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**Mountain Ash Limited Partnership Aggregate Operation  
NW and SW 31-26-03 W5M, Rocky View County, Alberta**

**Biophysical Impact Assessment Report**



**MOUNTAIN ASH**  
· LIMITED PARTNERSHIP ·

**January 2020**  
**SLR Project No.: 212.06650.00003**

**BIOPHYSICAL IMPACT ASSESSMENT**

**MOUNTAIN ASH LIMITED PARTNERSHIP AGGREGATE OPERATION**

**NW AND SW 31-26-03 W5M**

**ROCKY VIEW COUNTY, ALBERTA**

**SLR Project No.: 212.06650.00003**

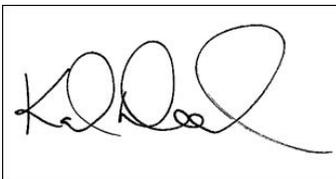
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## EXECUTIVE SUMMARY

Mountain Ash Limited Partnership (MALP) is proposing to develop an aggregate resource in the west half of Section 31, Township 26, Range 3, west of the 5th Meridian (NW and SW 31-26-03 W5M) approximately 9 km northeast of Cochrane in Rocky View County, Alberta. SLR Consulting (Canada) Ltd. was retained to conduct a biophysical investigation of the property and prepare a biophysical impact assessment to support MALP's Land Use application. The NW ¼ section is currently zoned Natural Resource Industrial District (NRI), a designation that allows development of the aggregate resource under the County's *Land Use Bylaw*; the SW ¼ section is zoned Ranch and Farm District (RF) and requires re-designation to allow for development of the aggregate resource (RVC 2019).

### The Project (Section 2)

The proposed aggregate project (Project or development) would extract sand and gravel to meet the high demand for aggregate resources in the Calgary region. The Project is to be worked in six phases starting in the southeast corner of the property and moving in a counter-clockwise direction. Each phase is expected to occur over a period of 5 to 7 years. The sand and gravel will be extracted under dry conditions, with no dewatering of the underlying aquifer needed. Topsoil, subsoil and overburden will be salvaged separately and stored either in berms along the edge of the property to create a visual barrier from adjacent roads and properties or in an identified reclamation stockpile area outside the planned areas of excavation. Surface water will be managed during development and operation by temporary and long-term drainage features in accordance with the stormwater management plan being developed for the Project. Development will not occur in the northwest portion of the property where two wetlands will be retained on the landscape and a section in the southwest corner will also be excluded to retain an additional four wetlands. Reclamation will be undertaken in a progressive manner, after each extraction phase.

### Regulatory Framework (Section 3)

The Project, when applied for, is subject to and must align with all relevant municipal, provincial and federal legislation, regulations and policies. Relevant federal legislation includes the *Migratory Birds Convention Act*, *Species at Risk Act* (SARA) and, if applicable, the *Fisheries Act*. Relevant provincial legislation includes the *Environmental Protection and Enhancement Act* (EPEA), *Water Act* and associated *Wetland Policy*, *Public Lands Act*, *Wildlife Act*, *Weed Control Act*, *Historical Resources Act*, and the provincial Code of Practice for Pits (2004) made under the EPEA and the Conservation and Reclamation Regulation. Relevant municipal guiding documents and standards and requirements specific to the County include the County Plan (RVC updated to 2018), County Land Use Bylaw (RVC 2019), the *County Servicing Standards* (RVC 2013) and, as applicable, the County land management policies.

### Biophysical Baseline Characterization (Sections 4 and 5)

A biophysical assessment completed for the Project involved collection of information through a desktop review of publicly available information and a field investigation. Information was collected on soils and terrain, vegetation, wetlands, wildlife and wildlife habitat. The wetland assessment included desktop and field study, mapping, and reporting, and was conducted by two ecologists following the Alberta Wetland Policy (GoA 2013a) and associated directives and tools required to comply with current regulations and guidelines. Biophysical information was also obtained from other studies being undertaken by SLR, including the hydrogeological update,

stormwater management plan, and landscape and visual assessment. Collected information was used to characterize the existing conditions of the Project area (the property) and vicinity.

**Natural and Physiographic Regions:** The Project is located within the Foothills Parkland Natural Subregion characterized by short, cool summers where hay or feed crops are the dominant crops; and at an average elevation of approximately 1,280 m above sea level (masl) within the Southern Alberta Upland physiographic region of the interior plains division (Pettapiece 1986). The Project area slopes to the southeast from the topographic high to the north and hosts a low-relief valley feature running northwest to southeast across the NW  $\frac{1}{4}$  section. In the SW  $\frac{1}{4}$  section the topography slopes steeply south-westerly into the valley running west-northwest to east-southeast which eventually leads into Bighill Creek.

**Soil:** Soils across the Project area are fertile loam to clay loam Orthic Black Chernozemics of the Dunvargan soil series, with Gleysolic soils present in poorly drained wetland areas. These soils have low wind erosion risk and moderate water erosion risk; no sensitive soils were observed within the Project area during the field investigation.

**Vegetation:** Vegetation in the Project area, similar to the surrounding area, has been heavily modified by agricultural land use. Vegetation communities documented in the Project area are primarily non-native hay crop, tame pasture and non-native species associated with the residences. Some areas of native pasture are present and pockets of aspen trees were found in the south half of the Project area. These communities were interspersed with prairie potholes exhibiting characteristic wetland species and treed areas dominated by aspen and native shrubs. No rare plants were found in the Project area. No prohibited or noxious weeds listed under the *Weed Control Act* were observed.

**Wildlife:** A review of all inventory data available for the area was completed to determine which species may be present within the Project area and to determine the potential for species at risk. A review of potential wildlife habitat was also completed, by accessing available air photos, to gain an understanding of potential habitat types (vegetation communities) present within the area. Field maps were used to provide reference during assessment of vegetation communities which may also provide key wildlife habitat in the area of the Project.

Provincially sensitive species and federally listed species have the potential to be present within the Project area. Four species at risk were observed during the assessment within the Project including the barn swallow, least flycatcher, eastern kingbird and great blue heron. Two active barn swallow nests were observed at two of the residences present in the Project area. The great blue heron was observed flying over the Project area and no evidence of nesting was found.

**Wetlands:** A desktop study following the wetland assessment protocol was completed for the Project area. A wetland field assessment was then conducted on June 2 and 3, 2019 by two Qualified Wetland Science Practitioners (QWSP). Twenty wetlands were identified and classified as gramminoid marsh wetlands (one Class III; five Class II; and 14 Class I, which included one identified as a dugout at the time of the assessment) and the required ABWRET-A forms subsequently submitted to Alberta Environment and Parks (AEP). Based on AEP evaluation of the ABWRET-A data, each wetland was assigned a wetland value category (i.e., A, B, C, or D, where A is considered the highest functioning); 13 category B, five category C, and two category D wetlands.

An assessment of wetland permanence was conducted, following guidance provided in the Guide for Assessing Permanence of Wetland Basins (GoA 2016). As wetland permanence is the

determining factor in whether the Crown can claim ownership of a wetland under the *Public Lands Act*, a review of the wetland's inundation characteristics over its current and historical presence is required. To assess the permanence of each wetland, the current state of the wetland was assessed through the site visit, and the historical state and inundation cycle was assessed through review of historical air photos, vegetation presence and climate data. Five of the wetlands were determined to have the potential to be Crown-claimable. Four wetlands could be considered Crown claimable; however, these four wetlands are outside of the planned development area and will be avoided through mitigation measures.

**Water Resources:** The Project area is within the Bighill Creek watershed within the Bow River Basin (RVC 2014). No mapped watercourses were identified in the Project area during the desktop review, and no obvious drainages were observed during the field assessment. One wetland, which currently presents as a dugout that appears to have been excavated at the location of an historical wetland, contained standing water at the time of field investigation. This dugout is located outside the area of planned aggregate extraction but within the area identified for storage of reclamation material.

A hydrogeological assessment was undertaken to gain an understanding of how the Project could potentially affect the groundwater; and to assess Project effects on water quantity and water quality. Based on study, the Project area lies in an area of substantive sand and gravel, overlain by a blanket of fine grained soils, and groundwater beneath the Project area eventually discharges at the Big Hill Springs (SLR 2019). The study determined that the wetlands are all surface water fed, with no permanent groundwater source.

### **Potential Project Effects and Mitigation Measures (Section 6)**

Potential effects of the Project on the biophysical resources were assessed by resource and best practices and mitigation measures are identified to avoid or minimize the potential effects. Residual effects of the Project after planned implementation of such practices and mitigation measures were then identified and described. Mitigation measures were identified to reduce or minimize Project effects on biophysical resources. With the implementation of mitigation measures, residual effects on biophysical resources are predicted to range from no residual effect to negligible residual effects.

### **Cumulative Effects Assessment (Section 7)**

A cumulative effects assessment was completed to assess the anticipated effects on the biophysical environment of the Project in combination with other reasonably foreseeable projects and activities in the area. Land use in the region includes intensive agricultural practices; oil and gas wells and associated infrastructure; residential acreages and low density residential communities; roads and aggregate developments. Given the small size of the Project, the disturbed nature of habitat within the Project area, and the intensive agricultural setting in the region, the Project is expected to have a negligible contribution to cumulative effects on vegetation and vegetation communities and wildlife and wildlife habitat in the region.

At the request of the County, a cumulative effects assessment is being completed (under separate cover) for air and noise for the three planned aggregate operations (Lafarge Canada, McNair Sand and Gravel, MALP); the subject aggregate developments will be expected to follow best practices and mitigation measures identified to minimize cumulative effects on air and noise in the region.

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## 1.0 INTRODUCTION

Mountain Ash Limited Partnership (MALP) is planning to develop an aggregate pit (the Project or development) along Highway 567 within the West half of Section 31, Township 26, Range 3, west of the 5<sup>th</sup> Meridian (W1/2 Sec 31-26-03 W5M), northeast of the Town of Cochrane, Alberta (Figure 1). The land is owned by 1410266 Alberta Ltd. (a general partner of Mountain Ash Limited Partnership). MALP is required to submit a Land Use Application (the Application) to Rocky View County (RVC or County) for land re-designation to allow for development of the aggregate resource. A portion of the Project (NW 31-26-03 W5M) was previously reviewed by the County and land use re-designation received in 2017. The current proposed project (the Project or development) has been expanded in area to include a portion of SW 31-26-03 W5M.

SLR Consulting (Canada) Ltd. (SLR) was retained to complete a Biophysical Impact Assessment (BIA) and wetland assessment to support Application to the County by MALP. This BIA report includes the following:

- Project description;
- Regulatory framework for the Project;
- Baseline inventory of biophysical resources;
- Identification of potential effects of the Project on these resources, recommended mitigation measures, identification of the residual effects and, as relevant, recommended monitoring; and
- Cumulative effects description of the residual effects of the Project in combination with effects of other development in the region.

