (GoC). 2021. Species at Risk Registry Species Search Tool. https://species-registry.canada.ca/index-en.html#/species?ranges=2&taxonomyId=3&sortBy=commonNameSort&sortDirection=asc&pageSize=10
[10] A salvage fishing licence is a special licence that can be issued in certain situations that allows for the harvest of fish resources that would otherwise be lost due to an environmental or extreme condition (i.e. low water levels, low dissolved oxygen, dewatering of irrigation canals). https://mywildalberta.ca/buy-licences/fishing-licenses-fees/salvage-fishing-licences.aspx

entering and becoming entrained in irrigation canals and diversions" (GoA 2003[11]), which is also applicable to the Project. In addition, as a note on water quality, the BRID system receives chemical treatment annually to control aquatic weeds and algae (Magnicide H Chemical treatments) (BRID 2019[12]). In addition, water is drained from BRID October to April.

The primary objectives for assessments of this nature is to review the potential for fish and fish habitat, under the following general concerns:

1. The death of fish by means other than fishing and the harmful alteration, disruption or destruction of fish habitat which are prohibited under subsections 34.4(1) and 35(1) of the Fisheries Act.
2. Effects to listed aquatic species at risk, any part of their critical habitat or the residences of their individuals in a manner which is prohibited under sections 32, 33 and subsection 58(1) of the Species at Risk Act.
3. The introduction of aquatic species into regions or bodies of water frequented by fish where they are not indigenous, which is prohibited under section 10 of the Aquatics Invasive Species Regulations.

1.1.3 Fish Species

The BRID does not have known records of species captured on FWMIS (GOA 2021); however, as indicated above, should they occur upstream in the reservoirs there is potential for them to occur in the BRID. These species have been noted in Table 1. Each species and associated preferences for key life stage processes is listed following the table with the data primarily referenced from Langhorne e*t al.* (2001[13]).

[11] GoA. 2003. South Saskatchewan River Basin Fisheries Management Objectives, Appendix A. https://open.alberta.ca/dataset/ae679f1f-c1e5-4431-a9b2-abdce96169b9/resource/93e09ee0-8429-43a7-acdd-6a234a17ce8e/download/instreamflowneeds-appendixa-2003.pdf
[12] BRID. 2019. Annual Report. https://www.brid.ca/files/AnnualReports/2019_AnnualReport.pdf
[13] Langhorne, A.L., M. Neufeld, G. Hoar, V. Bourhis, D.A. Fernet, and C.K. Minns. 2001. Life history characteristics of freshwater fishes occurring in Manitoba, Saskatchewan, and Alberta, with major emphasis on lake habitat requirements. Can. MS Rpt. Fish. Aquat. Sci. 2579: xii+170p.

Table 1. Potential Fish Species in the BRID

Common Name (CODE)	Species Name	Species at Risk Ranking Alberta (2015) SARA COSEWIC	Fish Type	Spawning Habitat	Rearing and Feeding Habitat	Presence Likelihood Notes	Provincial Restricted Activity Period (Applicable only during flow periods)
Little Bow Lake Reservoir							
Brown Trout (BNTR)	*Salmo trutta*	Exotic/ Alien N/A N/A	Recreation	October to December spawning when water falls below 8 -10 C. Digging redds and cover within gravel in flowing water.	Young hatch from March to late April and feed on invertebrates, larvae, pupae, nymphs.	Presence likelihood exists during summer months given tolerance for warmer water; however, no overwintering potential exists given lack of flow and lack of sufficient DO.	October 1 – April 15
Burbot (BURB)	*Lota lota*	Secure N/A N/A	Recreation and Subsistence	Spawning in water body or larger watercourses under ice from January to April and can broadcast spawn up to one million eggs and can spawn multiple times.	Newly hatched larvae are pelagic and drift in open water, transitioning to benthic habitat and prefer cool water feeding on invertebrates, macroinvertebrates, and other fish.	Presence likelihood for young burbot exists in the downstream reservoir given depths to buffer the cold. Low potential for overwintering in smaller reservoirs with lack of sufficient DO.	January 1 – April 30
Cisco (CISC)	*Coregonus artedi*	Secure N/A N/A	Recreation	Spawn between November to mid-December in near lake shores in waters from 5 to 6 C on rocky substrates.	Live in rocky areas feeding on algae, small invertebrates, larvae and small fish.	Ciscos have preference in deep water bodies. Not anticipated to occur in the BRID canal, excluding incidental YoY flowing into the system from the upstream reservoirs. Low potential for overwintering in smaller reservoirs with lack of sufficient DO.	N/A
Lake Trout (LKTR)	*Salvelinus namaycush*	Secure N/A N/A	Recreation	Spawn between September and December over areas of boulder or rubble bottoms of lakes.	Young Lake Trout feed on freshwater shrimp and other aquatic invertebrates and move to eating other fish species as they grow in various areas of a lake	Lake Trout have preference in deep water bodies. Not anticipated to occur in the BRID canal, excluding incidental YoY flowing into the system from the upstream reservoirs. Low potential for overwintering in smaller reservoirs with lack of sufficient DO.	N/A
Lake Whitefish (LKWF)	*Coregonus clupeaformis*	Secure N/A N/A	Recreation, Commercial and Subsistence	Spawning generally occurs from September to January in water 2 – 4 m deep at night in the shoals of gravel of rubble along a lake shore or large rivers (ie Athabasca River).	Young hatch and feed on plankton and then shift to bottom-dwelling snails, larvae, zebra mussels, fingernail clams in deeper lake waters.	Lake Trout have preference in deep water bodies. Not anticipated to occur in the BRID canal, excluding incidental YoY flowing into the system from the upstream reservoirs. Low potential for overwintering in smaller reservoirs with lack of sufficient DO.	October 1 – May 31
Northern Pike	*Esox lucius*	Secure	Recreation	Broadcast spawning in shallow or slow moving waters from April to May with	Young require areas to hide from other fish and siblings, given cannibalism	Potential for Northern Pike in the canals given their affinity for shallow highly	April 1 – May 31