SLR conducted a biophysical assessment to address the following biophysical components: soil and terrain; vegetation and wetlands; surface water, including fish and fish habitat; wildlife and wildlife habitat; and presence of species at risk.

SLR is also providing the following services based on requirements indicated in the *County Servicing Standards* (RVC 2013) (documents under separate cover):

- Hydrogeological Assessment Update;
- Conceptual Storm Water Management Plan (SWMP) Update;
- Landscape and Visual Assessment; and
- Cumulative Effects Assessment for Air and Noise.

## 2.0 PROJECT DESCRIPTION

The Project is being developed to extract sand and gravel that will be shipped to markets around Balzac, the Calgary International Airport, and north Calgary growth areas to meet the high demand for aggregate resources in the region. The area of aggregate extraction is anticipated to be 87.7 ha (216.6 acres). Aggregate extraction will not occur in the natural area in the northwest corner of the NW ¼ section or in the southern portion of the SW ¼ section. The Project to remove the aggregate resource, will be worked in six phases starting in the southeast corner and moving in a counter-clockwise direction, as shown in Figure 2. Each phase will be developed over a period of approximately 5 to 7 years through extraction within individual cells. The sand and gravel will be extracted under dry conditions. No dewatering of the underlying aquifer is planned; in this manner groundwater resources will be protected.

Approximately 4 to 6 m of glacial till overburden will be removed to access the sand and gravel resource. Topsoil and subsoil will be stripped, salvaged and stockpiled around the perimeter of the relevant extraction phase area, where it will serve to screen the development and ultimately be available for future use in site restoration. An earth berm and variable width buffer space will extend along the north and east perimeter of the Project area to serve as a visual and noise barrier.

Temporary and long-term drainage ditches will be built to collect and direct surface runoff, and infiltration sumps will be located to direct water flow through culverts to attenuation/settlement ponds located within the development. Erosion and sediment control measures will be implemented to prevent loss of soil and prevent release of sedimented water from the Project area.

During operation, progressive reclamation is planned as excavation in each phase is completed.

### **3.0 REGULATORY FRAMEWORK**

The aggregate development, when applied for, is subject to and must align with all relevant municipal, provincial and federal legislation, regulations and policies. Relevant federal legislation includes the *Migratory Birds Convention Act*, *Species at Risk Act* (SARA) and, if applicable, the *Fisheries Act*. Relevant provincial legislation includes the *Environmental Protection and Enhancement Act* (EPEA), *Water Act* and associated *Wetland Policy*, *Public Lands Act*, *Wildlife Act*, *Weed Control Act*, and *Historical Resources Act*. Relevant municipal guiding documents and standards and requirements specific to the County include the County Plan (RVC updated to 2018), County Land Use Bylaw (RVC 2019), the *County Servicing Standards* (RVC 2013) and, as applicable, the County land management policies.

The SW ¼ section of the property is zoned as Ranch and Farm District (RF) and the NW ¼ section is zoned as Natural Resource Industrial District (NRI) under the County's *Land Use Bylaw* (RVC 2019). The property's current use is ranch farming by a tenant occupier who lives in a dwelling on the site and ranches cattle, horses and sheep, and uses some of the land as hay pasture. Under the County municipal framework, to allow for aggregate extraction and processing on the property, SW ¼ section must be re-designated. Application requirements for land use are outlined in the *County Servicing Standards* (RVC 2013).

The Project will also be subject to the provincial Code of Practice for Pits (2004) made under the EPEA and the Conservation and Reclamation Regulation. Under the Code of Practice for Pits, the Project will require a Registration under EPEA.

### **4.0 METHODS**

The following steps were undertaken to complete the BIA:

- Project Description (Section 2) – provides a preliminary understanding of the Project components and activities;
- Regulatory Framework (Section 3) – provides an understanding of legislation and policies relevant to the Project;
- Biophysical Conditions (Section 5) – presents a description of existing conditions in the Project area based on desktop review and field investigation according to the methods presented in this section;

- Potential Project Effects and Mitigation Measures (Section 6) – presents a description of the potential effects of the Project on the biophysical resources, identifies mitigation measures that will be undertaken to avoid or minimize effects, and describes the residual effects of the Project by resource, and monitoring measures to be conducted throughout the life of the Project; and
- Cumulative Effects Assessment (Section 7) – presents a brief assessment of the residual Project effects within the regional context.

The primary spatial boundary considered in the Project assessment is the Project area (W1/2 31-26-03 W5M, including the planned extraction phase footprints, stockpile areas and undeveloped areas). The temporal boundary considered includes the period from phased clearing and excavation, and progressive reclamation to completion of reclamation. This time period may vary depending on progress through extraction phases and market conditions, but is expected to last up to 35 years.

#### **4.1 Biophysical Assessment**

The assessment of biophysical resources completed by two ecologists included a desktop review and field investigation, including a wetland assessment to meet requirements set out in the Alberta Wetland Policy (GoA 2013a). A review of available and relevant databases and secondary source material was completed prior to conducting the field investigation. The ecologists undertook a field investigation of the Project area (W1/2 Sec 31-26-03 W5M) on June 1 to 4, 2019.

A desktop review of publicly available information was completed, and the information was used to characterize the baseline conditions of the Project and vicinity. The following information sources were reviewed (references at end of report):

- Alberta Soil Information Centre (ASIC) Agricultural regions of Alberta soil inventory database (AGRASID) (Version 4.0 and 4.1) (Alberta Agriculture and Forestry 2016);
- Alberta Conservation Information Management System (GoA 2019a);
- Alberta Fisheries and Wildlife Management Information System (FWMIS 2019b);
- Alberta Merged Wetland Inventory (AEP 2019);
- Current General Status of Alberta's Wild Species – 2015 (GoA 2017a);
- Natural Regions and Subregions of Alberta (2006);
- Federal Species at Risk Public Registry (GoC 2012);
- Committee on the Status of Endangered Wildlife in Canada (GoC 2019a);
- Current and historical Alberta Government and Google Earth aerial images; and
- Rocky View County – County Servicing Standards (Approved by Resolution No. 188-13) (RVC 2013).

##### **4.1.1 Soil Assessment**

The AGRASID Alberta Soil Information Viewer (Alberta Agriculture and Forestry 2016) was accessed to determine soils expected to be present in the Project area. The Alberta Soil Names File (Generation 4) User's Handbook (Alberta Soil Information Centre 2016) was also consulted. This document presents the authoritative suite of acceptable soil series names, with some of their defining attributes, for use in Alberta. The document outlines soil series name, characteristics such as order, great group, subgroup and parent material type and texture of soils that occur within a subject area (Alberta Soil Information Centre 2016).

#### **4.1.2 Vegetation Assessment**

Information on the types of vegetation, which may be present within the Project, was achieved by accessing sites and documents such as the *Natural Regions and Sub-regions of Alberta* (Natural Resources Committee 2006) and *Range Plant Communities and Range Health Assessment Guidelines for the Foothills Parkland Subregion of Alberta* (Alberta Sustainable Resources Development 2012). The AEP ACIMS (GoA 2019a) database was also used to determine if any sensitive species had been recorded in the area.

#### **4.1.3 Watercourse Assessment**

The AEP Fisheries and Wildlife Management Information System (FWMIS) Fish and Wildlife Internet Mapping Tool (FWIMT) (GoA 2019b) was accessed prior to conducting the field assessment to determine if any information was available on presence of mapped watercourses and associated fish.

#### **4.1.4 Wildlife and Wildlife Habitat Assessment**

A review of FWMIS using the FWIMT and other inventory data available for the area was completed to determine which species may be present within the Project area and to determine if any of these species may be provincially (GoA 2017a) or federally (GoC 2019a) listed species at risk (SAR). A review of potential wildlife habitat was also completed, by accessing available air photos, to gain an understanding of potential habitat types (vegetation communities) present within the area. Field maps, similar to those prepared for the wetland assessment, were used to provide reference during assessment of vegetation communities which may also provide key wildlife habitat in the area of the Project.

To determine which bird species are present within the area of the Project, standard survey methods as identified in the *AEP Sensitive Species Inventory Guidelines* (GoA 2013b) were used in the field in addition to collecting incidental observations of bird sign. Point counts were identified as the best survey method for the available habitat. As such, points were established in the field based on changes in vegetation, topography and land use. As identified in the desktop review, the Project was understood to be composed of hay field, grazing areas, small copses of trees and residential areas. To ensure that all habitat types were assessed, point count locations were distributed throughout the Project area. In addition to bird point counts, incidental observations, including visual, vocalizations, scat, track and sign, were also documented in the field for all wildlife species.

#### **4.1.5 Wetland Assessment**

##### **4.1.5.1 Identification of Wetlands**

Prior to conducting the field portion of the BIA, a review of the Alberta Merged Wetland Inventory (AEP 2019) was conducted to determine if any of the potential wetlands within the Project area have been mapped by the province. Following this, a review of current and available historical air photos was completed to confirm presence and locations of mapped wetlands by the province and to determine if any additional smaller, unmapped wetlands were present within the Project area. Comparison of air photos for both wet and dry years allowed for identification of all potential wetlands which may appear dry during the 2019 site visit. Following this review, a field map of all potential wetlands was created with a centroid location for each wetland marked to allow for field relocation.

#### **4.1.5.2 Wetland Delineation, Classification and ABWRET-A**

The Wetland Assessment, mapping, and reporting conducted by SLR in the field followed the Alberta Wetland Policy (GoA 2013a) and associated directives and tools required to comply with current regulations and guidelines. The Alberta Wetland Classification System was applied which groups wetlands into five major classes – bogs, fens, swamps, marshes and shallow open water wetlands – based on common physical, chemical and biological characteristics. The system subdivides each class by their vegetative form (e.g., dominated by trees, shrubs, grass-like plants, aquatic plants) and type (e.g., water permanence, pH, salinity; GoA 2015a).

Following completion of classifying the wetlands, the Alberta Wetland Rapid Evaluation Tool (ABWRET-A), which is a standardized method, was used to assess the function of the wetlands using on-site observations and off-site spatial data. This method is used to determine the relative value of each wetland. The output of this tool provides the relative value of each wetland which is then used to inform decisions to avoid high-value wetlands and the output determines the replacement ratios and costs for wetland replacement where avoidance of wetland loss is not possible (GoA 2015b). Alberta has calibrated ABWRET-A into broad regions in Alberta; the Parkland-Grassland Natural Region and the Boreal-Foothills Natural Region. The Project is within the Parkland-Grassland Natural Region.

### **5.0 EXISTING BIOPHYSICAL CONDITIONS**

The current biophysical conditions on the Project area are described in this section, based on results of the desktop and field investigation. Photographs taken during the field investigation are provided in Appendix A, and figures prepared to support this section are provided in Appendix B.

#### **5.1 Natural Subregion**

The Project is located within the Foothills Parkland Natural Subregion characterized by short, cool summers where hay or feed crops are the dominant crops. Where seepage zones or low areas are present, aspen (*Populus tremuloides*) forests with understories of snowberry (*Symphoricarpos albus*), silverberry (*Elaeagnus commutata*), white meadowsweet (*Spiraea alba*), prickly rose (*Rosa acicularis*), saskatoon (*Amelanchier alnifolia*) and a diverse array of herbaceous species on well to imperfectly drained Black and Dark Gray Chernozems can be found (Natural Resources Committee 2006).

Wildlife composition within the Foothills Parkland Natural Subregion closely resembles species found in the Rocky Mountain Natural Region. Birds found in the subregion include: blue grouse, alder flycatcher, dusky flycatcher, yellow warbler, MacGillivray's warbler, white-crowned sparrow, and clay-coloured sparrow, (Alberta Wilderness Association 2015). Habitat is excellent for elk and moose, and where watercourses are present, bull trout habitat can also be found (Alberta Wilderness Association 2015).

#### **5.2 Physiography, Topography and Geomorphology**

The Project area is situated in the Southern Alberta Upland physiographic region of the interior plains division (Pettapiece 1986). The geomorphological characteristics of this physiographic region are provided by the proximity of bedrock to the surface which causes a varied topography with elevations up to 1,650 m above sea level (asl) to the west. The Project area is located at an average elevation of approximately 1,280 masl. The Project area slopes to the southeast from the topographic high to the north and hosts a low-relief valley feature running northwest to southeast

across the NW ¼ section. In the SW ¼ section the topography slopes steeply southwesterly into the valley running west-northwest to east-southeast which eventually leads into to Bighill Creek within the Bighill Creek watershed.

The physiographic region coincides with the Foothills Natural Region which is comprised of dissected plateaus and rolling uplands with surficial geology comprising glacial till and abundant fluvial deposits. The climate in this natural sub-region is typically characterized by cool summers and cold winters but highly influenced by the periodic warm Chinook winds (Downing and Pettapiece 2006). Compared to the rest of the country, Alberta has relatively low precipitation in the lee of the mountains and total average annual rainfall in the area is 450 to 500 mm per year (Alberta Agriculture, Food and Rural Development 2000).

### 5.3 Soil

Desktop review determined that underlying parent material in the Project area is moderately to strongly calcareous, mixed Continental and Cordilleran till (Alberta Soil Information Centre 2016). Fertile loam to clay loam Orthic Black Chernozemic soils are extensive, with Gleysolic soils present in poorly drained and lower slope positions expected at the Project (Alberta Agriculture and Forestry 2016). The Dunvargan soil series, a fertile, well-drained Orthic Black Chernozem formed on glacial till parent material, was identified across the majority of the Project area, with the gleyed variant (Dunvargan-GL) identified in depressional areas.

Outside of the low areas and wetlands, shovel tests conducted during the field investigation confirmed that the majority of the Project area consists of Orthic Black Chernozems of the Dunvargan soil series. Textures were loam to sandy clay loam. Wetlands contained gleyed Dunvargan soil series, with mottling in the Bmgj and Ccag and Ckg horizons (Figure 1). Areas of soil disturbance were noted in the vicinity of the several residences in the Project area. Example profiles of Dunvargan and Dunvargan-GL soils are identified in Tables 1 and 2. These soils have low wind erosion risk and moderate water erosion risk. During construction, best practices for erosion and sedimentation control will need to occur to prevent soil erosion once the vegetation is removed. Topsoil and upper subsoil should be salvaged and stockpiled separately for reclamation purposes.

**Table 1**  
**Example Profile for Dunvargan Soil Series**

Horizon	Depth (cm)	Colour	Field Texture	Structure	Consistence
Ap	0 - 19	black	clay loam	-	friable
Bm	19 - 38	dark yellowish brown	clay loam	-	firm
Cca	38 - 57	pale brown	sandy clay loam	massive	very firm
Ck	57 - 100	yellowish brown	sandy clay loam	massive	very firm

**Table 2**  
**Example Profile for Dunvargan-GL Soil Series**

Horizon	Depth (cm)	Colour	Field Texture	Structure	Consistence
Ap	0 - 33	black	clay loam	-	friable
Bmgj	33 - 52	brown	clay loam	-	firm
Ccag	52 - 59	grayish brown	clay loam	massive	firm
Ckg	59 - 100	yellowish brown	sandy clay loam	massive	firm

## 5.4 Vegetation

The field investigation determined that the majority of the vegetation in the Project area is either tame pasture or hay with an area of native pasture in the southeast and treed areas. Vegetation in the tame pasture consisted of smooth brome (*Bromus inermis*), slender wheatgrass (*Agropyron trachycaulum*) and forbs such as yarrow (*Achillea millefolium*) and dandelion (*Taraxacum officinale*). The native pasture was comprised of a range of species including fescue (*Festuca*), western wheatgrass (*Agropyron smithii*), shooting star (*Dodecatheon pulchellum*), golden bean (*Thermopsis rhombifolia*) and shrubby cinquefoil (*Potentilla fruticosa*). Pockets of aspen trees with prickly rose (*Rosa acicularis*), prairie rose (*Rosa arkansana*) and shrubby cinquefoil (*Dasiphora fruticose*) were found in the south half of the Project area. The residences on site were associated with non-native vegetation including caragana (*Caragana arborescens*). No rare plants were found in the Project area. No prohibited or noxious weeds listed under the *Weed Control Act* were observed.

Vegetation communities identified in the Project area are delineated on Figure 2 (Appendix B) and a vegetation (vascular plant) species list with indication of the associated vegetation community type is provided in Appendix C.

## 5.5 Wildlife

A review of the FWMIS database using the FWIMT resulted in identification of five provincially sensitive species listed under the current *General Status of Alberta's Wild Species* (GoA 2017a) within a 1,000 m buffer of and including the Project area. Of the five species identified, the barn swallow is also listed as Threatened under the COSEWIC and under Schedule 1 of SARA (GoC 2019a). The following species were found within the FWMIS search area:

- great blue heron
- sora
- least flycatcher
- eastern kingbird
- barn swallow

### 5.5.1 Wildlife and Wildlife Habitat Observed

A wildlife and wildlife habitat assessment was completed in the field to understand potential for reduction or loss of habitat following development of the Project. Prepared field maps were reviewed in the field and confirmation of suitable habitat was documented from identification of wildlife use (observations, vocalizations, scat, track, sign).

The Project area supported hay crop, tame pasture, native pasture, treed areas, wetlands and dwellings. The area is fenced along the perimeter and within the Project area as cattle graze within the tame pasture areas.

The potential for grass nesters and tree nesters to use the Project area for nesting habitat is high as both nesting types of birds were observed during the point count surveys and as incidental observations. No active grassland nests were observed; however, a smaller unoccupied stick nest was observed in the southeast part of the Project area. Nest boxes were observed along the access roads leading to one of the dwellings. One nest box was occupied by a pair of mountain blue birds.

Three dwellings are present in the Project area. Two of the larger dwellings within the south portion of the Project had barn swallows constructing and occupying nests located under the eaves troughs of the roofs (Figure 3; Appendix B). Garden shrubs and trees adjacent to the dwellings were also occupied by migratory songbirds, including American goldfinches and house wrens.

Deer and elk scat was observed in the Project area. No deer were observed; however, observations were made off site where shrubby habitat is present.

### 5.5.2 Bird Point Counts

Bird point counts were conducted between 6:30 am and 10:00 am June 2 and 3, 2019. Point count locations were established commencing in the northwest corner of the Project area moving on foot in a meandering pattern eastward to the east edge of the Project area (see Figure 2; Appendix B). This pattern was repeated south of the first row of point count locations moving westward and continued until the south end of the Project area. Point count locations were adjusted to include differing habitat types such as stands of trees, shrubs, grassland, residences, pasture and hayfield.

The bird point count was repeated on the second day to increase the probability of detecting all species present in the Project area. Care was taken to note any ground nesting birds which may have flushed due to the biologists moving through the area. In total, 26 different species of birds were identified during the point count survey (Table 3). Seven of the 26 birds identified are not listed under the *Migratory Bird Convention Act* (GoC 2019b) and two species identified are listed as Sensitive in Alberta.

**Table 3**  
**Bird Species Observed During Bird Point Counts June 2-3, 2019**

Common name	Scientific name	Common name	Scientific name
Red-tailed Hawk	<i>Buteo jamaicensis</i>	Mountain Bluebird	<i>Sialia currucoides</i>
Wilson's Snipe	<i>Gallinago delicata</i>	American Robin	<i>Turdus migratorius</i>
Least Flycatcher <sup>(a)</sup>	<i>Empidonax minimus</i>	Savannah Sparrow	<i>Passerculus sandwichensis</i>
Alder Flycatcher	<i>Empidonax alnorum</i>	Clay-colored Sparrow	<i>Spizella pallida</i>
Western Wood-Peevee	<i>Contopus sordidulus</i>	Vesper Sparrow	<i>Pooecetes gramineus</i>

Common name	Scientific name	Common name	Scientific name
Eastern Kingbird <sup>(a)</sup>	<i>Tyrannus</i>	Song Sparrow	<i>Melospiza melodia</i>
Common Raven	<i>Corvus corax</i>	White-throated Sparrow	<i>Zonotrichia albicollis</i>
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>	Red-winged Blackbird	<i>Agelaius phoeniceus</i>
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>	Brewer's Blackbird	<i>Euphagus cyanocephalus</i>
Tree Swallow	<i>Tachycineta bicolor</i>	Brown-headed Cowbird	<i>Molothrus ater</i>
Black-billed Magpie	<i>Pica hudsonia</i>	House Sparrow	<i>Passer domesticus</i>
Black-capped Chickadee	<i>Poecile atricapillus</i>	American Goldfinch	<i>Spinus tristis</i>
House Wren	<i>Troglodytes aedon</i>		

Notes:

<sup>(a)</sup> Listed as "Sensitive" in Alberta (AEP Alberta Wild Species General Status Listing, 2015 [GoA 2017a]).

### 5.5.3 Incidental Observations

In addition to bird species recorded during the bird point count survey, incidental observations of other bird species, mammals, scat, track and sign were recorded. Table 4 lists the species observed.