Common Name (CODE)	Species Name	Species at Risk Ranking Alberta (2015) SARA COSEWIC	Fish Type	Spawning Habitat	Rearing and Feeding Habitat	Presence Likelihood Notes	Provincial Restricted Activity Period (Applicable only during flow periods)
(NRPK)		N/A N/A		instream vegetation for eggs to adhere to for incubation.	nature, feeding on inveterate when young and move to other fish and macroinvertebrates.	vegetated water. If the existing reservoir has suitable depths, there is potential for overwintering and spawning, given mesotolerence and vegetation.	
Rainbow Trout (non-native) (RBTR)	*Onchorhynchus mykiss*	Secure/ introduced or stocked/ Hybridized N/A N/A	Recreation	Spring spawning from May to July in 6 – 7 C water, within redds in gravel in a riffle which is well oxygenated water upstream of a pool.	Diet includes aquatic insects, leeches, snails, and other fishes and fish eggs. Are a very hardy fish and can live in lakes and cool watercourses throughout much of Alberta	Are a hardy fish and have the potential to live in the canal if the reservoir has sufficient DO during the winter months.	May 1 – July 15
Shorthead Redhorse (SHRH)	*Moxostoma macrolepidotum*	Secure N/A N/A	Coarse	Shallow streams and spawn over gravel or rocky shoals. They will also spawn in springs with swift moving water.	Benthic invertebrates and plant material from the benthic environments and in diverse habitat.	Likely given their tolerance for extreme temperatures and lack of depth.	N/A
Spottail Shiner (SPSH)	*Notropis hudonius*	Secure N/A N/A	Non-recreation	Spawning late June to July spawning on sandy bottoms or shorelines of rivers, lakes and creeks.	Living in lakes, rivers and creeks, feeding on plants, invertebrates, zoobenthos along shorelines and bottoms.	Sensitive to DO changes so likely not present unless DO is stable.	N/A
Walleye (WALL)	*Sander vitreus*	Secure N/A N/A	Recreation	Broadcast spawning from April to June over gravel and rock along shoals of lakes and rivers in temperatures between 10 and 13 C.	Living primarily in deeper waters primarily with rubble or vegetation for hiding, feeding on other fish, invertebrates or macroinvertebrates.	Potential for Walleye in the canals given their affinity for shallow highly vegetated water. If the existing reservoir has suitable depths, there is potential for overwintering and spawning, given mesotolerence and vegetation.	April 1 – June 30
White Sucker (WHSC)	*Catostomus commersoni*	Secure N/A N/A	Non-recreation (or rarely fished recreationally)	Spring spawning from mid-May to June within gravel-bottoms streams or lake margins where water reaches 10 C.	Young will feed on plankton and small invertebrates, with older consuming molluscs, larvae and algae.	Known in warmer shallower waters with tolerance for low DO.	N/A
Yellow Perch (YLPR)	*Perca flavescens*	Secure N/A N/A	Recreation or Table fish	Spring spawning from April to June in 6 – 12 C water along shallow areas of a lake or low-velocity watercourses. Eggs are released on the bottom, either attaching to vegetation or floating with current.	Common in shallow water feeding on larger invertebrates, macroinvertebrates, fish eggs, crayfish, fish eggs, crayfish, mysid shrimp, and juvenile fish.	Shallow water species, with the potential in the reservoir given tolerance for low DO.	April 16 – June 30

Common Name (CODE)	Species Name	Species at Risk Ranking Alberta (2015) SARA COSEWIC	Fish Type	Spawning Habitat	Rearing and Feeding Habitat	Presence Likelihood Notes	Provincial Restricted Activity Period (Applicable only during flow periods)
Additional Species to the Above Noted Upstream of LBLR (FWMIS)							
Brook Stickleback (BRST)	*Culaea inconstans*	Secure N/A N/A	Non-recreation	Mid-simmer spawning in a nest constructed of aquatic grasses, within slow moving waters.	Can rear in rivers, streams, floodwater streams and drainages, lakes, ponds, potholes, hot springs, sinkholes, and seasonal melt water or spring fed ponds with cover of grasses, boulders, undercut banks, feeding on inveterate larvae, fish eggs, macrophytes and algae.	Potential to occur in areas with low DO, prefer vegetation and have a high affinity for silty bottoms.	N/A
Bull Trout (BLTR)	*Salvelinus confluentus*	At Risk Threatened Threatened	Recreation	Spawning occurs from August to October when water is below 10 C, creating a redd, in cool headwaters with complex habitat. Redds are generally created above a pool in gravel and small cobble with groundwater influences and sufficient depths to elude freezing, and to oxygenate the eggs. The eggs are covered and hatch in March onwards.	Require temperatures below 13 C with deep pools, complex cover such as coarse woody debris, undercut banks, and interconnected watercourses which connect to spawning habitat. Early feeding includes invertebrates, other fish, amphibians, fish eggs and larvae, and as they grow, feeing on nearly all potential aquatic Animalia, birds, rodents, and also includes small Bull trout.	Not anticipated in BRID.	September 1 – April 30
Emerald Shiner (EMSH)	*Notropis atherinoides*	Secure N/A N/A	Non-recreational	Late spring (mid-May to August beginng at 22.2C (threshold temperature) and spawn near surface on boulders and gravel shoals.	Common in larger deeper lands and rivers, less common in small watercourses. Feeding on small invertebrates and plankton.	Low potential given high vegetation.	N/A
Fathead Minnow (FTMN)	*Ppimephales promelas*	Secure N/A N/A	Non-recreational	Creates a nest in various environments between May and August. Males defend the nest.	Rearing with tolerance to multiple environments, including turbid and low oxygen water, in small lakes, ponds, wetlands, streams, rivers and lakes feeding as a benthic filter of invertebrates, phytoplankton and algae.	Potential given their affinity for mud bottom and high vegetation water bodies; however temperatures may not be suitable.	N/A
Lake Chub (LKCH)	*Couesius plumbeus*	Secure N/A N/A	Non-recreational	Spawn at the surface in early summer in tributary streams over rocks or gravel.	Living in lakes, rivers and streams feeding on zooplankton, invertebrates, larvae and algae.	Potential given their tolerance for many habitats,	N/A

Common Name (CODE)	Species Name	Species at Risk Ranking Alberta (2015) SARA COSEWIC	Fish Type	Spawning Habitat	Rearing and Feeding Habitat	Presence Likelihood Notes	Provincial Restricted Activity Period (Applicable only during flow periods)
Longnose Dace (LNDC)	*Rhinichthys cataractae*	Secure N/A N/A	Non-recreational	Spawning May to August in 14 – 19 C on rocky substrates.	Occurs in moderately cool water streams, rivers and lakes with temperatures up to 22C. Feeding on algae and invertebrates.	Often inhabit areas where Lake chub are present. Low potential here given primary affinity for faster moving watercourses.	N/A
Pearl Dace (PRDC)	*Margariscus margarita*	Undetermined N/A N/A	Non-recreational	Spawning occurs in spring and early summer (May to June) on shallow water with sand or gravel substrate.	Occurs in cool bogs, streams, and lakes feeding on invertebrates and plankton.	Low potential given lack of cold water regime.	N/A
Trout-Perch (TRPR)	*Percopsis Omiscomaycus*	Secure N/A N/A	Non-recreational	Spawning May to August consisting of sandbars and rocks in lakes or tributary streams	Clear to slightly turbid water feeding on small invertebrates, larvae and zooplankton.	Potential given substrates and vegetation presence.	N/A

2.0 PROPOSED WORKS

2.1 Scope of Work

Long dykes would be required to be constructed from rock fill and concrete contain the reservoir, specifically on the north side, or it would cover Lost Lake and a large amount of irrigated land (Figure 1). The dam's maximum height would be 12 m and the maximum depth is estimated at 9 m and a flooded area of 500 hectares. Although the reservoir will function primarily for irrigation, it should provide an excellent sport fishery, and day-use will be accommodated.

Figure 1. Project Location and Conceptual Design (Alberta Water Portal Society, 2021[14])

[14] Alberta Water Portal Society. 2021. Bow River Irrigation Districts. Reservoir Projects. Published 08 August 2021. https://albertawater.com/images/Irrigation/BRID_Maps/Resovoir.png

3.0 METHODOLOGY

3.1 Fish Habitat Assessment

The assessment was conducted, as adapted from Guide to Watercourse Crossings (GoA 2000), to assess habitat quality and current canal characteristics. Fish habitat data was collected at the sample "Areas", including immediately upstream of the proposed Project area and immediately downstream of the sample area to capture the zone of influence (ZOI)[15].

Site data collection points were measured in the field using a Global Positioning System (GPS) distance odometer via Avenza. The date, time, and location (UTM coordinates) for each assessment point were recorded in the field prior to conducting the survey.

Channel/canal and reservoir characteristics were recorded at each assessment area, including estimated max depth, bed material and substrate composition were estimated at each transect based on total percentage of bed materials within field of view. Instream submergent and emergent vegetation (not under snow or ice) was recorded in total percentage cover.

Banks were referred to as left and right when facing downstream. At each sample area the percentage of each bank covered by vegetation and the dominant type of vegetative cover was estimated in the field of view.

Characteristics and features of the canal which have the potential to affect fish habitat were described at the site and within the ZOI. These include, but are not limited to, flood signs, instream cover, riparian vegetation characteristics, and any other applicable information. The location of described features were recorded.

The site was photo-documented with an iPhone in Avenza. Photos were taken from the site showing the view upstream, downstream and right and/or left banks. Additional photos were collected to document representative habitat and features within the Project.

Fish habitat quality and value was evaluated for rearing, spawning, and overwintering habitat given water was present at the time of assessment. Habitat was rated for target species residing in the area and in these sites. Each habitat parameter was qualitatively rated as excellent, moderate, and poor or nil based on limiting factors and habitat value throughout the reach assessed. The QAES evaluated habitat based on personal experience in ranking habitat in similar habitat assess previously and under the following are considerations:

- The proportion of suitable spawning habitat were recorded as a percentage of the total bankfull area.
- Rearing habitat was evaluated as a function of available cover.

[15] The ZOI is defined as the area of bed and bank disturbance, and where 90% of the total sediment potentially generated during construction would be expected to be deposited, and therefore will be dependent on site specific conditions such as flow rates and channel characteristics, at the time of construction.

- Overwintering was evaluated based on sufficient depths, water volume, and potential DO limitations.

In addition to the above, additional considerations for each ranking included:

Excellent: Habitat is critical to the survival of the species in the area for example, critical spawning habitat. Habitat and/or species are rare. This would include at least one listed species (based on nationally or regionally utilized/important species) or high value recreational or traditional value species, expected to be present and/or their habitat. Water thermal regime that cannot easily buffer temperature changes, physical conditions making the system unable to change with flow regime being permanent or volume of water suitable to support species sensitive to regime changes. Features such as gravel/cobble riffles or shore line fish sensitive zones that, once disturbed or removed, may not recover naturally or take greater than one year to recover, would fit into this category. Forage abundant.

Moderate: Habitat is important and is used for a specific life function, but is not critical habitat. Habitat and/or species have a limited distribution or confined to small areas. Water thermal regime that can buffer a temperature change, physical conditions that make system moderately stable and resilient with suitable water volume. Forage abundant. No listed species expected to be present.

Poor: Habitat is common and used for a range of life requisites by species that are present; however not critical. Habitat and/or species are prevalent. Limited to no flow and or low suitable water volume and abundant resilient instream vegetation or areas of subsurface flows or intermittent flows. These and other physical characteristic make the system stable and resilient to change and perturbation. Flow regime is typically intermittent or ephemeral. No listed, culturally, recreational or commercially significant species expected to be present. Limited forage.

Nil: Habitat is common or not utilized for life stages of fish or no fish are anticipated to be present. No critical habitat is within or adjacent to the study area. Subsurface, intermittent or ephemeral flows or no flow dominates the area with little to no water volume to support fish. Water quality is poor due to natural or non-natural sources (high runoff and high sediment loading due to fine substrates dominated upland areas or chemical applications) and/or substrates are cemented or absent with poor substrates or instream vegetation for associated present species life stages. Limited to no forage.

4.0 RESULTS

Locations of each of the areas of assessments are included in Figure 2. The locations of each of the areas are as follows:

- Area 1: 12U 400339E 5552605N
- Area 2: 12U 401526E 5551438N
- Area 3: 12U 402153E 5550652N
- Area 4: 12U 402604E 5550529N
- Area 5: 12U 404176E 5550024N

4.1 Area 1

The canal at this location has been historically noted as being seasonal operating from the end of April/beginning of May to the end of October. It was dry with remnant isolated shallow layers of ice from residual puddling at the time of the assessment. Average maximum depths were 30-40 cm.

Plates 1, 2 and 3 show Upstream, downstream and cross section respectively. Canal widths here are approximately 30 m at 2 to 3 m bankfull heights throughout. The spill way height is approximately 1.3 m providing an upstream migration barrier.

No flows were observed, and not connected to flow. Crown closure was nil, with riparian vegetation dominated by Canary Reed Grass (*Phalaris arundinacea*), Smooth Brome (*Bromus inermis)*, and Slender Wheatgrass (*Elymus trachycaulus*). Both banks are primarily vertical with limited to no cover, excluding riprap under the bridge and kochia. Banks are dominated by gravels (60%) and fines (40%). Plate 4 shows substrates being primarily fines (hardpan clay) with some gravels, sparce instream vegetation, including limited submergent species and periphyton. No fish were observed at this Area.