**Table 4  
Incidental Wildlife Observations June 1-4, 2019**

Common name	Scientific name	Type of observation
<b>Birds</b>		
Great Blue Heron <sup>(a)</sup>	<i>Ardea herodias</i>	Flyover
Common Raven	<i>Corvus corax</i>	Observed/vocal
Barn Swallow <sup>(a)</sup>	<i>Hirundo rustica</i>	Residual mud nests along eaves troughs
House Wren	<i>Troglodytes aedon</i>	Observed/vocal
Mountain Bluebird	<i>Sialia currucoides</i>	Nesting pair observed at nest box
American Robin	<i>Turdus migratorius</i>	Observed/vocal
Song Sparrow	<i>Melospiza melodia</i>	Vocal
Brown-headed Cowbird	<i>Molothrus ater</i>	Observed
American Goldfinch	<i>Spinus tristis</i>	Observed/vocal

Common name	Scientific name	Type of observation
<b>Mammals</b>		
Elk	<i>Cervus elaphus</i>	Scat
Mule Deer	<i>Odocoileus hemionus</i>	Scat
Red Fox	<i>Vulpes</i>	Adult observed

Notes:

<sup>(a)</sup> Listed as “Sensitive” in Alberta (AEP Alberta Wild Species General Status Listing, 2015 [GoA 2017a]). Barn swallow is also listed under the SARA (GoC 2019a).

### 5.5.4 Species At Risk or of Conservation Concern

Provincially sensitive species and federally listed species have the potential to be present within the Project area, as indicted above. Of the five bird species listed, four species were observed during point counts or incidentally within the Project area (Figure 3; Appendix B). Two active barn swallow nests were observed under the eaves troughs of two of the residences present in the Project area. The least flycatcher and eastern kingbird were heard singing in aspen stands at a few locations in the Project area. A single great blue heron was observed flying over the Project and no evidence of nesting was found. Sora, the fifth provincially sensitive species, were not observed during field surveys; and specific habitat for sora was not present.

### 5.6 Wetland Assessments

The Project area includes wetlands as described in this section. These wetlands will be subject to the County’s Wetland and Conservation Management Policy (C-420), effective March 2010 (RVC 2010). The purpose of the policy is to conserve and manage wetlands within the context of protecting biodiversity and protecting wildlife habitat, maintaining water quality and quantity, contributing to groundwater recharge, and reducing erosion and flooding (RVC 2010).

Vegetation species found within each of the wetlands are listed in Appendix C and can be cross referenced for location on Figure 4 (Appendix B).

#### 5.6.1 Wetlands and Watercourses

The desktop review of potential wetlands within the Project area was conducted using the Alberta Merged Wetland Inventory database (AEP 2019). A total of 10 mapped wetlands were identified and confirmed on available air photos. In addition, current and historical air photos were assessed using wetter years to capture all possible wetlands and low areas which may be present in the Project area that may not have been mapped. Review of these air photos resulted in an additional ten wetlands which were confirmed in the field. In total, 20 wetlands were identified within the Project area.

No mapped watercourses, including those with documented fish species presence, were identified within the Project area based on using the FWIMT tool on FWMIS.

The wetland field assessment was conducted on June 2 and 3, 2019 by Kalina Noel, P.Biol. and Katrina Sharko, P.Ag. Under both professional designations, Ms. Noel and Ms. Sharko are permitted to complete wetland assessments as Qualified Wetland Science Practitioners (QWSP)

within the province of Alberta. All wetland assessment and reporting were conducted in accordance with the Alberta Wetland Policy (GoA 2013a) and its associated Directives and tools (GoA 2017b).

### 5.6.2 Classification of Wetlands

Each wetland area identified during the desktop assessment was assessed for vegetation structure and soil structure as well as biological, hydrological, and where possible, chemical attributes to determine if it met criteria to be considered as a wetland under the Alberta Wetland Policy (GoA 2013a). If so, the Alberta Wetland Classification System (GoA 2015a) was used to classify each wetland as a bog, fen, swamp, or marsh. There were no shallow open water wetlands identified other than the dugout. The 20 wetland areas identified from the desktop assessment were located and classified in the field as the following (see Figure 4):

- one Class III graminoid marsh wetland;
- five Class II graminoid marsh wetlands;
- 14 Class I graminoid wetlands, including one identified as a dugout at the time of the assessment.

At the time of the assessment, these 14 Class I graminoid wetlands were farmed through, being identified within cultivated hay fields or tame pasture in the Project area. Due to the presence of hay crop or tame pasture and the lack of water or graminoid marsh and obligate wetland species present, confirmation of the location of the wetland was made by identification of remnant disturbance species such as dandelion, smooth brome or Kentucky blue grass (*Poa pratensis*). In addition, an observation of a depression in the topography was made at each wetland, where present. Where no obvious vegetation or topographical signs were observed, the centroid location of the wetland identified during the desktop assessment was used in the field to identify the location of the wetland.

The five wetlands identified as Class II were more notable on the landscape and had a number of species present including silverweed (*Argentina anserina*), common plantain (*Plantago major*), hair grass (*Deschampsia cespitosa*), dandelion, clover (*Trifolium sp.*) and western dock (*Rumex occidentalis*). Within one wetland, water sedge (*Carex aquatilis*), which is typically found in shallow open water wetlands, was observed. However, no standing water was observed at the time of the assessment and grazing of the sedge as noted during the field investigation suggests that the sedge likely germinated following snow melt earlier in the year. The two largest Class II wetlands (wetlands 19 and 20) were observed in the northwest corner of the Project area. Although these wetlands are located within an area that is not slated for disturbance, they were still classified and delineated for the purposes of avoidance mitigation. Review of historical air photos revealed that these wetlands were likely Class III or IV wetlands in the past. However, due to ongoing use of the area as pasture, in 2019 these wetlands exhibited extensive damage from cattle grazing. This has resulted in the decreased ability of each wetland to retain water and to provide good habitat for obligate wetland species. The remaining two Class II wetlands were also dry at the time of the assessment.

One wetland (wetland 1) was classified as a Class III graminoid wetland. This wetland is located in the southwest corner of the Project area. Needle spikerush (*Eleocharis acicularis*) (central zone), water sedge (inner zone), wild mint (*Mentha arvensis*), smooth brome, curled dock, and hair grass (outer zone) were observed. As identified in the historical air photos, this wetland has likely always been a Class III wetland. Due to limited use of the area as pasture, this wetland has sustained little damage and has retained its function.

### 5.6.3 **Wetland Valuation – ABWRET-A**

Following submission of the ABWRET-A forms to AEP and providing additional information to AEP, SLR received wetland valuation results from AEP. AEP generates a score for each wetland based on data collected in the field and provided on ABWRET-A forms, existing spatial data compiled case-by-case by AEP, and models (logic-based formulas); the score represents the relative levels of 14 wetland function criteria (GoA 2015b, 2013a). A wetland's overall function is then assigned a wetland value category (i.e., A, B, C, or D, where A is considered the highest functioning) (GoA 2015b). Based on AEP's evaluation, the wetlands on the Project area were classified as follows:

- 13 are category B wetlands;
- five are category C wetlands; and
- two are category D wetlands.

These categories are intended to assist AEP and the applicant seeking a *Water Act* approval related to wetlands in making decisions about wetland avoidance, minimization and replacement, (GoA 2015b). Results of the ABWRET-A submission for the 20 classified wetlands can be found in Appendix D.

### 5.6.4 **Crown Claimability**

#### 5.6.4.1 *Regulation*

Under the Guide for Assessing Permanence of Wetland Basins (GoA 2016), assessment of wetland permanence and subsequently ownership is undertaken. In the case of the proposed aggregate resource development, a commercial land use is intended to occur on a land parcel where wetlands may be Crown claimed under the *Public Lands Act*. The bed and shores of water bodies which fall under Crown ownership under Section 3 of the *Public Lands Act* include those wetlands which are (GoA 2016):

- Bodies of water supporting open water and associated aquatic vegetation;
- Must be naturally occurring having geomorphic origin and not man-made; and
- Must be permanent – sustaining persistent inundation.

As permanence is the determining factor in whether the Crown can claim ownership to a wetland, a review of the wetland's inundation characteristics over its current and historical presence is required (GoA 2016). Any alterations to a water body such as ditching, dugouts and impounding works is not taken into account in the determination of permanence (GoA 2016). To assess the permanence of the wetland, the current state of the wetland was assessed through the site visit, and the historical state and inundation cycle was assessed through review of historical air photos, vegetation presence and climate data.

#### 5.6.4.2 *Determination*

Review of available historical air photos and climate data was conducted to determine potential permanence of the classified wetlands. The following air photos were available for the site:

- August 14, 1953;
- September 19, 1964;
- May 31, 1974;

- April 26, 1980;
- May 7, 1994;
- September 28, 2008; and
- Mid-Summer 2016.

Climate data accessed using the *Interpolated Weather Data Since 1961 for Alberta Townships* (Alberta Agriculture and Forestry 2019) provided monthly precipitation and the total annual precipitation for the corresponding years.

Review of the available air photos and corresponding climate data determined that the Class III wetland (wetland 1), 4 of the Class II wetlands (wetlands 3, 17, 19, and 20) and 4 of the Class I wetlands (wetland 2, 4, 11, and 18) show historical water persistence between 1954 and 2016. Of note, wetland 5, which was assessed in 2019 as a dugout, was interpreted as a functioning Class III wetland historically. The excavation of the wetland likely occurred between 2008 and 2016 as determined from the available air photos.

Based on review of available climate data for the time of each historical air photo, the following annual rainfall values correspond to the associated historical air photos:

- 1953 – no data available;
- 1964 – 473.68 mm;
- 1974 – 387.42 mm;
- 1980 – 471.41 mm;
- 1994 – 506.88 mm;
- 2008 – 662.5 mm; and
- 2016 – 441.54 mm.

## **5.7 Water Resources Assessment**

### **5.7.1 Surface Water**

The Project area falls within the Bighill Creek watershed within the Bow River Basin, as shown on the Rocky View County map of Watershed Sub-Basins (RVC 2014). Bighill Creek flows within Big Hill Springs Provincial Park, which is located southeast of the Project area in N ½ Sec 29, Twp 26, Rge 2 W5M. Bighill Creek is considered of provincial environmental significance (GoA 2015c) based on the presence of the natural spring that feeds the perennial creek. An environmentally significant area is defined as an area important to the long-term maintenance of biological diversity, physical landscape features or other natural processes (Fiera 2014).

No mapped watercourses were identified in the Project area during the desktop assessment. No obvious drainages were observed during the field assessment that would connect wetlands hydraulically.