Below outlines habitat ranked for spawning, rearing, migration and overwintering for the species listed in Table 1:

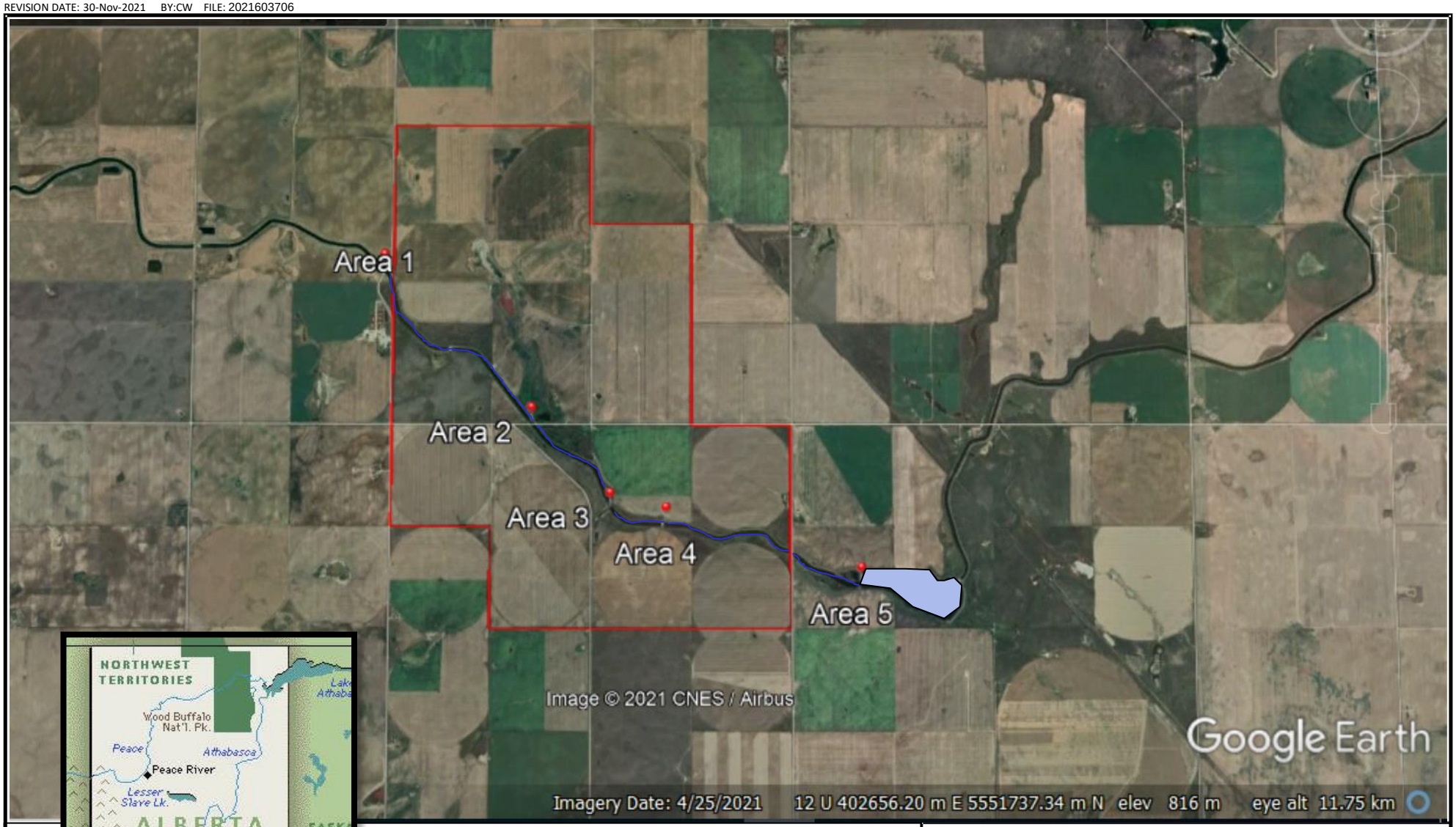
- Spawning: Nil for cool to cold water species (Salmonids) given no gravels exist and the canal is exposed to increased temperatures throughout from summer to early fall. Fines were present throughout with limited instream vegetation (soft bed dominated by fines), excluding riprap, which may create some (low to moderate potential) conditions for broadcast or small substrate bottom spawners (i.e., Yellow Perch, Walleye and Northern Pike) if they obtain access to the location, having to be washed downstream through the LBLR dam or migrating upstream from the small unnamed reservoir. Influence of continuous sedimentation along the reach from the exposed banks could limit incubation and emergence success for most species which are oxygen dependent (i.e., all trout species), and the intermittent or lack of riparian vegetation could limit species which utilize vegetation for egg adhesion (i.e., Northern Pike).

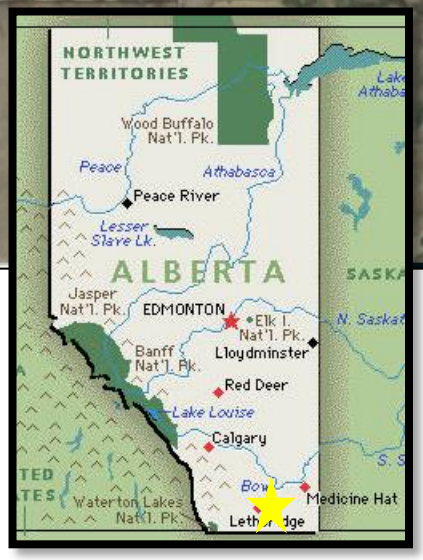
- Rearing: Epilithic algae which attached to substrates, periphyton, and riparian macrophytes serve as the basis of the food chain and is sparse. No invertebrate carcasses, shucks or shells were observed during the assessment; however, specific invertebrate sampling was not completed given winter conditions. Rearing is low given forage and cover limitations. Instream vegetation

and algae is a detriment to the irrigation canals and chemical treatment is completed annually to limit both. Rearing would be limited to flow conditions.

- Overwintering: Nil given lack of suitable depths and flow, and all fish would be eliminated if stranded in the canal in this area during drainage. Isolated puddles of water were present in frozen form, and are likely frozen to the bottom throughout the winter season and during time of construction.

REVISION DATE: 30-Nov-2021 BY:CW FILE: 2021603706





LEGEND

- Location of Project in Alberta
- Project Study Area
- Existing Canal System
- Existing Reservoir
- Site Assessment Areas

PROJECT

Bow River Irrigation District
6-18-14 W4M

TITLE

Figure 1.
Sample Locations
Deadhorse Reservoir Project

NORTHERN RESOURCE ANALYSTS
Calgary, Alberta

FILE NO. Figure template_BRID.ppt				
PROJECT No. 2021603706			SCALE NOT SHOWN	REV. 1
DESIGN	CW	15-Aug-2021	**FIGURE: 1**	
REVISION	CW	30-Nov-2021		
CHECK				
REVIEW				

4.2 Area 2

Similar to Area 1, primarily dry with remnant isolated shallow layers of ice from residual puddling at the time of the assessment with maximum depths being 15 cm.

Plates 5, 6 and 7 show upstream, downstream and cross section, respectively. Upstream of the bridge is 36 m wide with downstream at 33 m, and 2 to 3 m bankfull heights throughout.

No flows were observed, and not connected to flow. Crown closure was nil, with riparian vegetation dominated by Canary Reed Grass (*Phalaris arundinacea*) and Crested Wheatgrass (*Agropyron cristatum).* Both left and right banks were dominated by gravels (50%), with 45% small gavels and fines and 10% large and small cobble. Substrates were dominated by periphyton covered gravels and hardpan clay with sporadic pockets of cobble and boulder. Left bank being similar in nature with more fines. Instream submergent vegetation (Coontail *Ceratophyllum demersum)* is isolated to the centre of the canal. Plate 8 shows substrates and instream vegetation. Limited cover exists with patches of instream vegetation, rip rap, bank-lined kochia, and instream cobble and boulder. No fish were observed.

Below outlines habitat ranked for spawning, rearing and overwintering for the species listed in Table 1:

- Spawning: Nil for cool to cold water species given no suitable spawning gravels exist in the manner suitable for salmonids, and the canal is exposed to increased temperatures throughout from summer to early fall. Fines were present throughout with instream vegetation (soft bed dominated by fines), excluding riprap at the base of the drop, which may create some (low) potential conditions for broadcast or small substrate bottom spawners (i.e., Yellow Perch, Walleye and Northern Pike). Influence of continuous sedimentation along the reach from the exposed banks could limit incubation and emergence success for most species which are oxygen dependent (i.e., all trout species), and the intermittent or lack of riparian vegetation could limit species which utilize vegetation for egg adhesion (i.e., Northern Pike).

- Rearing: Epilithic algae which attached to substrates, periphyton, and riparian macrophytes serve as the basis of the food chain and is sparse. No invertebrate carcasses, shucks or shells were observed during the assessment; however, specific invertebrate sampling was not completed given winter conditions. Rearing is low given forage and cover limitations. Instream vegetation and algae is a detriment to the irrigation canals and chemical treatment is completed annually to limit both. Rearing would only be limited to flow conditions if present.

- Overwintering: nil, given the lack and/or absence of water and overwintering pools observed in the work area. Isolated puddles of water were present in frozen form and are likely frozen to the bottom throughout the winter season and during time of construction.

4.3 Area 3

It was dry with remnant isolated shallow layers of ice from residual puddling at the time of the assessment with puddles measuring at maximum of 15 cm. Plates 9, 10 and 11 show upstream, downstream and cross section, respectively. A gate and irrigation ditch lie on the right bank. Substrates were dominated by

coarse boulder and cobble along the thalweg with pockets of clean gravels. Nearing the canal walls, fines become more dominant. Cover exists with coarse substrates and some instream vegetation.

No flows were observed, and not connected to flow. Crown closure was nil, with riparian vegetation dominated by Canary Reed Grass (*Phalaris arundinacea*), Crested Wheatgrass (*Agropyron cristatum)* and Canada thistle (*Cirsium arvense*). Both the left and right banks were dominated by gravels and 25% large and small cobble. Instream vegetation exists intermittently throughout the area (Coontail *Ceratophyllym demersum*, Northern Watermilfoil *Myriophyllum exalbescens, and Potamogeton spp.*). Plate 12 shows substrates and instream vegetation. No fish were observed.

Below outlines habitat ranked for spawning, rearing, migration and overwintering for the species listed in Table 1:

- Spawning: Nil for cool to cold water species given no suitable spawning gravels exist in the manner suitable for salmonids. The canal is exposed to increased temperatures throughout from summer to early fall. Given substrates were dominated by coarse substrates in the thalweg, there is potential conditions for broadcast or small substrate bottom spawners (i.e. Walleye). Influence of continuous sedimentation along the reach from the exposed banks could limit incubation and emergence success for most species which are oxygen dependent (i.e., all trout species), and the intermittent or lack of riparian vegetation could limit species which utilize vegetation for egg adhesion (i.e., Northern Pike).

- Rearing: Epilithic algae which attached to substrates, periphyton, and riparian macrophytes serve as the basis of the food chain and is sparse. No invertebrate carcasses, shucks or shells were observed during the assessment; however, specific invertebrate sampling was not completed given winter conditions. Rearing is low given forage and cover limitations. Instream vegetation and algae is a detriment to the irrigation canals and chemical treatment is completed annually to limit both. Rearing would only be limited to flow conditions and it is likely for species such as Pike, Walleye (with sufficient depths), and other coarse species.

- Migration: Low to Moderate (Migration only occurring in downstream direction). Fish presence during flow conditions has not been confirmed based on discussions with BRID, however, AEP has indicated that there is possibility for fish to exist during flow conditions migrating from adjacent waterbodies (i.e., LBLR 26 km upstream). It is unlikely fish could migrate upstream from the Bow River given the 4+ m drops at 35 - 45 degree gradient and being approximately 75 km downstream. Should fish be washed downstream during flow conditions, they would be limited to the sections between drops or be washed downstream.

- Overwintering: nil, given the lack and/or absence of water and overwintering pools observed in the work area. Isolated puddles of water were present in frozen form, and are likely frozen to the bottom throughout the winter season and during time of construction.

4.4 Area 4

Standing water was observed with a maximum depth of 1 m in this area. The standing water had full ice cover at the time of the assessment.

Plates 13, 14 and 15 show upstream, downstream and cross section respectively. The spill way height is 1.3 m creating a migration barrier for upstream migration. Plate 16 shows deeper pool below the weir, fully covered in ice.

Flow was observed out of the side of the weir at a pipe into the pooling water. Crown closure was low, with some Kochia creating overhead cover frozen into the ice. Riparian vegetation dominated by Canary Reed Grass (*Phalaris arundinacea*) and Crested Wheatgrass (*Agropyron cristatum*). Right and left banks were dominated by gravels (50%), with 45% small gavels and fines and 10% large and some small cobble. Very little instream vegetation was observed with periphyton evident on substrates.

No fish were observed; however, there is potential given flow and sufficient depths. Below outlines habitat ranked for spawning, rearing, migration and overwintering for the species listed in Table 1:

- Spawning: Nil for cool to cold water species given no suitable spawning gravels exist in the manner suitable for salmonids, and the canal is exposed to increased temperatures throughout from summer to early fall. Various substrates, including riprap at the base of the drop, were present throughout. Instream vegetation, which may create some (low) potential conditions for broadcast or small substrate bottom spawners (i.e., Yellow Perch, Walleye and Northern Pike). Influence of continuous sedimentation along the reach from the exposed banks could limit incubation and emergence success for most species which are oxygen dependent (i.e., all trout species), and the intermittent or lack of vegetation could limit species which utilize vegetation for egg adhesion (i.e., Northern Pike). Coarse species have the potential for spawning in this area given some rearing opportunities.