None of the wetlands observed—except wetland 5—contained standing water at the time of the field investigation. Wetland 5 presents as a dugout in the Project area, outside the area of planned aggregate extraction but within the area identified for storage of reclamation material. It was determined during the desktop assessment that this dugout had been excavated at the location of an historical wetland.

Based on study of groundwater conditions in the Project area as characterized in the hydrogeological update study being completed as described below, the wetlands are all surface water fed, with no permanent groundwater source.

### **5.7.2 Groundwater**

A hydrogeological assessment was completed by SLR for the proposed Project (SLR 2019) to gain an understanding of how the Project could potentially affect the groundwater; and to assess Project effects on water quantity and water quality. Water quantity refers to potential effects on water levels in wells and wetlands, groundwater flow volumes, and spring discharge volumes. Water quality refers to the potential changes in groundwater quality or surface water quality. To initiate the assessment, a review of available information including published geological maps and water well records was conducted; and then a field investigation was undertaken to find local wells, and to drill and install monitoring wells within the Project area.

Based on study findings, the Project area lies in an area of substantive sand and gravel, overlain by a blanket of fine grained soils. Groundwater beneath the Project area eventually discharges at the Big Hill Springs. Neighbouring domestic wells, nearby natural heritage features (Bighill Creek), and the Big Hill Springs Provincial Park were considered in the assessment in relation to the potential for cumulative impacts.

## **5.8 Historical Resources**

Land Subdivisions (LDSs) 3 to 6 within SW 31-26-03 W5M and and LSDs 11 to 14 within NW 31-26-03 W5M are assigned a Historical Resource Value (HRV) of 5a under the October 2019 Listing of Historical Resources (Alberta Culture, Multiculturalism and Status of Women 2019a). A listing of 5a indicates that the area has the high potential to contain a historic resource of archaeological concern (Alberta Culture, Multicultural and Status of Women 2019b).

To meet provincial requirements, it is recommended that application under the *Historical Resources Act* be made and clearance obtained prior to Project development.

## **5.9 Other Features**

### **5.9.1 Landscape and Visual Assessment**

A landscape and visual assessment is being completed for the Project; the “assessment” is considered a “visual appraisal” rather than a formal “visual impact assessment”. This report will be provided under separate cover.

### **5.9.2 Air and Noise Assessments**

Air and noise data collection has been completed for the Project. Data analysis and preparation of an assessment report under separate cover is underway for provision to MALP to support the Application.

## **6.0 POTENTIAL PROJECT EFFECTS AND MITIGATION MEASURES**

### **6.1 Soil**

#### **6.1.1 Potential Effects**

No sensitive soils were identified during the field investigation.

Soil could be affected by any Project activity that involves soil disturbance. Soil handling and storage during Project development provides the potential for soil loss and reduced soil quality. Removal of the topsoil and subsoil to access the aggregate material may result in soil admixing and loss of organic matter. Soil loss from wind or water erosion may occur following vegetation removal and during soil stockpiling. The potential also exists for contamination of soils during equipment refueling or as a result of an inadvertent spill or leak of hydrocarbon or other deleterious substance.

#### **6.1.2 Mitigation**

Soil will be salvaged in a manner that supports successful reclamation and return to equivalent land capability. To maintain the productivity of the topsoil for future use in reclamation, the upper subsoil (Bm and Bmgj) horizons will be salvaged and stored separately from the topsoil (Ap). MALP has identified a location at the south end of the Project area for stockpiling of soil material to be used during reclamation (Figure 2, identified as Stockpiling / Reclamation Material).

A Project-specific erosion and sediment control plan will be developed, including the establishment of specific erosion control measures at specific locations to reduce the likelihood of soil loss due to erosion. In addition, soil stockpiles will be vegetated for stability, if necessary, and monitored for erosion, and remedial action will be taken as needed to maintain the integrity of topsoil and subsoil stockpiles.

During site reclamation, the subsoil and topsoil will be placed in the reverse order to their removal to provide a suitable growing medium. Average topsoil depth should be at least 80% of what it was prior to disturbance, following reclamation.

#### **6.1.3 Residual Effects**

The Project is expected to result in loss of productive soil within the Project area for the duration of aggregate extraction in a given Project phase until reclamation is completed in that area. It is anticipated that with the implementation of the planned soil handling measures and erosion and sediment control plan, topsoil and subsoil will be available and suitable for use in reclamation; and no residual effects of the Project on the soils are expected upon completion of reclamation in the Project area.

### **6.2 Vegetation**

#### **6.2.1 Potential Effects**

No rare plants or rare ecological communities were documented in ACIMS or identified during the field investigation.

Vegetation could be affected by any Project activity that involves vegetation clearing or soil disturbance. Clearing of vegetation during all phases of development will result in vegetation loss. The majority of the vegetation loss will be non-native vegetation species within the tame pasture and hayland. Small treed areas of native aspen and shrubs and the heavily grazed native pasture present in the southern half of the planned development will be lost.

Equipment coming on site from another property could introduce weedy or invasive species, and soil disturbance has the potential to result in the spread of weedy species within disturbed areas and stockpiles and, potentially, outside the planned development area. Introduction and proliferation of invasive or non-native plant species into adjacent native vegetation communities (riparian and wetland areas) may result in alteration of natural habitats.

### **6.2.2 Mitigation**

MALP is making provisions to retain the tame pasture with two wetlands in the northwest corner of the Project area as part of their proposed wetland mitigation plan.

The phased approach of the development will allow for seeds from the undeveloped areas to continue to enter the seed bank and be dispersed by wind and wildlife. Re-establishment of the seed laden topsoil during site reclamation will allow for propagation of species that were present prior to disturbance.

The *Weed Control Act* requires that all landowners keep weeds under control. Weed control measures (e.g., by spraying with non-persistent herbicide or mowing) will be implemented to prevent or limit the growth and spread of undesirable species, in accordance with the *Weed Control Act* and County expectations.

All equipment involved in clearing and topsoil salvage activities that arrives in the Project area must be clean and free of soil, debris and vegetative matter. A clean equipment protocol is recommended to reduce the chance of invasive species proliferation, and any equipment that arrives in a dirty condition should be cleaned off before working on site.

Topsoil stockpiles and screening berms consisting of salvaged soil will be monitored for growth of invasive species frequently during the growing season and corrective measures taken, if warranted, to remove plants (e.g., by mowing, spraying with non-persistent herbicide) before weedy species produce seed.

### **6.2.3 Residual Effects**

The Project is expected to result in loss of primarily non-native vegetation within the Project area for the duration of aggregate extraction in a given Project phase until reclamation is completed in that area. It is anticipated that with the implementation of the planned phased development approach, weed control measures and proper soil management, residual effects of the Project on the native vegetation resource are expected to be negligible (i.e., loss of treed areas, a small amount of heavily disturbed native pasture, and wetland vegetation).

## **6.3 Wildlife and Wildlife Habitat, including Species at Risk**

### **6.3.1 Potential Effects**

The Project area is heavily modified by existing land uses, with limited areas of native vegetation that provide limited habitat for wildlife species. The wetlands were dry during the 2019 surveys and would have limited value for wetland wildlife species. Active barn swallow (provincially 'sensitive' and federally 'threatened' species) nests were observed on two residences in the Project area; therefore, the potential exists to interact with or disturb species at risk.

Wildlife could be affected by activities including vegetation removal, removal of residences, topsoil stripping and salvage, excavation activities, and by vehicle and equipment traffic. Development will require the removal of habitat (treed areas and wetlands) and dwellings that may affect local wildlife use.

### **6.3.2 Mitigation**

As due diligence to avoid contravening the *Migratory Birds Convention Act* and to reduce the potential for impacting active migratory nesting birds which may nest between mid-April and late August, clearing of wetlands and vegetation will occur outside of this period (GoC 2019c). Similarly, care will be taken to demolish the residences or remove barn swallow nests from the residences outside the breeding season and prevent their renewed use; thereby avoiding interaction with a species at risk.

Best management practices will be implemented (e.g., abiding by restricted activity periods; keeping garbage in wildlife-proof containers; using measures to reduce noise and light during night hours; being aware of the potential for wildlife at the Project access and on haul routes) to limit the likelihood of adversely interacting with wildlife.

### **6.3.3 Residual Effects**

The Project is expected to result in minimal loss of wildlife habitat, and no interaction with or disturbance to species at risk. The Project area consists of primarily disturbed habitat and the area surrounding the Project consists of a similar intensive agricultural land use. Wildlife using the Project area is comprised of species typically found in a modified landscape and are accustomed to high levels of human use. Given the small area of the proposed development relative to habitat availability in the region, the development is not likely to adversely affect wildlife in the area. Effects of the Project are expected to persist throughout the development period; however, residual effects are expected to be reversed upon completion of reclamation. The Project effects are local and negligible in magnitude. Although habitat will be lost for the duration of the Project, the Project is not anticipated to have an effect on regional wildlife populations and residual effects therefore, are expected to be negligible.

## **6.4 Wetlands**

### **6.4.1 Potential Effects**

Development of the Project will necessarily disturb wetlands. SLR conducted a wetland assessment and has prepared a Wetland Assessment and Impact Report (WAIR) as required under the Alberta Wetland Policy (GoA 2013a) and for inclusion in the *Water Act* application. Twenty wetlands were identified on the Project area during the wetland assessment (Figure 3).

Seven of the wetlands within the development area (wetlands 1, 3, 5, 7, 11, 17 and 18) were historically interpreted as potentially permanent wetlands and, therefore, are potentially Crown-claimable.

#### **6.4.2 Mitigation**

MALP plans to mitigate Project effects on some wetlands by avoidance (wetlands 2, 3, 4, 7, 19 and 20); however, all other wetlands will be removed.

Under the Alberta Wetland Mitigation Directive (GoA 2018), the Wetland Mitigation Hierarchy outlines the management approach to wetland impacts in Alberta. The primary preferred wetland mitigation is to avoid and, secondarily, to minimize impacts to a wetland. Based on the conceptual footprint for the Project, the two larger wetlands in the northwest corner of the Project area (wetlands 19 and 20) will be avoided and 4 wetlands in the sensitive SW corner of the Project area (wetland 2, 3, 4, and 7). As the applicant under the *Water Act*, MALP is responsible to demonstrate that avoidance of these wetlands will occur and that the relative wetland value is preserved (GoA 2018). To meet provincial requirements MALP may need to submit a wetland minimization proposal including how these avoided wetlands will continue to maintain natural functions and conditions, and implement construction timing to minimize effects on wetland-dependent species (GoA 2018) following submission of the WAIR to AEP.