- Rearing: Epilithic algae which attached to substrates, Periphyton, instream vegetation, and riparian macrophytes serve as the basis of the food chain and were present. No invertebrate carcasses, shucks or shells were observed during the assessment; however, specific invertebrate sampling was not completed given winter conditions. Rearing is low to moderate given cover present at this location (riprap). Instream vegetation and algae is a detriment to the irrigation canals and chemical treatment is completed annually to limit both.

- Overwintering: low, given 1 m depth water and overwintering pools observed with flow from an irrigation pipe and periphyton present on the rocks. This pool may not freeze to the bottom throughout the winter season.

4.5 Area 5

The reservoir is measured at 1 km length by 350 m wide (max width) with an estimated maximum depth of up to 2-3 m in this area. Plates 17, 18 and 19 show upstream, downstream and cross section respectively. Plate 20 shows substrates and vegetation. Substrates are high fines and deep (> 35 m in areas). Crown closure was nil.

Riparian vegetation dominated by Canary Reed Grass (*Phalaris arundinacea*) and Crested Wheatgrass (*Agropyron cristatum*). The reservoir substrates were dominated by fines with sporadic areas of cobble or coarse substrates. Some instream vegetation was observed (Coontail *Ceratophyllym demersum*, Northern Watermilfoil *Myriophyllum exalbescens, and Potamogeton spp.*). This reservoir is not suspected to freeze to the bottom during winter conditions.

The Area 5 has been extensively damaged by cattle. It has been pugged at several locations with evidence of cattle defecating in the water and wallowing. The damage by cattle may create increased nutrient loading and sedimentation in the reservoir.

No fish were observed; however, there is potential given flow and sufficient depths. Below outlines habitat ranked for spawning, rearing, migration and overwintering for the species listed in Table 1:

- Spawning: Nil for cool to cold water species given no suitable spawning gravels exist in the manner suitable for salmonids. Various substrates and instream vegetation creates moderate potential for spawning for many types of species listed in Table 1 (i.e., Yellow Perch, Walleye and Northern Pike). The intermittent or lack of vegetation could limit species which utilize vegetation for egg adhesion (i.e., Northern Pike); however, a snorkel survey was not completed to confirm instream vegetation abundance.

- Rearing: Moderate, given periphyton, instream vegetation, and riparian macrophytes serve as the basis of the food chain and were present. No invertebrate carcasses, shucks or shells were observed during the assessment; however, specific invertebrate sampling was not completed given winter conditions. Fish sampling was not conducted however, it is anticipated that this reservoir could sustain a population of various fish species.

- Overwintering: Good given suitable depths. This pool would not freeze to the bottom throughout the winter season.

- Migration: Low to Moderate with migration occurring in downstream direction and upstream direction through the reservoir and extending into the Project study area. Fish presence during flow conditions has not been confirmed based on discussions with BRID, however, AEP has indicated that there is possibility for fish to exist during flow conditions migrating from adjacent waterbodies. It is unlikely fish could migrate greater than 50 km upstream from the Bow River given the 4+ m drops at 45 degree gradient. Should fish be washed downstream during flow conditions, they would be limited to the sections between drops or be washed downstream or remain in areas such as this reservoir.

5.0 ANTICIPATED EFFECTS AND MITIGATION

BRID and the contractor are required to ensure works are executed in accordance with construction designs, regulatory permits, DFO's Letter of Advice/Authorization, Fisheries and Oceans (DFO's) Measures to Avoid Serious Harm to Fish and Fish Habtiat (DFO 2019[16]), Water Act Code of Practice and Approval, best management practices and guidelines, and QAES recommendations.

Below outlines the potential for some anticipated effects based on a general knowledge of works, standard practise, regulations and permits, DFO's pathways of effects and general mitigation measures and recommendations by the QAES. A more details mitigation plan is recommended upon completion of the final design.

Many reasons why a dam would be constructed are positive such as to support water use/retention during drought conditions (domestic, drinking, agricultural, commercial use) and for flood protection. Other ancillary considerations may be to support energy production by creating a hydroelectric dam, create recreational and commercial fisheries opportunities and recreational experiences for the region, enhanced social opportunities, and create economic opportunities. Some negative effects to dams could be environmental, biological (including water quality, invertebrate, fisheries and wildlife), archaeological and palaeontological, social and culture, soils, and topographical impacts.

5.1 Pathways of Effects

Given there is potential for impacts to fish, the *Fisheries Act* is applicable to this Project. Proponents are advised that under the new *Fisheries Act* project review by DFO, prior to construction. *Measures to Protect Fish and Fish Habitat* are to be investigated and satisfied to reduce land-based and in-water impacts to fish and fish habitat. The following "Pathways of Effects" webpages (DFO 2018) associated with the above aquatic environment and species stressors for Land-Based Activities and In-Water Activities should be considered for this work are outlined below with the potential for changes upon final design:

- Fish Passage Issues: 'Activities that cause physical or physiological impediments to fish movement or migration'. Potential effects may include changes in access to habitats, incidental entrainment, impingement, or mortality of resident species, alterations in migration patterns, alteration in nutrient transfer, changes in thermal cues and total gas pressure, and flow barrier.
    - This is anticipated to be high. Although works will be conducted in the winter, a reservoir of this magnitude will have extensive migration changes to fish in this part of the canal system. Fish cannot migrate upstream once hitting a weir, making fish flushed downstream subject to being stranded upon draining of the canal in October. Having a large reservoir capable of sustaining significant overwintering will create opportunities for fish populations to increase and become sustainable.

[16] DFO 2019b. DFO Measures to Avoid Serious Harm to Fish and Fish Habtiat. https://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures-eng.html

- Placement of Material or Structures in Water: 'The placement of material or structures such as… [rip-rap, infill material] other structures that either fully or partially obstruct flow on the bed or banks of a water body' (DFO 2010). Potential effects may include changes in substrate composition and food supply, changes in nutrient and sediment concentrations, change in aquatic vegetation and habitat structure and cover, changes in ecosystem dynamics, and changes in hydraulic regime.
    - Changes from primarily lotic to lentic habitat will occur; however, current species suspected in the system are anticipated to be surviving in lentic habitat throughout much of their life cycle and are known lentic species. Temporary changes in substrates are anticipated to occur.
- Structure Removal: The removal of non-natural structures such as riprap, budges or dams removed manually or with equipment.
    - There are several bridges, weirs, intakes, riprap, and other irrigation equipment which many be removed or may or left insitu, as approved. Should water be present, an isolation and fish salvage may be required.
    - Changes in instream structure/cover will occur with removal of infrastructure which may create a change in sediment concentrations settling downstream. The canal connects to the Bow River downstream and sediment transportation from increased magnitude of sedimentation must be controlled to ensure the Bow River and downstream fish and fish habitat in the canal is not impacted.
- Change in Timing, Duration and Frequency of Flow: 'Any activities that result in changes in the timing, duration, and/or frequency of water flow. Bank erosion and sediment deposit, underwater soil erosion, and the construction (DFO 2010) have the potential to cause effects such as the displacement or stranding of fish, water quality changes, ecosystem dynamics, changes to migration/access to habitat, habitat structure and cover and food supply, as well as changes to water temperature and nutrient, contaminant, and sediment concentrations.
    - Changes in flow is suspected to occur given water spill is a goal as a result of construction of this reservoir. Storage capacities are anticipated to increase by 21,000 acre ft with fisheries habitat provided. The downstream existing reservoir will likely act as a buffer for changes in temperature, contaminants, and direct sediment loading.
- Upland Vegetation Clearing: 'The removal or clearing of the existing terrestrial vegetation within a given tract of land. This may be achieved through the manual or mechanized removal of vegetation using industrial equipment, herbicides which kill or inhibit the growth of certain plants, or any other method (i.e., manual) that results in the alteration of terrestrial vegetation' (DFO 2010). Alteration/ removal of riparian vegetation has the potential to effect bank stability, habitat structure and cover, sediment, contaminant and nutrient concentrations, water temperature, and potential food sources.

  Changes vegetation are anticipated; however, this is temporary in nature given the prolific nature of the species which exists within the irrigation district.
- Addition or Removal of Aquatic Vegetation: The removal or clearing of existing aquatic vegetation within a lake may be achieved through the use of mechanical or hand tools in this situation. Removal

of this vegetation may create a change in habitat cover, nutrient inputs, light penetration, and resuspension and entrainment of sediment. These stressors have the ability to change water temperatures, dissolved oxygen levels, primary productivity (food sources), and contaminants and sedimentation.

    - Changes instream vegetation are anticipated; however, this is temporary in nature given the prolific nature of instream vegetation growth. Recovery of vegetation occurs quickly in irrigation and reservoir conditions.

- Excavation: 'The process of removing soil and rock from the land. It does not include grading or dredging. This is achieved through mechanical cutting, digging, or scooping which leaves a cut, cavity, trench, or depression in the land surface' (DFO 2018). Potential effects may include changes to baseline flow, water temperature, and sediment concentration through excavation of the landscape.
    - Changes in sedimentation will occur as a result of the construction practices. In addition, exposing potential upland contaminants is also a potential.
- Use of Industrial Equipment: 'The use of mechanical equipment for the purpose of construction, maintenance, and/or transportation and generally any activity where machinery is working on land or in water' (DFO 2018). Potential effects may include contaminant concentrations due to activities in and near the waterbody.
- Riparian Seeding: 'Planting terrestrial vegetation adjacent to a water body/watercourse. This may involve the use of fertilizers, site preparation methods, and the introduction of native and non-native plant species' (DFO 2018). Potential effects may include change in sediment, nutrient and contaminant concentrations, change in water temperature, and change in habitat structure, cover, and food supply.

Avoidance of construction activities in fish habitat (where feasible) or the successful implementation of best management practices (i.e., mitigation) can, in many instances, break all project pathways of effects. Leading "Measures to Protect Fish and Fish Habitat" are categorized with regards to the following mitigations to stressors on fish and fish habitat:

- Prevent the Death of Fish
- Maintain Riparian Vegetation
- Carry out Works, Undertakings and Activities on Land
- Maintain Fish Passage
- Ensure Proper Sediment Control
- Prevent Entry of Deleterious Substances in Water

However, in some instances, unavoidable construction or logistical considerations (e.g., nature of activities, method or timing) may render typical avoidance or mitigations unfeasible. In these scenarios, unmitigated or residual effects may result from unmitigated stressors, unless additional or site-specific mitigation can be developed to reduce or eliminate the potential for death of fish or HADD. Project review by DFO is recommended, where required mitigation extends beyond DFO's Measures to Protect Fish and Fish Habitat.

5.2 General Considerations for Mitigation

The following considerations are provided to support high level planning. Detailed site-specific planning is recommended upon final site design and planning.

Select general considerations regarding fish and fish habitat is as follows:

- If not previously completed, conducted a Water Management and Hydrological Impact Assessments including water use stakeholders.
- Conduct a Water Quality Impact Assessment to evaluate water quality and predictive modelling and mitigation planning for changes in chemical and nutrient loading, thermal regime changes, sedimentation and depositional changes, decomposition of upland vegetation and avoidance of toxic gas and chemical releases, and changes in flow regime.
- Conduct a Phase II on the upland area to ensure all contaminated sites have been remediated prior to flooding. In addition, a spraying restriction plan and implementation is recommended prior to flooding to limit the amount of commercial cropland sprays applied to the land.
- The area is within a Yellow Decontamination Zone (GoA 2021), therefore develop a decontamination plan for all equipment and potential exposure areas.
- Develop a Sediment and Erosion Control and Clean and Dirty Water Plan for the management of all water during each phase of construction.
- Develop a detailed ECO Plan which includes a fish handling is recommended.
- Acquire regulatory permits and approvals.
- Obtain FRL for fish removal and relocation for isolations or fish removal from pooled areas.

6.0 CLOSING

Given site specific considerations and planning has not been completed it is recommended to review updated information to support fish and fish habitat impacts and associated mitigations. Fish species in the canal are subject to change each year with what fish are flushed downstream and which fish species were able to overwintering in Area 5 reservoir. No Species at Risk are anticipated in the Study area given the unlikelihood that Bull Trout would migrate downstream from upstream reservoirs of from the Bow River. The current rearing and spawning habitat, for species with the potential to occur in the canal during each season, is sporadic in nature and is supported by instream vegetation which are chemically controlled each year. Substrates are primarily clay-pan fines with some coarse substrates sporadically occurring throughout the reach, primarily in riprap supporting weir outflow. Overwintering is anticipated to potentially occur in Area 4 and 5 within and adjacent to the Study area for species tolerant to low DO, high fines, and no flow.

A dam created in this area would support a fisheries if chemical concentration changes can be planned for and mitigated.