It is proposed that the other 14 wetlands be removed to accommodate planned development phases and the area designated for stockpiling soil for future site reclamation. In this case, under the Alberta Wetland Mitigation Directive (GoA 2018), MALP will be responsible to undertake one of the following options:

- Permittee-responsible replacement – Undertake a wetland replacement project to restore a previously drained wetland or construct a new wetland; or
- Pay a wetland replacement fee to AEP – replacement fee rates will be \$17,700/ha based on calculations in accordance with the Alberta Wetland Mitigation Directive (GoA 2018).

#### **6.4.3 Residual Effects**

Wetlands will be lost to develop the Project as currently planned. Based on implementing the required mitigation measures under the Alberta Wetland Policy, the effect on wetlands is considered to be addressed. Depending on the mitigation option implemented, wetlands may be established within the Project area during reclamation or at another location as directed by AEP.

### **6.5 Water Resources Assessment**

#### **6.5.1 Potential Effects**

Surface water could be affected by any Project activity that involves soil or ground disturbance during all phases of development. Potential effects on surface water include change in flow quantity and direction and change in water quality. Potential effects of the Project on groundwater could result from excavation activities, and include changes to the level or flow volume, change in flow direction, or change in quality. During the aggregate extraction and associated processing (crushing, screening, conveying), there is potential for on site runoff water to become affected by suspended solids due to surface runoff from working areas, stockpiles and haul roads. The main potential source of water pollution is from manmade sources such as fuels and solvents and natural sources such as suspended solids from reworking of the material on site.

### **6.5.2 Mitigation**

It is proposed that the excavation will be operated “dry” (i.e., above the water table, with no dewatering needed), with the base of the excavation lying 1.5 m above the maximum recorded groundwater level within the sand and gravel deposits. The phased development and limited area open to excavation at a given time will minimize the working area and reduce the potential for generation of suspended sediment in surface water runoff that could result in a change in water quality.

A stormwater management plan is being developed for the Project. Settlement lagoons and surface infiltration features established early in the development will serve to collect, control and contain surface runoff within the Project area; and there will be no direct off site discharge of surface water. In addition, temporary catch basins and sumps are planned to collect, gather and manage surface water runoff generated at site within the working areas.

During Project development and operation, best management practices to maintain water quality (as described above and the implementation of appropriate spill prevention and response) will be implemented.

### **6.5.3 Residual Effects**

With implementation of the planned mitigation measures including establishment of the stormwater management plan, Project effects on the surface water and groundwater environment are expected to be negligible. Any changes in surface water flow are expected to be temporary and eventual restoration of natural surface water flow will be addressed during reclamation activities. Groundwater flow directions will remain the same and no reduction in groundwater flow volumes is anticipated, a positive feature as this is expected to result in no reduction in flow at the Big Hill Springs.

### **6.5.4 Monitoring**

As an additional safeguard and as described in more detail in the Hydrogeological Assessment report (SLR 2019), it is recommended that the current groundwater monitoring program continues to be undertaken, including the following:

- Regular monitoring of water levels within the perimeter monitoring boreholes and the nearby residential water sources;
- Routine inspections and documentation to confirm that there are no signs of groundwater entering the excavation;
- Installation (on a temporary basis) of shallow confirmatory monitoring wells as the base of the excavation is lowered to near the anticipated depth (1.5 m above maximum water level) to refine the actual position of the water table; and
- Routine review and interpretation of all monitoring data to allow any unanticipated problems to be addressed in a timely manner.

## **6.6 Other Features**

Following completion of the Landscape and Visual Assessment and the Noise and Air Cumulative Effects Assessment, reports under separate cover will be prepared. These reports will provide information on potential effects of the Project on the specific resources, planned mitigation measures, and residual effects which may be identified as a result of the Project. Where relevant,

cumulative effects assessments for each of these resources will be presented (i.e., cumulative effects of air and noise conditions as a result of the residual effects attributed to the MALP Project in combination with the anticipated effects of adjacent planned Lafarge Canada and McNair Sand and Gravel developments).

## **7.0 CUMULATIVE EFFECTS ASSESSMENT**

Cumulative effects are changes to the environment that are caused by an activity or project in combination with other past, present and reasonably foreseeable future activities or projects. Where a project results in a residual effect on a given biophysical resource after implementation of mitigation measures, it is considered in the cumulative effects assessment.

Vegetation in the region, similar to the Project area, has been heavily modified by existing land uses consistent with intensive agricultural practices. The current land use in the region is primarily agricultural with cultivation and grazing activity. Residential acreages and low density residential communities have also developed on the lands nearby the Project area, in close proximity to amenities in Cochrane and the city of Calgary. Oil and gas wells and associated infrastructure have been established in the surrounding lands, as evidenced immediately north of the Project area. Aggregate extraction operations have been developed to take advantage of the abundant sand and gravel resources within the County, in close proximity to potential end users in the Calgary region.

This cumulative effects assessment is focused on consideration of the nearby operating and planned aggregate developments. The existing Big Hills Springs gravel operation (NW 36-26-04 W5M) is located approximately 800 m west of the Project area, and two other aggregate developments are currently under application with the County – the proposed Lafarge Canada (NE 36-26-04 W5M) development located immediately adjacent to the west and the proposed McNair Sand and Gravel development (SE 1-27-04 W5M) located immediately to the northwest.

Extraction of natural resources including aggregate development is an important land use in Rocky View County (RVC 2018). Aggregate development in the County is also an area of concern for some members of the public (e.g., Rocky View Gravel Watch; Bighill Creek Preservation Society). To obtain approval for development and operation, aggregate developments must adhere to the relevant County policies as well as provincial legislation and requirements. Developments are expected to operate using best management practices to minimize effects on biophysical resources.

The Project will contribute to cumulative effects in the region on native vegetation and wildlife resources. In combination with the nearby aggregate developments, the Project will contribute to cumulative effects on vegetation, wildlife, as well as air and noise. At the request of the County, a cumulative effects assessment is being completed for air and noise for the three planned aggregate operations (Lafarge Canada, McNair Sand and Gravel, MALP).

The minimal loss of native vegetation as a result of the Project will contribute to the anticipated combined loss of native vegetation from aggregate development. Wildlife typically found in the area are accustomed to high levels of human activity. Given the small size of the Project, the disturbed nature of habitat within the Project area, and the intensive agricultural setting in the region, the Project is expected to have a negligible contribution to cumulative effects on wildlife and wildlife habitat (vegetation and wetlands), and vegetation communities in the region.

The expectation is that development and operation of all aggregate projects will be guided by the Code of Practice for Pits (GoA 2004), best management practices (e.g., Best Management Practices: User Manual for Aggregate Operators on Public Land, GoA 2010), and project-specific environmental management plans will be developed and implemented to avoid or minimize environmental effects on biophysical resources.

## 8.0 STATEMENT OF LIMITATIONS

This report has been prepared and the work referred to in this report has been undertaken by SLR Consulting (Canada) Ltd. (SLR) for Mountain Ash Limited Partnership, hereafter referred to as the "Client". It is intended for the sole and exclusive use of Mountain Ash Limited Partnership. The report has been prepared in accordance with the Scope of Work and agreement between SLR and the Client. Other than by the Client and as set out herein, copying or distribution of this report or use of or reliance on the information contained herein, in whole or in part, is not permitted unless payment for the work has been made in full and express written permission has been obtained from SLR.

This report has been prepared in a manner generally accepted by professional consulting principles and practices for the same locality and under similar conditions. No other representations or warranties, expressed or implied, are made.

Opinions and recommendations contained in this report are based on conditions that existed at the time the services were performed and are intended only for the client, purposes, locations, time frames and project parameters as outlined in the Scope of Work and agreement between SLR and the Client. The data reported, findings, observations and conclusions expressed are limited by the Scope of Work. SLR is not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. SLR does not warranty the accuracy of information provided by third party sources.

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## **APPENDIX A**

### **Photographs**

Biophysical Impact Assessment Report  
Mountain Ash Limited Partnership Aggregate Operation  
NW and SW 31-26-03 W5M, Rocky View County, Alberta  
SLR Project No. 212.06650.00003



**Photo 1:** Wetland 1 – Class III - Southwest corner of Project area located in Phase 6 (June 3, 2019).



**Photo 2:** Wetland 3 – Class II - Southwest corner of Project area located in Stockpile area (June 3, 2019)



Biophysical Impact Assessment Report  
 NW and SW 31-26-03 W5M  
 Rocky View County, Alberta

SITE PHOTOGRAPHS

Project No: 212.06650.00003.



**Photo 3:** Wetland 17 – Class II - North end of Project area located in adjacent to Phase 3 (June 4, 2019).



**Photo 4:** Wetland 19 – Class II - Northwest corner of Project site located in exclusion area (June 4, 2019).



SITE PHOTOGRAPHS

Biophysical Impact Assessment Report  
NW and SW 31-26-03 W5M  
Rocky View County, Alberta

Project No: 212.06650.00003.



**Photo 5:** Wetland 20 – Class II - Northwest corner of Project site located in exclusion area (June 4, 2019).



**Photo 6:** Wetland 19 – Hoof shear within wetland located in exclusion area (June 4, 2019).



Biophysical Impact Assessment Report  
 NW and SW 31-26-03 W5M  
 Rocky View County, Alberta

SITE PHOTOGRAPHS

Project No: 212.06650.00003.



**Photo 7:** Wetland 20 – Hoof shear within wetland located in exclusion area (June 4, 2019).



**Photo 8:** Wetland 7 – Class I - South end of Project site located in stockpile area (June 3, 2019).



SITE PHOTOGRAPHS

Biophysical Impact Assessment Report  
NW and SW 31-26-03 W5M  
Rocky View County, Alberta

Project No: 212.06650.00003.



**Photo 9:** Wetland 11 – Class I - south end of Project site located in Phase I (June 3, 2019)



**Photo 10:** Wetland 18 – Class I - North end of Project site located in Phase 3 (June 4, 2019).



SITE PHOTOGRAPHS

Biophysical Impact Assessment Report  
NW and SW 31-26-03 W5M  
Rocky View County, Alberta

Project No: 212.06650.00003.



**Photo 11:** Wetland 5 – Historically a Class III wetland – excavated to a dugout – located in stockpile area (June 4, 2019).