The report was prepared by the following:

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6.1 Limitation

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Appendix A: Photo Plates

Plate 1. Upstream at Area 1

Plate 2. Downstream at Area 1

Plate 3. Left banks at Area 1

Plate 4. Substrates at Area 1

Plate 5. Upstream at Area 2

Plate 6. Downstream at Area 2

Plate 7. Right bank at Area 2

Plate 8. Substrates and instream vegetation at Area 2

Plate 9. Upstream at Area 3

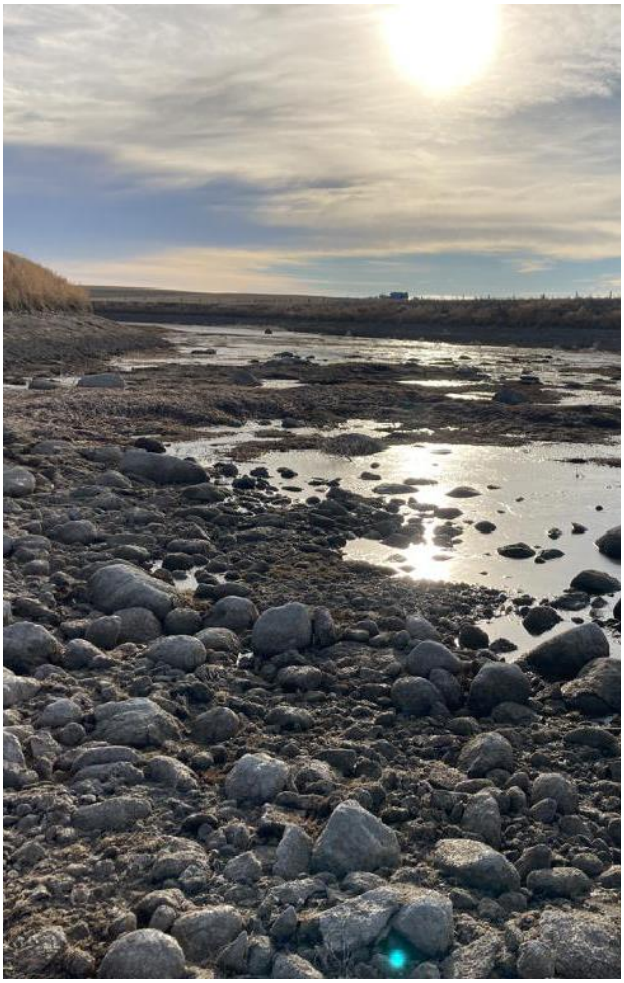

Plate 10. Downstream at Area 3

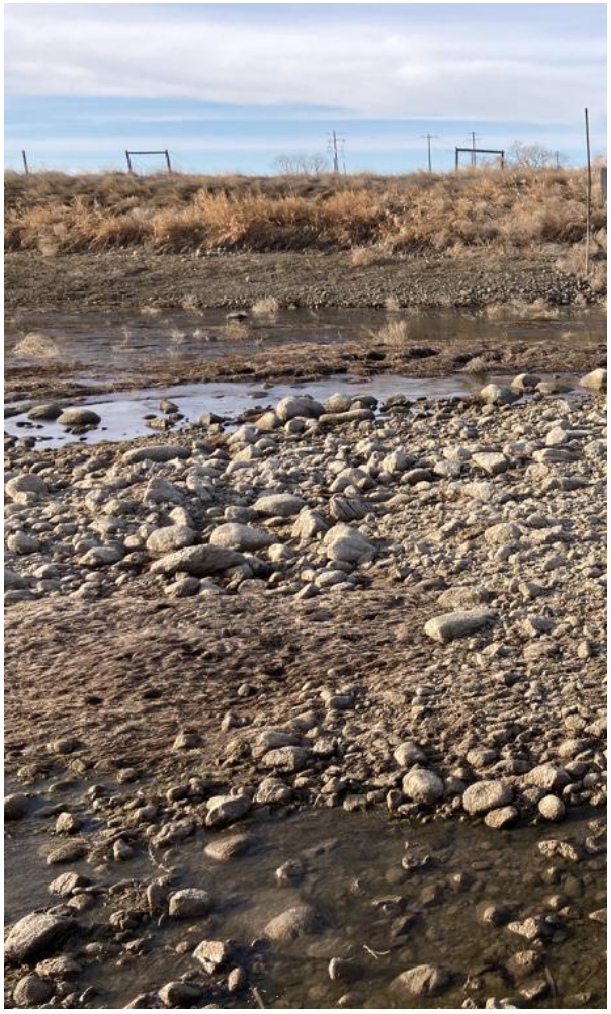

Plate 11. Right bank at Area 3

Plate 12. Substrates and instream vegetation at Area 3

Plate 13. Upstream of the weir at Area

Plate 14. Downstream of the weir at Area 4

Plate 15. Right bank and top of weir at Area 4

Plate 16. Pooling downstream of weir at Area 4

Plate 17. Upstream at Area 5

Plate 18. Downstream at Area 5

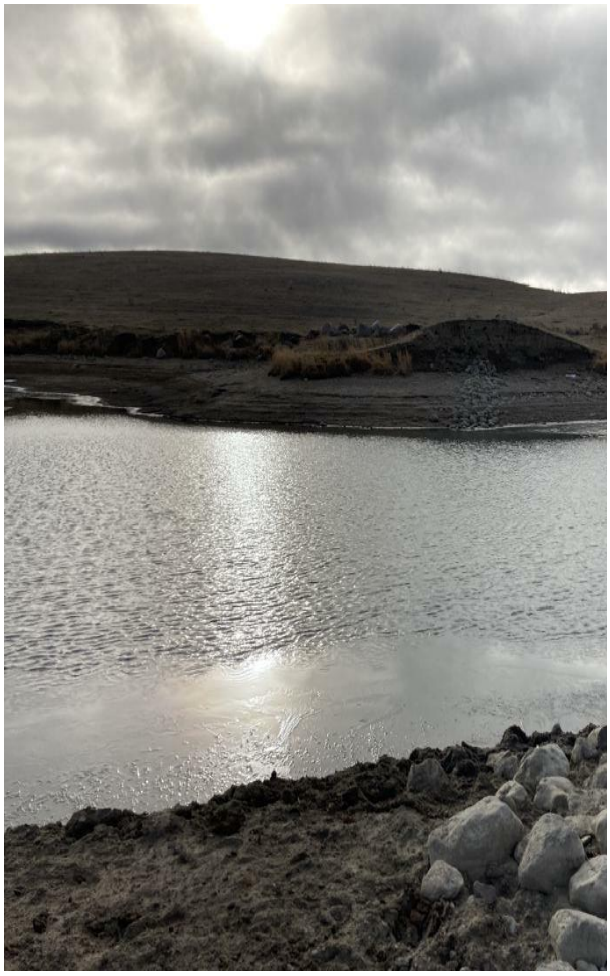

Plate 19. Right bank at Area 5

Plate 20. Substrates and vegetation at Area 5