**Photo 12:** Wetland 8 – located with Wetlands 9 and 10 (all Class I) within hay field in Phase 2 (June 5, 2019).



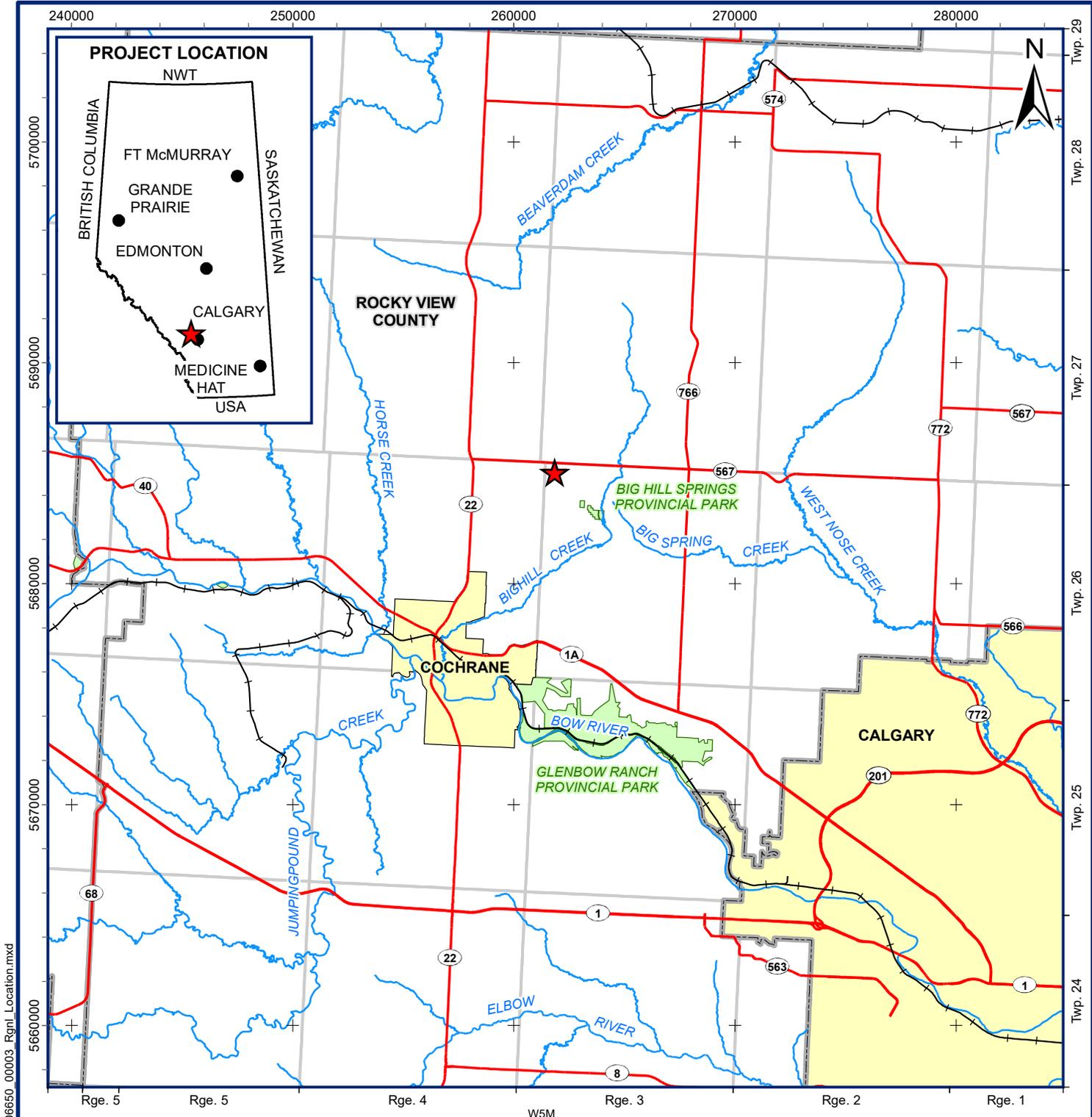
SITE PHOTOGRAPHS

Biophysical Impact Assessment Report  
 NW and SW 31-26-03 W5M  
 Rocky View County, Alberta

Project No: 212.06650.00003.

**APPENDIX B**  
**Figures**

Biophysical Impact Assessment Report  
Mountain Ash Limited Partnership Aggregate Operation  
NW and SW 31-26-03 W5M, Rocky View County, Alberta  
SLR Project No. 212.06650.00003



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**LEGEND**

- PROJECT LOCATION
- HIGHWAY
- COUNTY BOUNDARY
- RAILWAY
- PROVINCIAL PARK
- WATERCOURSE
- URBAN

**NOTES**

This map is for conceptual purposes only and should not be used for navigational purposes.  
 Basedata: AltaLIS Government of Alberta under the Alberta Open Data License.



SCALE: 1:250,000 KILOMETRES  
 WHEN PLOTTED CORRECTLY AT 8-1/2 x 11  
 NAD 1983 UTM Zone 12N

**MOUNTAIN ASH LIMITED PARTNERSHIP  
 AGGREGATE OPERATION  
 NW & SW 31-26-03 W5M  
 ROCKY VIEW COUNTY, ALBERTA**

**BIOPHYSICAL IMPACT  
 ASSESSMENT REPORT**

**REGIONAL LOCATION**

January 15, 2020	Rev 0.0	Figure No.
Project No.	212.06650.00003	<b>1</b>





Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

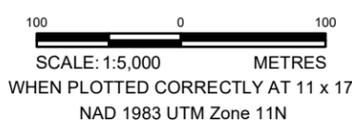


- LEGEND**
- AREA ASSESSED
  - EXTRACTION PHASE BOUNDARY
  - SITE LOCATION
- SOILS**
- GLEYED DUNVARGAN SOIL<sup>1</sup>

- VEGETATION**
- HAY
  - MARSH
  - NATIVE PASTURE
  - TAME PASTURE
  - TREED

**NOTES**

1. Soil within the rest of the Project Area is classified as Orthic Black Chernozem of the Dunvargan soil series. This map is for conceptual purposes only and should not be used for navigational purposes.  
Basedata:



**MOUNTAIN ASH LIMITED PARTNERSHIP  
AGGREGATE OPERATION  
NW & SW 31-26-03 W5M  
ROCKY VIEW COUNTY, ALBERTA**

BIOPHYSICAL IMPACT  
ASSESSMENT REPORT

SOILS AND VEGETATION

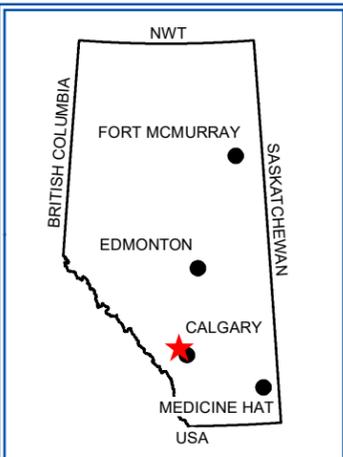
January 15, 2020	Rev 0.0	Figure No.
Project No. 212.06650.00003		<b>2</b>



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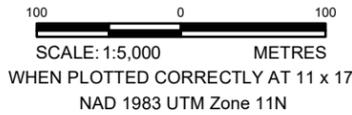


Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



- LEGEND**
- ★ BIRD POINT COUNT LOCATION
  - ▭ AREA ASSESSED
  - ▭ EXTRACTION PHASE BOUNDARY
  - ▭ SITE LOCATION

**NOTES**  
 This map is for conceptual purposes only and should not be used for navigational purposes.  
 Basedata:



**MOUNTAIN ASH LIMITED PARTNERSHIP  
 AGGREGATE OPERATION  
 NW & SW 31-26-03 W5M  
 ROCKY VIEW COUNTY, ALBERTA**

**BIOPHYSICAL IMPACT  
 ASSESSMENT REPORT**

**BIRD POINT COUNT LOCATIONS**

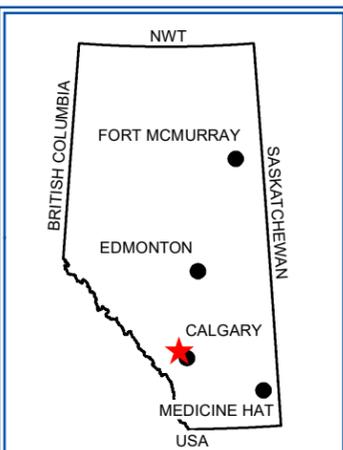
January 15, 2020	Rev 0.0	Figure No.
Project No. 212.06650.00003		<b>3</b>



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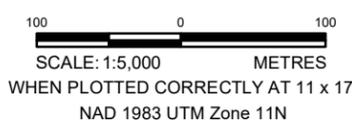


Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



- LEGEND**
- AREA ASSESSED
  - EXTRACTION PHASE BOUNDARY
  - SITE LOCATION
  - WETLAND (# IDENTIFICATION)

**NOTES**  
 This map is for conceptual purposes only and should not be used for navigational purposes.  
 Basedata:



**MOUNTAIN ASH LIMITED PARTNERSHIP  
 AGGREGATE OPERATION  
 NW & SW 31-26-03 W5M  
 ROCKY VIEW COUNTY, ALBERTA**

**BIOPHYSICAL IMPACT  
 ASSESSMENT REPORT**

**IDENTIFIED WETLANDS**

January 15, 2020	Rev 0.0	Figure No.
Project No. 212.06650.00003		<b>4</b>



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## **APPENDIX C**

### **Vegetation Species List**

Biophysical Impact Assessment Report  
Mountain Ash Limited Partnership Aggregate Operation  
NW and SW 31-26-03 W5M, Rocky View County, Alberta  
SLR Project No. 212.06650.00003

**Vascular Plant List**

Scientific Name	Common Name	Tame Pasture	Native Pasture	Hay	Treed
<b>Vascular Plants</b>					
<i>Achillea millefolium</i>	common yarrow	X	X	X	X
<i>Agropyron smithii</i>	western wheatgrass	X	X		
<i>Agropyron trachycaulum</i>	slender wheatgrass	X			
<i>Anemone patens</i>	prairie crocus	X	X		
<i>Antennaria microphylla</i>	small-leaved pussytoes	X	X		
<i>Artemisia ludoviciana</i>	white sage-brush	X			X
<i>Aster sp.</i>	aster species	X	X		
<i>Astragalus agrestis</i>	purple milk-vetch	X	X		
<i>Bromus inermus</i>	smooth brome	X			X
<i>Cerastium vulgatum</i>	mouse-eared chickweed	X			
<i>Cirsium arvense</i>	canada thistle	X			X
<i>Comandra umbellata</i>	bastard toadflax	X	X		
<i>Dodecatheon pulchellum</i>	saline shooting-star	X	X		
<i>Erigeron sp.</i>	fleabane species	X	X		X
<i>Fragaria virginiana</i>	wild strawberry	X			X
<i>Galium sp.</i>	bedstraw species	X			X
<i>Galium trifidum</i>	small bedstraw	X			
<i>Geranium viscosissimum</i>	sticky purple geranium	X			X
<i>Geum triflorum</i>	three-flowered avens	X	X		
<i>Heuchera cylindrica</i>	roundleaf alumroot	X			
<i>Lathyrus ochroleucus</i>	creamy peavine	X			X
<i>Medicago sativa</i>	alfalfa			X	
<i>Oxytropis deflexa</i>	nodding locoweed		X		

**Vascular Plant List**

Scientific Name	Common Name	Tame Pasture	Native Pasture	Hay	Treed
<i>Phleum pratense</i>	timothy grass			X	
<i>Poa pratense</i>	Kentucky bluegrass	X			X
<i>Populus tremuloides</i>	aspen poplar	X			X
<i>Potentilla anserina</i>	silverweed	X	X		
<i>Potentilla fruticosa</i>	shrubby cinquefoil	X	X		X
<i>Potentilla gracilis</i>	graceful cinquefoil		X		
<i>Ribes oxycanthoides</i>	northern gooseberry	X			X
<i>Rosa arcicularis</i>	prickly rose	X			X
<i>Rosa arkansana</i>	prairie rose	X			
<i>Smilacina stellata</i>	false solomon's-seal	X			X
<i>Sonchus arvensis</i>	perennial sow-thistle	X			
<i>Symphoricarpos albus</i>	common snowberry	X	X		X
<i>Taraxacum officinale</i>	common dandelion	X	X	X	X
<i>Thalictrum occidentale</i>	western meadow rue	X			
<i>Thermopsis rhombifolia</i>	golden bean		X		X
<i>Trifidum sp.</i>	clover species	X			
<i>Vicia americana</i>	wild vetch	X			
<i>Viola adunca</i>	early blue violet	X			
<i>Zizia aptera</i>	heart-leaved alexanders	X			

**Wetland Assessments - Classification and Species Lists Based on Field Investigation (June 1-4, 2019)**

Wetland ID	Classification	Area (ha)	Predominant species present	Scientific Names
1	Class III	0.291	needle spikerush, water sedge, wild mint , smooth brome, western dock, and hair grass	<i>Eleocharis acicularis, Carex aquatilis, Mentha arvensis, Rumex occidentalis, Deschampsia cespitosa</i>
2	Class I	0.008	Dandelion, silverweed and common plantain	<i>Taraxacum officinale, Argentina anserina, Plantago major</i>
3	Class II	0.045	Dandelion, silverweed, common plantain, hair grass, kentucky bluegrass, clover	<i>Taraxacum officinale, Argentina anserina, Plantago major, Deschampsia cespitosa, Poa pratensis, Trifolium sp.</i>
4	Class I	0.028	Dandelion, silverweed and common plantain	<i>Taraxacum officinale, Argentina anserina, Plantago major</i>
5	Class I	0.067	Dominated by smooth brome and slender wheatgrass	<i>Bromus inermis and Agropyron trachycaulum</i>
6	Class I	0.048	Kentucky bluegrass, smooth brome, canada thistle, western dock	<i>Poa pratensis, Bromus inermis, Cirsium arvense, Rumex occidentalis</i>
7	Class I	0.055	Hay crop	
8	Class I	0.058	Hay crop, dandelion	<i>Taraxacum officinale</i>
9	Class I	0.028	Hay crop	
10	Class I	0.063	Hay crop	
11	Class I	0.009	Hay crop, western dock	<i>Rumex occidentalis</i>
12	Class I	0.014	Hay crop	
13	Class I	0.023	Tame pasture - fowl bluegrass, slender wheatgrass, smooth brome, timothy grass	<i>Poa palustris, Agropyron trachycaulum, Bromus inermis, Phleum pratense</i>
14	Class I	0.028	Kentucky bluegrass, smooth brome, canada thistle, western dock	<i>Poa pratensis, Bromus inermis, Cirsium arvense, Rumex occidentalis</i>
15	Class I	0.017	Kentucky bluegrass, smooth brome, canada thistle, western dock	<i>Poa pratensis, Bromus inermis, Cirsium arvense, Rumex occidentalis</i>
16	Class II	0.013	Smooth brome, slender wheatgrass, water sedge	<i>Bromus inermis and Agropyron trachycaulum, Carex aquatilis</i>
17	Class II	0.118	Hay crop, dandelion, western dock, water sedge	<i>Taraxacum officinale, Rumex occidentalis, Carex aquatilis</i>
18	Class I	0.05	Hay crop, dandelion	<i>Taraxacum officinale</i>
19	Class II	0.676	Tame pasture - clover, dandelion, water sedge, western dock	<i>Trifolium sp., Taraxacum officinale, Carex aquatilis, Rumex occidentalis</i>
20	Class II	0.722	Tame pasture - clover, dandelion, water sedge, western dock	<i>Trifolium sp., Taraxacum officinale, Carex aquatilis, Rumex occidentalis</i>

**APPENDIX D**  
**ABWRET-A Results**

Biophysical Impact Assessment Report  
Mountain Ash Limited Partnership Aggregate Operation  
NW and SW 31-26-03 W5M, Rocky View County, Alberta  
SLR Project No. 212.06650.00003

Function (ABWRET-A Raw Score)	Wetland 19	Wetland 20	Wetland 18	Wetland 17	Wetland 16	Wetland 15	Wetland 14	Wetland 13	Wetland 12	Wetland 10	Wetland 9	Wetland 8	Wetland 4	Wetland 3	Wetland 2	Wetland 11	Wetland 1	Wetland 6	Wetland 7	Wetland 5
Surface Water Storage (WS)	6.12	6.11	2.75	6.20	6.20	2.75	2.74	2.74	2.74	5.85	5.84	5.84	6.16	6.16	6.16	2.64	6.17	5.84	5.82	5.47
Stream Flow Support (SFS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Streamwater Cooling (WC)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sediment & Toxicant Retention & Stabilization (SR)	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Phosphorus Retention (PR)	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Nitrate Removal & Retention (NR)	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Organic Nutrient Export (OE)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fish Habitat (FH)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aquatic Invertebrate Habitat (INV)	5.35	5.36	4.26	4.76	4.78	4.31	4.36	4.31	4.35	4.76	4.73	4.77	4.92	4.89	4.83	4.22	5.20	4.80	4.94	4.51
Amphibian Habitat (AM)	2.74	2.76	2.28	2.52	2.47	2.29	2.29	2.29	2.29	2.50	2.46	2.52	4.15	4.13	2.94	2.31	2.98	2.47	2.59	3.79
Waterbird Habitat (WB)	4.83	4.85	3.94	4.68	4.28	3.93	3.59	3.93	3.59	4.55	4.18	4.59	5.30	5.34	4.89	3.93	5.04	4.29	4.26	4.68
Songbird, Raptor, & Mammal Habitat	3.39	3.30	2.70	2.95	2.91	2.75	2.76	2.75	2.75	2.90	2.90	2.93	3.56	3.46	3.32	2.60	3.51	2.55	2.89	3.38
Pollinator & Native Plant Habitat (PH)	3.14	3.11	1.75	2.90	3.09	1.83	1.83	1.83	1.82	2.27	2.81	2.75	3.09	3.00	2.89	1.72	3.11	2.42	2.80	3.06
Human Use & Recognition (HU)	3.20	3.28	2.54	3.01	3.01	2.74	2.74	2.74	2.74	2.52	3.02	3.02	3.64	3.56	3.56	2.97	3.65	3.72	3.27	2.97
<b>Function (ABWRET-A Normalized)</b>																				
Surface Water Storage (WS)	0.84	0.84	0.25	0.86	0.86	0.25	0.25	0.25	0.25	0.79	0.79	0.79	0.85	0.85	0.85	0.23	0.85	0.79	0.79	0.73
Stream Flow Support (SFS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Streamwater Cooling (WC)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sediment & Toxicant Retention & Stabilization (SR)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Phosphorus Retention (PR)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Nitrate Removal & Retention (NR)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Organic Nutrient Export (OE)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fish Habitat (FH)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aquatic Invertebrate Habitat (INV)	0.54	0.54	0.40	0.46	0.47	0.41	0.41	0.41	0.41	0.47	0.46	0.47	0.49	0.48	0.47	0.39	0.52	0.47	0.49	0.43
Amphibian Habitat (AM)	0.35	0.35	0.28	0.32	0.31	0.28	0.28	0.28	0.28	0.31	0.31	0.32	0.58	0.58	0.38	0.28	0.39	0.31	0.33	0.52
Waterbird Habitat (WB)	0.36	0.36	0.25	0.34	0.29	0.25	0.21	0.25	0.21	0.33	0.28	0.33	0.42	0.42	0.37	0.25	0.39	0.29	0.29	0.34
Songbird, Raptor, & Mammal Habitat	0.34	0.32	0.21	0.26	0.25	0.22	0.22	0.22	0.22	0.25	0.25	0.25	0.37	0.35	0.32	0.19	0.36	0.18	0.24	0.34
Pollinator & Native Plant Habitat (PH)	0.25	0.24	0.00	0.20	0.24	0.02	0.02	0.02	0.02	0.10	0.19	0.18	0.24	0.22	0.20	0.00	0.24	0.12	0.19	0.23
Human Use & Recognition (HU)	0.42	0.44	0.29	0.39	0.39	0.33	0.33	0.33	0.33	0.29	0.39	0.39	0.51	0.49	0.49	0.38	0.51	0.53	0.44	0.38
<b>Normalized Score (ABWRET_A) Based on Wetlands in RWVAU</b>																				
Normalized Hydrological Health (HH)	0.84	0.84	0.25	0.86	0.86	0.25	0.25	0.25	0.25	0.79	0.79	0.79	0.85	0.85	0.85	0.23	0.85	0.79	0.79	0.73
Normalized Water Quality (WQ)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Normalized Ecological Health (EH)	0.54	0.54	0.40	0.46	0.47	0.41	0.41	0.41	0.41	0.47	0.46	0.47	0.58	0.58	0.47	0.39	0.52	0.47	0.49	0.52
Normalized Human Use (HU)	0.42	0.44	0.29	0.39	0.39	0.33	0.33	0.33	0.33	0.29	0.39	0.39	0.51	0.49	0.49	0.38	0.51	0.53	0.44	0.38
RWVAU #	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
Normalized Value Score (ABWRET_a)	0.76	0.76	0.52	0.73	0.74	0.53	0.53	0.53	0.53	0.71	0.72	0.72	0.78	0.78	0.75	0.53	0.76	0.73	0.73	0.71
Value Category (a, b, c, d)	c	c	d	c	c	d	d	d	d	d	c	c	c	c	c	d	c	c	c	c
Abundance Factor	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Final Score(A, B, C, D)	B	B	D	B	B	C	C	C	C	C	B	B	B	B	B	D	B	B	B	B



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